

FCC ID: 2AB7K-D2311

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.

Measurement Result

BT:

Operation Frequency: 2402MHz~2480MHz
 Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB antenna

WIFI antenna gain: 1.0dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(1/10)}=1.26$

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		
2402	GFSK	-4.93	-4.0±1	-3	0.501187	1.26	0.00013	1
2441		-4.66	-4.0±1	-3	0.501187	1.26	0.00013	1
2480		-5.68	-5.0±1	-4	0.398107	1.26	0.00010	1
2402	π/4-DQPSK,	-5.85	-5.0±1	-4	0.398107	1.26	0.00010	1
2441		-5.59	-5.0±1	-4	0.398107	1.26	0.00010	1
2480		-6.61	-6.0±1	-5	0.316228	1.26	0.00008	1
2402	8DPSK	-5.76	-5.0±1	-4	0.398107	1.26	0.00010	1
2441		-5.49	-5.0±1	-4	0.398107	1.26	0.00010	1
2480		-6.52	-6.0±1	-5	0.316228	1.26	0.00008	1
2402	BLE(GFSK)	-5.06	-5.0±1	-4	0.398107	1.26	0.00010	1
2441		-4.81	-4.0±1	-3	0.501187	1.26	0.00013	1
2480		-5.86	-5.0±1	-4	0.398107	1.26	0.00010	1

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,
 WIFI 802.11n HT40:2422-2452MHz
 Power density limited: $1\text{mW}/\text{cm}^2$

Antenna Type: FPCB Antenna

WIFI antenna gain: 1.0dBi;

R=20cm

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

antenna gain Numeric= $10^{(\text{dBi}/10)}=10^{(1/10)}=1.26$

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	15.4	15.0±1	16	39.81072	1.26	0.00998	1
2437		15.6	15.0±1	16	39.81072	1.26	0.00998	1
2462		15.5	15.0±1	16	39.81072	1.26	0.00998	1
2412	802.11g	12.7	12.0±1	13	19.95262	1.26	0.00500	1
2437		12.7	12.0±1	13	19.95262	1.26	0.00500	1
2462		12.7	12.0±1	13	19.95262	1.26	0.00500	1
2412	802.11n H20	15.13	15.0±1	16	39.81072	1.26	0.00998	1
2437		15.14	15.0±1	16	39.81072	1.26	0.00998	1
2462		14.97	14.0±1	15	31.62278	1.26	0.00793	1
2422	802.11n H40	15.32	15.0±1	16	39.81072	1.26	0.00998	1
2437		15.36	15.0±1	16	39.81072	1.26	0.00998	1
2452		15.37	15.0±1	16	39.81072	1.26	0.00998	1

5G WIFI:

Operation Frequency: WIFI 802.11a/n(HT20): 5180-5240MHz;5745-5825MHz

WIFI 802.11n(HT40): 5190-5230MHz;5755-5795MHz

Power density limited: 1mW/ cm

Antenna Type: FPCB Antenna

WIFI antenna gain: 1.0dBi;

R=20cm

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

antenna gain Numeric= $10^{(dBi/10)}=10^{(1/10)}=1.26$

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	17.4	17.0±1	18	63.09573	1.26	0.01582	1
5200		17.6	17.0±1	18	63.09573	1.26	0.01582	1
5240		17.4	17.0±1	18	63.09573	1.26	0.01582	1
5745		17.8	17.0±1	18	63.09573	1.26	0.01582	1
5785		17.5	17.0±1	18	63.09573	1.26	0.01582	1
5825		17.4	17.0±1	18	63.09573	1.26	0.01582	1
5180	802.11n H20	19.61	19.0±1	20	100	1.26	0.02507	1
5200		19.53	19.0±1	20	100	1.26	0.02507	1
5240		19.51	19.0±1	20	100	1.26	0.02507	1
5745		19.68	19.0±1	20	100	1.26	0.02507	1
5785		19.51	19.0±1	20	100	1.26	0.02507	1
5825		19.55	19.0±1	20	100	1.26	0.02507	1
5190	802.11n H40	19.6	19.0±1	20	100	1.26	0.02507	1
5230		19.77	19.0±1	20	100	1.26	0.02507	1
5755		19.77	19.0±1	20	100	1.26	0.02507	1
5795		19.74	19.0±1	20	100	1.26	0.02507	1

Conclusion:

All of the WLAN 5GHz Band, WLAN 2.4GHz band and Bluetooth can transmit simultaneously, the formula of calculated the MPE is:

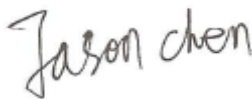
$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.00013 / 1 + 0.00998 / 1 + 0.02507 = 0.03518$, which is less than "1".

For the max result : $0.03518 \leq 1.0$ for Max Power Density, No SAR is required.



Signature:

Date: 2017-05-25

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 518126 P.R. China