

## FCC 47 CFR PART 15 SUBPART E

### TEST REPORT

For

**WLAN Module**

**Model: WCBN4511R(12)**

**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.)  
<http://www.ccsrf.com>  
[service@ccsrf.com](mailto:service@ccsrf.com)  
Issued Date: September 12, 2016**



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**Revision History**

| Rev. | Issue Date         | Revisions  | Effect Page           | Revised By |
|------|--------------------|--|-----------------------|------------|
| 00   | September 12, 2016 | Initial Issue  | ALL                   | Doris Chu  |
| 01   | September 23, 2016 | 1. Added MIMO: Total ANT.<br>2. Modify maximum conducted output power limit.<br>3. Modify peak power spectral density. | P.5,<br>P.42,<br>P.64 | 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

**Equipment Under Test:** WLAN Module

**Model Number:** WCBN4511R(12)

**Trade Name:** LITE-ON

**Date of Test:** June 20 ~ September 10, 2016

| APPLICABLE STANDARDS         |                         |
|------------------------------|-------------------------|
| STANDARD                     | TEST RESULT             |
| FCC 47 CFR Part 15 Subpart E | No non-compliance noted |

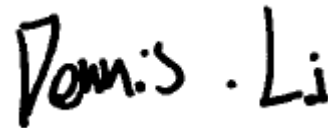
### We hereby certify that:

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:

Tested by:



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Miller Lee  
Manager  
Compliance Certification Services Inc.

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Dennis Li  
Engineer  
Compliance Certification Services Inc.

## 2. EUT DESCRIPTION

|                              |  |
|------------------------------|--|
| <b>Product</b>               | WLAN Module  |
| <b>Model Number</b>          | WCBN4511R(12)  |
| <b>Trade Name</b>            | LITE-ON  |
| <b>Power Supply</b>          | Powered from host device.  |
| <b>Received Date</b>         | August 4, 2016   |
| <b>Frequency Range</b>       | IEEE 802.11a/ IEEE 802.11n HT 20 MHz: 5745~5825 MHz<br>IEEE 802.11n HT 40 MHz: 5755~5795 MHz<br>IEEE 802.11ac VHT 80 mode: 5775MHz                           |
| <b>Transmit Power</b>        | IEEE 802.11a mode: 18.79 dBm<br>IEEE 802.11n HT 20 MHz mode: 18.58 dBm<br>IEEE 802.11n HT 40 MHz mode: 16.91 dBm<br>IEEE 802.11ac VHT 80 MHz mode: 12.01 dBm |
| <b>Number of Channels</b>    | IEEE 802.11a mode: 5 Channels<br>IEEE 802.11n HT 20 MHz mode: 5 Channels<br>IEEE 802.11n HT 40 MHz mode: 2 Channels<br>IEEE 802.11ac VHT 80 mode: 1 Channel  |
| <b>Antenna Specification</b> | LITE-ON / WCBN4511R<br>PIFA Antenna<br>ANT-L: Gain: 2.94dBi<br>ANT-R: Gain: 3.35dBi<br>MIMO: Total ANT= 6.29dBi  |
| <b>Product SW/HW version</b> | V02/V02  |
| <b>Radio SW version</b>      | V02/V02  |
| <b>Radio HW version</b>      | V1.0.3.19  |

**Note:** The device is restricted to transmit in the band 5600 ~ 5650 Mhz

### **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 v01r02.

#### **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: WCBN4511R(12)) 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 lie-down position (Y axis) and the worst case was recorded.



### 3.6 THE WORST CASE POWER SETTING PARAMETER

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

| Channel | Frequency (MHz) | RF power setting in TEST SW (Chin 0) | RF power setting in TEST SW (Chin 1) |
|---------|-----------------|--------------------------------------|--------------------------------------|
| Low     | 5745            | 17                                   | 17                                   |
| Mid     | 5785            | 23                                   | 23                                   |
| High    | 5825            | 1D                                   | 1D                                   |

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

| Channel | Frequency (MHz) | RF power setting in TEST SW (Chin 0) | RF power setting in TEST SW (Chin 1) |
|---------|-----------------|--------------------------------------|--------------------------------------|
| Low     | 5745            | 1A                                   | 1A                                   |
| Mid     | 5785            | 26                                   | 26                                   |
| High    | 5825            | 20                                   | 20                                   |

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

| Channel | Frequency (MHz) | RF power setting in TEST SW (Chin 0) | RF power setting in TEST SW (Chin 1) |
|---------|-----------------|--------------------------------------|--------------------------------------|
| Low     | 5755            | 16                                   | 16                                   |
| High    | 5795            | 23                                   | 23                                   |

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

| Channel | Frequency (MHz) | RF power setting in TEST SW (Chin 0) | RF power setting in TEST SW (Chin 1) |
|---------|-----------------|--------------------------------------|--------------------------------------|
| Mid     | 5775            | 1D                                   | 1D                                   |

## 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 Date | Calibration Due |
| DC Power Supplies               | GW Instek    | SPS-3610  | GPE880163     | 01/19/2016       | 01/18/2017      |
| Power Meter                     | Anritsu      | ML2495A   | 1012009       | 07/04/2016       | 07/03/2017      |
| Power Sensor                    | Anritsu      | MA2411B   | 917072        | 07/04/2016       | 07/03/2017      |
| Signal Analyzer                 | R&S          | FSV 40    | 101073        | 07/20/2015       | 07/19/2016      |
| Spectrum Analyzer               | Agilent      | E4446A    | US42510268    | 02/15/2016       | 02/14/2017      |
| Thermostatic/Hrgrosatic Chamber | TAICHY       | MHG-150LF | 930619        | 10/08/2015       | 10/07/2016      |
| Vector Signal Generator         | R&S          | SMU 200A  | 102239        | 03/10/2016       | 03/09/2017      |
| AC Power Source                 | EXTECH       | 6205      | 1140845       | N.C.R            | N.C.R           |

| Wugu 966 Chamber A |                    |                      |               |                  |                 |
|--------------------|--------------------|----------------------|---------------|------------------|-----------------|
| Name of Equipment  | Manufacturer       | Model                | Serial Number | Calibration Date | Calibration Due |
| Bilog Antenna      | Sunol Sciences     | JB3                  | A030105       | 08/06/2015       | 08/05/2016      |
| EMI Test Receiver  | R&S                | ESCI                 | 100064        | 05/31/2016       | 05/30/2017      |
| Horn Antenna       | EMCO               | 3117                 | 55165         | 02/24/2016       | 02/23/2017      |
| Horn Antenna       | EMCO               | 3116                 | 26370         | 01/15/2016       | 01/14/2017      |
| K Type Cable       | Huber+Suhner       | SUCOFLEX 102         | 29406/2       | 01/12/2016       | 01/11/2017      |
| K Type Cable       | Huber+Suhner       | SUCOFLEX 102         | 22470/2       | 01/12/2016       | 01/11/2017      |
| Pre-Amplifier      | MITEQ              | AMF-6F-2604 00-40-8P | 985646        | 01/14/2016       | 01/13/2017      |
| Pre-Amplifier      | EMCI               | EMC 012635           | 980151        | 06/23/2016       | 06/22/2017      |
| Pre-Amplifier      | EMCI               | EM330                | N/A           | 06/08/2016       | 06/07/2017      |
| Spectrum Analyzer  | Agilent            | E4446A               | US42510252    | 12/08/2015       | 12/07/2016      |
| Antenna Tower      | CCS                | CC-A-1F              | N/A           | N.C.R            | N.C.R           |
| Controller         | CCS                | CC-C-1F              | N/A           | N.C.R            | N.C.R           |
| Turn Table         | CCS                | CC-T-1F              | N/A           | N.C.R            | N.C.R           |
| Software           | EZ-EMC (CCS-3A1RE) |                      |               |                  |                 |

| Conducted Emission Room # B |              |           |               |                  |                 |
|-----------------------------|--------------|-----------|---------------|------------------|-----------------|
| Name of Equipment           | Manufacturer | Model     | Serial Number | Calibration Date | Calibration Due |
| EMI Test Receiver           | R&S          | ESCI      | 101073        | 09/09/2015       | 09/08/2016      |
| LISN                        | SCHWARZBECK  | NSLK 8127 | 8127-541      | 11/23/2015       | 11/22/2016      |
| LISN                        | R&S          | ENV216    | 101054        | 05/11/2016       | 05/10/2017      |
| Capacitive Voltage Probe    | FCC          | F-CVP-1   | 100185        | 03/09/2016       | 03/08/2017      |
| 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



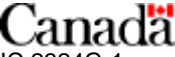
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 2013 and CISPR Publication 22.

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   | <br>FCC MRA: TW1039          |
| Taiwan  | TAF             | LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-247, RSS-310<br>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<br>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<br>FCC Method –47 CFR Part 15 Subpart B<br>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  | <br>IC 2324G-1<br>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 | ASUS  | M5200AE | 5BN0AG019631 | PD9WM3B2100 | N/A        | AC I/P:<br>Unshielded, 1.8m<br>with a core<br>DC O/P:<br>Unshielded, 1.8m |

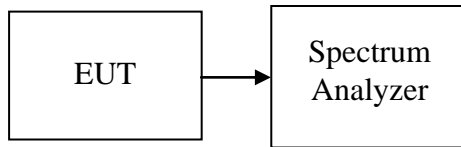
**Remark:**

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 FCC PART 15 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 / Chain 0**

| Channel | Frequency (MHz) | 99%Bandwidth (MHz) |
|---------|-----------------|--------------------|
| Low     | 5745            | 16.4109            |
| Mid     | 5785            | 17.2793            |
| High    | 5825            | 16.5412            |

### **Test mode: IEEE 802.11a mode / Chain 1**

| Channel | Frequency (MHz) | 99%Bandwidth (MHz) |
|---------|-----------------|--------------------|
| Low     | 5745            | 16.4544            |
| Mid     | 5785            | 17.0188            |
| High    | 5825            | 16.4978            |

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

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 5745            | 17.5832             |
| Mid     | 5785            | 17.8871             |
| High    | 5825            | 17.6266             |

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

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 5745            | 17.5397             |
| Mid     | 5785            | 17.8871             |
| High    | 5825            | 17.6266             |

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

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 5755            | 35.8900             |
| High    | 5795            | 36.3531             |

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

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 5755            | 35.8900             |
| High    | 5795            | 36.2373             |

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

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Mid     | 5755            | 75.0217             |

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

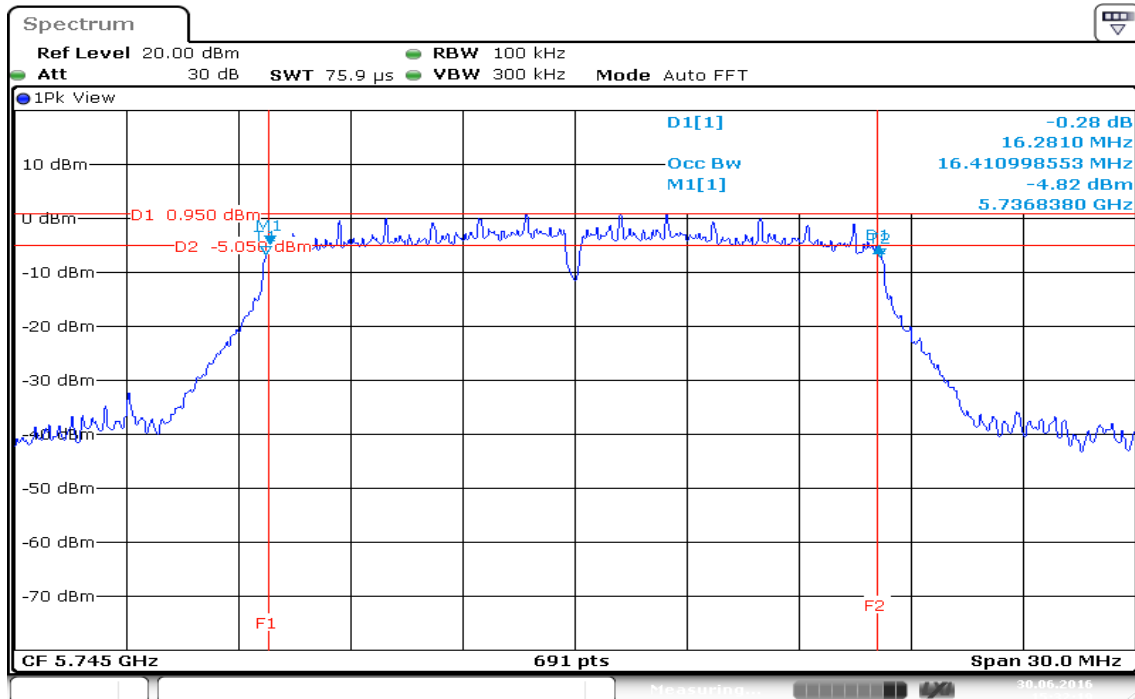
| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Mid     | 5755            | 75.0217             |



## Test Plot

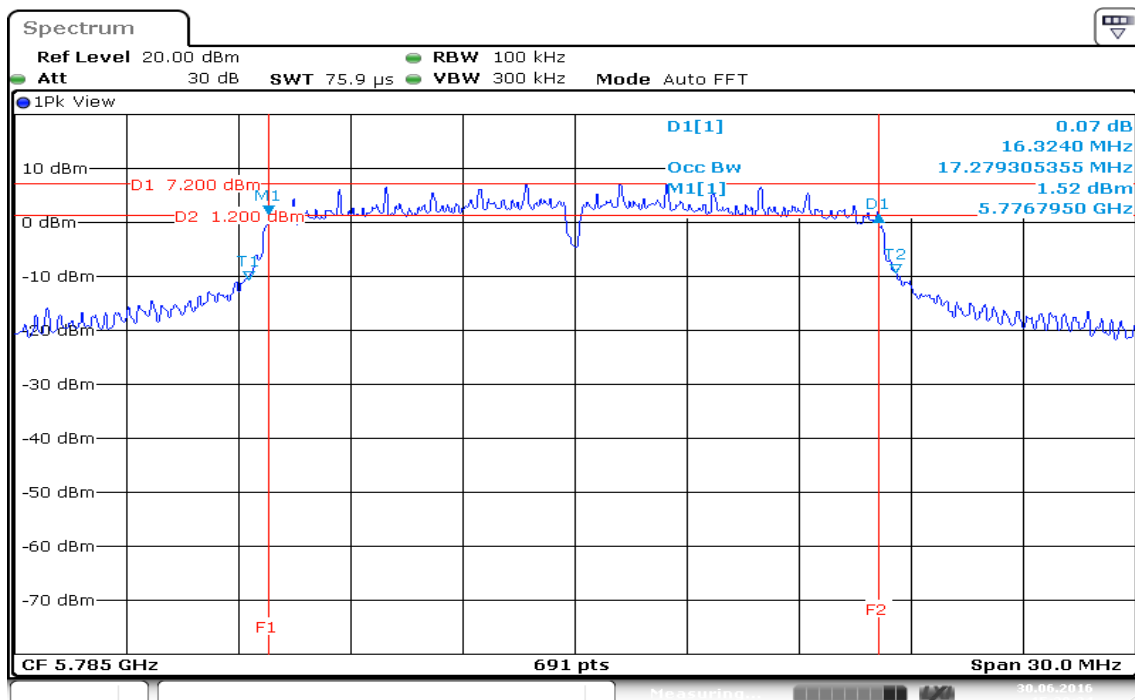
### IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 0

#### 99% Bandwidth (CH Low)



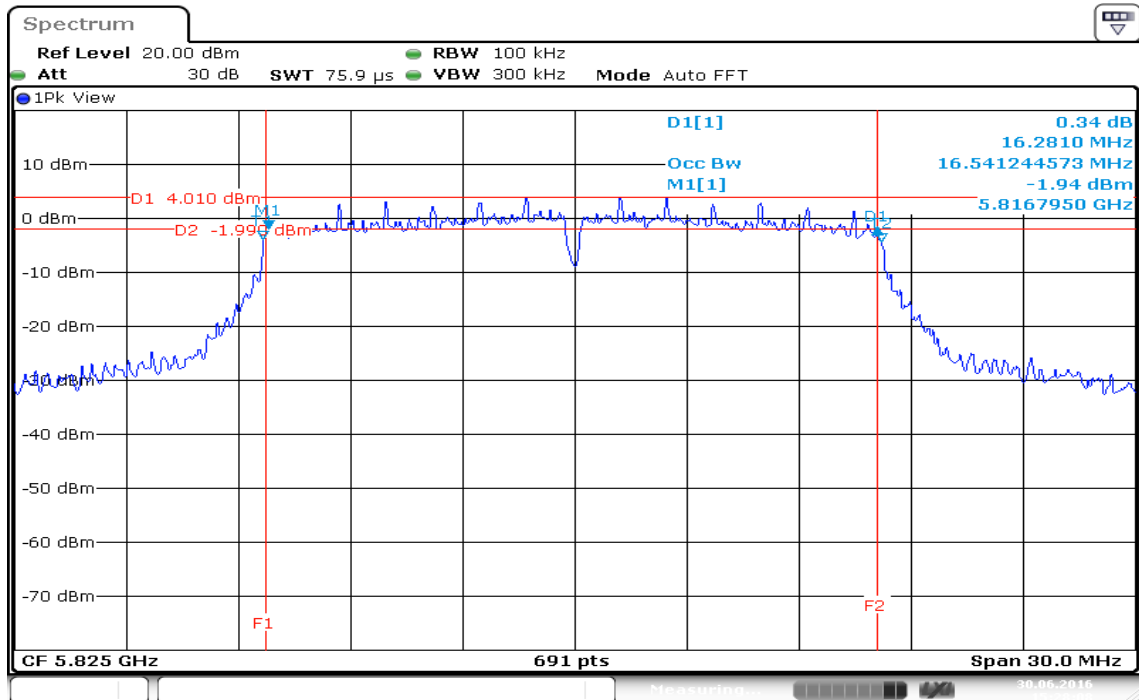
Date: 30 JUN 2016 15:32:19

#### 99% Bandwidth (CH Mid)



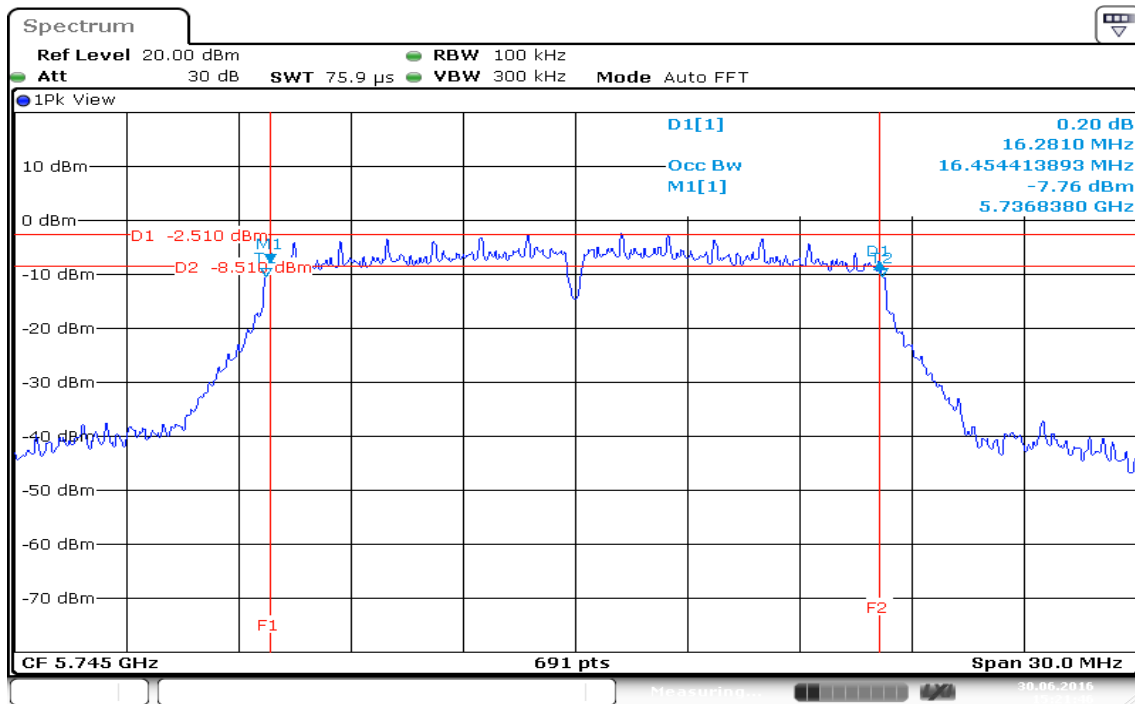
Date: 30 JUN 2016 15:30:34

## 99% Bandwidth (CH High)



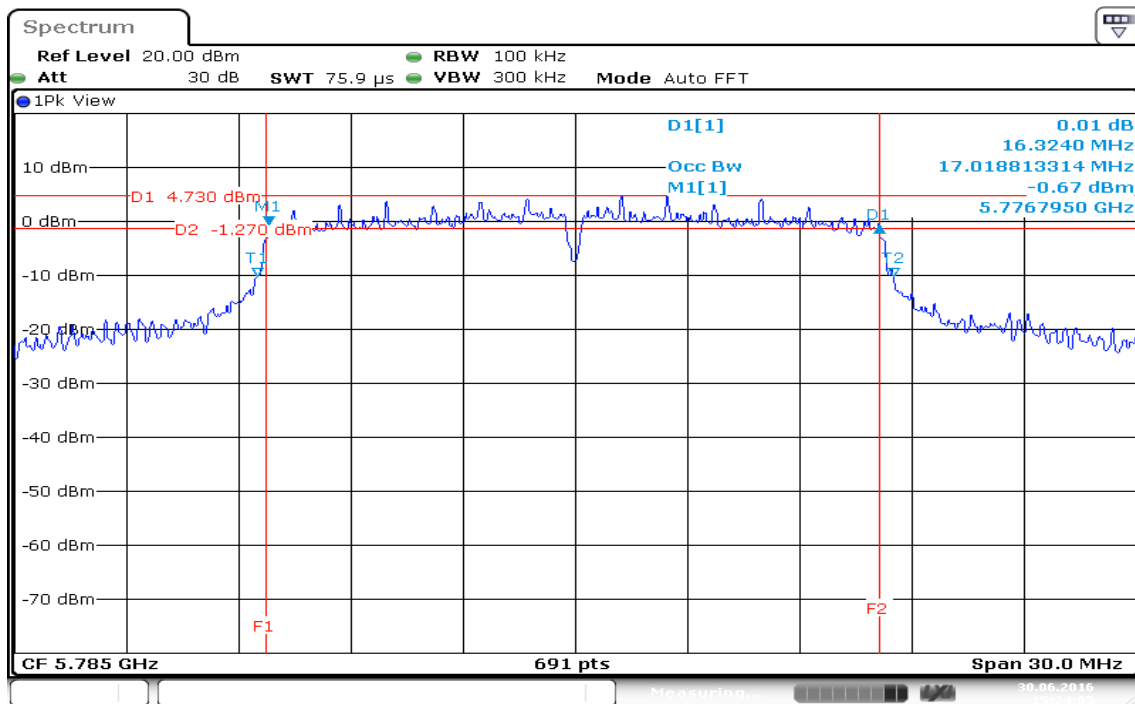
Date: 30 JUN 2016 15:28:08

**IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 1**  
**99% Bandwidth (CH Low)**



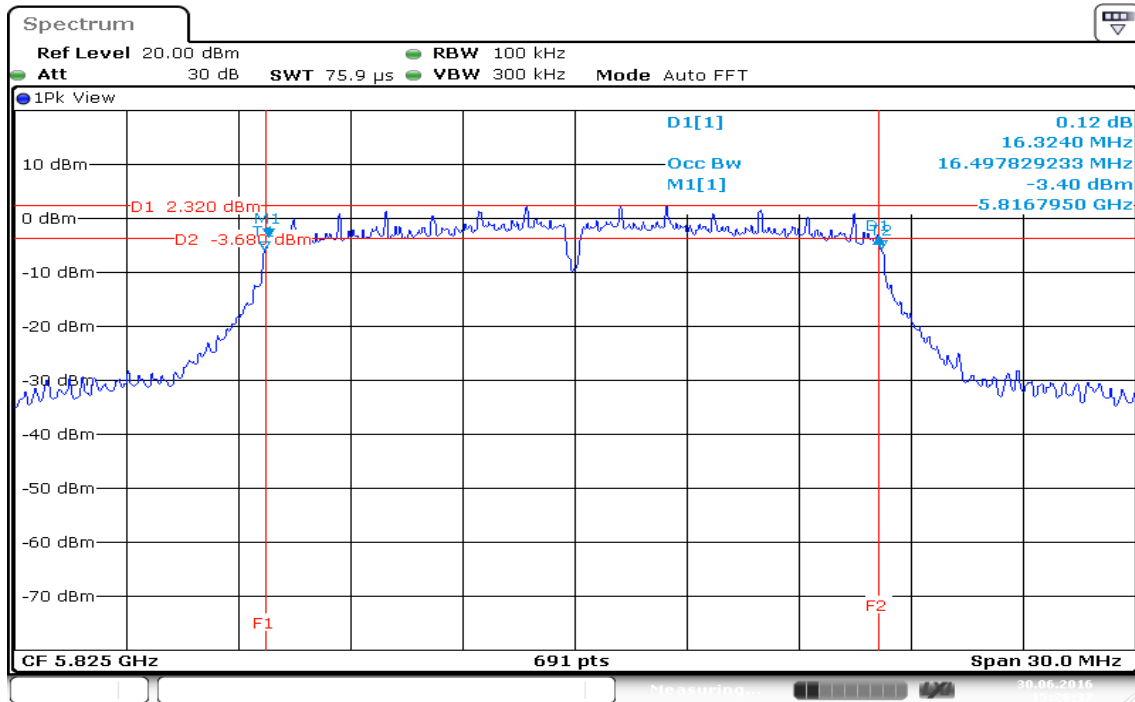
Date: 30 JUN 2016 15:21:47

**99% Bandwidth (CH Mid)**



Date: 30 JUN 2016 15:24:06

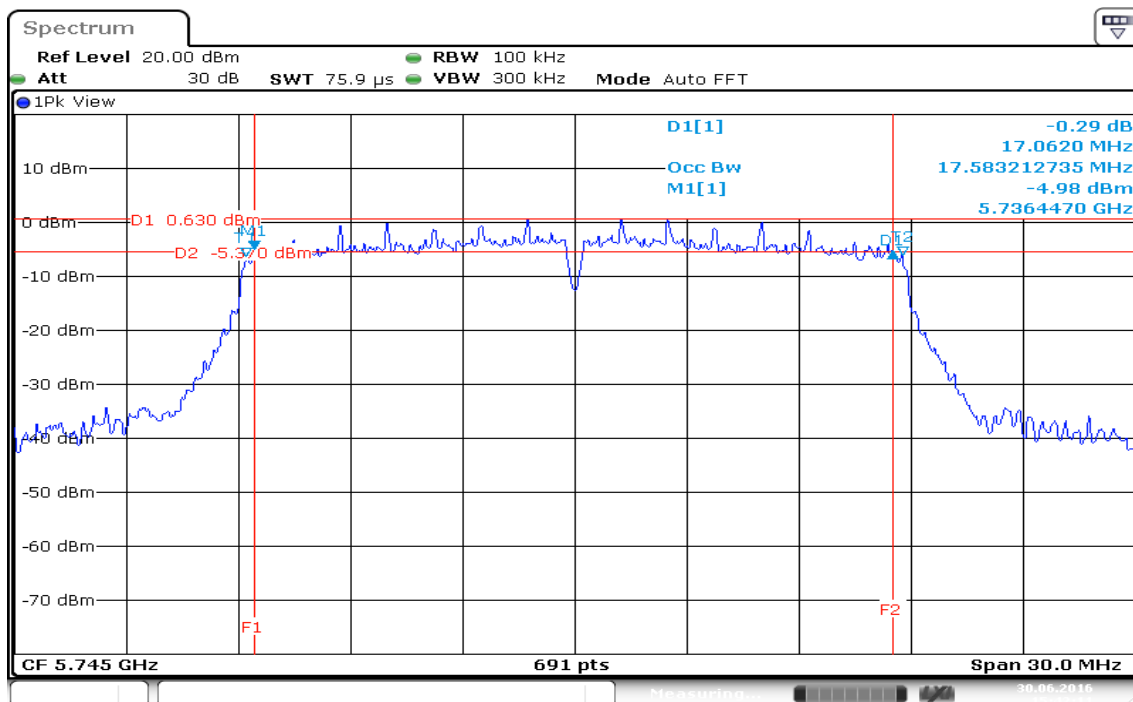
## 99% Bandwidth (CH High)



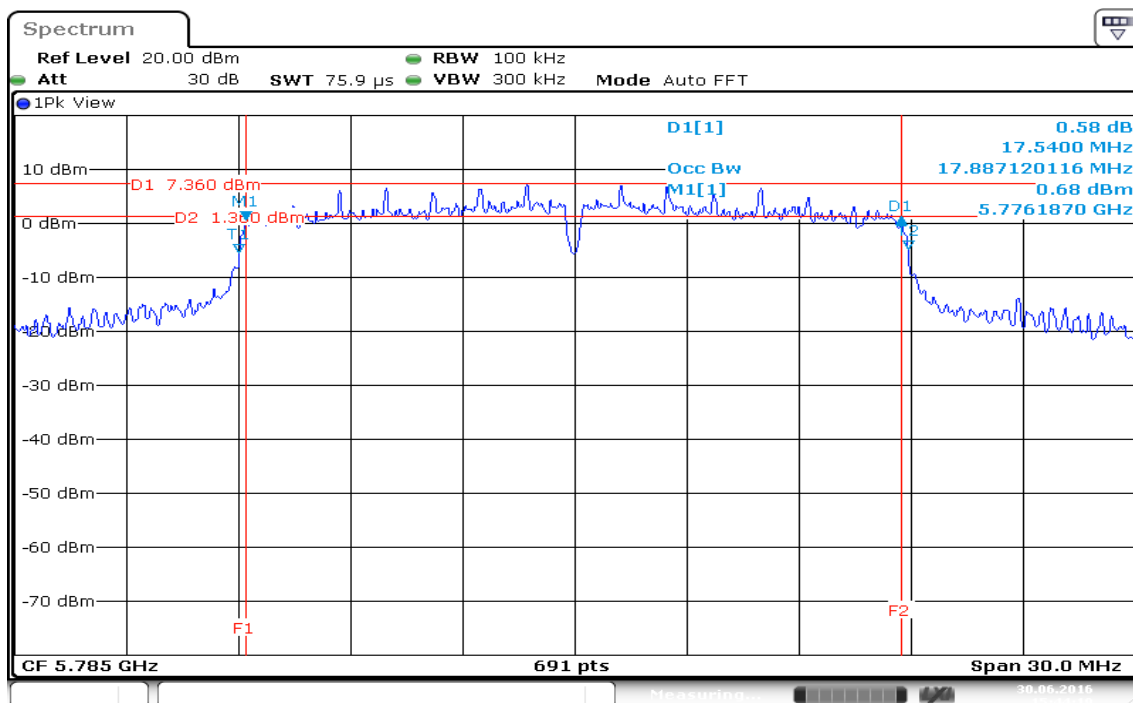
Date: 30 JUN 2016 15:26:37

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

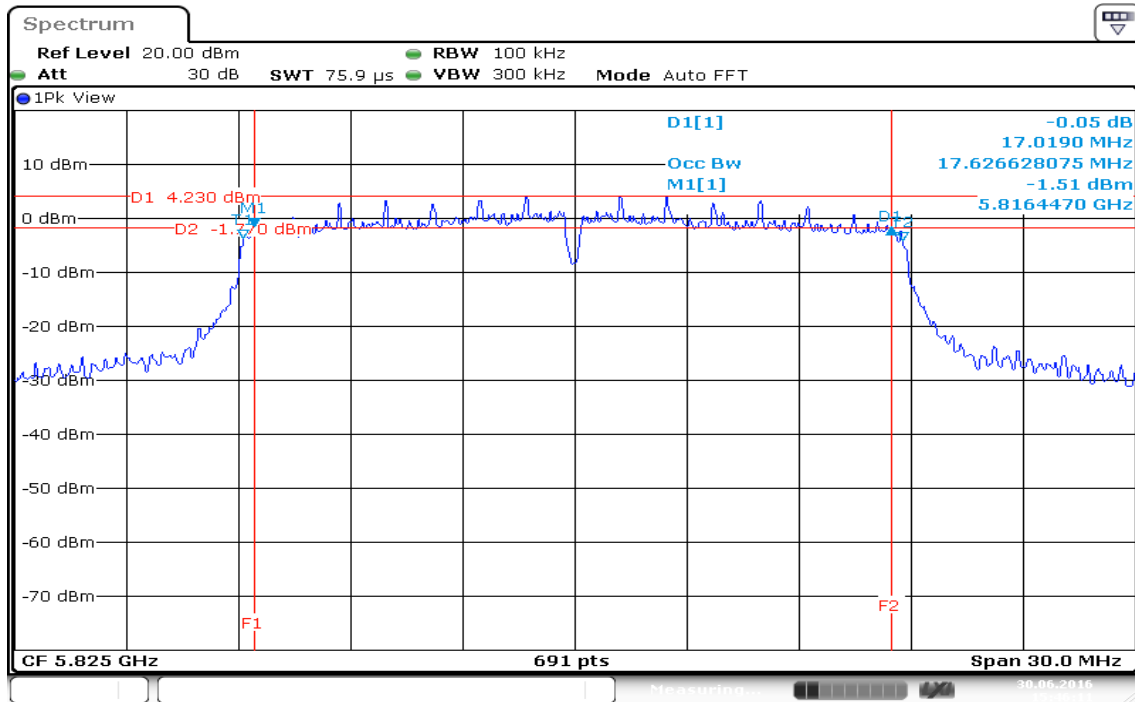
### 99% Bandwidth (CH Low)



### 99% Bandwidth (CH Mid)



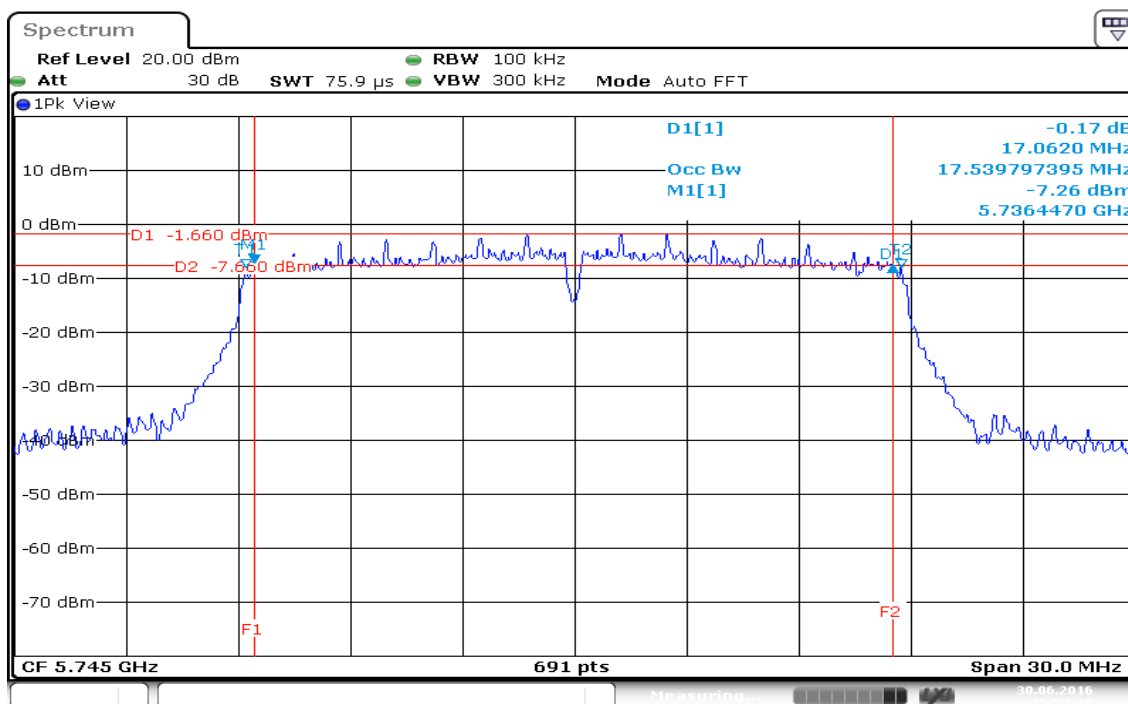
## 99% Bandwidth (CH High)



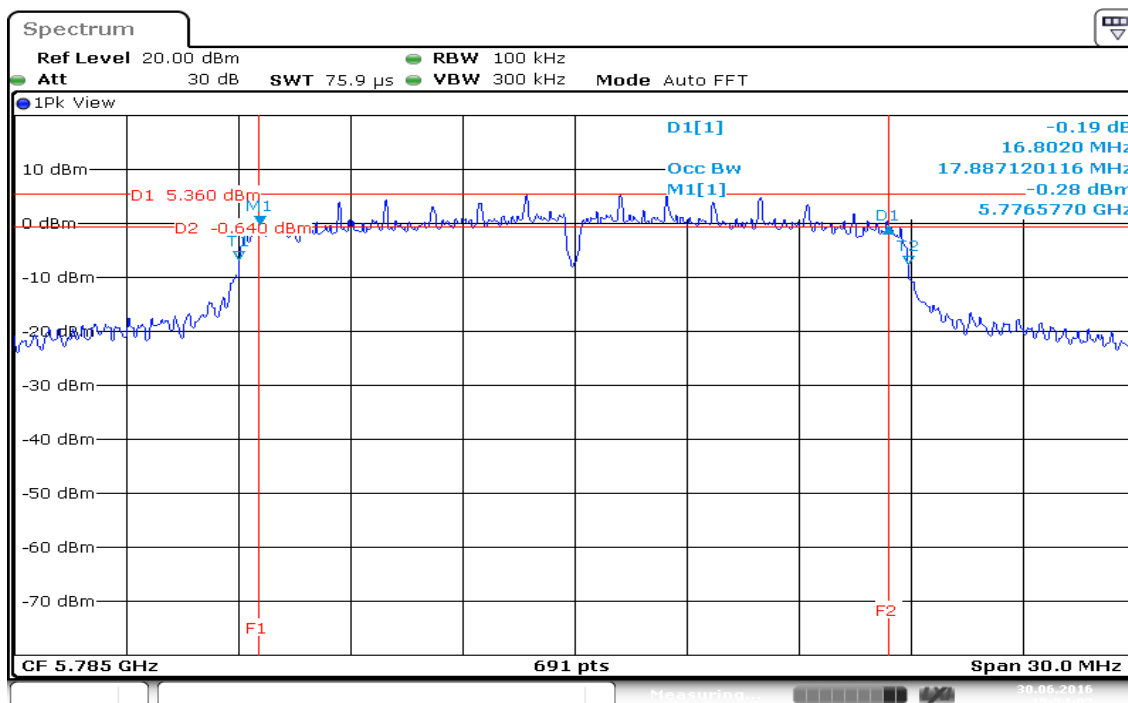
Date: 30 JUN 2016 15:46:11

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

### 99% Bandwidth (CH Low)



### 99% Bandwidth (CH Mid)



**Spectrum**

Ref Level 20.00 dBm RBW 100 kHz  
Att 30 dB SWT 75.9  $\mu$ s VBW 300 kHz Mode Auto FFT

1Pk View

0.46 dB  
17.2790 MHz  
17.626628075 MHz  
-3.90 dBm  
5.8162300 GHz

D1[1]  
Occ BW  
M1[1]

D1 2.790 dBm  
D2 -3.90 dBm

F1 F2

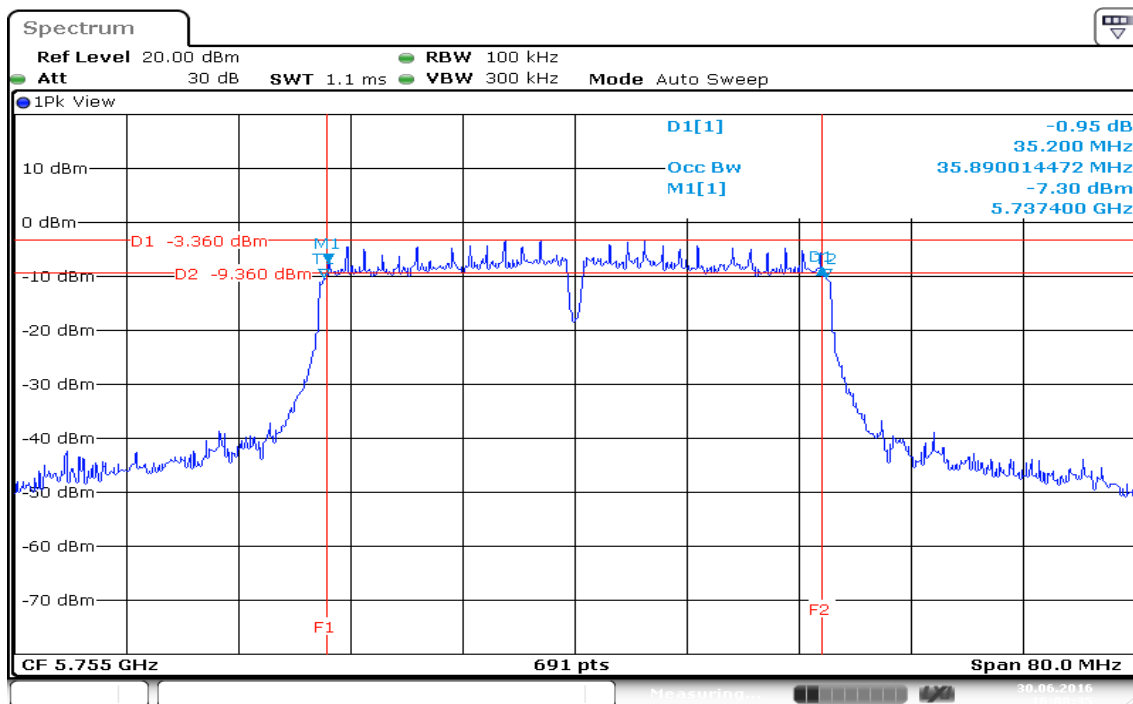
CF 5.825 GHz 691 pts Span 30.0 MHz

Date: 30 JUN 2016 15:48:37



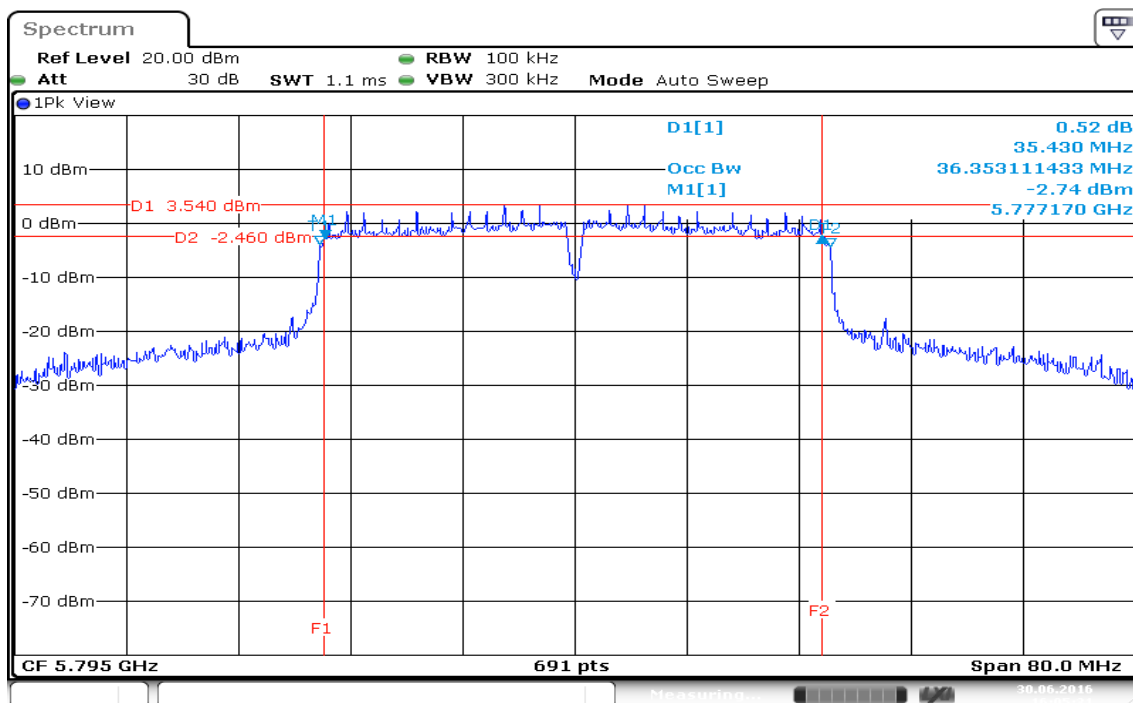
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

### 99% Bandwidth (CH Low)



Date: 30 JUN 2016 16:08:36

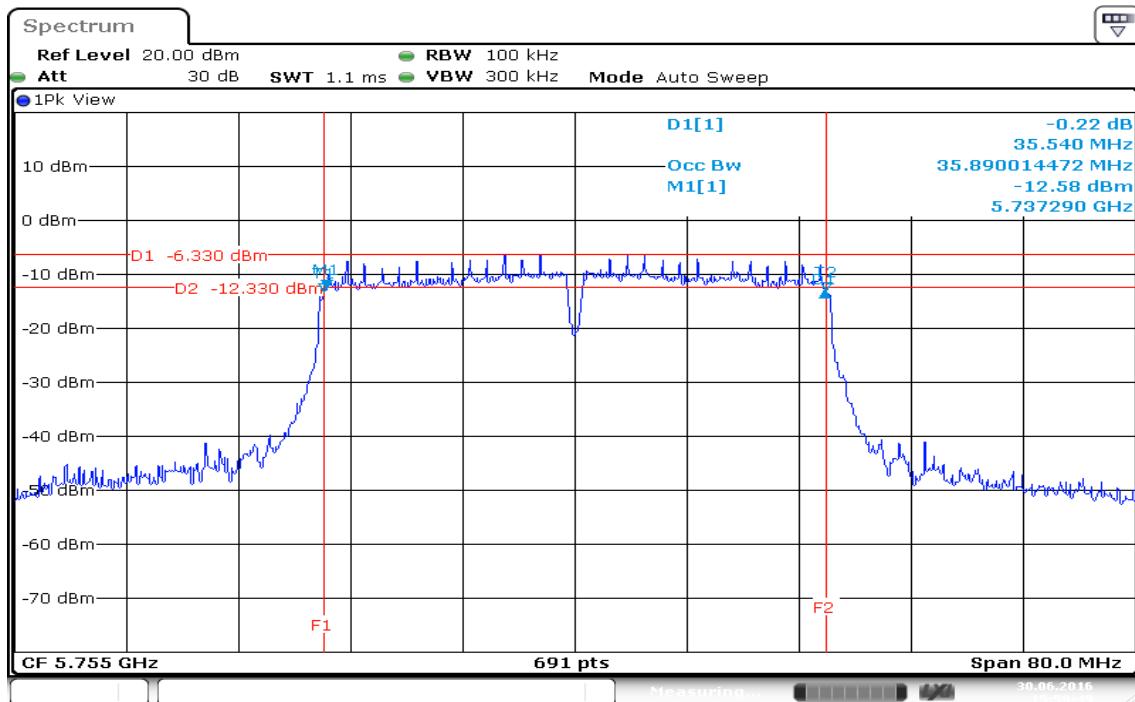
### 99% Bandwidth (CH High)



Date: 30 JUN 2016 16:05:31

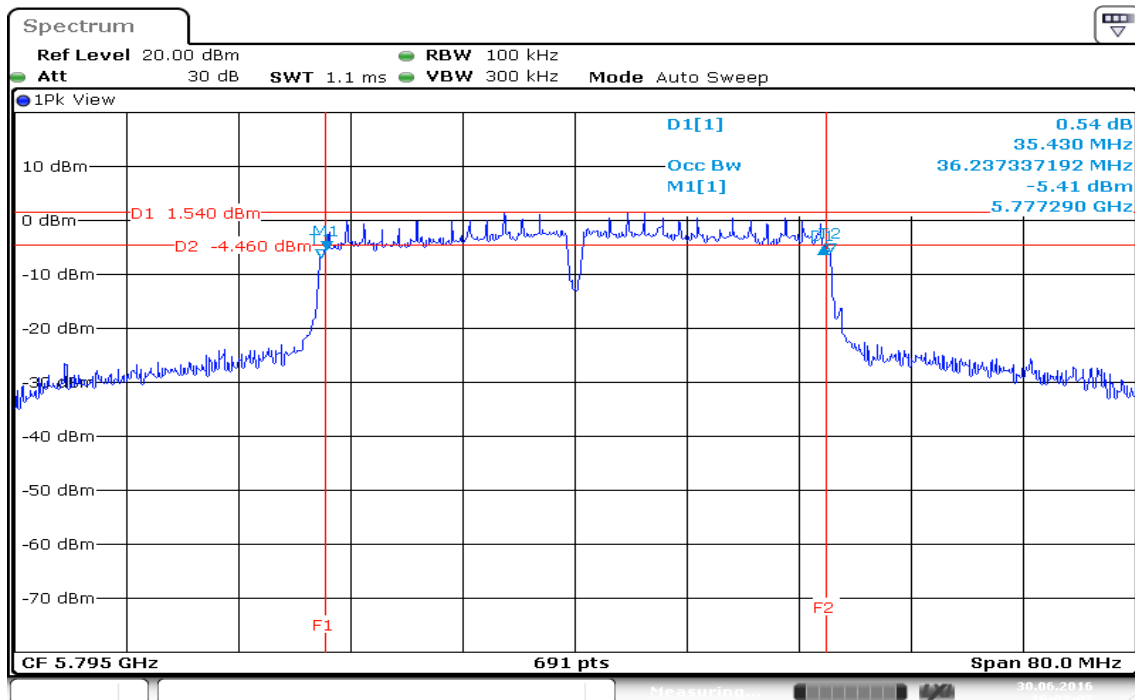
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

### 99% Bandwidth (CH Low)



Date: 30 JUN 2016 15:59:49

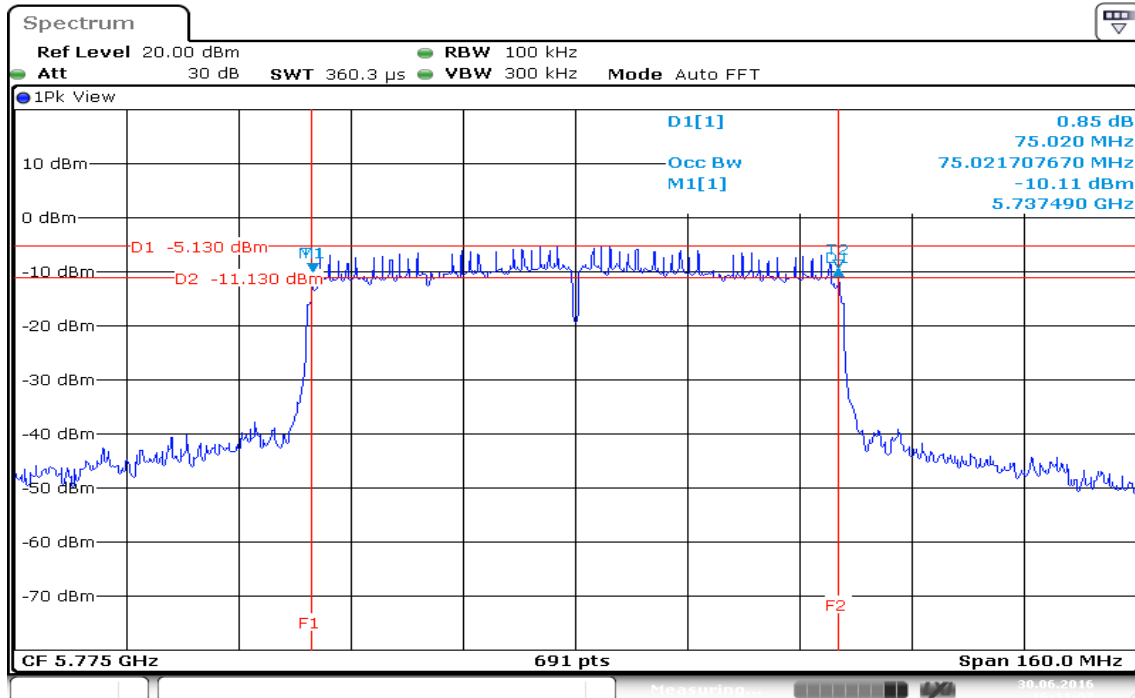
### 99% Bandwidth (CH High)



Date: 30 JUN 2016 16:03:07

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

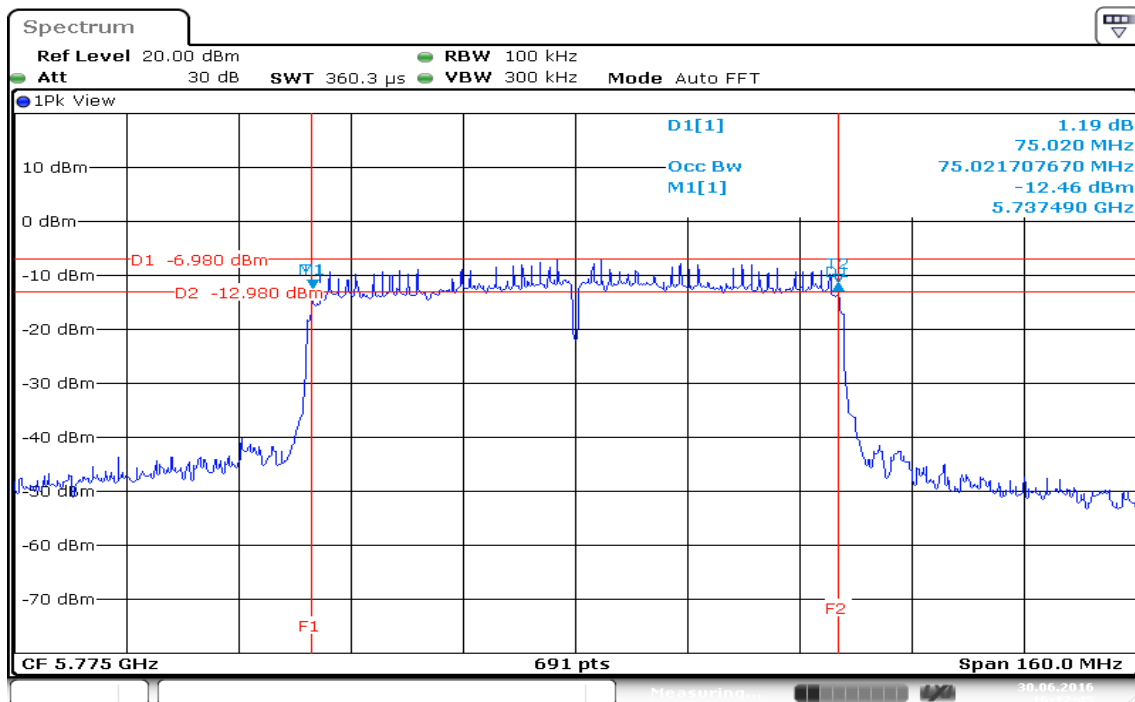
### 99% Bandwidth (CH Mid)



Date: 30 JUN 2016 16:11:07

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

### 99% Bandwidth (CH Mid)



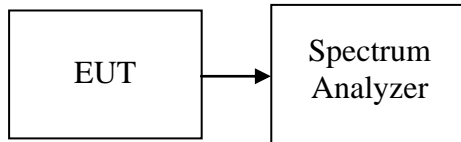
Date: 30 JUN 2016 16:12:45

## 7.2 6DB BANDWIDTH

### **LIMIT**

According to §15.407, systems using digital modulation techniques may operate in the 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 = 3 x RBW, 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 / Chain 0

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5745            | 16.2810             | >500        | PASS   |
| Mid     | 5785            | 16.3240             |             | PASS   |
| High    | 5825            | 16.2810             |             | PASS   |

### Test mode: IEEE 802.11a mode / Chain 1

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5745            | 16.2810             | >500        | PASS   |
| Mid     | 5785            | 16.3240             |             | PASS   |
| High    | 5825            | 16.3240             |             | PASS   |

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

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5745            | 17.0620             | >500        | PASS   |
| Mid     | 5785            | 17.5400             |             | PASS   |
| High    | 5825            | 17.0190             |             | PASS   |

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

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5745            | 17.0620             | >500        | PASS   |
| Mid     | 5785            | 17.8020             |             | PASS   |
| High    | 5825            | 17.2790             |             | PASS   |

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

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5755            | 35.2000             | >500        | PASS   |
| High    | 5795            | 35.4300             |             | PASS   |

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

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Low     | 5755            | 35.5400             | >500        | PASS   |
| High    | 5795            | 35.4300             |             | PASS   |

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

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Mid     | 5755            | 75.0200             | >500        | PASS   |

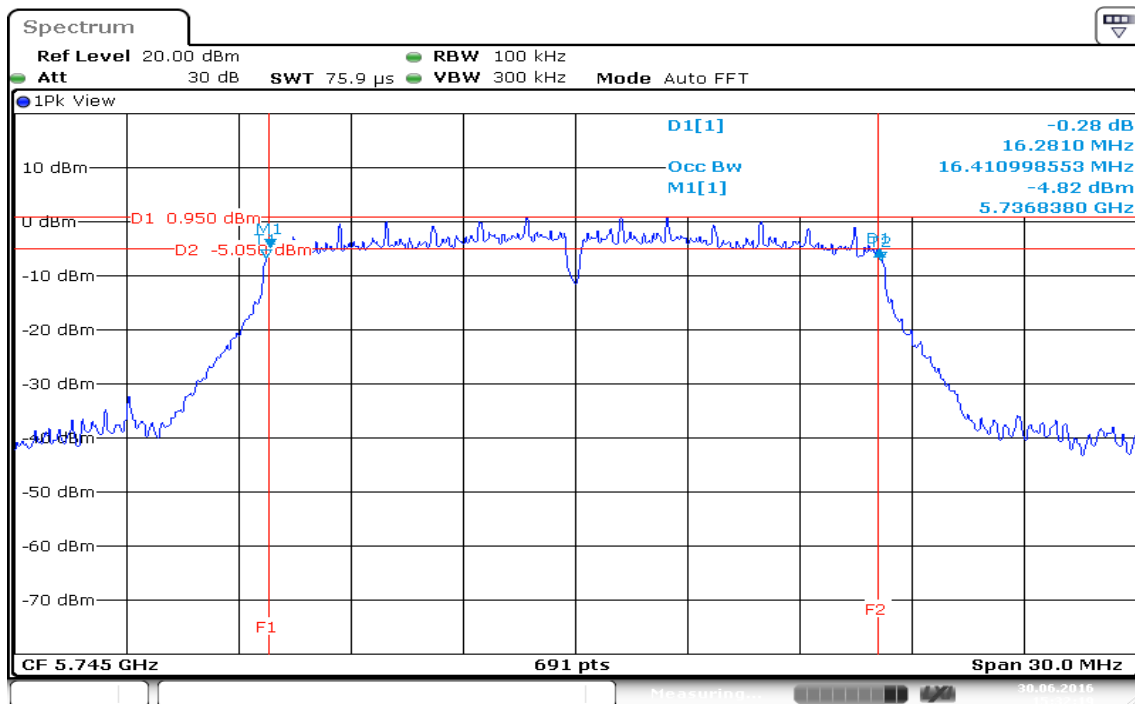
### Test mode: IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1

| Channel | Frequency (MHz) | 6dB Bandwidth (MHz) | Limit (kHz) | Result |
|---------|-----------------|---------------------|-------------|--------|
| Mid     | 5755            | 75.0200             | >500        | PASS   |

## Test Plot

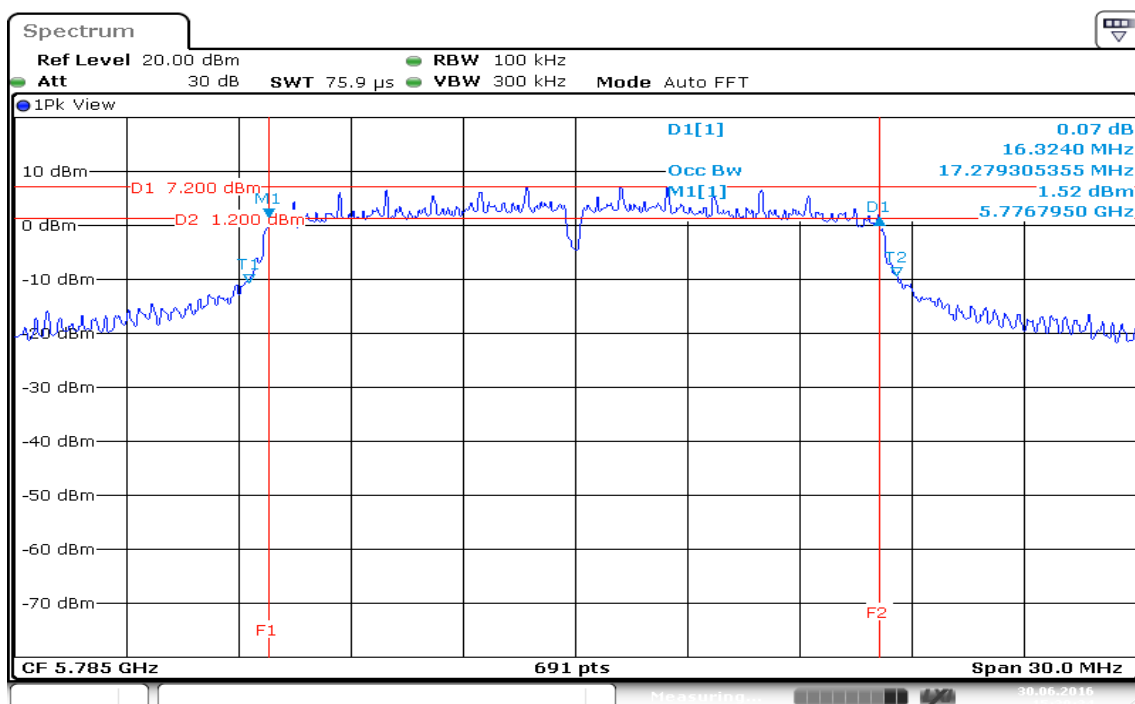
### IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 0

#### 6dB Bandwidth (CH Low)



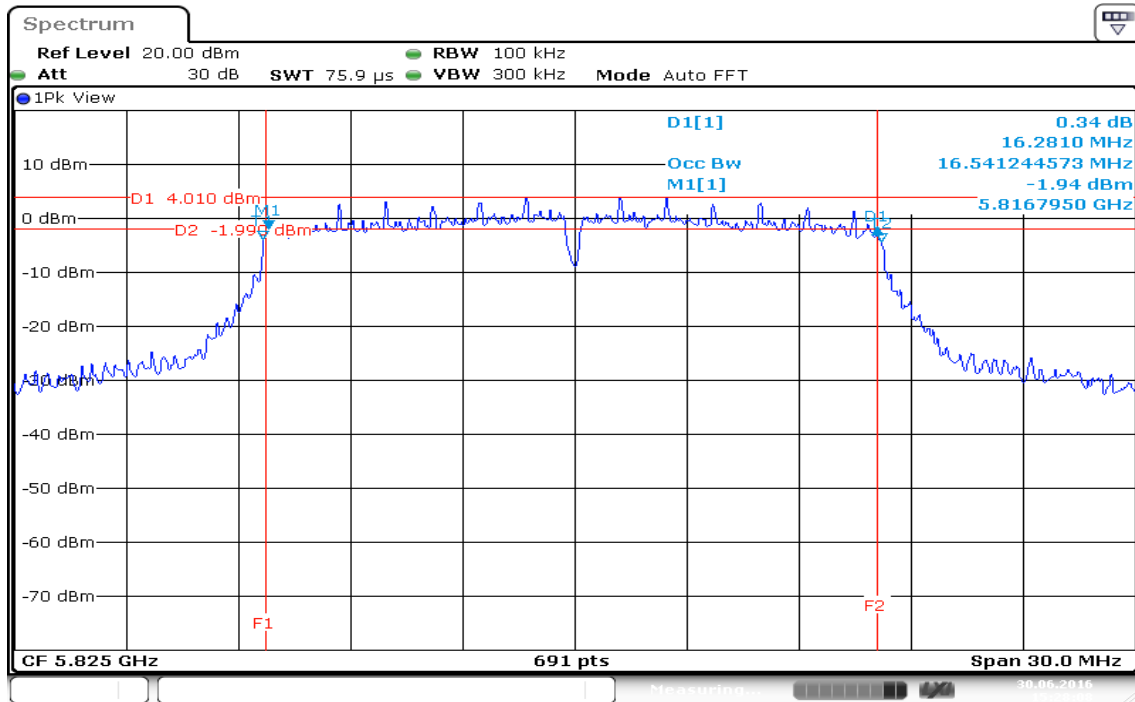
Date: 30 JUN 2016 15:32:19

#### 6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 15:30:34

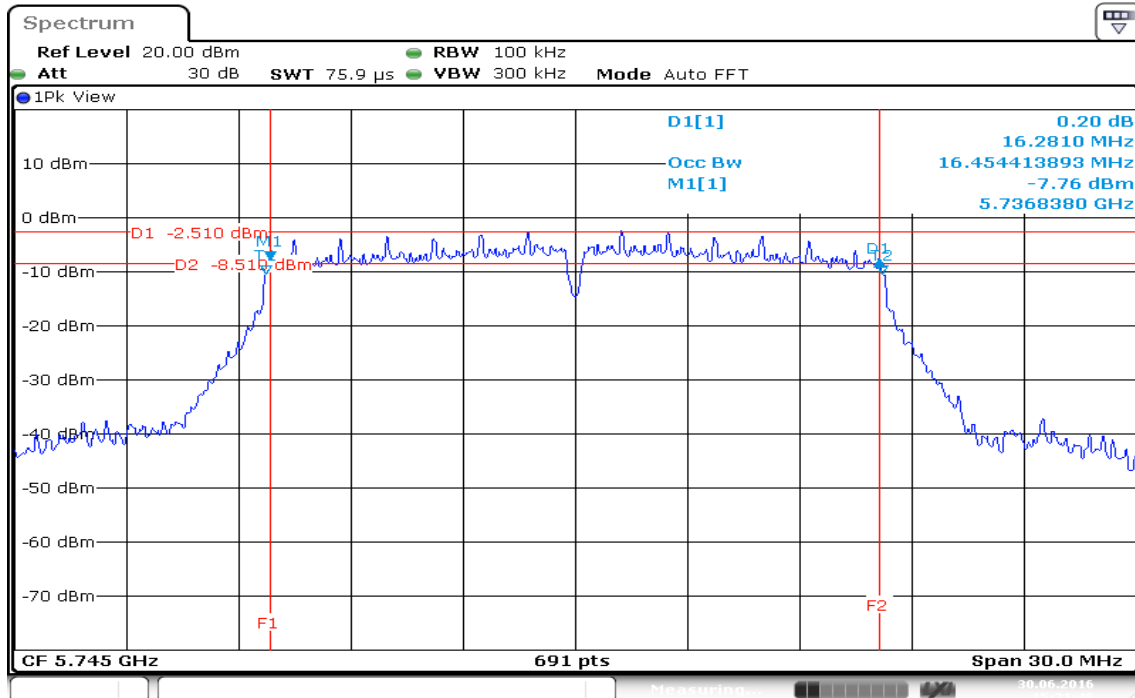
## 6dB Bandwidth (CH High)



Date: 30 JUN 2016 15:28:08

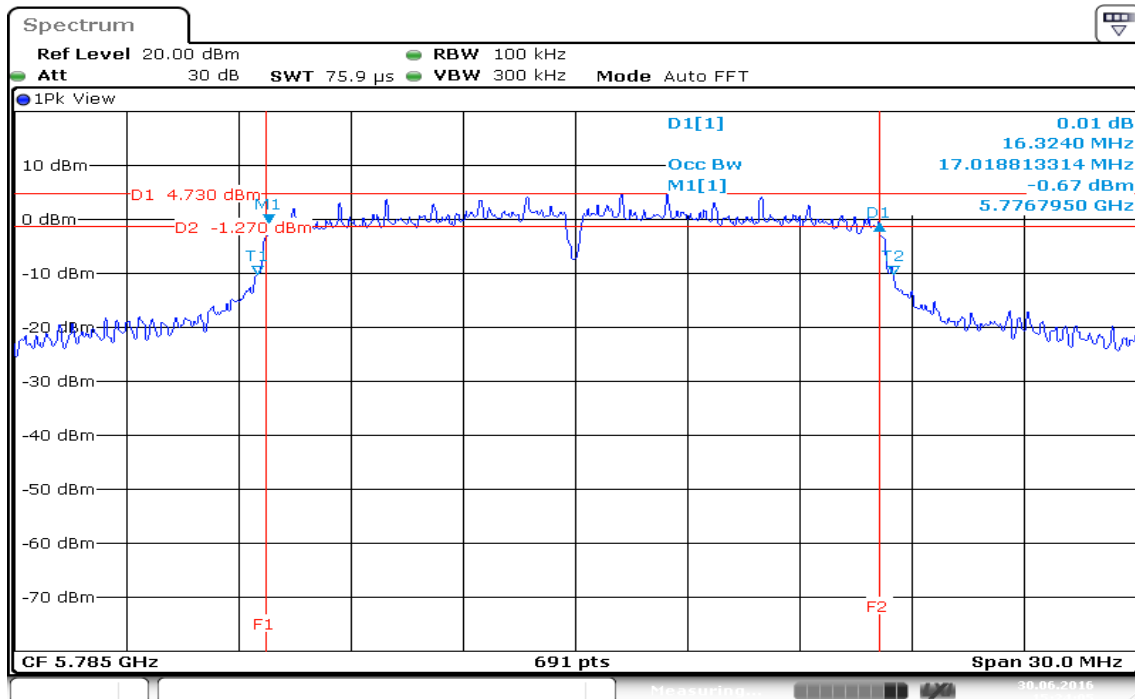
## IEEE 802.11a mode / 5745 ~ 5825MHz / Chain 1

### 6dB Bandwidth (CH Low)



Date: 30 JUN 2016 15:21:47

### 6dB Bandwidth (CH Mid)



Date: 30 JUN 2016 15:24:06



**Spectrum**

Ref Level 20.00 dBm RBW 100 kHz  
 Att 30 dB SWT 75.9  $\mu$ s VBW 300 kHz Mode Auto FFT

1Pk View

10 dBm  
 0 dBm  
 -10 dBm  
 -20 dBm  
 -30 dBm  
 -40 dBm  
 -50 dBm  
 -60 dBm  
 -70 dBm

D1[1] 0.12 dB  
 16.3240 MHz  
 16.497829233 MHz  
 -3.40 dBm  
 5.8167950 GHz

Occ BW  
 M1[1]

D1 2.320 dBm  
 D2 -3.680 dBm

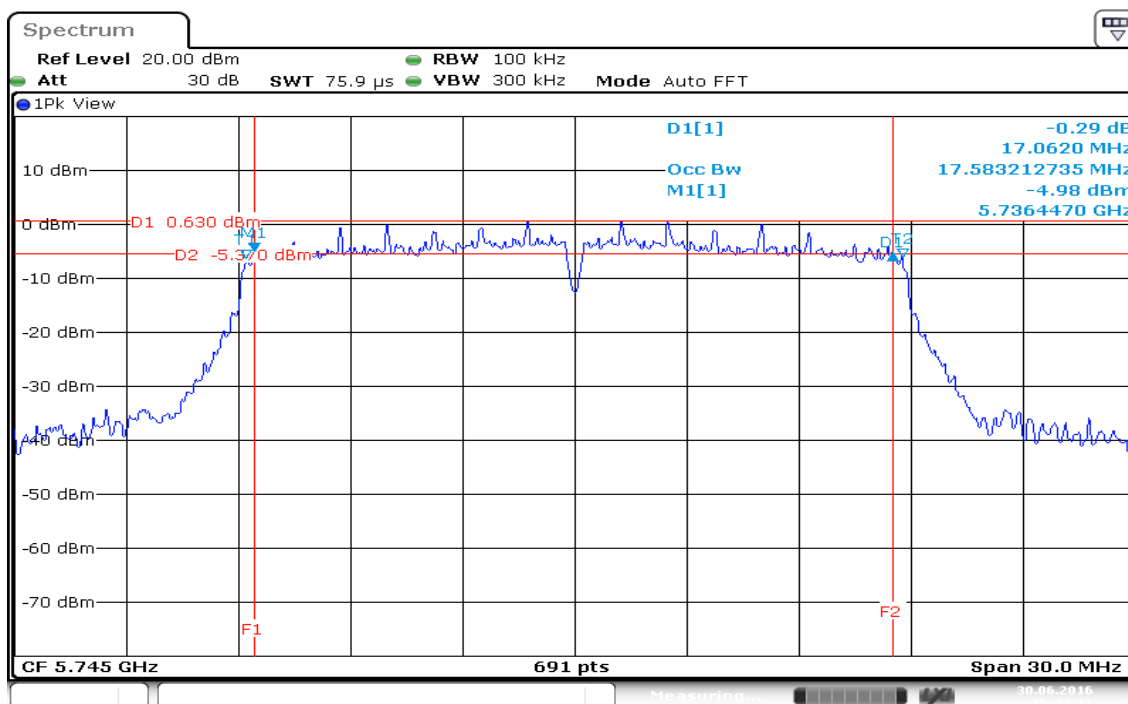
F1 F2

CF 5.825 GHz 691 pts Span 30.0 MHz

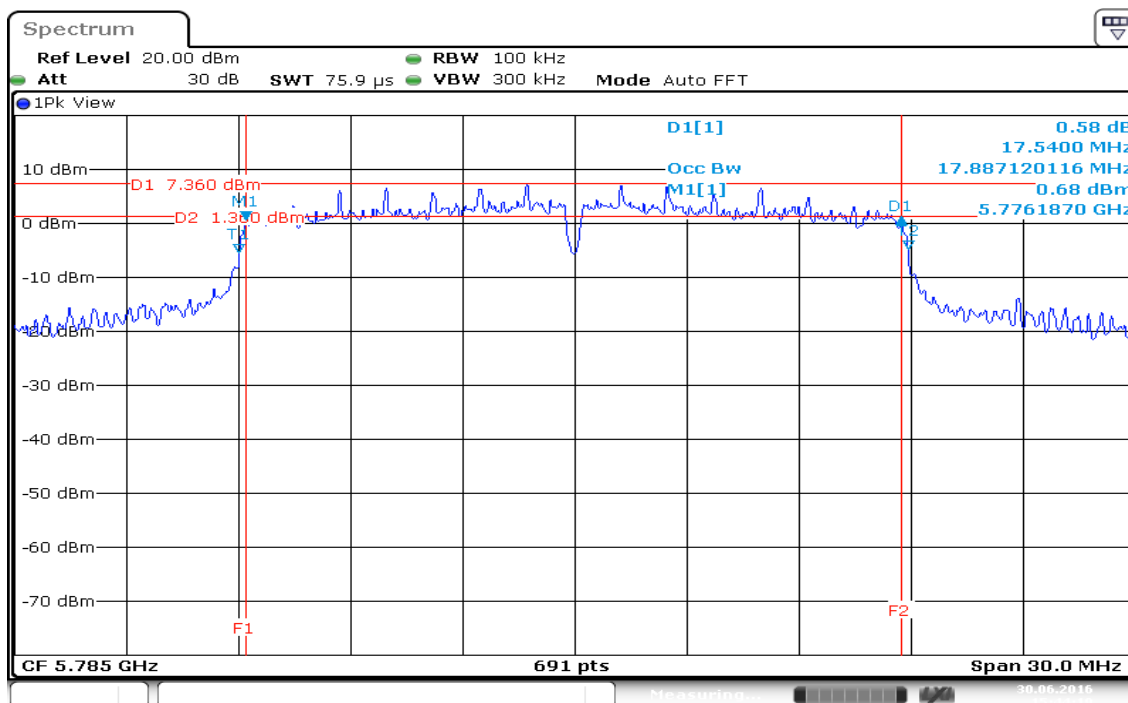
Date: 30 JUN 2016 15:26:37

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

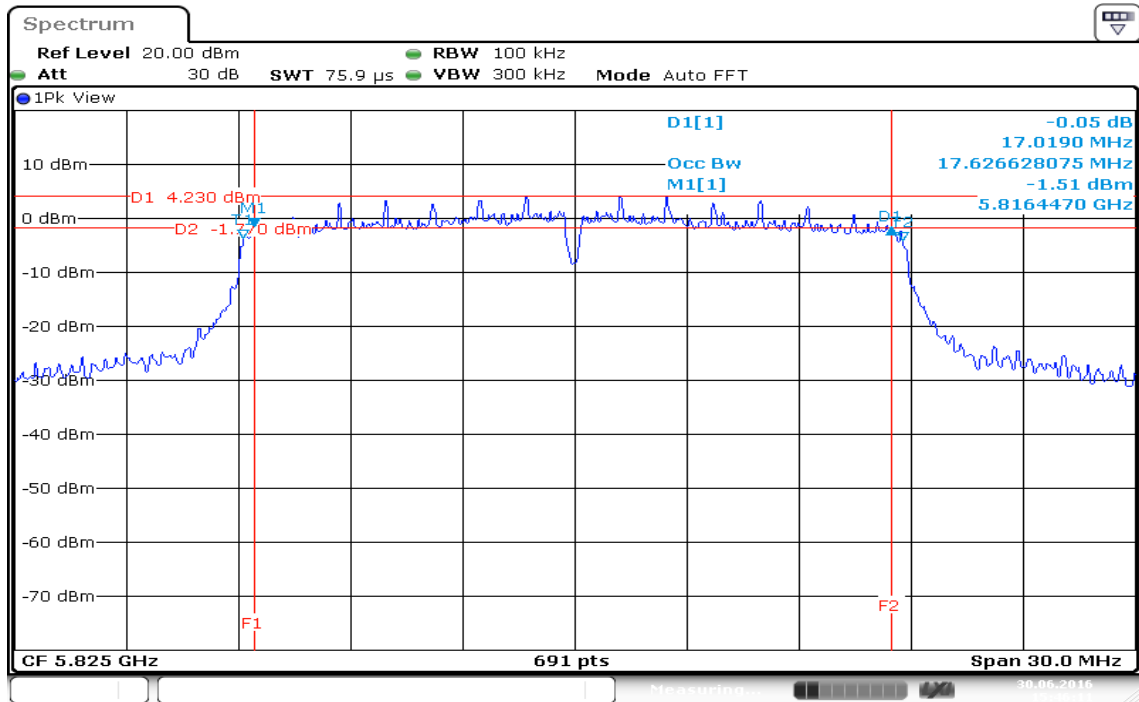
### 6dB Bandwidth (CH Low)



### 6dB Bandwidth (CH Mid)



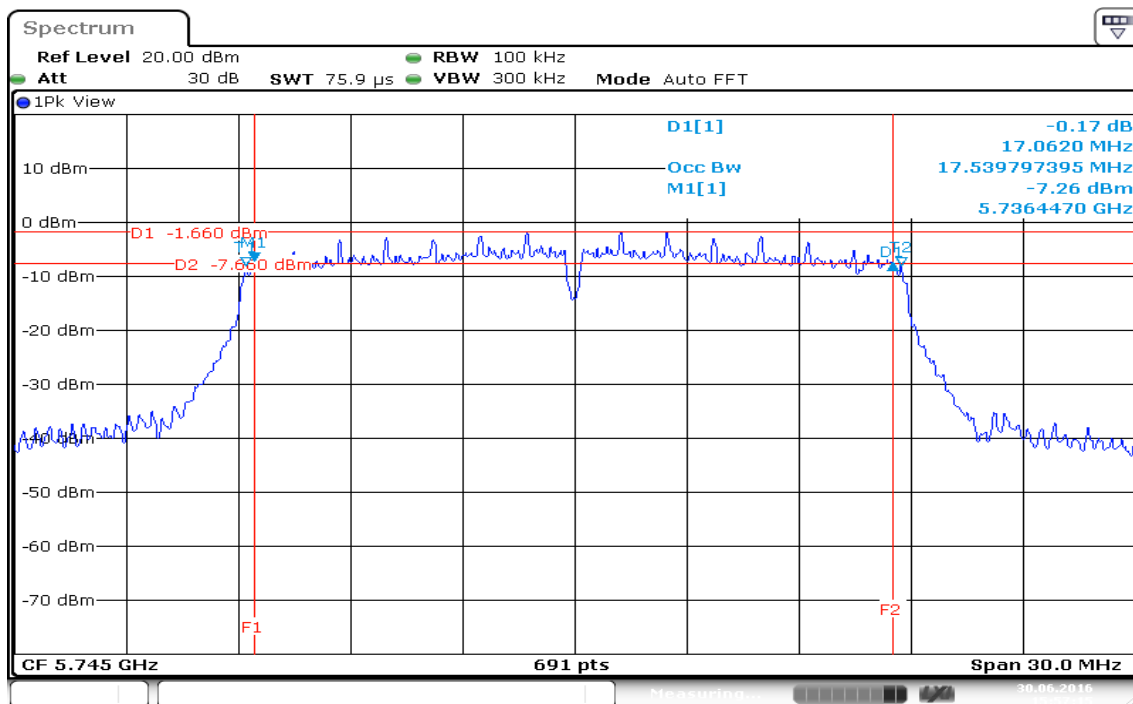
## 6dB Bandwidth (CH High)



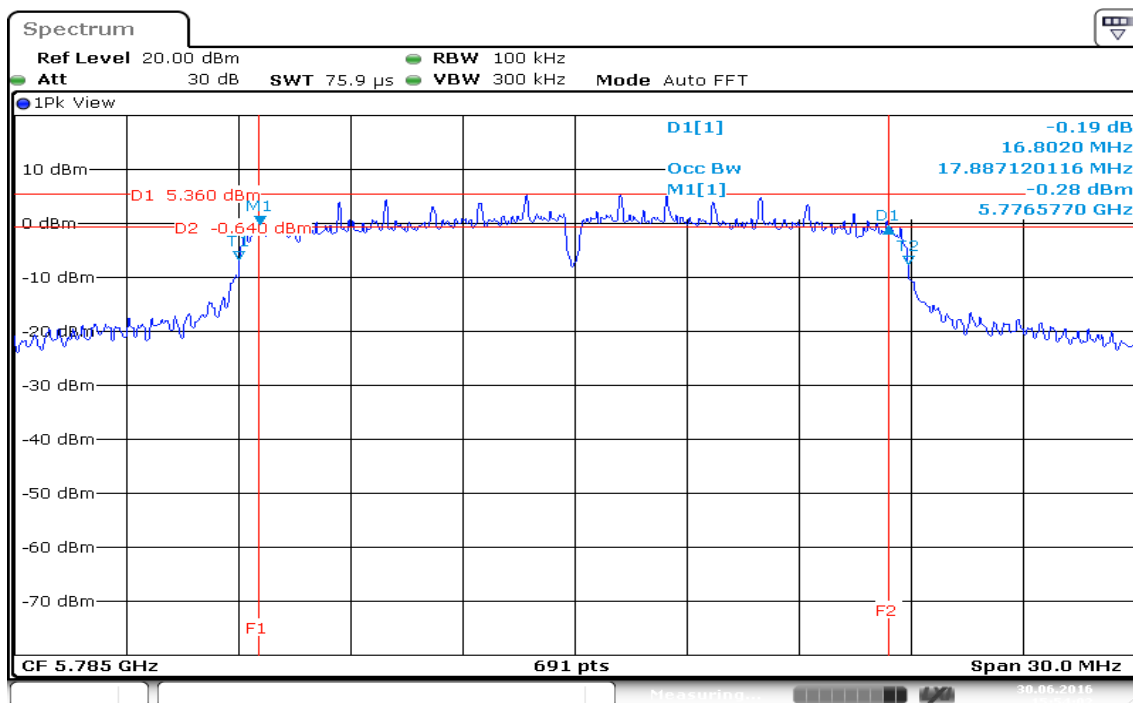
Date: 30 JUN 2016 15:46:11

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

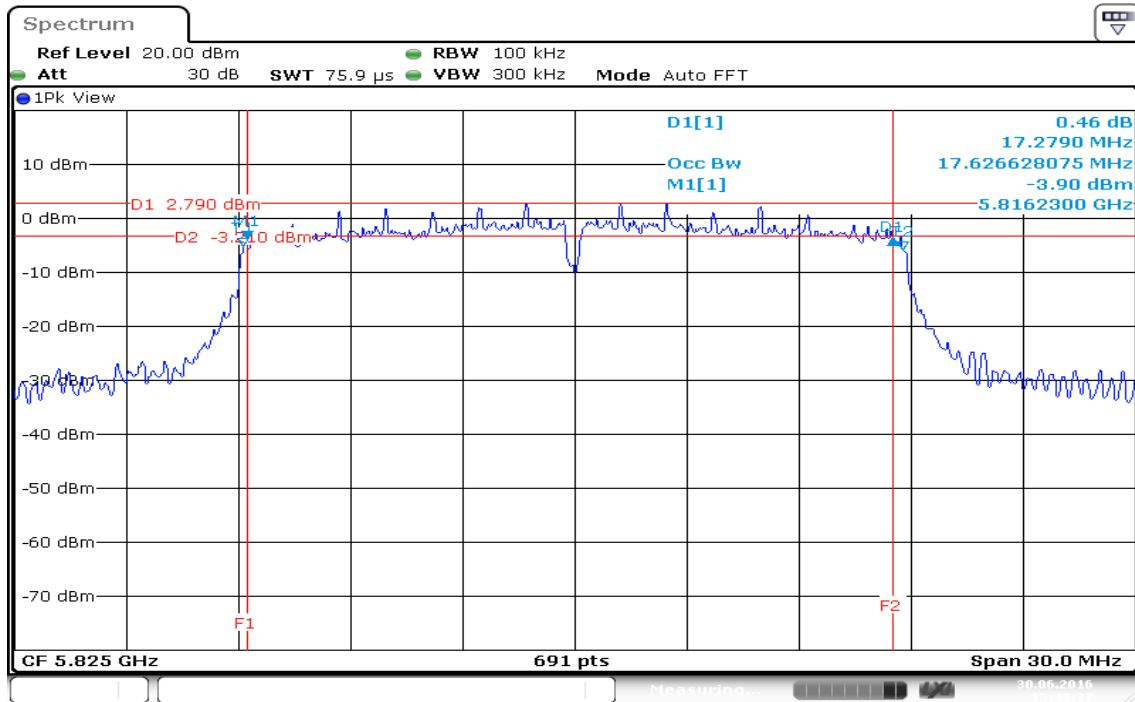
### 6dB Bandwidth (CH Low)



### 6dB Bandwidth (CH Mid)



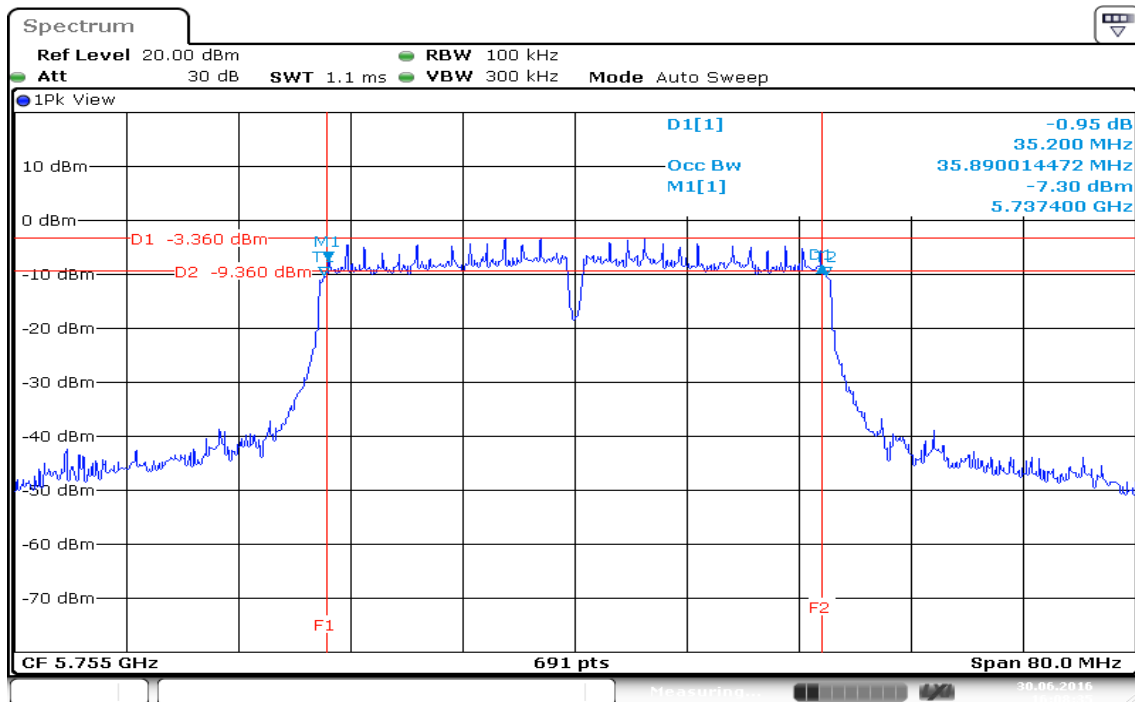
## 6dB Bandwidth (CH High)



Date: 30 JUN 2016 15:48:37

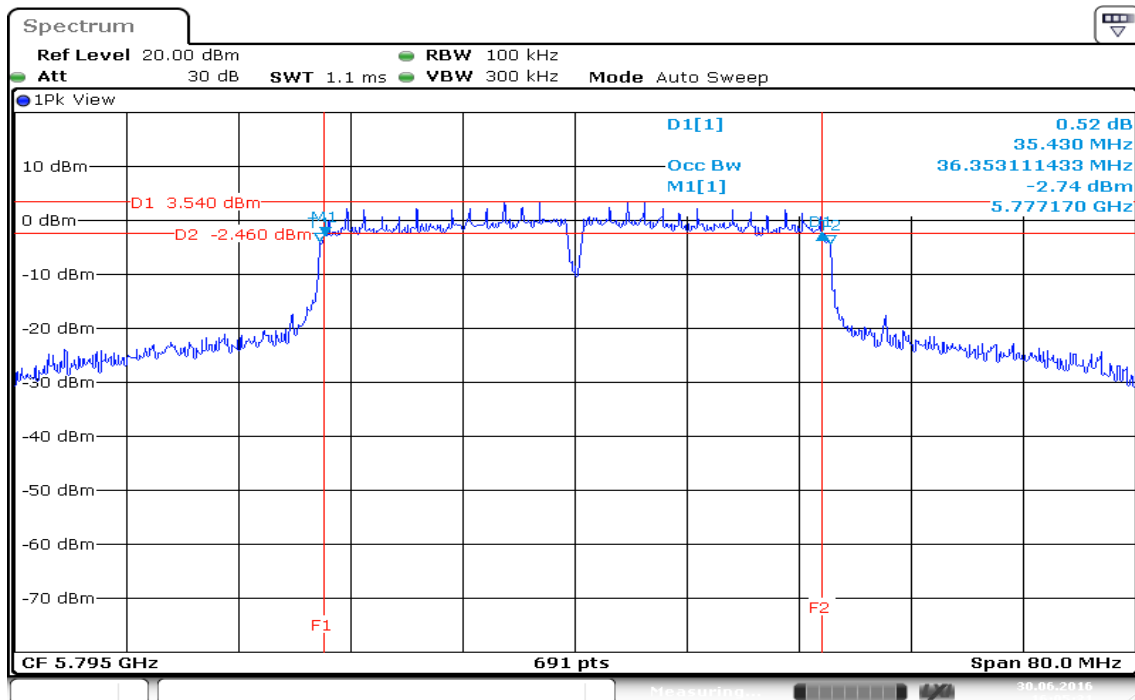
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

### 6dB Bandwidth (CH Low)



Date: 30 JUN 2016 16:08:36

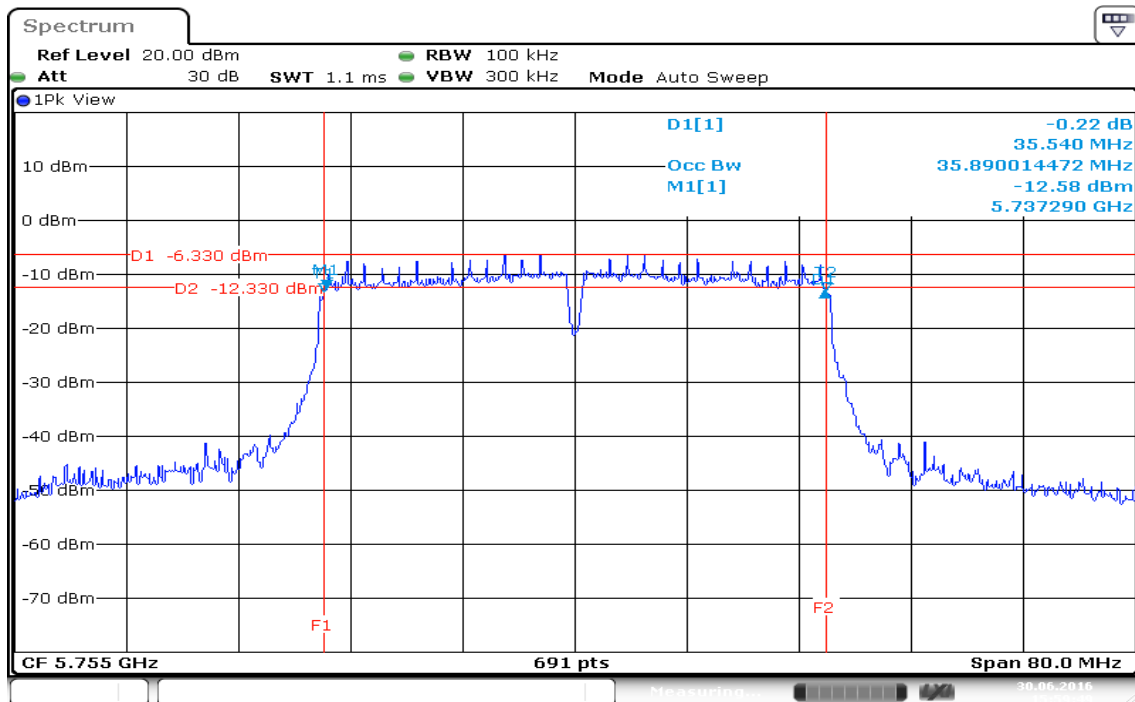
### 6dB Bandwidth (CH High)



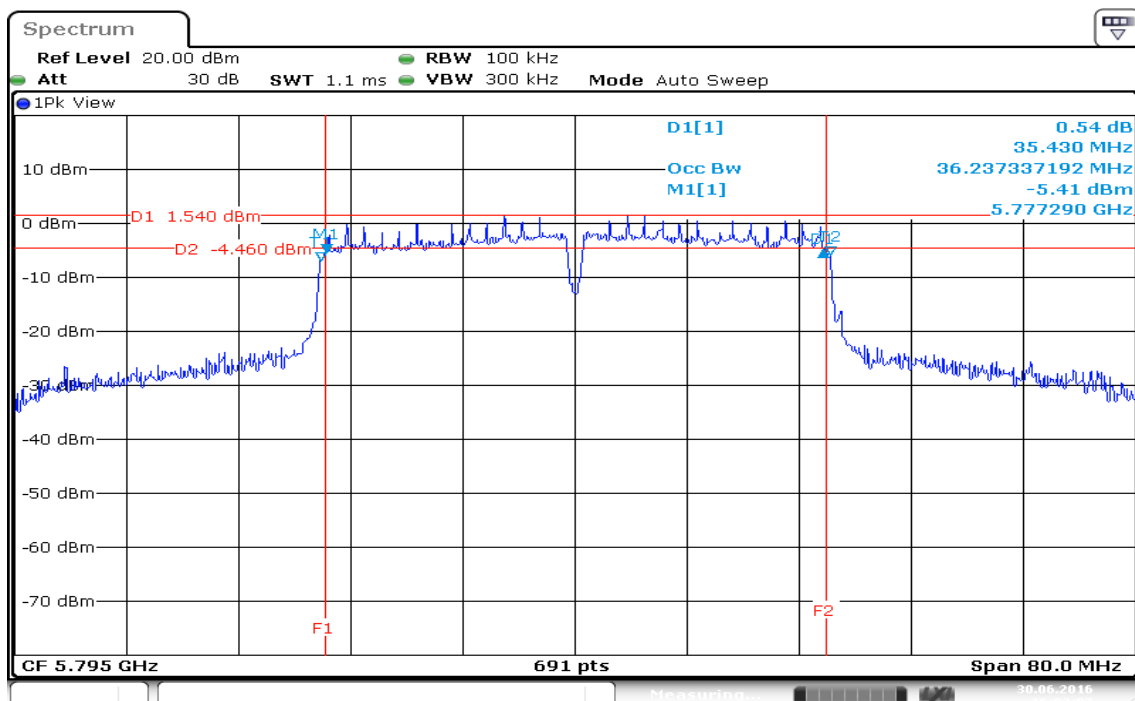
Date: 30 JUN 2016 16:05:31

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

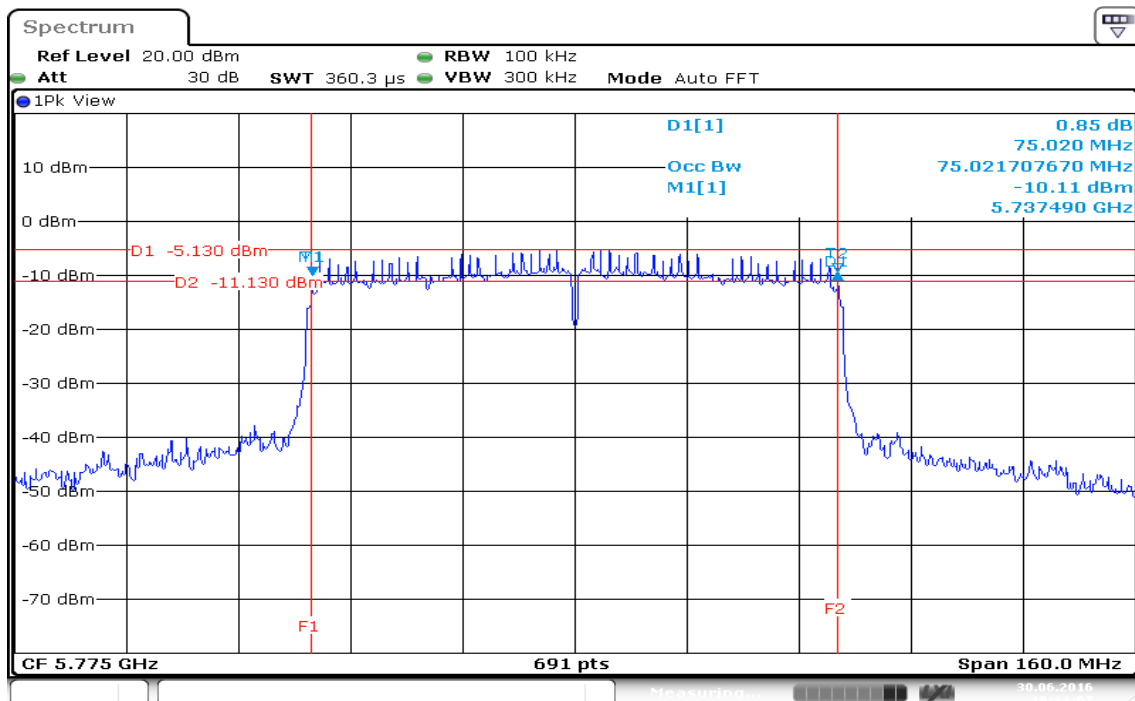
### 6dB Bandwidth (CH Low)



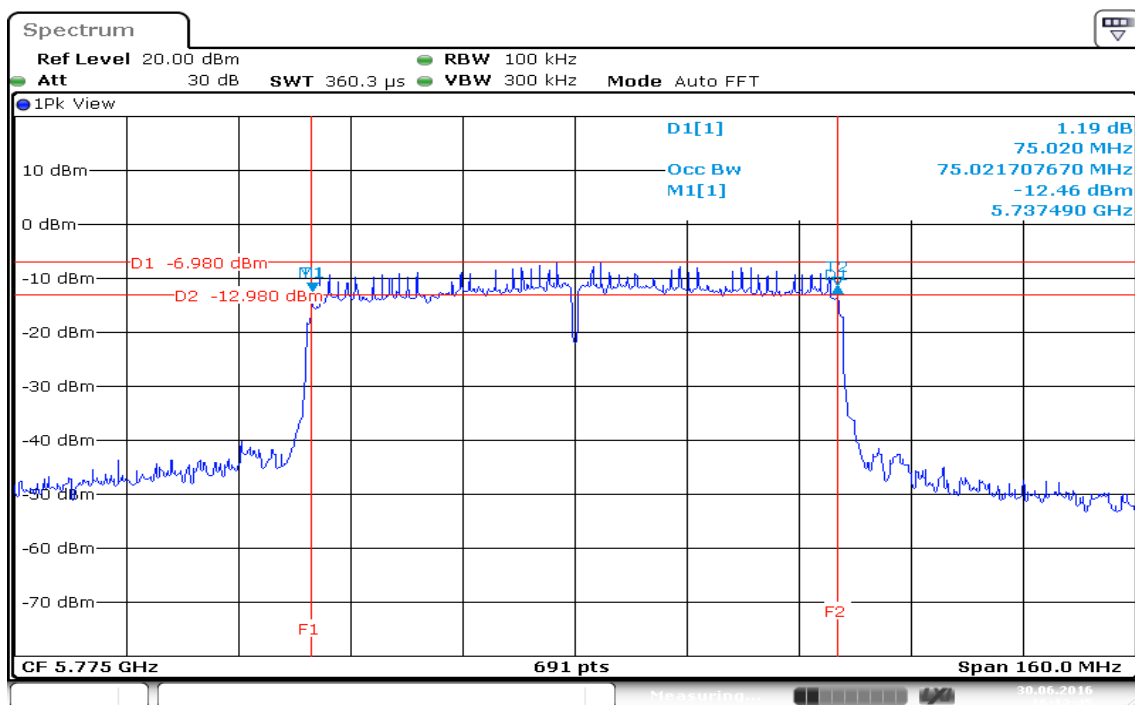
### 6dB Bandwidth (CH High)



# IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 0 6dB Bandwidth (CH Mid)



# IEEE 802.11ac VHT 80 MHz mode / 5775MHz / Chain 1 6dB Bandwidth (CH Mid)





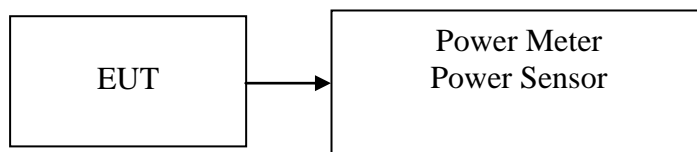
## 7.3 MAXIMUM CONDUCTED OUTPUT POWER

### 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 5725-5850 MHz: 1 Watt.

### 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) | Chain 0 Output Power (dBm) | Chain 1 Output Power (dBm) | Output Power (dBm) | Output Power (W) | Limit (dBm) |
|---------|-----------------|----------------------------|----------------------------|--------------------|------------------|-------------|
| Low     | 5745            | 9.87                       | 10.47                      | 13.19              | 0.0208           | 29.71       |
| Mid     | 5785            | 15.76                      | 15.79                      | <b>*18.79</b>      | 0.0757           | 29.71       |
| High    | 5825            | 13.22                      | 12.98                      | 16.11              | 0.0408           | 29.71       |

### 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            | 9.11                       | 10.81                      | 13.05              | 0.0202           | 29.71       |
| Mid     | 5785            | 15.19                      | 15.92                      | <b>*18.58</b>      | 0.0721           | 29.71       |
| High    | 5825            | 13.08                      | 13.64                      | 16.38              | 0.0435           | 29.71       |

### 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            | 6.78                       | 7.53                       | 10.18              | 0.0104           | 29.71       |
| High    | 5795            | 13.64                      | 14.14                      | <b>*16.91</b>      | 0.0491           | 29.71       |

### 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            | 8.52                       | 9.43                       | <b>*12.01</b>      | 0.0159           | 29.71       |

#### Remark:

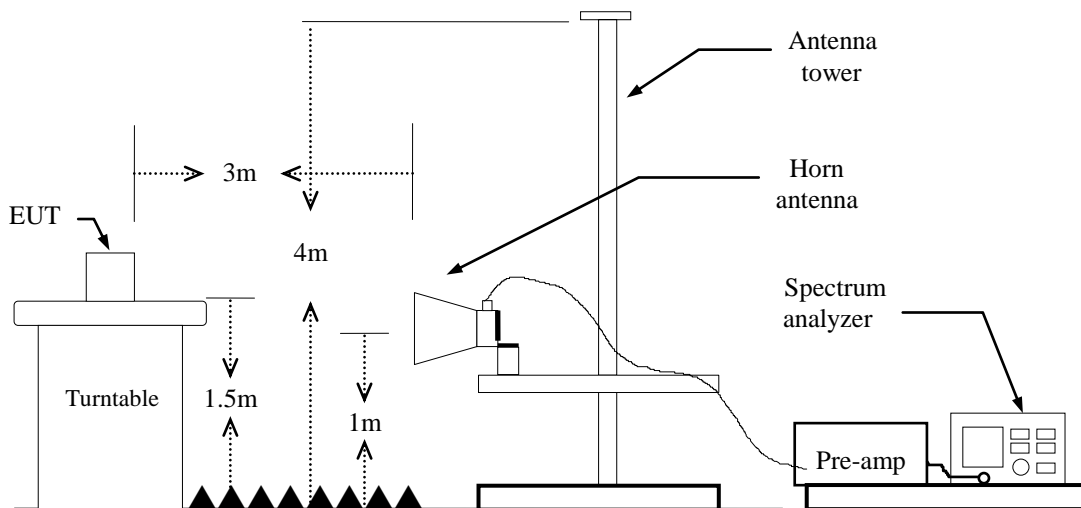
1. Total Output Power (w) = Chain 0 ( $10^{(\text{Output Power}/10)/1000}$ ) + Chain 1 ( $10^{(\text{Output Power}/10)/1000}$ )
2. The maximum antenna gain is 6.29dBi; therefore the reduction due to antenna gain is 0.29dBi, so the limit is 29.71dBm.

## 7.4 BAND EDGES MEASUREMENT

### LIMIT

According to §15.407(d), 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



## **TEST PROCEDURE**

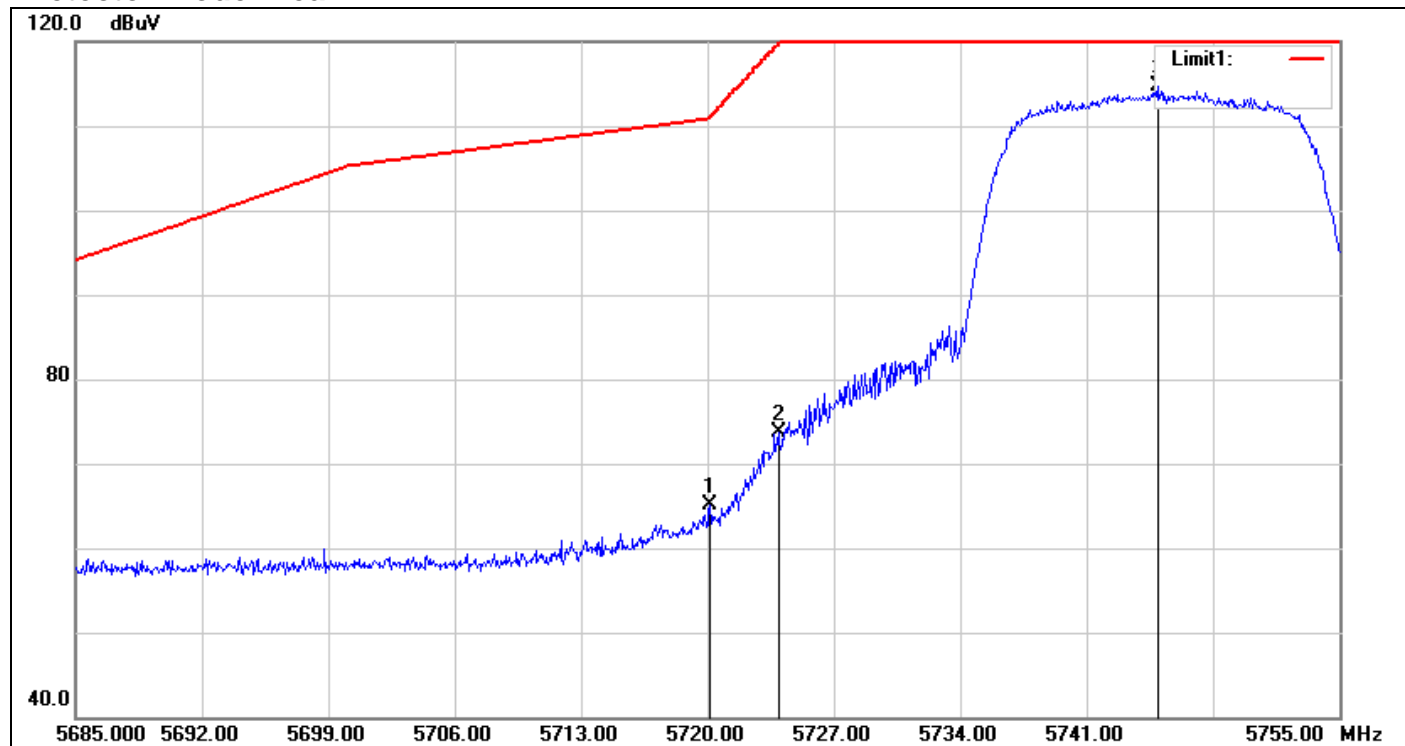
1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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:** =94%, VBW=680Hz  
**IEEE 802.11n HT 20 MHz mode:** =89%, VBW=750Hz  
**IEEE 802.11n HT 40 MHz mode:** =81%, VBW=1.5kHz  
**IEEE 802.11ac VHT 80 MHz mode:** =68%, VBW=3kHz
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

## **TEST RESULTS**

Refer to attach spectrum analyzer data chart.

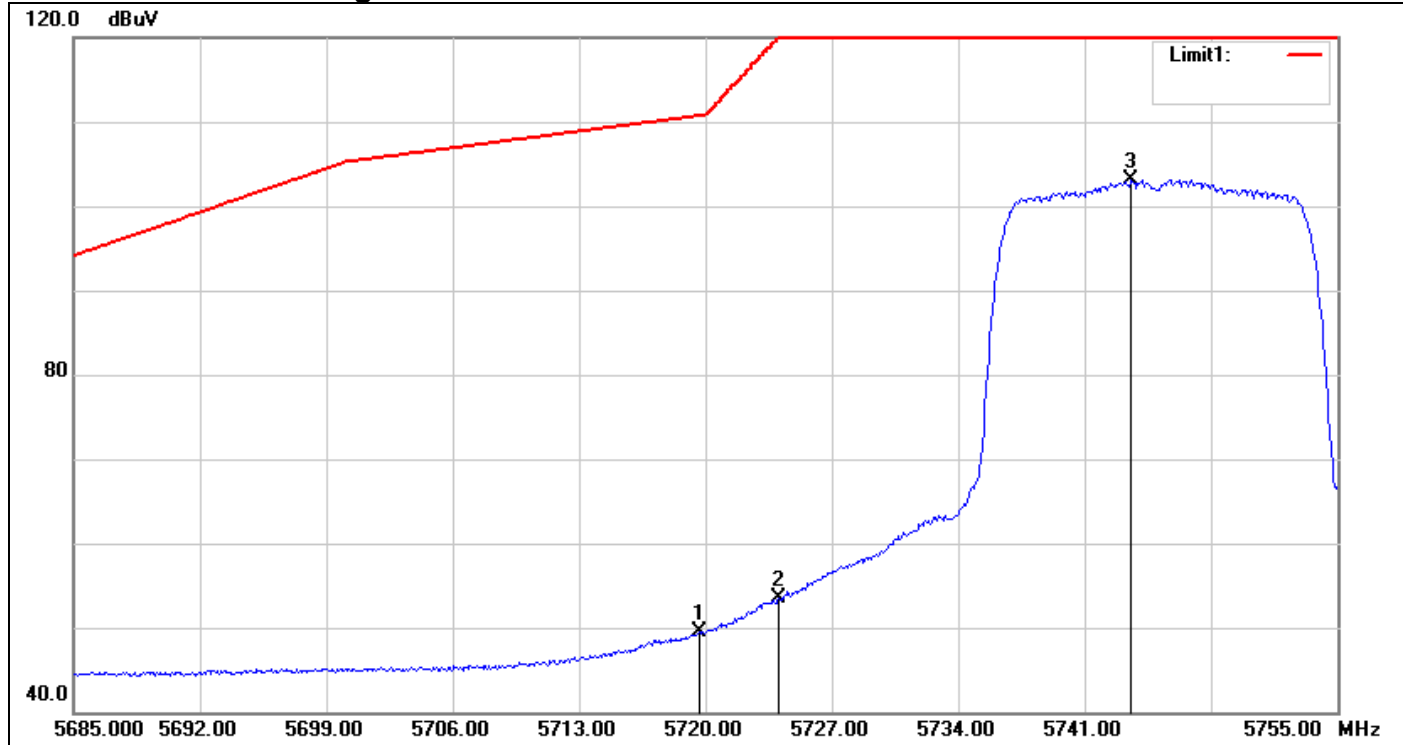
## Band Edges (IEEE 802.11a mode / CH Low)

Detector mode: Peak



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>Factor(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|----------------|--------|
| 1   | 5720.140           | 58.93             | 6.19                  | 65.12            | 111.12          | -46.00         | peak   |
| 2   | 5723.920           | 67.43             | 6.20                  | 73.63            | 119.74          | -46.11         | peak   |
| 3   | 5744.920           | 108.38            | 6.29                  | 114.67           | -               | -              | peak   |

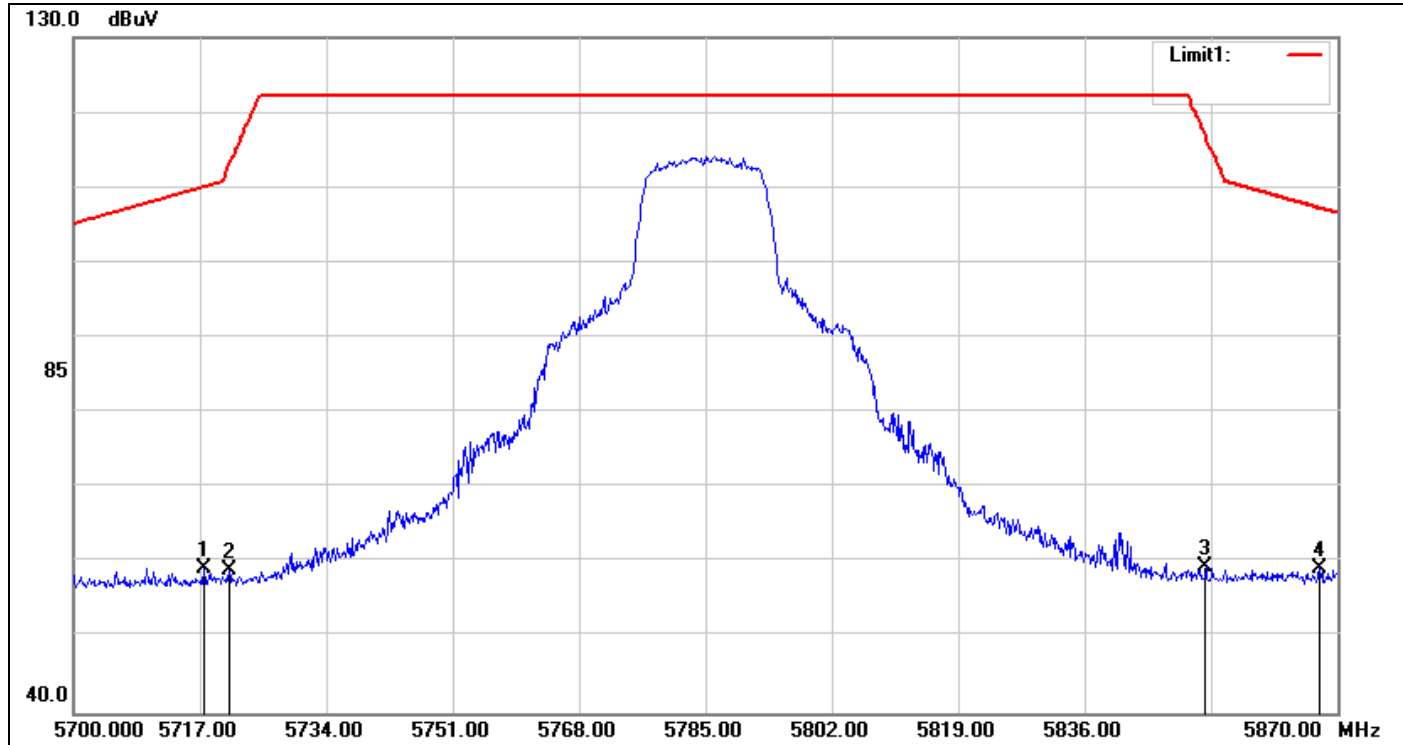
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.650        | 43.37          | 6.19               | 49.56         | 110.70       | -61.14      | AVG    |
| 2   | 5724.060        | 47.28          | 6.20               | 53.48         | 120.06       | -66.58      | AVG    |
| 3   | 5743.590        | 96.77          | 6.29               | 103.06        | -            | -           | AVG    |

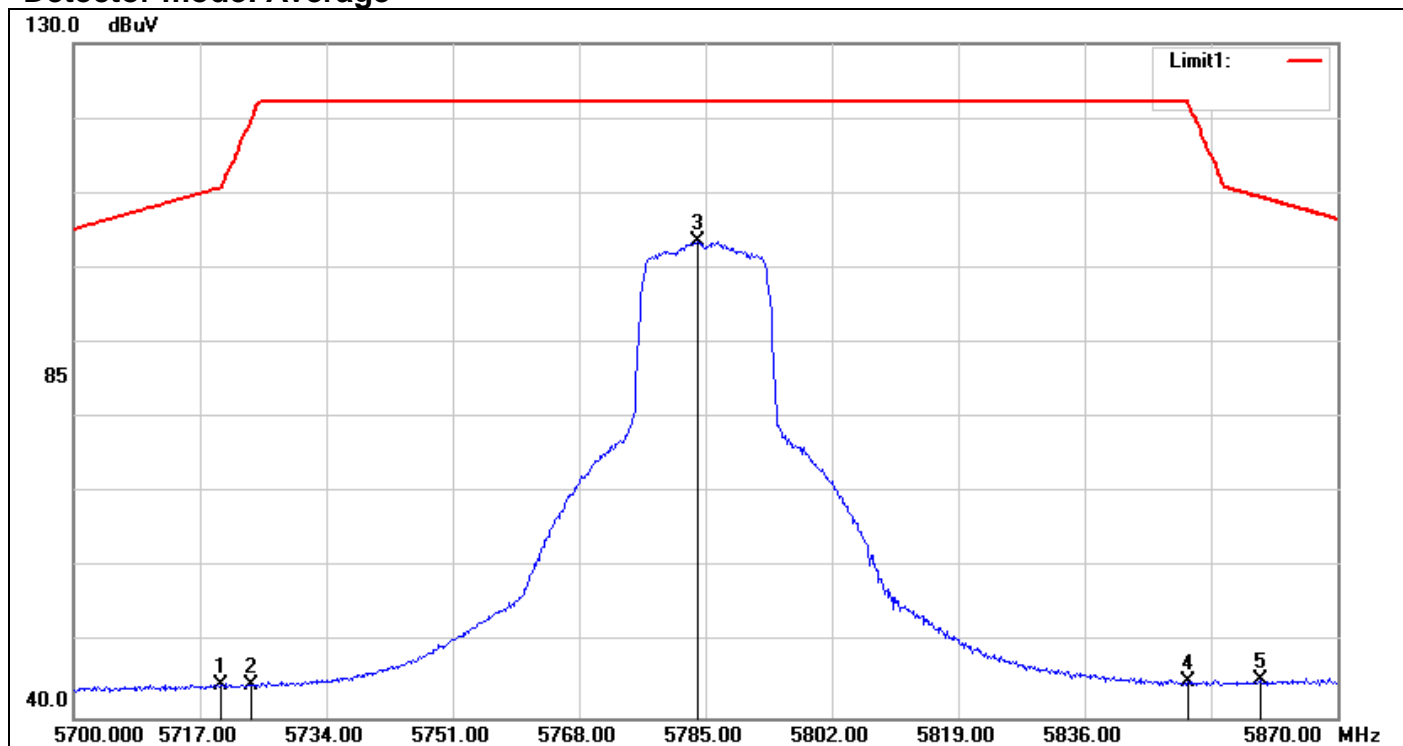
## Band Edges (IEEE 802.11a mode / CH Mid)

Detector mode: Peak



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>Factor(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------------|------------------|-----------------|----------------|--------|
| 1   | 5717.510           | 53.04             | 6.18                  | 59.22            | 110.10          | -50.88         | peak   |
| 2   | 5720.910           | 52.73             | 6.19                  | 58.92            | 112.87          | -53.95         | peak   |
| 3   | 5852.320           | 52.80             | 6.75                  | 59.55            | 116.91          | -57.36         | peak   |
| 4   | 5867.620           | 52.33             | 6.82                  | 59.15            | 107.27          | -48.12         | peak   |

**Detector mode: Average**

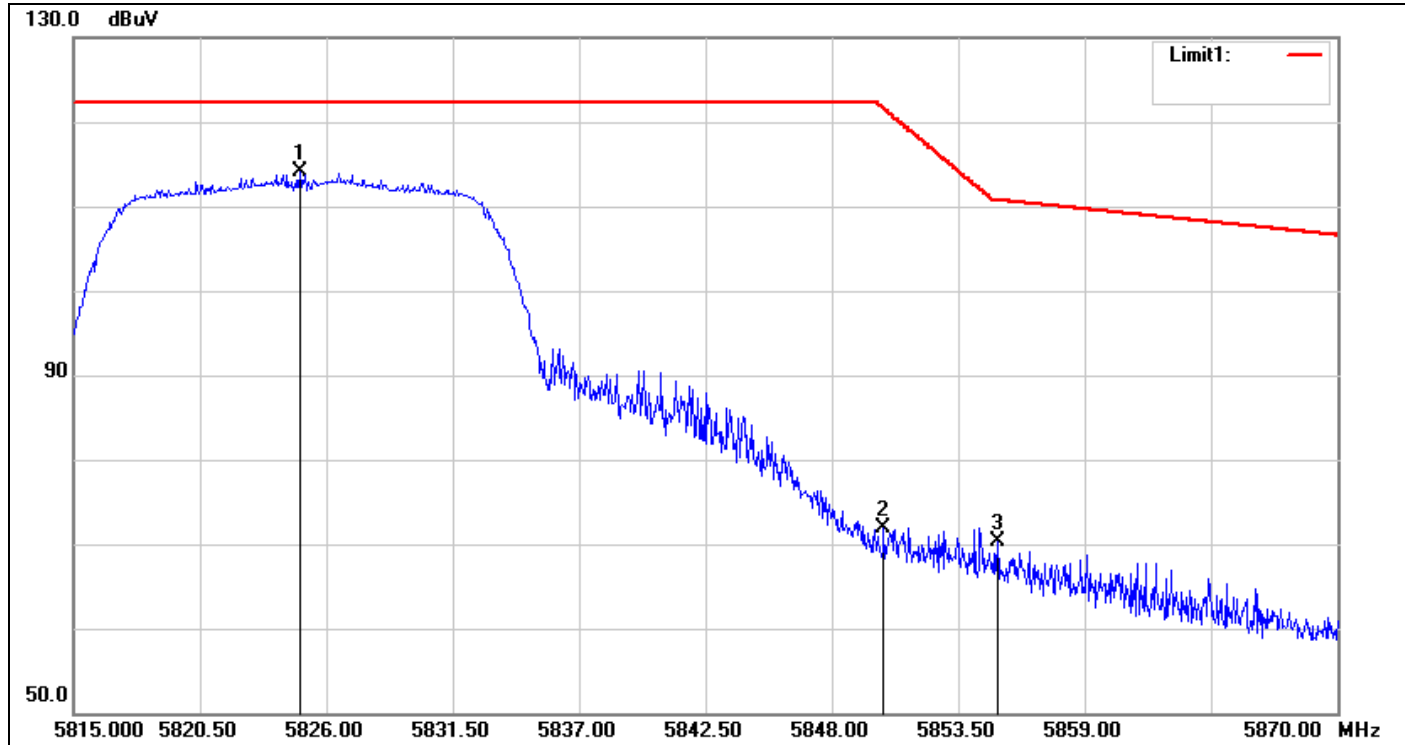


| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.890        | 38.29          | 6.19               | 44.48         | 110.77       | -66.29      | AVG    |
| 2   | 5723.800        | 38.29          | 6.20               | 44.49         | 119.46       | -74.97      | AVG    |
| 3   | 5783.980        | 97.12          | 6.46               | 103.58        | -            | -           | AVG    |
| 4   | 5849.940        | 38.14          | 6.74               | 44.88         | 122.20       | -77.32      | AVG    |
| 5   | 5859.630        | 38.18          | 6.78               | 44.96         | 109.50       | -64.54      | AVG    |



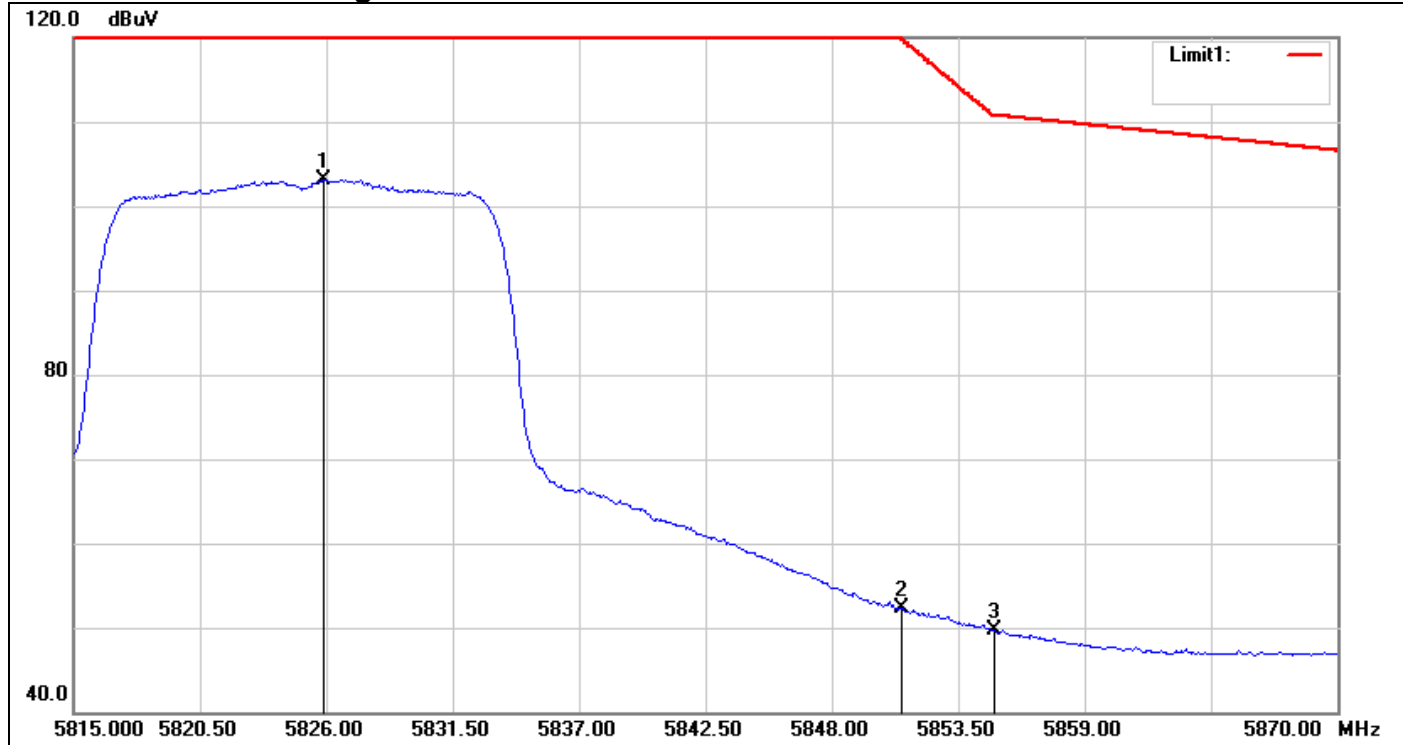
## Band Edges (IEEE 802.11a mode / CH High)

Detector mode: Peak



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5824.845        | 107.46         | 6.63               | 114.09        | -            | -           | peak   |
| 2   | 5850.255        | 65.23          | 6.74               | 71.97         | 121.62       | -49.65      | peak   |
| 3   | 5855.205        | 63.60          | 6.76               | 70.36         | 110.74       | -40.38      | peak   |

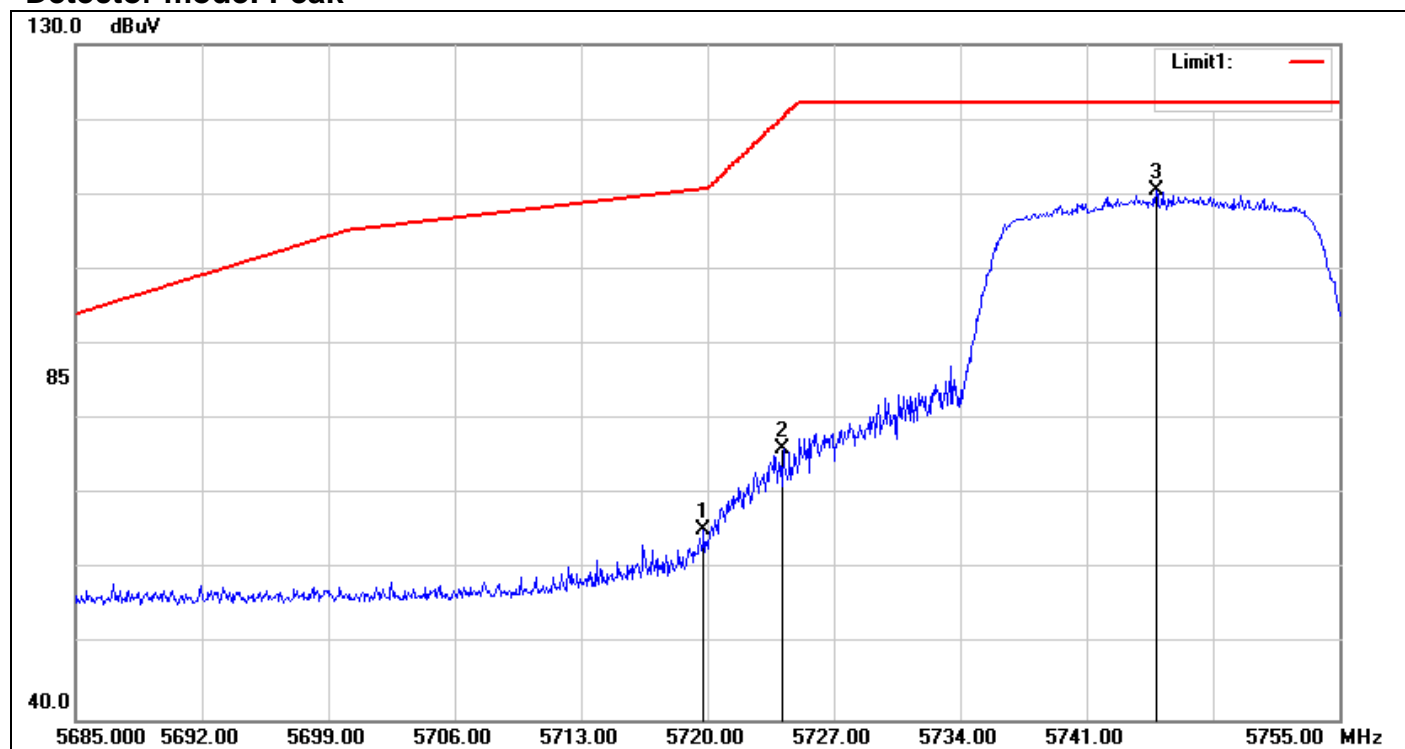
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5825.890        | 96.49          | 6.64               | 103.13        | -            | -           | AVG    |
| 2   | 5851.025        | 45.52          | 6.75               | 52.27         | 119.86       | -67.59      | AVG    |
| 3   | 5855.095        | 42.95          | 6.76               | 49.71         | 110.77       | -61.06      | AVG    |

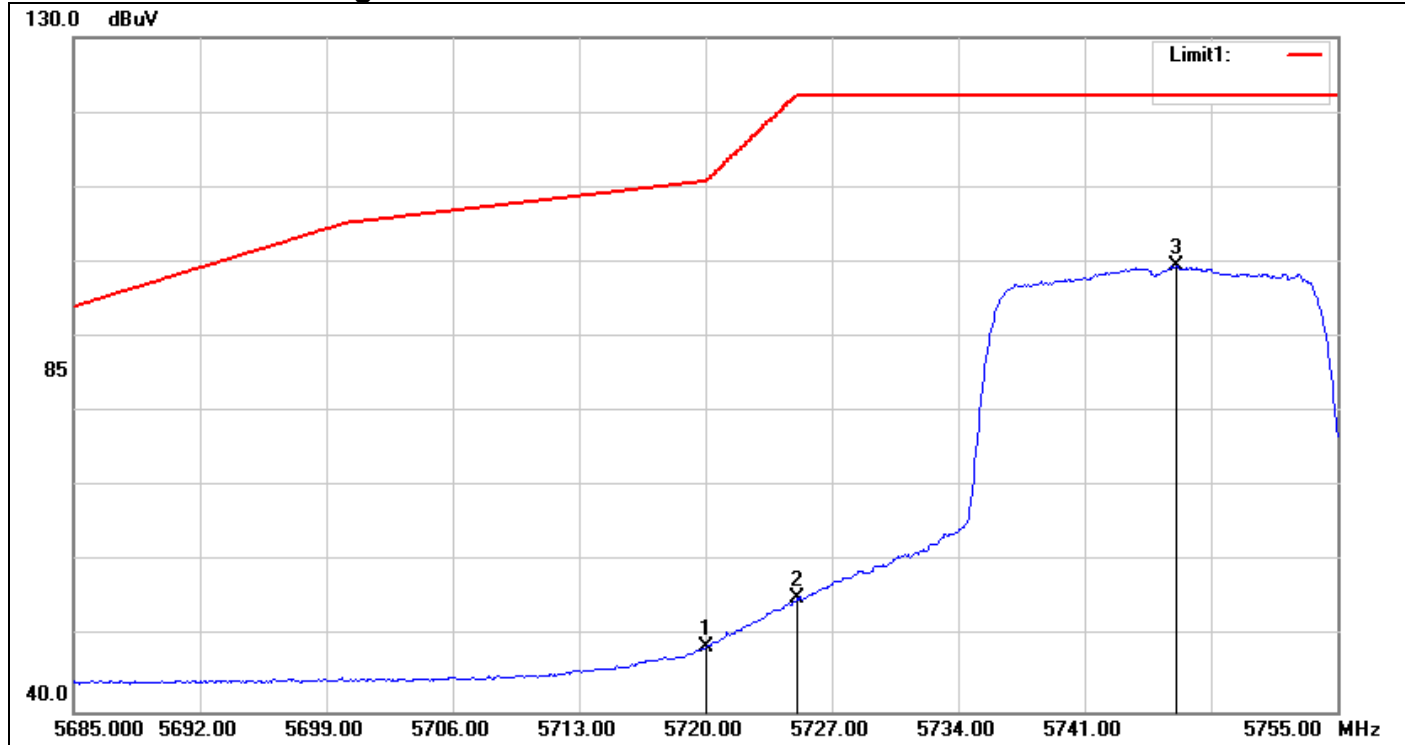
# Band Edges (IEEE 802.11n HT 20 MHz mode / CH Low)

Detector mode: Peak



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.790        | 59.12          | 6.19               | 65.31         | 110.74       | -45.43      | peak   |
| 2   | 5724.200        | 69.82          | 6.21               | 76.03         | 120.38       | -44.35      | peak   |
| 3   | 5744.850        | 104.26         | 6.29               | 110.55        | -            | -           | peak   |

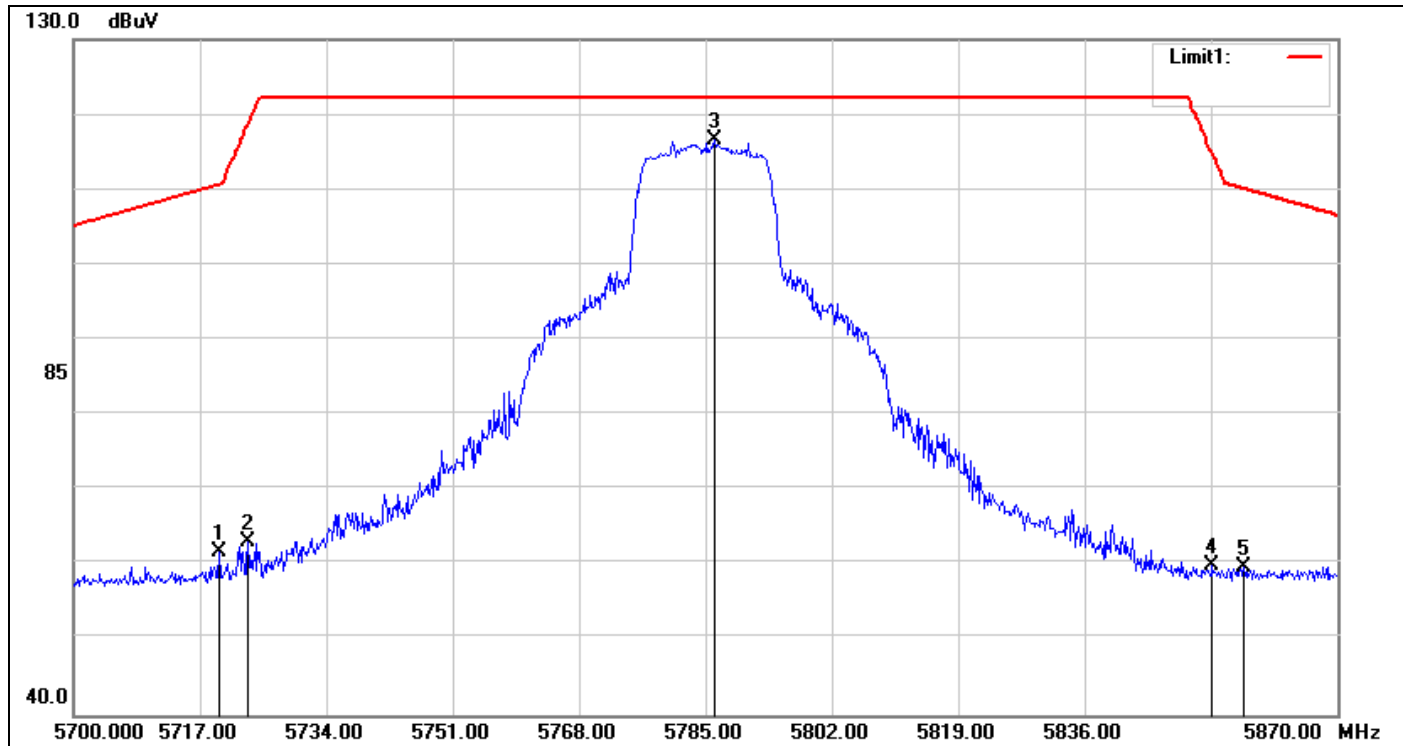
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5720.070        | 42.47          | 6.19               | 48.66         | 110.96       | -62.30      | AVG    |
| 2   | 5725.110        | 48.87          | 6.21               | 55.08         | 122.20       | -67.12      | AVG    |
| 3   | 5746.110        | 93.18          | 6.30               | 99.48         | -            | -           | AVG    |

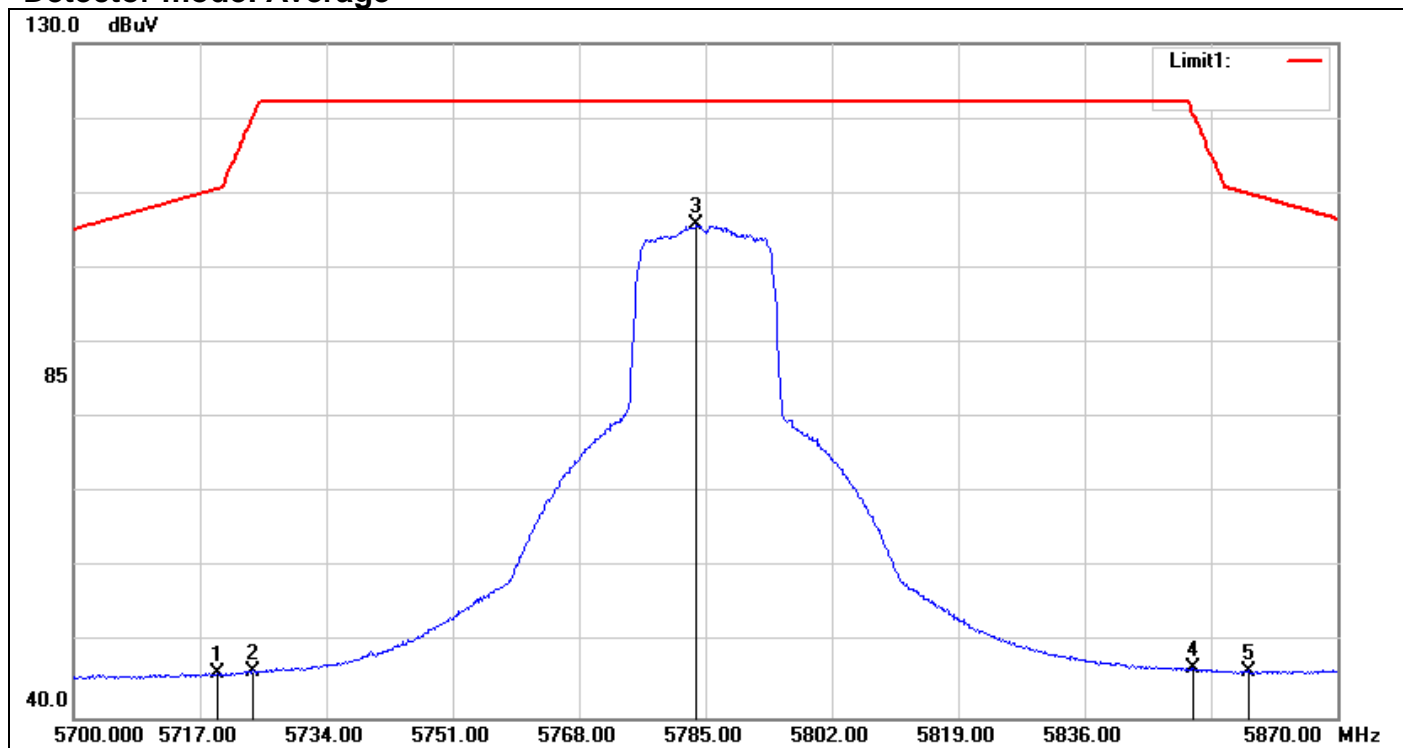
**Band Edges (IEEE 802.11n HT 20 MHz mode / CH Mid)**

**Detector mode: Peak**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.550        | 55.41          | 6.19               | 61.60         | 110.67       | -49.07      | peak   |
| 2   | 5723.460        | 56.97          | 6.20               | 63.17         | 118.69       | -55.52      | peak   |
| 3   | 5786.190        | 110.08         | 6.47               | 116.55        | -            | -           | peak   |
| 4   | 5853.170        | 53.07          | 6.75               | 59.82         | 114.97       | -55.15      | peak   |
| 5   | 5857.420        | 52.96          | 6.77               | 59.73         | 110.12       | -50.39      | peak   |

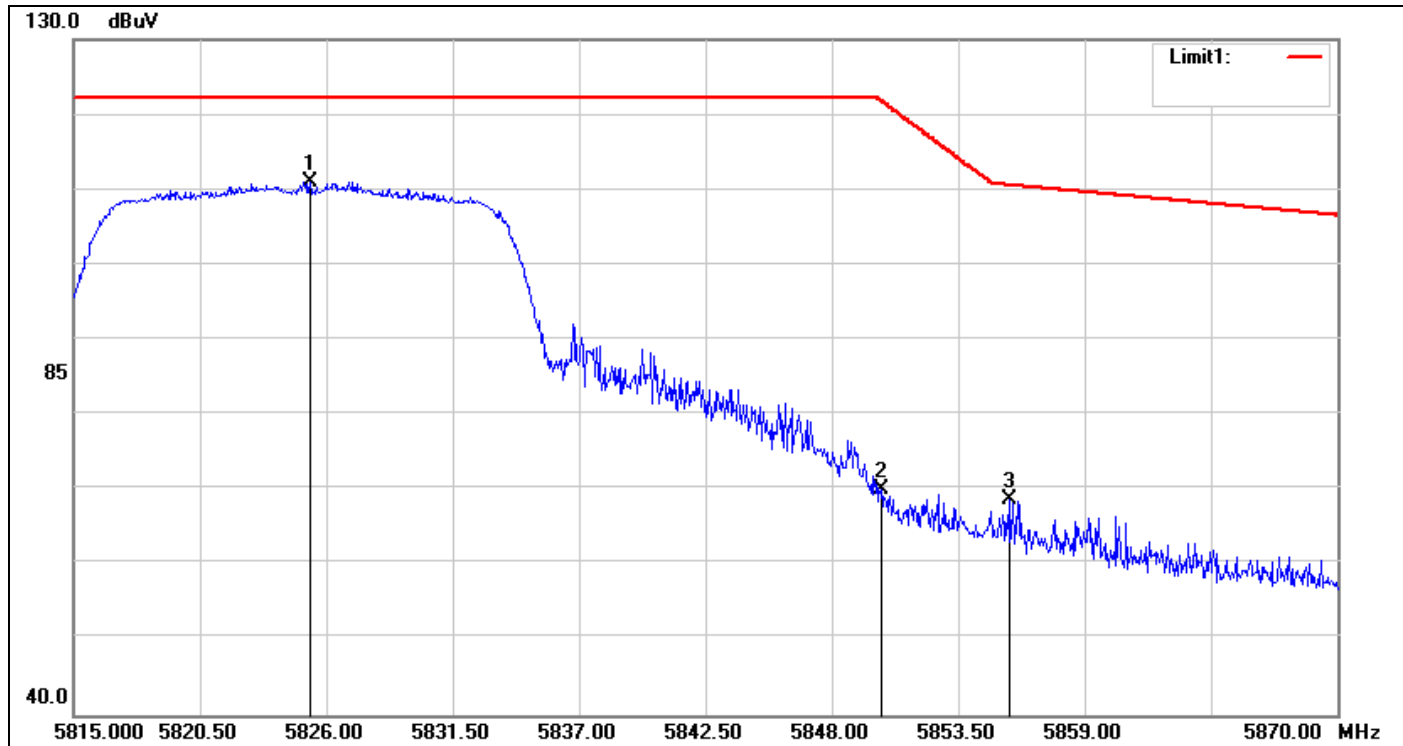
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.380        | 39.88          | 6.18               | 46.06         | 110.63       | -64.57      | AVG    |
| 2   | 5724.140        | 40.10          | 6.20               | 46.30         | 120.24       | -73.94      | AVG    |
| 3   | 5783.810        | 99.26          | 6.46               | 105.72        | -            | -           | AVG    |
| 4   | 5850.620        | 39.83          | 6.74               | 46.57         | 120.79       | -74.22      | AVG    |
| 5   | 5858.100        | 39.52          | 6.78               | 46.30         | 109.93       | -63.63      | AVG    |

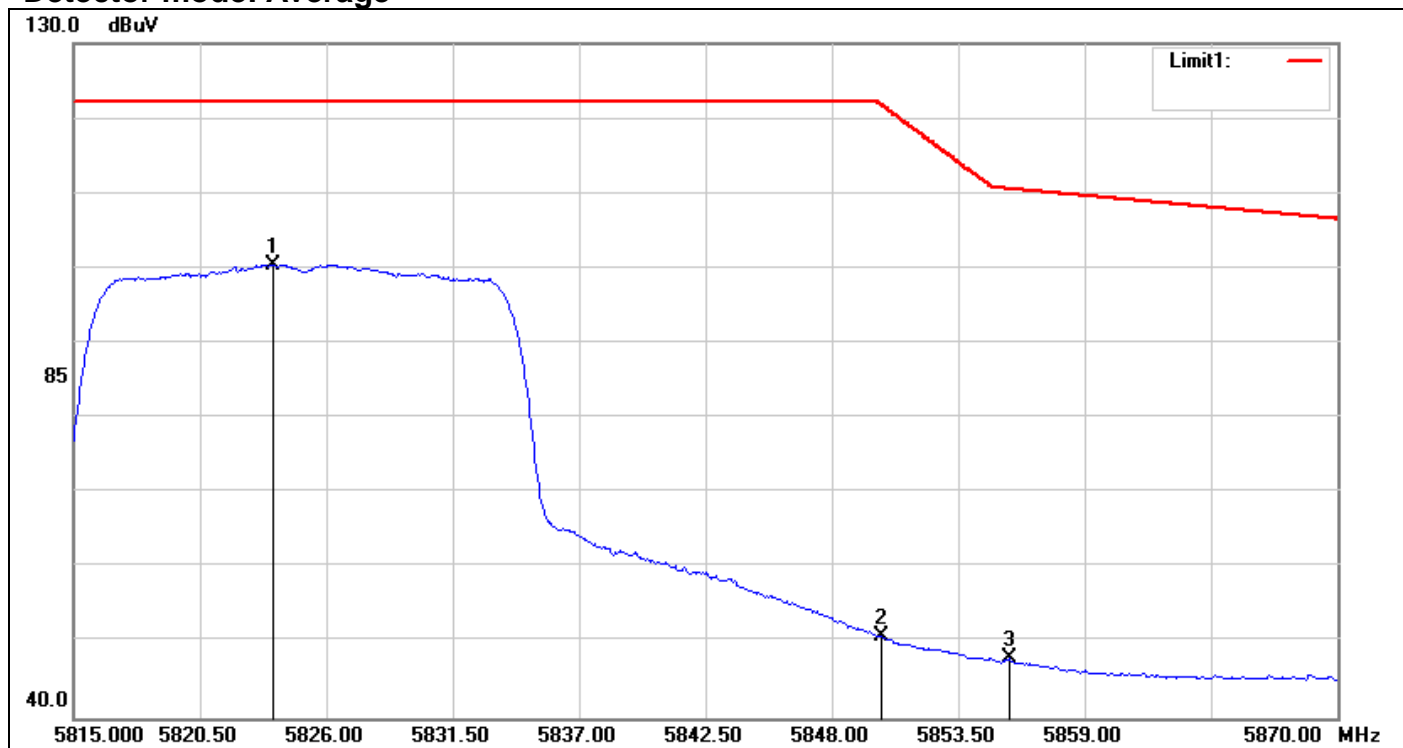
# Band Edges (IEEE 802.11n HT 20 MHz mode / CH High)

Detector mode: Peak



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5825.285        | 104.45         | 6.64               | 111.09        | -            | -           | peak   |
| 2   | 5850.145        | 63.24          | 6.74               | 69.98         | 121.87       | -51.89      | peak   |
| 3   | 5855.755        | 61.84          | 6.77               | 68.61         | 110.59       | -41.98      | peak   |

**Detector mode: Average**

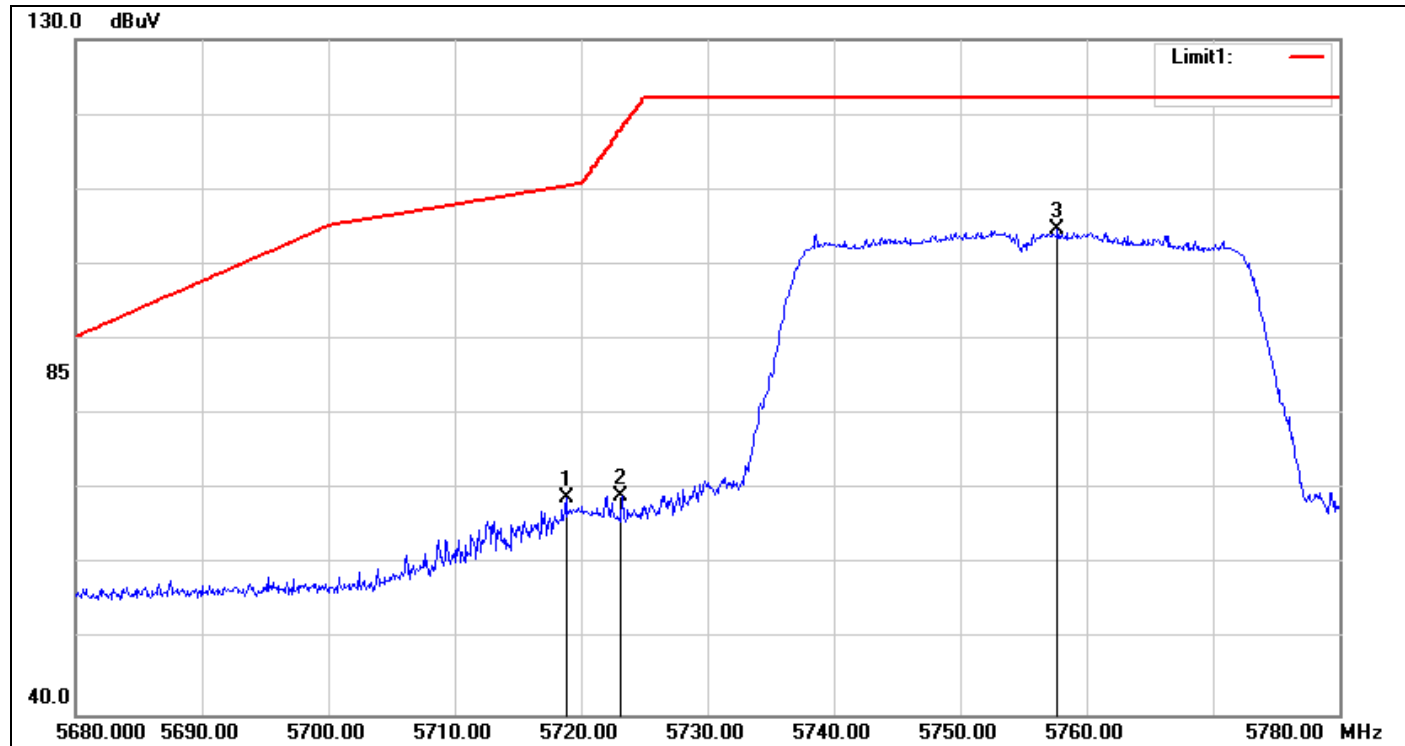


| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5823.690        | 93.89          | 6.63               | 100.52        | -            | -           | AVG    |
| 2   | 5850.145        | 44.12          | 6.74               | 50.86         | 121.87       | -71.01      | AVG    |
| 3   | 5855.755        | 41.13          | 6.77               | 47.90         | 110.59       | -62.69      | AVG    |



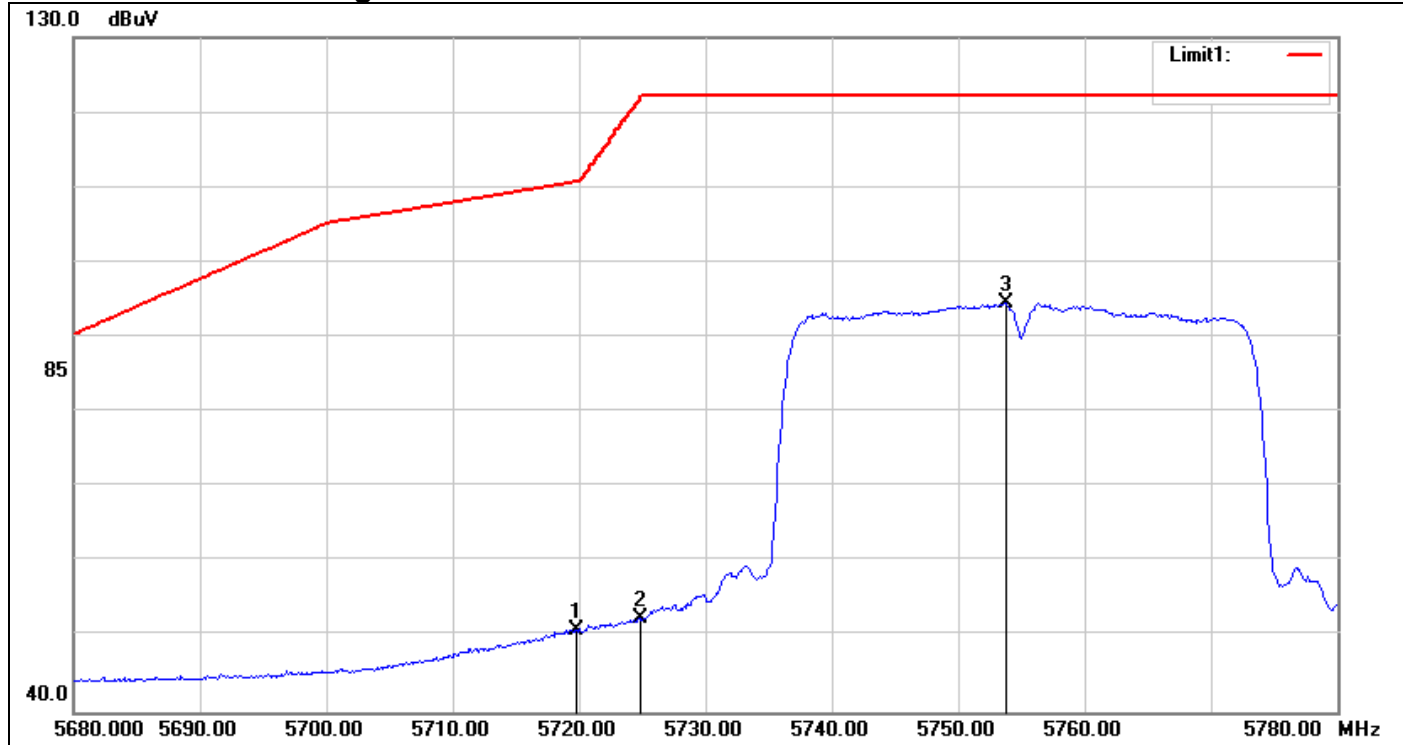
**Band Edges (IEEE 802.11n HT 40 MHz mode / CH Low)**

**Detector mode: Peak**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5718.800        | 62.80          | 6.18               | 68.98         | 110.46       | -41.48      | peak   |
| 2   | 5723.200        | 62.95          | 6.20               | 69.15         | 118.10       | -48.95      | peak   |
| 3   | 5757.700        | 98.23          | 6.35               | 104.58        | -            | -           | peak   |

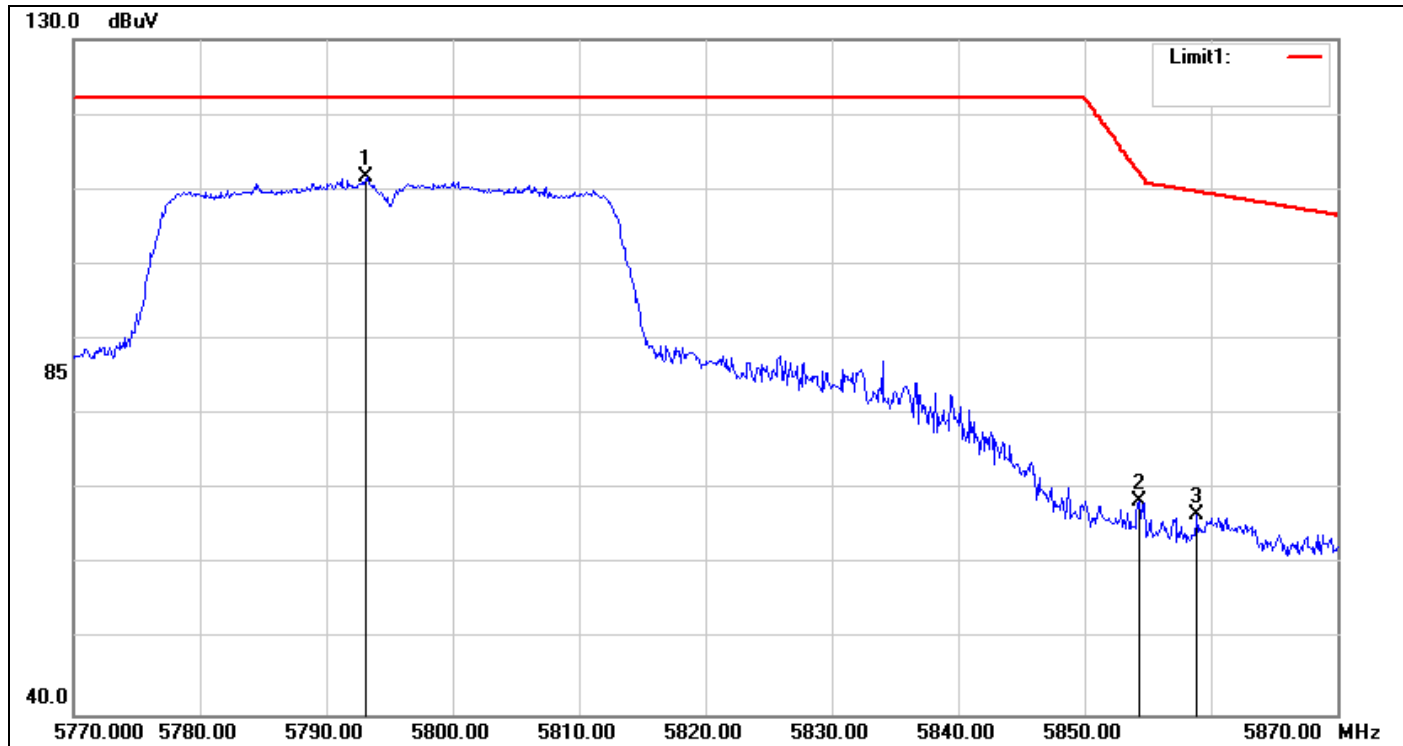
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.800        | 44.72          | 6.19               | 50.91         | 110.74       | -59.83      | AVG    |
| 2   | 5724.900        | 46.20          | 6.21               | 52.41         | 121.97       | -69.56      | AVG    |
| 3   | 5753.800        | 88.26          | 6.33               | 94.59         | -            | -           | AVG    |

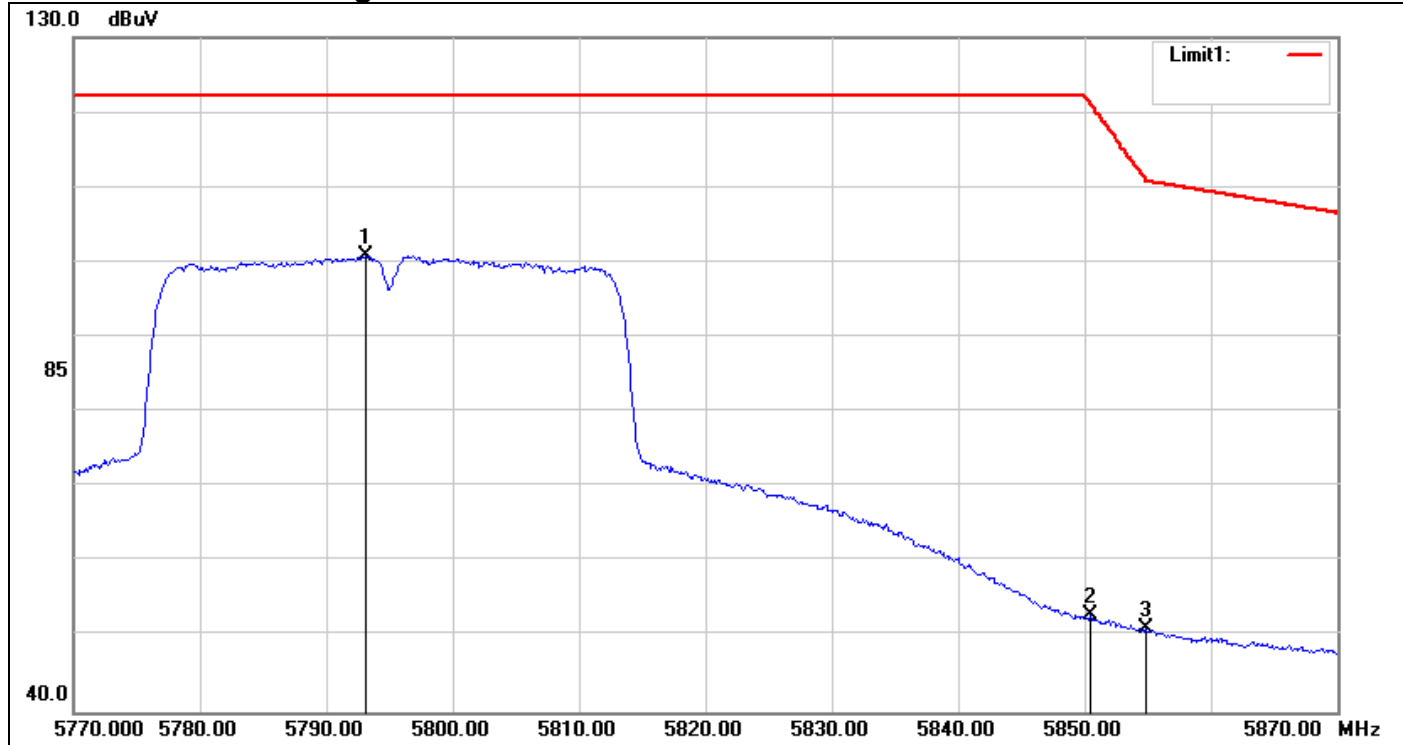
**Band Edges (IEEE 802.11n HT 40 MHz mode / CH High)**

**Detector mode: Peak**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5793.200        | 105.20         | 6.50               | 111.70        | -            | -           | peak   |
| 2   | 5854.300        | 61.61          | 6.76               | 68.37         | 112.40       | -44.03      | peak   |
| 3   | 5858.900        | 59.78          | 6.78               | 66.56         | 109.71       | -43.15      | peak   |

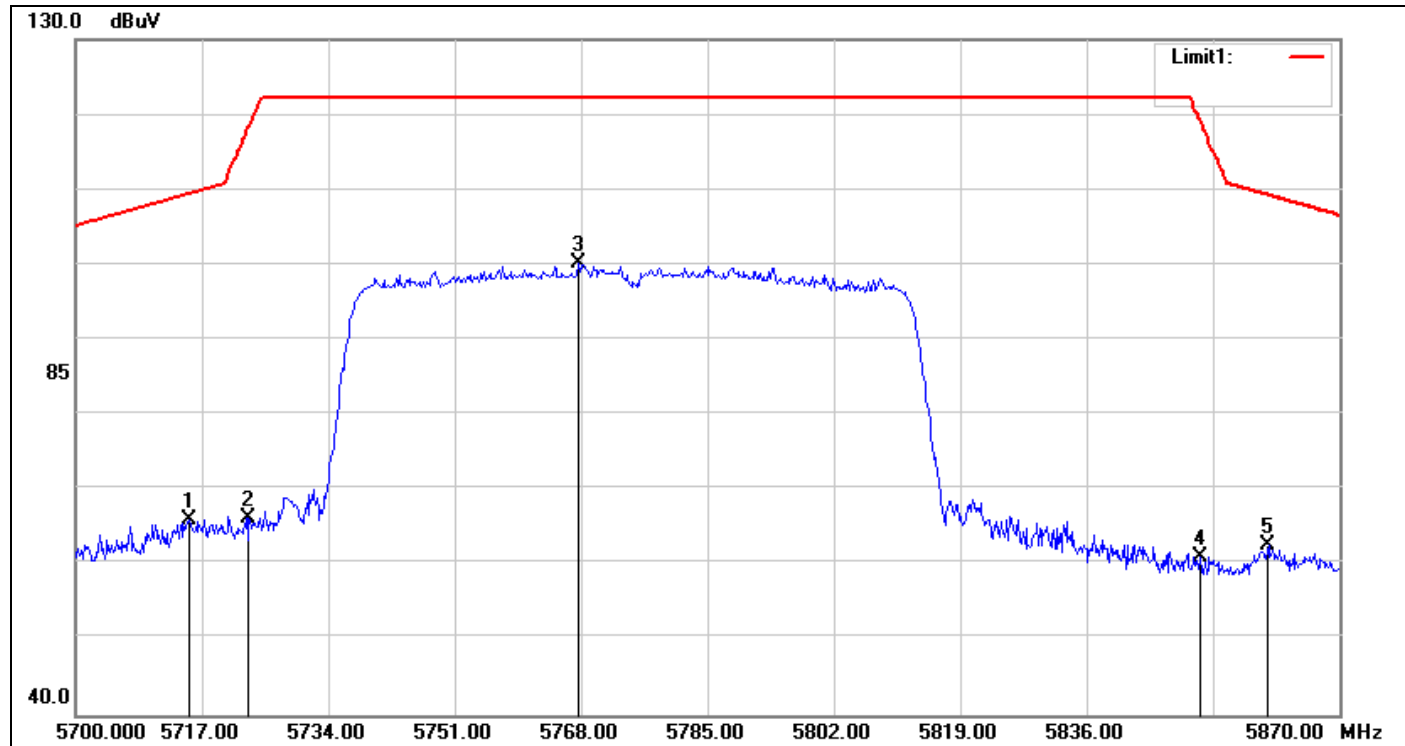
**Detector mode: Average**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5793.100        | 94.31          | 6.50               | 100.81        | -            | -           | AVG    |
| 2   | 5850.500        | 46.11          | 6.74               | 52.85         | 121.06       | -68.21      | AVG    |
| 3   | 5854.900        | 44.28          | 6.76               | 51.04         | 111.03       | -59.99      | AVG    |

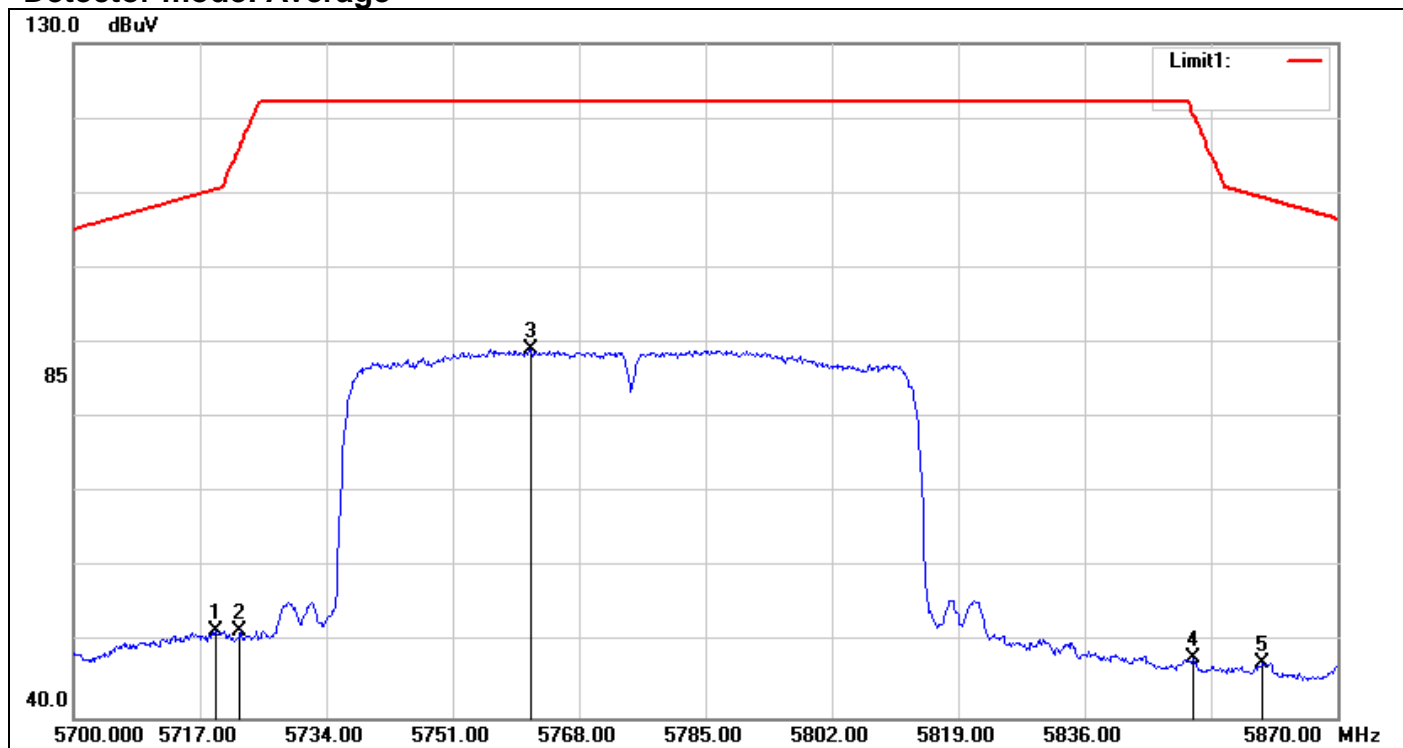
**Band Edges (IEEE 802.11ac VHT 80 MHz mode / CH Mid)**

**Detector mode: Peak**



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5715.300        | 59.90          | 6.17               | 66.07         | 109.48       | -43.41      | peak   |
| 2   | 5723.290        | 60.05          | 6.20               | 66.25         | 118.30       | -52.05      | peak   |
| 3   | 5767.660        | 93.80          | 6.39               | 100.19        | -            | -           | peak   |
| 4   | 5851.300        | 54.32          | 6.75               | 61.07         | 119.24       | -58.17      | peak   |
| 5   | 5860.480        | 55.92          | 6.79               | 62.71         | 109.27       | -46.56      | peak   |

**Detector mode: Average**



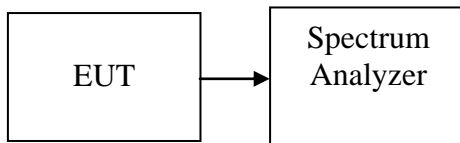
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1   | 5719.040        | 45.33          | 6.18               | 51.51         | 110.53       | -59.02      | AVG    |
| 2   | 5722.440        | 45.38          | 6.20               | 51.58         | 116.36       | -64.78      | AVG    |
| 3   | 5761.540        | 82.82          | 6.36               | 89.18         | -            | -           | AVG    |
| 4   | 5850.620        | 41.17          | 6.74               | 47.91         | 120.79       | -72.88      | AVG    |
| 5   | 5859.970        | 40.56          | 6.78               | 47.34         | 109.41       | -62.07      | AVG    |

## 7.5 PEAK POWER SPECTRAL DENSITY

### LIMIT

1. According to §15.407, 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 = 3 x RBW, Span = 1.5 x bandwidth, Sweep=auto
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

Duty Cycle = 89.47%      Duty Factor = 0.48

| Channel | Frequency (MHz) | Chain 0 PPSD (dBm) | Chain 1 PPSD (dBm) | PPSD (dBm) | Limit (dBm) | Result |
|---------|-----------------|--------------------|--------------------|------------|-------------|--------|
| Low     | 5745            | 7.42               | 9.22               | 11.91      | 29.71       | PASS   |
| Mid     | 5785            | 11.81              | 13.79              | 16.41      |             | PASS   |
| High    | 5825            | 10.35              | 11.80              | 14.63      |             | PASS   |

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

Duty Cycle = 88.89%      Duty Factor = 0.51

| Channel | Frequency (MHz) | Chain 0 PPSD (dBm) | Chain 1 PPSD (dBm) | PPSD (dBm) | Limit (dBm) | Result |
|---------|-----------------|--------------------|--------------------|------------|-------------|--------|
| Low     | 5745            | 7.10               | 8.98               | 11.66      | 29.71       | PASS   |
| Mid     | 5785            | 11.92              | 13.51              | 16.31      |             | PASS   |
| High    | 5825            | 10.21              | 11.67              | 14.52      |             | PASS   |

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

Duty Cycle = 80.00%      Duty Factor = 0.97

| Channel | Frequency (MHz) | Chain 0 PPSD (dBm) | Chain 1 PPSD (dBm) | PPSD (dBm) | Limit (dBm) | Result |
|---------|-----------------|--------------------|--------------------|------------|-------------|--------|
| Low     | 5755            | 2.37               | 4.62               | 7.62       | 29.71       | PASS   |
| High    | 5795            | 8.52               | 9.88               | 13.23      |             | PASS   |

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

Duty Cycle = 67.57%      Duty Factor = 1.70

| Channel | Frequency (MHz) | Chain 0 PPSD (dBm) | Chain 1 PPSD (dBm) | PPSD (dBm) | Limit (dBm) | Result |
|---------|-----------------|--------------------|--------------------|------------|-------------|--------|
| Mid     | 5775            | 1.59               | 3.72               | 7.50       | 29.71       | PASS   |

#### Remark:

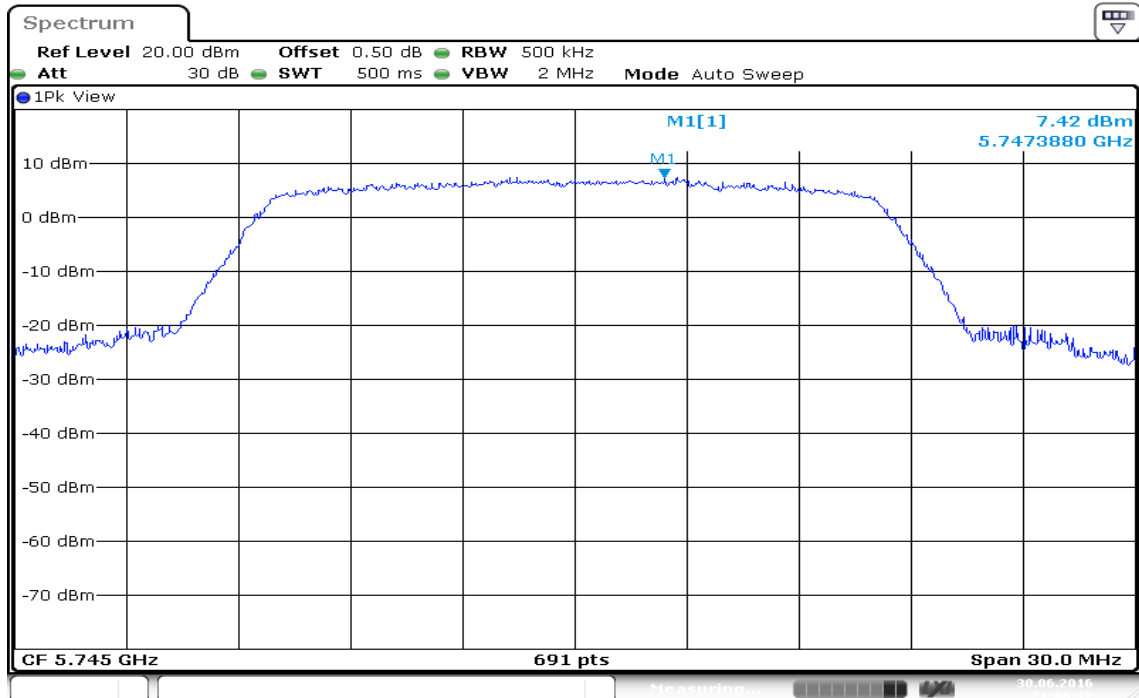
1. Total PPSD (dBm) =  $10 \cdot \text{LOG}(10^{\text{Chain 0 PPSD} / 10} + 10^{\text{Chain 1 PPSD} / 10})$
2. The maximum antenna gain is 6.29dBi; therefore the reduction due to antenna gain is 0.29dBi, so the limit is 29.71dBm.



## Test Plot

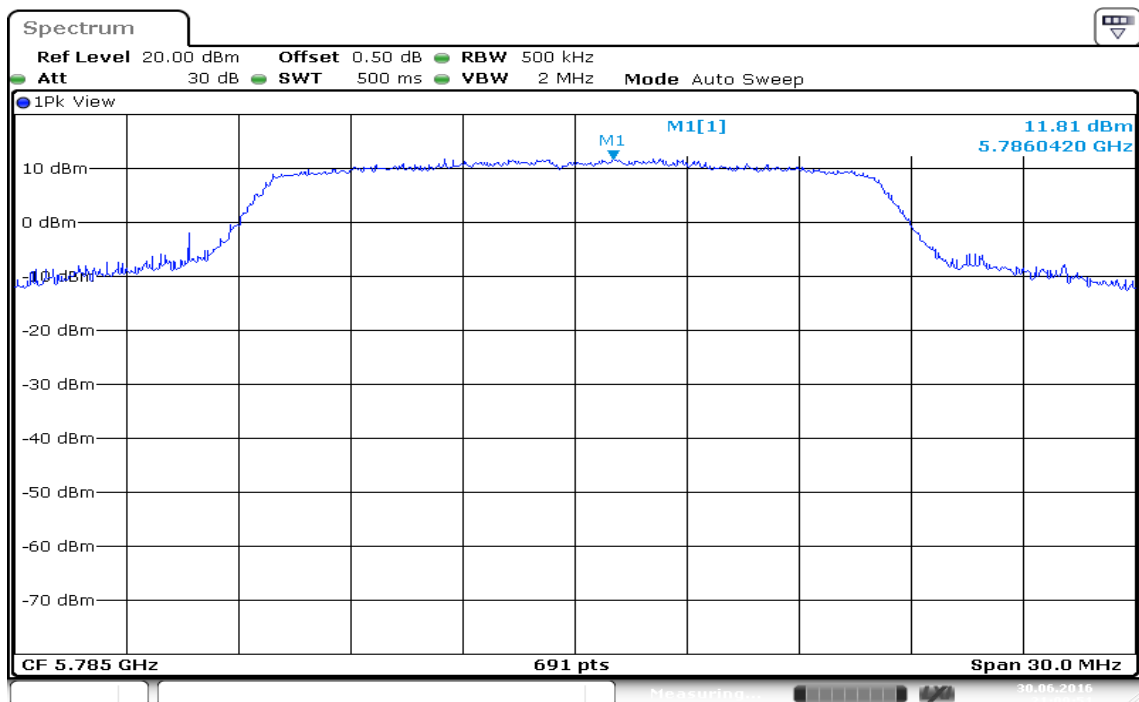
### IEEE 802.11a MHz mode / 5745 ~ 5825MHz / Chain 0

### PPSD (CH Low)



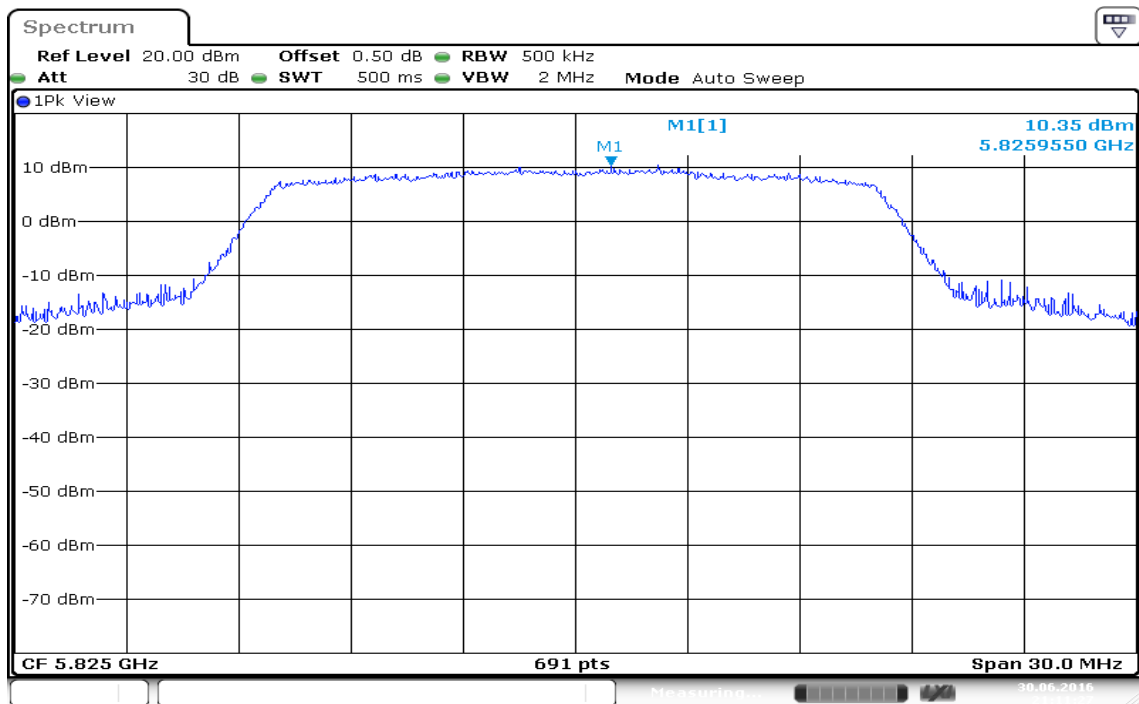
Date: 30 JUN 2016 21:06:12

### PPSD (CH Mid)



Date: 30 JUN 2016 21:09:51

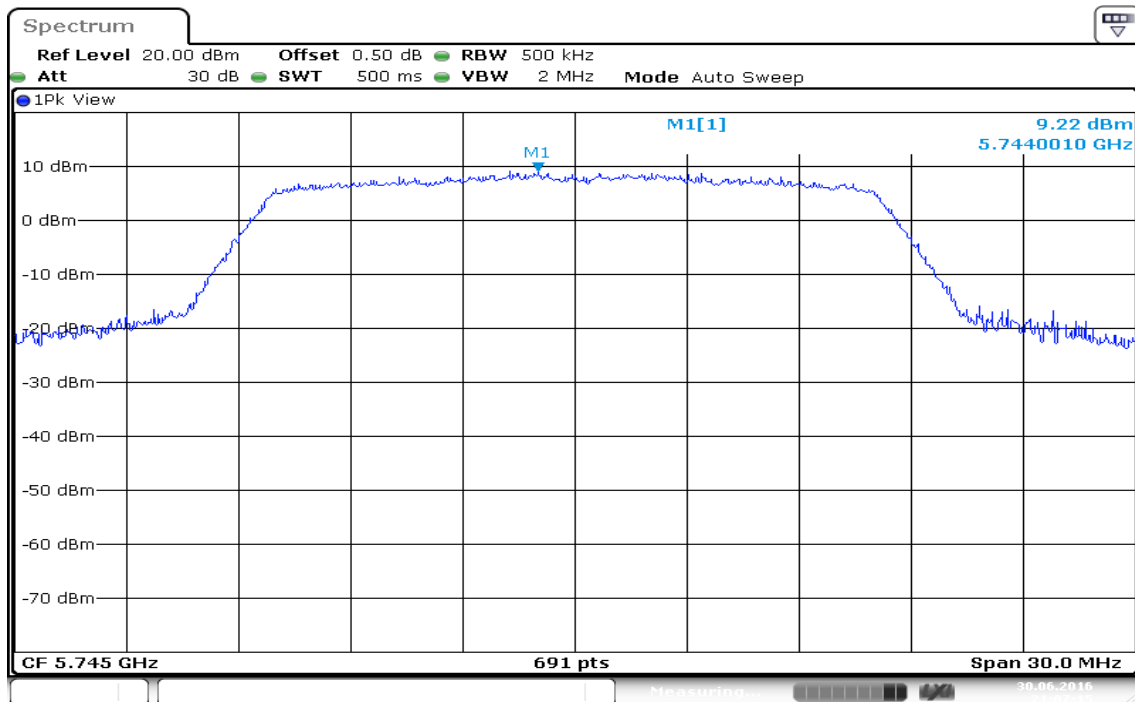
## PPSD (CH High)



Date: 30 JUN 2016 21:11:28

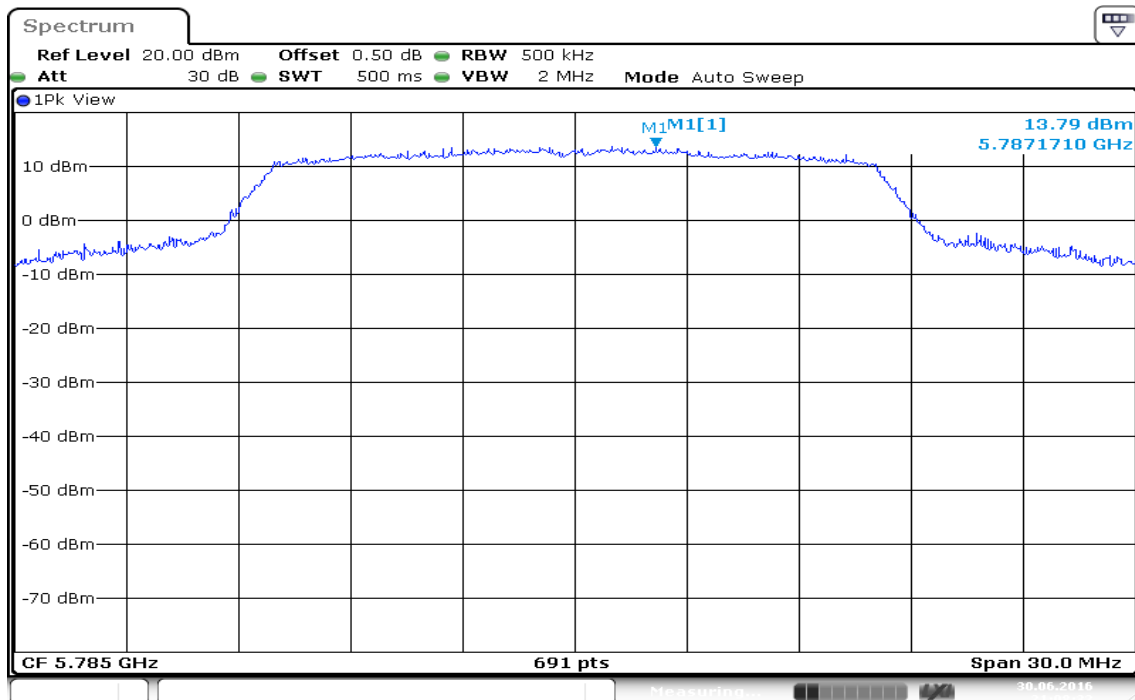
## IEEE 802.11a MHz mode / 5745 ~ 5825MHz / Chain 1

### PPSD (CH Low)



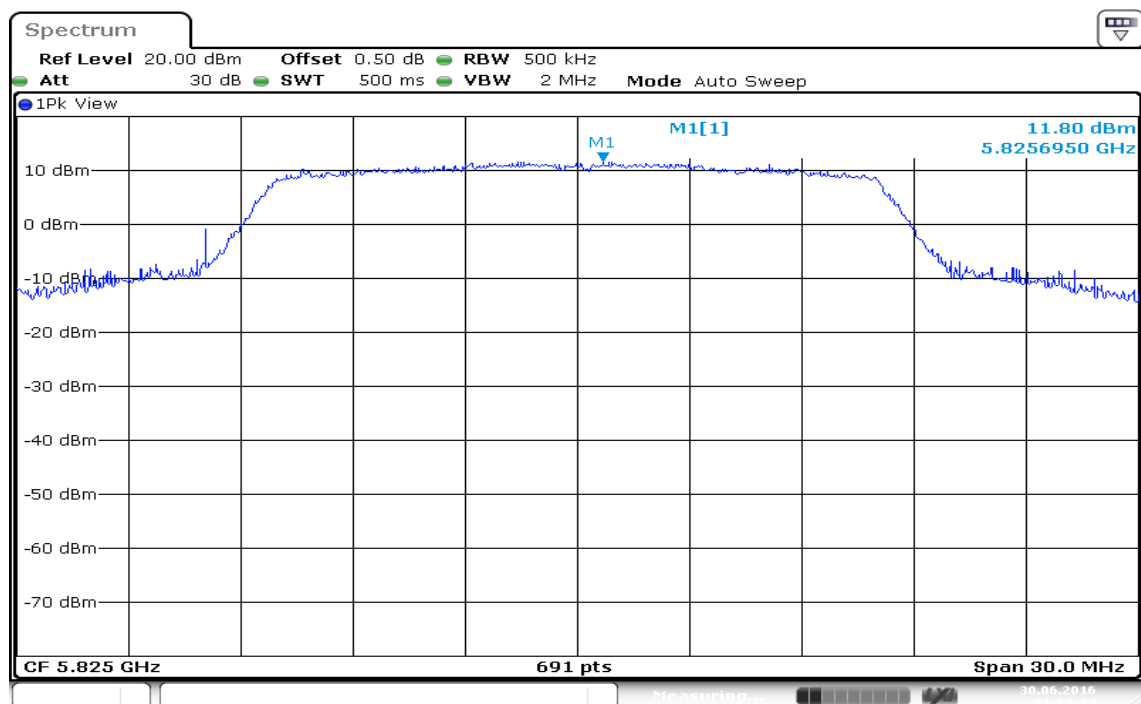
Date: 30 JUN 2016 21:07:15

### PPSD (CH Mid)



Date: 30 JUN 2016 21:08:32

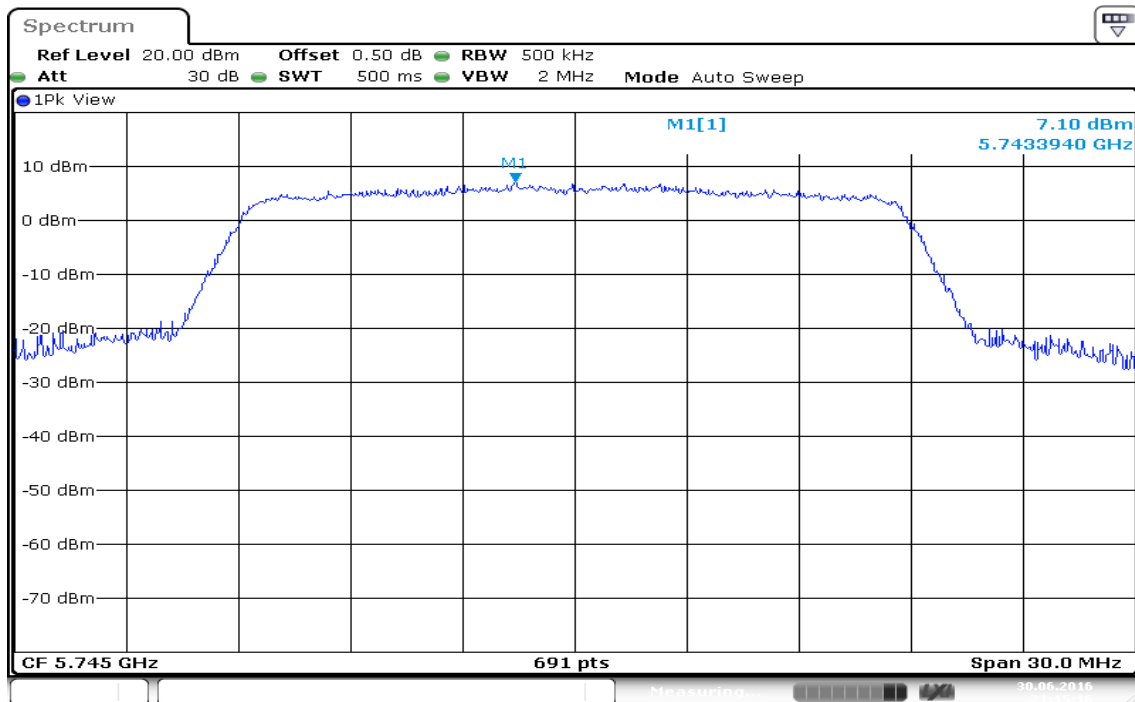
## PPSD (CH High)



Date: 30 JUN 2016 21:12:35

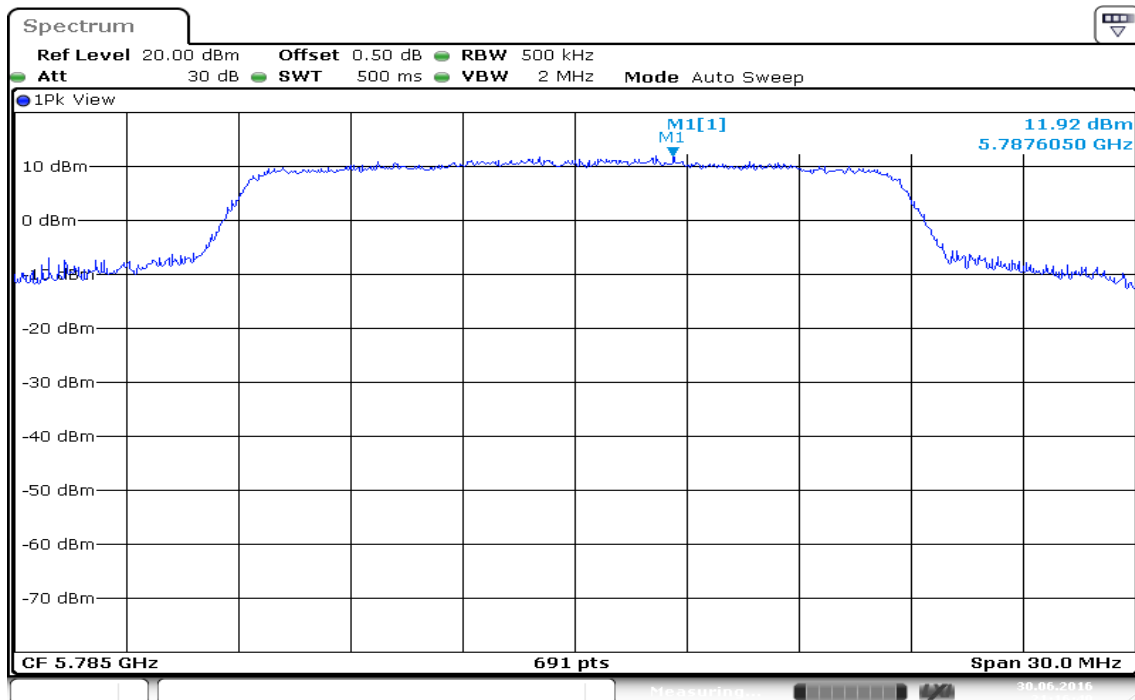
## IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 0

### PPSD (CH Low)



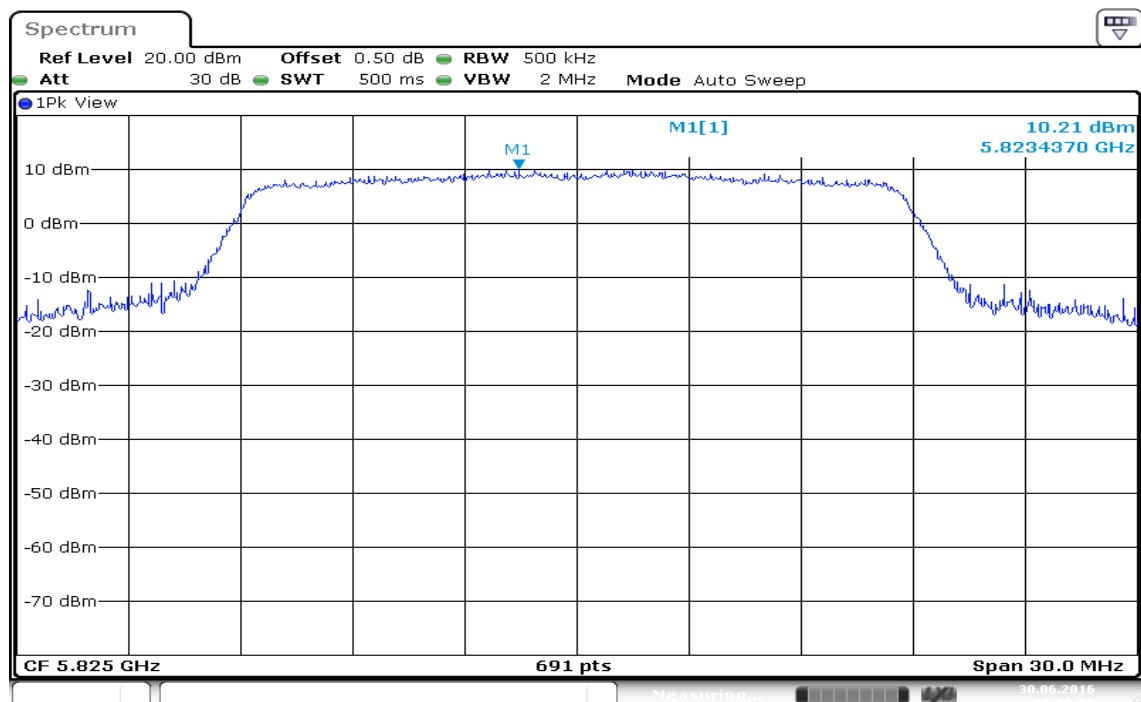
Date: 30 JUN 2016 21:15:17

### PPSD (CH Mid)



Date: 30 JUN 2016 21:16:40

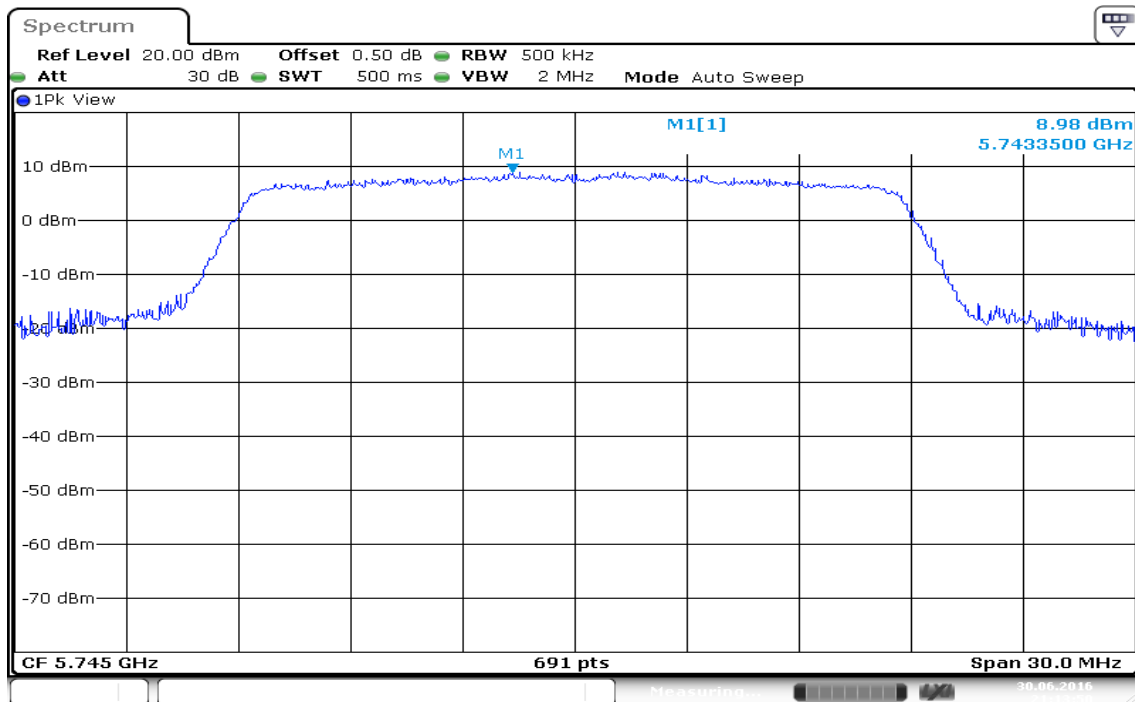
## PPSD (CH High)



Date: 30 JUN 2016 21:20:00

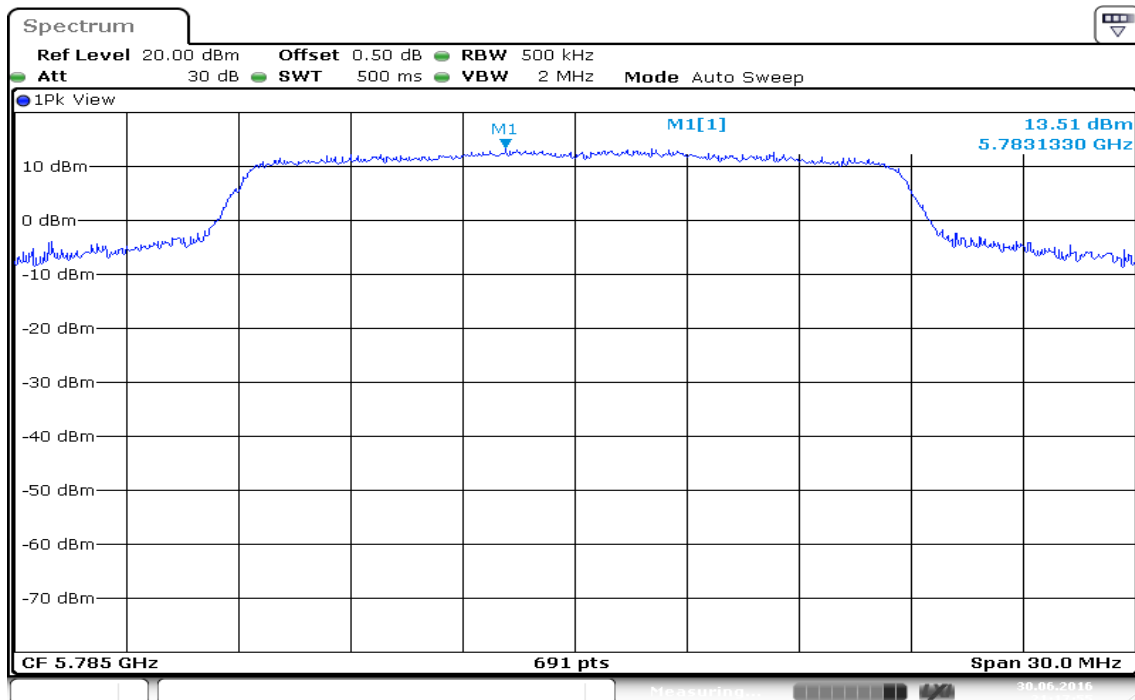
## IEEE 802.11n HT 20 MHz mode / 5745 ~ 5825MHz / Chain 1

### PPSD (CH Low)



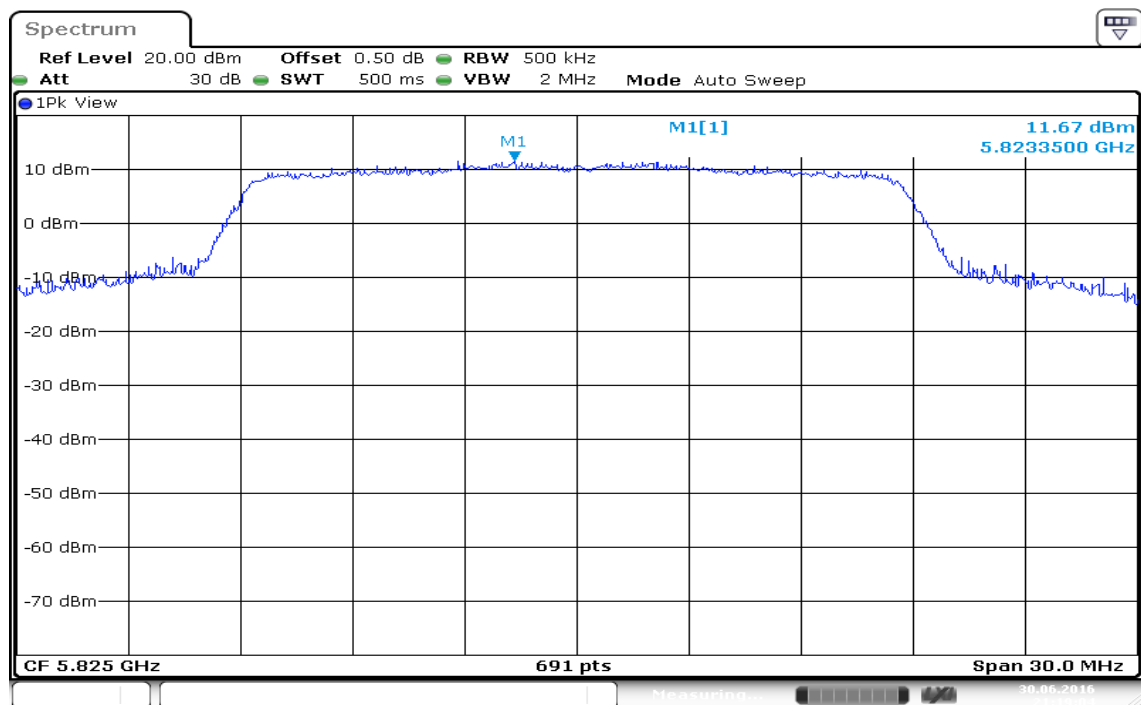
Date: 30 JUN 2016 21:13:51

### PPSD (CH Mid)



Date: 30 JUN 2016 21:17:54

## PPSD (CH High)

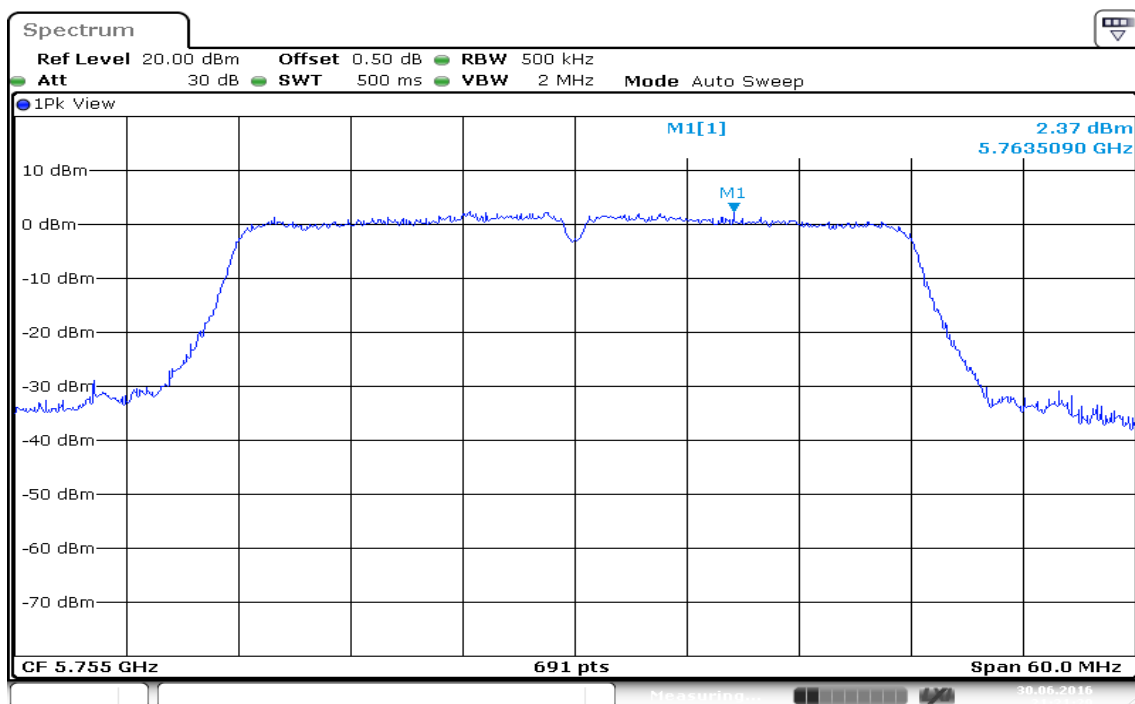


Date: 30 JUN 2016 21:19:04



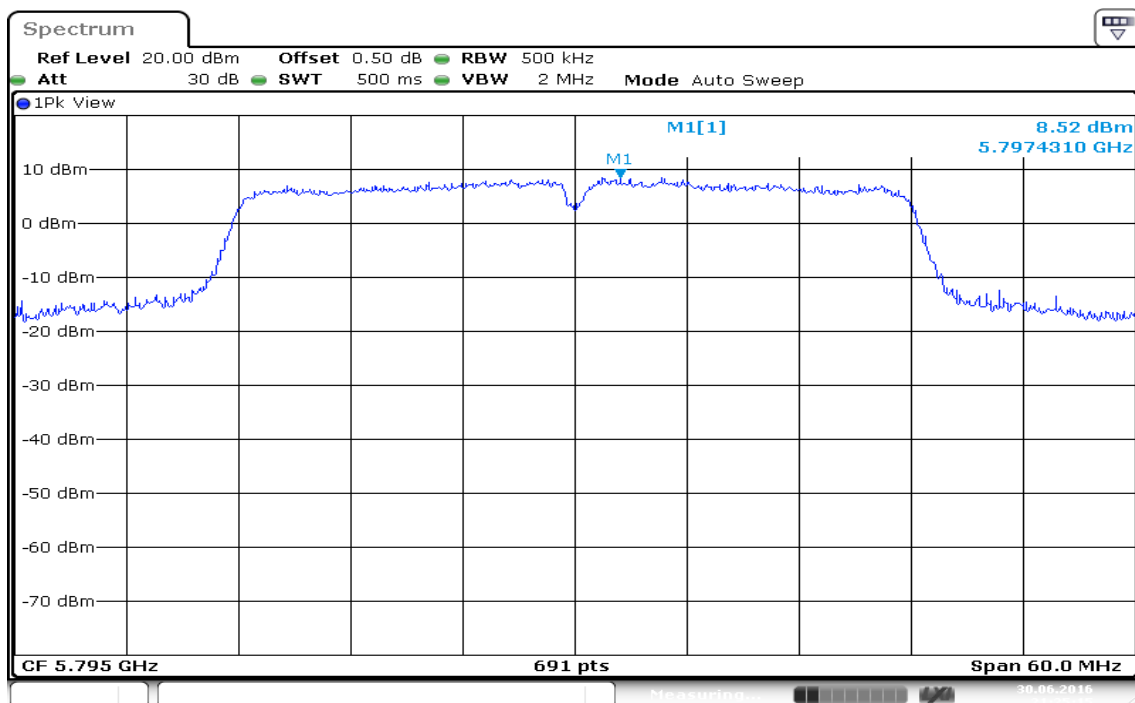
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 0

### PPSD (CH Low)



Date: 30 JUN 2016 21:21:29

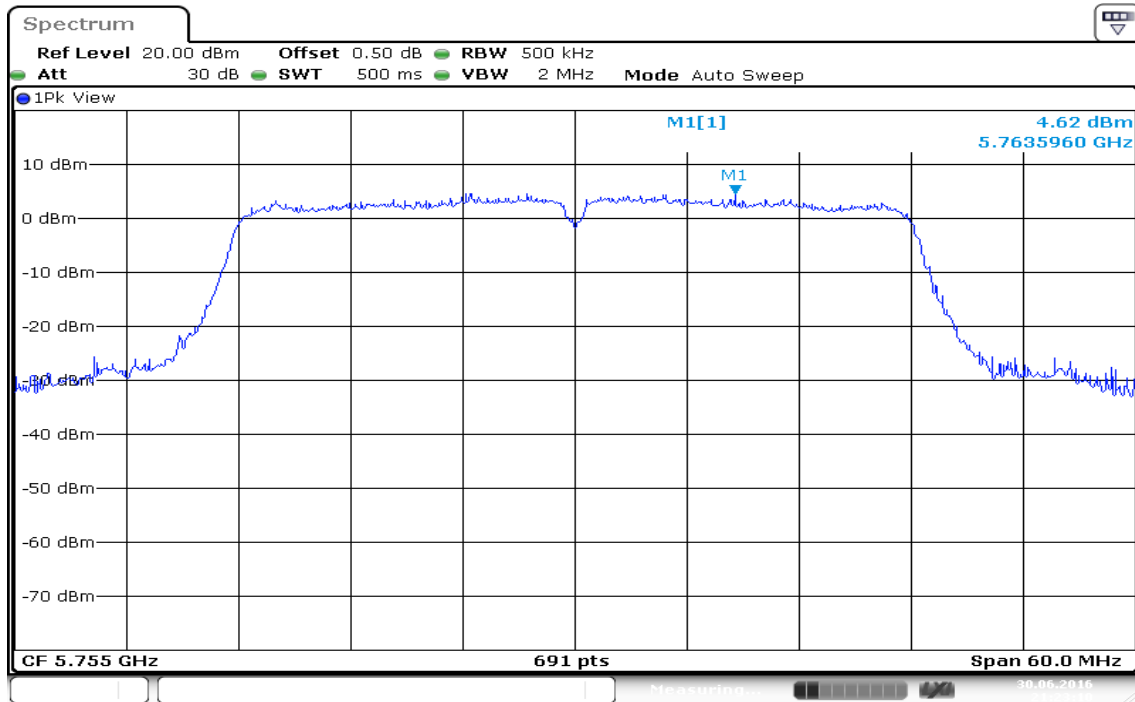
### PPSD (CH High)



Date: 30 JUN 2016 21:25:15

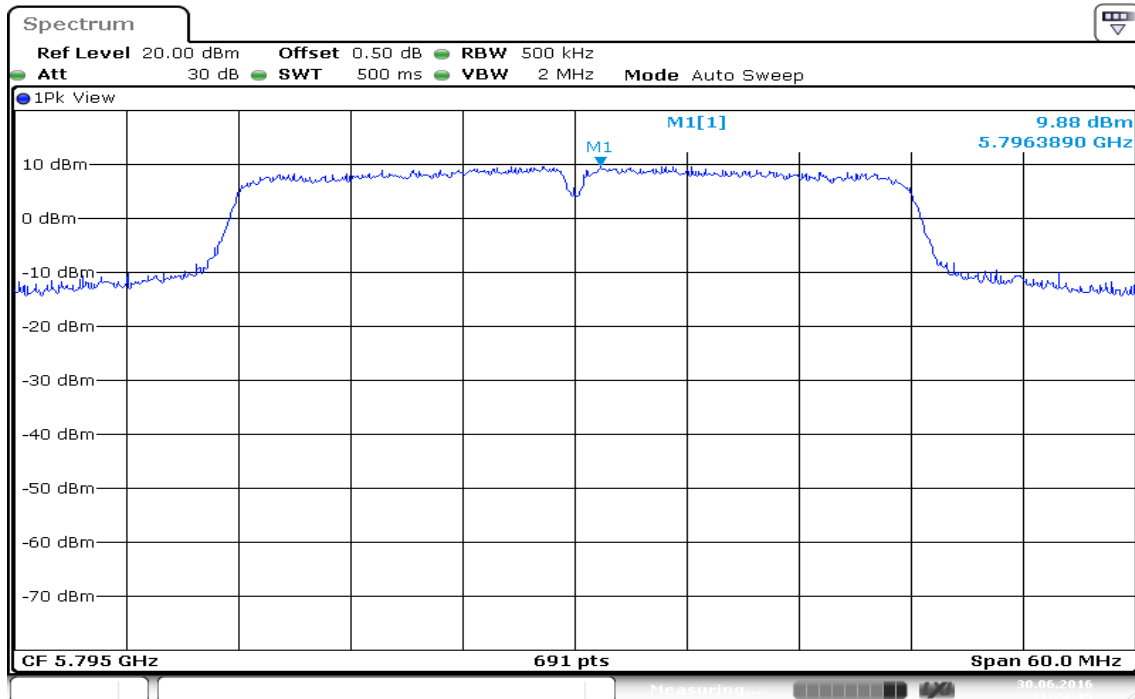
## IEEE 802.11n HT 40 MHz mode / 5755 ~ 5795MHz / Chain 1

### PPSD (CH Low)



Date: 30 JUN 2016 21:23:11

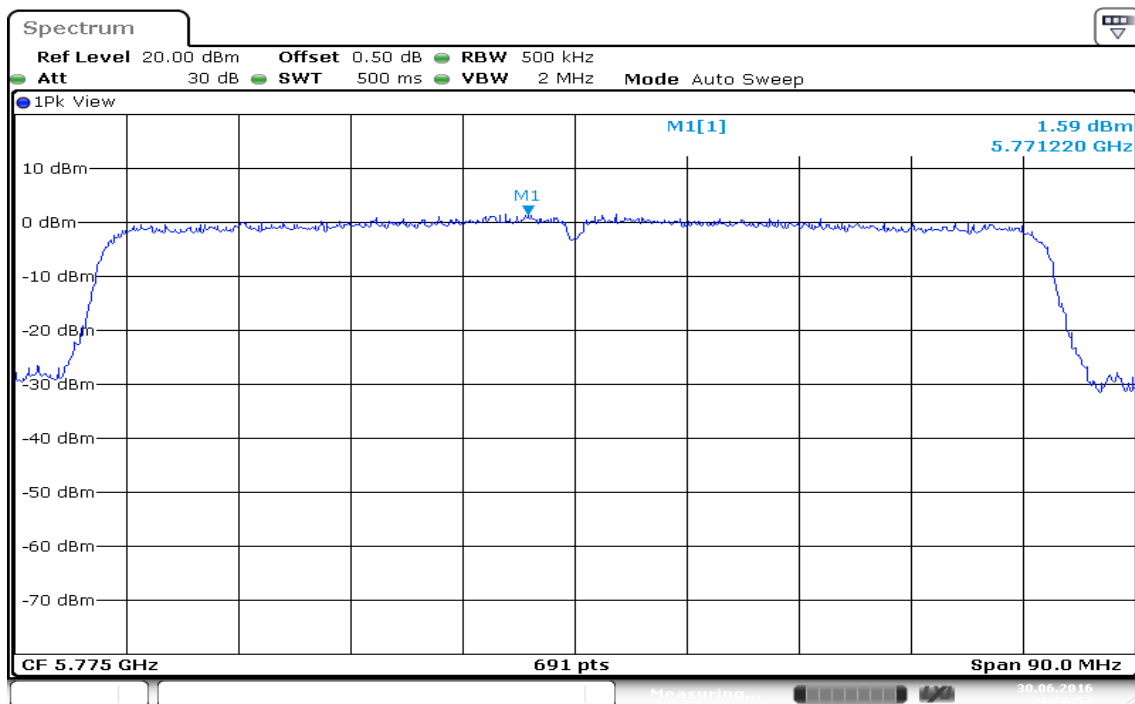
### PPSD (CH High)



Date: 30 JUN 2016 21:24:15

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

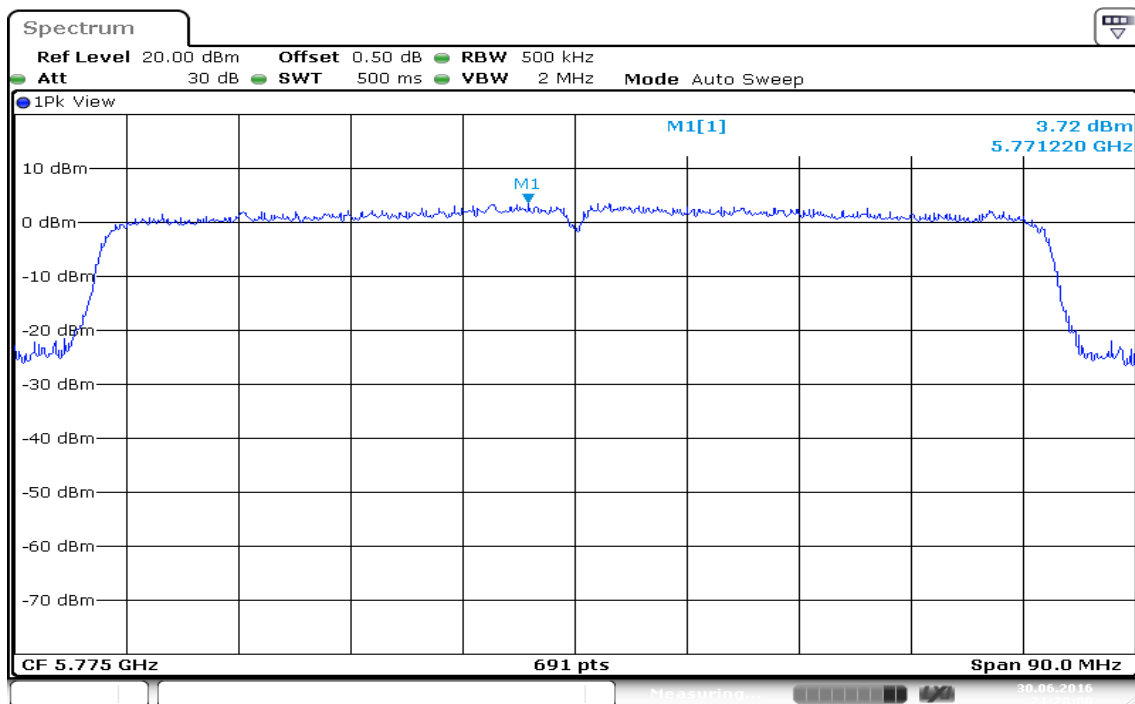
## PPSD (CH Mid)



Date: 30 JUN 2016 21:26:53

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

## PPSD (CH Mid)



Date: 30 JUN 2016 21:28:01

## 7.6 RADIATED EMISSIONS

### LIMIT

1. According to §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 (μV/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                        |

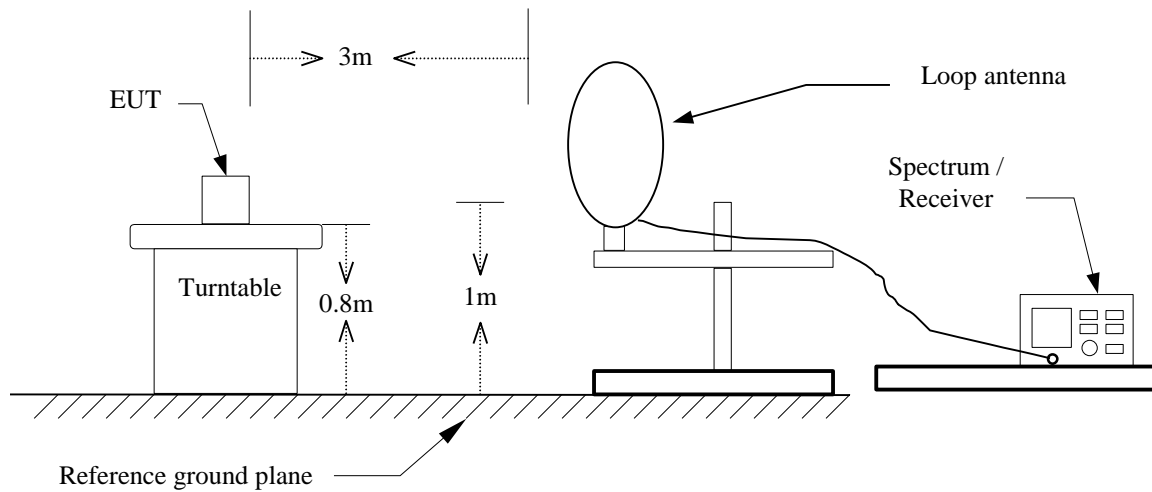
**Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the emission table above, the tighter limit applies at the band edges.

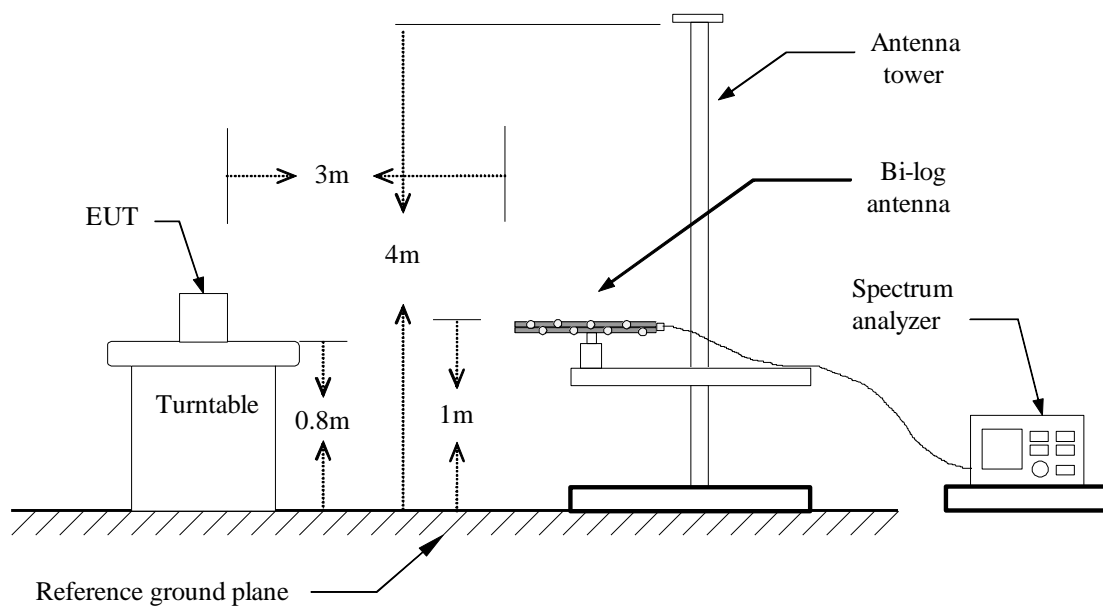
| Frequency (MHz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|-----------------|----------------------------------|------------------------------------|
| 0.009 - 0.490   | 2400/F(kHz) +80                  | 20LOG((2400/F(kHz))+80)            |
| 0.490 - 1.705   | 24000/F(kHz) +40                 | 20LOG((24000/F(kHz))+40)           |
| 1.705 – 30.0    | 30                               | 69.54                              |
| 30-88           | 100                              | 40                                 |
| 88-216          | 150                              | 43.5                               |
| 216-960         | 200                              | 46                                 |
| Above 960       | 500                              | 54                                 |

## Test Configuration

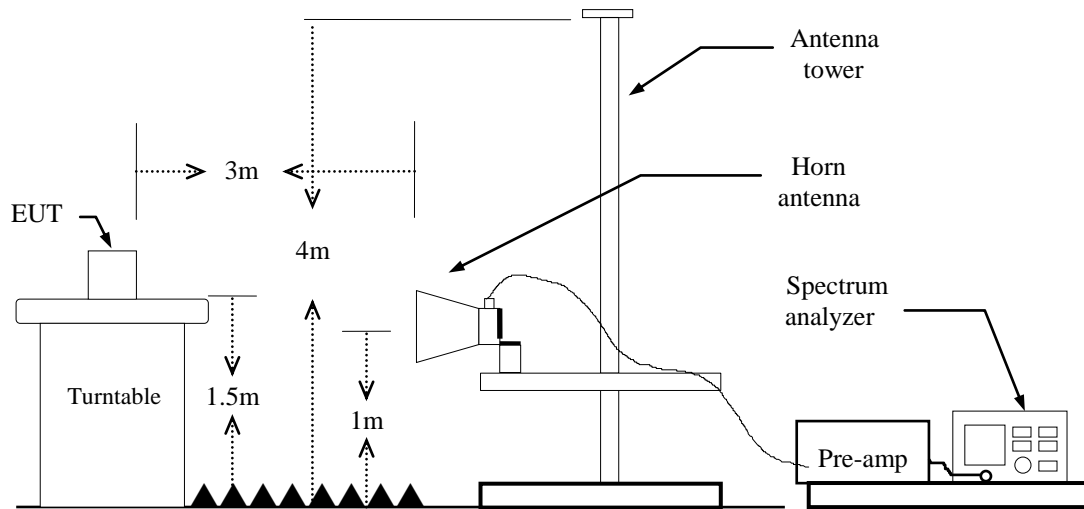
### 9kHz ~ 30MHz



### 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=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:** =94%, VBW=680Hz

**IEEE 802.11n HT 20 MHz mode:** =89%, VBW=750Hz

**IEEE 802.11n HT 40 MHz mode:** =81%, VBW=1.5kHz

**IEEE 802.11ac VHT 80 MHz mode:** =68%, VBW=3kHz

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 1 GHz

**Operation Mode:** Normal Link

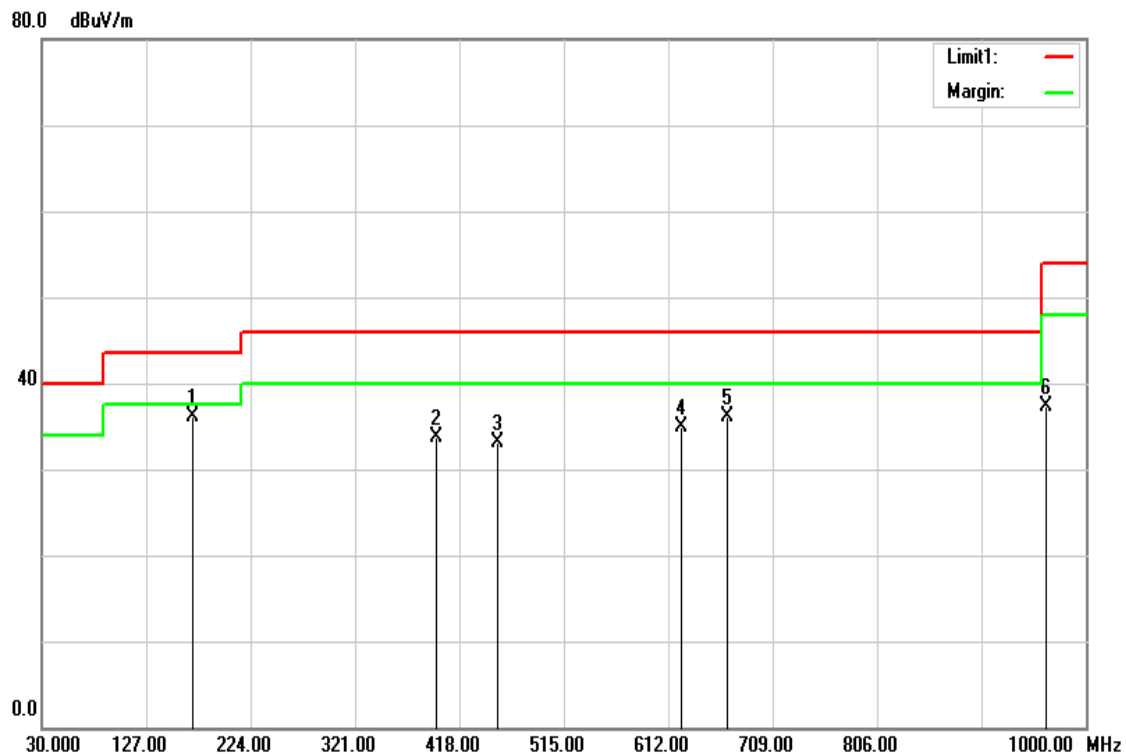
**Test Date:** September 10, 2016

**Temperature:** 27°C

**Tested by:** Dennis Li

**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) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|----------------|
| 169.6800        | 52.91          | -16.83                   | 36.08           | 43.50          | -7.42       | peak   | V              |
| 396.6600        | 45.46          | -11.78                   | 33.68           | 46.00          | -12.32      | peak   | V              |
| 452.9200        | 43.27          | -10.13                   | 33.14           | 46.00          | -12.86      | peak   | V              |
| 623.6400        | 42.14          | -7.20                    | 34.94           | 46.00          | -11.06      | peak   | V              |
| 666.3200        | 42.50          | -6.41                    | 36.09           | 46.00          | -9.91       | peak   | V              |
| 963.1400        | 39.56          | -2.18                    | 37.38           | 54.00          | -16.62      | peak   | V              |

### Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
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. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).



**Operation Mode:** Normal Link

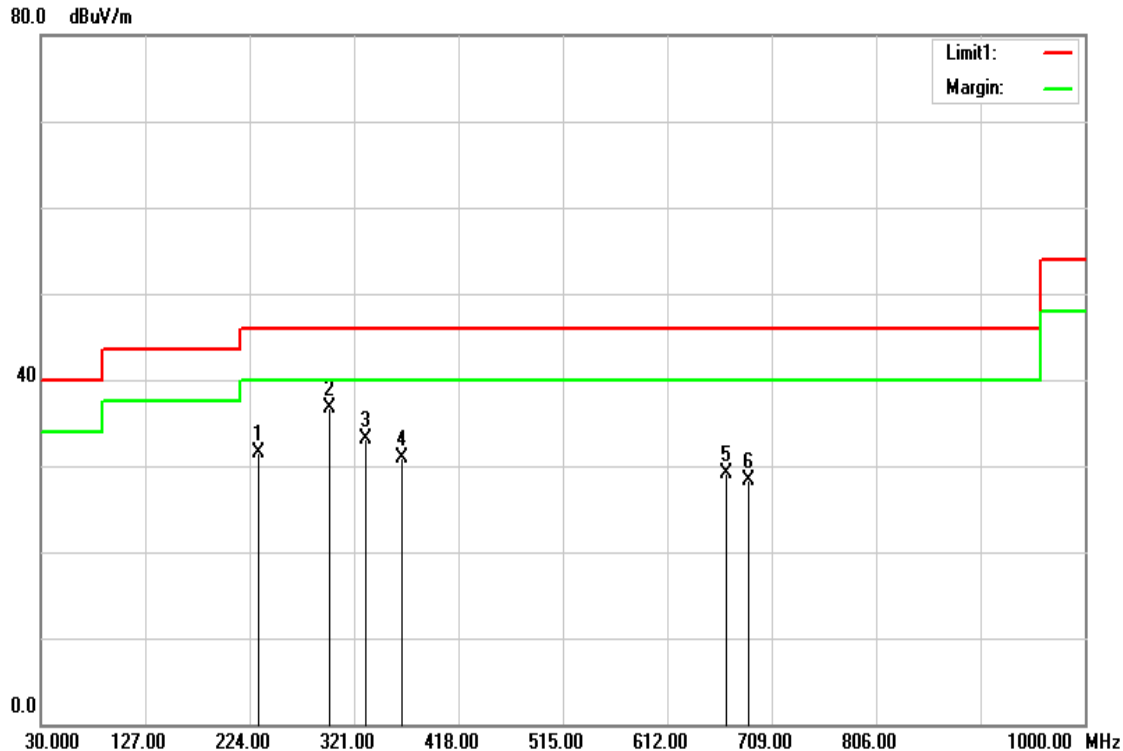
**Test Date:** September 10, 2016

**Temperature:** 27°C

**Tested by:** Dennis Li

**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) |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------|----------------|
| 232.7300        | 48.26          | -16.67                   | 31.59           | 46.00          | -14.41      | peak   | H              |
| 298.6900        | 50.87          | -14.26                   | 36.61           | 46.00          | -9.39       | peak   | H              |
| 331.6700        | 46.44          | -13.38                   | 33.06           | 46.00          | -12.94      | peak   | H              |
| 365.6200        | 43.39          | -12.52                   | 30.87           | 46.00          | -15.13      | peak   | H              |
| 666.3200        | 35.46          | -6.41                    | 29.05           | 46.00          | -16.95      | peak   | H              |
| 687.6600        | 34.47          | -6.19                    | 28.28           | 46.00          | -17.72      | peak   | H              |

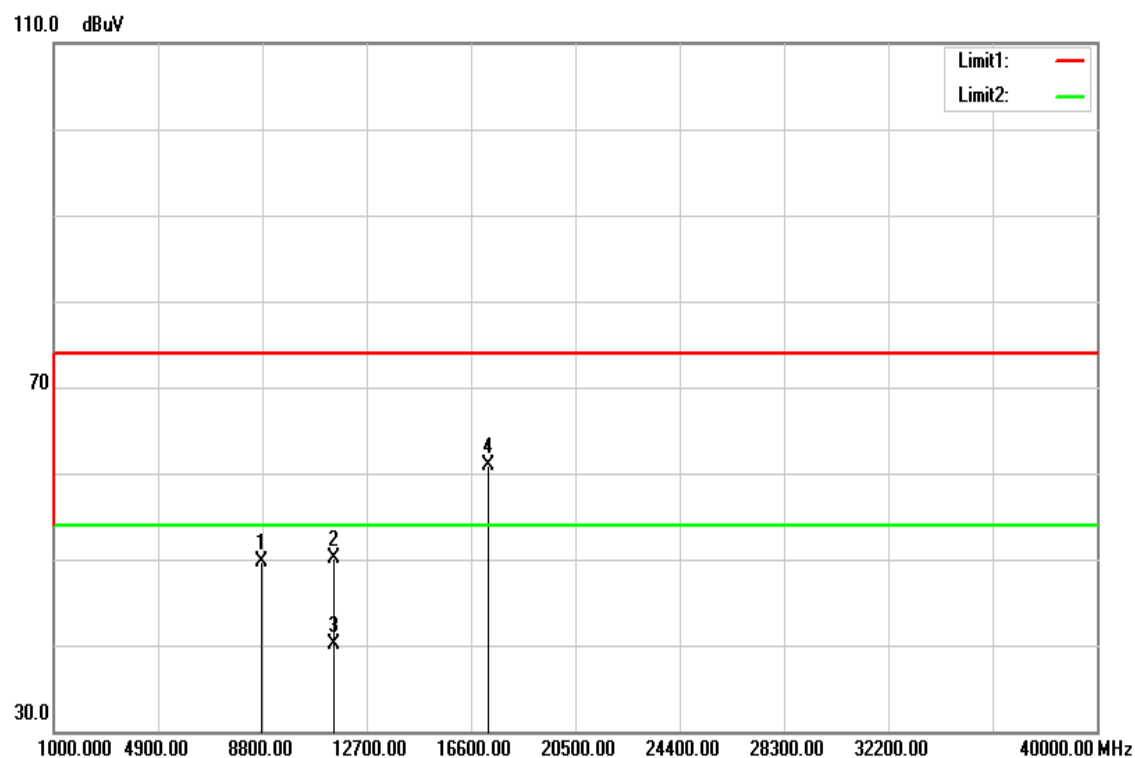
**Remark:**

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
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. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

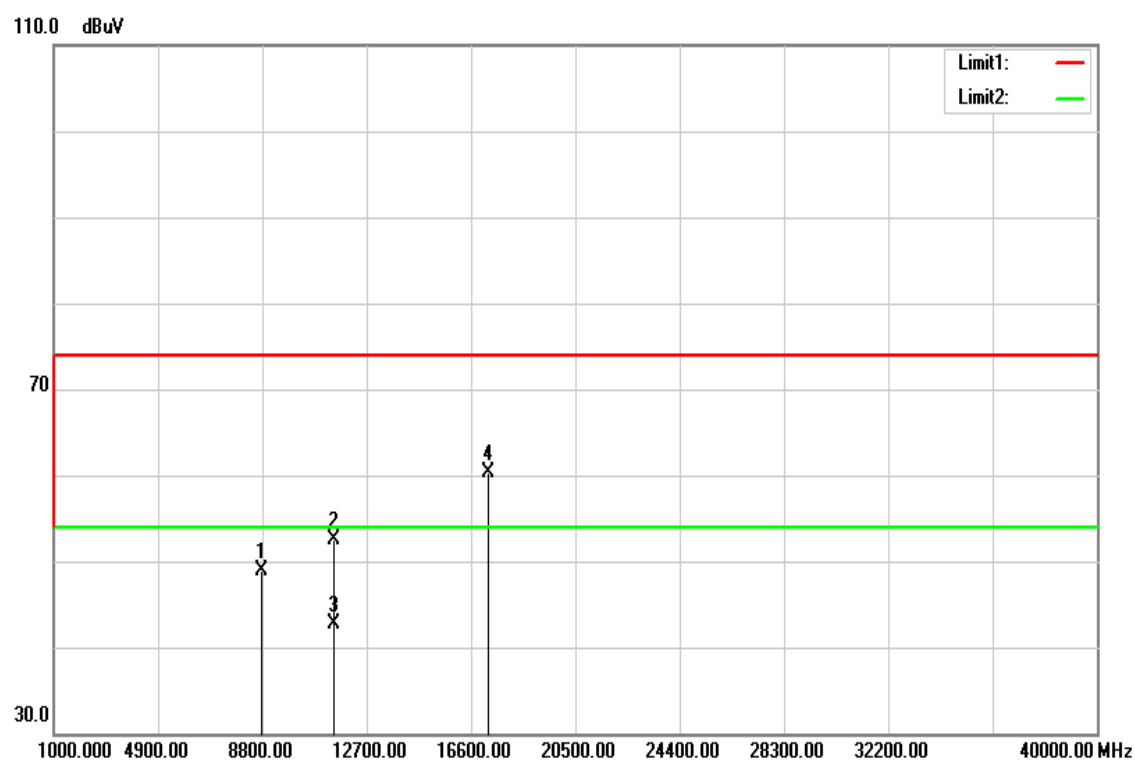
# Above 1 GHz

## TX / IEEE 802.11a mode / CH Low

**Polarity: Vertical**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11a mode / CH Low **Test Date:** June 22, 2016  
**Temperature:** 27°C **Tested by:** Dennis Li  
**Humidity:** 53% RH **Polarity:** Ver. / Hor.

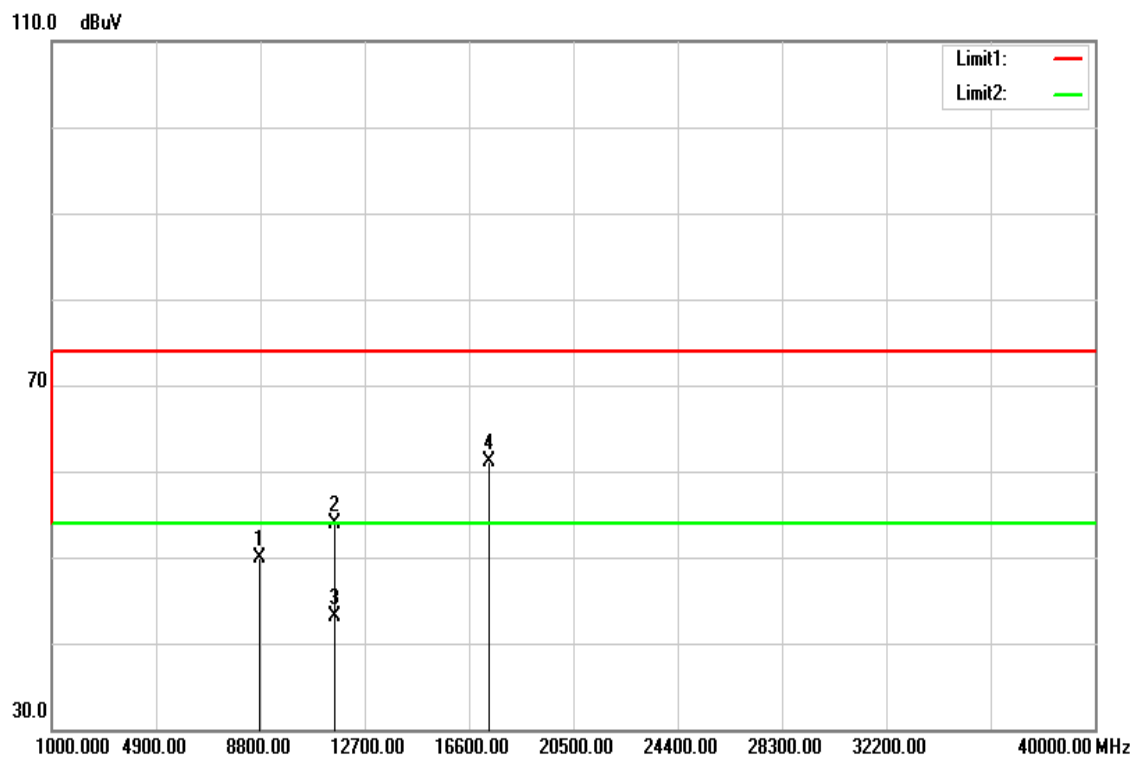
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8754.000        | 35.96          | 13.76             | 49.72           | 74.00          | -24.28      | peak   | V              |
| 11490.000       | 33.26          | 16.78             | 50.04           | 74.00          | -23.96      | peak   | V              |
| 11490.000       | 23.34          | 16.78             | 40.12           | 54.00          | -13.88      | AVG    | V              |
| 17235.000       | 35.61          | 25.28             | 60.89           | 74.00          | -13.11      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8754.000        | 35.13          | 13.76             | 48.89           | 74.00          | -25.11      | peak   | H              |
| 11490.000       | 35.80          | 16.78             | 52.58           | 74.00          | -21.42      | peak   | H              |
| 11490.000       | 25.91          | 16.78             | 42.69           | 54.00          | -11.31      | AVG    | H              |
| 17235.000       | 35.00          | 25.28             | 60.28           | 74.00          | -13.72      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

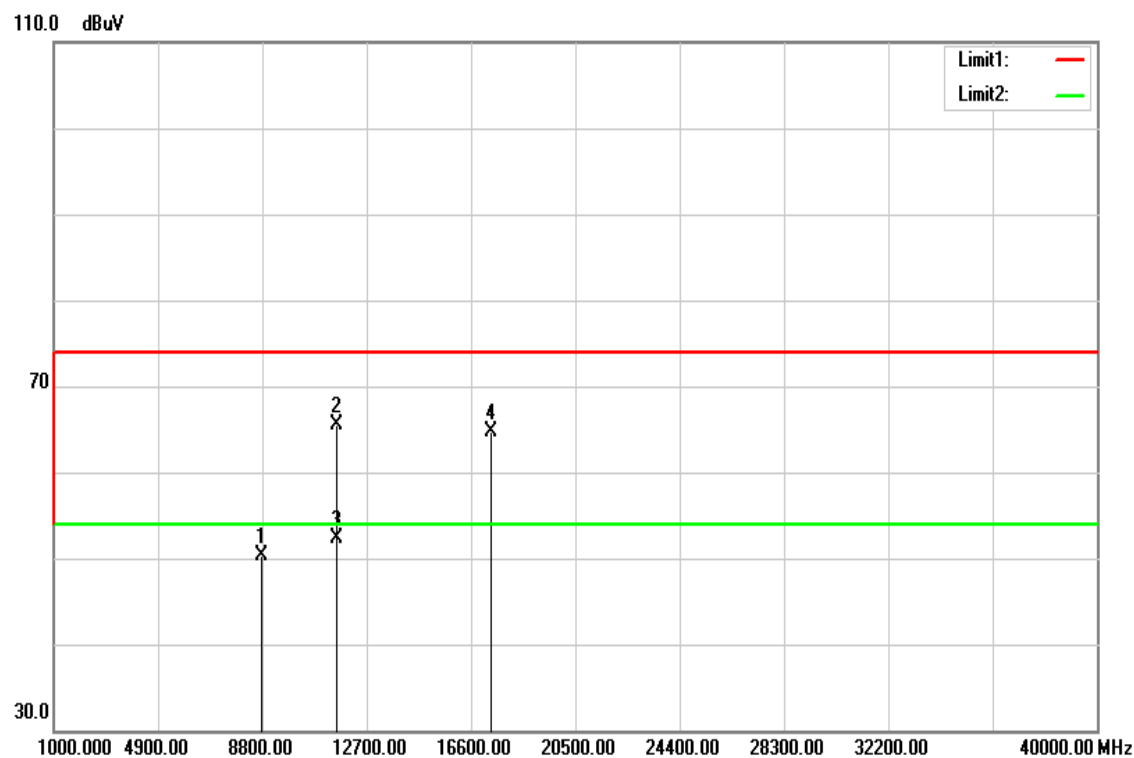
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11a mode / CH Mid **Test Date:** June 22, 2016  
**Temperature:** 27°C **Tested by:** Dennis Li  
**Humidity:** 53% RH **Polarity:** Ver. / Hor.

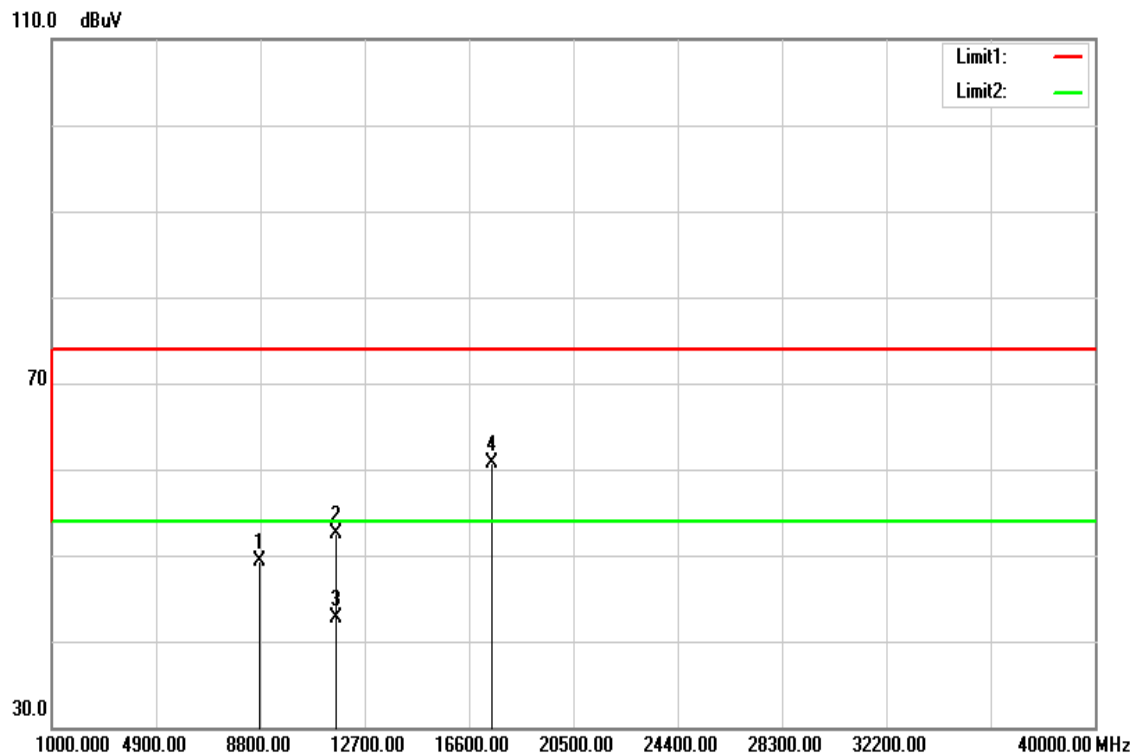
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8798.000        | 36.09          | 13.78             | 49.87           | 74.00          | -24.13      | peak   | V              |
| 11570.000       | 37.03          | 16.84             | 53.87           | 74.00          | -20.13      | peak   | V              |
| 11570.000       | 26.28          | 16.84             | 43.12           | 54.00          | -10.88      | AVG    | V              |
| 17355.000       | 35.29          | 25.75             | 61.04           | 74.00          | -12.96      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8762.000        | 36.45          | 13.76             | 50.21           | 74.00          | -23.79      | peak   | H              |
| 11570.000       | 48.67          | 16.84             | 65.51           | 74.00          | -8.49       | peak   | H              |
| 11570.000       | 35.55          | 16.84             | 52.39           | 54.00          | -1.61       | AVG    | H              |
| 17355.000       | 39.02          | 25.75             | 64.77           | 74.00          | -9.23       | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

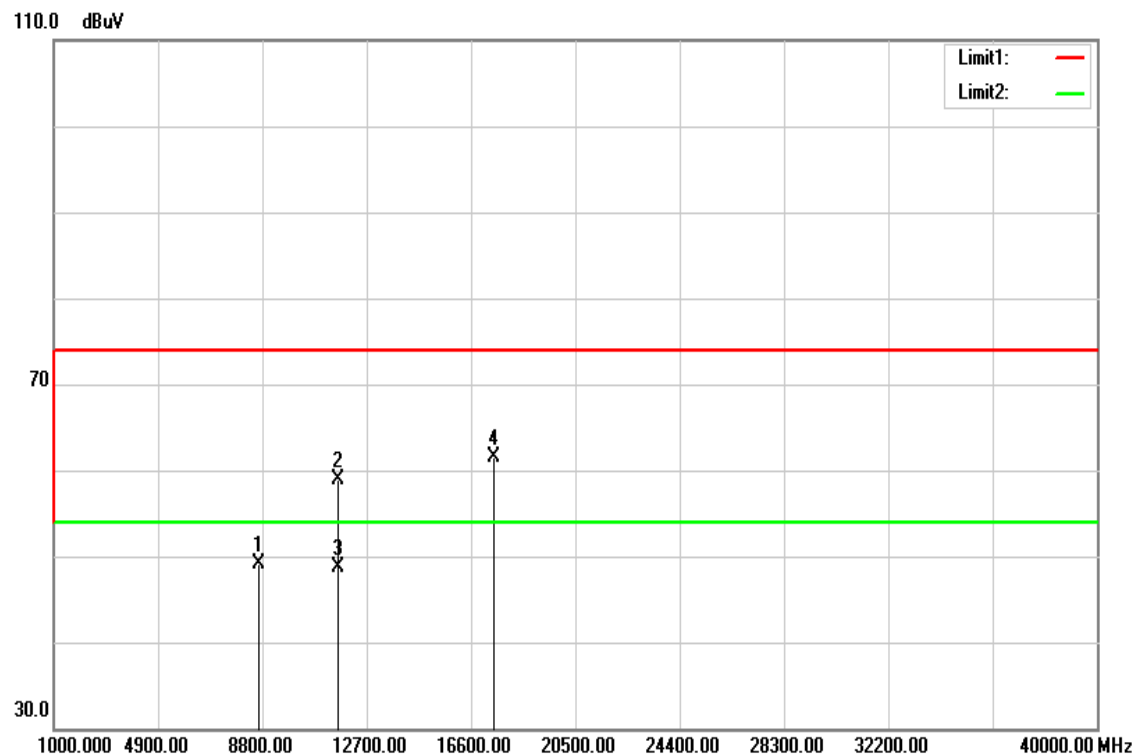
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11a mode / CH High **Test Date:** June 22, 2016  
**Temperature:** 27°C **Tested by:** Dennis Li  
**Humidity:** 53% RH **Polarity:** Ver. / Hor.

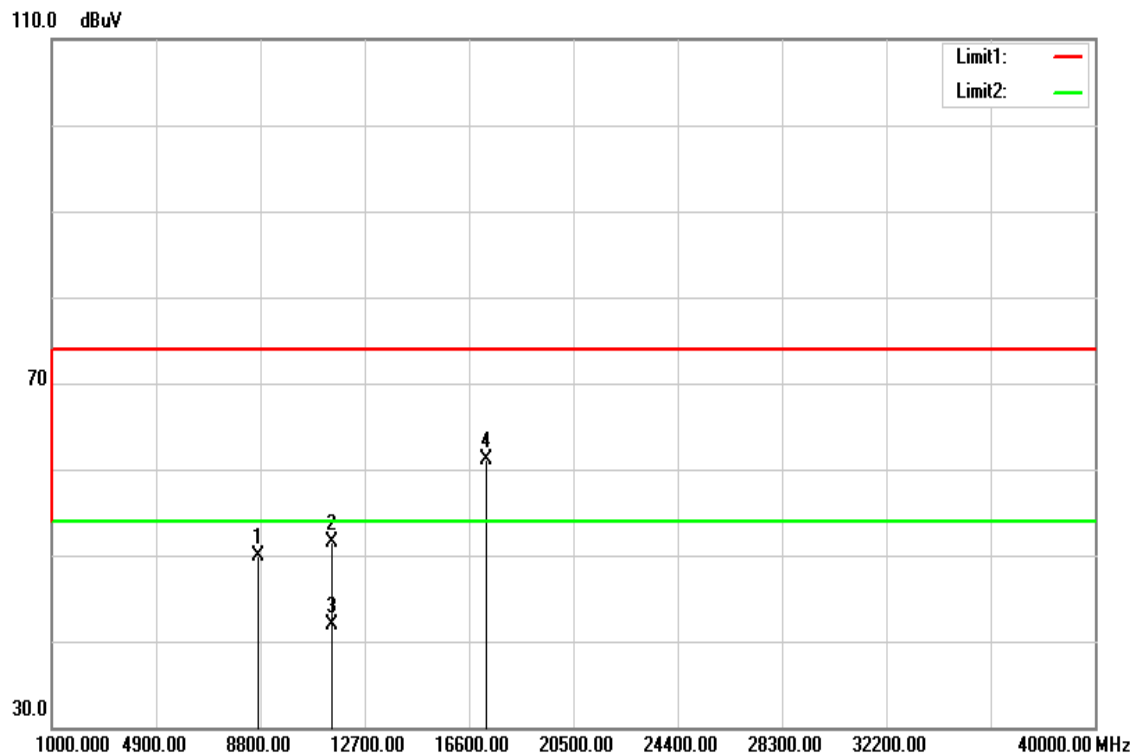
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8766.000        | 35.53          | 13.76             | 49.29           | 74.00          | -24.71      | peak   | V              |
| 11650.000       | 35.66          | 16.91             | 52.57           | 74.00          | -21.43      | peak   | V              |
| 11650.000       | 25.78          | 16.91             | 42.69           | 54.00          | -11.31      | AVG    | V              |
| 17475.000       | 34.55          | 26.22             | 60.77           | 74.00          | -13.23      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8692.000        | 35.28          | 13.73             | 49.01           | 74.00          | -24.99      | peak   | H              |
| 11650.000       | 42.00          | 16.91             | 58.91           | 74.00          | -15.09      | peak   | H              |
| 11650.000       | 31.89          | 16.91             | 48.80           | 54.00          | -5.20       | AVG    | H              |
| 17475.000       | 35.29          | 26.22             | 61.51           | 74.00          | -12.49      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

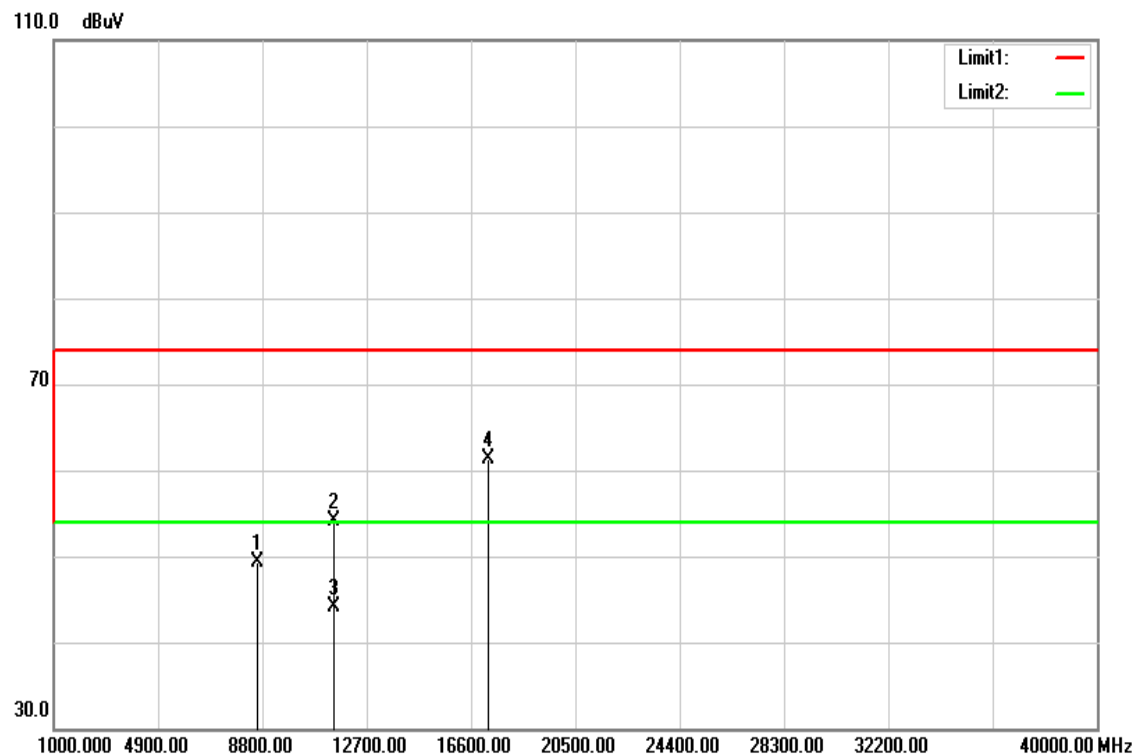
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
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 802.11n HT 20 MHz mode / CH Low**

**Polarity: Vertical**



**Polarity: Horizontal**





**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode /  
CH Low  
**Temperature:** 27°C  
**Humidity:** 53% RH

**Test Date:** June 22, 2016  
**Tested by:** Dennis Li  
**Polarity:** Ver. / Hor.

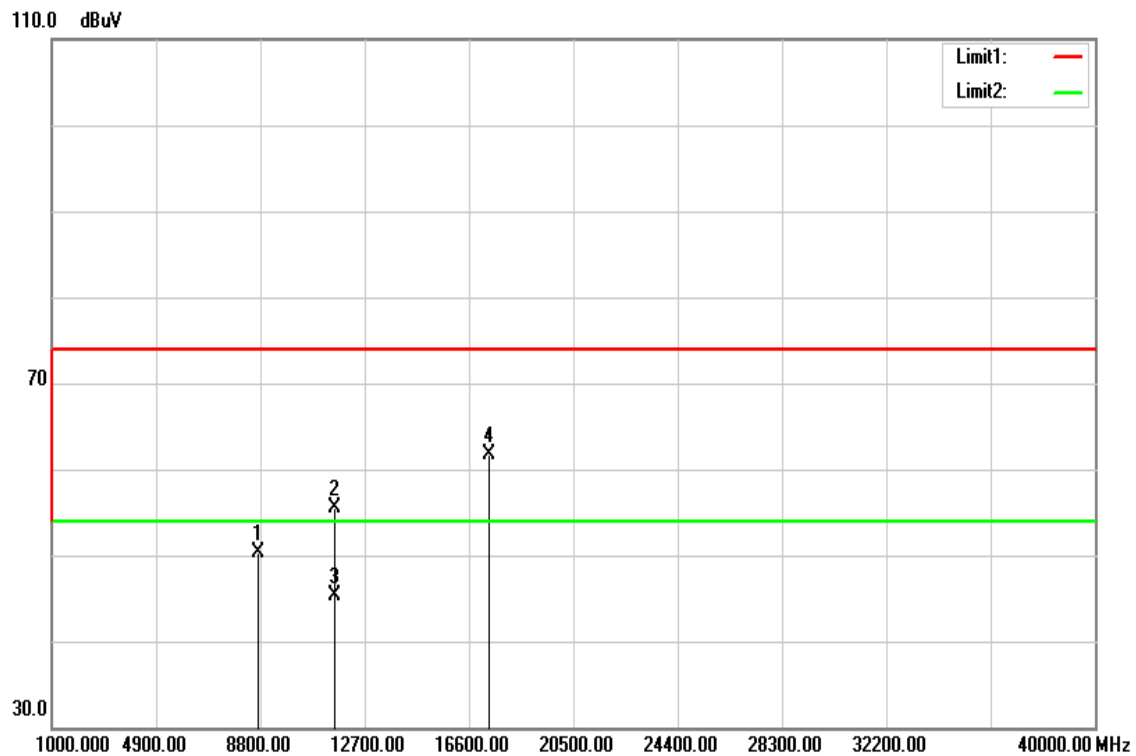
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8744.000        | 36.07          | 13.75             | 49.82           | 74.00          | -24.18      | peak   | V              |
| 11490.000       | 34.70          | 16.78             | 51.48           | 74.00          | -22.52      | peak   | V              |
| 11490.000       | 25.21          | 16.78             | 41.99           | 54.00          | -12.01      | AVG    | V              |
| 17235.000       | 35.77          | 25.28             | 61.05           | 74.00          | -12.95      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8631.000        | 35.60          | 13.70             | 49.30           | 74.00          | -24.70      | peak   | H              |
| 11490.000       | 37.28          | 16.78             | 54.06           | 74.00          | -19.94      | peak   | H              |
| 11490.000       | 27.37          | 16.78             | 44.15           | 54.00          | -9.85       | AVG    | H              |
| 17235.000       | 36.11          | 25.28             | 61.39           | 74.00          | -12.61      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

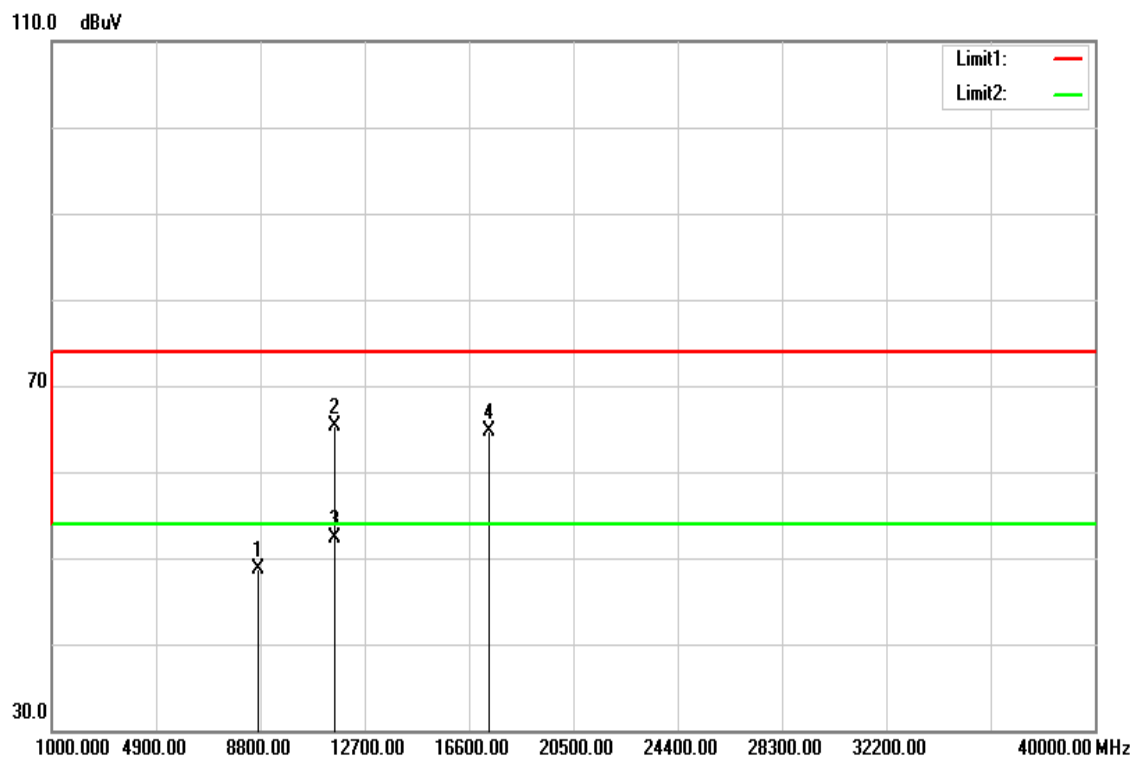
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / CH Mid  
**Temperature:** 27°C  
**Humidity:** 53% RH

**Test Date:** June 22, 2016  
**Tested by:** Dennis Li  
**Polarity:** Ver. / Hor.

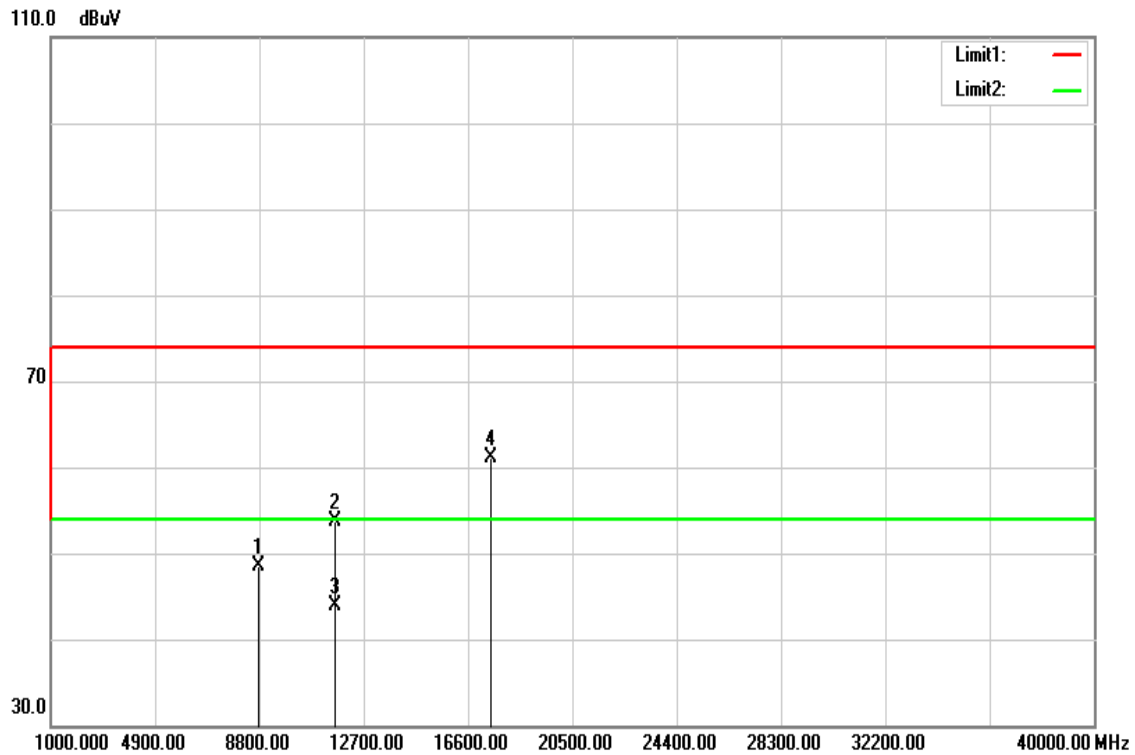
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8746.000        | 36.46          | 13.75             | 50.21           | 74.00          | -23.79      | peak   | V              |
| 11570.000       | 38.67          | 16.84             | 55.51           | 74.00          | -18.49      | peak   | V              |
| 11570.000       | 28.49          | 16.84             | 45.33           | 54.00          | -8.67       | AVG    | V              |
| 17355.000       | 35.98          | 25.75             | 61.73           | 74.00          | -12.27      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8744.000        | 34.88          | 13.75             | 48.63           | 74.00          | -25.37      | peak   | H              |
| 11570.000       | 48.55          | 16.84             | 65.39           | 74.00          | -8.61       | peak   | H              |
| 11570.000       | 35.51          | 16.84             | 52.35           | 54.00          | -1.65       | AVG    | H              |
| 17355.000       | 38.97          | 25.75             | 64.72           | 74.00          | -9.28       | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

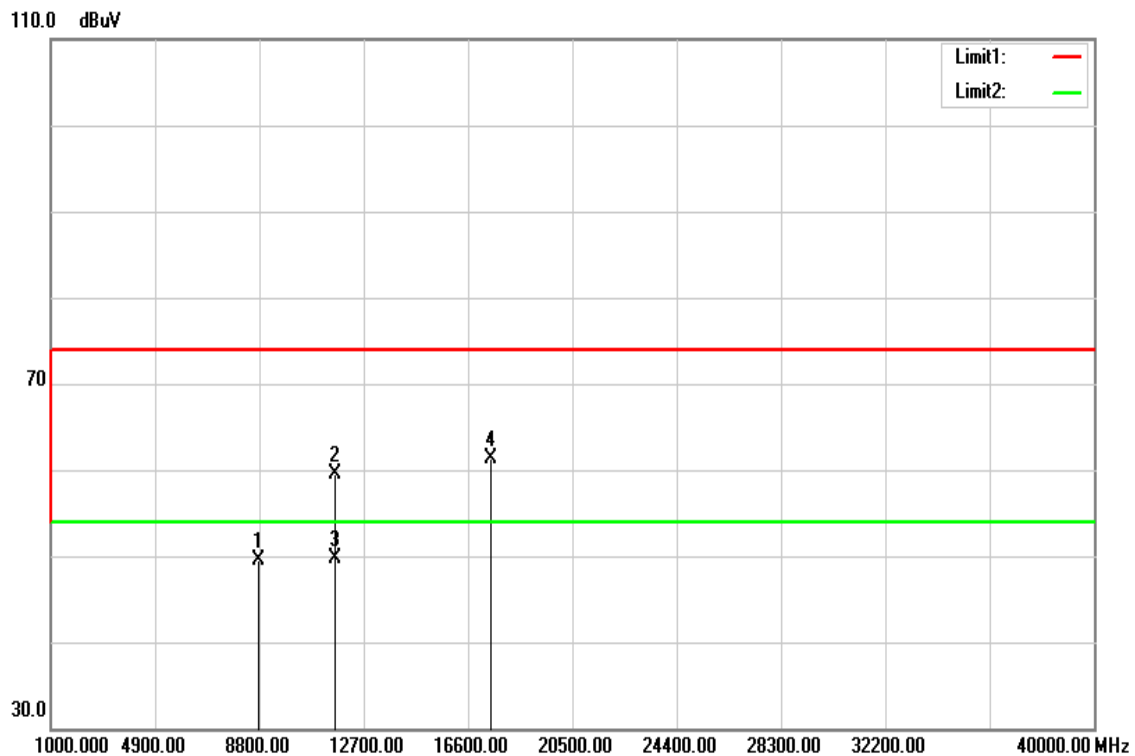
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11n HT 20 MHz mode / CH High  
**Temperature:** 27°C  
**Humidity:** 53% RH

**Test Date:** June 22, 2016  
**Tested by:** Dennis Li  
**Polarity:** Ver. / Hor.

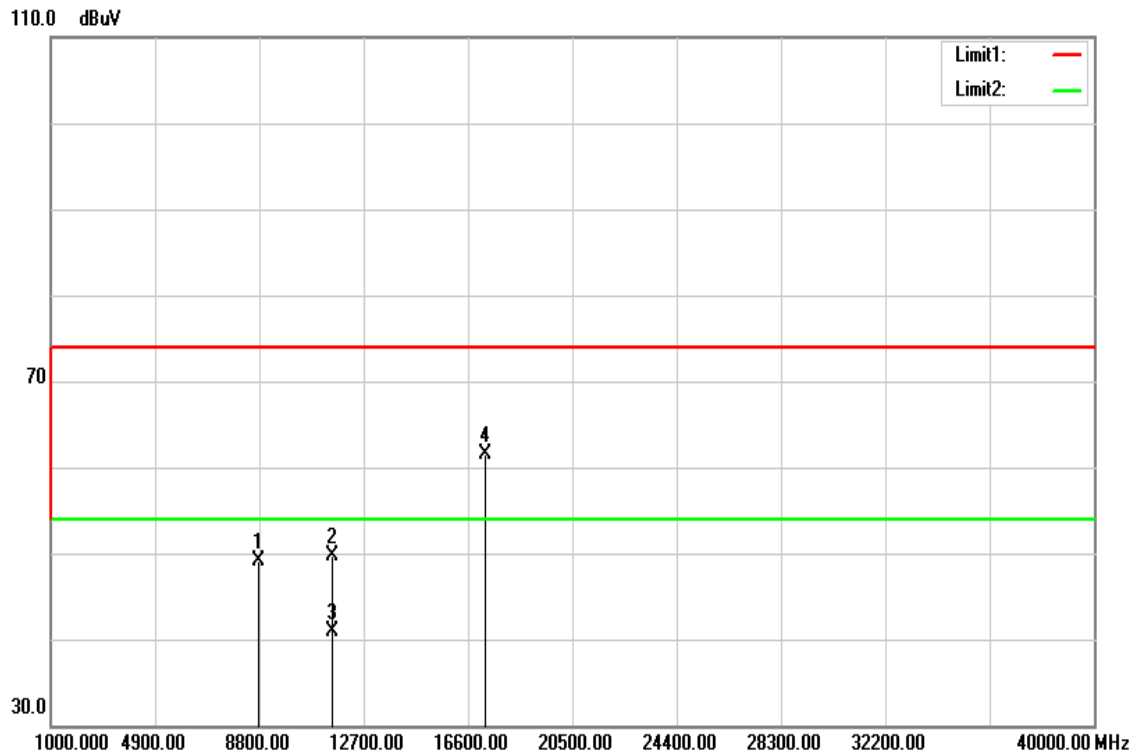
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8755.000        | 34.83          | 13.76             | 48.59           | 74.00          | -25.41      | peak   | V              |
| 11650.000       | 36.84          | 16.91             | 53.75           | 74.00          | -20.25      | peak   | V              |
| 11650.000       | 26.96          | 16.91             | 43.87           | 54.00          | -10.13      | AVG    | V              |
| 17475.000       | 34.92          | 26.22             | 61.14           | 74.00          | -12.86      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8766.000        | 35.83          | 13.76             | 49.59           | 74.00          | -24.41      | peak   | H              |
| 11650.000       | 42.69          | 16.91             | 59.60           | 74.00          | -14.40      | peak   | H              |
| 11650.000       | 32.87          | 16.91             | 49.78           | 54.00          | -4.22       | AVG    | H              |
| 17475.000       | 35.16          | 26.22             | 61.38           | 74.00          | -12.62      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

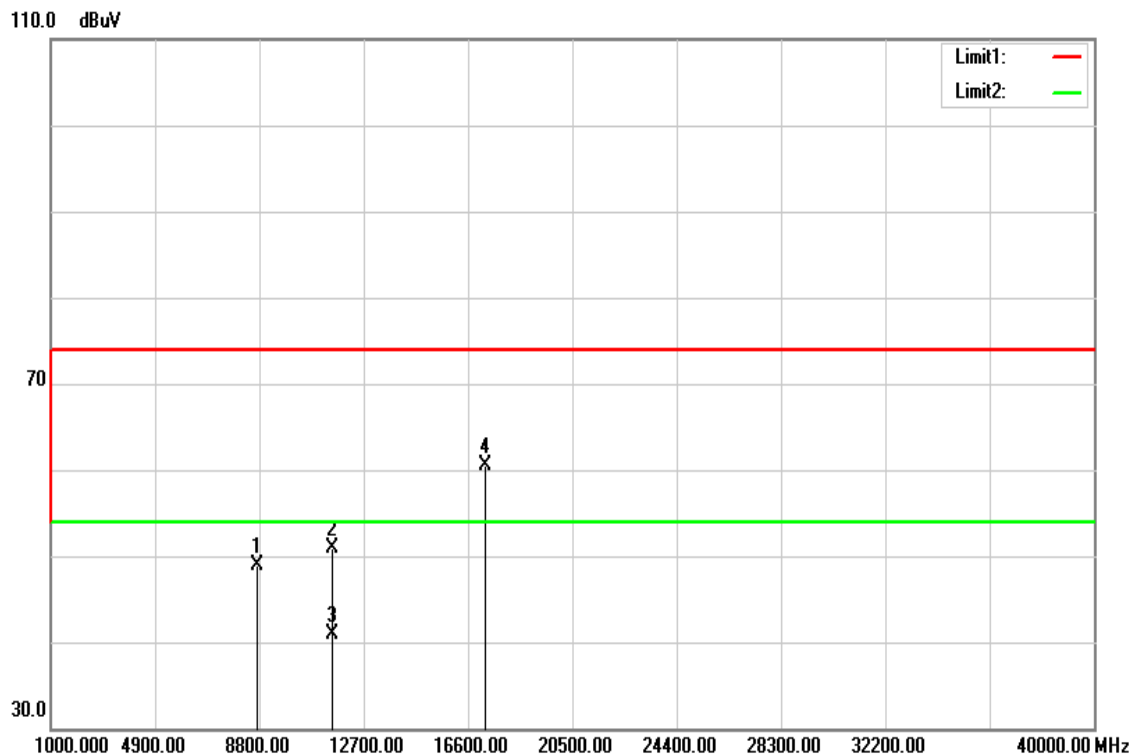
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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 40 MHz mode / CH Low**

**Polarity: Vertical**



**Polarity: Horizontal**



**Operation Mode:** TX / IEEE 802.11n HT 40 MHz mode  
/ CH Low  
**Temperature:** 27°C  
**Humidity:** 53% RH

**Test Date:** June 22, 2016  
**Tested by:** Dennis Li  
**Polarity:** Ver. / Hor.

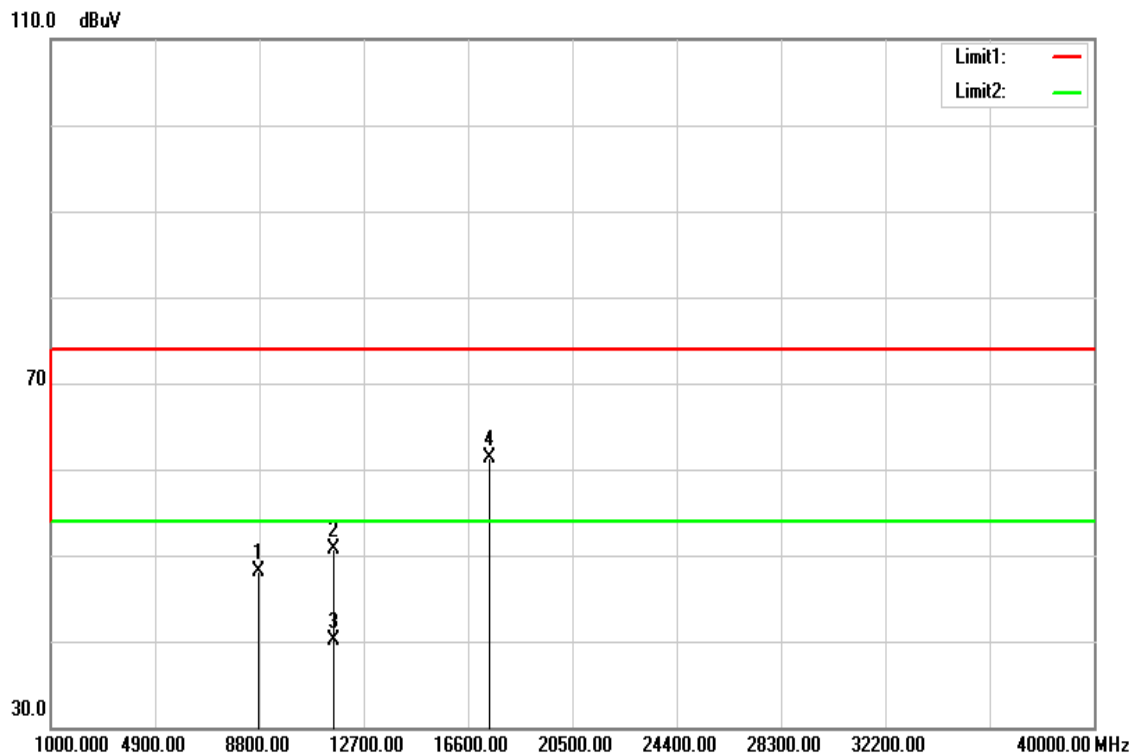
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8792.000        | 35.24          | 13.77             | 49.01           | 74.00          | -24.99      | peak   | V              |
| 11510.000       | 32.82          | 16.79             | 49.61           | 74.00          | -24.39      | peak   | V              |
| 11510.000       | 24.09          | 16.79             | 40.88           | 54.00          | -13.12      | AVG    | V              |
| 17265.000       | 36.13          | 25.40             | 61.53           | 74.00          | -12.47      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8712.000        | 35.18          | 13.74             | 48.92           | 74.00          | -25.08      | peak   | H              |
| 11510.000       | 34.13          | 16.79             | 50.92           | 74.00          | -23.08      | peak   | H              |
| 11510.000       | 24.19          | 16.79             | 40.98           | 54.00          | -13.02      | AVG    | H              |
| 17265.000       | 35.09          | 25.40             | 60.49           | 74.00          | -13.51      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

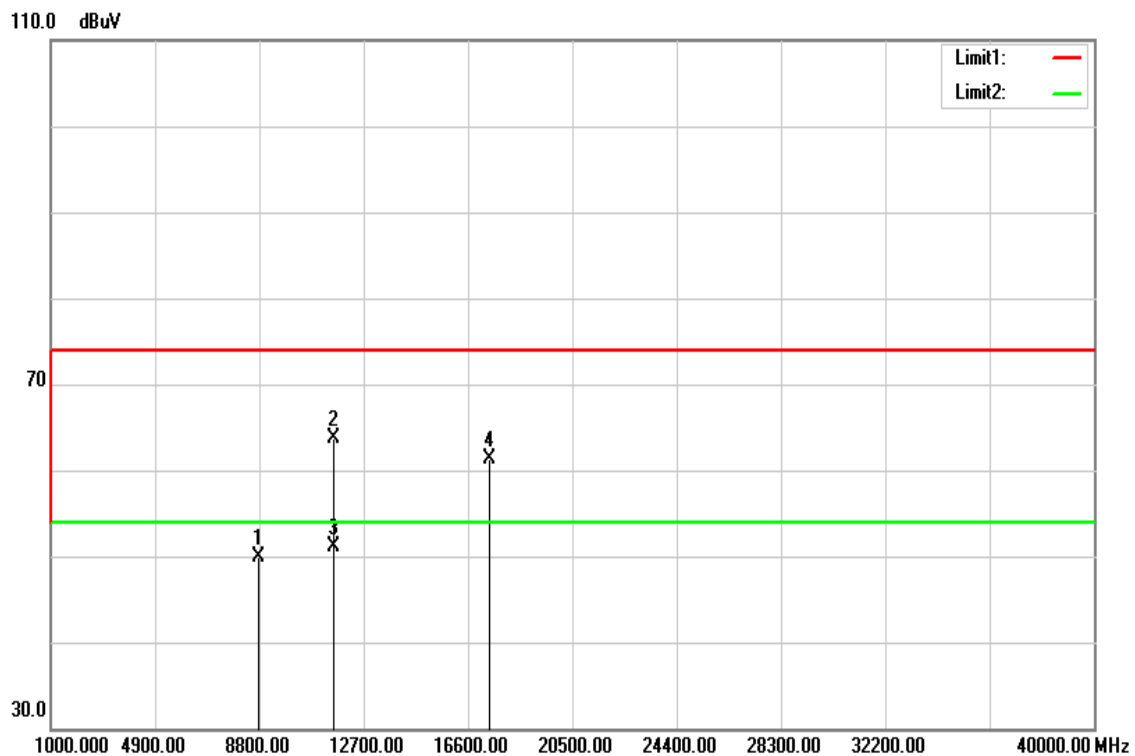
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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 40 MHz mode / CH High**

**Polarity: Vertical**



**Polarity: Horizontal**





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

**Test Date:** June 22, 2016

**Temperature:** 27°C

**Tested by:** Dennis Li

**Humidity:** 53% RH

**Polarity:** Ver. / Hor.

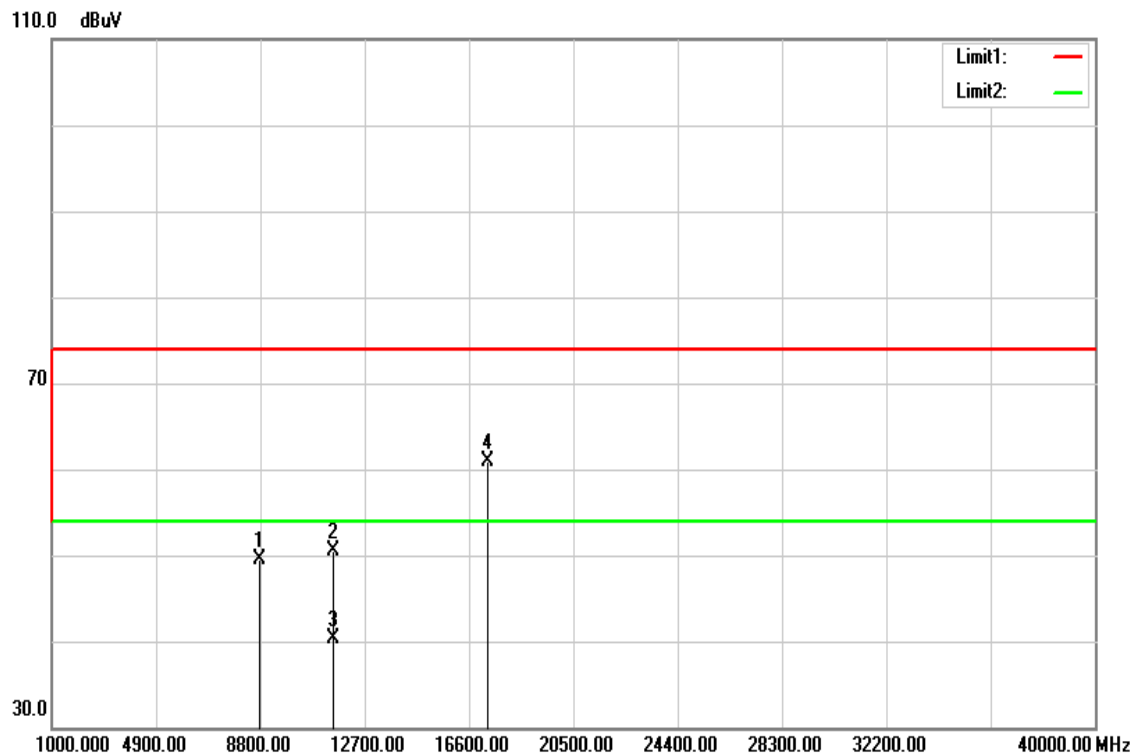
| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8755.000        | 34.38          | 13.76             | 48.14           | 74.00          | -25.86      | peak   | V              |
| 11590.000       | 33.81          | 16.86             | 50.67           | 74.00          | -23.33      | peak   | V              |
| 11590.000       | 23.27          | 16.86             | 40.13           | 54.00          | -13.87      | AVG    | V              |
| 17385.000       | 35.43          | 25.87             | 61.30           | 74.00          | -12.70      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8774.000        | 36.17          | 13.77             | 49.94           | 74.00          | -24.06      | peak   | H              |
| 11590.000       | 46.90          | 16.86             | 63.76           | 74.00          | -10.24      | peak   | H              |
| 11590.000       | 34.32          | 16.86             | 51.18           | 54.00          | -2.82       | AVG    | H              |
| 17385.000       | 35.34          | 25.87             | 61.21           | 74.00          | -12.79      | peak   | H              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |

**Remark:**

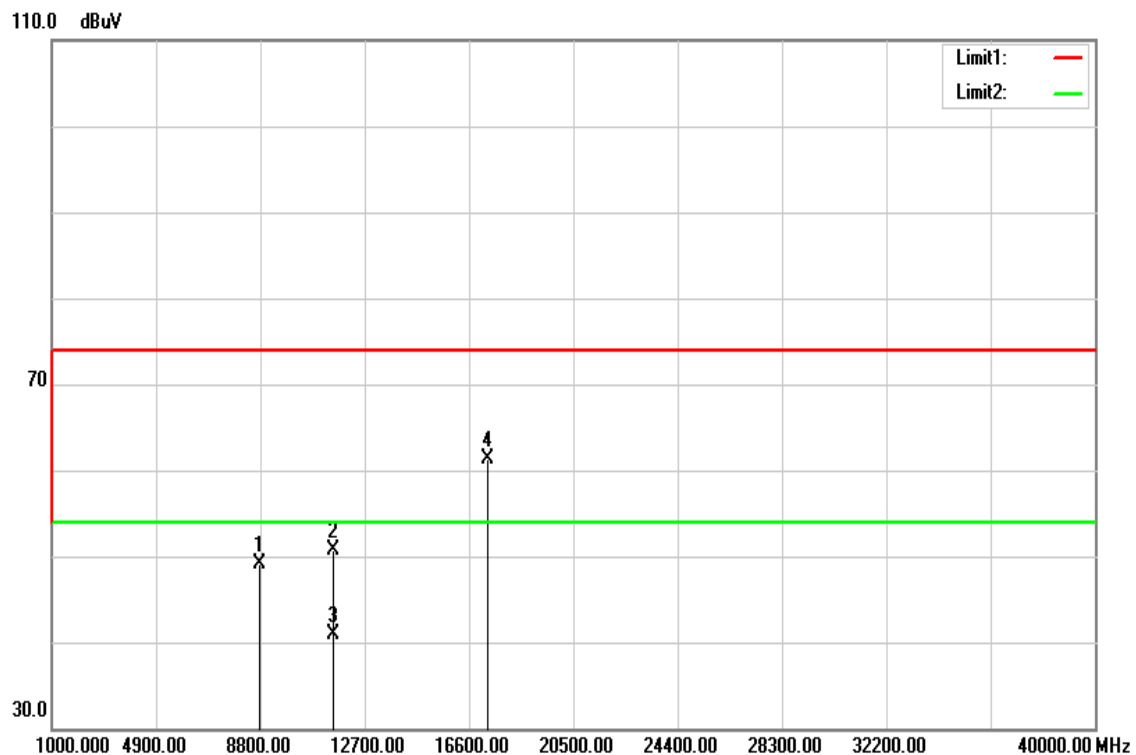
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit 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**



**Polarity: Horizontal**



**Operation Mode:** Tx / IEEE 802.11ac VHT 80 MHz mode / CH Mid  
**Temperature:** 27°C  
**Humidity:** 53% RH

**Test Date:** June 22, 2016

**Tested by:** Dennis Li

**Polarity:** Ver. / Hor.

| Frequency (MHz) | Reading (dBuV) | Correction (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Ant.Pol. (H/V) |
|-----------------|----------------|-------------------|-----------------|----------------|-------------|--------|----------------|
| 8799.000        | 35.72          | 13.78             | 49.50           | 74.00          | -24.50      | peak   | V              |
| 11550.000       | 33.69          | 16.82             | 50.51           | 74.00          | -23.49      | peak   | V              |
| 11550.000       | 23.46          | 16.82             | 40.28           | 54.00          | -13.72      | AVG    | V              |
| 17325.000       | 35.18          | 25.63             | 60.81           | 74.00          | -13.19      | peak   | V              |
| N/A             |                |                   |                 |                |             |        |                |
|                 |                |                   |                 |                |             |        |                |
| 8756.000        | 35.31          | 13.76             | 49.07           | 74.00          | -24.93      | peak   | H              |
| 11550.000       | 33.91          | 16.82             | 50.73           | 74.00          | -23.27      | peak   | H              |
| 11550.000       | 24.14          | 16.82             | 40.96           | 54.00          | -13.04      | AVG    | H              |
| 17325.000       | 35.66          | 25.63             | 61.29           | 74.00          | -12.71      | 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), except as shown in paragraphs (b) and (c) of this section, 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency Range<br>(MHz) | Limits<br>(dB $\mu$ V) |           |
|--------------------------|------------------------|-----------|
|                          | Quasi-peak             | Average   |
| 0.15 to 0.50             | 66 to 56*              | 56 to 46* |
| 0.50 to 5                | 56                     | 46        |
| 5 to 30                  | 60                     | 50        |

\* 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:** July 6, 2016  
**Temperature:** 24°C      **Tested by:** Dennis Li  
**Humidity:** 50% RH

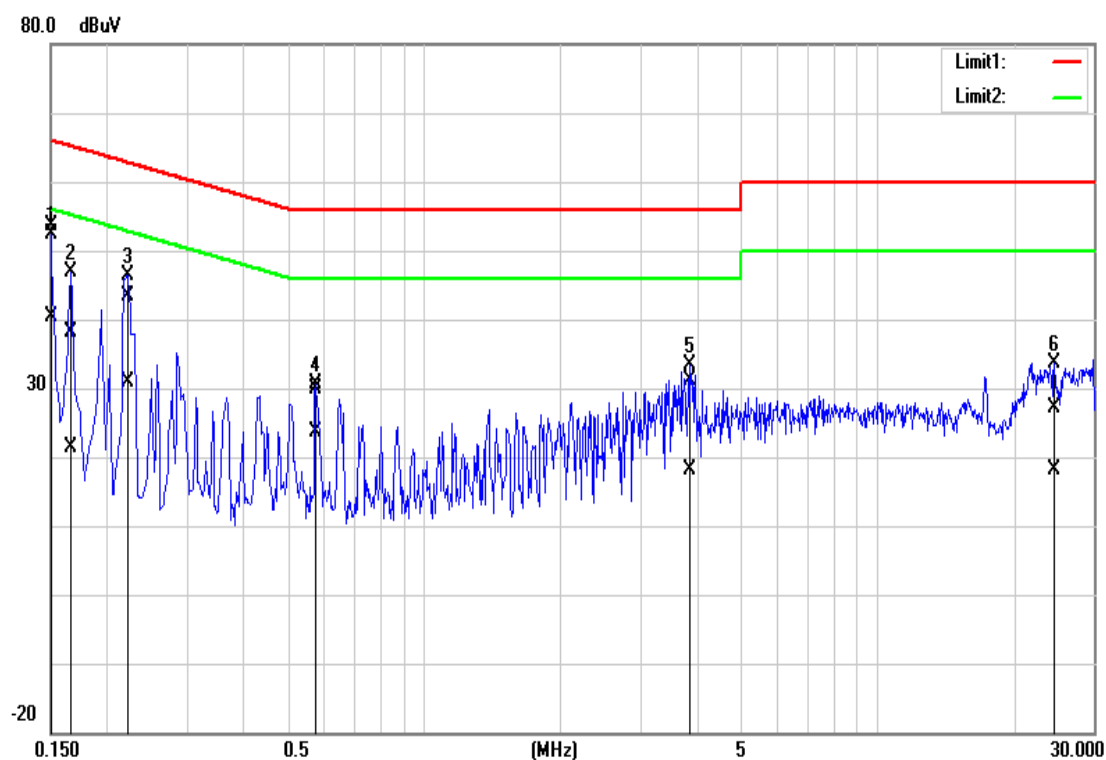
| Freq. (MHz) | QP Reading (dBuV) | AV Reading (dBuV) | Corr. factor (dB/m) | QP Result (dBuV/m) | AV Result (dBuV/m) | QP Limit (dBuV) | AV Limit (dBuV) | QP Margin (dB) | AV Margin (dB) | Note |
|-------------|-------------------|-------------------|---------------------|--------------------|--------------------|-----------------|-----------------|----------------|----------------|------|
| 0.1500      | 43.90             | 30.72             | 9.71                | 53.61              | 40.43              | 66.00           | 56.00           | -12.39         | -15.57         | L1   |
| 0.1660      | 28.46             | 11.57             | 9.71                | 38.17              | 21.28              | 65.16           | 55.16           | -26.99         | -33.88         | L1   |
| 0.2220      | 33.57             | 21.20             | 9.70                | 43.27              | 30.90              | 62.74           | 52.74           | -19.47         | -21.84         | L1   |
| 0.5780      | 20.18             | 13.94             | 9.70                | 29.88              | 23.64              | 56.00           | 46.00           | -26.12         | -22.36         | L1   |
| 3.8780      | 21.39             | 8.34              | 9.74                | 31.13              | 18.08              | 56.00           | 46.00           | -24.87         | -27.92         | L1   |
| 24.5540     | 17.31             | 8.34              | 9.83                | 27.14              | 18.17              | 60.00           | 50.00           | -32.86         | -31.83         | L1   |
| 0.1700      | 27.84             | 9.88              | 9.78                | 37.62              | 19.66              | 64.96           | 54.96           | -27.34         | -35.30         | L2   |
| 0.2220      | 33.94             | 22.10             | 9.77                | 43.71              | 31.87              | 62.74           | 52.74           | -19.03         | -20.87         | L2   |
| 0.3700      | 22.19             | 13.24             | 9.76                | 31.95              | 23.00              | 58.50           | 48.50           | -26.55         | -25.50         | L2   |
| 0.6580      | 20.91             | 15.78             | 9.76                | 30.67              | 25.54              | 56.00           | 46.00           | -25.33         | -20.46         | L2   |
| 3.6620      | 16.40             | 2.97              | 9.82                | 26.22              | 12.79              | 56.00           | 46.00           | -29.78         | -33.21         | L2   |
| 29.9220     | 19.39             | 11.12             | 10.38               | 29.77              | 21.50              | 60.00           | 50.00           | -30.23         | -28.50         | 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)

