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 Ethertronics Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 21.80 dBm + 5.00 dBi
EIRP = 26.80 dBm (478.63 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (151.36 \times 3.162) / (4 \times 20^2 \times \pi)$
$S = 0.095\ mW/cm^2$

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.

Estimated safe separation:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(151.36 \times 3.162) / 4\pi}$
R = 6.17 cm

Where
P = Power input to the antenna (mW).
G = Numeric power gain of the antenna
R = The safe estimated separation that the user must maintain from the antenna (cm)

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

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (5.00 dBi/10)
G = 3.162

Using the Ethertronics Antennas @ 2.4 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 24.0 dBm + 3.00 dBi
EIRP = 27.00 dBm (501.18 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (251.19 \times 1.995) / (4 \times 20^2 \times \pi)$
$S = 0.099\ mW/cm^2$

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.

Estimated safe separation:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(251.19 \times 1.995) / 4\pi}$
R = 6.31 cm

Where
P = Power input to the antenna (mW).
G = Numeric power gain of the antenna
R = The safe estimated separation that the user must maintain from the antenna (cm)

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

$G = Log^{-1}$ (dB antenna gain/10)
$G = Log^{-1}$ (3.00 dBi/10)
G = 1.995