



# FCC RF Test Report

**APPLICANT** : Lenovo(Shanghai) Electronics Technology Co., Ltd.  
**EQUIPMENT** : Notebook Computer  
**BRAND NAME** : Lenovo  
**MODEL NAME** : Lenovo YB-J912L  
**FCC ID** : O57YBJ912L  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

The product were integrated the WWAN module (Brand Name: Fibocom, Model Name: L850-GL, FCC ID: ZMOL850GL) and the BT/WLAN module (Brand Name: Intel®, Model Name: 8265D2W, FCC ID: PD98265D2) during the test.

The product was received on Jan. 03, 2018 and testing was completed on Mar. 28, 2018. 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.



Approved by: James Huang / Manager

**Sporton International (Kunshan) Inc.**

**No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335  
China**



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## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR810315C	Rev. 01	Initial issue of report	Mar. 30, 2018



### SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	1
-	-	99% Bandwidth	-	Pass	1
3.1	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
-	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	1
-	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	1
		Conducted Spurious Emission		Pass	1
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 1.1 dB at 2484.34 MHz
3.3	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 10.21 dB at 0.212 MHz
3.4	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass	-
<p><b>Remark 1:</b> All conducted test items were leverage from module RF report which can refer to Report No. "160321-02.TR04".</p>					



# 1 General Description

## 1.1 Applicant

Lenovo(Shanghai) Electronics Technology Co., Ltd.  
NO.68 BUILDING, 199 FENJU RD, Pilot Free Trade Zone, 200131, China

## 1.2 Manufacturer

Lenovo PC HK Limited  
23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay, Hong Kong

## 1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Notebook Computer
Brand Name	Lenovo
Model Name	Lenovo YB-J912L
FCC ID	O57YBJ912L
EUT supports Radios application	WCDMA/HSPA/HSPA+ (16QAM uplink is not supported)/DC-HSDPA/LTE WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth v3.0+EDR/ Bluetooth v4.0 LE/ Bluetooth v4.1 LE/ Bluetooth v4.2 LE
HW Version	Lenovo YB-J912L
SW Version	Windows 10
EUT Stage	Identical Prototype

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



### 1.4 Product Specification of Equipment Under Test

Standards-related Product Specification										
<b>Tx/Rx Channel Frequency Range</b>	2412 MHz ~ 2472 MHz									
<b>Maximum (Peak) Output Power to antenna</b>	<b>&lt;Ant. 2&gt;</b> 802.11b : 16.47 dBm (0.0444 W) 802.11g : 19.27 dBm (0.0845 W) <b>MIMO&lt;Ant. 1+2&gt;</b> 802.11n HT20 : 22.36 dBm (0.1722 W) 802.11n HT40 : 21.41 dBm (0.1384 W)									
<b>Antenna Type / Gain</b>	<b>For PC Mode:</b> Ant. 1: PIFA Antenna with gain 2.10 dBi Ant. 2: PIFA Antenna with gain 3.60 dBi <b>For Pad Mode:</b> Ant. 1: PIFA Antenna with gain -0.70 dBi Ant. 2: PIFA Antenna with gain -0.40 dBi									
<b>Type of Modulation</b>	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)									
<b>Antenna Function for Transmitter</b>	<table border="1"> <thead> <tr> <th></th> <th>Ant. 1</th> <th>Ant. 2</th> </tr> </thead> <tbody> <tr> <td>802.11 b/g/n</td> <td>V</td> <td>V</td> </tr> <tr> <td>802.11 n MIMO</td> <td>V</td> <td>V</td> </tr> </tbody> </table>		Ant. 1	Ant. 2	802.11 b/g/n	V	V	802.11 n MIMO	V	V
	Ant. 1	Ant. 2								
802.11 b/g/n	V	V								
802.11 n MIMO	V	V								

### 1.5 Modification of EUT

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



### 1.6 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No is CN5013.

<b>Test Site</b>	Sporton International (Kunshan) Inc.			
<b>Test Site Location</b>	No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL : +86-512-57900158 FAX : +86-512-57900958			
<b>Test Site No.</b>	<b>Sporton Site No.</b>			<b>FCC Test Firm Registration No.</b>
	TH01-KS	CO01-KS	03CH03-KS	630927

**Note:** The test site complies with ANSI C63.4 2014 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 v04
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ♦ ANSI C63.10-2013

**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

- a. 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: conduction emission (150 kHz to 30 MHz), radiation 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 were recorded in this report.
  
- b. AC power line Conducted Emission was tested under maximum output power.

### 2.1 Carrier Frequency and 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	12	2467
	-	-	13	2472





## 2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

For 802.11b/g SISO mode, we only test Antenna 2 for RSE by referring to the higher conducted power.

For 802.11n HT20/HT40 mode, we only test MIMO mode for RSE by referring to the higher conducted power.

### Single Antenna

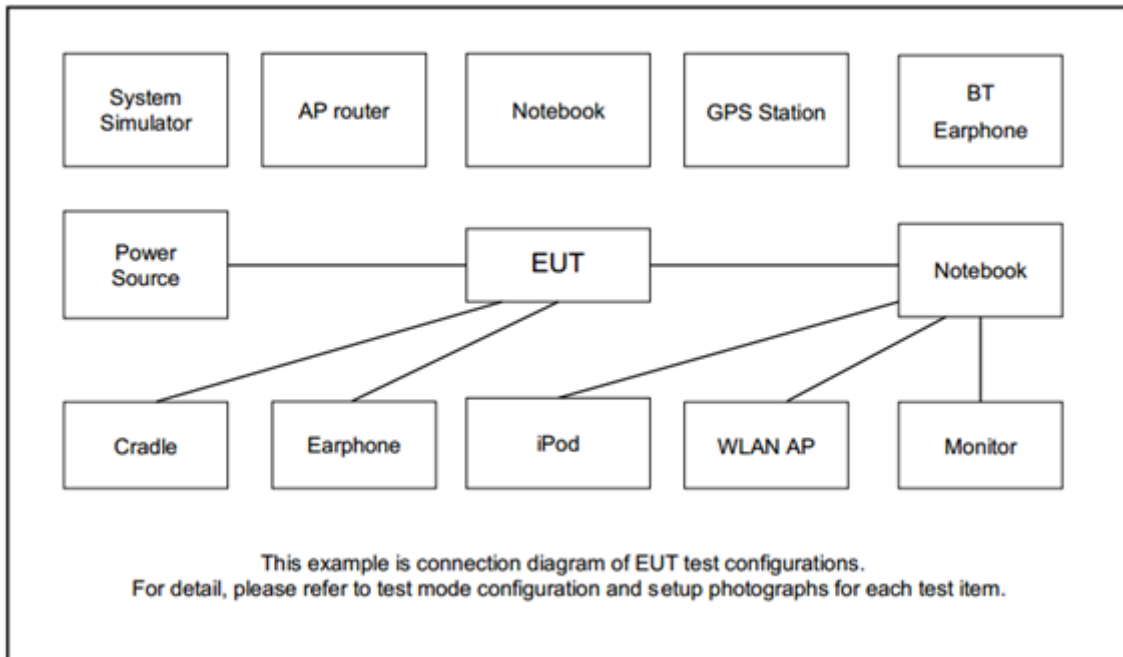
Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps

### MIMO Antenna

Modulation	Data Rate
802.11n HT20	MCS0
802.11n HT40	MCS0

Test Cases	
AC Conducted Emission	Mode 1 :Bluetooth Link + WLAN Link(2.4G) + Adaptor 1 with Type C cable 1 + Type C port 2 + USB Link with U-Disk from Type C port 2 + Play H Plane

## 2.3 Connection Diagram of Test System



## 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
2.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
3.	SD Card	Kingston	SDC4/4GB	N/A	N/A	N/A
4.	U Disk	SanDisk	SDCZ51-004G	N/A	N/A	N/A

## 2.5 EUT Operation Test Setup

For WLAN RF test items, an 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.

### 3 Test Result

#### 3.1 Output Power Measurement

##### 3.1.1 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.

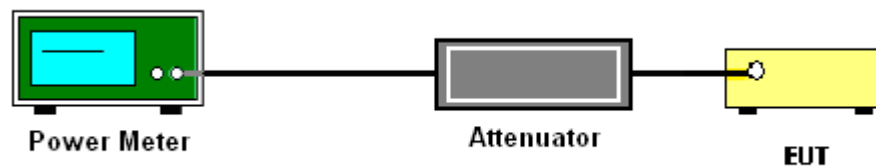
##### 3.1.2 Measuring Instruments

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

##### 3.1.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak power meter method.
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.

##### 3.1.4 Test Setup





3.1.5 Test Result of Peak Output Power

2.4GHz Band																
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11b	1Mbps	1	1	2412	16.45	16.47		30.00	30.00	2.10	3.60	18.55	20.07	36.00	36.00	Pass
11b	1Mbps	1	6	2437	16.28	16.37		30.00	30.00	2.10	3.60	18.38	19.97	36.00	36.00	Pass
11b	1Mbps	1	11	2462	16.22	16.43		30.00	30.00	2.10	3.60	18.32	20.03	36.00	36.00	Pass
11b	1Mbps	1	12	2467	16.31	16.13		30.00	30.00	2.10	3.60	18.41	19.73	36.00	36.00	Pass
11b	1Mbps	1	13	2472	10.77	11.02		30.00	30.00	2.10	3.60	12.87	14.62	36.00	36.00	Pass
11g	6Mbps	1	1	2412	19.25	19.27		30.00	30.00	2.10	3.60	21.35	22.87	36.00	36.00	Pass
11g	6Mbps	1	6	2437	19.04	19.14		30.00	30.00	2.10	3.60	21.14	22.74	36.00	36.00	Pass
11g	6Mbps	1	11	2462	19.09	19.11		30.00	30.00	2.10	3.60	21.19	22.71	36.00	36.00	Pass
11g	6Mbps	1	12	2467	17.00	15.74		30.00	30.00	2.10	3.60	19.10	19.34	36.00	36.00	Pass
11g	6Mbps	1	13	2472	3.22	3.04		30.00	30.00	2.10	3.60	5.32	6.64	36.00	36.00	Pass
HT20	MCS0	1	1	2412	19.32	19.46		30.00	30.00	2.10	3.60	21.42	23.06	36.00	36.00	Pass
HT20	MCS0	1	6	2437	19.17	19.17		30.00	30.00	2.10	3.60	21.27	22.77	36.00	36.00	Pass
HT20	MCS0	1	11	2462	19.38	19.34		30.00	30.00	2.10	3.60	21.48	22.94	36.00	36.00	Pass
HT20	MCS0	1	12	2467	16.45	16.29		30.00	30.00	2.10	3.60	18.55	19.89	36.00	36.00	Pass
HT20	MCS0	1	13	2472	3.40	3.05		30.00	30.00	2.10	3.60	5.50	6.65	36.00	36.00	Pass
HT40	MCS0	1	3	2422	18.42	18.53		30.00	30.00	2.10	3.60	20.52	22.13	36.00	36.00	Pass
HT40	MCS0	1	6	2437	18.18	18.16		30.00	30.00	2.10	3.60	20.28	21.76	36.00	36.00	Pass
HT40	MCS0	1	9	2452	18.35	18.36		30.00	30.00	2.10	3.60	20.45	21.96	36.00	36.00	Pass
HT40	MCS0	1	10	2457	17.17	17.85		30.00	30.00	2.10	3.60	19.27	21.45	36.00	36.00	Pass
HT40	MCS0	1	11	2462	1.99	2.18		30.00	30.00	2.10	3.60	4.09	5.78	36.00	36.00	Pass
HT20	MCS0	2	1	2412	19.28	19.42	22.36	30.00	30.00	3.60	3.60	25.96	25.96	36.00	36.00	Pass
HT20	MCS0	2	6	2437	19.21	19.25	22.24	30.00	30.00	3.60	3.60	25.84	25.84	36.00	36.00	Pass
HT20	MCS0	2	11	2462	19.15	19.27	22.22	30.00	30.00	3.60	3.60	25.82	25.82	36.00	36.00	Pass
HT20	MCS0	2	12	2467	16.52	15.95	19.25	30.00	30.00	3.60	3.60	22.85	22.85	36.00	36.00	Pass
HT20	MCS0	2	13	2472	-0.61	-0.22	2.60	30.00	30.00	3.60	3.60	6.20	6.20	36.00	36.00	Pass



HT40	MCS0	2	3	2422	18.36	18.43	21.41	30.00	3.60	25.01	36.00	Pass
HT40	MCS0	2	6	2437	18.39	18.38	21.40	30.00	3.60	25.00	36.00	Pass
HT40	MCS0	2	9	2452	18.33	18.28	21.32	30.00	3.60	24.92	36.00	Pass
HT40	MCS0	2	10	2457	15.13	15.54	18.35	30.00	3.60	21.95	36.00	Pass
HT40	MCS0	2	11	2462	-0.42	-0.36	2.62	30.00	3.60	6.22	36.00	Pass



### 3.2 Radiated Band Edges and Spurious Emission Measurement

#### 3.2.1 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 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

#### 3.2.2 Measuring Instruments

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

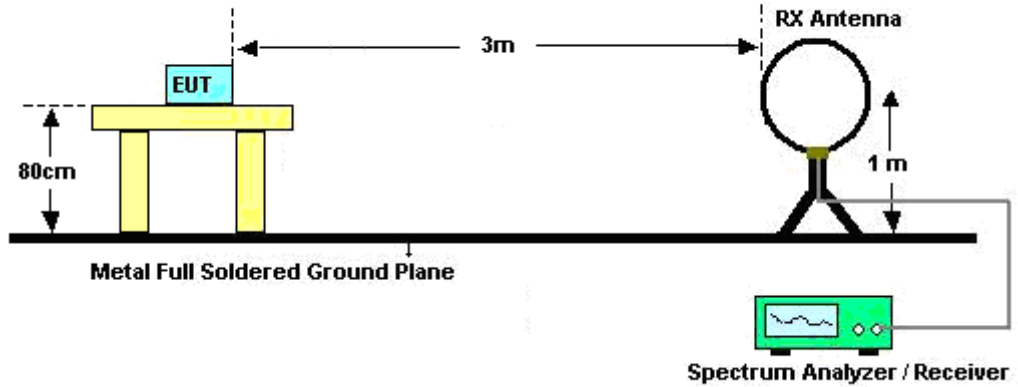


**3.2.3 Test Procedures**

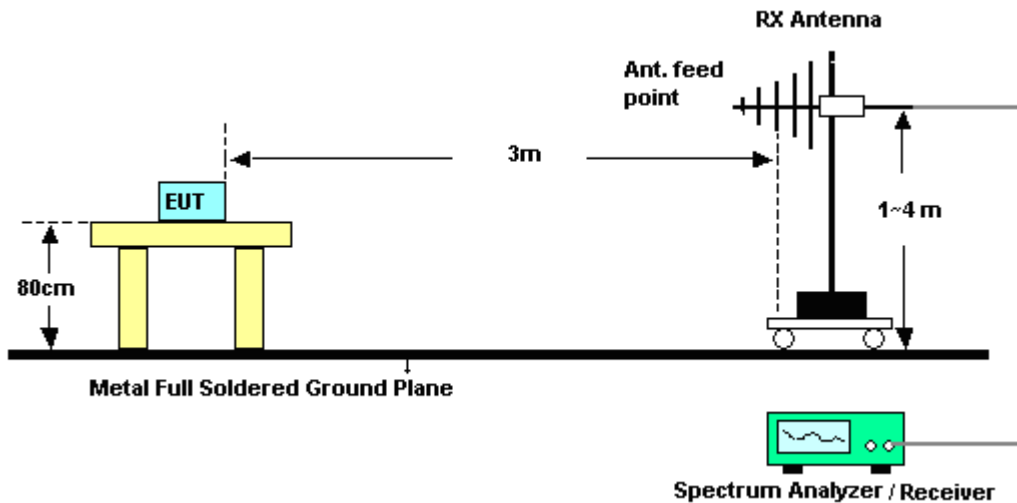
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively 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 testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. 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  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.  
For average measurement:
    - VBW = 10 Hz, when duty cycle is no less than 98 percent.
    - VBW  $\geq 1/T$ , 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.

### 3.2.4 Test Setup

For radiated emissions below 30MHz

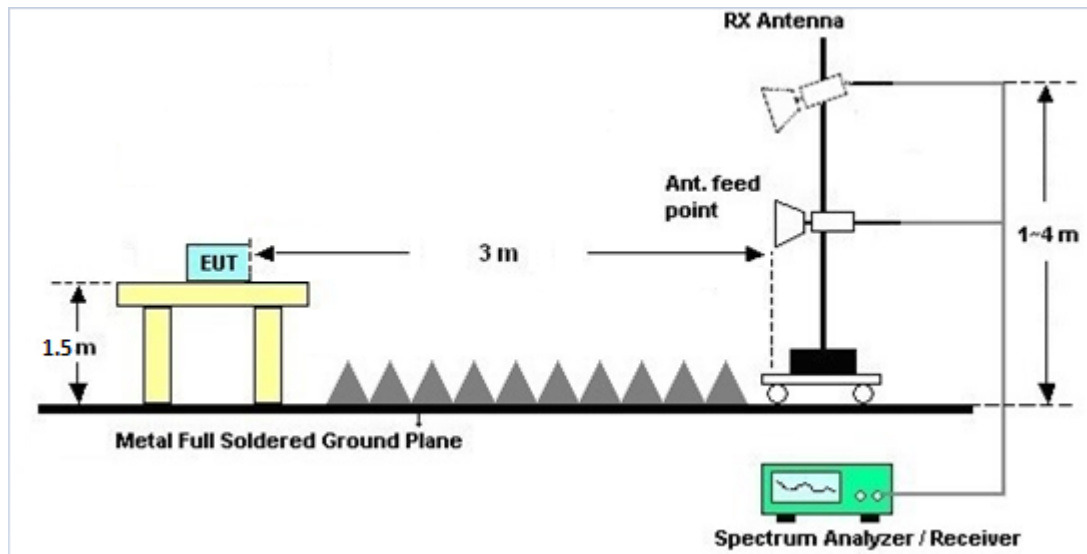


For radiated emissions from 30MHz to 1GHz





For radiated emissions above 1GHz



### 3.2.5 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 was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

### 3.2.7 Duty Cycle

Please refer to Appendix B.

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

Please refer to Appendix A.



### 3.3 AC Conducted Emission Measurement

#### 3.3.1 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.

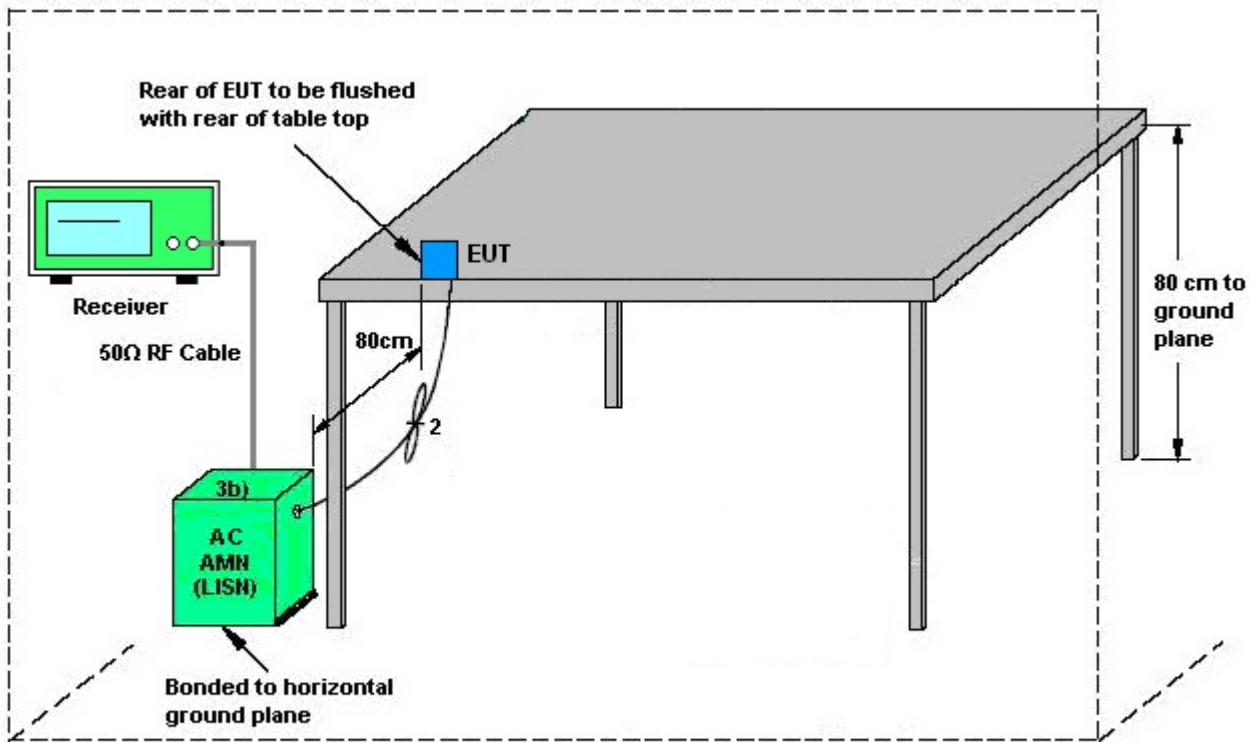
#### 3.3.2 Measuring Instruments

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

#### 3.3.3 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.

### 3.3.4 Test Setup

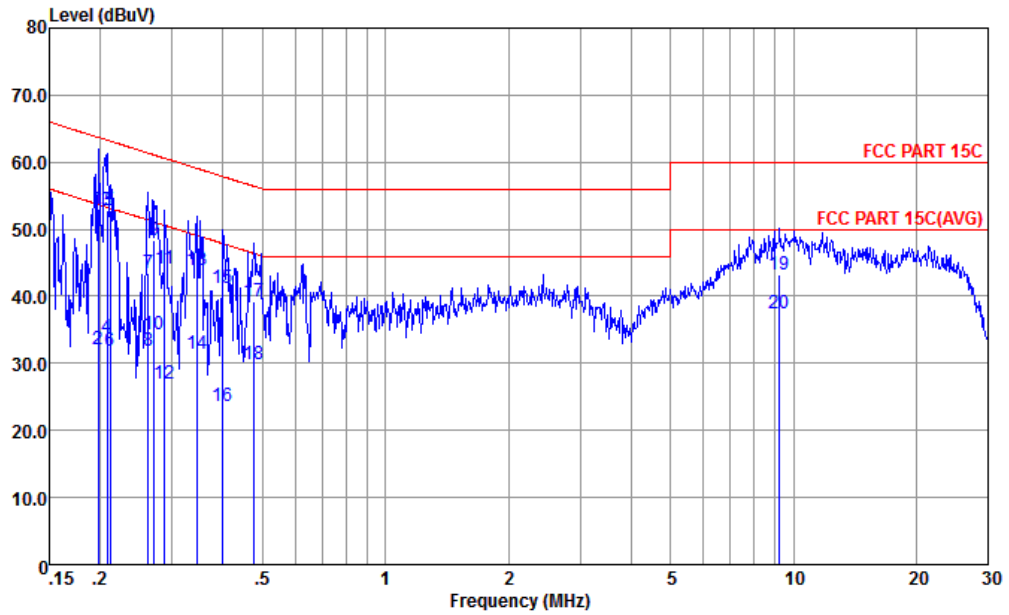


AMN = Artificial mains network (LISN)  
AE = Associated equipment  
EUT = Equipment under test  
ISN = Impedance stabilization network



3.3.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	24.4~24.7°C
Test Engineer :	Amos Zhang	Relative Humidity :	33~37%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN Link(2.4G) + Adaptor 1 with Type C cable 1 + Type C port 2 + USB Link with U-Disk from Type C port 2 + Play H Plane		

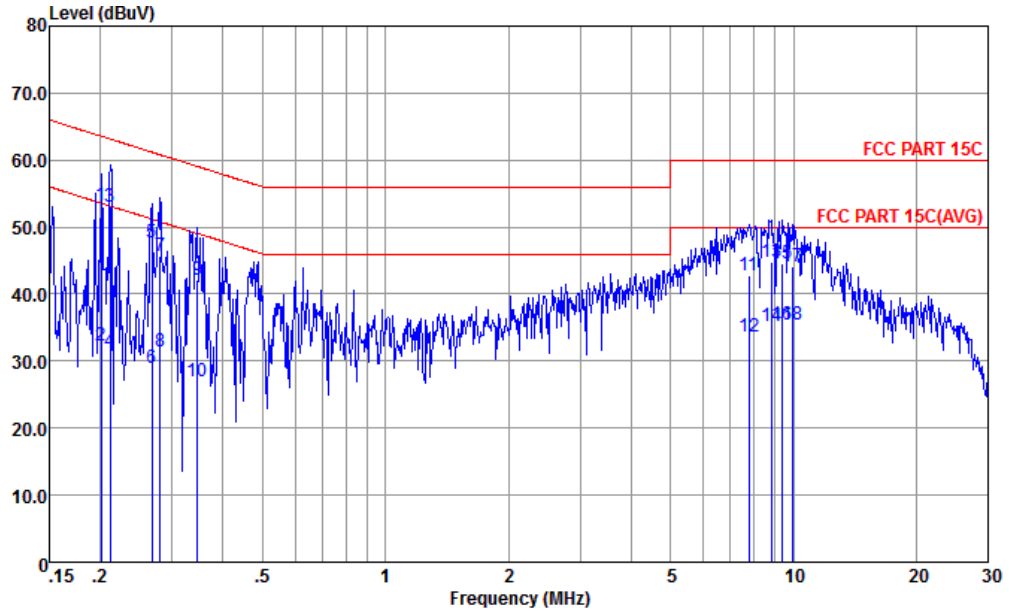


Site : CO01-KS  
 Condition : FCC PART 15C LISN-L-171013-060103 LINE

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.198	52.96	-10.75	63.71	42.30	0.20	10.46	QP
2	0.198	32.16	-21.55	53.71	21.50	0.20	10.46	Average
3	0.208	52.85	-10.42	63.27	42.20	0.20	10.45	QP
4	0.208	33.95	-19.32	53.27	23.30	0.20	10.45	Average
5 *	0.212	52.86	-10.28	63.14	42.21	0.20	10.45	QP
6	0.212	31.96	-21.18	53.14	21.31	0.20	10.45	Average
7	0.262	43.55	-17.83	61.38	32.89	0.22	10.44	QP
8	0.262	31.85	-19.53	51.38	21.19	0.22	10.44	Average
9	0.272	48.45	-12.62	61.07	37.80	0.22	10.43	QP
10	0.272	34.25	-16.82	51.07	23.60	0.22	10.43	Average
11	0.288	44.15	-16.44	60.59	33.50	0.22	10.43	QP
12	0.288	26.85	-23.74	50.59	16.20	0.22	10.43	Average
13	0.345	43.85	-15.24	59.09	33.19	0.24	10.42	QP
14	0.345	31.45	-17.64	49.09	20.79	0.24	10.42	Average
15	0.400	41.15	-16.71	57.86	30.49	0.25	10.41	QP
16	0.400	23.55	-24.31	47.86	12.89	0.25	10.41	Average
17	0.476	39.18	-17.23	56.41	28.59	0.26	10.33	QP
18	0.476	29.78	-16.63	46.41	19.19	0.26	10.33	Average
19	9.253	43.28	-16.72	60.00	32.60	0.35	10.33	QP
20	9.253	37.48	-12.52	50.00	26.80	0.35	10.33	Average



Test Mode :	Mode 1	Temperature :	24.4~24.7°C
Test Engineer :	Amos Zhang	Relative Humidity :	33~37%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN Link(2.4G) + Adaptor 1 with Type C cable 1 + Type C port 2 + USB Link with U-Disk from Type C port 2 + Play H Plane		



Site : CO01-KS  
 Condition : FCC PART 15C LISN-N-171013-060103 NEUTRAL

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.201	53.24	-10.34	63.58	42.51	0.28	10.45	QP
2	0.201	32.34	-21.24	53.58	21.61	0.28	10.45	Average
3 *	0.212	52.93	-10.21	63.14	42.20	0.28	10.45	QP
4	0.212	31.33	-21.81	53.14	20.60	0.28	10.45	Average
5	0.267	47.62	-13.58	61.20	36.90	0.28	10.44	QP
6	0.267	28.92	-22.28	51.20	18.20	0.28	10.44	Average
7	0.280	45.62	-15.19	60.81	34.91	0.28	10.43	QP
8	0.280	31.32	-19.49	50.81	20.61	0.28	10.43	Average
9	0.346	42.20	-16.85	59.05	31.49	0.29	10.42	QP
10	0.346	27.00	-22.05	49.05	16.29	0.29	10.42	Average
11	7.769	42.85	-17.15	60.00	32.21	0.31	10.33	QP
12	7.769	33.55	-16.45	50.00	22.91	0.31	10.33	Average
13	8.822	44.84	-15.16	60.00	34.20	0.31	10.33	QP
14	8.822	35.24	-14.76	50.00	24.60	0.31	10.33	Average
15	9.401	44.54	-15.46	60.00	33.91	0.30	10.33	QP
16	9.401	35.54	-14.46	50.00	24.91	0.30	10.33	Average
17	9.966	44.23	-15.77	60.00	33.60	0.30	10.33	QP
18	9.966	35.43	-14.57	50.00	24.80	0.30	10.33	Average



## 3.4 Antenna Requirements

### 3.4.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

### 3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.4.3 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
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 18, 2018	Mar. 28, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 18, 2018	Mar. 28, 2018	Jan. 17, 2019	Conducted (TH01-KS)
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Aug. 08, 2017	Mar. 28, 2018	Aug. 07, 2018	Conducted (TH01-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 20, 2017	Mar. 23, 2018	Apr. 19, 2018	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2017	Mar. 23, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060105	9kHz~30MHz	Oct. 13, 2017	Mar. 23, 2018	Oct. 12, 2018	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2017	Mar. 23, 2018	Oct. 11, 2018	Conduction (CO01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz; Max 30dBm	Oct.19.2017	Jan. 20, 2018~Jan. 23, 2018	Oct.18.2018	Radiation (03CH03-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz~44GHz	Apr. 18, 2017	Jan. 20, 2018~Jan. 23, 2018	Apr.17, 2018	Radiation (03CH03-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 22, 2017	Jan. 20, 2018~Jan. 23, 2018	Oct.21, 2018	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	35406	25MHz-2GHz	Apr. 22, 2017	Jan. 20, 2018~Jan. 23, 2018	Apr 21, 2018	Radiation (03CH03-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1356	1GHz~18GHz	Apr. 22, 2017	Jan. 20, 2018~Jan. 23, 2018	Apr 21, 2018	Radiation (03CH03-KS)
SHF-EHF Horn	Schwarzbeck	BBHA 9170	BBHA170249	15GHz~40GHz	Feb. 07, 2017	Jan. 20, 2018~Jan. 23, 2018	Feb. 06, 2018	Radiation (03CH03-KS)
Amplifier	com-power	PA-103A	161069	1MHz ~1000MHz / 32 dB	Apr 18, 2017	Jan. 20, 2018~Jan. 23, 2018	Apr 17, 2018	Radiation (03CH03-KS)
Amplifier	MITEQ	TTA1840-35-HG	1887435	18~40GHz	Oct. 12, 2017	Jan. 20, 2018~Jan. 23, 2018	Oct. 11, 2018	Radiation (03CH03-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Apr.18.2017	Jan. 20, 2018~Jan. 23, 2018	Apr.17.2018	Radiation (03CH03-KS)
Amplifier	Agilent	8449B	3008A02370	1GHz~26.5GHz	Oct. 12, 2017	Jan. 20, 2018~Jan. 23, 2018	Oct. 11, 2018	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jan. 20, 2018~Jan. 23, 2018	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jan. 20, 2018~Jan. 23, 2018	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jan. 20, 2018~Jan. 23, 2018	NCR	Radiation (03CH03-KS)

NCR: No Calibration Required



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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.6 dB
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### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.5 dB
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### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	4.5 dB
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## Appendix A. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
2		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11b CH 01 2412MHz		2321.83	56.81	-17.19	74	51.69	31.19	5.57	31.64	174	228	P	H
		2336.78	45.39	-8.61	54	40.22	31.22	5.59	31.64	174	228	A	H
	*	2412	101.09	-	-	95.55	31.33	5.67	31.46	174	228	P	H
	*	2410	95.11	-	-	89.57	31.33	5.67	31.46	174	228	A	H
		2383.45	57.17	-16.83	74	51.79	31.27	5.63	31.52	330	187	P	V
		2389.95	46.36	-7.64	54	40.87	31.3	5.65	31.46	330	187	A	V
	*	2410	105.99	-	-	100.45	31.33	5.67	31.46	330	187	P	V
	*	2410	101.41	-	-	95.87	31.33	5.67	31.46	330	187	A	V
802.11b CH 06 2437MHz		2354.07	57.08	-16.92	74	51.8	31.25	5.61	31.58	185	229	P	H
		2334.05	45.32	-8.68	54	40.2	31.19	5.57	31.64	185	229	A	H
	*	2438	100.84	-	-	95.05	31.39	5.71	31.31	185	229	P	H
	*	2438	94.72	-	-	88.93	31.39	5.71	31.31	185	229	A	H
		2489.38	56.49	-17.51	74	50.25	31.47	5.77	31	185	229	P	H
		2487.4	45.71	-8.29	54	39.52	31.44	5.75	31	185	229	A	H
		2336.39	56.78	-17.22	74	51.61	31.22	5.59	31.64	368	186	P	V
		2336.13	45.23	-8.77	54	40.06	31.22	5.59	31.64	368	186	A	V
	*	2438	107.35	-	-	101.56	31.39	5.71	31.31	368	186	P	V
	*	2438	101.15	-	-	95.36	31.39	5.71	31.31	368	186	A	V
		2488.18	56.95	-17.05	74	50.71	31.47	5.77	31	368	186	P	V
		2485.12	45.71	-8.29	54	39.52	31.44	5.75	31	368	186	A	V



802.11b CH 11 2462MHz	*	2464	98.92	-	-	92.93	31.41	5.73	31.15	208	230	P	H
	*	2464	95.12	-	-	89.13	31.41	5.73	31.15	208	230	A	H
		2493.16	56.32	-17.68	74	49.93	31.47	5.77	30.85	208	230	P	H
		2483.5	45.71	-8.29	54	39.52	31.44	5.75	31	208	230	A	H
	*	2464	104.34	-	-	98.35	31.41	5.73	31.15	362	182	P	V
	*	2464	100.81	-	-	94.82	31.41	5.73	31.15	362	182	A	V
		2483.5	59.59	-14.41	74	53.4	31.44	5.75	31	362	182	P	V
		2485.9	47	-7	54	40.81	31.44	5.75	31	362	182	A	V
802.11b CH 12 2467MHz	*	2468	98.23	-	-	92.09	31.41	5.73	31	215	224	P	H
	*	2470	93.9	-	-	87.76	31.41	5.73	31	215	224	A	H
		2487.4	58.36	-15.64	74	52.17	31.44	5.75	31	215	224	P	H
		2484.52	48	-6	54	41.81	31.44	5.75	31	215	224	A	H
	*	2468	105.18	-	-	99.04	31.41	5.73	31	368	136	P	V
	*	2470	101.12	-	-	94.98	31.41	5.73	31	368	136	A	V
		2484.7	60.7	-13.3	74	54.51	31.44	5.75	31	368	136	P	V
		2484.52	52.88	-1.12	54	46.69	31.44	5.75	31	368	136	A	V



802.11b CH 13 2472MHz		2486.8	56.69	-17.31	74	50.5	31.44	5.75	31	225	227	P	H
		2484.82	45.98	-8.02	54	39.79	31.44	5.75	31	225	227	A	H
	*	2472	92.99	-	-	86.8	31.44	5.75	31	225	227	P	H
	*	2474	89.85	-	-	83.66	31.44	5.75	31	225	227	A	H
		2485.18	57.62	-16.38	74	51.43	31.44	5.75	31	358	186	P	V
		2484.7	47.88	-6.12	54	41.69	31.44	5.75	31	358	186	A	V
	*	2472	98.12	-	-	91.93	31.44	5.75	31	358	186	P	V
	*	2474	95.07	-	-	88.88	31.44	5.75	31	358	186	A	V
<b>Remark</b>	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 2	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 )
802.11b CH 01 2412MHz		4824	49.6	-24.4	74	63.08	35.65	7.86	56.99	100	360	P	H
		4824	50.55	-23.45	74	64.03	35.65	7.86	56.99	100	360	P	V
802.11b CH 06 2437MHz		4872	43.33	-30.67	74	61.02	35.61	7.9	61.2	100	360	P	H
		7308	41.01	-32.99	74	58.72	35.89	9.5	63.1	100	360	P	H
		4872	43.28	-30.72	74	60.97	35.61	7.9	61.2	100	360	P	V
		7308	40.94	-33.06	74	58.65	35.89	9.5	63.1	100	360	P	V
802.11b CH 11 2462MHz		4926	45.33	-28.67	74	62.9	35.57	7.94	61.08	100	360	P	H
		7386	42.67	-31.33	74	60.37	35.94	9.53	63.17	100	360	P	H
		4926	46.33	-27.67	74	63.9	35.57	7.94	61.08	100	360	P	V
		7386	41.19	-32.81	74	58.89	35.94	9.53	63.17	100	360	P	V



802.11b CH 12 2467MHz		4932	44.28	-29.72	74	61.85	35.57	7.94	61.08	100	360	P	H
		7404	42.22	-31.78	74	59.92	35.95	9.54	63.19	100	360	P	H
		4932	45.76	-28.24	74	63.33	35.57	7.94	61.08	100	360	P	V
		7404	41.67	-32.33	74	59.37	35.95	9.54	63.19	100	360	P	V
802.11b CH 13 2472MHz		4944	43.39	-30.61	74	60.92	35.55	7.96	61.04	100	360	P	H
		7416	42.37	-31.63	74	60.07	35.95	9.54	63.19	100	360	P	H
		4944	43.44	-30.56	74	60.97	35.55	7.96	61.04	100	360	P	V
		7416	41.88	-32.12	74	59.58	35.95	9.54	63.19	100	360	P	V
Remark	3. No other spurious found. 4. All results are PASS against Peak and Average limit line.												



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

WIFI Ant. 2	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 )
802.11g CH 01 2412MHz		2323.52	56.57	-17.43	74	51.45	31.19	5.57	31.64	234	226	P	H
		2323.52	45.75	-8.25	54	40.63	31.19	5.57	31.64	234	226	A	H
	*	2408	101.15	-	-	95.61	31.33	5.67	31.46	234	226	P	H
	*	2408	93.36	-	-	87.82	31.33	5.67	31.46	234	226	A	H
		2354.72	56.55	-17.45	74	51.27	31.25	5.61	31.58	306	188	P	V
		2389.95	46.81	-7.19	54	41.32	31.3	5.65	31.46	306	188	A	V
	*	2408	107.5	-	-	101.96	31.33	5.67	31.46	306	188	P	V
	*	2408	98.77	-	-	93.23	31.33	5.67	31.46	306	188	A	V
802.11g CH 06 2437MHz		2368.24	56.56	-17.44	74	51.22	31.25	5.61	31.52	243	228	P	H
		2315.46	45.75	-8.25	54	40.68	31.16	5.55	31.64	243	228	A	H
	*	2440	100.92	-	-	95.13	31.39	5.71	31.31	243	228	P	H
	*	2438	92.95	-	-	87.16	31.39	5.71	31.31	243	228	A	H
		2492.8	56.43	-17.57	74	50.04	31.47	5.77	30.85	243	228	P	H
		2486.26	46.19	-7.81	54	40	31.44	5.75	31	243	228	A	H
		2385.92	56.25	-17.75	74	50.82	31.3	5.65	31.52	369	185	P	V
		2335.09	45.7	-8.3	54	40.53	31.22	5.59	31.64	369	185	A	V
	*	2438	107.1	-	-	101.31	31.39	5.71	31.31	369	185	P	V
	*	2438	99.38	-	-	93.59	31.39	5.71	31.31	369	185	A	V
		2484.58	57.81	-16.19	74	51.62	31.44	5.75	31	369	185	P	V
		2484.16	46.38	-7.62	54	40.19	31.44	5.75	31	369	185	A	V



802.11g CH 11 2462MHz	*	2458	100.76	-	-	94.77	31.41	5.73	31.15	207	228	P	H
	*	2458	92.93	-	-	86.94	31.41	5.73	31.15	207	228	A	H
		2493.7	56.56	-17.44	74	50.17	31.47	5.77	30.85	207	228	P	H
		2483.5	46.46	-7.54	54	40.27	31.44	5.75	31	207	228	A	H
	*	2466	106.96	-	-	100.97	31.41	5.73	31.15	362	183	P	V
	*	2466	99.1	-	-	93.11	31.41	5.73	31.15	362	183	A	V
		2483.8	59.33	-14.67	74	53.14	31.44	5.75	31	362	183	P	V
	!	2483.5	48.42	-5.58	54	42.23	31.44	5.75	31	362	183	A	V
802.11g CH 12 2467MHz	*	2470	98.4	-	-	92.26	31.41	5.73	31	225	229	P	H
	*	2470	90.65	-	-	84.51	31.41	5.73	31	225	229	A	H
		2483.74	58.86	-15.14	74	52.67	31.44	5.75	31	225	229	P	H
		2483.5	47.48	-6.52	54	41.29	31.44	5.75	31	225	229	A	H
	*	2470	104.23	-	-	98.09	31.41	5.73	31	320	187	P	V
	*	2470	97.45	-	-	91.31	31.41	5.73	31	363	187	A	V
		2483.5	67.51	-6.49	74	61.32	31.44	5.75	31	363	187	P	V
		2483.5	51.54	-2.46	54	45.35	31.44	5.75	31	320	187	A	V



802.11g CH 13 2472MHz	*	2476	84.63	-	-	78.44	31.44	5.75	31	213	227	P	H
	*	2474	76.99	-	-	70.8	31.44	5.75	31	213	227	A	H
		2483.86	57.42	-16.58	74	51.23	31.44	5.75	31	213	227	P	H
		2483.74	47.38	-6.62	54	41.19	31.44	5.75	31	213	227	A	H
	*	2474	91.38	-	-	85.19	31.44	5.75	31	364	185	P	V
	*	2474	83.55	-	-	77.36	31.44	5.75	31	364	185	A	V
		2483.8	63.99	-10.01	74	57.8	31.44	5.75	31	364	185	P	V
		2483.5	51.25	-2.75	54	45.06	31.44	5.75	31	364	185	A	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												





2.4GHz 2400~2483.5MHz
WIFI 802.11g (Harmonic @ 3m)

Table with 14 columns: WIFI Ant. 2, 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). Rows include data for channels 01, 06, and 11.



802.11g CH 12 2467MHz		4932	41.68	-32.32	74	59.25	35.57	7.94	61.08	100	100	P	H
		7404	39.16	-34.84	74	56.86	35.95	9.54	63.19	100	100	P	H
		4932	42.29	-31.71	74	59.86	35.57	7.94	61.08	100	188	P	V
		7404	39.91	-34.09	74	57.61	35.95	9.54	63.19	100	188	P	V
802.11g CH 13 2472MHz		4944	43.92	-30.08	74	61.45	35.55	7.96	61.04	100	360	P	H
		7416	40.01	-33.99	74	57.71	35.95	9.54	63.19	100	360	P	H
		4944	43.03	-30.97	74	60.56	35.55	7.96	61.04	100	360	P	V
		7416	40.27	-33.73	74	57.97	35.95	9.54	63.19	100	360	P	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (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+2		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	(P/A)	(H/V)
802.11n HT20 CH 01 2412MHz		2389.69	58.04	-15.96	74	52.61	31.3	5.65	31.52	236	128	P	H
		2389.95	47.09	-6.91	54	41.6	31.3	5.65	31.46	236	128	A	H
	*	2410	104.5	-	-	98.96	31.33	5.67	31.46	236	128	P	H
	*	2410	96.47	-	-	90.93	31.33	5.67	31.46	236	128	A	H
		2389.82	65.86	-8.14	74	60.37	31.3	5.65	31.46	391	180	P	V
	!	2389.95	51.45	-2.55	54	45.96	31.3	5.65	31.46	391	180	A	V
	*	2408	109.51	-	-	103.97	31.33	5.67	31.46	391	180	P	V
		2408	101.02	-	-	95.48	31.33	5.67	31.46	391	180	A	V
802.11n HT20 CH 06 2437MHz		2318.97	56.25	-17.75	74	51.13	31.19	5.57	31.64	256	127	P	H
		2323	46.52	-7.48	54	41.4	31.19	5.57	31.64	256	127	A	H
	*	2434	105.1	-	-	99.36	31.36	5.69	31.31	256	127	P	H
	*	2434	96.78	-	-	91.04	31.36	5.69	31.31	256	127	A	H
		2487.34	56.79	-17.21	74	50.6	31.44	5.75	31	256	127	P	H
		2489.92	46.85	-7.15	54	40.61	31.47	5.77	31	256	127	A	H
		2346.79	56.13	-17.87	74	50.9	31.22	5.59	31.58	376	182	P	V
		2389.69	46.46	-7.54	54	41.03	31.3	5.65	31.52	376	182	A	V
	*	2436	111.05	-	-	105.31	31.36	5.69	31.31	376	182	P	V
	*	2434	101.69	-	-	95.95	31.36	5.69	31.31	376	182	A	V
	2483.92	56.83	-17.17	74	50.64	31.44	5.75	31	376	182	P	V	
	2484.64	47.05	-6.95	54	40.86	31.44	5.75	31	376	182	A	V	



802.11n HT20 CH 11 2462MHz	*	2460	105.24	-	-	99.25	31.41	5.73	31.15	238	126	P	H
	*	2462	96.7	-	-	90.71	31.41	5.73	31.15	238	126	A	H
		2493.34	56.53	-17.47	74	50.14	31.47	5.77	30.85	238	126	P	H
		2483.56	47.59	-6.41	54	41.4	31.44	5.75	31	238	126	A	H
	*	2460	109.62	-	-	103.63	31.41	5.73	31.15	380	183	P	V
	*	2460	101.16	-	-	95.17	31.41	5.73	31.15	380	183	A	V
		2483.56	60.59	-13.41	74	54.4	31.44	5.75	31	380	183	P	V
	!	2483.5	50.27	-3.73	54	44.08	31.44	5.75	31	380	183	A	V
802.11n HT20 CH 12 2467MHz		2462	101.6	-	-	95.61	31.41	5.73	31.15	143	125	P	H
		2462	93.45	-	-	87.46	31.41	5.73	31.15	143	125	A	H
		2485.36	57.56	-16.44	74	51.37	31.44	5.75	31	143	125	P	H
		2483.5	47.93	-6.07	54	41.74	31.44	5.75	31	143	125	A	H
		2466	107.94	-	-	101.95	31.41	5.73	31.15	252	180	P	V
		2464	98.93	-	-	92.94	31.41	5.73	31.15	252	180	A	V
		2484.04	64.76	-9.24	74	58.57	31.44	5.75	31	252	180	P	V
		2483.56	52.86	-1.14	54	46.67	31.44	5.75	31	252	180	A	V
802.11n HT20 CH 13 2472MHz		2470	82.17	-	-	76.03	31.41	5.73	31	226	230	P	H
		2470	74.27	-	-	68.13	31.41	5.73	31	226	230	A	H
		2483.8	58.7	-15.3	74	52.51	31.44	5.75	31	226	230	P	H
		2483.5	47.7	-6.3	54	41.51	31.44	5.75	31	226	230	A	H
		2470	88.65	-	-	82.51	31.41	5.73	31	289	183	P	V
		2470	82.38	-	-	76.24	31.41	5.73	31	365	185	A	V
		2483.56	64.62	-9.38	74	58.43	31.44	5.75	31	365	184	P	V
		2483.5	51.25	-2.75	54	45.06	31.44	5.75	31	289	183	A	V
Remark	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



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

WIFI Ant. 1+2	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 2412MHz		4824	44.35	-29.65	74	62.15	35.65	7.86	61.31	100	360	P	H
		4824	44.71	-29.29	74	62.51	35.65	7.86	61.31	100	360	P	V
802.11n HT20 CH 06 2437MHz		4872	43.84	-30.16	74	61.53	35.61	7.9	61.2	100	360	P	H
		7308	40.05	-33.95	74	57.76	35.89	9.5	63.1	100	360	P	H
		4872	43.9	-30.1	74	61.59	35.61	7.9	61.2	100	360	P	V
		7308	41	-33	74	58.71	35.89	9.5	63.1	100	360	P	V
802.11n HT20 CH 11 2462MHz		4926	44.37	-29.63	74	61.94	35.57	7.94	61.08	100	360	P	H
		7386	42.42	-31.58	74	60.12	35.94	9.53	63.17	100	360	P	H
		4926	43.48	-30.52	74	61.05	35.57	7.94	61.08	100	360	P	V
		7386	42.04	-31.96	74	59.74	35.94	9.53	63.17	100	360	P	V
802.11n HT20 CH 12 2467MHz		4932	43.49	-30.51	74	61.06	35.57	7.94	61.08	100	360	P	H
		7404	41.48	-32.52	74	59.18	35.95	9.54	63.19	100	360	P	H
		4932	43.8	-30.2	74	61.37	35.57	7.94	61.08	100	360	P	V
		7404	41.22	-32.78	74	58.92	35.95	9.54	63.19	100	360	P	V
802.11n HT20 CH 13 2472MHz		4944	42.93	-31.07	74	60.46	35.55	7.96	61.04	100	360	P	H
		7416	42.44	-31.56	74	60.14	35.95	9.54	63.19	100	360	P	H
		4944	44	-30	74	61.53	35.55	7.96	61.04	100	360	P	V
		7416	40.92	-33.08	74	58.62	35.95	9.54	63.19	100	360	P	V
<b>Remark</b>	<ol style="list-style-type: none"> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												



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

Table with 14 columns: WIFI Ant. 1+2, 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). Rows include data for 802.11n HT40 CH 03 (2422MHz) and 802.11n HT40 CH 06 (2437MHz).



802.11n HT40 CH 09 2452MHz		2326.64	56.56	-17.44	74	51.44	31.19	5.57	31.64	260	127	P	H
		2349.52	46.35	-7.65	54	41.12	31.22	5.59	31.58	260	128	A	H
	*	2442	102.13	-	-	96.18	31.39	5.71	31.15	260	128	P	H
	*	2440	93.29	-	-	87.5	31.39	5.71	31.31	260	128	A	H
		2484.28	60.4	-13.6	74	54.21	31.44	5.75	31	260	127	P	H
	!	2483.86	50.09	-3.91	54	43.9	31.44	5.75	31	260	127	A	H
		2332.75	57.02	-16.98	74	51.9	31.19	5.57	31.64	259	181	P	V
		2388.39	46.88	-7.12	54	41.45	31.3	5.65	31.52	259	181	A	V
	*	2440	107.04	-	-	101.25	31.39	5.71	31.31	259	181	P	V
	*	2440	99	-	-	93.21	31.39	5.71	31.31	259	181	A	V
		2484.22	62.55	-11.45	74	56.36	31.44	5.75	31	259	181	P	V
	!	2484.34	52.9	-1.1	54	46.71	31.44	5.75	31	259	181	A	V
	802.11n HT40 CH 10 2457MHz		2335.61	56.69	-17.31	74	51.52	31.22	5.59	31.64	288	131	P
		2329.37	46.59	-7.41	54	41.47	31.19	5.57	31.64	288	131	A	H
*		2452	99.83	-	-	93.88	31.39	5.71	31.15	288	131	P	H
*		2444	89.96	-	-	84.01	31.39	5.71	31.15	288	131	A	H
		2483.5	57.34	-16.66	74	51.15	31.44	5.75	31	288	131	P	H
		2483.5	48.52	-5.48	54	42.33	31.44	5.75	31	288	131	A	H
		2349.52	56.29	-17.71	74	51.06	31.22	5.59	31.58	252	180	P	V
		2335.87	46.73	-7.27	54	41.56	31.22	5.59	31.64	252	180	A	V
*		2462	104.8	-	-	98.81	31.41	5.73	31.15	252	180	P	V
*		2464	95.85	-	-	89.86	31.41	5.73	31.15	252	180	A	V
	2483.56	60.26	-13.74	74	54.07	31.44	5.75	31	252	180	P	V	
!	2483.5	52.22	-1.78	54	46.03	31.44	5.75	31	252	180	A	V	



802.11n HT40 CH 11 2462MHz		2336.65	55.76	-18.24	74	50.59	31.22	5.59	31.64	237	129	P	H
		2333.01	46.49	-7.51	54	41.37	31.19	5.57	31.64	237	129	A	H
	*	2460	82.68	-	-	76.69	31.41	5.73	31.15	237	129	P	H
	*	2460	74.89	-	-	68.9	31.41	5.73	31.15	237	129	A	H
		2491.48	57.1	-16.9	74	50.86	31.47	5.77	31	237	129	P	H
		2483.56	47.62	-6.38	54	41.43	31.44	5.75	31	237	129	A	H
		2315.33	57.02	-16.98	74	51.95	31.16	5.55	31.64	251	180	P	V
		2321.44	46.71	-7.29	54	41.59	31.19	5.57	31.64	251	180	A	V
	*	2468	88.34	-	-	82.2	31.41	5.73	31	251	180	P	V
	*	2464	80.48	-	-	74.49	31.41	5.73	31.15	251	180	A	V
		2483.62	61.62	-12.38	74	55.43	31.44	5.75	31	251	180	P	V
	!	2483.5	52.6	-1.4	54	46.41	31.44	5.75	31	251	180	A	V
<b>Remark</b>	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												





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

WIFI Ant. 1+2	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 HT40 CH 03		4842	43.38	-30.62	74	61.15	35.63	7.87	61.27	100	360	P	H
		7266	41.7	-32.3	74	59.41	35.87	9.48	63.06	100	360	P	H
		4842	42.98	-31.02	74	60.75	35.63	7.87	61.27	100	360	P	V
2422MHz		7266	41.37	-32.63	74	59.08	35.87	9.48	63.06	100	360	P	V
		4872	43.97	-30.03	74	61.66	35.61	7.9	61.2	150	360	P	H
802.11n HT40 CH 06		7308	40.09	-33.91	74	57.8	35.89	9.5	63.1	150	360	P	H
		4872	43.58	-30.42	74	61.27	35.61	7.9	61.2	150	360	P	V
		7308	40.83	-33.17	74	58.54	35.89	9.5	63.1	150	360	P	V
2437MHz		4902	43	-31	74	60.61	35.58	7.93	61.12	100	360	P	H
		7356	41.88	-32.12	74	59.58	35.92	9.52	63.14	100	360	P	H
802.11n HT40 CH 09		4902	45.19	-28.81	74	62.8	35.58	7.93	61.12	100	360	P	V
		7356	40.44	-33.56	74	58.14	35.92	9.52	63.14	100	360	P	V
		4914	43.4	-30.6	74	61.01	35.58	7.93	61.12	100	360	P	H
802.11n HT40 CH 10		7368	40.98	-33.02	74	58.68	35.93	9.53	63.16	100	360	P	H
		4914	42.8	-31.2	74	60.41	35.58	7.93	61.12	100	360	P	V
		7368	42.58	-31.42	74	60.28	35.93	9.53	63.16	100	360	P	V
2457MHz		4926	43.75	-30.25	74	61.32	35.57	7.94	61.08	100	360	P	H
		7386	42.11	-31.89	74	59.81	35.94	9.53	63.17	100	360	P	H
802.11n HT40 CH 11		4926	42.8	-31.2	74	60.37	35.57	7.94	61.08	100	360	P	V
		7386	41.43	-32.57	74	59.13	35.94	9.53	63.17	100	360	P	V
		7386	41.43	-32.57	74	59.13	35.94	9.53	63.17	100	360	P	V
2462MHz		7386	41.43	-32.57	74	59.13	35.94	9.53	63.17	100	360	P	V
		7386	41.43	-32.57	74	59.13	35.94	9.53	63.17	100	360	P	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz  
2.4GHz WIFI 802.11n HT40 (LF)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1+2		( MHz )	( dBμV/m )	( dB )	( dBμV/m )	( dBμV )	( dB/m )	( dB )	( dB )	( cm )	( deg )	( P/A )	( H/V )
2.4GHz 802.11n HT40 LF		46.49	21.75	-18.25	40	35.58	16.87	0.73	31.43	-	-	P	H
		89.17	26.63	-16.87	43.5	39.59	16.76	1.04	30.76	-	-	P	H
		149.31	29.31	-14.19	43.5	41.58	17.31	1.32	30.9	100	319	P	H
		329.73	31.03	-14.97	46	40	20.55	1.98	31.5	-	-	P	H
		419.94	30.02	-15.98	46	36.43	22.88	2.25	31.54	-	-	P	H
		720.64	30.96	-15.04	46	31.82	27.01	2.99	30.86	-	-	P	H
		30.97	33.6	-6.4	40	38.36	25.74	0.58	31.08	-	-	P	V
		45.52	36.92	-3.08	40	50.28	17.33	0.73	31.42	100	214	P	V
		89.17	34.64	-8.86	43.5	47.6	16.76	1.04	30.76	-	-	P	V
		149.31	33.93	-9.57	43.5	46.2	17.31	1.32	30.9	-	-	P	V
		329.73	28.51	-17.49	46	37.48	20.55	1.98	31.5	-	-	P	V
	500.45	30.15	-15.85	46	35.16	24.1	2.49	31.6	-	-	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.
!	Test result is <b>not under limit 6dB</b> .
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)

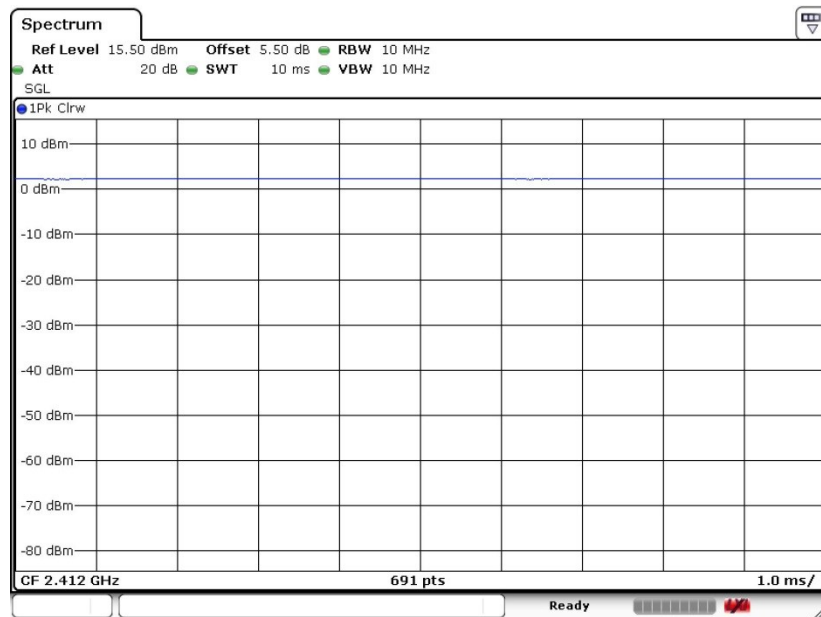
Both peak and average measured complies with the limit line, so test result is “PASS”.



## Appendix B. Duty Cycle Plots

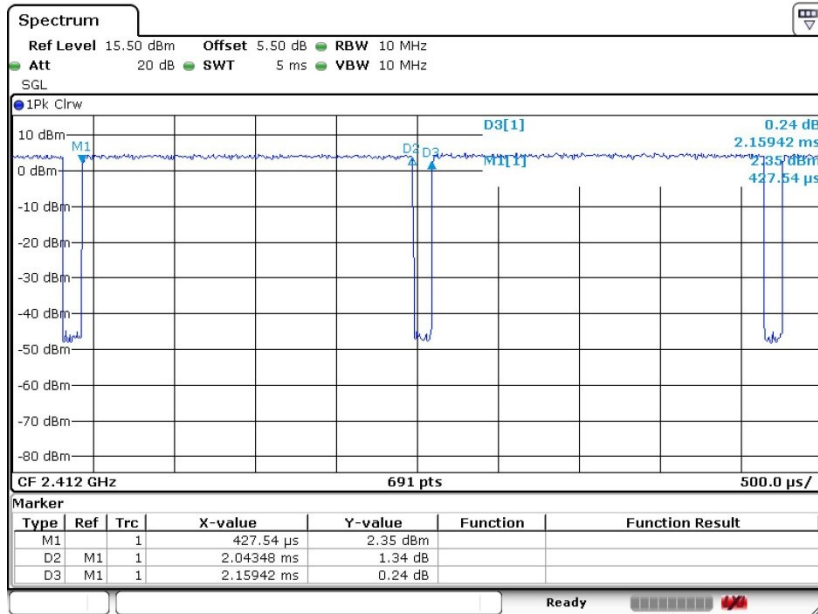
Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
2	802.11b	100	-	-	10Hz
2	802.11g	94.63	2.043	0.489	1kHz
1+2	802.11n HT20	84.25	0.977	1.024	3kHz
1+2	802.11n HT40	83.70	0.491	2.035	3kHz

802.11b Ant.2

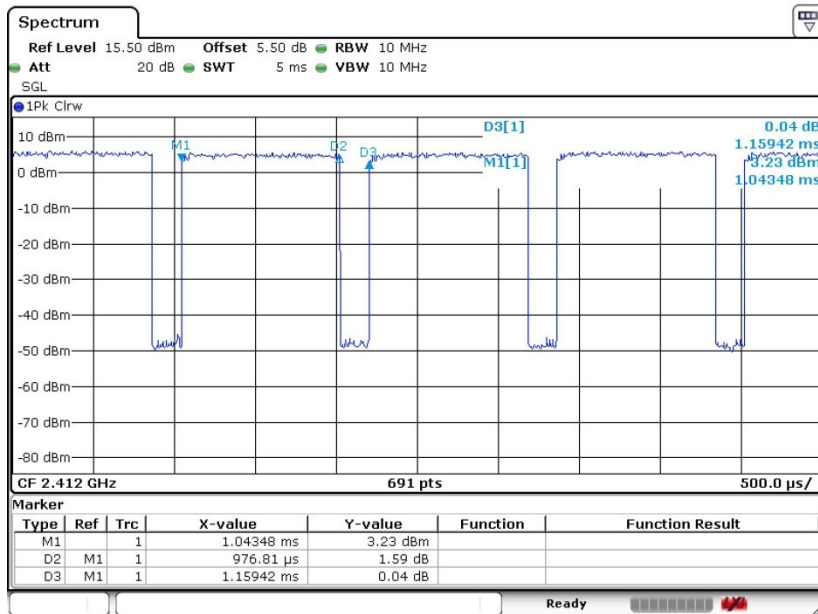




802.11g Ant.2



802.11n HT20 Ant. 1+2





802.11n HT40 Ant. 1+2

