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 Yokowo (Pumpkin) 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 + 2.95 dBi
EIRP = 26.25 dBm (421.69 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 1.97) / (4 \times 20^2 \times \pi)$
$S = 0.083\ mW/cm^2$

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)
$G = Log^{-1}$ (2.95 dBi/10)
G = 1.97

Using the Yokowo (Pumpkin) 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 + 2.31 dBi
EIRP = 26.41 dBm (437.52 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.10 \times 1.70) / (4 \times 20^2 \times \pi)$
$S = 0.087$ 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:

$G = \text{Log}^{-1}$ (dB antenna gain/10)
$G = \text{Log}^{-1}$ (2.31 dBi/10)
G = 1.70

Using the Yokowo (Mint) 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 + 1.45 dBi
EIRP = 24.75 dBm (298.53 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 1.39) / (4 \times 20^2 \times \pi)$
$S = 0.059\ mW/cm^2$

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)
$G = Log^{-1}$ (1.45 dBi/10)
G = 1.39

Using the Yokowo (Mint) 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 + 2.85 dBi
EIRP = 26.95 dBm (495.45 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.04 \times 1.92) / (4 \times 20^2 \times \pi)$
$S = 0.098\ mW/cm^2$

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)
$G = Log^{-1}$ (2.85 dBi/10)
G = 1.92

Using the Fujitsu (Emilia) 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 + 1.18 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:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 1.31) / (4 \times 20^2 \times \pi)$
$S = 0.056\ mW/cm^2$

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)
$G = Log^{-1}$ (1.18 dBi/10)
G = 1.31

Using the Fujitsu (Emilia) 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 + 1.06 dBi
EIRP = 25.16 dBm (328.09 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.04 \times 1.27) / (4 \times 20^2 \times \pi)$
$S = 0.065$ 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)
$G = \text{Log}^{-1}$ (1.06 dBi/10)
G = 1.27

Using the Foxconn (Jakarta) 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 + (-1.05) dBi
EIRP = 22.25 dBm (167.88 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (213.80 \times 0.79) / (4 \times 20^2 \times \pi)$
$S = 0.034\ mW/cm^2$

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)
$G = Log^{-1}$ (-1.05 dBi/10)
G = 0.79

Using the Foxconn (Jakarta) 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 + 2.51 dBi
EIRP = 26.61 dBm (458.14 mW)

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

Power density at the specific separation:

$S = PG/(4R^2\pi)$
$S = (257.04 \times 1.78) / (4 \times 20^2 \times \pi)$
$S = 0.091$ 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)
$G = Log^{-1}$ (2.51 dBi/10)
G = 1.78