RF EXPOSURE REPORT

Report No.: 15050045-1-FCC-H

Applicant	Quectel Wireless Solutions Co., Ltd.
Product Name	UMTS/HSPA+ Module
Model No.	UC20-G
Serial No.	UC20-G Mini PCIe
Test Standard	FCC 2.1091
Test Date	July 6-7, 2016
Issue Date	July 7, 2016
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Winnie Zhang	David Huang	
Winnie Zhang Test Engineer	David Huang Checked By	

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Test result presented in this test report is applicable to the tested sample only

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
15050045-1-FCC-H	NONE	Original	July 7, 2016

2. Customer information

Applicant Name	Quectel Wireless Solutions Co., Ltd.
Applicant Add	Room 501, Building 13, No.99 TianZhouRoad,Xuhui District, Shanghai
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer Add	Room 501, Building 13, No.99 TianZhouRoad,Xuhui District, Shanghai

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Labview of SIEMIC version 2.0

4. Equipment under Test (EUT) Information

Description of EUT:	UMTS/HSPA+ Module
Main Model:	UC20-G
Serial Model:	UC20-G Mini PCIe
Date EUT received:	October 09, 2015
Test Date(s):	July 6-7, 2016
Equipment Category：	PCB
Antenna Gain:	UMTS-FDD Band V: 1 dBi UMTS-FDD Band II: 1 dBi **（Note: The radio module will be sold without antenna, this antenna only used limited to ERP/EIRP or radiated spurious emission test.）**
Type of Modulation:	UMTS-FDD: QPSK, 16QAM
RF Operating Frequency (ies):	UMTS-FDD Band V TX: 826.4 ~ 846.6 MHz; RX: 871.4 ~ 891.6 MHz UMTS-FDD Band II TX:1852.4 ~ 1907.6 MHz; RX: 1932.4 ~ 1987.6 MHz
Number of Channels:	UMTS-FDD Band V : 102CH UMTS-FDD Band II ：277CH
Port:	N/A
Input Power:	DC 3.8V 600mA
Trade Name :	Quectel
FCC ID:	XMR201510UC20

5. FCC §2.1091 - Radiofrequency radiation exposure evaluation

6.1 Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission' s guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Table 1

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
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

6.2 Test Result

UMTS-FDD Band V

Band/ Time Slot configuration	Channel	Frequency	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	4132	826.4	23.43	23±1
	4175	835	23.25	23±1
	4233	846.6	**23.53**	23±1
HSDPA Subtest1	4132	826.4	23.38	23±1
	4175	835	23.41	23±1
	4233	846.6	23.46	23±1
HSDPA Subtest2	4132	826.4	23.39	23±1
	4175	835	23.32	23±1
	4233	846.6	23.42	23±1
HSDPA Subtest3	4132	826.4	23.31	23±1
	4175	835	23.39	23±1
	4233	846.6	23.33	23±1
HSDPA Subtest4	4132	826.4	23.39	23±1
	4175	835	23.31	23±1
	4233	846.6	23.36	23±1
HSUPA Subtest1	4132	826.4	23.33	23±1
	4175	835	23.36	23±1
	4233	846.6	23.35	23±1
HSUPA Subtest2	4132	826.4	23.36	23±1
	4175	835	23.39	23±1
	4233	846.6	23.45	23±1
HSUPA Subtest3	4132	826.4	23.34	23±1
	4175	835	23.39	23±1
	4233	846.6	23.36	23±1
HSUPA Subtest4	4132	826.4	23.30	23±1
	4175	835	23.36	23±1
	4233	846.6	23.31	23±1
HSUPA Subtest5	4132	826.4	23.37	23±1
	4175	835	23.32	23±1
	4233	846.6	23.36	23±1

Table 2

UMTS-FDD Band II

Band/ Time Slot configuration	Channel	Frequency	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	9262	1852.4	22.74	22.5±1
	9400	1880	**22.84**	22.5±1
	9538	1907.6	22.75	22.5±1
HSDPA Subtest1	9262	1852.4	22.35	22.5±1
	9400	1880	22.38	22.5±1
	9538	1907.6	22.41	22.5±1
HSDPA Subtest2	9262	1852.4	22.33	22.5±1
	9400	1880	22.39	22.5±1
	9538	1907.6	22.42	22.5±1
HSDPA Subtest3	9262	1852.4	22.39	22.5±1
	9400	1880	22.31	22.5±1
	9538	1907.6	22.35	22.5±1
HSDPA Subtest4	9262	1852.4	22.38	22.5±1
	9400	1880	22.42	22.5±1
	9538	1907.6	22.46	22.5±1
HSUPA Subtest1	9262	1852.4	22.36	22.5±1
	9400	1880	22.39	22.5±1
	9538	1907.6	22.33	22.5±1
HSUPA Subtest2	9262	1852.4	22.42	22.5±1
	9400	1880	22.44	22.5±1
	9538	1907.6	22.48	22.5±1
HSUPA Subtest3	9262	1852.4	22.32	22.5±1
	9400	1880	22.36	22.5±1
	9538	1907.6	22.39	22.5±1
HSUPA Subtest4	9262	1852.4	22.38	22.5±1
	9400	1880	22.31	22.5±1
	9538	1907.6	22.34	22.5±1
HSUPA Subtest5	9262	1852.4	22.35	22.5±1
	9400	1880	22.37	22.5±1
	9538	1907.6	22.39	22.5±1

Table 3

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

Where: S = power density (in appropriate units, e.g. mW/cm^2)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

7 Introduction

Quectel Wireless Solutions Co., Ltd. seeks modular approval for the UC20-G UMTS/HSPA+ Module for use in mobile configuration. This Maximum Permissive Exposure (“ MPE”) report demonstrates compliance for UC20-G UMTS/HSPA+ Module with FCC CFR 47 §1.1310 and 2.1091 for standalone and collocated simultaneous transmission in mobile exposure conditions. The MPE analysis is valid for transmitters operating within the parameters defined in Table 5 used for analysis.

Any collocated transmitter must have a valid FCC ID documenting equivalent or degraded RF characteristics with the collocated parameters defined in this MPE analysis.

The mobile classification applies when 20 cm or more separation distance is maintained between the end user and both WWAN and WLAN ,BT or RFID transmission antennas.

The WWAN MPE calculations in the filing are based on conservative conducted transmit power exceeding those listed in the FCC ID: XMR201510UC20 filing and the maximum allowable antenna gains per relevant grant notes. The higher transmit power levels are used to present a worst case assessment.

Portable user conditions or additional collocated modules not allowed based on this RF exposure analysis require a Class II permissive change and updated MPE or SAR report.

8 Product Declarations:

Table 4 summarizes transmitter parameters associated with this permissive change application.

Table 4 WWAN Transmitter Declarations

Mode	Max Transmitter Duty Cycle	Band Name	Transmitter Range (MHz)	Maximum Conducted Power		Max Antenna Gain (dBi)
				(dBm)	(W)	
UMTS-FDD	100%	Band II 1900 MHz	1852.4 ~ 1907.6	23.5	0.25	9.5
		Band V 850 MHz	826.4 ~ 846.6 MHz	24.0	0.22	7.0

8.1 Collocated Transmitters

This MPE analysis is applicable to any collocated transmitters with transmit power less than or equal to 29.0 dBm for WLAN, BT and RFID(902MHz), 23.0 dBm for RFID(13.56MHz) and 26.5 dBm for RFID(902MHz) . Specific FCC IDs for those devices are not necessary or identified in this analysis providing they are classified as mobile transmitters. A 100% duty cycle is used for calculations to present a worst-case analysis except 77.52% duty cycle for BT.

9 Transmitter Summary

Table 5 summarizes transmitter parameters associated with this permissive change application.

The WWAN modes of operation reflect the UC20-G UMTS/HSPA+ Module parameters associated with this FCC ID: XMR201510UC20.

The RFID, BT, WLAN and WIMAX transmit power and antenna gain parameters represent a maximum transmit power for a given frequency band.

Integration of a RFID, BT, WLAN and WIMAX module that exceeds the parameters requires a new FCC authorization or permissive change application. A worst-case antenna gain of 5 dBi has been assumed for all collocated antennas.

Table 5 WWAN and WLAN Declared Transmitter Parameters

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)	Duty Cycle
UMTS	826.4	24	0.25	7.0	1.0
UMTS	1852.4	23.5	0.22	9.5	1.0
RFID	13.56	23.00	0.200	5.0	1.0
RFID	902	26.5	0.447	5.0	1.0
RFID	2400	29.00	0.794	5.0	1.0
BT	2400	29.00	0.794	5.0	0.7752
WLAN	2400	29.00	0.794	5.0	1.0
WLAN	5150	29.00	0.794	5.0	1.0
WLAN	5250	29.00	0.794	5.0	1.0
WLAN	5500	29.00	0.794	5.0	1.0
WLAN	5800	29.00	0.794	5.0	1.0
WIMAX	2600	29.00	0.794	5.0	1.0

10 MPE Calculations

10.1 Stand Alone Transmitter Calculations

The power density calculations for standalone transmitters at an exposure separation distance of 20 cm are shown in Table 6 per the transmit power and antenna gain values declared in Table 5.

For frequency dependent limits, the lowest transmitter frequency was used to represent the lowest MPE limit (e.g. 826.6MHz = 0.551 mW/cm2).

The WLAN power levels listed represent the worst-case values for the corresponding frequency ranges given.

Table 6 WWAN and WLAN Standalone MPE Calculations

Technology	Frequency (MHz)	Maximum Conducted Power (dBm)	Conducted Power (W)	Maximum Antenna Gain (dBi)	Duty Cycle	Average EIRP (dBm)	Average EIRP (W)	Power Density @ 20cm (mW/cm^2)	FCC MPE Limit (mW/cm^2)
UMTS Band 5	826.4	24	0.25	7.0	1.0	31.0	1.26	0.250	0.551
UMTS Band 2	1852.4	23.5	0.22	9.5	1.0	33.0	2.00	0.397	1.000
RFID	13.56	23.00	0.200	5.00	1	28.00	0.63	0.126	0.979
RFID	902	26.50	0.447	5.00	1.0	31.50	1.41	0.28	0.601
RFID	2400	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
BT	2400	29.00	0.794	5.00	0.7752	32.9	1.95	0.388	1.000
WLAN	2400	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5150	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5250	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5500	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WLAN	5800	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000
WIMAX	2600	29.00	0.794	5.00	1.00	34.00	2.51	0.500	1.000

9.2 Collocated MPE Calculations

Per OET 65, when RF sources have difference frequencies, the fraction of the FCC power density limit shall be determined and the sum of all fractional components shall be less than 1.

Table 7 WWAN 850 MHz Collocation Power Density

Wireless Band	WLAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WLAN Pd) / (MPE Limit)	850 MHz WWAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WWAN 850 MHz) / MPE Limit)	(850 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
13.56 MHz	0.126	0.979	0.129	0.250	0.551	0.454	0.583	1	Pass
902 MHz	0.28	0.601	0.466	0.250	0.551	0.454	0.92	1	Pass
2.4GHz(RFID)	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
2.4GHz(BT)	0.388	1.000	0.388	0.250	0.551	0.454	0.842	1	Pass
2.4 GHz(WIFI)	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
5.1 GHz	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
5.2 GHz	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
5.5 GHz	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
5.8 GHz	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass
2.6 GHz	0.500	1.000	0.500	0.250	0.551	0.454	0.954	1	Pass

Table 8 WWAN 1900 MHz Collocation Power Density

Wireless Band	WLAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WLAN Pd) / (MPE Limit)	1900 MHz WWAN Pd (mW/cm^2)	FCC MPE Limit (mW/cm^2)	(WWAN 1900 MHz) / MPE Limit)	(1900 MHz WWAN fraction) + (WLAN fraction)	Limit	Pass/Fail
13.56 MHz	0.126	0.979	0.129	0.397	1.000	0.397	0.526	1	Pass
902 MHz	0.28	0.601	0.466	0.397	1.000	0.397	0.843	1	Pass
2.4GHz(RFID)	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
2.4GHz(BT)	0.388	1.000	0.388	0.397	1.000	0.397	0.785	1	Pass
2.4 GHz(WIFI)	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
5.1 GHz	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
5.2 GHz	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
5.5 GHz	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
5.8 GHz	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass
2.6 GHz	0.500	1.000	0.500	0.397	1.000	0.397	0.897	1	Pass