

FCC ID: LNQRTL8812AUCG

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.

11.2 Measurement Result

Exposure Environment: General Population / Uncontrolled Exposure

For 2.4GHz Band:

For WLAN

Antenna Type : PIFA Antenna

For 2.4GHz mode, antenna A/ B are transmitting, two antennas simultaneously transmit. And the data is recorded for radiated emission and band edge.

For MIMO mode, Directional gain=GANT +10log(N)dbi =6.54dbi in 2.4GHz

802.11 (HT20/HT40) has MIMO mode.

Conducted Power for IEEE 802.11n 20: 20.75 dBm

Distance (cm)	Directional Gain	Antenna Gain (numeric)	The maximum combined Distance Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
			dBm	mW			
20	6.54	4.508	20.75	118.8502	0.1066	1	Complies

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

For 5GHz ISM Band:

Antenna Type : PIFA Antenna

For 5GHz mode, antenna A B are transmitting, May antennas simultaneously transmit.

And the data is recorded for radiated emission, and band edge.

Model 8812 For MIMO mode , Directional gain=GANT +10log(N)dbi =8.56dbi in 5GHz

802.11n/ac 5GHz has MIMO mode.

Conducted Power for IEEE 802.11n VHT20: 18.96dBm

Distance (cm)	Directional Gain	Antenna Gain (numeric)	The maximum combined Distance Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
			dBm	mW			
20	8.56	7.178	18.96	78.70458	0.1124	1	Complies

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

For 5GHz UNII Band:

Antenna Type : PIFA Antenna

For 5GHz mode, antenna A B are transmitting, May antennas simultaneously transmit.

And the data is recorded for radiated emission, and band edge.

Model 8812 For MIMO mode , Directional gain=GANT +10log(N)dbi =8.56dbi in 5GHz

802.11n/ac 5GHz has MIMO mode.

Conducted Power for IEEE 802.11ac VHT20 : 18.69dBm

Distance (cm)	Directional Gain	Antenna Gain (numeric)	The maximum combined Distance Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
			dBm	mW			
20	8.56	7.178	18.69	73.96053	0.1056	1	Complies

$$DirectionalGain = 10 \cdot \log \left\{ \frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{SEG}} g_{j,k} \right\}^2}{N_{ANT}} \right\}$$

For Bluetooth

Antenna Type : PIFA Antenna

Antenna Gain: 3.53dBi

Max Conducted Power for Bluetooth ER (GFSK) 1Mbps : 4.47 dBm

Distance (cm)	Directional Gain	Antenna Gain (numeric)	The maximum combined Distance PK Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
			dBm	mW			
20	3.53	2.254	4.47	2.798981	0.0013	1	Complies

Max Conducted Power for Bluetooth 4.0 : 5.22 dBm

Distance (cm)	Directional Gain	Antenna Gain (numeric)	The maximum combined Distance PK Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
			dBm	mW			
20	3.53	2.254	5.22	3.326596	0.0015	1	Complies

CONCLUSION:

Both of the WLAN 5GHz 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 $0.1124 / 1 + 0.0015 / 1 = 0.1139$, which is less than "1".

Both of the WLAN 5GHz Band and WLAN 2.4GHz Band 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 $0.1124 / 1 + 0.1066 / 1 = 0.2190$, which is less than "1".

This confirmed that the device comply with FCC 1.1310 MPE limit.

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Signature:

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