

RF Exposure Evaluation Report

APPLICANT : Quetel Wireless Solutions Co., Ltd.
EQUIPMENT : Smart Module
BRAND NAME : Quetel
MODEL NAME : SG560D-WF
FCC ID : XMR2023SG560DWF
STANDARD : 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

The product evaluation date was started from Sep. 30, 2024 and completed on Sep. 30, 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**



Table of Contents

1. ADMINISTRATION DATA	4
1.1. Testing Laboratory	4
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	5
3. MAXIMUM RF AVERAGE OUTPUT TUNE UP POWER AMONG PRODUCTION UNITS	6
4. RF EXPOSURE LIMIT INTRODUCTION	8
5. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION	9
5.1. Standalone Power Density Calculation	9
5.2. Collocated Power Density Calculation.....	10



Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA482209	Rev. 01	Initial issue of report.	Oct. 23, 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	SG560D-WF
FCC ID	XMR2023SG560DWF
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 6GHz U-NII-5: 5955 MHz ~ 6415 MHz WLAN 6GHz U-NII-6: 6435 MHz ~ 6515 MHz WLAN 6GHz U-NII-7: 6535 MHz ~ 6855 MHz WLAN 6GHz U-NII-8: 6875 MHz ~ 7095 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 5GHz 802.11a WLAN 5GHz 802.11n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 WLAN 6GHz 802.11a WLAN 6GHz 802.11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
Antenna Gain	Bluetooth: 0.20 dBi Ant0/1: WLAN2.4GHz: 0.2 dBi WLAN5.2GHz: -0.7 dBi WLAN5.3GHz: -0.8 dBi WLAN5.5GHz: -1.2 dBi WLAN5.8GHz: -1.5 dBi WLAN 6GHz U-NII-5: -0.9 dBi WLAN 6GHz U-NII-6: -0.9 dBi WLAN 6GHz U-NII-7: 0.4 dBi WLAN 6GHz U-NII-8: 1.6 dBi
Antenna Type	WLAN/Bluetooth: Dipole antenna
HW Version	R2.0
SW Version	SG560DWFPBR03A01
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. WLAN2.4GHz /WLAN5GHz /WLAN6GHz all support SISO and MIMO mode, MIMO tune up power was chosen 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.



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

< Bluetooth >

Mode	Maximum Average Power (dBm)	
	Ant.0	
Bluetooth BR/EDR	10.00	
Bluetooth LE	1.00	

<For CDD/MIMO Mode>

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.0+1
2.4GHz	802.11b	20.50
	802.11g	20.50
	802.11n-HT20	19.00
	802.11n-HT40	19.00
	802.11ax-HE20	19.00
	802.11ax-HE40	19.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.0+1
5.2GHz	802.11a	18.00
	802.11n-HT20	19.50
	802.11n-HT40	19.50
	802.11ac-VHT20	18.00
	802.11ac-VHT40	18.00
	802.11ac-VHT80	18.00
	802.11ax-HE20	18.00
	802.11ax-HE40	18.00
	802.11ax-HE80	18.00
5.3GHz	802.11a	19.00
	802.11n-HT20	19.50
	802.11n-HT40	19.50
	802.11ac-VHT20	19.00
	802.11ac-VHT40	18.00
	802.11ac-VHT80	17.50
	802.11ax-HE20	19.00
	802.11ax-HE40	18.00
	802.11ax-HE80	17.00
5.5GHz	802.11a	19.50
	802.11n-HT20	19.50
	802.11n-HT40	19.50
	802.11ac-VHT20	19.00
	802.11ac-VHT40	18.00
802.11ac-VHT80	18.00	



	802.11ax-HE20	18.00
	802.11ax-HE40	18.00
	802.11ax-HE80	18.00
	802.11ax-HE160	17.00
5.8GHz	802.11a	18.00
	802.11n-HT20	19.50
	802.11n-HT40	19.50
	802.11ac-VHT20	18.00
	802.11ac-VHT40	18.00
	802.11ac-VHT80	18.00
	802.11ax-HE20	18.00
	802.11ax-HE40	18.00
	802.11ax-HE80	18.00

<6GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.0+1
6GHz	802.11a	11.00
	802.11ax-HE20	11.00
	802.11ax-HE40	14.00
	802.11ax-HE80	18.00
	802.11ax-HE160	20.00

Note: WLAN2.4GHz /WLAN5GHz/WLAN6GHz all support SISO/MIMO mode, 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
2.4GHz WLAN	2412.0	0.20	20.50	20.700	117.490	0.023	1.000	0.023
5.2GHz WLAN	5180.0	-0.70	19.50	18.800	75.858	0.015	1.000	0.015
5.3GHz WLAN	5260.0	-0.80	19.50	18.700	74.131	0.015	1.000	0.015
5.5GHz WLAN	5500.0	-1.20	19.50	18.300	67.608	0.013	1.000	0.013
5.8GHz WLAN	5745.0	-1.50	19.50	18.000	63.096	0.013	1.000	0.013
6GHz WLAN	5955.0	1.60	20.00	21.600	144.544	0.029	1.000	0.029
Bluetooth	2402.0	0.20	10.00	10.200	10.471	0.002	1.000	0.002

Note:

1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. WLAN2.4GHz and WLAN5/6GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.
3. Chose the maximum RF output tune up power and the maximum antenna gain of all antennas among same frequency WLAN band to perform MPE calculation conservatively.

5.2. Collocated Power Density Calculation

WLAN 2.4GHz Power Density / Limit	Bluetooth Power Density / Limit	Σ (Power Density / Limit) of WLAN2.4GHz + Bluetooth
0.023	0.002	0.025

WLAN 5GHz Power Density / Limit	Bluetooth Power Density / Limit	Σ (Power Density / Limit) of WLAN 5GHz + Bluetooth
0.015	0.002	0.017

WLAN 6GHz Power Density / Limit	Bluetooth Power Density / Limit	Σ (Power Density / Limit) of WLAN 6GHz + Bluetooth
0.029	0.002	0.031

WLAN 2.4GHz Power Density / Limit	WLAN 6GHz Power Density / Limit	Σ (Power Density / Limit) of WLAN2.4GHz + WLAN 6GHz
0.023	0.029	0.052

Note:

1. According to the EUT characteristic, WLAN 2.4GHz and WLAN 5GHz can't transmit simultaneously.
2. According to the EUT characteristic, Bluetooth and WLAN2.4G/5GHz/6GHz can transmit simultaneously.
3. According to the EUT characteristic, WLAN 2.4GHz and WLAN 6GHz can transmit simultaneously.
4. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WLAN 2.4GHz/5GHz/6GHz + Bluetooth, WLAN6GHz + WLAN2.4GHz.
5. 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-----