

RF Exposure Evaluation Report

APPLICANT : Rolling Wireless S.a r.l.
EQUIPMENT : 5G module
BRAND NAME : Rolling Wireless
MODEL NAME : RW350R-GL
FCC ID : 2AX2URW350RGL
STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Jun. 01, 2024 and completed on Jun. 01, 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

Sporton International Inc. (Shenzhen)

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA430728	Rev. 01	Initial issue of report.	Jun. 13, 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.a r.l.
Address	8-10, rue Mathias Hardt 1717, Luxembourg

Manufacturer	
Company Name	Rolling Wireless S.a r.l.
Address	8-10, rue Mathias Hardt 1717, Luxembourg



2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	5G module
Brand Name	Rolling Wireless
Model Name	RW350R-GL
FCC ID	2AX2URW350RGL
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 7: 2500 MHz ~ 2570 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 25 : 1850 MHz ~ 1915 MHz LTE Band 26 : 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 42: 3450 MHz ~ 3600 MHz LTE Band 43: 3600 MHz ~ 3700MHz LTE Band 48: 3550 MHz ~ 3700 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 n7 : 2500 MHz ~ 2570 MHz 5G NR n12 : 699 MHz ~ 716 MHz 5G NR n14 : 788 MHz ~ 798 MHz 5G NR n25 : 1850 MHz ~1915 MHz 5G NR n26 : 814 MHz ~ 849 MHz 5G NR n30 : 2305 MHz ~ 2315 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n48 : 3550 MHz ~ 3700 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 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 Gain	WCDMA Band II: 4.00 dBi WCDMA Band IV: 3.00 dBi WCDMA Band V: 3.00 dBi LTE Band 2 : 4.00 dBi LTE Band 4 : 3.00 dBi LTE Band 5 : 3.00 dBi LTE Band 7 : 3.00 dBi LTE Band 12 : 3.00 dBi LTE Band 13 : 3.00 dBi LTE Band 14 : 3.00 dBi LTE Band 17 : 3.00 dBi LTE Band 25 : 4.00 dBi



	LTE Band 26 : 3.00 dBi LTE Band 30 : 1.00 dBi LTE Band 38 : 3.00 dBi LTE Band 41 : 3.00 dBi LTE Band 42 : 3.00 dBi for 3450 MHz ~ 3550 MHz; 1.00 dBi for 3550 MHz ~ 3600 MHz; LTE Band 43 : 1.00 dBi LTE Band 48 : 1.00 dBi LTE Band 66: 3.00 dBi LTE Band 71: 3.00 dBi 5G NR n2 : 4.00 dBi 5G NR n5 : 3.00 dBi 5G NR n7 : 3.00 dBi 5G NR n12 : 3.00 dBi 5G NR n14 : 3.00 dBi 5G NR n25: 4.00 dBi 5G NR n26 : 3.00 dBi 5G NR n30 : 1.00 dBi 5G NR n38 : 3.00 dBi 5G NR n41 : 3.00 dBi 5G NR n48: 1.00 dBi 5G NR n66 : 3.00 dBi 5G NR n71 : 3.00 dBi 5G NR n77 : 3.00 dBi 5G NR n78 : 3.00 dBi
Antenna Type	WWAN : External Monopole Antenna / External PIFA Antenna
HW Version	V1.1
SW Version	81601.0000.00.29.24.13
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 n2/5/7/12/14/25/26/30/38/41/48/66/71/77/78 supports SA mode.
5. 5G NR n2/5/25/41/48/66/71/77/78 supports NSA mode.
6. This device supports HPUE mode for 5G NR n41/77/78 with class 2 power level, so HPUE has been performed to do MPE analysis.
7. For 5G NR FDD/TDD supports SCS15KHz and SCS30KHz, chose higher power which is for FDD/TDD bands to perform MPE analysis.
8. There are two antenna types provided by different manufacturers, and the manufacturer declares that the antenna gain values are the same.
9. Chose the maximum RF output tune up power and the maximum antenna gain of all antennas among same frequency WWAN bands to perform MPE calculation conservatively.
10. There are two types of EUT, the differences could be referred to the RW350R-GL_Operational Description of Product Equality Declaration which is exhibit separately, and the differences do not affect the MPE analysis results.

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	24.50
	Band IV	24.50
	Band II	24.50

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	24.00
	Band 4	24.00
	Band 5	24.00
	Band 7	24.00
	Band 12	24.00
	Band 13	24.00
	Band 14	24.00
	Band 17	24.00
	Band 25	24.00
	Band 26	24.00
	Band 30	23.00
	Band 38	24.00
	Band 41	24.00
	Band 42	22.00
	Band 43	22.00
	Band 48	22.00
	Band 66	24.00
	Band 71	24.00



<5GNR>

Mode		Maximum Average power(dBm)
5GNR	n2	24.00
	n5	24.00
	n7	24.00
	n12	24.00
	n14	24.00
	n25	24.00
	n26	24.00
	n30	23.00
	n38	24.00
	n41	24.00
	n41 HPUE	27.00
	n48	22.00
	n66	24.00
	n71	24.00
	n77	24.00
	n77 HPUE	27.00
	n78	24.00
	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)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
WCDMA Band 2	1852.4	4.00	24.50	28.500	707.946	0.141	1.000	0.141
WCDMA Band 4	1712.4	3.00	24.50	27.500	562.341	0.112	1.000	0.112
WCDMA Band 5	826.4	3.00	24.50	27.500	562.341	0.112	0.551	0.203
LTE Band 2	1850.0	4.00	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 4	1710.0	3.00	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 5	824.0	3.00	24.00	27.000	501.187	0.100	0.549	0.182
LTE Band 7	2500.0	3.00	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 12	699.0	3.00	24.00	27.000	501.187	0.100	0.466	0.214
LTE Band 13	777.0	3.00	24.00	27.000	501.187	0.100	0.518	0.193
LTE Band 14	788.0	3.00	24.00	27.000	501.187	0.100	0.525	0.190
LTE Band 17	704.0	3.00	24.00	27.000	501.187	0.100	0.469	0.213
LTE Band 25	1850.0	4.00	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 26	814.0	3.00	24.00	27.000	501.187	0.100	0.543	0.184
LTE Band 30	2305.0	1.00	23.00	24.000	251.189	0.050	1.000	0.050
LTE Band 38	2570.0	3.00	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 41	2496.0	3.00	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 42	3450.0	3.00	22.00	25.000	316.228	0.063	1.000	0.063
LTE Band 43	3600.0	3.00	22.00	25.000	316.228	0.040	1.000	0.040
LTE Band 48	3550.0	1.00	22.00	23.000	199.526	0.040	1.000	0.040
LTE Band 66	1710.0	3.00	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 71	663.0	3.00	24.00	27.000	501.187	0.100	0.442	0.226
5G NR n2	1850.0	4.00	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n5	824.00	3.00	24.00	27.000	501.187	0.100	0.549	0.182
5G NR n7	2500.00	3.00	24.00	27.000	501.187	0.100	1.000	0.100
5G NR n12	699.00	3.00	24.00	27.000	501.187	0.100	0.466	0.214
5G NR n14	788.00	3.00	24.00	27.000	501.187	0.100	0.525	0.190
5G NR n25	1850.00	4.00	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n26	814.00	3.00	24.00	27.000	501.187	0.100	0.543	0.184
5G NR n30	2305.00	1.00	23.00	24.000	251.189	0.050	1.000	0.050
5G NR n38	2570.00	3.00	24.00	27.000	501.187	0.100	1.000	0.100
5G NR n41	2496.00	3.00	27.00	30.000	1000.000	0.199	1.000	0.199
5G NR n48	3550.00	1.00	22.00	23.000	199.526	0.040	1.000	0.040
5G NR n66	1710.00	3.00	24.00	27.000	501.187	0.100	1.000	0.100
5G NR n71	663.00	3.00	24.00	27.000	501.187	0.100	0.442	0.226
5G NR n77	3450.00	3.00	27.00	30.000	1000.000	0.199	1.000	0.199
5G NR n78	3450.00	3.00	27.00	30.000	1000.000	0.199	1.000	0.199

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. Chose the maximum RF output tune up power of all antennas among same frequency WWAN bands and the maximum antenna gain to perform MPE calculation conservatively.
3. This device supports HPUE mode for 5G NR n41/77/78 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
0.226	0.226	0.452

<LTE inter-band ULCA>

LTE Power Density / Limit	LTE Power Density / Limit	$\Sigma(\text{Power Density / Limit})$ of LTE + LTE
0.226	0.226	0.452

< 5G NR inter-band ULCA>

5G NR Power Density / Limit	5G NR Power Density / Limit	$\Sigma(\text{Power Density / Limit})$ of 5G NR + 5G NR
0.226	0.226	0.452

Note:

1. Always chose the worst evaluation value of NR and LTE standalone band to do analysis.
2. $\Sigma(\text{Power Density / Limit})$: This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for LTE + 5G NR/ LTE /5G NR inter-band ULCA.
3. 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-----