

RF Exposure Evaluation Report

APPLICANT : Quetel Wireless Solutions Co., Ltd.
EQUIPMENT : Smart Module
BRAND NAME : Quetel
MODEL NAME : SG885G-WF
FCC ID : XMR2023SG885GWF
STANDARD : 47 CFR Part 2.1091

The product evaluation date was started from Feb. 08, 2024 and completed on Feb. 08, 2024. 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.



Approved by: Si Zhang

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
FA3N0102	Rev. 01	Initial issue of report.	Mar. 14, 2024



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		
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	SG885G-WF
FCC ID	XMR2023SG885GWF
Wireless Technology and Frequency Range	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 WLAN 5.9GHz Band: 5845 MHz ~ 5885 MHz WLAN 6GHz U-NII-5: 5925 MHz ~ 6425 MHz WLAN 6GHz U-NII-6: 6425 MHz ~ 6525 MHz WLAN 6GHz U-NII-7: 6525 MHz ~ 6875 MHz WLAN 6GHz U-NII-8: 6875 MHz ~ 7125 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	WLAN 2.4GHz 802.11b/g WLAN 2.4GHz 802.11n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 2.4GHz 802.11be EHT20/ EHT40 WLAN 5GHz 802.11a WLAN 5GHz 802.11n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 5GHz 802.11be EHT20/EHT40/EHT80/EHT160 WLAN 6GHz 802.11a WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11be EHT20/EHT40/EHT80/EHT160/EHT320 Bluetooth BR/EDR/LE
Antenna Type	Dipole antenna
HW Version	R1.0
SW Version	SG885GWFNAR01A03
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.
- WLAN2.4GHz /WLAN5GHz/WLAN6GHz all support SISO and MIMO mode, we chose MIMO tune up power to perform MPE calculation conservatively.
- The device supports WLAN MIMO CDD mode and TX Beamforming mode, TX Beamforming mode is only supported in 2.4GHz WLAN 802.11ax/be, 5GHz WLAN 802.11ac/ax/be and 6GHz WLAN 802.11ax/be.

Comments and Explanations:

- 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.
- The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.



Antenna Gain:

WLAN	Ant.1	Ant.2
WLAN2.4GHz	0.47	0.47
WLAN5.2GHz	-0.67	-0.67
WLAN5.3GHz	-0.19	-0.19
WLAN5.5GHz	1.28	1.28
WLAN5.8GHz	1.1	1.1
WLAN5.9GHz	1.16	1.16
WLAN6GHz U-NII-5	3.76	3.76
WLAN6GHz U-NII-6	3.62	3.62
WLAN6GHz U-NII-7	2.66	2.66
WLAN6GHz U-NII-8	2.2	2.2
Bluetooth	0.47	0.47

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

<Bluetooth>

Mode		Maximum Average power(dBm)	
		Ant.1	Ant.2
Bluetooth	BR/EDR	9.00	8.00
	LE	0.50	0.50

<For CDD/MIMO mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
2.4GHz	802.11b	22.00
	802.11g	21.50
	802.11n-HT20	20.50
	802.11n-HT40	20.50
	802.11ax-HE20	20.50
	802.11ax-HE40	20.50
	802.11be-EHT20	20.50
	802.11be-EHT40	20.50

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
5.2GHz	802.11a	19.00
	802.11n-HT20	19.00
	802.11n-HT40	20.00
	802.11ac-VHT20	19.00
	802.11ac-VHT40	20.00
	802.11ac-VHT80	19.00
	802.11ac-VHT160	17.00



	802.11ax-HE20	19.00
	802.11ax-HE40	20.00
	802.11ax-HE80	20.00
	802.11ax-HE160	19.00
	802.11be-EHT20	18.50
	802.11be-EHT40	18.50
	802.11be-EHT80	18.50
	802.11be-EHT160	18.50
5.3GHz	802.11a	20.00
	802.11n-HT20	19.50
	802.11n-HT40	20.00
	802.11ac-VHT20	19.50
	802.11ac-VHT40	20.00
	802.11ac-VHT80	19.00
	802.11ax-HE20	20.00
	802.11ax-HE40	20.00
	802.11ax-HE80	18.00
	802.11be-EHT20	19.00
	802.11be-EHT40	19.00
	802.11be-EHT80	18.50
5.5GHz	802.11a	19.00
	802.11n-HT20	19.00
	802.11n-HT40	20.00
	802.11ac-VHT20	19.00
	802.11ac-VHT40	20.00
	802.11ac-VHT80	19.50
	802.11ac-VHT160	17.00
	802.11ax-HE20	19.00
	802.11ax-HE40	20.00
	802.11ax-HE80	20.00
	802.11ax-HE160	19.00
	802.11be-EHT20	18.00
	802.11be-EHT40	19.00
	802.11be-EHT80	19.00
802.11be-EHT160	17.50	
5.8GHz	802.11a	18.50
	802.11n-HT20	18.50
	802.11n-HT40	19.00
	802.11ac-VHT20	18.50
	802.11ac-VHT40	19.00
	802.11ac-VHT80	19.00
	802.11ax-HE20	18.50
	802.11ax-HE40	20.00
	802.11ax-HE80	20.00
	802.11be-EHT20	18.00
	802.11be-EHT40	18.00
802.11be-EHT80	18.00	
5.9GHz	802.11a	19.00
	802.11n-HT20	19.00



	802.11n-HT40	19.00
	802.11ac-VHT20	19.00
	802.11ac-VHT40	19.50
	802.11ac-VHT80	19.50
	802.11ac-VHT160	18.00
	802.11ax-HE20	19.00
	802.11ax-HE40	20.00
	802.11ax-HE80	20.00
	802.11ax-HE160	18.50
	802.11be-EHT20	18.50
	802.11be-EHT40	18.50
	802.11be-EHT80	18.50
	802.11be-EHT160	18.00

<6GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
6GHz	802.11a	13.00
	802.11ax-HE20	14.00
	802.11ax-HE40	17.00
	802.11ax-HE80	18.00
	802.11ax-HE160	18.00
	802.11be-EHT20	14.00
	802.11be-EHT40	17.00
	802.11be-EHT80	17.00
	802.11be-EHT160	17.00
	802.11be-EHT320	17.00

Note: WLAN2.4GHz /WLAN5GHz/WLAN6GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.



<For Beamforming mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
2.4GHz	802.11ax-HE20	17.50
	802.11ax-HE40	17.50
	802.11be-EHT20	17.50
	802.11be-EHT40	17.50

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
5.2GHz	802.11ac-VHT20	16.00
	802.11ac-VHT40	17.00
	802.11ac-VHT80	16.00
	802.11ac-VHT160	14.00
	802.11ax-HE20	16.00
	802.11ax-HE40	17.00
	802.11ax-HE80	17.00
	802.11ax-HE160	16.00
	802.11be-EHT20	15.50
	802.11be-EHT40	15.50
	802.11be-EHT80	15.50
	802.11be-EHT160	15.50
5.3GHz	802.11ac-VHT20	16.50
	802.11ac-VHT40	17.00
	802.11ac-VHT80	16.00
	802.11ax-HE20	17.00
	802.11ax-HE40	17.00
	802.11ax-HE80	15.00
	802.11be-EHT20	16.00
	802.11be-EHT40	16.00
802.11be-EHT80	15.50	
5.5GHz	802.11ac-VHT20	16.00
	802.11ac-VHT40	17.00
	802.11ac-VHT80	16.50
	802.11ac-VHT160	14.00
	802.11ax-HE20	16.00
	802.11ax-HE40	17.00
	802.11ax-HE80	17.00
	802.11ax-HE160	16.00
	802.11be-EHT20	15.00
	802.11be-EHT40	16.00
	802.11be-EHT80	16.00
	802.11be-EHT160	14.50



5.8GHz	802.11ac-VHT20	15.50
	802.11ac-VHT40	16.00
	802.11ac-VHT80	16.00
	802.11ax-HE20	15.50
	802.11ax-HE40	17.00
	802.11ax-HE80	17.00
	802.11be-EHT20	15.00
	802.11be-EHT40	15.00
5.9GHz	802.11ac-VHT20	16.00
	802.11ac-VHT40	16.50
	802.11ac-VHT80	16.50
	802.11ac-VHT160	15.00
	802.11ax-HE20	16.00
	802.11ax-HE40	17.00
	802.11ax-HE80	17.00
	802.11ax-HE160	15.50
	802.11be-EHT20	15.50
	802.11be-EHT40	15.50
	802.11be-EHT80	15.50
	802.11be-EHT160	15.00

<6GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
6GHz	802.11ax-HE20	11.00
	802.11ax-HE40	14.00
	802.11ax-HE80	15.00
	802.11ax-HE160	15.00
	802.11be-EHT20	11.00
	802.11be-EHT40	14.00
	802.11be-EHT80	14.00
	802.11be-EHT160	14.00
	802.11be-EHT320	14.00

Note: This device support beamforming for WLAN 2.4GHz 802.11ax/be HE20/HE40/EHT20/EHT40, WLAN 5GHz 802.11ac/ax/be VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160, and WLAN 6GHz 802.11ax/be HE20/HE40/HE80/HE160/EHT20/EHT40/EHT80/EHT160/EHT320.



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

<For CDD/MIMO mode>

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
2.4GHz WLAN	2412.0	0.47	22.00	22.470	176.604	0.035	1.000	0.035
5.2GHz WLAN	5180.0	-0.67	20.00	19.330	85.704	0.017	1.000	0.017
5.3GHz WLAN	5260.0	-0.19	20.00	19.810	95.719	0.019	1.000	0.019
5.5GHz WLAN	5500.0	1.28	20.00	21.280	134.276	0.027	1.000	0.027
5.8GHz WLAN	5745.0	1.10	20.00	21.100	128.825	0.026	1.000	0.026
5.9GHz WLAN	5845.0	1.16	20.00	21.160	130.617	0.026	1.000	0.026
6GHz WLAN	5925.0	3.76	18.00	21.760	149.968	0.030	1.000	0.030
Bluetooth	2402.0	0.47	9.00	9.470	8.851	0.002	1.000	0.002

<For Beamforming mode>

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
2.4GHz WLAN	2412.0	3.48	17.50	20.980	125.314	0.025	1.000	0.025
5.2GHz WLAN	5180.0	2.34	17.00	19.340	85.901	0.017	1.000	0.017
5.3GHz WLAN	5260.0	2.82	17.00	19.820	95.940	0.019	1.000	0.019
5.5GHz WLAN	5500.0	4.29	17.00	21.290	134.586	0.027	1.000	0.027
5.8GHz WLAN	5745.0	4.11	17.00	21.110	129.122	0.026	1.000	0.026
5.9GHz WLAN	5845.0	4.17	17.00	21.170	130.918	0.026	1.000	0.026
6GHz WLAN	5925.0	6.77	15.00	21.770	150.314	0.030	1.000	0.030

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. WLAN2.4GHz, WLAN5GHz (UNII-1/2A/2C/-3/-4) and WLAN6GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.
3. Chose the maximum RF output tune up power of all antennas among same frequency WLAN/BT bands and the maximum antenna gain to perform MPE calculation conservatively.
4. The gain calculation method of WLAN beamforming mode is referenced to KDB 662911.



5.2. Collocated Power Density Calculation

<For CDD/MIMO mode>

Table with 3 columns: WLAN 2.4GHz Power Density / Limit, WLAN 5GHz (UNII-1/2A/2C/-3/-4) Power Density / Limit, and Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz (UNII-1/2A/2C/-3/-4). Values: 0.035, 0.027, 0.062.

Table with 3 columns: WLAN 5GHz (UNII-1/2A/2C/-3) Power Density / Limit, WLAN 6GHz Power Density / Limit, and Σ(Power Density / Limit) of WLAN 5GHz (UNII-1/2A/2C/-3) + WLAN 6GHz. Values: 0.027, 0.030, 0.057.

Table with 3 columns: WLAN 2.4GHz Power Density / Limit, WLAN 6GHz Power Density / Limit, and Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 6GHz. Values: 0.035, 0.030, 0.065.

<For Beamforming mode>

Table with 3 columns: WLAN 2.4GHz Power Density / Limit, WLAN 5GHz (UNII-1/2A/2C/-3/-4) Power Density / Limit, and Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 5GHz (UNII-1/2A/2C/-3/-4). Values: 0.025, 0.027, 0.052.

Table with 3 columns: WLAN 5GHz (UNII-1/2A/2C/-3) Power Density / Limit, WLAN 6GHz Power Density / Limit, and Σ(Power Density / Limit) of WLAN 5GHz (UNII-1/2A/2C/-3) + WLAN 6GHz. Values: 0.027, 0.030, 0.057.

Table with 3 columns: WLAN 2.4GHz Power Density / Limit, WLAN 6GHz Power Density / Limit, and Σ(Power Density / Limit) of WLAN 2.4GHz + WLAN 6GHz. Values: 0.025, 0.030, 0.055.

Note:

- 1. According to the EUT characteristic, WLAN 2.4GHz + WLAN5GHz (UNII-1/2A/2C/-3/-4) + WLAN6GHz cannot transmit simultaneously.
2. According to the EUT characteristic, WLAN 2.4GHz / WLAN5GHz (UNII-1/2A/2C/-3/-4) / WLAN6GHz and Bluetooth cannot transmit simultaneously.
3. According to the EUT characteristic, WLAN5GHz (UNII-4) and WLAN6GHz cannot transmit simultaneously.
4. According to the EUT characteristic, Bluetooth antenna1 and Bluetooth antenna2 cannot transmit simultaneously.
5. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission) / (corresponding MPE limit)], for WLAN2.4GHz +WLAN5GHz, WLAN5GHz + WLAN6GHz.
6. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1.

Conclusion:

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

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