



RF Exposure Evaluation Declaration

FCC ID: XMR2022EM060KGL
Applicant: Quectel Wireless Solutions Co., Ltd
Product: LTE-A Cat 6 M.2 Module
Model No.: EM060K-GL
Brand Name: Quectel
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): FCC Part 2.1091
Evaluation Date: 2023-10-13
Result: Complies

Reviewed By:

Sunny Sun

Approved By:

Robin Wu



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

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Revision History

Report No.	Version	Description	Issue Date	Note
2309RSU052-U8	V01	Initial Report	2023-10-26	Valid

CONTENTS

Description	Page
1. General Information	4
1.1. Applicant.....	4
1.2. Manufacturer	4
1.3. Testing Facility.....	4
1.4. Product Information	5
1.5. Antenna Details	6
1.6. Device Classification	6
1.7. Applied Standards	6
2. RF Exposure Evaluation.....	7
2.1. Test Limits	7
2.2. MPE Exemptions.....	8
2.3. Calculated Result	11

1. General Information

1.1. Applicant

Quectel Wireless Solutions Co., Ltd

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

1.2. Manufacturer

Quectel Wireless Solutions Co., Ltd

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

1.3. Testing Facility

<input checked="" type="checkbox"/>	Test Site – MRT Suzhou Laboratory Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China Laboratory Location (Suzhou - SIP) 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China Laboratory Accreditations A2LA: 3628.01 CNAS: L10551 FCC: CN1166 ISED: CN0001 VCCI: <input type="checkbox"/> R-20025 <input type="checkbox"/> G-20034 <input type="checkbox"/> C-20020 <input type="checkbox"/> T-20020 <input type="checkbox"/> R-20141 <input type="checkbox"/> G-20134 <input type="checkbox"/> C-20103 <input type="checkbox"/> T-20104
<input type="checkbox"/>	Test Site – MRT Shenzhen Laboratory Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China Laboratory Accreditations A2LA: 3628.02 CNAS: L10551 FCC: CN1284 ISED: CN0105
<input type="checkbox"/>	Test Site – MRT Taiwan Laboratory Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) Laboratory Accreditations TAF: 3261 FCC: 291082, TW3261 ISED: TW3261

1.4. Product Information

Product Name	LTE-A Cat 6 M.2 Module
Model No.	EM060K-GL
Brand Name	Quectel
IMEI	Conducted sample: 867228050091049 Radiated sample: 857228050091213
3GPP Specification	WCDMA Band II/IV/V LTE FDD Band 2, 4, 5, 7, 12, 13, 14, 17, 25, 26, 30, 66, 71 LTE TDD Band 38, 41, 42, 43, 46, 48
GNSS Specification	GPS, GLONASS, Bei Dou, Galileo
Temperature Operating Range	-25 ~ 75 °C
Power Supply Rating	3.135 ~ 4.4Vdc, typical 3.7Vdc
Remark: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Antenna Details

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
WCDMA Band II	1850 ~ 1910	Dipole PIFA	0.25
WCDMA Band IV	1710 ~ 1755		1.47
WCDMA Band V	824 ~ 849		1.10
LTE Band 2	1850 ~ 1910		0.25
LTE Band 4	1710 ~ 1755		1.47
LTE Band 5	824 ~ 849		1.10
LTE Band 7	2500 ~ 2570		2.40
LTE Band 12	699 ~ 716		1.30
LTE Band 13	777 ~ 787		1.30
LTE Band 14	788 ~ 798		1.30
LTE Band 17	704 ~ 716		1.30
LTE Band 25	1850 ~ 1915		0.25
LTE Band 26	814 ~ 849		1.30
LTE Band 30	2305 ~ 2315		-3.00
LTE Band 38	2570 ~ 2620		2.40
LTE Band 41	2496 ~ 2690		2.40
LTE Band 42	3450 ~ 3550		-1.80
LTE Band 43	3700 ~ 3800		0.60
LTE Band 48	3550 ~ 3700		0.60
LTE Band 66	1710 ~ 1780		1.47
LTE Band 71	663 ~ 698		1.22

Note: The antenna gain is from antenna data sheet provided by the manufacturer.

1.6. Device Classification

According to the user manual, this device is classified as a Mobile Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

1.7. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01

2. RF Exposure Evaluation

2.1. Test Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits for Occupational/ Control 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
300-1,500	--	--	f/300	<6
1,500-100,000	--	--	5	<6
(B) Limits for General Population/ Uncontrolled Exposures				
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
300-1,500	--	--	f/1500	<30
1,500-100,000	--	--	1.0	<30

f= frequency in MHz. * = Plane-wave equivalent power density.

2.2. MPE Exemptions

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

(Option A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.

Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

(Option B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P is given by:

$$P_{th}(mW) = \{ERP_{20cm}(d / 20cm)^x \quad d \leq 20cm$$

$$P_{th}(mW) = \{ERP_{20cm} \quad 20cm < d \leq 40cm$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20cm}\sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20cm}(mW) = \{2040f \quad 0.3GHz \leq f < 1.5GHz$$

$$ERP_{20cm}(mW) = \{3060 \quad 1.5GHz \leq f \leq 6GHz$$

(Option C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1920R ²
1.34-30	3450R ² /f ²
30-300	3.83R ²
300-1,500	0.0128R ² f
1,500-100,000	19.2R ²

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P_{th} , including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

$P_{th,i}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i .

ERP_j = the ERP of fixed, mobile, or portable RF source j .

$ERP_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2\pi$ according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

$Evaluated_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

$Exposure Limit_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k , as applicable from §1.1310 of this chapter.

2.3. Calculated Result

Product	LTE-A Cat 6 M.2 Module
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Tune-up Conducted Power (dBm)	Antenna Gain (dBi)	Tune-up ERP (dBm)
WCDMA Band II	1850 ~ 1910	25.0	0.25	23.10
WCDMA Band IV	1710 ~ 1755	25.0	1.47	24.32
WCDMA Band V	824 ~ 849	25.0	1.10	23.95
LTE Band 2	1850 ~ 1910	24.5	0.25	22.60
LTE Band 4	1710 ~ 1755	24.5	1.47	23.82
LTE Band 5	824 ~ 849	24.5	1.10	23.45
LTE Band 7	2500 ~ 2570	24.0	2.40	24.25
LTE Band 12	699 ~ 716	24.5	1.30	23.65
LTE Band 13	777 ~ 787	24.5	1.30	23.65
LTE Band 14	788 ~ 798	24.5	1.30	23.65
LTE Band 17	704 ~ 716	24.5	1.30	23.65
LTE Band 25	1850 ~ 1915	24.5	0.25	22.60
LTE Band 26	814 ~ 849	24.5	1.30	23.65
LTE Band 30	2305 ~ 2315	23.0	-3.00	17.85
LTE Band 38	2570 ~ 2620	24.0	2.40	24.25
LTE Band 41	2496 ~ 2690	24.0	2.40	24.25
LTE Band 42	3450 ~ 3550	22.0	-1.80	18.05
LTE Band 43	3700 ~ 3800	22.0	0.60	20.45
LTE Band 48	3550 ~ 3700	22.0	0.60	20.45
LTE Band 66	1710 ~ 1780	24.5	1.47	23.82
LTE Band 71	663 ~ 698	24.5	1.22	23.57

Note: Tune-up power was declared by manufacturer.

For single RF source, Option C

Test Mode	$\lambda / 2 \pi$ (m)	R (m)	Tune-up ERP (mW)	Thresholds ERP (mW)	Gain according to Pd (dBi)
WCDMA Band II	0.0258	0.20	204.2	768	6.00
WCDMA Band IV	0.0279	0.20	270.4	768	6.00
WCDMA Band V	0.0579	0.20	248.3	425	3.40
LTE Band 2	0.0258	0.20	182.0	768	6.50
LTE Band 4	0.0279	0.20	241.0	768	6.50
LTE Band 5	0.0579	0.20	221.3	425	3.90
LTE Band 7	0.0191	0.20	266.1	768	7.00
LTE Band 12	0.0683	0.20	231.7	358	3.19
LTE Band 13	0.0614	0.20	231.7	398	3.65
LTE Band 14	0.0606	0.20	231.7	403	3.71
LTE Band 17	0.0678	0.20	231.7	360	3.22
LTE Band 25	0.0258	0.20	182.0	768	6.50
LTE Band 26	0.0587	0.20	231.7	417	3.85
LTE Band 30	0.0207	0.20	61.0	768	8.00
LTE Band 38	0.0186	0.20	266.1	768	7.00
LTE Band 41	0.0191	0.20	266.1	768	7.00
LTE Band 42	0.0138	0.20	63.8	768	9.00
LTE Band 43	0.0129	0.20	110.9	768	9.00
LTE Band 48	0.0134	0.20	110.9	768	9.00
LTE Band 66	0.0279	0.20	241.0	360	6.50
LTE Band 71	0.0720	0.20	227.5	339	2.96

Note: R is from user manual.

Therefore, the device qualifies for RF exposure test exemption.