RF Exposure Evaluation Report

APPLICANT	:	Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	:	Smart Module
BRAND NAME	:	QUECTEL
MODEL NAME	:	SC680A-NA
FCC ID	:	XMR2022SC680ANA
STANDARD	:	47 CFR Part 2.1091

The product evaluation date was started from Feb. 06, 2023 and completed on Feb. 06, 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)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China

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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA2D2302	Rev. 01	Initial issue of report.	Feb. 13, 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	Smart Module
Brand Name	QUECTEL
Model Name	SC680A-NA
FCC ID	XMR2022SC680ANA
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 41: 2496 MHz ~ 2690 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	LTE: QPSK, 16QAM WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
Antenna Gain	LTE Band 2 : 1.59 dBi LTE Band 4 : 2.00 dBi LTE Band 5 : 2.53 dBi LTE Band 7 : 3.00 dBi LTE Band 12 : 3.95 dBi LTE Band 13 : 4.45 dBi LTE Band 14 : 4.45 dBi LTE Band 17 : 3.95 dBi LTE Band 25 : 1.59 dBi LTE Band 26 : 3.19 dBi LTE Band 41: 3.60 dBi LTE Band 66: 2.00 dBi LTE Band 71: 1.32 dBi WLAN2.4GHz/Bluetooth: 0.47 dBi WLAN5.2GHz: -0.67 dBi WLAN5.3GHz: -0.19 dBi WLAN5.5GHz: 1.28 dBi WLAN5.8GHz: 1.10 dBi
Antenna Type	WWAN: PCB Antenna WLAN/Bluetooth: Folded Dipole Antenna
HW Version	R1.0
SW Version	SC680ANAPAR02A04
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.

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

<LTE>

Mode		Maximum Average power(dBm)
LTE	Band 2	25.00
	Band 4	25.00
	Band 5	25.00
	Band 7	25.00
	Band 12	25.00
	Band 13	25.00
	Band 14	25.00
	Band 17	25.00
	Band 25	25.00
	Band 26	25.00
	Band 41	25.00
	Band 66	25.00
	Band 71	25.00

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
2.4GHz	802.11b	19.00
	802.11g	18.00
	802.11n-HT20	17.00
	802.11n-HT40	16.00

<Bluetooth>

Mode		Maximum Average power(dBm)
Bluetooth	BR/EDR	10.00
	LE	2.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
5.2GHz	802.11a	17.00
	802.11n-HT20	16.00
	802.11n-HT40	16.00
	802.11ac-VHT20	16.00
	802.11ac-VHT40	16.00
	802.11ac-VHT80	16.00
5.3GHz	802.11a	17.00
	802.11n-HT20	16.00
	802.11n-HT40	16.00
	802.11ac-VHT20	16.00
	802.11ac-VHT40	16.00
	802.11ac-VHT80	16.00
5.5GHz	802.11a	17.00
	802.11n-HT20	16.00
	802.11n-HT40	16.00
	802.11ac-VHT20	16.00
	802.11ac-VHT40	16.00
	802.11ac-VHT80	16.00
5.8GHz	802.11a	17.00
	802.11n-HT20	16.00
	802.11n-HT40	16.00
	802.11ac-VHT20	16.00
	802.11ac-VHT40	16.00
	802.11ac-VHT80	16.00

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
LTE Band 2	1850	1.59	25.00	26.590	456.037	0.091	1.000	0.091
LTE Band 4	1710	2.00	25.00	27.000	501.187	0.100	1.000	0.100
LTE Band 5	824	2.53	25.00	27.530	566.239	0.113	0.549	0.205
LTE Band 7	2500	3.00	25.00	28.000	630.957	0.126	1.000	0.126
LTE Band 12	699	3.95	25.00	28.950	785.236	0.156	0.466	0.335
LTE Band 13	777	4.45	25.00	29.450	881.049	0.175	0.518	**0.339**
LTE Band 14	788	4.45	25.00	29.450	881.049	0.175	0.525	0.334
LTE Band 17	704	3.95	25.00	28.950	785.236	0.156	0.469	0.333
LTE Band 25	1850	1.59	25.00	26.590	456.037	0.091	1.000	0.091
LTE Band 26	814	3.19	25.00	28.190	659.174	0.131	0.543	0.242
LTE Band 41	2496	3.60	25.00	28.600	724.436	0.144	1.000	0.144
LTE Band 66	1710	2.00	25.00	27.000	501.187	0.100	1.000	0.100
LTE Band 71	663	1.32	25.00	26.320	428.549	0.085	0.442	0.193
Bluetooth	2402	0.47	10.00	10.470	11.143	0.002	1.000	**0.002**
2.4GHz WLAN	2412	0.47	19.00	19.470	88.512	0.018	1.000	**0.018**
5.2GHz WLAN	5180	-0.67	17.00	16.330	42.954	0.009	1.000	0.009
5.3GHz WLAN	5260	-0.19	17.00	16.810	47.973	0.010	1.000	0.010
5.5GHz WLAN	5500	1.28	17.00	18.280	67.298	0.013	1.000	**0.013**
5.8GHz WLAN	5745	1.10	17.00	18.100	64.565	0.013	1.000	0.013

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.

5.2. Collocated Power Density Calculation

WWAN Power Density / Limit	Bluetooth Power Density / Limit	Σ(Power Density / Limit) of WWAN + Bluetooth
0.339	0.002	0.341
WWAN Power Density / Limit	**WLAN 2.4GHz Power Density / Limit**	**Σ(Power Density / Limit) of WWAN + WLAN 2.4GHz**
0.339	0.018	0.357
WWAN Power Density / Limit	**WLAN 5GHzPower Density / Limit**	**Σ(Power Density / Limit) of WWAN + WLAN 5GHz**
0.339	0.013	0.352

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 WWAN + Bluetooth, WWAN + WLAN2.4GHz, WWAN + WLAN5GHz.
2. According to the EUT characteristic, WLAN and Bluetooth cannot transmit simultaneously.
3. According to the EUT characteristic, WLAN2.4GHz and WLAN5GHz cannot transmit simultaneously.

Conclusion:

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

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