

FCC ID:2A5WH-DE1230B005F4

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

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

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

Antenna Type: PCB antenna

Antenna gain: 3.21dBi;

R=20cm

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain (dBi)	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)			
2402	GFSK	4.854	4±1	5	3.162278	3.21	0.00132	1
2441		3.816	4±1	5	3.162278	3.21	0.00132	1
2480		4.797	4±1	5	3.162278	3.21	0.00132	1
2402	π/4-DQPSK,	6.632	6±1	7	5.011872	3.21	0.00209	1
2441		8.331	7.5±1	8.5	7.079458	3.21	0.00295	1
2480		6.487	6±1	7	5.011872	3.21	0.00209	1
2402	8DPSK	0.678	0±1	1	1.258925	3.21	0.00052	1
2441		2.585	2±1	3	1.995262	3.21	0.00083	1
2480		0.523	0±1	1	1.258925	3.21	0.00052	1
2402	BLE(GFSK)	-3.863	-4±1	-3	0.501187	3.21	0.00021	1
2440		-3.157	-4±1	-3	0.501187	3.21	0.00021	1
2480		-4.468	-4±1	-3	0.501187	3.21	0.00021	1

2.4G WIFI:

Module 1: Operation Frequency: 2412-2462MHz;

Antenna Type: PCB antenna

Antenna gain: 3.21dBi;

R=20cm

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain (dBi)	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)			
2412	802.11b	14.94	15±1	16	39.81072	3.21	0.01659	1
2437		15.51	15±1	16	39.81072	3.21	0.01659	1
2462		15.66	15±1	16	39.81072	3.21	0.01659	1
2412	802.11g	13.37	12.5±1	13.5	22.38721	3.21	0.00933	1
2437		12.64	12.5±1	13.5	22.38721	3.21	0.00933	1
2462		12.4	12.5±1	13.5	22.38721	3.21	0.00933	1
2412	802.11n20	11.03	10.5±1	11.5	14.12538	3.21	0.00588	1
2437		10.7	10.5±1	11.5	14.12538	3.21	0.00588	1
2462		10.68	10.5±1	11.5	14.12538	3.21	0.00588	1
2422	802.11n40	10.25	9.5±1	10.5	11.22018	3.21	0.00467	1
2437		9.59	9.5±1	10.5	11.22018	3.21	0.00467	1
2452		9.78	9.5±1	10.5	11.22018	3.21	0.00467	1

Module 2: Operation Frequency: 2412-2462MHz;
Antenna Type: Sucker Antenna
Antenna gain: 2dBi;
R=20cm

Antenna No.	Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
			(dBm)	(dBm)	tune-up power		Gain (dBi)	Power density(mW/cm ²)	(mW/cm ²)
					(dBm)	(mW)			
Ant 1	2412	802.11b	15.93	15±1	16	39.81072	2	0.01255	1
Ant 1	2437		14.94	15±1	16	39.81072	2	0.01255	1
Ant 1	2462		15.63	15±1	16	39.81072	2	0.01255	1
Ant 1	2412	802.11g	11.34	11±1	12	15.84893	2	0.00500	1
Ant 1	2437		11.04	11±1	12	15.84893	2	0.00500	1
Ant 1	2462		11.92	11±1	12	15.84893	2	0.00500	1
Ant 1	2412	802.11n20	10.2	10±1	11	12.58925	2	0.00397	1
Ant 1	2437		9.97	10±1	11	12.58925	2	0.00397	1
Ant 1	2462		10.76	10±1	11	12.58925	2	0.00397	1
Ant 1	2422	802.11n40	8.46	8±1	9	7.943282	2	0.00250	1
Ant 1	2437		7.66	8±1	9	7.943282	2	0.00250	1
Ant 1	2452		8.46	8±1	9	7.943282	2	0.00250	1
Ant 2	2412	802.11b	15.35	15±1	16	39.81072	2	0.01255	1
Ant 2	2437		14.97	15±1	16	39.81072	2	0.01255	1
Ant 2	2462		16.45	15±1	16	39.81072	2	0.01255	1
Ant 2	2412	802.11g	12.92	12.5±1	13.5	22.38721	2	0.00706	1
Ant 2	2437		12.78	12.5±1	13.5	22.38721	2	0.00706	1
Ant 2	2462		13.02	12.5±1	13.5	22.38721	2	0.00706	1
Ant 2	2412	802.11n20	9.77	9±1	10	10	2	0.00315	1
Ant 2	2437		9.15	9±1	10	10	2	0.00315	1
Ant 2	2462		8.77	9±1	10	10	2	0.00315	1
Ant 2	2422	802.11n40	7.31	7±1	8	6.309573	2	0.00199	1
Ant 2	2437		7.55	7±1	8	6.309573	2	0.00199	1
Ant 2	2452		7.17	7±1	8	6.309573	2	0.00199	1

Note: Module 1&Module 2 and 4G Module cannot be transmitted at the same time.In a separate module, WIFI and BT cannot be sent at the same time.

Conclusion:

The conclusion should be $0.01659 < 1$ for Max Power Density, Compliance the RF Exposure requirement.

Signature:

Date: 2022-05-06



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