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 450 - 520 MHz. Highest conducted power is 36.47 dBm. Maximum 3 dBi antenna gain; 50% source-based, time-averaged maximum duty cycle.

Power Density Determination:
$S = PG / 4\pi R^2$ or $R = \sqrt{(PG / 4\pi S)}$
where, S = Power Density (mW/cm^2)
P = Linear Power Input to antenna in mW (4436 mW peak, 2218 mW average)
G = Numerical Antenna Gain (2.0)
R = Radius (45cm or 18 in, as noted in installation instructions)
$S = (2218*2.0/4\pi 45^2) = (4436/25{,}447) = 0.1743$ mW/cm^2 @ 45cm

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

Power Density Determination:
$S = PG / 4\pi R^2$ or $R = \sqrt{(PG / 4\pi S)}$
where, S = Power Density (mW/cm^2)
P = Linear Power Input to antenna (941 mW)
G = Numerical Antenna Gain (3.16)
R = Radius (45cm or 18 in, as noted in installation instructions)
$S = (941*3.16/4\pi 45^2) = (2974/25{,}447) = 0.117$ mW/cm^2 @ 45cm

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

450 – 520 MHz band: MPE limit = 1 mW/cm^2 Occupational/Controlled Exposure limit;
Calculated MPE/MPE limit = 0.1743/1 = 0.1743

2412-2462 MHz band: MPE limit = 5 mW/cm^2; Occupational/Controlled Exposure limit;
Calculated MPE/MPE limit = 0.117/5 = 0.0234

Sum of ratios is 0.1743 + 0.0234 = 0.198, which is below the relative MPE limit of 1.0 for co-transmitting sources.