

## 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<br/>(GHz)</i> | <i>Power input to the<br/>antenna<br/>(P)<br/>(dBm)</i> | <i>Power gain of the<br/>antenna<br/>(G)<br/>(dBi)</i> | <i>EIRP<br/>(P+G)<br/>(dBm)</i> | <i>EIRP<br/><math>\text{Log}^{-1}(\text{dBm}/10)</math><br/>(mW)</i> |
|----------------|----------------------------|---------------------------------------------------------|--------------------------------------------------------|---------------------------------|----------------------------------------------------------------------|
| Yageo Shelby   | 2.4                        | 24.76                                                   | 2.82                                                   | 27.58                           | 572.80                                                               |
| Yageo Shelby   | 5                          | 19.80                                                   | 1.09                                                   | 20.89                           | 122.74                                                               |

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

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<br/>(GHz)</i> | <i>Antenna Gain<br/>(G)<br/>(dBi)</i> | <i>Numeric Antenna Gain<br/><math>\text{Log}^{-1}(\text{dBm}/10)</math><br/>(dB)</i> |
|----------------|----------------------------|---------------------------------------|--------------------------------------------------------------------------------------|
| Yageo Shelby   | 2.4                        | 2.82                                  | 1.91                                                                                 |
| Yageo Shelby   | 5                          | 1.09                                  | 1.29                                                                                 |

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

**Power density at the specific separation:**

| <i>Antenna</i> | <i>Frequency<br/>(GHz)</i> | <i>Power input to the<br/>antenna<br/>(P)<br/>(mW)</i> | <i>Numeric Power<br/>Gain of the<br/>Antenna<br/>(G)<br/>(dB)</i> | <i>Maximum Power<br/>Spectral Density<br/><math>S=PG/(4R^2\pi)</math><br/>(mW/cm<sup>2</sup>)</i> | <i>Maximum Power<br/>Spectral Density<br/>Limit<br/>(mW/cm<sup>2</sup>)</i> |
|----------------|----------------------------|--------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Yageo Shelby   | 2.4                        | 299.23                                                 | 1.91                                                              | 0.114                                                                                             | 1.00                                                                        |
| Yageo Shelby   | 5                          | 95.50                                                  | 1.29                                                              | 0.024                                                                                             | 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.