

Report No.: SEWA2301000005RG06

Rev.: 01

Page: 1 of 8

TEST REPORT

Application No.: SEWA2301000005RG

Applicant: Quectel Wireless Solutions Co., Ltd.

Address of Applicant: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

Manufacturer: Quectel Wireless Solutions Co., Ltd.

Address of Manufacturer: Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

EUT Description: Wi-Fi & Bluetooth Module

Model No.: AF51Y

Trade Mark: Quectel

FCC ID: XMR202303AF51Y

Standards: 47 CFR Part 2.1091
FCC KDB 447498 D01 v06

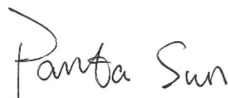
Date of Receipt: 2023/01/09

Date of Issue: 2023/02/23

Test Result:	PASS*
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Panta Sun
Wireless Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2023/02/23		Original

Prepared By	
	(Nick Hu) / Test Engineer
Checked By	
	(Well Wei) / Reviewer



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2 General Information

2.1 Client Information

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

2.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

• **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

• **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327



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2.3 General Description of EUT

EUT Description:	Wi-Fi & Bluetooth Module
Model No.:	AF51Y
Trade Mark:	Quectel
Hardware Version:	R1.0
Software Version:	NA
Antenna Type:	External Antenna
Antenna Gain:	BT/BLE: 3.44dBi (Ant0)
	2.4G WIFI: 3.44dBi (Ant0); 5.26dBi (Ant1)
	5150MHz to 5250MHz: 3.16dBi (Ant0); 3.26dBi (Ant1)
	5250MHz to 5350MHz: 3.35dBi (Ant0); 3.26dBi (Ant1)
	5470MHz to 5725MHz: 3.26dBi (Ant0); 3.28dBi (Ant1)
	5725MHz to 5850MHz: 2.96dBi (Ant0); 3.24dBi (Ant1)
	Note: The antenna gain are derived from the gain information report provided by the manufacturer.
Remark:	As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.



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3 RF Exposure Evaluation

3.1 RF Exposure Compliance Requirement

3.1.1 Limits

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

F=frequency in MHz
 *=Plane-wave equivalent power density
 RF exposure compliance will need to be determined with respect to 1.1307(c) and (d) of the FCC rules. The emissions should be within the limits at 300kHz in Table 1 of 1.1310(use the 300kHz limits for 150kHz:614V/m,1.63A/m).

Friis Formula

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.



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3.1.2 Test Procedure

Software provided by client enabled the EUT to transmit data at lowest, middle and highest channel individually

3.1.3 EUT RF Exposure Evaluation

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.0 / 2.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

This confirmed that the device comply with MPE limit.

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	MIMO Directional gain	Max Conducted Average Output Power (dBm)	EIRP(ERP) (dBm)	EIRP(ERP) Limit (dBm)	Power Density at R = 20 cm (mW/cm2)	Limit (mW/cm2)	Gain according to EIRP(ERP) (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
Bluetooth	2402.0	3.44	NA	11.00	14.44	30.00	0.0055	1.0000	NA			Pass
2.4G WLAN Ant0	2412.0	3.44	NA	19.00	22.44	30.00	0.0349	1.0000				Pass
2.4G WLAN Ant1	2412.0	5.26	NA	19.00	24.26	30.00	0.0531	1.0000				Pass
2.4G WLAN (MIMO)	2412.0	NA	7.41	18.50	25.91	30.00	0.0775	1.0000				Pass
5G WLAN Ant0	5320.0	3.35	NA	17.00	20.35	30.00	0.0216	1.0000				Pass
5G WLAN Ant1	5320.0	3.26	NA	17.00	20.26	30.00	0.0211	1.0000				Pass
5G WLAN (MIMO)	5320.0	NA	6.32	17.00	23.32	30.00	0.0427	1.0000				Pass



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3.1.4 Exposure calculations for multiple sources

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE in accordance with the provisions of Table(A) and Table(B). To comply with the MPE, the fraction of the MPE in terms of E2, H2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity.

In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

The product also has multiple transmitters The Simultaneous Transmission Possibilities are as below:

Simultaneous Tx Combination	Configuration
1	WLAN2.4G Ant0+BT
2	WLAN2.4G Ant1+BT
3	WLAN 2.4G Ant0+WLAN 2.4G Ant1
4	WLAN2.4G Ant0+WLAN 2.4G Ant1+BT
5	WLAN5G Ant0+BT
6	WLAN5G Ant1+BT
7	WLAN5G Ant0+WLAN5G Ant1
8	WLAN5G Ant0+WLAN5G Ant1+BT
9	WLAN2.4G Ant0+WLAN5G Ant1
10	WLAN2.4G Ant1+WLAN5G Ant0

No.	Mode	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	Result Ratio	Total Ratio	Limit	Result
4	WLAN 2.4G Ant0	0.0349	1.0000	0.0349	0.0935	1.0000	Pass
	WLAN 2.4G Ant1	0.0531	1.0000	0.0531			
	Bluetooth	0.0055	1.0000	0.0055			

---End of Report---



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