

RF EXPOSURE EVALUATION

According to FCC 1.1310 and KDB 447498 D01 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)

According to FCC 2.1091

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

BT:

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/ cm²

Antenna Type:PCB Antenna

Antenna gain: 3.33 dBi;

R=20cm

mW=10^{^(dBm/10)}

antenna gain Numeric=10^{^(dBi/10)}

BLE

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	BLE 1M	0.43	1±1	2	1.585	3.33	2.15	0.0007	1
2440		1.1	1±1	2	1.585	3.33	2.15	0.0007	1
2480		1.2	1±1	2	1.585	3.33	2.15	0.0007	1
2402	BLE 2M	0.42	1±1	2	1.585	3.33	2.15	0.0007	1
2440		1.12	1±1	2	1.585	3.33	2.15	0.0007	1
2480		1.22	1±1	2	1.585	3.33	2.15	0.0007	1

2.4G WIFI

Operation Frequency:

WIFI 802.11b/g/n/ax20: 2412-2462MHz,

WIFI 802.11n/ax40: 2422-2452MHz,

Power density limited: 1mW/ cm²

Antenna Type: PCB Antenna

Antenna 0 gain/Antenna 1 gain: 3.33 dBi;

R=20cm

$mW=10^{(dBm/10)}$

$Antenna\ gain\ Numeric=10^{(dBi/10)}$

Antenna	Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density limits
			(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
					(dBm)	(mW)	(dBi)	Numeric		
Ant 1	2412	b	14.465	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2437		14.6054	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2462		14.5954	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2412	g	13.1932	13±1	14	25.119	3.33	2.15	0.0108	1
Ant 1	2437		13.4232	13±1	14	25.119	3.33	2.15	0.0108	1
Ant 1	2462		13.4154	13±1	14	25.119	3.33	2.15	0.0108	1
Ant 1	2412	802.11n H20	14.2884	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2437		14.4376	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2462		14.4422	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2422	802.11n H40	13.9266	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2437		14.2066	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2452		14.5975	14±1	15	31.623	3.33	2.15	0.0135	1
Ant 1	2412	802.11n ax20	12.0327	12±1	13	19.953	3.33	2.15	0.0085	1
Ant 1	2437		12.1205	12±1	13	19.953	3.33	2.15	0.0085	1
Ant 1	2462		12.2014	12±1	13	19.953	3.33	2.15	0.0085	1
Ant 1	2422	802.11n ax40	11.6518	12±1	13	19.953	3.33	2.15	0.0085	1
Ant 1	2437		12.0284	12±1	13	19.953	3.33	2.15	0.0085	1
Ant 1	2452		12.5584	12±1	13	19.953	3.33	2.15	0.0085	1

Conclusion:

For the max result : $0.0135 \leq 1.0$, SAR is not required.

Bluetooth and Wi-Fi 2.4 GHz do not support simultaneous transmission.

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