RF Exposure Evaluation Report

1. Product Information

FCC ID:	2AZ48-X
Product Name	Jump Starter
Model Number	PPS1CW xxxxx (the suffix: "x" may be "0-9" or "A-Z" or omitted)
Power Supply	Input: 14.5V DC, 800mA. rechargeable by external adaptor (Adaptor input: AC 120V, 60Hz) Output: USB DC 5V, 3.1A Output: Wireless 10W
Modulation Type	Continuous Wave
Frequency Range	110.0~205.0KHz
Operation Frequency	128.0 KHz
Antenna Type	Coil Antenna
Hardware version	/
Software version	/
Accessories	/
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Portable Device

2. Evaluation Method

Per KDB 680106 D01 Section 3. RF Exposure Requirements;

1) Consumer wireless power transfer devices approved under Part 18 in some cases have to demonstrate compliance with RF exposure requirements. The potential for exposure must be assessed according to the operating configurations of the wireless system and the exposure conditions of users and bystanders. RF exposure must be evaluated with the client device(s) being charged by the primary at maximum output power. The RF exposure requirements must be determined in conjunction with the device operating characteristics, according to the mobile and portable exposure requirements in Section 2.1091 and Section 2.1093 of the rules. SAR and MPE limits do not cover the frequency range for wireless power transfer applications which operate below 100 kHz and 300 kHz respectively; therefore, RF exposure compliance needs to be determined with respect to 1.1307 (c) and (d) of the FCC rules.
2) Based on the design and implementation of the power transfer application, it must be clearly identified if mobile or portable RF exposure conditions apply. Devices that are installed to provide separation of at least 20 cm from users and bystanders may qualify for mobile exposure conditions. For some conditions where users and bystanders may be exposed at closer than 20 cm, section 2.1091(d) (4) of the rules may apply.
3) For devices designed for typical desktop applications, such a wireless charging pads, RF exposure evaluation should be conducted assuming a user separation distance of 15 cm. E and H field strength measurements or numerical modeling may be used to demonstrate compliance. Measurements should be made from all sides and the top of the primary/client pair, with the 15 cm measured from the center of the probe(s) to the edge of the device. Emissions between 100 kHz to 300 kHz should be

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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.

4) Portable exposure conditions from 100 kHz to 6 GHz are determined with respect to SAR requirements. Existing SAR systems and test procedures are generally intended for measurements above 100 MHz. While numerical modeling can be an alternative, the constraints of substantial computational resources at low frequencies could introduce further limitations. Under these circumstances, including operations below 100 kHz, the Commission may consider a combination of analytical analysis, field strength, radiated and conducted power measurements, in conjunction with some limited numerical modeling to assess compliance.

5) Depending on the operating frequency, existing SAR and MPE measurement procedures may be adapted to evaluate wireless power transfer devices for compliance with respect to mobile or portable exposure conditions. If the grantee or its test lab have any questions regarding RF exposure evaluation they should contact the FCC Laboratory with sufficient system operating configuration details to determine if RF exposure evaluation is necessary and, if required, how to apply specific test procedures. Below 100 MHz, when SAR testing is required and the device is operating at close proximity to persons, information on device design, implementation, operating configurations, exposure conditions of users and bystanders are needed to determine the evaluation and testing requirements. In addition, the influence of nearby objects may also need consideration according to the wireless power transfer system implementation; for example, the effects of placing the device, its coils or radiating elements on or near metallic surfaces

6) According to April 2018 TCB Workshop, No need to report E-field measurements. Only H-field required.

3. Evaluation Limit

3.1 Refer evaluation method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 680106 D01 RF Exposure Wireless Charging Apps v03: RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices

FCC CFR 47 part 18.107:Indusial, Scientific, and Medical Equipment

FCC CFR 47 part2 2.1093: Radiofrequency radiation exposure evaluation: portable devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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
300-1,500	/	/	f/300	6
1,500-100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm²)	Averaging Time (minute)
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
300-1,500	/	/	f/1500	30
1,500-100,000	/	/	1.0	30

F=frequency in MHz

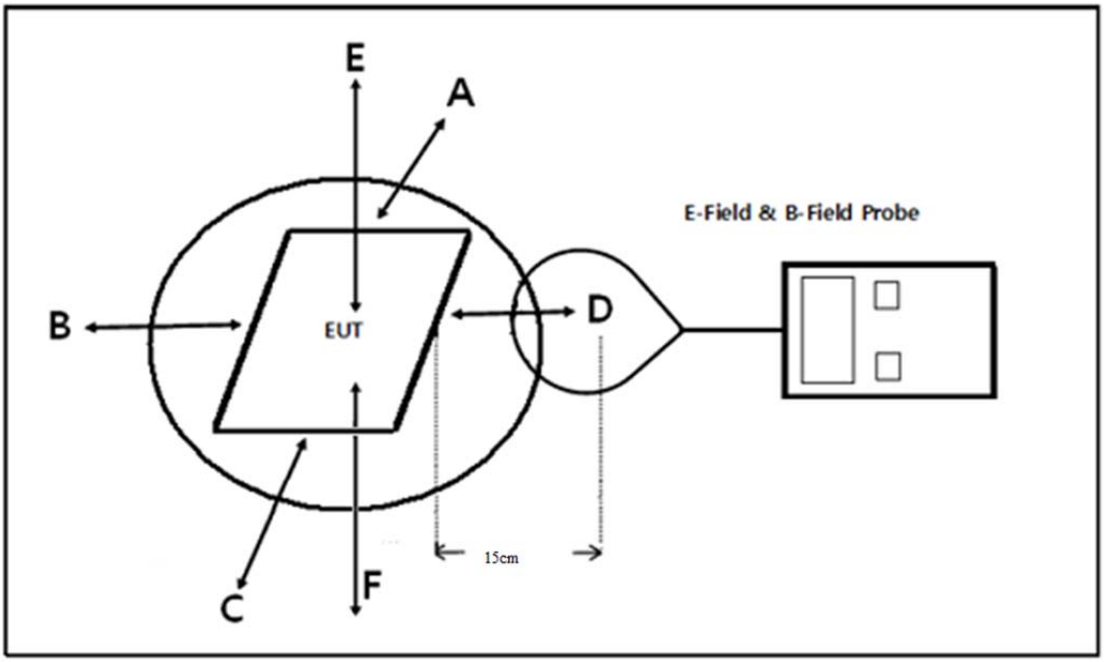
*=Plane-wave equivalent power density

According to FCC KDB 680106 D01 Section 3. RF Exposure Requirements clause 3 the Emission-Limits in the frequency range from 100 KHz to 300 KHz should be assessed versus the limits at 300 KHz in Table 1 of CFR 47 – Section1.310 as following (measured distance shall be 15cm from the center of the probe to the edge of the device):

	E-Field	*/*	B-Field
Frequency	V/m	A/m	uT
0.3 MHz – 3.0 MHz	614	1.613	2.0
3.0 MHz – 30 MHz	824/f (=27.5_{30MHz})	2.19/f (=0.073_{30MHz})	--

A KDB inquire was required to determine/confirm the applicable limits below 100 KHz.

4. Test Setup Diagram



5. Test Equipment

Equipment	Manufacturer	Model	Serial no.	Calibrated date	Calibrated Due
Exposure Level Tester	Narda	ELT-400	N-0713	2020-06-22	2021-06-21
B-Field Probe	Narda	ELT-400	M-1154	2020-06-22	2021-06-21

6. Measurement Procedure

For mobile RF exposure

a) The RF exposure test was performed on 360 degree turn table in anechoic chamber.

b) The measurement probe was placed at test distance (15cm) which is between the edge of the charger and the geometric center of probe.

c) The turn table was rotated 360d degree to search of highest strength.

d) The highest emission level was recorded and compared with limit as soon as measurement of each points (A, B, C, D, E) were completed.

e) The EUT were measured according to the dictates of KDB 680106D01v03.

For portable RF exposure

a) The RF exposure test was performed on 360 degree turn table in anechoic chamber.

b) The measurement probe was placed at test distance (0cm) which is between the edge of the charger and the geometric center of probe.

c) The turn table was rotated 360d degree to search of highest strength.

d) 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.

e). Repeated measured (a) – (d) at measure distance 5cm, 10cm and 15cm.

e) The EUT were measured according to the dictates of KDB 680106D01v03.

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7. Equipment Approval Considerations

The EUT does comply with item 5.2 of KDB 680106 D01v03 as follows table;

Requirements of KDB 680106 D01	Yes / No	Description
Power transfer frequency is less than 1 MHz	Yes	The device operate in the frequency range 110.0 KHz - 205 KHz
Output power from each primary coil is less than 15 watts	Yes	The maximum output power of the primary coil is less than 10W.
The transfer system includes only single primary and secondary coils. This includes charging systems that may have multiple primary coils and clients that are able to detect and allow coupling only between individual pairs of coils.	Yes	The transfer system includes single coil that is able to detect receiver device.
Client device is placed directly in contact with the transmitter.	Yes	Client device is placed directly in contact with the transmitter.
Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).	NO	According to April 2018 TCB Workshop, for inductive applications where the primary does not physically attach (clip, lock on) to the client, and it is intended for desktop use, the desktop guidance in KDB 680106 D01 may be applied.
The aggregate H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit.	Yes	The EUT H-field strengths at 15 cm surrounding the device and 20 cm above the top surface from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit.

In all other cases, unless excluded above, an RF exposure evaluation report must be reviewed and accepted through a KDB or PBA inquiry to enable authorization of the equipment. When evaluation is required to show compliance; for example, using field strength, power density, SAR measurements or computational modeling etc., the specific authorization requirements will be determined based on the results of the RF exposure evaluation.

8. E and H field Strength

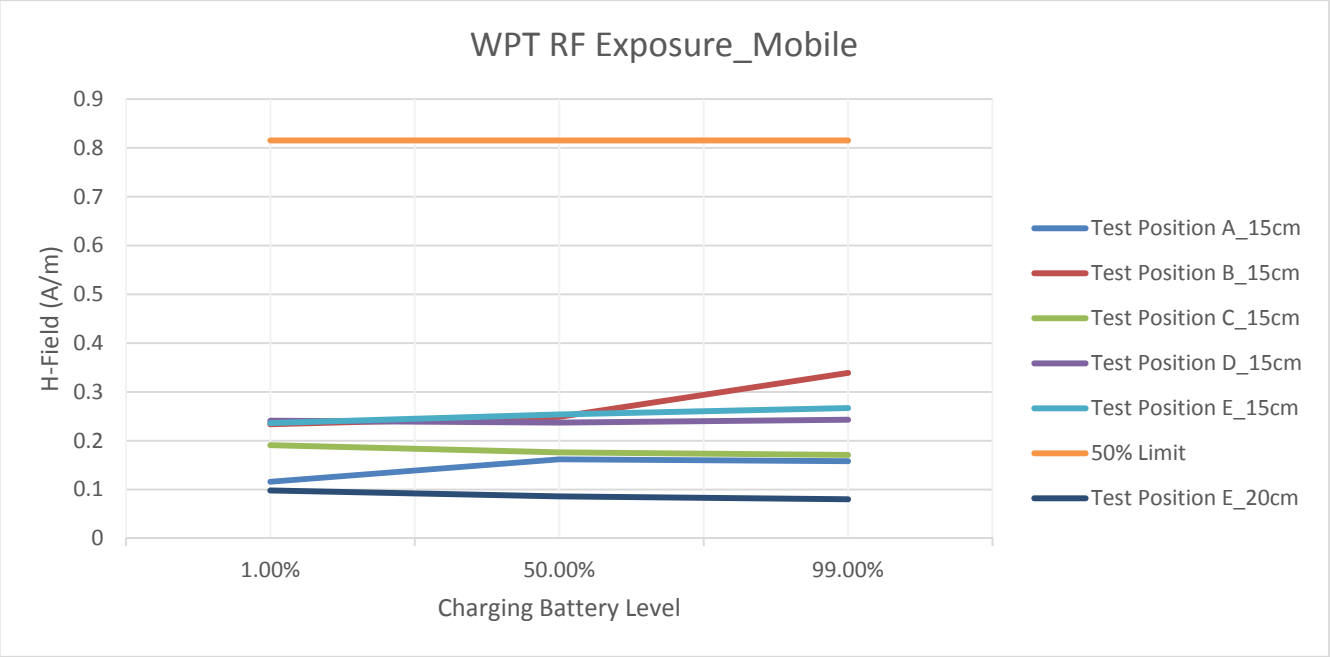
Test Modes:		
Mode 1	AC/DC Adapter + EUT + Mobile Phone (Battery Status: <1%)	Record
Mode 2	AC/DC Adapter + EUT + Mobile Phone (Battery Status: <50%)	Record
Mode 3	AC/DC Adapter + EUT + Mobile Phone (Battery Status: 100%)	Record
Note: All test modes were pre-tested, but we only recorded the worst case in this report.		

Field Strength at 15 cm from the edges surrounding the EUT and 15cm from the top surface of the EUT

Charging Battery Level	Frequency Range (MHz)	Field Strength	Measured E-Field Strength Values (V/m) Measured H-Field Strength Values (A/m)					50% Limits	Limits
			Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
1%	0.128	uT	0.121	0.139	0.137	0.131	0.138	--	--
1%	0.128	A/m	0.097	0.111	0.110	0.105	0.111	0.815	1.63
1%	0.128	V/m	36.294	41.760	41.291	39.419	41.600	307.0	614.0
50%	0.128	uT	0.129	0.134	0.139	0.131	0.148	--	--
50%	0.128	A/m	0.103	0.107	0.111	0.105	0.119	0.815	1.63
50%	0.128	V/m	38.800	40.153	41.885	39.455	44.538	307.0	614.0
99%	0.128	uT	0.122	0.138	0.138	0.125	0.144	--	--
99%	0.128	A/m	0.097	0.110	0.110	0.100	0.115	0.815	1.63
99%	0.128	V/m	36.584	41.377	41.502	37.582	43.359	307.0	614.0

Field Strength at 20cm from the top surface of the EUT

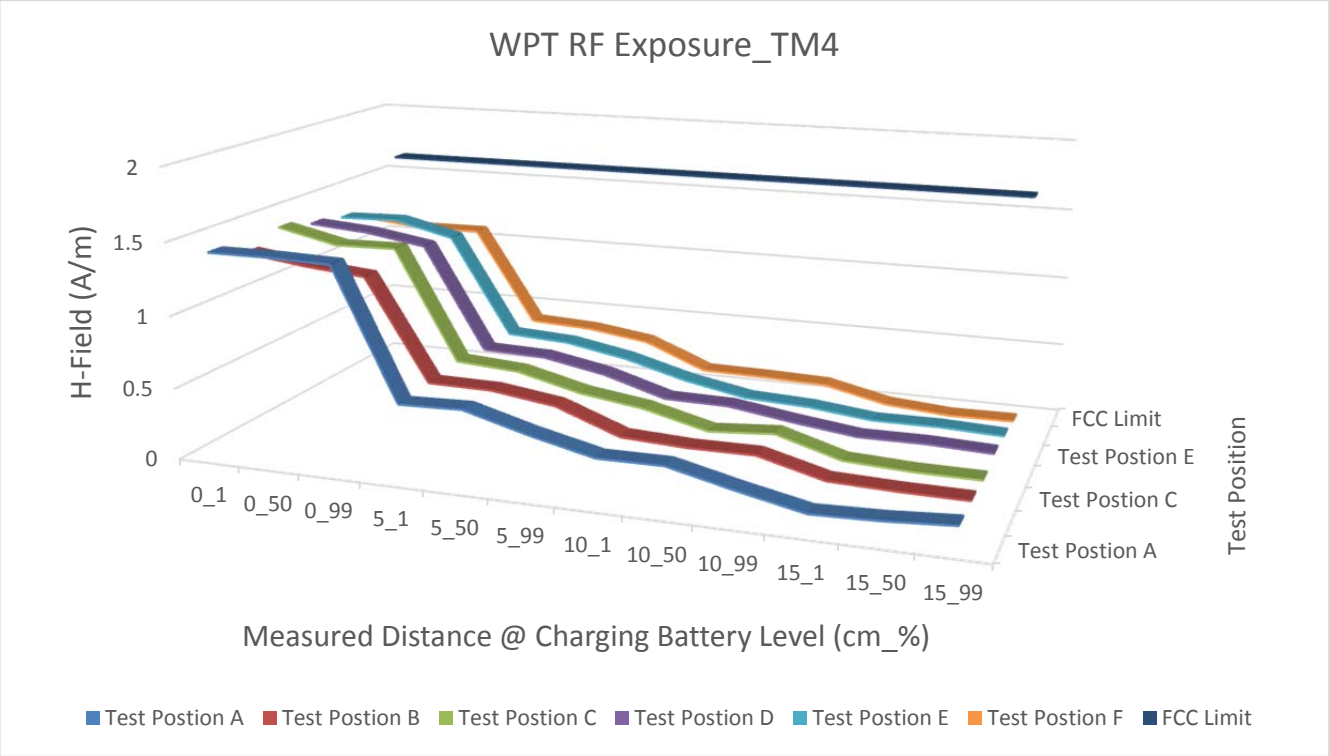
Charging Battery Level	Frequency Range (MHz)	Field Strength	Measured E-Field Strength Values (V/m) Measured H-Field Strength Values (A/m)	50% Limits	Limits
			Test Position		
1%	0.128	uT	0.141	--	--
1%	0.128	A/m	0.113	0.815	1.63
1%	0.128	V/m	42.537	307.0	614.0
50%	0.128	uT	0.138	--	--
50%	0.128	A/m	0.111	0.815	1.63
50%	0.128	V/m	41.560	307.0	614.0
99%	0.128	uT	0.142	--	--
99%	0.128	A/m	0.113	0.815	1.63
99%	0.128	V/m	42.629	307.0	614.0


WPT RF Exposure_Mobile
H-Field (A/m)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1.00%
50.00%
99.00%
Charging Battery Level
Test Position A_15cm
Test Position B_15cm
Test Position C_15cm
Test Position D_15cm
Test Position E_15cm
50% Limit
Test Position E_20cm

For portable exposure

Field Strength at all sides of the EUT

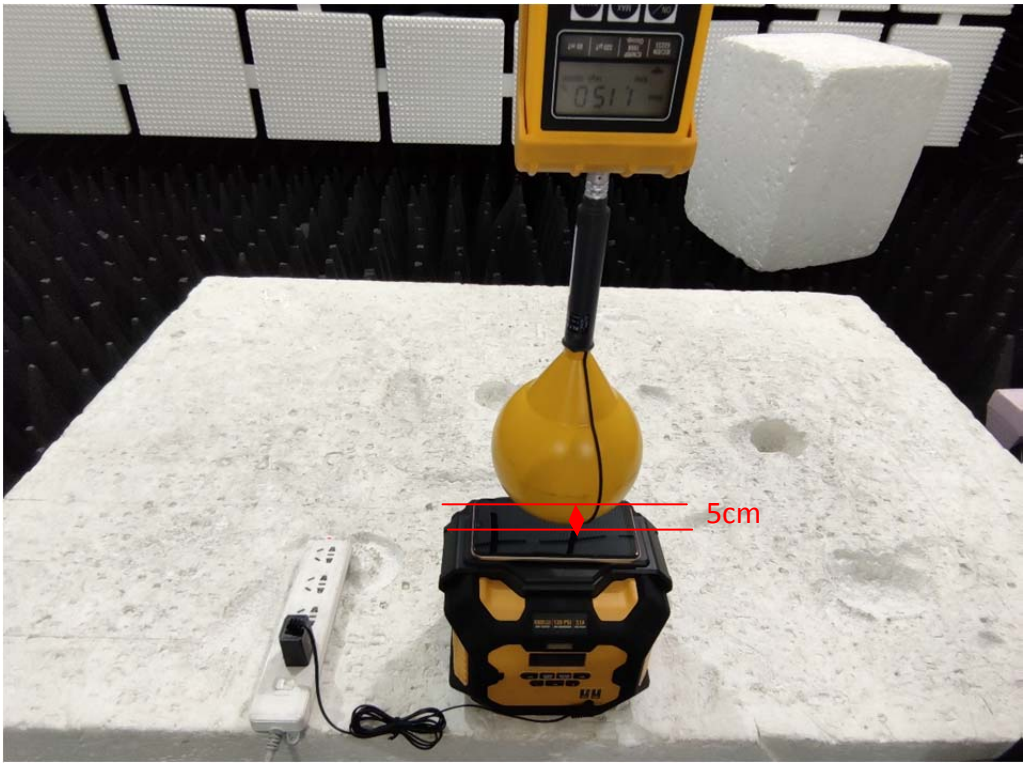
Operate mode	Charging Battery Level	Measured Distance (cm)	Frequency Range (MHz)	Field Strength	Measured E-Field Strength Values (V/m) Measured H-Field Strength Values (A/m)						Limits
					Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	Test Position F	
TM4	1%	0	0.128	uT	1.738	1.811	1.768	1.767	1.726	1.795	--
TM4	1%	0	0.128	A/m	1.391	1.449	1.415	1.414	1.381	1.436	1.63
TM4	1%	0	0.128	V/m	522.653	544.401	531.705	531.337	518.904	539.838	614.0
TM5	50%	0	0.128	uT	1.725	1.827	1.735	1.824	1.819	1.736	--
TM5	50%	0	0.128	A/m	1.380	1.462	1.388	1.459	1.455	1.389	1.63
TM5	50%	0	0.128	V/m	518.509	549.296	521.691	548.360	547.016	522.004	614.0
TM6	99%	0	0.128	uT	1.812	1.760	1.796	1.734	1.816	1.819	--
TM6	99%	0	0.128	A/m	1.450	1.408	1.437	1.387	1.453	1.455	1.63
TM6	99%	0	0.128	V/m	544.949	529.064	540.022	521.465	546.116	546.999	614.0
TM4	1%	5	0.128	uT	1.116	1.126	1.081	1.092	1.116	1.092	--
TM4	1%	5	0.128	A/m	0.893	0.901	0.865	0.874	0.893	0.873	1.63
TM4	1%	5	0.128	V/m	335.564	338.605	324.936	328.465	335.647	328.245	614.0
TM5	50%	5	0.128	uT	1.100	1.115	1.108	1.086	1.113	1.120	--
TM5	50%	5	0.128	A/m	0.880	0.892	0.887	0.869	0.891	0.896	1.63
TM5	50%	5	0.128	V/m	330.710	335.302	333.245	326.604	334.755	336.793	614.0
TM6	99%	5	0.128	uT	1.124	1.098	1.112	1.115	1.081	1.128	--
TM6	99%	5	0.128	A/m	0.899	0.878	0.890	0.892	0.865	0.902	1.63
TM6	99%	5	0.128	V/m	337.901	330.068	334.456	335.294	325.120	339.066	614.0
TM4	1%	10	0.128	uT	0.519	0.522	0.516	0.510	0.528	0.520	--
TM4	1%	10	0.128	A/m	0.415	0.417	0.413	0.408	0.422	0.416	1.63
TM4	1%	10	0.128	V/m	156.024	156.900	155.151	153.331	158.746	156.388	614.0
TM5	50%	10	0.128	uT	0.529	0.517	0.518	0.525	0.519	0.520	--
TM5	50%	10	0.128	A/m	0.423	0.413	0.414	0.420	0.415	0.416	1.63
TM5	50%	10	0.128	V/m	159.015	155.305	155.606	157.903	155.923	156.331	614.0
TM6	99%	10	0.128	uT	0.527	0.529	0.519	0.514	0.526	0.509	--
TM6	99%	10	0.128	A/m	0.422	0.423	0.415	0.411	0.421	0.408	1.63
TM6	99%	10	0.128	V/m	158.592	159.063	156.114	154.496	158.172	153.187	614.0
TM4	1%	15	0.128	uT	0.124	0.132	0.141	0.134	0.141	0.144	--
TM4	1%	15	0.128	A/m	0.099	0.105	0.113	0.107	0.113	0.115	1.63
TM4	1%	15	0.128	V/m	37.278	39.562	42.307	40.397	42.309	43.389	614.0
TM5	50%	15	0.128	uT	0.129	0.137	0.143	0.127	0.141	0.140	--
TM5	50%	15	0.128	A/m	0.104	0.110	0.115	0.102	0.113	0.112	1.63
TM5	50%	15	0.128	V/m	38.909	41.330	43.091	38.172	42.524	42.133	614.0
TM6	99%	15	0.128	uT	0.122	0.134	0.139	0.132	0.144	0.140	--
TM6	99%	15	0.128	A/m	0.098	0.107	0.111	0.106	0.115	0.112	1.63
TM6	99%	15	0.128	V/m	36.825	40.373	41.736	39.728	43.181	42.056	614.0

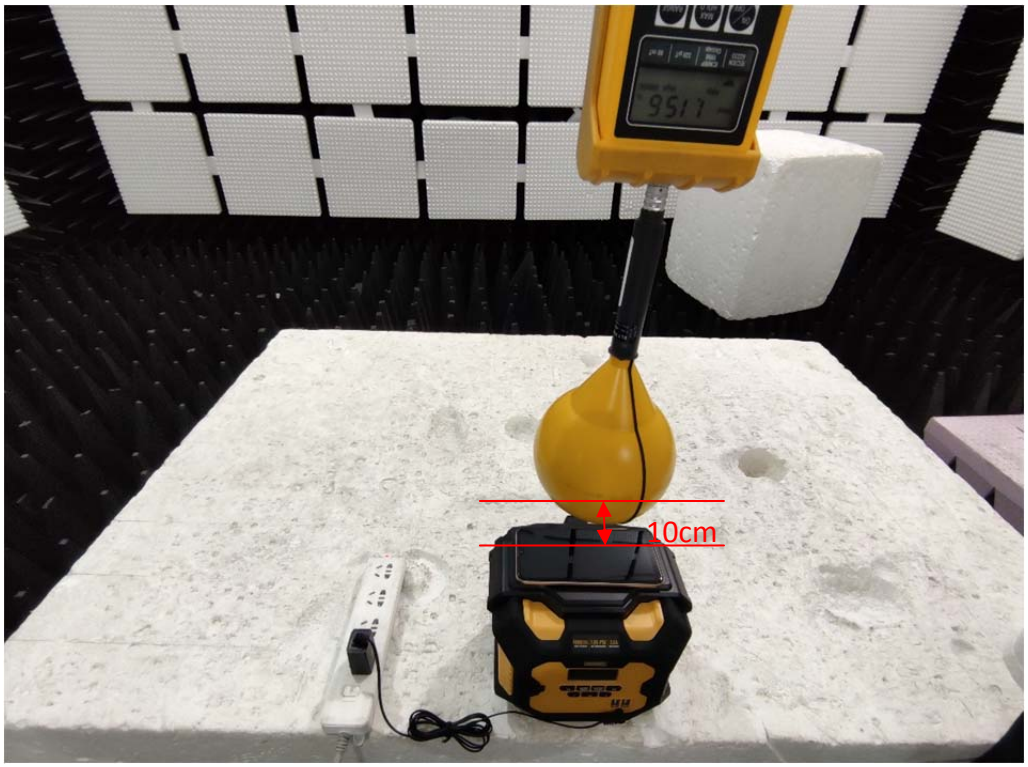

WPT RF Exposure_TM4
H-Field (A/m)
2
1.5
1
0.5
0
0_1
0_50
0_99
5_1
5_50
5_99
10_1
10_50
10_99
15_1
15_50
15_99
Measured Distance @ Charging Battery Level (cm_%)
FCC Limit
Test Postion E
Test Postion C
Test Postion A
Test Position
Test Postion A
Test Postion B
Test Postion C
Test Postion D
Test Postion E
Test Postion F
FCC Limit

9. Test Setup Photos

Portable exposure

9.1. Test Position E - Exposure photo from top surface

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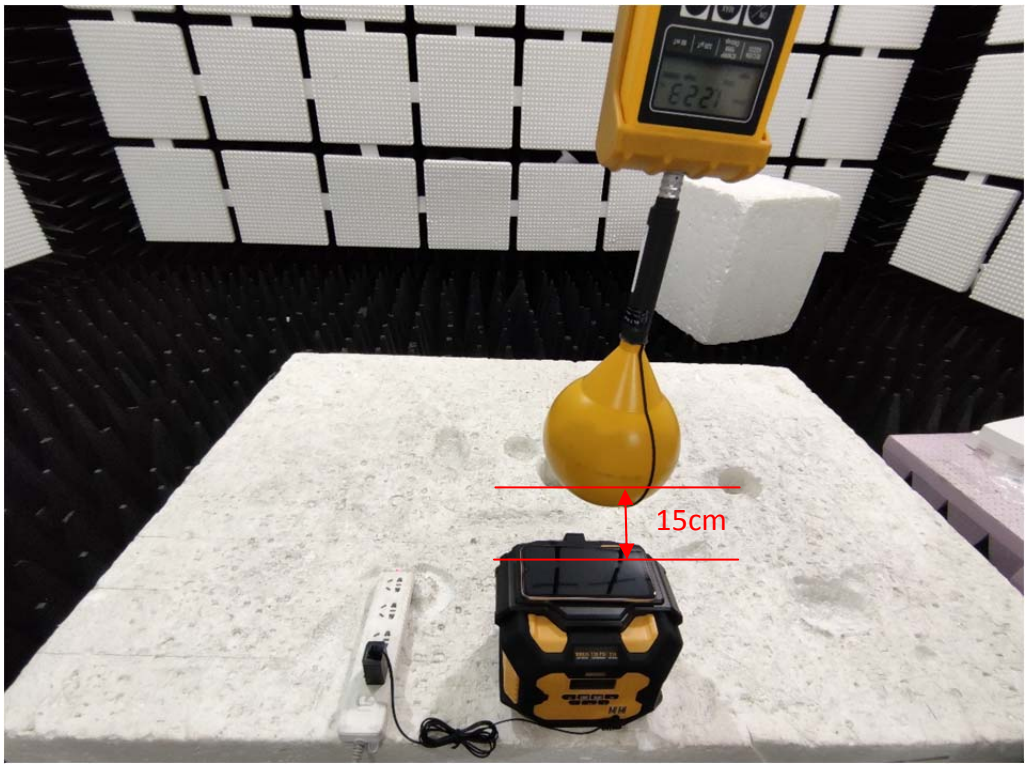
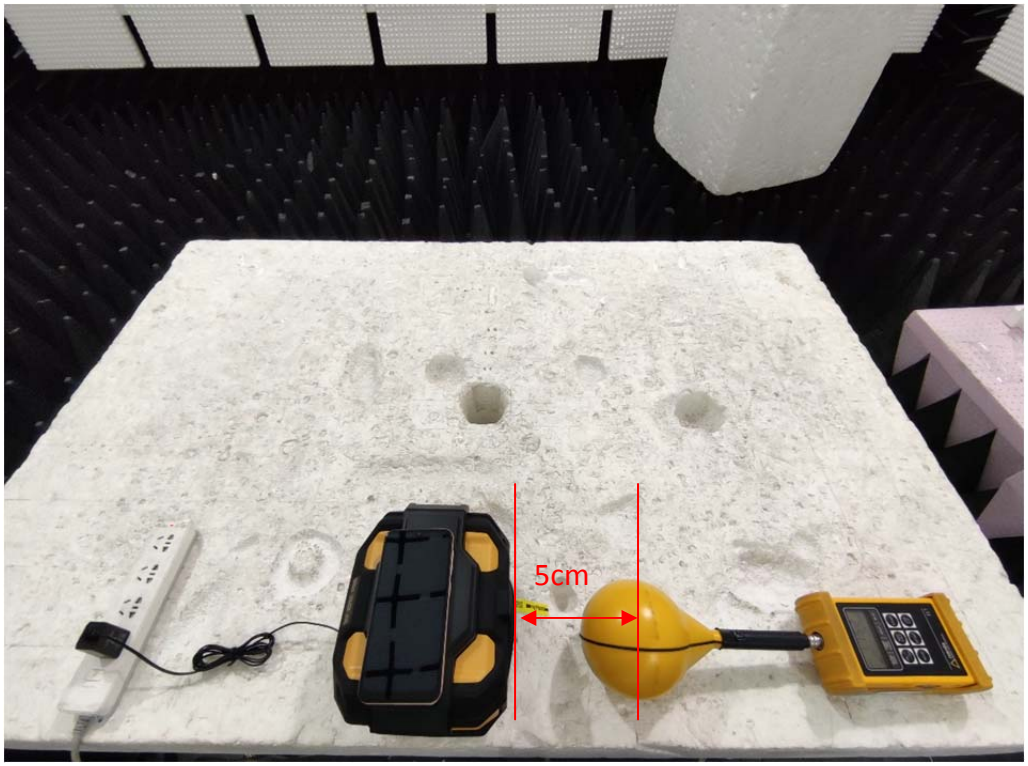
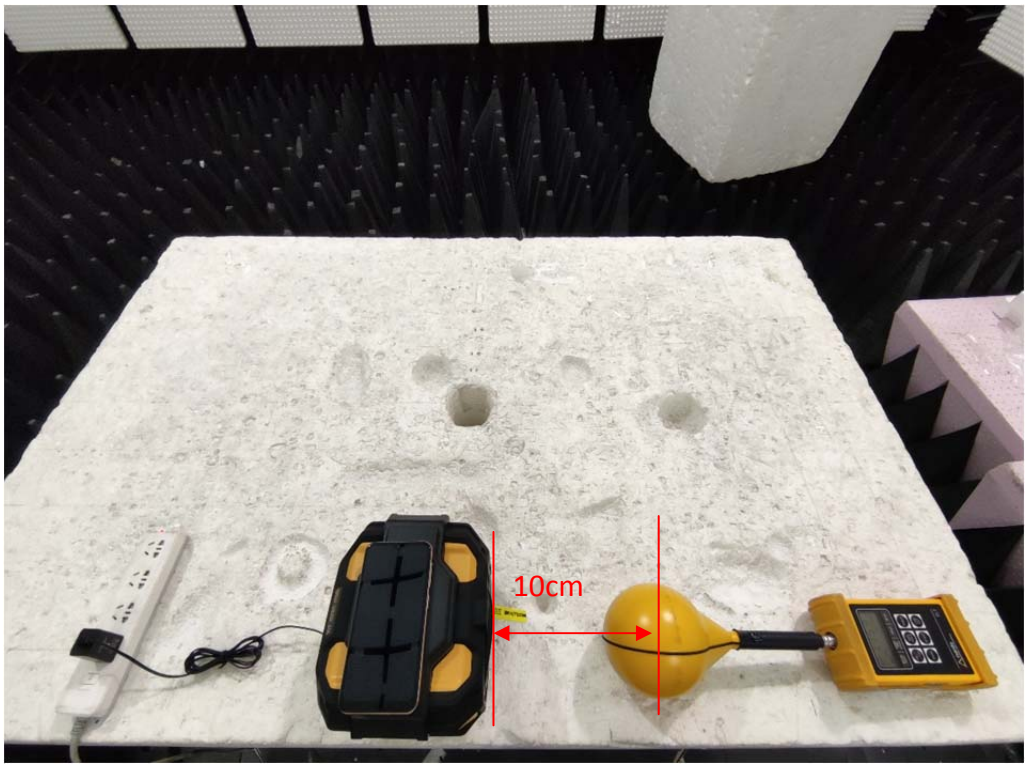
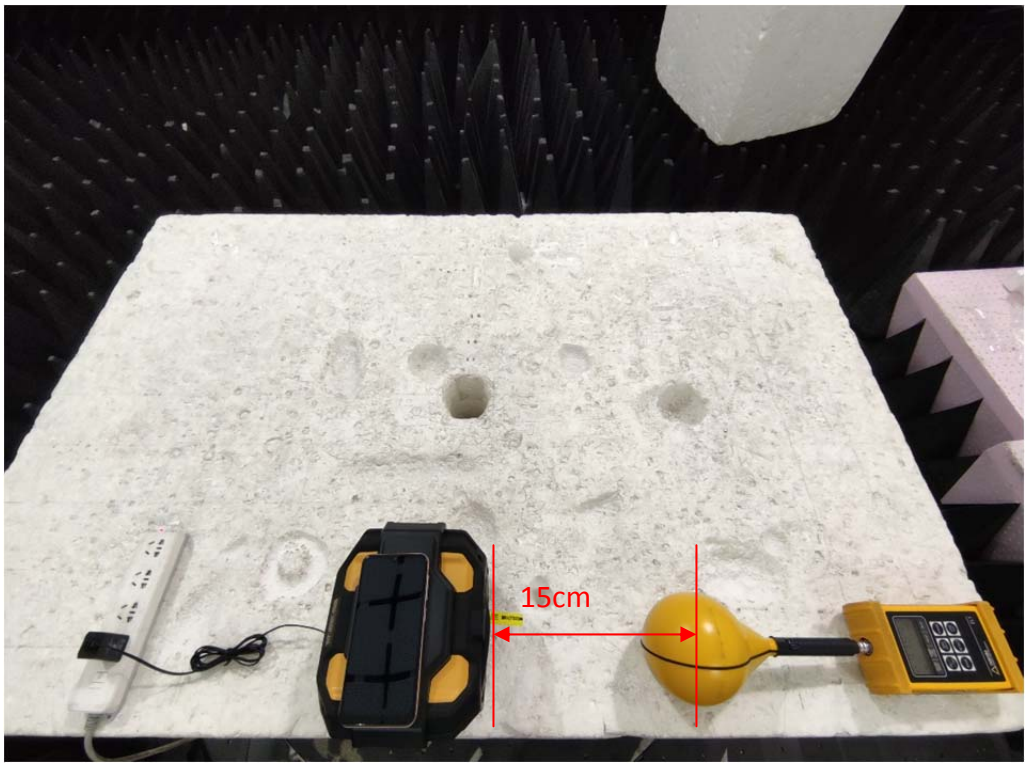

15cm

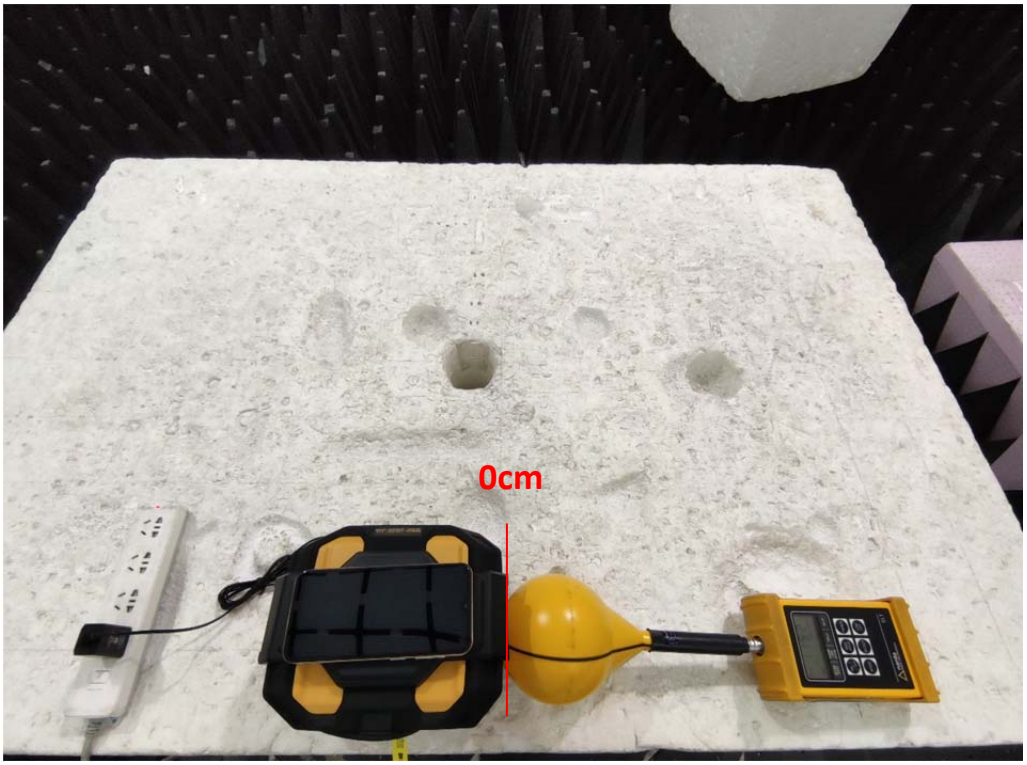
9.2. Test Position A - Exposure photo from side edge surface-Rear

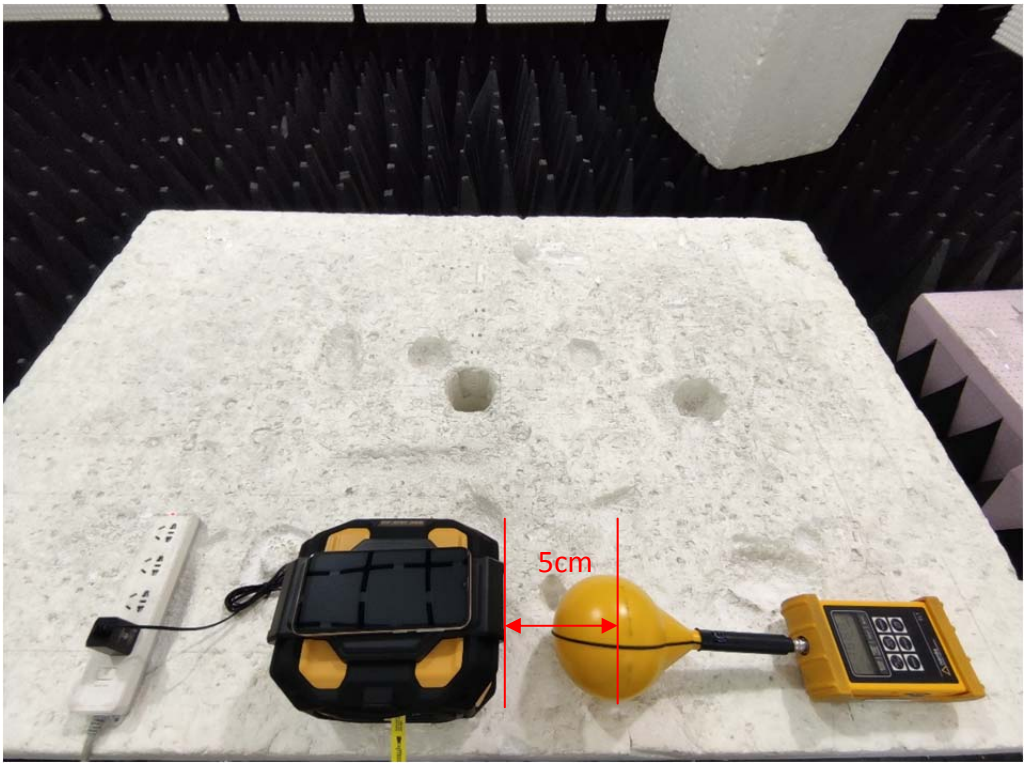


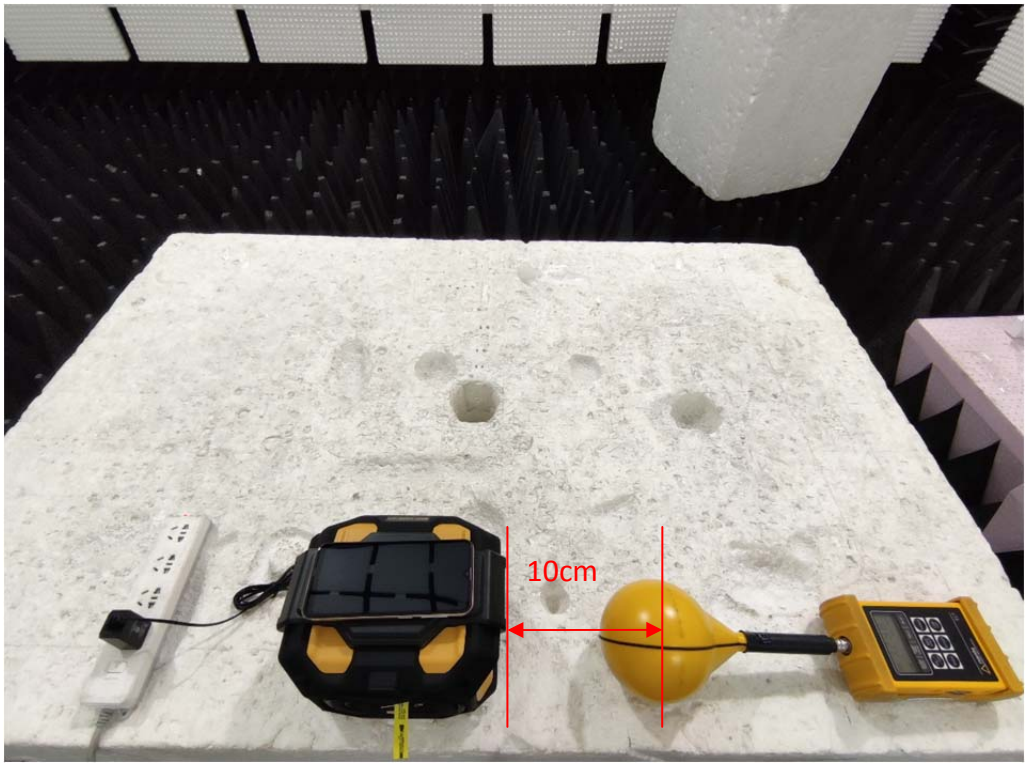

10cm

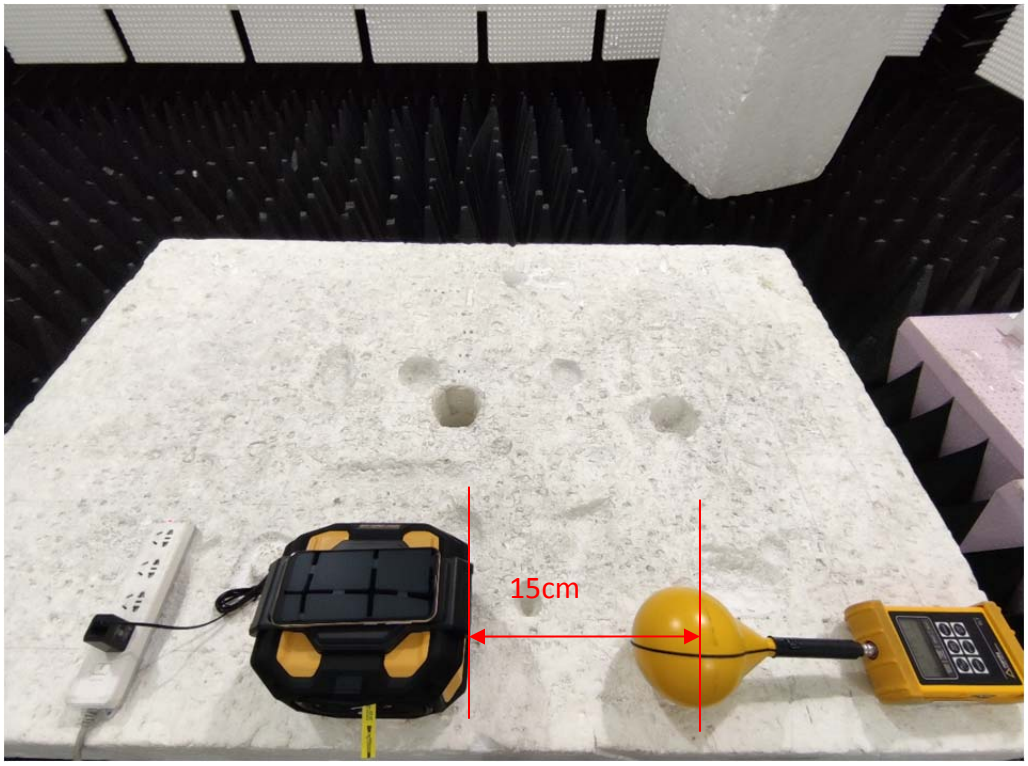

15cm

9.3. Test Position B - Exposure photo from side edge surface-Left

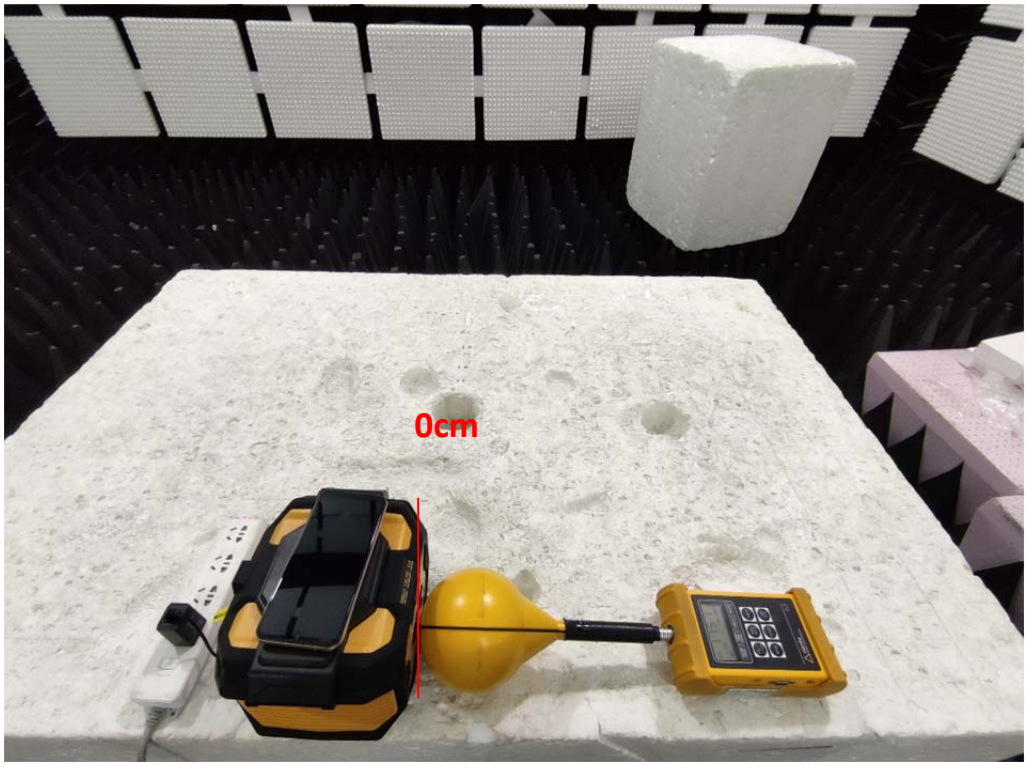




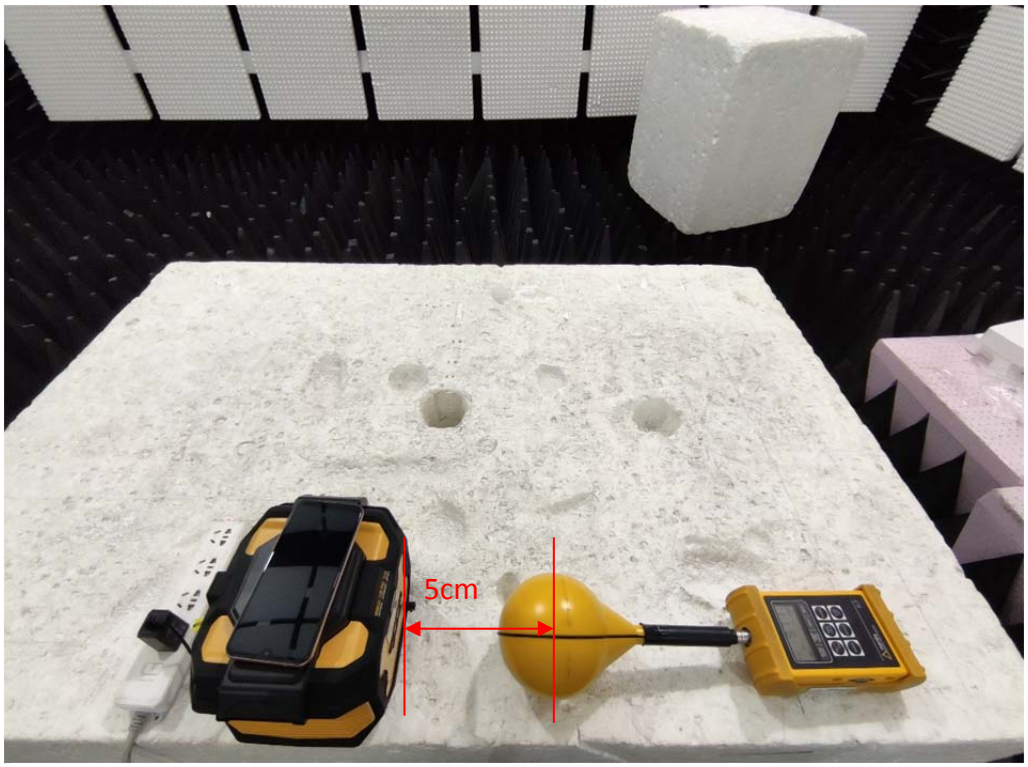

10cm

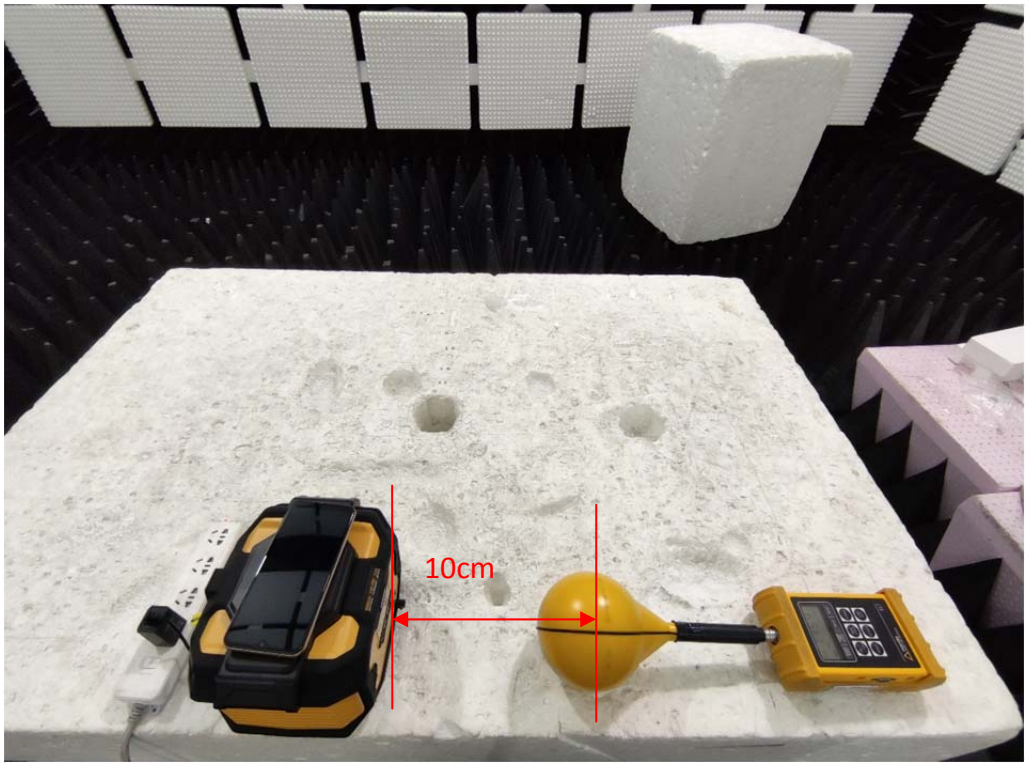

15cm

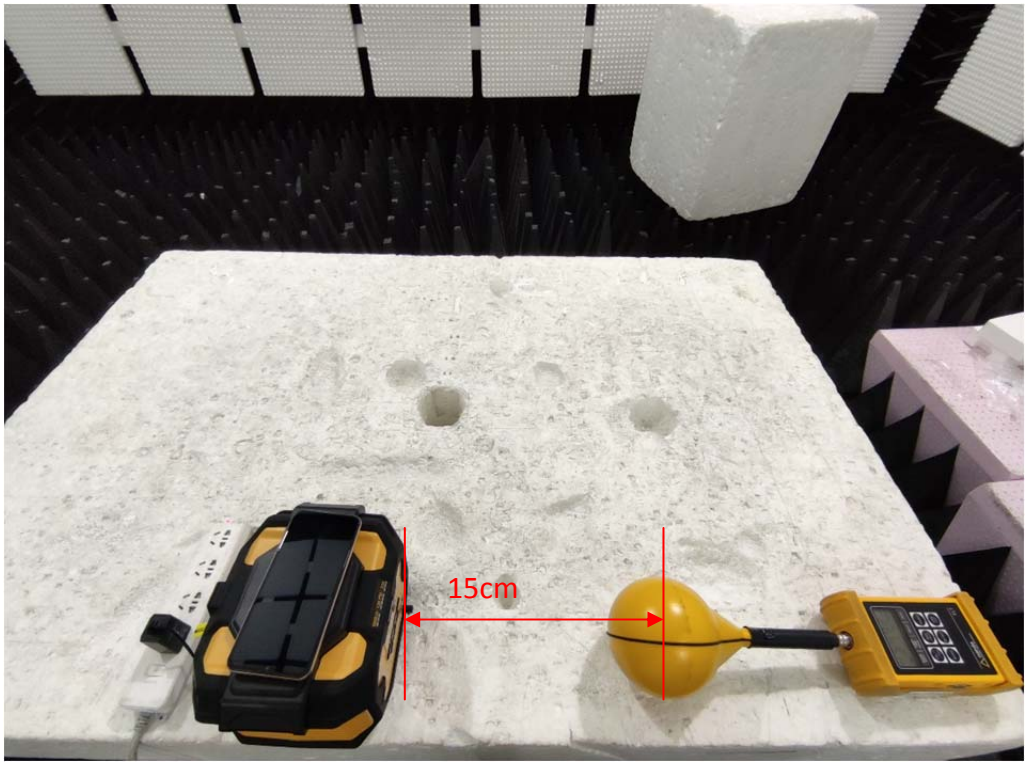
9.4. Test Position C - Exposure photo from side edge surface-Front



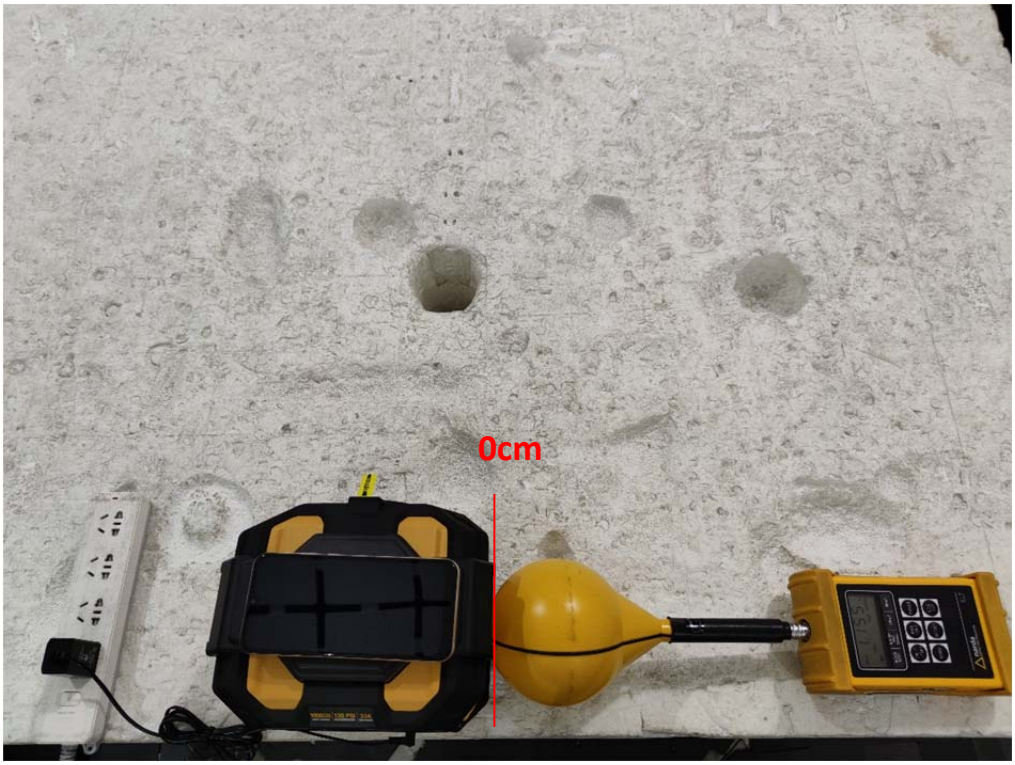
(TM4)



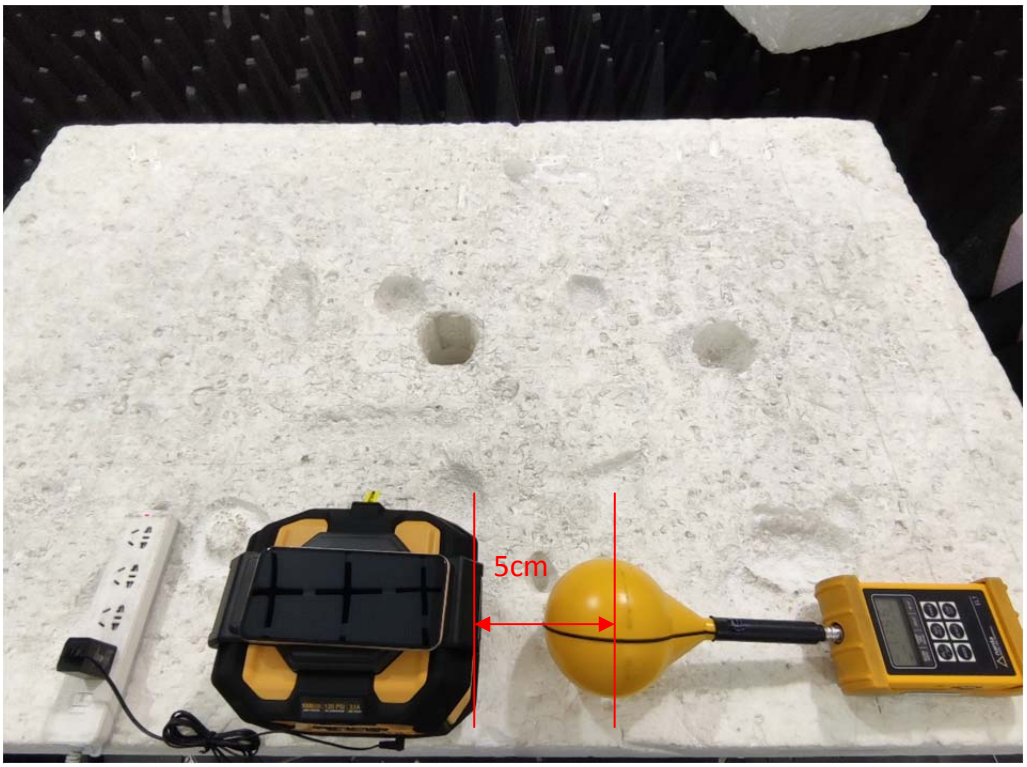

10cm

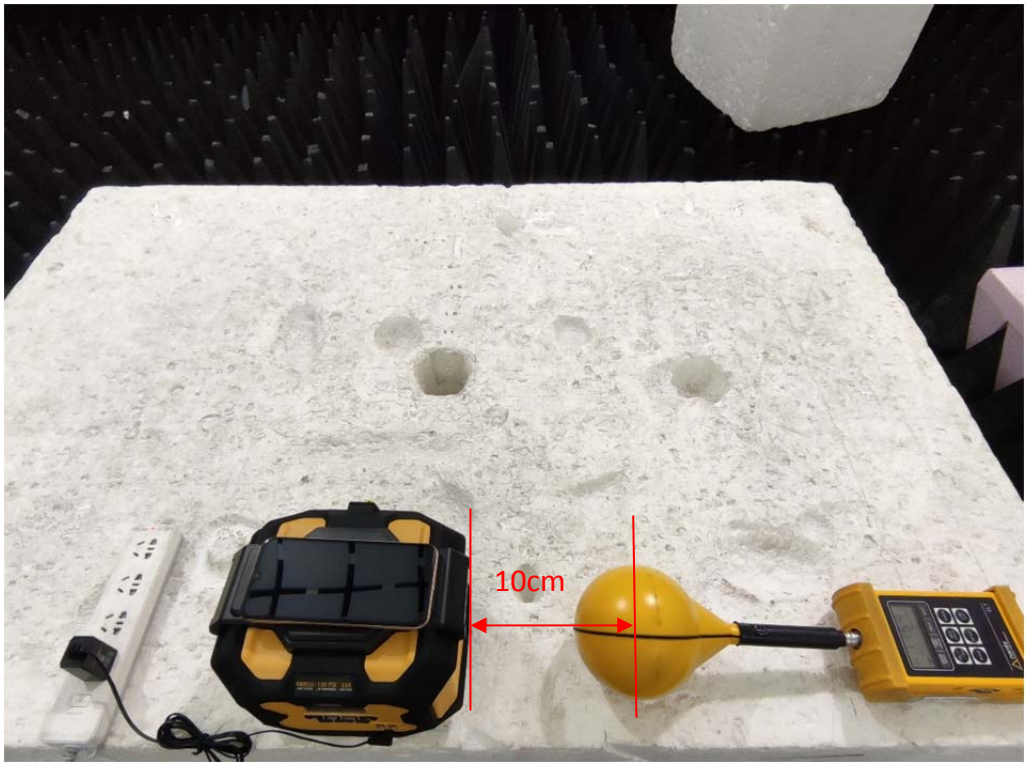

15cm

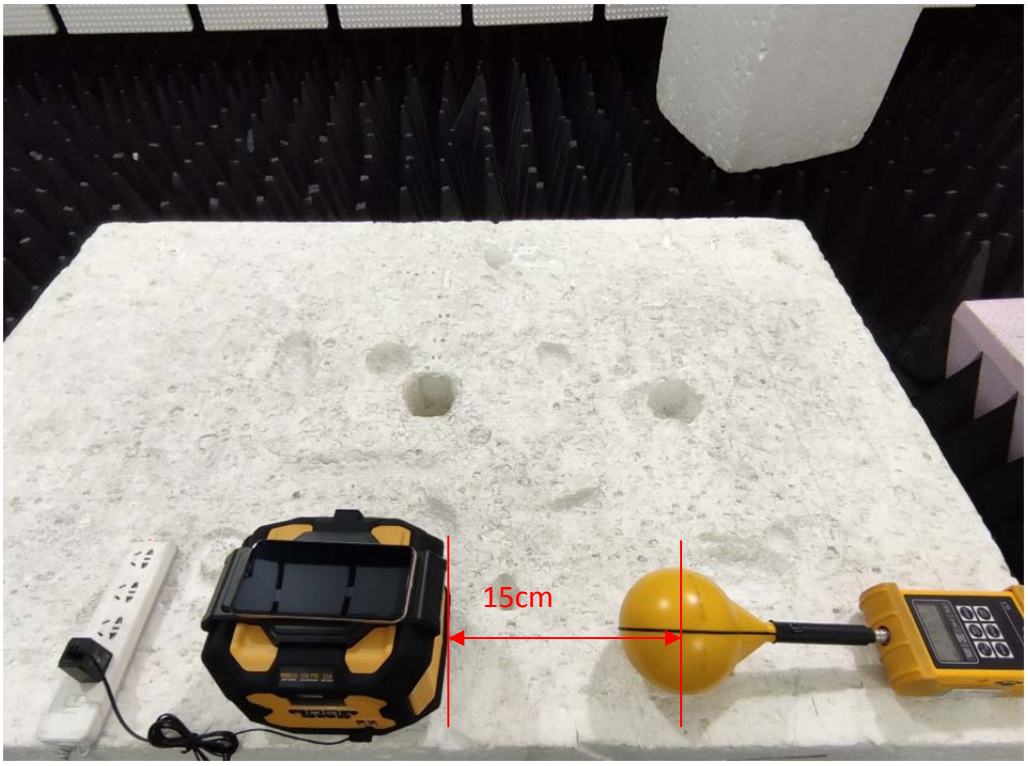
9.5. Test Position D - Exposure photo from side edge surface-Right



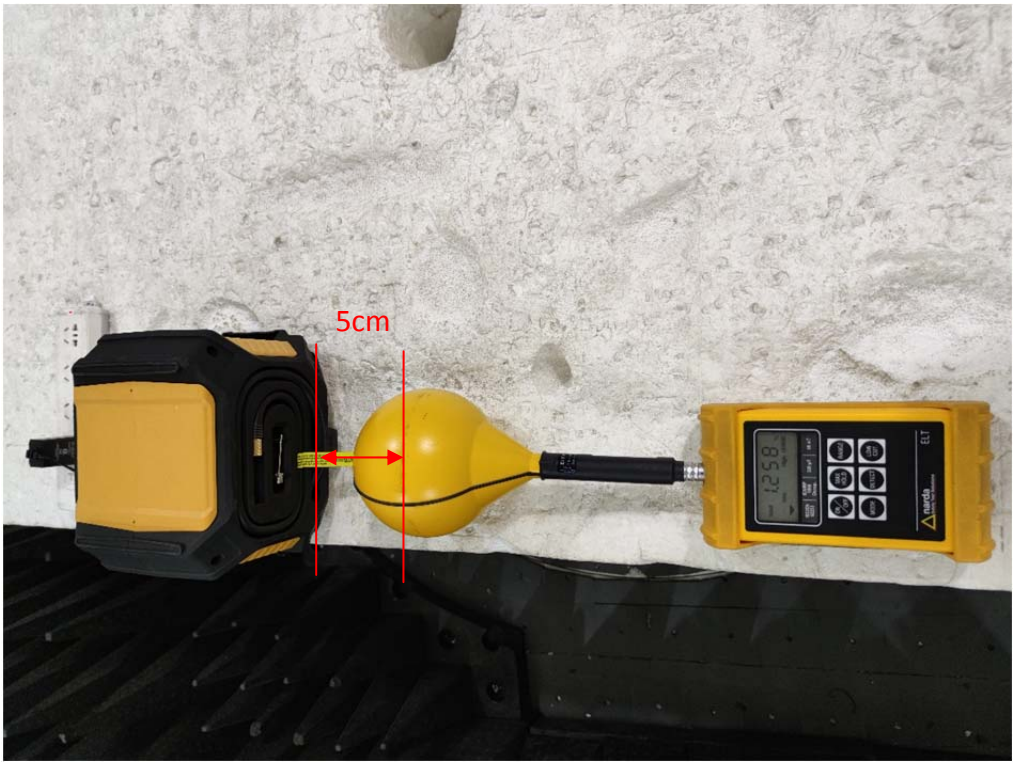
(TM4)



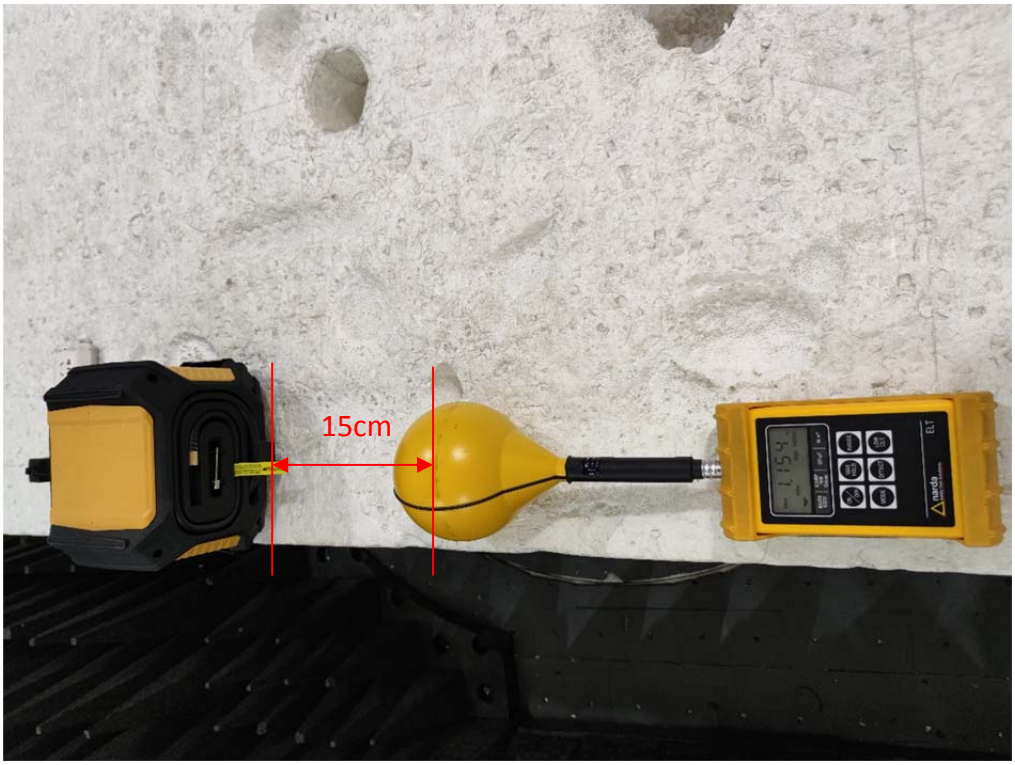

10cm


15cm

9.6. Test Position F - Exposure photo from surface-Bottom

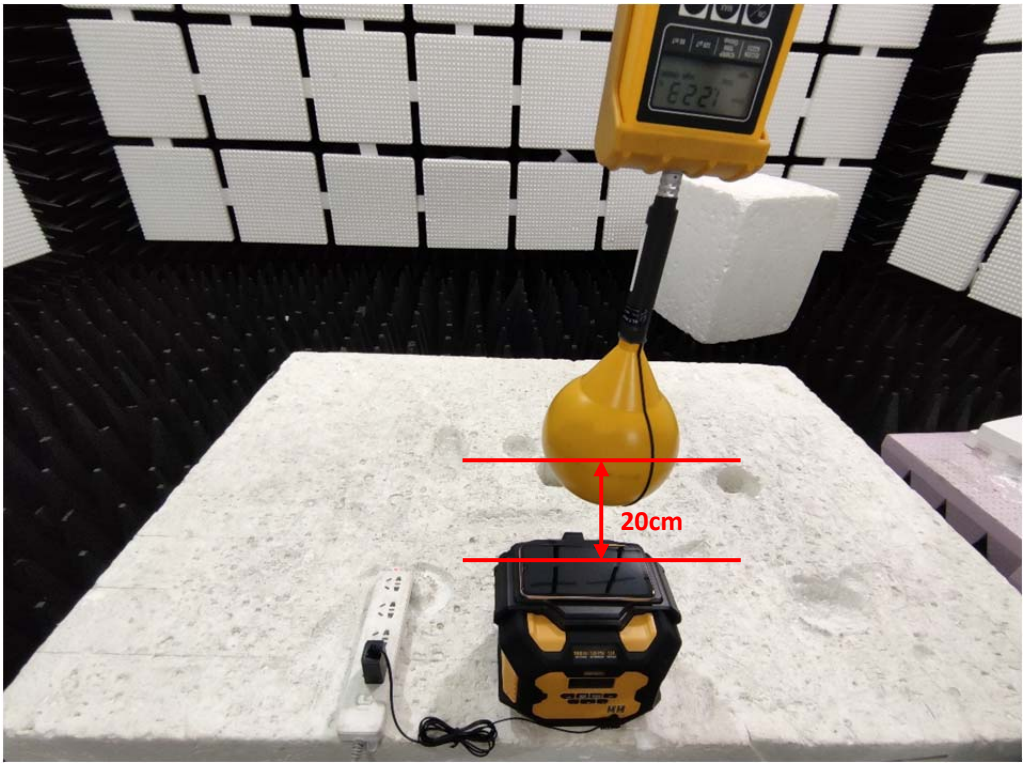


10cm


15cm

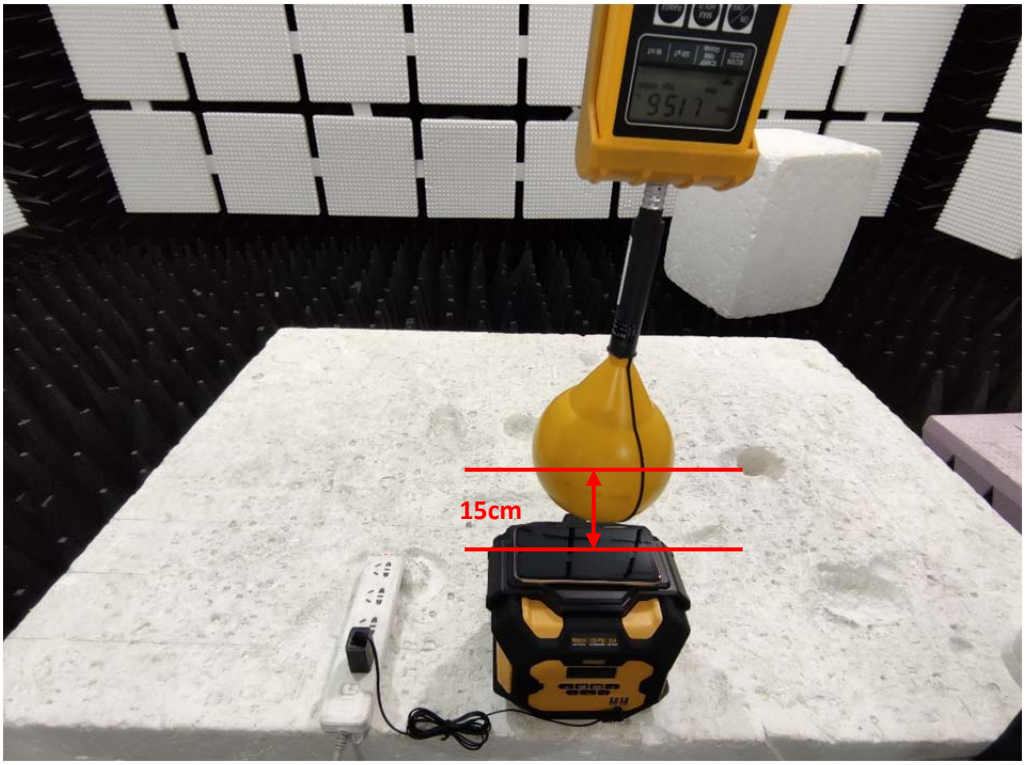
Mobile exposure

9.7. Test Position E - Exposure photo from top surface (20cm)



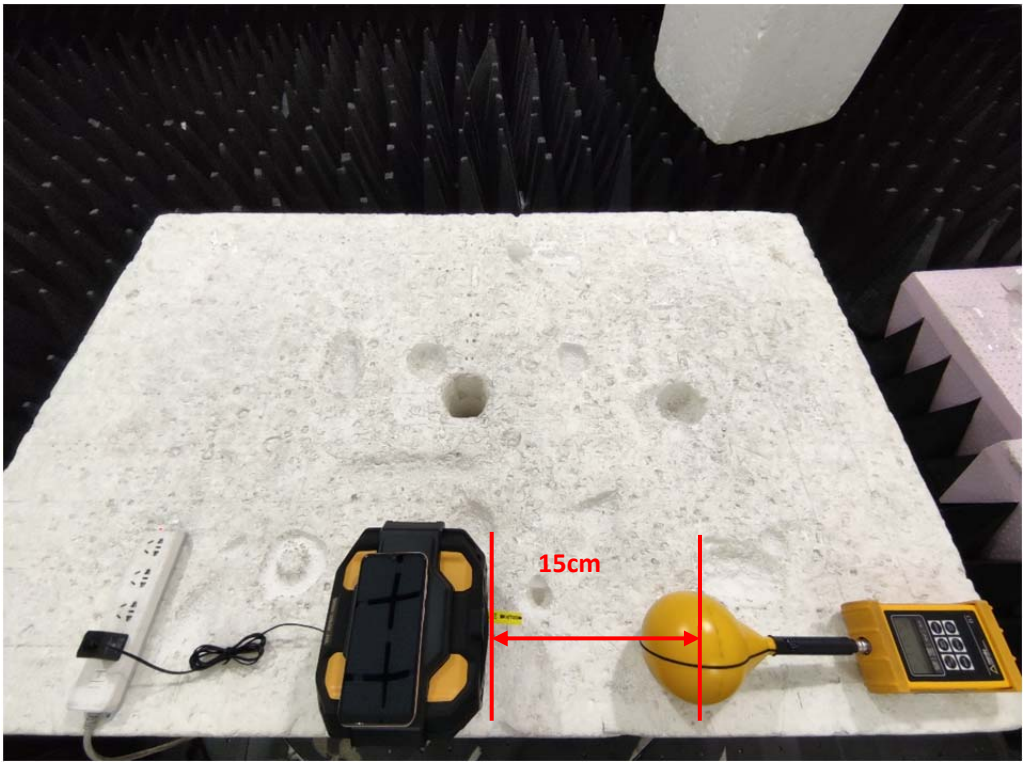
(TM1)

9.8. Test Position HE - Exposure photo from top surface (15cm)



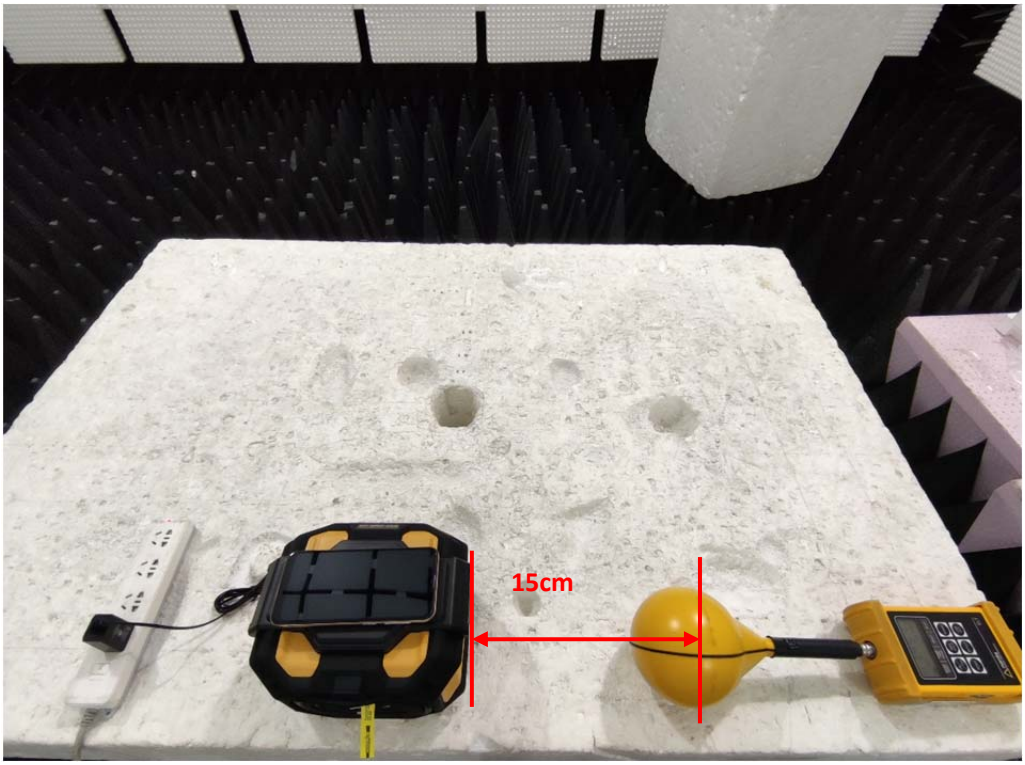
(TM1)

9.9. Test Position A - Exposure photo from side edge surface-Rear



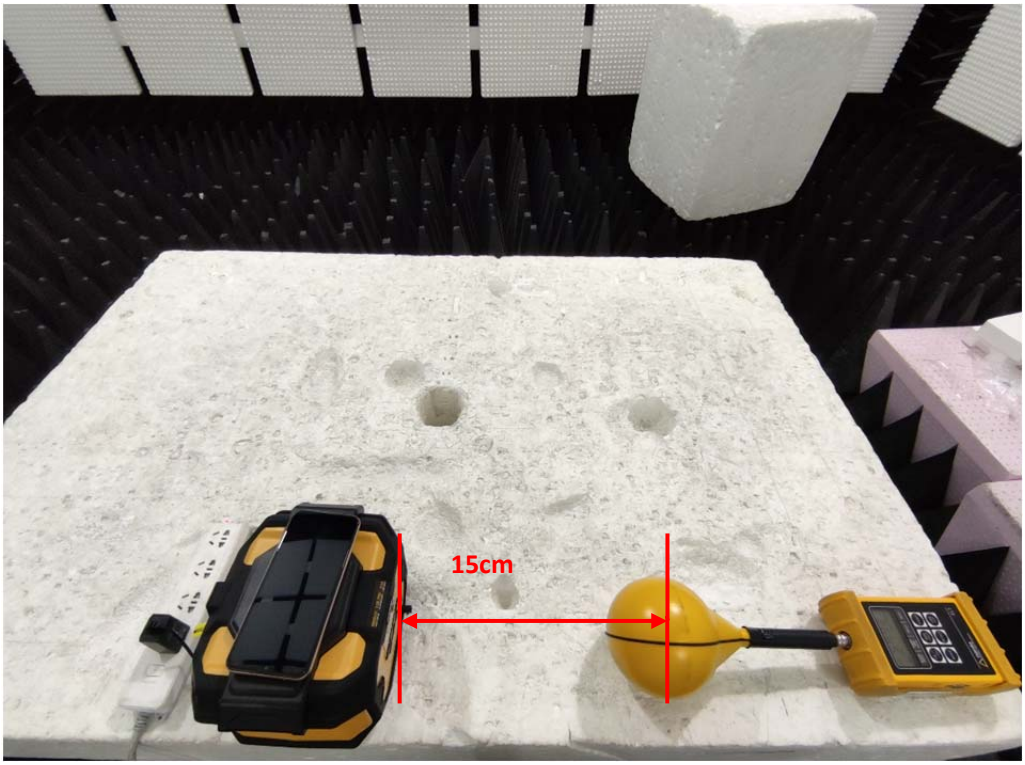
(TM1)

9.10. Test Position B - Exposure photo from side edge surface-Left



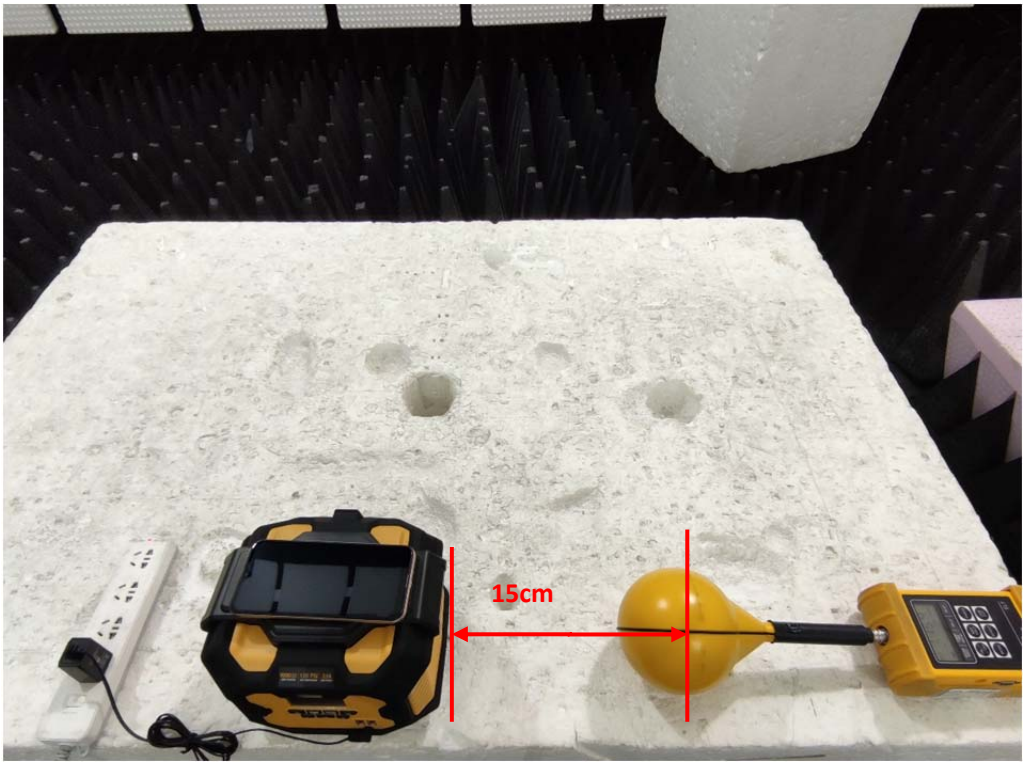
(TM1)

9.11. Test Position C - Exposure photo from side edge surface-Front



(TM1)

9.12. Test Position D - Exposure photo from side edge surface-Right



(TM1)

10. Conclusion

A minimum safety distance of at 15 cm surrounding the device and 20 cm above the top surface of the device is required when the device is charging a smart phone. The detected emissions with a distance of 15 cm surrounding the device and 20 cm above the top surface of the device are below the limitations according to FCC KDB 680106 D01 Section 3. RF Exposure Requirement Clause 3.

Revision History

Revision	Issue Date	Revisions	Revised By
000	June 08, 2021	Initial Issue	Gavin Liang

.....END OF REPORT.....