

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: 2A8WL-BWNIP-4L-BS

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.

KDB 447498 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 givendistance

Equation from page 18 of OET Bulletin 65, Edition97-01

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

Where: S=powerdensity

P=power input toantenna

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

R=distance to the center of radiation of theantenna

4. Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, atleast20 cm from any body part of the user or nearby persons; from the maximum EUT

RFoutputpower, the minimum separation distance, r =20cm, as well as the gain of the used BT antenna is 204dBi, the RF power density can beobtained.

BLE

Freq.(MHz)	Output Power (dBm)	TargetpowerW/tolerance (dBm)	Max tuneuppower tolerance (dBm)	Output power toantenna	AntGai n(dBi)	PowerDensit y atR=20cm (mW/cm2)	Limit(mW/cm2)	Result
GFSK								
2402	3.112	3±1.0	4	2.512	2.04	0.00080	1	Pass
2440	3.253	3±1.0	4	2.512	2.04	0.00080	1	Pass
2480	2.125	2±1.0	3	1.995	2.04	0.00063	1	Pass

WIFI 2.4G

Modulation Type	Target power W/ tolerance (dBm)	Max tune up power tolerance(dBm)	Max Output power to antenna (mW)	Antenna Gain	Antenna Gain (linear)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11b	18±1.0	19	79.433	2.04	1.60	0.02528	1.0	Pass
802.11g	15±1.0	16	39.811	2.04	1.60	0.01267	1.0	Pass
802.11n (HT20)	15±1.0	16	39.811	2.04	1.60	0.01267	1.0	Pass
802.11n (HT40)	14±1.0	15	31.623	2.04	1.60	0.01006	1.0	Pass
802.11ax (HT20)	14±1.0	15	31.623	2.04	1.60	0.01006	1.0	Pass
802.11ax (HT40)	9±1.0	10	10.000	2.04	1.60	0.00318	1.0	Pass

Power Density at R=20cm (mW/cm2) BLE	Power Density at R=20cm (mW/cm2) 2.4G WIFI	Power Density at R=20cm (mW/cm2) 5.18GHz – 5.24 GHz WIFI	Σ MPE ratios	Limit (mW/cm2)	Result
0.00080	0.02528	0.00974	0.03582	1.0	Pass

Power Density at R=20cm (mW/cm2) BLE	Power Density at R=20cm (mW/cm2) 2.4G WIFI	Power Density at R=20cm (mW/cm2) 5.745 GHz -5.825 GHz WIFI	Σ MPE ratios	Limit (mW/cm2)	Result
0.00080	0.02528	0.00974	0.03582	1.0	Pass

Note: The estimation distance is 20cm

5. Conclusion

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