

FCC RF Test Report

APPLICANT : VeriFone Inc.
EQUIPMENT : Point of Sale Terminal
BRAND NAME : VeriFone
MODEL NAME : VX680 BT-WiFi
FCC ID : B32VX680BTWIFI
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : Digital Spread Spectrum (DSS)

The product was received on Jul. 01, 2011 and completely tested on Aug. 02, 2011. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown the compliance with the applicable technical standards.

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

Reviewed by:



Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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

SPORTON INTERNATIONAL INC.

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FCC ID : B32VX680BTWIFI

Page Number : 1 of 59

Report Issued Date : Aug. 17, 2011

Report Version : Rev. 01



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR170108-01A	Rev. 01	Initial issue of report	Aug. 17, 2011

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	A8.4(2)	Number of Channels	$\geq 15\text{Chs}$	Pass	-
3.2	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.2	-	Gen 4.4.1	99% Bandwidth	-	Pass	-
3.3	15.247(a)(1)	A8.1(b)	Channel Separation	$\geq 2/3$ of 20dB BW	Pass	-
3.4	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	$\leq 125\text{ mW}$	Pass	-
3.6	15.247(d)	A8.5	Frequency Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	A8.5	Spurious Emission	$< 20\text{ dBc}$	Pass	-
3.8	15.207	Gen 7.2.2	AC Conducted Emission	15.207(a)	Pass	Under limit 9.2 dB at 0.15 MHz
3.9	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.04 dB at 2483.5 MHz
3.10	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

VeriFone Inc.

1400 West Stanford Ranch Road Suit 200 Rocklin CA 95765 USA

1.2 Manufacturer

Inventec Appliances (Pudong) Co., Ltd.

No. 789 Pu Xing Road, Shanghai, P.R.C.

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Point of Sale Terminal
Brand Name	VeriFone
Model Name	VX680 BT-WiFi
FCC ID	B32VX680BTWIFI
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Channel Spacing	1 MHz
Maximum Output Power to Antenna	Bluetooth (1Mbps) : -3.36 dBm (0.0005 W) Bluetooth EDR (2Mbps) : -0.69 dBm (0.0009 W) Bluetooth EDR (3Mbps) : -3 dBm (0.0005 W)
Antenna Type	Bluetooth : PIFA Antenna with gain 3.75 dBi
Type of Antenna Connector	N/A
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
EUT Stage	Identical Prototype

Remark:

1. For other wireless features of this EUT, test report will be issued separately.
2. This test report recorded only product characteristics and test results of Digital Spread Spectrum (DSS).
3. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Testing Site

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

1.5 Applied Standards

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

- FCC Part 15 Subpart C §15.247
- FCC Public Notice DA 00-705
- ANSI C63.4-2003
- IC RSS-210 Issue 8

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 (DoC), recorded in a separate test report.



1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
2.	Notebook	DELL	Vostro 1510	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

Preliminary tests were performed in different data rate 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	-5.13	dBm	-2.45	dBm	-4.71	dBm
Ch39	2441MHz	-3.84	dBm	-1.25	dBm	-3.36	dBm
Ch78	2480MHz	-3.36	dBm	-0.69	dBm	-3	dBm

Remark:

1. The data rate was set in 2Mbps for all the test items due to the highest RF output power.
2. The EUT is programmed to transmit signals continuously for all testing.

2.2 Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

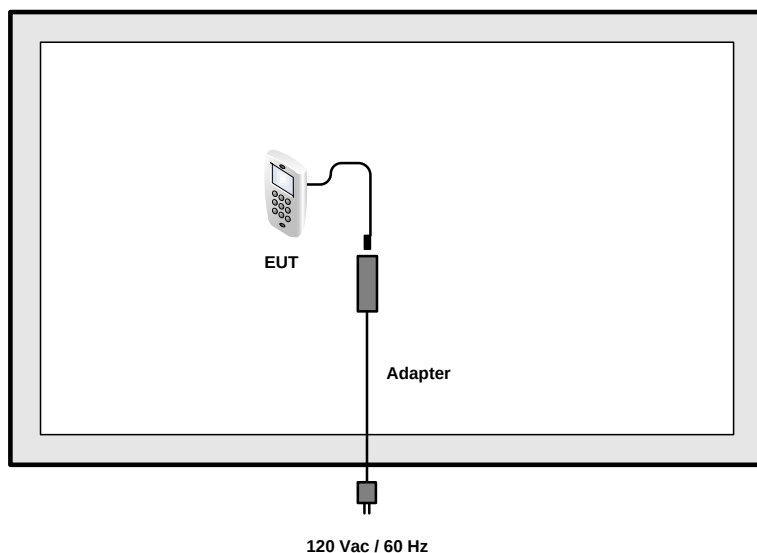
Pre-scanned tests were conducted to determine the final configuration from all possible combinations.

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

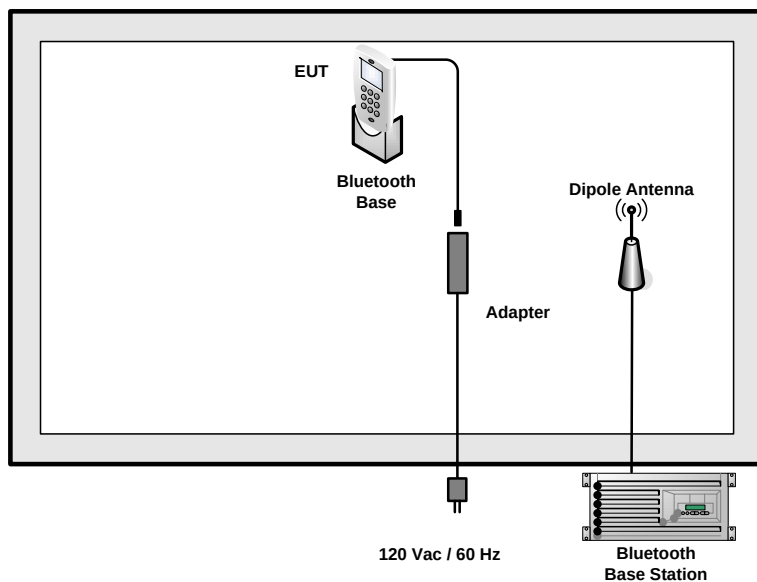
Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	N/A	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	N/A
AC Conducted Emission	Mode 1 :Bluetooth Link with Bluetooth Base + Battery 1 + Adapter 1 Mode 2 :WLAN Link + Battery 2 + Adapter 2		
Remark:			
1. For radiated TCs, the data rate was set in 2Mbps due to the highest RF output power; only the data of these modes was reported.			
2. For conducted emission, the worst case is mode 2; only the test data of this mode was reported.			

2.3 Connection Diagram of Test System

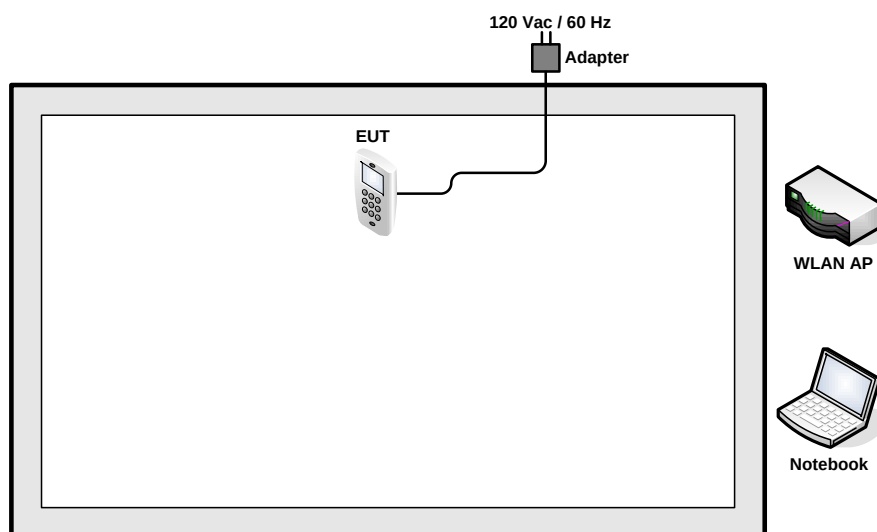
<Bluetooth Tx Mode>



<AC Conducted Emission Mode 1>



< AC Conducted Emission Mode 2 >



2.4 RF Utility

For Bluetooth function, the RF utility, "BlueTool.exe" was installed in EUT which was programmed in order to make the EUT into the engineering modes to contact with Bluetooth base station for transmitting and receiving signals continuously.

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.

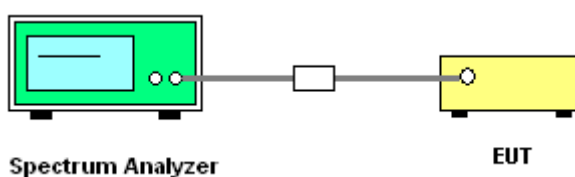
3.1.2 Measuring Instruments

See list of measuring instruments 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 a low loss cable.
3. The modulation types of EUT are irrelevant to number of hopping channels deviation.
4. The EUT must have its hopping function enabled. 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.
5. The number of hopping frequency used is defined as the device has the numbers of total channel.

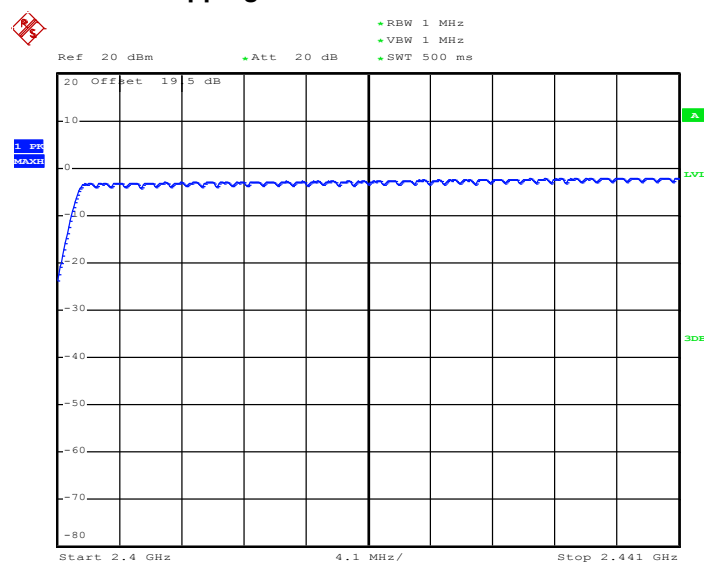
3.1.4 Test Setup



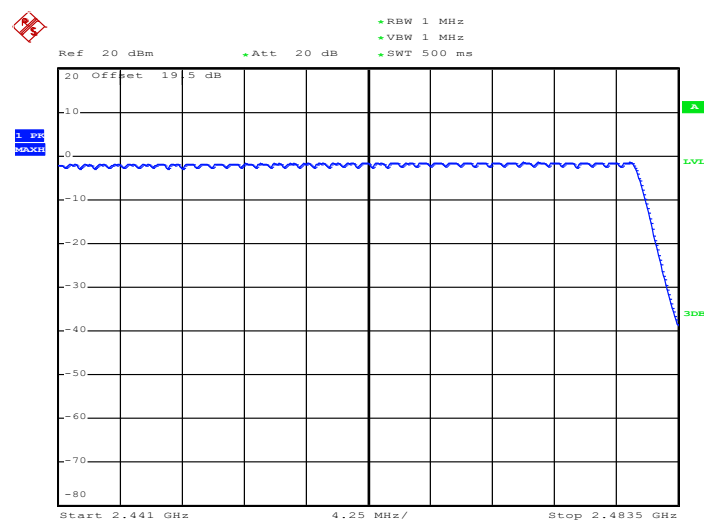
3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	Mode 4~6	Temperature :	24~26℃
Test Engineer :	Pinkston	Relative Humidity :	63~65%
Number of Hopping Channels (Channel)		Limits (Channel)	Pass/Fail
79		> 15	Pass

Number of Hopping Channel Plot on Channel 00 - 78



Date: 28.JUL.2011 11:15:36



Date: 28.JUL.2011 11:22:06

3.2 20dB and 99% Bandwidth Measurement

3.2.1 Limit of 20dB Bandwidth

N/A

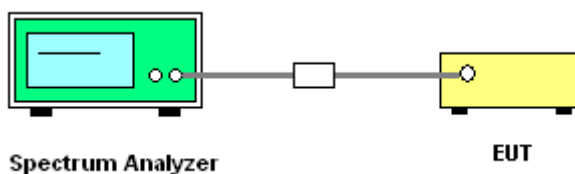
3.2.2 Measuring Instruments

See list of measuring instruments 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 a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
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. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

3.2.4 Test Setup

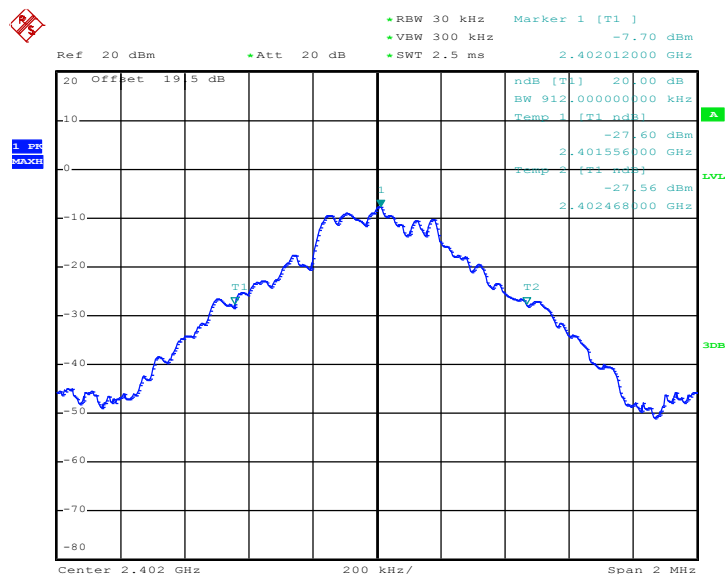


3.2.5 Test Result of 20dB Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Pinkston	Relative Humidity :	63~65%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.912
39	2441	0.908
78	2480	0.908

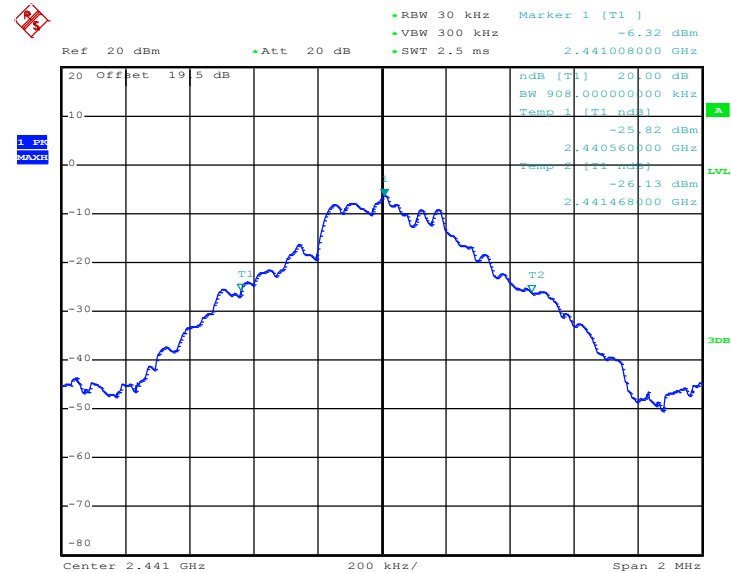
20 dB Bandwidth Plot on Channel 00



Date: 28.JUL.2011 12:37:38

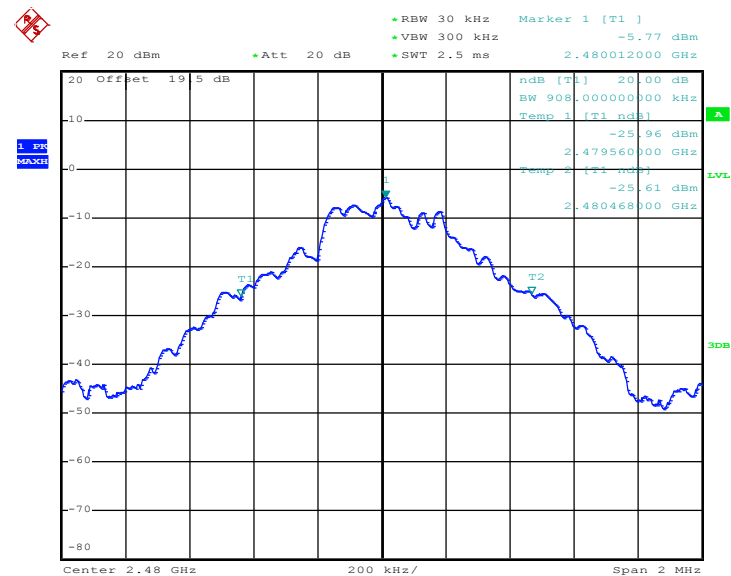


20 dB Bandwidth Plot on Channel 39



Date: 28.JUL.2011 12:36:26

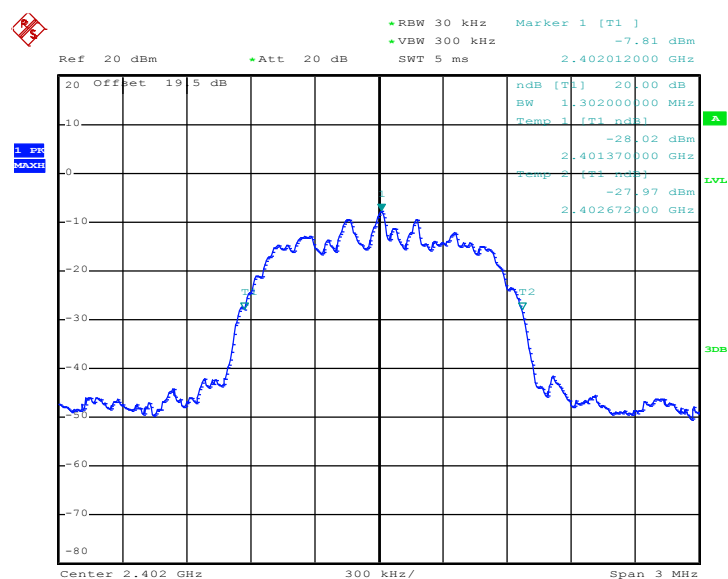
20 dB Bandwidth Plot on Channel 78



Date: 28.JUL.2011 12:35:19

Test Mode :	Mode 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

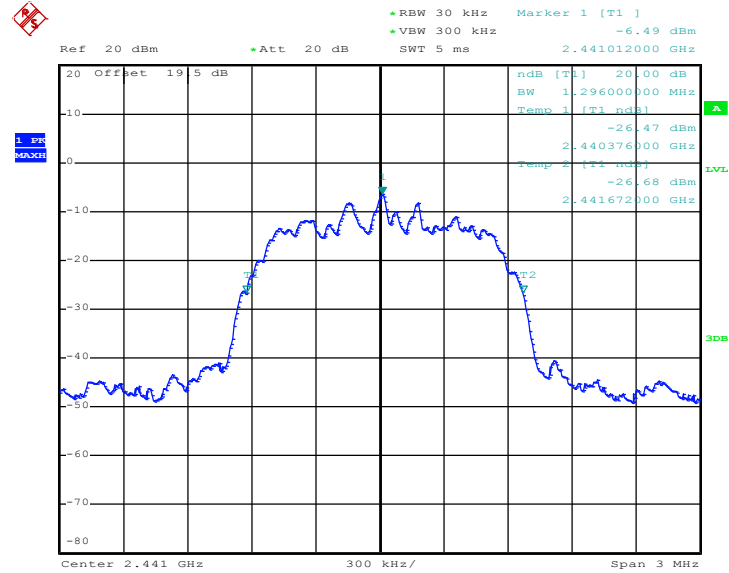
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.302
39	2441	1.296
78	2480	1.296

20 dB Bandwidth Plot on Channel 00


Date: 3.AUG.2011 11:42:06

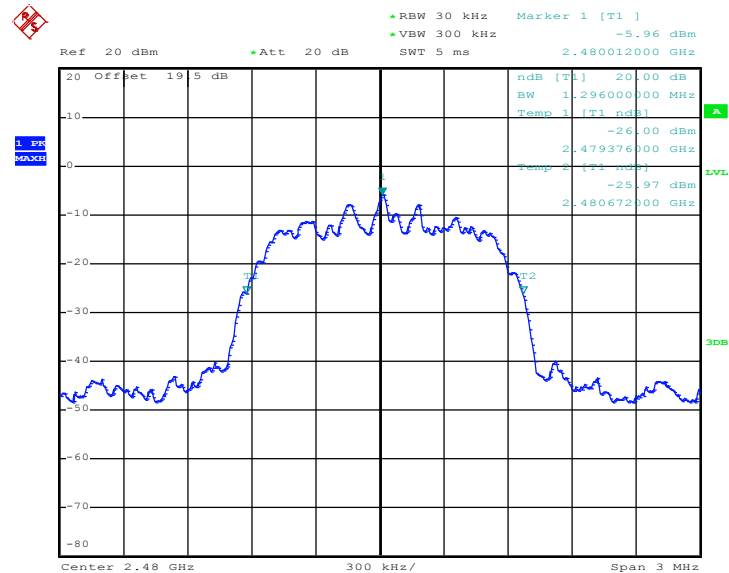


20 dB Bandwidth Plot on Channel 39



Date: 3.AUG.2011 11:43:32

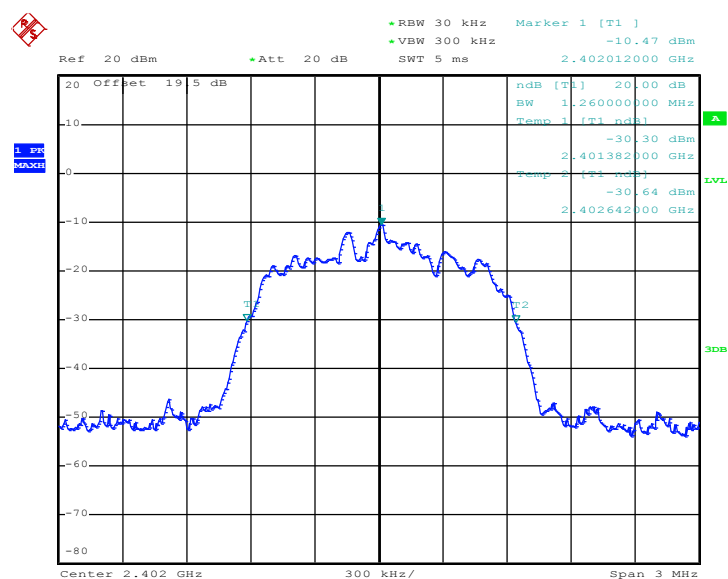
20 dB Bandwidth Plot on Channel 78



Date: 3.AUG.2011 11:44:21



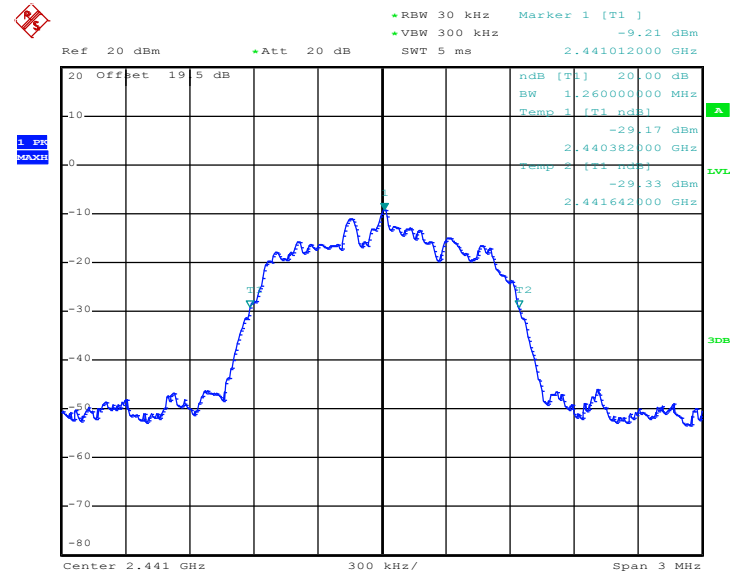
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.260
39	2441	1.260
78	2480	1.254



Date: 3.AUG.2011 11:48:13

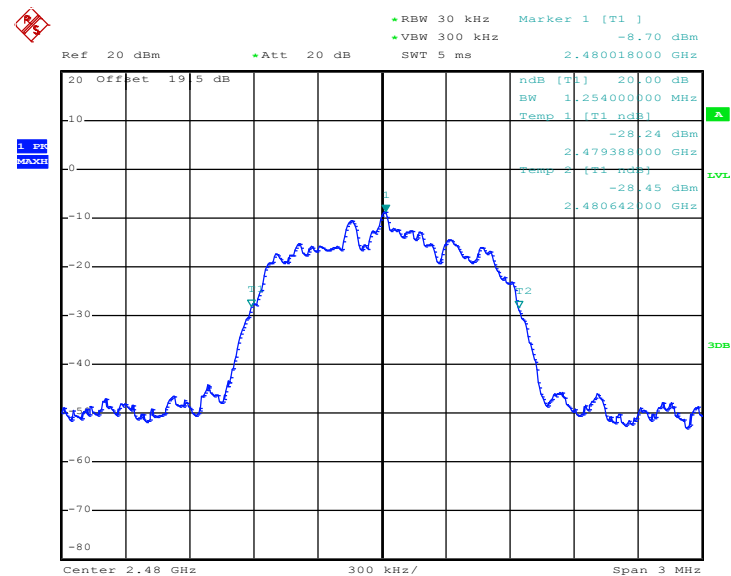


20 dB Bandwidth Plot on Channel 39



Date: 3.AUG.2011 11:46:38

20 dB Bandwidth Plot on Channel 78



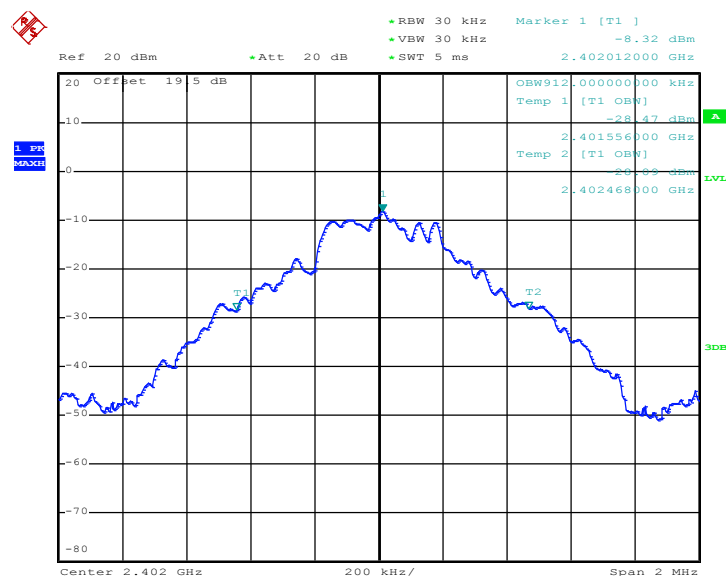
Date: 3.AUG.2011 11:45:47

3.2.6 Test Result of 99% Occupied Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	24~26℃
Test Engineer :	Pinkston	Relative Humidity :	63~65%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	0.912
39	2441	0.912
78	2480	0.912

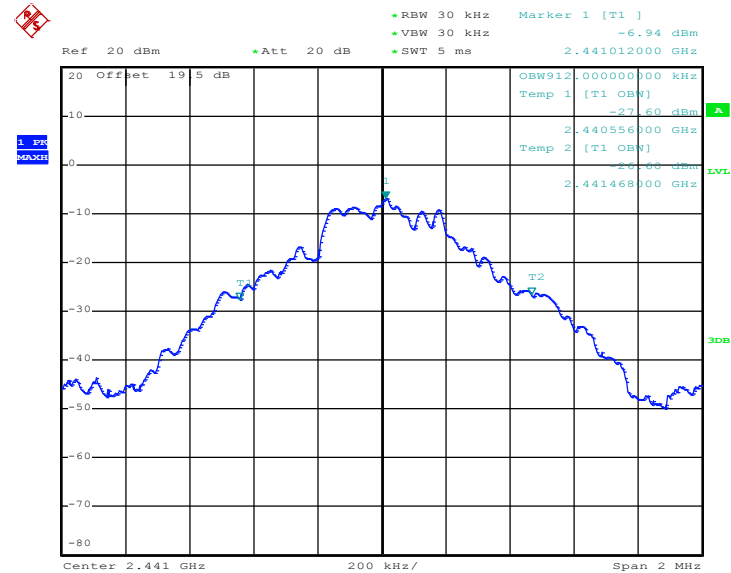
99% Bandwidth Plot on Channel 00



Date: 28.JUL.2011 13:01:18

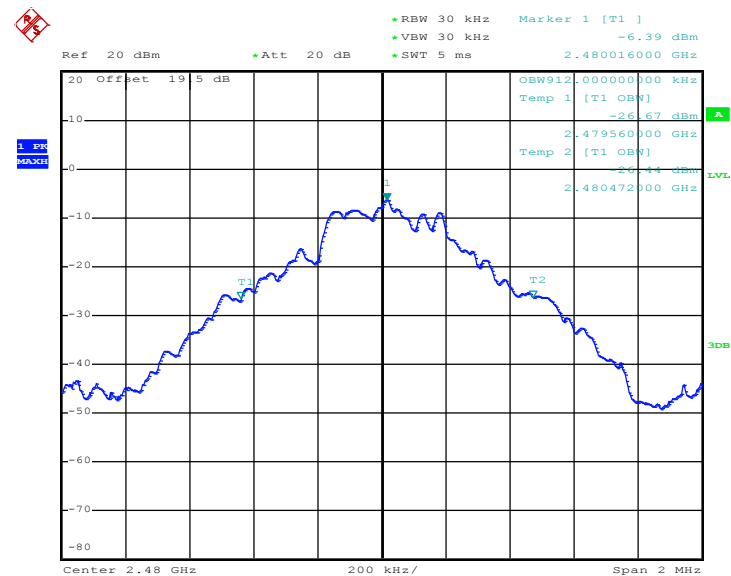


99% Occupied Bandwidth Plot on Channel 39



Date: 28.JUL.2011 12:57:52

99% Occupied Bandwidth Plot on Channel 78



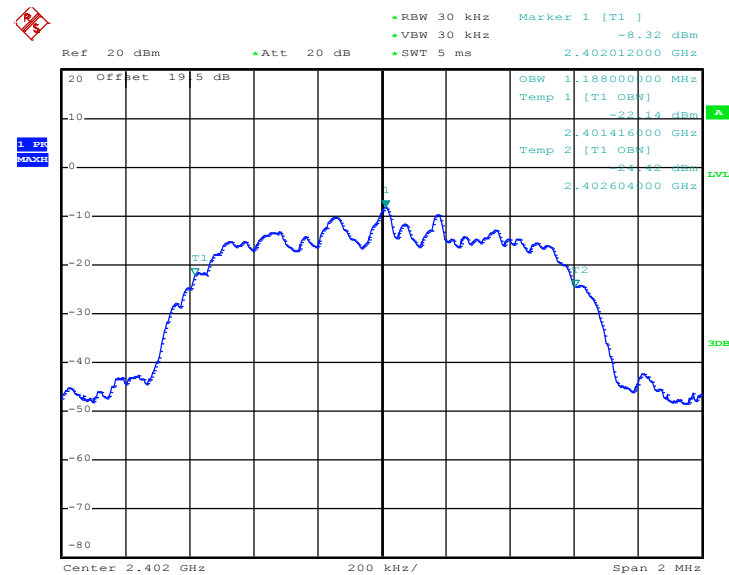
Date: 28.JUL.2011 13:00:04



Test Mode :	Mode 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.188
39	2441	1.188
78	2480	1.184

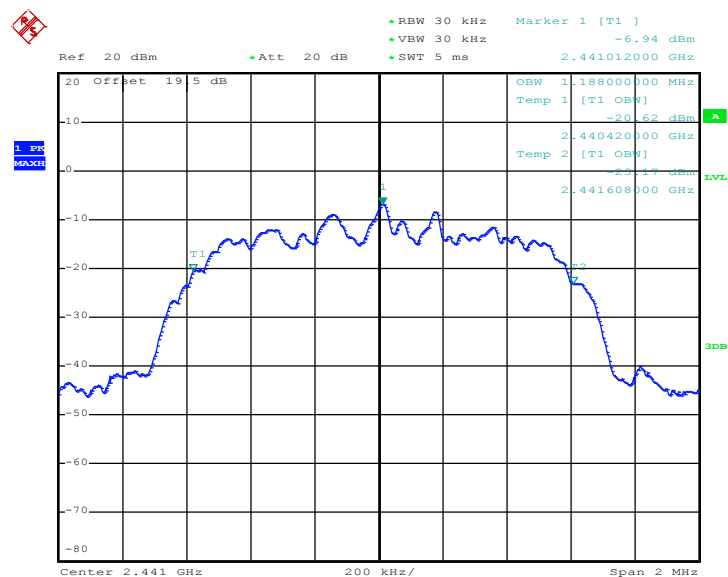
99% Bandwidth Plot on Channel 00



Date: 28.JUL.2011 13:04:16

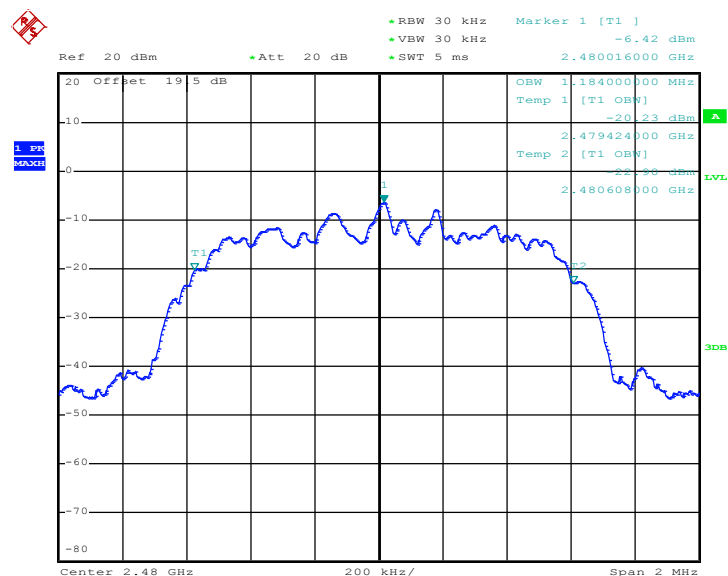


99% Occupied Bandwidth Plot on Channel 39



Date: 28.JUL.2011 13:32:07

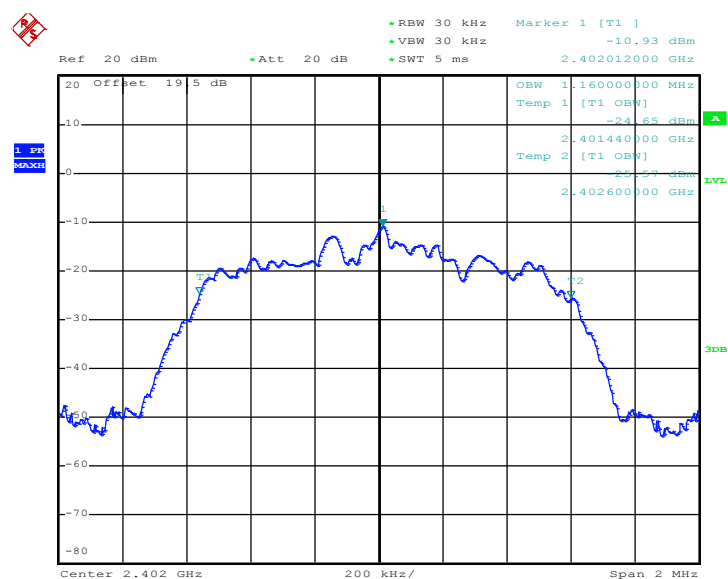
99% Occupied Bandwidth Plot on Channel 78



Date: 28.JUL.2011 13:33:14

Test Mode :	Mode 7, 8, 9	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

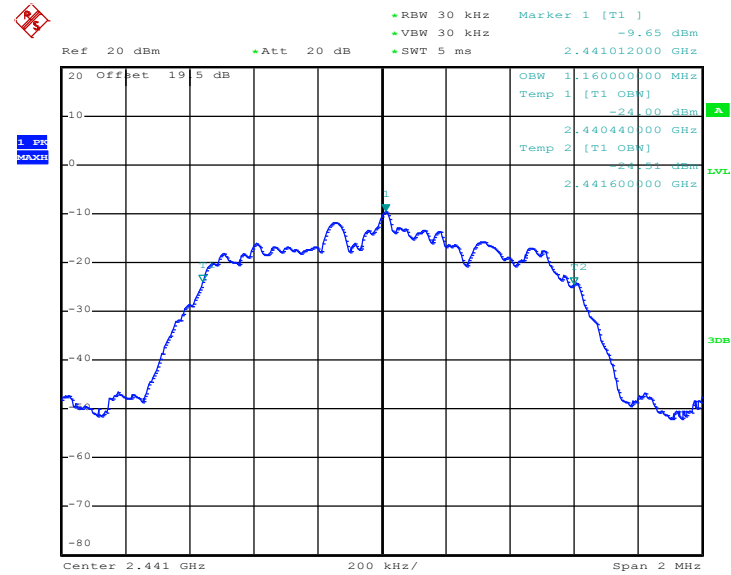
Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.160
39	2441	1.160
78	2480	1.160

99% Bandwidth Plot on Channel 00


Date: 28.JUL.2011 13:35:56

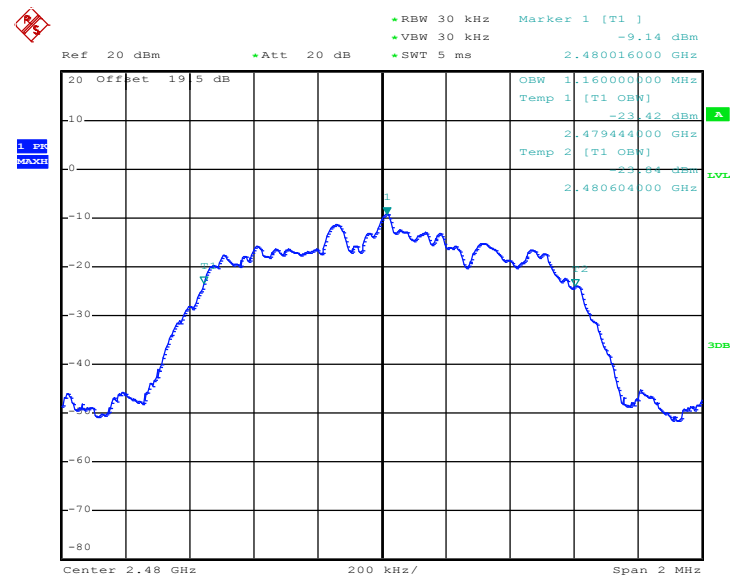


99% Occupied Bandwidth Plot on Channel 39



Date: 28.JUL.2011 13:35:15

99% Occupied Bandwidth Plot on Channel 78



Date: 28.JUL.2011 13:34:25

3.3 Hopping Channel Separation Measurement

3.3.1 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.

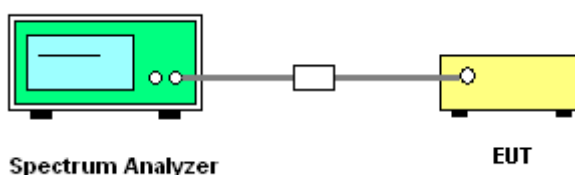
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. Please refer FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. 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.
5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

3.3.4 Test Setup

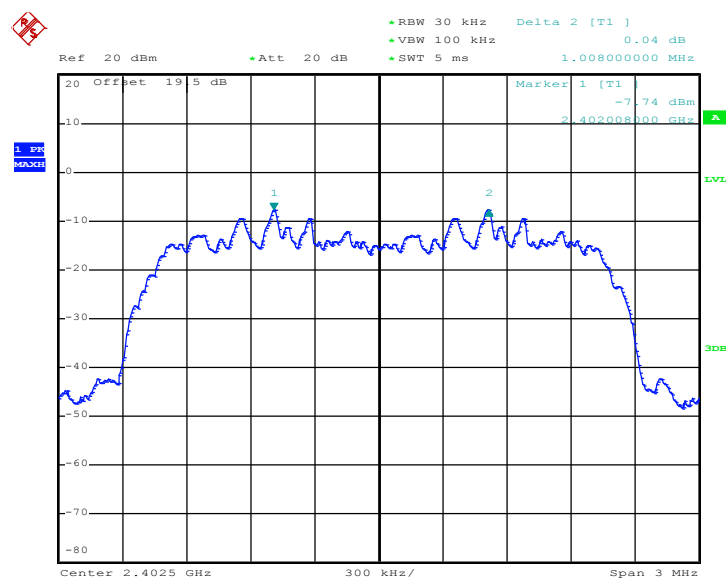


3.3.5 Test Result of Hopping Channel Separation

Test Mode :	Mode 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.008	0.608	Pass
39	2441	1.002	0.605	Pass
78	2480	1.002	0.605	Pass

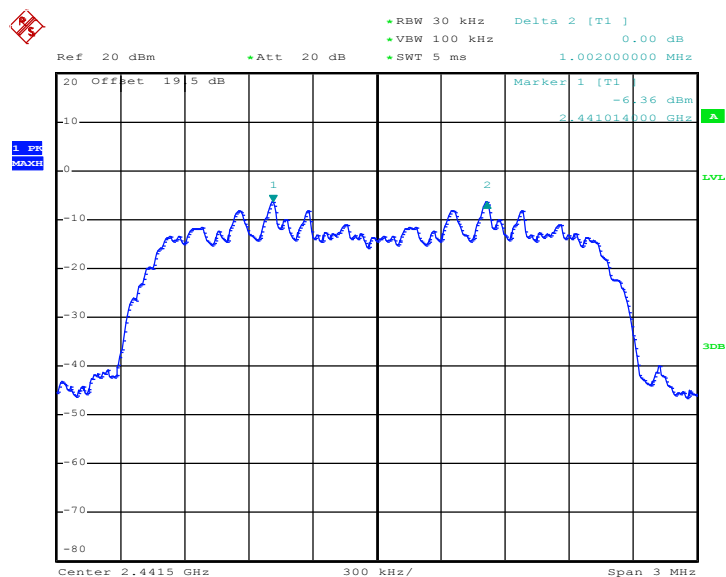
Channel Separation Plot on Channel 00 - 01



Date: 28.JUL.2011 11:49:29

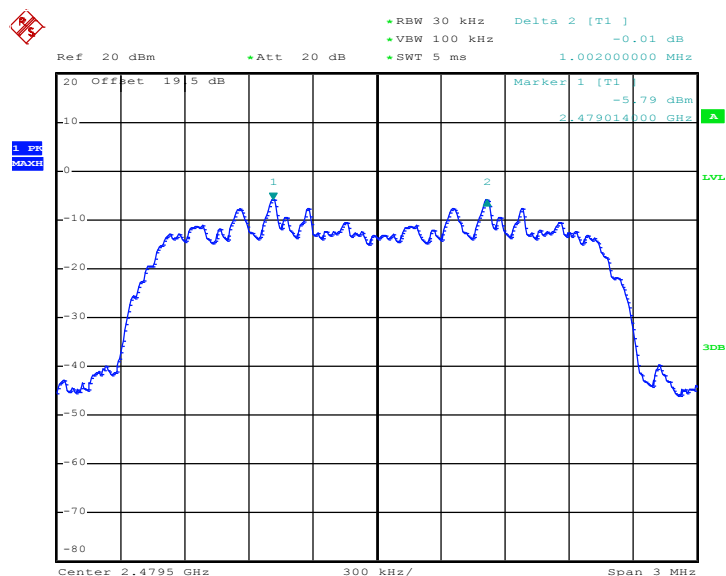


Channel Separation Plot on Channel 39 - 40



Date: 28.JUL.2011 11:46:39

Channel Separation Plot on Channel 77 - 78



Date: 28.JUL.2011 11:44:20

3.4 Dwell Time Measurement

3.4.1 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.

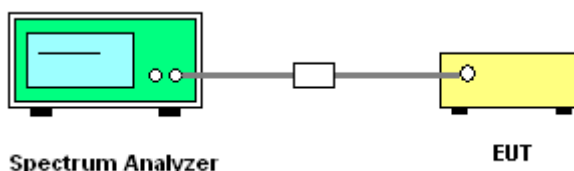
3.4.2 Measuring Instruments

See list of measuring instruments 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 a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. The EUT must have its hopping function enabled. 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.
5. Use the marker-delta function to calculate the dwell time.

3.4.4 Test Setup



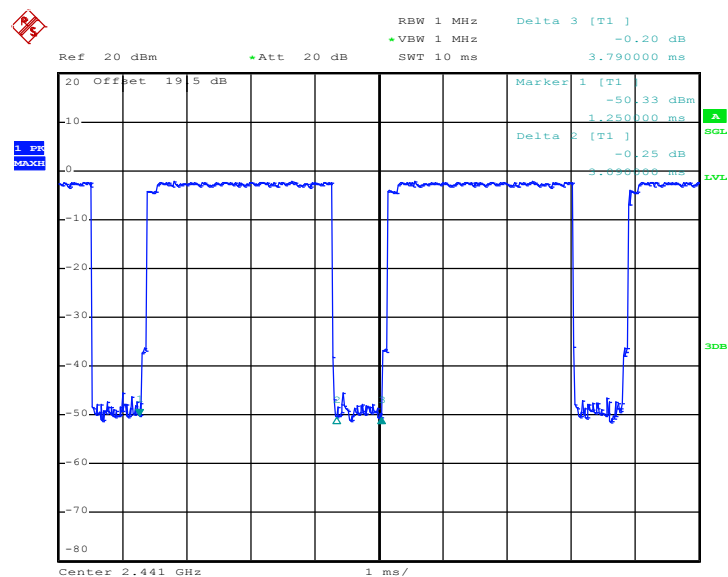
3.4.5 Test Result of Dwell Time

Test Mode :	Mode 5	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

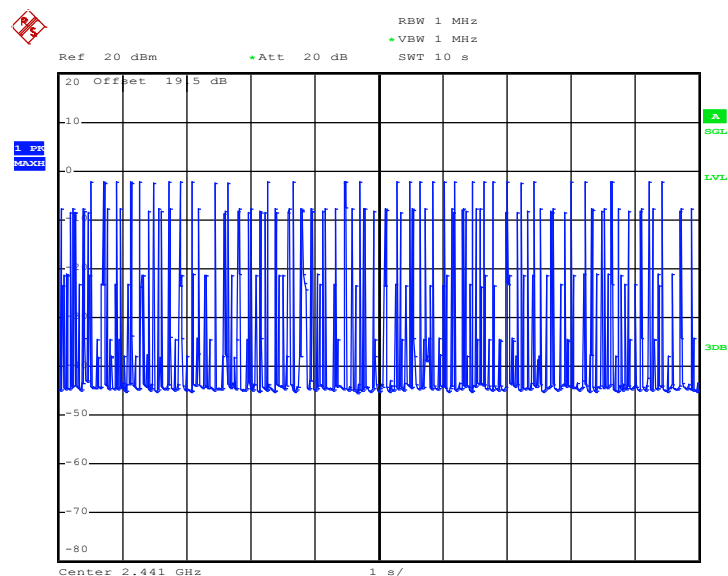
Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
2DH5	3.30	3090.00	0.32	0.4	Pass

Remark:

1. Dwell Time=79(channels) x 0.4(s) x average hopping channel x package transfer time
2. 79 channels come from the Hopping Channel number.
3. Average Hopping Channel = hops/sweep time
4. t: Package Transfer Time(us)

2DH5 Dwell Time (One Pulse) Plot on Channel 39


Date: 28.JUL.2011 11:07:08

2DH5 Dwell Time (Count Pulses) Plot on Channel 39


Date: 28.JUL.2011 11:24:32

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

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, provided the systems operate with an output power no greater than 125 mW (20.97dBm).

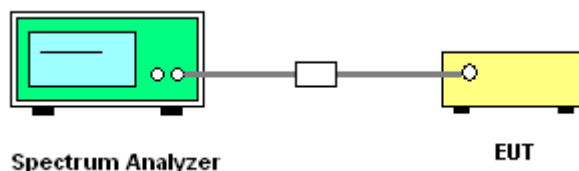
3.5.2 Measuring Instruments

See list of measuring instruments 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 spectrum analyzer by a low loss cable.

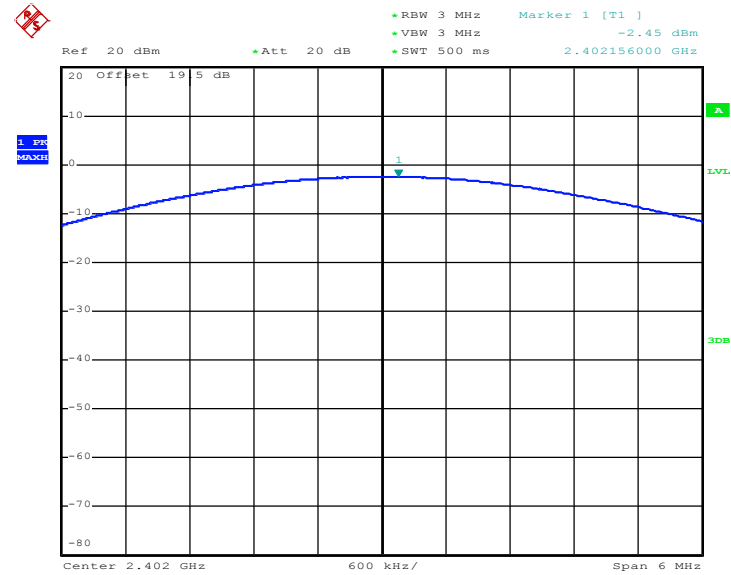
3.5.4 Test Setup



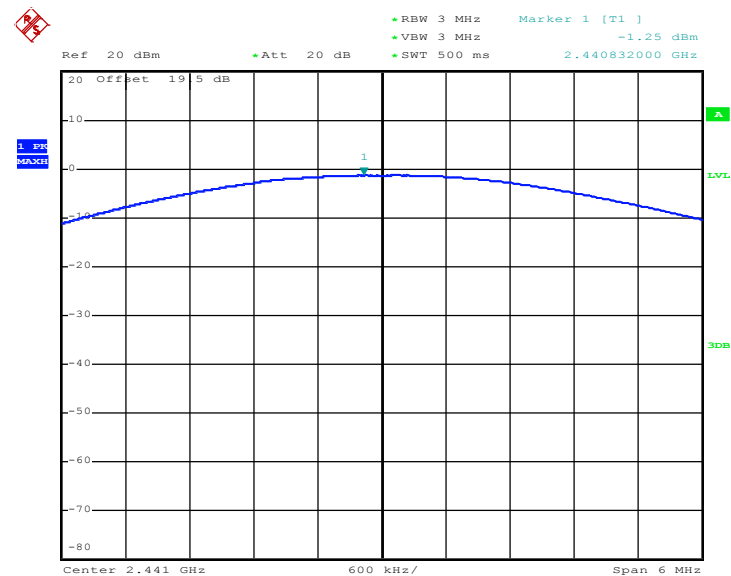
3.5.5 Test Result of Peak Output Power

Test Mode :	Mode 4, 5, 6	Temperature :	24~26°C
Test Engineer :	Pinkston	Relative Humidity :	63~65%

Channel	Frequency (MHz)	RF Power (dBm)		
		$\pi/4$ -DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	-2.45	20.97	Pass
39	2441	-1.25	20.97	Pass
78	2480	-0.69	20.97	Pass

Peak Output Power Plot on Channel 00


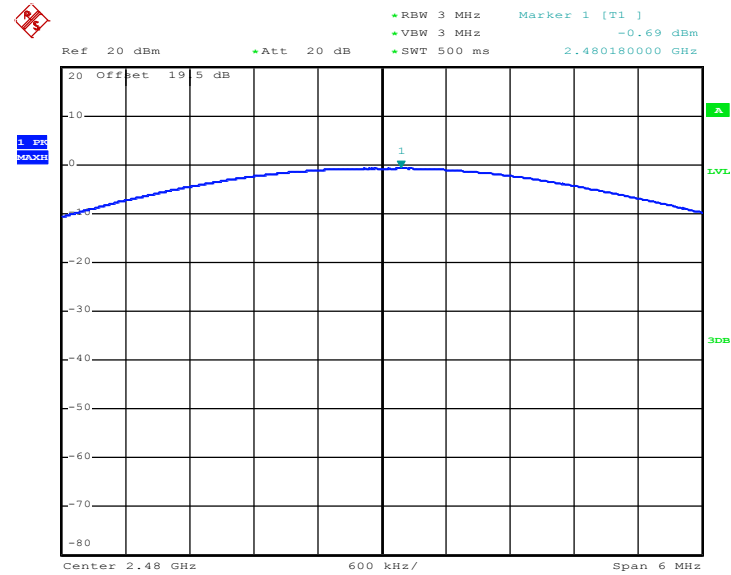
Date: 28.JUL.2011 10:29:42

Peak Output Power Plot on Channel 39


Date: 28.JUL.2011 10:30:44



Peak Output Power Plot on Channel 78



Date: 28.JUL.2011 10:31:27

3.6 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

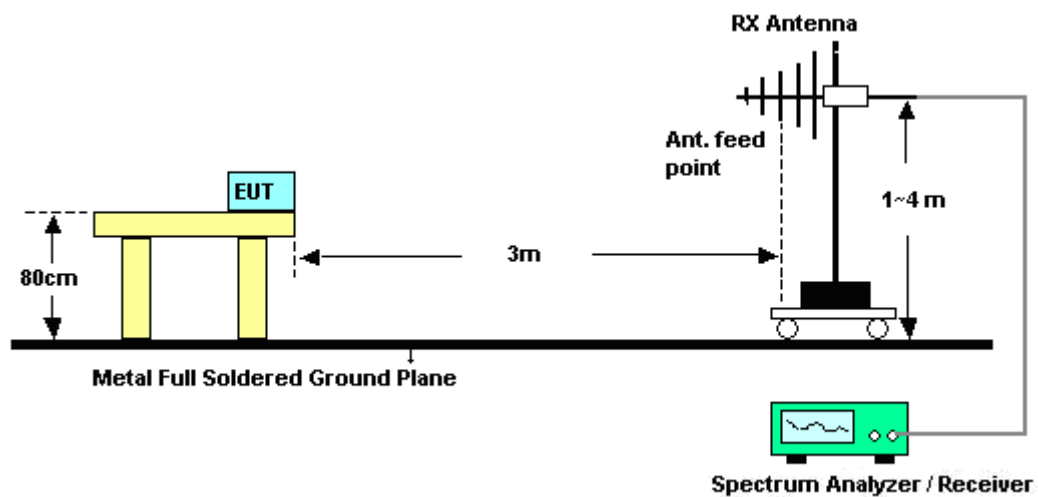
See list of measuring instruments of this test report.

3.6.3 Test Procedures

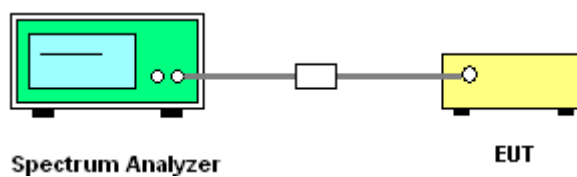
1. The testing follows the guidelines in ANSI C63.4-2003 and FCC Public Notice DA 00-705 Measurement Guidelines.
2. RF antenna conducted test: Set RBW = 300kHz, Video bandwidth (VBW) $\geq$ RBW. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 300k Hz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.
3. Radiated emission test: Applies to band edge emissions that fall in the restricted bands listed in FCC Section 15.205. The maximum permitted average field strength is listed in FCC Section 15.209. A pre-amp is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 1MHz, Sweep: Auto for Peak; set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto for Average. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See FCC Section 15.35(b) and (c).
4. In case the emission is fail due to the used RBW / VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

3.6.4 Test Setup

<Radiated Band Edges>



<Conducted Band Edges>



3.6.5 Test Result of Radiated Band Edges

Test Mode :	Mode 1	Temperature :	21~23 °C
Test Channel :	00	Relative Humidity :	47~49 %
		Test Engineer :	David Yang

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2370.42	45.47	-28.53	74	41.16	32.16	5.99	33.84	153	356	Peak
2370.42	33.51	-20.49	54	29.2	32.16	5.99	33.84	153	356	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2384.86	34.65	-19.35	54	30.31	32.16	6.03	33.85	114	5	Peak
2384.86	47.35	-26.65	74	43.01	32.16	6.03	33.85	114	5	Average

Test Mode :	Mode 3	Temperature :	21~23 °C
Test Channel :	78	Relative Humidity :	47~49 %
		Test Engineer :	David Yang

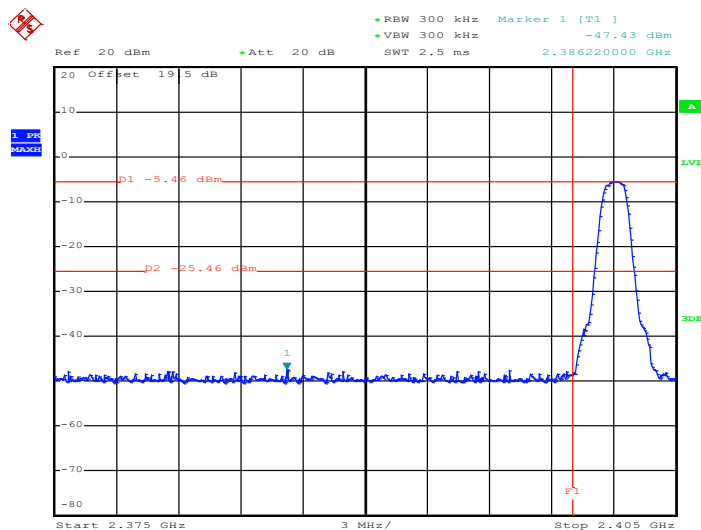
ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	60.84	-13.16	74	56.28	32.28	6.18	33.9	101	283	Peak
2483.5	48.2	-5.8	54	43.64	32.28	6.18	33.9	101	283	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	65.14	-8.86	74	60.58	32.28	6.18	33.9	111	23	Peak
2483.5	50.96	-3.04	54	46.4	32.28	6.18	33.9	111	23	Average

3.6.6 Test Result of Conducted Band Edges

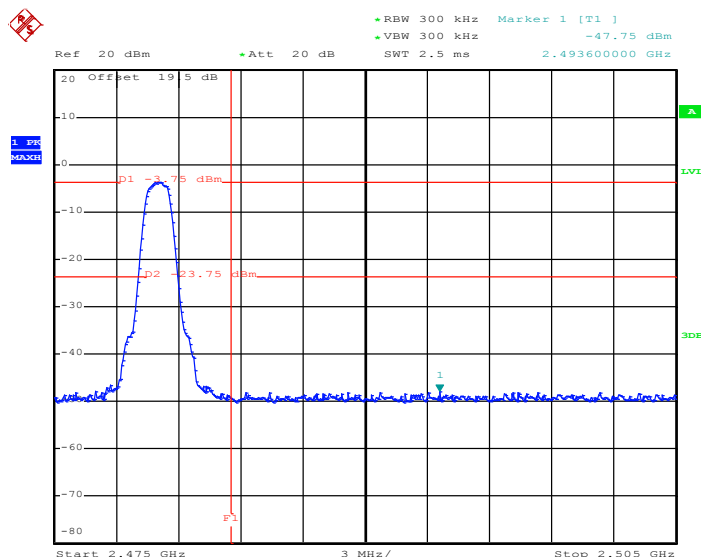
Test Mode :	Mode 4 and 6	Temperature :	24~26℃
Test Channel :	00 and 78	Relative Humidity :	63~65%
		Test Engineer :	Pinkston

Low Band Edge Plot on Channel 00



Date: 28.JUL.2011 13:50:34

High Band Edge Plot on Channel 78



Date: 28.JUL.2011 13:48:40

3.7 Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

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

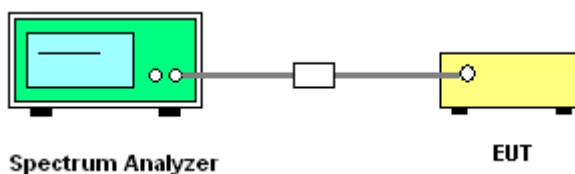
3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

3.7.3 Test Procedure

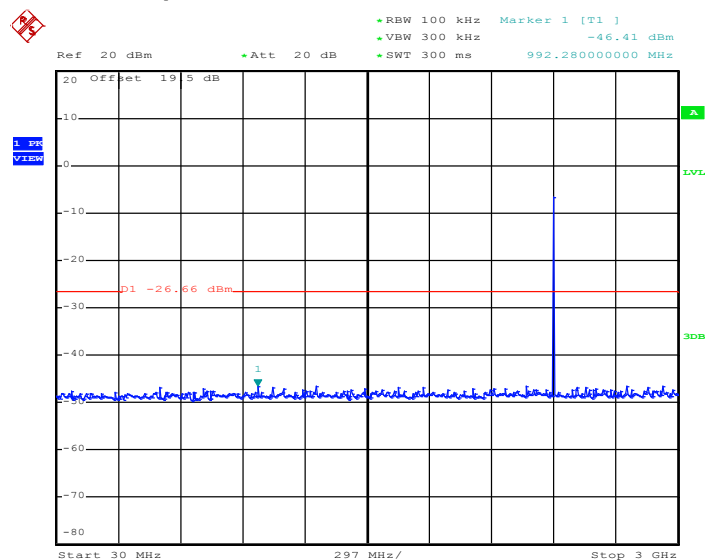
1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set RBW = 100 kHz, Video bandwidth (VBW) $\geq$ RBW, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

3.7.4 Test Setup

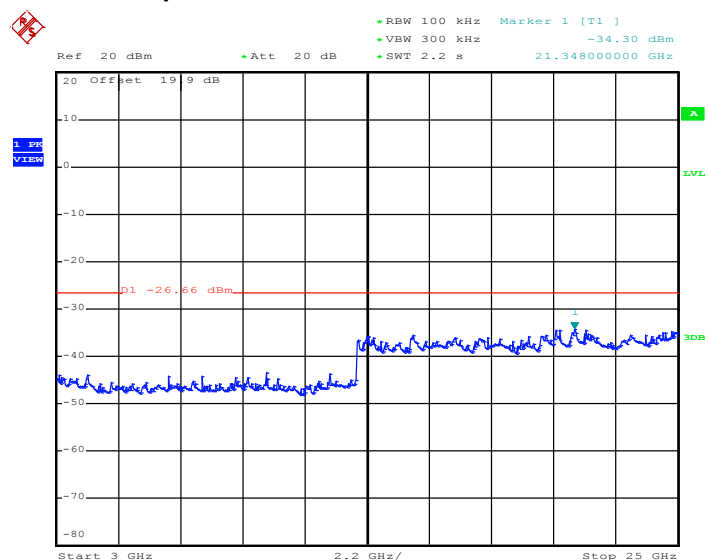




Test Mode :	Mode 4	Temperature :	24~26℃
Test Channel :	00	Relative Humidity :	63~65%
		Test Engineer :	Pinkston



Date: 28.JUL.2011 14:16:21

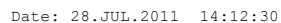


Date: 28.JUL.2011 14:17:31



Report No. : FR170108-01A

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz

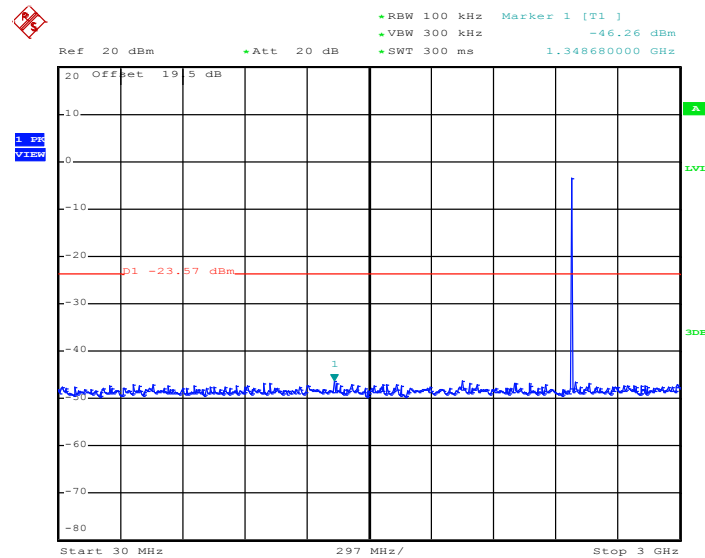


Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz



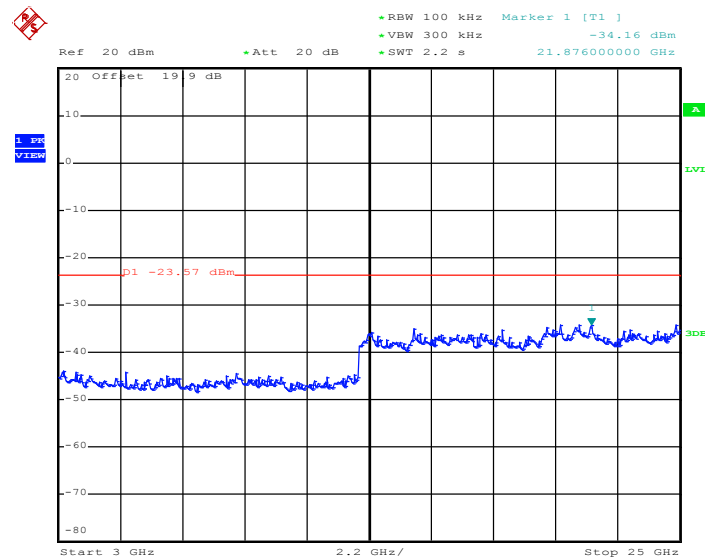
Test Mode :	Mode 6	Temperature :	24~26℃
Test Channel :	78	Relative Humidity :	63~65%
		Test Engineer :	Pinkston

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



Date: 28.JUL.2011 14:09:44

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz



Date: 28.JUL.2011 14:11:09

3.8 AC Conducted Emission Measurement

3.8.1 Limit of AC Conducted Emission

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

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

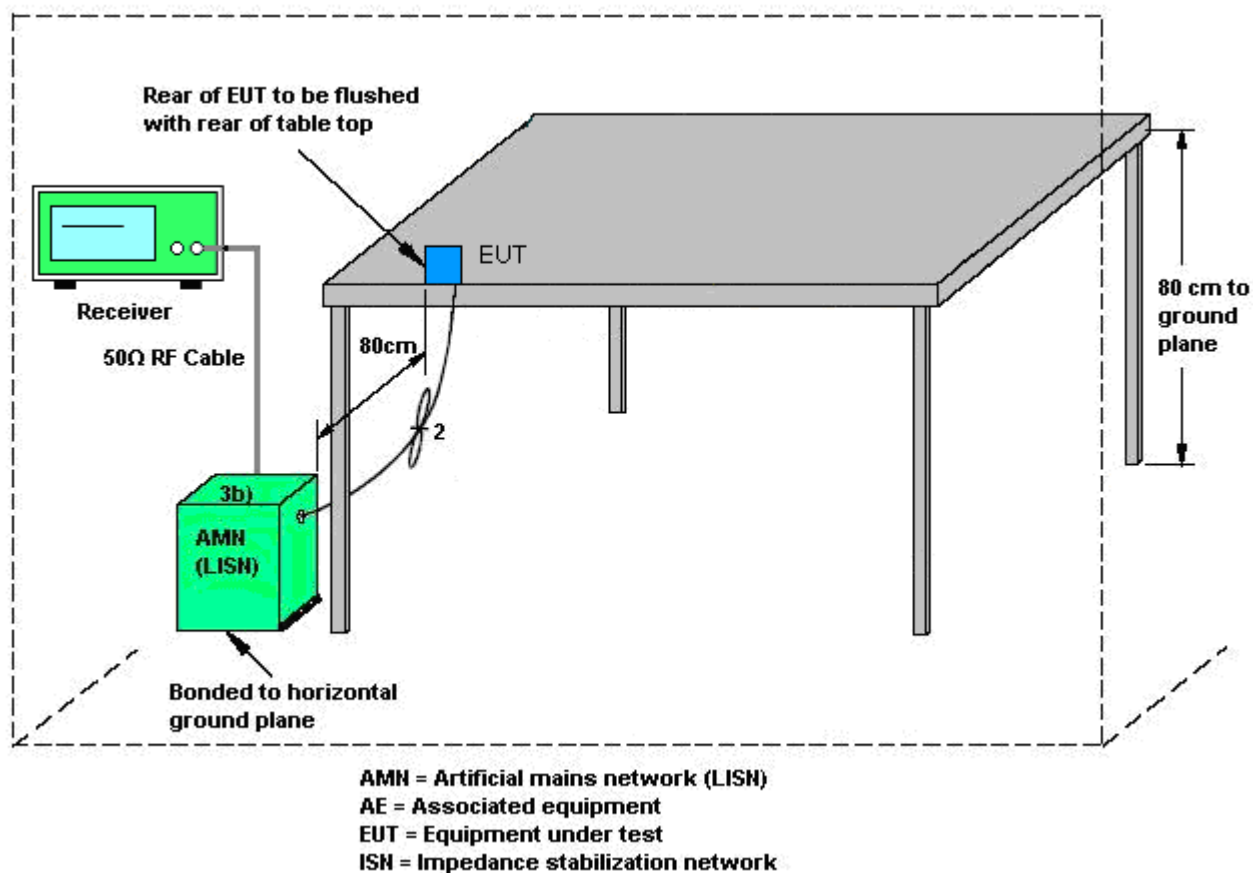
3.8.2 Measuring Instruments

See list of measuring instruments of this test report.

3.8.3 Test Procedures

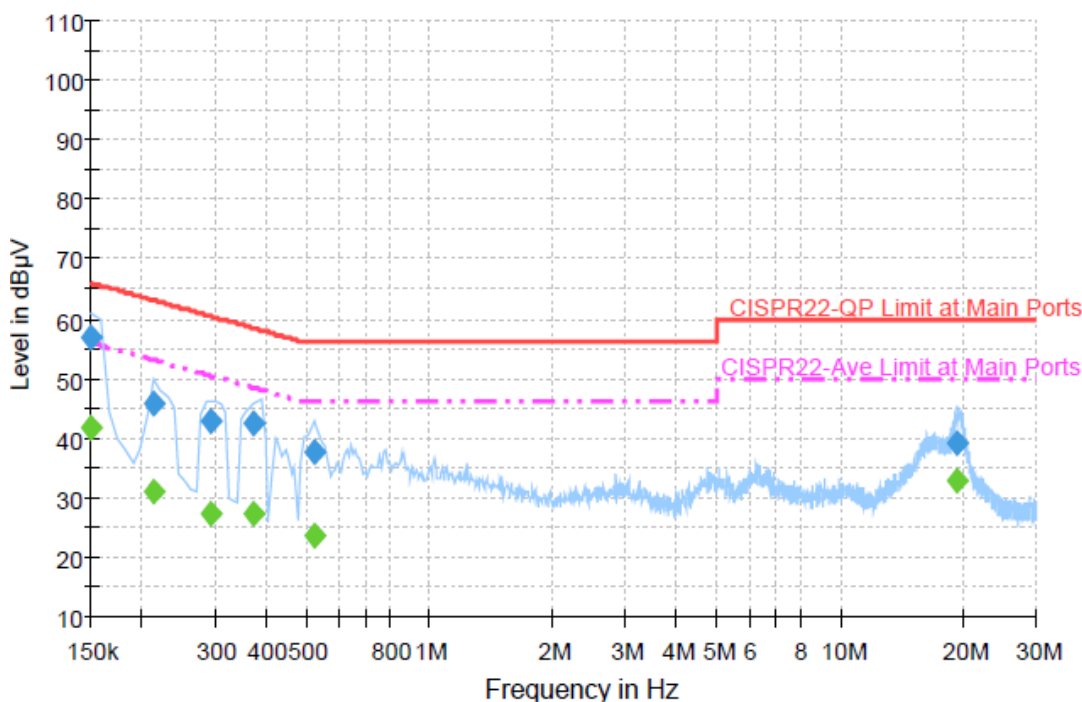
1. Please follow the guidelines in ANSI C63.4-2003.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 kHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.8.4 Test Setup



3.8.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	Temperature :	21~23°C
Test Engineer :	Novic Chiang	Relative Humidity :	41~43%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN Link + Battery 2 + Adapter 2		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



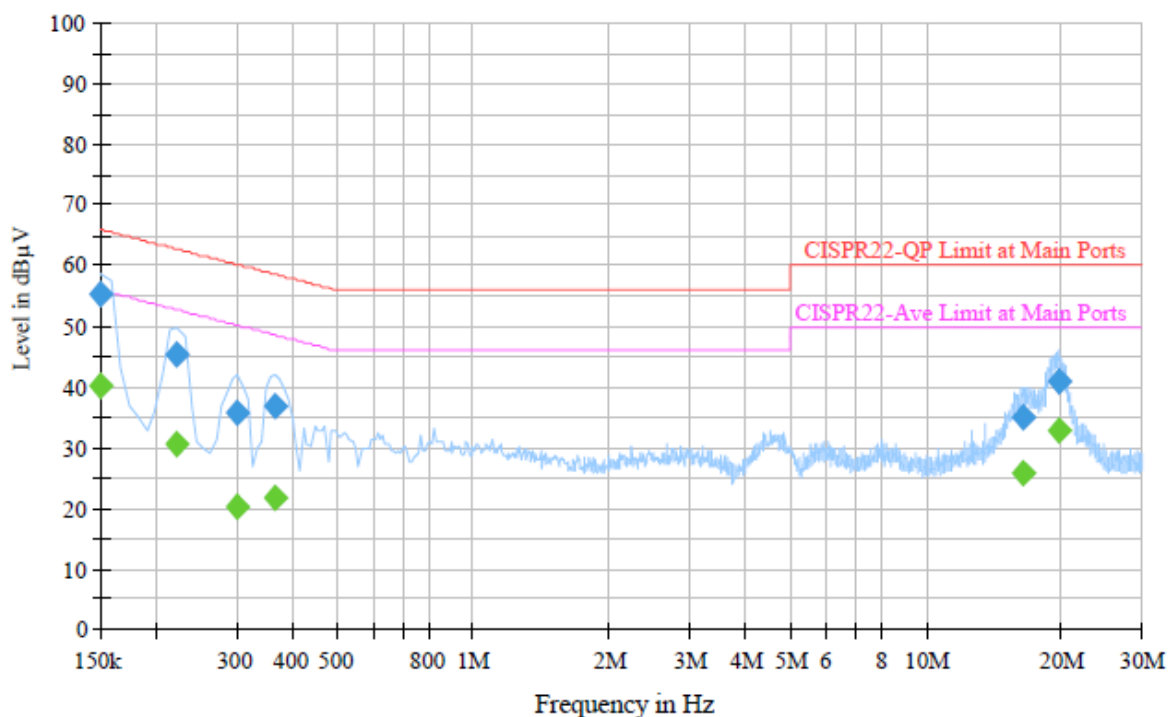
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	56.8	Off	L1	19.4	9.2	66.0
0.214000	45.8	Off	L1	19.3	16.9	62.7
0.294000	42.7	Off	L1	19.3	17.9	60.6
0.374000	42.5	Off	L1	19.4	15.6	58.1
0.526000	37.6	Off	L1	19.3	18.4	56.0
19.286000	39.2	Off	L1	19.7	20.8	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	41.8	Off	L1	19.4	14.2	56.0
0.214000	30.9	Off	L1	19.3	21.8	52.7
0.294000	27.5	Off	L1	19.3	23.1	50.6
0.374000	27.3	Off	L1	19.4	20.8	48.1
0.526000	23.8	Off	L1	19.3	22.2	46.0
19.286000	33.0	Off	L1	19.7	17.0	50.0

Test Mode :	Mode 2	Temperature :	21~23°C
Test Engineer :	Novic Chiang	Relative Humidity :	41~43%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN Link + Battery 2 + Adapter 2		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	55.3	Off	N	19.4	10.7	66.0
0.222000	45.5	Off	N	19.4	17.5	63.0
0.302000	35.8	Off	N	19.3	25.1	60.9
0.366000	36.8	Off	N	19.3	22.2	59.0
16.358000	35.0	Off	N	19.8	25.0	60.0
19.686000	40.8	Off	N	19.9	19.2	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	40.3	Off	N	19.4	15.7	56.0
0.222000	30.8	Off	N	19.4	22.2	53.0
0.302000	20.2	Off	N	19.3	30.7	50.9
0.366000	21.8	Off	N	19.3	27.2	49.0
16.358000	25.8	Off	N	19.8	24.2	50.0
19.686000	32.9	Off	N	19.9	17.1	50.0

3.9 Radiated Emission Measurement

3.9.1 Limit of Radiated 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

3.9.2 Measuring Instruments

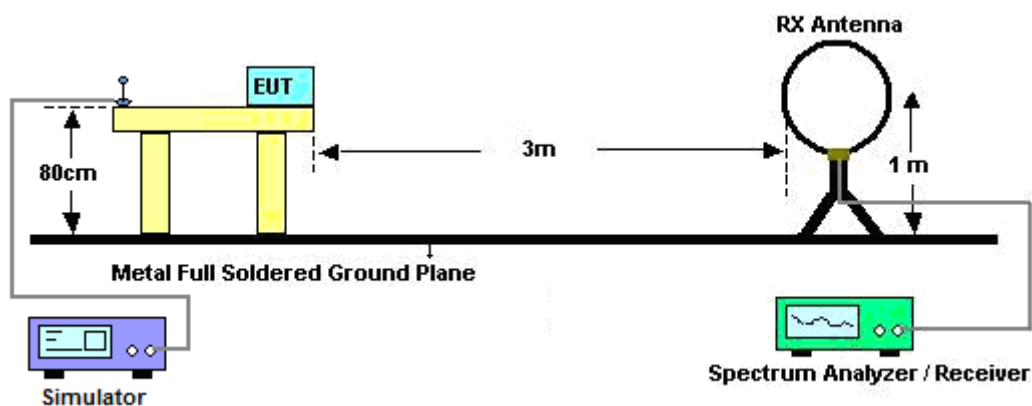
See list of measuring instruments of this test report.

3.9.3 Test Procedures

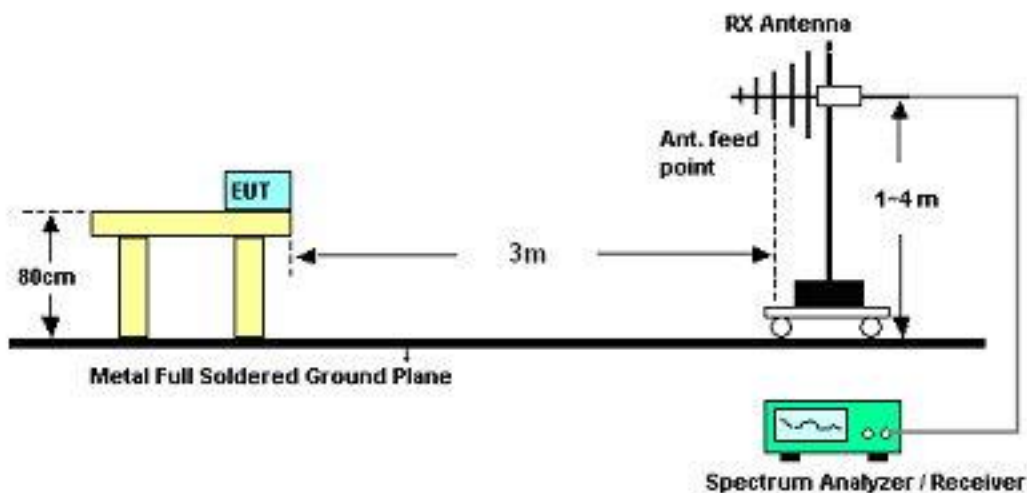
- The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
- Use the following spectrum analyzer settings:
 - Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
 - Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.
Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1m]})$ (dB)
- Follow the guidelines in ANSI C63.4-2003 with respect to maximizing the emission by rotating the EUT, measuring the emission for three EUT orthogonal planes, and adjusting the measurement antenna height and polarization. A pre-amp and a high pass filter are used for this test in order to get the good signal level.
- Measured average value for the peak value is greater than 54 dBuV/m

3.9.4 Test Setup

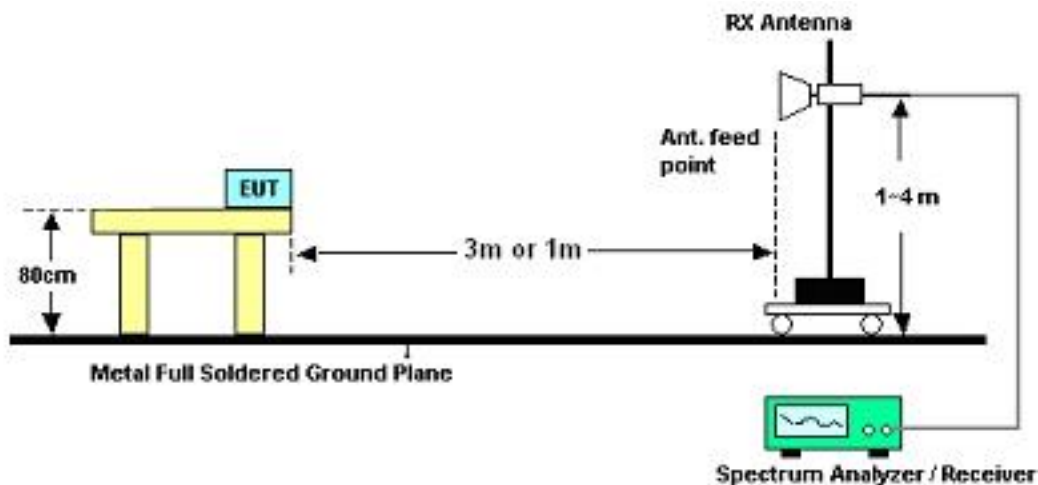
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

Test Engineer :	David Yang	Temperature :	21~23 °C	
		Relative Humidity :	47~49 %	
Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

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

Test Mode :	Mode 1	Temperature :	21~23 °C
Test Channel :	00	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Horizontal
Remark :	2402 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
31.62	18.93	-21.07	40	33.8	16.04	0.55	31.46	-	-	Peak
165.81	18.25	-25.25	43.5	38.52	10.02	1.23	31.52	-	-	Peak
262.74	21.11	-24.89	46	38.04	12.87	1.61	31.41	-	-	Peak
799.8	30.83	-15.17	46	35.9	22.47	3.14	30.68	-	-	Peak
875.4	33.15	-12.85	46	37.2	23.35	3.31	30.71	100	5	Peak
925.8	33.07	-12.93	46	36.34	23.96	3.4	30.63	-	-	Peak
2370.42	45.47	-28.53	74	41.16	32.16	5.99	33.84	153	356	Peak
2370.42	33.51	-20.49	54	29.2	32.16	5.99	33.84	153	356	Average
2402	93.37	-	-	88.99	32.2	6.03	33.85	153	356	Peak
2402	77.05	-	-	72.69	32.18	6.03	33.85	153	356	Average
2500	32.58	-21.42	54	28	32.3	6.18	33.9	153	356	Average
2500	45.09	-28.91	74	40.51	32.3	6.18	33.9	153	356	Peak

Test Mode :	Mode 1	Temperature :	21~23 °C
Test Channel :	00	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Vertical
Remark :	2402 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
34.05	22.86	-17.14	40	38.19	15.57	0.57	31.47	-	-	Peak
165.81	22.11	-21.39	43.5	42.38	10.02	1.23	31.52	-	-	Peak
298.38	23.54	-22.46	46	39.67	13.44	1.76	31.33	-	-	Peak
663.3	32.38	-13.62	46	39.89	20.48	2.87	30.86	100	11	Peak
799.8	31.6	-14.4	46	36.67	22.47	3.14	30.68	-	-	Peak
925.8	31.94	-14.06	46	35.21	23.96	3.4	30.63	-	-	Peak
2384.86	34.65	-19.35	54	30.31	32.16	6.03	33.85	114	5	Average
2384.86	47.35	-26.65	74	43.01	32.16	6.03	33.85	114	5	Peak
2402	81.87	-	-	77.51	32.18	6.03	33.85	114	5	Average
2402	98.81	-	-	94.43	32.2	6.03	33.85	114	5	Peak
2486	32.8	-21.2	54	28.24	32.28	6.18	33.9	114	5	Average
2486	44.47	-29.53	74	39.91	32.28	6.18	33.9	114	5	Peak



Test Mode :	Mode 2	Temperature :	21~23 °C
Test Channel :	39	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Horizontal
Remark :	2441 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
165.81	30.05	-13.45	43.5	50.32	10.02	1.23	31.52	-	-	Peak
248.97	25.12	-20.88	46	42.4	12.6	1.53	31.41	-	-	Peak
290.82	25.58	-20.42	46	41.88	13.32	1.7	31.32	-	-	Peak
799.8	31.79	-14.21	46	36.86	22.47	3.14	30.68	-	-	Peak
875.4	32.85	-13.15	46	36.9	23.35	3.31	30.71	-	-	Peak
925.8	33	-13	46	36.27	23.96	3.4	30.63	100	157	Peak
2388	46.29	-27.71	74	41.93	32.18	6.03	33.85	135	279	Peak
2388	33.24	-20.76	54	28.88	32.18	6.03	33.85	135	279	Average
2441	93.02	-	-	88.55	32.24	6.11	33.88	135	279	Peak
2441	77.15	-	-	72.68	32.24	6.11	33.88	135	279	Average
2492	45.22	-28.78	74	40.64	32.3	6.18	33.9	135	279	Peak
2492	33.02	-20.98	54	28.44	32.3	6.18	33.9	135	279	Average

Test Mode :	Mode 2	Temperature :	21~23 °C
Test Channel :	39	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Vertical
Remark :	2441 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
34.05	23.87	-16.13	40	39.2	15.57	0.57	31.47	-	-	Peak
126.66	18.72	-24.78	43.5	37.59	11.57	1.13	31.57	-	-	Peak
165.81	21.93	-21.57	43.5	42.2	10.02	1.23	31.52	-	-	Peak
663.3	31.82	-14.18	46	39.33	20.48	2.87	30.86	-	-	Peak
799.8	31.87	-14.13	46	36.94	22.47	3.14	30.68	-	-	Peak
903.4	32.61	-13.39	46	36.28	23.67	3.35	30.69	100	43	Peak
2390	44.88	-29.12	74	40.52	32.18	6.03	33.85	108	0	Peak
2390	33.26	-20.74	54	28.9	32.18	6.03	33.85	108	0	Average
2441	98.61	-	-	94.14	32.24	6.11	33.88	108	0	Peak
2441	81.75	-	-	77.28	32.24	6.11	33.88	108	0	Average
2494	46.85	-27.15	74	42.27	32.3	6.18	33.9	108	0	Peak
2494	33.68	-20.32	54	29.1	32.3	6.18	33.9	108	0	Average

Test Mode :	Mode 3	Temperature :	21~23 °C
Test Channel :	78	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Horizontal
Remark :	2480 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
31.89	19.43	-20.57	40	34.3	16.04	0.55	31.46	-	-	Peak
160.14	17.35	-26.15	43.5	37.27	10.38	1.22	31.52	-	-	Peak
165.81	18.03	-25.47	43.5	38.3	10.02	1.23	31.52	-	-	Peak
799.8	31.74	-14.26	46	36.81	22.47	3.14	30.68	-	-	Peak
875.4	32.86	-13.14	46	36.91	23.35	3.31	30.71	100	155	Peak
925.8	32.69	-13.31	46	35.96	23.96	3.4	30.63	-	-	Peak
2380	45.21	-28.79	74	40.87	32.16	6.03	33.85	101	283	Peak
2380	33.21	-20.79	54	28.87	32.16	6.03	33.85	101	283	Average
2480	95.2	-	-	90.64	32.28	6.18	33.9	101	283	Peak
2480	78.84	-	-	74.28	32.28	6.18	33.9	101	283	Average
2483.5	60.84	-13.16	74	56.28	32.28	6.18	33.9	101	283	Peak
2483.5	48.2	-5.8	54	43.64	32.28	6.18	33.9	101	283	Average

Test Mode :	Mode 3	Temperature :	21~23 °C
Test Channel :	78	Relative Humidity :	47~49 %
Test Engineer :	David Yang	Polarization :	Vertical
Remark :	2480 MHz is Fundamental Signals which can be ignored.		

Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
34.05	23.05	-16.95	40	38.38	15.57	0.57	31.47	-	-	Peak
82.65	25.4	-14.6	40	48.53	7.51	0.89	31.53	-	-	Peak
165.81	22.17	-21.33	43.5	42.44	10.02	1.23	31.52	-	-	Peak
663.3	31.77	-14.23	46	39.28	20.48	2.87	30.86	-	-	Peak
799.8	32.04	-13.96	46	37.11	22.47	3.14	30.68	100	207	Peak
925.8	31.56	-14.44	46	34.83	23.96	3.4	30.63	-	-	Peak
2380	45.25	-28.75	74	40.91	32.16	6.03	33.85	111	23	Peak
2380	33.29	-20.71	54	28.95	32.16	6.03	33.85	111	23	Average
2480	82.34	-	-	77.78	32.28	6.18	33.9	111	23	Average
2480	99.34	-	-	94.78	32.28	6.18	33.9	111	23	Peak
2483.5	65.14	-8.86	74	60.58	32.28	6.18	33.9	111	23	Peak
2483.5	50.96	-3.04	54	46.4	32.28	6.18	33.9	111	23	Average



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 Connected Construction

The antennas type used in this product is Bluetooth : PIFA Antenna without connector and it is considered to meet antenna requirement.

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	Due Date	Remark
System Simulator	R&S	CMU200	117995	N/A	Aug. 11, 2010	Aug.10, 2011	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 13, 2011	Jun. 12, 2012	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 13, 2010	Sep. 12, 2011	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	0846202	N/A	Sep. 14, 2010	Sep. 13, 2011	Conducted (TH02-HY)
Thermal Chamber	Ten Billion	TTH-D35P	TBN-930701	N/A	Jul. 27, 2011	Jul. 26, 2012	Conducted (TH02-HY)
EMI Test Receive	R&S	ESCS 30	100356	9KHz – 2.75GHz	Aug. 16, 2010	Aug. 15, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz – 30MHz	Dec. 03, 2010	Dec. 02, 2011	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz – 30MHz	Dec. 01, 2010	Nov. 30, 2011	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	N/A	Conduction (CO05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 31, 2010	Oct. 30, 2011	Radiation (03CH07-HY)
Spectrum Analyzer	R&S	FSP30	101067	9KHz ~ 30GHz	Dec. 03, 2010	Dec. 02, 2011	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 19, 2010	Aug. 18, 2011	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz- 40GHz	Oct. 18, 2010	Oct. 17, 2011	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A02362	1GHz~ 26.5GHz	Dec. 06, 2010	Dec. 05, 2011	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32dB.GAIN	Mar. 29, 2011	Mar. 28, 2012	Radiation (03CH07-HY)

5 Uncertainty of Evaluation

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.10	Normal (k=2)	0.05
Cable Loss	0.10	Normal (k=2)	0.05
AMN Insertion Loss	2.50	Rectangular	0.63
Receiver Specification	1.50	Rectangular	0.43
Site Imperfection	1.39	Rectangular	0.80
Mismatch	+0.34 / -0.35	U-Shape	0.24
Combined Standard Uncertainty $U_c(y)$	1.13		
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.26		

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

Contribution	Uncertainty of X_i		$u(X_i)$
	dB	Probability Distribution	
Receiver Reading	0.41	Normal (k=2)	0.21
Antenna Factor Calibration	0.83	Normal (k=2)	0.42
Cable Loss Calibration	0.25	Normal (k=2)	0.13
Pre-Amplifier Gain Calibration	0.27	Normal (k=2)	0.14
RCV/SPA Specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site Imperfection	1.43	Rectangular	0.83
Mismatch	+0.39 / -0.41	U-Shape	0.28
Combined Standard Uncertainty $U_c(y)$	1.27		
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	2.54		

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

Contribution	Uncertainty of X_i		$u(X_i)$	C_i	$C_i * u(X_i)$
	dB	Probability Distribution			
Receiver Reading	± 0.10	Normal (k=2)	0.10	1	0.10
Antenna Factor Calibration	± 1.70	Normal (k=2)	0.85	1	0.85
Cable Loss Calibration	± 0.50	Normal (k=2)	0.25	1	0.25
Receiver Correction	± 2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	± 1.50	Rectangular	0.87	1	0.87
Site Imperfection	± 2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR $\Gamma_1 = 0.197$ Antenna VSWR $\Gamma_2 = 0.194$ Uncertainty = $20\text{Log}(1-\Gamma_1*\Gamma_2)$	+0.34 / -0.35	U-Shape	0.244	1	0.244
Combined Standard Uncertainty $U_c(y)$	2.36				
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_c(y)$)	4.72				



Appendix A. Photographs of EUT

Please refer to Sporton report number EP170108-01 as below.