



# MPE TEST REPORT

|                   |                                     |
|-------------------|-------------------------------------|
| <b>Applicant</b>  | Quectel Wireless Solutions Co., Ltd |
| <b>FCC ID</b>     | XMR201912BG77                       |
| <b>Product</b>    | LTE Cat M1 & Cat NB2 Module         |
| <b>Brand</b>      | Quectel                             |
| <b>Model</b>      | BG77                                |
| <b>Marketing</b>  | Quectel BG77                        |
| <b>Report No.</b> | R2004A0248-M1                       |
| <b>Issue Date</b> | May 8, 2020                         |

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.

Handwritten signature of Yu Wang in black ink.

*Performed by: Yu Wang*

Handwritten signature of Guangchang Fan in black ink.

*Approved by: Guangchang Fan*

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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

#### **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.

### 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>    | Building 5, Shanghai Business Park Phase III (Area B), No.1016<br>Tianlin Road, Minhang District, Shanghai, China 200233 |
| <b>Manufacturer</b>         | Quectel Wireless Solutions Co., Ltd                                                                                      |
| <b>Manufacturer address</b> | Building 5, Shanghai Business Park Phase III (Area B), No.1016<br>Tianlin Road, Minhang District, Shanghai, China 200233 |

### General Technologies

|                                                                                                                                                                                                                                                                                                                                                                                                      |                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>Model</b>                                                                                                                                                                                                                                                                                                                                                                                         | BG77                                |
| <b>IMEI</b>                                                                                                                                                                                                                                                                                                                                                                                          | 866349040044541                     |
| <b>Hardware Version</b>                                                                                                                                                                                                                                                                                                                                                                              | R1.2                                |
| <b>Software Version</b>                                                                                                                                                                                                                                                                                                                                                                              | BG77LAR02A04                        |
| <b>Date of Testing:</b>                                                                                                                                                                                                                                                                                                                                                                              | December 13, 2019 ~January 14, 2020 |
| Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.<br>2. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. |                                     |

There is no test for BG77 in this report(Report No.: R2004A0248-M1).All test values duplicated from the BG77 report (Report No. : R1909A0576-M1). The detailed product change description please refers to the *Statement letter*.

### 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  

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

| Band           | Maximum Conducted Output Power (dBm) |         |
|----------------|--------------------------------------|---------|
|                | (dBm)                                | (mW)    |
| LTE Band 2     | 22.00                                | 158.489 |
| LTE Band 4     | 22.00                                | 158.489 |
| LTE Band 5     | 22.00                                | 158.489 |
| LTE Band 12    | 22.00                                | 158.489 |
| LTE Band 13    | 22.00                                | 158.489 |
| LTE Band 25    | 22.00                                | 158.489 |
| LTE Band 26    | 22.00                                | 158.489 |
| LTE Band 66    | 22.00                                | 158.489 |
| LTE Band 85    | 22.00                                | 158.489 |
| NB-IOT Band 2  | 22.00                                | 158.489 |
| NB-IOT Band 4  | 22.00                                | 158.489 |
| NB-IOT Band 5  | 22.00                                | 158.489 |
| NB-IOT Band 12 | 22.00                                | 158.489 |
| NB-IOT Band 13 | 22.00                                | 158.489 |
| NB-IOT Band 25 | 22.00                                | 158.489 |
| NB-IOT Band 66 | 22.00                                | 158.489 |
| NB-IOT Band 71 | 22.00                                | 158.489 |
| NB-IOT Band 85 | 22.00                                | 158.489 |

## 4 Test Result

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 2     | 1.0mW/cm2                        |
| LTE Band 4     | 1.0mW/cm2                        |
| LTE Band 5     | 0.55mW/cm2                       |
| LTE Band 12    | 0.47mW/cm2                       |
| LTE Band 13    | 0.52mW/cm2                       |
| LTE Band 25    | 1.0mW/cm2                        |
| LTE Band 26    | 1.0mW/cm2                        |
| LTE Band 66    | 1.0mW/cm2                        |
| LTE Band 85    | 1.0mW/cm2                        |
| NB-IOT Band 2  | 1.0mW/cm2                        |
| NB-IOT Band 4  | 1.0mW/cm2                        |
| NB-IOT Band 5  | 1.0mW/cm2                        |
| NB-IOT Band 12 | 0.55mW/cm2                       |
| NB-IOT Band 13 | 0.47mW/cm2                       |
| NB-IOT Band 25 | 1.0mW/cm2                        |
| NB-IOT Band 66 | 1.0mW/cm2                        |
| NB-IOT Band 71 | 0.44mW/cm2                       |
| NB-IOT Band 85 | 1.0mW/cm2                        |



| 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 2     | 22.000                               | 33.00            | 11.000       | 1.000                 | 37.013 | 15.013       | 11.000            |
| LTE Band 4     | 22.000                               | 30.00            | 8.000        | 1.000                 | 37.013 | 15.013       | 8.000             |
| LTE Band 5     | 22.000                               | 38.45            | 16.450       | 0.550                 | 34.416 | 12.416       | 12.416            |
| LTE Band 12    | 22.000                               | 34.77            | 12.770       | 0.470                 | 33.734 | 11.734       | 11.734            |
| LTE Band 13    | 22.000                               | 34.77            | 12.770       | 0.520                 | 34.173 | 12.173       | 12.173            |
| LTE Band 25    | 22.000                               | 33.00            | 11.000       | 1.000                 | 37.013 | 15.013       | 11.000            |
| LTE Band 26    | 22.000                               | 38.45            | 16.450       | 1.000                 | 37.013 | 15.013       | 15.013            |
| LTE Band 66    | 22.000                               | 30.00            | 8.000        | 1.000                 | 37.013 | 15.013       | 8.000             |
| LTE Band 85    | 22.000                               | 34.77            | 12.770       | 1.000                 | 37.013 | 15.013       | 12.770            |
| NB-IOT Band 2  | 22.000                               | 33.00            | 11.000       | 1.000                 | 37.013 | 15.013       | 11.000            |
| NB-IOT Band 4  | 22.000                               | 30.00            | 8.000        | 1.000                 | 37.013 | 15.013       | 8.000             |
| NB-IOT Band 5  | 22.000                               | 38.45            | 16.450       | 1.000                 | 37.013 | 15.013       | 15.013            |
| NB-IOT Band 12 | 22.000                               | 34.77            | 12.770       | 0.550                 | 34.416 | 12.416       | 12.416            |
| NB-IOT Band 13 | 22.000                               | 34.77            | 12.770       | 0.470                 | 33.734 | 11.734       | 11.734            |
| NB-IOT Band 25 | 22.000                               | 33.00            | 11.000       | 1.000                 | 37.013 | 15.013       | 11.000            |
| NB-IOT Band 66 | 22.000                               | 30.00            | 8.000        | 1.000                 | 37.013 | 15.013       | 8.000             |
| NB-IOT Band 71 | 22.000                               | 34.77            | 12.770       | 0.440                 | 33.447 | 11.447       | 11.447            |
| NB-IOT Band 85 | 22.000                               | 34.77            | 12.770       | 1.000                 | 37.013 | 15.013       | 12.770            |

Note: 1. The Maximum allowed antenna gain per Band should be less than or equal to the **Final Margin** which is the allowable maximum gain value to comply with limits for maximum permissible exposure (MPE).

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/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 2                   | 1995.262 | 0.397                             | 1.000                             | Pass       |
| LTE Band 4                   | 1000.000 | 0.199                             | 1.000                             | Pass       |
| LTE Band 5                   | 2764.394 | 0.550                             | 0.550                             | Pass       |
| LTE Band 12                  | 2362.653 | 0.470                             | 0.470                             | Pass       |
| LTE Band 13                  | 2613.966 | 0.520                             | 0.520                             | Pass       |
| LTE Band 25                  | 1995.262 | 0.397                             | 1.000                             | Pass       |
| LTE Band 26                  | 5026.897 | 1.000                             | 1.000                             | Pass       |
| LTE Band 66                  | 1000.000 | 0.199                             | 1.000                             | Pass       |
| LTE Band 85                  | 2999.163 | 0.597                             | 1.000                             | Pass       |
| NB-IOT Band 2                | 1995.262 | 0.397                             | 1.000                             | Pass       |
| NB-IOT Band 4                | 1000.000 | 0.199                             | 1.000                             | Pass       |
| NB-IOT Band 5                | 5026.897 | 1.000                             | 1.000                             | Pass       |
| NB-IOT Band 12               | 2764.394 | 0.550                             | 0.550                             | Pass       |
| NB-IOT Band 13               | 2362.653 | 0.470                             | 0.470                             | Pass       |
| NB-IOT Band 25               | 1995.262 | 0.397                             | 1.000                             | Pass       |
| NB-IOT Band 66               | 1000.000 | 0.199                             | 1.000                             | Pass       |
| NB-IOT Band 71               | 2211.566 | 0.440                             | 0.440                             | Pass       |
| NB-IOT Band 85               | 2999.163 | 0.597                             | 1.000                             | Pass       |
| Note: R = 20cm<br>π = 3.1416 |          |                                   |                                   |            |

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

\*\*\*\*\*END OF REPORT \*\*\*\*\*