

RF Exposure Evaluation Report

APPLICANT : Rolling Wireless S.à r.l.
EQUIPMENT : Module
BRAND NAME : Rolling Wireless
MODEL NAME : RN932N
FCC ID : 2AX2URN932N
STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Apr. 07, 2024 and completed on Apr. 15, 2024. We, Sporton International Inc. (Shenzhen), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.



Approved by: Si Zhang

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA420801	Rev. 01	Initial issue of report.	Apr. 15, 2024



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. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Module
Brand Name	Rolling Wireless
Model Name	RN932N
FCC ID	2AX2URN932N
Wireless Technology and Frequency Range	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 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 66 : 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n71 : 663 MHz ~ 698 MHz 5G NR n77 : 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3980 MHz 5G NR n78 : 3450 MHz ~ 3550 MHz, 3700 MHz ~ 3800 MHz
Mode	RMC/AMR 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+(16QAM uplink is supported) LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM
Antenna Type	WWAN: Glue Stick Antenna
HW Version	1
SW Version	AFPQ52XA_00.12.09.00
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. The intra-band/inter-band ULCA and EN-DC mode combination could be referred to the product spec.
3. This device supports intra-band ULCA, due to intra-band ULCA and non-CA power is same, so non-CA MPE analysis can represent ULCA MPE analysis.
4. 5G NR n2/5/66/71/41 supports SA mode only, and 5G NR n77/78 supports SA mode and NSA mode.
5. This device supports HPUE mode for LTE Band 41 and 5G NR n77/78 with class 2 power level, so HPUE has been performed to do MPE analysis.

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.

**3. Maximum RF average output tune up power among production units****<WCDMA>**

Mode		Maximum Average power(dBm)
WCDMA	Band II	25.00
	Band IV	25.00
	Band V	25.00

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	24.50
	Band 4	24.50
	Band 5	24.50
	Band 12	24.50
	Band 13	24.50
	Band 14	24.50
	Band 17	24.50
	Band 41	24.50
	Band 41 HPUE	26.50
	Band 66	24.50
	Band 71	24.50



<5G NR>

Mode		Maximum Average power(dBm)
5G NR	n2	24.50
	n5	24.50
	n41	24.50
	n66	24.50
	n71	24.50
	n77	24.50
	n77 HPUE	27.00
	n78	24.50
	n78 HPUE	27.00

4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
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
1500-100,000			5	6
(B) 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
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Maximum Power (dBm)	MPE evaluation distance (cm)	FCC ERP/EIRP Limit (W)	Power Density for Max Gain to meet FCC ERP/EIRP and MPE limit (mW/cm ²)	Power Density for Max gain allowed (mW/cm ²)	FCC MPE Limit (mW)/cm ²	FCC MPE Result / FCC MPE Limit Ratio	Ant Gain to meet FCC MPE limit (dBi)	Ant Gain to meet FCC ERP/EIRP limit (dBi)	Max Gain to meet FCC ERP/EIRP and MPE limit (dBi)	Max Gain to consider same frequency with LTE or EN-DC Active	Max gain allowed (dBi)
WCDMA Band 2	1850.0	25.00	20.00	2.000	0.397	0.397	1.000	0.397	12.0	8.0	8.0	8.0	8.0
WCDMA Band 4	1710.0	25.00	20.00	1.000	0.199	0.199	1.000	0.199	12.0	5.0	5.0	5.0	5.0
WCDMA Band 5	824.0	25.00	20.00	7.000	0.548	0.251	0.549	0.456	9.4	13.4	9.4	6.0	6.0
LTE Band 2	1850.0	24.50	20.00	2.000	0.397	0.354	1.000	0.354	12.5	8.5	8.5	8.0	8.0
LTE Band 4	1710.0	24.50	20.00	1.000	0.199	0.177	1.000	0.177	12.5	5.5	5.5	5.0	5.0
LTE Band 5	824.0	24.50	20.00	7.000	0.548	0.223	0.549	0.407	9.9	13.9	9.9	6.0	6.0
LTE Band 12	699.0	24.50	20.00	3.000	0.456	0.199	0.466	0.427	9.1	10.2	9.1	5.5	5.5
LTE Band 13	777.0	24.50	20.00	3.000	0.512	0.223	0.518	0.431	9.6	10.2	9.6	6.0	6.0
LTE Band 14	788.0	24.50	20.00	3.000	0.524	0.223	0.525	0.425	9.7	10.2	9.7	6.0	6.0
LTE Band 17	704.0	24.50	20.00	3.000	0.467	0.199	0.469	0.424	9.2	10.2	9.2	5.5	5.5
LTE Band 41-HPUE	2496.0	26.50	20.00	2.000	0.397	0.397	1.000	0.397	10.5	6.5	6.5	6.5	6.5
LTE Band 66	1710.0	24.50	20.00	1.000	0.199	0.177	1.000	0.177	12.5	5.5	5.5	5.0	5.0
LTE Band 71	663.0	24.50	20.00	3.000	0.435	0.199	0.442	0.450	8.9	10.2	8.9	5.5	5.5
5G NR n2	1850.0	24.50	20.00	2.000	0.397	0.354	1.000	0.354	12.5	8.5	8.5	8.0	8.0
5G NR n5	824.0	24.50	20.00	7.000	0.548	0.223	0.549	0.407	9.9	13.9	9.9	6.0	6.0
5G NR n41	2496.00	24.50	20.00	2.000	0.397	0.251	1.000	0.251	12.5	8.5	8.5	6.5	6.5
5G NR n66	1710.0	24.50	20.00	1.000	0.199	0.177	1.000	0.177	12.5	5.5	5.5	5.0	5.0
5G NR n71	663.0	24.50	20.00	3.000	0.435	0.199	0.442	0.450	8.9	10.2	8.9	5.5	5.5
5G NR n77-HPUE	3450.0	27.00	20.00	1.000	0.199	0.199	1.000	0.199	10.0	3.0	3.0	3.0	3.0
5G NR n78-HPUE	3450.0	27.00	20.00	1.000	0.199	0.199	1.000	0.199	10.0	3.0	3.0	3.0	3.0

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum power to do MPE analysis.
3. This device supports HPUE mode for LTE Band 41 and 5G NR n77/78 with class 2 power level, so HPUE has been performed to do standalone power density calculation.

**5.2. Collocated Power Density Calculation****<EN-DC>**

LTE Power Density / Limit	5G NR Power Density / Limit	$\Sigma(\text{Power Density / Limit})$ of WWAN + 5G NR
0.450	0.450	0.900

<inter-band ULCA>

5G NR Power Density / Limit	5G NR Power Density / Limit	$\Sigma(\text{Power Density / Limit})$ of 5G NR + 5G NR
0.450	0.450	0.900

Note:

1. For collocation analysis, LTE Band 71 is chosen for summation due to the highest (power density/limit) among all WWAN wireless modes.
2. For collocation analysis, 5G NR n71 is chosen for summation due to the highest (power density/limit) among all 5G NR modes.
3. $\Sigma(\text{Power Density / Limit})$: This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE + 5G NR/ 5G NR inter-band ULCA.
4. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 2 collocated transmitters is compliant.

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.

-----THE END-----