



APPENDIX I 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:

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

$$d (cm) = d(m) / 100$$

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

Numeric antenna gain :

Antenna Gain 1 (2.4G):	3	dBi =	1.995262
Antenna Gain 2 (2.4G):	6.01	dBi =	3.990525
Antenna Gain (5G):	5	dBi =	3.162278
Total Antenna Gain (5G):	8.01	dBi =	6.324555

No non-compliance noted: (MPE distance equals 20 cm)

IEEE 802.11b (2.4G)	=	0.0796 *	360.5786	*	1.99526231	÷ 400 =	0.14317
IEEE 802.11g (2.4G)	=	0.0796 *	497.7371	*	1.99526231	÷ 400 =	0.19763
IEEE 802.11n HT20 (2.4G)=		0.0796 *	367.3697	*	3.99052463	÷ 400 =	0.29173
IEEE 802.11n HT40 (2.4G)=		0.0796 *	262.0236	*	3.99052463	÷ 400 =	0.20808
IEEE 802.11a (5G)	=	0.0796 *	342.7678	*	3.16227766	÷ 400 =	0.2157
IEEE 802.11n HT20 (5G)	=	0.0796 *	219.8557	*	6.32455532	÷ 400 =	0.27671
IEEE 802.11n HT40 (5G)	=	0.0796 *	222.9109	*	6.32455532	÷ 400 =	0.28055

Mode	Antenna Gain (dBi)	Minimum separation distance (cm)	Output Power (dBm)	Output Power (mW)	Power Density Limit (mW/cm ²)	Power Density at 20cm (mW/cm ²)
IEEE 802.11b (2.4G)	3.00	20.0	25.57	360.58	1.00	0.143170
IEEE 802.11g (2.4G)	3.00	20.0	26.97	497.74	1.00	0.197630
IEEE 802.11n HT20 (2.4G)	6.01	20.0	25.65	367.37	1.00	0.291734
IEEE 802.11n HT40 (2.4G)	6.01	20.0	24.18	262.02	1.00	0.208077
IEEE 802.11a (5G)	5.00	20.0	25.35	342.77	1.00	0.215701
IEEE 802.11n HT20 (5G)	8.01	20.0	23.42	219.86	1.00	0.276707
IEEE 802.11n HT40 (5G)	8.01	20.0	23.48	222.91	1.00	0.280553

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.