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 ZL1 Hon Hai Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 23.30 dBm + 3.18 dBi
EIRP = 26.48 dBm (444.63 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 2.08) / (4 \times 20^2 \times \pi)$
$S = 0.088$ mW/cm^2

Where
S = Maximum power density (mW/cm^2)
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^2.

The power density at 20cm does not exceed the 1mW/cm^2 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:

$G = \text{Log}^{-1}$ (dB antenna gain/10)
$G = \text{Log}^{-1}$ (3.18 dBi/10)
G = 2.08

Using the ZL1 Hon Hai Antennas @ 2.4 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 24.10 dBm + 2.33 dBi
EIRP = 26.43 dBm (439.54 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.10 \times 1.71) / (4 \times 20^2 \times \pi)$
$S = 0.087$ mW/cm^2

Where
S = Maximum power density (mW/cm^2)
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^2.

The power density at 20cm does not exceed the 1mW/cm^2 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:

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (2.33 dBi/10)
G = 1.71

Using the ZI6 Hon Hai Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 23.30 dBm + 0.20 dBi
EIRP = 23.50 dBm (223.87 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 1.05) / (4 \times 20^2 \times \pi)$
$S = 0.045\ mW/cm^2$

Where
S = Maximum power density (mW/cm^2)
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 $1mW/cm^2$.

The power density at 20cm does not exceed the $1mW/cm^2$ 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:

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (0.20 dBi/10)
G = 1.05

Using the ZI6 Hon Hai Antennas @ 2.4 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 24.10 dBm + 0.38 dBi
EIRP = 24.48 dBm (280.54 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.04 \times 1.09) / (4 \times 20^2 \times \pi)$
$S = 0.056\ mW/cm^2$

Where
S = Maximum power density (mW/cm^2)
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 $1mW/cm^2$.

The power density at 20cm does not exceed the $1mW/cm^2$ 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:

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (0.38 dBi/10)
G = 1.09

Using the ZI6 Wistron NeWeb Corp. Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 23.30 dBm + 0.78 dBi
EIRP = 24.08 dBm (255.86 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 1.19) / (4 \times 20^2 \times \pi)$
$S = 0.051\ mW/cm^2$

Where
S = Maximum power density (mW/cm^2)
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 $1mW/cm^2$.

The power density at 20cm does not exceed the $1mW/cm^2$ 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:

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (0.78 dBi/10)
G = 1.19

Using the ZI6 Wistron NeWeb Corp. Antennas @ 2.4 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 24.10 dBm + 0.59 dBi
EIRP = 24.69 dBm (294.44 mW)

Where
P = Power input to the antenna (mW).
G = Power gain of the antenna (dBi)

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.04 \times 1.15) / (4 \times 20^2 \times \pi)$
$S = 0.059\ mW/cm^2$

Where
S = Maximum power density (mW/cm^2)
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 $1mW/cm^2$.

The power density at 20cm does not exceed the $1mW/cm^2$ 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:

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (0.59 dBi/10)
G = 1.15