

RF Exposure Compliance Requirement

Model no.: 4412311000

1. Standard requirement

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 limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

(a) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S)(mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
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
1500-100000	--	--	5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S)(mW/cm ²)	Averaging Times E ² , H ² or S (minutes)
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
1500-100000	--	--	1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

2. MPE Calculation Method

$$E (V/m) = (30 * P * G)^{0.5} / d \quad \text{Power Density: } Pd(W/m^2) = E^2 / 377$$

E=Electric Field (V/m)

P=Peak RF output Power (W)

G=EUT Antenna numeric gain (numeric)

d= Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = (30 * P * G) / (377 * d^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

3. Calculated Result and Limit

5.8GHz:

E=90.1dB μ V/m@3m(max. value provided by client), antenna gain = 0dBi

Frequency (MHz)	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
5730-5870	1	-5.1	0.31	0.000061	1	Complies

MPE ratio:

$$0.000061 (mW/cm^2) / 1(mW/cm^2) = 0.000061$$

WIFI:

Peak Output Power = 20.50dBm

(The power for WIFI module refers to certificate of FCC ID:2AC7Z-ESP3WROOM1), antenna gain = 3.26dBi

Frequency (MHz)	Antenna Gain (Numeric)	Max Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2412-2462	1.259	20.5	112.20	0.047	1	Complies

MPE ratio:

$$0.047 (mW/cm^2) / 1(mW/cm^2) = 0.047$$

Bluetooth:

Peak Output Power = 10dBm

(The power for BLE module refers to certificate of FCC ID:2AC7Z-ESP3WROOM1), antenna gain = 3.26dBi

Frequency (MHz)	Antenna Gain (Numeric)	Max Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2402-2480	1.259	10	10	0.004	1	Complies

MPE ratio:

$$0.004 \text{ (mW/cm}^2\text{)} / 1 \text{ (mW/cm}^2\text{)} = 0.004$$

The sample support one Bluetooth& WIFI modular and one antenna, Not need consider simultaneous Transmission of Bluetooth& WIFI. The maximum MPE ratio of 5.8GHz and WIFI were selected as the evaluation.

Sum of the MPE ratio for all simultaneously transmitting antennas:

$$0.000061 + 0.047 = 0.047061 < 1$$

According to MPE test Exclusion condition in KDB 447498 (D01) General RF Exposure Guidance D01 v06, the MPE report is not required.

Test Location:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch

All tests were performed at:

Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China