

RF Exposure Evaluation Report

APPLICANT : Fibocom Wireless Inc.
EQUIPMENT : 5G Module
BRAND NAME : Fibocom
MODEL NAME : FM350-GL
FCC ID : ZMOFM350GL
STANDARD : 47 CFR Part 2.1091

The product evaluation date was started from Jun. 15, 2023 and completed on Jun. 15, 2023. 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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People's Republic of China



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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	Fibocom Wireless Inc.
Address	1101, Tower A, Building 6, Shenzhen International Innovation Valley, Dashi 1st Rd, Nanshan, Shenzhen, China.

Manufacturer	
Company Name	Fibocom Wireless Inc.
Address	1101, Tower A, Building 6, Shenzhen International Innovation Valley, Dashi 1st Rd, Nanshan, Shenzhen, China.

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	5G Module
Brand Name	Fibocom
Model Name	FM350-GL
FCC ID	ZMOFM350GL
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 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 n25 : 1850 MHz ~1915 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) LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : DFT-s-OFDM (PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM) CP-OFDM (QPSK / 16QAM / 64QAM / 256QAM)
HW Version	V1.0.6
SW Version	81600.0000.00.29.22.06
EUT Stage	Identical Prototype

Remark:

- The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- This device supports HPUE for LTE band 41, 5G NR n41/n77/n78, CA_41C and n77 for ENDC 2A_n77, 5A_n77, 12A_n77A, 14A_n77A, 30A_n77A, 66A_n77A with class 2 power level, so HPUE has been performed standalone power density calculation.
- For DFT-s-OFDM and CP-OFDM output power measurement reduction, according to maximum power



reduction for the CP-OFDM mode will not higher than DFT-s-OFDM mode, therefore, CP-OFDM measurement is unnecessary. We always chose higher power (DFT-s-OFDM mode) to perform MPE analysis.

4. 5GNR n2/n5/n41/n66/n71/n77/n78/n48 supports NSA mode.
5. 5GNR n2/n5/n7/n25/n30/n38/n41/n66/n71/n77/n78/n48 supports SA mode.
6. 5GNR EN-DC mode, summed standalone MPE at total power level to show compliance.
7. 5GNR n41/n77/n78 supports MIMO mode, MIMO MPE using single each antenna MPE summed together as MIMO MPE is more conservatively.
8. NSA and SA mode should perform MPE analysis. For the maximum power of NSA mode is the same as SA total power level, so SA standalone total power level MPE can represent NSA mode MPE.
9. This device supports 5GNR CA combination: N2A-N5A and N5A-N66A, so 5GNR CA combination MPE summed single antenna MPE as 5GNR CA combination MPE for more conservatively evaluation.
10. The ULCA/EN-DC mode combination could be referred to the product spec.
11. This is a variant report for FM350-GL. For model change note, please refer to the FM350-GL_Class II Permissive Change letter which is exhibit separately. So based on the similarity between current and previous project, added 5GNR n48 evaluation based on original test report (Sporton Report Number FA051802-04 and SGS Report Number ZEWM2304000531RG02). And 5GNR n48 maximum tune up power from SGS MPE report and declared by applicant.

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 V	24.50

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	24.00
	Band 4	24.00
	Band 5	25.00
	Band 7	24.00
	Band 12	25.00
	Band 13	25.00
	Band 14	25.00
	Band 17	25.00
	Band 25	24.00
	Band 26	25.00
	Band 30	23.00
	Band 38	24.00
	Band 41	24.00
	Band 41-HPUE	27.00
	Band 48	22.00
Band66	24.00	
Band71	25.00	



<5G NR>

Mode		Maximum Average power(dBm)
5G NR	n2	24.00
	n5	25.00
	n7	24.00
	n25	24.00
	n30	23.00
	n38	24.00
	n41	24.00
	n41-HPUE	27.00
	n48	22.00
	n66	24.00
	n71	25.00
	n77-HPUE	27.00
	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	4.0	24.50	28.500	707.946	0.141	1.000	0.141
WCDMA Band 4	1712.4	3.0	24.50	27.500	562.341	0.112	1.000	0.112
WCDMA Band 5	826.4	3.0	24.50	27.500	562.341	0.112	0.551	0.203
LTE Band 2	1850.7	4.0	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 4	1710.7	3.0	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 5	824.7	3.0	25.00	28.000	630.957	0.126	0.550	0.228
LTE Band 7	2502.5	4.0	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 12	699.7	3.0	25.00	28.000	630.957	0.126	0.466	0.269
LTE Band 13	779.5	3.0	25.00	28.000	630.957	0.126	0.520	0.242
LTE Band 14	790.5	3.0	25.00	28.000	630.957	0.126	0.527	0.238
LTE Band 17	706.5	3.0	25.00	28.000	630.957	0.126	0.471	0.267
LTE Band 25	1850.7	4.0	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 26	814.7	3.0	25.00	28.000	630.957	0.126	0.543	0.231
LTE Band 30	2307.5	1.0	23.00	24.000	251.189	0.050	1.000	0.050
LTE Band 38	2572.5	4.0	24.00	28.000	630.957	0.126	1.000	0.126
LTE Band 41-HPUE	2498.5	4.0	27.00	31.000	1258.925	0.251	1.000	0.251
LTE Band 48	3552.5	1.0	22.00	23.000	199.526	0.040	1.000	0.040
LTE Band 66	1710.7	3.0	24.00	27.000	501.187	0.100	1.000	0.100
LTE Band 71	665.5	3.0	25.00	28.000	630.957	0.126	0.444	0.283
5G NR n2	1850	4.0	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n5	824	3.0	25.00	28.000	630.957	0.126	0.549	0.229
5G NR n7	2500	4.0	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n25	1850	4.0	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n30	2305	1.0	23.00	24.000	251.189	0.050	1.000	0.050
5G NR n38	2570	4.0	24.00	28.000	630.957	0.126	1.000	0.126
5G NR n41-HPUE	2496	4.0	27.00	31.000	1258.925	0.251	1.000	0.251
5G NR n48	3550.0	1.0	22.00	23.000	199.526	0.040	1.000	0.040
5G NR n66	1710	3.0	24.00	27.000	501.187	0.100	1.000	0.100
5G NR n71	663	3.0	25.00	28.000	630.957	0.126	0.442	0.284
5G NR n77-HPUE	3450	3.0	27.00	30.000	1000.000	0.199	1.000	0.199

Note:

- For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
- This device supports HPUE for LTE band 41 and 5G NR n41/n77/n78 with class 2 power level, so HPUE has been performed standalone power density calculation.
- Chose the maximum power to do MPE analysis.
- 5G NR n78 covered by 5G NR n77 with the same power level, so only chose 5G NR n77 to perform standalone power density calculation.
- 5G NR n41/n77/n78 supports MIMO mode, MIMO MPE using single each antenna MPE summed together as MIMO MPE is more conservatively.
- NSA and SA mode should perform MPE analysis. For the maximum power of NSA mode is the same as SA total power level, so SA standalone total power level MPE can represent NSA mode MPE.



5.2. Collocated Power Density Calculation

LTE + 5G NR

Table with 3 columns: WWAN Power Density / Limit, 5G NR Power Density / Limit, and Σ(Power Density / Limit) of WWAN + 5G NR. Values: 0.283, 0.284, 0.567

5G NR MIMO

Table with 3 columns: 5NR n41 Power Density / Limit, 5NR n41 Power Density / Limit, and Σ(Power Density / Limit) of 5G NR n41 + 5G NR n41. Values: 0.251, 0.251, 0.502

Table with 3 columns: 5NR n77 Power Density / Limit, 5NR n77 Power Density / Limit, and Σ(Power Density / Limit) of 5G NR n77 + 5G NR n77. Values: 0.199, 0.199, 0.398

5G NR CA:

Table with 3 columns: 5NR n2 Power Density / Limit, 5NR n5 Power Density / Limit, and Σ(Power Density / Limit) of 5G NR n2 + 5G NR n5. Values: 0.126, 0.229, 0.355

Table with 3 columns: 5NR n5 Power Density / Limit, 5NR n66 Power Density / Limit, and Σ(Power Density / Limit) of 5G NR n5 + 5G NR n66. Values: 0.229, 0.100, 0.329

Note:

- 1. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for 5G NR EN-DC mode, 5G NR MIMO mode and 5G NR CA.
2. 5G NR EN-DC mode, summed standalone MPE at total power level to show compliance.
3. For 5G NR MIMO mode, summed per chain together is more conservatively.
4. For collocation analysis, LTE band 71 and 5G NR n71 are chosen for summation due to the highest (power density/limit) among all WWAN wireless modes. Whether they can EN-DC component or not.
5. For collocation analysis, 5G NR n41/n77 is chosen for summation due to the mimo mode (power density/limit) among all 5G NR modes.
6. The aggregated (power density /limit) listed in the table above 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-----