



8.3 MAXIMUM PERMISSIBLE EXPOSURE

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)	Average Time
(A) Limits for Occupational / Control Exposures				
300-1,500	--	--	F/300	6
1,500-100,000	--	--	5	6
(B) Limits for General Population / Uncontrol Exposures				
300-1,500	--	--	F/1500	6
1,500-100,000	--	--	1	30

CALCULATIONS

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{3770}$

Where E = Field strength in Volts / meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{3770d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²



LIMIT

Power Density Limit, S=1.0mW/cm²

TEST RESULTS

No non-compliance noted.

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

G=3.39dBi = 2.18273 mW

IEEE 802.11b = 0.0796 * 30.1301 * 2.18272991 ÷ 400 = 0.01309

IEEE 802.11g = 0.0796 * 143.5489 * 2.18272991 ÷ 400 = 0.06235

IEEE 802.11n HT20 = 0.0796 * 118.5769 * 2.18272991 ÷ 400 = 0.05151

IEEE 802.11n HT40 = 0.0796 * 55.2077 * 2.18272991 ÷ 400 = 0.02398

Mode	Minimum separation distance (cm)	Output Power (dBm)	Output Power (mw)	Antenna Gain (dBi)	Power Density Limit (mW/cm ²)	Power Density at 20cm (mW/cm ²)
IEEE 802.11b	20	14.79	30.13	3.39	1.00	0.013087
IEEE 802.11g	20	21.57	143.55	3.39	1.00	0.062352
IEEE 802.11n HT20	20	20.74	118.58	3.39	1.00	0.051505
IEEE 802.11n HT40	20	17.42	55.21	3.39	1.00	0.023980

REMARK: For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm² even if the calculation indicates that the power density would be larger.

**Co-Location Mode**

3G Module FCC ID: Q78-ZTEMF209V

WWAN MPE						
Channel NO	Channel Frequency (MHz)	Output Power (mW)	Antenna Gain(dBi)	Antenna Gain(mW)	Power Density (S) (mW/cm2)	Limit of Power Density (S) (mW/cm2)
189	836.4	1510	-1.82	0.652	0.1976	0.558
512	1850.2	720	0.85	1.216	0.1743	1

WWAN 850 MHz Collocated MPE Calculations					
WLAN Band	(WLAN Pd)/(MPE Limit)	(WWAN 850MHz)/(MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412 - 2462	0.06235	0.3541	0.41645	1	Pass

WWAN 1900 MHz Collocated MPE Calculations					
WLAN Band	(WLAN Pd)/(MPE Limit)	(WWAN 1900MHz)/(MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412 - 2462	0.06235	0.1743	0.23665	1	Pass