

**FCC 47 CFR PART 15 SUBPART E &  
INDUSTRY CANADA RSS-247**

**TEST REPORT**

**For**

**Wi-Fi (11a/b/g/n/ac 2Tx2R) + BT (V4.1 LE) SDIO Combo Module**

**Model: WCBN4503M**

**Trade Name: LITE-ON**

*Issued to*

**Lite-On Technology Corp.**

**Bldg. C, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C**

*Issued by*

**Compliance Certification Services Inc.**

**No.11, Wugong 6th Rd., Wugu Dist.,  
New Taipei City 24891, Taiwan. (R.O.C.)**

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**Issued Date: January 15, 2016**



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**Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	January 15, 2016	Initial Issue	ALL	Doris Chu
01	February 22, 2016	1. Modify Test methodology	P.7	Doris Chu

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## 1. TEST RESULT CERTIFICATION

**Applicant:** Lite-On Technology Corp.  
Bldg. C, 90, Chien 1 Road, Chung Ho, New Taipei City  
23585, Taiwan, R.O.C

**Manufacturer:** Lite-On Technology (Changzhou) CO., LTD.  
A9 Building, No.88, Yanghu Road, Wujin Hi-Tech Industrial  
Development Zone, Changzhou City, Jiangsu Province, P. R.  
China

**Equipment Under Test:** Wi-Fi (11a/b/g/n/ac 2Tx2R) + BT (V4.1 LE) SDIO Combo  
Module

**Model Number:** WCBN4503M

**Trade Name:** LITE-ON

**Date of Test:** November 20 ~ December 30, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart E Industry Canada RSS-247 Issue 1	No non-compliance noted

### We hereby certify that:

Compliance Certification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The test results of this report relate only to the tested sample identified in this report.

*Approved by*

*Reviewed by*



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Miller Lee  
Manager  
Compliance Certification Services Inc.

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Angel Cheng  
Section Manager  
Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

<b>Product</b>	Wi-Fi (11a/b/g/n/ac 2Tx2R) + BT (V4.1 LE) SDIO Combo Module
<b>Model Number</b>	WCBN4503M
<b>Trade Name</b>	LITE-ON
<b>Model Discrepancy</b>	N/A
<b>Power Supply</b>	Powered from host device
<b>Received Date</b>	November 2, 2015
<b>Frequency Range</b>	IEEE 802.11a/ IEEE 802.11n HT 20 MHz: 5745~5825 MHz IEEE 802.11n HT 40 MHz: 5755~5795 MHz IEEE 802.11ac VHT 80 mode: 5775MHz
<b>Transmit Power</b>	IEEE 802.11a mode: 16.54 dBm IEEE 802.11n HT 20 MHz mode: 18.11 dBm IEEE 802.11n HT 40 MHz mode: 16.94 dBm IEEE 802.11ac VHT 80 MHz mode: 14.22 dBm
<b>Modulation Technique &amp; Transmit Data Rate</b>	IEEE 802.11a mode: OFDM (54, 48, 36, 24, 18, 12, 9, 6 Mbps) IEEE 802.11n HT 20 mode: OFDM (6.5, 7.2, 13, 14.4, 14.44, 19.5, 21.7, 26, 28.9, 39, 43.3, 52, 57.8, 58.5, 65.0, 72.2, 78, 86.67, 104, 115.56, 117, 130, 144.44 Mbps) IEEE 802.11n HT 40 mode: OFDM (13.5, 15, 27, 30, 40.5, 45, 54, 60, 81, 90, 108, 120, 121.5, 135, 150, 162, 180, 216, 240, 243, 270, 300 Mbps) IEEE 802.11ac VHT 80 Mode: OFDM (2x2 80MHz, up to 866.6Mbps)

<b>Number of Channels</b>	IEEE 802.11a mode: 5 Channels IEEE 802.11n HT 20 MHz mode: 5 Channels IEEE 802.11n HT 40 MHz mode: 2 Channels IEEE 802.11ac VHT 80 mode: 1 Channels
<b>Antenna Specification</b>	1. Walsin / RFMTA401029IMLB703 PIFA Antenna / 3.77 dBi 2. Walsin / RFMTA340770IMLB701 PIFA Antenna / 3.68 dBi 3. Walsin / RFMTA340740IMLB701 PIFA Antenna / 3.24 dBi 4. Walsin / RFMTA340770IMLB701 PIFA Antenna / 3.68 dBi 5. Walsin / RFMTA340745IMLB701 PIFA Antenna / 2.76 dBi 6. Walsin / RFMTA34071AIMLB701 PIFA Antenna / 2.75 dBi 7. Walsin / RFMTA340745IMLB701 PIFA Antenna / 2.40 dBi

### **3. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.407 and KDB 789033 D02 General UNII Test Procedures New Rules v01r01.

The tests documented in this report were performed in accordance with IC RSS-247, IC RSS-Gen and ANSI C63.10:2013.

This submittal(s) (test report) is intended for IC Certification with Industry Canada RSS-247.

#### **3.1 EUT CONFIGURATION**

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

#### **3.2 EUT EXERCISE**

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

#### **3.3 GENERAL TEST PROCEDURES**

##### **Conducted Emissions**

According to the requirements in ANSI C63.10: 2013, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

##### **Radiated Emissions**

The EUT is placed on the turntable, which is 1.5 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10: 2013.

### 3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

- (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



### 3.5 DESCRIPTION OF TEST MODES

The EUT (model: WCBN4503M) had been tested under operating condition.

The EUT is a 2x2 configuration spatial MIMO (2Tx & 2Rx) without beam forming function that operate in double TX chains and double RX chains. The 2x2 configuration is implemented with two outside TX & RX chains (Chain 0 and 1).

Software used to control the EUT for staying in continuous transmitting and receiving mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

#### **IEEE 802.11a mode / 5745 ~ 5825MHz**

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 6Mbps data rate were chosen for full testing.

#### **IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

Channel Low(5745MHz), Channel Mid(5785MHz) and Channel High(5825MHz) with 6.5Mbps data rate were chosen for full testing.

#### **IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

Channel Low(5755MHz) and Channel High(5795MHz) with 13.5Mbps data rate were chosen for full testing.

#### **IEEE 802.11ac VHT 80 MHz mode for 5775MHz:**

Channel (5775MHz) with 6.5Mbps data rate were chosen for full testing.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

## 4. INSTRUMENT CALIBRATION

### 4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

### 4.2 MEASUREMENT EQUIPMENT USED

#### Equipment Used for Emissions Measurement

**Remark:** Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	12/07/2016
Thermostatic/Humidity Chamber	TAICHY	MHG-150LF	930619	10/07/2016
AC Power Source	EXTECH	6205	1140845	N.C.R
DC Power Supply	ABM	8301HD	D011531	N.C.R
Power Meter	Anritsu	ML2495A	1012009	07/07/2016
Power Sensor	Anritsu	MA2411A	0917072	07/07/2016
Spectrum Analyzer	ROHDE&SCHWARZ	FSV40	101073	07/19/2016

Wugu 966 Chamber A				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510268	01/25/2016
EMI Test Receiver	R&S	ESCI	100064	06/03/2016
Bilog Antenna	Sunol Sciences	JB3	A030105	08/05/2016
Horn Antenna	EMCO	3117	00055165	01/26/2016
Horn Antenna	EMCO	3116	26370	12/24/2016
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Pre-Amplifier	MITEQ	1652-3000	1490939	08/09/2016
Pre-Amplifier	EMC	EMC 012635	980151	06/04/2016
Pre-Amplifier	MITEQ	AMF-6F-260400-40-8P	985646	12/24/2016
Coaxial Cable	Huber+Suhner	102	29212/2	12/24/2016
Coaxial Cable	Huber+Suhner	102	29406/2	12/24/2016
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission room # B				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI	101073	09/08/2016
LISN	R&S	ENV216	101054	06/06/2016
LISN	SCHWARZBECK	NSLK 8127	8127-541	11/22/2016
Capacitive Voltage Probe	FCC	F-CVP-1	100185	03/12/2016
Test S/W	CCS-3A1-CE			

### 4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 1.2575
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

**Remark:** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

## 5 FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 248, Taiwan (R.O.C.)

Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.

Tel: 886-3-324-0332 / Fax: 886-3-324-5235



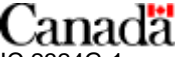
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 5.2 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by American Association for Laboratory Accreditation Program for the specific scope accreditation under Lab Code: 0824-01 to perform Electromagnetic Interference tests according to FCC Part 15 and CISPR 22 requirements. In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, IC 2324G-1 for 3M Semi Anechoic Chamber A, IC 2324G-2 for 3M Semi Anechoic Chamber B.

### 5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210 RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12.2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method -47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

\* No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.

## 6 SETUP OF EQUIPMENT UNDER TEST

### 6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

### 6.2 SUPPORT EQUIPMENT

No	Equipment	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Notebook PC	IBM	7663 (T61)	L3E9812	N/A	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core

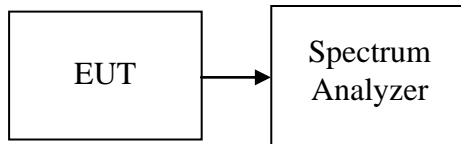
**Remark:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

## 7 RSS-247 REQUIREMENTS

### 7.1 99%BANDWIDTH

#### Test Configuration



#### TEST PROCEDURE

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold.

#### TEST RESULTS

*No non-compliance noted.*

**Test Data****Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz**

Channel	Frequency (MHz)	99%Bandwidth (MHz)
Low	5745	16.8017
Mid	5785	16.8017
High	5825	16.7583

**Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.7134
Mid	5785	17.7134
High	5825	17.7134

**Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.6700
Mid	5785	17.6700
High	5825	17.6700

**Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 0**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.7004
High	5795	36.7004

**Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 1**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	36.4688
High	5795	36.3531

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0**

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5775	77.5687

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1**

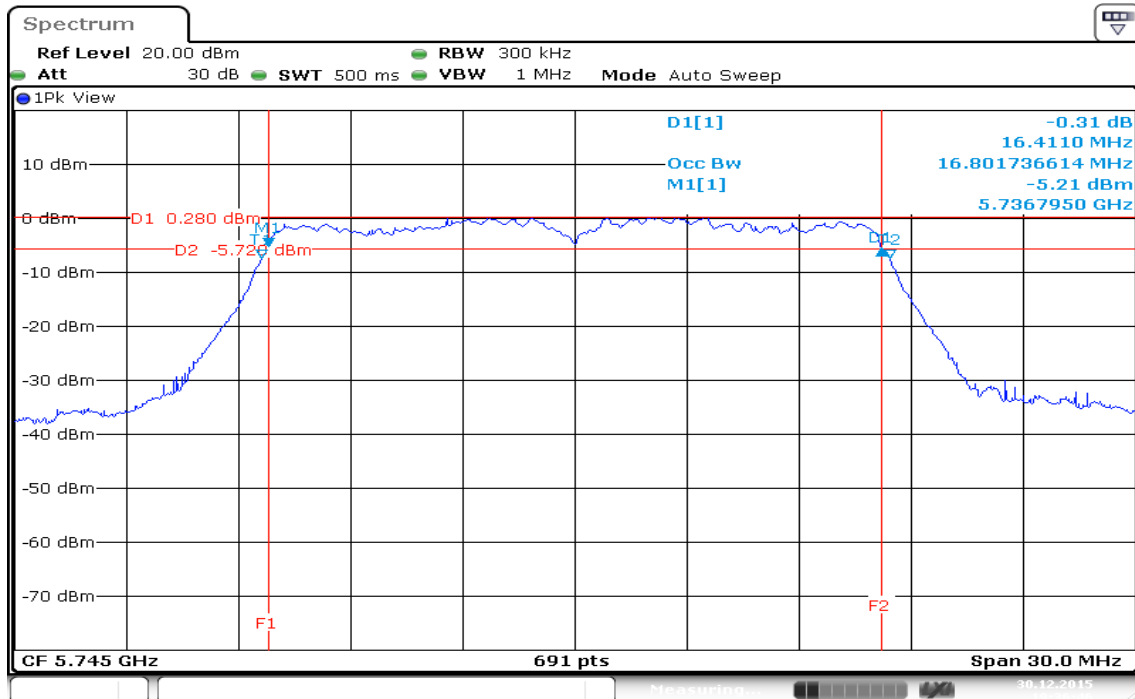
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Mid	5775	77.5687



## Test Plot

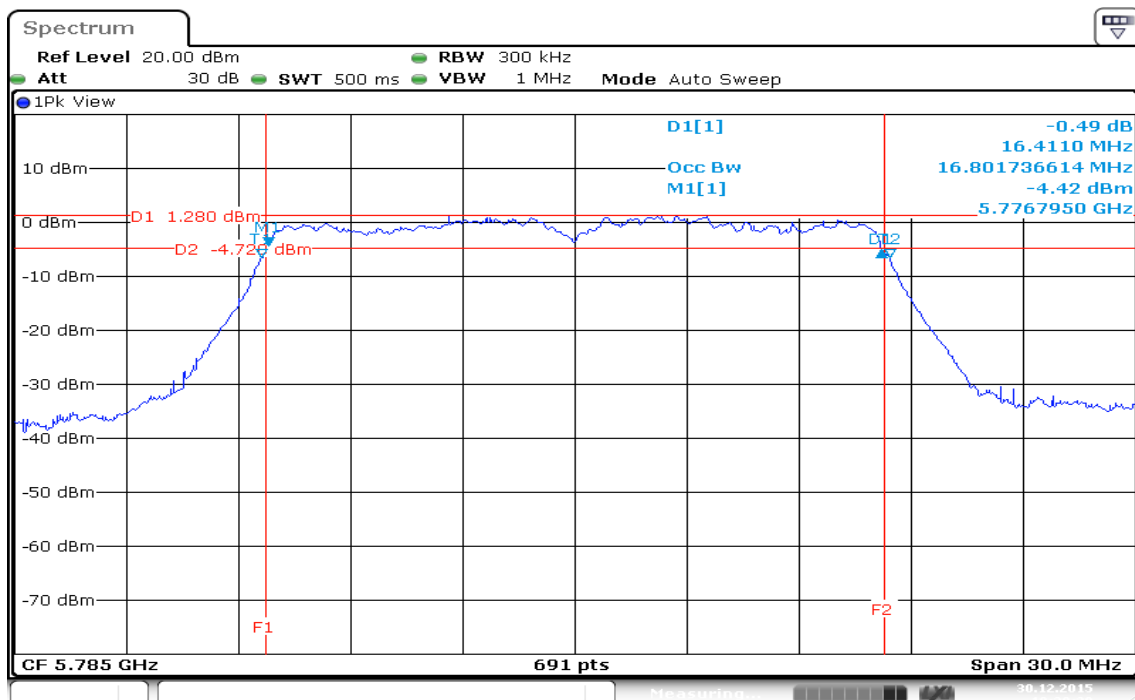
### IEEE 802.11a mode / 5745 ~ 5825MHz

#### 99% Bandwidth (CH Low)



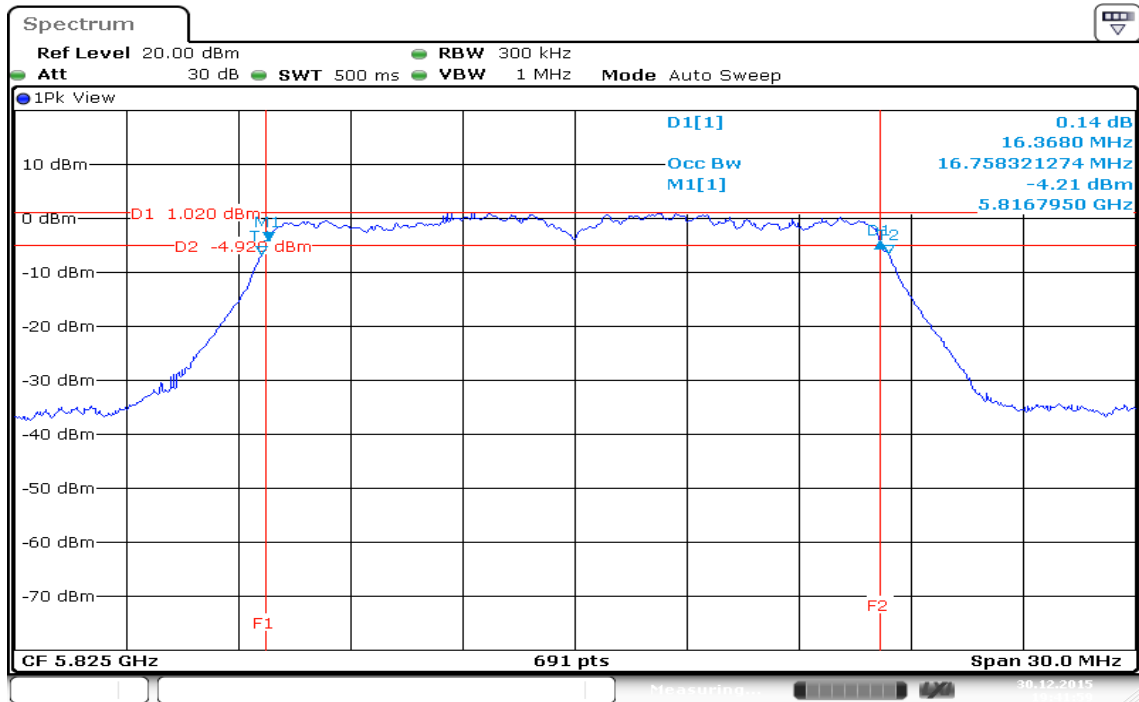
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#### 99% Bandwidth (CH Mid)



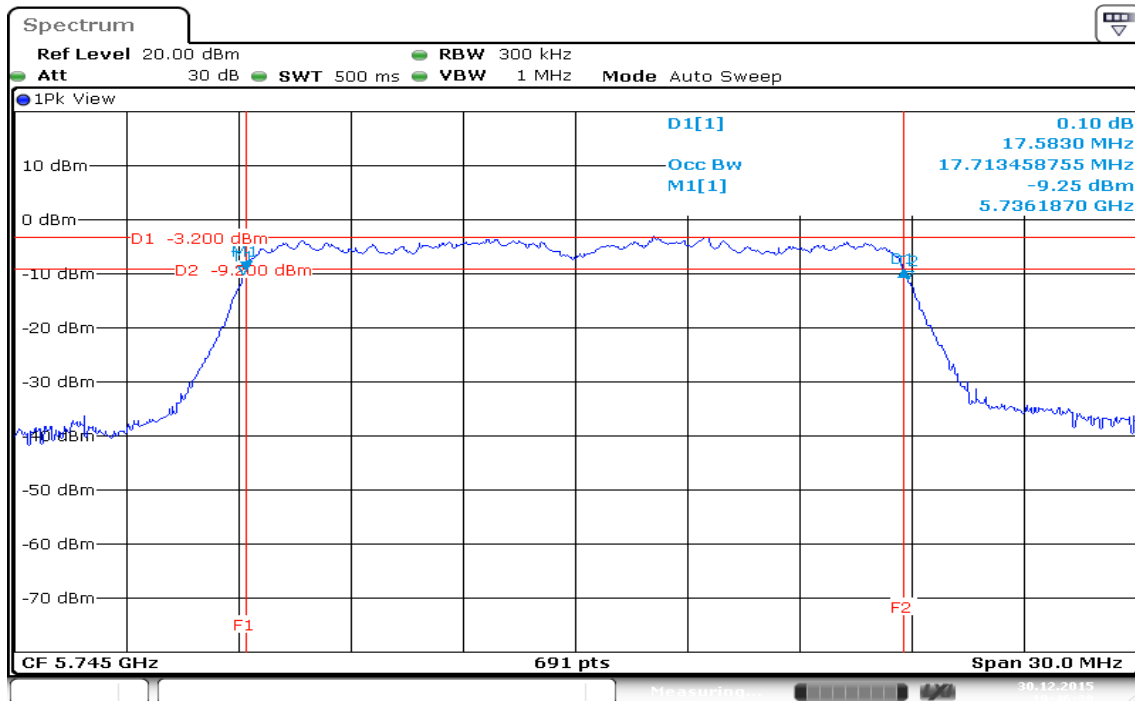
Date: 30.DEC.2015 19:39:28

## 99% Bandwidth (CH High)



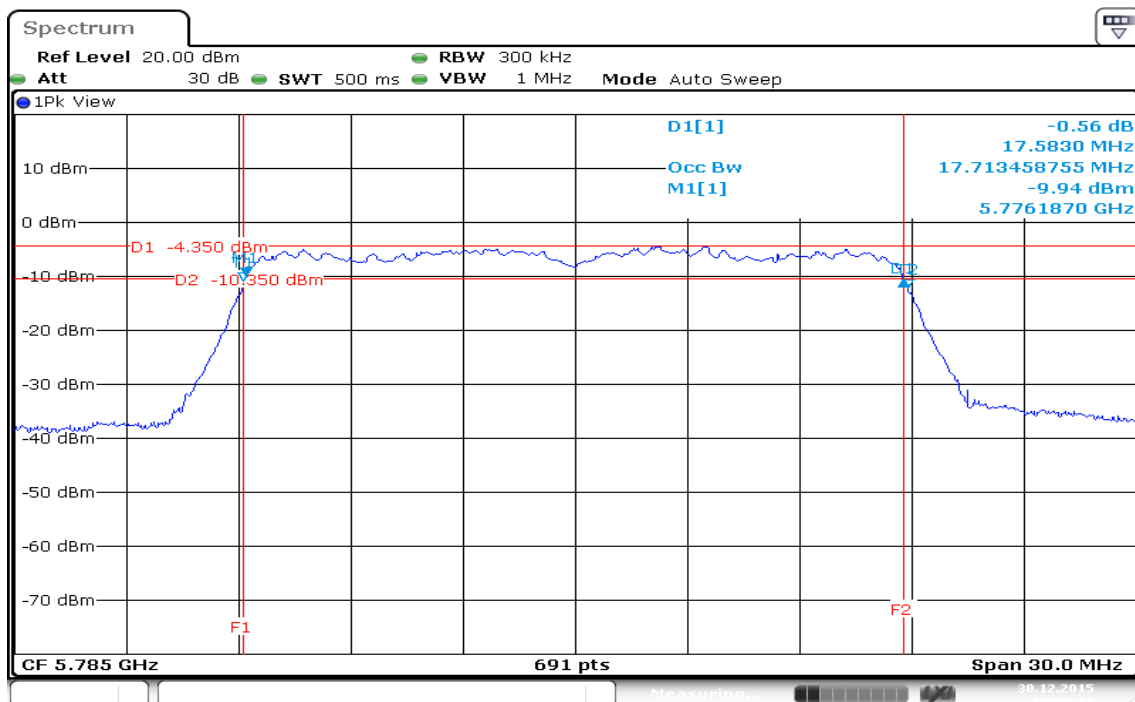
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### 99% Bandwidth (CH Low)



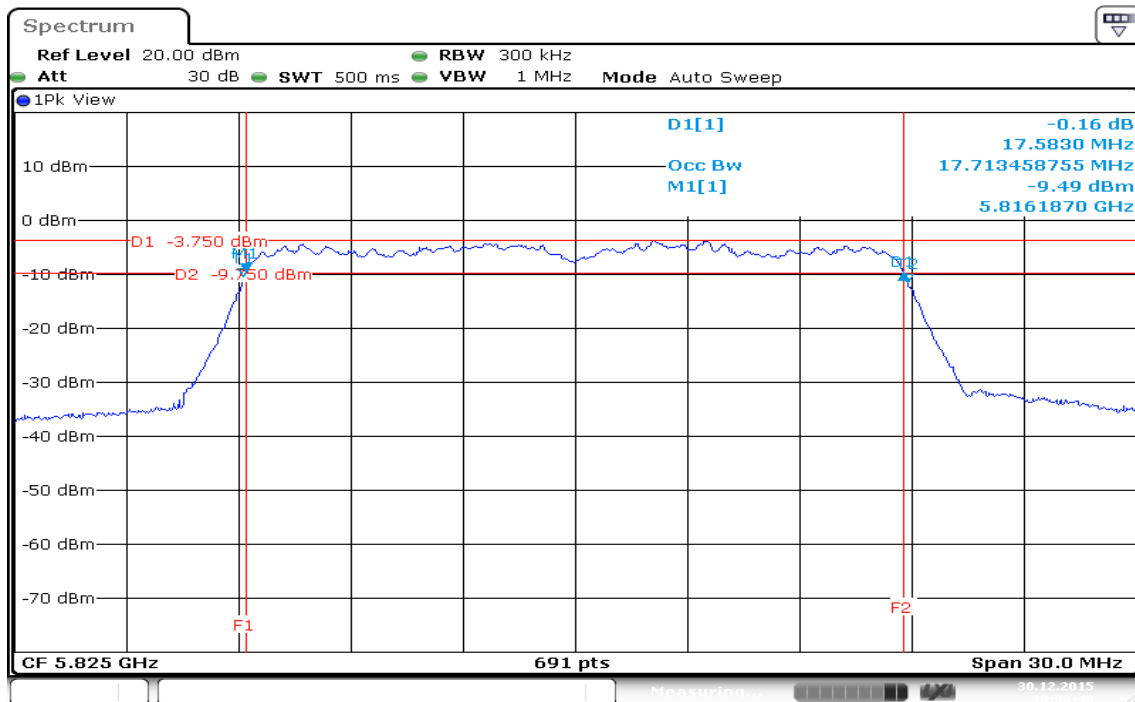
Date: 30.DEC.2015 19:46:39

### 99% Bandwidth (CH Mid)



Date: 30.DEC.2015 19:50:12

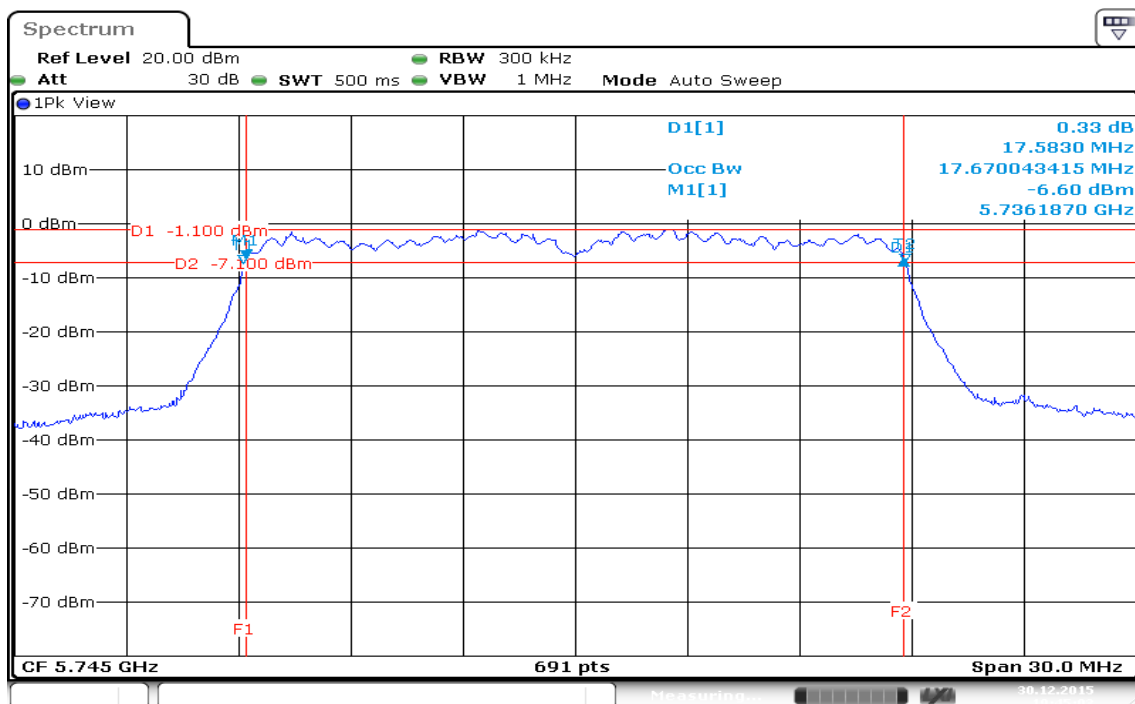
## 99% Bandwidth (CH High)



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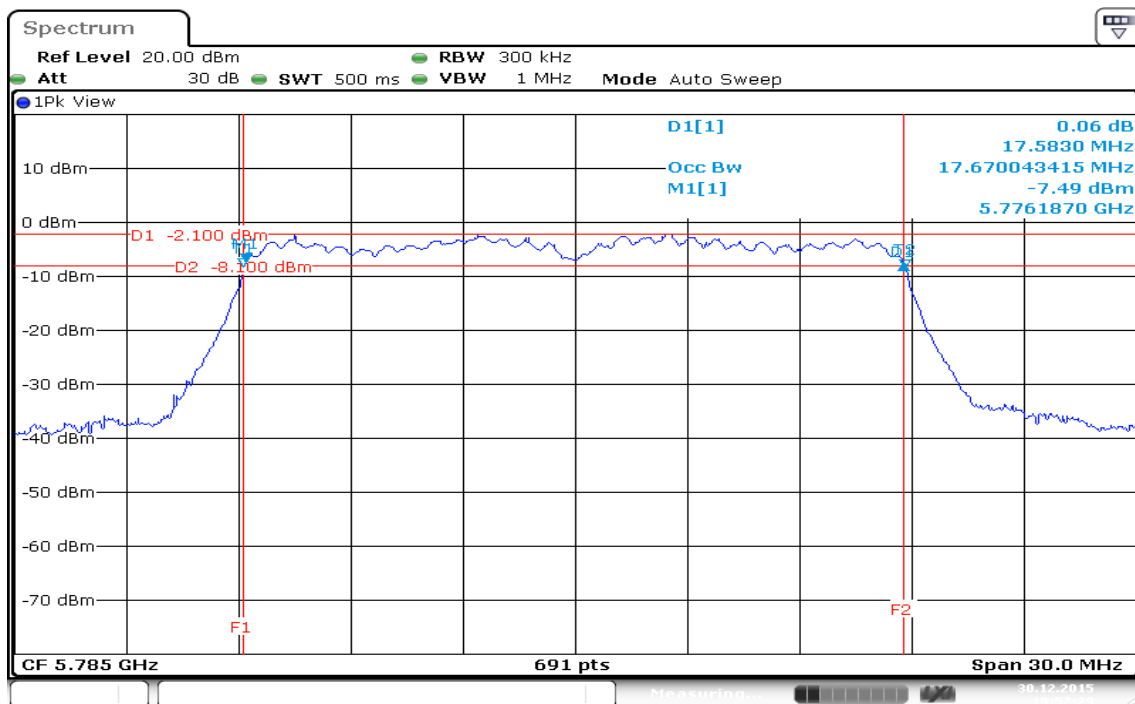
Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

### 99% Bandwidth (CH Low)



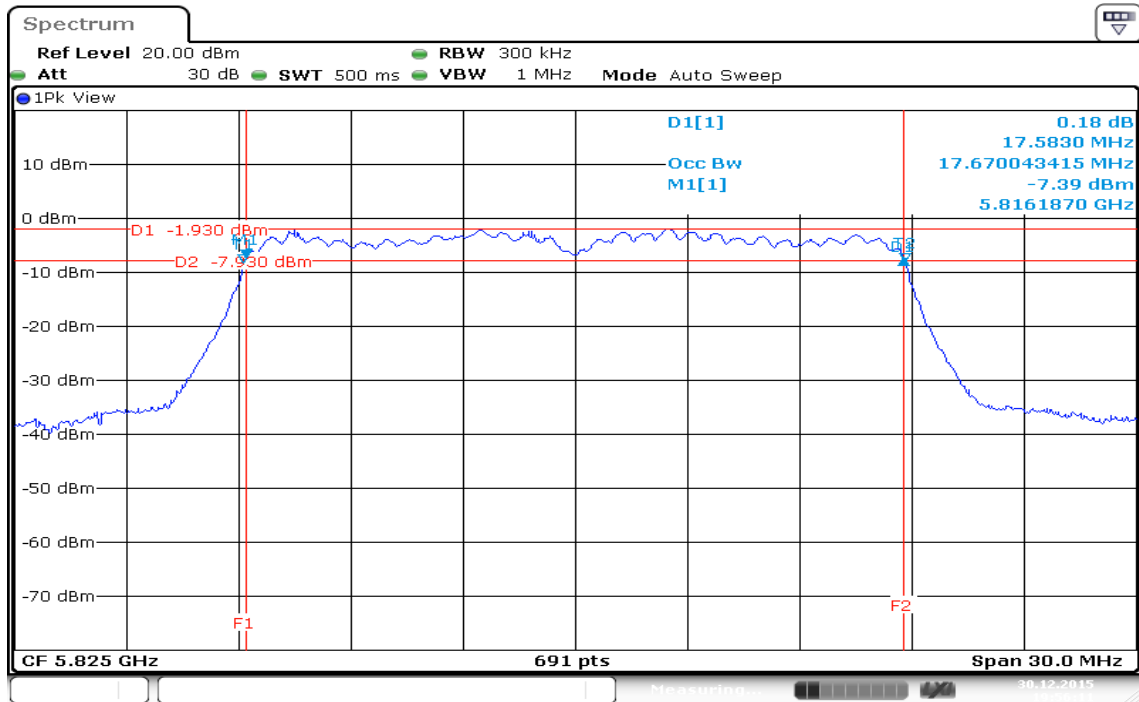
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### 99% Bandwidth (CH Mid)



Date: 30.DEC.2015 19:52:29

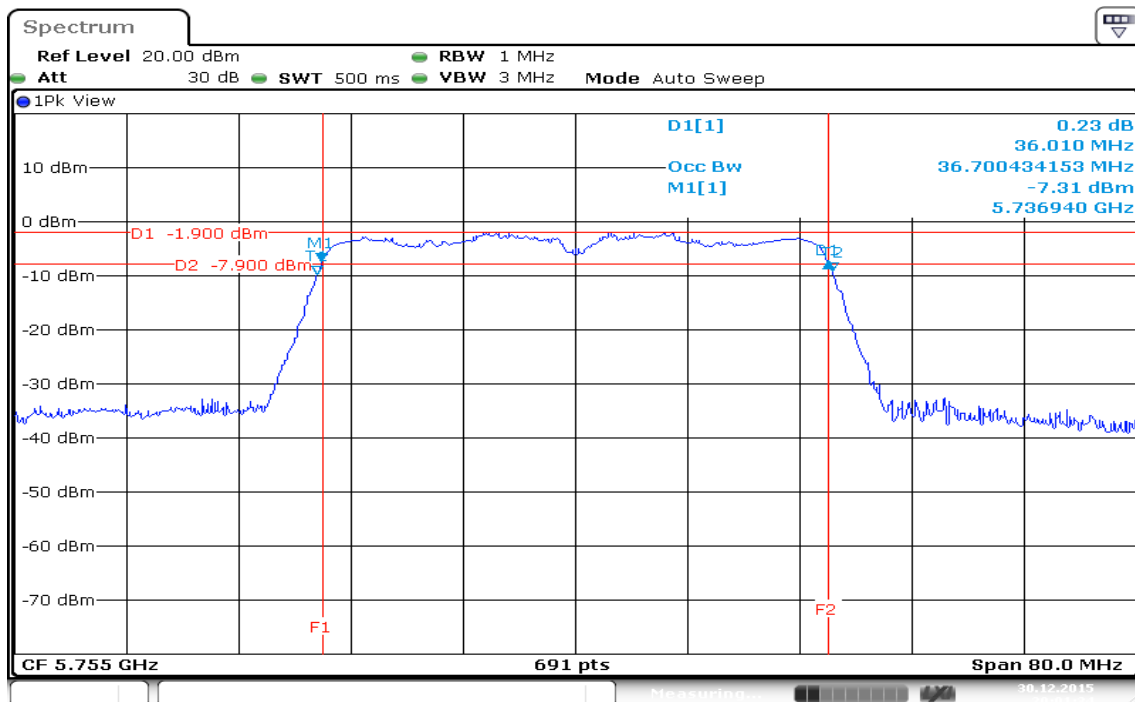
## 99% Bandwidth (CH High)



Date: 30.DEC.2015 19:56:11

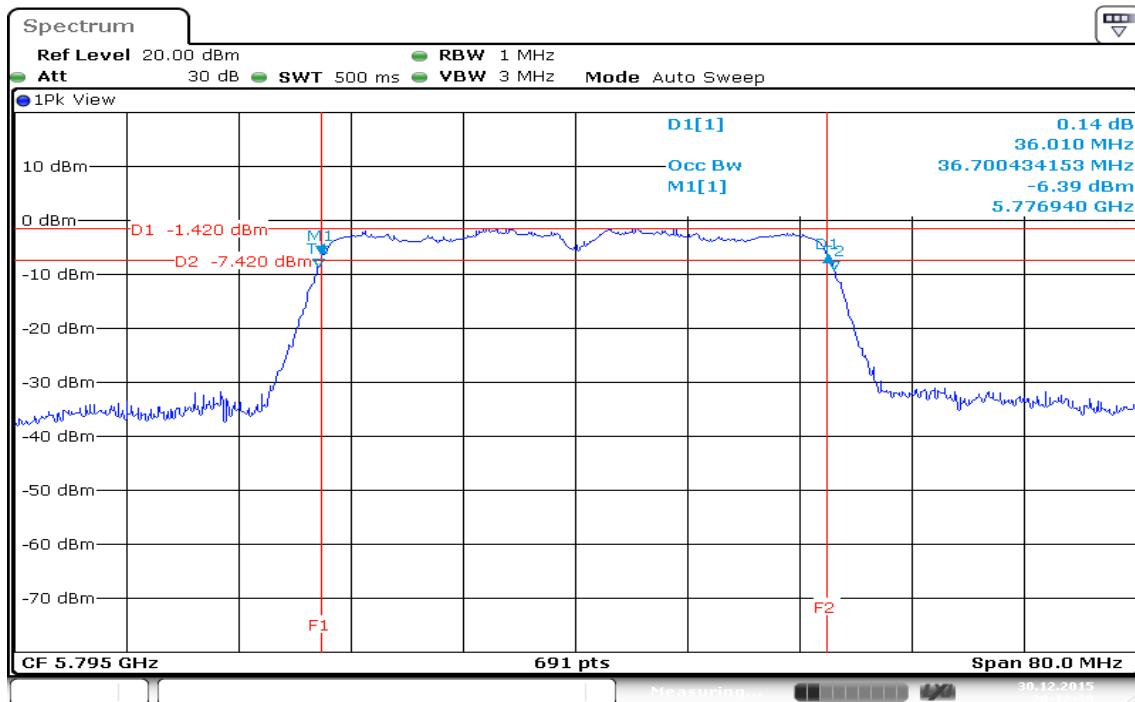
Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 0

### 99% Bandwidth (CH Low)



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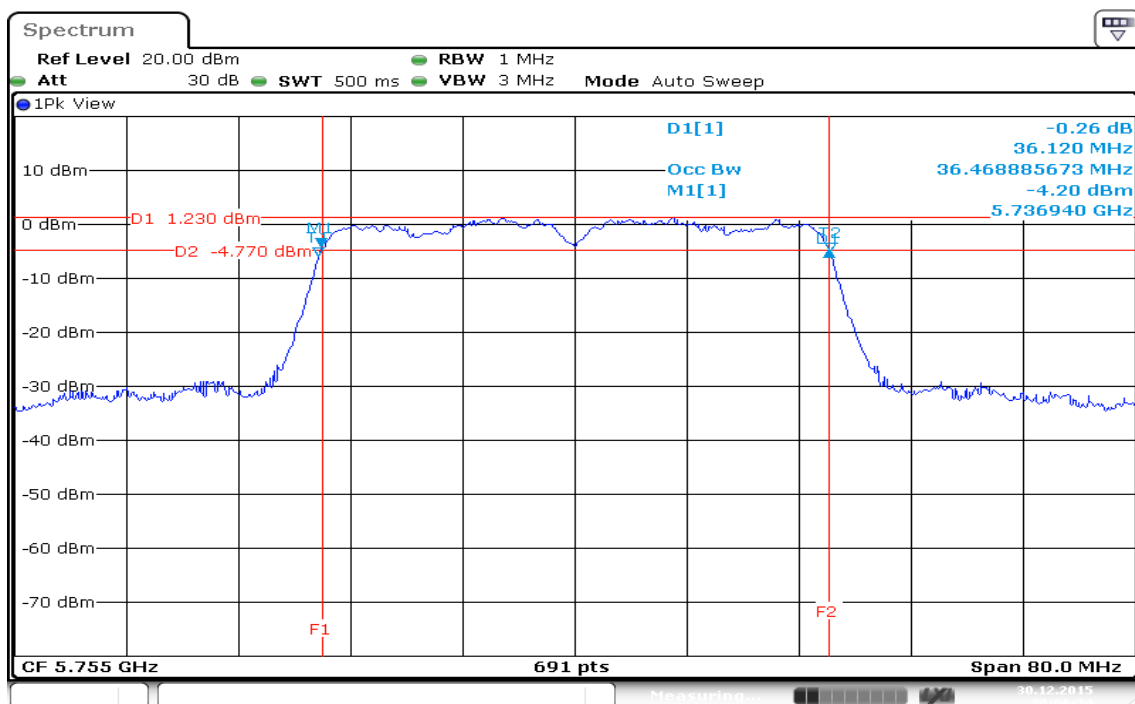
### 99% Bandwidth (CH High)



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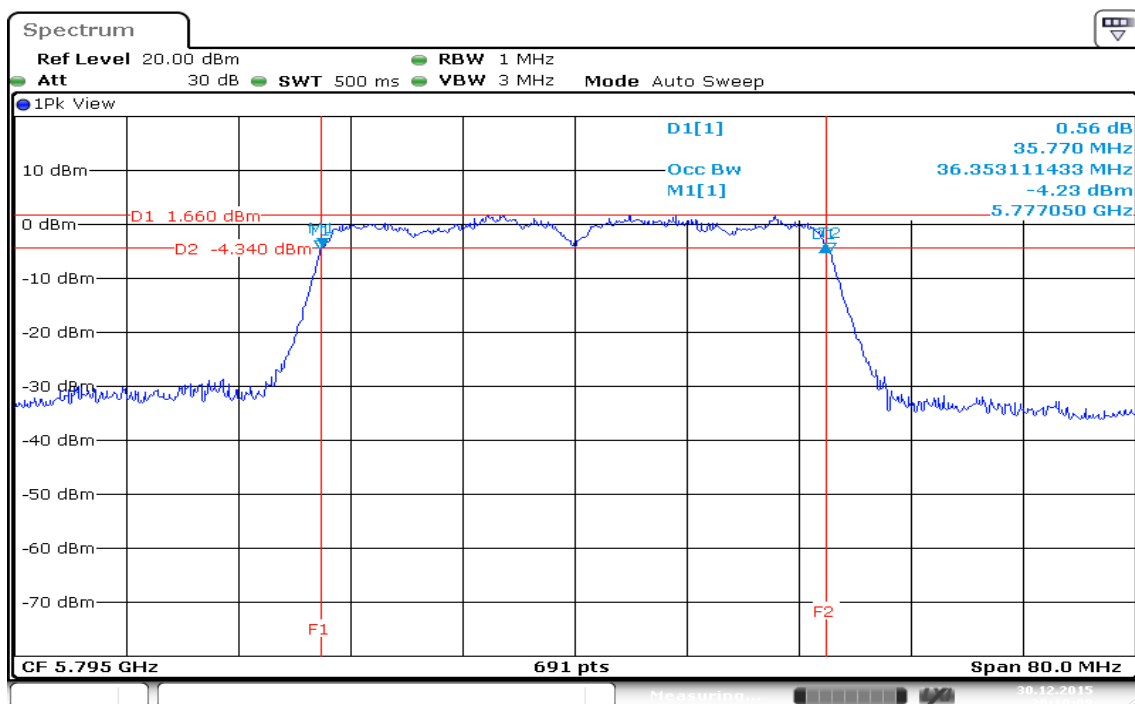
## Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 1

## 99% Bandwidth (CH Low)



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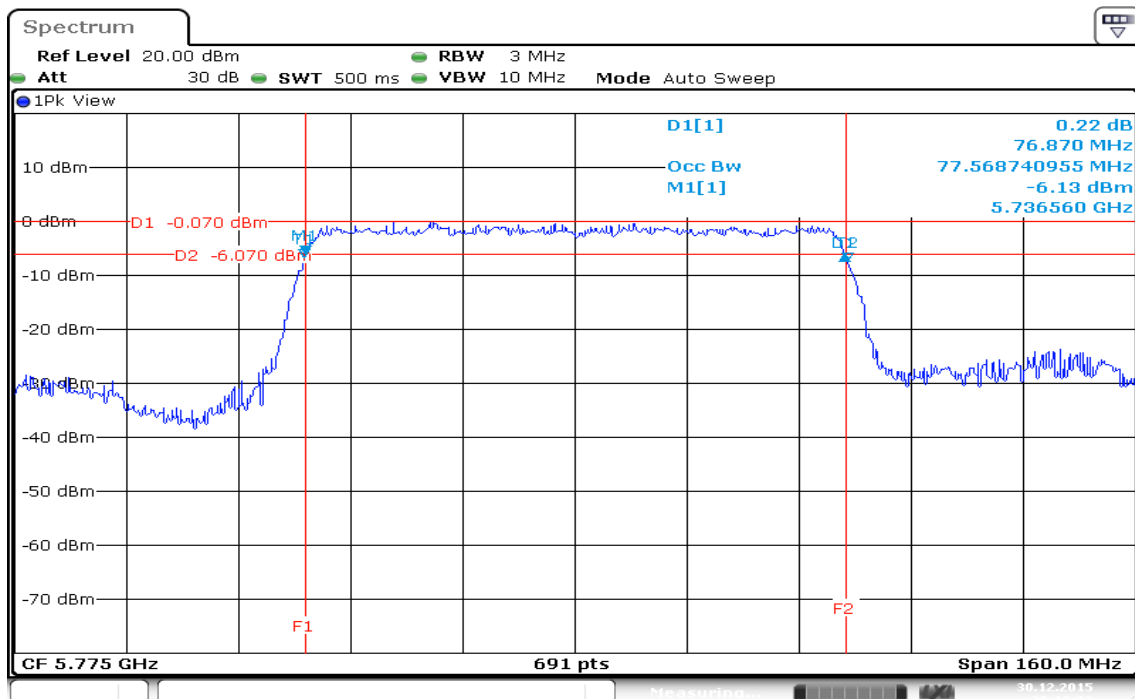
## 99% Bandwidth (CH High)



Date: 30.DEC.2015 20:10:08

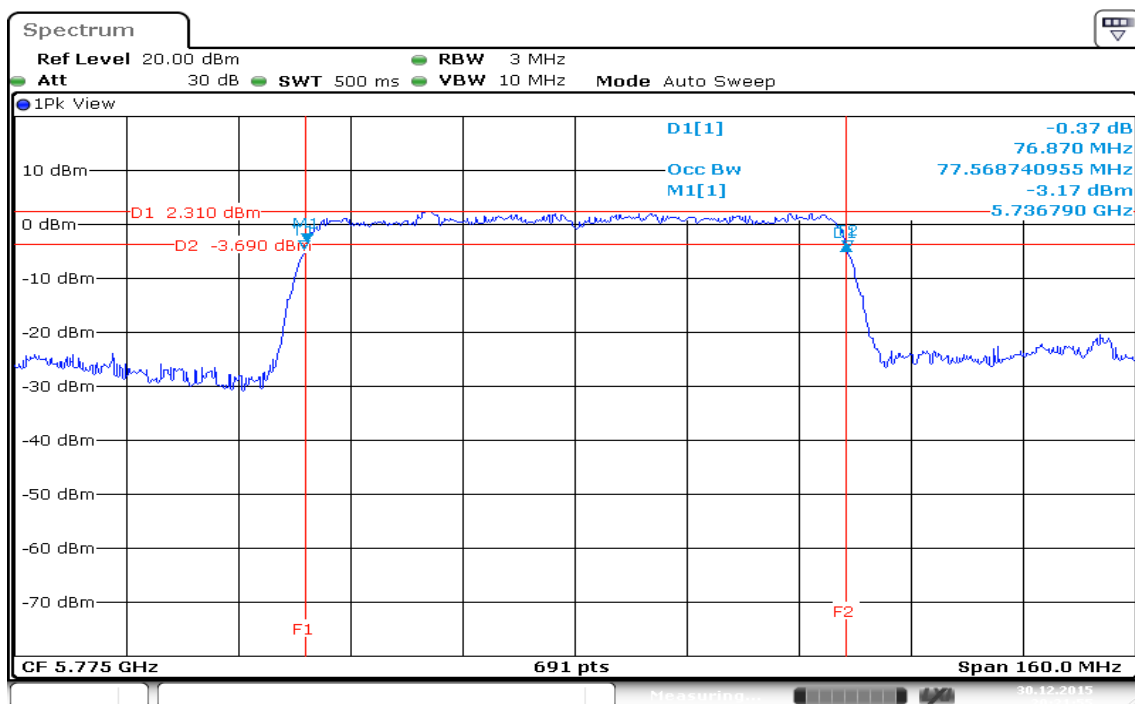


**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0**  
**99% Bandwidth (CH Mid)**



Date: 30.DEC.2015 20:18:33

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1**  
**99% Bandwidth (CH Mid)**



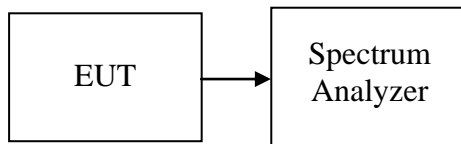
Date: 30.DEC.2015 20:21:55

## 7.2 6DB BANDWIDTH

### **LIMIT**

According to §15.407 & RSS-247§, systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

### **Test Configuration**



### **TEST PROCEDURE**

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW: 100kHz / VBW: 300kHz, Span = 50MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

### **TEST RESULTS**

*No non-compliance noted*

**Test Data****Test mode: IEEE 802.11a mode**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	16.3680	>500	PASS
Mid	5785	16.3680		PASS
High	5825	16.1940		PASS

**Test mode: IEEE 802.11n HT 20 MHz mode / Chain 0**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.5400	>500	PASS
Mid	5785	17.4960		PASS
High	5825	17.5830		PASS

**Test mode: IEEE 802.11n HT 20 MHz mode / Chain 1**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5745	17.4960	>500	PASS
Mid	5785	17.5400		PASS
High	5825	17.4960		PASS

**Test mode: IEEE 802.11n HT 40 MHz mode / Chain 0**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	35.890	>500	PASS
High	5795	35.770		PASS

**Test mode: IEEE 802.11n HT 40 MHz mode / Chain 1**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	5755	35.660	>500	PASS
High	5795	35.430		PASS

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	76.410	>500	PASS

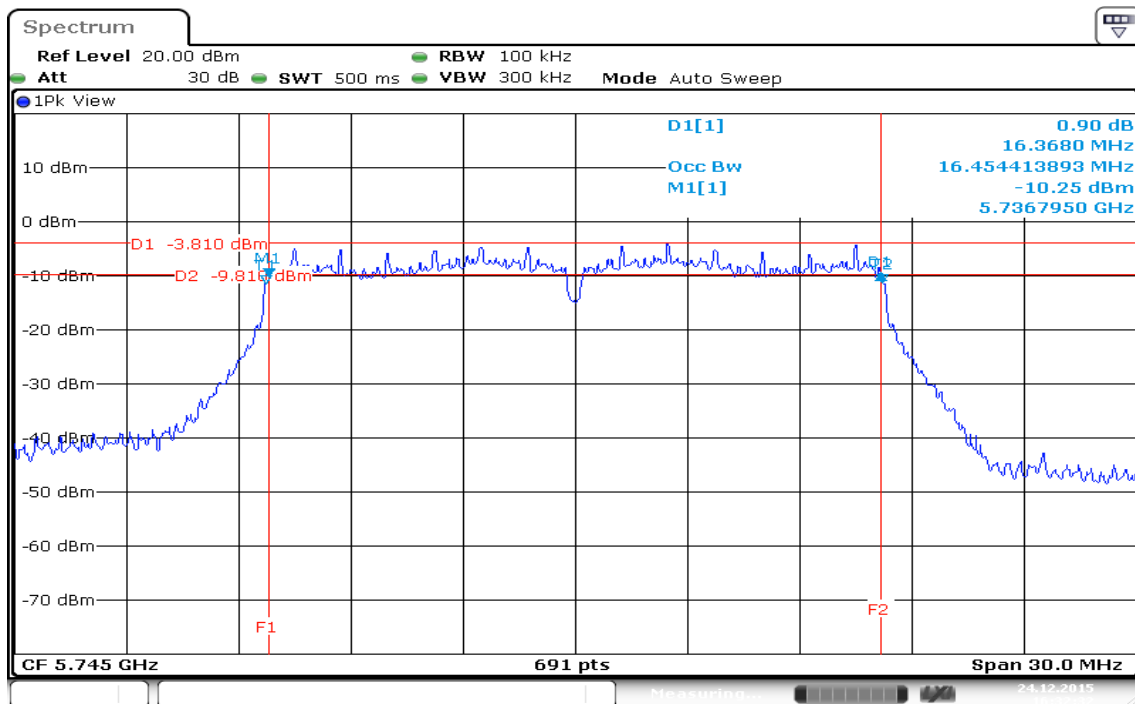
**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1**

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Mid	5755	76.180	>500	PASS

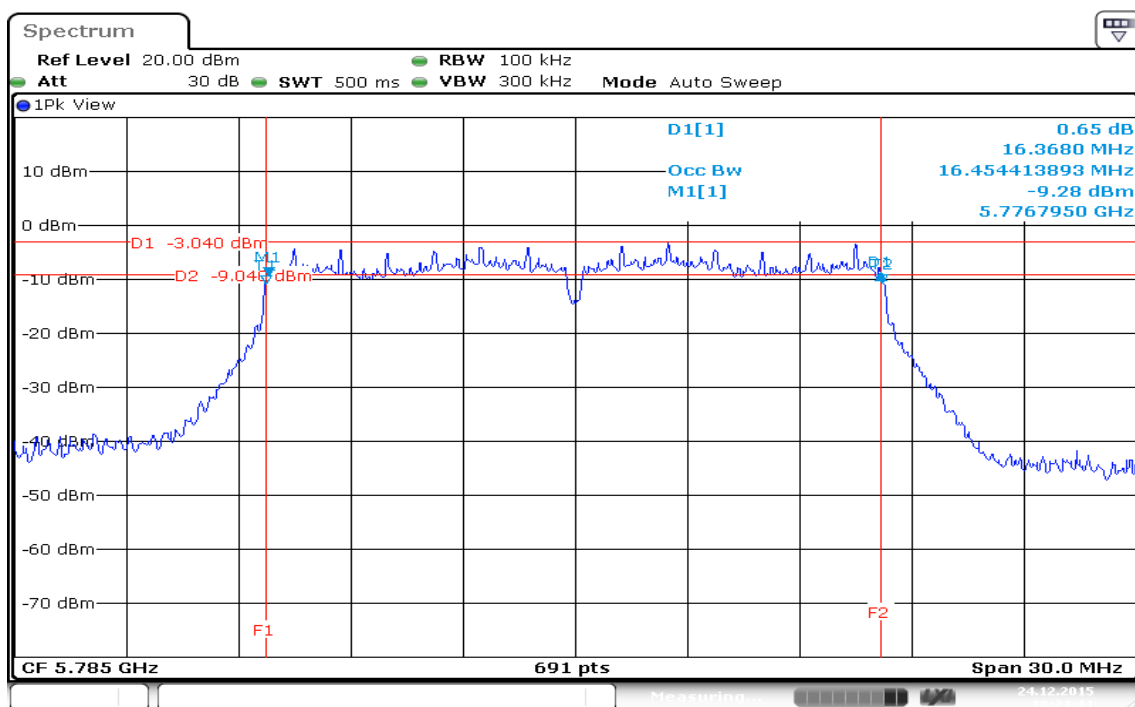
## Test Plot

### IEEE 802.11a mode / 5745 ~ 5825MHz

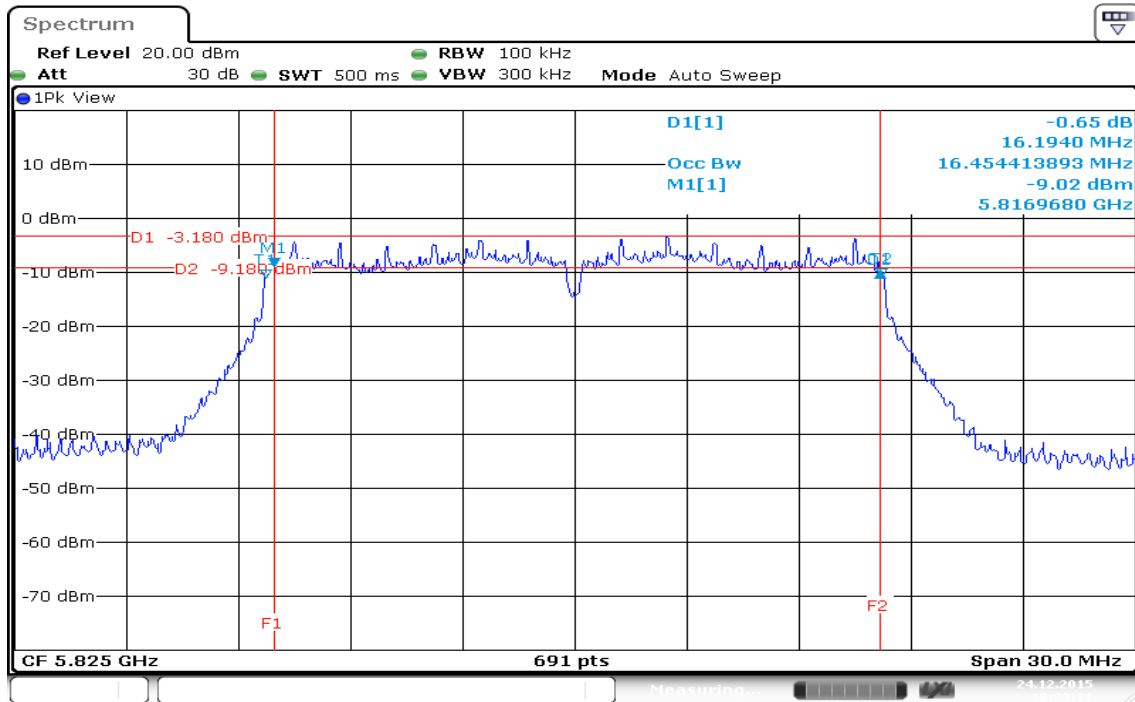
#### 6dB Bandwidth (CH Low)



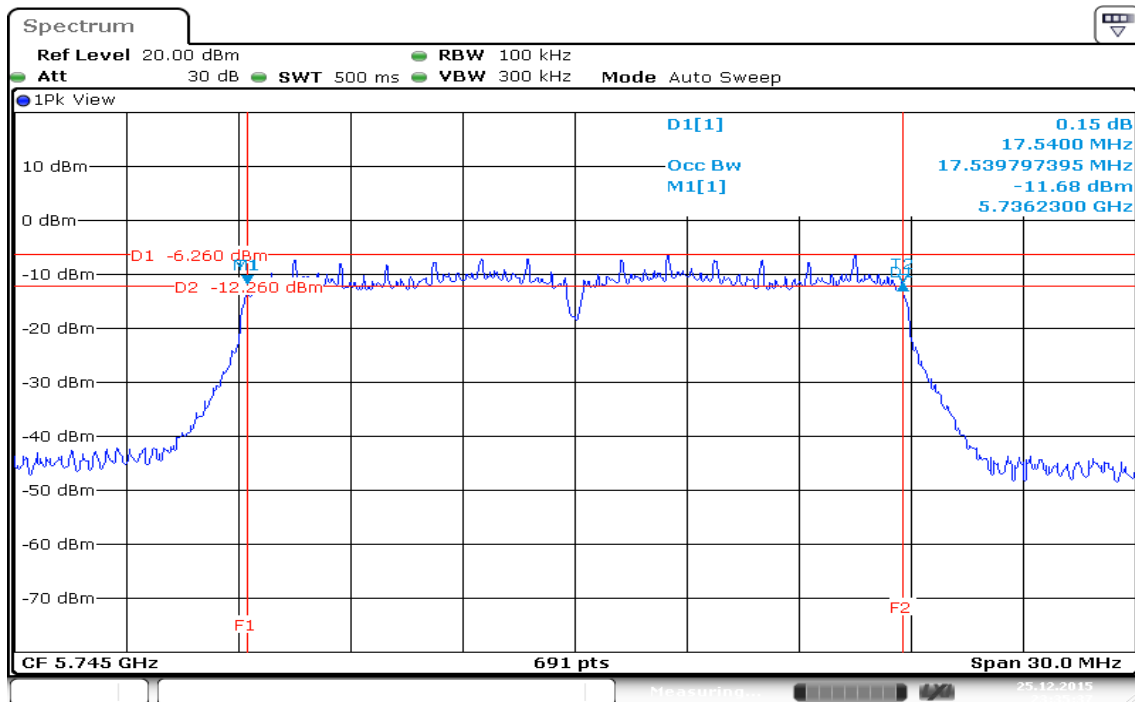
#### 6dB Bandwidth (CH Mid)



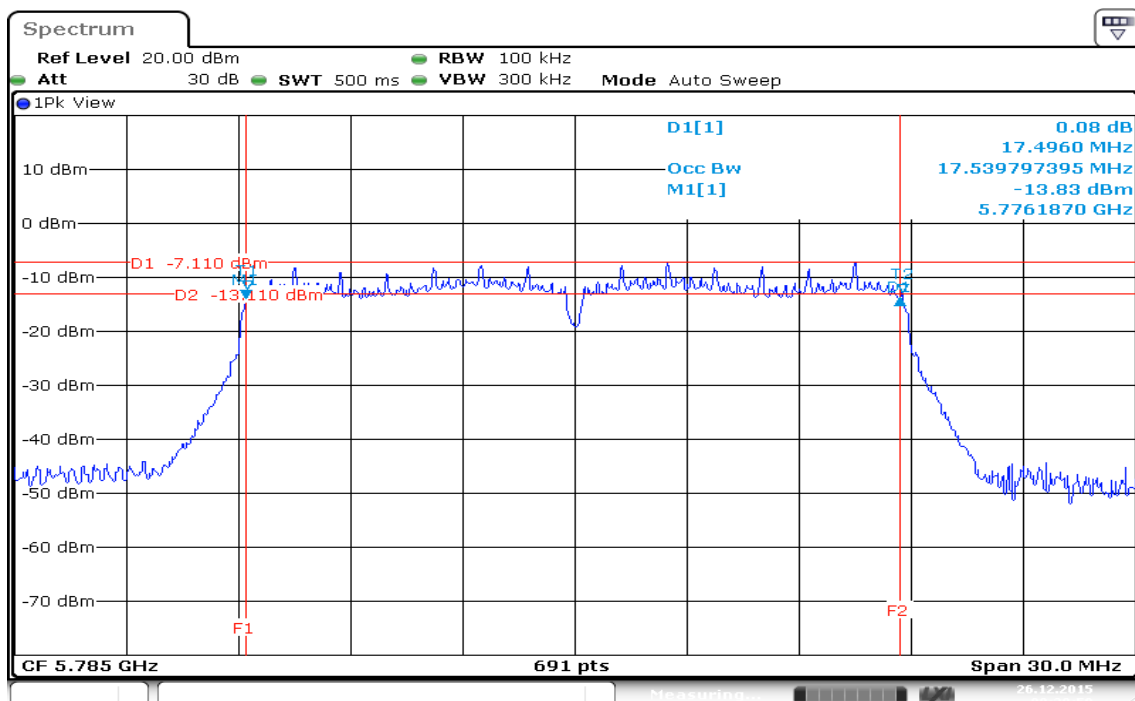
## 6dB Bandwidth (CH High)



Date: 24.DEC.2015 18:23:12

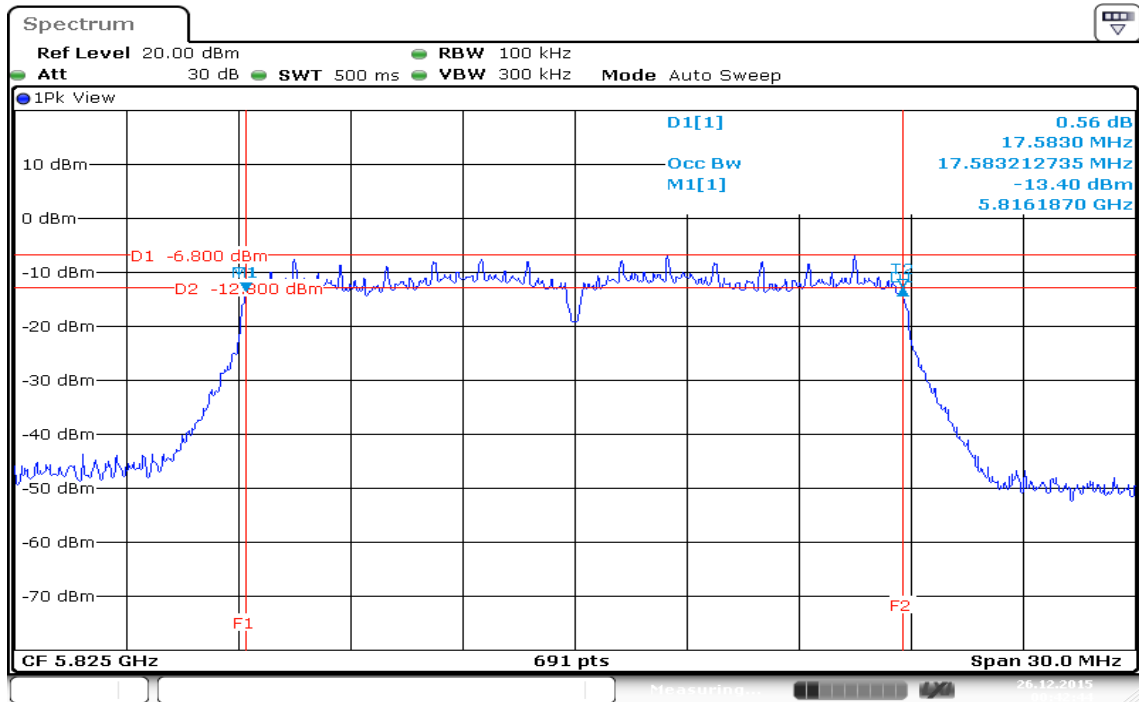
**IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0****6dB Bandwidth (CH Low)**

Date: 25.DEC.2015 23:35:38

**6dB Bandwidth (CH Mid)**

Date: 26.DEC.2015 00:29:50

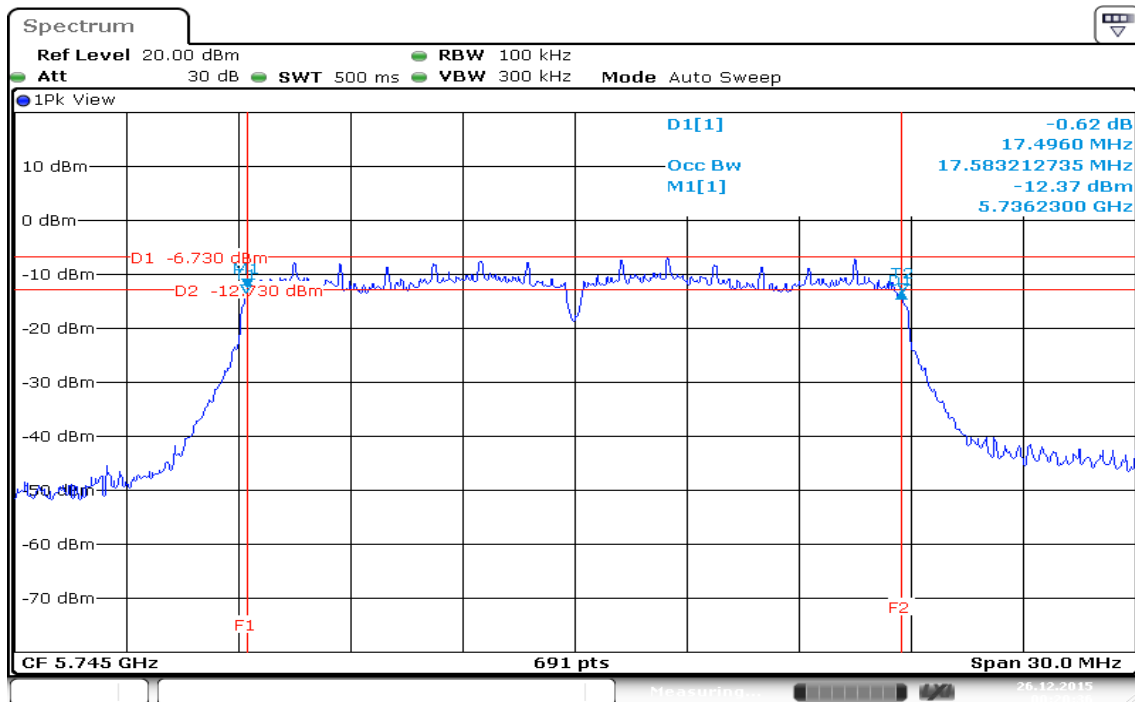
## 6dB Bandwidth (CH High)



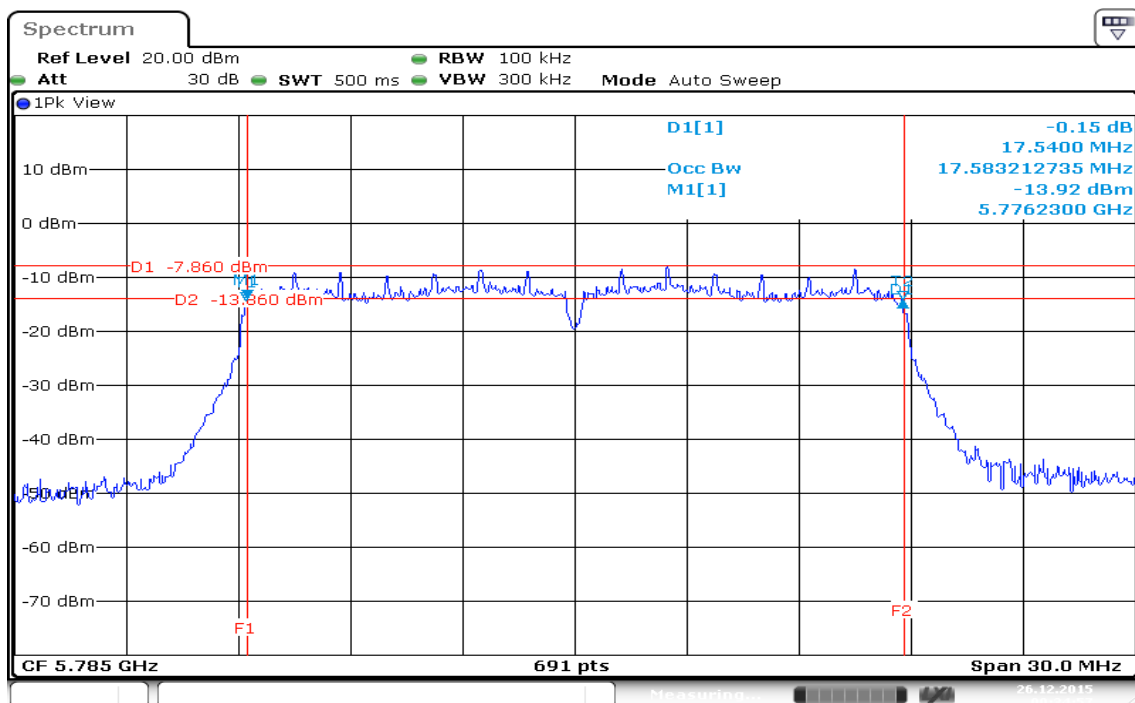
Date: 26.DEC.2015 00:42:45

## IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

### 6dB Bandwidth (CH Low)

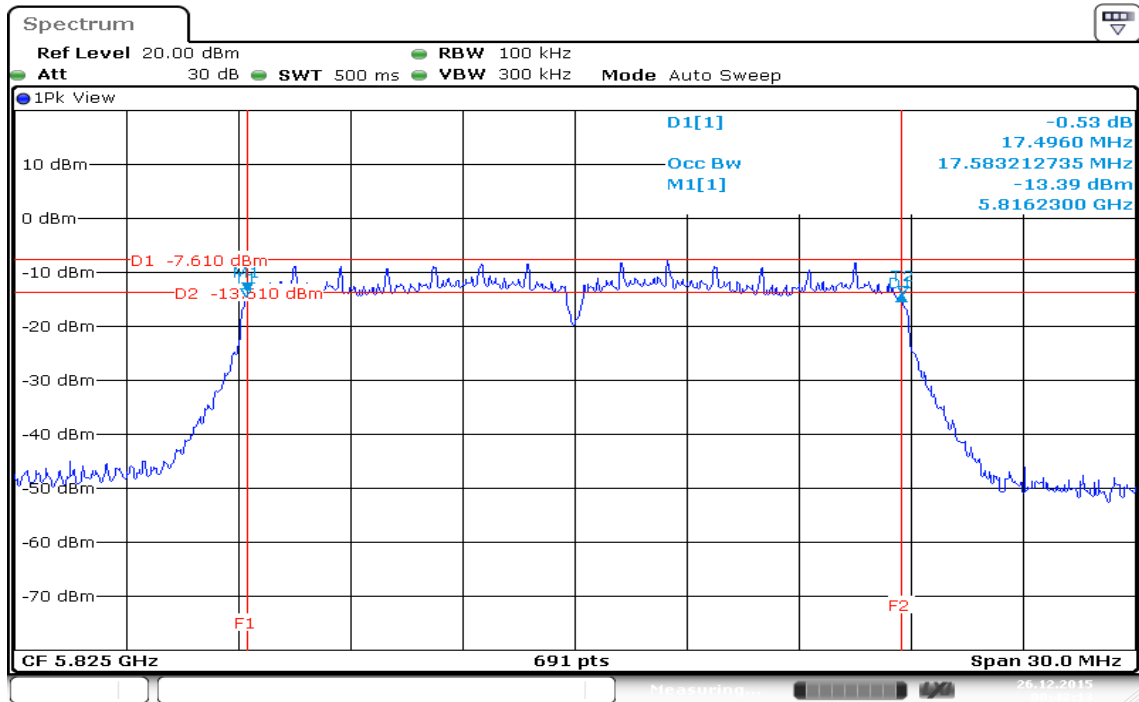


### 6dB Bandwidth (CH Mid)

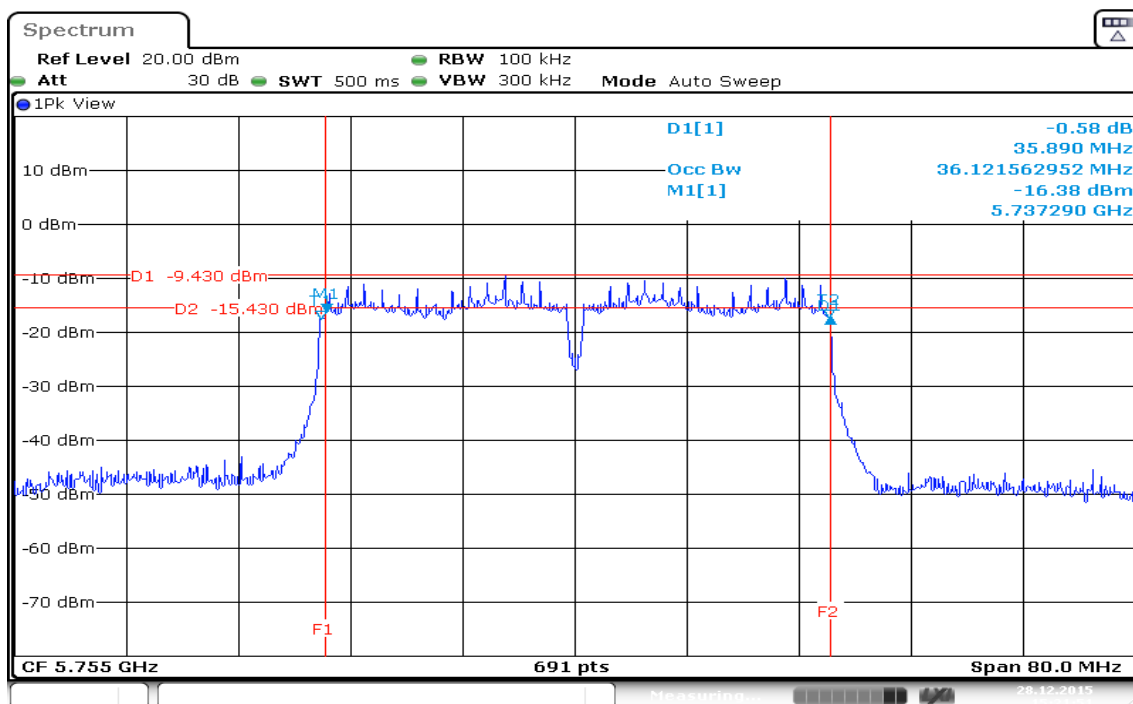




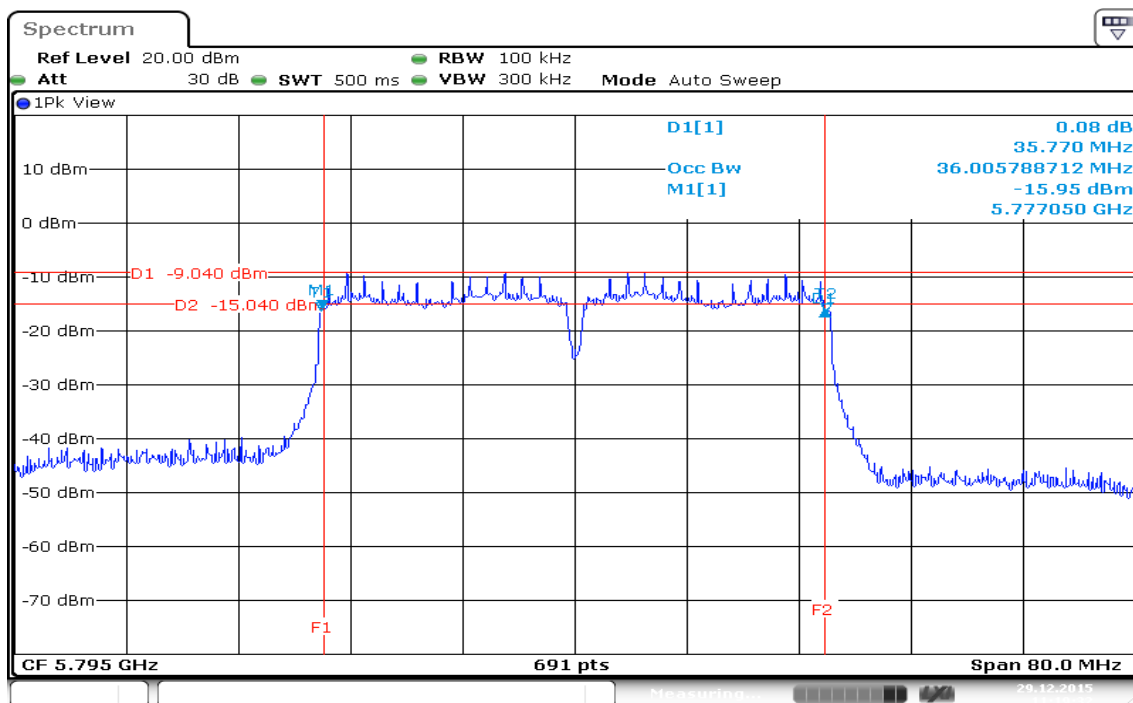
## 6dB Bandwidth (CH High)



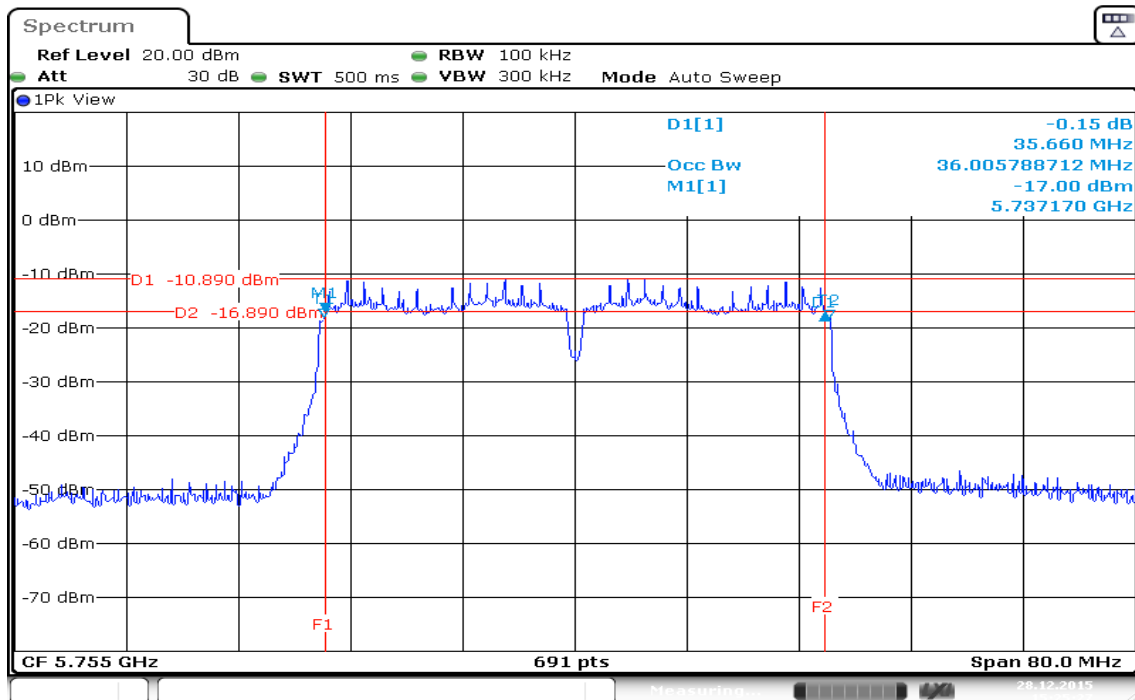
Date: 26.DEC.2015 00:48:13

**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 0****6dB Bandwidth (CH Low)**

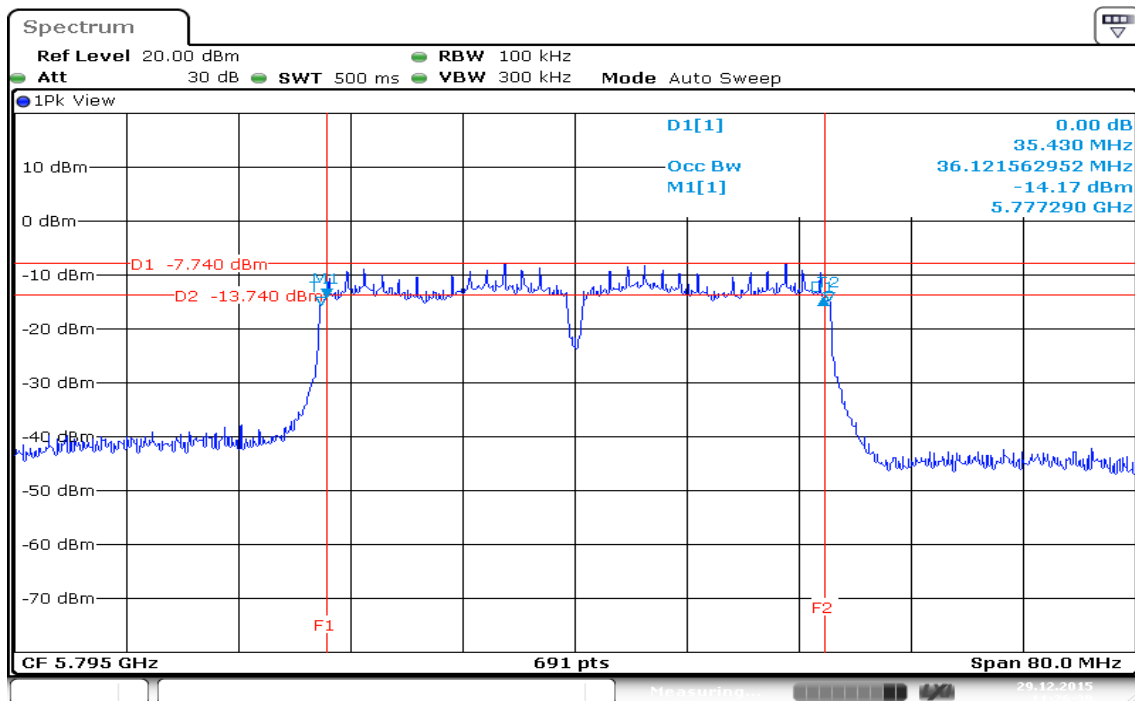
Date: 28.DEC.2015 15:21:51

**6dB Bandwidth (CH High)**

Date: 29.DEC.2015 11:19:32

**IEEE 802.11n HT 40 MHz mode / 5755 ~ 5815MHz / Chain 1****6dB Bandwidth (CH Low)**

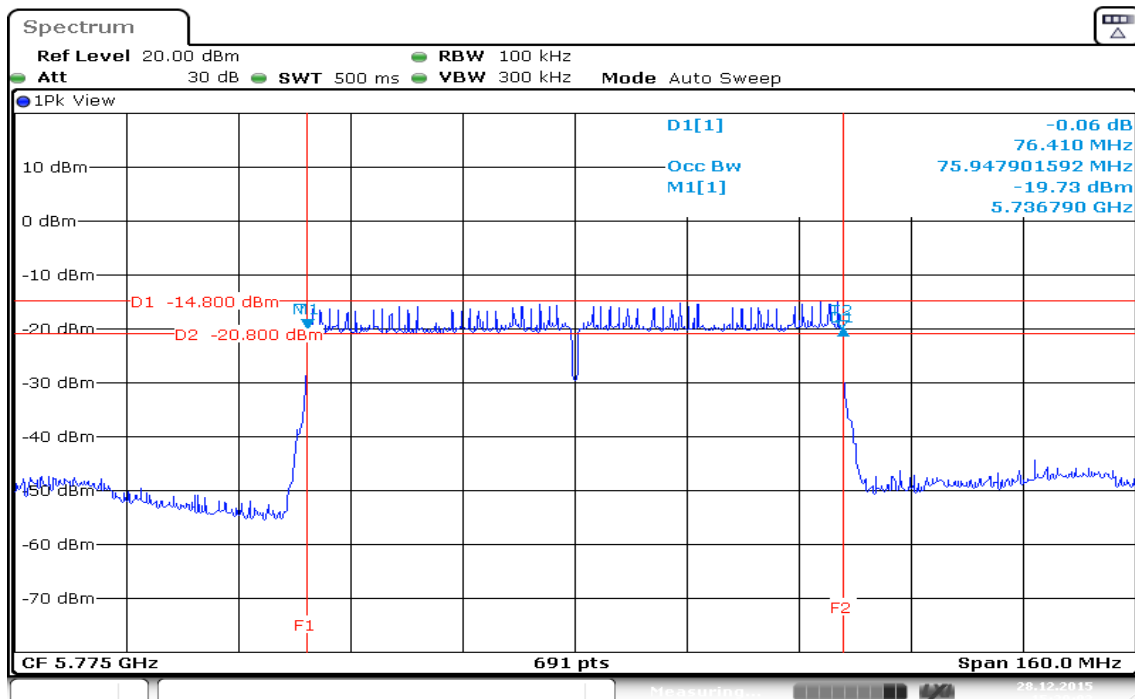
Date: 28.DEC.2015 15:25:27

**6dB Bandwidth (CH High)**

Date: 29.DEC.2015 11:26:39

## IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

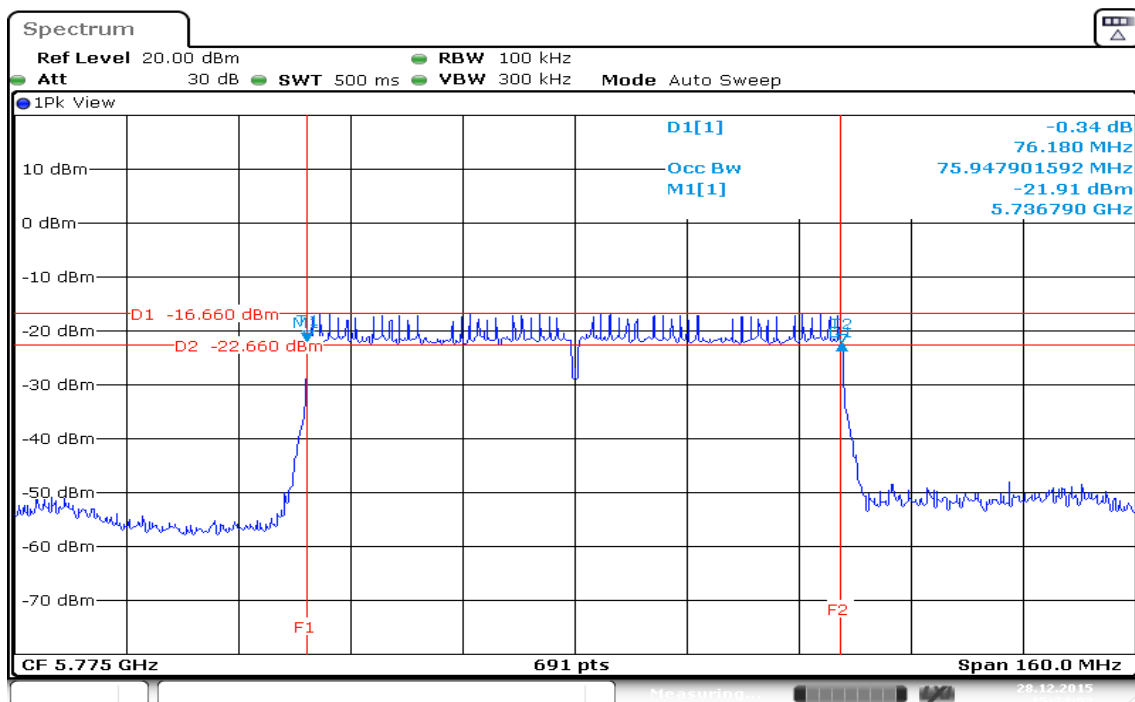
## 6dB Bandwidth (CH Mid)



Date: 28.DEC.2015 15:39:02

## IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

## 6dB Bandwidth (CH Mid)



Date: 28.DEC.2015 15:34:03

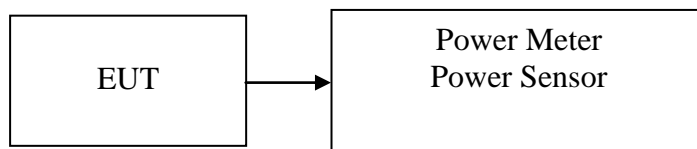
## 7.3 MAXIMUM CONDUCTED OUTPUT POWER

### LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.407, for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to RSS-247 §, for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

### Test Configuration



### TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

### TEST RESULTS

*No non-compliance noted*

**Test Data****Test mode: IEEE 802.11a mode / 5745 ~ 5825MHz**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5745	*16.54	0.0451	30
Mid	5785	16.47	0.0444	30
High	5825	16.54	0.0451	30

**Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5745	13.69	16.16	*18.11	0.0647	30
Mid	5785	13.35	14.59	17.02	0.0504	30
High	5825	13.71	14.99	17.41	0.0550	30

**Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Low	5755	12.65	14.92	*16.94	0.0495	30
High	5795	12.74	13.79	16.31	0.0427	30

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz**

Channel	Frequency (MHz)	Chain 0 Output Power (dBm)	Chain 1 Output Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (dBm)
Mid	5775	10.74	11.63	*14.22	0.0264	30

**Remark:**

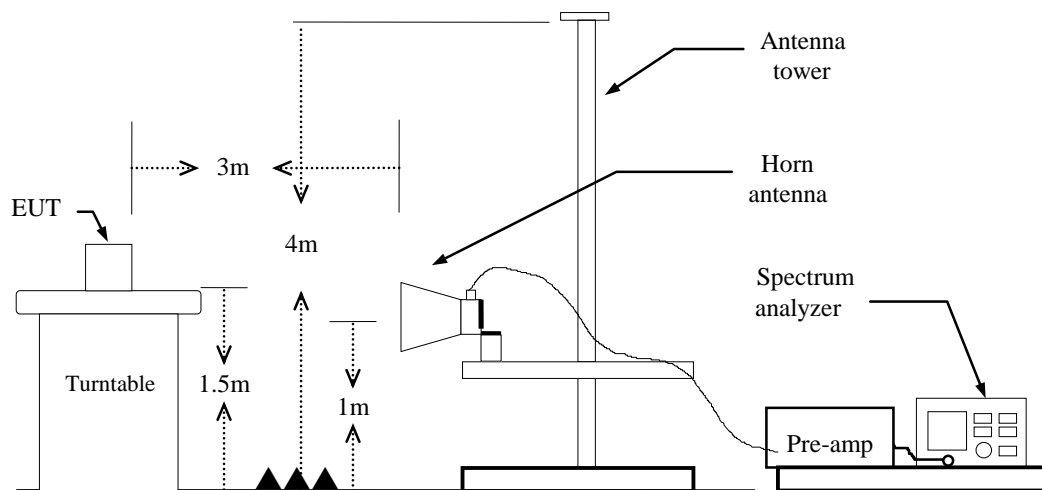
1. Total Output Power (w) = Chain 0 ( $10^{(\text{Output Power}/10)/1000}$ ) + Chain 1 ( $10^{(\text{Output Power}/10)/1000}$ )

## 7.4 BAND EDGES MEASUREMENT

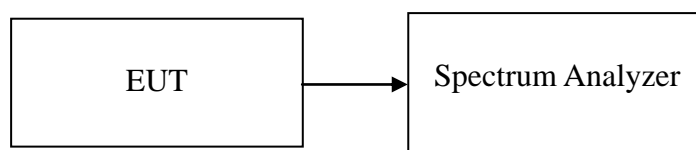
### LIMIT

According to §15.407 & RSS-247 §, in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) (see Section 15.205(c)).

### Test Configuration



### For Conducted



## **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz,  
if duty cycle  $\geq 98\%$ , VBW=10Hz.  
if duty cycle  $< 98\%$  VBW=1/T.  
**IEEE 802.11a mode:**  $\geq 98\%$ , VBW=10Hz  
**IEEE 802.11n HT 20 MHz mode:**  $\geq 98\%$ , VBW=10Hz  
**IEEE 802.11n HT 40 MHz mode:**  $\geq 98\%$ , VBW=10Hz  
**IEEE 802.11ac VHT 80 MHz mode:**  $\geq 98\%$ , VBW=10Hz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.
6. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

### **For Conducted**

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

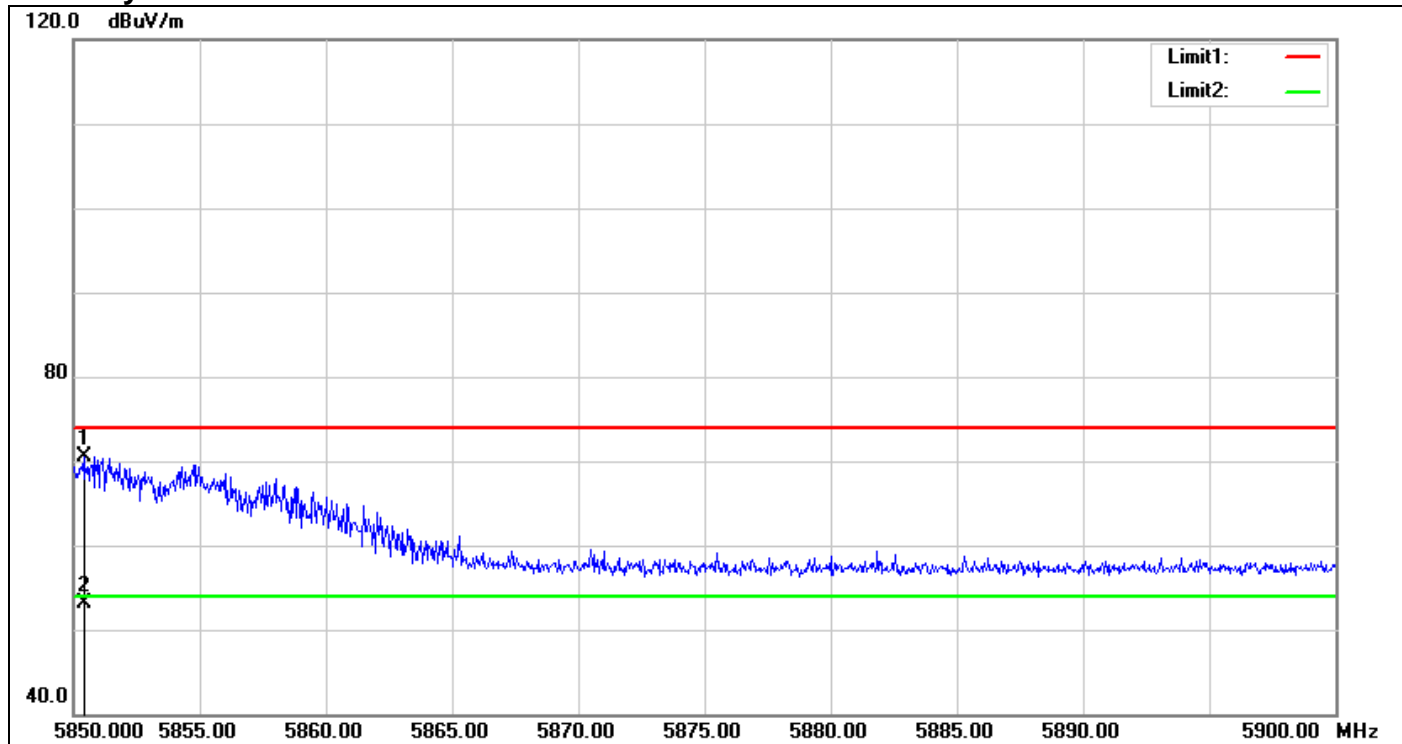
## **TEST RESULTS**

Refer to attach spectrum analyzer data chart.



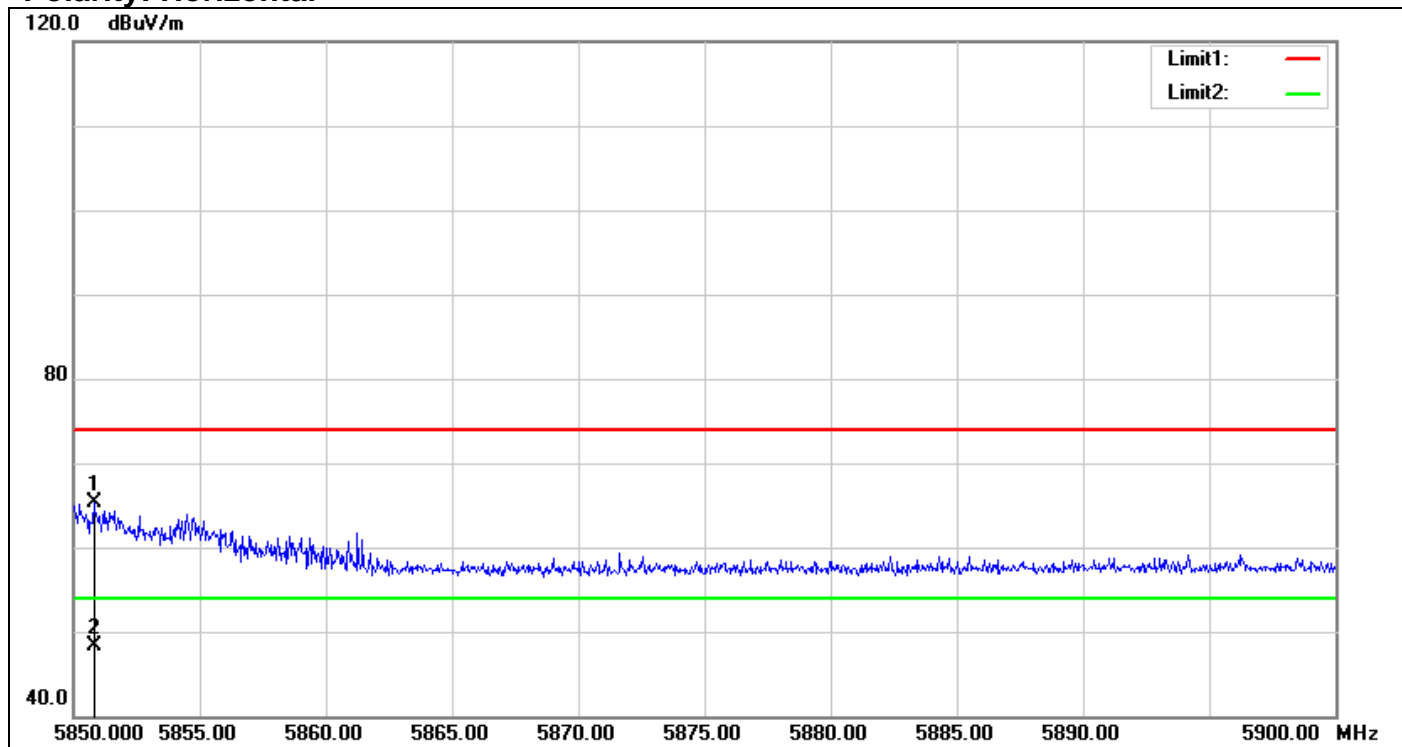
## Band Edges (IEEE 802.11a mode / CH 5825 MHz)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5850.400	63.83	6.74	70.57	74.00	-3.43	150	273	peak
2	5850.400	46.43	6.74	53.17	54.00	-0.83	150	273	AVG

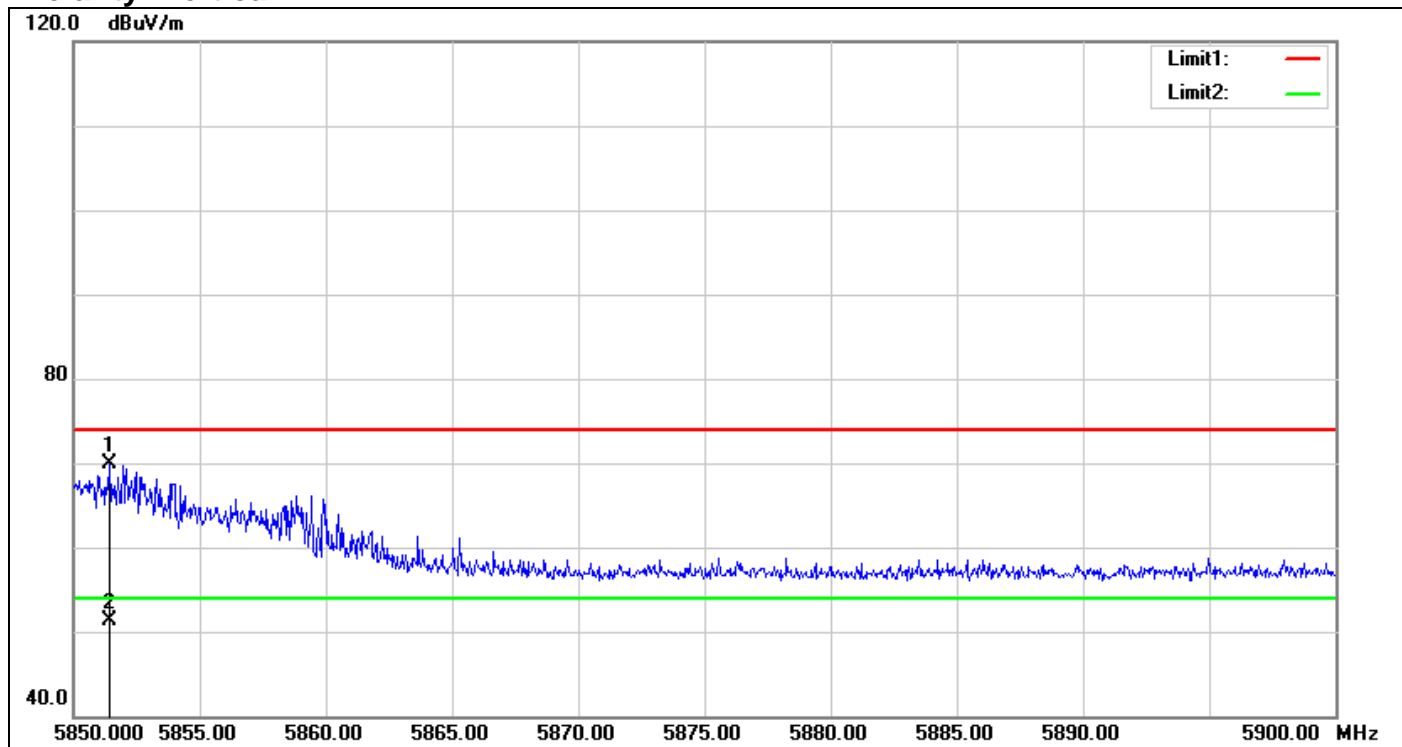
## Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5850.800	58.53	6.74	65.27	74.00	-8.73	150	296	peak
2	5850.800	41.54	6.74	48.28	54.00	-5.72	150	296	AVG

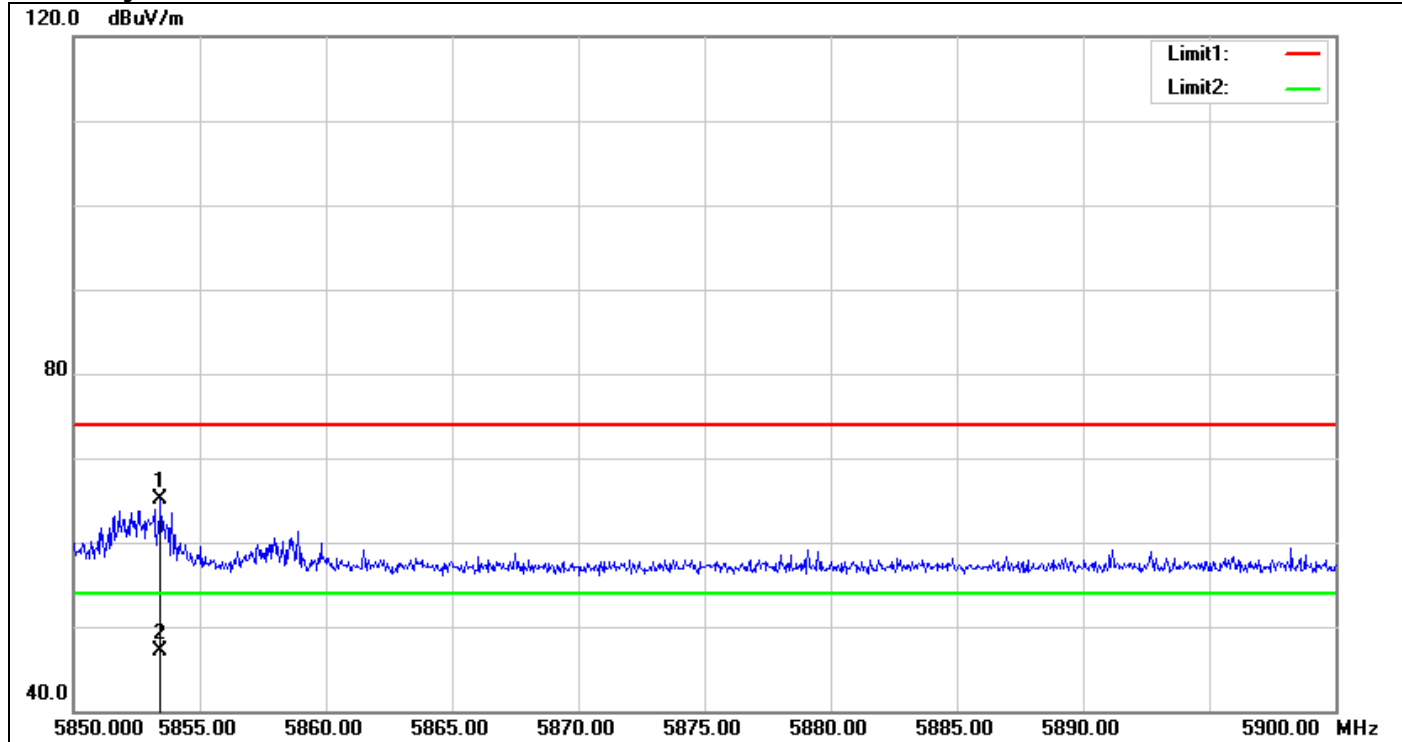
## Band Edges (IEEE 802.11n HT 20 MHz Channel mode / CH 5825 MHz)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5851.400	63.16	6.75	69.91	74.00	-4.09	150	142	peak
2	5851.400	44.63	6.75	51.38	54.00	-2.62	150	142	AVG

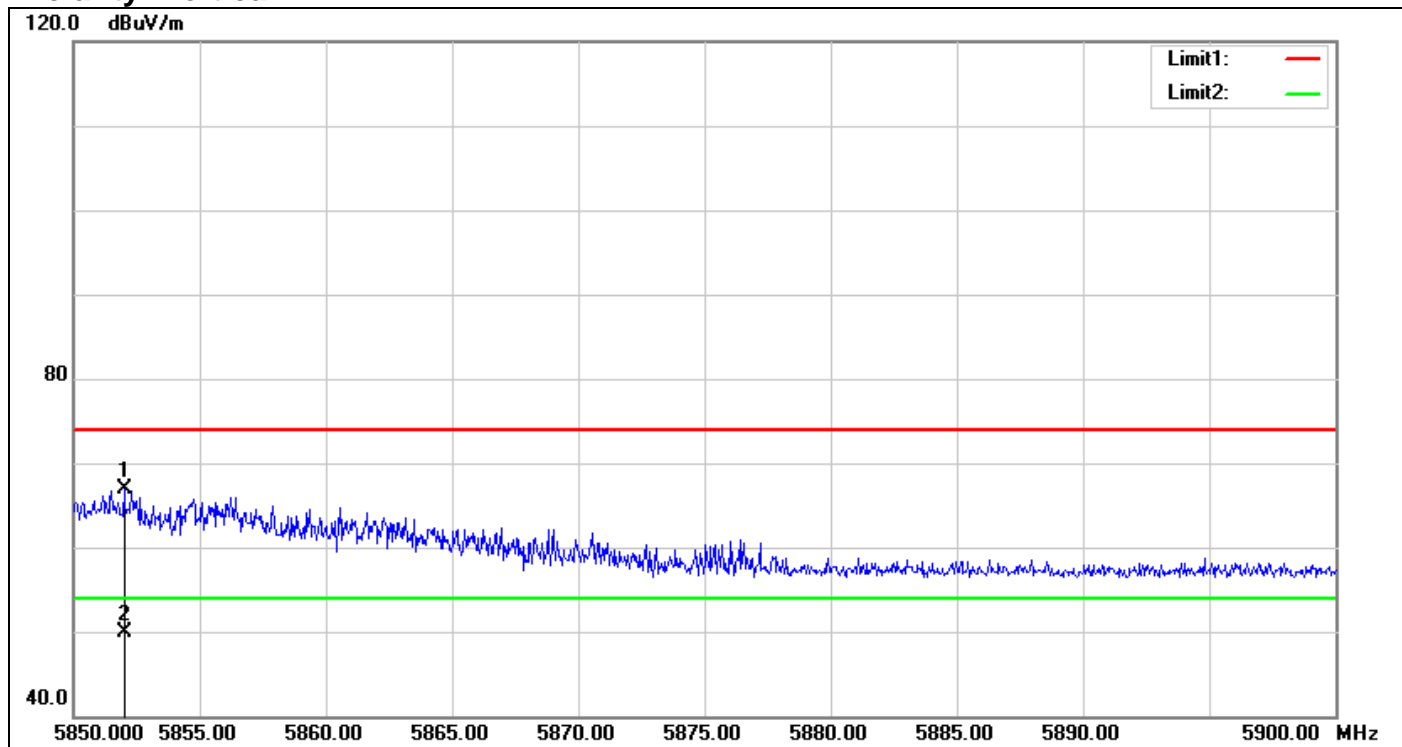
## Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5853.450	58.29	6.76	65.05	74.00	-8.95	150	163	peak
2	5853.450	40.26	6.76	47.02	54.00	-6.98	150	163	AVG

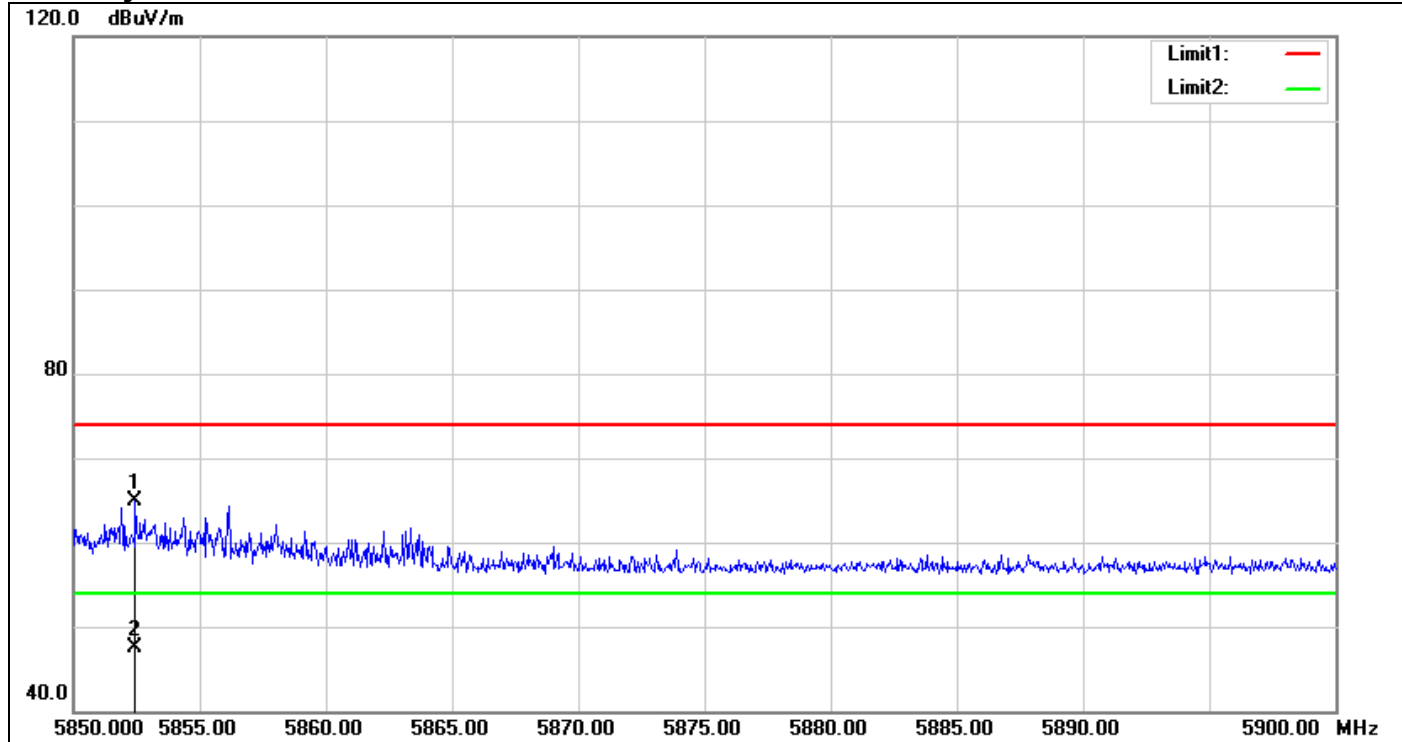
## Band Edges (IEEE 802.11n HT 40 MHz mode / CH 5795 MHz)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5852.000	60.08	6.75	66.83	74.00	-7.17	150	185	peak
2	5852.000	43.11	6.75	49.86	54.00	-4.14	150	185	AVG

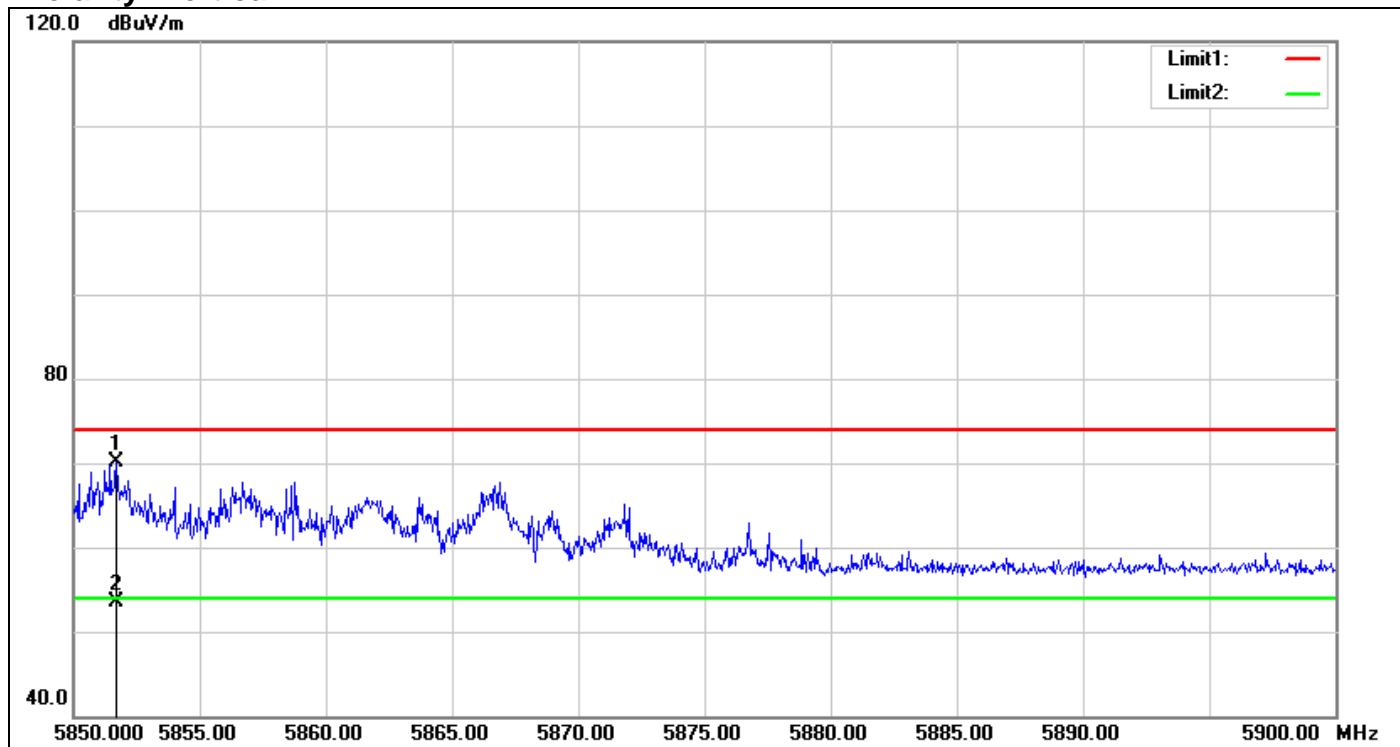
## Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5852.450	58.23	6.75	64.98	74.00	-9.02	150	243	peak
2	5852.450	40.69	6.75	47.44	54.00	-6.56	150	243	AVG

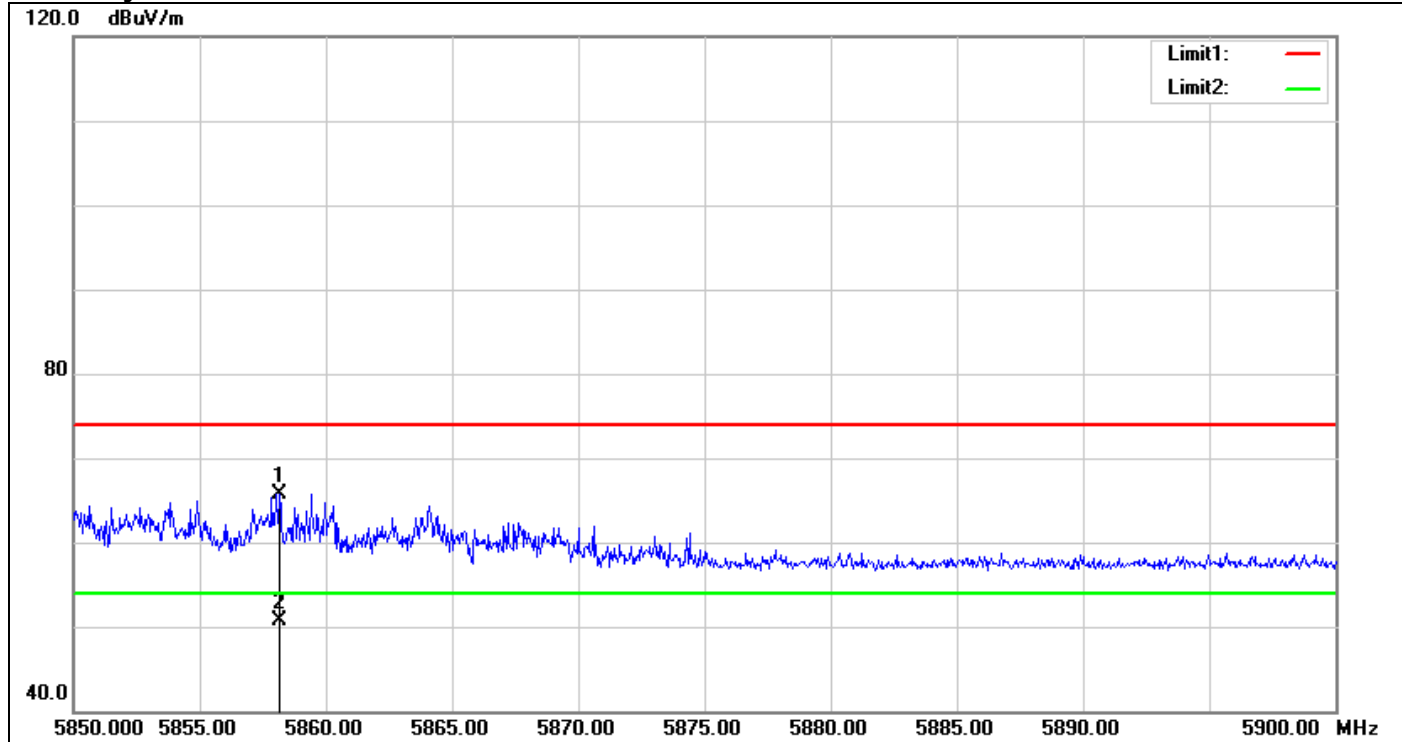
## Band Edges (IEEE 802.11ac VHT 80 MHz mode / CH 5775 MHz)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5851.700	63.38	6.75	70.13	74.00	-3.87	140	294	peak
2	5851.700	46.73	6.75	53.48	54.00	-0.52	140	294	AVG

## Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	5858.150	58.96	6.78	65.74	74.00	-8.26	150	14	peak
2	5858.150	43.85	6.78	50.63	54.00	-3.37	150	14	AVG

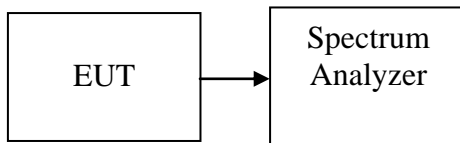


## 7.5 PEAK POWER SPECTRAL DENSITY

### LIMIT

1. According to §15.407 & RSS-247 §, for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 30 dBm in any 500 kHz band during any time interval of continuous transmission.

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.  
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 500kHz, VBW = 3RBW, Span = 300kHz, Sweep=100s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

### TEST RESULTS

*No non-compliance noted*

**Test Data****Test mode: IEEE 802.11a mode/ 5745 ~ 5825MHz**

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5745	3.31	30.00	-26.69	PASS
Mid	5785	3.79		-26.21	PASS
High	5825	3.17		-26.83	PASS

**Test mode: IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz**

Channel	Frequency (MHz)	Chain 0 PPSP (dBm)	Chain 1 PPSP (dBm)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5745	2.65	0.13	4.58	30.00	-25.42	PASS
Mid	5785	1.41	-0.92	3.41		-26.59	PASS
High	5825	0.93	-0.94	3.11		-26.89	PASS

**Test mode: IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz**

Channel	Frequency (MHz)	Chain 0 PPSP (dBm)	Chain 1 PPSP (dBm)	PPSD (dBm)	Limit (dBm)	Margin	Result
Low	5755	-1.93	-3.88	0.21	30.00	-29.79	PASS
High	5795	-2.22	-3.66	0.13		-29.87	PASS

**Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz**

Channel	Frequency (MHz)	Chain 0 PPSP (dBm)	Chain 1 PPSP (dBm)	PPSD (dBm)	Limit (dBm)	Margin	Result
Mid	5775	-7.64	-9.60	-5.50	30.00	-35.5	PASS

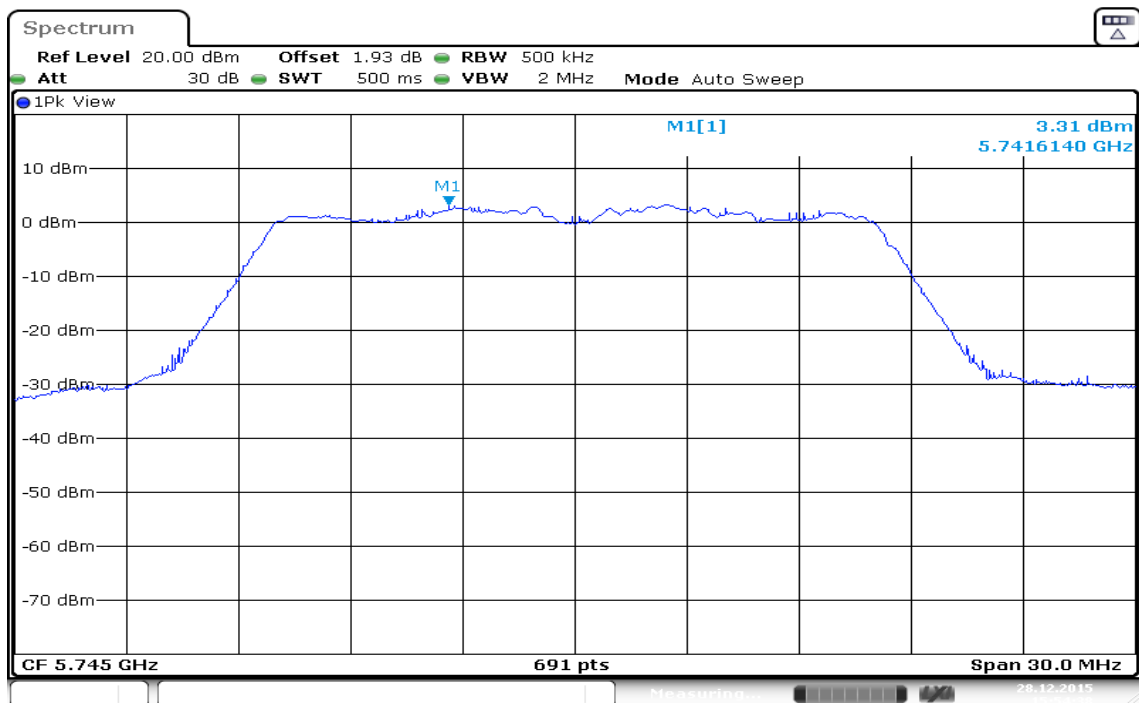
**Remark:**

1. Total PPSP (dBm) =  $10 \cdot \log(10^{(\text{Chain 0 PPSP} / 10)} + 10^{(\text{Chain 1 PPSP} / 10)})$

## Test Plot

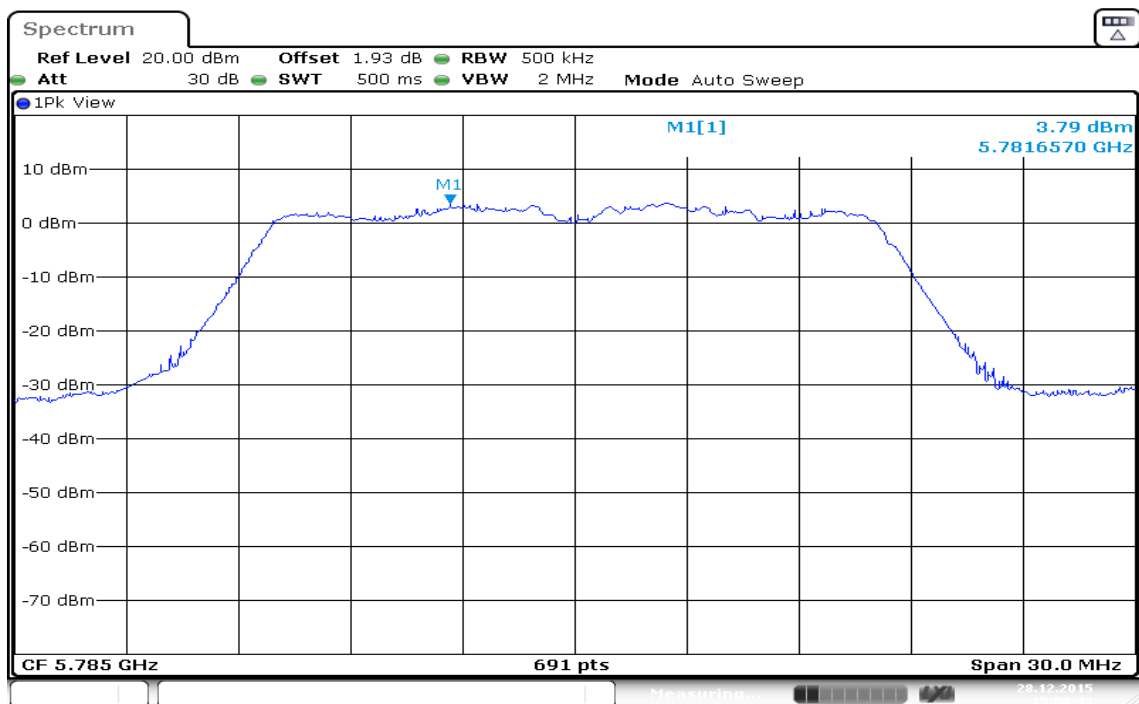
### IEEE 802.11a MHz mode / 5745 ~ 5825MHz

#### PPSD (CH Low)



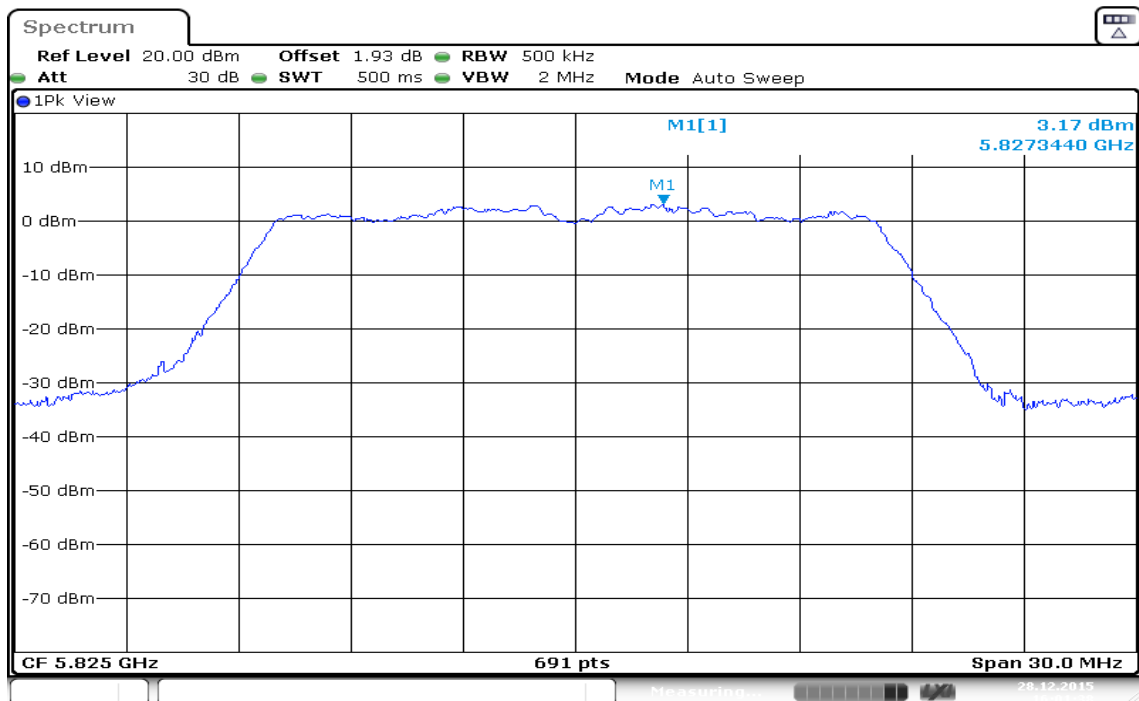
Date: 28.DEC.2015 15:54:37

#### PPSD (CH Mid)



Date: 28.DEC.2015 15:58:43

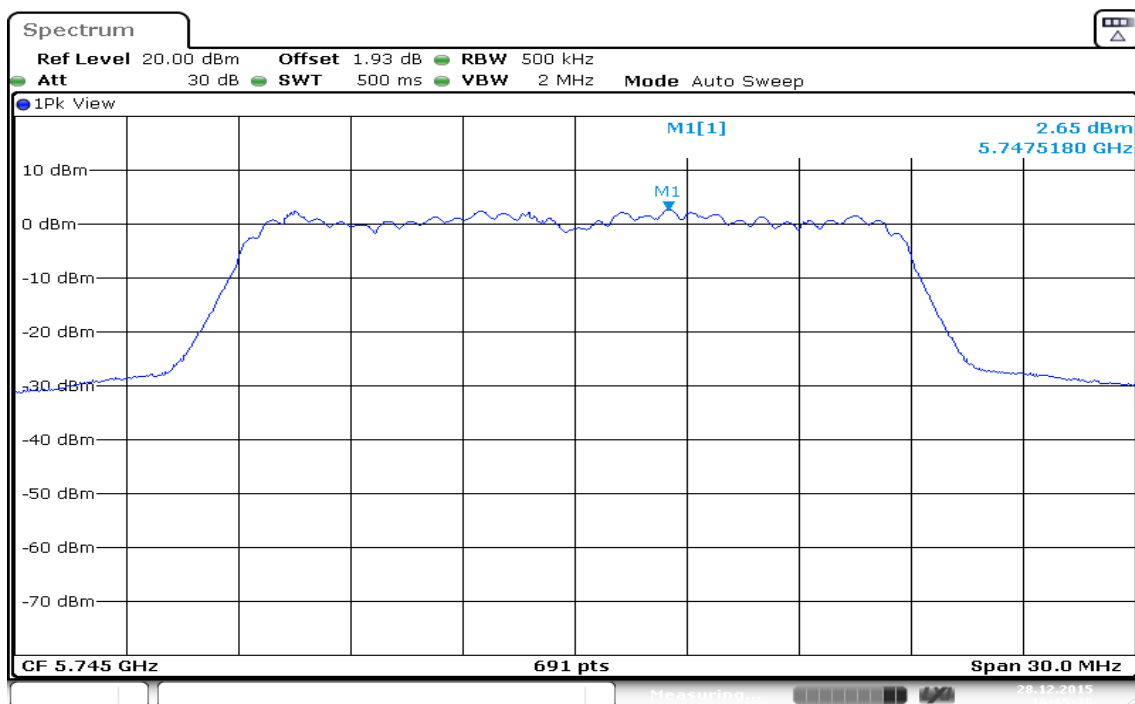
## PPSD (CH High)



Date: 28.DEC.2015 16:01:38

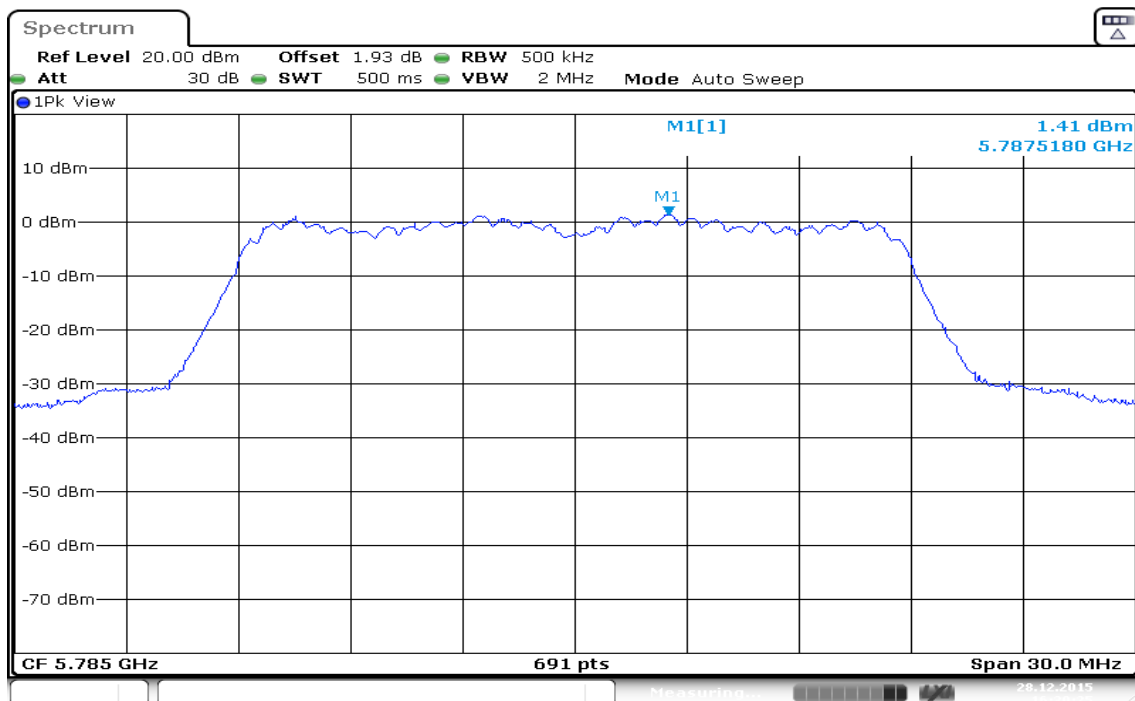
## IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

## PPSD (CH Low)



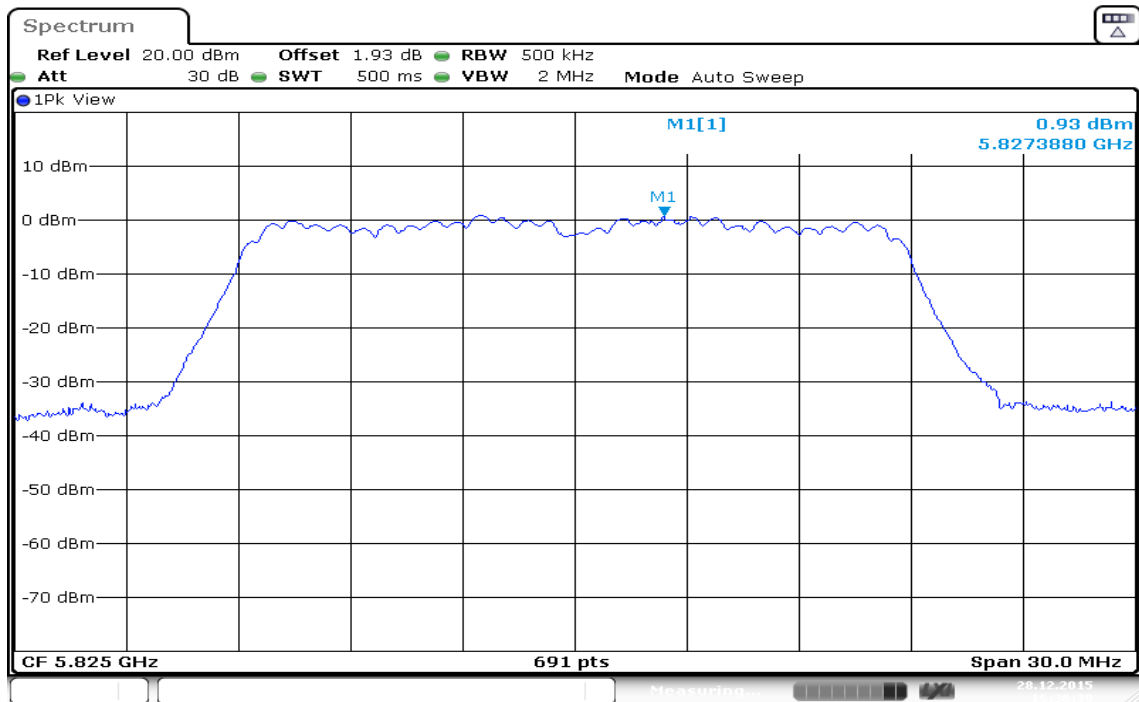
Date: 28.DEC.2015 16:15:38

## PPSD (CH Mid)



Date: 28.DEC.2015 16:30:25

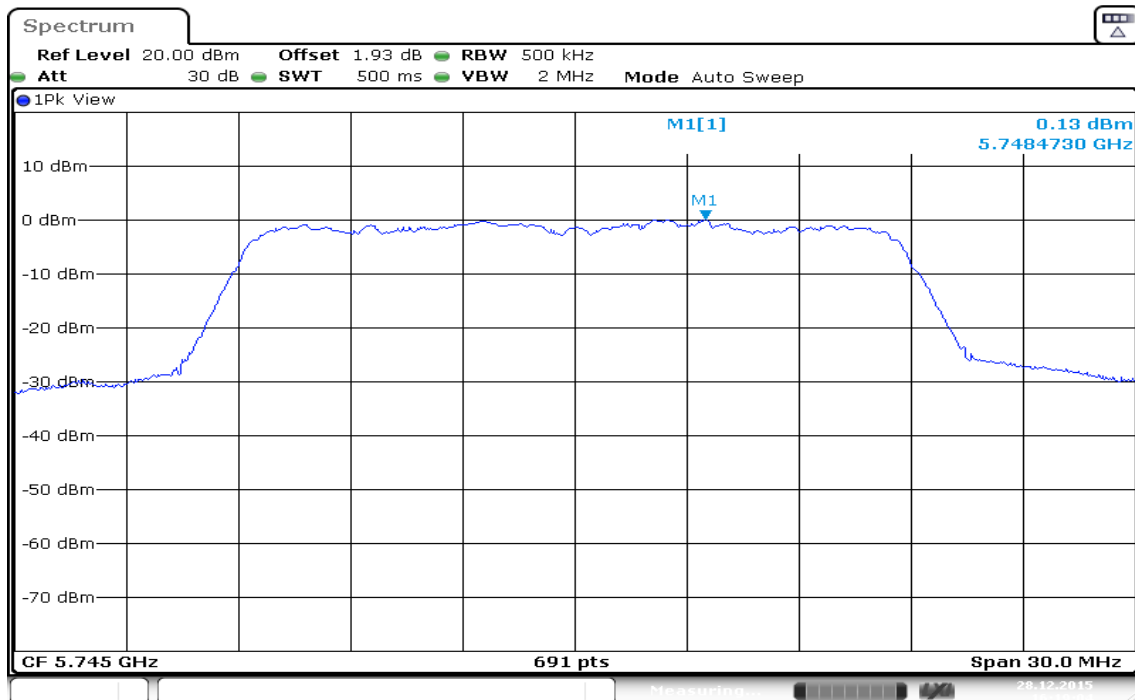
## PPSD (CH High)



Date: 28.DEC.2015 16:36:39

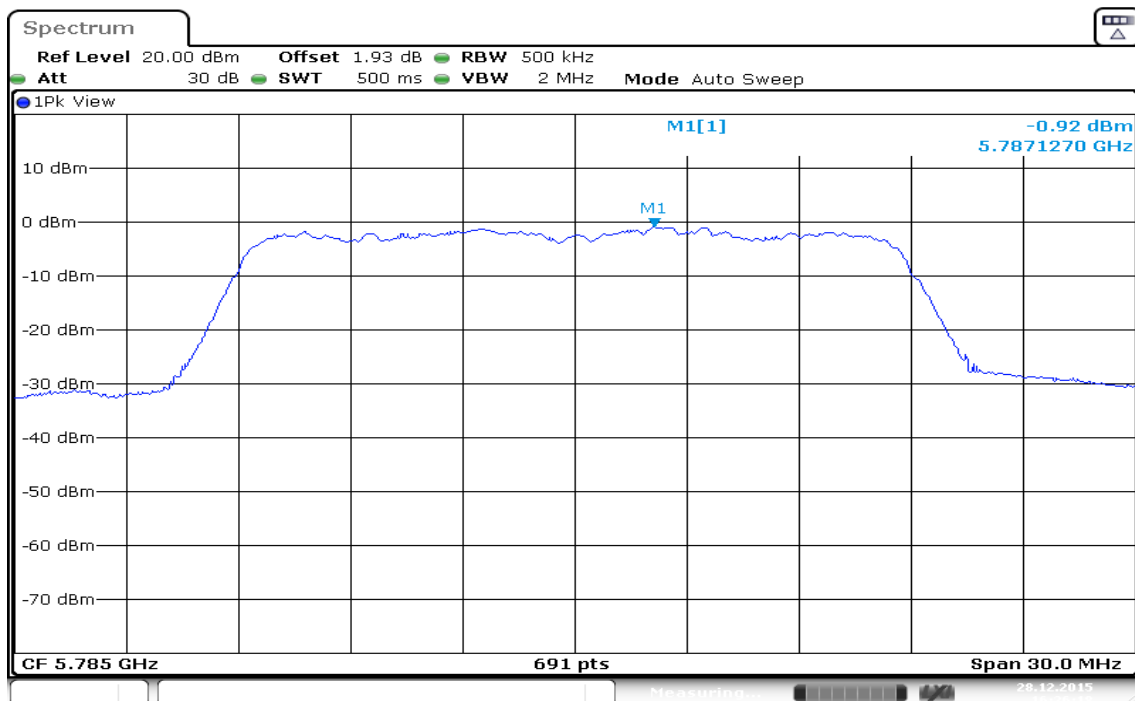
## IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

## PPSD (CH Low)



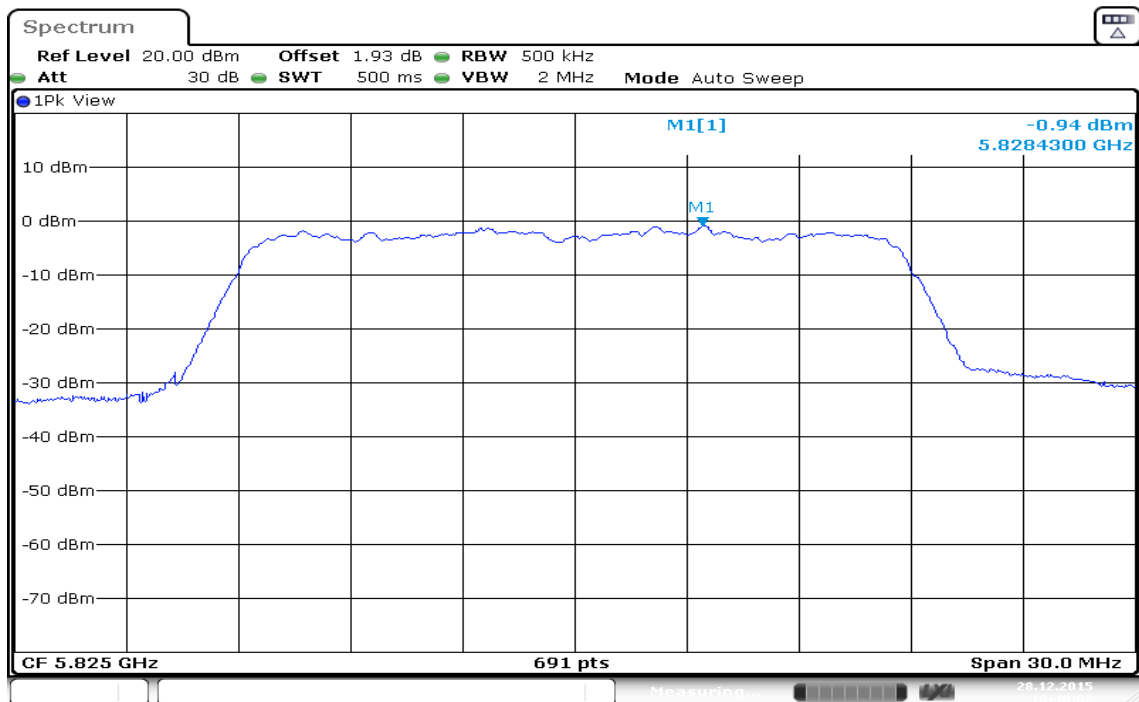
Date: 28.DEC.2015 16:19:04

## PPSD (CH Mid)



Date: 28.DEC.2015 16:26:17

## PPSD (CH High)

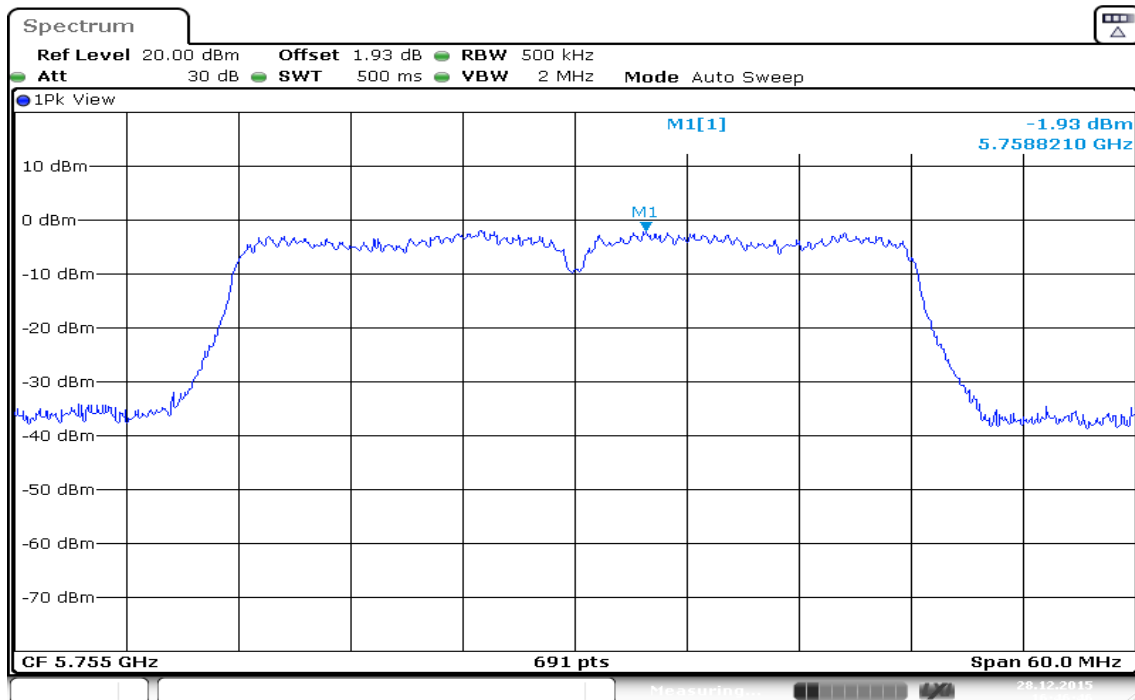


Date: 28.DEC.2015 16:40:02



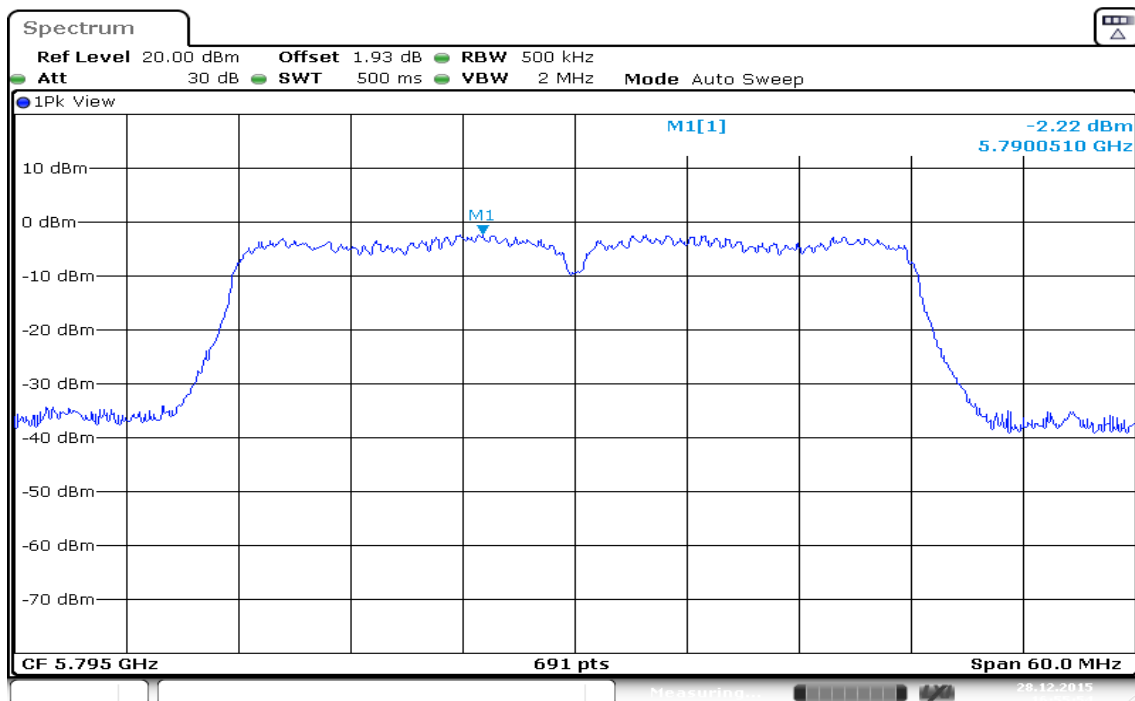
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

## PPSD (CH Low)



Date: 28.DEC.2015 16:46:46

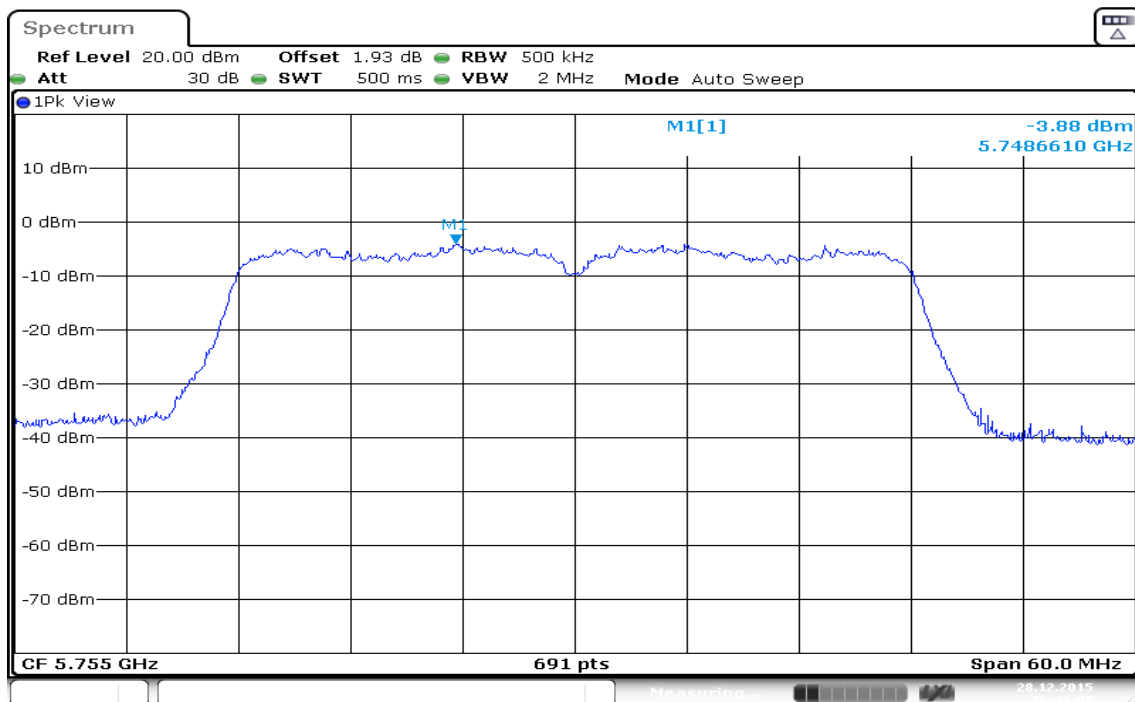
## PPSD (CH High)



Date: 28.DEC.2015 16:55:54

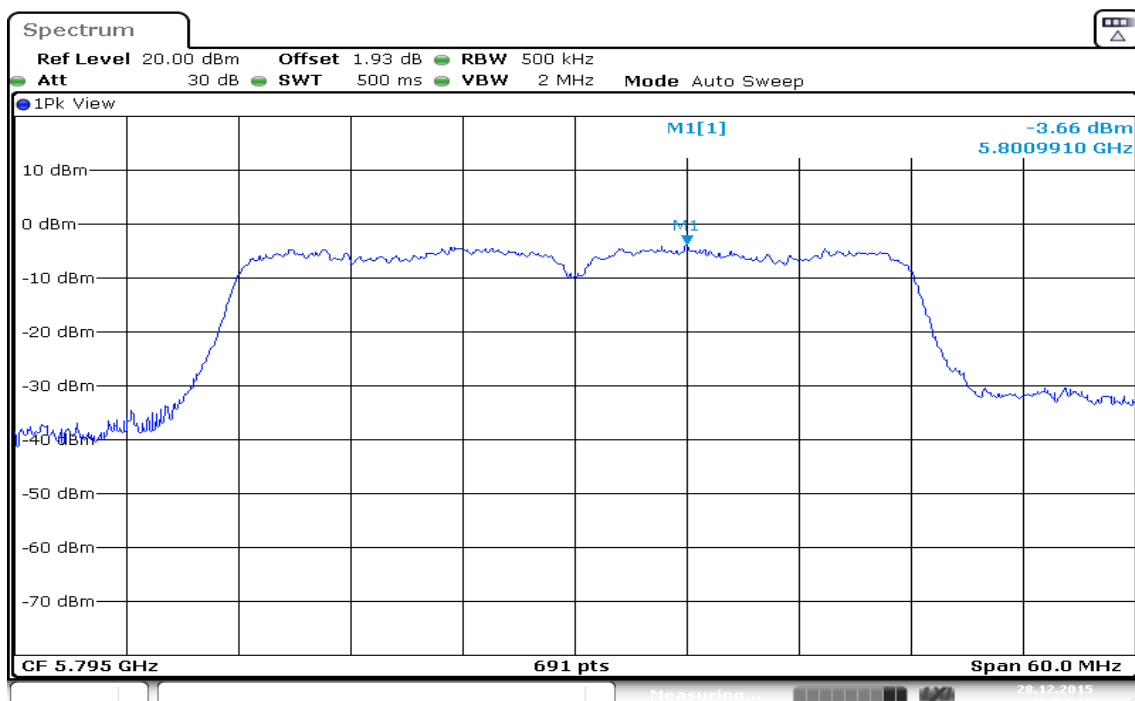
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

## PPSD (CH Low)



Date: 28.DEC.2015 16:49:07

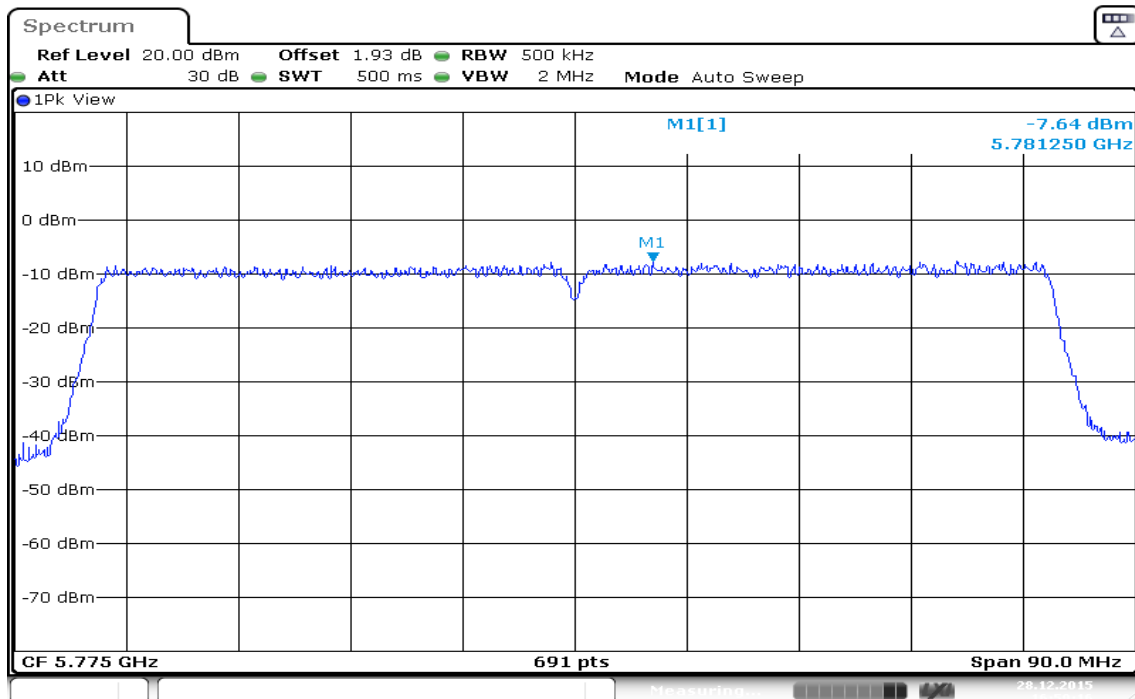
## PPSD (CH High)



Date: 28.DEC.2015 16:54:15

## IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0

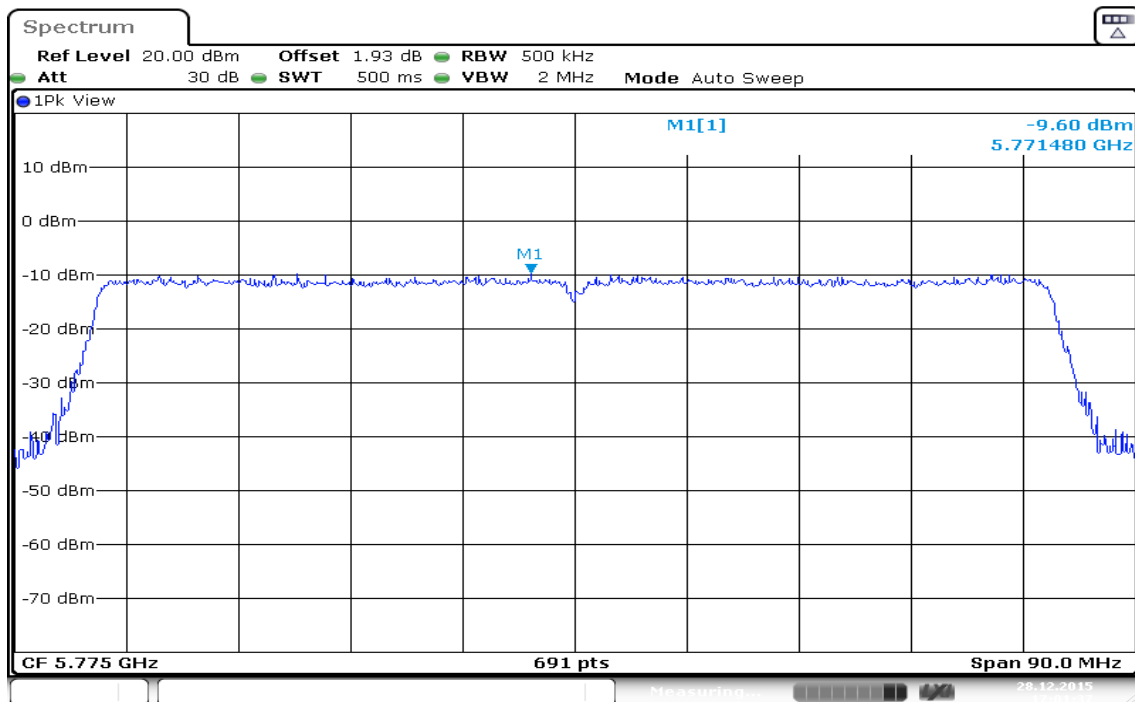
## PPSD (CH Mid)



Date: 28.DEC.2015 16:59:16

## IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

## PPSD (CH Mid)



Date: 28.DEC.2015 17:01:37

## 7.6 RADIATED EMISSIONS

### LIMIT

All spurious emissions shall comply with the limits of §15.209(a) and RSS-Gen Table 2 & Table 5.

### RSS-Gen Table 2 & Table 5: General Field Strength Limits for Transmitters and Receivers at Frequencies Above 30 MHz <sup>(Note)</sup>

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

**Note:** \*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7.

Transmitting devices are not permitted in Table 1 bands or, unless stated otherwise, in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-806 MHz).

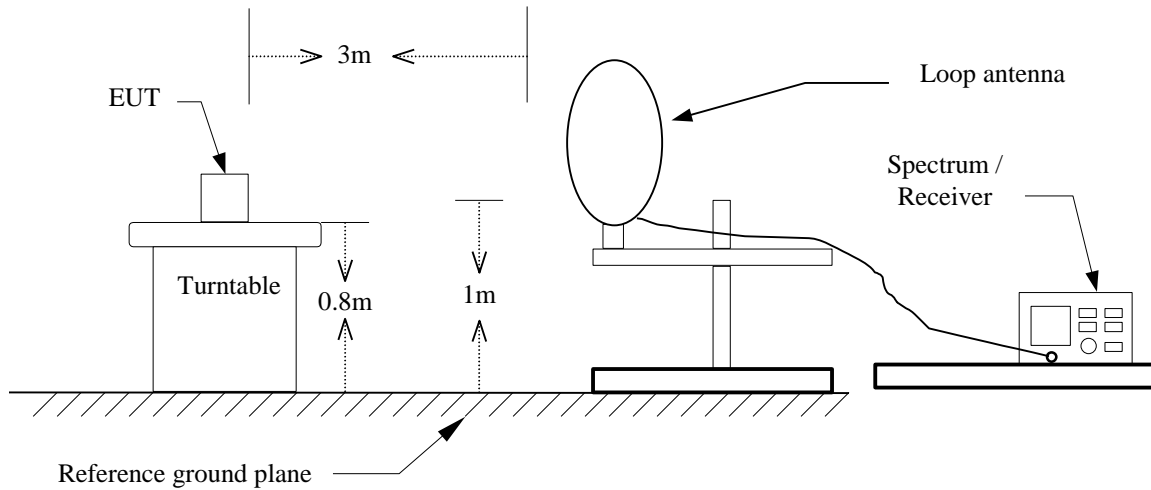
### RSS-Gen Table 6: General Field Strength Limits for Transmitters at Frequencies Below 30 MHz (Transmit)

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	3000
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

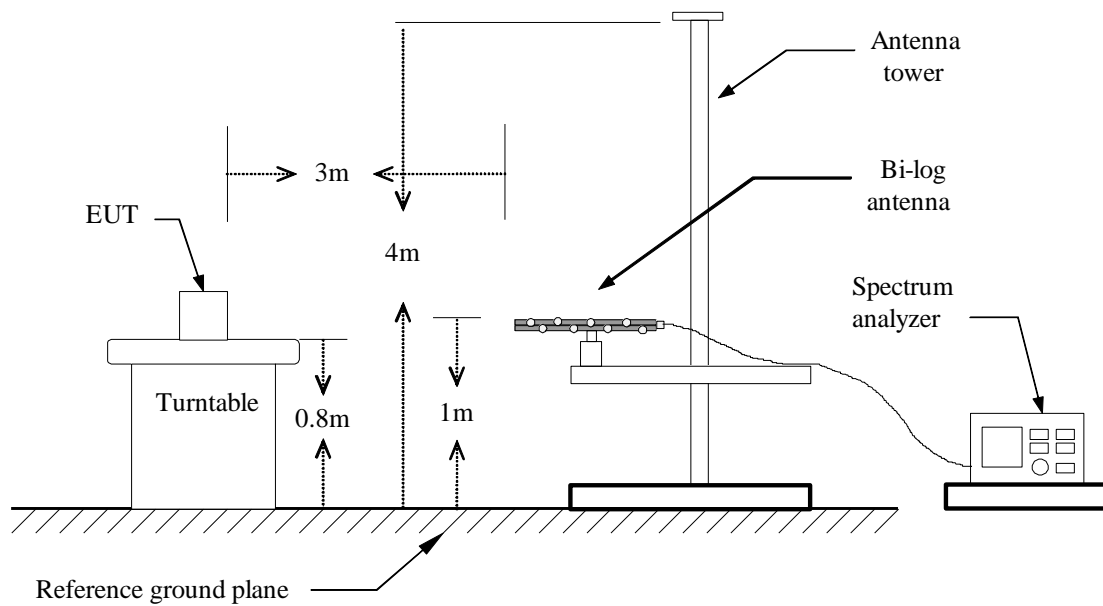
**Note:** The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

## Test Configuration

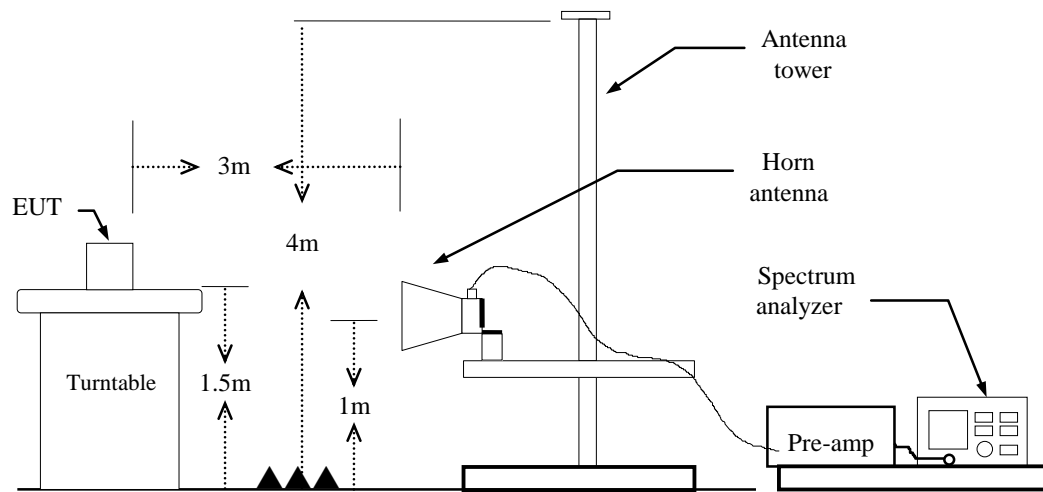
### 9kHz ~ 30MHz



### 30MHz ~ 1GHz



## Above 1 GHz



## **TEST PROCEDURE**

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m high and below 1 GHz is 0.8m high above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW: 1MHz / VBW: 3MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz,  
if duty cycle  $\geq 98\%$ , VBW=10Hz.  
if duty cycle  $< 98\%$  VBW=1/T.

**IEEE 802.11a mode:**  $\geq 98\%$ , VBW=10Hz

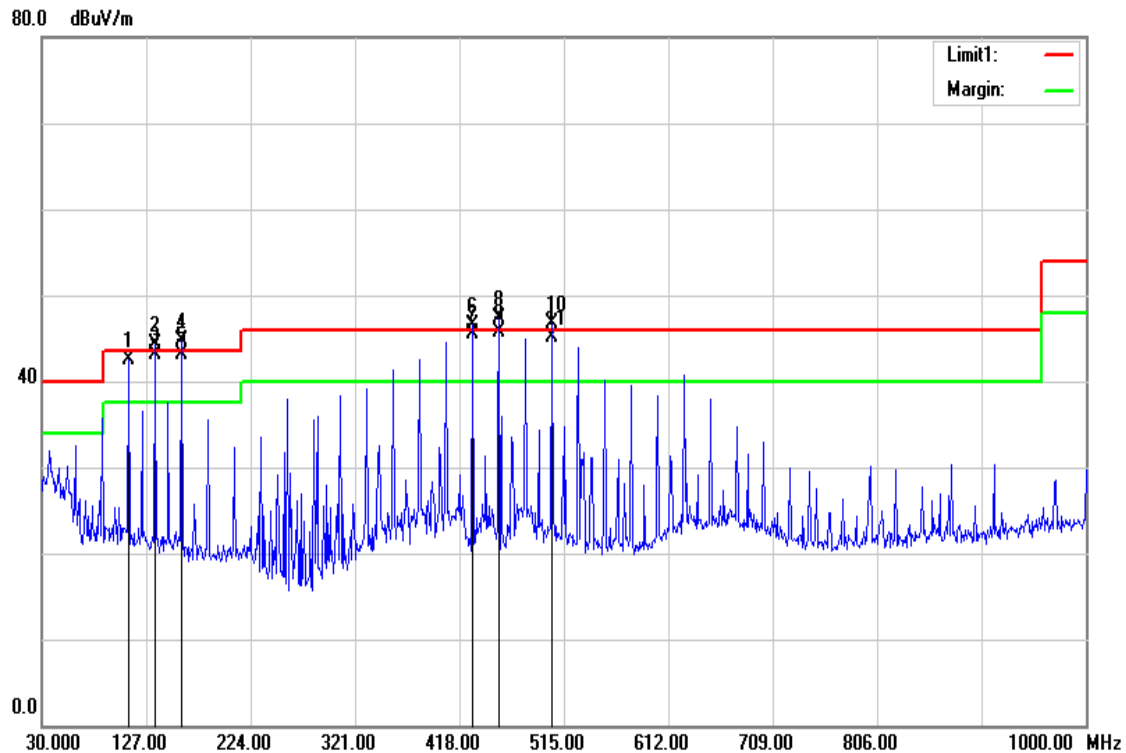
**IEEE 802.11n HT 20 MHz mode:**  $\geq 98\%$ , VBW=10Hz

**IEEE 802.11n HT 40 MHz mode:**  $\geq 98\%$ , VBW=10Hz

**IEEE 802.11ac VHT 80 MHz mode:**  $\geq 98\%$ , VBW=10Hz

7. Repeat above procedures until the measurements for all frequencies are complete.
8. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

**Note:** We checked every harmonics frequencies from Fundamental frequencies with reduced VBW, and we mark a point to prove pass or not if we find any emission. For this case, there are no emissions hidden in the noise floor.

**Below 1GHz****Operation Mode:** Normal Link**Test Date:** December 22, 2015**Temperature:** 27°C**Tested by:** Jason Lu**Humidity:** 53% RH**Polarity:** Ver.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
110.5100	59.72	-17.17	42.55	43.50	-0.95	QP	V
134.7600	58.81	-15.71	43.10	43.50	-0.40	QP	V
159.9800	59.56	-16.36	43.20	43.50	-0.30	QP	V
429.6400	56.36	-10.80	45.56	46.00	-0.44	QP	V
454.8600	55.83	-10.10	45.73	46.00	-0.27	QP	V
503.3600	54.31	-9.19	45.12	46.00	-0.88	QP	V

**Remark:**

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5.  $\text{Margin (dB)} = \text{Result (dBuV/m)} - \text{Limit (dBuV/m)}$ .



Operation Mode: Normal Link

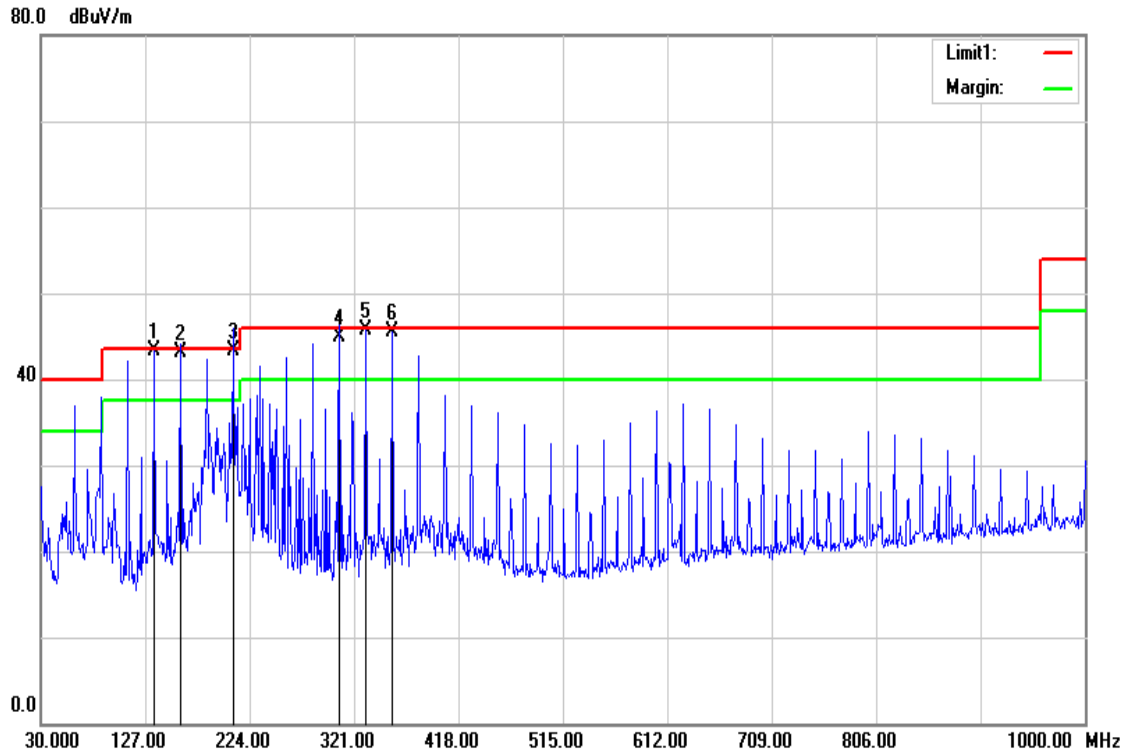
Test Date: December 22, 2015

Temperature: 27°C

Tested by: Jason Lu

Humidity: 53% RH

Polarity: Hor.



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
134.7600	58.93	-15.71	43.22	43.50	-0.28	QP	H
159.9800	59.47	-16.36	43.11	43.50	-0.39	QP	H
208.4800	59.48	-16.15	43.33	43.50	-0.17	QP	H
307.4200	58.92	-14.04	44.88	46.00	-1.12	QP	H
331.6700	59.08	-13.38	45.70	46.00	-0.30	QP	H
355.9200	58.34	-12.75	45.59	46.00	-0.41	QP	H

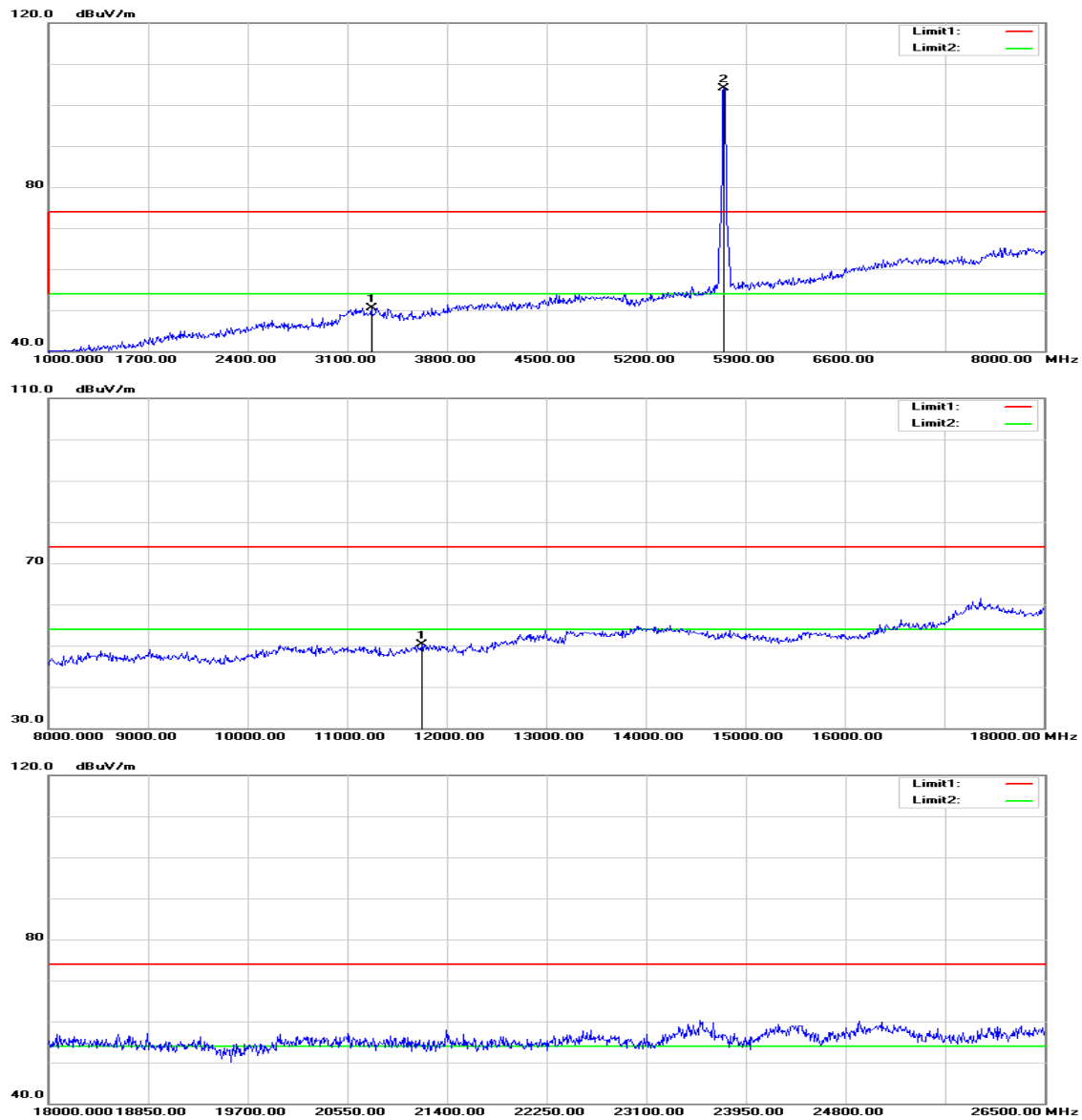
**Remark:**

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5.  $\text{Margin (dB)} = \text{Result (dBuV/m)} - \text{Limit (dBuV/m)}$ .

## Above 1 GHz

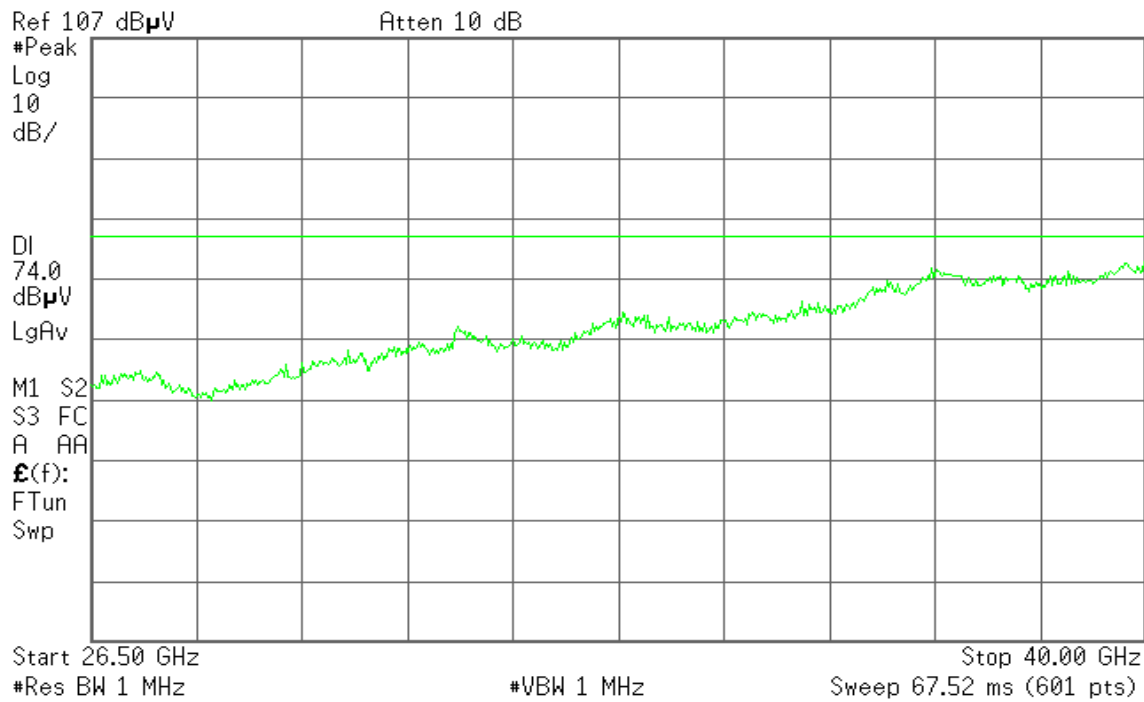
## TX / IEEE 802.11a mode / CH Low

Polarity: Vertical

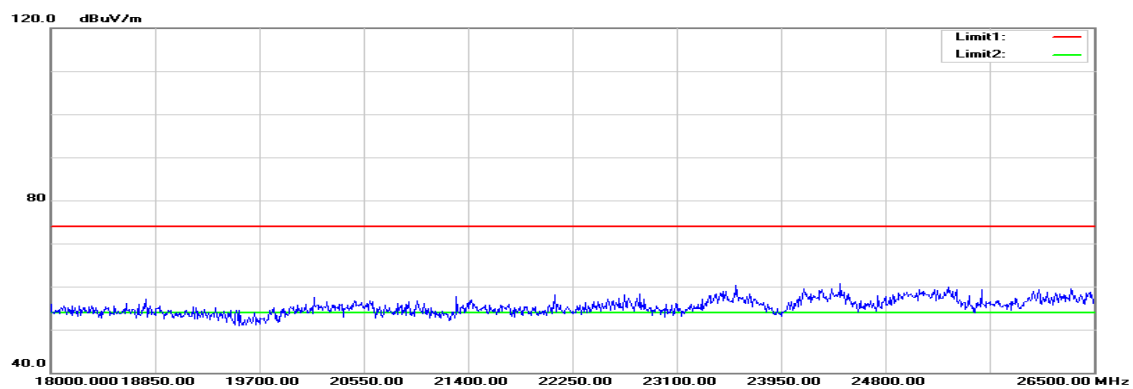
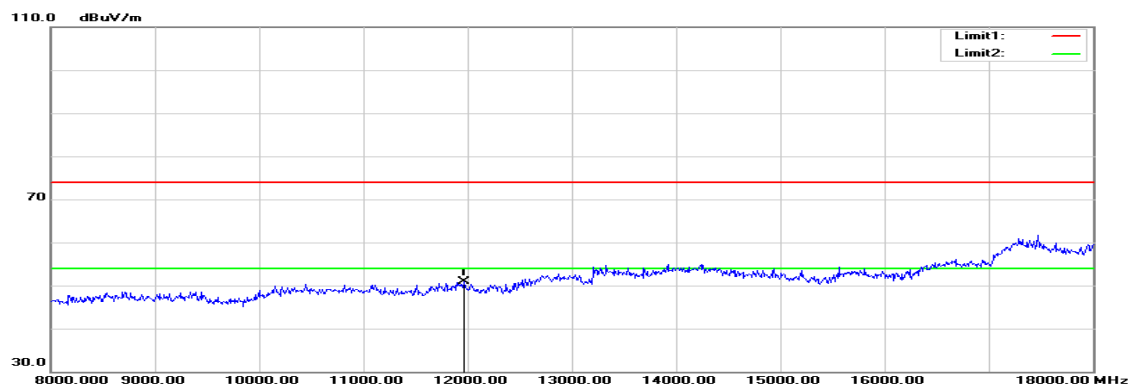
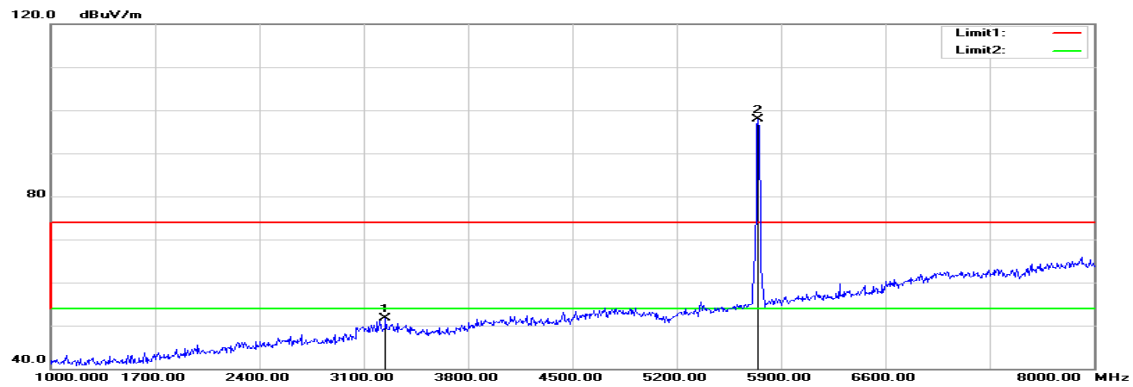


Agilent

R L

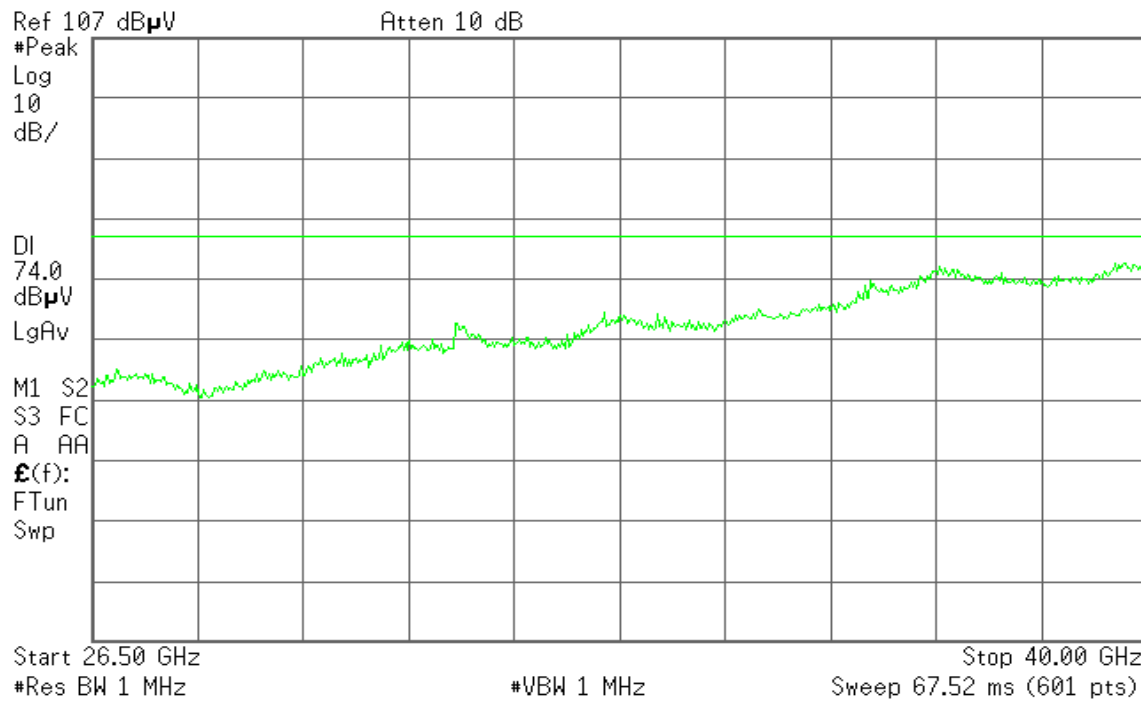


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11a mode / CH Low **Test Date:** December 10, 2015  
**Temperature:** 27°C **Tested by:** Jason Lu  
**Humidity:** 53% RH **Polarity:** Ver. / Hor.

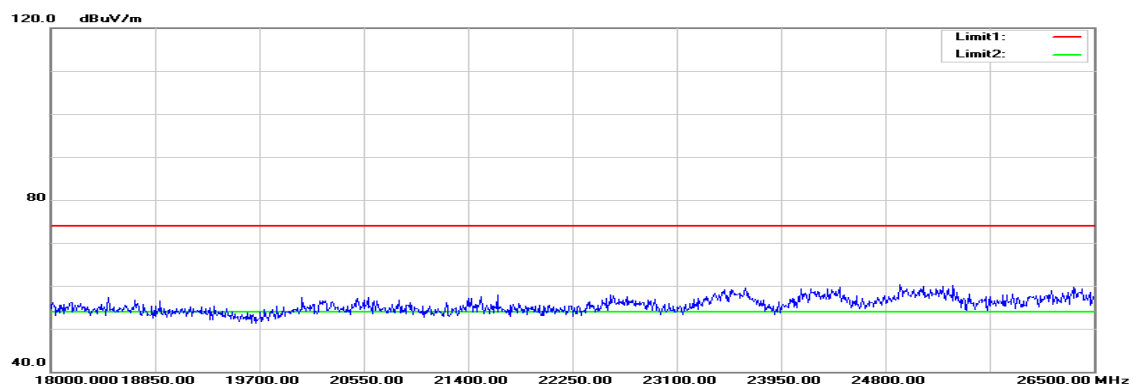
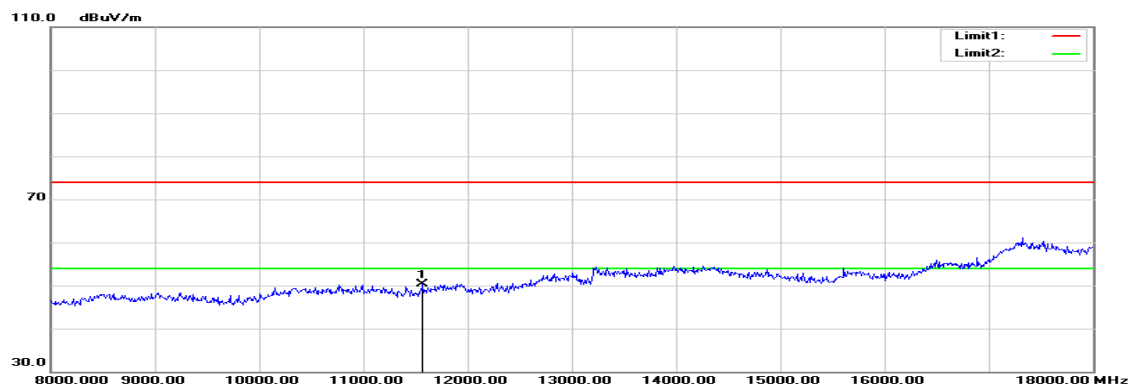
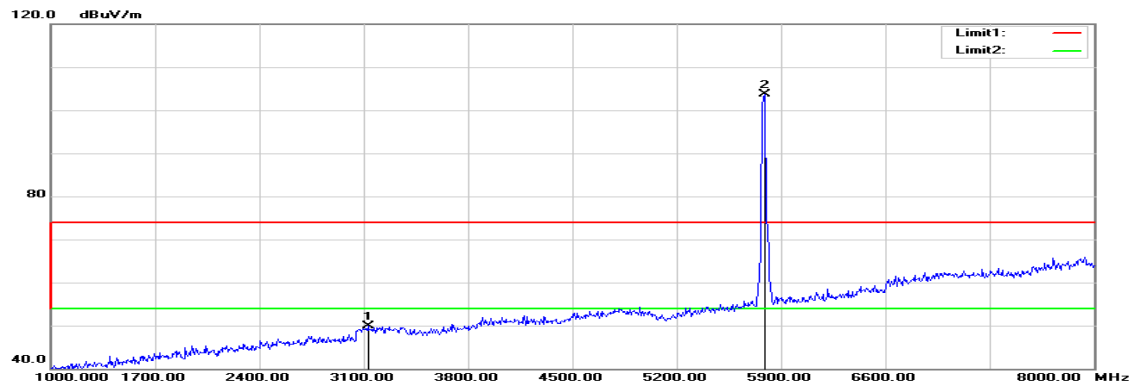
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3268.000	52.03	-1.47	50.56	74.00	-23.44	peak	V
11750.000	33.25	17.00	50.25	74.00	-23.75	peak	V
N/A							
3247.000	53.27	-1.52	51.75	74.00	-22.25	peak	H
11970.000	33.64	17.19	50.83	74.00	-23.17	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

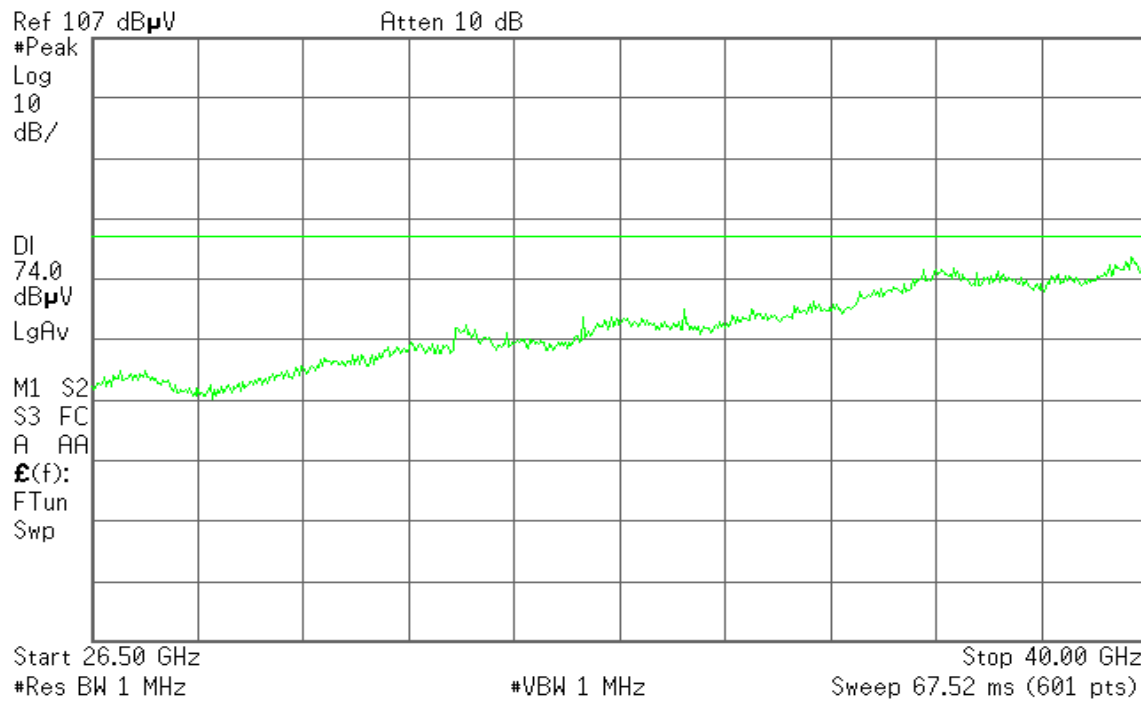
# TX / IEEE 802.11a mode / CH Mid

**Polarity: Vertical**



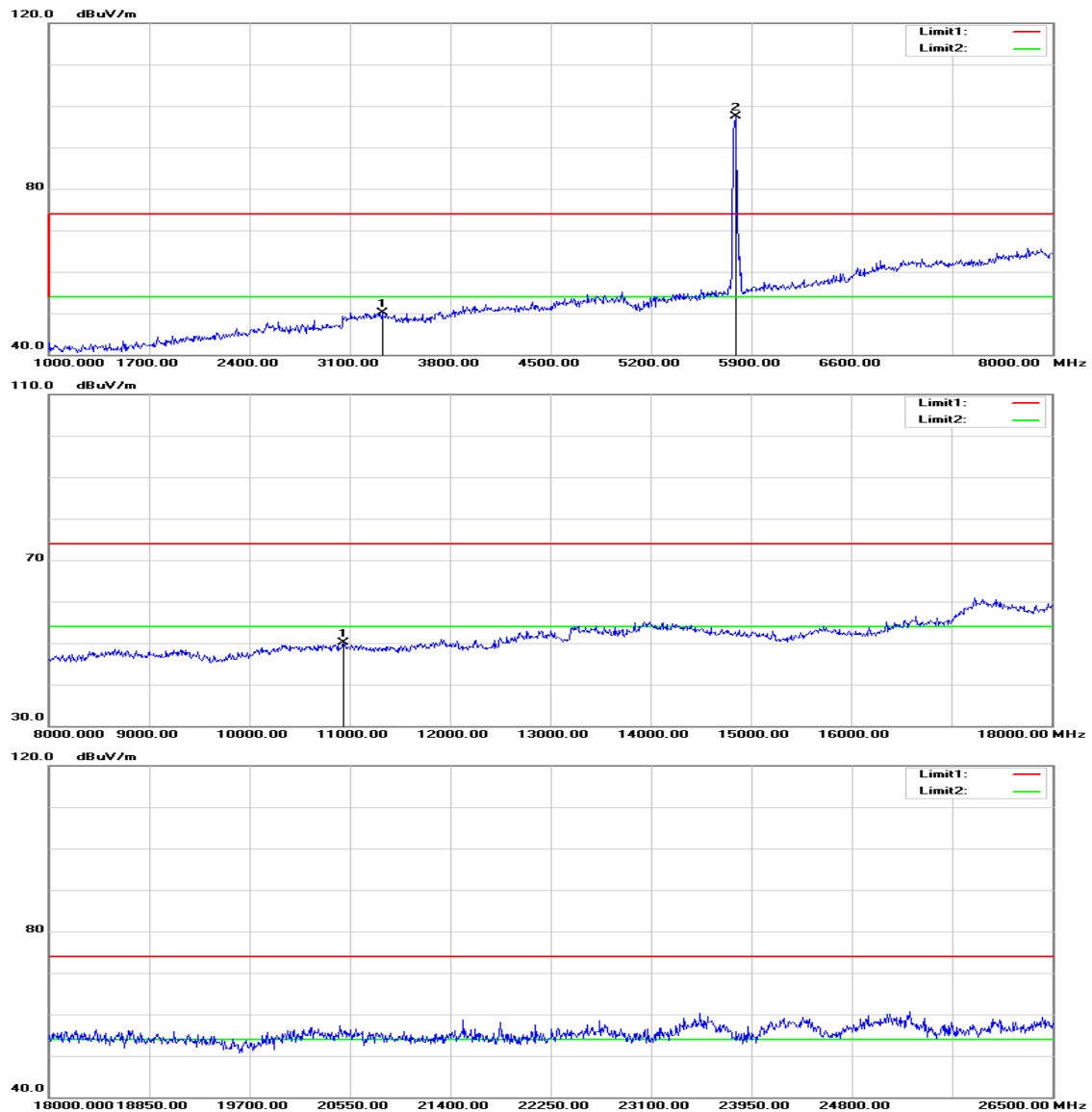
Agilent

R L



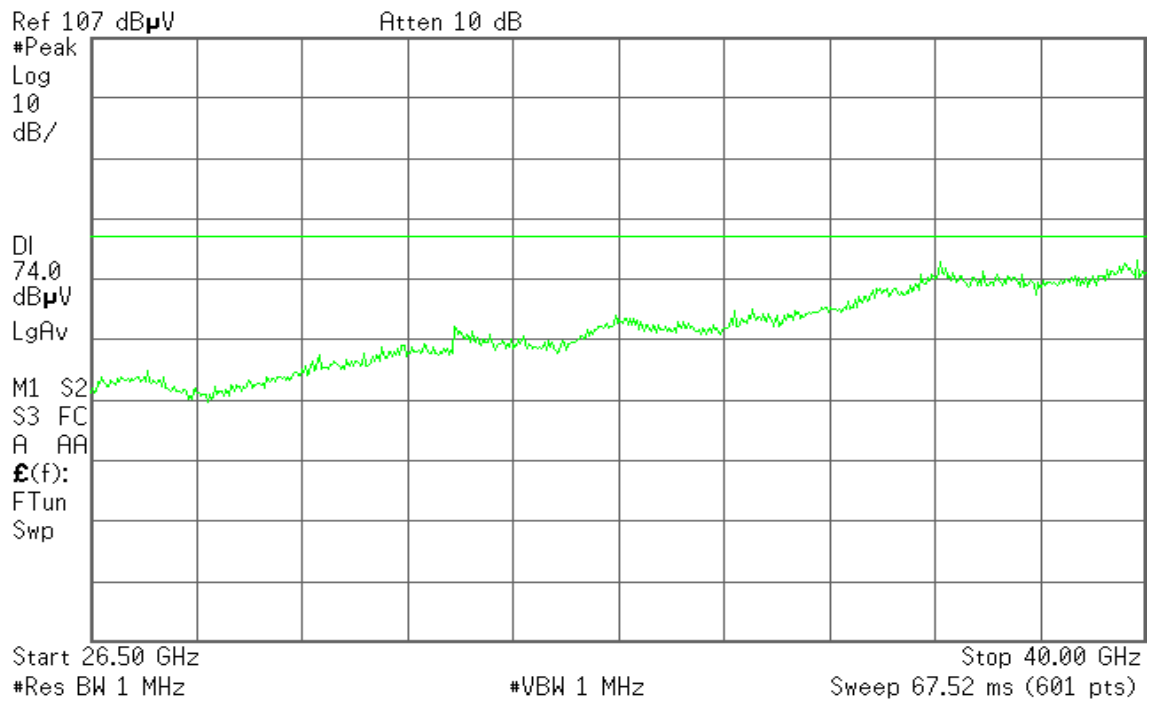


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11a mode / CH Mid      **Test Date:** December 10, 2015  
**Temperature:** 27°C      **Tested by:** Jason Lu  
**Humidity:** 53% RH      **Polarity:** Ver. / Hor.

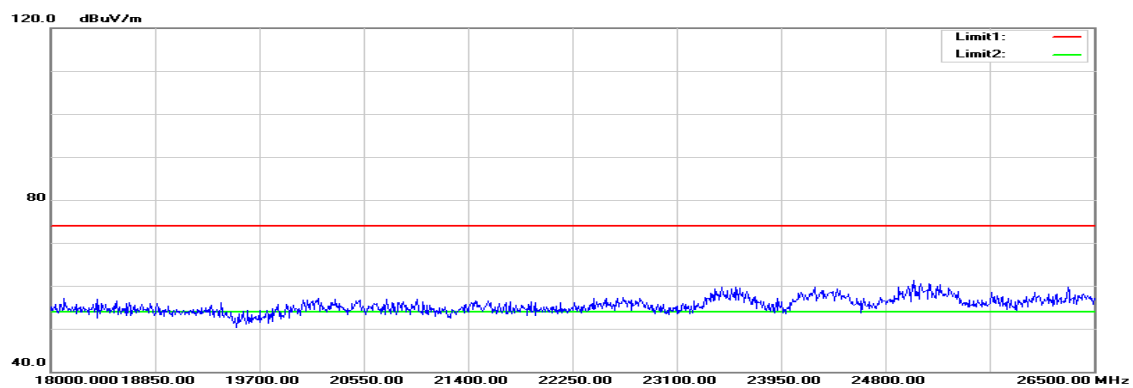
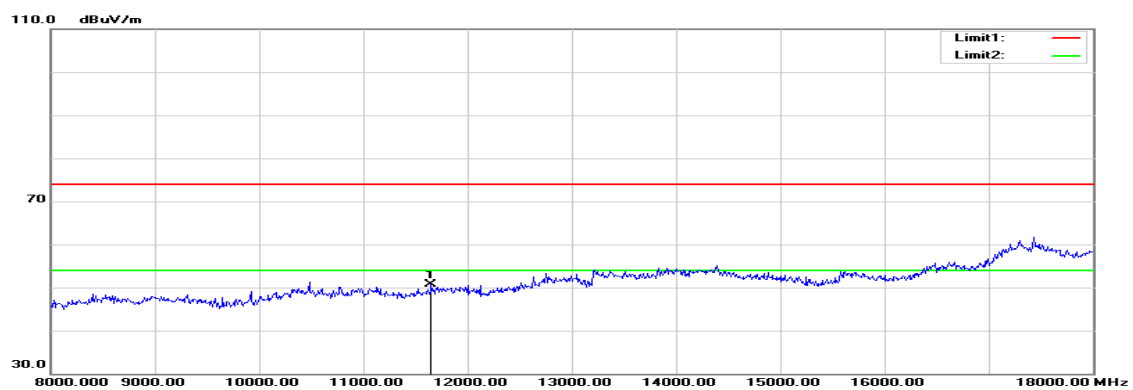
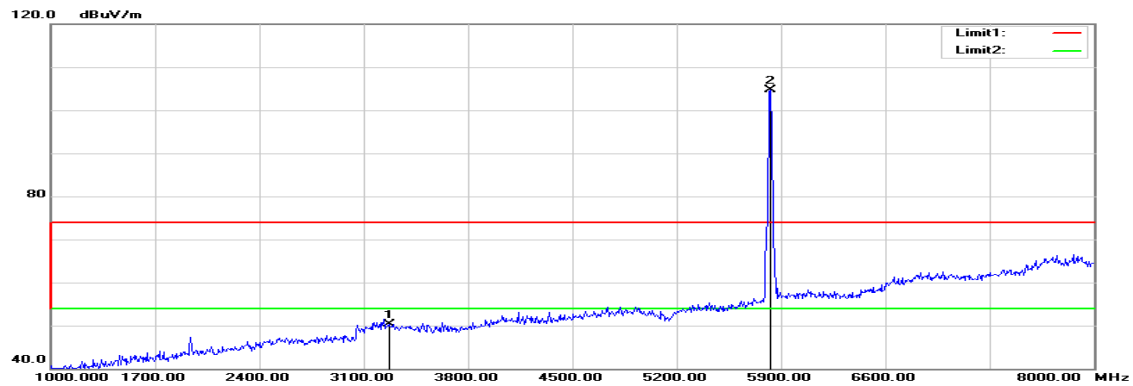
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3128.000	51.77	-1.80	49.97	74.00	-24.03	peak	V
11570.000	33.55	16.84	50.39	74.00	-23.61	peak	V
N/A							
3324.000	51.52	-1.33	50.19	74.00	-23.81	peak	H
10940.000	33.30	16.78	50.08	74.00	-23.92	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

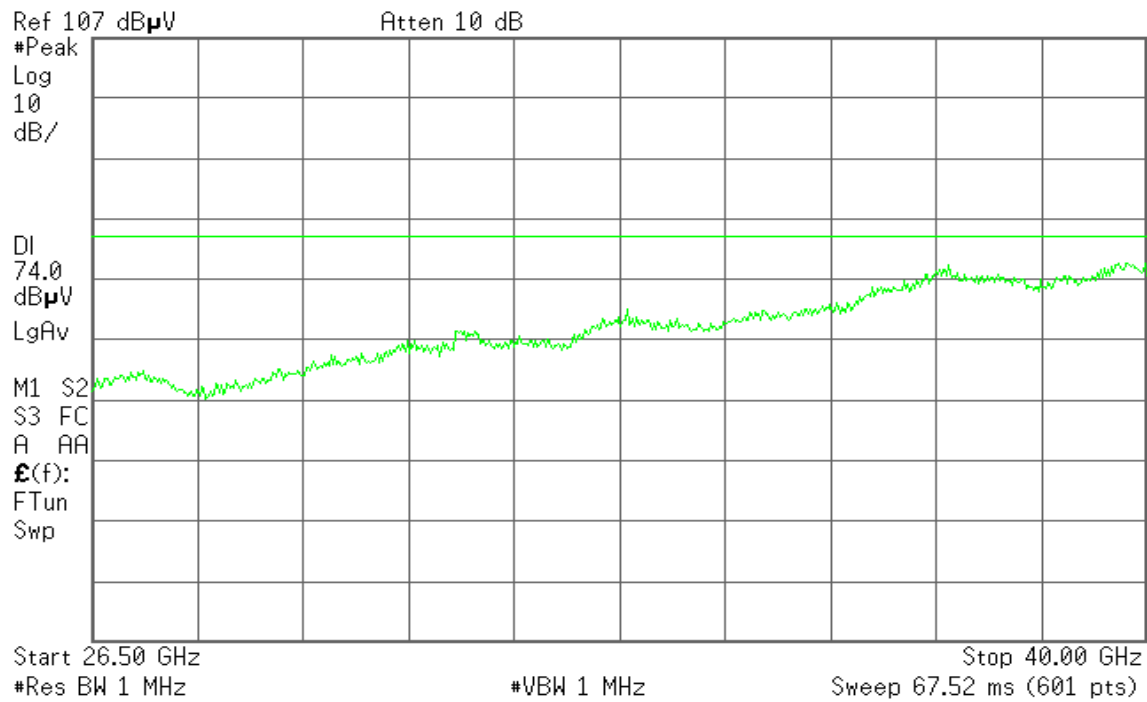
# TX / IEEE 802.11a mode / CH High

**Polarity: Vertical**

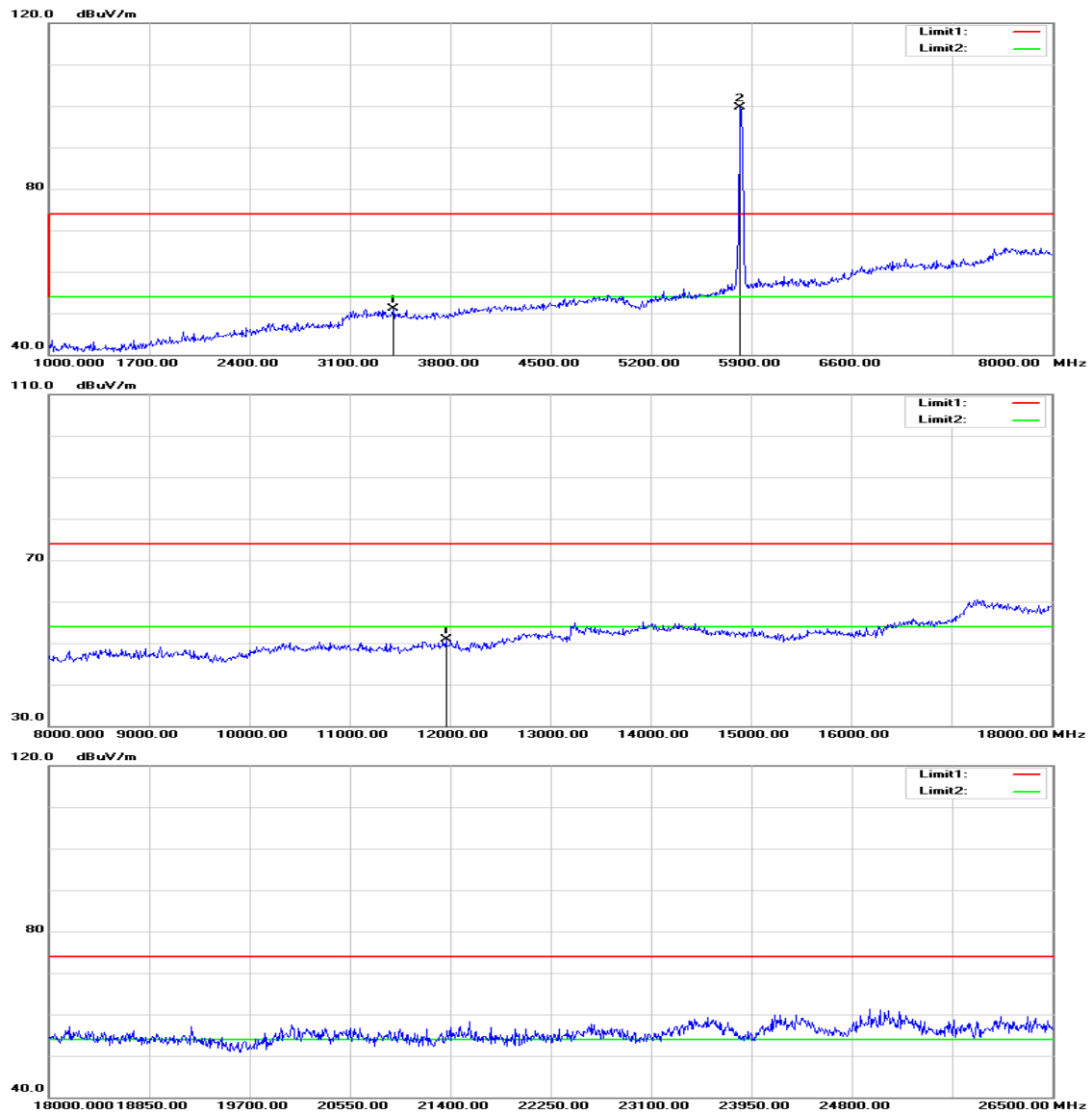


Agilent

R L

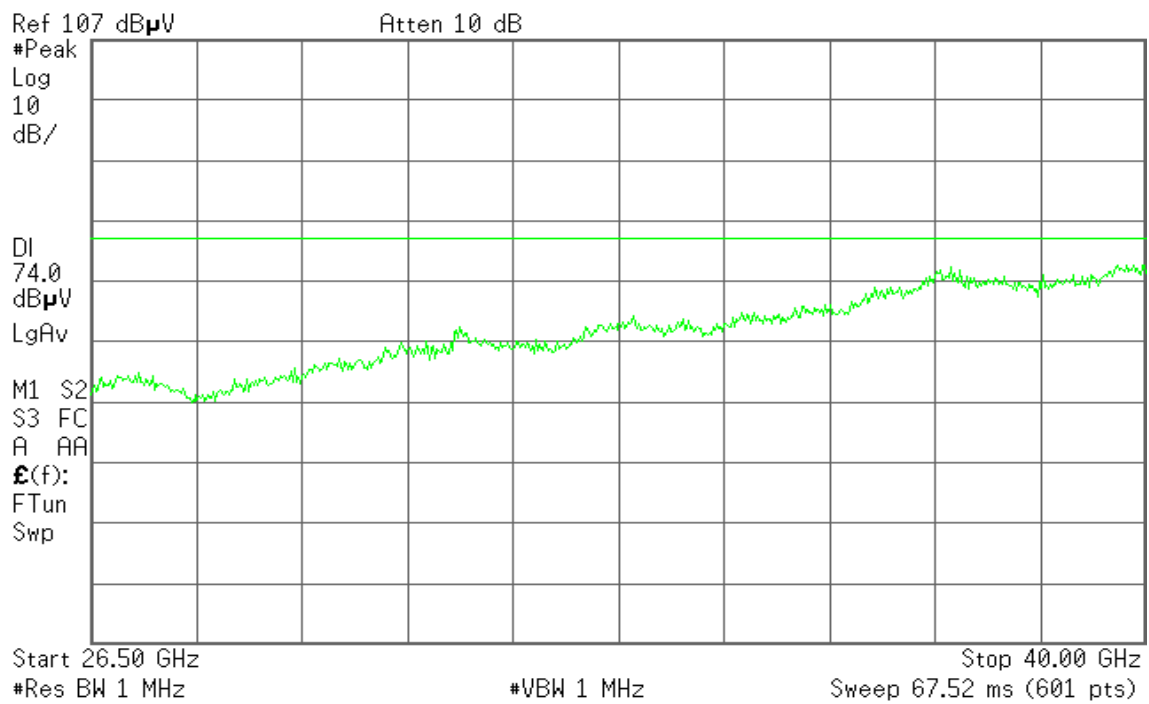


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11a mode / CH High    **Test Date:** December 10, 2015  
**Temperature:** 27°C    **Tested by:** Jason Lu  
**Humidity:** 53% RH    **Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3268.000	51.86	-1.47	50.39	74.00	-23.61	peak	V
11650.000	33.76	16.91	50.67	74.00	-23.33	peak	V
N/A							
3401.000	52.18	-1.15	51.03	74.00	-22.97	peak	H
11960.000	33.76	17.18	50.94	74.00	-23.06	peak	H
N/A							

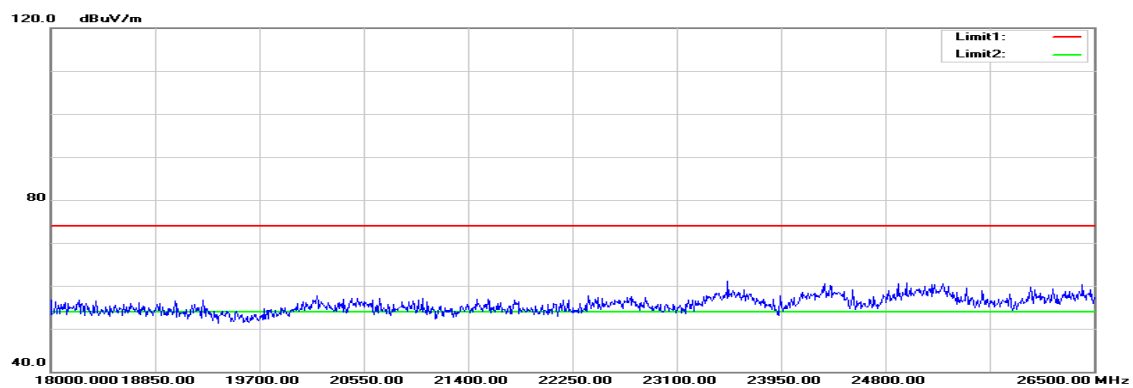
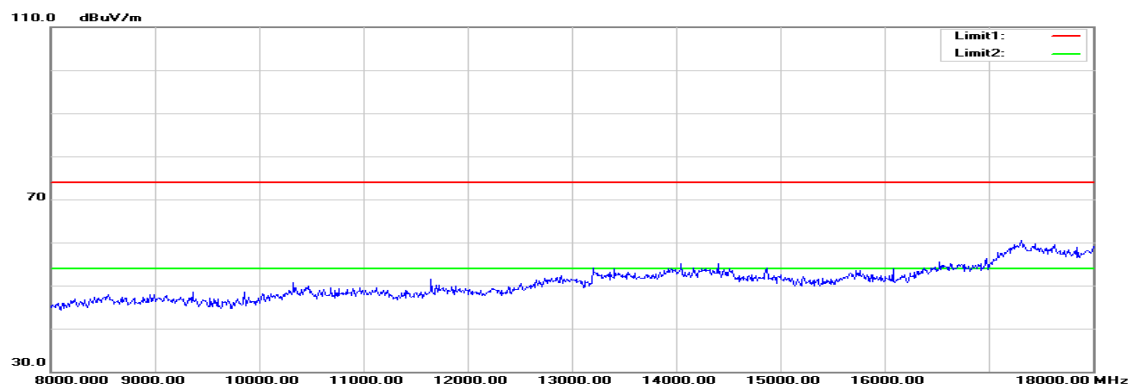
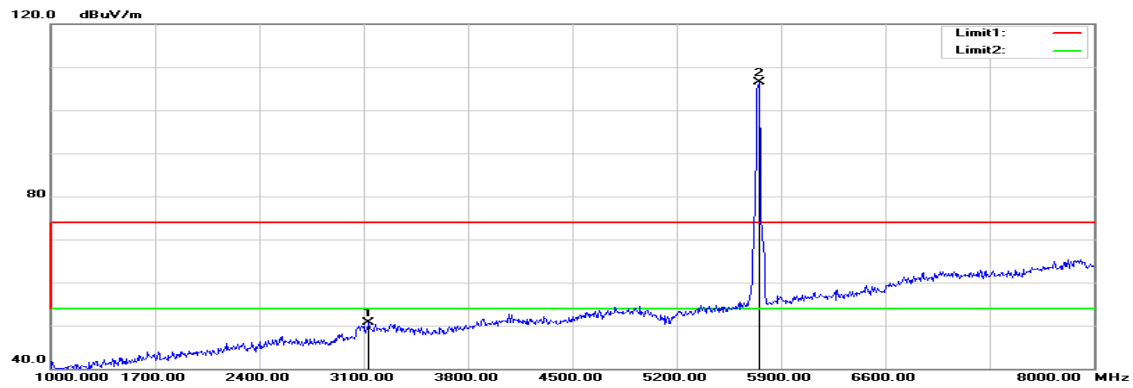
**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6.  $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$ .



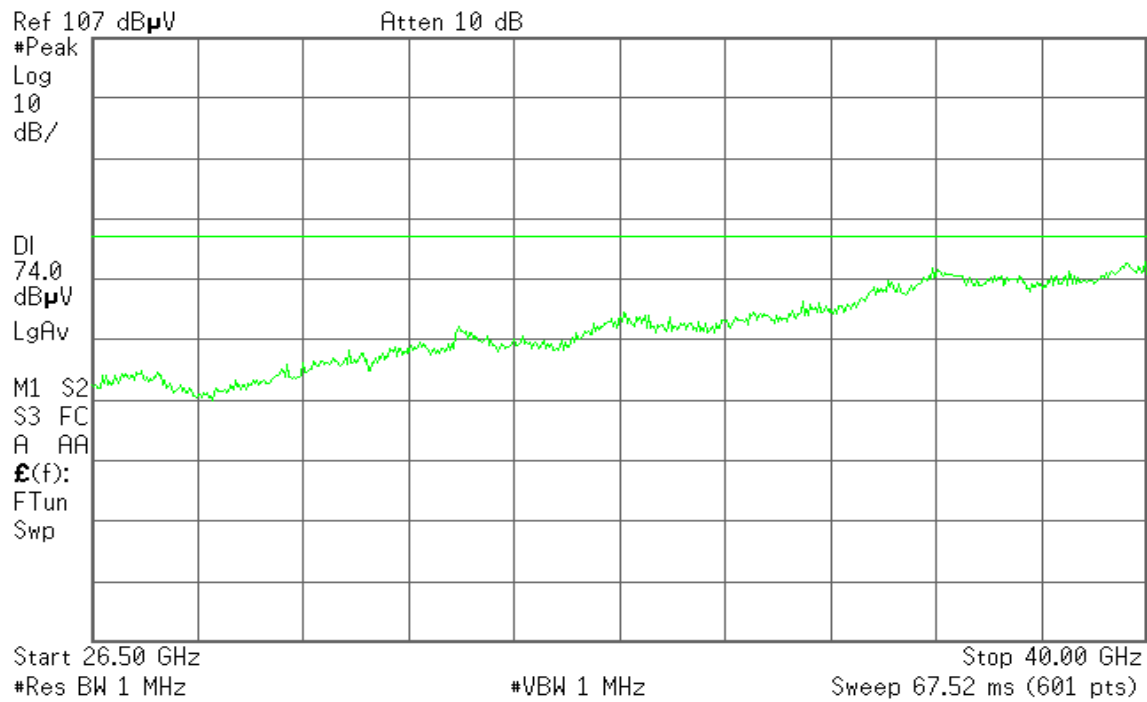
# TX / IEEE 802.11n HT 20 MHz mode / CH Low

**Polarity: Vertical**

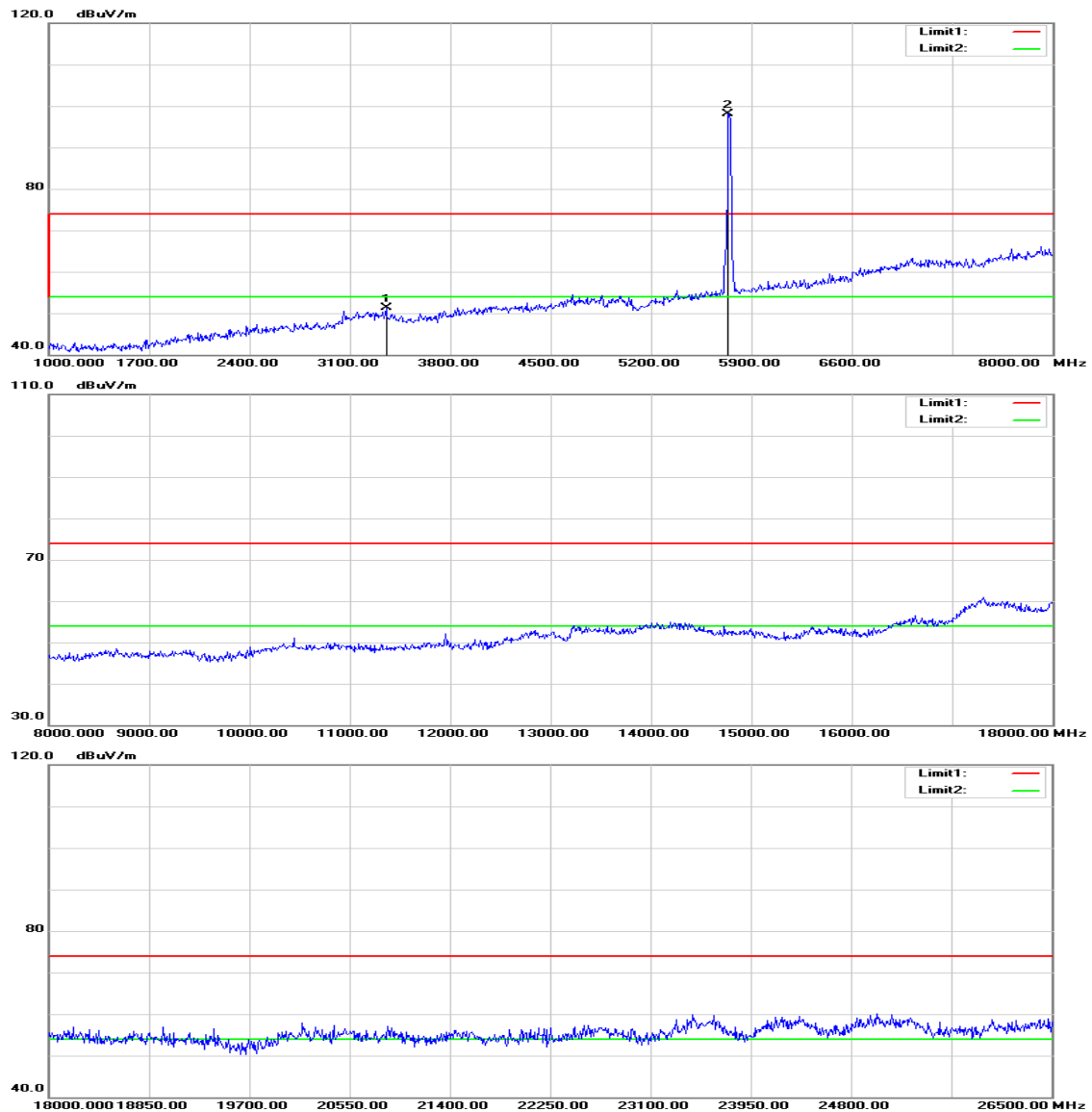


Agilent

R L

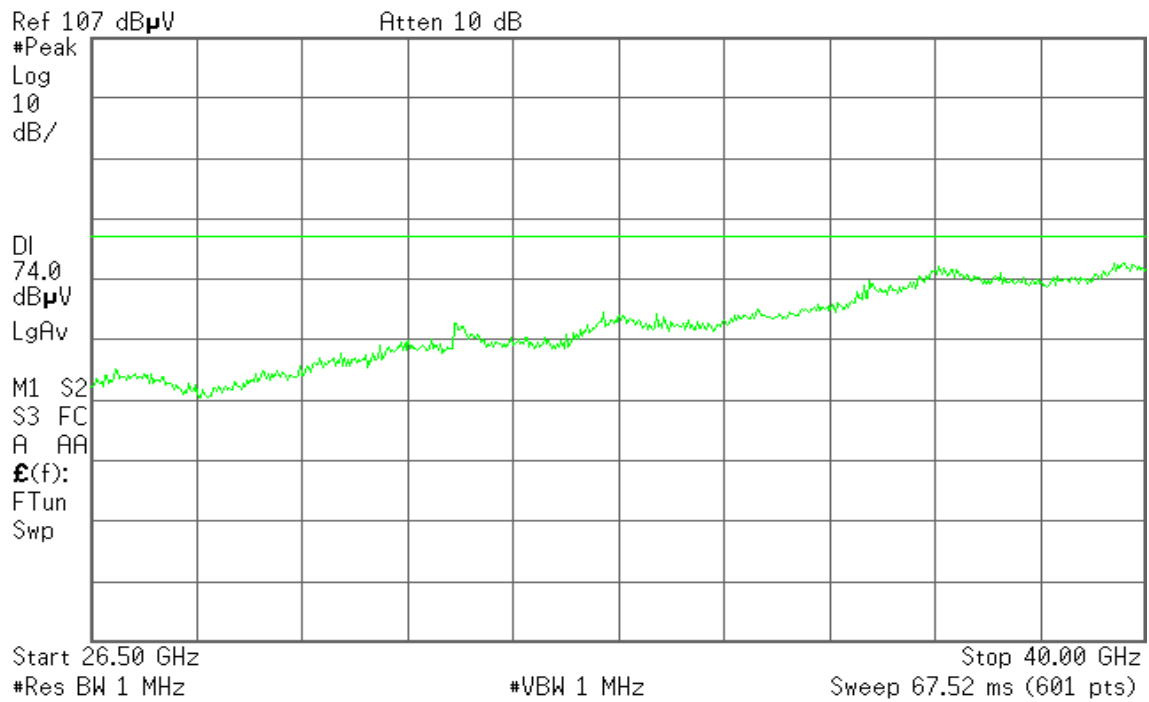


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode /  
CH Low

**Test Date:** December 10, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

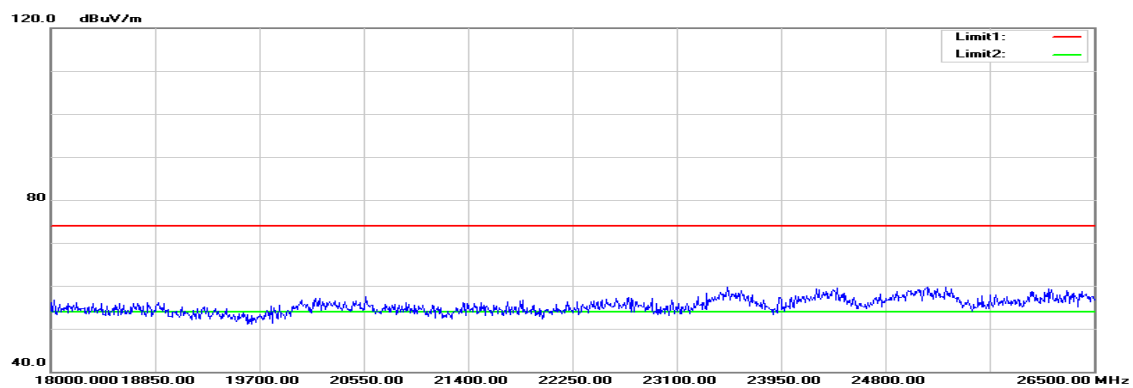
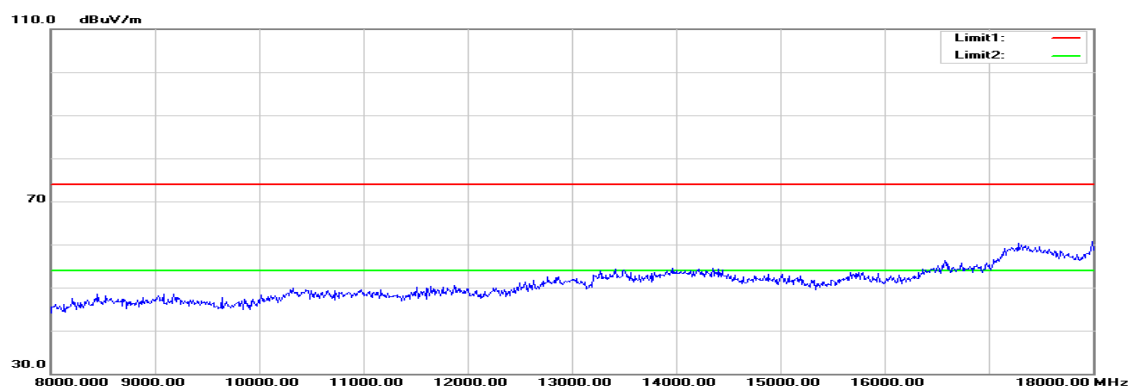
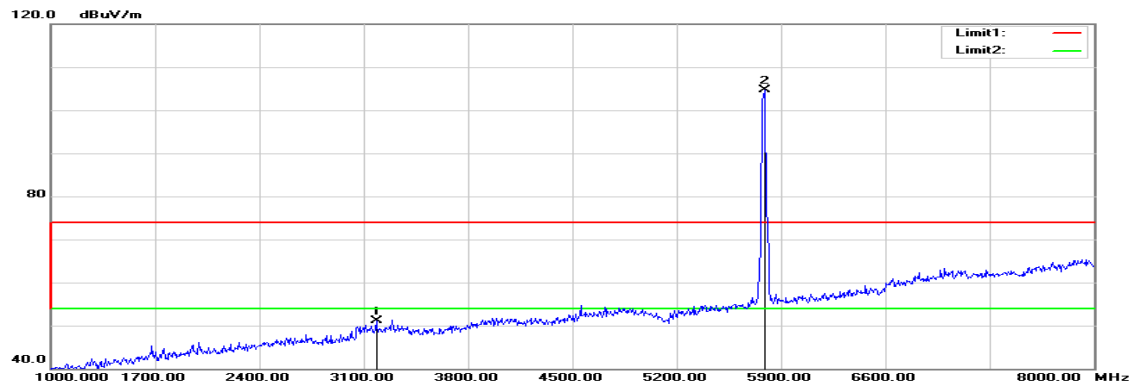
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3135.000	52.46	-1.79	50.67	74.00	-23.33	peak	V
N/A							
3352.000	52.54	-1.27	51.27	74.00	-22.73	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

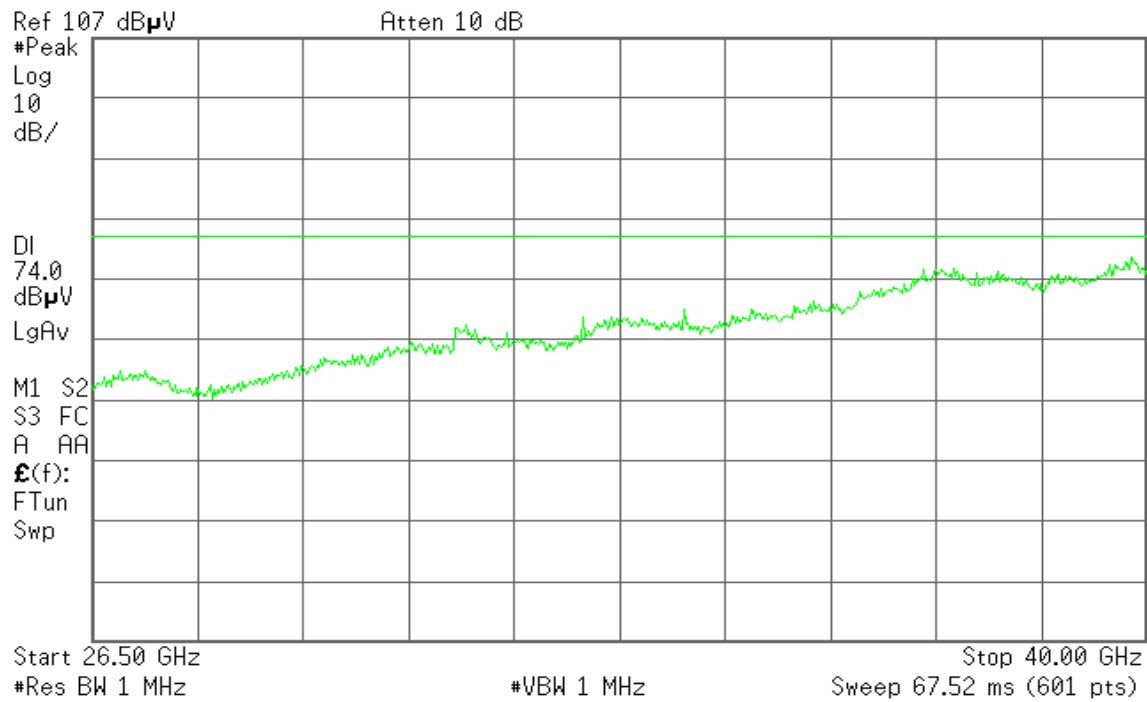
# **TX / IEEE 802.11n HT 20 MHz mode / CH Mid**

**Polarity: Vertical**

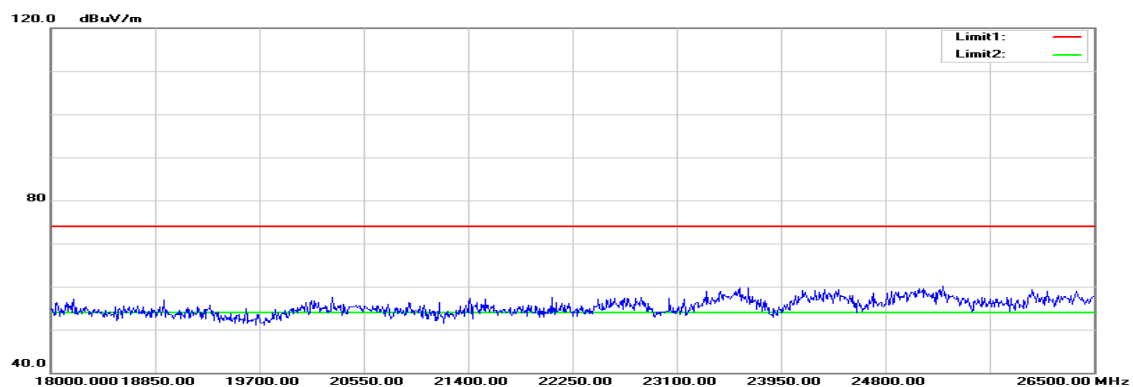
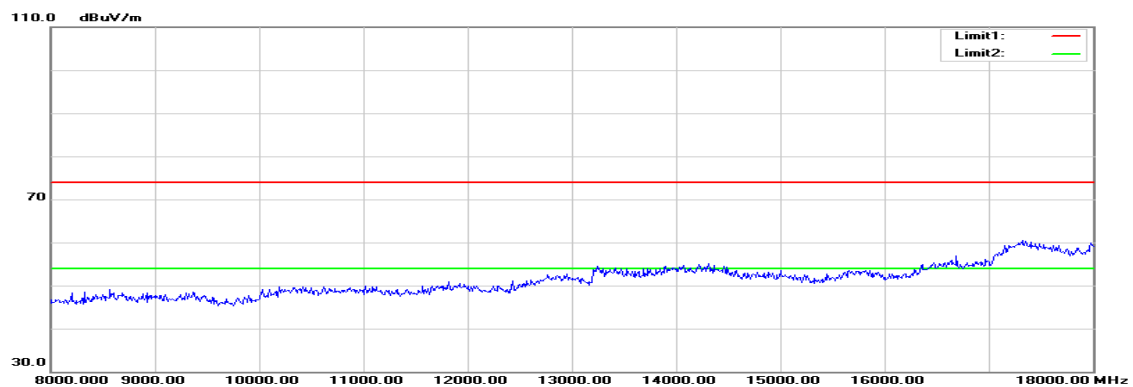
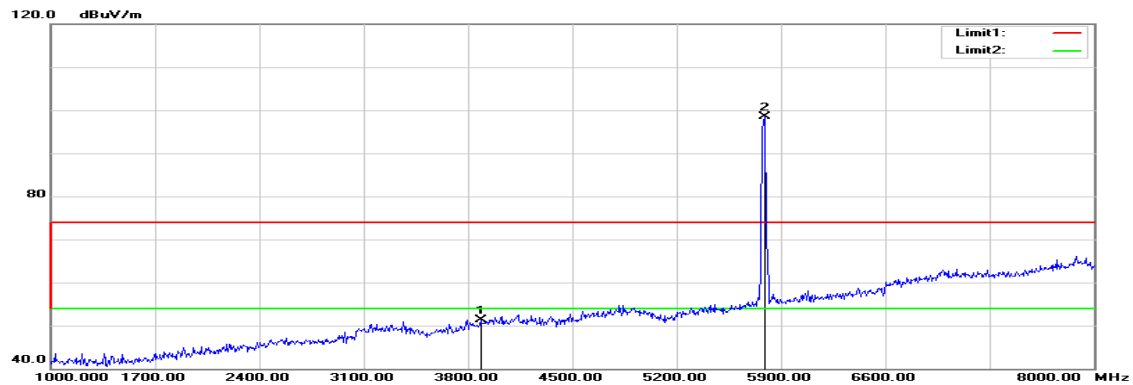


Agilent

R L



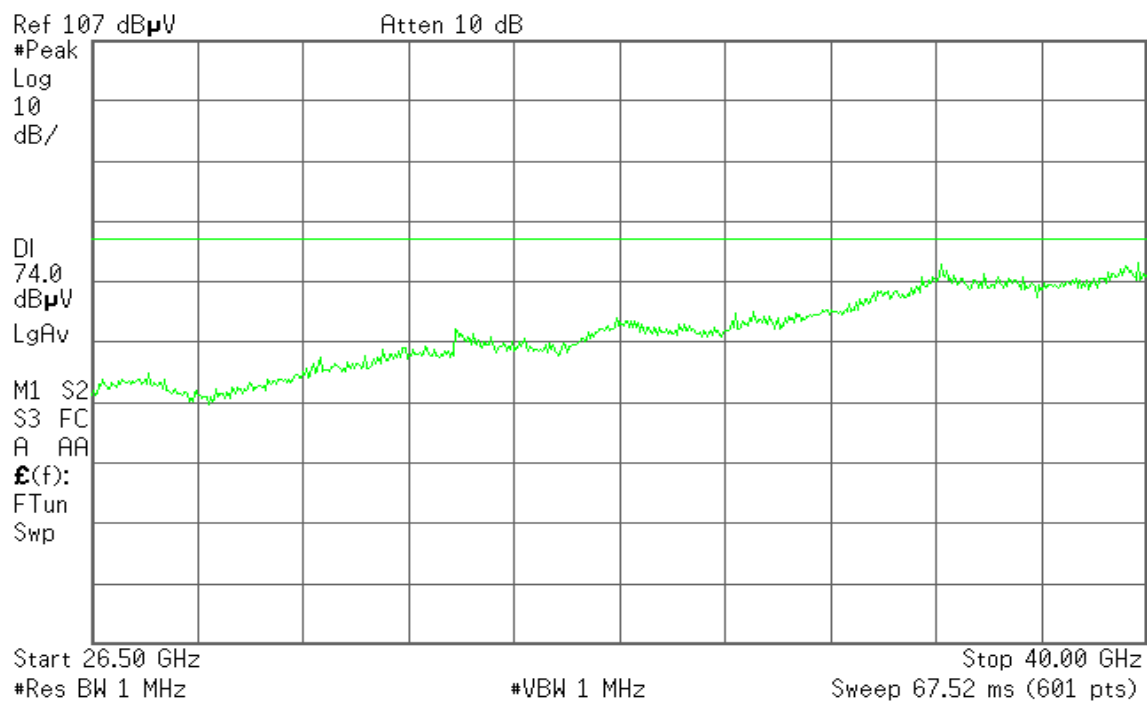
## Polarity: Horizontal





\* Agilent

R L



**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode /  
CH Mid

**Test Date:** December 10, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

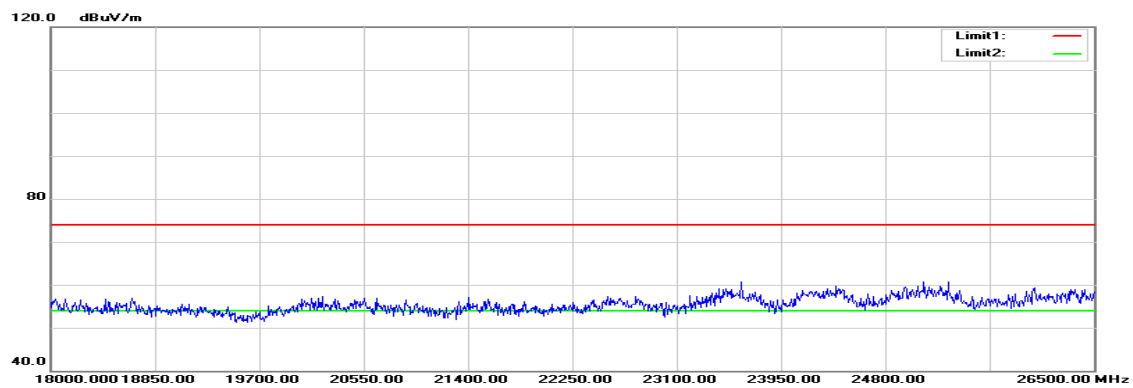
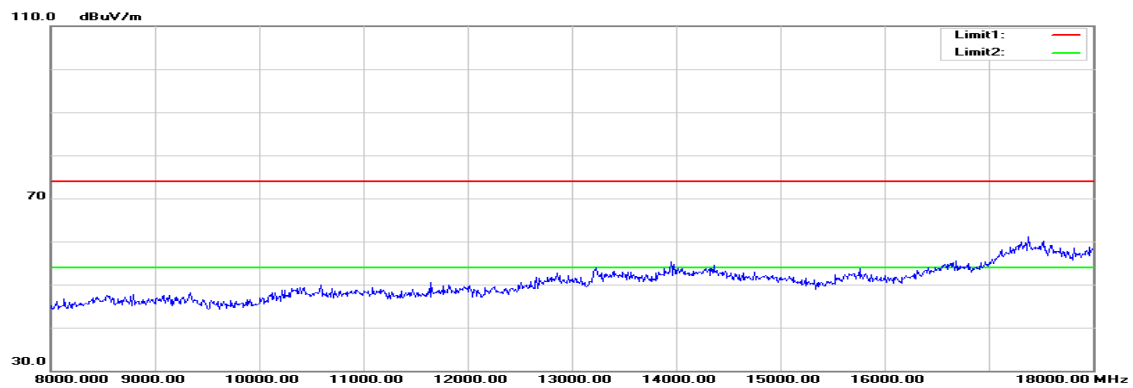
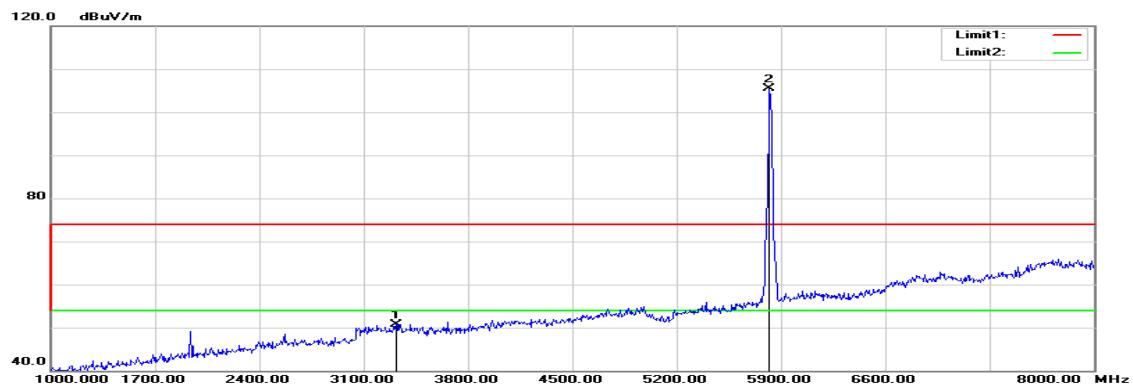
**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3184.000	52.76	-1.67	51.09	74.00	-22.91	peak	V
N/A							
3884.000	50.60	0.73	51.33	74.00	-22.67	peak	H
N/A							

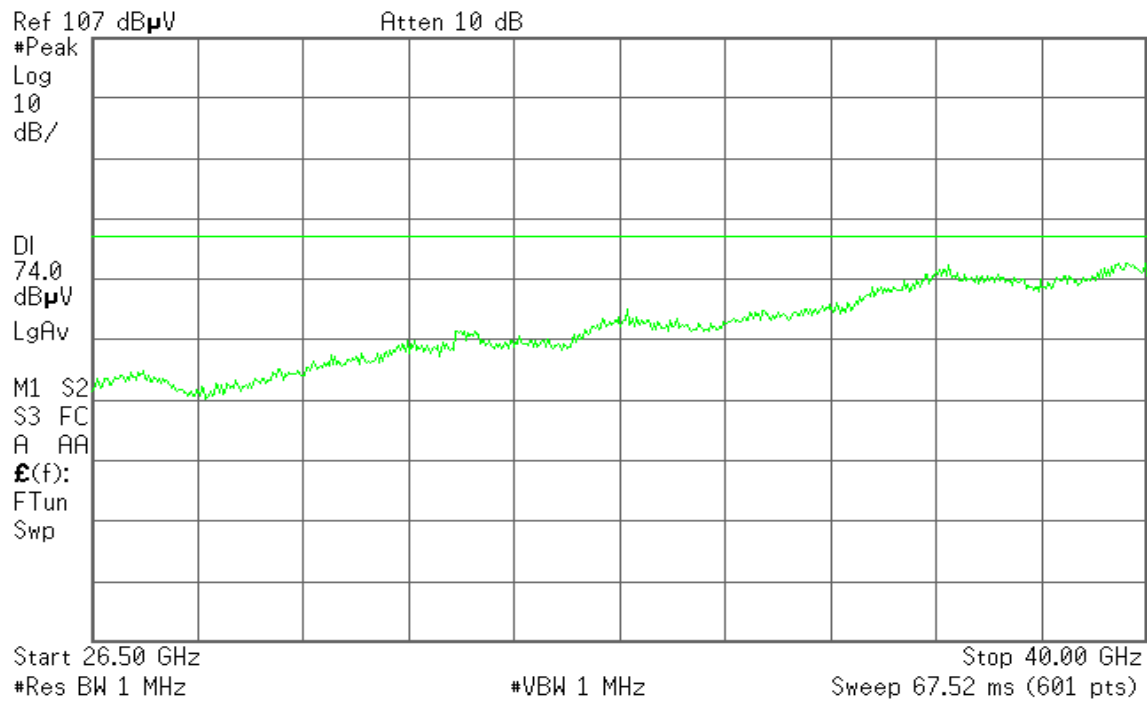
**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

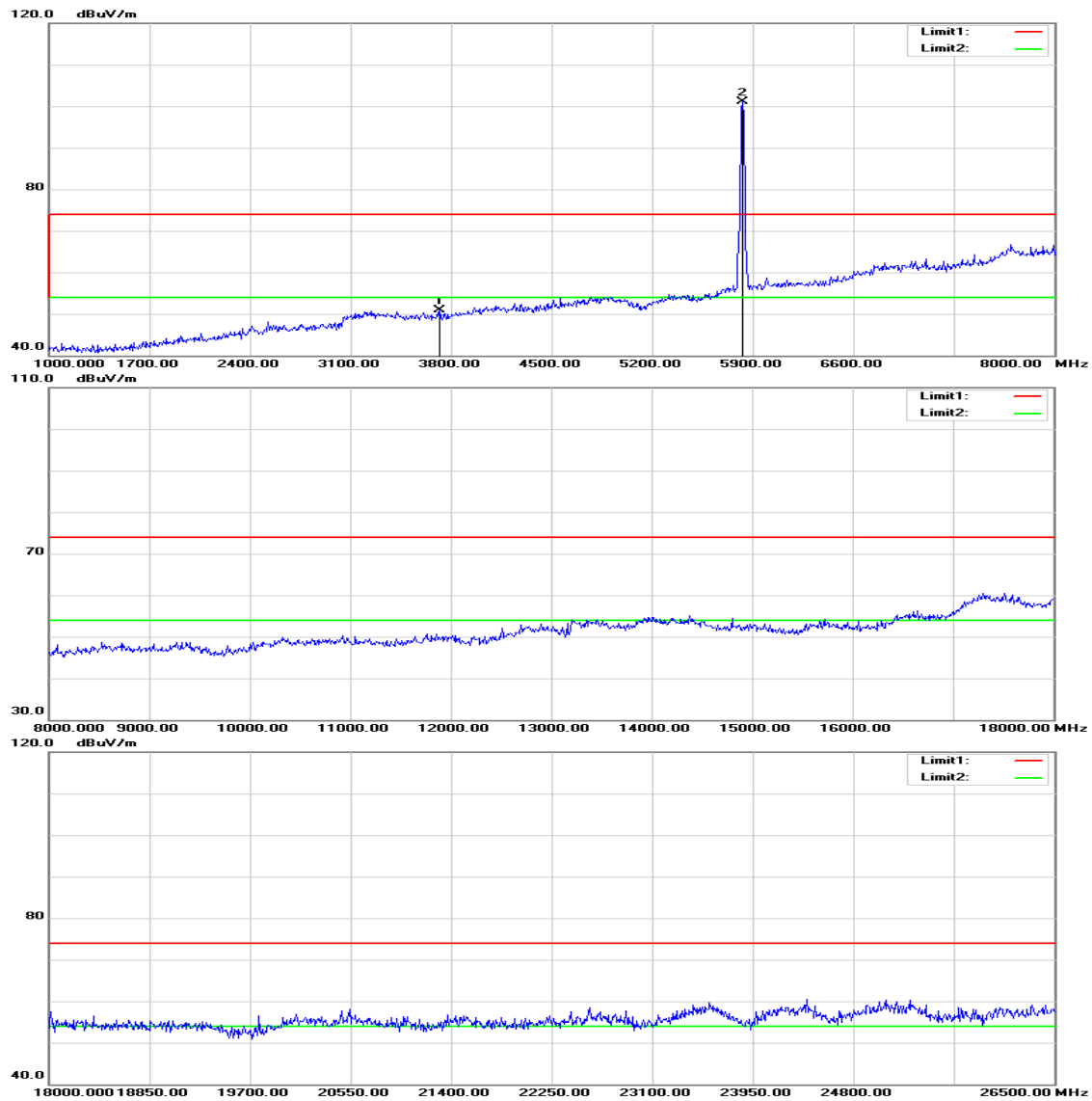
**TX / IEEE 802.11n HT 20 MHz mode / CH High****Polarity: Vertical**

Agilent

R L

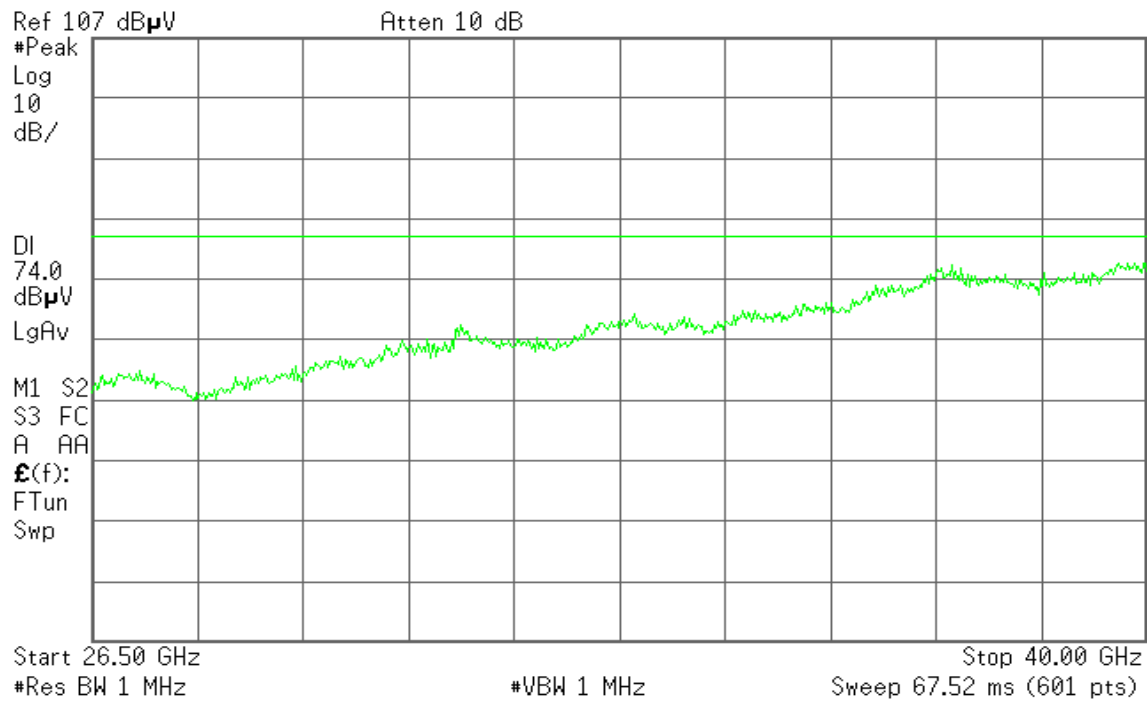


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / CH High

**Test Date:** December 10, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

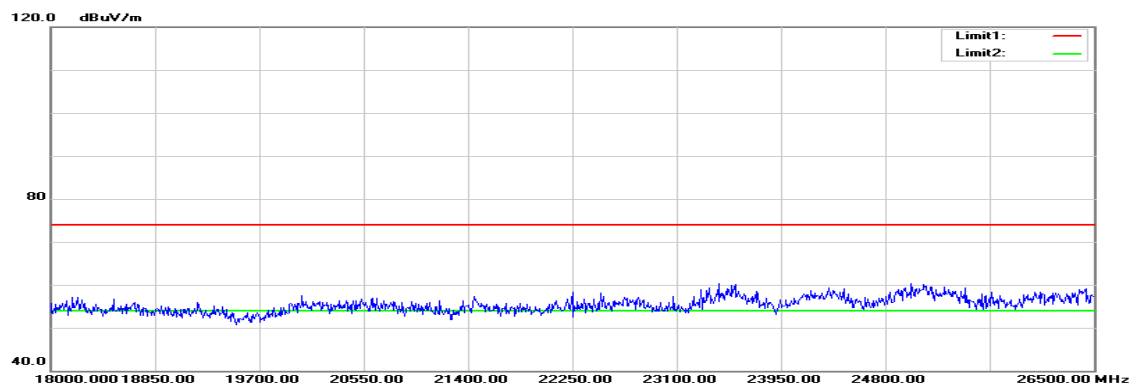
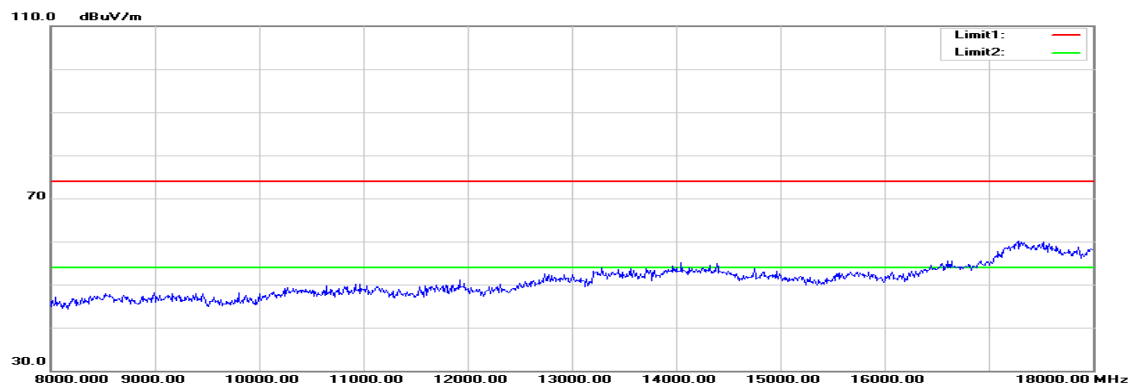
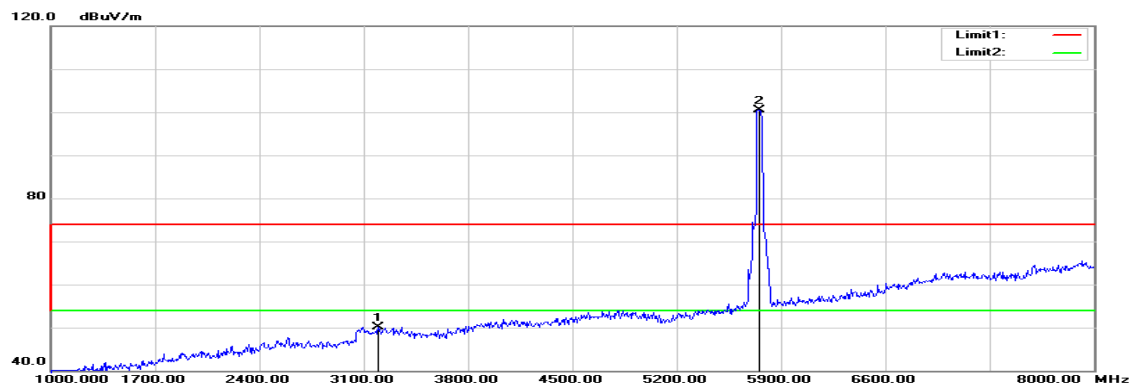
**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3317.000	52.15	-1.35	50.80	74.00	-23.20	peak	V
N/A							
3723.000	50.87	0.04	50.91	74.00	-23.09	peak	H
N/A							

**Remark:**

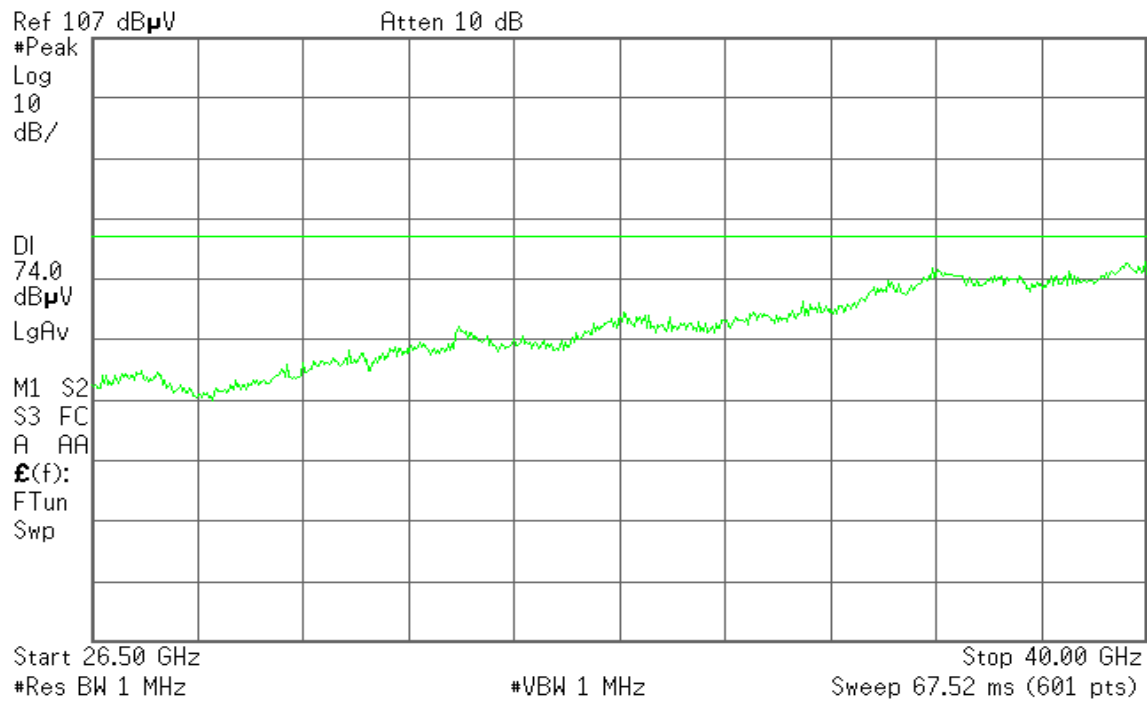
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6.  $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$ .

**TX / IEEE 802.11n HT 40 MHz mode / CH Low****Polarity: Vertical**

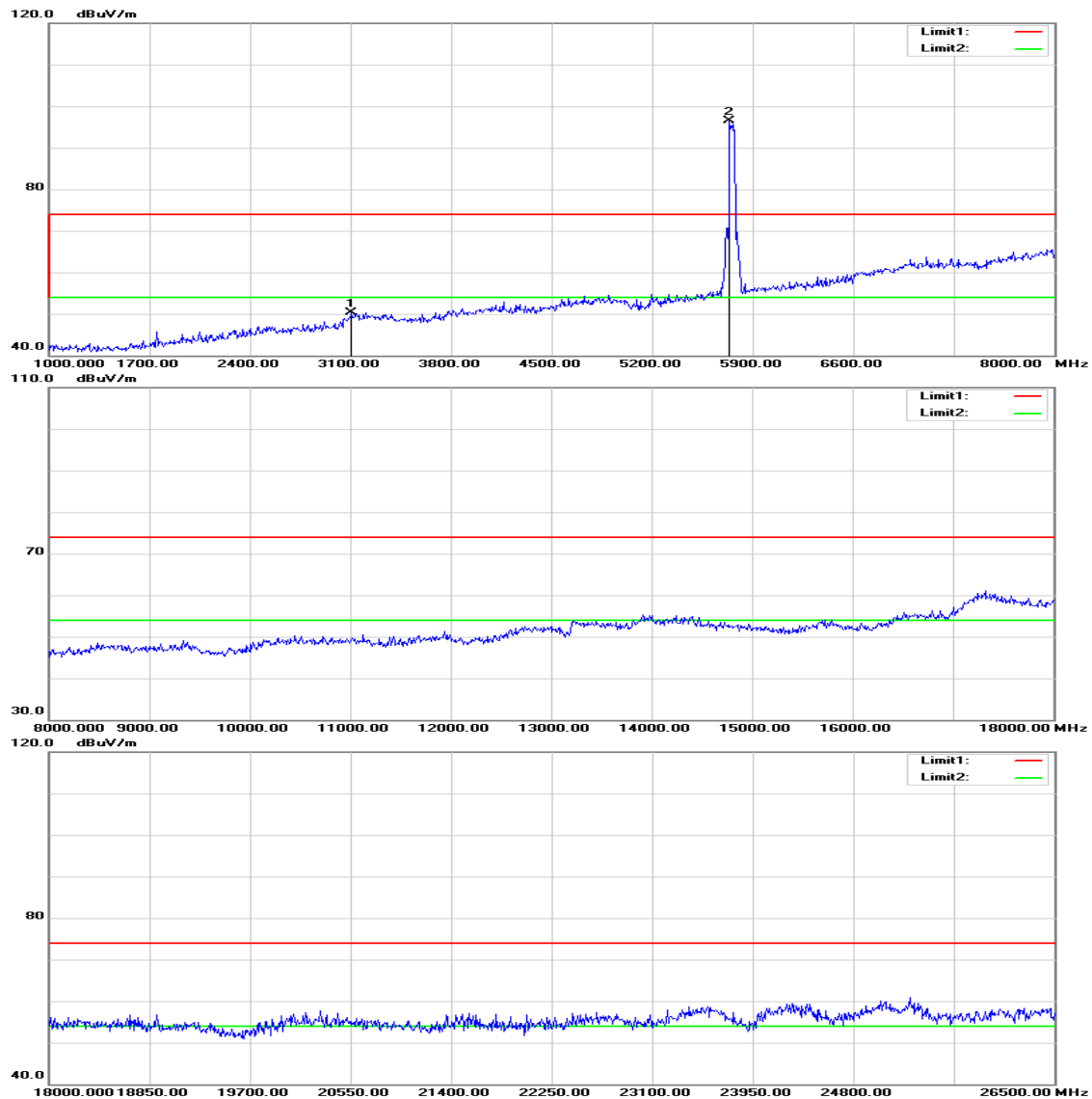


Agilent

R L

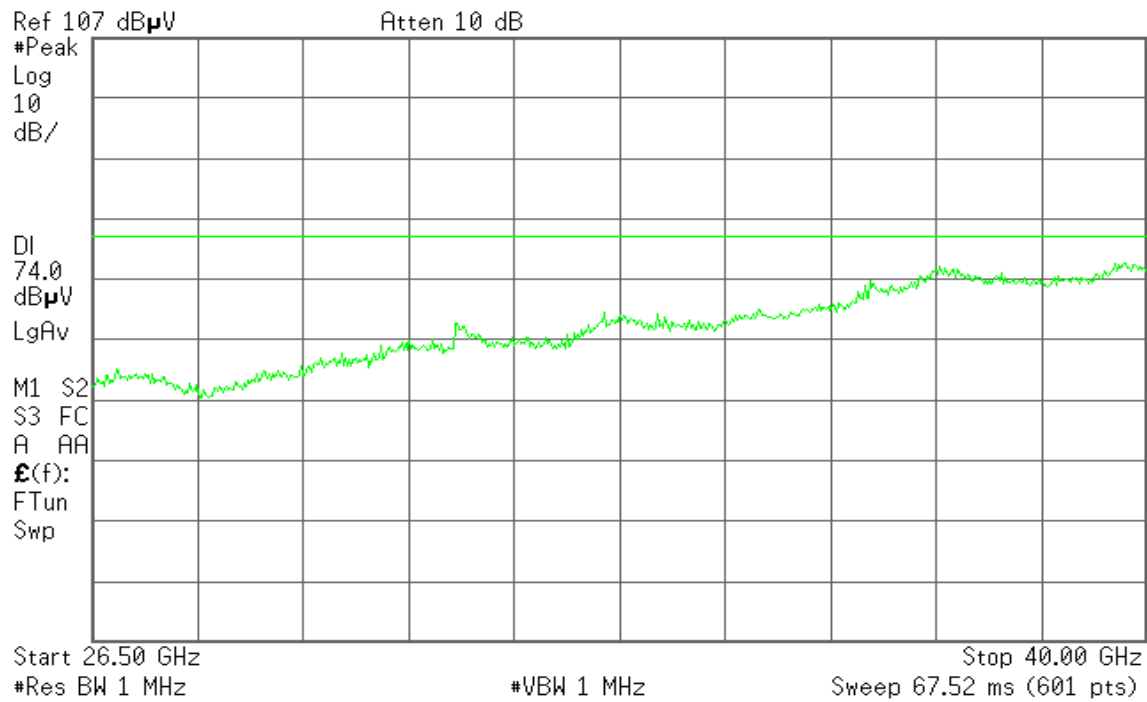


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** TX / IEEE 802.11n HT 40 MHz mode  
/ CH Low

**Test Date:** December 10, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

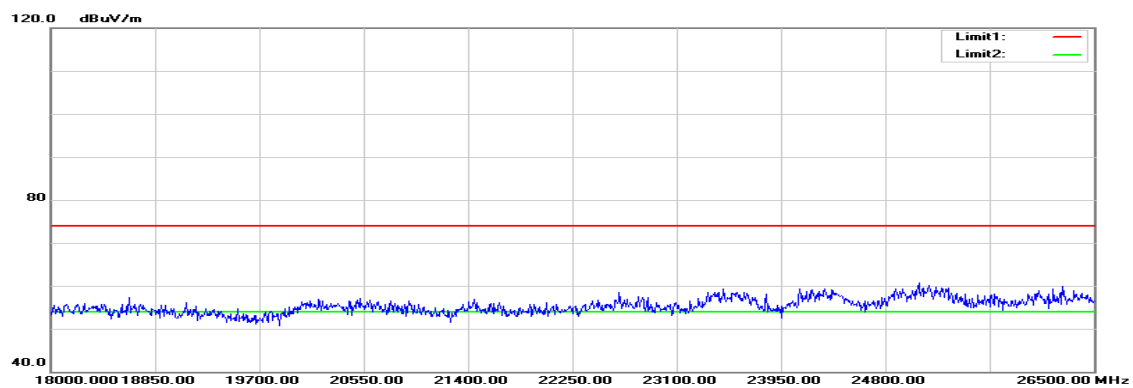
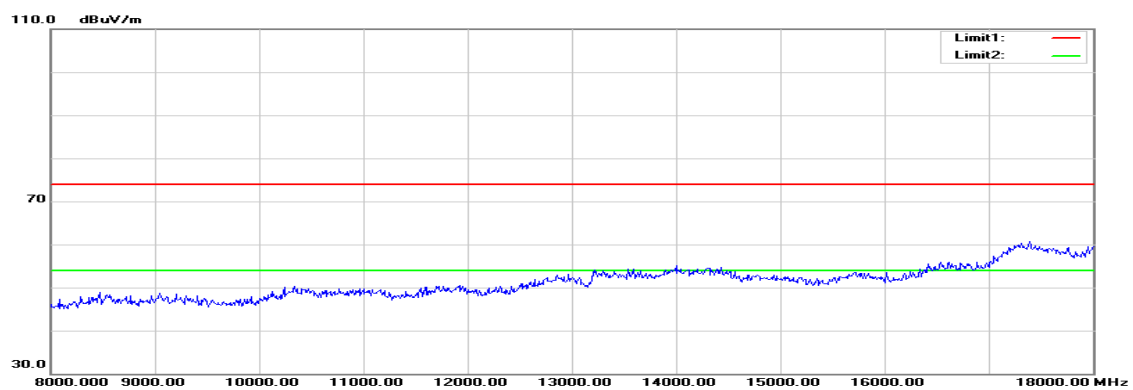
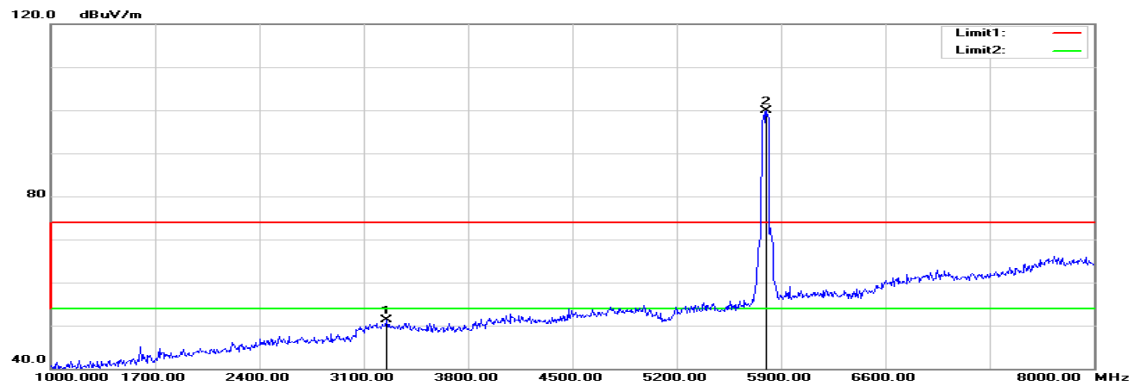
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3198.000	51.77	-1.63	50.14	74.00	-23.86	peak	V
N/A							
3107.000	52.17	-1.85	50.32	74.00	-23.68	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6.  $\text{Margin (dB)} = \text{Remark result (dBuV/m)} - \text{Average limit (dBuV/m)}$ .

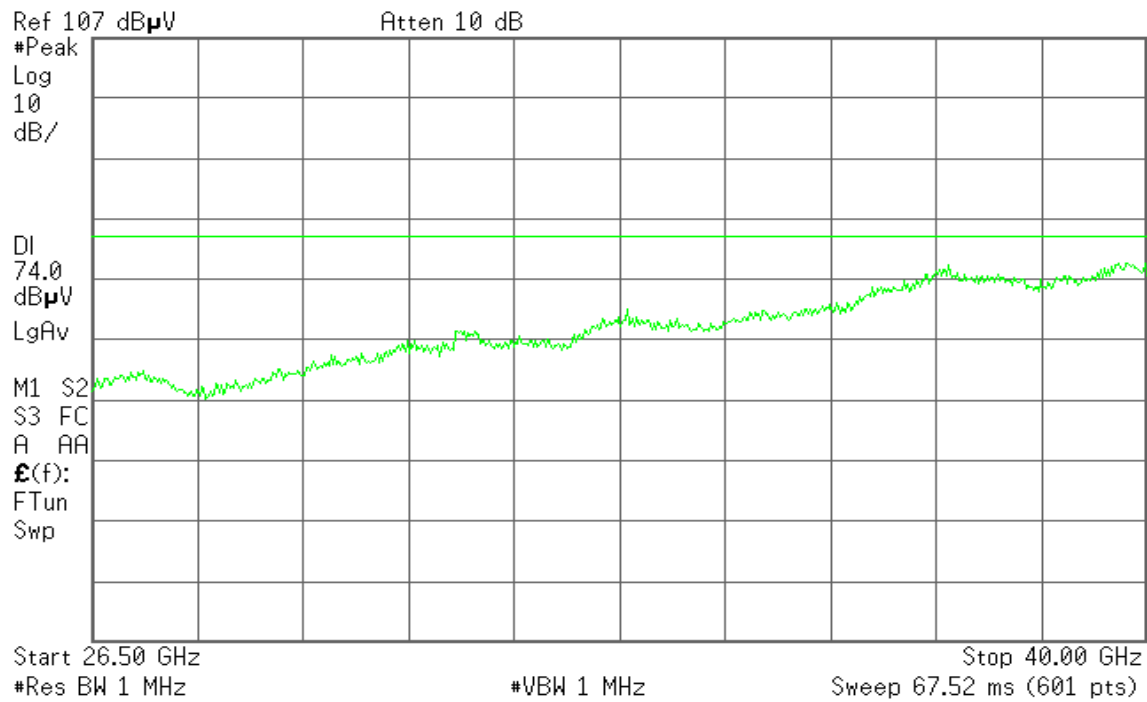
# TX / IEEE 802.11n HT 40 MHz mode / CH High

**Polarity: Vertical**

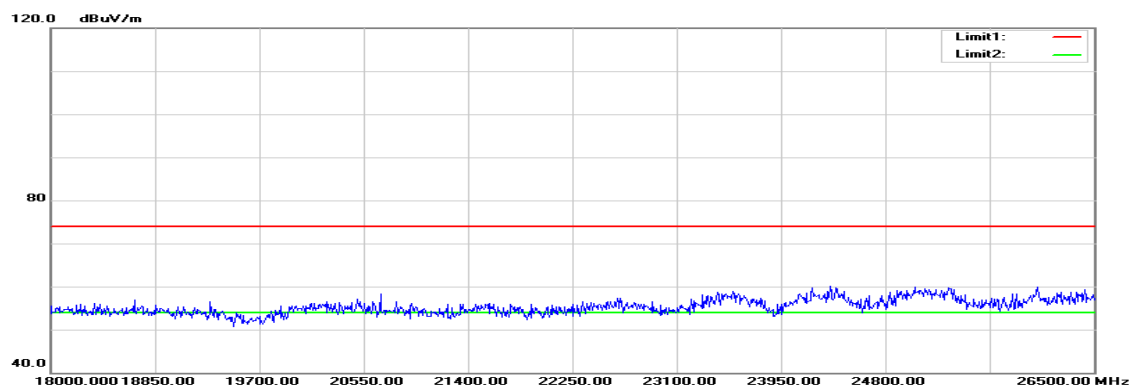
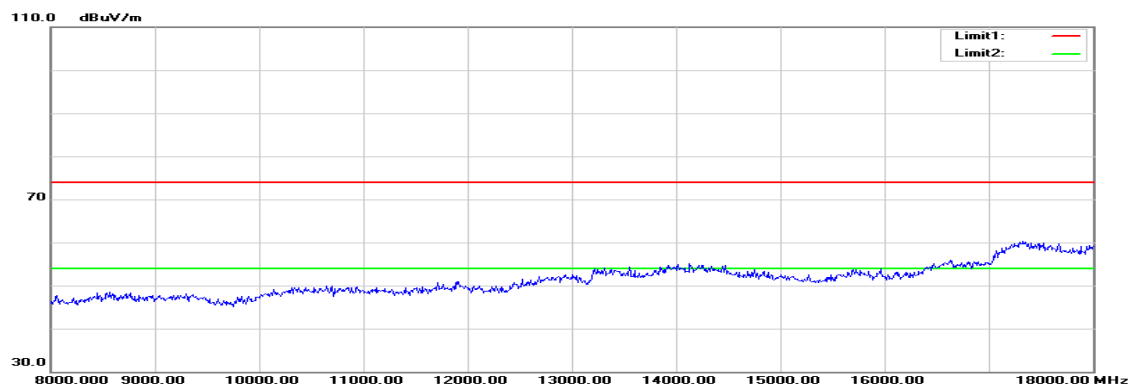
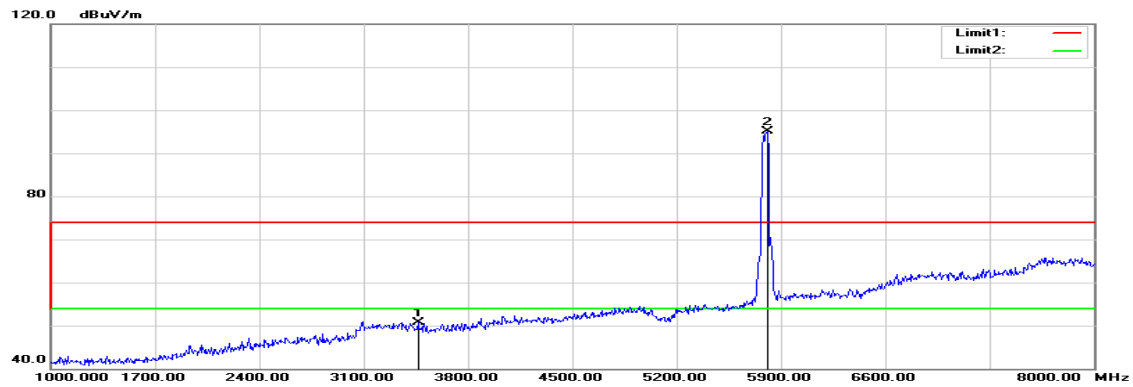


Agilent

R L

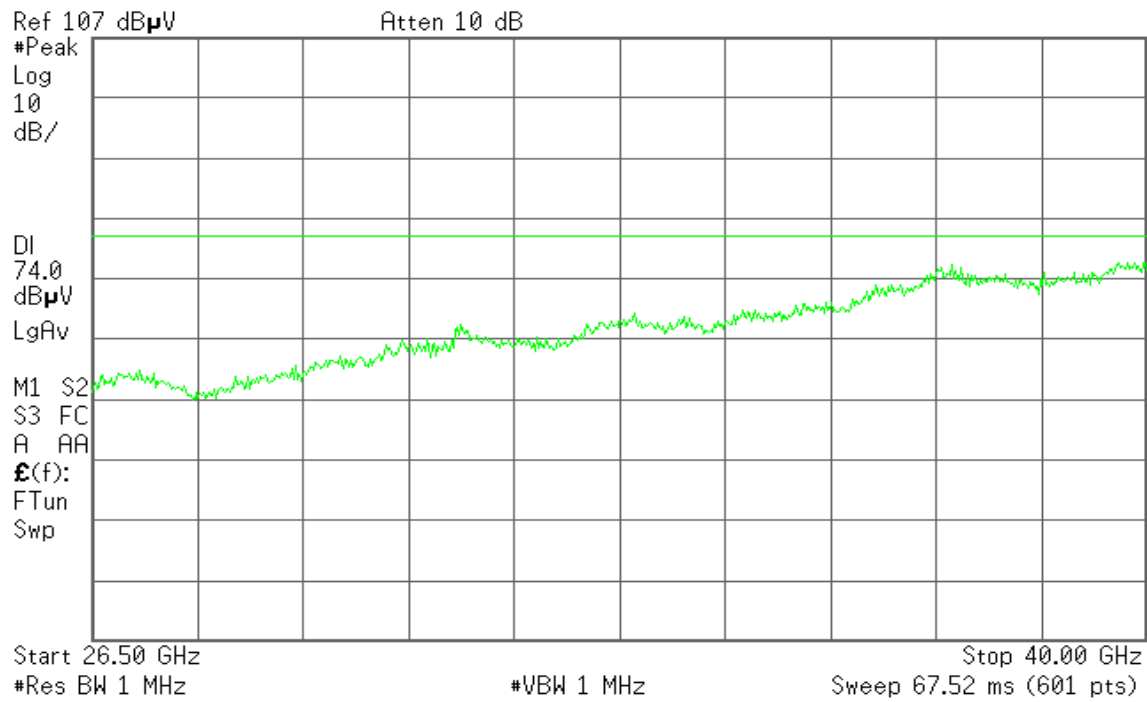


## Polarity: Horizontal



✱ Agilent

R L





**Operation Mode:** TX / IEEE 802.11n HT 40 MHz mode  
/ CH High

**Test Date:** December 10, 2015

**Temperature:** 27°C

**Tested by:** Jason Lu

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

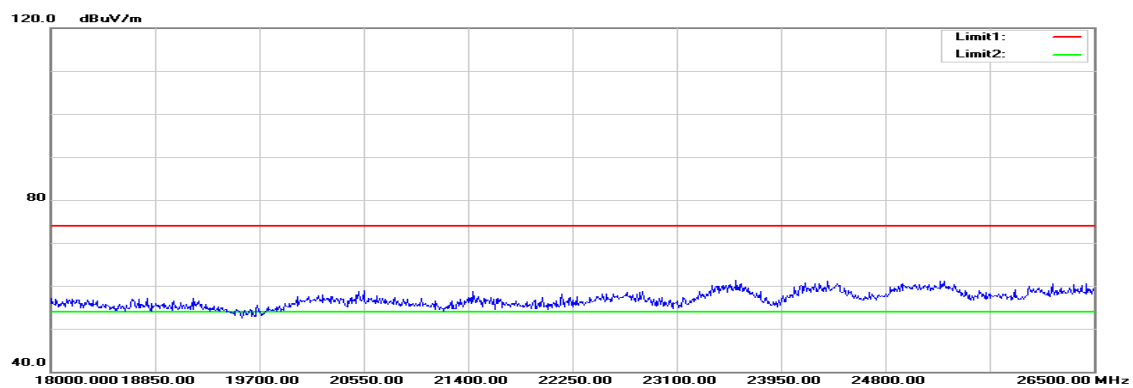
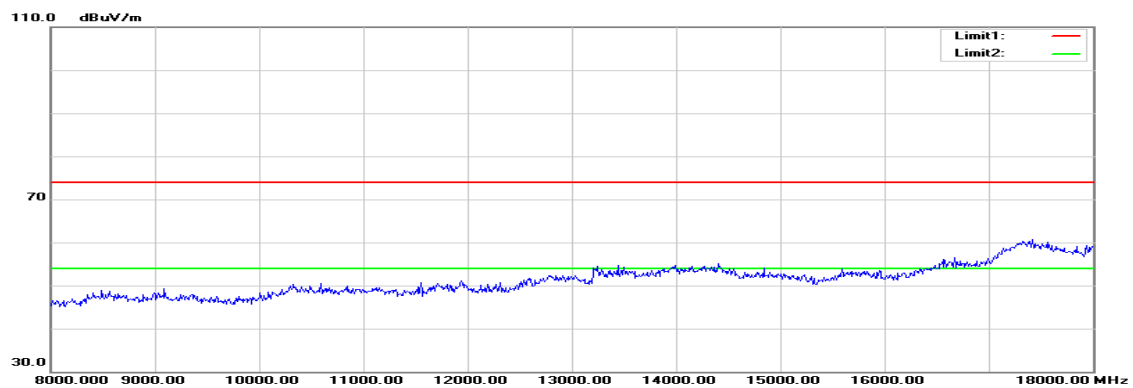
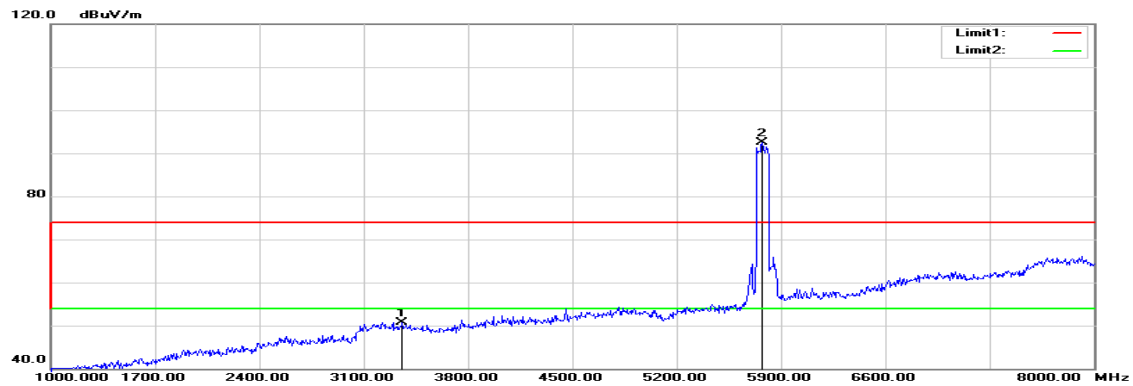
Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3254.000	52.77	-1.50	51.27	74.00	-22.73	peak	V
N/A							
3464.000	51.73	-1.00	50.73	74.00	-23.27	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

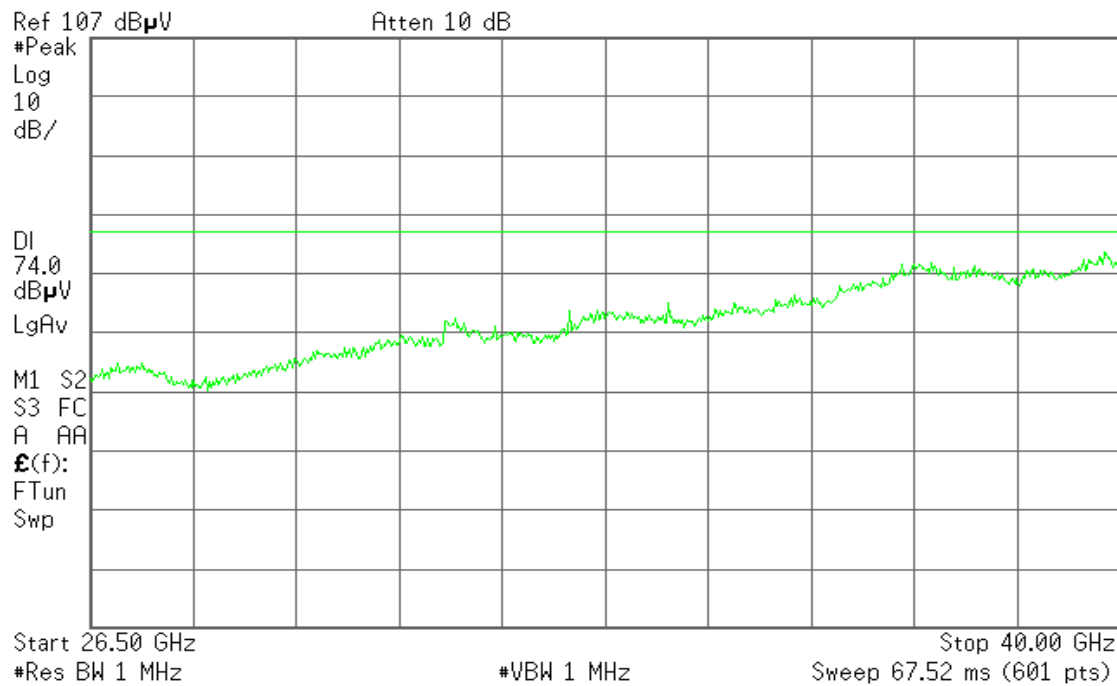
**Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid**

**Polarity: Vertical**

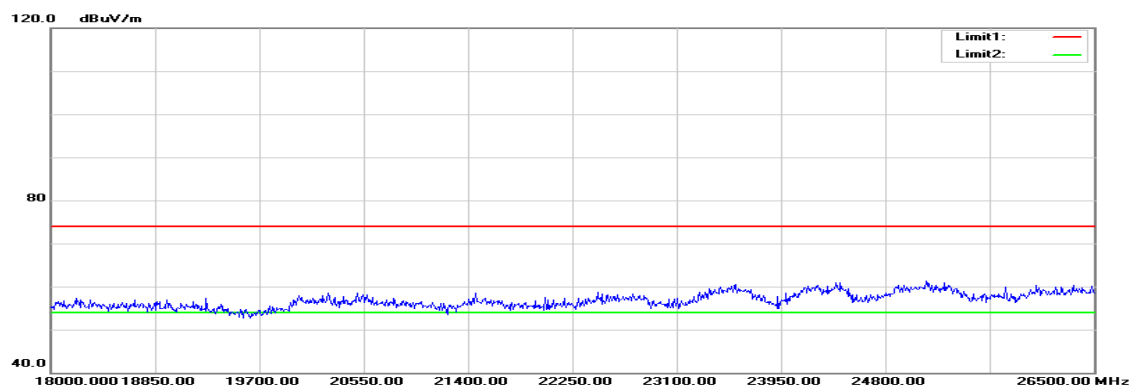
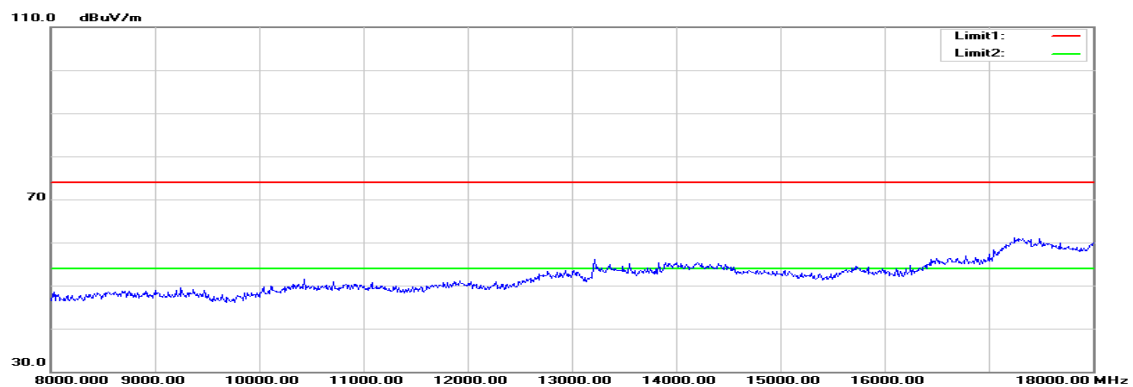
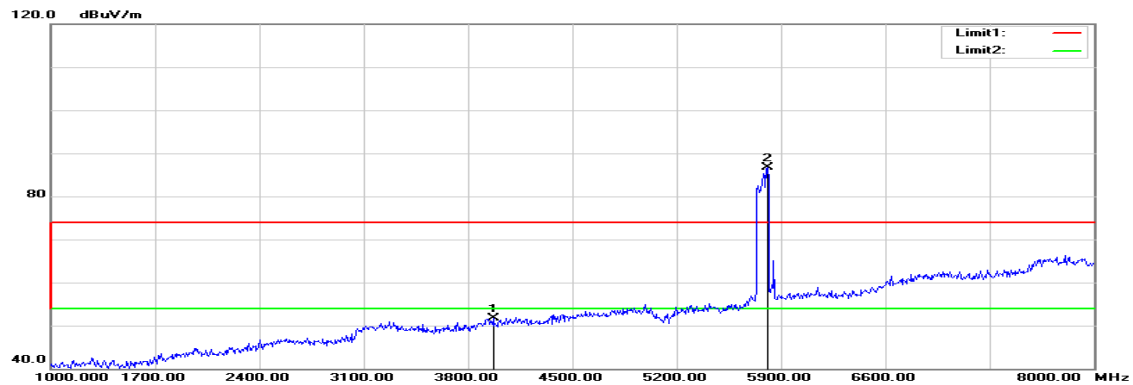


Agilent

R L

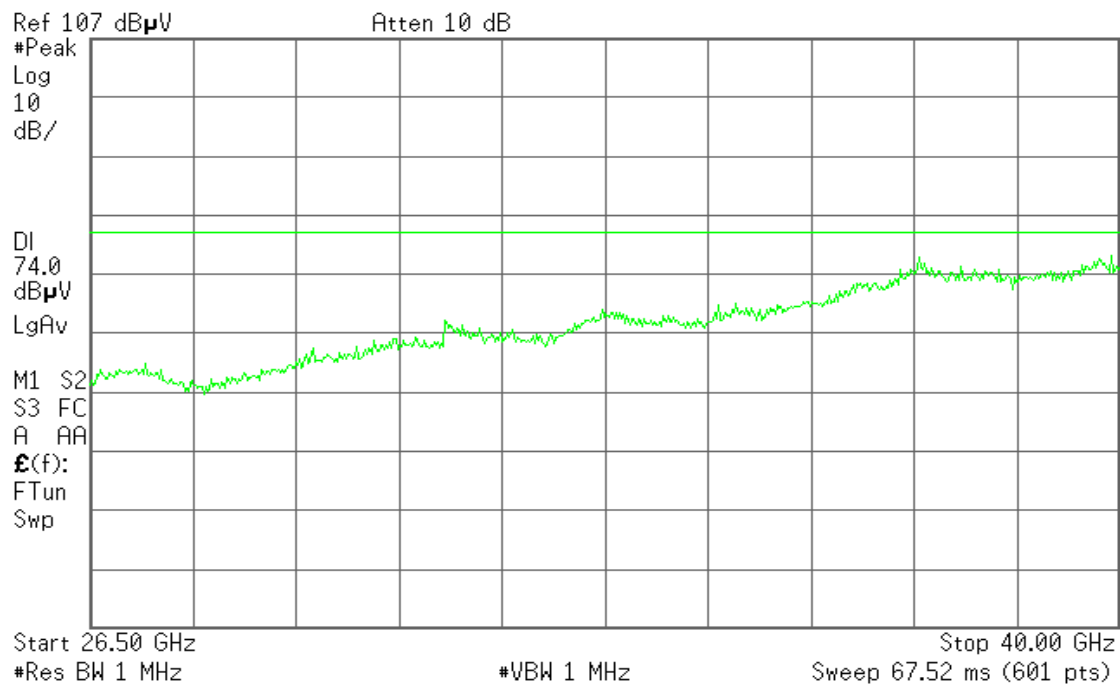


## Polarity: Horizontal



Agilent

R L



**Operation Mode:** Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid**Temperature:** 27°C**Humidity:** 53% RH**Test Date:** December 10, 2015**Tested by:** Jason Lu**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
3359.000	51.98	-1.25	50.73	74.00	-23.27	peak	V
N/A							
3968.000	50.55	1.09	51.64	74.00	-22.36	peak	H
N/A							

**Remark:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

## 7.7 POWERLINE CONDUCTED EMISSIONS

### LIMIT

According to §15.207(a) & RSS-Gen §7.2.4, except when the requirements applicable to a given device state otherwise, for any licence-exempt radiocommunication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2.

The tighter limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network.

### **RSS-Gen Table 2 – AC Power Lines Conducted Emission Limits**

Frequency Range (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*\*Decreases with the logarithm of the frequency*

### **Test Configuration**

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### **TEST PROCEDURE**

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

**Test results**

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Test Data**

**Operation Mode:** Normal Link      **Test Date:** November 20, 2015  
**Temperature:** 24°C      **Tested by:** Dennis Li  
**Humidity:** 50% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1580	42.29	26.62	0.42	42.71	27.04	65.56	55.57	-22.85	-28.53	L1
0.1860	37.66	23.67	0.32	37.98	23.99	64.21	54.21	-26.23	-30.22	L1
0.2180	32.05	17.97	0.27	32.32	18.24	62.89	52.89	-30.57	-34.65	L1
0.2740	28.35	13.70	0.25	28.60	13.95	60.99	51.00	-32.39	-37.05	L1
0.4980	23.38	18.03	0.21	23.59	18.24	56.03	46.03	-32.44	-27.79	L1
4.0220	23.44	11.89	0.33	23.77	12.22	56.00	46.00	-32.23	-33.78	L1
0.1580	42.50	26.50	0.42	42.92	26.92	65.56	55.57	-22.64	-28.65	L2
0.1860	40.76	24.61	0.32	41.08	24.93	64.21	54.21	-23.13	-29.28	L2
0.2140	35.45	18.61	0.27	35.72	18.88	63.04	53.05	-27.32	-34.17	L2
0.2660	28.36	14.20	0.25	28.61	14.45	61.24	51.24	-32.63	-36.79	L2
0.5100	22.08	15.71	0.20	22.28	15.91	56.00	46.00	-33.72	-30.09	L2
3.8820	22.34	10.46	0.33	22.67	10.79	56.00	46.00	-33.33	-35.21	L2

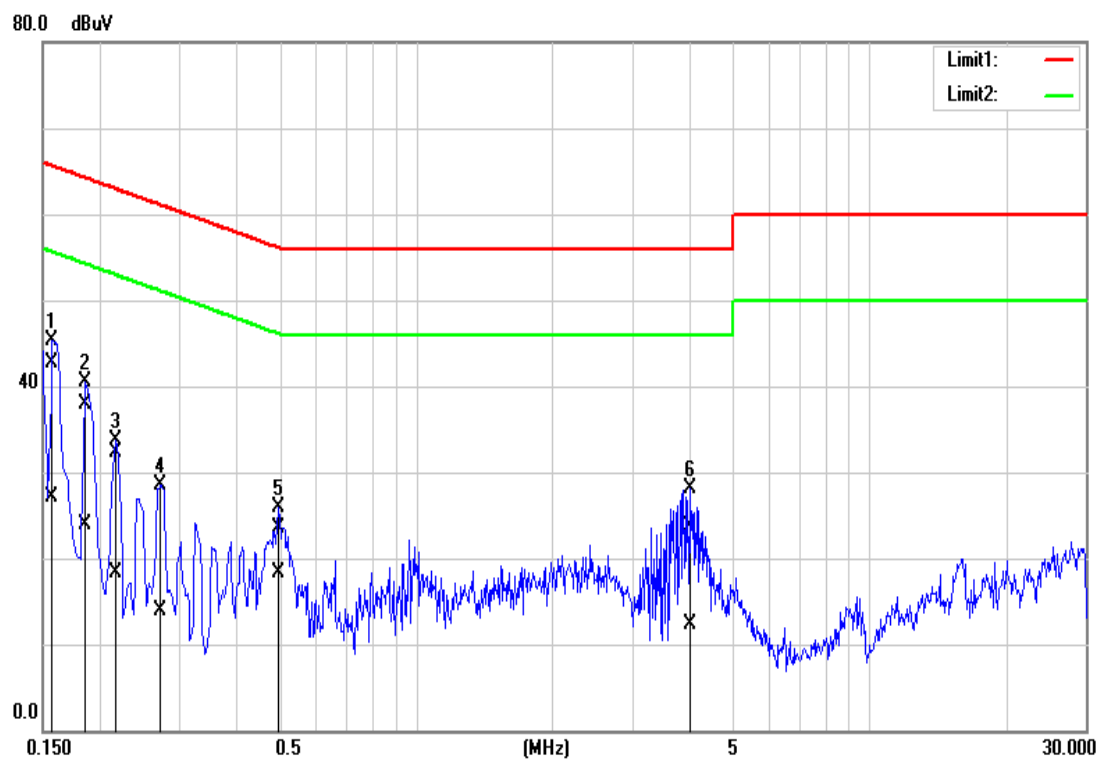
**Remark:**

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10 kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9 kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



## Test Plots

### Conducted emissions (Line 1)



### Conducted emissions (Line 2)

