

RF Exposure Evaluation Report

APPLICANT : Fibocom Wireless Inc.
EQUIPMENT : 5G Module
BRAND NAME : Fibocom
MODEL NAME : FG190W-NA, FG190-NA
FCC ID : ZMOFG190WNA
STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Aug. 29, 2024 and completed on Aug. 29, 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
FA472418	Rev. 01	Initial issue of report.	Aug. 04, 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	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	FG190W-NA, FG190-NA
FCC ID	ZMOFG190WNA
Wireless Technology and Frequency Range	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 n13 : 777 MHz ~ 787 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 n70 : 1695 MHz ~ 1710 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	LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM
Antenna Type	WWAN : Dipole Antenna
HW Version	V1.3
SW Version	99101.1000.00.01.06.23
EUT Stage	Production Unit

Remark:

- The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
- There are two types of EUT: Sample1(FG190W-NA) and Sample2(FG190-NA) , The difference between them is that Sample1 with RF interface while Sample2 without, all the others are the same. and the differences do not affect the MPE analysis results.
- The intra-band/inter-band ULCA, UL MIMO and EN-DC mode combination could be referred to the product spec.
- 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.
- 5GNR n2/5/7/12/13/14/25/26/30/38/41/48/66/70/71/77/78 supports SA mode.
- 5GNR n2/5/7/12/25/30/38/41/66/71/77/78 supports NSA mode.
- This device supports HPUE for LTE Band 41 and 5GNR n41/77/78 with class 2, so HPUE has been performed to do MPE analysis.
- The device supports HPUE (power class 2) under SISO mode and HPUE (power class 1.5) under UL MIMO mode for



5G NR n41/77/78, so HPUE (power class 1.5) has been performed MPE calculation.

9. 5G NR n2/25/41/48/66/70/71/77/78 support SISO/MIMO mode, only MIMO tune up power was chosen to perform MPE calculation conservatively for MIMO power is higher.
10. 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.

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.

Antenna Gain:

WWAN	Maximum Antenna gain (dBi)			
	Ant.1	Ant.2	Ant.7	Ant.8
LTE Band 2	-1.85	/	/	-1.85
LTE Band 4	-2.98	/	/	-2.98
LTE Band 5	/	/	/	1.32
LTE Band 7	-1.21	/	/	/
LTE Band 12	/	/	/	1.61
LTE Band 13	/	/	/	1.83
LTE Band 14	/	/	/	2.19
LTE Band 17	/	/	/	1.61
LTE Band 25	-1.85	/	/	-1.85
LTE Band 26	/	/	/	1.32
LTE Band 30	0.22	/	/	/
LTE Band 38	-1.21	/	/	/
LTE Band 41	-1.21	/	/	/
LTE Band 42	/	-4.13	/	/
LTE Band 43	/	-4.13	/	/
LTE Band 48	/	-4.13	/	/
LTE Band 66	-2.98	/	/	-2.98
LTE Band 71	1.61	/	/	1.61
5G NR n2	-1.85	/	/	-1.85
5G NR n5	/	/	/	1.32
5G NR n7	-1.21	/	/	/
5G NR n12	/	/	/	1.61
5G NR n13	/	/	/	1.83
5G NR n14	/	/	/	2.19
5G NR n25	-1.85	/	/	-1.85
5G NR n26	/	/	/	1.32
5G NR n30	0.22	/	/	/
5G NR n38	-1.21	/	/	-1.21
5G NR n41	-1.21	/	/	-1.21
5G NR n48	/	-4.13	-4.13	/
5G NR n66	-2.98	/	/	-2.98
5G NR n70	-2.86	/	/	-2.86
5G NR n71	1.61	/	/	1.61
5G NR n77(3450 MHz ~ 3550 MHz)	/	-6.13	-6.13	/
5G NR n77(3700 MHz ~ 3980 MHz)	/	-6.13	-6.13	/
5G NR n78(3450 MHz ~ 3550 MHz)	/	-6.13	-6.13	/
5G NR n78(3700 MHz ~ 3800 MHz)	/	-6.13	-6.13	/



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

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	25.5
	Band 4	25.5
	Band 5	25.5
	Band 7	24.5
	Band 12	25.5
	Band 13	25.5
	Band 14	25.5
	Band 17	25.5
	Band 25	25.5
	Band 26	25.5
	Band 30	23.5
	Band 38	25.5
	Band 41	25.5
	Band 41 HPUE	27.0
	Band 42	25.5
	Band 43	25.5
	Band 48	25.5
	Band 66	25.5
	Band 71	25.5

**<5GNR>**

Mode		Maximum Average power(dBm)
5GNR	n2	25.5
	n5	25.5
	n7	25.0
	n12	25.5
	n13	25.5
	n14	25.5
	n25	25.5
	n26	25.5
	n30	23.5
	n38	25.0
	n41	25.5
	n41 HPUE	27.0
	n48	25.5
	n66	25.5
	n70	25.5
	n71	25.5
	n77	25.5
	n77 HPUE	28.5
	n78	25.5
	n78 HPUE	28.5

<5GNR-MIMO>

Mode		Maximum Average power(dBm)
5GNR	n2	28.5
	n25	28.5
	n41	28.5
	n41 HPUE	30.0
	n48	28.5
	n66	28.5
	n70	28.5
	n71	28.5
	n77	28.5
	n77 HPUE	31.5
	n78	28.5
	n78 HPUE	31.5

Note: WWAN support SISO/MIMO mode, only MIMO tune up power was chosen to perform MPE calculation conservatively for MIMO power is higher.

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
LTE Band 2	1850.0	-1.85	25.50	23.650	231.739	0.046	1.000	0.046
LTE Band 4	1710.0	-2.98	25.50	22.520	178.649	0.036	1.000	0.036
LTE Band 5	824.0	1.32	25.50	26.820	480.839	0.096	0.549	0.174
LTE Band 7	2500.0	-1.21	24.50	23.290	213.304	0.042	1.000	0.042
LTE Band 12	699.0	1.61	25.50	27.110	514.044	0.102	0.466	0.220
LTE Band 13	777.0	1.83	25.50	27.330	540.754	0.108	0.518	0.208
LTE Band 14	788.0	2.19	25.50	27.690	587.489	0.117	0.525	0.223
LTE Band 17	704.0	1.61	25.50	27.110	514.044	0.102	0.469	0.218
LTE Band 25	1850.0	-1.85	25.50	23.650	231.739	0.046	1.000	0.046
LTE Band 26	814.0	1.32	25.50	26.820	480.839	0.096	0.543	0.176
LTE Band 30	2305.0	0.22	23.50	23.720	235.505	0.047	1.000	0.047
LTE Band 38	2570.0	-1.21	25.50	24.290	268.534	0.053	1.000	0.053
LTE Band 41	2496.0	-1.21	27.00	25.790	379.315	0.076	1.000	0.076
LTE Band 42	3450.0	-4.13	25.50	21.370	137.088	0.027	1.000	0.027
LTE Band 43	3600.0	-4.13	25.50	21.370	137.088	0.027	1.000	0.027
LTE Band 48	3550.0	-4.13	25.50	21.370	137.088	0.027	1.000	0.027
LTE Band 66	1710.0	-2.98	25.50	22.520	178.649	0.036	1.000	0.036
LTE Band 71	663.0	1.61	25.50	27.110	514.044	0.102	0.442	0.231
5G NR n2	1850.0	-1.85	25.50	23.650	231.739	0.046	1.000	0.046
5G NR n5	824.00	1.32	25.50	26.820	480.839	0.096	0.549	0.174
5G NR n7	2500.00	-1.21	25.00	23.790	239.332	0.048	1.000	0.048
5G NR n12	699.00	1.61	25.50	27.110	514.044	0.102	0.466	0.220
5G NR n13	777.00	1.83	25.50	27.330	540.754	0.108	0.518	0.208
5G NR n14	788.00	2.19	25.50	27.690	587.489	0.117	0.525	0.223
5G NR n25	1850.00	-1.85	25.50	23.650	231.739	0.046	1.000	0.046
5G NR n26	814.00	1.32	25.50	26.820	480.839	0.096	0.543	0.176
5G NR n30	2305.00	0.22	23.50	23.720	235.505	0.047	1.000	0.047
5G NR n38	2570.00	-1.21	25.00	23.790	239.332	0.048	1.000	0.048
5G NR n41	2496.00	-1.21	27.00	25.790	379.315	0.076	1.000	0.076
5G NR n48	3550.00	-4.13	25.50	21.370	137.088	0.027	1.000	0.027
5G NR n66	1710.00	-2.98	25.50	22.520	178.649	0.036	1.000	0.036
5G NR n70	1695.00	-2.86	25.50	22.640	183.654	0.037	1.000	0.037
5G NR n71	663.00	1.61	25.50	27.110	514.044	0.102	0.442	0.231
5G NR n77	3450.00	-6.13	28.50	22.370	172.584	0.034	1.000	0.034
5G NR n78	3450.00	-6.13	28.50	22.370	172.584	0.034	1.000	0.034

**<MIMO>**

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
5G NR n2	1850.0	1.16	28.50	29.660	924.698	0.184	1.000	0.184
5G NR n25	1850.00	1.16	28.50	29.660	924.698	0.184	1.000	0.184
5G NR n41	2496.00	1.80	30.00	31.800	1513.561	0.301	1.000	0.301
5G NR n48	3550.00	-1.12	28.50	27.380	547.016	0.109	1.000	0.109
5G NR n66	1710.00	0.03	28.50	28.530	712.853	0.142	1.000	0.142
5G NR n70	1695.00	0.15	28.50	28.650	732.825	0.146	1.000	0.146
5G NR n71	663.00	4.62	28.50	33.120	2051.162	0.408	0.442	0.924
5G NR n77	3450.00	-3.12	31.50	28.380	688.652	0.137	1.000	0.137
5G NR n78	3450.00	-3.12	31.50	28.380	688.652	0.137	1.000	0.137

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. 5G NR n2/25/41/48/66/70/71/77/78 support SISO/MIMO mode, the MIMO mode is correlated, so the gain calculation method of 5G NR UL MIMO mode is referenced to KDB 662911.

**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
0.231	0.231	0.462

<LTE inter-band ULCA>

LTE Power Density / Limit	LTE Power Density / Limit	$\Sigma(\text{Power Density / Limit})$ of LTE + LTE
0.231	0.231	0.462

< 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
0.231	0.231	0.462

Note:

1. For collocation analysis, LTE Band 71 is chosen for summation due to the highest (power density/limit) among all LTE Band modes.
2. For collocation analysis, 5G NR FR1 n71 is chosen for summation due to the highest (power density/limit) among all 5G NR FR1 modes.
3. For 5G NR EN-DC mode, always chose the highest LTE power density and the highest 5G NR power density to sum as EN-DC conservatively.
4. $\Sigma(\text{Power Density / Limit})$: 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.
5. 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-----