

RADIO TEST REPORT

Type of assessment:

MPE Calculation report

Manufacturer:

Smartwave Technologies

Hardware Version Identification Number (HVIN):

Pulse Rat IQ Total

Product Marketing Name (PMN):

Bell IQ Total Solutions

Model variant(s):

Pulse Mouse IQ Total, 24/7 IQ Total

FCC ID:

2ASYW-B01004

IC certification number:

24934-B01004

Specification:

- ◆ FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310
- ◆ FCC 47 CFR Part 2 Subpart J, §2.1091
- ◆ FCC KDB 447498 D01 General RF Exposure Guidance v06
- ◆ ISED Canada RSS-102 Issue 5 Amendment 1, (February 2021)

RSS-102 Annex B - Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in Annex A is correct; that the Technical Brief was prepared and the information contained therein is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed; and that the device meets the SAR and/or RF field strength limits of RSS-102.

Date of issue: **May 26, 2023**

Ketav Jani, EMC/RF Specialist

Prepared by



Signature

Lab locations

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Test site identifier	Organization FCC: ISED:	Ottawa/Almonte CA2040 2040A-4	Montreal CA2041 2040G-5	Cambridge CA0101 24676
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Section 1 Evaluation summary

1.1 MPE calculation for standalone and simultaneous transmission

1.1.1 References, definitions and limits

FCC §2.1091(d)

(2) (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

Table 1.1-1: Table 1 to §1.1310(e)(1)—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	*(100)	≤6
3.0–30	1842 / f	4.89 / f	*(900 / f ²)	<6
30–300	61.4	0.163	1.0	<6
300–1500			f / 300	<6
1500–100000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	<30
1.34–30	824 / f	2.19 / f	*(180 / f ²)	<30
30–300	27.5	0.073	0.2	<30
300–1500			f / 1500	<30
1500–100000			1.0	<30

Notes: f = frequency in MHz. * = Plane-wave equivalent power density.

RSS-102, Section 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $0.0131 f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

References, definitions and limits, continued

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (mW/cm² or W/m²)

P = power input to the antenna (mW or W)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm or m)

1.1.2 EUT technical information

Prediction BLE frequency	2402 MHz
Prediction LoRa frequency	903 MHz
Antenna type	Type: Helical antenna with connector style PCB-mount base Manufacturer: Linx Technologies Model: ANT-915-VHETH
Antenna gain	0.9 dBi
Number of antennas	1
Maximum BLE conducted power	-3.3 dBm, 0.00047(W)
Maximum LoRa conducted power	16.5 dBm, 0.045 (W)
Prediction distance	20 cm

1.1.3 MPE calculation for BLE

Fundamental transmit (prediction) frequency:	<u>2402</u> MHz	
Maximum measured conducted peak output power:	<u>-3.3</u> dBm	
Cable and/or jumper loss:	<u>0</u> dB	
Maximum peak power at antenna input terminal:	<u>-3.3</u> dBm	
Tx On time:	<u>1.000</u> ms	
Tx period time:	<u>1.000</u> ms	
Average factor:	<u>100</u> %	
μm calculated average power at antenna input terminal:	<u>0.4677351</u> mW	
Single Antenna gain (typical):	<u>0.9</u> dBi	
Number of antennae:	<u>1</u>	
Total system gain:	<u>0.90</u> dBi	
FCC limit:		ISED limit:
Maximum uncontrolled exposure at prediction frequency:	<u>1.000000</u> mW/cm ²	<u>0.535080</u> mW/cm ²
	<u>10.000000</u> W/m ²	<u>5.350805</u> W/m ²
Minimum calculated prediction distance for compliance:	<u>20</u> cm	<u>20</u> cm
Typical (declared) distance:	<u>20</u> cm	<u>20</u> cm
Average power density at prediction frequency:	<u>0.000114</u> mW/cm ²	<u>0.000114</u> mW/cm ²
	<u>0.001145</u> W/m ²	<u>0.001145</u> W/m ²
Margin of Compliance:	<u>39.41</u> dB	<u>36.70</u> dB
Maximum allowable antenna gain:	<u>40.31</u> dBi	<u>37.60</u> dBi

1.1.4 MPE calculation for LoRa

Fundamental transmit (prediction) frequency:	903 MHz
Maximum measured conducted peak output power:	16.5 dBm
Cable and/or jumper loss:	0 dB
Maximum peak power at antenna input terminal:	16.5 dBm
Tx On time:	1.000 ms
Tx period time:	1.000 ms
Average factor:	100 %
Maximum calculated average power at antenna input terminal:	44.668359 mW
Single Antenna gain (typical):	0.9 dBi
Number of antennae:	1
Total system gain:	0.90 dBi
FCC limit:	
MPE limit for uncontrolled exposure at prediction frequency:	0.602000 mW/cm ² 6.020000 W/m ²
Minimum calculated prediction distance for compliance:	20 cm
Typical (declared) distance:	20 cm
ISED limit:	
MPE limit for controlled exposure at prediction frequency:	0.274191 mW/cm ² 2.741906 W/m ²
Minimum calculated prediction distance for compliance:	20 cm
Average power density at prediction frequency:	0.010933 mW/cm ² 0.109328 W/m ²
Margin of Compliance:	
Margin of Compliance:	17.41 dB
Maximum allowable antenna gain:	18.31 dBi
Margin of Compliance:	13.99 dB
Maximum allowable antenna gain:	14.89 dBi

1.1.5 MPE calculation for simultaneous operation

BLE	LoRa
Fundamental transmit (prediction) frequency:	903 MHz
Maximum measured conducted peak output power:	16.5 dBm
Cable and/or jumper loss:	0 dB
Maximum peak power at antenna input terminal:	16.5 dBm
Duty cycle:	100 %
Maximum calculated average power at antenna input terminal:	44.668359 mW
Single Antenna gain (typical):	0.9 dBi
Number of antennae:	1
Total system gain:	0.90 dBi
ISED limit	FCC limit
0.53508 mW/cm ² 5.350805 W/m ²	1.000000 mW/cm ² 10.00000 W/m ²
3.16361 mW/cm ² 31.63609 W/m ²	5.000000 mW/cm ² 50.00000 W/m ²
20 cm	20 cm
20 cm	20 cm
Average power density at prediction frequency:	0.000114 mW/cm ² 0.001145 W/m ²
ISED limit	FCC limit
0.27419 mW/cm ² 2.741906 W/m ²	1.00000 mW/cm ² 10.00000 W/m ²
1.93972 mW/cm ² 19.39725 W/m ²	3.01000 mW/cm ² 30.10000 W/m ²
20 cm	20 cm
20 cm	20 cm
MPE compliance for simultaneous operation:	
Margin of Compliance for controlled environment:	44.41 dB
with Maximum permitted antenna gain:	45.31 dBi
Margin of Compliance for uncontrolled environment:	36.70 dB
with Maximum permitted antenna gain:	37.60 dBi
Average power density to MPE limit ratio (uncontrolled):	0.000
Average power density to MPE limit ratio (controlled):	0.000
Total sum of ratios for FCC (uncontrolled):	0.011 <1
Total sum of ratios for ISED (uncontrolled):	0.040 <1
Maximum allowed sum of ratios:	1
Total sum of ratios for FCC (controlled):	0.004 <1
Total sum of ratios for ISED (controlled):	0.006 <1
Total RF value for ISED:	0.1105 W/m ²

1.1.6 Verdict

The calculation is below the limit; therefore, the product is passing the RF Exposure requirements for the declared distance.

1.1.7 RSS-102, Annex A - RF technical brief cover sheet

IC Certification Number	24934-B01004		
Product marketing name (PMN)	Bell IQ Total Solutions		
Hardware version identification number (HVIN)	Pulse Rat IQ Total, Pulse Mouse IQ Total, 24/7 IQ Total		
Firmware version identification number (FVIN)	N/A		
Host marketing name (HMN)	N/A		
Applicant name	Smartwave Technologies		
SAR/RF exposure test laboratory	2040A-4 (3 m semi anechoic chamber)		
Type of evaluation	<input type="checkbox"/> SAR Evaluation: Device Used in the Vicinity of the Human Head <input type="checkbox"/> SAR Evaluation: Body-Worn Device and Body-Supported Device <input type="checkbox"/> SAR Evaluation: Limb-Worn Device <input checked="" type="checkbox"/> RF Exposure Evaluation <input type="checkbox"/> Nerve Stimulation Exposure Evaluation (SPR-002)		
RF exposure evaluation (BLE)	Evaluated against exposure limits:	<input checked="" type="checkbox"/> General Public Use	<input type="checkbox"/> Controlled Use
	Duty cycle used in evaluation:	100 %	
	Operational frequency:	2402 MHz	
	Standard used for evaluation:	Safety Code 6	
	Measurement distance:	0.2 m	
	RF value:	0.0011	<input checked="" type="checkbox"/> W/m ² <input type="checkbox"/> V/m <input type="checkbox"/> A/m <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input checked="" type="checkbox"/> Calculated
	Evaluated against exposure limits:	<input checked="" type="checkbox"/> General Public Use	<input type="checkbox"/> Controlled Use
RF exposure evaluation (LoRa)	Duty cycle used in evaluation:	100 %	
	Operational frequency:	903 MHz	
	Standard used for evaluation:	Safety Code 6	
	Measurement distance:	0.2 m	
	RF value:	0.1093	<input checked="" type="checkbox"/> W/m ² <input type="checkbox"/> V/m <input type="checkbox"/> A/m <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input checked="" type="checkbox"/> Calculated
	Evaluated against exposure limits:	<input checked="" type="checkbox"/> General Public Use	<input type="checkbox"/> Controlled Use
	Duty cycle used in evaluation:	100 %	
RF exposure evaluation (BLE + LoRa)	Operational frequency:	2402 + 903 MHz	
	Standard used for evaluation:	Safety Code 6	
	Measurement distance:	0.2 m	
	RF value:	0.1105	<input checked="" type="checkbox"/> W/m ² <input type="checkbox"/> V/m <input type="checkbox"/> A/m <input type="checkbox"/> Measured <input type="checkbox"/> Computed <input checked="" type="checkbox"/> Calculated
	Evaluated against exposure limits:	<input checked="" type="checkbox"/> General Public Use	<input type="checkbox"/> Controlled Use
	Duty cycle used in evaluation:	100 %	
	Operational frequency:	2402 + 903 MHz	

End of the test report