



## 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 <sup>2</sup> )	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 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 / cm<sup>2</sup>

**LIMIT**Power Density Limit,  $S=1.0\text{mW/cm}^2$ **TEST RESULTS***Numeric antenna gain :*

Antenna Gain 1 (5G):	4.00	dBi =	2.51188643
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Array Gain (5G):	8.77	dBi =	7.53565929

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

IEEE 802.11a	=	0.0796 *	23.7137	*	2.51188643	$\div 400 =$	0.01185
IEEE 802.11n HT20	=	0.0796 *	13.0038	*	7.53565929	$\div 400 =$	0.0195
IEEE 802.11n HT40	=	0.0796 *	12.9972	*	7.53565929	$\div 400 =$	0.01949

Mode	Antenna Gain (dBi)	Minimum separation distance (cm)	Output Power (dBm)	Output Power (mW)	Power Density Limit (mW/cm <sup>2</sup> )	Power Density at 20cm (mW/cm <sup>2</sup> )
IEEE 802.11a	4.0	20.0	13.75	23.71	1.00	0.011854
IEEE 802.11n HT20	8.77	20.0	11.14	13.00	1.00	0.019500
IEEE 802.11n HT40	8.77	20.0	11.14	13.00	1.00	0.019491

**Remark:** For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm<sup>2</sup> even if the calculation indicates that the power density would be larger.