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RADIO TEST REPORT – 454155-3APFWL

Type of assessment:

MPE Calculation report

Manufacturer:

Redline Communications Inc.

Hardware Version Identification Number (HVIN):

RDL-3211 XC

Product Marketing Name (PMN):

RDL-3211 XC

FCC ID:

QC8-RDL3211XC

IC certification number:

4310A-RDL3211XC

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: March 29, 2022

Fahar Abdul Sukkoor, EMC/RF Specialist

Prepared by

Signature

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SCC File Number: 15064 (Ottawa/Almonte); 151100 (Montreal); 151097 (Cambridge)

FCC and RSS-102 Annex C – MPE Calculation; Date: May 2021

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Lab locations

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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.

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Section 1 Evaluation summary

1.1 MPE calculation for 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

	Transmitter 1 (UNII-3)	Transmitter 2 (2.4 GHz BLE)
Prediction frequency	5.790 GHz	2.444 GHz
Antenna type	Dual Polarization Antenna	Dipole Antenna
Antenna gain	25 dBi	2.14 dBi
Maximum transmitter conducted power	24.46 dBm (279.25 mW)	19.56 dBm (90.37 mW)
Prediction distance	100 cm	100 cm

1.1.3 MPE calculation

	Transmitter 1		Transmitter 2	
Fundamental transmit (prediction) frequency:	5790 MHz		2444 MHz	
Maximum measured conducted peak output power:	24.46 dBm		19.56 dBm	
Cable and/or jumper loss:	0.7 dB		0 dB	
Maximum peak power at antenna input terminal:	23.76 dBm		19.56 dBm	
Tx On time:	0.950 ms		1.000 ms	
Tx period time:	1.000 ms		1.000 ms	
Average factor:	95 %		100 %	
Maximum calculated average power at antenna input terminal:	225.8 mW		90.3649 mW	
Single Antenna gain (typical):	25 dBi		2.14 dBi	
Number of antennae:	1		1	
Total system gain:	25.00 dBi		2.14 dBi	
MPE limit for uncontrolled exposure at prediction frequency:	ISSED limit 0.976225 mW/cm ²	FCC limit 1.000000 mW/cm ²	ISSED limit 0.541457 mW/cm ²	FCC limit 1.000000 mW/cm ²
Minimum calculated prediction distance for compliance:	9.762252 W/m ² 76 cm	10.00 W/m ² 75 cm	5.414569 W/m ² 20 cm	10.00 W/m ² 20 cm
Typical (declared) distance:	100 cm	100 cm	100 cm	100 cm
Average power density at prediction frequency:	0.568216 mW/cm ² 5.682164 W/m ²	0.568216 mW/cm ² 5.682164 W/m ²	0.001177 mW/cm ² 0.011770 W/m ²	0.001177 mW/cm ² 0.011770 W/m ²
Combined MPE compliance:				
Margin of Compliance:	2.35 dB	2.45 dB	26.63 dB	29.29 dB
Maximum allowable antenna gain:	27.35 dBi	2.45 dBi	28.77 dBi	29.29 dBi
Average power density to MPE limit ratio:	0.582	0.568	0.002	0.001
Total sum of ratios for FCC:	0.569			
Total sum of ratios for ISSED:	0.584			
Maximum allowed sum of ratios:	1			

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	4310A-RDL3211XC
Product marketing name (PMN)	RDL-3211 XC
Hardware version identification number (HVIN)	RDL-3211 XC
Firmware version identification number (FVIN)	N/A
Host marketing name (HMN)	N/A
Applicant company number	4310A
Applicant name	Redline Communications Inc.
SAR/RF exposure test laboratory	2040A-4 (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)
SAR evaluation	Multiple transmitters: ☐ Yes ☐ No Evaluated against exposure limits: ☐ General Public Use ☐ Controlled Use Duty cycle used in evaluation: N/A % Separation distance: N/A mm Standard used for evaluation: N/A SAR value: N/A W/kg ☐ Measured ☐ Computed ☐ Calculated
Nerve Stimulation Evaluation (SPR-002)	Evaluated against exposure limits: ☐ General Public Use ☐ Controlled Use Measurement distance: N/A m Field Strength: N/A ☐ V/m (electric) ☐ A/m (magnetic) ☐ Measured ☐ Computed ☐ Calculated Exposure condition: ☐ Whole body/Torso/Head ☐ Leg ☐ Arm ☐ Hand/Foot
RF exposure evaluation	Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use Duty cycle used in evaluation: 95 % Operational frequency: 5790 MHz Standard used for evaluation: Safety Code 6 Measurement distance: 1.0 m RF value: ☒ W/m ² ☐ V/m ☐ A/m ☐ Measured ☐ Computed ☒ Calculated

End of the test report