

FCC ID: 2A4A7-PTM102

Maximum Permissible Exposure (MPE)

According to FCC 2.1091, FCC 1.1310 and KDB 447498 D01 General RF Exposure Guidance v06: 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

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

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.

Measurement Result

BLE:

Operation Frequency: 2402MHz~2480MHz

Antenna Type: FPC antenna

Antenna gain:3dBi;

R=20cm

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	BLE 1M	0.55	0±1	1	1.259	3.00	2.00	0.0005	1
2440		1.25	1±1	2	1.585	3.00	2.00	0.0006	1
2480		1.51	1±1	2	1.585	3.00	2.00	0.0006	1

2.4GWIFI:

Operation Frequency:

2412MHz~2462MHz (20M)

2422MHz~2452MHz (40M)

Antenna Type: FPC antenna

Antenna gain :3dBi;

R=20cm

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)
2412	11b ant1	16.11	16±1	17	50.119	3.00	2.00	0.0199	1
2437		15.66	15±1	16	39.811	3.00	2.00	0.0158	1
2462		15.88	15±1	16	39.811	3.00	2.00	0.0158	1
2412	11g ant1	14.66	14±1	15	31.623	3.00	2.00	0.0126	1
2437		15.09	15±1	16	39.811	3.00	2.00	0.0158	1
2462		15.3	15±1	16	39.811	3.00	2.00	0.0158	1
2412	11n20 ant1	13.28	13±1	14	25.119	3.00	2.00	0.0100	1
2437		12.8	12±1	13	19.953	3.00	2.00	0.0079	1
2462		12.74	12±1	13	19.953	3.00	2.00	0.0079	1
2422	11n40 ant1	12.06	12±1	13	19.953	3.00	2.00	0.0079	1
2437		11.6	11±1	12	15.849	3.00	2.00	0.0063	1
2452		11.7	11±1	12	15.849	3.00	2.00	0.0063	1

5G WIFI:
 Antenna gain
 WIFI5.2G: 2.41dBi;
 WIFI5.3G: 2.75dBi;
 WIFI5.6G: 2.67dBi;
 WIFI5.8G: 1.97dBi;
 R=20cm

WIFI 5.2G

modulation	Antenna	Channel Freq. (MHz)	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)
802.11a	Ant 1	5180	10.543	10±1	11.00	12.589	2.41	1.74	0.0044	1
	Ant 1	5200	9.968	9±1	10.00	10.000	2.41	1.74	0.0035	1
	Ant 1	5240	10.402	10±1	11.00	12.589	2.41	1.74	0.0044	1
802.11n20	Ant 1	5180	11.371	11±1	12.00	15.849	2.41	1.74	0.0055	1
	Ant 1	5200	10.732	10±1	11.00	12.589	2.41	1.74	0.0044	1
	Ant 1	5240	10.519	10±1	11.00	12.589	2.41	1.74	0.0044	1
802.11n40	Ant 1	5190	10.166	10±1	11.00	12.589	2.41	1.74	0.0044	1
	Ant 1	5230	9.155	9±1	10.00	10.000	2.41	1.74	0.0035	1

WIFI 5.3G

modulation	Antenna	Channel Freq. (MHz)	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
802.11a	Ant 1	5260	10.67	10±1	11.00	12.589	2.75	1.88	0.0047	1
	Ant 1	5280	11.046	11±1	12.00	15.849	2.75	1.88	0.0059	1
	Ant 1	5320	12.465	12±1	13.00	19.953	2.75	1.88	0.0075	1
802.11n20	Ant 1	5260	9.82	9±1	10.00	10.000	2.75	1.88	0.0037	1
	Ant 1	5280	10.708	10±1	11.00	12.589	2.75	1.88	0.0047	1
	Ant 1	5320	10.9	10±1	11.00	12.589	2.75	1.88	0.0047	1
802.11n40	Ant 1	5270	8.585	8±1	9.00	7.943	2.75	1.88	0.0030	1
	Ant 1	5310	9.7	9±1	10.00	10.000	2.75	1.88	0.0037	1

WIFI 5.6G

modulation	Antenna	Channel Freq. (MHz)	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
			(dBm)		tune-up power		Gain			
					(dBm)	(mW)	(dBi)	Numeric		
802.11a	Ant 1	5500	12.278	12±1	13.00	19.953	2.67	1.85	0.0073	1
	Ant 1	5600	11.791	11±1	12.00	15.849	2.67	1.85	0.0058	1
	Ant 1	5700	12.209	12±1	13.00	19.953	2.67	1.85	0.0073	1
802.11n20	Ant 1	5500	11.084	11±1	12.00	15.849	2.67	1.85	0.0058	1
	Ant 1	5580	11.693	11±1	12.00	15.849	2.67	1.85	0.0058	1
	Ant 1	5600	10.769	10±1	11.00	12.589	2.67	1.85	0.0046	1
	Ant 1	5700	10.67	10±1	11.00	12.589	2.67	1.85	0.0046	1
802.11n40	Ant 1	5510	9.52	9±1	10.00	10.000	2.67	1.85	0.0037	1
	Ant 1	5590	9.466	9±1	10.00	10.000	2.67	1.85	0.0037	1
	Ant 1	5670	9.133	9±1	10.00	10.000	2.67	1.85	0.0037	1

WIFI 5.8G

modulation	Antenna	Channel Freq. (MHz)	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)
802.11a	Ant 1	5745	12.142	12±1	13.00	19.953	2.71	1.87	0.0074	1
	Ant 1	5785	13.309	13±1	14.00	25.119	2.71	1.87	0.0093	1
	Ant 1	5825	12.885	12±1	13.00	19.953	2.71	1.87	0.0074	1
802.11n20	Ant 1	5745	11.094	11±1	12.00	15.849	2.71	1.87	0.0059	1
	Ant 1	5785	12.312	12±1	13.00	19.953	2.71	1.87	0.0074	1
	Ant 1	5825	12.426	12±1	13.00	19.953	2.71	1.87	0.0074	1
802.11n40	Ant 1	5755	11.299	11±1	12.00	15.849	2.71	1.87	0.0059	1
	Ant 1	5795	11.065	11±1	12.00	15.849	2.71	1.87	0.0059	1

SIMULTANEOUS TRANSMISSIONS

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE. To comply with the MPE, the fraction of the MPE in terms of E^2 , H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

Note: BLE, WIFI 2.4G and WIFI 5G share the same antenna and cannot transmit simultaneously.

Conclusion:

compliance RF exposure.

Signature: 

Date: 2025-05-30

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