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## RF Exposure Evaluation

FCC ID: 2BDNE-NX-MS15

### 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 §2.1093 RF exposure is calculated. According KDB680106 D01: KDB 680106 D01 Wireless Power Transfer v04.

### 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 (0/2/4/6/8/10/12/14/16/18/20cm) surrounding the device six surfaces.

### 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 <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	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  
\* =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).

### 3 Test Setup

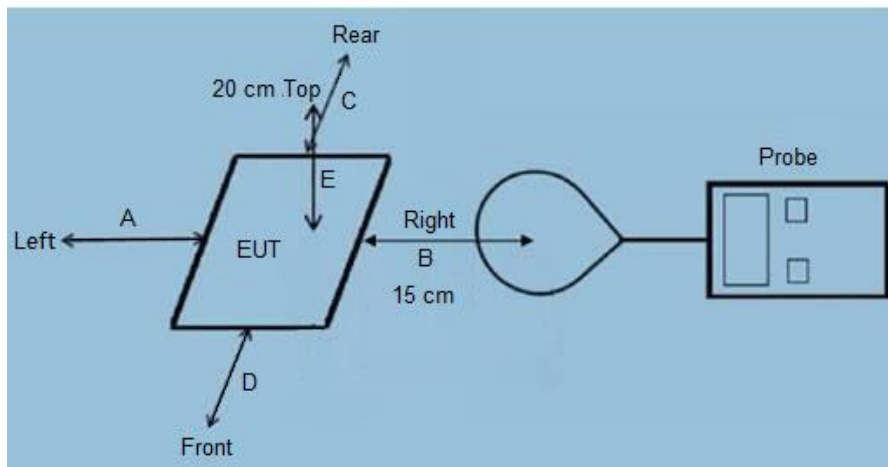


Figure 1

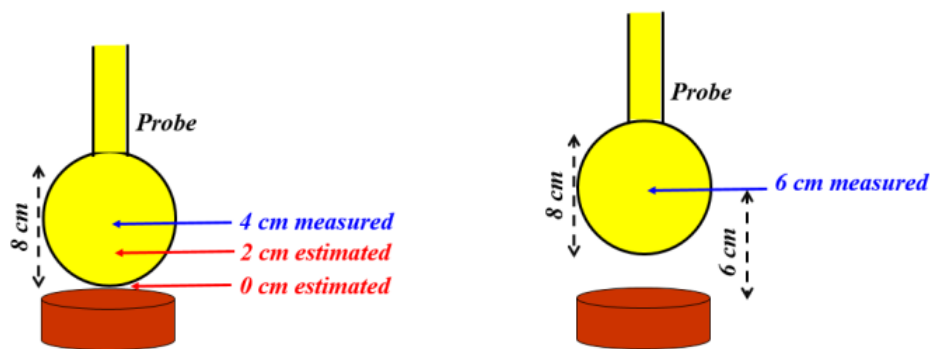


Figure 2

### 4 Test Procedure

- 1) The RF exposure test was performed in anechoic chamber.
- 2) The measurement probe was placed at test distance (0/2/4/6/8/10/12/14/16/18/20cm) which is between the edge of the charger and the geometric center 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 D01v04.
- 5) Large size probes may prevent the measurement of E- and/or H-fields near the surface of the radiating structure (e.g., a WPT source coil), as in the example shown in Figure 2. These estimates shall include points spaced no more than 2 cm from each other. Thus, in the example of Figure 2, at least the estimates at 0 cm<sup>2</sup> and 2 cm are required, while only one point would not be sufficient. In addition, the model needs to be validated through the probe measurements for the two closest points to the device surface, and with 2-cm increments, as indicated in Figure 2. In that example, the same model must also be applied to the 4 cm and 6 cm positions, and then compared with the measured data, for validation purposes. The validation is considered sufficient if a 30% agreement between the model and the (E- and/or H-field) probe measurements is demonstrated. If such a level of agreement cannot be shown, a more accurate model (and/or a smaller probe) shall be used.

## 5 Equipment Approval Considerations

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

Requirements of KDB 680106 D01	Yes / No	Description
Mobile Device and Portable Device Configurations	Yes	Portable Device
Equipment Authorization Procedures for Devices Operating at Frequencies Below 4 MHz	Yes	The device operate in the frequency range 110KHz~205KHz

## 6 Description of the test mode

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

Charging and communication mode

Test Modes:		
Mode 1	AC/DC Adapter (5V/2.0A) + EUT + Mobile phone (Battery Status: <1%)	Record
Mode 2	AC/DC Adapter (5V/2.0A) + EUT + Mobile phone (Battery Status: <50%)	Record
Mode 3	AC/DC Adapter (5V/2.0A) + EUT + Mobile phone (Battery Status: 100%)	Record

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

## 7 Description of Support Units

Follow auxiliary equipment(s) test with EUT that provided by the manufacturer or laboratory is listed as follow:

Description	Manufacturer	Model	Technical Parameters	Certificate	Provided by
Adapter	/	EP-TA20CBC	Input: AC 100-240V 50/60Hz Output: DC 5V 2A	SDOC	Manufacturer

## 8 Test Instruments list

Test Equipment	Manufacturer	Model No.	SN.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
Exposure Level Tester	Narda	ELT-400	N-0231	June 25 2023	June 24 2024
Magnetic field probe 100cm <sup>2</sup>	Narda	ELT probe 100cm <sup>2</sup>	M0675	June 25 2023	June 24 2024

Note: The probe radius is 8 cm

## 9 Test Result

The probe radius is 8 cm.

E-Field Strength at 8/10/12/14/16/18/20cm from the edges surrounding the EUT

Charging Battery Level	Measure d Distance (cm)	Measured E-Field Strength Values (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	
99%	8	16.965	26.767	26.39	26.767	27.144	26.767	614
50%	8	18.473	27.521	27.144	28.275	30.537	29.783	614
1%	8	19.981	26.39	29.406	26.39	29.406	30.537	614
99%	10	14.703	19.227	22.62	18.85	22.997	22.997	614
50%	10	14.703	18.096	18.85	22.997	18.85	23.374	614
1%	10	15.457	20.735	24.505	22.243	25.636	26.013	614
99%	12	15.457	17.719	20.735	22.997	23.374	16.965	614
50%	12	14.703	15.457	19.227	21.866	19.227	19.227	614
1%	12	15.457	16.588	19.604	20.735	21.112	21.866	614
99%	14	11.687	14.326	16.211	15.834	15.457	17.719	614
50%	14	12.064	15.08	16.965	16.211	16.211	18.473	614
1%	14	14.326	16.965	18.473	16.588	17.719	19.227	614
99%	16	14.326	12.441	11.31	11.687	13.572	12.441	614
50%	16	13.949	12.818	11.687	12.441	14.326	12.818	614
1%	16	12.441	14.703	13.195	13.949	15.08	14.703	614
99%	18	9.048	11.687	12.441	12.064	12.064	11.687	614
50%	18	10.556	12.818	13.572	12.441	12.441	12.064	614
1%	18	10.933	13.195	13.949	12.818	13.572	13.572	614
99%	20	8.671	9.425	8.671	9.048	8.294	9.425	614
50%	20	8.671	9.048	7.917	9.048	9.048	9.802	614
1%	20	9.425	9.802	8.294	9.802	10.556	10.179	614

Note: V/m= A/m \*377

H-Field Strength at 8/10/12/14/16/18/20cm from the edges surrounding the EUT

Charging Battery Level	Measured Distance (cm)	Unit	Measured H-Field Strength Values (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	
99%	8	uT	0.056	0.089	0.088	0.089	0.090	0.089	--
99%	8	A/m	0.045	0.071	0.07	0.071	0.072	0.071	1.63
50%	8	uT	0.061	0.091	0.090	0.094	0.101	0.099	--
50%	8	A/m	0.049	0.073	0.072	0.075	0.081	0.079	1.63
1%	8	uT	0.066	0.088	0.098	0.088	0.098	0.101	--
1%	8	A/m	0.053	0.070	0.078	0.070	0.078	0.081	1.63
99%	10	uT	0.049	0.064	0.075	0.063	0.076	0.076	--
99%	10	A/m	0.039	0.051	0.06	0.05	0.061	0.061	1.63
50%	10	uT	0.060	0.063	0.076	0.063	0.078	0.076	--
50%	10	A/m	0.048	0.05	0.061	0.05	0.062	0.061	1.63
1%	10	uT	0.051	0.069	0.081	0.074	0.085	0.086	--
1%	10	A/m	0.041	0.055	0.065	0.059	0.068	0.069	1.63
99%	12	uT	0.051	0.059	0.069	0.076	0.078	0.056	--
99%	12	A/m	0.041	0.047	0.055	0.061	0.062	0.045	1.63
50%	12	uT	0.049	0.051	0.064	0.073	0.064	0.064	--
50%	12	A/m	0.039	0.041	0.051	0.058	0.051	0.051	1.63
1%	12	uT	0.051	0.055	0.065	0.069	0.070	0.073	--
1%	12	A/m	0.041	0.044	0.052	0.055	0.056	0.058	1.63
99%	14	uT	0.039	0.048	0.054	0.053	0.051	0.059	--
99%	14	A/m	0.031	0.038	0.043	0.042	0.041	0.047	1.63
50%	14	uT	0.040	0.050	0.056	0.054	0.054	0.061	--
50%	14	A/m	0.032	0.04	0.045	0.043	0.043	0.049	1.63
1%	14	uT	0.048	0.056	0.061	0.055	0.059	0.064	--
1%	14	A/m	0.038	0.045	0.049	0.044	0.047	0.051	1.63
99%	16	uT	0.048	0.041	0.038	0.039	0.045	0.041	--
99%	16	A/m	0.038	0.033	0.03	0.031	0.036	0.033	1.63
50%	16	uT	0.046	0.043	0.039	0.041	0.048	0.043	--
50%	16	A/m	0.037	0.034	0.031	0.033	0.038	0.034	1.63
1%	16	uT	0.041	0.049	0.044	0.046	0.050	0.049	--
1%	16	A/m	0.033	0.039	0.035	0.037	0.04	0.039	1.63
99%	18	uT	0.030	0.039	0.041	0.040	0.040	0.039	0.023
99%	18	A/m	0.024	0.031	0.033	0.032	0.032	0.031	1.63
50%	18	uT	0.035	0.043	0.045	0.041	0.041	0.040	--
50%	18	A/m	0.028	0.034	0.036	0.033	0.033	0.032	1.63
1%	18	uT	0.036	0.044	0.046	0.043	0.045	0.045	--

1%	18	A/m	0.029	0.035	0.037	0.034	0.036	0.036	1.63
99%	20	uT	0.029	0.031	0.029	0.030	0.028	0.031	--
99%	20	A/m	0.023	0.025	0.023	0.024	0.022	0.025	1.63
50%	20	uT	0.029	0.030	0.026	0.030	0.030	0.033	--
50%	20	A/m	0.023	0.024	0.021	0.024	0.024	0.026	1.63
1%	20	uT	0.031	0.033	0.028	0.033	0.035	0.034	--
1%	20	A/m	0.025	0.026	0.022	0.026	0.028	0.027	1.63

Note:A/m=uT/1.25

According to the formula:

The formula for the magnetic field strength at a distance r from the coil is

$$H = I/(2\pi r) * \mu$$

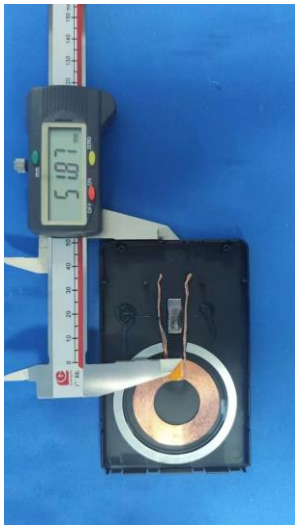
H is A/m

I is the current intensity

$\mu$  is the permeability, and its value depends on the medium.

The other parameters are fixed, so H is inversely proportional to r.

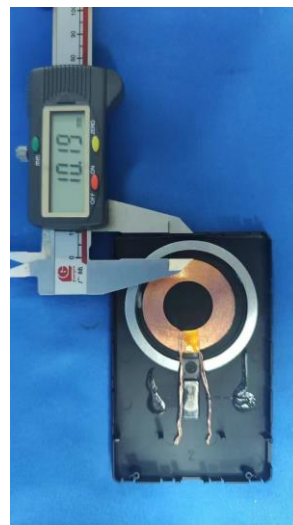
A:



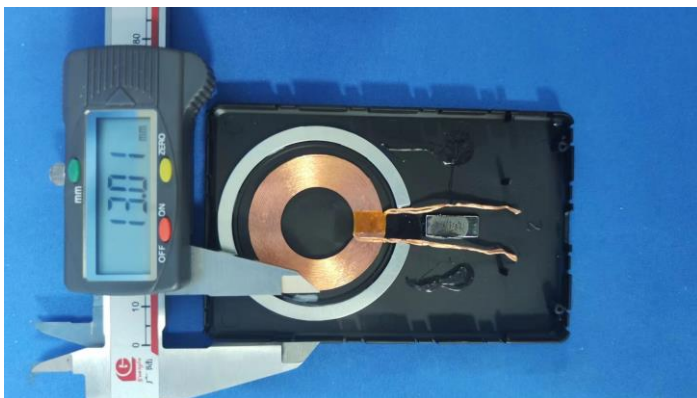
B:



C:



D:



ABCDEF direction The actual distance(r) to the antenna coil.

measured distance(cm)	Actual distance r to the antenna (cm)					
	Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	Test Position F
20	25.187	21.301	21.019	21.301	20.74	20.51
18	23.187	19.301	19.019	19.301	18.74	18.51
16	21.187	17.301	17.019	17.301	16.74	16.51
14	19.187	15.301	15.019	15.301	14.74	14.51

12	17.187	13.301	13.019	13.301	12.74	12.51
10	15.187	11.301	11.019	11.301	10.74	10.51
8	13.187	9.301	9.019	9.301	8.74	8.51
6	11.187	7.301	7.019	7.301	6.74	6.51
4	9.187	5.301	5.019	5.301	4.74	4.51
2	7.187	3.301	3.019	3.301	2.74	2.51
0	5.187	1.301	1.019	1.301	0.74	0.51

Note: The phone is 7.4mm thick

The result is calculated by the above formula:

H-Field Strength at 0/2/4/6cm from the edges surrounding the EUT

Charging Battery Level	Measured Distance	Unit	Measured H-Field Strength Values (A/m)						FCC H-Field Strength Limits (A/m)
	(cm)		Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	Test Position F	
1%	0	A/m	0.124	0.496	0.633	0.496	0.872	1.265	1.63
50%	0	A/m	0.120	0.477	0.609	0.477	0.839	1.218	1.63
99%	0	A/m	0.117	0.465	0.594	0.465	0.818	1.186	1.63
1%	2	A/m	0.090	0.195	0.214	0.195	0.235	0.257	1.63
50%	2	A/m	0.086	0.188	0.206	0.188	0.227	0.247	1.63
99%	2	A/m	0.084	0.183	0.200	0.183	0.221	0.241	1.63
1%	4	A/m	0.070	0.122	0.129	0.122	0.136	0.143	1.63
50%	4	A/m	0.068	0.117	0.124	0.117	0.131	0.138	1.63
99%	4	A/m	0.066	0.114	0.121	0.114	0.128	0.134	1.63
1%	6	A/m	0.058	0.088	0.092	0.088	0.096	0.099	1.63
50%	6	A/m	0.056	0.085	0.088	0.085	0.092	0.095	1.63
99%	6	A/m	0.054	0.083	0.086	0.083	0.090	0.093	1.63

## 10 Conclusion

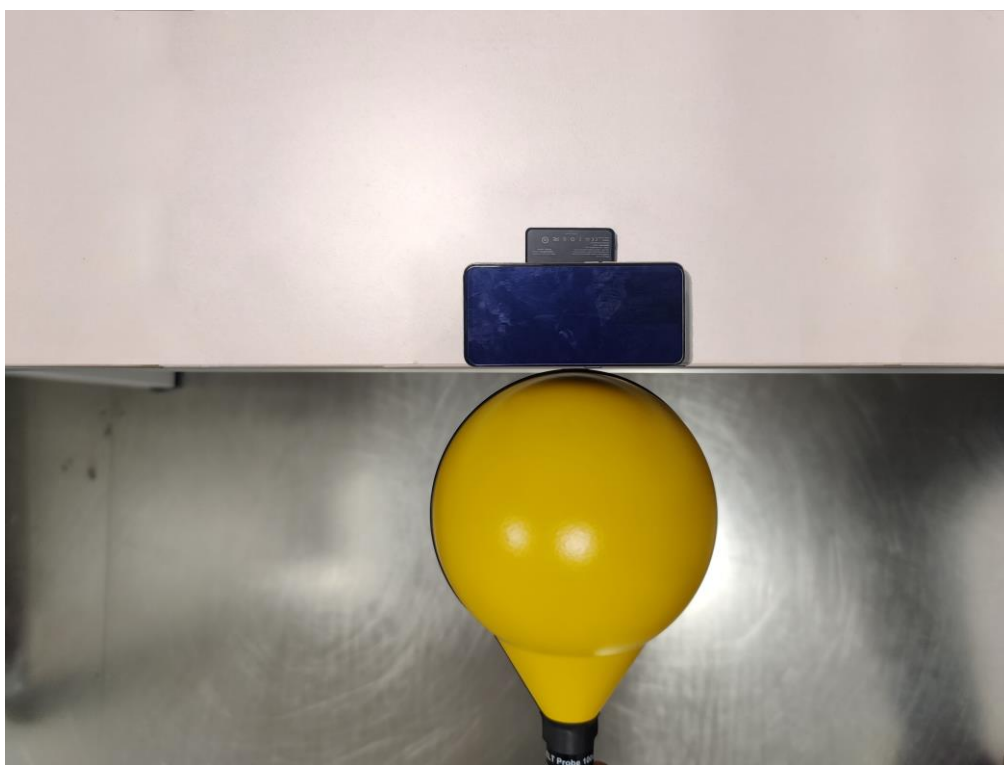
A minimum safety distance of 0 cm to the antenna is required when the device is charging a smart phone for mobile exposure. The detected emissions are below the limitations according FCC KDB 680106.

**The model was established with a 30% agreement, so it was considered to be approved.**



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**11 Test Set-up Photo**



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