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RADIO TEST REPORT

Report ID
REP007132

Project ID
PRJ0018887

Type of assessment:
MPE Calculation report

Manufacturer:
TopVu Ltd.

Hardware Version Identification Number (HVIN):
RDRG3

Product Marketing Name (PMN):
RDRG3

FCC identifier:
FCC ID: 2APX4RDRG3

ISED certification number:
IC: 22620-RDRG3

Specification:

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

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: February 17, 2023

Alvin Liu, EMC/RF Specialist
Prepared by

Signature

Lab locations

Company name	Nemko Canada Inc.			
Facilities	*Ottawa site:* 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	*Montréal site:* 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	*Cambridge site:* 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2 Tel: +1 519 650 4811	*Almonte site:* 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0 Tel: +1 613 256-9117

Test site identifier	**Organization**	**Ottawa/Almonte**	**Montreal**	**Cambridge**
	FCC:	CA2040	CA2041	CA0101
	ISED:	2040A-4	2040G-5	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.

Copyright notification

Table of Contents

Section 1 Evaluation summary

1.1 MPE calculation for standalone 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 ƒ 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 ƒ 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 frequency	902.5 MHz
Antenna type	Panel antenna
Antenna gain	7 dBi
Number of antennas	1
Maximum transmitter conducted power	25.25 dBm (335 mW)
Prediction distance	25 cm

1.1.3 MPE calculation

Fundamental transmit (prediction) frequency:	902.5	MHz
Maximum measured conducted peak output power:	25.25	dBm
Cable and/or jumper loss:	0	dB
Maximum peak power at antenna input terminal:	25.25	dBm
Tx On time:	1.000	ms
Tx period time:	1.000	ms
Average factor:	100	%
Maximum calculated average power at antenna input terminal:	334.9654392	mW
Single Antenna gain (typical):	7	dBi
Number of antennae:	1	
Total system gain:	7.00	dBi

	FCC limit:		ISED limit:	
MPE limit for uncontrolled exposure at prediction frequency:	**0.601667**	**mW/cm²**	**0.274087**	**mW/cm²**
	6.016667	W/m²	2.740868	W/m²
Minimum calculated prediction distance for compliance:	20	cm	22	cm
Typical (declared) distance:	25	cm	25	cm
Average power density at prediction frequency:	**0.213752**	**mW/cm²**	**0.213752**	**mW/cm²**
	2.137520	W/m²	2.137520	W/m²
Margin of Compliance:	**4.49**	**dB**	**1.08**	**dB**
Maximum allowable antenna gain:	11.49	dBi	8.08	dBi

1.1.4 Verdict

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

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

IC Certification Number	22620-RDRG3		
Product marketing name (PMN)	RDRG3		
Hardware version identification number (HVIN)	RDRG3		
Firmware version identification number (FVIN)	N/A		
Host marketing name (HMN)	RDRG3		
Applicant company number	22620		
Applicant name	TopVu Ltd.		
SAR/RF exposure test laboratory	24676 (3 m semi anechoic chamber)		
Type of evaluation	☐ SAR Evaluation: Device Used in the Vicinity of the Human Head ☐ SAR Evaluation: Body-Worn Device and Body-Supported Device ☐ SAR Evaluation: Limb-Worn Device ☒ RF Exposure Evaluation ☐ Nerve Stimulation Exposure Evaluation (SPR-002)		
RF exposure evaluation	Evaluated against exposure limits:	☒ General Public Use ☐ Controlled Use	
	Duty cycle used in evaluation:	**100**	%
	Operational frequency:	**902.5**	MHz
	Standard used for evaluation:	**Safety Code 6**	
	Measurement distance:	**0.25**	m
	RF value:	**2.138**	☒ W/m² ☐ V/m ☐ A/m ☐ Measured ☐ Computed ☒ Calculated

1.2 MPE calculation for simultaneous transmission

1.2.1 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 1.2-1: *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 ƒ 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 ƒ 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)

1.2.2 EUT technical information

	Transmitter 1 (RFID)	Transmitter 2 (Wi-Fi)	Transmitter 3 (BLE)
Prediction frequency	902.5 MHz	2437 MHz	2402 – 2480 MHz
Antenna type	Panel antenna	Whip antenna	PCB
Antenna gain	7 dBi	3 dBi	3.5 dBi
Maximum transmitter conducted power	25.25 dBm (335 mW)	19.69 dBm (93.11 mW)	4.8 dBm (3.02 mW)
Prediction distance	25 cm	25 cm	25 cm

1.2.3 MPE calculation

	Transmitter 1		Transmitter 2		Transmitter 3	
Fundamental transmit (prediction) frequency:	902.5 MHz		2437 MHz		2402 MHz	
Maximum measured conducted peak output power:	25.25 dBm		19.69 dBm		4.8 dBm	
Cable and/or jumper loss:	0 dB		0 dB		0 dB	
Maximum peak power at antenna input terminal:	25.25 dBm		19.69 dBm		4.8 dBm	
Tx On time:	1.000 ms		1.000 ms		1.000 ms	
Tx period time:	1.000 ms		1.000 ms		1.000 ms	
Average factor:	100 %		100 %		100 %	
Maximum calculated average power at antenna input terminal:	334.96544 mW		93.110788 mW		3.0199517 mW	
Single Antenna gain (typical):	7 dBi		3 dBi		3.5 dBi	
Number of antennae:	1		1		1	
Total system gain:	7.00 dBi		3.00 dBi		3.50 dBi	
	ISED limit	**FCC limit**	**ISED limit**	**FCC limit**	**ISED limit**	**FCC limit**
MPE limit for uncontrolled exposure at prediction frequency:	**0.274087 mW/cm²**	**1.000000 mW/cm²**	**0.540397 mW/cm²**	**1.000000 mW/cm²**	**0.535080 mW/cm²**	**1.000000 mW/cm²**
	2.740868 W/m²	10.000000 W/m²	5.403965 W/m²	10.000000 W/m²	5.350805 W/m²	10.000000 W/m²
Minimum calculated prediction distance for compliance:	22 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Typical (declared) distance:	25 cm	25 cm	25 cm	25 cm	25 cm	25 cm
Average power density at prediction frequency:	**0.213752 mW/cm²**	**0.213752 mW/cm²**	**0.023654 mW/cm²**	**0.023654 mW/cm²**	**0.000861 mW/cm²**	**0.000861 mW/cm²**
	2.137520 W/m²	2.137520 W/m²	0.236543 W/m²	0.236543 W/m²	0.008608 W/m²	0.008608 W/m²
Combined MPE compliance:						
Margin of Compliance:	**1.08 dB**	**6.70 dB**	**13.59 dB**	**16.26 dB**	**27.94 dB**	**30.65 dB**
Maximum allowable antenna gain:	8.08 dBi	6.70 dBi	16.59 dBi	16.26 dBi	31.44 dBi	30.65 dBi
Average power density to MPE limit ratio:	0.780	0.214	0.044	0.024	0.002	0.001
Total sum of ratios for FCC:	0.238					
Total sum of ratios for ISED:	0.825					
Maximum allowed sum of ratios:	1					

1.2.4 Verdict

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

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

IC Certification Number	22620-RDRG3		
Product marketing name (PMN)	RDRG3		
Hardware version identification number (HVIN)	RDRG3		
Firmware version identification number (FVIN)	N/A		
Host marketing name (HMN)	RDRG3		
Applicant company number	22620		
Applicant name	TopVu Ltd.		
SAR/RF exposure test laboratory	24676 (3 m semi anechoic chamber)		
Type of evaluation	☐ SAR Evaluation: Device Used in the Vicinity of the Human Head ☐ SAR Evaluation: Body-Worn Device and Body-Supported Device ☐ SAR Evaluation: Limb-Worn Device ☒ RF Exposure Evaluation ☐ Nerve Stimulation Exposure Evaluation (SPR-002)		
RF exposure evaluation	Evaluated against exposure limits:	☒ General Public Use	☐ Controlled Use
	Duty cycle used in evaluation:	**100**	%
	Operational frequency:	**902.5**	MHz
	Standard used for evaluation:	**Safety Code 6**	
	Measurement distance:	**0.25**	m
	RF value:	**2.383**	☒ W/m^2 ☐ V/m ☐ A/m ☐ Measured ☐ Computed ☒ Calculated

End of the test report