

Maximum Permissible Exposure (MPE) Calculations

15.407: U-NII devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Given

$$E = \sqrt{(30 \cdot P \cdot G)/d} \text{ and } S = E^2/3770$$

where

E=Field Strength in Volts/meter

P=Power in Watts

G=Numeric Antenna Gain

d=Distance in meters

S=Power Density in mW/cm²

Combine equations and rearrange the terms to express the distance as a function of the remaining variables:

$$d = \sqrt{((30 \cdot P \cdot G)/(3770 \cdot S))}$$

Changing to units of power in mW and distance in cm, using:

$$P(\text{mW}) = P(\text{W})/1000 \quad d(\text{cm}) = 100 \cdot d(\text{m})$$

yields

$$d = 100 \cdot \sqrt{((30 \cdot (P/1000) \cdot G)/(3770 \cdot S))}$$

$$d = 0.282 \cdot \sqrt{(P \cdot G/S)}$$

where

d=Distance in cm

P=Power in mW

G=Numeric Antenna Gain

S=Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm})/10)} \quad G(\text{numeric}) = 10^{(G(\text{dBi})/10)}$$

yields

$$d = 0.282 \cdot 10^{((P+G)/20)} / \sqrt{S} \quad \text{Equation (1)}$$

and

$$S = ((0.282 \cdot 10^{((P+G)/20)})/d)^2 \quad \text{Equation (2)}$$

where

d=MPE distance in cm

P=Power in dBm

G=Antenna Gain in dBi

S=Power Density in mW/cm²

Equation (1) and the measured peak power are used to calculate the MPE distance. Note that for mobile or fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

$S=1\text{mW/cm}^2$ maximum. The highest supported antenna gain is 6 dBi (9dBi with beamforming). Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

Frequency (MHz)	Power Density (mW/cm ²)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
5260	1	24	6	8.92	20	11.08
5320	1	24	6	8.92	20	11.08

MPE Calculations

To maintain compliance, installations will assure a separation distance of at least 20cm.

Using Equation 2, the MPE levels (s) at 20 cm are calculated as follows:

Frequency (MHz)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin (mW/cm ²)
5260	20	24	6	0.20	1	0.80
5320	20	24	6	0.20	1	0.80

**Appendix C: Test Equipment/Software Used to perform the test**

Equip #	Manufacturer	Model	Description	Last Cal	Next Due
CIS004882	EMC Test Systems	3115	Double Ridged Guide Horn Antenna	04-Jun-12	04-Jun-13
CIS004927	Miteq	NSP1000-S1	Broadband Preamplifier	01-Feb-13	01-Feb-14
CIS007704	Fischer	FCC-LISN-50/250-50-2-01	LISN	11-May-12	11-May-13
CIS021117	Micro-Coax	UFB311A-0-2484-520520	RF Coaxial Cable, to 18GHz, 248.4 in	24-Aug-12	24-Aug-13
CIS030564	Micro-Coax	UFB311A-1-0950-504504	RF Coaxial Cable, to 18GHz, 95 in	24-Aug-12	24-Aug-13
CIS030652	Sunol Sciences	JB1	Combination Antenna, 30MHz-2GHz	04-Sep-12	04-Sep-13
CIS044940	Rohde & Schwarz	ESU40	EMI Test Receiver	08-May-12	08-May-13
CIS018313	HP	8447D	RF Preamplifier	08-Jan-13	08-Jan-14
CIS043116	Huber + Suhner	Sucoflex 104PE	N & SMA RF cable	14-Dec-12	14-Dec-13
CIS049381	Agilent	N9030A	Spectrum Analyzer	28-Aug-12	28-Aug-13