

RF EXPOSURE REPORT



Report No.: 15050028-FCC-H2

Applicant	Quectel Wireless Solutions Co., Ltd.	
Product Name	UMTS/HSPA Module	
Model No.	UG96	
Serial No.	N/A	
Test Standard	FCC 2.1091.2014	
Test Date	July 10 to July 21, 2015	
Issue Date	August 04, 2015	
Test Result	☒ Pass ☐ Fail	
Equipment complied with the specification ☒		
Equipment did not comply with the specification ☐		
<i>Winnie Zhang</i>	<i>David Huang</i>	
Winnie Zhang Test Engineer	David Huang Checked By	
This test report may be reproduced in full only 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
15050028-FCC-H2	NONE	Original	July 22. 2015
15050028-FCC-H2 V	NONE	Revise PCS1900 Tune Up	July 29.2015
15050028-FCC-H2 V1	NONE	Revise GPRS/EGRS Power	August 04.2015

2. Customer information

Applicant Name	Quectel Wireless Solutions Co., Ltd.
Applicant Add	RM501,Building 13,No.99 TianZhou Road,Xuhui District,Shanghai,China
Manufacturer	Quectel Wireless Solutions Co., Ltd.
Manufacturer Add	RM501,Building 13,No.99 TianZhou Road,Xuhui District,Shanghai,China

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:	UG96
Serial Model:	N/A
Equipment Category :	PCB
Antenna Gain:	GSM850: 1 dBi PCS1900: 1 dBi UMTS-FDD Band V: 1dBi UMTS-FDD Band II: 1dBi
Input Power:	Spec: DC 3.8V,600mA
Trade Name :	Quectel

Type of Modulation: GSM / GPRS: GMSK
EGPRS: GMSK, 8PSK
UMTS-FDD: QPSK, 16QAM

RF Operating Frequency (ies): GSM850 TX: 824.2 ~ 848.8 MHz; RX: 869.2 ~ 893.8 MHz
PCS1900 TX: 1850.2 ~ 1909.8 MHz; RX: 1930.2 ~ 1989.8 MHz
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: GSM 850: 124CH
PCS1900: 299CH
UMTS-FDD Band V : 102CH
UMTS-FDD Band II : 277CH

5. FCC §2.1091 - Maximum Permissible exposure (MPE)

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

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

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/cm²)

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)

Burst Average Power (dBm);								
Band	GSM850				PCS1900			
Channel	128	190	251	Tune up Power tolerant	512	661	810	Tune up Power tolerant
Frequency (MHz)	824.2	836.6	848.8	/	1850.2	1880	1909.8	/
GSM Voice (1 uplink),GMSK	32.63	32.57	32.50	32.5±1	29.83	29.74	29.65	29.5±1
GPRS Multi-Slot Class 8 (1 uplink),GMSK	32.62	32.55	32.48	32.5±1	29.28	29.07	29.16	29.5±1
GPRS Multi-Slot Class 10 (2 uplink) GMSK	32.58	32.51	32.44	32.5±1	29.24	29.06	29.12	29.5±1
GPRS Multi-Slot Class 12 (4 uplink) GMSK	29.46	29.41	29.34	29.5±1	29.10	28.91	28.93	29.5±1
EGPRS Multi-Slot Class 8 (1 uplink) GMSK MCS1	32.60	32.52	32.46	32.5±1	29.38	29.20	29.25	29.5±1
EGPRS Multi-Slot Class 10 (2 uplink) GMSK MCS1	32.54	32.50	32.44	32.5±1	29.35	29.15	29.22	29.5±1
EGPRS Multi-Slot Class 12 (4 uplink) GMSK MCS1	29.45	29.41	29.35	29.5±1	29.24	29.00	29.02	29.5±1
EGPRS Multi-Slot Class 8 (1 uplink) 8PSK MCS5	26.80	26.81	26.79	27±1	25.63	25.46	25.54	26±1
EGPRS Multi-Slot Class 10 (2 uplink) 8PSK MCS5	26.70	26.70	26.64	27±1	25.60	25.41	25.50	26±1
EGPRS Multi-Slot Class 12 (4 uplink) 8PSK MCS5	26.65	26.64	26.63	27±1	25.49	25.3	25.40	26±1
Remark : GPRS, CS1 coding scheme.								

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EGPRS, MCS1 coding scheme.

EGPRS, MCS5 coding scheme.

Multi-Slot Class 8 , Support Max 4 downlink, 1 uplink , 5 working link

Multi-Slot Class 10 , Support Max 4 downlink, 2 uplink , 5 working link

Multi-Slot Class 12 , Support Max 4 downlink, 4 uplink , 5 working link

	Source Based time Average Power (dBm)									
Band	GSM850					PCS1900				
Channel	128	190	251	Time Average factor	Tune up Power tolerant	512	661	810	Time Average factor	Tune up Power tolerant
Frequency (MHz)	824.2	836.6	848.8	/	/	1850.2	1880	1909.8	/	/
GSM Voice (1 uplink),GMSK	23.6	23.64	23.47	-9.03	23.5±1	20.8	20.71	20.62	-9.03	20.5±1
GPRS Multi- Slot Class 8 (1 uplink),GMSK	23.59	23.52	23.45	-9.03	23.5±1	20.25	20.04	20.13	-9.03	20.5±1
GPRS Multi- Slot Class 10 (2 uplink) GMSK	26.56	26.49	26.42	-6.02	26.5±1	23.22	23.04	23.1	-6.02	23.5±1
GPRS Multi- Slot Class 12 (4 uplink) GMSK	26.45	26.4	26.33	-3.01	26.5±1	26.09	25.9	25.92	-3.01	26.5±1
EGPRS Multi- Slot Class 8 (1 uplink) GMSK MCS1	23.57	23.49	23.43	-9.03	23.5±1	20.35	20.17	20.22	-9.03	20.5±1
EGPRS Multi- Slot Class 10 (2 uplink) GMSK MCS1	26.52	26.48	26.42	-6.02	26.5±1	23.33	23.13	23.2	-6.02	23.5±1
EGPRS Multi- Slot Class 12 (4 uplink) GMSK MCS1	26.44	26.4	26.34	-3.01	26.5±1	26.23	25.99	26.01	-3.01	26.5±1

EGPRS Multi-Slot Class 8 (1 uplink) 8PSK MCS5	17.77	17.78	17.76	-9.03	18.0±1	16.6	16.43	16.51	-9.03	17.0±1
EGPRS Multi-Slot Class 10 (2 uplink) 8PSK MCS5	20.68	20.68	20.62	-6.02	21.0±1	19.58	19.39	19.48	-6.02	20.0±1
EGPRS Multi-Slot Class 12 (4 uplink) 8PSK	23.64	23.63	23.62	-3.01	24.0±1	22.48	22.29	22.39	-3.01	23.0±1
		Remark : GPRS, CS1 coding scheme. EGPRS, MCS1 coding scheme. EGPRS, MCS5 coding scheme. Multi-Slot Class 8 , Support Max 4 downlink, 1 uplink , 5 working link Multi-Slot Class 10 , Support Max 4 downlink, 2 uplink , 5 working link Multi-Slot Class 12 , Support Max 4 downlink, 4 uplink , 5 working link								

UMTS-FDD Band V

Band/ Time Slot configuration	Channel	Frequency	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	4132	826.4	22.84	22±1
	4175	835.0	22.91	22±1
	4233	846.6	22.59	22±1
HSDPA Subtest1	4132	826.4	22.45	22±1
	4175	835	22.13	22±1
	4233	846.6	22.25	22±1
HSDPA Subtest2	4132	826.4	22.14	22±1
	4175	835	22.24	22±1
	4233	846.6	22.45	22±1
HSDPA Subtest3	4132	826.4	22.21	22±1
	4175	835	22.14	22±1
	4233	846.6	22.18	22±1
HSDPA Subtest4	4132	826.4	22.25	22±1
	4175	835	22.30	22±1
	4233	846.6	22.10	22±1
HSUPA Subtest1	4132	826.4	22.24	22±1
	4175	835	22.35	22±1
	4233	846.6	22.17	22±1
HSUPA Subtest2	4132	826.4	22.14	22±1
	4175	835	22.24	22±1
	4233	846.6	22.45	22±1
HSUPA Subtest3	4132	826.4	22.18	22±1
	4175	835	22.45	22±1
	4233	846.6	22.51	22±1
HSUPA Subtest4	4132	826.4	22.89	22±1
	4175	835	22.17	22±1
	4233	846.6	22.45	22±1
HSUPA Subtest5	4132	826.4	22.24	22±1
	4175	835	22.18	22±1
	4233	846.6	22.18	22±1

UMTS-FDD Band II

Band/ Time Slot configuration	Channel	Frequency	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	9262	1852.4	22.41	22±1
	9400	1880	22.73	22±1
	9538	1907.6	22.55	22±1
HSDPA Subtest1	9262	1852.4	22.24	22±1
	9400	1880	22.70	22±1
	9538	1907.6	22.67	22±1
HSDPA Subtest2	9262	1852.4	22.19	22±1
	9400	1880	22.46	22±1
	9538	1907.6	22.59	22±1
HSDPA Subtest3	9262	1852.4	22.14	22±1
	9400	1880	22.57	22±1
	9538	1907.6	22.64	22±1
HSDPA Subtest4	9262	1852.4	23.11	22±1
	9400	1880	22.64	22±1
	9538	1907.6	22.67	22±1
HSUPA Subtest1	9262	1852.4	22.16	22±1
	9400	1880	22.69	22±1
	9538	1907.6	22.67	22±1
HSUPA Subtest2	9262	1852.4	22.14	22±1
	9400	1880	22.64	22±1
	9538	1907.6	22.65	22±1
HSUPA Subtest3	9262	1852.4	22.69	22±1
	9400	1880	22.72	22±1
	9538	1907.6	22.64	22±1
HSUPA Subtest4	9262	1852.4	23.12	22±1
	9400	1880	22.54	22±1
	9538	1907.6	22.56	22±1
HSUPA Subtest5	9262	1852.4	22.17	22±1
	9400	1880	22.73	22±1
	9538	1907.6	22.59	22±1

GSM850

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 27.5 dBm

Maximum output power at antenna input terminal: 562.34mW

Prediction distance: >20 (cm)

Predication frequency: 848.2 MHz Low frequency

Antenna Gain (typical): 1 (dBi)

Antenna Gain (typical): 1.259 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.14(mW/cm²)

MPE limit for general population exposure at prediction frequency: 0.57(mW/cm²)

$0.14(\text{mW}/\text{cm}^2) < 0.57 (\text{mW}/\text{cm}^2)$

PCS1900

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 27.5 dBm

Maximum output power at antenna input terminal: 562.34 (mW)

Prediction distance: >20 (cm)

Predication frequency: 1909.8 (MHz) High frequency

Antenna Gain (typical): 1 (dBi)

Antenna Gain (typical): 1.259 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.14(mW/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mW/cm²)

$0.14(\text{mW}/\text{cm}^2) < 1.0 (\text{mW}/\text{cm}^2)$

WCDMA BAND V

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 23.0 dBm

Maximum output power at antenna input terminal: 199.53(mW)

Prediction distance: >20 (cm)

Predication frequency: 826.4 (MHz) Low frequency

Antenna Gain (typical): 1 (dBi)

Antenna Gain (typical): 1.259 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.05(mW/cm²)

MPE limit for general population exposure at prediction frequency: 0.56 (mW/cm²)

$0.05(\text{mW}/\text{cm}^2) < 0.56 (\text{mW}/\text{cm}^2)$

WCDMA BAND II

For the antenna manufacturer provide only used limited to ERP/EIRP or radiated spurious emission test. The MPE evaluation as below:

Maximum output power at antenna input terminal: 23.00dBm

Maximum output power at antenna input terminal: 199.53(mW)

Prediction distance: >20 (cm)

Predication frequency: 1852.4 (MHz) Low frequency

Antenna Gain (typical): 1 (dBi)

Antenna Gain (typical): 1.259 (numeric)

The worst case is power density at predication frequency at 20 cm: 0.05(mW/cm²)

MPE limit for general population exposure at prediction frequency: 1.0 (mW/cm²)

$0.05(\text{mW}/\text{cm}^2) < 1.0(\text{mW}/\text{cm}^2)$

Result: Pass

Additional: (For Max allowed antenna calculate)

Step 1 ERP/EIRP calculate:

Frequency bands	Max Turn-up Conducted power (dBm)	ERP/EIRP Limit (dBm)	Margin (dB)
GSM 850	33.5	38.45	4.95
PCS 1900	30.5	33.00	2.5
WCDMA band V	23.0	38.45	15.45
WCDMA band II	23.0	33.00	10.00

Step 2 MPE calculate:

Frequency bands	Max Turn-up Conducted Source Based time Average Power (dBm)	Max Turn-up Conducted Source Based time Average Power (mw)	Distance (cm)	Power Density Limit (mW/cm2)	Max allow antenna gain (dBi)
GSM 850	27.5	562.34	20	0.549	6.91
PCS 1900	27.5	562.34	20	1	9.51
WCDMA band V	23.0	199.53	20	0.551	11.43
WCDMA band II	23.0	199.53	20	1	14.01

Step 3:

If meet above step 1 and 2, the Max allows antenna gain show is below:

Frequency bands	Max allow antenna gain (dBi)
GSM 850	4.95
PCS 1900	2.5
WCDMA band V	11.43
WCDMA band II	10.0

Note:

Single Modular Approval.

Output power is conducted. This device is to be used in mobile or fixed applications only. Antenna gain including cable loss must not exceed 4.95 dBi of GSM 850, 2.5 dBi of PCS 1900, 11.43 dBi of WCDMA bandV and 10.0 dBi of WCDMA band II for the purpose of satisfying the requirements of 2.1043 and 2.1091. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operated in conjunction with any antenna or transmitter not described under this FCC ID. The final product

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operating with this transmitter must include operating instructions and antenna installation instructions, for end-users and installers to satisfy RF exposure compliance requirements. Compliance of this device in all final product configurations is the responsibility of the Grantee. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate. Installation of this device into specific final products may require the submission of a Class II permissive change application containing data pertinent to RF Exposure, spurious emissions, ERP/EIRP, and host/module authentication, or new application if appropriate.