

## MPE Calculations

Systems operating under the provision of 47 CFR 1.1307(b)(1) shall be operated in a manor 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 Foxconn Antennas @ 5 GHz Range with highest output power:**

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

$$EIRP = P + G$$

$$EIRP = 22.05 \text{ dBm} + 1.63 \text{ dBi}$$

$$EIRP = 23.68 \text{ dBm (233.35 mW)}$$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

Power density at the specific separation:

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

$$S = (160.32 \times 1.46) / (4 \times 20^2 \times \pi)$$

$$S = 0.047 \text{ mW/cm}^2$$

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.

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

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

$$G = \text{Log}^{-1}(1.63 \text{ dBi}/10)$$

$$G = 1.46$$

## **Using the Foxconn Antennas @ 2.4 GHz Range with highest output power:**

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

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

$$\text{EIRP} = 24.00 \text{ dBm} + 1.18 \text{ dBi}$$

$$\text{EIRP} = 25.18 \text{ dBm (329.61 mW)}$$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

Power density at the specific separation:

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

$$S = (251.19 \times 1.31) / (4 \times 20^2 \times \pi)$$

$$S = 0.065 \text{ mW/cm}^2$$

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.

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

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

$$G = \text{Log}^{-1}(1.18 \text{ dBi}/10)$$

$$G = 1.31$$

### **Using the Hitachi Antennas @ 5 GHz Range with highest output power:**

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

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

$$\text{EIRP} = 22.05 \text{ dBm} + 3.60 \text{ dBi}$$

$$\text{EIRP} = 25.65 \text{ dBm (367.28 mW)}$$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

Power density at the specific separation:

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

$$S = (160.32 \times 2.29) / (4 \times 20^2 \times \pi)$$

$$S = 0.073 \text{ mW/cm}^2$$

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.

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

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

$$G = \text{Log}^{-1}(3.60 \text{ dBi}/10)$$

$$G = 2.29$$

## **Using the Hitachi Antennas @ 2.4 GHz Range with highest output power:**

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

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

$$\text{EIRP} = 24.00 \text{ dBm} + 2.10 \text{ dBi}$$

$$\text{EIRP} = 26.10 \text{ dBm (407.38 mW)}$$

Where

P = Power input to the antenna (mW).

G = Power gain of the antenna (dBi)

Power density at the specific separation:

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

$$S = (251.19 \times 1.62) / (4 \times 20^2 \times \pi)$$

$$S = 0.081 \text{ mW/cm}^2$$

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.

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

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

$$G = \text{Log}^{-1}(2.10 \text{ dBi}/10)$$

$$G = 1.62$$