

December 21, 2014

RF Exposure calculation

Based on FCC 1.1307 & 2.1091, FCC OET Bulletin 65

1. Categorically Exclusion from exposure Evaluation:

According to FCC regulation, RF exposure evaluation is Categorically Excluded if transmitter's operation frequency is less than 1.5GHz and ERP is less than 1.5W.

2. The specification of LCU transmitter:

- Operational frequency band **450MHz to 470MHz**
- The LCU transmitter is measured for **MAX RF Power 4W**
- **Maximum transmission time(duration)** for any LCU transmitters does not exceed **150mSec**
- Transmission period-absolute maximum is **1 transmission per 30 minutes.**
- LCU transmitters utilize 4GFSK modulation.

3. Average RF Power Calculation

FCC regulation on permissible RF exposure are not based on the peak envelope power, but on average power (P_{ave}) over a 30-minute time period for uncontrolled environments.

As mentioned in (2), during any 30 minutes LCU can transmit 1 time. Duration is 150 mSec.

With maximum RF radiation equal to 4W, the average RF Power over 30 minutes is:

$$P_{ave}(\text{worst case}) \text{ at } 30 \text{ minute} = 4 \times 150 \times 10^{-3} = 600 \text{mW}$$

4. Maximum radiated Power Density prediction (S):

The predict power density (S) at distance **R=20cm** from transmitter with **P_{ave} =600mW**, next formula is used:

$$S = P_{ave} / (4 \times \pi \times R^2)$$

$$S = 600\text{mW} / (4 \times \pi \times 20\text{cm} \times 20\text{cm}) = 0.119\text{mW} / \text{cm}^2$$

5. Maximum Permissible Exposure (MPE) from LCU

As FCC require, the maximum permissible exposure for general public in “uncontrolled situation” at 20cm is:

$$\text{MPE} = \text{frequency}[\text{MHz}] / 1500 = 460\text{MHz} / 1500 = 0.307\text{mW} / \text{cm}^2$$

Compare results in (4) and (5),

$$S = 0.119\text{mW} / \text{cm}^2 < \text{MPE} = 0.307\text{mW} / \text{cm}^2$$

We see that LCU is fully complies with RF safety at a distance 20cm.