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05/15/2012

LLB10004X2

RF Exposure calculations

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

(1) Categorical Exclusion from RF exposure Evaluation: According to FCC regulations, RF exposure evaluation is Categorical Exclusion if transmitter's operation frequency is less than 1.5 GHz and ERP is less than 1.5 watt.

(2) Absolute Maximum specifications of LLB10004X2 transmitter

- Operational frequency band 450 MHz to 470 MHz.
- The LLB10004X2 transmitter is measured for Max RF Power = 0.661 W.
- Absolute Maximum transmission time (duration) for any Hexagram transmitters does not exceed 100 mS (0.10second).
- Transmission period – Absolute maximum is 4 transmissions per hour.
- All Hexagram Transmitters utilize FSK modulation.

(3) 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 Hexagram MTU can transmit only two times. Duration = 0.10 second. With maximum RF radiation equal to 0.661 W, the Average RF Power over 30 minutes is: P_{ave} (worst case) at 30 minute = $0.661W \cdot 30 \cdot [0.10sec / ((30 \cdot 60)sec)] = 0.661 \cdot 30 \cdot 0.000055 = 1.1mW$

(4) Maximum Radiated Power Density prediction (S): To predict power density (S) at distance $R=20$ cm from transmitter with $P_{ave} = 0.00007W$, next formula is used: $S = P_{ave} / (4 \cdot \pi \cdot R^2)$
For the worst of the worst worst-case prediction of power density at or near a transmitter surface let's use: $S = P_{ave} / (\pi \cdot R^2) = 1.1 mW / (4 \cdot 3.14 \cdot 20cm \cdot 20cm) = 0.217uW/cm^2$. This is the worst case of the near field power density of LLB10004X2 transmitter.

(5) Maximum Permissible Exposure (MPE): AS FCC require, the maximum permissible exposure for general public in "uncontrolled situation" at 20 cm is: $MPE = 460MHz / 1500 = 1.228 mW/cm^2$. By comparing results in (4) and (5), $S=0.217uW/cm^2 < MPE=1.228 mW/cm^2$. We see that LLB10004X2 fully complies with RF safety at a distance of 20 cm.

Sincerely,

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