



MPE TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR201909EG91NAX
Product	LTE Module
Brand	Quectel
Model	EG91-NAX
Report No.	R1907A0406-M2V1
Issue Date	November 28, 2019

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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Table of Contents

1	Test Laboratory.....	3
1.1	Notes of the Test Report	3
1.2	Testing Location.....	3
1.3	Laboratory Environment.....	3
2	Description of Equipment under Test.....	4
3	Maximum conducted output power (measured) and antenna Gain	5

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 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
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1.3 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	EG91-NAX
SN	868050040003283
Hardware Version	R1.0
Software Version	EG91NAXGAR07A01M1G
Date of Testing:	May 25, 2018 ~ June 27, 2018

EG91-NAX (Report No.: R1907A0406-M2) is a variant of the EG91-NA (Report No.: R1805A0250-M1). Test values duplicated from Original for variant. There is no test for variant in this report.

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

Band	Maximum Conducted Output Power	
	(dBm)	(mW)
WCDMA Band II	24.000	251.189
WCDMA Band IV	24.000	251.189
WCDMA Band V	24.000	251.189
LTE Band 2	24.500	281.838
LTE Band 4	24.500	281.838
LTE Band 5	24.500	281.838
LTE Band 12	24.500	281.838
LTE Band 13	24.500	281.838

According to section 1.1310 of FCC 47 CFR Part 1, limits for maximum permissible exposure (MPE) are as following

TABLE 1 – LIMITS FOR MAXIMUN 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
WCDMA II	$1.0\text{mW}/\text{cm}^2$
WCDMA IV	$1.0\text{mW}/\text{cm}^2$
WCDMA V	$0.55\text{mW}/\text{cm}^2$
LTE Band 2	$1.0\text{mW}/\text{cm}^2$
LTE Band 4	$1.0\text{mW}/\text{cm}^2$
LTE Band 5	$0.55\text{mW}/\text{cm}^2$
LTE Band 12	$0.47\text{mW}/\text{cm}^2$
LTE Band 13	$0.52\text{mW}/\text{cm}^2$

Band	Maximum Conducted Output Power (dBm)	EIRP limit (dBm)	Margin1 (dB)	Power density Limit		Margin2 (dB)	Final Margin (dB)
				(mW/cm ²)	(dBm)		
WCDMA II	24.000	33.000	9.000	1.000	37.013	13.013	9.000
WCDMA IV	24.000	30.000	6.000	1.000	37.013	13.013	6.000
WCDMA V	24.000	40.600	16.600	0.550	34.416	10.416	10.416
LTE Band 2	24.500	33.000	8.500	1.000	37.013	12.513	8.500
LTE Band 4	24.500	30.000	5.500	1.000	37.013	12.513	5.500
LTE Band 5	24.500	40.600	16.100	0.550	34.416	9.916	9.916
LTE Band 12	24.500	36.920	12.420	0.470	33.734	9.234	9.234
LTE Band 13	24.500	36.920	12.420	0.520	34.173	9.673	9.673

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)
WCDMA Band II	1995.262	0.397	1.000
WCDMA Band IV	1000.000	0.199	1.000
WCDMA Band V	2764.394	0.550	0.550
LTE Band 2	1995.262	0.397	1.000
LTE Band 4	1000.000	0.199	1.000
LTE Band 5	2764.394	0.550	0.550
LTE Band 12	2362.653	0.470	0.470
LTE Band 13	2613.966	0.520	0.520
Note: R = 20cm $\pi = 3.1416$			

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