RF Exposure Evaluation Report

1. Product Information

FCC ID:	2AGR4-100936
Number of tested samples	1
Sample number	210312022A
Product Name	Quinn 5-in-1 Wireless Charging Station
Model Number	100936-121
Power Supply	Input: DC 12V/3.75A Output (USB): 5W*2 Wireless Output: 10W(max)*3 Adapter parameters: Input: 100-240V 50/60Hz 1.5A Output: DC 12V/3.75A
Modulation Type	CW (Continuous Wave)
Frequency Range	110.7 KHz - 148 KHz
Operation Frequency	139.6 KHz
Antenna Type	Coil Antenna
Hardware version	FC-HM03-V33
Software version	/
Accessories	Mobile Phone(iPhone 12)*3
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

2. Evaluation Method

Per KDB 680106 D01 Section 3. RF Exposure Requirements;

a) Consumer wireless power transfer devices approved under Parts 15 and 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 Sections 2.1091 and 2.1093 of the rules.

(1) 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 Sections 1.1307 (c) and (d) of the FCC rules.

(2) Evaluation of RF Exposure test data for determining compliance of wireless power transfer (WPT) systems (both portable and not) operating at frequencies below 100 kHz is provided on a case-bycase basis following a KDB inquiry. In these situations, a WPT device may be considered acceptable when supporting data from measurements and/or numerical simulations show that, for all the positions of space relevant for the body exposure, the external (unperturbed) temporal peak field strengths do not exceed the following reference levels:

- 83 V/m for the electric field , and
- 90 A/m for the magnetic field.

b) 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 someconditions where users and bystanders may be exposed at closer than 20 cm, Section 2.1091(d) (4) of the rules may apply.

c) 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 assessed versus the limits at 300 kHz in Table 1 of Section 1.1310: 614 V/m and 1.63 A/m. Below 100 kHz, applicable reference levels for maximum instantaneous exposure field strengths are defined in clause 3.a).(2).

d) 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 several 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.

e) 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.

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 App v03r01: 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

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/cm^2)	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/cm^2)	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

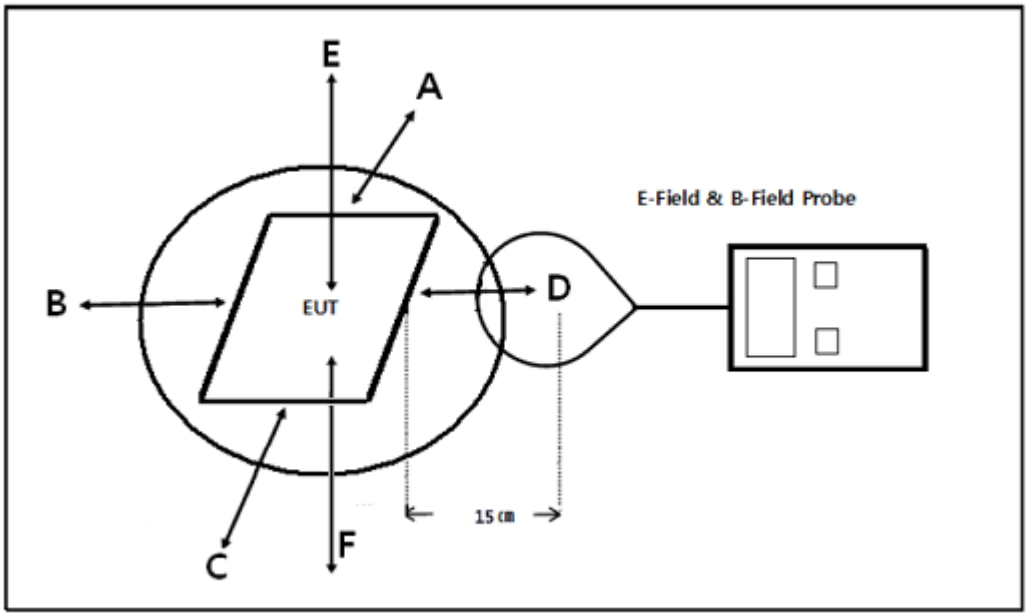
*=Plane-wave equivalent power density

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 – Section1.1310 as following (measured distance shall be 15cm from the center of the probe to the edge of the device):

	E-filed	H-filed	B-filed
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



Due to installation limitations no tests from the underside of the charging device (Test Position F) are required.

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

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 and 20cm) 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.

7. Equipment Approval Considerations

The EUT does not fully comply with item 5(b) of KDB 680106 D01 V03r01 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 110.7 KHz – 148.0 KHz
Output power from each primary coil is less than 15 watts		Yes	The maximum output power of the each primary coil is 10W.
The system may consist of more than one		No	The transfer system includes three identical

source primary coils, charging one or more clients. If more than one primary coil is present, the coil pairs may be powered on at the same time.			Coils and evenly spaced from each other.
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).		Yes	Mobile exposure conditions only
The aggregate H-field strengths anywhere at or beyond 15 cm surrounding the device, and 20 cm away from the surface from all coils that by design can simultaneously transmit, and while those coils are simultaneously energized, are demonstrated to be less than 50% of the applicable 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 by 5. b) above, an RF exposure evaluation report must be reviewed and accepted through a KDB 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

8.1 Standalone E-Filed Strength and H-Filed Strength

Test Modes:		
TM1	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 1)+(Battery Status: <1%)	Record
TM2	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 2)+(Battery Status: <1%)	Record
TM3	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 3)+(Battery Status: <1%)	Record
TM4	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Three iPhone 12 on coils)+(Battery Status: <1%)	Record
TM5	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coil 1&2)+(Battery Status: <1%)	Record
TM6	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coil 1&3)+(Battery Status: <1%)	Record
TM7	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coil 2&3)+(Battery Status: <1%)	Record
TM8	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 1)+(Battery Status: <50%)	Pre-tested
TM9	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 2)+(Battery Status: <50%)	Pre-tested
TM10	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 3)+(Battery Status: <50%)	Pre-tested
TM11	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 1)+(Battery Status: <100%)	Pre-tested
TM12	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 2)+(Battery Status: <100%)	Pre-tested
TM13	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (One iPhone 12 on coil 3)+(Battery Status: <100%)	Pre-tested
TM14	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Three iPhone 12 on coils)+(Battery Status: <50%)	Pre-tested
TM15	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Three iPhone 12 on coils)+(Battery Status: <100%)	Pre-tested

TM16	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils1&2)+(Battery Status: <50%)	Pre-tested
TM17	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils1&2)+(Battery Status: <100%)	Pre-tested
TM18	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils1&3)+(Battery Status: <50%)	Pre-tested
TM19	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils1&3)+(Battery Status: <100%)	Pre-tested
TM20	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils2&3)+(Battery Status: <50%)	Pre-tested
TM21	AC/DC Adapter (12V/3.75A) + EUT + Mobile Phone (Two iPhone 12 on coils2&3)+(Battery Status: <100%)	Pre-tested
Note: All modes were tested, only recorded the worst case data(TM1,TM2,TM3,TM4,TM5,TM6,TM7) in the test report.		

E-Filed Strength at 15 cm from the edges surrounding the EUT and 15 cm above the top surface

Test Mode	Unit	Charging Battery Level	Frequency Range (MHz)	Measured E-Field Strength Values (V/m)					FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
				Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
TM1	V/m	1%	0.1396	67.106	91.234	99.151	93.873	94.627	307.0	614.0
TM2	V/m	1%	0.1396	88.218	86.333	88.595	91.988	89.726	307.0	614.0
TM3	V/m	1%	0.1396	82.563	85.579	70.122	87.087	91.611	307.0	614.0
TM4	V/m	1%	0.1396	128.93	112.35	137.23	104.05	97.64	307.0	614.0
TM5	V/m	1%	0.1396	96.889	112.346	107.82	106.691	109.707	307.0	614.0
TM6	V/m	1%	0.1396	105.183	106.691	104.42	105.937	104.052	307.0	614.0
TM7	V/m	1%	0.1396	111.215	111.969	93.873	108.953	110.461	307.0	614.0

Note: V/m= A/m *377

H-Filed Strength at 15 cm from the edges surrounding the EUT and 15 cm above the top surface

Test Mode	Unit	Charging Battery Level	Frequency Range (MHz)	Measured H-Field Strength Values (A/m)					FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
				Test Position A	Test Position B	Test Position C	Test Position D	Test Position E		
TM1	uT	1%	0.1396	0.2225	0.3025	0.3288	0.3113	0.3138	--	--
	A/m	1%	0.1396	0.178	0.242	0.263	0.249	0.251	0.815	1.63
TM2	uT	1%	0.1396	0.2925	0.2863	0.2938	0.3050	0.2975	--	--
	A/m	1%	0.1396	0.234	0.229	0.235	0.244	0.238	0.815	1.63
TM3	uT	1%	0.1396	0.2738	0.2838	0.2325	0.2888	0.3038	--	--
	A/m	1%	0.1396	0.219	0.227	0.186	0.231	0.243	0.815	1.63
TM4	uT	1%	0.1396	0.4275	0.3725	0.4550	0.3450	0.3238	--	--
	A/m	1%	0.1396	0.342	0.298	0.364	0.276	0.259	0.815	1.63
TM5	uT	1%	0.1396	0.321	0.373	0.358	0.354	0.364	--	--
	A/m	1%	0.1396	0.257	0.298	0.286	0.283	0.291	0.815	1.63
TM6	uT	1%	0.1396	0.349	0.354	0.346	0.351	0.345	--	--
	A/m	1%	0.1396	0.279	0.283	0.277	0.281	0.276	0.815	1.63
TM7	uT	1%	0.1396	0.369	0.371	0.311	0.361	0.366	--	--
	A/m	1%	0.1396	0.295	0.297	0.249	0.289	0.293	0.815	1.63

Note:A/m=uT/1.25

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

Test Mode	Unit	Charging Battery Level	Frequency Range (MHz)	Measured H-Field Strength Values (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
				Test Position E		
TM1	uT	1%	0.1396	0.2688	--	--
	A/m	1%	0.1396	0.215	0.815	1.63
TM2	uT	1%	0.1396	0.285	--	--
	A/m	1%	0.1396	0.228	0.815	1.63
TM3	uT	1%	0.1396	0.2475	--	--
	A/m	1%	0.1396	0.198	0.815	1.63
TM4	uT	1%	0.1396	0.2988	--	--
	A/m	1%	0.1396	0.239	0.815	1.63
TM5	uT	1%	0.1396	0.283	--	--
	A/m	1%	0.1396	0.226	0.815	1.63
TM6	uT	1%	0.1396	0.291	--	--
	A/m	1%	0.1396	0.233	0.815	1.63
TM7	uT	1%	0.1396	0.289	--	--
	A/m	1%	0.1396	0.231	0.815	1.63

Note:A/m=uT/1.25

9. Test Setup Photos

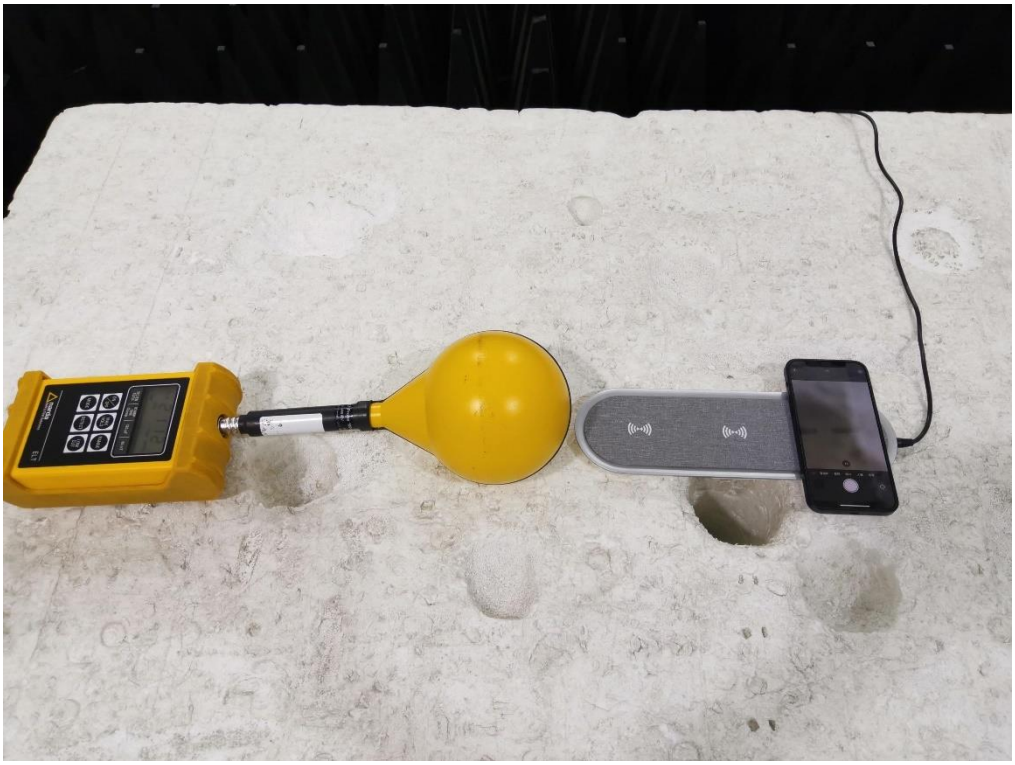
Test Position E - Exposure photo from top surface (20cm)

(TM1)

Test Position E - Exposure photo from top surface (15cm)

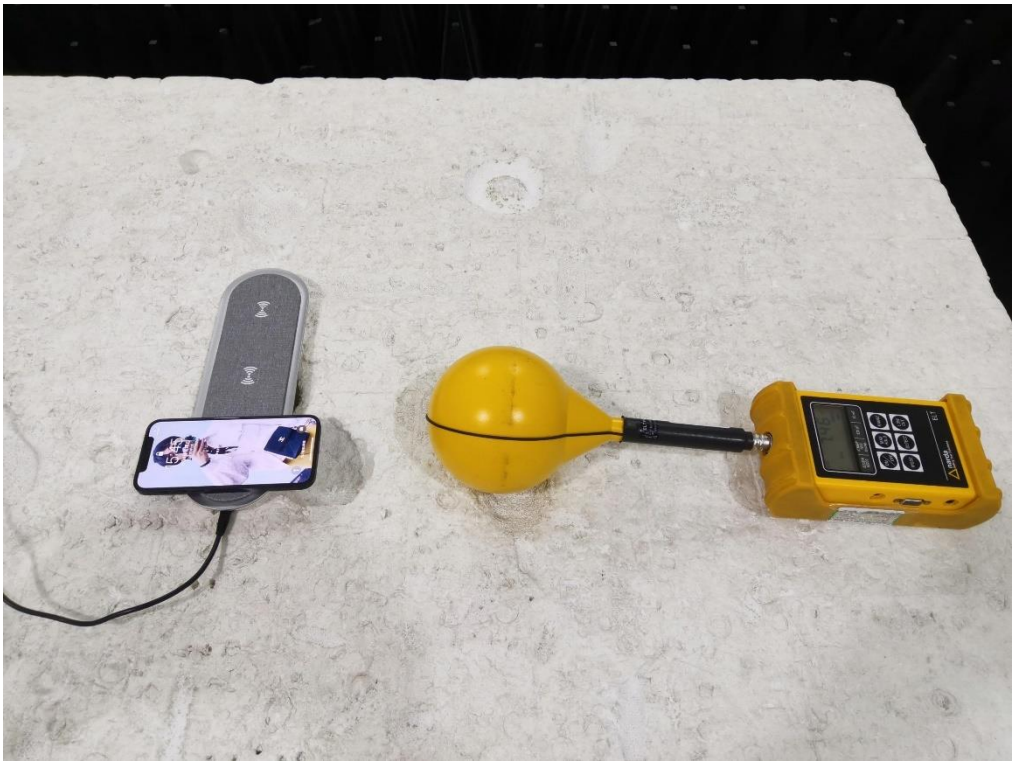
(TM1)

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



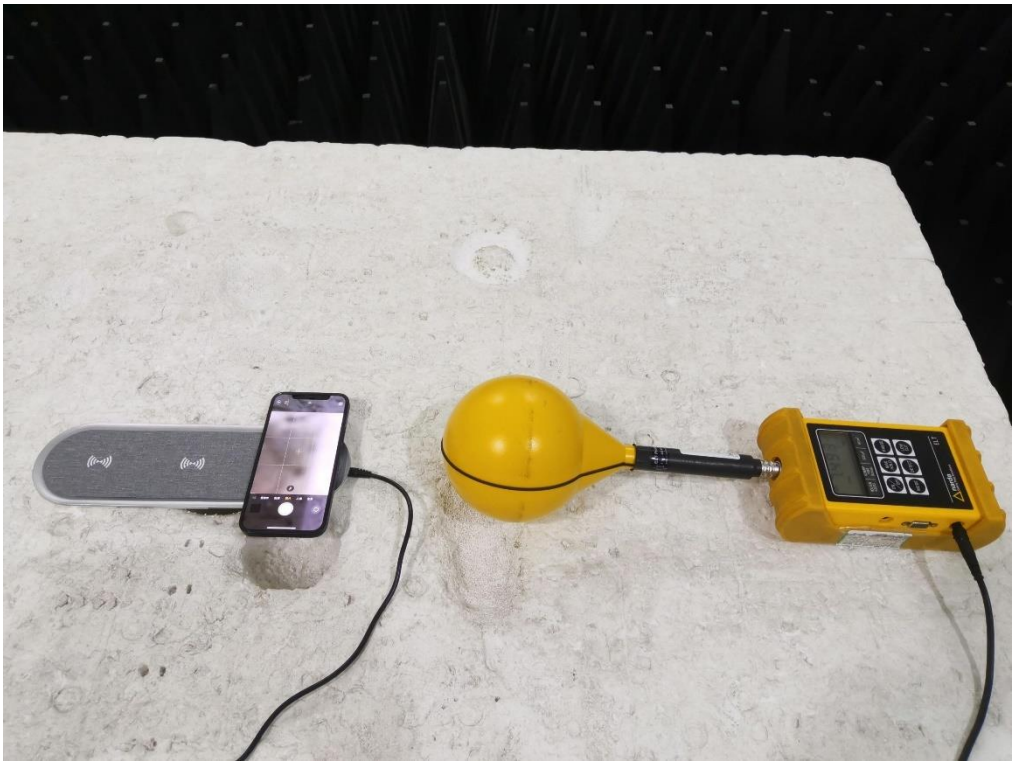
(TM1)

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



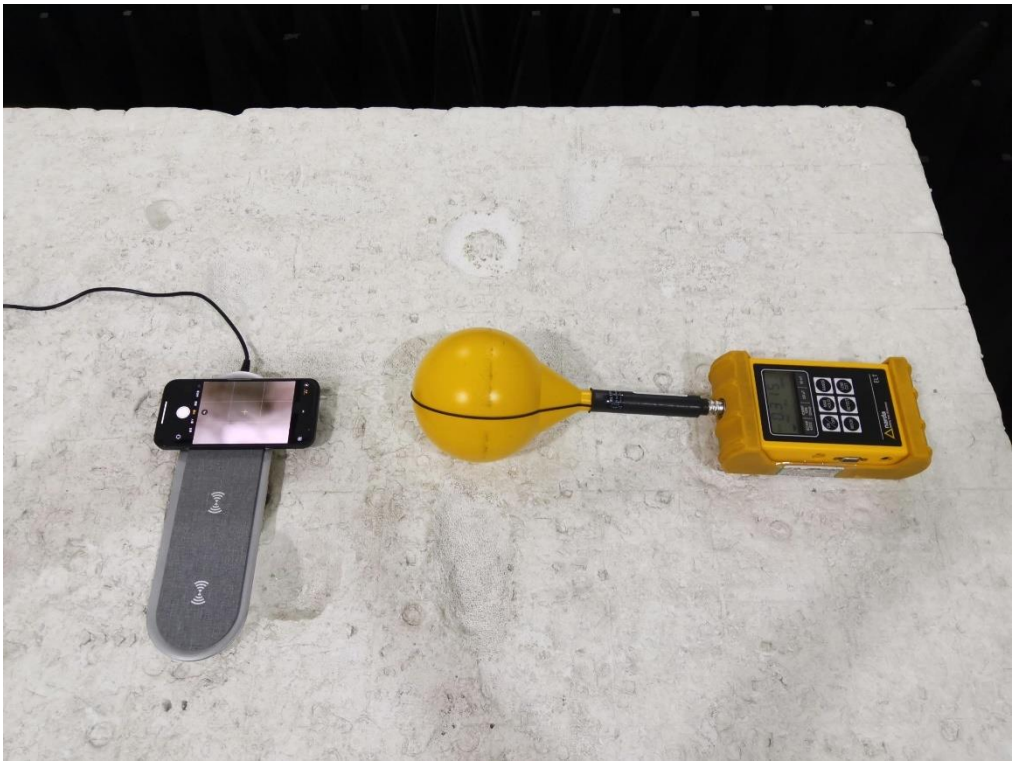
(TM1)

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



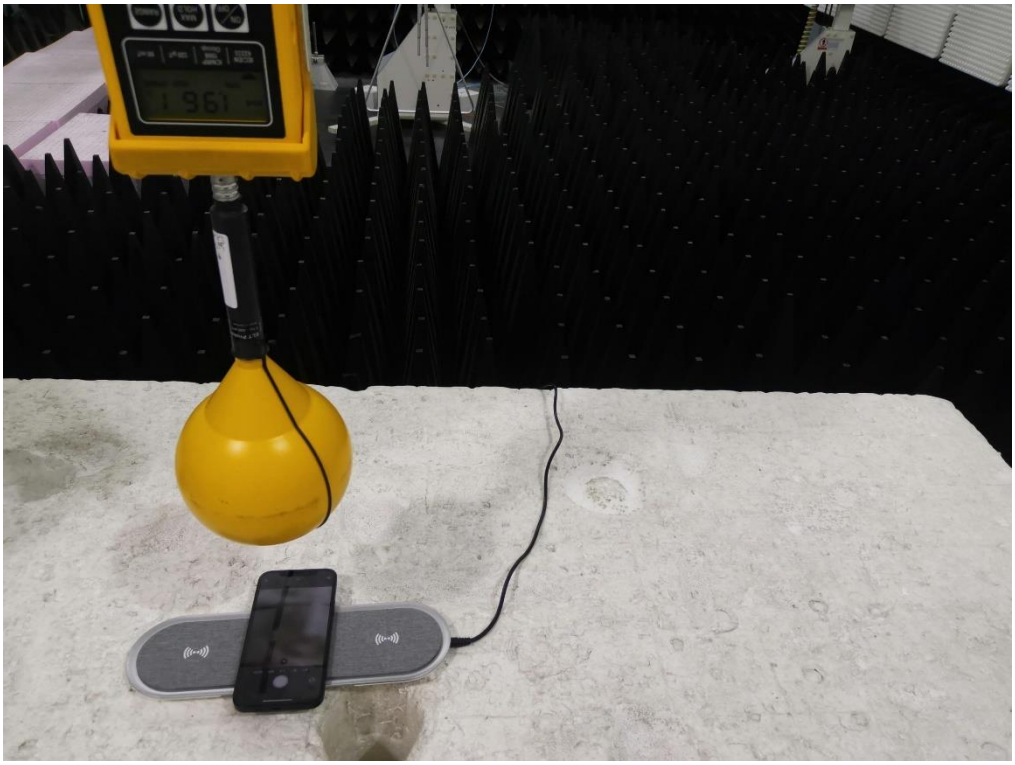
(TM1)

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



(TM1)

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

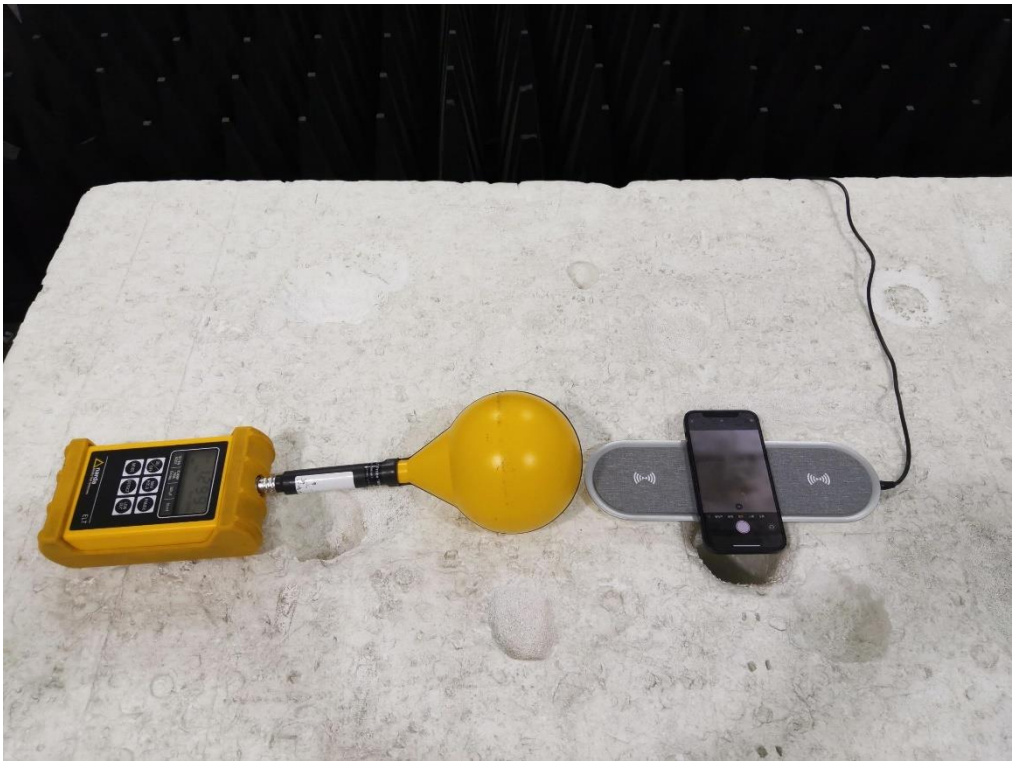


(TM2)

Test Position E - Exposure photo from top surface (15cm)

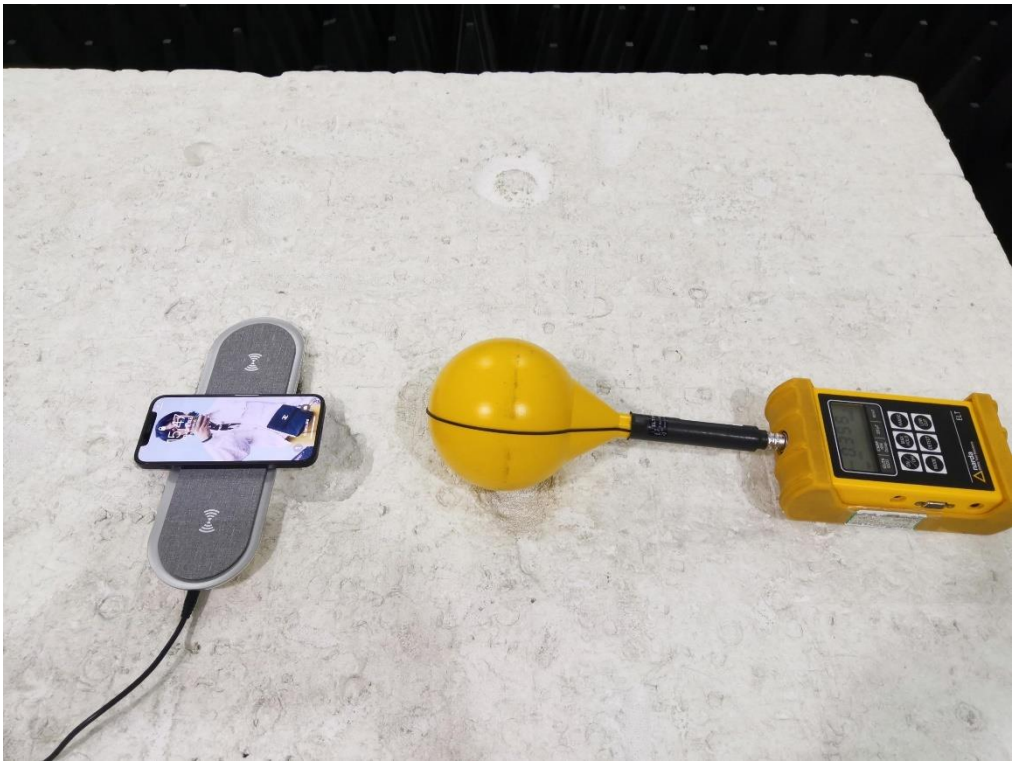
(TM2)

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



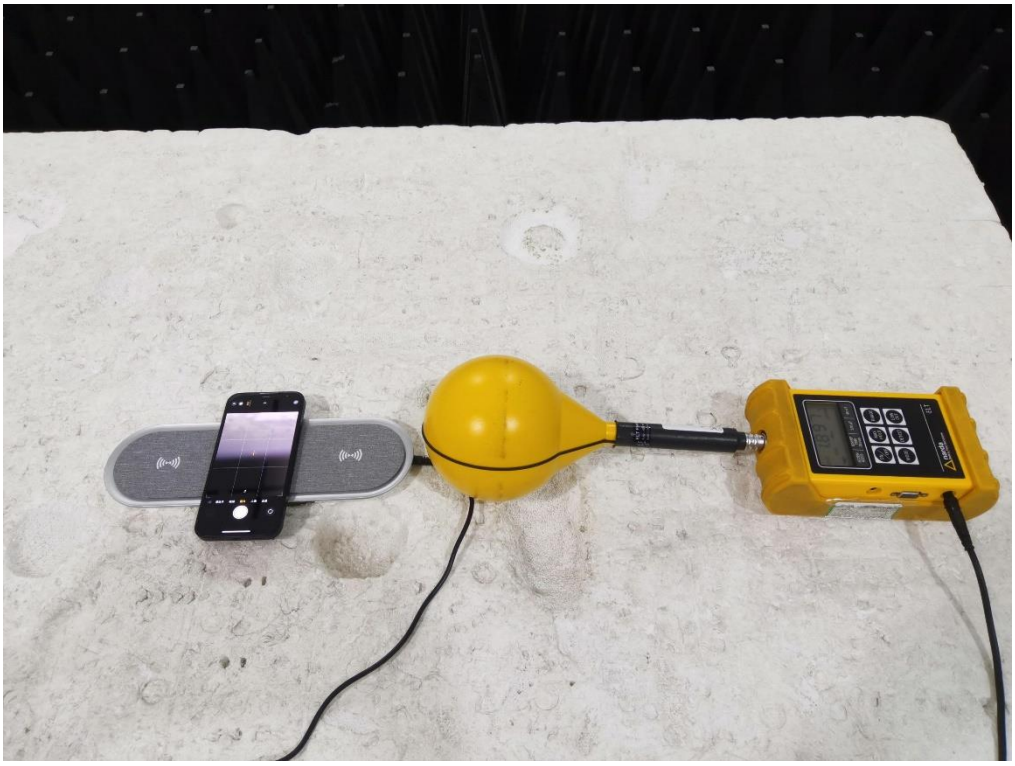
(TM2)

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



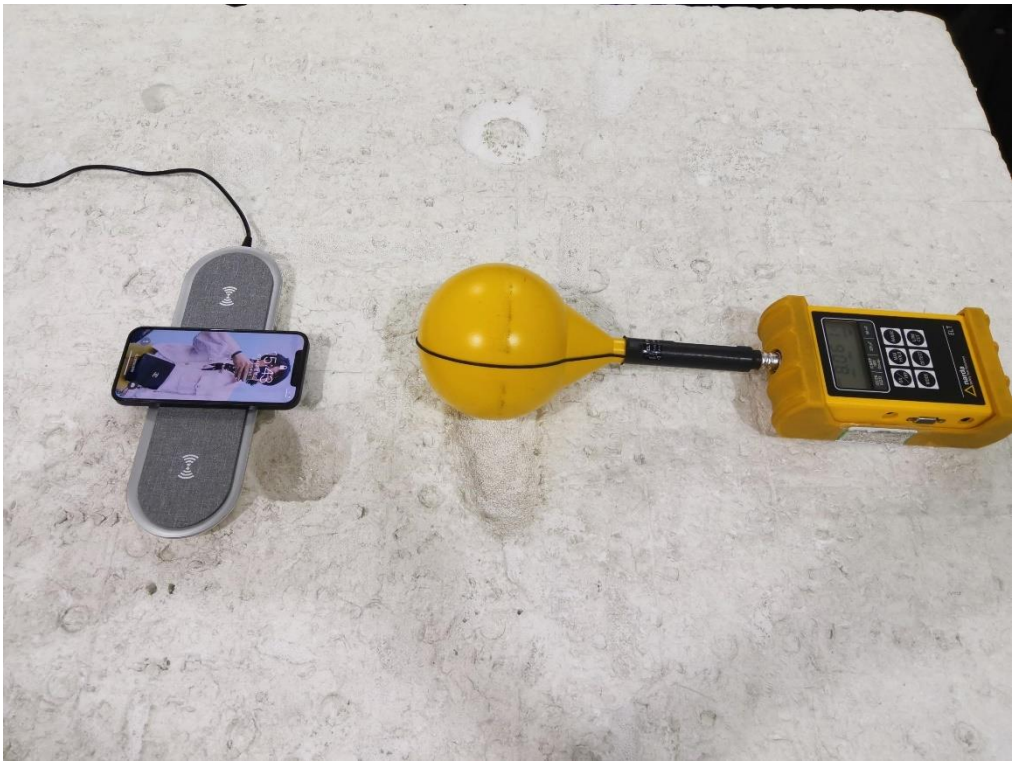
(TM2)

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



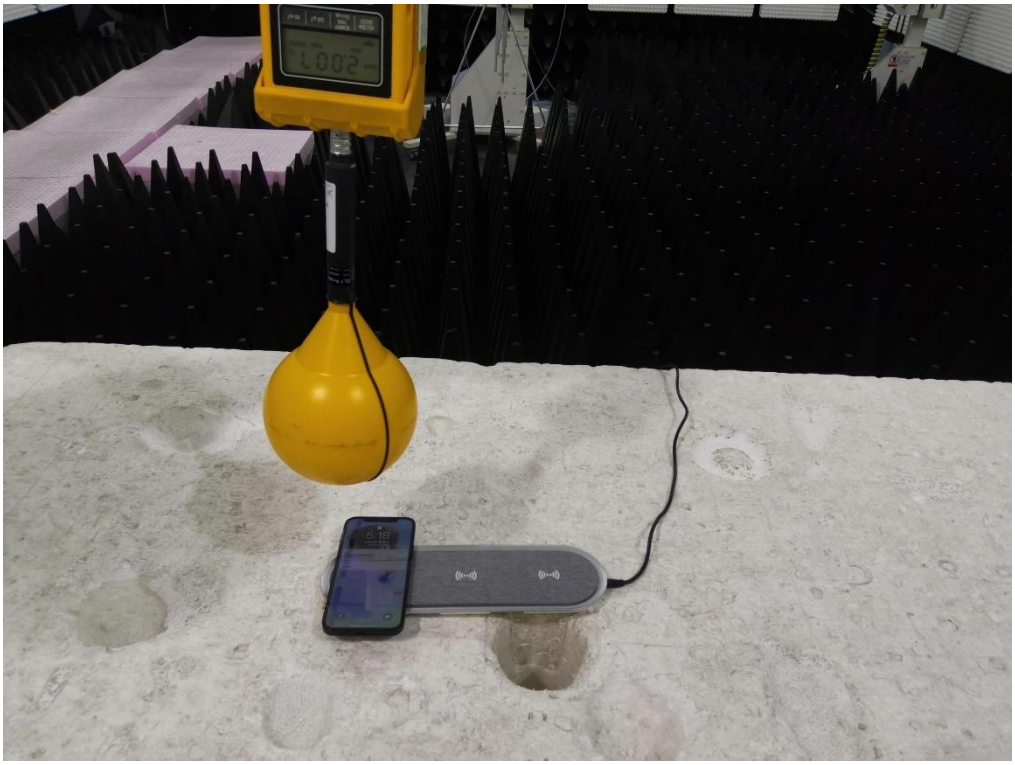
(TM2)

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



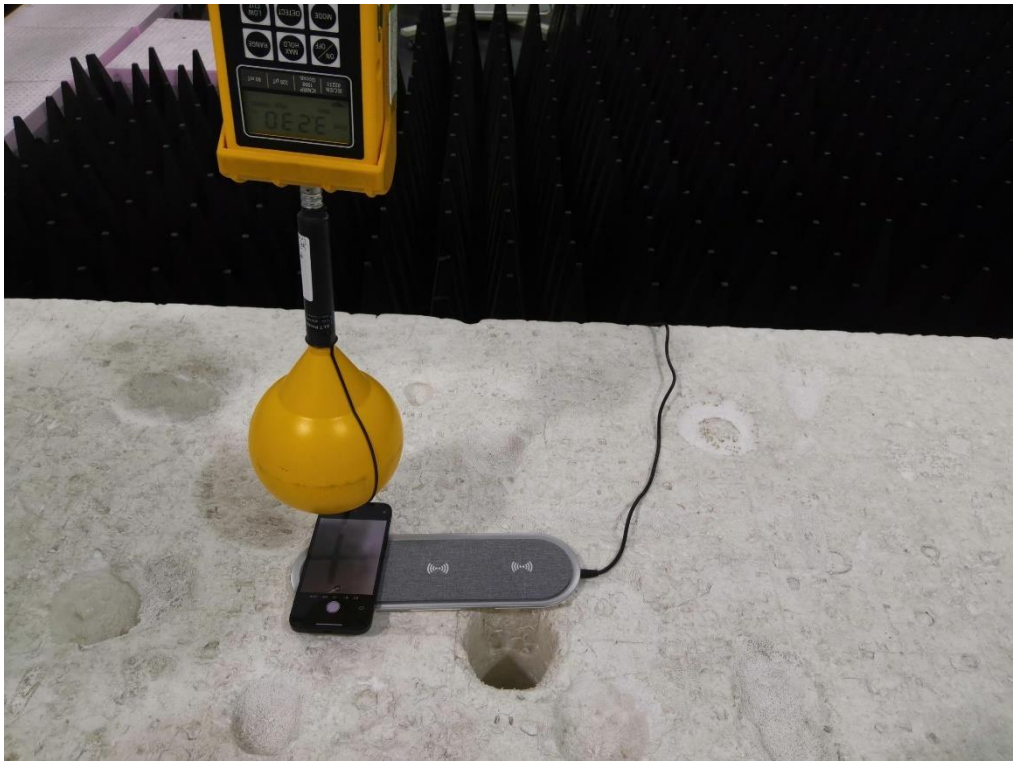
(TM2)

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



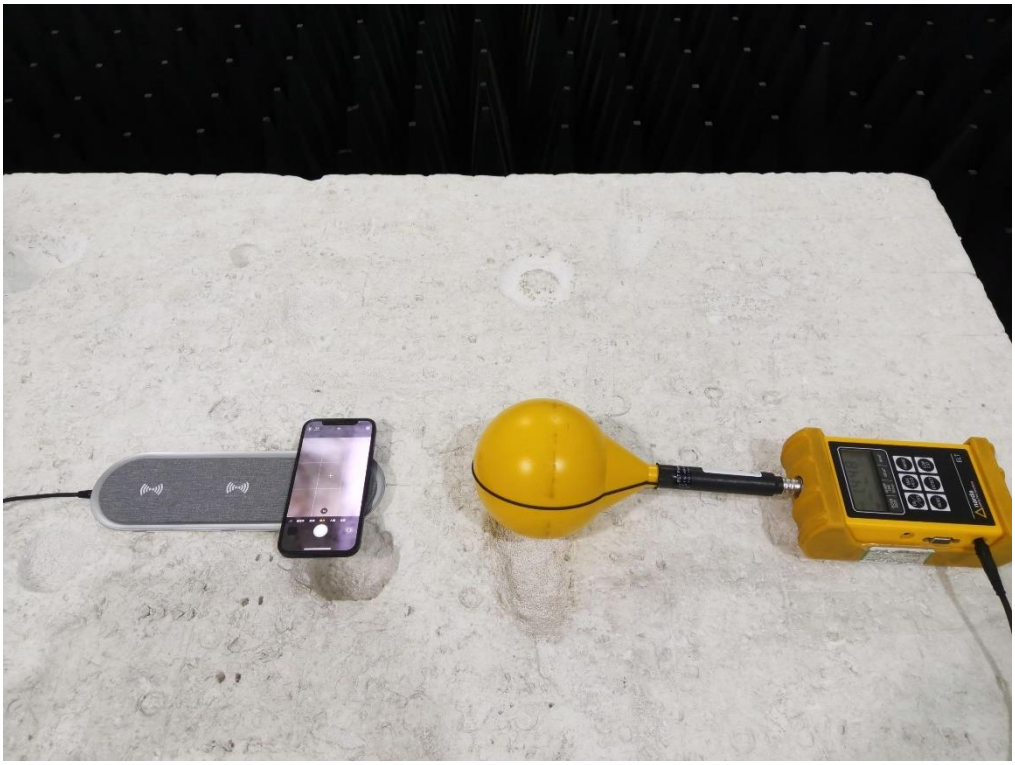
(TM3)

Test Position E - Exposure photo from top surface (15cm)



(TM3)

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

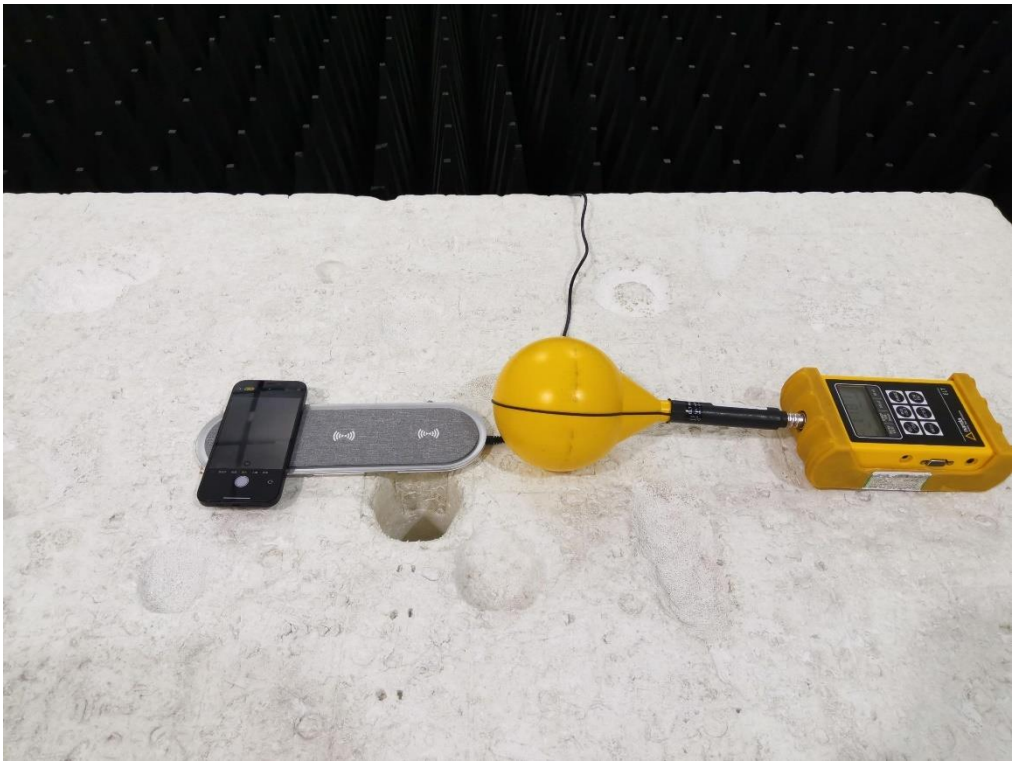


(TM3)

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

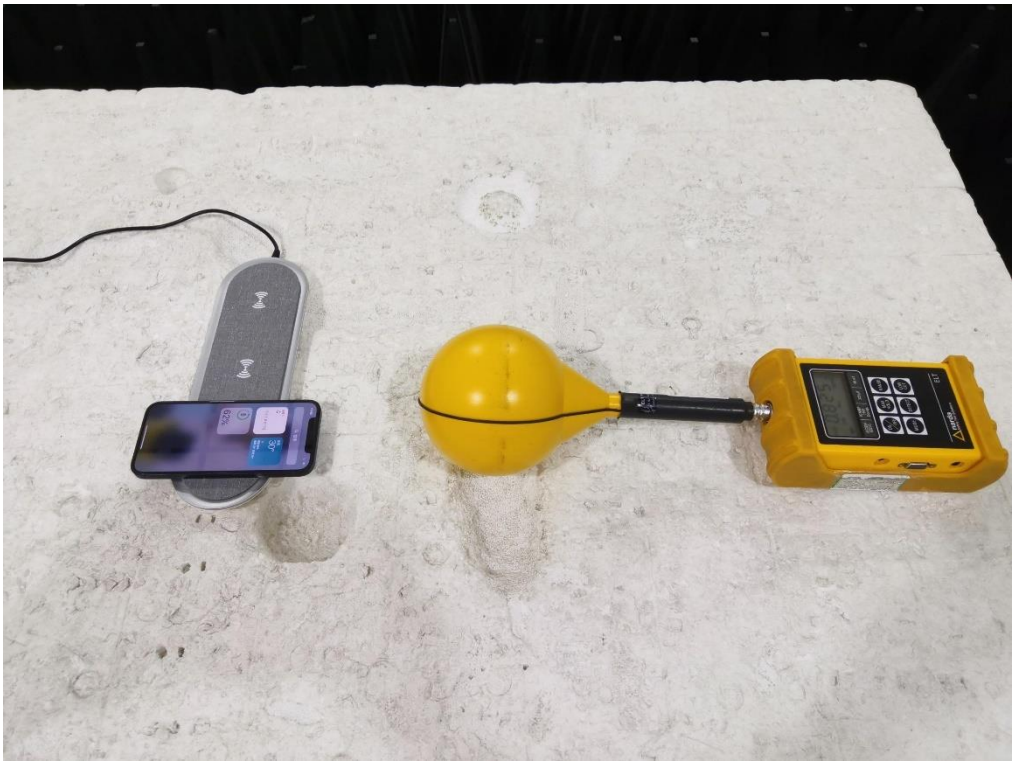
(TM3)

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



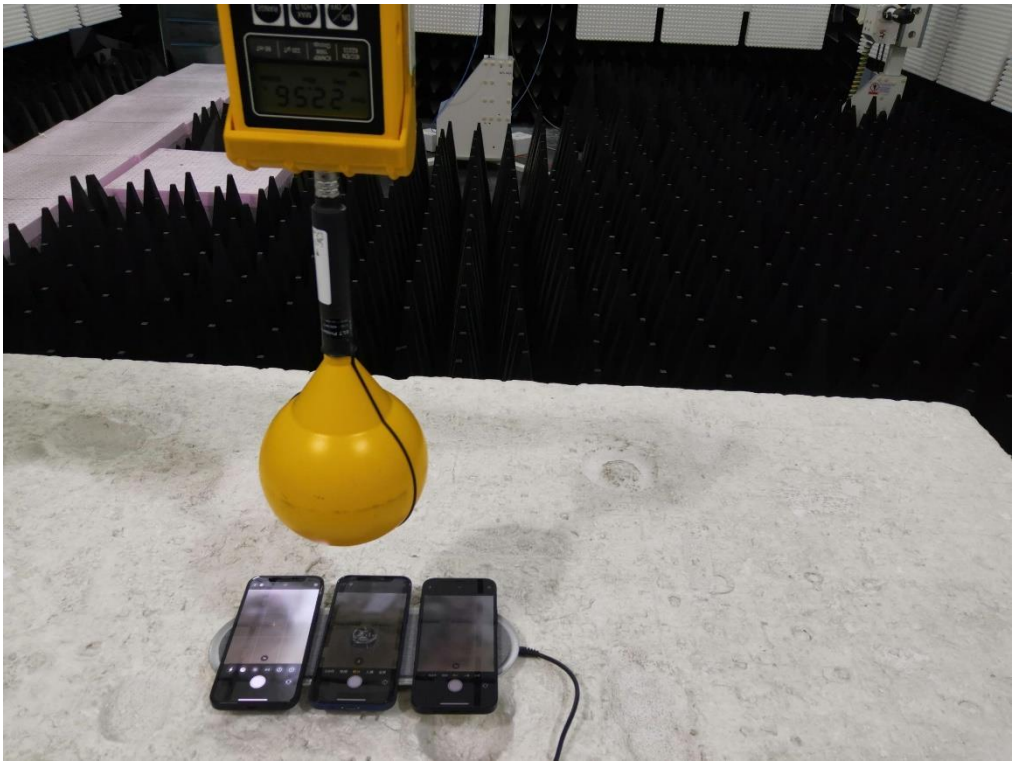
(TM3)

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



(TM3)

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

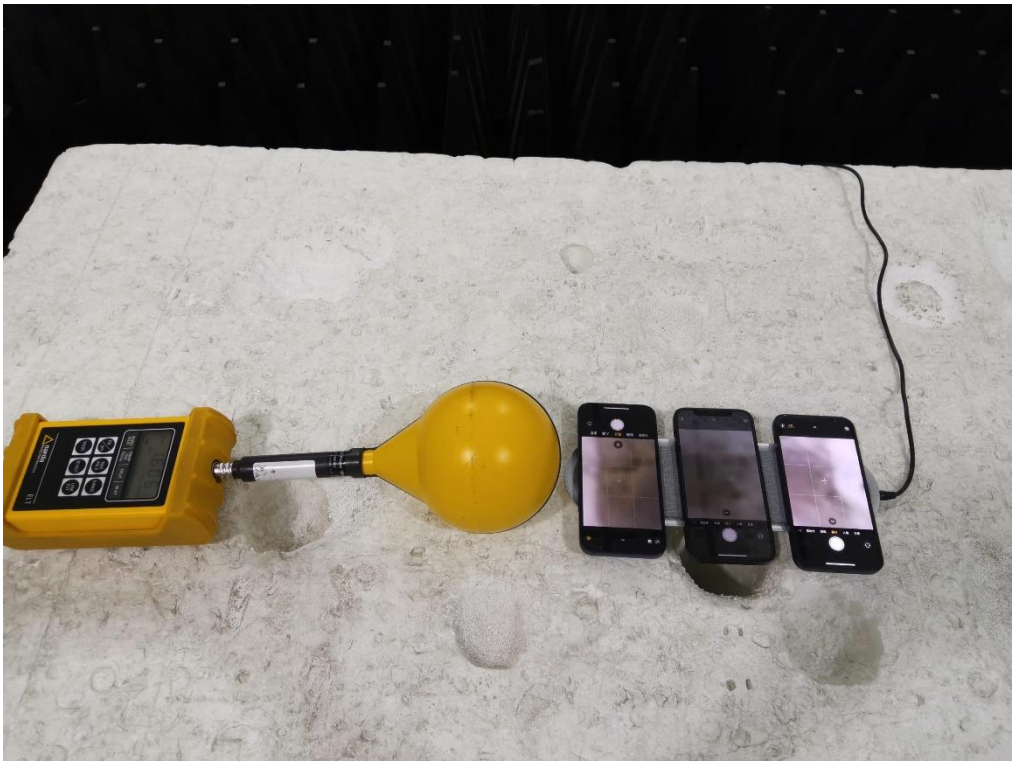


(TM4)

Test Position E - Exposure photo from top surface (15cm)

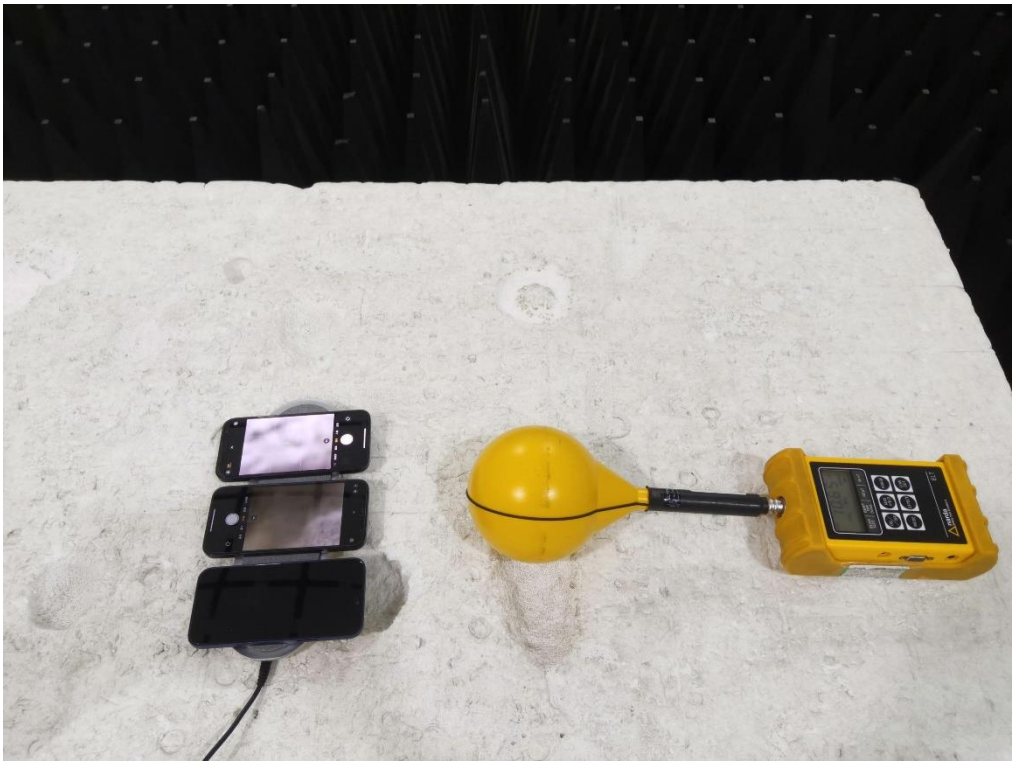
(TM4)

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



(TM4)

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

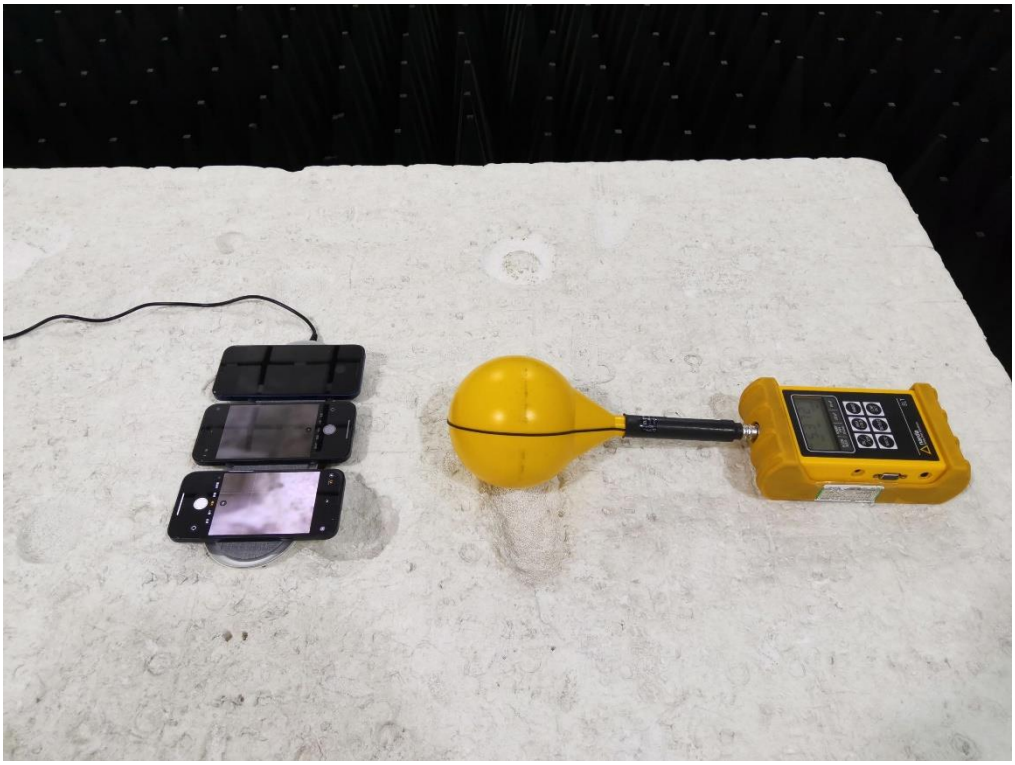


(TM4)

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

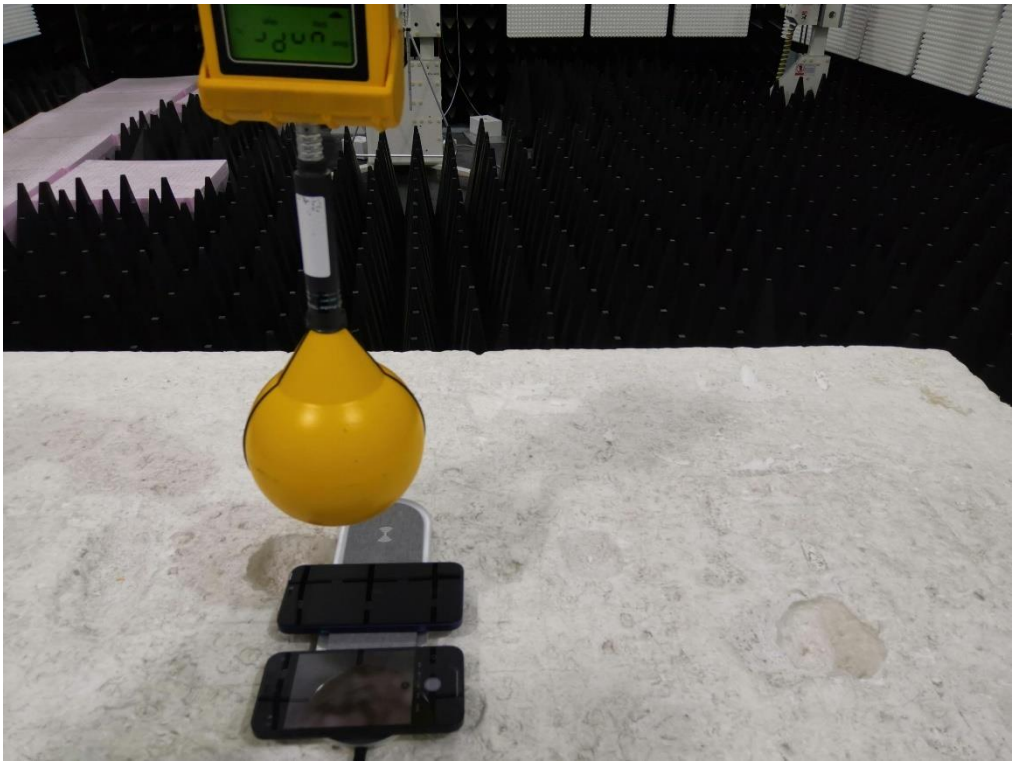
(TM4)

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



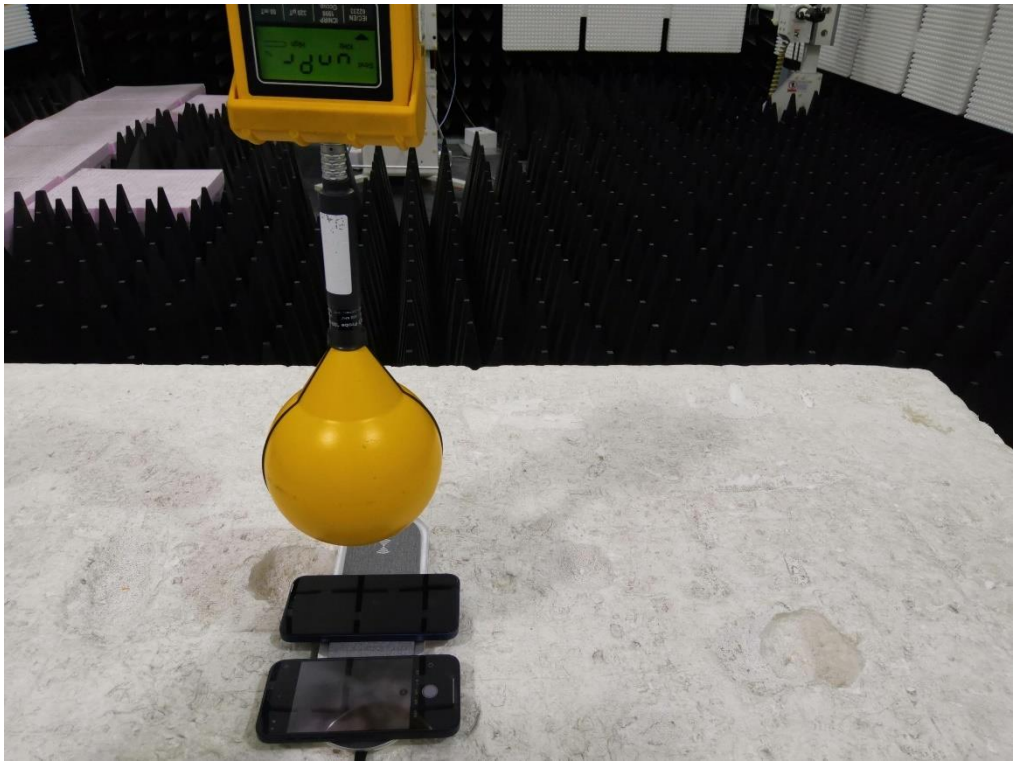
(TM4)

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



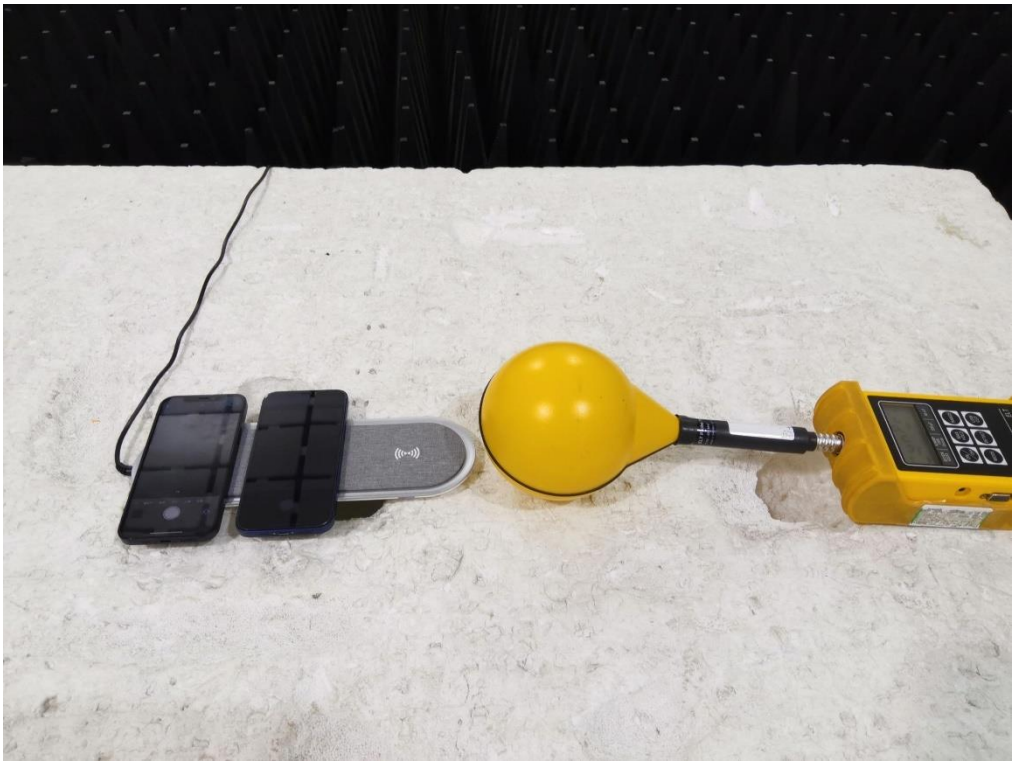
(TM5)

Test Position E - Exposure photo from top surface (15cm)



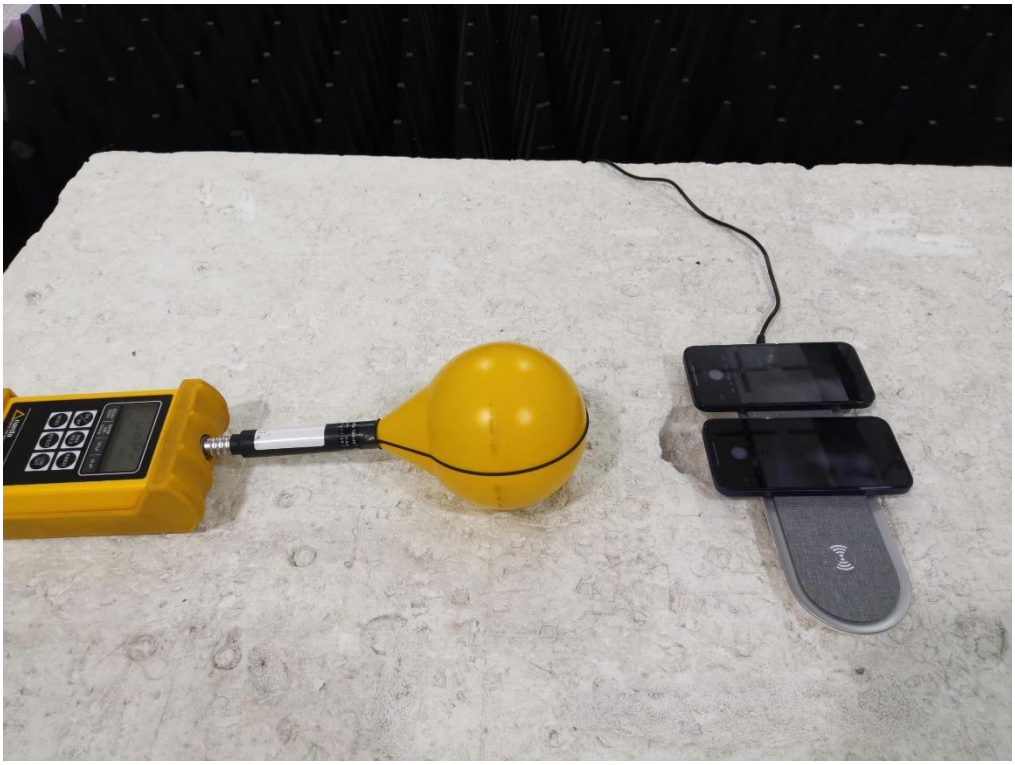
(TM5)

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



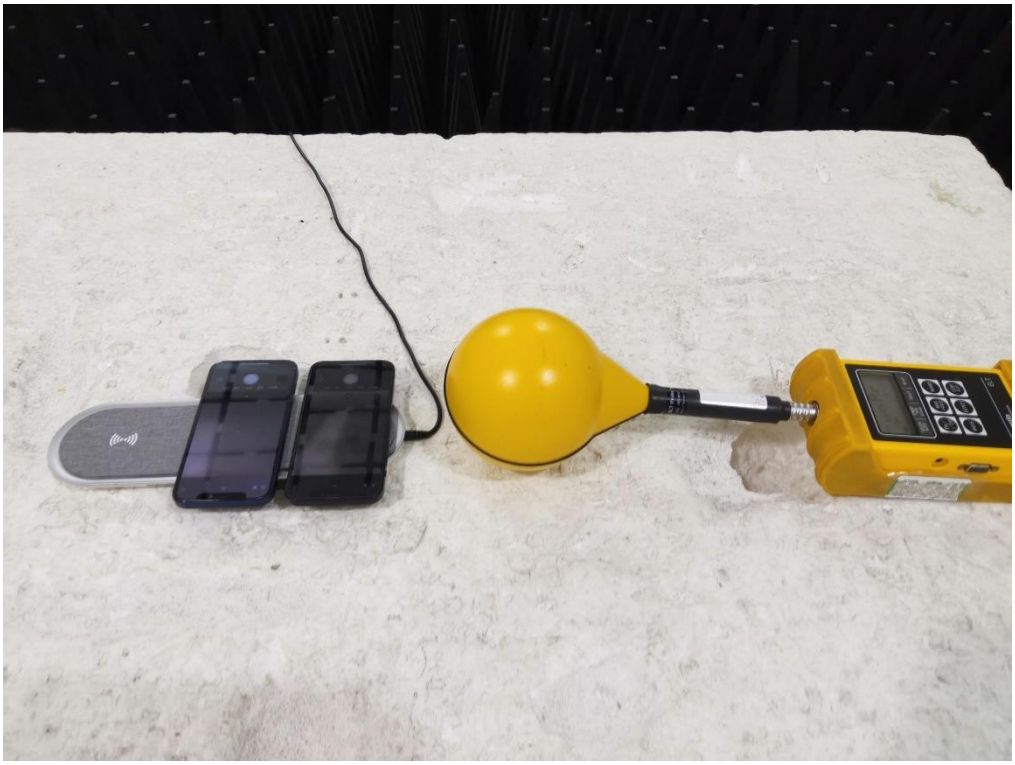
(TM5)

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



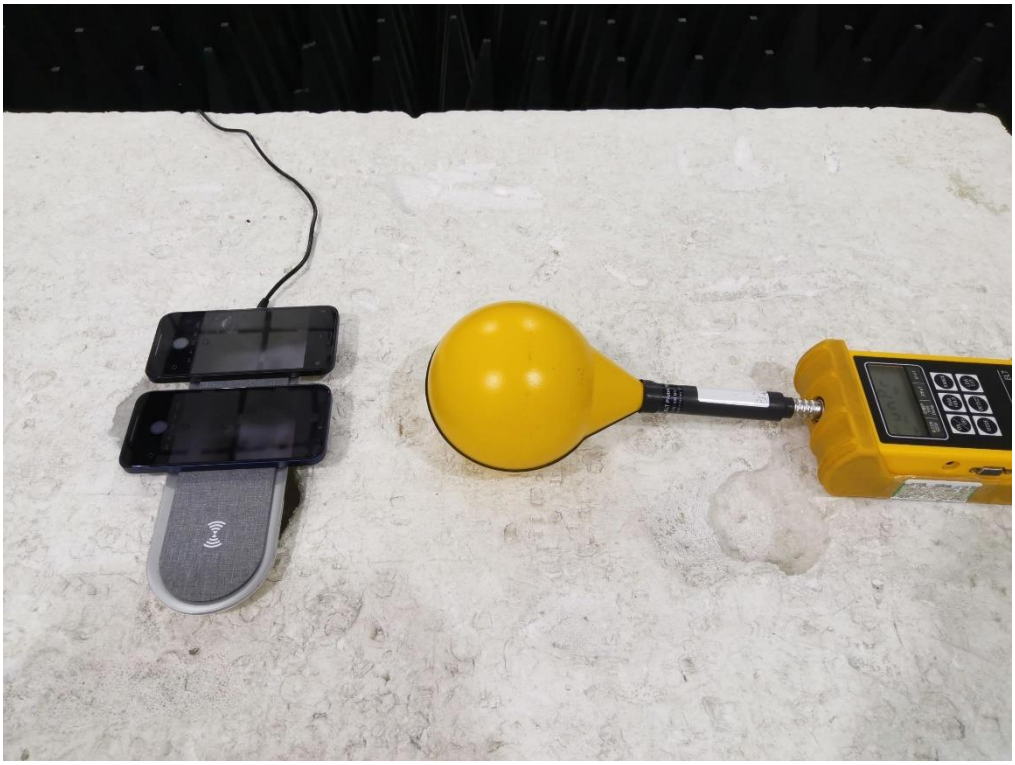
(TM5)

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



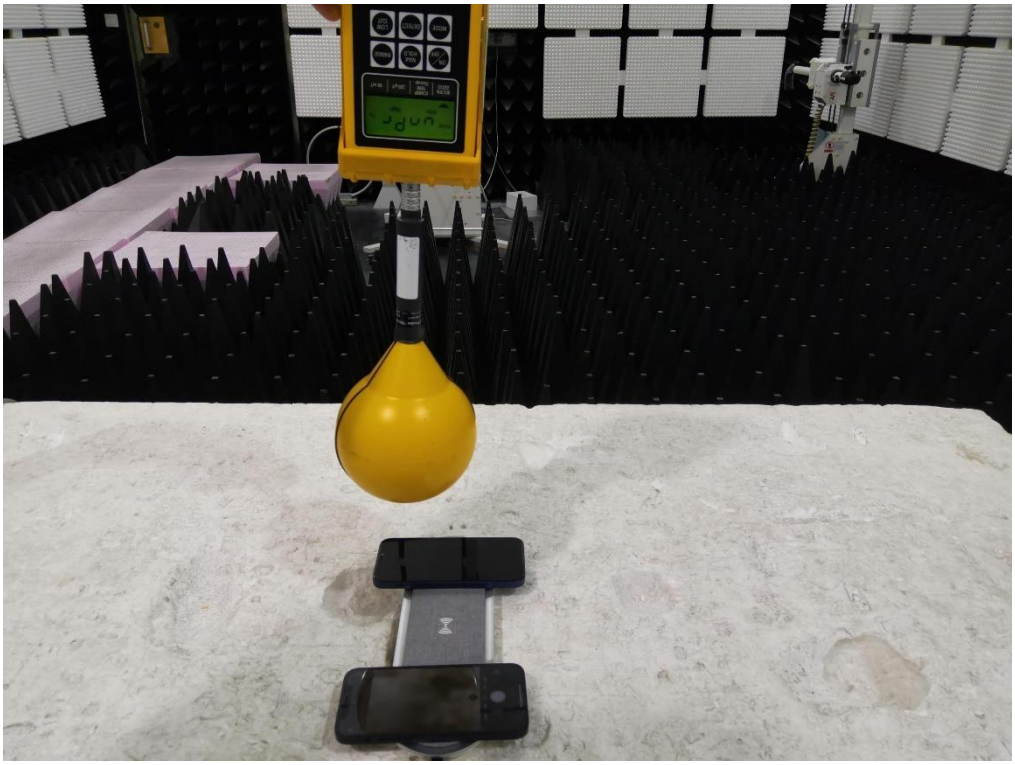
(TM5)

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



(TM5)

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

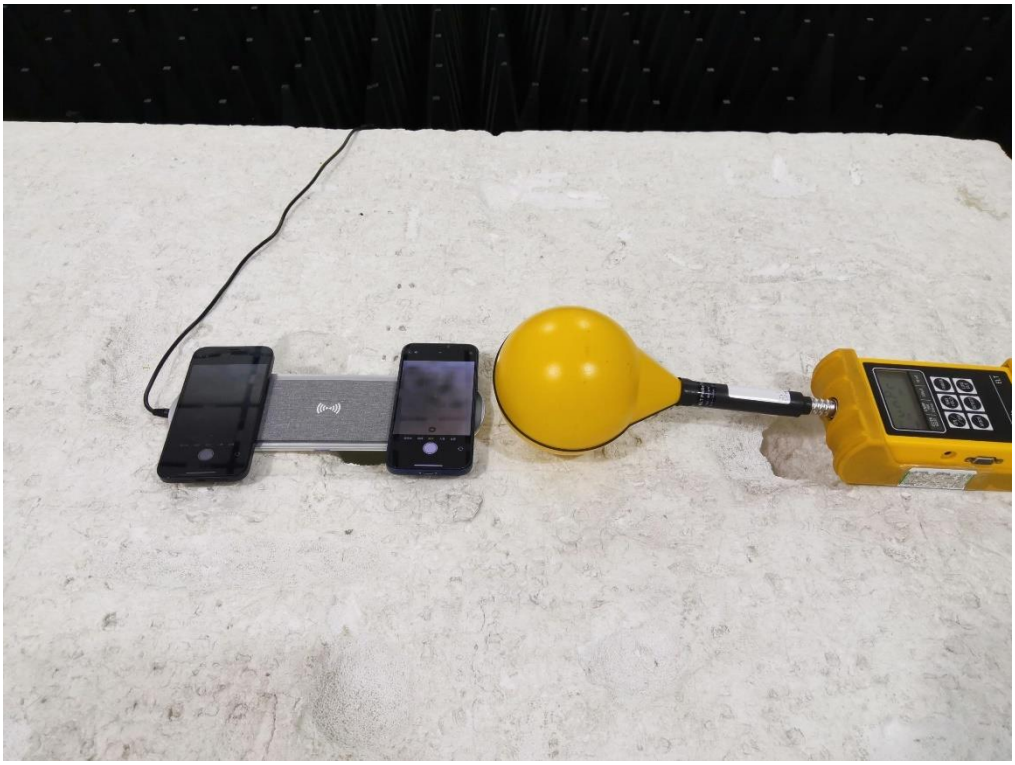


(TM6)

Test Position E - Exposure photo from top surface (15cm)

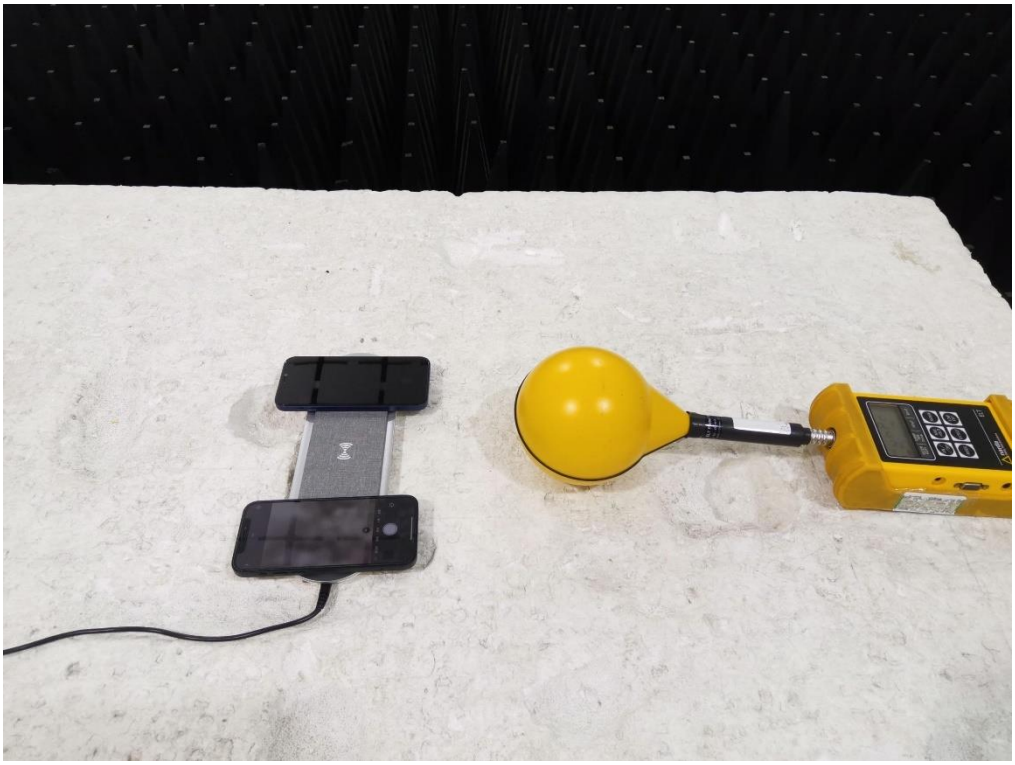
(TM6)

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



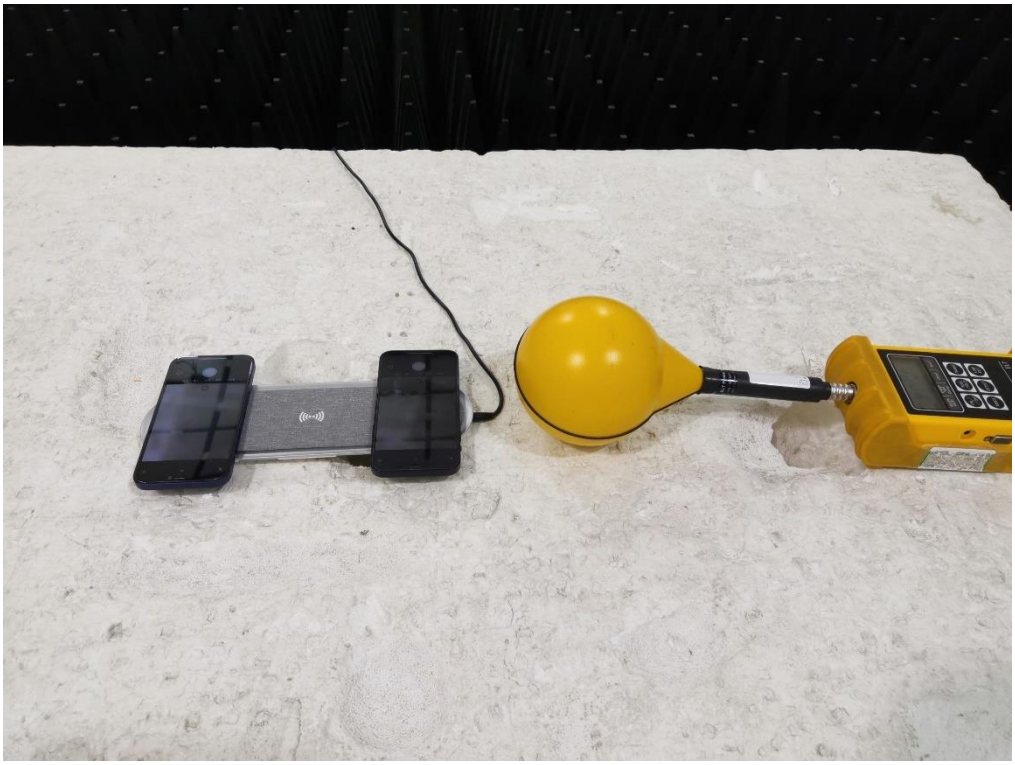
(TM6)

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



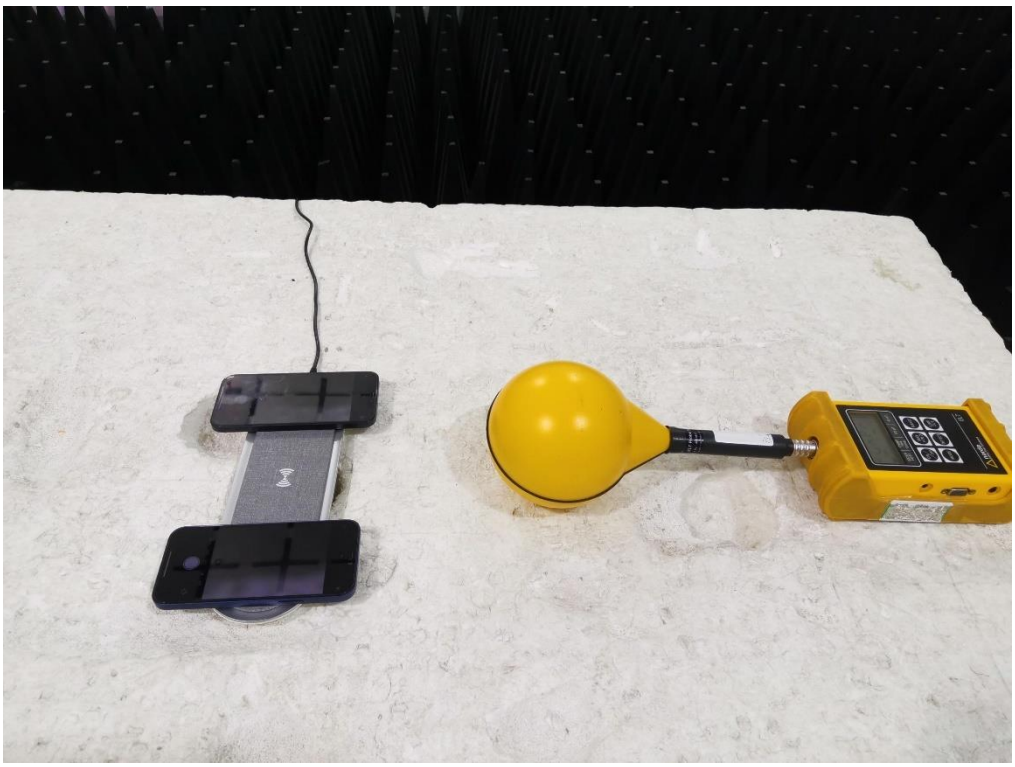
(TM6)

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



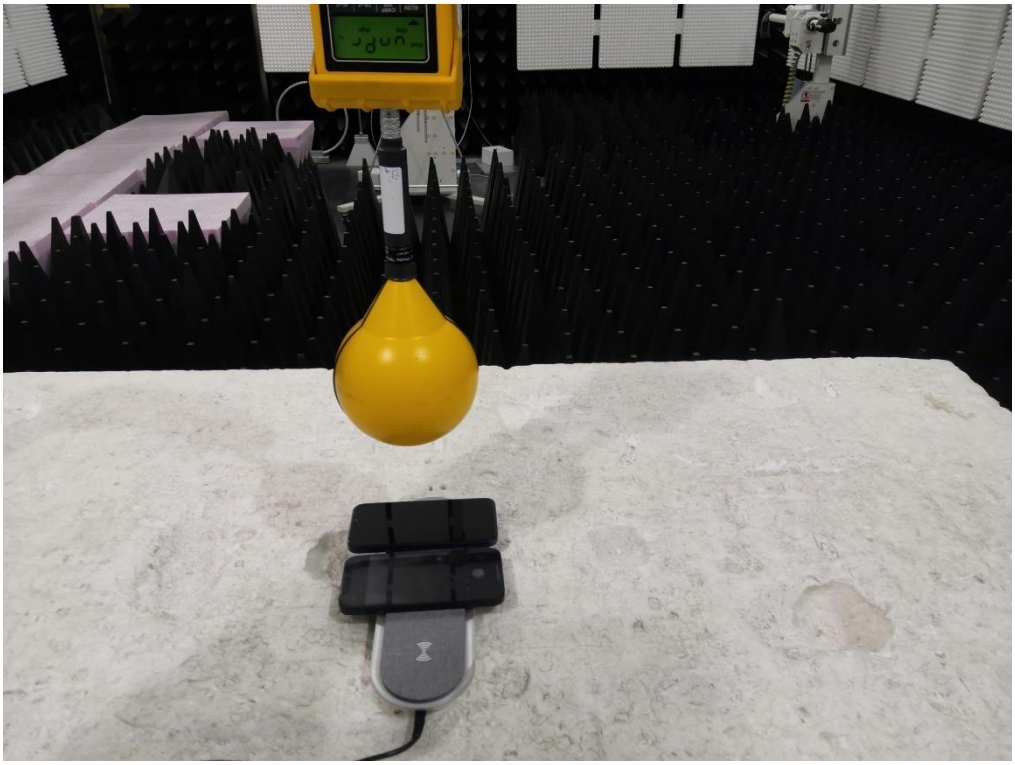
(TM6)

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



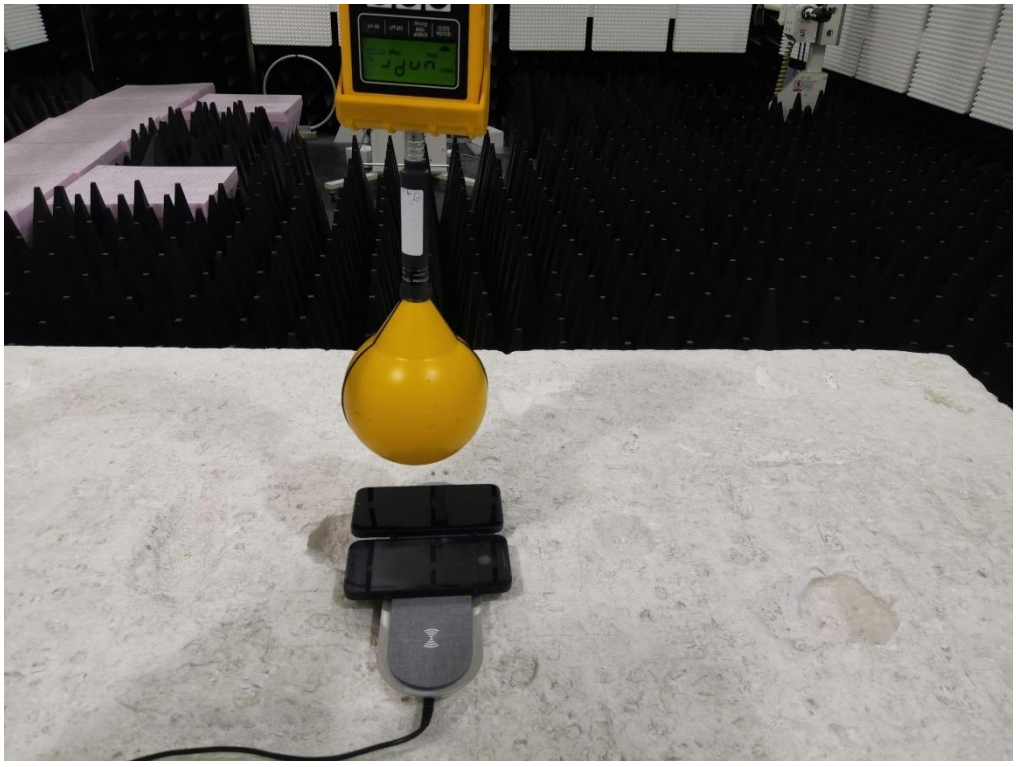
(TM6)

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



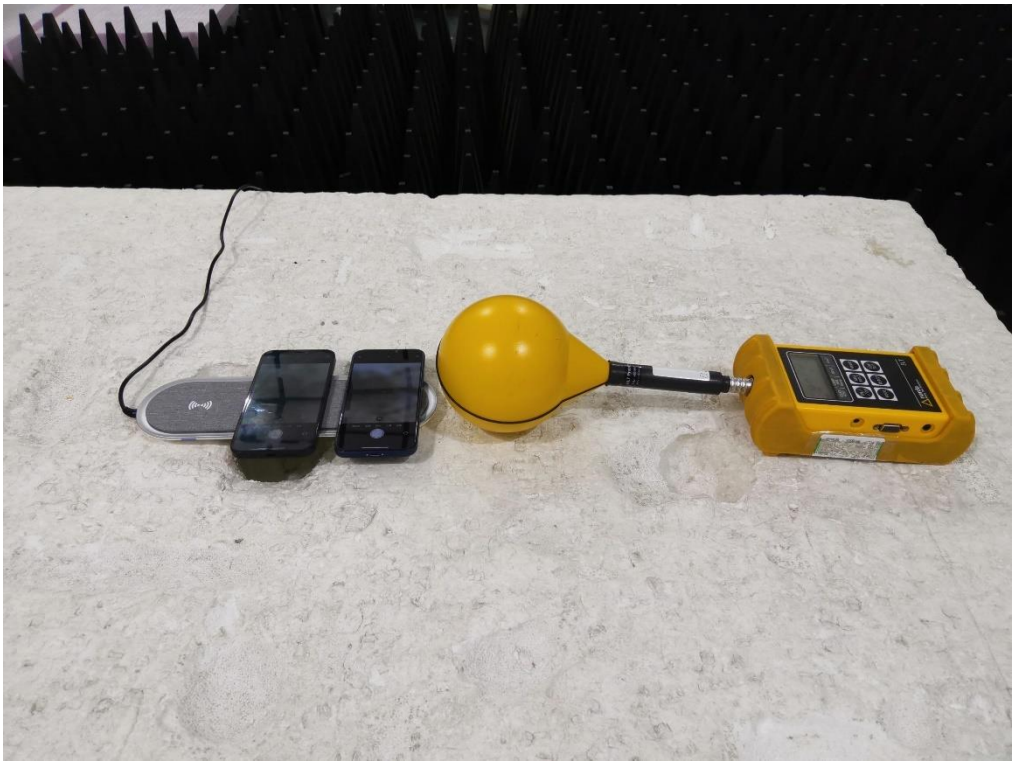
(TM7)

Test Position E - Exposure photo from top surface (15cm)



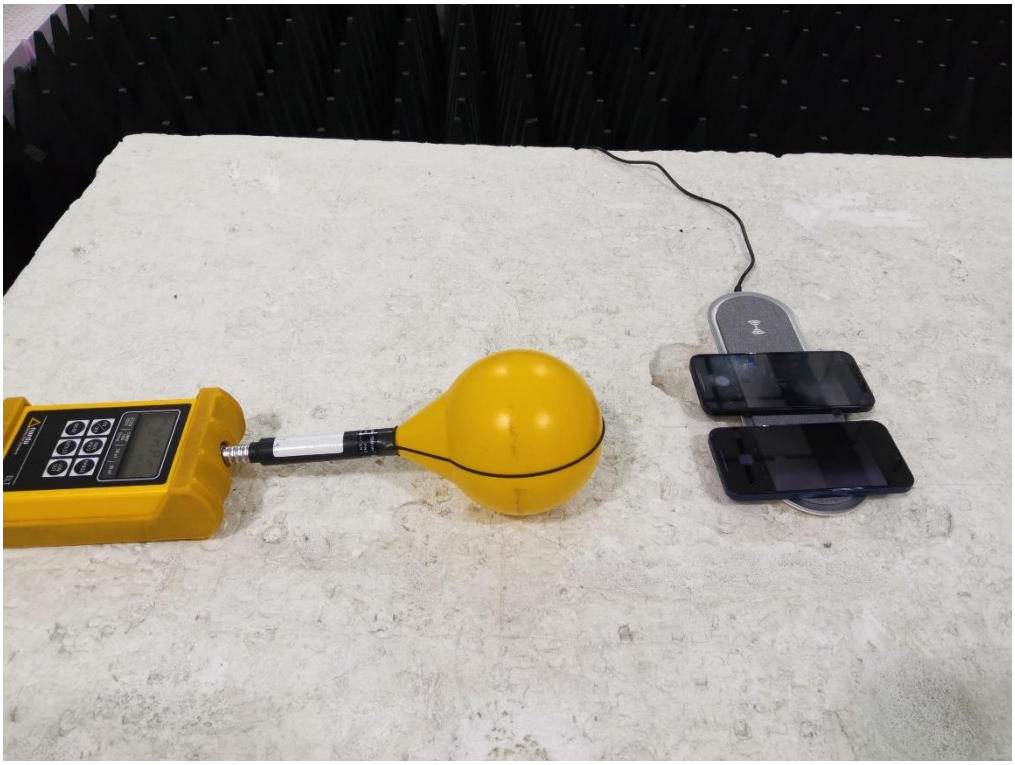
(TM7)

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



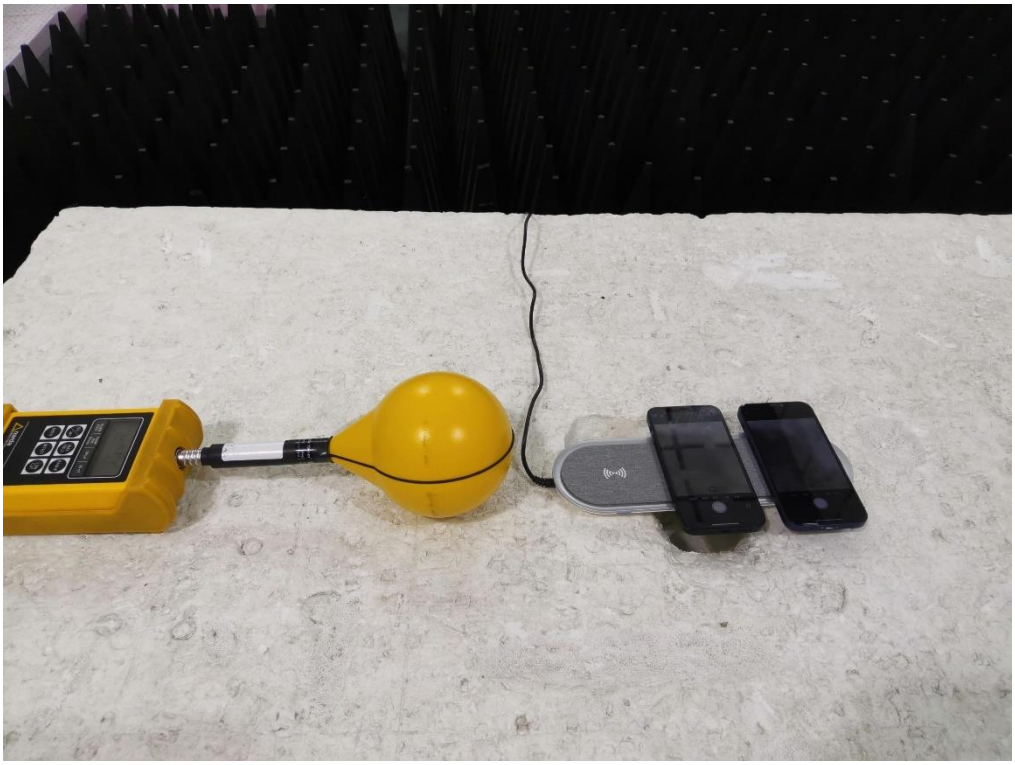
(TM7)

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



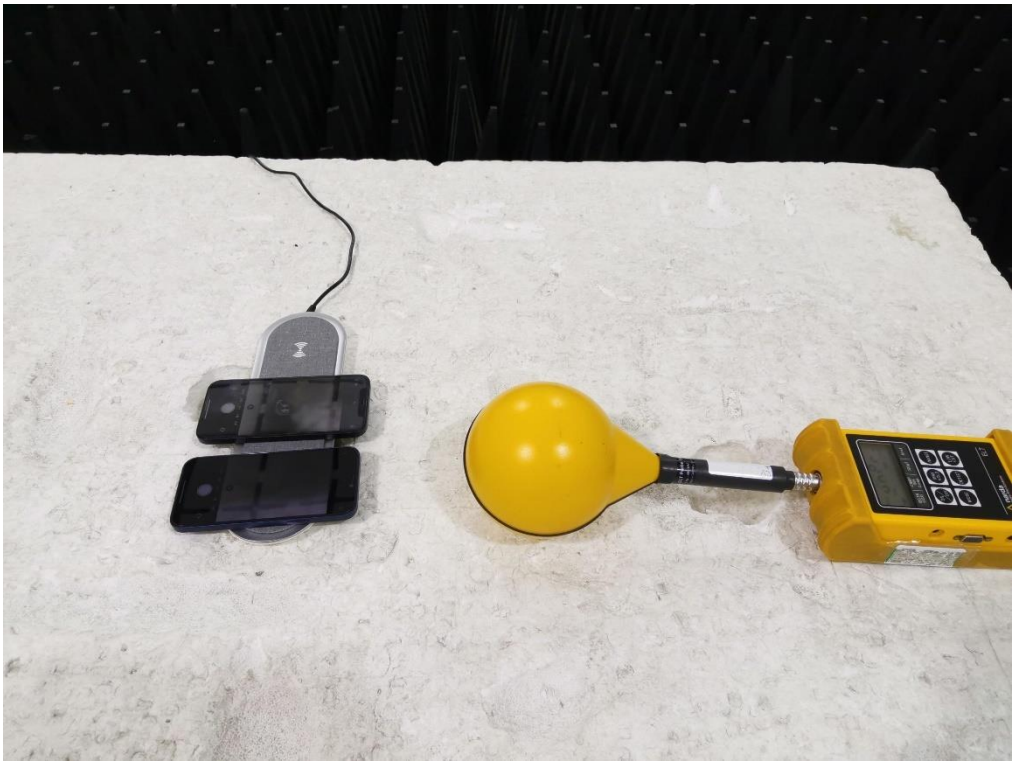
(TM7)

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



(TM7)

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



(TM7)

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	April 9, 2021	Initial Issue	Gavin Liang
001	June 25, 2021	Add test item	Gavin Liang

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