



MPE TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR201912BG77
Product	LTE Cat M1 & Cat NB2 Module
Brand	Quectel
Model	BG77
Marketing	Quectel BG77
Report No.	R2004A0248-M1
Issue Date	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 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	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

General Technologies

Model	BG77
IMEI	866349040044541
Hardware Version	R1.2
Software Version	BG77LAR02A04
Date of Testing:	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. 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

Numeric gain (G)=10^{^(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 (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 2	1.0mW/cm ²
LTE Band 4	1.0mW/cm ²
LTE Band 5	0.55mW/cm ²
LTE Band 12	0.47mW/cm ²
LTE Band 13	0.52mW/cm ²
LTE Band 25	1.0mW/cm ²
LTE Band 26	1.0mW/cm ²
LTE Band 66	1.0mW/cm ²
LTE Band 85	1.0mW/cm ²
NB-IOT Band 2	1.0mW/cm ²
NB-IOT Band 4	1.0mW/cm ²
NB-IOT Band 5	1.0mW/cm ²
NB-IOT Band 12	0.55mW/cm ²
NB-IOT Band 13	0.47mW/cm ²
NB-IOT Band 25	1.0mW/cm ²
NB-IOT Band 66	1.0mW/cm ²
NB-IOT Band 71	0.44mW/cm ²
NB-IOT Band 85	1.0mW/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 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/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 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 π = 3.1416				

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

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