

## 1.0 Maximum Permissible Exposure Evaluation

The results of power measurement and intended use/proximity are compared against the requirements for safety of RF exposure.

### 1.2 Criteria

| Section Reference           | Date       |
|-----------------------------|------------|
| 2.1091, FCC OET Bulletin 65 | 2013-10-31 |

### 1.3 Procedure

Using measurement of peak power and intended application, determine the permissible exposure level or whether additional exposure tests (SAR) are indicated. Justify conclusion for selected exposure area and separation distance.

### 1.4 Power Calculation

Antenna for this device is a printed circuit.

A separation distance of 20 cm was selected. Power is determined from the measured field strength at 10 meters and antenna gain applied to determine ERP. The ERP is compared to the referenced table threshold value.

Exposure is determined for the 15.247 915 MHz transmitter. The 15.231 433 MHz transmitter is combined to arrive at a worse-case exposure assuming both transmitters will operate simultaneously.

Source duty cycle factor for 915 MHz exposure calculation:  $10 * \log_{10} ( 0.712 \text{ ms} / 3,744 \text{ ms} ) = -37.2 \text{ dB}$

Source duty cycle factor for 433 MHz exposure calculation:  $10 * \log_{10} ( 54.6 \mu\text{s} / 1,036 \mu\text{s} ) = -12.78 \text{ dB}$

A separation distance of 20 cm was selected. Power is determined from the measured field strength at 10 meters and antenna gain applied to determine EIRP.

| Measured Field Strength<br>dB $\mu$ V/m* | At Distance | Source Duty Cycle Factor<br>dB | Calculated Average Field Strength<br>dB $\mu$ V/m | Antenna Gain Estimated<br>dBi | Calculated Field Strength<br>dB $\mu$ V/m | Calculated EIRP<br>mW |
|--|-------------|--------------------------------|---|-------------------------------|---|-----------------------|
| 100.49                                   | 10 m        | -37.2                          | 63.29   | 1.7                           | 63.29+1.7=<br>64.99                       | 0.0105                |
| 75.58                                    | 10 m        | -12.78                         | 62.80   | 1.7                           | 62.80+1.7=<br>64.50                       | 0.0094                |

\*This is the peak measurement.

## 1.5 Field Density Limit Determination

The field density limits are determined as:

$$f_{(\text{MHz})} / 1500 = 902 / 1500 = 0.6013 \text{ mW/cm}^2$$

Ref. FCC Bulletin OET-65 Table 1(B)

$$f_{(\text{MHz})} / 1500 = 433 / 1500 = 0.2887 \text{ mW/cm}^2$$

Ref. FCC Bulletin OET-65 Table 1(B)

## 1.6 Field Density Determination

902 MHz 15.247: Field density is determined at 20 cm:

$$S = \text{EIRP} / (4 \pi 20^2)$$

Ref. FCC Bulletin OET-65 Equation (4)

$$S = 0.0105 \text{ mW} / 5026.55 \text{ cm}^2$$

$$S = 0.0000021 \text{ mW/cm}^2$$

Percentage of field density limit used:  $0.0000021 / 0.6013 = 0.000349 \%$

433 MHz 15.231: Field density is determined at 20 cm:

$$S = \text{EIRP} / (4 \pi 20^2)$$

Ref. FCC Bulletin OET-65 Equation (4)

$$S = 0.0094 \text{ mW} / 5026.55 \text{ cm}^2$$

$$S = 0.00000187 \text{ mW/cm}^2$$

Percentage of field density limit used:  $0.00000187 / 0.2887 = 0.000648 \%$

Summed percentage of field density exposure is:  $0.000349 \% + 0.000648 \% = 0.000997 \%$

The field density levels are individually below their respective limits and the summed percentage of field density exposure is below 100%, it therefore meets the criteria for exclusion from SAR testing.

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