



FCC RF Test Report

APPLICANT : Advantech Co., Ltd.
EQUIPMENT : HandHeld Terminal
BRAND NAME : Advantech
MODEL NAME : PWS-430
FCC ID : M82-PWS-430
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Jun. 06, 2012 and completely tested on Jun. 17, 2012. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

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

Reviewed by:

Jones Tsai / Manager



SPORTON INTERNATIONAL INC.

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



TABLE OF CONTENTS

REVISION HISTORY..... 3

SUMMARY OF TEST RESULT 4

1. GENERAL DESCRIPTION..... 5

 1.1 Applicant..... 5

 1.2 Manufacturer 5

 1.3 Feature of Equipment Under Test..... 5

 1.4 Testing Site..... 6

 1.5 Applied Standards 6

 1.6 Ancillary Equipment List 7

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST 8

 2.1 RF Output Power..... 8

 2.2 Test Mode..... 9

 2.3 Connection Diagram of Test System 10

 2.4 RF Utility 10

3 TEST RESULT 11

 3.1 Number of Channel Measurement 11

 3.2 Hopping Channel Separation Measurement 13

 3.3 Dwell Time Measurement..... 16

 3.4 20dB Bandwidth Measurement 18

 3.5 Peak Output Power Measurement 25

 3.6 Conducted Band Edges Measurement 28

 3.7 Conducted Spurious Emission Measurement 30

 3.8 Radiated Band Edges Measurement 34

 3.9 Radiated Spurious Emission Measurement 37

 3.10 AC Conducted Emission Measurement 45

 3.11 Antenna Requirements..... 49

4 LIST OF MEASURING EQUIPMENT 50

5 UNCERTAINTY OF EVALUATION 51

APPENDIX A. PHOTOGRAPHS OF EUT

APPENDIX B. SETUP PHOTOGRAPHS



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	≥ 15Chs	Pass	-
3.2	15.247(a)(1)	A8.1(b)	Hopping Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.3	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.4	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	≤ 125 mW	Pass	-
3.6	15.247(d)	A8.5	Conducted Band Edges	≤ 20dBc	Pass	-
3.7	15.247(d)	A8.5	Conducted Spurious Emission	≤ 20dBc	Pass	-
3.8	15.247(d)	A8.5	Radiated Band Edges	15.209(a) & 15.247(d)	Pass	-
3.9	15.247(d)	A8.5	Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.12 dB at 42.420 MHz
3.10	15.207	Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 11.70 dB at 4.598 MHz
3.11	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1. General Description

1.1 Applicant

Advantech Co., Ltd.

No. 1, Alley 20, Lane 26, Rueiguang Road, NeiHu District, Taipei 114, R.O.C.

1.2 Manufacturer

Advantech Co., Ltd.

No. 1, Alley 20, Lane 26, Rueiguang Road, NeiHu District, Taipei 114, R.O.C.

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	HandHeld Terminal
Brand Name	Advantech
Model Name	PWS-430
FCC ID	M82-PWS-430
EUT supports Radios application	WLAN 11bg / Bluetooth
HW Version	A101
SW Version	v307
EUT Stage	Production Unit

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

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	Bluetooth (1Mbps) : -1.92 dBm (0.0006 W) Bluetooth EDR (2Mbps) : -3.54 dBm (0.0004 W) Bluetooth EDR (3Mbps) : -3.24 dBm (0.0005 W)
Antenna Type	Fixed Internal Antenna with gain 2.00 dBi
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth 2.1 EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth 2.1 EDR (3Mbps) : 8-DPSK

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.
	TH02-HY	CO05-HY	03CH05-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 and ANSI C63.10-2009
- ♦ IC RSS-210 Issue 8
- ♦ IC RSS-Gen Issue 3

Remark:

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



1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	GPS Station	T&E	GS-50	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	P20G	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	LCD Monitor	Lenovo	6135-AB1	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
6.	Bluetooth Mobile Phone	Sony Ericsson	W595	PY7A3052191	N/A	N/A
7.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A



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:

Band	Bluetooth RF Output Power		
Channel	00	39	78
Frequency	2402	2441	2480
Peak Power	-1.92	-2.41	-4.51

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 1Mbps for all the test items due to the highest RF output power.
3. 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 ANSI C63.10-2009 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 KHz to 30 MHz), radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

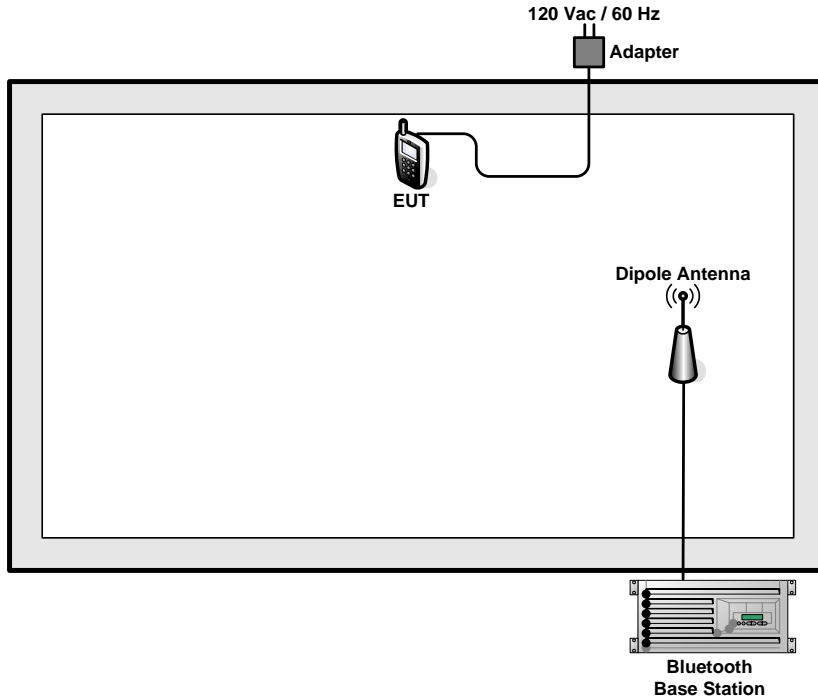
Pre-scanned tests, X, Y, Z in three orthogonal panels, were conducted to determine the final configuration from all possible combinations.

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

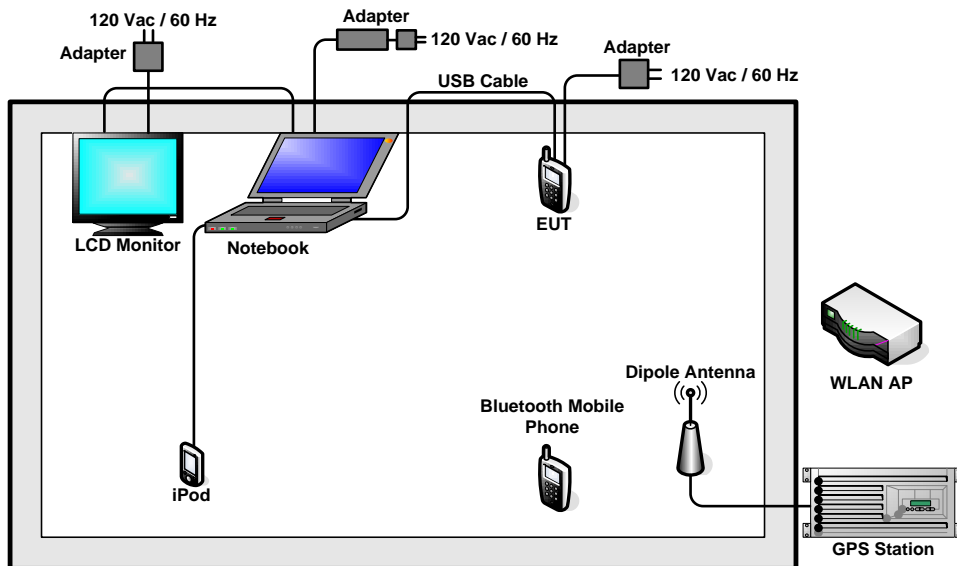
Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	N/A	N/A
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN Link + GPS Rx + Cradle + Battery + USB Cable (Data Link with Notebook) + Adapter 1 Mode 2 :Bluetooth Link + WLAN Link + GPS Rx + Cradle + Battery + USB Cable (Data Link with Notebook) + Adapter 2		
Remark:			
<ol style="list-style-type: none"> For radiated TCs, the data rate was set in 1Mbps due to the highest RF output power; only the data of these modes was reported. For conducted emission, the worst case is mode 2; only the test data of this mode was reported. Link with Notebook means data application transferred mode between EUT and Notebook. 			

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>



2.4 RF Utility

For Bluetooth function, execute "Command" to make the EUT contact with Bluetooth base station for continuous transmitting and receiving signals.

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.

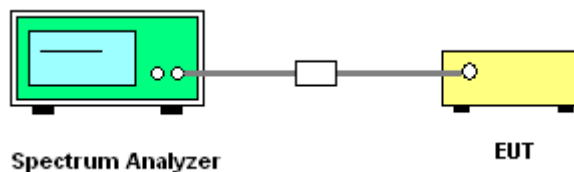
3.1.2 Measuring Instruments

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.
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.
4. The number of hopping frequency used is defined as the device has the numbers of total channel.

3.1.4 Test Setup

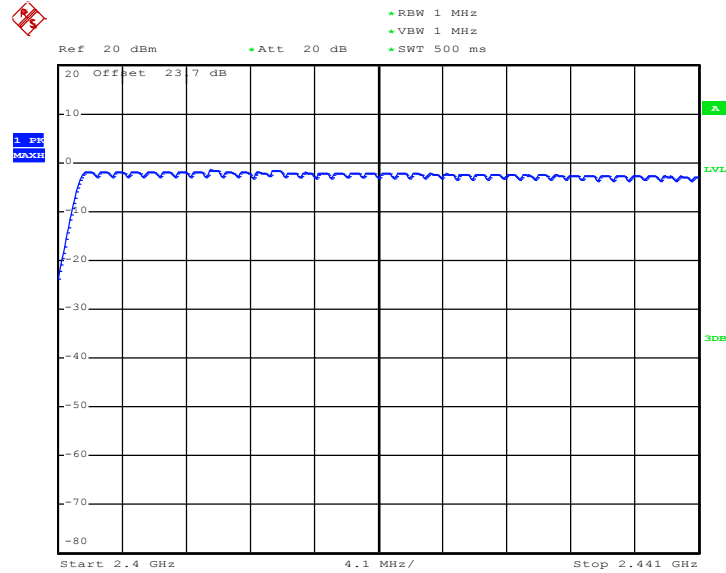


3.1.5 Test Result of Number of Hopping Frequency

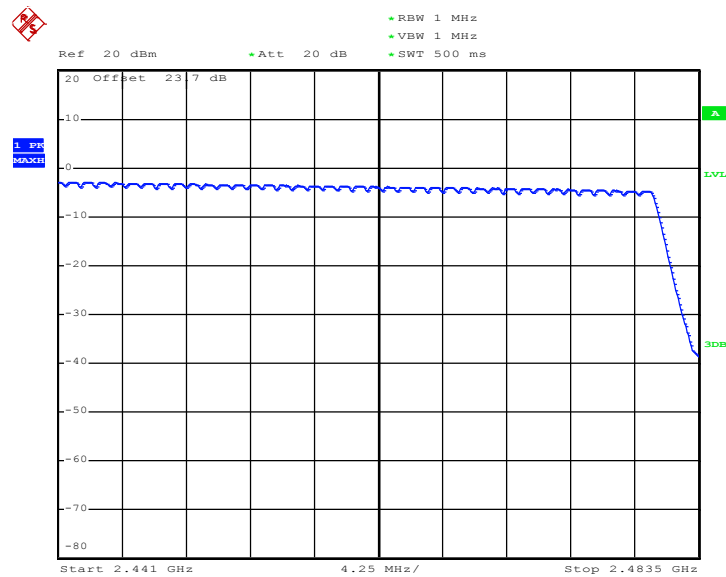
Test Mode :	1Mbps	Temperature :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%
Number of Hopping Channels (Channel)		Limits (Channel)	Pass/Fail
79		> 15	Pass



Number of Hopping Channel Plot on Channel 00 - 78



Date: 17.JUN.2012 14:10:16



Date: 17.JUN.2012 14:13:15

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.

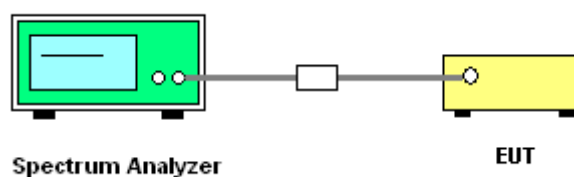
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 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.

3.2.4 Test Setup



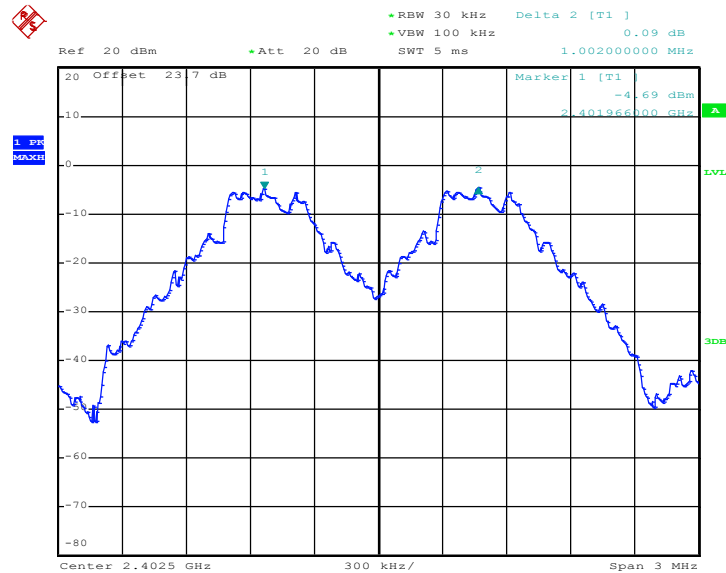


3.2.5 Test Result of Hopping Channel Separation

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

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.6080	Pass
39	2441	1.008	0.6293	Pass
78	2480	1.008	0.6080	Pass

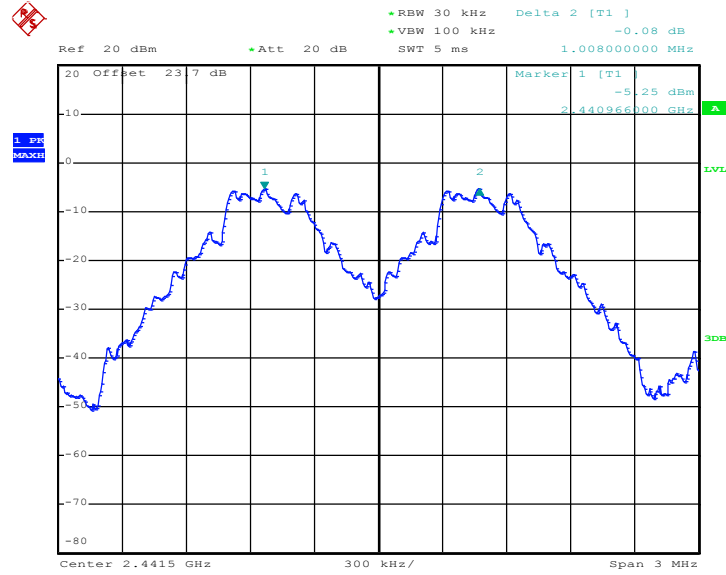
Channel Separation Plot on Channel 00 - 01



Date: 17.JUN.2012 13:29:07

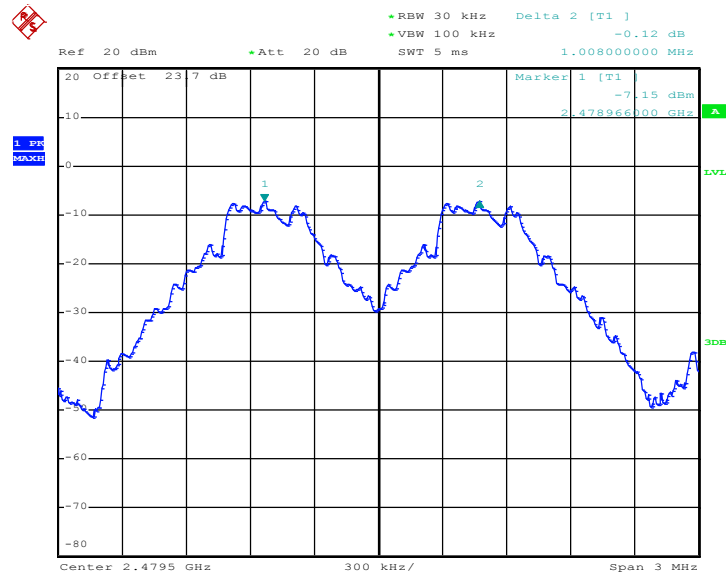


Channel Separation Plot on Channel 39 - 40



Date: 17.JUN.2012 13:29:48

Channel Separation Plot on Channel 77 - 78



Date: 17.JUN.2012 13:30:28

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.

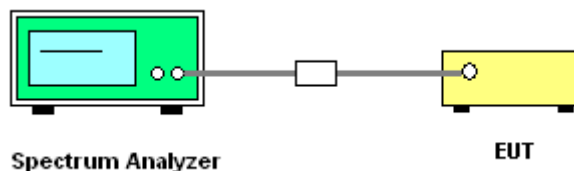
3.3.2 Measuring Instruments

See list of measuring instruments 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 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 ≥ 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.

3.3.4 Test Setup



3.3.5 Test Result of Dwell Time

Test Mode :	DH5	Temperature :	24~26°C
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

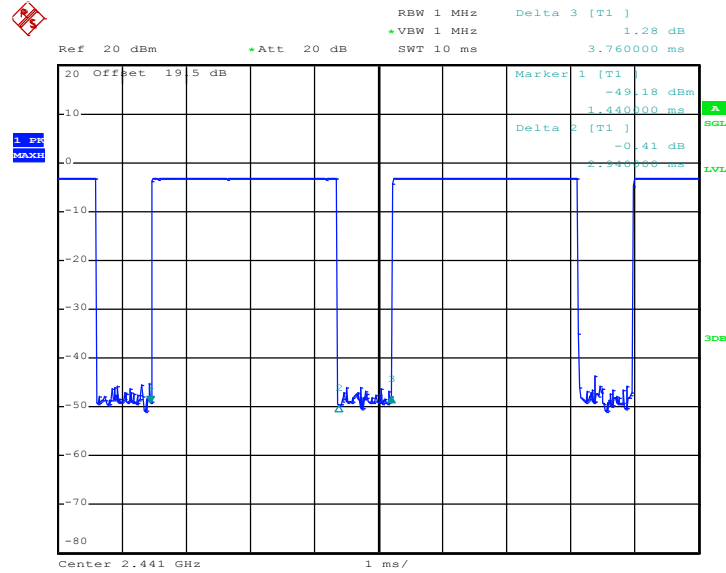
Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
DH5	3.10	2940.00	0.29	0.4	Pass

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)

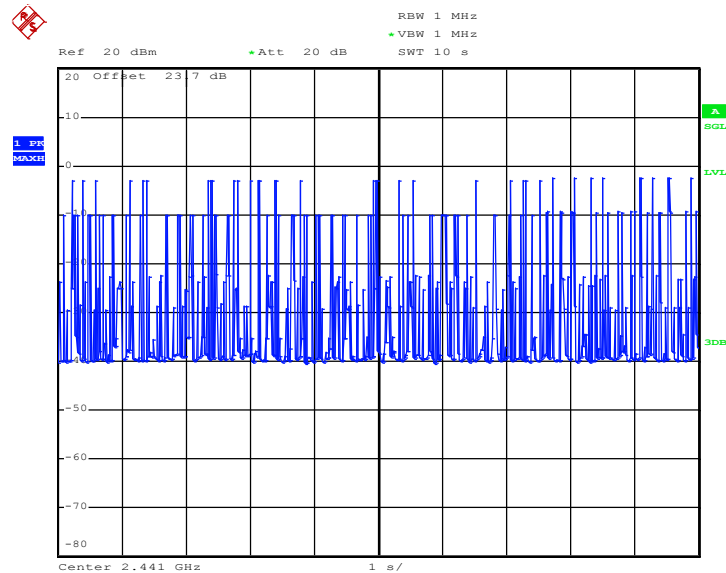


DH5 Dwell Time (One Pulse) Plot on Channel 39



Date: 8.JUN.2012 21:58:23

DH5 Dwell Time (Count Pulses) Plot on Channel 39



Date: 17.JUN.2012 13:39:47

3.4 20dB Bandwidth Measurement

3.4.1 Limit of 20dB Bandwidth

N/A

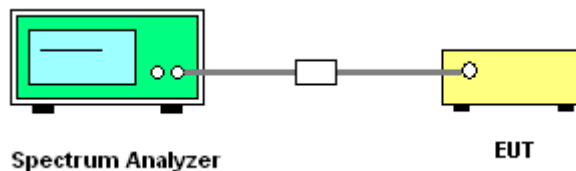
3.4.2 Measuring Instruments

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. 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.

3.4.4 Test Setup



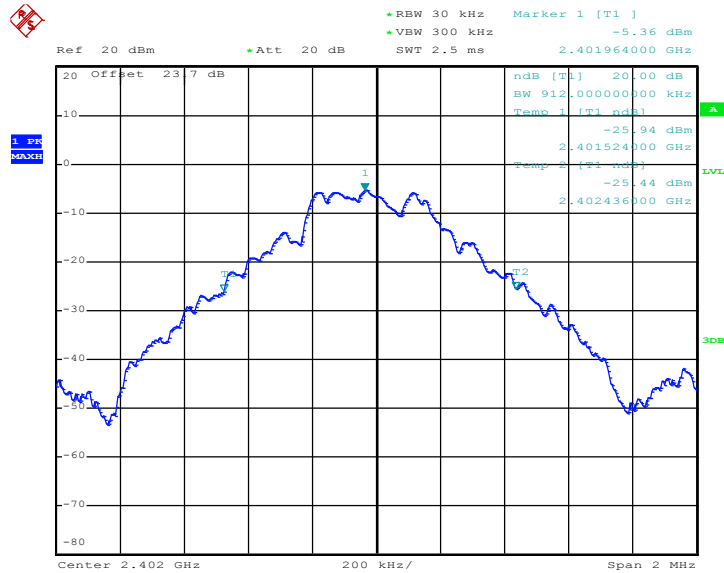


3.4.5 Test Result of 20dB Bandwidth

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

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.912
39	2441	0.944
78	2480	0.912

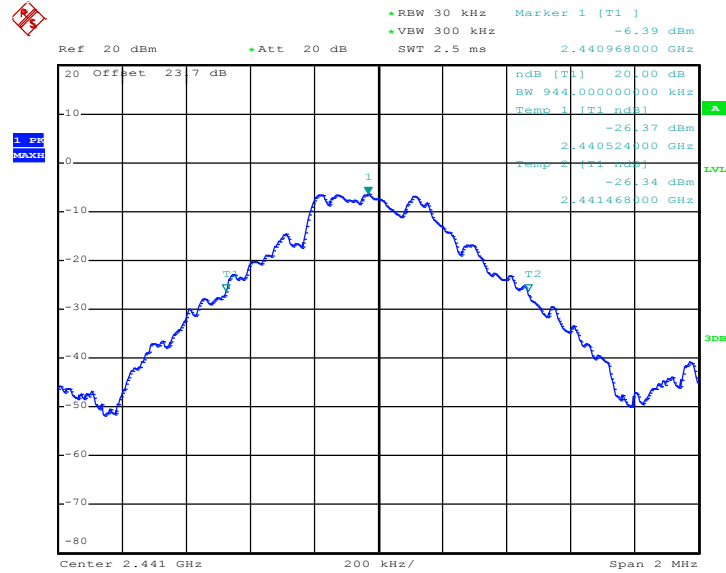
20 dB Bandwidth Plot on Channel 00



Date: 17.JUN.2012 13:41:39

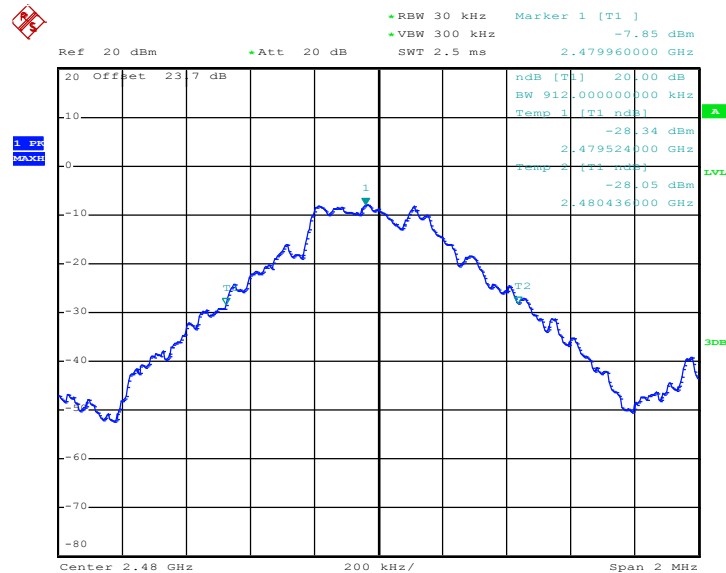


20 dB Bandwidth Plot on Channel 39



Date: 17.JUN.2012 13:41:59

20 dB Bandwidth Plot on Channel 78



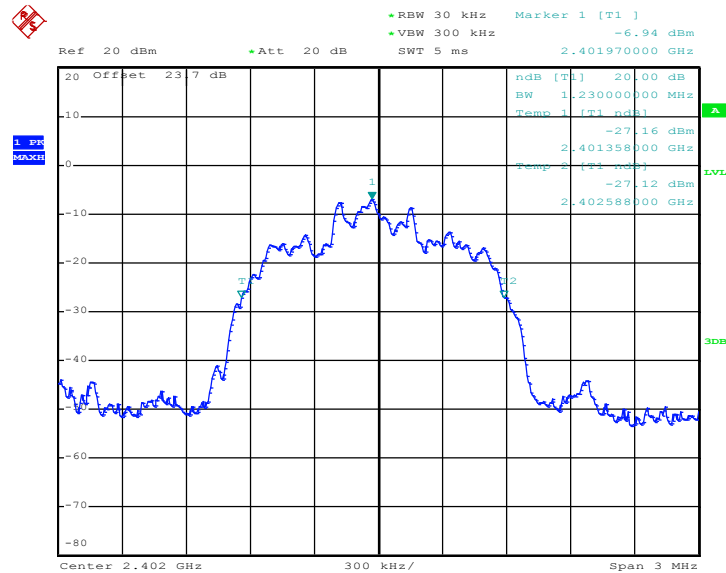
Date: 17.JUN.2012 13:42:18



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

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.230
39	2441	1.254
78	2480	1.248

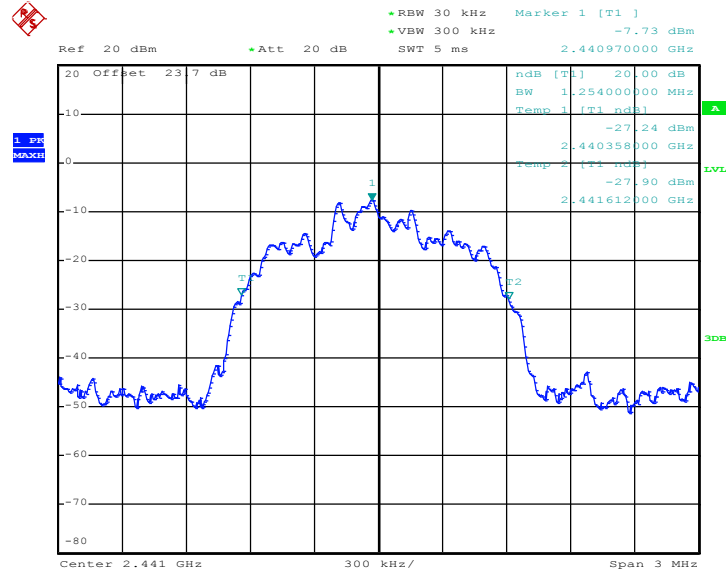
20 dB Bandwidth Plot on Channel 00



Date: 17.JUN.2012 13:42:42

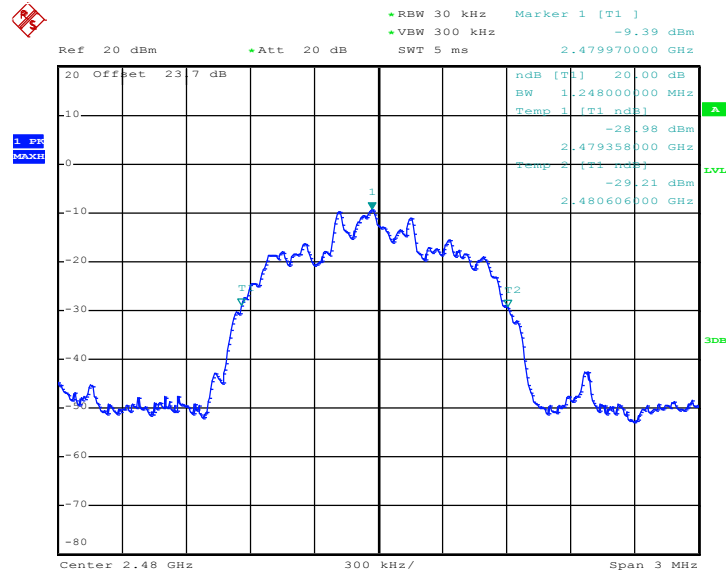


20 dB Bandwidth Plot on Channel 39



Date: 17.JUN.2012 13:43:01

20 dB Bandwidth Plot on Channel 78



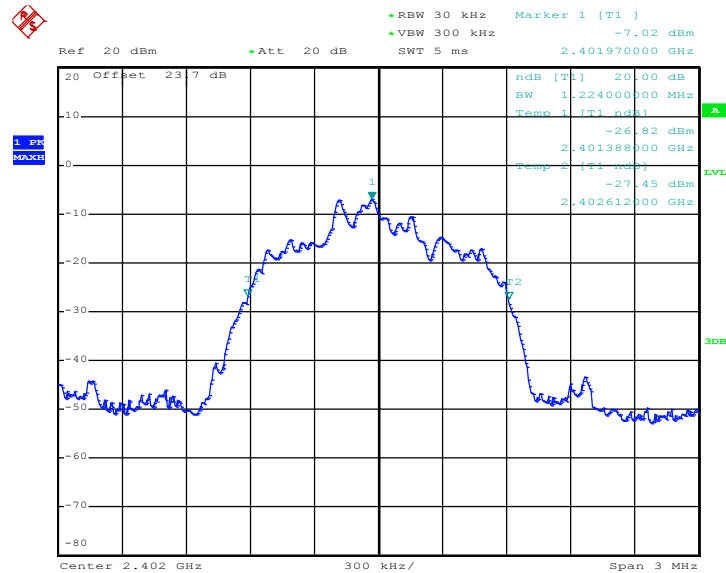
Date: 17.JUN.2012 13:43:23



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

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.224
39	2441	1.224
78	2480	1.224

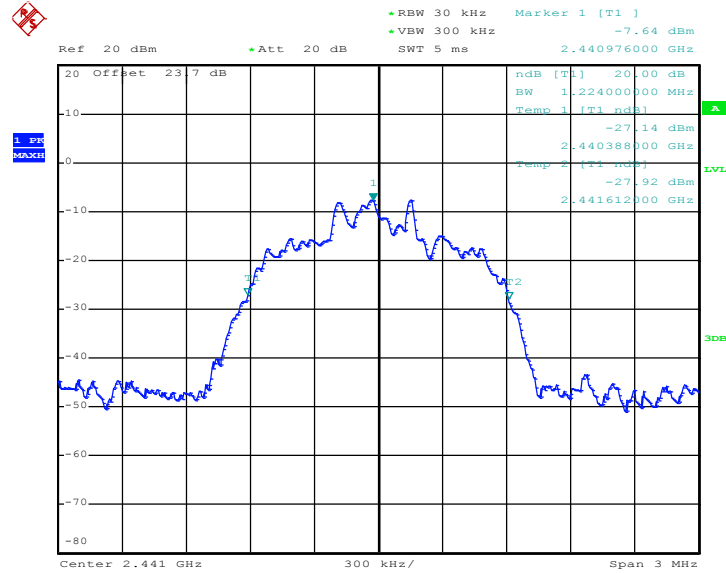
20 dB Bandwidth Plot on Channel 00



Date: 17.JUN.2012 13:44:06

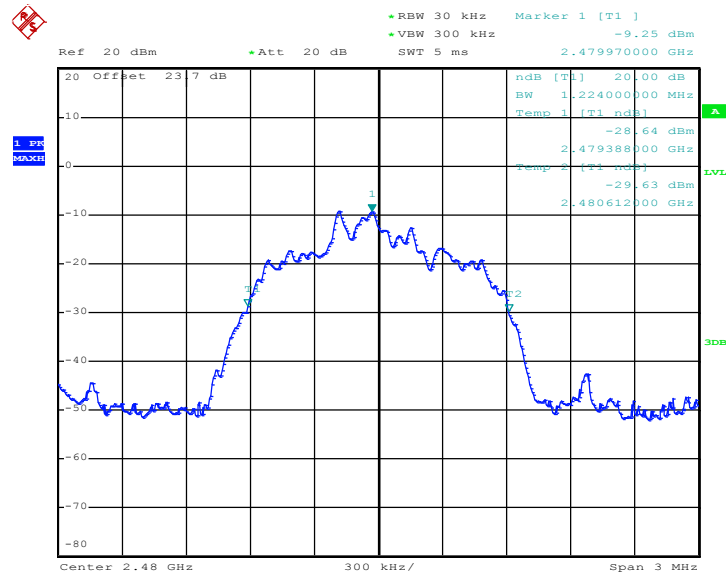


20 dB Bandwidth Plot on Channel 39



Date: 17.JUN.2012 13:44:32

20 dB Bandwidth Plot on Channel 78



Date: 17.JUN.2012 13:44:59

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

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

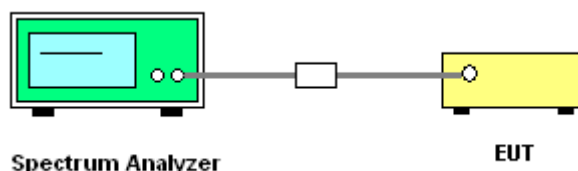
3.5.2 Measuring Instruments

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



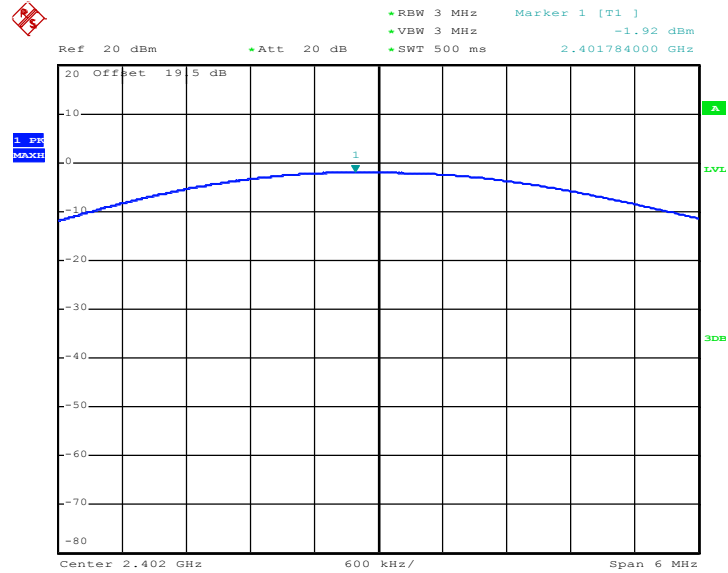
3.5.5 Test Result of Peak Output Power

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

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	-1.92	30.00	Pass
39	2441	-2.41	30.00	Pass
78	2480	-4.51	30.00	Pass

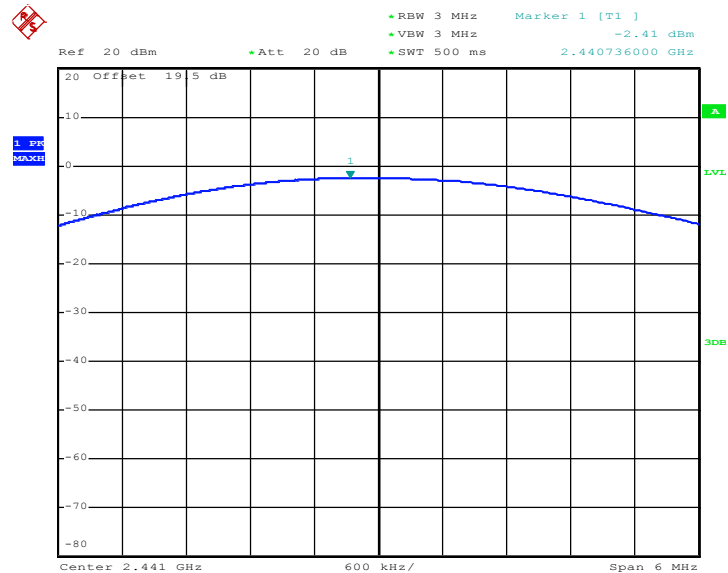


Peak Output Power Plot on Channel 00



Date: 8.JUN.2012 21:47:07

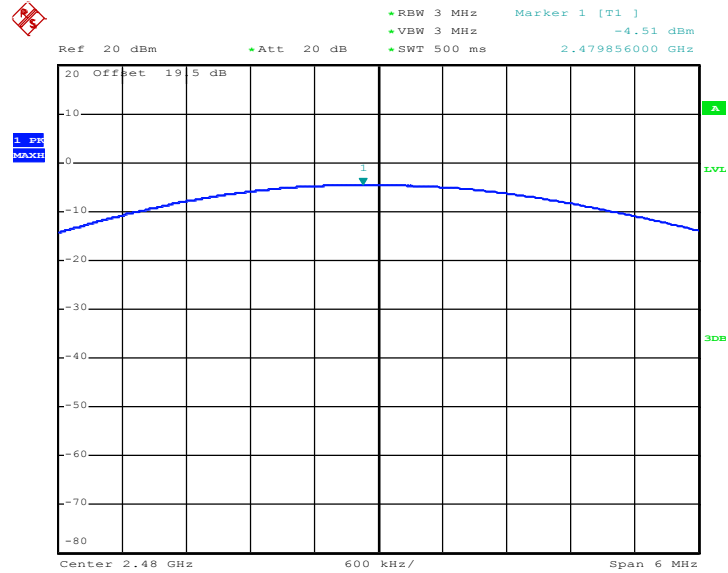
Peak Output Power Plot on Channel 39



Date: 8.JUN.2012 21:48:23



Peak Output Power Plot on Channel 78



Date: 8.JUN.2012 21:49:37

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.

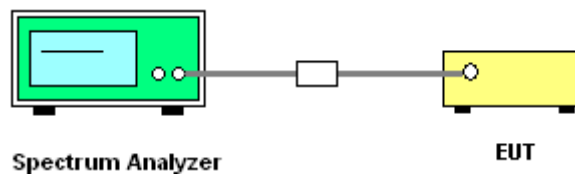
3.6.2 Measuring Instruments

See list of measuring instruments 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 RBW = 300KHz ($\geq 1\%$ span=30MHz), VBW = 300KHz (\geq RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 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. 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

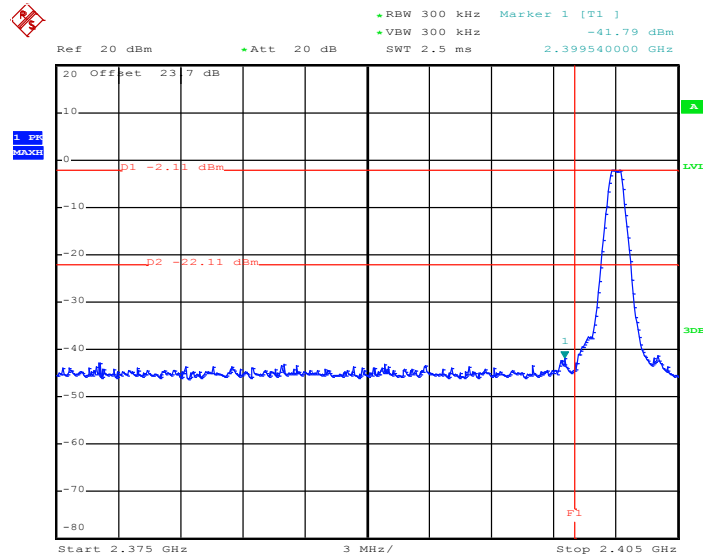




3.6.5 Test Result of Conducted Band Edges

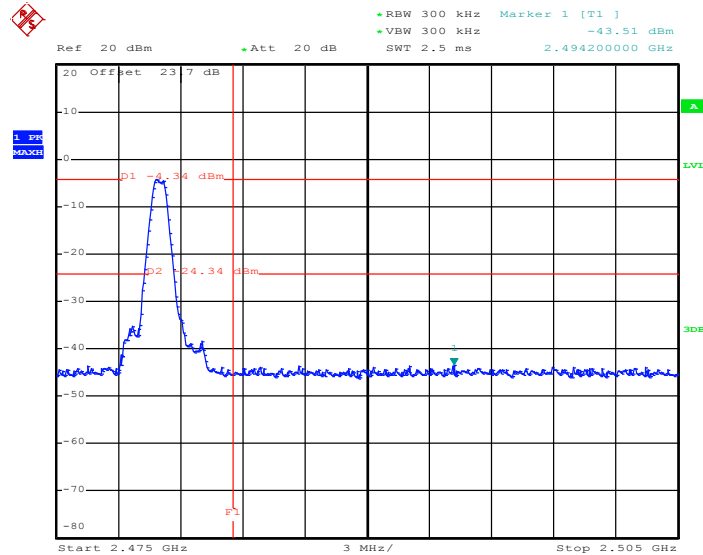
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Bill Kuo

Low Band Edge Plot on Channel 00



Date: 17.JUN.2012 13:45:52

High Band Edge Plot on Channel 78



Date: 17.JUN.2012 13:46:56

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.

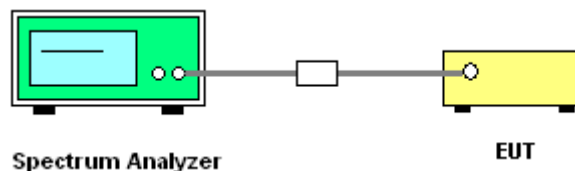
3.7.2 Measuring Instruments

See list of measuring instruments 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 transmitter output was connected to the spectrum analyzer via a low lose cable.
3. 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.

3.7.4 Test Setup

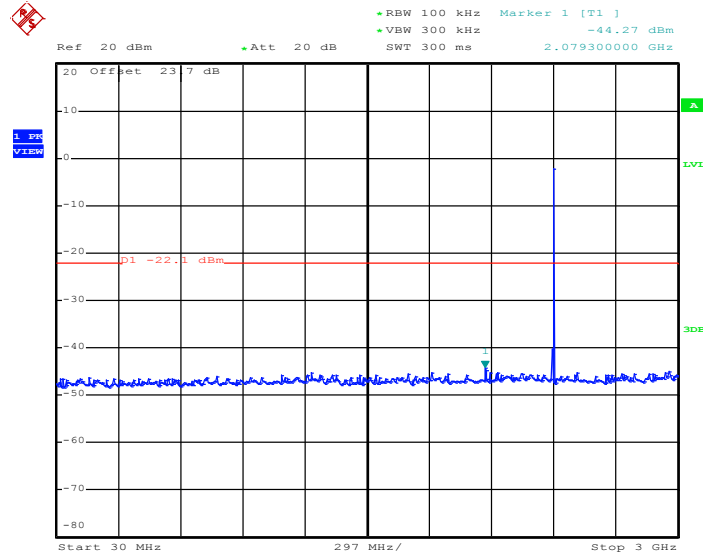




3.7.5 Test Result

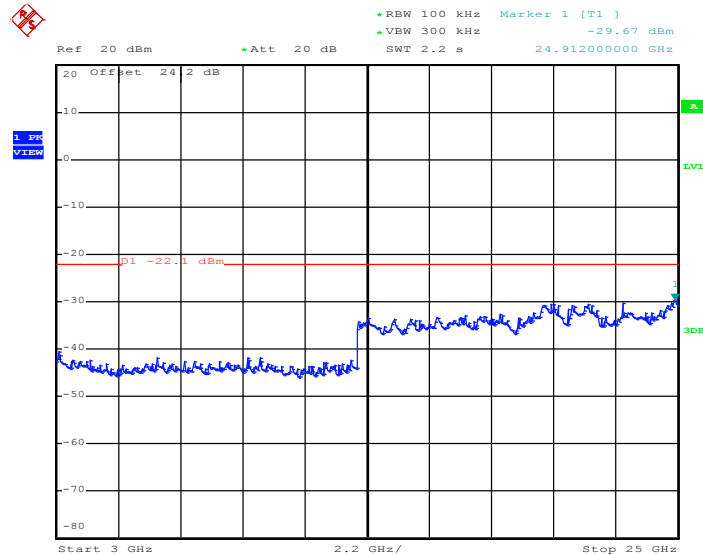
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



Date: 17.JUN.2012 13:57:05

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz

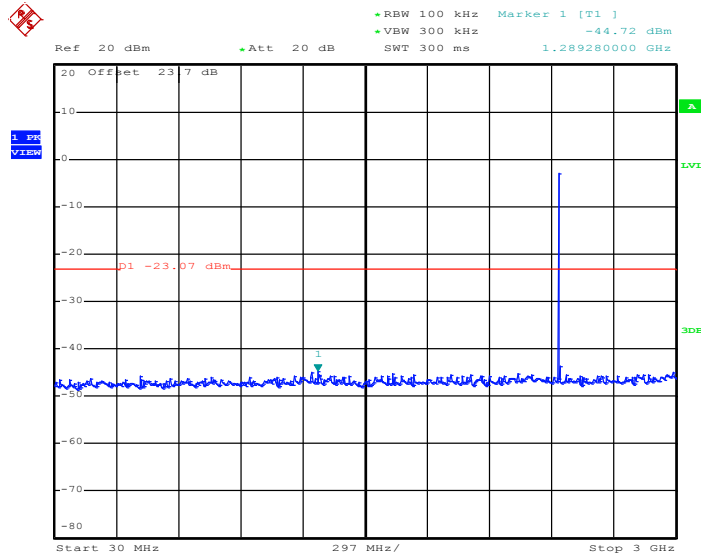


Date: 17.JUN.2012 13:57:17



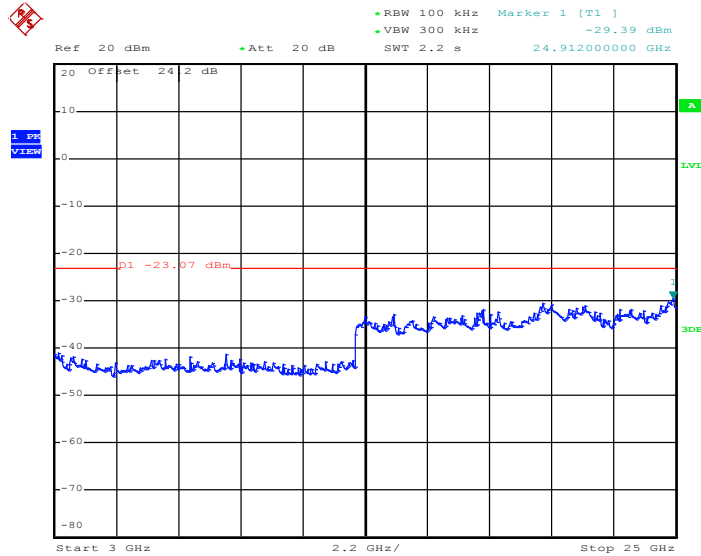
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



Date: 17.JUN.2012 13:58:09

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz

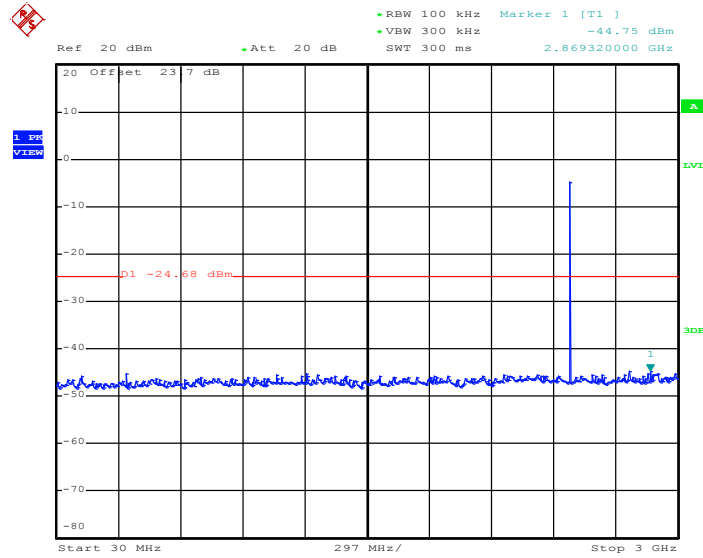


Date: 17.JUN.2012 13:58:21



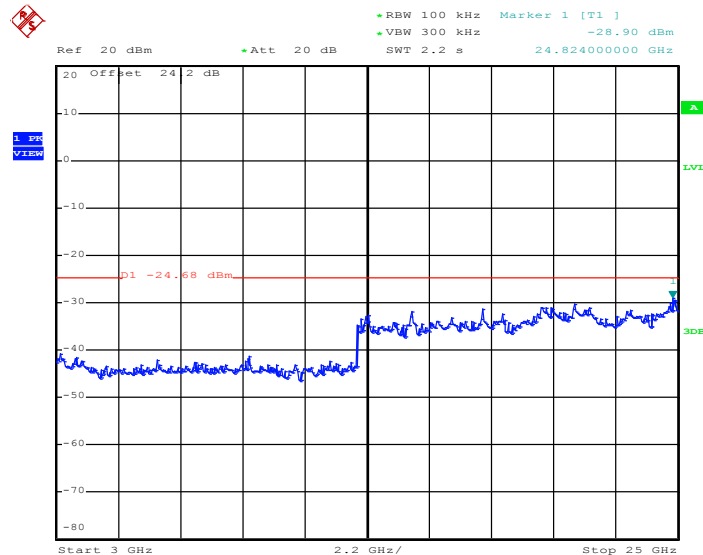
Test Mode :	1Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Bill Kuo

Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



Date: 17.JUN.2012 13:59:14

Conducted Spurious Emission Plot between 3 GHz ~ 25 GHz



Date: 17.JUN.2012 13:59:26



3.8 Radiated Band Edges Measurement

3.8.1 Limit of Radiated Band Edges

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

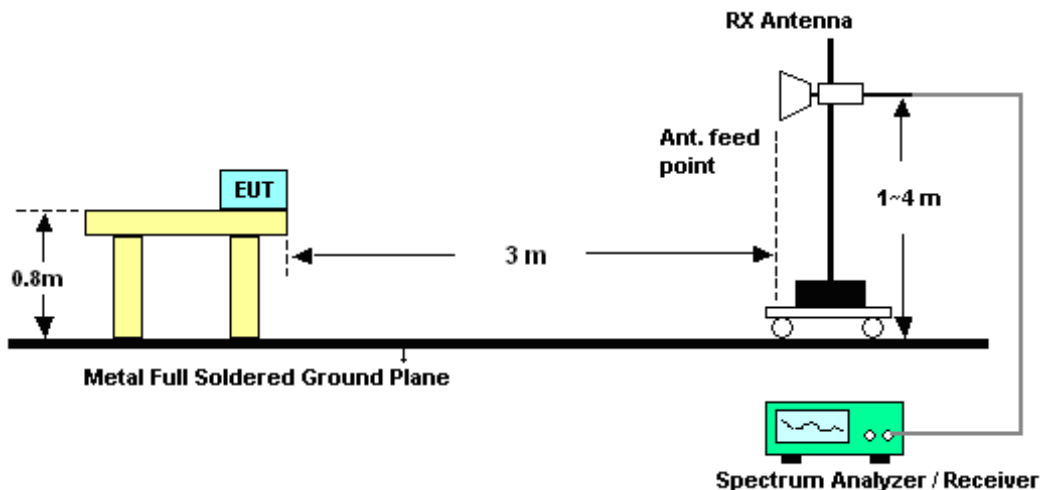
3.8.2 Measuring Instruments

See list of measuring instruments 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 and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test site requirement. 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.
2. 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).
3. 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.

3.8.4 Test Setup





3.8.5 Test Result of Radiated Band Edges

Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	00	Relative Humidity :	47~48%
		Test Engineer :	Hayden 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
2347.71	47.37	-26.63	74	46.73	31.98	4.55	35.89	104	210	Peak
2347.71	36.16	-17.84	54	35.52	31.98	4.55	35.89	104	210	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
2352.03	46.53	-27.47	74	45.88	31.99	4.55	35.89	195	265	Peak
2352.03	34.9	-19.1	54	34.25	31.99	4.55	35.89	195	265	Average

Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	47~48%
		Test Engineer :	Hayden 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
2483.96	51.39	-22.61	74	50.47	32.09	4.64	35.81	100	208	Peak
2483.96	40.93	-13.07	54	40.01	32.09	4.64	35.81	100	208	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
2483.72	47.32	-26.68	74	46.4	32.09	4.64	35.81	186	261	Peak
2483.72	36.14	-17.86	54	35.22	32.09	4.64	35.81	186	261	Average

3.9 Radiated Spurious 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.

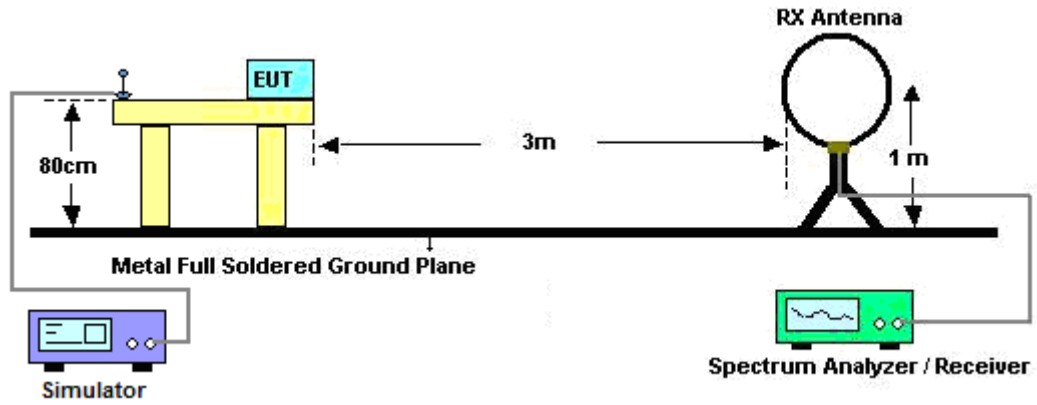


3.9.3 Test Procedures

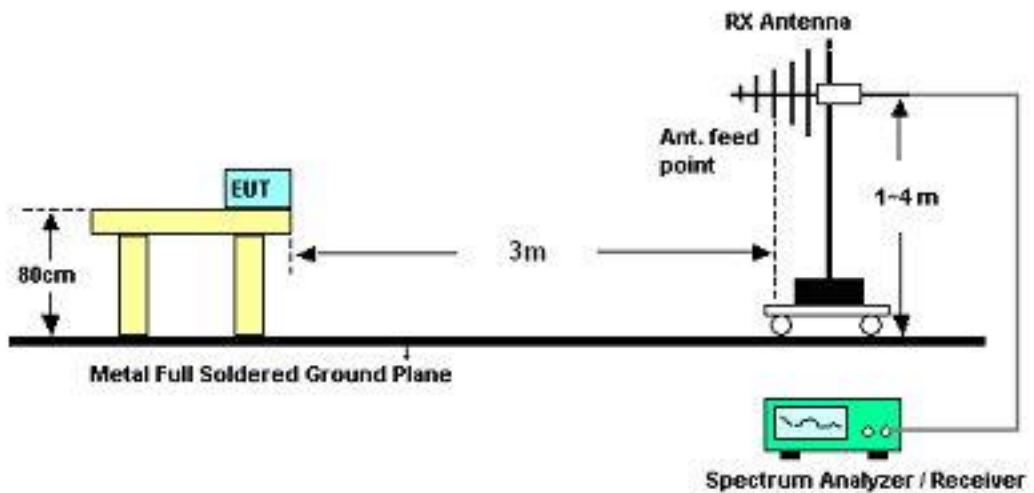
1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test site requirement.
2. Applies to band edge emissions that fall in the restricted bands listed in FCC Section 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).
3. Follow the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009 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.
4. Measured average value if the peak value is greater than 54 dBu/m

3.9.4 Test Setup

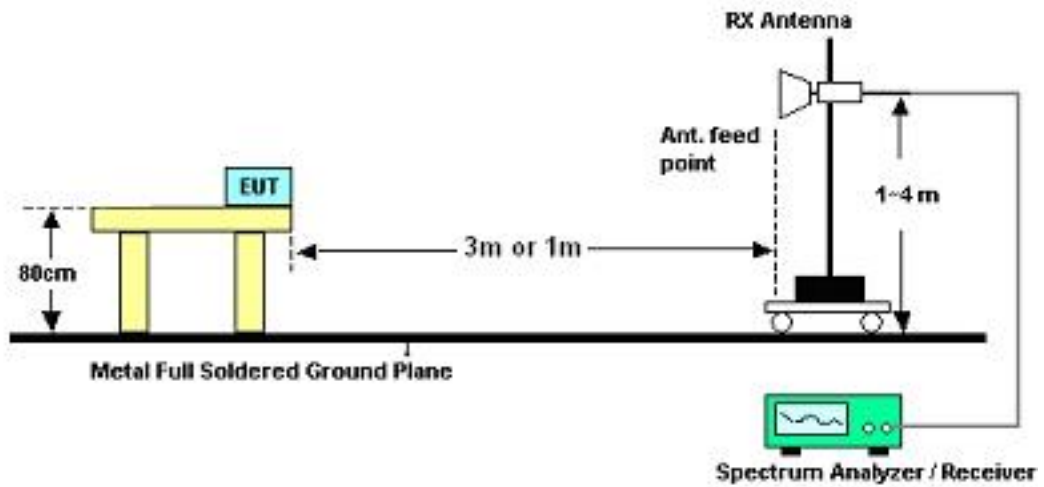
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



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

Test Mode :	3Mbps	Temperature :	22~23°C
Test Channel :	00	Relative Humidity :	47~48%
Test Engineer :	Hayden Wu	Polarization :	Horizontal
Remark :	1. 2402 MHz is fundamental signal which can be ignored. 2. 9608 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. For example, 91.01 dBuV/m - 20dB = 71.01 dBuV/m.		

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
2347.71	36.16	-17.84	54	35.52	31.98	4.55	35.89	104	210	Average
2347.71	47.37	-26.63	74	46.73	31.98	4.55	35.89	104	210	Peak
2402	78.6	-	-	77.86	32.02	4.58	35.86	104	210	Average
2402	91.01	-	-	90.27	32.02	4.58	35.86	104	210	Peak
2500	34.73	-19.27	54	33.79	32.1	4.64	35.8	104	210	Average
2500	46.18	-27.82	74	45.24	32.1	4.64	35.8	104	210	Peak
4804	44.22	-29.78	74	62.94	33.84	6.5	59.06	100	0	Peak
9608	50.27	-20.74	71.01	60.22	36.54	9.48	55.97	100	0	Peak

Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	00	Relative Humidity :	47~48%
Test Engineer :	Hayden Wu	Polarization :	Vertical
Remark :	1. 2402 MHz is fundamental signal which can be ignored. 2. 9608 MHz is not within a restricted band.		

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
2352.03	34.9	-19.1	54	34.25	31.99	4.55	35.89	195	265	Average
2352.03	46.53	-27.47	74	45.88	31.99	4.55	35.89	195	265	Peak
2402	70.52	-	-	69.78	32.02	4.58	35.86	195	265	Average
2402	80.7	-	-	79.96	32.02	4.58	35.86	195	265	Peak
2486	34.68	-19.32	54	33.76	32.09	4.64	35.81	195	265	Average
2486	45.66	-28.34	74	44.74	32.09	4.64	35.81	195	265	Peak
4804	44.74	-29.26	74	63.46	33.84	6.5	59.06	100	0	Peak
9608	51.04	-9.66	60.7	60.99	36.54	9.48	55.97	100	0	Peak



Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	39	Relative Humidity :	47~48%
Test Engineer :	Hayden Wu	Polarization :	Horizontal
Remark :	1. 2441 MHz is fundamental signal which can be ignored. 2. 9764 MHz is not within a restricted band.		

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
32.7	36.15	-3.85	40	49.3	17.76	0.72	31.63	100	208	Peak
144.21	34.51	-8.99	43.5	53.37	11.13	1.27	31.26	-	-	Peak
253.56	35.83	-10.17	46	52.1	12.99	1.67	30.93	-	-	Peak
487.6	34.84	-11.16	46	45.43	17.86	2.21	30.66	-	-	Peak
507.2	33.47	-12.53	46	43.72	18.17	2.24	30.66	-	-	Peak
624.1	33.04	-12.96	46	40.26	20.54	2.5	30.26	-	-	Peak
2358	34.9	-19.1	54	34.23	31.99	4.57	35.89	131	199	Average
2358	45.91	-28.09	74	45.24	31.99	4.57	35.89	131	199	Peak
2441	77.6	-	-	76.76	32.06	4.61	35.83	131	199	Average
2441	89.7	-	-	88.86	32.06	4.61	35.83	131	199	Peak
2490	34.7	-19.3	54	33.77	32.1	4.64	35.81	131	199	Average
2490	45.59	-28.41	74	44.66	32.1	4.64	35.81	131	199	Peak
4882	46.3	-27.7	74	64.82	33.82	6.54	58.88	100	0	Peak
7323	46.08	-27.92	74	60.07	35.6	8.42	58.01	100	0	Peak
9764	50.69	-19.01	69.7	60.32	36.76	9.5	55.89	100	0	Peak



Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	39	Relative Humidity :	47~48%
Test Engineer :	Hayden Wu	Polarization :	Vertical
Remark :	1. 2441 MHz is fundamental signal which can be ignored. 2. 9764 MHz is not within a restricted band.		

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
32.97	33.73	-6.27	40	46.88	17.76	0.72	31.63	-	-	Peak
42.42	36.88	-3.12	40	56.12	11.56	0.76	31.56	110	235	Peak
142.59	37.9	-5.6	43.5	56.69	11.2	1.27	31.26	-	-	Peak
487.6	34.91	-11.09	46	45.5	17.86	2.21	30.66	-	-	Peak
507.2	35.17	-10.83	46	45.42	18.17	2.24	30.66	-	-	Peak
624.1	34.11	-11.89	46	41.33	20.54	2.5	30.26	-	-	Peak
2346	34.89	-19.11	54	34.25	31.98	4.55	35.89	187	254	Average
2346	45.64	-28.36	74	45	31.98	4.55	35.89	187	254	Peak
2441	70.88	-	-	70.04	32.06	4.61	35.83	187	254	Average
2441	81.24	-	-	80.4	32.06	4.61	35.83	187	254	Peak
2500	34.71	-19.29	54	33.77	32.1	4.64	35.8	187	254	Average
2500	45.56	-28.44	74	44.62	32.1	4.64	35.8	187	254	Peak
4882	43.64	-30.36	74	62.16	33.82	6.54	58.88	100	0	Peak
9764	54.17	-7.07	61.24	63.8	36.76	9.5	55.89	100	0	Peak



Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	47~48%
Test Engineer :	Hayden 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
2344	34.95	-19.05	54	34.31	31.98	4.55	35.89	100	208	Average
2344	47.01	-26.99	74	46.37	31.98	4.55	35.89	100	208	Peak
2480	77.4	-	-	76.48	32.09	4.64	35.81	100	208	Average
2480	89.43	-	-	88.51	32.09	4.64	35.81	100	208	Peak
2483.96	40.93	-13.07	54	40.01	32.09	4.64	35.81	100	208	Average
2483.96	51.39	-22.61	74	50.47	32.09	4.64	35.81	100	208	Peak

Test Mode :	1Mbps	Temperature :	22~23°C
Test Channel :	78	Relative Humidity :	47~48%
Test Engineer :	Hayden Wu	Polarization :	Vertical
Remark :	1. 2480 MHz is fundamental signal which can be ignored. 2. 9920 MHz is not within a restricted band.		

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
2330	34.84	-19.16	54	34.25	31.96	4.53	35.9	186	261	Average
2330	45.96	-28.04	74	45.37	31.96	4.53	35.9	186	261	Peak
2480	70.04	-	-	69.12	32.09	4.64	35.81	186	261	Average
2480	80.2	-	-	79.28	32.09	4.64	35.81	186	261	Peak
2483.72	36.14	-17.86	54	35.22	32.09	4.64	35.81	186	261	Average
2483.72	47.32	-26.68	74	46.4	32.09	4.64	35.81	186	261	Peak
7440	46.81	-27.19	74	60.79	35.6	8.63	58.21	100	0	Peak
9920	48.94	-11.26	60.2	58.23	37	9.51	55.8	100	0	Peak

3.10 AC Conducted Emission Measurement

3.10.1 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.

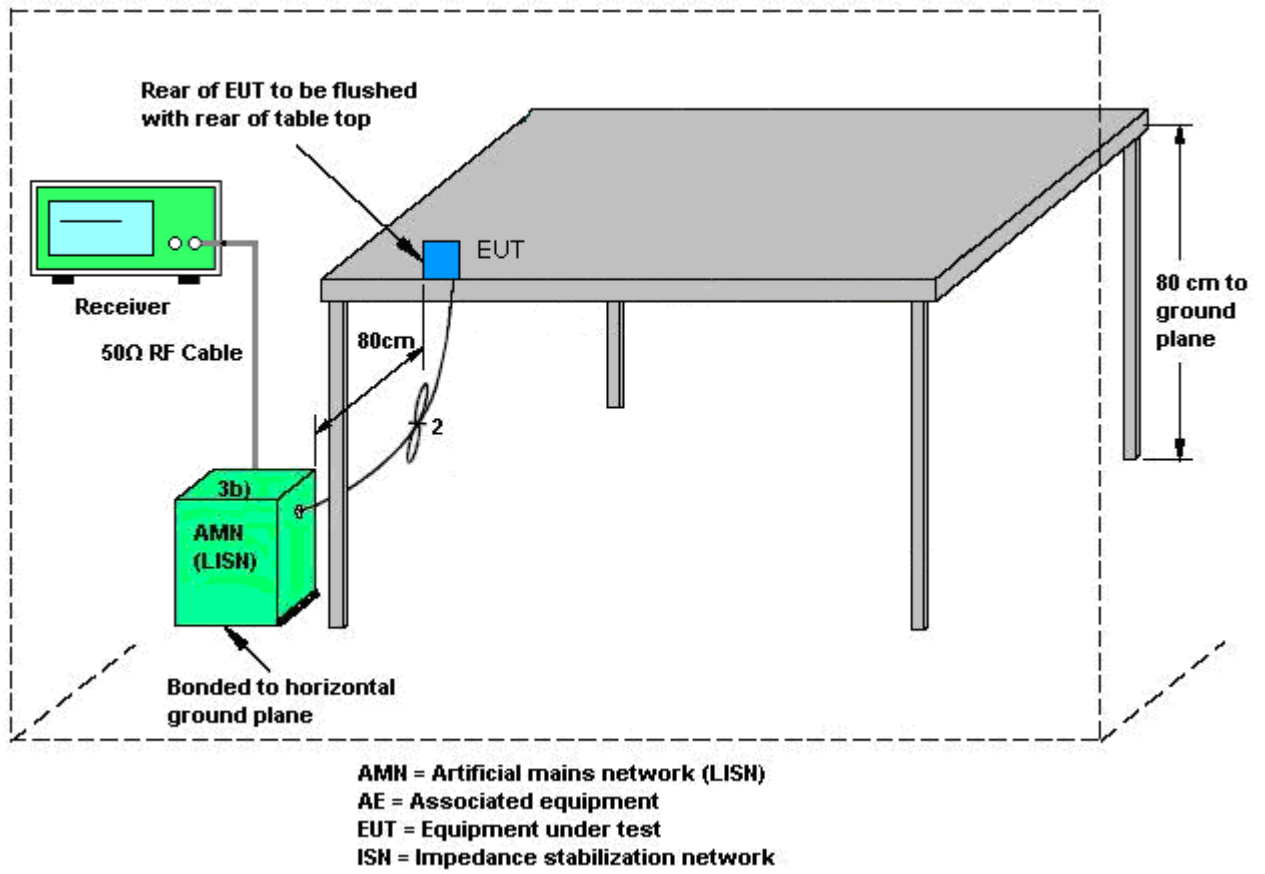
3.10.2 Measuring Instruments

See list of measuring instruments of this test report.

3.10.3 Test Procedures

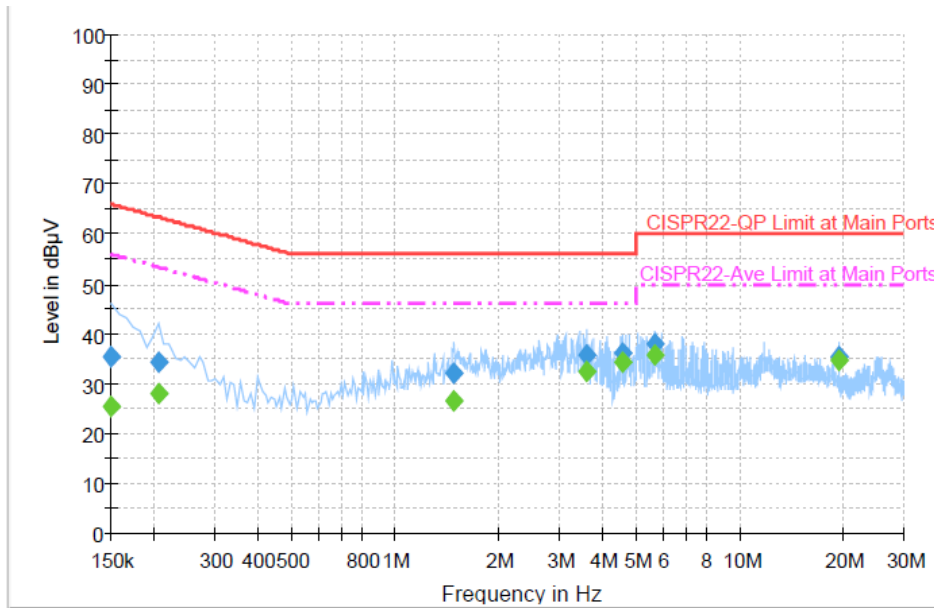
1. Please follow the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009 test site requirement.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 KHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.10.4 Test Setup



3.10.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN Link + GPS Rx + Cradle + Battery + USB Cable (Data Link with Notebook) + Adapter 2		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



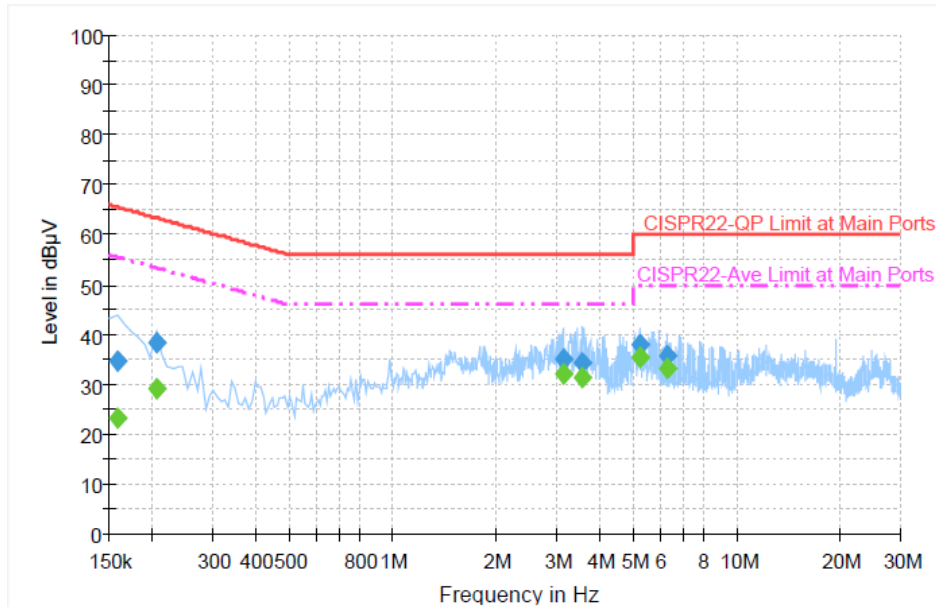
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	35.6	Off	L1	19.4	30.4	66.0
0.206000	34.3	Off	L1	19.4	29.1	63.4
1.486000	32.0	Off	L1	19.5	24.0	56.0
3.614000	35.8	Off	L1	19.6	20.2	56.0
4.598000	36.1	Off	L1	19.7	19.9	56.0
5.710000	38.0	Off	L1	19.7	22.0	60.0
19.502000	35.3	Off	L1	19.8	24.7	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	25.5	Off	L1	19.4	30.5	56.0
0.206000	28.2	Off	L1	19.4	25.2	53.4
1.486000	26.6	Off	L1	19.5	19.4	46.0
3.614000	32.5	Off	L1	19.6	13.5	46.0
4.598000	34.3	Off	L1	19.7	11.7	46.0
5.710000	35.7	Off	L1	19.7	14.3	50.0
19.502000	34.7	Off	L1	19.8	15.3	50.0

Test Mode :	Mode 2	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN Link + GPS Rx + Cradle + Battery + USB Cable (Data Link with Notebook) + Adapter 2		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	34.7	Off	N	19.3	30.9	65.6
0.206000	38.2	Off	N	19.4	25.2	63.4
3.126000	35.0	Off	N	19.7	21.0	56.0
3.582000	34.4	Off	N	19.6	21.6	56.0
5.222000	38.0	Off	N	19.5	22.0	60.0
6.294000	35.9	Off	N	19.7	24.1	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	23.3	Off	N	19.3	32.3	55.6
0.206000	29.0	Off	N	19.4	24.4	53.4
3.126000	32.1	Off	N	19.7	13.9	46.0
3.582000	31.3	Off	N	19.6	14.7	46.0
5.222000	35.4	Off	N	19.5	14.6	50.0
6.294000	33.4	Off	N	19.7	16.6	50.0



3.11 Antenna Requirements

3.11.1 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.

3.11.2 Antenna Connected Construction

Non-standard connector used.

3.11.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 06, 2012	Jun. 08, 2012~ Jun. 17, 2012	Jun. 05, 2013	Conducted (TH02-HY)
Bluetooth Base Station	R&S	CBT32	100522	N/A	Feb. 09, 2012	Jun. 08, 2012~ Jun. 17, 2012	Feb. 08, 2014	Conducted (TH02-HY)
EMI Test Receive	R&S	ESCS 30	100356	9KHz ~ 2.75GHz	Oct. 27, 2011	Jun. 14, 2012	Oct. 26, 2012	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz ~ 30MHz	Dec. 09, 2011	Jun. 14, 2012	Dec. 08, 2012	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz ~ 30MHz	Dec. 06, 2011	Jun. 14, 2012	Dec. 05, 2012	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Jun. 14, 2012	N/A	Conduction (CO05-HY)
GPS Station	T&E	GS-50	N/A	N/A	N/A	Jun. 14, 2012	N/A	Conduction (CO05-HY)
Spectrum Analyzer	R&S	ESU26	100390	20Hz ~ 26.5GHz	Dec. 22, 2011	Jun. 14, 2012	Dec. 21, 2012	Radiation (03CH05-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2725	30MHz ~ 2GHz	Oct. 22, 2011	Jun. 14, 2012	Oct. 21, 2012	Radiation (03CH05-HY)
Turn Table	HD	Deis HD 2000	420/611	0 ~ 360 degree	N/A	Jun. 14, 2012	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	MA 240	240/666	1 m ~ 4 m	N/A	Jun. 14, 2012	N/A	Radiation (03CH05-HY)
Horn Antenna	ESCO	3117	66584	1GHz ~ 18GHz	Aug. 04, 2011	Jun. 14, 2012	Aug. 03, 2012	Radiation (03CH05-HY)
Pre Amplifier	COM-POWER	PA-103A	161075	10Hz ~ 1000MHz Gain:32dB	Feb. 27, 2012	Jun. 14, 2012	Feb. 26, 2013	Radiation (03CH05-HY)
Pre Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	159087	1GHz~18GHz	Feb. 27, 2012	Jun. 14, 2012	Feb. 26, 2013	Radiation (03CH05-HY)
Pre Amplifier	Agilent	8449B	3008A019 17	1GHz~26.5GHz	Aug. 30, 2011	Jun. 14, 2012	Aug. 29, 2012	Radiation (03CH05-HY)
Bluetooth Base Station	R&S	CBT32	100522	N/A	Feb. 09, 2012	Jun. 14, 2012	Feb. 08, 2014	Radiation (03CH05-HY)
Loop Antenna	R&S	HFH2-Z2	860004/00 1	9 kHz~30 MHz	Jul. 29, 2010	Jun. 14, 2012	Jul. 28, 2012	Radiation (03CH05-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% ($U = 2Uc(y)$)	2.54
---	------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.72
---	------



Appendix A. Photographs of EUT

Please refer to Sporton report number EP260605 as below.