



**MOBILE DEVICES BUSINESS**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT - Addendum**

**Test Report Number** –24965-1 WLAN

**Report Date** –2012-04-13

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

Signature:

Name: Lei Yang

Title: EMC Project Engineer

Test: 2012-03-20 to 2012-04-11

As the responsible test lab manager, I hereby declare that the model tested as specified in this report conforms to the requirements indicated.

Signature:

Name: Yilin Zhao

Title: Test Lab Manager

Date: 2012-04-17

This report must not be reproduced, except in full, without written approval from this laboratory.

FCC Registration Number: 402854

IC Registration Number: 109AW-1

ADR Testing Service location ADR BJ  
ISO/IEC-17025:2005 accredited by UKAS



**UKAS Certificate Number: 2404**

## **Table of Contents**

Test Report Details .....	3
Applicable Standards .....	4
Summary of Testing.....	5
General and Special Conditions.....	5
Equipment and Cable Configurations.....	6
Measuring Equipment and Calibration Information .....	6
Measurement Procedures and Data.....	8
FIELD STRENGTH OF SPURIOUS EMISSIONS .....	8
Measurement Procedure.....	8
Measurement Results .....	9
WLAN Band (b) .....	10
WLAN Band (g) .....	13
BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS.....	16
Measurement Procedure.....	16
Measurement Results .....	16
WLAN Band (b) .....	17
WLAN Band (g) .....	19
WLAN Band (n) 2.4G 400ns GI.....	21
WLAN Band (n) 2.4G 800ns GI.....	23

## **Test Report Details**

Tests Performed By: Motorola (Beijing) Mobility Technologies Co., Ltd.  
Asia Global Compliance Labs  
No.1 Wang Jing East Road  
Chao Yang District  
Beijing, 100102, P. R. China  
Phone: +86 10 8499 5891  
FCC Registration Number: 402854  
IC Registration Number: 109AW-1

Tests Requested By: Motorola Mobility Inc.  
No. 1 Wang Jing East Road  
Chao Yang District  
Beijing, 100102, P. R. China

Product Type: Cell phone with embedded Bluetooth

Signaling Capability: GSM850/1900, EDGE850/1900, CDMA 850/1900,  
EVDO, Bluetooth, 802.11b/802.11g/802.11n

HEX: A000002C98F7E8

FCC ID: IHDT56NH2

Project number: 24965-1

Testing Complete Date: 2012-04-11

## **Applicable Standards**

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

- ☒ Part 15 Subpart C – Intentional Radiators
- ☐ Part 22 Subpart H - Public Mobile Services
- ☐ Part 24 - Personal Communications Services
- ☐ Part 27 - Wireless Communications Service
- ☐ Part 90 - Private Land Mobile Radio Service

Applicable Standards: ANSI C63.4-2003, RSS-Gen Issue 3, RSS-210 Issue 8.

KDB 558074(2005), "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" published by the Federal Communications Commission was also used in the testing of this product.

The following tests were performed according to the regulations:

- The **spurious radiated emission** requirements of **§ 15.247, § 15.249 and § 15.407 of CFR 47 Part 15 2007**, specifically "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) (see Section 15.205(c)).
- Under this project 30 to 1000 MHz, 1 to 26.5 GHz radiated and radiated band-edge measurements were performed.
- For frequencies below 1 GHz a 100 kHz RBW (6 dB) is used and above 1 GHz a 1 MHz RBW (6 dB) is used.

**Summary of Testing**

Test	Test Name	Pass/Fail
1	Field Strength of Spurious Emissions	Pass
2	Band-edge Compliance of RF Radiated Emissions	Pass

Test	Test Name	Results
1	Field Strength of Spurious Emissions	See plots
2	Band-edge Compliance of RF Radiated Emissions	See plots

The margin with respect to the limit is the minimum margin for all modes and bands.

**General and Special Conditions**

The 24965-1 test sample was tested using a fully charged battery when applicable. Where a battery could not be used due to the need for a controlled variation of input voltage, an external power supply was utilized.

Special test SW was used for these tests. Radiated testing was done in the following modes:

802.11 b mode @ 11 Mbps

802.11 g mode @ 9 Mbps

802.11 n mode 2.4G 400ns GI @ 21.7 Mbps

802.11 n mode 2.4G 800ns GI @ 19.5 Mbps

All testing was done in an indoor controlled environment with an average temperature of  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$  and relative humidity of  $45\% \pm 6\%$  over the dates used for testing.

Radiated emissions was measured from 9kHz to 30MHz and all emission were 20 dB below the limit.

## **Equipment and Cable Configurations**

The EUT was tested in a stand-alone configuration that is representative of typical use.

## **Measuring Equipment and Calibration Information**

Equipment related to the semi-anechoic chamber testing:

<b>Equipment</b>	<b>Model/type</b>	<b>Serial number</b>	<b>Operational range</b>	<b>Date of calibration</b>
EMI Receiver	ESU 40	100036	20 Hz – 40 GHz	11.11.2011
Pre Amplifiers	PA-02-0001:	2007343	10 kHz – 3 GHz	07.04.2011
	PA-02-218	2007344	3 GHz – 18 GHz	07.04.2011
	PA-02-5	2007345	18 GHz – 40 GHz	07.04.2011
Radio Communication Tester	CMU 200	112790	GSM 850/900/1800/1900, IS95, UMTS, CDMA, Bluetooth	N/A
Band Reject Filter	WRCG	N/A	ISM band	N/A
	4N45-24241/3/6	N/A	WLAN	N/A

The antennas used in the various tests are listed in the below table.

<b>Antenna</b>	<b>Type</b>	<b>Serial number</b>	<b>Operational range</b>	<b>Date of calibration</b>
Hybrid-log periodic	TDK HLP 3003C	130376	30 MHz – 3 GHz	11.14.2011
Double ridged Horn	TDK HRN0118	130408	1 GHz – 18 GHz	01.22.2011
Double ridged Horn	ETS HRN3116	00071938	18 GHz – 40 GHz	07.13.2011
Active Loop Antenna	FMZB 1513	1513-105	9 kHz – 30 MHz	04.01.2012

Note that the hybrid antenna and horn antenna are on a three-year calibration cycle. All other equipments are on a one-year calibration cycle.

## **Description of WLAN (WiFi) Transmitter**

The 24983-1 test sample offers WLAN as a feature. The WLAN direct sequence spread-spectrum transceiver is designed to operate between 2400 and 2483 MHz. The WLAN antenna is mounted on the PCB inside of the EUT. The antenna installation is permanent. For a more thorough description of the functionality please refer to Exhibit 12 of this package.

As a WLAN transmitter, it is designed operate with other WLAN devices as defined by industrial standard. In this application, the device is battery-operated.

There is a switch in the Bluetooth/WLAN (BT/WiFi) module that switches between BT and WiFi. They share the same antenna, and you are able to use a BT headset while in a WiFi VoIP call, however, they do not transmit and receive at the same time. There is a 20 ms delay (for switching between the two systems in time domain) using an intelligent multiplexing scheme. Even though they share the same antenna they are **NOT ON** at the same time. The WiFi is therefore tested as a standalone transmitter.

## **Measurement Procedures and Data**

### **FIELD STRENGTH OF SPURIOUS EMISSIONS**

CFR Part 2.1053, 15.247, 15.249, 15.407

#### **Measurement Procedure**

The Equipment-Under-Test is placed inside the semi-anechoic chamber on a polystyrene table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

For 30 MHz – 18 GHz:

Field Strength (dB $\mu$ V/m) = EMI Receiver Level (dB $\mu$ V) + Cable Loss (dB) - Amplifier Gain (dB) + Filter loss (dB) + Antenna Correction Factor (3/m)

For 18 GHz – 40 GHz:

Field Strength (dB $\mu$ V/m) = EMI Receiver Level (dB $\mu$ V) + Cable Loss (dB) - Amplifier Gain (dB) + Filter loss (dB) + Antenna Correction Factor (1/m)

A fully charged battery was used for the supply voltage.

#### **The test sample was operated during the measurements under the following conditions:**

- Tests were performed at low, mid and high channels.
- Tests were performed in both horizontal and vertical polarity.
- Tests were performed in both operational WiFi bands (b), (g) and (n).



## **Measurement Results**

### Comments:

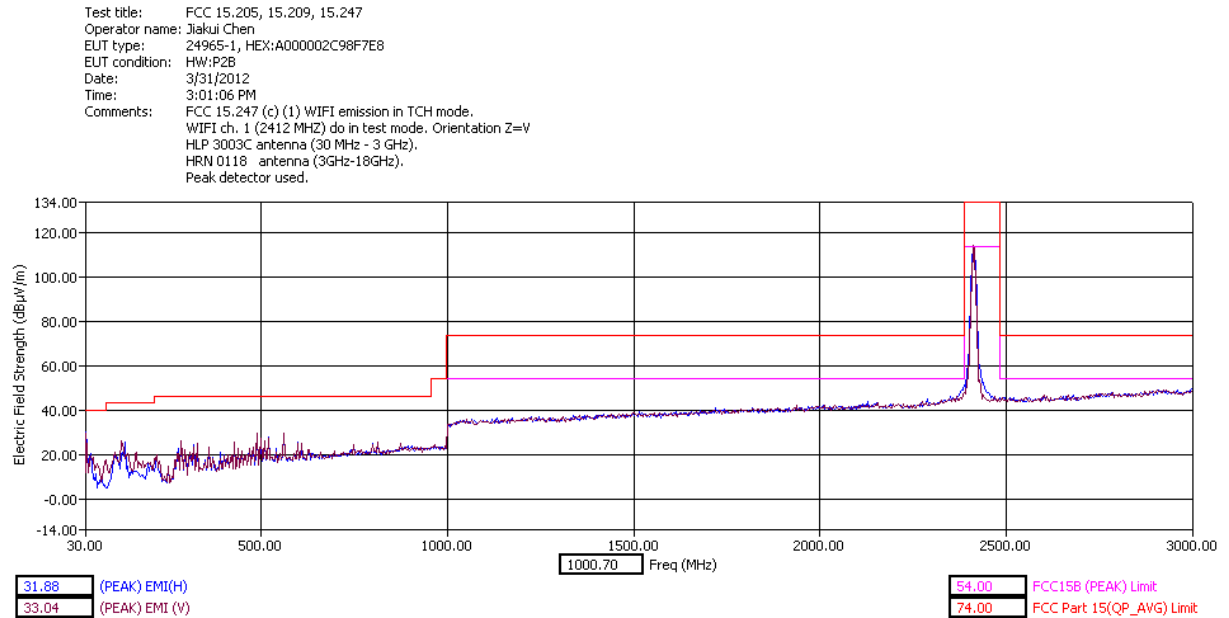
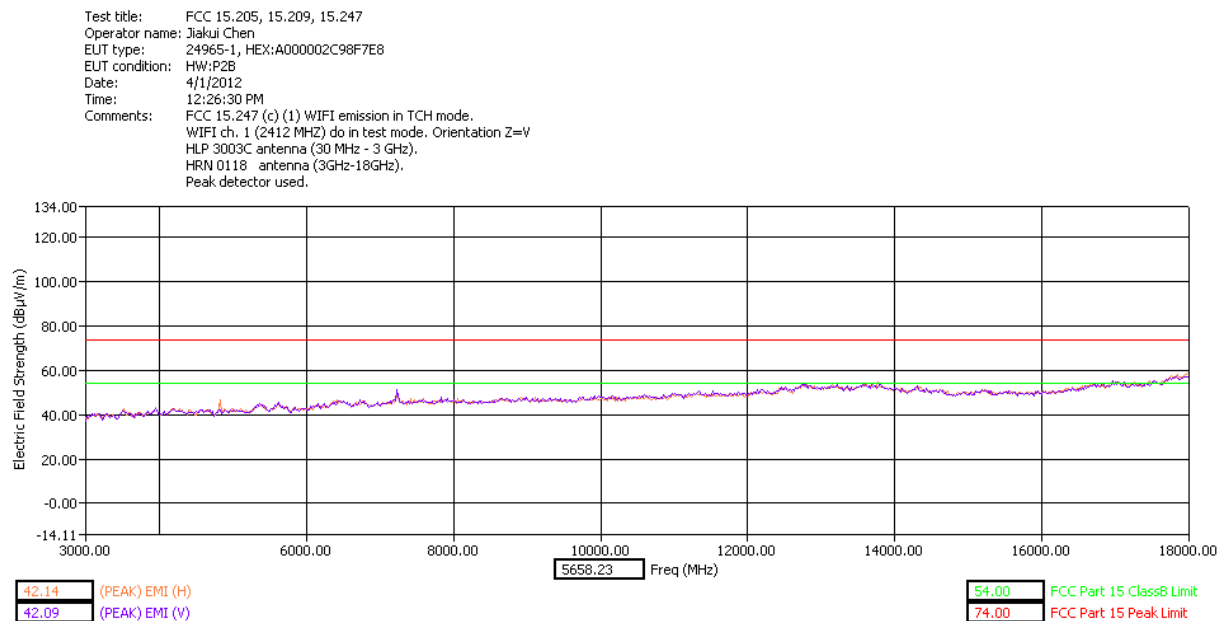
The band edge measurements crossing the corner for the low channel with respect to the average limit line is acceptable when applying the FCC rule specified in CFR 15.35(b) for the use of peak detector above 1 GHz. The peak detector limit line has been added to the graphical plots.

For peak emissions detected above 1 GHz, only those emissions that are higher than the AVG limit line plus 8 dB are selected for final emission analysis.

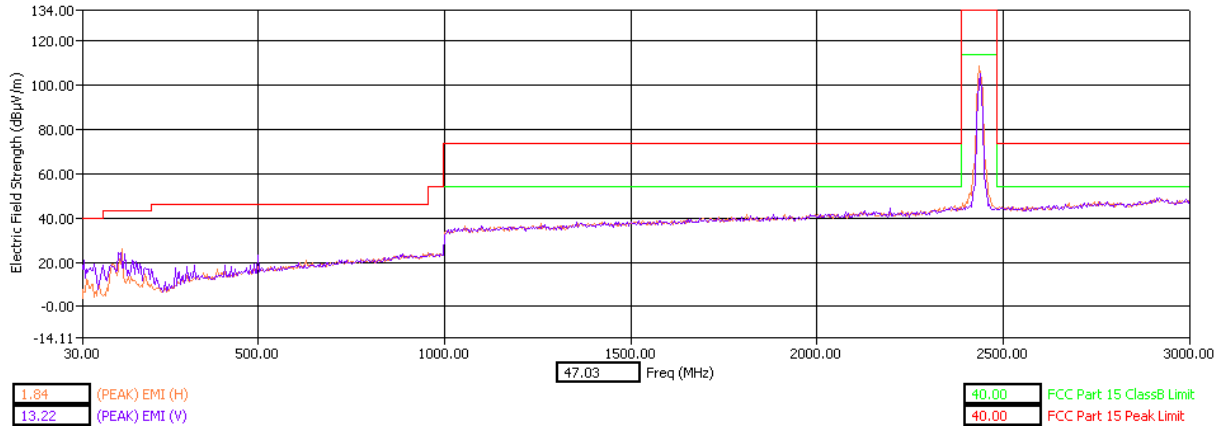
Radiated emissions were measured from 9 kHz to 30 MHz and all emissions were 20 dB below the limit.

**WLAN Band (b)**

Only the worst field strength of spurious emissions for each channel is displayed for WLAN (b).

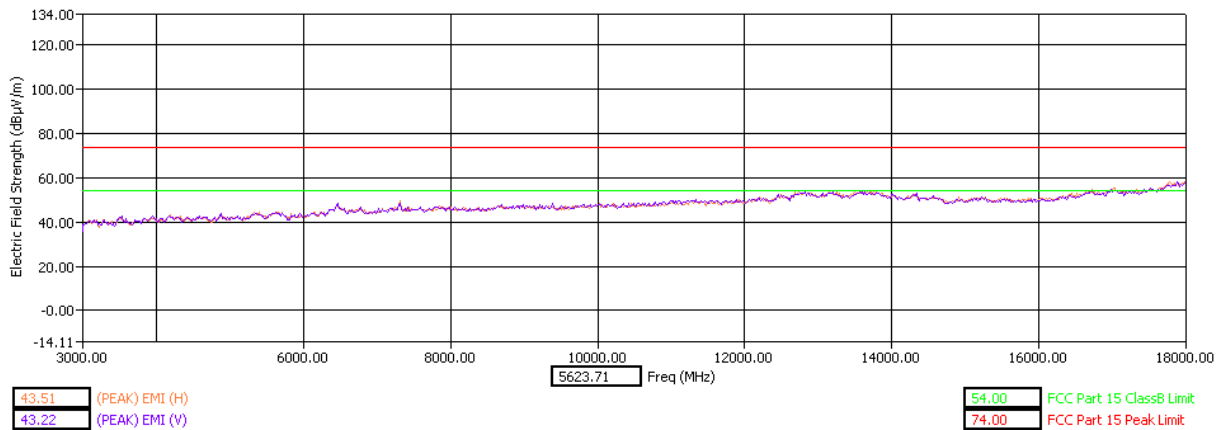
**30 MHz – 3 GHz Low Channel Dual Polarization Z****3 GHz – 18 GHz Low Channel Dual Polarization Z**

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 3/31/2012  
 Time: 2:27:17 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 6 (2437 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



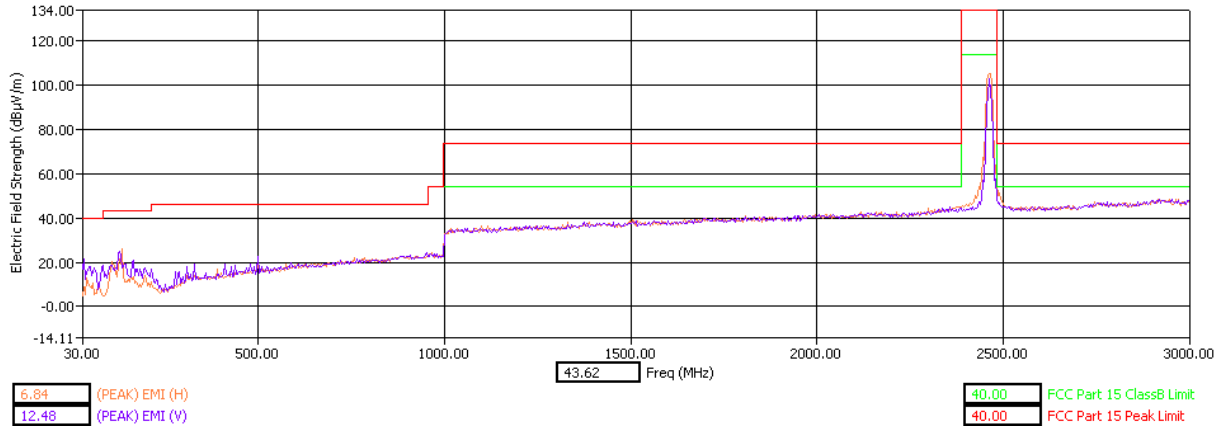
### 30 MHz – 3 GHz Middle Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 4/1/2012  
 Time: 12:40:39 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 6 (2437 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



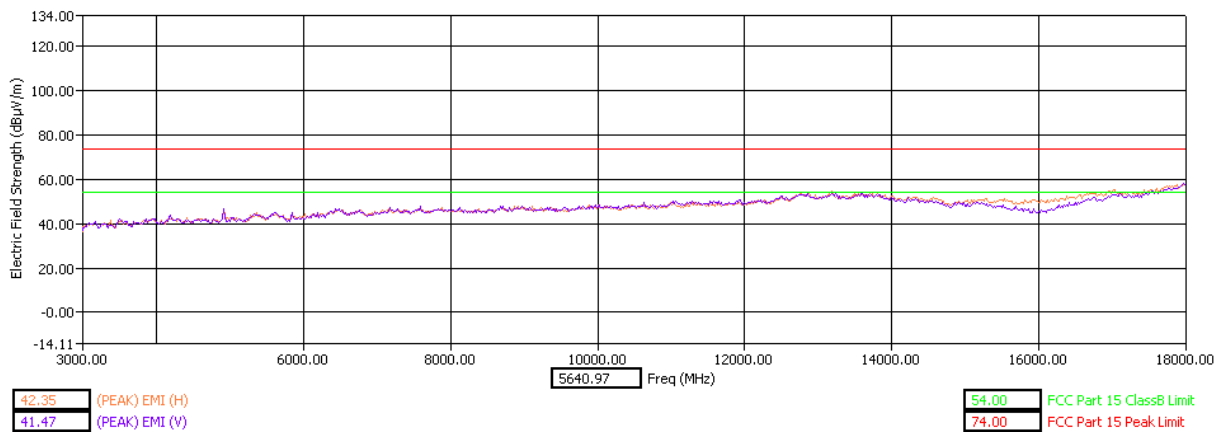
### 3 GHz – 18 GHz Middle Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 3/31/2012  
 Time: 3:28:46 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



### 30 MHz – 3 GHz High Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 4/1/2012  
 Time: 12:52:46 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 11 (2472 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.

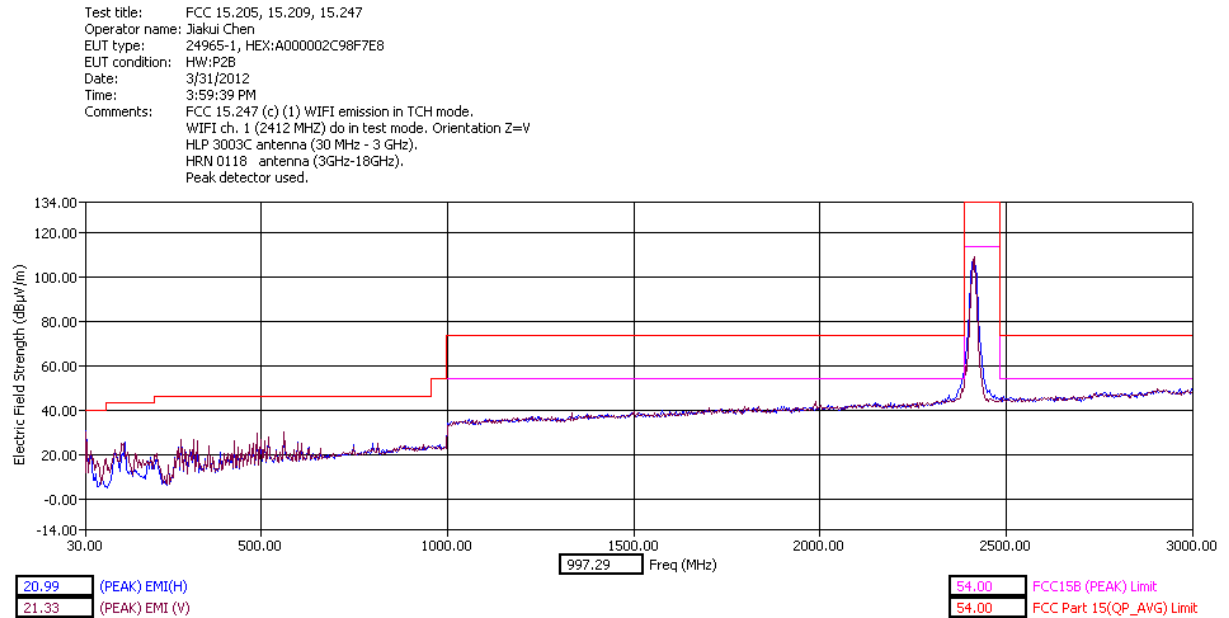
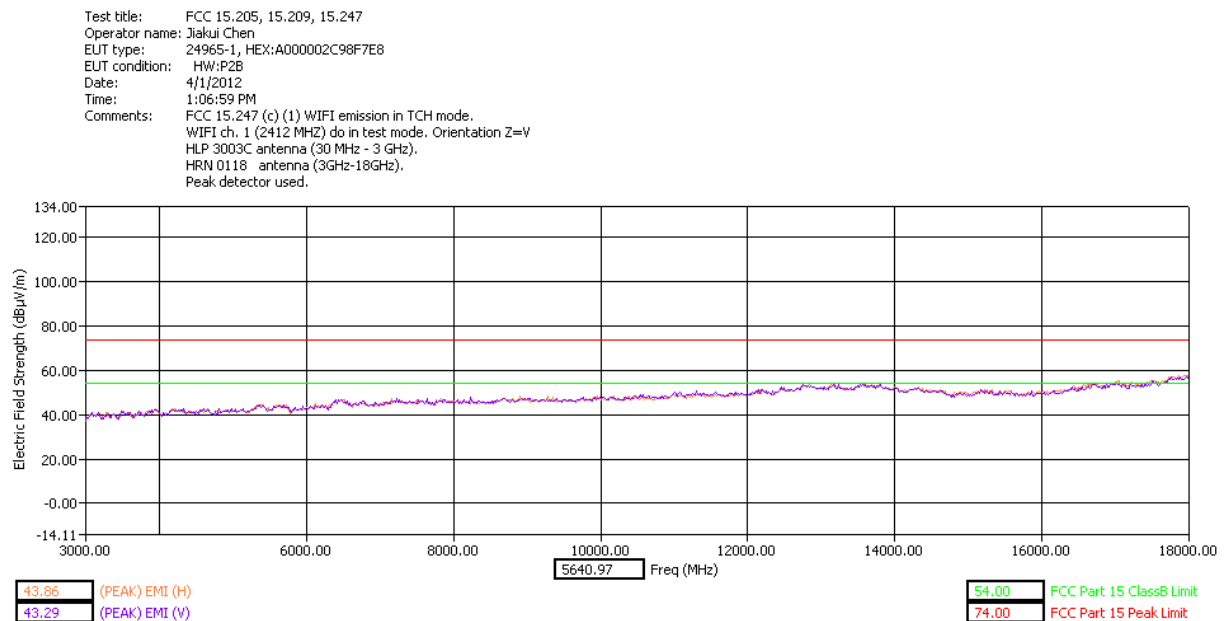


### 3 GHz – 18 GHz High Channel Dual Polarization Z

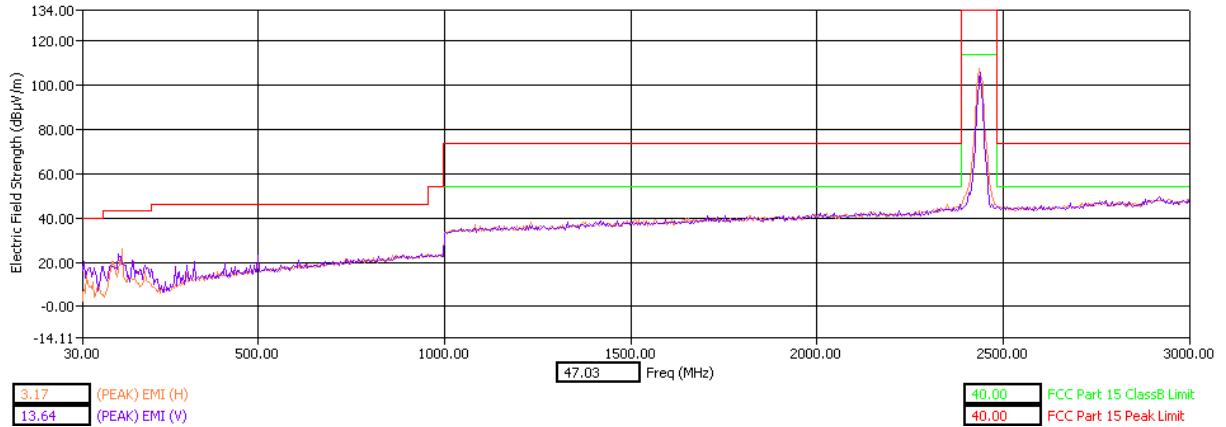
**There were no discernible emissions above the noise floor for 18-26.5 GHz for Low, Mid and High Channels and all polarizations in WLAN band**

**WLAN Band (g)**

Only the worst field strength of spurious emissions for each channel is displayed for WLAN (g).

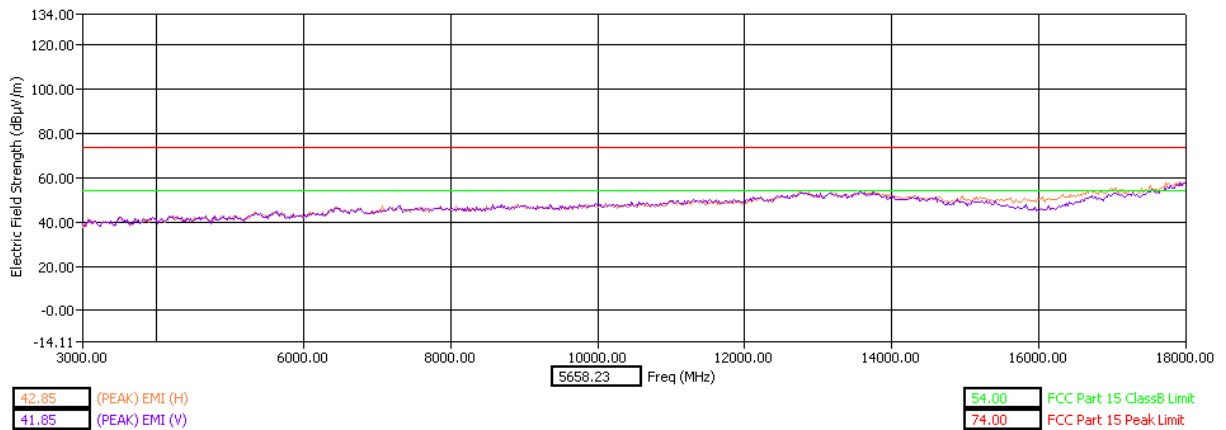
**30 MHz – 3 GHz Low Channel Dual Polarization Z****3 GHz – 18 GHz Low Channel Dual Polarization Z**

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 3/31/2012  
 Time: 4:25:52 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 6 (2437 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



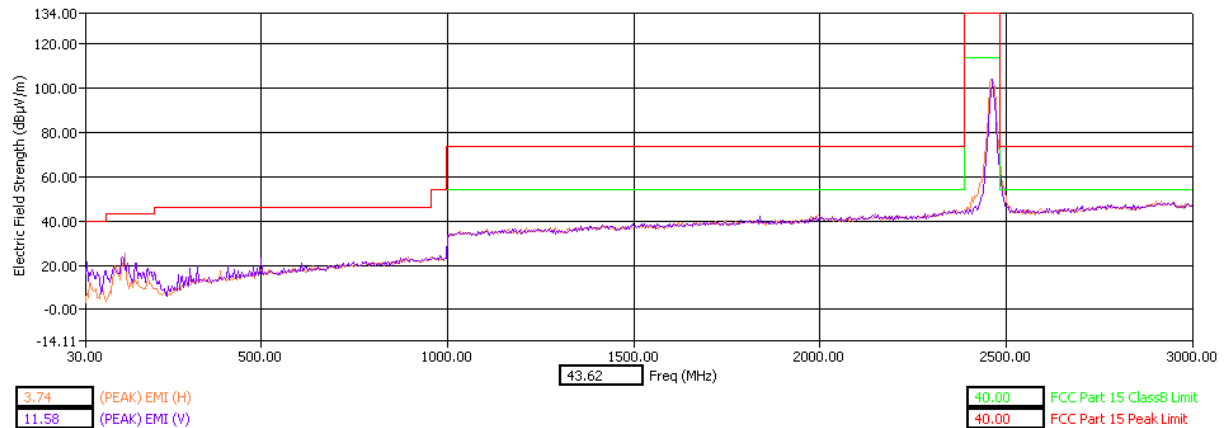
### 30 MHz – 3 GHz Middle Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 4/1/2012  
 Time: 1:36:38 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 6 (2437 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



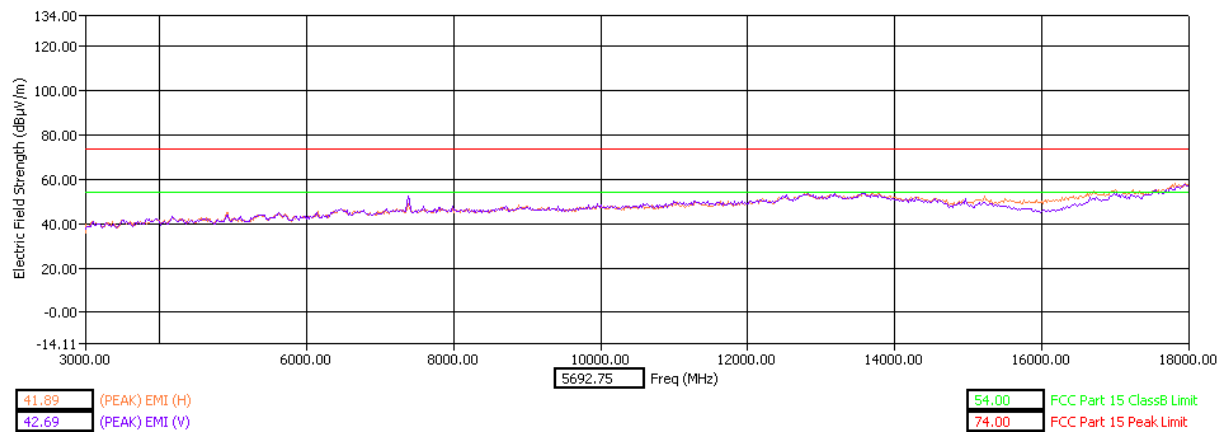
### 3 GHz – 18 GHz Middle Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 3/31/2012  
 Time: 4:53:20 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



### 30 MHz – 3 GHz High Channel Dual Polarization Z

Test title: FCC 15.205, 15.209, 15.247  
 Operator name: Jiakui Chen  
 EUT type: 24965-1, HEX:A000002C98F7E8  
 EUT condition: HW:P2B  
 Date: 4/1/2012  
 Time: 1:50:39 PM  
 Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
 WIFI ch. 11 (2472 MHz) do in test mode. Orientation Z=V  
 HLP 3003C antenna (30 MHz - 3 GHz).  
 HRN 0118 antenna (3GHz-18GHz).  
 Peak detector used.



### 3 GHz – 18 GHz High Channel Dual Polarization Z

**There were no discernible emissions above the noise floor for 18-26.5 GHz for Low, Mid and High Channels and all polarizations in WLAN band**

**BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS**

CFR 47 Part 15.247, 15.407

**Measurement Procedure**

The test sample is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

For 30 MHz – 18 GHz:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{EMI Receiver Level (dB}\mu\text{V)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)} + \text{Filter loss (dB)} + \text{Antenna Correction Factor (3/m)}$$

For 18 GHz – 26.5 GHz:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{EMI Receiver Level (dB}\mu\text{V)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)} + \text{Filter loss (dB)} + \text{Antenna Correction Factor (1/m)}$$

The test sample WLAN transmitter was enabled using a test script.

A fully charged battery was used for the supply voltage.

**Measurement Results**

Comments:

The band edge measurements crossing the corner for the low/high channel with respect to the average limit line is acceptable when applying the FCC rule specified in CFR 47 part 15.35(b) for the use of peak detector above 1 GHz.

The peak detector limit line has been added to the graphical plots.

Note: No WLAN band notch filters were used.

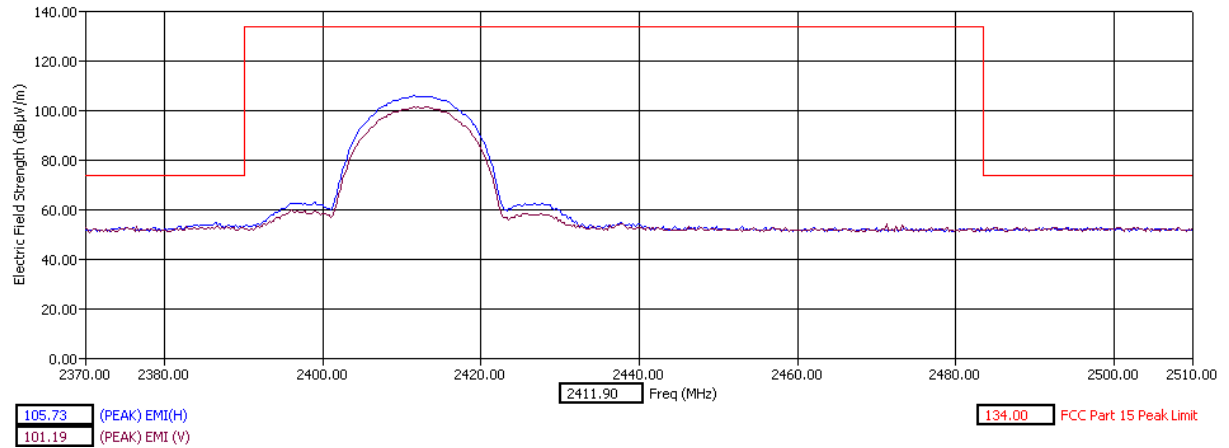
See below attached plots for the measurement results with both peak detector and average detector:



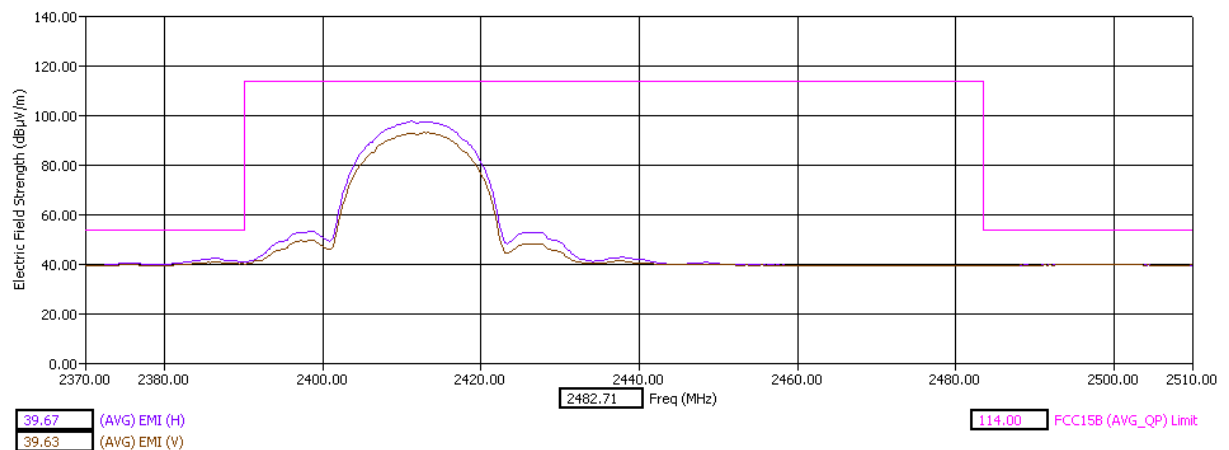
**WLAN Band (b)**

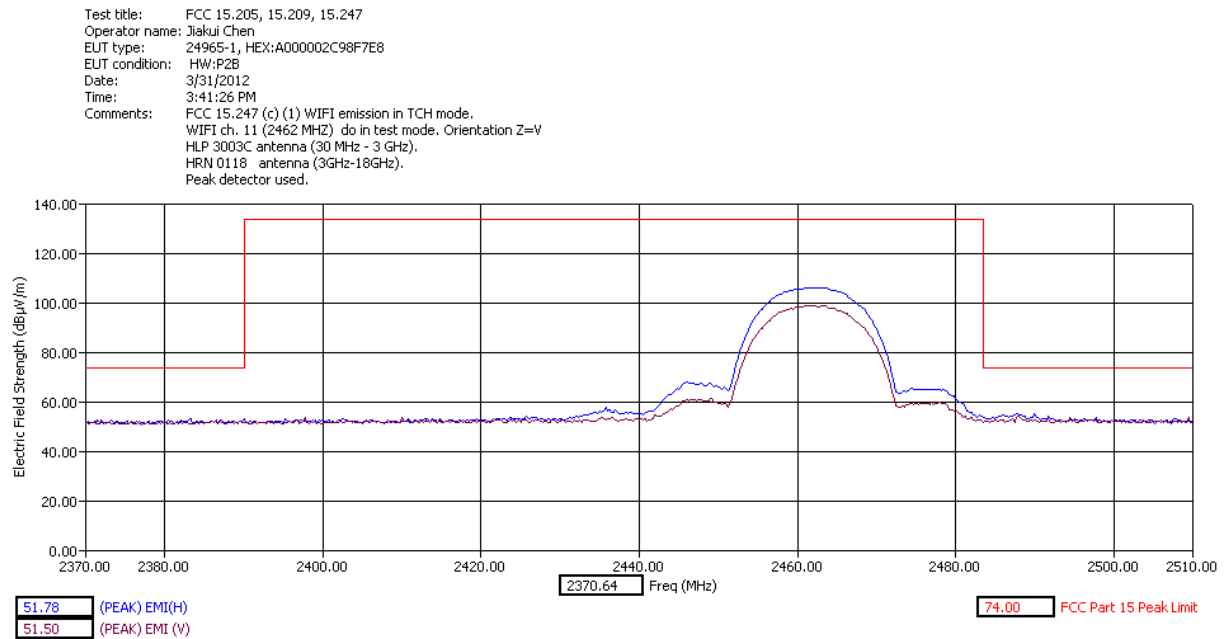
Only the worst band edge is displayed for WLAN band (b)

Test title: FCC 15.205, 15.209, 15.247  
Operator name: Jiakui Chen  
EUT type: 24965-1, HEX:A000002C98F7E8  
EUT condition: HW:P2B  
Date: 3/31/2012  
Time: 2:12:49 PM  
Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
HLP 3003C antenna (30 MHz - 3 GHz).  
HRN 0118 antenna (3GHz-18GHz).  
Peak detector used.

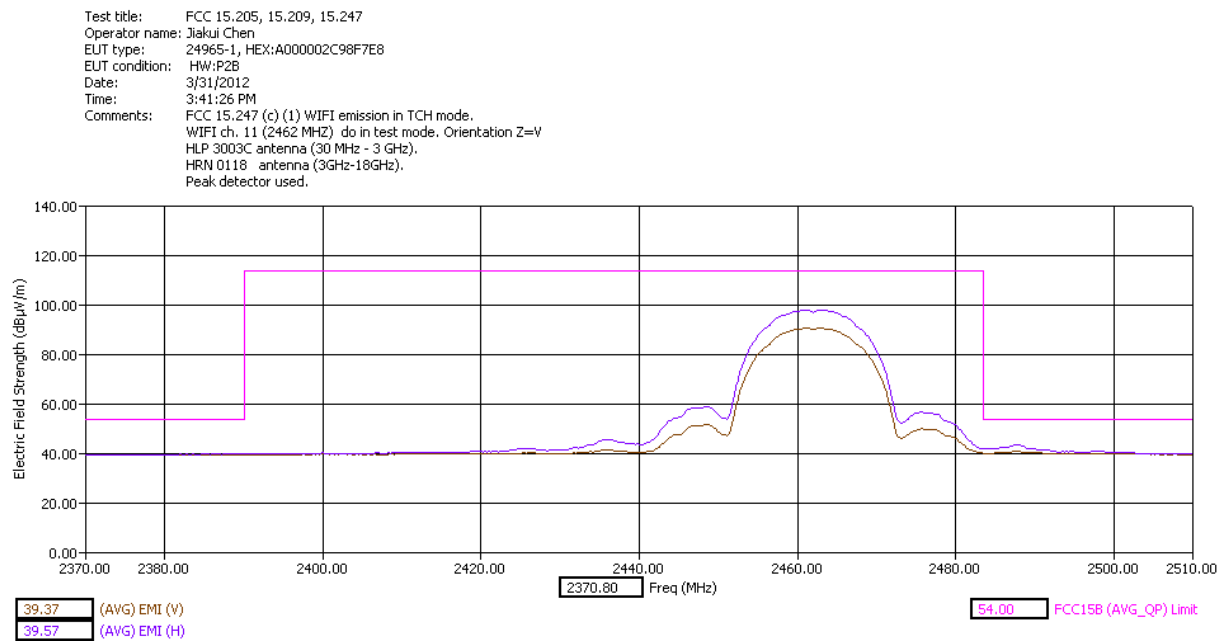
**Low Band Edge Z Orientation Peak Detector**

Test title: FCC 15.205, 15.209, 15.247  
Operator name: Jiakui Chen  
EUT type: 24965-1, HEX:A000002C98F7E8  
EUT condition: HW:P2B  
Date: 3/31/2012  
Time: 2:12:49 PM  
Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
HLP 3003C antenna (30 MHz - 3 GHz).  
HRN 0118 antenna (3GHz-18GHz).  
Peak detector used.

**Low Band Edge Z Orientation AVG Detector**



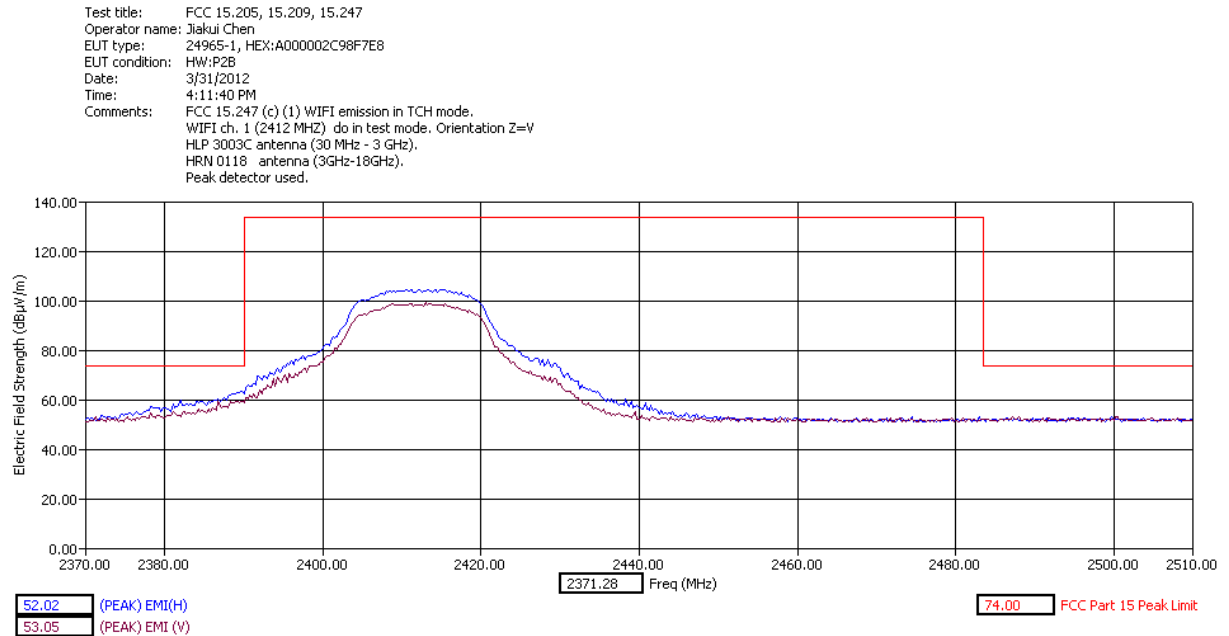
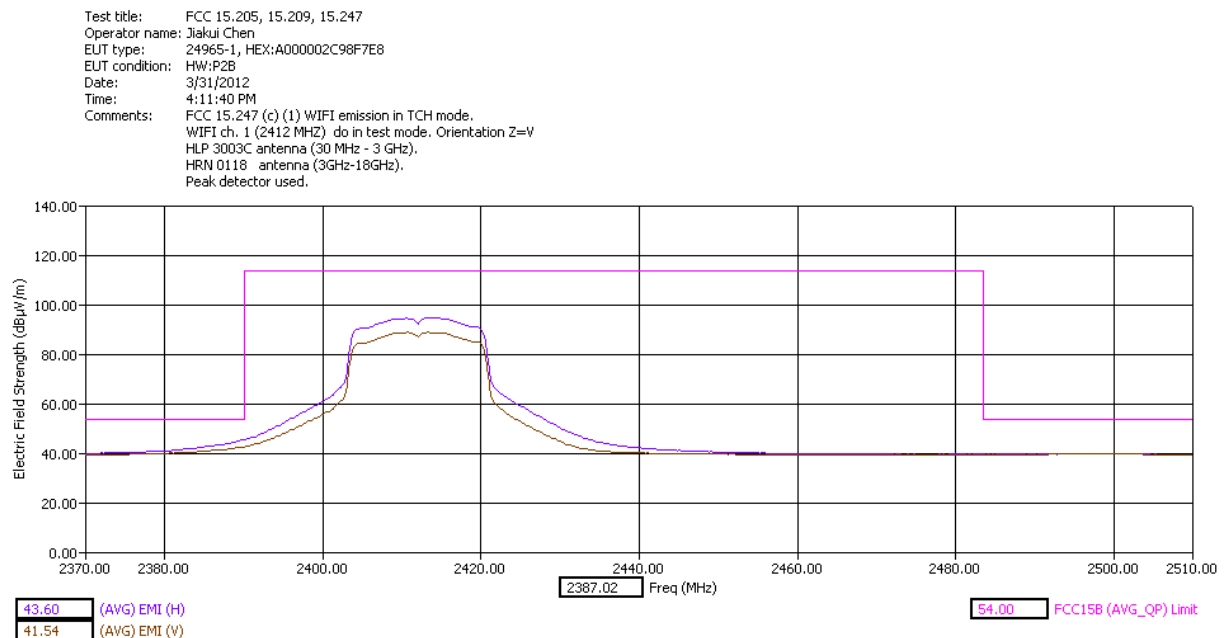
### High Band Edge Z Orientation Peak Detector

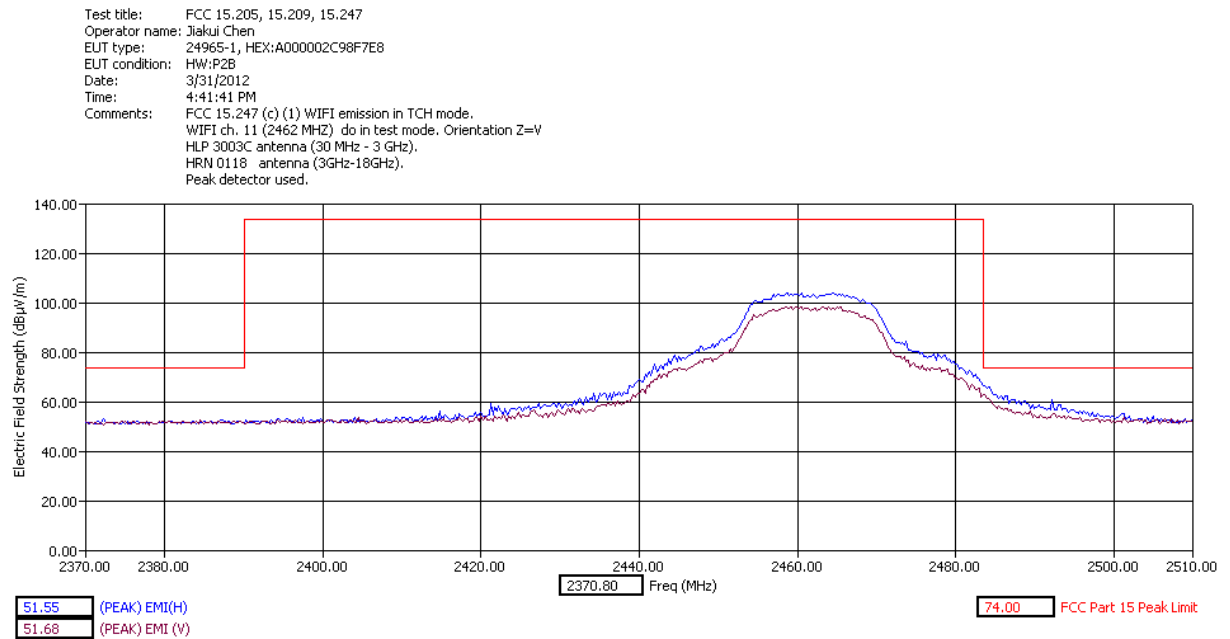


### High Band Edge Z Orientation AVG Detector

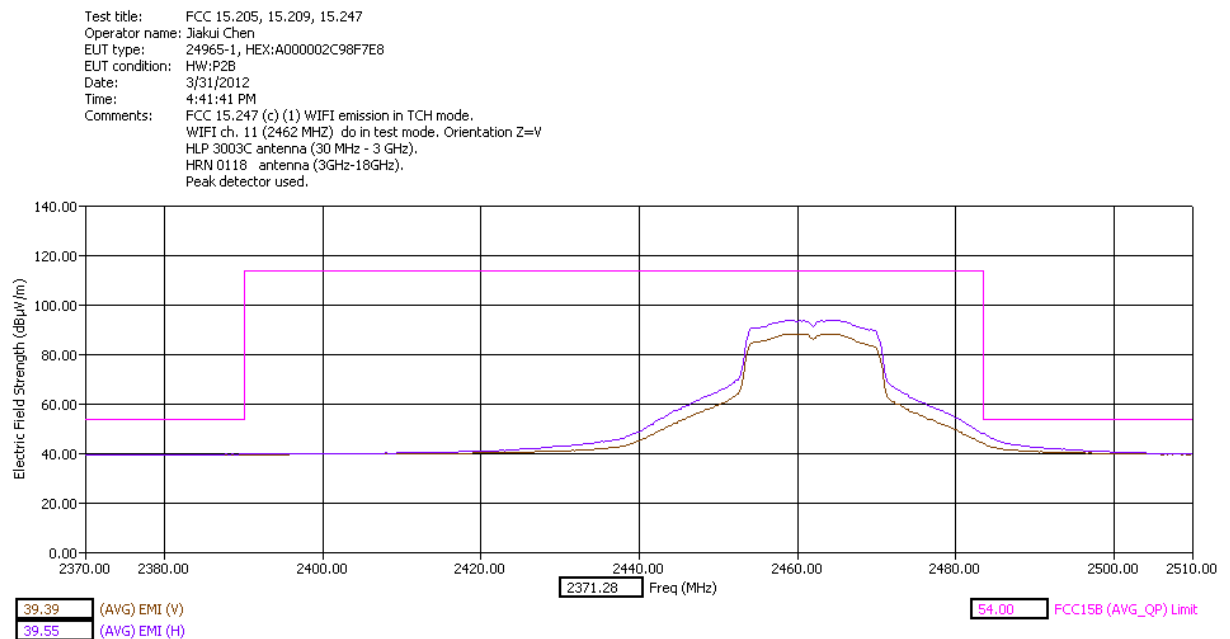
**WLAN Band (g)**

Only the worst band edge is displayed for WLAN band (g)

**Low Band Edge Z Orientation Peak Detector****Low Band Edge Z Orientation AVG Detector**



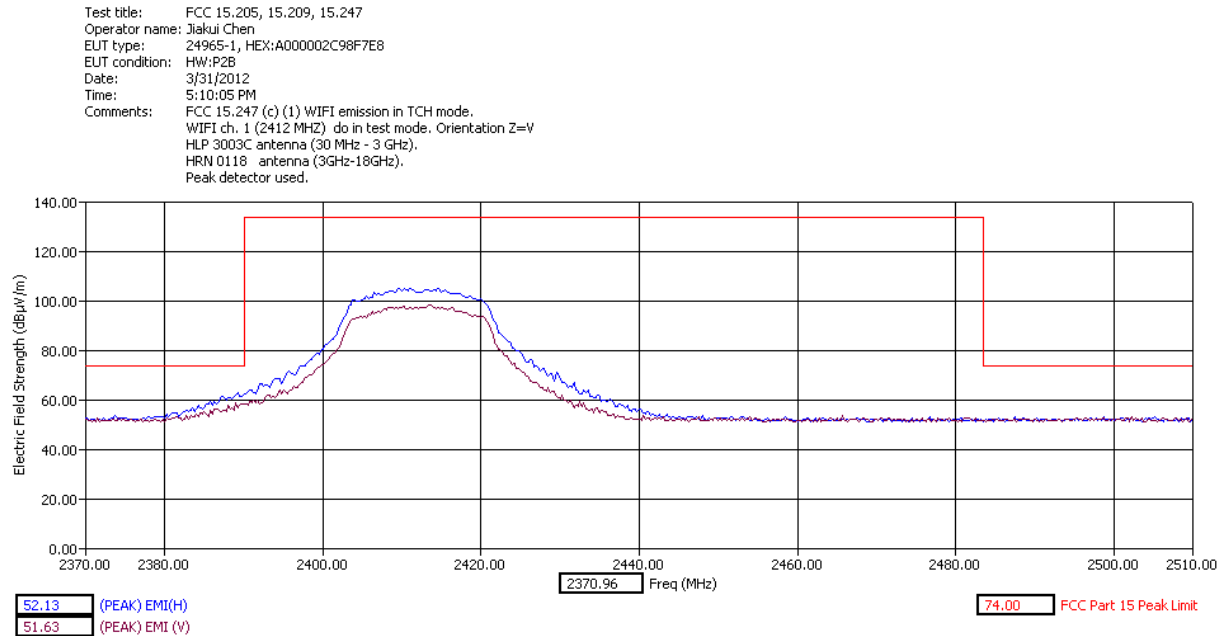
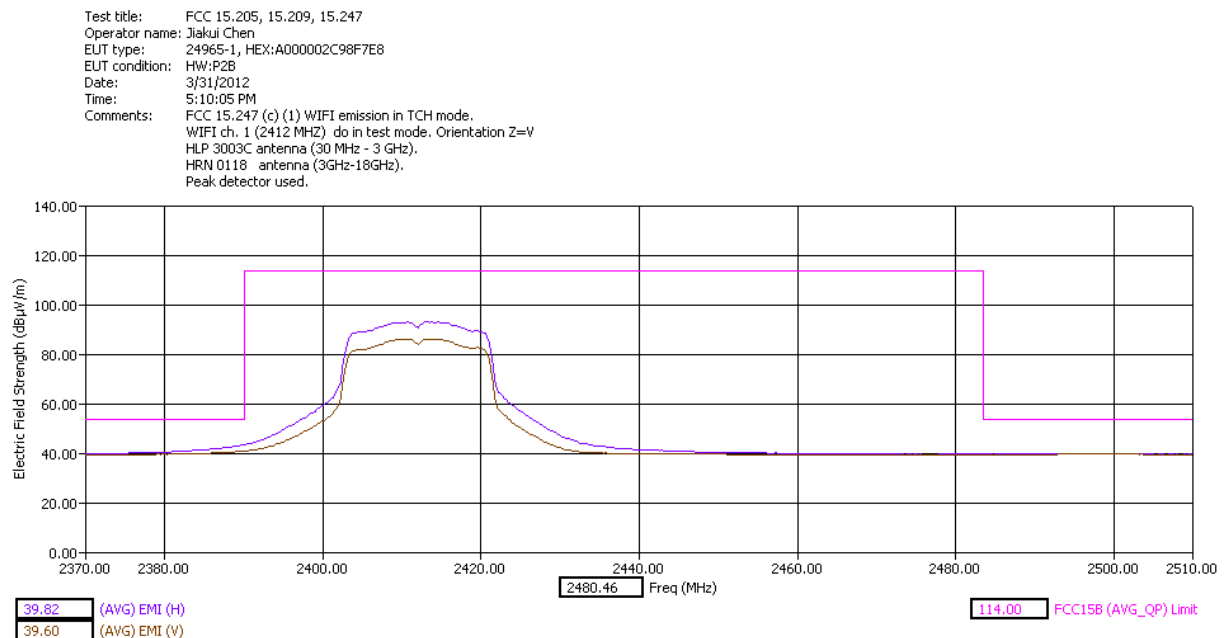
### High Band Edge Z Orientation Peak Detector



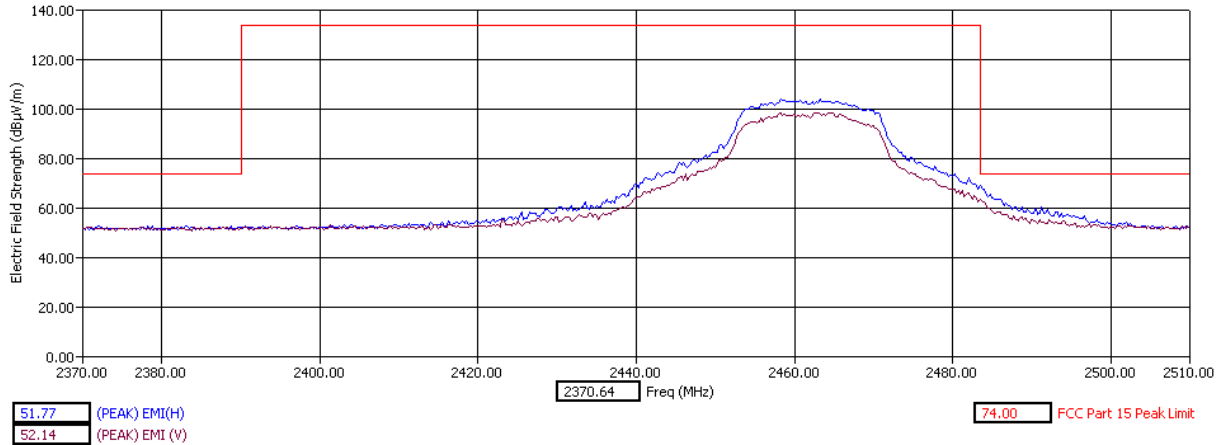
### High Band Edge Z Orientation AVG Detector

**WLAN Band (n) 2.4G 400ns GI**

Only the worst band edge is displayed for WLAN band (n).

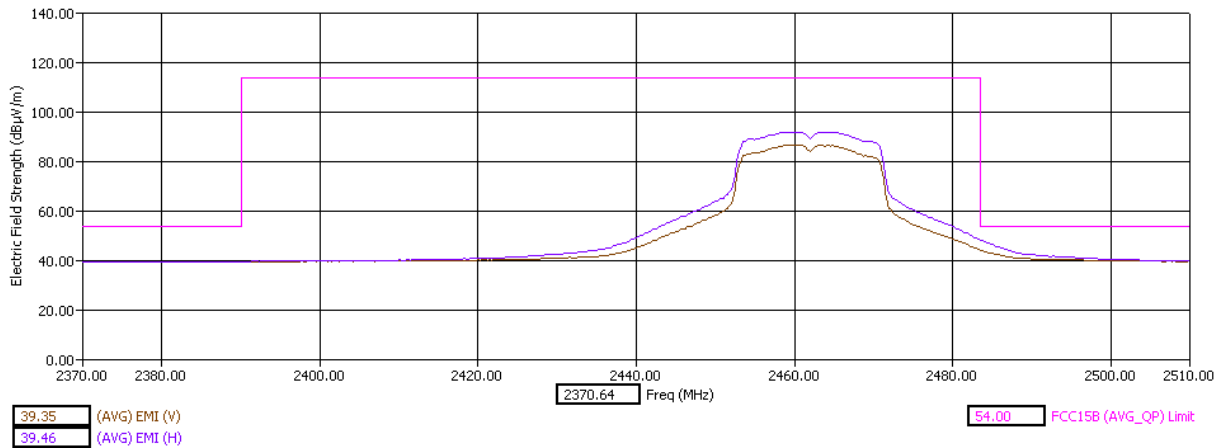
**Low Band Edge Z Orientation Peak Detector****Low Band Edge Z Orientation AVG Detector**

Test title: FCC 15.205, 15.209, 15.247  
Operator name: Jiakui Chen  
EUT type: 24965-1, HEX:A000002C98F7E8  
EUT condition: HW:P2B  
Date: 3/31/2012  
Time: 5:26:00 PM  
Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
HLP 3003C antenna (30 MHz - 3 GHz).  
HRN 0118 antenna (3GHz-18GHz).  
Peak detector used.



### High Band Edge Z Orientation Peak Detector

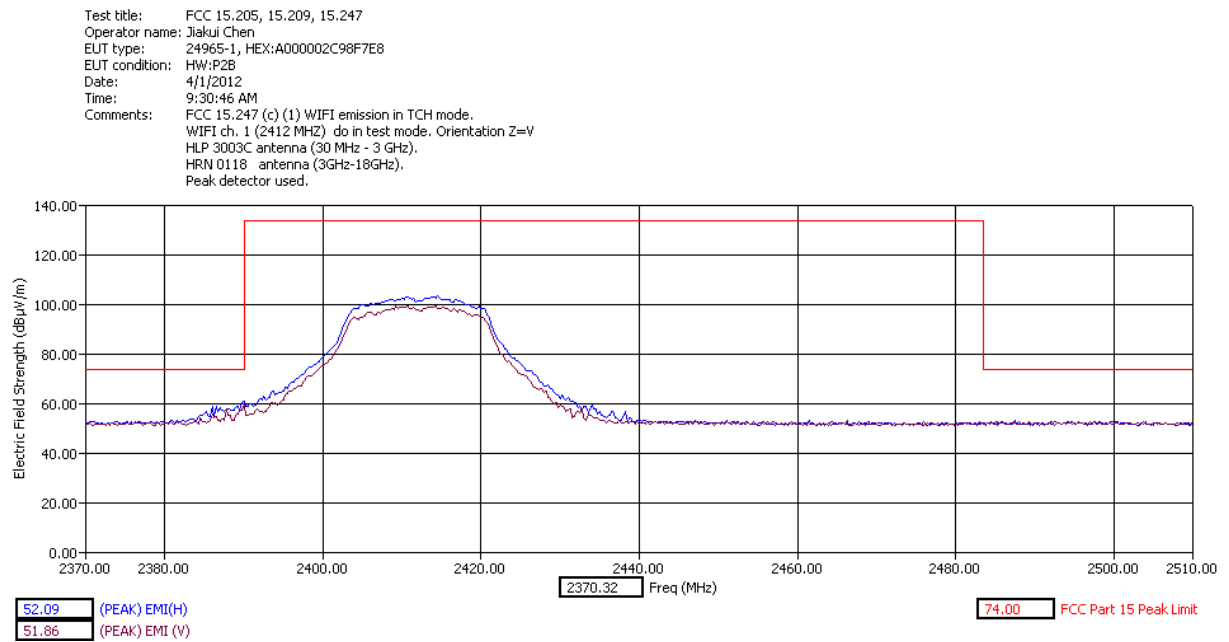
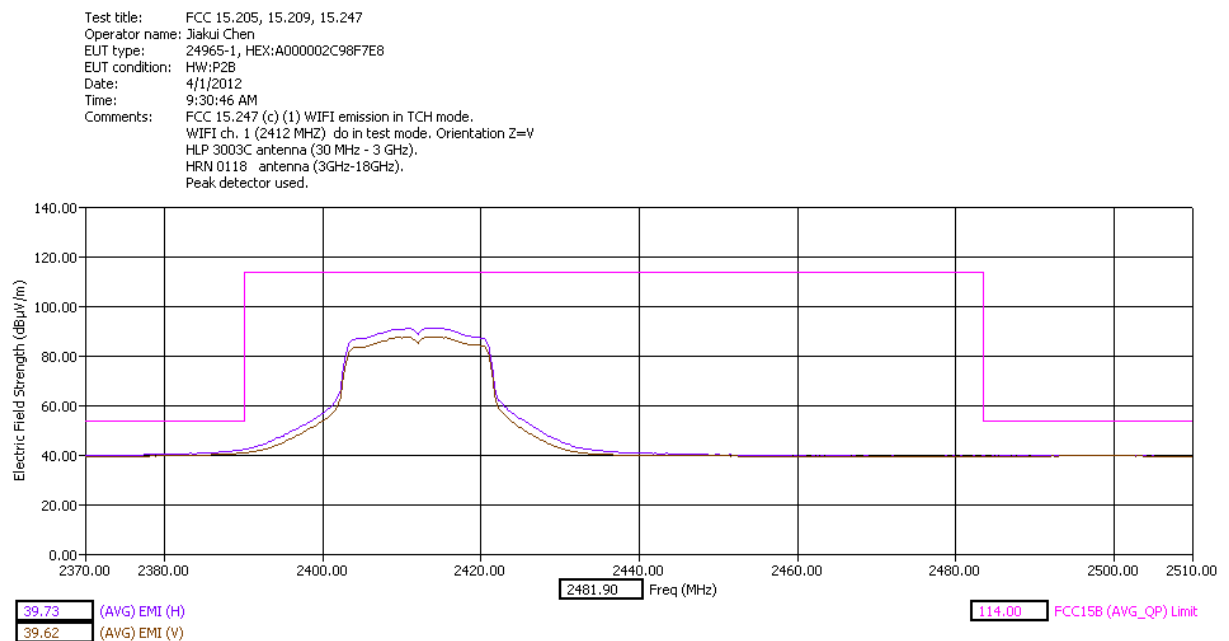
Test title: FCC 15.205, 15.209, 15.247  
Operator name: Jiakui Chen  
EUT type: 24965-1, HEX:A000002C98F7E8  
EUT condition: HW:P2B  
Date: 3/31/2012  
Time: 5:26:00 PM  
Comments: FCC 15.247 (c) (1) WIFI emission in TCH mode.  
WIFI ch. 11 (2462 MHz) do in test mode. Orientation Z=V  
HLP 3003C antenna (30 MHz - 3 GHz).  
HRN 0118 antenna (3GHz-18GHz).  
Peak detector used.

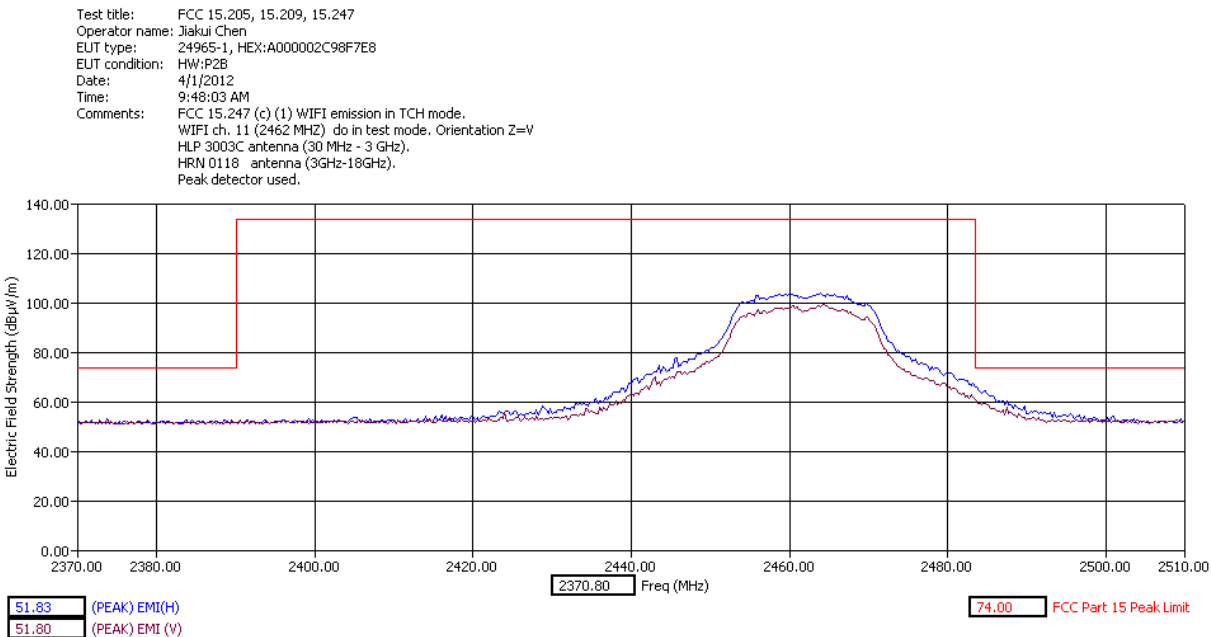


### High Band Edge Z Orientation AVG Detector

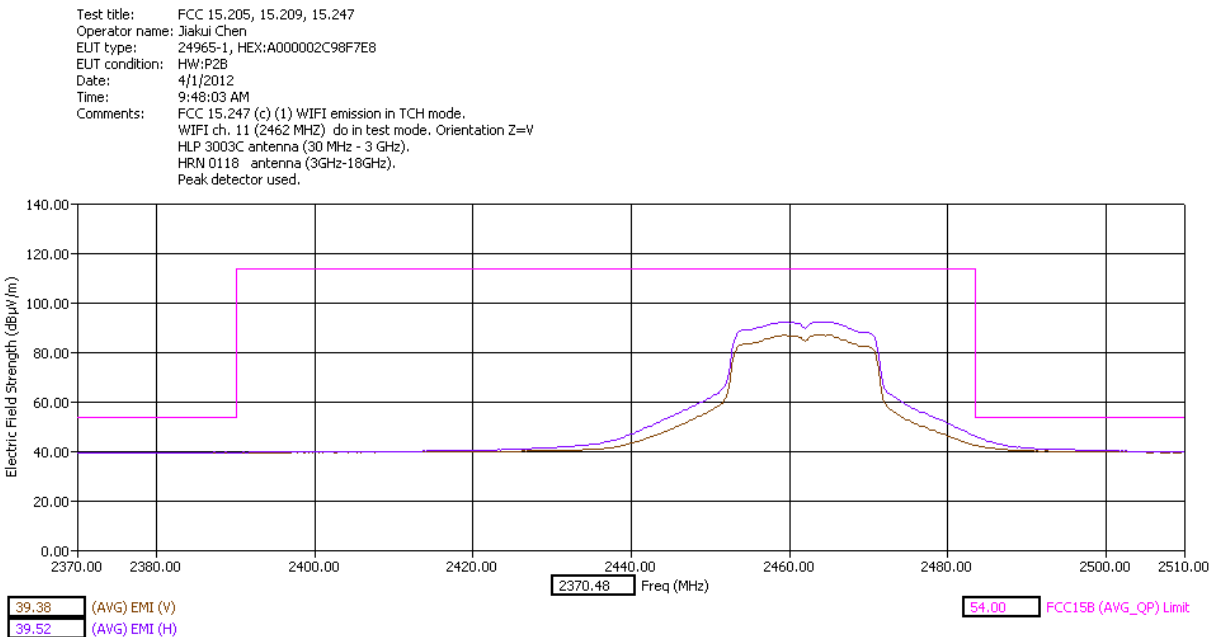
**WLAN Band (n) 2.4G 800ns GI**

Only the worst band edge is displayed for WLAN band (n).

**Low Band Edge Z Orientation Peak Detector****Low Band Edge Z Orientation AVG Detector**



High Band Edge Z Orientation Peak Detector



High Band Edge Z Orientation AVG Detector

End of Test Report