

TEST REPORT

Applicant: Quectel Wireless Solutions Company Limited
Address: Building 5, Shanghai Business Park PhaseIII (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Equipment Type: LTE-A Cat 6 M.2 Module
Model Name: EM060K-GL
Brand Name: N/A
FCC ID: XMR2022EM060KGL
Test Standard: 47 CFR Part 2.1093
KDB 447498 D04 v01
Test Date: Nov. 06, 2023
Date of Issue: Dec. 11, 2023

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Xiong Lining**Checked by:** Xu Rui**Approved by:** Tolan Tu
(Testing Director)

Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Dec. 11, 2023</u>	<u>Initial Issue</u>

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☒ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☐ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Quectel Wireless Solutions Company Limited
Address	Building 5, Shanghai Business Park PhaseIII (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

2.2 Manufacturer Information

Manufacturer	Quectel Wireless Solutions Company Limited
Address	Building 5, Shanghai Business Park PhaseIII (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

2.3 General Description for Equipment under Test (EUT)

EUT Name	LTE-A Cat 6 M.2 Module
Model Name Under Test	EM060K-GL
Series Model Name	N/A
Description of Model name differentiation	N/A
Integrated WLAN Module	Brand Name: MediaTek Model Name: MT7921(FCC ID: RAS-MT7921)
Hardware Version	N/A
Software Version	N/A

2.3.1 Host Information:

Product Name	Notebook Computer
Model Name	Lenovo 100e Chromebook Gen 4
Brand Name	Lenovo

2.3.1 Antenna Information:

Frequency Band	Antenna Gain (dBi)	Antenna Manufacturer & Model Name
Band 2	1.812	INPAQ: WA-P-S6G1-15-001 INNOWAVE: F00192907110001
Band 4	2.76	
Band 5	0.94	
Band 7	0.823	
Band 12	0.115	
Band 13	1.725	
Band 14	1.425	
Band 17	0.115	
Band 25	1.803	
Band 26	0.94	
Band 30	0.894	
Band 38	1.29	
Band 41	0.915	
Band 42	1.254	
Band 43	1.632	
Band 48	0.897	
Band 66	2.378	
Band 71	0.173	

2.4 Ancillary Equipment

Note: Not applicable.

2.5 Technical Information

Network and Wireless connectivity	3G Network WCDMA/HSDPA/HSUPA Band 2/4/5 4G Network FDD LTE Band 2/4/5/7/12/13/14/17/25/26/30/66/71 TDD LTE Band 38/41/42/43/48 Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n, VHT, 802.11ac and 802.11ax U-NII-1/2A/2C/3
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WCDMA, LTE, WLAN, Bluetooth		
Frequency Range	WCDMA Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	WCDMA Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	LTE Band 12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE Band 13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	LTE Band 14	TX: 788 ~ 798 MHz	RX: 758 ~ 768 MHz
	LTE Band 17	TX: 704 ~ 716 MHz	RX: 734 ~ 746 MHz
	LTE Band 25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	LTE Band 26	TX: 814 ~ 849 MHz	RX: 859 ~ 894 MHz
	LTE Band 30	TX: 2305 ~ 2315 MHz	RX: 2350 ~ 2360 MHz
	LTE Band 38	TX: 2570 ~ 2620 MHz	RX: 2570 ~ 2620 MHz
	LTE Band 41	TX: 2496 ~ 2690 MHz	RX: 2496 ~ 2690 MHz
	LTE Band 42	TX: 3450 ~ 3550 MHz	RX: 3450 ~ 3550 MHz
	LTE Band 43	TX: 3700 ~ 3800 MHz	RX: 3700 ~ 3800 MHz
	LTE Band 48	TX: 3550 ~ 3700 MHz	RX: 3550 ~ 3700 MHz
	LTE Band 66	TX: 1710 ~ 1780 MHz	RX: 2110 ~ 2200 MHz
	LTE Band 71	TX: 663 ~ 698 MHz	RX: 617 ~ 652 MHz
	802.11b/g/n(HT20/HT40)	2412 ~ 2472 MHz	
	802.11ac(VHT20/VHT40)	2412 ~ 2472 MHz	
	802.11ax(HE20/HE40)	2412 ~ 2472 MHz	
	802.11a/n(HT20/HT40)	5180 ~ 5240 MHz	
		5260 ~ 5320 MHz	
		5500 ~ 5720 MHz	
		5745 ~ 5825 MHz	
	802.11ac(VHT20/VHT40/VHT80)	5180 ~ 5240 MHz	
		5260 ~ 5320 MHz	
		5500 ~ 5720 MHz	

		5745 ~ 5825 MHz
	802.11 ax(HE20/HE40/ HE80)	5180 ~ 5240 MHz
		5260 ~ 5320 MHz
		5500 ~ 5720 MHz
		5745 ~ 5825 MHz
	Bluetooth	2402 ~ 2480 MHz
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna	
Exposure Category	General Population/Uncontrolled exposure	
EUT Type	Portable Device	

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	KDB 447498 D04 v01	KDB 447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Portable Derives:

CFR Title 47 §2.1093(b)

(b) For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

FCC KDB 447498 Derives:

According with FCC KDB 447498 D04, Appendix B, The SAR-based exemption formula applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). The following table shows the power threshold from 5mm to 50mm.

Power Thresholds (mW)					
Frequency (MHz)	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
300	39 mW	65 mW	88 mW	110 mW	129 mW
450	22 mW	44 mW	67 mW	89 mW	112 mW
835	9 mW	25 mW	44 mW	66 mW	90 mW
1900	3 mW	12 mW	26 mW	44 mW	66 mW
2450	3 mW	10 mW	22 mW	38 mW	59 mW
3600	2 mW	8 mW	18 mW	32 mW	49 mW
5800	1 mW	6 mW	14 mW	25 mW	40 mW
Frequency (MHz)	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of 50 mm
300	148 mW	166 mW	184 mW	201 mW	217 mW
450	135 mW	158 mW	180 mW	203 mW	226 mW
835	116 mW	145 mW	175 mW	207 mW	240 mW
1900	92 mW	122 mW	157 mW	195 mW	236 mW
2450	83 mW	111 mW	143 mW	179 mW	219 mW
3600	71 mW	96 mW	125 mW	158 mW	195 mW
5800	58 mW	80 mW	106 mW	136 mW	169 mW

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power including tune-up tolerance among production units
2. Per KDB 447498 D04, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D04, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D04, for separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive), the threshold Pth (mW) is given by Following:

$$P_{th}(mW) = \begin{cases} ERP_{20cm}(d/20cm)^x & d \leq 20cm \\ ERP_{20cm} & 20cm < d \leq 40cm \end{cases}$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm}\sqrt{f}} \right)$$

- a. f(GHz) is the RF channel transmit frequency in GHz
- b. d is the separation distance (cm), The result is rounded to one decimal place for comparison
- c. ERP_{20cm} are determined by:

$$ERP_{20cm}(mW) = f(x) = \begin{cases} 2040f & 0.3GHz \leq f < 1.5GHz \\ 3060 & 1.5GHz \leq f \leq 6GHz \end{cases}$$

5 ASSESSMENT RESULT

5.1 Output Power

WCDMA			
Mode	Band 2	Band 4	Band 5
Peak Power (dBm)	23.67	23.59	23.61
Antenna Gain (dBi)	0.25	1.47	1.1
EIRP/ERP (dBm)	23.92	25.06	22.56

Note: This table listed the worst case power value, please refer to 2309RSU052-U6 FCC Exposure report for more details.

LTE				
Mode	Band 2	Band 4	Band 5	Band 7
Peak Power (dBm)	23.76	23.75	23.75	23.35
Antenna Gain (dBi)	0.25	1.47	1.1	2.4
EIRP/ERP (dBm)	24.01	25.22	22.7	25.75
Mode	Band 12	Band 13	Band 14	Band 17
Peak Power (dBm)	23.58	23.76	23.67	23.58
Antenna Gain (dBi)	1.3	1.3	1.3	1.3
EIRP/ERP (dBm)	22.73	22.91	22.82	22.73
Mode	Band 25	Band 26	Band 30	Band 38
Peak Power (dBm)	23.76	23.79	23	23.56
Antenna Gain (dBi)	0.25	1.3	-3	2.4
EIRP/ERP (dBm)	24.01	22.94	20	25.96
Mode	Band 41	Band 42	Band 43	Band 48
Peak Power (dBm)	23.56	21.46	21.56	21.56
Antenna Gain (dBi)	2.4	-1.8	0.6	0.6
EIRP/ERP (dBm)	25.96	19.66	22.16	22.16
Mode	Band 66	Band 71	/	/
Peak Power (dBm)	23.75	23.77	/	/
Antenna Gain (dBi)	1.47	1.22	/	/
EIRP/ERP (dBm)	25.22	22.84	/	/

Note: This table listed the worst case power value, please refer to 2309RSU052-U1-U7 FCC Exposure report for more details.

5.2 Tune-up power

Mode	Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
WCDMA B2	[22.00, 24.00]	[22.00, 24.00]	[19.85, 21.85]
WCDMA B4	[22.00, 24.00]	[23.50, 25.50]	[21.35, 23.35]
WCDMA B5	[22.00, 24.00]	/	[21.00, 23.00]
LTE B2	[22.00, 24.00]	[22.50, 24.50]	[20.35,22.35]
LTE B4	[22.00, 24.00]	[23.50, 25.50]	[21.35, 23.35]
LTE B5	[22.00, 24.00]	/	[21.00, 23.00]
LTE B7	[22.00, 24.00]	[24.00, 26.00]	[21.85, 23.85]
LTE B12	[22.00, 24.00]	/	[21.00, 23.00]
LTE B13	[22.00, 24.00]	/	[21.00, 23.00]
LTE B14	[22.00, 24.00]	/	[21.00, 23.00]
LTE B17	[22.00, 24.00]	/	[21.00, 23.00]
LTE B25	[22.00, 24.00]	[22.50, 24.50]	[20.35,22.35]
LTE B26	[22.00, 24.00]	/	[21.00, 23.00]
LTE B30	[21.00, 23.00]	[18.00, 20.00]	[15.85,17.85]
LTE B38	[22.00, 24.00]	[24.00, 26.00]	[21.85, 23.85]
LTE B41	[22.00, 24.00]	[24.00, 26.00]	[21.85, 23.85]
LTE B42	[20.00, 22.00]	[18.00, 20.00]	[15.85,17.85]
LTE B43	[20.00, 22.00]	[21.00, 23.00]	[18.85, 20.85]
LTE B48	[20.00, 22.00]	[21.00, 23.00]	[18.85, 20.85]
LTE B66	[22.00, 24.00]	[24.00, 26.00]	[21.85, 23.85]
LTE B71	[22.00, 24.00]	/	[21.00, 23.00]

Note1: ERP= EIRP -2.15dB

Note2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth.

5.3 RF Exposure Evaluation Result

Mode	Distance (mm)	Calculation Frequency (GHz)	Tune-up limit power (dBm)	Tune-up limit power (mW)	Threshold Value (mW)	Power/Limit	Verdict
WCDMA B2	180	1.91	24.00	251.19	2518.59	0.10	Pass
WCDMA B4	180	1.755	24.00	251.19	2523.47	0.10	Pass
WCDMA B5	180	0.849	24.00	251.19	1490.53	0.17	Pass
LTE B2	180	1.91	24.00	251.19	2518.59	0.10	Pass
LTE B4	180	1.755	24.00	251.19	2523.47	0.10	Pass
LTE B5	180	0.849	24.00	251.19	1490.53	0.17	Pass
LTE B7	180	2.57	24.00	251.19	2501.55	0.10	Pass
LTE B12	180	0.716	24.00	251.19	1271.82	0.20	Pass
LTE B13	180	0.787	24.00	251.19	1388.89	0.18	Pass
LTE B14	180	0.798	24.00	251.19	1406.96	0.18	Pass
LTE B17	180	0.716	24.00	251.19	1271.82	0.20	Pass
LTE B25	180	1.915	24.00	251.19	2518.44	0.10	Pass
LTE B26	180	0.849	24.00	251.19	1490.53	0.17	Pass
LTE B30	180	2.315	23.00	199.53	2507.53	0.08	Pass
LTE B38	180	2.62	24.00	251.19	2500.44	0.10	Pass
LTE B41	180	2.69	24.00	251.19	2498.94	0.10	Pass
LTE B42	180	2.69	22.00	158.49	2498.94	0.06	Pass
LTE B43	180	2.69	22.00	158.49	2498.94	0.06	Pass
LTE B48	180	3.7	22.00	158.49	2480.78	0.06	Pass
LTE B66	180	1.78	24.00	251.19	2522.66	0.10	Pass
LTE B71	180	0.698	24.00	251.19	1242.01	0.20	Pass

Estimated SAR

Mode	Power/Limit	SAR Limit 1g (W/Kg)	Estimated SAR 1g (W/Kg)
WCDMA B2	0.10	1.60	0.16
WCDMA B4	0.10	1.60	0.16
WCDMA B5	0.17	1.60	0.27
LTE B2	0.10	1.60	0.16
LTE B4	0.10	1.60	0.16
LTE B5	0.17	1.60	0.27
LTE B7	0.10	1.60	0.16
LTE B12	0.20	1.60	0.32
LTE B13	0.18	1.60	0.29
LTE B14	0.18	1.60	0.29
LTE B17	0.20	1.60	0.32
LTE B25	0.10	1.60	0.16
LTE B26	0.17	1.60	0.27
LTE B30	0.08	1.60	0.13
LTE B38	0.10	1.60	0.16
LTE B41	0.10	1.60	0.16
LTE B42	0.06	1.60	0.10
LTE B43	0.06	1.60	0.10
LTE B48	0.06	1.60	0.10
LTE B66	0.10	1.60	0.16
LTE B71	0.20	1.60	0.32

Collocated SAR Calculation

Evolution Mode	Report SAR (W/Kg)	ΣSAR of Max WWAN + Max WLAN 2.4G (W/Kg)	Verdict
MAX.WWAN	0.32	0.75	Pass
MAX.WLAN 2.4G	0.43		
Note: The report SAR of WLAN refer to SFBARR-WTW-P21050905 Report for more details.			

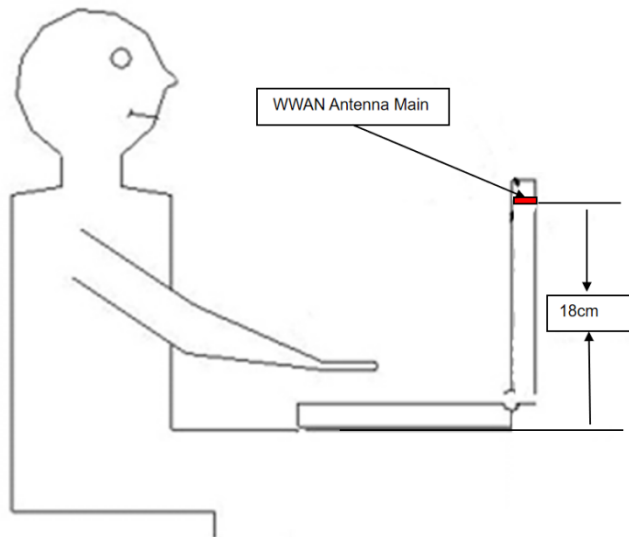
Evolution Mode	Report SAR（W/Kg）	ΣSAR of Max WWAN + Max WLAN 5G + Bluetooth（W/Kg）	Verdict
MAX.WWAN	0.32	1.40	Pass
MAX.WLAN 5G	0.79		
Bluetooth	0.29		
Note: The report SAR of WLAN and Bluetooth refer to SFBARR-WTW-P21050905 Report for more details.			

5.4 Conclusion

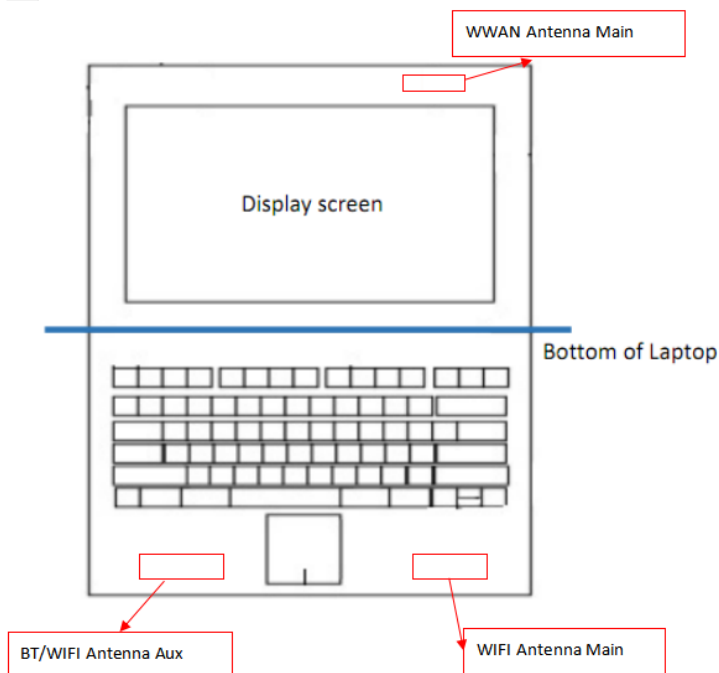
This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

ANNEX A ANTENNA LOCATION SKETCH

Notebook mode antenna position:



Antenna separation:



Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
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6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--