



Variant FCC/IC RF Test Report

APPLICANT : Qualcomm Atheros, Inc.
EQUIPMENT : 1X1 802.11b/g/n - BT4.0 Combo PCIe minicard
BRAND NAME : Qualcomm Atheros
MODEL NAME : QCWB335
FCC ID : PPD-QCWB335
IC : 4104A-QCWB335
STANDARD : FCC Part 15 Subpart C §15.247
IC RSS-210 issue 8
CLASSIFICATION : (DTS) Digital Transmission System

This is a variant report which is only valid together with the original test report. The WiFi + Bluetooth module was tested on extended card inserted to a host laptop PC. The product was received on Oct. 17, 2012 and completely tested on Mar. 04, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : PPD-QCWB335

IC : 4104A-QCWB335

Page Number : 1 of 44

Report Issued Date : Mar. 06, 2013

Report Version : Rev. 02



TABLE OF CONTENTS

REVISION HISTORY 3

SUMMARY OF TEST RESULT 4

1 GENERAL DESCRIPTION..... 5

 1.1 Applicant 5

 1.2 Manufacturer..... 5

 1.3 Feature of Equipment Under Test 5

 1.4 Product Specification of Equipment Under Test..... 5

 1.5 Testing Site..... 6

 1.6 Applied Standards 6

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST..... 7

 2.1 Descriptions of Test Mode 7

 2.2 Antenna Information 8

 2.3 Test Mode..... 9

 2.4 Connection Diagram of Test System..... 10

 2.5 Support Unit used in test configuration and system 10

 2.6 Description of RF Function Operation Test Setup..... 11

 2.7 Measurement Results Explanation Example..... 11

3 TEST RESULT 12

 3.1 6dB Bandwidth Measurement 12

 3.2 Peak Output Power Measurement 15

 3.3 Power Spectral Density Measurement 18

 3.4 Conducted Band Edges and Spurious Emission Measurement 23

 3.5 Radiated Band Edges and Spurious Emission Measurement 32

 3.6 Antenna Requirements..... 42

4 LIST OF MEASURING EQUIPMENT..... 43

5 UNCERTAINTY OF EVALUATION..... 44

APPENDIX A. PHOTOGRAPHS OF EUT

APPENDIX B. SETUP PHOTOGRAPHS



SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-210 A8.2(a)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	RSS-210 A8.2(b)	Power Spectral Density	$\leq 8\text{dBm}$	Pass	-
3.4	15.247(d)	RSS-210 A8.5	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.5	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 6.75 dB at 2483.500 MHz
3.6	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Qualcomm Atheros, Inc.
1700 Technology Drive, San Jose, CA95110

1.2 Manufacturer

Qualcomm Atheros, Inc.
1700 Technology Drive, San Jose, CA95110

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	1X1 802.11b/g/n - BT4.0 Combo PCIe minicard
Brand Name	Qualcomm Atheros
Model Name	QCWB335
FCC ID	PPD-QCWB335
IC	4104A-QCWB335
EUT supports Radios application	WLAN 11bgn / Bluetooth 2.1/3.0 /4.0
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	Antenna port 0 8.17 dBm (0.0066 W) Antenna port 1 7.38 dBm (0.0055 W)
Antenna Type	Antenna 1 : PIFA Antenna type with gain 3.62 dBi Antenna 2 : Dipole Antenna type with gain 3.20 dBi
Type of Modulation	Bluetooth 4.0 - LE : GFSK



1.5 Testing Site

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
Test Site No.	Sporton Site No.		FCC/IC Registration No.
	TH02-HY	03CH06-HY	722060/4086B-1

The test site complies with ANSI C63.4 2003 requirement.

1.6 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02
- ♦ ANSI C63.10-2009
- ♦ IC RSS-210 Issue 8
- ♦ IC RSS-Gen Issue 3
- ♦ NOTICE 2012-DRS0126

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. Per the section 2.2.3 of Notice of 2012-DRS0126, “ Receivers Excluded from Industry Canada Requirements”, only radiocommunication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to Industry Canada requirements.



2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

2.1.1 Peak Power

<For Antenna port 0>

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power	
		Data Rate / Modulation	
		GFSK	
		1Mbps	
Ch00	2402MHz	7.18 dBm	
Ch19	2440MHz	7.93 dBm	
Ch39	2480MHz	8.17 dBm	

<For Antenna port 1>

The RF output power was recorded in the following table:

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power	
		Data Rate / Modulation	
		GFSK	
		1Mbps	
Ch00	2402MHz	7.04 dBm	
Ch19	2440MHz	7.38 dBm	
Ch39	2480MHz	7.22 dBm	

2.1.2 Average Power (Reporting Only)

<For Antenna port 0>

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power	
		Data Rate / Modulation	
		GFSK	
		1Mbps	
Ch00	2402MHz	6.84 dBm	
Ch19	2440MHz	7.66 dBm	
Ch39	2480MHz	7.93 dBm	

<For Antenna port 1>

Channel	Frequency	Bluetooth 4.0 – LE RF Output Power	
		Data Rate / Modulation	
		GFSK	
		1Mbps	
Ch00	2402MHz	7.20 dBm	
Ch19	2440MHz	7.14 dBm	
Ch39	2480MHz	7.37 dBm	

2.2 Antenna Information

Brand / Model Name	Type	Frequency Range (MHz)	Antenna Gain (dBi)
Wistron Neweb Corporation / EBJ Aux	PIFA	2400 ~ 2483.5	3.62
INPAQ / DAMA1BM30000402	Dipole	2400 ~ 2483.5	3.20

	Antenna port 0	Antenna port 1
Single antenna	WLAN/BT timely coexistence	RX diversity or terminated
Dual antenna	WLAN TX/RX	Bluetooth TX/RX

2.3 Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.10-2009 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

For radiated: The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	X-Y axis
Mode B	Y-Z axis
Mode C	X-Z axis

From the above modes, the worst case was found in Mode A. Therefore only the test data of the mode was recorded in this report.

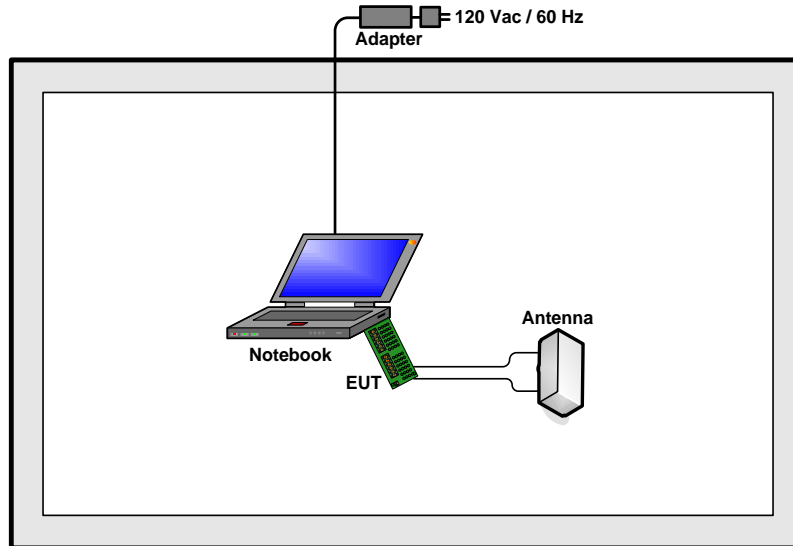
The details of test channels and bandwidth were for RF conductive measurement.

Mode	Tested Channel	6dB Bandwidth	Output Power	Band Edges	Spurious Emission	Power Spectral Density	Radiated Emission
BT 4.0 - LE	1, 6, 11	✓	✓	✓	✓	✓	✓

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH39_2480 MHz_1Mbps for PIFA Antenna port 0

2.4 Connection Diagram of Test System



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	Lenovo	0769	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m



2.6 Description of RF Function Operation Test Setup

The programmed RF utility, execute "BT Test_Aphrodite.exe" is installed in notebook make the EUT to provide channel selection, power level, data rate and the application type. RF Utility can send transmitting signal for all testing. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 KHz.

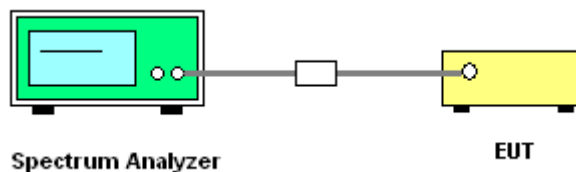
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 KHz.
5. Measure and record the results in the test report.

3.1.4 Test Setup



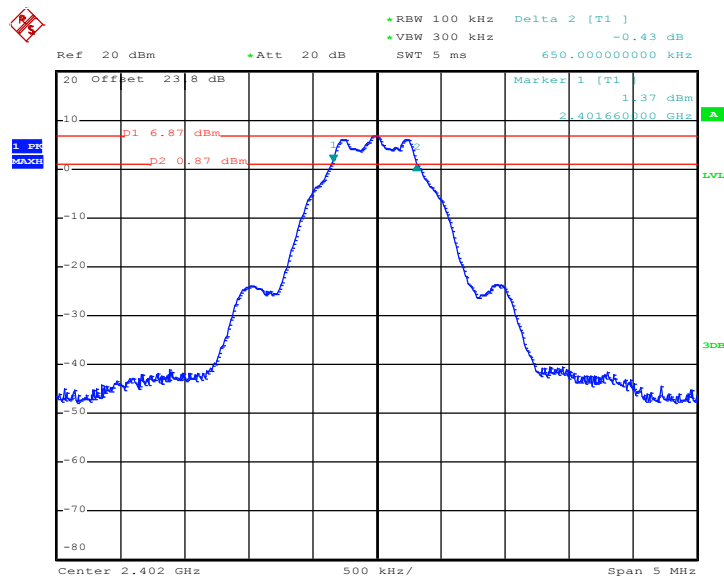


3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Engineer :	Rover Lee	Relative Humidity :	55~58%

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
00	2402	0.65	0.5	Pass
19	2440	0.65	0.5	Pass
39	2480	0.66	0.5	Pass

6 dB Bandwidth Plot on Channel 00



Date: 4.MAR.2013 09:42:27

3.2 Peak Output Power Measurement

3.2.1 Limit of Peak Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

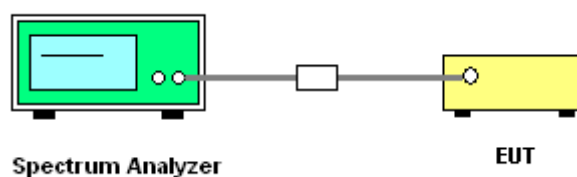
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



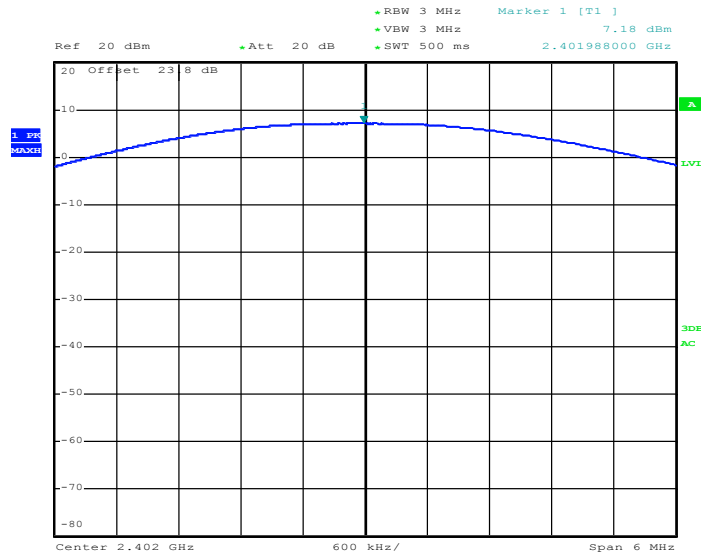


3.2.5 Test Result of Peak Output Power

Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Engineer :	Rover Lee	Relative Humidity :	55~58%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	7.18	30.00	Pass
19	2440	7.93	30.00	Pass
39	2480	8.17	30.00	Pass

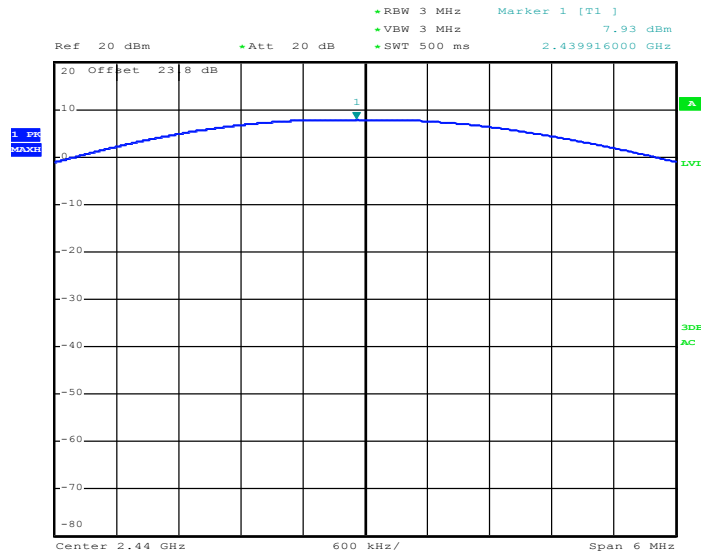
Peak Output Power Plot on Channel 00



Date: 25.FEB.2013 22:19:06

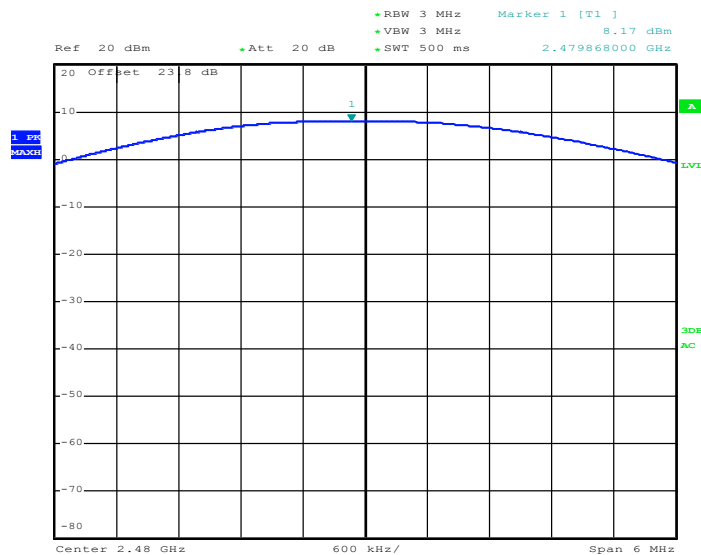


Peak Output Power Plot on Channel 19



Date: 25.FEB.2013 22:18:36

Peak Output Power Plot on Channel 39



Date: 25.FEB.2013 22:18:02

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3KHz band at any time interval of continuous transmission.

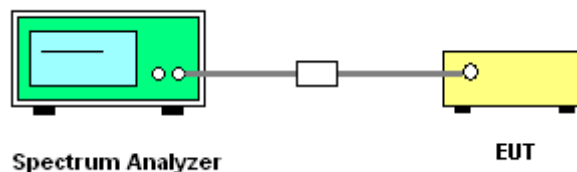
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 9.1 Option 1 of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100KHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Engineer :	Rover Lee	Relative Humidity :	55~58%

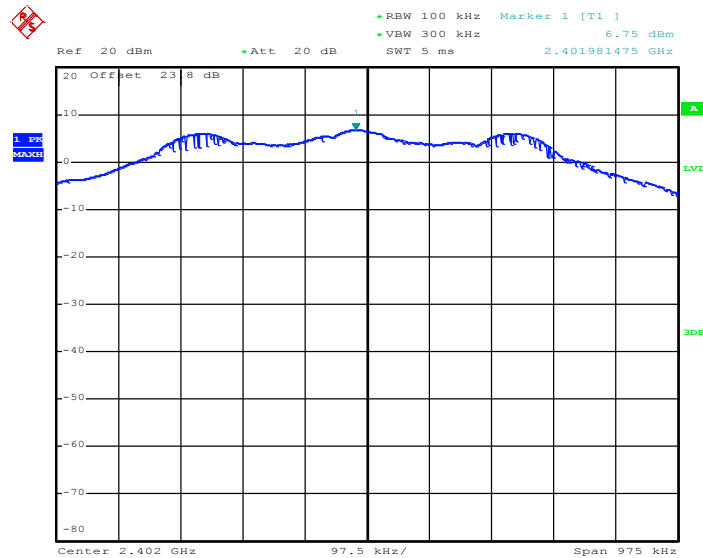
Channel	Frequency (MHz)	Power Density		Max. Limits (dBm/3kHz)	Pass/Fail
		PSD/100kHz (dBm)	PSD/3kHz (dBm)		
00	2402	6.75	-4.01	8	Pass
19	2440	7.15	-3.55	8	Pass
39	2480	6.81	-3.83	8	Pass

Note:

1. Measured power density (dBm) has offset with cable loss.
2. The Measured power density (dBm)/ 100kHz is reference level and used as 20dBc down for Conducted Band Edges and Conducted Spurious Emission limit line.

3.3.6 Test Result of Power Spectral Density Plots (100kHz)

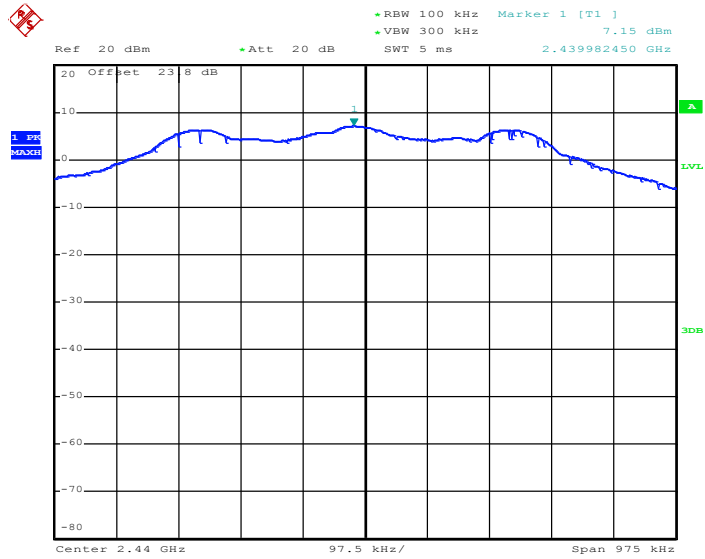
PSD 100kHz Plot on Channel 00



Date: 4.MAR.2013 09:43:45

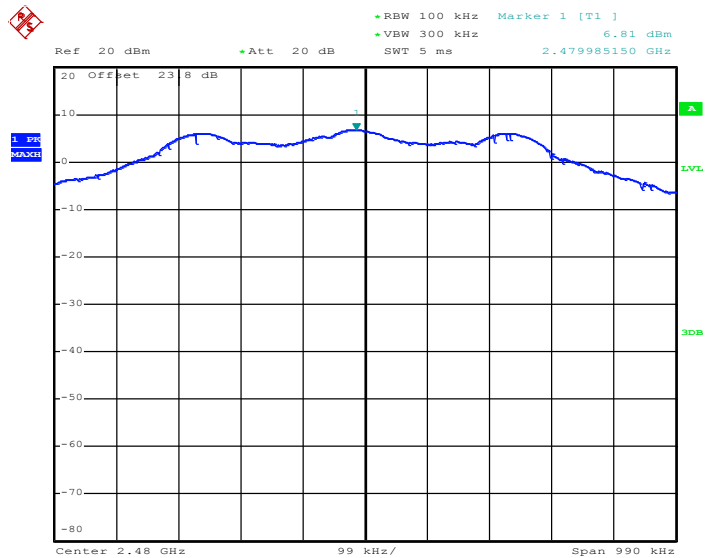


PSD 100kHz Plot on Channel 19



Date: 4.MAR.2013 09:47:01

PSD 100kHz Plot on Channel 39

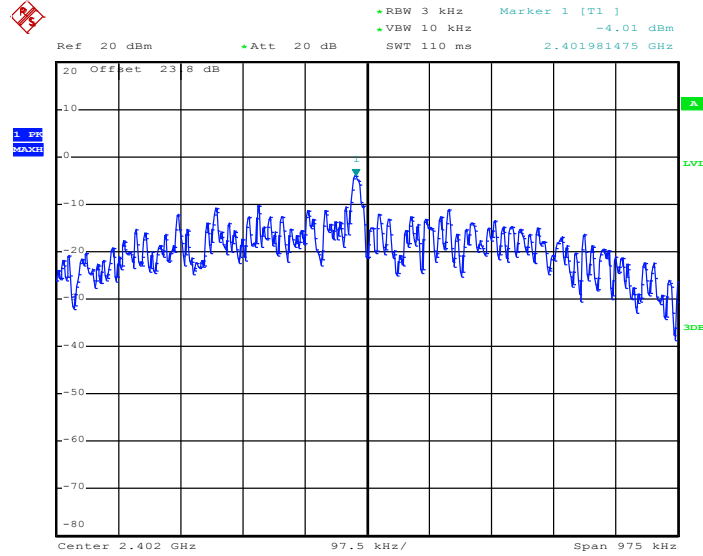


Date: 4.MAR.2013 09:51:12



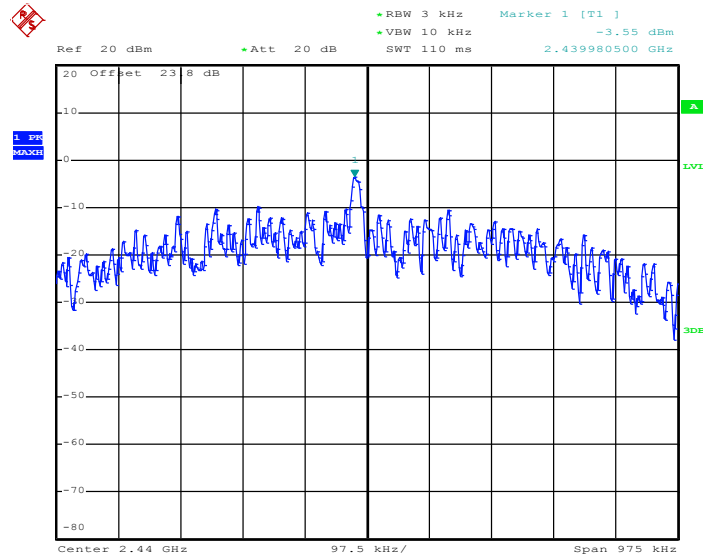
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

PSD 3kHz Plot on Channel 00



Date: 4.MAR.2013 09:43:26

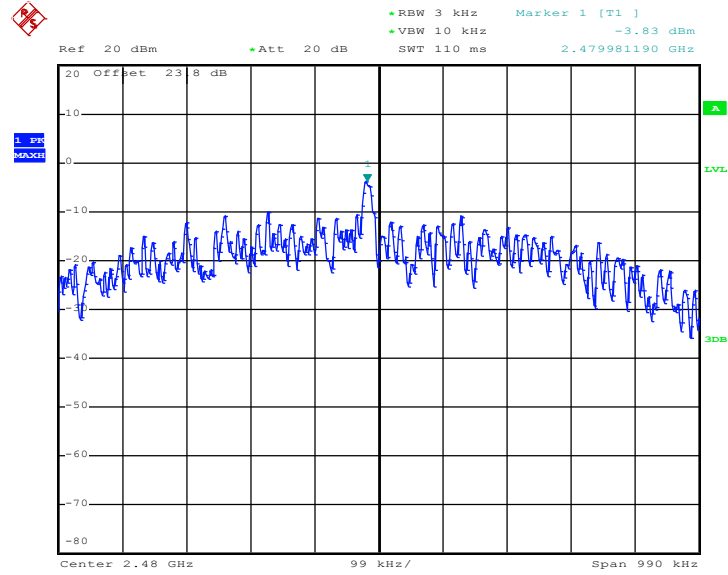
PSD 3kHz Plot on Channel 19



Date: 4.MAR.2013 09:46:43



PSD 3kHz Plot on Channel 39



Date: 4.MAR.2013 09:50:56

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

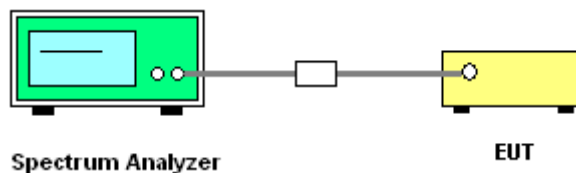
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 KHz, VBW=300 KHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

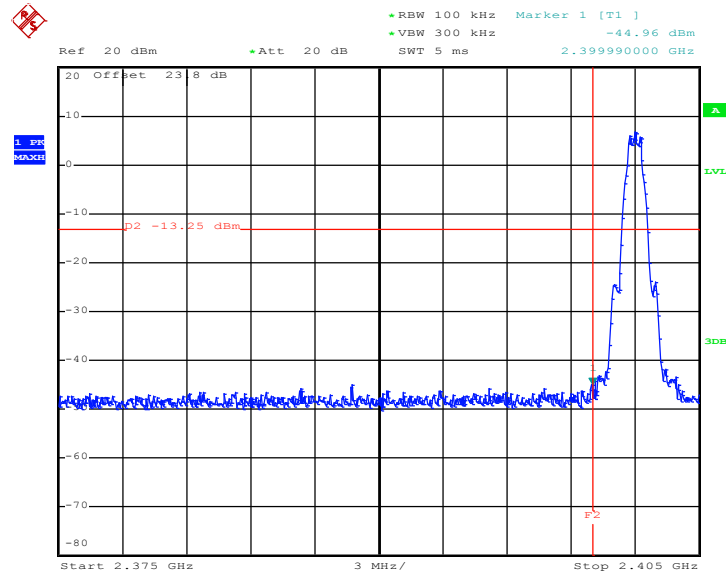




3.4.5 Test Result of Conducted Band Edges

Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Channel :	00 and 39	Relative Humidity :	55~58%
		Test Engineer :	Rover Lee

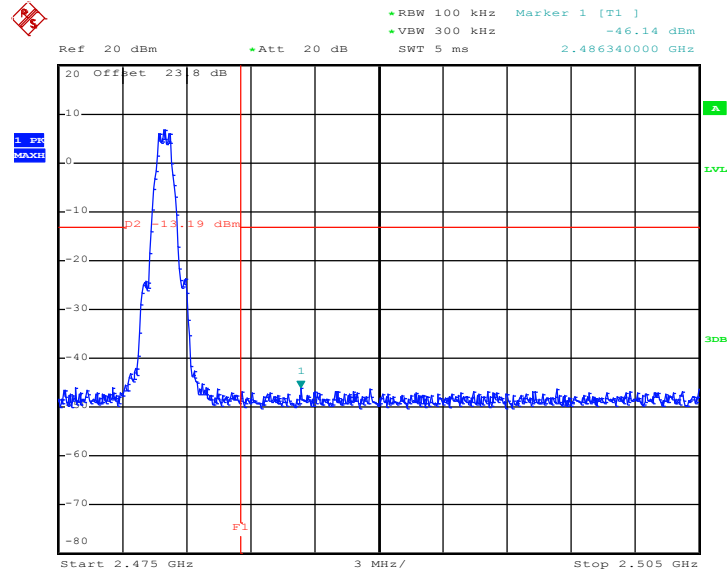
Low Band Edge Plot on Channel 00



Date: 4.MAR.2013 09:44:02



High Band Edge Plot on Channel 39



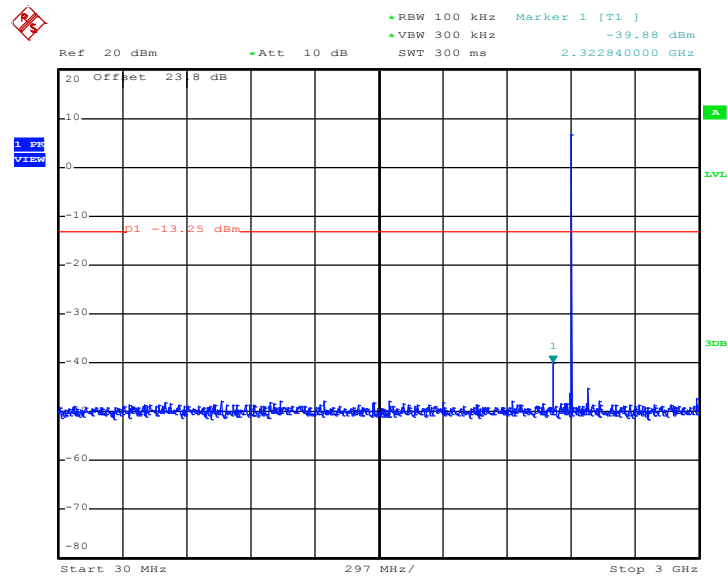
Date: 4.MAR.2013 09:51:31



3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Channel :	00	Relative Humidity :	55~58%
		Test Engineer :	Rover Lee

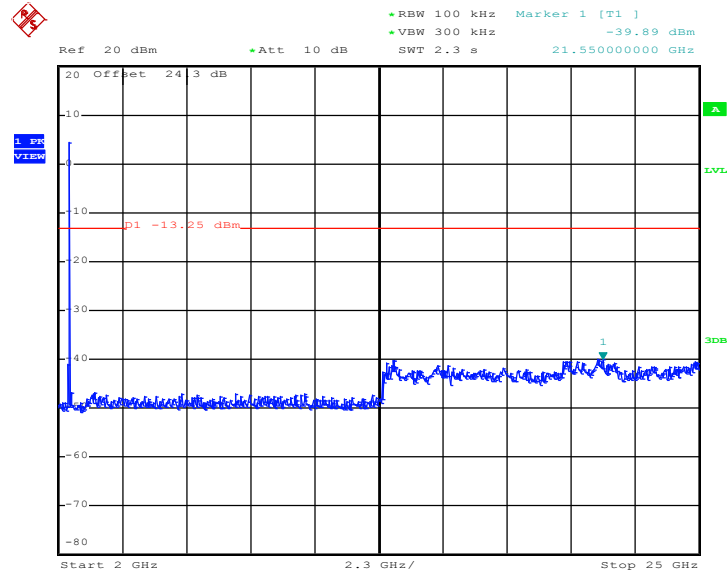
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00



Date: 4.MAR.2013 09:44:35



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 00

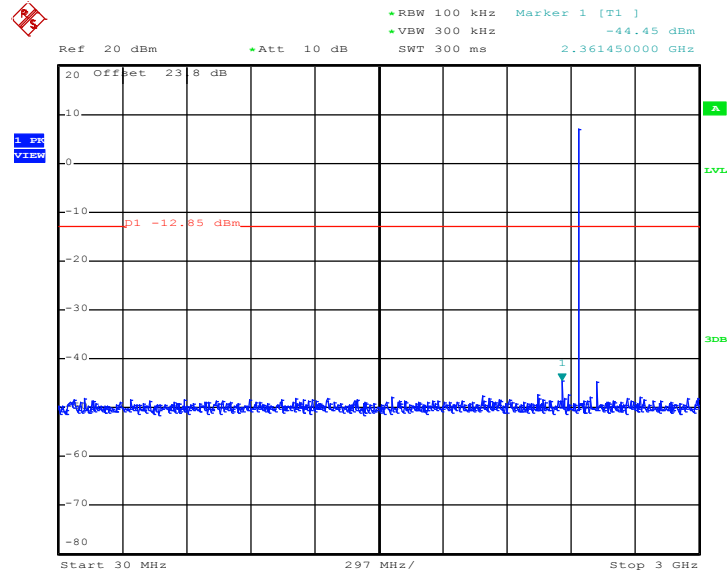


Date: 4.MAR.2013 09:44:54



Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Channel :	19	Relative Humidity :	55~58%
		Test Engineer :	Rover Lee

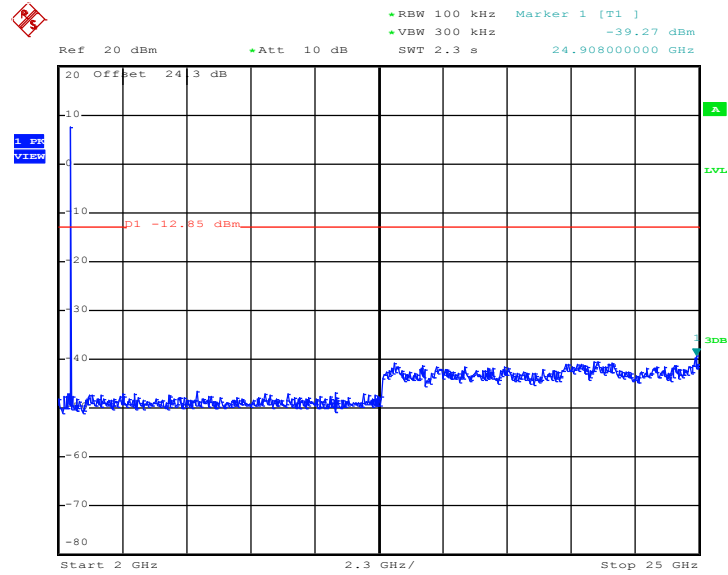
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19



Date: 4.MAR.2013 09:47:24



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19

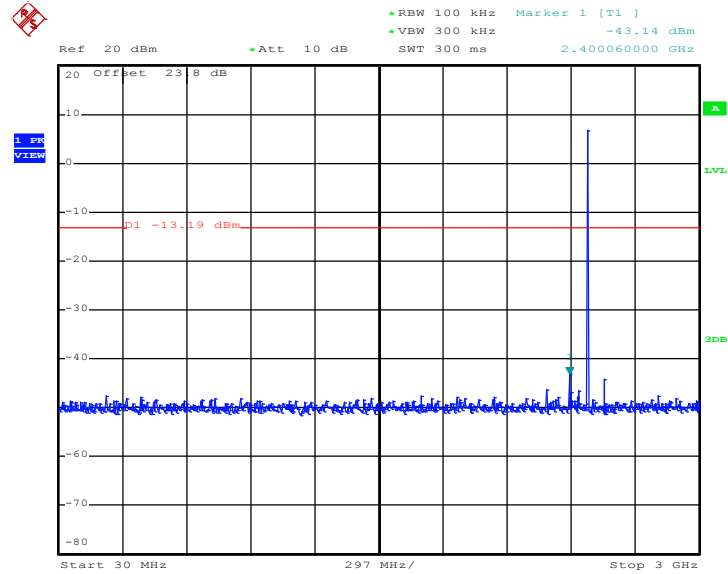


Date: 4.MAR.2013 09:47:42



Test Mode :	Bluetooth 4.0 - LE	Temperature :	23~25°C
Test Channel :	39	Relative Humidity :	55~58%
		Test Engineer :	Rover Lee

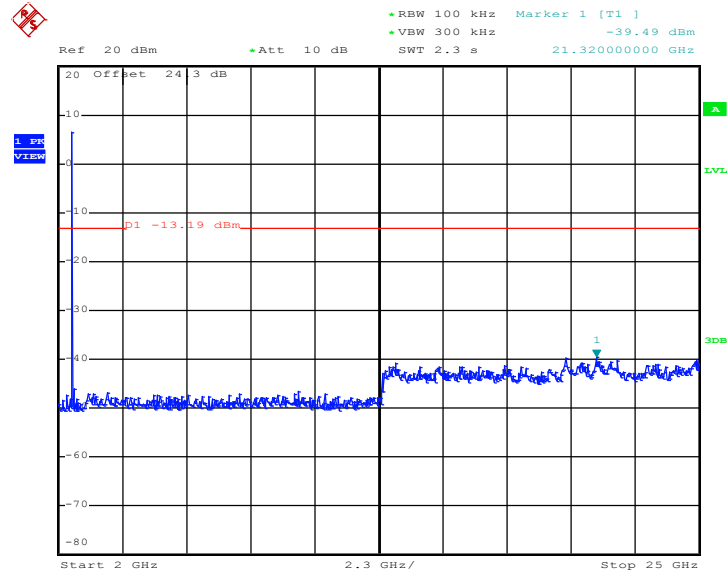
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 4.MAR.2013 09:52:06



Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39



Date: 4.MAR.2013 09:52:25

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 KHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

See list of measuring instruments of this test report.



3.5.3 Test Procedures

1. The testing follows the guidelines in ANSI C63.10-2009.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 KHz for $f < 1$ GHz; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, $VBW = 3$ MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - $VBW = 10$ Hz, when duty cycle is no less than 98 percent.
 - $VBW \geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Band	Duty Cycle(%)	T(μs)	1/T(KHz)	VBW Setting
Bluetooth 4.0 - LE	72.15	456.000	2.19	3KHz

Note: For average measurement with duty cycle < 98%, use reduced VBW measurement method 4.2.3.2.3 in ANSI C63.10.



Marker-Delta method :

- (1) Set RBW = 1 MHz, VBW = 3 MHz, peak detector.

Repeat the measurement with an average detector, use RBW = 1MHz

VBW = 10 Hz, when duty cycle is no less than 98 percent.

VBW \geq 1/T, when duty cycle is less than 98 percent

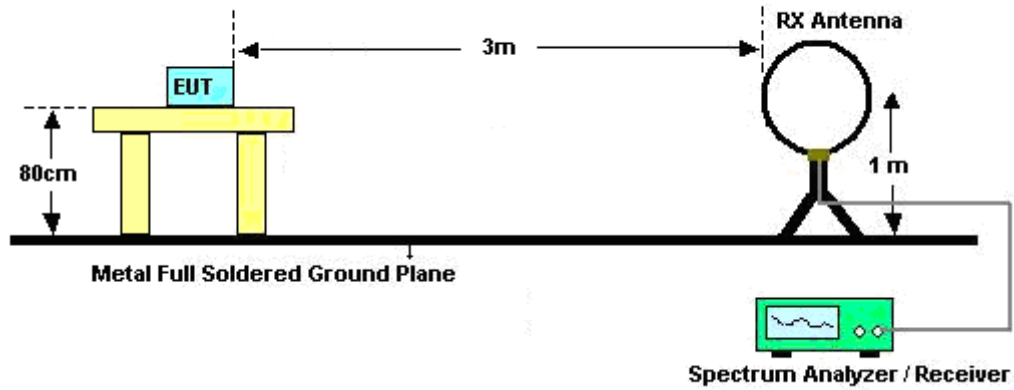
- (2) Set span = 10MHz, that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set RBW = 100KHz, 1% of the total span. Set VBW = 100KHz \geq RBW.

- (3) Subtract the delta measured in step (2) from the field strengths measured in step (1).

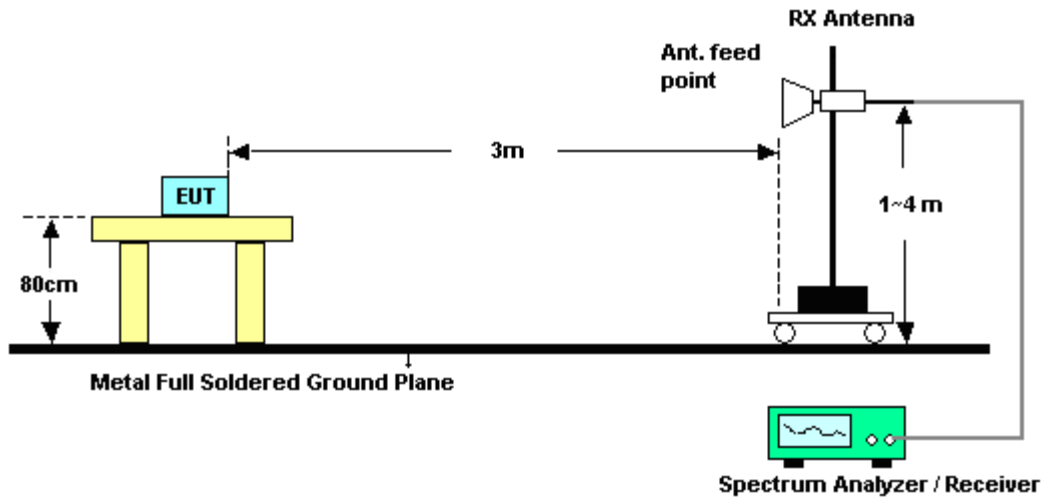
The resultant field strengths (peak/average) are then used to determine band-edge compliance as required by Section 15.205.

3.5.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 1GHz



3.5.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.5.6 Test Result of Radiated Band Edges

Test Mode :	Mode 3	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
		Test Engineer :	Kai Wang

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	70.78	-3.22	74	66.26	32.48	6.59	34.55	148	308	Peak
2483.5	67.67	*13.67	54	63.15	32.48	6.59	34.55	148	308	Average
2483.5	48.73	-25.27	74	-	-	-	-	-	-	Peak
2483.5	47.25	-6.75	54	-	-	-	-	-	-	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Measurement Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
Peak	108.89	60.16	48.73	74	-25.27	Pass
Average	107.41	60.16	47.25	54	-6.75	Pass

Note: Measurement result = Maximum field strength – Delta result

*Delta-Marker Method is used for the 2483.5MHz average measurement as described in the test procedure of this report and the test result is under 6.75dB.

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	67.49	-6.51	74	62.97	32.48	6.59	34.55	191	5	Peak
2483.5	64.13	*10.13	54	59.61	32.48	6.59	34.55	191	5	Average
2483.5	46.49	-27.51	74	-	-	-	-	-	-	Peak
2483.5	44.92	-9.08	54	-	-	-	-	-	-	Average

Summary results of marker-delta method:

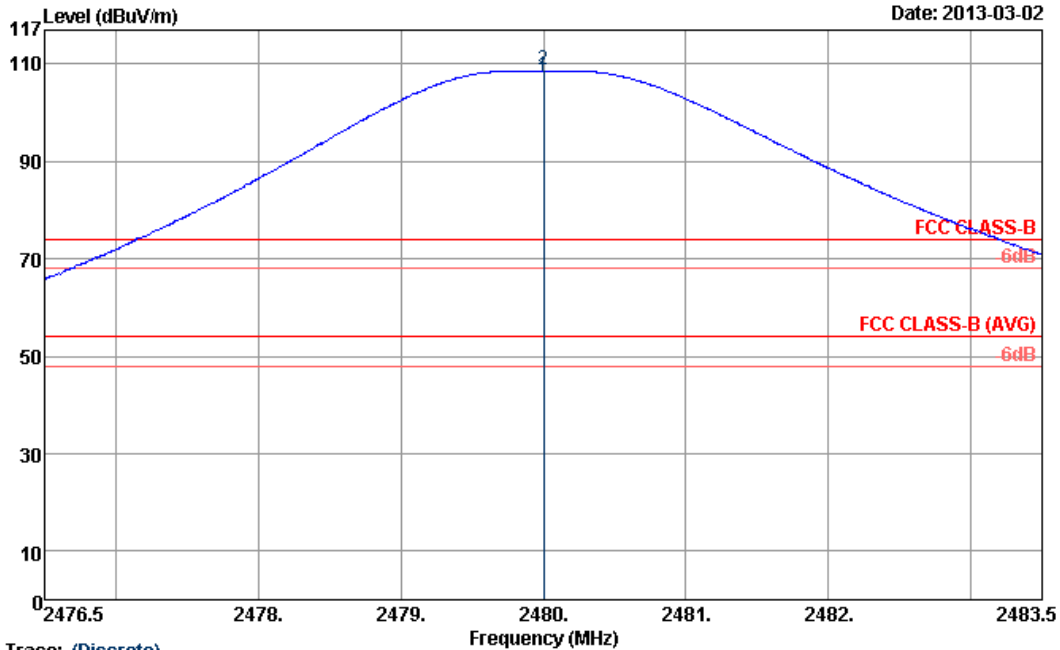
Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Measurement Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
Peak	105.19	58.7	46.49	74	-27.51	Pass
Average	103.62	58.7	44.92	54	-9.08	Pass

Note: Measurement result = Maximum field strength – Delta result

*Delta-Marker Method is used for the 2483.5MHz average measurement as described in the test procedure of this report and the test result is under 6.75dB.



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Horizontal



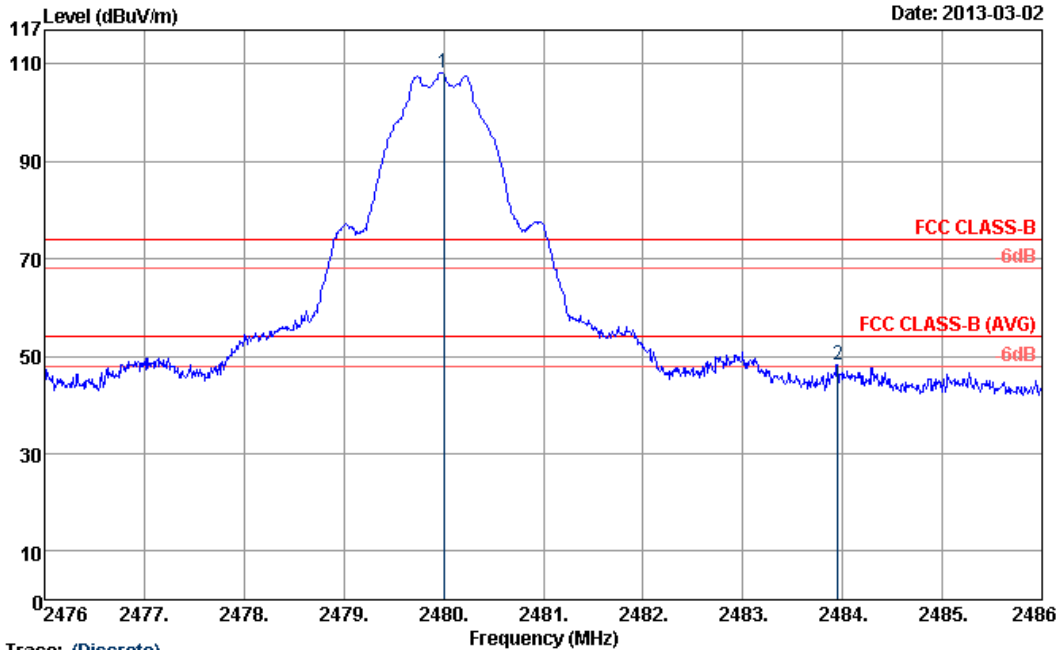
Trace: (Discrete)
 Site : 03CH06-HY
 Condition : FCC CLASS-B 3m HF-ANT_120801 HORIZONTAL
 : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBUV/m	dB	dBUV/m	dBuV	dB/m	dB	dB	cm	deg	
1 *	2480.00	107.41	53.41	54.00	102.89	32.48	6.59	34.55	148	308	Average
2 *	2480.00	108.89	34.89	74.00	104.37	32.48	6.59	34.55	148	308	Peak

* Maximum field strength of the fundamental emission



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Horizontal



Trace: (Discrete)

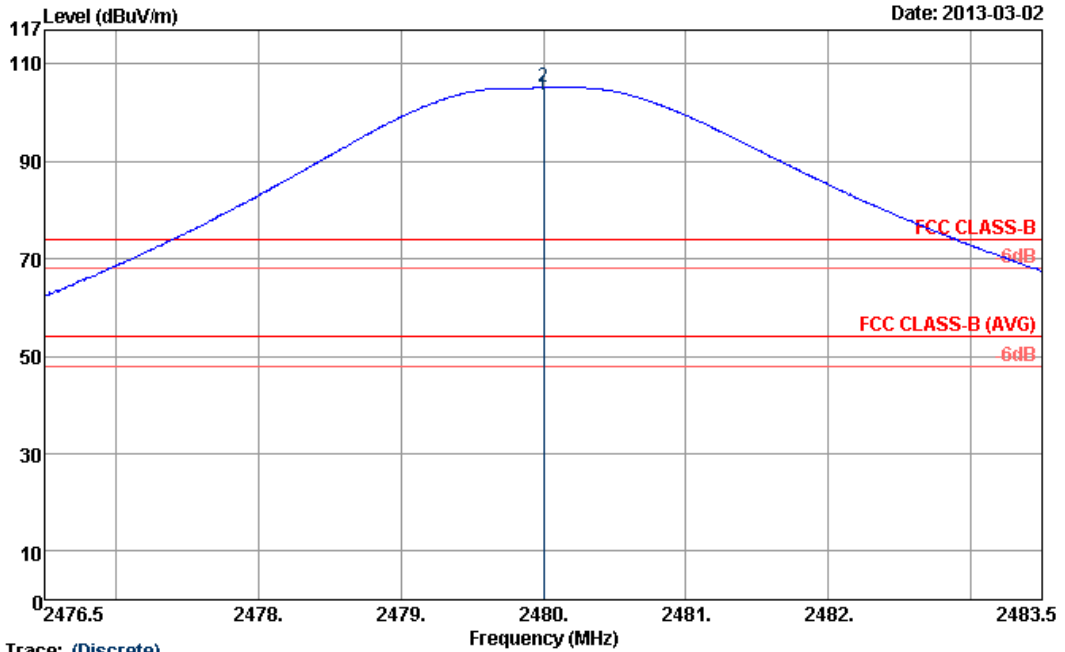
Site : 03CH06-HY
 Condition : FCC CLASS-B 3m HF-ANT_120801 HORIZONTAL
 : RBW:100.000KHz VBW:300.000KHz SWT:Auto

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 *	2480.00	108.30	34.30	74.00	103.78	32.48	6.59	34.55	148	308	Peak
2	2483.95	48.14	-25.86	74.00	43.62	32.48	6.59	34.55	148	308	Peak

* Marker-Delta Method (RBW/VBW=100KHz): 60.16 dB , single carrier Mode



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Vertical



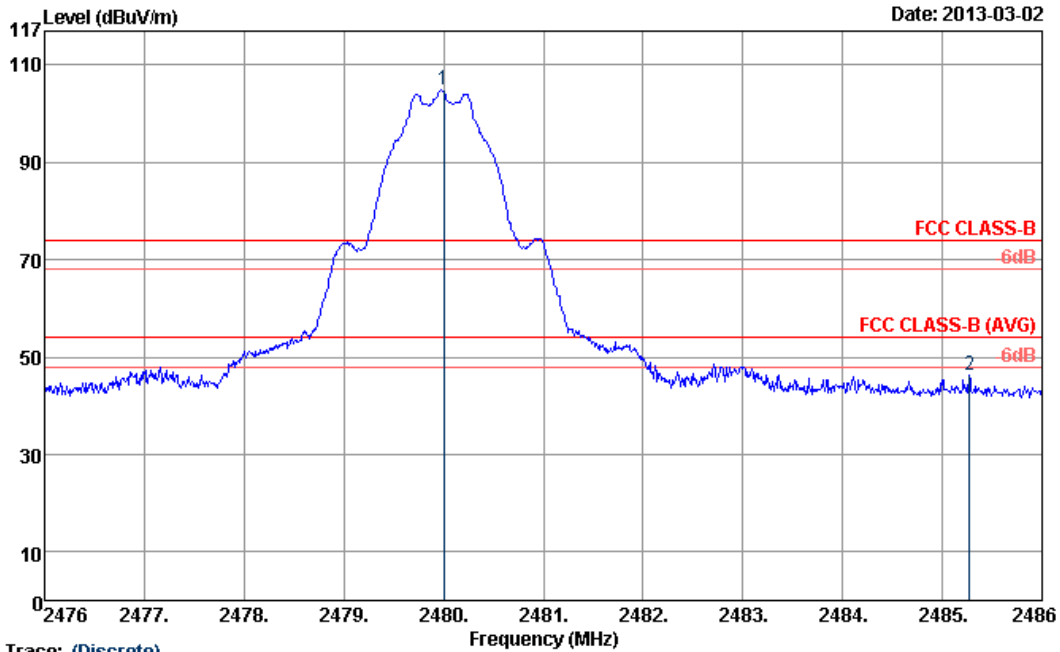
Trace: (Discrete)
 Site : 03CH06-HY
 Condition : FCC CLASS-B 3m HF-ANT_120801 VERTICAL
 : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Loss	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 *	2480.00	103.62	49.62	54.00	99.10	32.48	6.59	34.55	191	5	Average
2 *	2480.00	105.19	31.19	74.00	100.67	32.48	6.59	34.55	191	5	Peak

* Maximum field strength of the fundamental emission



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Vertical



Trace: (Discrete)
 Site : 03CH06-HY
 Condition : FCC CLASS-B 3m HF-ANT_120801 VERTICAL
 : RBW:100.000KHz VBW:300.000KHz SWT:Auto

	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 *	2480.00	104.82	30.82	74.00	100.30	32.48	6.59	34.55	191	5	Peak
2	2485.27	46.12	-27.88	74.00	41.60	32.48	6.59	34.55	191	5	Peak

* Marker-Delta Method (RBW/VBW=100KHz): 58.70 dB , single carrier Mode

3.5.7 Test Result of Radiated Emission (1000 MHz ~ 10th Harmonic)

Test Mode :	Mode 1	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Horizontal
Remark :	1. 2482 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2482	107.41	-	-	102.89	32.48	6.59	34.55	148	308	Average
2482	108.58	-	-	104.06	32.48	6.59	34.55	148	308	Peak
4962	48.38	-25.62	74	59.2	34.81	10.21	55.84	100	0	Peak
7440	50.03	-23.97	74	59.02	36.11	10.9	56	100	0	Peak

Note: Other harmonics are lower than background noise.

Test Mode :	Mode 1	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	58~61%
Test Engineer :	Kai Wang	Polarization :	Vertical
Remark :	1. 2482 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2482	103.62	-	-	99.1	32.48	6.59	34.55	191	5	Average
2482	104.88	-	-	100.36	32.48	6.59	34.55	191	5	Peak
4962	47.86	-26.14	74	58.68	34.81	10.21	55.84	100	0	Peak
7440	49.86	-24.14	74	58.85	36.11	10.9	56	100	0	Peak

Note: Other harmonics are lower than background noise.



3.6 Antenna Requirements

3.6.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.6.2 Antenna Connected Construction

The antennas type used in this product is Antenna 1 : PIFA Antenna type with IPEX connector and Antenna 2 : Dipole Antenna type with Reverse-SMA type RF connector. And it is considered to meet antenna requirement.

3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 06, 2012	Feb. 25, 2013 ~ Mar. 04, 2013	Jun. 05, 2013	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Sep. 08, 2012	Feb. 25, 2013 ~ Mar. 04, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Sep. 08, 2012	Feb. 25, 2013 ~ Mar. 04, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP30	101352	9KHz~30GHz	Nov. 07, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Nov. 06, 2013	Radiation (03CH06-HY)
Spectrum Analyzer	Agilent	E4408B	MY44211030	9KHz ~ 26.5GHz	Nov. 26, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Nov. 25, 2013	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/0003	20MHz ~ 1000MHz	May 04, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	May 03, 2013	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Aug. 01, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Jul. 31, 2013	Radiation (03CH06-HY)
Double Ridge Horn Antenna	COM-POWER	AH-118	071025	1GHz~18GHz	Aug. 09, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Aug. 08, 2013	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz ~ 40GHz	Sep. 28, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Sep. 27, 2013	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz ~ 26.5GHz	Apr. 13, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Apr. 12, 2013	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9KHz ~ 1GHz	Apr. 11, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Apr. 10, 2013	Radiation (03CH06-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 21, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Jul. 20, 2013	Radiation (03CH06-HY)
Pre Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	159087	1GHz~18GHz	Feb. 27, 2012	Jan. 31, 2013 ~ Feb. 25, 2013	Feb. 26, 2013	Radiation (03CH06-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	159087	1GHz~18GHz	Feb. 26, 2013	Feb. 26, 2013 ~ Mar. 02, 2013	Feb. 25, 2014	Radiation (03CH06-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9KHz ~ 30MHz	Jul. 03, 2012	Jan. 31, 2013 ~ Mar. 02, 2013	Jul. 02, 2013	Radiation (03CH06-HY)



5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.72
---	------



Appendix A. Photographs of EUT

Please refer to Sporton report number EP240322-08 as below.