FCC RF Test Report

APPLICANT	:	VERTU Corporation Limited
EQUIPMENT	:	Cellular Telephone
BRAND NAME	:	VERTU
MODEL NAME	:	SIGNATURE TOUCH
TYPE (LTE)	:	RM-980V
TYPE (WCDMA)	:	RM-980C
FCC ID	:	P7QRM-980V
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DSS) Spread Spectrum Transmitter

The product was received on Mar. 03, 2014 and testing was completed on May 21, 2014. 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

Testing Laboratory 1190

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 Product Specification of Equipment Under Test 7
1.5 Modification of EUT 7
1.6 Testing Site 7
1.7 Applied Standards 8

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST **9**

2.1 Descriptions of Test Mode 9
2.2 Test Mode 10
2.3 Connection Diagram of Test System 11
2.4 Support Unit used in test configuration and system 13
2.5 EUT Operation Test Setup 14
2.6 Measurement Results Explanation Example 14

3 TEST RESULT **15**

3.1 Number of Channel Measurement 15
3.2 Hopping Channel Separation Measurement 17
3.3 Dwell Time Measurement 24
3.4 20dB and 99% Bandwidth Measurement 26
3.5 Peak Output Power Measurement 39
3.6 Conducted Band Edges Measurement 41
3.7 Conducted Spurious Emission Measurement 48
3.8 Radiated Band Edges and Spurious Emission Measurement 58
3.9 AC Conducted Emission Measurement 74
3.10 Antenna Requirements 78

4 LIST OF MEASURING EQUIPMENT **79**

5 UNCERTAINTY OF EVALUATION **81**

APPENDIX A. SETUP PHOTOGRAPHS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR430314A	Rev. 01	Initial issue of report	May 26, 2014

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	≥ 15Chs	Pass	-
3.2	15.247(a)(1)	RSS-210 A8.1(b)	Hopping Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.3	15.247(a)(1)	RSS-210 A8.1(d)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.4	15.247(a)(1)	RSS-210 A8.1(a)	20dB Bandwidth	NA	Pass	-
3.4	-	RSS-Gen 4.6.1	99% Bandwidth	-	Pass	-
3.5	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	≤ 125 mW	Pass	-
3.6	15.247(d)	RSS-210 A8.5	Conducted Band Edges	≤ 20dBc	Pass	-
3.7	15.247(d)	RSS-210 A8.5	Conducted Spurious Emission	≤ 20dBc	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 9.98 dB at 44.580 MHz
3.9	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 9.10 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

VERTU Corporation Limited
Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.2 Manufacturer

VERTU Corporation Limited
Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Cellular Telephone
Brand Name	VERTU
Model Name	SIGNATURE TOUCH
Type (LTE)	RM-980V
Type (WCDMA)	RM-980C
FCC ID	P7QRM-980V
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/NFC WLAN 2.4GHz 802.11b/g/n HT20/ WLAN 5GHz 802.11a/n HT20/HT40/ WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/ Bluetooth v3.0 + EDR/Bluetooth v4.0 LE
HW Version	F2
SW Version	1_160_0001
Sample #1	LTE SKU
Sample #2	WCDMA SKU
Sample #3	LTE SKU with 2nd EMMC
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. There are three different types of EUT sample #1, sample #2 and sample #3. For WWAN bands, Sample 1 support WCDMA and LTE bands, sample #2 only support WCDMA band and LTE band is disabled by software. Sample #1 and Sample #3 are different for EMMC. We choose sample #1 to perform all tests.

List of Accessory:

Specification of Accessory		
AC Adapter	**Brand Name**	VERTU
	Model Name	AC-32V
Battery	**Brand Name**	VERTU
	Model Name	BP-9V
Car Charger	**Brand Name**	VERTU
	Model Name	DC-30V
Portable Power Charger	**Brand Name**	VERTU
	Model Name	DC-15V
Earphone 1	**Brand Name**	VERTU
	Model Name	WH-4V
Earphone 2	**Brand Name**	VERTU
	Model Name	WH-5V
USB Cable	**Brand Name**	VERTU
	Model Name	CA-225DV
Wireless Charger	**Brand Name**	VERTU
	Model Name	AC-35V

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) : 9.20 dBm (0.0083 W) Bluetooth EDR (2Mbps) : 10.06 dBm (0.0101 W) Bluetooth EDR (3Mbps) : 10.41 dBm (0.0110 W)
99% Occupied Bandwidth	Bluetooth BR(1Mbps) : 0.872MHz Bluetooth EDR (2Mbps) : 1.168MHz Bluetooth EDR (3Mbps) : 1.148MHz
Antenna Type	PIFA Antenna with gain -2.00 dBi
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π/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 1st 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	03CH06-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
- IC RSS-210 Issued 8
- IC RSS-Gen Issue 3
- NOTICE 2012-DRS0126

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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	π/4-DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	8.25 dBm	9.18 dBm	9.51 dBm
Ch39	2441MHz	9.20 dBm	10.06 dBm	**10.41** dBm
Ch78	2480MHz	7.77 dBm	8.69 dBm	8.97 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 3Mbps 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 3Mbps 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.

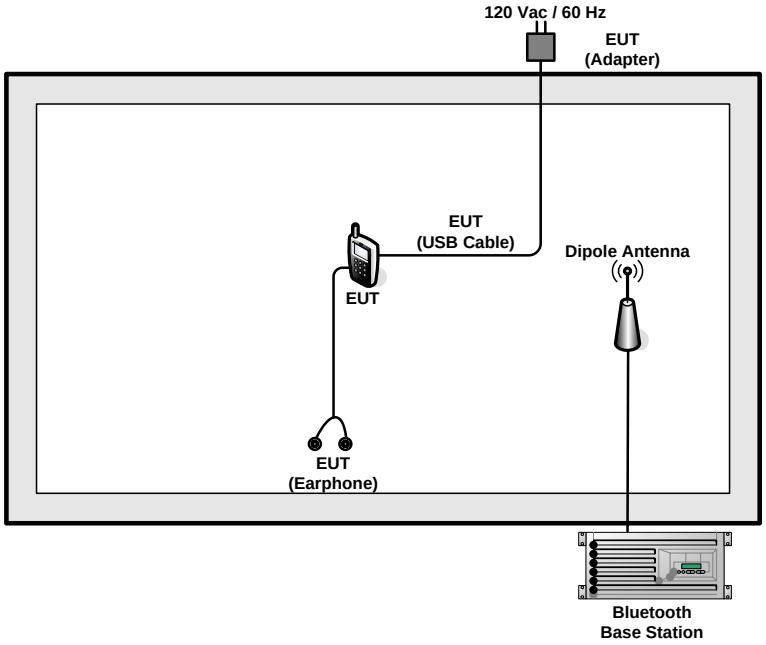
Summary table of Test Cases			
Test Item	**Data Rate / Modulation**		
	Bluetooth BR 1Mbps GFSK	**Bluetooth EDR 2Mbps π/4-DQPSK**	**Bluetooth EDR 3Mbps 8-DPSK**
Conducted Test Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated Test Cases	**Bluetooth EDR 3Mbps 8-DPSK**		
	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz Mode 4: CH78_2480 MHz + WPC Charging		
AC Conducted Emission	Mode 1 :LTE Band 2 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC Tx + Earphone 1 + USB Cable (Data Link with Notebook) Mode 2 : LTE Band 2 Idle + WLAN (5GHz) Link + Bluetooth Link + NFC Tx + Earphone 1 + USB Cable (Data Link with Notebook) Mode 3 :GSM1900 Idle + WLAN (2.4GHz) Link + Bluetooth Link + WPC Charging + GPS Rx + Earphone 2 + Wireless charger (Charging from Adapter)		

Remark:

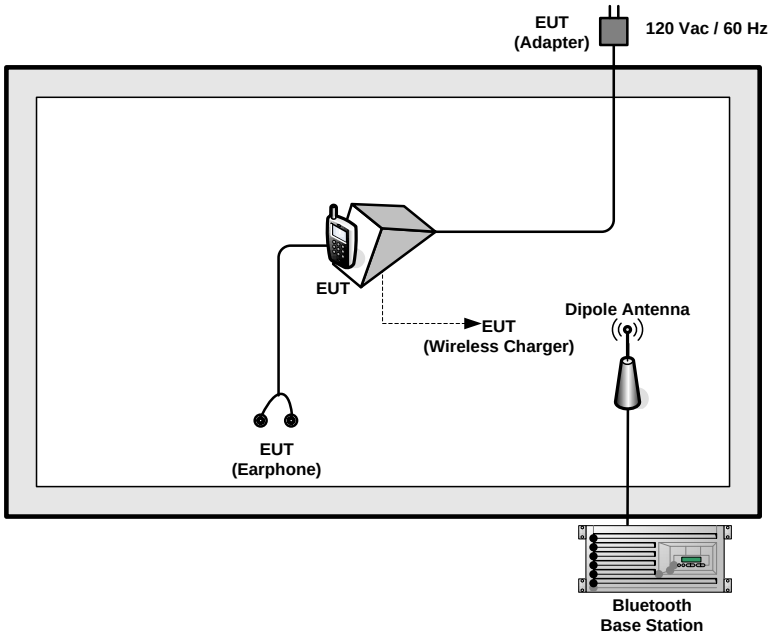
1. For radiated test cases, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and no other significantly frequencies found in conducted spurious emission.
2. The worst case of conducted emission is mode 1; only the test data of it is reported.

2.3 Connection Diagram of Test System

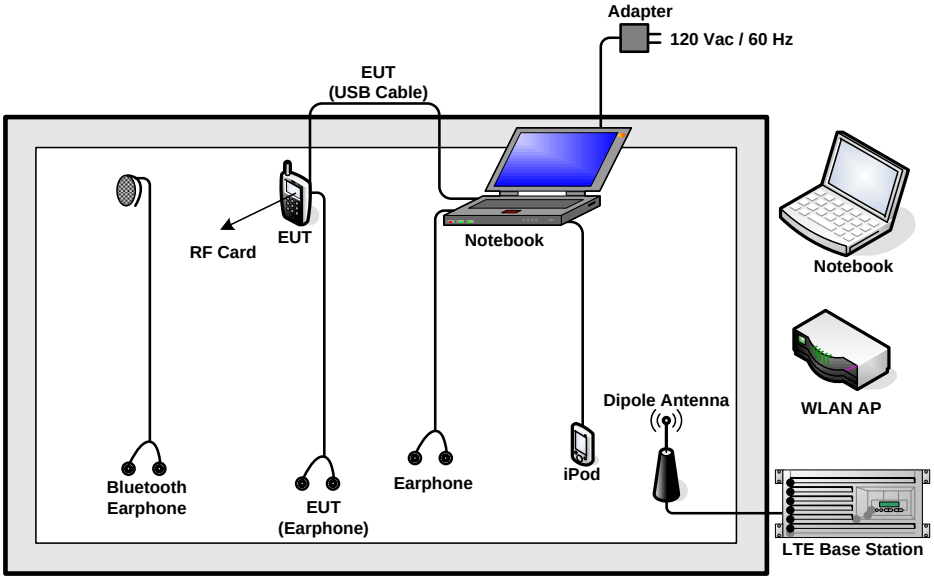
<Bluetooth Tx Mode>



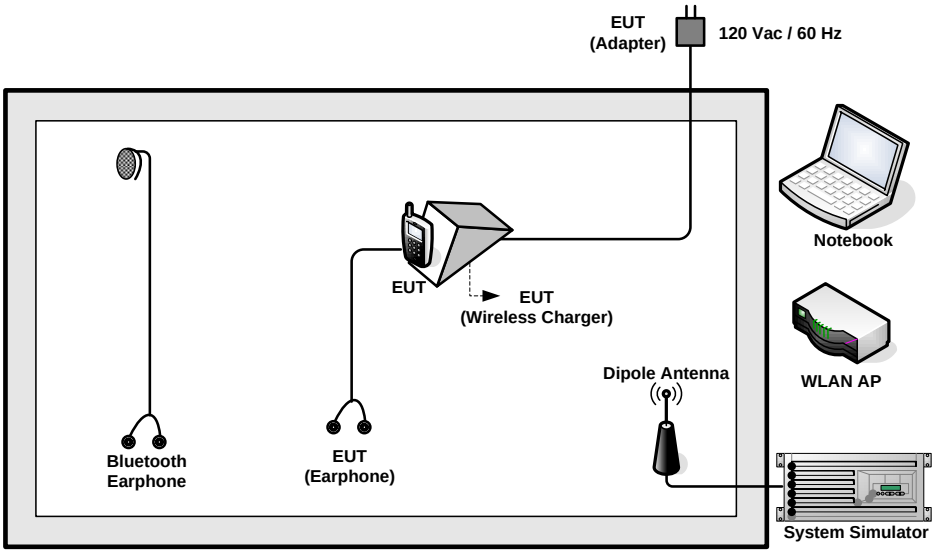
<Bluetooth Tx Mode with WPC Charging>



<AC Conducted Emission Mode for Data Link with Notebook>



<AC Conducted Emission Mode for WPC Charging Mode>



2.4 Support Unit used in test configuration and system

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.	LTE Base Station	R&S	CMW 500	N/A	N/A	Unshielded, 1.8 m
3.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
4.	DC Power Supply	TOPWARD	3303D	N/A	N/A	Unshielded, 1.8 m
5.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
6.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
7.	Notebook	Lenovo	G480	N/A	N/A	AC I/P: Unshielded, 0.9 m DC O/P: Shielded, 1.8 m
8.	Bluetooth Earphone	Sony Erricsson	MW600	PY700A2029	N/A	N/A
9.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
10.	Earphone	Apple	A1285	FCC DoC	Unshielded, 1.2 m	N/A
11.	RF Card	Metro Taipei	Easy Card	N/A	N/A	N/A
12.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

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 5.4 dB and 20dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 5.4 + 20 = 25.4 (dB)

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 ≥ 1% of the span; VBW ≥ 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.

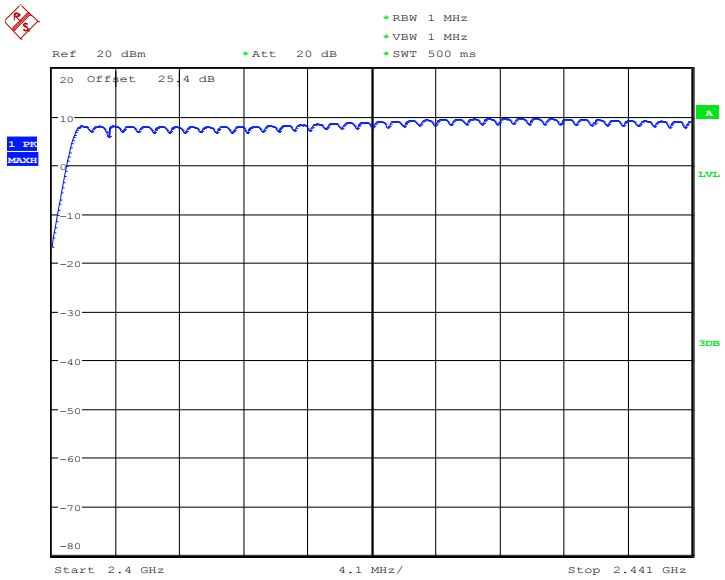
3.1.4 Test Setup

3.1.5 Test Result of Number of Hopping Frequency

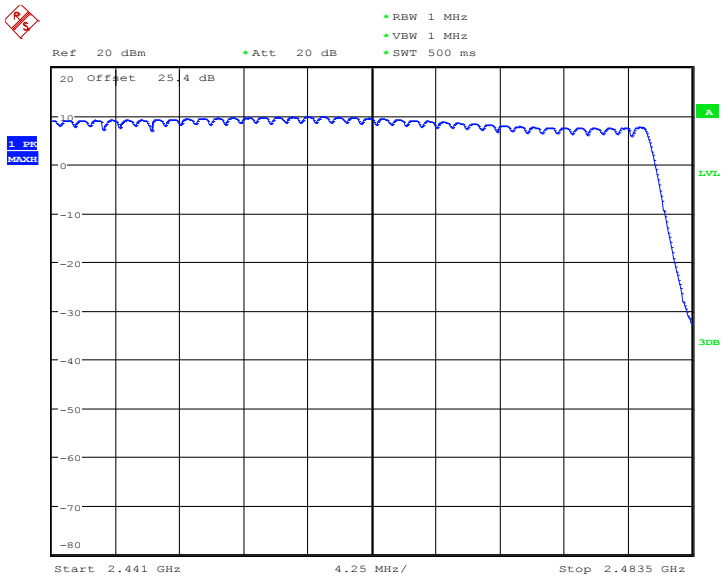
Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

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: 1.APR.2014 17:50:23



Date: 1.APR.2014 17:54:42

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 ≥ 1% of the span; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

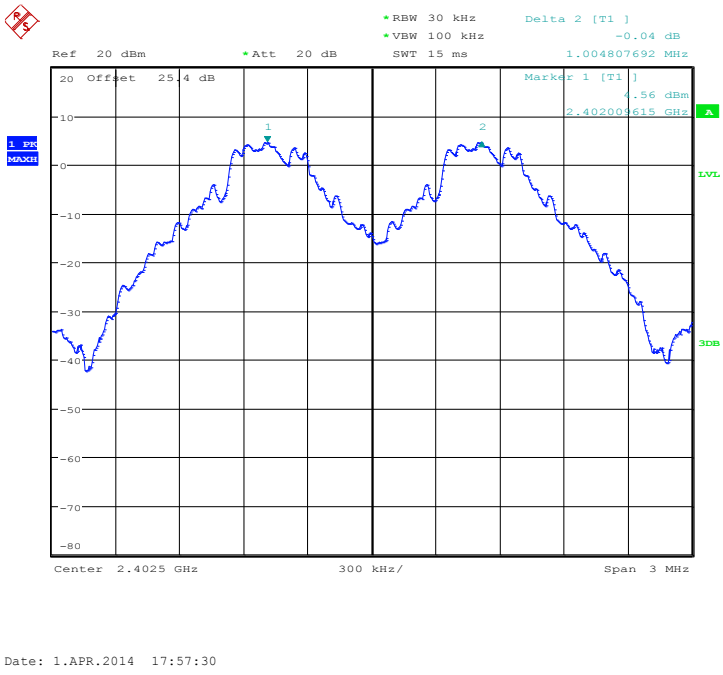
3.2.4 Test Setup

3.2.5 Test Result of Hopping Channel Separation

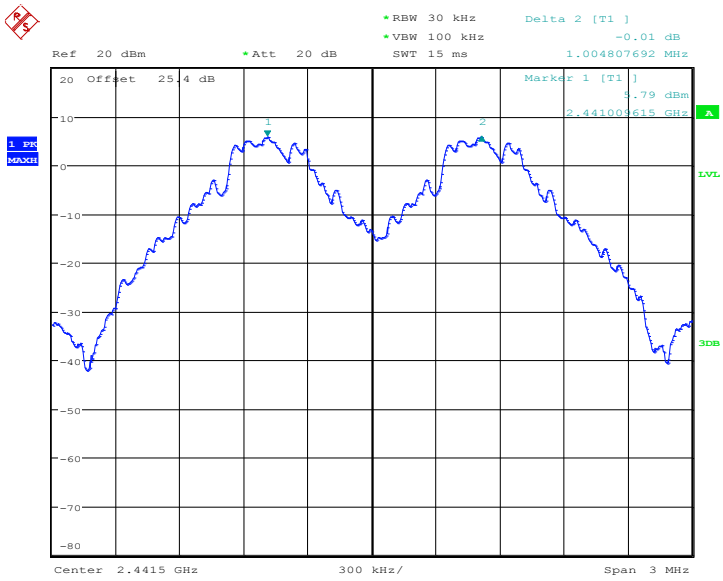
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.005	0.6303	Pass
39	2441	1.005	0.6282	Pass
78	2480	1.005	0.6261	Pass

Channel Separation Plot on Channel 00 - 01

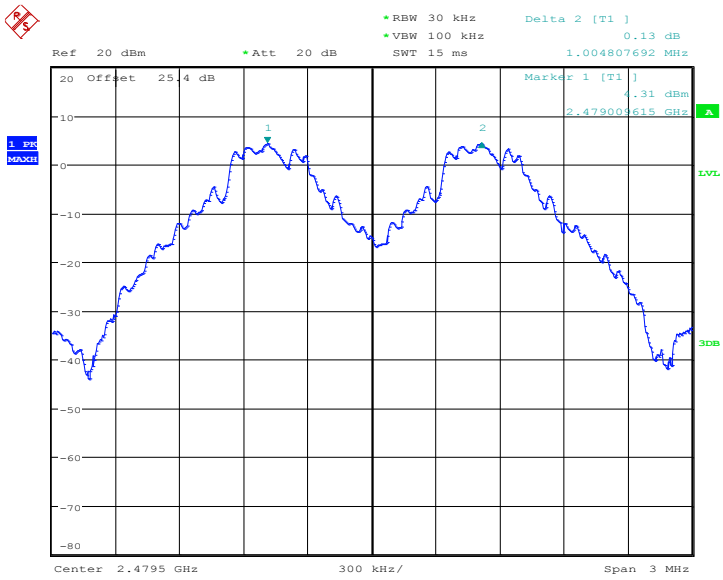


Channel Separation Plot on Channel 39 - 40



Date: 1.APR.2014 18:01:24

Channel Separation Plot on Channel 77 - 78

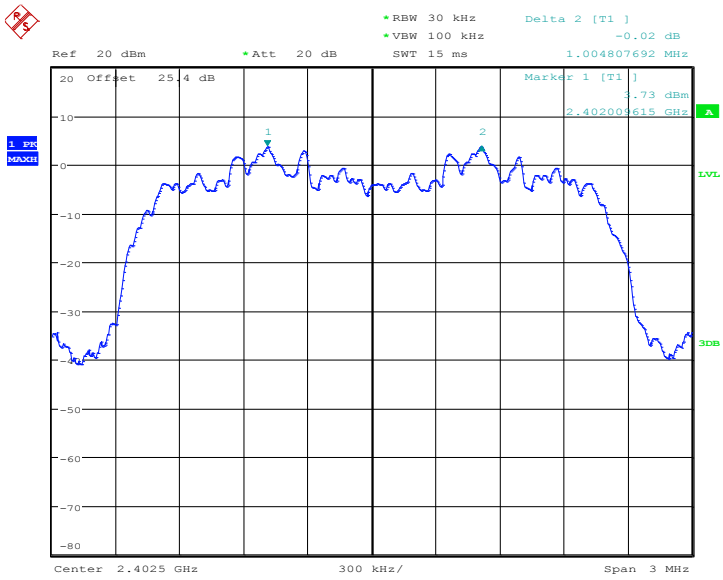


Date: 1.APR.2014 18:05:12

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

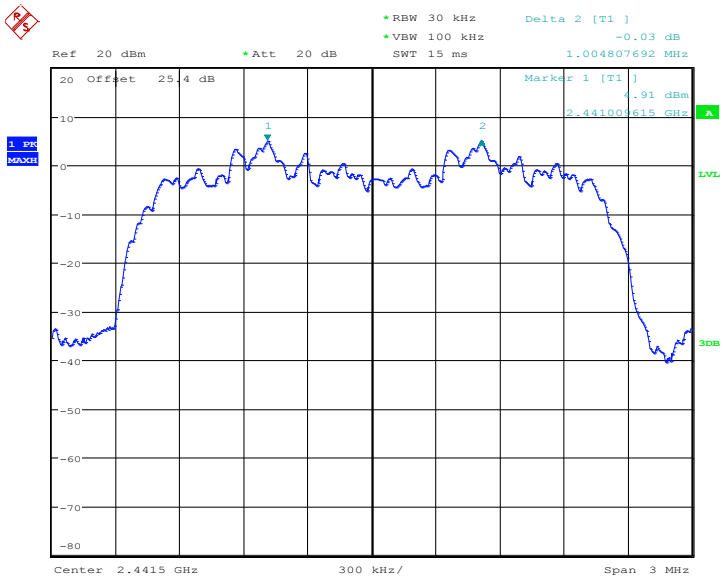
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.005	0.8525	Pass
39	2441	1.005	0.8558	Pass
78	2480	1.005	0.8558	Pass

Channel Separation Plot on Channel 00 - 01



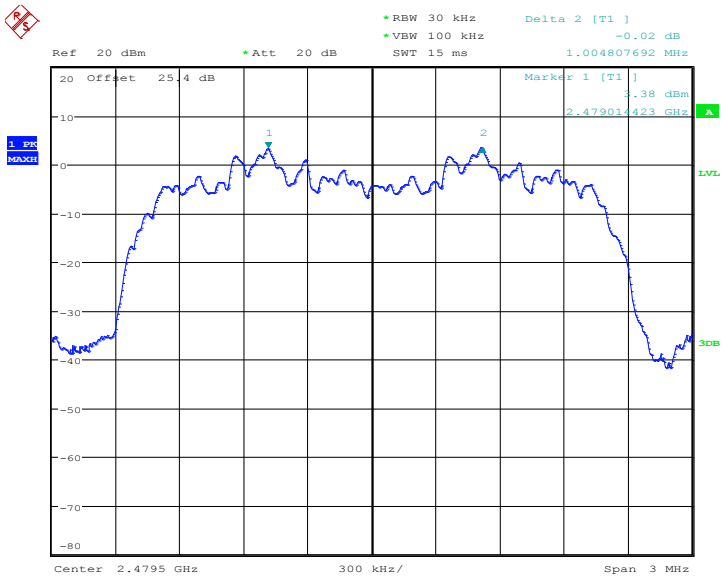
Date: 1.APR.2014 18:15:28

Channel Separation Plot on Channel 39 - 40



Date: 1.APR.2014 18:19:44

Channel Separation Plot on Channel 77 - 78

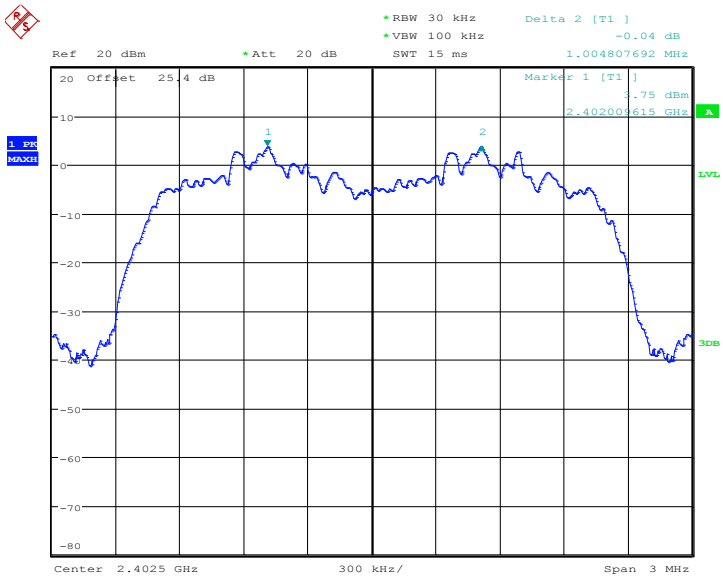


Date: 1.APR.2014 18:26:17

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

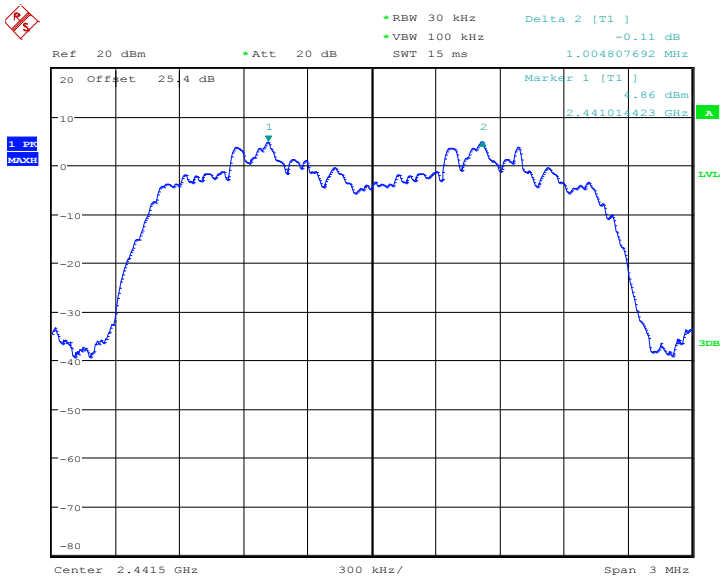
Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.005	0.8461	Pass
39	2441	1.005	0.8333	Pass
78	2480	1.005	0.8365	Pass

Channel Separation Plot on Channel 00 - 01



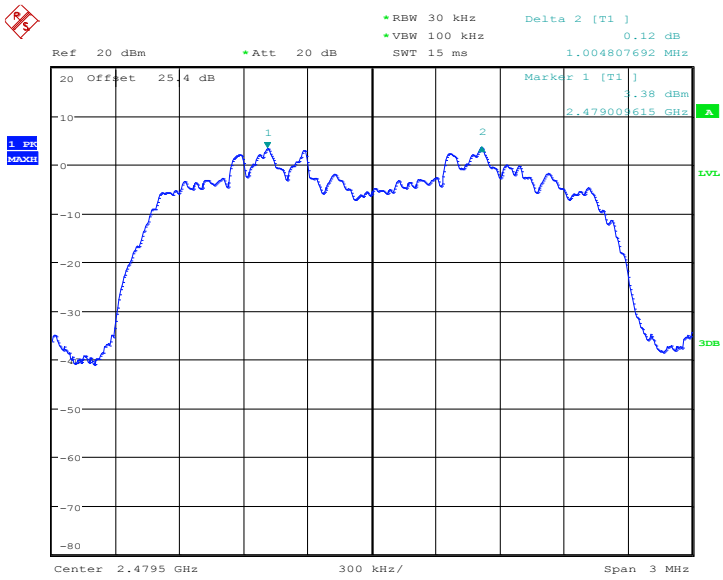
Date: 1.APR.2014 18:35:14

Channel Separation Plot on Channel 39 - 40



Date: 1.APR.2014 18:32:24

Channel Separation Plot on Channel 77 - 78



Date: 1.APR.2014 18:27:53

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 ≥ 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

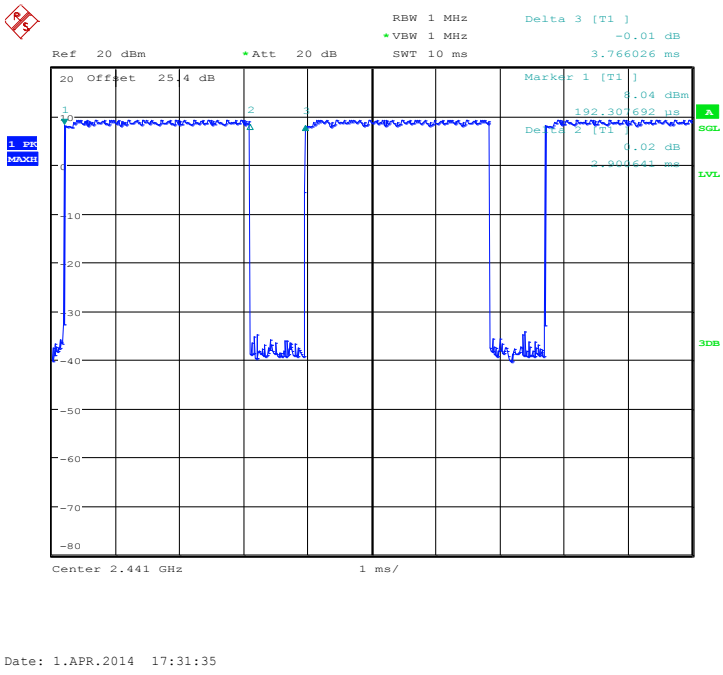
Test Mode :	3DH5	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

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:

1. 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 x 79) (s),
   Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.
2. 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 x 20) (s),
   Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.
3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

Package Transfer Time Plot



3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

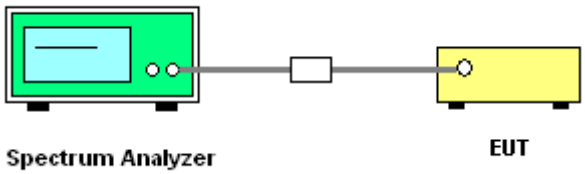
3.4.2 Measuring Instruments

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 ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   For 99% Bandwidth measurement, the RBW=30kHz, and VBW = 100kHz. Sweep = auto ;
   Detector function = sample. Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

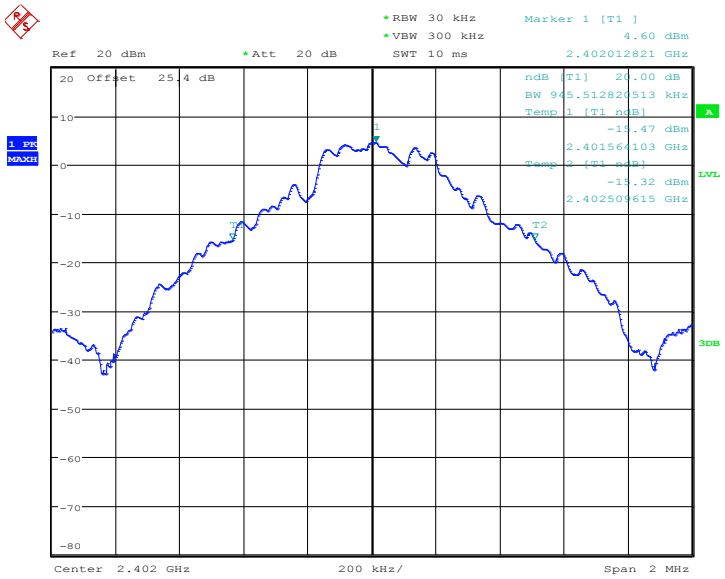


3.4.5 Test Result of 20dB Bandwidth

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

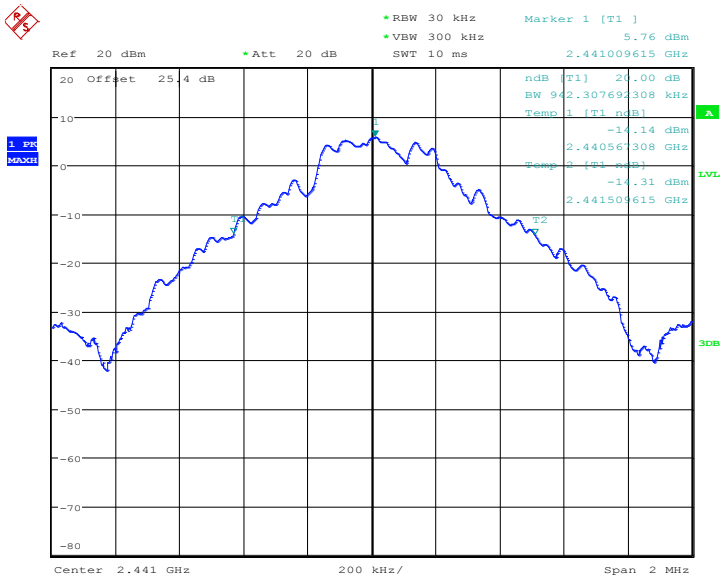
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.946
39	2441	0.942
78	2480	0.939

20 dB Bandwidth Plot on Channel 00



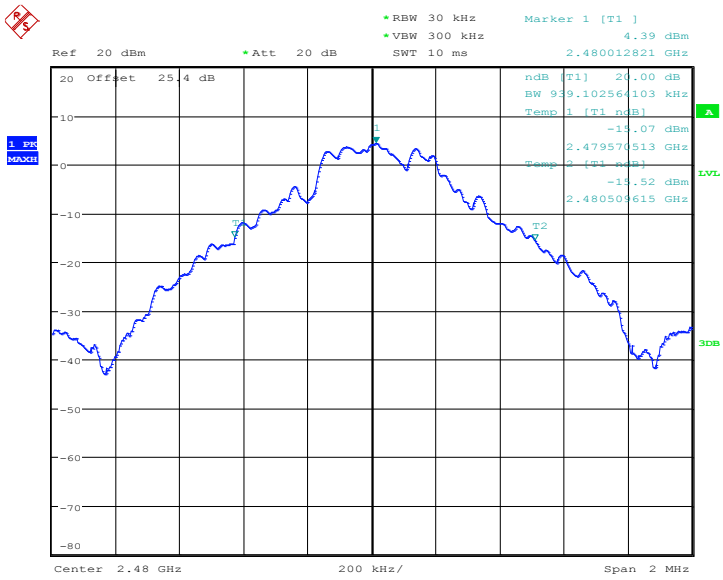
Date: 1.APR.2014 17:57:54

20 dB Bandwidth Plot on Channel 39



Date: 1.APR.2014 18:01:48

20 dB Bandwidth Plot on Channel 78

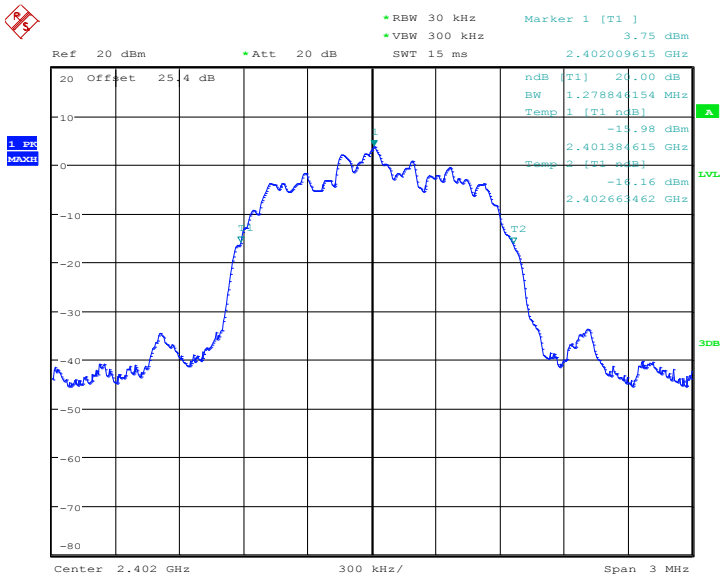


Date: 1.APR.2014 18:09:45

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

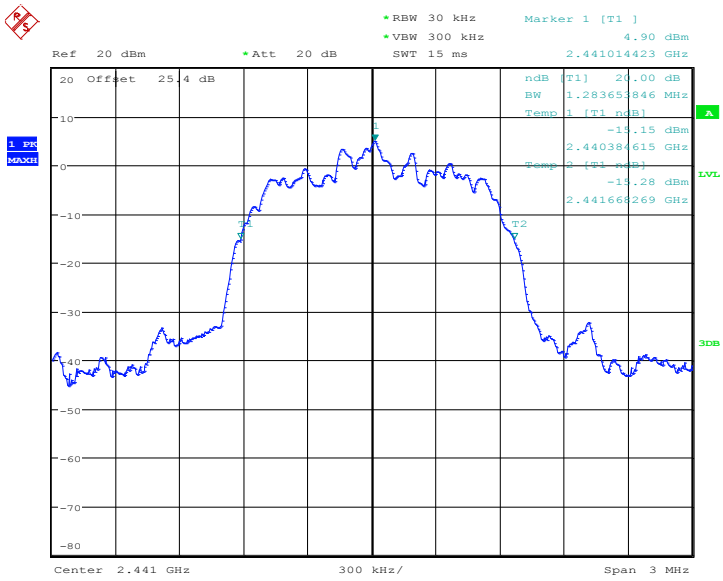
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.279
39	2441	1.284
78	2480	1.284

20 dB Bandwidth Plot on Channel 00



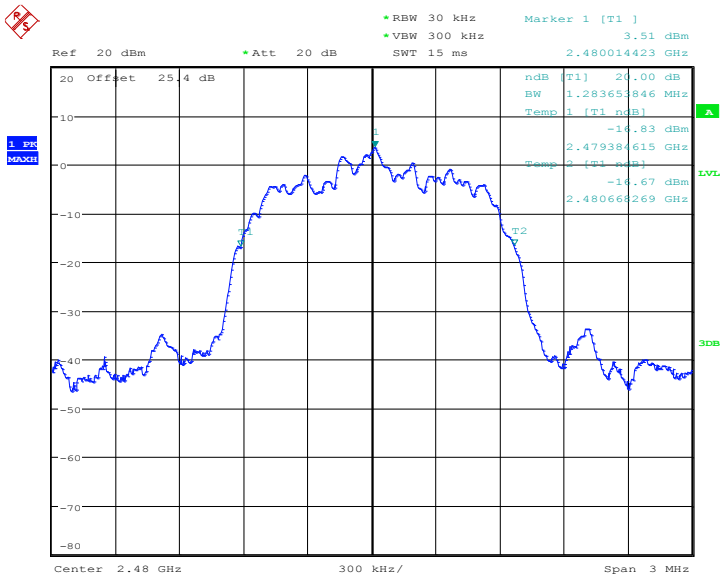
Date: 1.APR.2014 18:15:53

20 dB Bandwidth Plot on Channel 39



Date: 1.APR.2014 18:20:08

20 dB Bandwidth Plot on Channel 78

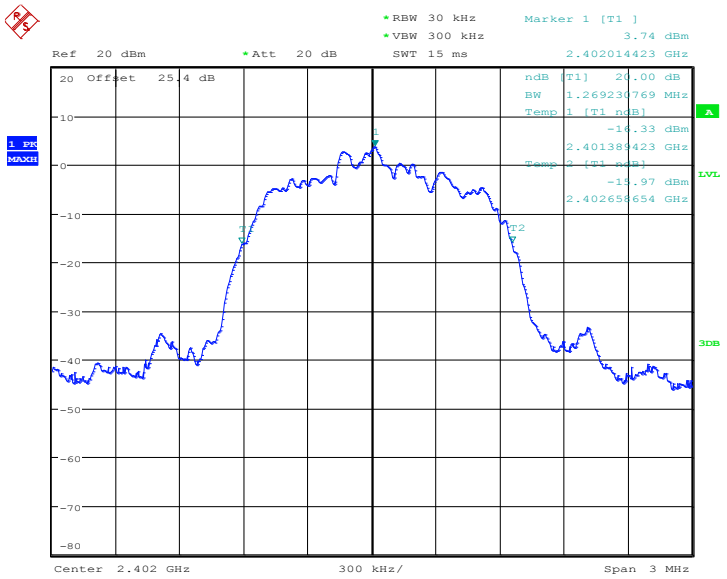


Date: 1.APR.2014 18:21:58

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

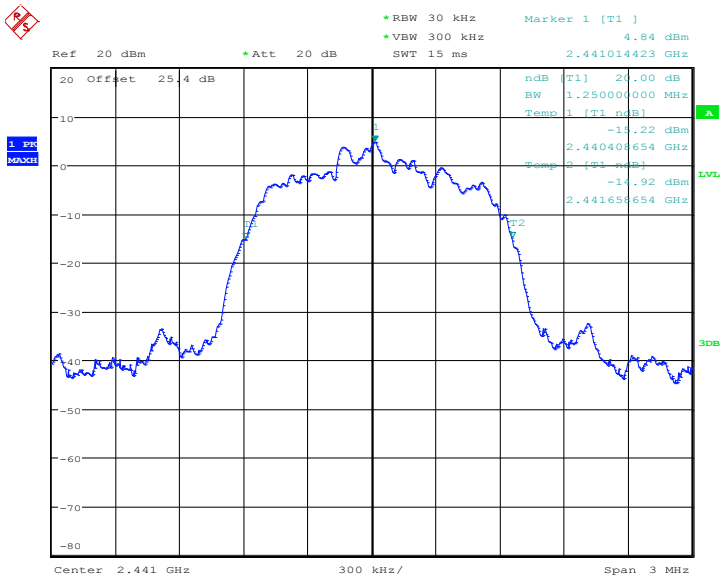
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.269
39	2441	1.250
78	2480	1.255

20 dB Bandwidth Plot on Channel 00

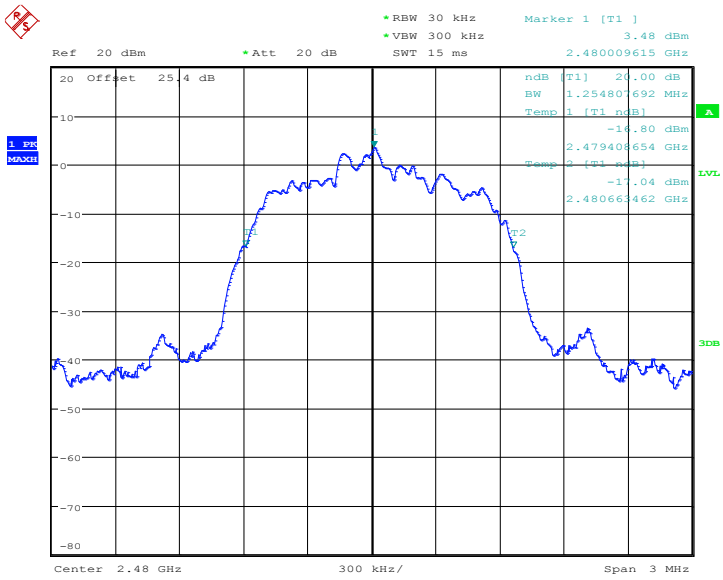


Date: 1.APR.2014 18:35:38

20 dB Bandwidth Plot on Channel 39



20 dB Bandwidth Plot on Channel 78

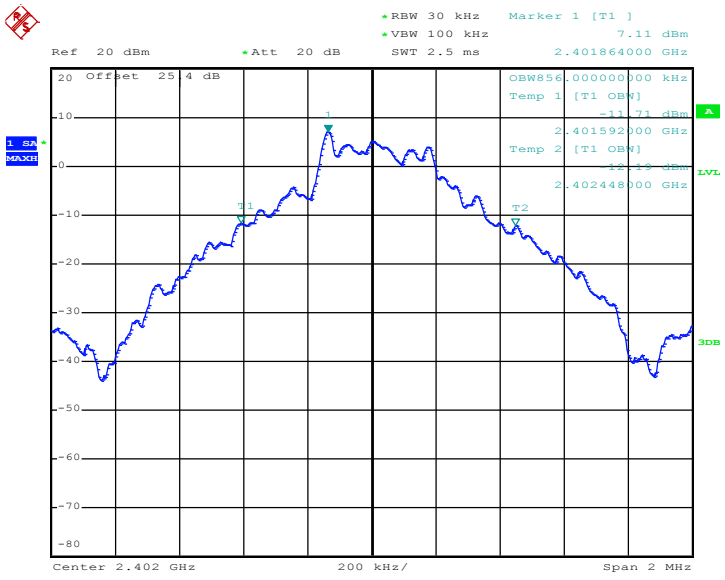


3.4.6 Test Result of 99% Occupied Bandwidth

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

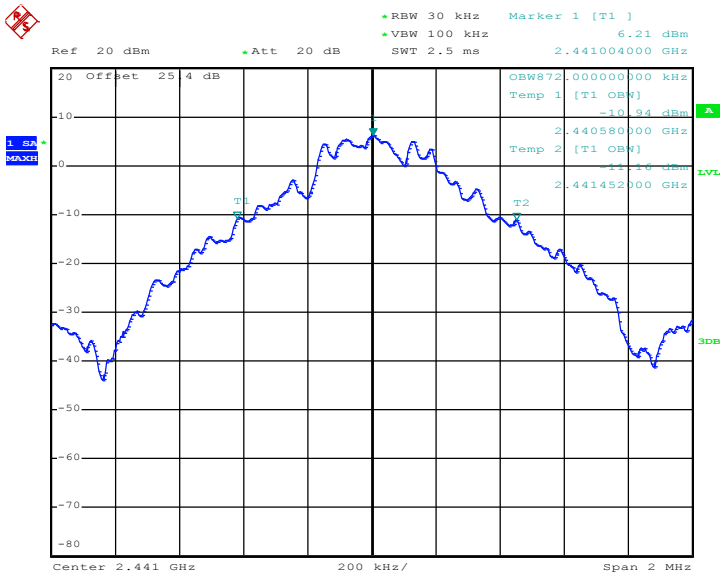
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	0.856
39	2441	0.872
78	2480	0.872

99% Occupied Bandwidth Plot on Channel 00



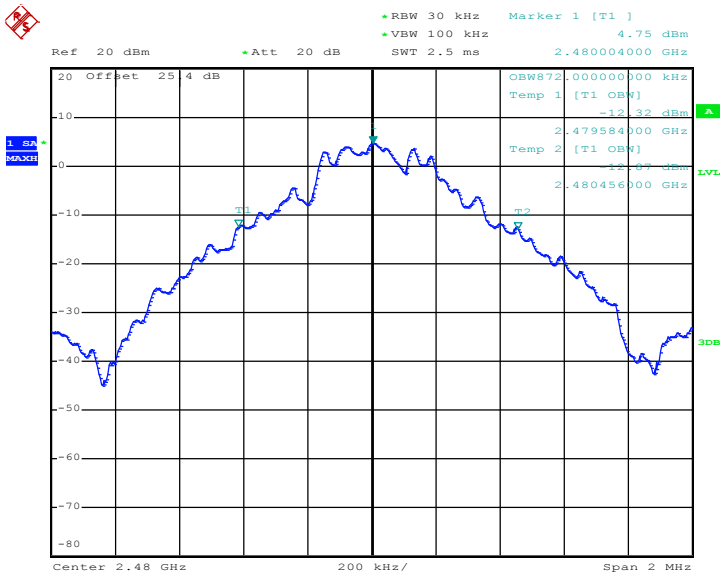
Date: 8.APR.2014 20:42:05

99% Occupied Bandwidth Plot on Channel 39



Date: 8.APR.2014 20:45:26

99% Occupied Bandwidth Plot on Channel 78

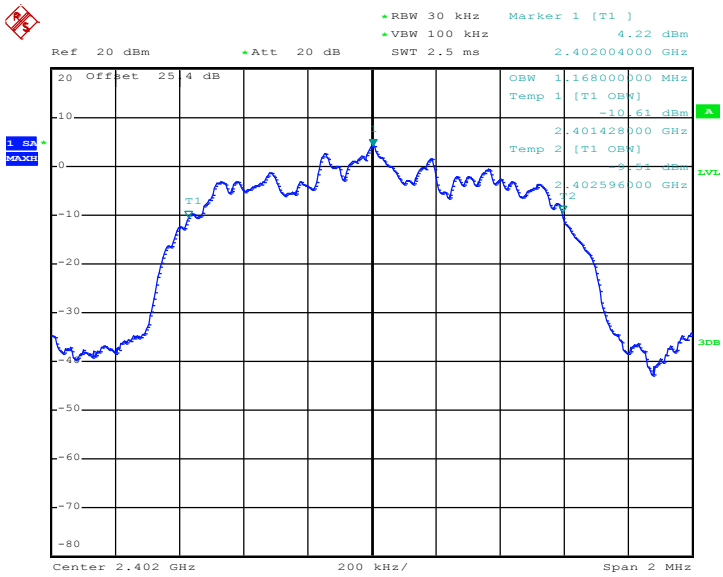


Date: 8.APR.2014 20:46:10

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

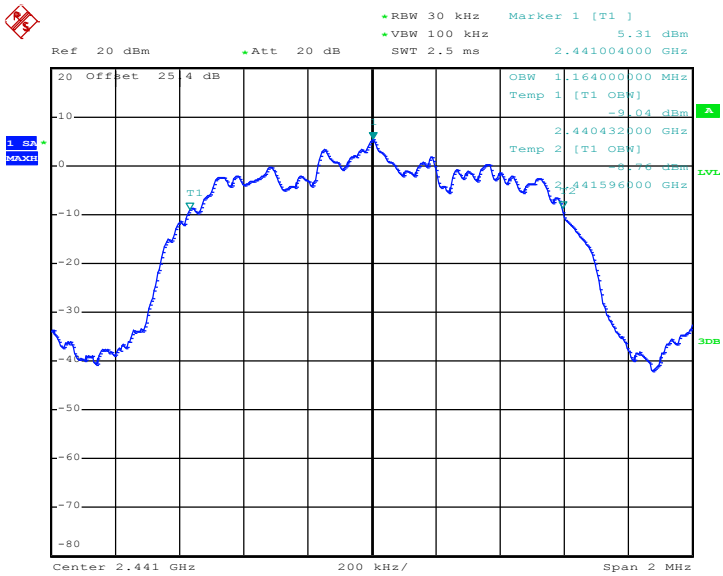
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.168
39	2441	1.164
78	2480	1.160

99% Occupied Bandwidth Plot on Channel 00



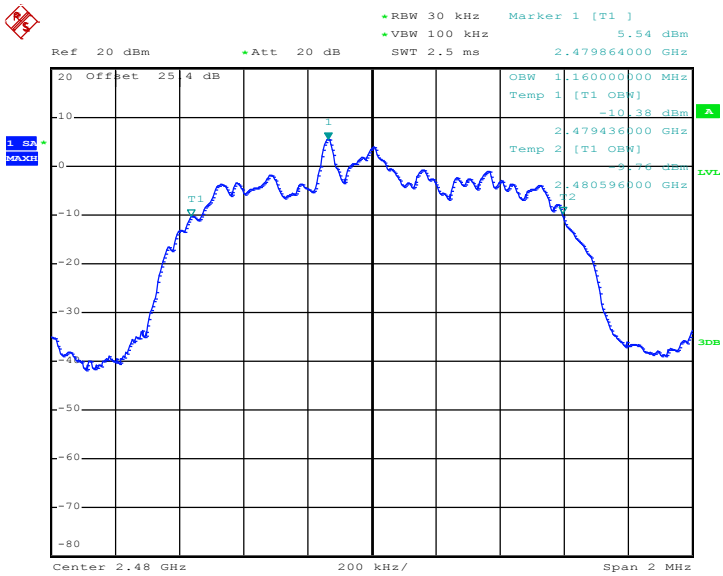
Date: 8.APR.2014 20:50:11

99% Occupied Bandwidth Plot on Channel 39



Date: 8.APR.2014 20:50:49

99% Occupied Bandwidth Plot on Channel 78

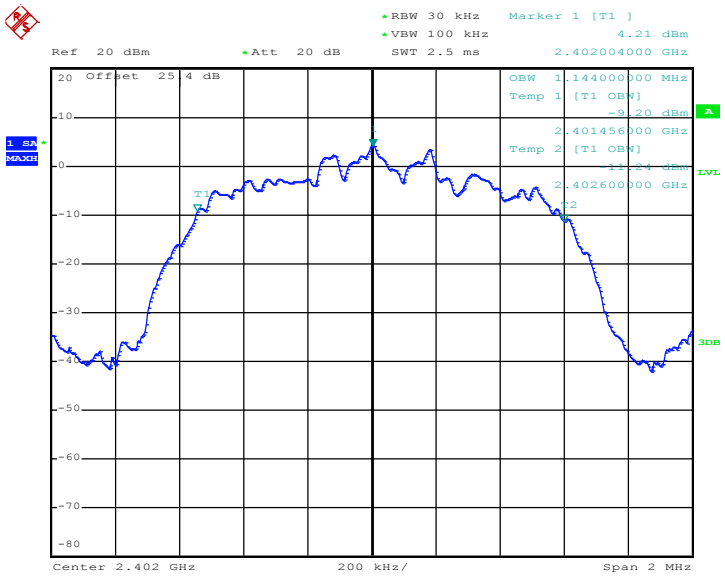


Date: 8.APR.2014 20:56:39

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

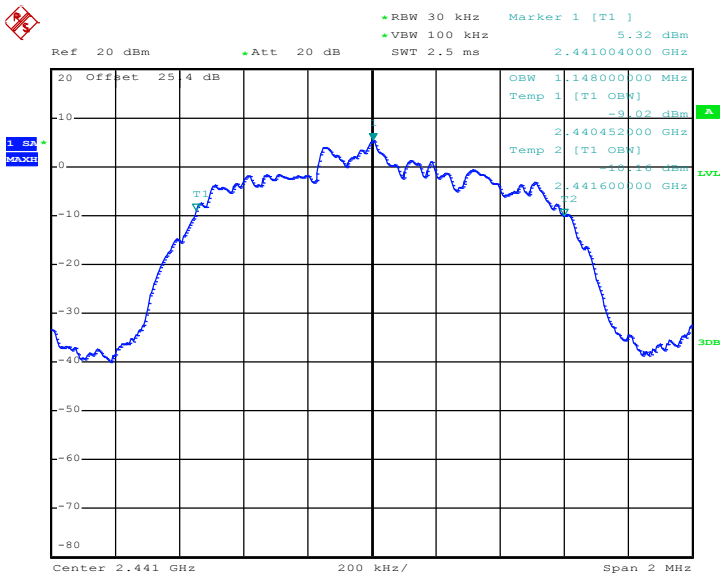
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.144
39	2441	1.148
78	2480	1.148

99% Occupied Bandwidth Plot on Channel 00



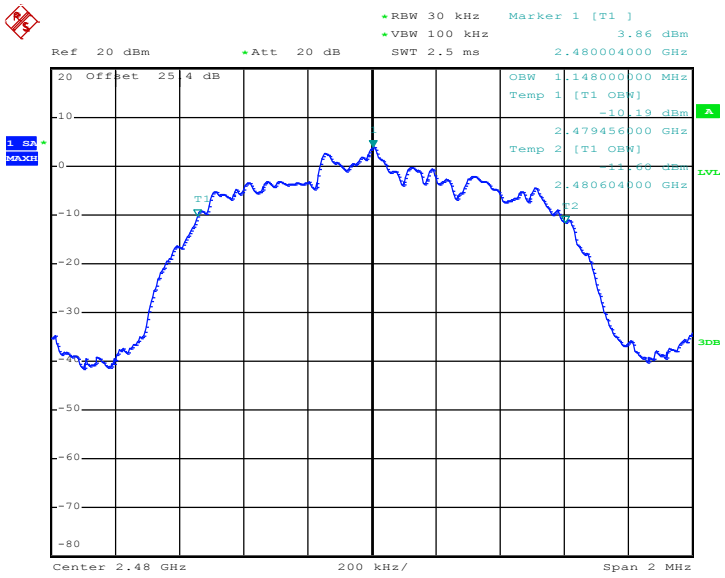
Date: 8.APR.2014 20:52:19

99% Occupied Bandwidth Plot on Channel 39



Date: 8.APR.2014 20:53:17

99% Occupied Bandwidth Plot on Channel 78



Date: 8.APR.2014 20:55:03

Note : The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

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.

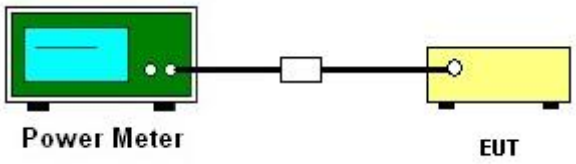
3.5.2 Measuring Instruments

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℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	8.25	20.97	Pass
39	2441	9.20	20.97	Pass
78	2480	7.77	20.97	Pass

Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		π/4-DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	9.18	20.97	Pass
39	2441	10.06	20.97	Pass
78	2480	8.69	20.97	Pass

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	9.51	20.97	Pass
39	2441	10.41	20.97	Pass
78	2480	8.97	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

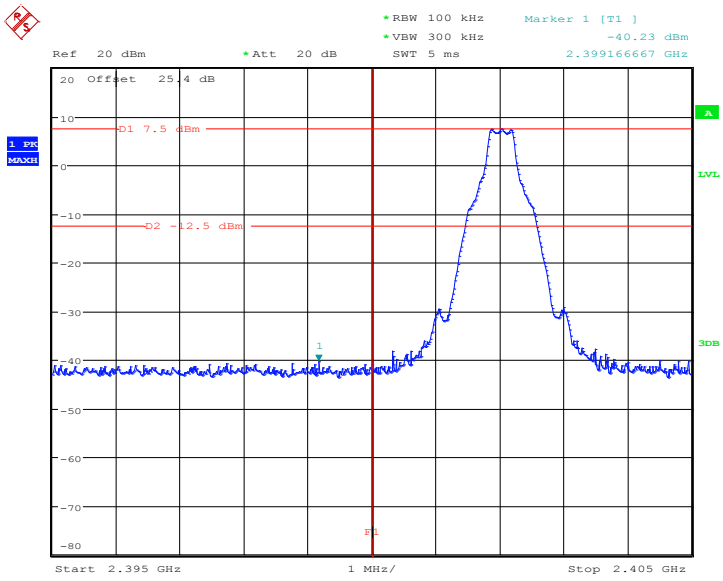
1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz (≥ 1% span=10MHz), VBW = 300kHz (≥ RBW). Band edge emissions 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

3.6.5 Test Result of Conducted Band Edges

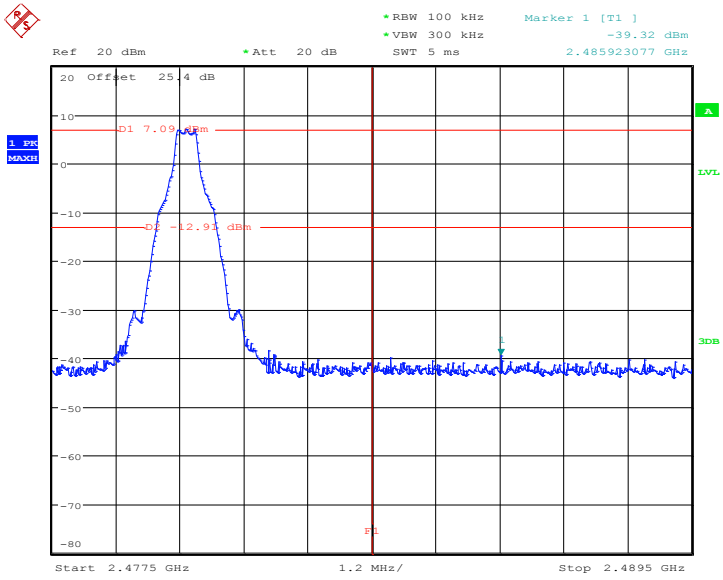
Test Mode :	1Mbps	**Temperature :**	24~26℃
Test Channel :	00 and 78	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

Low Band Edge Plot on Channel 00



Date: 1.APR.2014 17:59:04

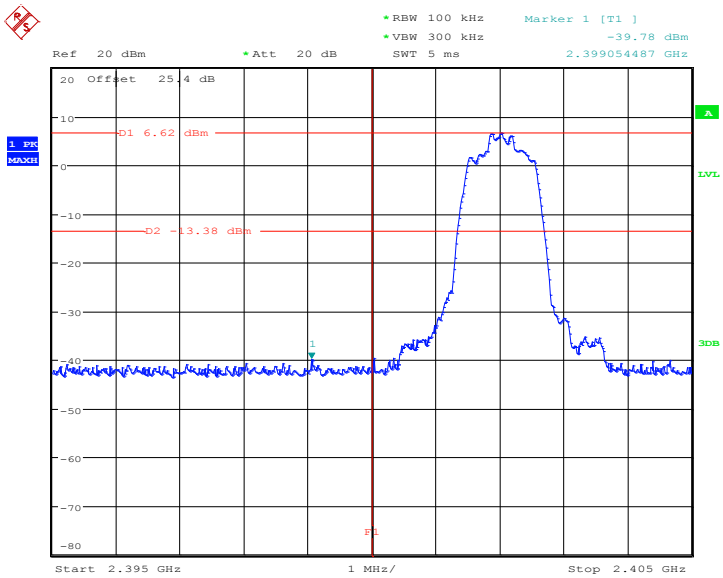
High Band Edge Plot on Channel 78



Date: 1.APR.2014 18:08:01

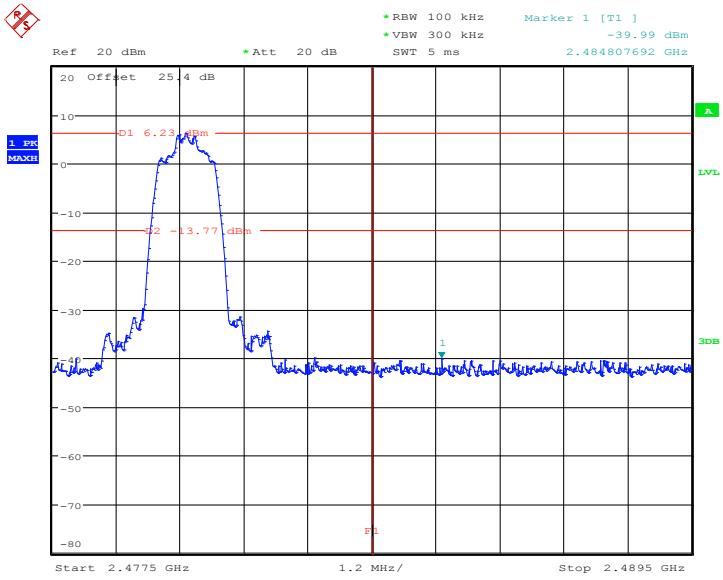
Test Mode :	2Mbps	**Temperature :**	24~26℃
Test Channel :	00 and 78	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

Low Band Edge Plot on Channel 00



Date: 1.APR.2014 18:17:21

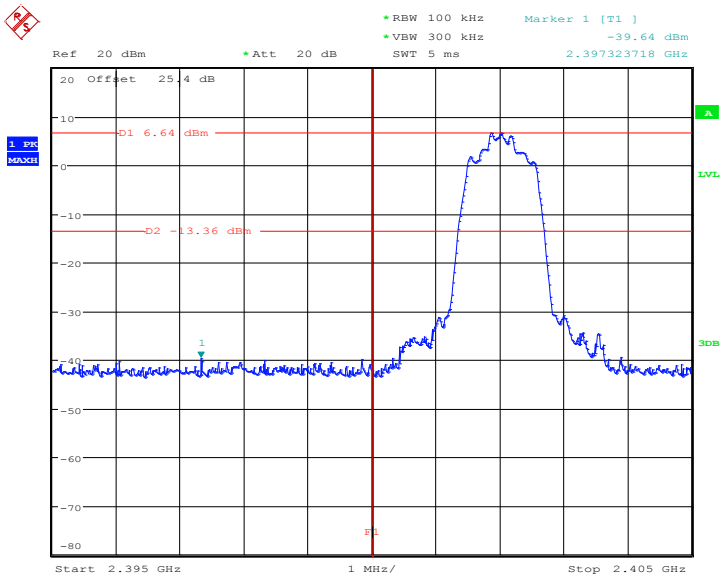
High Band Edge Plot on Channel 78



Date: 1.APR.2014 18:24:01

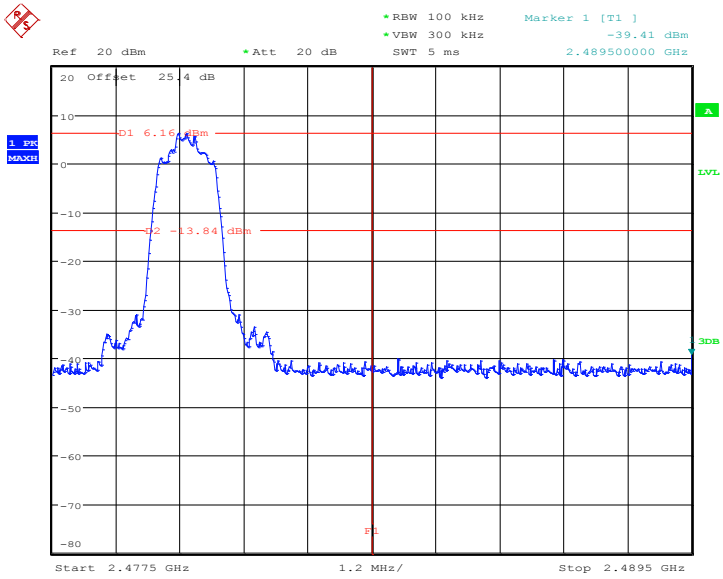
Test Mode :	3Mbps	**Temperature :**	24~26℃
Test Channel :	00 and 78	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

Low Band Edge Plot on Channel 00



Date: 1.APR.2014 18:36:52

High Band Edge Plot on Channel 78

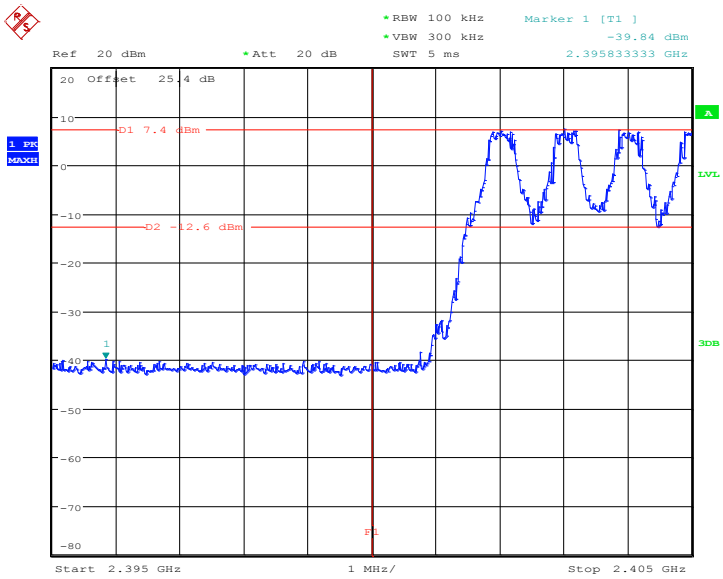


Date: 1.APR.2014 18:30:02

3.6.6 Test Result of Conducted Hopping Mode Band Edges

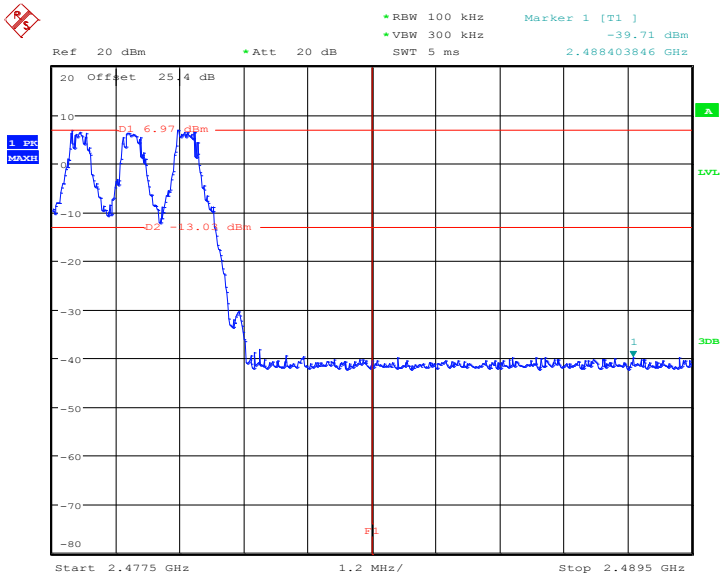
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

1Mbps Hopping Mode Low Band Edge Plot



Date: 1.APR.2014 17:58:46

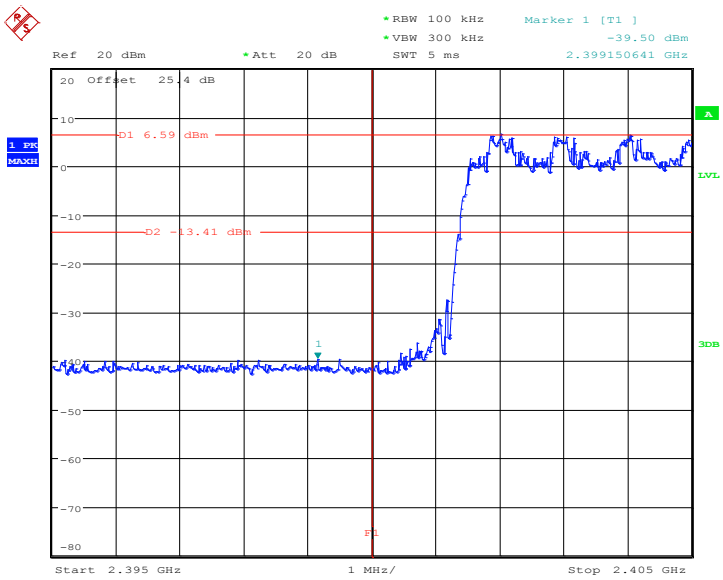
1Mbps Hopping Mode High Band Edge Plot



Date: 1.APR.2014 18:07:43

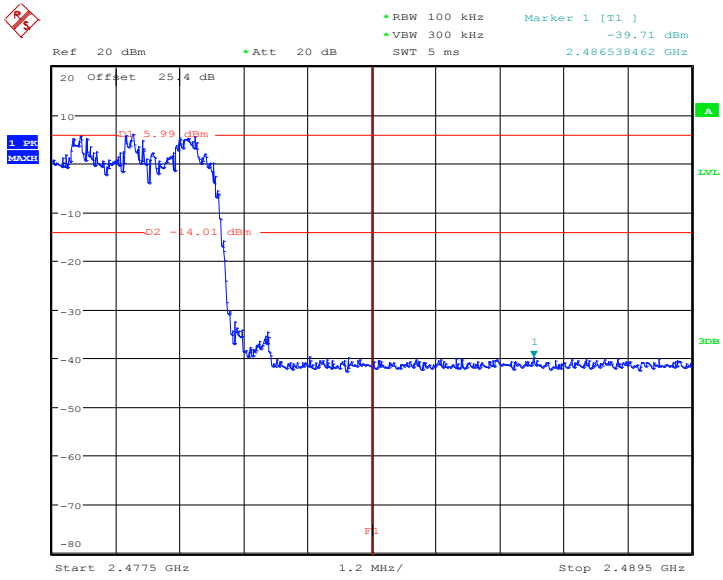
Test Mode :	2Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

2Mbps Hopping Mode Low Band Edge Plot



Date: 1.APR.2014 18:17:04

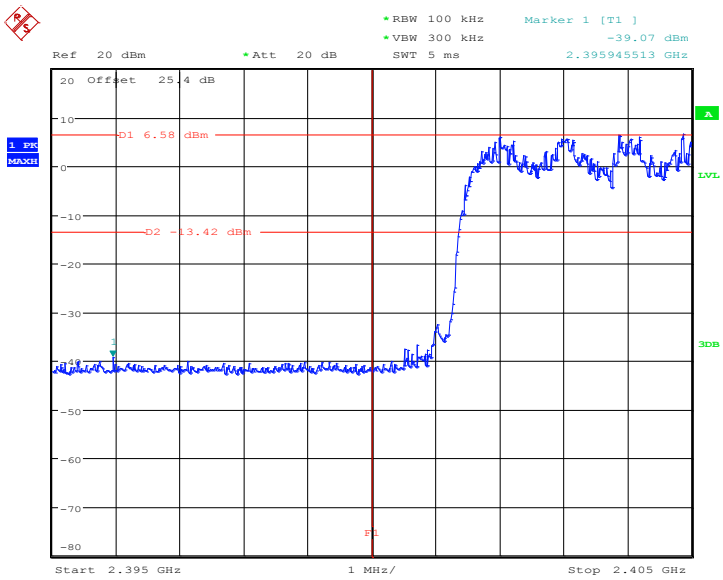
2Mbps Hopping Mode High Band Edge Plot



Date: 1.APR.2014 18:23:42

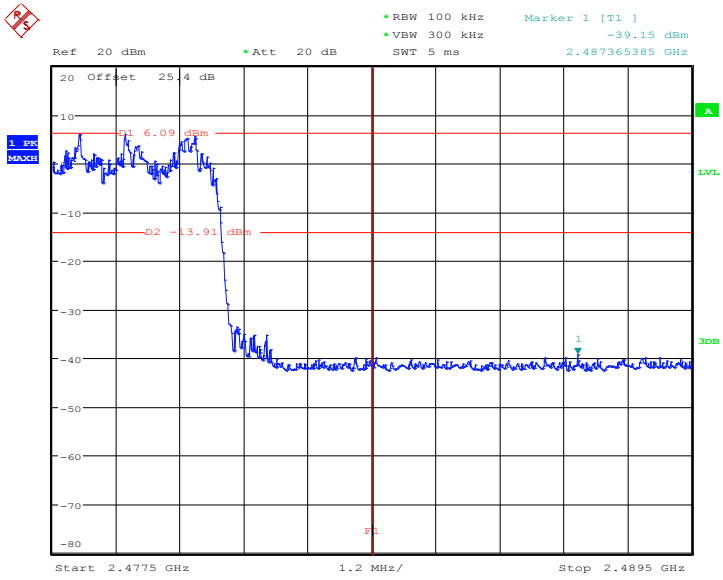
Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Alex Lee	Relative Humidity :	50~53%

3Mbps Hopping Mode Low Band Edge Plot



Date: 1.APR.2014 18:36:32

3Mbps Hopping Mode High Band Edge Plot



Date: 1.APR.2014 18:29:44

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

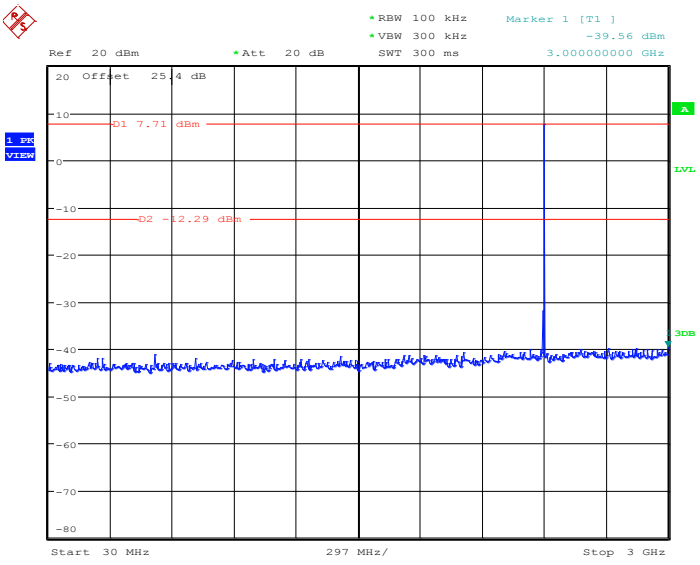
1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum 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

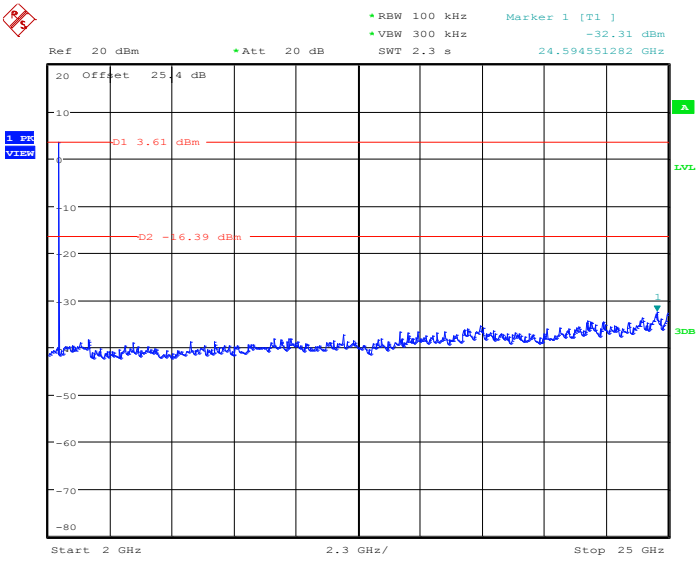
Test Mode :	1Mbps	Temperature :	24~26℃
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:13:50

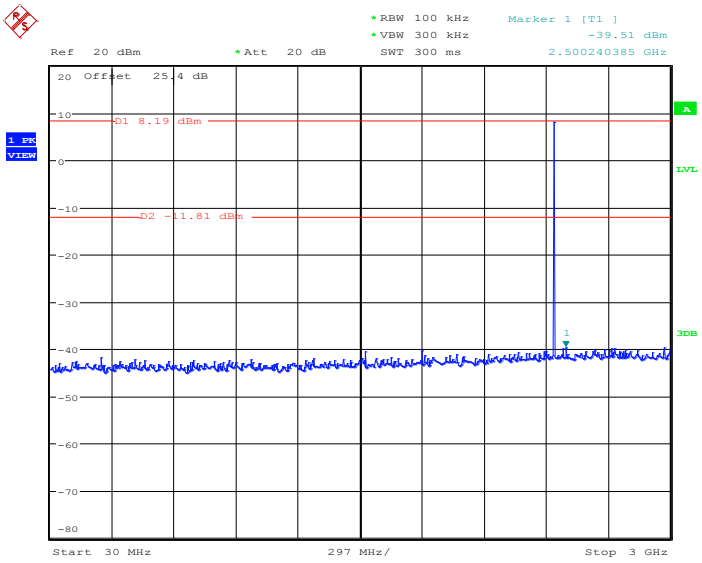
1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



Date: 1.APR.2014 18:14:12

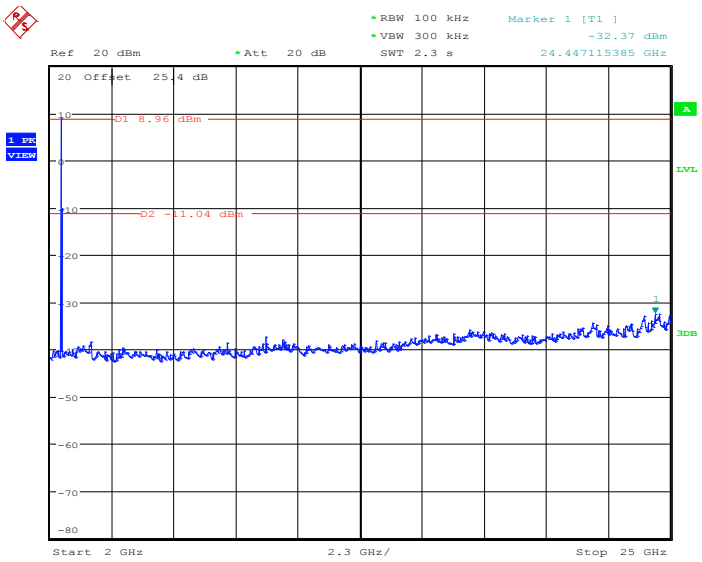
Test Mode :	1Mbps	**Temperature :**	24~26℃
Test Channel :	39	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:13:03

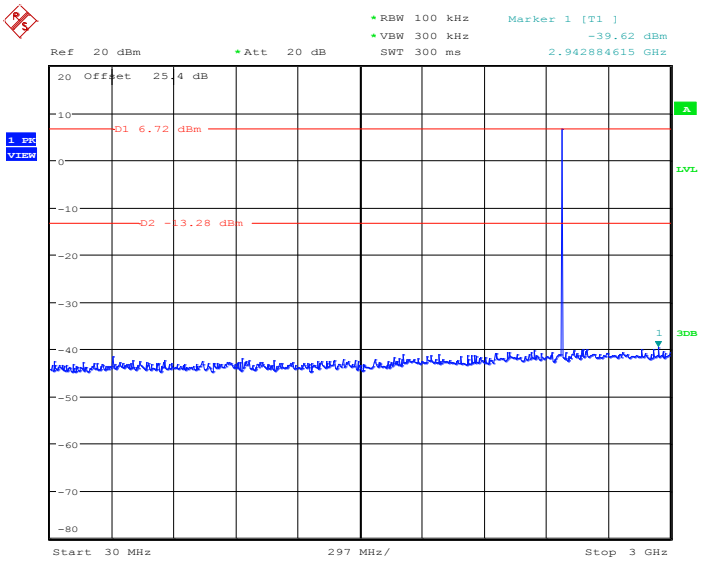
1Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



Date: 1.APR.2014 18:13:24

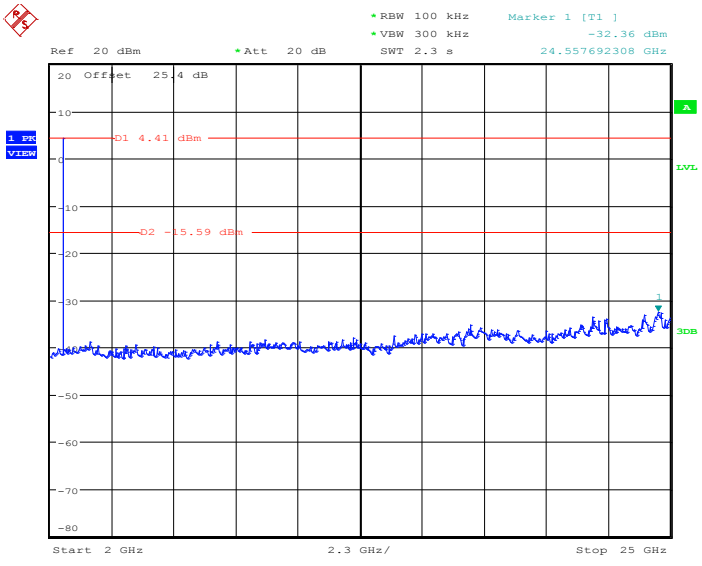
Test Mode :	1Mbps	Temperature :	24~26℃
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:11:12

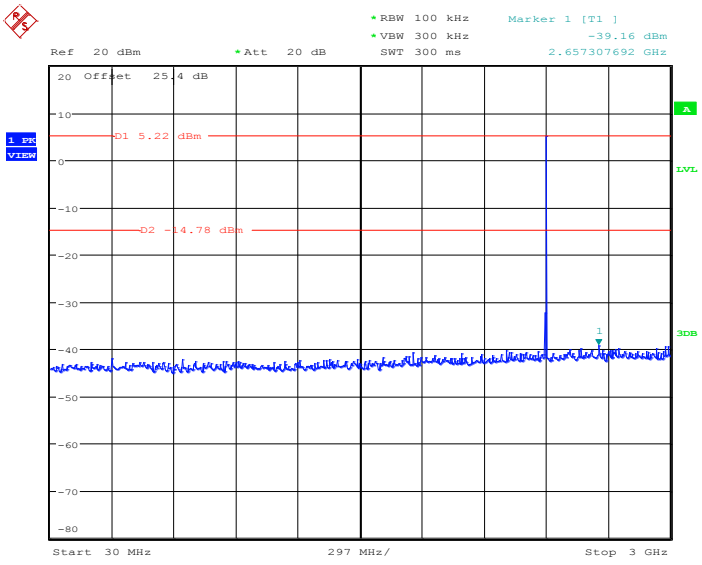
1Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



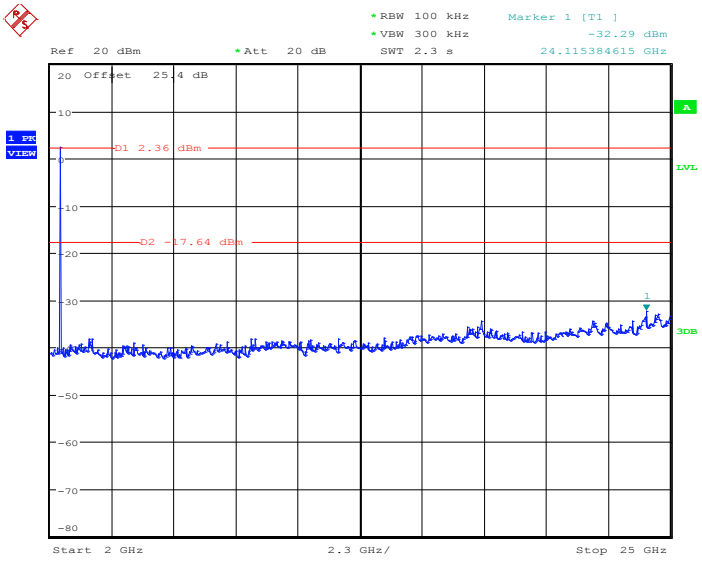
Date: 1.APR.2014 18:11:34

Test Mode :	2Mbps	**Temperature :**	24~26℃
Test Channel :	00	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

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

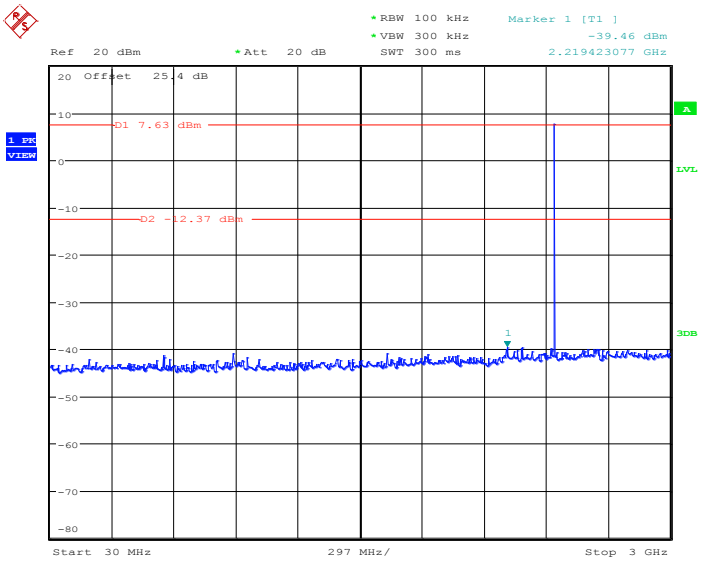


2Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

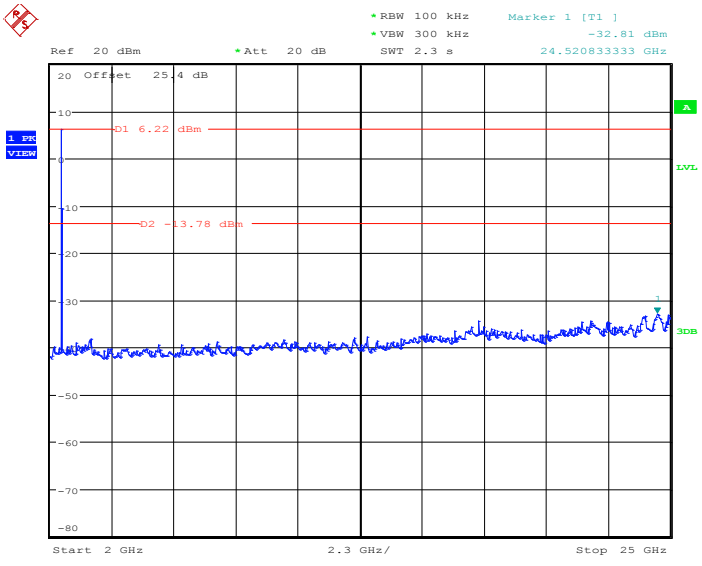


Test Mode :	2Mbps	Temperature :	24~26℃
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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

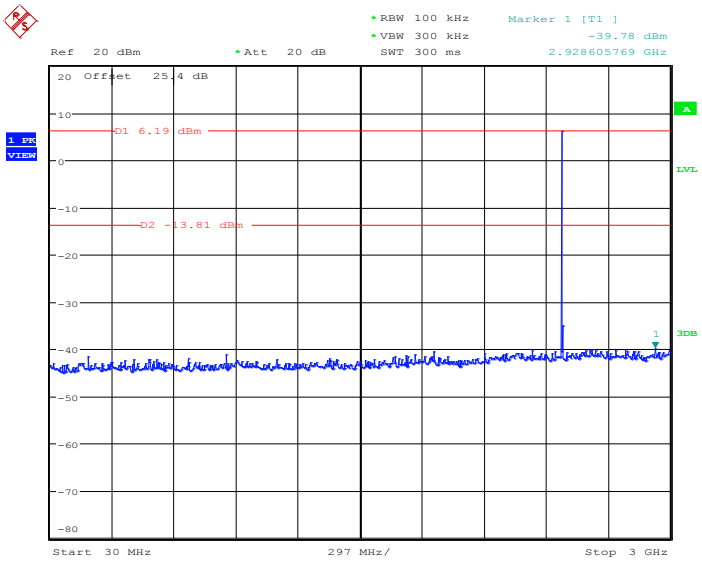


2Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



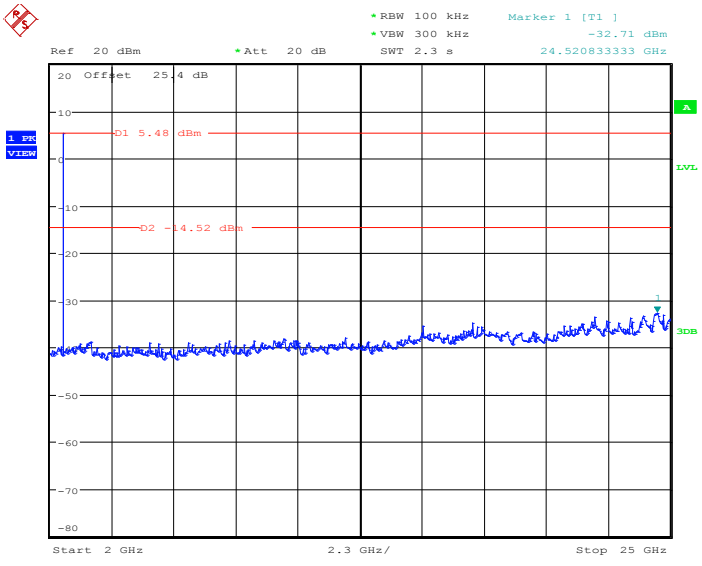
Test Mode :	2Mbps	Temperature :	24~26℃
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:25:01

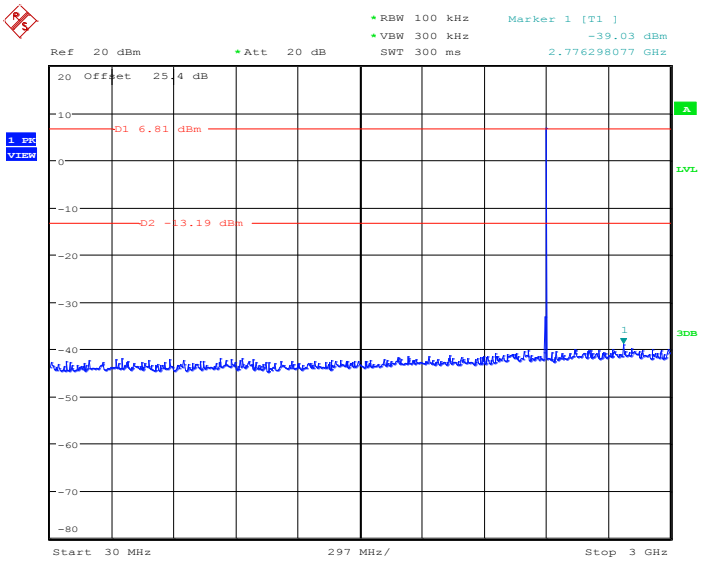
2Mbps CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



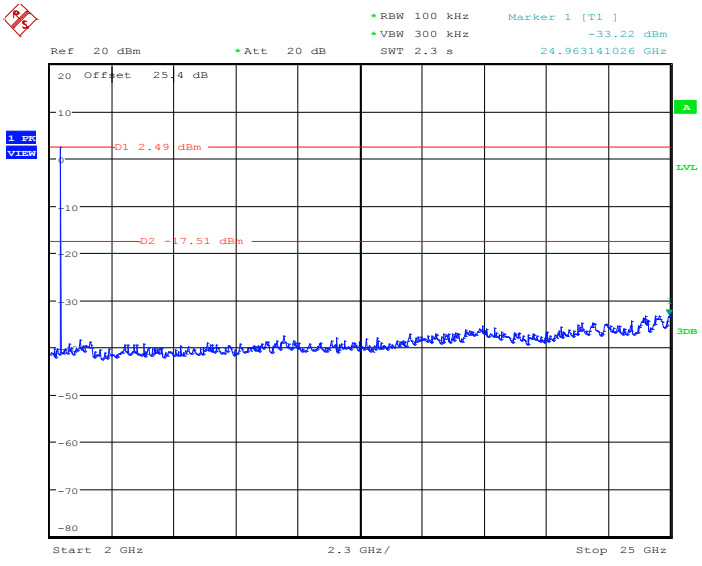
Date: 1.APR.2014 18:25:22

Test Mode :	3Mbps	Temperature :	24~26℃
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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

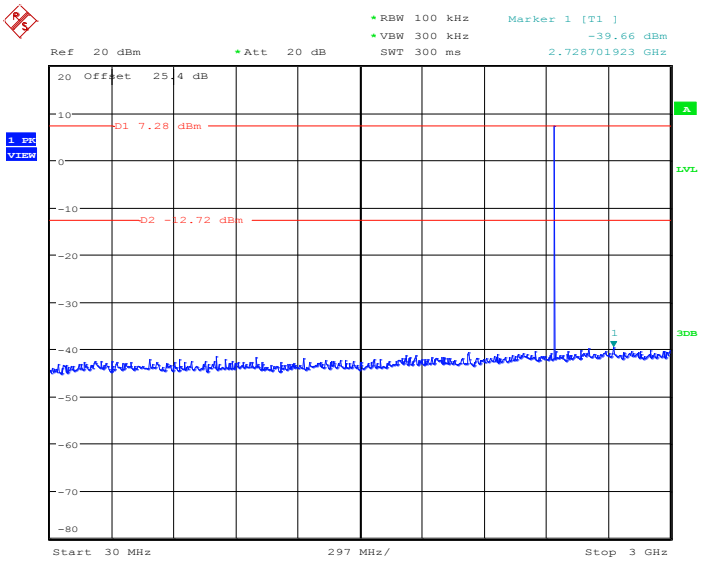


3Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



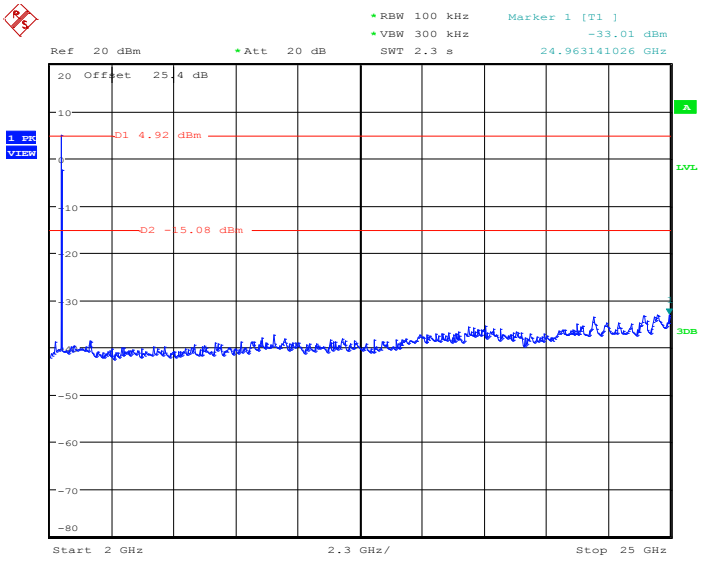
Test Mode :	3Mbps	Temperature :	24~26℃
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:33:52

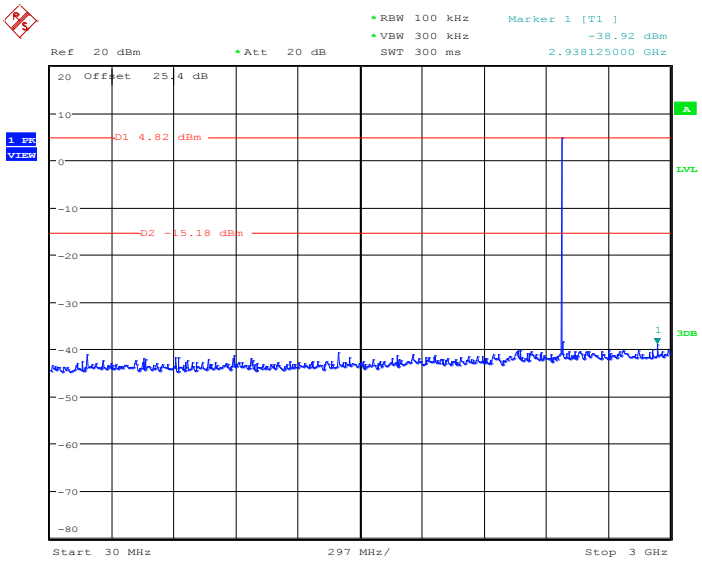
3Mbps CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



Date: 1.APR.2014 18:34:13

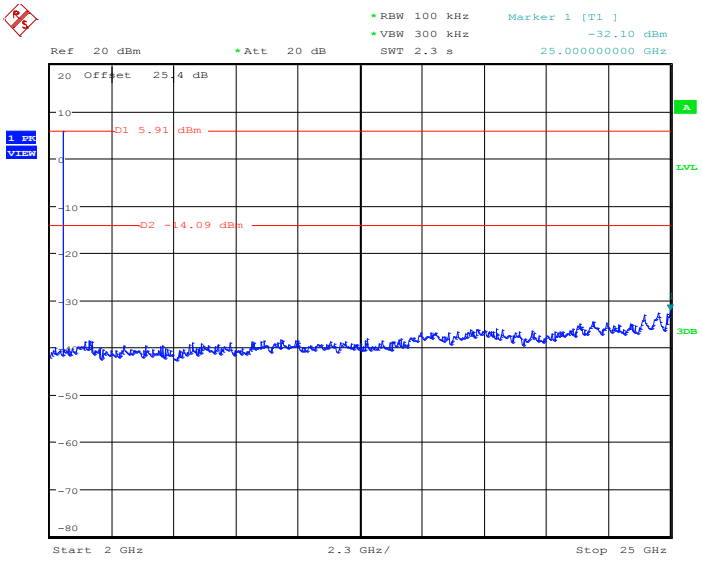
Test Mode :	3Mbps	**Temperature :**	24~26℃
Test Channel :	78	**Relative Humidity :**	50~53%
		Test Engineer :	Alex Lee

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



Date: 1.APR.2014 18:31:01

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



Date: 1.APR.2014 18:31:23

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.

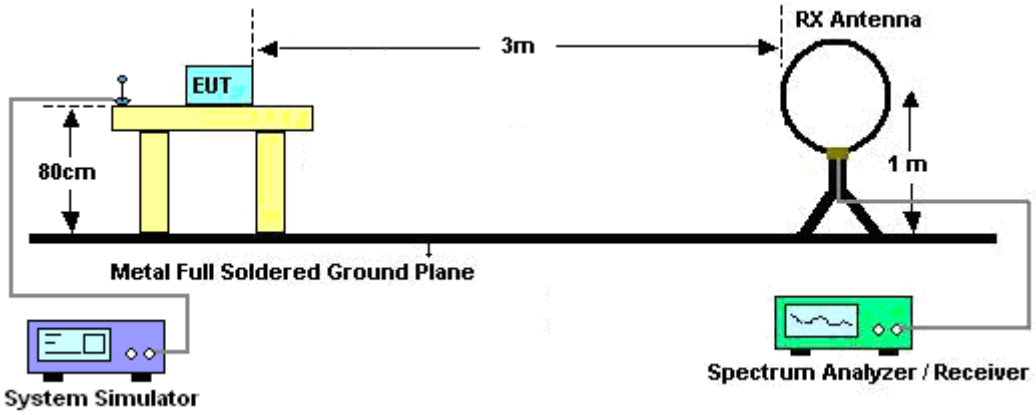
3.8.3 Test Procedures

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>1GHz ; VBW ≥ 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
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   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(Duty cycle)
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

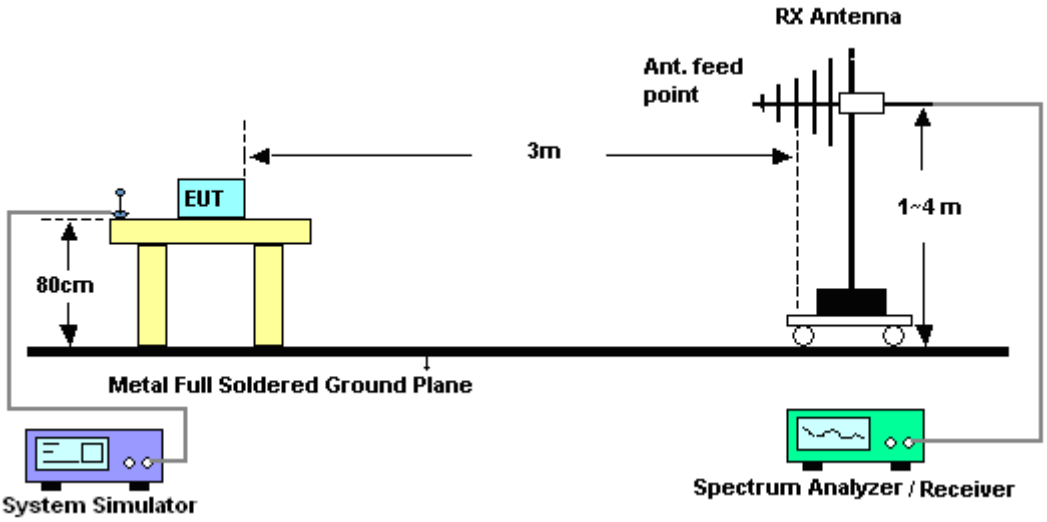
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.73dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

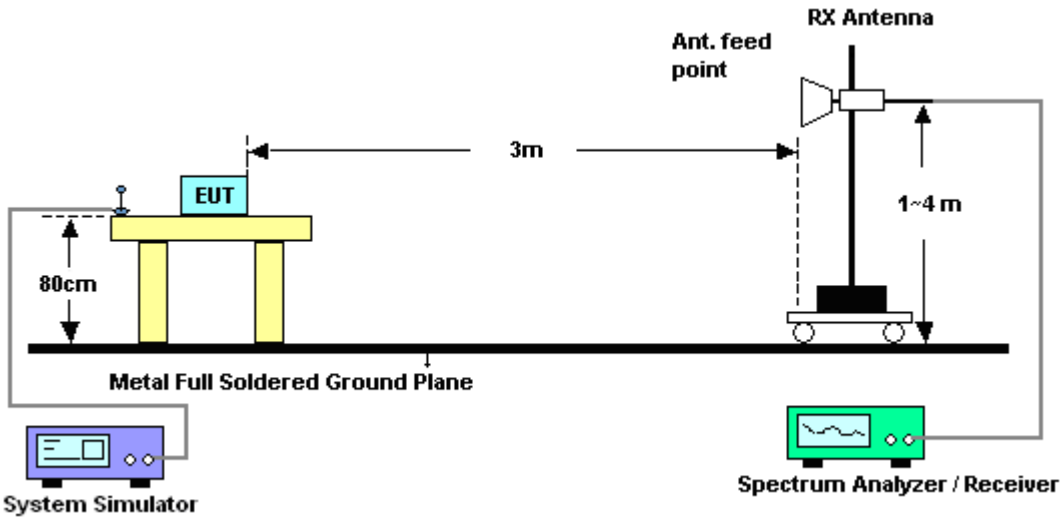
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz

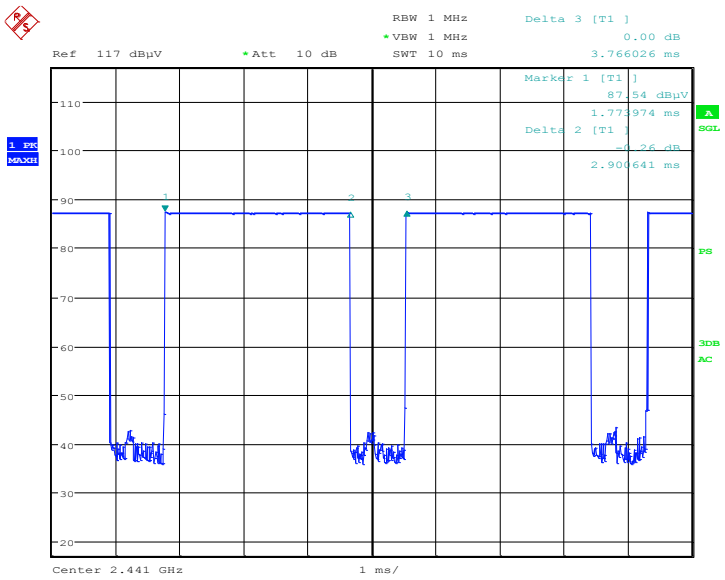


For radiated emissions above 1GHz



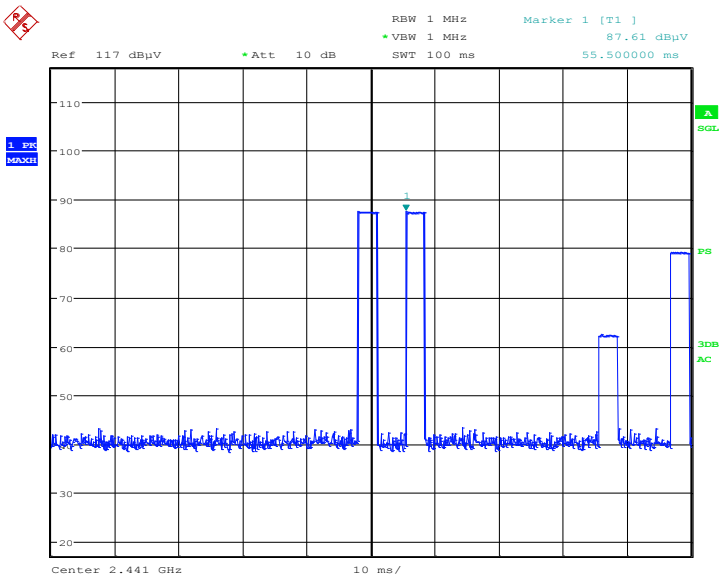
3.8.5 Duty cycle correction factor for average measurement

3DH5 on time (One Pulse) Plot on Channel 39



Date: 27.MAR.2014 22:22:43

3DH5 on time (Count Pulses) Plot on Channel 39



Date: 27.MAR.2014 22:23:44

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.90 / 100 = 5.80 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.73 dB
3. 3DH5 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

2.90 ms x 20 channels = 58.0 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. [100ms / 57.6ms] = 2 hops

Thus, the maximum possible ON time:

2.90 ms x 2 = 5.80 ms

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

20 x log(5.80 ms/100ms) = -24.73 dB

3.8.6 Test Result of Radiated Spurious at Band Edges

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	00	Relative Humidity :	44~45%
		Test Engineer :	Gavin Wu

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
2360.85	48.56	-25.44	74	44.59	31.89	6.42	34.34	146	13	Peak
2360.85	23.83	-30.17	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
2350.5	48.41	-25.59	74	44.49	31.88	6.38	34.34	102	124	Peak
2350.5	23.68	-30.32	54	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	44~45%
		Test Engineer :	Gavin Wu

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	56.64	-17.36	74	52.36	31.99	6.59	34.3	200	16	Peak
2483.5	31.91	-22.09	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	57.52	-16.48	74	53.24	31.99	6.59	34.3	100	114	Peak
2483.5	32.79	-21.21	54	-	-	-	-	-	-	Average

< Bluetooth Tx Mode with WPC Charging Mode>

Test Mode :	3Mbps	**Temperature :**	23~25°C
Test Channel :	78	**Relative Humidity :**	43~45%
		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	57.84	-16.16	74	53.56	31.99	6.59	34.3	100	310	Peak
2483.5	33.11	-20.89	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	57.99	-16.01	74	53.71	31.99	6.59	34.3	200	149	Peak
2483.5	33.26	-20.74	54	-	-	-	-	-	-	Average

Note: Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73dB)

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

Note: Pre-scanned all test modes and only choose the worst case mode recorded in the test report for radiated spurious emission below 30MHz.

< Bluetooth Tx Mode with WPC Charging Mode>

Test Mode :	3Mbps	**Temperature :**	23~25°C
Test Channel :	78	**Relative Humidity :**	43~45%
Test Engineer :	Eric Shih	**Polarization :**	Horizontal

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.01793	35.98	-86.56	122.54	15.43	20.26	0.29	-	-	Average
0.06435	21.52	-89.91	111.43	1.12	20.11	0.29	-	-	Average
0.09666	21.92	-85.98	107.9	1.56	20.07	0.29	-	-	QP
0.14504	21.97	-82.4	104.37	1.64	20.04	0.29	-	-	Average
0.17516	51.41	-51.33	102.74	31.09	20.03	0.29	-	-	Average
0.45192	46.06	-48.44	94.5	25.77	20	0.29	-	-	Average
1.571	48.88	-14.8	63.68	28.54	20.01	0.33	100	68	QP
11.792	35.64	-34.36	70	15.47	19.77	0.4	-	-	QP
20.077	37.19	-32.81	70	16.61	20.15	0.43	-	-	QP
27.765	35.91	-34.09	70	15.06	20.35	0.5	-	-	QP

Test Mode :	3Mbps	Temperature :	23~25°C
Test Channel :	78	Relative Humidity :	43~45%
Test Engineer :	Eric Shih	Polarization :	Vertical

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.04837	36.49	-77.42	113.91	16.03	20.17	0.29	-	-	Average
0.08145	23.27	-86.12	109.39	2.87	20.11	0.29	-	-	Average
0.09668	27.66	-80.24	107.9	7.3	20.07	0.29	-	-	QP
0.13008	24.56	-80.76	105.32	4.21	20.06	0.29	-	-	Average
0.17176	41.07	-61.84	102.91	20.74	20.04	0.29	-	-	Average
0.34788	40.15	-56.63	96.78	19.86	20	0.29	-	-	Average
3.366	34.82	-35.18	70	14.46	20.02	0.34	-	-	QP
12.008	36.58	-33.42	70	16.41	19.77	0.4	-	-	QP
18.304	37.21	-32.79	70	16.85	19.94	0.42	100	177	QP
28.525	35.76	-34.24	70	14.96	20.29	0.51	-	-	QP

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 :	3Mbps	**Temperature :**	25~26°C
Test Channel :	00	**Relative Humidity :**	44~45%
Test Engineer :	Gavin Wu	**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	100.01	-	-	95.97	31.92	6.45	34.33	146	13	Peak
2402	75.28	-	-	-	-	-	-	-	-	Average
4803	47.59	-26.41	74	58.58	34.41	10.16	55.56	100	0	Peak
4803	22.86	-31.14	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	**Temperature :**	25~26°C
Test Channel :	00	**Relative Humidity :**	44~45%
Test Engineer :	Gavin Wu	**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	99.05	-	-	95.01	31.92	6.45	34.33	102	124	Peak
2402	74.32	-	-	-	-	-	-	-	-	Average
4803	46.62	-27.38	74	57.61	34.41	10.16	55.56	100	0	Peak
4803	21.89	-32.11	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	39	Relative Humidity :	44~45%
Test Engineer :	Gavin Wu	Polarization :	Horizontal
Remark :	2441 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
2441	100.06	-	-	95.89	31.96	6.52	34.31	200	18	Peak
2441	75.33	-	-	-	-	-	-	-	-	Average
4881	46.57	-27.43	74	57.69	34.37	10.19	55.68	100	0	Peak
4881	21.84	-32.16	54	-	-	-	-	-	-	Average
7323	47.66	-26.34	74	57.36	35.6	10.94	56.24	100	0	Peak
7323	22.93	-31.07	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	39	Relative Humidity :	44~45%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	2441 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
2441	99.26	-	-	95.09	31.96	6.52	34.31	100	108	Peak
2441	74.53	-	-	-	-	-	-	-	-	Average
4881	47.4	-26.6	74	58.52	34.37	10.19	55.68	100	0	Peak
4881	22.67	-31.33	54	-	-	-	-	-	-	Average
7323	47.27	-26.73	74	56.97	35.6	10.94	56.24	100	0	Peak
7323	22.54	-31.46	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	44~45%
Test Engineer :	Gavin Wu	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
155.55	24.64	-18.86	43.5	44.79	10.2	1.4	31.75	-	-	Peak
198.75	27.24	-16.26	43.5	48.28	9.18	1.53	31.75	100	149	Peak
204.96	26.92	-16.58	43.5	47.97	9.15	1.55	31.75	-	-	Peak
310.5	24.53	-21.47	46	40.92	13.4	1.94	31.73	-	-	Peak
349	22.11	-23.89	46	37.38	14.45	2.05	31.77	-	-	Peak
812.4	22.43	-23.57	46	30.97	20.26	3.1	31.9	-	-	Peak
2480	100.1	-	-	95.82	31.99	6.59	34.3	200	16	Peak
2480	75.37	-	-	-	-	-	-	-	-	Average
4959	47.19	-26.81	74	47.19	0	0	0	100	0	Peak
4959	22.46	-31.54	54	-	-	-	-	-	-	Average
7440	47.59	-26.41	74	57.16	35.53	10.9	56	100	0	Peak
7440	22.86	-31.14	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	44~45%
Test Engineer :	Gavin Wu	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
34.05	20.5	-19.5	40	35.51	16.1	0.68	31.79	-	-	Peak
44.04	27.64	-12.36	40	48.4	10.26	0.76	31.78	102	261	Peak
50.25	22.9	-17.1	40	45.58	8.3	0.8	31.78	-	-	Peak
307	22.58	-23.42	46	39.03	13.35	1.93	31.73	-	-	Peak
384	19.62	-26.38	46	34.02	15.26	2.14	31.8	-	-	Peak
646.5	23.2	-22.8	46	32.91	19.53	2.8	32.04	-	-	Peak
2480	100.31	-	-	96.03	31.99	6.59	34.3	100	114	Peak
2480	75.58	-	-	-	-	-	-	-	-	Average
4959	47.18	-26.82	74	58.49	34.32	10.21	55.84	100	0	Peak
4959	22.45	-31.55	54	-	-	-	-	-	-	Average
7440	47.35	-26.65	74	56.92	35.53	10.9	56	100	0	Peak
7440	22.62	-31.38	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

< Bluetooth Tx Mode with WPC Charging Mode>

Test Mode :	3Mbps	**Temperature :**	25~26°C
Test Channel :	78	**Relative Humidity :**	44~45%
Test Engineer :	Gavin Wu	**Polarization :**	Horizontal
Remark :	2481 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
121.8	25	-18.5	43.5	43.4	12.12	1.23	31.75	-	-	Peak
134.22	25.25	-18.25	43.5	44.15	11.56	1.29	31.75	-	-	Peak
183.63	25.06	-18.44	43.5	46.23	9.12	1.46	31.75	-	-	Peak
304.9	31.92	-14.08	46	48.43	13.29	1.92	31.72	102	332	Peak
336.4	22.95	-23.05	46	38.82	13.89	2	31.76	-	-	Peak
372.8	21.08	-24.92	46	35.81	14.94	2.12	31.79	-	-	Peak
2481	100.18	-	-	95.9	31.99	6.59	34.3	100	310	Peak
2481	75.54	-	-	-	-	-	-	-	-	Average
4959	40.13	-33.87	74	56.08	34.32	10.21	60.48	100	0	Peak
4959	15.4	-38.6	54	-	-	-	-	-	-	Average
7440	41.82	-32.18	74	55.97	35.53	10.9	60.58	100	0	Peak
7440	17.09	-36.91	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

Test Mode :	3Mbps	Temperature :	25~26°C
Test Channel :	78	Relative Humidity :	44~45%
Test Engineer :	Gavin Wu	Polarization :	Vertical
Remark :	2481 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
44.58	30.02	-9.98	40	51.44	9.6	0.76	31.78	100	151	Peak
50.52	29.06	-10.94	40	51.74	8.3	0.8	31.78	-	-	Peak
83.73	29.12	-10.88	40	52.35	7.52	1.01	31.76	-	-	Peak
303.5	26.36	-19.64	46	42.89	13.27	1.92	31.72	-	-	Peak
375.6	22.44	-23.56	46	37.12	15	2.12	31.8	-	-	Peak
452.6	23.05	-22.95	46	35.62	16.99	2.32	31.88	-	-	Peak
2481	101.42	-	-	97.14	31.99	6.59	34.3	200	149	Peak
2481	76.69	-	-	-	-	-	-	-	-	Average
4959	40.73	-33.27	74	56.68	34.32	10.21	60.48	100	0	Peak
4959	16	-38	54	-	-	-	-	-	-	Average
7440	42	-32	74	56.15	35.53	10.9	60.58	100	0	Peak
7440	17.27	-36.73	54	-	-	-	-	-	-	Average

Note: 1. Other harmonics are lower than background noise.

2. Average Emission Level = Peak Emission Level + duty cycle correction factor(-24.73)

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 (dBμV)	
	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.

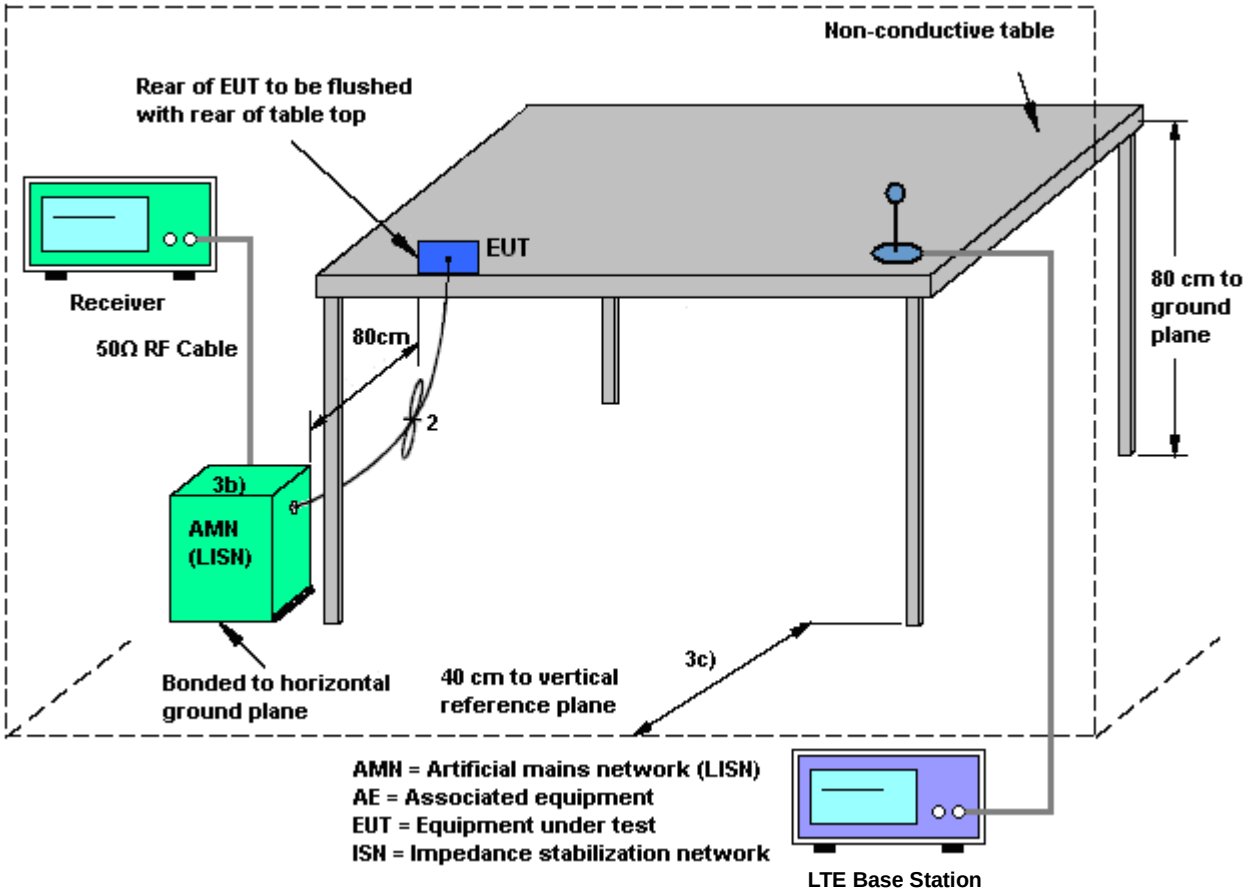
3.9.2 Measuring Instruments

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

3.9.3 Test Procedures

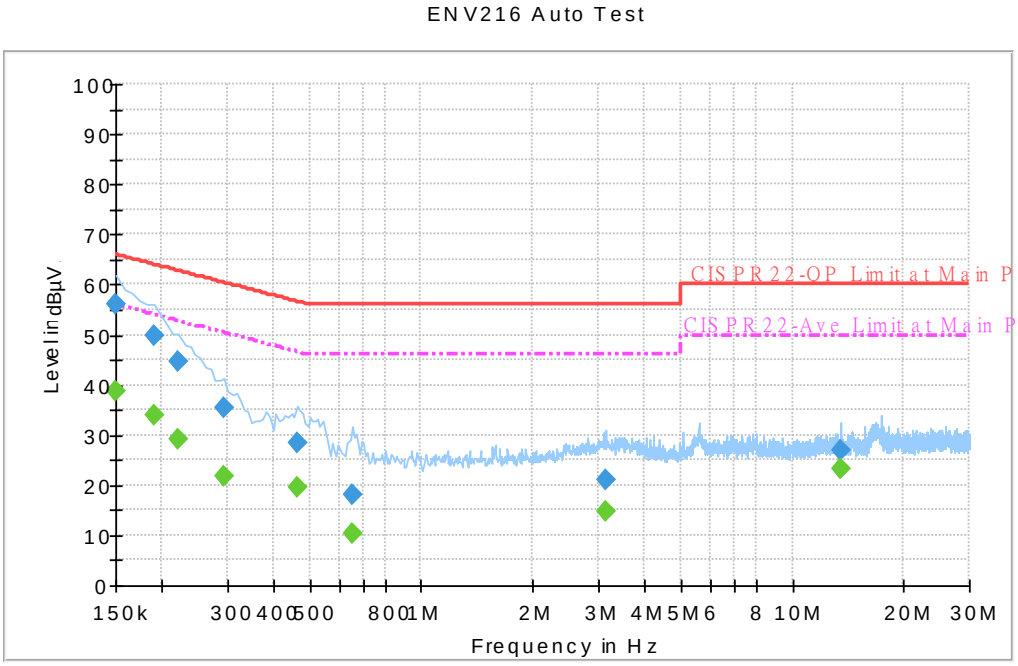
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
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 :	20~22℃
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	LTE Band 2 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC Tx + Earphone 1 + USB Cable (Data Link with Notebook)		



Final Result : Quasi-Peak

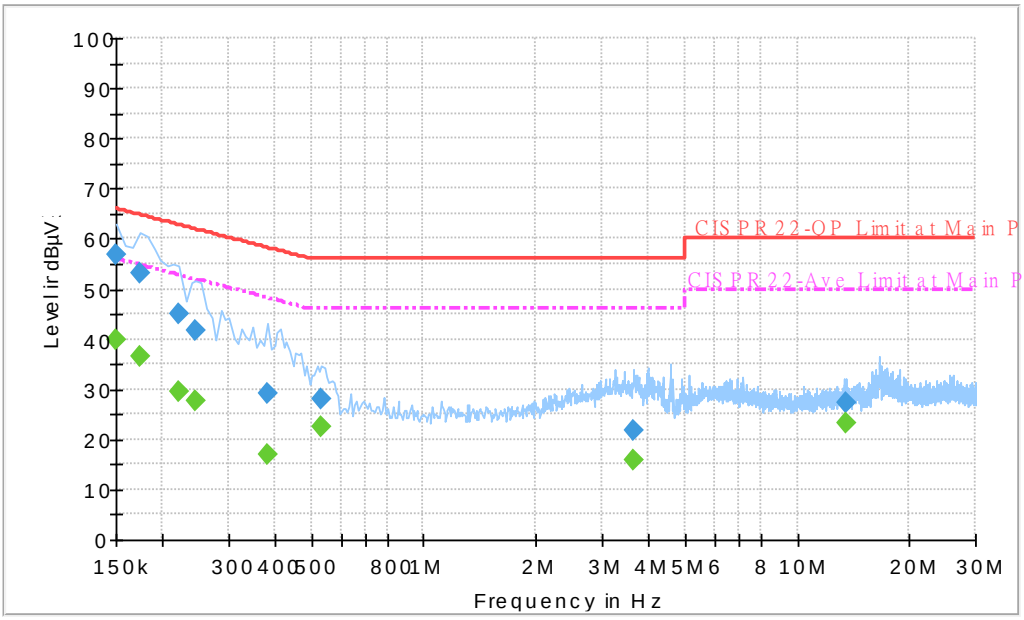
Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	56.2	Off	L1	19.4	9.8	66.0
0.190000	49.8	Off	L1	19.4	14.2	64.0
0.222000	44.6	Off	L1	19.4	18.1	62.7
0.294000	35.3	Off	L1	19.4	25.1	60.4
0.462000	28.4	Off	L1	19.3	28.3	56.7
0.654000	18.0	Off	L1	19.4	38.0	56.0
3.134000	20.9	Off	L1	19.6	35.1	56.0
13.558000	27.1	Off	L1	19.8	32.9	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	38.7	Off	L1	19.4	17.3	56.0
0.190000	33.8	Off	L1	19.4	20.2	54.0
0.222000	29.1	Off	L1	19.4	23.6	52.7
0.294000	21.7	Off	L1	19.4	28.7	50.4
0.462000	19.7	Off	L1	19.3	27.0	46.7
0.654000	10.2	Off	L1	19.4	35.8	46.0
3.134000	14.9	Off	L1	19.6	31.1	46.0
13.558000	23.1	Off	L1	19.8	26.9	50.0

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Kai-Chun Chu	Relative Humidity :	46~48%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	LTE Band 2 Idle + WLAN (2.4GHz) Link + Bluetooth Link + NFC Tx + Earphone 1 + USB Cable (Data Link with Notebook)		

ENV216 Auto Test



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	56.9	Off	N	19.4	9.1	66.0
0.174000	53.1	Off	N	19.3	11.7	64.8
0.222000	44.9	Off	N	19.4	17.8	62.7
0.246000	41.6	Off	N	19.4	20.3	61.9
0.382000	29.0	Off	N	19.3	29.2	58.2
0.534000	28.0	Off	N	19.4	28.0	56.0
3.646000	21.8	Off	N	19.6	34.2	56.0
13.558000	27.2	Off	N	19.9	32.8	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	39.9	Off	N	19.4	16.1	56.0
0.174000	36.7	Off	N	19.3	18.1	54.8
0.222000	29.7	Off	N	19.4	23.0	52.7
0.246000	27.5	Off	N	19.4	24.4	51.9
0.382000	16.8	Off	N	19.3	31.4	48.2
0.534000	22.4	Off	N	19.4	23.6	46.0
3.646000	16.0	Off	N	19.6	30.0	46.0
13.558000	23.4	Off	N	19.9	26.6	50.0

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	Apr. 01, 2014~ Apr. 08, 2014	Jun. 06, 2014	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Jan. 28, 2014	Apr. 01, 2014~ Apr. 08, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Jan. 28, 2014	Apr. 01, 2014~ Apr. 08, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP30	101067	9kHz ~ 30GHz	Nov. 20, 2013	Mar. 27, 2014 ~ May 21, 2014	Nov. 19, 2014	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/0003	20MHz ~ 1000MHz	May 06, 2013	Mar. 27, 2014~ Mar. 28, 2014	May 05, 2014	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/0003	20MHz ~ 1000MHz	May 06, 2014	May 21, 2014	May 05, 2015	Radiation (03CH06-HY)
Bilog Antenna	Schaffner	CBL6112B	2885	30MHz -2GHz	Oct. 10, 2013	Mar. 27, 2014~ May 21, 2014	Oct. 09, 2014	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Aug. 02, 2013	Mar. 27, 2014~ May 21, 2014	Aug. 01, 2014	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9kHz ~ 1GHz	Apr. 12, 2013	Mar. 27, 2014~ Mar. 28, 2014	Apr. 11, 2014	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9kHz ~1GHz	Apr. 16, 2014	May 21, 2014	Apr. 15, 2015	Radiation (03CH06-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 18, 2013	Mar. 27, 2014~ May 21, 2014	Jul. 17, 2014	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz ~ 40GHz	Oct. 03, 2013	Mar. 27, 2014~ May 21, 2014	Oct. 02, 2014	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz ~ 26.5GHz	Feb. 10, 2014	Mar. 27, 2014~ May 21, 2014	Feb. 19, 2015	Radiation (03CH06-HY)
Turn Table	INN-CO	DS2000	420/650/00	0 - 360 degree	N/A	Mar. 27, 2014~ May 21, 2014	N/A	Radiation (03CH06-HY)
Antenna Mast	MF	MF-7802	MF780208212	1 m ~ 4 m	N/A	Mar. 27, 2014~ May 21, 2014	N/A	Radiation (03CH06-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Mar. 27, 2014 ~ May 19, 2014	Nov. 14, 2014	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Mar. 27, 2014 ~ May 19, 2014	Dec. 11, 2014	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Mar. 27, 2014 ~ May 19, 2014	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Mar. 27, 2014 ~ May 19, 2014	N/A	Conduction (CO05-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Sep. 06, 2013	May 21, 2014	Sep. 05, 2014	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	860004/0001	9 kHz~30 MhZ	Jul. 03, 2012	May 21, 2014	Jul. 02, 2014	Radiation (03CH07-HY)
Bilog Antenna	Schaffner	CBL6111C	2726	30MHz ~ 1GHz	Oct. 10, 2013	May 21, 2014	Oct. 09, 2014	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10 MHz ~ 1000MHz 32dB GAIN	Mar. 17, 2014	May 21, 2014	Mar. 16, 2015	Radiation (03CH07-HY)
Turn Table	ChainTek	ChainTek 3000	N/A	0 ~ 360 degree	N/A	May 21, 2014	N/A	Radiation (03CH07-HY)
Antenna Mast	ChainTek	ChainTek 3000	N/A	N/A	N/A	May 21, 2014	N/A	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 = 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**