



# 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*

*Kai Xu*

*Approved by: Kai Xu*

**TA Technology (Shanghai) Co., Ltd.**

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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.  
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### 1.4 Laboratory Environment

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

## 2 Description of Equipment under Test

### Client Information

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

### General Technologies

|                         |                               |
|-------------------------|-------------------------------|
| <b>Model</b>            | EC21-V; EC21-V MINIPCIE       |
| <b>IMEI</b>             | 861108030344575               |
| <b>Hardware Version</b> | R1.1                          |
| <b>Software Version</b> | EC21VGBR05A01M4G              |
| <b>Date of Testing:</b> | 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<br>(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<br>(MHz)                                | Electric Field<br>Strength<br>(V/m) | Magnetic Field<br>Strength<br>(A/m) | Power Density<br>(mW/cm <sup>2</sup> ) | Averaging Time<br>(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 <sup>2</sup> )                 | 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 <sup>2</sup> )                 | 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 <sup>2</sup>           |
| LTE Band 13 | 0.523mW/cm <sup>2</sup>          |

| Band                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Maximum Conducted Output Power (dBm) | EIRP limit (dBm) | Margin1 (dB) | Power density Limit   |        | Margin2 (dB) | Final Margin (dB) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------|--------------|-----------------------|--------|--------------|-------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                      |                  |              | (mW/cm <sup>2</sup> ) | (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            |
| <p>Note: 1. The Maximum allowed antenna gain per Band should be less than or equal to the Final Margin.</p> <p>2. The Final Margin is determined and selected to the worst-case of Margin1 and Margin2.</p> <p>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).</p> <p>4. Margin2=Power density Limit(dBm)-Maximum Conducted Power (dBm). Power density Limit(dBm): The max. obtained by MPE with 20cm.</p> |                                      |                  |              |                       |        |              |                   |

**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/cm<sup>2</sup>)

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 <sup>2</sup> ) | Limit Value (mW/cm <sup>2</sup> ) | Conclusion |
|----------------------------------|----------|-----------------------------------|-----------------------------------|------------|
| LTE Band 4                       | 1000.000 | 0.199                             | 1.000                             | Pass       |
| LTE Band 13                      | 2629.057 | 0.523                             | 0.523                             | Pass       |
| Note: R = 20cm<br>$\pi = 3.1416$ |          |                                   |                                   |            |

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.

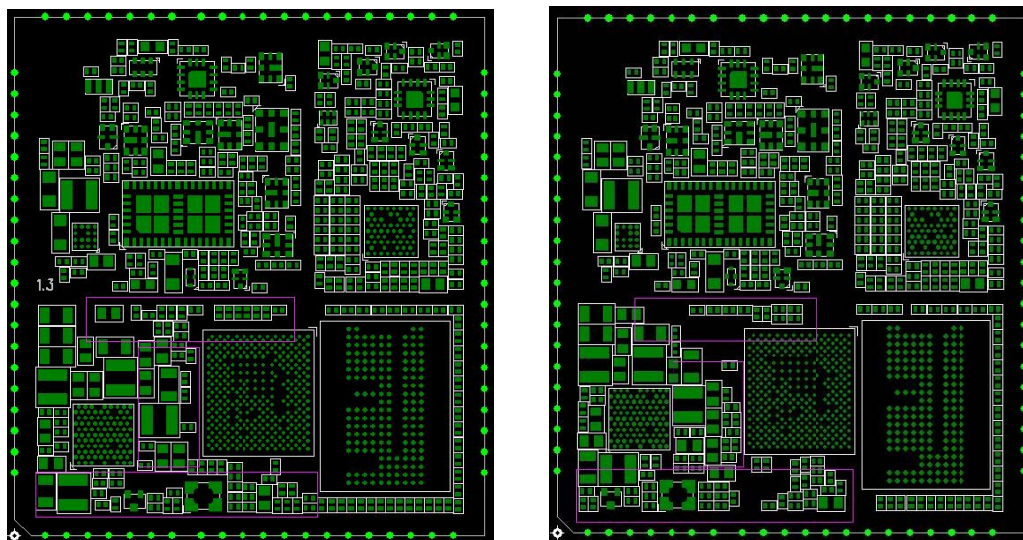
**Product Name:** LTE Module

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

**Hardware version:** Refer to below table

| Model                   | Certified<br>HW Version A | New<br>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<br>(mm, mm) | R1.1 Position<br>(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