



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:

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

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

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

No non-compliance noted.

Antenna Gain	4.04 dBi
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$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Once Antenna Gain=4.04dBi=2.53512863mW

IEEE 802.11b	=	0.0796 *	91.6220	*	2.53512863	÷ 400 =	0.04622
IEEE 802.11g	=	0.0796 *	134.2765	*	2.53512863	÷ 400 =	0.06774
IEEE 802.11n HT20	=	0.0796 *	145.2112	*	2.53512863	÷ 400 =	0.07326
IEEE 802.11n HT40	=	0.0796 *	164.8162	*	2.53512863	÷ 400 =	0.08315

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	19.62	91.62	4.04	1.00	0.046222
IEEE 802.11g	20	21.28	134.28	4.04	1.00	0.067741
IEEE 802.11n HT20	20	21.62	145.21	4.04	1.00	0.073258
IEEE 802.11n HT40	20	22.17	164.82	4.04	1.00	0.083148

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.



Antenna Gain	2.0 dBi
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$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Once Antenna Gain=2.0dBi=1.58489319mW

IEEE 802.11b	=	0.0796 *	140.6048	*	1.58489319	÷ 400 =	0.04435
IEEE 802.11g	=	0.0796 *	187.9317	*	1.58489319	÷ 400 =	0.05927
IEEE 802.11n HT20	=	0.0796 *	211.3489	*	1.58489319	÷ 400 =	0.06666
IEEE 802.11n HT40	=	0.0796 *	194.0886	*	1.58489319	÷ 400 =	0.06121

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	21.48	140.60	2.00	1.00	0.044346
IEEE 802.11g	20	22.74	187.93	2.00	1.00	0.059272
IEEE 802.11n HT20	20	23.25	211.35	2.00	1.00	0.066658
IEEE 802.11n HT40	20	22.88	194.09	2.00	1.00	0.061214

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.

Antenna Gain	2.35 dBi
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$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$

Once Antenna Gain=2.35dBi=1.71790839mW

IEEE 802.11b	=	0.0796 *	112.2018	*	1.71790839	÷ 400 =	0.03836
IEEE 802.11g	=	0.0796 *	151.3561	*	1.71790839	÷ 400 =	0.05174
IEEE 802.11n HT20	=	0.0796 *	162.9296	*	1.71790839	÷ 400 =	0.0557
IEEE 802.11n HT40	=	0.0796 *	126.7652	*	1.71790839	÷ 400 =	0.04334

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	20.50	112.20	2.35	1.00	0.038358
IEEE 802.11g	20	21.80	151.36	2.35	1.00	0.051743
IEEE 802.11n HT20	20	22.12	162.93	2.35	1.00	0.055700
IEEE 802.11n HT40	20	21.03	126.77	2.35	1.00	0.043336

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.