



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:

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

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, $S=1.0\text{mW/cm}^2$ **TEST RESULTS**

No non-compliance noted.

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

Once Antenna Gain: 2 dBi = 1.584893 mW

IEEE 802.11b = $0.0796 * 47.7529 * 1.58489319 \div 400 = 0.01506$ IEEE 802.11g = $0.0796 * 202.3019 * 1.58489319 \div 400 = 0.06380$ IEEE 802.11n HT20 = $0.0796 * 194.5360 * 1.58489319 \div 400 = 0.06136$ IEEE 802.11n HT40 = $0.0796 * 198.6095 * 1.58489319 \div 400 = 0.06264$

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	16.79	47.75	2.00	1.00	0.015061
IEEE 802.11g	20	23.06	202.30	2.00	1.00	0.063805
IEEE 802.11n HT20	20	22.89	194.54	2.00	1.00	0.06136
IEEE 802.11n HT40	20	22.98	198.61	2.00	1.00	0.06264

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.

Note:

-The 3G or LTE dongle used are not provided the applicant and should already been FCC certified.

-Per KDB 447498 D01 Wireless Router RF Exposure v04, item 8) a) ii) :

Min. WLAN Antenna-3G antenna = 9.5cm >5cm that there is deemed to comply with the simultaneous transmission issue.

**Co-Location Mode****WWAN MPE**

Channel NO	Channel Frequency (MHz)	Output Power (mW)	Power Density (S) (mW/cm2)	Limit of Power Density (S) (mW/cm2)
777	848.31	398.11	0.079	0.566
661	1880	654.64	0.1302	1

Collocated MPE Calculations

WLAN Band	(WLAN Pd)/(MPE Limit)	(WWAN 850MHz)/(MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412 - 2462	0.0638	0.1396	0.2034	1	Pass

WLAN Band	(WLAN Pd)/(MPE Limit)	(WWAN 1900MHz)/(MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
2412 - 2462	0.0638	0.1302	0.194	1	Pass