FCC ID: 2AK77W1

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 (V/m) = $\frac{\sqrt{30*P*G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

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

EDR:

Test Channel	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	LIMIT (dBm)	Verdict
1Mbps					
0	2402	Default	2.61	30	PASS
39	2441	Default	2.80	30	PASS
78	2480	Default	2.71	30	PASS
2Mbps					
0	2402	Default	2.55	20.97	PASS
39	2441	Default	2.77	20.97	PASS
78	2480	Default	2.70	20.97	PASS
3Mbps					
0	2402	Default	2.53	20.97	PASS
39	2441	Default	2.77	20.97	PASS
78	2480	Default	2.70	20.97	PASS

BLE

Test Channel	Frequency (MHz)	Power Setting	Peak Output Power (dBm)	LIMIT (dBm)	Verdict
1Mbps					
00	2402	Default	-1.58	30	PASS
19	2440	Default	-1.20	30	PASS
39	2480	Default	-1.02	30	PASS

2.4G 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	13.1	13.1	30	PASS
6	2437	Default	0	13.2	13.2	30	PASS
11	2462	Default	0	13.1	13.1	30	PASS
	802.11g						
1	2412	Default	0	12.4	12.4	30	PASS
6	2437	Default	0	12.0	12.0	30	PASS
11	2462	Default	0	12.1	12.1	30	PASS
	802.11n HT20						
1	2412	Default	0	11.9	11.9	30	PASS
6	2437	Default	0	11.9	11.9	30	PASS
11	2462	Default	0	12.0	12.0	30	PASS
	802.11n HT40						
3	2422	Default	0	11.8	11.8	30	PASS
6	2437	Default	0	12.0	12.0	30	PASS
9	2452	Default	0	11.7	11.7	30	PASS

5.2G WIFI

Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV) (dBm)	LIMIT dBm	Result
TX 802.11a Mode				
CH36	5180	12.6	23.98	Pass
CH40	5200	12.2	23.98	Pass
CH48	5240	10.6	23.98	Pass
TX 802.11 n20M Mode				
CH36	5180	12.0	23.98	Pass
CH40	5200	11.8	23.98	Pass
CH48	5240	10.0	23.98	Pass
TX 802.11 n40M Mode				
CH38	5190	11.2	23.98	Pass
CH46	5230	9.7	23.98	Pass
TX 802.11 ac20M Mode				
CH36	5180	12.5	23.98	Pass
CH40	5200	11.9	23.98	Pass
CH48	5240	10.5	23.98	Pass
TX 802.11 ac40M Mode				
CH38	5190	11.2	23.98	Pass
CH46	5230	9.7	23.98	Pass
TX 802.11 ac80M Mode				
CH42	5210	10.1	23.98	Pass

5.8G WIFI

Test Channel	Frequency (MHz)	Maximum output power. Antenna port (AV) (dBm)	LIMIT dBm	Result
TX 802.11a Mode				
CH 149	5745	9.2	30	Pass
CH 157	5785	7.4	30	Pass
CH 165	5825	8.3	30	Pass
TX 802.11 n20M Mode				
CH 149	5745	9.0	30	Pass
CH 157	5785	7.2	30	Pass
CH 165	5825	8.1	30	Pass
TX 802.11 n40M Mode				
CH 151	5755	7.7	30	Pass
CH 159	5795	6.3	30	Pass
TX 802.11 ac20M Mode				

CH 149	5745	8.9	30	Pass
CH 157	5785	7.1	30	Pass
CH 165	5825	8.0	30	Pass
TX 802.11 ac40M Mode				
CH 151	5755	7.7	30	Pass
CH 159	5795	6.3	30	Pass
TX 802.11 ac80M Mode				
CH 155	5775	6.4	30	Pass

Measurement Result

Operation Frequency: EDR: 2402MHz~2480MHz;
BLE: 2402MHz~2480MHz;
2.4GWIFI 802.11b/g/n HT20: 2412-2462MHz, 2422-2452MHz for 802.11n(HT40);
5.2G WIFI 802.11a/n(HT20)/ac20 5180-5240MHz, 5190-5230MHz for 802.11n(HT40)/ac40, 5210MHz for 802.11 ac80;
5.8G WIFI 5745-5825 MHz for 802.11a/n(HT20)/ac20, 5755-5795 MHz for 802.11a/n(HT40)/ac40, 5775MHz for 802.11 ac80;
Power density limited: 1mW/ cm^2
Antenna Type: FPCB Antenna
Antenna gain: 1.9dBi,
R=20cm

EDR:

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/cm2)	Power density (mW/cm2)
2402	GFSK	2.61	3±1	4	2.512	1.90	1.55	0.0008	1
2441		2.80	3±1	4	2.512	1.90	1.55	0.0008	1
2480		2.71	3±1	4	2.512	1.90	1.55	0.0008	1
2402	π/4-DQPSK	2.55	3±1	4	2.512	1.90	1.55	0.0008	1
2441		2.77	3±1	4	2.512	1.90	1.55	0.0008	1
2480		2.70	3±1	4	2.512	1.90	1.55	0.0008	1
2402	8DPSK	2.53	3±1	4	2.512	1.90	1.55	0.0008	1
2441		2.77	3±1	4	2.512	1.90	1.55	0.0008	1
2480		2.70	3±1	4	2.512	1.90	1.55	0.0008	1

BLE:

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/cm2)	Power density (mW/cm2)
2402	GFSK	-1.58	-1±1	0	1.000	1.90	1.55	0.0003	1
2440		-1.2	-1±1	0	1.000	1.90	1.55	0.0003	1
2480		-1.02	-1±1	0	1.000	1.90	1.55	0.0003	1

2.4G WIFI:

Freq. (MHz)	modulation	(dBm)	power (dBm)	tune-up power (dBm)	tune-up power (mW)	Gain (dBi)	Gain Numeric	(mW/cm2)	(mW/cm2)
2412	802.11b	13.1	13±1	14	25.119	1.90	1.55	0.0077	1
2437		13.2	13±1	14	25.119	1.90	1.55	0.0077	1
2462		13.1	13±1	14	25.119	1.90	1.55	0.0077	1
2412	802.11g	12.4	12±1	13	19.953	1.90	1.55	0.0061	1
2437		12	12±1	13	19.953	1.90	1.55	0.0061	1
2462		12.1	12±1	13	19.953	1.90	1.55	0.0061	1
2412	802.11n H20	11.9	12±1	13	19.953	1.90	1.55	0.0061	1
2437		11.9	12±1	13	19.953	1.90	1.55	0.0061	1
2462		12	12±1	13	19.953	1.90	1.55	0.0061	1
2422	802.11n H40	11.8	12±1	13	19.953	1.90	1.55	0.0061	1
2437		12	12±1	13	19.953	1.90	1.55	0.0061	1
2452		11.7	12±1	13	19.953	1.90	1.55	0.0061	1

5.2G WIFI:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
5180	802.11a	12.6	12±1	13	19.953	1.90	1.55	0.0061	1
5200		12.2	12±1	13	19.953	1.90	1.55	0.0061	1
5240		11.6	12±1	13	19.953	1.90	1.55	0.0061	1
5180	802.11 N20m	12	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5200		11.8	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5240		11	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5190	802.11 n40M	11.2	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5230		10.7	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5180	802.11 ac20M	12.5	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5200		11.9	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5240		11.5	11.5±1	12.5	17.783	1.90	1.55	0.0055	1
5190	802.11 ac40M	11.2	11±1	12	15.849	1.90	1.55	0.0049	1
5230		10.7	11±1	12	15.849	1.90	1.55	0.0049	1
5210	802.11 ac80M	10.1	10±1	11	12.589	1.90	1.55	0.0039	1

5.8G WIFI:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density (mW/cm2)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
5745	802.11a	9.2	8.3±1	9.3	8.511	1.90	1.55	0.0026	1
5785		7.4	8.3±1	9.3	8.511	1.90	1.55	0.0026	1
5825		8.3	8.3±1	9.3	8.511	1.90	1.55	0.0026	1
5745	802.11 N20m	9	8.1±1	9.1	8.128	1.90	1.55	0.0025	1
5785		7.2	8.1±1	9.1	8.128	1.90	1.55	0.0025	1
5825		8.1	8.1±1	9.1	8.128	1.90	1.55	0.0025	1
5755	802.11 n40M	7.7	7±1	8	6.310	1.90	1.55	0.0019	1
5795		6.3	7±1	8	6.310	1.90	1.55	0.0019	1
5745	802.11 ac20M	8.9	8±1	9	7.943	1.90	1.55	0.0024	1
5785		7.1	8±1	9	7.943	1.90	1.55	0.0024	1
5825		8	8±1	9	7.943	1.90	1.55	0.0024	1
5755	802.11 ac40M	7.7	7±1	8	6.310	1.90	1.55	0.0019	1
5795		6.3	7±1	8	6.310	1.90	1.55	0.0019	1
5775	802.11 ac80M	6.4	6±1	7	5.012	1.90	1.55	0.0015	1

Conclusion:

For the max result : 0.0077≤ 1.0, compliance with FCC's RF Exposure.

Jason chen

Signature: **Date:** 2018-12-19

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