

LLB09014

May 21, 2010

RF Exposure calculations

Based on FCC 1.1307 & 2.1091, FCC OET Bulletin 65.

(1) Absolute Maximum specifications of
LLB09013 transmitter

- Operational frequency band **450 MHz to 470 MHz.**
- The LLB09014 transmitter is measured for **Max RF Power = 1.698 W.**
- Absolute **Maximum transmission time (duration)** for any Aclara RF transmitters does not exceed **150 mS** (0.15second).
- Transmission period -
Absolute maximum is **1 transmission per 4 hours.**
- All Aclara RF Transmitters utilize **FSK modulation.**

(2) Average RF Power Calculation:

FCC regulations on permissible RF exposure are not based on peak envelope power (PEP), but on average power (P_ave) over a 30-minute time period for uncontrolled environments.

As mentioned in (2), during any 30 minute Aclara MTU can transmit only once. Duration = 0.15 second.

With maximum RF radiation equal to 1.698 W, the Average RF Power over 30 minutes is:

$$\begin{aligned} \text{P_ave (worst case) at 30 minute} &= \\ &= 1.698 \text{ mW} * 1 * [0.15\text{sec} / ((30 * 60)\text{sec})] = 1698 * 0.000083 = 141 \text{ uW} \end{aligned}$$

(3) Maximum Radiated Power Density prediction (S):

To predict power density (S) at distance R=20 cm from transmitter with P_ave = 0.000141W, next formula is used:

$$S = P_ave * G_a / (4 * (PI) * R^2).$$

For the worst of the worst worst-case prediction of power density at or near a transmitter surface that uses the non-directional antenna (Ga=1) let's use:

$$S = (P_{ave} * G_a) / ((PI) * R^2) = \\ (141uW * 1) / (3.14 * 20cm * 20cm) = 0.112 uW/cm^2$$

This is the impossible worst Case of the near field power density of **LLB09014** transmitter.

(4) Maximum Permissible Exposure (MPE) from LLB09014:

AS FCC require, the maximum permissible exposure for general public in "uncontrolled situation" at 20 cm is:

$$MPE = frequency[MHz] / 1500 == 460MHz / 1500 = 0.307 mW/cm^2.$$

Compare results in (4) and (5),

$$S = 0.112 uW/cm^2 < MPE = 0.307 mW/cm^2$$

We see that LLB09014 fully complies with RF safety at a distance of 20 cm.

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