



MPE TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR202102FC21
Product Wi-Fi&BT module
Model FC21
Report No. R2108A0712-M1
Issue Date September 7, 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.

Yurui Zhao

Prepared by: Yurui Zhao

Guangchang Fan

Approved by: Guangchang Fan

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

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

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



Table of Contents

1	Test Laboratory	3
1.1	Notes of the Test Report.....	3
1.2.	Test facility	3
1.3	Testing Location.....	3
1.4	Laboratory Environment	4
2	Description of Equipment under Test.....	5
3	Maximum conducted output power (measured) and antenna Gain	6
4	Test Result.....	7
	ANNEX A: The EUT Appearance	10
	ANNEX B: Product Change Description	11



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: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, 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, 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	FC21
SN	E1821BN10000039
Hardware Version	R1.1
Software Version	FC21SA-Q93
Date of Testing:	April 26, 2021 ~ May 28, 2021
<p>Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.</p> <p>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.</p>	

FC21 (Report No.: R2108A0712-M1) is a variant model of FC21 (Report No.: R2101A0021-M1). The differences between the two products are shown below.

Product Change Description		
Item	Original	Variant
Chip	QCA1023-0	QCA9377-3
MCN	QCA-1023-0-115WLNSP-TR/SR/HR-03-0	QCA-9377-3-115WLNSP-TR/SR/HR-03-0
MU-MIMO and TxBF client mode	Disable	Support
HW Version	R1.0	R1.1
SW Version	FC21SA-Q73	FC21SA-Q93
Others	The same	The same

There is no tested in the report. The detailed product change description please refers to the Difference Declaration Letter.

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		Maximum Conducted Output Power		Antenna Gain (dBi)	Numeric gain
		(dBm)	(mW)		
Wi-Fi 2.4G	802.11b	19.0	79.433	5.16	3.281
	802.11g	18.5	70.795	5.16	3.281
	802.11n HT20	18.5	70.795	5.16	3.281
	802.11n HT40	17.0	50.119	5.16	3.281
Wi-Fi 5G U-NII-1	802.11a	17.0	50.119	4.48	2.805
	802.11n HT20	15.5	35.481	4.48	2.805
	802.11n HT40	15.5	35.481	4.48	2.805
	802.11ac HT20	14.5	28.184	4.48	2.805
	802.11ac HT40	14.0	25.119	4.48	2.805
	802.11ac HT80	14.0	25.119	4.48	2.805
Wi-Fi 5G U-NII-2A	802.11a	17.0	50.119	4.48	2.805
	802.11n HT20	15.5	35.481	4.48	2.805
	802.11n HT40	15.5	35.481	4.48	2.805
	802.11ac HT20	14.5	28.184	4.48	2.805
	802.11ac HT40	14.0	25.119	4.48	2.805
	802.11ac HT80	14.0	25.119	4.48	2.805
Wi-Fi 5G U-NII-2C	802.11a	17.0	50.119	5.05	3.199
	802.11n HT20	15.5	35.481	5.05	3.199
	802.11n HT40	15.5	35.481	5.05	3.199
	802.11ac HT20	14.5	28.184	5.05	3.199
	802.11ac HT40	14.0	25.119	5.05	3.199
	802.11ac HT80	14.0	25.119	5.05	3.199
Wi-Fi 5G U-NII-3	802.11a	17.0	50.119	4.54	2.844
	802.11n HT20	15.5	35.481	4.54	2.844
	802.11n HT40	15.5	35.481	4.54	2.844
	802.11ac HT20	14.5	28.184	4.54	2.844
	802.11ac HT40	14.0	25.119	4.54	2.844
	802.11ac HT80	14.0	25.119	4.54	2.844
Bluetooth		15.0	31.623	3.00	1.995

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 1500~100,000MHz is 1.0.So

Band	The maximum permissible exposure (mW/cm ²)
Wi-Fi 2.4GHz	1.000
Wi-Fi 5GHz	1.000
Bluetooth	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	PG (mW)	Test Result (mW/cm ²)	Limit Value (mW/cm ²)	The MPE ratio
Wi-Fi 2.4G	802.11b	260.615	0.052	1.000	0.052
	802.11g	232.274	0.046	1.000	0.046
	802.11n HT20	232.274	0.046	1.000	0.046
	802.11n HT40	164.437	0.033	1.000	0.033
Wi-Fi 5G U-NII-1	802.11a	140.605	0.028	1.000	0.028
	802.11n HT20	99.541	0.020	1.000	0.020
	802.11n HT40	99.541	0.020	1.000	0.020
	802.11ac HT20	79.068	0.016	1.000	0.016
	802.11ac HT40	70.469	0.014	1.000	0.014
	802.11ac HT80	70.469	0.014	1.000	0.014
Wi-Fi 5G U-NII-2A	802.11a	140.605	0.028	1.000	0.028
	802.11n HT20	99.541	0.020	1.000	0.020
	802.11n HT40	99.541	0.020	1.000	0.020
	802.11ac HT20	79.068	0.016	1.000	0.016
	802.11ac HT40	70.469	0.014	1.000	0.014
	802.11ac HT80	70.469	0.014	1.000	0.014
Wi-Fi 5G U-NII-2C	802.11a	160.325	0.032	1.000	0.032
	802.11n HT20	113.501	0.023	1.000	0.023
	802.11n HT40	113.501	0.023	1.000	0.023
	802.11ac HT20	90.157	0.018	1.000	0.018
	802.11ac HT40	80.353	0.016	1.000	0.016
	802.11ac HT80	80.353	0.016	1.000	0.016
Wi-Fi 5G U-NII-3	802.11a	142.561	0.028	1.000	0.028
	802.11n HT20	100.925	0.020	1.000	0.020



	802.11n HT40	100.925	0.020	1.000	0.020
	802.11ac HT20	80.168	0.016	1.000	0.016
	802.11ac HT40	71.450	0.014	1.000	0.014
	802.11ac HT80	71.450	0.014	1.000	0.014
	Bluetooth	63.096	0.013	1.000	0.013
Note: $R = 20\text{cm}$ $\pi = 3.1416$ The MPE ratio = Mac Test Result÷Limit Value					

So the simultaneous transmitting antenna pairs as below:

Σ of MPE ratios= Wi-Fi 2.4G Antenna + Wi-Fi 5G Antenna + Bluetooth = 0.052 + 0.032 + 0.013 = 0.097 <1

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

The Product Change Description are submitted separately.