



MPE TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR201609EC21V
Product LTE Module
Brand Quectel
Model EC21-V; EC21-V MINIPCIE
Report No. R1806A0295-M2
Issue Date August 6, 2018

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC 47 CFR Part 1 1.1310**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Jiang peng Lan

Performed by: Jiangpeng Lan

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1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test facility

CNAS (accreditation number:L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City: Shanghai
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E-mail: xukai@ta-shanghai.com

1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2 Description of Equipment under Test

Client Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	7th Floor, Hongye Building, No.1801 Hongmei Road, Xuhui District, Shanghai 200233, China

General Technologies

Model	EC21-V; EC21-V MINIPCIE
IMEI	861108030344575
Hardware Version	R1.1
Software Version	EC21VGBR05A01M4G
Date of Testing:	June 20, 2018 ~ July 13, 2018

EC21-V; EC21-V MINIPCIE (Report No: R1806A0295-M2) is a variant model of EC25-V (Report No: RTWK160705002-00). Test values all retested for variant in this report. The detailed product change description please refers to the ANNEX A.

3 Maximum conducted output power (measured) and antenna Gain

The numeric gain (G) of the antenna with a gain specified in dB is determined by

Numeric gain (G)= $10^{(\text{antenna gain}/10)}$

Band	Maximum Conducted Output Power (dBm)	
	(dBm)	(mW)
LTE Band 4	23.5	223.872
LTE Band 13	23.5	223.872



According to section 1.1310 of FCC 47 CFR Part 1, limits for maximum permissible exposure (MPE) are as following

TABLE 1 – LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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
3-30	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

Note1. Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational / controlled limits apply provided he or she is made aware of the potential for exposure.

Note2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



The maximum permissible exposure for 300~1500 MHz is f/1500, for 1500~100,000MHz is 1.0. So

Band	The maximum permissible exposure
LTE Band 4	1.00mW/cm ²
LTE Band 13	0.523mW/cm ²

Band	Maximum Conducted Output Power (dBm)	EIRP limit (dBm)	Margin1 (dB)	Power density Limit		Margin2 (dB)	Final Margin (dB)
				(mW/cm ²)	(dBm)		
LTE Band 4	23.5	30.000	6.500	1.000	37.013	13.513	6.500
LTE Band 13	23.5	36.920	13.420	0.523	34.198	10.698	10.698

Note: 1. The Maximum allowed antenna gain per Band should be less than or equal to the Final Margin.

2. The Final Margin is determined and selected to the worst-case of Margin1 and Margin2.

3. Margin1=EIRP Limit(dBm)-Maximum Conducted Power (dBm). EIRP limit reference standard part22/ part24/part27and part90 for each band, EIRP = ERP + 2.15 (dB).

4. Margin2=Power density Limit(dBm)-Maximum Conducted Power (dBm). Power density Limit(dBm): The max. obtained by MPE with 20cm.

IMPORTANT NOTE: To comply with the FCC RF exposure compliance requirements, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. No change to the antenna or the device is permitted. Any change to the antenna or the device could result in the device exceeding the RF exposure requirements and void user's authority to operate the device.

**RF Exposure Calculations:**

The following information provides the minimum separation distance for the highest gain antenna provided. This calculation is based on the conducted power, considering maximum power and antenna gain. The formula shown in KDB 447498 D01 is used in the calculation.

Equation from KDB 447498 D01 General RF Exposure Guidance v06 (10/23/2015) is:

$$S = PG / 4\pi R^2$$

Where: S = power density (in appropriate units, e.g. mW/cm²)

P = Time-average maximum tune up procedure (in appropriate units, e.g., mW)

G = the numeric gain of the antenna

R = distance to the center of radiation of the antenna (20 cm = limit for MPE)

Band	PG (mW)	Test Result (mW/cm ²)	Limit Value (mW/cm ²)	Conclusion
LTE Band 4	1000.000	0.199	1.000	Pass
LTE Band 13	2629.057	0.523	0.523	Pass
Note: R = 20cm $\pi = 3.1416$				

Note: For transmitters, minimum separation distance is 20cm, even if calculations indicate MPE distance is less.

ANNEX A: Product Change Description

Statement

We **Quectel Wireless Solutions Co., Ltd** declare the following models.

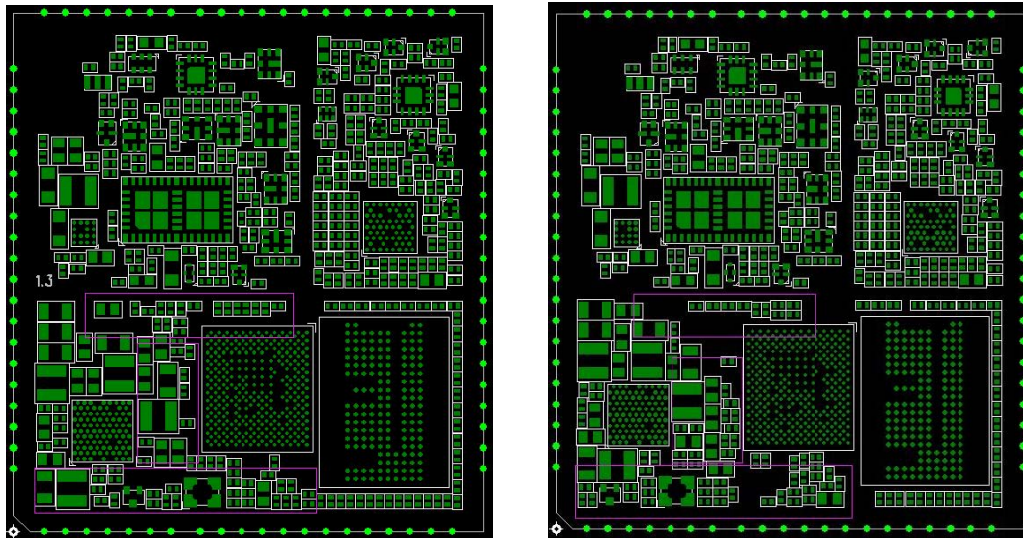
Product Name: LTE Module

Model Number: EC21-V, EC21-V MINIPCIE,

Hardware version: Refer to below table

Model	Certified HW Version A	New HW Version B
EC21-V, EC21-V MINIPCIE	R1.0	R1.1

All above series models share the same hardware and software design. Here we need to update the hardware to improve power supply. There are some differences between **Certified HW Version A** and **New HW Version B** on PCB design which are some capacitors and resistors' location which used for BB. The details are shown as following pictures and table.



Designator	R1.0 Position (mm, mm)	R1.1 Position (mm, mm)
C0301	(5.8, 13.7)	(9.7,6.89)
C0306	(7.475, 13.75)	(10.84,7.81)
C0310	-	(8.707, 13.847)
C0307	(10.85, 11.1)	-
C0328	(8.85, 12.78)	-
C0227	(8.085, 11.15)	-



R0501	(16.35, 13.9)	(19.08, 13.91)
C0340	-	(9.23, 1.7)
C0402	-	(12.37, 4.25)
C0227	(8.085, 11.15)	(4.45, 13.58)
C0330	(9.1, 11.375)	(9.66, 5.12)
C0211	(2.575, 11.03)	(2.42, 12.35)
L0201	(2.35, 9.15)	(2.32, 10.45)
L0202	(8.925, 7.1)	(8.15, 7.94)
C0214	(1.91, 2.73)	(1.89, 4.05)
L0204	(3.62, 2.64)	(3.78, 3.97)
Y0101	(11.61, 2.45)	(7.45, 2.39)
Q0101	(7.36, 2.125)	(3.32, 2.12)
C0317	(15.46, 2.3)	(17.01, 1.87)

We hereby state that there is no any other internal difference between them and the change is layout part of power supply BB which won't affect the RF portions and the original RF data can be re-used.

Your assistance on this matter is highly appreciated.

Sincerely,

Name: Jean Hu

Title: Certification Section