



RF Exposure Evaluation Report

Application No.: HR/2021/30007
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: LTE Module
Model No.: EM05-G
Trade Mark: Quectel
FCC ID: XMR2021EM05G
Standards: 47 CFR Part 2.1091
 FCC KDB 447498 D01 v06
Date of Receipt: 2021/4/12
Date of Test: 2021/4/12 to 2021/5/5
Date of Issue: 2021/5/6

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

Authorized Signature:

Derek Yang
Wireless Laboratory Manager





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

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 No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
 中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2021/5/6		Original

Authorized for issue by:		
Prepared By		 (Dee Zheng) / Engineer
Checked By		 (Jim Huang) / 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 Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057

2.3 Test Facility

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

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory 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.

• **FCC –Designation Number: CN1178**

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

Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.



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

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.ssgroup.com.cn
中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com



2.4 General Description of EUT

EUT Description::	LTE Module
Model No.:	EM05-G
Trade Mark:	Quectel
Hardware Version:	R1.0
Software Version:	EM05GFAR07A05M1G
Sample Type:	<input type="checkbox"/> Portable Device, <input checked="" type="checkbox"/> Module
Antenna Type:	<input checked="" type="checkbox"/> External, <input type="checkbox"/> Integrated
Antenna Gain:	WCDMA Band II:1.59dBi(ANT1); 3.07dBi(ANT2); WCDMA Band IV:1.94dBi(ANT1); 3.38dBi(ANT2); WCDMA Band V:2.29dBi(ANT1); 3.96dBi(ANT2); LTE Band 2:1.59 dBi(ANT1); 3.07dBi(ANT2); LTE Band 4:1.94dBi(ANT1); 3.38dBi(ANT2); LTE Band 5:2.29dBi(ANT1); 3.96dBi(ANT2); LTE Band 7:2.68dBi(ANT1); 3.15dBi(ANT2); LTE Band 12:2.26dBi(ANT1); 3.6dBi(ANT2); LTE Band 13:4.45dBi(ANT1); 3.55dBi(ANT2); LTE Band 14:3.65dBi(ANT1); 3.55dBi(ANT2); LTE Band 25:1.59dBi(ANT1); 3.07dBi(ANT2); LTE Band 26:2.53dBi(ANT1); 3.96dBi(ANT2); LTE Band 38:2.06dBi(ANT1); 3.22dBi(ANT2); LTE Band 41:2.68dBi(ANT1); 3.31dBi(ANT2); LTE Band 66:1.94dBi(ANT1); 3.7dBi(ANT2); LTE Band 71:1.66dBi(ANT1); 3.07dBi(ANT2);



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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SGS-CSTC Standards Technical Services Co., Ltd.
 Shenzhen Branch (FCC Laboratory)

No.1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, China 518057 t (86-755) 26012053 f (86-755) 26710594 www.sgsgroup.com.cn
 中国·深圳·科技园中区M-10栋一号厂房 邮编: 518057 t (86-755) 26012053 f (86-755) 26710594 sgs.china@sgs.com

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:

Operating Band	Frequency (MHz)	Antenna Gain (dBi)	Max Conducted Average Output Power (dBm)	Output Power to Antenna (dBm)	EIRP(ERP) Limit (dBm)	Output Power to Antenna (mw)	Power Density at R = 20 cm (mW/cm ²)	Limit (mW/cm ²)	Gain according to EIRP (dBi)	Gain according to Pd (dBi)	Max Gain Allowed (dBi)	MAX Power Density	conclusion
WCDMA B2	1852.4	3.07	25.50	28.57	33.00	354.8134	0.1431	1.0000	7.50	11.51	7.50	0.3969	Pass
WCDMA B4	1712.4	3.38	25.50	28.88	30.00	354.8134	0.1537	1.0000	4.50	11.51	4.50	0.1989	Pass
WCDMA B5	826.4	3.96	25.50	27.31	38.45	354.8134	0.1757	0.5509	15.10	8.92	8.92	0.5505	Pass
LTE B2	1880	3.07	25.50	28.57	33.00	354.8134	0.1431	1.0000	7.50	11.51	7.50	0.3969	Pass
LTE B4	1710.7	3.38	25.50	28.88	30.00	354.8134	0.1537	1.0000	4.50	11.51	4.50	0.1989	Pass
LTE B5	824.70	3.96	25.50	27.31	38.45	354.8134	0.1757	0.5498	15.10	8.91	8.91	0.5492	Pass
LTE B7	2502.50	3.15	25.50	28.65	33.00	354.8134	0.1458	1.0000	7.50	11.51	7.50	0.3969	Pass
LTE B12	699.70	3.60	25.50	26.95	34.77	354.8134	0.1617	0.4665	11.42	8.20	8.20	0.4664	Pass
LTE B13	779.50	3.55	25.50	26.90	34.77	354.8134	0.1599	0.5197	11.42	8.66	8.66	0.5185	Pass
LTE B14	790.5	3.55	25.50	26.90	34.77	354.8134	0.1599	0.5270	11.42	8.73	8.73	0.5269	Pass
LTE B25	1850.7	3.07	25.50	28.57	33.00	354.8134	0.1431	1.0000	7.50	11.51	7.50	0.3969	Pass
LTE B26(824-849)	824.7	3.96	25.50	27.31	38.45	354.8134	0.1757	0.5498	15.10	8.91	8.91	0.5492	Pass
LTE B38	2572.5	3.22	25.50	28.72	33.00	354.8134	0.1482	1.0000	7.50	11.51	7.50	0.3969	Pass
LTE B41	2498.5	3.32	25.50	28.82	33.00	354.8134	0.1516	1.0000	7.50	11.51	7.50	0.3969	Pass
LTE B66	1710.7	3.70	25.50	29.20	30.00	354.8134	0.1655	1.0000	4.50	11.51	4.50	0.1989	Pass
LTE B71	665.5	3.07	25.50	26.42	34.77	354.8134	0.1431	0.4437	11.42	7.98	7.98	0.4433	Pass
WLAN 2.4GHz	2412	5.00	23.00	28.00		199.5262	0.1255	1.0000					
WLAN 5GHz	5180	5.00	23.00	28.00		199.5262	0.1255	1.0000					
Bluetooth	2402	5.00	23.00	28.00		199.5262	0.1255	1.0000					

Note

1. This MPE analysis is applicable to any collocated transmitters with transmit power for WLAN is less than or equal to 28dBm and for Bluetooth is less than or equal to 28dBm.
 2. A maximum antenna gain of 5dBi for WLAN/BT has been assumed for all collocated antennas.
- This confirmed that the device comply with MPE limit.



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:

WWAN	WLAN	Bluetooth	Σ (Power Density / Limit)
Power Density / Limit	Power Density / Limit	Power Density / Limit	WWAN + WLAN + Bluetooth
0.5505	0.1255	0.1255	0.8015

Note : Considering the WWAN module collocation with the WLAN and Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant.

The End

