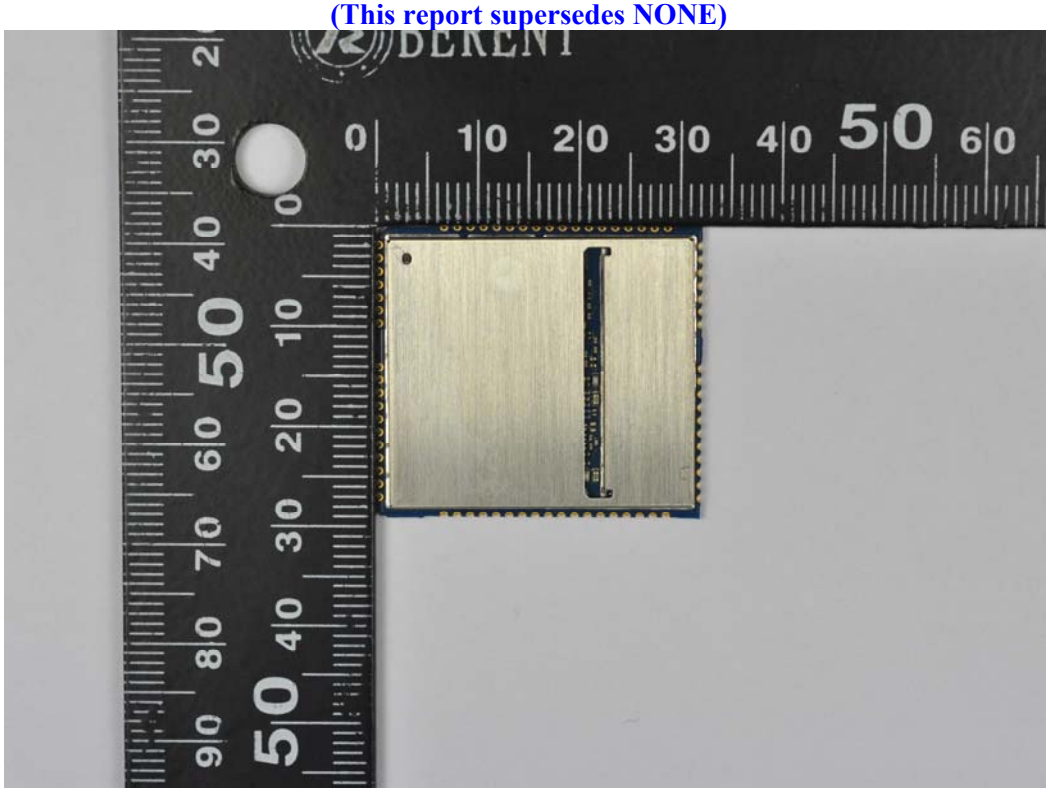
Quectel Wireless Solutions Co., Ltd.

UMTS/HSPA+ Module

Main Model: UC20
Serial Model: UC20 Mini PCIe

January 9, 2014
Report No.: 13050053-FCC-R1
(This report supersedes NONE)



Modifications made to the product : None

This Test Report is Issued Under the Authority of:		
William Long	Alex Liu	
William Long **Compliance Engineer**	**Alex Liu** **Technical Manager**	

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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): 2013

SIEMIC, INC.
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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

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CONTENTS

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): 2013.

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): 2013**

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 (Nanjing-China) Laboratories NO.2-1,Longcang Dadao, Yuhua Economic Development Zone, Nanjing, China Tel: +86(25)86730128/86730129 Fax: +86(25)86730127 Email: China@siemic.com.cn**
Test report reference number	**13050053-FCC-R1**
Date EUT received	**December 30, 2013**
Standard applied	**FCC Part 22(H) & FCC Part 24(E): 2013**
Dates of test	**January 3, 2014**
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
§ 1.1307, § 2.1091	RF Exposure (SAR)	See Above	Pass
§2.1046; § 22.913 (a); § 24.232 (c)	RF Output Power	See Above	Pass
§ 2.1047	Modulation Characteristics	See Above	N/A
§ 2.1049; § 22.905 § 22.917; § 24.238	Occupied Bandwidth	See Above	Pass
§ 2.1051, § 22.917 (a); § 24.238 (a)	Spurious Emissions at Antenna Terminal	See Above	Pass
§ 2.1053 § 22.917; § 24.238	Spurious Radiated Emissions	See Above	Pass
§ 22.917 (a); § 24.238 (a)	Band Edge	See Above	Pass
§ 2.1055 § 22.355; § 24.235	Frequency Stability	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 §1.1307, §2.1091- RF Exposure (SAR)

Test Result: Pass

The EUT is a mobile device, thus requires MPE evaluation;
please refer to SIEMIC RF Exposure Report: 13050053-FCC-H

5.2 §2.1046 ;§22.913 (a); §24.232 (c)- RF Output Power

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted 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 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test date : January 3, 2014
   Tested By : William Long

Procedures:

For Conducted Power:

1. The transmitter output port was connected to base station.
2. Set EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different test mode.

For ERP/EIRP:

1. The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

2. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

3. The frequency range up to tenth harmonic of the fundamental frequency was investigated.

4. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

   Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

   Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

Test Result: Pass

Remark: Conducted Burst Average power for reporting purposes only

Conducted Power

UMTS Mode:

UMTS-FDD Band V

Band/ Time Slot configuration	Channel	Frequency	Peak power (dBm)	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	4132	826.4	24.03	22.26	22.5+/-1 dBm
	4175	835	24.12	22.15	22.5+/-1 dBm
	4233	846.6	24.03	22.36	22.5+/-1 dBm
HSDPA Subtest1	4132	826.4	24.11	22.23	22.5+/-1 dBm
	4175	835	24.08	22.36	22.5+/-1 dBm
	4233	846.6	24.1	22.45	22.5+/-1 dBm
HSDPA Subtest2	4132	826.4	24.02	22.36	22.5+/-1 dBm
	4175	835	24.06	22.53	22.5+/-1 dBm
	4233	846.6	24.12	22.26	22.5+/-1 dBm
HSDPA Subtest3	4132	826.4	24.08	22.42	22.5+/-1 dBm
	4175	835	24.01	22.26	22.5+/-1 dBm
	4233	846.6	24.11	22.36	22.5+/-1 dBm
HSDPA Subtest4	4132	826.4	24.15	22.53	22.5+/-1 dBm
	4175	835	24.13	22.43	22.5+/-1 dBm
	4233	846.6	24.11	22.15	22.5+/-1 dBm
HSUPA Subtest1	4132	826.4	24.05	22.36	22.5+/-1 dBm
	4175	835	24.18	22.25	22.5+/-1 dBm
	4233	846.6	24.05	22.42	22.5+/-1 dBm
HSUPA Subtest2	4132	826.4	24.06	22.26	22.5+/-1 dBm
	4175	835	24.09	**22.53**	22.5+/-1 dBm
	4233	846.6	24.1	22.32	22.5+/-1 dBm
HSUPA Subtest3	4132	826.4	24.12	22.3	22.5+/-1 dBm
	4175	835	24.02	22.51	22.5+/-1 dBm
	4233	846.6	24.03	22.36	22.5+/-1 dBm
HSUPA Subtest4	4132	826.4	24.11	22.23	22.5+/-1 dBm
	4175	835	24.12	22.15	22.5+/-1 dBm
	4233	846.6	24.11	22.35	22.5+/-1 dBm
HSUPA Subtest5	4132	826.4	24.1	22.36	22.5+/-1 dBm
	4175	835	24.09	22.42	22.5+/-1 dBm
	4233	846.6	24.06	22.26	22.5+/-1 dBm

UMTS-FDD Band Ⅱ

Band/ Time Slot configuration	Channel	Frequency	Peak power (dBm)	Average power (dBm)	Tune up Power tolerant
RMC 12.2kbps	9262	1852.4	24.06	22.36	22.5+/-1 dBm
	9400	1880	24.11	22.42	22.5+/-1 dBm
	9538	1907.6	24.1	22.35	22.5+/-1 dBm
HSDPA Subtest1	9262	1852.4	24.06	22.52	22.5+/-1 dBm
	9400	1880	24.12	22.43	22.5+/-1 dBm
	9538	1907.6	24.09	22.36	22.5+/-1 dBm
HSDPA Subtest2	9262	1852.4	24.11	22.36	22.5+/-1 dBm
	9400	1880	24.12	22.35	22.5+/-1 dBm
	9538	1907.6	24.09	22.45	22.5+/-1 dBm
HSDPA Subtest3	9262	1852.4	24.11	**22.53**	22.5+/-1 dBm
	9400	1880	24.05	22.35	22.5+/-1 dBm
	9538	1907.6	24.12	22.42	22.5+/-1 dBm
HSDPA Subtest4	9262	1852.4	24.05	22.36	22.5+/-1 dBm
	9400	1880	24.08	22.53	22.5+/-1 dBm
	9538	1907.6	24.11	22.42	22.5+/-1 dBm
HSUPA Subtest1	9262	1852.4	24.12	22.35	22.5+/-1 dBm
	9400	1880	24.08	22.53	22.5+/-1 dBm
	9538	1907.6	24.03	22.36	22.5+/-1 dBm
HSUPA Subtest2	9262	1852.4	24.08	22.45	22.5+/-1 dBm
	9400	1880	24.06	22.47	22.5+/-1 dBm
	9538	1907.6	24.11	22.4	22.5+/-1 dBm
HSUPA Subtest3	9262	1852.4	24.08	22.39	22.5+/-1 dBm
	9400	1880	24.11	22.52	22.5+/-1 dBm
	9538	1907.6	24.12	22.36	22.5+/-1 dBm
HSUPA Subtest4	9262	1852.4	24.05	22.48	22.5+/-1 dBm
	9400	1880	24.03	22.25	22.5+/-1 dBm
	9538	1907.6	24.11	22.31	22.5+/-1 dBm
HSUPA Subtest5	9262	1852.4	24.08	22.48	22.5+/-1 dBm
	9400	1880	24.03	22.52	22.5+/-1 dBm
	9538	1907.6	24.12	22.45	22.5+/-1 dBm

ERP & EIRP (worst case)

ERP for UMTS-FDD Band Ⅴ (Part 22H)

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
826.4	19.25	V	6.4	2.5	23.15	33
826.4	19.05	H	6.4	2.5	22.95	33
835	19.22	V	6.5	2.5	**23.22**	33
835	19.01	H	6.5	2.5	23.01	33
846.6	19.26	V	6.6	2.67	23.19	33
846.6	19.05	H	6.6	2.67	22.98	33

EIRP for UMTS-FDD Band Ⅱ (Part 24E)

Frequency (MHz)	Substituted level (dBm)	Antenna Polarization	Antenna Gain correction (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)
1852.4	19.27	V	8	4	23.27	33
1852.4	19.1	H	8	4	23.1	33
1880	19.33	V	8	4	**23.33**	33
1880	19.05	H	8	4	23.05	33
1907.6	19.23	V	8	4.17	23.06	33
1907.6	19.06	H	8	4.17	22.89	33

Note: *Factors= Antenna Gain Correction-Cable Loss*

5.3 §2.1047 - Modulation Characteristic

According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

5.4 §2.1049, §22.905,§22.917 & §24.238 - Occupied Bandwidth

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyser was connected to the antenna terminal.
2. Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

3. Conducted 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 30MHz – 40GHz is ±1.5dB.
4. Test date : January 3, 2014
   Tested By : William Long

Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.

2. The 99% and 26 dB occupied bandwidth (BW) of the middle channel for the highest RF powers.

Test Results: Pass

UMTS-FDD Band Ⅴ (Part 22H)

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
4132	826.4	4.133	4.680
4175	835.0	4.150	4.680
4233	846.6	4.133	4.680

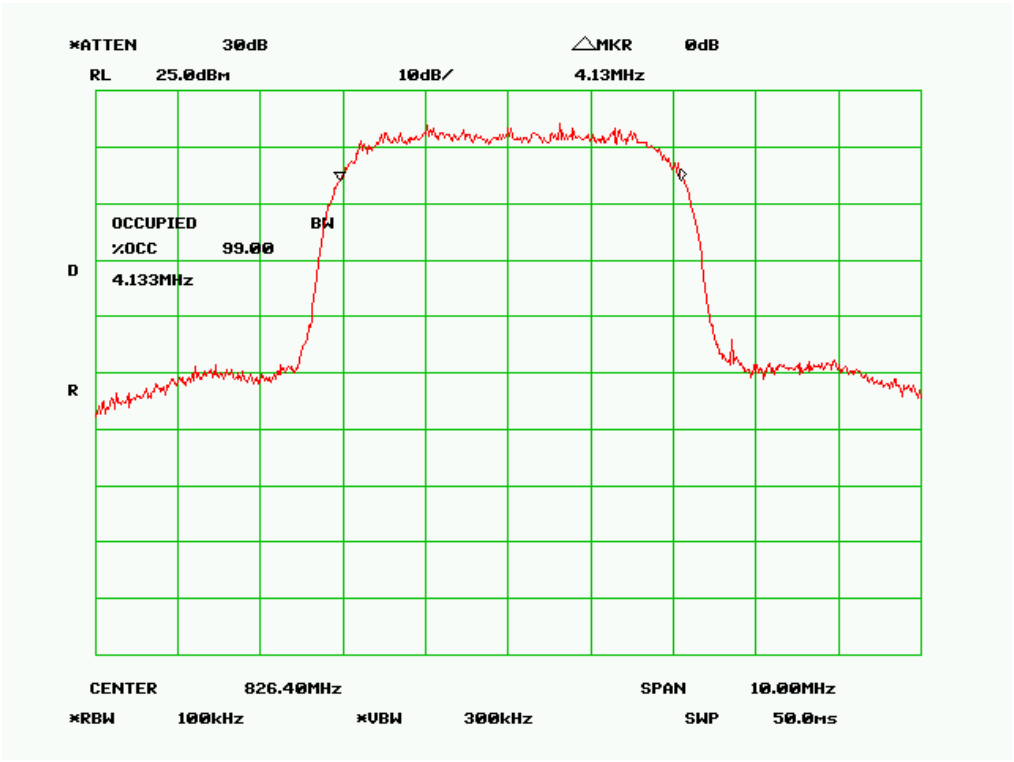
UMTS-FDD Band Ⅱ (Part 24E)

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)	26 dB Bandwidth (MHz)
9262	1852.4	4.167	4.700
9400	1880.0	4.167	4.680
9538	1907.6	4.167	4.700

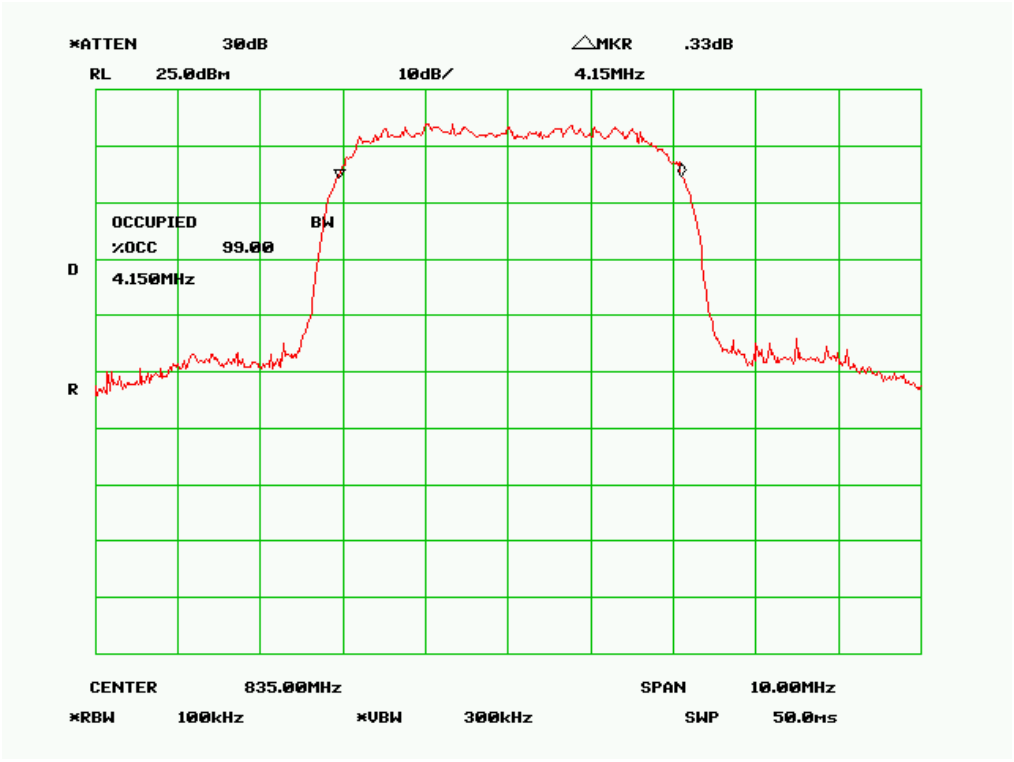
Please refer to the following plots.

UMTS-FDD Band Ⅴ (Part 22H)

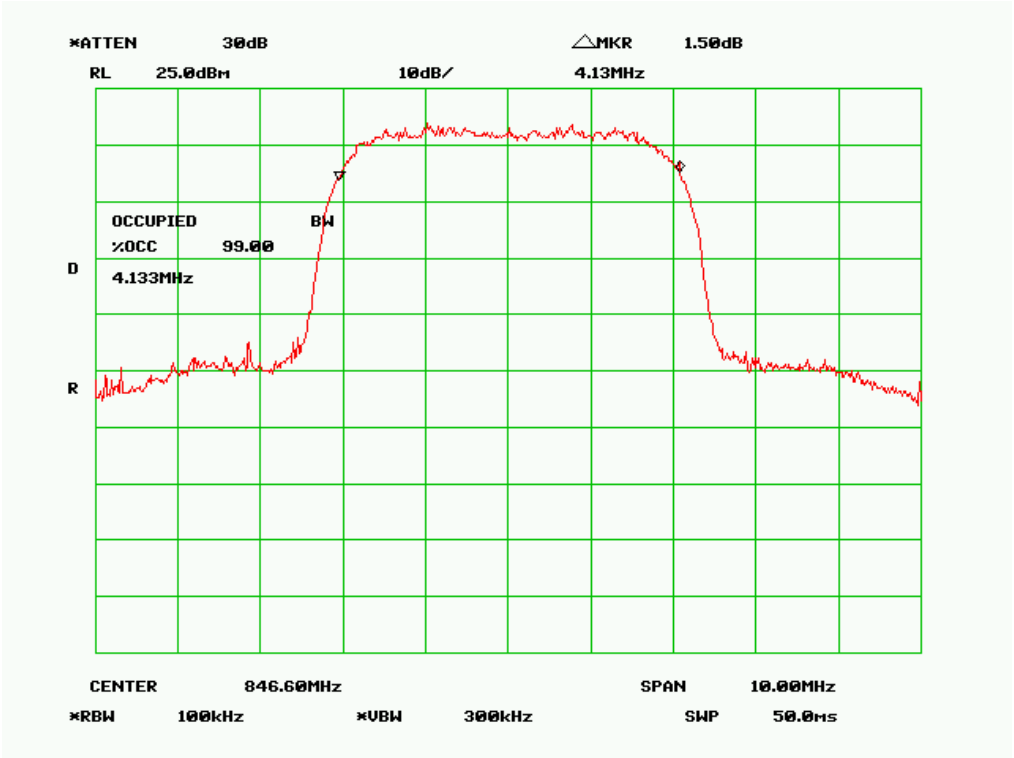
99% Occupied Bandwidth
Low Channel



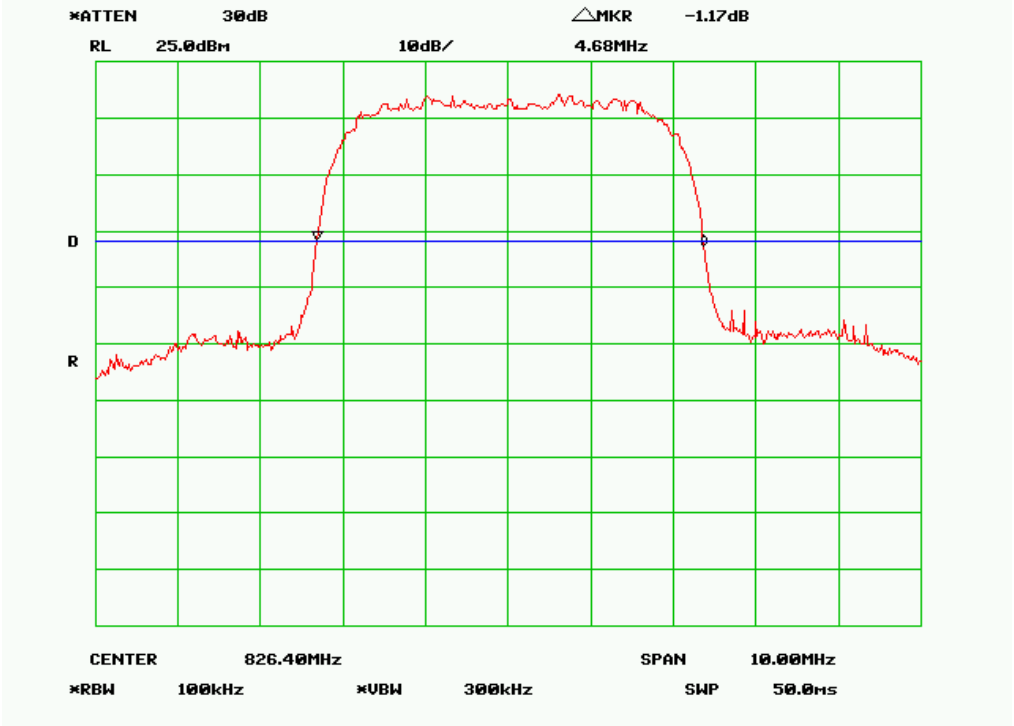
Middle Channel



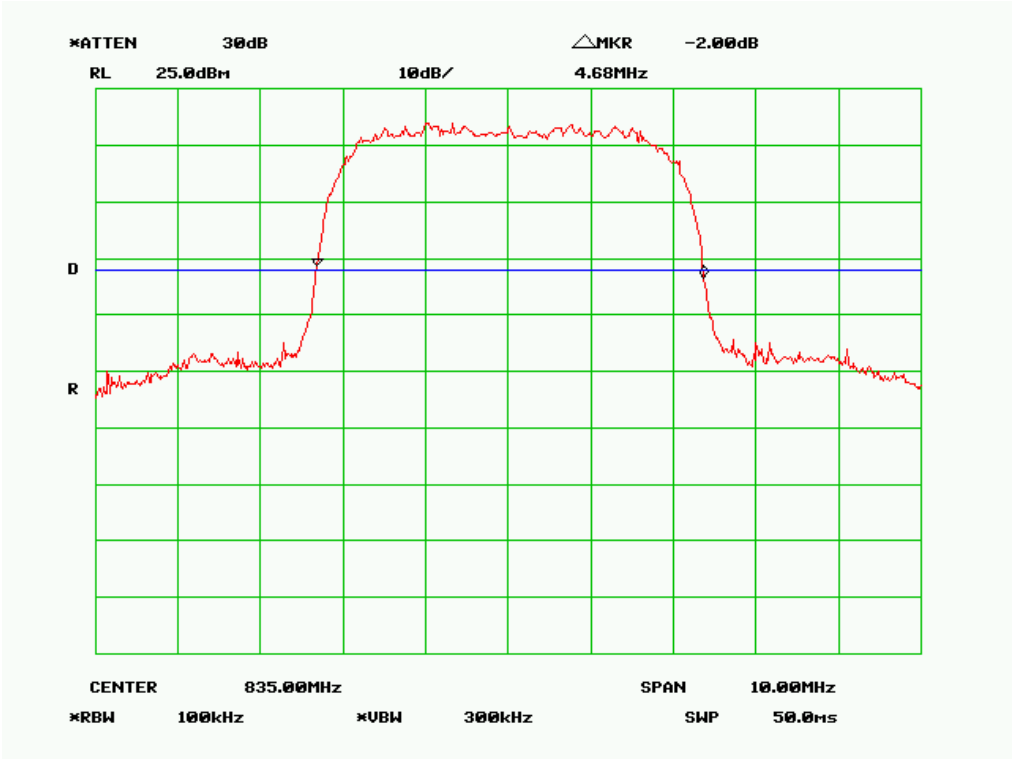
High Channel



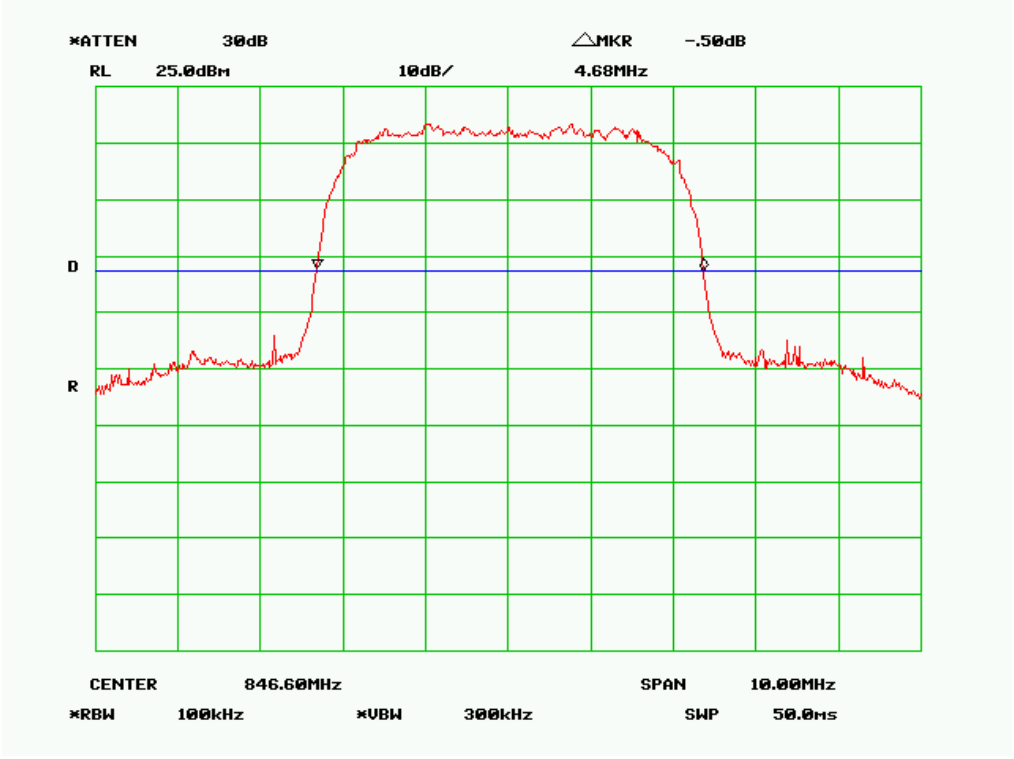
26 dB Bandwidth
Low Channel



Middle Channel

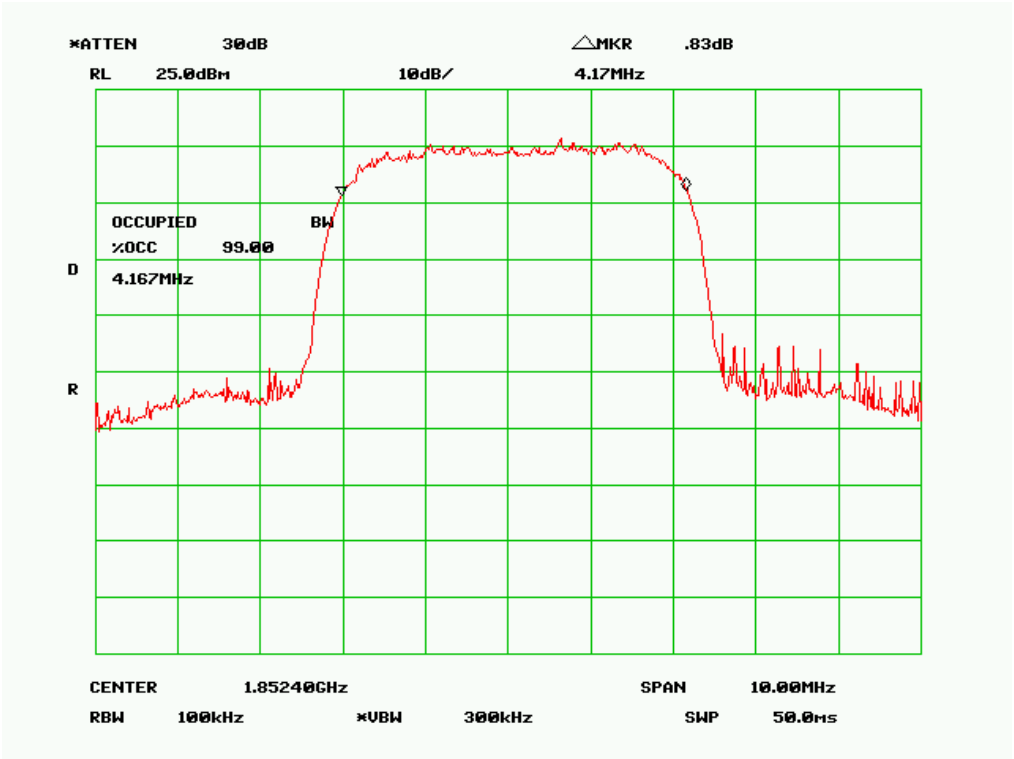


High Channel

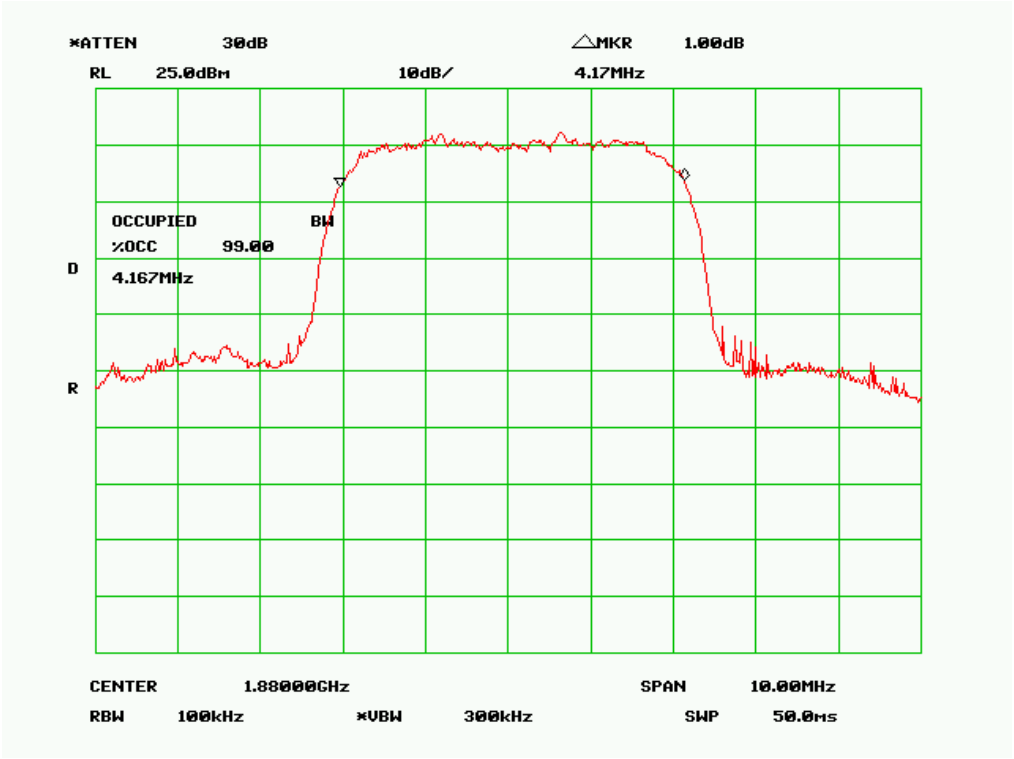


UMTS-FDD Band Ⅱ (Part 24E)

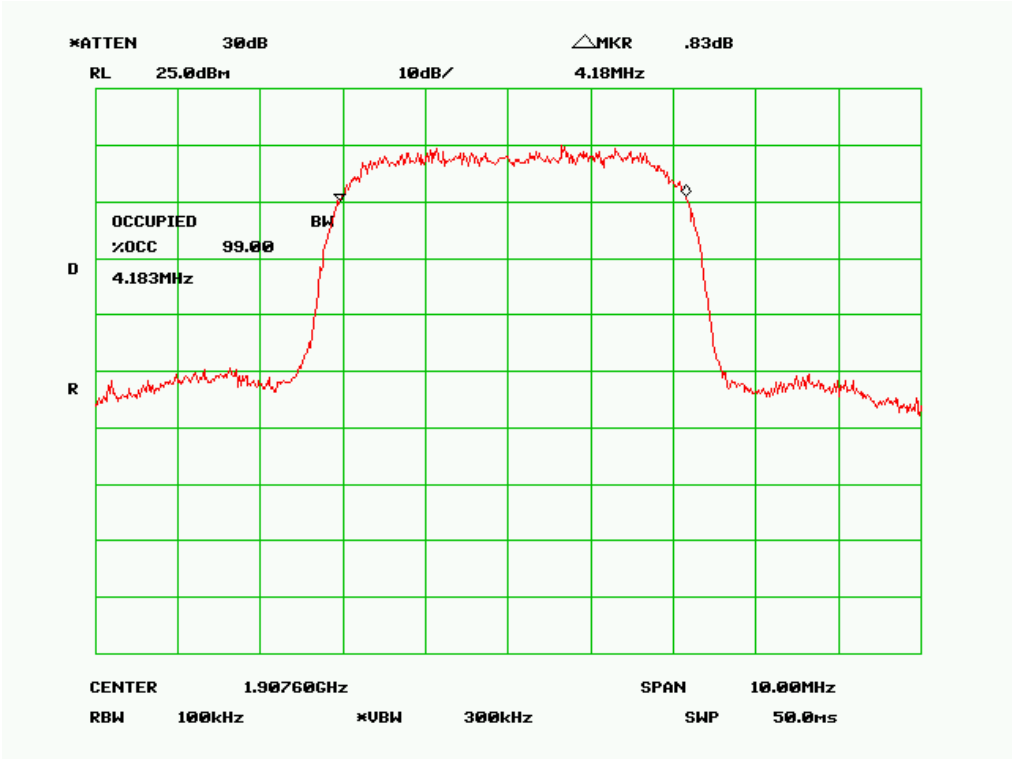
99% Occupied Bandwidth
Low Channel



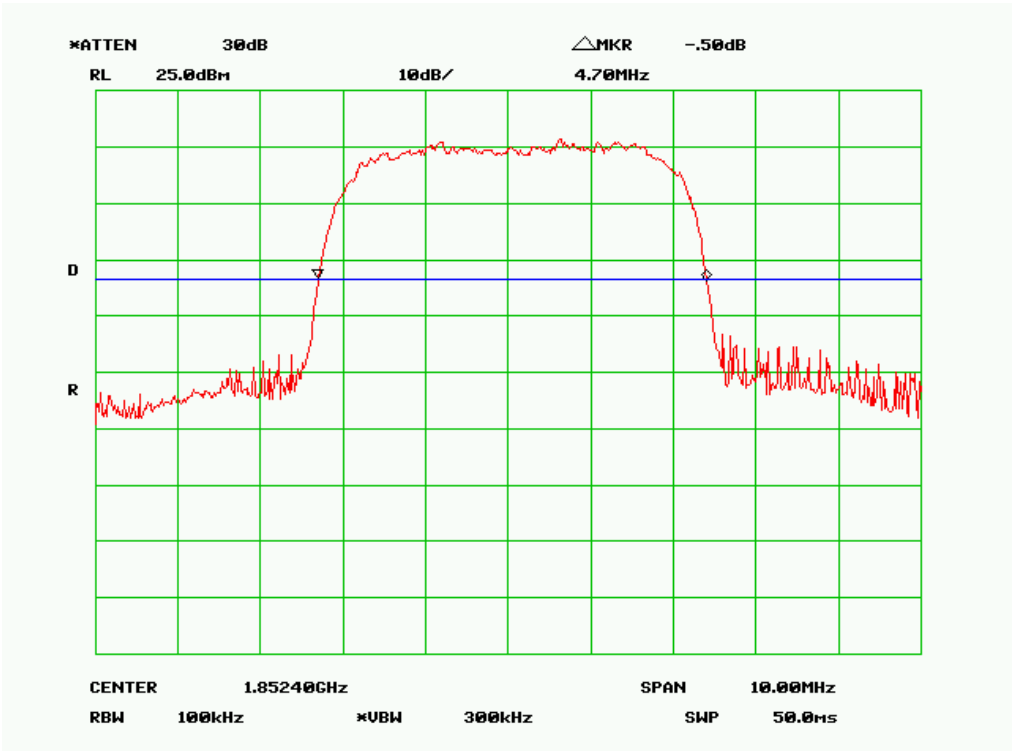
Middle Channel



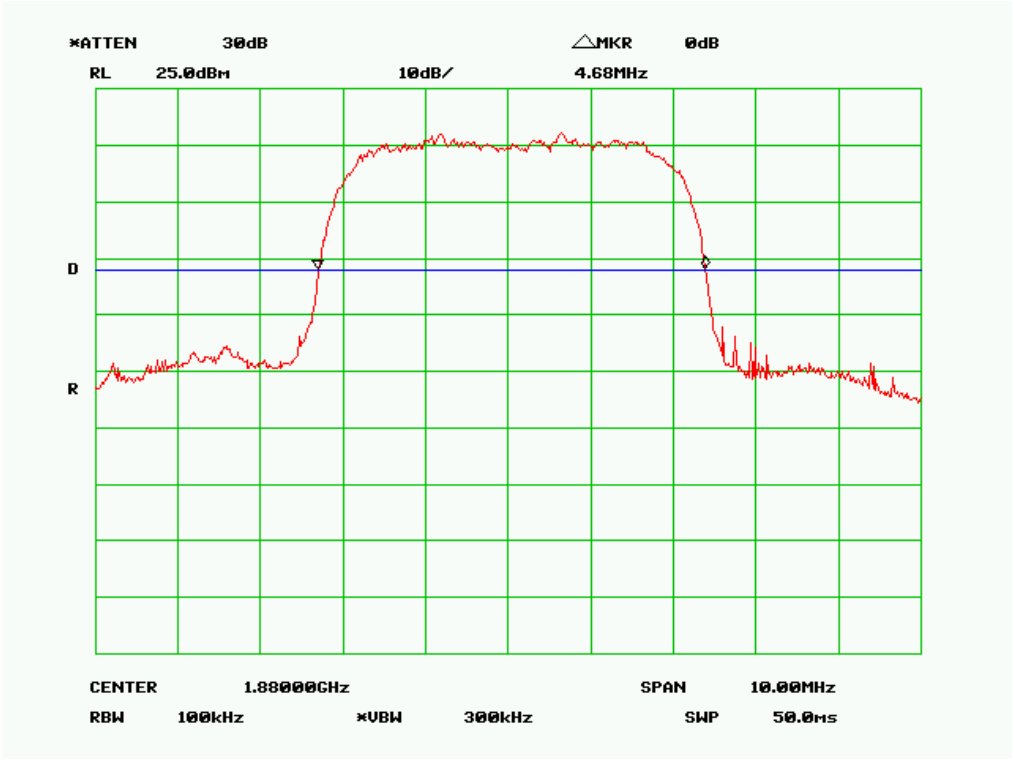
High Channel



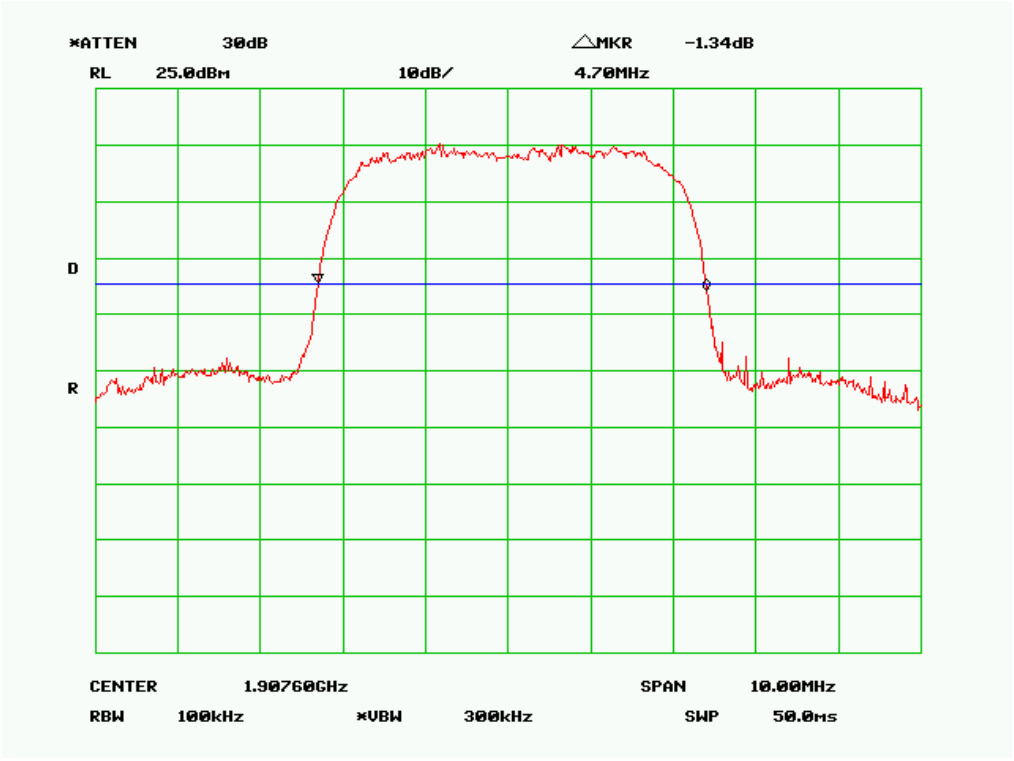
26 dB Bandwidth
Low Channel



Middle Channel



High Channel



5.5 §2.1051, §22.917(a) & §24.238(a) - Spurious Emissions at Antenna Terminals

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted 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 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test date : January 3, 2014
   Tested By : William Long

Standard Requirement:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The Band Edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.

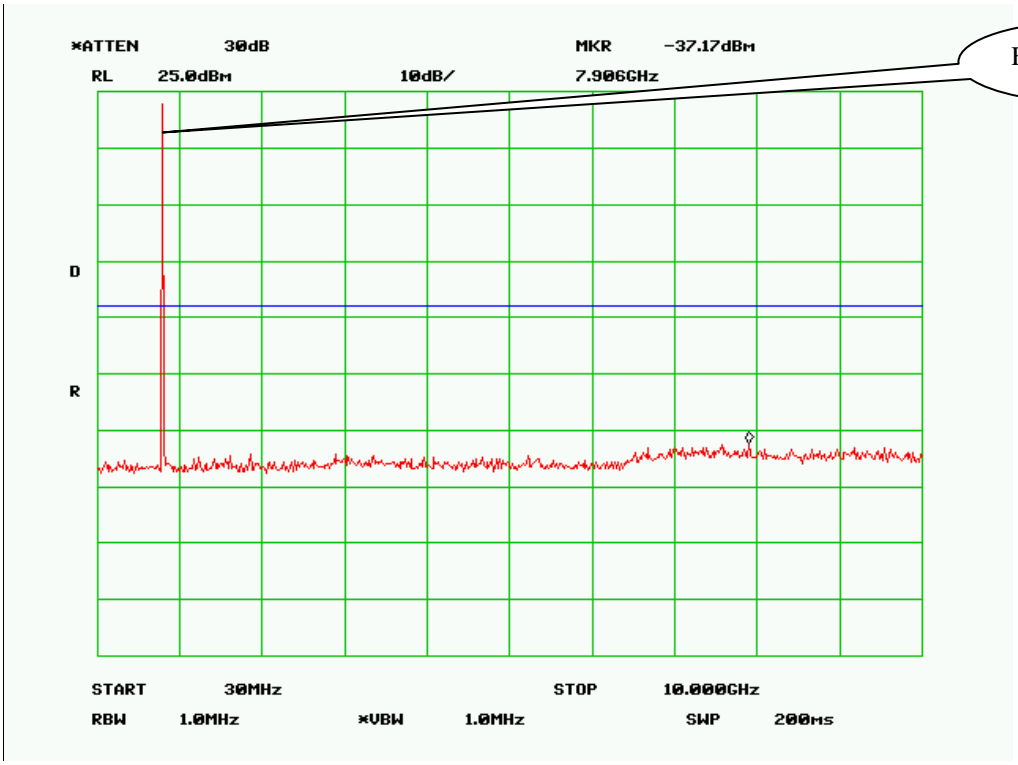
Test Result: Pass

Refer to the attached plots.

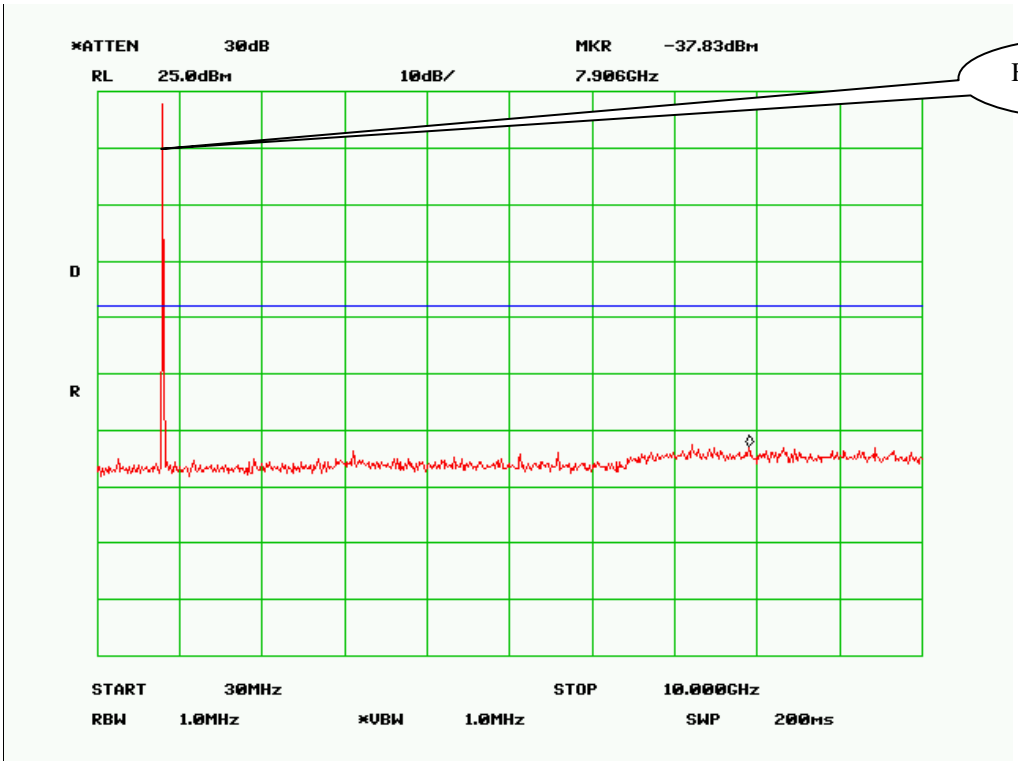
UMTS-FDD Band Ⅴ (Part 22H)

30MHz-10G – WCDMA 850

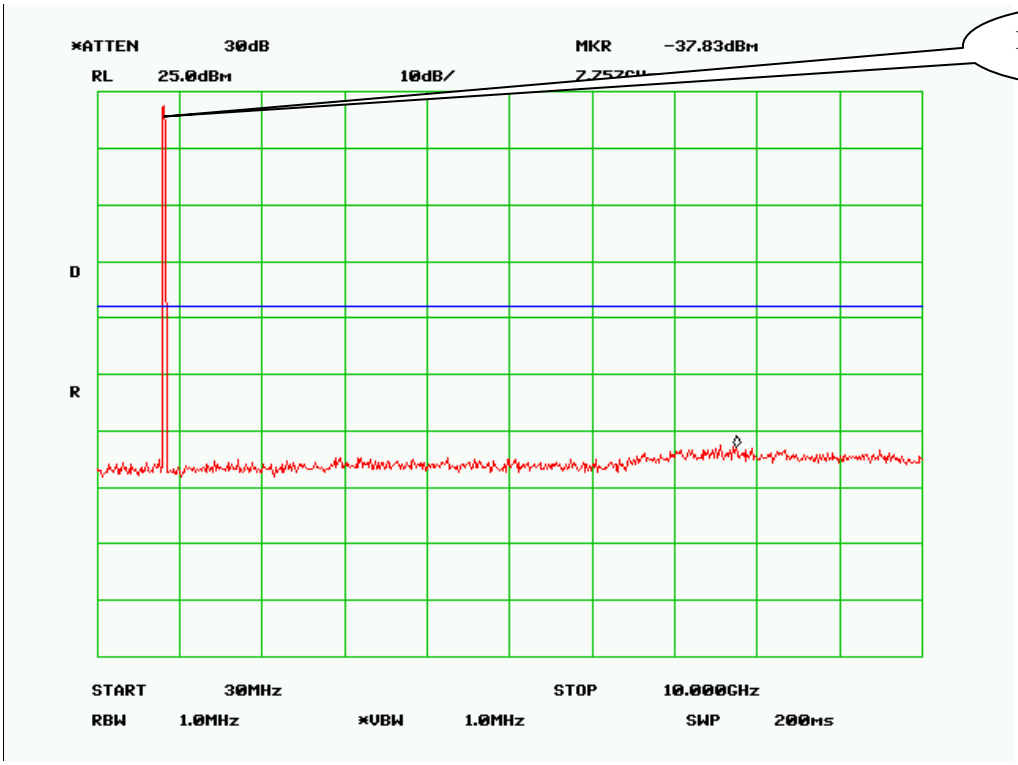
Low Channel



Middle Channel



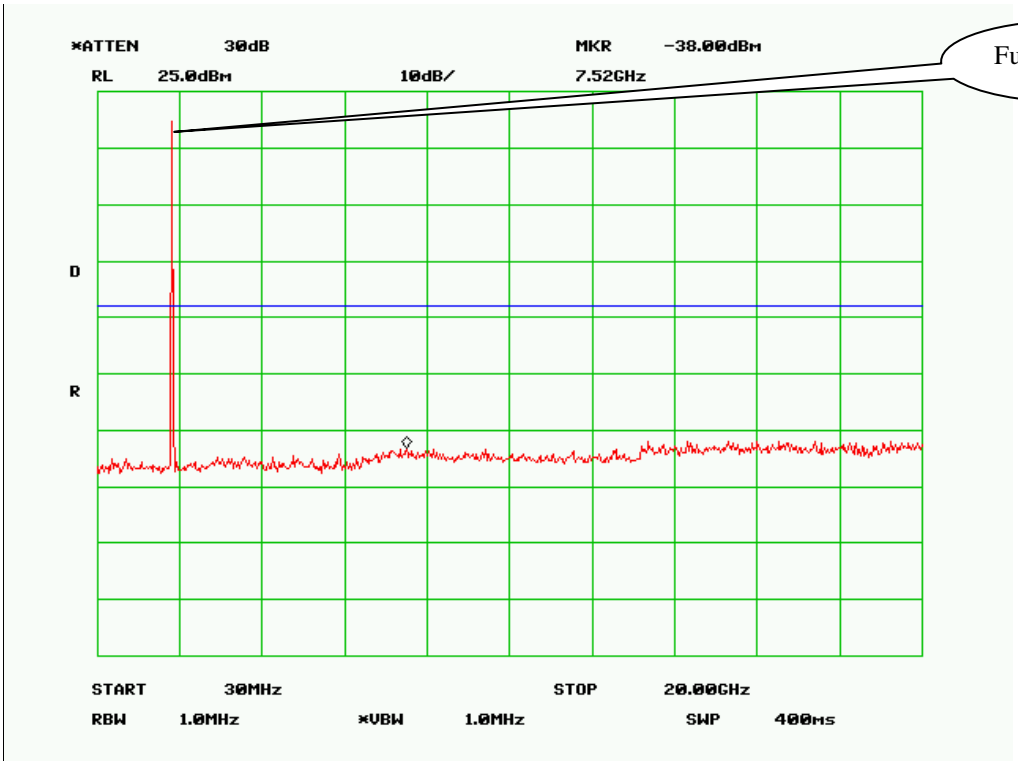
High Channel



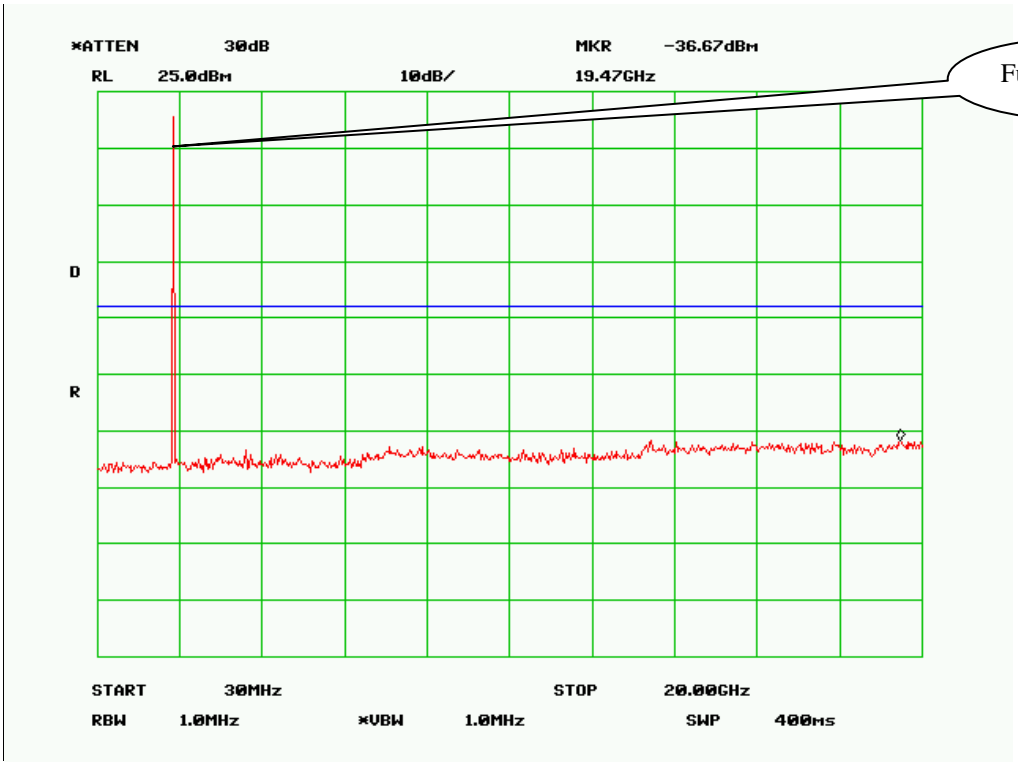
UMTS-FDD Band Ⅱ (Part24E)

30MHz-25G – WCDMA1900

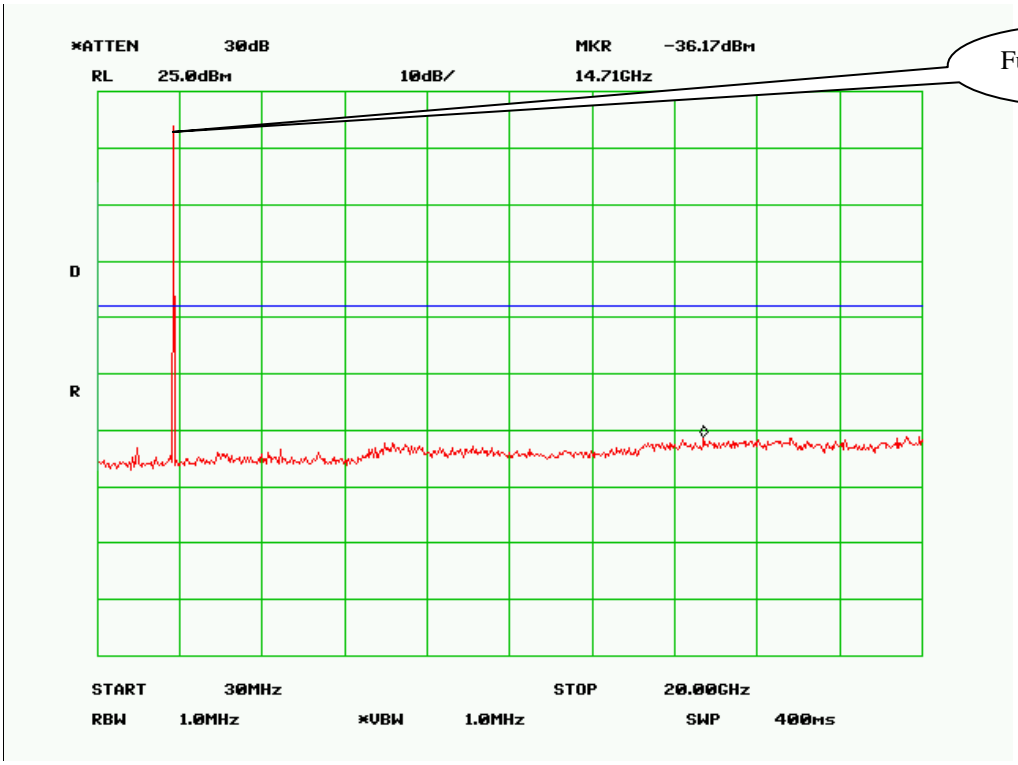
Low Channel



Middle Channel



High Channel



5.6 §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	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

5. Test date : January 3, 2014
   Tested By : William Long

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

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UMTS-FDD Band Ⅴ (Part 22H)

Low channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.45	-30.5	152	152	V	8	3.67	0	-26.17	-13	-13.17
1652.47	-28.56	26	262	H	8	3.67	0	-24.23	-13	-11.23
535	-44.02	263	262	V	6.3	2	0	-39.72	-13	-26.72
785.22	-40.26	2	260	H	6.5	2.33	0	-36.09	-13	-23.09

Middle channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670.59	-30.2	56	120	V	8	3.67	0	-25.87	-13	-12.87
1670.61	-28.03	263	125	H	8	3.67	0	-23.7	-13	-10.7
983.55	-45.26	1	151	V	6.5	2.67	0	-41.43	-13	-28.43
758.14	-44.09	25	223	H	6.4	2.33	0	-40.02	-13	-27.02

High channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.22	-30.55	262	110	V	8	3.67	0	-26.22	-13	-13.22
1693.22	-29.56	2	233	H	8	3.67	0	-25.23	-13	-12.23
485.02	-40.2	258	110	V	5.8	1.84	0	-36.24	-13	-23.24
758.15	-44.08	19	252	H	6.4	2.33	0	-40.01	-13	-27.01

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UMTS-FDD Band Ⅴ (Part 22H)

Low channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1652.8	-30.26	5	152	V	8	3.67	0	-25.93	-13	-12.93
1652.8	-29.5	262	221	H	8	3.67	0	-25.17	-13	-12.17
484.22	-40.1	223	153	V	5.8	1.84	0	-36.14	-13	-23.14
633.5	-39.56	262	225	H	6.3	2.16	0	-35.42	-13	-22.42

Middle channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1670.2	-29.59	5	135	V	8	3.67	0	-25.26	-13	-12.26
1670.21	-30.55	222	202	H	8	3.67	0	-26.22	-13	-13.22
499.5	-44.05	22	163	V	5.9	1.84	0	-39.99	-13	-26.99
701.2	-41.2	151	223	H	6.5	2.33	0	-37.03	-13	-24.03

High channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1693.2	-30.2	6	212	V	8	3.67	0	-25.87	-13	-12.87
1693.2	-28.56	262	205	H	8	3.67	0	-24.23	-13	-11.23
553.6	-40.5	23	112	V	6.3	2	0	-36.2	-13	-23.2
700.55	-42.05	285	252	H	6.5	2.33	0	-37.88	-13	-24.88

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UMTS-FDD Band Ⅱ (Part 24E)

Low channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.8	-33.56	5	165	V	9.9	6	0	-29.66	-13	-16.66
3704.8	-34.5	258	252	H	9.9	6	0	-30.6	-13	-17.6
488.36	-44.33	222	151	V	5.8	1.84	0	-40.37	-13	-27.37
517.29	-48.05	22	223	H	6.4	2	0	-43.65	-13	-30.65

Middle channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760.2	-31.56	48	120	V	9.9	6	0	-27.66	-13	-14.66
3760.12	-35.33	296	152	H	9.9	6	0	-31.43	-13	-18.43
565	-40.45	5	110	V	6.3	2	0	-36.15	-13	-23.15
669.88	-39.3	292	252	H	6.4	2.16	0	-35.06	-13	-22.06

High channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	-30.66	165	100	V	9.9	6	0	-26.76	-13	-13.76
3815.2	-34.8	233	262	H	9.9	6	0	-30.9	-13	-17.9
563.5	-39.56	252	110	V	6.3	2	0	-35.26	-13	-22.26
705.55	-42.05	151	233	H	6.6	2.33	0	-37.78	-13	-24.78

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UMTS-FDD Band Ⅱ (Part 24E)

Low channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3704.5	-33.5	2	105	V	9.9	6	0	-29.6	-13	-16.6
3704.52	-32.4	258	233	H	9.9	6	0	-28.5	-13	-15.5
595.56	-44.56	226	136	V	6.4	2	0	-40.16	-13	-27.16
778.13	-40.22	233	205	H	6.3	2.33	0	-36.25	-13	-23.25

Middle channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3760.8	-30.26	5	152	V	9.9	6	0	-26.36	-13	-13.36
3760.75	-33.56	225	225	H	9.9	6	0	-29.66	-13	-16.66
484	-40.5	22	165	V	5.8	1.84	0	-36.54	-13	-23.54
166.55	-39.88	16	202	H	2.2	1.17	0	-38.85	-13	-25.85

High channel

Frequency (MHz)	Substituted level (dBm)	Direction (degree)	Height (cm)	Polarity (H/V)	Antenna Gain Correction (dB)	Cable Loss (dB)	Amplifier (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
3815.2	-29.8	165	100	V	9.9	6	0	-25.9	-13	-12.9
3815.2	-35.36	333	225	H	9.9	6	0	-31.46	-13	-18.46
690.56	-44.2	3	151	V	6.6	2.16	0	-39.76	-13	-26.76
780.2	-41.58	305	225	H	6.4	2.33	0	-37.51	-13	-24.51

5.7 §22.917(a) & §24.238(a) - Band Edge

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Conducted 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 30MHz – 40GHz is ±1.5dB.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar

4. Test date : January 3, 2014
   Tested By : William Long

Standard Requirement:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

Procedures:

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The Band Edges of low and high channels for the highest RF powers were measured. Setting RBW as roughly BW/100.

Test Result: Pass

Refer to the attached plots.

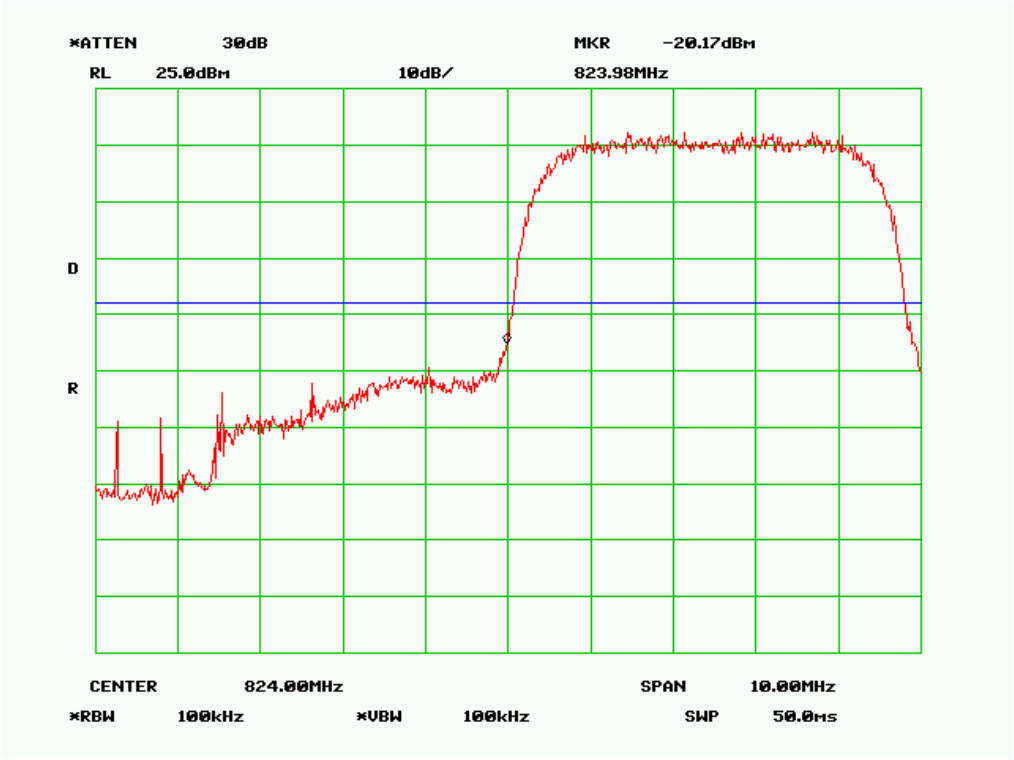
UMTS-FDD Band Ⅴ (Part 22H)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
824.000	-20.17	-13
849.100	-16.17	-13

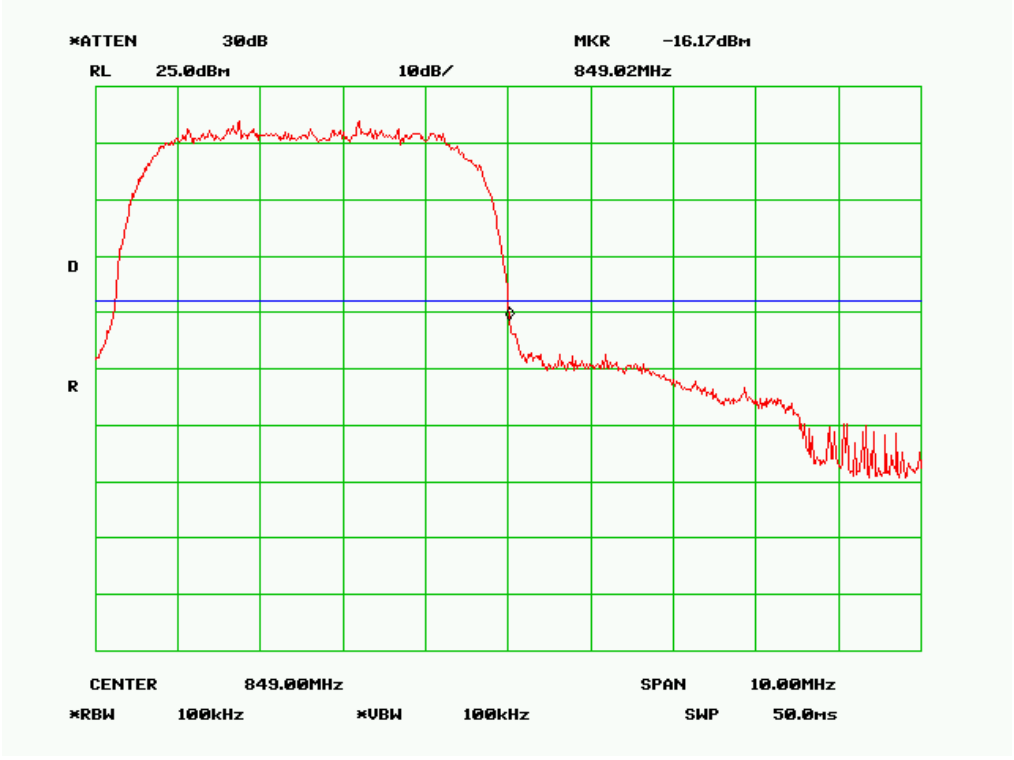
UMTS-FDD Band Ⅱ (Part 24E)

Frequency (MHz)	Emission (dBm)	Limit (dBm)
1850.000	-25.17	-13
1910.000	-16.00	-13

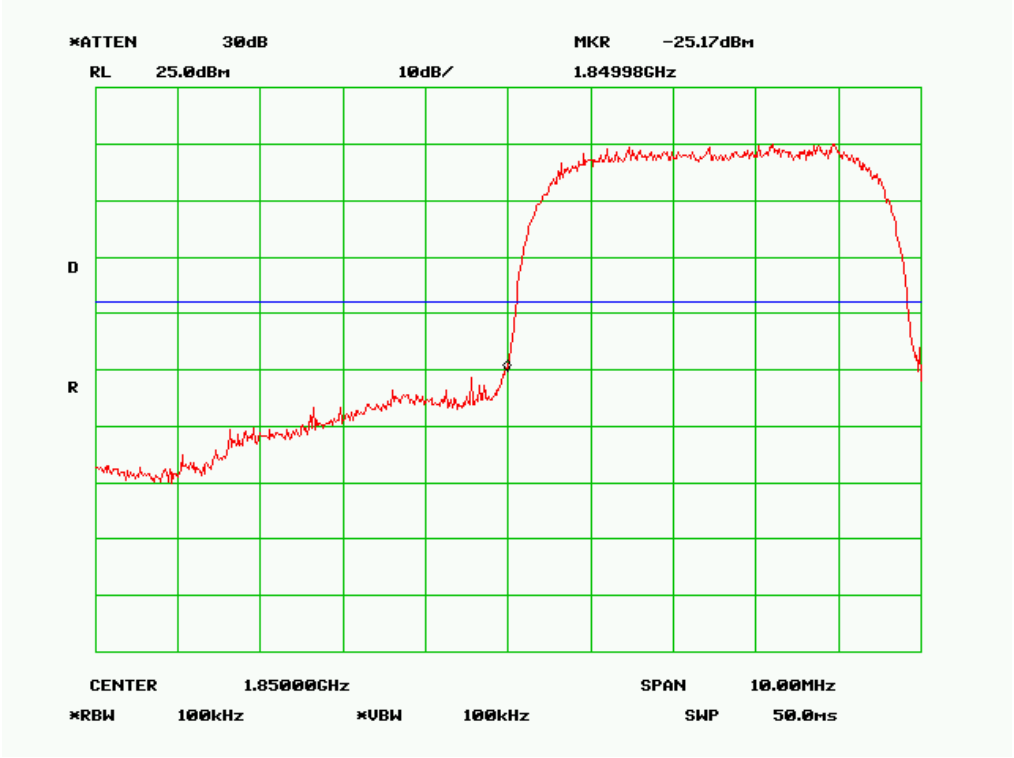
UMTS-FDD Band Ⅴ, Low Channel



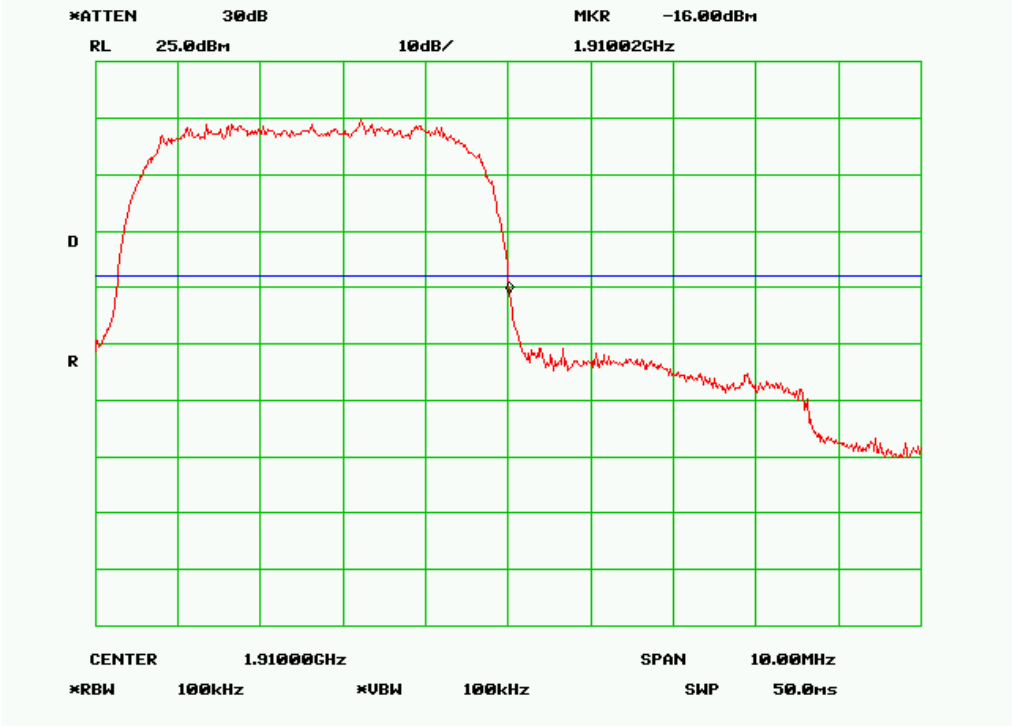
UMTS-FDD Band Ⅴ, High Channel



UMTS-FDD Band Ⅱ, Low Channel



UMTS-FDD Band Ⅱ, High Channel



5.8 §2.1055, §22.355 & §24.235 - Frequency Stability

1.	Environmental Conditions	Temperature	23°C
		Relative Humidity	50%
		Atmospheric Pressure	1019mbar
2.	Test date : January 3, 2014		
	Tested By : William Long		

Standard Requirement:

According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table below:

Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency Range (MHz)	Base, fixed (ppm)	Mobile ≤ 3 watts (ppm)	Mobile ≤ 3 watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.0
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929.	5.0	N/A	N/A
929 to 960.	1.5	N/A	N/A
2110 to 2220	10.0	N/A	N/A

According to §24.235, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency block.

Procedures:

A communication link was established between EUT and base station. The frequency error was monitored and measured by base station under variation of ambient temperature and variation of primary supply voltage.

Limit: The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

Test Results: Pass

Frequency Stability versus Temperature: The Frequency tolerance of the carrier signal shall be maintained within 2.5ppm of the operating frequency over a temperature variation of -10ºC to +55ºC at normal supply voltage.

UMTS-FDD Band Ⅴ (Part 22H)

Middle Channel, f_o = 835 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-10	3.8	19.71	0.0236	2.5
0		18.62	0.0223	2.5
10		30.23	0.0362	2.5
20		27.14	0.0325	2.5
30		17.95	0.0215	2.5
40		10.52	0.0126	2.5
50		19.21	0.0230	2.5
55		10.44	0.0125	2.5
25	4.3	27.56	0.0330	2.5
	3.4	21.38	0.0256	2.5

UMTS-FDD Band Ⅱ (Part 24E)

Middle Channel, f_o = 1880 MHz				
Temperature (℃)	**Power Supplied (V_{DC})**	**Frequency Error (Hz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-10	3.8	19.18	0.0102	2.5
0		21.06	0.0112	2.5
10		23.50	0.0125	2.5
20		18.42	0.0098	2.5
30		23.50	0.0125	2.5
40		26.88	0.0143	2.5
50		21.06	0.0112	2.5
55		20.68	0.0110	2.5
25	4.3	23.12	0.0123	2.5
	3.4	32.34	0.0172	2.5

Annex A. TEST INSTRUMENT & METHOD

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Model	Serial #	Calibration Date	Calibration Due Date
RF conducted test				
Hp Spectrum Analyzer	8563E	3821A09023	09/27/2013	09/26/2014
Power Splitter	1#	1#	02/02/2013	02/01/2014
Universal Radio Communication Tester	CMU200	104031	09/27/2013	09/26/2014
Temperature/Humidity Chamber	1007H	N/A	01/08/2013	01/07/2014
DC Power Supply	PS-305D	010943059	02/22/2013	02/21/2014
Radiated Emissions				
Hp Spectrum Analyzer	8563E	3821A09023	09/27/2013	09/26/2014
R&S EMI Receiver	ESPI3	101216	09/27/2013	09/26/2014
Antenna (30MHz~6GHz)	JB6	A121411	03/27/2013	03/26/2014
ETS-Lindgren Antenna(1 ~18GHz)	3115	N/A	10/09/2013	10/08/2014
A- INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/09/2013	10/08/2014
Horn Antenna (18~40GHz)	AH-840	101013	04/22/2013	04/22/2014
Microwave Pre-Amp (18~40GHz)	PA-840	181250	05/30/2013	05/29/2014
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/27/2013	10/26/2014
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	AMF-7D-00101800-30-10P	1451710	10/27/2013	10/26/2014
Universal Radio Communication Tester	CMU200	104031	09/27/2013	09/26/2014
Chamber	3m	N/A	04/13/2013	04/12/2014

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.

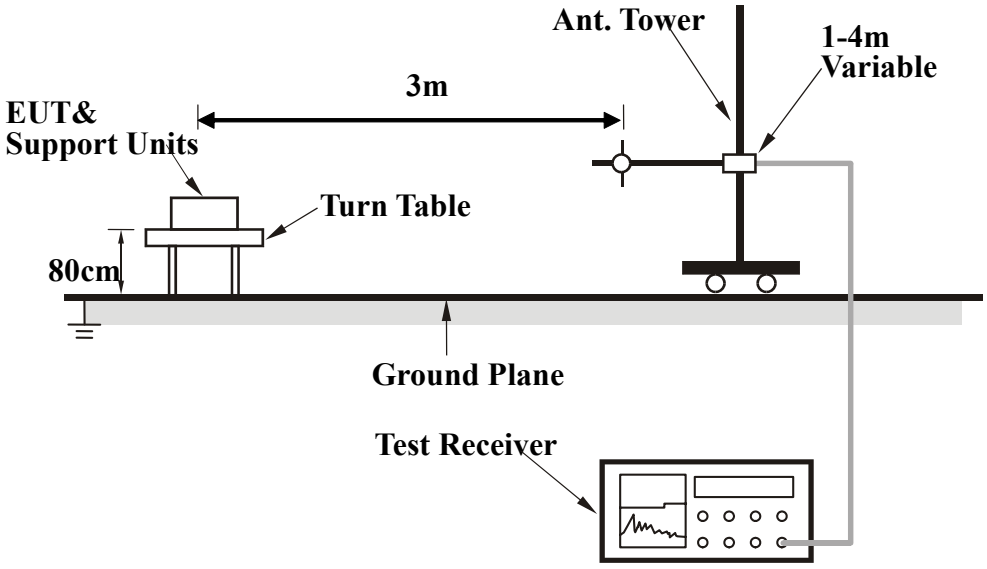
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m or 10m away from the EUT. Radiated emissions from the EUT were maximised by rotating 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

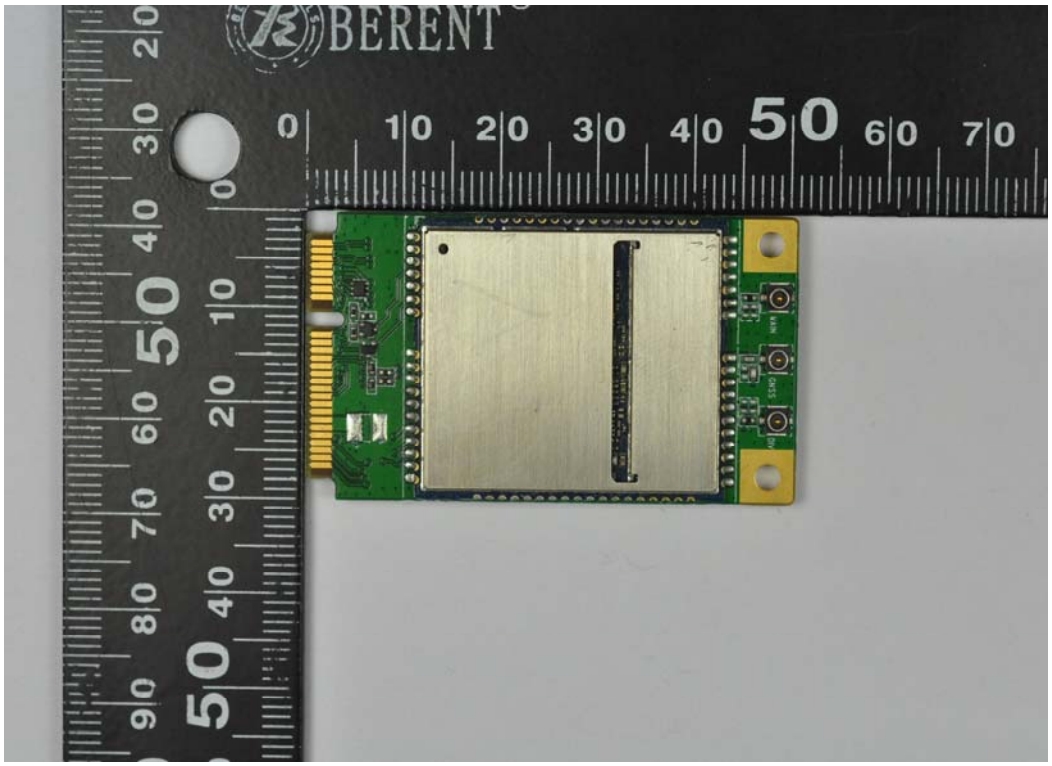
Set RBW = 1MHz, VBW = 10Hz.

Note:

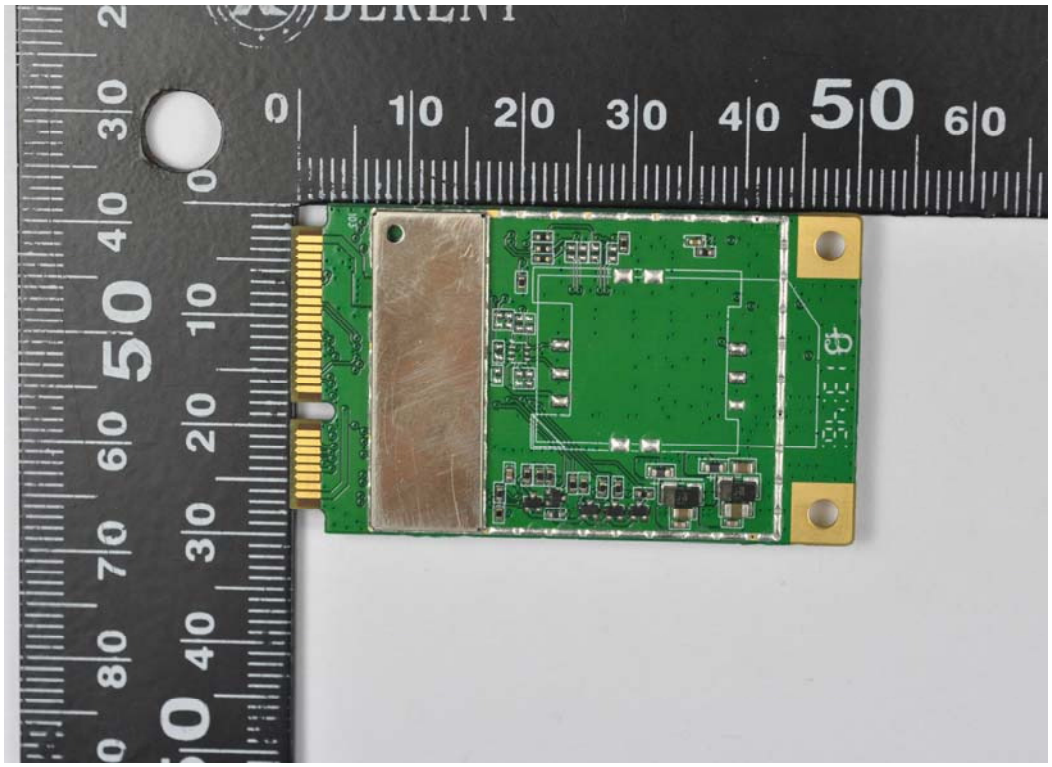
If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex B. EUT AND TEST SETUP PHOTOGRAPHS

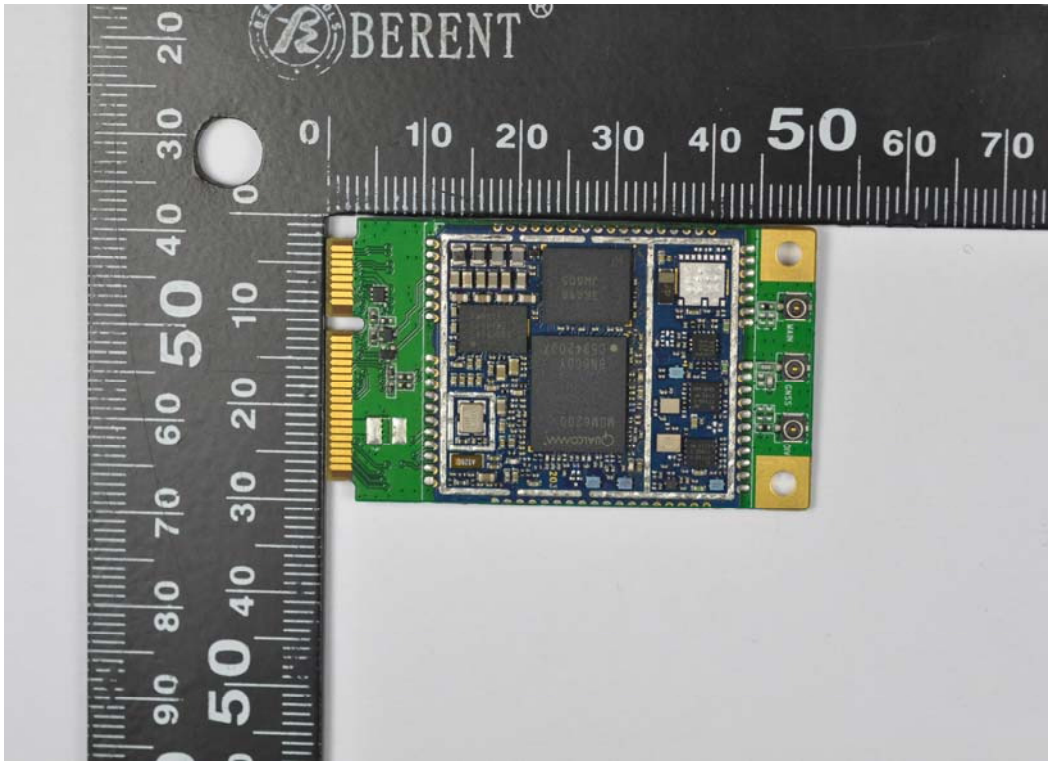
Annex B.i. Photograph 1: EUT External Photo



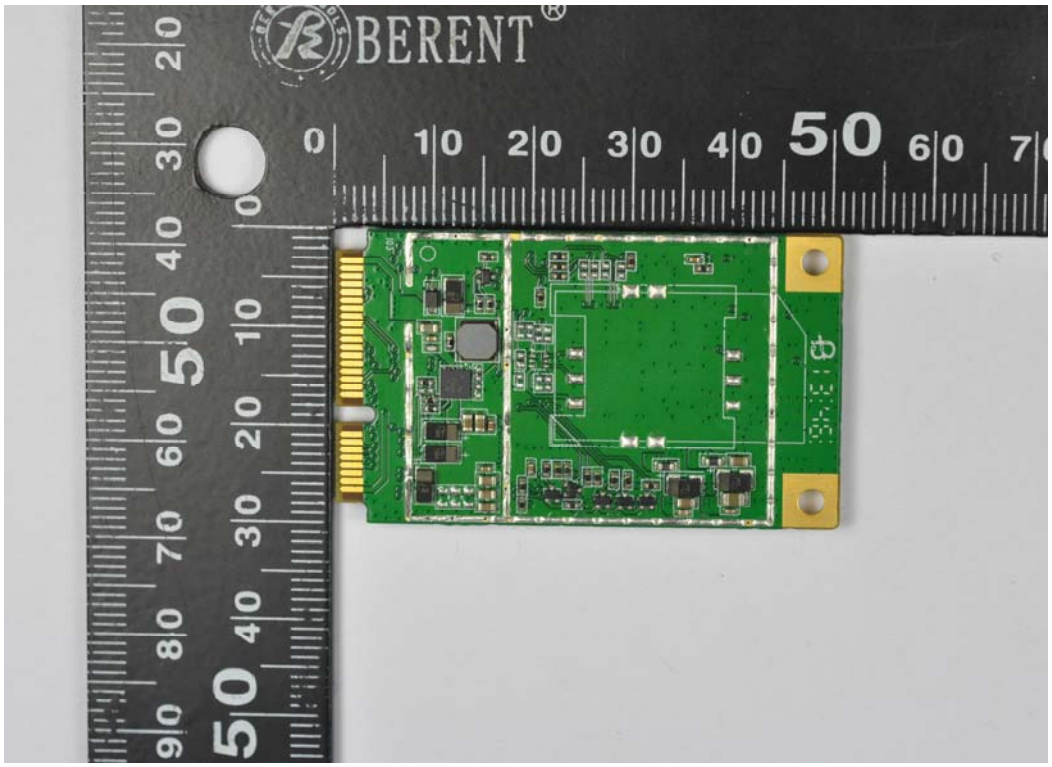
MINI Front Side



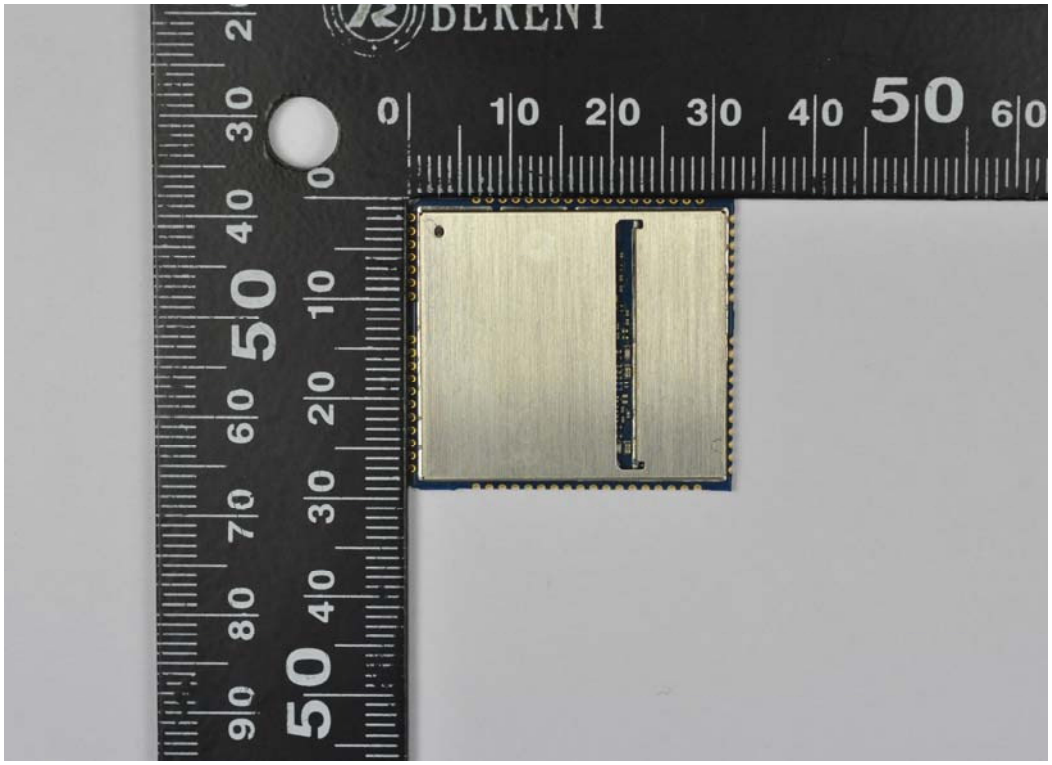
Mini Rear Side



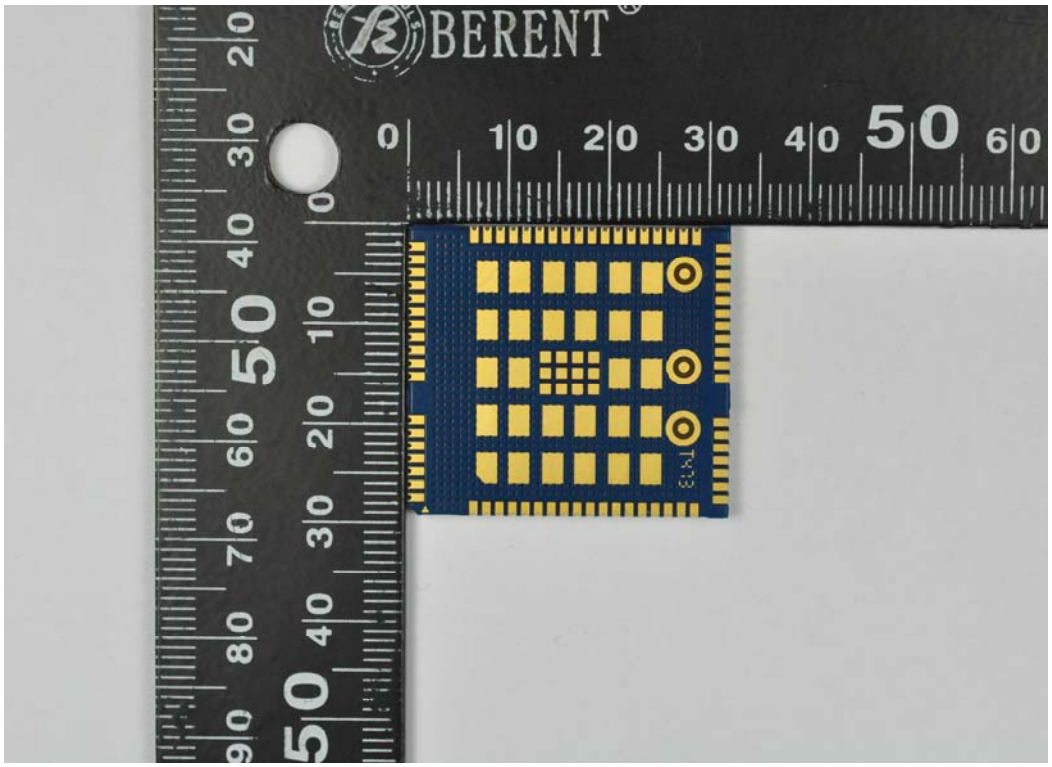
MINI Front Side no Shield



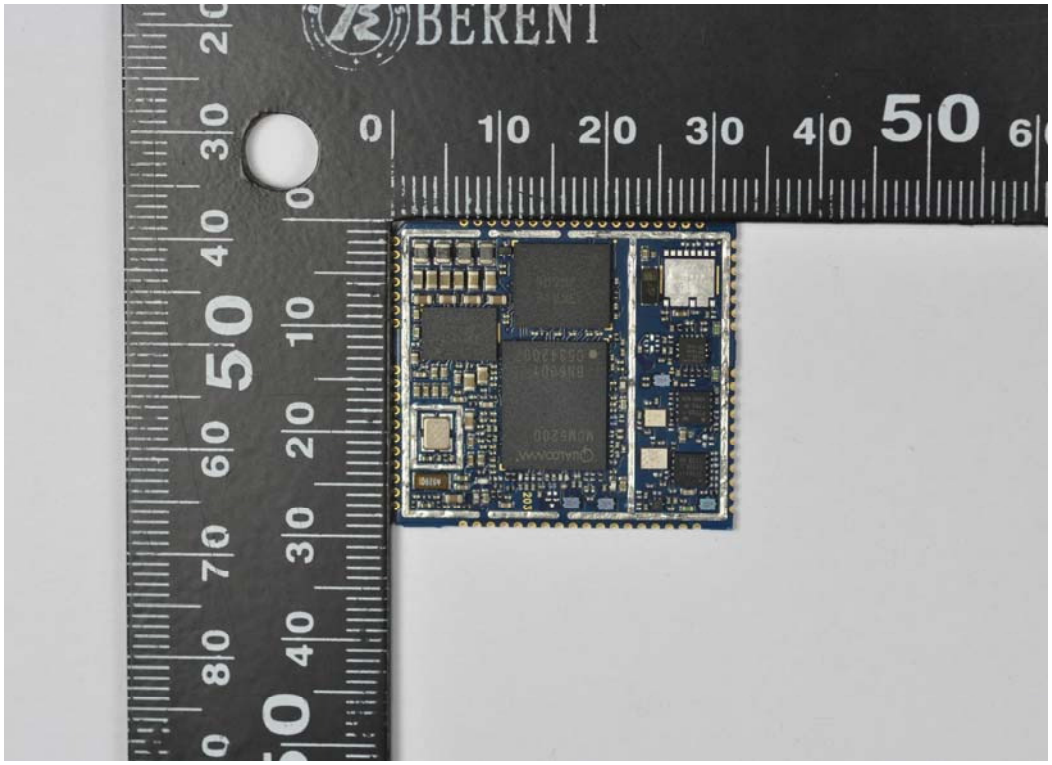
Mini Rear Side No Shield



UC20 Front Side

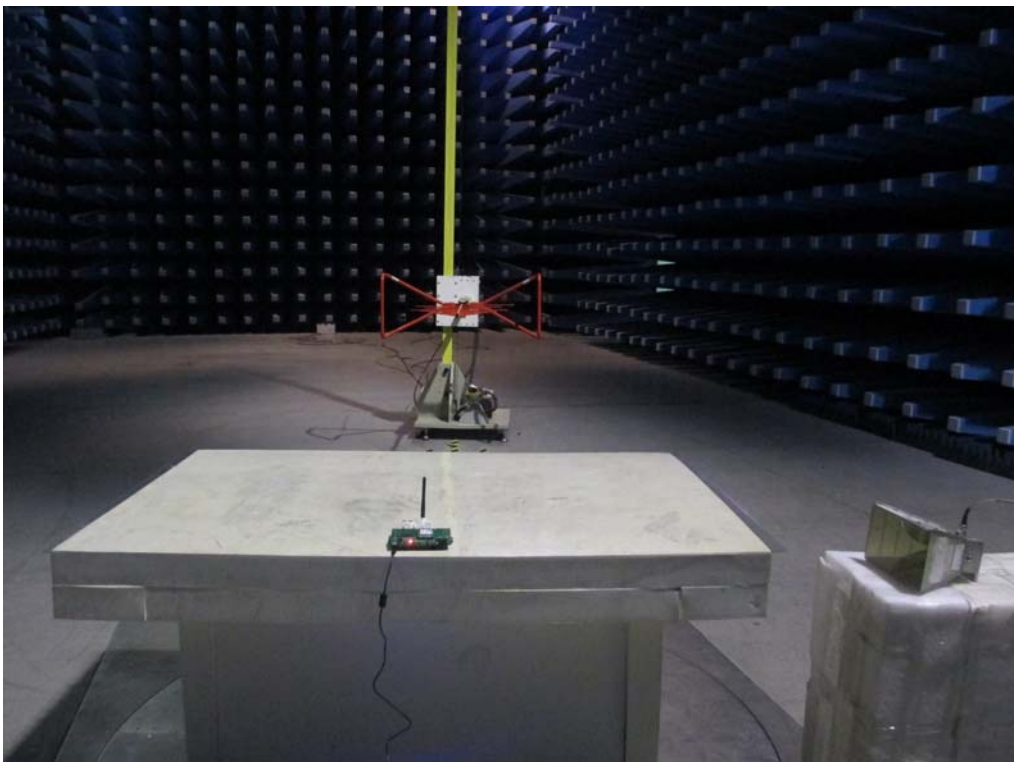


UC20 Rear Side

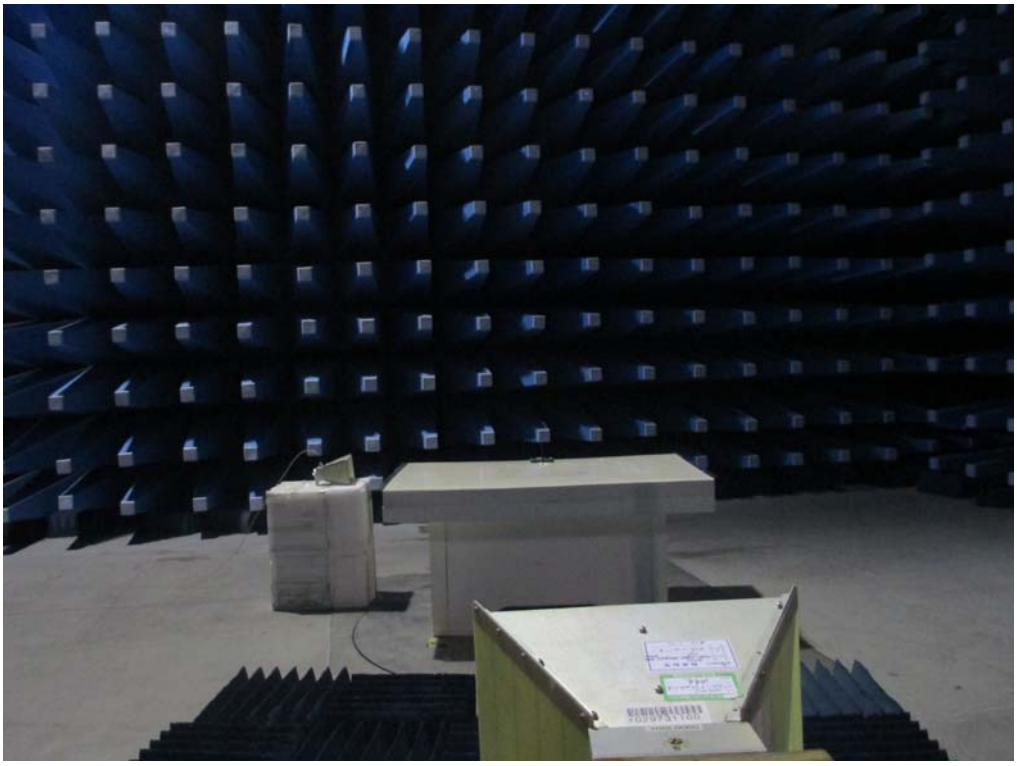


UC20 Front Side No Shield

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

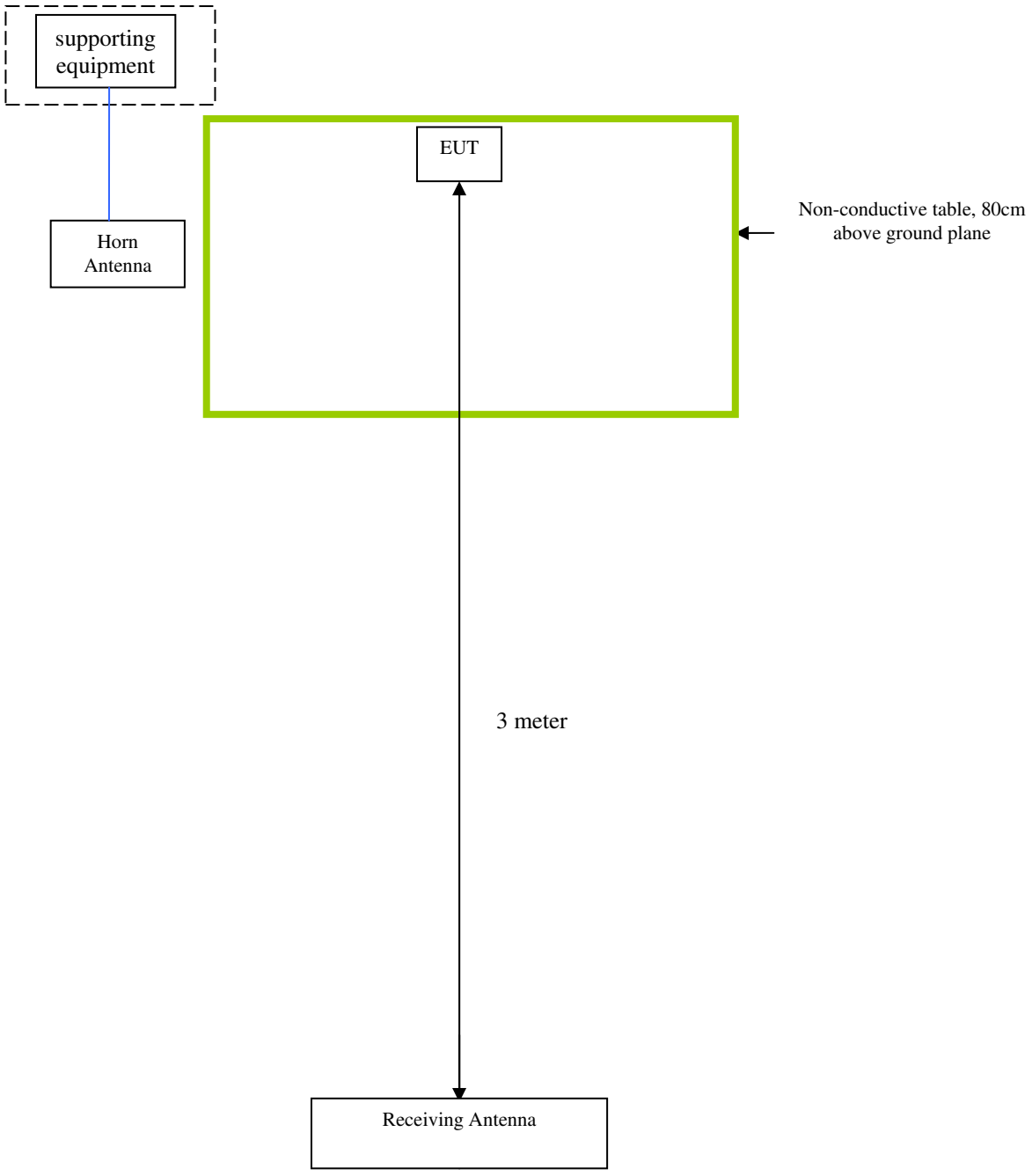
EUT TEST CONDITIONS

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	10/09/2013	10/09/2014
Rohde & Schwarz	Universal Radio Communication Tester	CMU200	09/27/2013	09/26/2014

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 军