RF Exposure Evaluation Report

APPLICANT	:	**Rolling Wireless S.à r.l.**
EQUIPMENT	:	**Module**
BRAND NAME	:	**Rolling Wireless**
MODEL NAME	:	**RL9422**
FCC ID	:	**2AX2URL9422**
STANDARD	:	**47 CFR Part 2.1091**

The product evaluation date was started from Sep. 13, 2022 and completed on Sep. 13, 2022. We, Sporton International Inc. (Shenzhen), would like to declare that the device has been evaluated in accordance with 47 CFR Part2.1091, and pass the limit. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA240603	Rev. 01	Initial issue of report.	Sep. 19, 2022

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	SAR01-SZ	CN1256	421272

Applicant	
Company Name	Rolling Wireless S.à r.l.
Address	15, rue Edward Steichen, 2540 Luxembourg

Manufacturer	
Company Name	Rolling Wireless S.à r.l.
Address	15, rue Edward Steichen, 2540 Luxembourg

2. Guidance Applied

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR Part 2.1091
- KDB 447498 D04 Interim General RF Exposure Guidance v01
- FCC 47 CFR Part 1.1307

3. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Module
Brand Name	Rolling Wireless
Model Name	RL9422
FCC ID	2AX2URL9422
Wireless Technology and Frequency Range	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2 : 1850 MHz ~ 1910 MHz LTE Band 4 : 1710 MHz ~ 1755 MHz LTE Band 5 : 824 MHz ~ 849 MHz LTE Band 12 : 699 MHz ~ 716 MHz LTE Band 13 : 777 MHz ~ 787 MHz LTE Band 17: 704 MHz ~ 716 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is not supported) LTE: QPSK, 16QAM, 64QAM (Downlink Only)
Antenna Gain	WWAN: 2.0 dBi
Antenna Type	WWAN: Dipole Antenna
HW Version	1.0
SW Version	AFPQ9X40A_01.08.00.00
EUT Stage	Identical Prototype

Remark:

1. There are two antennas on the jig, the main antenna supports TX/RX, and the diversity antenna supports RX only.

2. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Comments and Explanations:
1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.
2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

4. Maximum RF average output tune up power among production units

<GSM>

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GSM (GMSK, 1 Tx slot)	35.00	32.00
GPRS (GMSK, 1 Tx slot)	35.00	32.00
GPRS (GMSK, 2 Tx slots)	33.00	30.00
GPRS (GMSK, 3 Tx slots)	31.00	27.50
GPRS (GMSK, 4 Tx slots)	29.00	26.00
EDGE (8PSK, 1 Tx slot)	30.00	29.00
EDGE (8PSK, 2 Tx slots)	30.00	29.00
EDGE (8PSK, 3 Tx slots)	28.00	26.00
EDGE (8PSK, 4 Tx slots)	28.00	26.00

<WCDMA>

Mode		Maximum Average power(dBm)
WCDMA	Band II	25.70
	Band IV	25.70
	Band V	25.70

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	25.70
	Band 4	25.70
	Band 5	25.70
	Band 12	25.70
	Band 13	25.70
	Band 17	25.70

5. RF Exposure Limit Introduction

1. Per 1.1307(b)(3), (i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$\mathrm{P}_{th}\ (\mathrm{mW}) = \begin{cases} \mathrm{ERP}_{20\ cm}\ (\mathrm{d}/20\ \mathrm{cm})^{x} & d \le 20\ cm \\ \mathrm{ERP}_{20\ cm} & 20\ cm < d \le 40\ cm \end{cases} \quad [1]$$

$$\text{Where} \quad \mathrm{x} = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and f is in GHz} \quad [2]$$

$$\text{and} \quad \mathrm{ERP}_{20\ cm}\ (\mathrm{mW}) = \begin{cases} 2040\mathrm{f} & 0.3\ GHz < f \le 1.5\ GHz \\ 3060 & 1.5\ GHz < f \le 6\ GHz \end{cases} \quad [3]$$

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value)

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2 /f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2 f
1,500-100,000	19.2 R^2

2. For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) In the case of ¦xed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

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

a. a = number of fixed, mobile, or portable RF sources claiming exemption using the § 1.1307(b)(3)(i)(B) formula for *P*th, including existing exempt transmitters and those being added.

b. b = number of fixed, mobile, or portable RF sources claiming exemption using the applicable § 1.1307(b)(3)(i)(C) Table 1 formula for Threshold ERP, including existing exempt transmitters and those being added.

c. c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance.

d. *Pi,* the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive)

e. *P*th,*i* the exemption threshold power (*P*th) according to the § 1.1307(b)(3)(i)(B) formula for fixed, mobile, or portable RF source *i*.

f. *ERPj* the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source *j*.

g. *ERP*th,*j* exemption threshold ERP for fixed, mobile, or portable RF source *j*, at a distance of at least λ/2π, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

h. *Evaluatedk* the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation.

i. *Exposure Limitk* either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable sources RF source k, as applicable from § 1.1310 of this chapter.

j. The relationship between EIRP and ERP is: ERP (dBm) = EIRP - 2.15, Where EIRP is the sum of the conducted power (dBm) and the antenna gain (dBi)

The sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance

6. Radio Frequency Radiation Exposure Evaluation

6.1. Standalone assessment

Band	Antenna Gain (dBi)	Maximum Burst average Power (dBm)	Frame-Average EIRP (dBm)	Average ERP (dBm)	Average ERP (mW)	Separation Distance (cm)	Part1.1307 option(b) Threshold (mW)
GSM/GPRS 850 (1 Tx slot)	2.00	35.00	28.00	25.85	384.59	20	1681.368
GPRS 850 (2 Tx slots)	2.00	33.00	29.00	26.85	484.17	20	1680.960
GPRS 850 (3 Tx slots)	2.00	31.00	28.74	26.59	456.04	20	1681.368
GPRS 850 (4 Tx slots)	2.00	29.00	28.00	25.85	384.59	20	1681.368
EGPRS 850 (1 Tx slot)	2.00	30.00	23.00	20.85	121.62	20	1681.368
EGPRS 850 (2 Tx slots)	2.00	30.00	26.00	23.85	242.66	20	1680.960
EGPRS 850 (3 Tx slots)	2.00	28.00	25.74	23.59	228.56	20	1680.960
EGPRS 850 (4 Tx slots)	2.00	28.00	27.00	24.85	305.49	20	1680.960
GSM/GPRS 1900 (1 Tx slot)	2.00	32.00	25.00	22.85	192.75	20	3060.000
GPRS 1900 (2 Tx slots)	2.00	30.00	26.00	23.85	242.66	20	3060.000
GPRS 1900 (3 Tx slots)	2.00	27.50	25.24	23.09	203.70	20	3060.000
GPRS 1900 (4 Tx slots)	2.00	26.00	25.00	22.85	192.75	20	3060.000
EGPRS 1900 (1 Tx slot)	2.00	29.00	22.00	19.85	96.61	20	3060.000
EGPRS 1900 (2 Tx slots)	2.00	29.00	25.00	22.85	192.75	20	3060.000
EGPRS 1900 (3 Tx slots)	2.00	26.00	23.74	21.59	144.21	20	3060.000
EGPRS 1900 (4 Tx slots)	2.00	26.00	25.00	22.85	192.75	20	3060.000

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.
To frame-averaged power, the Division Factors are shown as below:

Tx slot	1 Tx Slot	2 Tx Slot	3 Tx Slot	4 Tx Slot
Division Factors(dB)	-9	-6	-4.26	-3

The calculated method are shown as below:
Frame-averaged power = Maximum burst averaged power (1 Tx Slot) - 9 dB
Frame-averaged power = Maximum burst averaged power (2 Tx Slots) - 6 dB
Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB
Frame-averaged power = Maximum burst averaged power (4 Tx Slots) - 3 dB

Band	Antenna Gain (dBi)	Maximum Conducted Power (dBm)	Maximum EIRP (dBm)	Maximum ERP (dBm)	Maximum ERP (mW)	Separation Distance (cm)	Part1.1307 option(b) Threshold (mW)
WCDMA Band 2	2.00	25.70	27.70	25.55	358.92	20	3060.000
WCDMA Band 4	2.00	25.70	27.70	25.55	358.92	20	3060.000
WCDMA Band 5	2.00	25.70	27.70	25.55	358.92	20	1680.960
LTE Band 2	2.00	25.70	27.70	25.55	358.92	20	3060.000
LTE Band 4	2.00	25.70	27.70	25.55	358.92	20	3060.000
LTE Band 5	2.00	25.70	27.70	25.55	358.92	20	1680.960
LTE Band 12	2.00	25.70	27.70	25.55	358.92	20	1425.960
LTE Band 13	2.00	25.70	27.70	25.55	358.92	20	1585.080
LTE Band 17	2.00	25.70	27.70	25.55	358.92	20	1436.160

Note:
1. Chose the maximum power to do MPE analysis.

Conclusion:

According to 47 CFR §1.1307 (b)(3)(i)(B), the RF exposure analysis concludes that the RF Exposure is FCC compliant.

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