

# SPOT CHECK REPORT

## FCC PART 27

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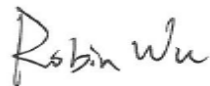
**FCC ID:** XMR2021EM121RGL  
**Application:** Quectel Wireless Solutions Company Limited  
**Application Type:** Certification  
**Product:** LTE-A Cat 12 M.2 Module  
**Model No.:** EM121R-GL  
**Brand Name:** Quectel  
**FCC Rule Part(s):** Part 27 Subpart D  
**Test Procedure(s):** ANSI C63.26: 2015  
**Test Date:** April 28, 2021 ~ May 18, 2021

Reviewed By:



Sunny Sun

Approved By:



Robin Wu



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.26-2015. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

## Revision History

| Report No.    | Version | Description    | Issue Date | Note  |
|---------------|---------|----------------|------------|-------|
| 2104RSU063-U5 | Rev. 01 | Initial Report | 05-30-2021 | Valid |
|               |         |                |            |       |

Note: This application for certification is leveraging the data reuse procedures from KDB 484596 based on reference FCC ID: XMR2020EM120RGL to cover variant FCC ID: XMR2021EM121RGL.

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## 1. GENERAL INFORMATION

### 1.1. Applicant

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

### 1.2. Manufacturer

Quectel Wireless Solutions Company Limited  
 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"/> | <b>Test Site - MRT Suzhou Laboratory</b>  |
|                                     | <b>Laboratory Location (Suzhou - Wuzhong)</b>   |
|                                     | D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China              |
|                                     | <b>Laboratory Location (Suzhou - SIP)</b>   |
|                                     | 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China    |
|                                     | <b>Laboratory Accreditations</b>  |
|                                     | A2LA: 3628.01 <span style="float: right;">CNAS: L10551</span>                                   |
|                                     | FCC: CN1166 <span style="float: right;">ISED: CN0001</span>                                     |
|                                     | VCCI: R-20025, G-20034, C-20020, T-20020  |
| <input type="checkbox"/>            | <b>Test Site - MRT Shenzhen Laboratory</b>  |
|                                     | <b>Laboratory Location (Shenzhen)</b>   |
|                                     | 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China |
|                                     | <b>Laboratory Accreditations</b>  |
|                                     | A2LA: 3628.02 <span style="float: right;">CNAS: L10551</span>                                   |
|                                     | FCC: CN1284 <span style="float: right;">ISED: CN0105</span>                                     |
| <input type="checkbox"/>            | <b>Test Site - MRT Taiwan Laboratory</b>  |
|                                     | <b>Laboratory Location (Taiwan)</b>   |
|                                     | No. 38, Fuxing 2 <sup>nd</sup> Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)            |
|                                     | <b>Laboratory Accreditations</b>  |
|                                     | TAF: L3261-190725   |
|                                     | FCC: 291082, TW3261 <span style="float: right;">ISED: TW3261</span>                             |

#### 1.4. Product Information

|                        |   |
|------------------------|---|
| Product Name:          | LTE-A Cat 12 M.2 Module                                 |
| Model No.:             | EM121R-GL   |
| Brand Name:            | Quectel   |
| IMEI:                  | 862718050001670   |
| Operating Temperature: | -25 ~ 75 °C   |
| Power Type:            | 3.1 ~ 4.4Vdc, typical 3.7Vdc                            |
| UMTS Specification     |   |
| Single Band:           | Band 2, 4, 5  |
| Modulation:            | Uplink up to 16QAM, Downlink up to 64QAM                |
| E-UTRA Specification   |   |
| Single Band:           | Band 2, 4, 5, 7, 12, 13, 14, 25, 26, 30, 38, 41, 48, 66 |
| Uplink CA Band:        | Intra-Band CA_41C                                       |
| Modulation:            | Uplink up to 64QAM, Downlink up to 256QAM               |

#### 1.5. Radio Specification under Test

|                                     |                          |
|-------------------------------------|--------------------------|
| FDD T <sub>x</sub> Frequency Range: | Band 30: 2305 ~ 2315 MHz |
| FDD R <sub>x</sub> Frequency Range: | Band 30: 2350 ~ 2360 MHz |

Note 1: For other features of this EUT, test report will be issued separately.

Note 2: The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

## 1.6. Description of Available Antennas

| Technology  | Frequency Range (MHz) | Antenna Type | Max Peak Gain (dBi) |
|-------------|-----------------------|--------------|---------------------|
| LTE Band 2  | 1850 ~ 1910           | Dipole       | 1.15                |
| LTE Band 4  | 1710 ~ 1755           |              | -0.50               |
| LTE Band 5  | 824 ~ 849             |              | 1.85                |
| LTE Band 7  | 2500 ~ 2570           |              | 1.32                |
| LTE Band 12 | 699 ~ 716             |              | -2.43               |
| LTE Band 13 | 777 ~ 787             |              | -0.10               |
| LTE Band 14 | 788 ~ 798             |              | 2.40                |
| LTE Band 25 | 1850 ~ 1915           |              | 1.15                |
| LTE Band 26 | 814 ~ 849             |              | 1.85                |
| LTE Band 30 | 2305 ~ 2315           |              | -3.64               |
| LTE Band 38 | 2570 ~ 2620           |              | 0.93                |
| LTE Band 41 | 2496 ~ 2690           |              | 0.93                |
| LTE Band 48 | 3550 ~ 3700           |              | -3.37               |
| LTE Band 66 | 1710 ~ 1780           |              | -0.50               |

Note: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

## 1.7. Test Methodology

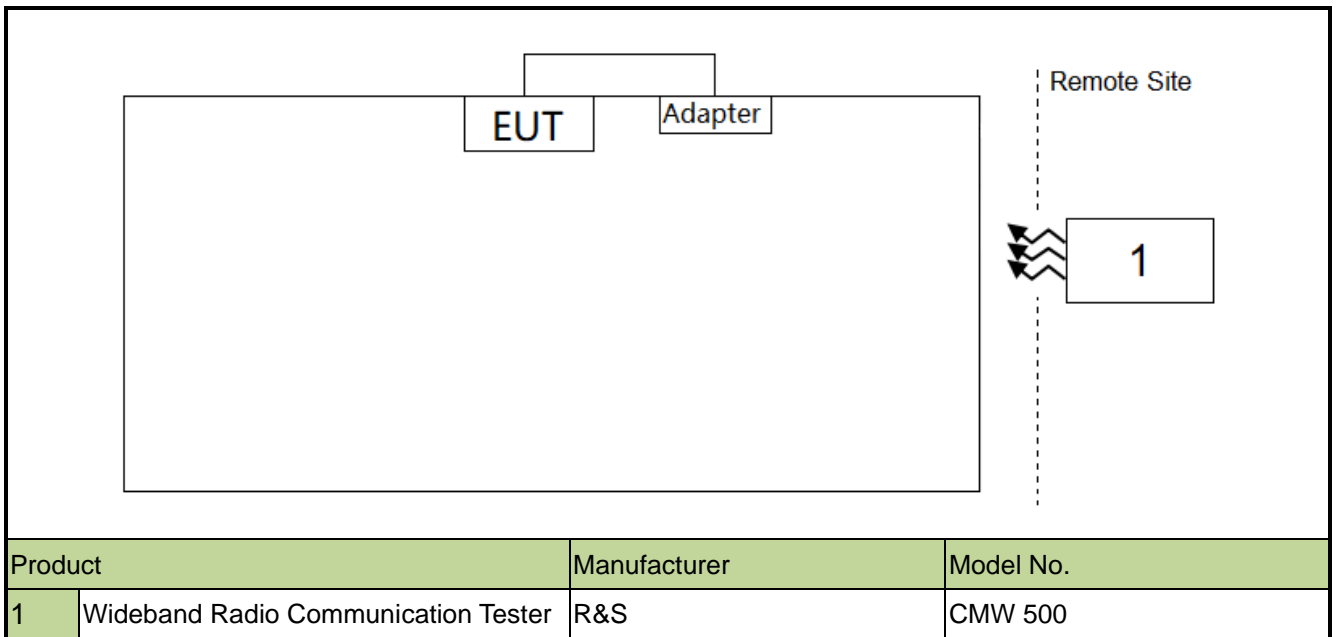
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26:2015
- FCC CFR 47 Part 27
- FCC KDB 971168 D01 v03r01: Power Meas License Digital Systems
- FCC KDB 971168 D02 v02r01: Misc Rev Approv License Devices

## 1.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

### 1.9. Configuration of Tested System



### 1.10. Test Environment Condition

|                     |             |
|---------------------|-------------|
| Ambient Temperature | 15 ~ 35°C   |
| Relative Humidity   | 20% ~ 75%RH |

## 2. TEST EQUIPMENT CALIBRATION DATE

Conducted Test Equipment (WZ-SR6, WZ-TR3)

| Instrument                             | Manufacturer | Type No.  | Asset No.   | Cali. Interval | Cali. Due Date |
|--|--------------|-----------|-------------|----------------|----------------|
| EXA Signal Analyzer                    | Agilent      | N9020A    | MRTSUE06106 | 1 year         | 2022/04/13     |
| EXA Signal Analyzer                    | Keysight     | N9010B    | MRTSUE06452 | 1 year         | 2021/07/11     |
| Signal Analyzer                        | R&S          | FSV40     | MRTSUE06218 | 1 year         | 2022/04/13     |
| Wideband Radio<br>Communication Tester | R&S          | CMW 500   | MRTSUE06243 | 1 year         | 2021/11/07     |
| Power Meter                            | Agilent      | U2021XA   | MRTSUE06030 | 1 year         | 2021/11/18     |
| DC Power Supply                        | GWINSTEK     | DPS-3303C | MRTSUE06064 | N/A            | N/A            |
| True RMS Clamp Meter                   | Fluke        | 319       | MRTSUE06080 | 1 year         | 2022/05/05     |
| Directional Coupler                    | Agilent      | 87301D    | MRTSUE06082 | 1 year         | 2022/03/08     |
| Dual Directional Coupler               | Agilent      | 7778D     | MRTSUE06083 | 1 year         | 2022/03/24     |
| Attenuator                             | MVE          | 6dB       | MRTSUE06534 | 1 year         | 2021/12/12     |
| Attenuator                             | MVE          | 10dB      | MRTSUE06543 | 1 year         | 2021/12/12     |
| Temperature & Humidity<br>Chamber      | BAOYT        | BYH-150CL | MRTSUE06051 | 1 year         | 2021/11/07     |
| Thermohygrometer                       | testo        | 608-H1    | MRTSUE06401 | 1 year         | 2021/08/08     |



### 3. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

|  |
|--|
| <b>Conducted Spurious Emissions</b>  |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>0.78dB |
| <b>Output Power</b>  |
| Measuring Uncertainty for a Level of Confidence of 95% ( $U=2Uc(y)$ ):<br>1.13dB |

## 4. TEST RESULT

### 4.1. Summary

| FCC Part Section(s) | Test Description                            | Test Limit                            | Test Condition | Test Result | Reference   |
|---------------------|---|---------------------------------------|----------------|-------------|-------------|
| 27.50(a)(3)         | Equivalent Isotropic Radiated Power Density | < 250mW/5MHz                          | Conducted      | Pass        | Section 4.2 |
| 2.1051, 27.53(a)(4) | Spurious Emission                           | <70 + 10log10 (P <sub>[Watts]</sub> ) |                | Pass        | Section 4.3 |

**Notes:**

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) The difference compared with the original report is only different GNSS Bands. Output power and conducted spurious emissions verification worst test refer to original report.

## 4.2. Equivalent Isotropically Radiated Power Measurement

### 4.2.1. Test Limit

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth

### 4.2.2. Test Procedures Used

ANSI C63.26-2015 - Section 5.2.4.4.2 & 5.2.5.5

### 4.2.3. Test Setting

When the fundamental condition for average power measurements cannot be realized (i.e., the EUT can not be configured to transmit at full-power on a continuous basis (i.e., duty cycle < 98%) and the instrumentation cannot be configured to measure only during active full-power transmissions), then the following procedure can be used if the EUT duty cycle is constant (i.e., duty cycle variations are less than or equal to  $\pm 2\%$ ).

- a) Set span to  $2 \times$  to  $3 \times$  the OBW.
- b) Set RBW = 1% to 5% of the OBW.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Set number of measurement points in sweep  $\geq 2 \times$  span / RBW.
- e) Sweep time:
  - 1) Set = auto-couple, or
  - 2) Set  $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$  for single sweep (automation-compatible) measurement.
- f) Detector = power averaging (rms).
- g) Set sweep trigger to "free run."
- h) Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple.

To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

i) Using the marker function to identify the maximum PSD.

j) Add  $10 \log (1/\text{duty cycle})$  to the measured power level to compute the average power during continuous transmission. For example, add  $[10 \log (1/0.25)] = 6 \text{ dB}$  if the duty cycle is a constant 25%.

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation (1) as follows:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_{\text{T}} \quad (1)$$

where

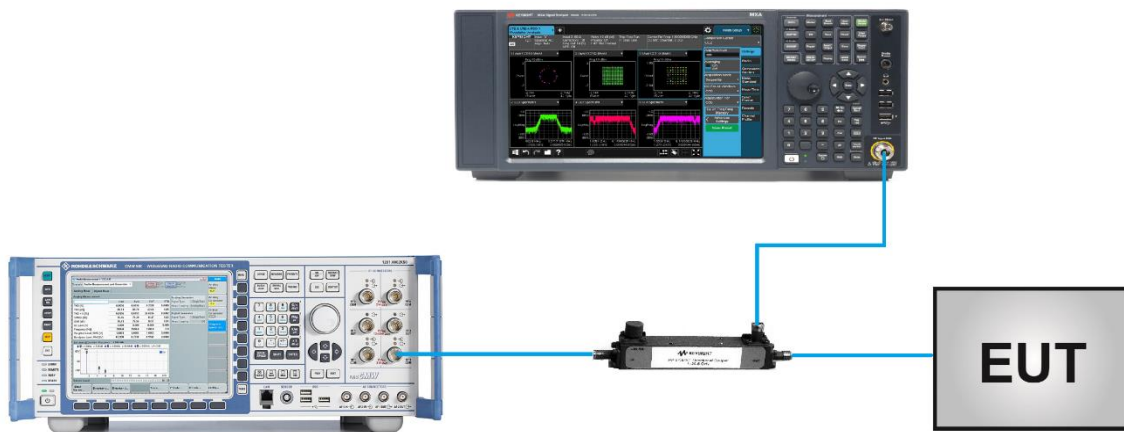
ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as  $P_{\text{Meas}}$ , e.g., dBm or dBW)

$P_{\text{Meas}}$  measured transmitter output power or PSD, in dBm or dBW

$G_{\text{T}}$  gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

For devices utilizing multiple antennas, see 6.4 for guidance with respect to determining the effective array transmit antenna gain term to be used in the above equation.

#### 4.2.4. Test Setup



#### 4.2.5. Test Result

|               |                         |           |            |
|---------------|-------------------------|-----------|------------|
| Product       | LTE-A Cat 12 M.2 Module | Test Site | WZ-SR6     |
| Test Engineer | Cloud Guo               | Test Date | 2021/04/28 |

| Channel No. | Frequency (MHz) | Channel Bandwidth (MHz) | RB Size | RB Offset | Power Density (dBm/5MHz) | EIRP Density (dBm/5MHz) | Limit (dBm /5MHz) |
|-------------|-----------------|-------------------------|---------|-----------|--------------------------|-------------------------|-------------------|
| QPSK        |                 |                         |         |           |                          |                         |                   |
| 27685       | 2307.5          | 5                       | 25      | 0         | 21.43                    | 17.79                   | < 23.98           |
| 27710       | 2310.0          | 5                       | 25      | 0         | 21.79                    | 18.15                   | < 23.98           |
| 27735       | 2312.5          | 5                       | 25      | 0         | 21.78                    | 18.14                   | < 23.98           |
| 27710       | 2310.0          | 10                      | 50      | 0         | 19.53                    | 15.89                   | < 23.98           |

Note: The EIRP Density (dBm/5MHz) = Power Density (dBm/5MHz) + Antenna Gain (dBi)

### **4.3. Conducted Spurious Emissions**

#### **4.3.1. Test Limit**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least  $70 + 10 \log (P)$  dB.

#### **4.3.2. Test Procedure Used**

ANSI C63.26-2015 - Section 5.7

#### **4.3.3. Test Setting**

1. Set the analyzer frequency to low, mid, high channel.
2. RBW = 1MHz
3. VBW  $\geq 3 \cdot$ RBW
4. Sweep time = auto
5. Detector = power averaging (rms)
6. Set sweep trigger to "free run."
7. User gate triggered such that the analyzer only sweeps when the device is transmitting at full power.
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple.

To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.

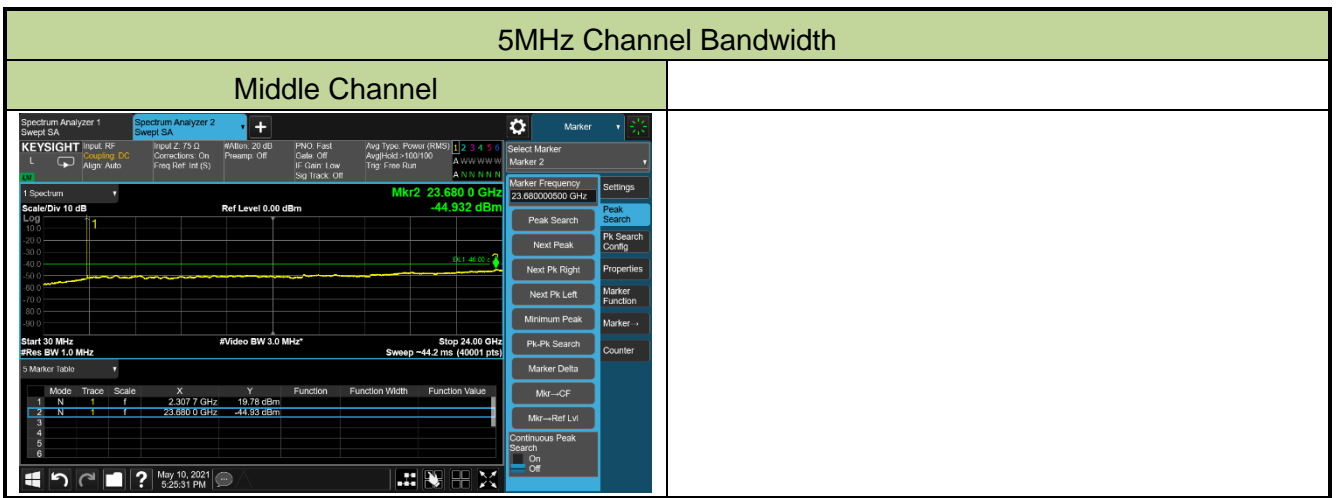
### 4.3.4. Test Setup



### 4.3.5. Test Result

|               |                         |           |            |
|---------------|-------------------------|-----------|------------|
| Product       | LTE-A Cat 12 M.2 Module | Test Site | WZ-SR6     |
| Test Engineer | Cloud Guo               | Test Date | 2021/05/10 |

| Channel | Frequency (MHz) | Channel Bandwidth (MHz) | Frequency Range (MHz) | Max Spurious Emissions (dBm) | Limit (dBm) | Result |
|---------|-----------------|-------------------------|-----------------------|------------------------------|-------------|--------|
| QPSK    |                 |                         |                       |                              |             |        |
| 27710   | 2310.0          | 5                       | 30 ~ 24000            | -44.93                       | ≤ -40.00    | Pass   |





## 5. CONCLUSION

The data collected relate only the item(s) tested and show that unitis compliance with FCC Rules.

## **Appendix A - Test Setup Photograph**

Refer to "2104RSU063-UT" file.

## **Appendix B - EUT Photograph**

Refer to "2104RSU063-UE" file.

## Appendix C - Reference Test Report