MPE TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd
FCC ID	XMR2019SC650TNA
Product	Smart Module
Brand	Quectel
Model	SC650T-NA
Report No.	R2210A0926-M1V2
Issue Date	November 8, 2022

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

Version	Revision description	Issue Date
Rev.0	Initial issue of report.	October 25, 2022
Rev.1	Update FCC ID.	November 7, 2022
Rev.2	Update Model.	November 8, 2022
Note: This revised report (Report No. R2210A0926-M1V2) supersedes and replaces the previously issued report (Report No. R2210A0926-M1V1). 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.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
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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	SC650T-NA
IMEI	IMEI 1:865920060000042 IMEI 2:865920060000059
Hardware Version	R1.0
Software Version	SC650TNALPAR05A01
Date of Testing	October 12, 2022 ~ October 18, 2022
Date of Sample Received	October 12, 2022
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 Tune Up and Antenna Gain

Band	Maximum Tune Up Power		Antenna Gain (dBi)	Numeric Gain
	(dBm)	(mW)		
WCDMA Band II	25.000	316.228	1.590	1.442
WCDMA Band IV	25.000	316.228	2.000	1.585
WCDMA Band V	25.000	316.228	2.530	1.791
LTE Band 2	25.000	316.228	1.590	1.442
LTE Band 4	25.000	316.228	2.000	1.585
LTE Band 5	25.000	316.228	2.530	1.791
LTE Band 7	25.000	316.228	3.000	1.995
LTE Band 12	25.000	316.228	3.950	2.483
LTE Band 13	25.000	316.228	4.450	2.786
LTE Band 14	25.000	316.228	4.450	2.786
LTE Band 25	25.000	316.228	1.590	1.442
LTE Band 26	25.000	316.228	3.190	2.084
LTE Band 66	25.000	316.228	2.000	1.585
Bluetooth	10.500	11.220	5.380	3.451
Bluetooth (Low Energy)	2.500	1.778	5.380	3.451
Wi-Fi 2.4G	19.000	79.433	5.380	3.451
Wi-Fi 5G	19.500	89.125	5.050	3.199

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 MAXIMUN PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	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/f2)	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/f2)	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)
WCDMA Band II	1.000
WCDMA Band IV	1.000
WCDMA Band V	0.549
LTE Band 2	1.000
LTE Band 4	1.000
LTE Band 5	0.549
LTE Band 7	1.000
LTE Band 12	0.466
LTE Band 13	0.518
LTE Band 14	0.525
LTE Band 25	1.000
LTE Band 26	0.543
LTE Band 66	1.000
Wi-Fi 2.4GHz	1.000
Wi-Fi 5GHz	1.000
Bluetooth	1.000
Bluetooth LE	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/cm^2)

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 Tune up (dBm)	Antenna Gain (dBi)	Maximum EIRP (dBm)	PG (mW)	Test Result (mW/cm^2)	Limit Value (mW/cm^2)	The MPE ratio
WCDMA Band II	25.000	1.590	26.590	456.037	0.091	1.000	0.091
WCDMA Band IV	25.000	2.000	27.000	501.187	0.100	1.000	0.100
WCDMA Band V	25.000	2.530	27.530	566.239	0.113	0.549	0.205
LTE Band 2	25.000	1.590	26.590	456.037	0.091	1.000	0.091
LTE Band 4	25.000	2.000	27.000	501.187	0.100	1.000	0.100
LTE Band 5	25.000	2.530	27.530	566.239	0.113	0.549	0.205
LTE Band 7	25.000	3.000	28.000	630.957	0.126	1.000	0.126
LTE Band 12	25.000	3.950	28.950	785.236	0.156	0.466	0.335
LTE Band 13	25.000	4.450	29.450	881.049	0.175	0.518	**0.338**
LTE Band 14	25.000	4.450	29.450	881.049	0.175	0.525	0.334
LTE Band 25	25.000	1.590	26.590	456.037	0.091	1.000	0.091
LTE Band 26	25.000	3.190	28.190	659.174	0.131	0.543	0.242
LTE Band 66	25.000	2.000	27.000	501.187	0.100	1.000	0.100
Bluetooth	10.500	5.380	15.880	38.726	0.008	1.000	**0.008**
Bluetooth (Low Energy)	2.500	5.380	7.880	6.138	0.001	1.000	0.001
Wi-Fi 2.4G	19.000	5.380	24.380	274.157	0.055	1.000	**0.055**
Wi-Fi 5G	19.500	5.050	24.550	285.102	0.057	1.000	**0.057**

Note: **R** = 20cm

π= 3.1416

The MPE ratio = Mac Test Result÷Limit Value

So the simultaneous transmitting antenna pairs as below:

∑of MPE ratios=Main Antenna + Wi-Fi 2.4G Antenna + Wi-Fi 5G Antenna + Bluetooth =0.338 + 0.055 + 0.057 = 0.458 <1

Band	Maximum Conducted Output Power (Maximum Tune up) (dBm)	EIRP Limit (dBm)	Margin 1 (dB)	Power Density Limit		Margin 2 (dB)	Final Margin (dB)	Gain (dBi)
				(mW/cm^2)	(dBm)			
WCDMA Band II	25.000	33.000	8.000	1.000	37.013	12.013	8.000	8.000
WCDMA Band IV	25.000	30.000	5.000	1.000	37.013	12.013	5.000	5.000
WCDMA Band V	25.000	40.600	15.600	0.549	34.408	9.408	9.408	9.408
LTE Band 2	25.000	33.000	8.000	1.000	37.013	12.013	8.000	8.000
LTE Band 4	25.000	30.000	5.000	1.000	37.013	12.013	5.000	5.000
LTE Band 5	25.000	40.600	15.600	0.549	34.408	9.408	9.408	9.408
LTE Band 7	25.000	33.000	8.000	1.000	37.013	12.013	11.850	8.000
LTE Band 12	25.000	36.920	11.920	0.466	33.697	8.697	8.697	8.697
LTE Band 13	25.000	36.920	11.920	0.518	34.156	9.156	9.156	9.156
LTE Band 14	25.000	36.920	11.920	0.525	34.214	9.214	9.214	9.214
LTE Band 25	25.000	33.000	8.000	1.000	37.013	12.013	8.000	8.000
LTE Band 26	25.000	40.600	15.600	0.543	34.361	9.361	9.361	9.361
LTE Band 66	25.000	30.000	5.000	1.000	37.013	12.013	5.000	5.000

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 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/part 90S and part 90R for each band.
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	PG (mW)	Test Result (mW/cm^2)	Limit Value (mW/cm^2)	Conclusion
WCDMA Band II	1995.262	0.397	1.000	Pass
WCDMA Band IV	1000.000	0.199	1.000	Pass
WCDMA Band V	2759.307	0.549	0.549	Pass
LTE Band 2	1995.262	0.397	1.000	Pass
LTE Band 4	1000.000	0.199	1.000	Pass
LTE Band 5	2759.307	0.549	0.549	Pass
LTE Band 7	1995.262	0.397	1.000	Pass
LTE Band 12	2342.610	0.466	0.466	Pass
LTE Band 13	2603.754	0.518	0.518	Pass
LTE Band 14	2638.761	0.525	0.525	Pass
LTE Band 25	1995.262	0.397	1.000	Pass
LTE Band 26	2729.606	0.543	0.543	Pass
LTE Band 66	1000.000	0.199	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 ******

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.