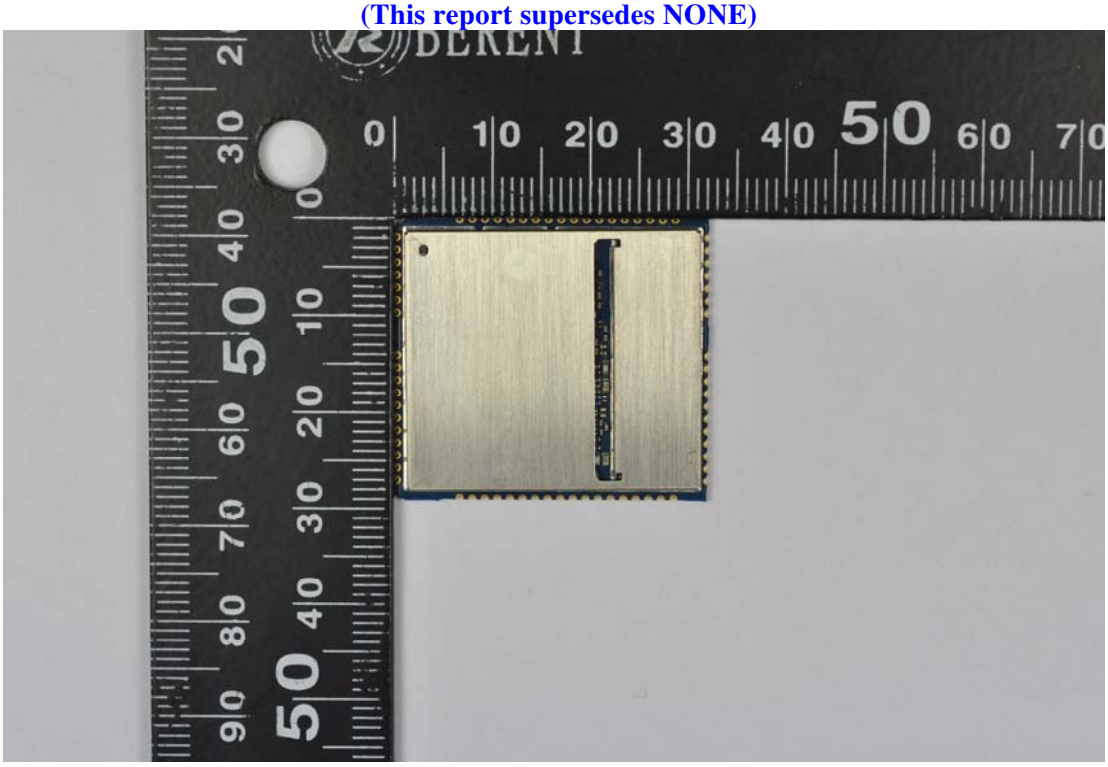
Quectel Wireless Solutions Co., Ltd.

UMTS/HSPA+ Module

Main Model: UC20
Serial Model: UC20 Mini PCIe

May 23, 2016
Report No.: 16050016-FCC-R
(This report supersedes NONE)



Modifications made to the product : None

This Test Report is Issued Under the Authority of:		
Winnie Zhang	David Huang	
Winnie Zhang Compliance Engineer	David Huang Technical Manager	

This test report may be reproduced in full only.
Test result presented in this test report is applicable to the representative sample only.

RF Test Report

To: FCC Part 22(H) & FCC Part 24(E): 2015

SIEMIC, INC.
Accessing global markets

Laboratory 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 through out 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 , Telecom
Canada	EMC, RF/Wireless , Telecom
Taiwan	EMC, RF, Telecom , Safety
Hong Kong	RF/Wireless ,Telecom
Australia	EMC, RF, Telecom , Safety
Korea	EMI, EMS, RF , Telecom, Safety
Japan	EMI, RF/Wireless, Telecom
Singapore	EMC , RF , Telecom
Europe	EMC, RF, Telecom , Safety

This page has been left blank intentionally.

CONTENTS

1. EXECUTIVE SUMMARY & EUT INFORMATION 5

2. TECHNICAL DETAILS 6

3. MODIFICATION 7

4. TEST SUMMARY 8

5. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS 9

ANNEX A. TEST INSTRUMENT & METHOD 12

ANNEX B. EUT AND TEST SETUP PHOTOGRAPHS 15

ANNEX C. TEST SETUP AND SUPPORTING EQUIPMENT 18

ANNEX D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST 21

ANNEX E. DECLARATION OF SIMILARITY 22

1. EXECUTIVE SUMMARY & EUT INFORMATION

The purpose of this test programmed was to demonstrate compliance of the Quectel Wireless Solutions Co., Ltd., UMTS/HSPA+ Module and model: UC20 against the current Stipulated Standards. The UMTS/HSPA+ Module has demonstrated compliance with the FCC Part 22(H) & FCC Part 24(E): 2015.

EUT Information	
EUT Description	UMTS/HSPA+ Module
Main Model	UC20
Serial Model	UC20 Mini PCIe
Antenna Gain	UMTS-FDD Band V/GSM850: 1 dBi UMTS-FDD Band II/PCS1900: 1 dBi
Maximum Conducted AV Power to Antenna	UMTS-FDD Band Ⅴ: 22.53 dBm UMTS-FDD Band Ⅱ: 22.53 dBm
Maximum Radiated ERP/EIRP	UMTS-FDD Band Ⅴ: 23.22dBm / ERP UMTS-FDD Band Ⅱ: 23.33 dBm / EIRP
Temperature	-10℃ - 55℃
Classification Per Stipulated Test Standard	FCC Part 22(H) & FCC Part 24(E): 2015

The difference between the new revision and old revision of UC20 and UC20 Mini PCIe is flash memory, all above were explained in the attached Declaration Letter. And based on the letter the difference, the item “ the spurious radiated emissions” is re-evaluated.

2. TECHNICAL DETAILS

Purpose	Compliance testing of UMTS/HSPA+ Module with stipulated standard
Applicant / Client	Quectel Wireless Solutions Co., Ltd. Room 501, Building 13, No.99 TianZhouRoad,Xuhui District, Shanghai
Manufacturer	Quectel Wireless Solutions Co., Ltd. Room 501, Building 13, No.99 TianZhouRoad,Xuhui District, Shanghai
Laboratory performing the tests	SIEMIC (Shenzhen-China) LABORATORIES Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao'an District, Shenzhen, Guangdong China 518108
Test report reference number	16050016-FCC-R
Date EUT received	May 06, 2016
Standard applied	FCC Part 22(H) & FCC Part 24(E): 2015
Dates of test	May 23, 2016
No of Units	#1
Equipment Category	PCB
Trade Name	Quectel
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
Modulation	UMTS-FDD: QPSK
FCC ID	XMR201312UC20

3. MODIFICATION

NONE

4. TEST SUMMARY

The product was tested in accordance with the following specifications.
All testing has been performed according to below product classification:

PCE

Test Results Summary

Test Standard	Description	Product Class	Pass / Fail
§ 2.1053 § 22.917; § 24.238	Spurious Radiated Emissions	See Above	Pass

Note: Testing was performed by configuring EUT to maximum output power status, the declared output power class for different.

5. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

5.1 §2.1053, §22.917 & §24.238 - Spurious Radiated Emissions

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 1GHz – 40GH is ±6.0dB (for EUTs < 0.5m X 0.5m X 0.5m).
4. Environmental Conditions

Temperature	24°C
Relative Humidity	56%
Atmospheric Pressure	1023mbar

5. Test date : May 23, 2016
   Tested By : Winnie Zhang

Standard Requirement:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

Procedures:

Equipment was setup in a semi-anechoic chamber. For measurements above 1 GHz an average measurement was taken with a 10Hz video bandwidth. The EUT was tested at low, mid and high with the highest output power. An emission was scan up to 10th harmonic of the operating frequency.

Sample Calculation:

EUT Field Strength = Raw Amplitude (dBμV/m) – Amplifier Gain (dB) + Antenna Factor (dB) + Cable Loss (dB) + Filter Attenuation (dB, if used)

Test Result: Pass

UC20 Mini PCIe

UMTS-FDD Band Ⅴ (Part 22H)

Low channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.8	-47.23	V	7.95	0.78	-40.06	-13	-27.06
1652.8	-46.81	H	7.95	0.78	-39.64	-13	-26.64
273.2	-52.69	V	6.4	0.26	-46.55	-13	-33.55
405.5	-52.44	H	6.8	0.37	-46.01	-13	-33.01

Middle channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670	-46.95	V	7.95	0.78	-39.78	-13	-26.78
1670	-46.68	H	7.95	0.78	-39.51	-13	-26.51
272.8	-52.53	V	6.4	0.26	-46.39	-13	-33.39
405.3	-52.37	H	6.8	0.37	-45.94	-13	-32.94

High channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.2	-47.41	V	7.95	0.78	-40.24	-13	-27.24
1693.2	-47.15	H	7.95	0.78	-39.98	-13	-26.98
273.6	-53.24	V	6.4	0.26	-47.1	-13	-34.10
405.1	-53.08	H	6.8	0.37	-46.65	-13	-33.65

UC20 Mini PCIe

UMTS-FDD Band Ⅱ (Part 24E)

Low channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.8	-47.71	V	10.25	2.73	-40.19	-13	-27.19
3704.8	-47.25	H	10.25	2.73	-39.73	-13	-26.73
273.5	-52.44	V	6.4	0.26	-46.3	-13	-33.3
406.1	-52.92	H	6.8	0.37	-46.49	-13	-33.49

Middle channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760	-47.59	V	10.25	2.73	-40.07	-13	-27.07
3760	-47.32	H	10.25	2.73	-39.8	-13	-26.8
273.9	-52.46	V	6.4	0.26	-46.32	-13	-33.32
405.4	-52.87	H	6.8	0.37	-46.44	-13	-33.44

High channel

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization (H/V)	Antenna Gain correction (dBi)	Cable Loss (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	-47.65	V	10.36	2.73	-40.02	-13	-27.02
3815.2	-47.18	H	10.36	2.73	-39.55	-13	-26.55
273.6	-52.34	V	6.4	0.26	-46.2	-13	-33.2
405.3	-52.77	H	6.8	0.37	-46.34	-13	-33.34

Annex A. TEST INSTRUMENT & METHOD

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Model	Serial #	Cal Date	Cal Due	In use
Radiated Emissions					
EMI test receiver	ESL6	100262	09/17/2015	09/16/2016	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/01/2015	08/31/2016	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/24/2016	03/23/2017	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/21/2015	09/20/2016	☑
Bilog Antenna (30MHz~2GHz)	JB1	A112017	09/21/2015	09/20/2016	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71259	09/24/2015	09/23/2016	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/24/2015	09/23/2016	☑
SYNTHESIZED SIGNAL GENERATOR	8665B	3744A01293	09/17/2015	09/16/2016	☑
Tunable Notch Filter	3NF-800/1000-S	AA4	09/01/2015	08/31/2016	☑
Tunable Notch Filter	3NF-1000/2000-S	AM 4	09/01/2015	08/31/2016	☑

Annex A. ii. RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 1GHz (for FCC tests, until the 10th harmonic for operating frequencies ≥ 108MHz),, was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

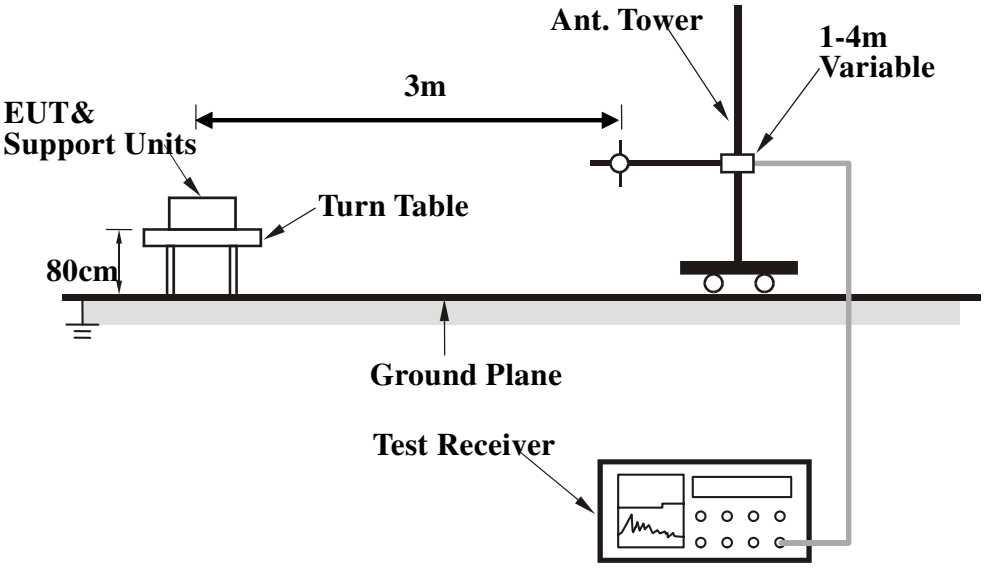
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m or 10m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS) or EMC 3m chamber.

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.

2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement

1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site or EMC 10m chamber. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ◦ to 360 ◦ with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Description of Radiated Emission Program

This EMC Measurement software run LabView automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the scan on four different antenna heights, 2 antenna polarity, and 360 degrees table rotation. For example, the program was set to run 30 MHz to 1 GHz scan; the program will first start from a meter antenna height and divide the 30 MHz to 1 GHz into 10 separate parts of maximum hold sweeps. Each parts of maximum hold sweep, the program will collect the data from 0 degree to 360 degrees table rotation. After the program complete the 1m scan, the antenna continues to rise to 2m and continue the scan. The step will repeated for all specified antenna height and polarity. This program will perform the Quasi Peak measurement after the signal maximization process and pre-scan routine. The final measurement will be base on the pre-scan data reduction result.

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

And the average value is

Average = Peak Value + Duty Factor or

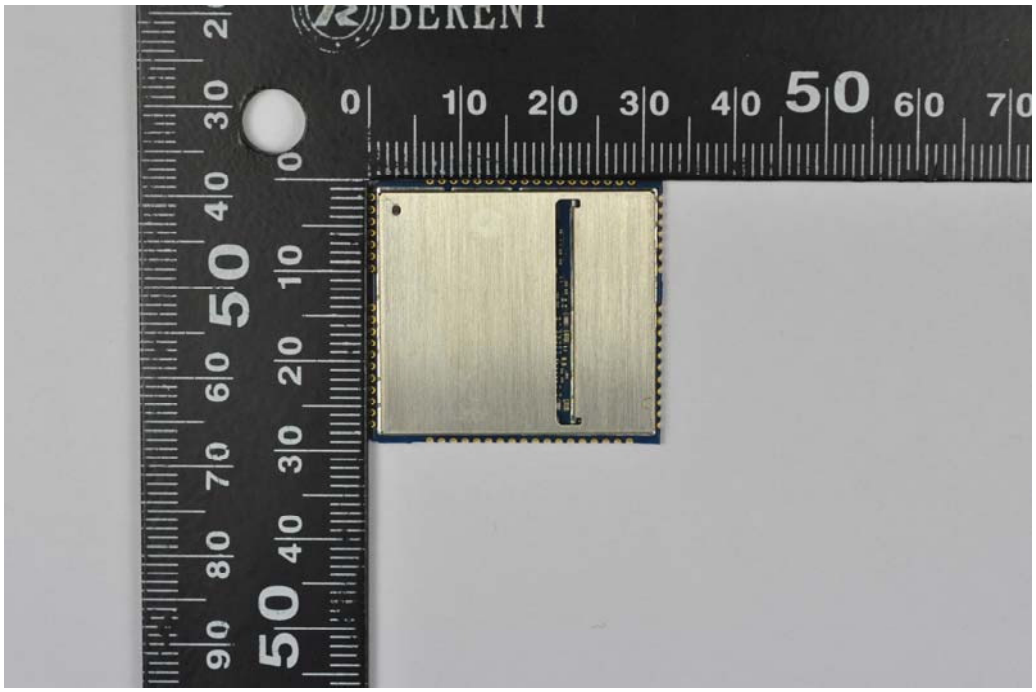
Set RBW = 1MHz, VBW = 10Hz.

Note:

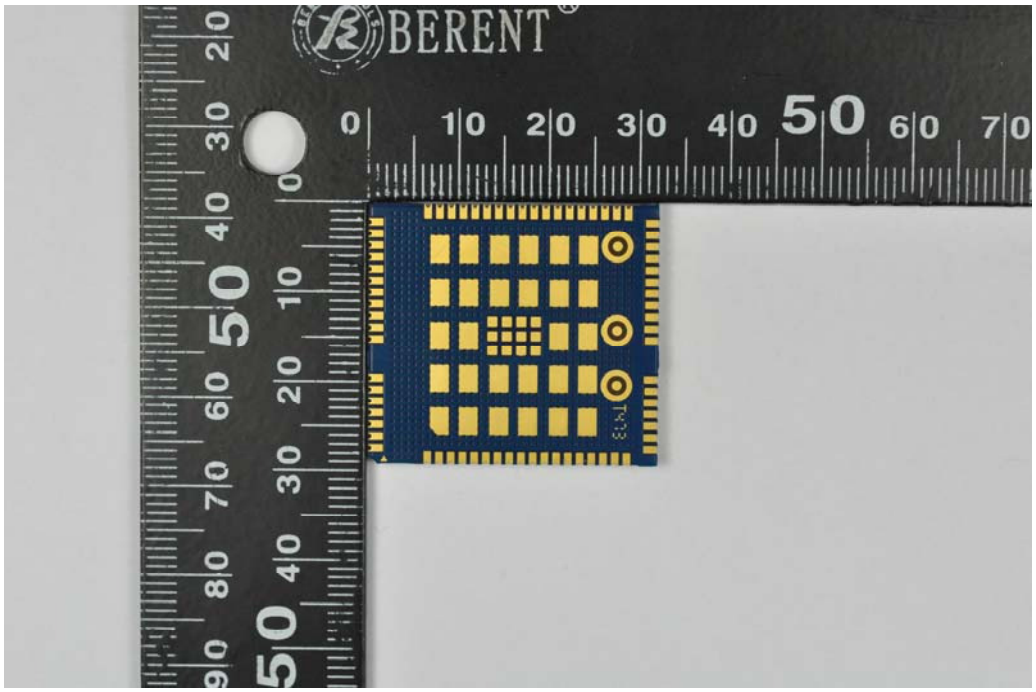
If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex B. EUT AND TEST SETUP PHOTOGRAPHS

Annex B.i. Photograph 1: EUT External Photo

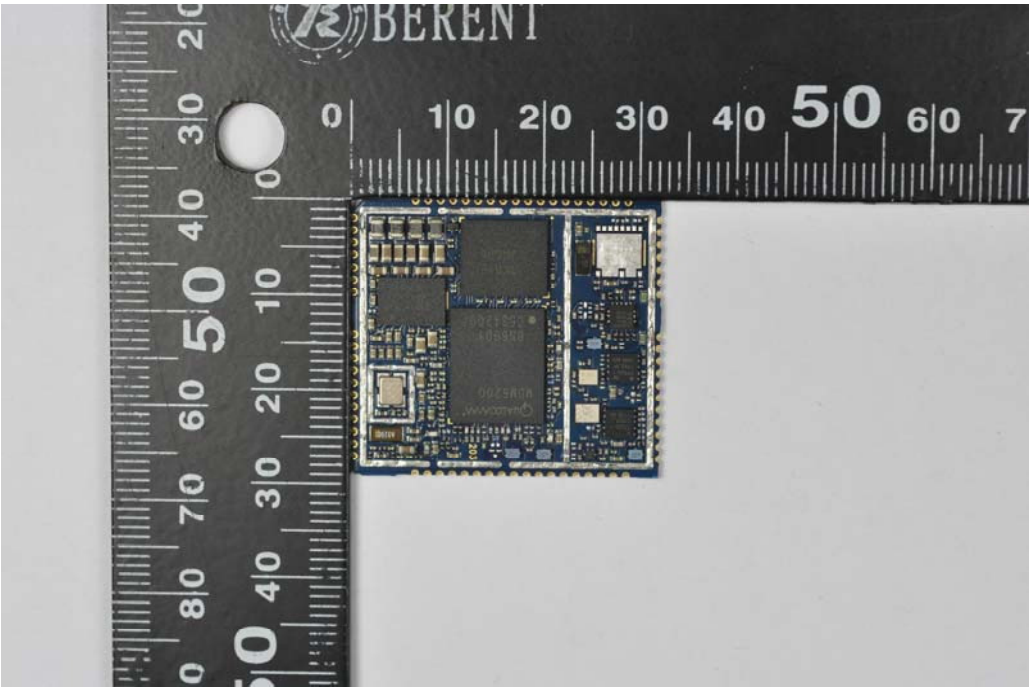


UC20 Front Side

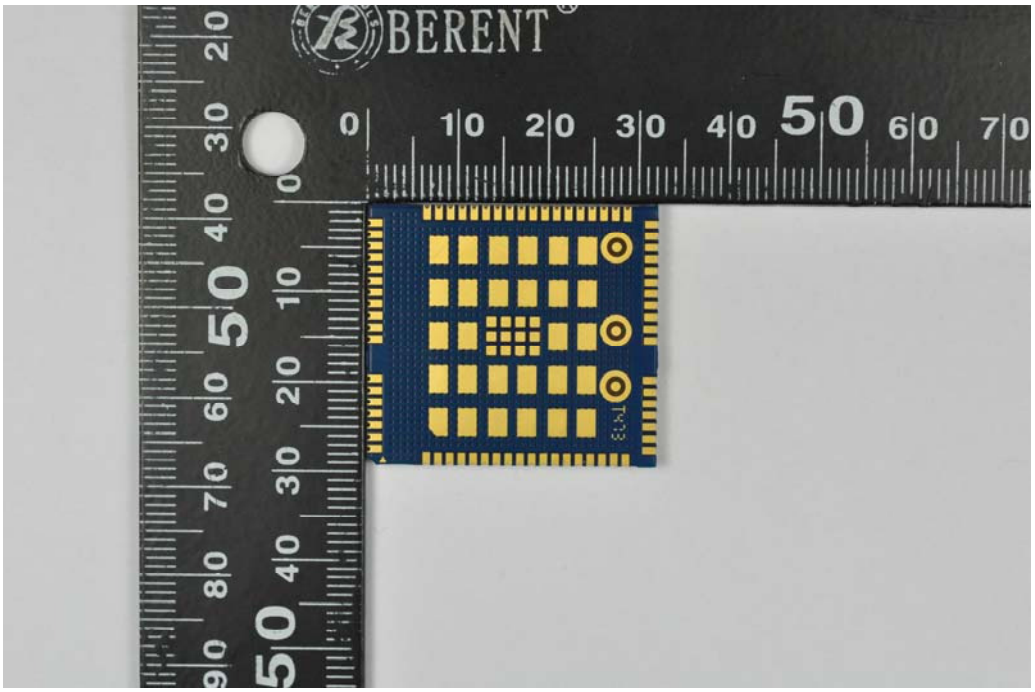


UC20 Rear Side

Annex B.i. Photograph 1: EUT Internal Photo

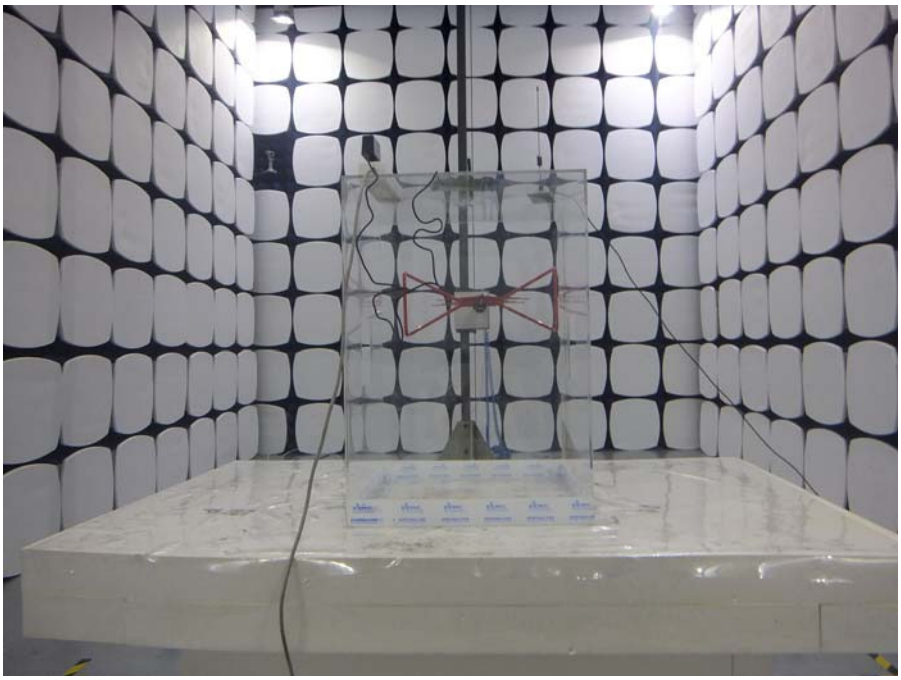


UC20 Front Side No Shield

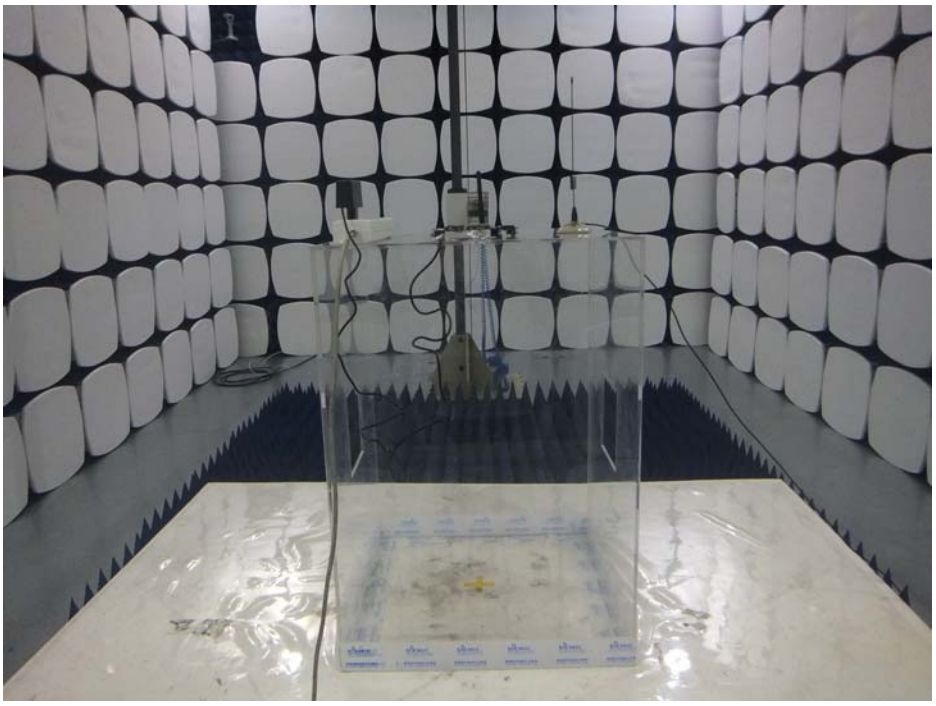


UC20 Rear Side

Annex B.ii. Photograph 2: Test Setup Photo



Radiated Spurious Emissions Test Setup Below 1GHz - Front View



Radiated Spurious Emissions Test Setup Above 1GHz –Front View

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

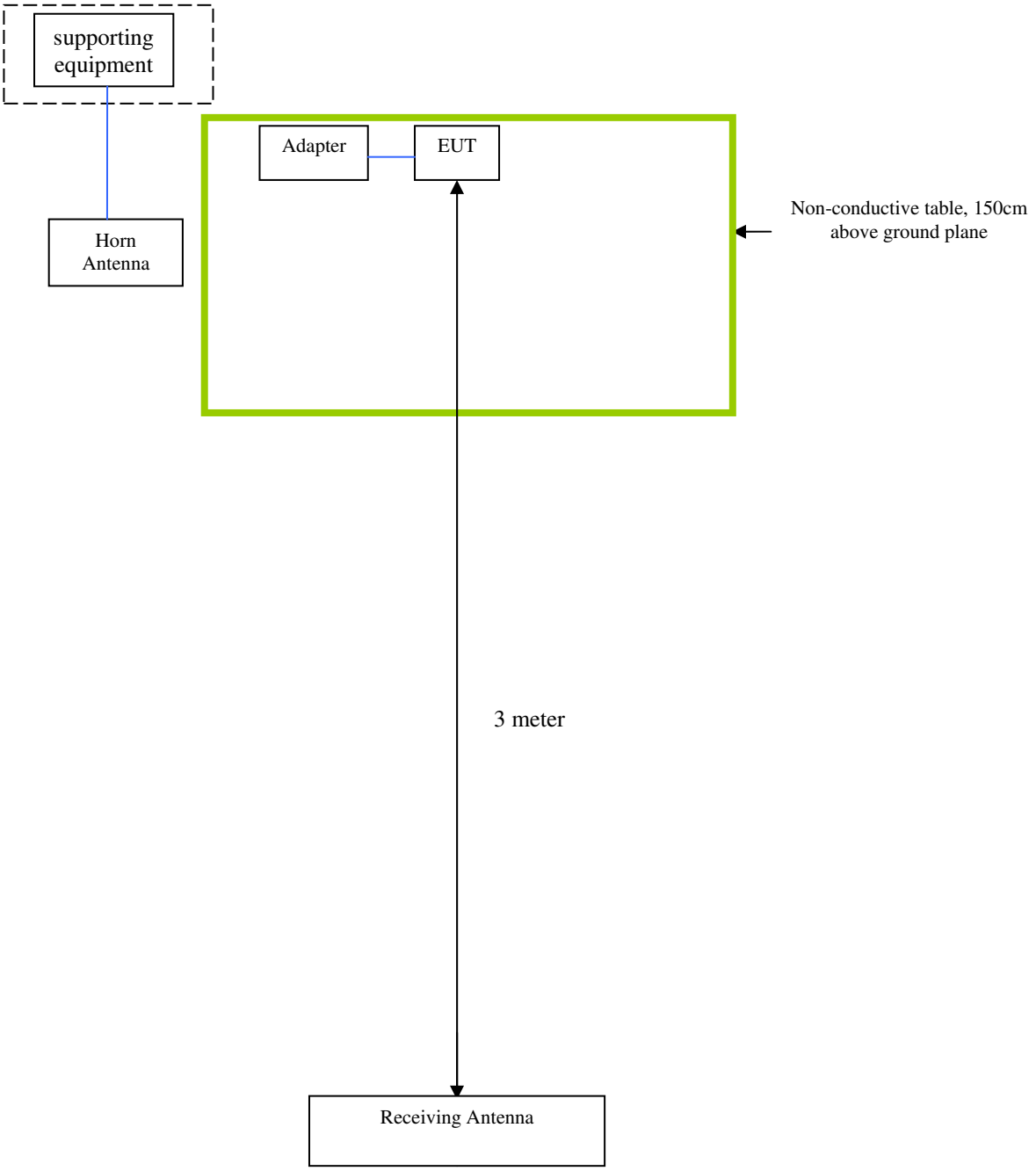
EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description (Including Brand Name)	Model	Calibration Date	Calibration Due Date
A-INFOMW	Horn Antenna	JXTXLB-10180	10/08/2015	10/07/2016
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	09/25/2015	09/24/2016

Block Configuration Diagram for Radiated Emissions



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was communicating with base station and set to work at maximum output power.
Others Testing	The EUT was communicating with base station and set to work at maximum output power.

Annex D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST

Please see attachment

Annex E. DECLARATION OF SIMILARITY

Statement

We Quectel Wireless Solutions Co., Ltd declare the following models as series application.

Name: UMTS/HSPA+ Module

Model number: UC20/UC20 Mini PCIe

UC20 and UC20 Mini PCIe Module are both UMTS/HSDPA+ modules. UC20 Mini PCIe Module makes up of UC20 module and PCIe transferred board. The transferred board switches UC20 module to follow PCI Express Mini Card 1.2 standard connector protocol. No any other internal changes in UC20 module.

We hereby state that two models are identical in interior structure and components, and just connector interface is different for the marketing requirement.

Your assistance on this matter is highly appreciated.

Sincerely,
Name: Harris
Title: Test Engineer

Signature: 何 昇

SIEMIC
GLOBAL TESTING & CERTIFICATIONS

775 Montague Expressway
Milpitas, CA 95035
Tel: 408-526-1188
Fax: 408-526-1088
Email: TCB@siemic.com

FCC CLASS II PERMISSIVE CHANGE REQUEST LETTER

Reason for Amendment (current / obsolete)	Revision History		Approved Date
	From	To	
Initial Release (current)	1.0	1.0	Feb-20-2012

QUECTEL

Quectel Wireless Solutions Co., Ltd.
Room 501, Building 13, No.99 Tianzhou Road, Shanghai
Tel: 86 21 51086236 Fax: 86 21 54453668 Zip: 200233

FCC Class II Permissive Change Request Letter

Date: 05/23/2016

To FCC:

RE: FCC Permissive II Change Request for Company: Quectel Wireless Solutions Co.,Ltd. **FCC ID: XMR201312UC20**

We are submitting an application for a class II permissive change to the FCC approval of the Company name: Quectel Wireless Solutions Co.,Ltd., product description: UMTS/HSPA+ Module (FCC: **XMR201312UC20**, Original Grant Date: 01/19/2014). The transmitter module itself has not changed. Here are the changes:

Item/Category	Brief Description
Hardware	Add support for ESMT flash with 40nm process.
Software	Fix bug and upgrade software version

[Antenna gain changes]
We want to add evaluation for allowed max antenna gain into application.
The correct allowed max antenna gain can be used should be 10.92dBi for WCDMA band V, 9.5dBi for WCDMA band II.

No change in RF parameters.

Sincerely,

Johnny Yang