

RF Exposure Evaluation

Client Information:

Applicant: Otter Products, LLC.
Applicant add.: 209 South Meldrum, Fort Collins, Colorado 80521, United States
Manufacturer: Hamedata Technology Co., Limited
Manufacturer add.: 1-3F & 6-8F, BLDG#A, Changfang Industrial Park, No.2 Guihua 5th Road,
Pingshan District, Shenzhen

Product Information:

Product Name: Power Bank
Model No.: OBFTC-0178-A
Brand Name: N/A
FCC ID: 2AEEV-OBFTC-0178-A

Applicable standards: FCC CFR 47 PART 1, § 1.1310
KDB 680106 D01 Wireless Power Transfer v04

Prepared By:

Guangdong Asia Hongke Test Technology Limited

B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District,
Shenzhen, Guangdong, China

Tel.: +86 0755-230967639 Fax.: +86 0755-230967639

Date of Receipt: Jul. 12, 2024

Date of Test: Jul. 12, 2024 ~ Jul. 23, 2024

Date of Issue: Jul. 23, 2024

Test Result: Pass

This device described above has been tested by Guangdong Asia Hongke Test Technology Limited and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Note: This report shall not be reproduced except in full, without the written approval of Guangdong Asia Hongke Test Technology Limited, this document may be altered or revised by Guangdong Asia Hongke Test Technology Limited, personal only, and shall be noted in the revision of the document. This test report must not be used by the client to claim product endorsement.

Reviewed by: _____

Leon.yi

Approved by: _____

Sean She



TABLE OF CONTENTS

1	TEST FACILITY	4
1.1	Deviation from standard	4
1.2	Abnormalities from standard conditions	4
1.3	Test Location	4
2	GENERAL INFORMATION	5
2.1	Coil Specifications	6
2.2	Coil Size	6
2.3	Location(s) – Coil to the outer surface of the enclosure(s)	7
3	TEST METHODOLOGY	8
3.1	Measuring Standard	8
3.2	Requirements	8
3.3	Test Setup	9
3.4	Test Procedure	10
4	Equipment Approval Considerations	11
4.1	Description of the test mode	12
4.2	Peripheral List	12
4.3	Test Instruments list	12
4.4	Duty Cycle	13
4.5	Compliance Location: Center vs Tip-Surface of the Probe	14
4.6	Test Result	16
5	Test Setup photo	19



Revision History

Revision	Issue Date	Revisions	Revised By
00	Jul. 23, 2024	Initial Issue	Sean She

1 TEST FACILITY

The test facility is recognized, certified or accredited by the following organizations:

FCC-Registration No.: 251906 Designation Number: CN1376

Guangdong Asia Hongke Test Technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC —Registration No.: 31737 CAB identifier: CN0165

The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737

A2LA-Lab Cert. No.: 7133.01

Guangdong Asia Hongke Test Technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

1.1 Deviation from standard

None

1.2 Abnormalities from standard conditions

None

1.3 Test Location

Guangdong Asia Hongke Test Technology Limited

Address: B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Tel.: +86 0755-230967639 Fax.: +86 0755-230967639

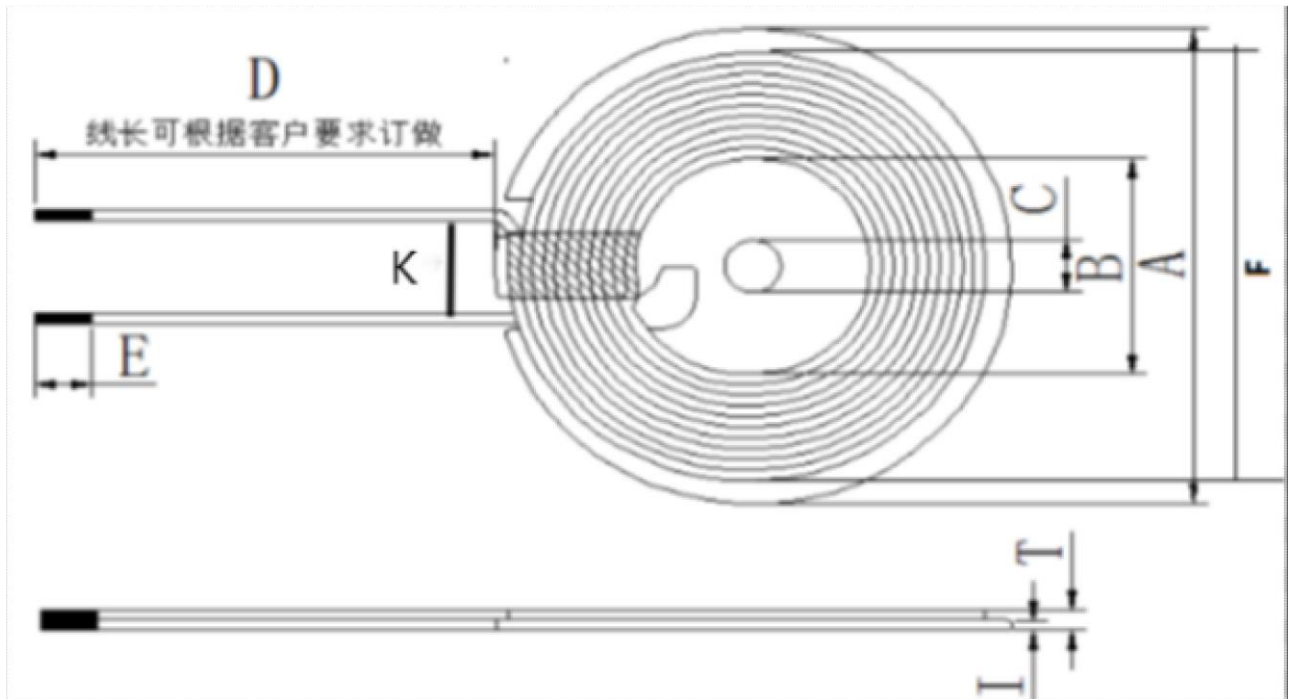
2 GENERAL INFORMATION

EUT Name:	Power Bank
Model No:	OBFTC-0178-A
Serial Model:	N/A
Test sample(s) ID:	AiTDG-240712013-1
Sample(s) Status:	Engineer sample
Operation frequency:	111kHz-205kHz
Modulation Technology:	ASK
Antenna Type:	loop coil Antenna
Antenna gain:	0dBi
Hardware version.:	N/A
Software version.:	N/A
Power supply:	Battery Capacity: 5000mAh/3.7V/18.5Wh Type-C Input: 5V=3A 9V=2A Output: Wireless charging 7.5W Type-C Output: 5V=2.4A Output: 12W(Max)
Model different:	N/A
Note:	For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.1 Coil Specifications

Item	Parameter
Input inductance:	L0A (Individual coils) = $3.8\mu\text{H} \pm 20\%$ L0A(Coil + magnetic sheet) = $6.8\mu\text{H} \pm 10\%$
Material of enclosure(s):	Hot Air stranded Wire
Number of turns:	Transmitter 1: 11 turns

2.2 Coil Size



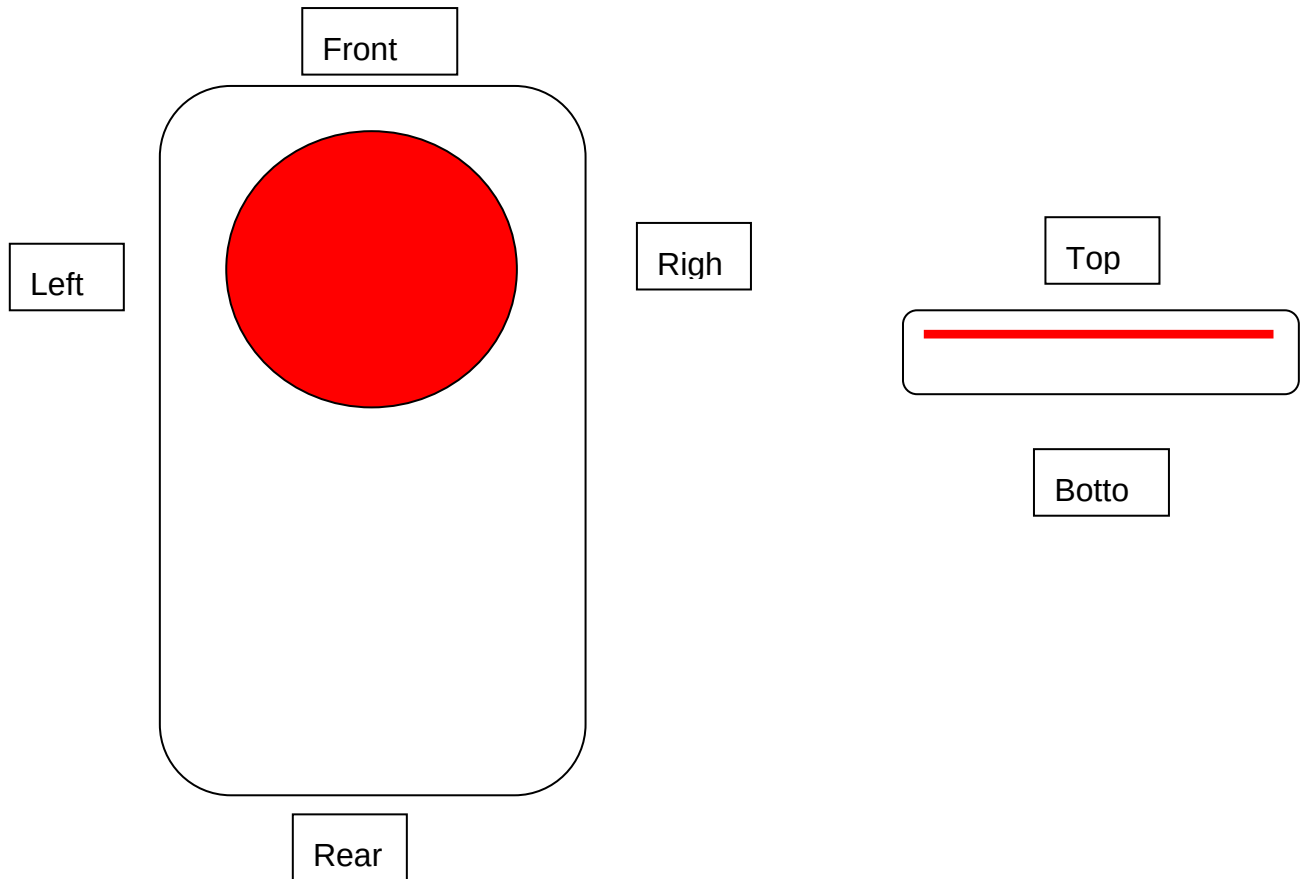
Unit: mm

A	B	C	D	E	F	I	T	K
43.5 ± 0.5	18 ± 0.5	5.3 ± 0.5	35 ± 2	2-5	39.5 ± 1.2	0.6 ± 0.1	1.5Max	≤ 5

2.3 Location(s) – Coil to the outer surface of the enclosure(s)

Unit: mm

Front A	Rear B	Left C	Right D	Top E	Bottom F
45	8	10	10	3	7



3 TEST METHODOLOGY

3.1 Measuring Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines. According to §1.1310 and §2.1091 RF exposure is calculated. According KDB680106 D01: KDB 680106 D01 Wireless Power Transfer v04.

3.2 Requirements

According to the item 3 of KDB 680106 D01v04:

Inductive wireless power transfer applications that meet all of the following requirements are excluded from submitting an RF exposure evaluation.

- (1) Mobile Device and Portable Device Configurations
- (2) Equipment Authorization Procedures for Devices Operating at Frequencies Below 4 MHz
- (3) The aggregate H-field strengths anywhere at or beyond 15 cm surrounding the device, and 20 cm away from the top surface.

Limits

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

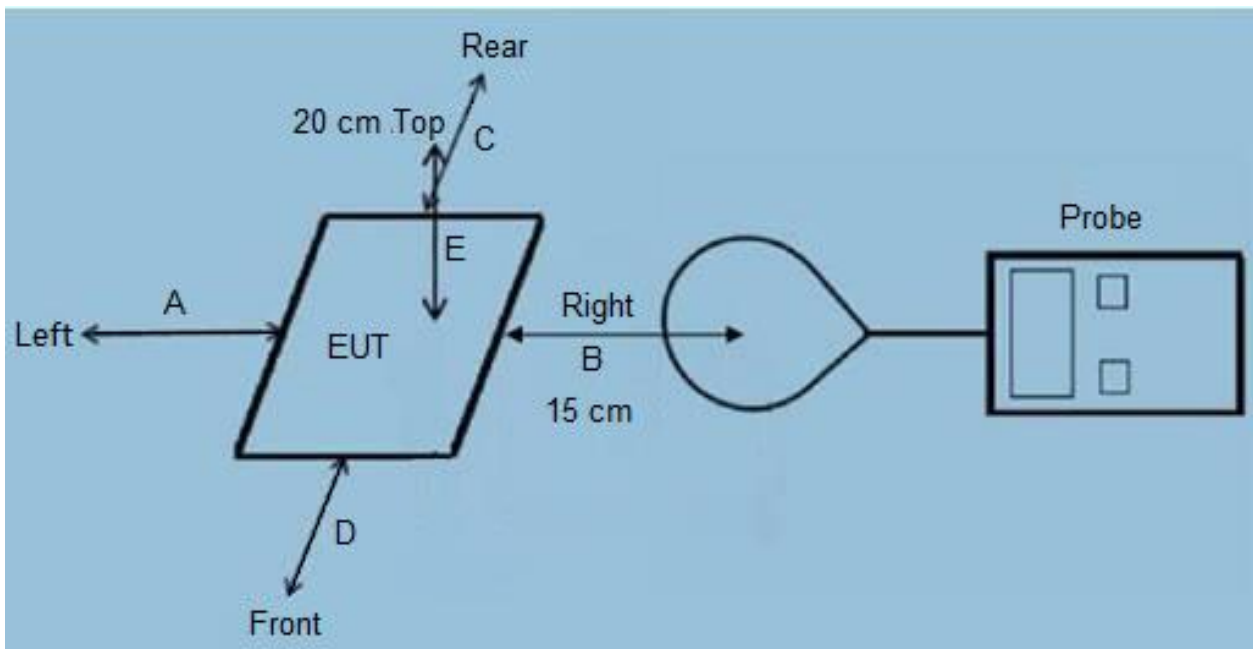
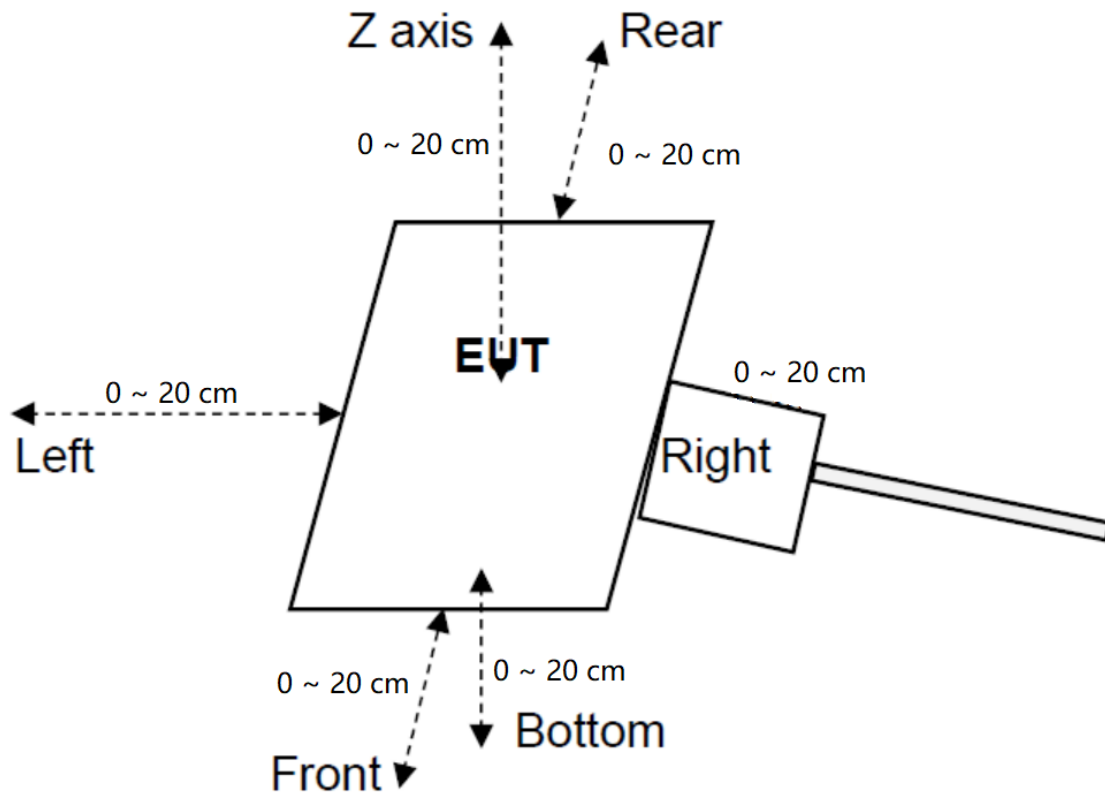
F=frequency in MHz
 f=Plane-wave equivalent power density
 RF exposure compliance will need to be determined with respect to 1.1307(c) and (d) of the FCC rules. The emissions should be within the limits at 300kHz in Table 1 of 1.1310(use the 300kHz limits for 150kHz:614V/m,1.63A/m).

Note 1: f = frequency in MHz; *Plane-wave equivalent power density

Note 2: For the applicable limit, see FCC 1.1310, 680106 D01 RF Exposure Wireless Charging Apps v03

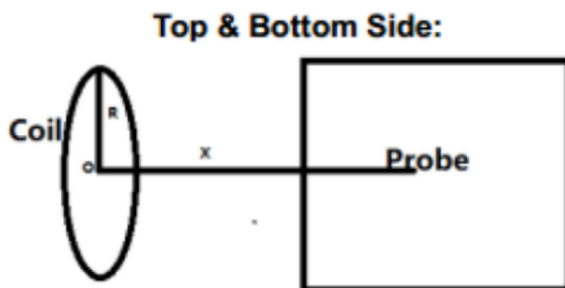
Note 3: Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m. A KDB inquiry is required to determine the applicable exposure limits below 100 kHz.

3.3 Test Setup

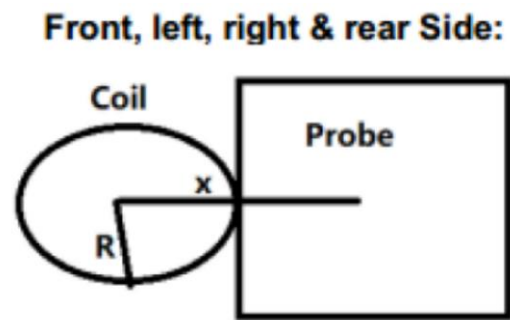


3.4 Test Procedure

- 1) The RF exposure test was performed in anechoic chamber.
- 2) The measurement probe was placed at test distance (2cm increments from 0 ~ 20 cm for all sides for portable mode, 15 cm from all sides and 20 cm from the top for mobile mode) which is between the edge of the charger and the geometric edge of probe.
- 3) The highest emission level was recorded and compared with limit as soon as measurement of each points (A, B, C, D, E, F) were completed.
- 4) The EUT was measured according to the dictates of KDB 680106 D01 Wireless Power Transfer v04.
- 5) According to the requirements of KDB 680106 D01 v04, If the center of the probe sensing element is located more than 5mm from the probe outer surface, the field strengths need to be estimated through modeling for those positions that are not reachable. (The sensitive elements are located approximately 18.5 mm below the external surface specified in user manual of MAGPy-8H3D+E3D)
- 6) Use Biot-Savart Law, the value of 0 cm can be estimated through the results of 2 cm, according to the formula:



$$B = \frac{\mu_0 * I * N * R^2}{2 * (R^2 + x^2)^{3/2}}$$



$$B = \frac{\mu_0 * I * N}{2 * x}$$

Remark:

B: H-field (Unit:T)

μ_0 : Space permeability = $4\pi \times 10^{-7}$

I (Unit: A):The current element passing through a radiated coil

R: Radius of radiated coil, according to the coil specification: R=0.01975m

X: The distance from the sensing elements of the probe to the edge of the radiated coil (the dimensions of EUT and load are take into account), (Unit: m)

N: Turns of the radiated coil, according to the coil specification: N=11.

4 Equipment Approval Considerations

The EUT does comply with KDB 680106 D01 as follow table.

Requirements of section 5 of KDB 680106 D01	Yes / No	Description
Mobile Device and Portable Device Configurations	Yes	Mobile Device or Portable Device
Equipment Authorization Procedures for Devices Operating at Frequencies Below 4 MHz	Yes	The device operates in the frequency range 111kHz-205kHz
RF Exposure compliance may be ensured only for a minimum separation distance that is greater than 20 cm, while use conditions at smaller distances can still be considered unlikely.	Yes	Mobile mode: The EUT H-field strengths at 15 cm surrounding the device and 20 cm above the top surface. Portable mode: H-field and E-field measurement taken every 2 cm (starting as close to 20 cm as possible) on each edge/top surface of the host/client pair were also evaluated for portable use conditions.

4.1 Description of the test mode

Equipment under test was operated during the measurement under the following conditions:

Test Mode	Description	
Mode 1	AC Adapter + EUT + phone (Battery Status: < 1%)	Record
Mode 2	AC Adapter + EUT + phone (Battery Status: < 50%)	Record
Mode 3	AC Adapter + EUT + phone (Battery Status: < 99%)	Record
Mode 4	EUT + phone (Battery Status: < 1%)	Record
Mode 5	EUT + phone (Battery Status: < 50%)	Pre-tested
Mode 6	EUT + phone (Battery Status: < 99%)	Pre-tested
Mode 7	Test the EUT in idle mode.	Pre-tested
Note: All test modes were pre-tested, but we only recorded the worst case in this report.		

4.2 Peripheral List

No.	Equipment	Manufacturer	Model No.	Serial No.	Power cord	signal cable
1	Phone	Apple	iPhone 14	N/A	N/A	N/A
2	Adapter	HNT	HNT-QC530	N/A	N/A	N/A

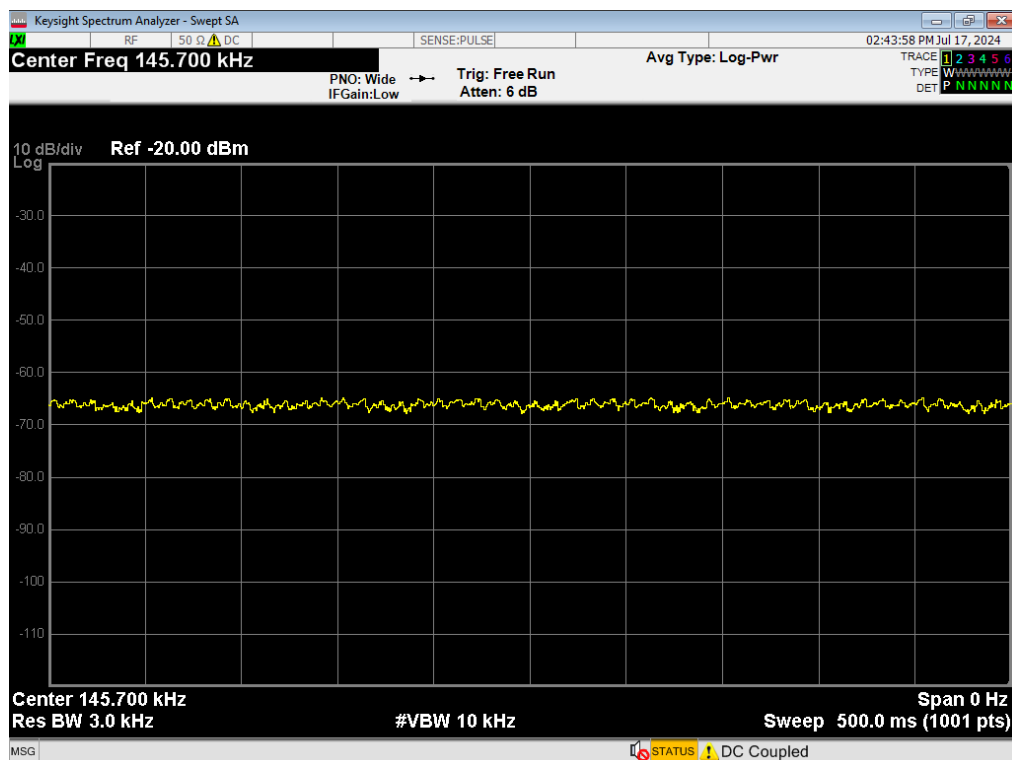
4.3 Test Instruments list

Test Equipment	Manufacturer	Model No.	SN.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Magnetic Amplitude and Gradient Probe System	SPEAG	MAGPy-8H3D+E3D V2.6 & MAGPy-DAS V2.6	3107 & 3097	03.15.2024	03.14.2025

Parameter	Specs
PROBE DESIGN	
Diameter	60 mm
8 isotropic <i>H</i> -field sensors	concentric loops of 1 cm ² arranged at the corner of a cube of 22 mm side length
1 isotropic <i>E</i> -field sensor	orthogonal dipole/monopole (arm length: 50 mm)
Measurement center	18.5 mm from the probe tip
Temperature range	0–40 °C
Dimensions	110 × 635 × 35 mm (MAGPy-8H3D+E3D V2 & MAGPy-DAS V2)
<i>H</i> -FIELD SPECIFICATION	
Frequency range	3 kHz–10 MHz
Measurement range	0.1–3200 A/m, 0.12 μT–4 mT
Gradient range	0–80 T/m/T
<i>E</i> -FIELD SPECIFICATION	
Frequency range	3 kHz–10 MHz
Measurement range	0.08–2000 V/m

4.4 Duty Cycle

Mode	ON Time(ms)	Period(ms)	Duty Cycle(%)
Operating(113kHz-205kHz)	/	/	100



4.5 Compliance Location: Center vs Tip-Surface of the Probe

The following information is from the equipment manual:

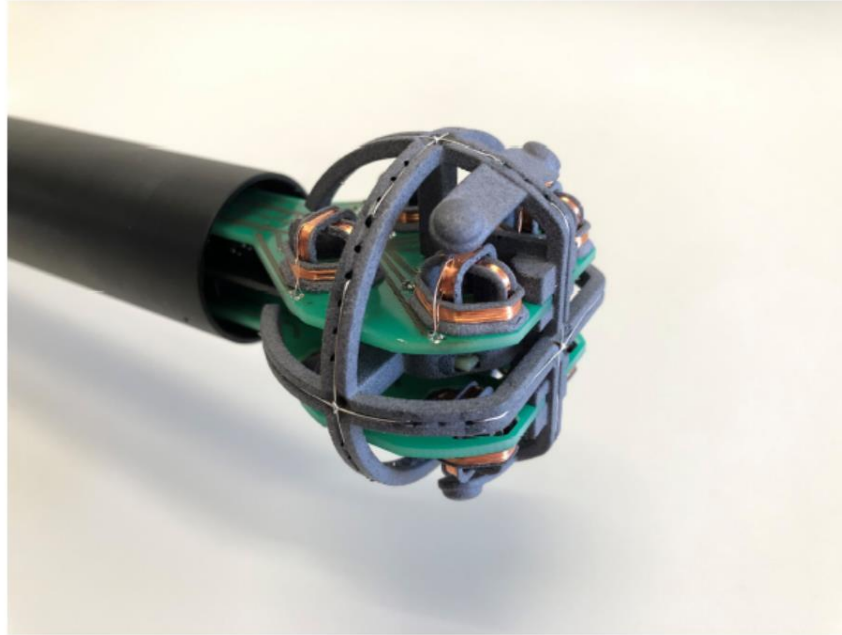


Figure 2.1: MAGPy-8H3D+E3D V2 probe, without the casing

In the MAGPy V2.0 implementation, the H -field is evaluated at the center of the probe (which is 18.5mm above the surface of its tip) and also at the surface of its tip.

In the MAGPy V2.0 implementation, the H -field is evaluated at the center of the probe (which is 18.5 mm above the surface of its tip) and also at the surface of its tip.

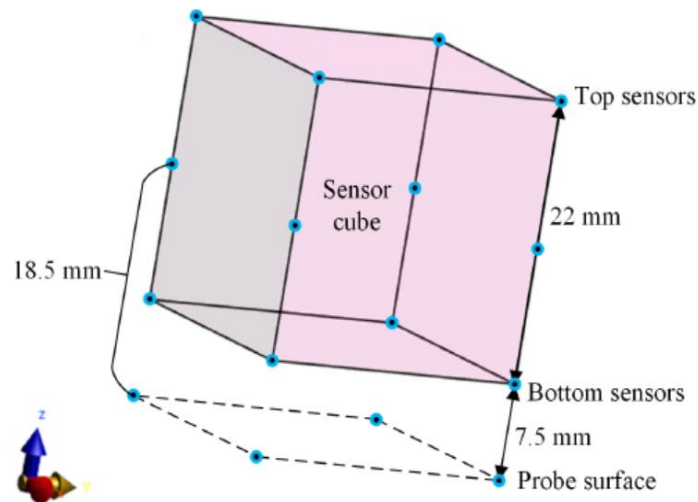


Figure 2.5: Extrapolation of the total H -field at the probe surface is made at each pair of sensors (i.e., bottom and top sensors) around the sensor cube

The total H -field at the tip-surface $H_{tip-surface}$ can be extrapolated using the total H -field measured at the top and bottom sensors (Figure 2.5), H_{top} and H_{bottom} , as well as the normalized H -field gradient G_n . The field extrapolation formula is a polynomial function of G_n ($\Delta d = 18.5$ mm) [7].

$$H_{tip-surface} = \frac{H_{bottom} + H_{top}}{2} \sum_{i=0}^7 c_i (G_n \Delta d)^i \quad (1.6)$$

The polynomial coefficients c_i are given in Table 2.2. They have been determined from simulations of 70 coils covering normalized gradients up to 80 for the 97.5th percentile (Figure 2.6). This provides a conservative estimate of the total H -field at the tip-surface without large overestimation.

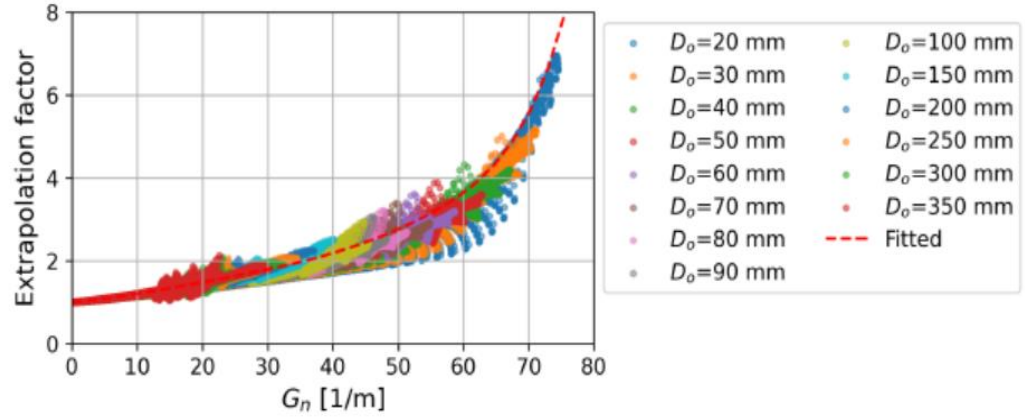


Figure 2.6: Extrapolation factors (i.e., ratios between the simulated results of $H_{tip-surface}$ and $\frac{H_{bottom} + H_{top}}{2}$) plotted as a function of the normalized H -field gradient. The data are from simulations of 70 coils with varying outer diameters D_o and filling ratios (0.1–0.9). The predication of the polynomial function $\sum_{i=0}^7 c_i (G_n \Delta d)^i$ with coefficients fitted for 97.5th percentile (i.e., the red dashed line) is also shown.

Coefficient	Value
c_0	1.00
c_1	1.00
c_2	-1.01
c_3	15.9
c_4	-50.8
c_5	74.7
c_6	-51.4
c_7	13.7

Table 2.2: Coefficients of the polynomial function for the H-field extrapolation to the tip-surface of the probe, determined with 0.975 quantile regression (i.e., the 97.5th percentile)

4.6 Test Result

Mode 1

MPE				
Test distance	Battery levels	Probe from EUT Side	E-field (V/m)	H-field (A/m)
20cm	< 1%	Top	1.281	0.337
15cm	< 1%	Top	1.396	0.452
15cm	< 1%	Left	0.969	0.314
15cm	< 1%	Right	0.957	0.408
15cm	< 1%	Front	1.114	0.361
15cm	< 1%	Rear	1.036	0.342
Limit			614	1.63

Mode 2

MPE				
Test distance	Battery levels	Probe from EUT Side	E-field (V/m)	H-field (A/m)
20cm	< 50%	Top	1.190	0.307
15cm	< 50%	Top	1.351	0.447
15cm	< 50%	Left	0.939	0.294
15cm	< 50%	Right	0.887	0.385
15cm	< 50%	Front	1.103	0.359
15cm	< 50%	Rear	0.988	0.338
Limit			614	1.63

Mode 3

MPE				
Test distance	Battery levels	Probe from EUT Side	E-field (V/m)	H-field (A/m)
20cm	< 99%	Top	1.072	0.301
15cm	< 99%	Top	1.236	0.440
15cm	< 99%	Left	0.861	0.280
15cm	< 99%	Right	0.875	0.349
15cm	< 99%	Front	1.046	0.340
15cm	< 99%	Rear	0.942	0.305
Limit			614	1.63

Note: All test modes were pre-tested, but we only recorded the worst case in this report.

Mode 4

Note: <1%, 50%, >95% load all have been tested, only worse case Max load (<1%) is reported.
H-Filed Strength at (distance 0cm to 20cm at 2cm iteration, i.e. at a distance of 20cm, 18cm, 16cm, ... 0cm, Which is between the edge of the charger and the edge of probe,) surrounding the EUT (A/m)

Test Distance (cm)	Test Position A (A/m)	Test Position B (A/m)	Test Position C (A/m)	Test Position D (A/m)	Test Position E (A/m)	Test Position F (A/m)	Limit (A/m)
2	0.515	0.372	0.152	0.145	0.336	0.381	1.63
4	0.349	0.227	0.101	0.093	0.106	0.124	
6	0.327	0.209	0.099	0.084	0.097	0.121	
8	0.312	0.188	0.098	0.084	0.089	0.120	
10	0.293	0.180	0.094	0.079	0.085	0.119	
12	0.288	0.169	0.090	0.072	0.082	0.109	
14	0.271	0.167	0.085	0.068	0.079	0.103	
16	0.263	0.151	0.082	0.063	0.076	0.100	
18	0.238	0.145	0.075	0.062	0.073	0.099	
20	0.217	0.144	0.068	0.060	0.073	0.090	

Use the Biot-Sacart Law to estimated the results of 2cm through 4cm

Test position	Measure Value (A/m)	Estimated Value (A/m)	Agreement Ratio	Limits
A	0.515	0.431	-16.24%	30%
B	0.372	0.322	-13.42%	30%
C	0.152	0.142	-6.84%	30%
D	0.145	0.130	-10.08%	30%
E	0.336	0.403	19.96%	30%
F	0.381	0.439	15.20%	30%

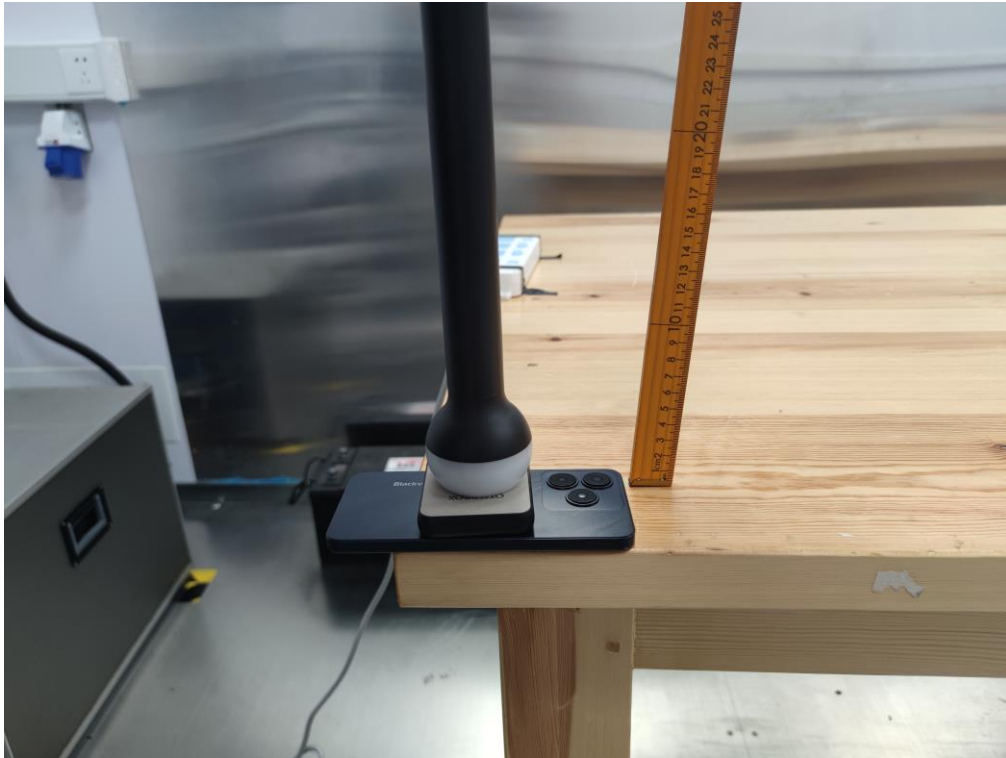
As the model is sufficient, the value of 0cm can be estimated through the results of 2 cm

Test position	Estimated Value (A/m)	Limits (A/m)
A	0.674	1.63
B	0.640	
C	0.254	
D	0.242	
E	1.174	
F	1.550	

5 Test Setup photo

Portable mode:

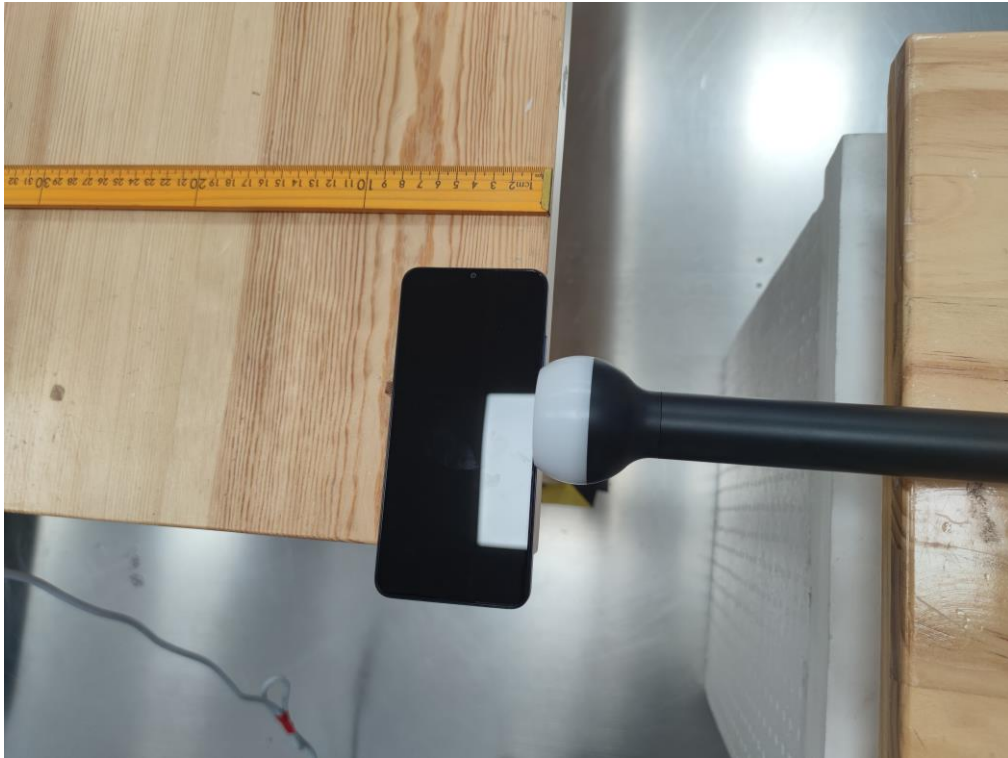
0cm-Bottom



0cm-Front



0cm-Left



0cm-Rear



0cm-Right

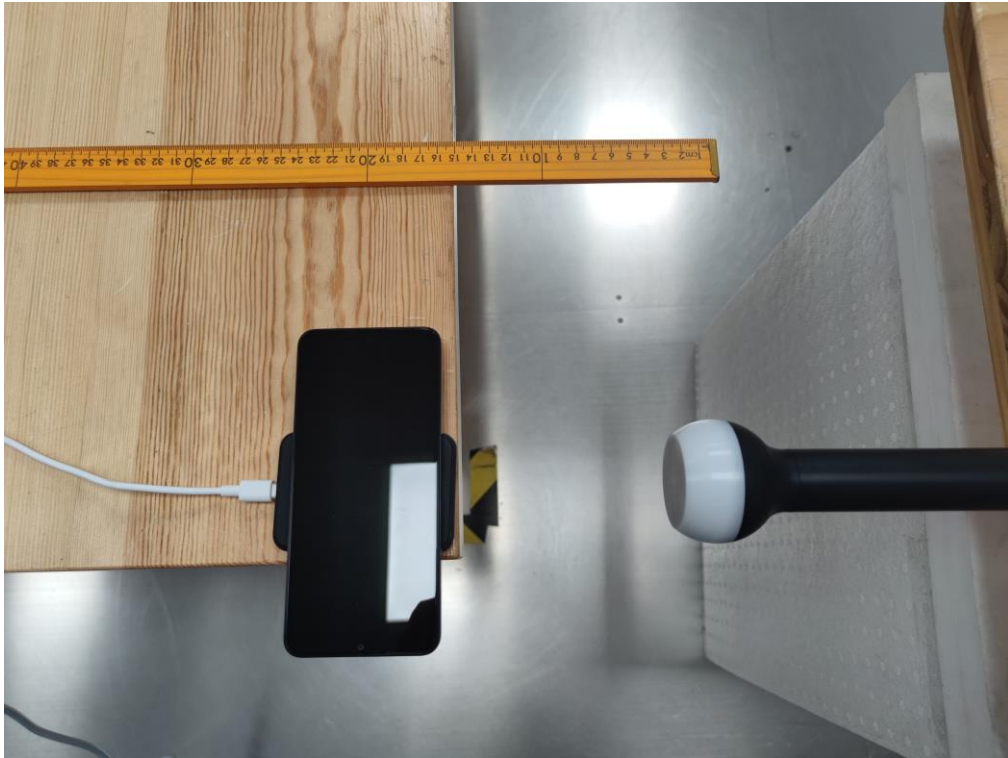


0cm-Top



Mobile mode:

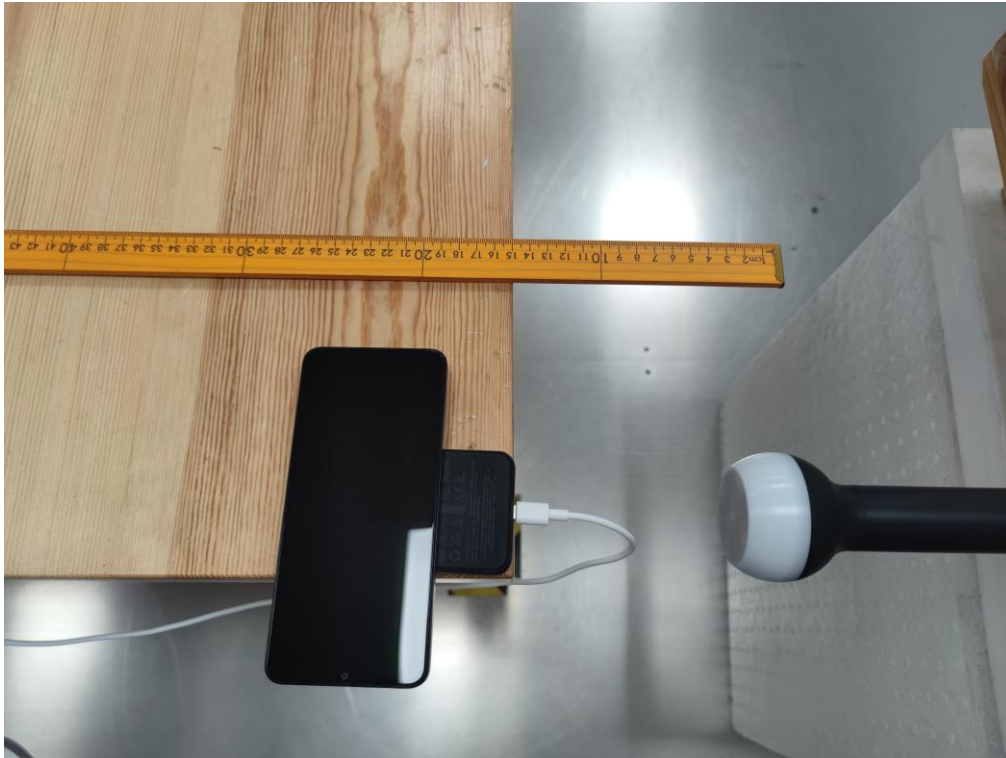
15cm-Front



15cm-Left



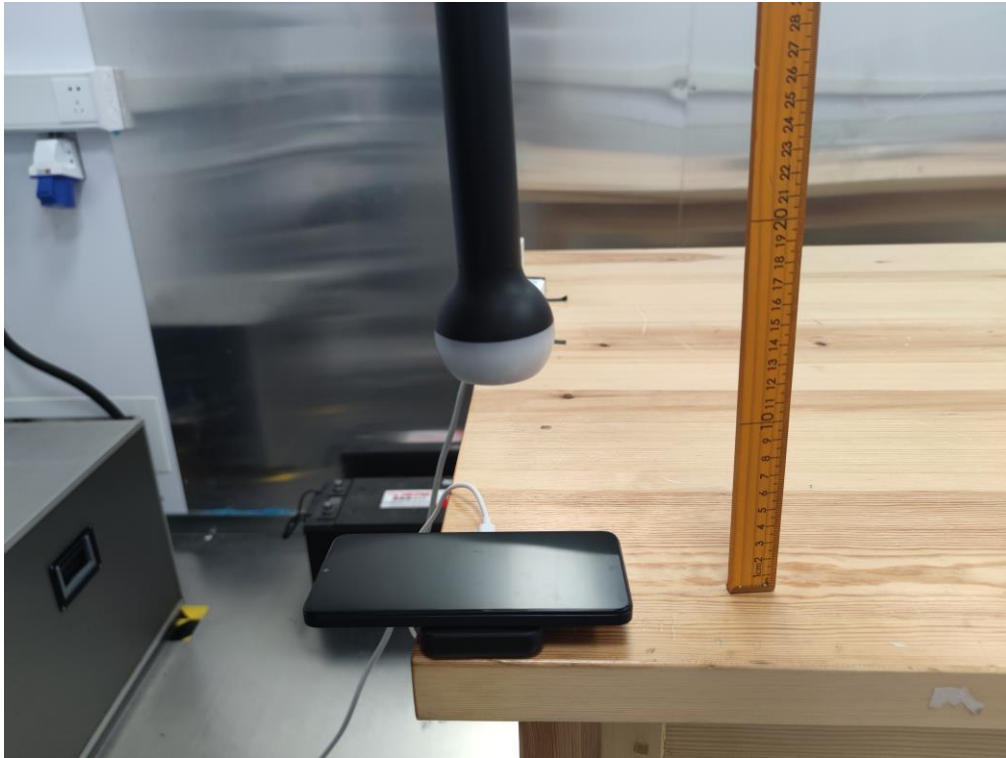
15cm-Rear



15cm-Right



15cm-Top



End of report