

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.

MAX OUTPUT POWER

BT

Test Channel	Frequency	Power Setting	Peak Output Power	LIMIT	Verdict
	(MHz)		(dBm)	(dBm)	
1Mbps					
0	2402	Default	2.71	30	PASS
39	2441	Default	3.35	30	PASS
78	2480	Default	3.85	30	PASS
2Mbps					
0	2402	Default	1.30	20.97	PASS
39	2441	Default	1.73	20.97	PASS
78	2480	Default	2.57	20.97	PASS
3Mbps					
0	2402	Default	1.77	20.97	PASS
39	2441	Default	2.08	20.97	PASS
78	2480	Default	2.77	20.97	PASS

BLE

Test Channel	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	LIMIT (dBm)	Verdict
1Mbps					
00	2402	Default	-5.16	30	PASS
19	2440	Default	-4.02	30	PASS
39	2480	Default	-5.14	30	PASS

WIFI

Test Channel	Frequency (MHz)	Power Setting	Duty Cycle Factor (dB)	Peak Output Power (dBm)	Maximum Output Power(dBm)	LIMIT (dBm)	Verdict
802.11b							
1	2412	Default	0	13.6	13.6	30	PASS
6	2437	Default	0	13.9	13.9	30	PASS
11	2462	Default	0	13.1	13.1	30	PASS
802.11g							
1	2412	Default	0	12.5	12.5	30	PASS
6	2437	Default	0	12.8	12.8	30	PASS
11	2462	Default	0	12.6	12.6	30	PASS
802.11n HT20							
1	2412	Default	0	12.3	12.3	30	PASS
6	2437	Default	0	13.5	13.5	30	PASS
11	2462	Default	0	12.7	12.7	30	PASS
802.11n HT40							
3	2422	Default	0	12.1	12.1	30	PASS
6	2437	Default	0	12.3	12.3	30	PASS
9	2452	Default	0	12.4	12.4	30	PASS

Measurement Result

Operation Frequency: BT: 2402-2480MHz
WIFI: 2412-2462MHz

Power density limited: 1mW/ cm²

Antenna Type: FPCB on board Antenna

Antenna gain: 2.89 dBi,

R=20cm

WIFI:

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	2.71	3±1	4	2.512	2.89	1.95	0.0010	1
2441		3.35	3±1	4	2.512	2.89	1.95	0.0010	1
2480		3.85	3±1	4	2.512	2.89	1.95	0.0010	1
2402	π/4-DQPSK	1.30	2±1	3	1.995	2.89	1.95	0.0008	1
2441		1.73	2±1	3	1.995	2.89	1.95	0.0008	1
2480		2.57	2±1	3	1.995	2.89	1.95	0.0008	1
2402	8-DPSK	1.77	2±1	3	1.995	2.89	1.95	0.0008	1
2441		2.08	2±1	3	1.995	2.89	1.95	0.0008	1
2480		2.77	2±1	3	1.995	2.89	1.95	0.0008	1
2402	BLE	-5.16	-5±1	-4	0.398	2.89	1.95	0.0002	1
2440		-4.02	-5±1	-4	0.398	2.89	1.95	0.0002	1
2480		-5.14	-5±1	-4	0.398	2.89	1.95	0.0002	1
2412	802.11b	13.6	13±1	14	25.119	2.89	1.95	0.0097	1
2437		13.9	13±1	14	25.119	2.89	1.95	0.0097	1
2462		13.1	13±1	14	25.119	2.89	1.95	0.0097	1
2412	802.11g	12.5	13±1	14	25.119	2.89	1.95	0.0097	1
2437		12.8	13±1	14	25.119	2.89	1.95	0.0097	1
2462		12.6	13±1	14	25.119	2.89	1.95	0.0097	1
2412	802.11n HT20	12.3	13±1	14	25.119	2.89	1.95	0.0097	1
2437		13.5	13±1	14	25.119	2.89	1.95	0.0097	1
2462		12.7	13±1	14	25.119	2.89	1.95	0.0097	1
2412	802.11n HT40	12.1	13±1	14	25.119	2.89	1.95	0.0097	1
2437		12.3	13±1	14	25.119	2.89	1.95	0.0097	1
2452		12.4	13±1	14	25.119	2.89	1.95	0.0097	1

Conclusion:

For the max result : 0.0097≤ 1.0 for Max Power Density, compliance RF exposure.

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Signature:

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