

FCC §1.1307(b) & 2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (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
1500-100,000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Result**For worst case:**

Mode	Frequency (MHz)	Antenna Gain [#]		Tune up conducted power [#]		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
		(dBi)	(numeric)	(dBm)	(mW)			
BT	2402-2480	2.38	1.73	12.5	17.78	20	0.006	1
BLE	2402-2480	2.38	1.73	7.5	5.62	20	0.002	1
2.4G Wi-Fi	2412-2462	2.38	1.73	24.5	281.84	20	0.097	1
5.2G Wi-Fi	5180-5240	4.01	2.52	16.0	39.81	20	0.020	1
5.3G Wi-Fi	5260-5320	4.01	2.52	16.0	39.81	20	0.020	1
5.6G Wi-Fi	5500-5720	4.01	2.52	16.0	39.81	20	0.020	1
5.8G Wi-Fi	5745-5825	4.01	2.52	17.5	56.23	20	0.028	1

Note: The tune-up power and antenna gain was declared by the applicant.

According to applicant, the Bluetooth and Wi-Fi can transmit at same time, the 2.4G Wi-Fi and 5G Wi-Fi cannot transmit at same time

Simultaneous transmitting consideration (worst case):

The ratio= $MPE_{Wi-Fi}/limit_{Wi-Fi} + MPE_{BT}/limit_{BT} = 0.006/1 + 0.097/1 = 0.103 < 1.0$

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

Result: Compliant.