MAXIMUM RF EXPOSURE CALCULATIONS
FOR THE 7720PLUS TRANSMITTER

Note: The limits, definitions and methods used are from FCC Bulletin 65 referenced to in CFR 47 §1.1310.

DEVICE DEFINITION: The 7720PLUS is defined as a "MOBILE" device meant to operate > 20cm from the user as it is typically mounted on a wall or ceiling by an alarm installer.

MESSAGE CYCLE: The 7720PLUS message cycle is controlled by its' software. A message cycle is initiated for certain events such as when the device is first powered up , alarm messages or AC power loss. The message cycle consists of 61 messages of 50ms each. The time it takes to transmit a full message cycle is 4 to 6 minutes or, 240 to 360 seconds. This interval is determined by the software based on the units' software ID number. The interval between each 50ms transmission is staggered by the software. A 4 minute interval is used to average the maximum RF exposure for maximum duty factor.

The average time between each 50ms transmission in a 4 minute cycle time is:

Average Message Interval = 61 messages / 240 s = 1 message / 3.93s

"Worst Case " MAXIMUM MESSAGE DUTY FACTOR
The message duty factor for a 4 minute cycle time is:

$$(0.05s/ (3.93s)) = 0.0127 \qquad \textbf{(1)}$$ **This will be used in the RF exposure calculation.**

FCC LIMIT MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATION:
The MPE limit used is for the **GENERALAL POPULATION/UNCONTROLLED EXPOSURE** of CFR 47 § 1.1310 Table 1.(B).

The 7720PLUS center channel frequency is 928.1625MHz = f

MPE Power Density Limit = f / 1500 = 0.619 mW / cm^2

ANTENNAS USED WITH THE 7720PLUS TRANSMITTER: The antennas available for use with the 7720PLUS have numeric gains over isotropic that range from 1.64 (2.1dBi) for the omni directional λ/2 antenna mounted directly to the unit to 6.46 (8.1dBi) for an optional directional antenna mounted away from the unit in an attic or outside the installation site. Antennas that connect directly to the 7720PLUS are:

Antenna Type	Numeric Gain	
λ/2 Dipole	1.64	
Monopole	2.0	
5 λ /8	2.14	(supplied with the unit)

"Worst Case" Calculation of Maximum RF Exposure for Direct Mount Antennas

This calculation uses the duty factor calculated in **(1)** and assumes this over the 30minute averaging time defined for Limits for General Population/Uncontrolled Exposure. This would only happen if the unit sensed events to cause the unit continuously repeat the message cycle over the 30 minute averaging time. This is unlikely, but, represents the worst case transmission. The highest gain antenna mounted at the unit is also assumed. ie. G=2.14

$$EIRP = (P_{tx}) (G_{ant})$$
$$= (5W) (2.14)$$
$$EIRP = 10.7W$$

where: $P_{tx} =$ Power to Antenna = 5 watts
$G_{ant} =$ Numeric Gain = 2
EIRP = Effective Isotropic Radiated Power

$$\text{Time Averaged   EIRP} = (EIRP) (\text{Message Duty Factor})$$
$$= (10.7W)) (0.0127)$$

$$\text{Time Averaged EIRP} = 136mW$$

$$\text{Time Averaged Power Density @ 20cm from the antenna} = 136mW / (4Bx (20cm)^2)$$
$$= 0.027mW / cm^2$$

The Time Averaged Power Density at a distance 20cm from a directly mounted antenna of maximum gain is much less than the Time Averaged MPE Power Density Limit of $0.619mW / cm^2$.

"Worst Case" Calculation of Maximum RF Exposure for Remotely Mounted Antennas

For the remotely mounted directional antenna with numeric gain over isotropic of 6.45
and a Maximum Message Duty Factor :

$$\text{Time Averaged EIRP} = (P_{tx}) (G_{ant}) (\text{Message Duty Factor})$$
$$= (5W) (6.45) (0.0127)$$

$$\text{Time Averaged EIRP} = 409mW$$

$$\text{Time Averaged Power Density @ 20cm from the antenna} = 409mW / (4Bx (20cm)^2)$$
$$= 0.081mW / cm^2$$

The Time Averaged Power Density at a distance 20cm from the remotely mounted antenna of maximum gain is less than the Time Averaged MPE Power Density Limit of $0.619mW / cm^2$.

CONCLUSION: Calculations for the **" worst case "** Maximum RF Exposure from the maximum gain directly and remotely mounted antennas for use with the 7720PLUS were presented. The maximum software controlled duty factor was assumed in the calculations.

The Time Averaged Power Densities at 20 cm from the directly and remotely mounted antennas of maximum gain used with the 7720PLUS were shown to be within FCC limits for Time Averaged Power Density.

The users manual will include the following information for the installer/user :
" The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons. Owners and Licensees of co-located installations must be in compliance with 1.1307(b)(3) of the FCC regulations. "