FCC RF Test Report

APPLICANT	:	Ubiquiti Networks
EQUIPMENT	:	mFi Light Dimmer
BRAND NAME	:	
MODEL NAME	:	mFi-LD
FCC ID	:	SWX-MFILD
STANDARD	:	FCC Part 15 Subpart C §15.247
CLASSIFICATION	:	(DTS) Digital Transmission System

The product was received on May 28, 2013 and completely tested on Nov. 02, 2013. 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: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager

Testing Laboratory 1190

SPORTON INTERNATIONAL INC.
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APPENDIX A. SETUP PHOTOGRAPHS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR352810-01	Rev. 01	Initial issue of report	Dec. 11, 2013
FR352810-01	Rev. 02	Adding the measuring equipment Loop Antenna in section 4	Dec. 13, 2013

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	-
3.1	-	RSS-Gen 4.6.1	99% Bandwidth	-	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 5.04 dB at 4926.000 MHz
3.6	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 16.20 dB at 0.174 MHz
3.7	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

Ubiquiti Networks
12F, No105, Song Ren Rd., SinYiDestrict, Taipei, Taiwan

1.2 Manufacturer

Nanning FuGui Precision Industrial Co., LTD.
No. 18, Zhongbu Road, Nanning New& High-Tech Industrial Development Zone, Guangxi

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	mFi Light Dimmer
Brand Name	UBIQUITI NETWORKS
Model Name	mFi-LD
FCC ID	SWX-MFILD
EUT supports Radios application	WLAN 11bgn
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.

1.4 Product Specification of Equipment Under Test

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	802.11b/g/n : 2412 MHz ~ 2462 MHz
Maximum Output Power to Antenna	**<2412 MHz ~ 2462 MHz>** 802.11b : 20.18 dBm (0.1042 W) 802.11g : 23.01 dBm (0.2000 W) 802.11n HT20 : 23.04 dBm (0.2014 W) 802.11n HT40 : 22.17 dBm (0.1648 W)
99% Occupied Bandwidth	**<2412 MHz ~ 2462 MHz>** 802.11b : 14.60MHz 802.11g : 18.30MHz 802.11n HT20 : 19.10MHz 802.11n HT40 : 37.60MHz
Antenna Type	802.11b/g/n : PCB Antenna with gain 2.79 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	03CH08HY	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: All test items were verified and recorded according to the standards and without any deviation during the test.

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).

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 the highest data rates of peak 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)	**20.18**	20.12	20.11	20.10

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)	21.65	21.64	21.63	21.61	21.63	22.82	22.76	**23.01**

2.4GHz 802.11n HT20 mode									
Data Rate (MHz)		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	400GI	21.18	21.15	21.03	21.14	21.17	22.73	22.72	22.80
	800GI	21.22	21.15	21.07	21.03	21.15	22.97	23.03	**23.04**

2.4GHz 802.11n HT40 mode									
Data Rate (MHz)		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Peak Power (dBm)	400GI	20.75	20.57	20.55	20.70	20.57	22.13	22.03	22.15
	800GI	20.79	20.59	20.57	20.72	20.59	22.16	22.05	**22.17**

2.3 Test Mode

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

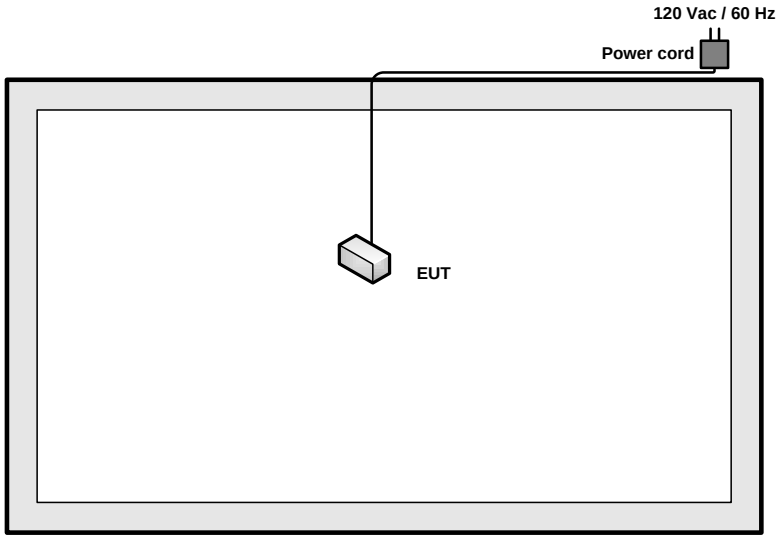
<2.4GHz>

Test Cases				
	Test Items	Mode	Data Rate	Test Channel
Conducted TCs	6dB and 99% BW Power Spectral Density	802.11b	1 Mbps	1/6/11
		802.11g	54 Mbps	1/6/11
		802.11n HT20	MCS7	1/6/11
		802.11n HT40	MCS7	3/6/9
	Output Power	802.11b	1 Mbps	1/6/11
		802.11g	54 Mbps	1/6/11
		802.11n HT20	MCS7	1/6/11
		802.11n HT40	MCS7	3/6/9
	Conducted Band Edge	802.11b	1 Mbps	1/11
		802.11g	54 Mbps	1/11
		802.11n HT20	MCS7	1/11
		802.11n HT40	MCS7	3/9
	Conducted Spurious Emission	802.11b	1 Mbps	1/6/11
		802.11g	54 Mbps	1/6/11
		802.11n HT20	MCS7	1/6/11
		802.11n HT40	MCS7	3/6/9
Radiated TCs	Radiated Band Edge	802.11b	1 Mbps	1/11
		802.11g	54 Mbps	1/11
		802.11n HT20	MCS7	1/11
		802.11n HT40	MCS7	3/9
	Radiated Spurious Emission	802.11b	1 Mbps	1/6/11
		802.11g	54 Mbps	1/6/11
		802.11n HT20	MCS7	1/6/11
		802.11n HT40	MCS7	3/6/9

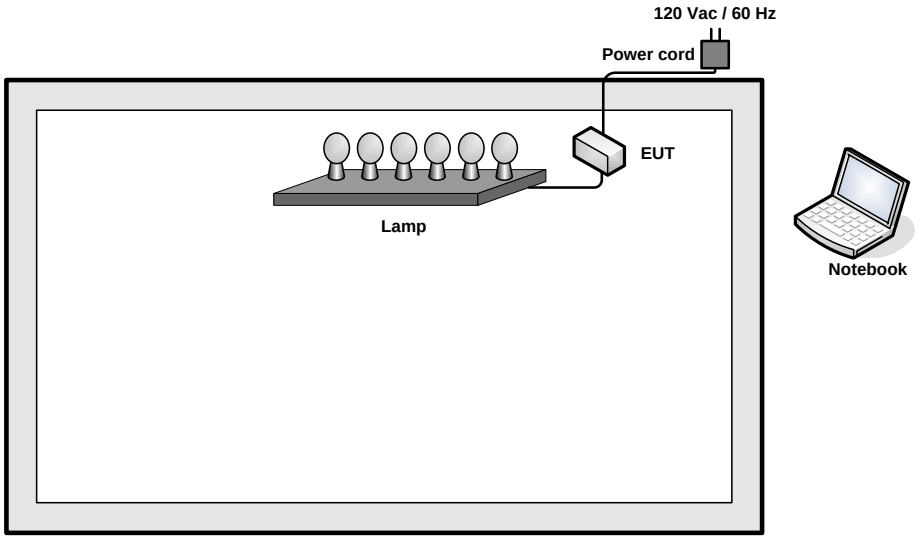
Test Cases	
AC Conducted Emission	Mode 1 : WLAN Link + Lamp

2.4 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>



2.5 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
2.	Lamp	N/A	N/A	N/A	N/A	Unshielded, 1.8 m

2.6 Description of RF Function Operation Test Setup

For WLAN function, programmed RF utility, “artgui.exe” 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 and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

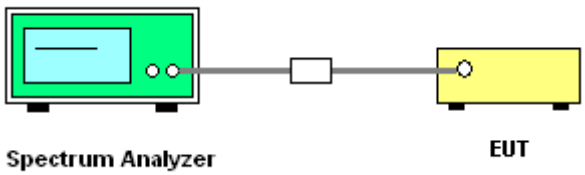
3.1.2 Measuring Instruments

See list of measuring instruments 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. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 1MHz and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

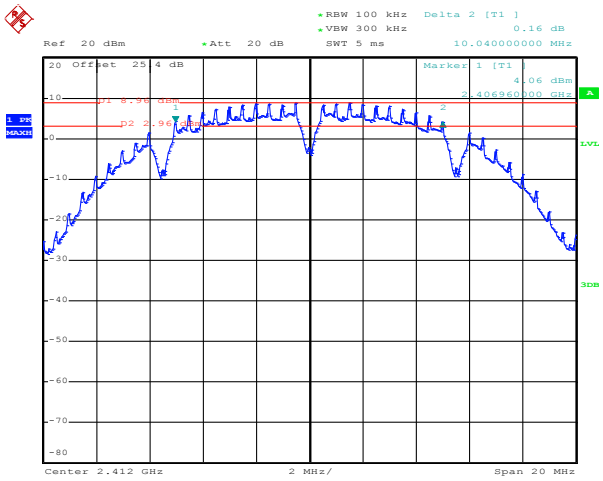
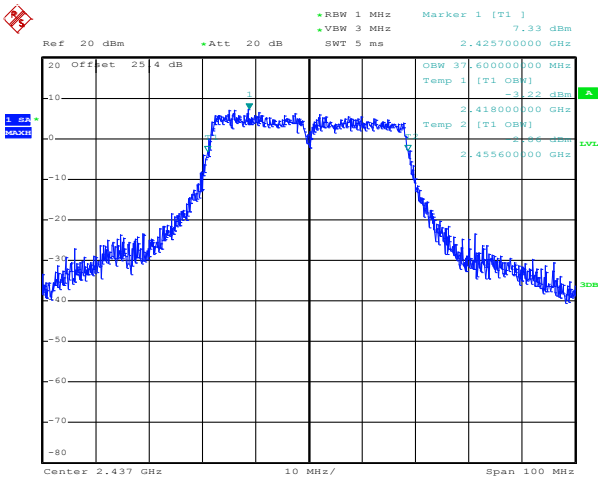
3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Test Band :	2.4GHz	Temperature :	24~26℃
Test Engineer :	Bill Kuo	Relative Humidity :	50~53%

Mod.	Data Rate	N_{TX}	Channel	Freq. (MHz)	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	14.55	10.04	0.5	Pass
11b	1Mbps	1	6	2437	14.60	10.08	0.5	Pass
11b	1Mbps	1	11	2462	14.55	10.08	0.5	Pass
11g	6Mbps	1	1	2412	18.30	16.44	0.5	Pass
11g	6Mbps	1	6	2437	18.15	16.48	0.5	Pass
11g	6Mbps	1	11	2462	18.25	16.48	0.5	Pass
HT20	MCS0	1	1	2412	19.00	17.72	0.5	Pass
HT20	MCS0	1	6	2437	19.05	17.72	0.5	Pass
HT20	MCS0	1	11	2462	19.10	17.68	0.5	Pass
HT40	MCS0	1	3	2422	37.30	36.40	0.5	Pass
HT40	MCS0	1	6	2437	37.60	36.40	0.5	Pass
HT40	MCS0	1	9	2452	37.50	36.40	0.5	Pass

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	
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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.

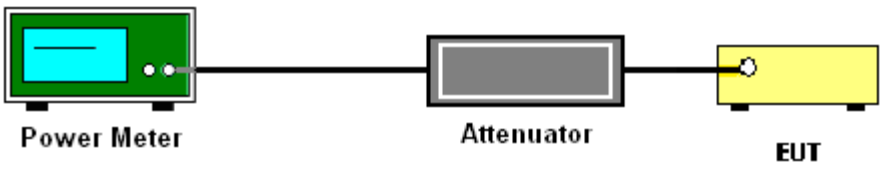
3.2.2 Measuring Instruments

See list of measuring instruments 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 :	24~26℃
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	20.15	30	2.79	Pass
11b	1Mbps	1	6	2437	20.18	30	2.79	Pass
11b	1Mbps	1	11	2462	20.03	30	2.79	Pass
11g	6Mbps	1	1	2412	23.01	30	2.79	Pass
11g	6Mbps	1	6	2437	22.25	30	2.79	Pass
11g	6Mbps	1	11	2462	21.99	30	2.79	Pass
HT20	MCS0	1	1	2412	23.04	30	2.79	Pass
HT20	MCS0	1	6	2437	22.45	30	2.79	Pass
HT20	MCS0	1	11	2462	21.96	30	2.79	Pass
HT40	MCS0	1	3	2422	22.02	30	2.79	Pass
HT40	MCS0	1	6	2437	22.11	30	2.79	Pass
HT40	MCS0	1	9	2452	22.17	30	2.79	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 :	24~26℃
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	17.91	30	2.79	Pass
11b	1Mbps	1	6	2437	0.00	17.99	30	2.79	Pass
11b	1Mbps	1	11	2462	0.00	17.81	30	2.79	Pass
11g	6Mbps	1	1	2412	0.35	14.18	30	2.79	Pass
11g	6Mbps	1	6	2437	0.35	14.06	30	2.79	Pass
11g	6Mbps	1	11	2462	0.35	14.05	30	2.79	Pass
HT20	MCS0	1	1	2412	0.40	13.09	30	2.79	Pass
HT20	MCS0	1	6	2437	0.40	13.00	30	2.79	Pass
HT20	MCS0	1	11	2462	0.40	12.99	30	2.79	Pass
HT40	MCS0	1	3	2422	0.59	12.10	30	2.79	Pass
HT40	MCS0	1	6	2437	0.59	12.19	30	2.79	Pass
HT40	MCS0	1	9	2452	0.59	12.20	30	2.79	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.

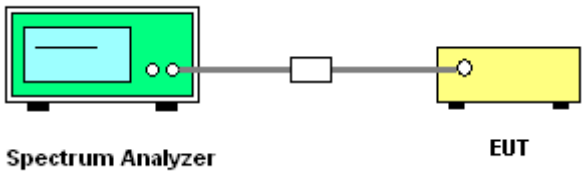
3.3.2 Measuring Instruments

See list of measuring instruments 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



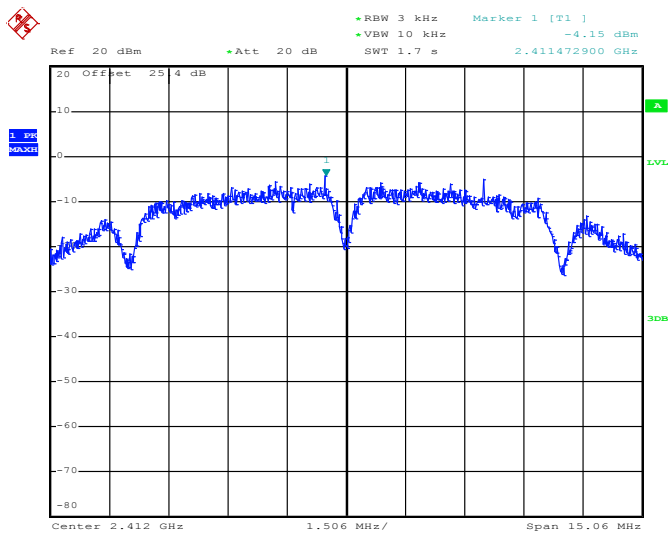
3.3.5 Test Result of Power Spectral Density

Test Mode :	2.4GHz	Temperature :	24~26℃
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	-4.15	8	2.79	Pass
11b	1Mbps	1	6	2437	-5.04	8	2.79	Pass
11b	1Mbps	1	11	2462	-5.49	8	2.79	Pass
11g	6Mbps	1	1	2412	-11.08	8	2.79	Pass
11g	6Mbps	1	6	2437	-11.23	8	2.79	Pass
11g	6Mbps	1	11	2462	-11.01	8	2.79	Pass
HT20	MCS0	1	1	2412	-12.84	8	2.79	Pass
HT20	MCS0	1	6	2437	-13.16	8	2.79	Pass
HT20	MCS0	1	11	2462	-12.56	8	2.79	Pass
HT40	MCS0	1	3	2422	-16.99	8	2.79	Pass
HT40	MCS0	1	6	2437	-16.71	8	2.79	Pass
HT40	MCS0	1	9	2452	-16.42	8	2.79	Pass

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

Worst Case Power Density (dBm/3kHz)



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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

See list of measuring instruments 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.

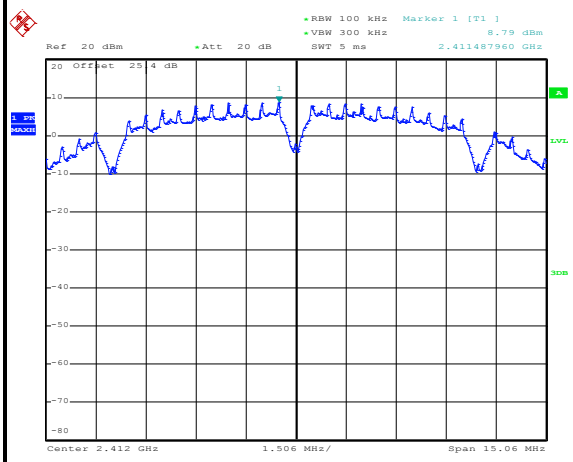
3.4.4 Test Setup

3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Bill Kuo

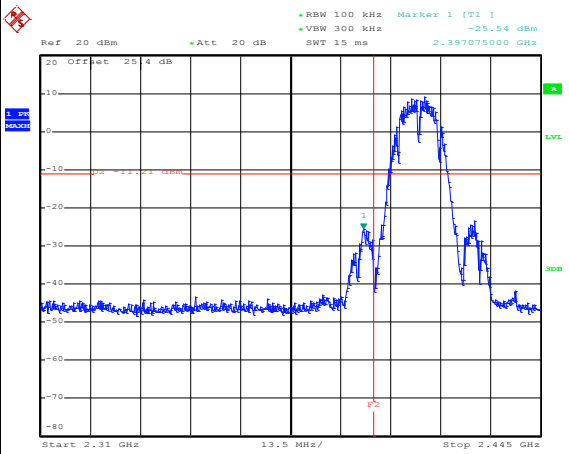
WLAN 802.11b Channel 01

100kHz PSD reference Level



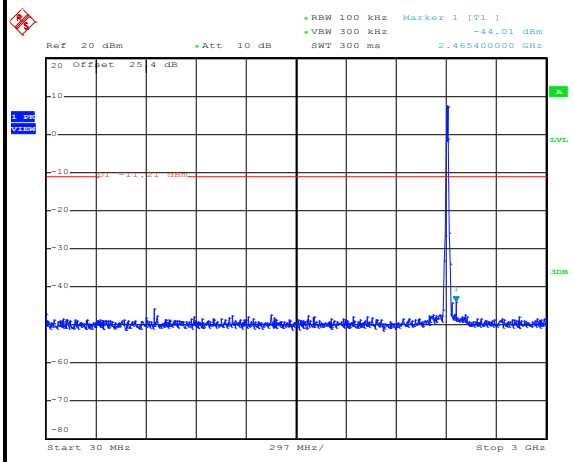
Date: 20.JUL.2013 00:15:45

Low Channel Plot



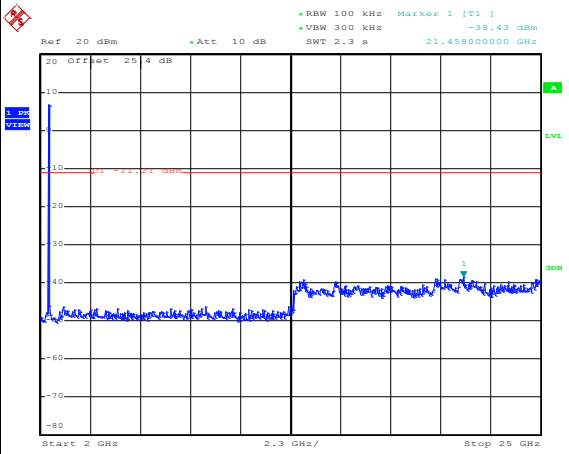
Date: 20.JUL.2013 00:15:59

Spurious Emission 30MHz~3GHz



Date: 20.JUL.2013 00:16:18

Spurious Emission 2GHz~25GHz

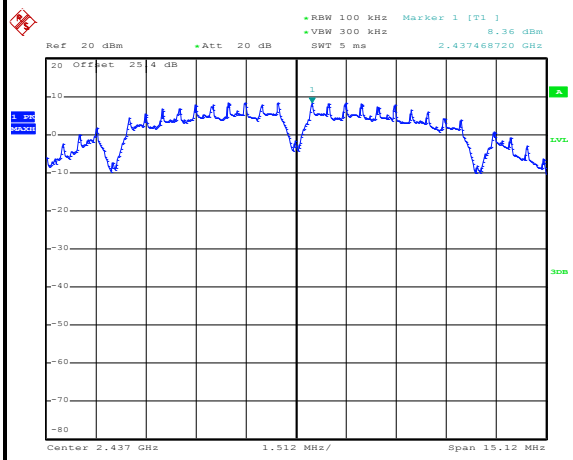


Date: 20.JUL.2013 00:16:37

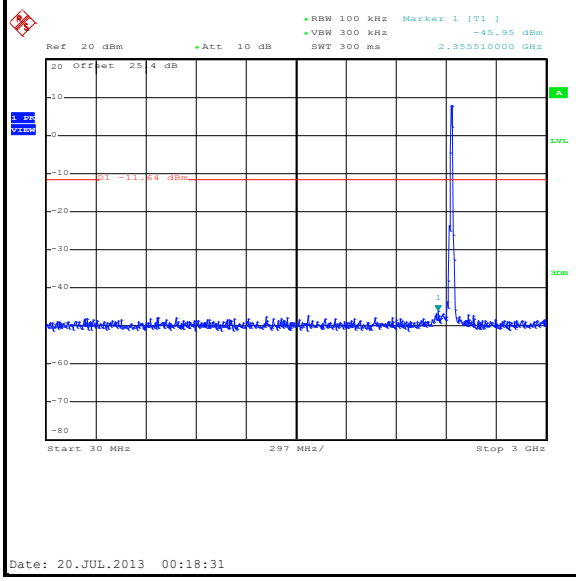
Test Mode :	802.11b	Temperature :	24~26℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Bill Kuo

WLAN 802.11b Channel 06

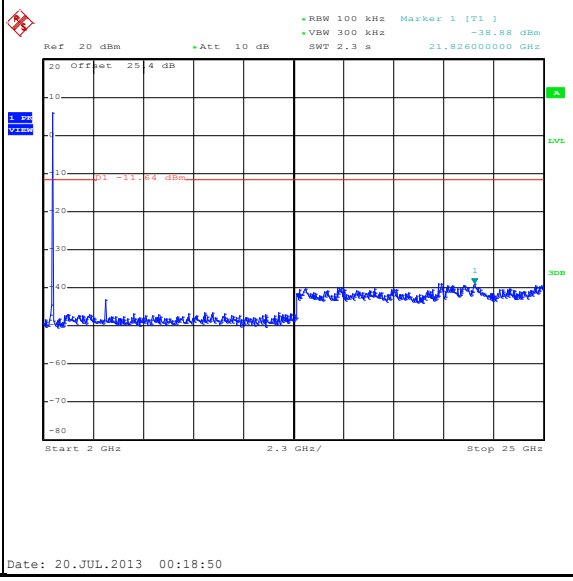
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



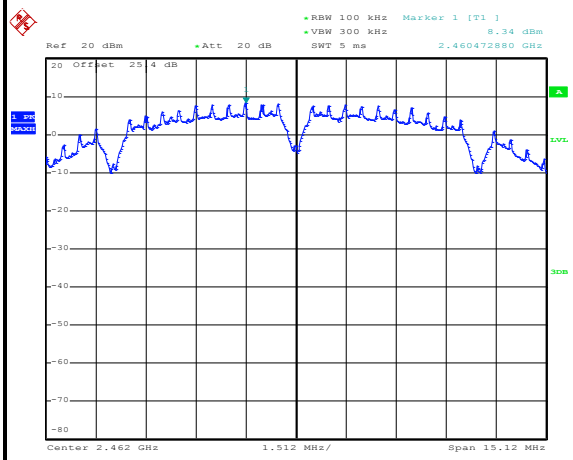
Spurious Emission 2GHz~25GHz



Test Mode :	802.11b	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Bill Kuo

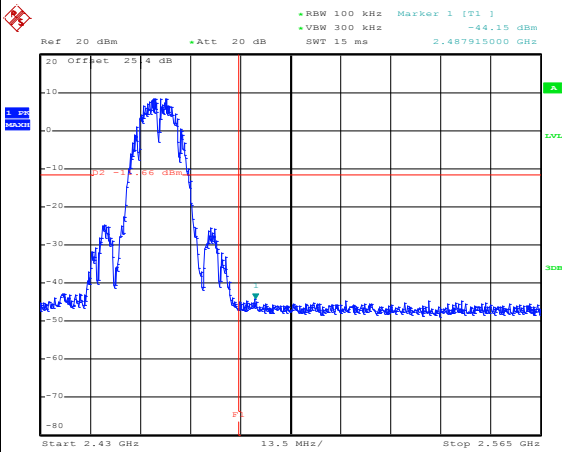
WLAN 802.11b Channel 11

100kHz PSD reference Level



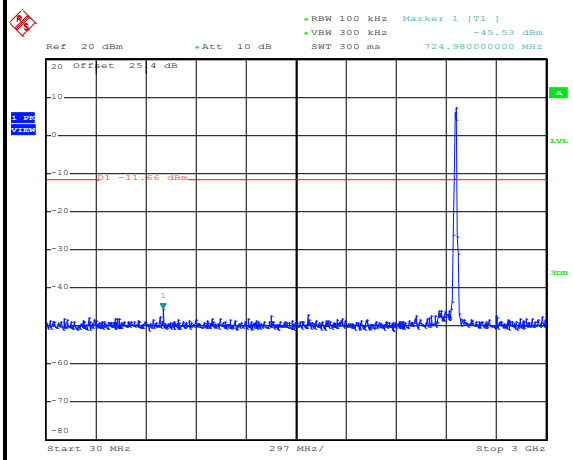
Date: 20.JUL.2013 00:20:39

High Channel Plot



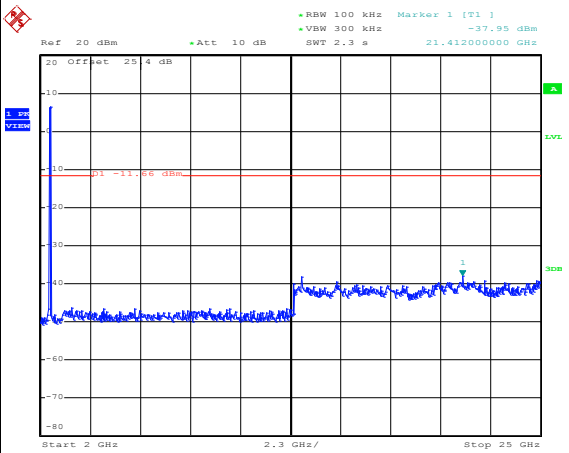
Date: 20.JUL.2013 00:20:53

Spurious Emission 30MHz~3GHz



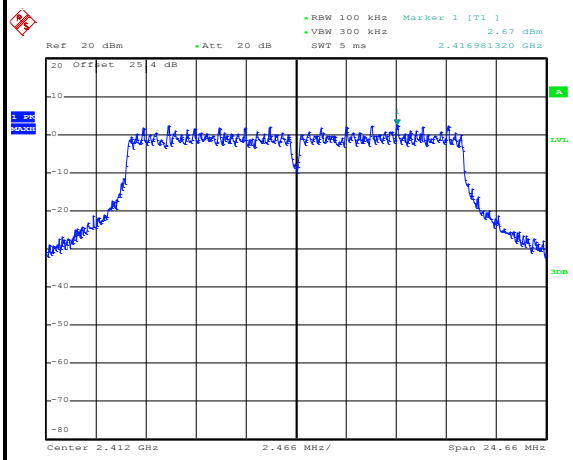
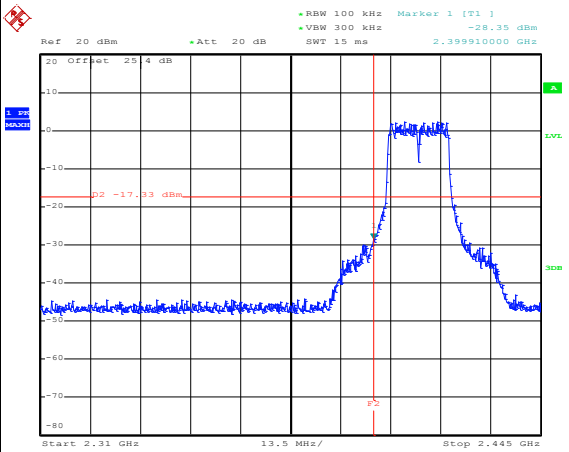
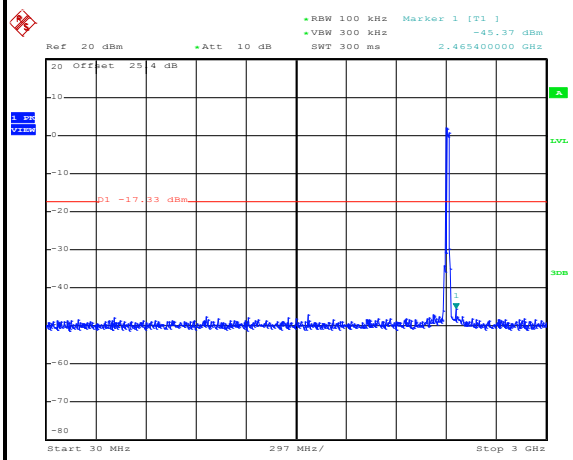
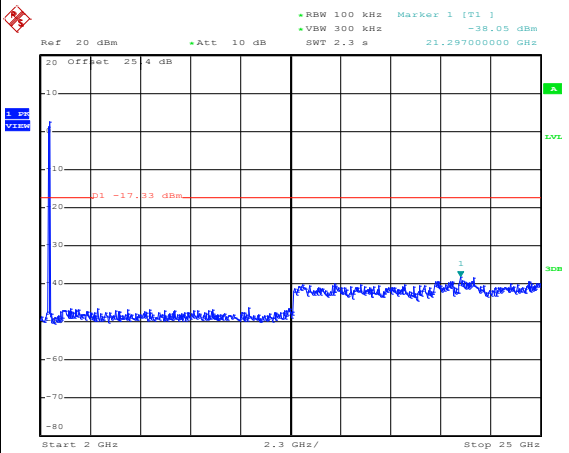
Date: 20.JUL.2013 00:21:12

Spurious Emission 2GHz~25GHz



Date: 20.JUL.2013 00:21:31

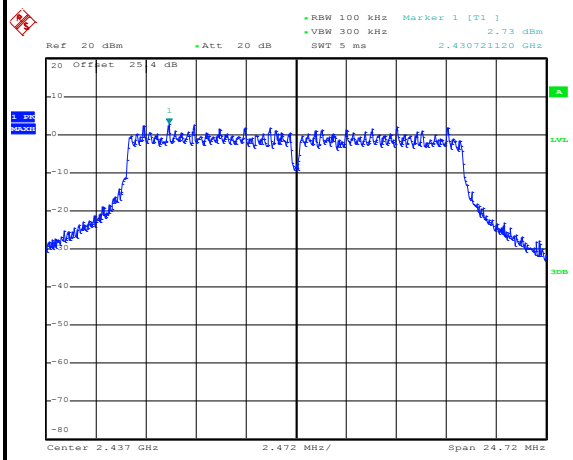
Test Mode :	802.11g	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Bill Kuo

WLAN 802.11g Channel 01	
100kHz PSD reference Level	Low Channel Plot
	
Date: 20.JUL.2013 00:34:32	Date: 20.JUL.2013 01:00:25
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	
Date: 20.JUL.2013 00:35:05	Date: 20.JUL.2013 00:35:23

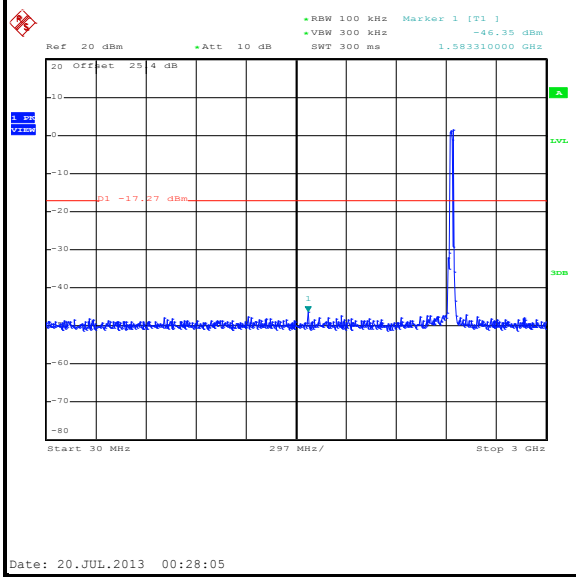
Test Mode :	802.11g	Temperature :	24~26℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Bill Kuo

WLAN 802.11g Channel 06

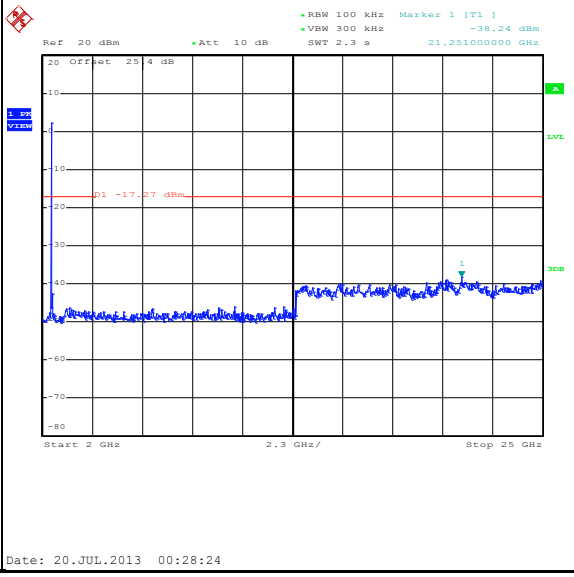
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



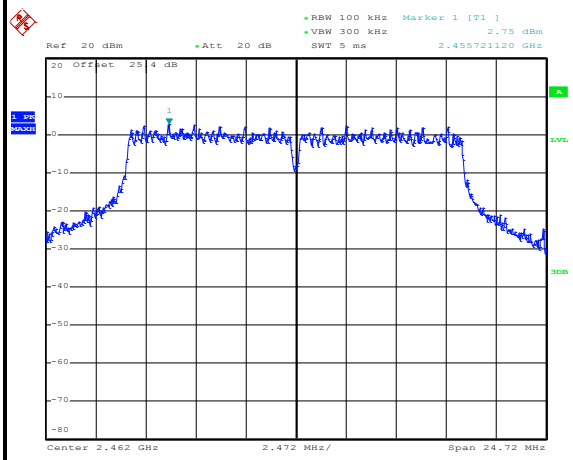
Spurious Emission 2GHz~25GHz



Test Mode :	802.11g	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Bill Kuo

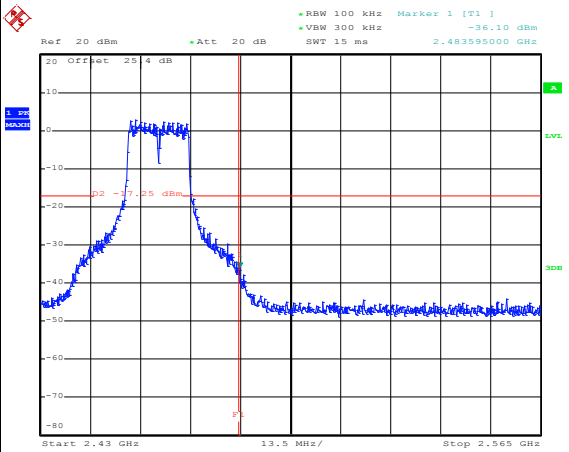
WLAN 802.11g Channel 11

100kHz PSD reference Level



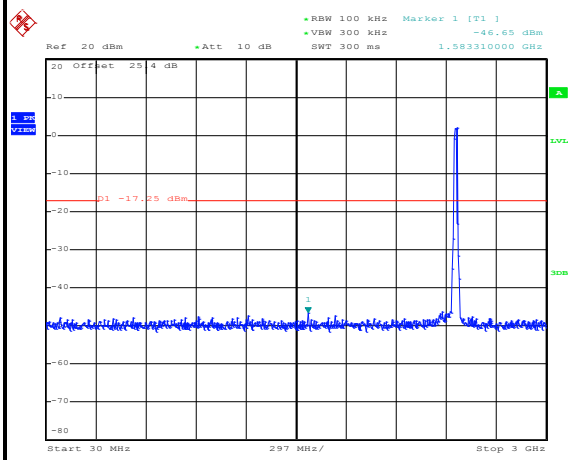
Date: 20.JUL.2013 00:23:28

High Channel Plot



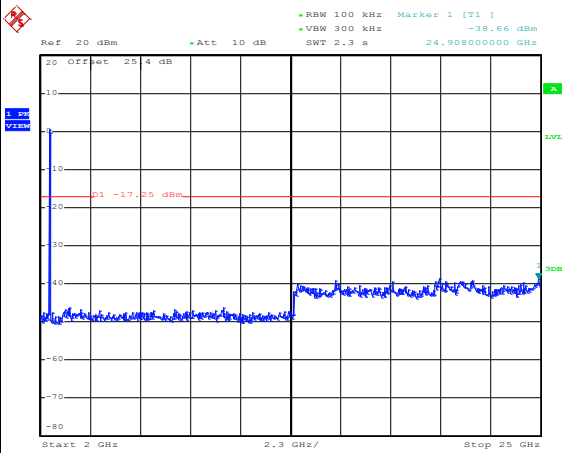
Date: 20.JUL.2013 00:23:42

Spurious Emission 30MHz~3GHz



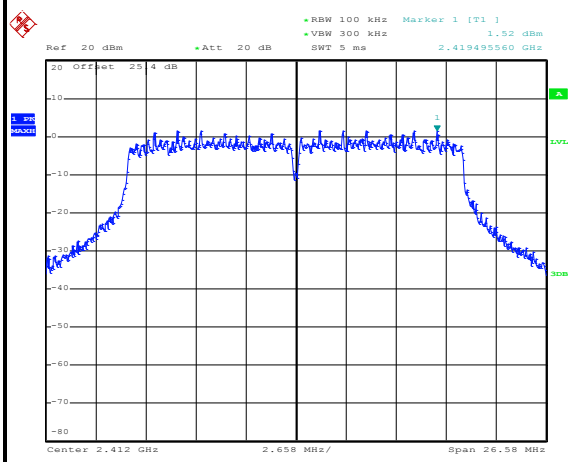
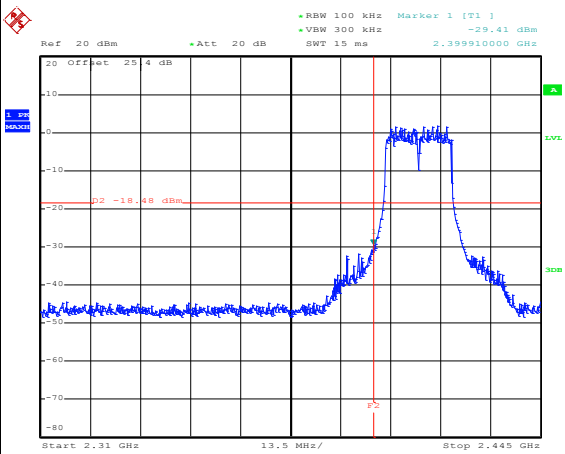
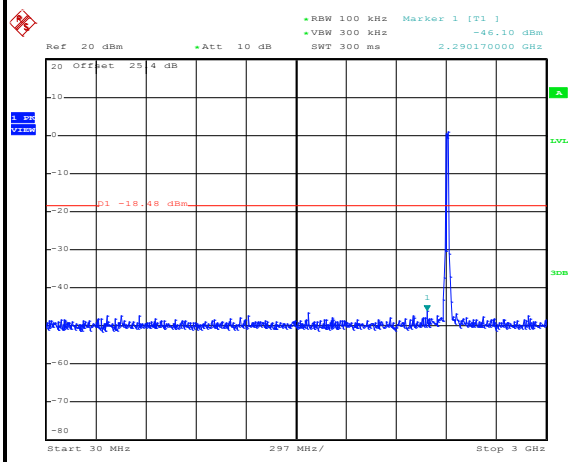
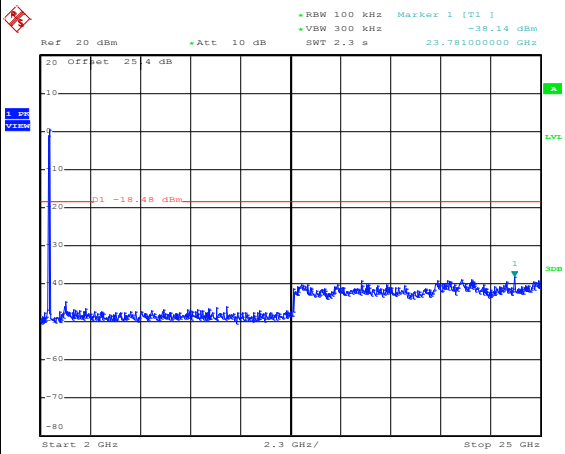
Date: 20.JUL.2013 00:24:01

Spurious Emission 2GHz~25GHz



Date: 20.JUL.2013 00:24:20

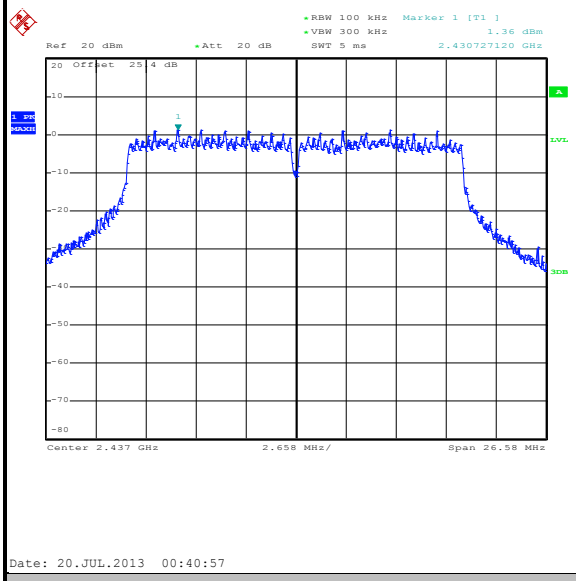
Test Mode :	802.11n HT20	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	01	Test Engineer :	Bill Kuo

WLAN 802.11n HT20 Channel 01	
100kHz PSD reference Level	Low Channel Plot
	
Date: 20.JUL.2013 00:38:25	Date: 20.JUL.2013 00:38:39
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	
Date: 20.JUL.2013 00:38:58	Date: 20.JUL.2013 00:39:17

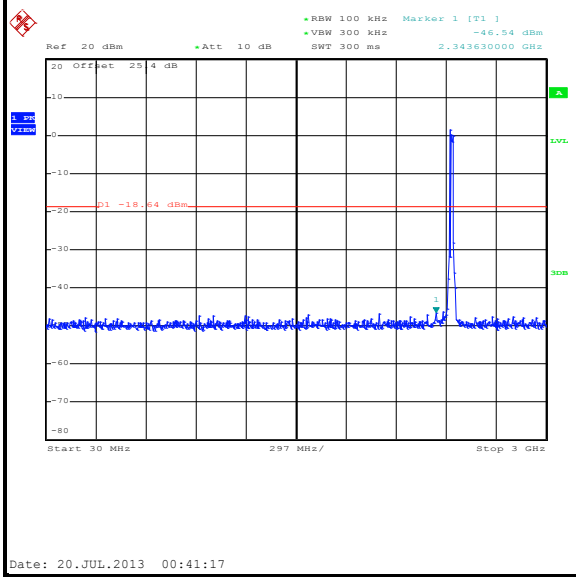
Test Mode :	802.11n HT20	Temperature :	24~26℃
Test Band :	2.4GHz Mid	Relative Humidity :	50~53%
Test Channel :	06	Test Engineer :	Bill Kuo

WLAN 802.11n HT20 Channel 06

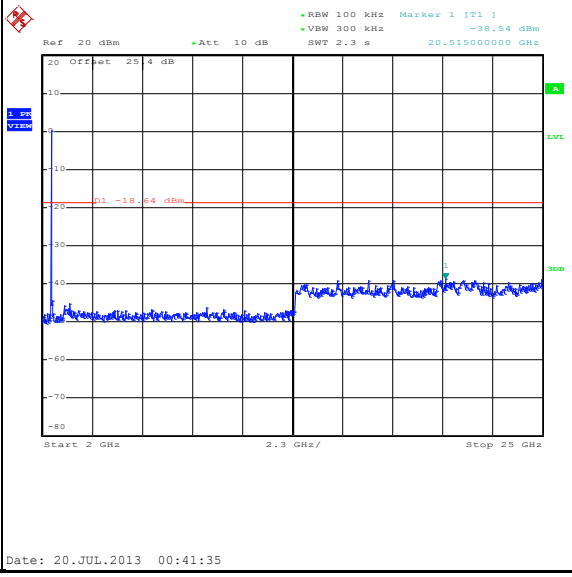
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



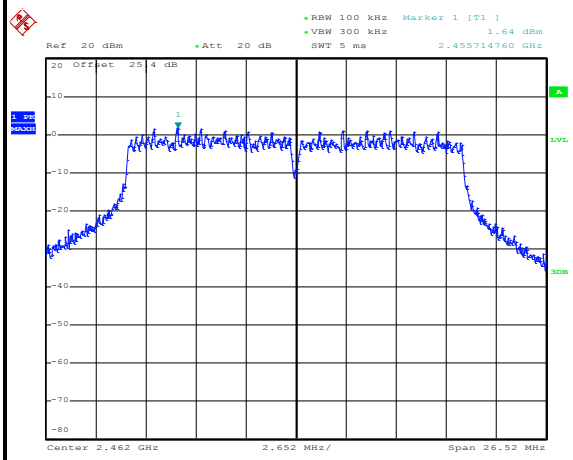
Spurious Emission 2GHz~25GHz



Test Mode :	802.11n HT20	**Temperature :**	24~26℃
Test Band :	2.4GHz High	**Relative Humidity :**	50~53%
Test Channel :	11	**Test Engineer :**	Bill Kuo

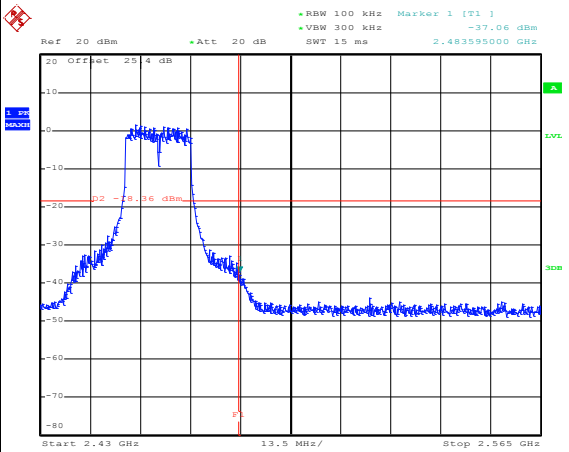
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



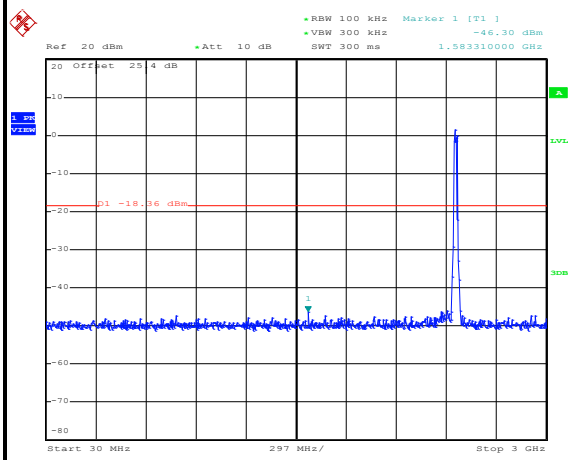
Date: 20.JUL.2013 00:43:07

High Channel Plot



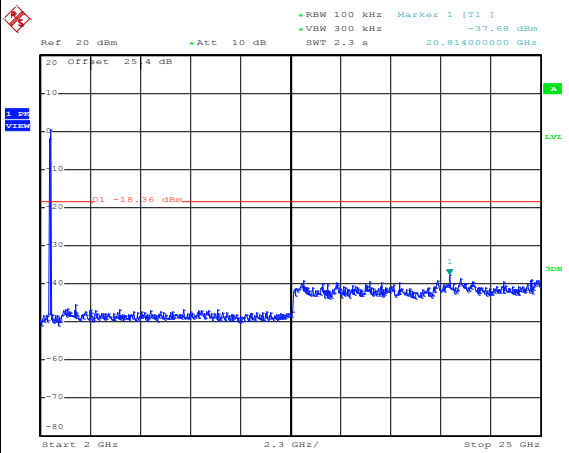
Date: 20.JUL.2013 00:43:20

Spurious Emission 30MHz~3GHz



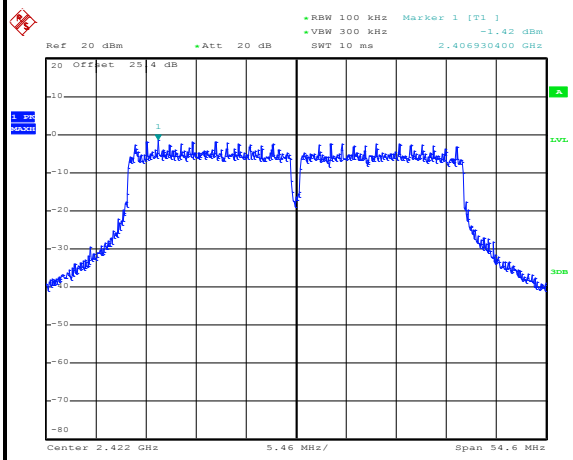
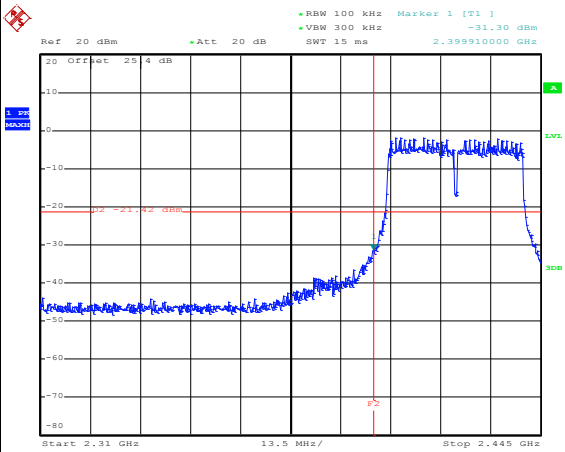
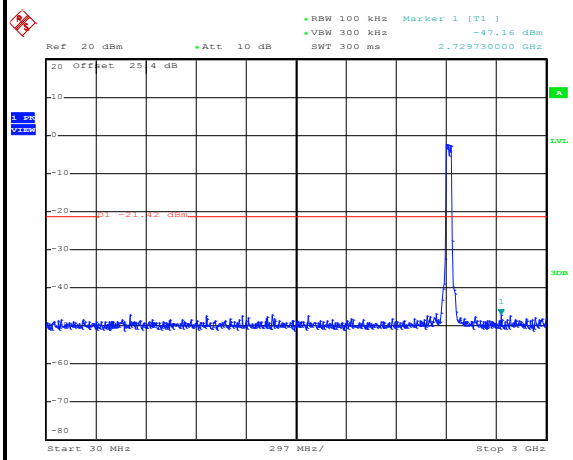
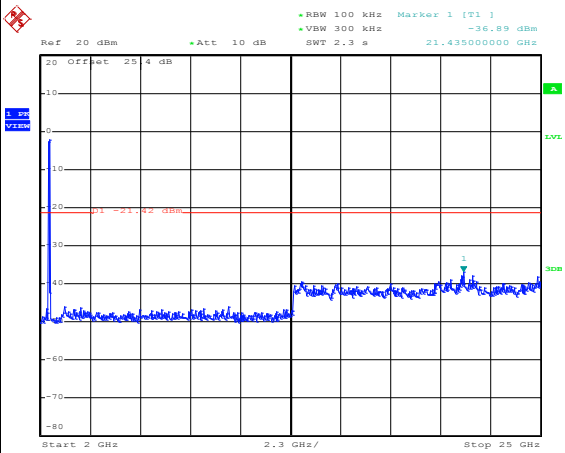
Date: 20.JUL.2013 00:43:40

Spurious Emission 2GHz~25GHz



Date: 20.JUL.2013 00:43:58

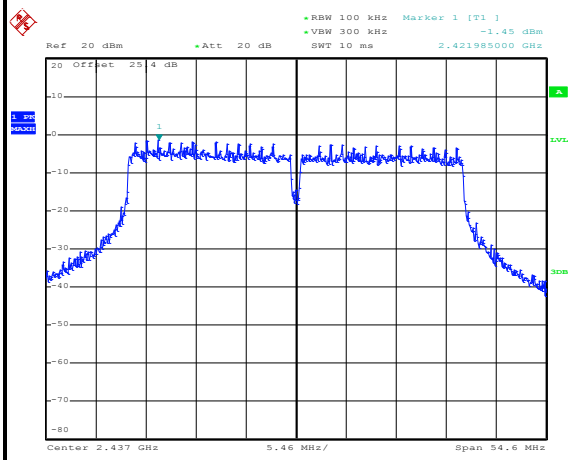
Test Mode :	802.11n HT40	Temperature :	24~26℃
Test Band :	2.4GHz Low	Relative Humidity :	50~53%
Test Channel :	03	Test Engineer :	Bill Kuo

WLAN 802.11n HT40 Channel 03	
100kHz PSD reference Level	Low Channel Plot
	
Date: 20.JUL.2013 00:48:03	Date: 20.JUL.2013 00:48:17
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	
Date: 20.JUL.2013 00:49:29	Date: 20.JUL.2013 00:49:48

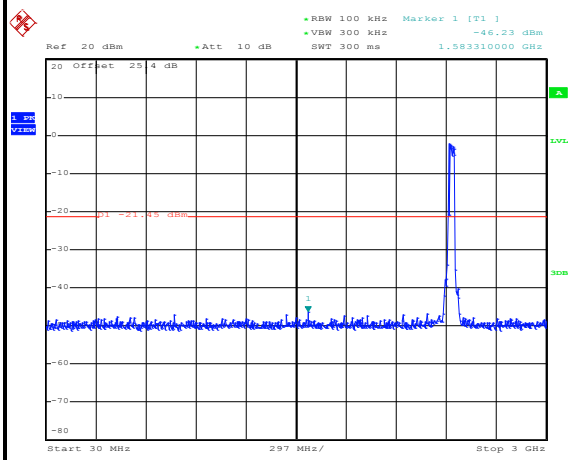
Test Mode :	802.11n HT40	**Temperature :**	24~26℃
Test Band :	2.4GHz Mid	**Relative Humidity :**	50~53%
Test Channel :	06	**Test Engineer :**	Bill Kuo

WLAN 802.11n HT40 Channel 06

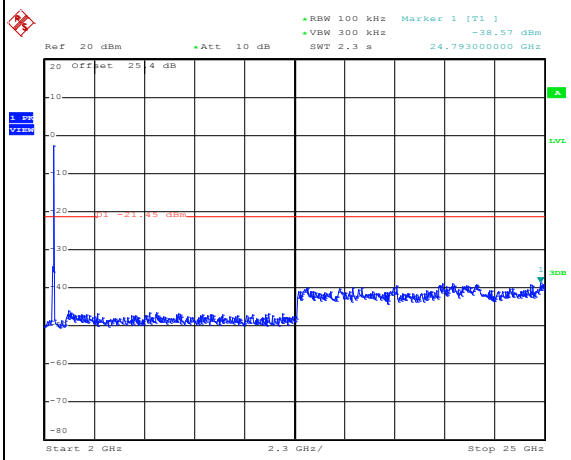
100kHz PSD reference Level



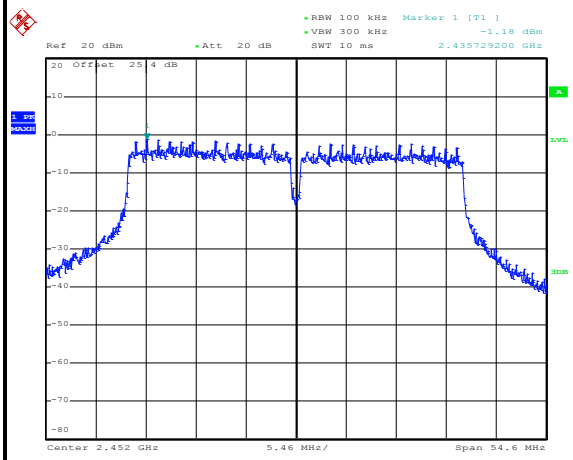
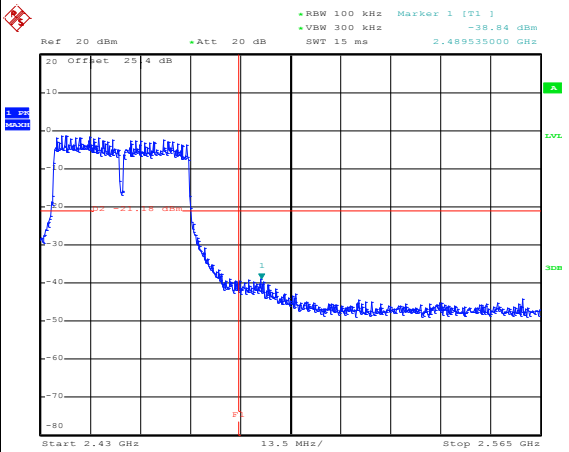
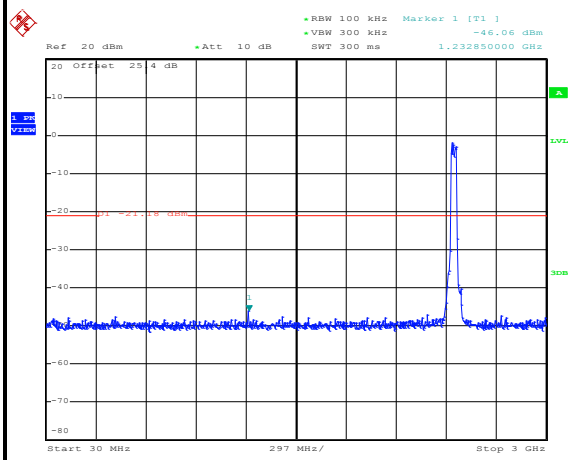
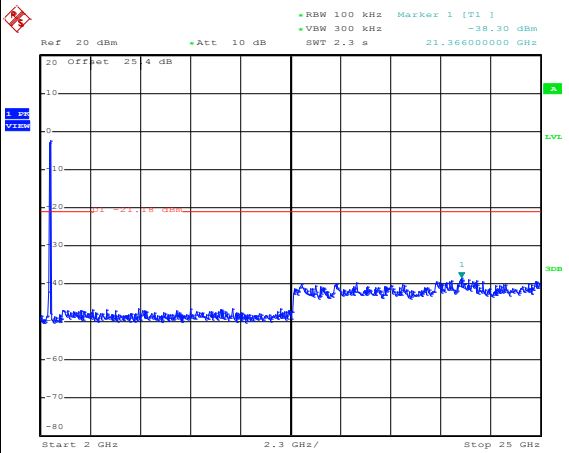
Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



Test Mode :	802.11n HT40	Temperature :	24~26℃
Test Band :	2.4GHz High	Relative Humidity :	50~53%
Test Channel :	09	Test Engineer :	Bill Kuo

WLAN 802.11n HT40 Channel 09	
100kHz PSD reference Level	High Channel Plot
	
Date: 20.JUL.2013 00:54:31	Date: 20.JUL.2013 00:54:45
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	
Date: 20.JUL.2013 00:55:04	Date: 20.JUL.2013 00:55:22

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

See list of measuring instruments of this test report.

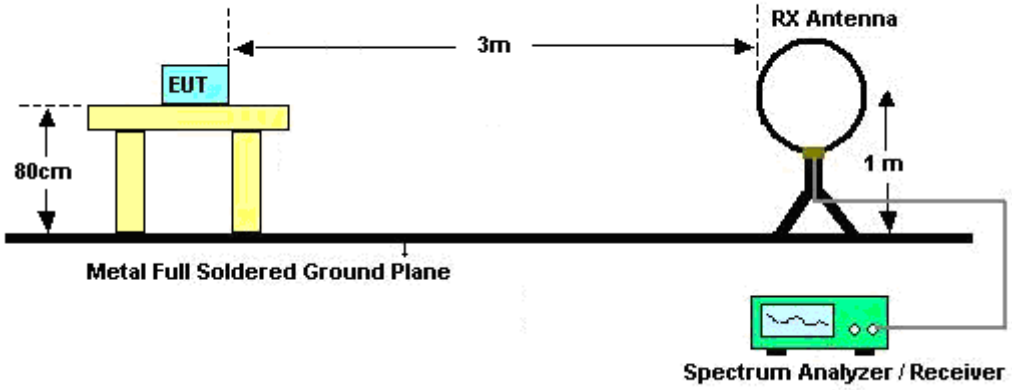
3.5.3 Test Procedures

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.

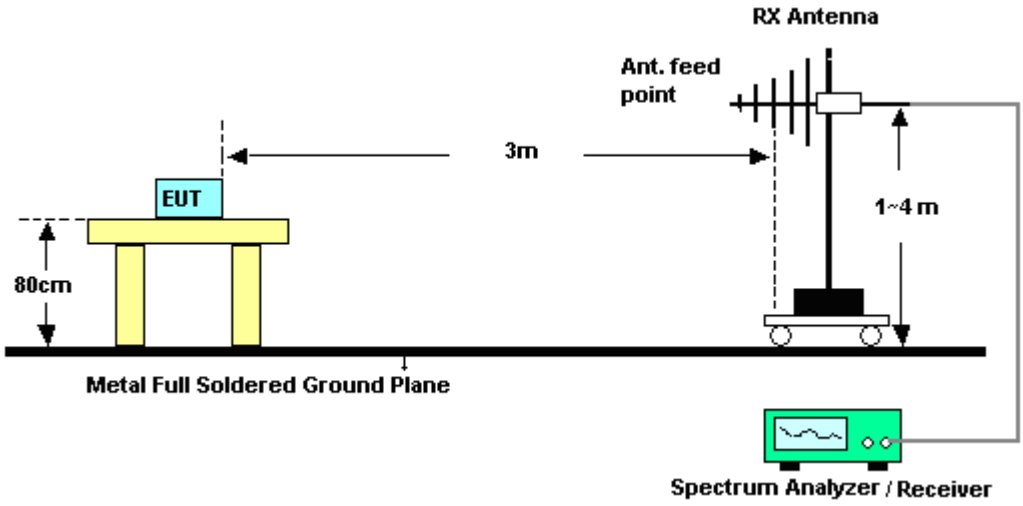
Band	Duty Cycle(%)	T(μs)	1/T(kHz)	VBW Setting
802.11b	100	-	-	10Hz
802.11g	92.26	620	1.61	3kHz
2.4GHz 802.11n HT20	91.16	536	1.87	3kHz
2.4GHz 802.11n HT40	87.34	276	3.62	10kHz

3.5.4 Test Setup

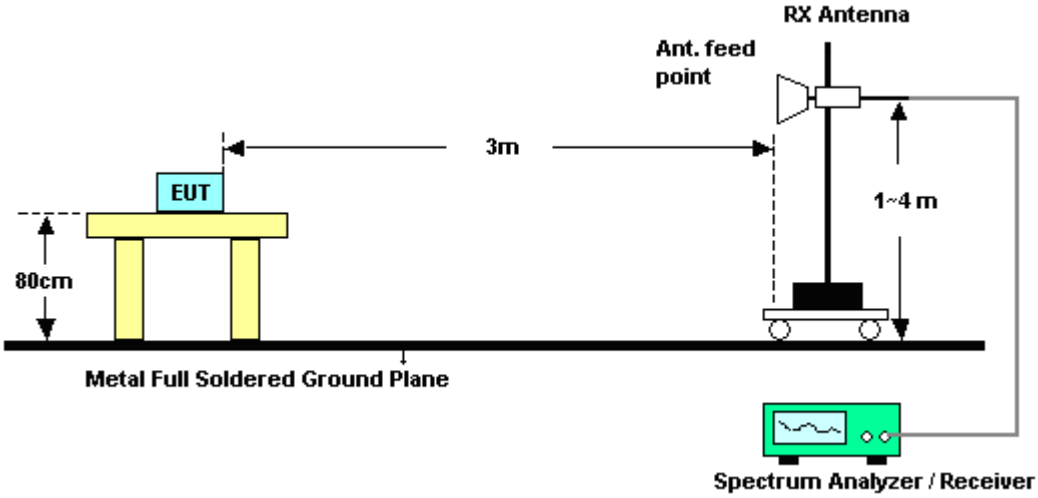
For radiated emissions below 30MHz



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

Test Mode :	802.11b	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	47~48%
Test Channel :	01	Test Engineer :	Kyle Jhuang

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
2324.49	54.08	-19.92	74	49.41	31.99	6.18	33.5	165	143	Peak
2310.09	41.45	-12.55	54	36.86	31.91	6.18	33.5	165	143	Average
2489.2	48.53	-25.47	74	42.84	32.7	6.45	33.46	165	143	Peak
2499.31	37.76	-16.24	54	32.07	32.7	6.45	33.46	165	143	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
2322.6	59.58	-14.42	74	55.27	31.63	6.18	33.5	122	244	Peak
2310	44.7	-9.3	54	40.5	31.52	6.18	33.5	122	244	Average
2498.5	51.22	-22.78	74	45.53	32.7	6.45	33.46	122	244	Peak
2498.62	38.23	-15.77	54	32.54	32.7	6.45	33.46	122	244	Average

Test Mode :	802.11b	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	47~48%
Test Channel :	11	Test Engineer :	Kyle Jhuang

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
2371.02	49.27	-24.73	74	44.34	32.2	6.21	33.48	174	280	Peak
2375.97	37.59	-16.41	54	32.66	32.2	6.21	33.48	174	280	Average
2492.41	50.9	-23.1	74	45.21	32.7	6.45	33.46	174	280	Peak
2483.53	39.02	-14.98	54	33.4	32.63	6.45	33.46	174	280	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
2314.32	52.59	-21.41	74	48.39	31.52	6.18	33.5	100	5	Peak
2310	41.11	-12.89	54	36.91	31.52	6.18	33.5	100	5	Average
2483.98	49.8	-24.2	74	44.22	32.59	6.45	33.46	100	5	Peak
2484.22	38.43	-15.57	54	32.85	32.59	6.45	33.46	100	5	Average

Test Mode :	802.11g	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	47~48%
Test Channel :	01	Test Engineer :	Kyle Jhuang

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
2312.79	53.09	-20.91	74	48.5	31.91	6.18	33.5	163	145	Peak
2310.27	40.81	-13.19	54	36.22	31.91	6.18	33.5	163	145	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
2319.72	58.64	-15.36	74	54.33	31.63	6.18	33.5	124	238	Peak
2310.63	44.36	-9.64	54	40.16	31.52	6.18	33.5	124	238	Average

Test Mode :	802.11g	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	47~48%
Test Channel :	11	Test Engineer :	Kyle Jhuang

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
2483.53	52.87	-21.13	74	47.25	32.63	6.45	33.46	185	230	Peak
2483.5	39.46	-14.54	54	33.84	32.63	6.45	33.46	185	230	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
2483.59	51.72	-22.28	74	46.14	32.59	6.45	33.46	121	7	Peak
2483.86	38.96	-15.04	54	33.38	32.59	6.45	33.46	121	7	Average

Test Mode :	802.11n HT20	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	47~48%
Test Channel :	01	Test Engineer :	Kyle Jhuang

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
2312.07	55.43	-18.57	74	50.84	31.91	6.18	33.5	110	311	Peak
2310	42.05	-11.95	54	37.46	31.91	6.18	33.5	110	311	Average
2495.98	49.03	-24.97	74	43.34	32.7	6.45	33.46	110	311	Peak
2492.47	38.19	-15.81	54	32.5	32.7	6.45	33.46	110	311	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
2314.5	55.88	-18.12	74	51.68	31.52	6.18	33.5	118	242	Peak
2313.42	41.75	-12.25	54	37.55	31.52	6.18	33.5	118	242	Average
2496.52	50.02	-23.98	74	44.33	32.7	6.45	33.46	118	242	Peak
2498.41	38.93	-15.07	54	33.24	32.7	6.45	33.46	118	242	Average

Test Mode :	802.11n HT20	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	47~48%
Test Channel :	11	Test Engineer :	Kyle Jhuang

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
2346.72	48	-26	74	43.24	32.06	6.19	33.49	100	345	Peak
2380.74	37.74	-16.26	54	32.8	32.2	6.22	33.48	100	345	Average
2484.22	54.21	-19.79	74	48.59	32.63	6.45	33.46	100	345	Peak
2483.56	38.85	-15.15	54	33.23	32.63	6.45	33.46	100	345	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
2313.33	52.64	-21.36	74	48.44	31.52	6.18	33.5	149	241	Peak
2312.97	39.59	-14.41	54	35.39	31.52	6.18	33.5	149	241	Average
2483.68	56.4	-17.6	74	50.82	32.59	6.45	33.46	149	241	Peak
2484.25	39.48	-14.52	54	33.9	32.59	6.45	33.46	149	241	Average

Test Mode :	802.11n HT40	Temperature :	22~24°C
Test Band :	Low	Relative Humidity :	47~48%
Test Channel :	03	Test Engineer :	Kyle Jhuang

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
2317.47	48.07	-25.93	74	43.48	31.91	6.18	33.5	100	345	Peak
2389.29	38.27	-15.73	54	33.26	32.27	6.22	33.48	100	345	Average
2495.2	49.32	-24.68	74	43.63	32.7	6.45	33.46	100	345	Peak
2489.62	39.4	-14.6	54	33.71	32.7	6.45	33.46	100	345	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
2389.47	53.12	-20.88	74	48.32	32.06	6.22	33.48	117	242	Peak
2310.99	41.23	-12.77	54	37.03	31.52	6.18	33.5	117	242	Average
2497.87	49.45	-24.55	74	43.76	32.7	6.45	33.46	117	242	Peak
2499.01	39.59	-14.41	54	33.9	32.7	6.45	33.46	117	242	Average

Test Mode :	802.11n HT40	Temperature :	22~24°C
Test Band :	High	Relative Humidity :	47~48%
Test Channel :	09	Test Engineer :	Kyle Jhuang

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
2352.66	48.08	-25.92	74	43.25	32.13	6.19	33.49	100	345	Peak
2387.67	38.01	-15.99	54	33	32.27	6.22	33.48	100	345	Average
2489.62	54.07	-19.93	74	48.38	32.7	6.45	33.46	100	345	Peak
2489.38	40.58	-13.42	54	34.89	32.7	6.45	33.46	100	345	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
2312.07	57.35	-16.65	74	53.15	31.52	6.18	33.5	100	6	Peak
2311.44	43.23	-10.77	54	39.03	31.52	6.18	33.5	100	6	Average
2483.53	54.49	-19.51	74	48.91	32.59	6.45	33.46	100	6	Peak
2483.53	40.54	-13.46	54	34.96	32.59	6.45	33.46	100	6	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.

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Channel :	01	**Relative Humidity :**	47~48%
Test Engineer :	Kyle Jhuang	**Polarization :**	Horizontal
Remark :	1. 2414 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
2414	89.41	-	-	84.27	32.34	6.28	33.48	165	143	Average
2414	94.93	-	-	89.79	32.34	6.28	33.48	165	143	Peak
4824	43.78	-30.22	74	60.24	34.44	8.04	58.94	100	0	Peak

Test Mode :	802.11b	**Temperature :**	22~24°C
Test Channel :	01	**Relative Humidity :**	47~48%
Test Engineer :	Kyle Jhuang	**Polarization :**	Vertical
Remark :	1. 2414 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
2414	91.98	-	-	87.02	32.16	6.28	33.48	122	244	Average
2414	97.58	-	-	92.62	32.16	6.28	33.48	122	244	Peak
4824	44.86	-29.14	74	61.32	34.44	8.04	58.94	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	92.41	-	-	87.05	32.49	6.34	33.47	143	295	Average
2439	97.54	-	-	92.18	32.49	6.34	33.47	143	295	Peak
4875	44.54	-29.46	74	60.9	34.4	8.11	58.87	100	0	Peak
7311	41.46	-32.54	74	53.83	35.62	10.47	58.46	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	92.75	-	-	87.5	32.38	6.34	33.47	149	241	Average
2439	97.61	-	-	92.36	32.38	6.34	33.47	149	241	Peak
4875	45.74	-28.26	74	62.1	34.4	8.11	58.87	100	0	Peak
7311	40.69	-33.31	74	53.12	35.56	10.47	58.46	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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
95.88	30.9	-12.6	43.5	52.15	9.57	1.14	31.96	-	-	Peak
112.62	31.95	-11.55	43.5	51.22	11.38	1.25	31.9	100	41	Peak
200.1	26.9	-16.6	43.5	48.14	8.82	1.64	31.7	-	-	Peak
346.9	26.78	-19.22	46	42.13	14.26	2.15	31.76	-	-	Peak
400.1	29.95	-16.05	46	43.24	15.88	2.31	31.48	-	-	Peak
800.5	23.46	-22.54	46	31.21	19.95	3.26	30.96	-	-	Peak
2464	94.08	-	-	88.6	32.56	6.39	33.47	174	280	Average
2464	99.77	-	-	94.29	32.56	6.39	33.47	174	280	Peak
4926	46.18	-27.82	74	62.4	34.36	8.22	58.8	100	0	Peak
7386	40.29	-33.71	74	52.79	35.66	10.45	58.61	100	0	Peak

Test Mode :	802.11b	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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
85.08	31.96	-8.04	40	54.55	8.17	1.08	31.84	100	136	Peak
156.36	28.01	-15.49	43.5	47.61	10.72	1.47	31.79	-	-	Peak
203.07	31.7	-11.8	43.5	52.45	9.29	1.66	31.7	-	-	Peak
400.1	28.15	-17.85	46	41.26	16.06	2.31	31.48	-	-	Peak
600.3	21.74	-24.26	46	31.18	18.91	2.83	31.18	-	-	Peak
673.1	22.16	-23.84	46	31.29	18.87	2.99	30.99	-	-	Peak
2464	92.04	-	-	86.63	32.49	6.39	33.47	100	5	Average
2464	97.13	-	-	91.72	32.49	6.39	33.47	100	5	Peak
4926	48.96	-5.04	54	62.16	34.36	8.22	55.78	100	136	Average
4926	51.17	-22.83	74	64.37	34.36	8.22	55.78	100	136	Peak
7386	42.6	-31.4	74	52.77	35.49	10.45	56.11	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Horizontal
Remark :	1. 2410 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
2410	81.46	-	-	76.32	32.34	6.28	33.48	163	145	Average
2410	92.06	-	-	86.92	32.34	6.28	33.48	163	145	Peak
4824	38.87	-35.13	74	55.33	34.44	8.04	58.94	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Vertical
Remark :	1. 2410 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
2410	83.79	-	-	78.83	32.16	6.28	33.48	124	238	Average
2410	94.86	-	-	89.9	32.16	6.28	33.48	124	238	Peak
4824	40.41	-33.59	74	56.87	34.44	8.04	58.94	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	83.55	-	-	78.19	32.49	6.34	33.47	187	126	Average
2439	95	-	-	89.64	32.49	6.34	33.47	187	126	Peak
4875	39.02	-34.98	74	55.38	34.4	8.11	58.87	100	0	Peak
7311	41.29	-32.71	74	53.66	35.62	10.47	58.46	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	83.88	-	-	78.63	32.38	6.34	33.47	144	243	Average
2439	94.84	-	-	89.7	32.27	6.34	33.47	144	243	Peak
4875	39.24	-34.76	74	55.6	34.4	8.11	58.87	100	0	Peak
7311	41.38	-32.62	74	53.81	35.56	10.47	58.46	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	84.22	-	-	78.74	32.56	6.39	33.47	185	230	Average
2464	94.95	-	-	89.47	32.56	6.39	33.47	185	230	Peak
4923	39.76	-34.24	74	56.02	34.36	8.18	58.8	100	0	Peak
7386	40.03	-33.97	74	52.53	35.66	10.45	58.61	100	0	Peak

Test Mode :	802.11g	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	81.36	-	-	75.95	32.49	6.39	33.47	121	7	Average
2464	92.72	-	-	87.31	32.49	6.39	33.47	121	7	Peak
4923	40.44	-33.56	74	56.7	34.36	8.18	58.8	100	0	Peak
7386	39.87	-34.13	74	52.54	35.49	10.45	58.61	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Horizontal
Remark :	1. 2414 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
2414	79.92	-	-	74.78	32.34	6.28	33.48	110	311	Average
2414	91.33	-	-	86.19	32.34	6.28	33.48	110	311	Peak
4824	38.81	-35.19	74	55.27	34.44	8.04	58.94	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	01	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Vertical
Remark :	1. 2410 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
2410	82.33	-	-	77.37	32.16	6.28	33.48	118	242	Average
2410	93.43	-	-	88.47	32.16	6.28	33.48	118	242	Peak
4824	40.21	-33.79	74	56.67	34.44	8.04	58.94	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	81.55	-	-	76.19	32.49	6.34	33.47	189	128	Average
2439	92.38	-	-	87.02	32.49	6.34	33.47	189	128	Peak
4875	39.28	-34.72	74	55.64	34.4	8.11	58.87	100	0	Peak
7311	41.11	-32.89	74	53.48	35.62	10.47	58.46	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	83.44	-	-	78.19	32.38	6.34	33.47	149	241	Average
2439	95.47	-	-	90.22	32.38	6.34	33.47	149	241	Peak
4875	39.07	-34.93	74	55.43	34.4	8.11	58.87	100	0	Peak
7311	42.2	-31.8	74	54.63	35.56	10.47	58.46	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	82.69	-	-	77.21	32.56	6.39	33.47	100	345	Average
2464	94.35	-	-	88.87	32.56	6.39	33.47	100	345	Peak
4923	40.22	-33.78	74	56.48	34.36	8.18	58.8	100	0	Peak
7386	40.72	-33.28	74	53.22	35.66	10.45	58.61	100	0	Peak

Test Mode :	2.4GHz 802.11n HT20	Temperature :	22~24°C
Test Channel :	11	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	84.26	-	-	78.85	32.49	6.39	33.47	149	241	Average
2464	96.23	-	-	90.82	32.49	6.39	33.47	149	241	Peak
4923	39.57	-34.43	74	55.83	34.36	8.18	58.8	100	0	Peak
7386	40.46	-33.54	74	53.13	35.49	10.45	58.61	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	03	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Horizontal
Remark :	1. 2424 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
2424	75.07	-	-	69.85	32.41	6.28	33.47	100	345	Average
2424	84.61	-	-	79.39	32.41	6.28	33.47	100	345	Peak
4845	38.91	-35.09	74	55.33	34.43	8.07	58.92	100	0	Peak
7266	40.4	-33.6	74	52.71	35.61	10.48	58.4	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	03	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Vertical
Remark :	1. 2424 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
2424	80.47	-	-	75.39	32.27	6.28	33.47	117	242	Average
2424	89.91	-	-	84.83	32.27	6.28	33.47	117	242	Peak
4845	38.91	-35.09	74	55.33	34.43	8.07	58.92	100	0	Peak
7266	41.02	-32.98	74	53.35	35.59	10.48	58.4	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	79.9	-	-	74.54	32.49	6.34	33.47	186	123	Average
2439	89.43	-	-	84.07	32.49	6.34	33.47	186	123	Peak
4875	39.99	-34.01	74	56.35	34.4	8.11	58.87	100	0	Peak
7311	40.81	-33.19	74	53.18	35.62	10.47	58.46	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	06	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	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	82.77	-	-	77.52	32.38	6.34	33.47	118	243	Average
2439	92.46	-	-	87.21	32.38	6.34	33.47	118	243	Peak
4875	39.42	-34.58	74	55.78	34.4	8.11	58.87	100	0	Peak
7311	40.64	-33.36	74	53.07	35.56	10.47	58.46	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	09	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Horizontal
Remark :	1. 2454 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
2454	80.67	-	-	75.19	32.56	6.39	33.47	100	345	Average
2454	90.12	-	-	84.64	32.56	6.39	33.47	100	345	Peak
4905	40.08	-33.92	74	56.35	34.37	8.18	58.82	100	0	Peak
7356	41.64	-32.36	74	54.09	35.64	10.46	58.55	100	0	Peak

Test Mode :	2.4GHz 802.11n HT40	Temperature :	22~24°C
Test Channel :	09	Relative Humidity :	47~48%
Test Engineer :	Kyle Jhuang	Polarization :	Vertical
Remark :	1. 2454 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
2454	80.07	-	-	74.66	32.49	6.39	33.47	100	6	Average
2454	90.06	-	-	84.65	32.49	6.39	33.47	100	6	Peak
4905	40.1	-33.9	74	56.37	34.37	8.18	58.82	100	0	Peak
7356	42	-32	74	54.58	35.51	10.46	58.55	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.

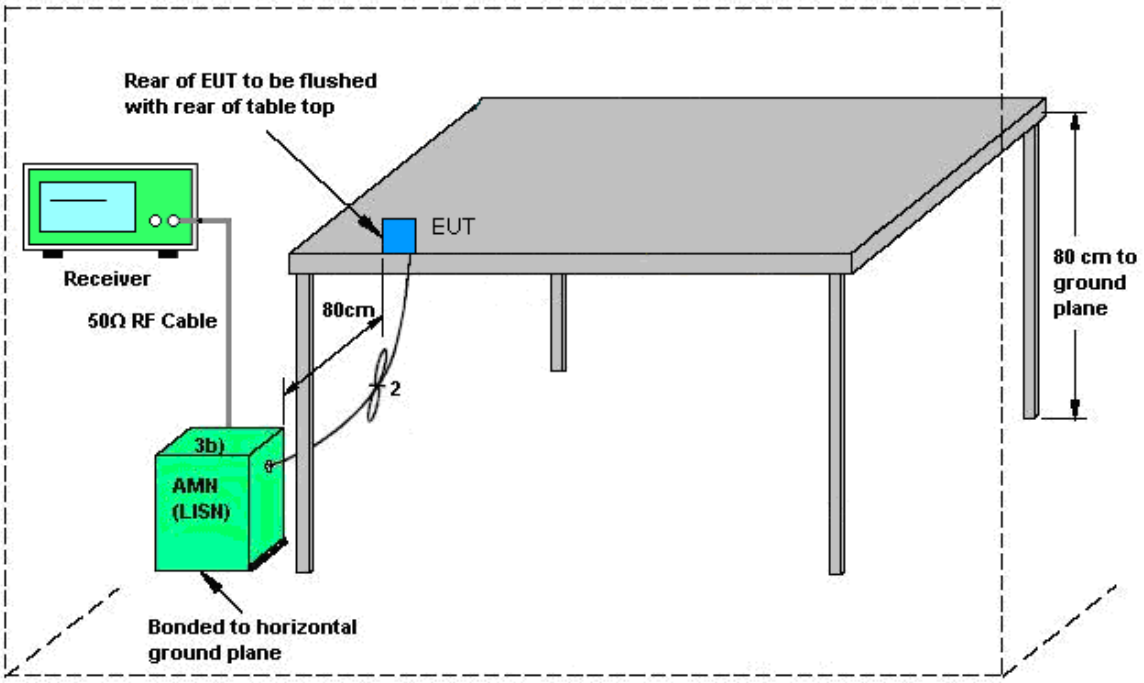
3.6.2 Measuring Instruments

See list of measuring instruments 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.

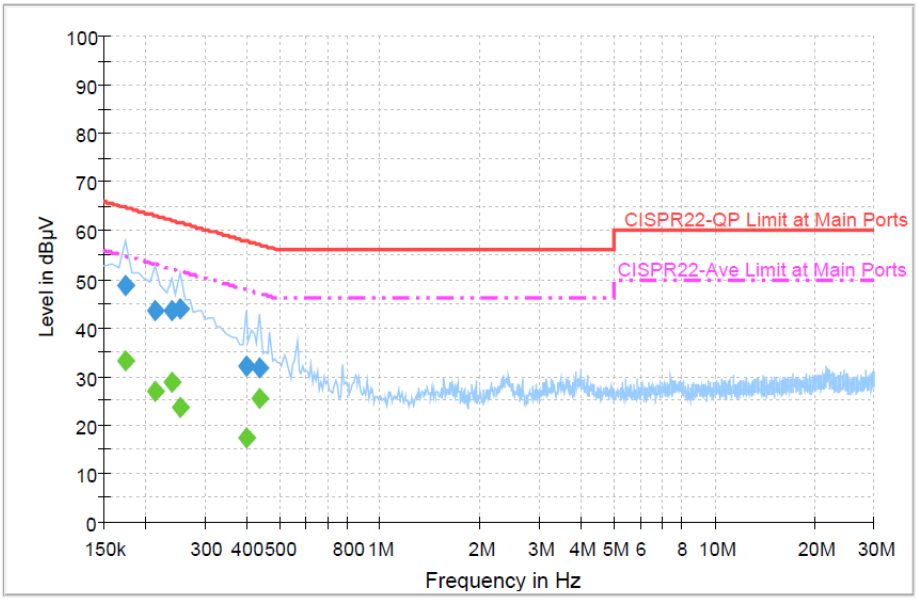
3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

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 :	WLAN Link + Lamp		



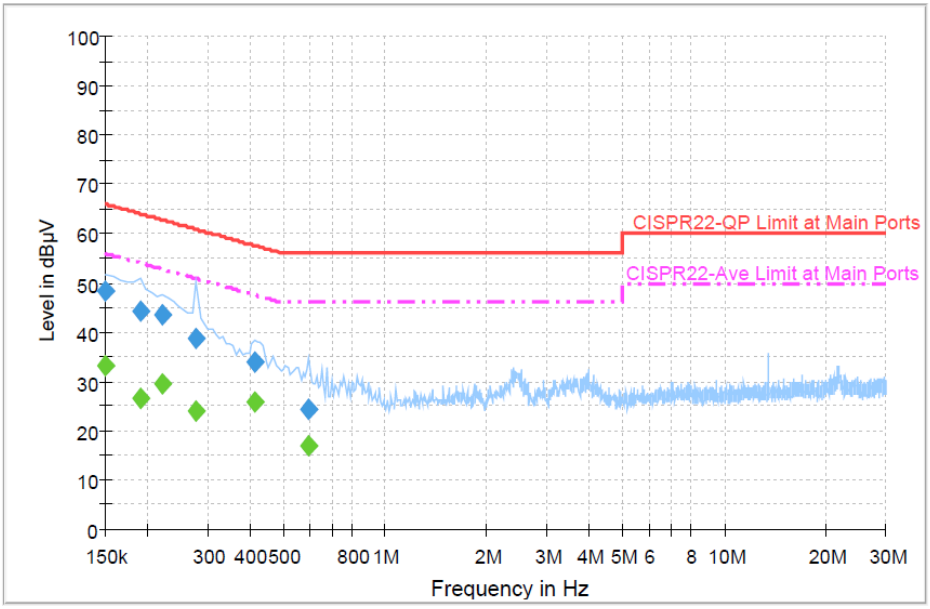
Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	48.6	Off	L1	19.4	16.2	64.8
0.214000	43.5	Off	L1	19.4	19.5	63.0
0.238000	43.5	Off	L1	19.5	18.7	62.2
0.254000	43.9	Off	L1	19.5	17.7	61.6
0.398000	32.1	Off	L1	19.5	25.8	57.9
0.438000	31.7	Off	L1	19.4	25.4	57.1

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.174000	33.2	Off	L1	19.4	21.6	54.8
0.214000	26.8	Off	L1	19.4	26.2	53.0
0.238000	28.9	Off	L1	19.5	23.3	52.2
0.254000	23.5	Off	L1	19.5	28.1	51.6
0.398000	17.4	Off	L1	19.5	30.5	47.9
0.438000	25.5	Off	L1	19.4	21.6	47.1

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN Link + Lamp		



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	48.5	Off	N	19.4	17.5	66.0
0.190000	44.4	Off	N	19.4	19.6	64.0
0.222000	43.5	Off	N	19.4	19.2	62.7
0.278000	38.8	Off	N	19.4	22.1	60.9
0.414000	33.9	Off	N	19.4	23.7	57.6
0.598000	24.2	Off	N	19.4	31.8	56.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	33.3	Off	N	19.4	22.7	56.0
0.190000	26.6	Off	N	19.4	27.4	54.0
0.222000	29.5	Off	N	19.4	23.2	52.7
0.278000	24.0	Off	N	19.4	26.9	50.9
0.414000	26.0	Off	N	19.4	21.6	47.6
0.598000	16.8	Off	N	19.4	29.2	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 Connected Construction

Non-standard connector 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	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 07, 2013	Jul. 19, 2013~ Jul. 20, 2013	Jun. 06, 2014	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Sep. 08, 2012	Jul. 19, 2013~ Jul. 20, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Sep. 08, 2012	Jul. 19, 2013~ Jul. 20, 2013	Sep. 07, 2013	Conducted (TH02-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 13, 2012	Jul. 22, 2013	Nov. 12, 2013	Conduction (CO05-HY)
Two-LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2012	Jul. 22, 2013	Dec. 11, 2013	Conduction (CO05-HY)
Two-LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 06, 2012	Jul. 22, 2013	Dec. 05, 2013	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Jul. 22, 2013	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100472	20Hz – 26.5GHz	Jan. 23, 2013	Nov. 02, 2013	Jan. 22, 2014	Radiation (03CH08HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	860004/0001	9 kHz~30 MhZ	Jul. 03, 2012	Nov. 02, 2013	Jul. 03, 2014	Radiation (03CH08HY)
Bilog Antenna	Teseq GmbH	CBL6112D	35379	30MHz~2GHz	Oct. 10, 2013	Nov. 02, 2013	Oct. 09, 2014	Radiation (03CH08HY)
Horn Antenna	ESCO	3117	000143261	1GHz~18GHz	Jan. 08, 2013	Nov. 02, 2013	Jan. 07, 2014	Radiation (03CH08HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 03, 2013	Nov. 02, 2013	Oct. 02, 2014	Radiation (03CH08HY)
Amplifier	SONOMA	310N	187231	9kHz~1GHz	May 15, 2013	Nov. 02, 2013	May 14, 2014	Radiation (03CH08HY)
Pre Amplifier	EMC INSTRUMENT	EMC011830	980148	100MHz~18GHz	Jun. 21, 2013	Nov. 02, 2013	Jun. 20, 2014	Radiation (03CH08HY)
Pre Amplifier	Agilent	8449B	3008A02665	1GHz~26.5GHz	Sep. 04, 2013	Nov. 02, 2013	Sep. 03, 2014	Radiation (03CH08HY)
Turn Table	Chaintek	Chaintek 3000	N/A	0~360 Degree	N/A	Nov. 02, 2013	N/A	Radiation (03CH08HY)
Antenna Mast	MF	MFA520BS	N/A	1m~4m	N/A	Nov. 02, 2013	N/A	Radiation (03CH08HY)

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 (30MHz ~ 1000MHz)

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