



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/cm²**

AVO-BTWI, WiFi Radio (see report 101039189MIN-001B) - maximum calculated MPE of **0.052mW/cm²**

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:

$S(\text{mW}/\text{cm}^2) = \text{EIRP}(\text{mW}) / 4\pi D^2$, or $S = 0.54 / (4\pi \times 400) = \mathbf{0.0001\text{mW}/\text{cm}^2}$

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

$\Sigma S(\text{mW}/\text{cm}^2) = 0.11\text{mW}/\text{cm}^2 + 0.0052\text{mW}/\text{cm}^2 + 0.0001\text{mW}/\text{cm}^2 = 0.163\text{mW}/\text{cm}^2$ that is less than 1mW/cm².

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3.6 RF Exposure Compliance

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 $1\text{mW}/\text{cm}^2$, or $10\text{W}/\text{m}^2$

D = distance of 20cm

$S(\text{mW}/\text{cm}^2) = \text{EIRP}(\text{mW}) / 4\pi D^2$, or $S = 263 / (4\pi \times 400) = 0.052\text{mW}/\text{cm}^2$, that is $< 1.0 \text{mW}/\text{cm}^2$



3.8 RF Exposure Compliance

MPE Requirement:

1.0 mW/cm²

Calculation:

Antenna Gain= 0.55dBi

The maximum EIRP power = 27dBm + 0.55dBi = 27.55dBm = 569mW

D = distance of 20cm

$S(\text{mW/cm}^2) = \text{EIRP}(\text{mW}) / 4\pi D^2$, 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/cm²

Calculation:

Antenna Gain= 1.8dBi

The maximum EIRP power = 470mW

D = distance of 20cm

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



3.8 RF Exposure Compliance

MPE Requirement:

$$S = f / 1500 \text{ mW/cm}^2$$

f = operating frequency

$$S = 824 / 1500 = 0.55 \text{ mW/cm}^2$$

Calculation:

Antenna Gain = 2.4dBi

The maximum ERP power = 1.26mW

D = distance of 20cm

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



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/cm², or 10W/m²

$$S = 10W/m^2$$

The Power Density is related to EIRP with the equation:

$$S = EIRP / 4\pi D^2, \text{ or } 10 = 0.013 / 4\pi D^2,$$

The minimum safe separation distance, D = 1cm, which is below 20cm, or RF Exposure at 20cm distance is 0.0026mW/cm²