

MPE TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd.
FCC ID XMR2021BG951AGL
Product LTE Cat M1/NB Module
Brand Quectel
Model BG951A-GL
Report No. R2301A0026-M1
Issue Date March 21, 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.

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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.

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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	BG951A-GL
IMEI	(Original) 869410050002659
Hardware Version	R1.5
Software Version	BG951AGLAAR02A01
Date of Sample Received	July 20, 2021
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.	

BG951A-GL (Report No.: R2301A0026-M1) is a variant model (Variant 2) of BG951A-GL (Report No.: R2111A0947-M1V2). BG951A-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	BG951A-GL (Cat NB1)	BG951A-GL (Cat NB2)
Category	Cat M1 & NB1	Cat M1 & NB2
Frequency Bands	Cat M1 Band 2/4/5/12/13/25/26/66 Cat NB1 Band 2/4/5/12/13/17/25/66	Cat M1 Band 2/4/5/12/13/25/26/66 Cat NB2 Band 2/4/5/12/13/17/25/66
Others	The same	

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

BG951A (Report No.: R2111A0947-M1V2) is a variant model (Variant 1) of BG950A (Report No.: R2107A0607-M1). The product only change mode, Software version, Hardware version, product name and FCC ID. There is no tested in this report. The detailed product change description please refers to the *Difference Declaration Letter (Variant 1)*.

3 Maximum 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 Output Power	
	(dBm)	(mW)
LTE eMTC Band 2	25.70	371.535
LTE eMTC Band 4	25.70	371.535
LTE eMTC Band 5	25.70	371.535
LTE eMTC Band 12	25.70	371.535
LTE eMTC Band 13	25.70	371.535
LTE eMTC Band 25	25.70	371.535
LTE eMTC Band 26	25.70	371.535
LTE eMTC 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 eMTC Band 2	1.000
LTE eMTC Band 4	1.000
LTE eMTC Band 5	0.566
LTE eMTC Band 12	0.477
LTE eMTC Band 13	0.525
LTE eMTC Band 25	1.000
LTE eMTC Band 26	0.566
LTE eMTC Band 66	1.000
NB-IoT Band 2	1.000
NB-IoT Band 4	1.000
NB-IoT Band 5	0.566
NB-IoT Band 12	0.477
NB-IoT Band 13	0.525
NB-IoT Band 17	0.469
NB-IoT Band 25	1.000
NB-IoT 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)	Margin1 (dB)	Power density Limit		Margin2 (dB)	Final Margin (dB)	Gain (dBi)
				(mW/cm ²)	(dBm)			
LTE eMTC Band 2	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
LTE eMTC Band 4	25.70	30.000	4.300	1.000	37.013	11.313	4.300	4.300
LTE eMTC Band 5	25.70	40.600	14.900	0.566	34.541	8.841	8.841	8.841
LTE eMTC Band 12	25.70	36.850	11.150	0.477	33.798	8.098	8.098	8.098
LTE eMTC Band 13	25.70	36.850	11.150	0.525	34.214	8.514	8.514	8.514
LTE eMTC Band 25	25.70	33.000	7.300	1.000	37.013	11.313	7.300	7.300
LTE eMTC Band 26	25.70	40.600	14.900	0.566	34.541	8.841	8.841	8.841
LTE eMTC 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	40.600	14.900	0.566	34.541	8.841	8.841	8.841
NB-IoT Band 12	25.70	36.850	11.150	0.477	33.798	8.098	8.098	8.098
NB-IoT Band 13	25.70	36.850	11.150	0.525	34.214	8.514	8.514	8.514
NB-IoT Band 17	25.70	36.850	11.150	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 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.

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	2845.116	0.566	0.566	Pass
LTE Band 12	2397.728	0.477	0.477	Pass
LTE Band 13	2638.761	0.525	0.525	Pass
LTE Band 25	1995.262	0.397	1.000	Pass
LTE Band 26	2845.116	0.566	0.566	Pass
LTE Band 66	1000.000	0.199	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	2845.116	0.566	0.566	Pass
NB-IoT Band 12	2397.728	0.477	0.477	Pass
NB-IoT Band 13	2638.761	0.525	0.525	Pass
NB-IoT Band 17	2357.219	0.469	0.469	Pass
NB-IoT Band 25	1995.262	0.397	1.000	Pass
NB-IoT Band 66	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.

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

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.