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:

EIRP = P + G
EIRP = 16.73 dBm + 0.11 dBi
EIRP = 16.84 dBm (48.32 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (47.1 \times 1.026) / (4 \times 20^2 \times \pi)$
$S = 0.009$ 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:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(47.1 \times 1.026) / 4\pi}$
R = 1.96 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)
$G = Log^{-1}$ (0.11 dBi/10)
G = 1.026

Using the Ethertronics Antennas:

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

EIRP = P + G
EIRP = 16.73 dBm + 1.18 dBi
EIRP = 17.91 dBm (61.80 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (47.1 \times 1.312) / (4 \times 20^2 \times \pi)$
$S = 0.012\ mW/cm^2$

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:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(47.1 \times 1.312) / 4\pi}$
R = 4.92 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)
$G = Log^{-1}$ (1.18 dBi/10)
G = 1.312

Using the Toshiba Dual Band Film Antennas:

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

EIRP = P + G
EIRP = 16.61 dBm + 0.6 dBi
EIRP = 17.21 dBm (52.60 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (45.81 \times 1.15) / (4 \times 20^2 \times \pi)$
$S = 0.010\ mW/cm^2$

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:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(45.81 \times 1.15) / 4\pi}$
R = 4.19 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)
$G = Log^{-1}$ (0.6 dBi/10)
G = 1.15

Using the Toshiba Wide Dual Band Film Antennas:

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

EIRP = P + G
EIRP = 16.60 dBm + 2.0 dBi
EIRP = 18.6 dBm (72.44 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (45.71 \times 1.58) / (4 \times 20^2 \times \pi)$
$S = 0.014\ mW/cm^2$

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:

$R = \sqrt{PG/4\pi}$
$R = \sqrt{(45.71 \times 1.58) / 4\pi}$
R = 5.75 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)
$G = Log^{-1}$ (2.0 dBi/10)
G = 1.58