RF Exposure Evaluation

FCC ID: 2BE8M-A5

Product Name:	Wireless charger Bluetooth speaker
Product Model No.:	A5
Test Auxiliary:	AC/DC Adapter, Phone, Watch, Earbuds
Test Auxiliary Model No.:	HW-050450C00, iPhone 13, iWatch S2, AirPods 2
Operation Frequency:	ANT 1&2&3: 115kHz-205kHz ANT 4: 320kHz
Modulation type:	ASK
Antenna Type:	ANT 1&2&3&4: Loop Coil Antenna
Antenna gain:	ANT 1&2&3&4: 0dBi
Power supply:	Input: 12V⎓2A, 9V⎓2A, 5V⎓2A Phone Output : 5W/15W (Max) Earbuds Output: 5W (Max) Watch Output: 3W (Max)
Transmitting mode	Keep the EUT in continuously wireless charging mode

a. EUT mode of operation before folding:

Test Modes:	Test Coil	Description:
Mode 1	ANT 1	AC/DC Adapter + EUT + Phone (Battery Status: <1%)
Mode 2		AC/DC Adapter + EUT + Phone (Battery Status: 50%)
Mode 3		AC/DC Adapter + EUT + Phone (Battery Status: >98%)
Mode 4	ANT 2	AC/DC Adapter + EUT + Phone (Battery Status: <1%)
Mode 5		AC/DC Adapter + EUT + Phone (Battery Status: 50%)
Mode 6		AC/DC Adapter + EUT + Phone (Battery Status: >98%)
Mode 7	ANT 3	AC/DC Adapter + EUT + Earbuds (Battery Status: <1%)
Mode 8		AC/DC Adapter + EUT + Earbuds (Battery Status: 50%)
Mode 9		AC/DC Adapter + EUT + Earbuds (Battery Status: >98%)
Mode 10	ANT 4	AC/DC Adapter + EUT + Watch (Battery Status: <1%)
Mode 11		AC/DC Adapter + EUT + Watch (Battery Status: 50%)
Mode 12		AC/DC Adapter + EUT + Watch (Battery Status: >98%)
Mode 13	ANT 1 + ANT 3 + ANT 4	AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: <1%)
Mode 14		AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: 50%)
Mode 15		AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: >98%)
Mode 16	ANT 2 + ANT 3 + ANT 4	AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: <1%)
Mode 17		AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: 50%)
Mode 18		AC/DC Adapter + EUT + Phone + Earbuds + Watch (Battery Status: >98%)

b. EUT works in folded mode:

Test Modes:	Test Coil	Description:
Mode 1a	ANT 1	AC/DC Adapter + EUT + Phone (Battery Status: <1%)
Mode 2a		AC/DC Adapter + EUT + Phone (Battery Status: 50%)
Mode 3a		AC/DC Adapter + EUT + Phone (Battery Status: >98%)
Mode 4a	ANT 2	AC/DC Adapter + EUT + Phone (Battery Status: <1%)
Mode 5a		AC/DC Adapter + EUT + Phone (Battery Status: 50%)
Mode 6a		AC/DC Adapter + EUT + Phone (Battery Status: >98%)

Note: Since the EUT operates in the same mode before and after folding, the report only reflects the test data before folding.

1 Measuring Standard

1.1 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 §2.1091 RF exposure is calculated. According KDB 680106 D01 Wireless Power Transfer v04.

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainly
1	H-filed	±0.93dB
2	E-filed	±0.51dB

2.1 Requirements

The EUT does comply with item 5.2 of KDB 680106 D01 V04:

1) The power transfer frequency is below 1 MHz.

Yes, the device operate in the frequency range from 115kHz to 205kHz and 320kHz.

2) The output power from each transmitting element (e.g., coil) is less than or equal to 15 watts.

Yes, the maximum output power of the primary coil is 15W.

3) A client device providing the maximum permitted load is placed in physical contact with the transmitter (i.e., the surfaces of the transmitter and client device enclosures need to be in physical contact).

Yes, the surfaces of the transmitter and client device enclosures are in physical contact.

4) Only § 2.1091-Mobile exposure conditions apply (i.e., this provision does not cover § 2.1093-Portable exposure conditions)..

Yes, the EUT is a Mobile Wireless Charger.

5) The E-field and H-field strengths, at and beyond 20 cm surrounding the device surface, are demonstrated to be less than 50% of the applicable MPE limit, per KDB 447498, Table 1.

Yes, the EUT field strength levels are less 50% * MPE limit.

6) For systems with more than one radiating structure, the conditions specified in (5) must be met when the system is fully loaded (i.e., clients absorbing maximum power available), and with all the radiating structures operating at maximum power at the same time, as per design conditions.

Yes, the EUT has four coil, all test modes met the conditions specified in (5).

2.2 Limits

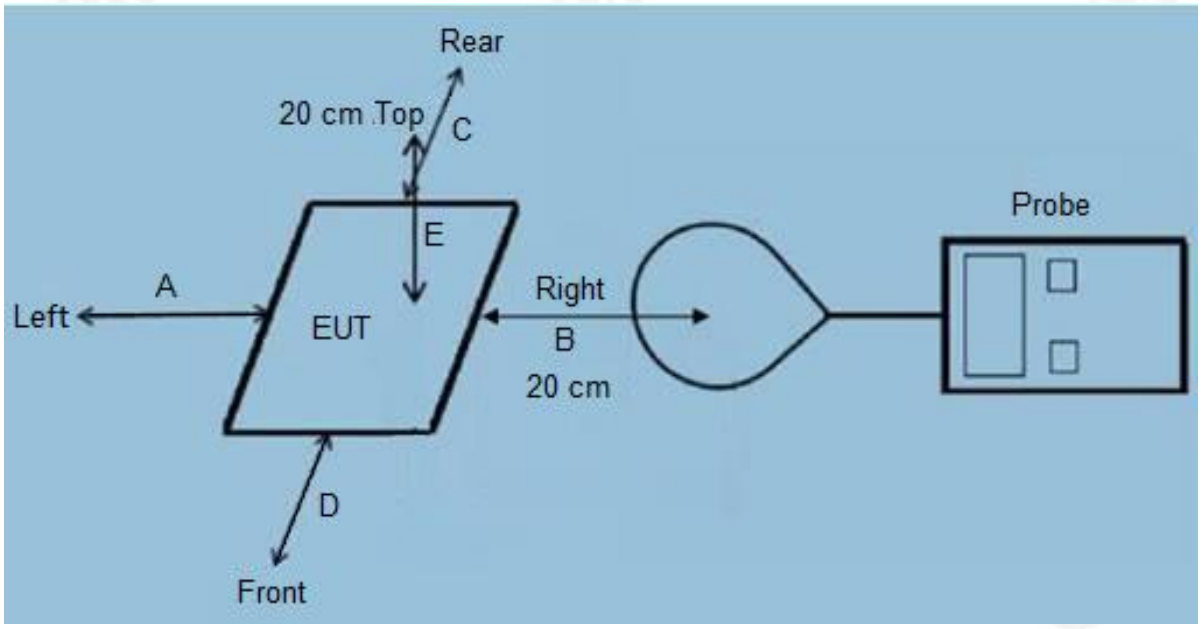
The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

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).

2.3 Test Setup



3 Test Procedure

1) The RF exposure test was performed on 360 degree turn table in anechoic chamber.
2) The measurement probe was placed at test distance (20 cm and above from all sides and Top) which is between the edge of the charger and the geometric centre of probe.
3) The turn table was rotated 360d degree to search of highest strength.
4) The highest emission level was recorded and compared with limit as soon as measurement of each points were completed.
5) The EUT were measured according to the dictates of KDB 680106 D01 V04.

4 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	180ZX10220	Nov. 16, 2023	Nov. 15, 2024
Magnetic field probe 100cm^2	Narda	ELT probe 100cm^2	M0675	Nov. 16, 2023	Nov. 15, 2024

5 Test Result

Test Mode 1~3:

H-Filed Strength at 20 cm from the edges surrounding the EUT (A/m):

Battery Level:	Frequency Range (MHz)	Test Position Left (uT)	Test Position Right (uT)	Test Position Rear (uT)	Test Position Front (uT)	Test Position Top (uT)
<1% Battery	0.115-0.205	0.27	0.28	0.32	0.27	0.33
50% Battery	0.115-0.205	0.24	0.27	0.26	0.24	0.25
>98% Battery	0.115-0.205	0.22	0.26	0.24	0.23	0.24

Battery Level:	Frequency Range (MHz)	Test Position Left (A/m)	Test Position Right(A/m)	Test Position Rear(A/m)	Test Position Front(A/m)	Test Position Top(A/m)	Limits 50% (A/m)	Limits (A/m)
<1% Battery	0.115-0.205	0.22	0.22	0.26	0.22	0.26	0.815	1.63
50% Battery	0.115-0.205	0.19	0.22	0.21	0.19	0.20	0.815	1.63
>98% Battery	0.115-0.205	0.18	0.21	0.19	0.18	0.19	0.815	1.63

Test Mode 4~6:

H-Filed Strength at 20 cm from the edges surrounding the EUT (A/m):

Battery Level:	Frequency Range (MHz)	Test Position Left (uT)	Test Position Right (uT)	Test Position Rear (uT)	Test Position Front (uT)	Test Position Top (uT)
<1% Battery	0.115-0.205	0.25	0.26	0.28	0.29	0.30
50% Battery	0.115-0.205	0.24	0.25	0.25	0.26	0.29
>98% Battery	0.115-0.205	0.23	0.26	0.24	0.25	0.26

Battery Level:	Frequency Range (MHz)	Test Position Left (A/m)	Test Position Right(A/m)	Test Position Rear(A/m)	Test Position Front(A/m)	Test Position Top(A/m)	Limits 50% (A/m)	Limits (A/m)
<1% Battery	0.115-0.205	0.20	0.21	0.22	0.23	0.24	0.815	1.63
50% Battery	0.115-0.205	0.19	0.20	0.20	0.21	0.23	0.815	1.63
>98% Battery	0.115-0.205	0.18	0.21	0.19	0.20	0.21	0.815	1.63

Test Mode 7~9:

H-Filed Strength at 20 cm from the edges surrounding the EUT (A/m):

Battery Level:	Frequency Range (MHz)	Test Position Left (uT)	Test Position Right (uT)	Test Position Rear (uT)	Test Position Front (uT)	Test Position Top (uT)
<1% Battery	0.115-0.205	0.21	0.22	0.26	0.21	0.27
50% Battery	0.115-0.205	0.17	0.20	0.19	0.17	0.18
>98% Battery	0.115-0.205	0.14	0.18	0.16	0.15	0.16

Battery Level:	Frequency Range (MHz)	Test Position Left (A/m)	Test Position Right(A/m)	Test Position Rear(A/m)	Test Position Front(A/m)	Test Position Top(A/m)	Limits 50% (A/m)	Limits (A/m)
<1% Battery	0.115-0.205	0.17	0.18	0.21	0.17	0.22	0.815	1.63
50% Battery	0.115-0.205	0.14	0.16	0.15	0.14	0.14	0.815	1.63
>98% Battery	0.115-0.205	0.11	0.14	0.13	0.12	0.13	0.815	1.63

Test Mode 10~12:

H-Filed Strength at 20 cm from the edges surrounding the EUT (A/m):

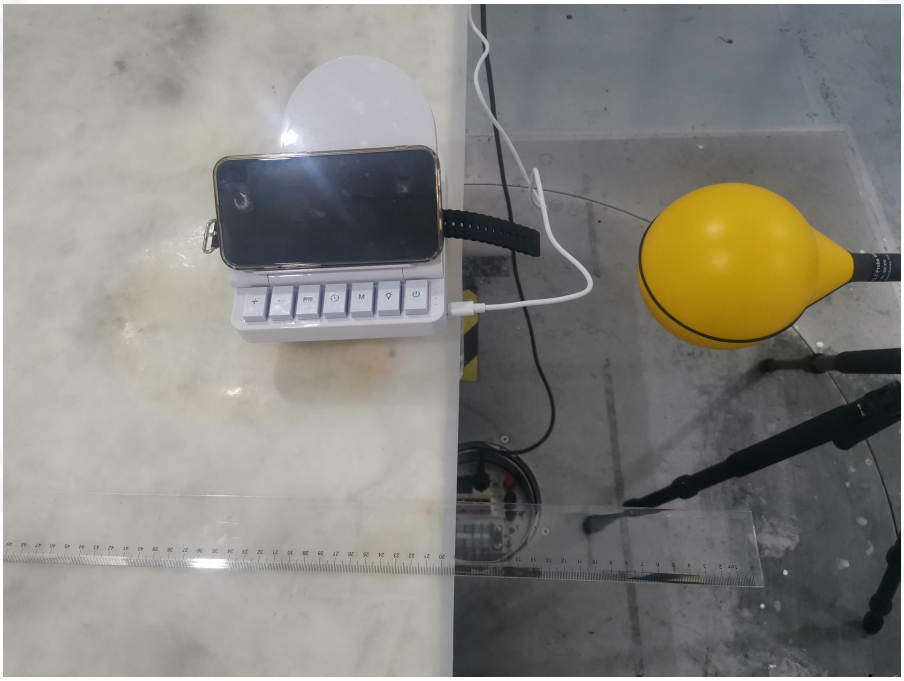
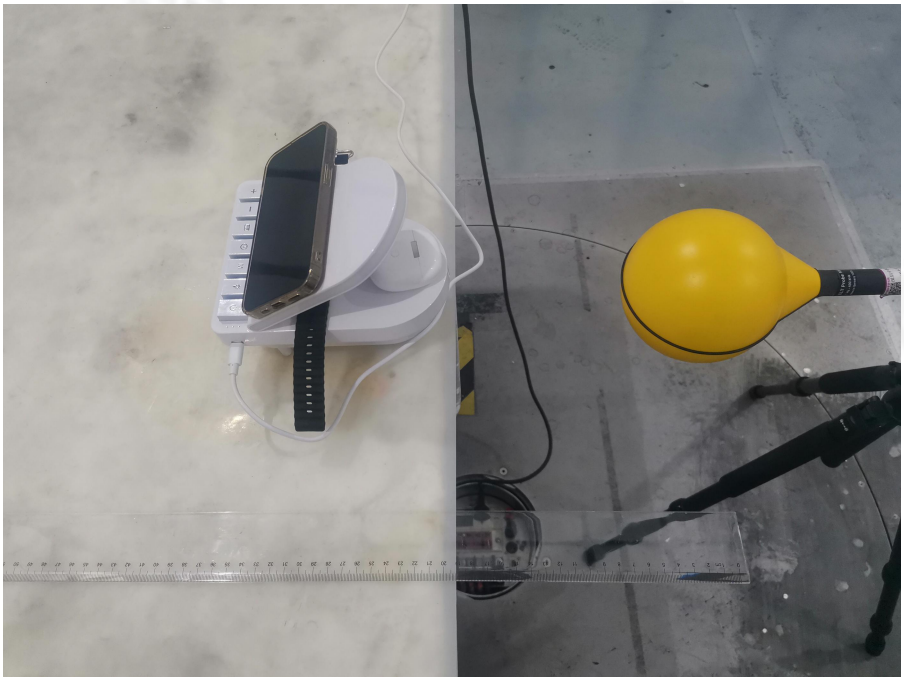
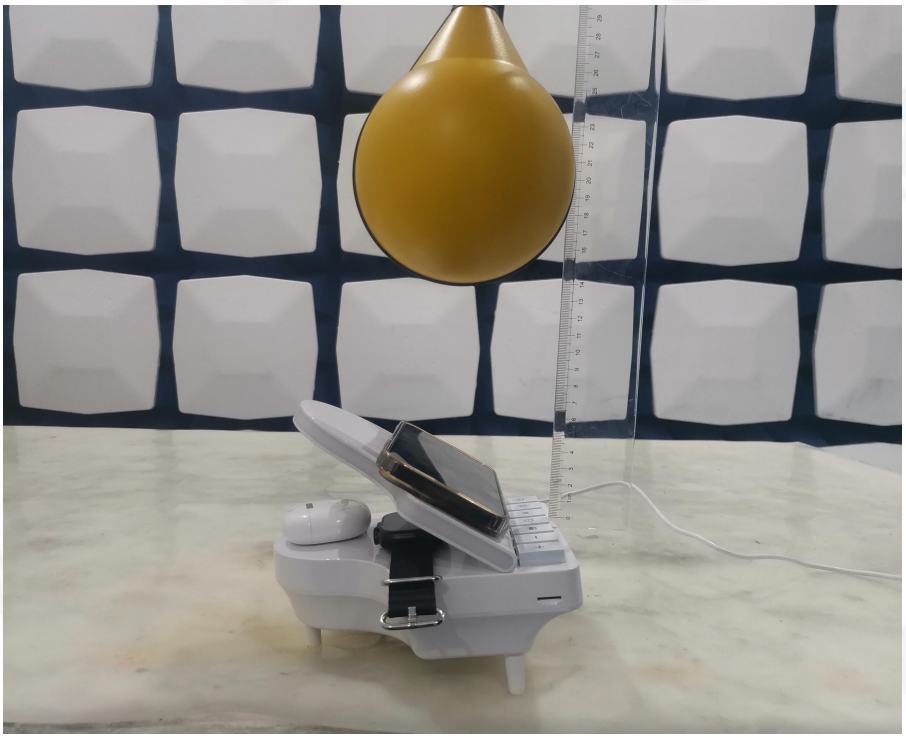
Battery Level:	Frequency Range (MHz)	Test Position Left (uT)	Test Position Right (uT)	Test Position Rear (uT)	Test Position Front (uT)	Test Position Top (uT)
<1% Battery	0.32	0.20	0.21	0.25	0.20	0.26
50% Battery	0.32	0.18	0.21	0.20	0.18	0.19
>98% Battery	0.32	0.15	0.19	0.17	0.16	0.17

Battery Level:	Frequency Range (MHz)	Test Position Left (A/m)	Test Position Right(A/m)	Test Position Rear(A/m)	Test Position Front(A/m)	Test Position Top(A/m)	Limits 50% (A/m)	Limits (A/m)
<1% Battery	0.32	0.16	0.17	0.20	0.16	0.21	0.815	1.63
50% Battery	0.32	0.14	0.17	0.16	0.14	0.15	0.815	1.63
>98% Battery	0.32	0.12	0.15	0.14	0.13	0.14	0.815	1.63

Remark: A/m = uT/1.25

EUT ant1 and ant2 cannot be launched at the same time, so there are two ways to evaluate the same launch with ant3 and ant4:

1. This product can charge the ANT 1 + ANT 3 + ANT 4 at the same time, So rated = H-Filed$_{(ANT1)}$ / limits + H-Filed$_{(ANT3)}$ + H-Filed$_{(ANT4)}$ / limits = 0.26 / 0.815 + 0.22 / 0.815 + 0.21 / 0.815 = 0.847 < 1.

2. This product can charge the ANT 2 + ANT 3 + ANT 4 at the same time, So rated = H-Filed$_{(ANT2)}$ / limits + H-Filed$_{(ANT3)}$ + H-Filed$_{(ANT4)}$ / limits = 0.24 / 0.815 + 0.22 / 0.815 + 0.21 / 0.815 = 0.822 < 1.

6 Test Set-up Photo