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 Foxconn Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 22.00 dBm + 0.37 dBi
EIRP = 22.37 dBm (172.58 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (158.49 \times 1.09) / (4 \times 20^2 \times \pi)$
$S = 0.034\ mW/cm^2$

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)
$G = Log^{-1}$ (0.37 dBi/10)
G = 1.09

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

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

EIRP = P + G
EIRP = 24.05 dBm + 2.60 dBi
EIRP = 26.65 dBm (462.38 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (254.10 \times 1.82) / (4 \times 20^2 \times \pi)$
$S = 0.092\ mW/cm^2$

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)
$G = Log^{-1}$ (2.60 dBi/10)
G = 1.82

Using the Hitachi Antennas @ 5 GHz Range with highest output power:

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

EIRP = P + G
EIRP = 22.00 dBm + 3.40 dBi
EIRP = 25.40 dBm (346.74 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (158.49 \times 2.19) / (4 \times 20^2 \times \pi)$
$S = 0.069\ mW/cm^2$

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)
$G = Log^{-1}$ (3.40 dBi/10)
G = 2.19

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

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

EIRP = P + G
EIRP = 24.05 dBm + 1.90 dBi
EIRP = 25.95 dBm (393.55 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (254.10 \times 1.55) / (4 \times 20^2 \times \pi)$
$S = 0.078\ mW/cm^2$

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)
$G = Log^{-1}$ (1.90 dBi/10)
G = 1.55