

FCC RF Test Report

APPLICANT : Quanta Computer Inc.
EQUIPMENT : Clover Station 1.0
BRAND NAME : Clover
MODEL NUMBER : P100/C100
FCC ID : HFS-CS100
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Oct. 05, 2013 and testing was completed on Nov. 13, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown to be compliant 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 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

SPORTON INTERNATIONAL INC.

TEL : 886-3-327-3456

FAX : 886-3-328-4978

FCC ID : HFS-CS100

Page Number : 1 of 70

Report Issued Date : Nov. 26, 2013

Report Version : Rev. 01



TABLE OF CONTENTS

REVISION HISTORY	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Feature of Equipment Under Test	5
1.4 Product Specification of Equipment Under Test	6
1.5 Modification of EUT	6
1.6 Testing Site	6
1.7 Applied Standards	7
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	8
2.1 Descriptions of Test Mode	8
2.2 Test Mode	9
2.3 Connection Diagram of Test System	10
2.4 Support Unit used in test configuration and system	11
2.5 EUT Operation Test Setup	11
2.6 Measurement Results Explanation Example	12
3 TEST RESULT	13
3.1 Number of Channel Measurement	13
3.2 Hopping Channel Separation Measurement	15
3.3 Dwell Time Measurement	22
3.4 20dB Bandwidth Measurement	25
3.5 Peak Output Power Measurement	32
3.6 Conducted Band Edges Measurement	34
3.7 Conducted Spurious Emission Measurement	41
3.8 Radiated Band Edges and Spurious Emission Measurement	51
3.9 AC Conducted Emission Measurement	62
3.10 Antenna Requirements	68
4 LIST OF MEASURING EQUIPMENT	69
5 UNCERTAINTY OF EVALUATION	70
APPENDIX A. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR3O0501-01A	Rev. 01	Initial issue of report	Nov. 26, 2013

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	RSS-210 A8.4(2)	Number of Channels	$\geq 15\text{Chs}$	Pass	-
3.2	15.247(a)(1)	RSS-210 A8.1(b)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass	-
3.3	15.247(a)(1)	RSS-210 A8.1(d)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	-
3.4	15.247(a)(1)	RSS-210 A8.1(a)	20dB Bandwidth	NA	Pass	-
3.5	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
3.6	15.247(d)	RSS-210 A8.5	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	RSS-210 A8.5	Conducted Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.8	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 2.71 dB at 2483.500 MHz
3.9	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 3.90 dB at 0.150 MHz
3.10	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Quanta Computer Inc.

211, Wen Hwa 2nd Rd., Kuei Shan, Tao Yuan 33377, Taiwan

1.2 Manufacturer

Quanta Computer Inc.

211, Wen Hwa 2nd Rd., Kuei Shan, Tao Yuan 33377, Taiwan

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Clover Station 1.0
Brand Name	Clover
Model Number	P100/C100
FCC ID	HFS-CS100
EUT supports Radios application	WLAN 11b/g/n (HT20), WLAN 11a/n (HT20/HT40) Bluetooth v3.0+EDR
HW Version	D
SW Version	S/W: shipping image: 148, factory image: 20E09.
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	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	Bluetooth BR(1Mbps) : 9.77 dBm (0.0095 W) Bluetooth EDR (2Mbps) : 8.61 dBm (0.0073 W) Bluetooth EDR (3Mbps) : 8.98 dBm (0.0079 W)
Antenna Type	PCB Antenna type with gain 3.12 dBi
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Site

Test Site	SPORTON INTERNATIONAL INC.			
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
Test Site No.	Sporton Site No.			FCC/IC Registration No.
	TH02-HY	CO05-HY	03CH07-HY	722060/4086B-1

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

1.7 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 Public Notice DA 00-705
- ♦ ANSI C63.4-2003

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.

2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Preliminary tests were performed in different data rates and recorded the RF output power in the following table:

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	$\pi/4$ -DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	9.37 dBm	8.31 dBm	8.74 dBm
Ch39	2441MHz	9.77 dBm	8.51 dBm	8.96 dBm
Ch78	2480MHz	9.69 dBm	8.61 dBm	8.98 dBm

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
 2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.
- a. The EUT has been associated with peripherals 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, and different data rates were conducted to determine the final configuration (Y plane as worst plane) from all possible combinations, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

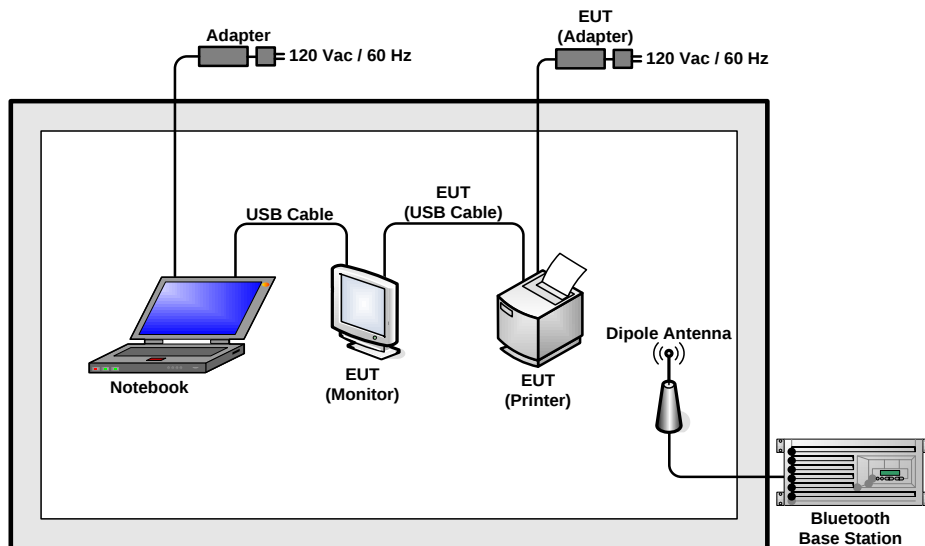
2.2 Test Mode

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

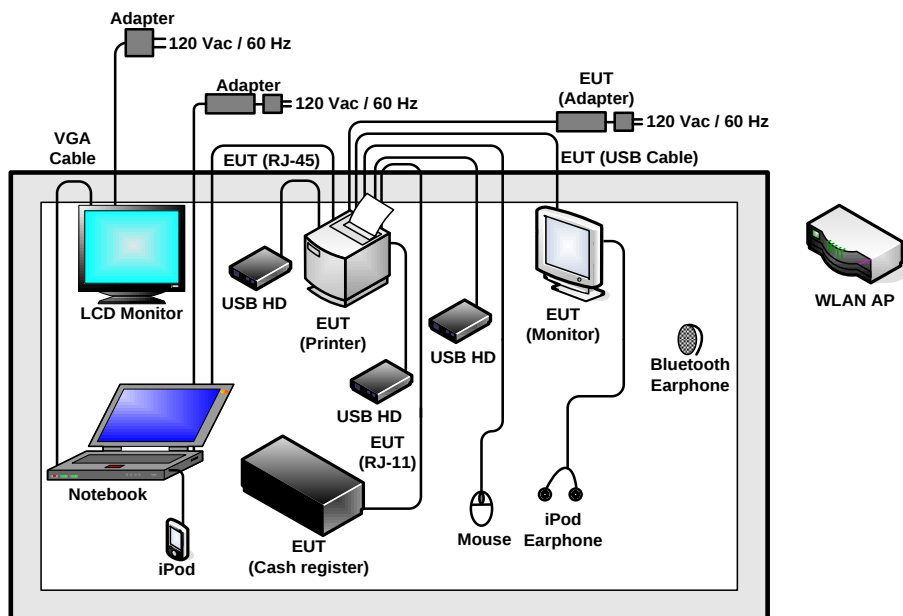
Summary table of Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted Test Cases	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz
Radiated Test Cases	Bluetooth BR 1Mbps GFSK		
	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz		
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + TC + Print + Adapter 1		
Remark:			
1. For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and the conducted spurious emissions and conducted band edge measurement for each data rate are no worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.			
2. TC stands for Test Configuration, and consists of Mouse, USB HD(Load), iPod Earphone, RJ-45 Link, and RJ-11(Load with cash register).			

2.3 Connection Diagram of Test System

<Bluetooth 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.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
3.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
4.	USB HD	WD	WDBAAR3200ABK-PESN	FCC DoC	Unshielded, 0.5 m	N/A
5.	(USB) Mouse	Genius	Traveier 515 Laser	FCC DoC	Shielded, 1.3 m	N/A
6.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.2 m	N/A
7.	Notebook	DELL	Latitude E6320	FCC DoC	Unshielded, 3.0 m	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
8.	Notebook	DELL	P20G	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
9.	Notebook	DELL	Vostro 1510	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
10.	iPod	Apple	A1285	FCC DoC	Unshielded, 1.0 m	N/A
11.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m

2.5 EUT Operation Test Setup

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.



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.

Example:

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.

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

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

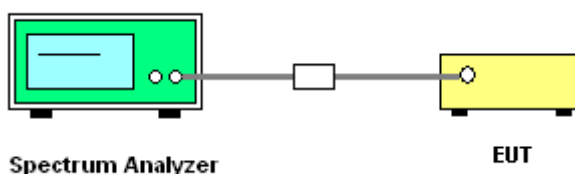
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

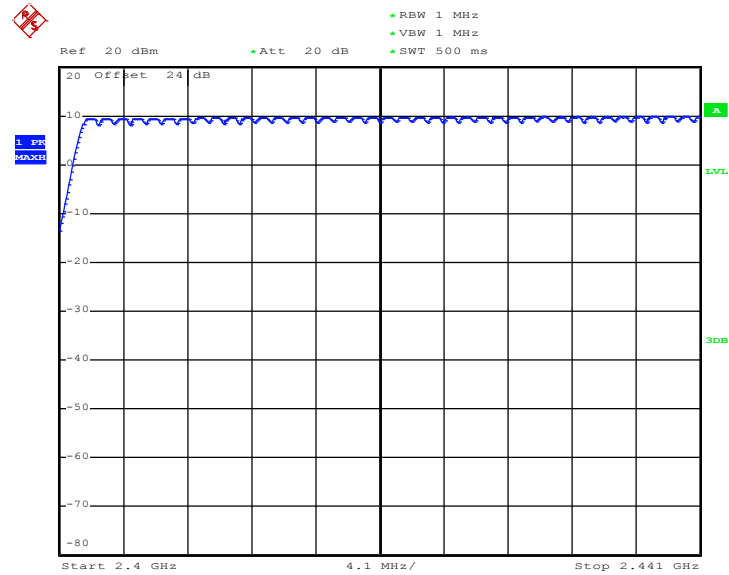
1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW $\geq$ 1% of the span; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup

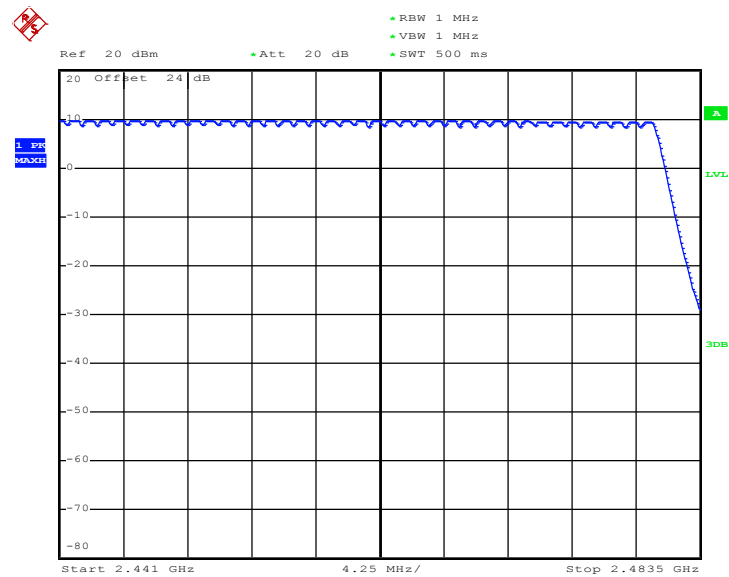


3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%
Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass

Number of Hopping Channel Plot on Channel 00 - 78


Date: 21.OCT.2013 10:31:08



Date: 21.OCT.2013 10:36:27

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

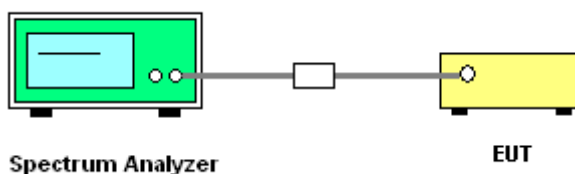
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels; $RBW \geq 1\%$ of the span;
 $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup

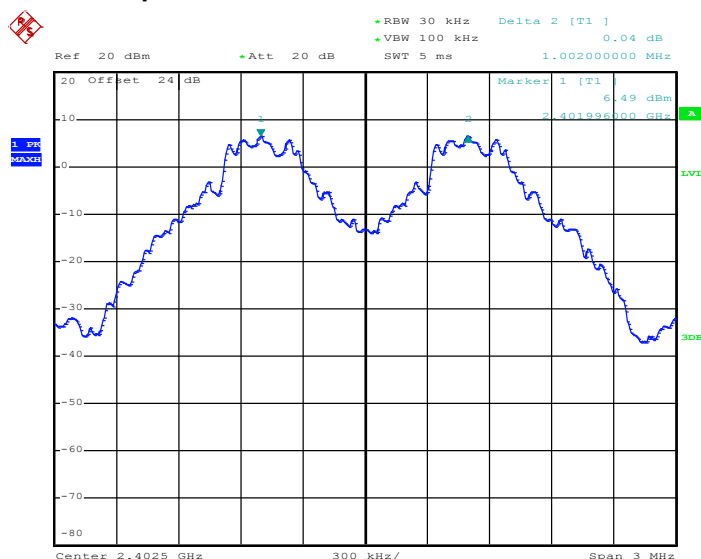


3.2.5 Test Result of Hopping Channel Separation

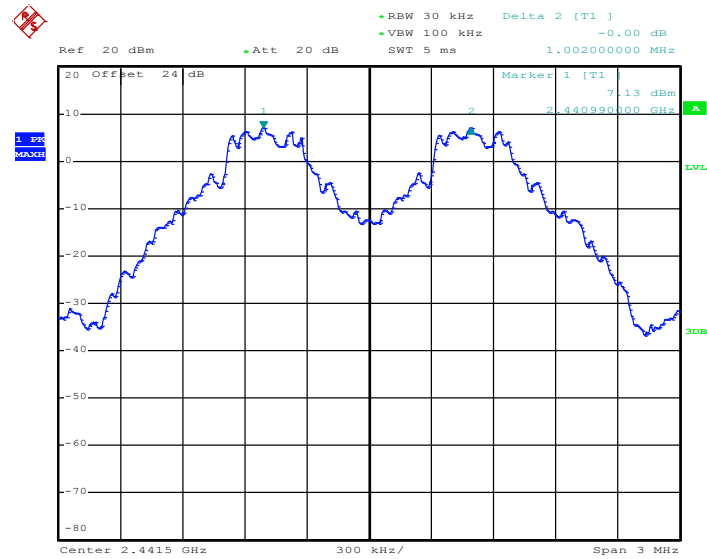
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.6027	Pass
39	2441	1.002	0.6027	Pass
78	2480	1.002	0.6027	Pass

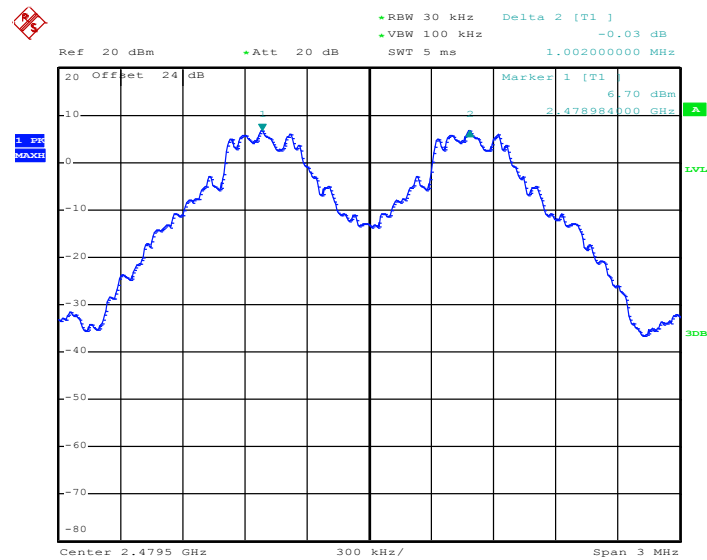
Channel Separation Plot on Channel 00 - 01



Date: 21.OCT.2013 10:02:18

Channel Separation Plot on Channel 39 - 40


Date: 21.OCT.2013 10:03:02

Channel Separation Plot on Channel 77 - 78


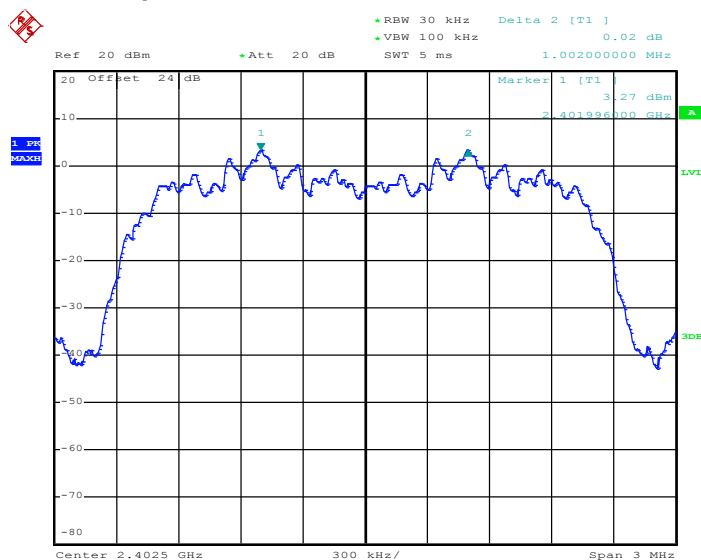
Date: 21.OCT.2013 10:05:44



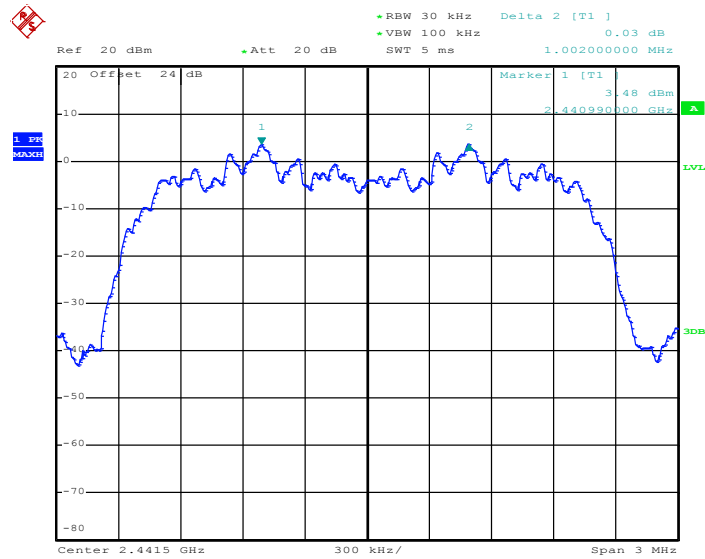
Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.8960	Pass
39	2441	1.002	0.8840	Pass
78	2480	1.002	0.8960	Pass

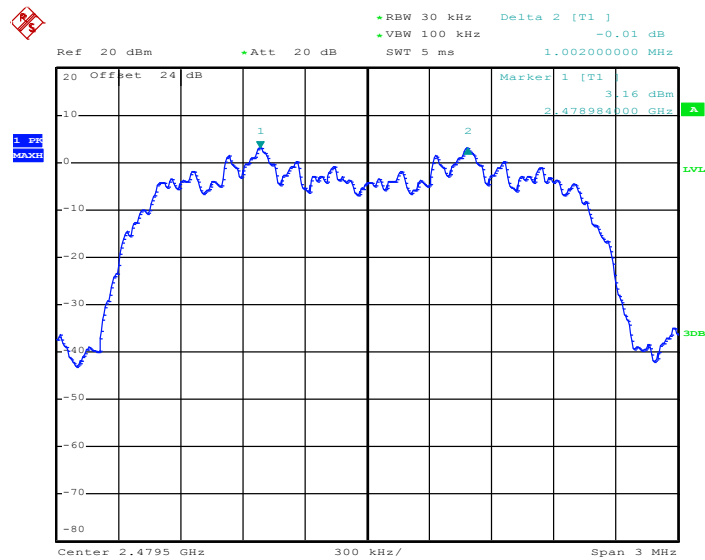
Channel Separation Plot on Channel 00 - 01



Date: 21.OCT.2013 10:07:40

Channel Separation Plot on Channel 39 - 40


Date: 21.OCT.2013 10:08:28

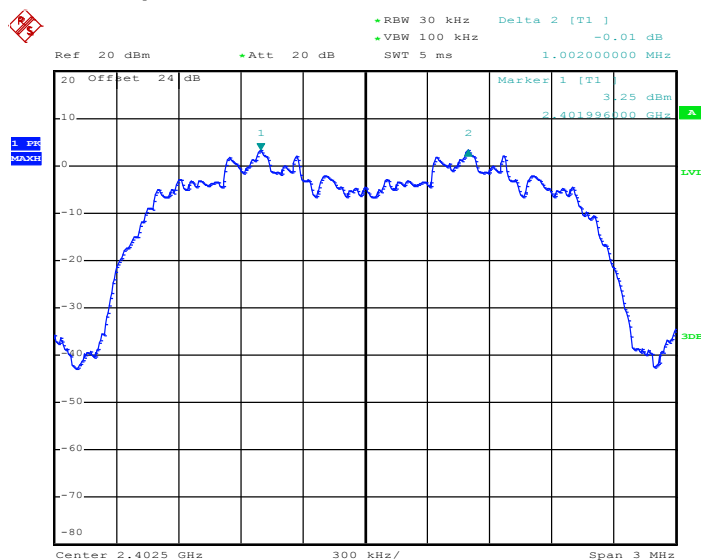
Channel Separation Plot on Channel 77 - 78


Date: 21.OCT.2013 10:10:41

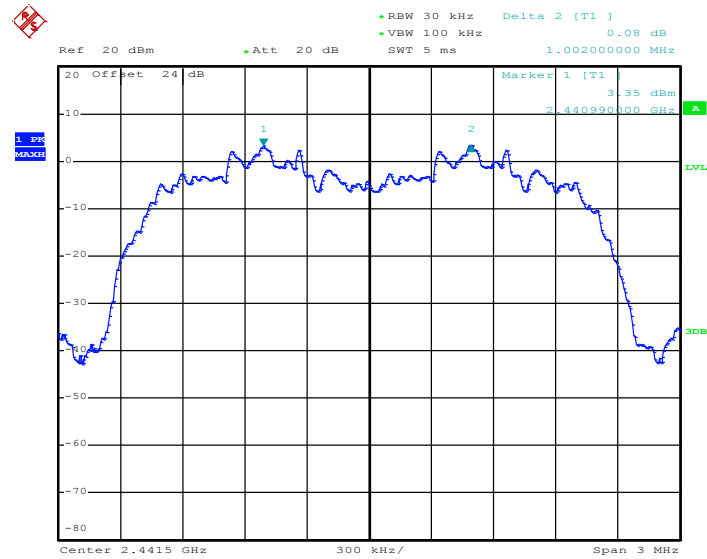


Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

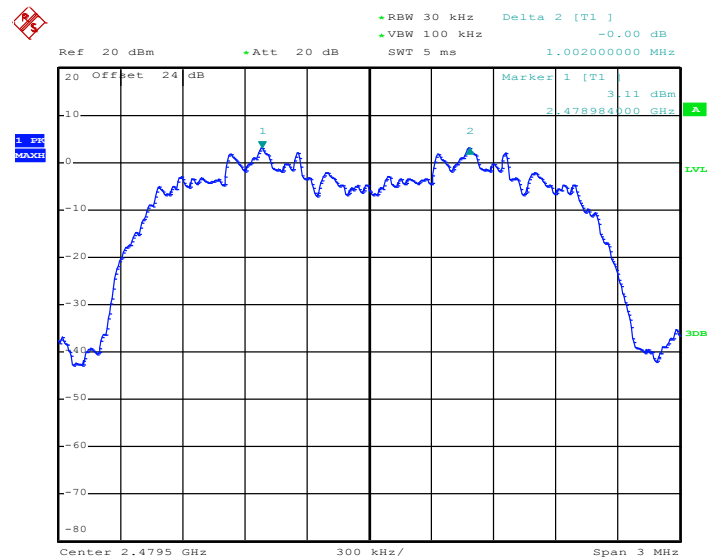
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.8560	Pass
39	2441	1.002	0.8560	Pass
78	2480	1.002	0.8560	Pass

Channel Separation Plot on Channel 00 - 01

Date: 21.OCT.2013 10:12:48

Channel Separation Plot on Channel 39 - 40


Date: 21.OCT.2013 10:13:27

Channel Separation Plot on Channel 77 - 78


Date: 21.OCT.2013 10:14:08

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

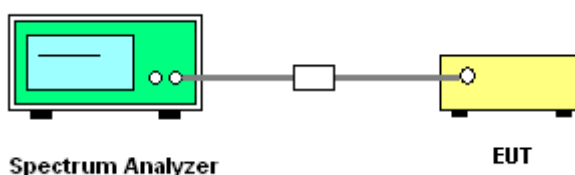
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW $\geq$ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Test Result of Dwell Time

Test Mode :	DH5	Temperature :	24~26℃
Test Engineer :	Book Lin	Relative Humidity :	50~53%

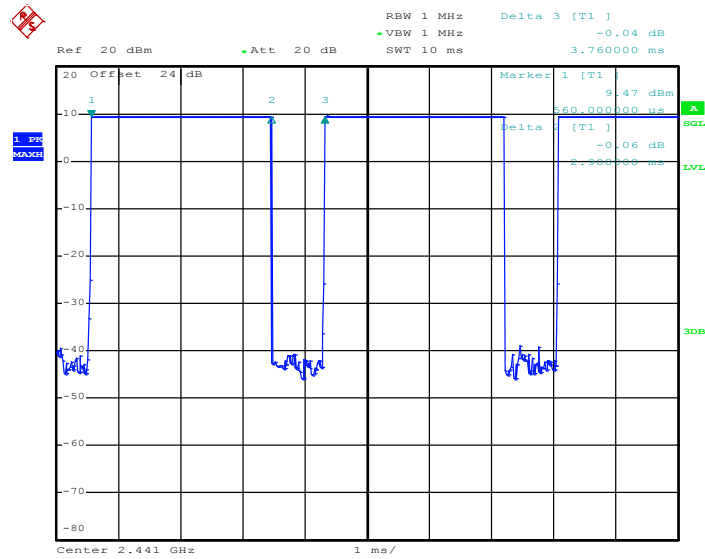
Mode	Hopping Channel Number	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Normal	79	106.67	2.90	0.31	0.4	Pass
AFH	20	53.33	2.90	0.15	0.4	Pass

Remark:

- In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.
With channel hopping rate $(1600 / 6 / 79)$ in Occupancy Time Limit (0.4×79) (s),
Hops Over Occupancy Time comes to $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$ hops.
- In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels.
With channel hopping rate $(800 / 6 / 20)$ in Occupancy Time Limit (0.4×20) (s),
Hops Over Occupancy Time comes to $(800 / 6 / 20) \times (0.4 \times 20) = 53.33$ hops.
- Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time



Package Transfer Time Plot



Date: 16.OCT.2013 15:10:30

3.4 20dB Bandwidth Measurement

3.4.1 Limit of 20dB Bandwidth

Reporting only

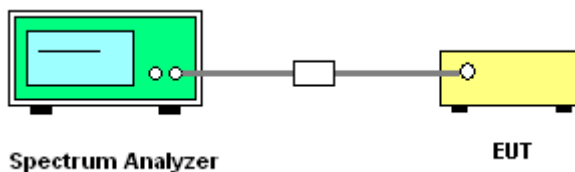
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
RBW $\geq$ 1% of the 20 dB bandwidth; VBW $\geq$ RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
5. Measure and record the results in the test report.

3.4.4 Test Setup

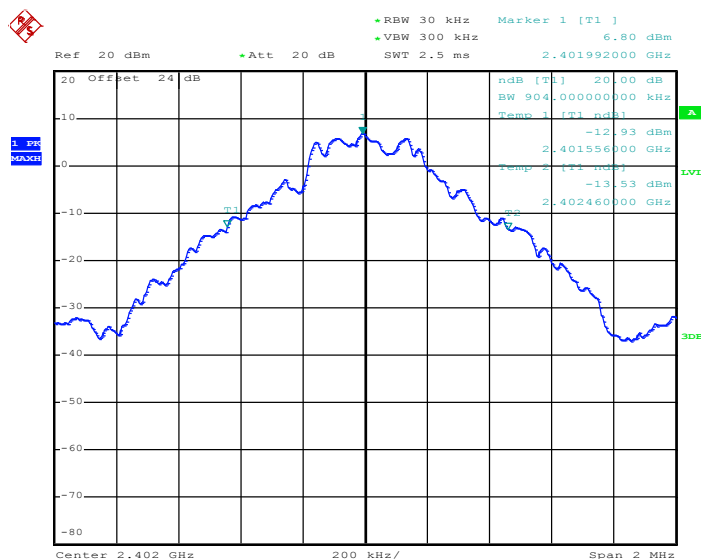


3.4.5 Test Result of 20dB Bandwidth

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.904
39	2441	0.904
78	2480	0.904

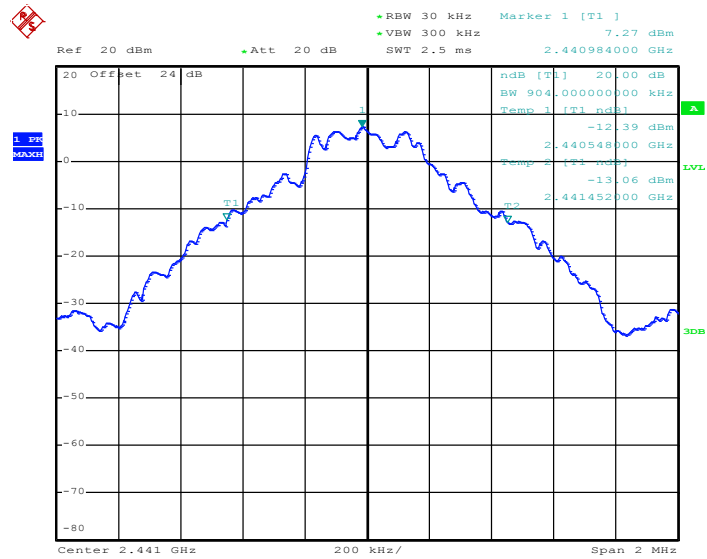
20 dB Bandwidth Plot on Channel 00



Date: 21.OCT.2013 10:14:44

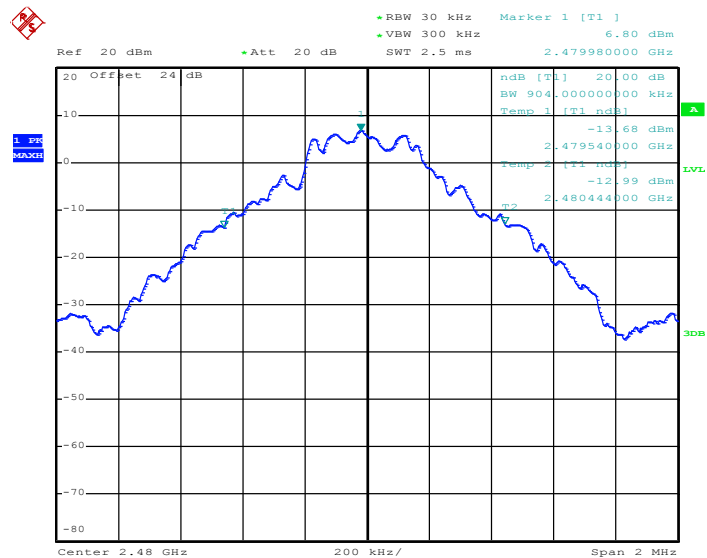


20 dB Bandwidth Plot on Channel 39



Date: 21.OCT.2013 10:15:14

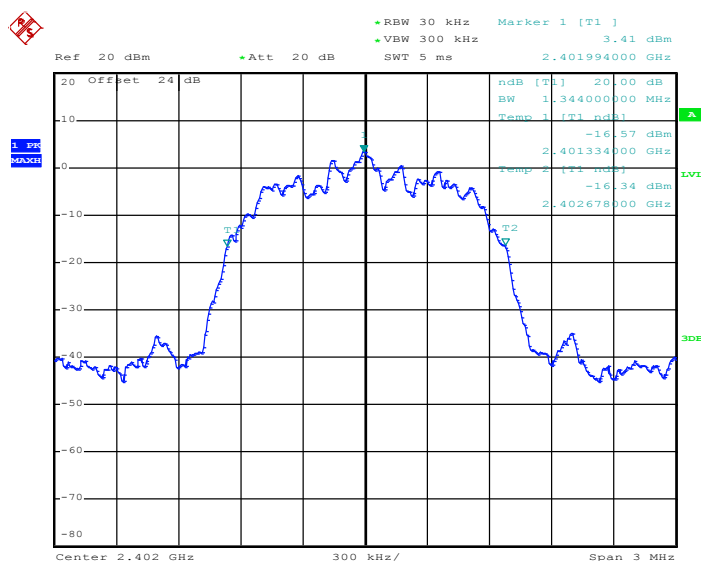
20 dB Bandwidth Plot on Channel 78



Date: 21.OCT.2013 10:16:16

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

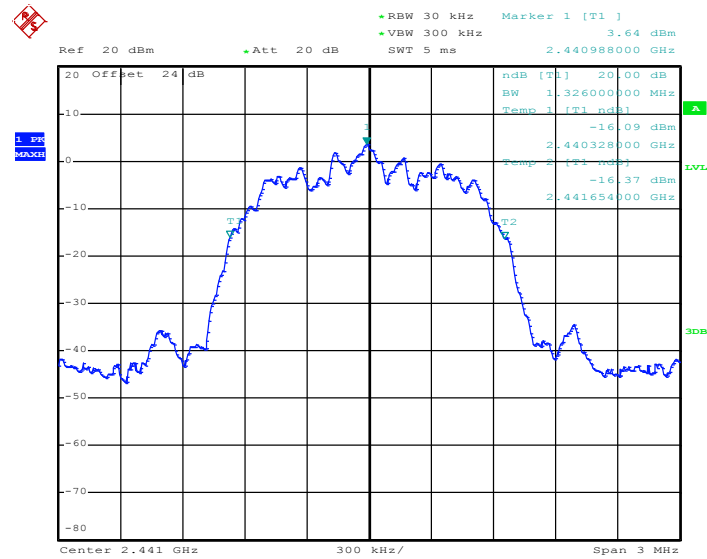
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.344
39	2441	1.326
78	2480	1.344

20 dB Bandwidth Plot on Channel 00


Date: 21.OCT.2013 10:17:28

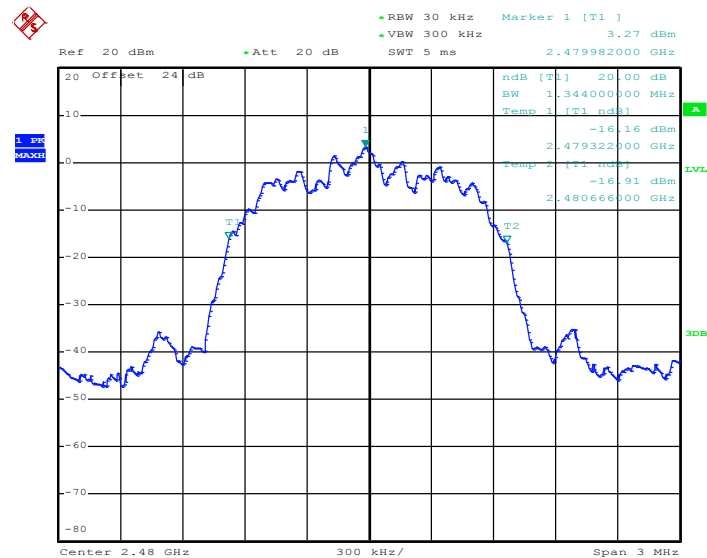


20 dB Bandwidth Plot on Channel 39



Date: 21.OCT.2013 10:18:09

20 dB Bandwidth Plot on Channel 78



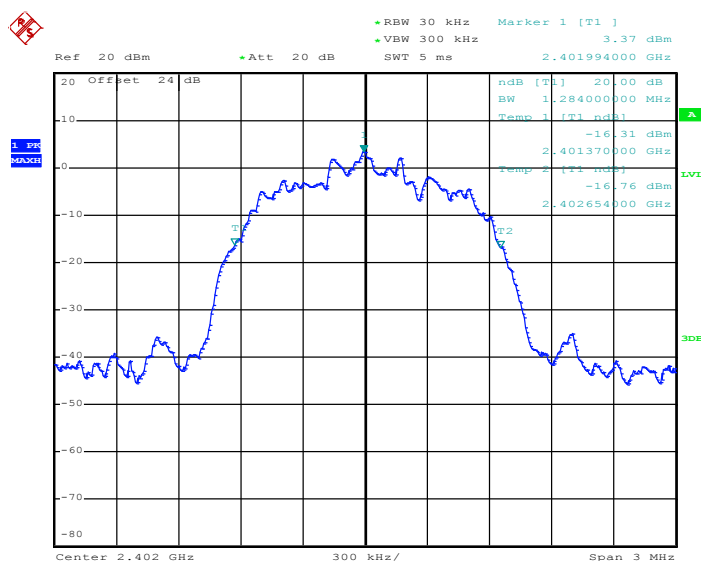
Date: 21.OCT.2013 10:19:04



Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

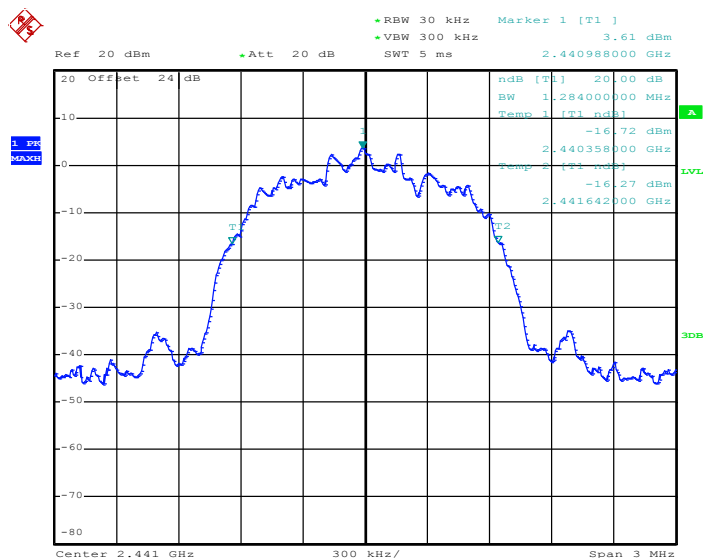
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.284
39	2441	1.284
78	2480	1.284

20 dB Bandwidth Plot on Channel 00



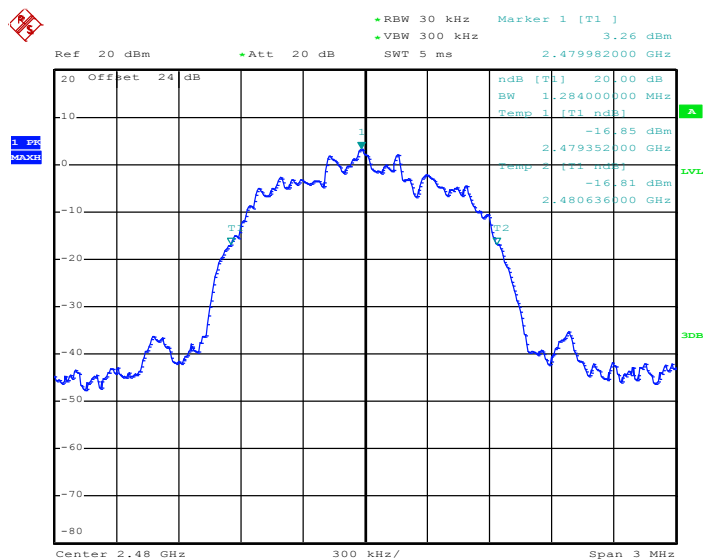
Date: 21.OCT.2013 10:19:46

20 dB Bandwidth Plot on Channel 39



Date: 21.OCT.2013 10:20:23

20 dB Bandwidth Plot on Channel 78



Date: 21.OCT.2013 10:21:00

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps is 1watt, and for 2Mbps, 3Mbps and AFH are 0.125 watts.

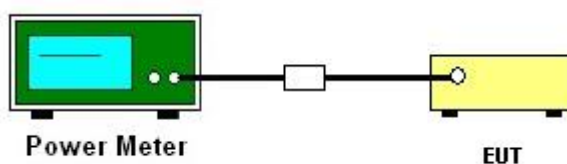
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	9.37	20.97	Pass
39	2441	9.77	20.97	Pass
78	2480	9.69	20.97	Pass

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 20.97dBm.

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		$\pi/4$ -DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	8.31	20.97	Pass
39	2441	8.51	20.97	Pass
78	2480	8.61	20.97	Pass

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	8.74	20.97	Pass
39	2441	8.96	20.97	Pass
78	2480	8.98	20.97	Pass

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

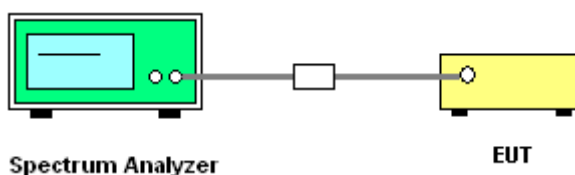
3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

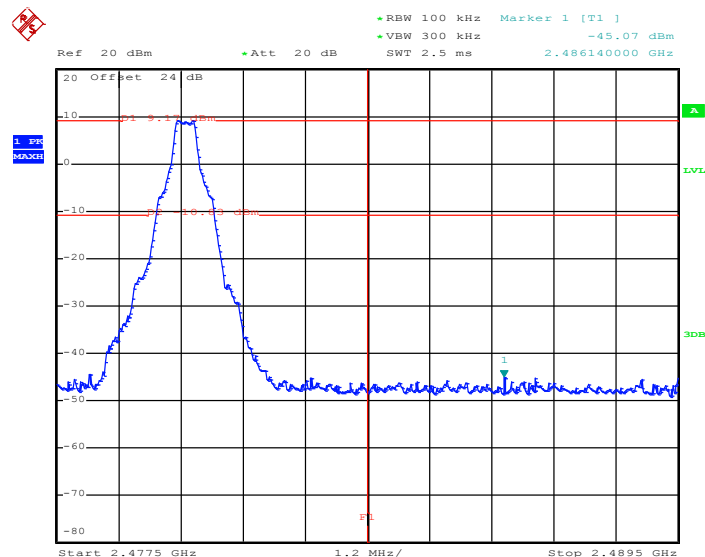
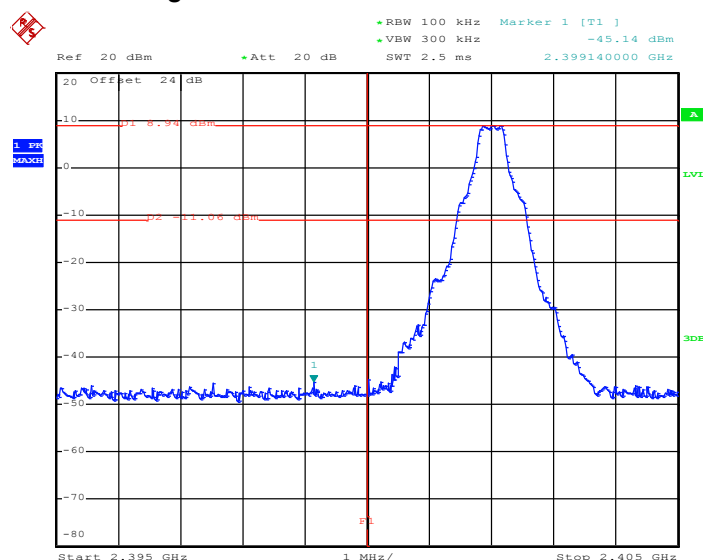
1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz ($\geq 1\%$ span=10MHz), VBW = 300kHz ($\geq$ RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

3.6.4 Test Setup





Test Mode :	1Mbps	Temperature :	24~26℃
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

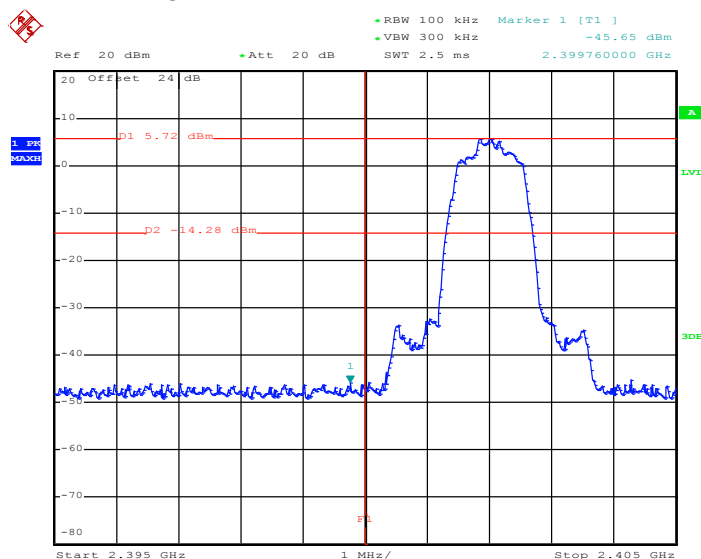


Date: 21.OCT.2013 10:52:33



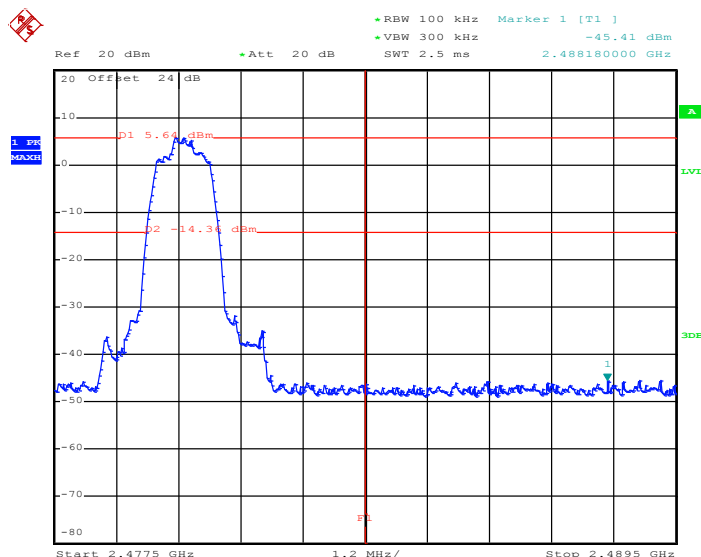
Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

Low Band Edge Plot on Channel 00



Date: 21.OCT.2013 10:42:10

High Band Edge Plot on Channel 78

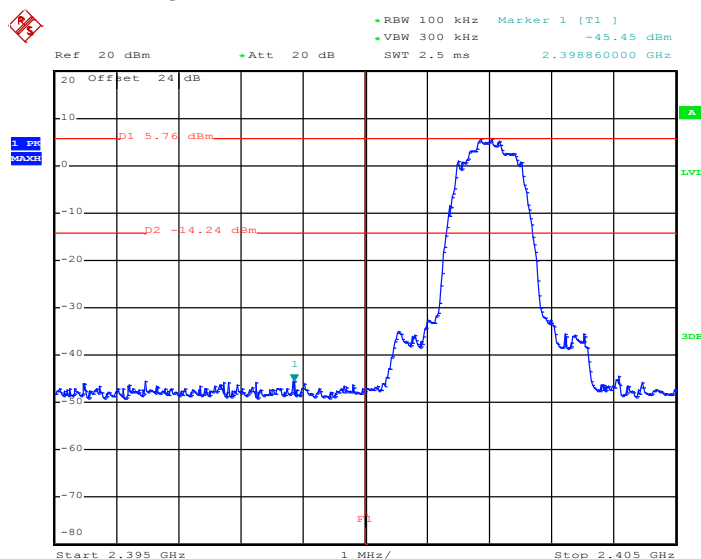


Date: 21.OCT.2013 10:50:08



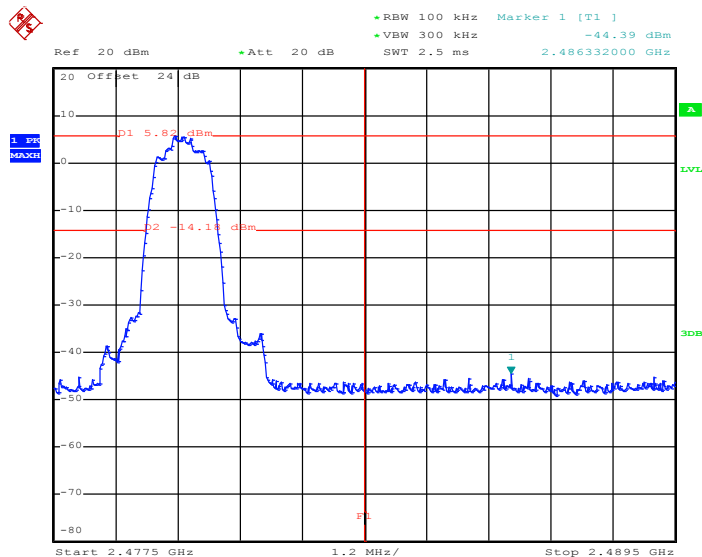
Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

Low Band Edge Plot on Channel 00



Date: 21.OCT.2013 10:44:18

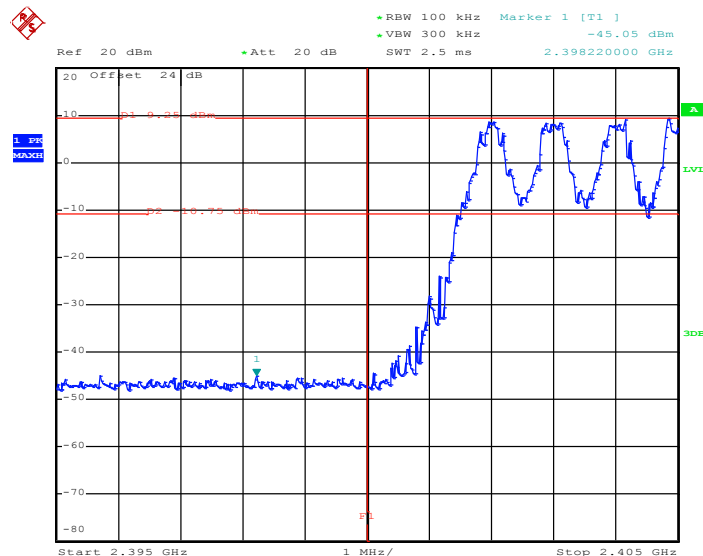
High Band Edge Plot on Channel 78



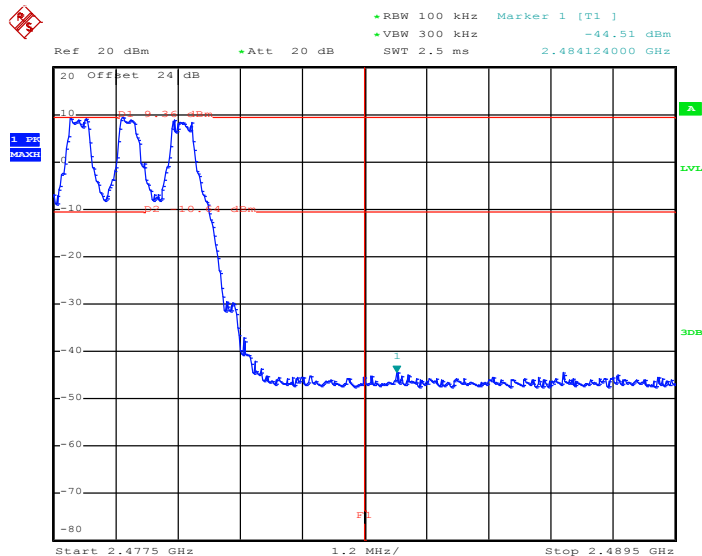
Date: 21.OCT.2013 10:47:56

3.6.7 Test Result of Conducted Hopping Mode Band Edges

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Book Lin	Relative Humidity :	50~53%

1Mbps Hopping Mode Low Band Edge Plot


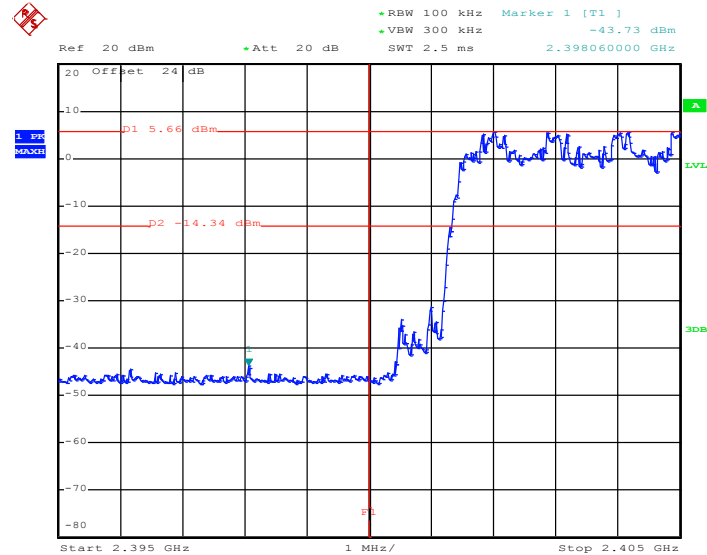
Date: 21.OCT.2013 10:38:13

1Mbps Hopping Mode High Band Edge Plot


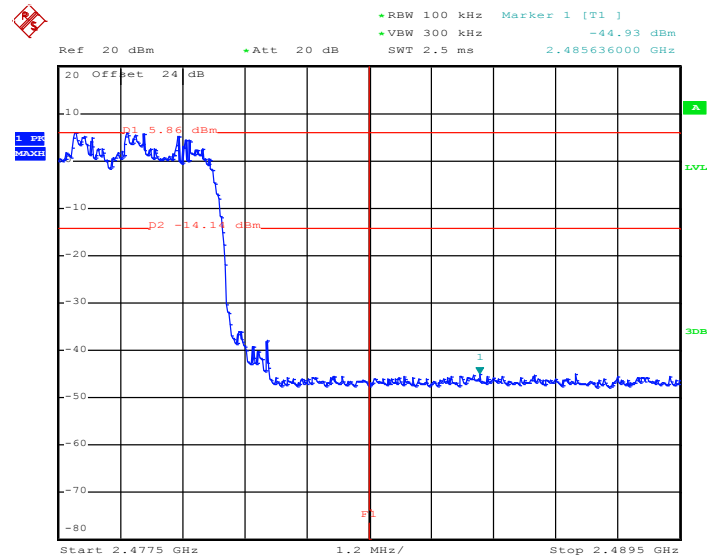
Date: 21.OCT.2013 10:52:13



Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

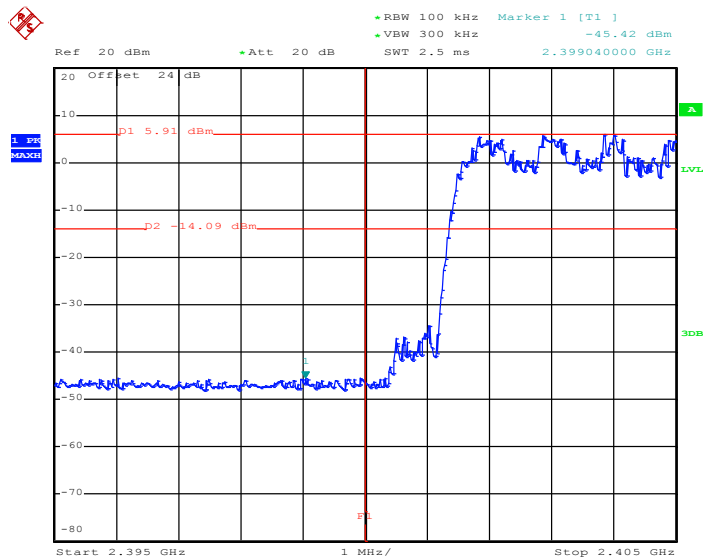
2Mbps Hopping Mode Low Band Edge Plot

Date: 21.OCT.2013 10:41:50

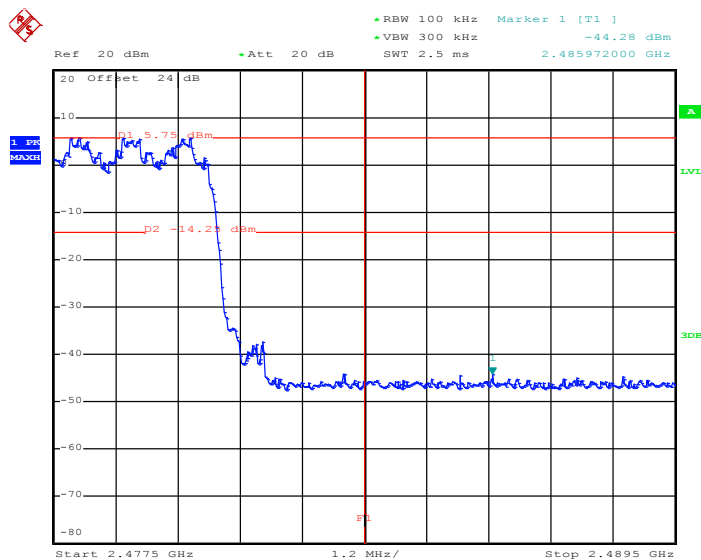
2Mbps Hopping Mode High Band Edge Plot

Date: 21.OCT.2013 10:49:49

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Book Lin	Relative Humidity :	50~53%

3Mbps Hopping Mode Low Band Edge Plot


Date: 21.OCT.2013 10:44:00

3Mbps Hopping Mode High Band Edge Plot


Date: 21.OCT.2013 10:47:35

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

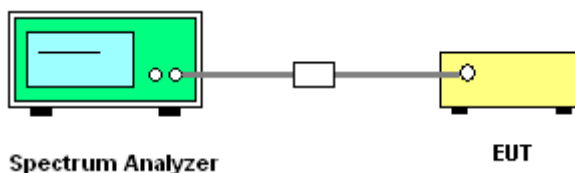
3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines
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 = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
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.

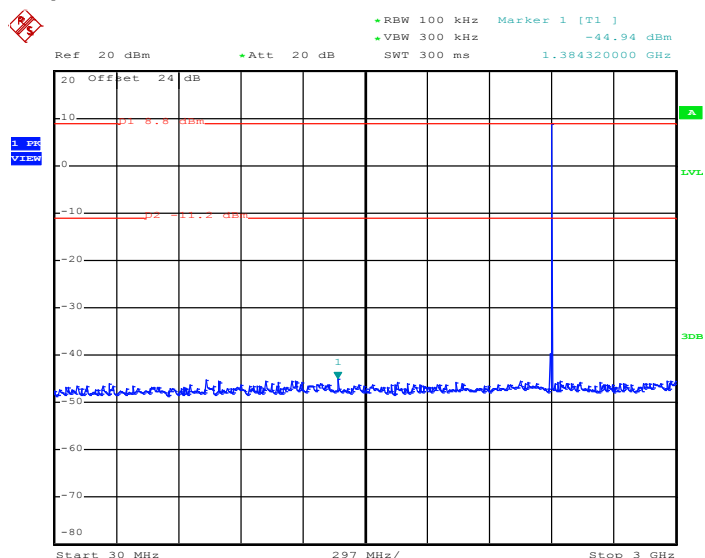
3.7.4 Test Setup



3.7.5 Test Result of Conducted Spurious Emission

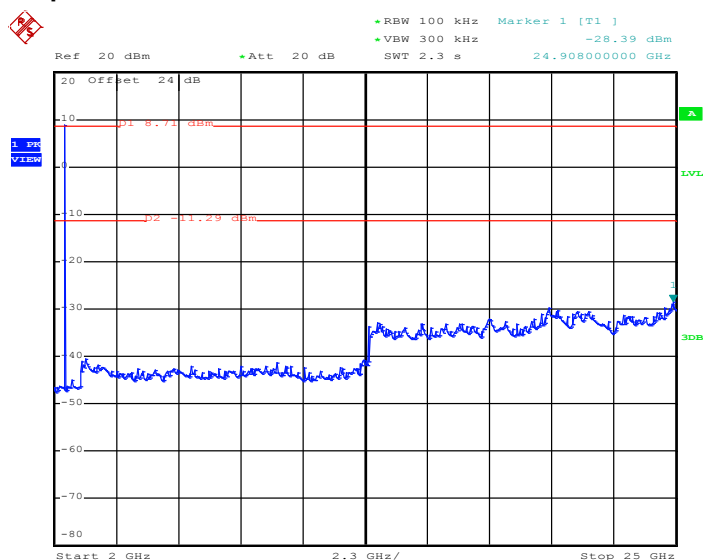
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

1Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 21.OCT.2013 10:53:04

1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

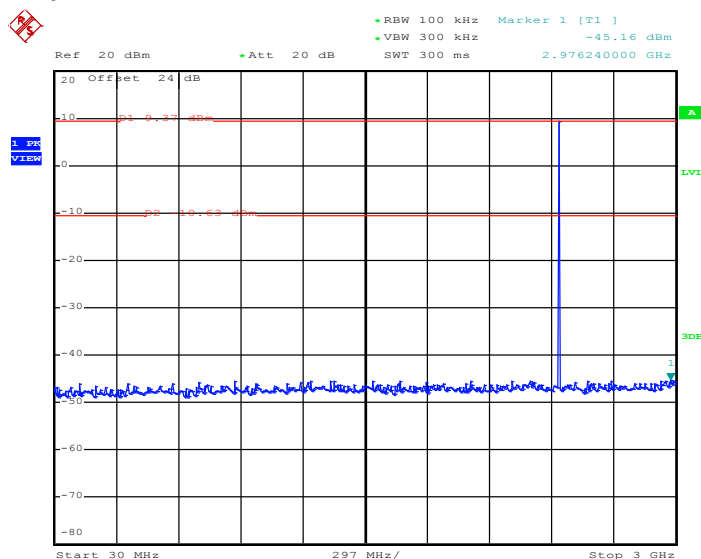


Date: 21.OCT.2013 10:53:26



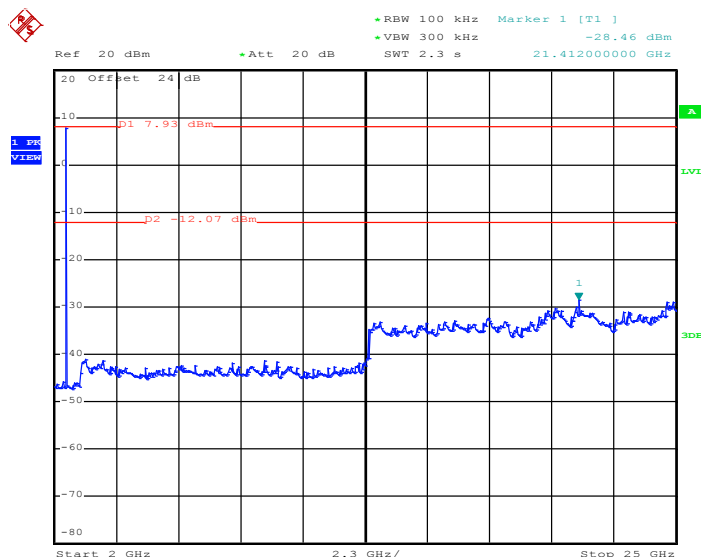
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

1Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz



Date: 21.OCT.2013 10:54:17

1Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



Date: 21.OCT.2013 10:54:39

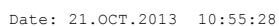


Report No. : FR3O0501-01A

1Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz



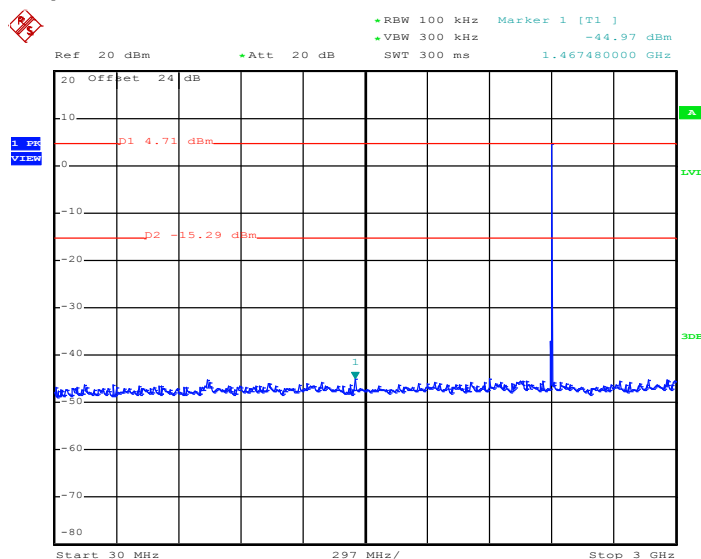
1Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz





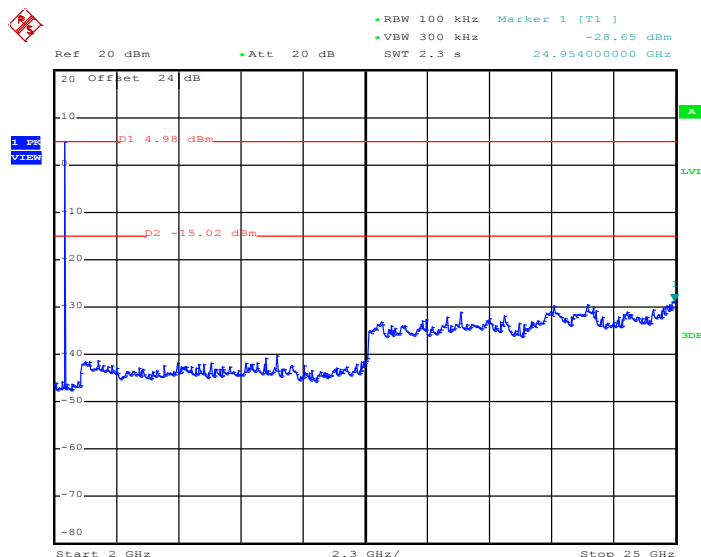
Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

2Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz



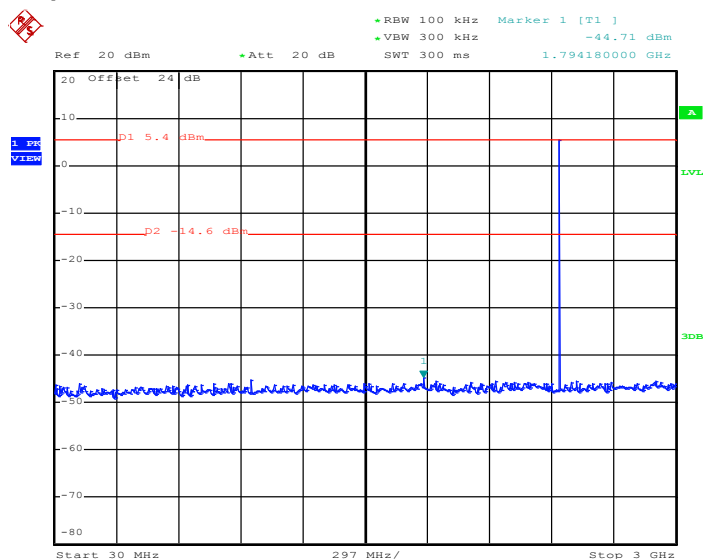
Date: 21.OCT.2013 10:58:24

2Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

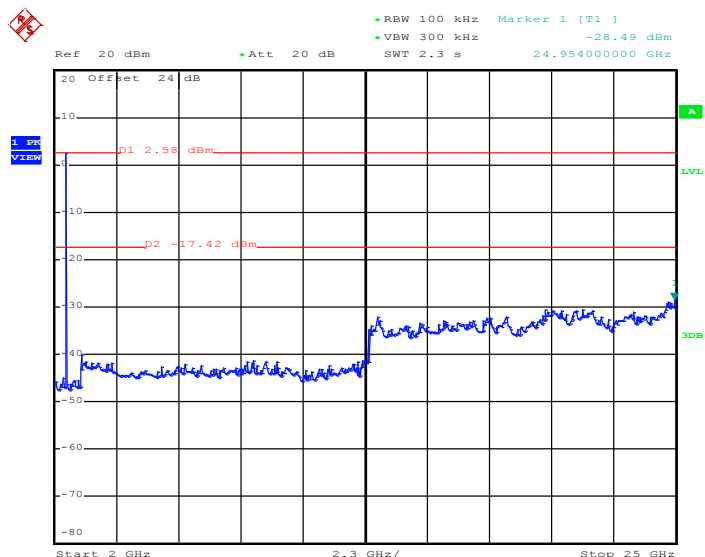


Date: 21.OCT.2013 10:58:46

Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

2Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz


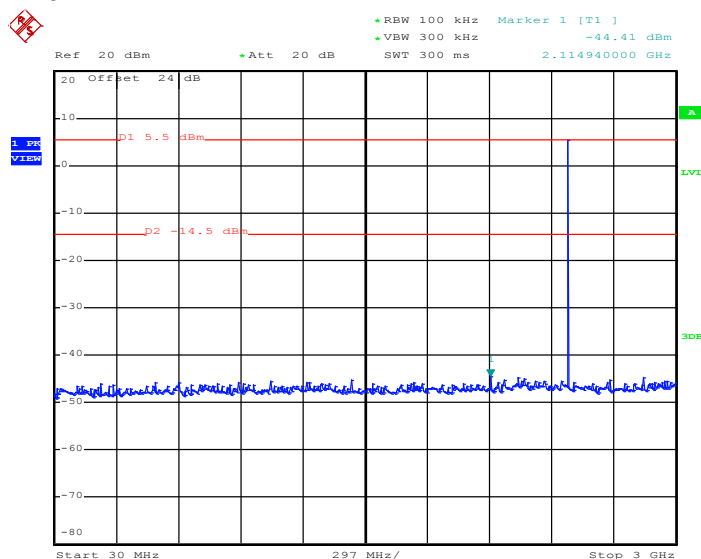
Date: 21.OCT.2013 10:57:30

2Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz


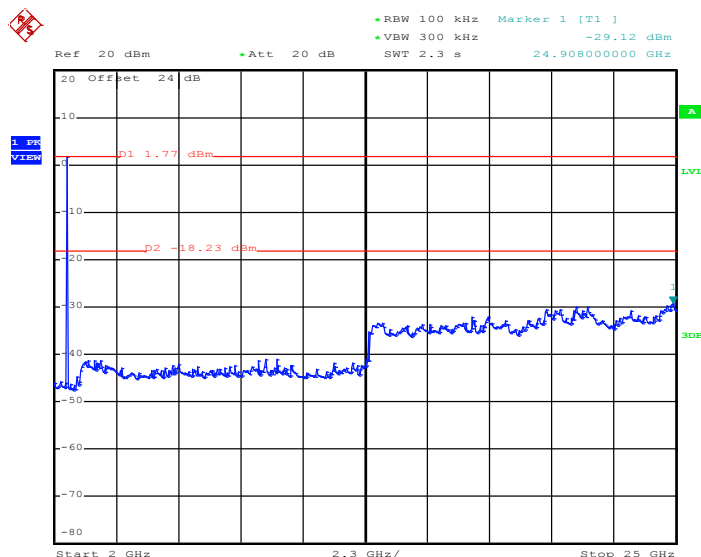
Date: 21.OCT.2013 10:57:52



Test Mode :	2Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

2Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 21.OCT.2013 10:56:40

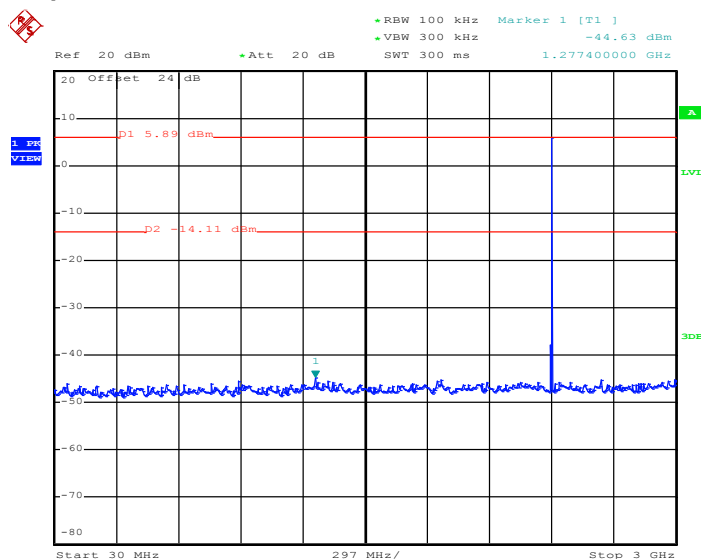
2Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

Date: 21.OCT.2013 10:57:02



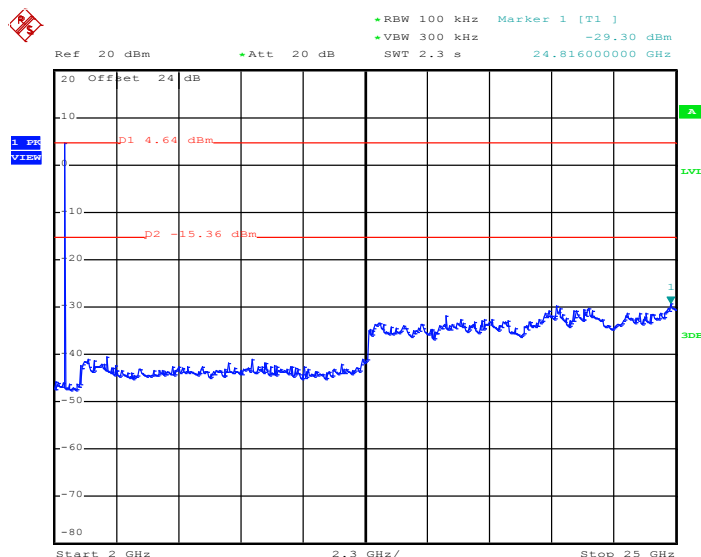
Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

3Mbps CSE Plot on Ch 00 between 30MHz ~ 3 GHz



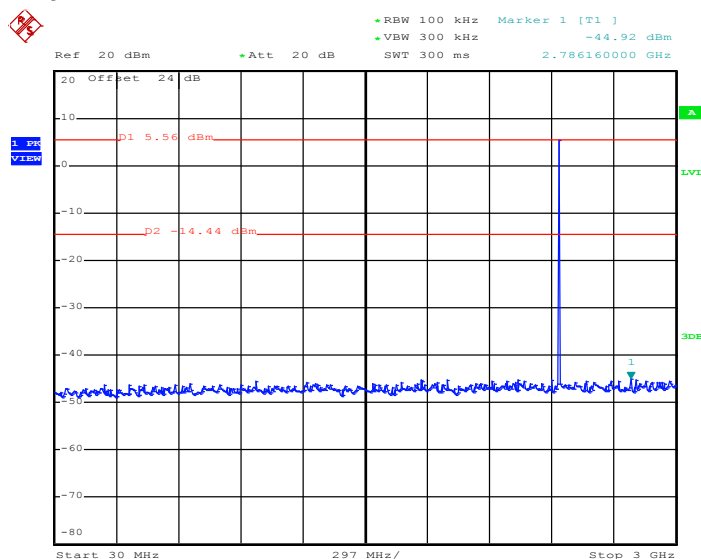
Date: 21.OCT.2013 10:59:18

3Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

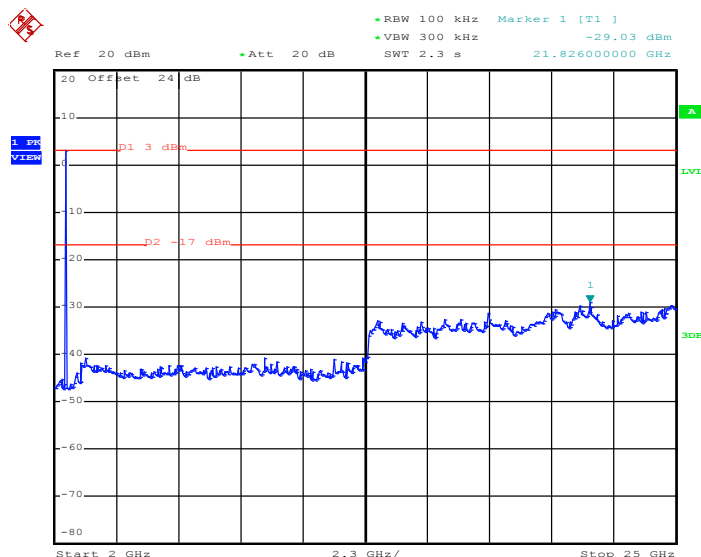


Date: 21.OCT.2013 10:59:40

Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

3Mbps CSE Plot on Ch 39 between 30MHz ~ 3 GHz


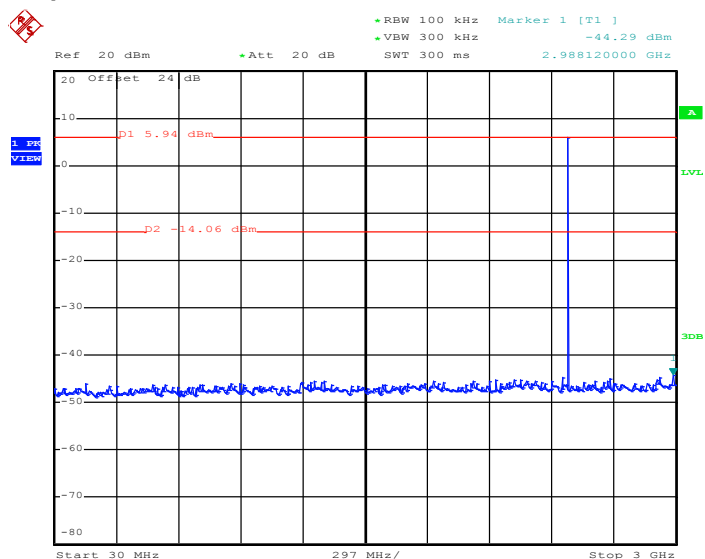
Date: 21.OCT.2013 11:00:35

3Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz


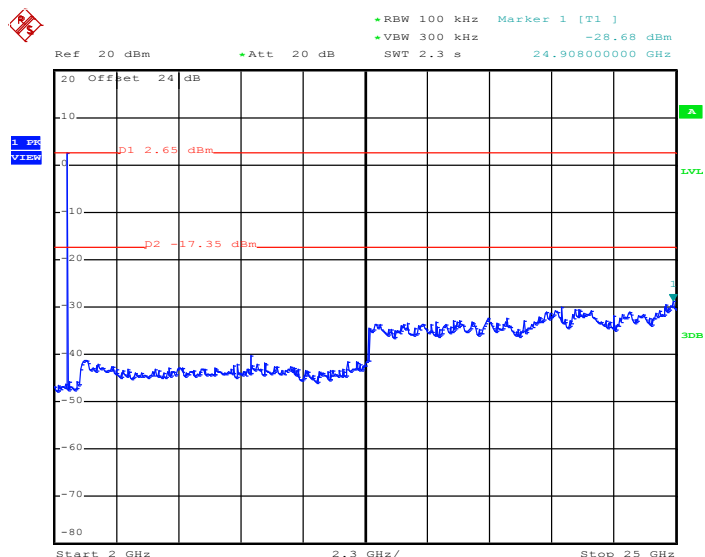
Date: 21.OCT.2013 11:00:57



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Book Lin

3Mbps CSE Plot on Ch 78 between 30MHz ~ 3 GHz

Date: 21.OCT.2013 11:01:40

3Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz

Date: 21.OCT.2013 11:02:01

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 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

3.8.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.8.3 Test Procedures

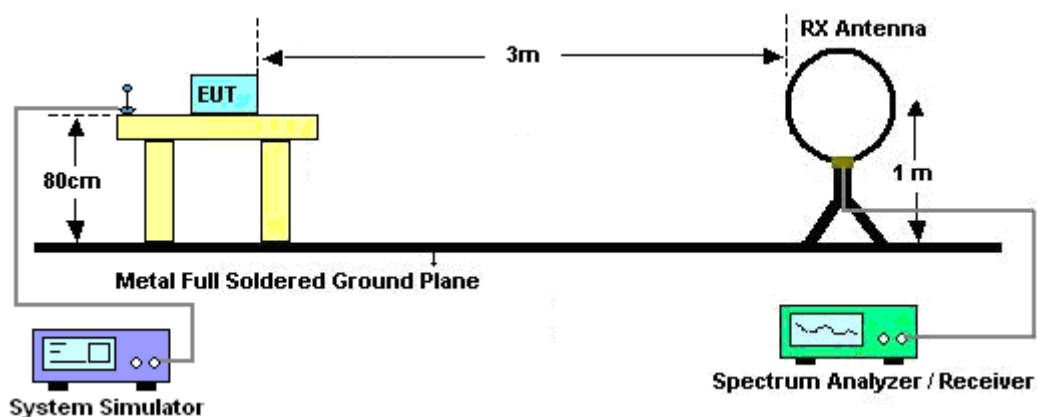
1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, 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 to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. 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, RBW=1MHz for $f > 1$ GHz ; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
$$\text{On time} = N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$$

Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

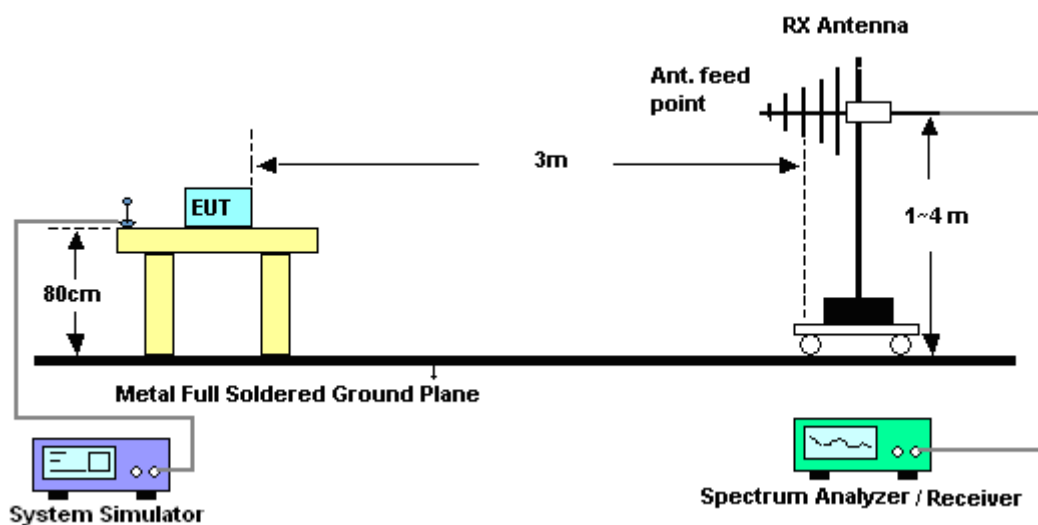
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.79dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

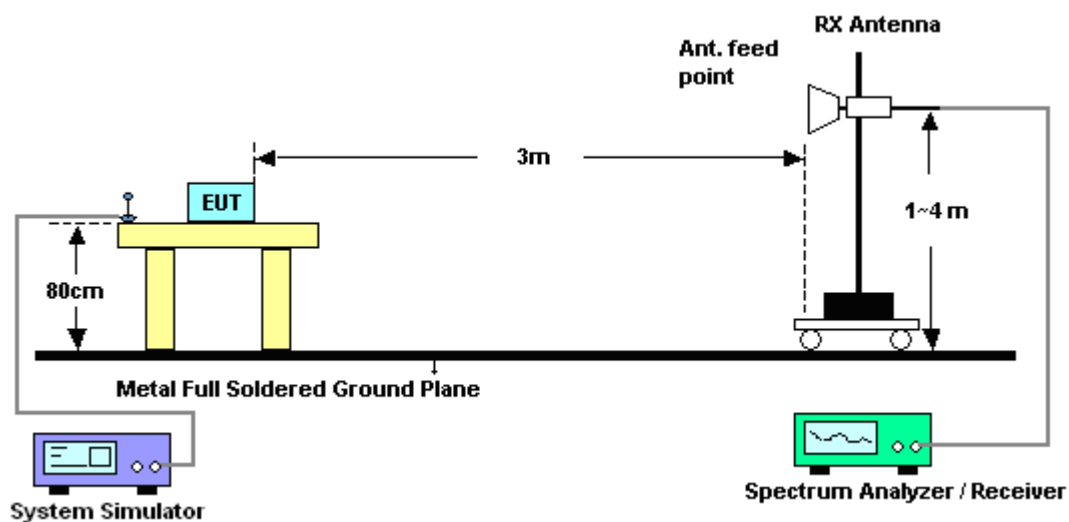
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



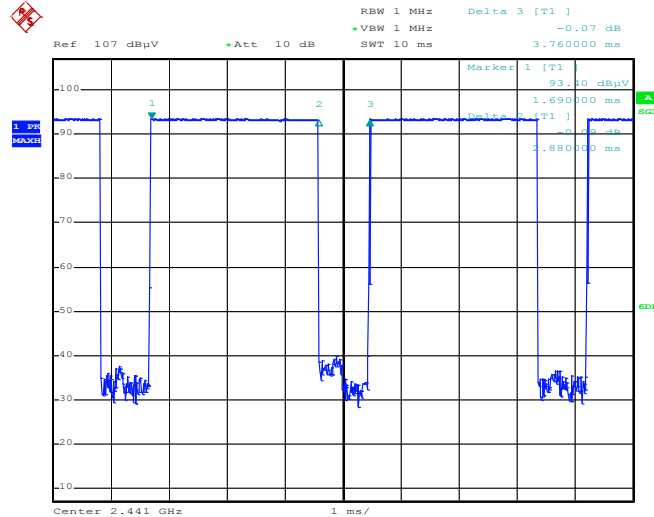
For radiated emissions above 1GHz



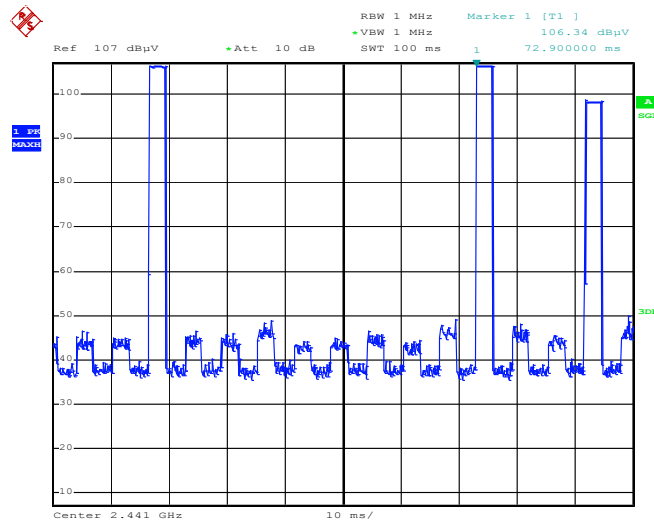
3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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.

3.8.6 Duty cycle correction factor for average measurement

DH5 on time (One Pulse) Plot on Channel 39


Date: 13.NOV.2013 16:52:02

DH5 on time (Count Pulses) Plot on Channel 39


Date: 12.NOV.2013 23:12:27

Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. $[100\text{ms} / 57.6\text{ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

$$20 \times \log(5.76 \text{ ms}/100\text{ms}) = -24.79 \text{ dB}$$

3.8.7 Test Result of Radiated Spurious at Band Edges

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	00	Relative Humidity :	51~54%
		Test Engineer :	Eric Shih

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
2389.56	49.96	-24.04	74	45.02	32.3	6.91	34.27	100	164	Peak
2389.56	25.17	-28.83	54	-	-	-	-	-	-	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
2365.26	48.42	-25.58	74	43.55	32.26	6.88	34.27	126	178	Peak
2365.26	23.63	-30.37	54	-	-	-	-	-	-	Average

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	78	Relative Humidity :	51~54%
		Test Engineer :	Eric Shih

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	71.29	-2.71	74	66.28	32.38	7.06	34.43	117	165	Peak
2483.5	46.5	-7.5	54	-	-	-	-	-	-	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
2483.5	68.06	-5.94	74	63.05	32.38	7.06	34.43	119	172	Peak
2483.5	43.27	-10.73	54	-	-	-	-	-	-	Average

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

Note: Pre-scanned all test modes and only choose the worst case mode recorded in the test report for radiated spurious emission below 1GHz.

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	00	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Horizontal
Remark :	2402 MHz is fundamental signal which can be ignored.		

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	109.43	-	-	104.51	32.31	6.91	34.3	100	164	Peak
2402	84.64	-	-	-	-	-	-	-	-	Average
4804	47.89	-26.11	74	64.1	33.98	8.77	58.96	100	0	Peak
4804	23.1	-30.9	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	00	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Vertical
Remark :	2402 MHz is fundamental signal which can be ignored.		

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	106.68	-	-	101.76	32.31	6.91	34.3	126	178	Peak
2402	81.89	-	-	-	-	-	-	-	-	Average
4804	47.09	-26.91	74	63.32	33.98	8.75	58.96	100	0	Peak
4804	22.3	-31.7	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	39	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Horizontal
Remark :	2442 MHz is fundamental signal which can be ignored.		

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
2442	111.4	-	-	106.45	32.35	6.99	34.39	119	166	Peak
2442	86.61	-	-	-	-	-	-	-	-	Average
4882	50.82	-23.18	74	66.85	33.95	8.85	58.83	100	0	Peak
4882	26.03	-27.97	54	-	-	-	-	-	-	Average
7323	43.42	-30.58	74	54.72	35.53	10.91	57.74	100	0	Peak
7323	18.63	-35.37	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	39	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Vertical
Remark :	2442 MHz is fundamental signal which can be ignored.		

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
2442	108.38	-	-	103.43	32.35	6.99	34.39	118	176	Peak
2442	83.59	-	-	-	-	-	-	-	-	Average
4881	50.7	-23.3	74	66.73	33.95	8.85	58.83	100	0	Peak
4881	25.91	-28.09	54	-	-	-	-	-	-	Average
7323	45.47	-28.53	74	56.77	35.53	10.91	57.74	100	0	Peak
7323	20.68	-33.32	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.



Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	78	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Horizontal
Remark :	2480 MHz is fundamental signal which can be ignored.		

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
50.25	30.66	-9.34	40	52.76	8.4	0.7	31.2	-	-	Peak
231.15	37.02	-8.98	46	56.31	10.22	1.49	31	-	-	Peak
269.76	40.75	-5.25	46	57.21	12.9	1.64	31	168	299	Peak
346.2	35.2	-10.8	46	50.01	14.28	1.94	31.03	-	-	Peak
461.7	32.72	-13.28	46	43.77	17.42	2.33	30.8	-	-	Peak
500.2	34.17	-11.83	46	44.32	18	2.45	30.6	-	-	Peak
2480	110.76	-	-	105.75	32.38	7.06	34.43	117	165	Peak
2480	85.97	-	-	-	-	-	-	-	-	Average
4960	46.48	-27.52	74	62.31	33.91	8.92	58.66	100	0	Peak
4960	21.69	-32.31	54	-	-	-	-	-	-	Average
7440	46.08	-27.92	74	57.38	35.51	11.04	57.85	100	0	Peak
7440	21.29	-32.71	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.

Test Mode :	1Mbps	Temperature :	22~25°C
Test Channel :	78	Relative Humidity :	51~54%
Test Engineer :	Eric Shih	Polarization :	Vertical
Remark :	2480 MHz is fundamental signal which can be ignored.		

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
52.14	32.28	-7.72	40	55.17	7.6	0.71	31.2	116	45	Peak
192.54	27.12	-16.38	43.5	48.04	8.89	1.29	31.1	-	-	Peak
269.49	29.92	-16.08	46	46.38	12.9	1.64	31	-	-	Peak
384.7	29.15	-16.85	46	42.72	15.3	2.11	30.98	-	-	Peak
479.9	26.84	-19.16	46	37.66	17.6	2.38	30.8	-	-	Peak
559	23.55	-22.45	46	31.76	19.98	2.57	30.76	-	-	Peak
2480	107.39	-	-	102.38	32.38	7.06	34.43	119	172	Peak
2480	82.6	-	-	-	-	-	-	-	-	Average
4959	47.21	-26.79	74	63.04	33.91	8.92	58.66	100	0	Peak
4959	22.42	-31.58	54	-	-	-	-	-	-	Average
7440	46.6	-27.4	74	57.9	35.51	11.04	57.85	100	0	Peak
7440	21.81	-32.19	54	-	-	-	-	-	-	Average

Note: Other harmonics are lower than background noise.

3.9 AC Conducted Emission Measurement

3.9.1 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 μ 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.

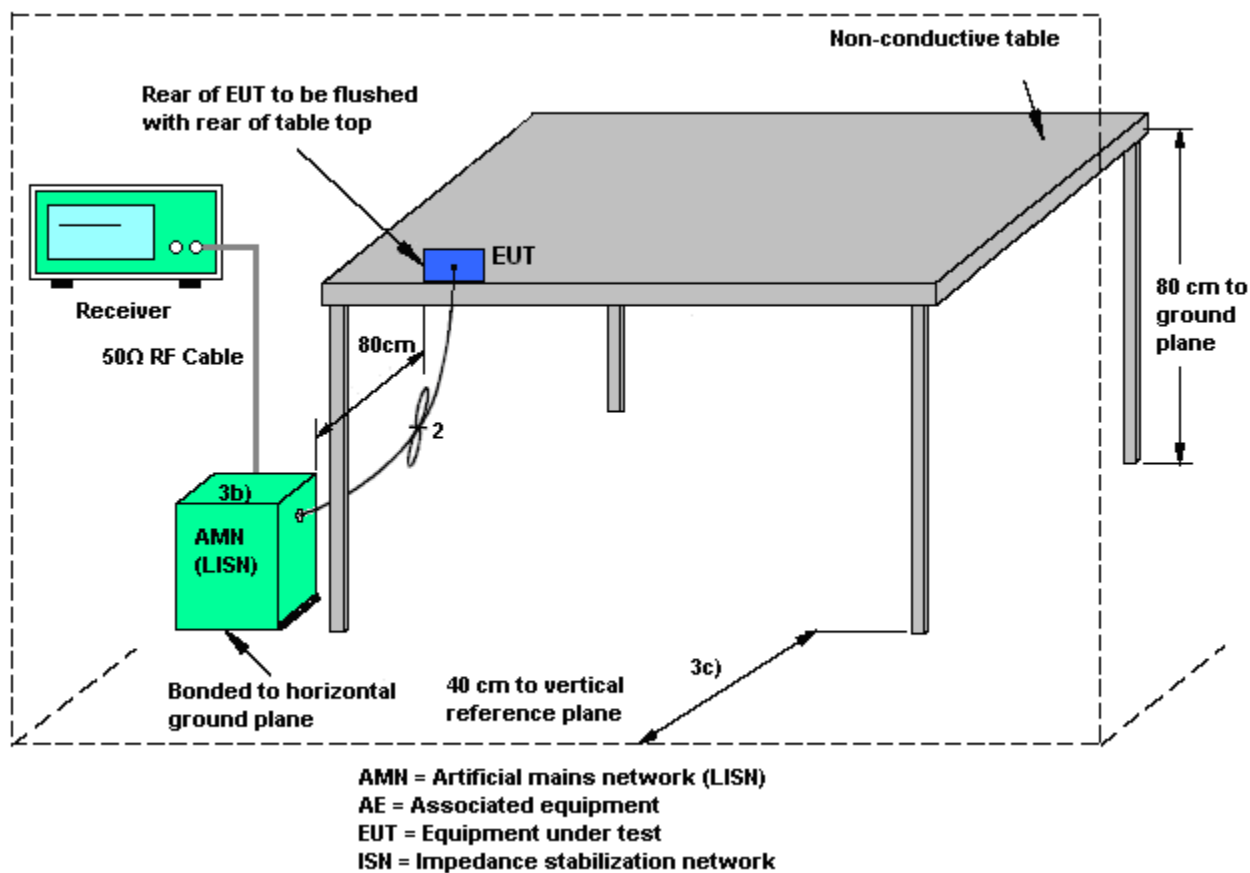
3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.9.3 Test Procedures

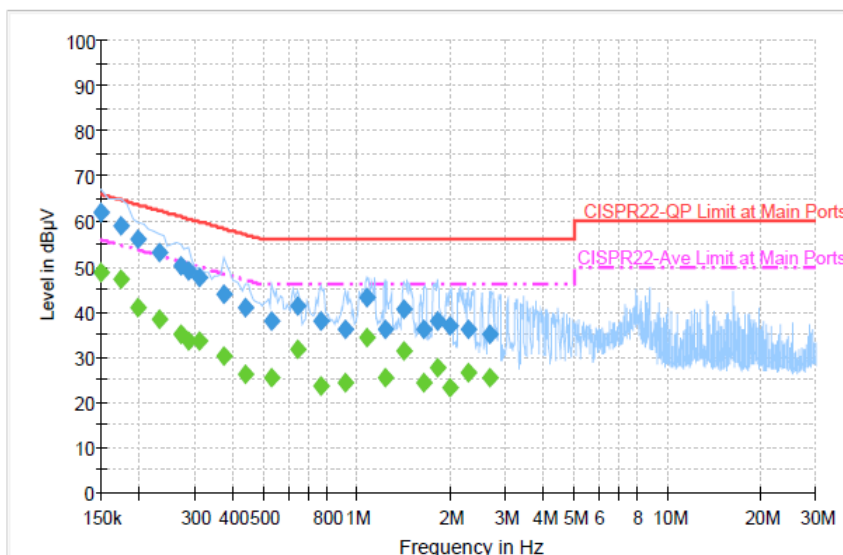
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.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

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

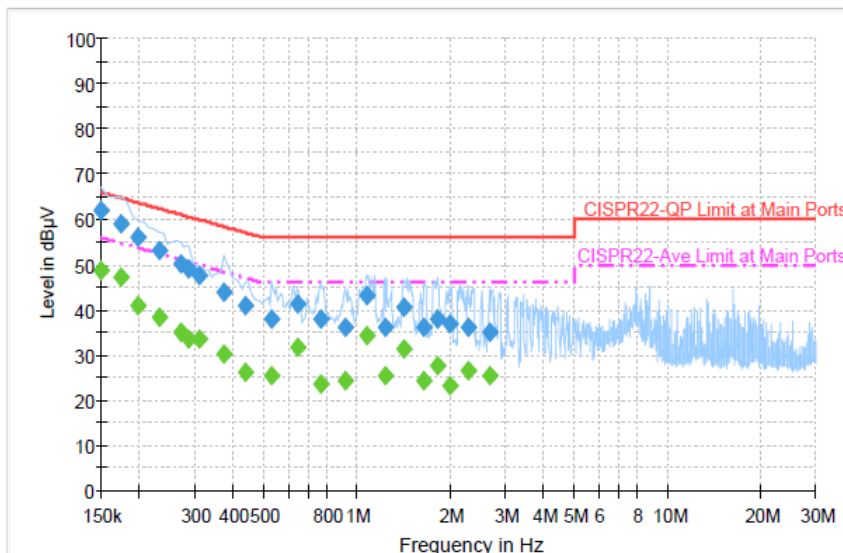
Test Mode :	Mode 1	Temperature :	20~29°C
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + TC + Print + Adapter 1		



Final Result : QuasiPeak

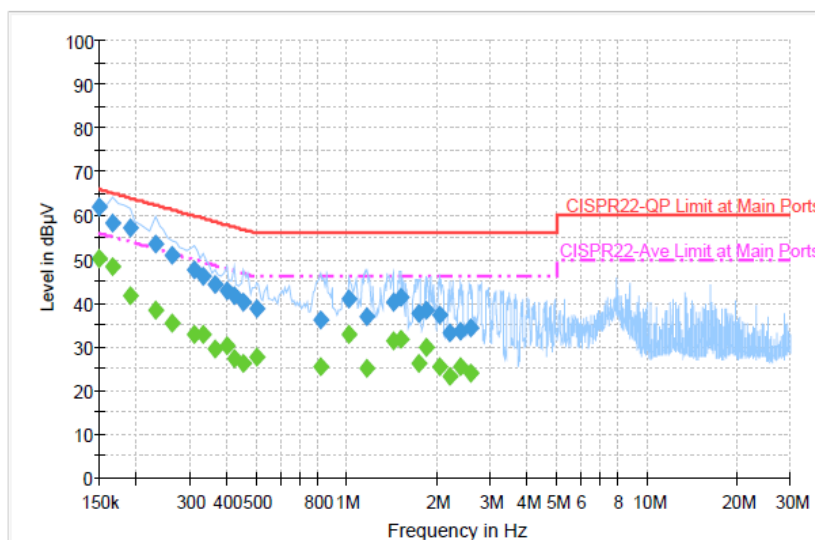
Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	62.1	Off	L1	19.4	3.9	66.0
0.174000	58.9	Off	L1	19.4	5.9	64.8
0.198000	56.2	Off	L1	19.3	7.5	63.7
0.230000	53.3	Off	L1	19.4	9.1	62.4
0.270000	50.1	Off	L1	19.3	11.0	61.1
0.286000	49.2	Off	L1	19.4	11.4	60.6
0.310000	47.5	Off	L1	19.4	12.5	60.0
0.374000	43.8	Off	L1	19.4	14.6	58.4
0.438000	40.8	Off	L1	19.4	16.3	57.1
0.534000	38.0	Off	L1	19.4	18.0	56.0
0.646000	41.2	Off	L1	19.4	14.8	56.0
0.766000	38.1	Off	L1	19.5	17.9	56.0
0.918000	36.3	Off	L1	19.4	19.7	56.0
1.078000	43.2	Off	L1	19.5	12.8	56.0
1.230000	36.0	Off	L1	19.5	20.0	56.0
1.414000	40.6	Off	L1	19.4	15.4	56.0
1.646000	36.1	Off	L1	19.5	19.9	56.0
1.814000	38.0	Off	L1	19.5	18.0	56.0
1.982000	37.0	Off	L1	19.5	19.0	56.0
2.286000	36.3	Off	L1	19.6	19.7	56.0
2.670000	35.2	Off	L1	19.5	20.8	56.0

Test Mode :	Mode 1	Temperature :	20~29°C
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + TC + Print + Adapter 1		


Final Result : Average

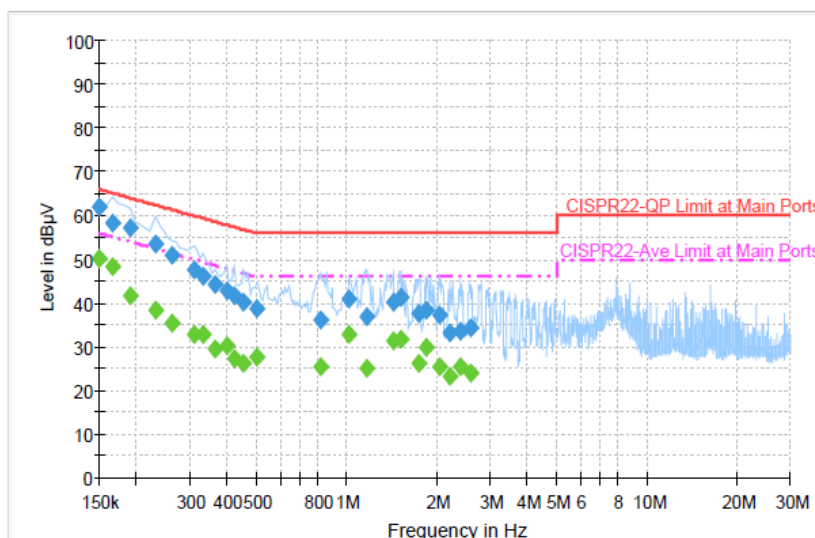
Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	48.6	Off	L1	19.4	7.4	56.0
0.174000	47.3	Off	L1	19.4	7.5	54.8
0.198000	41.0	Off	L1	19.3	12.7	53.7
0.230000	38.5	Off	L1	19.4	13.9	52.4
0.270000	35.0	Off	L1	19.3	16.1	51.1
0.286000	33.7	Off	L1	19.4	16.9	50.6
0.310000	33.5	Off	L1	19.4	16.5	50.0
0.374000	30.3	Off	L1	19.4	18.1	48.4
0.438000	26.2	Off	L1	19.4	20.9	47.1
0.534000	25.6	Off	L1	19.4	20.4	46.0
0.646000	31.8	Off	L1	19.4	14.2	46.0
0.766000	23.5	Off	L1	19.5	22.5	46.0
0.918000	24.2	Off	L1	19.4	21.8	46.0
1.078000	34.4	Off	L1	19.5	11.6	46.0
1.230000	25.6	Off	L1	19.5	20.4	46.0
1.414000	31.4	Off	L1	19.4	14.6	46.0
1.646000	24.4	Off	L1	19.5	21.6	46.0
1.814000	27.7	Off	L1	19.5	18.3	46.0
1.982000	23.2	Off	L1	19.5	22.8	46.0
2.286000	26.6	Off	L1	19.6	19.4	46.0
2.670000	25.5	Off	L1	19.5	20.5	46.0

Test Mode :	Mode 1	Temperature :	20~29°C
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + TC + Print + Adapter 1		


Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	62.0	Off	L1	19.4	4.0	66.0
0.166000	58.2	Off	L1	19.4	7.0	65.2
0.190000	57.2	Off	L1	19.4	6.8	64.0
0.230000	53.4	Off	L1	19.4	9.0	62.4
0.262000	51.0	Off	L1	19.4	10.4	61.4
0.310000	47.6	Off	L1	19.4	12.4	60.0
0.334000	46.0	Off	L1	19.4	13.4	59.4
0.366000	44.4	Off	L1	19.4	14.2	58.6
0.398000	42.8	Off	L1	19.5	15.1	57.9
0.422000	41.7	Off	L1	19.4	15.7	57.4
0.454000	40.4	Off	L1	19.3	16.4	56.8
0.502000	38.9	Off	L1	19.3	17.1	56.0
0.822000	36.3	Off	L1	19.5	19.7	56.0
1.022000	40.8	Off	L1	19.4	15.2	56.0
1.166000	36.7	Off	L1	19.4	19.3	56.0
1.430000	40.0	Off	L1	19.5	16.0	56.0
1.510000	41.5	Off	L1	19.4	14.5	56.0
1.734000	37.6	Off	L1	19.5	18.4	56.0
1.830000	38.5	Off	L1	19.5	17.5	56.0
2.030000	37.2	Off	L1	19.5	18.8	56.0
2.206000	33.3	Off	L1	19.6	22.7	56.0
2.398000	33.8	Off	L1	19.6	22.2	56.0
2.598000	34.4	Off	L1	19.6	21.6	56.0

Test Mode :	Mode 1	Temperature :	20~29°C
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN (2.4GHz) Link + MPEG4 + TC + Print + Adapter 1		


Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	50.2	Off	L1	19.4	5.8	56.0
0.166000	48.2	Off	L1	19.4	7.0	55.2
0.190000	41.8	Off	L1	19.4	12.2	54.0
0.230000	38.4	Off	L1	19.4	14.0	52.4
0.262000	35.6	Off	L1	19.4	15.8	51.4
0.310000	32.8	Off	L1	19.4	17.2	50.0
0.334000	33.0	Off	L1	19.4	16.4	49.4
0.366000	29.7	Off	L1	19.4	18.9	48.6
0.398000	30.2	Off	L1	19.5	17.7	47.9
0.422000	27.4	Off	L1	19.4	20.0	47.4
0.454000	26.2	Off	L1	19.3	20.6	46.8
0.502000	27.7	Off	L1	19.3	18.3	46.0
0.822000	25.3	Off	L1	19.5	20.7	46.0
1.022000	32.7	Off	L1	19.4	13.3	46.0
1.166000	24.9	Off	L1	19.4	21.1	46.0
1.430000	31.5	Off	L1	19.5	14.5	46.0
1.510000	31.7	Off	L1	19.4	14.3	46.0
1.734000	26.3	Off	L1	19.5	19.7	46.0
1.830000	29.9	Off	L1	19.5	16.1	46.0
2.030000	25.4	Off	L1	19.5	20.6	46.0
2.206000	23.4	Off	L1	19.6	22.6	46.0
2.398000	25.3	Off	L1	19.6	20.7	46.0
2.598000	23.9	Off	L1	19.6	22.1	46.0



3.10 Antenna Requirements

3.10.1 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.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 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	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 07, 2013	Oct. 16, 2013~ Oct. 21, 2013	Jun. 06, 2014	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Feb. 05, 2013	Oct. 16, 2013~ Oct. 21, 2013	Feb. 04, 2014	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Feb. 05, 2013	Oct. 16, 2013~ Oct. 21, 2013	Feb. 04, 2014	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 06, 2013	Nov. 12, 2013~ Nov. 13, 2013	Sep. 05, 2014	Radiation (03CH07-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101067	9KHz~30GHz	Nov. 30, 2012	Nov. 12, 2013~ Nov. 13, 2013	Nov. 29, 2013	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	860004/0001	9 kHz~30 MHz	Jul. 03, 2012	Nov. 12, 2013~ Nov. 13, 2013	Jul. 03, 2014	Radiation (03CH07-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Oct. 10, 2013	Nov. 12, 2013~ Nov. 13, 2013	Oct. 09, 2014	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	75962	1GHz~18GHz	Aug. 22, 2013	Nov. 12, 2013~ Nov. 13, 2013	Aug. 21, 2014	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA91702 51	15GHz- 40GHz	Oct. 03, 2013	Nov. 12, 2013~ Nov. 13, 2013	Oct. 02, 2014	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	30MHz~1GHz	Feb. 26, 2013	Nov. 12, 2013~ Nov. 13, 2013	Feb. 25, 2014	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Dec. 01, 2012	Nov. 12, 2013~ Nov. 13, 2013	Nov. 30, 2013	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0 0101800-3 0-10P	159088	DC~18G High Gain	Feb. 27, 2013	Nov. 12, 2013~ Nov. 13, 2013	Feb. 26, 2014	Radiation (03CH07-HY)
Turn Table	ChainTek	ChainTek 3000	N/A	0 ~ 360 degree	N/A	Nov. 12, 2013~ Nov. 13, 2013	N/A	Radiation (03CH07-HY)
Antenna Mast	ChainTek	ChainTek 3000	N/A	N/A	N/A	Nov. 12, 2013~ Nov. 13, 2013	N/A	Radiation (03CH07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 13, 2012	Oct. 22, 2013	Nov. 12, 2013	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2012	Oct. 22, 2013	Dec. 11, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 06, 2012	Oct. 22, 2013	Dec. 05, 2013	Conduction (CO05-HY)
AC Power Source	APC	APC-1000 W	N/A	N/A	N/A	Oct. 22, 2013	N/A	Conduction (CO05-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
---	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.50
---	------

