

RF Exposure evaluation

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1091

FCC ID: 2AJAA-R410

1. Reference

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.

KDB447498 D01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

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 – 1500	/	/	f/300	6
1500 – 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 Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

4. Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r = 20\text{cm}$, as well as the gain of the used BT antenna is 0dBi, the RF power density can be obtained.

EDR								
Freq. (MHz)	Output Power (dBm)	Target power W/ tolerance (dBm)	Max tune up power tolerance (dBm)	Output power to antenna (mW)	Ant Gain (dBi)	Power Density at R=20cm (mW/cm ²)	Limit (mW/c m ²)	Result
GFSK								
2402	6.402	6±1.0	7	5.012	0	0.00100	1	Pass
2441	6.270	6±1.0	7	5.012	0	0.00100	1	Pass
2480	10.288	10±1.0	11	12.589	0	0.00250	1	Pass
$\pi/4$ DQPSK								
2402	8.880	9±1.0	10	10.000	0	0.00199	1	Pass
2441	8.718	9±1.0	10	10.000	0	0.00199	1	Pass
2480	12.663	13±1.0	14	25.119	0	0.00500	1	Pass
8DPSK								
2402	9.491	9±1.0	10	10.000	0	0.00199	1	Pass
2441	9.409	9±1.0	10	10.000	0	0.00199	1	Pass
2480	13.389	13±1.0	14	25.119	0	0.00500	1	Pass
BLE								
Freq. (MHz)	Output Power (dBm)	Target power W/ tolerance (dBm)	Max tune up power tolerance (dBm)	Output power to antenna (mW)	Ant Gain (dBi)	Power Density at R=20cm (mW/cm ²)	Limit (mW/c m ²)	Result
LE								
2402	6.275	6±1.0	4	5.012	0	0.00100	1	Pass
2440	6.149	6±1.0	4	5.012	0	0.00100	1	Pass
2480	10.175	10±1.0	11	12.589	0	0.00250	1	Pass
2LE								
2402	6.293	6±1.0	7	5.012	0	0.00100	1	Pass
2440	6.191	6±1.0	7	5.012	0	0.00100	1	Pass
2480	10.222	10±1.0	11	12.589	0	0.00250	1	Pass

Note: The estimation distance is 20cm

5. Evaluation Results for Standalone

5.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BT	14.0	25.119	0.0	1.000	0.00500	1.0000
BLE	11.0	12.589	0.0	1.000	0.00250	1.0000

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

6. simultaneous MPE Result

BT MPE	WIFI MPE Ant 1	WIFI MPE Ant 2	simultaneous MPE Rate	MPE Rate Limits
0.00500	0.0608	0.0693	0.1351	1.0000

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.