

## MPE Calculations

### RF Exposure Requirements:

**§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

### RF Radiation Exposure Limit: §1.1310:

As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

### MPE Limit Calculations:

- 1) EUT operating frequency band 136 - 174 MHz. Highest conducted power is 37 dBm (5 W).  
Maximum 3 dBi antenna gain; 50% source-based, time-averaged maximum duty cycle.

Power Density Determination:

$$S = PG / 4\pi R^2 \text{ or } R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm<sup>2</sup>)

P = Linear Power Input to antenna in mW (5000 mW peak, 2500 mW average)

G = Numerical Antenna Gain (2)

R = Radius (45 cm or 18 in, as noted in installation instructions)

$$S = (2500 * 2.0 / 4\pi 45^2) = (5000 / 25,447) = 0.196 \text{ mW/cm}^2 @ 45\text{cm}$$

- 2) EUT operating frequency band 2412-2462 MHz; highest conducted power = 30 dBm (peak)  
Maximum antenna gain = 5 dBi.

Power Density Determination:

$$S = PG / 4\pi R^2 \text{ or } R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm<sup>2</sup>)

P = Linear Power Input to antenna (1000 mW)

G = Numerical Antenna Gain (3.16)

R = Radius (45cm or 18 in, as noted in installation instructions)

$$S = (1000 * 3.16 / 4\pi 45^2) = (3160 / 25,447) = 0.124 \text{ mW/cm}^2 @ 45\text{cm}$$

- 3) Worst-case MPE is simultaneous exposure from both antennas @ 45 cm to the respective limits in their bands;

806 - 869 MHz band: MPE limit = 1.0 mW/cm<sup>2</sup> Occupational/Controlled Exposure limit;  
Calculated MPE/MPE limit = 0.196/1.0 = 0.1966.

2412-2462 MHz band: MPE limit = 5 mW/cm<sup>2</sup>; Occupational/Controlled Exposure limit;  
Calculated MPE/MPE limit = 0.124/5 = 0.0248

**Sum of ratios is 0.196 + 0.0248 = 0.221, which is below the relative MPE limit of 1.0 for co-transmitting sources.**