

# FCC RF Test Report

APPLICANT : Hewlett-Packard Company  
EQUIPMENT : 802.11 a/b/g/n Wi-Fi + BT combo adapter  
BRAND NAME : HP  
MODEL NAME : HSTNN-AR01  
MARKETING NAME : Broadcom BCM4334 802.11abgn 2x2  
Wi-Fi + BT 4.0 Combo Adapter  
FCC ID : B94HNAR01  
STANDARD : FCC Part 15 Subpart C §15.247  
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Feb. 08, 2013 and completely tested on Apr. 19, 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: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager



## SPORTON INTERNATIONAL INC.

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



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### 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	-
3.1	-	RSS-Gen 4.6.1	99% Bandwidth	-	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 4.05 dB at 166.35 MHz
3.6	15.207	RSS-210 Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 10.70 dB at 0.150 MHz
3.7	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-



# 1 General Description

## 1.1 Applicant

Hewlett-Packard Company  
3000 Hanover Street, Palo Alto, California 94304, USA

## 1.2 Manufacturer

AzureWave Technologies (Shanghai) Inc.  
No. 8, Lane 66, Chenbao Road, Malu Town, Jiading District, Shanghai, 201801, China

## 1.3 Feature of Equipment Under Test

Product Feature	
Equipment	802.11 a/b/g/n Wi-Fi + BT combo adapter
Brand Name	HP
Model Name	HSTNN-AR01
Marketing Name	Broadcom BCM4334 802.11abgn 2x2 Wi-Fi + BT 4.0 Combo Adapter
FCC ID	B94HNAR01
EUT supports Radios application	WLAN 11abgn / Bluetooth 2.1/4.0
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	2402 MHz ~ 2480 MHz
Number of Channels	40
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)
Maximum Output Power to Antenna	8.43 dBm (0.0070 W)
99% Occupied Bandwidth	1.040MHz
Antenna Type	PIFA Antenna type with gain 3.00 dBi
Type of Modulation	GFSK

### 1.5 Testing Site

<b>Test Site</b>	SPORTON INTERNATIONAL INC.			
<b>Test Site Location</b>	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
<b>Test Site No.</b>	<b>Sporton Site No.</b>			<b>FCC/IC Registration No.</b>
	TH02-HY	CO05-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

1. **Remark:** 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

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	8.43 dBm	
Ch19	2440MHz	8.34 dBm	
Ch39	2480MHz	7.49 dBm	

- a. 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: conduction (150 KHz to 30 MHz), radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
- b. AC power line Conducted Emission was tested under maximum output power.

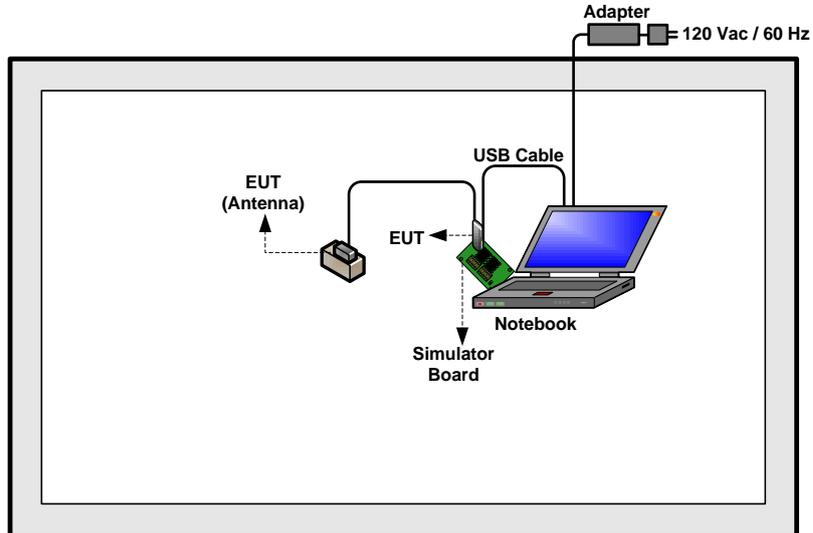
## 2.2 Test Mode

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

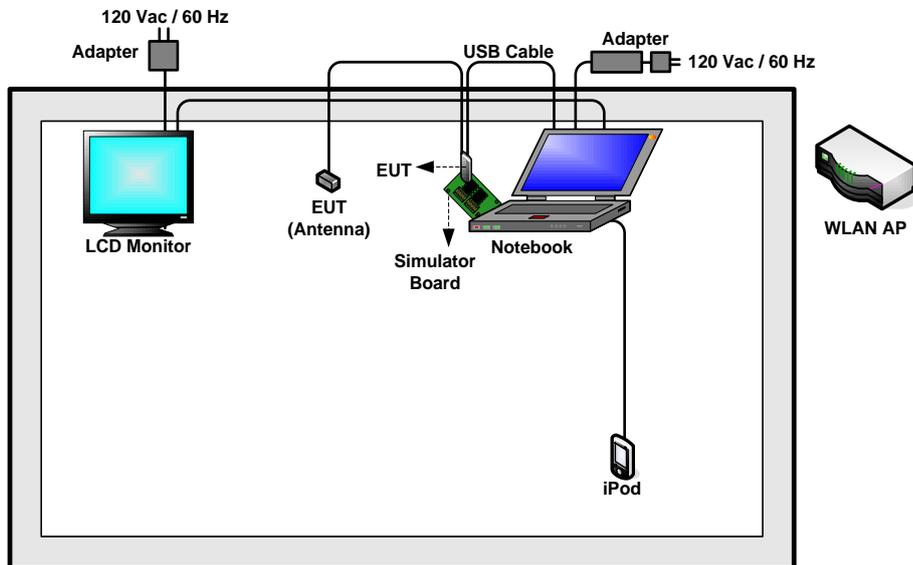
Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
<b>Conducted TCs</b>	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
<b>Radiated TCs</b>	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
<b>AC Conducted Emission</b>	Mode 1 :Bluetooth Tx + WLAN (2.4G) Link + USB Cable (Charging from Notebook) Mode 2 :Bluetooth Tx + WLAN (5G) Link + USB Cable (Charging from Notebook)
<b>Remark:</b> The worst case of conducted emission is mode 1; only the test data of it was reported.	

## 2.3 Connection Diagram of Test System

<Bluetooth 4.0 – LE Tx Mode>



<AC Conducted Emission Mode>



## 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	IBM	1860	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	LCD Monitor	Dell	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
4.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
5.	SD Card	SanDisk	MOcroSD HC	FCC DoC	N/A	N/A

## 2.5 Description of RF Function Operation Test Setup

For Bluetooth function, programmed RF utility, “Broadcom Blue Tool” installed in the notebook make the EUT provides functions like channel selection and power level for continuous transmitting and receiving signals.

## 2.6 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 and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

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

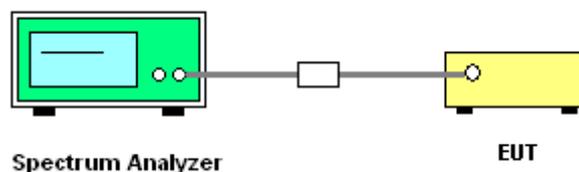
##### 3.1.2 Measuring Instruments

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) = 10 kHz. Set the Video bandwidth (VBW) = 30 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 KHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 10kHz and set the Video bandwidth (VBW) = 30kHz.
6. Measure and record the results in the test report.

##### 3.1.4 Test Setup



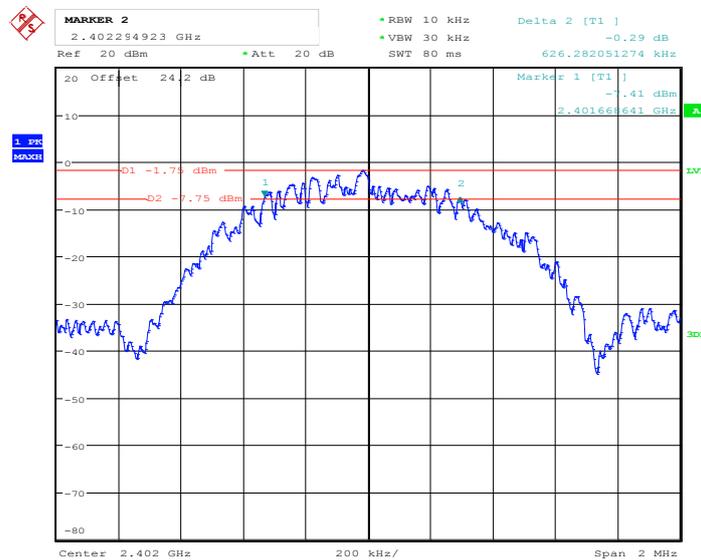


3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	58~61%

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
00	2402	0.63	0.5	Pass
19	2440	0.63	0.5	Pass
39	2480	0.62	0.5	Pass

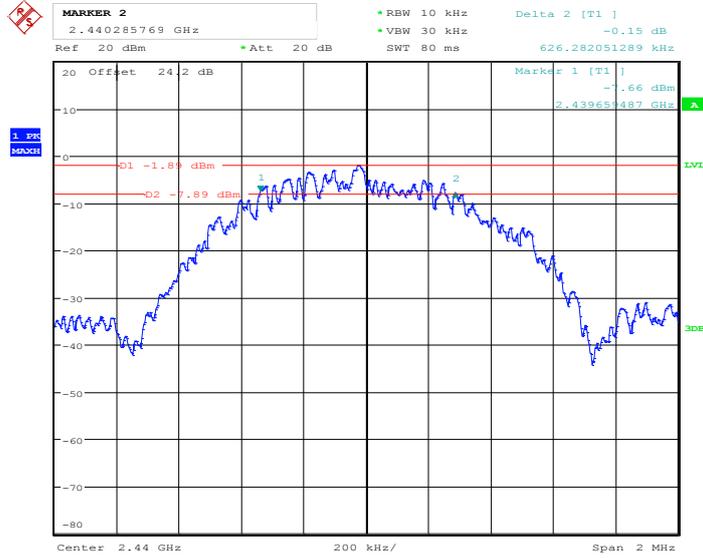
6 dB Bandwidth Plot on Channel 00



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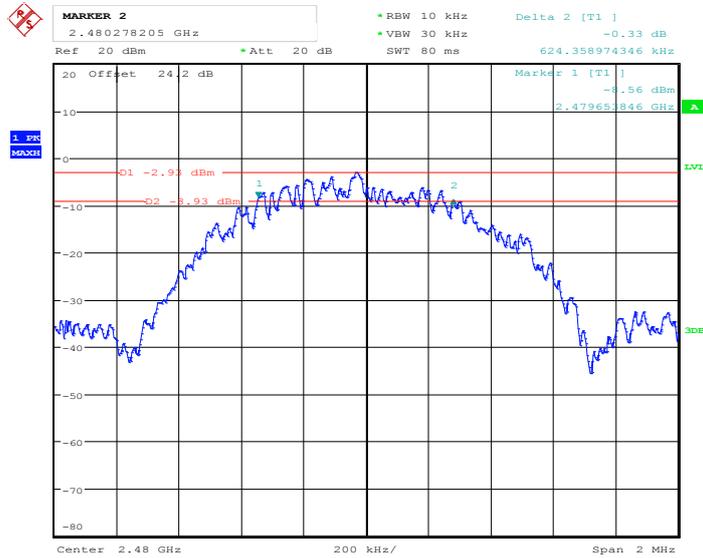


### 6 dB Bandwidth Plot on Channel 19



Date: 18.APR.2013 02:38:17

### 6 dB Bandwidth Plot on Channel 39



Date: 18.APR.2013 02:47:18

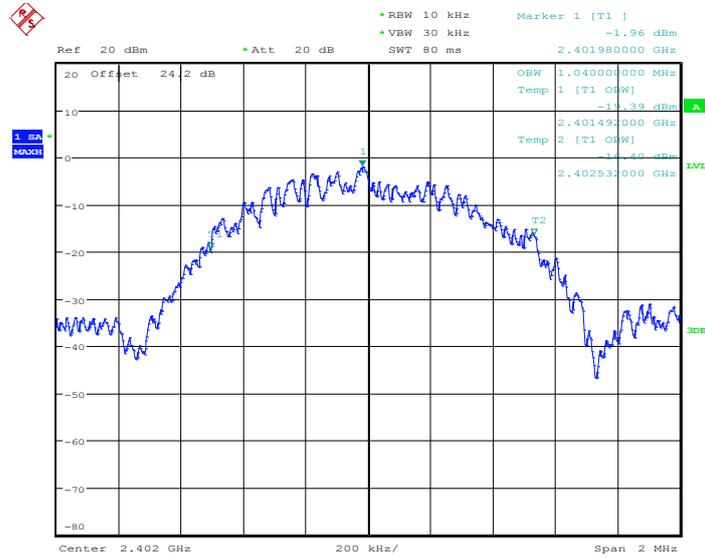


3.1.6 Test Result of 99% Occupied Bandwidth

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	58~61%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.040
19	2440	1.036
39	2480	1.036

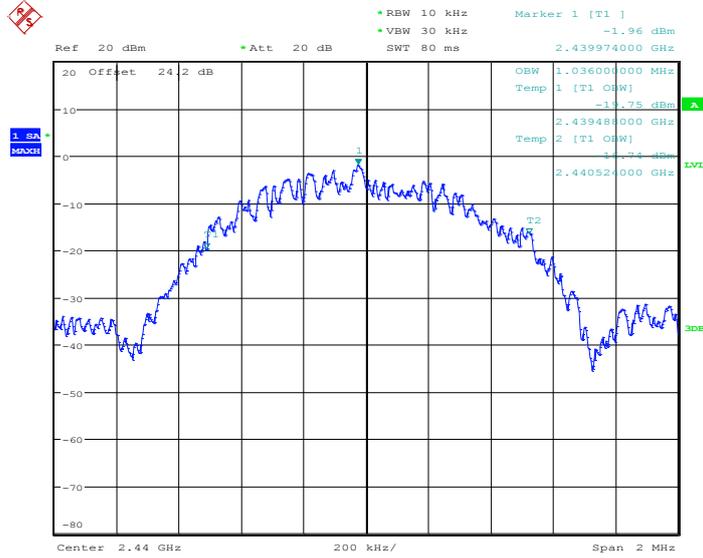
99% Bandwidth Plot on Channel 00



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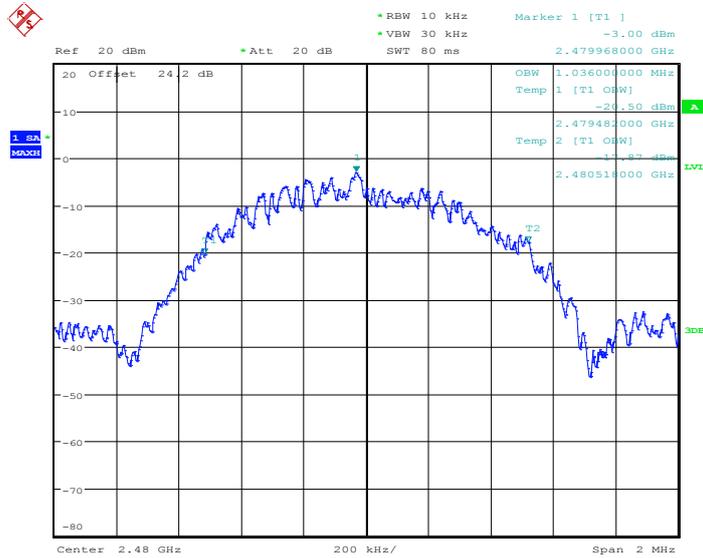


99% Occupied Bandwidth Plot on Channel 19



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99% Occupied Bandwidth Plot on Channel 39



Date: 18.APR.2013 02:49:07

## 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.

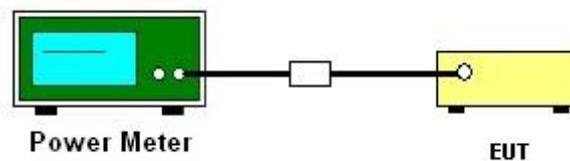
### 3.2.2 Measuring Instruments

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 power meter 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 :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	58~61%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	8.43	30.00	Pass
19	2440	8.34	30.00	Pass
39	2480	7.49	30.00	Pass

### 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.

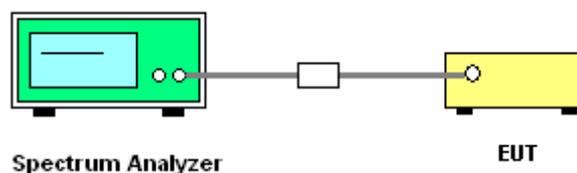
#### 3.3.2 Measuring Instruments

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 :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	58~61%

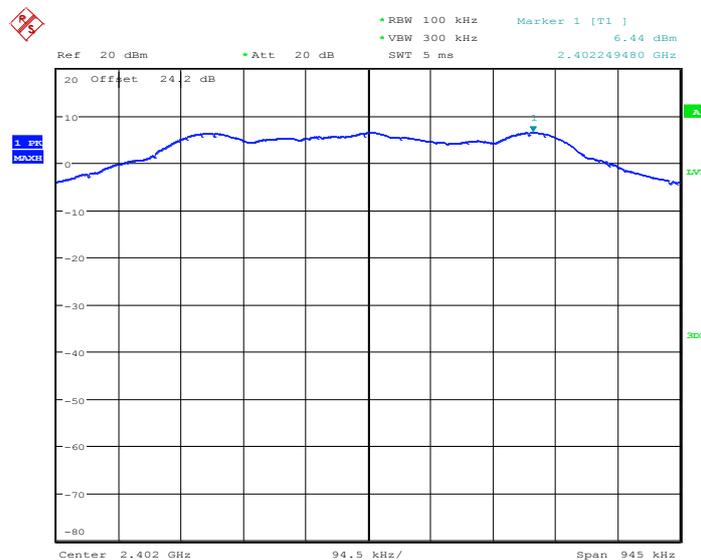
Channel	Frequency (MHz)	Power Density		Max. Limits (dBm/3kHz)	Pass/Fail
		PSD/100kHz (dBm)	PSD/3kHz (dBm)		
00	2402	6.44	-7.01	8	Pass
19	2440	6.34	-7.08	8	Pass
39	2480	5.28	-8.13	8	Pass

**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)

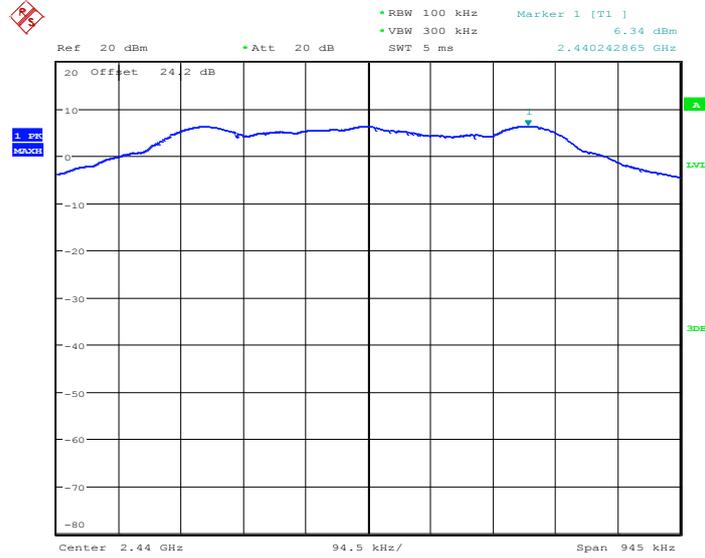
PSD 100kHz Plot on Channel 00



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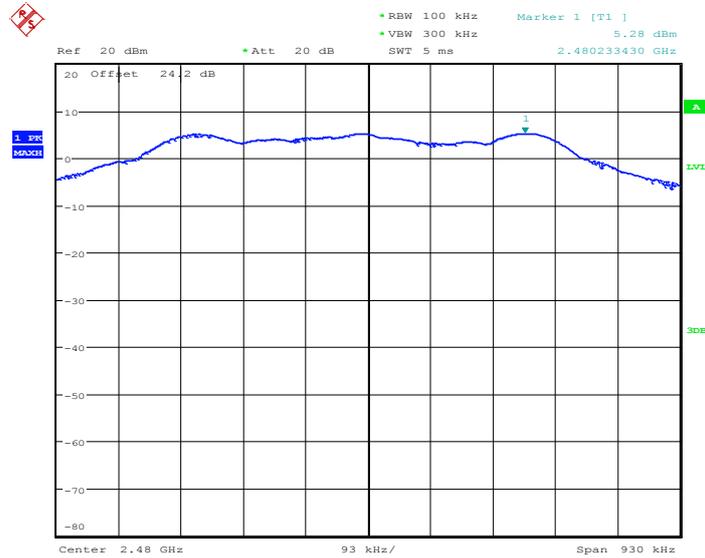


PSD 100kHz Plot on Channel 19



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PSD 100kHz Plot on Channel 39

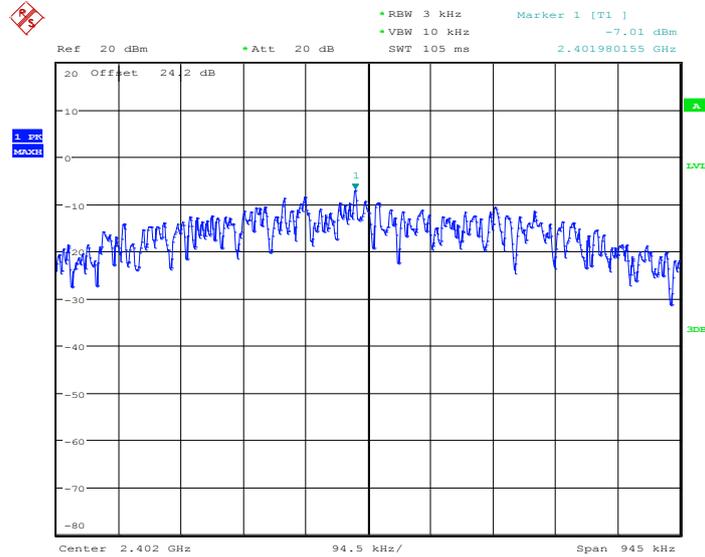


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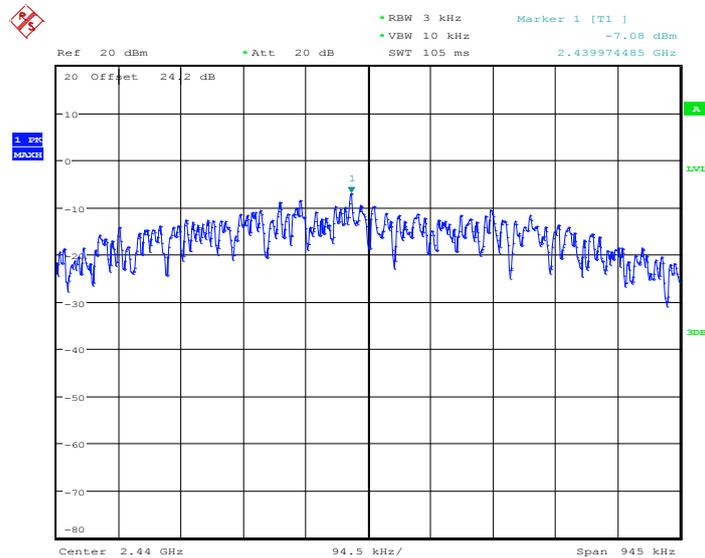
### 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

PSD 3kHz Plot on Channel 00



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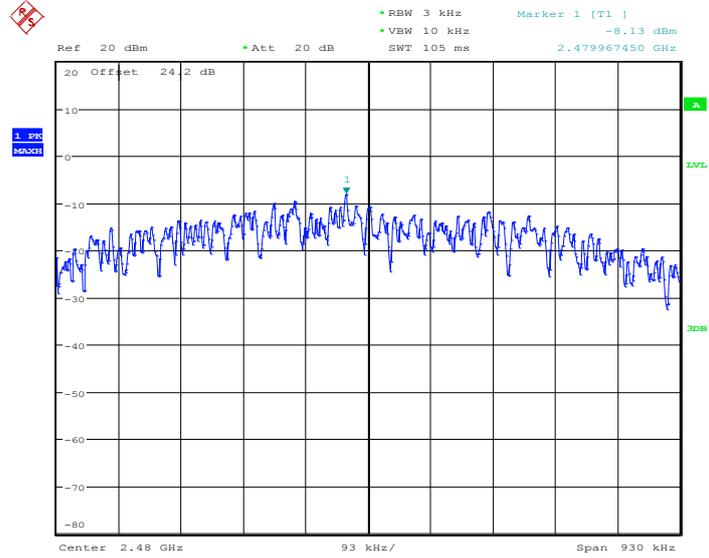
PSD 3kHz Plot on Channel 19



Date: 18.APR.2013 02:38:36



PSD 3kHz Plot on Channel 39



Date: 18.APR.2013 02:47:37

## 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.

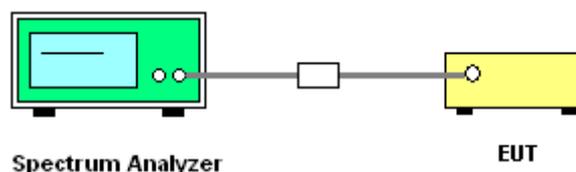
### 3.4.2 Measuring Instruments

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.

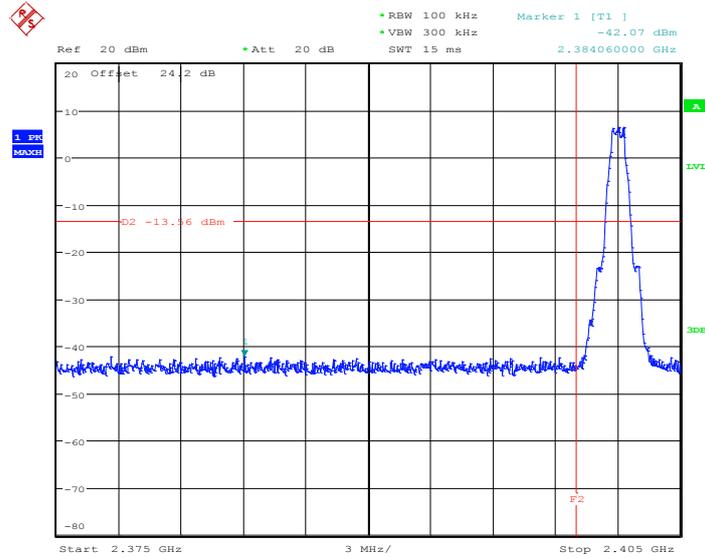
### 3.4.4 Test Setup



### 3.4.5 Test Result of Conducted Band Edges

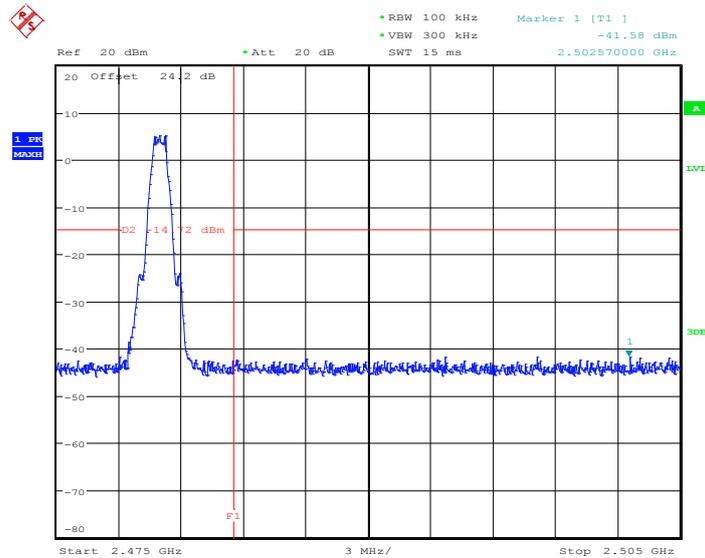
Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Channel :	00 and 39	Relative Humidity :	58~61%
		Test Engineer :	Bill Kuo

Low Band Edge Plot on Channel 00



Date: 18.APR.2013 02:42:46

High Band Edge Plot on Channel 39



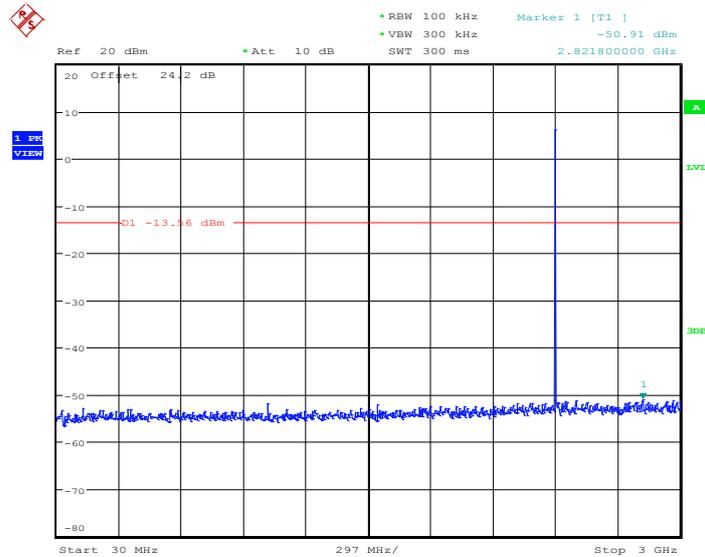
Date: 18.APR.2013 02:47:58



### 3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	58~61%
		Test Engineer :	Bill Kuo

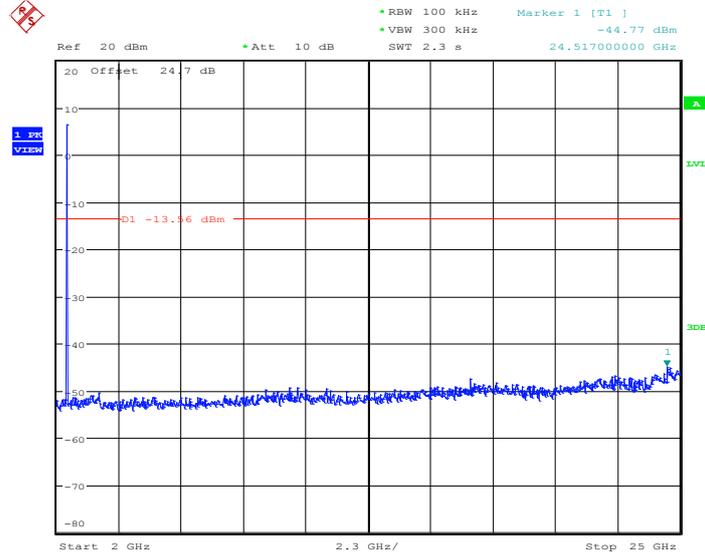
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps  
GFSK Channel 00



Date: 18.APR.2013 02:43:04



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

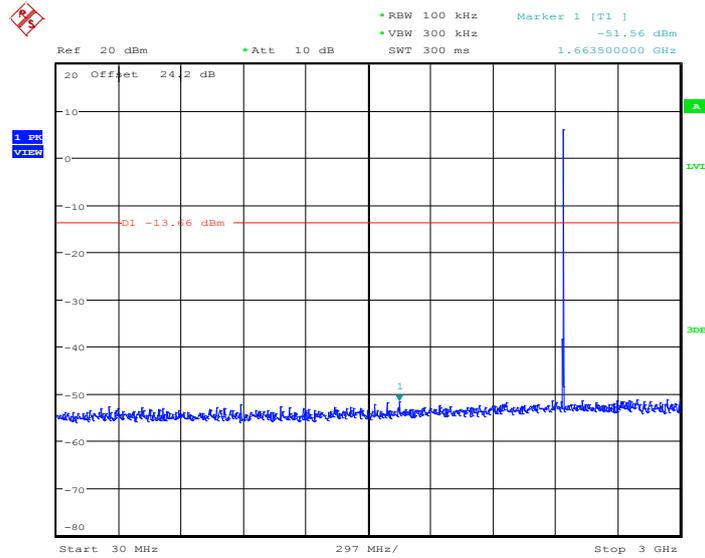


Date: 18.APR.2013 02:43:22



Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Channel :	19	Relative Humidity :	58~61%
		Test Engineer :	Bill Kuo

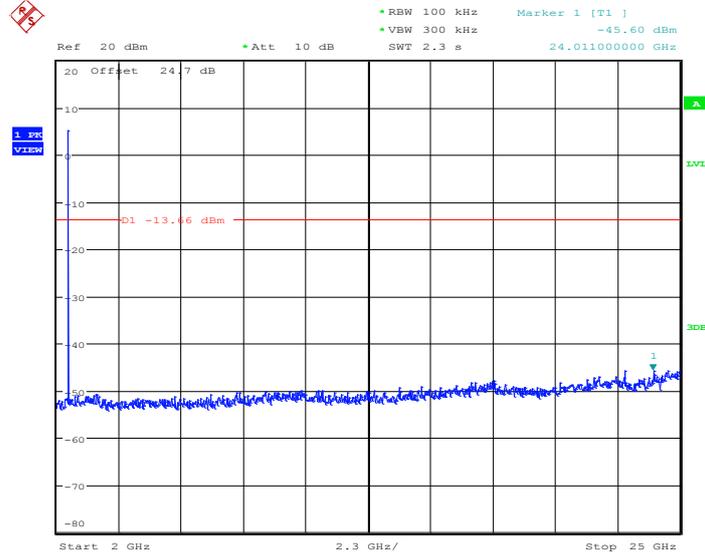
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps  
GFSK Channel 19



Date: 18.APR.2013 02:39:03



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

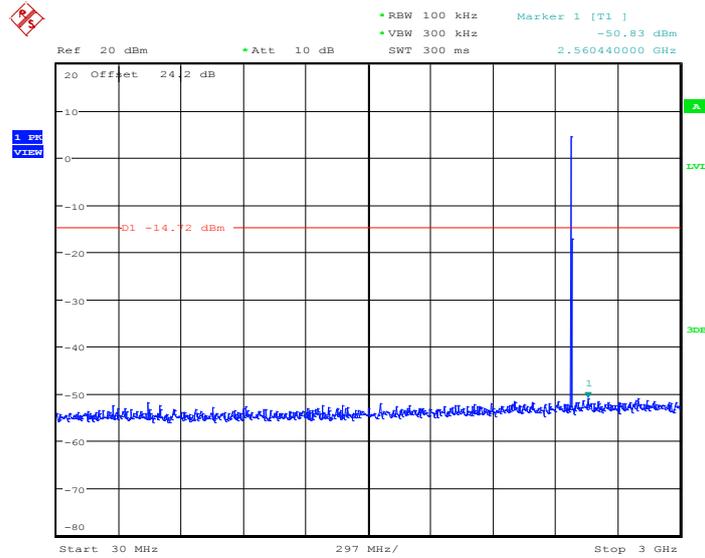


Date: 18.APR.2013 02:39:21



Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	58~61%
		Test Engineer :	Bill Kuo

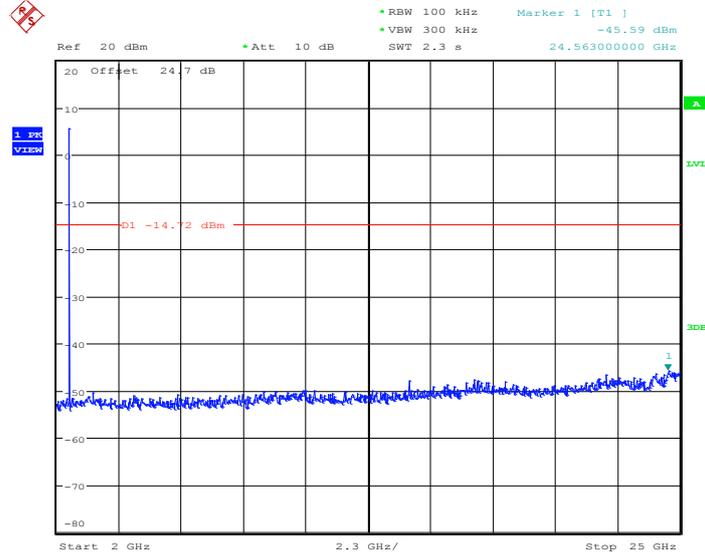
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps  
GFSK Channel 39



Date: 18.APR.2013 02:48:16



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



Date: 18.APR.2013 02:48:34

### 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	63.61	400.00	2.500	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

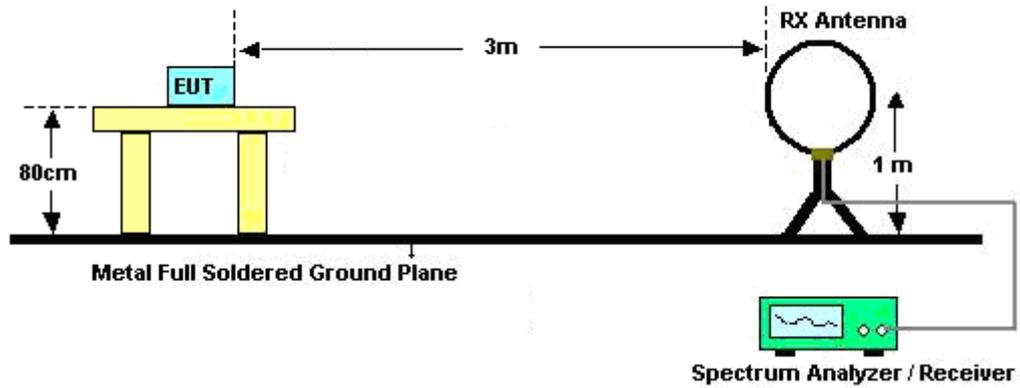
- (2) Set span = 10MHz, that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set RBW = 100KHz, 1% of the total span. Set VBW = 100KHz  $\geq$  RBW.

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

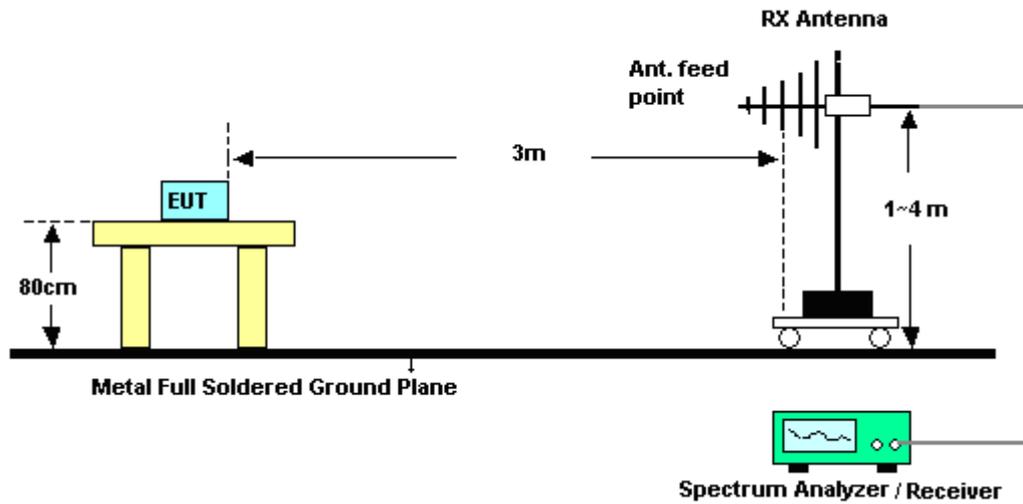
The resultant field strengths (peak/average) are then used to determine band-edge compliance as required by Section 15.205.

### 3.5.4 Test Setup

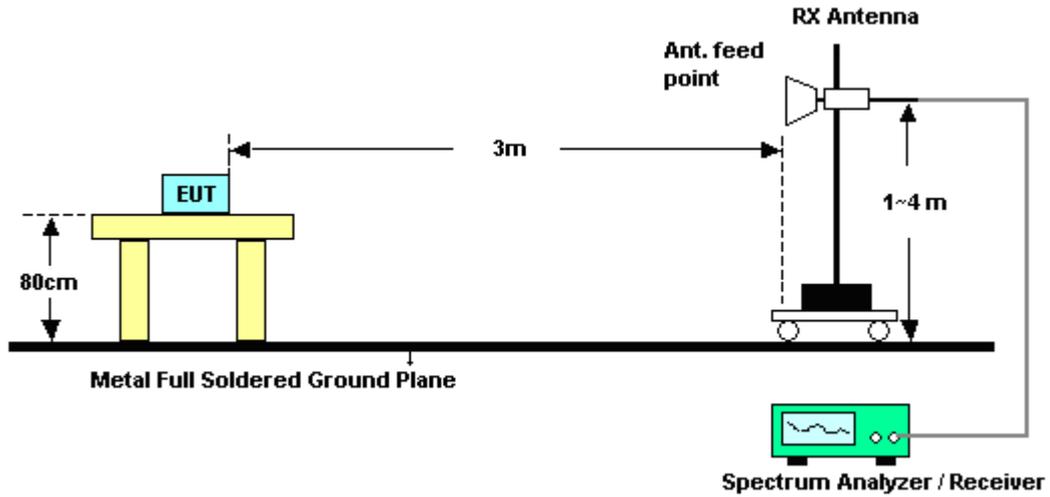
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



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 1	Temperature :	22~24°C
Test Channel :	00	Relative Humidity :	51~53%
		Test Engineer :	Marlboro Hsu

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
2372.73	52.67	-21.33	74	48.48	32.33	6.42	34.56	187	326	Peak
2389.47	41.49	-12.51	54	37.24	32.36	6.45	34.56	187	326	Average

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
2358.96	50.78	-23.22	74	46.61	32.31	6.42	34.56	185	260	Peak
2359.77	39.28	-14.72	54	35.11	32.31	6.42	34.56	185	260	Average



Test Mode :	Mode 3	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	51~53%
		Test Engineer :	Marlboro Hsu

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	67.18	-6.82	74	62.66	32.48	6.59	34.55	187	325	Peak
2483.5	63.78	*9.78	54	59.26	32.48	6.59	34.55	187	325	Average
2483.5	46.1	-27.9	74	-	-	-	-	-	-	Peak
2483.5	45.16	-8.84	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	109.58	63.48	46.1	74	-27.9	Pass
Average	108.64	63.48	45.16	54	-8.84	Pass

Note:

1. Measurement result = Maximum field strength – Delta result
2. \*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 8.84dB.

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	61.1	-12.9	74	56.58	32.48	6.59	34.55	200	265	Peak
2483.5	57.05	*3.05	54	52.53	32.48	6.59	34.55	200	265	Average
2483.5	43.68	-30.32	74	-	-	-	-	-	-	Peak
2483.5	42.95	-11.05	54	-	-	-	-	-	-	Average

Summary results of marker-delta method:

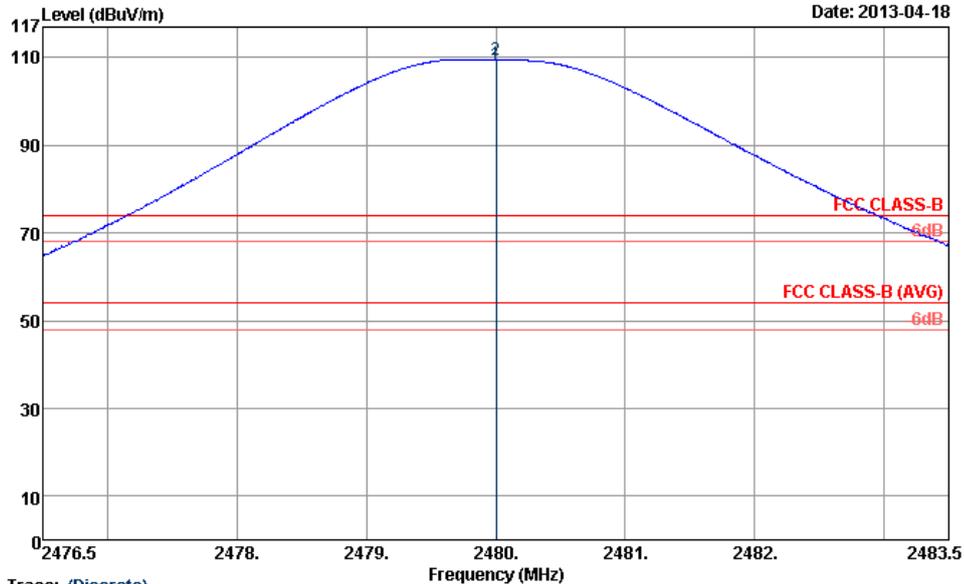
Test mode	Maximum field strength of the fundamental emission (dBμV/m)	Delta Result (dB)	Measurement Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
Peak	102.99	59.31	43.68	74	-30.32	Pass
Average	102.26	59.31	42.95	54	-11.05	Pass

Note:

1. Measurement result = Maximum field strength – Delta result
2. \*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 11.05dB.



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	51~53%
Test Engineer :	Marlboro Hsu	Polarization :	Horizontal



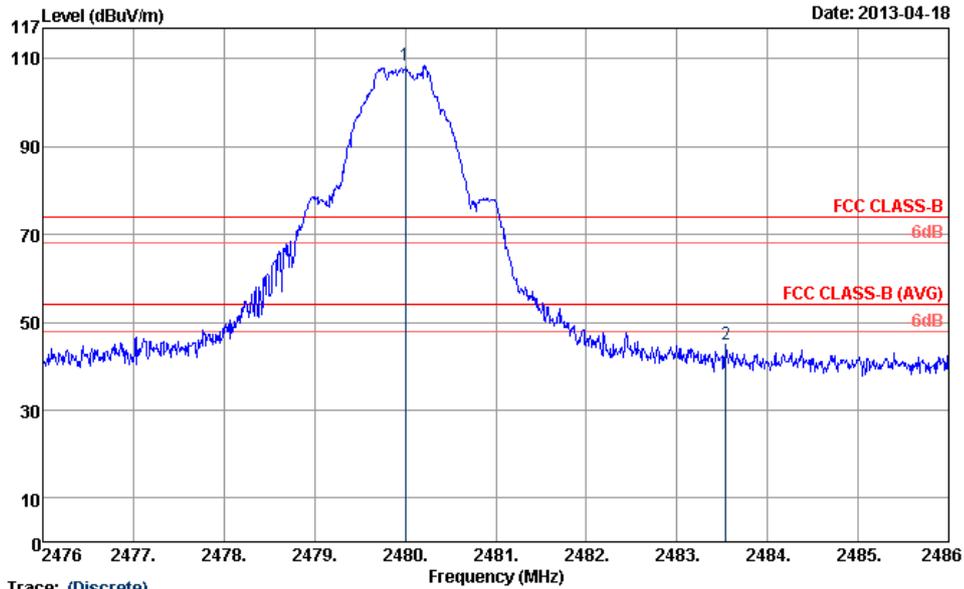
Trace: (Discrete)  
 Site : 03CH06-HY  
 Condition : FCC CLASS-B 3m HF-ANT\_120801 HORIZONTAL

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg
1 *	2480.00	108.64	54.64	54.00	104.12	32.48	6.59	34.55	187	325 Average
2 *	2480.00	109.58	35.58	74.00	105.06	32.48	6.59	34.55	187	325 Peak

\* Maximum field strength of the fundamental emission



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	51~53%
Test Engineer :	Marlboro Hsu	Polarization :	Horizontal



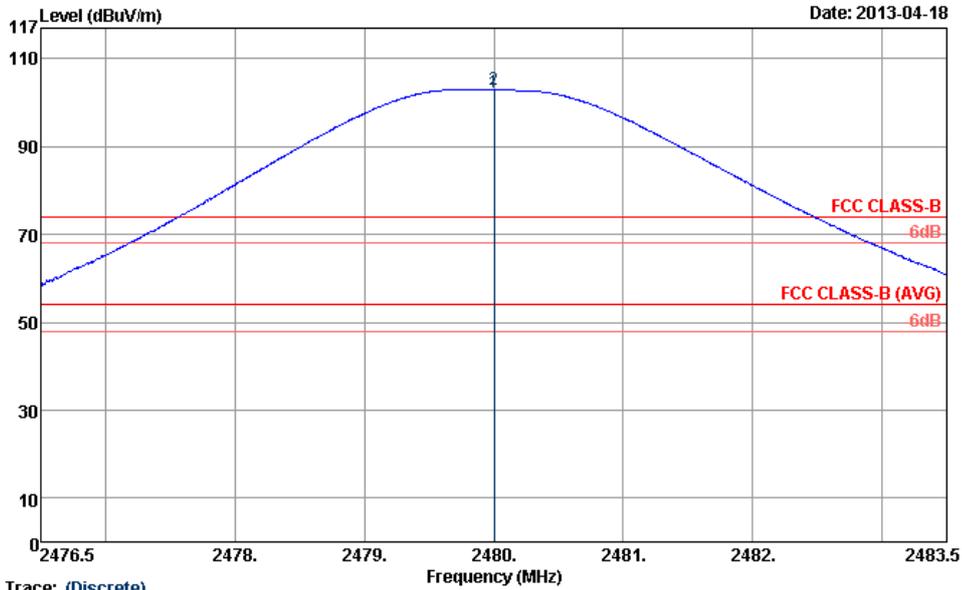
Trace: (Discrete)  
 Site : 03CH06-HY  
 Condition : FCC CLASS-B 3m HF-ANT\_120801 HORIZONTAL

	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	108.40	34.40	74.00	103.88	32.48	6.59	34.55	187	325	Peak
2	2483.54	44.92	-29.08	74.00	40.40	32.48	6.59	34.55	187	325	Peak

\* Marker-Delta Method (RBW/VBW=100KHz): 63.48 dB , single carrier Mode



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	51~53%
Test Engineer :	Marlboro Hsu	Polarization :	Vertical



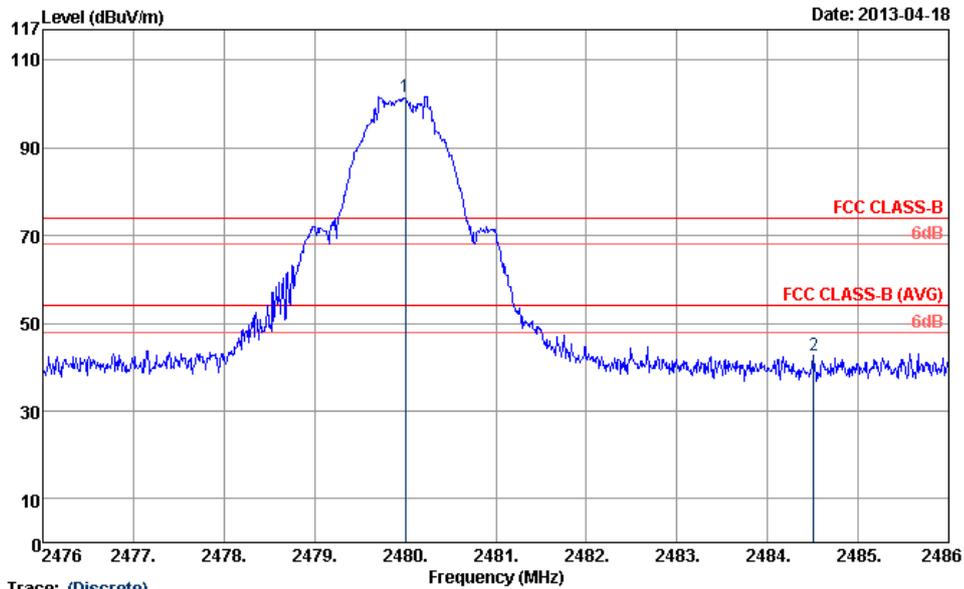
Trace: (Discrete)  
 Site : 03CH06-HY  
 Condition : FCC CLASS-B 3m HF-ANT\_120801 VERTICAL

Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Gain	A/Pos	T/Pos	Remark
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1 *	2480.00	102.26	48.26	54.00	97.74	32.48	6.59	34.55	200	265 Average
2 *	2480.00	102.99	28.99	74.00	98.47	32.48	6.59	34.55	200	265 Peak

\* Maximum field strength of the fundamental emission



Test Mode :	Bluetooth 4.0 - LE	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	51~53%
Test Engineer :	Marlboro Hsu	Polarization :	Vertical



Trace: (Discrete)  
 Site : 03CH06-HY  
 Condition : FCC CLASS-B 3m HF-ANT\_120801 VERTICAL

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	101.84	27.84	74.00	97.32	32.48	6.59	34.55	200	265 Peak
2	2484.51	42.53	-31.47	74.00	38.01	32.48	6.59	34.55	200	265 Peak

\* Marker-Delta Method (RBW/VBW=100KHz): 59.31 dB , single carrier Mode

3.5.7 Test Result of Radiated Emission (30 MHz ~ 10<sup>th</sup> Harmonic)

<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	00	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	<ol style="list-style-type: none"> <li>2402 MHz is fundamental signal which can be ignored.</li> <li>7206 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. For example, 110.72 dBμV/m - 20dB = 90.72 dBμV/m.</li> <li>Average measurement was not performed if peak level went lower than the average limit.</li> </ol>		

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
2402	109.93	-	-	105.68	32.36	6.45	34.56	187	326	Average
2402	110.72	-	-	106.47	32.36	6.45	34.56	187	326	Peak
4803	48.69	-25.31	74	59.21	34.88	10.16	55.56	100	0	Peak
7206	48.44	-42.28	90.72	57.8	36.16	10.97	56.49	100	0	Peak

Note: Other harmonics are lower than background noise.

<b>Test Mode :</b>	Mode 1	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	00	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Vertical
<b>Remark :</b>	<ol style="list-style-type: none"> <li>2402 MHz is fundamental signal which can be ignored.</li> <li>7206 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level.</li> <li>Average measurement was not performed if peak level went lower than the average limit.</li> </ol>		

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
2402	104.6	-	-	100.35	32.36	6.45	34.56	185	260	Average
2402	105.38	-	-	101.13	32.36	6.45	34.56	185	260	Peak
4803	47.66	-26.34	74	58.18	34.88	10.16	55.56	100	0	Peak
7206	49.23	-36.15	85.38	58.59	36.16	10.97	56.49	100	0	Peak

Note: Other harmonics are lower than background noise.



<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	19	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	1. 2440 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
2440	110.49	-	-	106.1	32.43	6.52	34.56	189	324	Average
2440	111.27	-	-	106.88	32.43	6.52	34.56	189	324	Peak
4881	48.4	-25.6	74	59.04	34.85	10.19	55.68	100	0	Peak
7320	47.94	-26.06	74	57.11	36.13	10.94	56.24	100	0	Peak

**Note:** Other harmonics are lower than background noise.

<b>Test Mode :</b>	Mode 2	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	19	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Vertical
<b>Remark :</b>	1. 2440 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
2440	104.02	-	-	99.63	32.43	6.52	34.56	178	260	Average
2440	104.83	-	-	100.44	32.43	6.52	34.56	178	260	Peak
4881	48.45	-25.55	74	59.09	34.85	10.19	55.68	100	0	Peak
7320	48.79	-25.21	74	57.96	36.13	10.94	56.24	100	0	Peak

**Note:** Other harmonics are lower than background noise.



<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	39	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	1. 2480 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
166.35	38.17	-5.33	43.5	58.29	9.88	1.75	31.75	100	127	Peak
216.3	35.7	-10.3	46	56.42	9.02	2.01	31.75	-	-	Peak
233.04	36.78	-9.22	46	55.81	10.53	2.18	31.74	-	-	Peak
366.5	37.79	-8.21	46	52.49	14.73	2.36	31.79	-	-	Peak
431.6	33.17	-12.83	46	46.02	16.52	2.49	31.86	-	-	Peak
699	34.97	-11.03	46	44.45	18.99	3.55	32.02	-	-	Peak
2480	108.69	-	-	104.17	32.48	6.59	34.55	187	325	Average
2480	109.43	-	-	104.91	32.48	6.59	34.55	187	325	Peak
4959	47.18	-26.82	74	58	34.81	10.21	55.84	100	0	Peak
7440	48.64	-25.36	74	57.63	36.11	10.9	56	100	0	Peak

**Note:** Other harmonics are lower than background noise.



<b>Test Mode :</b>	Mode 3	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	39	<b>Relative Humidity :</b>	51~53%
<b>Test Engineer :</b>	Marlboro Hsu	<b>Polarization :</b>	Vertical
<b>Remark :</b>	1. 2480 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
129.9	36.01	-7.49	43.5	54.57	11.8	1.39	31.75	-	-	Peak
166.35	39.45	-4.05	43.5	59.57	9.88	1.75	31.75	100	77	Peak
298.65	33.82	-12.18	46	49.97	13.18	2.39	31.72	-	-	Peak
366.5	33.59	-12.41	46	48.29	14.73	2.36	31.79	-	-	Peak
632.5	30.43	-15.57	46	40	19.2	3.28	32.05	-	-	Peak
699	32.04	-13.96	46	41.52	18.99	3.55	32.02	-	-	Peak
2480	101.77	-	-	97.25	32.48	6.59	34.55	200	265	Average
2480	102.58	-	-	98.06	32.48	6.59	34.55	200	265	Peak
4959	47.27	-26.73	74	58.09	34.81	10.21	55.84	100	0	Peak
7440	48.04	-25.96	74	57.03	36.11	10.9	56	100	0	Peak

**Note:** Other harmonics are lower than background noise.

## 3.6 AC Conducted Emission Measurement

### 3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

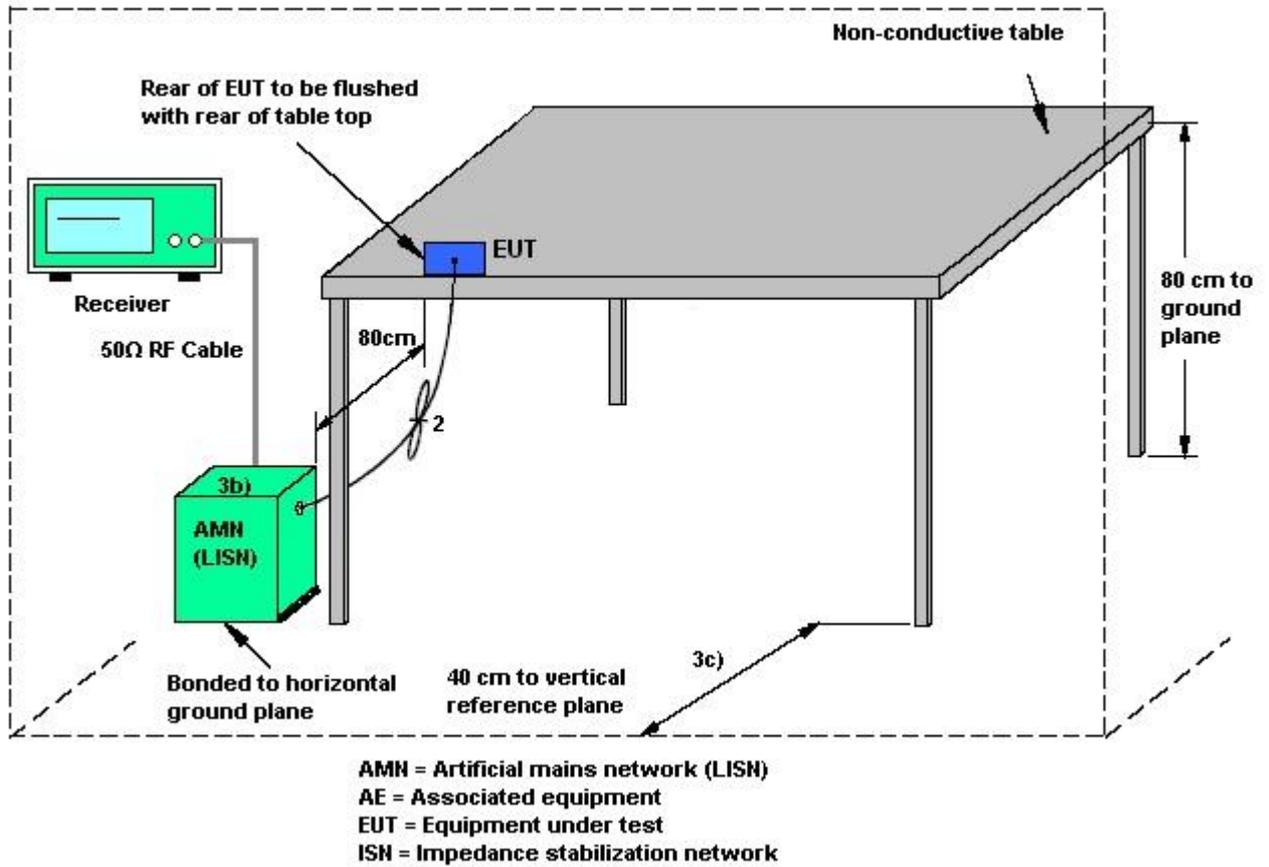
### 3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

### 3.6.3 Test Procedures

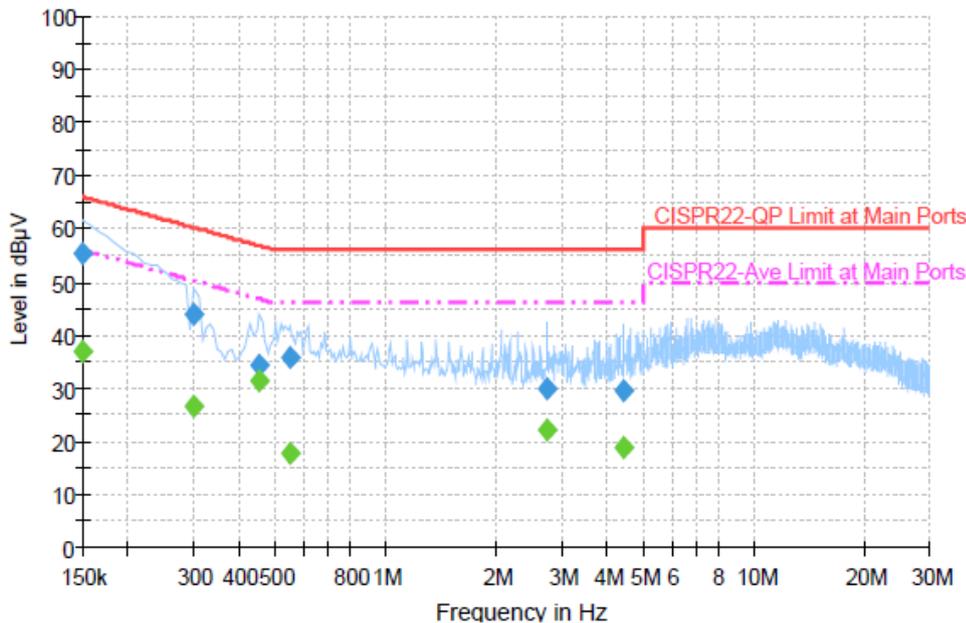
1. The testing follows the guidelines in ANSI C63.10-2009.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 kHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

### 3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Tx + WLAN (2.4G) Link + USB Cable (Charging from Notebook)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



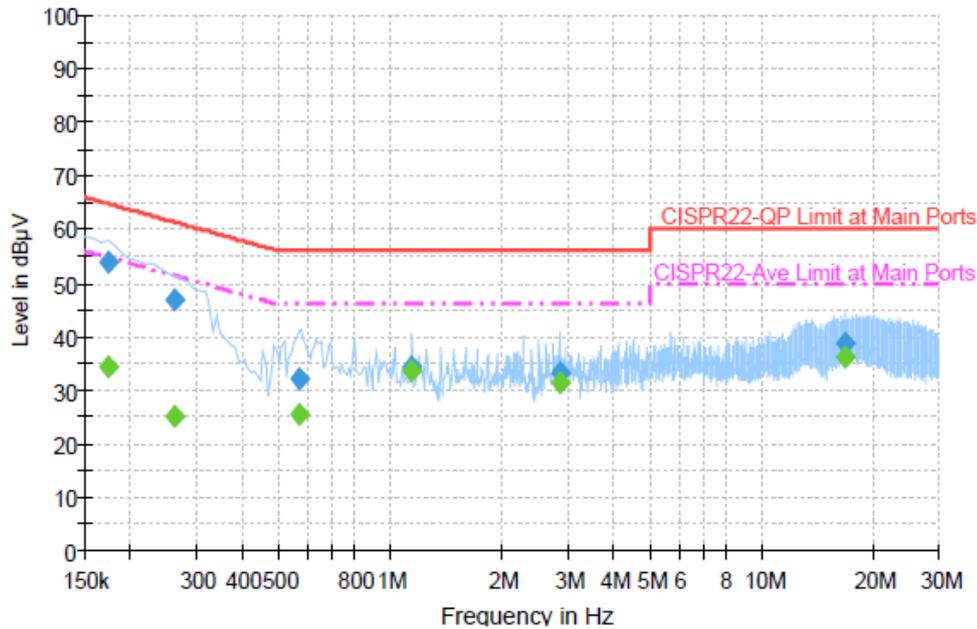
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	55.3	Off	L1	19.4	10.7	66.0
0.302000	43.8	Off	L1	19.3	16.4	60.2
0.454000	34.3	Off	L1	19.3	22.5	56.8
0.550000	35.8	Off	L1	19.4	20.2	56.0
2.734000	30.0	Off	L1	19.6	26.0	56.0
4.438000	29.5	Off	L1	19.6	26.5	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	36.8	Off	L1	19.4	19.2	56.0
0.302000	26.5	Off	L1	19.3	23.7	50.2
0.454000	31.3	Off	L1	19.3	15.5	46.8
0.550000	17.8	Off	L1	19.4	28.2	46.0
2.734000	22.1	Off	L1	19.6	23.9	46.0
4.438000	19.0	Off	L1	19.6	27.0	46.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Tx + WLAN (2.4G) Link + USB Cable (Charging from Notebook)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



**Final Result : Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	53.8	Off	N	19.4	11.0	64.8
0.262000	46.7	Off	N	19.4	14.7	61.4
0.566000	32.0	Off	N	19.4	24.0	56.0
1.142000	34.4	Off	N	19.5	21.6	56.0
2.854000	33.2	Off	N	19.6	22.8	56.0
16.790000	38.9	Off	N	19.8	21.1	60.0

**Final Result : Average**

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	34.2	Off	N	19.4	20.6	54.8
0.262000	25.0	Off	N	19.4	26.4	51.4
0.566000	25.4	Off	N	19.4	20.6	46.0
1.142000	33.5	Off	N	19.5	12.5	46.0
2.854000	31.3	Off	N	19.6	14.7	46.0
16.790000	36.3	Off	N	19.8	13.7	50.0



## **3.7 Antenna Requirements**

### **3.7.1 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.

### **3.7.2 Antenna Connected Construction**

Non-standard connector used.

### **3.7.3 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	Apr. 18, 2013	Jun. 05, 2013	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Sep. 08, 2012	Apr. 18, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Sep. 08, 2012	Apr. 18, 2013	Sep. 07, 2013	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9KHz ~ 2.75GHz	Nov. 13, 2012	Apr. 18, 2013	Nov. 12, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100081	9KHz ~ 30MHz	Dec. 12, 2012	Apr. 18, 2013	Dec. 11, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9KHz ~ 30MHz	Dec. 06, 2012	Apr. 18, 2013	Dec. 05, 2013	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Apr. 18, 2013	N/A	Conduction (CO05-HY)
Spectrum Analyzer	R&S	FSP30	101352	9KHz~30GHz	Nov. 07, 2012	Apr. 18, 2013~ Apr. 19, 2013	Nov. 06, 2013	Radiation (03CH06-HY)
Spectrum Analyzer	Agilent	E4408B	MY44211 030	9KHz ~ 26.5GHz	Nov. 26, 2012	Apr. 18, 2013~ Apr. 19, 2013	Nov. 25, 2013	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/00 03	20MHz ~ 1000MHz	May 04, 2012	Apr. 18, 2013~ Apr. 19, 2013	May 03, 2013	Radiation (03CH06-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2885	30MHz ~ 2GHz	Oct. 06, 2012	Apr. 18, 2013~ Apr. 19, 2013	Oct. 05, 2013	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Aug. 01, 2012	Apr. 18, 2013~ Apr. 19, 2013	Jul. 31, 2013	Radiation (03CH06-HY)
Double Ridge Horn Antenna	COM-POWER	AH-118	071025	1GHz~18GHz	Aug. 09, 2012	Apr. 18, 2013~ Apr. 19, 2013	Aug. 08, 2013	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917 0251	15GHz ~ 40GHz	Sep. 28, 2012	Apr. 18, 2013~ Apr. 19, 2013	Sep. 27, 2013	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A019 17	1GHz ~ 26.5GHz	Apr. 12, 2013	Apr. 18, 2013~ Apr. 19, 2013	Apr. 11, 2014	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9KHz ~ 1GHz	Apr. 12, 2013	Apr. 18, 2013~ Apr. 19, 2013	Apr. 11, 2014	Radiation (03CH06-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 21, 2012	Apr. 18, 2013~ Apr. 19, 2013	Jul. 20, 2013	Radiation (03CH06-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	159087	1GHz~18GHz	Feb. 26, 2013	Apr. 18, 2013~ Apr. 19, 2013	Feb. 25, 2014	Radiation (03CH06-HY)
Loop Antenna	R&S	HFH2-Z2	860004/00 1	9KHz ~ 30MHz	Jul. 03, 2012	Apr. 18, 2013~ Apr. 19, 2013	Jul. 02, 2013	Radiation (03CH06-HY)



## 5 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	2.26
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	2.54
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.72
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## **Appendix A. Photographs of EUT**

Please refer to Sporton report number EP320849 as below.