

RF EXPOSURE EVALUATION

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

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

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

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

Operation Frequency:

BT: 2402 MHz~2480MHz

ANT+:2457MHz

Power density limited: 1mW/ cm²

Antenna Type: Chip Antenna

Antenna gain: 0.5 dBi,
R=20cm

GFSK:

BLE 1M

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	-5.47	-5±1	-4	0.398	0.50	1.12	0.0001	1.00
2440		-4.65	-5±1	-4	0.398	0.50	1.12	0.0001	1.00
2480		-4.16	-5±1	-4	0.398	0.50	1.12	0.0001	1.00

BLE 2M

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		
2402	GFSK	-5.49	-5±1	-4	0.398	0.50	1.12	0.0001	1.00
2440		-4.62	-5±1	-4	0.398	0.50	1.12	0.0001	1.00
2480		-4.17	-5±1	-4	0.398	0.50	1.12	0.0001	1.00

ANT+

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		
2457	GFSK	-7.13	-7±1	-6	0.251	0.50	1.12	0.0001	1.00

Note: BLE and ANT+ can transmit cannot simultaneously

Conclusion:

For the max result : 0.0001≤ 1 for Max Power Density, compliance RF exposure..



Signature:

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