



SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Report No.: SZCR240100038410
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TEST REPORT

Application No.: SZCR2401000384AT
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 200233, China
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 200233, China
EUT Description: 5G Sub-6 GHz Smart Module with Wi-Fi 6E & Bluetooth
Model No.: SG560D-NA
Trade Mark: QUECTEL
FCC ID: XMR2024SG560DNA
Standards: FCC 47 CFR Part 2.1091
 FCC KDB 447498 D01 v06
Date of Receipt: 2024/01/29
Date of Issue: 2024/05/10

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

Authorized Signature:

Keny Xu
Laboratory Manager



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2024/05/10		Original

Prepared By	 <hr/> (Jack Huang) / Test Engineer
Checked By	 <hr/> (Flora Wang) / Reviewer



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Shenzhen Branch Inspection & Testing Services Laboratory

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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 200233, China
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 200233, China

2.2 Test Facility

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

- **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

- **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

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

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

- **FCC –Designation Number: CN1336**

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch has been recognized as an accredited testing laboratory.

Designation Number: CN1336.

Test Firm Registration Number: 787754



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2.3 General Description of EUT

EUT Description:	5G Sub-6 GHz Smart Module with Wi-Fi 6E & Bluetooth			
Model No.:	SG560D-NA			
Trade Mark:	QUECTEL			
Hardware Version:	R1.0			
Software Version:	SG560DNAPAR03A05			
Power Supply:	DC 4.0V			
Antenna Type:	<input checked="" type="checkbox"/> External, <input type="checkbox"/> Integrated			
HPUE Power Class:	Class 2: LTE Band 41, NR Band n41; NR Band n77; NR Band n78			
Feature:	UL 2*2 MIMO: NR Band n38; NR Band n41; NR Band n48; NR Band n77; NR Band n78			
Antenna Gain:	LTE Band 2:	1dBi(Ant0)	LTE Band 4:	2.7dBi(Ant0)
	LTE Band 5:	2.1dBi(Ant4)	LTE Band 7:	2.2dBi(Ant0)
	LTE Band 12:	0.7dBi(Ant4)	LTE Band 13:	2.6dBi(Ant4)
	LTE Band 14:	2.6dBi(Ant4)	LTE Band 17:	0.7dBi(Ant4)
	LTE Band 25:	1.1dBi(Ant0)	LTE Band 26:	2.4dBi(Ant4)
	LTE Band 30:	0.4dBi(Ant0)	LTE Band 38:	2dBi(Ant0)
	LTE Band 41:	2.2dBi(Ant0)	LTE Band 42: (3450 to 3550)	-1.5dBi(Ant1)
	LTE Band 42: (3550 to 3600)	-3.6dBi(Ant1)	LTE Band 43: (3600 to 3700)	-4.6dBi(Ant1)
	LTE Band 43: (3700 to 3800)	-5.4dBi(Ant1)	LTE Band 48:	-3.6dBi(Ant1)
	LTE Band 66:	3.4dBi(Ant0)	LTE Band 71:	-0.7dBi(Ant4)
	LTE CA_2C:	1dBi(Ant0)	LTE CA_5B:	2.1dBi(Ant4)
	LTE CA_7C:	2.2dBi(Ant0)	LTE CA_38C:	2dBi(Ant0)
	LTE CA_41C:	2.2dBi(Ant0)	LTE CA_42C: (3450 to 3550)	-1.5dBi(Ant1)
	LTE CA_42C: (3550 to 3600)	-3.6dBi(Ant1)	LTE CA_48C:	-3.6dBi(Ant1)
	LTE CA_66B:	3.4dBi(Ant0)	LTE CA_66C:	3.4dBi(Ant0)
	NR Band n2:	1dBi (Ant0)	NR Band n5:	2.1dBi (Ant4)
	NR Band n7:	2.2dBi (Ant0)	NR Band n12:	0.7dBi (Ant4)
	NR Band n13:	2.6dBi (Ant4)	NR Band n14:	2.6dBi (Ant4)
NR Band n25:	1.1dBi (Ant0)	NR Band n26:	2.4dBi (Ant4)	



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NR Band n30:	0.4dBi (Ant0)	NR Band n38:	2dBi (Ant0)
NR Band n41:	2.2dBi (Ant0)	NR Band n48:	-3.6dBi (Ant1)
NR Band n66:	3.4dBi (Ant0)	NR Band n70:	2.7dBi (Ant0)
NR Band n71:	-0.7dBi (Ant4)	NR Band n77:	3.2dBi (Ant1)
NR Band n78:	1.7dBi (Ant1)		
Bluetooth:	0.2dBi;		
WIFI 2.4G:	0.2dBi(Ant5); 0.2dBi(Ant6);		
WIFI5G:	-0.7dBi(Ant5); -0.7dBi(Ant6);		
6EWIFI:	1.6dBi(Ant5); 1.6dBi(Ant6);		
<p>LTE CA: LTE CA_2C;LTE CA_5B;LTE CA_7C;LTE CA_38C;LTE CA_41C;LTE CA_42C; LTE CA_48C;LTE CA_66B;LTE CA_66C.</p> <p>NR ENDC: DC_2A_n5A,DC_4A_n41A,DC_2A_n12A,DC_4A_n38A,DC_2A_n14A, DC_4A_n78A,DC_2A_n30A,DC_4A_n2A,DC_2A_n66A,DC_4A_n7A, DC_2A_n41A,DC_2A_n71A, DC_2A_n78A,DC_2A_n48A,DC_2A_n38A, DC_2A_n7A,DC_2A_n77A,DC_7A_n78A,DC_12A_n5A,DC_13A_n5A, DC_7A_n5A,DC_12A_n30A,DC_13A_n66A,DC_7A_n71A,DC_12A_n66A, DC_13A_n2A,DC_7A_n12A,DC_12A_n2A,DC_13A_n48A,DC_7A_n66A, DC_12A_n78A,DC_13A_n78A,DC_7A_n77A, DC_12A_n7A, DC_13A_n7A, DC_7A_n2A,DC_12A_n38A,DC_13A_n77A, DC_7A_n25A,DC_12A_n25A, DC_13A_n25A,DC_12A_n41A,DC_12A_n77A, DC_14A_n2A, DC_30A_n2A, DC_48A_n2A,DC_14A_n30A,DC_30A_n5A, DC_48A_n5A, DC_14A_n66A, DC_30A_n12A,DC_48A_n66A,DC_14A_n77A, DC_30A_n66A, DC_48A_n25A, DC_25A_n41A,DC_30A_n77A,DC_48A_n71A, DC_25A_n78A, DC_38A_n78A, DC_48A_n12A,DC_25A_n77A,DC_41A_n77A, DC_26A_n41A,DC_41A_n78A, DC_26A_n78A,DC_26A_n25A,DC_66A_n5A, DC_71A_n2A,DC_66A_n12A, DC_71A_n66A,DC_66A_n14A,DC_71A_n7A, DC_66A_n30A,DC_71A_n78A, DC_66A_n2A,DC_71A_n38A,DC_66A_n71A, DC_71A_n41A,DC_66A_n25A, DC_71A_n25A,DC_66A_n41A,DC_71A_n77A, DC_66A_n78A,DC_71A_n5A, DC_66A_n7A,DC_66A_n48A,DC_66A_n38A, DC_66A_n77A,</p>			
<p>Note: The antenna gain are derived from the gain information report provided by the manufacturer.</p>			
<p>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.</p>			



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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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

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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 Shenzhen Branch, Wireless Laboratory

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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

Output Power Into Antenna & RF Exposure Evaluation Distance:

This confirmed that the device comply with MPE limit.

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Max Conducted Power (dBm)	EIRP(ERP) (dBm)	EIRP(ERP) Limit (dBm)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	Gain according to EIRP(ERP) (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
LTE/CA Band 2	1850.7	1.00	25.00	26.00	33.00	0.0792	1.0000	8.00	12.01	8.00	Pass
LTE Band 4	1710.7	2.70	25.00	27.70	30.00	0.1171	1.0000	5.00	12.01	5.00	Pass
LTE/CA Band 5	824.7	2.10	25.00	24.95	38.45	0.1020	0.5498	15.60	9.41	9.41	Pass
LTE/CA Band 7	2502.5	2.20	25.00	27.20	33.00	0.1044	1.0000	8.00	12.01	8.00	Pass
LTE Band 12	699.7	0.70	25.00	23.55	34.77	0.0739	0.4665	11.92	8.70	8.70	Pass
LTE Band 13	779.5	2.60	25.00	25.45	34.77	0.1145	0.5197	11.92	9.16	9.16	Pass
LTE Band 14	790.5	2.60	25.00	25.45	34.77	0.1145	0.5270	11.92	9.23	9.23	Pass
LTE Band 17	706.5	0.70	25.00	23.55	34.77	0.0739	0.4710	11.92	8.74	8.74	Pass
LTE Band 25	1850.7	1.10	25.00	26.10	33.00	0.0810	1.0000	8.00	12.01	8.00	Pass
LTE Band 26 (814~824)	814.7	2.40	25.00	25.25	NA	0.1093	0.5431	NA	9.36	9.36	Pass
LTE Band 26 (824~849)	824.7	2.40	25.00	25.25	38.45	0.1093	0.5498	15.60	9.41	9.41	Pass
LTE Band 30	2307.5	0.40	23.50	23.90	23.98	0.0488	1.0000	0.48	13.51	0.48	Pass
LTE/CA Band 38	2572.5	2.00	25.00	27.00	33.00	0.0997	1.0000	8.00	12.01	8.00	Pass
LTE/CA Band 41	2498.5	2.20	25.00	27.20	33.00	0.1044	1.0000	8.00	12.01	8.00	Pass
LTE/CA Band 41 (HPUE)	2498.5	2.20	28.00	30.20	33.00	0.2083	1.0000	5.00	9.01	5.00	Pass
LTE/CA Band 42	3452.5	-1.50	25.00	23.50	30.00	0.0445	1.0000	5.00	12.01	5.00	Pass
LTE/CA Band 42 Part96	3552.5	-3.60	25.00	21.40	23.00	0.0275	1.0000	-2.00	12.01	-2.00	Pass
LTE Band 43	3702.5	-4.60	25.00	20.40	30.00	0.0218	1.0000	5.00	12.01	5.00	Pass
LTE Band 43 Part96	3602.5	-5.40	25.00	19.60	23.00	0.0181	1.0000	-2.00	12.01	-2.00	Pass
LTE/CA Band 48	3552.5	-3.60	25.00	21.40	23.00	0.0275	1.0000	-2.00	12.01	-2.00	Pass
LTE/CA Band 66	1710.7	3.40	25.00	28.40	30.00	0.1376	1.0000	5.00	12.01	5.00	Pass
LTE Band 71	665.5	-0.70	25.00	22.15	34.77	0.0535	0.4437	11.92	8.48	8.48	Pass



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Operating Band	Frequency (MHz)	Antenna Gain (dBi)	MIMO Directional gain	Max Conducted Power (dBm)	EIRP(ERP) (dBm)	EIRP(ERP) Limit (dBm)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	Gain according to EIRP(ERP) (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
NR Band n2	1852.5	1.00	N/A	25.00	26.00	33.00	0.0792	1.0000	8.00	12.01	8.00	Pass
NR Band n5	826.5	2.10	N/A	25.00	24.95	38.45	0.1020	0.5510	15.60	9.42	9.42	Pass
NR Band n7	2502.5	2.20	N/A	25.00	27.20	33.00	0.1044	1.0000	8.00	12.01	8.00	Pass
NR Band n12	701.5	0.70	N/A	25.00	23.55	34.77	0.0739	0.4677	11.92	8.71	8.71	Pass
NR Band n13	779.5	2.60	N/A	25.00	25.45	34.77	0.1145	0.5197	11.92	9.16	9.16	Pass
NR Band n14	790.5	2.60	N/A	25.00	25.45	34.77	0.1145	0.5270	11.92	9.23	9.23	Pass
NR Band n25	1852.5	1.10	N/A	25.00	26.10	33.00	0.0810	1.0000	8.00	12.01	8.00	Pass
NR Band n26 (814-824)	816.5	2.40	N/A	25.00	25.25	NA	0.1093	0.5443	NA	9.37	9.37	Pass
NR Band n26 (824-849)	826.5	2.40	N/A	25.00	25.25	38.45	0.1093	0.5510	15.60	9.42	9.42	Pass
NR Band n30	2307.5	0.40	N/A	23.50	23.90	23.98	0.0488	1.0000	0.48	13.51	0.48	Pass
NR Band n38	2580.0	2.00	N/A	25.00	27.00	33.00	0.0997	1.0000	8.00	12.01	8.00	Pass
NR Band n38 (MIMO)	2580.0	2.00	2.00	25.00	27.00	33.00	0.0997	1.0000	8.00	12.01	8.00	Pass
NR Band n41	2506.02	2.20	N/A	25.00	27.20	33.00	0.1044	1.0000	8.00	12.01	8.00	Pass
NR Band n41 (HPUE)	2506.02	2.20	N/A	28.00	30.20	33.00	0.2083	1.0000	5.00	9.01	5.00	Pass
NR Band n41 (MIMO)	2506.02	2.20	2.20	28.00	30.20	33.00	0.2083	1.0000	5.00	9.01	5.00	Pass
NR Band n48	3555.0	-3.60	N/A	25.00	21.40	23.00	0.0275	1.0000	-2.00	12.01	-2.00	Pass
NR Band n48 (MIMO)	3555.0	-3.60	-3.60	25.00	21.40	23.00	0.0275	1.0000	-2.00	12.01	-2.00	Pass
NR Band n66	1712.5	3.40	N/A	25.00	28.40	30.00	0.1376	1.0000	5.00	12.01	5.00	Pass
NR Band n70	1697.5	2.70	N/A	25.00	27.70	30.00	0.1171	1.0000	5.00	12.01	5.00	Pass
NR Band n71	665.5	-0.70	N/A	25.00	22.15	34.77	0.0535	0.4437	11.92	8.48	8.48	Pass



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Operating Band	Frequency (MHz)	Antenna Gain (dBi)	MIMO Directional gain	Max Conducted Power (dBm)	EIRP(ERP) (dBm)	EIRP(ERP) Limit (dBm)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	Gain according to EIRP(ERP) (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	conclusion
NR Band n77 (3450-3550)	3460.02	3.20	N/A	25.00	28.20	30.00	0.1314	1.0000	5.00	12.01	5.00	Pass
NR Band n77 (3450-3550) (HPUE)	3460.02	3.20	N/A	26.00	29.20	30.00	0.1655	1.0000	4.00	11.01	4.00	Pass
NR Band n77 (3450-3550) (MIMO)	3460.02	3.20	2.40	26.00	29.20	30.00	0.1655	1.0000	4.00	11.01	4.00	Pass
NR Band n77 (3700-3980)	3710.01	3.20	N/A	25.00	28.20	30.00	0.1314	1.0000	5.00	12.01	5.00	Pass
NR Band n77 (3700-3980) (HPUE)	3710.01	3.20	N/A	26.00	29.20	30.00	0.1655	1.0000	4.00	11.01	4.00	Pass
NR Band n77 (3700-3980) (MIMO)	3710.01	3.20	2.40	26.00	29.20	30.00	0.1655	1.0000	4.00	11.01	4.00	Pass
NR Band n78 (3450-3550)	3460.02	1.70	N/A	25.00	26.70	30.00	0.0931	1.0000	5.00	12.01	5.00	Pass
NR Band n78 (3450-3550) (HPUE)	3460.02	1.70	N/A	28.00	29.70	30.00	0.1857	1.0000	2.00	9.01	2.00	Pass
NR Band n78 (3450-3550) (MIMO)	3460.02	1.70	2.40	28.00	29.70	30.00	0.1857	1.0000	2.00	9.01	2.00	Pass
NR Band n78 (3700-3800)	3710.01	1.70	N/A	25.00	26.70	30.00	0.0931	1.0000	5.00	12.01	5.00	Pass
NR Band n78 (3700-3800) (HPUE)	3710.01	1.70	N/A	28.00	29.70	30.00	0.1857	1.0000	2.00	9.01	2.00	Pass
NR Band n78 (3700-3800) (MIMO)	3710.01	1.70	2.40	28.00	29.70	30.00	0.1857	1.0000	2.00	9.01	2.00	Pass
Bluetooth	2402.0	0.20	0.20	9.00	9.20	30.00	0.0017	1.0000	NA	NA	NA	Pass
2.4GWIFI	2412.0	0.20	0.20	20.00	20.20	30.00	0.0208	1.0000	NA	NA	NA	Pass
5GWIFI	5180.0	-0.70	-0.70	19.00	18.30	30.00	0.0135	1.0000	NA	NA	NA	Pass
6EWIFI	5955.0	1.60	1.60	20.00	21.60	24.00	0.0288	1.0000	NA	NA	NA	Pass



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Due to the EUT support NR ENDC and CA

Both LTE and NR/LTE band can transmit simultaneously, the formula of the calculated the MPE is:

$$\sum_{i=1}^n \frac{S_{E_i}(\text{duty factor})}{MPE_{E_i}} < 1$$

NOTE The corresponding MEs must be expressed in terms of power density in the above summation
Therefore, the worst-case(LTE CA_41C) situation is $0.2083+0.2083=0.4166$, which is less than "1",
this confirmed that the device comply with MPE limit.



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3.1.4 Exposure calculations for multiple sources

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	WWAN+ Bluetooth + WiFi 2.4G
2	WWAN+ Bluetooth + WiFi 5G
3	WWAN+ Bluetooth + 6EWiFi

No.	Mode	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)	Result Ratio	Total Ratio	Limit	Result
1	LTE Band 13	0.1145	0.5197	0.2203	0.2412	1.0000	PASS
	Bluetooth	0.0015	1.0000	0.0015			
	WiFi 2.4G	0.0194	1.0000	0.0194			
2	LTE Band 13	0.1145	0.5197	0.2203	0.2391	1.0000	PASS
	Bluetooth	0.0015	1.0000	0.0015			
	WiFi 5G	0.0173	1.0000	0.0173			
3	LTE Band 13	0.1145	0.5197	0.2203	0.2506	1.0000	PASS
	Bluetooth	0.0015	1.0000	0.0015			
	6E WiFi	0.0288	1.0000	0.0288			

Remark: This WWAN Band was recalculated on worst Band.

---End of Report---



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