

RF Exposure Evaluation

Client Information:

Applicant: Shenzhen Changxinghui Technology Co.,Ltd
Applicant add.: Room 1003,Building C,Lianjian Industrial Park,Huarong Road,Dalang,
Longhua,Shenzhen,China
Manufacturer: Shenzhen Changxinghui Technology Co.,Ltd
Manufacturer add.: Room 1003,Building C,Lianjian Industrial Park,Huarong Road,Dalang,
Longhua,Shenzhen,China

Product Information:

Product Name: Magnetic wireless charging mobile power game machine
Model No.: N/A
Brand Name: XH001
FCC ID: 2BH4Z-XH001

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

Prepared By:

Guangdong Asia Hongke Test Technology Limited

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Date of Receipt: July 16, 2024 Date of Test: July 16, 2024 ~ July 19, 2024
Date of Issue: July 19, 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.

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Reviewed by: _____

Leon.yi

Approved by: _____

Sean She



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Revision History

Revision	Issue Date	Revisions	Revised By
00	July 19, 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

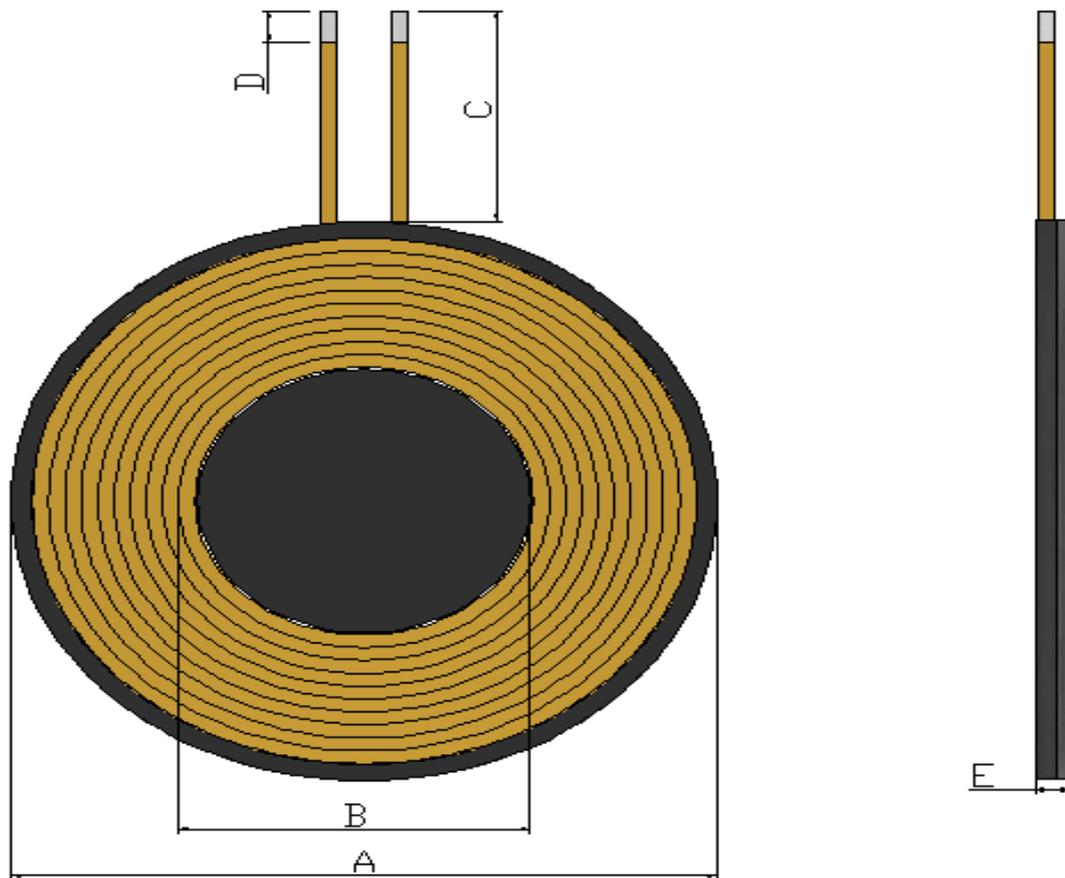
2 GENERAL INFORMATION

EUT Name:	Magnetic wireless charging mobile power game machine
Model No:	XH001
Serial Model:	N/A
Test sample(s) ID:	AiTDG-240716008-1
Sample(s) Status:	Engineer sample
Operation frequency:	113kHz-205kHz
Modulation Technology:	ASK
Antenna Type:	Loop coil Antenna
Antenna gain:	0dBi
Hardware version.:	N/A
Software version.:	N/A
Power supply:	Input: 5V3.1A / 9V2.22A / 12V1.67A Output: 5V2.4A / 9V2.22A / 12V1.67A Wireless Output: 5W 7.5W 10W 15W
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) = $3.6\mu\text{H} \pm 10\%$ L0A(Coil + magnetic sheet) = $6.2\mu\text{H} \pm 5\%$
Material of enclosure(s):	Hot Air stranded Wire
Number of turns:	Transmitter 1: 10 turns

2.2 Coil Size



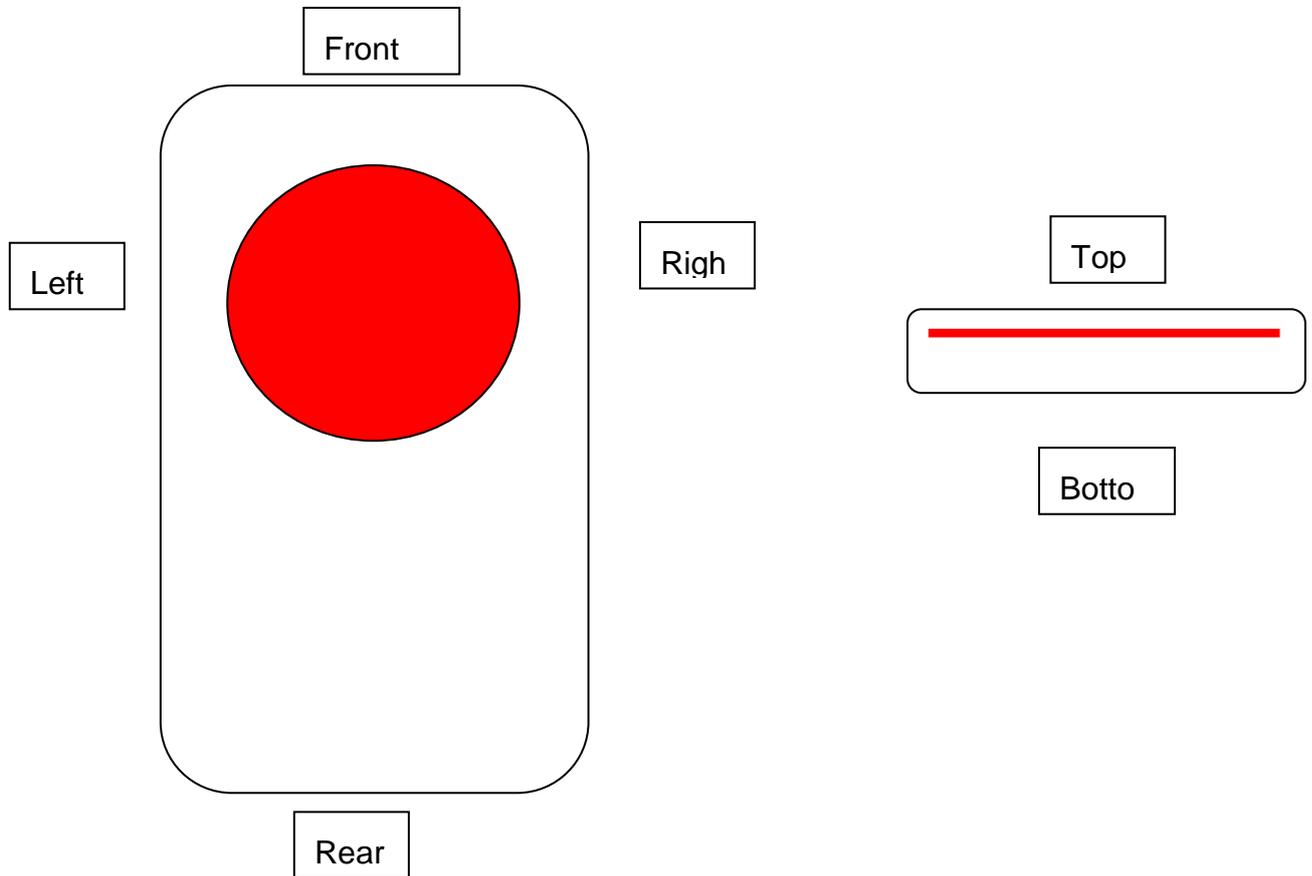
Unit: mm

A	B	C	D	E
42.5 ± 0.3	20.5 ± 0.3	18 ± 2	3 ± 1	2.0 ± 0.2

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
12	63	12	12	2	12



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

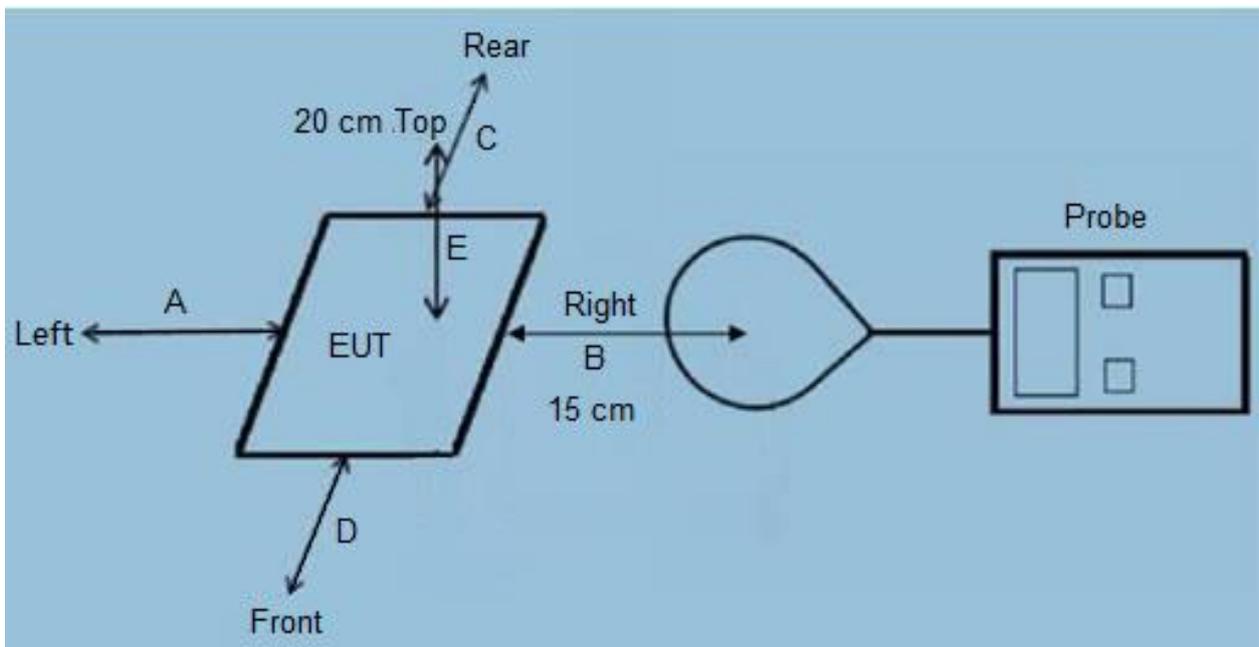
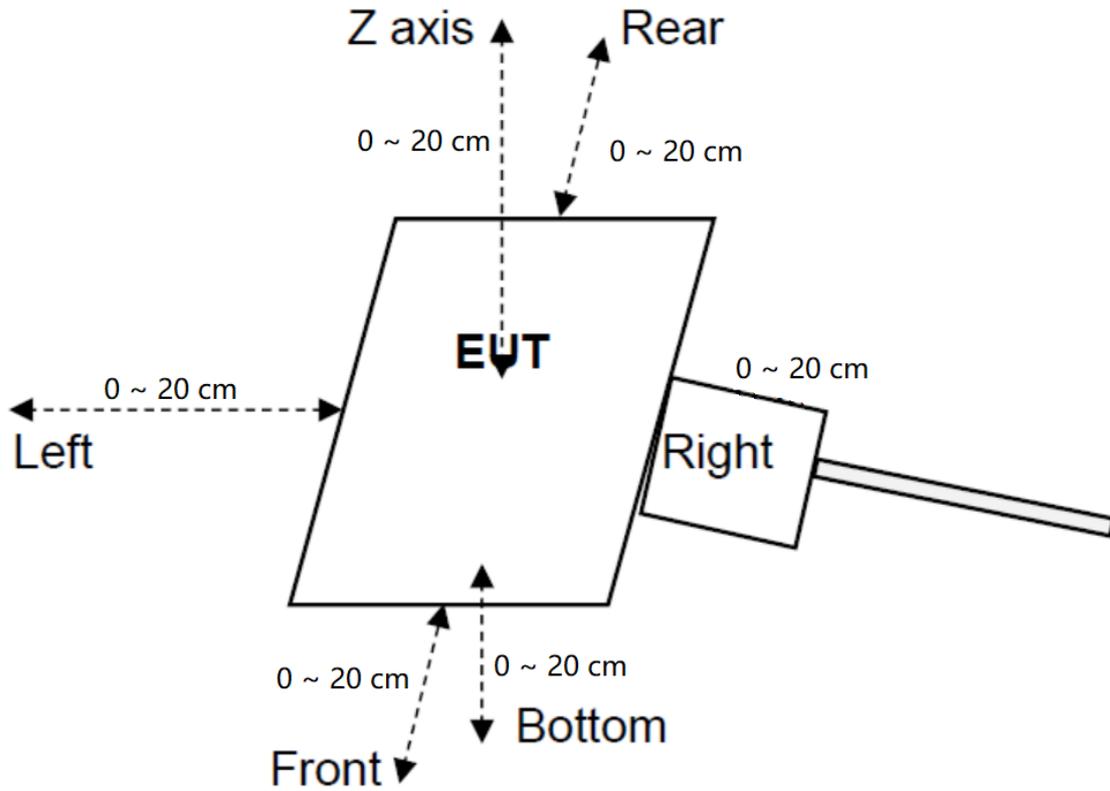
F=frequency in MHz
 E=Plane-wave equivalent power density
 RF exposure compliance will need to be determined with respect to 1.1307(c) and (d) of the FCC rules. The emissions should be within the limits at 300kHz in Table 1 of 1.1310(use the 300kHz limits for 150kHz:614V/m,1.63A/m).

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

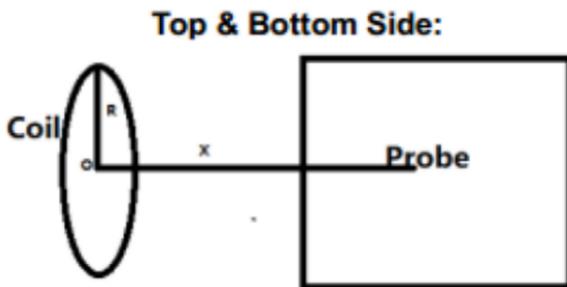
Note 3: Emissions between 100 kHz to 300 kHz should be assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m. A KDB inquiry is required to determine the applicable exposure limits below 100 kHz.

3.3 Test Setup

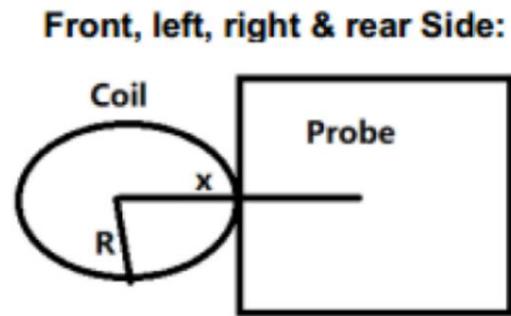


3.4 Test Procedure

- 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 = $4 * \pi * 10^{-7}$

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

R: Radius of radiated coil, according to the coil specification: R=0.02125m

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=10.

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 operate in the frequency range 113kHz-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	<p>Mobile mode: The EUT H-field strengths at 15 cm surrounding the device and 20 cm above the top surface.</p> <p>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.</p>

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	OSCAL	PILOT2	N/A	N/A	N/A
2	Adapter	HNT	HNT-QC530	N/A	N/A	N/A

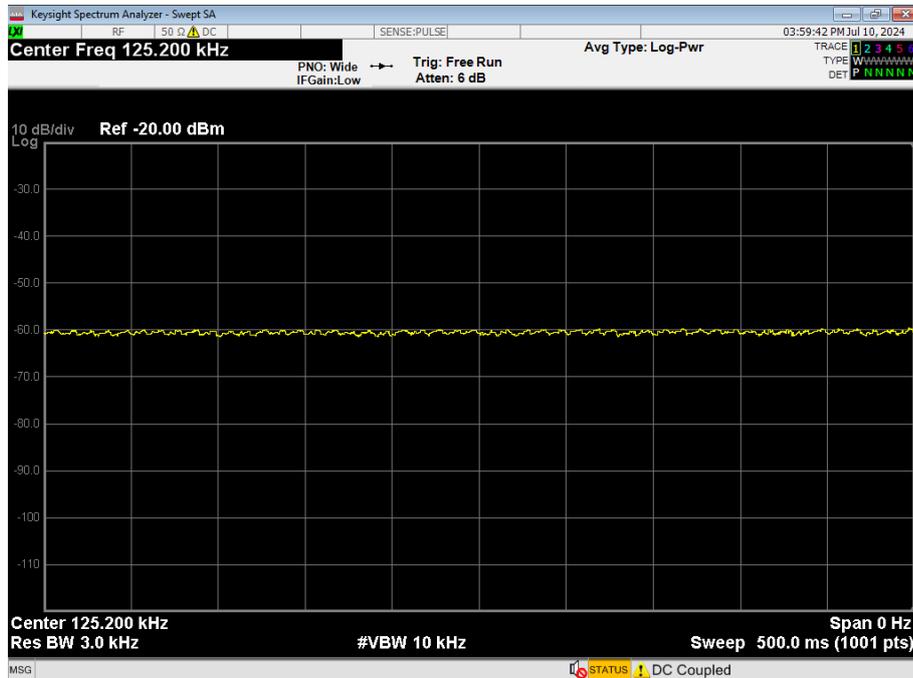
4.3 Test Instruments list

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.

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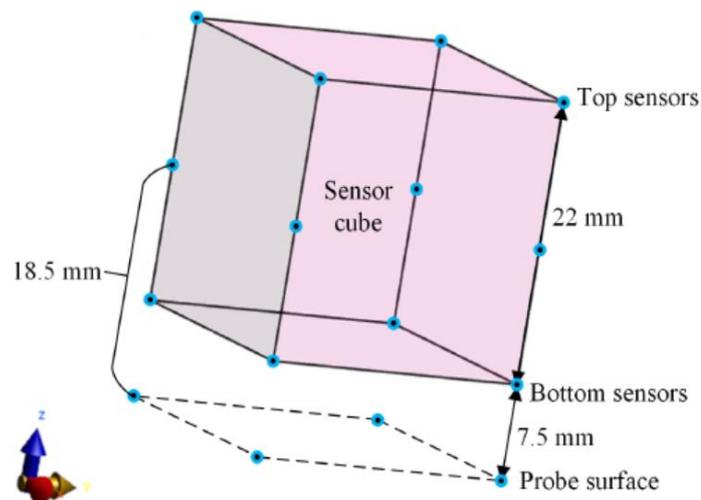


Figure 2.5: Extrapolation of the total H -field at the probe surface is made at each pair of sensors (i.e., bottom and top sensors) around the sensor cube

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.

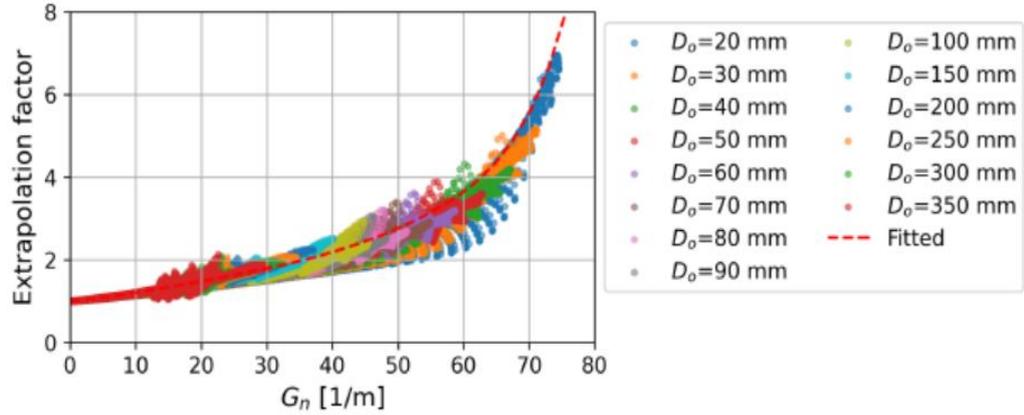


Figure 2.6: Extrapolation factors (i.e., ratios between the simulated results of $H_{tip-surface}$ and $\frac{H_{bottom} + H_{top}}{2}$) plotted as a function of the normalized H -field gradient. The data are from simulations of 70 coils with varying outer diameters D_o and filling ratios (0.1–0.9). The prediction 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	1.374	0.322
15cm	< 1%	Top	1.511	0.481
15cm	< 1%	Left	0.891	0.248
15cm	< 1%	Right	0.846	0.265
15cm	< 1%	Front	0.928	0.286
15cm	< 1%	Rear	0.919	0.278
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	1.259	0.298
15cm	< 50%	Top	1.476	0.453
15cm	< 50%	Left	0.850	0.231
15cm	< 50%	Right	0.823	0.250
15cm	< 50%	Front	0.910	0.259
15cm	< 50%	Rear	0.828	0.258
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	1.161	0.287
15cm	< 99%	Top	1.372	0.418
15cm	< 99%	Left	0.847	0.221
15cm	< 99%	Right	0.794	0.227
15cm	< 99%	Front	0.859	0.241
15cm	< 99%	Rear	0.748	0.243
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 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	0.317	0.255	0.142	0.153	0.489	0.374	1.63
4	0.264	0.208	0.097	0.092	0.172	0.142	
6	0.248	0.199	0.089	0.085	0.160	0.137	
8	0.236	0.195	0.081	0.082	0.148	0.124	
10	0.215	0.188	0.077	0.082	0.143	0.121	
12	0.209	0.175	0.077	0.080	0.143	0.119	
14	0.208	0.175	0.072	0.073	0.141	0.119	
16	0.196	0.167	0.072	0.068	0.139	0.113	
18	0.184	0.152	0.071	0.067	0.134	0.111	
20	0.184	0.138	0.067	0.064	0.128	0.109	

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	0.317	0.363	14.56%	30%
B	0.255	0.248	-2.78%	30%
C	0.142	0.133	-6.03%	30%
D	0.153	0.127	-17.28%	30%
E	0.489	0.627	28.18%	30%
F	0.374	0.444	18.74%	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	0.508	1.63
B	0.316	
C	0.227	
D	0.245	
E	1.439	
F	1.459	

5 Test Setup photo

Portable mode:

0cm-Botton



0cm-Front



0cm-Left



0cm-Rear



0cm-Right



0cm-Top



Mobile mode:

15cm-Front



15cm-Left



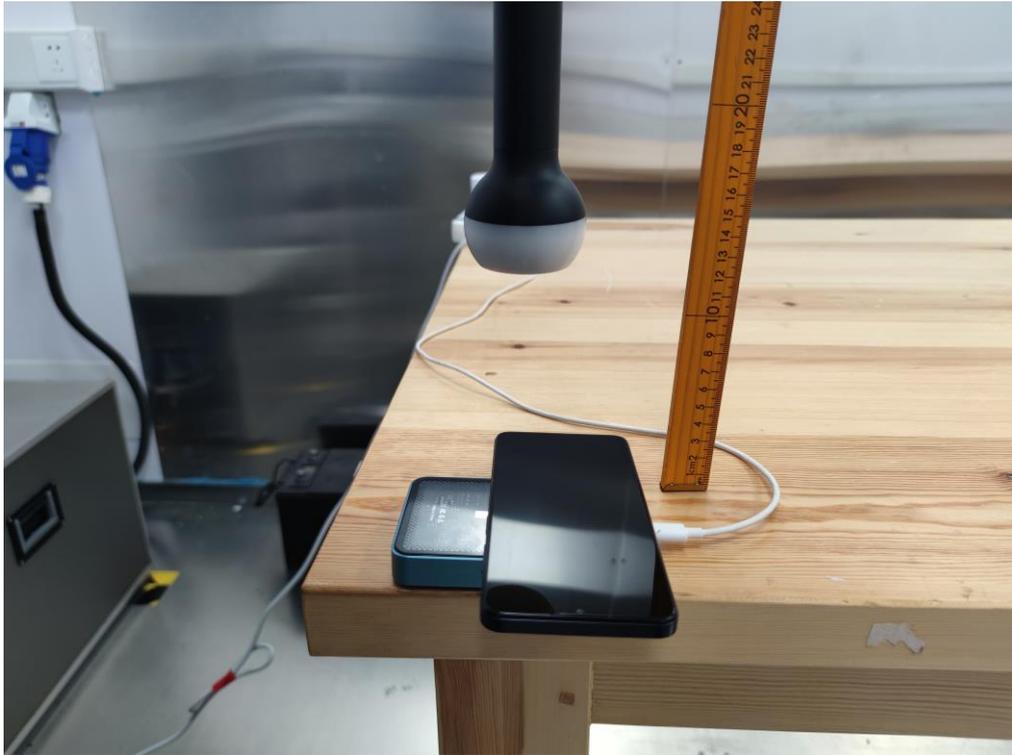
15cm-Rear



15cm-Right



15cm-Top



20cm-Top

