9. RF Exposure Information:

The device is compliant with both MPE requirements (47CFR2.1091) as well as SAR requirements (47CFR2.1093).

Calculation for compliance with MPE requirements (47CFR2.1091) is done using a worst-case transmitter power of 50 mW, assumption of a unity gain antenna, and an exposure limit of 0.6 mW/cm^2 (f/1500 mW/cm^2 at 20 cm per 47CFR1.1310) for general applications. This device is not carried or worn by the user. It has an extremely low duty cycle and a low rate of transmission that dramatically reduces the average power level that could pose an exposure hazard.

The OEM transmitter initiates a transmission upon sensing a change of state. In addition to these change-of-state transmissions, the transmitter is configured to transmit a supervisory message once every 3 minutes. The maximum message length may occur when the OEM transmitter transmits a serial message consisting of a 12 ms preamble followed by 32 ms of synchronization, identification, payload, and CRC data. The averaging interval specified in Table 1(B) of 47CFR1.1310 is 30 minutes. For the purposes of this calculation, it is assumed that ten supervisory and five change-of-state messages will be sent in the 30-minute interval. Each supervisory message consists of 3 redundant packets, and each change of state message contains 21 packets, for a total of 135 packets in the 30-minute interval. A packet is typically 22.4 ms in length. For this calculation, a maximum packet length of 44 ms will be used.

The worst-case average power density at a distance of 20 cm is then,

$$50mW \times \frac{135\,packets}{30\,\min} \times \frac{44ms}{packet} \times \frac{1\,\min}{60\times10^3\,ms} \times \frac{1}{4\pi(20cm)^2} = 32.8\frac{nW}{cm^2}$$

This is well below the 0.6 mW/cm^2 MPE limit.

Calculation for compliance with SAR requirements (47CFR2.1093) is done using a worst-case transmitter power of 50 mW time-averaged by the duty cycle of the transmitter, and the assumption that all RF energy could be absorbed in 1 gram of tissue. The peak exposure limit is 1.6 mW/g (equivalent to 1.6 W/kg per 47CFR2.1093) in any 1 gram of tissue for General Population/Uncontrolled applications.

In any 3-minute interval, worst-case the device may transmit up to 2 alarm messages and a supervision message for a total of 45 packets.

The maximum duty cycle of the device is,

$$\frac{45\,packets}{3\,\min} \times \frac{44ms}{packet} \times \frac{1\,\min}{60\times10^3\,ms} = 0.011 = 1.1\%$$

The time-averaged RF transmitted power is then,

$$0.05W \times 0.011 = 0.55mW$$

If all of the transmitted power were absorbed in a 1-gram sample of tissue, the resulting power density is 0.55 mW/gram and is well below the 1.6 mW/gram limit.