

 <p>CERTIFICATE 2518.08</p> <p>MS ISO/IEC 17025 TESTING SAMM NO. 0825</p>
<p><b>MOTOROLA PENANG ADV. COMM. LABORATORY</b> Motorola Solutions Malaysia Sdn. Bhd. Plot 2A Medan Bayan Lepas, Mukim 12, S.W.D. 11900 Bayan Lepas, Penang, Malaysia.</p>	<p><b>FCC / ISED TEST REPORT</b> Report Revision : Rev.B</p>
<p><b>Date/s Tested</b> : 21-Dec-2021 - 27-Dec-2021 <b>Report Issue Date</b> : 10-Feb-2022 <b>Manufacturer/Location</b> : Motorola Solutions Malaysia Sdn Bhd Plot 2A, Medan Bayan Lepas, Mukim 12 SWD, 11900, Bayan Lepas, Penang, Malaysia <b>Requestor</b> : MELLISA YURY KRISHNAN <b>Product Type</b> : Hand-held <b>Product Version (PMN)</b> : XPR 7550e <b>Model Number (HVIN)</b> : AAH56JDN9RA1AN (IC Model No: PMUD2904EBCNAA) <b>Frequency Band</b> : 2.412-2.462 GHz <b>Max RF Output Power</b> : 802.11b - 22.4 mWatts 802.11g - 8.3 mWatts 802.11n - 12.6 mWatts <b>Applicant Name</b> : Motorola Solutions Inc <b>Applicant Address</b> : 8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322 <b>FCC Registrations</b> : 461337 <b>ISED Registrations</b> : MY0001 <b>Firmware Version (FVIN)</b> : D02.21.06.0050</p> <p><b>The equipment was tested accordance to the requirement listed below:</b></p> <p><b>(2.4GHz Wifi)</b> <b>PASS</b> <b>47CFR Part 15C</b> <b>ISED RSS 247 Issue 2</b></p>	
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### REVISION HISTORY

<b>Revision History</b>	<b>Description</b>	<b>Date</b>	<b>Originator</b>
Rev. A	Initial Report	<b>28-Jan-2022</b>	<b>Gan Boon Teong</b>
Rev. B	Update Requestor Name	<b>10-Feb-2022</b>	<b>Gan Boon Teong</b>

## 1.0. General Information

### EUT Description:

<b>Technologies</b>	2.4GHz Wi-Fi
<b>TX Frequency range</b>	2412MHz – 2462MHz
<b>Modulation Type</b>	DSSS, OFDM
<b>Connector type</b>	PROGRAMMING, TEST & ALIGNMENT CABLE
<b>Antenna type</b>	INTERNAL BT/WLAN ANTENNA

### 1.1. Channel number and frequency information:

There are two bandwidth systems.

For 20MHz Bandwidth systems (802.11b, 802.11g, 802.11n), use channel 1 ~ channel 11

For 40MHz Bandwidth systems (802.11n), use channel 3 ~ channel 9

Channel	Frequency	Channel	Frequency
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

The EUT contains following accessory devices and data cable:

Item	Brand	Model or P/N
BELIZE NON-TIA HIGH CAP LV LI- ION BATTERY 2950M3000T	MOTOROLA	PMNN4493A
VHF WIDEBAND WHIP ANTENNA	MOTOROLA	PMAD4147A
PROGRAMMING, TEST AND ALIGNMENT CABLE	MOTOROLA	PMKN4013C

### General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

**FCC 47 CFR Part 15 Subpart C**  
**KDB 558074 D01 15.247 Meas Guidance v05**  
**ANSI C63.10-2013**

### Deviation from standard

Not applicable as no deviation from standard test method

### Modifications to EUT

For RF conducted measurements a pigtail was soldered out of the board while for radiated measurements there were no modifications to the device

### Test configuration of EUT

All relevant configurations involving radio models and accessories (including chargers, batteries, antennas) were assessed. Only worst case configurations will be included in this report.

## 2.0. Summary of Test Results

FCC Clause	IC Clause	Test Item	Result	Remark	Serial number tested	Tested by
15.247 (a)(2)	RSS-247 5.2(a)	DTS & 99% Channel Bandwidth	Pass	Highest 99% OCB: 802.11b: 13.490 MHz(13M5G1D) 802.11g: 16.743 MHz(16M7D1D) 802.11n: 17.702 MHz(17M7D1D)	871TXX3195	Gan
15.247 (b)(3)	RSS-247 5.4(d)	Conducted RF Output Power (Average)	Pass	Highest output power: 802.11b: 13.099dBm (20.41 mW) 802.11g: 8.675dBm (7.37 mW) 802.11n: 10.860dBm (12.19 mW)	871TXX3195	Gan
15.247(e)	RSS-247 5.2(b)	Maximum Power Spectral Density	Pass	Meet the limit requirement.	871TXX3195	Gan
15.247(d)	RSS-247 5.5	Conducted Spurious Emissions	Pass	Worst case emission: 802.11g: -39.95 dBm	871TXX3195	Gan
15.247 (d)	RSS-247 5.5	Band edge Conducted Spurious Emission	Pass	Worst case emission: 802.11n: -35.85 dBm	871TXX3195	Gan
15.205, 15.209, 15.247 (d)	RSS-247 5.5	Radiated Emission within Restricted Bands	Pass	Worst case emission: RBE: 65.5853 dBuV/m, Margin: 8.4147 dB. RSE: 50.2568 dBuV/m, Margin: 3.7432 dB Noise Floor.	871TXX3188	Aiman & Amaluddin
15.207	RSS-Gen 8.8	AC Power Line Conducted Emission	NA	Testing is not required, radio shall turn off during charging mode	NA	NA
15.203		Antenna requirement	NA	Internal antenna is not accessible to the enduser	NA	NA

NA → Not Available

## 3.0. Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=1.96) (±)
Radiated Emissions up to 1 GHz (Field Strength)	30MHz ~ 1000MHz	5.88 dB
Radiated Emissions above 1 GHz (Field Strength)	1GHz ~ 18GHz	5.84 dB
	18GHz ~ 40GHz	6.02 dB
Conducted Spurious Emissions	9kHz ~ 12.75GHz	2.82 dB

#### 4.0. Equipment List

##### Bluetooth ATE # 1 (SW Version: Ate Main\_3.1.11)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
POWER SUPPLY	6652A	3640A02941	22-Jan-21	22-Jan-22
ANALYZER SPECTRUM	E4440A	US45303111	14-Jul-21	14-Jul-22
CHAMBER	SH-641	92003820	14-Jul-21	14-Jul-22
N to N RF Cable # 1	SF126/11N/11N	NA	NA	NA

##### Radiated Emission Station (SW Version: EMC FCC RE v1.6.2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
DRG HORN FREQ.	SAS-571	720	06-Apr-21	06-Apr-23
DRG HORN FREQ.	SAS-571	719	13-Sep-21	13-Sep-22
POWER SUPPLY	N7976A	MY53410110	24-May-21	24-May-22
SIGNAL GENERATOR	SMB 100A	182511	4-Jun-21	4-Jun-24
EMI TEST RECEIVER	ESW44	101750	15-Jan-21	15-Jan-22
EMI TEST RECEIVER	ESIB26	827769/009	11-Mar-21	11-Mar-22
5m SEMI-ANECHOIC CHAMBER	S800-HX	J2308	Not Required	Not Required
BILOG ANTENNA	CBL6112D	55546	06-Jun-21	06-Jun-22
BILOG ANTENNA	CBL6112B	2964	4-May-21	4-May-22
HYGRO-THERMOMETER	SDL500	A.016800	18-May-21	18-May-22
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	Not Required	Not Required
ANTENNA POSITIONING TOWER	TLT2	NA	Not Required	Not Required
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	4-Feb-21	4-Feb-22
PREAMPLIFIER 18-40GHz	BBV9721	9721-007	Not Required	Not Required
PREAMPLIFIER	PAM-0118P	361	11-Sep-20	11-Sep-23
LOOP ANTENNA	6502	00203479	5-Feb-21	5-Feb-22

## 5.0. Test Mode Applicability and Test Channel Detail

The device employs MIMO technology. Below are the possible configurations.

WLAN Configurations		Mode					
		SISO		Spatial Diversity Multiplexing (MIMO)		Cyclic Delay Diversity (MIMO)	
	Antenna	Primary	Secondary	Primary	Secondary	Primary	Secondary
2.4GHz	802.11b	√	√	x	x	x	x
	802.11g	√	√	x	x	x	x
	802.11n (HT20)	√	√	x	x	x	x
	802.11n (HT40)	x	x	x	x	x	x

√ = Support;  
 x = NOT Support

**Note:** This Device supports simultaneous transmission operation, which allows for two SISO or two MIMO channels to operate independent of one another in the 2.4GHz band on each antenna. 802.11n mode is capable of transmitting simultaneously on two antennas using Cyclic Delay Diversity and Spatial Diversity Multiplexing (2x2 MIMO).

The following tables show the worst case configurations determined during testing. The data for these configurations is contained in this test report.

**Radiated Emission Test (Above 1GHz)**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11b	1 to 11	1,6,11	DSSS	DBPSK	1	SISO	23.3°C, 78.4%RH
Test Mode	802.11g	1 to 11	1,6,11	OFDM	BPSK	6	SISO	23.3°C, 78.4%RH
Test Mode	802.11n (HT20)	1 to 11	1,6,11	OFDM	BPSK	6.5	SISO CDD (MIMO)	23.3°C, 78.4%RH
Test Mode	802.11n (HT40)	3 to 9	3,6,9	OFDM	BPSK	6.5	SISO CDD (MIMO)	NA

**Radiated Emission Test (Below 1GHz)**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11b	1 to 11	1,6,11	DSSS	DBPSK	1	SISO	23.3°C, 78.4%RH
Test Mode	802.11g	1 to 11	1,6,11	OFDM	BPSK	6	SISO	23.3°C, 78.4%RH
Test Mode	802.11n (HT20)	1 to 11	1,6,11	OFDM	BPSK	6.5	SISO CDD (MIMO)	23.3°C, 78.4%RH
Test Mode	802.11n (HT40)	3 to 9	3,6,9	OFDM	BPSK	6.5	SISO CDD (MIMO)	NA

**Power Line Conducted Emission Test**

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Environmental Conditions
Application Mode	802.11bgn mixed	1 to 11	AUTO	DSSS, OFDM	AUTO	AUTO	NA

**Antenna Port Conducted Measurement:**

This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Data Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11b	1 to 11	1,6,11	DSSS	DBPSK	1	SISO	25°C, 54.6%RH
Test Mode	802.11g	1 to 11	1,6,11	OFDM	BPSK	6	SISO	25°C, 54.6%RH
Test Mode	802.11n (HT20)	1 to 11	1,6,11	OFDM	BPSK	6.5	SISO CDD (MIMO)	25°C, 54.6%RH
Test Mode	802.11n (HT40)	1 to 11	3,6,9	OFDM	BPSK	6.5	SISO CDD (MIMO)	NA

**Duty Cycle of Test Signal**

802.11b, 802.11g and 802.11n : Duty cycle of test signal is ≤98%. (Refer to Clause 6.3 for duty cycle test signal)



## 6.0. Transmitter Test Parameters

### 6.1. 6dB Channel Bandwidth

#### 6.1.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max hold
  - e. Sweep = auto
- e) Measure the freq different of two frequencies that were attenuated 6dB from peak of the emission & record the frequency difference as the emission bandwidth.
- f) Measure every antenna port by repeat the step above for MIMO measurement.

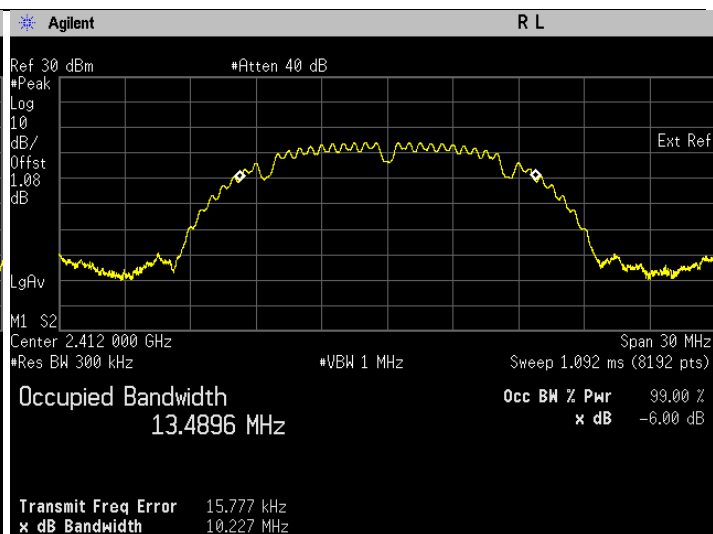
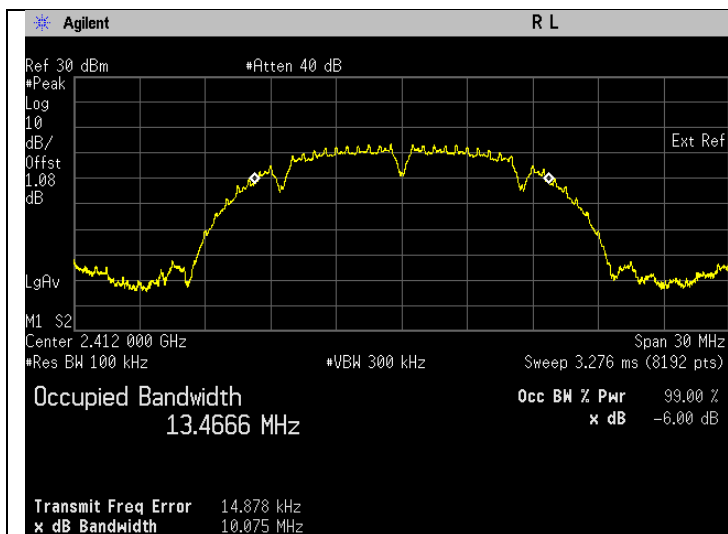
#### 6.1.2. Test Limits:

<b>Normal Condition (25 ° C)</b>
<b>≥500 kHz</b>

6.1.3. Test Data:

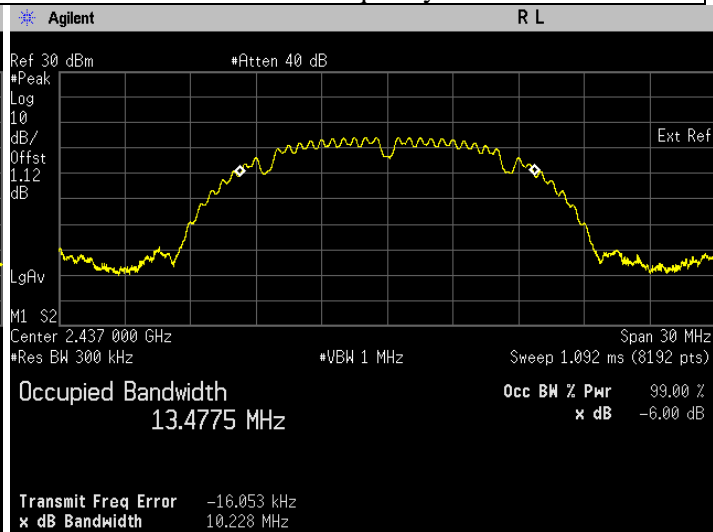
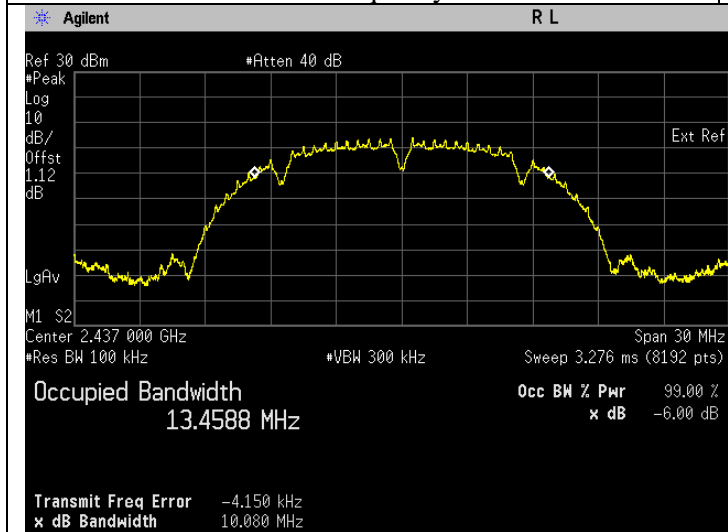
**802.11 b**

Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Status
802.11b	DSSS	DBPSK	1	2412	10.075	13.490	Pass
802.11b	DSSS	DBPSK	1	2437	10.080	13.478	Pass
802.11b	DSSS	DBPSK	1	2462	10.082	13.461	Pass



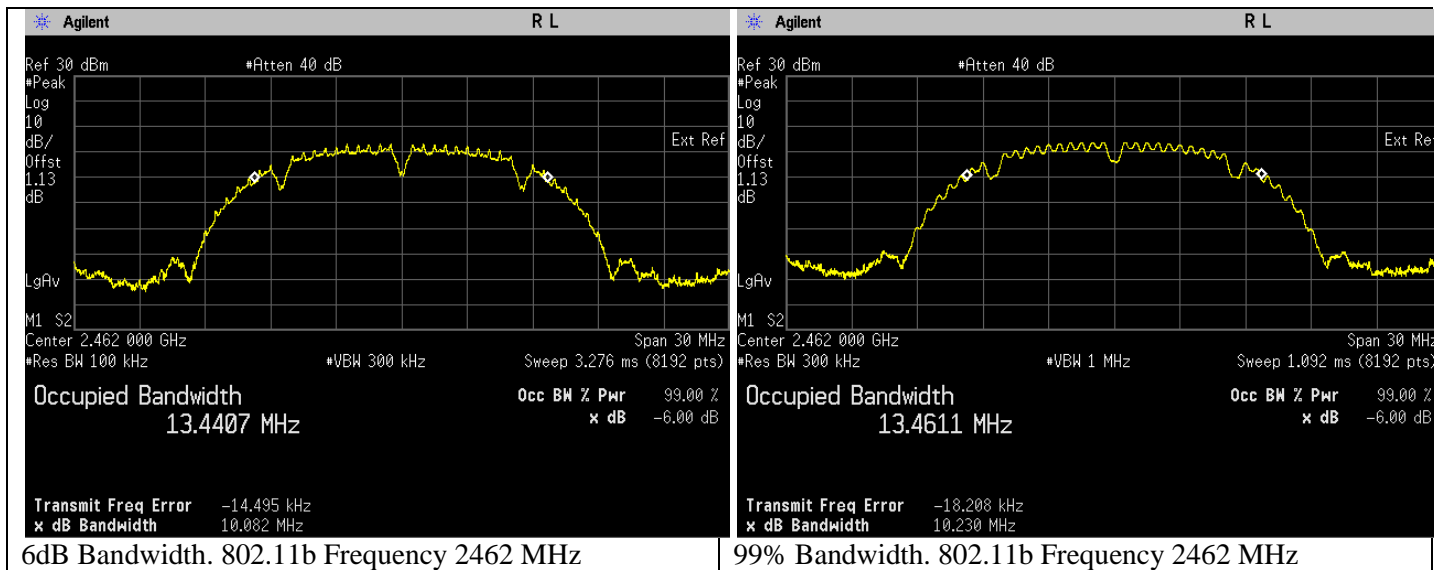
6dB Bandwidth. 802.11b Frequency 2412 MHz

99% Bandwidth. 802.11b Frequency 2412 MHz



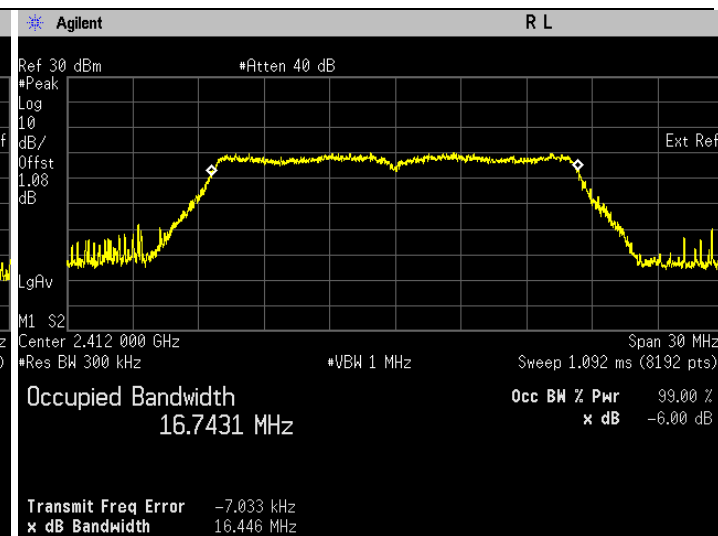
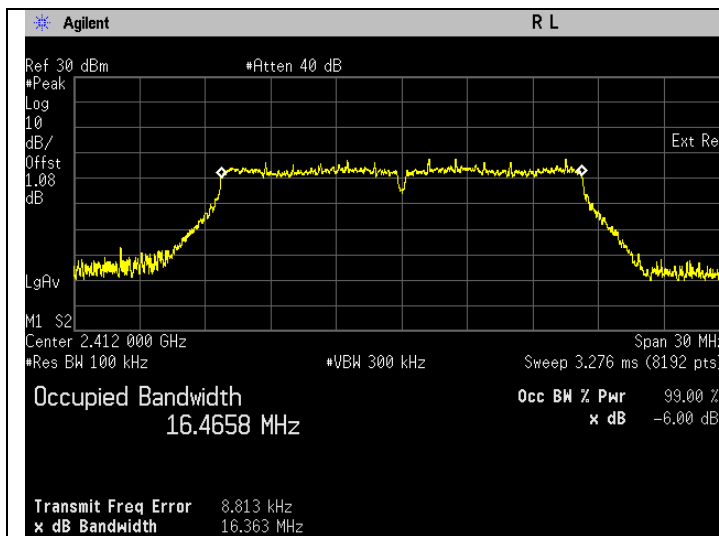
6dB Bandwidth. 802.11b Frequency 2437 MHz

99% Bandwidth. 802.11b Frequency 2437 MHz



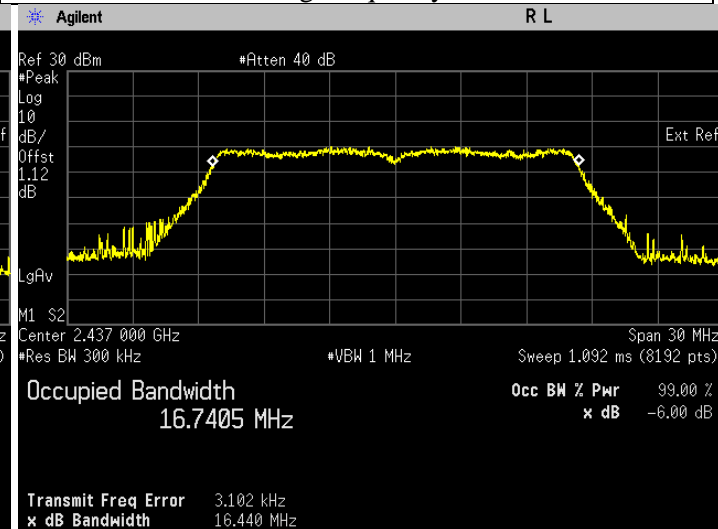
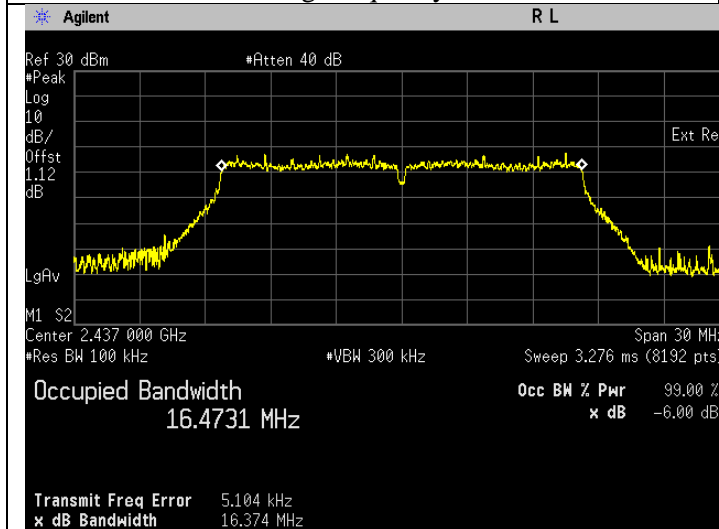
**802.11 g**

Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Status
802.11g	OFDM	BPSK	6	2412	16.363	16.743	Pass
802.11g	OFDM	BPSK	6	2437	16.374	16.741	Pass
802.11g	OFDM	BPSK	6	2462	16.356	16.731	Pass



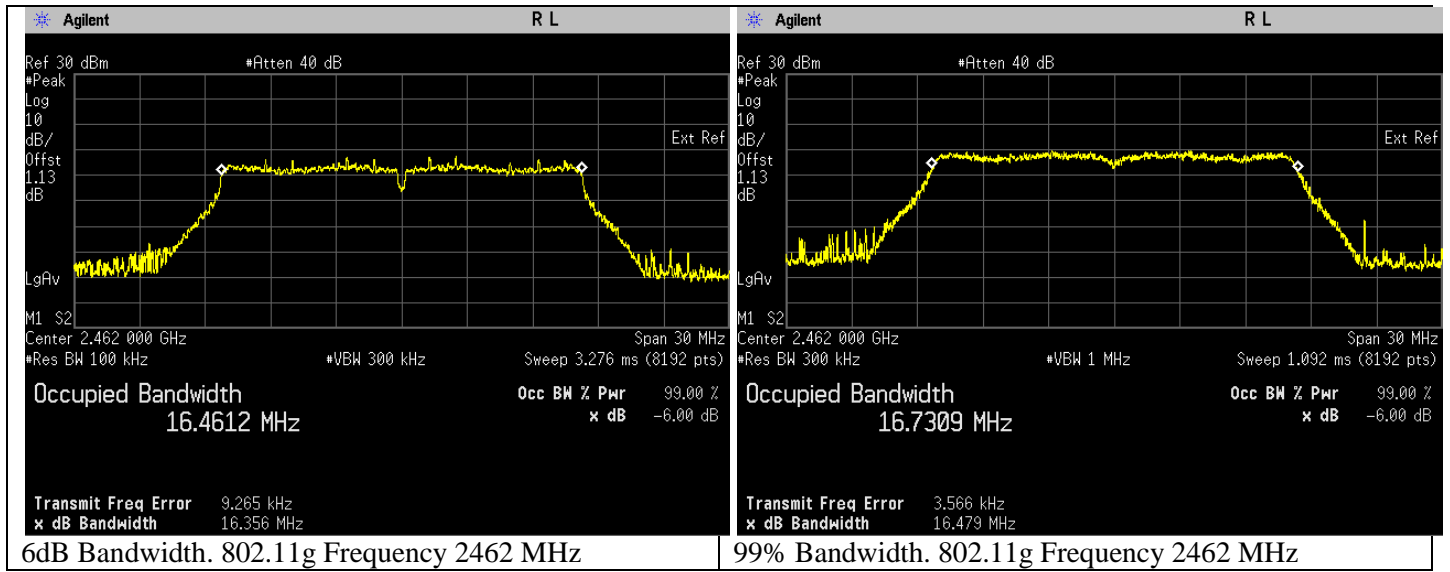
6dB Bandwidth. 802.11g Frequency 2412 MHz

99% Bandwidth. 802.11g Frequency 2412 MHz



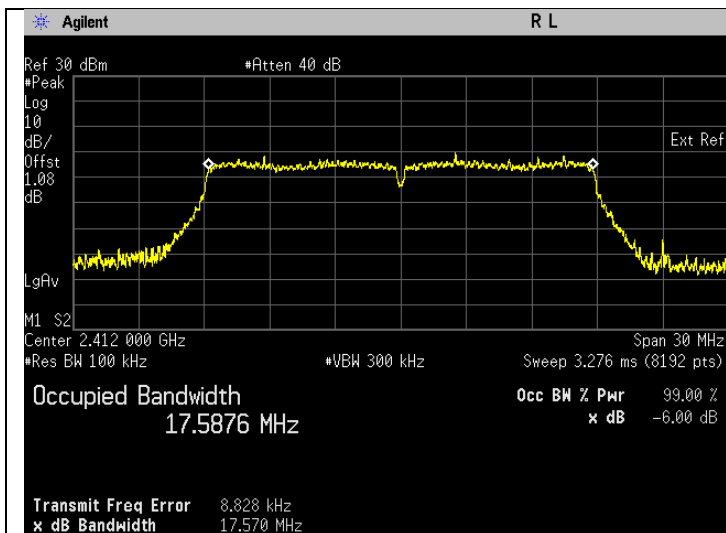
6dB Bandwidth. 802.11g Frequency 2437 MHz

99% Bandwidth. 802.11g Frequency 2437 MHz

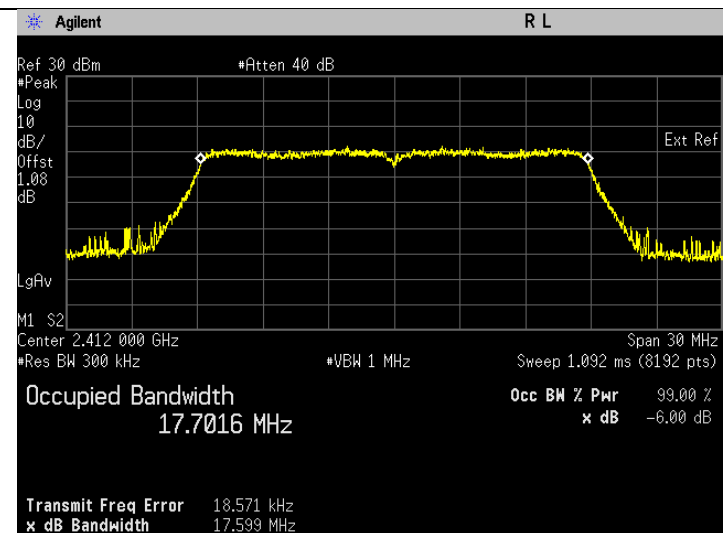


**802.11n (HT20)**

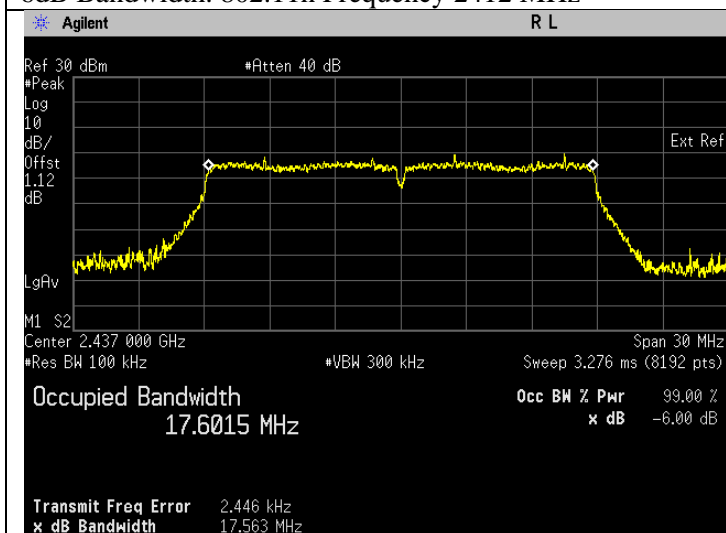
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Status
802.11n	OFDM	BPSK	6.5	2412	17.570	17.702	Pass
802.11n	OFDM	BPSK	6.5	2437	17.563	17.686	Pass
802.11n	OFDM	BPSK	6.5	2462	17.560	17.701	Pass



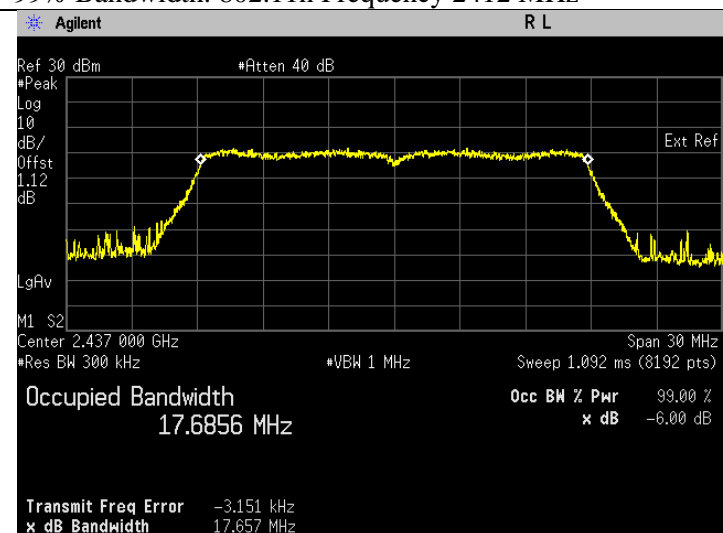
6dB Bandwidth. 802.11n Frequency 2412 MHz



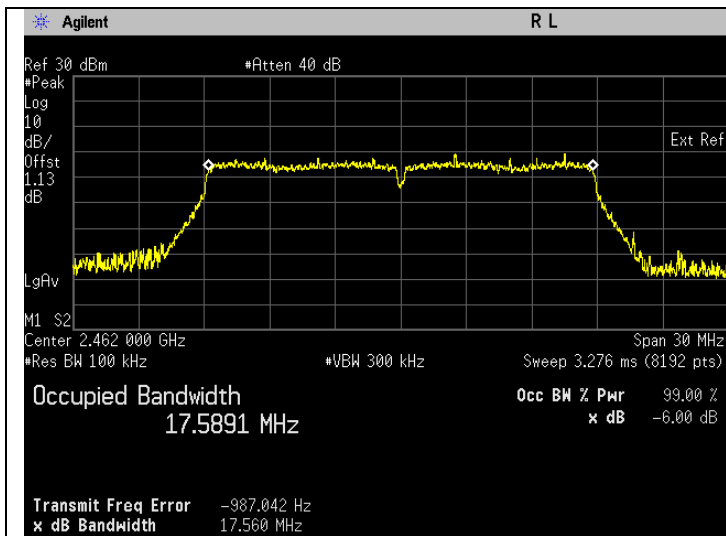
99% Bandwidth. 802.11n Frequency 2412 MHz



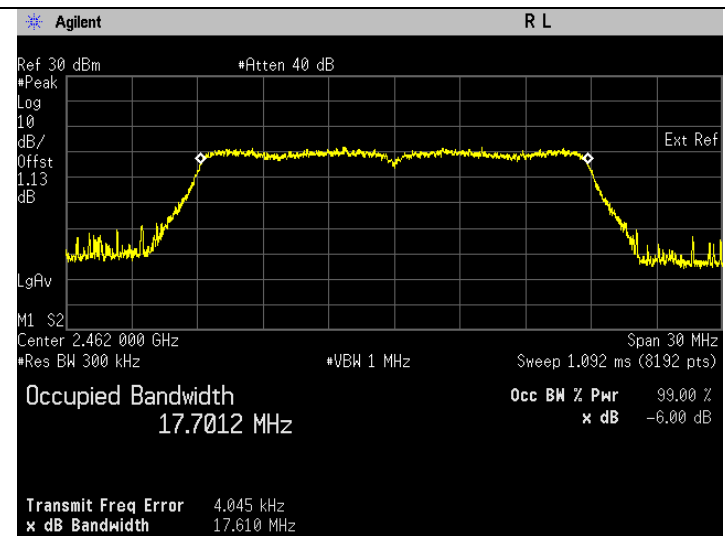
6dB Bandwidth. 802.11n Frequency 2437 MHz



99% Bandwidth. 802.11n Frequency 2437 MHz



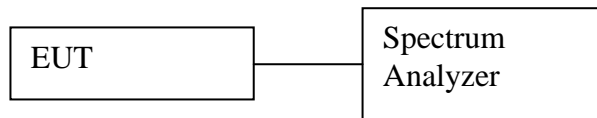
6dB Bandwidth. 802.11n Frequency 2462 MHz



99% Bandwidth. 802.11n Frequency 2462 MHz

## 6.2. Conducted RF Output Power

### 6.2.1. Test Setup



#### Average

- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Measure the duty cycle of transmitter output signal.
- d) Setting of Spectrum analyzer :
  - a. Set the RBW = 300 kHz.
  - b. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - c. Set the span  $\geq [1.5 \times \text{OBW bandwidth}]$ .
  - d. Detector = average.
  - e. Sweep time = auto couple.
  - f. Trace mode = free run.
  - g. Allow trace to fully stabilize.
- e) Add in duty cycle correction into final test result.
- f) Duty cycle correction is calculated as below:  
 $10 \log (1/x)$
- g) Measure every antenna port by repeat the step above for MIMO measurement.

### 6.2.2. Test Limits:

<b>Normal Condition (25 ° C)</b>
<b><math>\leq 1 \text{ Watt}(30 \text{ dBm})</math></b>

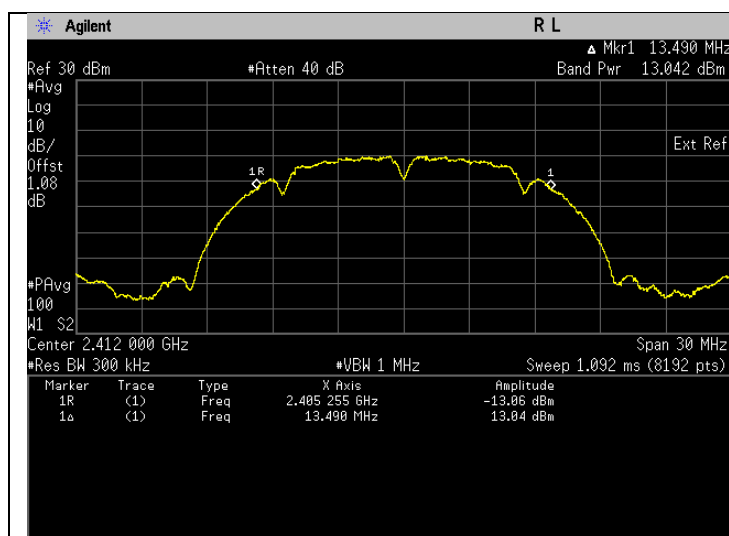


6.2.3. Test Data:

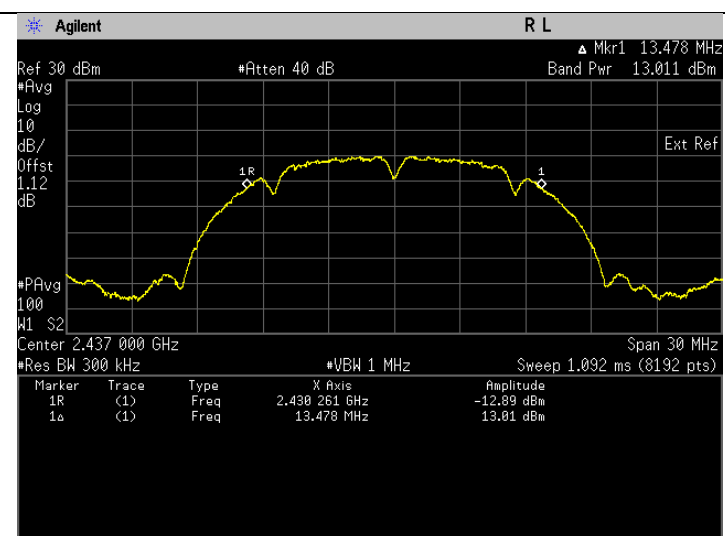
**802.11b**

$$\begin{aligned} \text{Output Power} &= \text{Band Power} + \text{Duty Cycle Factor} \\ &= \text{Band Power} + 0.057\text{dBm} \end{aligned}$$

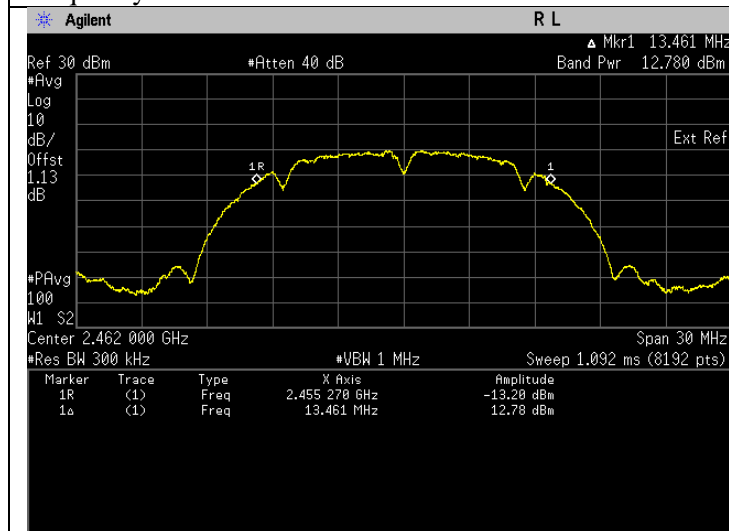
Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Output Power (dBm)	Status
802.11b	DSSS	DBPSK	1	2412	13.099	Pass
802.11b	DSSS	DBPSK	1	2437	13.068	Pass
802.11b	DSSS	DBPSK	1	2462	12.837	Pass



Frequency 802.11b MHz



Frequency 802.11b MHz

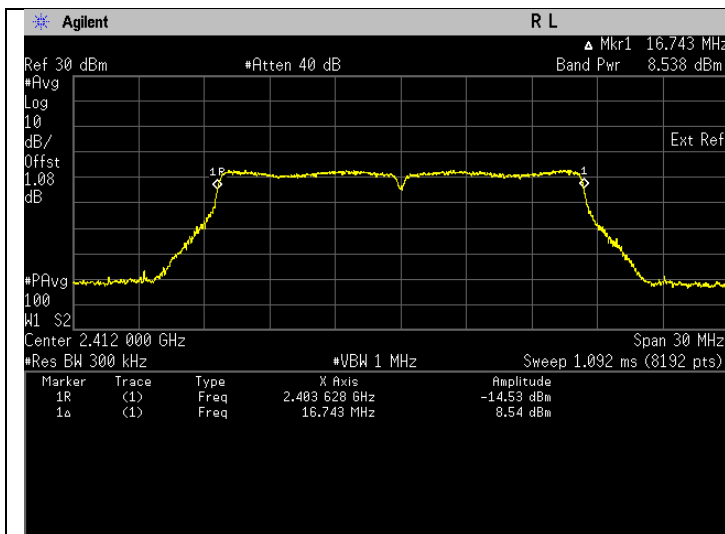


Frequency 802.11b MHz

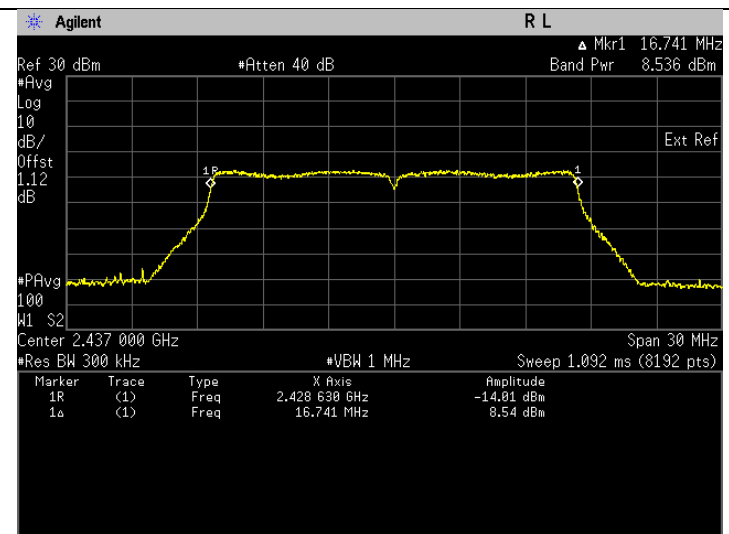
**802.11g**

Output Power = Band Power + Duty Cycle Factor  
 = Band Power + 0.137dBm

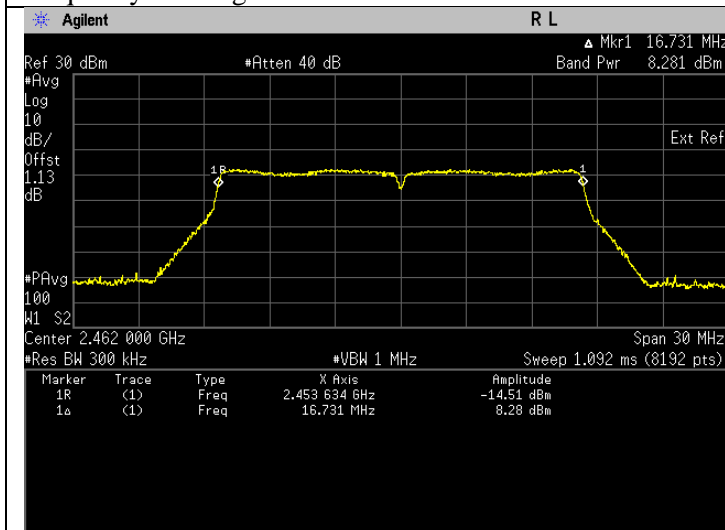
Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Output Power (dBm)	Status
802.11g	OFDM	BPSK	6	2412	8.675	Pass
802.11g	OFDM	BPSK	6	2437	8.673	Pass
802.11g	OFDM	BPSK	6	2462	8.418	Pass



Frequency 802.11g MHz



Frequency 802.11g MHz



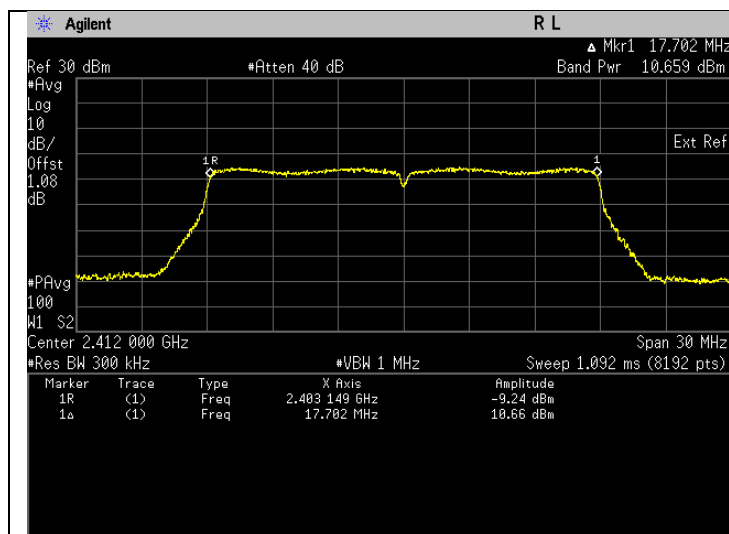
Frequency 802.11g MHz

**802.11n (HT20)**

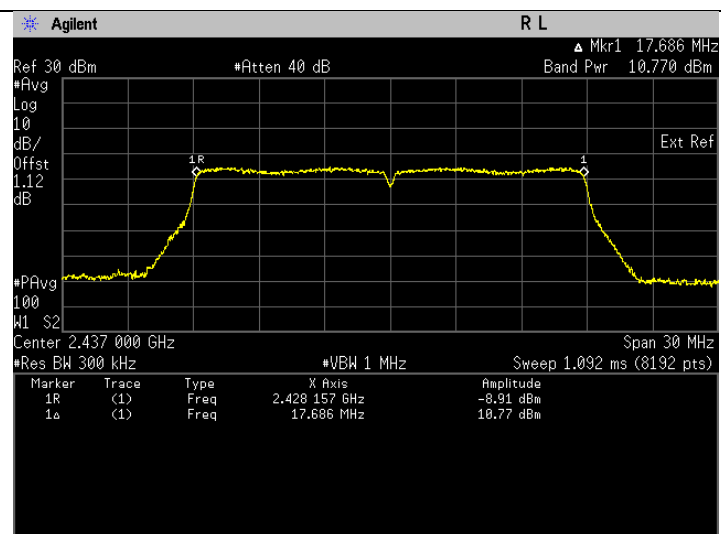
$$\text{Output Power} = \text{Band Power} + \text{Duty Cycle Factor}$$

$$= \text{Band Power} + 0.090\text{dBm}$$

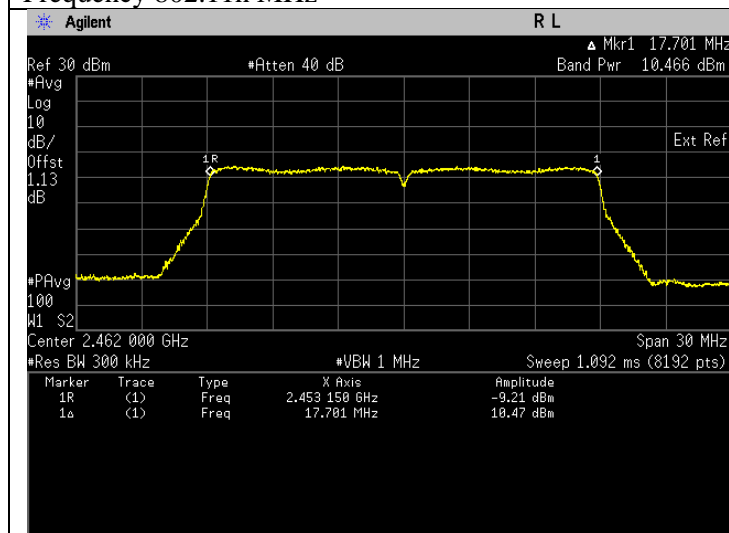
Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Output Power (dBm)	Status
802.11n	OFDM	BPSK	6.5	2412	10.749	Pass
802.11n	OFDM	BPSK	6.5	2437	10.860	Pass
802.11n	OFDM	BPSK	6.5	2462	10.556	Pass



Frequency 802.11n MHz



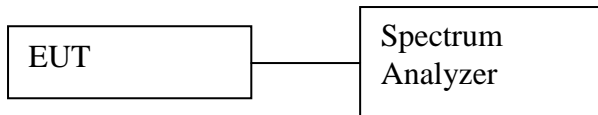
Frequency 802.11n MHz



Frequency 802.11n MHz

### 6.3.Duty Cycle of the test signal

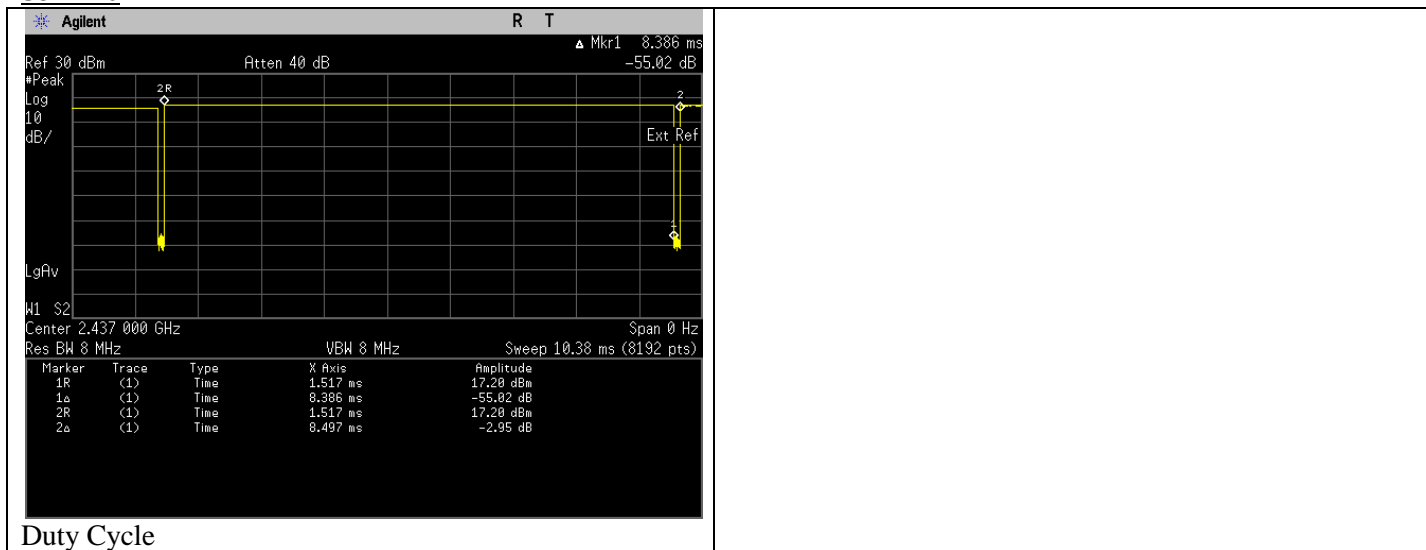
#### 6.3.1. Test Setup



- 1) Check and ensure the spectrum analyzer well calibrate.
- 2) Turn on the DUT and set DUT to transmit maximum power.
- 3) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- 4) Setting of Spectrum analyzer :
  - a. Set the RBW = 10 MHz or the highest RBW available on spectrum analyzer.
  - b. Set the VBW  $\geq$  RBW.
  - c. Set the span  $\geq$  [1.5  $\times$  DTS bandwidth].
  - d. Detector = Peak.
  - e. Sweep time = 10ms or others that allow to measure accurate duty cycle.
  - f. Trace mode = max hold.
  - g. Allow trace to fully stabilize.
- 5) Record the duty cycle as X and save the plot.
- 6) Measure every antenna port by repeat the step above for MIMO measurement.

### 6.3.2. Test Data

#### 802.11b

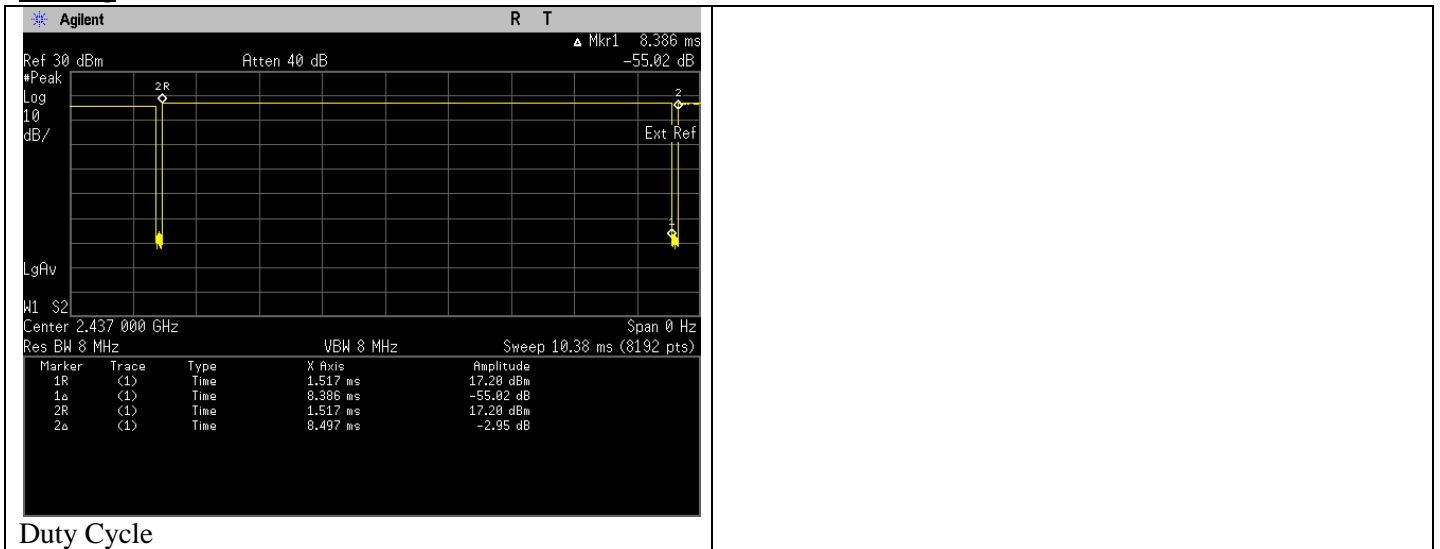


On time (ms)	8.386
On + Off Time (ms)	8.497
Duty cycle	0.9869
Duty Cycle factor	0.057

\*Duty cycle = On time/ On +off time

\*Duty Cycle factor = 10\*log(1/Duty Cycle)

**802.11g**

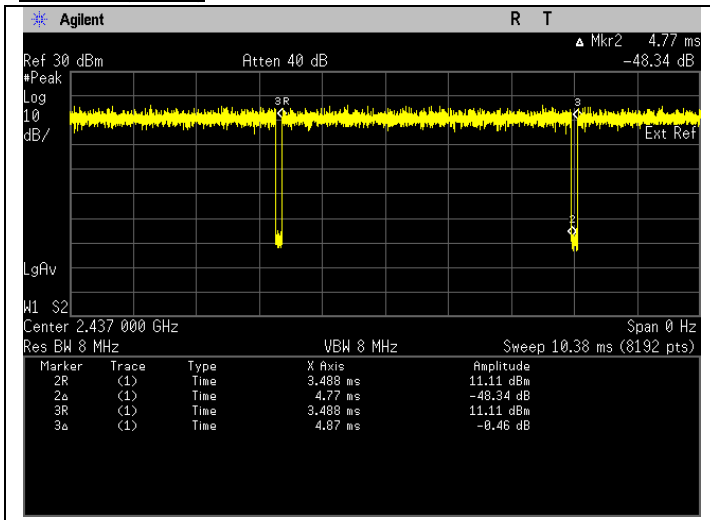


On time (ms)	3.109
On + Off Time (ms)	3.209
Duty cycle	0.9688
Duty Cycle factor	0.137

\*Duty cycle = On time/ On +off time

\*Duty Cycle factor =  $10 \cdot \log(1/\text{Duty Cycle})$

**802.11n (HT20)**



Duty Cycle

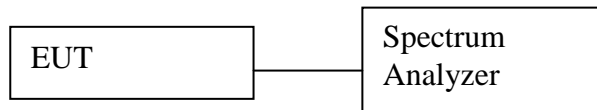
On time (ms)	4.77
On + Off Time (ms)	4.87
Duty cycle	0.9795
Duty Cycle factor	0.090

\*Duty cycle = On time/ On +off time

\*Duty Cycle factor =  $10 \cdot \log(1/\text{Duty Cycle})$

## 6.4. Maximum Peak Power Spectral Density

### 6.4.1. Test Setup



#### Maximum Peak

- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. Set analyzer center frequency to DTS channel center frequency.
  - b. Set the span to 1.5 times the DTS bandwidth.
  - c. Set the RBW to  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
  - d. Set the VBW  $\geq [3 \times \text{RBW}]$ .
  - e. Detector = peak.
  - f. Sweep time = auto couple.
  - g. Trace mode = max hold.
  - h. Allow trace to fully stabilize.
  - i. Use the peak marker function to determine the maximum amplitude level within the RBW.
  - j. If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.
- e) Measure every antenna port by repeat the step above for MIMO measurement.

### 6.4.2. Test Limits

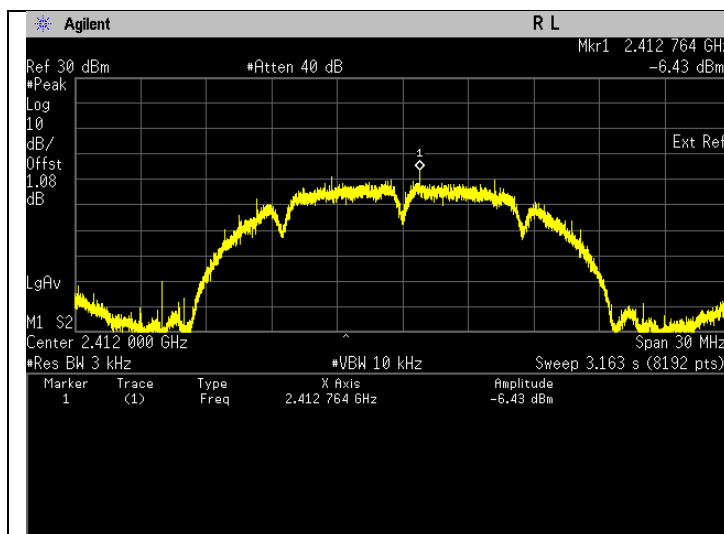
<b>Normal Condition (25 ° C)</b>
<b><math>\leq 8 \text{ dBm/3kHz}</math></b>



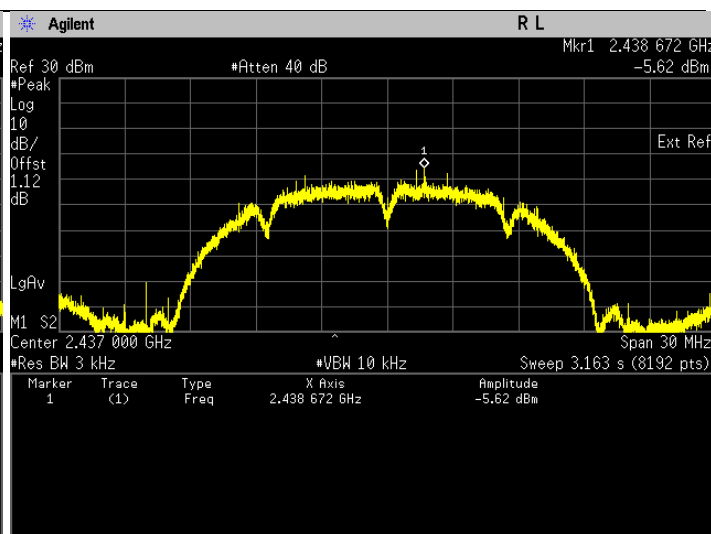
### 6.4.3. Test Result

#### 802.11b

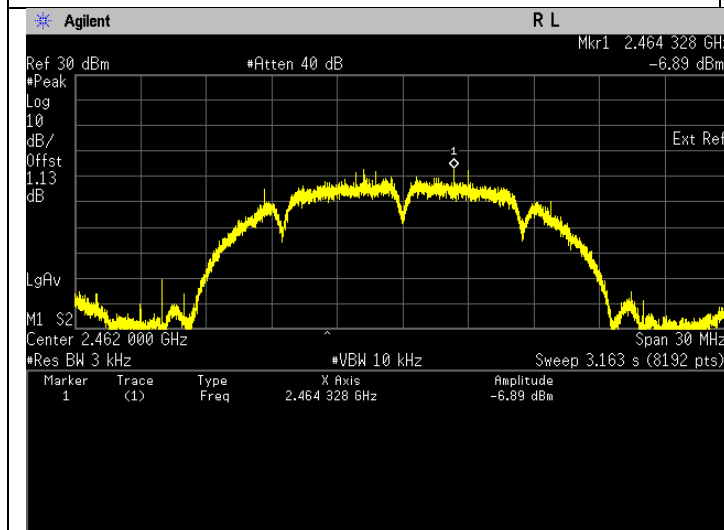
Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Power (dBm/3kHz)	Status
802.11b	DSSS	DBPSK	1	2412	-6.43	Pass
802.11b	DSSS	DBPSK	1	2437	-5.62	Pass
802.11b	DSSS	DBPSK	1	2462	-6.89	Pass



Maximum Power Spectral Density. 802.11b Frequency 2412 MHz



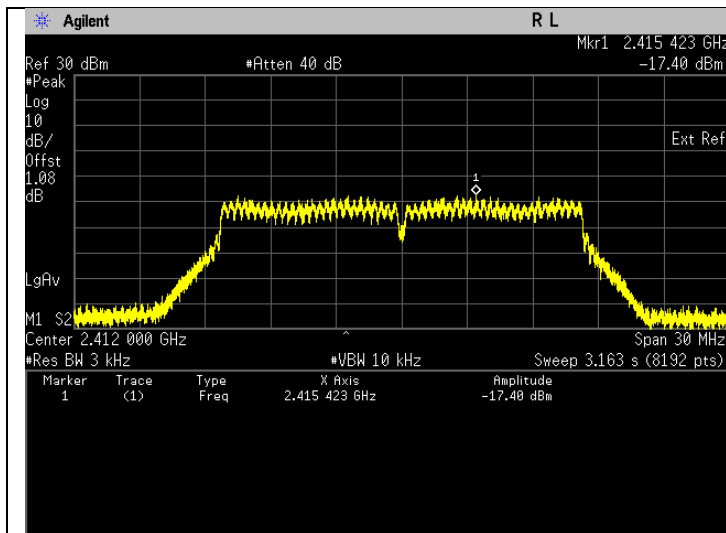
Maximum Power Spectral Density. 802.11b Frequency 2437 MHz



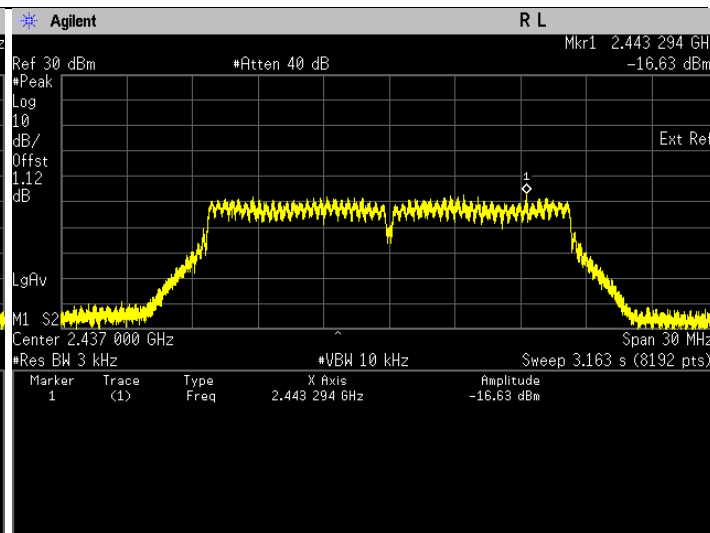
Maximum Power Spectral Density. 802.11b Frequency 2462 MHz

**802.11g**

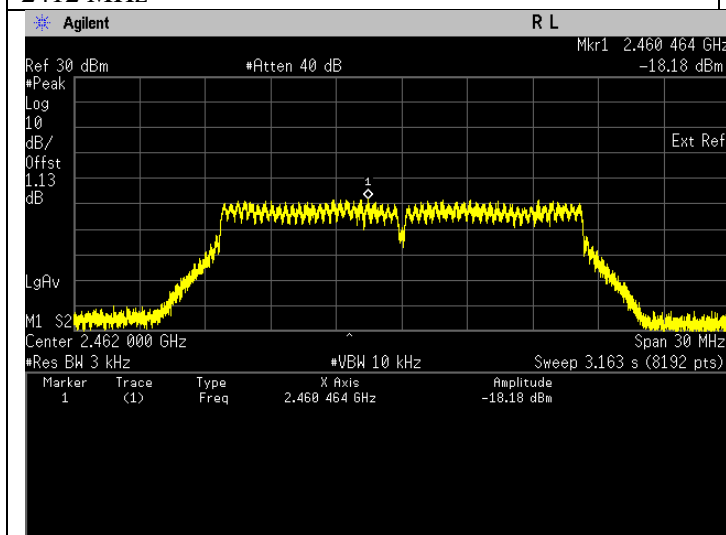
Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Power (dBm/3kHz)	Status
802.11g	OFDM	BPSK	6	2412	-17.39	Pass
802.11g	OFDM	BPSK	6	2437	-16.63	Pass
802.11g	OFDM	BPSK	6	2462	-18.18	Pass



Maximum Power Spectral Density. 802.11g Frequency 2412 MHz



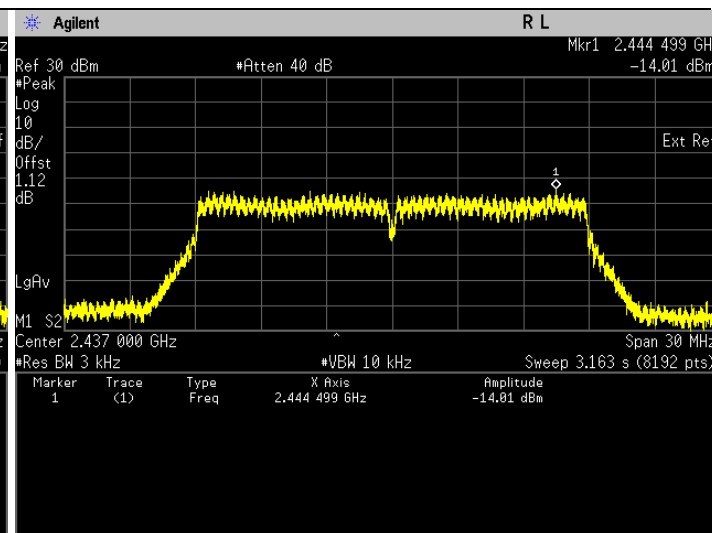
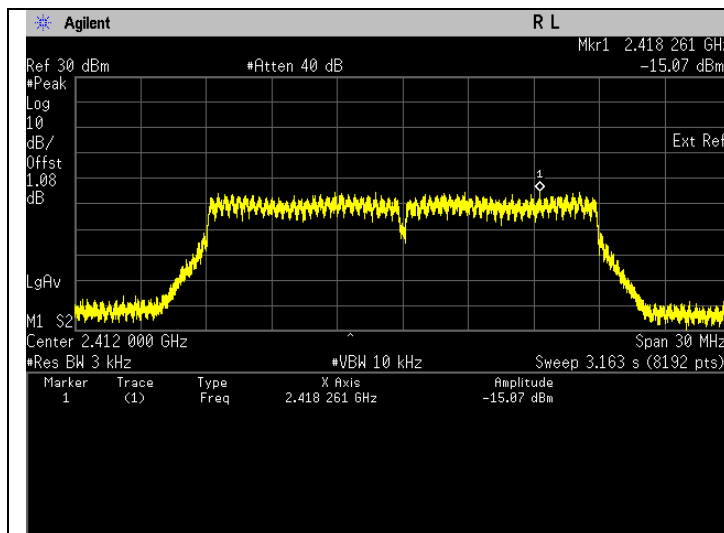
Maximum Power Spectral Density. 802.11g Frequency 2437 MHz



Maximum Power Spectral Density. 802.11g Frequency 2462 MHz

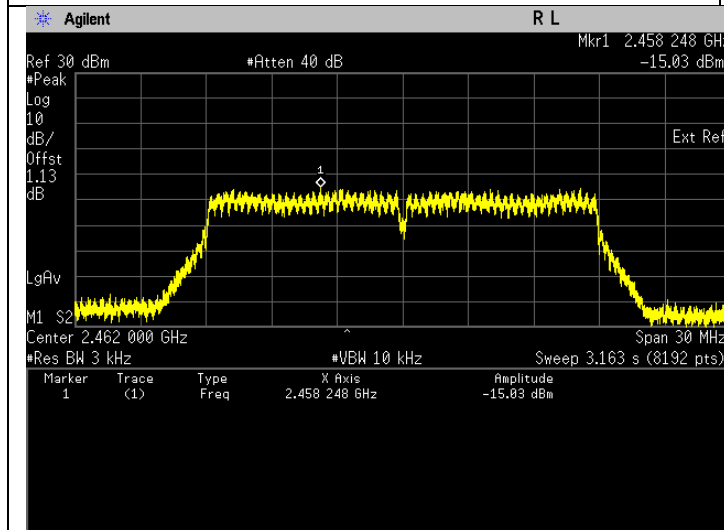
**802.11n (HT20)**

Test Conditions				Test Frequency	Results	
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Power (dBm/3kHz)	Status
802.11n	OFDM	BPSK	6.5	2412	-15.07	Pass
802.11n	OFDM	BPSK	6.5	2437	-14.01	Pass
802.11n	OFDM	BPSK	6.5	2462	-15.03	Pass



Maximum Power Spectral Density. 802.11n Frequency 2412 MHz

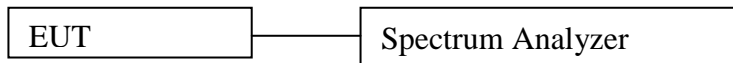
Maximum Power Spectral Density. 802.11n Frequency 2437 MHz



Maximum Power Spectral Density. 802.11n Frequency 2462 MHz

## 6.5. Conducted Spurious Emission

### 6.5.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT's antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- e) Use the peak marker function to measure highest emission and scan up to 10<sup>th</sup> harmonic.
- f) Measure every antenna port by repeat the step above for MIMO measurement.

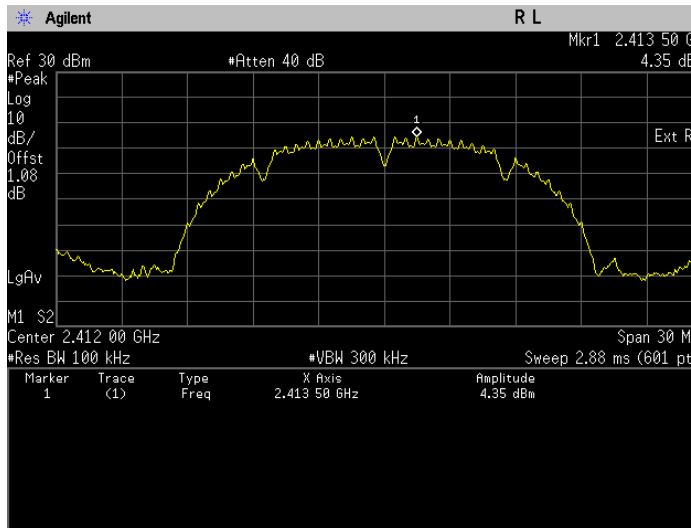
### 6.5.2. Test Limits:

<b>Normal Condition (25 ° C)</b>
<b>Shall be at least 30 dB below peak (max) power.</b>

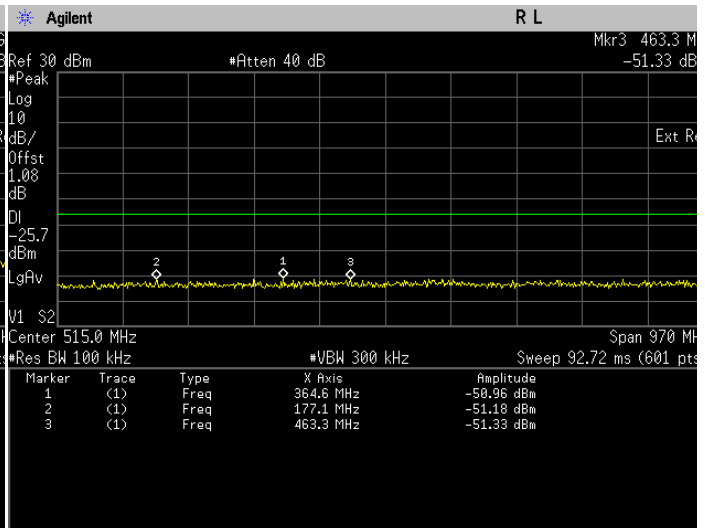
### 6.5.3. Test Result

#### **802.11b**

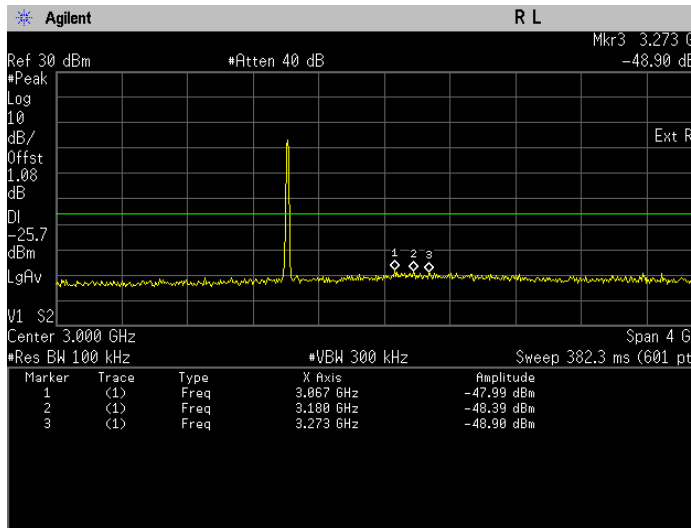
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Spurs (MHz)	Level (dBm)	Status
802.11b	DSSS	DBPSK	1	2412	24892.00	-40.85	Pass
					24133.00	-41.06	Pass
					24575.00	-41.53	Pass
802.11b	DSSS	DBPSK	1	2437	24608.00	-40.95	Pass
					24917.00	-41.39	Pass
					24333.00	-41.40	Pass
802.11b	DSSS	DBPSK	1	2462	24233.00	-40.43	Pass
					24608.00	-41.07	Pass
					24208.00	-41.15	Pass



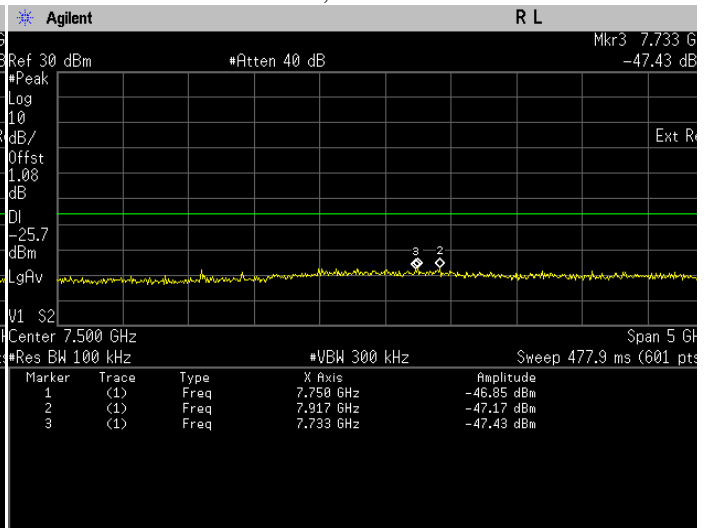
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Reference Level



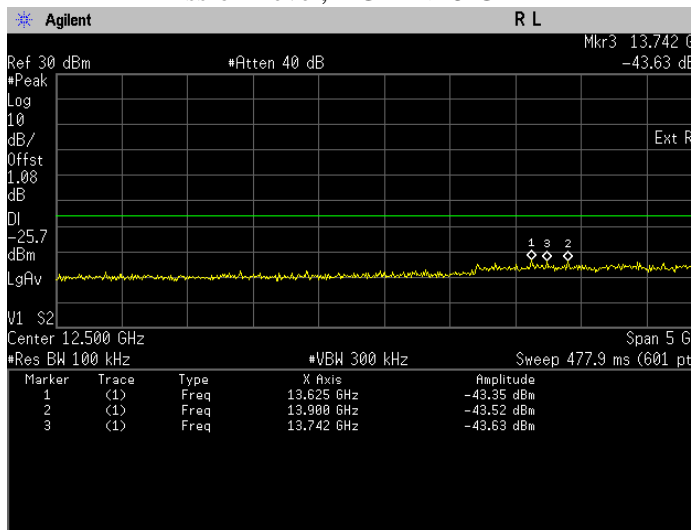
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 30 MHz -> 1 GHz



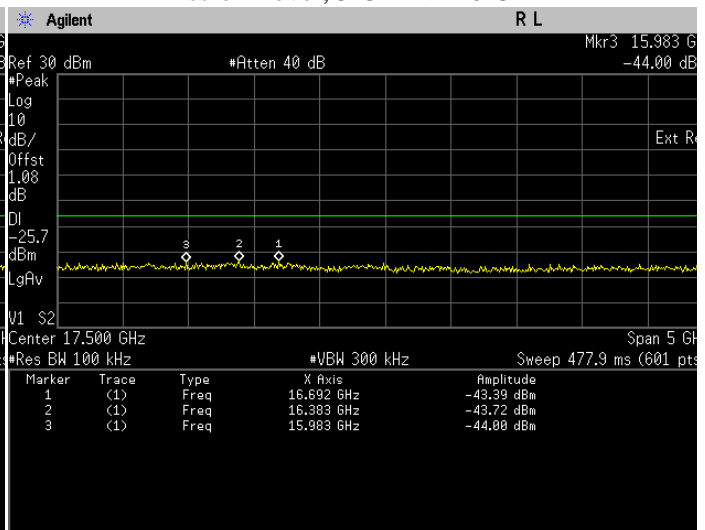
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 1 GHz -> 5 GHz



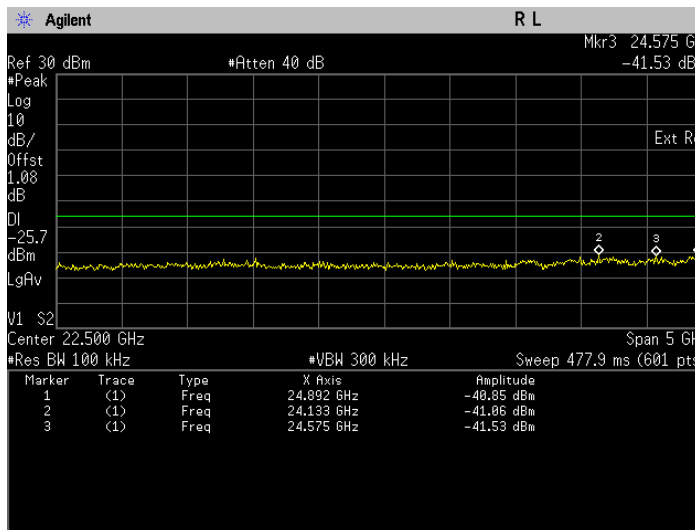
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 5 GHz -> 10 GHz



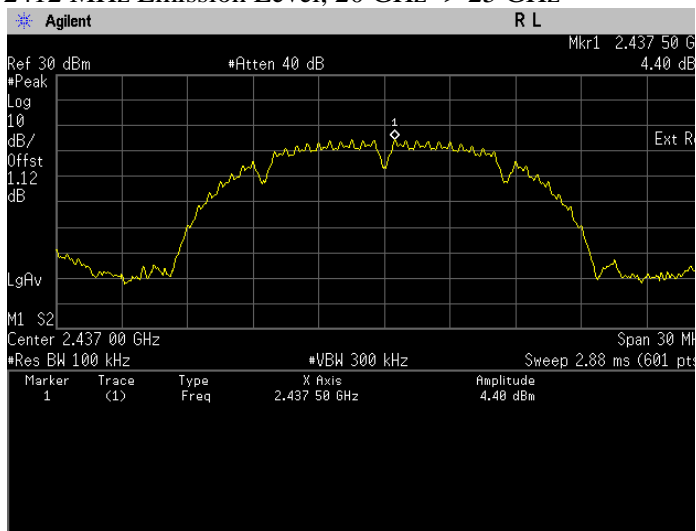
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 10 GHz -> 15 GHz



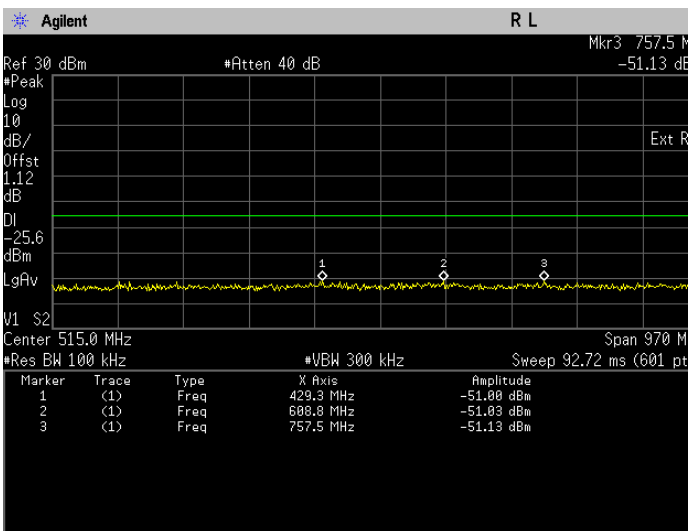
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 15 GHz -> 20 GHz



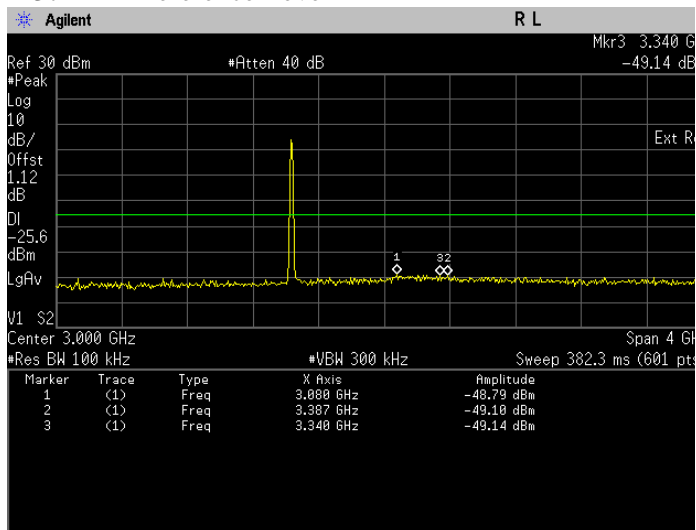
Conducted Emissions(Average). 802.11b, Frequency 2412 MHz Emission Level, 20 GHz -> 25 GHz



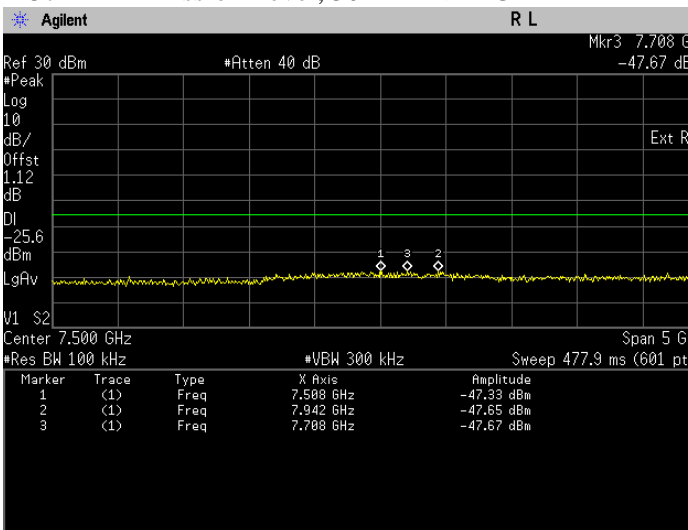
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Reference Level



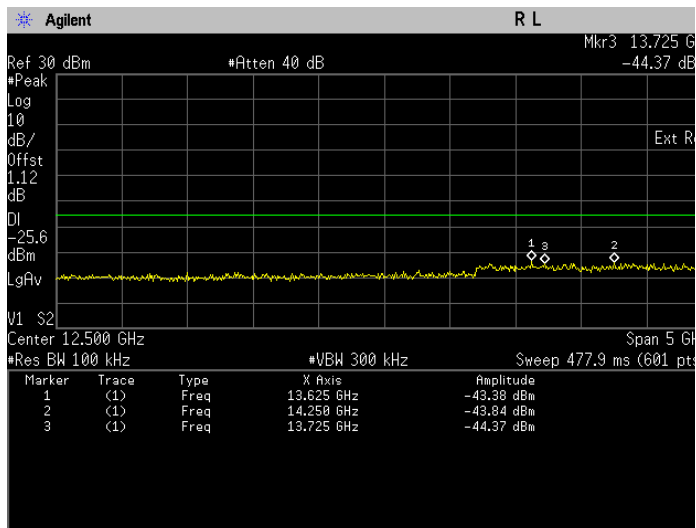
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Emission Level, 30 MHz -> 1 GHz



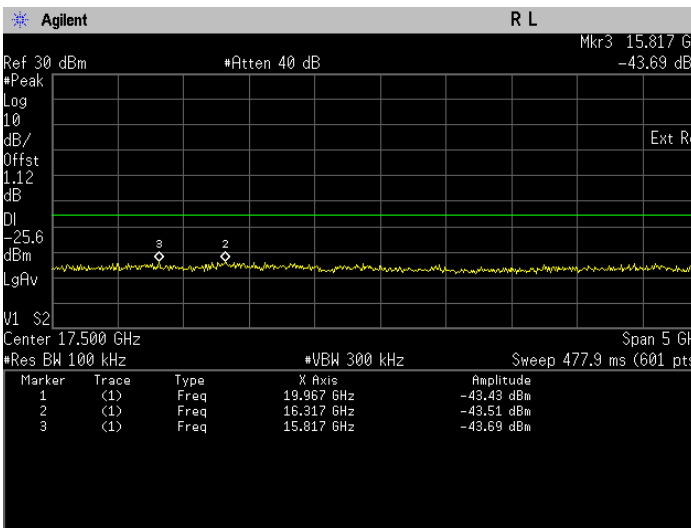
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Emission Level, 1 GHz -> 5 GHz



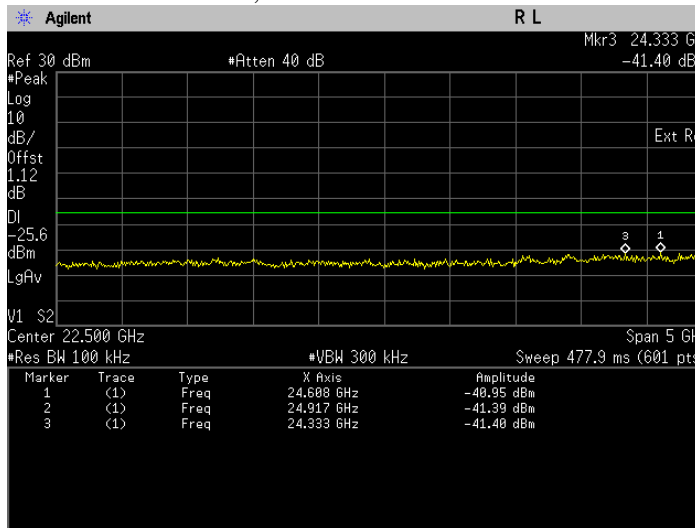
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Emission Level, 5 GHz -> 10 GHz



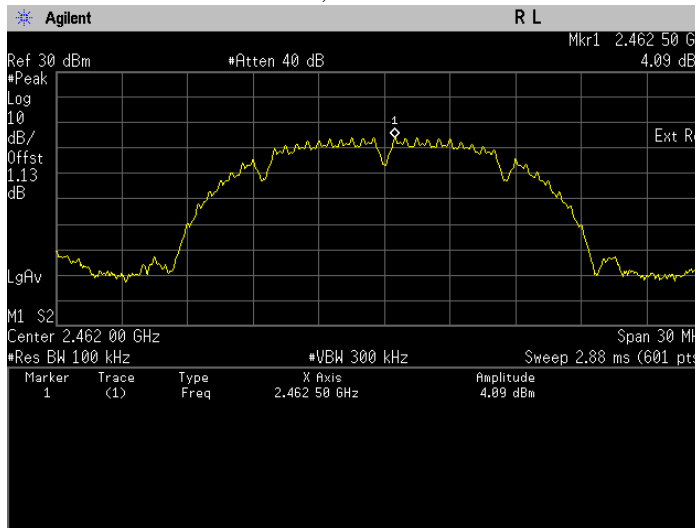
Conducted Emissions(Average). 802.11b, Frequency 2437 Emission Level, 10 GHz -> 15 GHz



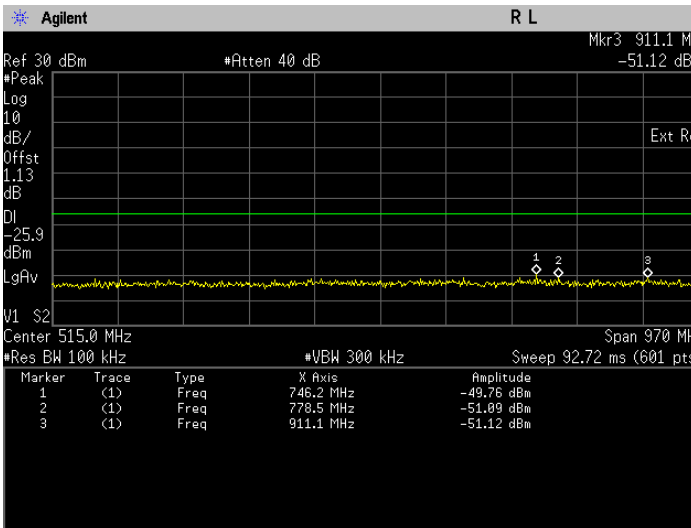
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Emission Level, 15 GHz -> 20 GHz



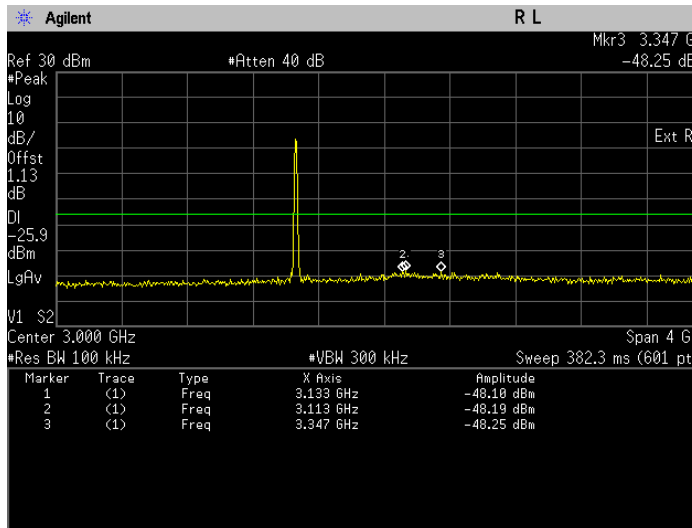
Conducted Emissions(Average). 802.11b, Frequency 2437 MHz Emission Level, 20 GHz -> 25 GHz



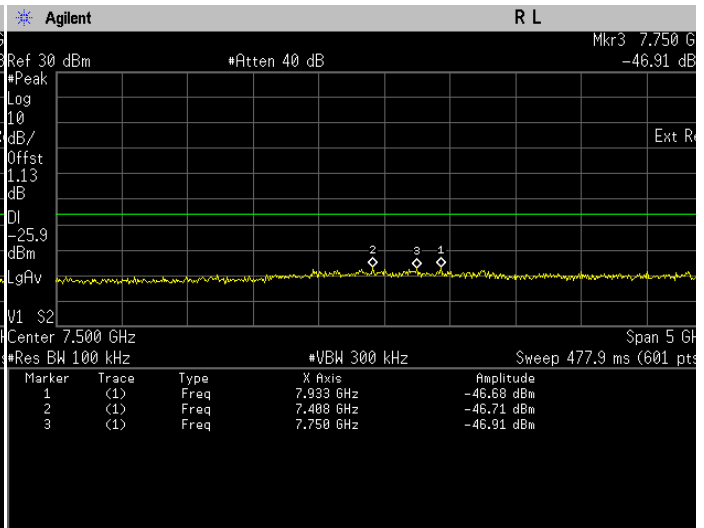
Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Reference Level



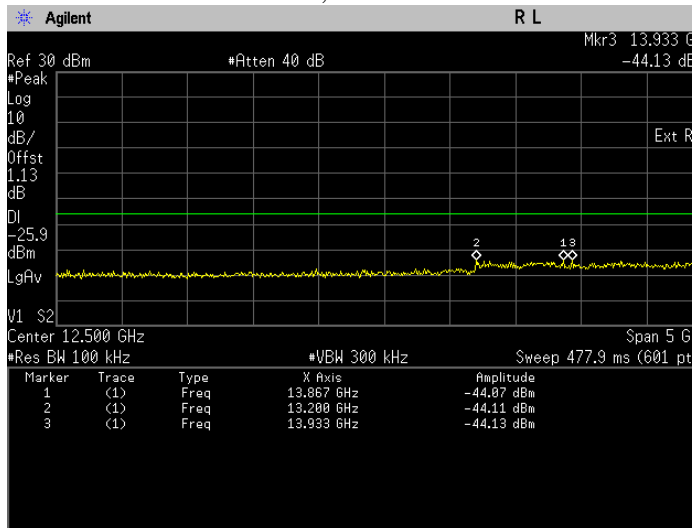
Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 30 MHz -> 1 GHz



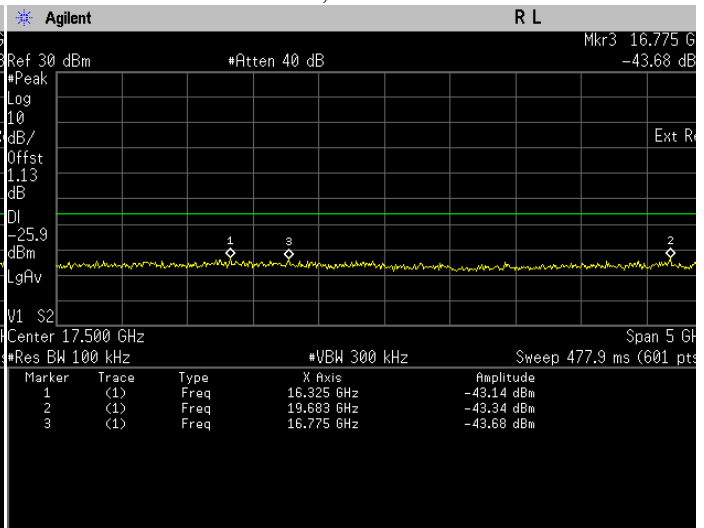
Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 1 GHz -> 5 GHz



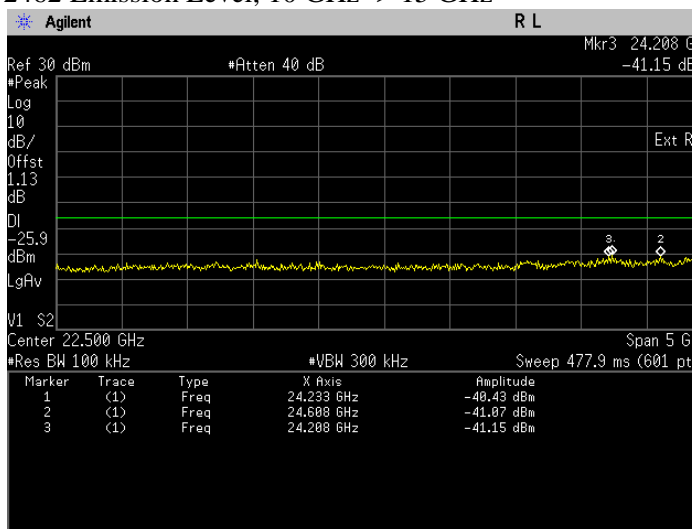
Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 5 GHz -> 10 GHz



Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 10 GHz -> 15 GHz



Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 15 GHz -> 20 GHz

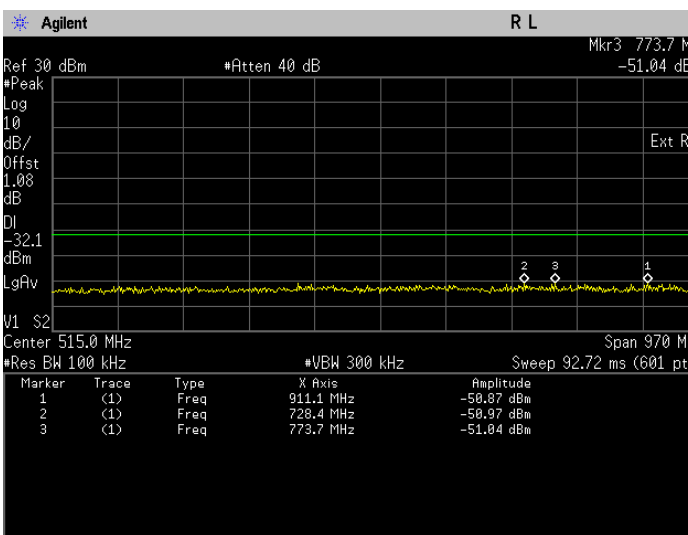
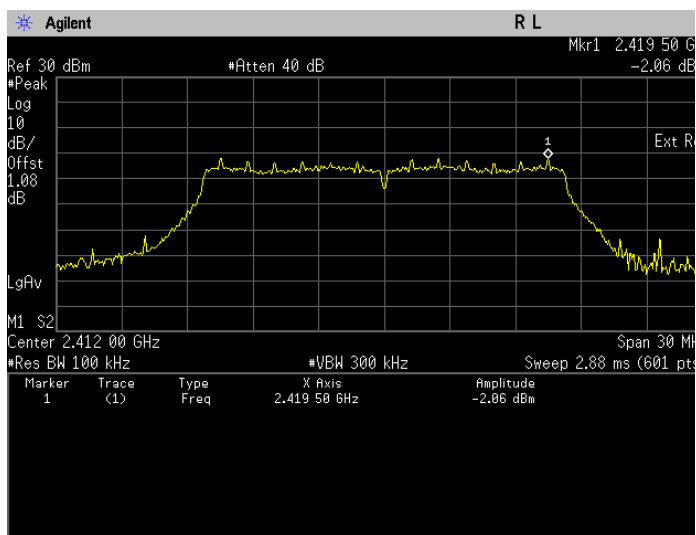


Conducted Emissions(Average). 802.11b, Frequency 2462 MHz Emission Level, 20 GHz -> 25 GHz

**802.11g**

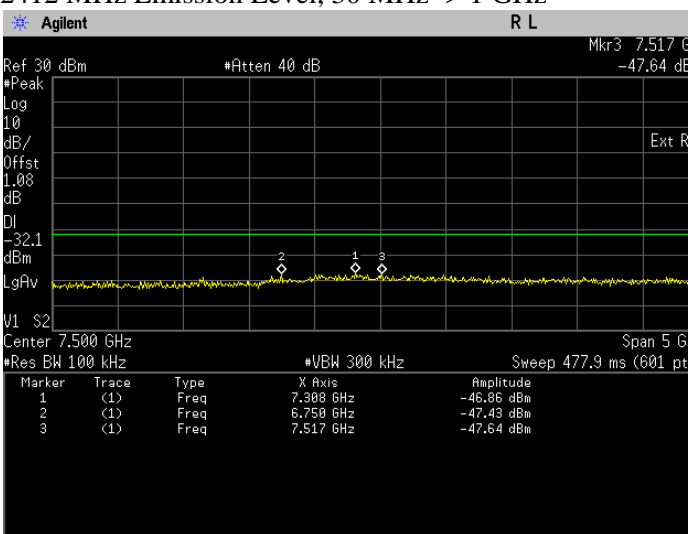
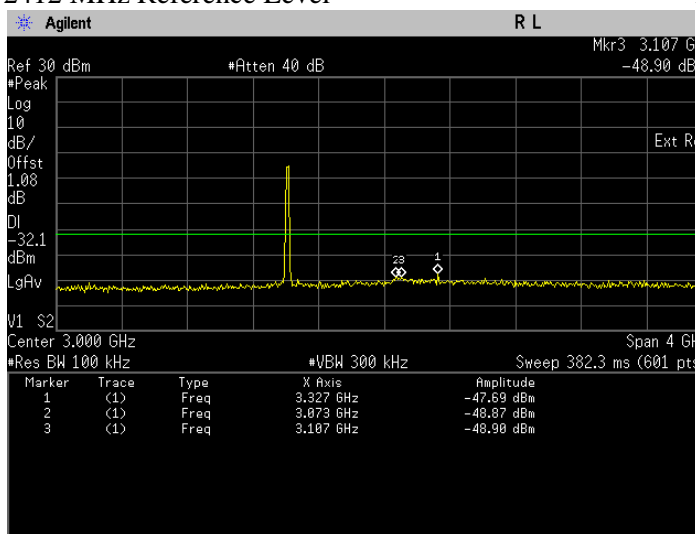


Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Spurs (MHz)	Level (dBm)	Status
802.11g	OFDM	BPSK	6	2412	24900.00	-41.09	Pass
					24200.00	-41.32	Pass
					24217.00	-41.40	Pass
802.11g	OFDM	BPSK	6	2437	24925.00	-39.95	Pass
					24867.00	-40.23	Pass
					24883.00	-41.33	Pass
802.11g	OFDM	BPSK	6	2462	24900.00	-41.37	Pass
					24567.00	-41.58	Pass
					23875.00	-41.66	Pass



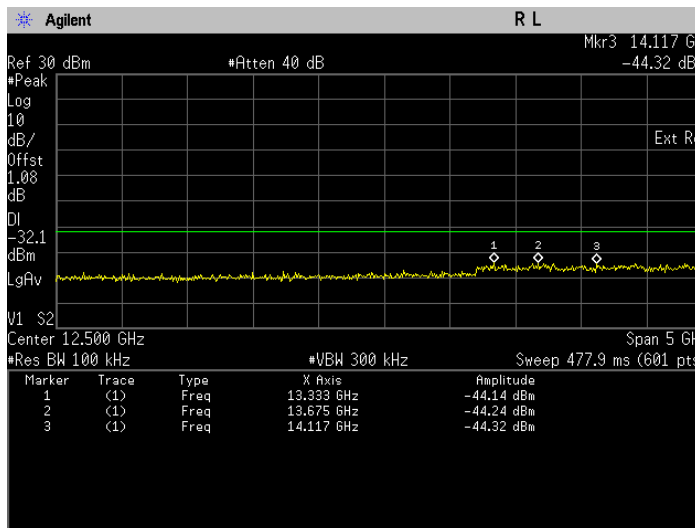
Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Reference Level

Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Emission Level, 30 MHz -> 1 GHz

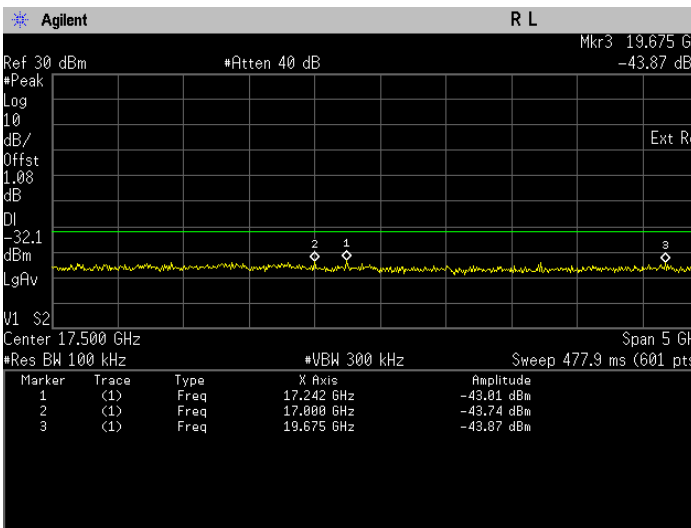


Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Emission Level, 1 GHz -> 5 GHz

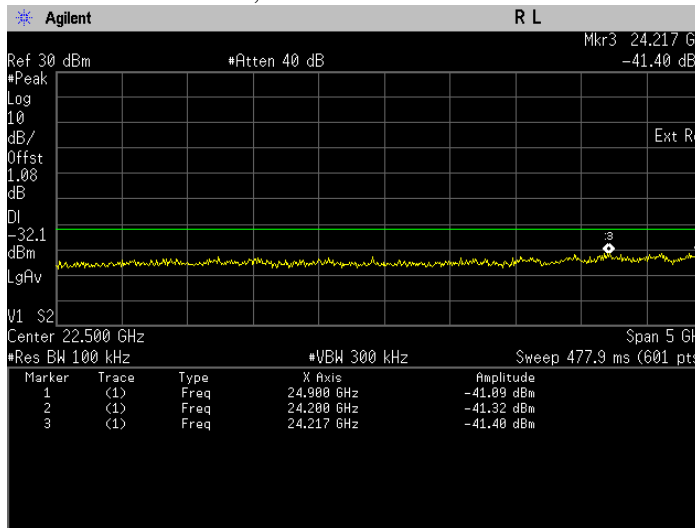
Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Emission Level, 5 GHz -> 10 GHz



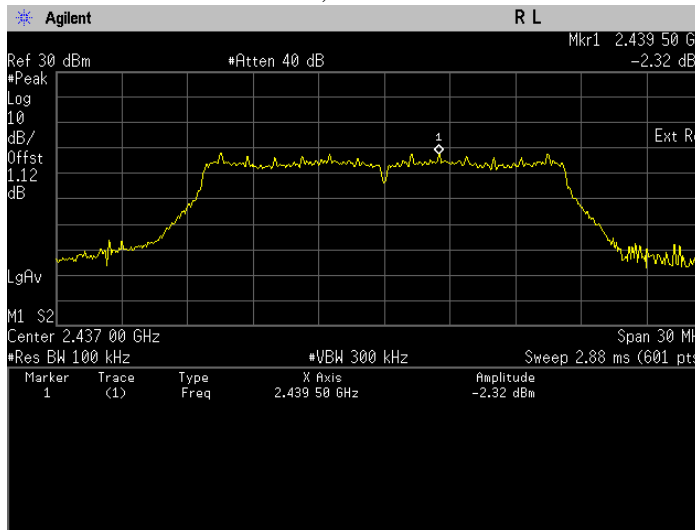
Conducted Emissions(Average). 802.11g, Frequency 2412 Emission Level, 10 GHz -> 15 GHz



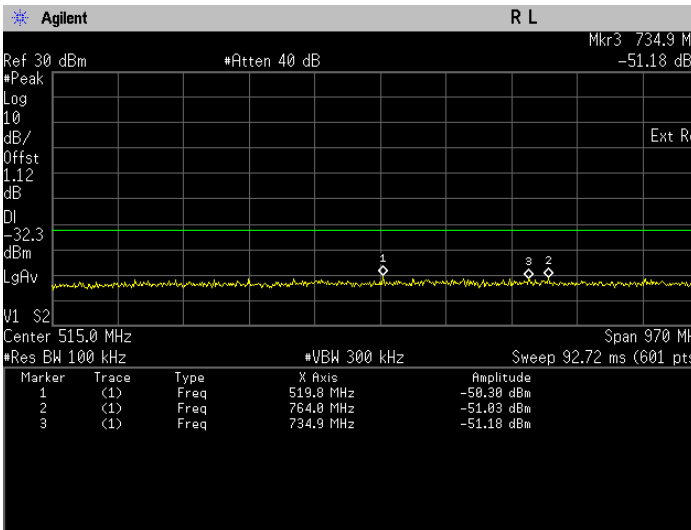
Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Emission Level, 15 GHz -> 20 GHz



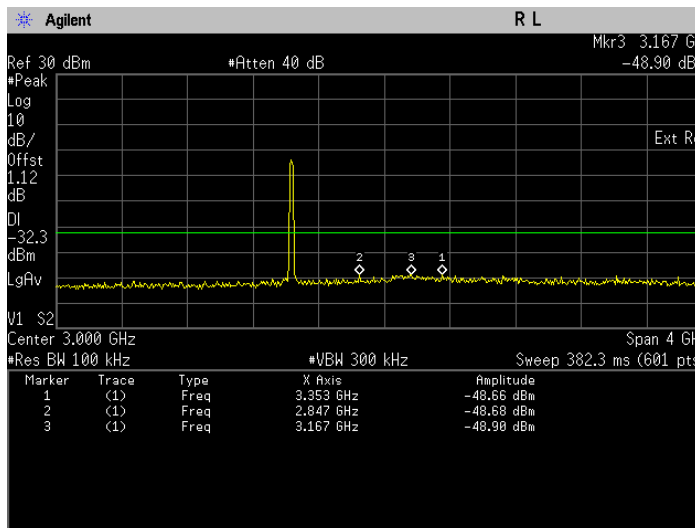
Conducted Emissions(Average). 802.11g, Frequency 2412 MHz Emission Level, 20 GHz -> 25 GHz



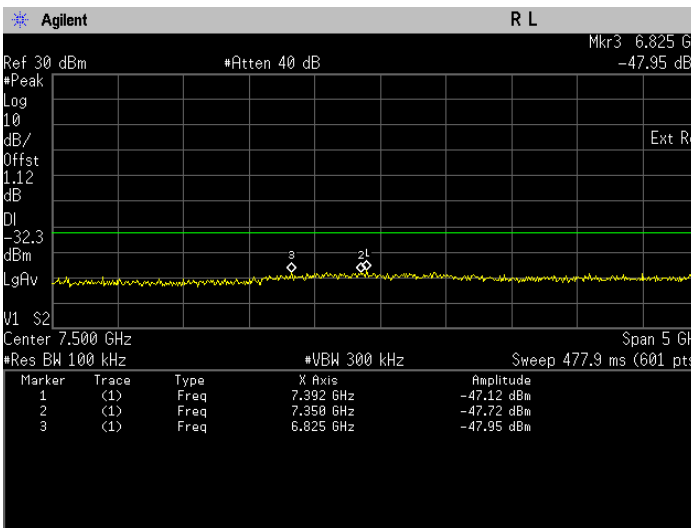
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Reference Level



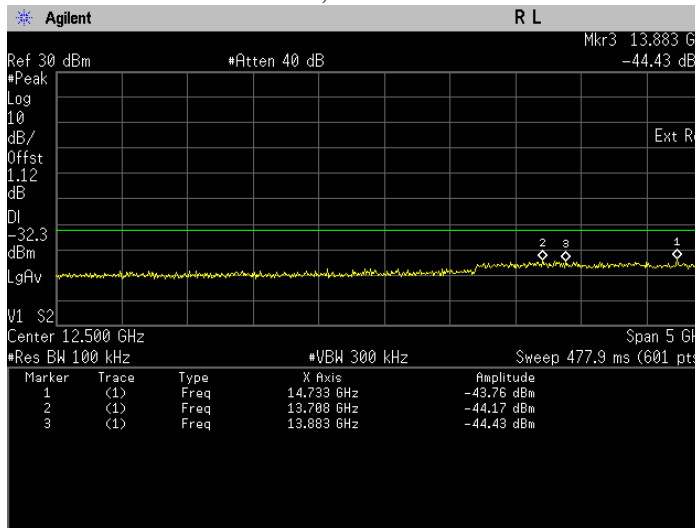
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 30 MHz -> 1 GHz



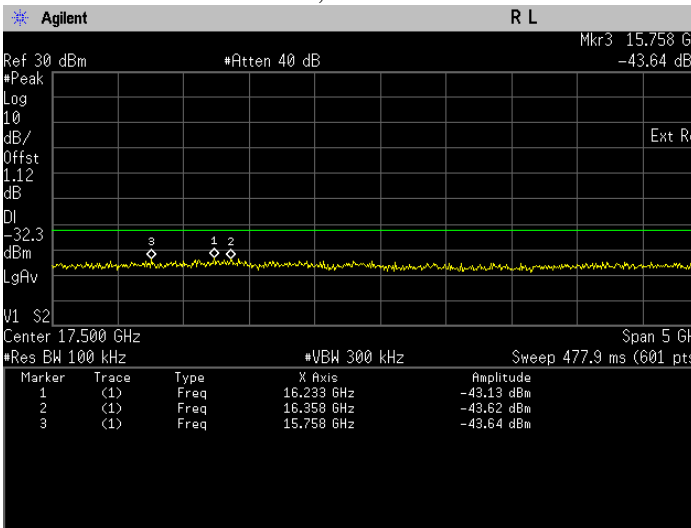
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 1 GHz -> 5 GHz



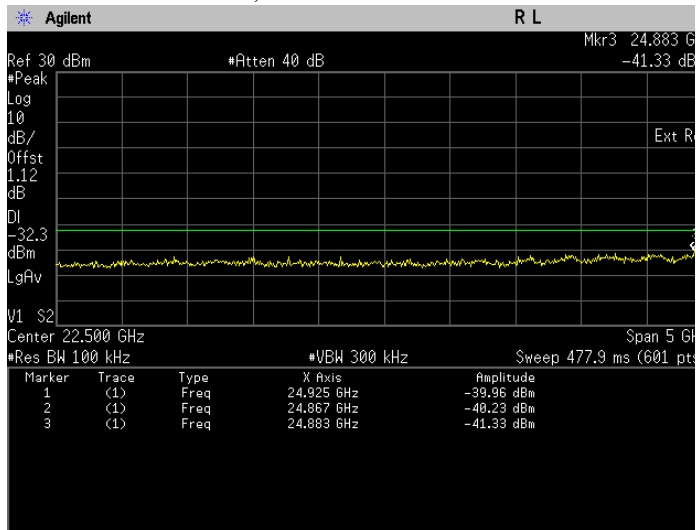
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 5 GHz -> 10 GHz



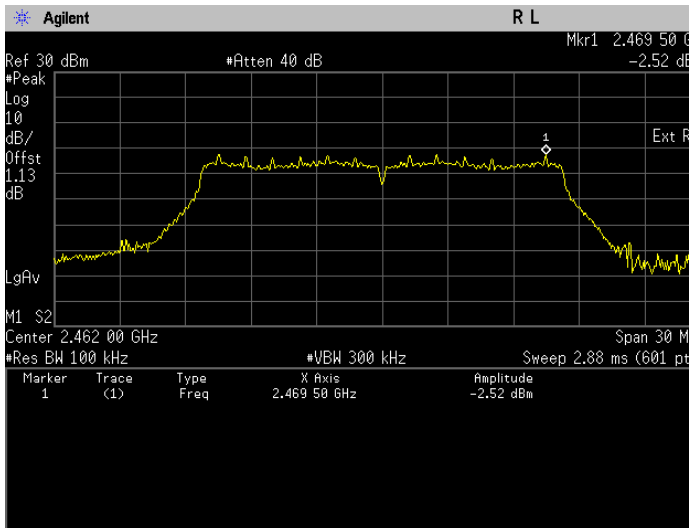
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 10 GHz -> 15 GHz



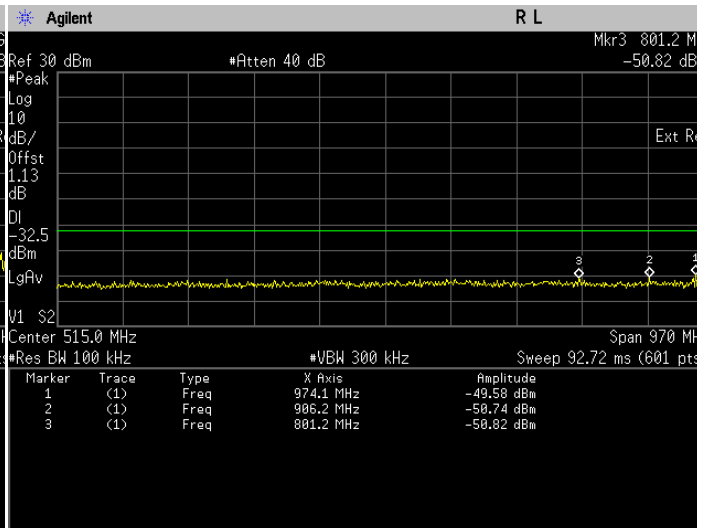
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 15 GHz -> 20 GHz



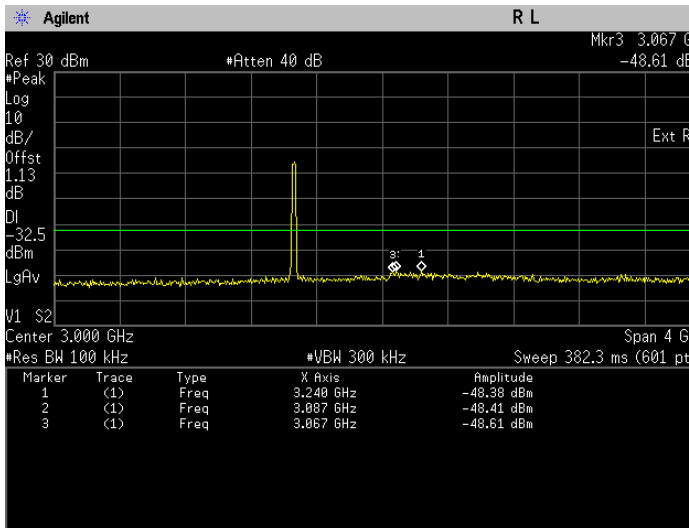
Conducted Emissions(Average). 802.11g, Frequency 2437 MHz Emission Level, 20 GHz -> 25 GHz



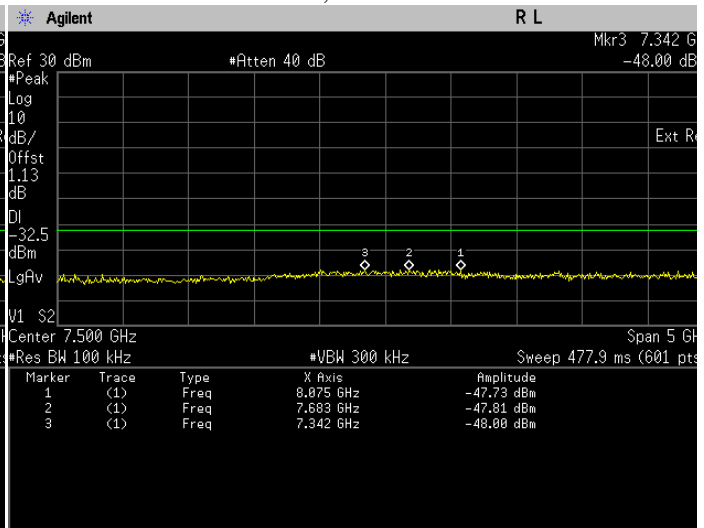
Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Reference Level



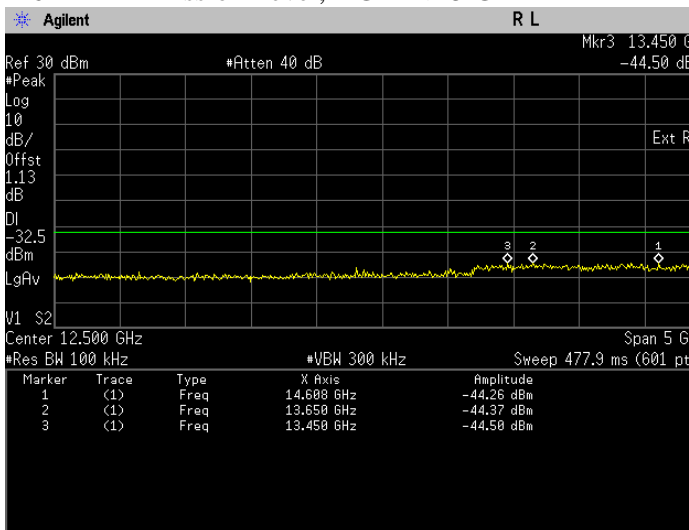
Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Emission Level, 30 MHz -> 1 GHz



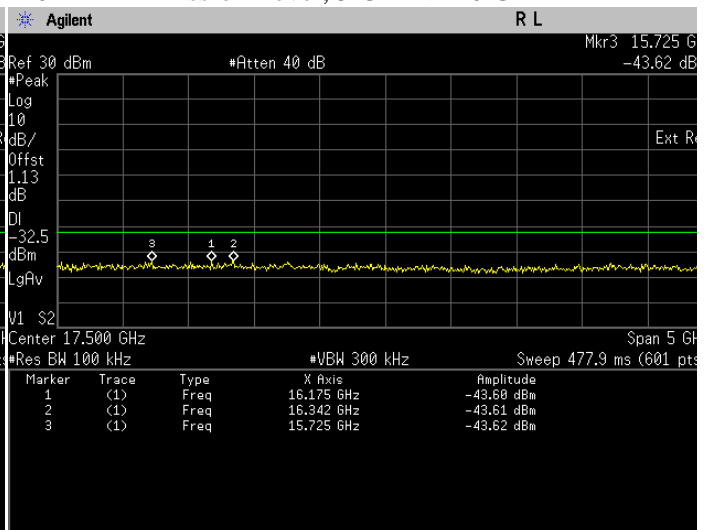
Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Emission Level, 1 GHz -> 5 GHz



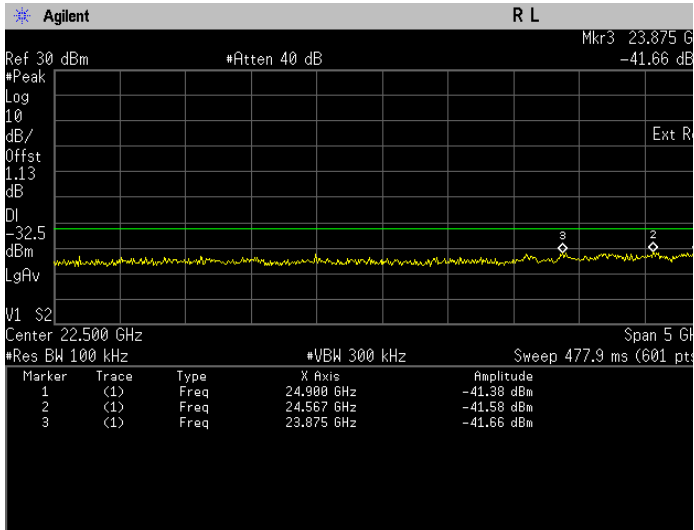
Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Emission Level, 5 GHz -> 10 GHz



Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Emission Level, 10 GHz -> 15 GHz



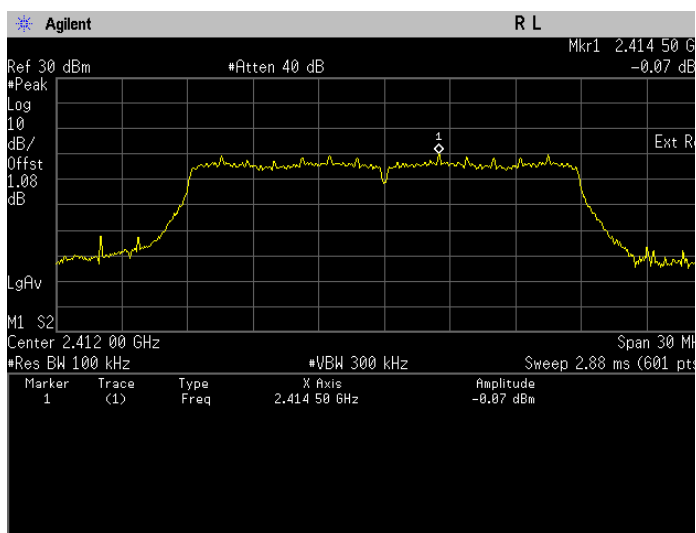
Conducted Emissions(Average). 802.11g, Frequency 2462 MHz Emission Level, 15 GHz -> 20 GHz



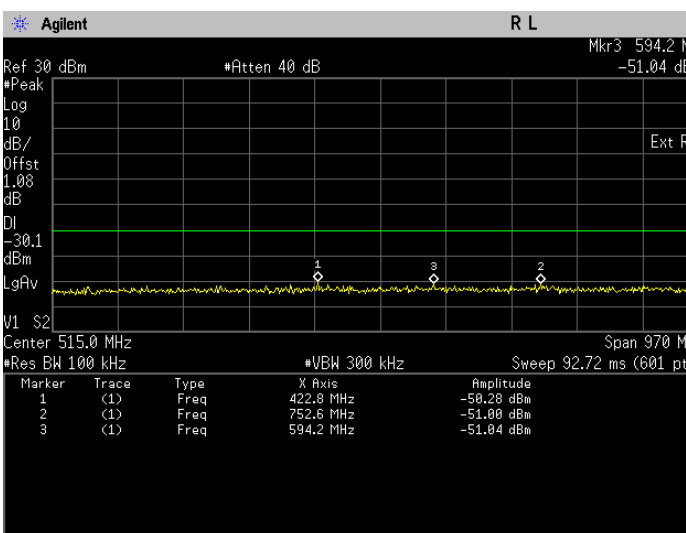
Conducted Emissions(Average). 802.11g, Frequency  
 2462 MHz Emission Level, 20 GHz -> 25 GHz

**802.11n (HT20)**

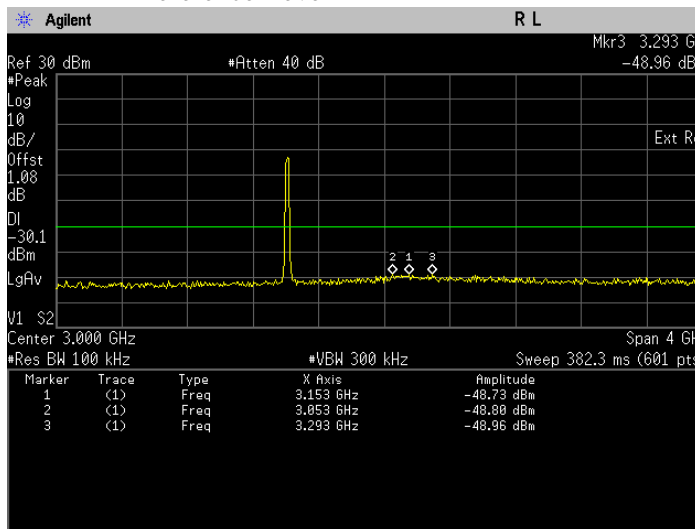
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Spurs (MHz)	Level (dBm)	Status
802.11n	OFDM	BPSK	6.5	2412	24942.00	-40.52	Pass
					24192.00	-40.66	Pass
					24175.00	-41.36	Pass
802.11n	OFDM	BPSK	6.5	2437	24175.00	-41.57	Pass
					24925.00	-41.58	Pass
					24508.00	-41.65	Pass
802.11n	OFDM	BPSK	6.5	2462	24217.00	-40.55	Pass
					24575.00	-41.10	Pass
					24300.00	-41.28	Pass



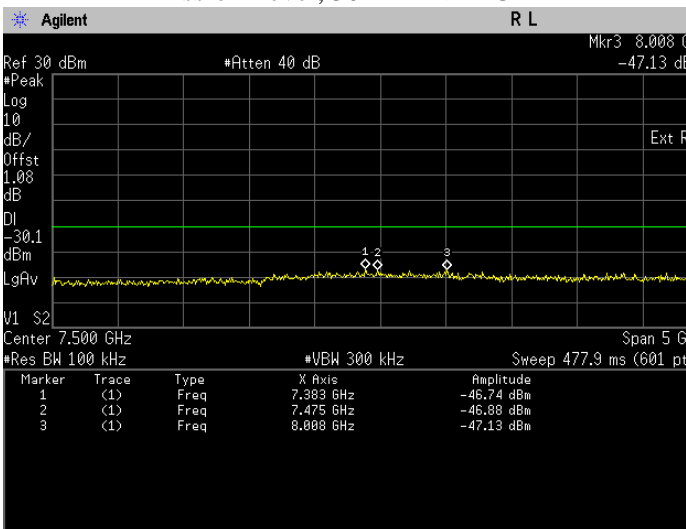
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Reference Level



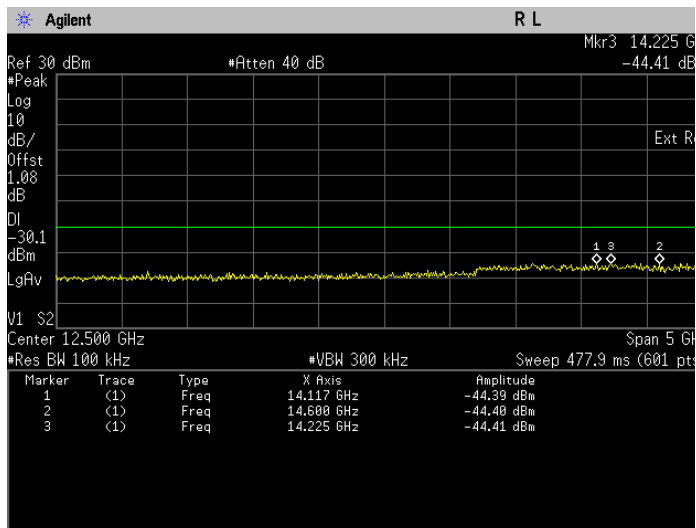
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Emission Level, 30 MHz -> 1 GHz



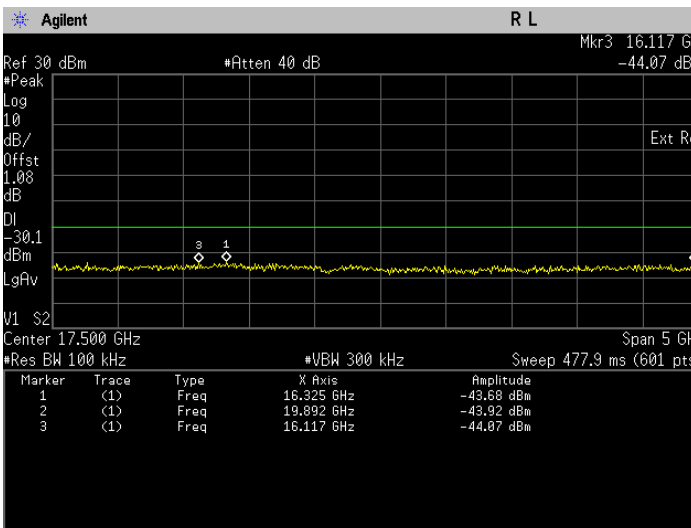
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Emission Level, 1 GHz -> 5 GHz



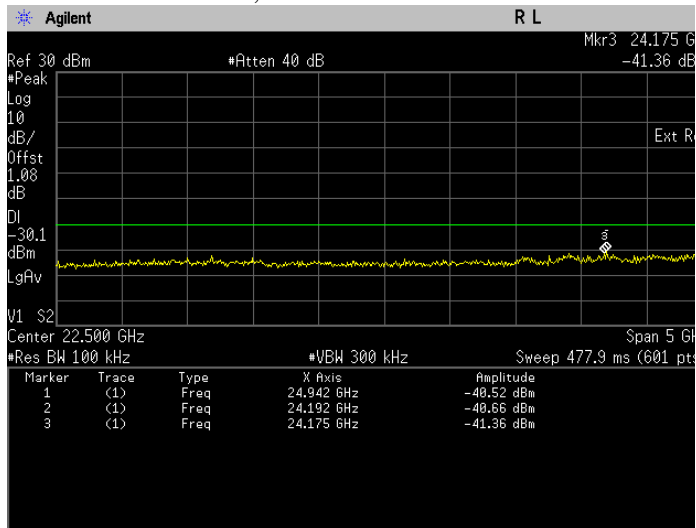
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Emission Level, 5 GHz -> 10 GHz



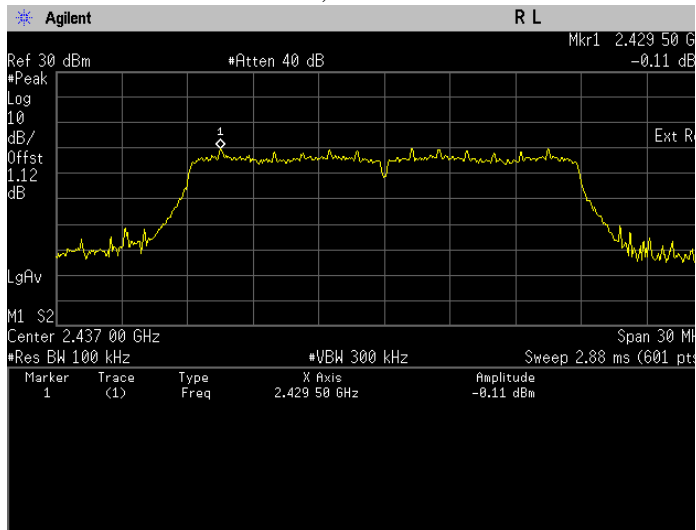
Conducted Emissions(Average). 802.11n, Frequency 2412 Emission Level, 10 GHz -> 15 GHz



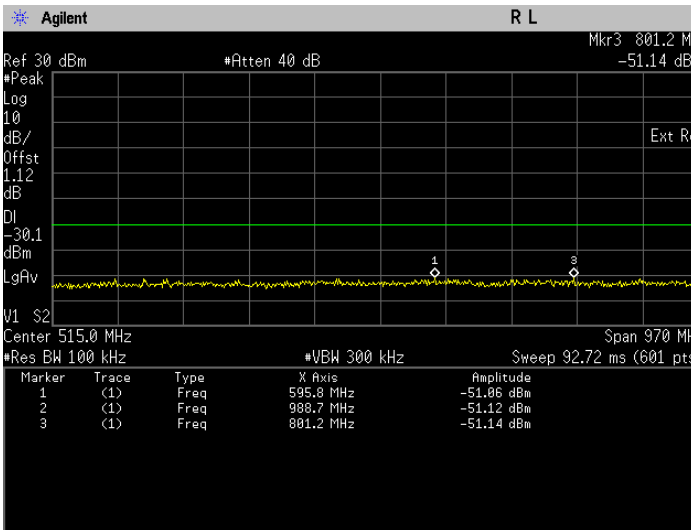
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Emission Level, 15 GHz -> 20 GHz



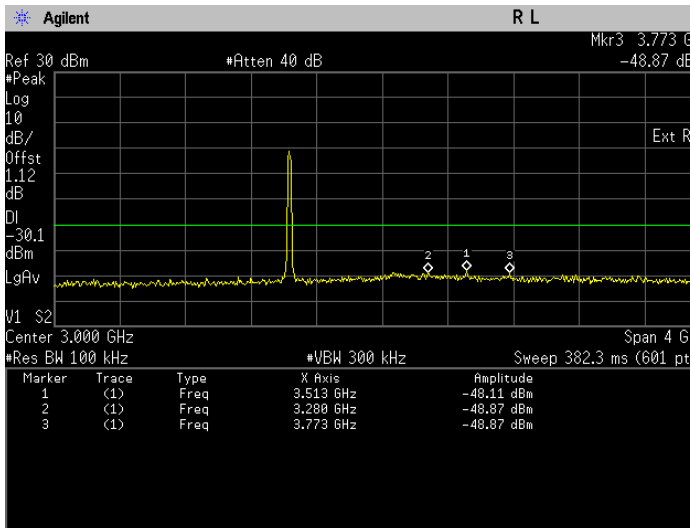
Conducted Emissions(Average). 802.11n, Frequency 2412 MHz Emission Level, 20 GHz -> 25 GHz



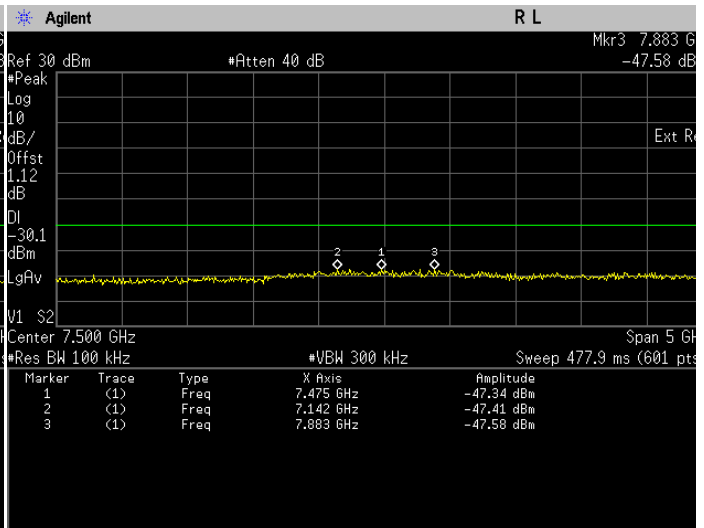
Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Reference Level



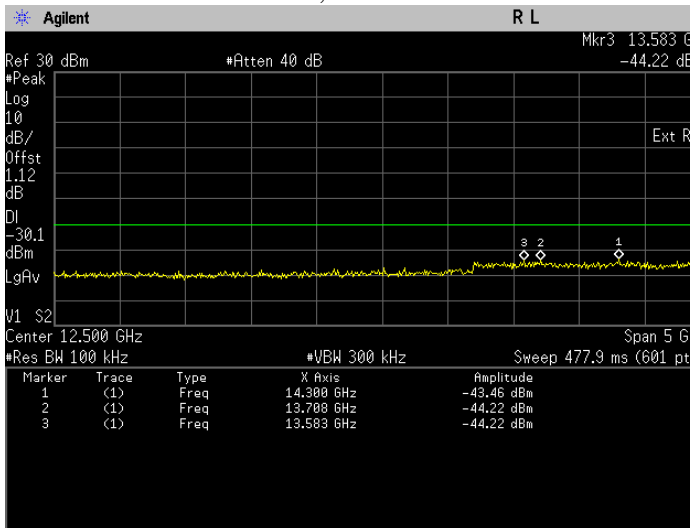
Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 30 MHz -> 1 GHz



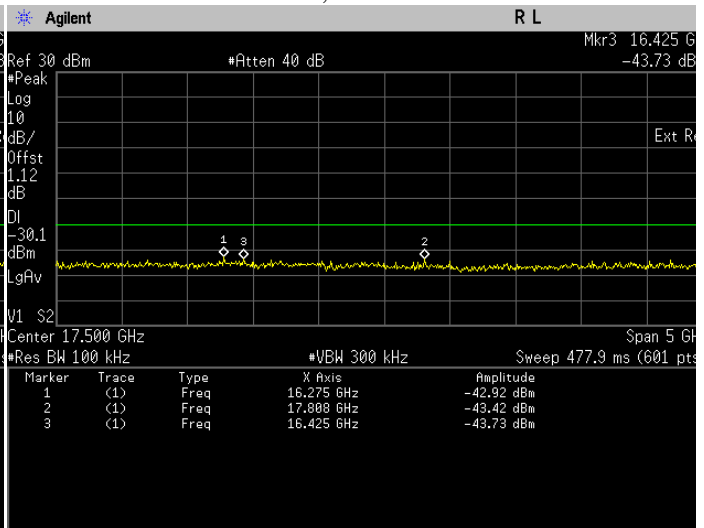
Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 1 GHz -> 5 GHz



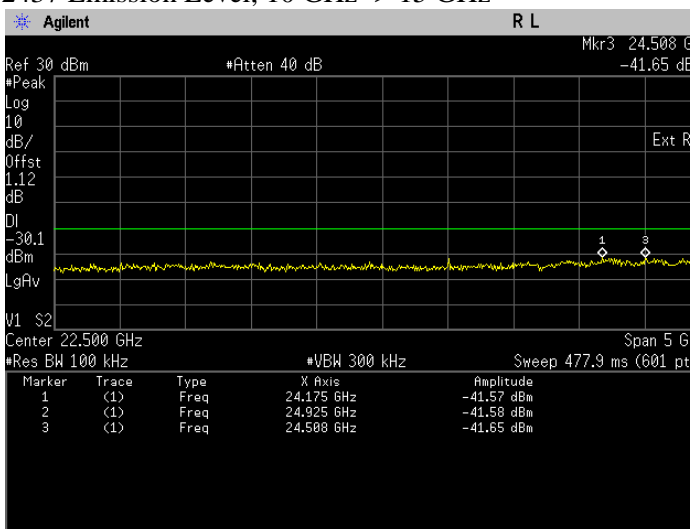
Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 5 GHz -> 10 GHz



Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 10 GHz -> 15 GHz

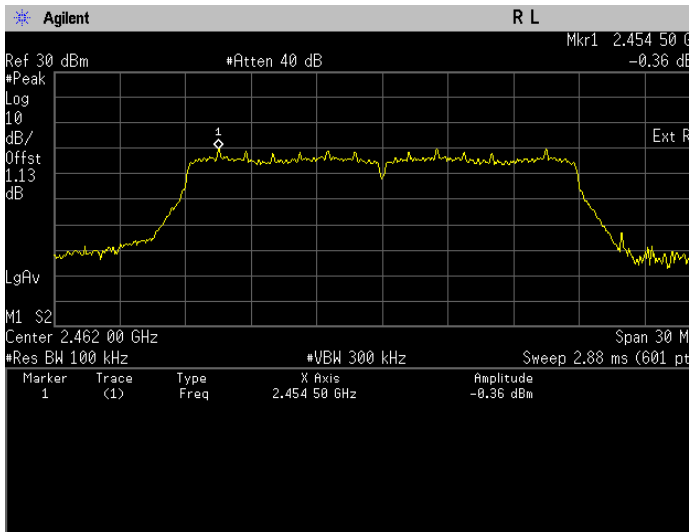


Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 15 GHz -> 20 GHz

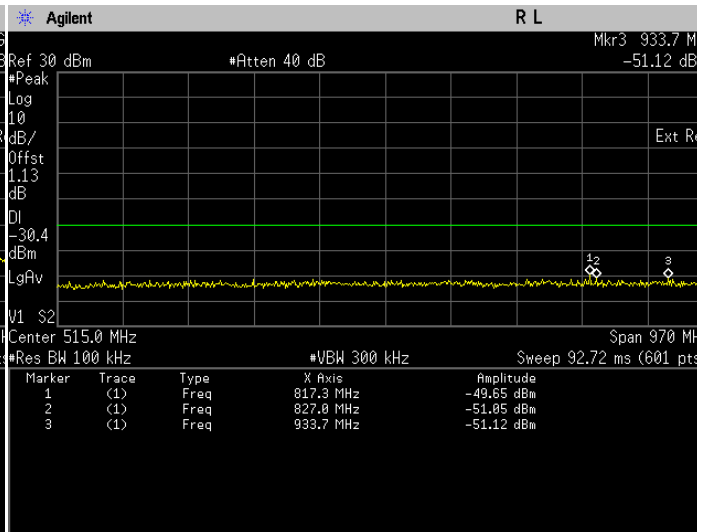


Conducted Emissions(Average). 802.11n, Frequency 2437 MHz Emission Level, 20 GHz -> 25 GHz

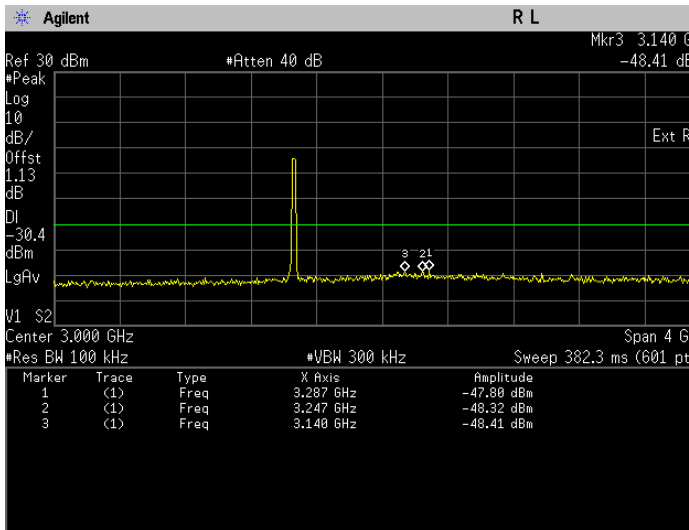




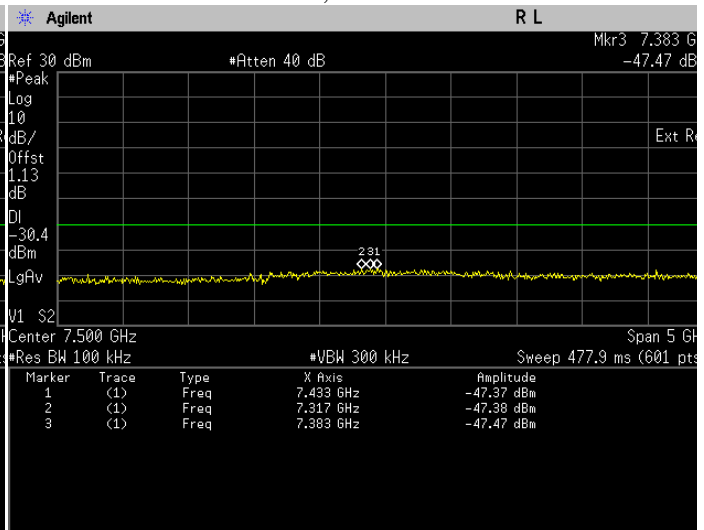
Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Reference Level



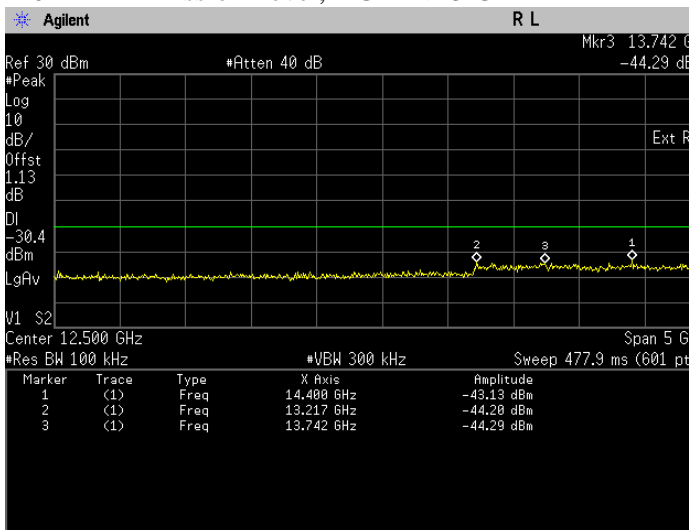
Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Emission Level, 30 MHz -> 1 GHz



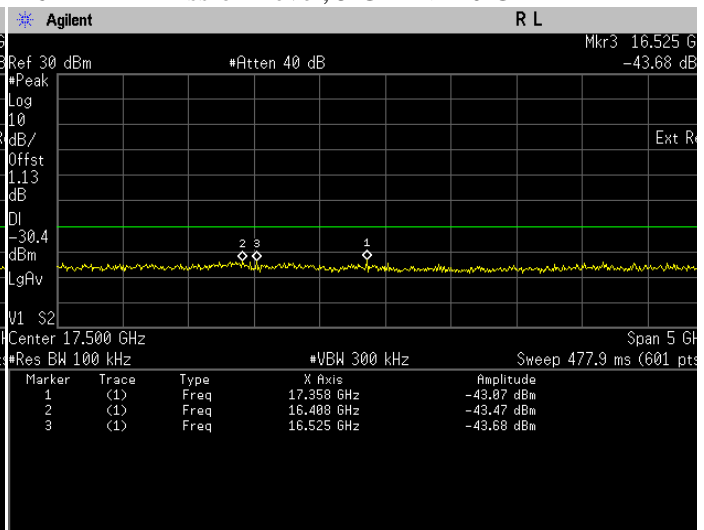
Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Emission Level, 1 GHz -> 5 GHz



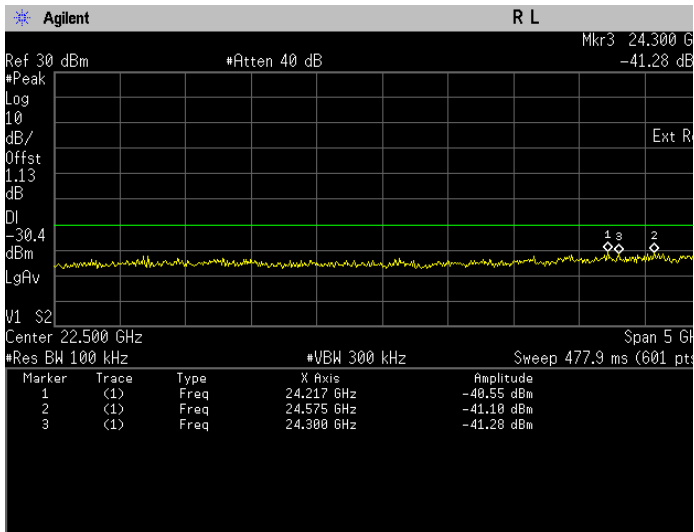
Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Emission Level, 5 GHz -> 10 GHz



Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Emission Level, 10 GHz -> 15 GHz



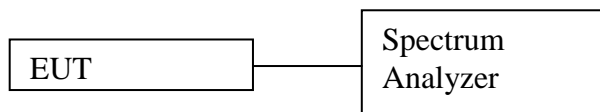
Conducted Emissions(Average). 802.11n, Frequency 2462 MHz Emission Level, 15 GHz -> 20 GHz



Conducted Emissions(Average). 802.11n, Frequency  
 2462 MHz Emission Level, 20 GHz -> 25 GHz

## 6.6. Band edge Conducted Spurious Emission

### 6.6.1. Test Setup



- a) Check and ensure the spectrum analyzer well calibrate.
- b) Turn on the DUT and set DUT to transmit maximum power.
- c) Connect DUT’s antenna terminal to spectrum analyzer with a low loss cable.
- d) Setting of Spectrum analyzer :
  - a. RBW = 100 kHz
  - b. VBW = 300 kHz
  - c. Detector mode = Peak
  - d. Trace = Max Hold
  - e. Sweep = auto
- e) Use the peak marker function to measure highest emission.
- f) Measure every antenna port by repeat the step above for MIMO measurement.

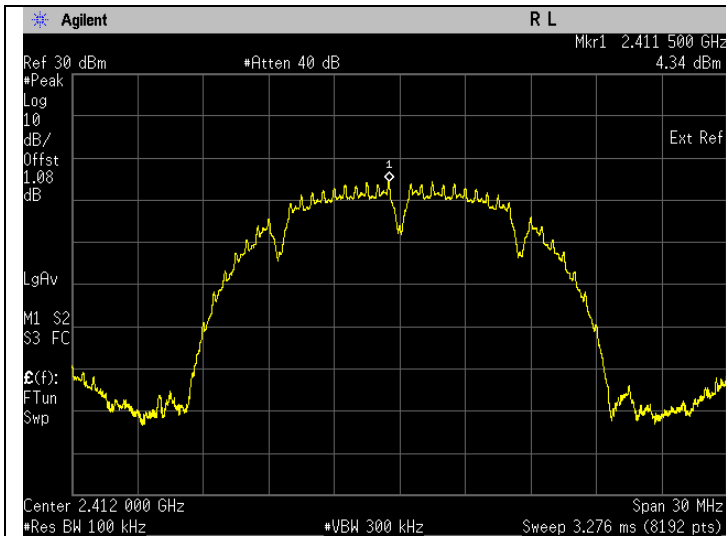
### 6.6.2. Test Limits:

<b>Normal Condition (25 ° C)</b>
<b>Shall be at least 30 dB below peak (max) power.</b>

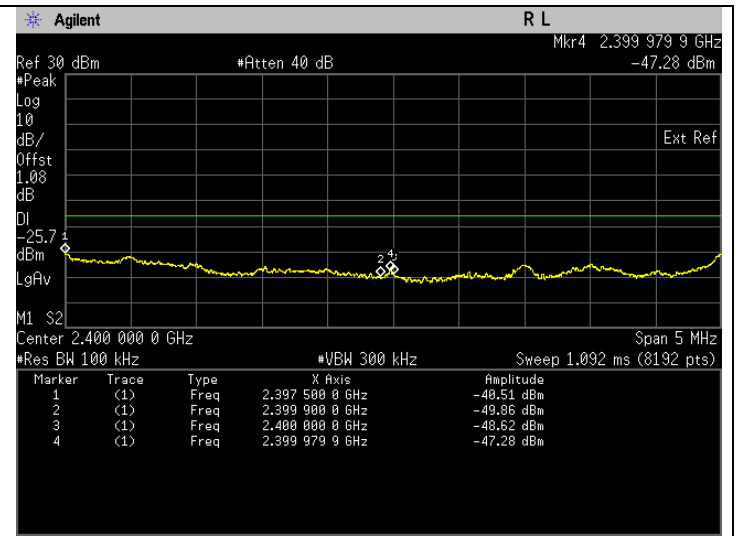
### 6.6.3. Test Result

#### **802.11b**

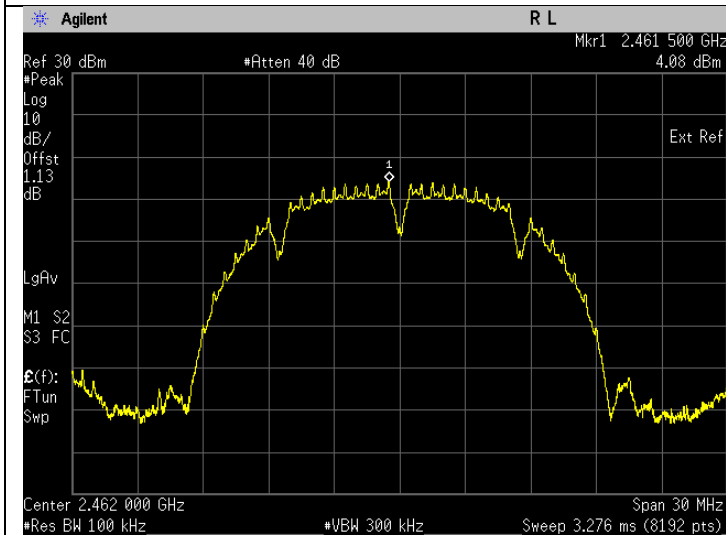
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Frequencies (MHz)	Power (dBm)	Status
802.11b	DSSS	DBPSK	1	2412	2399.98	-47.28	Pass
802.11b	DSSS	DBPSK	1	2462	2483.56	-49.83	Pass



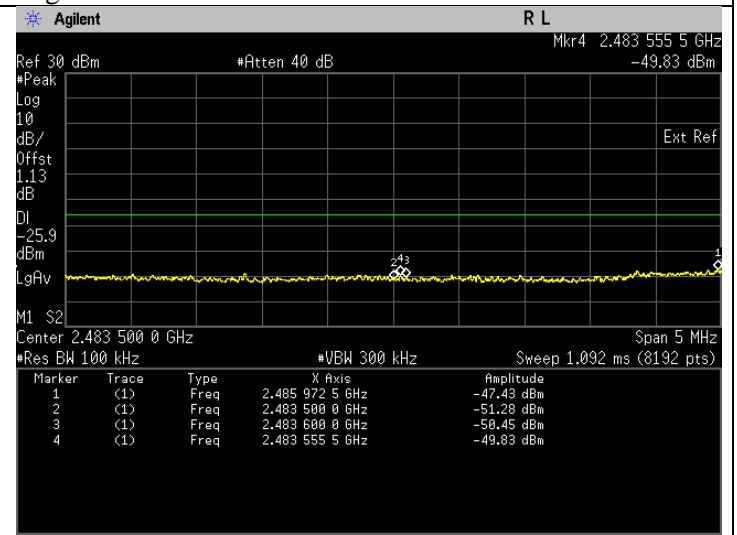
Band Edge(Average). 802.11b Frequency 2412 MHz  
 Reference Level



Band Edge(Average). 802.11b Frequency 2412 MHz Band  
 Edge

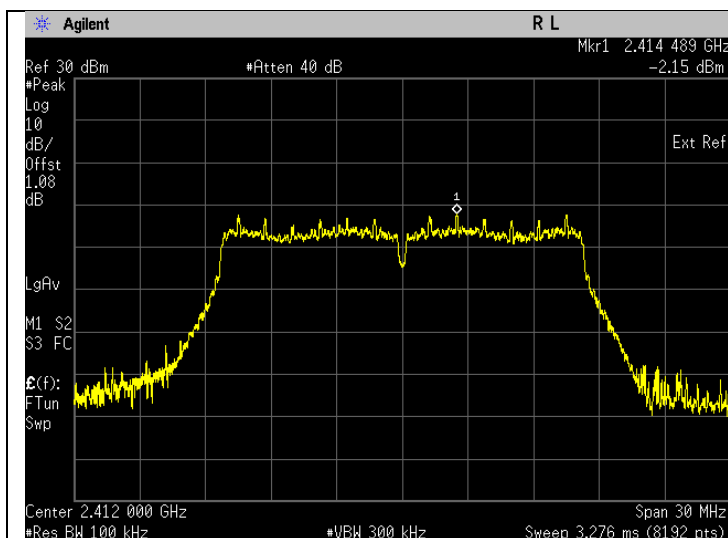


Band Edge(Average). 802.11b Frequency 2462 MHz  
 Reference Level

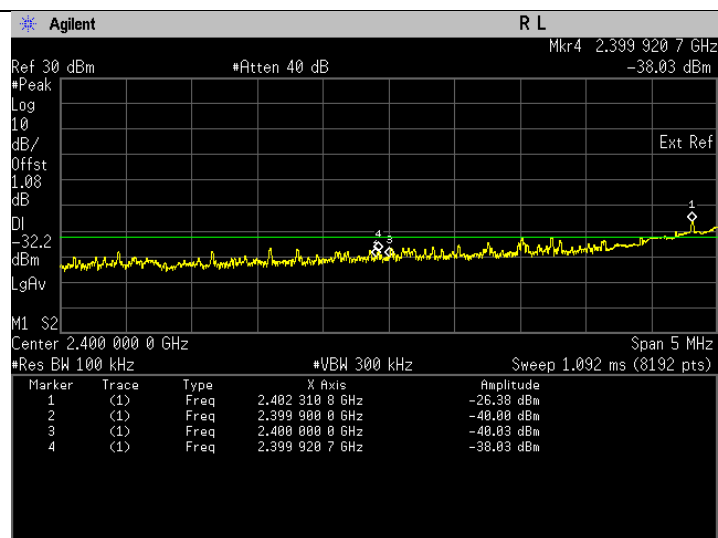


Band Edge(Average). 802.11b Frequency 2462 MHz Band  
 Edge

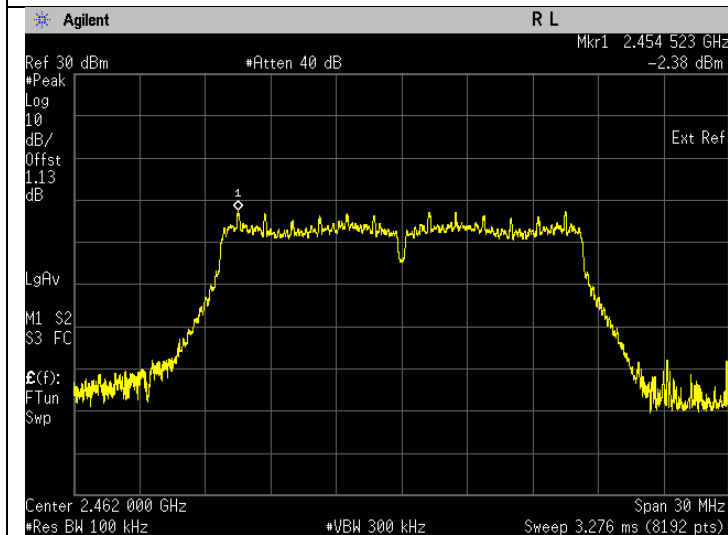
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Frequencies (MHz)	Power (dBm)	Status
802.11g	OFDM	BPSK	6	2412	2399.92	-38.03	Pass
802.11g	OFDM	BPSK	6	2462	2483.55	-49.35	Pass



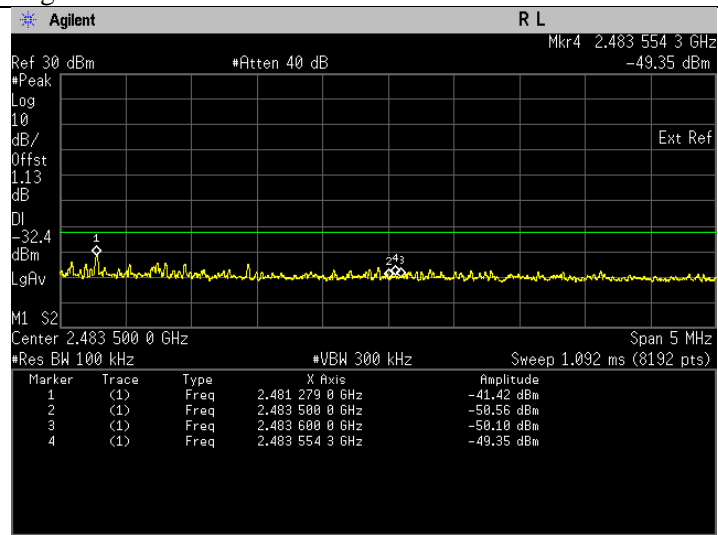
Band Edge(Average). 802.11g Frequency 2412 MHz Reference Level



Band Edge(Average). 802.11g Frequency 2412 MHz Band Edge



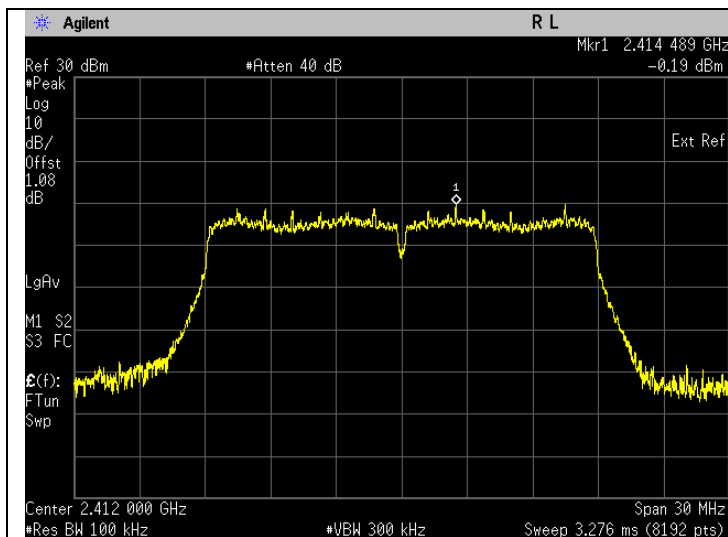
Band Edge(Average). 802.11g Frequency 2462 MHz Reference Level



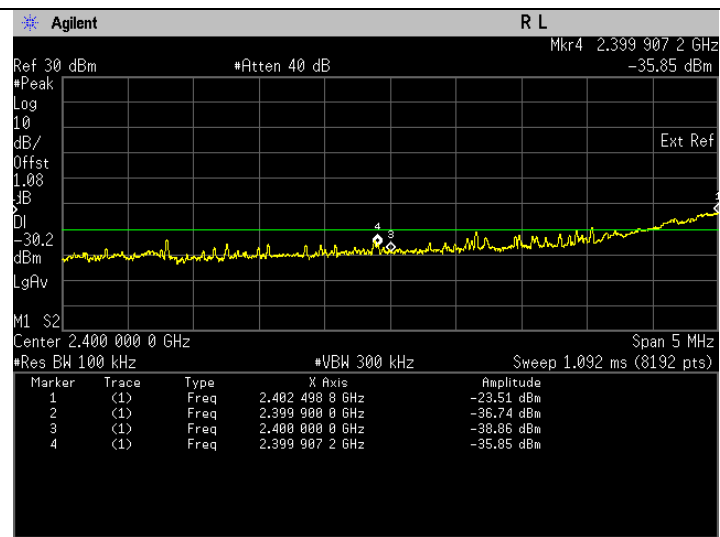
Band Edge(Average). 802.11g Frequency 2462 MHz Band Edge

**802.11n (HT20)**

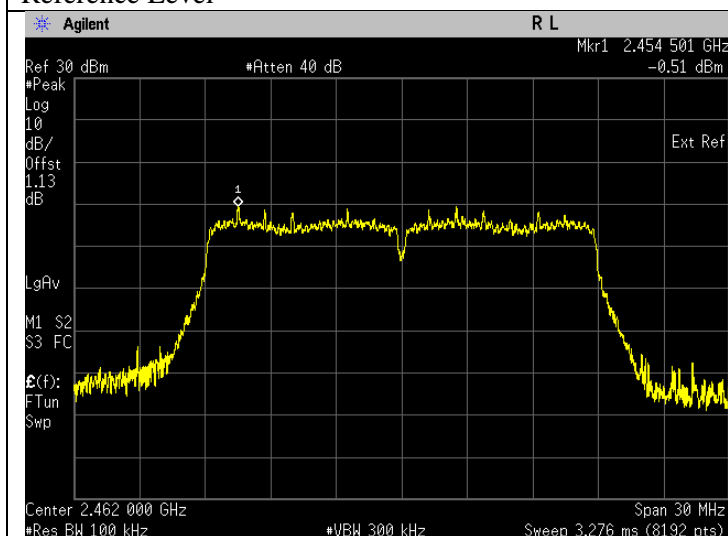
Test Conditions				Test Frequency	Results		
Standard	Modulation Type	Modulation Technology	Data Rate (mbps)	Tx (MHz)	Frequencies (MHz)	Power (dBm)	Status
802.11n	OFDM	BPSK	6.5	2412	2399.91	-35.85	Pass
802.11n	OFDM	BPSK	6.5	2462	2483.50	-47.65	Pass



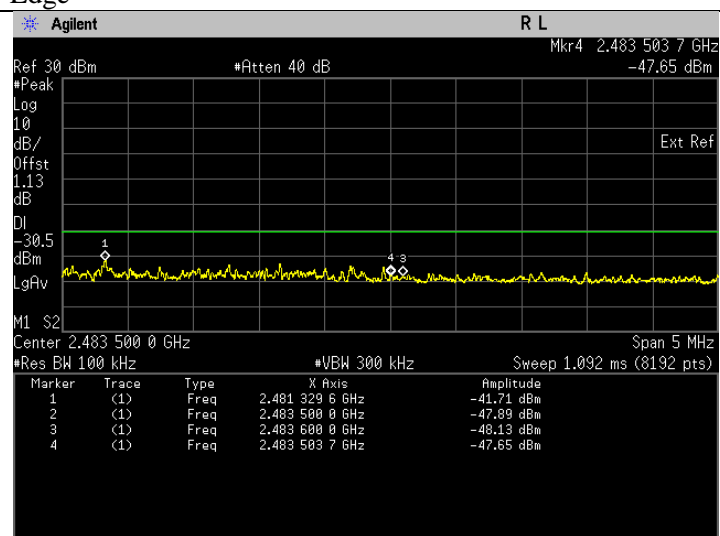
Band Edge(Average). 802.11n Frequency 2412 MHz Reference Level



Band Edge(Average). 802.11n Frequency 2412 MHz Band Edge



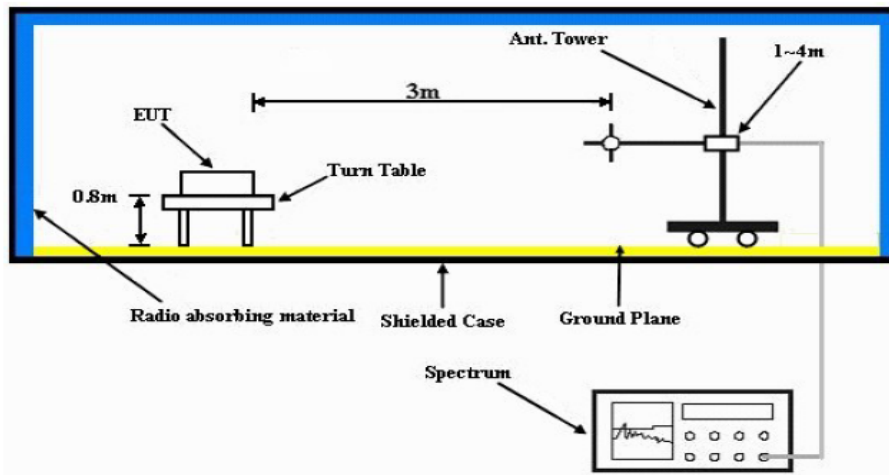
Band Edge(Average). 802.11n Frequency 2462 MHz Reference Level



Band Edge(Average). 802.11n Frequency 2462 MHz Band Edge

## 6.7. Radiated Emission within restricted Bands

### 6.7.1. Test Setup



- The EUT is placed on the top of a rotating table 0.8m above the ground (<1GHz) and 1.5m above the ground (>1GHz) at a 3m semi-anechoic chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
- The EUT is set 3m away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
- The antenna is Bilog/Horn antenna depend on which frequency range uses, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT is arranged to its worst case and then the antenna is tuned to heights from 1m to 4m and the rotatable table is turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system is set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode is fall within the range of 10dB from the limit specified, the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Otherwise, the testing could be stopped and the peak values of the EUT would be reported.

#### NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.

**6.7.2. Test Limits:**

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power.

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

**NOTE:**

- a. The lower limit shall apply at the transition frequencies.
- b. Emission level (dBuV/m) = 20 log Emission level (uV/m).
- c. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



**6.7.3. Test Data:**

**Test: WIFI SAC Restricted Band Edge**

Model Number: AAH56JDN9RA1AN S/N: 871TXX3188 EMC SR ID#: 10463-EMC-00077  
 Battery: PMNN4493A Accessory: PMAD4147A  
 Test Channel: Low Test Frequency: 2412.0000 MHz Test Standard: ANSI C63.10-2013  
 Worst Case Plane: Y-Plane (802.11n)

**Restricted Band Edge (Low Channel) tabular data**

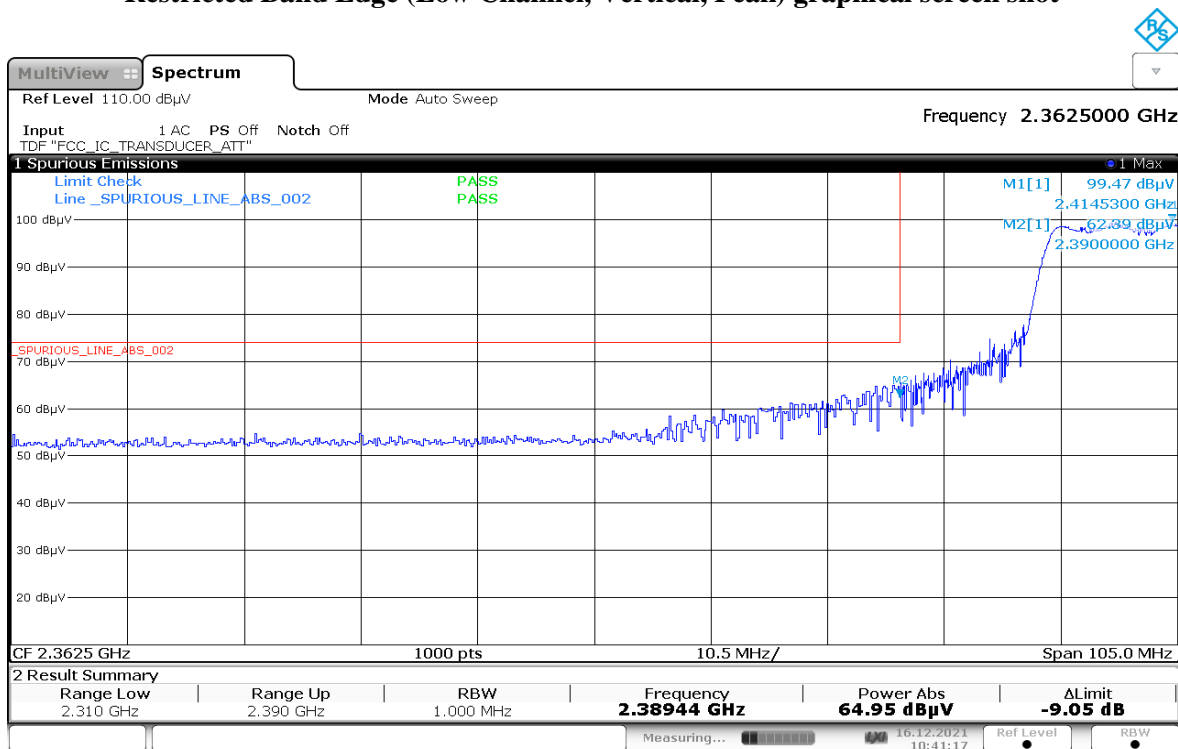
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBμV/m)	Spur level PK (dBμV/m)	Spur level AV (dBμV/m)	Limit QPK (dBμV/m)	Limit PK (dBμV/m)	Limit AV (dBμV/m)	Margin QPK (dBμV/m)	Margin PK (dBμV/m)	Margin AV (dBμV/m)	Carrier PK Power (dBμV/m)
2390.0000	-	61.9042	44.8873	-	74.0000	54.0000	-	-12.0958	-9.1127	-
Horizontal Radiated Emission Result										
2390.0000	-	65.5853	45.2134	-	74.0000	54.0000	-	-8.4147	-8.7866	-

Remarks: Pass Result	Marginal Result	Fail Result
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Temperature (degC):23.3  
 Test Performed by: Aiman&Amaluddin  
 System MU: 5.84dB

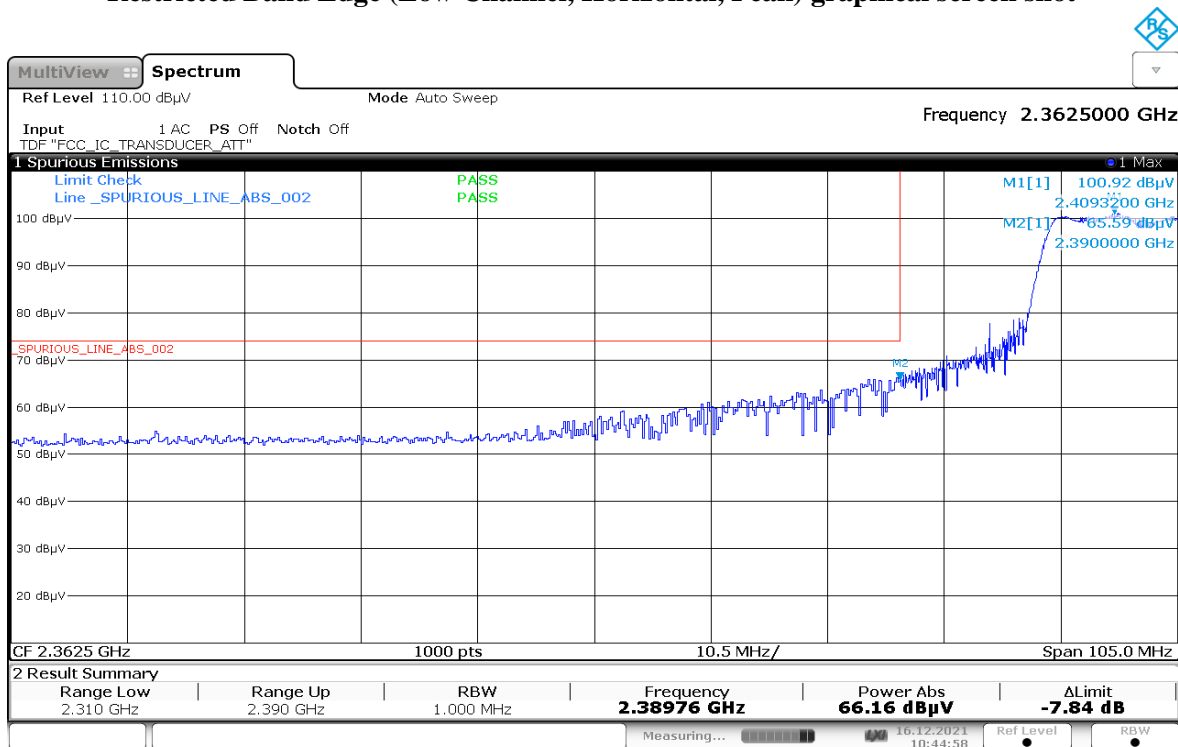
Humidity (%): 68.4  
 Test Date: Thu, 16 Dec, 2021

### Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



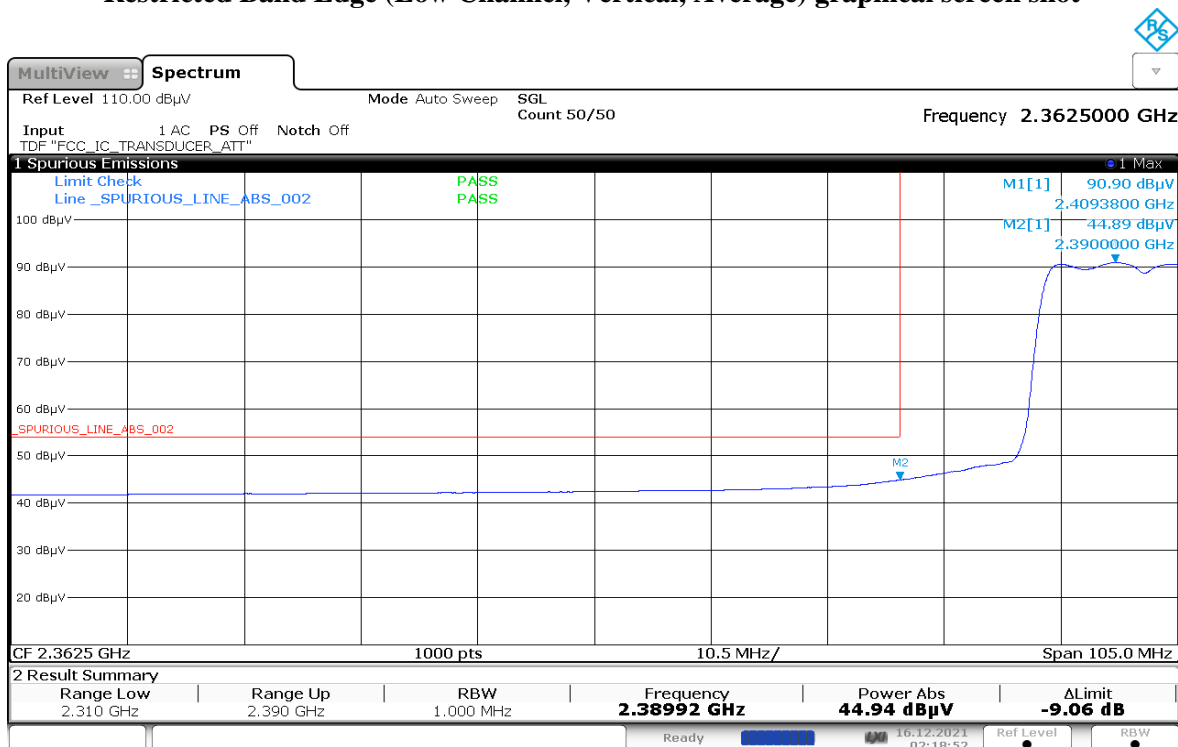
10:41:17 16.12.2021

### Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



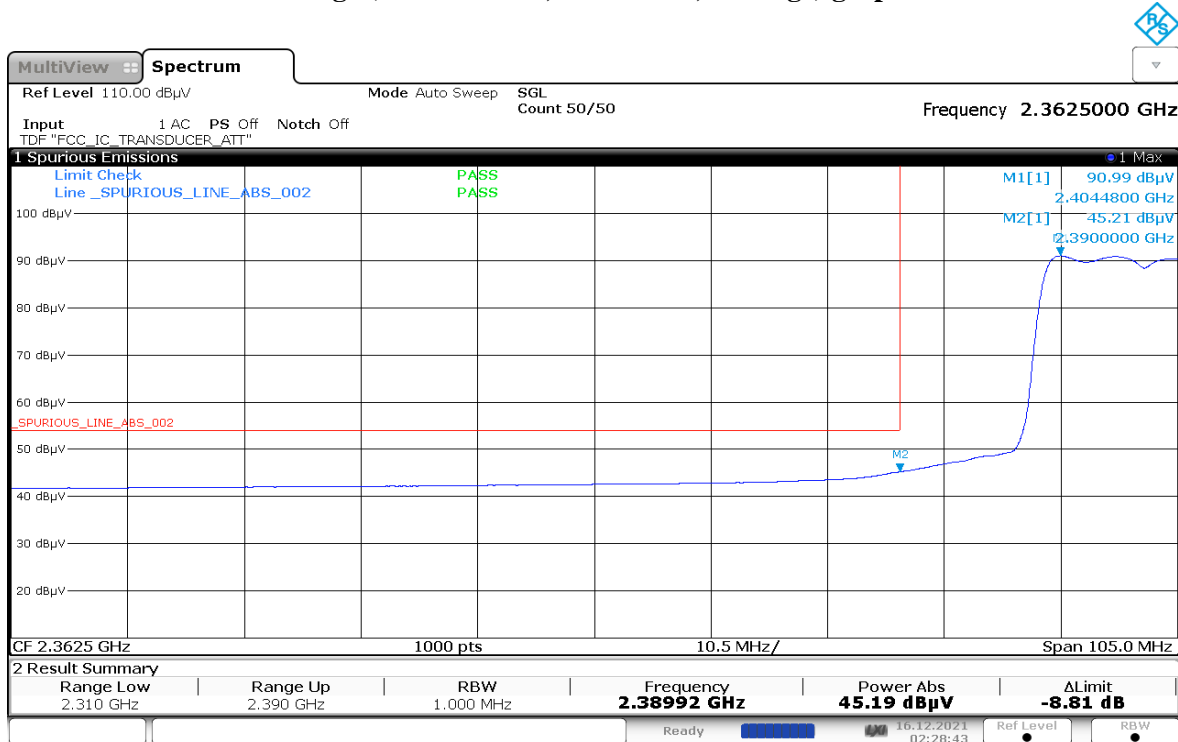
10:44:58 16.12.2021

### Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



02:18:53 16.12.2021

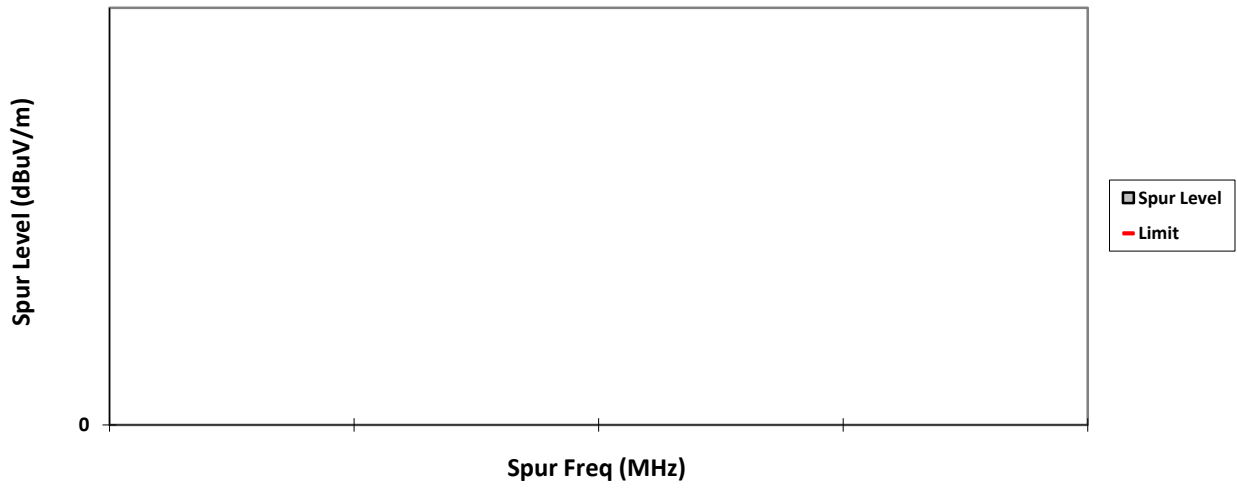
### Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



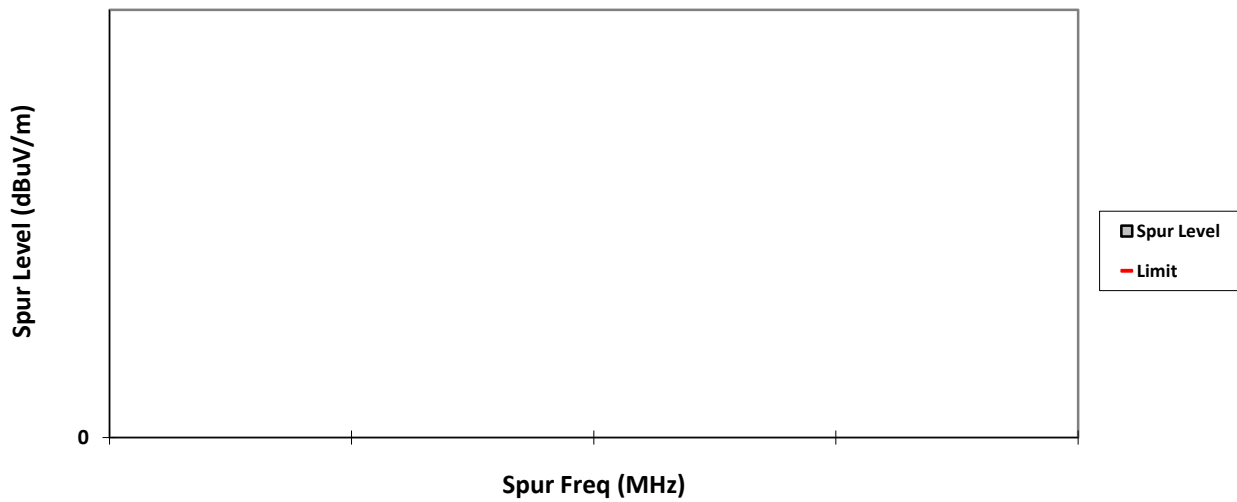
02:28:44 16.12.2021



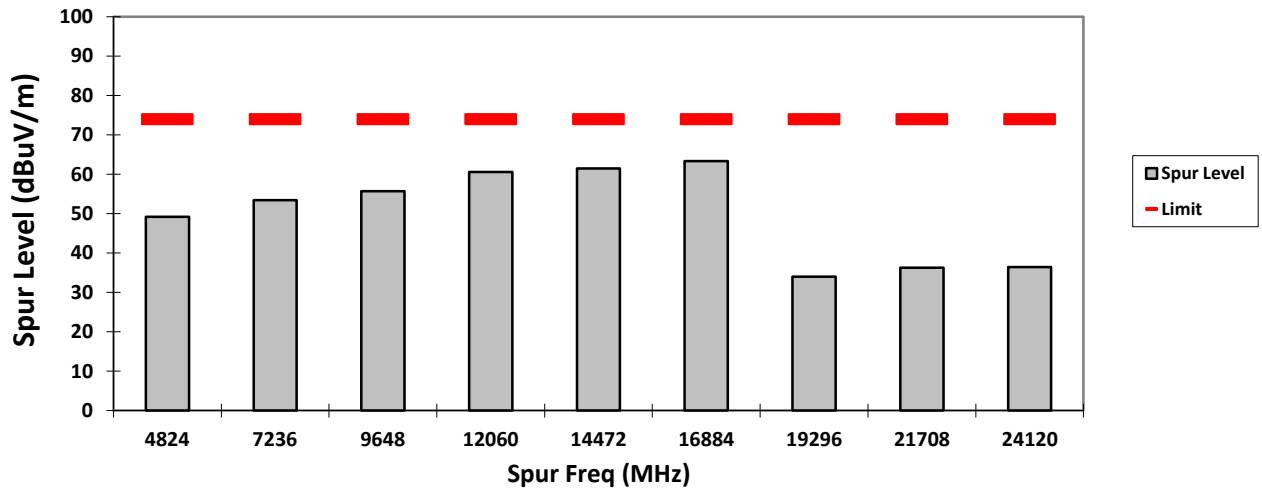
### VERTICAL, QPK



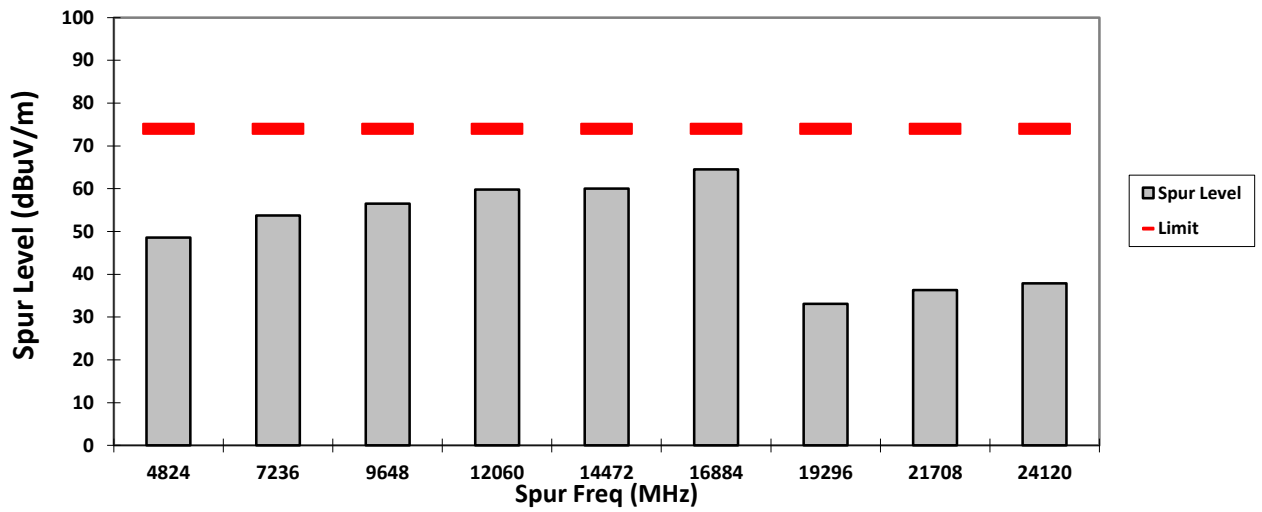
### HORIZONTAL, QPK



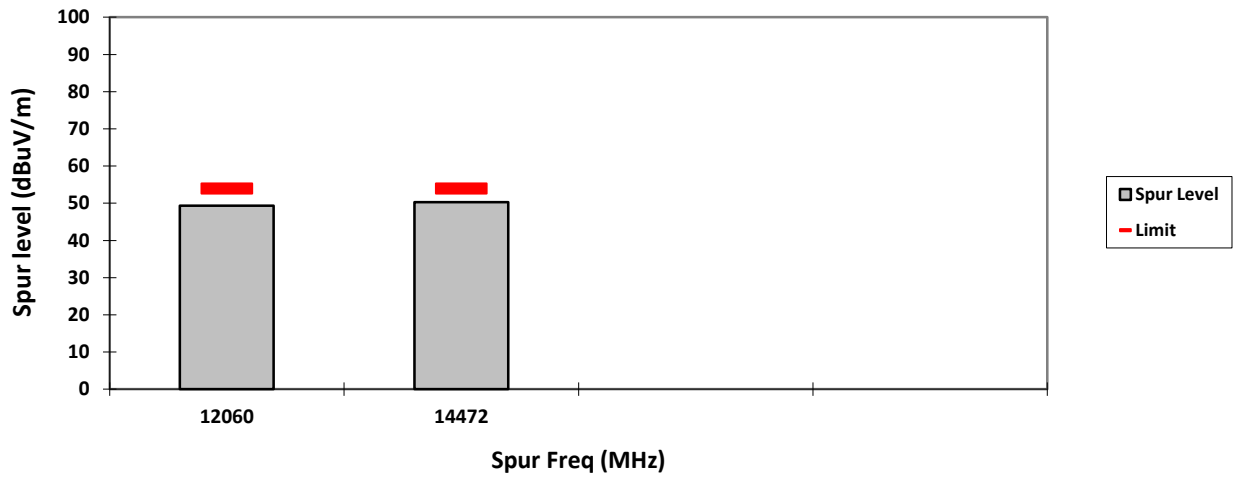
### VERTICAL, PK



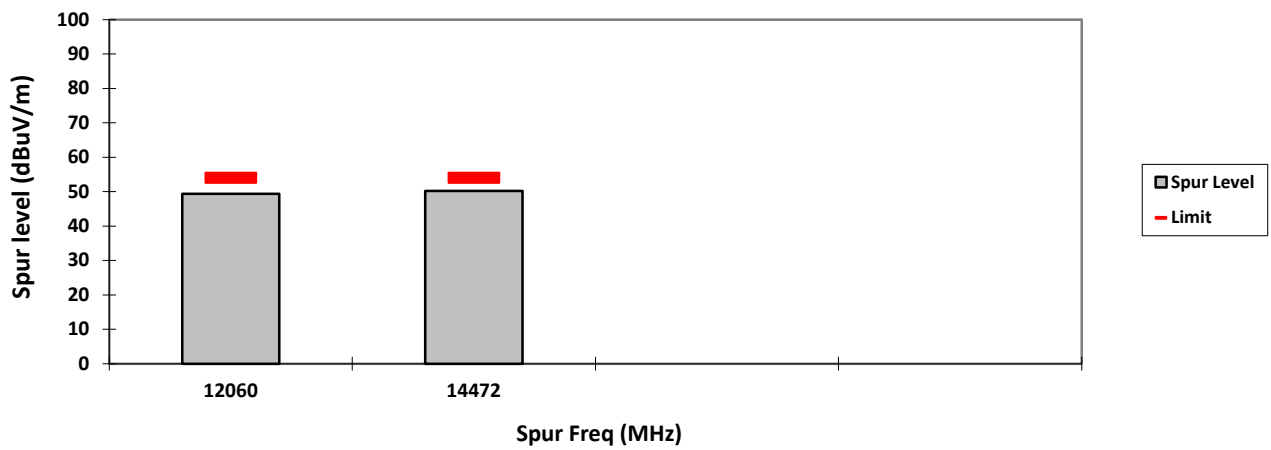
### HORIZONTAL, PK



### VERTICAL, AV

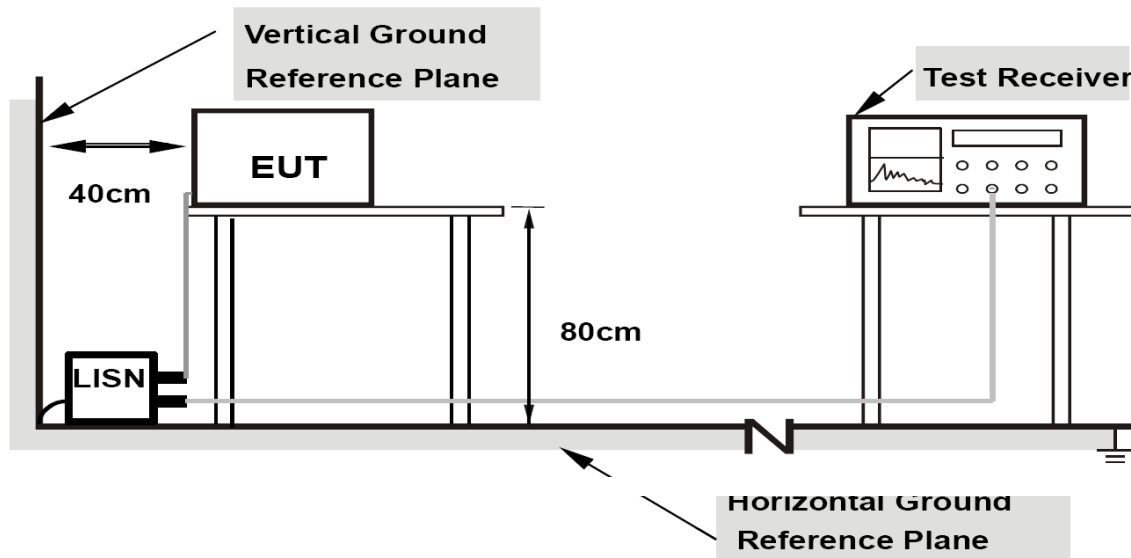


### HORIZONTAL, AV



## 6.8. AC Powerline Conducted Emission

### 6.8.1. Test Setup



- 1) Tests were conducted for both Receive and Transmit Mode of the EUT.
- 2) The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50uH of coupling impedance for the measuring instrument.
- 3) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 4) The frequency range from 150 kHz to 30MHz was measured.

### 6.8.2. Test Limits:

For AC Power Line Conducted Test Limit can be Class A or B depends on product classification.

Limits for conducted disturbance at the mains ports  
of class A ITE

Frequency range MHz	Limits dB( $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60

NOTE The lower limit shall apply at the transition frequency.

Table 1: Limits for Conducted Disturbance at the Mains Ports of Class A ITE.



**Limits for conducted disturbance at the mains ports  
of class B ITE**

Frequency range MHz	Limits dB( $\mu$ V)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.  
NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.

**Table 2: Limits for Conducted Disturbance at the Mains Ports of Class B ITE**

### 6.8.3. Test Result

**Not Applicable. Testing is not required, radio shall turn off during charging mode.**

**END OF TEST REPORT**