

§2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to 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

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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:

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

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	2.5	1.78	8.5	7.08	20	0.0025	1
BLE	2402-2480	2.5	1.78	1.0	1.26	20	0.0004	1
2.4GHz Wi-Fi	2412-2462	2.5	1.78	19.5	89.13	20	0.0316	1
5GHz Wi-Fi	5150-5250	3.52	2.25	13.5	22.39	20	0.0100	1
	5250-5350	3.03	2.01	14.0	25.12	20	0.0101	1
	5470-5725	2.59	1.82	14.0	25.12	20	0.0091	1
	5725-5850	1.97	1.57	13.0	19.95	20	0.0062	1

Note: The 2.4G Wi-Fi/BT/BLE can't transmit with the 5G Wi-Fi at the same time, but 2.4G Wi-Fi can transmit with BT/BLE simultaneously.

Simultaneous transmitting consideration (worst case):

The ratio= $MPE_{2.4G\ Wi-Fi}/limit + MPE_{BT}/limit = 0.0316/1 + 0.0025/1 = 0.0341 < 1.0$

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

Result: Compliance