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To Whom It May Concern:

To investigate the RF exposure of the Tantalus Systems Corp. RT-4200 TRUEdge Intelligent endpoint (FCC ID: OZFTXG000, IC ID: 3669A-TXG000) incorporated inside the TRUSense Gateway Series the FCC KDB publication 447498 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.

The EUT contains 2 different transmitters, the first transmitter operates in the 902 to 928MHz band and the second transmitter operates **either** in the 2400 to 2483MHz band **OR** the 5GHz band. It is impossible for second transmitter to operate in both bands at the same time.

The following analysis uses the following worst case operating conditions:

- Transmitter 1 operating at 902-928MHz has a maximum duty cycle of 34.6%
- Transmitter 2 operating at 2.4GHz/5.8GHz operates in half duplex and the duty cycle is 50%

For this product, transmitter 1 has 3 possible antenna configurations:

- Integrated Antenna (default configuration)
- External antenna: 6dBi Omni-directional in azimuth
- External antenna: 8dBi Directional in azimuth

The RF exposure analysis will be given for all 3 antenna configurations, **however** when analyzing the RF exposure of the external antenna's the RF power from the second transmitter will be ignored since the distance from the internal second transmitter and the external antenna connected to the first transmitter will be several meters apart.

Analysis per Health Canada Safety Code 6 guidelines:

As per 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:

$$S = f/150$$

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

For transmitter 1 that 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:

$$S = 902 /150 = 6.01\ W/m^2 = 0.601\ mW/cm^2$$

For transmitter 2 that operates in either the 2.4GHz band or the 5GHz band, the exposure limit is 10W/m or 1mW/ cm^2.

The power density for each transmitter when averaged spatially and over time at a distance of 20cm is given in the table below.

Transmitter #	Operating Frequency (MHz)	EIRP (W)	EIRP over time (W)
1 (Internal Antenna)	902-928	0.528	0.183
1 (External 6dBi Antenna)	902-928	1.854	0.641
1 (External 8dBi Antenna)	902-928	2.805	0.971
2	2400-2483	0.079*	0.040
2	5150-5850	0.079*	0.040

* At 2.4GHZ maximum output power is 19dBm with 0dBi antenna gain.
At 5.8GHz maximum output power is 15dBm with 4Bi maximum antenna gain.

Therefore the maximum power density at 20cm for the highest gain external antenna on transmitter 1 is $0.1915mW/cm^2$, the power from transmitter 2 can be ignored since the separation distance between the 2 antennas will be over 2m. This is lower than the maximum permissible exposure limit.

When using the internal antenna it is necessary to consider the RF emissions from both transmitters.

To determine whether the EUT meets the requirements that maximum exposure limits are not exceeded when exposed to multiple RF sources, Safety Code 6 requires that the sum of all ratios obtained for all frequencies shall not exceed unity when averaged spatially and over time.

The limit, as applied to multiple frequencies, can be expressed as:

$$\sum_{f\ =\ 3\ kHz}^{300\ GHz} R_f \leq 1$$

where f is the frequency for which measurements were taken and where the power desnity is measured,

$$R_f = \frac{Measured\ Value\ of\ Power\ Density\ at\ f}{Exposure\ Limit\ of\ Power\ Density\ at\ f}$$

Therefore, using the table shown below, the sum of the ratio's when both transmitters are operating simultaneously is 0.0679.

Transmitter #	Time Averaged EIRP (W)	Power Density at 20cm (mW/cm^2)	MPE (mW/cm^2)	Ratio
1	0.183	0.0361	0.601	0.0601
2	0.040	0.0078	1.0	0.0078

Since the sum of the ratio for all transmitters is less than unity the EUT meets the MPE requirements for a mobile device.

Analysis as per the FCC KDB publication 447498:

As per the FCC KDB publication 447498 D06 General RF Exposure Guidance, 4.3.1(b) states that SAR tests are not required if the RF power does not exceed the following formula:-

The maximum time averaged power (mW) must not exceed:-

*Max. Power (mW) Allowed at 50mm** + (test separation distance–50 mm) *x* $F_{(MHz)}/150$

*Where *Max. Power (mW) Allowed at 50mm* = 3 *x* 50 /√ $F_{(GHz)}$ = 155mW

From the equation above, the distance for the highest gain external antenna at which the output power does not exceed 970.53mW is when the distance is greater than 185.5mm. This value is less than the 20cm distance required for mobile devices.

FCC KDB publication 447498 D06 General RF Exposure Guidance, 4.3.2 states that in the case of co-located transmitters the SAR test exclusion is allowed if the sum of all transmissions meets the requirement. For transmitter 1 using the internal antenna the time averaged power is 183mW and the time averaged power for transmitter 2 is 40mW. The total power of these 2 transmitters is 223mW. In the case when the default internally integrated antenna is used together with the co-located transmitter 2, the distance at which the power does not exceed 223mW is 6.1cm.

Result:

SAR tests are not required for this product. The RF power emitted by the module is considered not to be dangerous for the general public as long as a distance of at least 6.1cm is maintained during normal operation using the integrated antenna or 18.5cm when using the high gain directional antenna. However, since this product is for fixed applications a minimum distance of 20cm from the general public must be observed during normal operation.

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