RF EXPOSURE COMPLIANCE

Report Number: 101039189MIN-001H
Project Number: G101039189

RF Exposure Compliance: MPE Requirements For Simultaneous Transmission Operations

The following are transmitters that qualify for simultaneous transmission:

AVO-GSM3 1900MHz Radio (see report 101039189MIN-001D) - maximum calculated MPE of **0.11mW/cm^2**

AVO-BTWI, WiFi Radio (see report 101039189MIN-001B) - maximum calculated MPE of **0.052mW/cm^2**

AVO-ZW, Z-Wave Radio – see calculations below:

The Maximum Radiated Field Strength for AVO-ZW, Z-Wave Radio at Fundamental Frequency is 93.4dBµV/m = 46.774µV/m = 0.047V/m (see report 101039189MIN-001A)

Antenna Gain = 1dBi or 1.26 numeric gain

ERP= (E x d)^2/30G= (0.047 V/m * 3m) / 30 * 1.26 = 0.54mW or -2.7dBm

Maximum Permissible Exposure (MPE) calculation:

S(mW/cm^2) = EIRP(mW) / 4πD^2, or S = 0.54 / (4πx400) = **0.0001mW/cm^2**

Therefore, the sum of the MPE for all three radios operating simultaneously based on calculation is:

ΣS(mW/cm^2) = 0.11mW/cm^2 + 0.0052mW/cm^2 + 0.0001mW/cm^2 = 0.163mW/cm^2 that is less then 1mW/cm^2.

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The maximum measured antenna conducted power, P is 21.7dBm

The antenna gain, G is 2.5dBi

The maximum EIRP power = P + G
ERP = 21.7+ 2.5 = 24.2dBm, or 263mW

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is $1mW/cm^2$, or $10W/m^2$

D = distance of 20cm

$S(mW/cm^2) = EIRP(mW) / 4\pi D^2$, or S = 263 / (4πx400)= $0.052mW/cm^2$, that is < 1.0 mW/cm^2

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3.8 RF Exposure Compliance

MPE Requirement:

1.0 mW/cm^2

Calculation:

Antenna Gain= 0.55dBi
The maximum EIRP power = 27dBm + 0.55dBi = 27.55dBm = 569mW
D = distance of 20cm

$S(\text{mW/cm}^2) = \text{EIRP(mW)} / 4\pi D^2$, or $S = 569 / (4\pi \times 400) = 0.11 \text{mW/cm}^2$, that is $< 1.0 \text{ mW/cm}^2$

3.8 RF Exposure Compliance

MPE Requirement:

1.0 mW/cm^2

Calculation:

Antenna Gain= 1.8dBi
The maximum EIRP power = 470mW
D = distance of 20cm

$S(\text{mW/cm}^2) = \text{EIRP(mW)} / 4\pi D^2$, or $S = 470 / (4\pi \times 400) = 0.09\text{mW/cm}^2$, < 1.0 mW/cm^2

3.8   RF Exposure Compliance

MPE Requirement:

$S = f/1500$ mW/cm^2
f= operating frequency
$S = 824/1500 = 0.55$ mW/cm^2

Calculation:

Antenna Gain= 2.4dBi
The maximum ERP power = 1.26mW
D = distance of 20cm

$S(\text{mW/cm}^2) = \text{ERP(mW)} / 4\pi D^2$, or S(mW) = $1260 / (4\pi \times 400) = 0.25$ mW/cm^2, < 0.55 mW/cm^2

3.8   RF Exposure Compliance

The maximum measured antenna conducted power, P is 8.7dBm

The antenna gain, G is 2.5dBi

The maximum EIRP power = P + G
ERP = 8.7+ 2.5 = 11.2dBm, or 0.013W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is 1mW/cm^2, or 10W/m^2

S = 10W/m^2

The Power Density is related to EIRP with the equation:
S = EIRP / $4\pi D^2$, or 10 = 0.013 / $4\pi D^2$,

The minimum safe separation distance, D = 1cm, which is below 20cm, or
RF Exposure at 20cm distance is 0.0026mW/cm^2