FCC RF Test Report

APPLICANT	:	Handheld Group AB
EQUIPMENT	:	Rugged Smartphone
BRAND NAME	:	Handheld Group AB
MODEL NAME	:	NX1-UMTS
FCC ID	:	YY3-NX1UMTS
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on Apr. 29, 2013 and testing was completed on Oct. 09, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown to be compliant with the applicable technical standards.

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

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR342939B	Rev. 01	Initial issue of report	Jan. 20, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-210 A8.2(a)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.2	15.247(b)	RSS-210 A8.4	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	RSS-210 A8.2(b)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	RSS-210 A8.5	Conducted Band Edges	≤ 20dBc	Pass	-
			Conducted Spurious Emission		Pass	-
3.5	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 6.47 dB at 30.000 MHz
3.6	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 6.00 dB at 0.190 MHz
3.7	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Handheld Group AB
Kinnegatan 17A
SE-531 33 Lidkoping
Sweden

1.2 Manufacturer

Handheld Group AB
Kinnegatan 17A
SE-531 33 Lidkoping
Sweden

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Rugged Smartphone
Brand Name	Handheld Group AB
Model Name	NX1-UMTS
FCC ID	YY3-NX1UMTS
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA WLAN 11b/g/n HT20 Bluetooth v2.1 + EDR
HW Version	ES4
SW Version	17
EUT Stage	Identical Prototype

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

1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Peak) Output Power to Antenna	802.11b : 15.03 dBm (0.0318 W) 802.11g : 16.98 dBm (0.0499 W) 802.11n HT20 : 16.86 dBm (0.0485 W)
Antenna Type	PIFA Antenna type with gain 1.67 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

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

1.6 Testing Site

Test Site	SPORTON INTERNATIONAL INC.			
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
Test Site No.	**Sporton Site No.**			**FCC/IC Registration No.**
	TH02-HY	CO05-HY	03CH08-HY	636805/4086B-2

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

1.7 Applied Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01
- ANSI C63.4-2003

Remark:

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

2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz) and radiated emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	-	-

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test shown in the following tables.

2.4GHz 802.11b mode				
Data Rate (MHz)	1M bps	2M bps	5.5M bps	11M bps
Peak Power (dBm)	**15.03**	15.02	14.95	15.01

2.4GHz 802.11g mode								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	**16.98**	16.97	16.97	16.84	16.42	16.45	16.49	16.43

2.4GHz 802.11n HT20 mode								
Data Rate (MHz)	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	**16.86**	16.71	16.45	16.31	16.26	16.32	16.30	16.33

2.3 Test Mode

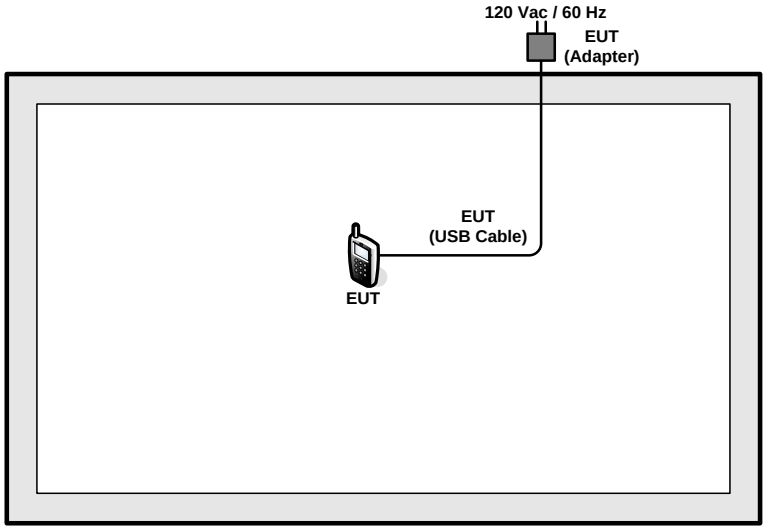
Final results of test modes, data rates and test channels are shown as following table.

Test Cases				
	Test Items	**Mode**	**Data Rate**	**Test Channel**
Conducted TCs	**6dB BW Power Spectral Density**	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
	Output Power	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
	Conducted Band Edge	**802.11b**	**1 Mbps**	**1/11**
		802.11g	**6 Mbps**	**1/11**
		802.11n HT20	**MCS0**	**1/11**
	Conducted Spurious Emission	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**
Radiated TCs	**Radiated Band Edge**	**802.11b**	**1 Mbps**	**1/11**
		802.11g	**6 Mbps**	**1/11**
		802.11n HT20	**MCS0**	**1/11**
	Radiated Spurious Emission	**802.11b**	**1 Mbps**	**1/6/11**
		802.11g	**6 Mbps**	**1/6/11**
		802.11n HT20	**MCS0**	**1/6/11**

Test Cases	
AC Conducted Emission	Mode 1 : WCDMA1900 Idle + Bluetooth Link + WLAN Link + GPS Rx + Earphone + Battery 1 + USB Cable (Data Link with Notebook)

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



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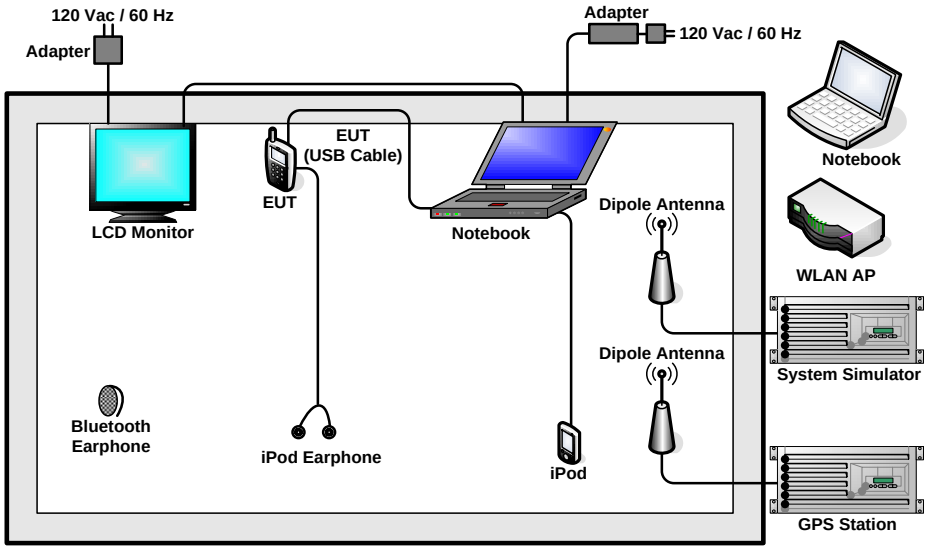


2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	GPS Station	Pendulum	GSG-54	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
4.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
5.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
6.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
7.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
8.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.2 m	N/A
9.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.6 EUT Operation Test Setup

For WLAN function, programmed RF utility, “ADB” installed in the notebook make the EUT provides functions like channel selection and power level for continuous transmitting and receiving signals.

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

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

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

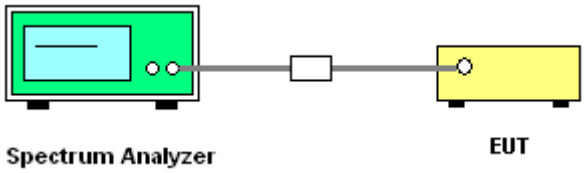
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v03r01.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. Measure and record the results in the test report.

3.1.4 Test Setup

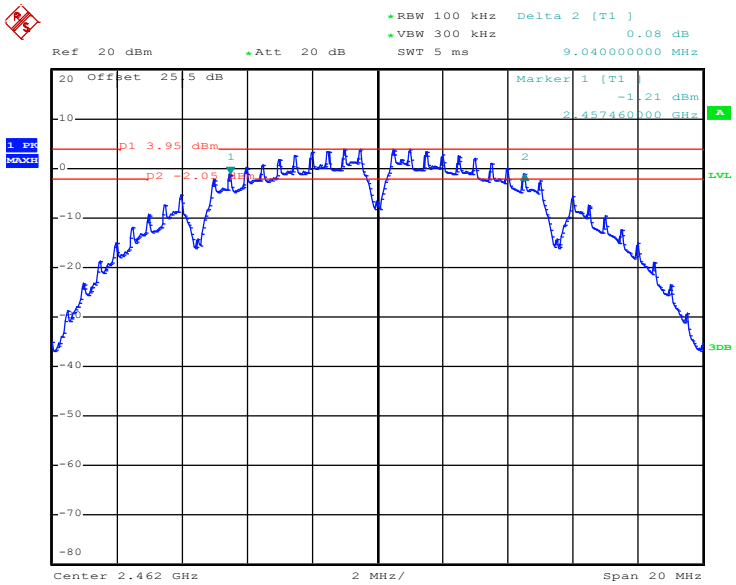


3.1.5 Test Result of 6dB Occupied Bandwidth

Test Band :	2.4GHz	Temperature :	22~24℃
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	9.08	0.5	Pass
11b	1Mbps	1	6	2437	9.56	0.5	Pass
11b	1Mbps	1	11	2462	9.04	0.5	Pass
11g	6Mbps	1	1	2412	15.28	0.5	Pass
11g	6Mbps	1	6	2437	15.64	0.5	Pass
11g	6Mbps	1	11	2462	15.32	0.5	Pass
HT20	MCS0	1	1	2412	15.32	0.5	Pass
HT20	MCS0	1	6	2437	15.40	0.5	Pass
HT20	MCS0	1	11	2462	15.16	0.5	Pass

Minimum 6dB Bandwidth



3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting Antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the Antenna exceeds 6dBi.

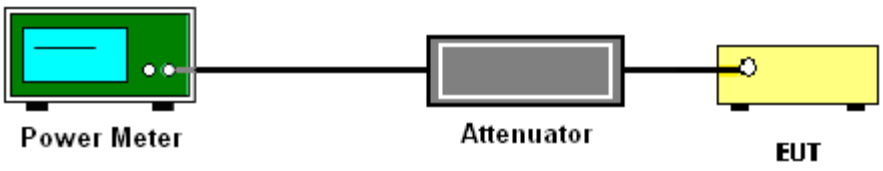
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r01.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Test Mode :	2.4GHz	Temperature :	22~24℃
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	RF Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	15.03	30	1.67	Pass
11b	1Mbps	1	6	2437	14.85	30	1.67	Pass
11b	1Mbps	1	11	2462	14.82	30	1.67	Pass
11g	6Mbps	1	1	2412	16.98	30	1.67	Pass
11g	6Mbps	1	6	2437	16.84	30	1.67	Pass
11g	6Mbps	1	11	2462	16.79	30	1.67	Pass
HT20	MCS0	1	1	2412	16.86	30	1.67	Pass
HT20	MCS0	1	6	2437	16.71	30	1.67	Pass
HT20	MCS0	1	11	2462	16.69	30	1.67	Pass

Note: Measured power (dBm) has offset with cable loss.

3.2.6 Test Result of Average output Power (Reporting Only)

Test Mode :	2.4GHz	Temperature :	22~24℃
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Duty Factor (dB)	Average Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	0.00	12.91	30	1.67	Pass
11b	1Mbps	1	6	2437	0.00	12.70	30	1.67	Pass
11b	1Mbps	1	11	2462	0.00	12.67	30	1.67	Pass
11g	6Mbps	1	1	2412	0.05	7.01	30	1.67	Pass
11g	6Mbps	1	6	2437	0.05	6.86	30	1.67	Pass
11g	6Mbps	1	11	2462	0.05	6.82	30	1.67	Pass
HT20	MCS0	1	1	2412	0.16	6.79	30	1.67	Pass
HT20	MCS0	1	6	2437	0.16	6.70	30	1.67	Pass
HT20	MCS0	1	11	2462	0.16	6.67	30	1.67	Pass

Note: Measured power (dBm) has offset with cable loss and duty factor.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

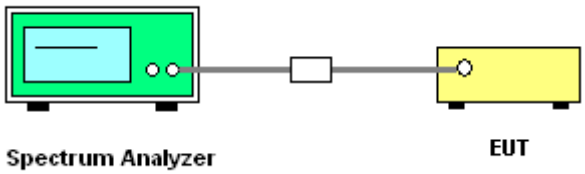
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

3.3.4 Test Setup



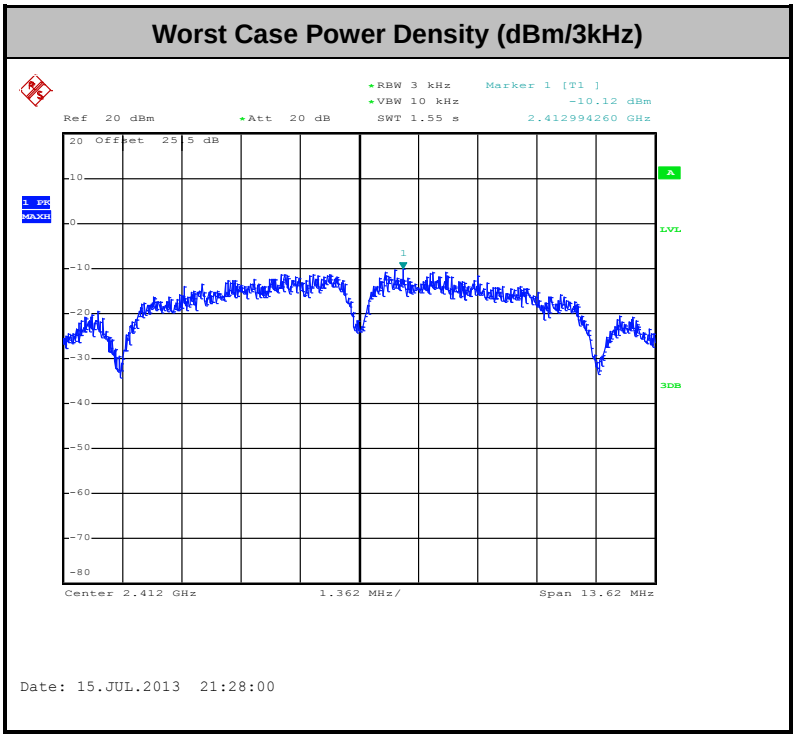
3.3.5 Test Result of Power Spectral Density

Test Mode :	2.4GHz	Temperature :	22~24℃
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	Peak Power Density (dBm/3kHz)	Max. Limits (dBm/3kHz)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	-10.12	8	1.67	Pass
11b	1Mbps	1	6	2437	-10.27	8	1.67	Pass
11b	1Mbps	1	11	2462	-10.62	8	1.67	Pass
11g	6Mbps	1	1	2412	-18.31	8	1.67	Pass
11g	6Mbps	1	6	2437	-19.00	8	1.67	Pass
11g	6Mbps	1	11	2462	-19.01	8	1.67	Pass
HT20	MCS0	1	1	2412	-18.74	8	1.67	Pass
HT20	MCS0	1	6	2437	-17.91	8	1.67	Pass
HT20	MCS0	1	11	2462	-18.72	8	1.67	Pass

Note: Measured power density (dBm) has offset with cable loss.

Worst Case Power Density (dBm/3kHz)



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

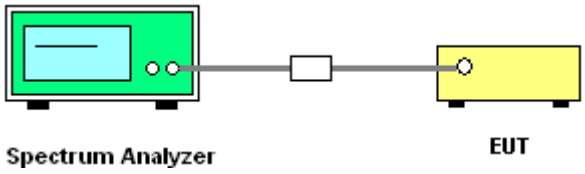
3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

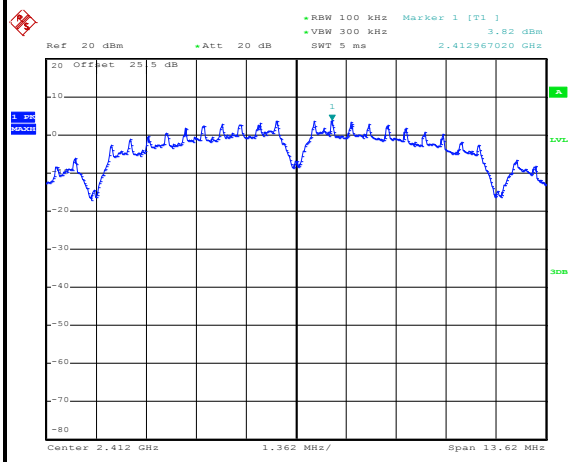


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	**Temperature :**	22~24℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Bill Kuo

WLAN 802.11b Channel 01

100kHz PSD reference Level



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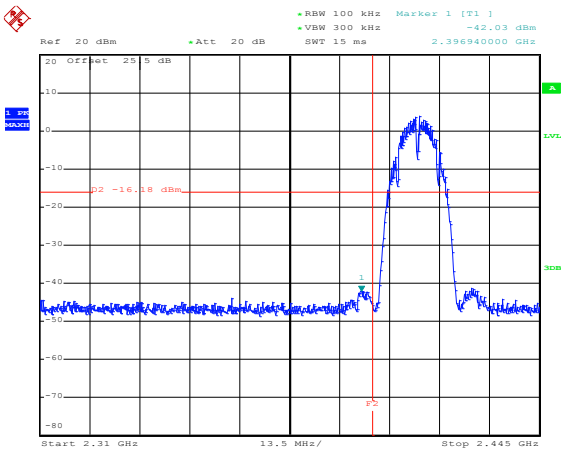
Low Channel Plot



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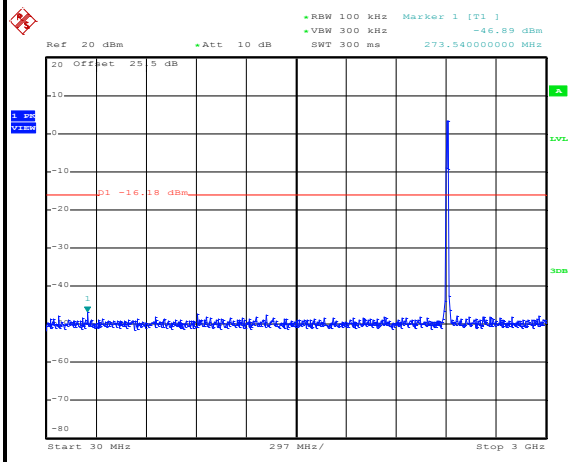
Spurious Emission 30MHz~3GHz



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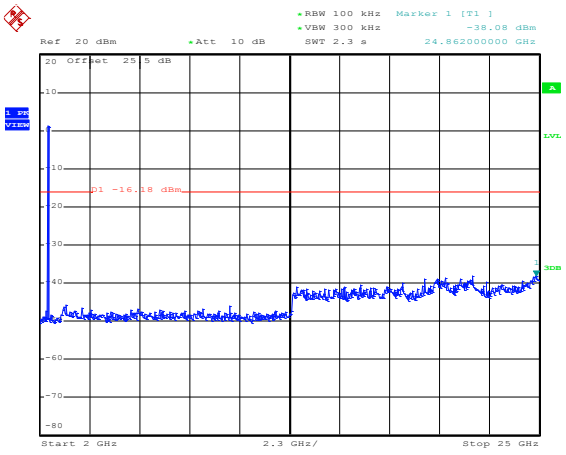
Spurious Emission 2GHz~25GHz



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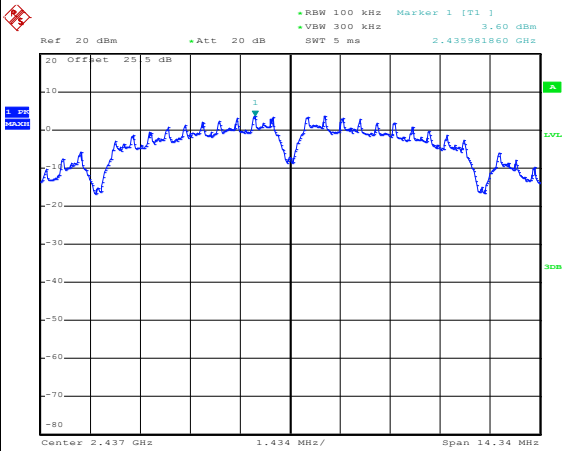
Test Mode :	802.11b	**Temperature :**	22~24℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Bill Kuo

WLAN 802.11b Channel 06

100kHz PSD reference Level



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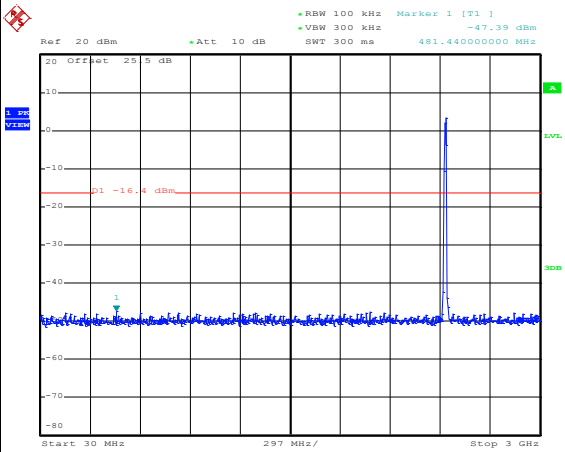
Spurious Emission 30MHz~3GHz



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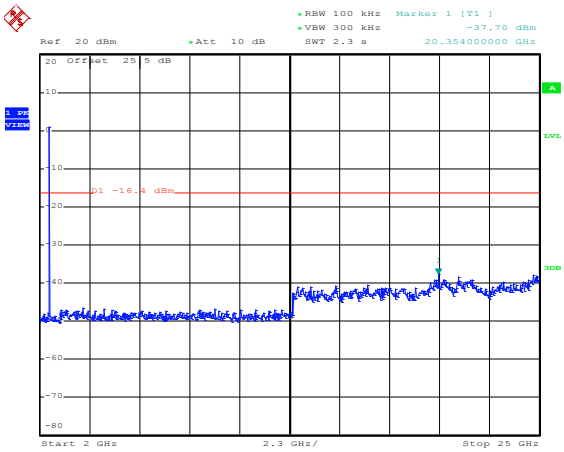
Spurious Emission 2GHz~25GHz



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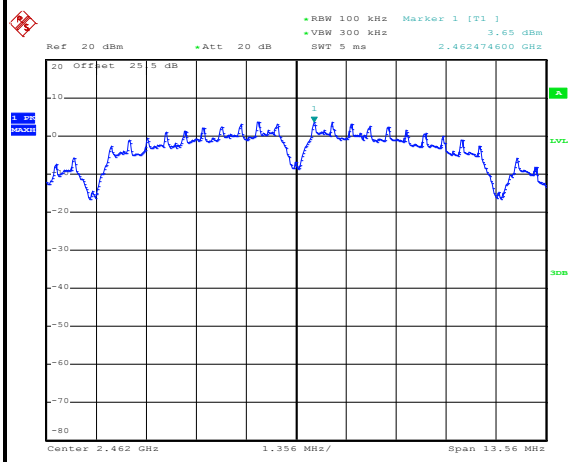
Test Mode :	802.11b	**Temperature :**	22~24℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Bill Kuo

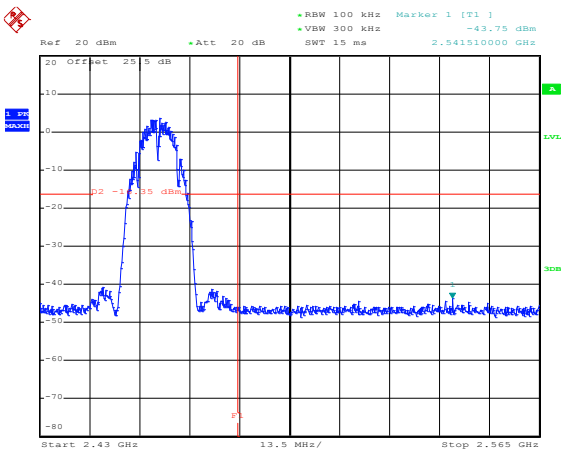
WLAN 802.11b Channel 11

100kHz PSD reference Level



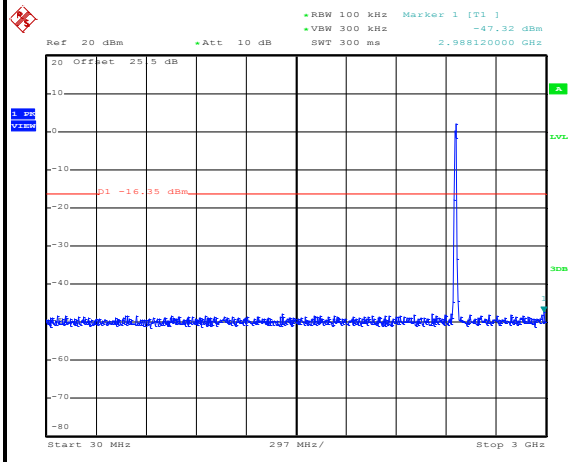
Date: 15.JUL.2013 21:54:43

High Channel Plot



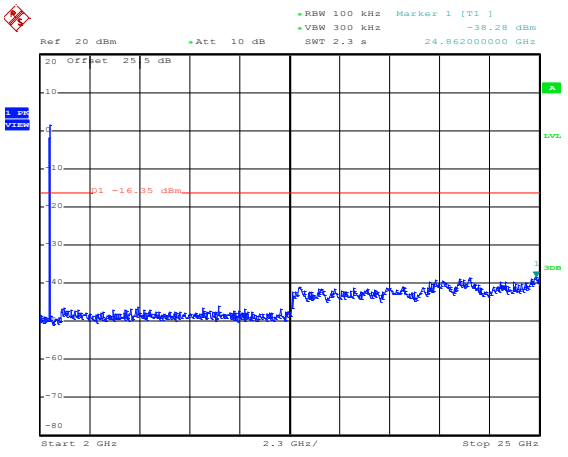
Date: 15.JUL.2013 21:54:56

Spurious Emission 30MHz~3GHz



Date: 15.JUL.2013 21:55:16

Spurious Emission 2GHz~25GHz

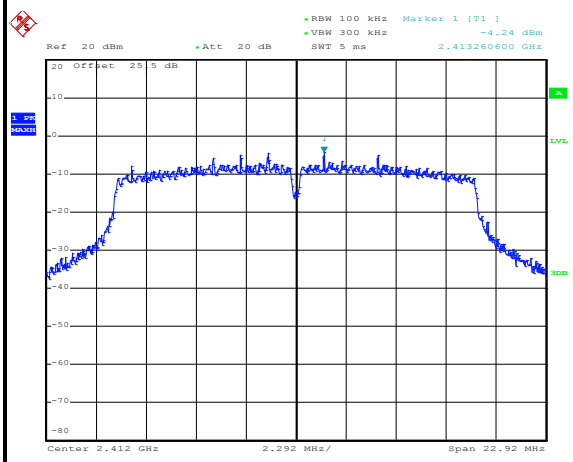


Date: 15.JUL.2013 21:55:34

Test Mode :	802.11g	**Temperature :**	22~24℃
Test Band :	2.4GHz Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Bill Kuo

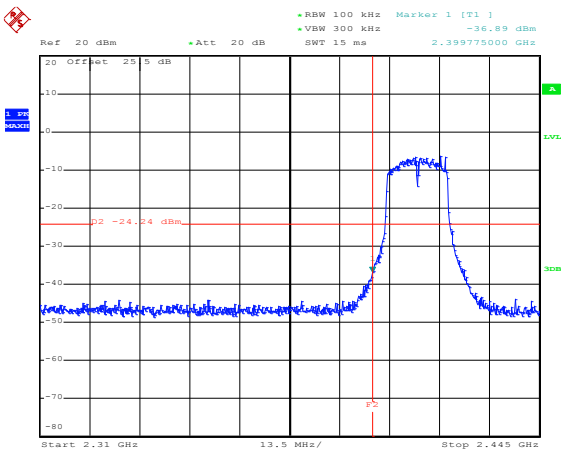
WLAN 802.11g Channel 01

100kHz PSD reference Level



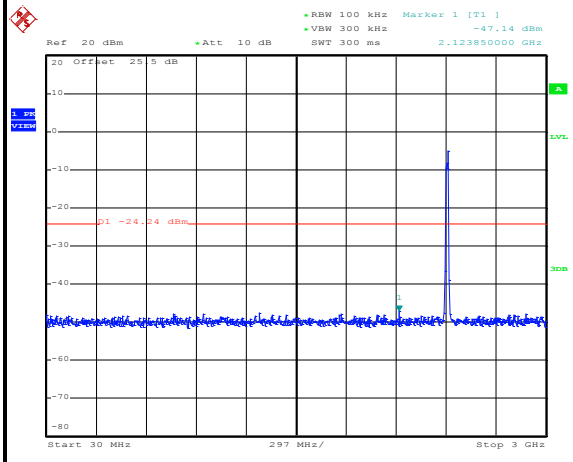
Date: 15.JUL.2013 21:45:34

Low Channel Plot



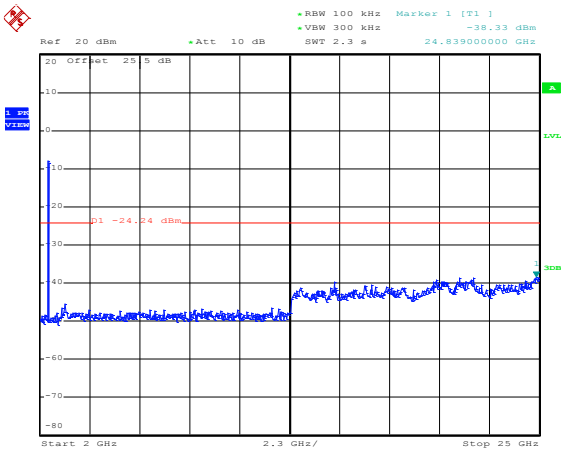
Date: 15.JUL.2013 21:49:59

Spurious Emission 30MHz~3GHz



Date: 15.JUL.2013 21:46:07

Spurious Emission 2GHz~25GHz

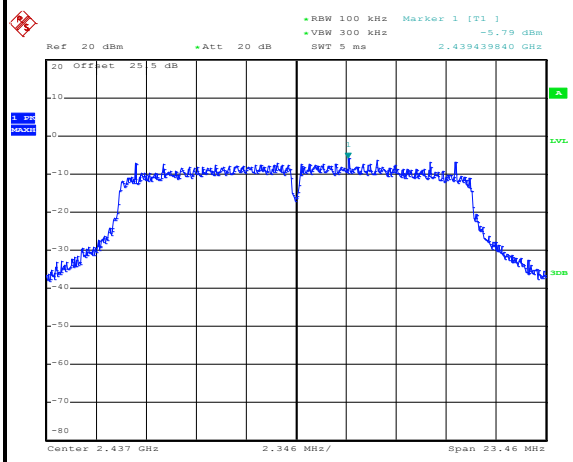


Date: 15.JUL.2013 21:46:26

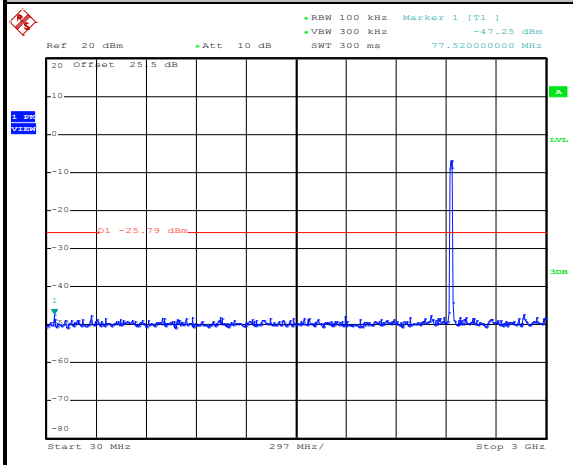
Test Mode :	802.11g	Temperature :	22~24℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Bill Kuo

WLAN 802.11g Channel 06

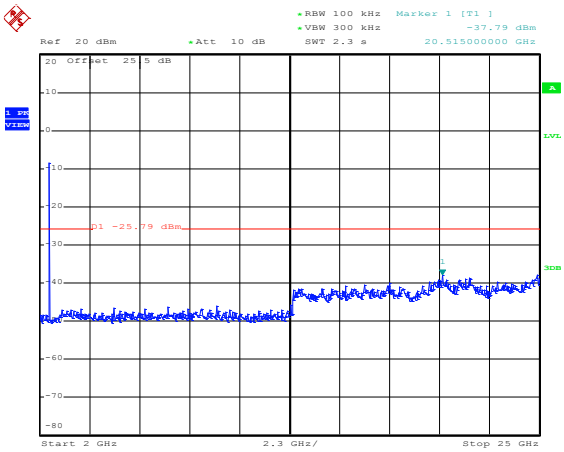
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



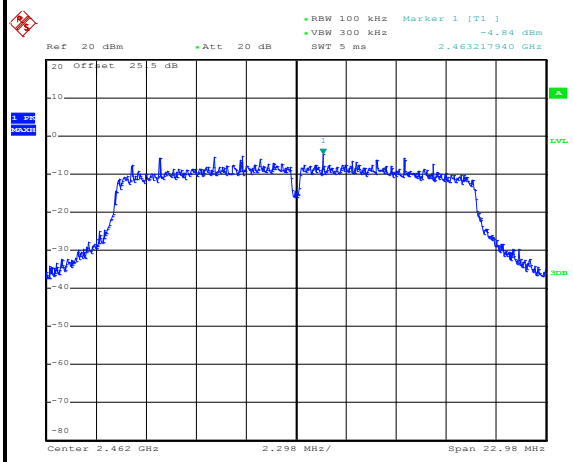
Spurious Emission 2GHz~25GHz



Test Mode :	802.11g	Temperature :	22~24℃
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Bill Kuo

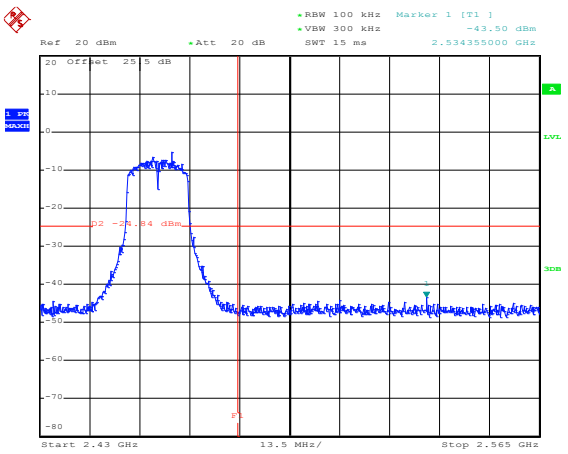
WLAN 802.11g Channel 11

100kHz PSD reference Level



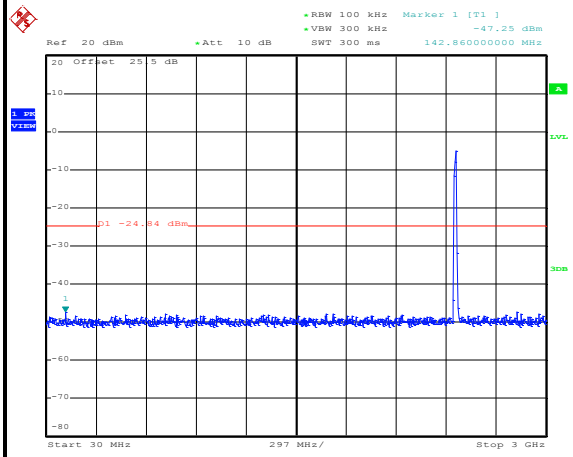
Date: 15.JUL.2013 21:48:09

High Channel Plot



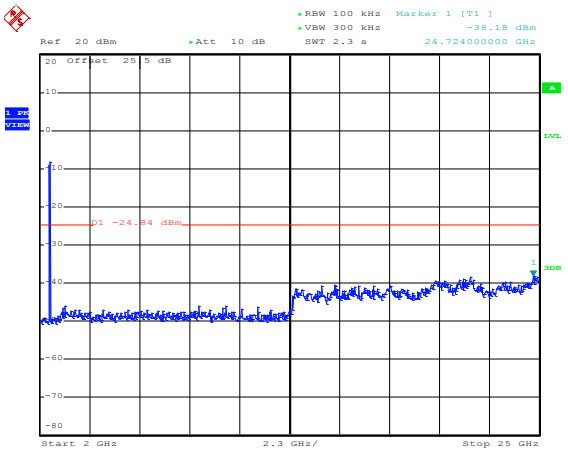
Date: 15.JUL.2013 21:48:23

Spurious Emission 30MHz~3GHz



Date: 15.JUL.2013 21:48:42

Spurious Emission 2GHz~25GHz

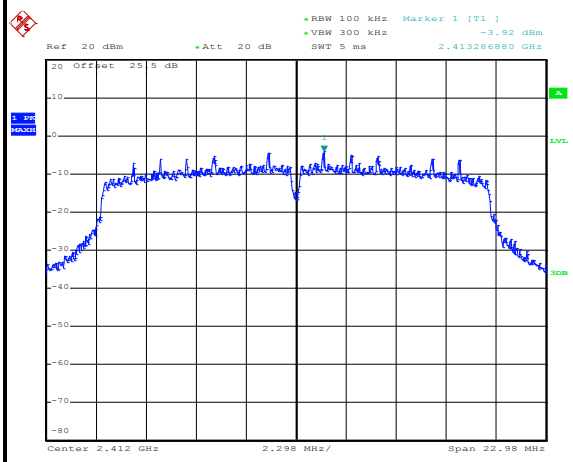


Date: 15.JUL.2013 21:49:01

Test Mode :	802.11n HT20	Temperature :	22~24℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Bill Kuo

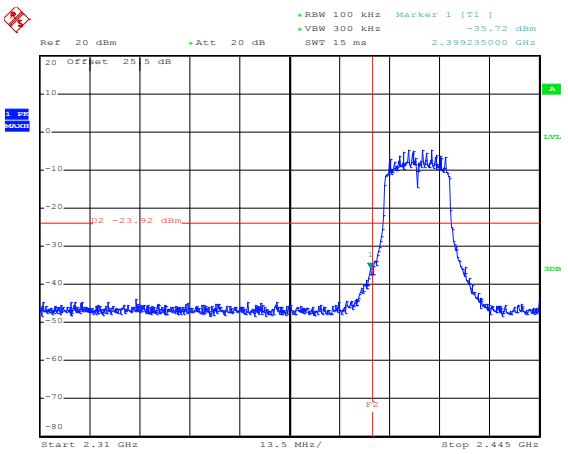
WLAN 802.11n HT20 Channel 01

100kHz PSD reference Level



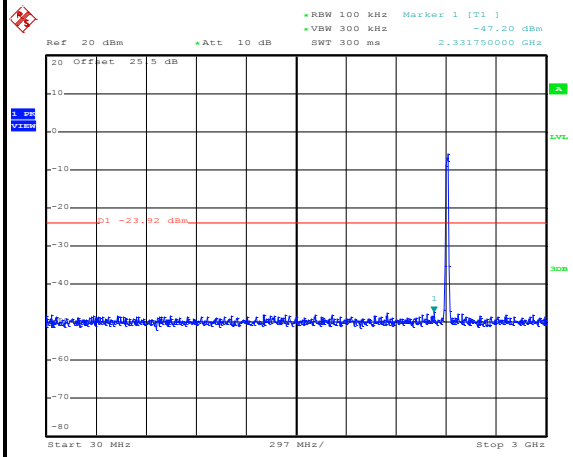
Date: 15.JUL.2013 22:03:14

Low Channel Plot



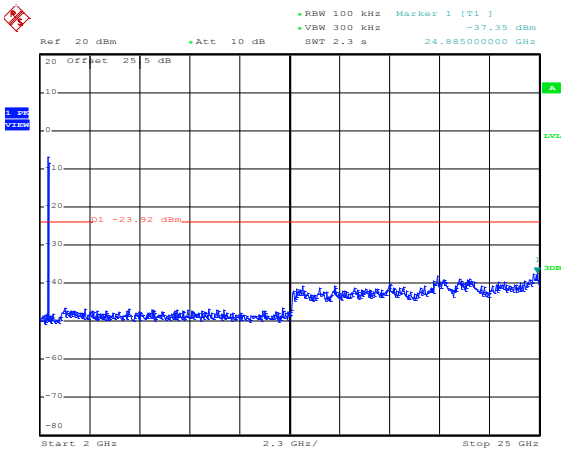
Date: 15.JUL.2013 22:03:28

Spurious Emission 30MHz~3GHz



Date: 15.JUL.2013 22:03:47

Spurious Emission 2GHz~25GHz

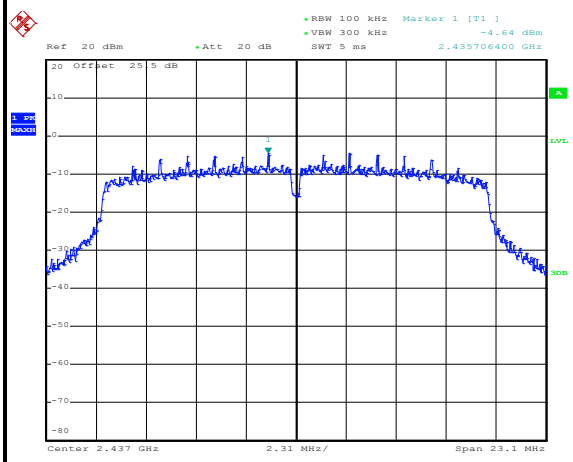


Date: 15.JUL.2013 22:04:06

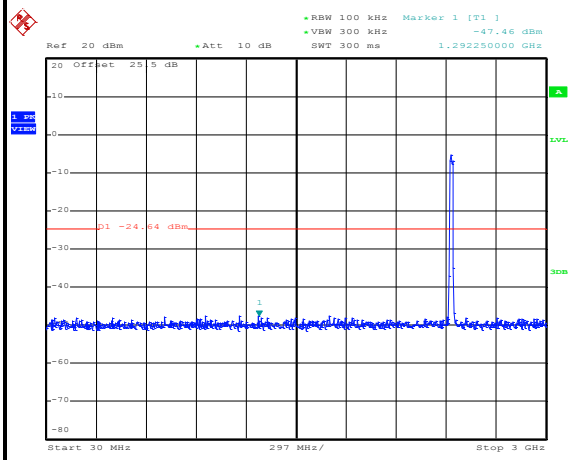
Test Mode :	802.11n HT20	Temperature :	22~24℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Bill Kuo

WLAN 802.11n HT20 Channel 06

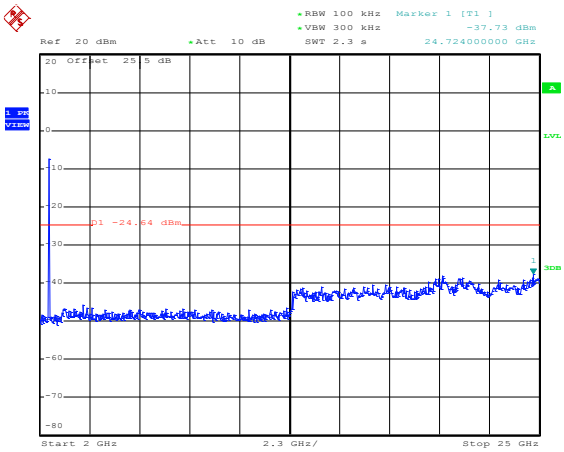
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



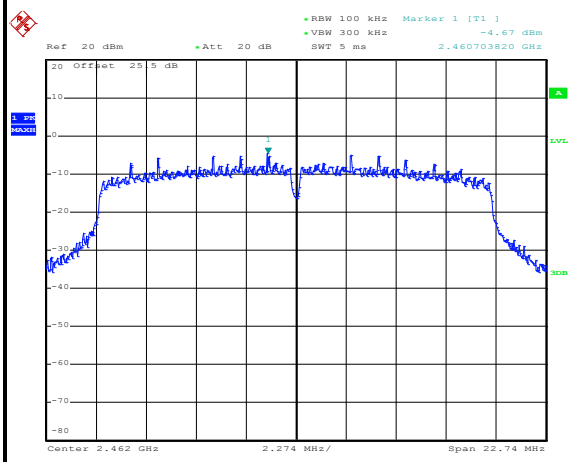
Spurious Emission 2GHz~25GHz



Test Mode :	802.11n HT20	Temperature :	22~24℃
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Bill Kuo

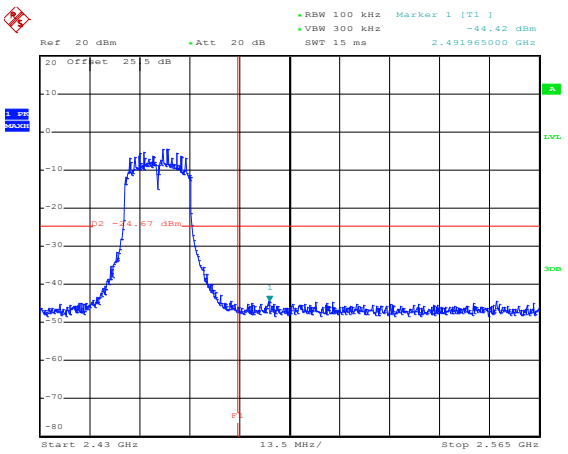
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



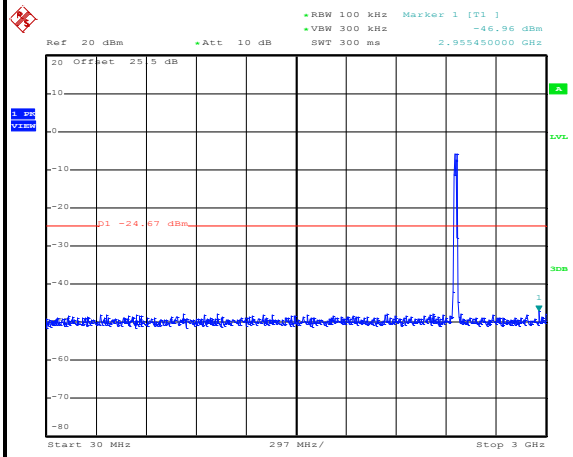
Date: 15.JUL.2013 21:57:33

High Channel Plot



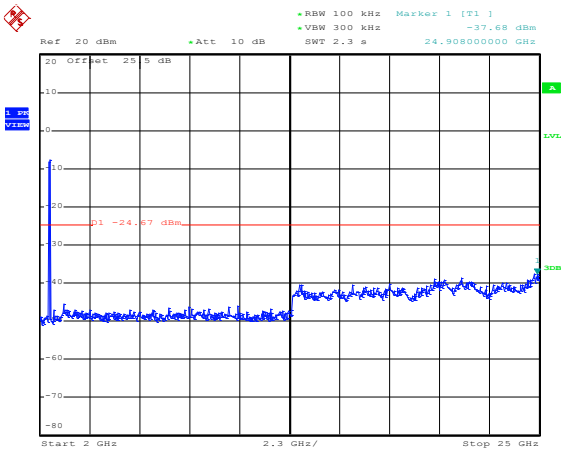
Date: 15.JUL.2013 21:57:47

Spurious Emission 30MHz~3GHz



Date: 15.JUL.2013 21:58:06

Spurious Emission 2GHz~25GHz



Date: 15.JUL.2013 21:58:25

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

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. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

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

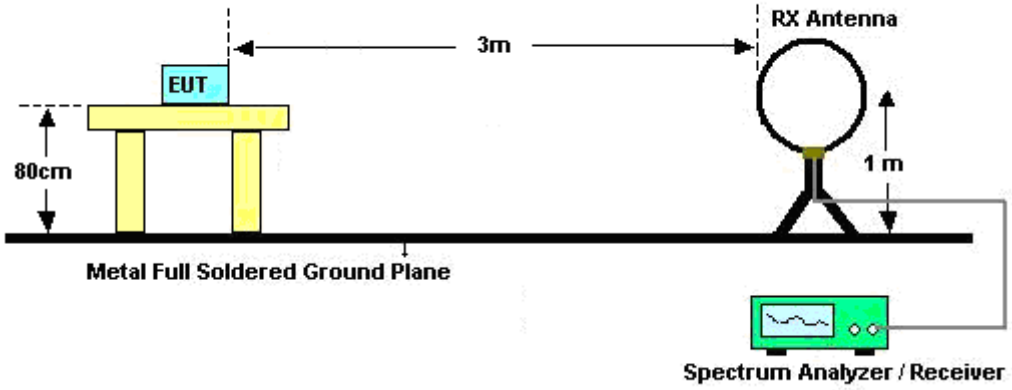
3.5.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

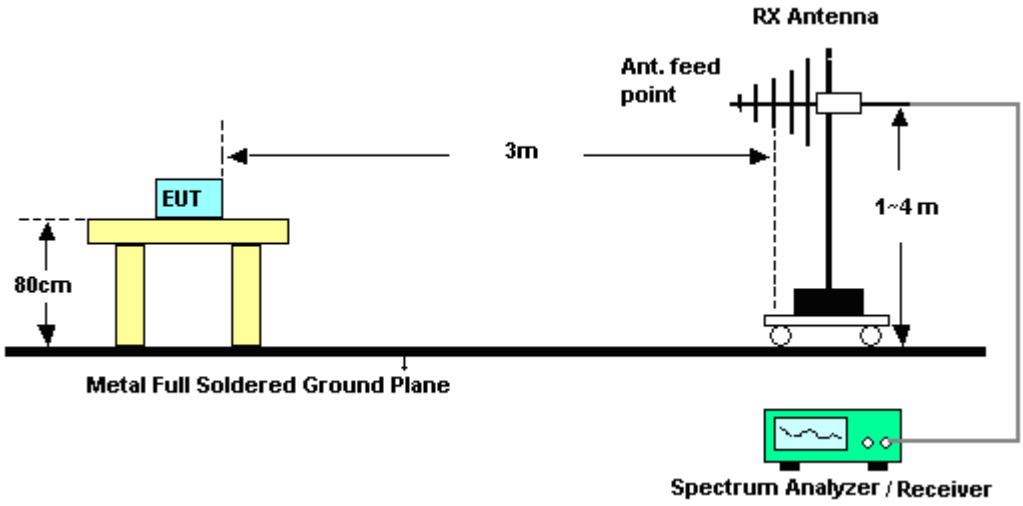
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
802.11b	100.00	-	-	10Hz
802.11g	98.92	-	-	10Hz
2.4GHz 802.11n HT20	96.40	1340	0.75	1kHz

3.5.4 Test Setup

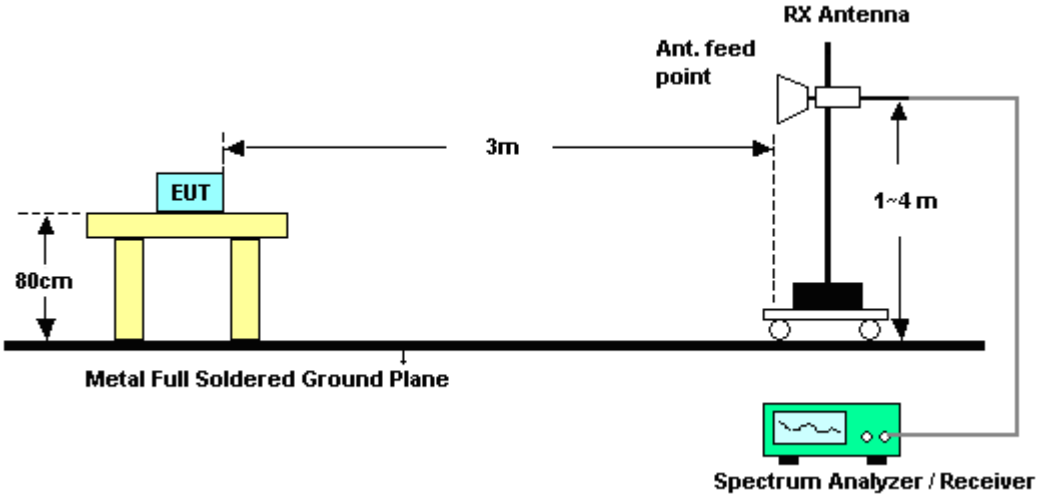
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

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

3.5.6 Test Result of Radiated Spurious at Band Edges

<EUT with Battery 1>

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Band :	Low	**Relative Humidity :**	50~53%
Test Channel :	01	**Test Engineer :**	Gavin Wu and Jet Lui

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
2385.69	54.33	-19.67	74	51.76	32.27	6.22	35.92	106	360	Peak
2385.6	43.03	-10.97	54	40.46	32.27	6.22	35.92	106	360	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
2387.76	49.14	-24.86	74	46.78	32.06	6.22	35.92	163	174	Peak
2385.33	37.38	-16.62	54	35.13	31.95	6.22	35.92	163	174	Average

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Band :	High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Gavin Wu and Jet Lui

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
2487.31	55.7	-18.3	74	52.45	32.63	6.45	35.83	102	357	Peak
2487.88	43.91	-10.09	54	40.59	32.7	6.45	35.83	102	357	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
2487.19	51.91	-22.09	74	48.7	32.59	6.45	35.83	132	275	Peak
2487.7	40.23	-13.77	54	36.91	32.7	6.45	35.83	132	275	Average

Test Mode :	802.11g	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Gavin Wu and Jet Lui

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2389.02	56.07	-17.93	74	53.5	32.27	6.22	35.92	106	0	Peak
2390	40.67	-13.33	54	38.08	32.27	6.22	35.9	106	0	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
2362.83	48.67	-25.33	74	46.57	31.84	6.21	35.95	163	140	Peak
2390	36.95	-17.05	54	34.57	32.06	6.22	35.9	163	140	Average

Test Mode :	802.11g	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Gavin Wu and Jet Lui

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
2483.89	59.24	-14.76	74	55.99	32.63	6.45	35.83	101	359	Peak
2483.5	41.73	-12.27	54	38.48	32.63	6.45	35.83	101	359	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
2483.77	52.95	-21.05	74	49.74	32.59	6.45	35.83	132	275	Peak
2483.53	38.82	-15.18	54	35.61	32.59	6.45	35.83	132	275	Average

Test Mode :	802.11n HT20	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Gavin Wu and Jet Lui

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
2390	58.32	-15.68	74	55.73	32.27	6.22	35.9	104	0	Peak
2390	42.68	-11.32	54	40.09	32.27	6.22	35.9	104	0	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
2389.74	52.5	-21.5	74	50.14	32.06	6.22	35.92	159	124	Peak
2390	38.03	-15.97	54	35.65	32.06	6.22	35.9	159	124	Average

Test Mode :	802.11n HT20	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	50~53%
Test Channel :	11	Test Engineer :	Gavin Wu and Jet Lui

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
2484.55	61.79	-12.21	74	58.54	32.63	6.45	35.83	100	7	Peak
2483.5	43.35	-10.65	54	40.1	32.63	6.45	35.83	100	7	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
2483.86	55.55	-18.45	74	52.34	32.59	6.45	35.83	129	266	Peak
2483.56	40.18	-13.82	54	36.97	32.59	6.45	35.83	129	266	Average

<EUT with Battery 2>

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Band :	High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Gavin Wu and Jet Lui

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**
2487.67	55.02	-18.98	74	51.7	32.7	6.45	35.83	100	360	Peak
2487.97	43.56	-10.44	54	40.24	32.7	6.45	35.83	100	360	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**
2484.25	52.11	-21.89	74	48.9	32.59	6.45	35.83	129	278	Peak
2487.76	40.1	-13.9	54	36.78	32.7	6.45	35.83	129	278	Average

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

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

<EUT with Battery 1>

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Channel :	01	**Relative Humidity :**	50~53%
Test Engineer :	Gavin Wu and Jet Lui	**Polarization :**	Horizontal
Remark :	1. 2412 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. For example, 108.98 dBµV/m - 20dB = 88.98 dBµV/m. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2412	104.2	-	-	101.48	32.34	6.28	35.9	106	360	Average
2412	108.98	-	-	106.26	32.34	6.28	35.9	106	360	Peak
4824	45.5	-28.5	74	58.61	34.44	8.04	55.59	100	0	Peak
7236	46.65	-42.33	88.98	56.98	35.61	10.48	56.42	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2414 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2414	96.58	-	-	94.04	32.16	6.28	35.9	163	174	Average
2414	101.39	-	-	98.85	32.16	6.28	35.9	163	174	Peak
4824	45.8	-28.2	74	58.91	34.44	8.04	55.59	100	0	Peak
7236	47.01	-34.38	81.39	57.35	35.6	10.48	56.42	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	104.42	-	-	101.47	32.49	6.34	35.88	130	0	Average
2439	109.2	-	-	106.25	32.49	6.34	35.88	130	0	Peak
4875	45.68	-28.32	74	58.85	34.4	8.11	55.68	100	0	Peak
7311	47.35	-26.65	74	57.54	35.62	10.47	56.28	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	98.72	-	-	95.88	32.38	6.34	35.88	136	261	Average
2439	103.92	-	-	101.08	32.38	6.34	35.88	136	261	Peak
4875	47.02	-26.98	74	60.19	34.4	8.11	55.68	100	0	Peak
7311	47.2	-26.8	74	57.45	35.56	10.47	56.28	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
30	23.28	-16.72	40	36.76	17.94	0.64	32.06	-	-	Peak
271.65	26.58	-19.42	46	43.9	12.47	1.92	31.71	-	-	Peak
273	26.02	-19.98	46	43.33	12.47	1.92	31.7	-	-	Peak
600.3	29.33	-16.67	46	39.09	18.59	2.83	31.18	102	230	Peak
659.8	29.14	-16.86	46	38.31	18.85	2.96	30.98	-	-	Peak
720	29.03	-16.97	46	37.58	19.32	3.09	30.96	-	-	Peak
2464	105.08	-	-	101.98	32.56	6.39	35.85	102	357	Average
2464	109.85	-	-	106.75	32.56	6.39	35.85	102	357	Peak
4923	44.86	-29.14	74	58.1	34.36	8.18	55.78	100	0	Peak
7386	47.35	-26.65	74	57.35	35.66	10.45	56.11	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
30	33.53	-6.47	40	43.29	21.66	0.64	32.06	108	142	Peak
44.04	25.79	-14.21	40	46.96	10.03	0.78	31.98	-	-	Peak
44.58	25.88	-14.12	40	47.05	10.03	0.78	31.98	-	-	Peak
540.1	28.42	-17.58	46	39.1	17.89	2.69	31.26	-	-	Peak
600.3	33.49	-12.51	46	42.93	18.91	2.83	31.18	-	-	Peak
960.1	28.4	-25.6	54	34.28	21.05	3.59	30.52	-	-	Peak
2464	98.66	-	-	95.63	32.49	6.39	35.85	132	275	Average
2464	103.77	-	-	100.74	32.49	6.39	35.85	132	275	Peak
4923	45.09	-28.91	74	58.33	34.36	8.18	55.78	100	0	Peak
7386	46.57	-27.43	74	56.74	35.49	10.45	56.11	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2410 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2410	92.74	-	-	90.02	32.34	6.28	35.9	106	0	Average
2410	105.22	-	-	102.5	32.34	6.28	35.9	106	0	Peak
4824	44.47	-29.53	74	57.58	34.44	8.04	55.59	100	0	Peak
7236	46.81	-38.41	85.22	57.14	35.61	10.48	56.42	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2414 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2414	85	-	-	82.46	32.16	6.28	35.9	163	140	Average
2414	96.44	-	-	93.9	32.16	6.28	35.9	163	140	Peak
4824	44.1	-29.9	74	57.21	34.44	8.04	55.59	100	0	Peak
7236	46.96	-29.48	76.44	57.3	35.6	10.48	56.42	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	93.32	-	-	90.37	32.49	6.34	35.88	131	0	Average
2439	105.09	-	-	102.14	32.49	6.34	35.88	131	0	Peak
4875	44.54	-29.46	74	57.71	34.4	8.11	55.68	100	0	Peak
7311	47.28	-26.72	74	57.47	35.62	10.47	56.28	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	87.58	-	-	84.74	32.38	6.34	35.88	196	263	Average
2439	98.79	-	-	95.95	32.38	6.34	35.88	196	263	Peak
4875	44.67	-29.33	74	57.84	34.4	8.11	55.68	100	0	Peak
7311	46.96	-27.04	74	57.21	35.56	10.47	56.28	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2464	94.28	-	-	91.18	32.56	6.39	35.85	101	359	Average
2464	105.74	-	-	102.64	32.56	6.39	35.85	101	359	Peak
4923	45.42	-28.58	74	58.66	34.36	8.18	55.78	100	0	Peak
7386	46.59	-27.41	74	56.59	35.66	10.45	56.11	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2464	88.02	-	-	84.99	32.49	6.39	35.85	132	275	Average
2464	99.27	-	-	96.24	32.49	6.39	35.85	132	275	Peak
4923	45.26	-28.74	74	58.5	34.36	8.18	55.78	100	0	Peak
7386	46.86	-27.14	74	57.03	35.49	10.45	56.11	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2410 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2410	94.14	-	-	91.42	32.34	6.28	35.9	104	0	Average
2410	104.79	-	-	102.07	32.34	6.28	35.9	104	0	Peak
4824	43.96	-30.04	74	57.07	34.44	8.04	55.59	100	0	Peak
7236	46.85	-37.94	84.79	57.18	35.61	10.48	56.42	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2410 MHz is fundamental signal which can be ignored. 2. 7236 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. 3. Average measurement was not performed if peak level went lower than the average limit.		

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
2410	85.67	-	-	83.13	32.16	6.28	35.9	159	124	Average
2410	96.31	-	-	93.77	32.16	6.28	35.9	159	124	Peak
4824	44.42	-29.58	74	57.53	34.44	8.04	55.59	100	0	Peak
7236	47.44	-28.87	76.31	57.78	35.6	10.48	56.42	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	94.26	-	-	91.31	32.49	6.34	35.88	127	8	Average
2439	104.91	-	-	101.96	32.49	6.34	35.88	127	8	Peak
4875	46.23	-27.77	74	59.4	34.4	8.11	55.68	100	0	Peak
7311	47.45	-26.55	74	57.64	35.62	10.47	56.28	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2439 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2439	88.29	-	-	85.45	32.38	6.34	35.88	134	264	Average
2439	98.71	-	-	95.87	32.38	6.34	35.88	134	264	Peak
4875	44.86	-29.14	74	58.03	34.4	8.11	55.68	100	0	Peak
7311	47.09	-26.91	74	57.34	35.56	10.47	56.28	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Horizontal
Remark :	1. 2460 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2460	95.14	-	-	92.04	32.56	6.39	35.85	100	7	Average
2460	105.53	-	-	102.43	32.56	6.39	35.85	100	7	Peak
4923	44.83	-29.17	74	58.07	34.36	8.18	55.78	100	0	Peak
7386	47.76	-26.24	74	57.76	35.66	10.45	56.11	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
2464	89.07	-	-	86.04	32.49	6.39	35.85	129	266	Average
2464	99.62	-	-	96.59	32.49	6.39	35.85	129	266	Peak
4923	45.72	-28.28	74	58.96	34.36	8.18	55.78	100	0	Peak
7386	47.47	-26.53	74	57.64	35.49	10.45	56.11	100	0	Peak

<EUT with Battery 2>

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Channel :	11	**Relative Humidity :**	50~53%
Test Engineer :	Gavin Wu and Jet Lui	**Polarization :**	Horizontal
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
190.65	26.2	-17.3	43.5	47.74	8.61	1.6	31.75	-	-	Peak
263.82	32.11	-13.89	46	49.16	12.78	1.89	31.72	-	-	Peak
267.06	32.28	-13.72	46	49.44	12.66	1.9	31.72	154	302	Peak
600.3	31.08	-14.92	46	40.84	18.59	2.83	31.18	-	-	Peak
659.8	29.74	-16.26	46	38.91	18.85	2.96	30.98	-	-	Peak
720	30.56	-15.44	46	39.11	19.32	3.09	30.96	-	-	Peak
2464	104.79	-	-	101.69	32.56	6.39	35.85	100	360	Average
2464	109.43	-	-	106.33	32.56	6.39	35.85	100	360	Peak
4923	46.54	-27.46	74	59.78	34.36	8.18	55.78	100	0	Peak
7386	46.65	-27.35	74	56.65	35.66	10.45	56.11	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	50~53%
Test Engineer :	Gavin Wu and Jet Lui	Polarization :	Vertical
Remark :	1. 2464 MHz is fundamental signal which can be ignored. 2. Average measurement was not performed if peak level went lower than the average limit.		

Frequency (MHz)	Level (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
30	30.62	-9.38	40	40.38	21.66	0.64	32.06	128	213	Peak
43.77	26.82	-13.18	40	48	10.03	0.77	31.98	-	-	Peak
270.57	26.39	-19.61	46	43.73	12.46	1.91	31.71	-	-	Peak
600.3	31.9	-14.1	46	41.34	18.91	2.83	31.18	-	-	Peak
659.8	30.03	-15.97	46	39.42	18.63	2.96	30.98	-	-	Peak
960.8	27.61	-26.39	54	33.49	21.05	3.59	30.52	-	-	Peak
2464	99.25	-	-	96.22	32.49	6.39	35.85	129	278	Average
2464	104.43	-	-	101.4	32.49	6.39	35.85	129	278	Peak
4923	46.15	-27.85	74	59.39	34.36	8.18	55.78	100	0	Peak
7386	47.95	-26.05	74	58.12	35.49	10.45	56.11	100	0	Peak

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

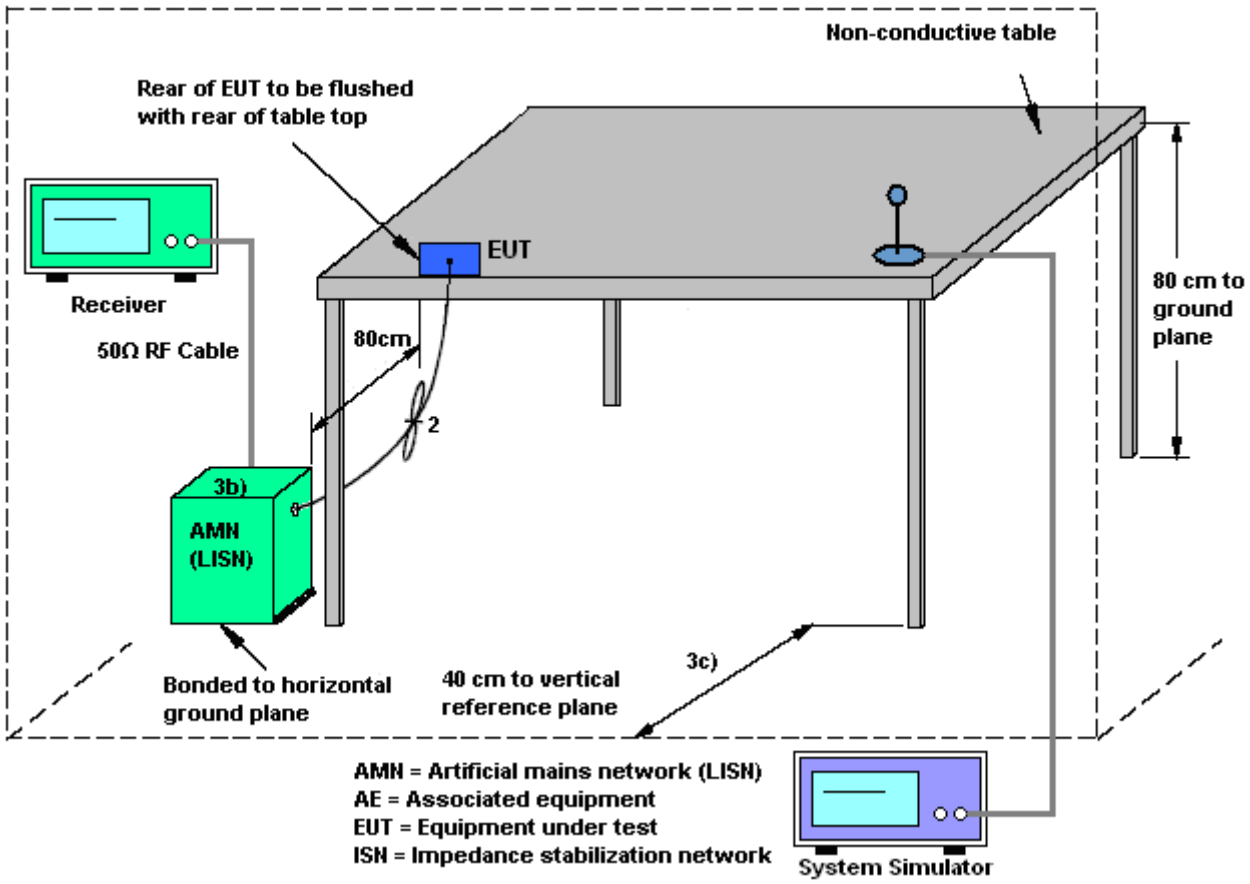
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

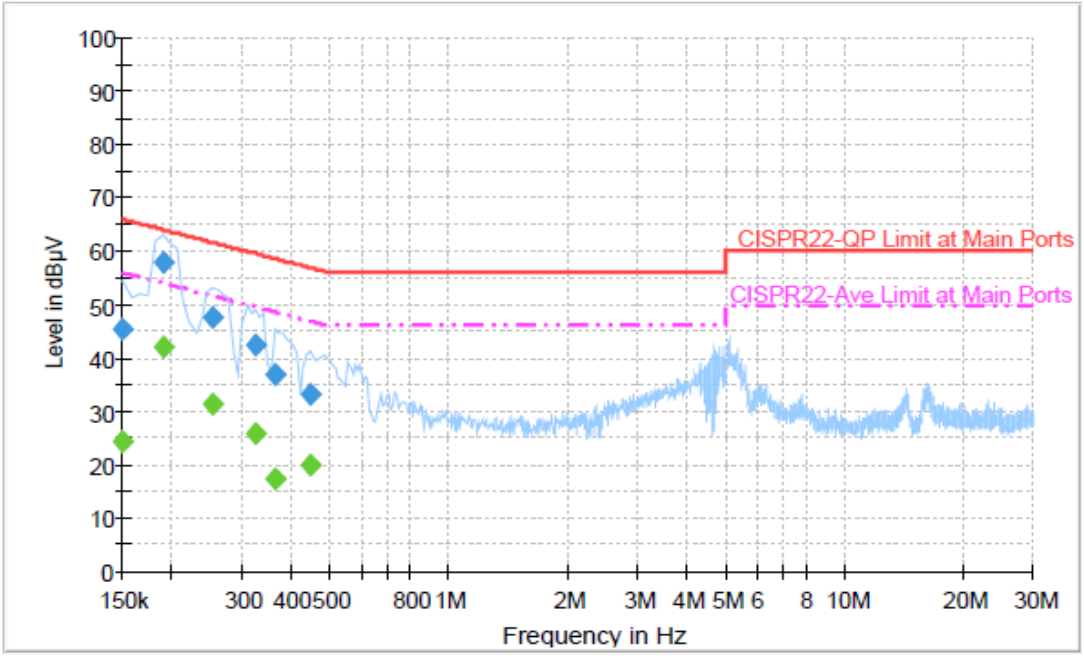
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other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

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WCDMA1900 Idle + Bluetooth Link + WLAN Link + GPS Rx + Earphone + Battery 1 + USB Cable (Data Link with Notebook)		



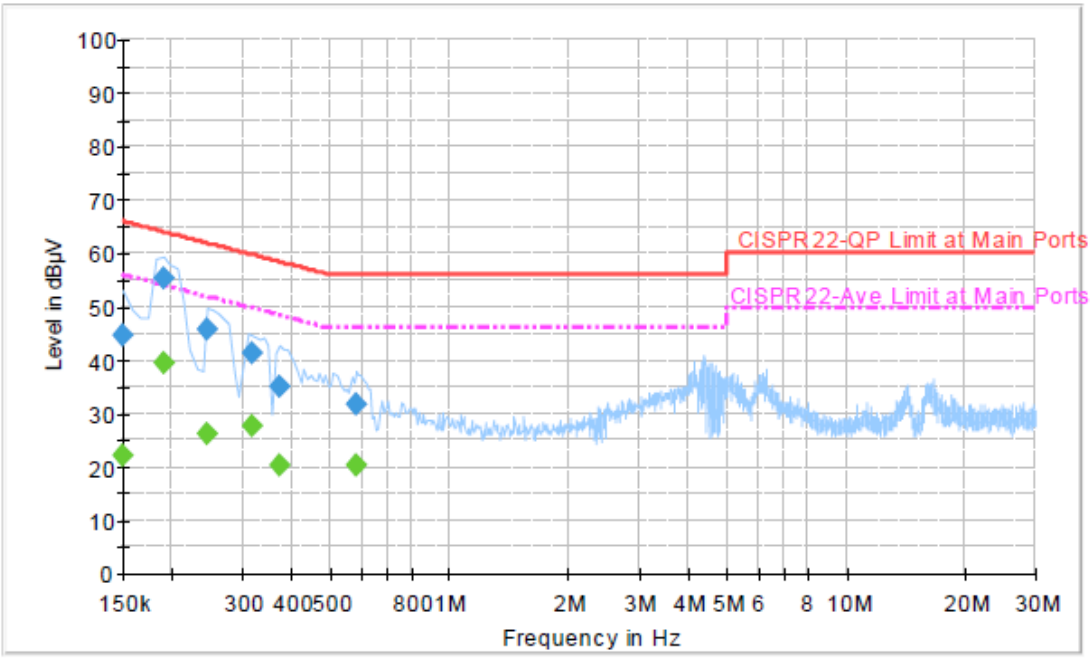
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	45.3	Off	L1	19.4	20.7	66.0
0.190000	58.0	Off	L1	19.4	6.0	64.0
0.254000	47.6	Off	L1	19.5	14.0	61.6
0.326000	42.5	Off	L1	19.4	17.1	59.6
0.366000	36.7	Off	L1	19.4	21.9	58.6
0.446000	33.2	Off	L1	19.3	23.7	56.9

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	24.2	Off	L1	19.4	31.8	56.0
0.190000	42.1	Off	L1	19.4	11.9	54.0
0.254000	31.4	Off	L1	19.5	20.2	51.6
0.326000	25.7	Off	L1	19.4	23.9	49.6
0.366000	17.2	Off	L1	19.4	31.4	48.6
0.446000	19.8	Off	L1	19.3	27.1	46.9

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WCDMA1900 Idle + Bluetooth Link + WLAN Link + GPS Rx + Earphone + Battery 1 + USB Cable (Data Link with Notebook)		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	44.5	Off	N	19.4	21.5	66.0
0.190000	55.4	Off	N	19.4	8.6	64.0
0.246000	45.9	Off	N	19.4	16.0	61.9
0.318000	41.5	Off	N	19.4	18.3	59.8
0.374000	35.1	Off	N	19.4	23.3	58.4
0.582000	31.9	Off	N	19.4	24.1	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	22.2	Off	N	19.4	33.8	56.0
0.190000	39.3	Off	N	19.4	14.7	54.0
0.246000	26.1	Off	N	19.4	25.8	51.9
0.318000	27.6	Off	N	19.4	22.2	49.8
0.374000	20.2	Off	N	19.4	28.2	48.4
0.582000	20.3	Off	N	19.4	25.7	46.0

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	Agilent	E4446A	MY50180136	3Hz~44GHz	Apr. 17, 2013	May 24, 2013 ~ Oct. 09, 2013	Apr. 16, 2014	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Feb. 05, 2013	May 24, 2013 ~ Oct. 09, 2013	Feb. 04, 2014	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Feb. 05, 2013	May 24, 2013 ~ Oct. 09, 2013	Feb. 04, 2014	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz – 26.5GHz	Jan. 23, 2013	Jun. 18, 2013 ~ Jun. 20, 2013	Jan. 22, 2014	Radiation (03CH08-HY)
Bilog Antenna	Teseq GmbH	CBL6112D	35379	30MHz~2GHz	Mar. 28, 2013	Jun. 18, 2013 ~ Jun. 20, 2013	Mar. 27, 2014	Radiation (03CH08-HY)
Horn Antenna	ESCO	3117	000143261	1GHz~18GHz	Jan. 08, 2013	Jun. 18, 2013 ~ Jun. 20, 2013	Jan. 07, 2014	Radiation (03CH08-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz ~ 40GHz	Sep. 28, 2012	Jun. 18, 2013 ~ Jun. 20, 2013	Sep. 27, 2013	Radiation (03CH08-HY)
Amplifier	SONOMA	310N	187231	9kHz~1GHz	May 15, 2013	Jun. 18, 2013 ~ Jun. 20, 2013	May 14, 2014	Radiation (03CH08-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 21, 2012	Jun. 18, 2013 ~ Jun. 20, 2013	Jul. 20, 2013	Radiation (03CH08-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz ~ 26.5GHz	Apr. 12, 2013	Jun. 18, 2013 ~ Jun. 20, 2013	Apr. 11, 2014	Radiation (03CH08-HY)
Turn Table	Chaintek	Chaintek 3000	N/A	0~360 Degree	N/A	Jun. 18, 2013 ~ Jun. 20, 2013	N/A	Radiation (03CH08-HY)
Antenna Mast	MF	MFA520BS	N/A	1m~4m	N/A	Jun. 18, 2013 ~ Jun. 20, 2013	N/A	Radiation (03CH08-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 13, 2012	May 13, 2013	Nov. 12, 2013	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2012	May 13, 2013	Dec. 11, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9KHz ~ 30MHz	Dec. 06, 2012	May 13, 2013	Dec. 05, 2013	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	May 13, 2013	N/A	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.30**