

FCC ID:2A2VW-V8E

KDB447498 D01 General RF Exposure Guidance v06

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.

BLE:

Measurement Result

Operation Frequency: 2402MHz~2480MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: built-in steel plate antenna

Antenna gain:2.91 dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2.91/10)}=1.95$

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
		(dBm)	(dBm)	(dBm)	(mW)	(dBi)	Numeric		
2402	BLE1M	0.79	0.5±1	1.5	1.413	2.91	1.95	0.0005	1
2440		1.02	0.5±1	1.5	1.413	2.91	1.95	0.0005	1
2480		1.09	0.5±1	1.5	1.413	2.91	1.95	0.0005	1
2402	BLE2M	0.84	0.5±1	1.5	1.413	2.91	1.95	0.0005	1
2440		1.07	0.5±1	1.5	1.413	2.91	1.95	0.0005	1
2480		1.11	0.5±1	1.5	1.413	2.91	1.95	0.0005	1

2.4GWIFI:

Measurement Result

Operation Frequency: 2412MHz~2462MHz

Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: built-in steel plate antenna

Antenna gain:2.91 dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(2.91/10)}=1.95$

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
		(dBm)	(dBm)	(dBm)	(mW)	(dBi)	Numeric		
2412	B	15.12	14.5±1	15.5	35.481	2.91	1.95	0.0138	1
2437		14.56	14.5±1	15.5	35.481	2.91	1.95	0.0138	1
2462		13.9	14.5±1	15.5	35.481	2.91	1.95	0.0138	1
2412	G	12.98	13±1	14	25.119	2.91	1.95	0.0098	1
2437		12.54	13±1	14	25.119	2.91	1.95	0.0098	1
2462		12.02	13±1	14	25.119	2.91	1.95	0.0098	1
2412	N20	13.02	12.5±1	13.5	22.387	2.91	1.95	0.0087	1
2437		12.41	12.5±1	13.5	22.387	2.91	1.95	0.0087	1
2462		11.91	12.5±1	13.5	22.387	2.91	1.95	0.0087	1

SRD_433.92MHz

Measurement Result

Operation Frequency: 433.92MHz;

Power density limited: 1mW/ cm²

Antenna Type: Spring antenna

Antenna gain: -3.57dBi

R=20cm

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

antenna gain Numeric=10^{^(dBi/10)}= 10^{^(-3.57/10)}=0.44

Transmit power

Frequency (MHz)	Max Output power (dBuV/m)	EIRP power (dBm)	EIRP power (mW)
433.92	76.03	-19.20	0.012

EIRP=E-104.8+20log(D)

EIRP=conducted power + antenna gain

Maximum Permissible Exposure:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Max tune-up power (mW)	Antenna Gain (dBi)	Antenna Gain Numeric	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
433.92	FSK	-15.63	-15±1	-14	0.04	-3.57	0.44	0.00000348	0.28928

BLE+2.4GWIFI+SRD_433MHz=0.0005+0.0138+0.00001203=0.01430348 < 0.28928

Conclusion:

For the max result : 0.01430348 ≤ 0.28928 for Max Power Density, compliance RF exposure..

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