

RF Exposure evaluation

FCC ID: 2ACOE-WG221BL

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Fixed Device

1. Reference

According to § 1.130(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 DOI: 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	/	/	0.300	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)*	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. Antenna Information

Only use antennas certificated as follows provided by manufacturer,

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
2.4G WIFI	/	External Antenna	3.81 dBi for 2400-2500MHz;	
Bluetooth	/	External Antenna	Bluetooth Maximum Gain is 3.81dBi	
Bluetooth BLE	/	External Antenna	Bluetooth BLE:Maximum Gain is 3.81dBi	

5. Standalone MPE 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 antenna above article 4(antenna information), the RF power density can be obtained.

Modulation Type	Max tum-up power (dBm)	Antenna Gain (dBi)	PG (mW)	MPE (mW/cm2)	MPE Limits (mW/cm2)
2.4GWIFI	20.33	3.81	259.41794	0.0516	1.0000
Bluetooth	3.92	3.81	5.92925	0.0012	1.0000
Bluetooth BLE	2.88	3.81	4.66659	0.0009	1.0000

Conclusion: $\text{Sum} = 0.0516 + 0.0012 = 0.0528 < 1$, therefore the result is PASS.

2.4Gwifi Ratio = $\text{MPE} / \text{MPE Limit} = 0.0516 / 1 = 0.0516$;

Bluetooth Ratio = $\text{MPE} / \text{MPE Limit} = 0.0012 / 1 = 0.0012$;

Remark:

1. Output power including tum-up tolerance:

2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

6. Conclusion

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

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