

MPE TEST REPORT

Applicant Quetel Wireless Solutions Co., Ltd.
FCC ID XMR2022BG772AGL
Product LTE Cat M1 & Cat NB2 Module
Brand Quetel
Model BG772A-GL
Report No. R2301A0034-M1
Issue Date July 18, 2023

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.



Prepared by: Wei Fangying

Approved by: Fan Guangchang

TA Technology (Shanghai) Co., Ltd.

Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

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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 measurements.

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
 Address: Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
 City: Shanghai
 Post code: 201201
 Country: P. R. China
 Contact: Fan Guangchang
 Telephone: +86-021-50791141/2/3
 Fax: +86-021-50791141/2/3-8000
 Website: <http://www.ta-shanghai.com>
 E-mail: fanguangchang@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	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233 China
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, 200233 China

General Technologies

Model	BG772A-GL	
IMEI	Original	863593050006733
Hardware Version	R1.1	
Software Version	BG772AGLAAR02A01	
Date of Sample Received	April 16, 2021	
<p>Note:</p> <ol style="list-style-type: none"> The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. 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. 		

BG772A-GL (Report No.: R2301A0034-M1) is a variant model (Variant 2) of BG772A-GL (Report No.: R2112A1193-M1).

BG772A-GL supports from Cat NB1 (3GPP R13) to Cat NB2 (3GPP R14) only by FW updating, the hardware remains the same.

The detailed product change description please refers to following table:

Module	BG772A-GL(Cat NB1)	BG772-GL(Cat NB2)
Category	Cat M1 & NB1	Cat M1 & NB2
Frequency Bands	Cat M1 Band 1/3/8/20/28 Cat NB1 Band 1/3/8/20/28	Cat M1 Band 1/3/8/20/28 Cat NB2 Band 1/3/8/20/28
Software Version	BG772AGLAAR01A03	BG772AGLAAR02A01
Product Name	LTE Module	LTE Cat M1 & Cat NB2 Module
Others	The same	

Test values all duplicated from Original for variant. There is no test for variant in this report.

The detailed product change description please refers to the *Difference Declaration Letter (Variant 2)*.

BG772A-GL (Report No.: R2112A1193-M1) is a variant model (Variant 1) of BG770A-GL (Report No.: R2104A0331-M1). Test values partial duplicated from Original for variant. There is no test for variant in this report. The detailed product change description please refers to the *Difference Declaration Letter (Variant 1)*.

3 Maximum Tune Up 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 Tune Up	
	(dBm)	(mW)
LTE-M Band 2	25.70	371.535
LTE-M Band 4	25.70	371.535
LTE-M Band 5	25.70	371.535
LTE-M Band 12	25.70	371.535
LTE-M Band 13	25.70	371.535
LTE-M Band 25	25.70	371.535
LTE-M Band 26	25.70	371.535
LTE-M Band 66	25.70	371.535
NB-IoT Band 2	25.70	371.535
NB-IoT Band 4	25.70	371.535
NB-IoT Band 5	25.70	371.535
NB-IoT Band 12	25.70	371.535
NB-IoT Band 13	25.70	371.535
NB-IoT Band 17	25.70	371.535
NB-IoT Band 25	25.70	371.535
NB-IoT Band 66	25.70	371.535

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 (mW/cm ²)
LTE-M Band 2	1.000
LTE-M Band 4	1.000
LTE-M Band 5	0.566
LTE-M Band 12	0.477
LTE-M Band 13	0.525
LTE-M Band 25	1.000
LTE-M Band 26	0.566
LTE-M Band 66	1.000
NB-LoT Band 2	1.000
NB-LoT Band 4	1.000
NB-LoT Band 5	0.566
NB-LoT Band 12	0.477
NB-LoT Band 13	0.525
NB-LoT Band 17	0.469
NB-LoT Band 25	1.000
NB-LoT Band 66	1.000

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	Maximum Conducted Output Power (dBm)	EIRP Limit (dBm)	Margin 1 (dB)	Power Density Limit (mW/cm ²)	PG (dBm)	Margin 2 (dB)	Final Margin (dB)	Gain (dBi)
LTE-M Band 2	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
LTE-M Band 4	25.70	30.000	4.300	1.000	37.013	11.313	4.300	4.300
LTE-M Band 5	25.70	38.450	12.750	0.566	34.541	8.841	8.841	8.841
LTE-M Band 12	25.70	34.770	9.070	0.477	33.798	8.098	8.098	8.098
LTE-M Band 13	25.70	34.770	9.070	0.525	34.214	8.514	8.514	8.514
LTE-M Band 25	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
LTE-M Band 26	25.70	38.450	12.750	0.566	34.541	8.841	8.841	8.841
LTE-M Band 66	25.70	30.000	4.300	1.000	37.013	11.313	4.300	4.300
NB-IoT Band 2	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
NB-IoT Band 4	25.70	30.000	4.300	1.000	37.013	11.313	4.300	4.300
NB-IoT Band 5	25.70	38.450	12.750	0.566	34.541	8.841	8.841	8.841
NB-IoT Band 12	25.70	34.770	9.070	0.477	33.798	8.098	8.098	8.098
NB-IoT Band 13	25.70	34.770	9.070	0.525	34.214	8.514	8.514	8.514
NB-IoT Band 17	25.70	34.770	9.070	0.469	33.724	8.024	8.024	8.024
NB-IoT Band 25	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
NB-IoT Band 66	25.70	30.000	4.300	1.000	37.013	11.313	4.300	4.300

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 Margin 1 and Margin 2.
3. Margin 1=EIRP Limit (dBm)-Maximum Conducted Power (dBm). EIRP limit reference standard part 22/ part 24 /part 27 for each band, EIRP = ERP + 2.15 (dB).
4. Margin 2=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.

Band	Maximum Tune up (dBm)	Antenna Gain (dBi)	PG (mW)	Test Result (mW/cm ²)	Limit Value (mW/cm ²)	Conclusion
LTE-M Band 2	25.70	7.300	1995.262	0.397	1.000	Pass
LTE-M Band 4	25.70	4.300	1000.000	0.199	1.000	Pass
LTE-M Band 5	25.70	8.841	2845.116	0.566	0.566	Pass
LTE-M Band 12	25.70	8.098	2397.728	0.477	0.477	Pass
LTE-M Band 13	25.70	8.514	2638.761	0.525	0.525	Pass
LTE-M Band 25	25.70	7.300	1995.262	0.397	1.000	Pass
LTE-M Band 26	25.70	8.841	2845.116	0.566	0.566	Pass
LTE-M Band 66	25.70	4.300	1000.000	0.199	1.000	Pass
NB-IoT Band 2	25.70	7.300	1995.262	0.397	1.000	Pass
NB-IoT Band 4	25.70	4.300	1000.000	0.199	1.000	Pass
NB-IoT Band 5	25.70	8.841	2845.116	0.566	0.566	Pass
NB-IoT Band 12	25.70	8.098	2397.728	0.477	0.477	Pass
NB-IoT Band 13	25.70	8.514	2638.761	0.525	0.525	Pass
NB-IoT Band 17	25.70	8.024	2357.219	0.469	1.000	Pass
NB-IoT Band 25	25.70	7.300	1995.262	0.397	1.000	Pass
NB-IoT Band 66	25.70	4.300	1000.000	0.199	1.000	Pass
Note: $R = 20\text{cm}$ $\pi = 3.1416$						

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

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Product Change Description (Variant 1)

The Product Change Description are submitted separately.

ANNEX C: Product Change Description (Variant 2)

The Product Change Description are submitted separately.

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