

EMC Test Report



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Applicant: Shenzhen Roborock Innovation Technology Co., Ltd.

Product: Auto-Empty Dock

Model: MDS24HRR

In accordance with, EN 55014-1, EN 61000-3-2,
EN 61000-3-3 and EN 55014-2

Prepared for: Shenzhen Roborock Innovation Technology Co., Ltd.
Room 1802, Building D1, Nanshan Zhiyuan, No.1001 Xueyuan Avenue,
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China

COMMERCIAL-IN-CONFIDENCE

Report Number: 4840125293800

RESPONSIBLE FOR	NAME	SIGNATURE	DATE
Approved By	Bo Dai		2025.06.09
Prepared By	Zhilan Xue		2025.06.09

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service control rules.

EXECUTIVE SUMMARY

One sample of this product were tested and found to be compliant with 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.

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2025.06.09

1.2 Introduction

The information contained in this report is intended to show verification of the EMC Qualification Approval Testing of the requirements of the standards for the tests listed in Section 1.3.

Applicant address	Shenzhen Roborock Innovation Technology Co., Ltd. Room 1802, Building D1, Nanshan Zhiyuan, No.1001 Xueyuan Avenue, Changyuan community, Taoyuan Street, Nanshan District, Shenzhen, P.R. China
Manufacturer address	Shenzhen Roborock Innovation Technology Co., Ltd. Room 1802, Building D1, Nanshan Zhiyuan, No.1001 Xueyuan Avenue, Changyuan community, Taoyuan Street, Nanshan District, Shenzhen, P.R. China
Model Number(s)	MDS24HRR
Rated voltage & frequency & current	Rated Input (Charging): 220-240 VAC, 50-60 Hz, 0.2A Rated Input (Dust evacuation & charging): 220-240 VAC, 50-60 Hz, 3A Rated Output: 26 VDC, 0.8A
Sample Tested	MDS24HRR
Test Specification	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
Date of Receipt of EUT	2025.05.14
Start of Test	2025.05.15
Finish of Test	2025.05.21
Name of Engineer(s)	Zhilan Xue

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with EN 55014-1, EN 61000-3-2, EN 61000-3-3 and EN 55014-2 is shown below.

Section	Specification	Clause	Test Description	Result	Comments/Base Standard
2.1	EN IEC 55014-1:2021	4.3, 3.6	Conducted Disturbance	Pass	--
2.2	EN IEC 55014-1:2021	4.3, 4.4	Disturbance Power	Pass	--
2.4	EN IEC 61000-3-2:2019/A1:2021	7	Harmonic current emission	Pass	
2.5	EN 61000-3-3:2013/A1:2019/A2:2021	6	Flicker	Pass	
2.6	EN IEC 55014-2:2021	5.1	Electrostatic discharge immunity test	Pass	IEC 61000-4-2
2.7	EN IEC 55014-2:2021	5.5	Radiated, radio-frequency, electromagnetic field immunity test	Pass	IEC 61000-4-3
2.8	EN IEC 55014-2:2021	5.2	Electrical fast transient /burst immunity test	Pass	IEC 61000-4-4
2.9	EN IEC 55014-2:2021	5.3	Immunity to conducted disturbances, induced by radio-frequency fields	Pass	IEC 61000-4-6
2.10	EN IEC 55014-2:2021	5.6	Surge immunity test	Pass	IEC 61000-4-5
2.11	EN IEC 55014-2:2021	5.7	Voltage dips, short interruptions and voltage variations immunity tests	Pass	IEC 61000-4-11

1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was an Auto-Empty Dock.

The highest clock frequency in Auto-Empty Dock is less than 15MHz.

The worst status was recorded.

1.4.2 EUT Port/Cable Identification

Port	Max Cable Length specified	Usage	Type	Screened
Power line	--	--	2 core	No

1.4.3 Test Configuration

Configuration	Description
1	230V AC 50Hz

The EUT was configured With Cordless Stick Vacuum Cleaner: H9A3A

1.4.4 Modes of Operation

Mode	Description
1	The EUT was dust evacuation & charging

1.4.5 Monitoring of Performance

The EUT works normally, the EUT was monitored by visual inspection.

1.4.6 Performance Criteria

EN 55014-2:

Performance 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 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.

Performance 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. During the test, degradation of performance is allowed, however no change of actual operating state or stored data is allowed to persist after test. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance 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 instruction for use.

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 Test Location

TÜV SÜD Product Service conducted the following tests at TÜV SÜD Certification and Testing (China) Co., Ltd.

Address:

Floor 1-4, Building B, No.37, Tuanjie Road(Middle), Xishan Economic and Technological Development Zone, Wuxi, Jiangsu, P.R.China

Test Name	Name of Engineer(s)
Conducted Disturbance at Mains Terminals	Haoyu Wang
Disturbance power	Haoyu Wang
Electrostatic discharge immunity test	Haoyu Wang
Electrical fast transient /burst immunity test	Haoyu Wang
Immunity to conducted disturbances, induced by radio-frequency fields	Haoyu Wang
Surge immunity test	Haoyu Wang
Voltage dips, short interruptions and voltage variations immunity tests	Haoyu Wang
Harmonic current emission	Haoyu Wang
Flicker	Haoyu Wang

2 Test Details

2.1 Conducted Disturbance at Mains Terminals

2.1.1 Specification Reference

Refer to 1.3

2.1.2 Equipment Under Test

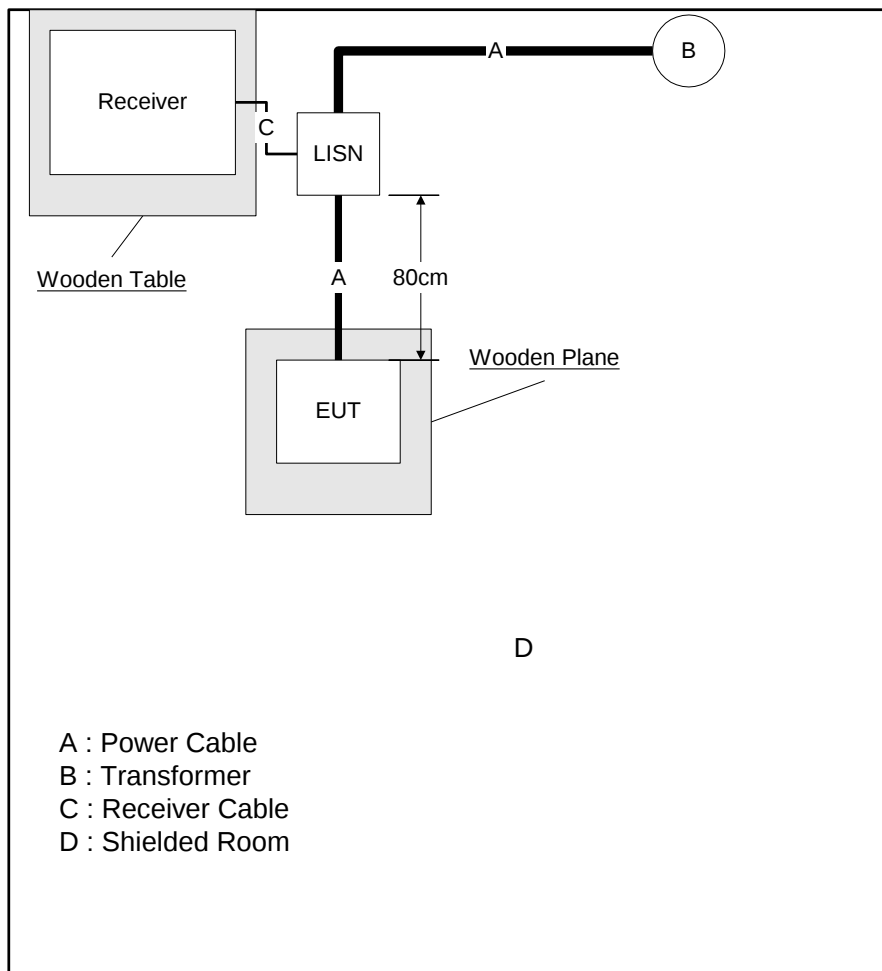
MDS24HRR

2.1.3 Date of Test

2025.05.21

2.1.4 Test Method

The EUT was placed on a non-conductive table 0.1m above a reference ground plane. All power was connected to the EUT through an Artificial Mains Network (AMN). Conducted disturbance voltage measurements on mains lines were made at the output of the AMN. The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.



2.1.5 Environmental Conditions

Ambient Temperature 25 °C
 Relative Humidity 53 %
 Atmospheric Pressure 1009.3 mbar

2.1.6 Specification Limits

Household appliances and equipment causing similar disturbances and regulating controls incorporating semiconductor devices						
Frequency range	Disturbance voltage at main terminals		Disturbance voltage at associated ports		Disturbance current at associated ports	
MHz	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ A	Average dB μ A
0.15 to 0.5	66 to 56	59 to 46	80	70	40 to 30	30 to 20
0.5 to 5	56	46	74	64	30	20
5 to 30	60	50	74	64		

2.1.7 Test Results

Results for Configuration and Mode: Configuration 1 & Mode 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

0.15-30MHz Conducted Emission Test

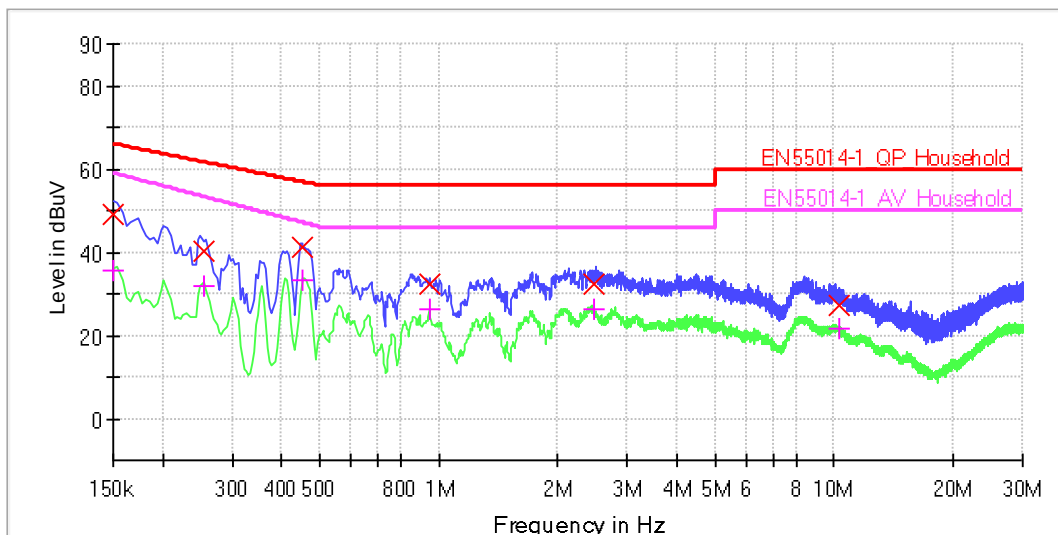
Common Information

EUT: Auto-Empty Dock
 Model: MDS24HRR
 Client: Shenzhen Roborock Innovation Technology Co.,Ltd.
 Operating Conditions: Power on, Dust evacuation & charging
 Operator Name: Wang Haoyu
 Input: AC 230V 50Hz
 Sample No.: WUX-0905161-001
 Test Standard: EN 55014-1
 Comment: Phase L
 Comment: Temp.:25°C,Humi.:47%,Atm.:1016.3hPa

Scan Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz Pre [EMI conducted]

Hardware Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz
 Receiver: [ESW 8]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	PK+ ; AVG	9 kHz	0.01 s	0 dB



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
0.150000	48.8	35.4	1000.0	9.000	10.5	17.2	66.0	23.6	59.0
0.254000	40.0	31.7	1000.0	9.000	10.5	21.6	61.6	21.6	53.3
0.450000	41.2	33.2	1000.0	9.000	10.5	15.7	56.9	14.0	47.1
0.950000	32.5	26.1	1000.0	9.000	10.5	23.5	56.0	19.9	46.0
2.466000	32.2	26.4	1000.0	9.000	10.6	23.8	56.0	19.6	46.0
10.286000	27.3	21.7	1000.0	9.000	10.8	32.8	60.0	28.3	50.0

0.15-30MHz Conducted Emission Test

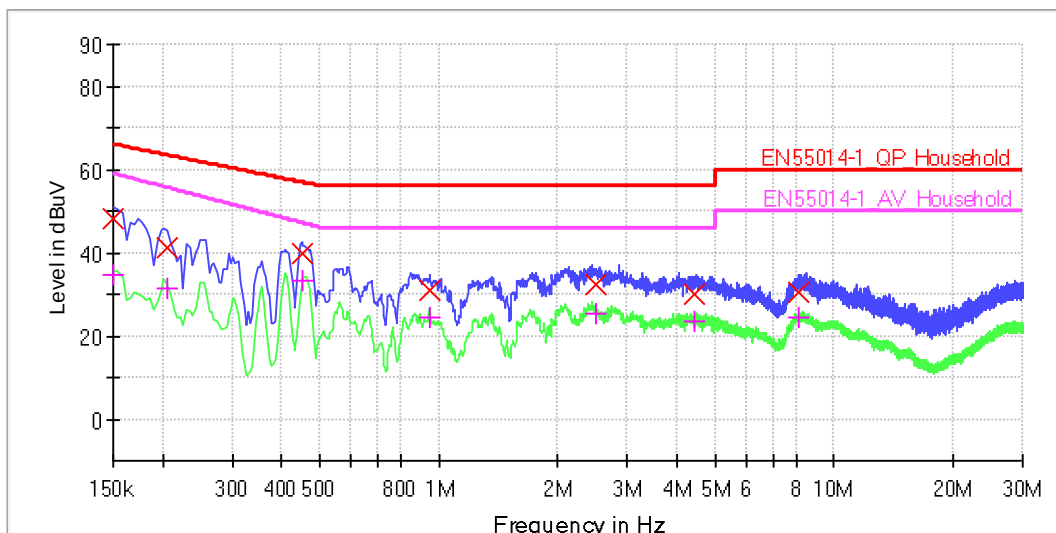
Common Information

EUT: Auto-Empty Dock
 Model: MDS24HRR
 Client: Shenzhen Roborock Innovation Technology Co.,Ltd.
 Operating Conditions: Power on, Dust evacuation & charging
 Operator Name: Wang Haoyu
 Input: AC 230V 50Hz
 Sample No.: WUX-0905161-001
 Test Standard: EN 55014-1
 Comment: Phase N
 Comment: Temp.:25°C,Humi.:47%,Atm.:1016.3hPa

Scan Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz Pre [EMI conducted]

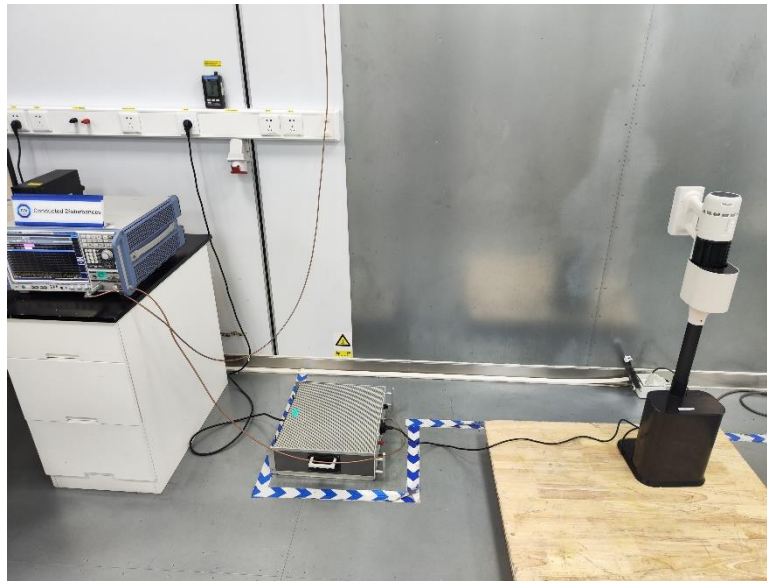
Hardware Setup: Mains Voltage LISN 2 Lines 150kHz-30MHz
 Receiver: [ESW 8]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	PK+ ; AVG	9 kHz	0.01 s	0 dB



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV)	Margin - CAV (dB)	Limit - CAV (dBuV)
0.150000	47.9	34.9	1000.0	9.000	10.5	18.1	66.0	24.1	59.0
0.206000	41.2	31.4	1000.0	9.000	10.5	22.1	63.4	24.2	55.6
0.454000	39.7	33.4	1000.0	9.000	10.5	17.1	56.8	13.7	47.0
0.954000	31.0	24.5	1000.0	9.000	10.5	25.0	56.0	21.5	46.0
2.502000	32.2	25.3	1000.0	9.000	10.6	23.8	56.0	20.7	46.0
4.442000	30.0	23.6	1000.0	9.000	10.6	26.0	56.0	22.4	46.0
8.166000	30.4	24.6	1000.0	9.000	10.7	29.6	60.0	25.4	50.0



Test Setup

2.1.8 Test Location

This test was carried out in Room 119, SR-C.

2.2 Disturbance power

2.2.1 Specification Reference

Refer to 1.3

2.2.2 Equipment Under Test

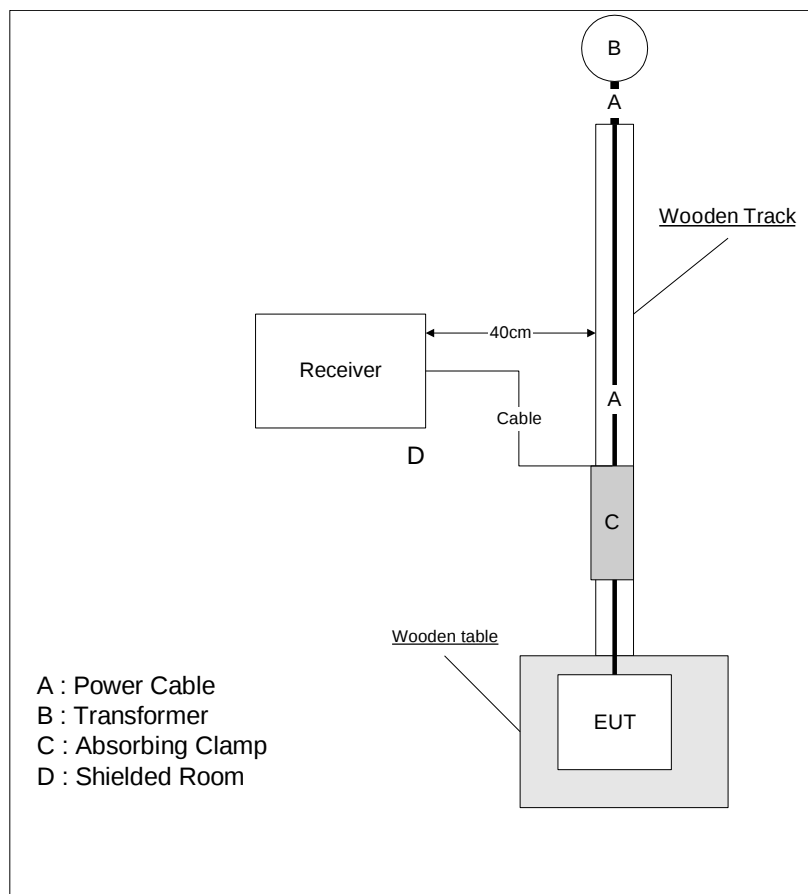
MDS24HRR

2.2.3 Date of Test

2025.05.21

2.2.4 Test Method

The associated equipment under test was placed on a non-metallic table of 0.8m above a reference ground plane and at least 0.8m from other metallic objects and from any person. The lead to be measured shall be stretched in a straight horizontal line for a length sufficient to accommodate the absorbing clamp. At each test frequency, the absorbing clamp shall be moved along the lead until the maximum value is found.



2.2.5 Environmental Conditions

Ambient Temperature 25.0 °C
 Relative Humidity 47.0 %
 Atmospheric Pressure 1016.3 mbar

2.2.6 Specification Limits

EN 55014-1

Disturbance power limits for frequency range 30MHz to 300MHz		
Frequency range	Household and similar appliances dB(pW)	
MHz	Quasi-peak	Average
30 to 300	45 to 55	35 to 45

Margin when performing disturbance power measurement in the frequency range 30MHz to 300MHz		
Frequency range	Household and similar appliances dB(pW)	
MHz	Quasi-peak	Average
	Increasing linearly with the frequency from	
200 to 300	0 to 10 dB	0

2.2.7 Test Results

Results for Configuration and Mode: Configuration 1 & Mode 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below

Line Under Test: Power line

30-300MHz Interference Power Test

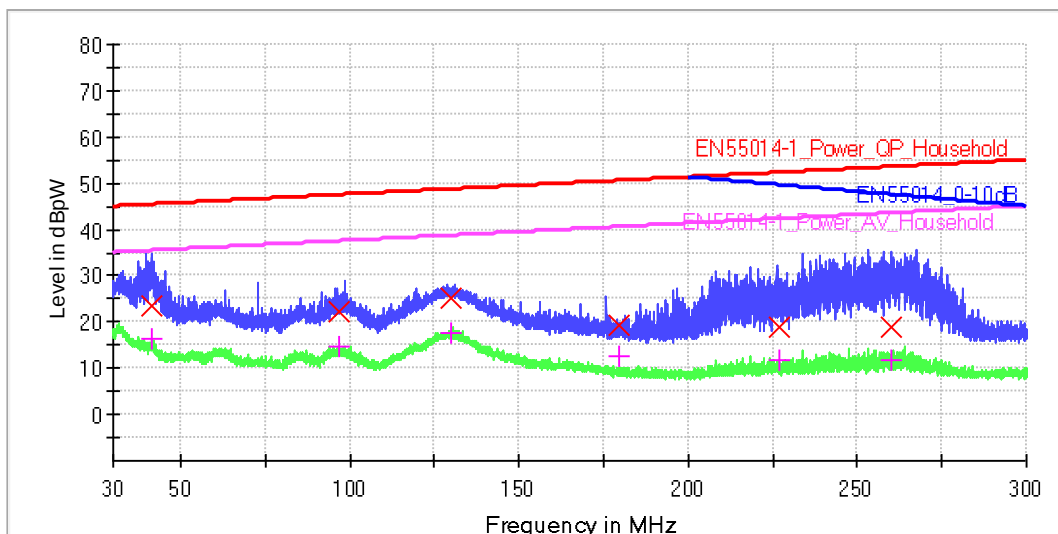
Common Information

EUT: Auto-Empty Dock
 Model: MDS24HRR
 Client: Shenzhen Roborock Innovation Technology Co.,Ltd.
 Operating Conditions: Power on, Dust evacuation & charging
 Operator Name: Wang Haoyu
 Input: AC 230V 50Hz
 Sample No.: WUX-0905161-001
 Test Standard: EN 55014-1
 Comment: Temp.:25°C,Humi.:47%,Atm.:1016.3hPa

Sweep Setup: Disturbances Power_30M-300M_Pre [EMI conducted]

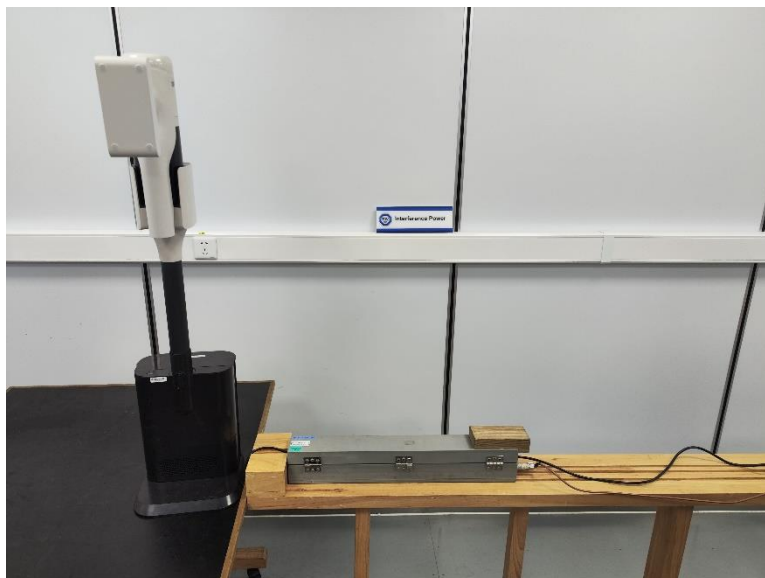
Hardware Setup: Disturbances Power 30MHz-300MHz
 Receiver: [ESW 8]
 Level Unit: dBpW

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 300 MHz	30 kHz	PK+ ; AVG	120 kHz	3 s	0 dB



Limit and Margin

Frequency (MHz)	QuasiPeak (dBpW)	CAverage (dBpW)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBpW)	Margin - CAV (dB)	Limit - CAV (dBpW)
41.240000	23.5	16.4	1000.0	120.000	9.9	22.0	45.4	19.0	35.4
96.720000	22.2	14.8	1000.0	120.000	6.9	25.3	47.5	22.6	37.5
129.760000	25.1	17.6	1000.0	120.000	6.8	23.6	48.7	21.1	38.7
179.760000	19.4	12.4	1000.0	120.000	6.1	31.1	50.5	28.1	40.5
227.120000	18.7	11.7	1000.0	120.000	5.6	33.6	52.3	30.6	42.3
260.200000	18.9	11.9	1000.0	120.000	5.8	34.7	53.5	31.7	43.5



Test Setup

2.2.1 Test Location

This test was carried out in Room 119, SR-C.

2.3 Harmonic current emission

2.3.1 Specification Reference

Refer to 1.3

2.3.2 Equipment Under Test

MDS24HRR

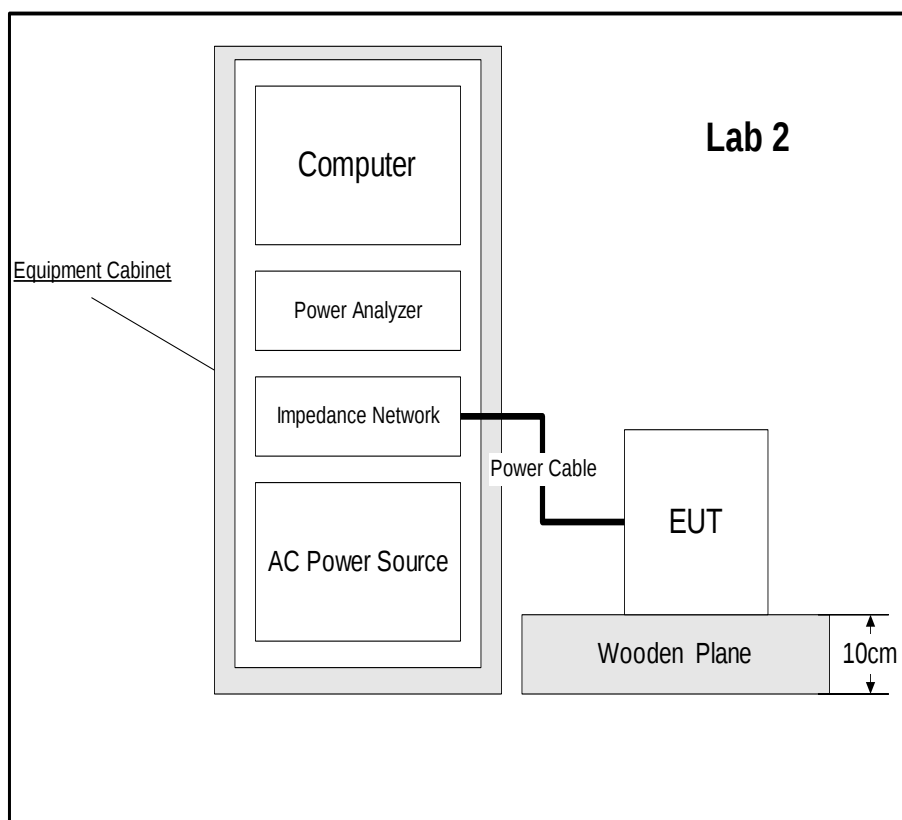
2.3.3 Date of Test

2025.05.21

2.3.4 Test Method

Harmonic current test should be conducted with the user's operation control or automatic programs set to the mode expected to produce the maximum total harmonic current under normal operating conditions.

Specific test conditions for the measurement of harmonic currents associated with some types of equipment are given in Annex C.



2.3.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	53.0 %
Atmospheric Pressure	1008.0 mbar

2.3.6 Specification Limits

Limits for class A Equipment	
Harmonic order n	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
$15 \leq n \leq 39$	$0.15(15/n)$
Even harmonics	
2	1.08
4	0.43
6	0.30
$8 \leq n \leq 40$	$0.23(8/n)$

2.3.7 Test Results

Results for Configuration and Mode: With Auto-Empty Dock: Configuration 1 & Operation mode 1.

Performance assessment of the EUT made during this test: *Pass*.

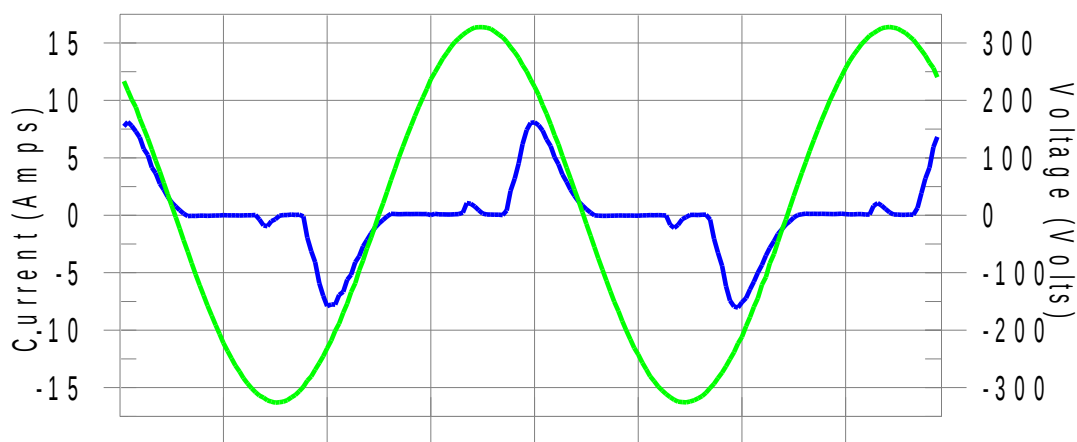
Detailed results are shown below.

Classification of EUT: Class A

EUT: Auto-Empty Dock
Test category: Class-A (European limits)
Test date: 2025.05.21 Start time: 15:49:36 End time: 15:52:18
Test duration (min): 2.5 Data file name: CTSMXL_H-000485.cts_data
Comment: Power on, Dust evacuation & charging; Model: MDS24HRR; T: 22°C, H: 53%, P: 1008hPa; SN: WUX-0905161-001
Customer: Shenzhen Roborock Innovation Technology Co., Ltd.

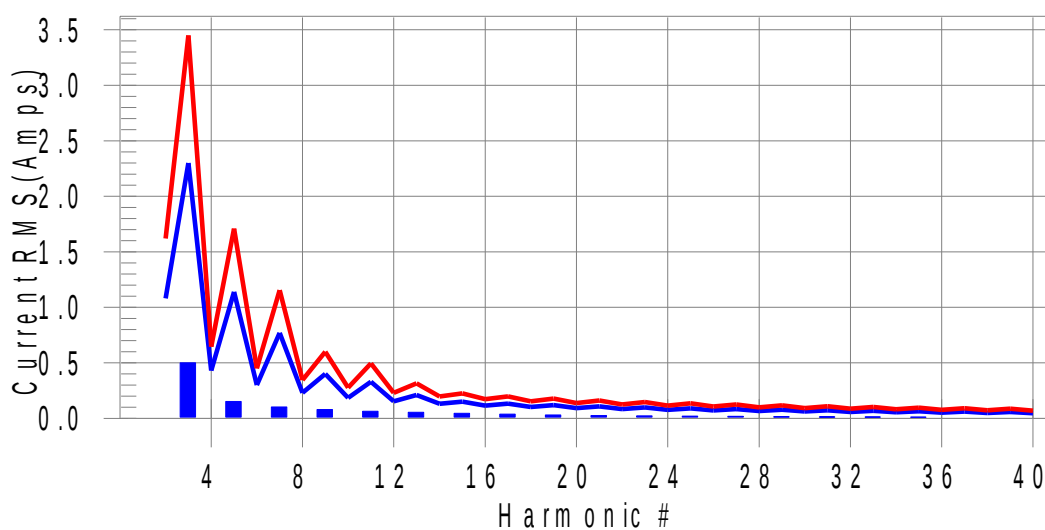
Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line

European Limits



Test result: Pass Worst harmonics H3-24.6% of 150% limit, H15-29.8% of 100% limit.

Current Test Result Summary (Run time)

EUT: Auto-Empty Dock
 Test category: Class-A (European limits)
 Test date: 2025.05.21 Start time: 15:49:36 End time: 15:52:18
 Test duration (min): 2.5 Data file name: CTSMXL_H-000485.cts_data
 Comment: Power on, Dust evacuation & charging; Model: MDS24HRR; T:22°C, H:53%, P:1008hPa; SN: WUX-0905161-001
 Customer: Shenzhen Roborock Innovation Technology Co.,Ltd.

Test Result: Pass Source qualification: Normal
 THC(A): 0.552 I-THD(%): 19.6 POHC(A): 0.053 POHC Limit(A): 0.251

Highest parameter values during test:

V_RMS (Volts):	230.945	Frequency(Hz):	50.00
I_Peak (Amps):	8.235	I_RMS (Amps):	3.256
I_Fund (Amps):	2.817	Crest Factor:	7.768
Power (Watts):	656.0	Power Factor:	0.978

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.009	1.080	N/A	0.039	1.620	N/A	Pass
3	0.500	2.300	21.8	0.850	3.450	24.6	Pass
4	0.010	0.430	N/A	0.044	0.645	N/A	Pass
5	0.153	1.140	13.4	0.409	1.710	23.9	Pass
6	0.008	0.300	N/A	0.039	0.450	N/A	Pass
7	0.102	0.770	13.3	0.214	1.155	18.5	Pass
8	0.007	0.230	N/A	0.029	0.345	N/A	Pass
9	0.079	0.400	19.9	0.139	0.600	23.1	Pass
10	0.005	0.184	N/A	0.021	0.276	N/A	Pass
11	0.064	0.330	19.3	0.092	0.495	18.5	Pass
12	0.005	0.153	N/A	0.015	0.230	N/A	Pass
13	0.054	0.210	25.9	0.065	0.315	20.8	Pass
14	0.004	0.131	N/A	0.012	0.197	N/A	Pass
15	0.045	0.150	29.8	0.055	0.225	24.4	Pass
16	0.004	0.115	N/A	0.010	0.173	N/A	Pass
17	0.037	0.132	28.4	0.045	0.198	22.9	Pass
18	0.004	0.102	N/A	0.008	0.153	N/A	Pass
19	0.031	0.118	26.0	0.038	0.178	21.6	Pass
20	0.004	0.092	N/A	0.009	0.138	N/A	Pass
21	0.026	0.107	24.2	0.033	0.161	20.7	Pass
22	0.004	0.084	N/A	0.008	0.125	N/A	Pass
23	0.022	0.098	22.6	0.030	0.147	20.3	Pass
24	0.004	0.077	N/A	0.008	0.115	N/A	Pass
25	0.020	0.090	22.1	0.027	0.135	19.9	Pass
26	0.004	0.071	N/A	0.008	0.107	N/A	Pass
27	0.018	0.083	21.4	0.024	0.125	19.2	Pass
28	0.004	0.066	N/A	0.007	0.099	N/A	Pass
29	0.015	0.078	N/A	0.022	0.116	N/A	Pass
30	0.004	0.061	N/A	0.007	0.092	N/A	Pass
31	0.013	0.073	N/A	0.020	0.109	N/A	Pass
32	0.004	0.058	N/A	0.007	0.086	N/A	Pass
33	0.012	0.068	N/A	0.018	0.102	N/A	Pass
34	0.004	0.054	N/A	0.007	0.081	N/A	Pass
35	0.011	0.064	N/A	0.016	0.096	N/A	Pass
36	0.004	0.051	N/A	0.006	0.077	N/A	Pass
37	0.010	0.061	N/A	0.014	0.091	N/A	Pass
38	0.005	0.048	N/A	0.006	0.073	N/A	Pass
39	0.008	0.058	N/A	0.013	0.087	N/A	Pass
40	0.004	0.046	N/A	0.008	0.069	N/A	Pass



Test setup

2.3.8 Test Location

This test was carried out in Room 134, Harmonic & Flicker Test area.

2.4 Flicker

2.4.1 Specification Reference

Refer to 1.3

2.4.2 Equipment Under Test

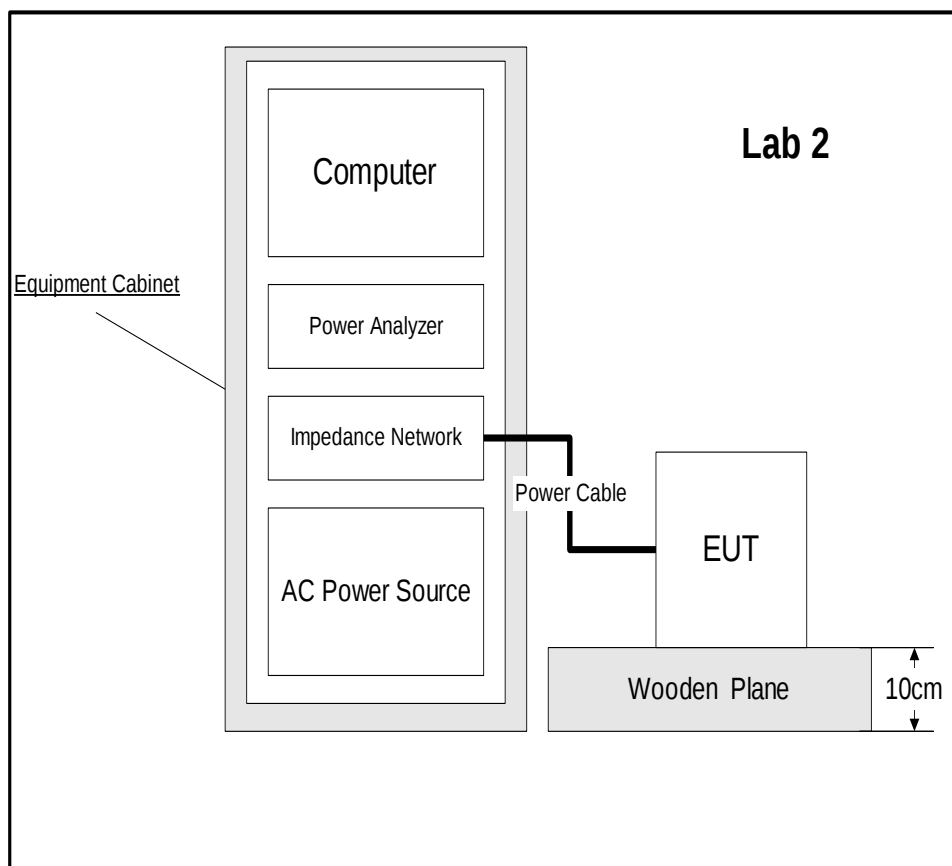
MDS24HRR

2.4.3 Date of Test

2025.05.21

2.4.4 Test Method

For equipment not mentioned in annex A, controls or automatic programs should be set to produce the most unfavorable sequence of voltage change, using only those combinations of controls and programmes which are mentioned by the manufacturer in the instruction manual, or are otherwise likely to be used



2.4.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	53.0 %
Atmospheric Pressure	1008.0 mbar

2.4.6 Specification Limits

The value of P_{st} shall not be greater than 1.0

The value of P_{lt} shall not be greater than 0.65

T_{max} , the accumulated time value of $d(t)$ with a deviation exceeding 3.3% during a single voltage change at the EUT terminals, shall not exceed 500ms

The maximum relative steady-state voltage change, d_c , shall not exceed 3.3%

The maximum relative voltage change d_{max} , shall not exceed

- a) 4% without additional conditions
- b) 6% for equipment which is:
 - Switched manually, or
 - Switched automatically more frequently than twice per day, and also has either a delayed start, or manual restart, after a power supply interruption
- c) 7% for equipment which is:
 - Attended whilst in use, or
 - Switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart or manual restart, after a power supply interruption

2.4.7 Test Results

Results for Configuration and Mode: With Auto-Empty Dock: Configuration 1 & Operation mode1.

Performance assessment of the EUT made during this test: *Pass*.

Detailed results are shown below.

EUT: Auto-Empty Dock

Tested by: Wang Haoyu

Test category: dt,dmax,dc and Pst (European limits)

Test Margin: 100

Test date: 2025.05.21

Start time: 15:37:54

End time: 15:48:22

Test duration (min): 10

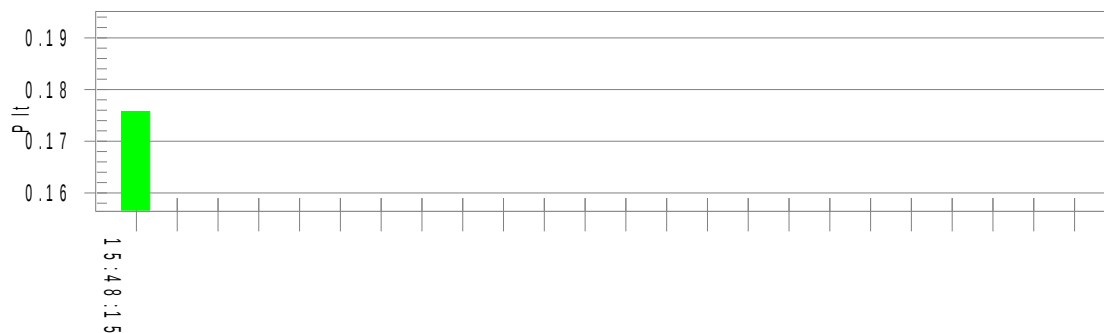
Data file name: CTSMXL_F-000484.cts_data

Comment: Power on, Charging and drying; Model: MDS24HRR; T:22°C, H:53%, P:1008hPa; SN: WUX-0905161-001

Customer: Shenzhen Roborock Innovation Technology Co.,Ltd.

Test Result: Pass

Status: Test Completed

Pst and limit lineEuropean LimitsPlt and limit line

Parameter values recorded during the test:

Vrms at the end of test (Volt): 231.05

T-max (mS): 0.0

Highest dc (%): 0.57

Highest dmax (%): 0.88

Highest Pst (10 min. period): 0.402

Test limit (mS): 500.0 Pass

Test limit (%): 3.30 Pass

Test limit (%): 4.00 Pass

Test limit: 1.000 Pass



Test setup

2.4.8 Test Location

This test was carried out in in Room 134, Harmonic & Flicker Test area.

2.5 Electrostatic discharge immunity test

2.5.1 Specification Reference

Refer to 1.3

2.5.2 Equipment Under Test

MDS24HRR

2.5.3 Date of Test

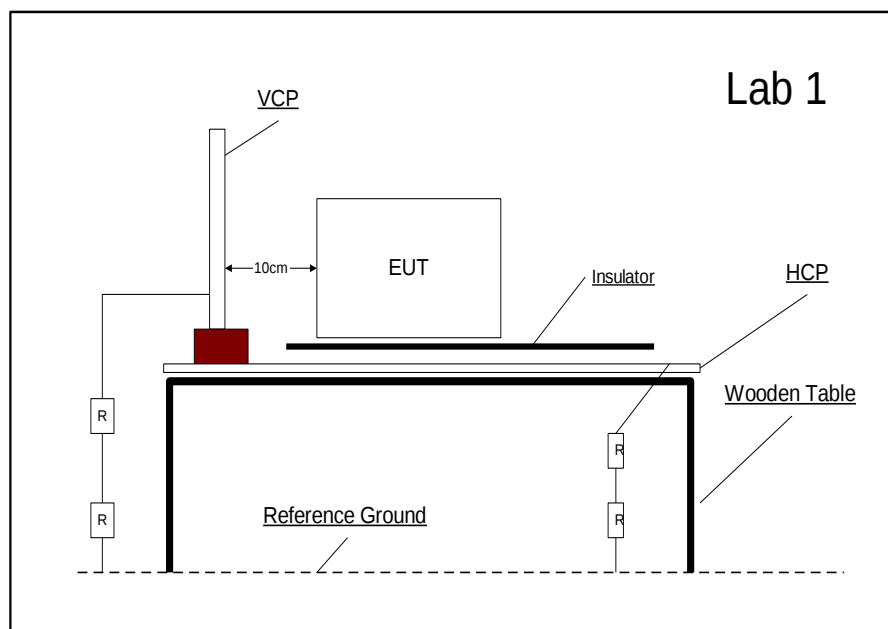
2025.05.15

2.5.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.5mm isolator, a horizontal coupling plane fitted to the top of a 0.8m non-conductive table for table-top equipment; and on a 0.1m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using the air discharge method for non-metallic parts, contact discharge method for metallic parts with both vertical and horizontal couple plane discharge methods for the sides of the equipment under test, the required electrostatic discharge voltage levels in both voltage polarities were applied at the detailed pulse repartition rate.

During this testing any anomalies in the equipment under tests performance was recorded.



2.5.5 Environmental Conditions

Ambient Temperature 21.4°C
 Relative Humidity 48.2 %
 Atmospheric Pressure 1023.5 mbar

2.5.6 Specification Limits

Required Test Levels				Performance Criteria
Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)	
	Positive	Negative		
Air – Direct	2, 4 and 8	2, 4 and 8	<10>	B
Contact – Direct	2 and 4	2 and 4	<10>	B
Contact – Indirect	2 and 4	2 and 4	<10>	B

2.5.7 Test Results

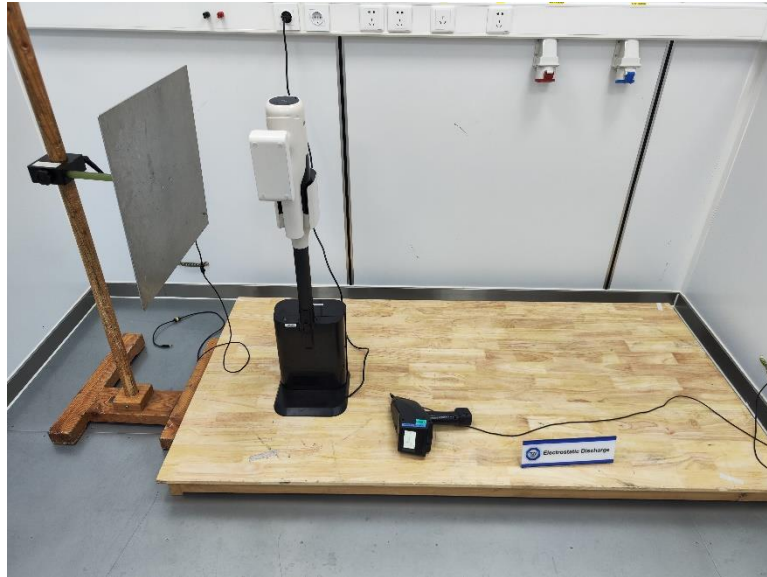
Results for Configuration and Mode: Configuration 1 & operation 1,
 Configuration 2 & operation 2/3

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

ID	Test Point	Discharge	Results									
			2kV		4kV		6kV		8kV		15kV	
			+	-	+	-	+	-	+	-	+	-
1	HCP	Contact	✓	✓	✓	✓						
2	VCP	Contact	✓	✓	✓	✓						
3	Bolt	Contact	✓	✓	✓	✓						
4	Gap	Air	✓*	✓*	✓*	✓*			✓*	✓*		
5	button	Air	✓*	✓*	✓*	✓*			✓*	✓*		

Key to Results	
✓	The EUTs performance was not impacted when the ESD pulse was applied.
✓*	No discharge occurred at this point when the ESD pulse was applied
Ox	
Fx	
N/A	Not Appliance



Test Setup

2.5.8 Test Location

This test was carried out in room 127, ESD-TR.

2.7 Electrical fast transient /burst immunity test

2.7.1 Specification Reference

Refer to 1.3

2.7.2 Equipment Under Test

MDS24HRR

2.7.3 Date of Test

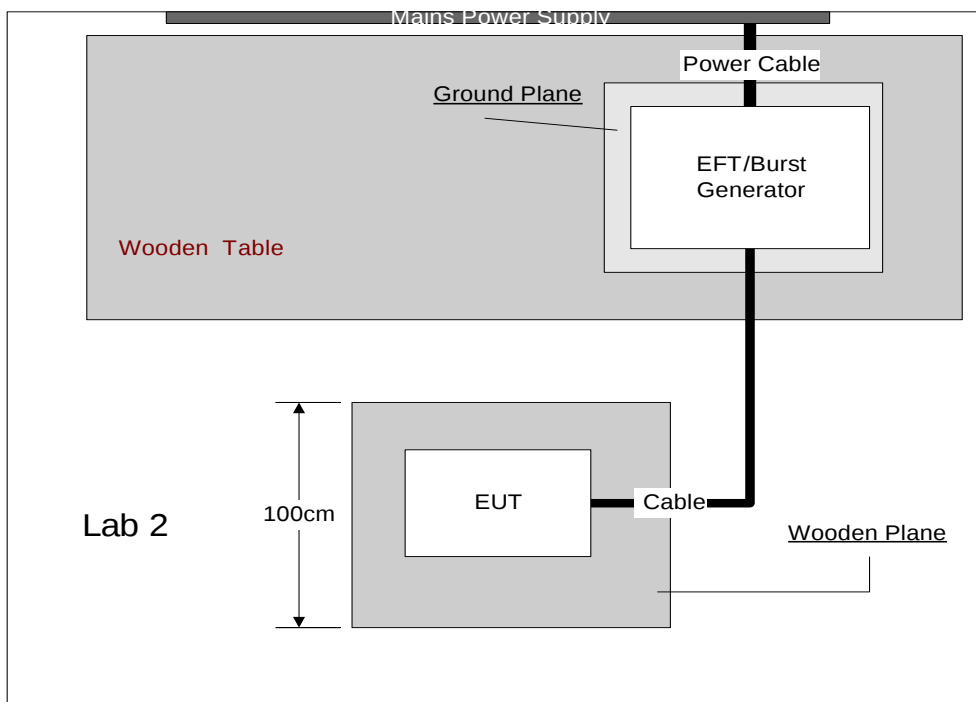
2025.05.15

2.7.4 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.1 m isolator, a horizontal coupling plane fitted to the top of a 0.8 m non-conductive table for table-top equipment; and on a 0.1 m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using a CDN for power ports, capacitive coupling clamp for signal and control ports and a 33nF coupling capacitor for earth ports, the required fast transient burst voltage levels in both voltage polarities were applied at the detailed pulse repartition rate and duration of test.

During this testing any anomalies in the equipment under tests performance was recorded.



2.7.5 Environmental Conditions

Ambient Temperature	21.4°C
Relative Humidity	48.2 %
Atmospheric Pressure	1023.5 mbar

2.7.6 Specification Limits

Required Test Levels Input and output a.c. power ports					Performance Criteria
Line Under Test	Level (kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	
AC power port	± 1	5 kHz	2 min per polarity	Direct	B
For extra low voltage a.c. ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3m according to the manufacturer's functional specification.					

2.7.7 Test Results

Results for Configuration and Mode: Configuration 1 & operation 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Fast Transient Burst Immunity					
Line under test	Test Level	Repetition Rate	Test Duration	Coupling Method	Result
Power line	± 0.5 & 1.0 kV	5 kHz	2 min	CDN	Pass PC A



Test Setup

2.7.8 Test Location

This test was carried out in Room 120, SR-C.

2.8 Surge immunity test

2.8.1 Specification Reference

Refer to 1.3

2.8.2 Equipment Under Test

MDS24HRR

2.8.3 Date of Test

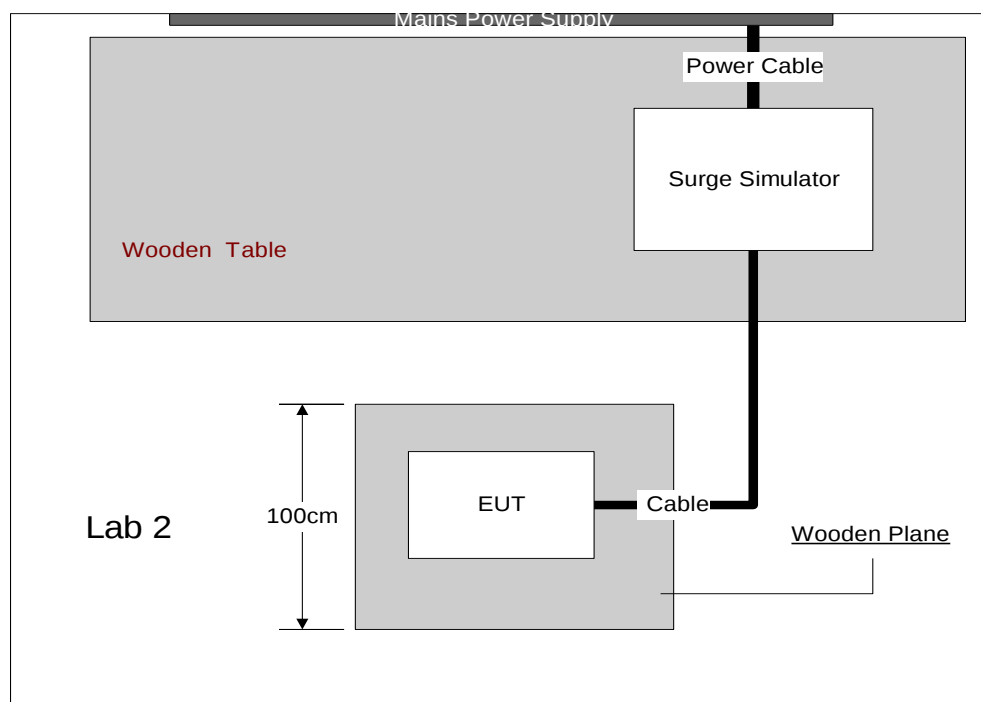
2025.05.15

2.8.4 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.

Using CDNs for power ports and appropriate coupling methods for applicable signal and control ports, the required number of surges was applied for each surge voltage level using both positive and negative surge voltage polarities. Surges were applied at the power line frequency phase angles and repartition rates detailed.

During this testing any anomalies in the equipment under tests performance was recorded.



2.8.5 Environmental Conditions

Ambient Temperature 21.4°C
 Relative Humidity 48.2 %
 Atmospheric Pressure 1023.5 mbar

2.8.6 Specification Limits

Characteristics	Test Levels	Performance Criteria
Wave- shape data Test levels line to line with 2Ω impedance line to earth with 12Ω impedance	1.2/50 μs ± 1.0 kV ±2.0 kV	B
Note In addition to the specified test level, all lower levels as detailed in IEC 61000-4-5 should also be satisfied.		

2.8.7 Test Results

Results for Configuration and Mode: Configuration 1 & operation 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Surge Immunity (Power Ports)							
Line Name	Coupling	Level	Polarity	Phase Angle	No of Pulses	Repetition Rate	Result
Power line	Live to Neutral	-1.0kV	NEGATIVE	270 deg	5	60 sec	Pass PC A
Power line	Live to Neutral	+1.0kV	POSITIVE	90 deg	5	60 sec	Pass PC A



Test Setup

2.8.8 Test Location

This test was carried out in Room 120, SR-C.

2.9 Immunity to conducted disturbances, induced by radio-frequency fields

2.9.1 Specification Reference

Refer to 1.3

2.9.2 Equipment Under Test

MDS24HRR

2.9.3 Date of Test

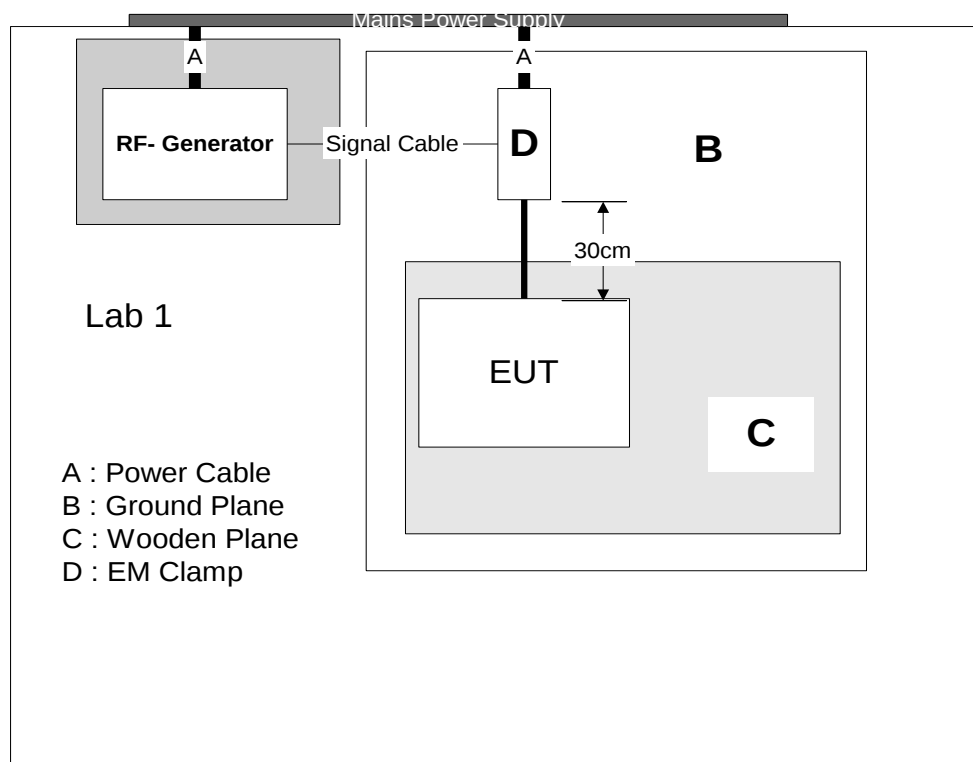
2025.05.15

2.9.4 Test Method

The equipment under test was configured, on but insulated from, using a 0.1 m isolator, a horizontal coupling plane fitted to the top of a 0.8 m non-conductive table for table-top equipment; and on a 0.1 m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

All associated cabling was configured, on but insulated from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

Using CDNs, EM Clamps or current clamps as appropriate, the power ports and applicable signal and control ports were subjected to the required, pre calibrated RF injected signal strength, modulated as described, swept over the frequency range of test. During this testing any anomalies in the equipment under tests performance was recorded.



2.9.5 Environmental Conditions

Ambient Temperature 21.4°C
 Relative Humidity 48.2 %
 Atmospheric Pressure 1023.5 mbar

2.9.6 Specification Limits

Required Test Levels Input and output a.c. power ports						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V)	Modulation	Step Size (%)	Dwell (s)	
AC power port	0.15 to 230	3	AM (80 %,1 kHz, sine wave)	1	3	A
For extra low voltage a.c. ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3m according to the manufacturer's functional specification.						

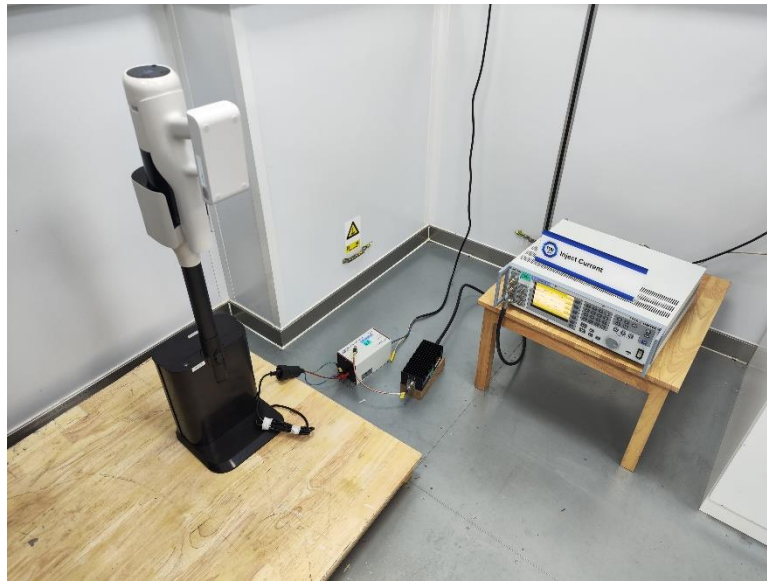
2.9.7 Test Results

Results for Configuration and Mode: Configuration 1 & operation 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Injected current						
Line under test	Test Level	Step	Dwell Time	Coupling Method	Modulation	Result
Power line	3V	1%	3S	CDN	1KHZ 80%	Pass PC A



Test Setup

2.9.8 Test Location

This test was carried out Room 120, SR-C.

2.10 Voltage dips, short interruptions and voltage variations immunity tests

2.10.1 Specification Reference

Refer to 1.3

2.10.2 Equipment Under Test

MDS24HRR

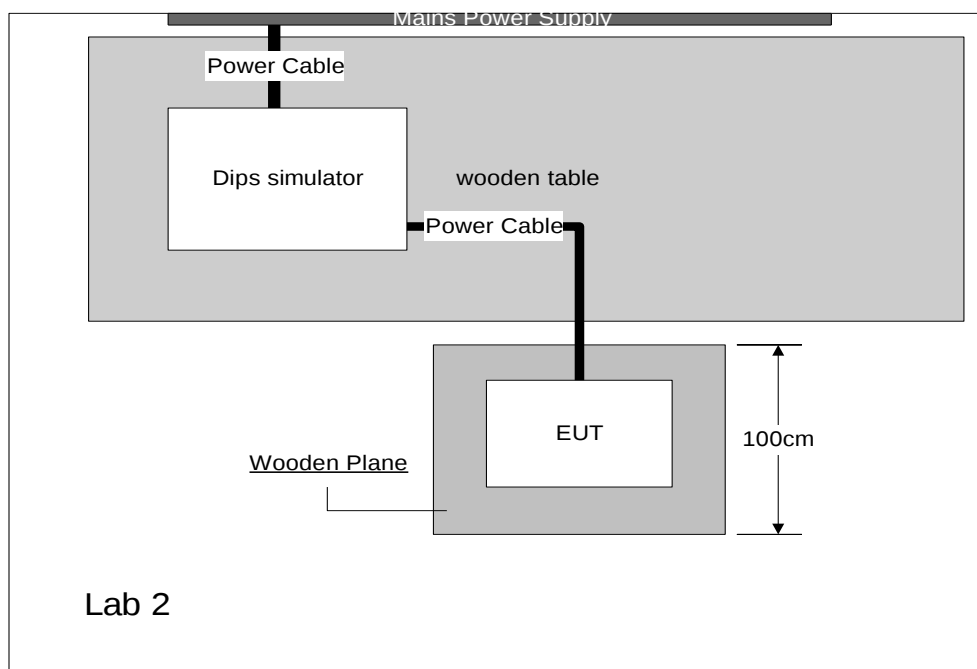
2.10.3 Date of Test

2025.05.15

2.10.4 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.

Using a programmable power supply the equipment under test was subjected to the detailed supply voltage dips and interruptions. The required supply phase synchronization and test repetition rate, detailed, was controlled by the programmable power supply. During this testing any anomalies in the equipment under tests performance was recorded.



2.10.5 Environmental Conditions

Ambient Temperature	21.4°C
Relative Humidity	48.2 %
Atmospheric Pressure	1023.5 mbar

2.10.6 Specification Limits

Voltage dips & interruption				
Voltage Dip in % Ut	Test level in % Ut	Duration		Performance Criteria
		50Hz	60Hz	
100	0	½ cycle	½ cycle	B
60	40	10 cycles	12 cycles	B
30	70	25 cycles	30 cycles	B
Ut is the rated voltage of the Equipment Under Test				

2.10.7 Test Results

Results for Configuration and Mode: Configuration 1 & operation 1

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Tabulated Results for Voltage Dip and Short Interruption					
Line under test	Vnom	Operating Frequency	Test Level	Duration	Result
Power line	230 Vac	50 Hz	0% of Vnom	½ cycle	Pass PC A
Power line	230 Vac	50 Hz	40% of Vnom	10 cycles (50Hz)	Pass PC A
Power line	230 Vac	50 Hz	70% of Vnom	25 cycles (50Hz)	Pass PC A



Test Setup

2.10.8 Test Location

This test was carried out in Room 120, SR-C.

3 Test Equipment Information

3.1 General Test Equipment Used

Instrument	Manufacturer	Type No	TE No	Calibration Date	Calibration Due
Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESW8	487/631911	2025.03.13	2026.03.12
LISN	Schwarzbeck	NSLK8127	487/601428	2024.09.02	2025.09.01
Disturbance Power					
EMI Test Receiver	Rohde & Schwarz	ESW8	487/631911	2025.03.13	2026.03.12
Clamp	Schwarzbeck	MDS21	487/601425	2024.11.23	2025.11.22
Harmonic and Flicker					
AC Power Supply Testing System	California Instruments	MX45-3PI	487/681243	2024.09.02	2025.09.01
Immunity					
ESD Simulator	HAEFELY	ONYX 30	487/751520	2025.03.31	2026.03.30
EFT/BURST Generator	EM TEST	UCS 500N5E	487/751219	2025.03.31	2026.03.30
SURGE Generator	EM TEST	UCS 500N5V	487/751218	2025.03.31	2026.03.30
RF-Generator	EM test	NSC-4070C-80	487/752227	2025.03.31	2026.03.30
Coupling/decoupling Network	TeseQ	CDN M0216S	487/571842	2024.09.02	2025.09.01
Voltage Drop Generator	EM test	UCS500N5-PFS	487/751117	2024.11.23	2025.11.22

EMC Testing software

software	version	Testing items
EMC32	10.6	Conducted Emission; Disturbance Power; Radiated Emission; Radiated, radio-frequency, electromagnetic field immunity test
ICD CONTROL	7.1.2	Immunity to conducted disturbances, induced by radio-frequency fields

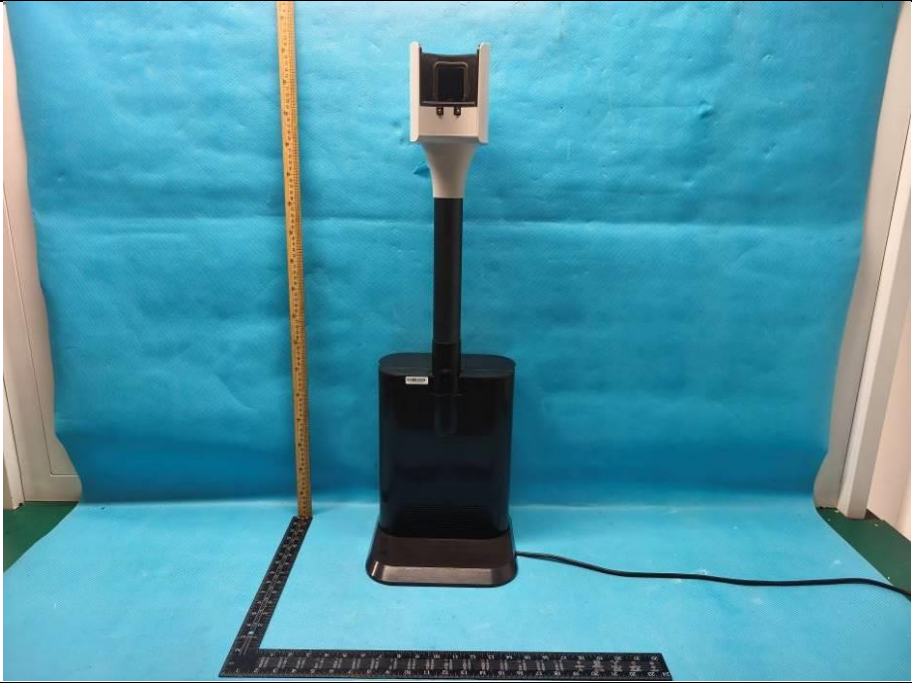
4 Measurement Uncertainty

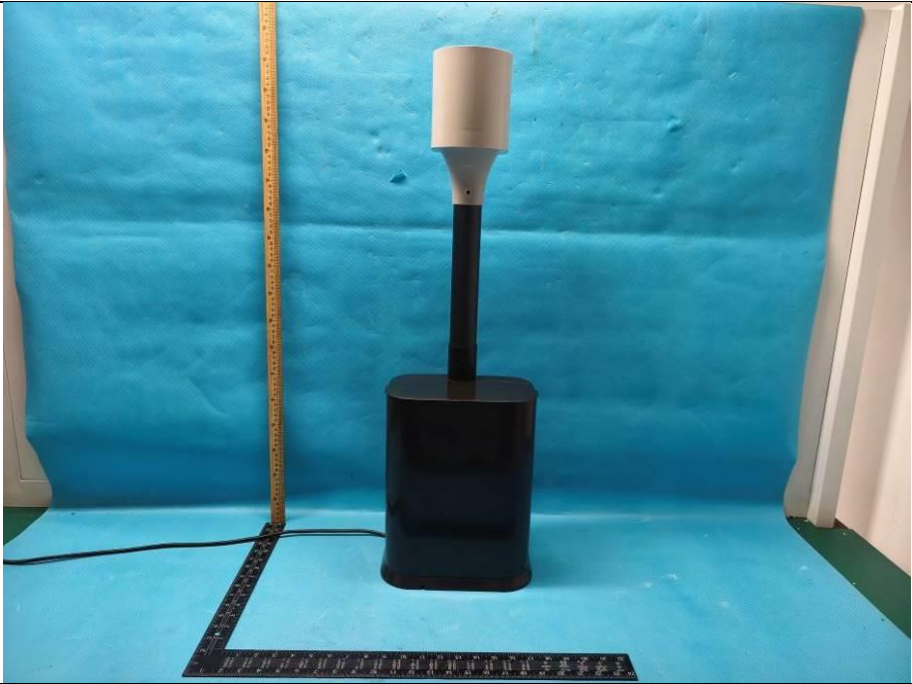
For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.07dB
Disturbance Power	30MHz to 300MHz, Clamp, 2.43dB
Radiated Disturbance	30MHz to 1GHz, Horizontal:4.12dB, Vertical: 4.30dB
Harmonic current emission	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2.
Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-3.
Electrostatic discharge immunity test	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2.
Radiated, radio-frequency, electromagnetic field immunity test	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-3.
Electrical fast transient /burst immunity test	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4.
Immunity to conducted disturbances, induced by radio-frequency fields	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-6.
Surge immunity test	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5.
Voltage dips, short interruptions and voltage variations immunity tests	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11.

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3.

5 Photographs

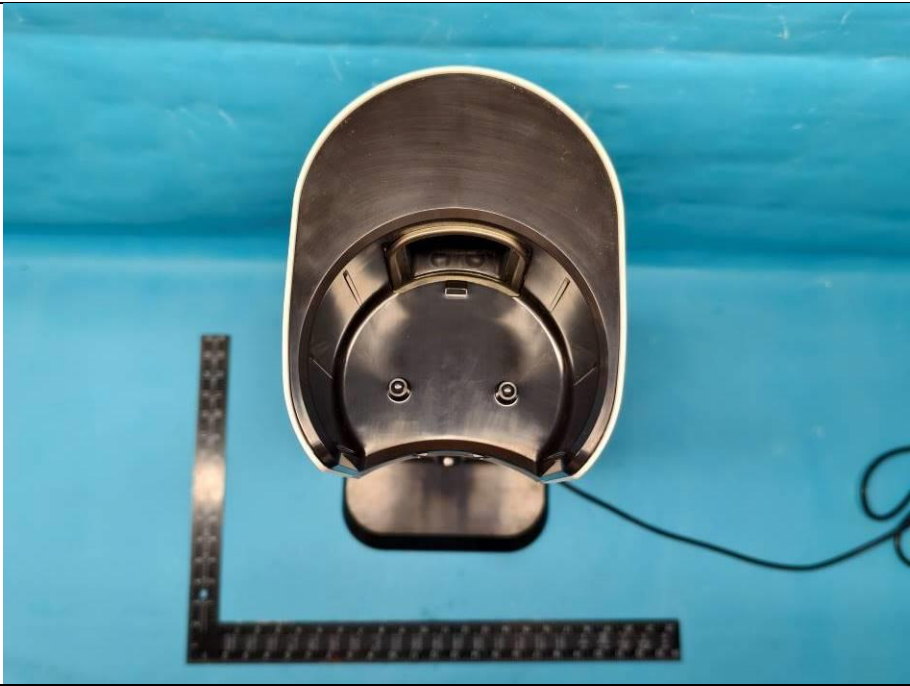
Details of:	Overview
View: ☐ General ☒ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

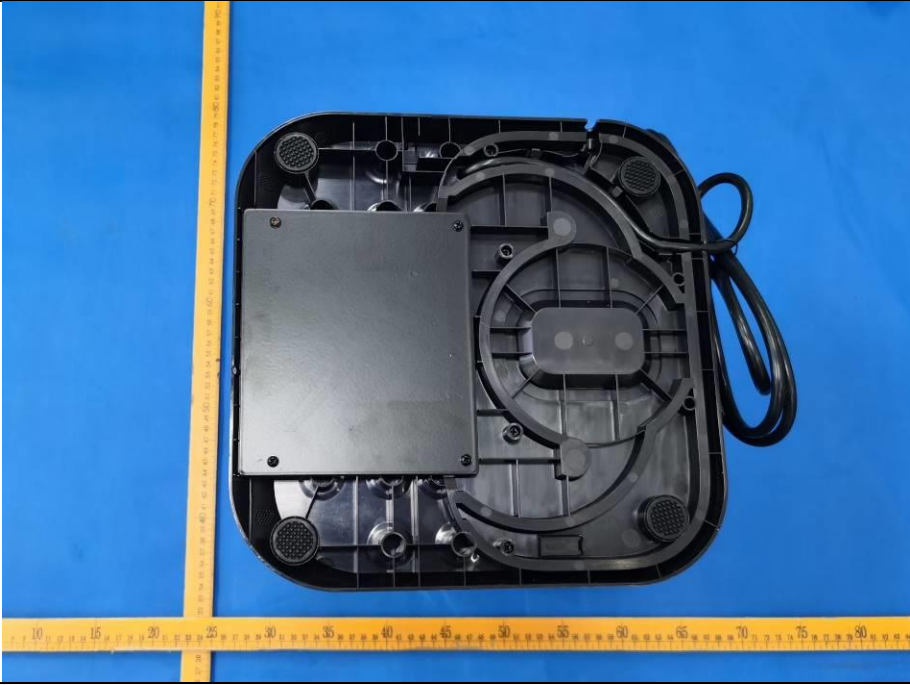
Details of:	Overview
View: ☐ General ☐ Front ☒ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

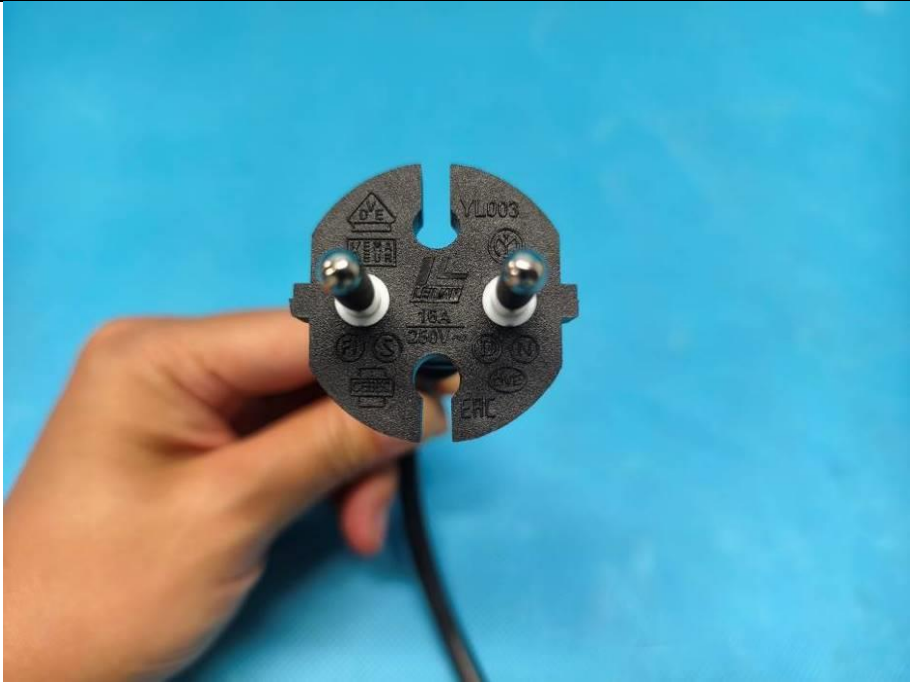


Details of:	Overview
View: ☐ General ☐ Front ☐ Rear ☐ Right ☒ Left ☐ Top ☐ Bottom	

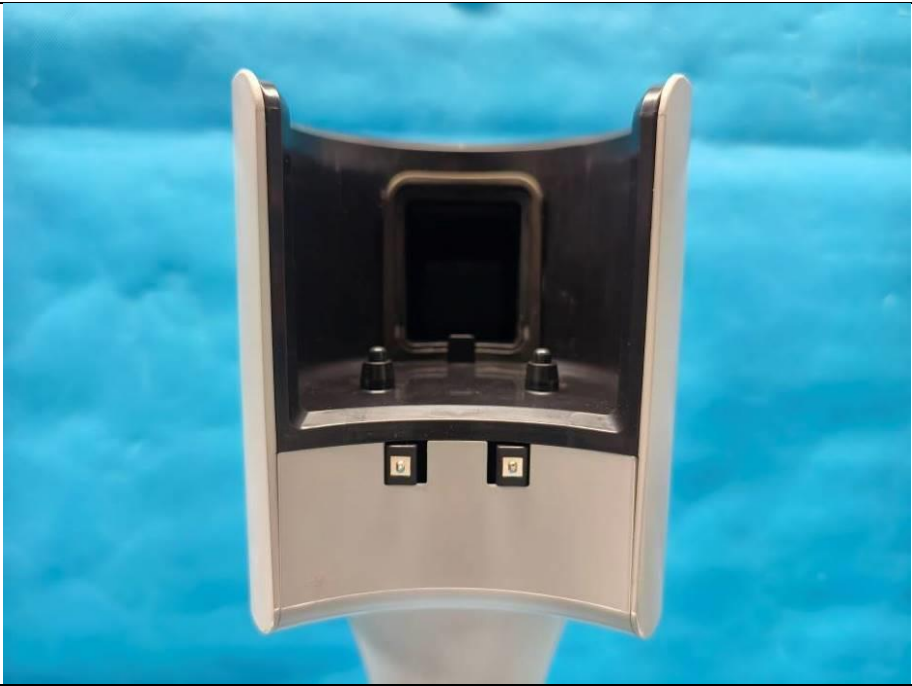
Details of:	Overview
View: ☐ General ☐ Front ☐ Rear ☒ Right ☐ Left ☐ Top ☐ Bottom	

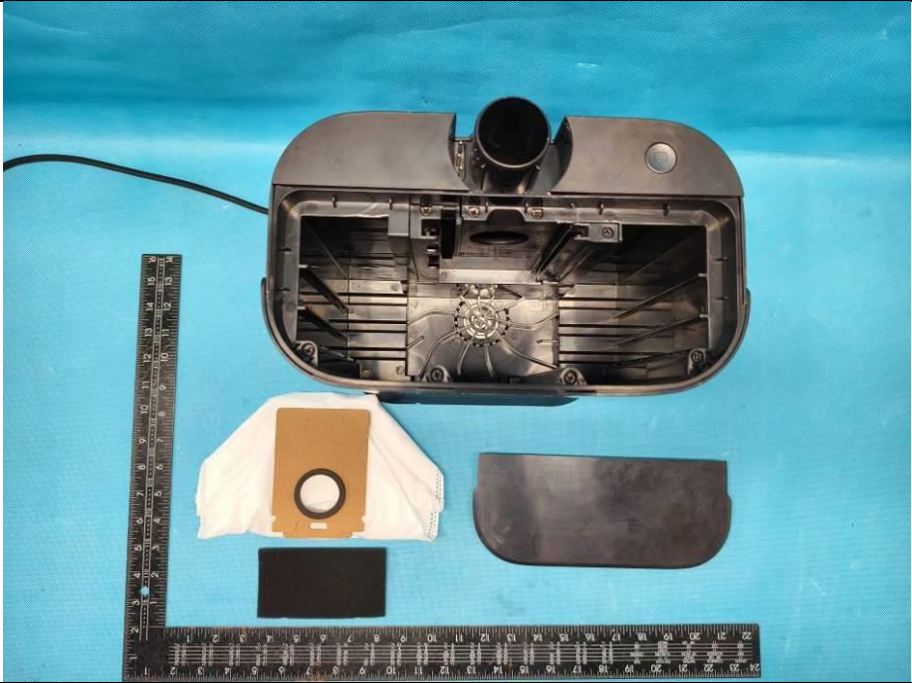
Details of:	Overview
View: ☐ General ☐ Front ☐ Rear ☐ Right ☐ Left ☒ Top ☐ Bottom	

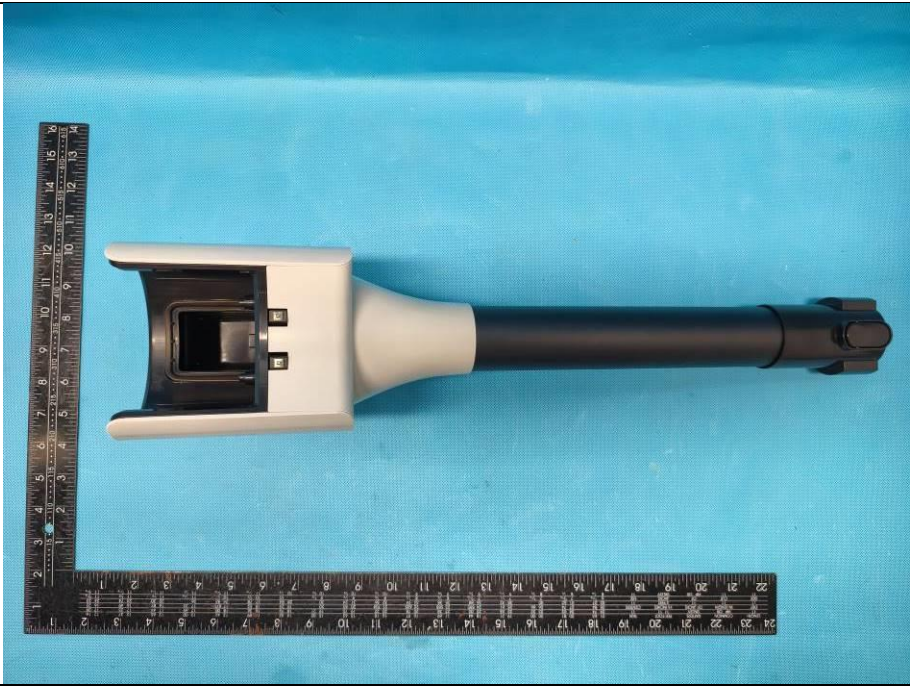
Details of:	Overview
View: ☐ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☒ Bottom	

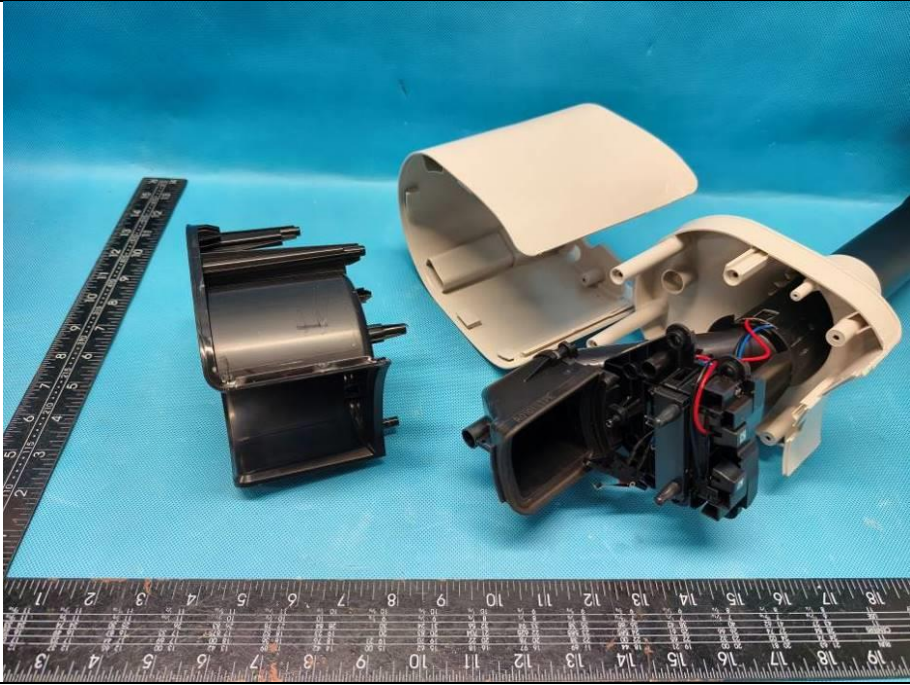
Details of: Power plug	
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of: Power cord	
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

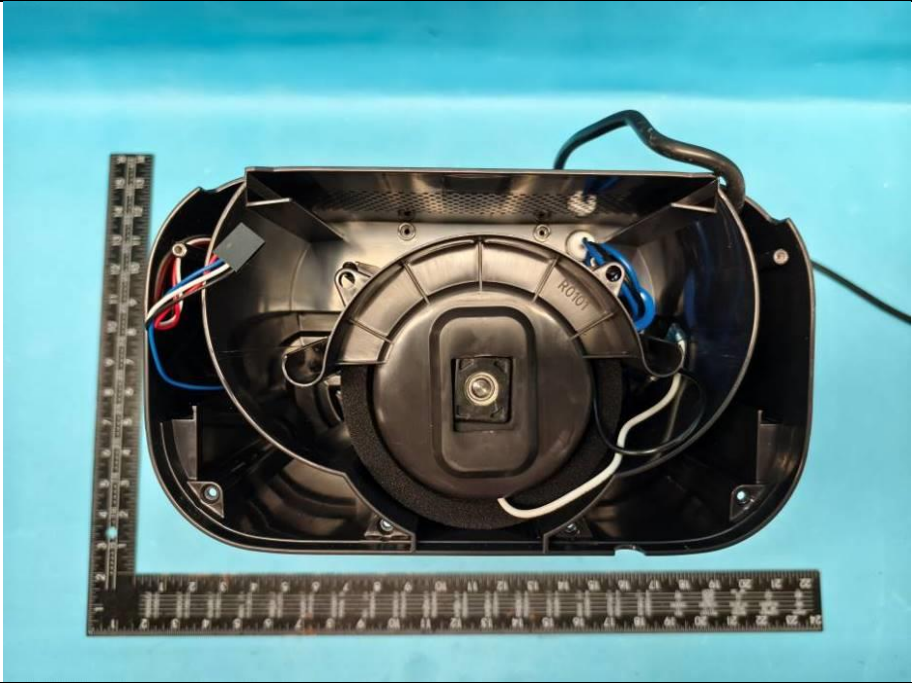
Details of:	Charging port
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

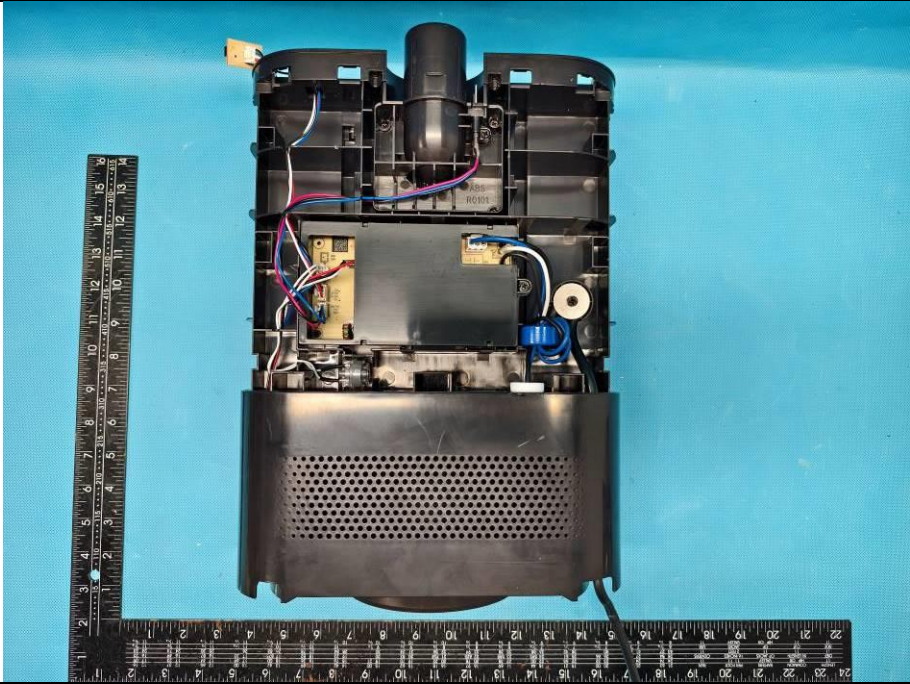
Details of:	Charging Connection Rod & Dust bag removed
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

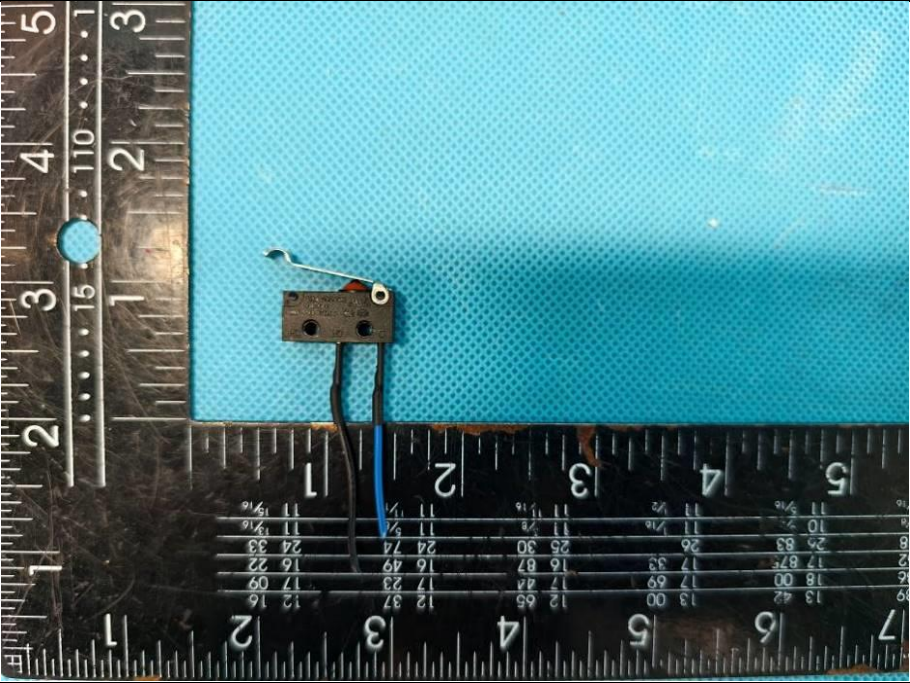
Details of:	Charging Connection Rod
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph showing the Charging Connection Rod against a blue background. The rod has a white plastic handle with a black rectangular opening and a black shaft. A metal ruler is placed vertically and horizontally next to the rod for scale.

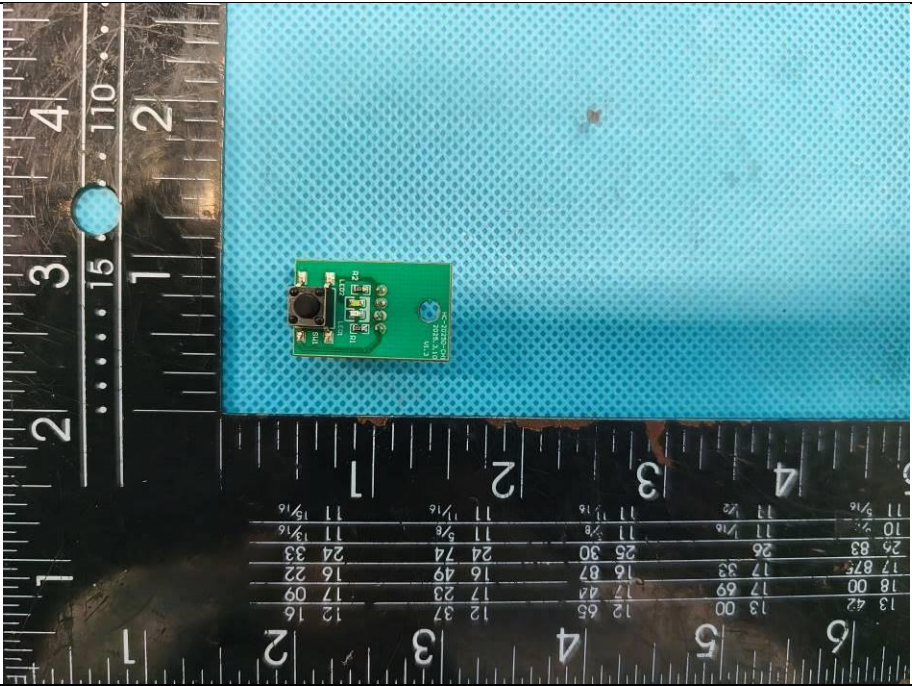
Details of:	Internal view
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph showing the internal components of the Charging Connection Rod. The white plastic handle is open, revealing the internal mechanism, including a black plastic housing, a metal spring, and a small red wire. A metal ruler is placed vertically and horizontally next to the components for scale.

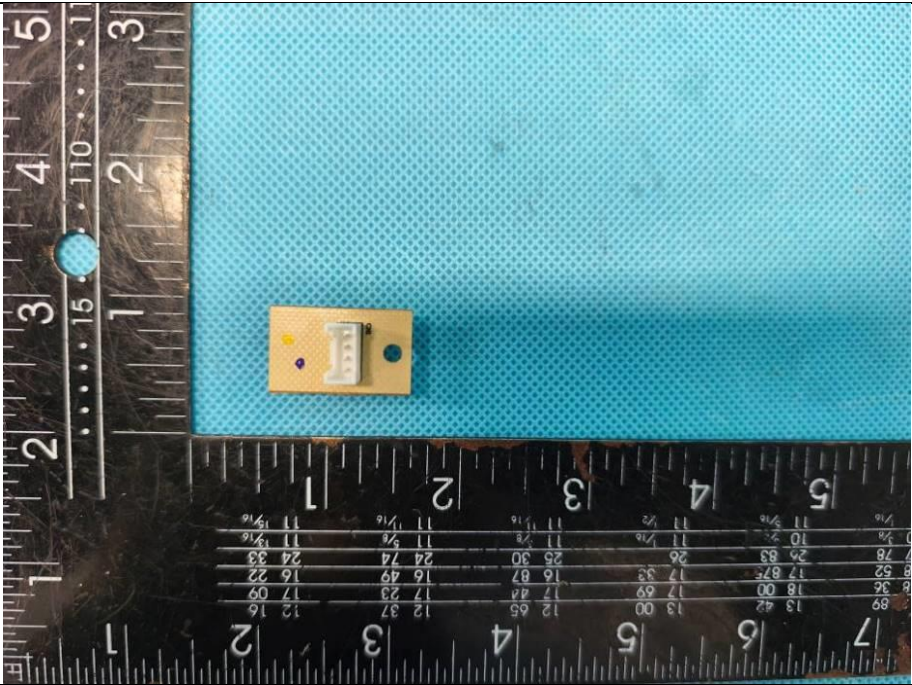
Details of:	Internal view
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph showing the internal components of a black, rectangular electronic device. The device is open, revealing a circular component with a central square opening and various internal wiring. A ruler is placed horizontally below the device for scale. The background is a light blue surface.

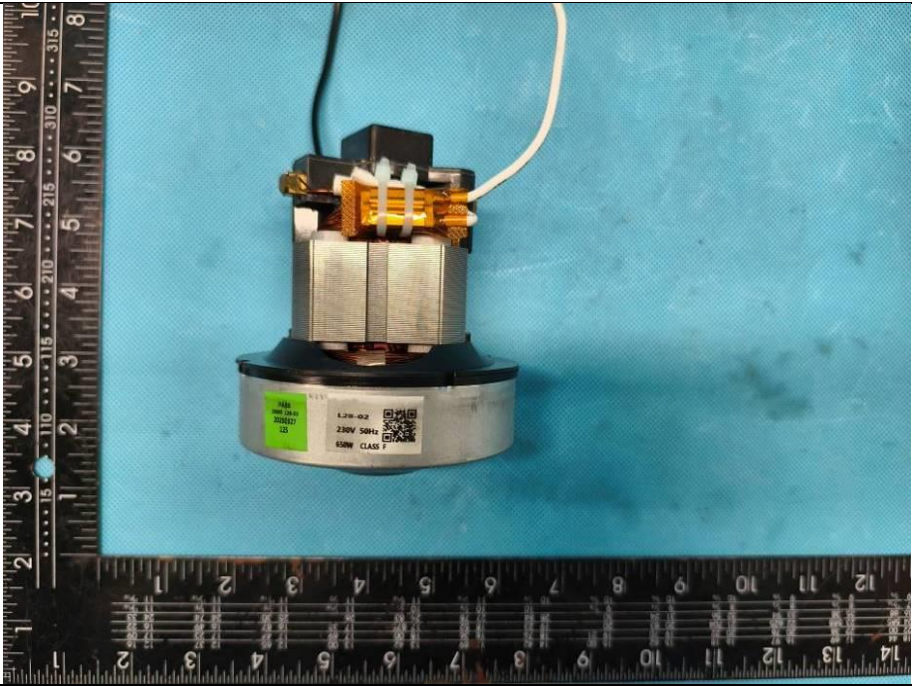
Details of:	Internal view
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph showing the internal components of a black, rectangular electronic device. The device is open, revealing a circular component with a central square opening and various internal wiring. A ruler is placed horizontally below the device for scale. The background is a light blue surface.

Details of:	Internal view
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

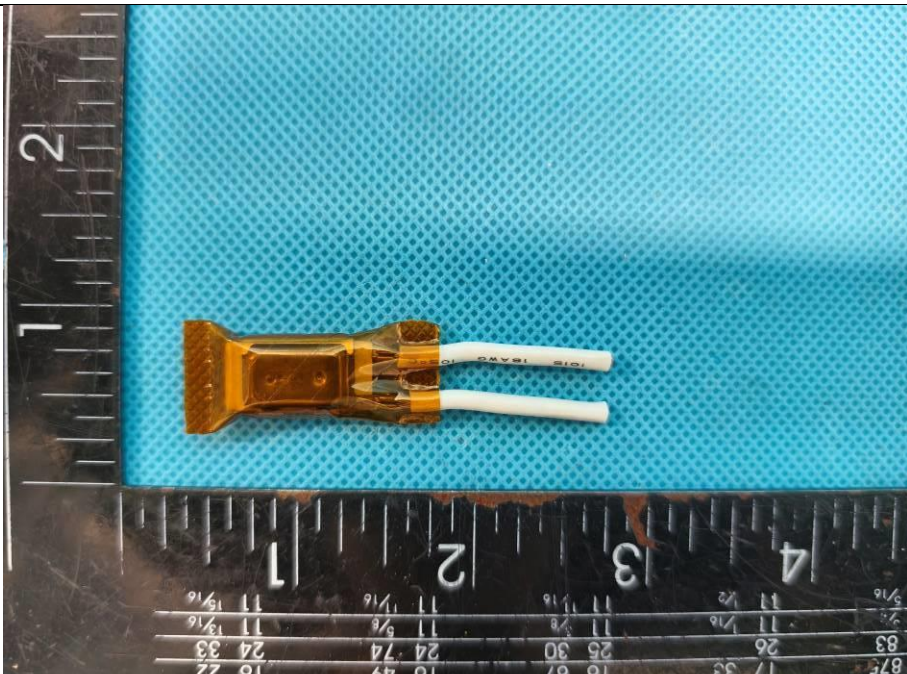
Details of:	Micro Switch
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

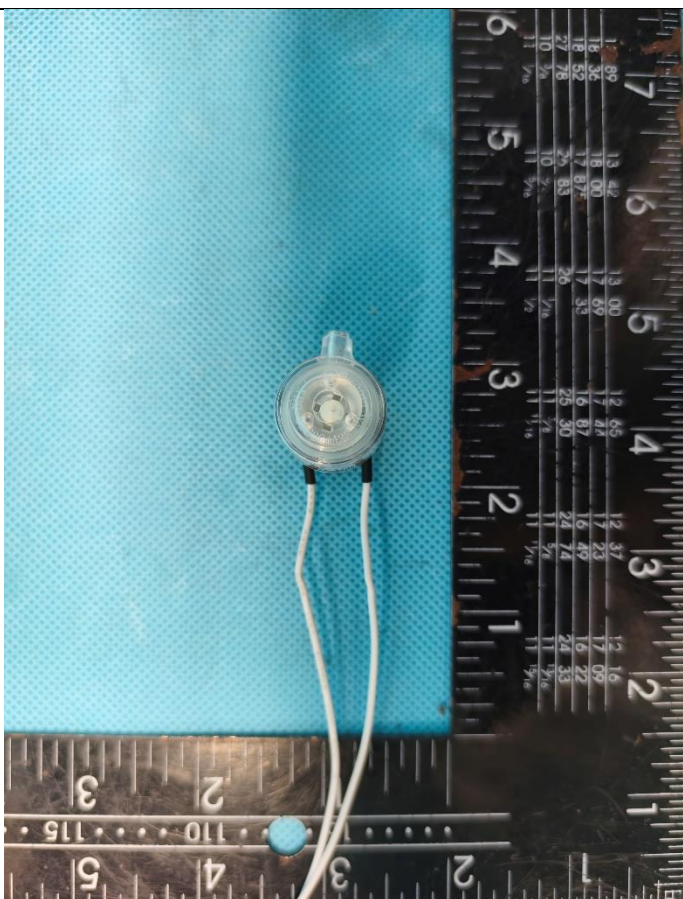
Details of:	Control PCB
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	Control PCB
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

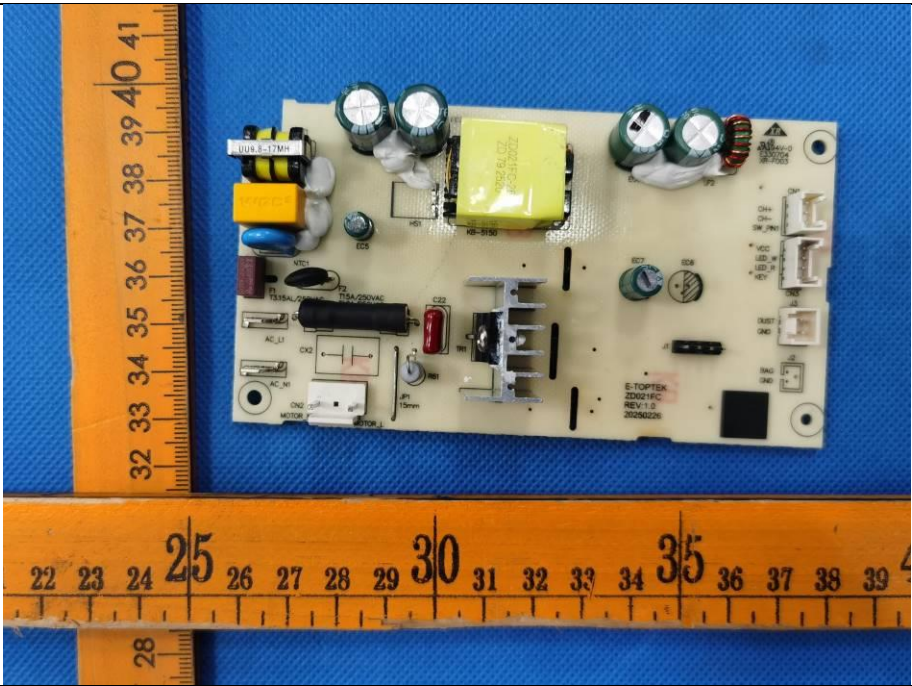
Details of:	Motor (L28-02)
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

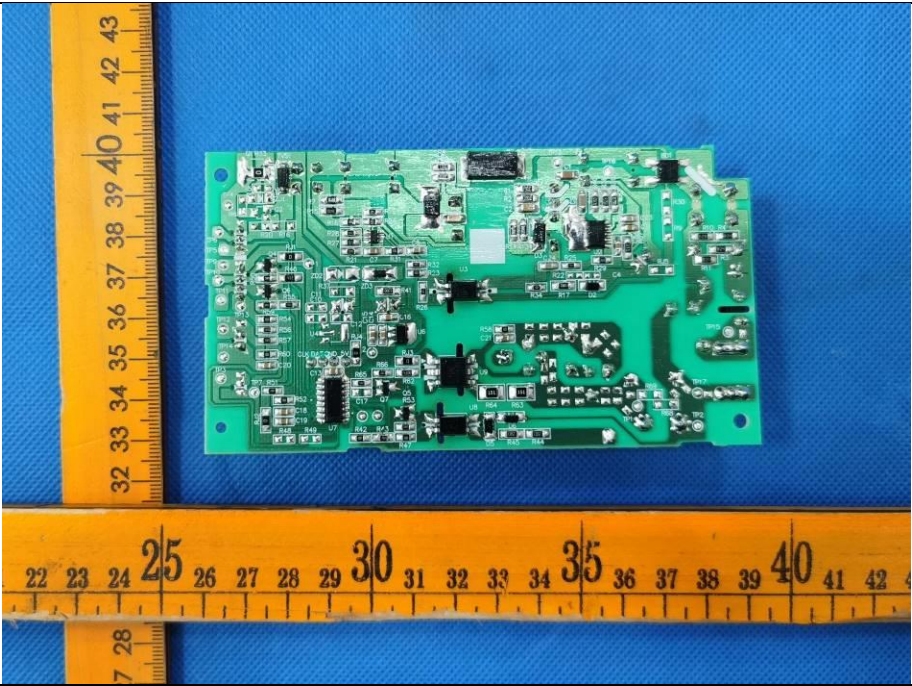
Details of:	Motor (L28-02)
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	Thermal cut-out of suction motor
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of a thermal cut-out component for a suction motor. The component is a small, rectangular, gold-colored metal piece with two white wires extending from one end. It is placed on a blue textured surface next to a metal ruler for scale. The ruler shows markings in inches and centimeters.

Details of:	Sensor
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of a sensor component. The sensor is a small, cylindrical, clear plastic device with two white wires extending from the bottom. It is placed on a blue textured surface next to a metal ruler for scale. The ruler shows markings in inches and centimeters.

Details of:	Main PCB with box
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of a main printed circuit board (PCB) assembly. The board is dark-colored and rectangular, with various electronic components and connectors visible. It is placed on a blue textured surface. A black ruler is positioned vertically to the left of the board, and a white ruler is positioned horizontally below it, providing scale for the components.

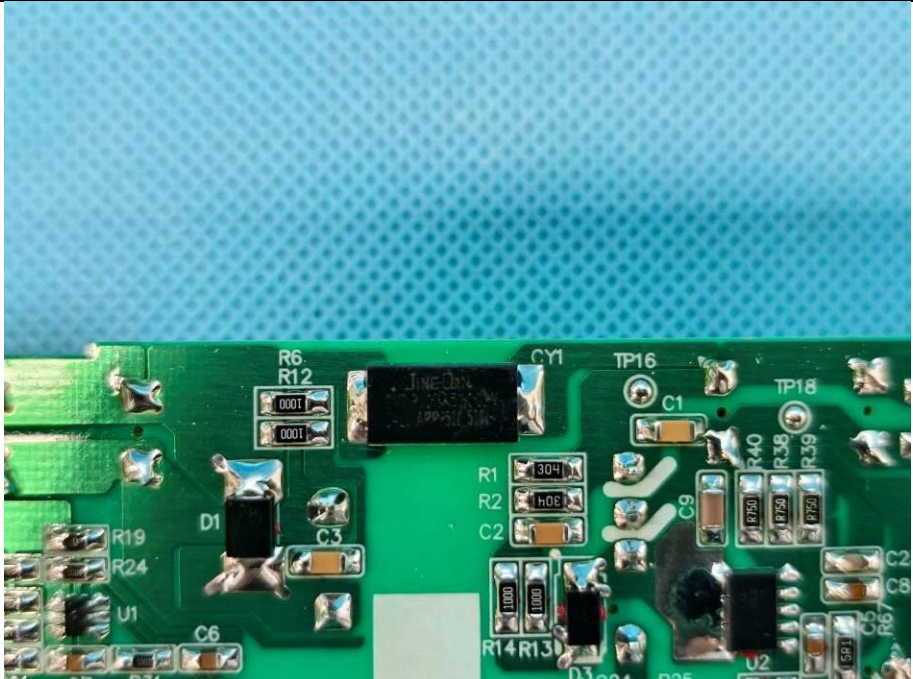
Details of:	Power supply board
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of a power supply board. The board is light-colored and populated with various electronic components, including capacitors, resistors, and integrated circuits. It is placed on a blue textured surface. A yellow ruler is positioned vertically to the left of the board, and a white ruler is positioned horizontally below it, providing scale for the components.

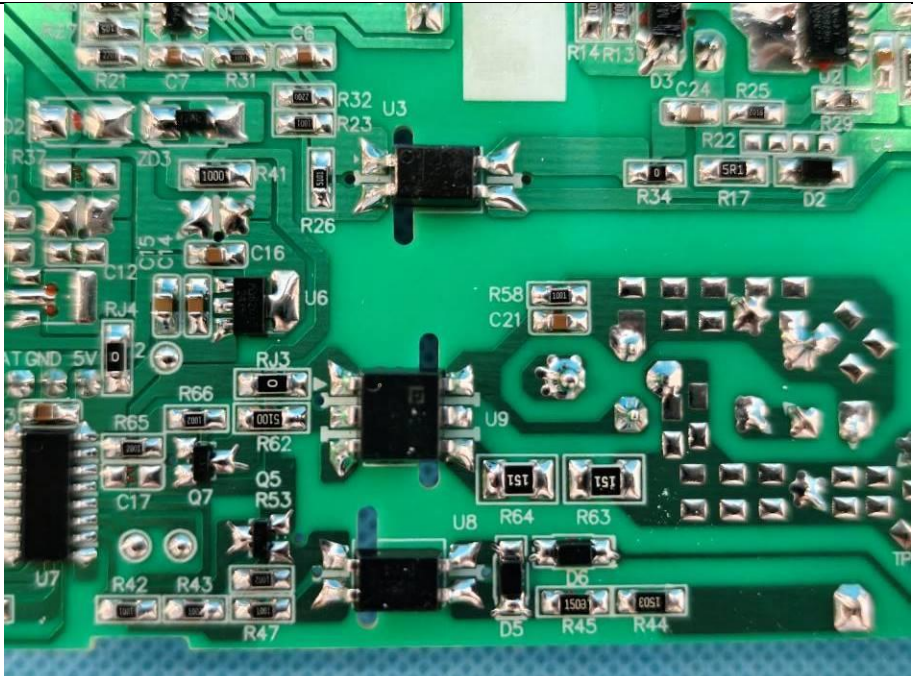
Details of:	Power supply board
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	Fuse
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	X capacitor
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of an electronic circuit board (PCB) featuring various components. In the center, there is a large yellow rectangular X capacitor labeled 'WDC MPX X2 375/300/210VAC 41A 50/60/55/8'. To its right are two large blue electrolytic capacitors. In the foreground, there is a black cylindrical component labeled '471BE' and a small green electrolytic capacitor labeled 'EC5'. Other components include a blue capacitor, a red capacitor, and a white ceramic component. The PCB is populated with various other electronic components, including resistors and integrated circuits.

Details of:	Varistor
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	 A photograph of an electronic circuit board (PCB) featuring various components. In the center, there is a black cylindrical component labeled 'MF 72 1.5D9'. To its right are two large blue electrolytic capacitors. In the foreground, there is a black cylindrical component labeled '471BE' and a small green electrolytic capacitor labeled 'EC5'. Other components include a blue capacitor, a red capacitor, and a white ceramic component. The PCB is populated with various other electronic components, including resistors and integrated circuits.

Details of:	Y capacitor
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	Opto-coupler
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	



Details of:	Transformer
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	

Details of:	Transformer
View: ☒ General ☐ Front ☐ Rear ☐ Right ☐ Left ☐ Top ☐ Bottom	