



# MPE TEST REPORT

**Applicant**      Quectel Wireless Solutions Company  
   Limited

**FCC ID**            XMR2021SC200LEM

**Product**           Multi-mode Smart LTE Module  
   with Wi-Fi & Bluetooth

**Brand**              Quectel

**Model**              SC200L-EM

**Report No.**        R2101A0120-M1V1

**Issue Date**        March 11, 2021

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.

*Prepared by: Yu Wang*

Handwritten signature of Guangchang Fan in black ink.

*Approved by: Guangchang Fan*

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	March 3, 2021
Rev.1	Update information of applicant and manufacture; Update results of Bluetooth.	March 11, 2021

Note: This revised report (Report No. R2101A0120-M1V1) supersedes and replaces the previously issued report (Report No. R2101A0120-M1). Please discard or destroy the previously issued report and dispose of it accordingly.

# 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 $\Omega$
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

<b>Applicant</b>	Quectel Wireless Solutions Company Limited
<b>Applicant address</b>	Building 5, Shanghai Business Park PhaseIII (Area B),No.1016 Tianlin Road, Minhang District Shanghai China
<b>Manufacturer</b>	Quectel Wireless Solutions Company Limited
<b>Manufacturer address</b>	Building 5, Shanghai Business Park PhaseIII (Area B),No.1016 Tianlin Road, Minhang District Shanghai China

### General Technologies

<b>Model</b>	SC200L-EM
<b>SN</b>	P1C20KB30000013
<b>Hardware Version</b>	R1.0
<b>Software Version</b>	SC200LEMNAR02A04
<b>Date of Testing:</b>	February 8, 2021~ February 26, 2021
<b>Date of Sample Received:</b>	February 4, 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.

### 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		Burst Turn up Power(dBm)	Division Factors (dB)	Time-Averaged Tune up Power (dBm)
GSM 850	GSM	35.000	-9.03	25.97
GSM 1900	GSM	32.000	-9.03	22.97

Note:

Division Factors

To average the power, the division factor is as follows:

1Txslot = 1 transmit time slot out of 8 time slots

=> conducted power divided by (8/1) => -9.03 dB

Band	Maximum Conducted Output Power	
	(dBm)	(mW)
GSM850	25.970	395.367
GSM1900	22.970	198.153
WCDMA II	25.000	316.228
WCDMA V	25.000	316.228
LTE Band 2	25.000	316.228
LTE Band 5	25.000	316.228
LTE Band 7	25.000	316.228
LTE Band 38	25.000	316.228
LTE Band 41	25.000	316.228

## 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 <sup>2</sup> )	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 <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
GSM850	0.55mW/cm <sup>2</sup>
GSM1900	1.0mW/cm <sup>2</sup>
WCDMA II	1.0mW/cm <sup>2</sup>
WCDMA V	0.55mW/cm <sup>2</sup>
LTE Band 2	1.0mW/cm <sup>2</sup>
LTE Band 5	0.55mW/cm <sup>2</sup>
LTE Band 7	1.0mW/cm <sup>2</sup>
LTE Band 38	1.0mW/cm <sup>2</sup>
LTE Band 41	1.0mW/cm <sup>2</sup>
Wi-Fi 2.4G	1.0mW/cm <sup>2</sup>
Bluetooth	1.0mW/cm <sup>2</sup>
Bluetooth (Low Energy)	1.0mW/cm <sup>2</sup>

**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	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	PG (mW)	Test Result (mW/cm <sup>2</sup> )	Limit Value (mW/cm <sup>2</sup> )	The MPE ratio
GSM850	2.100	25.970	28.070	641.210	0.128	0.550	<b>0.232</b>
GSM1900	1.300	22.970	24.270	267.301	0.053	1.000	0.053
WCDMA II	1.300	25.000	26.300	426.580	0.085	1.000	0.085
WCDMA V	2.100	25.000	27.100	512.861	0.102	0.550	0.186
LTE Band 2	1.300	25.000	26.300	426.580	0.085	1.000	0.085
LTE Band 5	2.100	25.000	27.100	512.861	0.102	0.550	0.186
LTE Band 7	2.600	25.000	27.600	575.440	0.114	1.000	0.114
LTE Band 38	2.000	25.000	27.000	501.187	0.100	1.000	0.100
LTE Band 41	2.000	25.000	27.000	501.187	0.100	1.000	0.100
Wi-Fi 2.4G	0.250	18.500	18.750	74.989	0.015	1.000	<b>0.015</b>
Bluetooth	0.250	10.000	10.250	10.593	0.002	1.000	<b>0.002</b>
Bluetooth (Low Energy)	0.250	10.000	10.250	10.593	0.002	1.000	<b>0.002</b>
Note: R = 20cm $\pi = 3.1416$ The MPE ratio = Mac Test Result÷Limit Value							

So the simultaneous transmitting antenna pairs as below:

$\Sigma$  of MPE ratios = Main Antenna + Wi-Fi Antenna + Bluetooth + BLE = 0.232 + 0.015 + 0.002 + 0.002 = 0.251 < 1

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)		
GSM850	25.970	40.600	14.630	0.550	34.416	8.446	8.446
GSM1900	22.970	33.000	10.030	1.000	37.013	14.043	10.030
WCDMA II	25.000	33.000	8.000	1.000	37.013	12.013	8.000
WCDMA V	25.000	40.600	15.600	0.550	34.416	9.416	9.416
LTE Band 2	25.000	33.000	8.000	1.000	37.013	12.013	8.000
LTE Band 5	25.000	40.600	15.600	0.550	34.416	9.416	9.416
LTE Band 7	25.000	33.000	8.000	1.000	37.013	12.013	8.000
LTE Band 38	25.000	33.000	8.000	1.000	37.013	12.013	8.000
LTE Band 41	25.000	33.000	8.000	1.000	37.013	12.013	8.000

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/part27 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 <sup>2</sup> )	Limit Value (mW/cm <sup>2</sup> )	The MPE ratio	Conclusion
GSM850	2764.394	0.550	0.550	1.000	Pass
GSM1900	1995.262	0.397	1.000	0.397	Pass
WCDMA II	1995.262	0.397	1.000	0.397	Pass
WCDMA V	2764.394	0.550	0.550	1.000	Pass
LTE Band 2	1995.262	0.397	1.000	0.397	Pass
LTE Band 5	2764.394	0.550	0.550	1.000	Pass
LTE Band 7	1995.262	0.397	1.000	0.397	Pass
LTE Band 38	1995.262	0.397	1.000	0.397	Pass
LTE Band 41	1995.262	0.397	1.000	0.397	Pass
Note: R = 20cm $\Gamma = 3.1416$					

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.