

#### 4.5 Test Conditions and Results – MAXIMUM PERMISSIBLE EXPOSURE CALCULATION

| Test Description  | Maximum Permissible Exposure calculation is performed to ensure that this device meets RF exposure limits for its intended environment. This device is required to meet the General Population/Uncontrolled exposure limits. |                                   |   |   |
|---|--|-----------------------------------|---|---|
| Basic Standard  | 47 CFR Part 1.1307<br>Industry Canada IC Safety Code 6   |                                   |   |   |
| FCC Limits for Occupational/Controlled Exposure         |  |                                   |   |   |
| Frequency Range (MHz)                                   | Electric Field Strength (E) (V/m)  | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E <sup>2</sup>  ,  H <sup>2</sup>  . or S (minutes) |
| 0.3 – 3.0   | 614  | 1.63                              | (100)*                                  | 6   |
| 3.0 - 30  | 1824/F   | 4.89/F                            | (900/F <sup>2</sup> )*                  | 6   |
| 30 - 300  | 61.4   | 0.163                             | 1.0                                     | 6   |
| 300 – 1500  | -  | -                                 | F/300                                   | 6   |
| 1500 – 100,000  | -  | -                                 | 5.0                                     | 6   |
| FCC Limits for General Population/Uncontrolled Exposure |  |                                   |   |   |
| Frequency Range (MHz)                                   | Electric Field Strength (E) (V/m)  | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E <sup>2</sup>  ,  H <sup>2</sup>  . or S (minutes) |
| 0.3 - 1.34  | 614  | 1.63                              | (100)*                                  | 30  |
| 1.34 - 30   | 824/F  | 2.19/F                            | (180/F <sup>2</sup> )*                  | 30  |
| 30 - 300  | 27.5   | 0.073                             | 0.2                                     | 30  |
| 300 – 1500  | -  | -                                 | F/1500                                  | 30  |
| 1500 – 100,000  | -  | -                                 | 1.0                                     | 30  |

Note: General Population / Uncontrolled Exposure Limit apply.

**Background:** Per the following guidance from OET Bulletin 65 Supplement C required minimum spacings are provided to the professional installer.

| <u>Transmitter or Device Type</u> <sup>18</sup>                                      | <u>Output</u> <sup>19</sup>                  | <u>Applicable Methods to Ensure Compliance</u> <sup>20</sup>  |
|--|--|---|
| Transmitters using indoor antennas that operate at 20 cm or more from nearby persons | >2.5 W at 915 MHz                            | If the MPE distance is greater than that required for normal operation of the device, operating instructions, warning instructions and/or warning labels may be used to ensure compliance by indicating the minimal separation distance to comply with MPE limits.<br><br>If the antennas are professionally installed to ensure compliance, warning instructions and warning labels are not necessary. |
|  | =< 2.5 W at 915 MHz or<br>=< 4 W at 2450 MHz | Transmitters operating at 2.5 W EIRP (1.5 W ERP) or less at 915 MHz, or at 4 W EIRP (2.4 W ERP) or less at 2450 MHz, generally are not expected to exceed MPE limits when nearby persons are 20 cm or more from most antennas. Therefore, special instructions and warnings are normally not necessary to ensure compliance.  |

**Table 15 MPE - Calculation**

**MPE Calculation with highest field strength:**

The highest electric field strength observed was 76.74 dB $\mu$ V/m at 3m distance. Adjusting this measurement to 20cm distance using 20dB/decade yields:

$$76.74 \text{ dB}\mu\text{V/m} + 20(\log(300/20)) = 76.74 \text{ dB}\mu\text{V} + 23.52 \text{ dB} = 100.26 \text{ dB}\mu\text{V/m at 20 cm, or } 0.10306 \text{ V/m}$$

**Calculating Power Density from Electric Field Strength**

$$\begin{aligned} S &= (\text{Electric Field Strength})^2 / \text{Impedance of Free Space} = (0.10306 \text{ V/m})^2 / 377 \text{ ohms} \\ &= 0.000028174 \text{ W/m}^2 \end{aligned}$$

Limit at Center of operating band is used to calculate limit. Duty cycle of 100% is assumed. 20cm spacing is assumed.

---

**Uncontrolled/General Exposure - 20 cm spacing**

|                     |         |
|---------------------|---------|
| Operating Frequency | 915 MHz |
| Separation Distance | 0.2 m   |

|  |                              |        |                                  |
|--|------------------------------|--------|----------------------------------|
| Peak Power Density                             | 0.000028174 W/m <sup>2</sup> | - or - | 0.00000028174 mW/cm <sup>2</sup> |
| Exposure %<br>(over 6 min timespan)            | 100%                         |        |                                  |
| Transmit Duty Cycle<br>(Peak-to-Average Ratio) | 100%                         |        |                                  |
| Average Power Density                          | 0.000028174 W/m <sup>2</sup> | - or - | 0.00000028174 mW/cm <sup>2</sup> |

Limit for **Uncontrolled/General**

|                                 |                      |        |                         |
|---------------------------------|----------------------|--------|-------------------------|
| Exposure at Operating Frequency | 6.1 W/m <sup>2</sup> | - or - | 0.61 mW/cm <sup>2</sup> |
|---------------------------------|----------------------|--------|-------------------------|

The product was found to comply with this requirement.