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

$\quad$ EIRP = P + G
$\quad$ EIRP = 17.51 dBm + 1.67 dBi
$\quad$ EIRP = 19.18 dBm (82.79mW)

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

Power density at the specific separation:

$\quad$ $S = PG/(4R^2\pi)$
$\quad$ $S = (56.36 \times 1.469) / (4 \times 20^2 \times \pi)$
$\quad$ $S = 0.016$ mW/cm^2

$\quad$ Where
$\quad$ S = Maximum power density (mW/cm^2)
$\quad$ P = Power input to the antenna (mW).
$\quad$ G = Numeric power gain of the antenna
$\quad$ R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)

$\quad$ The maximum permissible exposure (MPE) for the general population is 1mW/cm^2.

$\quad$ 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:

$\quad$ $R = \sqrt{PG/4\pi}$
$\quad$ $R = \sqrt{(56.36 \times 1.469) / 4\pi}$
$\quad$ $R = 2.57$ cm

$\quad$ Where
$\quad$ P = Power input to the antenna (mW).
$\quad$ G = Numeric power gain of the antenna
$\quad$ 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:

$\quad$ $G = \text{Log}^{-1}$ (dB antenna gain/10)
$\quad$ $G = \text{Log}^{-1}$ (1.67 dBi/10)
$\quad$ G = 1.469

Using the Ethertronics Antennas:

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

$$EIRP = P + G$$
$$EIRP = 17.51 \text{ dBm} + 2.00 \text{ dBi}$$
$$EIRP = 19.51 \text{ dBm } (89.33 \text{ mW})$$

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

Power density at the specific separation:

$$S = PG/(4R^2\pi)$$
$$S = (56.36 \times 1.585) / (4 \times 20^2 \times \pi)$$
$$S = 0.018 \text{ mW/cm}^2$$

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:

$$R = \sqrt{PG/4\pi}$$
$$R = \sqrt{(56.36 \times 1.585) / 4\pi}$$
$$R = 2.67 \text{ cm}$$

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:

$$G = Log^{-1} (\text{dB antenna gain}/10)$$
$$G = Log^{-1} (2.00 \text{ dBi}/10)$$
$$G = 1.585$$