Apr 22, 2013

To Whom It May Concern:

To investigate the RF exposure of the Tantalus Systems Corp. LM-142x demand response modules the FCC OET Bulletin 65 and the Health Canada Safety Code 6 (as specified in RSS-102) have been used as guidelines to determine compliance with the FCC and IC RF exposure limit.

In addition the FCC has allowed omitting SAR evaluation if the source-based time-averaged output powers are below the levels defined in the KDB publication 447487 D01 General RF Exposure Guidance v05.

Analysis:

As per OET Bulletin 65 and Health Canada Safety Code 6 guidelines:

The EUT is classed to meet the RF exposure that it subjects to the "General Population/Uncontrolled Environment". Under this class the limit is calculated by:

$$S = f/1500$$

Where S is the Power Density in mW/cm^2.
F is the frequency of operation in MHz.

The EUT operates in the 902 to 928 MHz band, the lower exposure limit would be obtained by using a frequency at the lower edge of the band, therefore:

$$S = 902\ /1500 = 0.601\ \text{mW/cm}^2$$

The maximum EIRP was measured to be 2.04W

However the LM142x is a low duty cycle device and under normal operation the transmitter is not on continuously and therefore its power must be time averaged. The maximum total transmit cycle is 4%.
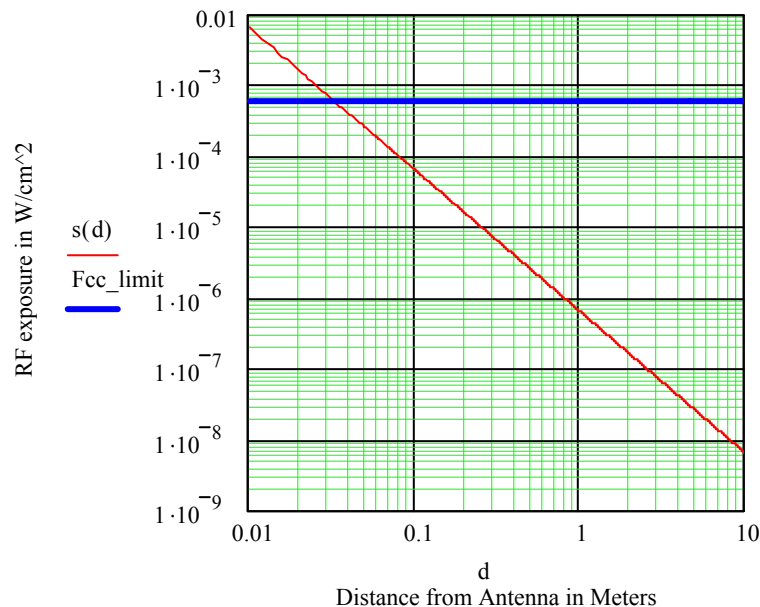
The average EIRP is therefore:

$$EIRP_{(average)} = EIRP_{(continuous)} * \text{duty cycle}$$
$$EIRP_{(average)} = 2.04 \text{ W} * 0.04 = 0.0816 \text{ W}$$

The predicted power density at a distance d, in the same horizontal plane as the elevation of the antenna is calculated and graphed below:

$Eirp := 2.04 \quad Duty\_cycle := 0.04 \quad Eirp\_avg := Eirp \cdot Duty\_cycle \quad Freq\_Mhz := 902$

$d := 0.01, 0.011 .. 10$ (Distance in meters) $\qquad Fcc\_limit := \dfrac{Freq\_Mhz}{1500 \cdot 1000}$ (Fcc Limit in W /cm ^{2})

$$s(d) := \frac{Eirp\_avg}{4 \cdot \pi \cdot (d \cdot 100)^2} \qquad \text{(Power in W / cm }^2\text{)}$$

RF exposure in W/cm^2

$s(d)$ ——

Fcc_limit ▬▬▬

d
Distance from Antenna in Meters

From the graph, it can be observed that the distance at which the RF exposure would exceed the limit would be 3.4cm. The far field distance for a small antenna is given by any distance greater than λ/2π; this equates to a minimum distance of 5.3cm, therefore 5.3cm must be used as the minimum distance not 3.8cm. The EUT is operated and housed within an electromechanical utility meter. If a human was to place his head touching the cover of the device the distance from the radiating slot of the internal antenna would be 3.5cm, therefore the minimum distance that a person must be away from the meter cover is 1.8cm (5.3=3.5+1.8), a notice of this distance has been placed in the user manual. In general this worst case situation would never happen since the device is attached to an exterior part of the occupants dwelling and the radiated energy is attenuated as it propagates through the building. Therefore typical exposures occur at distances greater than one meter. At 1 meter the predicted power density is 1 uW/cm^2 or 0.17% of the allowable FCC exposure limit.

As per the FCC KDB publication 447487 D01 General RF Exposure Guidance v05, SAR tests are not required if the RF power does not exceed the following formula:-

$$(f_{(GHz)})^{0.5} \text{ x Time averaged power (mW) /distance(mm)} \leq 3.0$$

or

$$(0.928)^{0.5} \text{ x Time averaged power (mW) /distance(mm)} \leq 3.0$$

As in the previous analysis the maximum time averaged sourced based output power is 81.6mW and the closest distance from the antenna to any body part is 53mm, this yields a numeric value of 1.48 which is 49% of the limit.

Result:

The EUT does not expose the public to radio frequency energy levels in excess of the FCC guidelines. The following statement is **not required** on a TCB Grant of Equipment Authorization or in the EUT user manual:

"The antenna used for this transmitter must be fixed-mounted in a permanent structure providing a separation distance of at least 20 cm from all persons during normal operation."

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