RF Exposure Evaluation Report

APPLICANT	:	Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	:	5G Sub-6 GHz LGA Module
BRAND NAME	:	Quectel
MODEL NAME	:	RG500L-LA
FCC ID	:	XMR2023RG500LLA
STANDARD	:	47 CFR Part 2.1091

The product evaluation date was started from Jun. 29, 2023 and completed on Jun. 29, 2023. We, Sporton International Inc. (Kunshan), 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. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA2D0201-01	Rev. 01	Initial issue of report.	Jul. 10, 2023

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

Manufacturer	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	5G Sub-6 GHz LGA Module
Brand Name	Quectel
Model Name	RG500L-LA
FCC ID	XMR2023RG500LLA
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 42: 3450 MHz ~ 3550 MHz LTE Band 66 : 1710 MHz ~ 1780 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n66 : 1710 MHz – 1780 MHz 5G NR n78: 3450 MHz ~ 3700 MHz
Mode	LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR : CP-OFDM / DFT-s-OFDM, PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM
Antenna Type	Dipole Antenna
HW Version	R1.0
SW Version	RG500LLA00AAR01A05E8_OCPU
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. WWAN 5G NR n78 support SISO/MIMO mode, so only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.
3. This device supports HPUE for 5G NR n78 with class 2 power level, so HPUE has been performed MPE calculation.
4. The intra-band ULCA and EN-DC mode combination could be referred to the product spec.
5. 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.

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 table:

Band	Antenna Gain (dBi)			
	Ant0	Ant1	Ant6	Ant7
WCDMA Band II	/	/	/	0.75
WCDMA Band IV	/	/	/	0.33
WCDMA Band V	/	/	/	-10.68
LTE Band2	/	0.73	/	0.75
LTE Band4	/	/	/	0.33
LTE Band5	/	/	/	-10.68
LTE Band7	/	1.42	/	1.26
LTE Band42	-4.29	/	/	/
LTE Band66	/	-0.2	/	0.33
5GNR n2	/	0.73	/	/
5GNR n5	/	/	/	-10.68
5GNR n7	/	1.42	/	/
5GNR n66	/	-0.2	/	/
5GNR n78	-4.29	/	-4.29	/

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

<WWAN>

Band	Maximum Average Power (dBm)			
	Ant0	Ant1	Ant6	Ant7
WCDMA Band II	/	/	/	25.00
WCDMA Band IV	/	/	/	25.00
WCDMA Band V	/	/	/	25.00
LTE Band2	/	25.00	/	25.00
LTE Band4	/	/	/	25.00
LTE Band5	/	/	/	25.00
LTE Band7	/	25.00	/	25.00
LTE Band42	25.00	/	/	/
LTE Band66	/	25.00	/	25.00
5GNR n2	/	25.00	/	/
5GNR n5	/	/	/	25.00
5GNR n7	/	25.00	/	/
5GNR n66	/	25.00	/	/
5GNR n78 PC3	25.00	/	25.00	/
5GNR n78 PC2	28.00	/	28.00	/

<MIMO>

Mode		Maximum Average power(dBm)
PC3	n78 Ant0+6	25.00
PC2	n78 Ant0+6	28.00

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/f2)	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/f2)	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 II	1850.0	0.75	25.00	25.750	375.837	0.075	1.000	0.075
WCDMA Band IV	1710.0	0.33	25.00	25.330	341.193	0.068	1.000	0.068
WCDMA Band V	824.0	-10.68	25.00	14.320	27.040	0.005	0.549	0.010
LTE Band 2	1850.0	0.75	25.00	25.750	375.837	0.075	1.000	0.075
LTE Band 4	1710.0	0.33	25.00	25.330	341.193	0.068	1.000	0.068
LTE Band 5	824.0	-10.68	25.00	14.320	27.040	0.005	0.549	0.010
LTE Band 7	2500.0	1.42	25.00	26.420	438.531	0.087	1.000	**0.087**
LTE Band 42	3450.0	-4.29	25.00	20.710	117.761	0.023	1.000	0.023
LTE Band 66	1710.0	0.33	25.00	25.330	341.193	0.068	1.000	0.068
5G NR n2	1850.0	0.73	25.00	25.730	374.111	0.074	1.000	0.074
5G NR n5	824.0	-10.68	25.00	14.320	27.040	0.005	0.549	0.010
5G NR n7	2500.0	1.42	25.00	26.420	438.531	0.087	1.000	**0.087**
5G NR n66	1710.0	-0.20	25.00	24.800	301.995	0.060	1.000	0.060
5G NR n78	3450.0	-4.29	28.00	23.710	234.963	0.047	1.000	0.047

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. 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.
4. The MIMO mode is completely uncorrelated, so selected the higher SISO gain among all antennas as MIMO gain to perform MPE calculation.

5.2. Collocated Power Density Calculation

WWAN LTE Power Density / Limit	WWAM 5GNR Power Density / Limit	Σ(Power Density / Limit) of WWAN LTE + WWAN 5GNR
0.087	0.087	0.174

Note:

1. For colocation analysis, LTE band 7 is chosen for summation due to the highest (power density/limit) among all WCDMA/LTE modes.
2. For colocation analysis, 5GNR n7 is chosen for summation due to the highest (power density/limit) among all 5GNR modes.
3. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN LTE+ WWAN 5GNR.
4. Considering the WWAN LTE module collocation with the WWAN 5GNR 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------