RF Exposure Evaluation

1 Measuring Standard

KDB 680106 RF Exposure Wireless Charging Apps v03r01

2 Requirements

According to the item 5 of KDB 680106 v03r01:

Inductive wireless power transfer applications that meet all of the following requirements are excluded from submitting an RF exposure evaluation.

(1) Power transfer frequency is less than 1MHz.

(2) Output power from each primary coil is less than or equal to 15 watts.

(3) 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.

(4) Client device is placed directly in contact with the transmitter.

(5) Mobile exposure conditions only (portable exposure conditions are not covered by this exclusion).

(6) 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.

Remark: Meet all the above requirements.

Limits

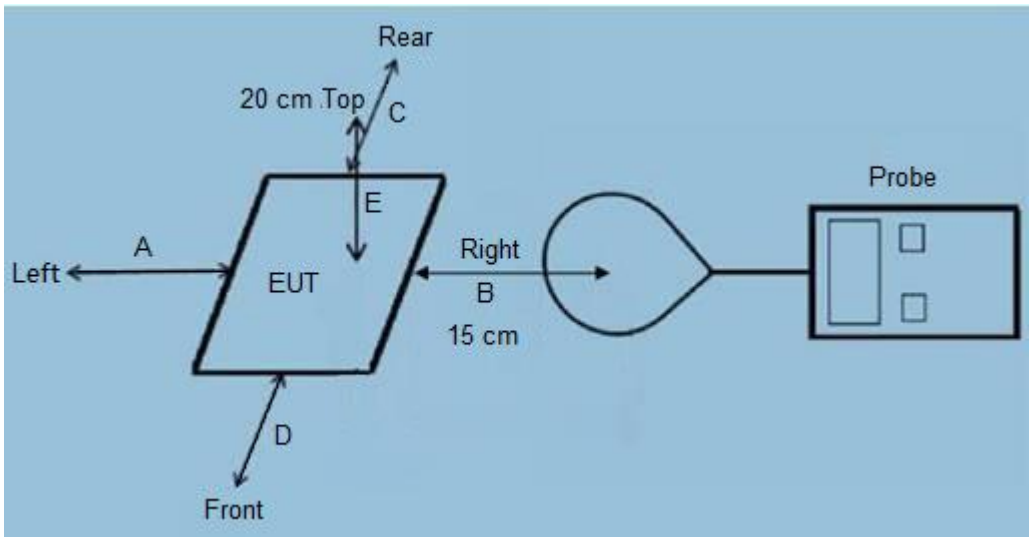
The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

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
*=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



4 Test Procedure

1) The RF exposure test was performed in anechoic chamber.

2) The measurement probe was placed at test distance (15 cm from all sides and 20 cm from the top) 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) were completed.

4) The EUT was measured according to the dictates of KDB 680106 D01v03.

Remark：The EUT's test position A, B, C, D and E is valid for the E and H field measurements.

5 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 + Mobile phone(15W)+ Earphone(3W)	Record
Mode 2	AC Adapter + EUT + Mobile phone (15W)	Record
Mode 3	AC Adapter + EUT + Earphone (3W)	Record
Note: All test modes were pre-tested, but we only recorded the worst case in this report.		

6 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	M-0155/M-0170	2021.08.30	2022.08.29
Magnetic field probe 100cm^2	Narda	ELT probe 100cm^2	M0675	2021.08.30	2022.08.29

7 Test Result

E-Filed Strength at 15 cm from the edges surrounding the EUT (V/m)

Unit	Test mode TM1	Frequency Range (MHz)	Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	50% Limits (V/m)	Limits (V/m)
V/m	Phone port	0.111	91.59	94.00	92.73	63.41	91.02	307	614
V/m	Earphone port	0.111	82.61	78.63	85.69	55.37	76.84	307	614

Unit	Test mode	Frequency Range (MHz)	Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	50% Limits (V/m)	Limits (V/m)
V/m	TM2	0.111	74.55	75.91	90.25	51.09	74.86	307	614
V/m	TM3	0.111	71.61	101.83	78.79	42.84	90.46	307	614

Note: V/m= A/m *377

H-Filed Strength at 15 cm from the edges surrounding the EUT (A/m)

Unit	Test mode TM1	Frequency Range (MHz)	Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	50% Limits (A/m)	Limits (A/m)
uT	Phone port	0.111	0.304	0.312	0.307	0.210	0.302	--	--
A/m			0.243	0.249	0.246	0.168	0.241	0.815	1.63
uT	Earphone port	0.111	0.305	0.276	0.285	0.196	0.217	--	--
A/m			0.244	0.221	0.228	0.157	0.174	0.815	1.63

Unit	Test mode	Frequency Range (MHz)	Test Position A	Test Position B	Test Position C	Test Position D	Test Position E	50% Limits (A/m)	Limits (A/m)
uT	TM2	0.111	0.247	0.252	0.299	0.169	0.248	--	--
A/m			0.198	0.201	0.239	0.136	0.199	0.815	1.63
uT	TM3	0.111	0.237	0.338	0.261	0.142	0.300	--	--
A/m			0.190	0.270	0.209	0.114	0.240	0.815	1.63

Note:A/m=uT/1.25

H-Filed Strength at 20 cm from the top of the EUT (A/m)

Unit	Test mode TM1	Frequency Range (MHz)	Test Position E	50% Limits (A/m)	Limits (A/m)
uT	Phone port	0.111	0.219	--	--
A/m			0.176	0.815	1.63
uT	Earphone port	0.111	0.179	--	--
A/m			0.143	0.815	1.63

Unit	Test mode	Frequency Range (MHz)	Test Position E	50% Limits (A/m)	Limits (A/m)
uT	TM2	0.111	0.138	--	--
A/m			0.111	0.815	1.63
uT	TM3	0.111	0.145	--	--
A/m			0.116	0.815	1.63

Note:A/m=uT/1.25

Simultaneous E-Filed Strength and H-Filed Strength

KDB 447498 points for simultaneous transmission on far-filed measurement, while for below 30 MHz usually measured at near-filed. KDB680106 require aggregate leakage fields at 15 cm surrounding the device from all simultaneous transmitting coils are demonstrated to be less than 50% of the MPE limit;
KDB680106 can accept 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.
Test labs suggest use Computational modelling to calculate Nerve Stimulation BRs;
Computational modelling, such as finite-difference time-domain (FDTD) may be used to demonstrate compliance with FCC § 1.1310 limits requirement,
Basic Calculations - The following calculations may be used to evaluate systems without consideration for the effects of phase resulting from multiple frequency and/or multiple antennas co-located in the measurement space, which may overestimate the actual result. If the result exceeds the limits, the advanced calculations described in follows may be used.

$$E_{AVG} = \frac{1}{n}\sum_{i=1}^{n}(E_{MaxRMS})_i$$

Where:
E-field measurements

E_{AVG} = Spatial average

E_{MaxRMS} = E-field at a measurement point

N = Number of spatially averaged points

And

$$H_{AVG} = \frac{1}{n}\sum_{i=1}^{n}(H_{MaxRMS})_i$$

Where:

H-field levels of magnetic field strength

H_{AVG} = Spatial average

H_{MaxRMS} = H-field at a measurement point

N = Number of spatially averaged points

E-Filed Strength at 15 cm from the edges surrounding the EUT (V/m)

Simultaneous combination	Frequency Range (MHz)	Max.Measured E-Field Strength Values (V/m)		Spatial Average E_{AVG} (V/m)	FCC E-Field Strength 50% Limits (V/m)	FCC E-Field Strength Limits (V/m)
		Phone port	Earphone port			
Phone+ Earphone TM1	0.111	94.00	85.69	89.85	307.0	614.0

H-Filed Strength at 15 cm from the edges surrounding the EUT (A/m)

Simultaneous combination	Frequency Range (MHz)	Max. Measured H-Field Strength Values (A/m)		Spatial Average H_{AVG} (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
		Phone port	Earphone port			
Phone+ Earphone TM1	0.111	0.249	0.244	0.247	0.815	1.63

H-Filed Strength at 20 cm from the top of the EUT (A/m)

Simultaneous combination	Frequency Range (MHz)	Max. Measured H-Field Strength Values (A/m)		Spatial Average H_{AVG} (A/m)	FCC H-Field Strength 50% Limits (A/m)	FCC H-Field Strength Limits (A/m)
		Phone port	Earphone port			
Phone+ Earphone TM1	0.111	0.176	0.143	0.160	0.815	1.63

8 Test Set-up Photo

End of report