Caylis Pump 675003 (EUT) RF Exposure calculation: -

FCC ID: **2BBKF675003**
IC: **30708-675003**

The Caylis 675003 EUT houses an RFID Reader for which certification is sought. The device also utilises a pre-approved FCC / ISED Radio module FCC ID: SQG-EWB1 and IC ID: 3147A-EWB1. The module can either operate using Bluetooth communication in the 2.4GHz band or using Wi-Fi communication in the 2.4GHz band, in combination with the 13.56MHz RFID transmission. RF exposure distance is typically worst case 20cm from persons. For the purposes of this exclusion calculation a distance of 200mm has been used as the worst case. The power used is the maximum field strength measured from the RFID transmitter (stand alone), and in combination (simultaneously transmitting) with either the Bluetooth transmission or the Wi-Fi transmission. Evaluation is for General population/uncontrolled exposure.

RFID stand-alone operation:
Maximum measured PK power from the RFID transmitter was 47.06 3dBuV/m @3m. This equates to an EIRP of -48.19dBm (or 0.000015 mW).

FCC Evaluation is for exposure potential against the Exclusion limits given in **KDB447498** D04 v01 section 2.1.2.

Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

As measured values for the RFID transmitter in the EUT were: 47.06dBuV/m @ 3m which is -48.19 dBm (or 0.000015 mW) and any antenna gain is included in the field strength measurement, the EUT is excluded from RF Exposure / SAR testing requirements in stand-alone operation as it meets the <1mW exemption requirement.

With reference to **RSS-102 issue 5** section 2.5.1 table 1, the exemption limit for devices operating on frequencies ≤ 300MHz at >=50mm separation distance is 345mW. Therefore, the RFID transmitter is also exempt from routine SAR/RF exposure evaluation according to RSS-102 Issue 5 in stand-alone mode.

In addition to the above single source RFID RF exposure, the device houses a pre-approved Bluetooth/Wi-Fi module, of which the FCC/IC ID references are stated above. Referring to the existing MPE exclusion calculation power levels as listed for the module under its certification performed at 20cm, we have the following powers and calculated Power Densities for Bluetooth LE and Wi-Fi 2.4 GHz operation (MPE from OET bulletin 65) along with the RFID ERP measurement:

$$S = \frac{P * G}{4 * \pi * R^2}$$

Where,

S = Power Density

P = Power Input to Antenna

G = Power Gain of Antenna

R = Distance to the center of Radiation of Antenna

RFID + BLE

Frequency range (MHz)	Maximum EIRP power (dBm)	Evaluated distance	Worst case exposure level mW/cm^2	Limit (mW/cm^2)	Worst case ratios %	Sum of ratios %	Limit %
2402 – 2480 MHz - BLE	8.6	20	0.00144	1	0.144	0.1440003	100
13.56 MHz RFID	-48.19	20	0.000000003	1	0.0000003		

RFID + Wi-Fi

Frequency range (MHz)	Maximum EIRP power (dBm)	Evaluated distance	Worst case exposure level mW/cm^2	Limit (mW/cm^2)	Worst case ratios %	Sum of ratios %	Limit %
2412 – 2462 MHz Wi-Fi	23	20	0.0397	1	3.97	3.9700003	100
13.56 MHz RFID	-48.19	20	0.000000003	1	0.0000003		

in this instance RF exposure above has been considered by summing the RF power of either the BT LE with RFID or the Wi-Fi with RFID for comparison to the MPE limits for uncontrolled exposure in line with KDB447498 D04 interim guidance clause 2.2.2 Simultaneous Transmission with both SAR-Based and MPE-based test exemptions using:

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Note: Per ISED notice 2016-DRS001: Certain measurement procedures are not currently covered in the international standards referenced in Innovation Science and Economic Development Canada's RSS-102 – RF exposure compliance of radiocommunication apparatus (All frequency Bands). Therefore, the Department accepts FCC RF exposure KDB procedures on an interim measure.

The above RF evaluation/calculations demonstrates compliance with the exemption criteria.

This calculation was prepared by Daniel Sims of RN Electronics Ltd, Acting as Agent towards FCC & ISED certifications.

Date: 4th October 2023

Signed:

(Radio Approvals Manager)