



# FCC RF Test Report

**APPLICANT** : HTC Corporation  
**EQUIPMENT** : Smartphone  
**MODEL NAME** : OPL4200  
**FCC ID** : NM80PL4200  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

The product was received on Dec. 08, 2014 and testing was completed on Dec. 28, 2014. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in 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 (KUNSHAN) INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



**SPORTON INTERNATIONAL (KUNSHAN) INC.**  
**No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China**



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**APPENDIX A. RADIATED SPURIOUS EMISSION**





### SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
		Conducted Spurious Emission		Pass	-
0	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 4.38 dB at 2388.660 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 6.94 dB at 0.950 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-



# 1 General Description

## 1.1 Applicant

**HTC Corporation**

1F, 6-3 Baoqiang Road, Xindian District, New Taipei City, Taiwan 231

## 1.2 Manufacturer

**Shanghai Huaqin Telecom Technology Co., Ltd**

Building 1, NO.399, keyuan Road, Shanghai, 201203

## 1.3 Product Feature of Equipment Under Test

Product Feature	
<b>Equipment</b>	Smartphone
<b>Model Name</b>	0PL4200
<b>FCC ID</b>	NM80PL4200
<b>EUT supports Radios application</b>	GSM/GPRS/EGPRS/WCDMA/HSPA/HSPA+(Downlink Only) WLAN 2.4GHz 802.11b/g/n HT20/HT40 Bluetooth v3.0 + EDR/Bluetooth v4.0 LE
<b>Sample 1</b>	EUT with LCD panel 1, front camera 1 and back camera 1
<b>Sample 2</b>	EUT with LCD panel 2, front camera 2 and back camera 2
<b>Sample 3</b>	EUT with LCD panel 3, front camera 2 and back camera 1
<b>Sample 4</b>	EUT with LCD panel 4, front camera 2 and back camera 1
<b>EUT Stage</b>	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 subjective to this standard

Product Specification subjective to this standard	
<b>Tx/Rx Channel Frequency Range</b>	802.11b/g/n : 2412 MHz ~ 2462 MHz
<b>Maximum (Peak) Output Power to Antenna</b>	802.11b : 15.93 dBm (0.0392 W) 802.11g : 21.92 dBm (0.1556 W) 802.11n HT20 : 21.84 dBm (0.1528 W) 802.11n HT40 : 21.78 dBm (0.1507 W)
<b>Antenna Type</b>	802.11b/g/n : PIFA Antenna with gain -3.30 dBi
<b>Type of Modulation</b>	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 Location

<b>Test Site</b>	SPORTON INTERNATIONAL (KUNSHAN) INC.			
<b>Test Site Location</b>	No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P.R.C. TEL: +86-0512-5790-0158 FAX: +86-0512-5790-0958			
<b>Test Site No.</b>	<b>Sporton Site No.</b>			<b>FCC Registration No.</b>
	TH01-KS	CO01-KS	03CH01-KS	149928

**Note:** The test site complies with ANSI C63.4 2009 requirement.

### 1.7 Applicable 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 v03r02
- ANSI C63.10-2009

**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/Z 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 RF Output Power (dBm)						
Power vs. Channel			Power vs. Data Rate			
Channel	Frequency (MHz)	Data Rate	Channel	2Mbps	5.5Mbps	11Mbps
		1Mbps				
CH 01	2412 MHz	15.42	CH 11	15.85	15.91	15.80
CH 06	2437 MHz	15.66				
CH 11	2462 MHz	<b>15.93</b>				

2.4GHz 802.11g RF Output Power (dBm)										
Power vs. Channel			Power vs. Data Rate							
Channel	Frequency (MHz)	Data Rate	Channel	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
		6Mbps								
CH 01	2412 MHz	21.89	CH 11	21.83	21.77	21.79	21.88	21.72	21.73	21.75
CH 06	2437 MHz	21.84								
CH 11	2462 MHz	<b>21.92</b>								

2.4GHz 802.11n HT20 RF Output Power (dBm)										
Power vs. Channel			Power vs. MCS Index							
Channel	Frequency (MHz)	MCS Index	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0								
CH 01	2412 MHz	21.67	CH 11	21.65	21.62	21.63	21.51	21.55	21.74	21.69
CH 06	2437 MHz	21.76								
CH 11	2462 MHz	<b>21.84</b>								

2.4GHz 802.11n HT40 RF Output Power (dBm)										
Power vs. Channel			Power vs. MCS Index							
Channel	Frequency (MHz)	MCS Index	Channel	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
		MCS0								
CH 03	2422 MHz	21.32	CH 09	21.56	21.61	21.52	21.45	21.48	21.44	21.56
CH 06	2437 MHz	21.40								
CH 09	2452 MHz	<b>21.78</b>								





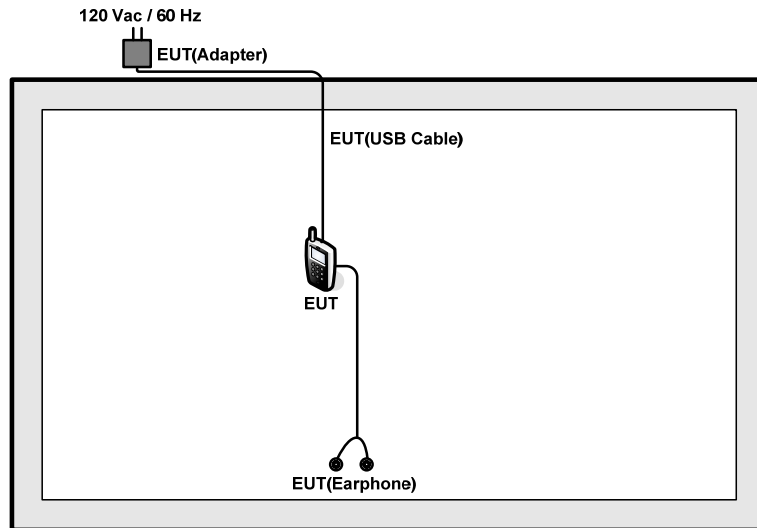
## 2.3 Test Mode

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

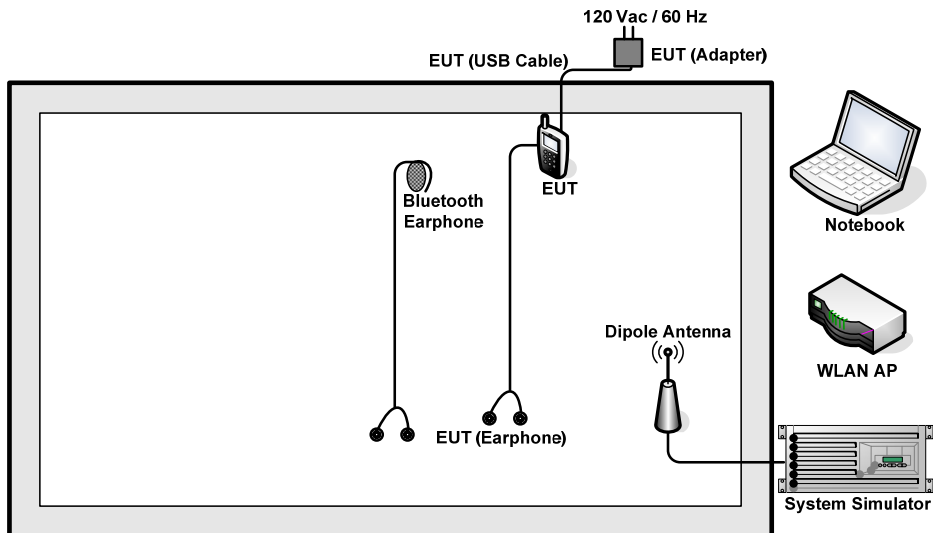
Test Cases				
	Test Items	Mode	Data Rate	Test Channel
Conducted TCs	6dB BW Power Spectral Density	802.11b	1 Mbps	1/6/11
		802.11g	6 Mbps	1/6/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9
	Output Power	802.11b	1 Mbps	1/6/11
		802.11g	6 Mbps	1/6/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9
	Conducted Band Edge	802.11b	1 Mbps	1/11
		802.11g	6 Mbps	1/11
		802.11n HT20	MCS0	1/11
		802.11n HT40	MCS0	3/9
	Conducted Spurious Emission	802.11b	1 Mbps	1/6/11
		802.11g	6 Mbps	1/6/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9
Radiated TCs	Radiated Band Edge	802.11b	1 Mbps	1/11
		802.11g	6 Mbps	1/11
		802.11n HT20	MCS0	1/11
		802.11n HT40	MCS0	3/9
	Radiated Spurious Emission	802.11b	1 Mbps	1/6/11
		802.11g	6 Mbps	1/6/11
		802.11n HT20	MCS0	1/6/11
		802.11n HT40	MCS0	3/6/9
AC Conducted Emission	Mode 1 : GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 1 + USB Cable 1 (Charging from Adapter 1) Mode 2 : GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 2 + USB Cable 2 (Charging from Adapter 2)			
<b>Remark:</b>				
1. The worst case of conducted emission is mode 1; only the test data of it was reported. 2. For Radiated TCs, The tests were performance with Adapter 1, Earphone 1 and USB Cable 1.				

## 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.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
3.	Notebook	Lenovo	G480	PRC4	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Nokia	BH-102	PYAHS-107W	N/A	N/A

## 2.6 EUT Operation Test Setup

For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

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

## 2.7 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 6 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 6 + 10 = 16 \text{ (dB)} \end{aligned}$$

### 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 v03r02.
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

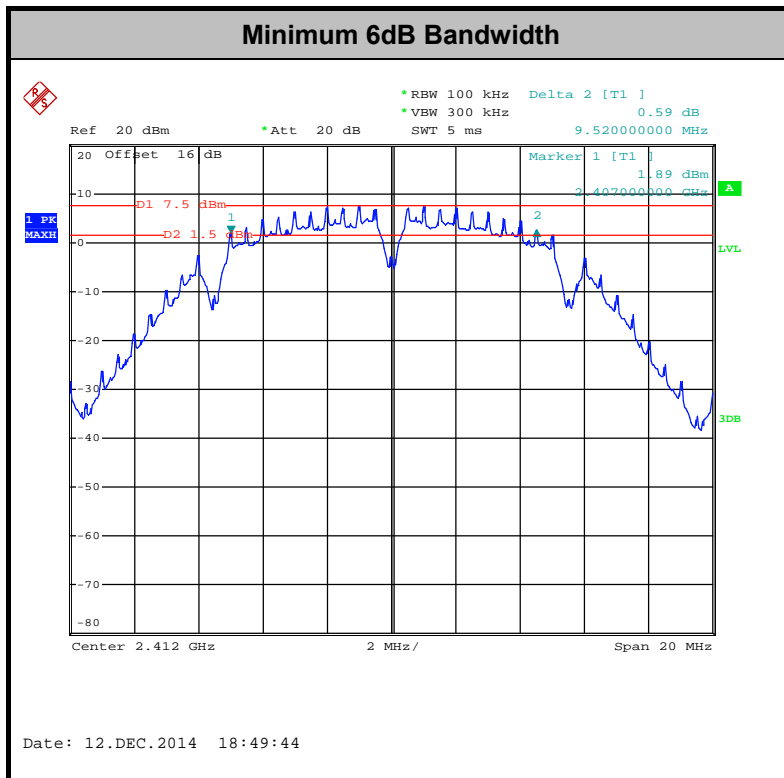




3.1.5 Test Result of 6dB Bandwidth

Test Band :	2.4GHz	Temperature :	24~25°C
Test Engineer :	Issac Song	Relative Humidity :	49~51%

Mod.	Data Rate	N <sub>TX</sub>	Channel	Freq. (MHz)	6dB Bandwidth (MHz)	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
11b	1Mbps	1	1	2412	9.52	0.50	Pass
11b	1Mbps	1	6	2437	9.52	0.50	Pass
11b	1Mbps	1	11	2462	10.00	0.50	Pass
11g	6Mbps	1	1	2412	15.68	0.50	Pass
11g	6Mbps	1	6	2437	15.48	0.50	Pass
11g	6Mbps	1	11	2462	15.64	0.50	Pass
HT20	MCS0	1	1	2412	17.56	0.50	Pass
HT20	MCS0	1	6	2437	17.60	0.50	Pass
HT20	MCS0	1	11	2462	17.56	0.50	Pass
HT40	MCS0	1	3	2422	35.20	0.50	Pass
HT40	MCS0	1	6	2437	35.20	0.50	Pass
HT40	MCS0	1	9	2452	35.20	0.50	Pass



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

## 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.

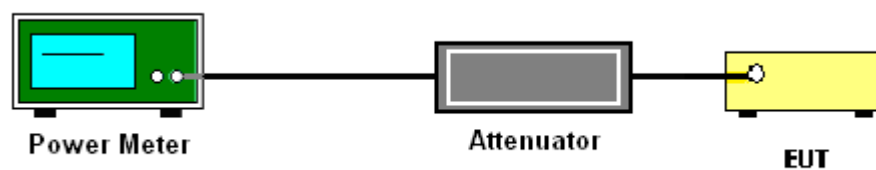
### 3.2.2 Measuring Instruments

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 v03r02.
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 :	24~25°C
Test Engineer :	Issac Song	Relative Humidity :	49~51%

Mod.	Data Rate	N <sub>TX</sub>	Channel	Freq. (MHz)	RF Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	15.42	30.00	-3.30	Pass
11b	1Mbps	1	6	2437	15.66	30.00	-3.30	Pass
11b	1Mbps	1	11	2462	15.93	30.00	-3.30	Pass
11g	6Mbps	1	1	2412	21.89	30.00	-3.30	Pass
11g	6Mbps	1	6	2437	21.84	30.00	-3.30	Pass
11g	6Mbps	1	11	2462	21.92	30.00	-3.30	Pass
HT20	MCS0	1	1	2412	21.67	30.00	-3.30	Pass
HT20	MCS0	1	6	2437	21.76	30.00	-3.30	Pass
HT20	MCS0	1	11	2462	21.84	30.00	-3.30	Pass
HT40	MCS0	1	3	2422	21.32	30.00	-3.30	Pass
HT40	MCS0	1	6	2437	21.40	30.00	-3.30	Pass
HT40	MCS0	1	9	2452	21.78	30.00	-3.30	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 :	24~25°C
Test Engineer :	Issac Song	Relative Humidity :	49~51%

Mod.	Data Rate	N <sub>TX</sub>	Channel	Freq. (MHz)	Duty Factor (dB)	Average Output Power (dBm)	Power Limit (dBm)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	0.08	12.22	30.00	-3.30	Pass
11b	1Mbps	1	6	2437	0.08	12.71	30.00	-3.30	Pass
11b	1Mbps	1	11	2462	0.08	13.07	30.00	-3.30	Pass
11g	6Mbps	1	1	2412	0.53	12.28	30.00	-3.30	Pass
11g	6Mbps	1	6	2437	0.53	12.23	30.00	-3.30	Pass
11g	6Mbps	1	11	2462	0.53	12.62	30.00	-3.30	Pass
HT20	MCS0	1	1	2412	0.54	11.33	30.00	-3.30	Pass
HT20	MCS0	1	6	2437	0.54	11.40	30.00	-3.30	Pass
HT20	MCS0	1	11	2462	0.54	11.71	30.00	-3.30	Pass
HT40	MCS0	1	3	2422	1.02	10.60	30.00	-3.30	Pass
HT40	MCS0	1	6	2437	1.02	10.75	30.00	-3.30	Pass
HT40	MCS0	1	9	2452	1.02	11.22	30.00	-3.30	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.

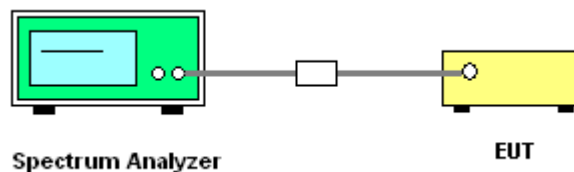
#### 3.3.2 Measuring Instruments

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 v03r02
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



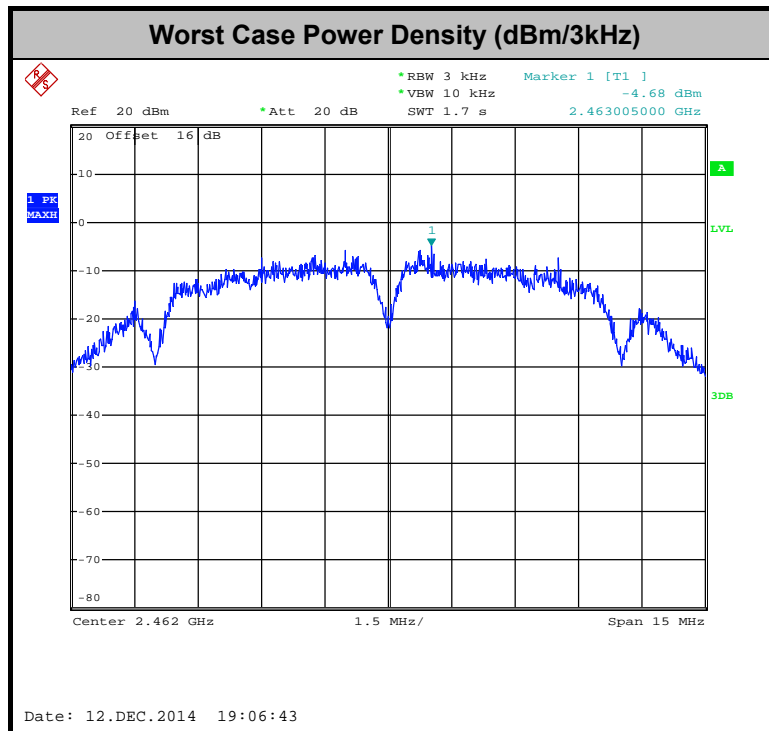


3.3.5 Test Result of Power Spectral Density

Test Mode :	2.4GHz	Temperature :	24~25°C
Test Engineer :	Issac Song	Relative Humidity :	49~51%

Mod.	Data Rate	N <sub>TX</sub>	Channel	Freq. (MHz)	Peak Power Density (dBm/3kHz)	Max. Limits (dBm/3kHz)	DG (dBi)	Pass/Fail
11b	1Mbps	1	1	2412	-6.63	8.00	-3.30	Pass
11b	1Mbps	1	6	2437	-6.58	8.00	-3.30	Pass
11b	1Mbps	1	11	2462	-4.68	8.00	-3.30	Pass
11g	6Mbps	1	1	2412	-11.57	8.00	-3.30	Pass
11g	6Mbps	1	6	2437	-12.08	8.00	-3.30	Pass
11g	6Mbps	1	11	2462	-10.89	8.00	-3.30	Pass
HT20	MCS0	1	1	2412	-12.54	8.00	-3.30	Pass
HT20	MCS0	1	6	2437	-12.67	8.00	-3.30	Pass
HT20	MCS0	1	11	2462	-12.55	8.00	-3.30	Pass
HT40	MCS0	1	3	2422	-18.35	8.00	-3.30	Pass
HT40	MCS0	1	6	2437	-17.85	8.00	-3.30	Pass
HT40	MCS0	1	9	2452	-16.31	8.00	-3.30	Pass

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



## 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).

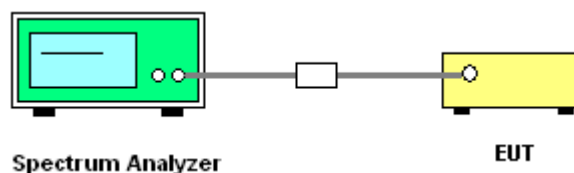
### 3.4.2 Measuring Instruments

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 v03r02.
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



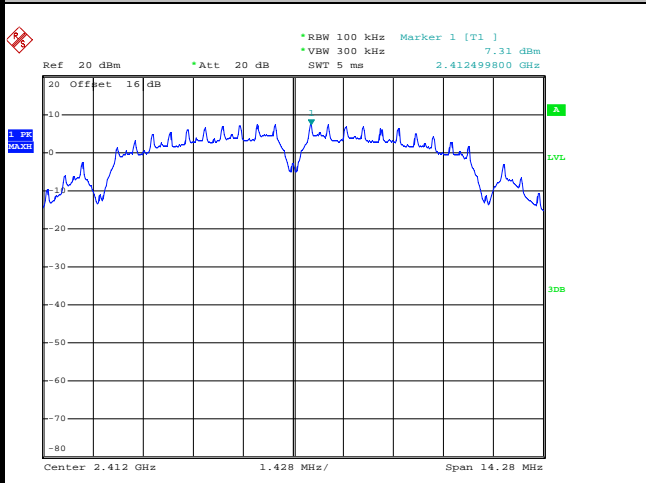


### 3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Mode :	802.11b	Temperature :	24~25°C
Test Band :	2.4GHz Low	Relative Humidity :	49~51%
Test Channel :	01	Test Engineer :	Issac Song

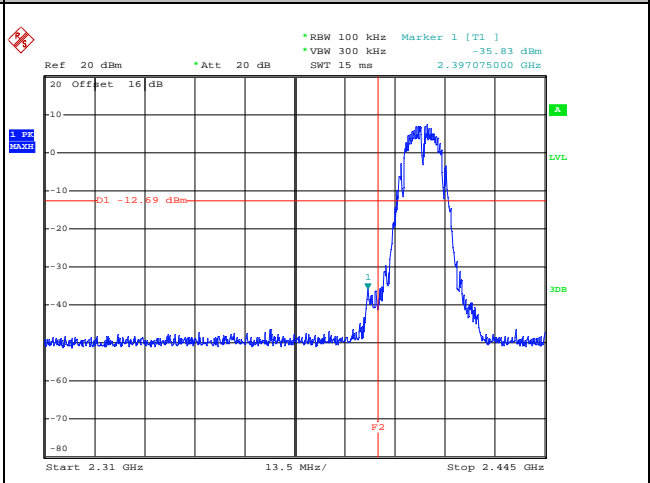
#### WLAN 802.11b Channel 01

##### 100kHz PSD reference Level



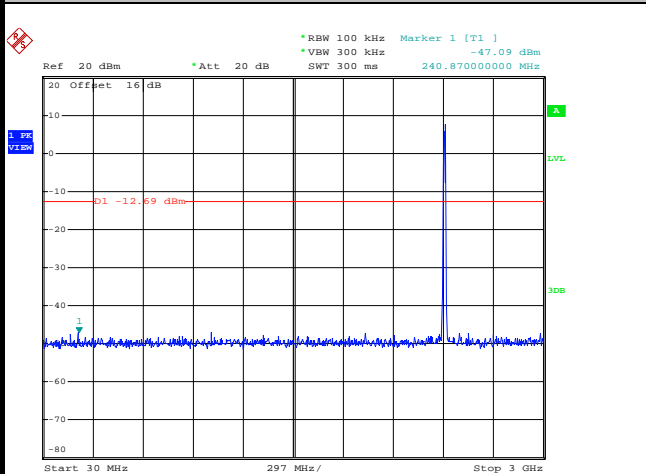
Date: 12.DEC.2014 18:51:17

##### Low Channel Plot



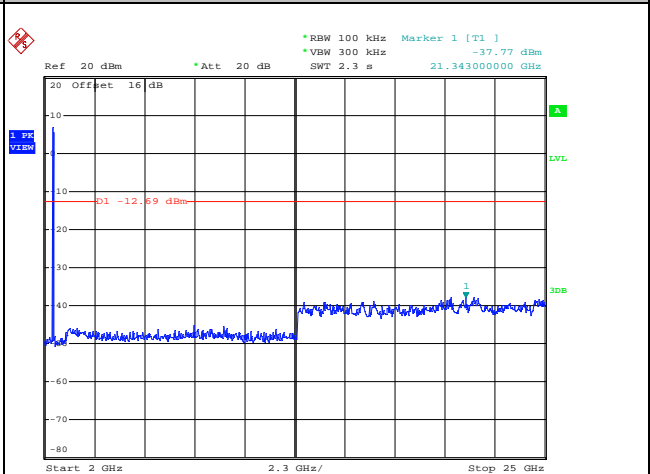
Date: 12.DEC.2014 18:51:37

##### Spurious Emission 30MHz~3GHz



Date: 12.DEC.2014 18:52:00

##### Spurious Emission 2GHz~25GHz



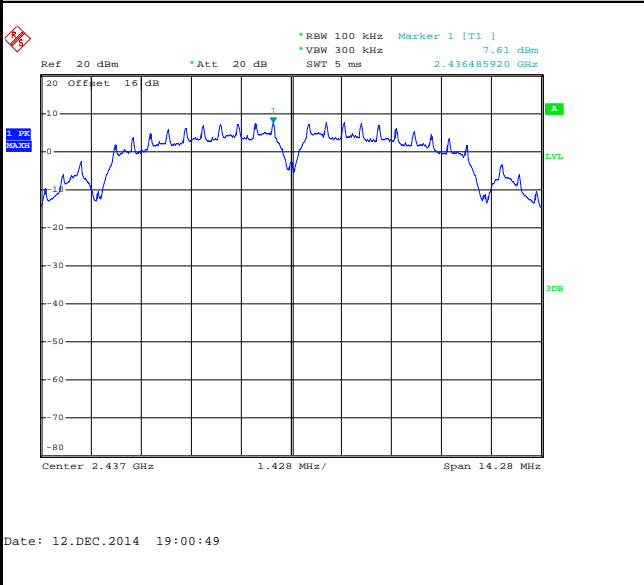
Date: 12.DEC.2014 18:52:18



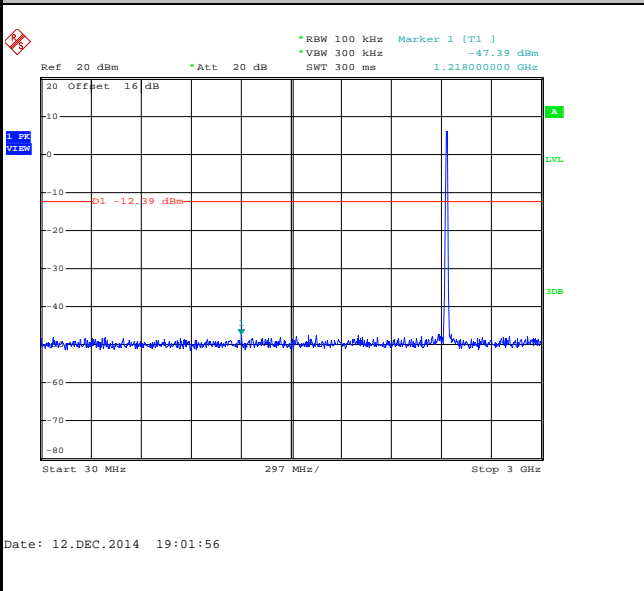
Test Mode :	802.11b	Temperature :	24~25°C
Test Band :	2.4GHz Mid	Relative Humidity :	49~51%
Test Channel :	06	Test Engineer :	Issac Song

WLAN 802.11b Channel 06

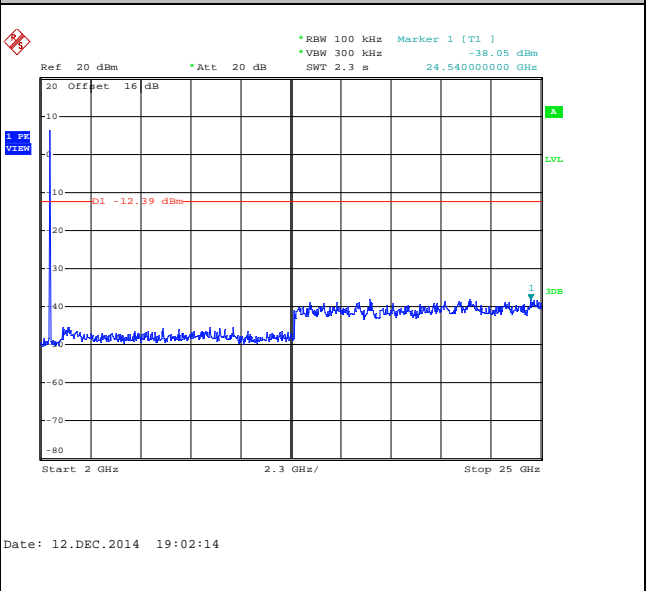
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

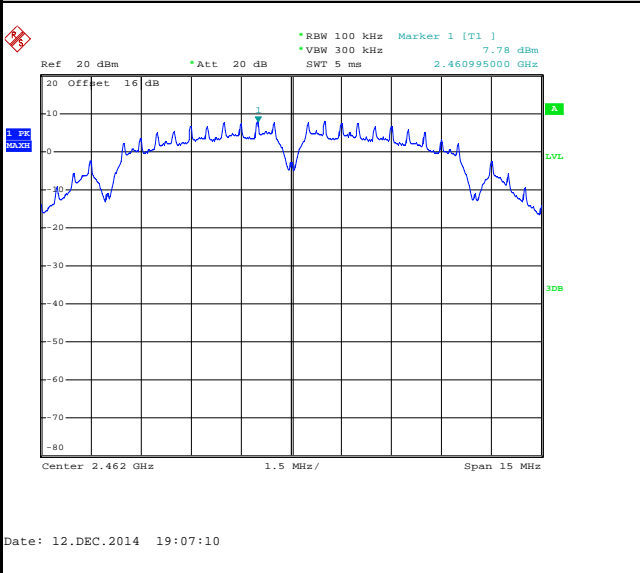




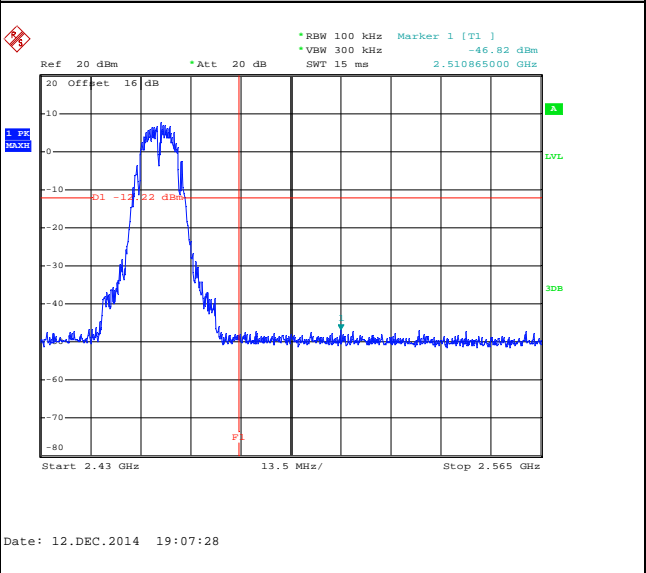
Test Mode :	802.11b	Temperature :	24~25°C
Test Band :	2.4GHz High	Relative Humidity :	49~51%
Test Channel :	11	Test Engineer :	Issac Song

WLAN 802.11b Channel 11

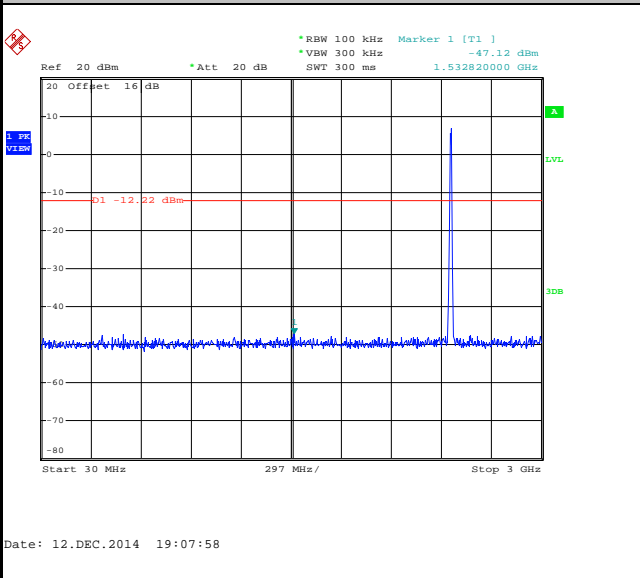
100kHz PSD reference Level



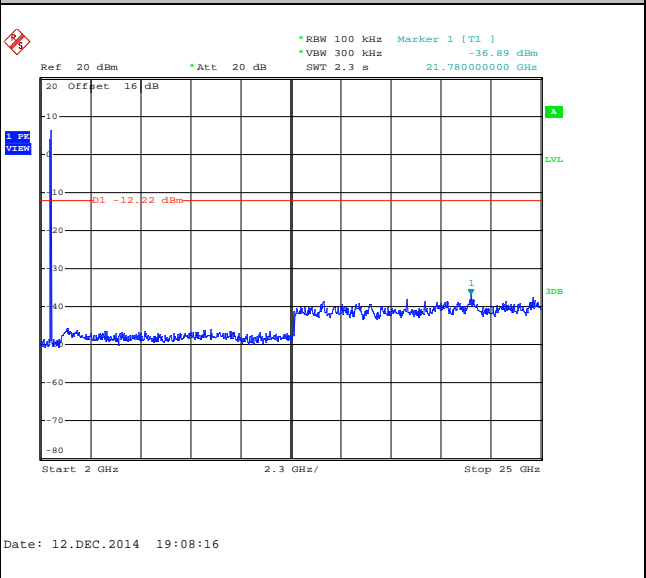
High Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



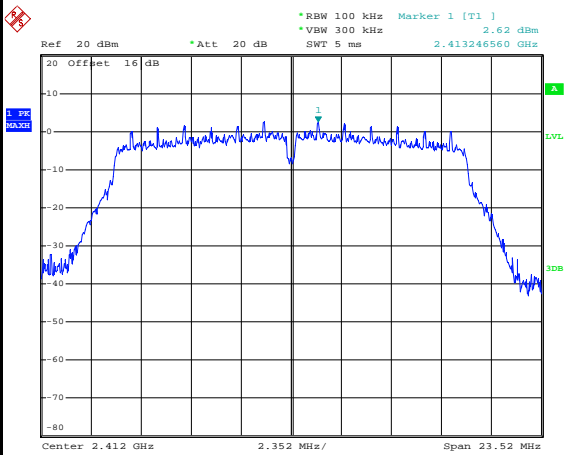




Test Mode :	802.11g	Temperature :	24~25°C
Test Band :	2.4GHz Low	Relative Humidity :	49~51%
Test Channel :	01	Test Engineer :	Issac Song

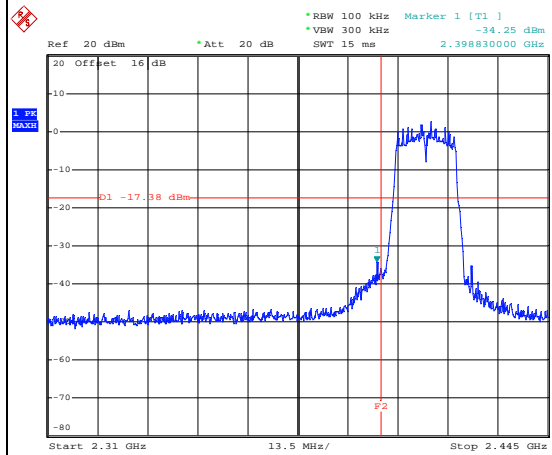
WLAN 802.11g Channel 01

100kHz PSD reference Level



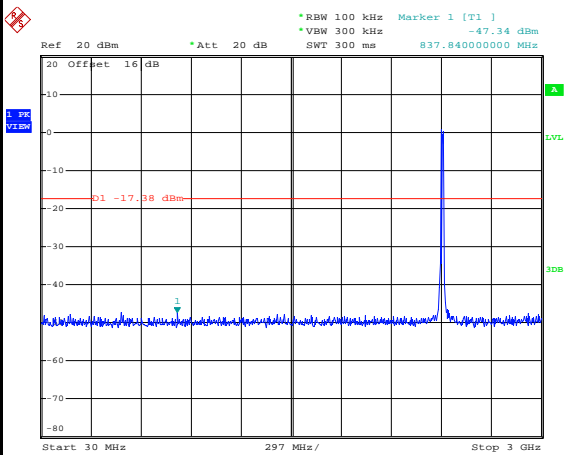
Date: 12.DEC.2014 19:13:18

Low Channel Plot



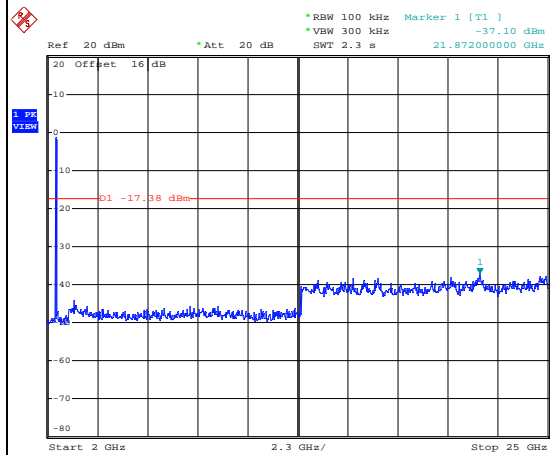
Date: 12.DEC.2014 19:19:57

Spurious Emission 30MHz~3GHz



Date: 12.DEC.2014 19:14:25

Spurious Emission 2GHz~25GHz



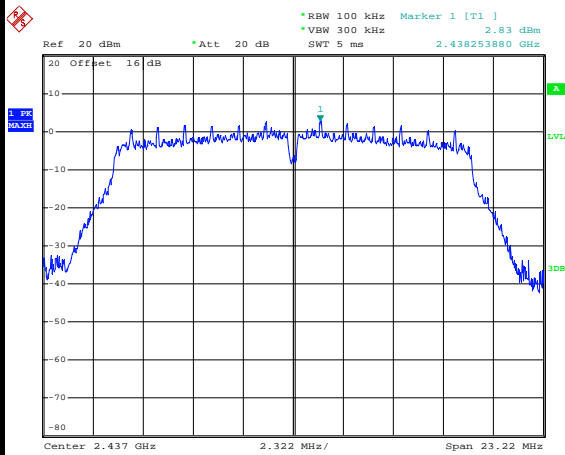
Date: 12.DEC.2014 19:14:43



Test Mode :	802.11g	Temperature :	24~25°C
Test Band :	2.4GHz Mid	Relative Humidity :	49~51%
Test Channel :	06	Test Engineer :	Issac Song

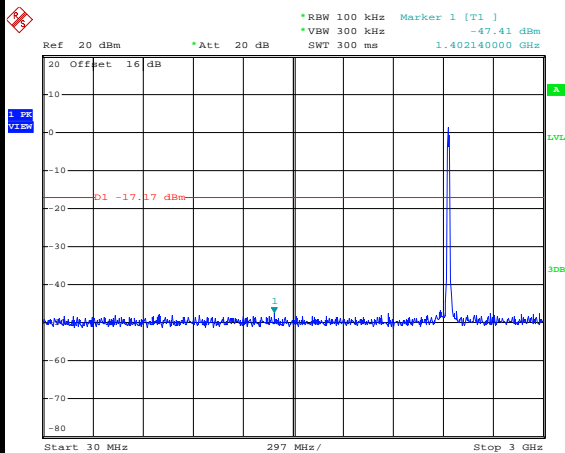
WLAN 802.11g Channel 06

100kHz PSD reference Level



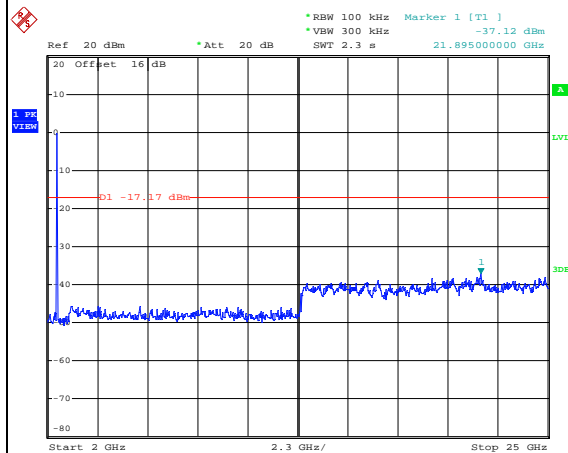
Date: 12.DEC.2014 19:17:31

Spurious Emission 30MHz~3GHz



Date: 12.DEC.2014 19:18:30

Spurious Emission 2GHz~25GHz



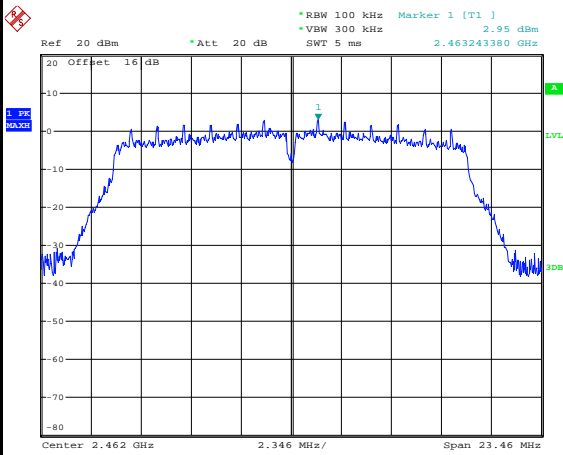
Date: 12.DEC.2014 19:18:48



Test Mode :	802.11g	Temperature :	24~25°C
Test Band :	2.4GHz High	Relative Humidity :	49~51%
Test Channel :	11	Test Engineer :	Issac Song

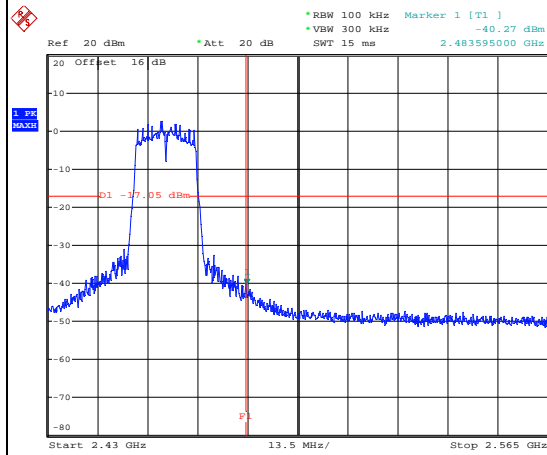
WLAN 802.11g Channel 11

100kHz PSD reference Level



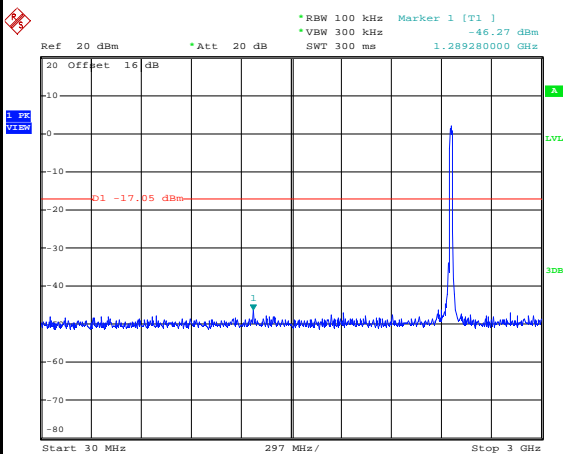
Date: 12.DEC.2014 19:23:40

High Channel Plot



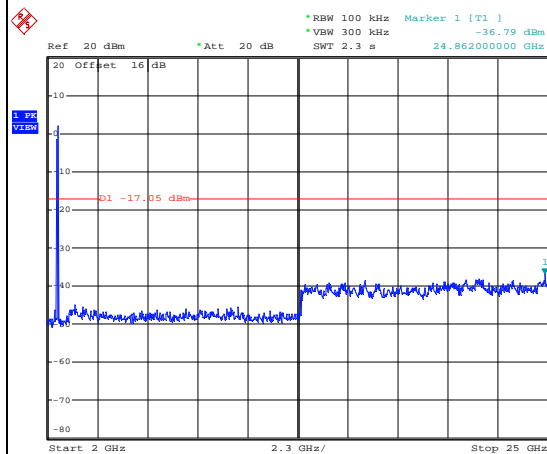
Date: 12.DEC.2014 19:24:00

Spurious Emission 30MHz~3GHz



Date: 12.DEC.2014 19:24:26

Spurious Emission 2GHz~25GHz



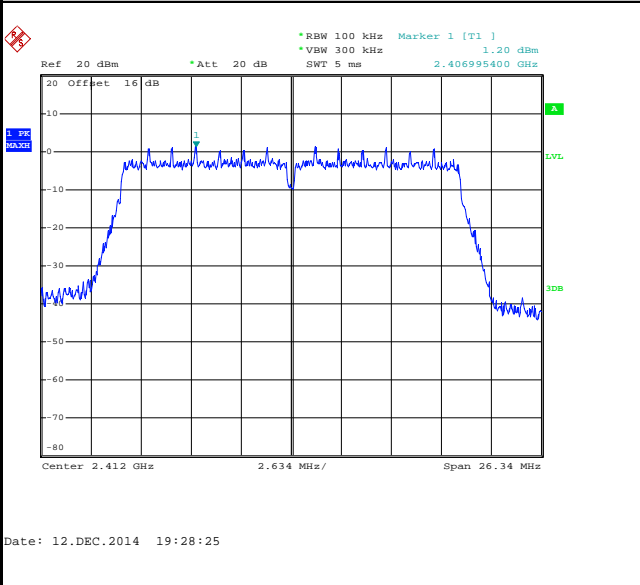
Date: 12.DEC.2014 19:24:44



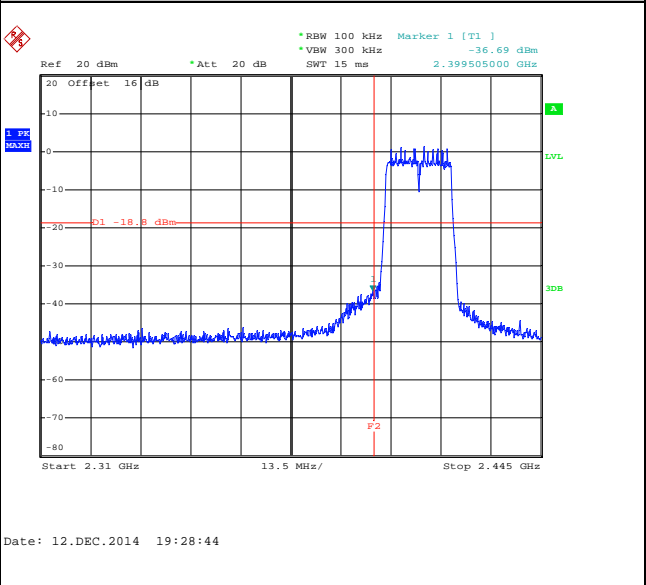
Test Mode :	802.11n HT20	Temperature :	24~25°C
Test Band :	2.4GHz Low	Relative Humidity :	49~51%
Test Channel :	01	Test Engineer :	Issac Song

WLAN 802.11n HT20 Channel 01

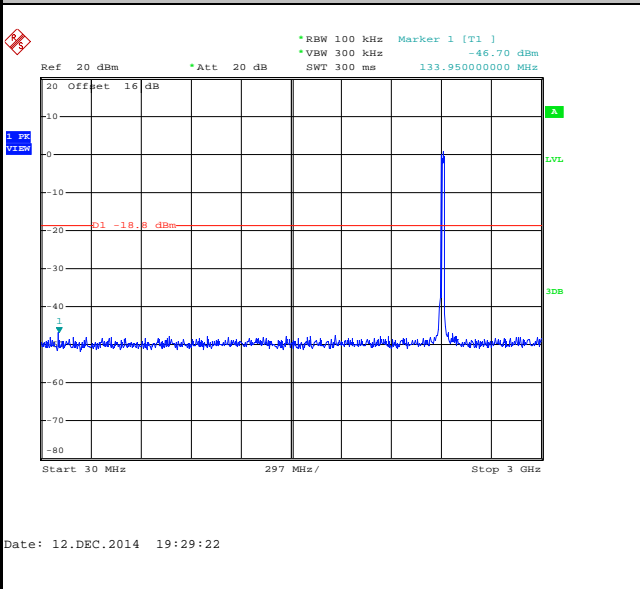
100kHz PSD reference Level



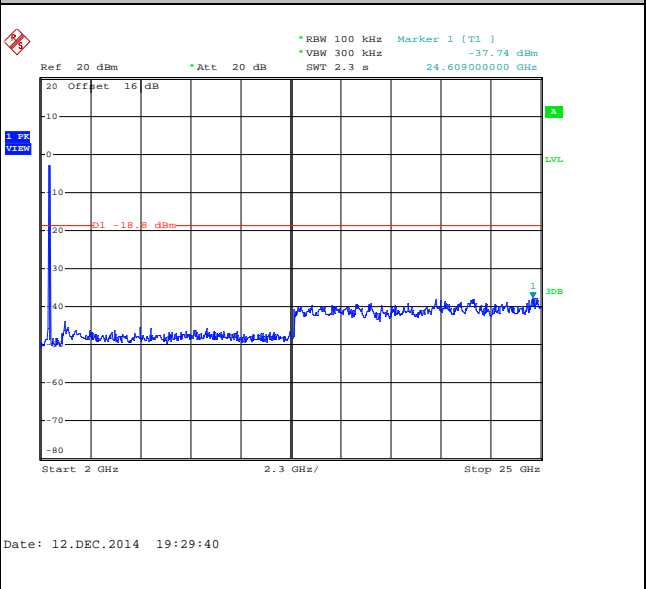
Low Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

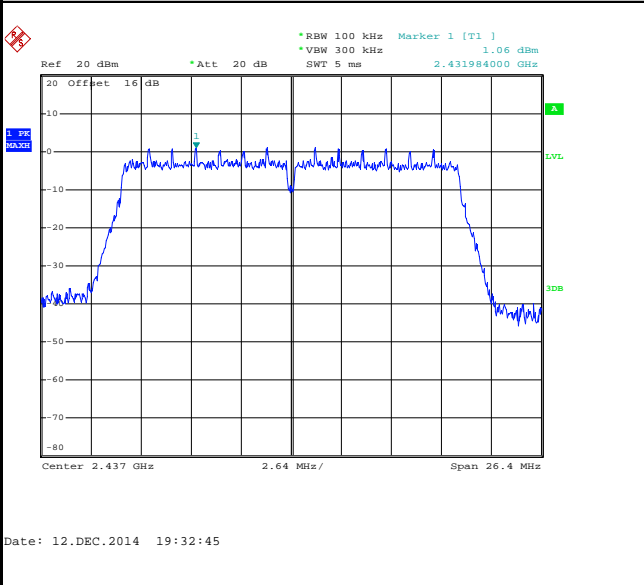




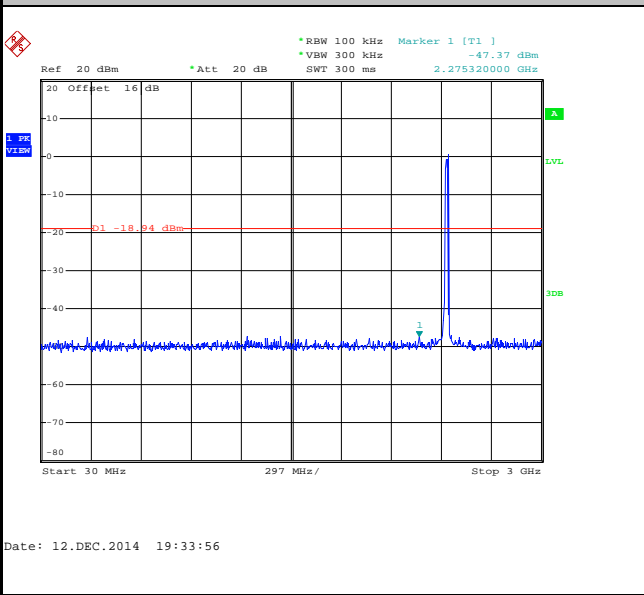
Test Mode :	802.11n HT20	Temperature :	24~25°C
Test Band :	2.4GHz Mid	Relative Humidity :	49~51%
Test Channel :	06	Test Engineer :	Issac Song

WLAN 802.11n HT20 Channel 06

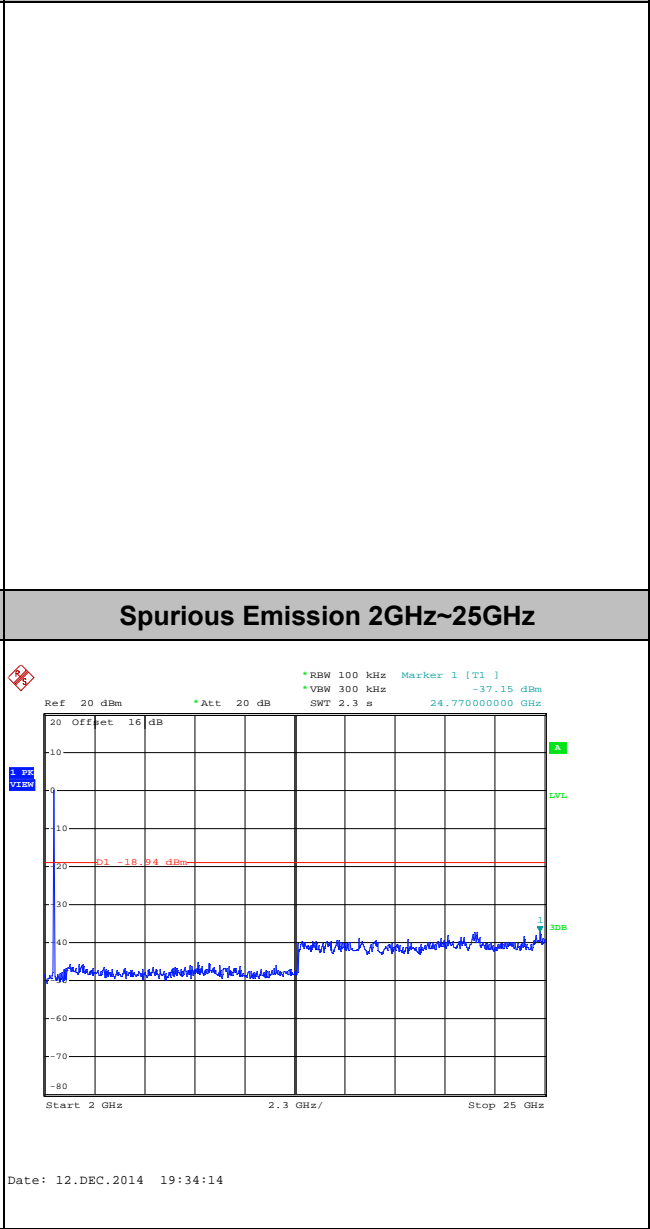
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

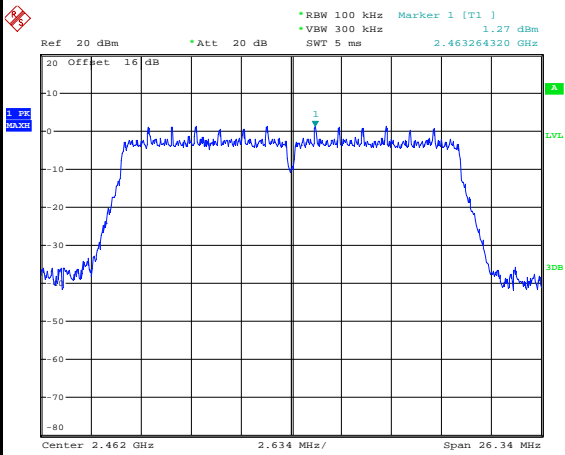




Test Mode :	802.11n HT20	Temperature :	24~25°C
Test Band :	2.4GHz High	Relative Humidity :	49~51%
Test Channel :	11	Test Engineer :	Issac Song

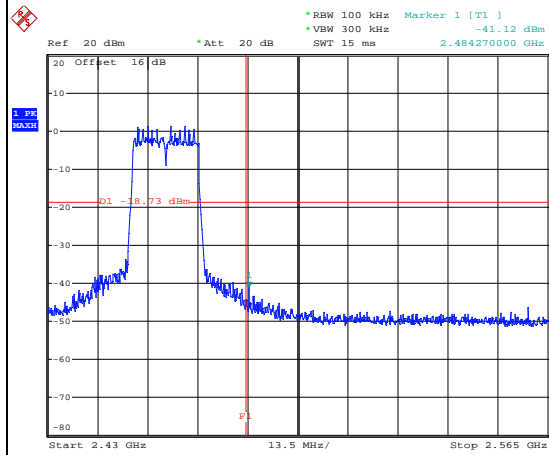
WLAN 802.11n HT20 Channel 11

100kHz PSD reference Level



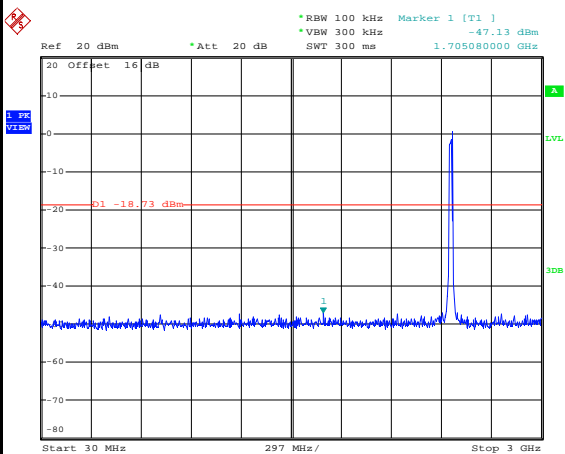
Date: 12.DEC.2014 19:36:47

High Channel Plot



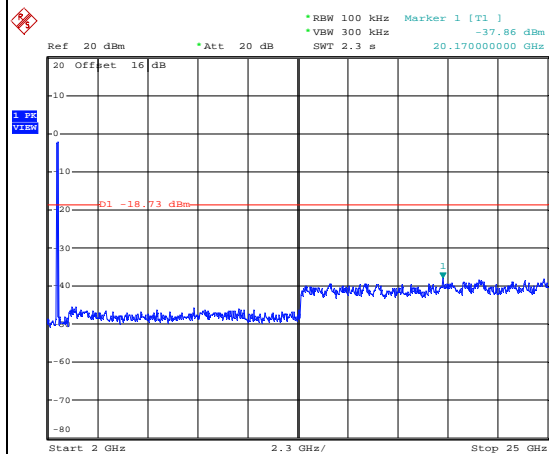
Date: 12.DEC.2014 19:37:19

Spurious Emission 30MHz~3GHz



Date: 12.DEC.2014 19:37:43

Spurious Emission 2GHz~25GHz



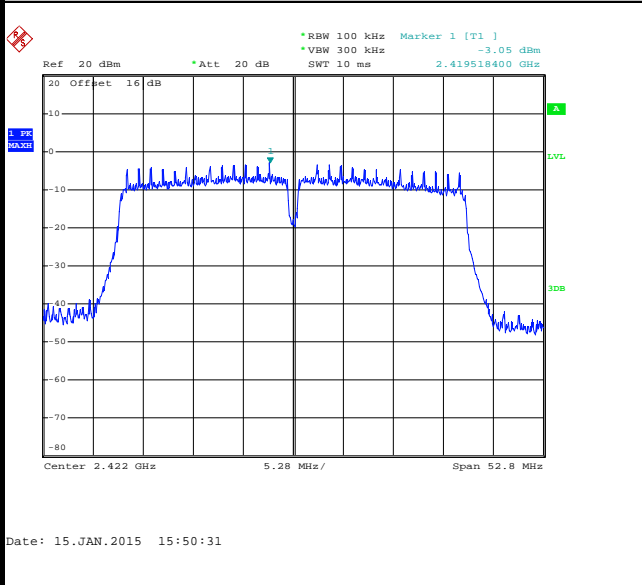
Date: 12.DEC.2014 19:38:01



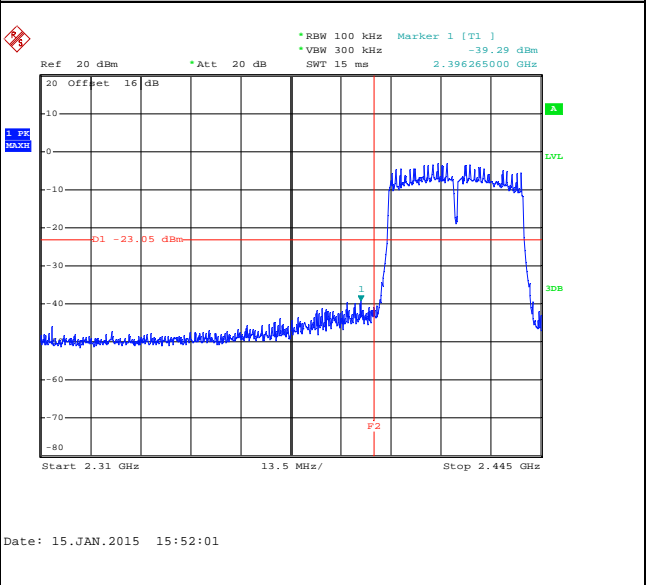
Test Mode :	802.11n HT40	Temperature :	24~25°C
Test Band :	2.4GHz Low	Relative Humidity :	49~51%
Test Channel :	03	Test Engineer :	Issac Song

WLAN 802.11n HT40 Channel 03

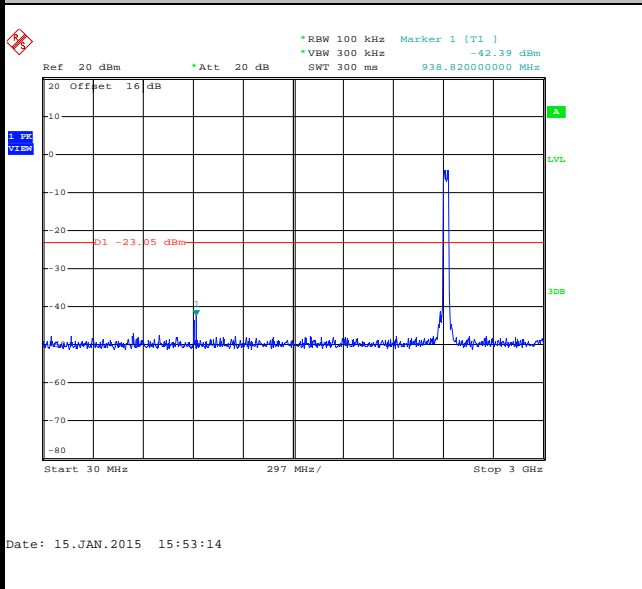
100kHz PSD reference Level



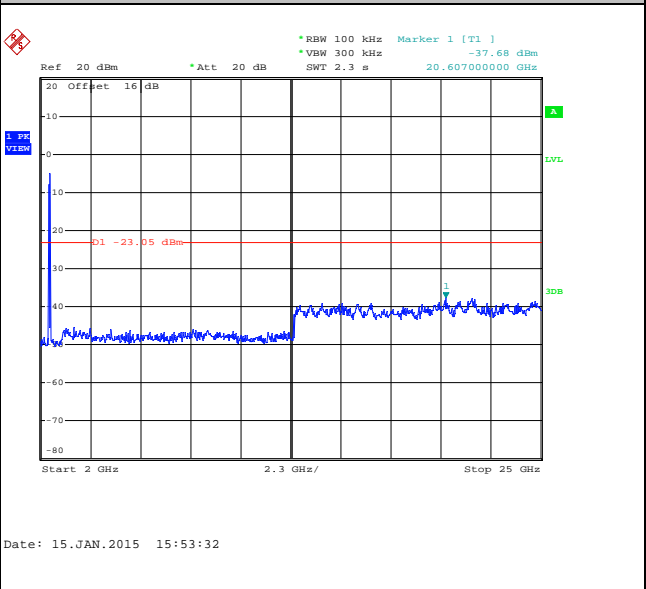
Low Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz

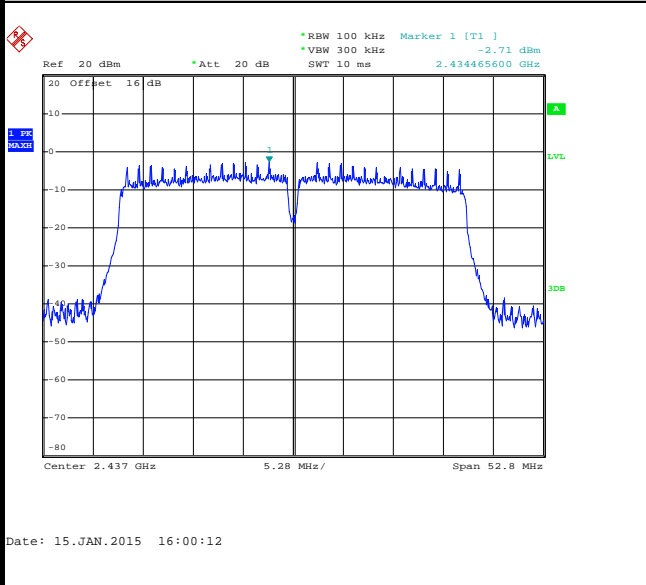




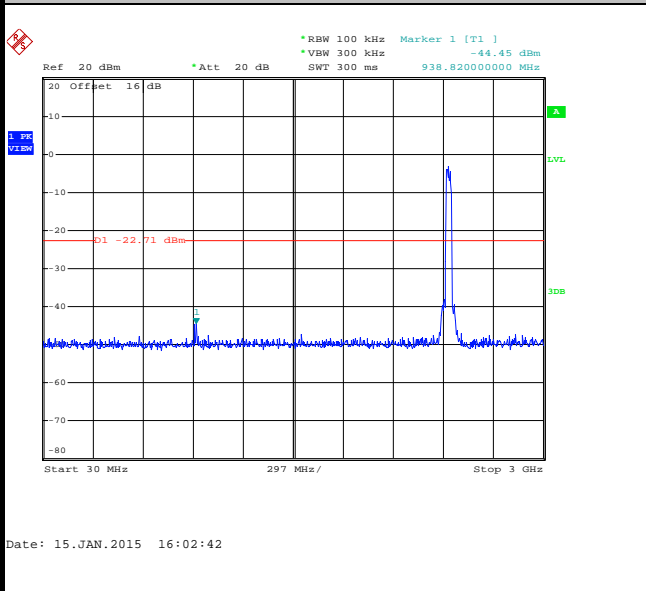
Test Mode :	802.11n HT40	Temperature :	24~25°C
Test Band :	2.4GHz Mid	Relative Humidity :	49~51%
Test Channel :	06	Test Engineer :	Issac Song

WLAN 802.11n HT40 Channel 06

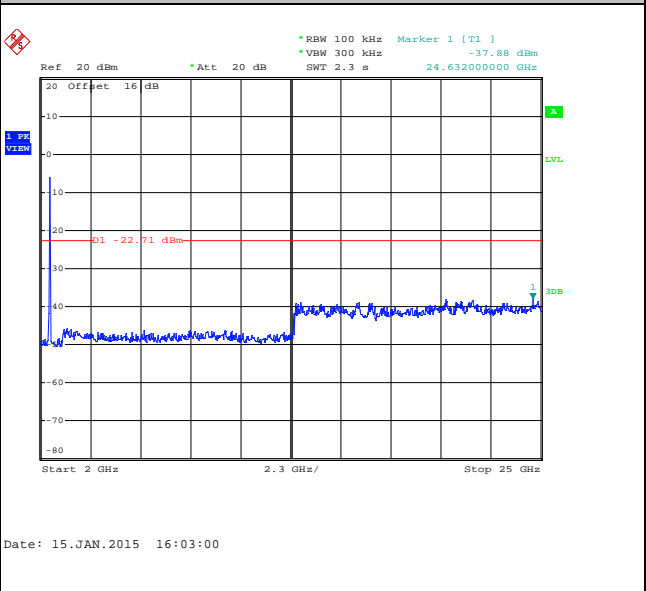
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz



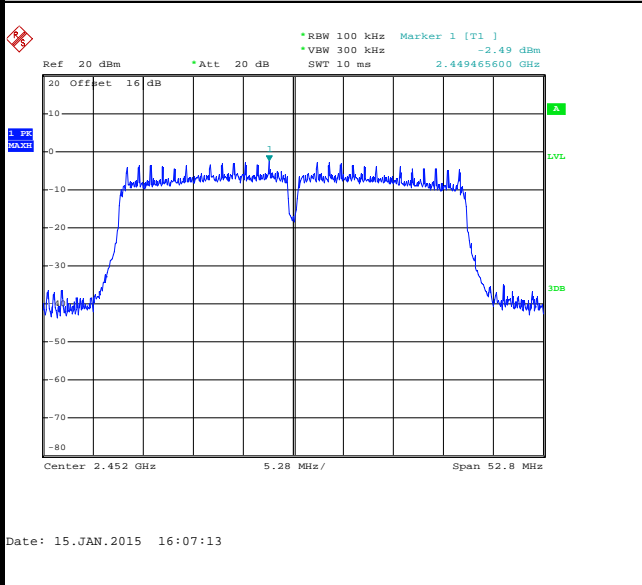




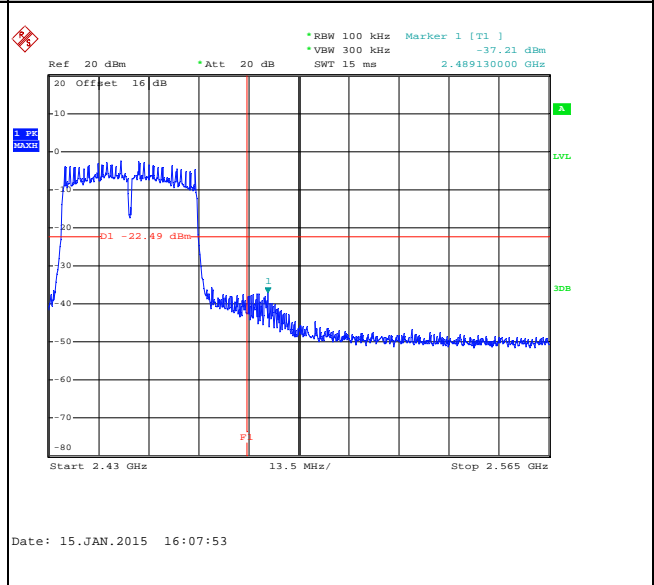
Test Mode :	802.11n HT40	Temperature :	24~25°C
Test Band :	2.4GHz High	Relative Humidity :	49~51%
Test Channel :	09	Test Engineer :	Issac Song

WLAN 802.11n HT40 Channel 09

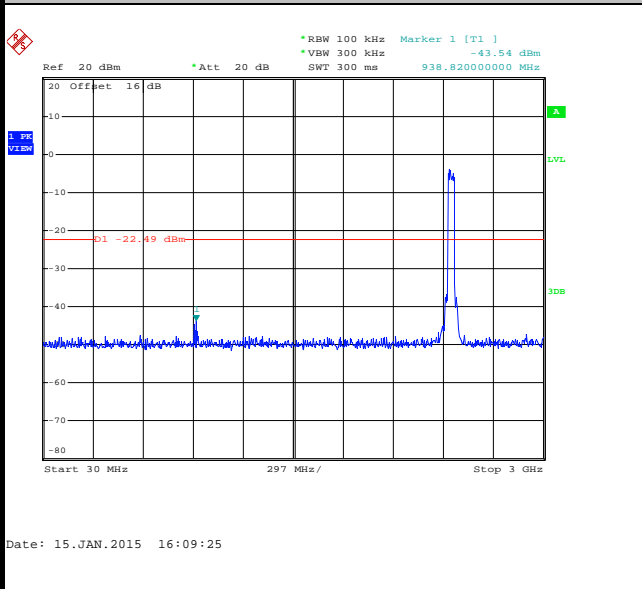
100kHz PSD reference Level



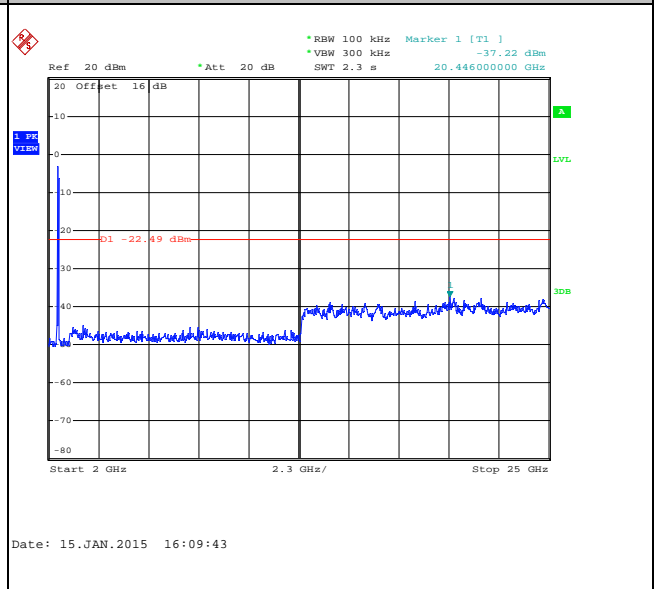
High Channel Plot



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz





### 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.



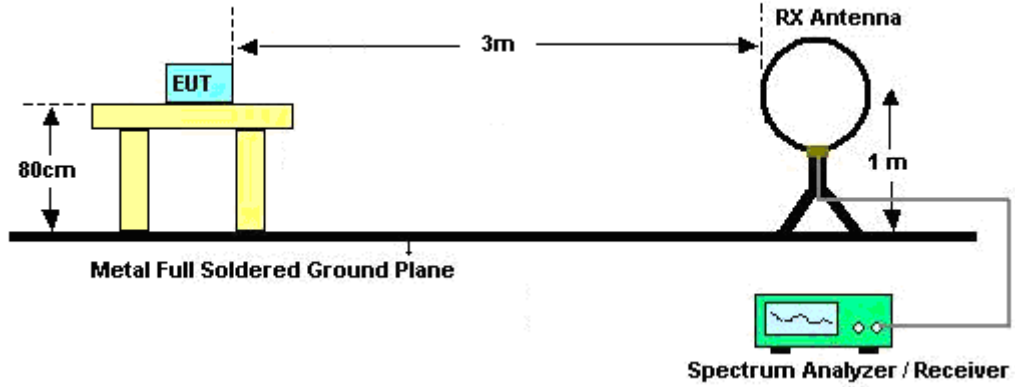
3.5.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
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.

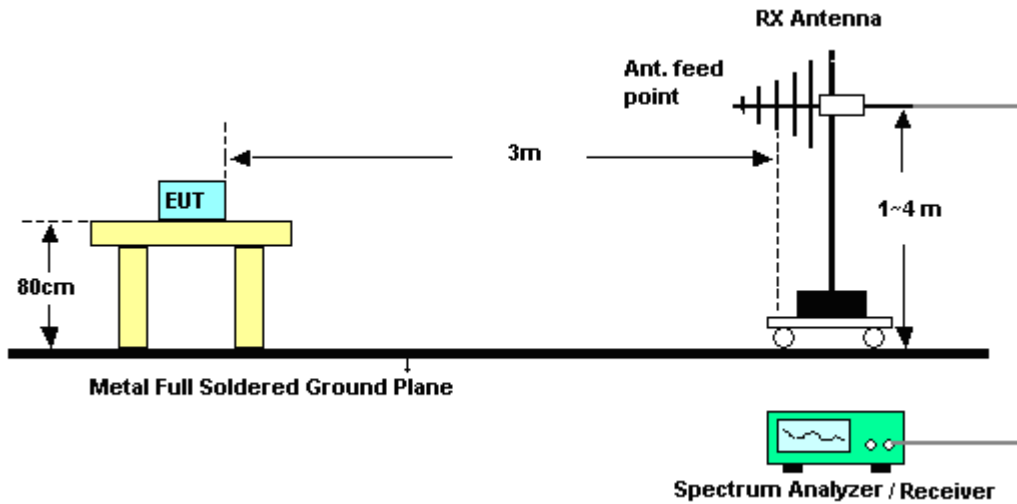
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11b	98.13	-	-	10Hz
802.11g	88.54	1.390	0.719	1kHz
2.4GHz 802.11n HT20	88.30	1.298	0.770	1kHz
2.4GHz 802.11n HT40	79.13	0.652	1.534	3kHz

### 3.5.4 Test Setup

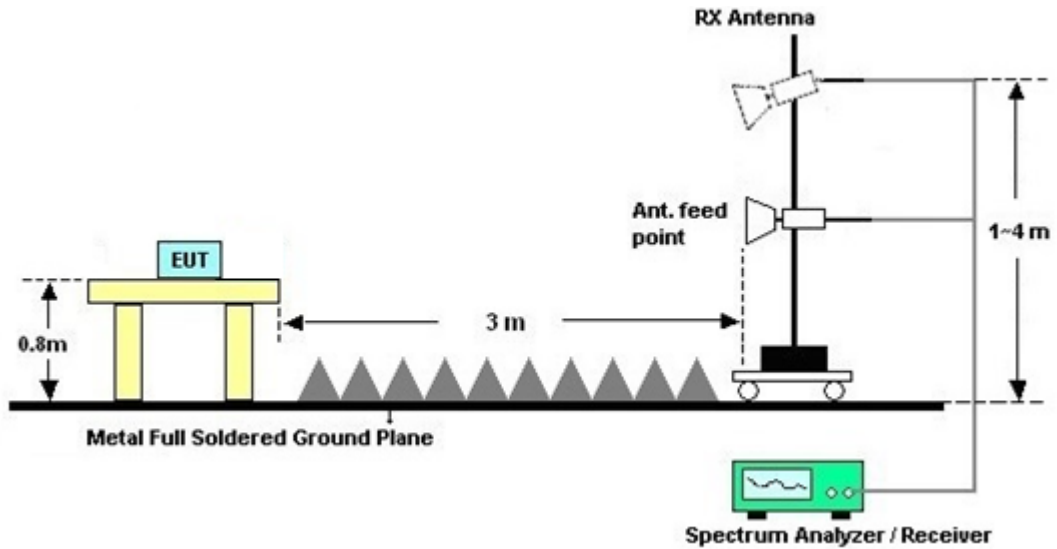
For radiated emissions below 30MHz



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

Please refer to Appendix A.

### 3.5.7 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix A.

## 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 (dB $\mu$ V)	
	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.

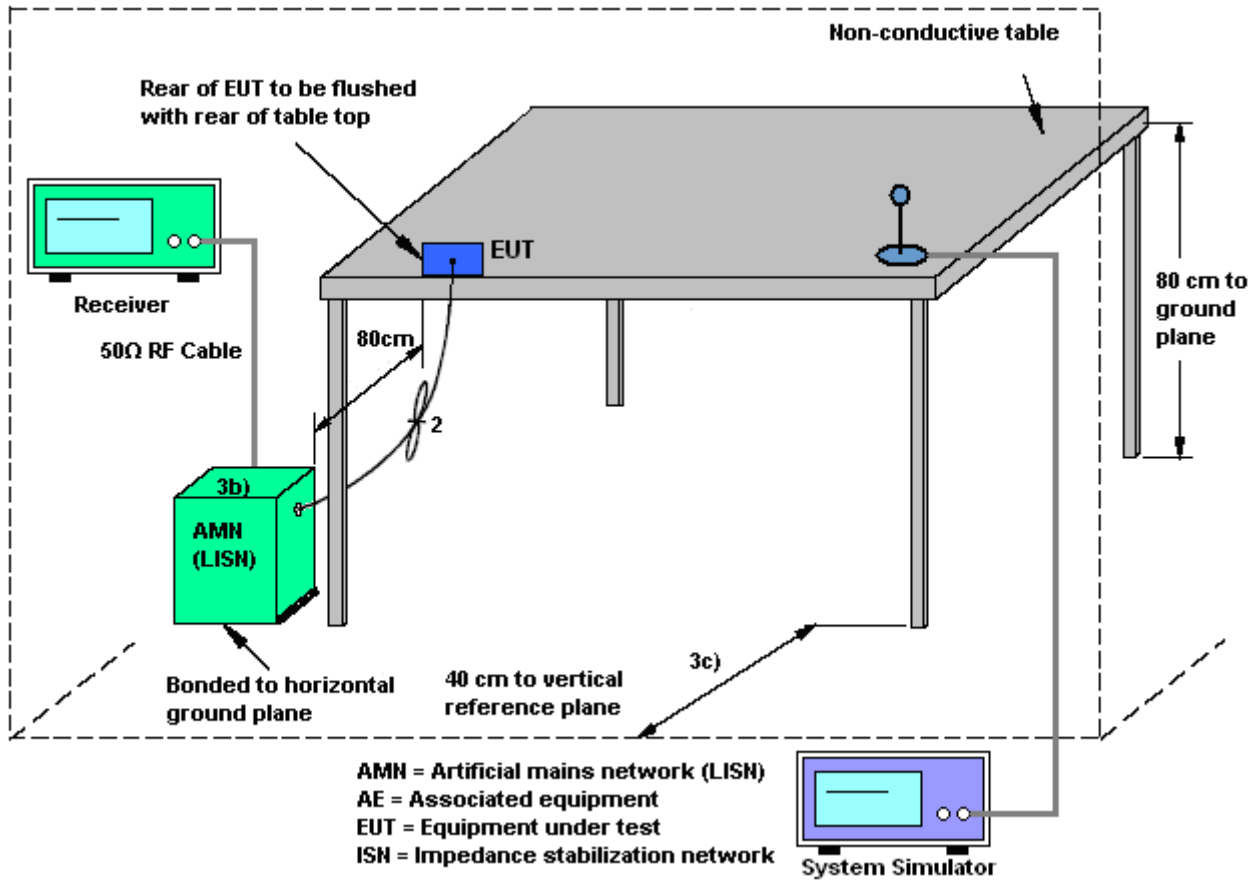
### 3.6.2 Measuring Instruments

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 (IF bandwidth = 9kHz) with Maximum Hold Mode.

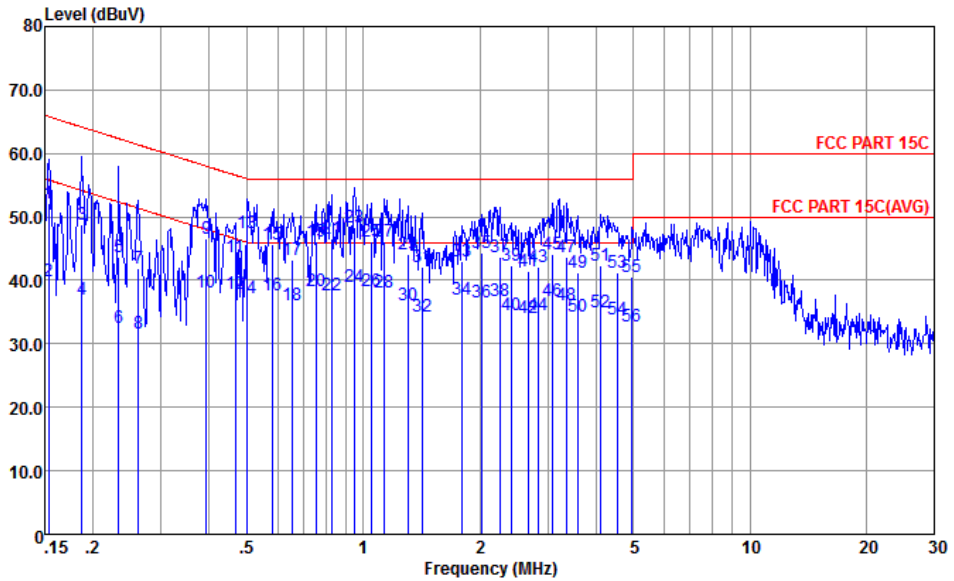
### 3.6.4 Test Setup





3.6.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Eligah Wang	Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 1 + USB Cable 1 (Charging from Adapter 1)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS  
 Condition : FCC PART 15C LISN-L20140306 LINE

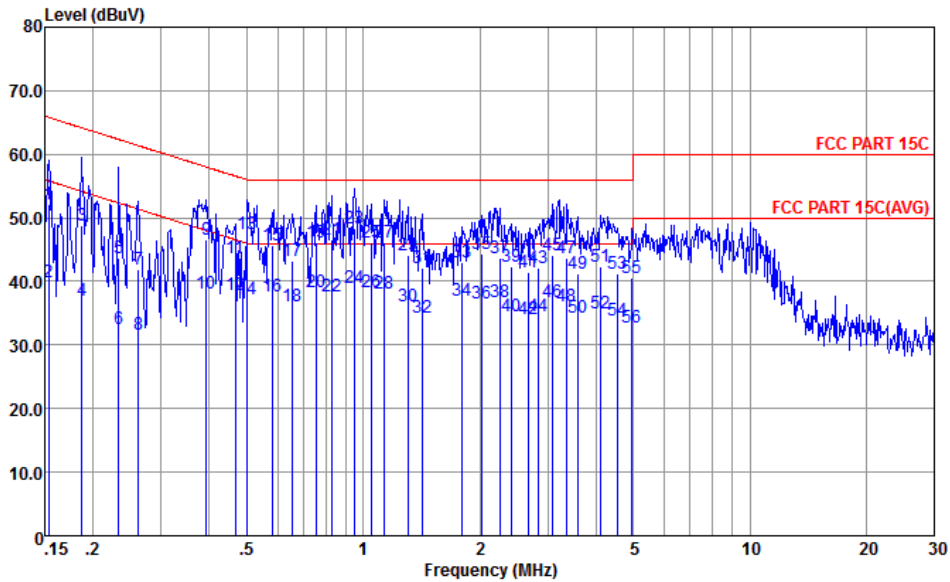
mode : Mode 1

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.15	52.18	-13.64	65.82	39.90	1.90	10.38	QP
2	0.15	39.88	-15.94	55.82	27.60	1.90	10.38	Average
3	0.19	48.84	-15.31	64.15	37.20	1.16	10.48	QP
4	0.19	36.94	-17.21	54.15	25.30	1.16	10.48	Average
5	0.23	43.64	-18.71	62.35	32.20	0.92	10.52	QP
6	0.23	32.54	-19.81	52.35	21.10	0.92	10.52	Average
7	0.26	41.98	-19.40	61.38	30.60	0.84	10.54	QP
8	0.26	31.68	-19.70	51.38	20.30	0.84	10.54	Average
9	0.39	46.55	-11.44	57.99	35.60	0.33	10.62	QP
10	0.39	38.15	-9.84	47.99	27.20	0.33	10.62	Average
11	0.47	43.65	-12.93	56.58	32.80	0.23	10.62	QP
12	0.47	37.95	-8.63	46.58	27.10	0.23	10.62	Average
13	0.50	47.42	-8.58	56.00	36.60	0.20	10.62	QP
14	0.50	37.22	-8.78	46.00	26.40	0.20	10.62	Average
15	0.58	45.63	-10.37	56.00	34.80	0.20	10.63	QP
16	0.58	37.63	-8.37	46.00	26.80	0.20	10.63	Average
17	0.66	43.24	-12.76	56.00	32.40	0.20	10.64	QP
18	0.66	36.14	-9.86	46.00	25.30	0.20	10.64	Average
19	0.75	46.03	-9.97	56.00	35.21	0.18	10.64	QP
20	0.75	38.43	-7.57	46.00	27.61	0.18	10.64	Average
21	0.83	46.60	-9.40	56.00	35.80	0.15	10.65	QP
22	0.83	37.70	-8.30	46.00	26.90	0.15	10.65	Average
23	0.95	48.26	-7.74	56.00	37.50	0.11	10.65	QP
24 *	0.95	39.06	-6.94	46.00	28.30	0.11	10.65	Average
25	1.05	46.05	-9.95	56.00	35.30	0.10	10.65	QP





Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Eligah Wang	Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 1 + USB Cable 1 (Charging from Adapter 1)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



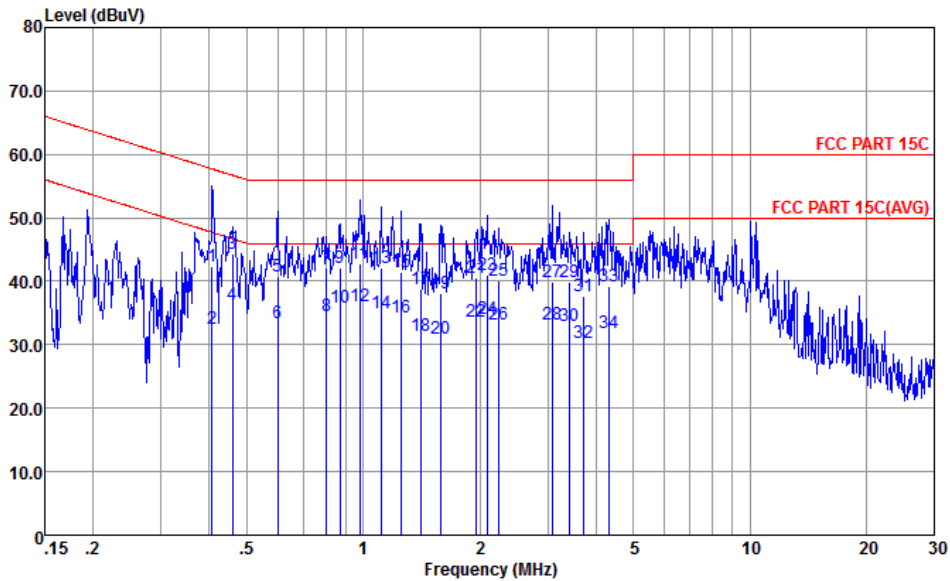
Site : CO01-KS  
 Condition : FCC PART 15C LISN-L20140306 LINE

mode : Mode 1

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
26	1.05	38.35	-7.65	46.00	27.60	0.10	10.65	Average
27	1.14	46.06	-9.94	56.00	35.30	0.10	10.66	QP
28	1.14	38.06	-7.94	46.00	27.30	0.10	10.66	Average
29	1.30	44.06	-11.94	56.00	33.30	0.10	10.66	QP
30	1.30	36.06	-9.94	46.00	25.30	0.10	10.66	Average
31	1.43	42.18	-13.82	56.00	31.40	0.10	10.68	QP
32	1.43	34.28	-11.72	46.00	23.50	0.10	10.68	Average
33	1.80	43.10	-12.90	56.00	32.30	0.10	10.70	QP
34	1.80	37.10	-8.90	46.00	26.30	0.10	10.70	Average
35	2.02	44.40	-11.60	56.00	33.60	0.10	10.70	QP
36	2.02	36.60	-9.40	46.00	25.80	0.10	10.70	Average
37	2.26	43.72	-12.28	56.00	32.90	0.11	10.71	QP
38	2.26	36.72	-9.28	46.00	25.90	0.11	10.71	Average
39	2.41	42.34	-13.66	56.00	31.51	0.11	10.72	QP
40	2.41	34.64	-11.36	46.00	23.81	0.11	10.72	Average
41	2.66	41.47	-14.53	56.00	30.60	0.12	10.75	QP
42	2.66	34.07	-11.93	46.00	23.20	0.12	10.75	Average
43	2.84	42.20	-13.80	56.00	31.30	0.13	10.77	QP
44	2.84	34.50	-11.50	46.00	23.60	0.13	10.77	Average
45	3.07	44.13	-11.87	56.00	33.20	0.14	10.79	QP
46	3.07	36.83	-9.17	46.00	25.90	0.14	10.79	Average
47	3.36	43.57	-12.43	56.00	32.60	0.16	10.81	QP
48	3.36	36.07	-9.93	46.00	25.10	0.16	10.81	Average
49	3.60	41.19	-14.81	56.00	30.20	0.17	10.82	QP
50	3.60	34.29	-11.71	46.00	23.30	0.17	10.82	Average
51	4.11	42.32	-13.68	56.00	31.30	0.19	10.83	QP
52	4.11	34.92	-11.08	46.00	23.90	0.19	10.83	Average
53	4.55	41.33	-14.67	56.00	30.30	0.19	10.84	QP
54	4.55	33.83	-12.17	46.00	22.80	0.19	10.84	Average
55	4.95	40.55	-15.45	56.00	29.50	0.20	10.85	QP
56	4.95	32.65	-13.35	46.00	21.60	0.20	10.85	Average



Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Eligah Wang	Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 1 + USB Cable 1 (Charging from Adapter 1)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



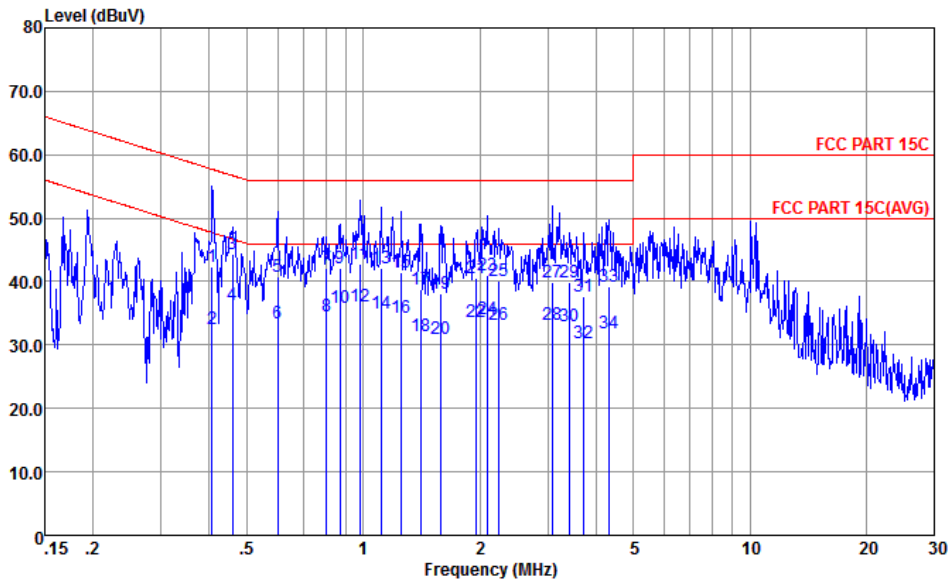
Site : CO01-KS  
 Condition : FCC PART 15C LISN-N20140306 NEUTRAL

mode : Mode 1

Freq	Level	Over	Limit	Read	LISN	Cable	Remark
MHz	dBuV	Limit	Line	Level	Factor	Loss	
		dB	dBuV	dBuV	dB	dB	
1	0.41	42.31	-15.42	57.73	31.30	0.39	10.62 QP
2	0.41	32.61	-15.12	47.73	21.60	0.39	10.62 Average
3	0.46	44.26	-12.45	56.71	33.31	0.33	10.62 QP
4	0.46	36.26	-10.45	46.71	25.31	0.33	10.62 Average
5	0.60	40.67	-15.33	56.00	29.80	0.24	10.63 QP
6	0.60	33.47	-12.53	46.00	22.60	0.24	10.63 Average
7	0.80	42.01	-13.99	56.00	31.19	0.17	10.65 QP
8	0.80	34.51	-11.49	46.00	23.69	0.17	10.65 Average
9	0.87	42.08	-13.92	56.00	31.30	0.13	10.65 QP
10	0.87	35.98	-10.02	46.00	25.20	0.13	10.65 Average
11	0.98	42.75	-13.25	56.00	32.00	0.10	10.65 QP
12 *	0.98	36.05	-9.95	46.00	25.30	0.10	10.65 Average
13	1.11	42.05	-13.95	56.00	31.30	0.10	10.65 QP
14	1.11	35.05	-10.95	46.00	24.30	0.10	10.65 Average
15	1.26	41.46	-14.54	56.00	30.70	0.10	10.66 QP
16	1.26	34.36	-11.64	46.00	23.60	0.10	10.66 Average
17	1.41	38.87	-17.13	56.00	28.10	0.10	10.67 QP
18	1.41	31.37	-14.63	46.00	20.60	0.10	10.67 Average
19	1.59	38.09	-17.91	56.00	27.30	0.10	10.69 QP
20	1.59	30.99	-15.01	46.00	20.20	0.10	10.69 Average
21	1.96	40.60	-15.40	56.00	29.80	0.10	10.70 QP
22	1.96	33.60	-12.40	46.00	22.80	0.10	10.70 Average
23	2.09	41.01	-14.99	56.00	30.21	0.10	10.70 QP
24	2.09	34.11	-11.89	46.00	23.31	0.10	10.70 Average
25	2.25	40.02	-15.98	56.00	29.20	0.11	10.71 QP



Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Eligah Wang	Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN Link + Earphone 1 + USB Cable 1 (Charging from Adapter 1)		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS  
 Condition : FCC PART 15C LISN-N20140306 NEUTRAL

mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
26	2.25	33.12	-12.88	46.00	22.30	0.11	10.71	Average
27	3.07	39.83	-16.17	56.00	28.90	0.14	10.79	QP
28	3.07	33.23	-12.77	46.00	22.30	0.14	10.79	Average
29	3.42	39.88	-16.12	56.00	28.90	0.17	10.81	QP
30	3.42	32.88	-13.12	46.00	21.90	0.17	10.81	Average
31	3.72	37.60	-18.40	56.00	26.60	0.18	10.82	QP
32	3.72	30.30	-15.70	46.00	19.30	0.18	10.82	Average
33	4.31	39.33	-16.67	56.00	28.30	0.19	10.84	QP
34	4.31	31.93	-14.07	46.00	20.90	0.19	10.84	Average



## **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	R&S	FSP40	100319	9kHz~40GHz	Oct. 28, 2014	Dec. 12, 2014~ Jan. 15, 2015	Oct. 27, 2015	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	30MHz~40GHz	Feb. 27, 2014	Dec. 12, 2014~ Jan. 15, 2015	Feb. 26, 2015	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Feb. 27, 2014	Dec. 12, 2014~ Jan. 15, 2015	Feb. 26, 2015	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESCI	100534	9kHz~3GHz	Oct. 25, 2014	Dec. 28, 2014	Oct. 24, 2015	Radiation (03CH01-KS)
Spectrum Analyzer	R&S	FSP30	101399	9kHz~30GHz	May 04, 2014	Dec. 28, 2014	May 03, 2015	Radiation (03CH01-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 13, 2014	Dec. 28, 2014	Nov. 12, 2015	Radiation (03CH01-KS)
Bilog Antenna	SCHAFFNER	CBL6112D	23182	25MHz~2GHz	Jan. 08, 2014	Dec. 28, 2014	Jan. 07, 2015	Radiation (03CH01-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Nov. 08, 2014	Dec. 28, 2014	Nov. 07, 2015	Radiation (03CH01-KS)
Active Horn Antenna	com-power	AHA-118	701030	1GHz~18GHz	Nov. 08, 2014	Dec. 28, 2014	Nov. 07, 2015	Radiation (03CH01-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA1702 49	15GHz~40GHz	Mar. 10, 2014	Dec. 28, 2014	Mar. 09, 2015	Radiation (03CH01-KS)
Amplifier	com-power	PA-103A	161073	1MHz~1GHz	May 04, 2014	Dec. 28, 2014	May 03, 2015	Radiation (03CH01-KS)
Amplifier	Agilent	8449B	3008A023 71	1GHz~26.5GHz	Oct. 28, 2014	Dec. 28, 2014	Oct. 27, 2015	Radiation (03CH01-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Dec. 28, 2014	NCR	Radiation (03CH01-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Dec. 28, 2014	NCR	Radiation (03CH01-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Dec. 28, 2014	NCR	Radiation (03CH01-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	May 04, 2014	Dec. 12, 2014	May 03, 2015	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 25, 2014	Dec. 12, 2014	Oct. 24, 2015	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 25, 2014	Dec. 12, 2014	Oct. 24, 2015	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 25, 2014	Dec. 12, 2014	Oct. 24, 2015	Conduction (CO01-KS)



## 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	2.3
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### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.7
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# Appendix A. Radiated Spurious Emission

15C 2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11b CH 01 2412MHz		2372.46	55.77	-18.23	74	54.48	31.28	6.17	36.16	100	189	P	H
		2376.78	38.94	-15.06	54	37.65	31.28	6.17	36.16	100	189	A	H
		2411.857	106.76	-	-	105.25	31.31	6.22	36.02	100	189	P	H
		2411.69	99.83	-	-	98.32	31.31	6.22	36.02	100	189	A	H
		2363.19	49.58	-24.42	74	48.4	31.26	6.17	36.25	140	348	P	V
		2389.38	37.07	-16.93	54	35.68	31.3	6.17	36.08	140	348	A	V
		2411.857	98	-	-	96.49	31.31	6.22	36.02	140	348	P	V
		2411.356	90.61	-	-	89.1	31.31	6.22	36.02	140	348	A	V
802.11b CH 06 2437MHz		2437.074	105.68	-	-	104.03	31.34	6.22	35.91	135	200	P	H
		2437.408	98.46	-	-	96.81	31.34	6.22	35.91	135	200	A	H
		2436.99	96.21	-	-	94.56	31.34	6.22	35.91	100	187	P	V
		2436.74	89.05	-	-	87.4	31.34	6.22	35.91	100	187	A	V



802.11b CH 11 2462MHz		2461.54	106.21	-	-	104.42	31.36	6.28	35.85	159	315	P	H
		2461.707	98.89	-	-	97.1	31.36	6.28	35.85	159	315	A	H
		2484.44	54.28	-19.72	74	52.37	31.37	6.33	35.79	159	315	P	H
		2483.96	39.22	-14.78	54	37.31	31.37	6.33	35.79	159	315	A	H
		2463.376	103.38	-	-	101.59	31.36	6.28	35.85	171	70	P	V
		2462.208	96.11	-	-	94.32	31.36	6.28	35.85	171	70	A	V
		2487.16	53.16	-20.84	74	51.25	31.37	6.33	35.79	171	70	P	V
		2483.68	38.21	-15.79	54	36.3	31.37	6.33	35.79	171	70	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												





15C 2.4GHz 2400~2483.5MHz
WIFI 802.11b (Harmonic @ 3m)

Table with 14 columns: WIFI, Note, Frequency, Level, Over, Limit, Read, Antenna, Cable, Preamp, Ant, Table, Peak, Pol. It contains test results for channels 01, 06, and 11, and a Remark section at the bottom.



15C 2.4GHz 2400~2483.5MHz
WIFI 802.11g (Band Edge @ 3m)

Table with 14 columns: WIFI, Note, Frequency, Level, Over, Limit, Read, Antenna, Cable, Preamp, Ant, Table, Peak, Pol. It contains test data for 802.11g CH 01 (2412MHz) and CH 06 (2437MHz).



802.11g CH 11 2462MHz		2459.285	103.35	-	-	101.56	31.36	6.28	35.85	112	166	P	H
		2460.955	92.99	-	-	91.2	31.36	6.28	35.85	112	166	A	H
		2484.56	66.27	-7.73	74	64.36	31.37	6.33	35.79	112	166	P	H
		2483.52	42.51	-11.49	54	40.6	31.37	6.33	35.79	112	166	A	H
		2462.542	105.21	-	-	103.42	31.36	6.28	35.85	100	139	P	V
		2460.872	94.92	-	-	93.13	31.36	6.28	35.85	100	139	A	V
		2483.76	68.54	-5.46	74	66.63	31.37	6.33	35.79	100	139	P	V
		2484.04	42.95	-11.05	54	41.04	31.37	6.33	35.79	100	139	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11g CH 01 2412MHz		4824	44.39	-29.61	74	37.42	34.89	8.73	36.65	100	0	P	H
		4824	45.32	-28.68	74	38.35	34.89	8.73	36.65	100	120	P	V
802.11g CH 06 2437MHz		4875	44.99	-29.01	74	38.15	34.92	8.76	36.84	123	64	P	H
		7311	45.72	-28.28	74	38.18	35.56	10.84	38.86	100	30	P	H
		4875	45.11	-28.89	74	38.27	34.92	8.76	36.84	142	0	P	V
		7311	44.25	-29.75	74	36.71	35.56	10.84	38.86	100	0	P	V
802.11g CH 11 2462MHz		4923	45.17	-28.83	74	38.46	34.95	8.79	37.03	125	168	P	H
		7386	44.89	-29.11	74	37.61	35.58	10.89	39.19	148	52	P	H
		4923	43.4	-30.6	74	36.69	34.95	8.79	37.03	100	79	P	V
		7386	43.93	-30.07	74	36.65	35.58	10.89	39.19	106	31	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C 2.4GHz 2400~2483.5MHz
WIFI 802.11n HT20 (Band Edge @ 3m)

Table with 14 columns: WIFI, Note, Frequency, Level, Over, Limit, Read, Antenna, Cable, Preamp, Ant, Table, Peak, Pol. It contains test data for 802.11n HT20 channels 01 and 06.



<b>802.11n</b> <b>HT20</b> <b>CH 11</b> <b>2462MHz</b>		2466.55	103.64	-	-	101.85	31.36	6.28	35.85	165	191	P	H
		2463.376	92.6	-	-	90.81	31.36	6.28	35.85	165	191	A	H
		2486.12	67.37	-6.63	74	65.46	31.37	6.33	35.79	165	191	P	H
		2483.52	44.19	-9.81	54	42.28	31.37	6.33	35.79	165	191	A	H
		2464.462	98.49	-	-	96.7	31.36	6.28	35.85	100	66	P	V
		2468.887	87.68	-	-	85.89	31.36	6.28	35.85	100	66	A	V
		2484.12	59.55	-14.45	74	57.64	31.37	6.33	35.79	100	66	P	V
	2483.52	39.12	-14.88	54	37.21	31.37	6.33	35.79	100	66	A	V	

Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



**15C 2.4GHz 2400~2483.5MHz**  
**WIFI 802.11n HT20 (Harmonic @ 3m)**

WIFI Ant.	Note	Frequency ( MHz )	Level ( dBμV/m )	Over Limit ( dB )	Limit Line ( dBμV/m )	Read Level ( dBμV )	Antenna Factor ( dB/m )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Peak Avg. ( P/A )	Pol. ( H/V )
802.11n HT20 CH 01		4824	45.98	-28.02	74	39.01	34.89	8.73	36.65	121	256	P	H
2412MHz		4824	45.97	-28.03	74	39	34.89	8.73	36.65	124	89	P	V
802.11n HT20 CH 06		4875	45.68	-28.32	74	38.84	34.92	8.76	36.84	105	236	P	H
2437MHz		7311	45.57	-28.43	74	38.03	35.56	10.84	38.86	121	56	P	H
		4875	44.32	-29.68	74	37.48	34.92	8.76	36.84	108	234	P	V
802.11n HT20 CH 11		7311	45.72	-28.28	74	38.18	35.56	10.84	38.86	120	78	P	V
		4923	45.38	-28.62	74	38.67	34.95	8.79	37.03	120	256	P	H
2462MHz		7386	47.15	-26.85	74	39.87	35.58	10.89	39.19	124	235	P	H
		4923	47.31	-26.69	74	40.6	34.95	8.79	37.03	129	320	P	V
		7386	46.05	-27.95	74	38.77	35.58	10.89	39.19	178	210	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**15C 2.4GHz 2400~2483.5MHz  
WIFI 802.11n HT40 (Band Edge @ 3m)**

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11n HT40 CH 03 2422MHz	!	2388.66	69.62	-4.38	74	68.23	31.3	6.17	36.08	100	330	P	H
		2389.74	46.88	-7.12	54	45.49	31.3	6.17	36.08	100	330	A	H
	*	2416.449	98.99	-	-	97.48	31.31	6.22	36.02	100	330	P	H
	*	2415.781	88.11	-	-	86.6	31.31	6.22	36.02	100	330	A	H
		2484.96	56.73	-17.27	74	54.82	31.37	6.33	35.79	100	330	P	H
		2483.56	38.92	-15.08	54	37.01	31.37	6.33	35.79	100	330	A	H
		2388.21	69.03	-4.97	74	67.64	31.3	6.17	36.08	152	278	P	V
		2389.2	46.16	-7.84	54	44.77	31.3	6.17	36.08	152	278	A	V
	*	2415.948	98.89	-	-	97.38	31.31	6.22	36.02	152	278	P	V
	*	2420.124	88.59	-	-	87	31.33	6.22	35.96	152	278	A	V
		2489.52	57.78	-16.22	74	55.8	31.39	6.33	35.74	152	278	P	V
		2488.96	38.9	-15.1	54	36.92	31.39	6.33	35.74	152	278	A	V
802.11n HT40 CH 06 2437MHz		2375.7	60.09	-13.91	74	58.8	31.28	6.17	36.16	100	325	P	H
		2388.75	41.36	-12.64	54	39.97	31.3	6.17	36.08	100	325	A	H
	*	2440.331	99.91	-	-	98.2	31.34	6.28	35.91	100	325	P	H
	*	2434.152	89.15	-	-	87.56	31.33	6.22	35.96	100	325	A	H
		2484.8	62.08	-11.92	74	60.17	31.37	6.33	35.79	100	325	P	H
		2485.56	40.35	-13.65	54	38.44	31.37	6.33	35.79	100	325	A	H
		2379.03	60.58	-13.42	74	59.29	31.28	6.17	36.16	191	275	P	V
		2389.47	41.16	-12.84	54	39.77	31.3	6.17	36.08	191	275	A	V
	*	2443.002	99.76	-	-	98.05	31.34	6.28	35.91	191	275	P	V
	*	2442.919	89.26	-	-	87.55	31.34	6.28	35.91	191	275	A	V
		2484.32	61.58	-12.42	74	59.67	31.37	6.33	35.79	191	275	P	V
		2483.68	39.89	-14.11	54	37.98	31.37	6.33	35.79	191	275	A	V





<b>802.11n</b>  <b>HT40</b>  <b>CH 09</b>  <b>2452MHz</b>		2385.06	54.66	-19.34	74	53.37	31.28	6.17	36.16	100	186	P	H
		2389.56	38.38	-15.62	54	36.99	31.3	6.17	36.08	100	186	A	H
	*	2444.506	98.74	-	-	97.03	31.34	6.28	35.91	100	186	P	H
	*	2445.925	88.56	-	-	86.85	31.34	6.28	35.91	100	186	A	H
		2485.52	66.59	-7.41	74	64.68	31.37	6.33	35.79	100	186	P	H
		2485.84	41.87	-12.13	54	39.96	31.37	6.33	35.79	100	186	A	H
		2383.35	57.3	-16.7	74	56.01	31.28	6.17	36.16	183	271	P	V
		2382.45	39.19	-14.81	54	37.9	31.28	6.17	36.16	183	271	A	V
	*	2453.273	99.28	-	-	97.57	31.34	6.28	35.91	183	271	P	V
	*	2450.267	88.74	-	-	87.03	31.34	6.28	35.91	183	271	A	V
		2487.4	68.68	-5.32	74	66.77	31.37	6.33	35.79	183	271	P	V
		2488.84	42.95	-11.05	54	40.97	31.39	6.33	35.74	183	271	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



**15C 2.4GHz 2400~2483.5MHz**  
**WIFI 802.11n HT40 (Harmonic @ 3m)**

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11n		4845	44.93	-29.07	74	38.02	34.9	8.73	36.72	100	0	P	H
HT40		7266	44.97	-29.03	74	37.33	35.56	10.81	38.73	100	36	P	H
CH 03		4845	46.27	-27.73	74	39.36	34.9	8.73	36.72	100	63	P	V
2422MHz		7266	44.9	-29.1	74	37.26	35.56	10.81	38.73	100	25	P	V
802.11n		4875	44.73	-29.27	74	37.89	34.92	8.76	36.84	100	300	P	H
HT40		7311	46.45	-27.55	74	38.91	35.56	10.84	38.86	100	68	P	H
CH 06		4875	44.33	-29.67	74	37.49	34.92	8.76	36.84	100	45	P	V
2437MHz		7311	45.53	-28.47	74	37.99	35.56	10.84	38.86	100	97	P	V
802.11n		4905	43.56	-30.44	74	36.79	34.94	8.79	36.96	100	26	P	H
HT40		7356	46.2	-27.8	74	38.83	35.57	10.86	39.06	100	16	P	H
CH 09		4905	45.04	-28.96	74	38.27	34.94	8.79	36.96	100	30	P	V
2452MHz		7356	45.71	-28.29	74	38.34	35.57	10.86	39.06	100	211	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



15C Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz 802.11b LF		30	21.15	-18.85	40	33.82	19.2	0.79	32.66			P	H
		51.34	22.58	-17.42	40	45.96	8.44	0.79	32.61			P	H
		74.62	23.43	-16.57	40	46.43	8.61	1.04	32.65			P	H
		110.51	28.73	-14.77	43.5	48.76	11.38	1.23	32.64	157	318	P	H
		153.19	22.26	-21.24	43.5	41.79	11.59	1.44	32.56			P	H
		224	26.29	-19.71	46	46.26	10.91	1.61	32.49			P	H
		30	32.84	-7.16	40	45.51	19.2	0.79	32.66	118	249	P	V
		51.34	32.18	-7.82	40	55.56	8.44	0.79	32.61			P	V
		70.74	26.02	-13.98	40	49.35	8.28	1.04	32.65			P	V
		109.54	28.35	-15.15	43.5	48.38	11.38	1.23	32.64			P	V
		225.94	31.67	-14.33	46	51.56	10.99	1.61	32.49			P	V
		837.04	35.29	-10.71	46	42.98	20.82	3.36	31.87			P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



15C Emission below 1GHz

2.4GHz WIFI 802.11g (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz 802.11g LF		50.37	22.63	-17.37	40	45.76	8.7	0.79	32.62			P	H
		75.59	23.11	-16.89	40	46.03	8.69	1.04	32.65			P	H
		109.54	28.1	-15.4	43.5	48.13	11.38	1.23	32.64	159	318	P	H
		154.16	21.63	-21.87	43.5	41.2	11.55	1.44	32.56			P	H
		227.88	27.03	-18.97	46	46.69	11.08	1.75	32.49			P	H
		898.15	26.55	-19.45	46	32.13	22.63	3.5	31.71			P	H
		30	31.76	-8.24	40	44.43	19.2	0.79	32.66			P	V
		51.34	32.37	-7.63	40	55.75	8.44	0.79	32.61	113	345	P	V
		71.71	31.7	-8.3	40	54.95	8.36	1.04	32.65			P	V
		109.54	28.43	-15.07	43.5	48.46	11.38	1.23	32.64			P	V
		156.1	20.84	-22.66	43.5	40.48	11.48	1.44	32.56			P	V
		225.94	29.43	-16.57	46	49.32	10.99	1.61	32.49			P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



15C Emission below 1GHz

2.4GHz WIFI 802.11n HT20 (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz 802.11n HT20 LF		41.64	21.79	-18.21	40	40.34	13.28	0.79	32.62			P	H
		50.37	22.78	-17.22	40	45.91	8.7	0.79	32.62			P	H
		73.65	21.17	-18.83	40	44.25	8.53	1.04	32.65			P	H
		109.54	26.99	-16.51	43.5	47.02	11.38	1.23	32.64	187	138	P	H
		154.16	22.36	-21.14	43.5	41.93	11.55	1.44	32.56			P	H
		217.21	25.72	-20.28	46	46	10.6	1.61	32.49			P	H
		30	31.47	-8.53	40	44.14	19.2	0.79	32.66			P	V
		50.37	32.28	-7.72	40	55.41	8.7	0.79	32.62	118	257	P	V
		68.8	26.15	-13.85	40	50.01	7.99	0.79	32.64			P	V
		109.54	25.48	-18.02	43.5	45.51	11.38	1.23	32.64			P	V
		155.13	20.25	-23.25	43.5	39.86	11.51	1.44	32.56			P	V
	225.94	26.56	-19.44	46	46.45	10.99	1.61	32.49			P	V	
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



15C Emission below 1GHz

2.4GHz WIFI 802.11n HT40 (LF)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz 802.11n HT40 LF		30	19.52	-20.48	40	32.19	19.2	0.79	32.66	100	213	P	H
		59.1	11.46	-28.54	40	36.91	6.36	0.79	32.6			P	H
		100.81	13.26	-30.24	43.5	33.54	11.31	1.04	32.63			P	H
		128.94	11.98	-31.52	43.5	31.83	11.53	1.23	32.61			P	H
		151.25	12.52	-30.98	43.5	31.98	11.66	1.44	32.56			P	H
		232.73	19.55	-26.45	46	38.99	11.3	1.75	32.49			P	H
		30	28.45	-11.55	40	41.12	19.2	0.79	32.66	100	0	P	V
		47.46	18.71	-21.29	40	40.33	10.23	0.79	32.64			P	V
		59.1	18.96	-21.04	40	44.41	6.36	0.79	32.6			P	V
		100.81	19.52	-23.98	43.5	39.8	11.31	1.04	32.63			P	V
		225.94	18.23	-27.77	46	38.12	10.99	1.61	32.49			P	V
		939.86	29.65	-16.35	46	35.9	21.82	3.68	31.75			P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

*	<b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency per 15.209(c).
!	Test result is <b>over limit</b> line.
P/A	<b>Peak</b> or <b>Average</b>
H/V	<b>Horizontal</b> or <b>Vertical</b>



A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01													
2412MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

- Level(dBμV/m) =  
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- Level(dBμV/m)  
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)  
= 55.45 (dBμV/m)
- Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

For Average Limit @ 2390MHz:

- Level(dBμV/m)  
= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)  
= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)  
= 43.54 (dBμV/m)
- Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.