

## MPE Calculations

Systems operating under the provision of 47 CFR 1.1307(b)(1) shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the FCC guidelines.

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user or nearby persons and can therefore be considered a mobile transmitter per 47 CFR 2.1091(b). The MPE calculation for this exposure is shown below.

### Using the Antennas with highest output power:

The peak radiated output power (EIRP) is calculated as follows:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Power input to the antenna (P) (dBm)</i>	<i>Power gain of the antenna (G) (dBi)</i>	<i>EIRP (P+G) (dBm)</i>	<i>EIRP <math>\text{Log}^{-1}(\text{dBm}/10)</math> (mW)</i>
Amphenol	2.4	24.88	1.66	26.54	450.82
Amphenol	5	19.80	2.36	22.16	164.44
Hitachi	2.4	24.88	3.00	27.88	613.76
Hitachi	5	19.80	2.10	21.90	154.88

$$\text{EIRP} = P + G$$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

The numeric gain (G) of the antenna with a gain specified in dB is determined by:

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Antenna Gain (G) (dBi)</i>	<i>Numeric Antenna Gain <math>\text{Log}^{-1}(\text{dBm}/10)</math> (dB)</i>
Amphenol	2.4	1.66	1.47
Amphenol	5	2.36	1.72
Hitachi	2.4	3.00	2.00
Hitachi	5	2.10	1.62

$$G = \text{Log}^{-1} (\text{dB antenna gain}/10)$$

**Power density at the specific separation:**

<i>Antenna</i>	<i>Frequency (GHz)</i>	<i>Power input to the antenna (P) (mW)</i>	<i>Numeric Power Gain of the Antenna (G) (dB)</i>	<i>Maximum Power Spectral Density <math>S=PG/(4R^2\pi)</math> (mW/cm<sup>2</sup>)</i>	<i>Maximum Power Spectral Density Limit (mW/cm<sup>2</sup>)</i>
Amphenol	2.4	307.61	1.47	0.090	1.00
Amphenol	5	95.50	1.72	0.033	1.00
Hitachi	2.4	307.61	2.00	0.122	1.00
Hitachi	5	95.50	1.62	0.031	1.00

$$S = PG/(4R^2\pi)$$

Where

S = Maximum power density (mW/cm<sup>2</sup>)

P = Power input to the antenna (mW).

G = Numeric power gain of the antenna

R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

The maximum permissible exposure (MPE) for the general population is 1mW/cm<sup>2</sup>.

The power density at 20cm does not exceed the 1mW/cm<sup>2</sup> limit. Therefore, the exposure condition is compliant with FCC rules.