



FCC RF Test Report

APPLICANT : Commtiva Technology Limited
EQUIPMENT : GSM/WCDMA Single SIM
BRAND NAME : SHARP
MODEL NAME : SH837Wi
MARKETING NAME : SH837Wi
FCC ID : X7H-SH837WI
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Nov. 09, 2012 and completely tested on Nov. 29, 2012. 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.



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 Testing Site.....	6
1.5 Applied Standards	6
1.6 Ancillary Equipment List	6
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST.....	7
2.1 RF Output Power	7
2.2 Test Mode.....	8
2.3 Connection Diagram of Test System.....	9
2.4 RF Utility	9
3 TEST RESULT	10
3.1 6dB Bandwidth Measurement	10
3.2 Peak Output Power Measurement	14
3.3 Power Spectral Density Measurement	18
3.4 Conducted Band Edges and Spurious Emission Measurement	26
3.5 Radiated Band Edges and Spurious Emission Measurement	35
3.6 AC Conducted Emission Measurement.....	45
3.7 Antenna Requirements	49
4 LIST OF MEASURING EQUIPMENT.....	50
5 UNCERTAINTY OF EVALUATION.....	51
APPENDIX A. PHOTOGRAPHS OF EUT	
APPENDIX B. SETUP PHOTOGRAPHS	



REVISION HISTORY



SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	A8.2(a)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)(1)	A8.1(b)	Peak Output Power	$\leq 30\text{dBm}$	Pass	-
3.5	15.247(e)	A8.2(b)	Power Spectral Density	$\leq 8\text{dBm}$	Pass	-
3.4	15.247(d)	A8.5	Conducted Band Edges and Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.5	15.247(d)	A8.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.69 dB at 4962.000 MHz
3.6	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 14.00 dB at 0.558 MHz
3.7	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Commtiva Technology Limited

4F., No. 32, Zhongcheng Rd., Tucheng District, New Taipei City 236, Taiwan

1.2 Manufacturer

Chi Mei Communication Systems, Inc.

No. 4, Minsheng St., Tucheng Dist., New Taipei City 236, Taiwan (R.O.C.)

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	GSM/WCDMA Single SIM
Brand Name	SHARP
Model Name	SH837Wi
Marketing Name	SH837Wi
FCC ID	X7H-SH837WI
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA WLAN 11bgn / Bluetooth
HW Version	PR3
SW Version	V 0.041
EUT Stage	Production Unit

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

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	Bluetooth 4.0 - LE : 8.59 dBm (0.0072 W)
Antenna Type	PIFA Antenna type with gain 0.81 dBi
Type of Modulation	Bluetooth 4.0 - LE : GFSK



1.4 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.	Sportun Site No.		FCC/IC Registration No.	
	TH02-HY	CO05-HY	03CH07-HY	722060/4086B-1

1.5 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 C63.4-2003 and ANSI C63.10-2009
- IC RSS-210 Issue 8
- IC RSS-Gen Issue 3

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.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
4.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m



2 Test Configuration of Equipment Under Test

2.1 RF Output Power

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	6.99 dBm
Ch19	2440MHz	8.59 dBm
Ch39	2480MHz	4.75 dBm



2.2 Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 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).

Pre-scanned tests, X, Y, Z in three orthogonal panels, were conducted to determine the final configuration from all possible combinations.

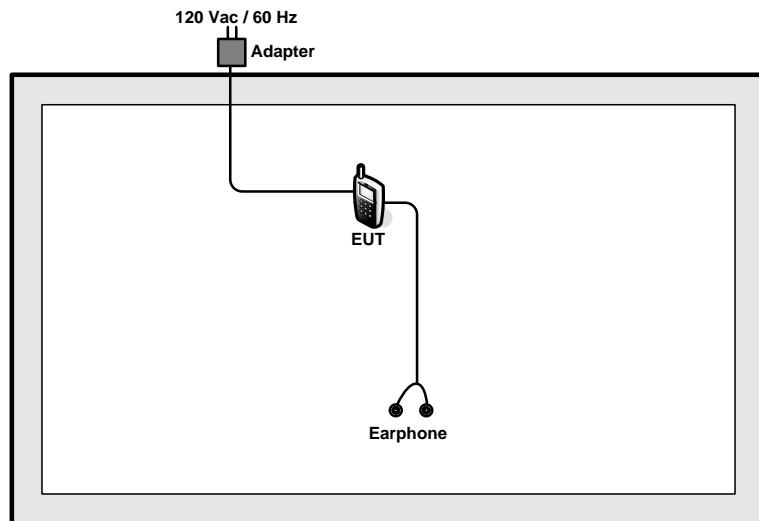
The following tables are showing the test modes as the worst cases (X plane) and recorded in this report.

The following tables are showing the test modes as the worst cases and recorded in this report.

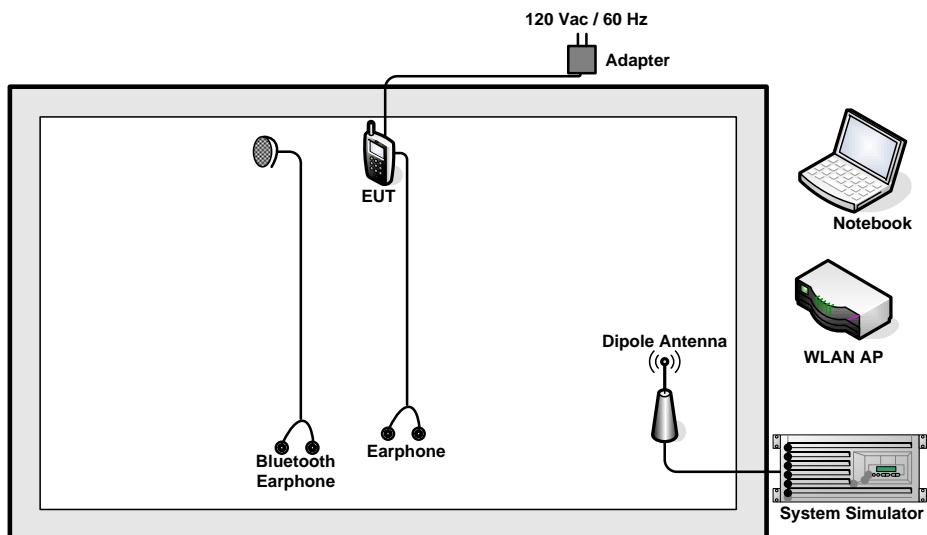
Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth 4.0 – LE / GFSK
Conducted TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated TCs	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1 :GSM850 Idle + Bluetooth Link + WLAN Link + Camera + Earphone + Battery + USB Cable (Charging from Adapter)

2.3 Connection Diagram of Test System

<Bluetooth 4.0 – LE Tx Mode>



<AC Conducted Emission Mode>



2.4 RF Utility

For Bluetooth function, programmed RF utility, "Command" installed in the notebook make the EUT provides functions like channel selection and power level for continuous transmitting and receiving signals.

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.

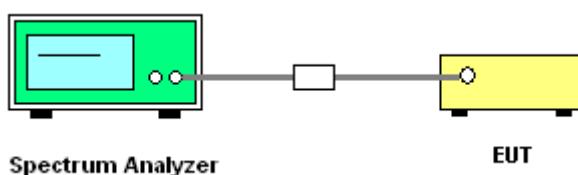
3.1.2 Measuring Instruments

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.

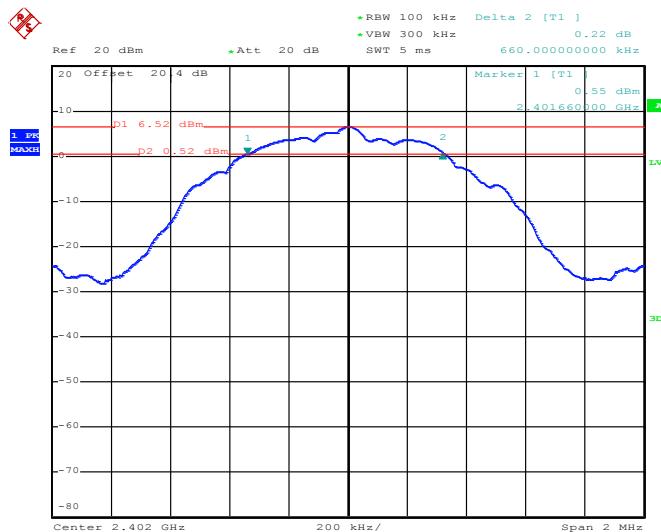
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Engineer :	Reece Li	Relative Humidity :	58~61%
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	
00	2402	0.66	
19	2440	0.65	
39	2480	0.66	

6 dB Bandwidth Plot on Channel 00



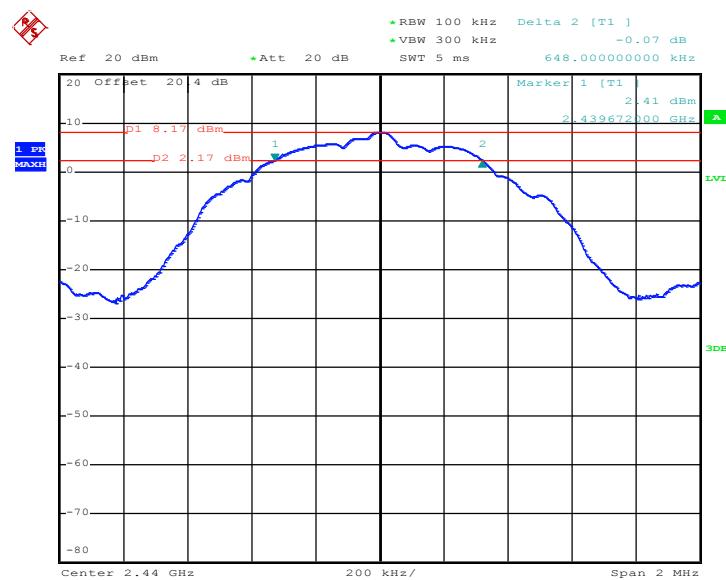
Date: 1.NOV.2012 20:45:28

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Example: the 6dB Bandwidth test item, the peak point of fundamental signal is 0.55dBm, has added (offset) with the total loss = attenuator factor + cable loss = 20.4dB, where, cable loss = 10.4dB and 10dB attenuator, and then the 6dB Bandwidth is measured and compliance with the limit line. Hereafter, each plot of spectrum analyzer has been added the total loss respectively and to demonstrate in compliance with the limit line.

6 dB Bandwidth Plot on Channel 19

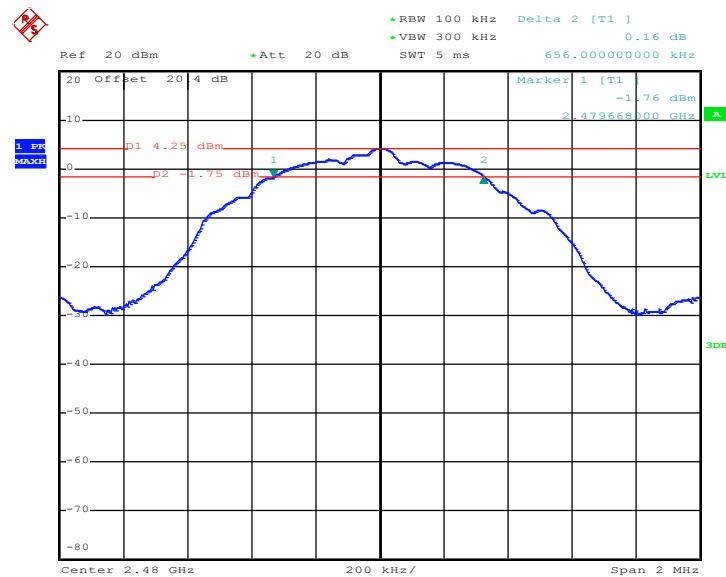


Date: 1.NOV.2012 20:55:43

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

6 dB Bandwidth Plot on Channel 39



Date: 1.NOV.2012 21:25:11

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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 are 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.

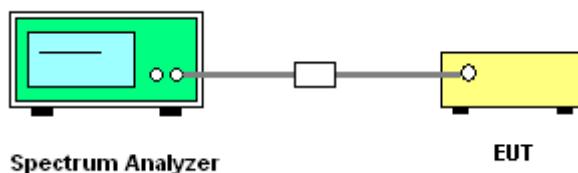
3.2.2 Measuring Instruments

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

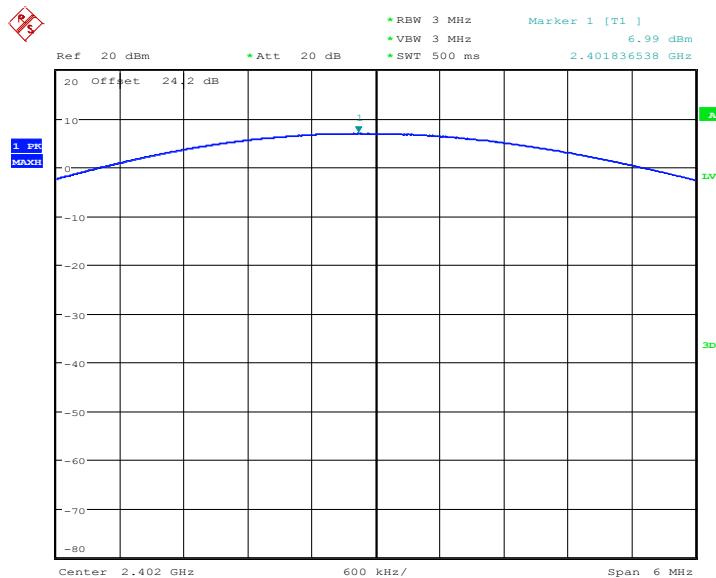


3.2.5 Test Result of Peak Output Power

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

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	6.99	30.00	Pass
19	2440	8.59	30.00	Pass
39	2480	4.75	30.00	Pass

Peak Output Power Plot on Channel 00

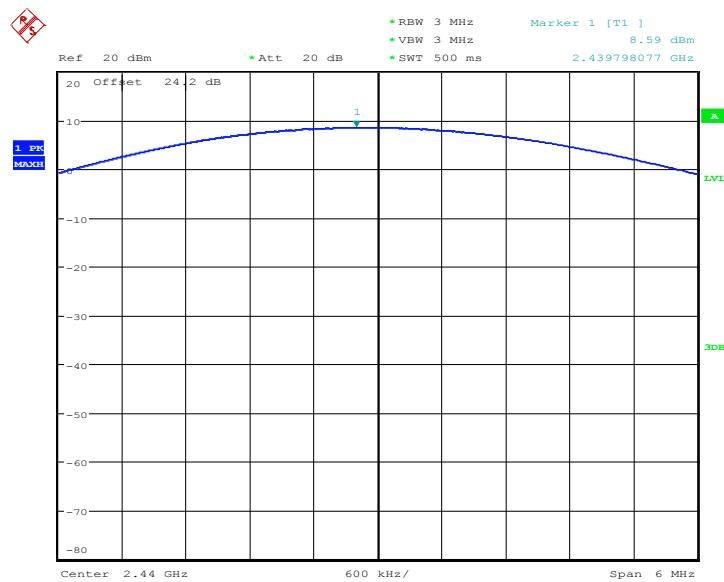


Date: 27.NOV.2012 23:32:51

Note:

The total loss is 24.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 19

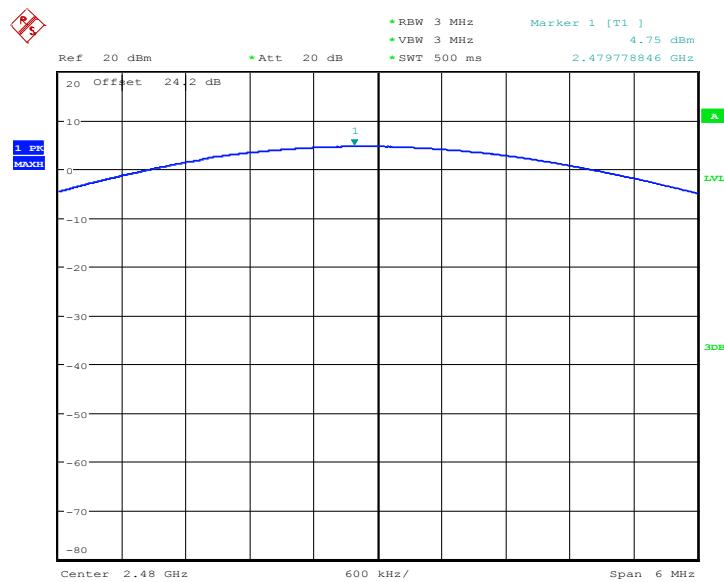


Date: 27.NOV.2012 23:40:07

Note:

The total loss is 24.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 39



Date: 27.NOV.2012 23:40:39

Note:

The total loss is 24.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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.

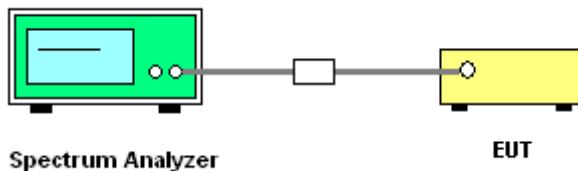
3.3.2 Measuring Instruments

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. Record the measurement data derived from spectrum analyzer.

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 :	Reece Li	Relative Humidity :	58~61%

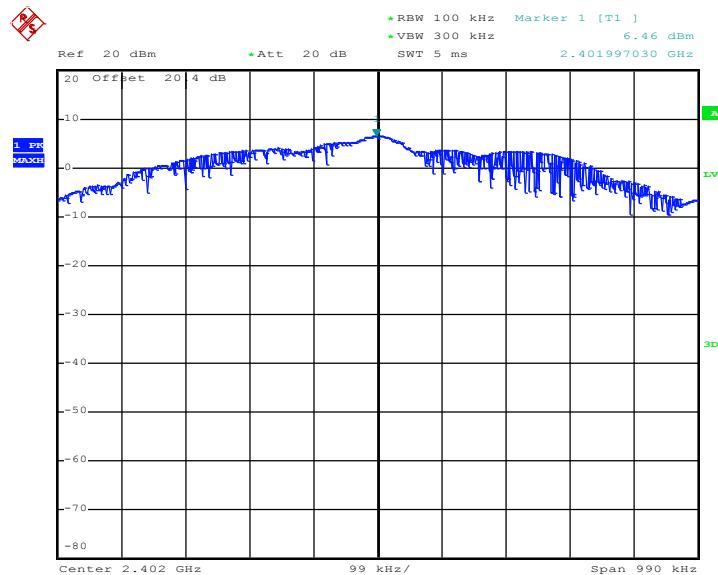
Channel	Frequency (MHz)	Power Density		Max. Limits (dBm/3KHz)	Pass/Fail
		PSD/100KHz (dBm)	PSD/3KHz (dBm)		
00	2402	6.46	5.19	8	Pass
19	2440	8.15	6.87	8	Pass
39	2480	4.22	2.95	8	Pass

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



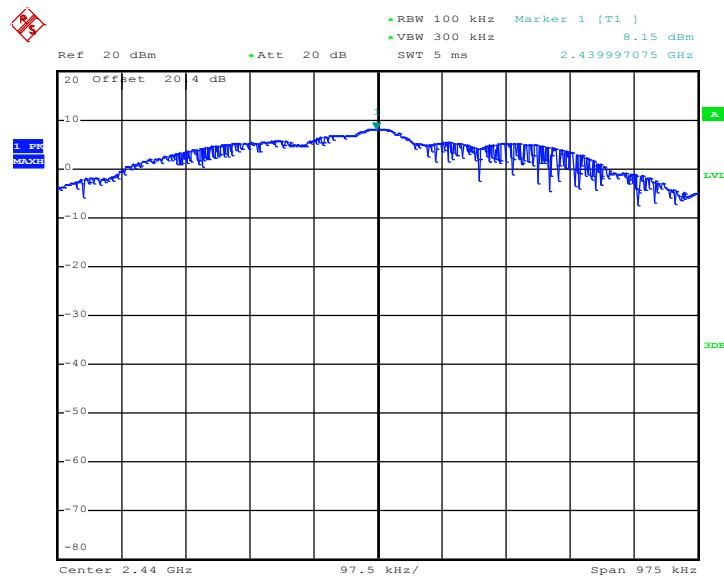
Date: 1.NOV.2012 20:46:38

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



PSD 100kHz Plot on Channel 19



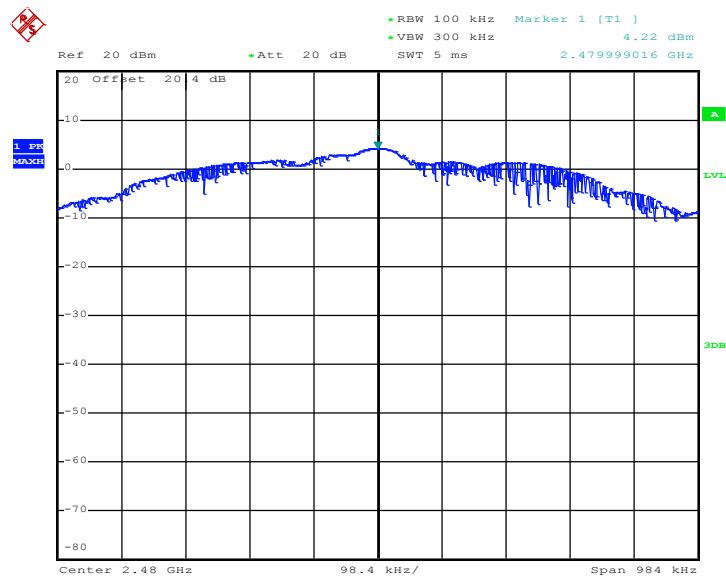
Date: 1.NOV.2012 20:59:51

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



PSD 100kHz Plot on Channel 39



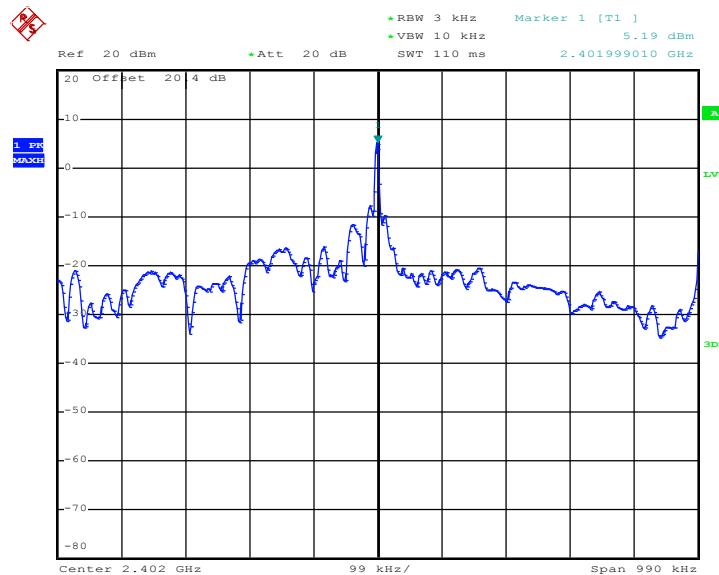
Date: 1.NOV.2012 21:26:25

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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

PSD 3kHz Plot on Channel 00

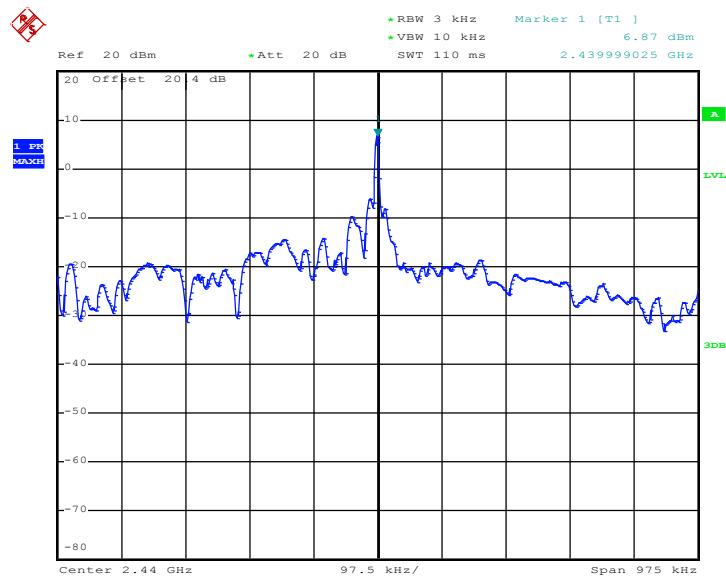


Date: 1.NOV.2012 20:46:17

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

PSD 3kHz Plot on Channel 19

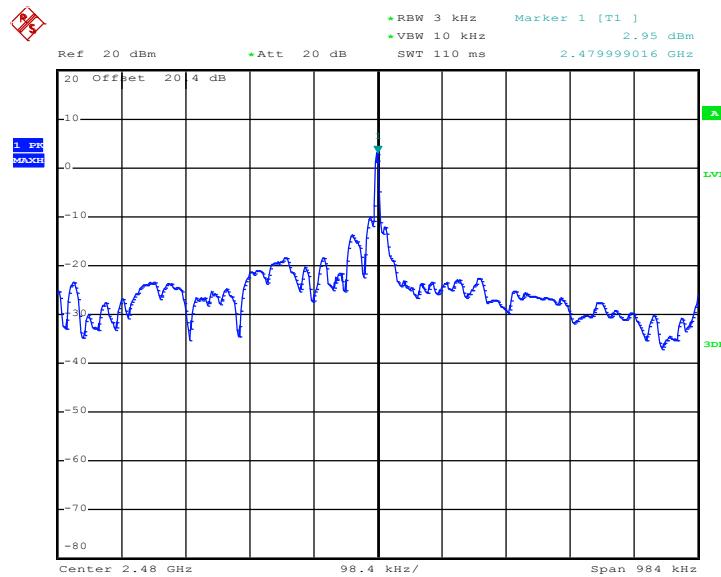


Date: 1.NOV.2012 20:59:44

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

PSD 3kHz Plot on Channel 39



Date: 1.NOV.2012 21:25:57

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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.

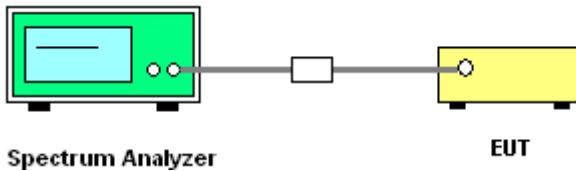
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedure

1. The testing follows the guidelines in ANSI C63.4-2003 and the Measurement Procedure 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. Set RBW = 100 KHz, Video bandwidth (VBW) \geq RBW. Out of the authorized frequency band emissions must be at least 20 dB lower than the highest emission level within the authorized band as measured with a 100 KHz RBW. 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.

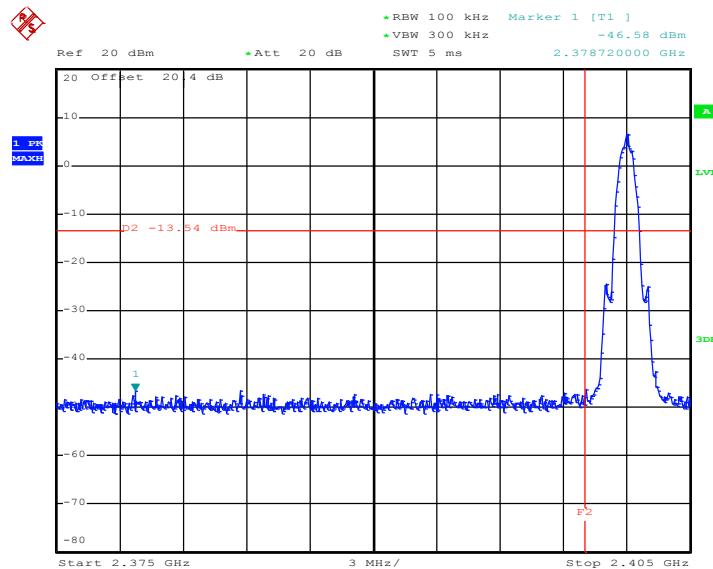
3.4.4 Test Setup



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 :	Reece Li

Low Band Edge Plot on Channel 00

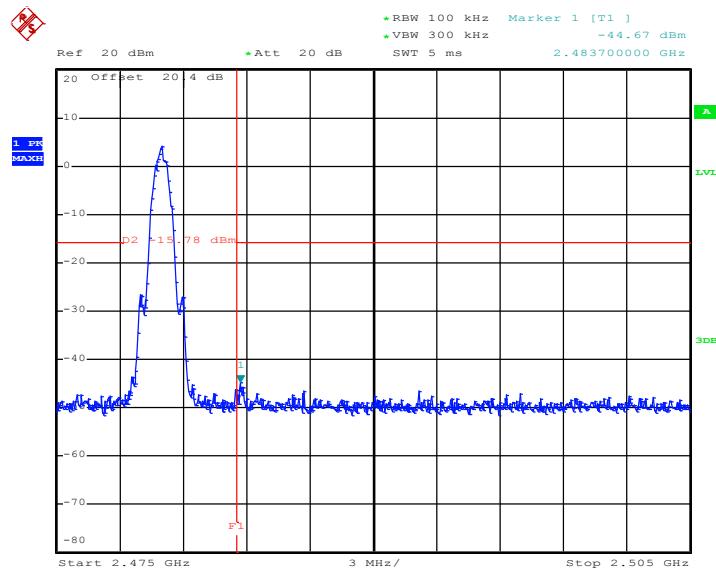


Date: 1.NOV.2012 20:46:54

Note:

The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

High Band Edge Plot on Channel 39



Date: 1.NOV.2012 21:26:42

Note:

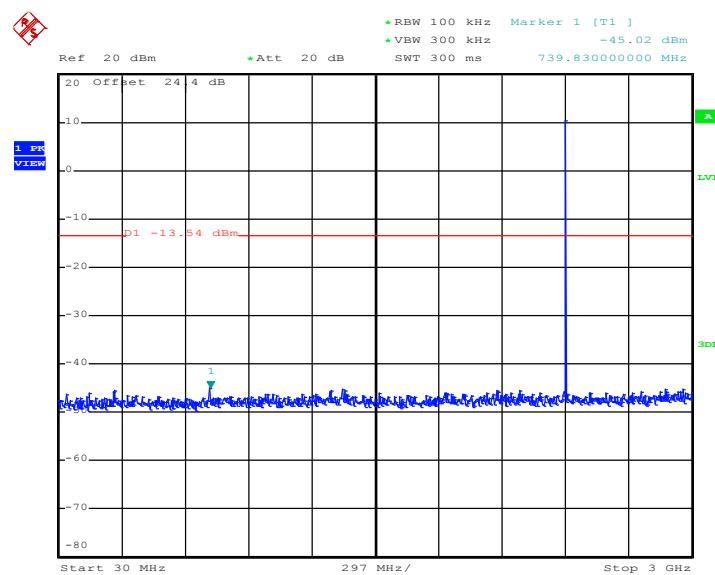
The total loss is 20.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.4.6 Test Result of Conducted Spurious Emission

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Band :	30MHz-3GHz and 2G-25GHz	Relative Humidity :	58~61%
Test Channel :	00	Test Engineer :	Reece Li

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 00

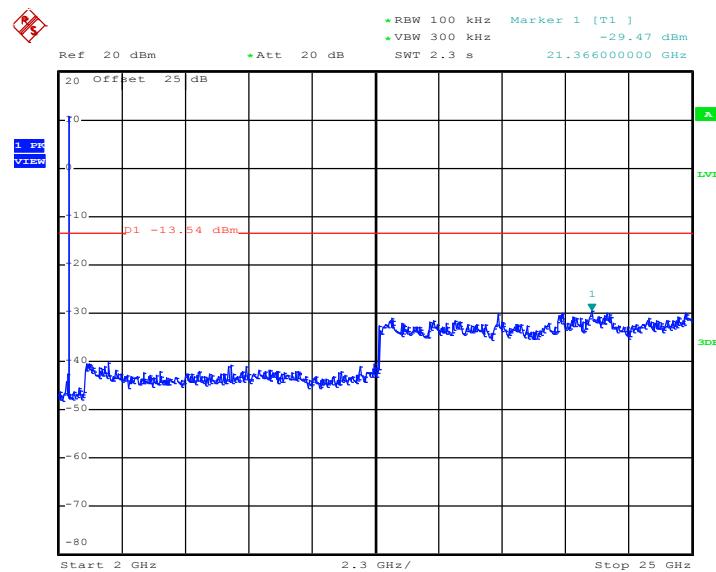


Date: 1.NOV.2012 20:47:17

Note:

The total loss is 24.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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

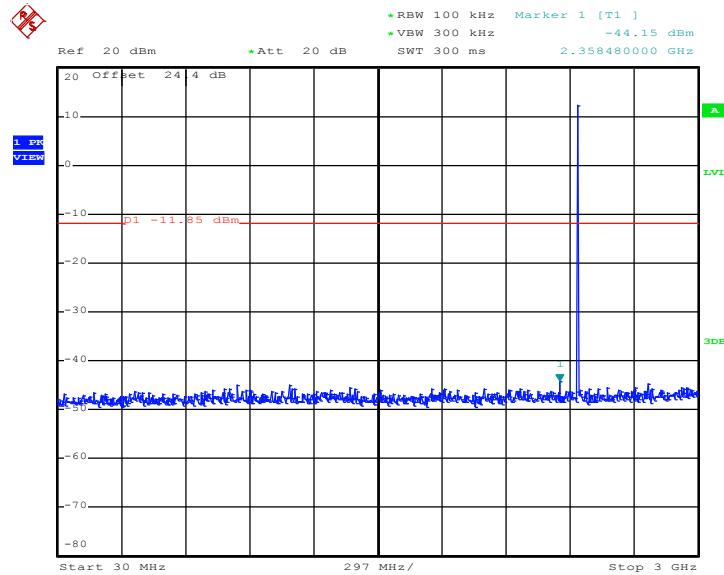


Date: 1.NOV.2012 20:47:34

Note:

The total loss is 25dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Band :	30MHz-3GHz and 2G-25GHz	Relative Humidity :	58~61%
Test Channel :	19	Test Engineer :	Reece Li

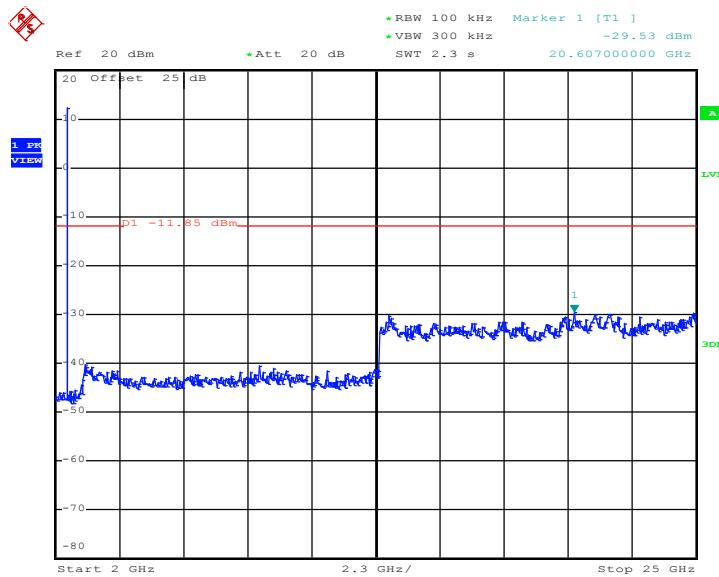
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19


Date: 1.NOV.2012 21:00:17

Note:

The total loss is 24.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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



Date: 1.NOV.2012 21:00:35

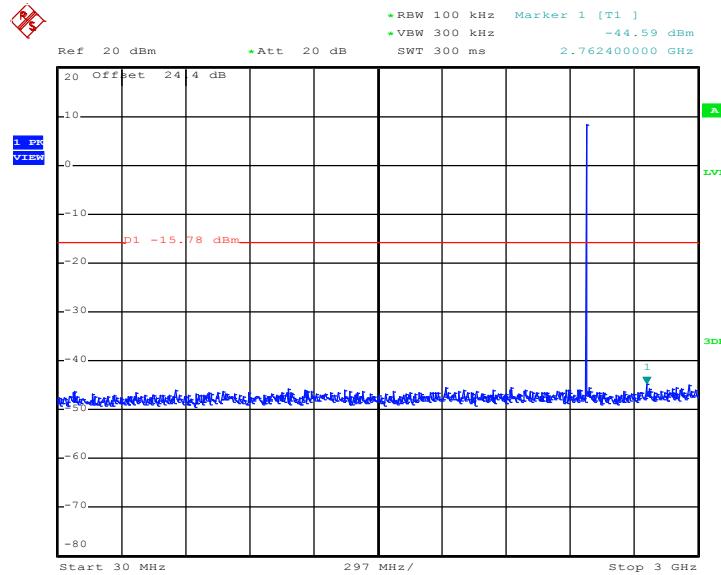
Note:

The total loss is 25dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	Bluetooth 4.0 - LE	Temperature :	24~26°C
Test Band :	30MHz-3GHz and 2G-25GHz	Relative Humidity :	58~61%
Test Channel :	39	Test Engineer :	Reece Li

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

GFSK Channel 39

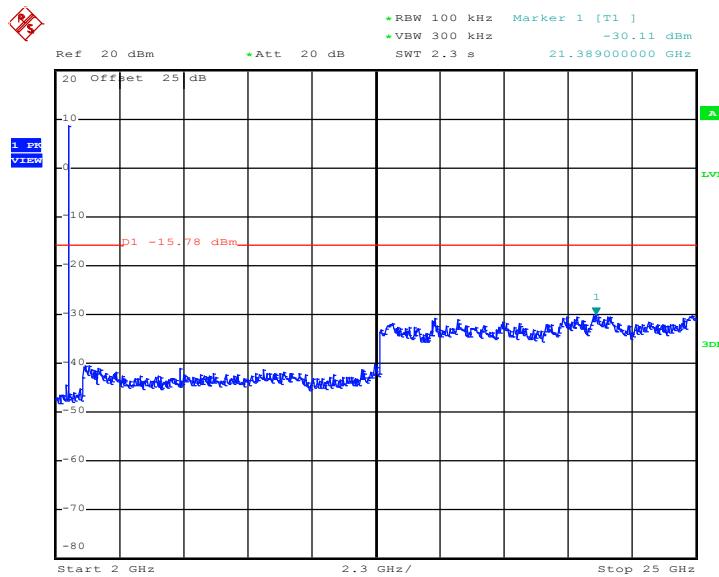


Date: 1.NOV.2012 21:27:07

Note:

The total loss is 24.4dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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



Date: 1.NOV.2012 21:27:25

Note:

The total loss is 25dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

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. 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 and ANSI C63.4-2003 test site requirement.
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= 3MHz 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(us)	1/T(KHz)	VBW Setting
Bluetooth 4.0 - LE	70.41	442.308	2.26	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 :

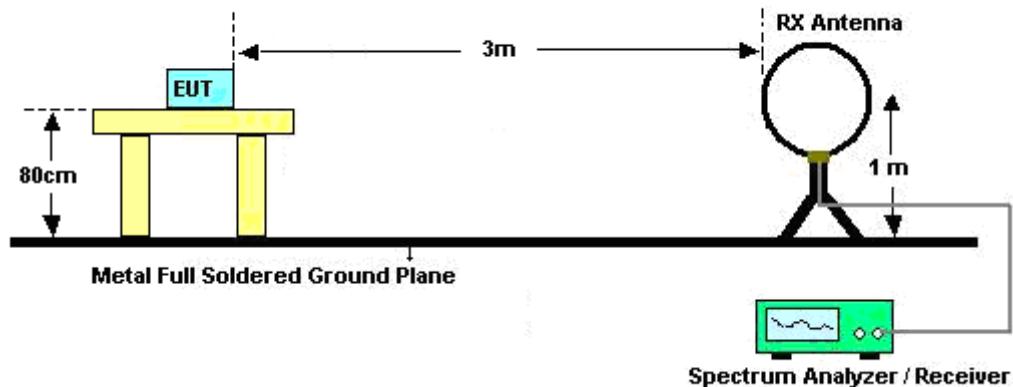
(1) Set RBW = 1 MHz, VBW = 3 MHz, peak detector.
Repeat the measurement with an average detector, use RBW = 1MHz
VBW = 10 Hz, when duty cycle is no less than 98 percent.
VBW $\geq 1/T$, when duty cycle is less than 98 percent

(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.

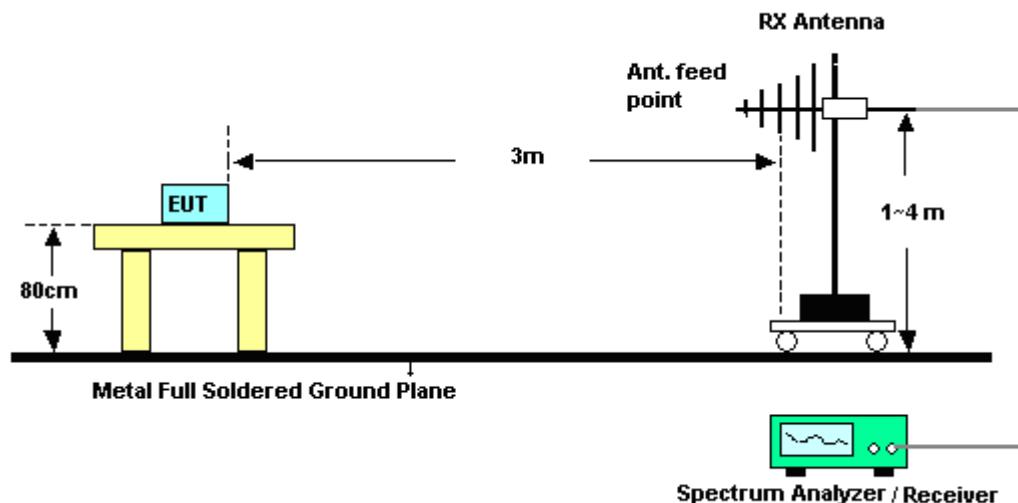
(3) Subtract the delta measured in step (2) from the field strengths measured in step (1).
The resultant field strengths (peak/average) are then used to determine band-edge compliance as required by Section 15.205.

3.5.4 Test Setup

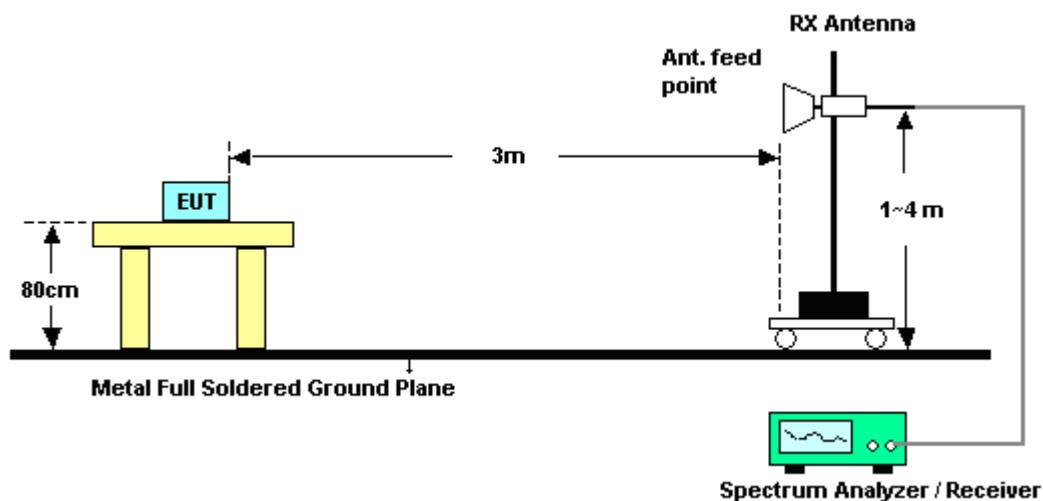
For radiated emissions below 30MHz



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 Band :	Low			Relative Humidity :		54~55%		
Test Channel :	00			Test Engineer :		Gavin Wu		

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2355	52.75	-21.25	74	48.48	32.26	5.95	33.94	148	24	Peak
2354.91	35.48	-18.52	54	31.21	32.26	5.95	33.94	148	24	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2355.54	51.25	-22.75	74	46.98	32.26	5.95	33.94	100	32	Peak
2355.09	35.04	-18.96	54	30.77	32.26	5.95	33.94	100	32	Average



Test Mode :	Mode 3	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	54~55%
Test Channel :	39	Test Engineer :	Gavin Wu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.52	63.29	-10.71	74	58.73	32.38	6.18	34	130	190	Peak
2483.5	60.24	*6.24	54	55.68	32.38	6.18	34	130	190	Average
2483.5	42.59	-31.41	74	-	-	-	-	-	-	Peak
2483.5	42.14	-11.86	54	-	-	-	-	-	-	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dB μ V/m)	Delta Result (dB)	Measurement Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Peak	101.67	59.08	42.59	74	-31.41	Pass
Average	101.22	59.08	42.14	54	-11.86	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 11.86dB.

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dB μ V/m)	Over Limit (dB)	Limit Line (dB μ V/m)	Read Level (dB μ V)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	60.56	-13.44	74	56	32.38	6.18	34	100	328	Peak
2483.5	57.17	*3.17	54	52.61	32.38	6.18	34	100	328	Average
2483.5	43.06	-30.94	74	-	-	-	-	-	-	Peak
2483.5	42.65	-11.35	54	-	-	-	-	-	-	Average

Summary results of marker-delta method:

Test mode	Maximum field strength of the fundamental emission (dB μ V/m)	Delta Result (dB)	Measurement Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
Peak	98.60	55.54	43.06	74	-30.94	Pass
Average	98.19	55.54	42.65	54	-11.35	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 11.35dB.

3.5.7 Test Result of Radiated Emission (30 MHz ~ 10th Harmonic)

Test Mode :	Mode 1	Temperature :	22~24°C
Test Channel :	00	Relative Humidity :	54~55%
Test Engineer :	Gavin Wu	Polarization :	Horizontal
Remark :	1. 2402 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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2402	101.55	-	-	97.18	32.3	6.03	33.96	148	24	Average
2402	101.67	-	-	97.3	32.3	6.03	33.96	148	24	Peak
4803	49.98	-4.02	54	64.36	33.98	9.11	57.47	102	117	Average
4803	52.83	-21.17	74	67.21	33.98	9.11	57.47	102	117	Peak

Test Mode :	Mode 1	Temperature :	22~24°C
Test Channel :	00	Relative Humidity :	54~55%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	1. 2402 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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2402	98.72	-	-	94.35	32.3	6.03	33.96	100	32	Average
2402	99.28	-	-	94.91	32.3	6.03	33.96	100	32	Peak
4803	46.53	-7.47	54	60.91	33.98	9.11	57.47	100	69	Average
4803	48.73	-25.27	74	63.11	33.98	9.11	57.47	100	69	Peak



Test Mode :	Mode 2		Temperature :		22~24°C				
Test Channel :	19		Relative Humidity :		54~55%				
Test Engineer :	Gavin Wu		Polarization :		Horizontal				
Remark :	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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2440	103.98	-	-	99.5	32.35	6.11	33.98	107	114	Average
2440	104.48	-	-	100	32.35	6.11	33.98	107	114	Peak
4881	50.21	-23.79	74	64.6	33.95	9.14	57.48	100	0	Peak

Test Mode :	Mode 2		Temperature :		22~24°C				
Test Channel :	19		Relative Humidity :		54~55%				
Test Engineer :	Gavin Wu		Polarization :		Vertical				
Remark :	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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2440	100.26	-	-	95.78	32.35	6.11	33.98	100	133	Average
2440	100.75	-	-	96.27	32.35	6.11	33.98	100	133	Peak
4881	44.69	-29.31	74	59.08	33.95	9.14	57.48	100	0	Peak



Test Mode :	Mode 3	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	54~55%
Test Engineer :	Gavin Wu	Polarization :	Horizontal
Remark :	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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
212.52	29.47	-14.03	43.5	49.48	9.98	1.37	31.36	-	-	Peak
267.33	33.08	-12.92	46	49.89	12.85	1.63	31.29	-	-	Peak
270.84	34.39	-11.61	46	51.17	12.89	1.64	31.31	110	181	Peak
357.4	32.39	-13.61	46	46.89	14.87	2.04	31.41	-	-	Peak
376.3	33.93	-12.07	46	47.79	15.37	2.09	31.32	-	-	Peak
480.6	32.43	-13.57	46	43.3	17.7	2.38	30.95	-	-	Peak
2480	101.17	-	-	96.61	32.38	6.18	34	130	190	Average
2480	101.54	-	-	96.98	32.38	6.18	34	130	190	Peak
4962	53.31	-0.69	54	67.73	33.91	9.16	57.49	100	228	Average
4962	54.58	-19.42	74	69	33.91	9.16	57.49	100	228	Peak



Test Mode :	Mode 3	Temperature :	22~24°C
Test Channel :	39	Relative Humidity :	54~55%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	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 (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
32.43	28.36	-11.64	40	41.83	17.84	0.56	31.87	101	225	Peak
206.58	27.55	-15.95	43.5	48.02	9.57	1.35	31.39	-	-	Peak
270.84	32.36	-13.64	46	49.14	12.89	1.64	31.31	-	-	Peak
328.7	26.34	-19.66	46	41.66	14.09	1.84	31.25	-	-	Peak
454	26.06	-19.94	46	37.78	17.13	2.31	31.16	-	-	Peak
473.6	30.86	-15.14	46	41.99	17.53	2.36	31.02	-	-	Peak
2480	98.01	-	-	93.45	32.38	6.18	34	100	328	Average
2480	98.39	-	-	93.83	32.38	6.18	34	100	328	Peak
4962	47.9	-26.1	74	62.32	33.91	9.16	57.49	100	0	Peak



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 (dBuV)	
	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.

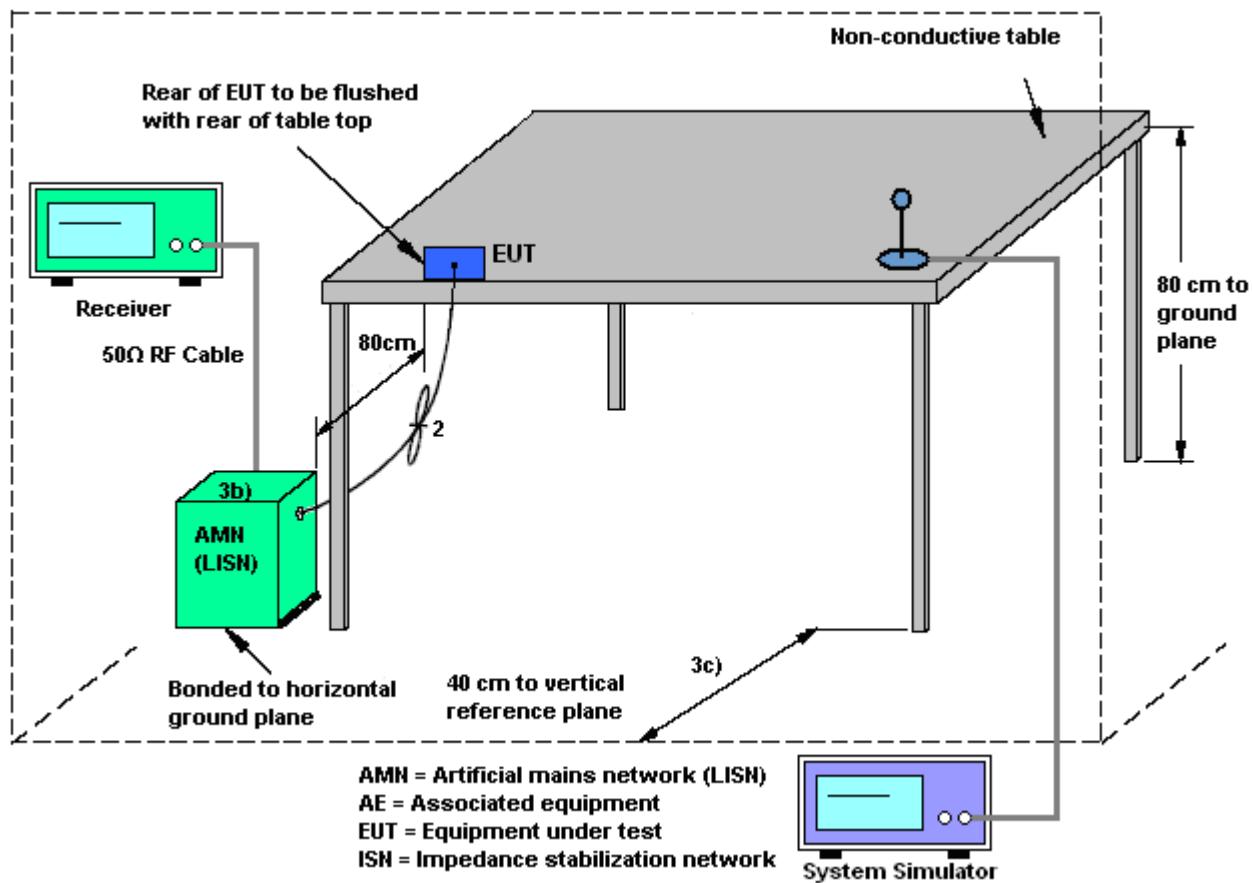
3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

3.6.3 Test Procedures

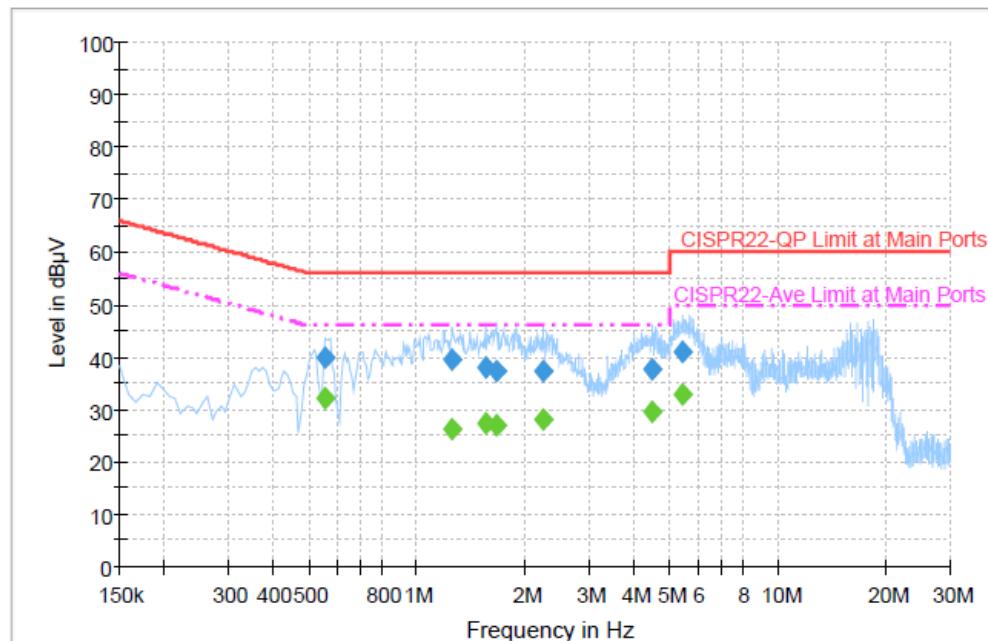
1. The testing follows the guidelines in ANSI C63.10-2009 and ANSI C63.4-2003 test site requirement.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a 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 :	GSM850 Idle + Bluetooth Link + WLAN Link + Camera + Earphone + Battery + USB Cable (Charging from Adapter)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result : Quasi-Peak

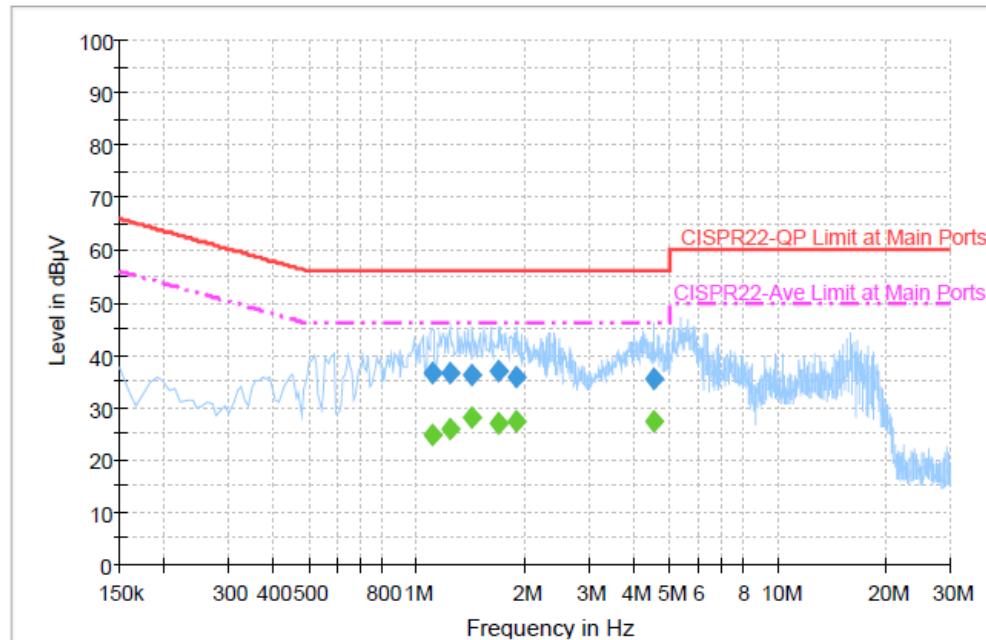
Frequency (MHz)	Quasi-Peak (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.558000	40.0	Off	L1	19.4	16.0	56.0
1.254000	39.4	Off	L1	19.4	16.6	56.0
1.542000	38.1	Off	L1	19.4	17.9	56.0
1.662000	37.4	Off	L1	19.4	18.6	56.0
2.230000	37.3	Off	L1	19.5	18.7	56.0
4.478000	37.8	Off	L1	19.5	18.2	56.0
5.414000	40.9	Off	L1	19.5	19.1	60.0

Final Result : Average

Frequency (MHz)	Average (dB μ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.558000	32.0	Off	L1	19.4	14.0	46.0
1.254000	26.1	Off	L1	19.4	19.9	46.0
1.542000	27.2	Off	L1	19.4	18.8	46.0
1.662000	27.1	Off	L1	19.4	18.9	46.0
2.230000	27.9	Off	L1	19.5	18.1	46.0
4.478000	29.4	Off	L1	19.5	16.6	46.0
5.414000	32.7	Off	L1	19.5	17.3	50.0



Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Camera + Earphone + Battery + USB Cable (Charging from Adapter)		
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)
1.102000	36.4	Off	N	19.5	19.6	56.0
1.230000	36.4	Off	N	19.5	19.6	56.0
1.422000	36.1	Off	N	19.5	19.9	56.0
1.678000	36.9	Off	N	19.5	19.1	56.0
1.886000	35.9	Off	N	19.5	20.1	56.0
4.526000	35.3	Off	N	19.5	20.7	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.102000	24.6	Off	N	19.5	21.4	46.0
1.230000	25.8	Off	N	19.5	20.2	46.0
1.422000	27.9	Off	N	19.5	18.1	46.0
1.678000	26.8	Off	N	19.5	19.2	46.0
1.886000	27.4	Off	N	19.5	18.6	46.0
4.526000	27.3	Off	N	19.5	18.7	46.0



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	Nov. 01, 2012 ~ Nov. 27, 2012	Jun. 05, 2013	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Sep. 08, 2012	Nov. 01, 2012 ~ Nov. 27, 2012	Sep. 07, 2013	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Sep. 08, 2012	Nov. 01, 2012 ~ Nov. 27, 2012	Sep. 07, 2013	Conducted (TH02-HY)
EMI Test Receiver	R&S	ESCI 7	100724	9kHz~7GHz	Sep. 03, 2012	Nov. 17, 2012	Sep. 02, 2013	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz ~ 30MHz	Dec. 09, 2011	Nov. 17, 2012	Dec. 08, 2012	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz ~ 30MHz	Dec. 06, 2011	Nov. 17, 2012	Dec. 05, 2012	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Nov. 17, 2012	N/A	Conduction (CO05-HY)
System Simulator	R&S	CMU200	117995	N/A	Jul. 28, 2011	Nov. 17, 2012	Jul. 27, 2013	Conduction (CO05-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Oct. 06, 2012	Nov. 29, 2012	Oct. 05, 2013	Radiation (03CH07-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9KHz ~ 30GHz	Dec. 06, 2011	Nov. 29, 2012	Dec. 05, 2012	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 22, 2012	Nov. 29, 2012	Aug. 21, 2013	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A023 62	1GHz ~ 26.5GHz	Dec. 05, 2011	Nov. 29, 2012	Dec. 04, 2012	Radiation (03CH07-HY)
Pre Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	159088	1GHz ~ 18GHz	Mar. 10, 2012	Nov. 29, 2012	Mar. 09, 2013	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32 dB.GAIN	Feb. 27, 2012	Nov. 29, 2012	Feb. 26, 2013	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 03, 2012	Nov. 29, 2012	Sep. 02, 2013	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170 251	BBHA9170 251	15GHz ~ 40GHz	Sep. 28, 2012	Nov. 29, 2012	Sep. 27, 2013	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9KHz ~ 30MHz	Jul. 03, 2012	Nov. 29, 2012	Jul. 02, 2014	Radiation (03CH07-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	2.26
---	------

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	2.54
---	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$)	4.72
---	------



Appendix A. Photographs of EUT

Please refer to Sporton report number EP2N0915 as below.