

FCC ID: 2ALQL-A63D

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/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2402	GFSK	1.82	1.0±1	2	1.584893	1.26	0.00040	1
2441		3.54	3.0±1	4	2.511886	1.26	0.00063	1
2480		3.23	3.0±1	4	2.511886	1.26	0.00063	1
2402	π/4-DQPSK,	2.96	2.0±1	3	1.995262	1.26	0.00050	1
2441		3.45	3.0±1	4	2.511886	1.26	0.00063	1
2480		3.23	3.0±1	4	2.511886	1.26	0.00063	1
2402	8DPSK	3.3	3.0±1	4	2.511886	1.26	0.00063	1
2441		3.82	3.0±1	4	2.511886	1.26	0.00063	1
2480		3.54	3.0±1	4	2.511886	1.26	0.00063	1
2402	BLE(GFSK)	-4.5	- 4.0±1	-3	0.501187	1.26	0.00013	1
2441		-4.09	- 4.0±1	-3	0.501187	1.26	0.00013	1
2480		-4.06	- 4.0±1	-3	0.501187	1.26	0.00013	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/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
2412	802.11b	15.2	15.0±1	16	39.81072	1.26	0.00998	1
2437		14.5	14.0±1	15	31.62278	1.26	0.00793	1
2462		14.6	14.0±1	15	31.62278	1.26	0.00793	1
2412	802.11g	13.4	13.0±1	14	25.11886	1.26	0.00630	1
2437		13.2	13.0±1	14	25.11886	1.26	0.00630	1
2462		13.2	13.0±1	14	25.11886	1.26	0.00630	1
2412	802.11n H20	10.9	10.0±1	11	12.58925	1.26	0.00316	1
2437		10.4	10.0±1	11	12.58925	1.26	0.00316	1
2462		10.4	10.0±1	11	12.58925	1.26	0.00316	1
2422	802.11n H40	9	8.0±1	9	7.943282	1.26	0.00199	1
2437		8.9	8.0±1	9	7.943282	1.26	0.00199	1
2452		8.8	8.0±1	9	7.943282	1.26	0.00199	1

5G WIFI:

Operation Frequency: WIFI 802.11a/n(HT20)/ac20: 5180-5240MHz;5745-5825MHz

WIFI 802.11n(HT40)/ac40: 5190-5230MHz;5755-5795MHz

WIFI 802.11ac80: 5210MHz; 5775MHz

Power density limited: 1mW/ cm

Antenna Type: FPCB Antenna

WIFI antenna gain: 1.0dBi;

R=20cm

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

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/cm2)	(mW/cm2)
				(dBm)	(mW)	Numeric		
5180	802.11a	11.6	11.0±1	12	15.84893	1.26	0.00397	1
5200		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5240		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5745		10.8	10.0±1	11	12.58925	1.26	0.00316	1
5785		11.2	11.0±1	12	15.84893	1.26	0.00397	1
5825		10.7	10.0±1	11	12.58925	1.26	0.00316	1
5180	802.11n H20	11.5	11.0±1	12	15.84893	1.26	0.00397	1
5200		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5240		10.9	10.0±1	11	12.58925	1.26	0.00316	1
5745		10.4	10.0±1	11	12.58925	1.26	0.00316	1
5785		11	10.0±1	11	12.58925	1.26	0.00316	1
5825		10.6	10.0±1	11	12.58925	1.26	0.00316	1
5190	802.11n H40	10.9	10.0±1	11	12.58925	1.26	0.00316	1
5230		10.5	10.0±1	11	12.58925	1.26	0.00316	1
5755		10.5	10.0±1	11	12.58925	1.26	0.00316	1
5795		11.2	11.0±1	12	15.84893	1.26	0.00397	1
5180	802.11n ac20	11.5	11.0±1	12	15.84893	1.26	0.00397	1
5200		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5240		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5745		10.4	10.0±1	11	12.58925	1.26	0.00316	1
5785		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5825		10.7	10.0±1	11	12.58925	1.26	0.00316	1
5190	802.11 ac40	10.9	10.0±1	11	12.58925	1.26	0.00316	1
5230		10.5	10.0±1	11	12.58925	1.26	0.00316	1
5755		10.5	10.0±1	11	12.58925	1.26	0.00316	1
5795		11.1	11.0±1	12	15.84893	1.26	0.00397	1
5210	802.11ac80	10.4	10.0±1	11	12.58925	1.26	0.00316	1
5775		10.7	10.0±1	11	12.58925	1.26	0.00316	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 $0.00063 / 1 + 0.00998 / 1 + 0.00397 = 0.01458$, which is less than "1".

For the max result : $0.01458 \leq 1.0$ for Max Power Density, No SAR is required.



Signature:

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