



# FCC Part 15C TEST REPORT

TESTING  
CNAS L3572

Issued to

Corporativo Lanix S.A. de C.V.

For

Smartphone

Model Name: Ilium S410  
Trade Name: Lanix  
Brand Name: Lanix  
FCC ID: ZC4S410  
Standard: 47 CFR Part 15 Subpart C  
Test date: 2013-7-17 to 2013-8-12  
Issue date: 2013-8-12

by

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Date 2013.8.12

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Date 2013.8.12

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(Project Manager)

Date 2013.8.12



CTIA Authorized Test Lab  
LAB CODE 20081223-00  
IEEE 1725

OFTA  
電訊管理局



GCF  
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Bluetooth  
BQTF

FCC  
Reg. No.  
695796

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Change History		
Issue	Date	Reason for change
1.0	August 7, 2013	First Edition
2.0	August 12, 2013	Second Edition

## 1. General Information

### 1.1. EUT Description

EUT Type .....: Smartphone  
Serial No.....: (n.a, marked #1 by test site)  
Hardware Version .....: V1.0  
Software Version .....: V1.2  
Applicant .....: Corporativo Lanix S.A. de C.V.  
Carretera Internacional Hermosillo-Nogales Km 8.5,Hermosillo  
Sonora, Mexico  
Manufacturer .....: Tinno Mobile Technology Corp.  
4/F, H-3 Building, OCT Eastern industrial Park, No.1 XiangShan  
East Road.,Nan Shan District, Shenzhen, P.R. China.  
Frequency Range.....: 802.11b/g/n-20MHz: 2.412GHz - 2.462GHz  
802.11n-40MHz: 2.422GHz- 2.452GHz  
Channel Number.....: 802.11b/g/n-20MHz: 11  
802.11n-40MHz: 7  
Modulation Type .....: DSSS (802.11b), OFDM (802.11g/n)  
Antenna Type.....: PIFA Antenna  
Antenna Gain.....: -3.77dBi

Note 1: The EUT is Smartphone, it contains WIFI Module operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report.

Note 2: The frequencies allocated is  $F \text{ (MHz)} = 2412 + 5 \cdot (n - 1)$  ( $1 \leq n \leq 11$ ). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1 (2412MHz), 6 (2437MHz) and 11 (2462MHz).

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 4: The antenna connector of EUT is designed with permanent attachment and no consideration of replacement.

## 1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Wi-Fi, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-09 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.247(b)	Peak Output Power	PASS
3	15.247(a)	Bandwidth	PASS
4	15.247(d)	Conducted Spurious Emission and Band Edge	PASS
5	15.247(d)	Restricted Frequency Bands	PASS
6	15.207	Conducted Emission	PASS
7	15.209 ,15.247(d)	Radiated Emission	PASS
8	15.247(e)	Power spectral density (PSD)	PASS
9	15.247(i), 1.1307&2.1093	RF exposure evaluation	PASS

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.4 2009.

These RF tests were performed according to the method of measurements prescribed in KDB558074 D01 V02 10/04/2012.

### **1.3. Facilities and Accreditations**

#### **1.3.1. Facilities**

Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

#### **1.3.2. Test Environment Conditions**

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

## 2. 47 CFR Part 15C Requirements

### 2.1. Antenna requirement

#### 2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section.

#### 2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

## 2.2. Peak Output Power

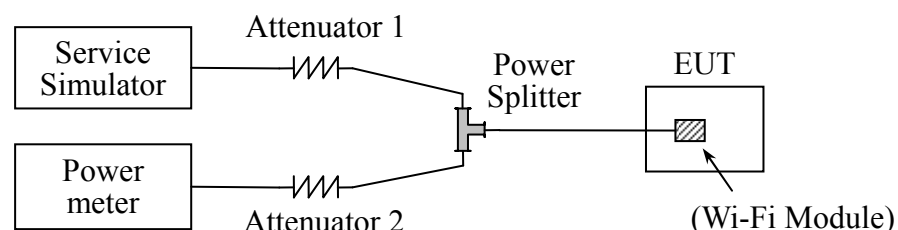
### 2.2.1. Requirement

According to FCC section 15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

### 2.2.2. Test Description

The measured output power was calculated by the reading of the Power Meter and calibration.

#### A. Test Setup:



The EUT (Equipment under the test) which is powered by the Battery is coupled to the Power Meter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in power meter.

#### B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EPM Series Power Meter	Agilent	E4418B	GB43318055	2013.05.12	2014.05.11
Power Sensor	Agilent	8482A	MY41091706	2013.05.12	2014.05.11

### 2.2.3. Test Result

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

#### 2.2.3.1. 802.11b Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	14.87	0.030690	30	1	PASS
6	2437	15.30	0.033884			PASS
11	2462	15.38	0.034514			PASS

#### 2.2.3.2. 802.11g Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	11.96	0.015704	30	1	PASS
6	2437	12.15	0.016406			PASS
11	2462	12.23	0.016711			PASS

#### 2.2.3.3. 802.11n-20MHz Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	12.01	0.015885	30	1	PASS
6	2437	12.17	0.016482			PASS
11	2462	12.16	0.016444			PASS

#### 2.2.3.4. 802.11n-40MHz Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2422	12.20	0.016596	30	1	PASS
6	2437	12.25	0.016788			PASS
11	2452	12.24	0.016749			PASS

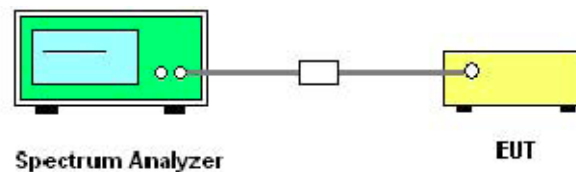
## 2.3. Bandwidth

### 2.3.1. Requirement

According to FCC section 15.247(a) (2), Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 2.3.2. Test Description

#### A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

#### B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11

### 2.3.3. Test Result

The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

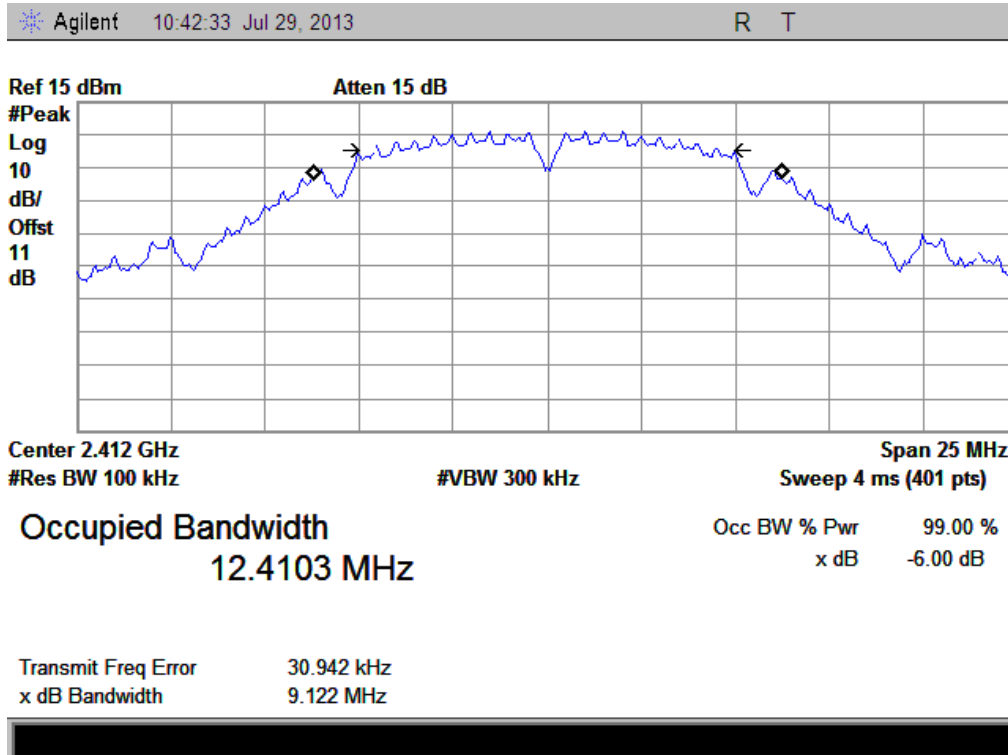
#### 2.3.3.1. 802.11b Test mode

#### A. Test Verdict:

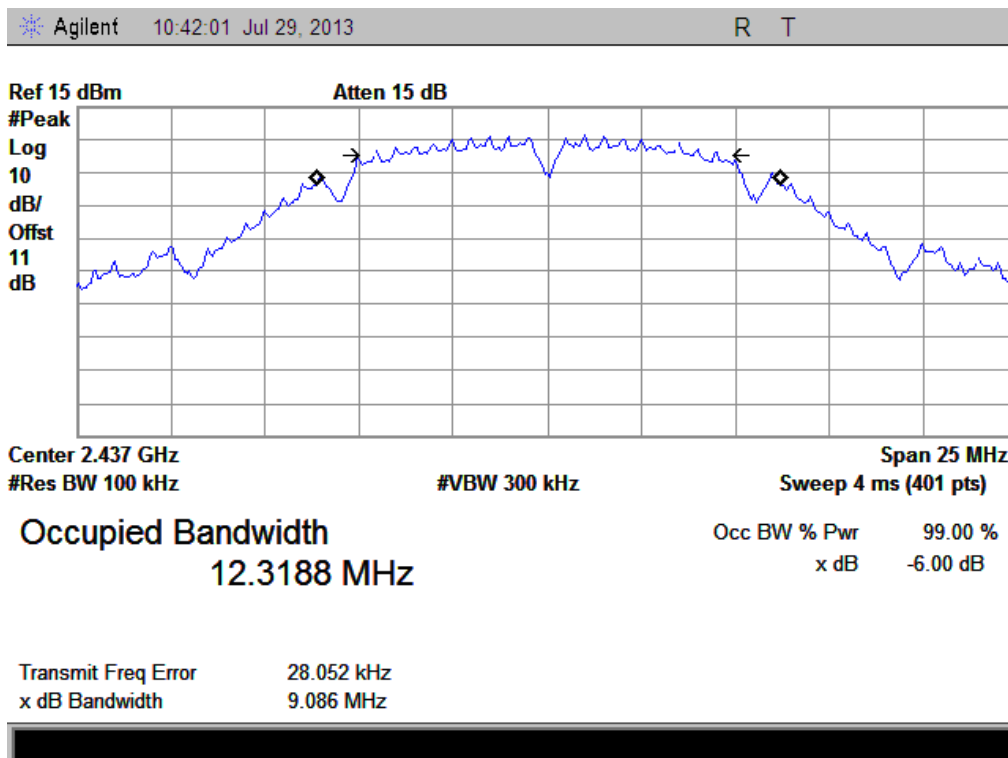
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits(kHz)	Result
1	2412	9.122	Plot A	$\geq 500$	PASS
6	2437	9.086	Plot B	$\geq 500$	PASS
11	2462	9.138	Plot C	$\geq 500$	PASS

#### B. Test Plots

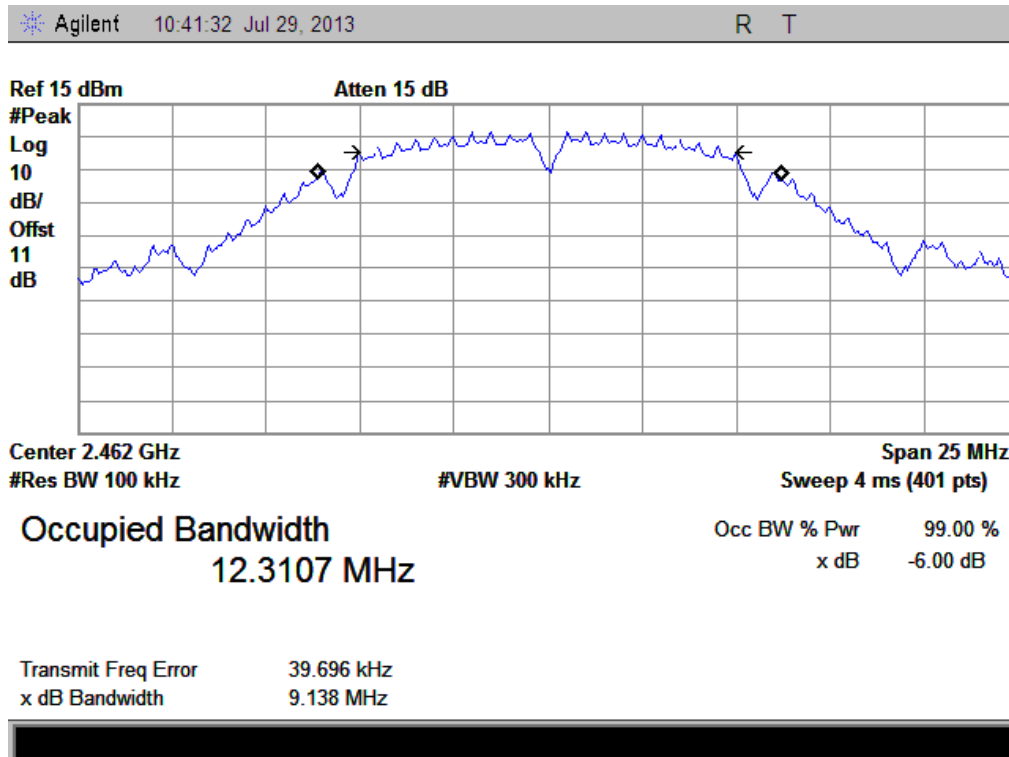




(Plot A: Channel 1: 2412MHz @ 802.11b)



(Plot B: Channel 6: 2437 MHz @ 802.11b)



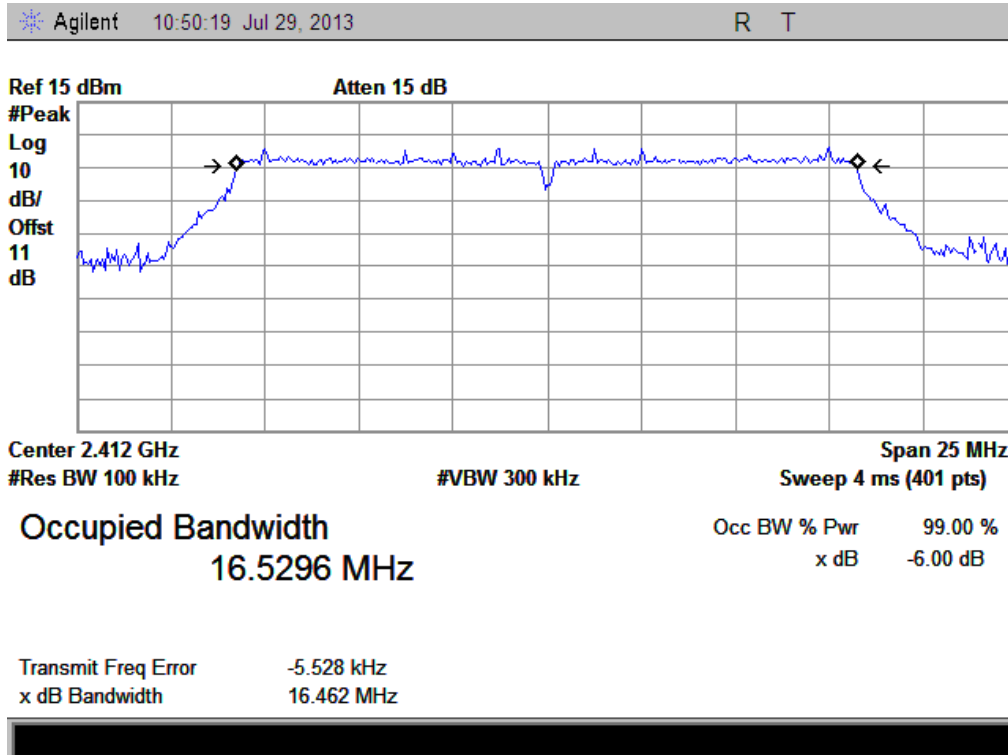
(Plot C: Channel 11: 2462MHz @ 802.11b)

### 2.3.3.2. 802.11g Test mode

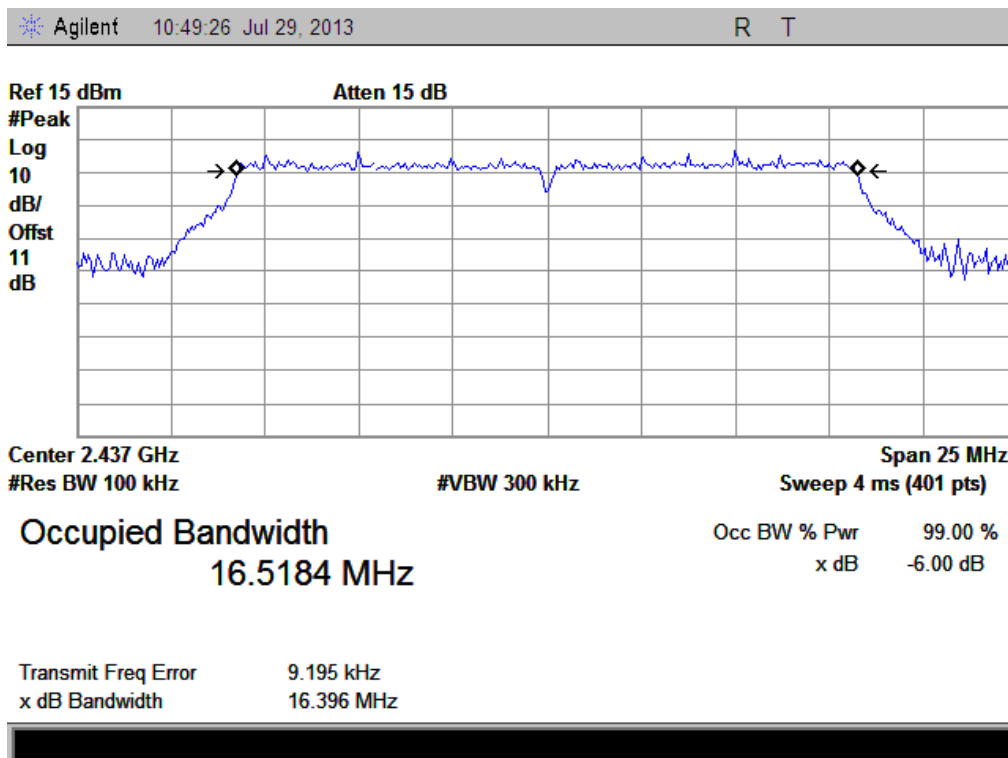
#### A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Result
1	2412	16.462	Plot D	$\geq 500$	PASS
6	2437	16.396	Plot E	$\geq 500$	PASS
11	2462	16.457	Plot F	$\geq 500$	PASS

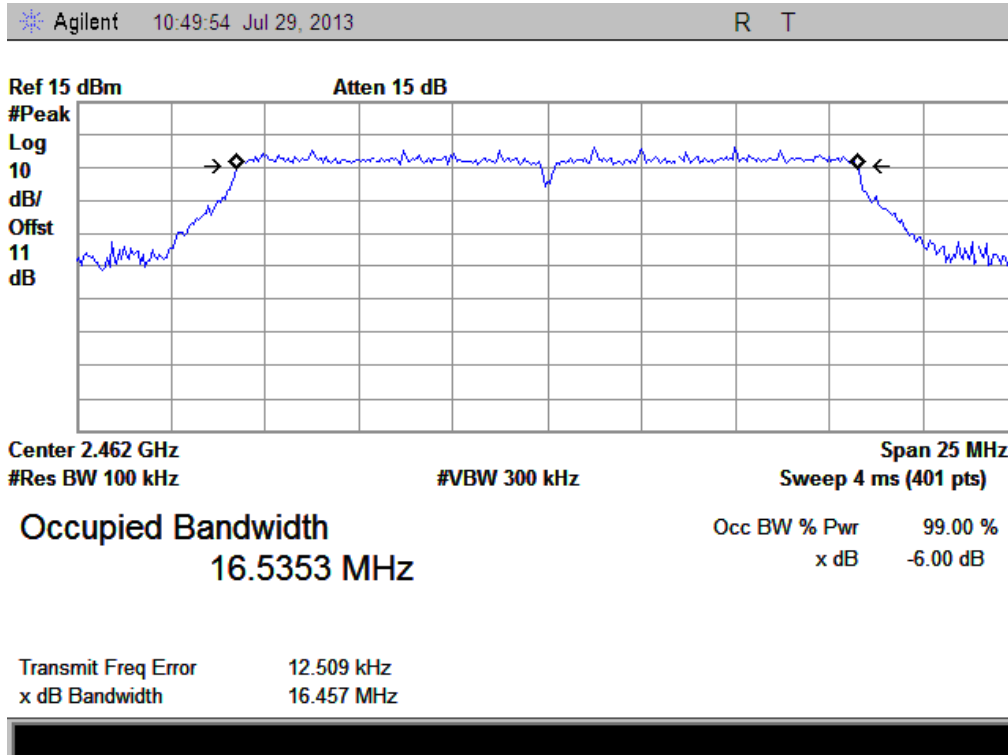
#### B. Test Plots:



(Plot D: Channel 1: 2412MHz @ 802.11g)



(Plot E: Channel 6: 2437MHz @ 802.11g)



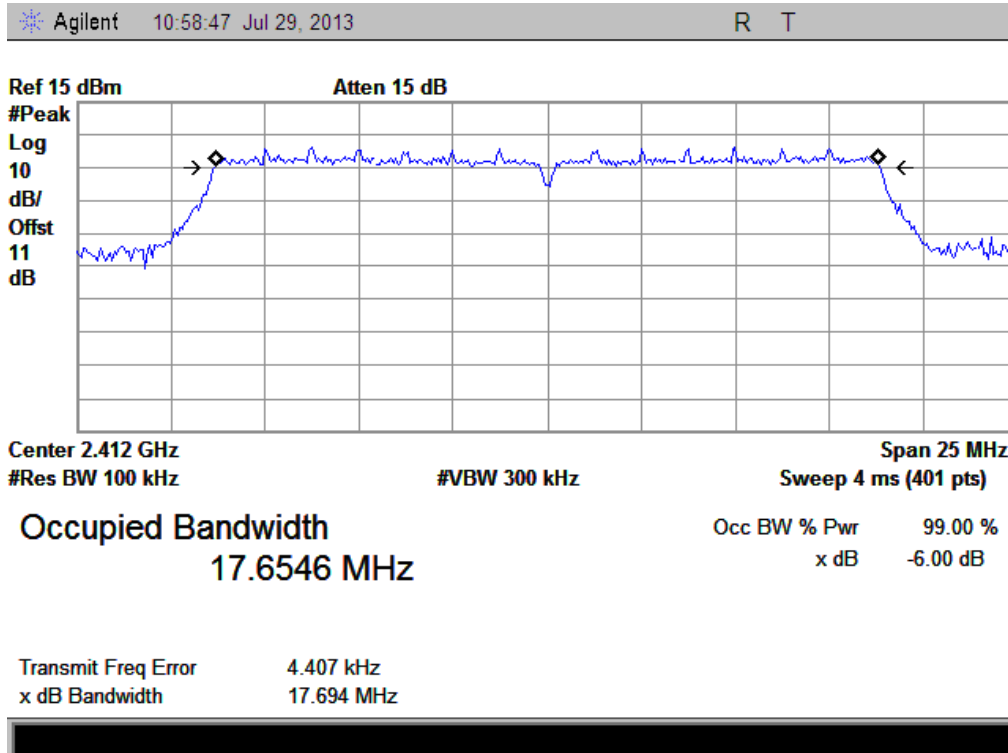
(Plot F: Channel 11: 2462MHz @ 802.11g)

### 2.3.3.3. 802.11n-20 Test mode

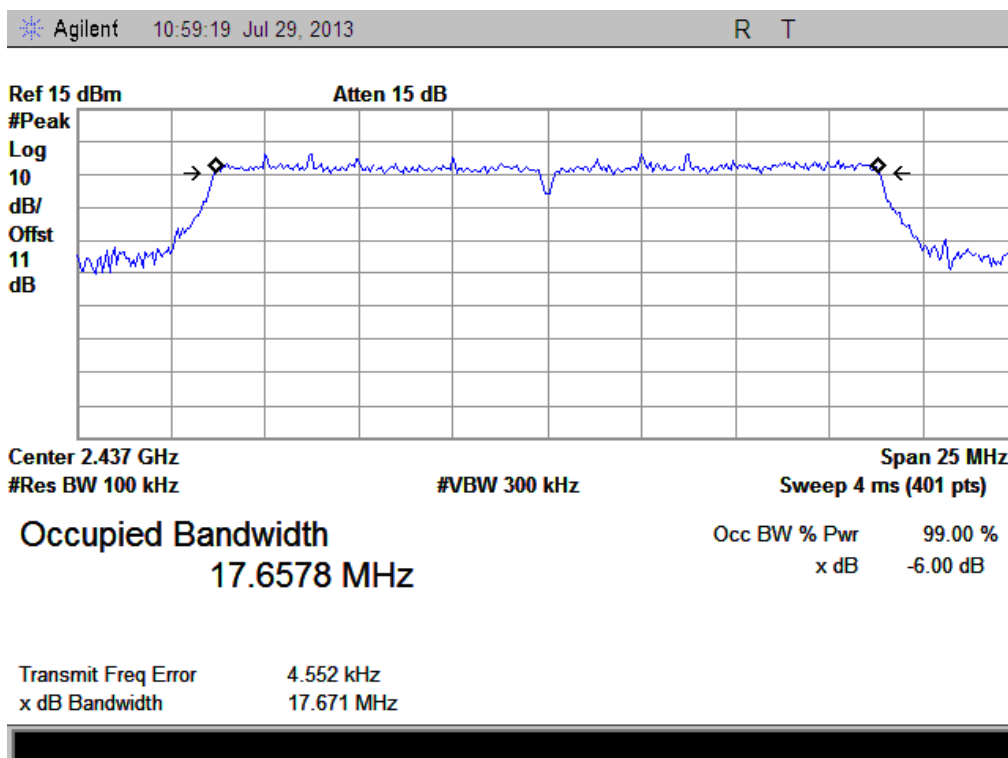
#### A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Result
1	2412	17.694	Plot G	$\geq 500$	PASS
6	2437	17.671	Plot H	$\geq 500$	PASS
11	2462	17.689	Plot I	$\geq 500$	PASS

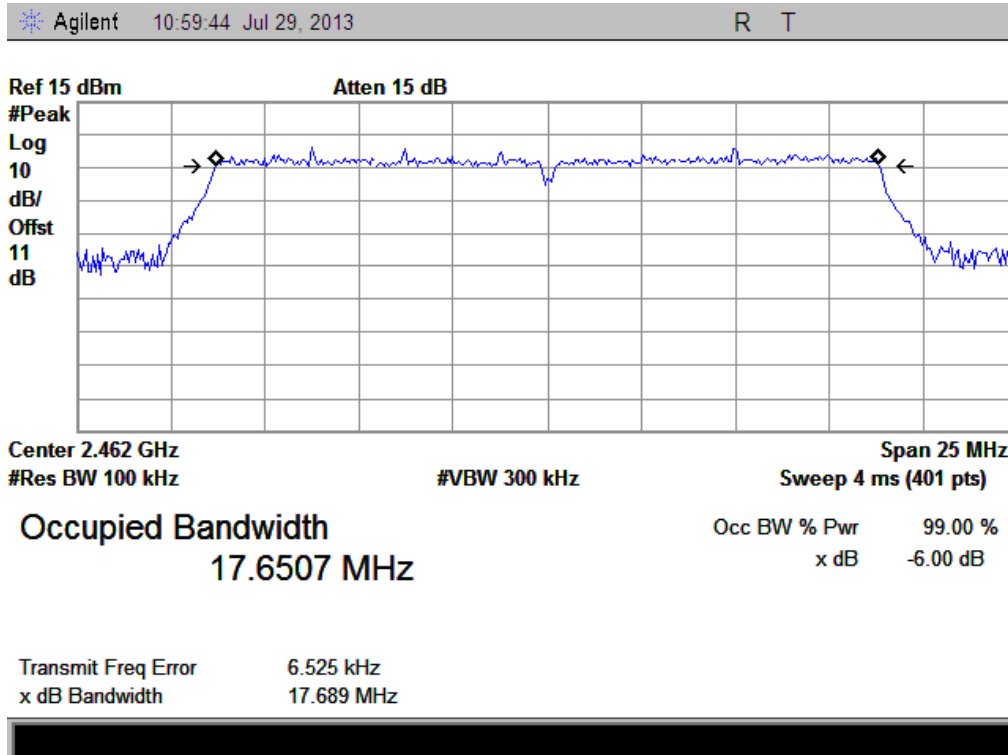
#### B. Test Plots:



(Plot G: Channel 1: 2412MHz @ 802.11n-20)



(Plot H: Channel 6: 2437MHz @ 802.11n-20)



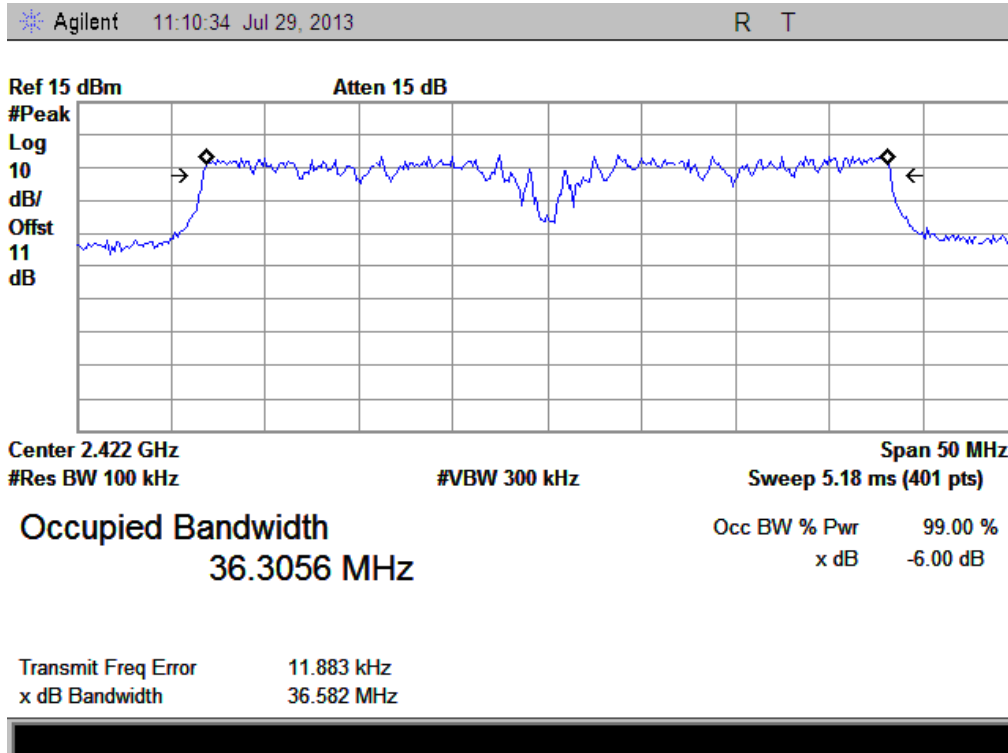
(Plot I: Channel 11: 2462MHz @ 802.11n-20)

#### 2.3.3.4. 802.11n-40 Test mode

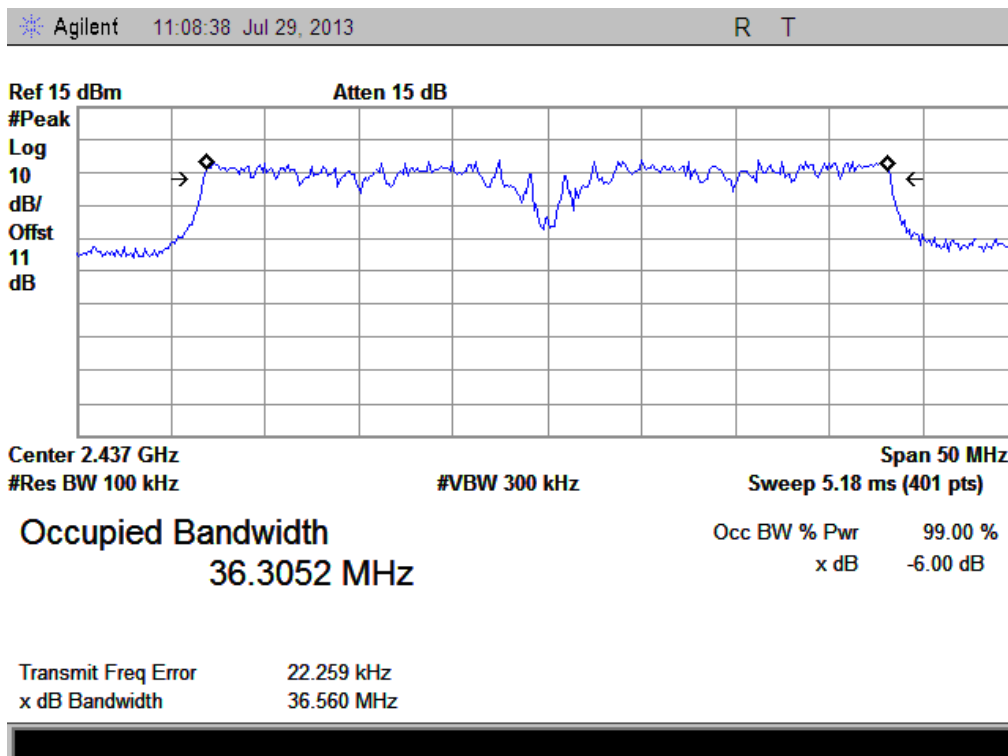
##### A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Refer to Plot	Limits (kHz)	Result
1	2422	36.582	Plot G	$\geq 500$	PASS
6	2437	36.560	Plot H	$\geq 500$	PASS
11	2452	36.581	Plot I	$\geq 500$	PASS

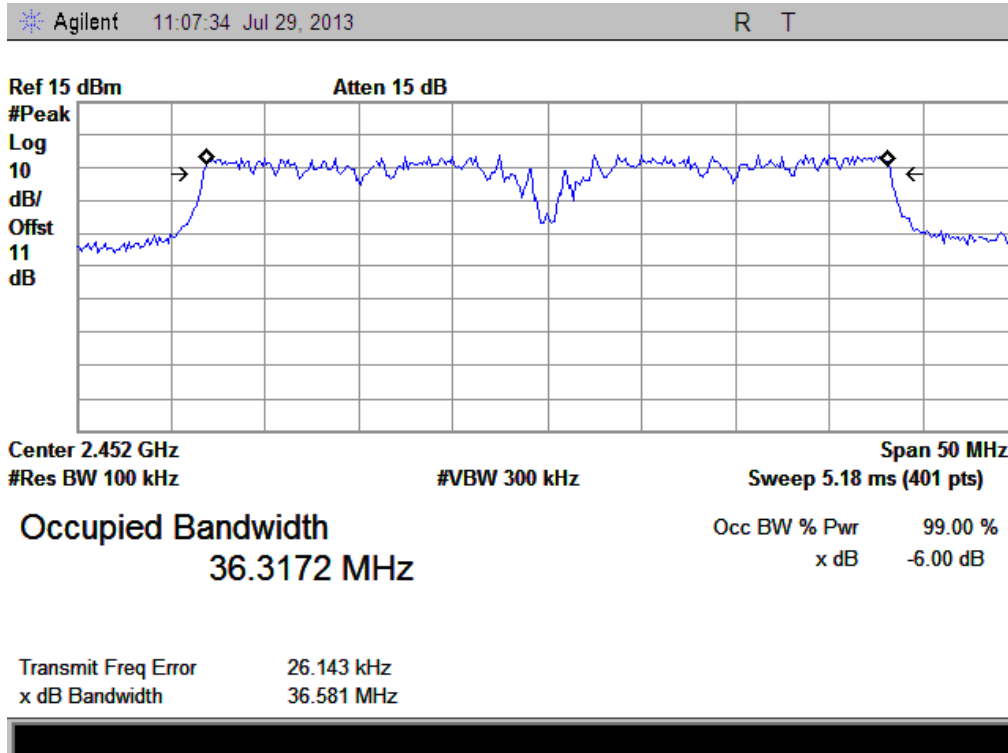
##### B. Test Plots:



(Plot G: Channel 1: 2422MHz @ 802.11n-40)



(Plot H: Channel 6: 2437MHz @ 802.11n-40)



(Plot I: Channel 11: 2452MHz @ 802.11n-40)



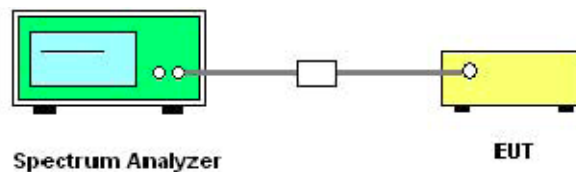
## 2.4. Conducted Spurious Emissions and Band Edge

### 2.4.1. Requirement

According to FCC section 15.247(c), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 2.4.2. Test Description

#### A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

#### B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11

### 2.4.3. Test Result

The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

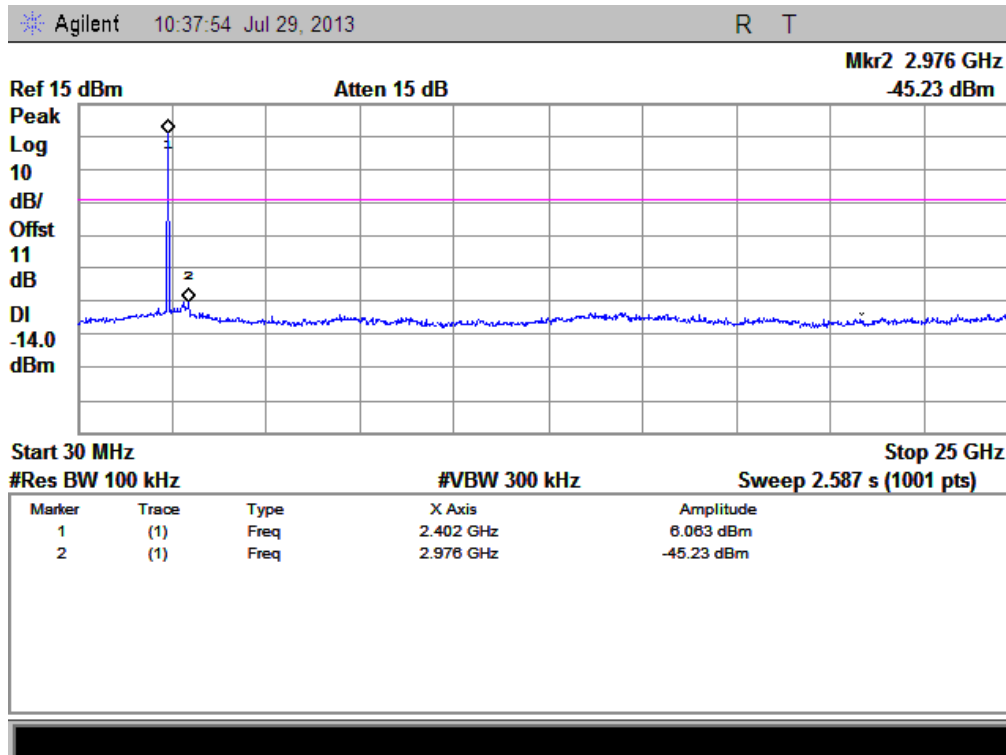
#### 2.4.3.1. 802.11b Test mode

#### A. Test Verdict:

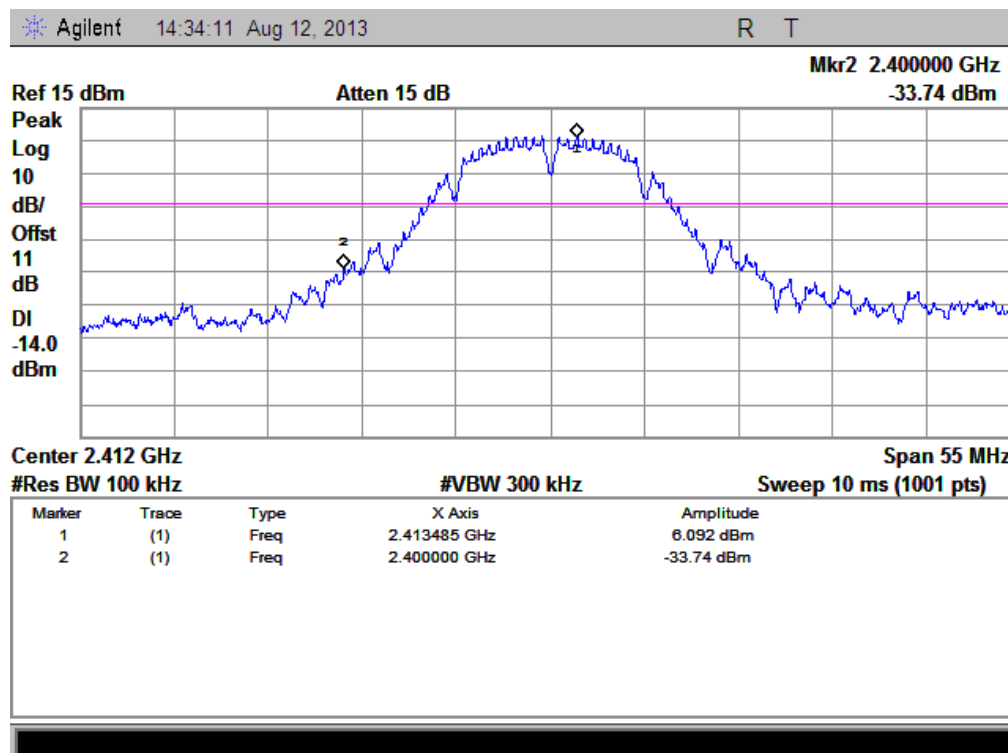
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-45.23	Plot A.1	6.063	-14.0	PASS
6	2437	-45.98	Plot B.1	5.952	-14.0	PASS
11	2462	-45.45	Plot C.1	5.325	-14.7	PASS

#### B. Test Plots:

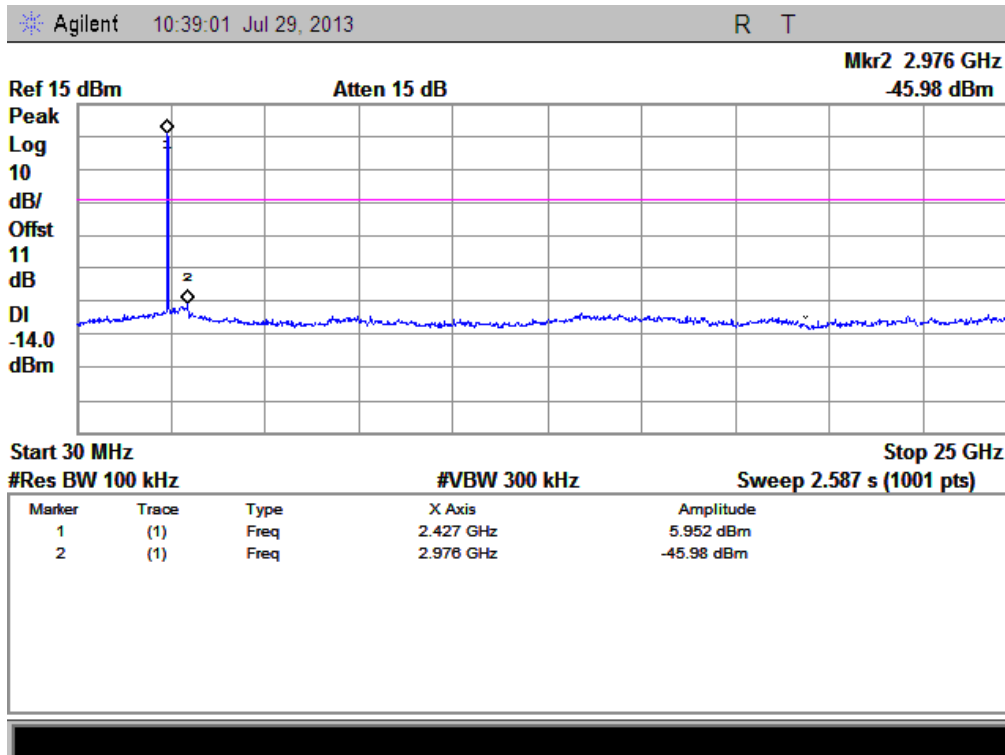
Note: the power of the Module transmitting frequency should be ignored.



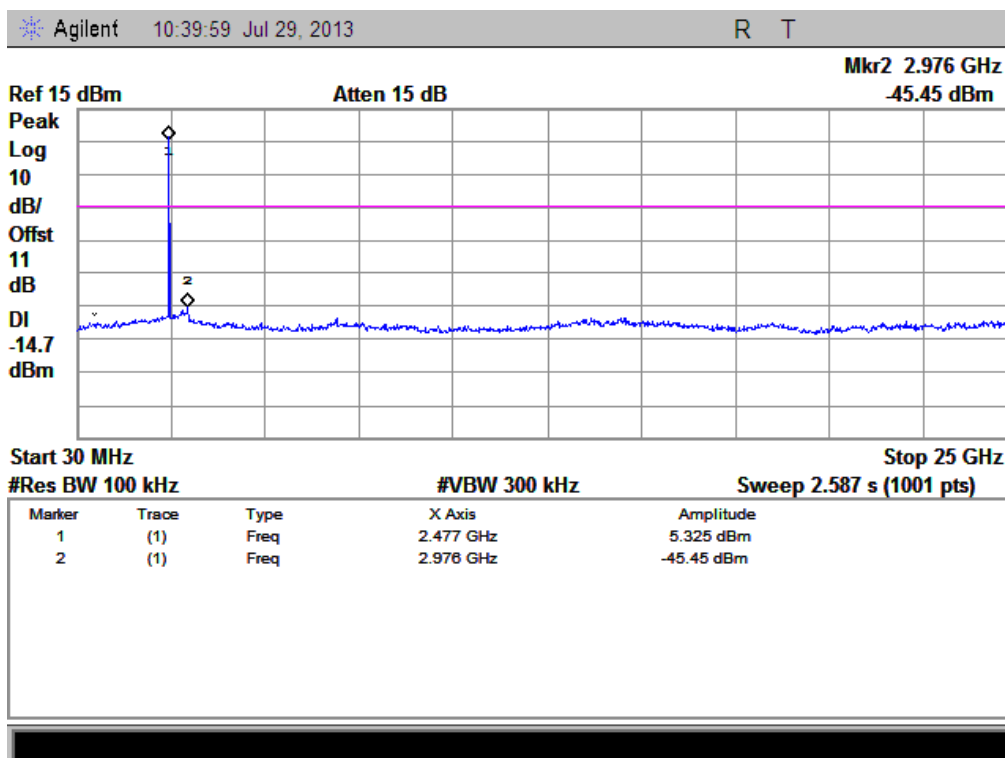
(Plot A.1: Channel = 1, 30MHz to 25GHz)



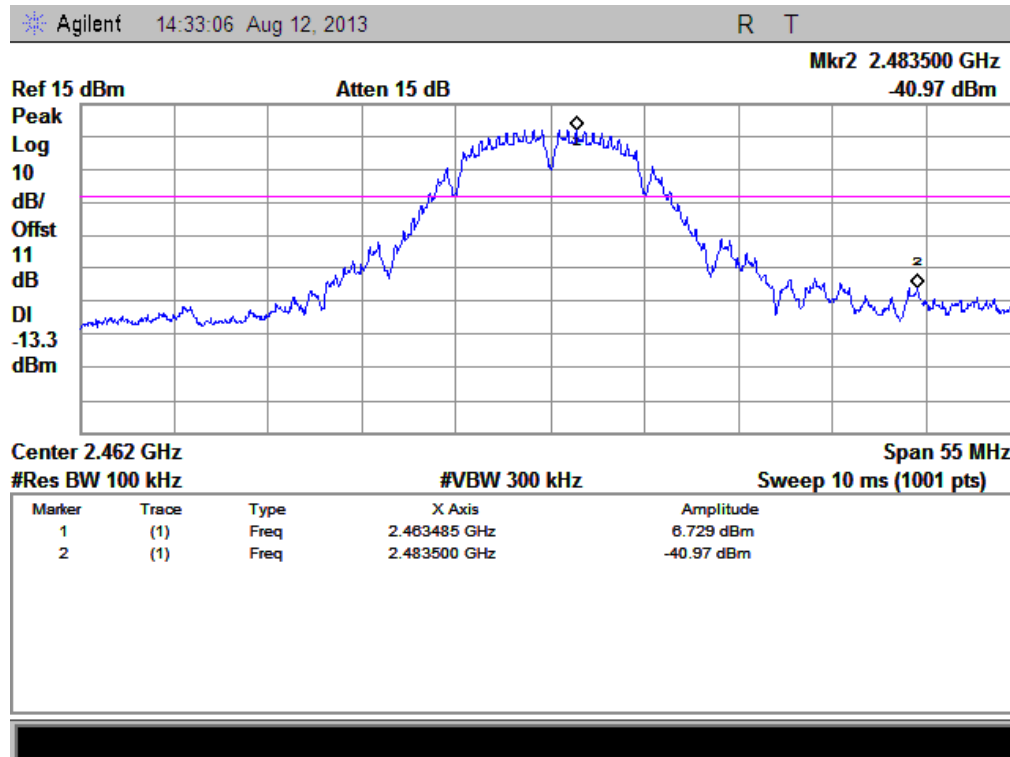
(Band Edge @ Channel = 1)



(Plot B.1: Channel = 6, 30MHz to 25GHz)



(Plot C.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

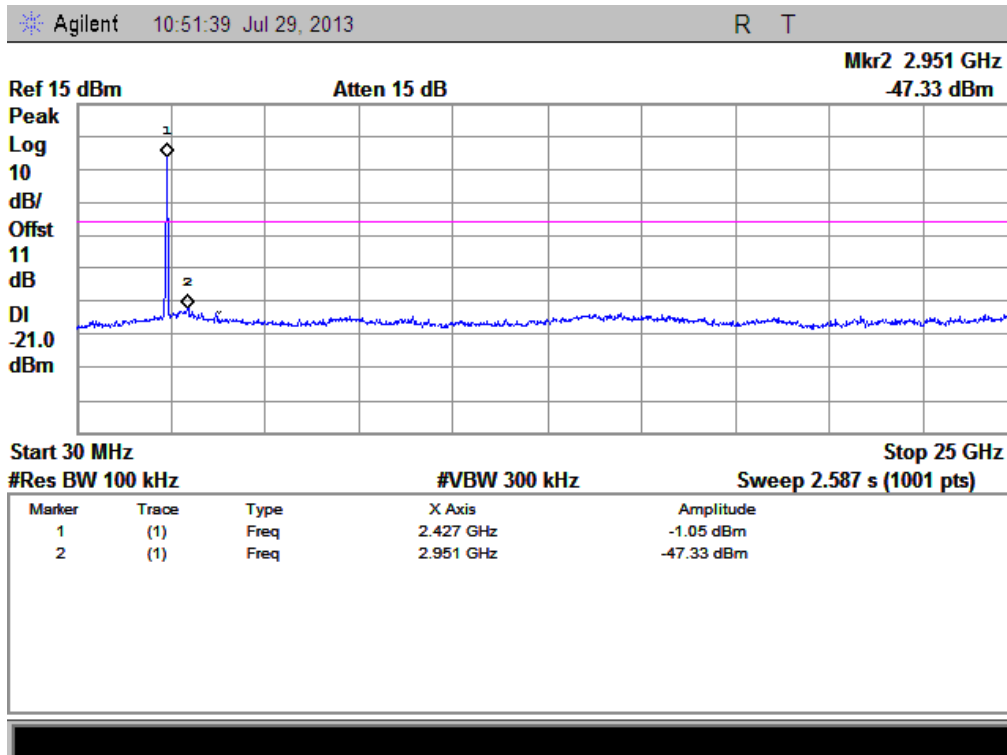
### 2.4.3.2. 802.11g Test mode

#### A. Test Verdict:

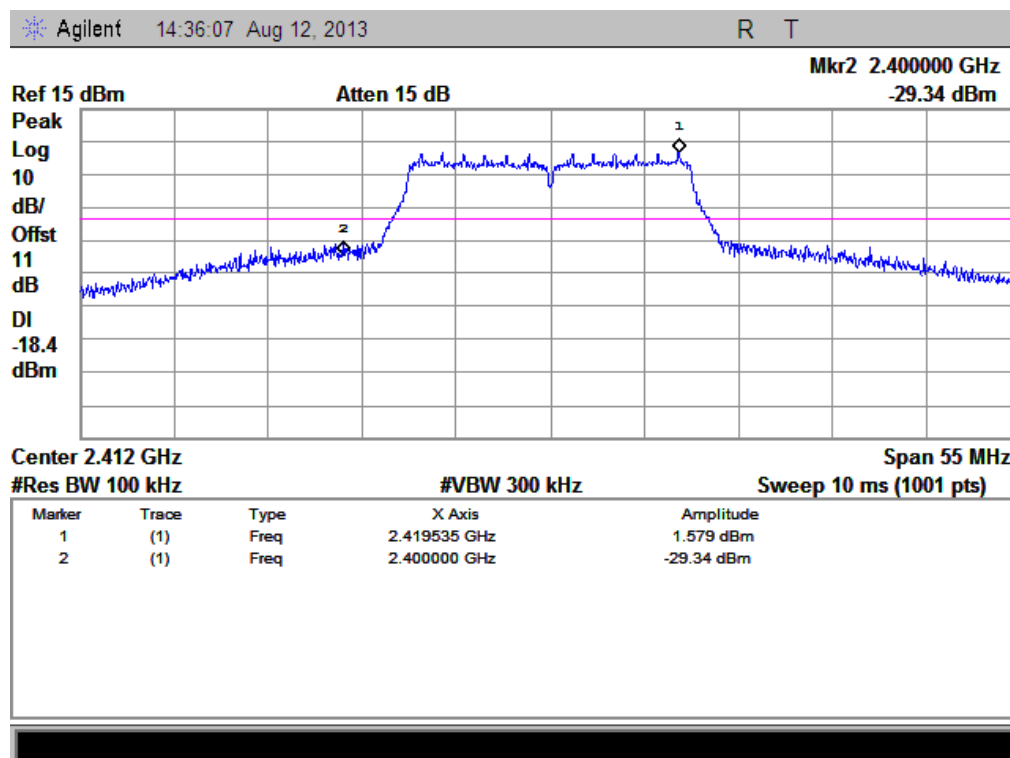
Channel	Frequency (MHz)	Measured Out of Band Emission (dBm)	Max. Band Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-47.33	Plot D.1	-1.050	-21.0	PASS
6	2437	-46.74	Plot E.1	1.348	-18.7	PASS
11	2462	-47.73	Plot F.1	-1.535	-21.5	PASS

#### B. Test Plots:

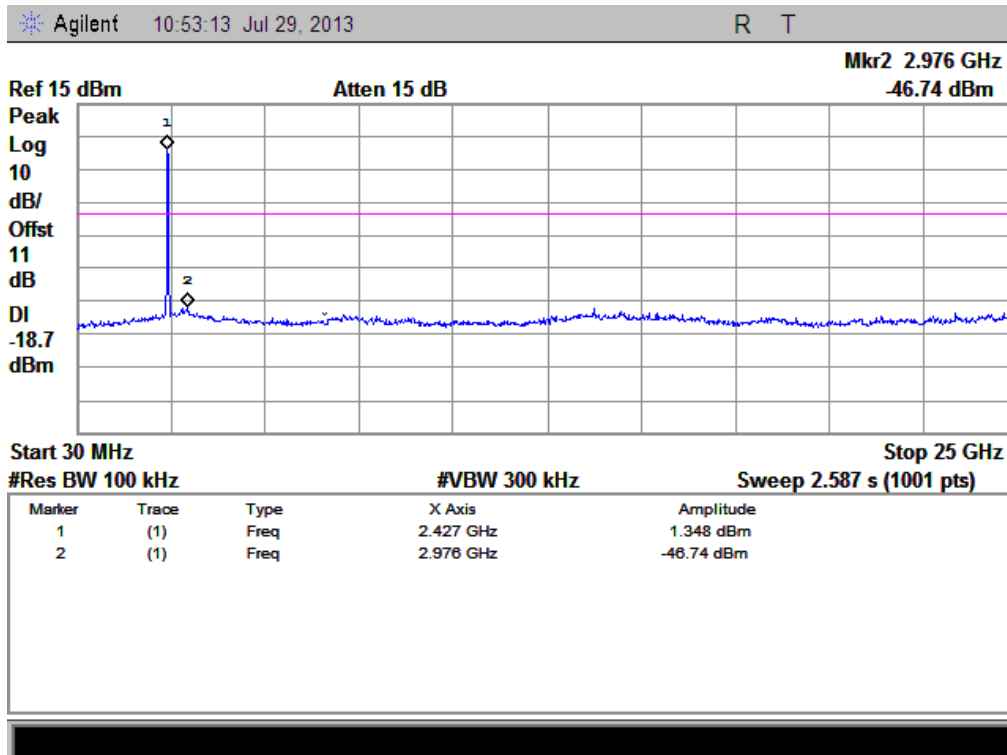
Note: the power of the Module transmitting frequency should be ignored.



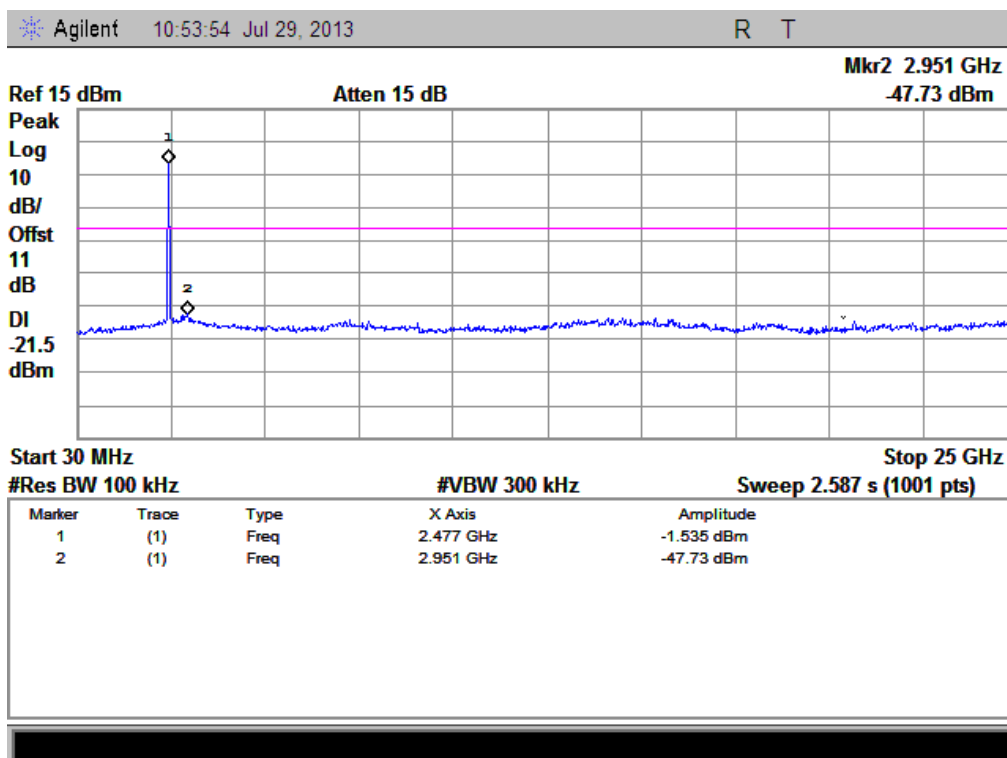
(Plot D.1: Channel = 1, 30MHz to 25GHz)



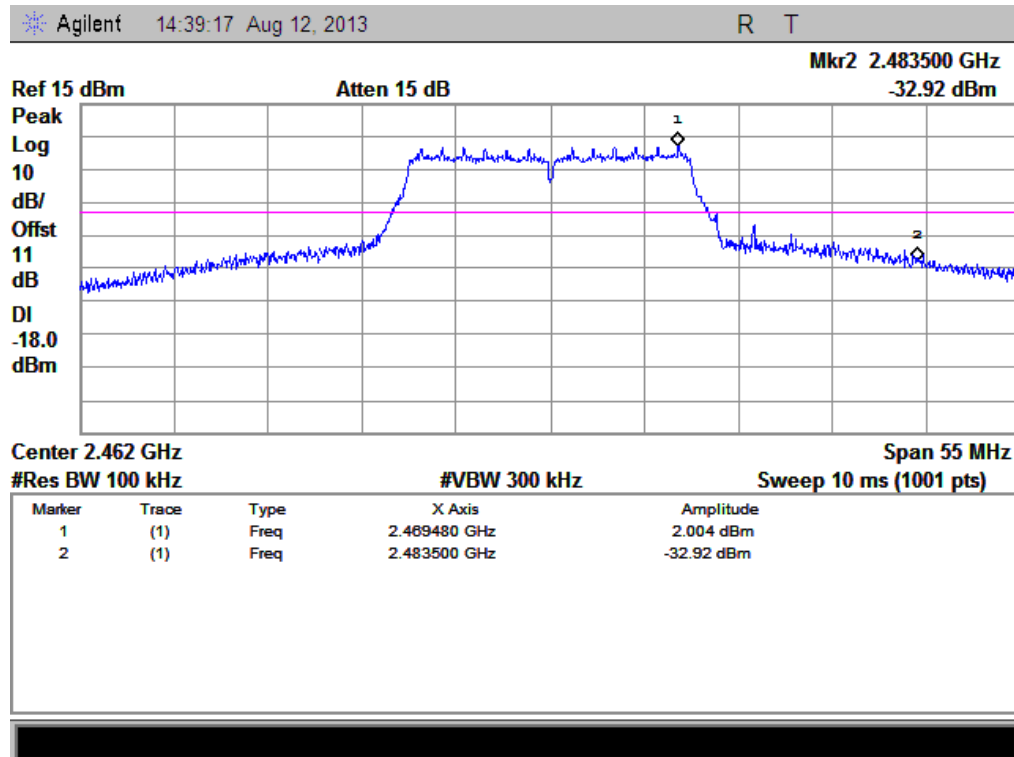
(Band Edge @ Channel = 1)



(Plot E.1: Channel = 6, 30MHz to 25GHz)



(Plot F.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

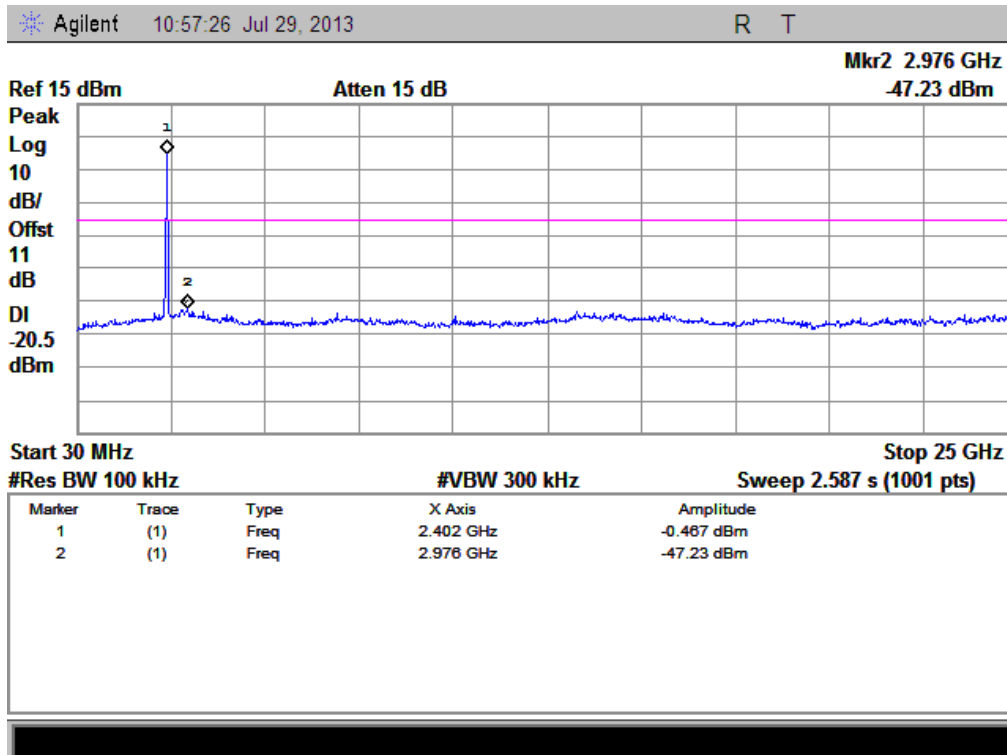
### 2.4.3.3. 802.11n -20MHz Test mode

#### A. Test Verdict:

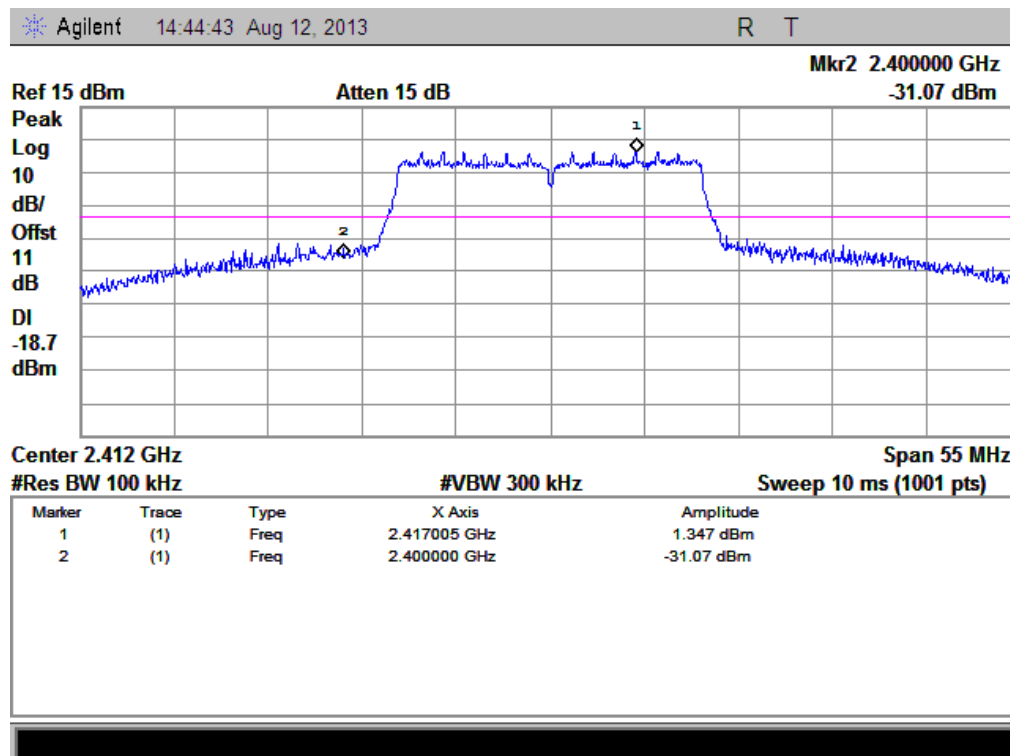
Channel	Frequency (MHz)	Measured Out of Band Emission (dBm)	Max. Band Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-47.23	Plot G.1	-0.467	-20.5	PASS
6	2437	-46.47	Plot H.1	1.027	-19.0	PASS
11	2462	-46.72	Plot I.1	-0.942	-20.9	PASS

#### B. Test Plots:

Note: the power of the Module transmitting frequency should be ignored.

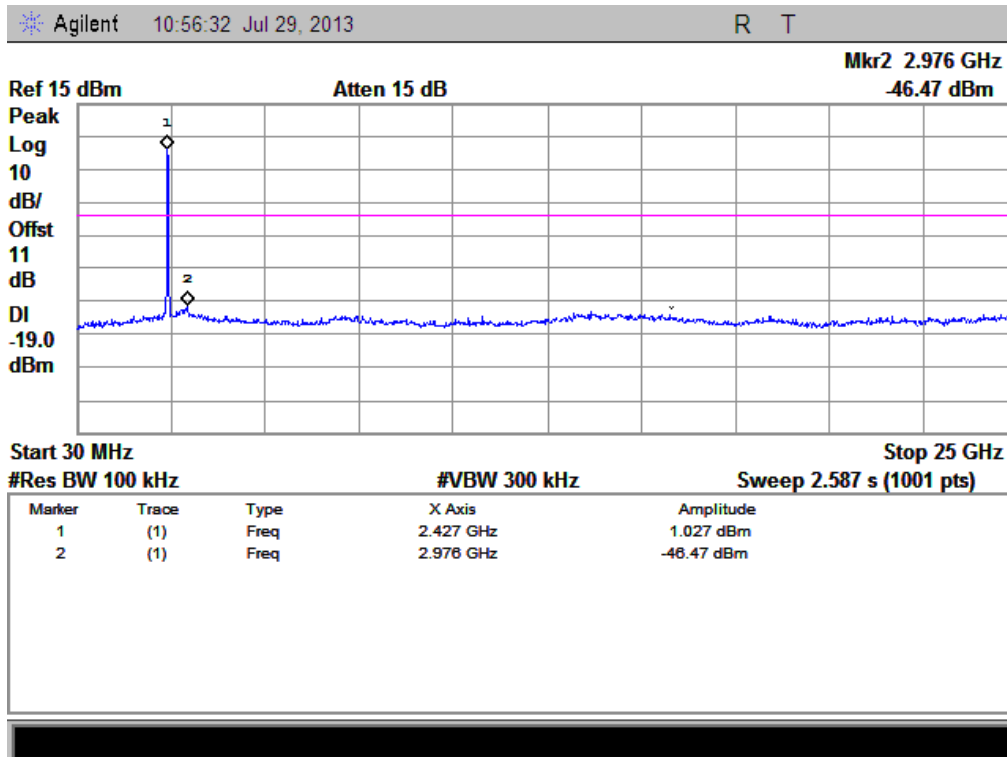


(Plot G.1: Channel = 1, 30MHz to 25GHz)

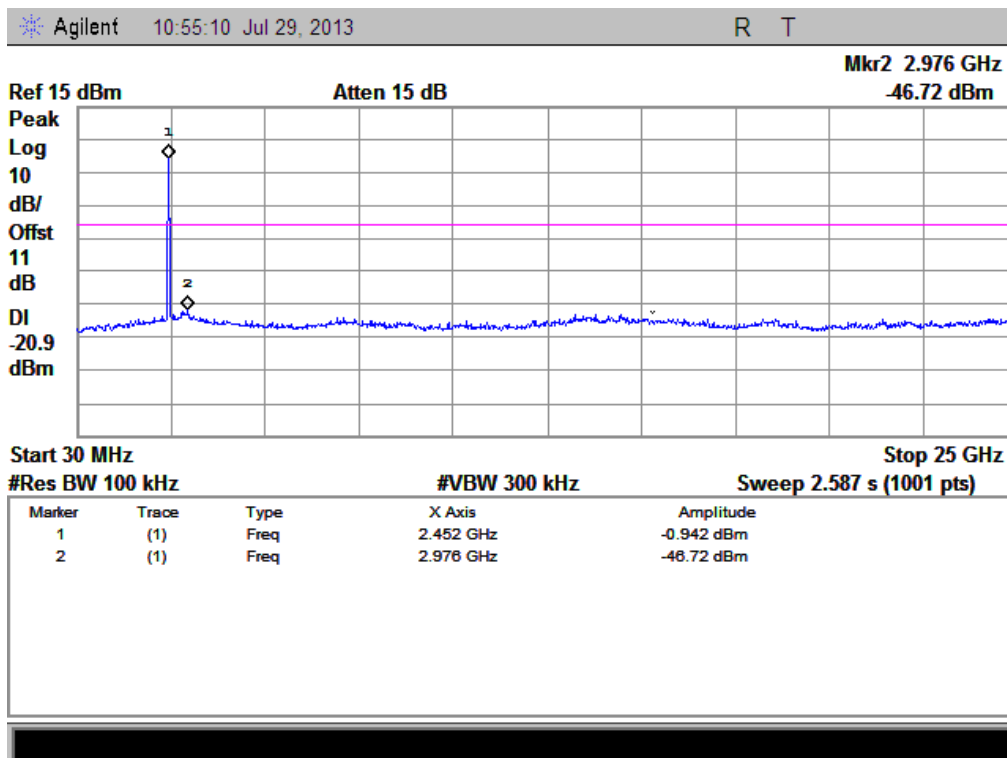


(Band Edge @ Channel = 1)

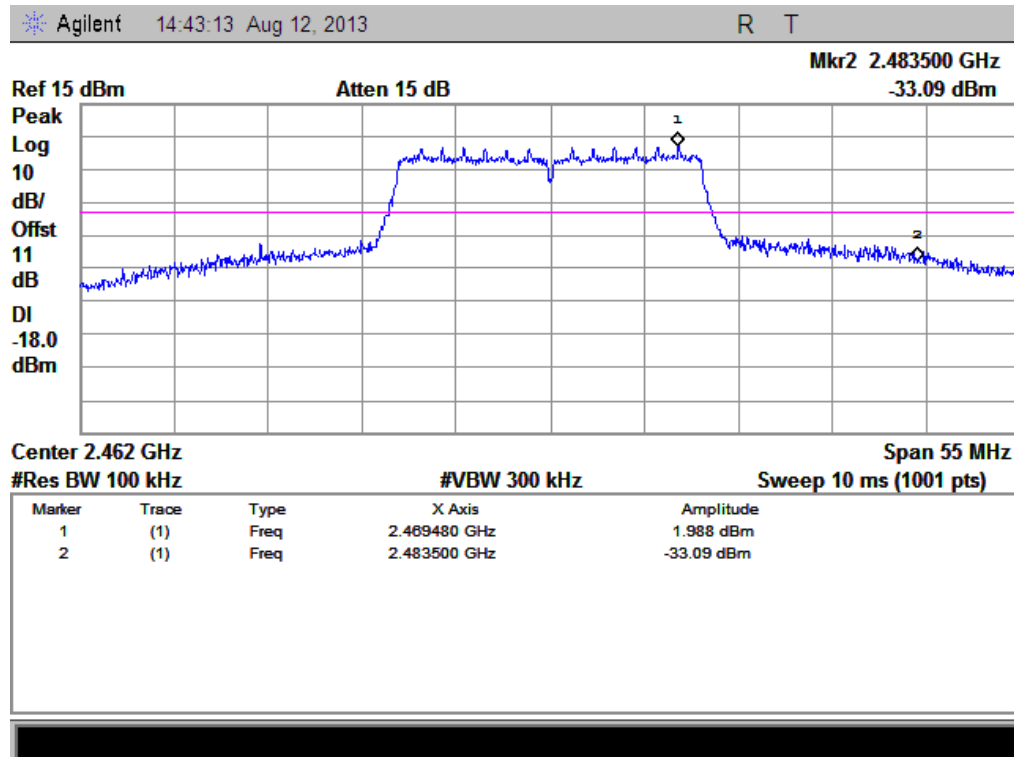




(Plot H.1: Channel = 6, 30MHz to 25GHz)



(Plot I.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

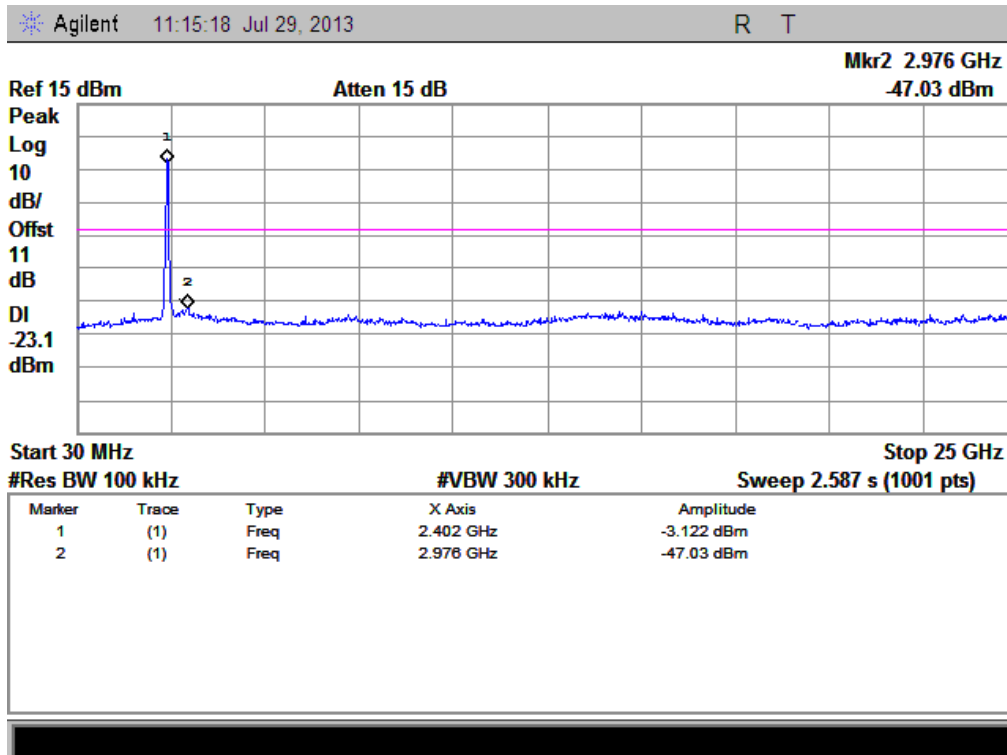
#### 2.4.3.4. 802.11n -40MHz Test mode

##### A. Test Verdict:

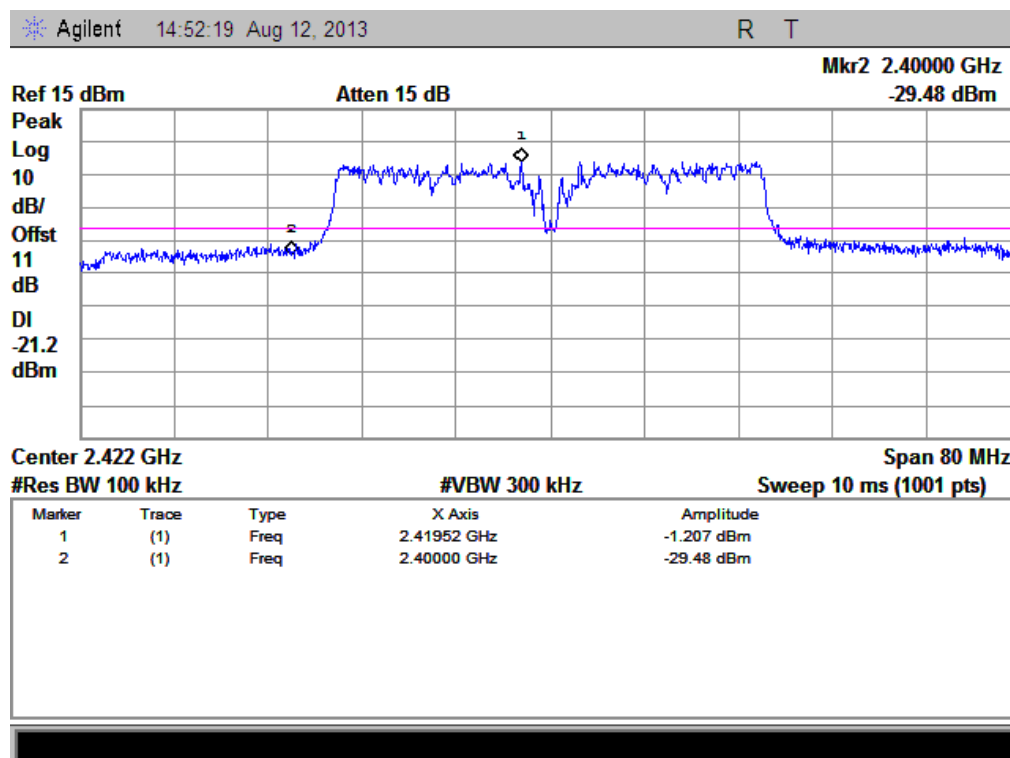
Channel	Frequency (MHz)	Measured Out of Band Emission (dBm)	Max. Band Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
3	2422	-47.03	Plot G.1	-3.122	-23.1	PASS
6	2437	-46.98	Plot H.1	-1.464	-21.5	PASS
9	2452	-46.88	Plot I.1	-1.829	-21.8	PASS

##### B. Test Plots:

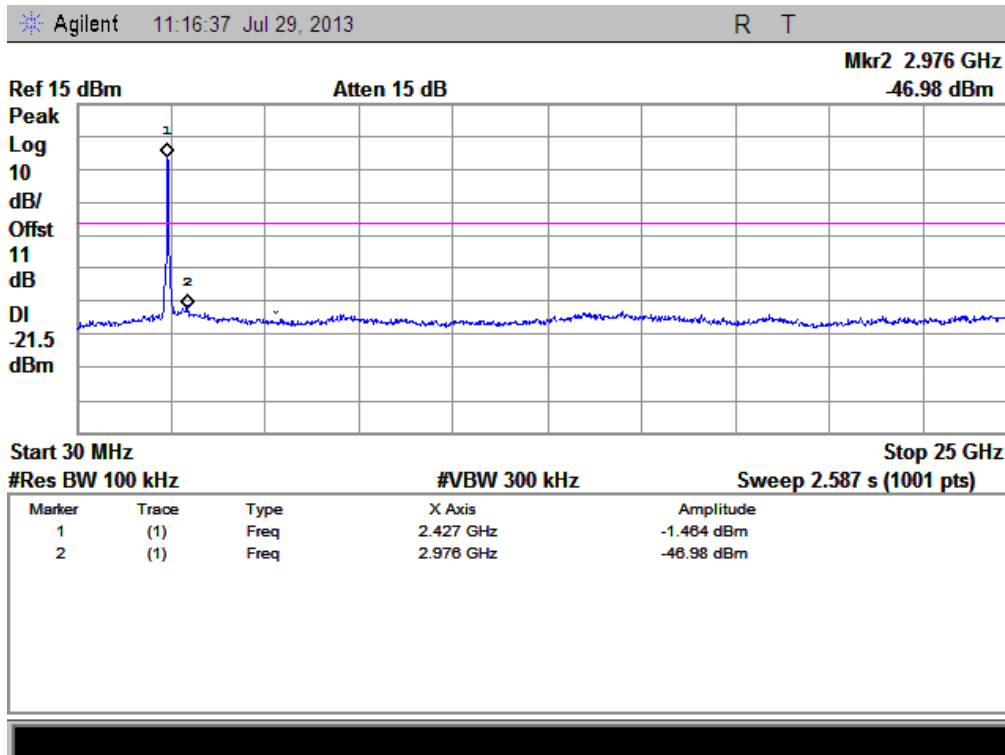
Note: the power of the Module transmitting frequency should be ignored.



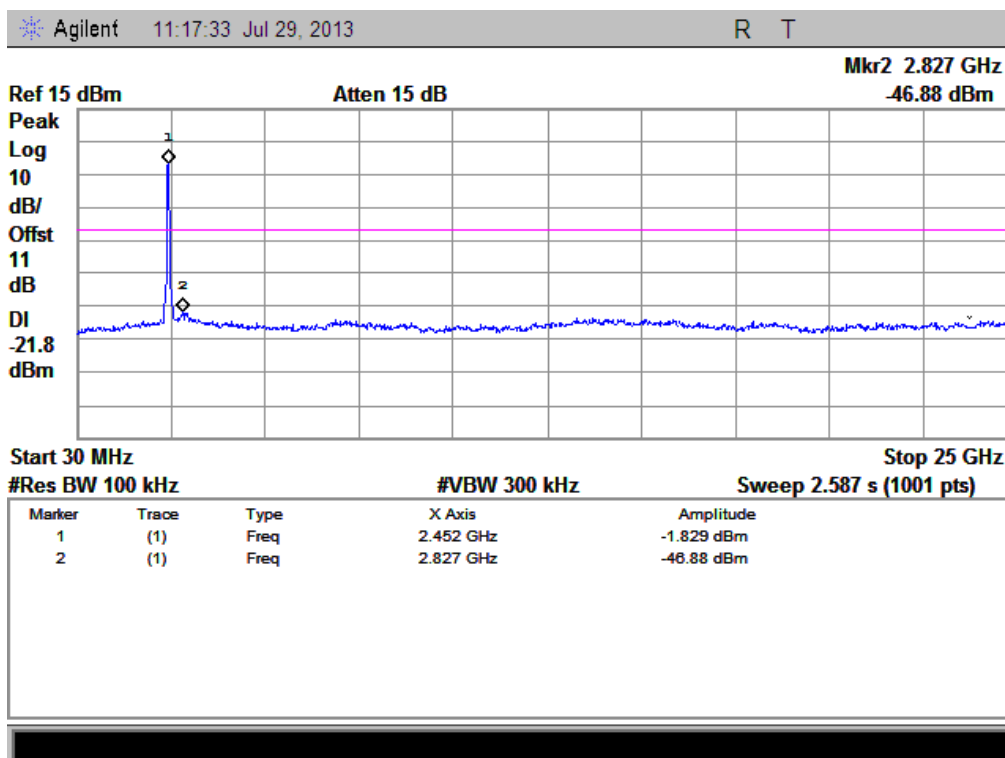
(Plot G.1: Channel = 3, 30MHz to 25GHz)



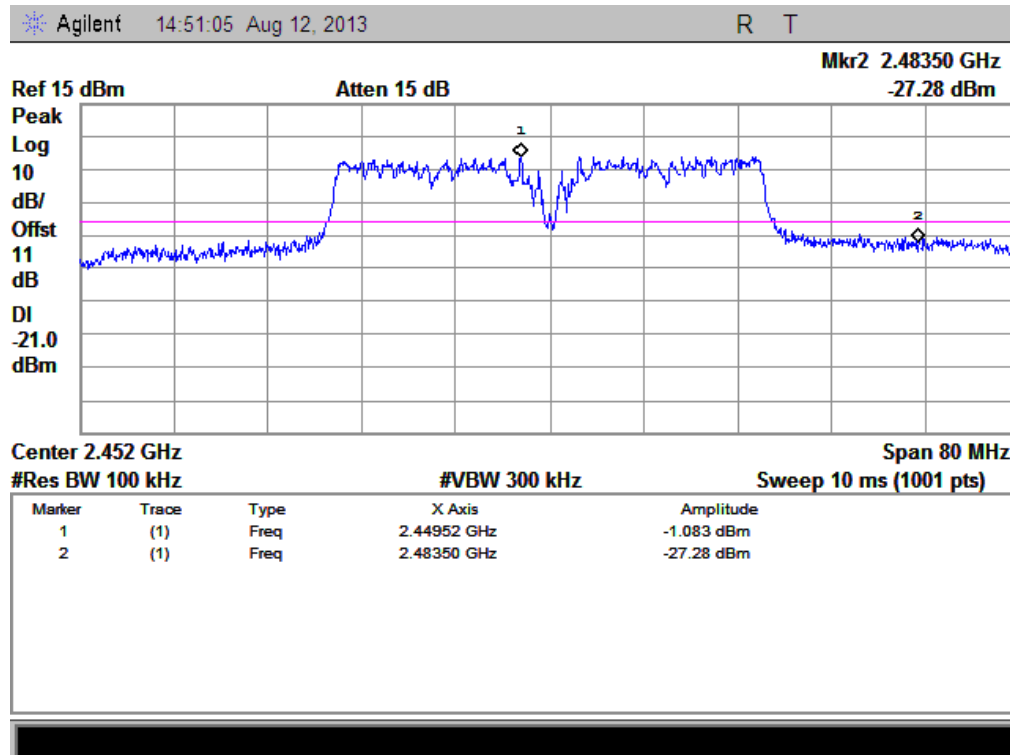
(Band Edge @ Channel = 3)



(Plot H.1: Channel = 6, 30MHz to 25GHz)



(Plot I.1: Channel = 9, 30MHz to 25GHz)



(Band Edge @ Channel = 9)

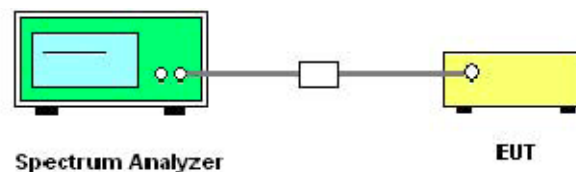
## 2.5. Power spectral density (PSD)

### 2.5.1. Requirement

According to FCC section 15.247(e), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

### 2.5.2. Test Description

#### A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

#### B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11

### 2.5.3. Test Result

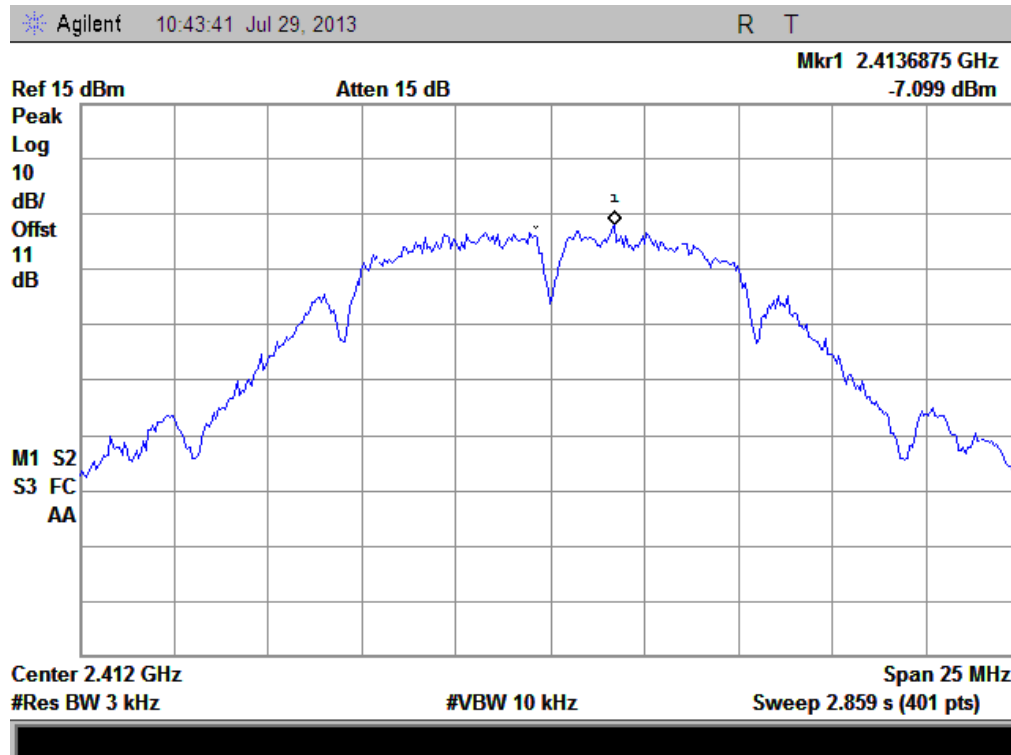
The lowest, middle and highest channels are tested to verify the band edge emissions.

#### 2.5.3.1. 802.11b Test mode

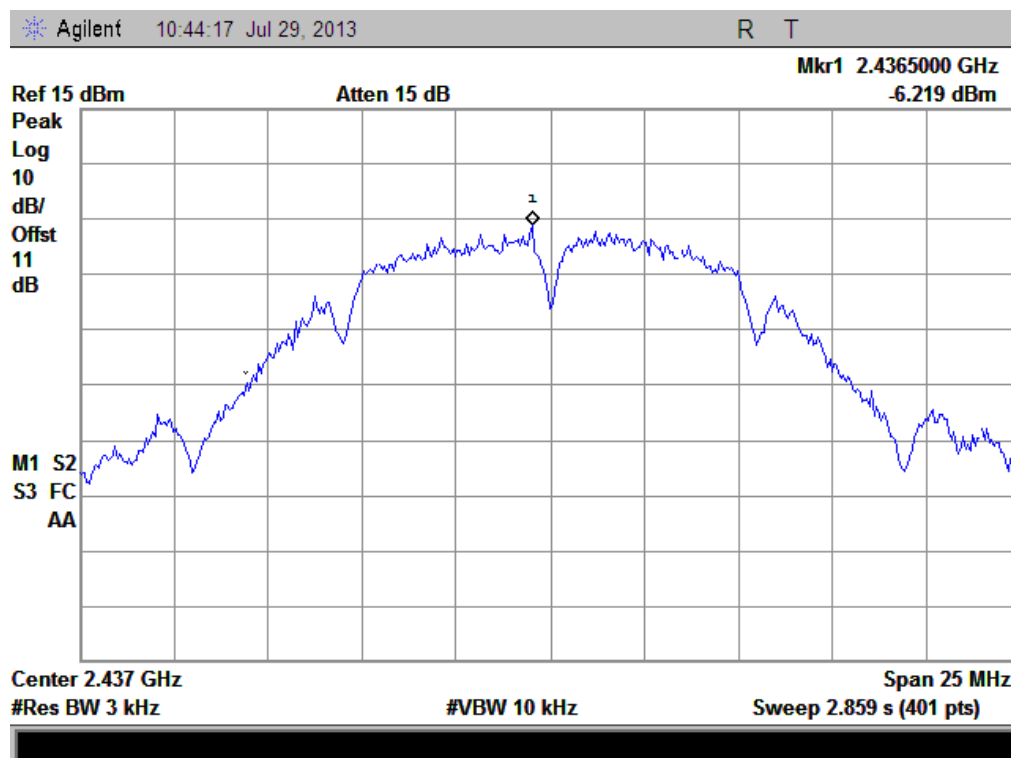
#### A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-7.099	Plot A	8	PASS
6	2437	-6.219	Plot B	8	PASS
11	2462	-6.359	Plot C	8	PASS
Measurement uncertainty: $\pm 1.3$ dB					

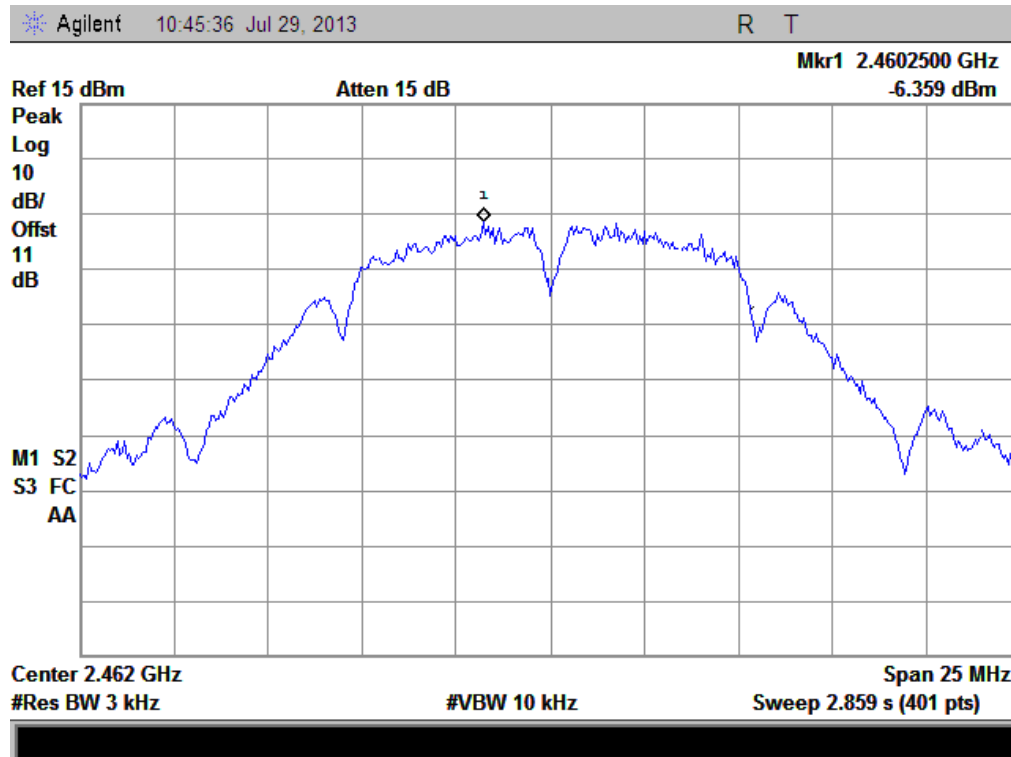
#### B. Test Plots:



(Plot A: Channel = 1 @ 802.11b)



(Plot B: Channel = 6 @ 802.11b)



(Plot C: Channel = 11 @ 802.11b)

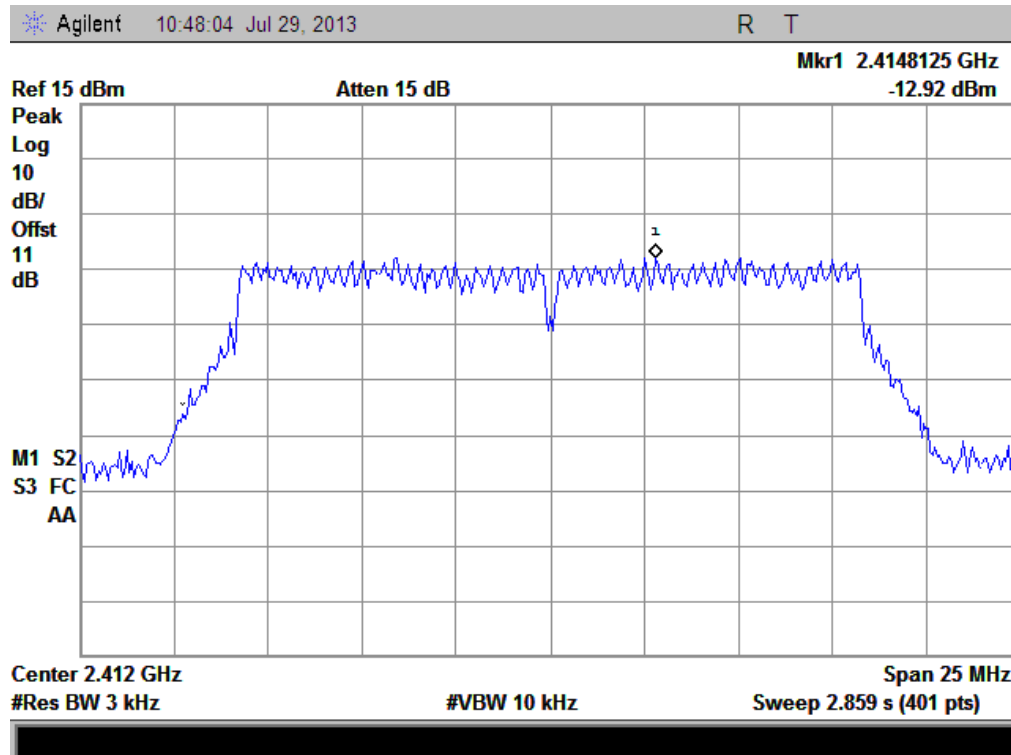
### 2.5.3.2. 802.11g Test mode

#### A. Test Verdict:

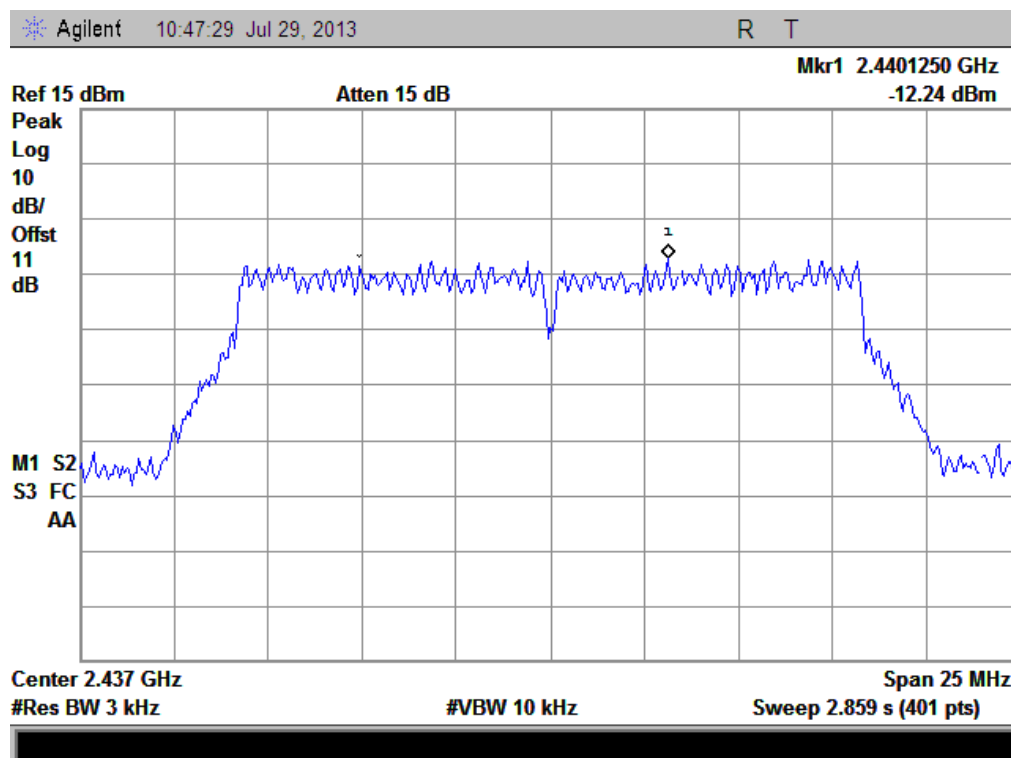
Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-12.92	Plot A	8	PASS
6	2437	12.24	Plot B	8	PASS
11	2462	-10.78	Plot C	8	PASS
Measurement uncertainty: $\pm 1.3$ dB					

#### B. Test Plots:

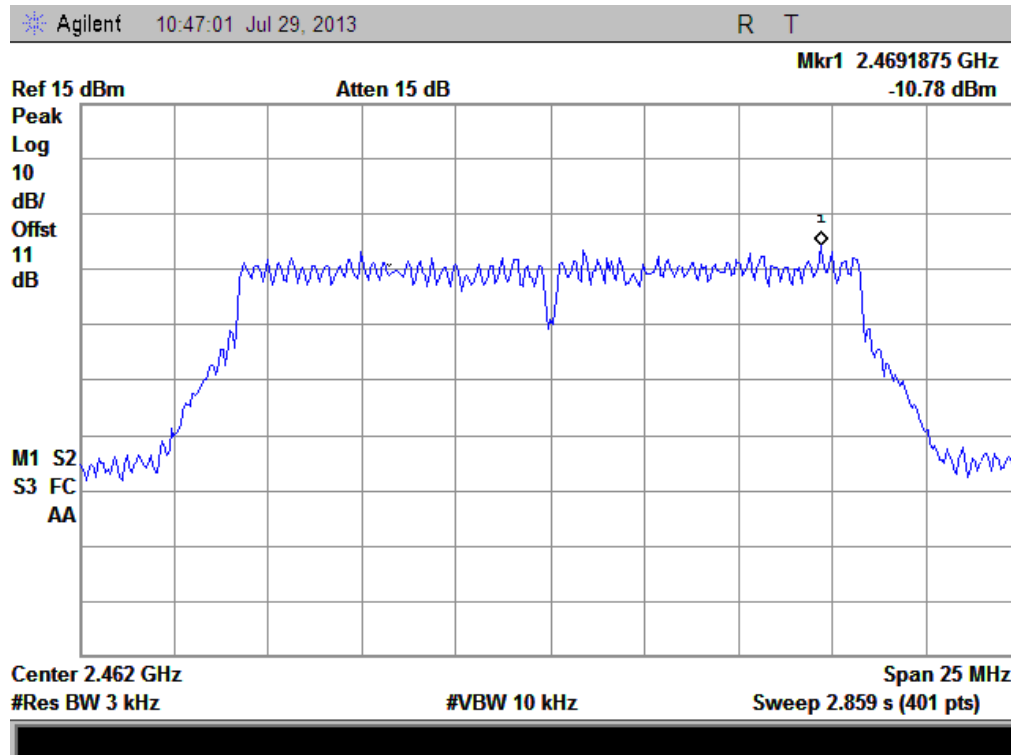




(Plot D: Channel = 1 @ 802.11g)



(Plot E: Channel = 6 @ 802.11g)



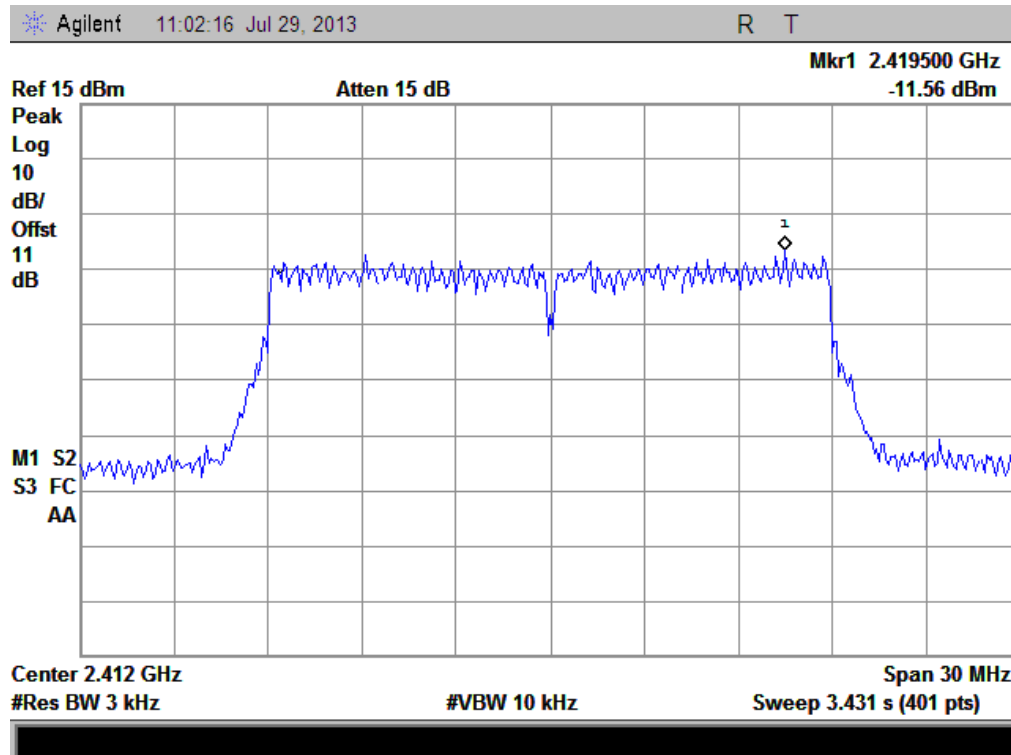
(Plot F: Channel = 11 @ 802.11g)

### 2.5.3.3. 802.11n-20MHz Test mode

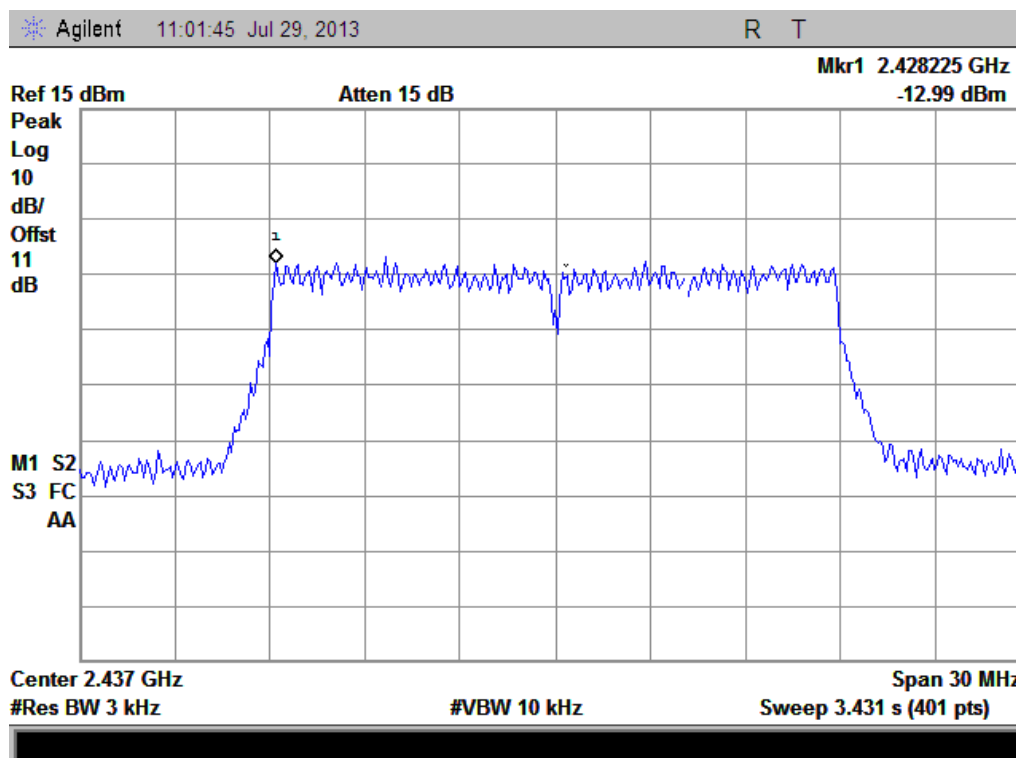
#### A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-11.56	Plot A	8	PASS
6	2437	-12.99	Plot B	8	PASS
11	2462	-12.03	Plot C	8	PASS
Measurement uncertainty: $\pm 1.3$ dB					

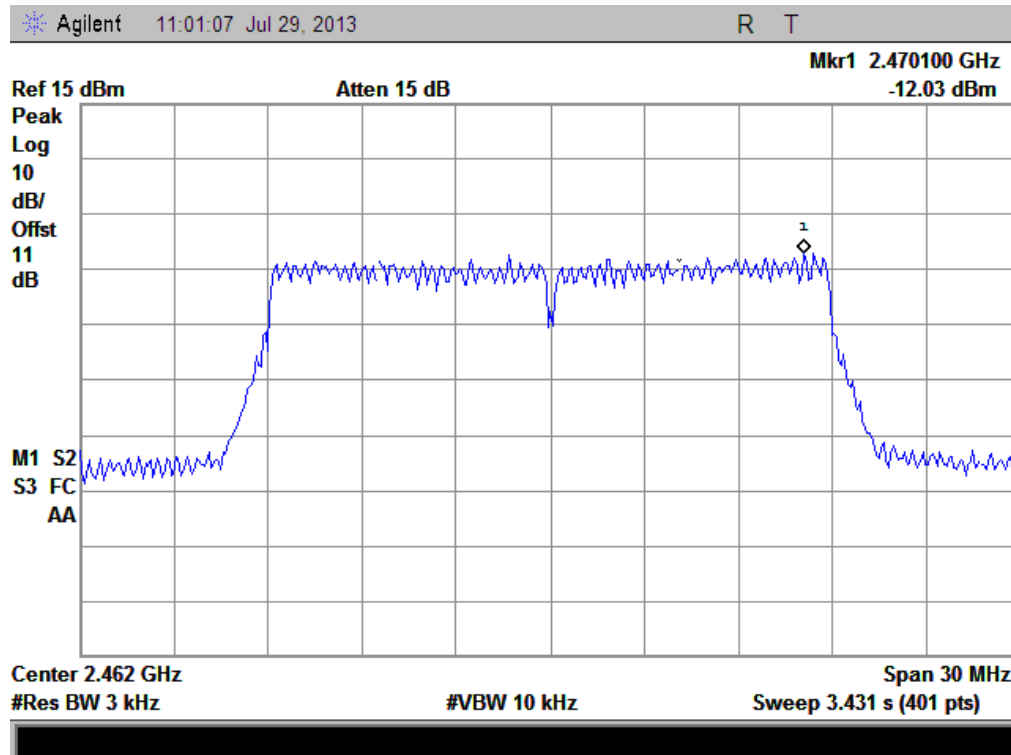
#### Test Plots:



(Plot G: Channel = 1 @ 802.11n-20MHz)



(Plot H: Channel = 6 @ 802.11n-20MHz)



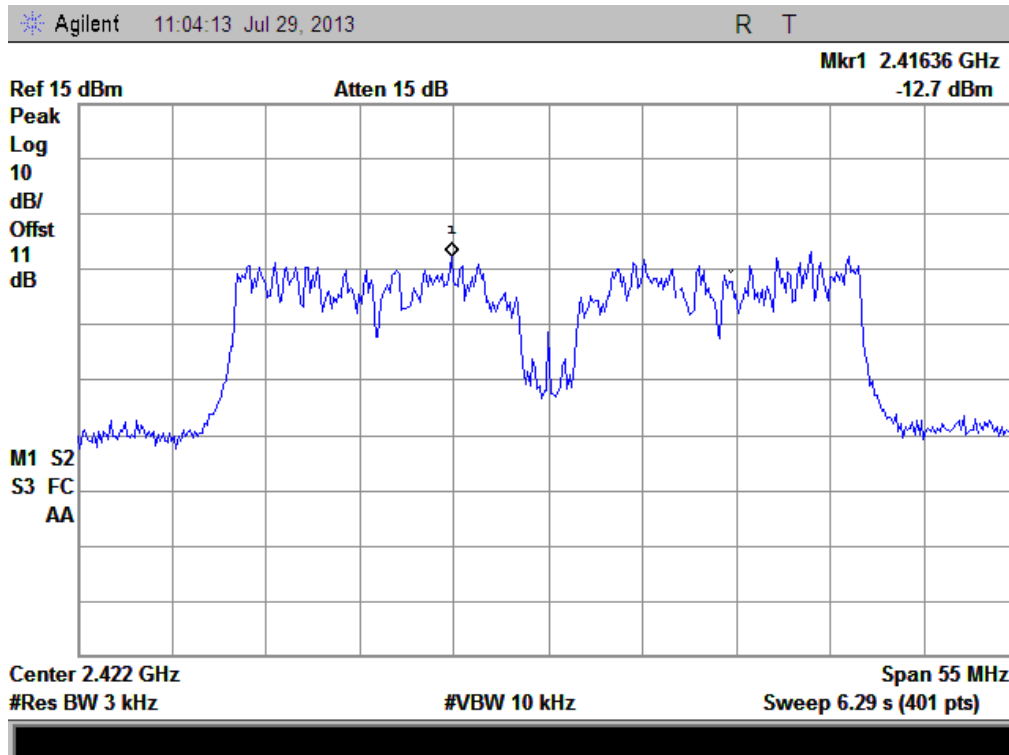
(Plot I: Channel = 11 @ 802.11n-20MHz)

#### 2.5.3.4. 802.11n-40MHz Test mode

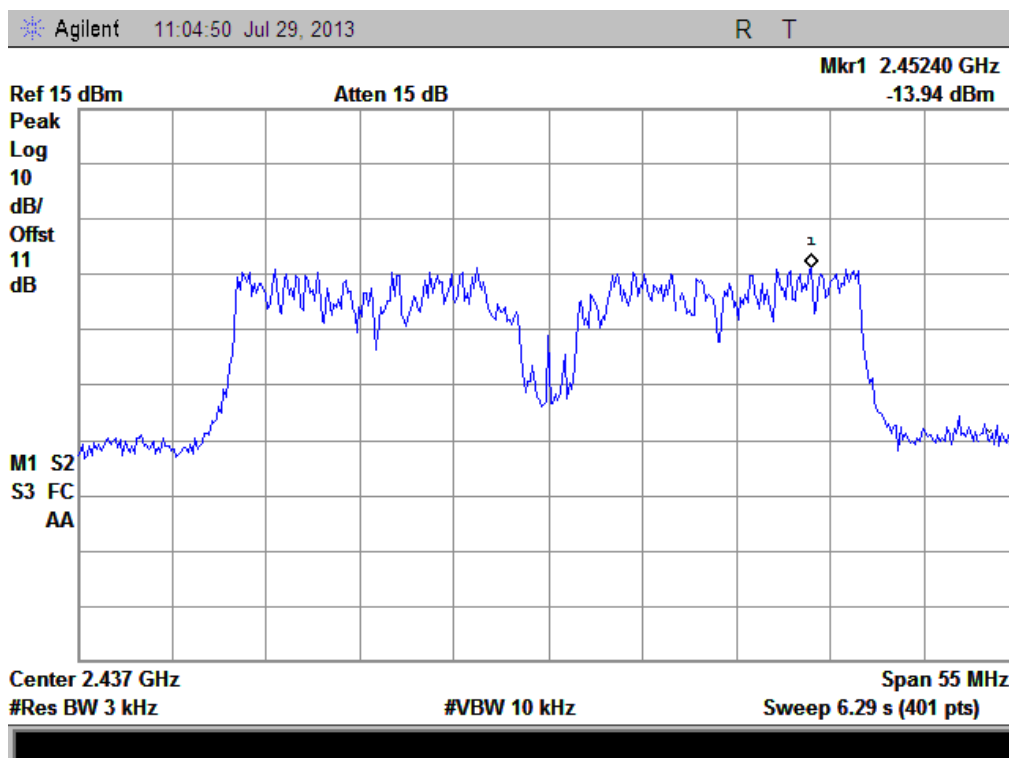
##### A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
3	2412	-12.70	Plot A	8	PASS
6	2437	-13.94	Plot B	8	PASS
9	2462	-13.21	Plot C	8	PASS
Measurement uncertainty: $\pm 1.3$ dB					

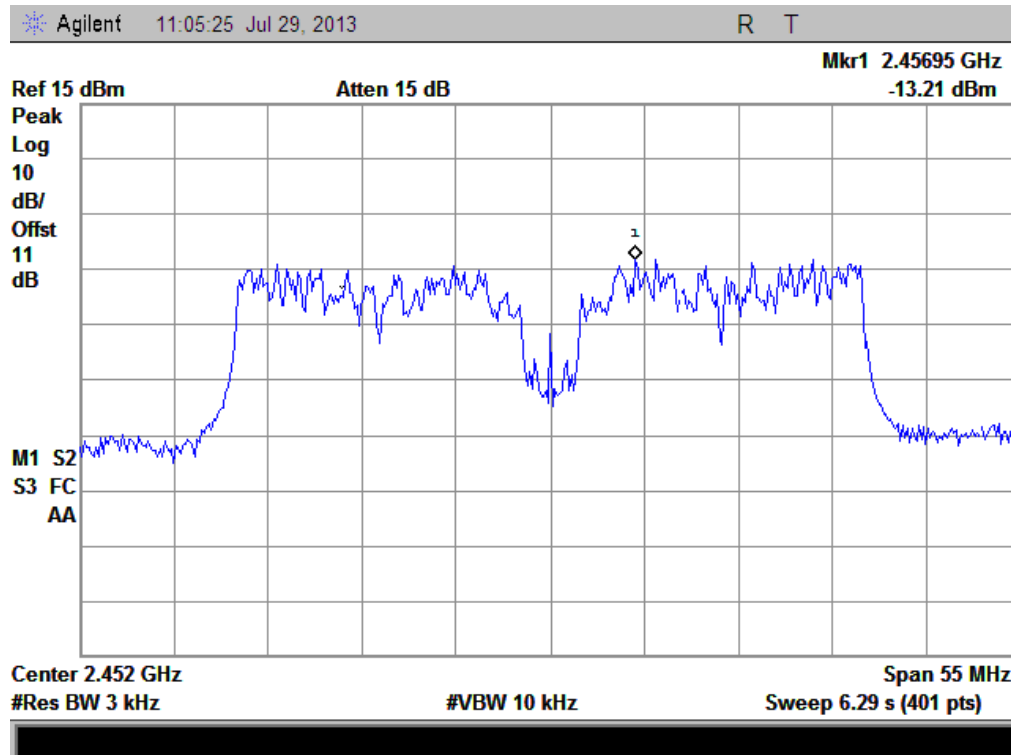
##### B. Test Plots:



(Plot G: Channel = 3 @ 802.11n-40MHz)



(Plot H: Channel = 6 @ 802.11n-40MHz)



(Plot I: Channel = 9 @ 802.11n-40MHz)

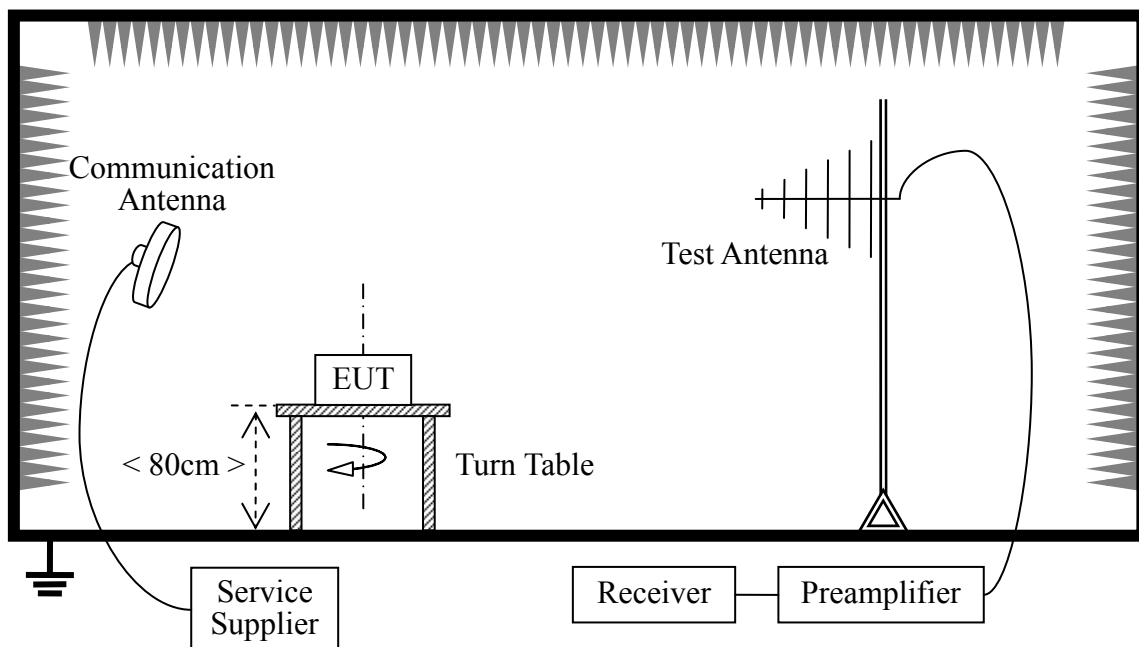
## 2.6. Restricted Frequency Bands

### 2.6.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

### 2.6.2. Test Description

#### A. Test Setup



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

## B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2012.05.12	2014.05.11
Test Antenna	Schwarzbeck	BBHA 9120C	9120C-384	2013.05.12	2014.05.11

### 2.6.3. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

#### 2.6.3.1. 802.11b Test mode

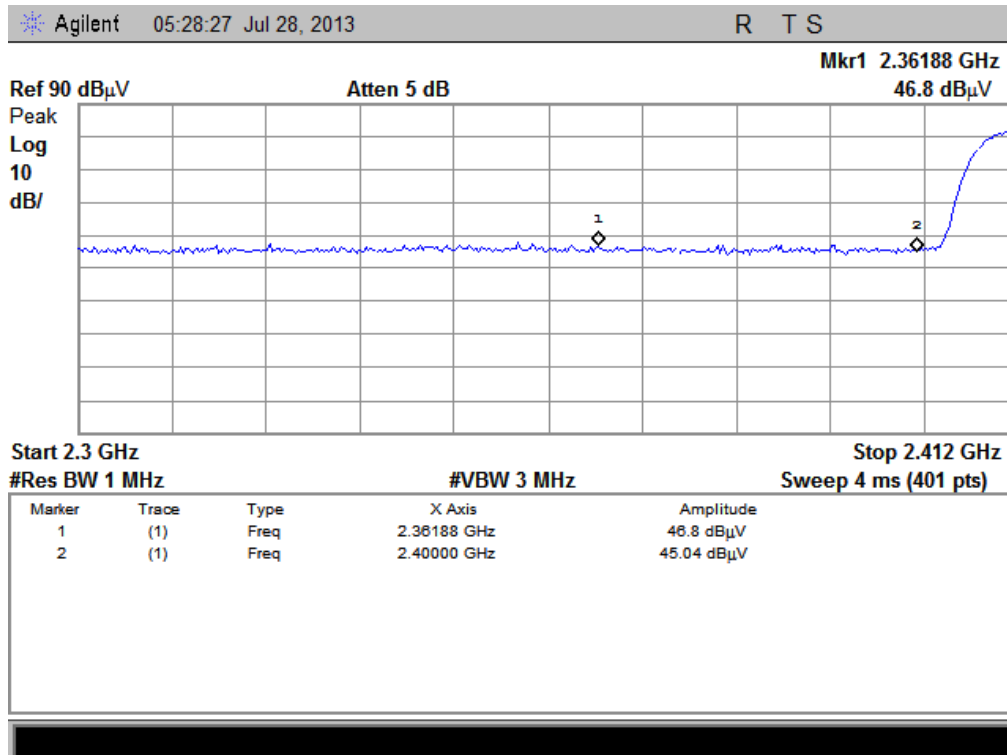
The lowest and highest channels are tested to verify the band edge emissions.

#### A. Test Verdict:

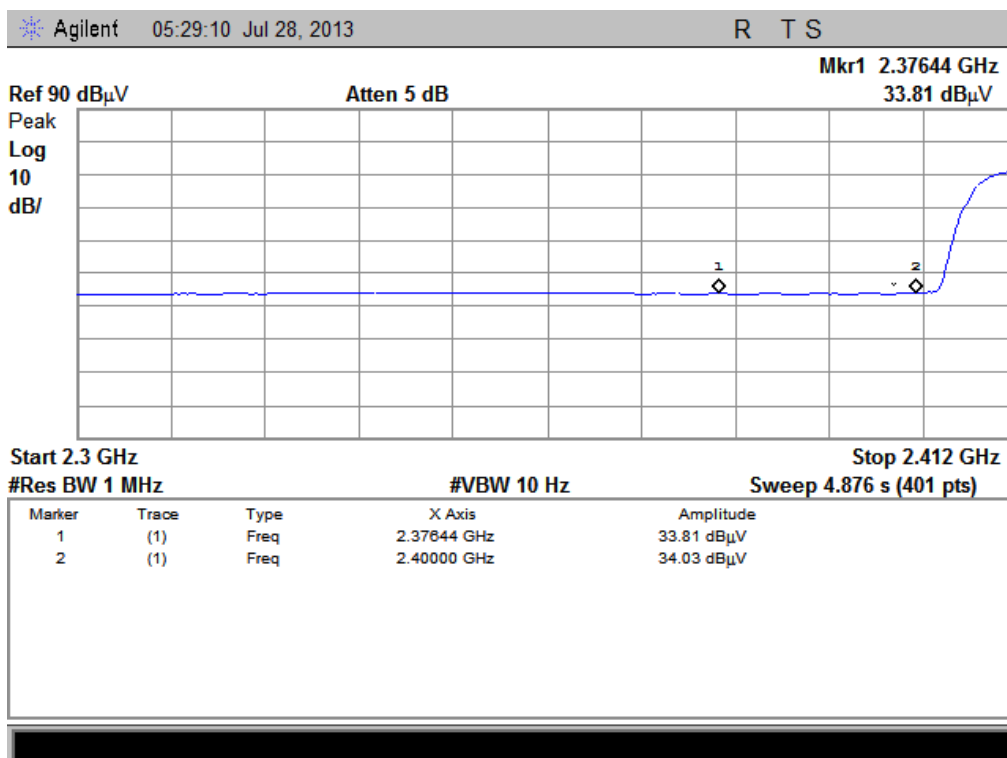
Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
1	2361.88	PK	46.80	-30.93	32.56	48.43	74	Pass
1	2376.44	AV	33.81	-30.93	32.56	35.44	54	Pass
11	2487.75	PK	46.22	-29.05	32.50	49.67	74	Pass
11	2487.18	AV	33.92	-29.05	32.50	37.37	54	Pass

#### B. Test Plots:

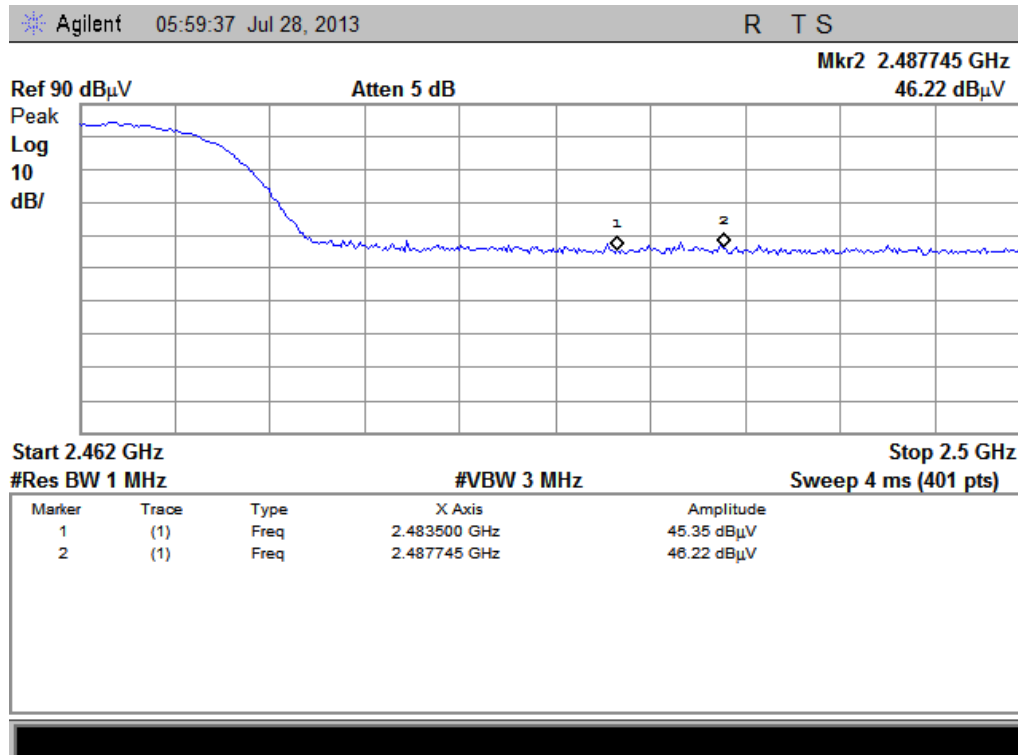




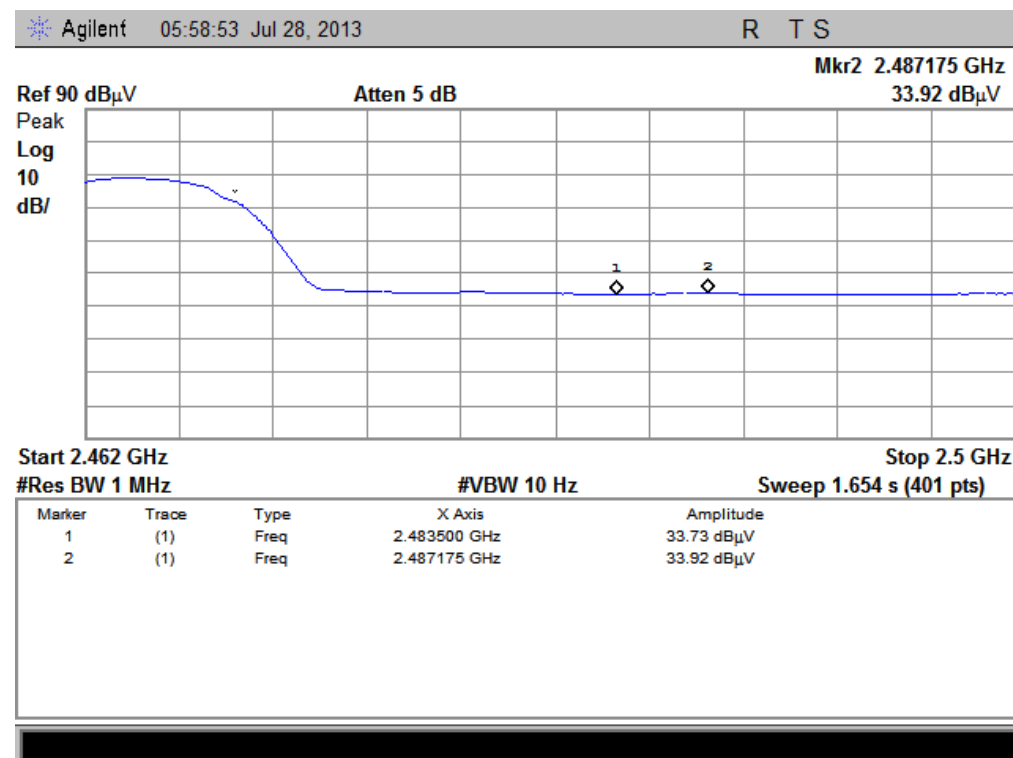
(Plot A1: Channel = 1 PEAK @ 802.11b)



(Plot A2: Channel = 1 AVG @ 802.11b)



(Plot B1: Channel = 11 PEAK @ 802.11b)



(Plot B2: Channel = 11 AVG @ 802.11b)

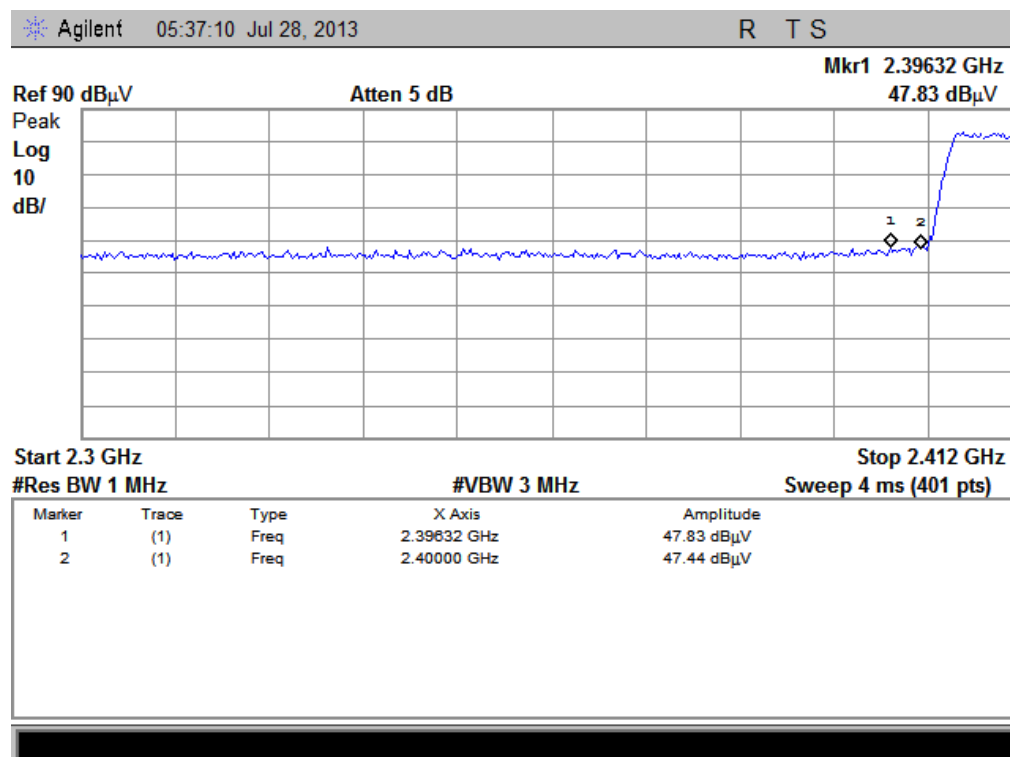
### 2.6.3.2. 802.11g Test mode

The lowest and highest channels are tested to verify the band edge emissions.

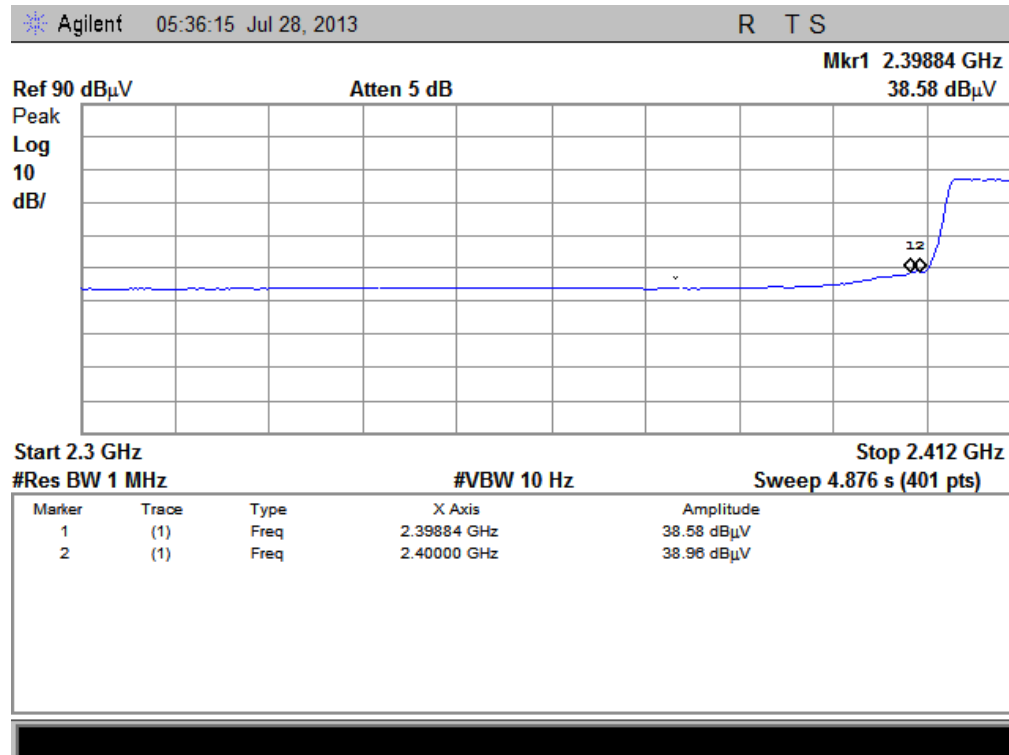
#### A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
1	2396.32	PK	47.83	-30.93	32.56	49.46	74	Pass
1	2398.84	AV	38.58	-30.93	32.56	40.21	54	Pass
11	2483.50	PK	52.53	-29.05	32.50	55.98	74	Pass
11	2483.50	AV	38.15	-29.05	32.50	41.60	54	Pass

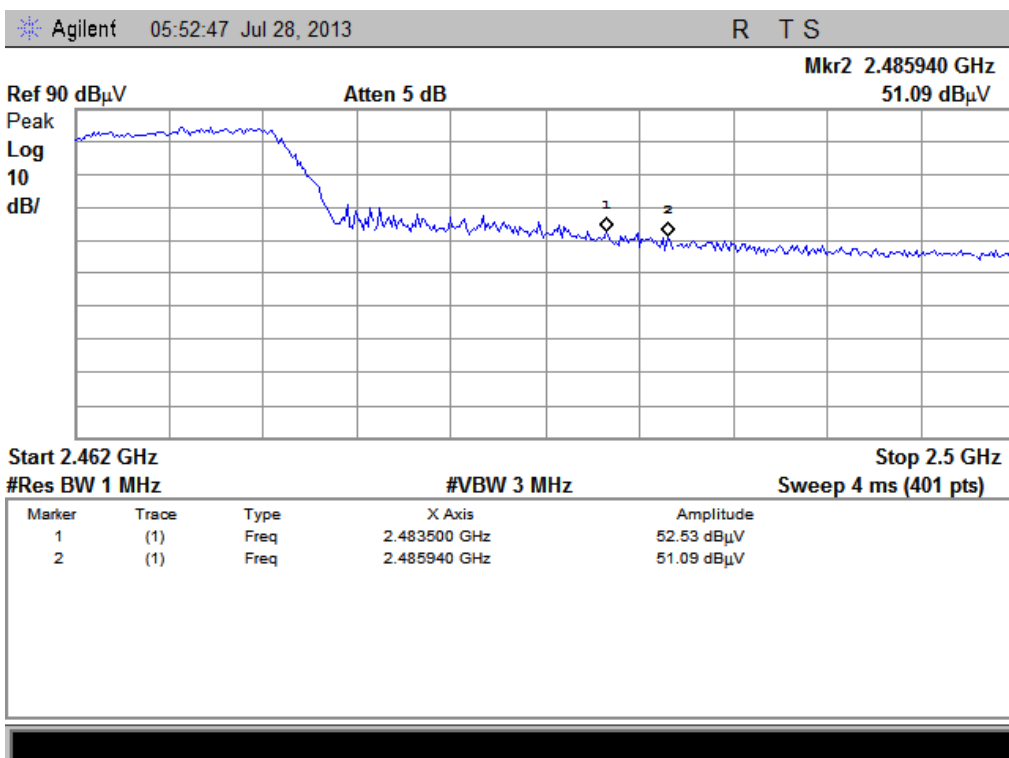
#### B. Test Plots:



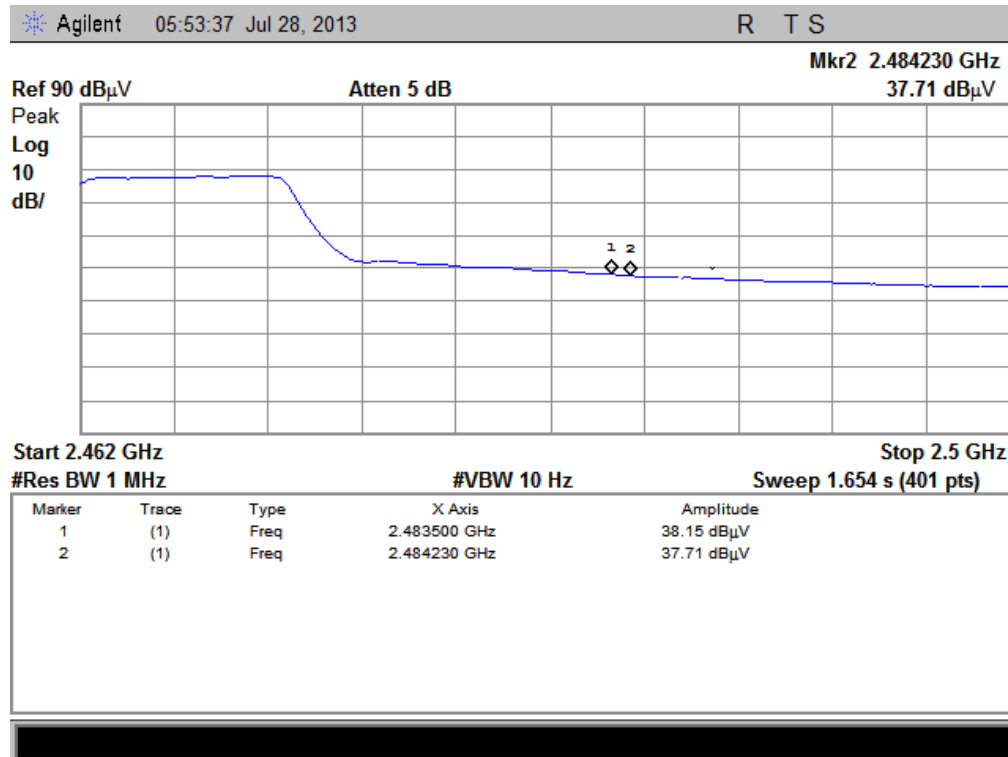
(Plot C1: Channel = 1 PEAK @ 802.11g)



(Plot C2: Channel = 1 AVG @ 802.11g)



(Plot D1: Channel = 11 PEAK @ 802.11g)



(Plot D2: Channel = 11 AVG @ 802.11g)

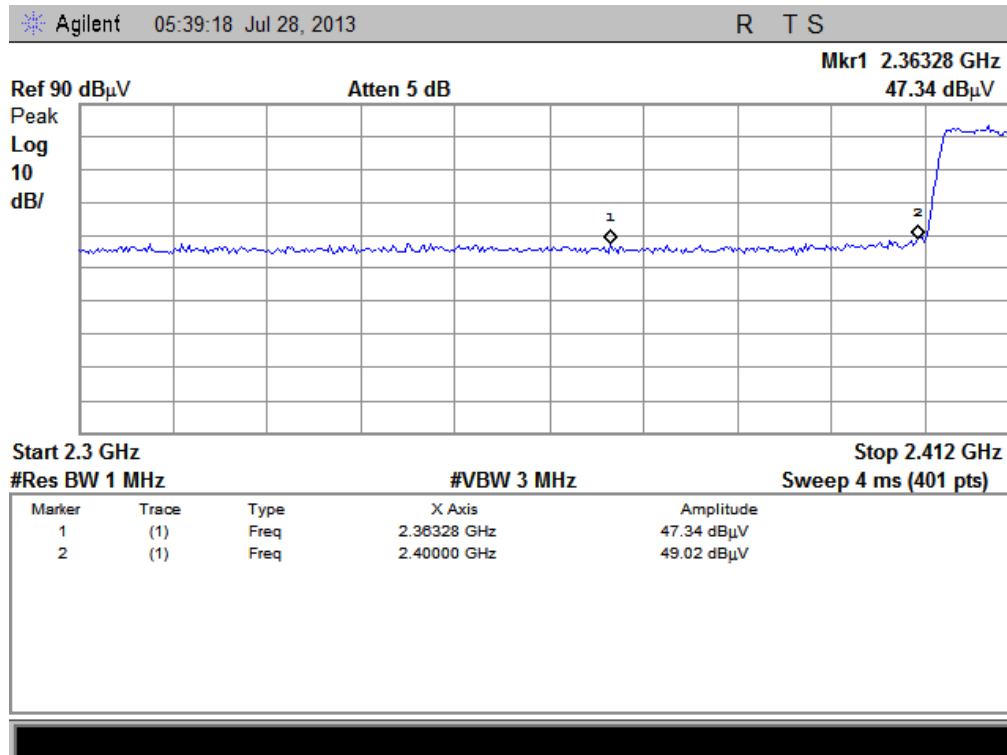
### 2.6.3.3. 802.11n-20MHz Test mode

The lowest and highest channels are tested to verify the band edge emissions.

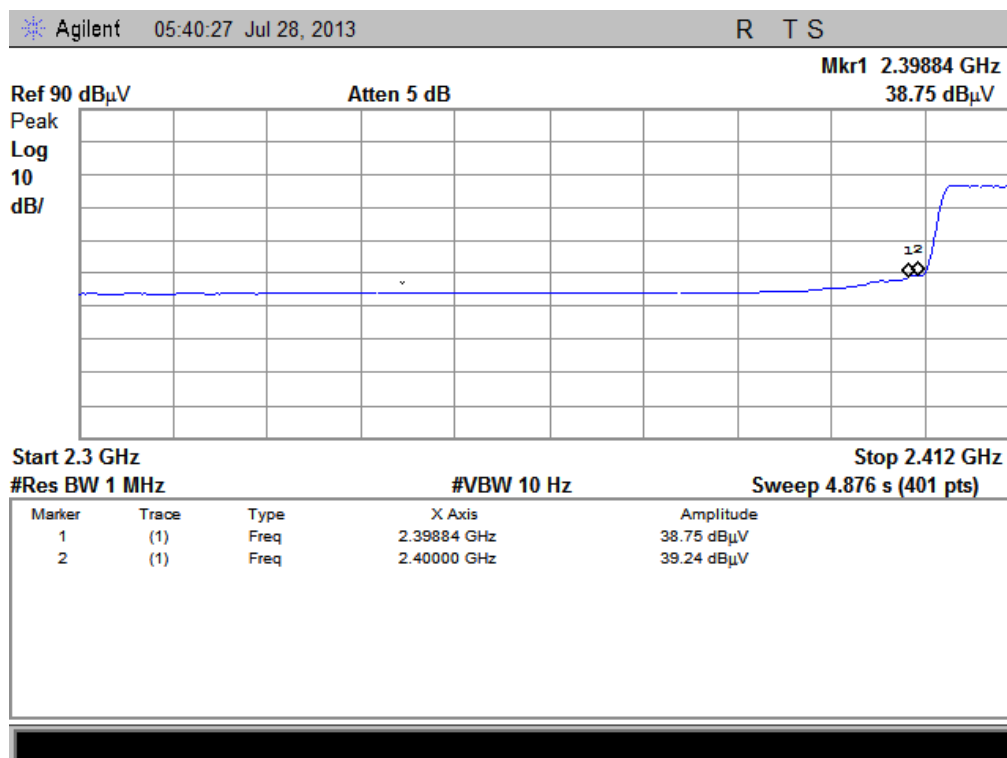
#### A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dB $\mu$ V)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Verdict
		PK/ AV						
1	2363.28	PK	47.34	-30.93	32.56	48.97	74	Pass
1	2398.84	AV	38.75	-30.93	32.56	40.38	54	Pass
11	2483.50	PK	52.26	-29.05	32.50	55.71	74	Pass
11	2483.50	AV	38.52	-29.05	32.50	41.97	54	Pass

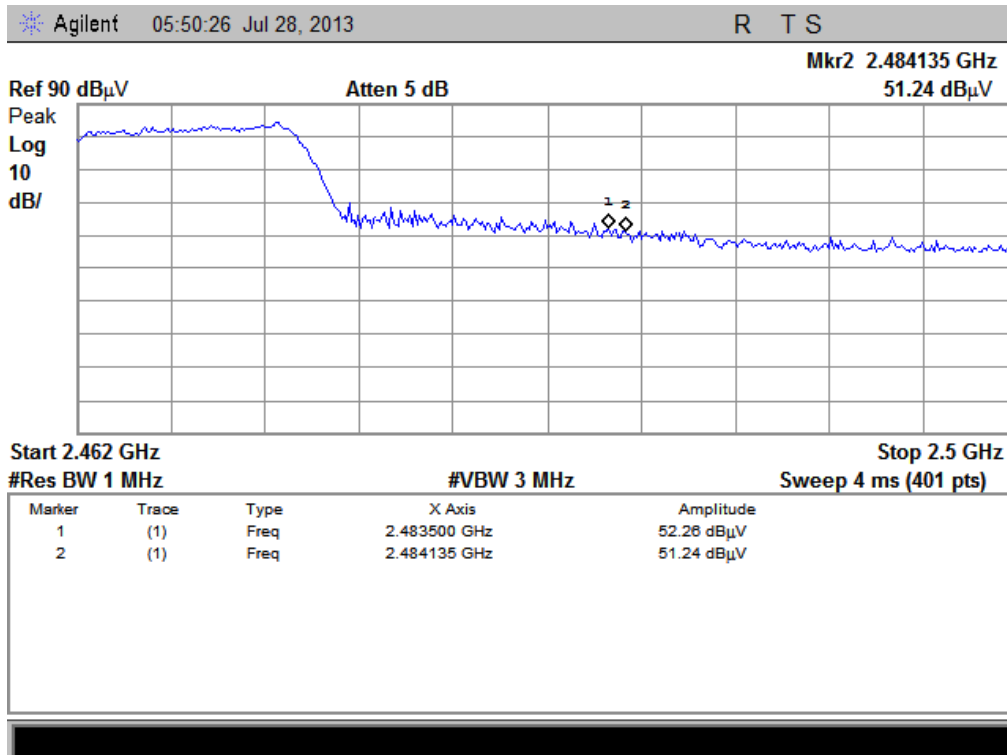
#### B. Test Plots:



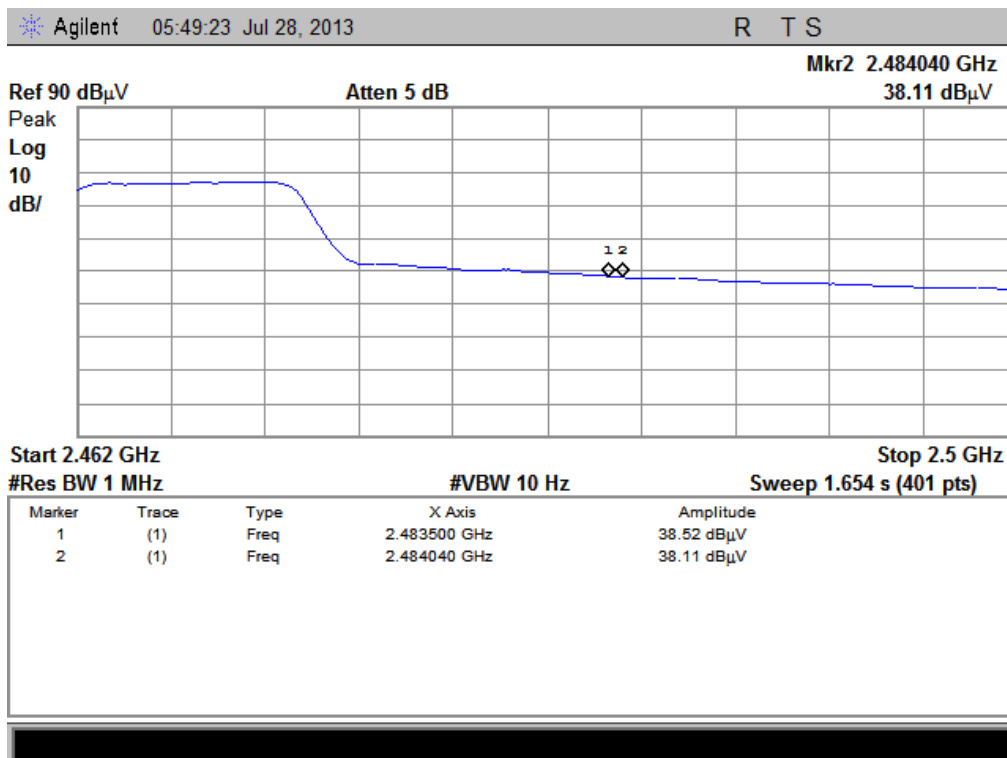
(Plot E1: Channel = 1 PEAK @ 802.11n-20)



(Plot E2: Channel = 1 AVG @ 802.11n-20)



(Plot F1: Channel = 11 PEAK @ 802.11n-20)



(Plot F2: Channel = 11 AVG @ 802.11n-20)

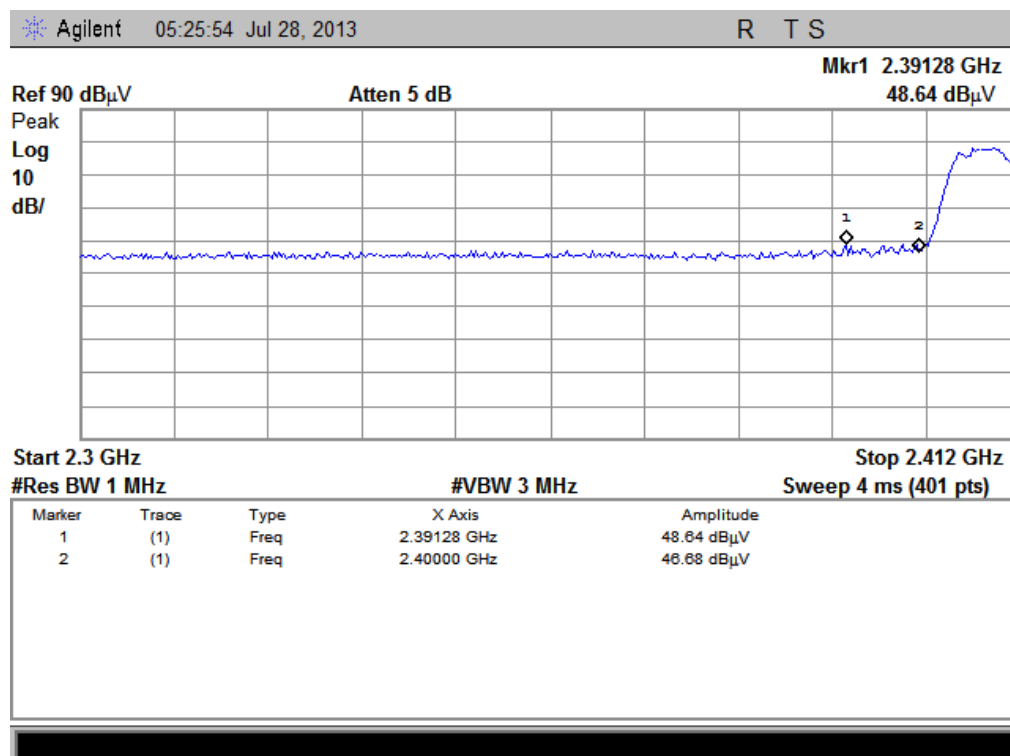
### 2.6.3.4. 802.11n-40MHz Test mode

The lowest and highest channels are tested to verify the band edge emissions.

#### A. Test Verdict:

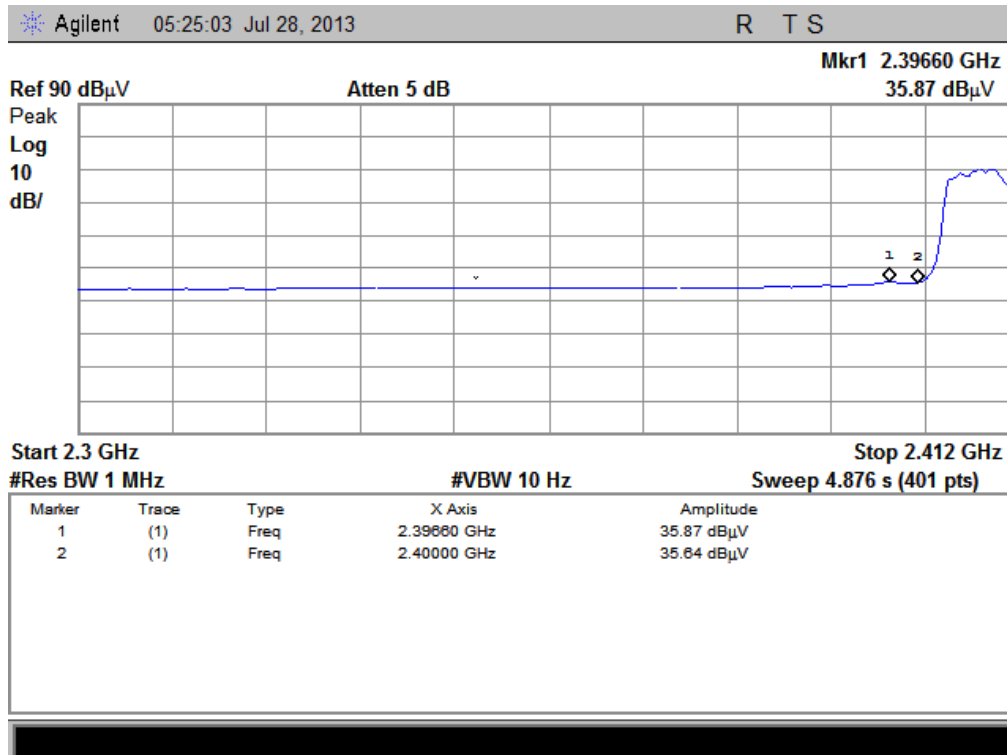
Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
3	2391.28	PK	48.64	-30.93	32.56	50.27	74	Pass
3	2396.60	AV	35.87	-30.93	32.56	37.50	54	Pass
9	2487.75	PK	52.87	-29.05	32.50	56.32	74	Pass
9	2485.09	AV	36.77	-29.05	32.50	40.22	54	Pass

#### B. Test Plots:

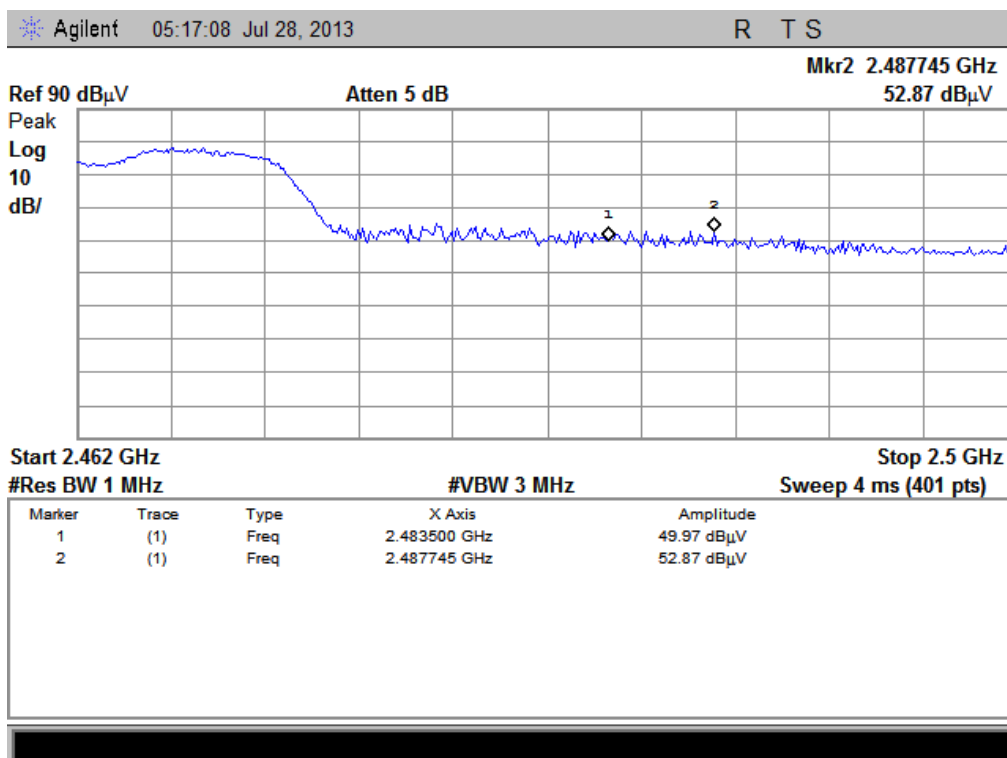


(Plot E1: Channel = 3 PEAK @ 802.11n-40)

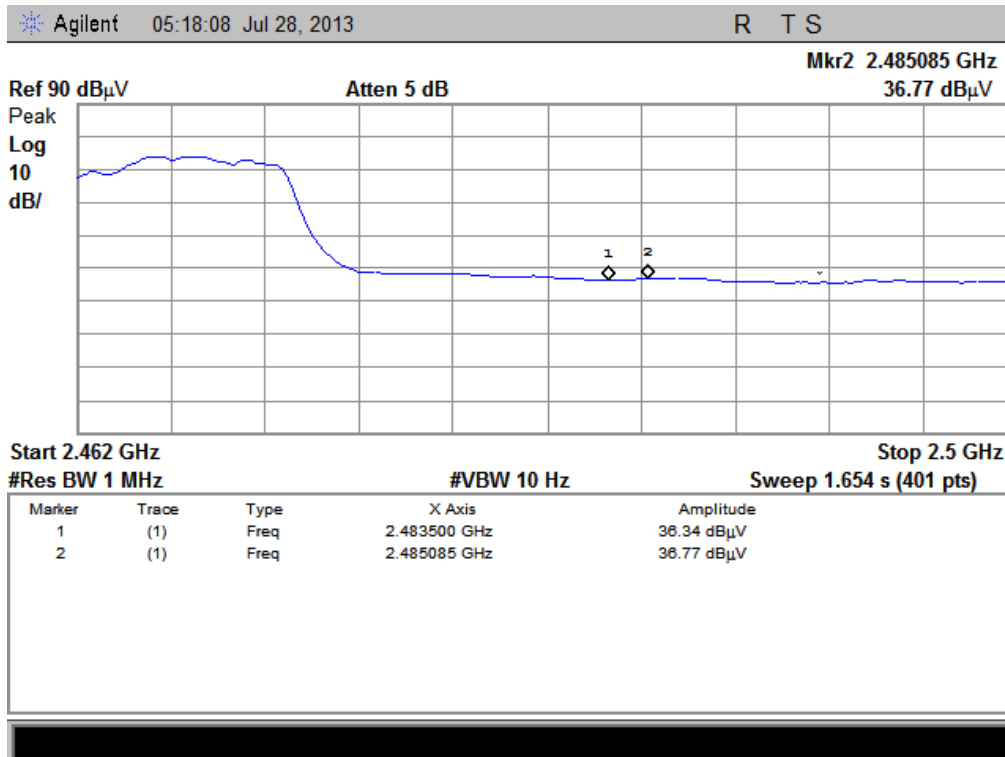




(Plot E2: Channel = 3 AVG @ 802.11n-40)



(Plot F1: Channel = 9 PEAK @ 802.11n-40)



(Plot F2: Channel = 9 AVG @ 802.11n-40)

## 2.7. Conducted Emission

### 2.7.1. Requirement

According to FCC section 15.207, for an intentional radiator 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 within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

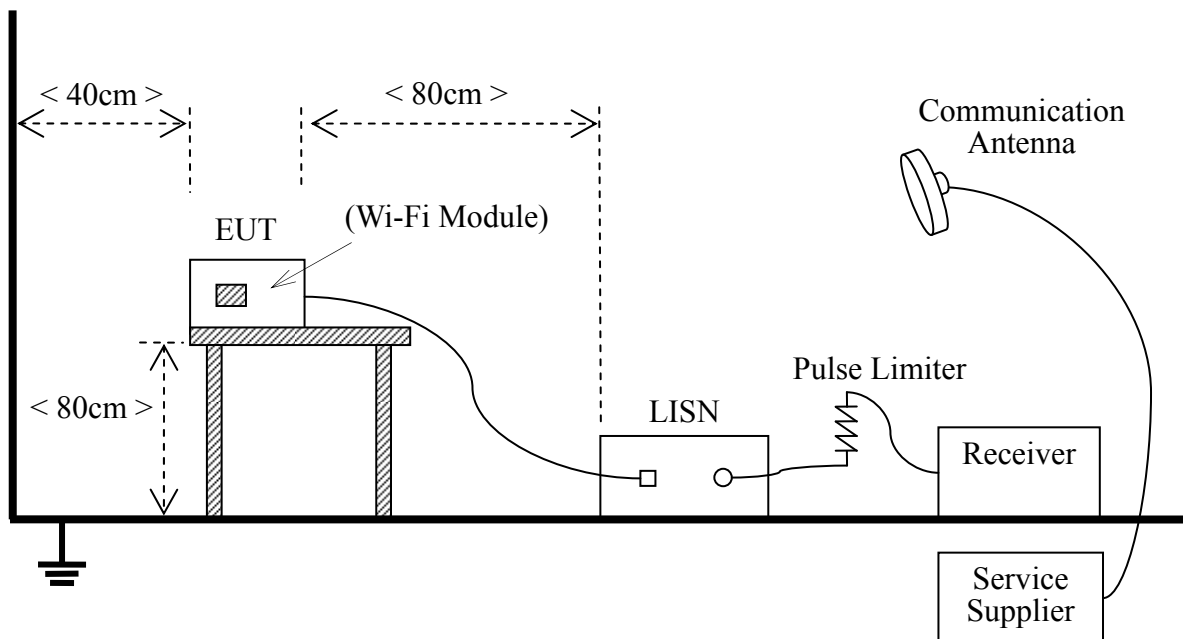
Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

### 2.7.2. Test Description

#### A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

The EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. The factors of the site are calibrated to correct the reading. During the measurement, the EUT is activated and controlled by the Wi-Fi Service Supplier (SS) via a Common Antenna.

## B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
LISN	Schwarzbeck	NSLK 8127	812744	2013.05.12	2014.05.11
Service Supplier	R&S	CMU200	100448	2013.05.12	2014.05.11
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	(n.a.)	(n.a.)

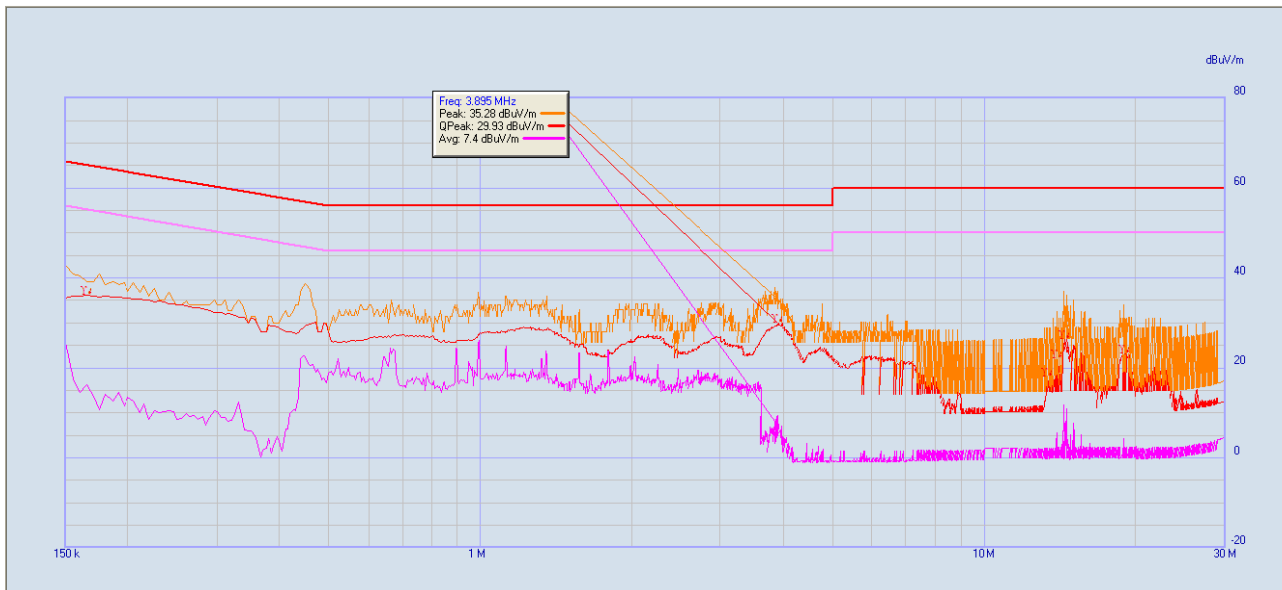
### 2.7.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

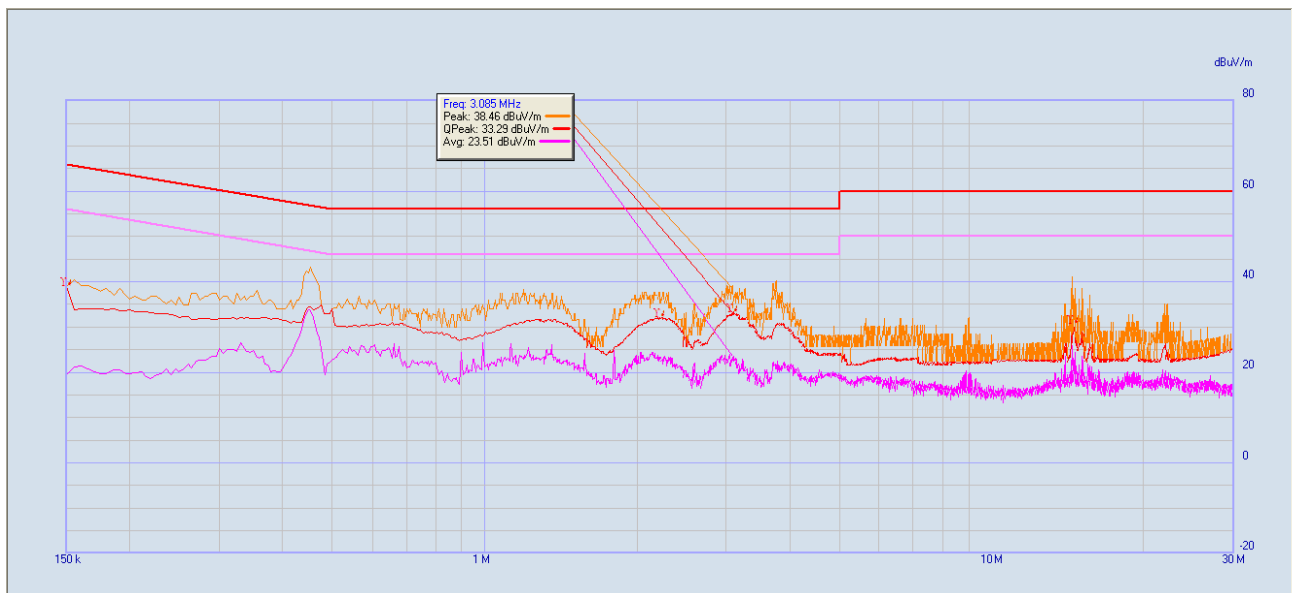
#### A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

#### B. Test Plots:



(Plot A: L Phase)



(Plot B: N Phase)

## 2.8. Radiated Emission

### 2.8.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ )	Measurement Distance (m)
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:

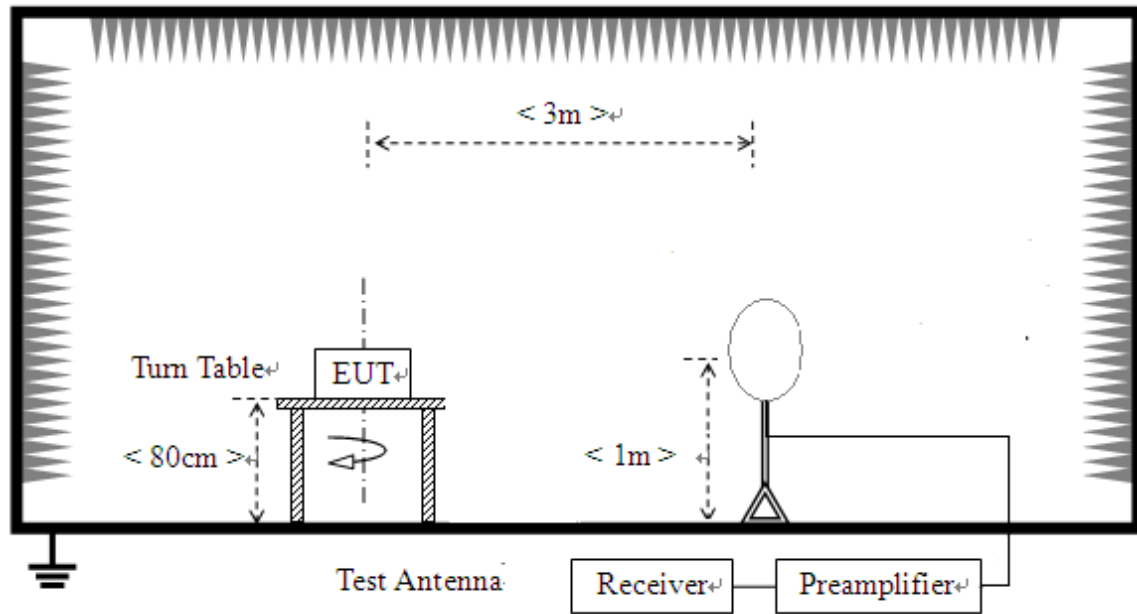
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

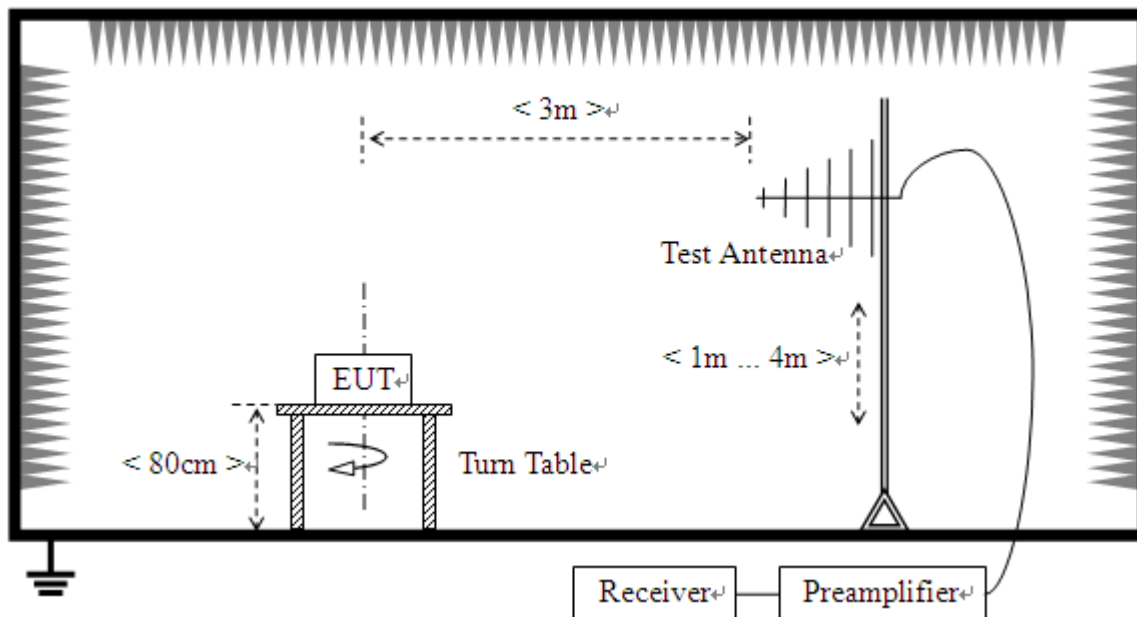
### 2.8.2. Test Description

#### A. Test Setup:

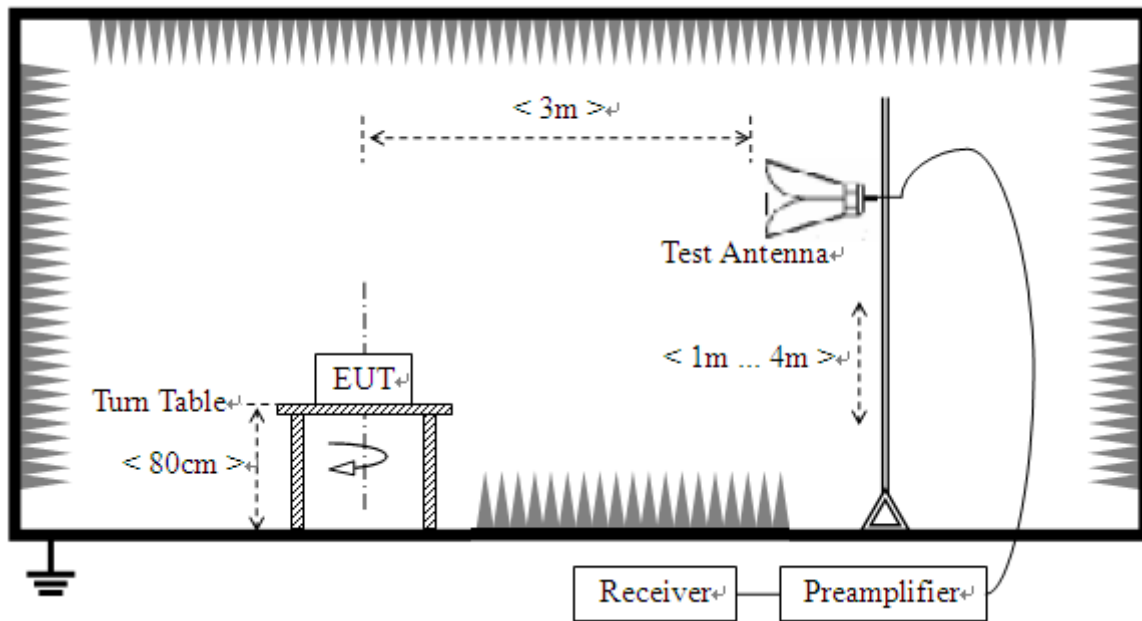
- 1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to 1GHz



### 3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The EUT of the EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the EUT is activated and controlled by the Wireless Router via a Common Antenna, and is set to operate under hopping-on test mode.

For the Test Antenna:

- In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

### B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2013.05.12	2014.05.11
Receiver	Agilent	E7405A	US44210471	2013.05.12	2014.05.11
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2012.05.12	2014.05.11
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2013.05.12	2014.05.11



Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120C-963	2013.05.12	2014.05.11
Test Antenna - Horn	R&S	HL050S7	71688	2013.05.12	2014.05.11
Test Antenna -Loop	Schwarzbeck	FMZB 1519	1519-022	2013.05.12	2014.05.11

### 2.8.3. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V/m]} = U_R + A_T + A_{\text{Factor}} \text{ [dB]}; A_T = L_{\text{Cable loss}} \text{ [dB]} - G_{\text{preamp}} \text{ [dB]}$$

$A_T$ : Total correction Factor except Antenna

$U_R$ : Receiver Reading

$G_{\text{preamp}}$ : Preamplifier Gain

$A_{\text{Factor}}$ : Antenna Factor at 3m

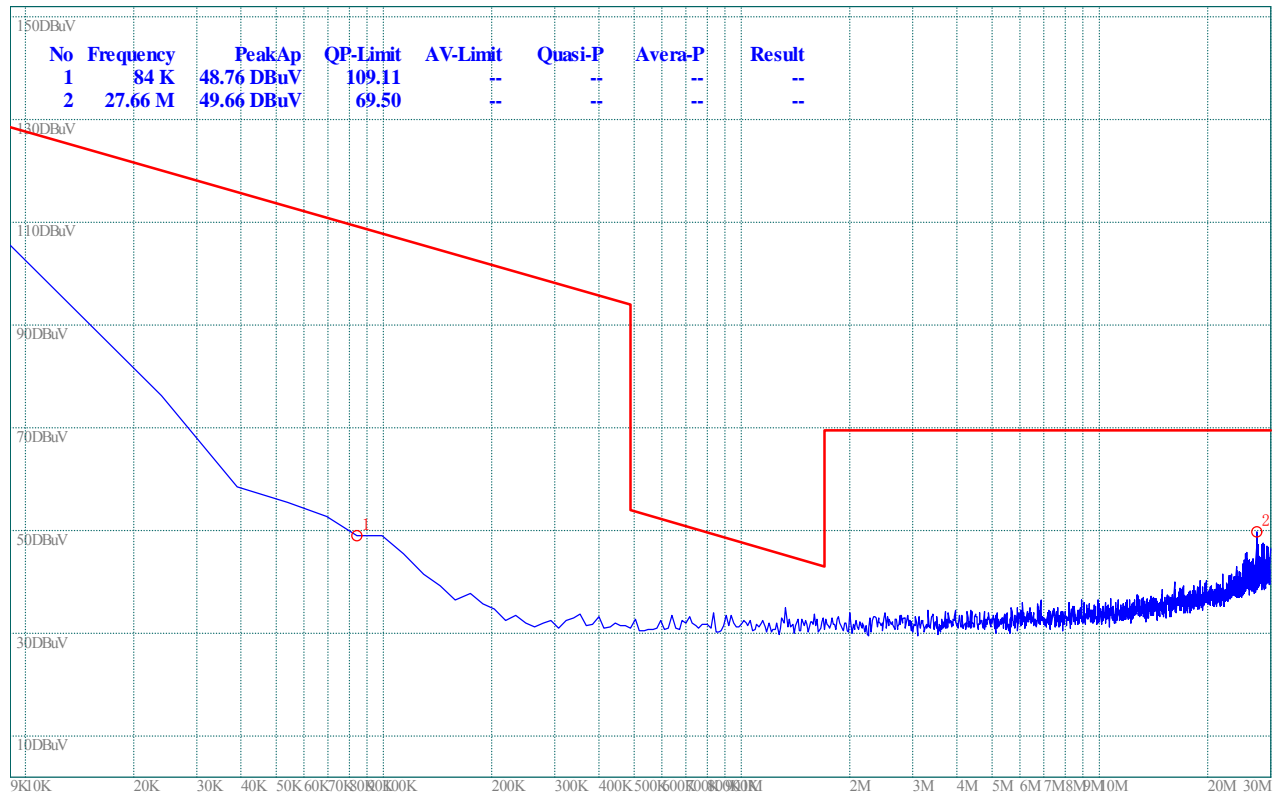
During the test, the total correction Factor  $A_T$  and  $A_{\text{Factor}}$  were built in test software.

Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

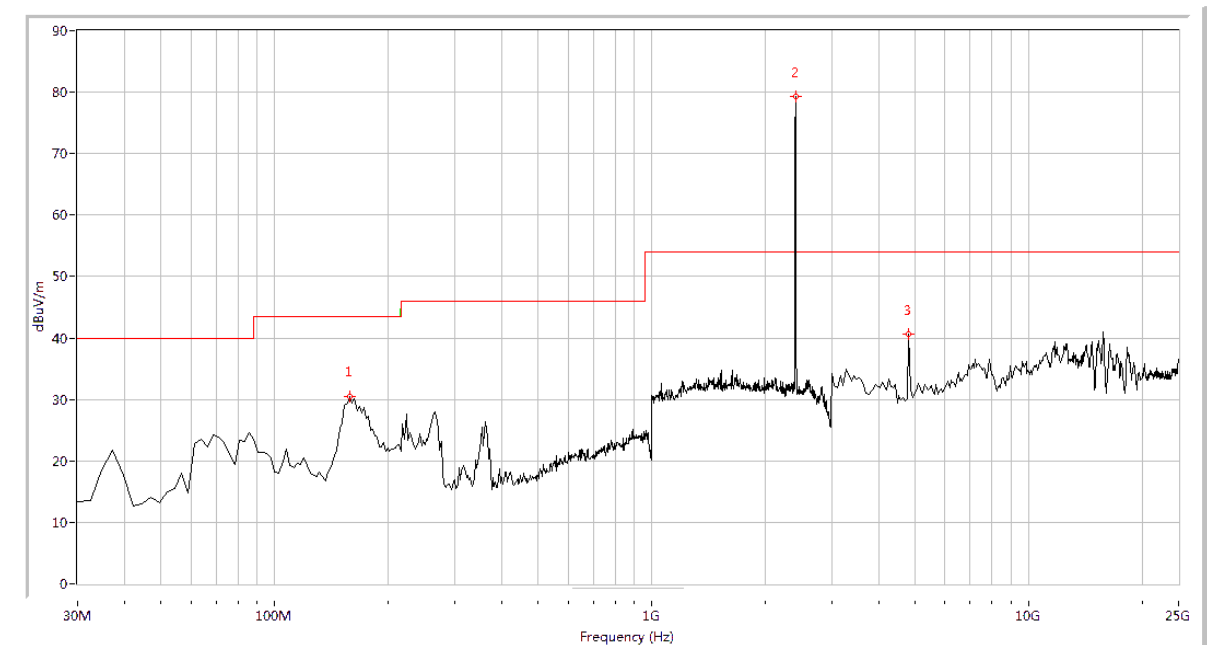
#### 2.8.3.1. 802.11b Test mode

##### A. Test Plots for the Whole Measurement Frequency Range:

# Plots for Channel = 1

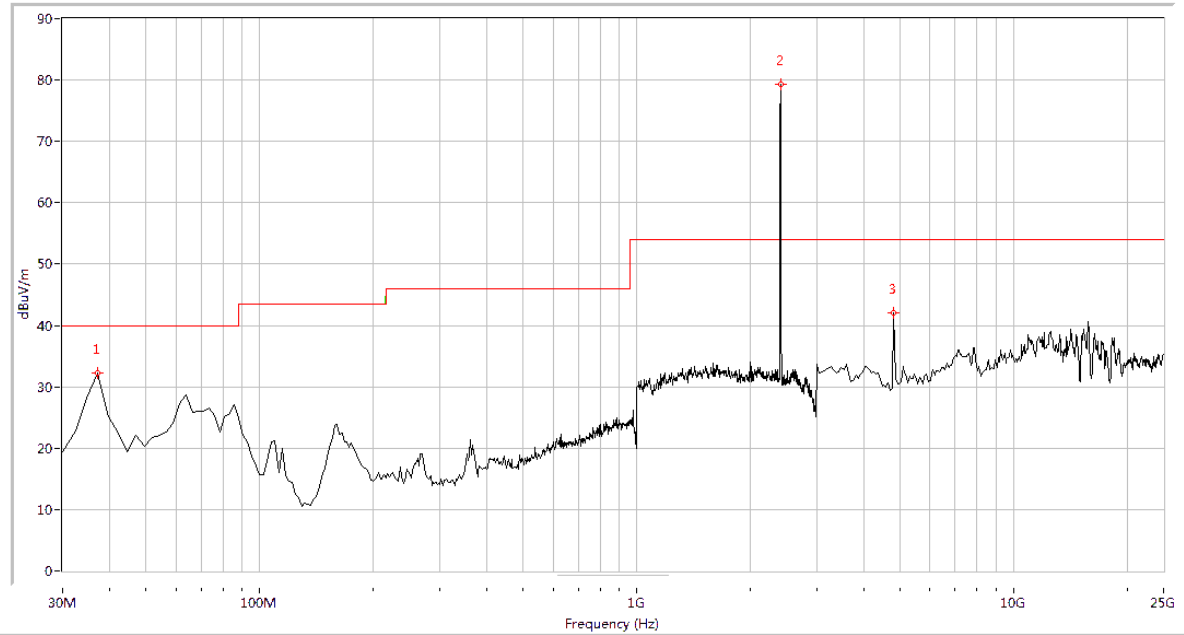


(Plot A.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
158.204	30.51	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2412.000	79.34	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4810.474	40.66	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

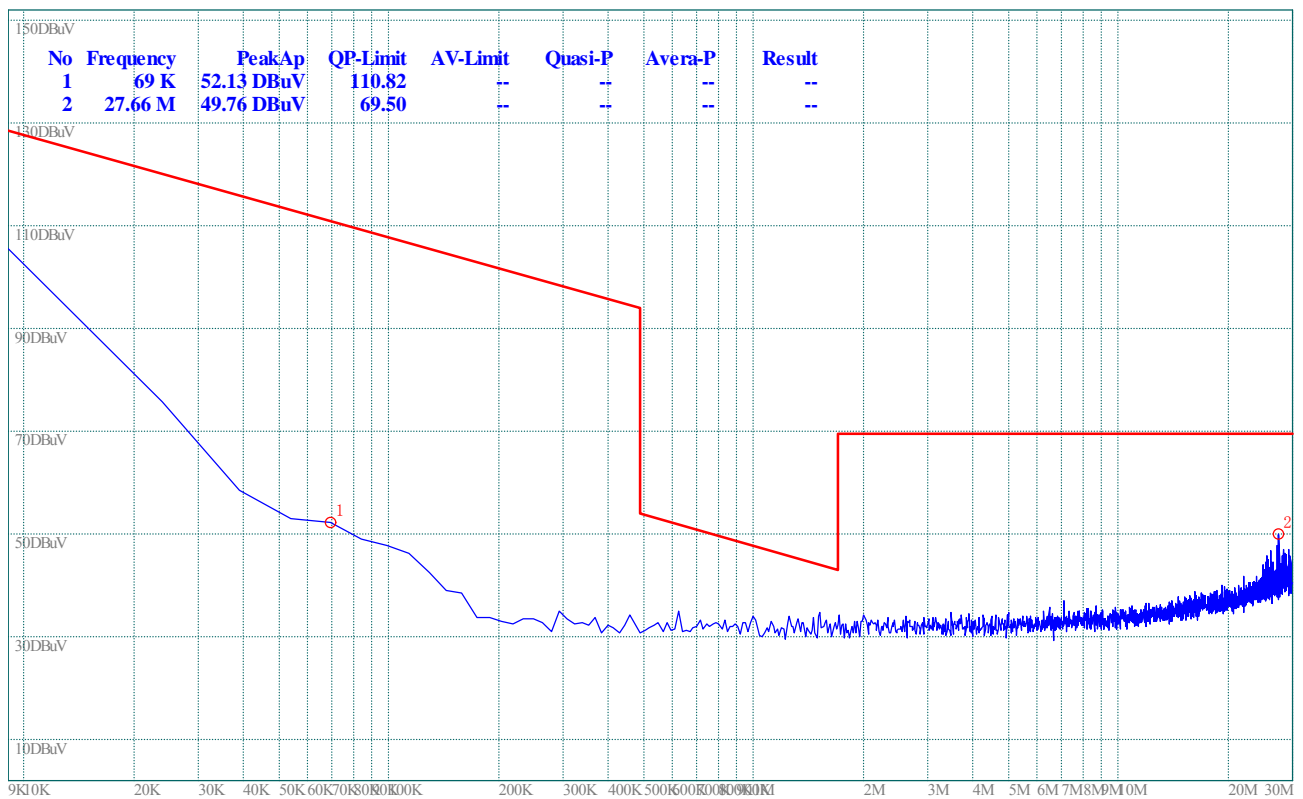
(Plot A.2: Antenna Horizontal, 30MHz to 25GHz)



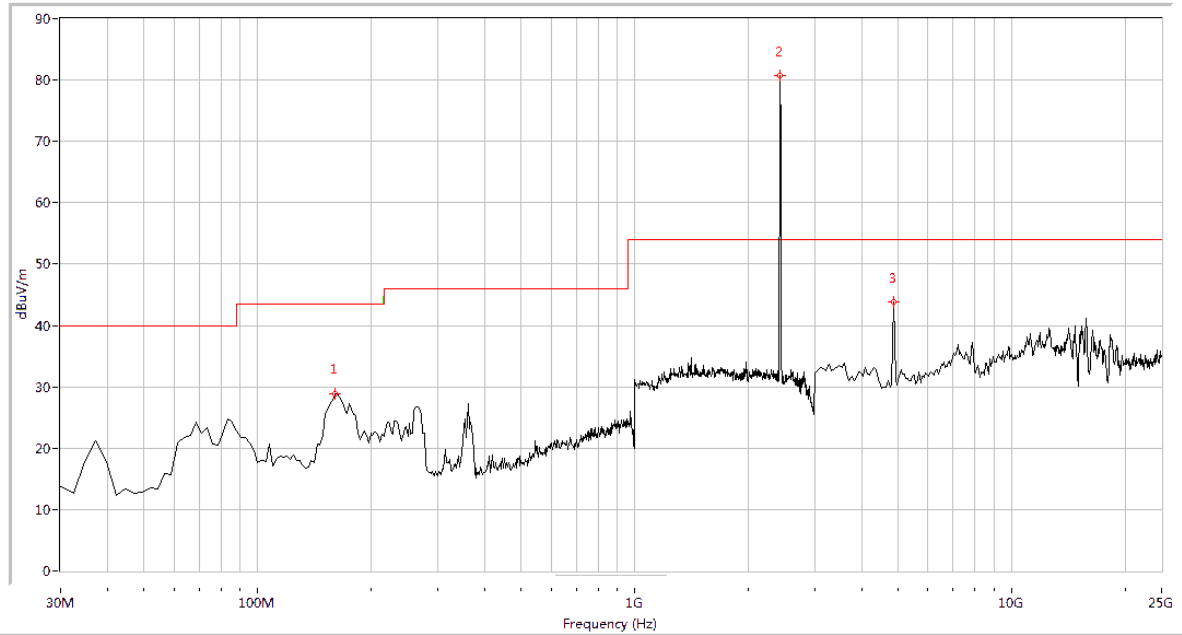
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.24	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2412.000	79.28	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4810.474	42.08	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot A.3: Antenna Vertical, 30MHz to 25GHz)

### Plot for Channel = 6

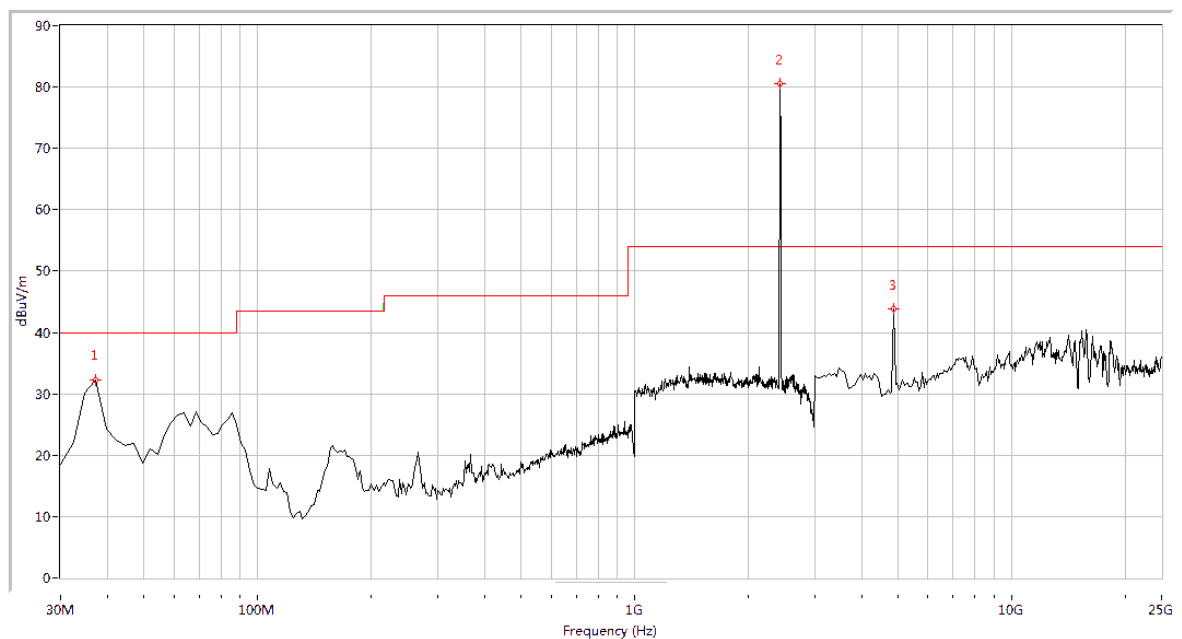


(Plot B.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
160.623	28.82	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2437.000	80.75	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4865.337	43.78	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

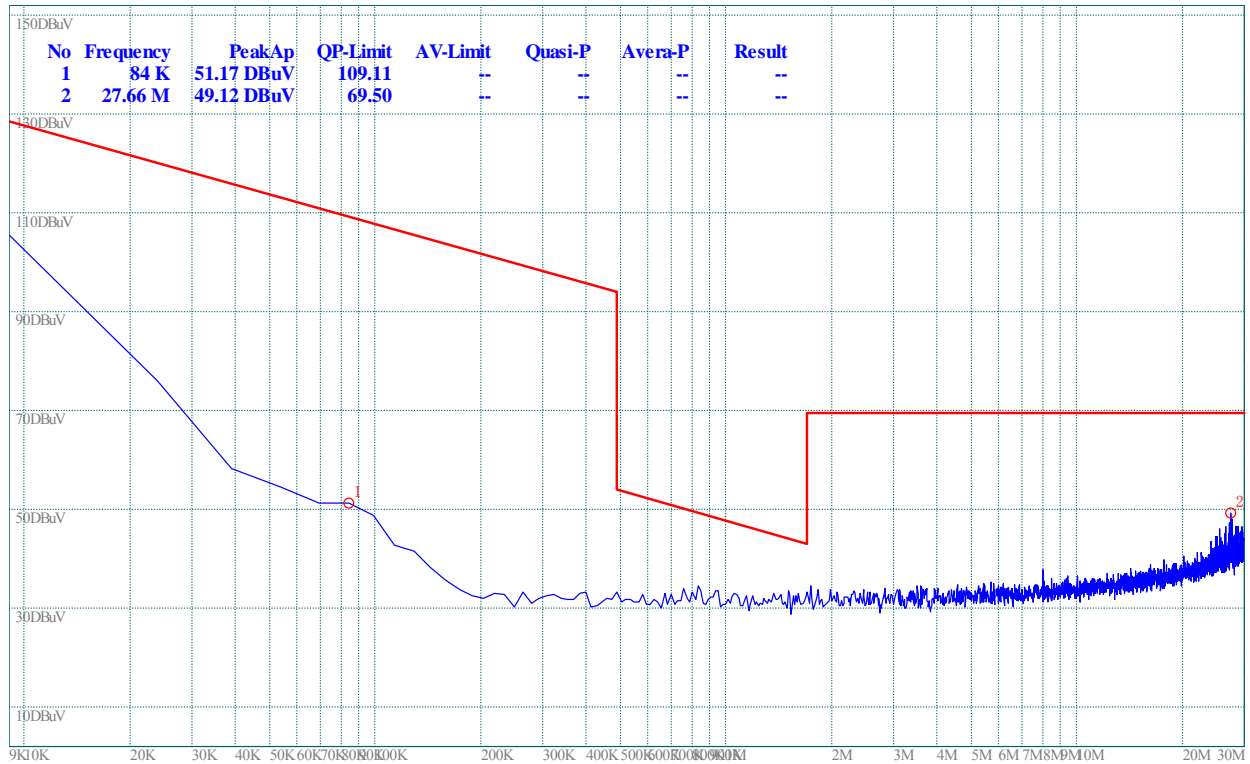
(Plot B.2: Antenna Horizontal, 30MHz to 25GHz)



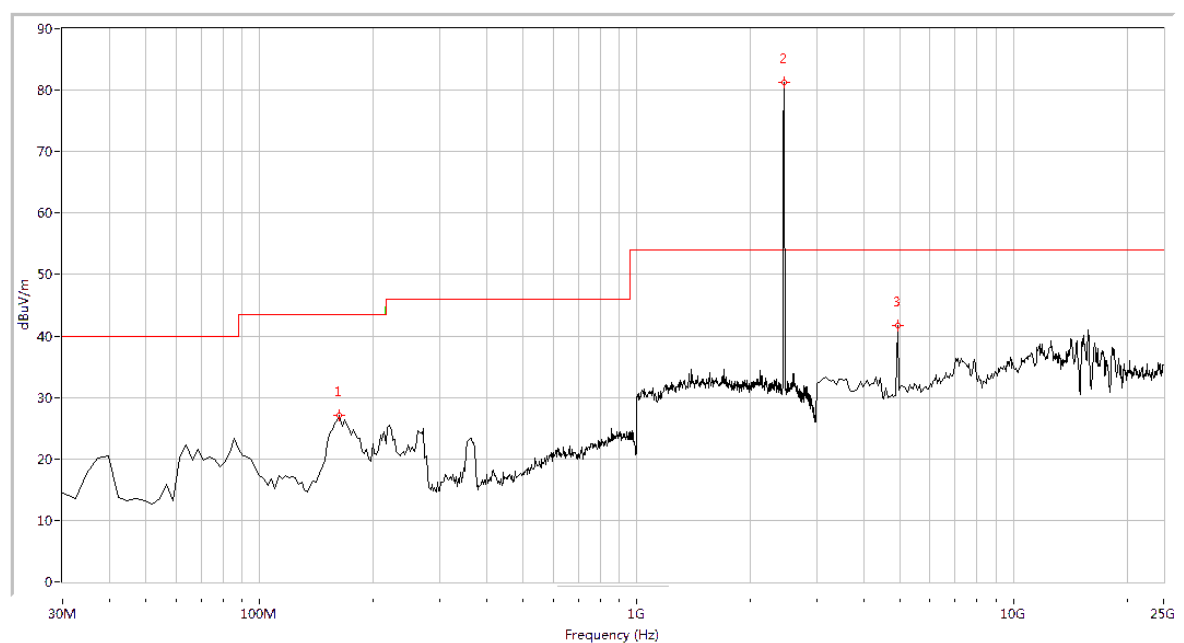
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.23	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2437.000	80.63	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4865.337	43.93	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot B.3: Antenna Vertical, 30MHz to 25GHz)

# Plot for Channel = 11

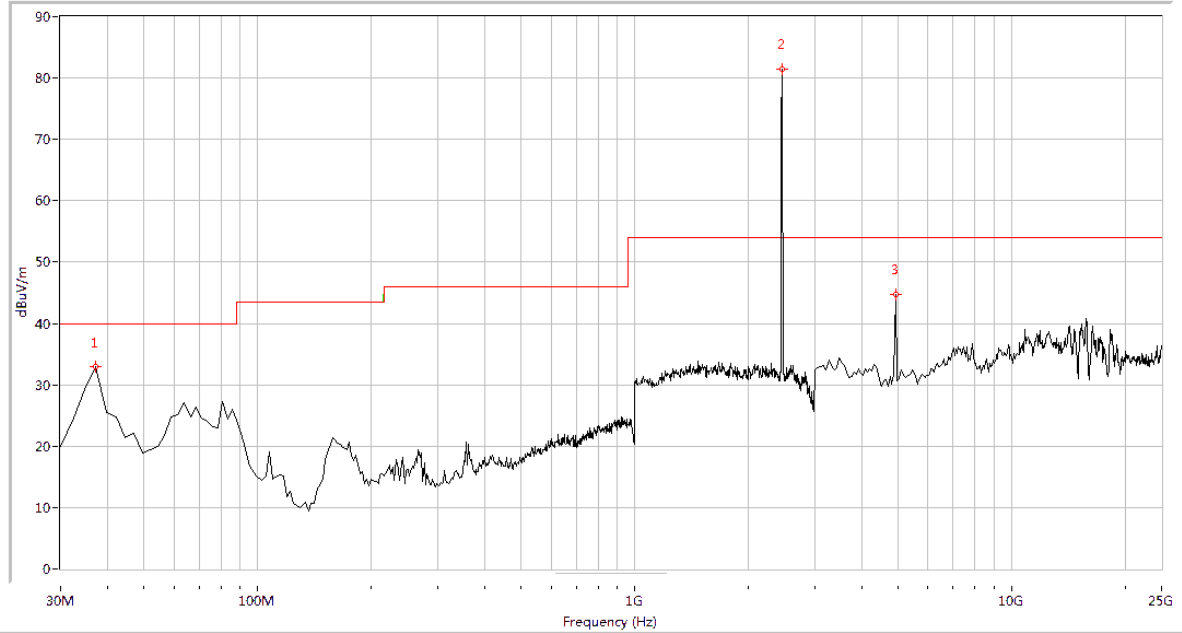


(Plot C.1: 9kHz to 30MHz)



(Plot C.2: Antenna Horizontal, 30MHz to 25GHz)

Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
163.042	27.03	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2462.000	81.19	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4920.200	41.61	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.99	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2462.000	81.42	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4920.200	44.74	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

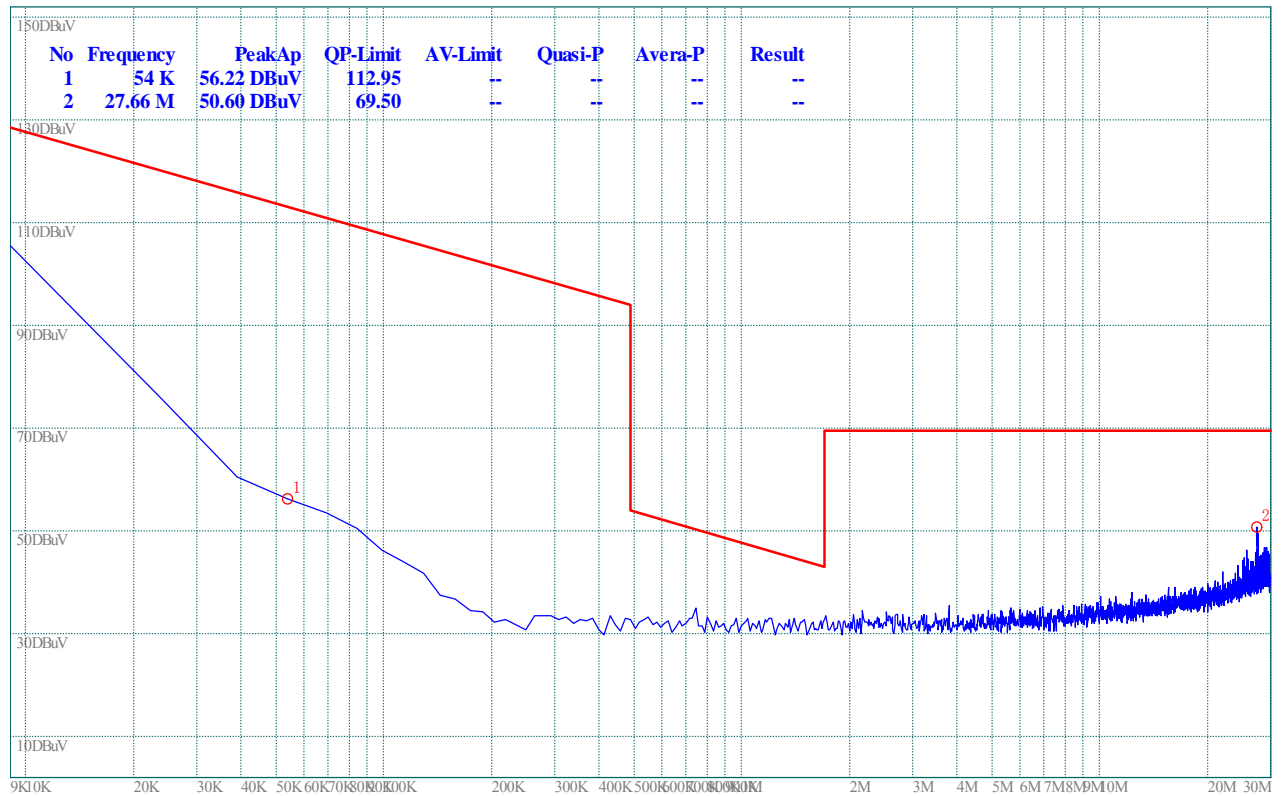
(Plot C.3: Antenna Vertical, 30MHz to 25GHz)

### 2.8.3.2. 802.11g Test mode

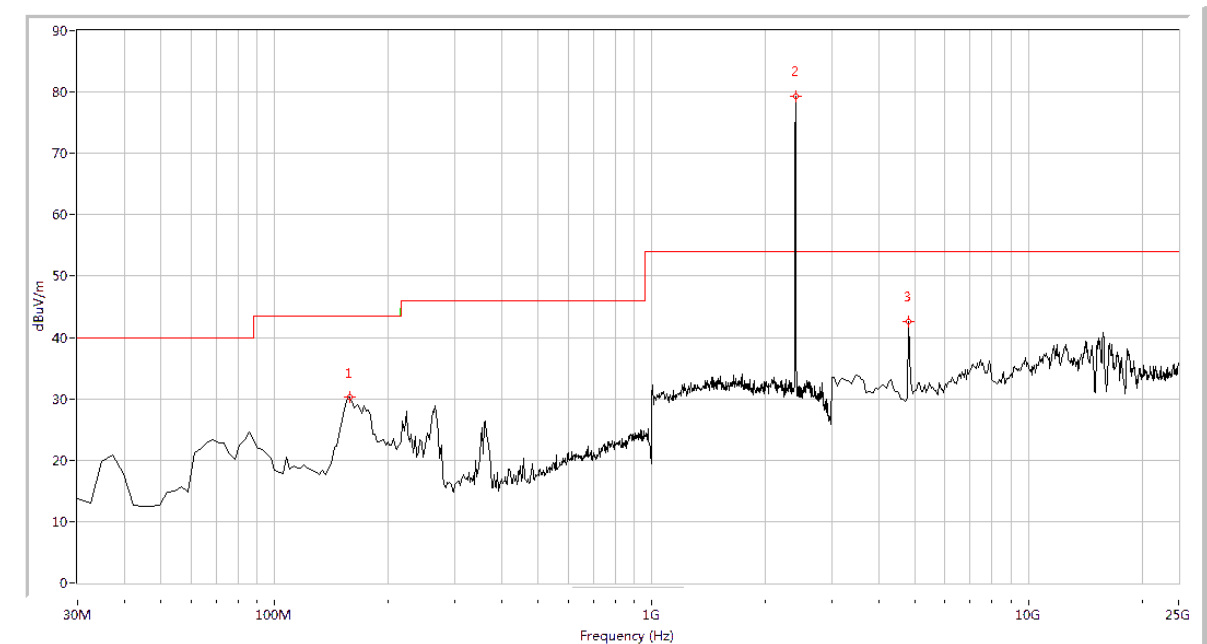
Also refer to following plots for the emissions falling in the restricted bands.

#### A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1

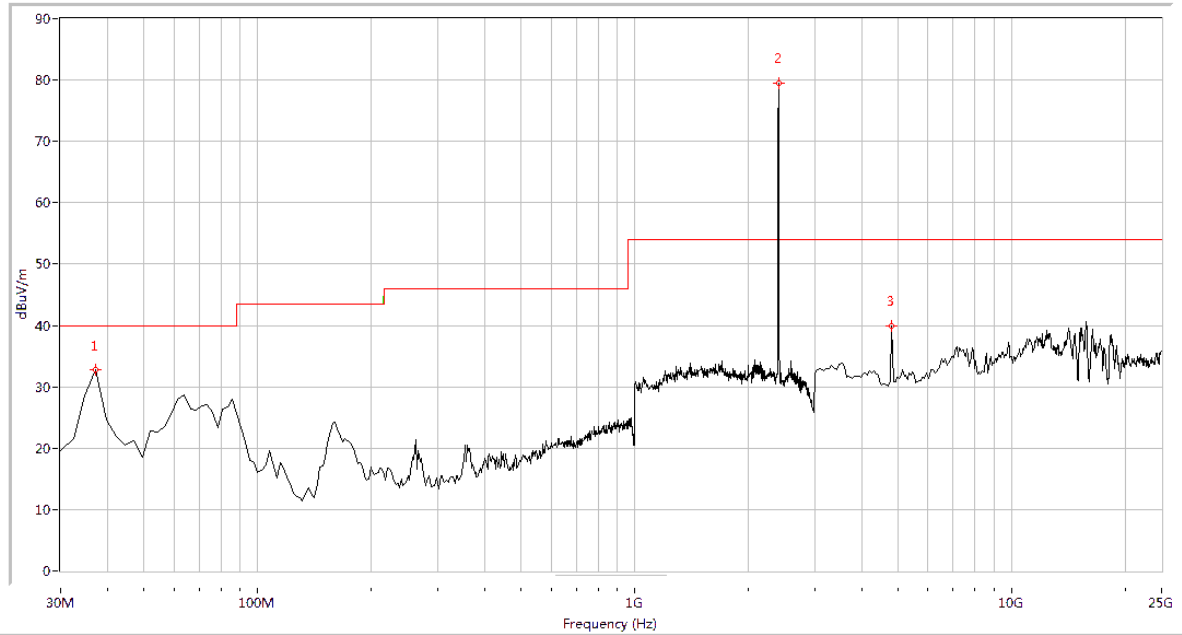


(Plot D.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
158.204	30.38	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2412.000	79.27	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4810.474	42.54	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

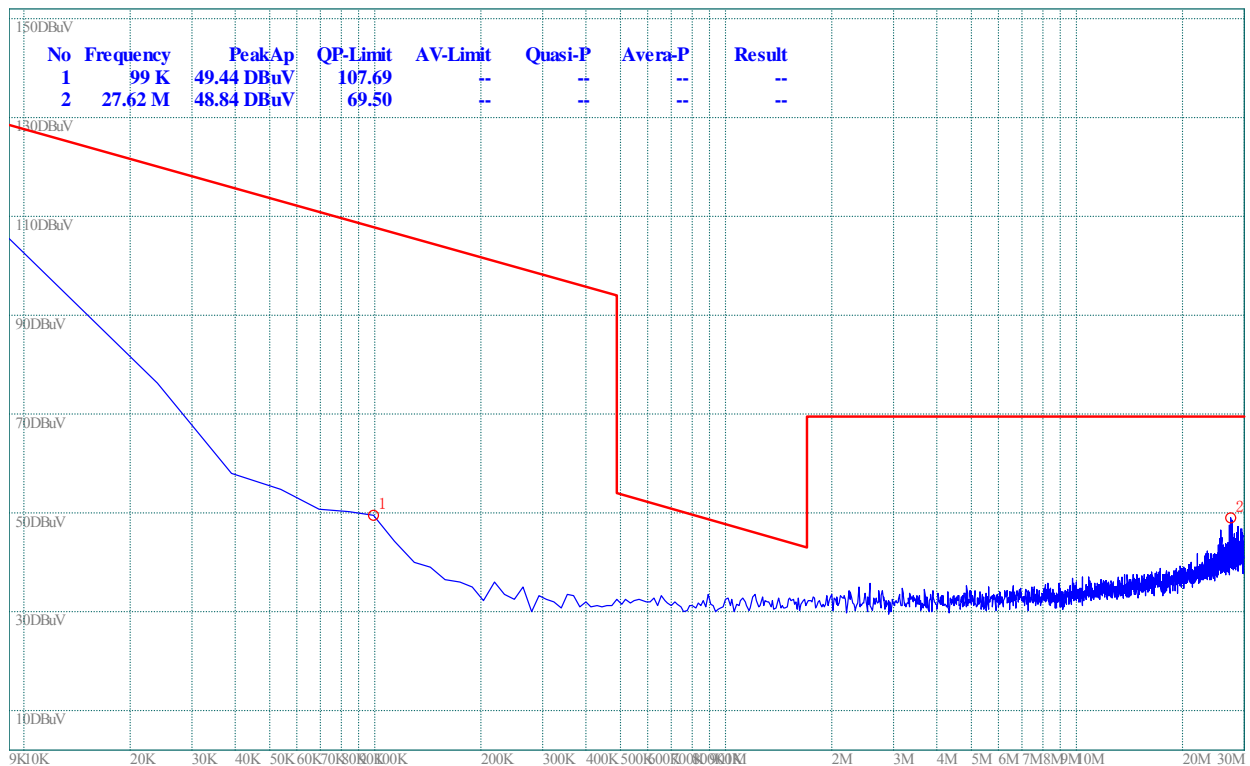
(Plot D.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.84	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2412.000	79.53	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4810.474	39.93	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

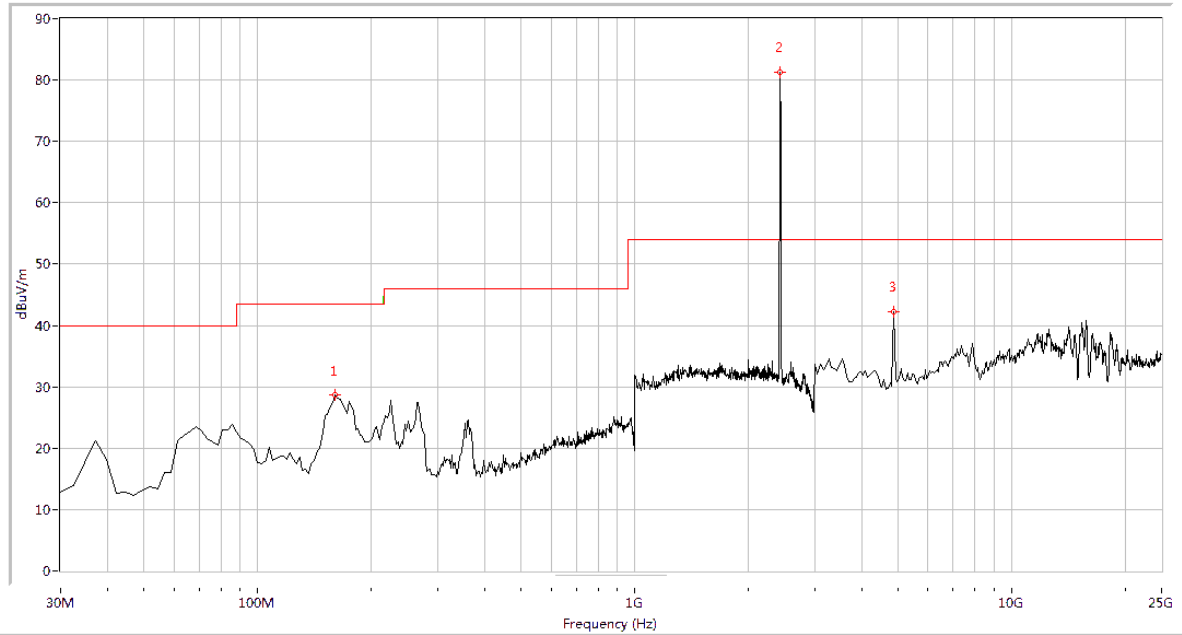
(Plot D.3: Antenna Vertical, 30MHz to 25GHz)

### Plot for Channel = 6



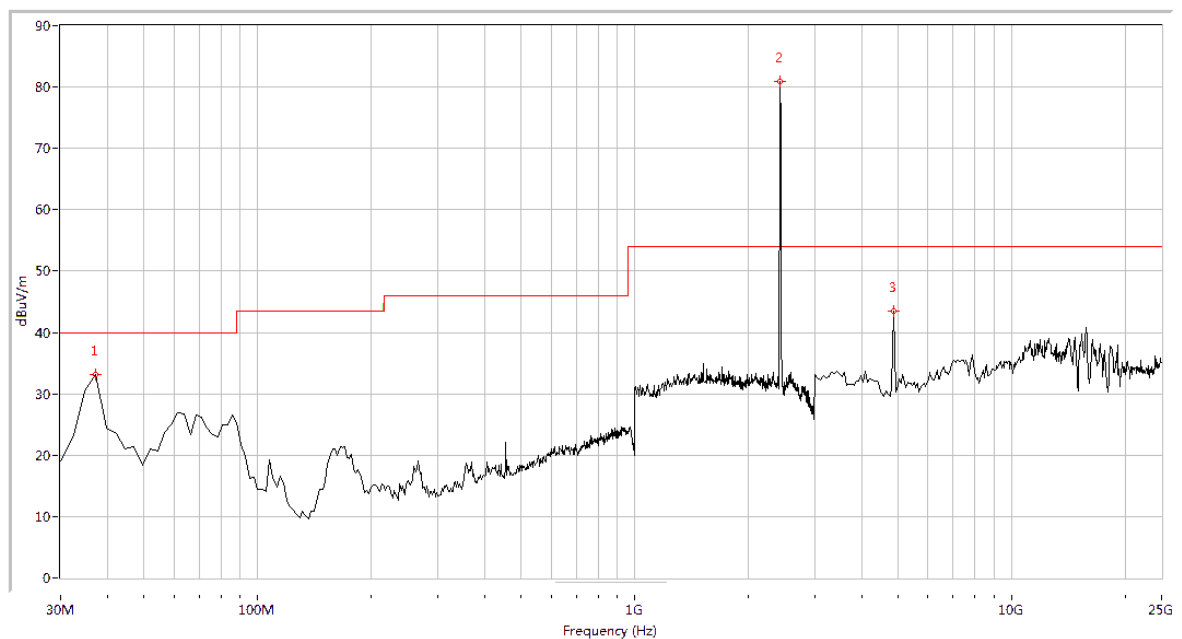
(Plot E.1: 9kHz to 30MHz)





Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
160.623	28.63	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2437.000	81.32	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4865.337	42.19	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot E.2: Antenna Horizontal, 30MHz to 25GHz)



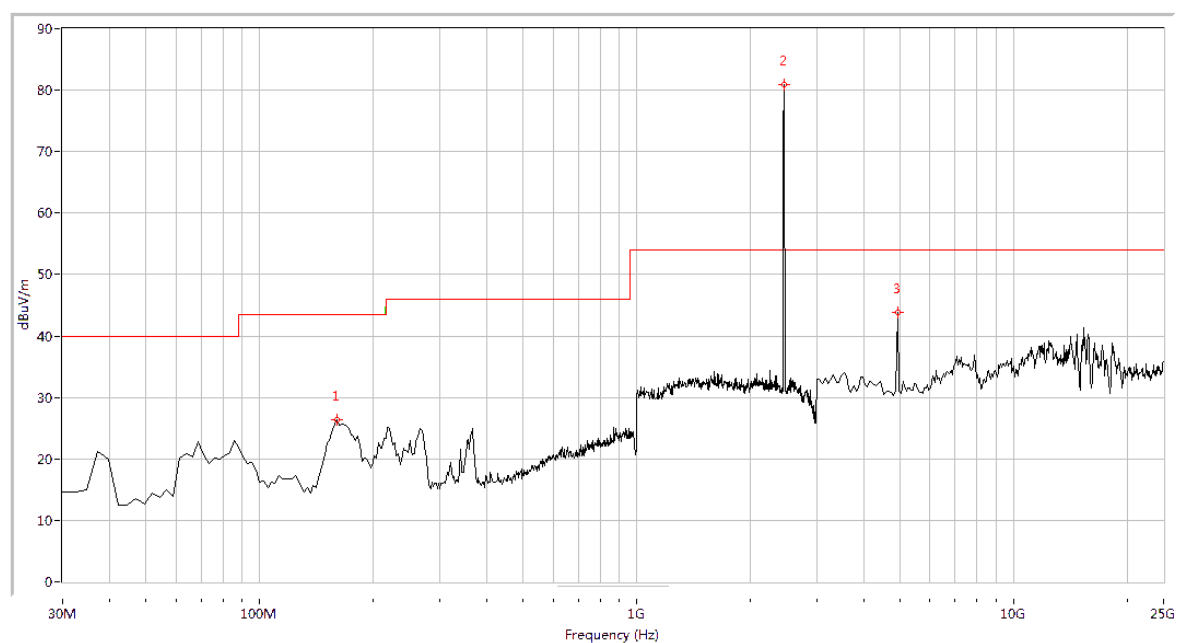
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	33.13	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2437.000	80.99	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4865.337	43.43	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot E.3: Antenna Vertical, 30MHz to 25GHz)

# Plot for Channel = 11

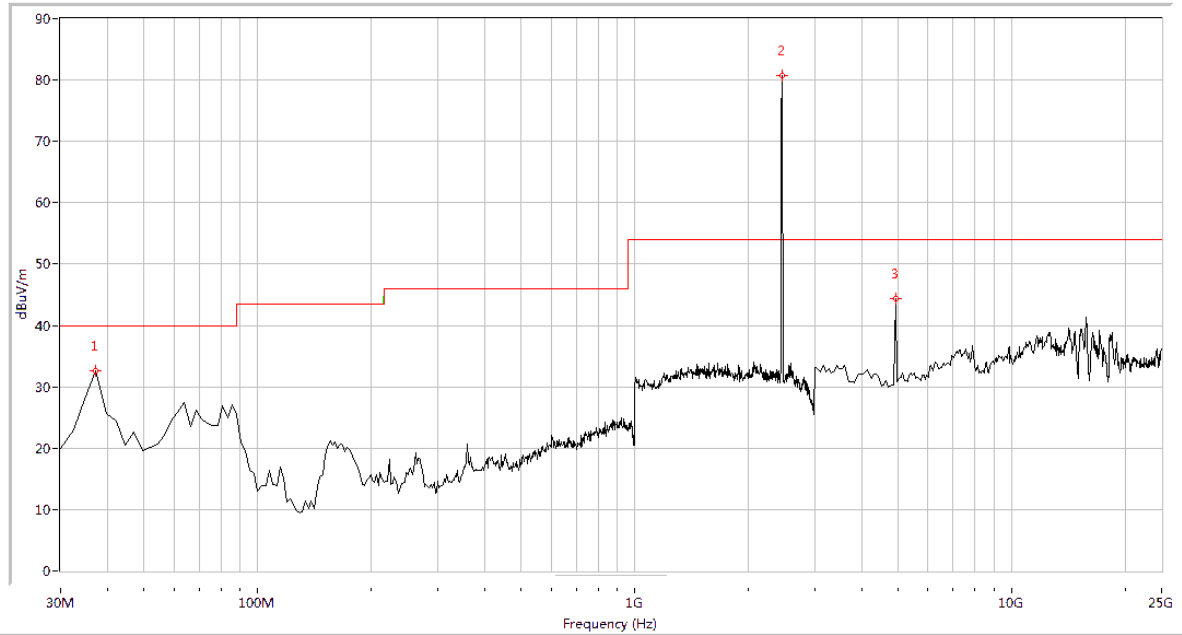


(Plot F.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
160.623	26.43	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2462.000	81.00	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4920.200	43.92	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot F.2: Antenna Horizontal, 30MHz to 25GHz)



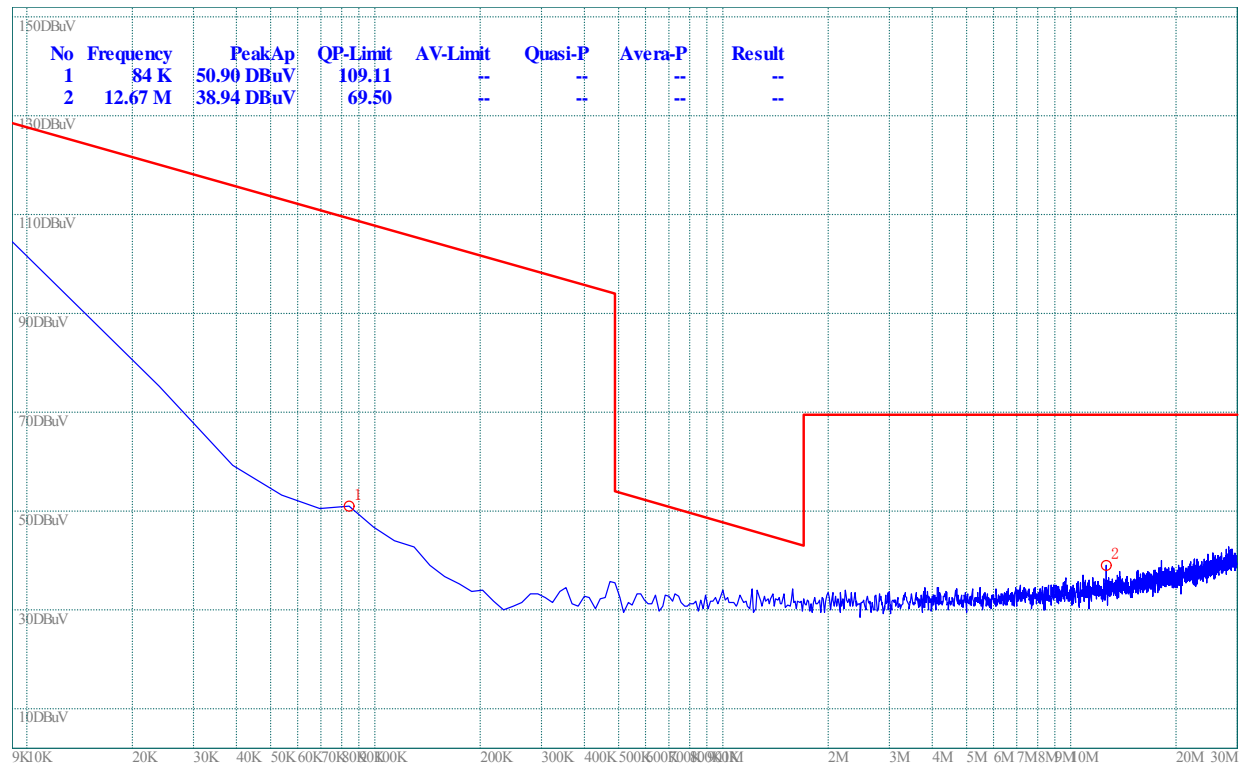
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.70	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2462.000	80.67	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4920.200	44.35	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot F.3: Antenna Vertical, 30MHz to 25GHz)

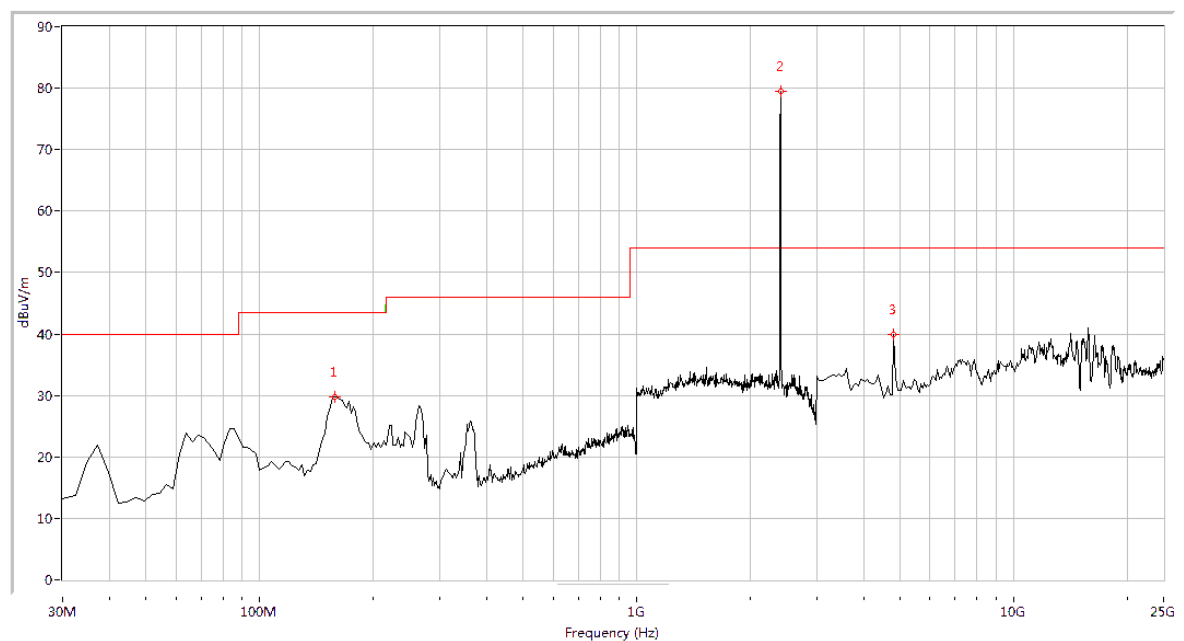
### 2.8.3.3. 802.11n-20MHz Test mode

#### B. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1

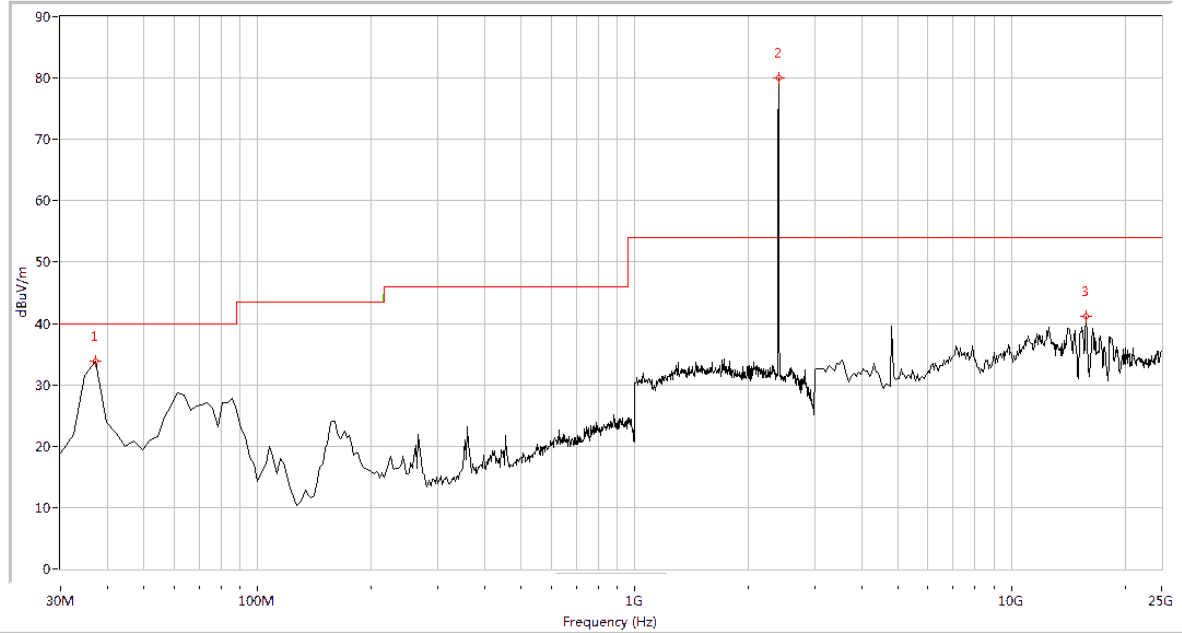


(Plot G.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
158.204	29.83	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2412.000	79.42	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4810.474	39.93	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot G.2: Antenna Horizontal, 30MHz to 25GHz)



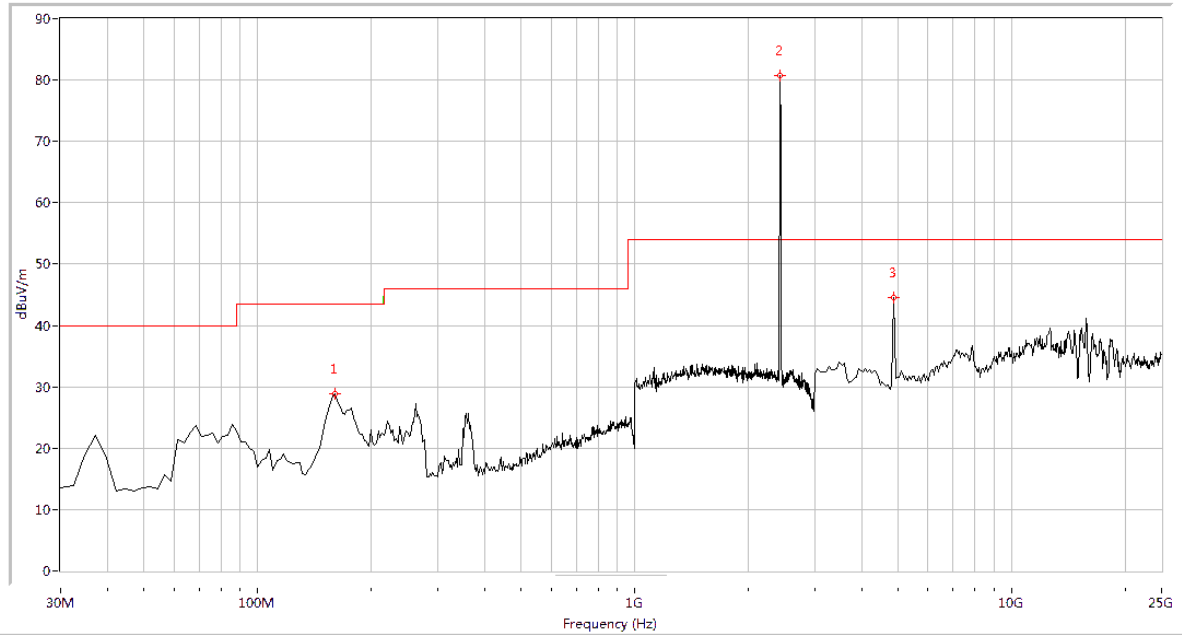
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	33.94	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2412.000	80.04	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15728.180	41.18	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot G.3: Antenna Vertical, 30MHz to 25GHz)

### Plot for Channel = 6

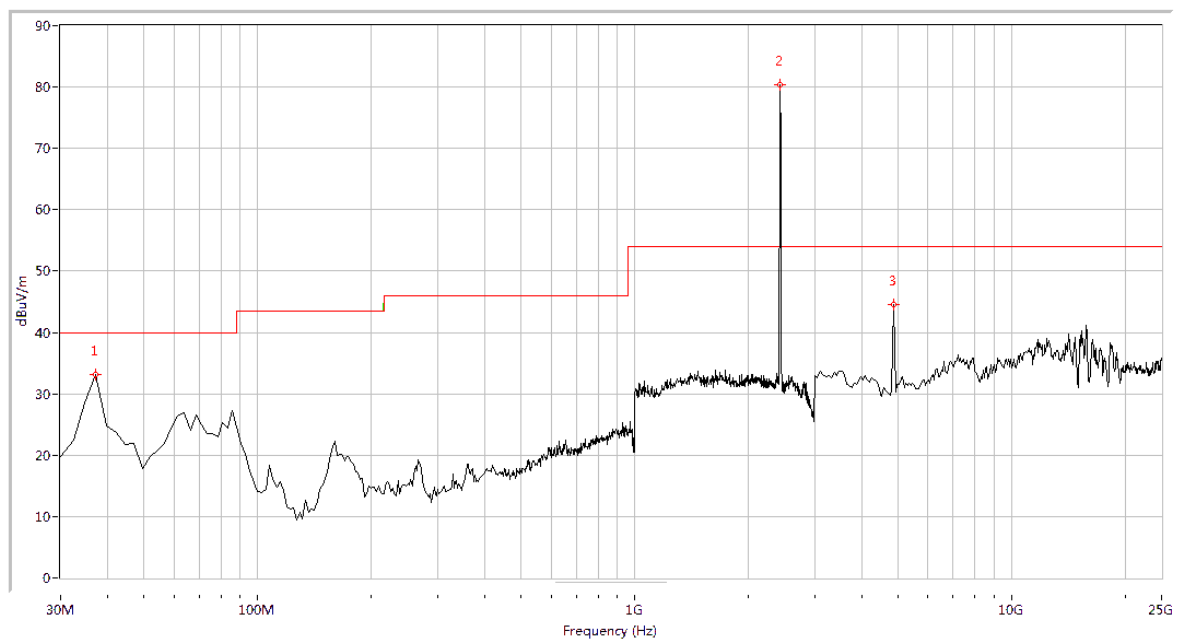


(Plot H.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
160.623	28.94	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2437.000	80.78	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4865.337	44.49	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

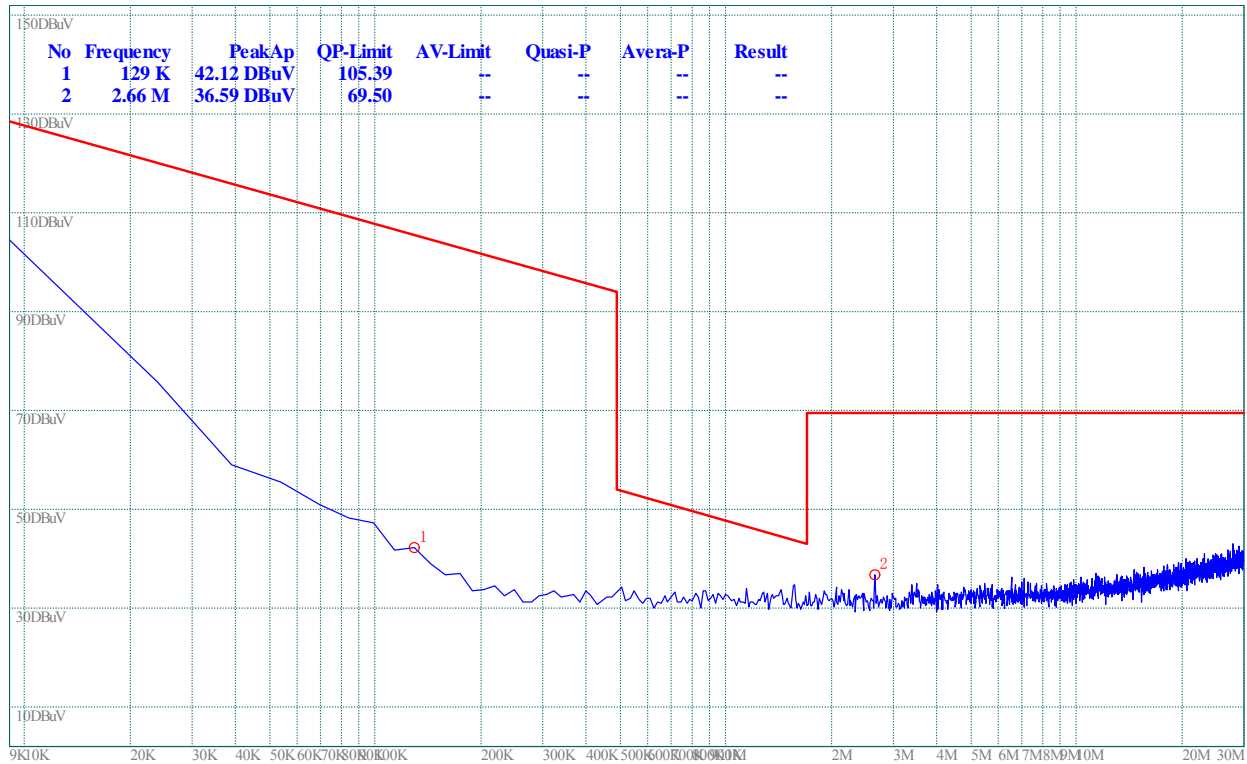
(Plot H.2: Antenna Horizontal, 30MHz to 25GHz)



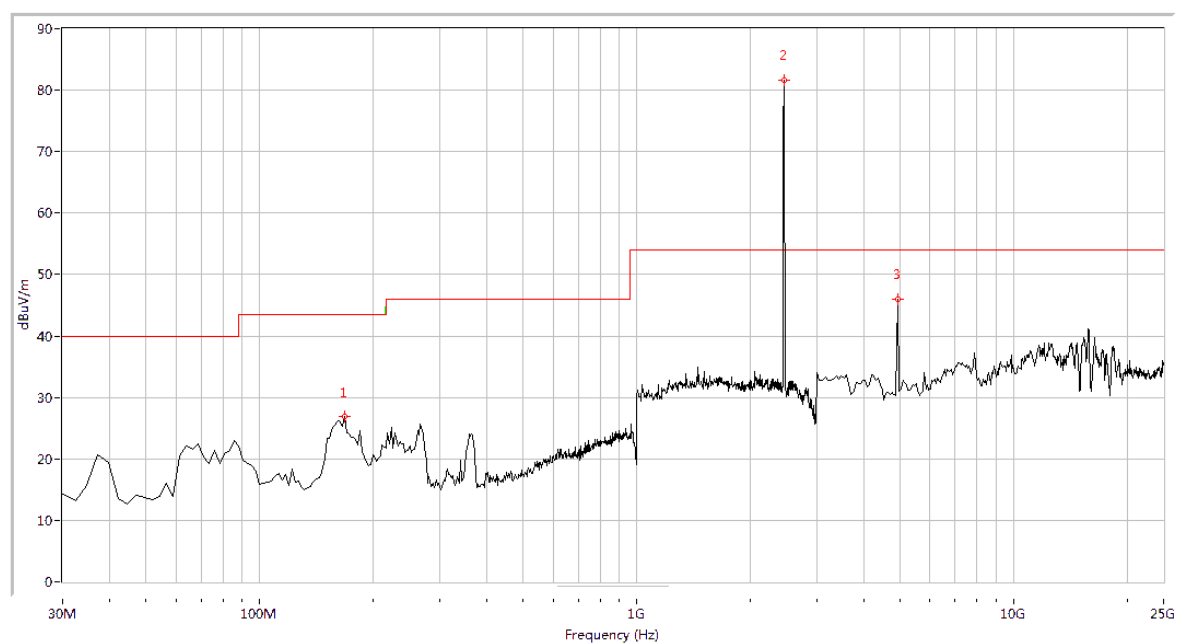
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	33.06	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2437.000	80.34	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4865.337	44.49	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot H.3: Antenna Vertical, 30MHz to 25GHz)

# Plot for Channel = 11

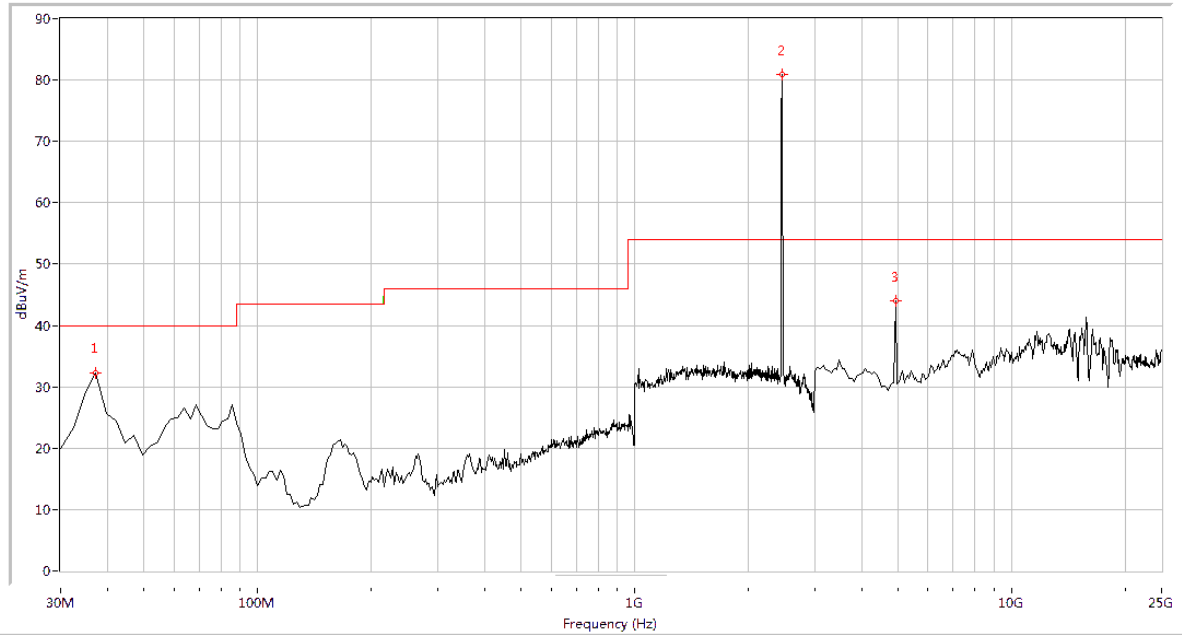


(Plot I.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
167.880	26.94	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
2462.000	81.62	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
4920.200	46.05	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot I.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.24	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2462.000	80.85	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
4920.200	44.09	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

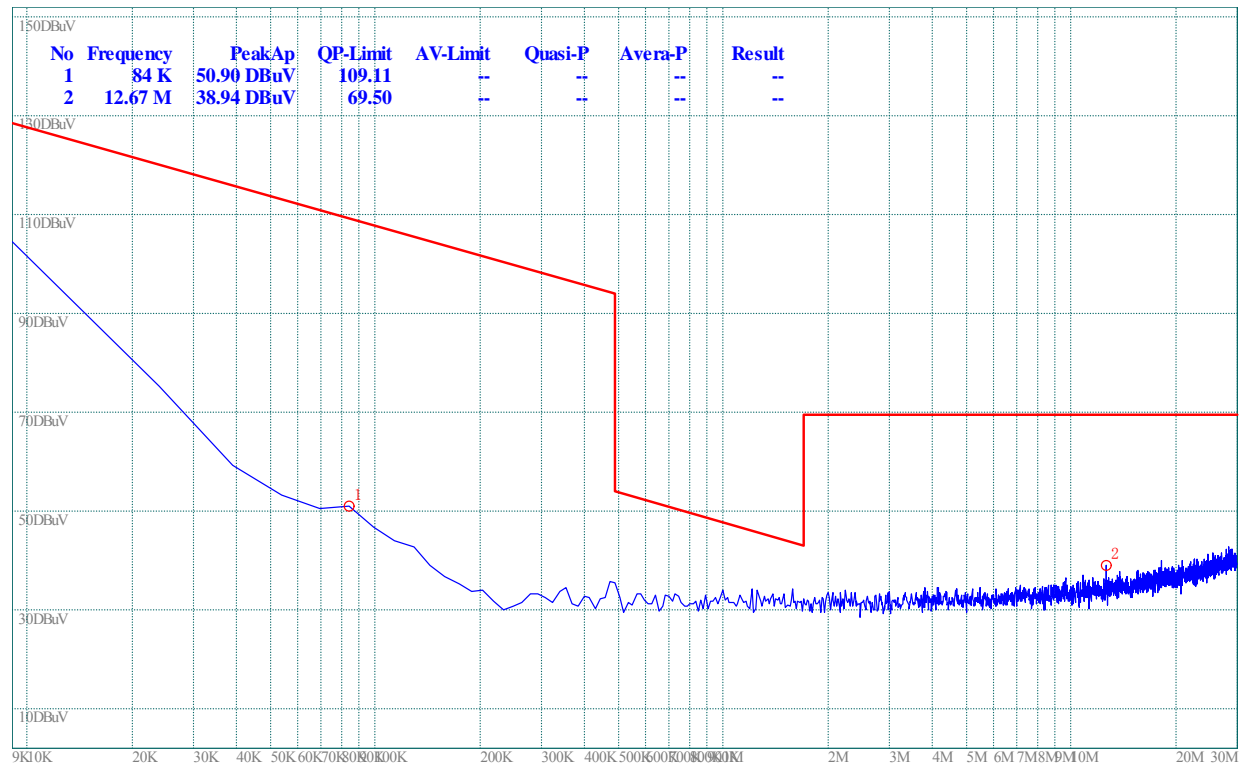
(Plot I.3: Antenna Vertical, 30MHz to 25GHz)

#### 2.8.3.4. 802.11n-40MHz Test mode

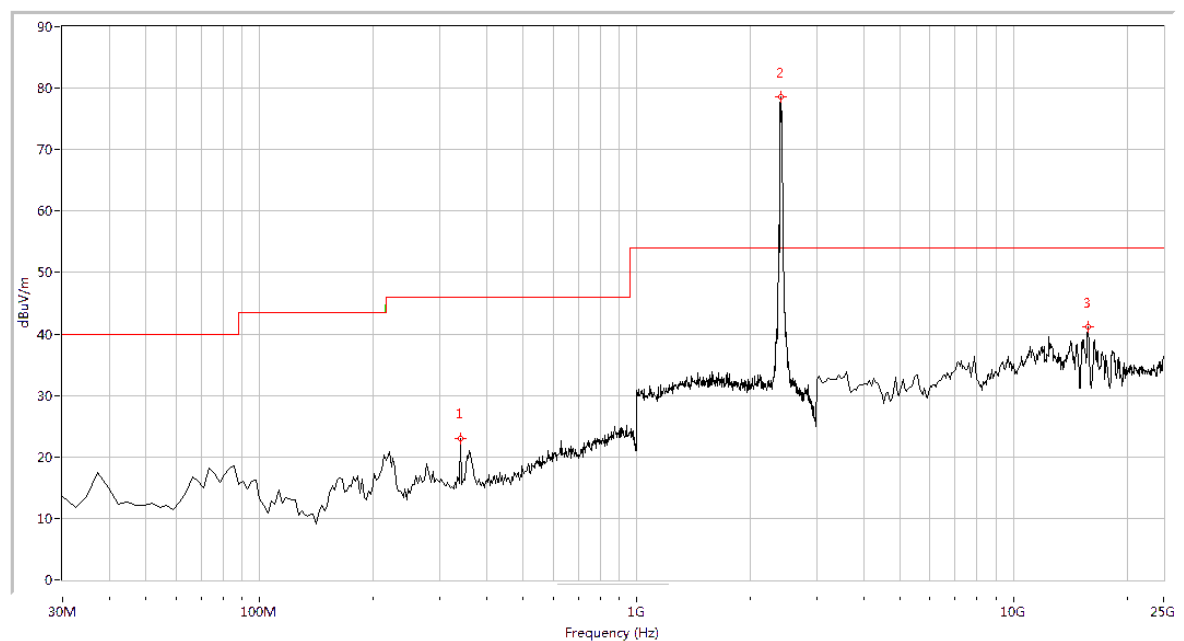
##### A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



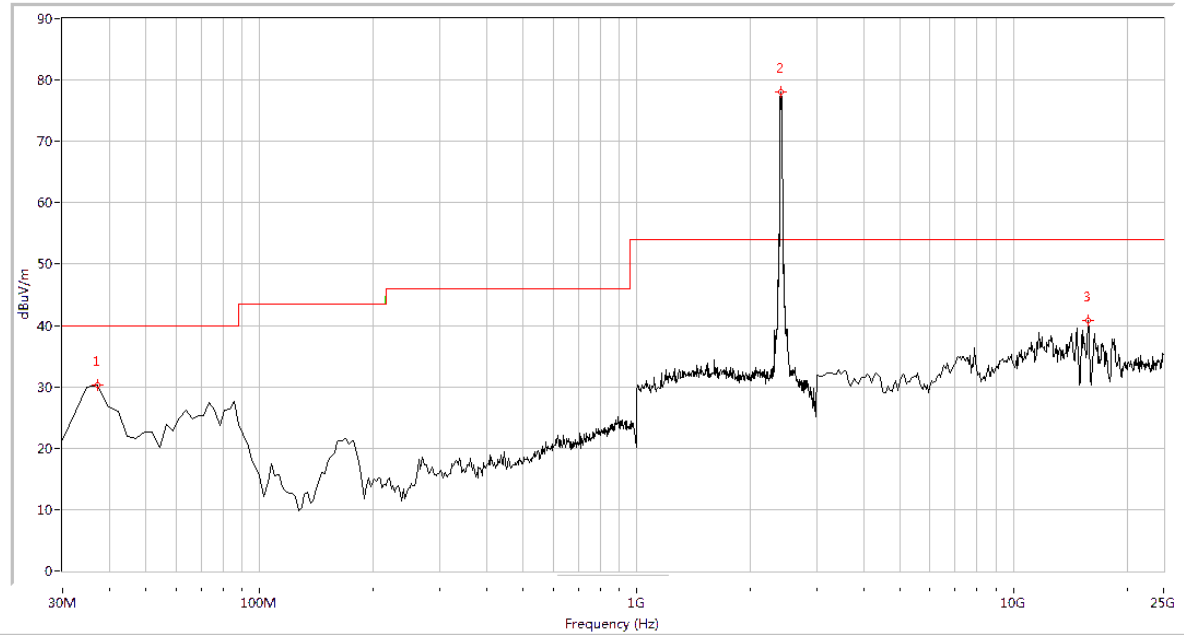


(Plot J.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
342.045	22.97	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2412.000	78.54	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15728.180	41.20	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

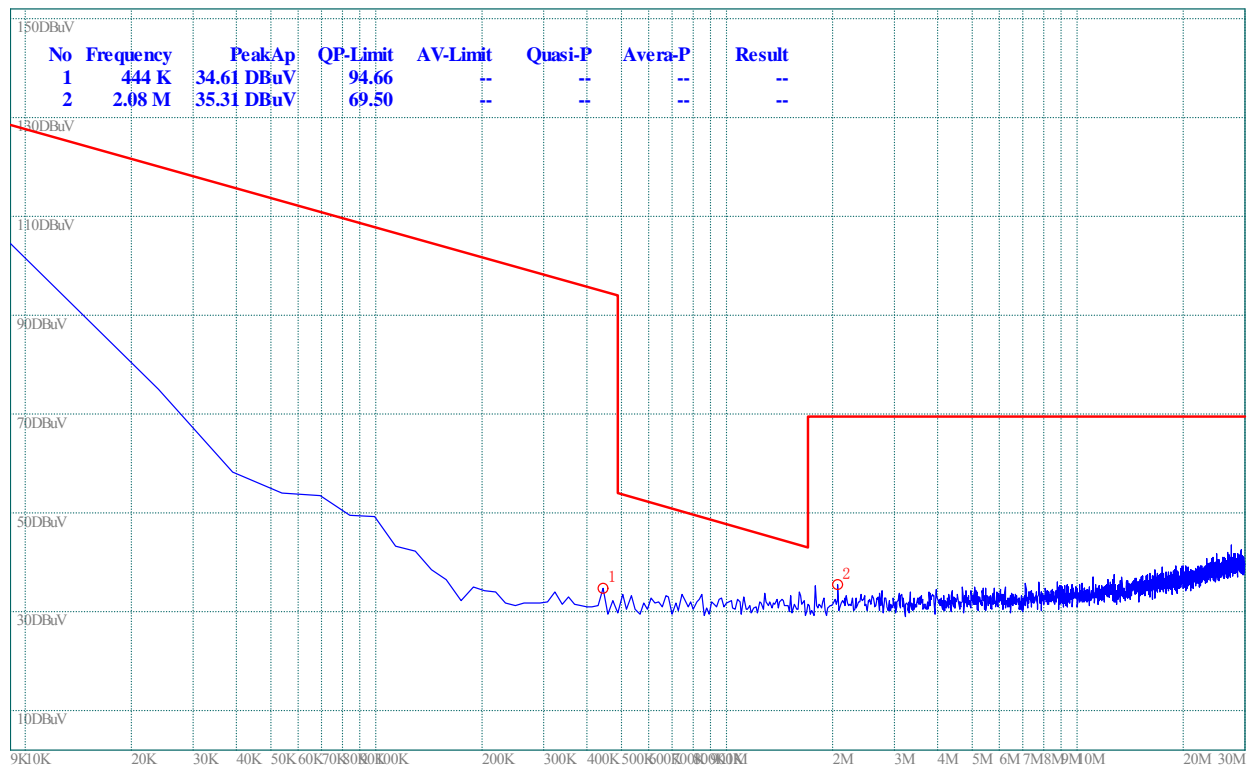
(Plot J.2: Antenna Horizontal, 30MHz to 25GHz)



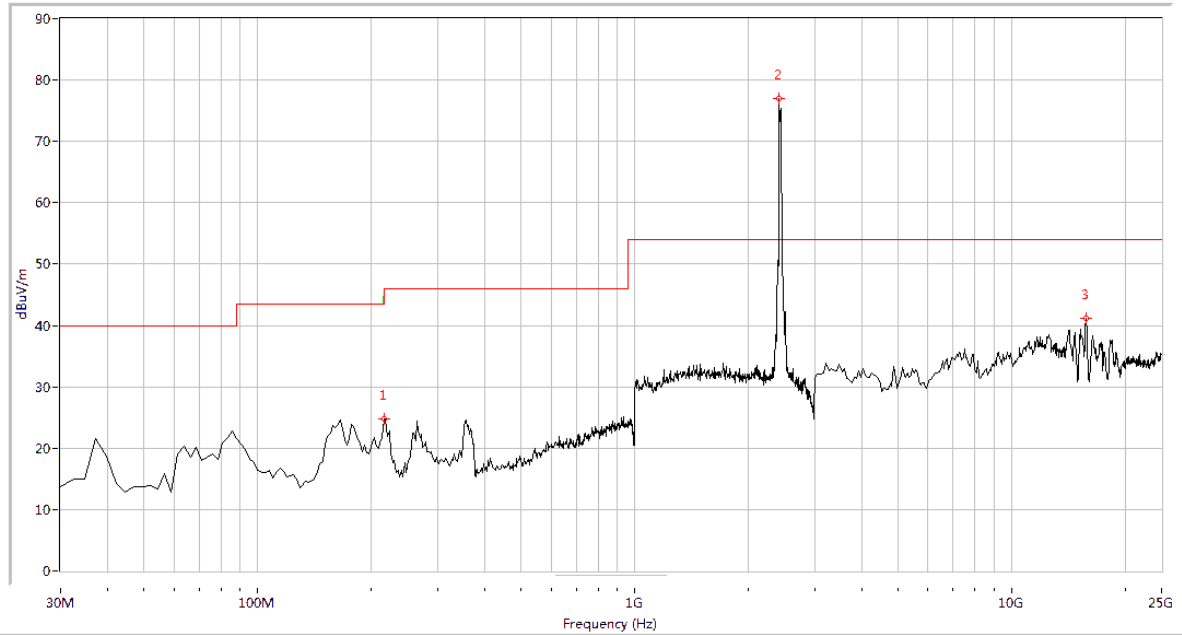
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	30.21	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2412.000	78.12	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.78	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot J.3: Antenna Vertical, 30MHz to 25GHz)

### Plot for Channel = 6

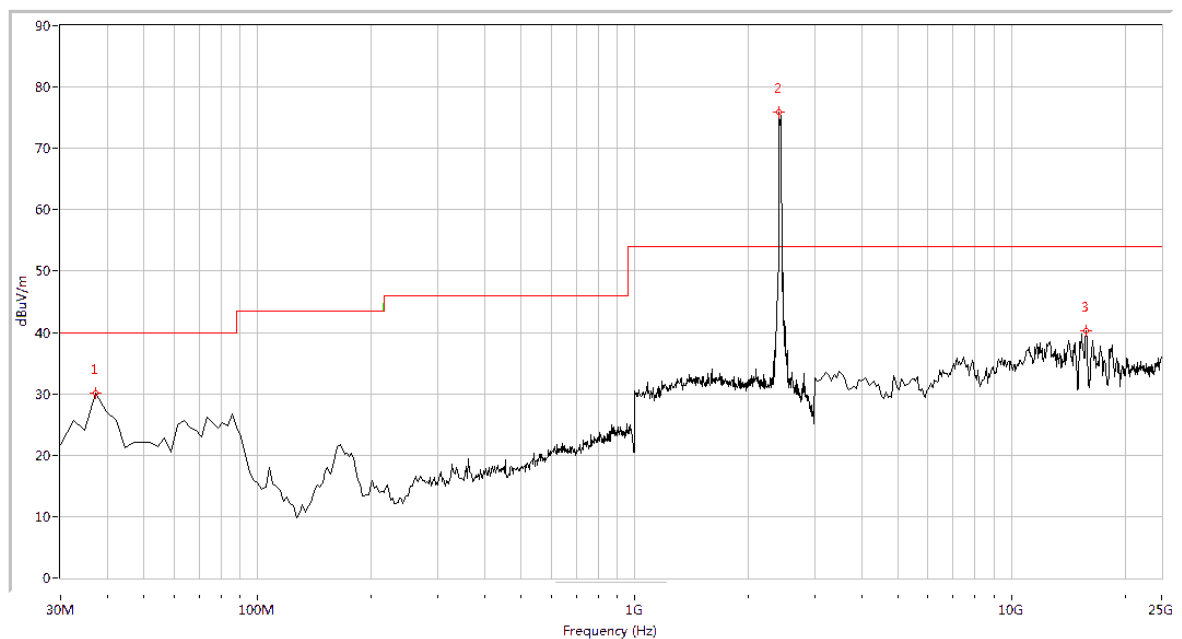


(Plot K.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
216.259	24.81	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2437.000	76.97	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15728.180	41.22	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

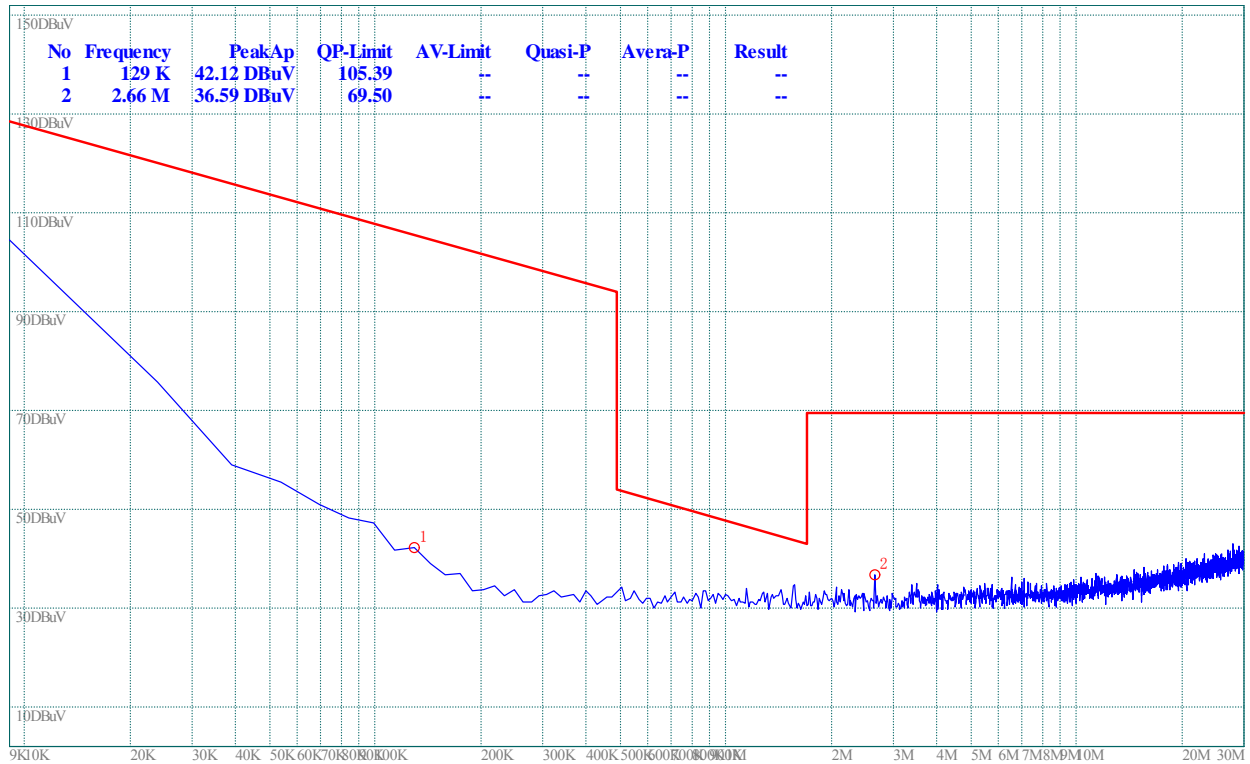
(Plot K.2: Antenna Horizontal, 30MHz to 25GHz)



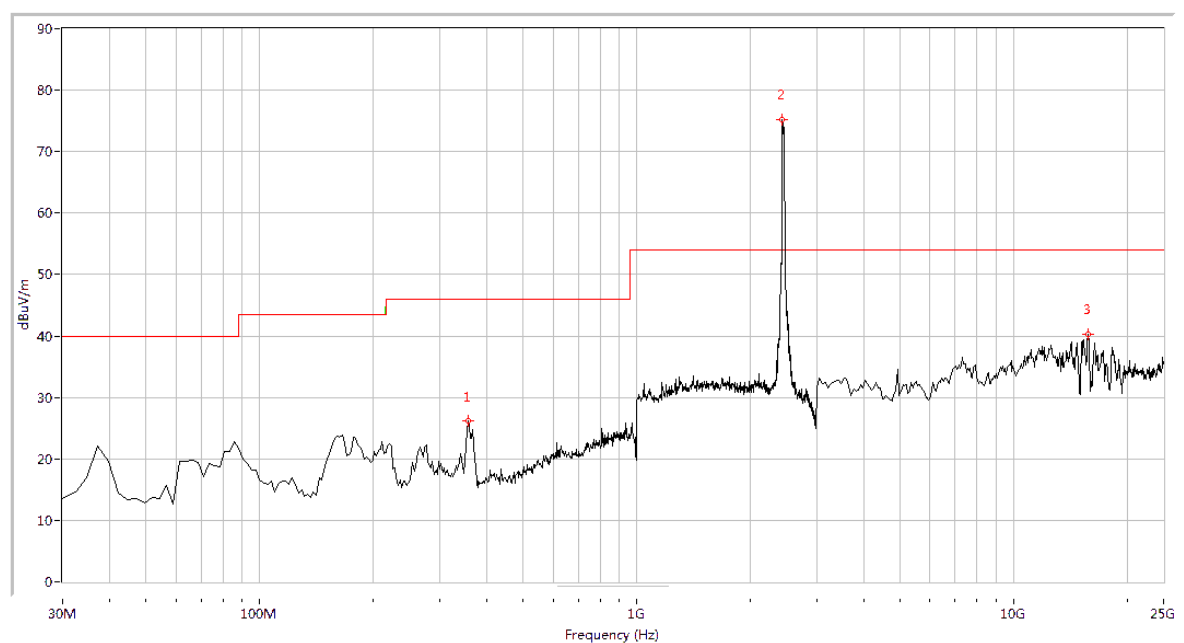
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	30.05	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2437.000	75.98	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15728.180	40.29	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot K.3: Antenna Vertical, 30MHz to 25GHz)

# Plot for Channel = 11

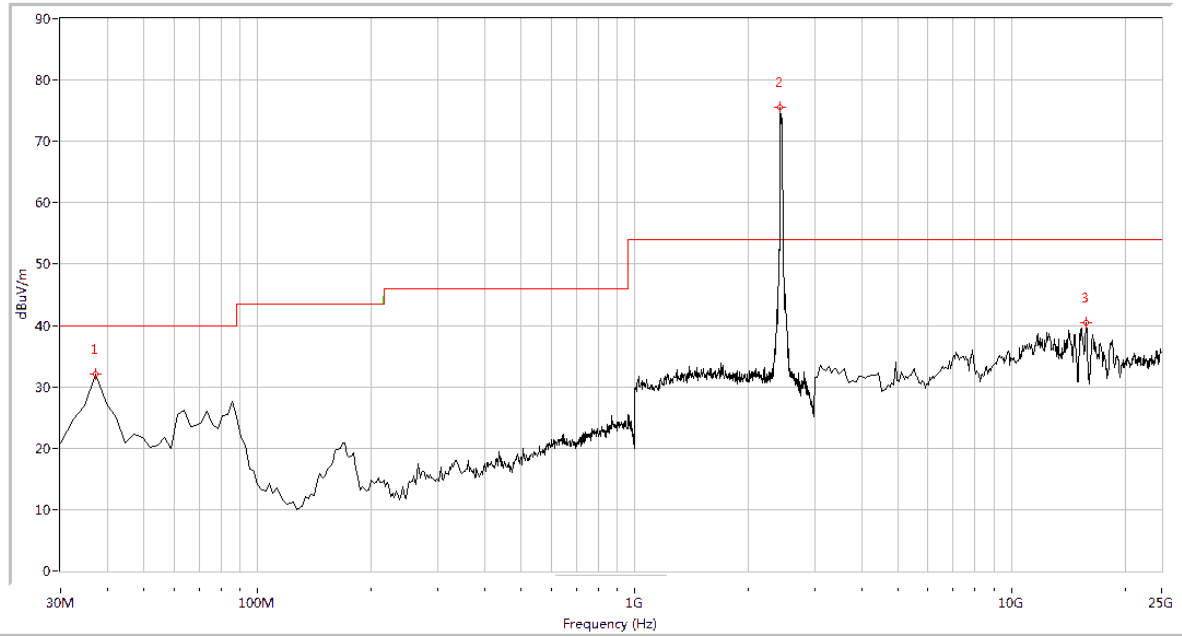


(Plot L.1: 9kHz to 30MHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
356.559	26.15	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
2437.000	75.18	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
15728.180	40.19	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot L.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
37.257	32.10	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
2437.000	75.49	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
15783.042	40.46	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot L.3: Antenna Vertical, 30MHz to 25GHz)

## **2.9. RF exposure evaluation**

### **2.9.1. Requirement**

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of Commission's guideline.

### **2.9.2. Result:**

Please refer to SAR report.

**\*\* END OF REPORT \*\***