

Appendix C. Maximum Permissible Exposure

1. Maximum Permissible Exposure

1.1. Applicable Standard

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

1.2. MPE Calculation Method

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

E = Electric field (V/m)

P = Peak 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

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2 m, as well as the gain of the used antenna, the RF power density can be obtained.

1.3. Calculated Result and Limit

<For WLAN Function>:

Antenna Type : Dipole antenna

Max Conducted Power for IEEE 802.11n MCS8 20MHz Ant. 1 + Ant. 2: 26.95 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2	1.5849	26.9512	495.5908	0.156341	1	Complies

Antenna Type : PIFA Antenna

Max Conducted Power for IEEE 802.11n MCS8 20MHz Ant. 3 + Ant. 4: 27.62 dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
2.30	1.6982	27.6203	578.1375	0.195426	1	Complies

<For GSM 1900 Function>:

WWAN USB Dongle, FCC ID: QISE220

Antenna Type : Fixed Internal Antenna

Frequency (MHz)	ERP power(dBm)	EIRP(dBm)	EIRP(mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
1850.2	28.9000	31.0400	1270.5741	0.252901	1	Complies
1880	28.8700	31.0100	1261.8275	0.251160	1	Complies
1909.8	28.4600	30.6000	1148.1536	0.228534	1	Complies

CONCLUSION:

Both of the WLAN and GSM 1900 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

For Dipole antenna:

Therefore, the worst-case situation is $0.156341 / 1 + 0.252901 / 1 = 0.409242$, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.

For PIFA antenna:

Therefore, the worst-case situation is $0.195426 / 1 + 0.252901 / 1 = 0.448327$, which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.