RF Exposure Evaluation Report

1 Product Information

FCC ID:	2A4LH-PN-W28
Product Name:	Magnetic Wireless Power Bank
Model Number:	PN-W28
Power Supply：	Capacity:10000mAh/3.7V/37Wh Lighting Input:DC 5V/2A Type-C Input: DC 5V/2.4A, 9V/2A, 12V/1.5A Type-C Output: DC 5V/3A, 9V/2A, 12V/1.5A Wireless: 5W,7.5W,10W
Frequency Range:	110-205 KHz
Antenna Type:	Coil Antenna
Hardware version	V1.0
Software version	V1.0
Accessories	Mobile phone: OPPO A96 Adapter: PD-014
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Portable Device

2 Evaluation Method

Per KDB 680106 D01v03r01 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 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.
680106 D01 RF Exposure Wireless Charging Apps 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

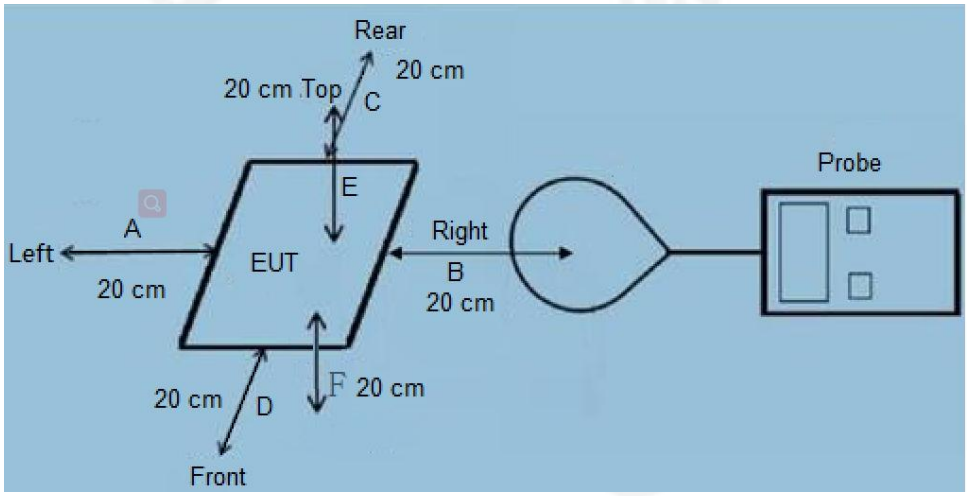
F=frequency in MHz
*=Plane-wave equivalent power density

According to FCC 680106 D01 RF Exposure Wireless Charging Apps v03r01 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



5 Test Instruments list

Test Equipment	Manufacturer	Model No.	SN.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
Electromagnetic radiation frequency probe	Narda	EHP-200A	N-1114	Mar. 02, 2022	Mar. 01, 2023

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 (0-20 cm,in 2 cm maximum increment) which is between the edge of the charger and the geometric center of probe.

c) 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.

d) The EUT were measured according to the dictates of 680106 D01 RF Exposure Wireless Charging Apps v03r01

7 Equipment Approval Considerations

The EUT does comply with item 5.2 of 680106 D01 RF Exposure Wireless Charging Apps v03r01 as follows table;

Requirements of 680106 D01 RF Exposure Wireless Charging Apps v03r01	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 system may consist of more than one 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.	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	portable exposure conditions
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 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 H field Strength

Test Modes:	Description	
Mode 1	AC/DC Adapter + EUT + Mobile Phone (Battery Status: <1%)	Pre-tested
Mode 2	AC/DC Adapter + EUT + Mobile Phone (Battery Status: <50%)	Pre-tested
Mode 3	AC/DC Adapter + EUT + Mobile Phone (Battery Status: 100%)	Pre-tested
Mode 4	AC/DC Adapter + EUT	Pre-tested
Mode 5	EUT + Mobile Phone (Battery Status: <1%)	Record
Mode 6	EUT + Mobile Phone (Battery Status: <50%)	Record
Mode 7	EUT + Mobile Phone (Battery Status: 100%)	Record
Note: All test modes were pre-tested, but we only recorded the worst case in this report.		

Charging Battery Level	measuring distance (cm)	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	Test Position F		
1%	0	0.698	0.695	0.673	0.747	0.690	0.683	0.815	1.63
50%	0	0.693	0.740	0.736	0.672	0.680	0.651	0.815	1.63
99%	0	0.727	0.692	0.742	0.674	0.654	0.720	0.815	1.63
1%	2	0.714	0.738	0.702	0.667	0.668	0.736	0.815	1.63
50%	2	0.750	0.731	0.708	0.658	0.666	0.726	0.815	1.63
99%	2	0.670	0.747	0.669	0.728	0.733	0.735	0.815	1.63
1%	4	0.749	0.694	0.690	0.715	0.695	0.716	0.815	1.63
50%	4	0.653	0.688	0.660	0.749	0.716	0.672	0.815	1.63
99%	4	0.650	0.749	0.709	0.676	0.659	0.742	0.815	1.63
1%	6	0.697	0.745	0.715	0.713	0.670	0.665	0.815	1.63
50%	6	0.703	0.738	0.750	0.722	0.670	0.718	0.815	1.63
99%	6	0.682	0.692	0.712	0.661	0.661	0.659	0.815	1.63
1%	8	0.629	0.606	0.633	0.562	0.588	0.550	0.815	1.63
50%	8	0.606	0.611	0.618	0.643	0.576	0.642	0.815	1.63
99%	8	0.598	0.635	0.635	0.631	0.641	0.585	0.815	1.63

Charging Battery Level	measuring distance (cm)	Measured H-Field Strength Values (A/m)						FCC E-Field Strength 50% Limits (A/m)	FCC E-Field Strength Limits (A/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	Test Position F		
1%	10	0.570	0.646	0.616	0.550	0.598	0.589	0.815	1.63
50%	10	0.635	0.613	0.592	0.561	0.570	0.551	0.815	1.63
99%	10	0.610	0.623	0.563	0.643	0.568	0.583	0.815	1.63
1%	12	0.457	0.540	0.522	0.470	0.498	0.548	0.815	1.63
50%	12	0.509	0.512	0.544	0.524	0.483	0.484	0.815	1.63
99%	12	0.514	0.453	0.512	0.450	0.462	0.462	0.815	1.63
1%	14	0.486	0.460	0.526	0.527	0.502	0.540	0.815	1.63
50%	14	0.514	0.500	0.506	0.499	0.525	0.476	0.815	1.63
99%	14	0.534	0.533	0.483	0.483	0.476	0.544	0.815	1.63
1%	16	0.428	0.353	0.389	0.375	0.407	0.424	0.815	1.63
50%	16	0.428	0.425	0.360	0.403	0.369	0.373	0.815	1.63
99%	16	0.442	0.352	0.398	0.450	0.354	0.444	0.815	1.63
1%	18	0.359	0.436	0.417	0.358	0.406	0.387	0.815	1.63
50%	18	0.396	0.417	0.385	0.431	0.371	0.354	0.815	1.63
99%	18	0.359	0.405	0.362	0.437	0.372	0.404	0.815	1.63
1%	20	0.241	0.231	0.266	0.251	0.270	0.254	0.815	1.63
50%	20	0.233	0.246	0.237	0.275	0.282	0.255	0.815	1.63
99%	20	0.285	0.266	0.294	0.300	0.285	0.264	0.815	1.63

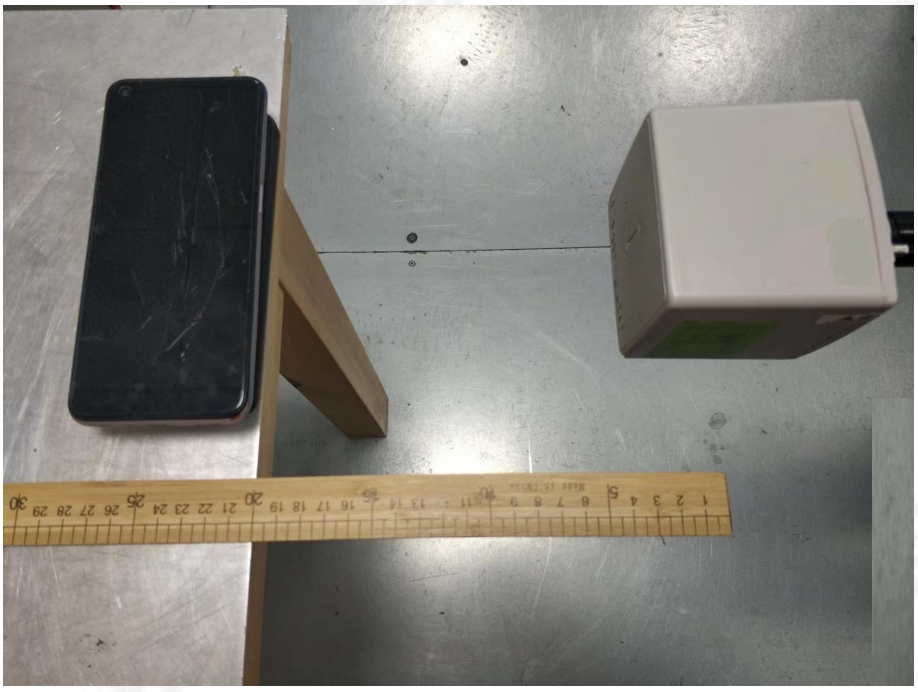
Charging Battery Level	measuring distance (cm)	Measured E-Field Strength Values (V/m)						FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	Test Position F		
1%	0	275	276	274	277	296	250	307	614
50%	0	298	276	294	288	272	256	307	614
99%	0	287	279	295	297	299	250	307	614
1%	2	286	274	285	271	278	245	307	614
50%	2	278	292	294	288	276	260	307	614
99%	2	295	284	271	296	288	247	307	614
1%	4	244	240	243	260	245	251	307	614
50%	4	266	249	253	270	257	257	307	614
99%	4	246	266	267	256	242	258	307	614
1%	6	250	244	251	240	241	220	307	614
50%	6	249	257	266	254	254	217	307	614
99%	6	261	254	260	256	269	220	307	614
1%	8	240	224	223	230	233	221	307	614
50%	8	236	223	202	215	204	220	307	614
99%	8	275	276	274	277	296	250	307	614

Charging Battery Level	measuring distance (cm)	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	Test Position F		
1%	10	225	214	230	215	229	221	307	614
50%	10	208	233	220	221	224	210	307	614
99%	10	215	227	215	231	236	215	307	614
1%	12	234	237	230	223	234	140	307	614
50%	12	184	178	202	173	171	146	307	614
99%	12	203	188	188	195	185	130	307	614
1%	14	195	202	187	189	205	142	307	614
50%	14	189	178	183	201	172	131	307	614
99%	14	205	183	183	191	191	133	307	614
1%	16	176	171	170	182	198	137	307	614
50%	16	177	156	164	168	171	132	307	614
99%	16	173	177	169	166	168	132	307	614
1%	18	171	157	177	168	171	139	307	614
50%	18	148	140	148	137	141	115	307	614
99%	18	154	156	155	149	152	109	307	614
1%	20	143	137	148	139	142	107	307	614
50%	20	131	130	122	123	122	118	307	614
99%	20	125	121	129	131	130	112	307	614

9 Test Set-up Photo

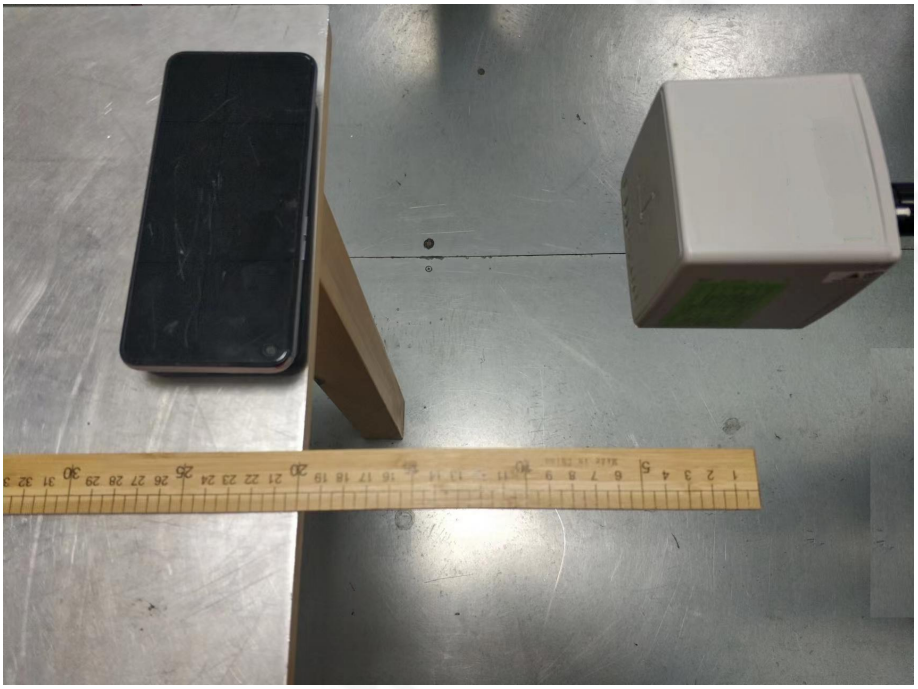
Test Position A（0cm）

Test Position A（20cm）



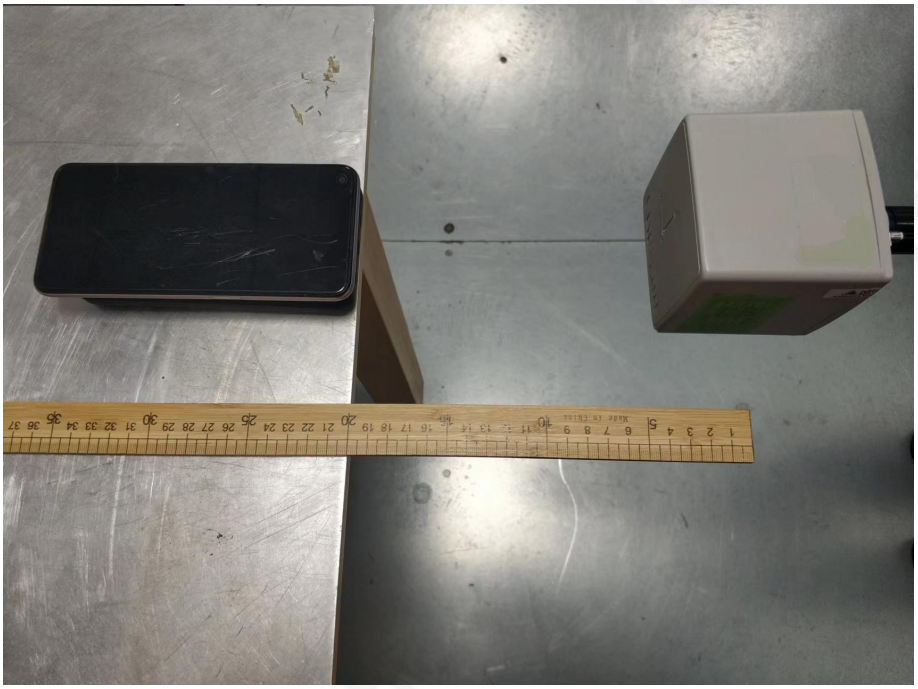
Test Position B（0cm）

Test Position B（20cm）



Test Position C（0cm）

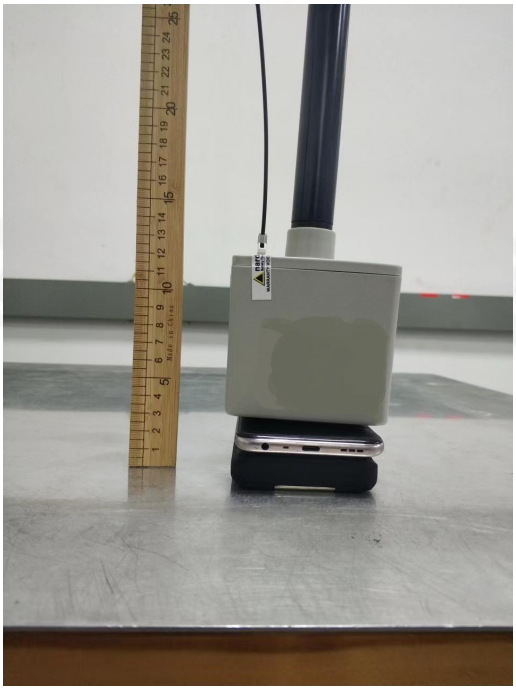
Test Position C（20cm）



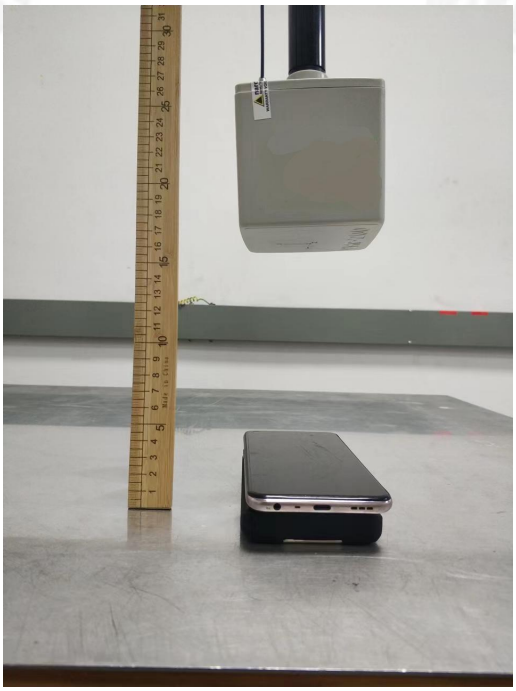
Test Position D（0cm）

Test Position D（20cm）

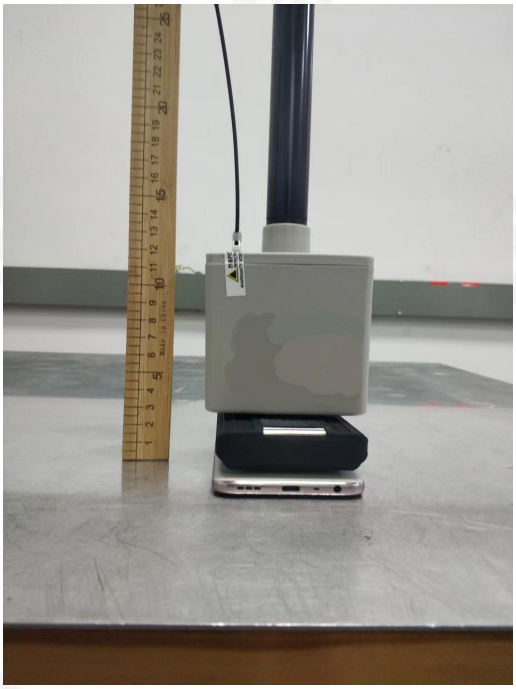
Test Position E（0cm）



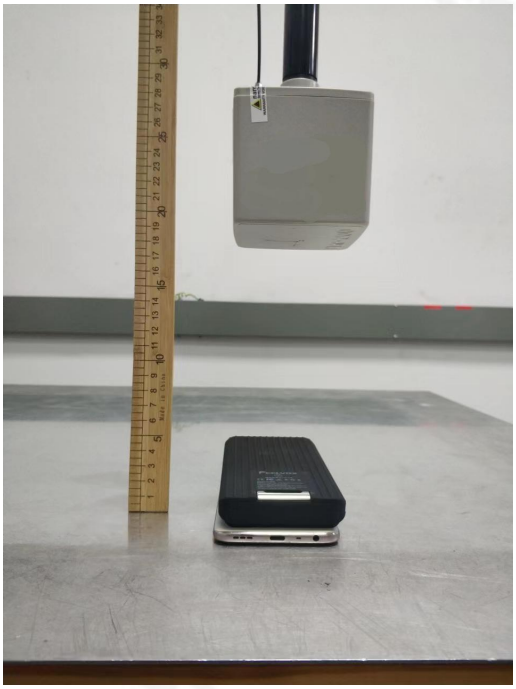
Test Position E（20cm）



Test Position F（0cm）



Test Position F（20cm）



10 Conclusion

A minimum safety distance of 0 cm to the antenna is required when the device is charging a smart phone for portable exposure and 20 cm to the antenna for mobile exposure. The detected emissions are below the limitations according FCC 680106 D01 RF Exposure Wireless Charging Apps v03r01 and confirmed by the FCC according to KDB Inquire.

The probe for the test is a cuboid with a size of 92*92*109mm.The probe is controlled by a PC-based program, and the measurement results are transmitted in real time through a fiber optic connection. An auxiliary input can measure the spectrum of external signals from any RF device. Because it has a very small volume and fiber connection, it does not affect the electromagnetic field it measures, thus ensuring the accuracy and sensitivity of the measurement. In the test process, in order to avoid the inaccurate results caused by the micro motion of the probe, we made several measurements and waited for the data to be stable before taking the value.