

Maximum Permissible Exposure (MPE)

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) 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
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
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
300-1,500			f/1500	30
1,500-100,000			1.0	30

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

MPE Calculation Method

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

E = Electric field (V/m)

P = Average 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

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the 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.

BT:
Measurement Result
Operation Frequency: 2402MHz~2480MHz
Power density limited: 1mW/ cm²
Antenna Type: Ant1/2: PCB antenna,
Antenna gain: Ant1/2: 4.77dBi/7.01dBi
R=20cm
mW=10^(dBm/10)

BLE

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
2402	GFSK(1M) ANT1	6.67	6±1	7	5.012	4.77	3.00	0.00299	1
2440		6.23	6±1	7	5.012	4.77	3.00	0.00299	1
2480		6.62	6±1	7	5.012	4.77	3.00	0.00299	1
2402	GFSK(1M) ANT2	3.83	3±1	4	2.512	7.01	5.02	0.00251	1
2440		3.3	3±1	4	2.512	7.01	5.02	0.00251	1
2480		3.82	3±1	4	2.512	7.01	5.02	0.00251	1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
2402	GFSK(2M) ANT1	6.76	6±1	7	5.012	4.77	3.00	0.00299	1
2440		6.36	6±1	7	5.012	4.77	3.00	0.00299	1
2480		6.8	6±1	7	5.012	4.77	3.00	0.00299	1
2402	GFSK(2M) ANT2	3.92	3±1	4	2.512	7.01	5.02	0.00251	1
2440		3.18	3±1	4	2.512	7.01	5.02	0.00251	1
2480		3.85	3±1	4	2.512	7.01	5.02	0.00251	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,

WIFI 802.11n HT40:2422-2452MHz

Power density limited: 1mW/ cm²

Antenna Type: Ant1/2: PCB antenna,

Antenna gain: Ant1/2: 4.77dBi/7.01dBi,

R=20cm

mW=10^(dBm/10)

ANT	Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm
			(dBm)	(dBm)	tune-up power		Gain	Power
					(dBm)	(mW)	Numeric	density(mW/cm2)
ANT1	2412	802.11b	16.89	16±1	17	50.12	3	0.02991
	2437		16.72	16±1	17	50.12	3	0.02991
	2462		16.9	16±1	17	50.12	3	0.02991
	2412	802.11g	15.81	15±1	16	39.81	3	0.02376
	2437		15.54	15±1	16	39.81	3	0.02376
	2462		15.91	15±1	16	39.81	3	0.02376
	2412	802.11n H20	14.69	14±1	15	31.62	3	0.01887
	2437		14.58	14±1	15	31.62	3	0.01887
	2462		14.96	14±1	15	31.62	3	0.01887
	2422	802.11n H40	14.65	14±1	15	31.62	3	0.01887
	2437		14.57	14±1	15	31.62	3	0.01887
	2452		14.87	14±1	15	31.62	3	0.01887
ANT2	2412	802.11b	16.45	17±1	18	63.10	5.02	0.06301
	2437		16.65	17±1	18	63.10	5.02	0.06301
	2462		17.11	17±1	18	63.10	5.02	0.06301
	2412	802.11g	15.61	16±1	17	50.12	5.02	0.05005
	2437		15.83	16±1	17	50.12	5.02	0.05005
	2462		16.21	16±1	17	50.12	5.02	0.05005
	2412	802.11n H20	14.71	15±1	16	39.81	5.02	0.03976
	2437		14.87	15±1	16	39.81	5.02	0.03976
	2462		15.37	15±1	16	39.81	5.02	0.03976
	2422	802.11n H40	14.75	15±1	16	39.81	5.02	0.03976
	2437		14.74	15±1	16	39.81	5.02	0.03976
	2452		15.14	15±1	16	39.81	5.02	0.03976

Note: BT & WIFI do not support simultaneous transmission.**Conclusion:**

The conclusion for Max mode should be 0.06301<1 for Max Power Density, Compliance the RF exposure.

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