

FCC ID: 2AQ6C-SG01

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 For Single Transmitting:

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

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 For Single Transmitting:

2. 4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz, 802.11n HT40: 2422-2452MHz.

Power density limited: 1mW/ cm²

Antenna Type: FPCB Antenna;

WIFI antenna gain: 3dBi;

R=20cm

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

antenna gain Numeric=10^{^(dBi/10)}= 10^{^(1/10)}=2

Note: The EUT has two Antenna, But Antenna B has the maximum output power, just evaluate the Antenna B data.

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
2412	802.11b	13	13±1	14	25.11886	2	0.00999	1
2437		13.2	13±1	14	25.11886	2	0.00999	1
2462		13.4	13±1	14	25.11886	2	0.00999	1
2412	802.11g	13.5	13±1	14	25.11886	2	0.00999	1
2437		13.6	13±1	14	25.11886	2	0.00999	1
2462		13.8	13±1	14	25.11886	2	0.00999	1
2412	802.11n H20	13.2	13±1	14	25.11886	2	0.00999	1
2437		13.5	13±1	14	25.11886	2	0.00999	1
2462		13.7	13±1	14	25.11886	2	0.00999	1
2422	802.11n H40	12.8	13±1	14	25.11886	2	0.00999	1
2437		13	13±1	14	25.11886	2	0.00999	1
2452		13.1	13±1	14	25.11886	2	0.00999	1

5G WIFI:

Operation Frequency: 5180-5240MHz for 802.11a/n(HT20)/ac20;

5190-5230MHz for 802.11n(HT40)/ac40;

5210MHz for 802.11 ac80;

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/ cm²

Antenna Type: FPCB Antenna;

WIFI antenna gain: 3dBi;

R=20cm

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

antenna gain Numeric=10^{^(dBi/10)}= 10^{^(1/10)}=2

Note: The EUT has two Antenna, But Antenna B has the maximum output power, just evaluate the Antenna B data.

5150-5250MHz

Channel Freq. (MHz)	modulation	conducted power	Tune-up power	Max		Antenna	Evaluation result at 20cm	Power density Limits
		(dBm)	(dBm)	tune-up power		Gain	Power density(mW/cm ²)	(mW/cm ²)
				(dBm)	(mW)	Numeric		
5180	802.11a	11.1	11±1	12	15.84893	2	0.00631	1
5200		10.6	11±1	12	15.84893	2	0.00631	1
5240		10.1	11±1	12	15.84893	2	0.00631	1
5180	802.11n20	10	10±1	11	12.58925	2	0.00501	1
5200		9.6	10±1	11	12.58925	2	0.00501	1
5240		9	10±1	11	12.58925	2	0.00501	1
5180	802.11ac20	7.5	8±1	9	7.943282	2	0.00316	1
5200		7.4	8±1	9	7.943282	2	0.00316	1
5240		7.1	8±1	9	7.943282	2	0.00316	1
5190	802.11n40	9.7	10±1	11	12.58925	2	0.00501	1
5230		8.8	8±1	9	7.943282	2	0.00316	1
5190	802.11ac40	7.3	8±1	9	7.943282	2	0.00316	1
5230		7.1	8±1	9	7.943282	2	0.00316	1
5210	802.11ac80	7.1	8±1	9	7.943282	2	0.00316	1

5725-5850MHz

Channel Freq. (MHz)	modulation	conducted power		Tune-up power	Max		Antenna	Evaluation result at 20cm
		(dBm)		(dBm)	tune-up power		Gain	Power density(mW/cm ²)
					(dBm)	(mW)	Numeric	
		ANT A	ANT B					
5745	802.11a	11.6	11.4	11±1	12	15.84893	2	0.00631
5785		11.7	11.5	11±1	12	15.84893	2	0.00631
5825		11.8	11.5	11±1	12	15.84893	2	0.00631
5745	802.11n20	11	10.7	11±1	12	15.84893	2	0.00631
5785		11.1	10.7	11±1	12	15.84893	2	0.00631
5825		11.2	10.9	11±1	12	15.84893	2	0.00631
5745	802.11ac20	9.6	9.4	10±1	11	12.58925	2	0.00501
5785		9.7	9.4	10±1	11	12.58925	2	0.00501
5825		9.8	9.5	10±1	11	12.58925	2	0.00501
5755	802.11n40	11.2	10.2	11±1	12	15.84893	2	0.00631
5795		11	10.5	11±1	12	15.84893	2	0.00631
5755	802.11ac40	10.7	9.1	10±1	11	12.58925	2	0.00501
5795		9.8	8.2	9±1	10	10	2	0.00398
5775	802.11ac8	8.1	8	9±1	10	10	2	0.00398

BT BR+EDR:

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/ cm²

Antenna Type: FPCB Antenna

Antenna gain: 3dBi,

R=20cm

Bluetooth DSS:

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	4.755	4±1	5	3.162	3.00	2.00	0.00126	1
2441		4.893	4±1	5	3.162	3.00	2.00	0.00126	1
2480		4.607	4±1	5	3.162	3.00	2.00	0.00126	1
2402	π/4-DQPSK	2.697	3±1	4	2.512	3.00	2.00	0.00100	1
2441		3.136	3±1	4	2.512	3.00	2.00	0.00100	1
2480		3.186	3±1	4	2.512	3.00	2.00	0.00100	1
2402	8DPSK	3.195	3±1	4	2.512	3.00	2.00	0.00100	1
2441		3.596	3±1	4	2.512	3.00	2.00	0.00100	1
2480		3.676	3±1	4	2.512	3.00	2.00	0.00100	1

MPE Calculation Method For multiple Transmitting:

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table (A) and Table (B). To comply with the MPE, the fraction of the MPE in terms of E², H² (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i}$$

Measurement Result For multiple Transmitting:

When BT ANT A & 2.4G WIFI ANT B transmitting simultaneously:

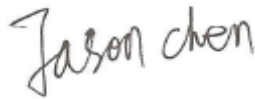
ANT	Max Tune-up (dBm)	Max Tune-up (mW)	Gain (dBi)	R(cm)	S (mW/cm ²)	Total S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
A	5	3.162	3	20	0.00126	0.01125	1.000	Pass
B	14	25.11886	3		0.00999			

When BT ANT A & 5.2G WIFI ANT B transmitting simultaneously:

ANT	Max Tune-up (dBm)	Max Tune-up (mW)	Gain (dBi)	R(cm)	S (mW/cm ²)	Total S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
A	5	3.162	3	20	0.00126	0.00757	1.000	Pass
B	12	15.84893	3		0.00631			

When BT ANT A & 5.8G WIFI ANT B transmitting simultaneously:

ANT	Max Tune-up (dBm)	Max Tune-up (mW)	Gain (dBi)	R(cm)	S (mW/cm ²)	Total S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
A	5	3.162	3	20	0.00126	0.00757	1.000	Pass
B	12	15.84893	3		0.00631			

Conclusion:For the max result: $0.01125 \leq 1.0$ for Max Power Density, compliance the RF Exposure.**Signature:****Date:** 2018-12-06**NAME AND TITLE** (Please print or type): Jason Chen/Manager**COMPANY** (Please print or type): Shenzhen NTEK Testing Technology Co., Ltd./ 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street Bao'an District, Shenzhen P.R. China.