

# TEST REPORT

## 1. Applicant

Name : I DO IT Co., Ltd.  
Brand Name : N/A  
Address : #637, Smart-Hub Industry-University Convergence  
Center, 237 Sangidaehak-ro, Siheung-si, Gyeonggi-do,  
Korea(429-793)  
FCC ID : XQ8WLE200N5-23ESD

## 2. Products

Name : PCIe MINI CARD  
Model No. : WLE200N5-23ESD  
Variant Model No. : N/A  
Manufacturer : I DO IT Co., Ltd.

## 3. Test Standard

: FCC 47 CFR Part 15 Subpart E  
Canada RSS-210:issue 8

## 4. Test Method

: ANSI C63.4:2009

## 5. Test Result

: PASS

## 6. Dates of Test

: February 02, 2015 ~ February 06, 2014

## 7. Date of Issue

: February 13, 2015

## 8. Test Laboratory

: Korea Standard Quality Laboratories  
FCC Designation Number : 100384

Tested by



Kwangmin, Lee

Test Engineer:

Approved by



YeoungRyul, Jo

Compliance Engineer:

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## 1. Test Summary

| Test Item                          | Test Specification clause       |                          | Result |
|------------------------------------|---------------------------------|--------------------------|--------|
| 6 DB EMISSION BANDWIDTH            | FCC PART 15 C section 15.407(e) | Canada RSS-210 : issue 8 | PASS   |
| MAXIMUM CONDUCTED OUTPUT POWER     | FCC PART 15 C section 15.407(a) | Canada RSS-210 : issue 8 | PASS   |
| BAND EDGES MEASUREMENT             | FCC PART 15 C section 15.407(b) | Canada RSS-210 : issue 8 | PASS   |
| POWER SPECTRAL DENSITY MEASUREMENT | FCC PART 15 C section 15.407(a) | Canada RSS-210 : issue 8 | PASS   |
| RADIATED UNDESIRABLE EMISSION      | FCC PART 15 C section 15.209(a) | Canada RSS-210 : issue 8 | PASS   |
| POWERLINE CONDUCTED EMISSIONS      | FCC PART 15 C section 15.207(a) | -                        | PASS   |

**Remark:**

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.4: the detail version is ANSI C63.4:2009 in the whole report.

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### 3. GENERAL INFORMATION

#### 3.1. Client Information

Applicant : I DO IT Co., Ltd.  
Address of Applicant : #637, Smart-Hub Industry-University Convergence Center, 237 Sangidaehak-ro, Siheung-si, Gyeonggi-do, Korea(429-793)

#### 3.2. General Description of E.U.T.

Product Name : PCIe MINI CARD  
Model No. : WLE200N5-23ESD

#### 3.3. Details of E.U.T.

Product Name : PCIe MINI CARD  
Model Name : WLE200N5-23ESD  
Series Model : N/A  
Model Discrepancy : N/A  
Operating Voltage : 3.3 VDC  
Frequency Range : 5 725 MHz-5 850 MHz  
Number of Channels : IEEE 802.11a mode: 5 Channels  
draft 802.11an 20MHz mode: 5 Channels  
draft 802.11an 40MHz mode: 3 Channels  
Antenna Specification : PCB antennas for 5 GHz Gain 4.98 dBi

#### Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: XQ8WLE200N5-23ESD filing to comply with FCC Part 15, Subpart E Rules.

## 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2009 and FCC CFR 47 15.207, 15.209 and 15.407,.

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.407 and KDB 789033 – 20140606.

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

### 4.1. 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.

### 4.2. 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.

### 4.3. General Test Procedures

#### Conducted Emissions

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.3 of ANSI C63.4, 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 0.8 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 Section 13.4 of ANSI C63.4.

### 4.4. Testing Applied Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.407

ANSI C63.4-2009

FCC KDB 412172

FCC KDB 789033 D02 General UNII Test Procedures New Rules v01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

#### 4.5. Description of Test Modes

| Description                      | Modulation Technology | Modulation Technology |
|----------------------------------|-----------------------|-----------------------|
| 26dB Bandwidth and 99% Bandwidth | OFDM                  | BPSK                  |
| Maximum conducted output power   | OFDM                  | BPSK                  |
| Band edges measurement           | OFDM                  | BPSK                  |
| Peak Power Spectral Density      | OFDM                  | BPSK                  |
| Peak excursion                   | OFDM                  | BPSK                  |
| Radiated undesirable emission    | OFDM                  | BPSK                  |
| Conducted undesirable emission   | OFDM                  | BPSK                  |
| Powerline conducted emission     | OFDM                  | BPSK                  |

The EUT transmitting and receiving with three antennas simultaneously working at a/an mode, so 2x2 configuration was used for all testing in this report.

Software used to control the EUT for staying in continuous transmitting 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:**

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 54Mbps data rate were chosen for full testing.

**draft 802.11an Standard-20 MHz Channel mode:**

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 65Mbps data rate were chosen for full testing.

**draft 802.11an Wide-40 MHz Channel mode:**

Channel Low (5755MHz)and Channel Mid (5795MHz) with 135Mbps data rate were chosen for full testing.

**Note:** After the preliminary san the EUT 5G antenna with 4.98 dBi gain was the worst mode, which mode data was recorded.

**5. EQUIPMENT USED DURING TEST**

| No. | Test Equipment           | Manufacturer       | Model No.    | Serial No.     | Next Cal. Data | Used equipment |
|-----|--------------------------|--------------------|--------------|----------------|----------------|----------------|
| 1   | Spectrum Analyzer        | Agilent            | E4440A       | MY45304715     | 15.11.11       | ■              |
| 2   | Frequency Counter        | HP                 | 5350B        | 3049A05530     | 15.06.02       | ■              |
| 3   | DC Power Supply          | ALINCO             | DM-340MV     | F001015        | 15.06.02       | ■              |
| 4   | Signal Generator         | Leader Electronics | 3220         | 137231         | 15.06.01       | ■              |
| 5   | Synthesized CW Generator | HP                 | 83711B       | US34490158     | 15.06.01       | ■              |
| 7   | SYNTHESIZED SWEEPER      | HP                 | 8340B        | 2804A00830     | 15.05.07       | ■              |
| 8   | Function Generator       | IWATSU             | SG-4105      | 62372780       | 15.04.29       | □              |
| 9   | Modulation Analyzer      | Agilent            | 8901B        | 3438A05099     | 15.06.02       | □              |
| 10  | Audio Analyaer           | Agilent            | 8903B        | 3729A18576     | 15.06.02       | □              |
| 11  | Power Meter              | Agilent            | E4418B       | GB43312894     | 15.06.01       | ■              |
| 12  | Power Sensor             | HP                 | 8485A        | 3316A14708     | 15.06.27       | ■              |
| 13  | Power Sensor             | Agilent            | 8482B        | 2703703543     | 15.06.29       | □              |
| 14  | Pre Amplifier            | GTC                | GA-1825A     | GT0929/003     | 15.06.01       | □              |
| 15  | Attenuator               | Weinschel          | 53-30-33     | MG906          | 15.04.17       | □              |
| 16  | Step Attenuator          | Agilent            | 8494B        | MY41110204     | 15.06.01       | □              |
| 17  | Step Attenuator          | Agilent            | 8495B        | 3308A17660     | 15.06.01       | □              |
| 18  | Step Attenuator          | Agilent            | 8496B        | US40152183     | 15.06.01       | □              |
| 19  | Attenuator               | HP                 | 8493C        | 01672          | 15.05.19       | □              |
| 20  | Attenuator               | HP                 | 30dB         | -              | 15.04.17       | □              |
| 21  | Attenuator               | TAE SUNG           | SMA-1        | -              | 15.06.01       | □              |
| 22  | Attenuator               | TAE SUNG           | SMA-2        | -              | 15.06.01       | □              |
| 23  | Termination              | KWANG YEOK         | KYTE-NJ-150W | 2040004        | 15.06.01       | □              |
| 24  | Spectrum Analyzer        | LIG                | ISA-265      | L0812M002      | 15.10.23       | □              |
| 25  | Bluetooth Tester         | TESCOM             | TC-3000A     | 3000A590236    | 15.06.01       | □              |
| 26  | Loop ANT.                | Com-Power          | AL-130       | 121010         | 15.04.25       | □              |
| 27  | Horn ANT.                | SCHWARZBECK        | BBHA 9120D   | 831            | 16.07.21       | ■              |
| 28  | Temp & Humidity Chamber  | Seoksan Tech       | SE-CT-02     | S7400JD5340618 | 15.06.02       | ■              |
| 29  | Vibration Tester         | Gana               | GNV-400      | C114           | 15.06.19       | □              |
| 30  | Drop Tester              | Self-made          | DOC-800      | DOC-01-43-14   | N/A            | □              |
| 31  | Power Divider            | Agilent            | 11636B       | 12002          | 15.06.19       | ■              |
| 32  | Power Divider            | Agilent            | 11636B       | 50591          | 15.06.19       | □              |
| 33  | RMS Multimeter           | RMS Multimeter     | FLUKE87      | 61160149       | 15.06.02       | ■              |
| 34  | TEST RECEIVER            | ROHDE&SCHWARZ      | ESPI         | 101014         | 15.08.05       | ■              |
| 35  | Bi-log Antenna           | SCHWARZBECK        | VULB9160     | 1163           | 15.11.21       | ■              |
| 36  | Spectrum Analyzer        | ROHDE&SCHWARZ      | FSV-40       | 100994         | 16.03.30       | ■              |
| 37  | Horn ANT.                | SCHWARZBECK        | BBHA 9170    | BBHA9170 573   | 16.03.24       | ■              |
| 38  | LISN                     | ROHDE & SCHWARZ    | ENV216       | 101732         | 16.03.01       | ■              |
| 39  | LISN                     | KNW-407            | Kyoritsu     | 8-1010-14      | 15.06.09       | ■              |

## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1. Setup Configuration of EUT

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

### 6.2. Support Equipment

| No. | Equipment        | Manufacturer  | Model No. |
|-----|------------------|---------------|-----------|
| 1   | DeskTop Computer | dell          | E5430     |
| 2   | Monitor          | CARDINAL      | CS-172    |
| 3   | Mouse            | Dell          | MS111-T   |
| 4   | Keyboard         | Azio Levetron | KB528U    |

**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.



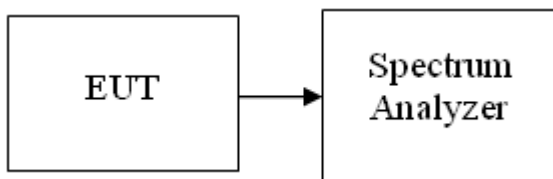
## 7. FCC PART 15 REQUIREMENTS

### 7.1. 6 DB Emission Bandwidth

#### LIMIT

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz.

#### 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  $\geq$  3RBW, Detector = Peak. Trace mode = max hold.
4. Measure the maximum width of the emission that is 6 dB down from the peak of the emission..
5. Measure and record the results in the test report

#### TEST RESULTS

No non-compliance noted



**Test Data**

Test mode: IEEE 802.11a mode/ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|----------------------|-------------------------------------|
| Low     | 5745            | 16.46                | 0.5                                 |
| Mid     | 5785            | 16.51                | 0.5                                 |
| High    | 5825            | 16.47                | 0.5                                 |

Test mode: IEEE 802.11a mode/ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5745            | 16.50               | 0.5                                 |
| Mid     | 5785            | 16.48               | 0.5                                 |
| High    | 5825            | 16.48               | 0.5                                 |

Test mode: IEEE 802.11a mode/ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5745            | 16.44               | 0.5                                 |
| Mid     | 5785            | 16.45               | 0.5                                 |
| High    | 5825            | 16.47               | 0.5                                 |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5745            | 17.73               | 0.5                                 |
| Mid     | 5785            | 17.72               | 0.5                                 |
| High    | 5825            | 17.72               | 0.5                                 |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5745            | 17.74               | 0.5                                 |
| Mid     | 5785            | 17.74               | 0.5                                 |
| High    | 5825            | 17.66               | 0.5                                 |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5745            | 17.71               | 0.5                                 |
| Mid     | 5785            | 17.66               | 0.5                                 |
| High    | 5825            | 17.66               | 0.5                                 |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5755            | 36.45               | 0.5                                 |
| High    | 5795            | 36.46               | 0.5                                 |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5755            | 36.48               | 0.5                                 |
| High    | 5795            | 36.45               | 0.5                                 |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

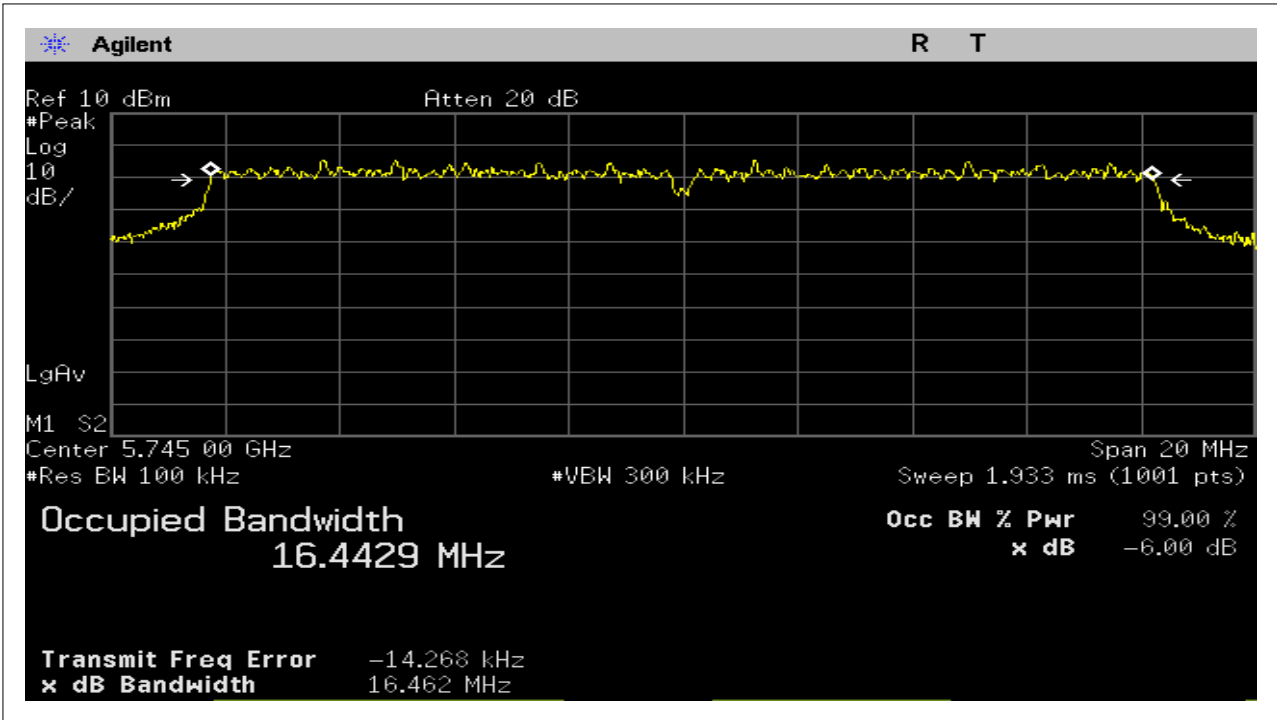
| Channel | Frequency (MHz) | Bandwidth (B) (MHz) | FCC 6 dB Bandwidth Min. Limit (MHz) |
|---------|-----------------|---------------------|-------------------------------------|
| Low     | 5755            | 36.28               | 0.5                                 |
| High    | 5795            | 35.37               | 0.5                                 |

Test Plot

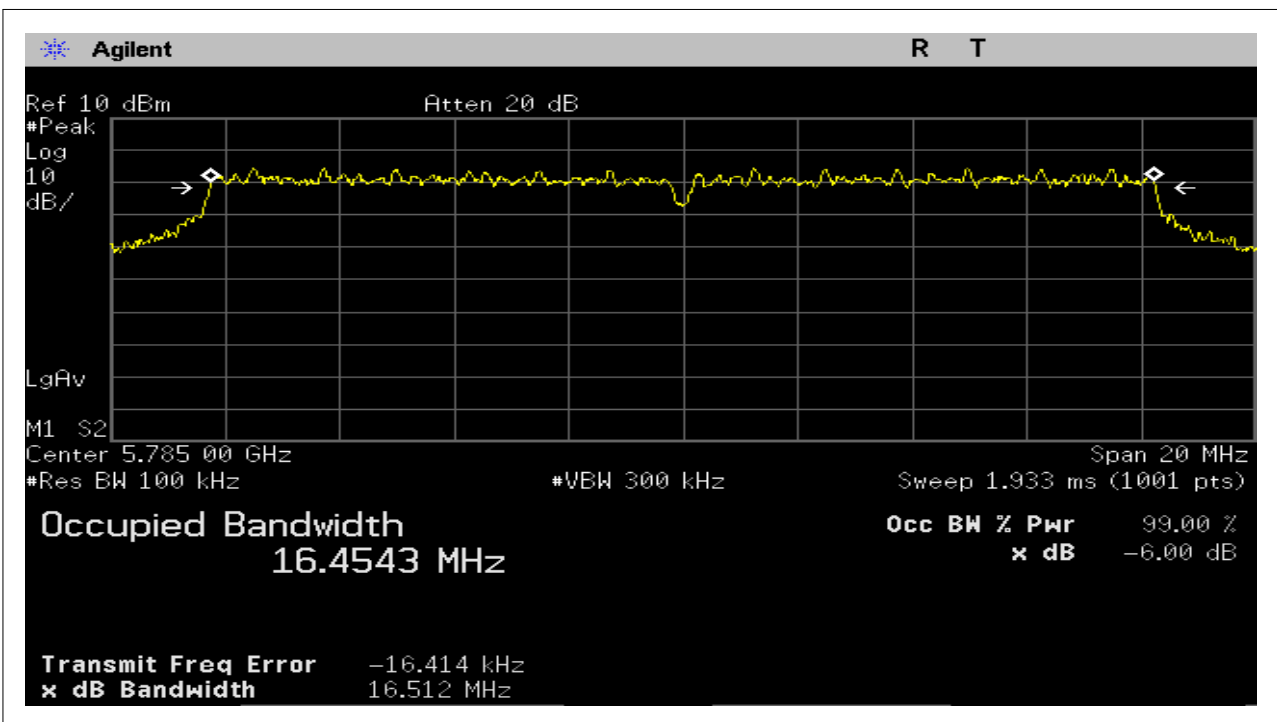
IEEE 802.11a mode/ANT 1:

5745~5850MHz

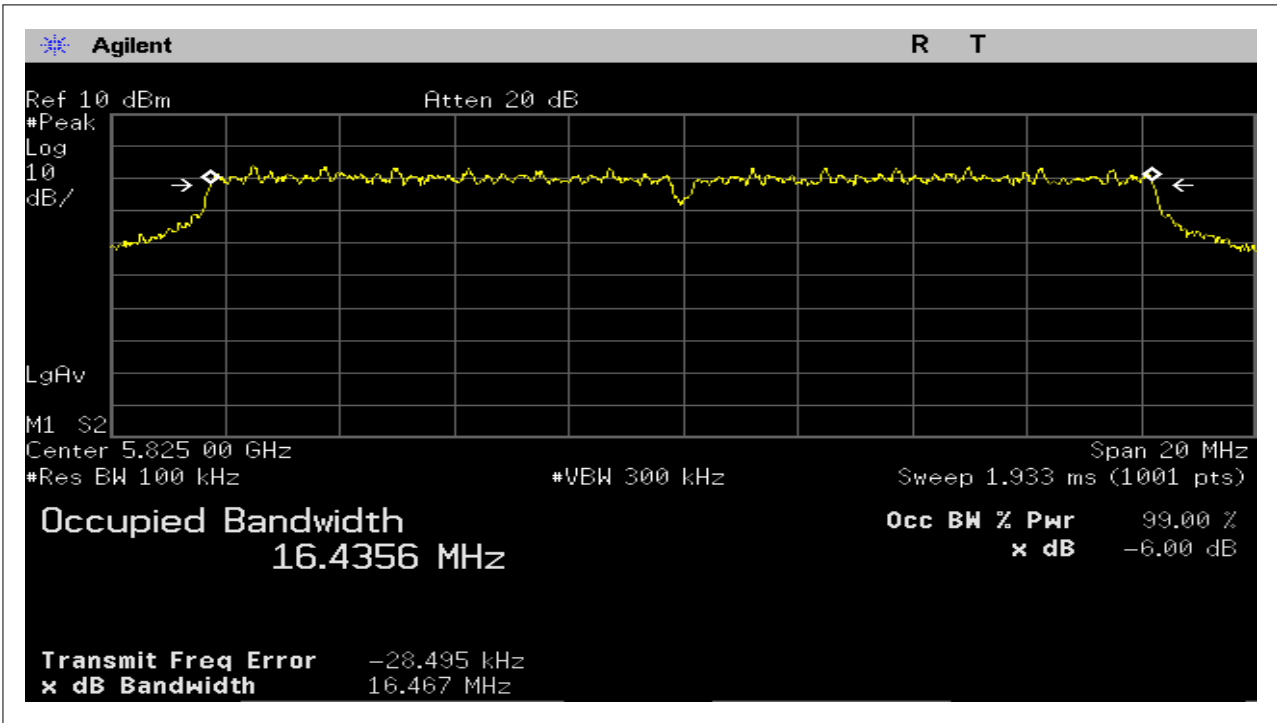
CH Low



CH Mid



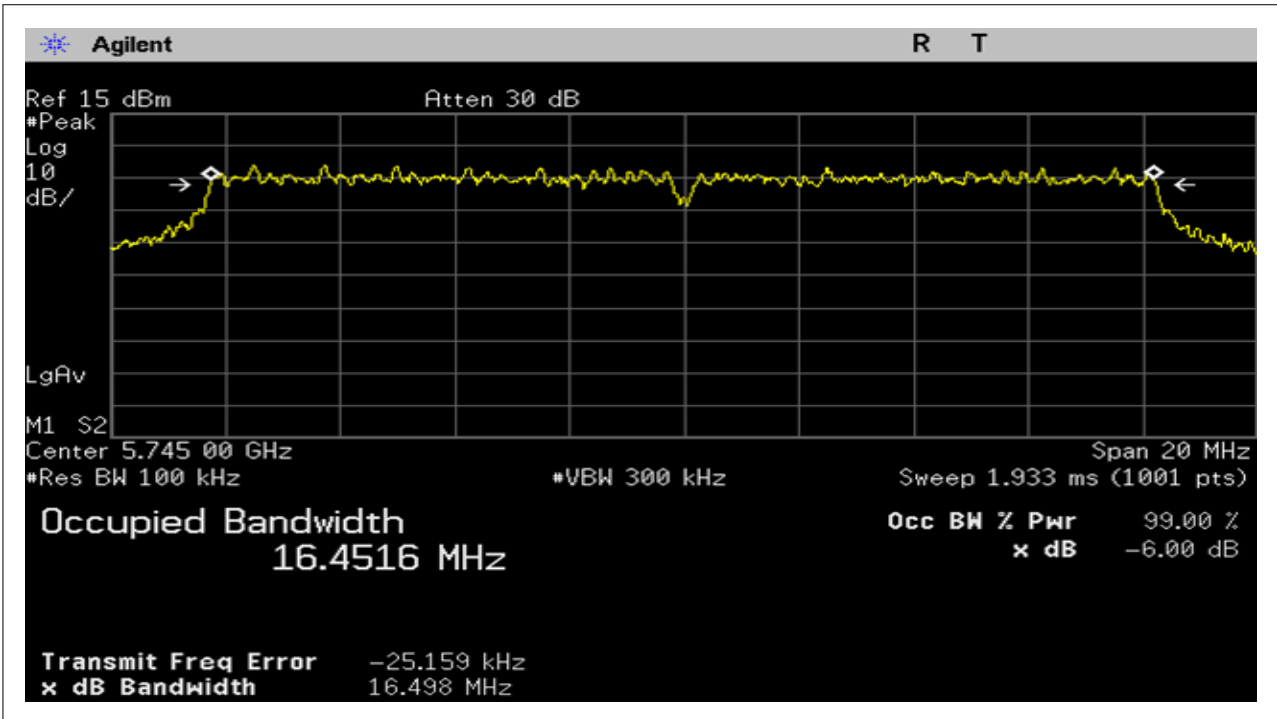
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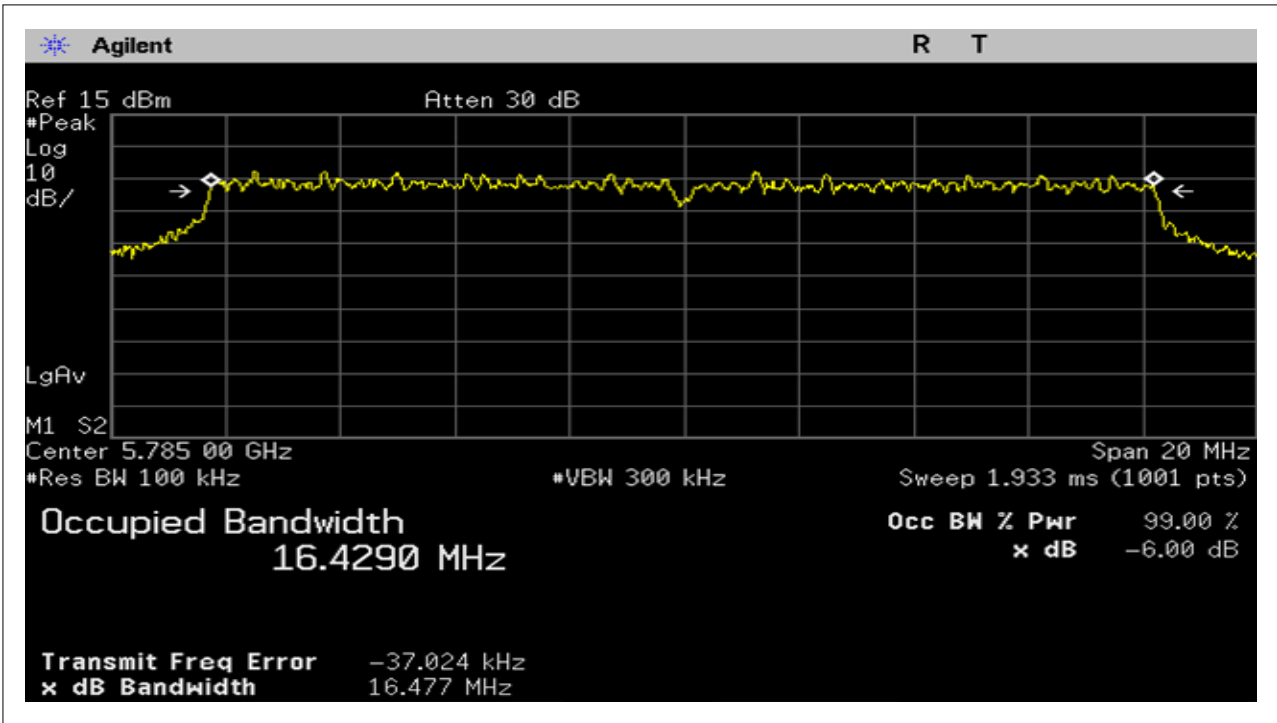
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5745~5850MHz

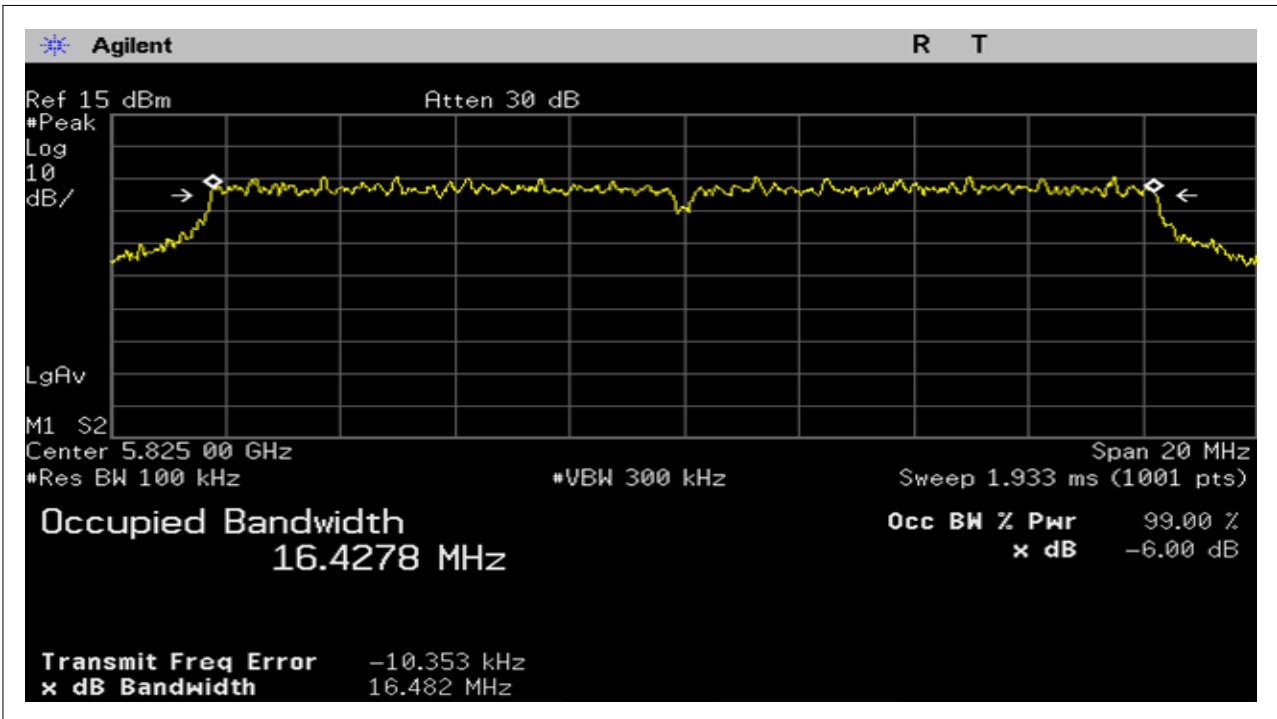
CH Low



CH Mid



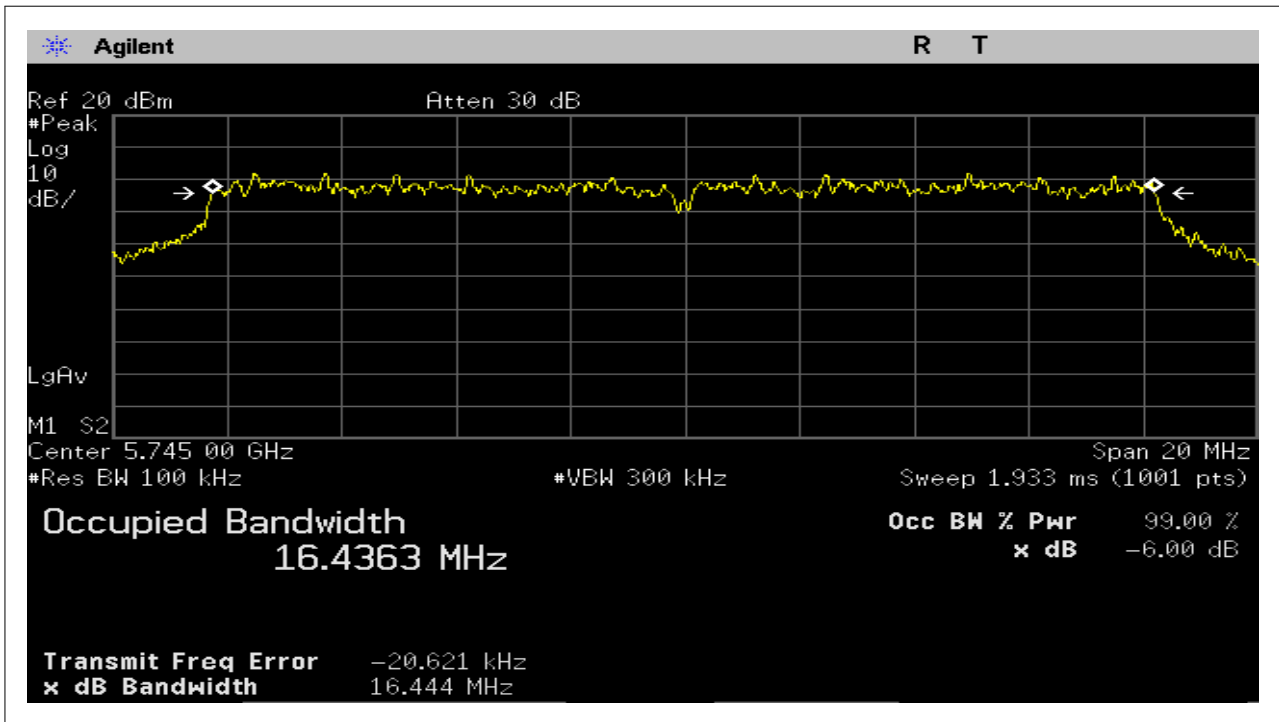
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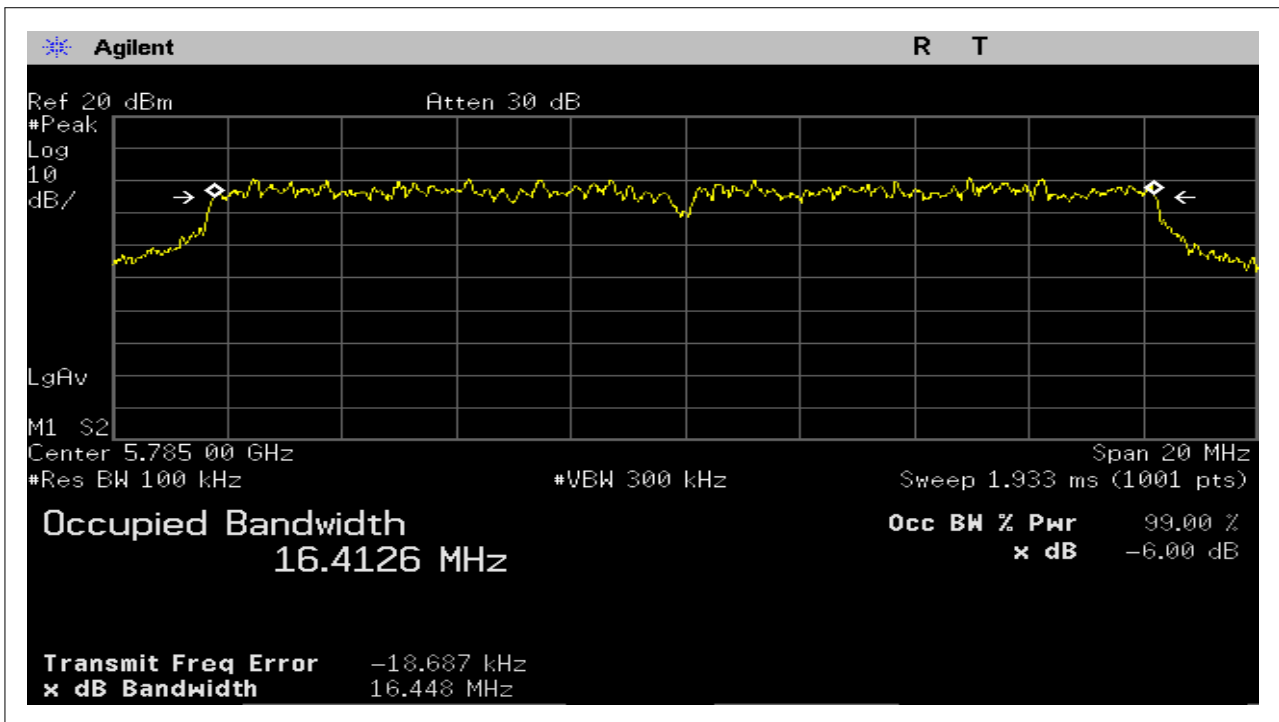
IEEE 802.11a mode/ANT 1+2:

5745~5850MHz

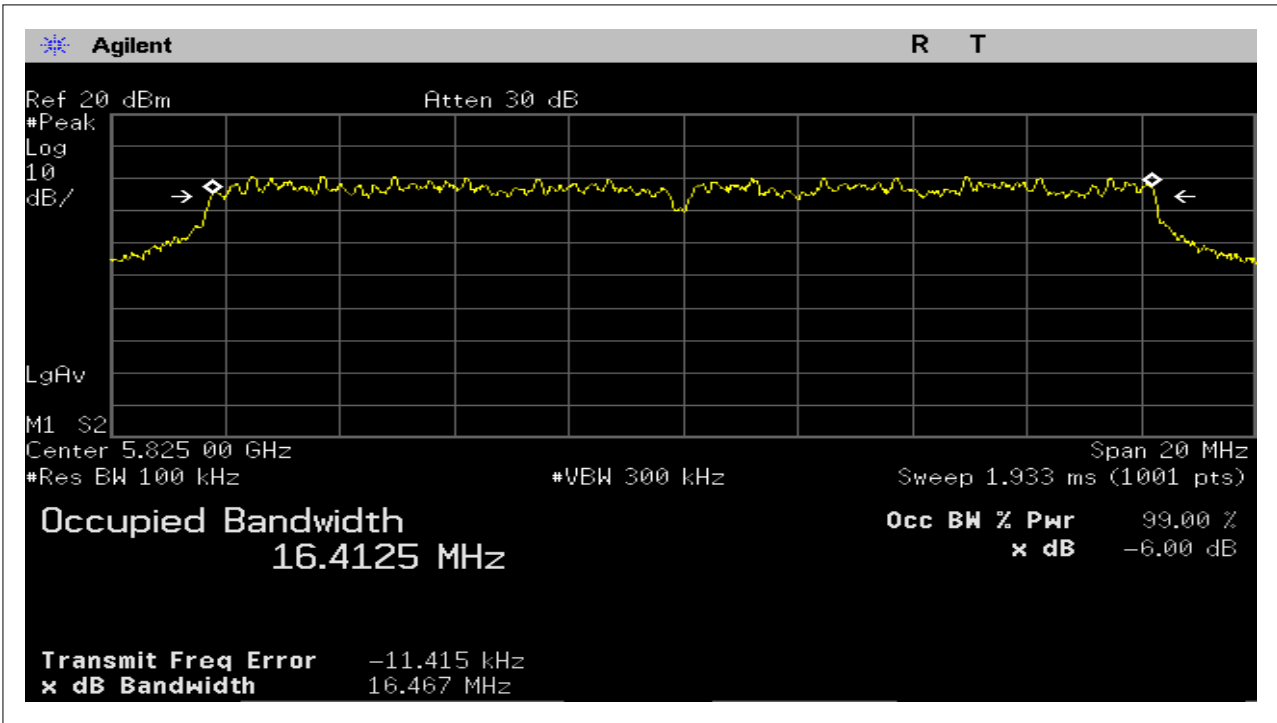
CH Low



CH Mid



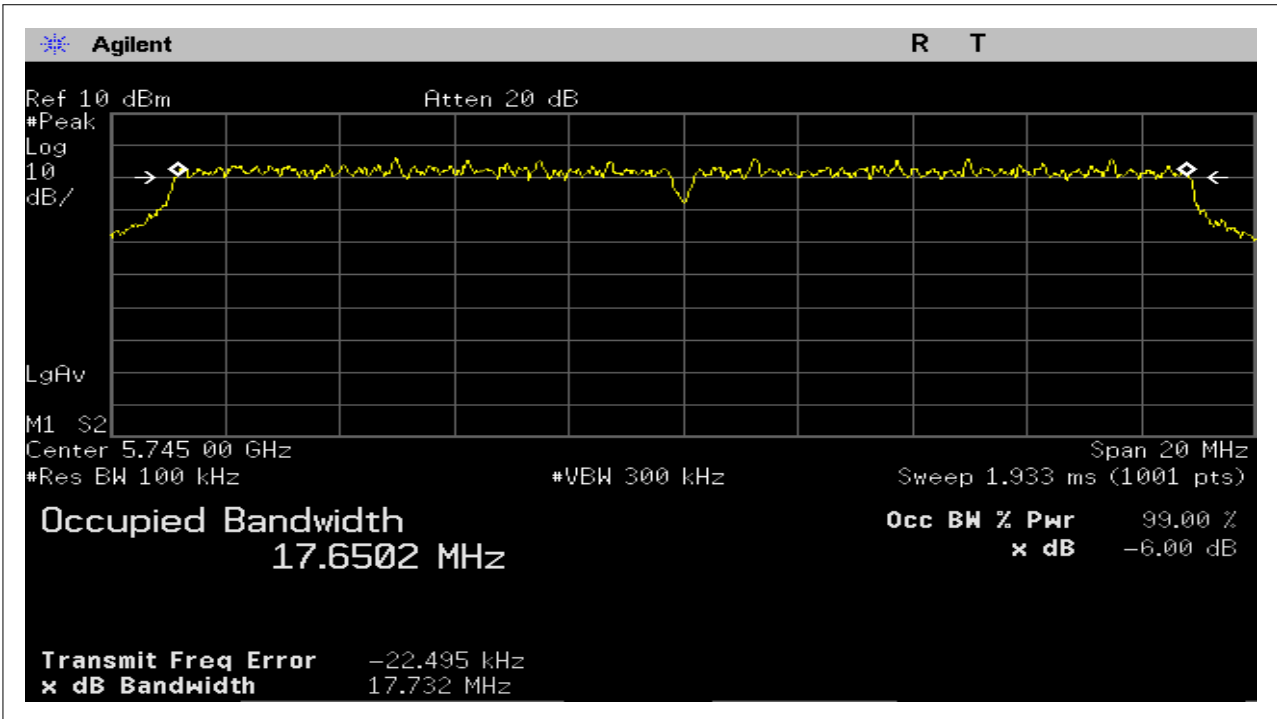
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draft 802.11n Standard-20 MHz Channel mode / ANT 1

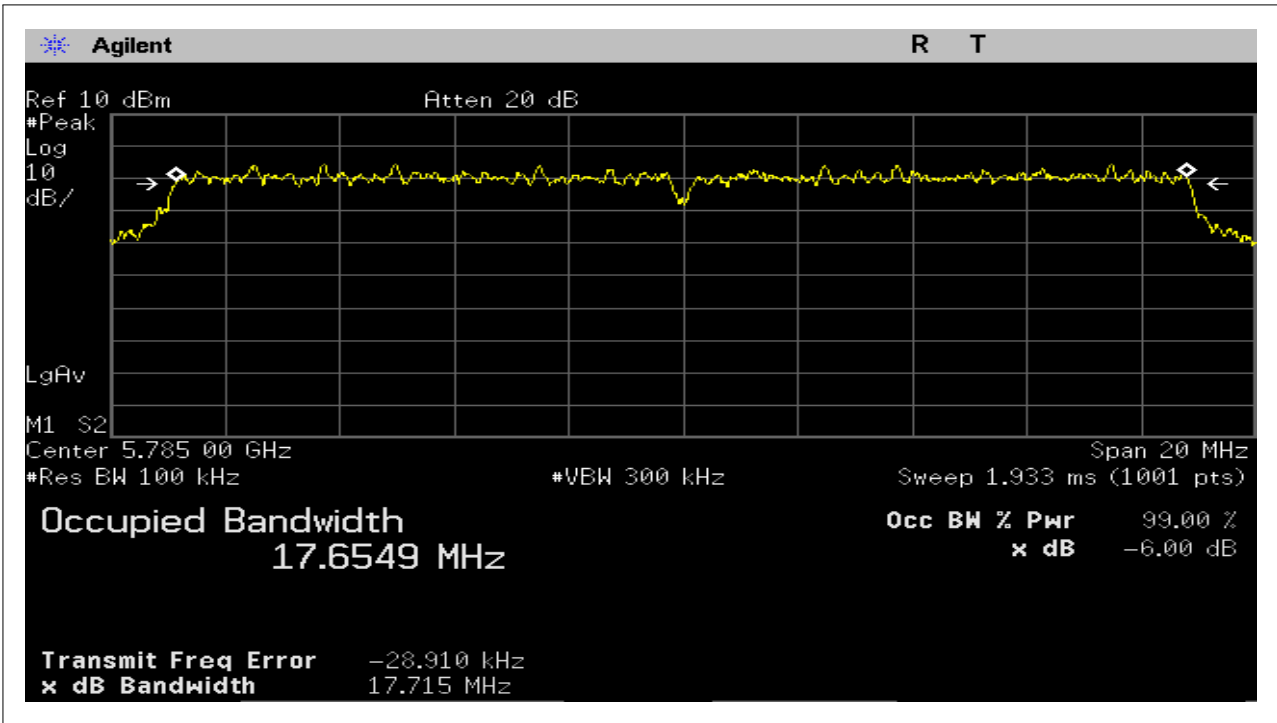
5745~5850MHz

CH Low

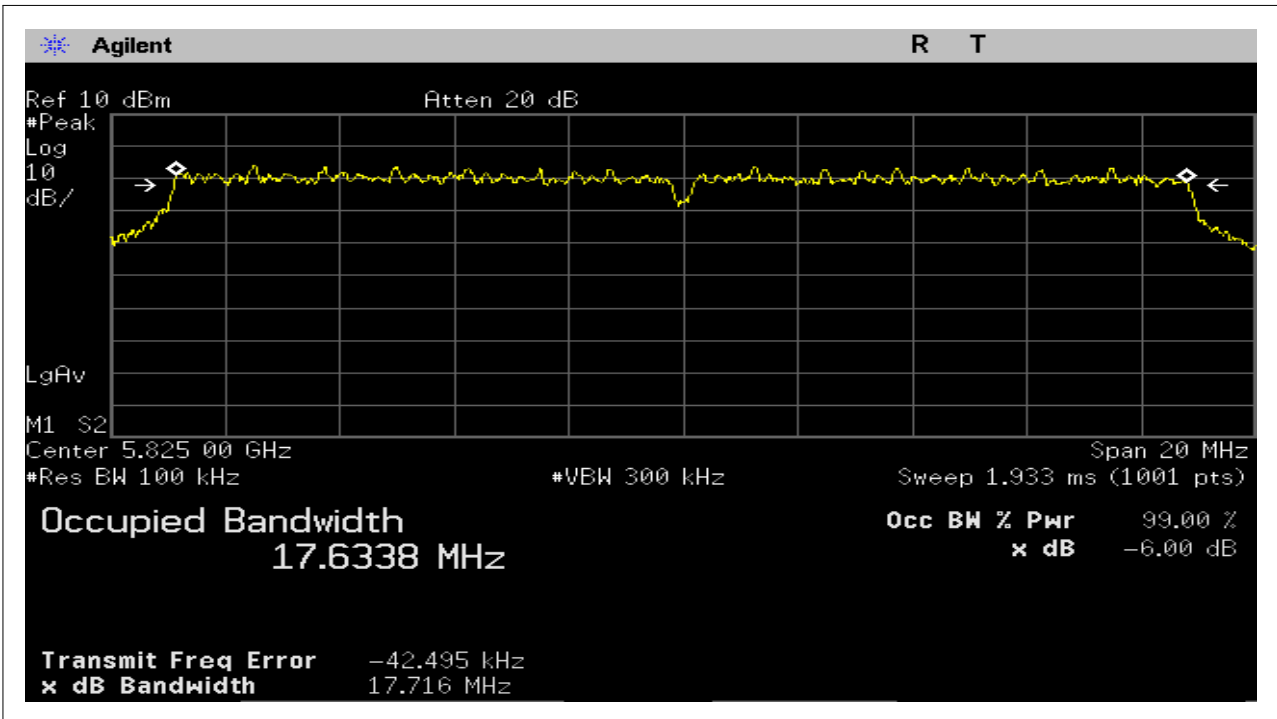




CH Mid



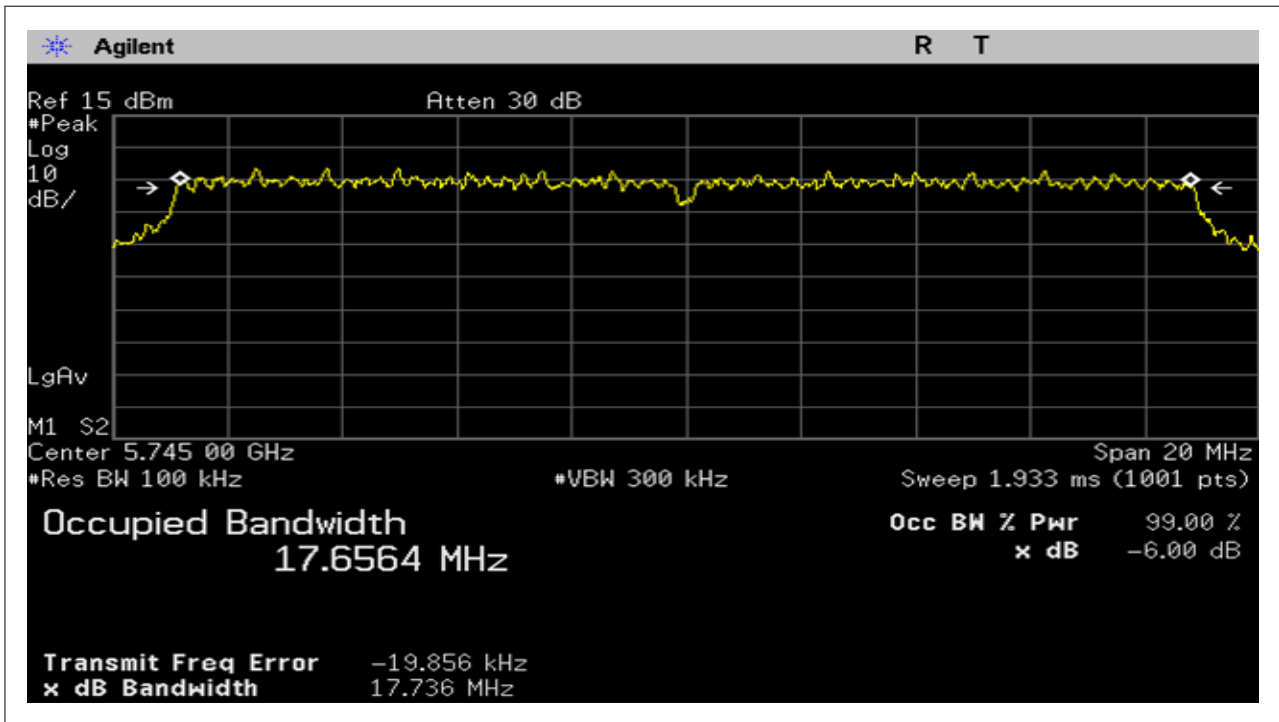
CH High



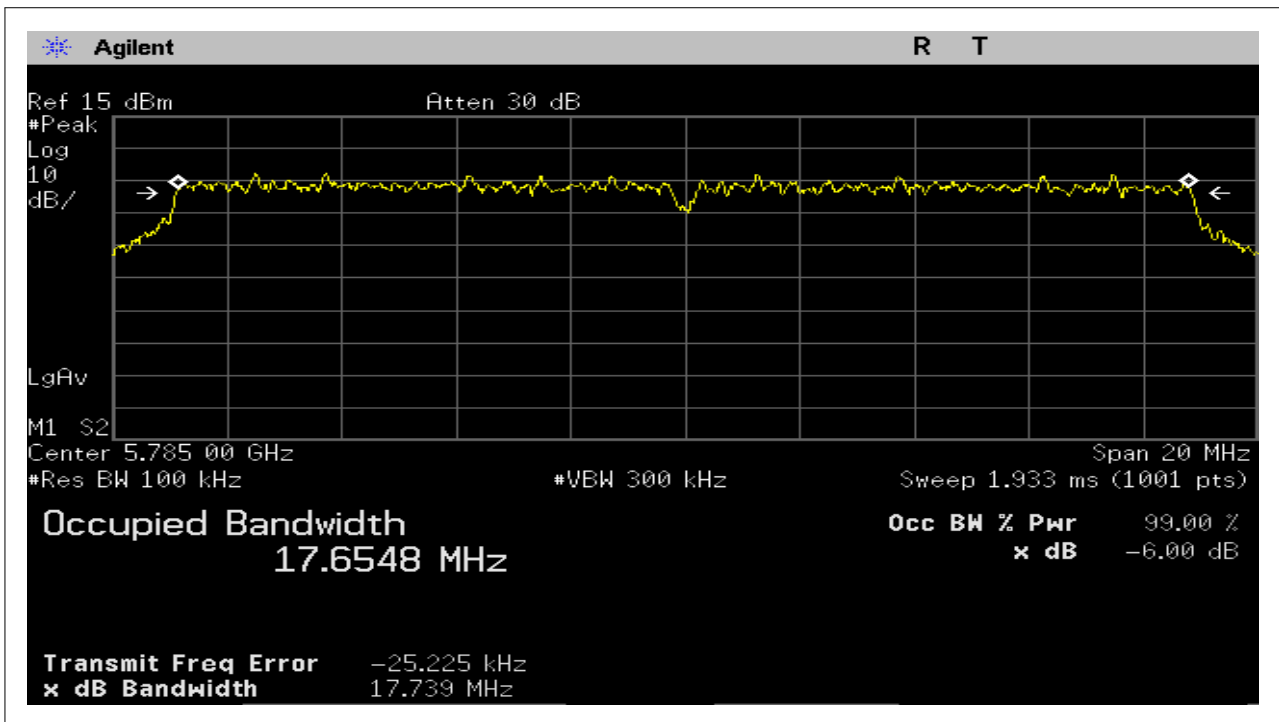
draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

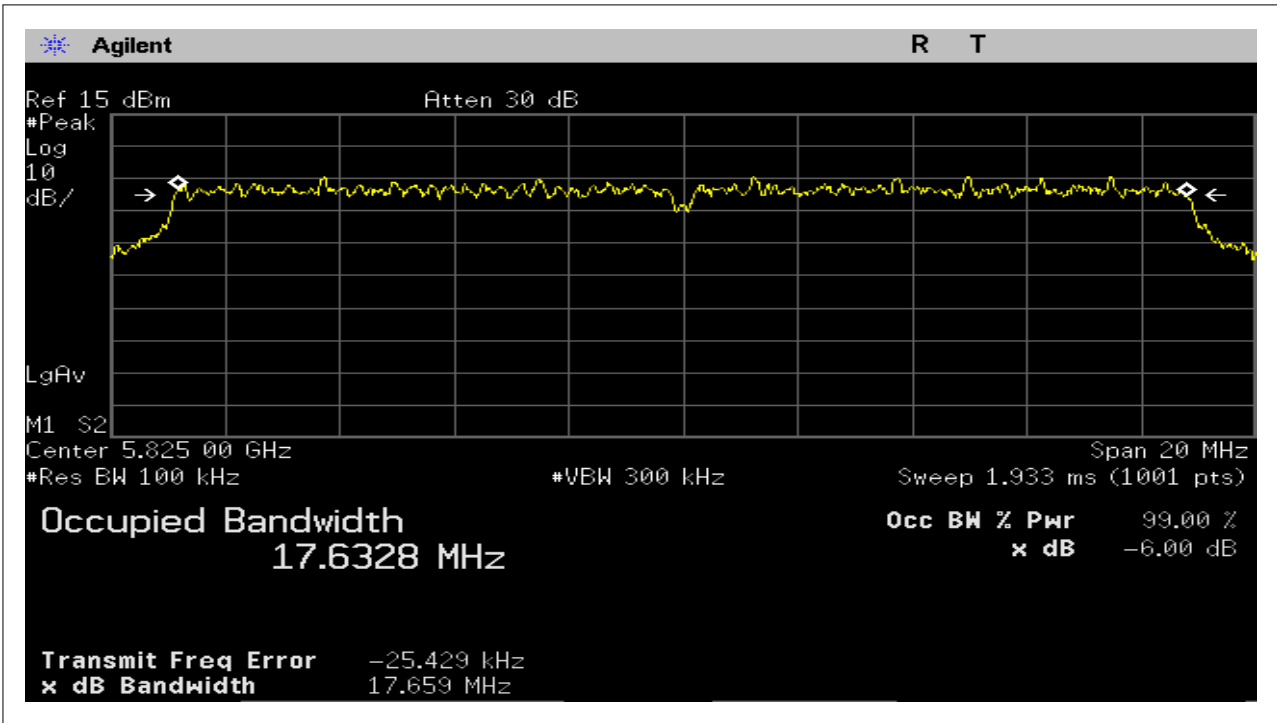
CH Low



CH Mid



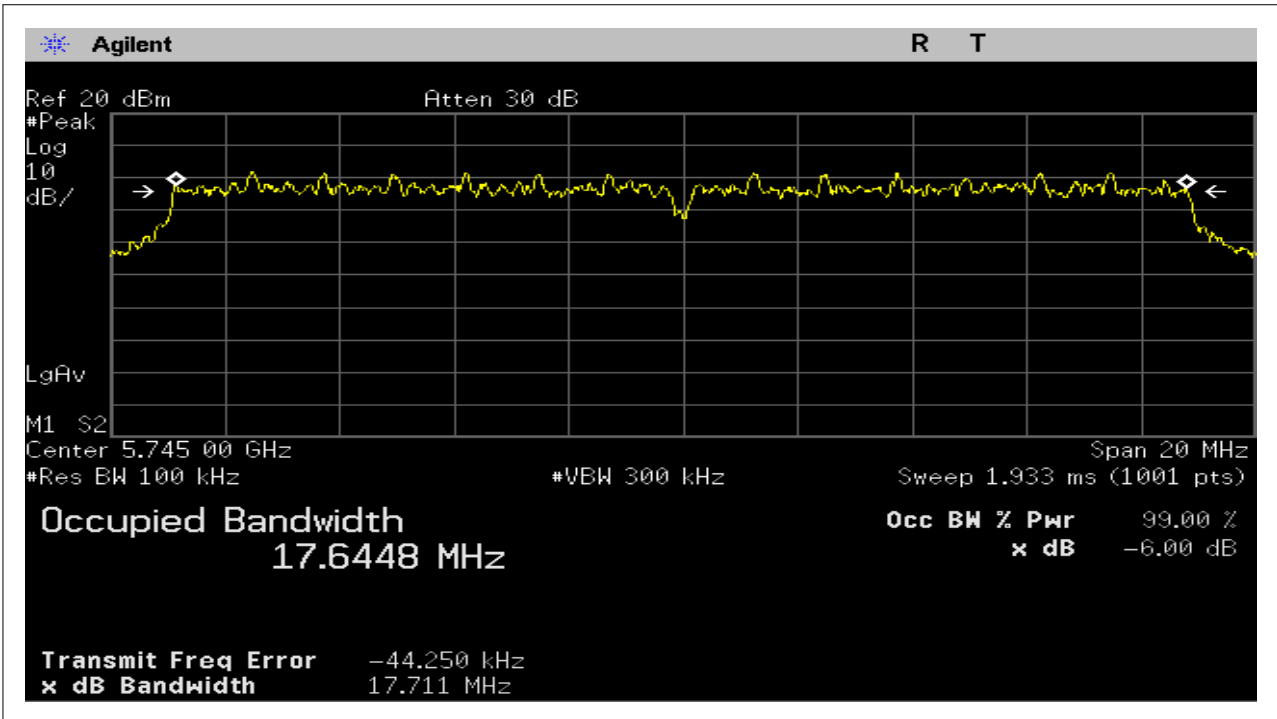
CH High



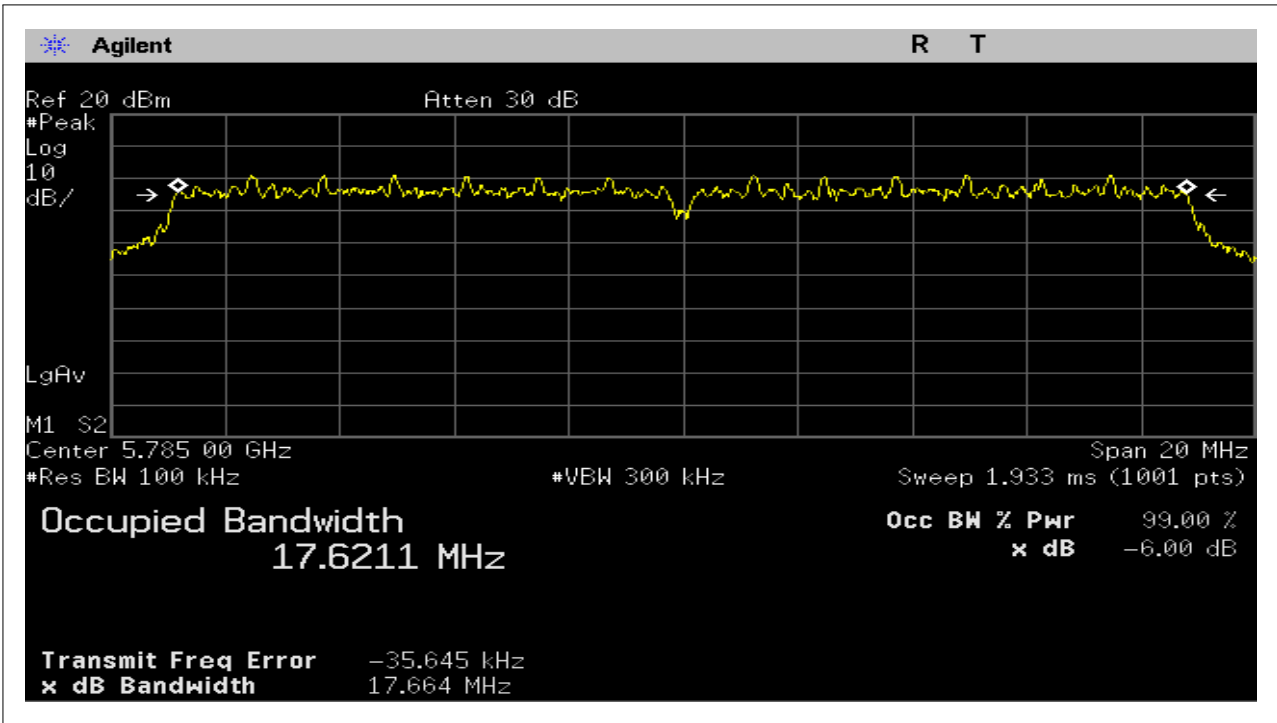
draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

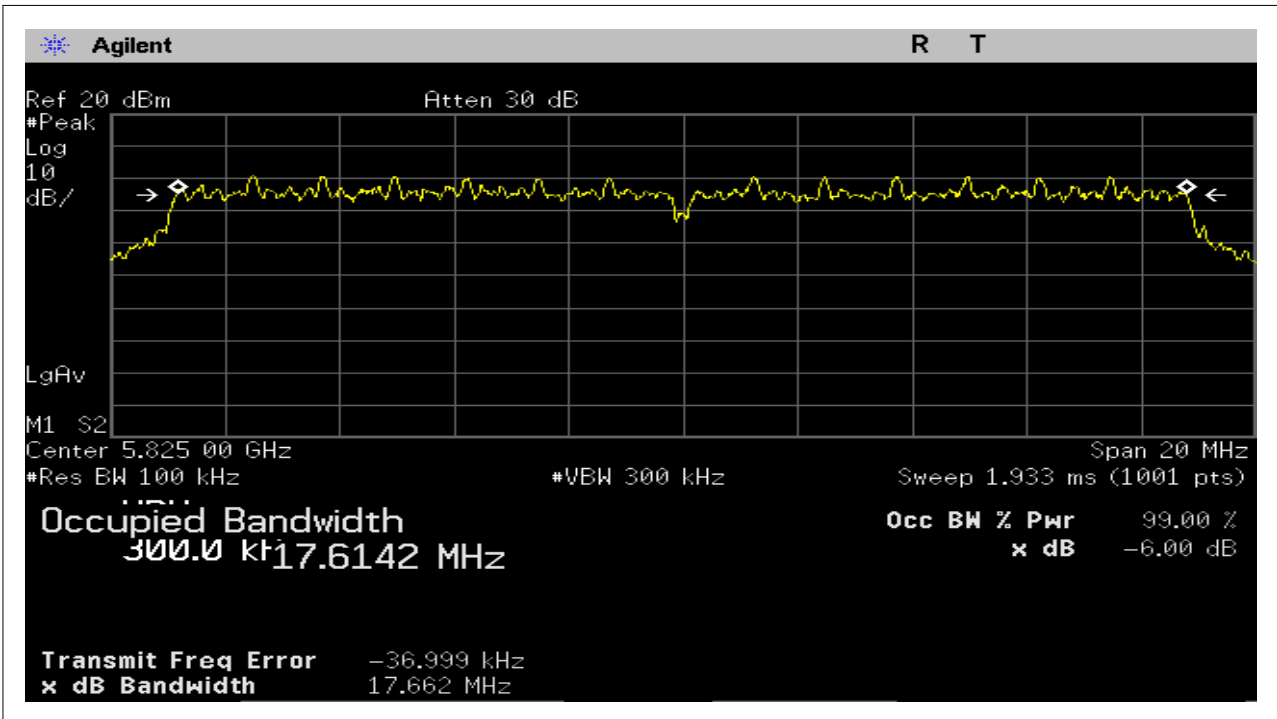
CH Low



CH Mid



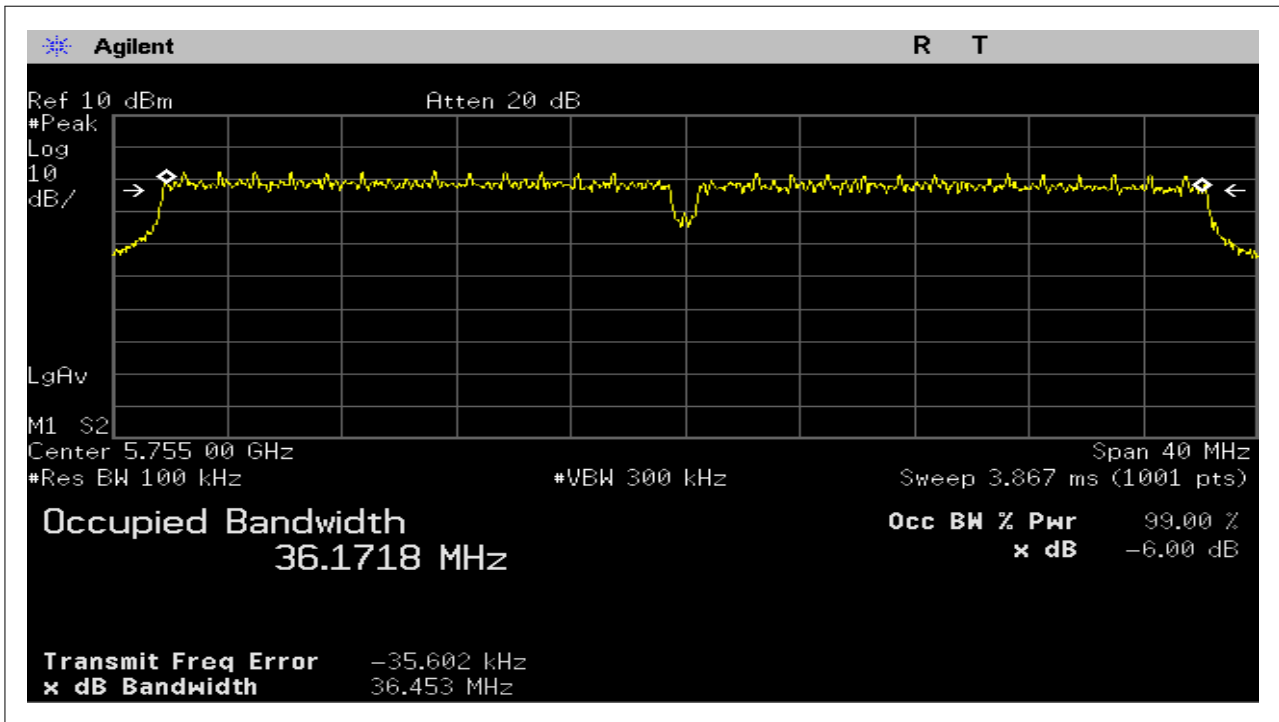
CH High



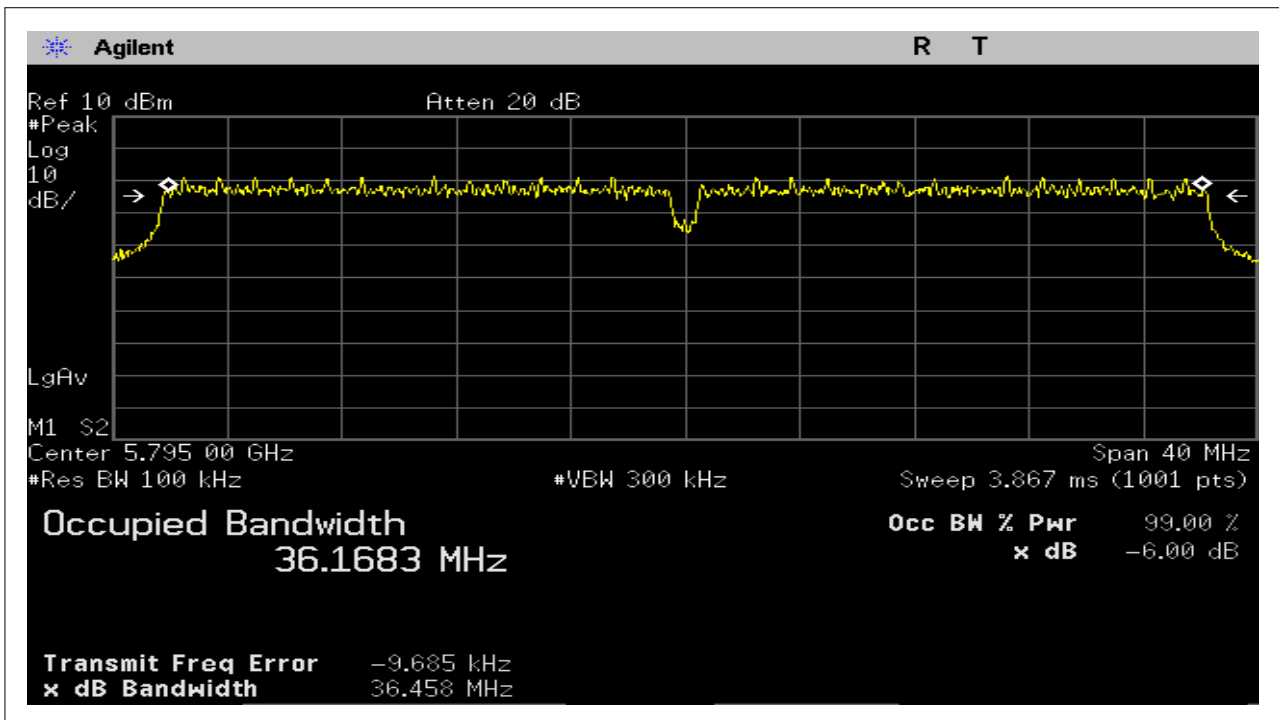
draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

CH Low



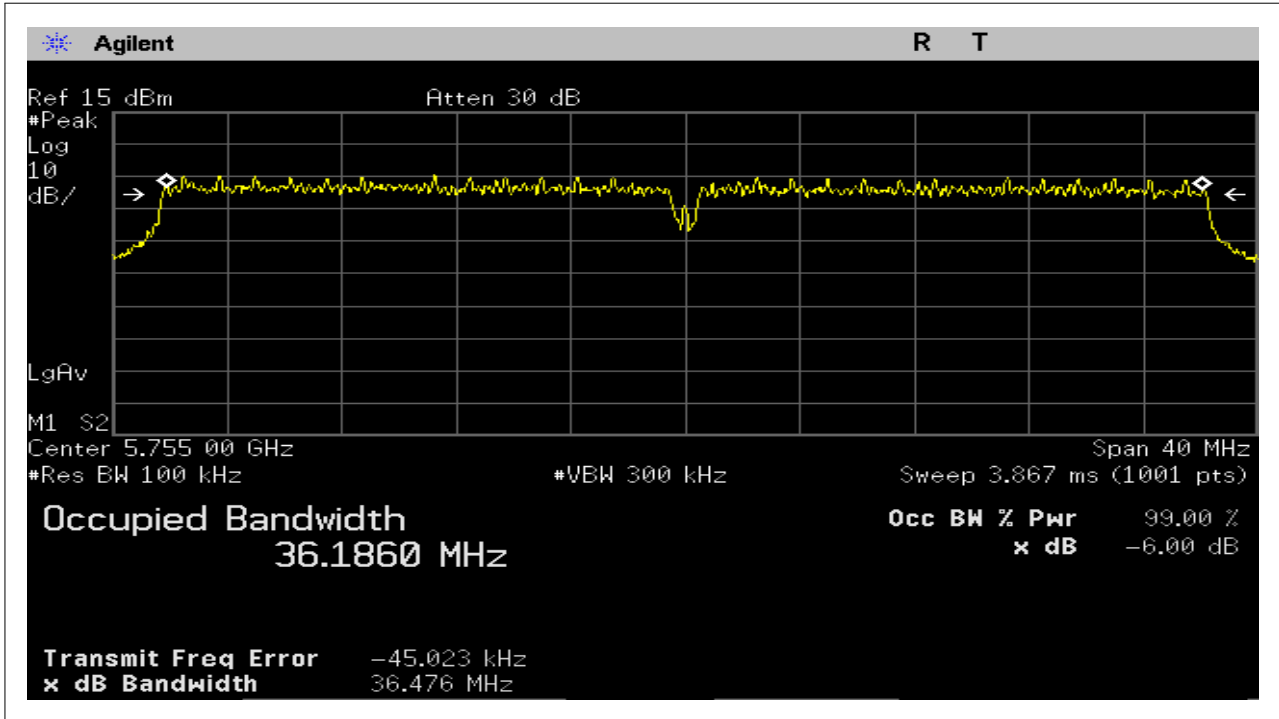
CH High



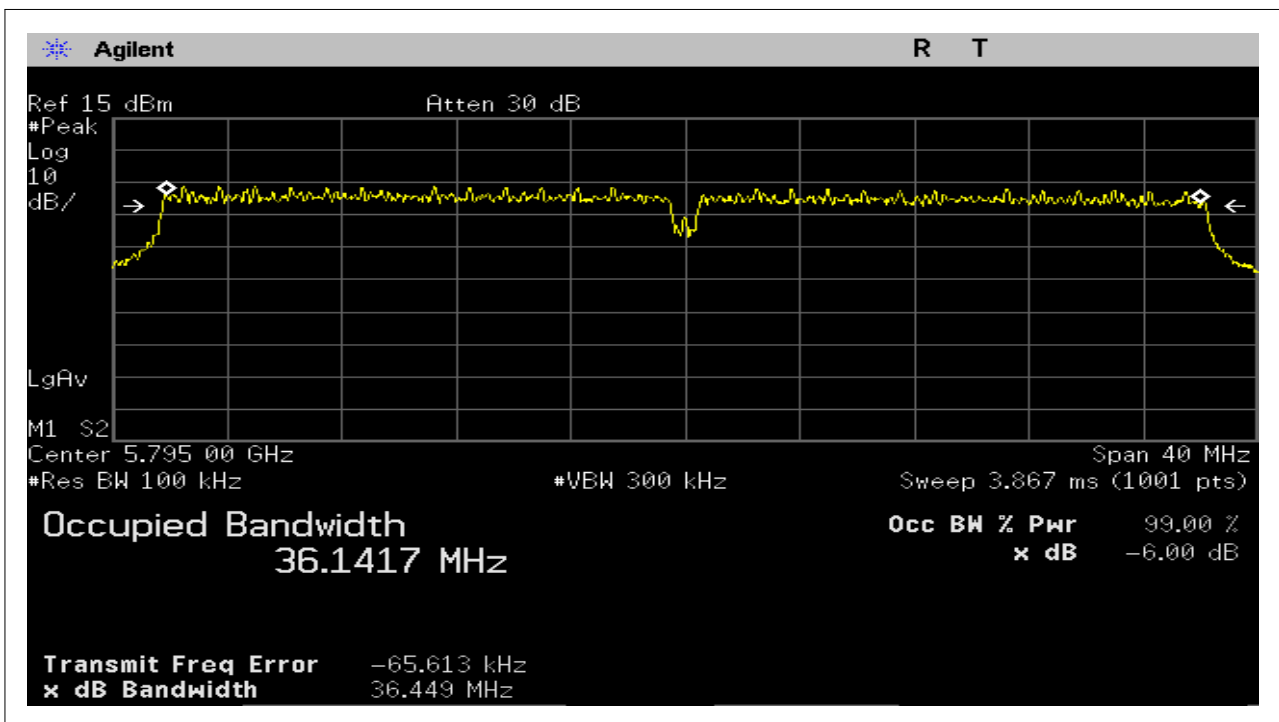
draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

CH Low



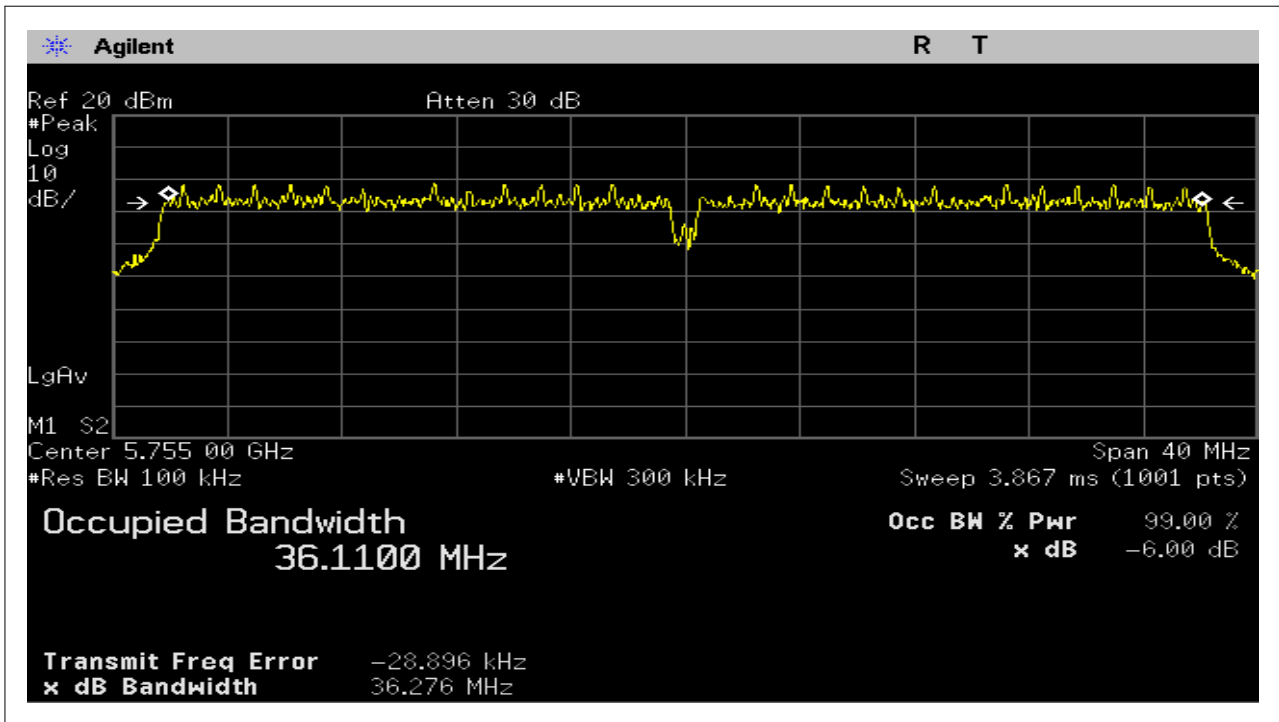
CH High



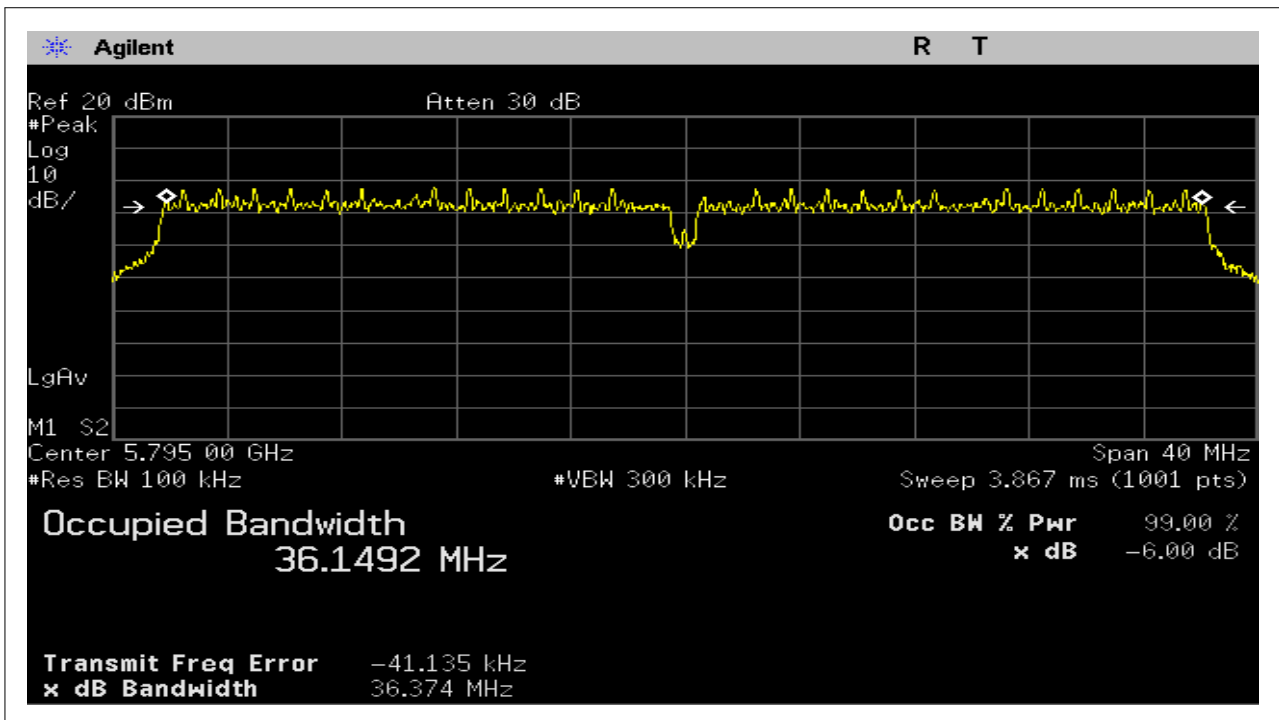
draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

CH Low



CH High



## 7.2. Maximum Conducted Output Power

### LIMIT

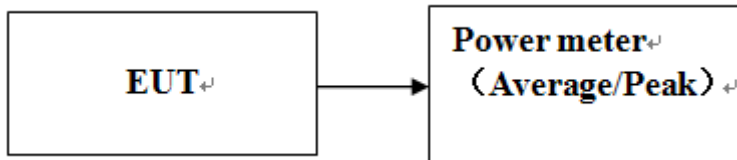
According to §15.407(a),

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

The peak power shall not exceed the limit as follow:

### Test Configuration



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

### TEST PROCEDURE

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor,  $10 \log(1/x)$ , where  $x$  is the duty cycle.

### TEST RESULTS

No non-compliance noted



Test Data

Test mode: IEEE 802.11a mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.19             | 2.67                          | 30          |
| Mid     | 5785            | 0.19             | 2.42                          | 30          |
| High    | 5825            | 0.19             | 1.85                          | 30          |

Test mode: IEEE 802.11a mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.20             | 6.05                          | 30          |
| Mid     | 5785            | 0.20             | 4.51                          | 30          |
| High    | 5825            | 0.20             | 2.72                          | 30          |

Test mode: IEEE 802.11a mode / ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.18             | 8.97                          | 30          |
| Mid     | 5785            | 0.18             | 8.88                          | 30          |
| High    | 5825            | 0.18             | 8.73                          | 30          |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.20             | 2.93                          | 30          |
| Mid     | 5785            | 0.20             | 2.19                          | 30          |
| High    | 5825            | 0.20             | 1.68                          | 30          |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.20             | 5.69                          | 30          |
| Mid     | 5785            | 0.20             | 3.82                          | 30          |
| High    | 5825            | 0.20             | 3.13                          | 30          |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.32             | 8.11                          | 30          |
| Mid     | 5785            | 0.32             | 7.88                          | 30          |
| High    | 5825            | 0.32             | 7.45                          | 30          |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.34             | -0.26                         | 30          |
| High    | 5785            | 0.34             | -1.57                         | 30          |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.35             | 1.95                          | 30          |
| High    | 5785            | 0.35             | 1.57                          | 30          |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average Conducted Power (dBm) | Limit (dBm) |
|---------|-----------------|------------------|-------------------------------|-------------|
| Low     | 5745            | 0.53             | 4.71                          | 30          |
| High    | 5785            | 0.53             | 3.93                          | 30          |

**Note:** Measured power(dBm) has offset with cable loss and duty factor

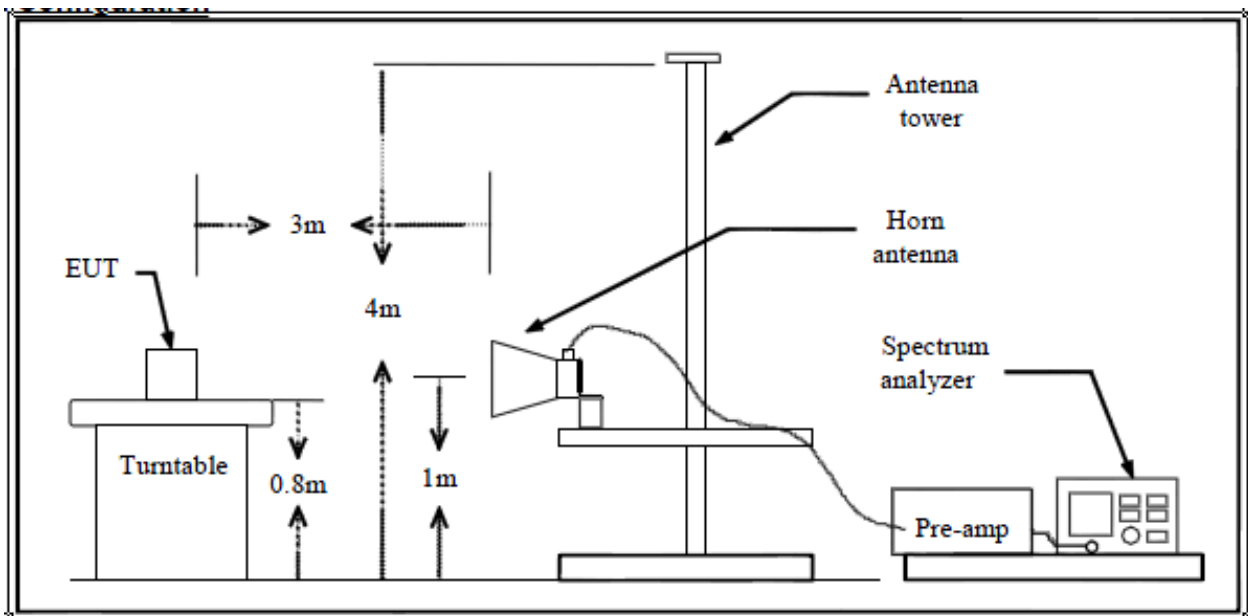
### 7.3. Band Edges Measurement

#### LIMIT

According to §15.407(b),

- (1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
- (2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

#### Test Configuration



#### TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m 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 / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

#### TEST RESULTS

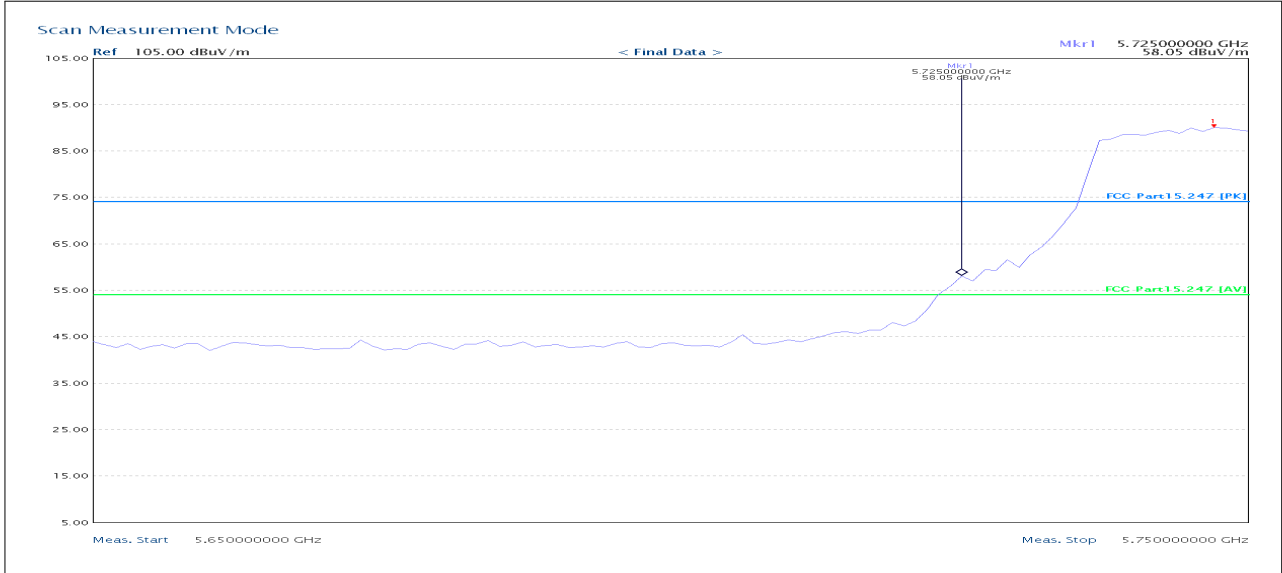
Refer to attach spectrum analyzer data chart.

Band Edges (draft 802.11a mode) / ANT 1

5745MHz

Detector mode: Peak

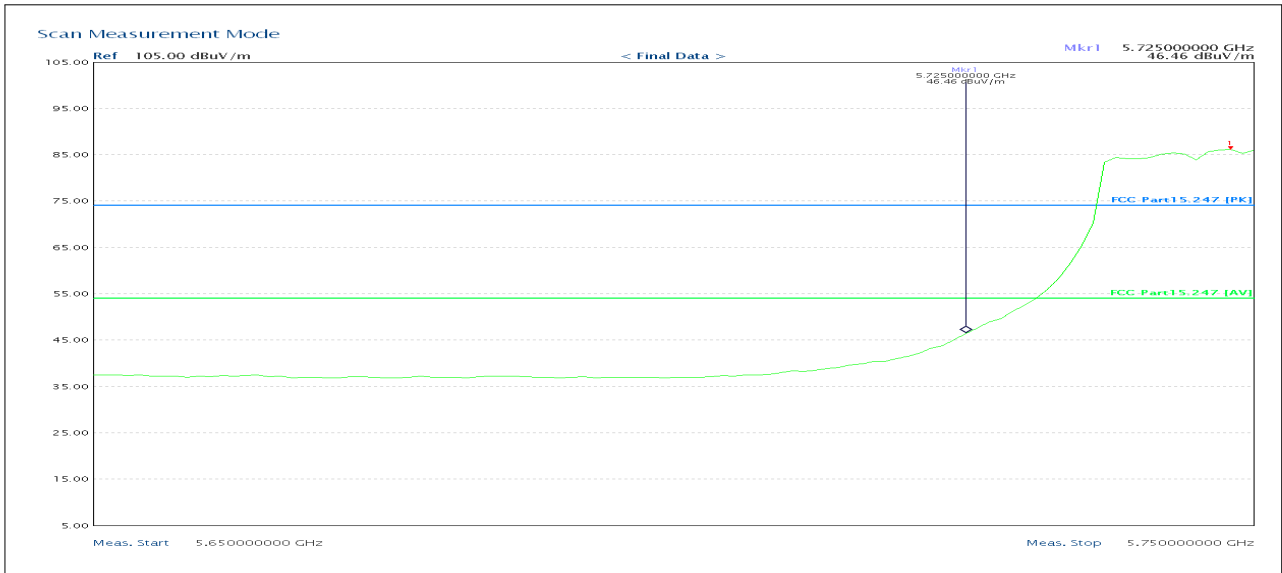
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 58.05           | 74.00          | 15.95       |

Detector mode: Average

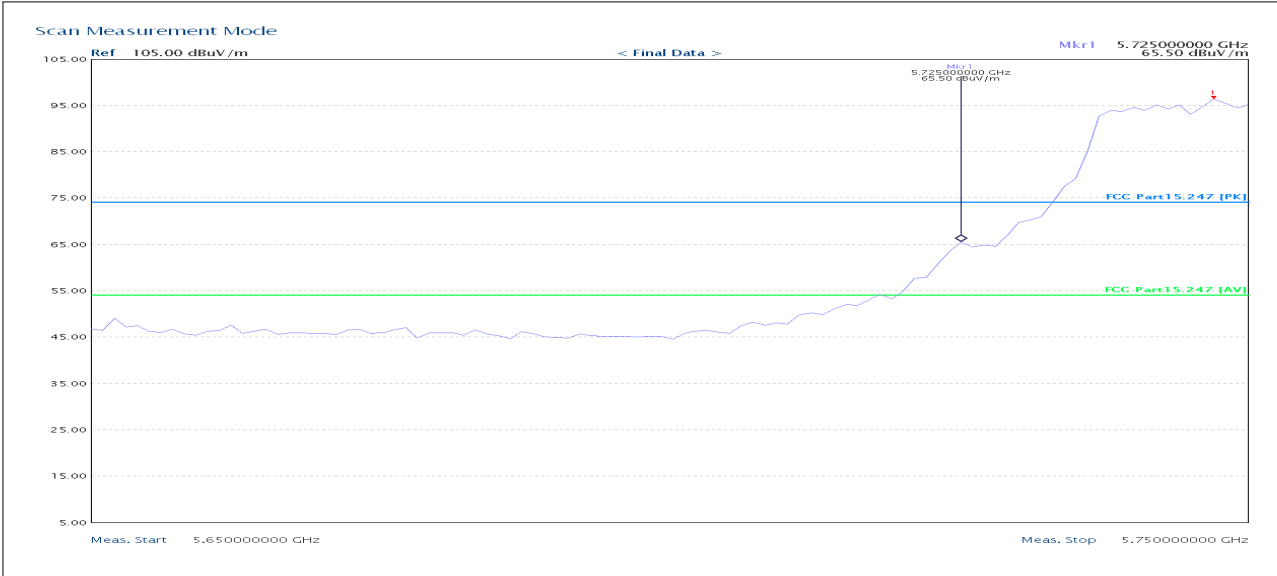
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 46.46           | 54.00          | 7.54        |

Detector mode: Peak

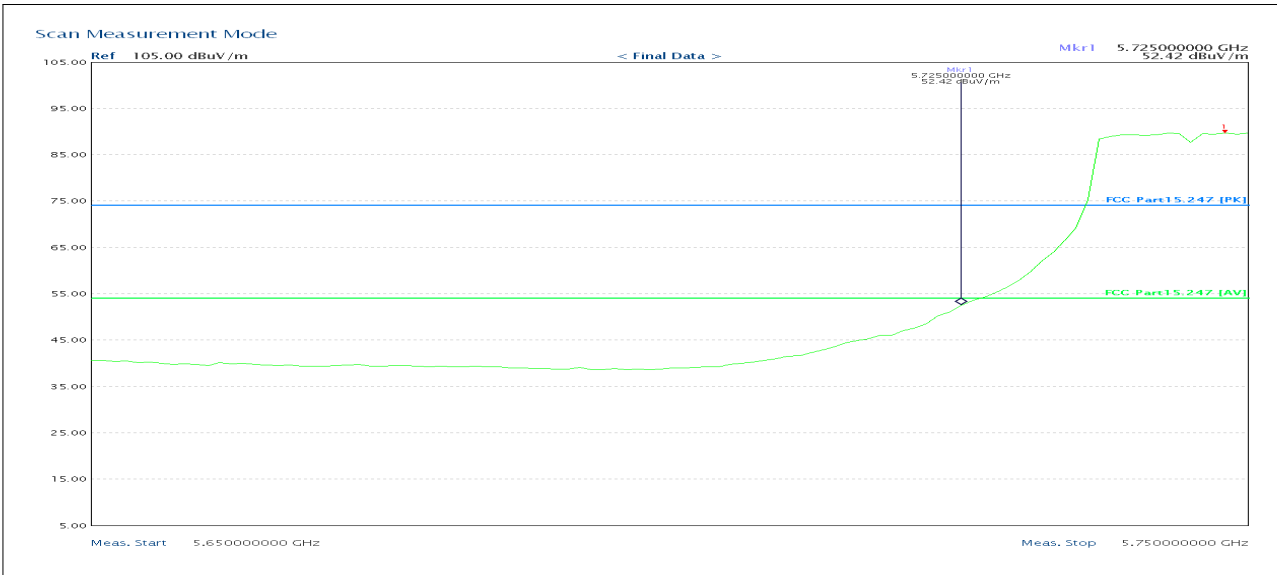
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 65.50           | 74.00          | 8.50        |

Detector mode: Average

Polarity: Horizontal



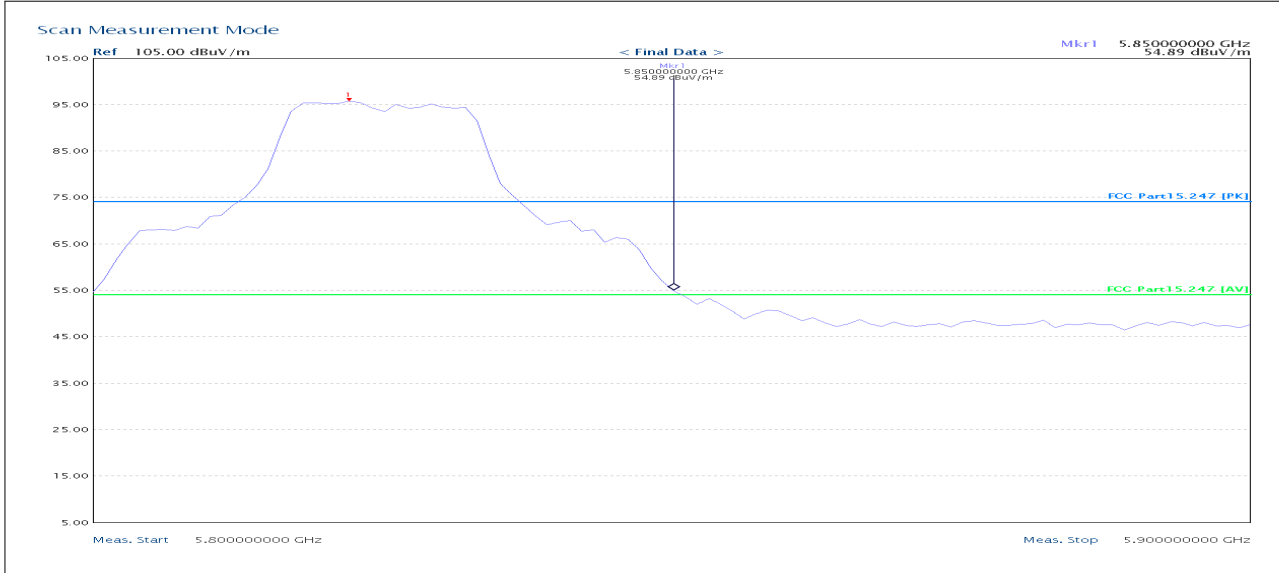
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.42           | 54.00          | 1.58        |

Band Edges (draft 802.11a mode) / ANT 1

5825MHz

Detector mode: Peak

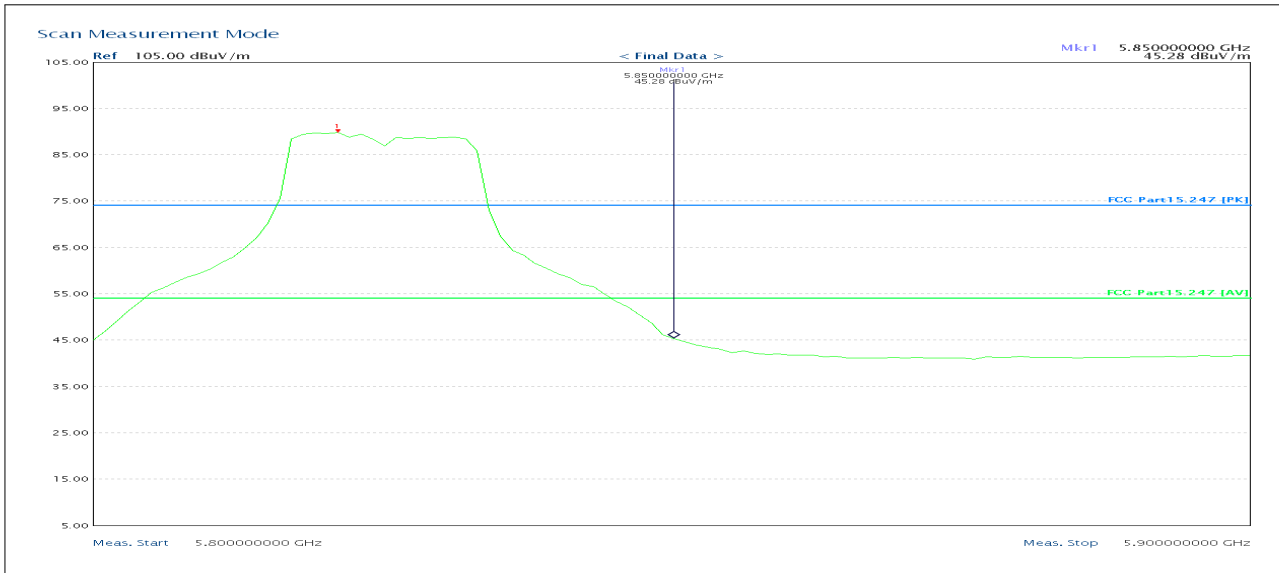
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 54.89           | 74.00          | 19.11       |

Detector mode: Average

Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 45.28           | 54.00          | 8.72        |

Detector mode: Peak

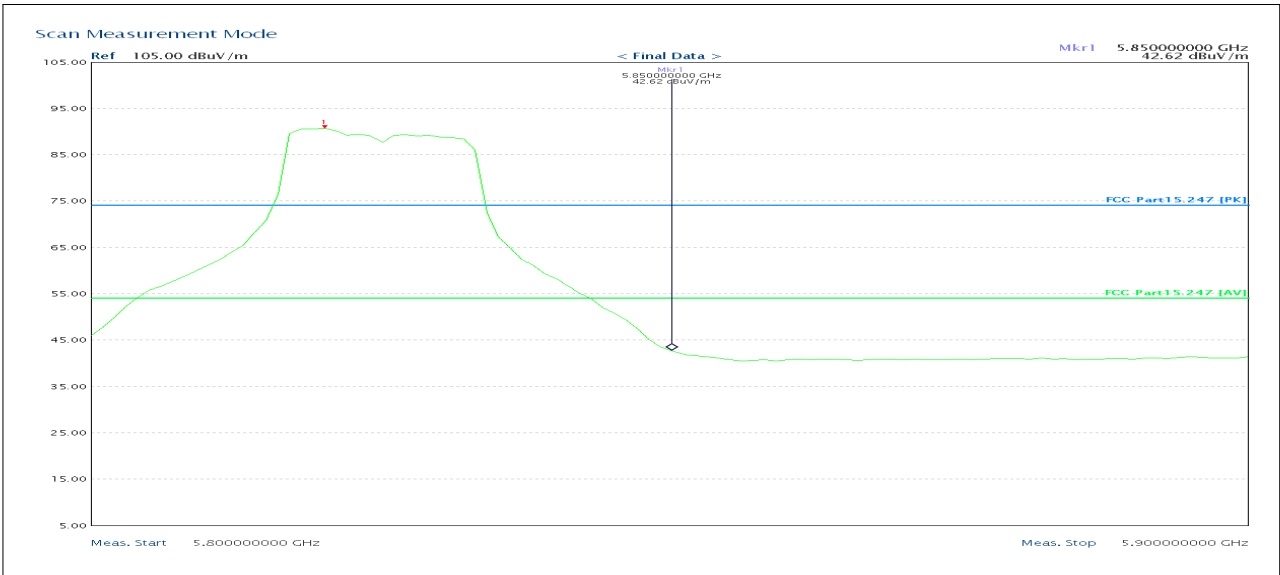
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 49.49           | 74.00          | 24.51       |

Detector mode: Average

Polarity: Horizontal



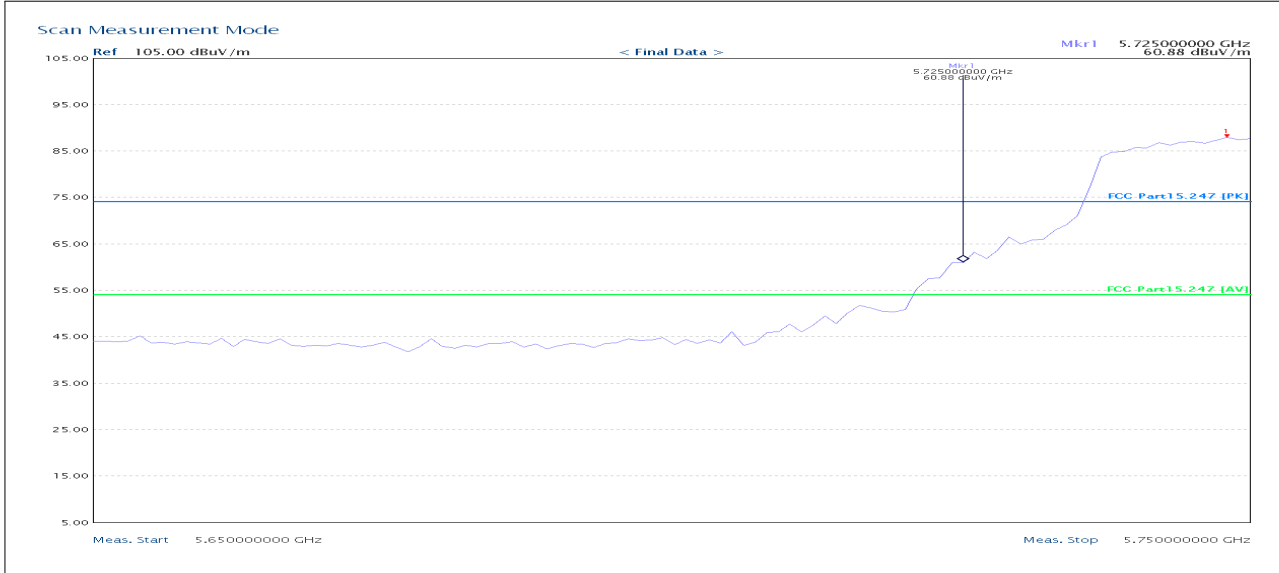
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 42.62           | 54.00          | 11.38       |

Band Edges (draft 802.11a mode) / ANT 2

5745MHz

Detector mode: Peak

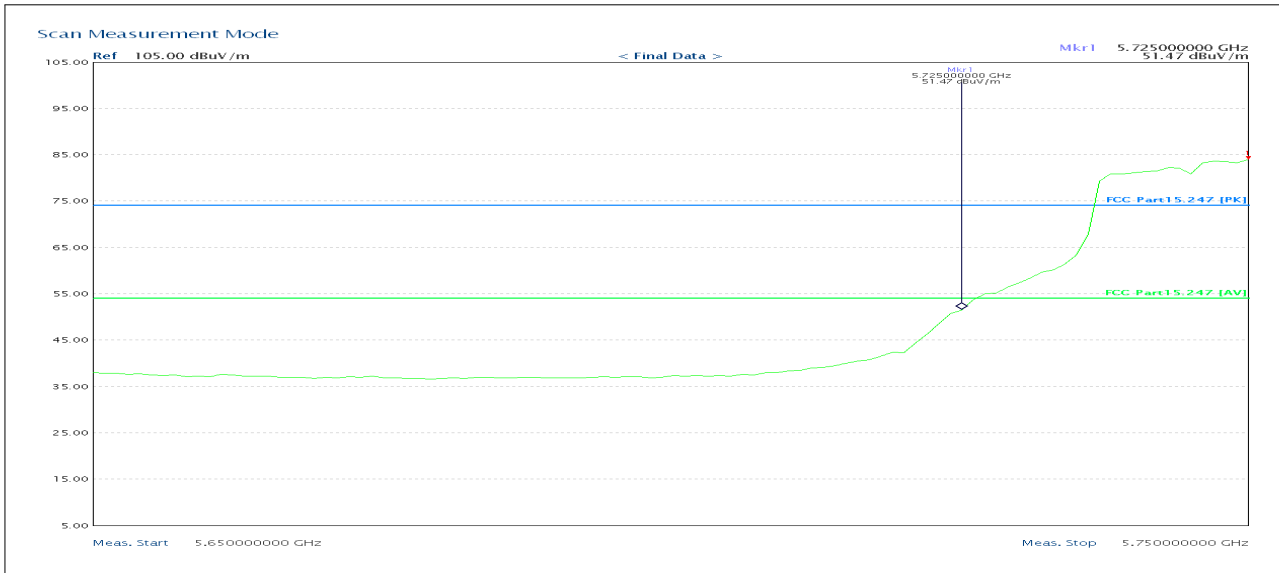
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 60.88           | 74.00          | 13.12       |

Detector mode: Average

Polarity: Vertical

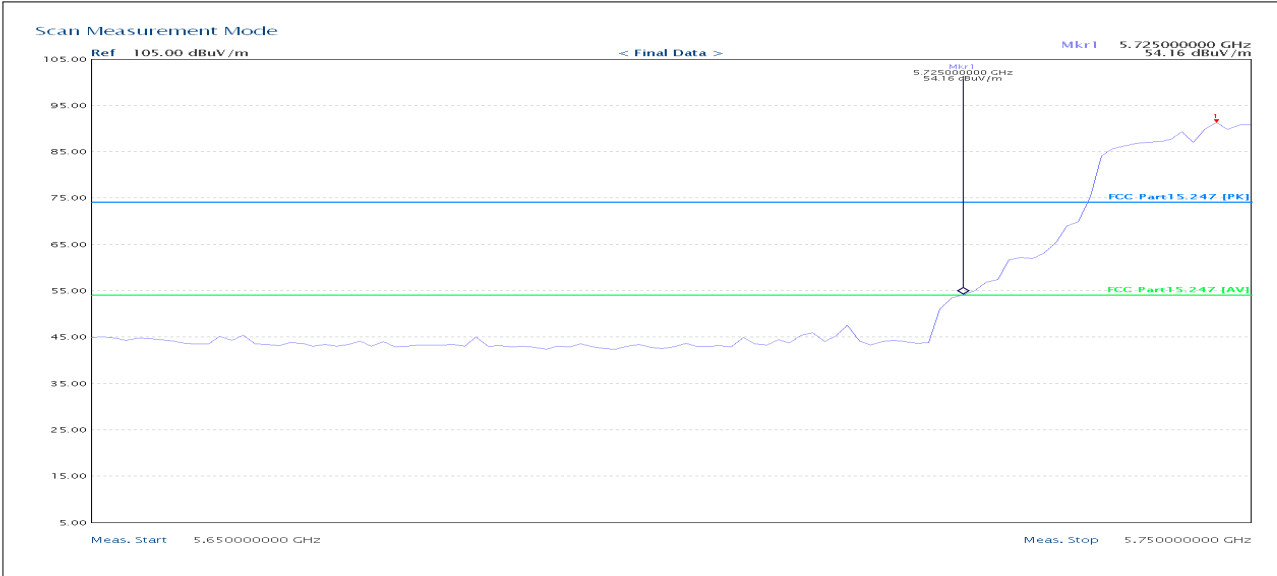


| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 51.47           | 54.00          | 2.53        |



Detector mode: Peak

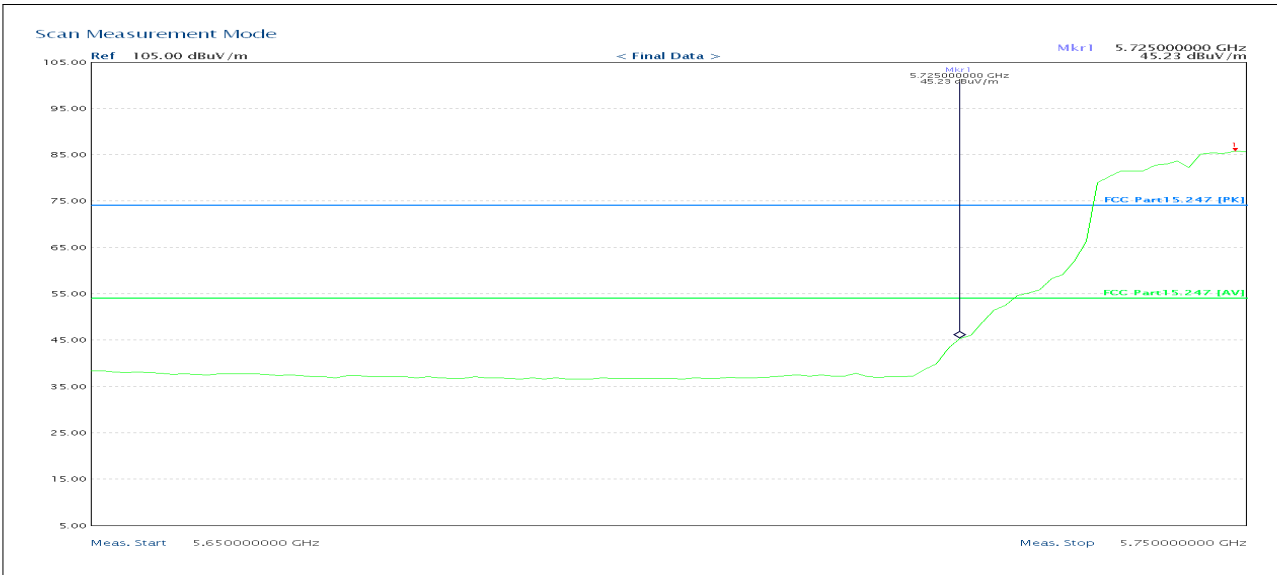
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 54.16           | 74.00          | 19.84       |

Detector mode: Average

Polarity: Horizontal



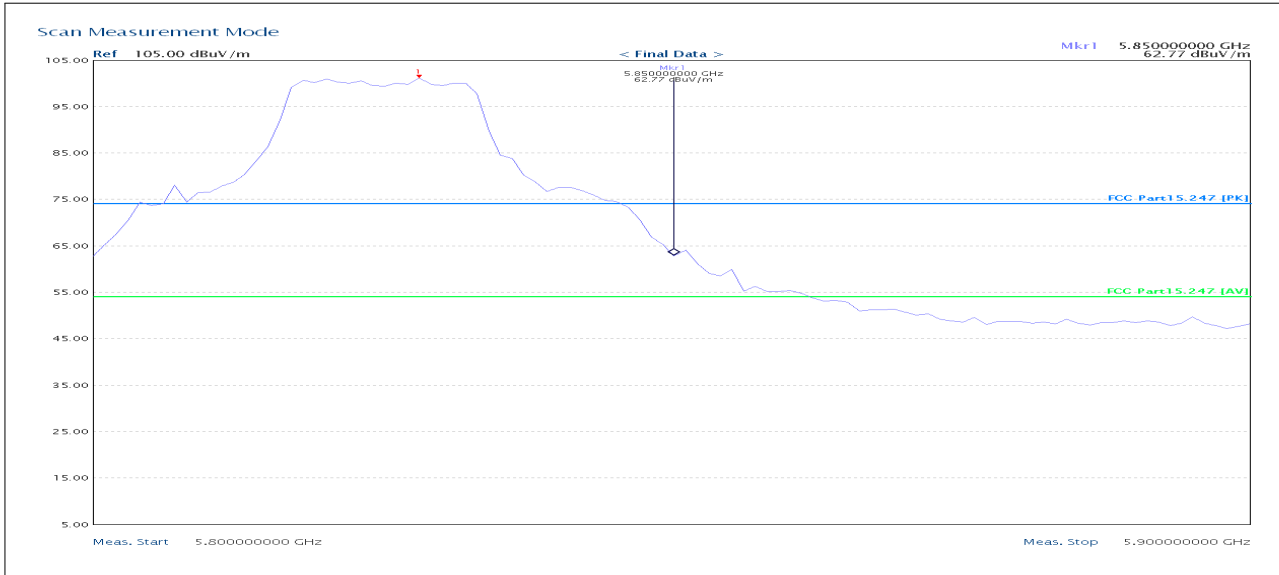
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 45.23           | 54.00          | 8.77        |

Band Edges (draft 802.11a mode) / ANT 2

5825MHz

Detector mode: Peak

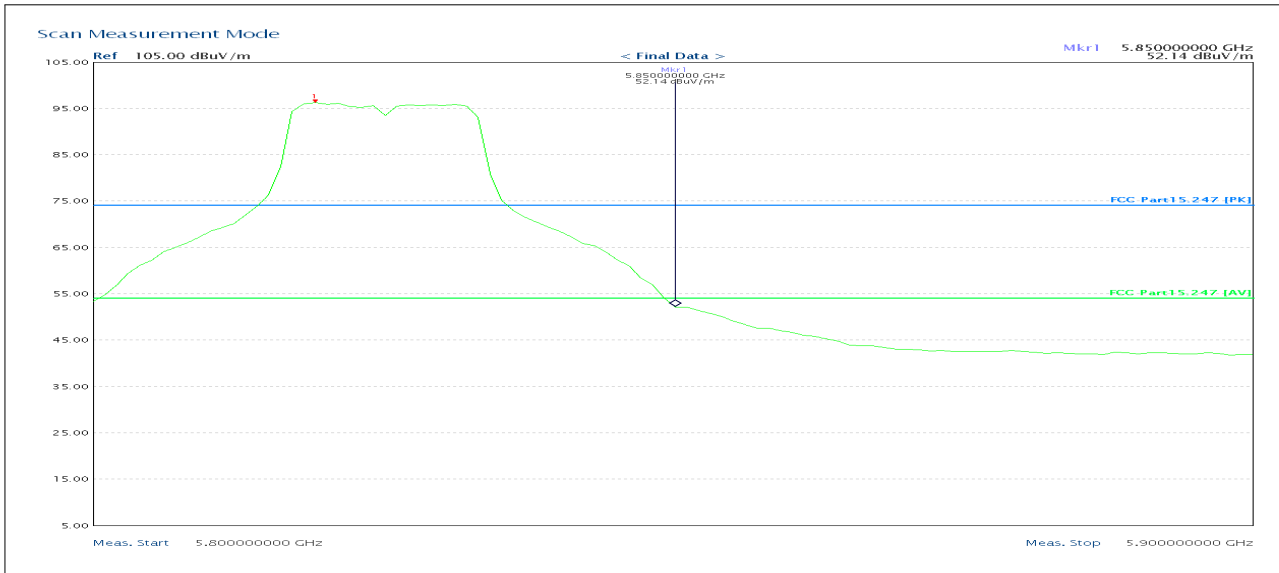
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 62.77           | 74.00          | 11.23       |

Detector mode: Average

Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.14           | 54.00          | 1.86        |

Detector mode: Peak

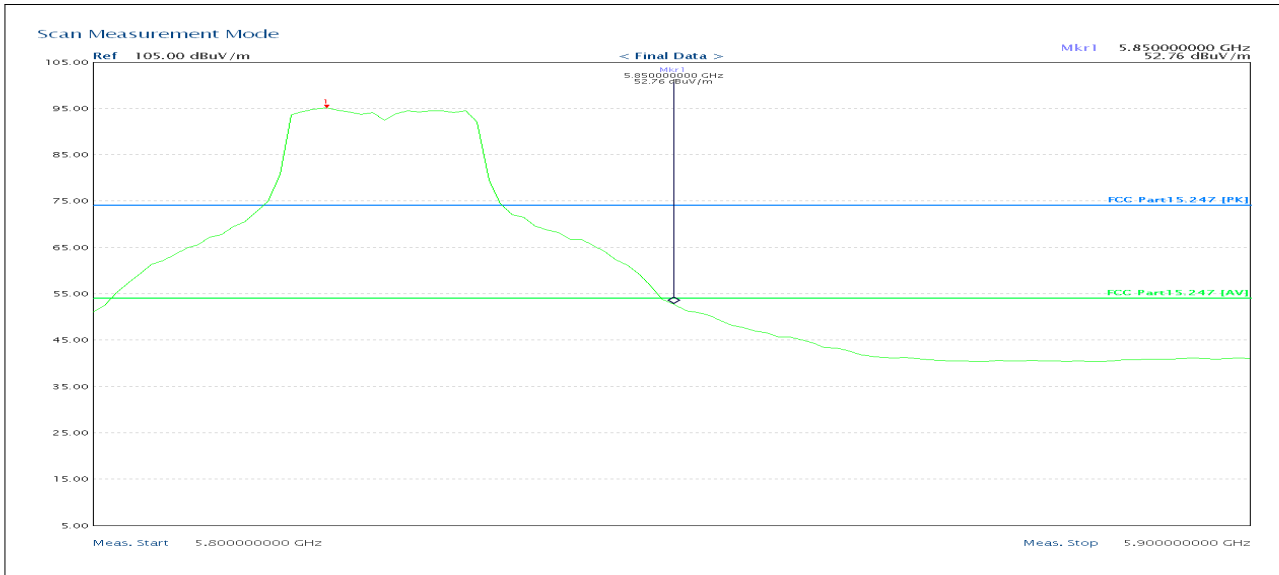
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 65.03           | 74.00          | 8.97        |

Detector mode: Average

Polarity: Horizontal



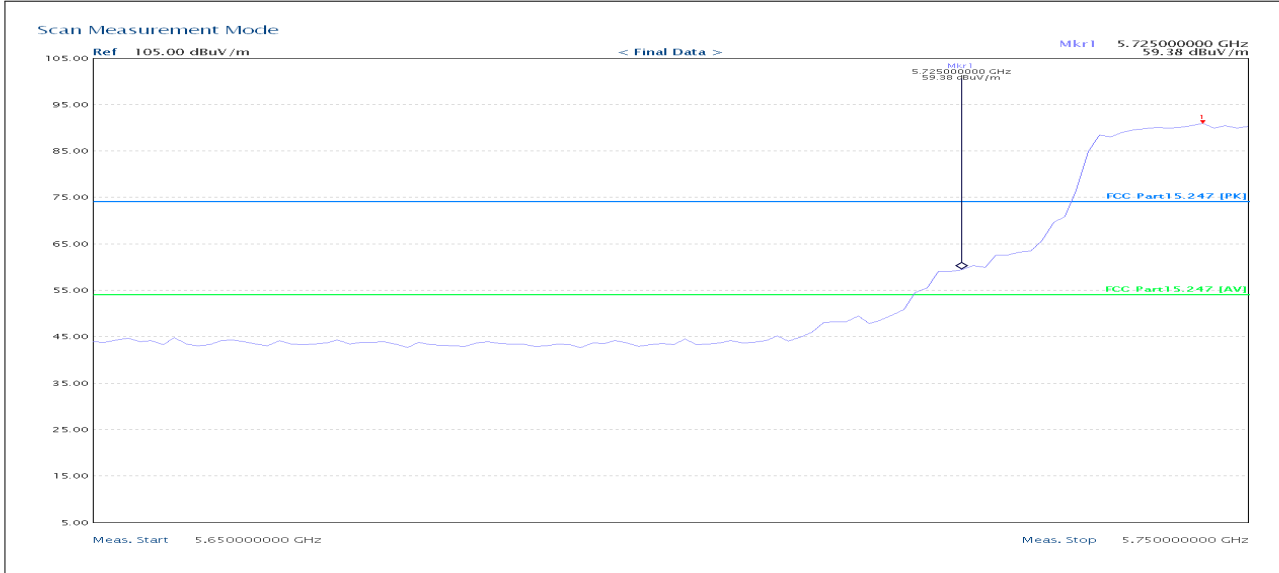
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.76           | 54.00          | 1.24        |

Band Edges (draft 802.11n Standard-20 MHz Channel mode) / ANT 1+2

5745MHz

Detector mode: Peak

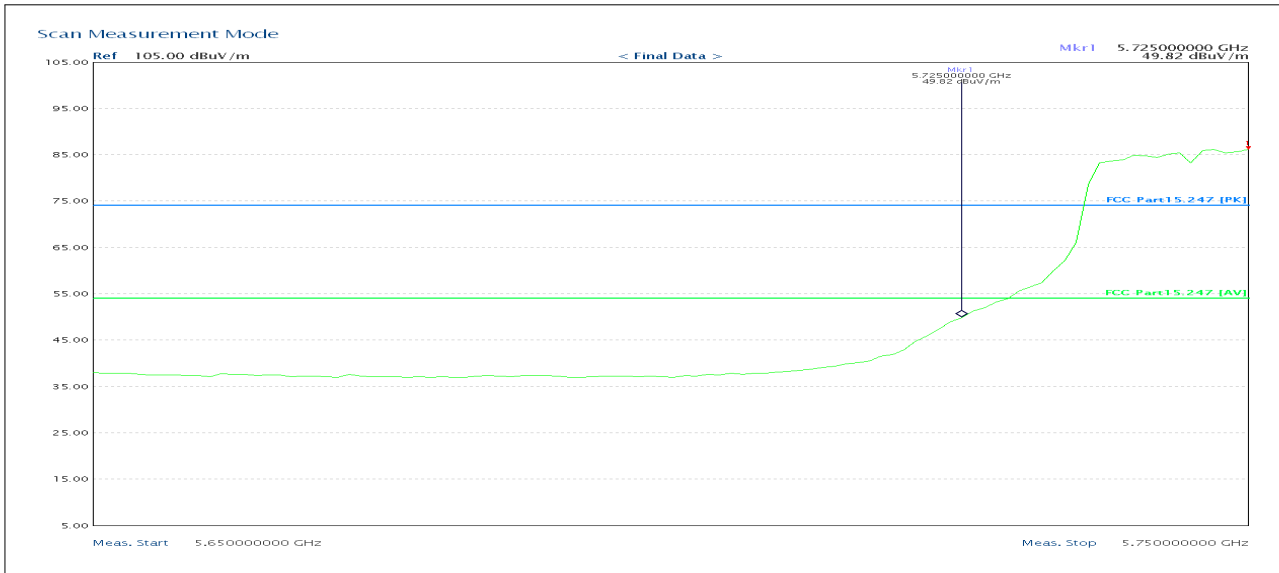
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 59.38           | 74.00          | 14.62       |

Detector mode: Average

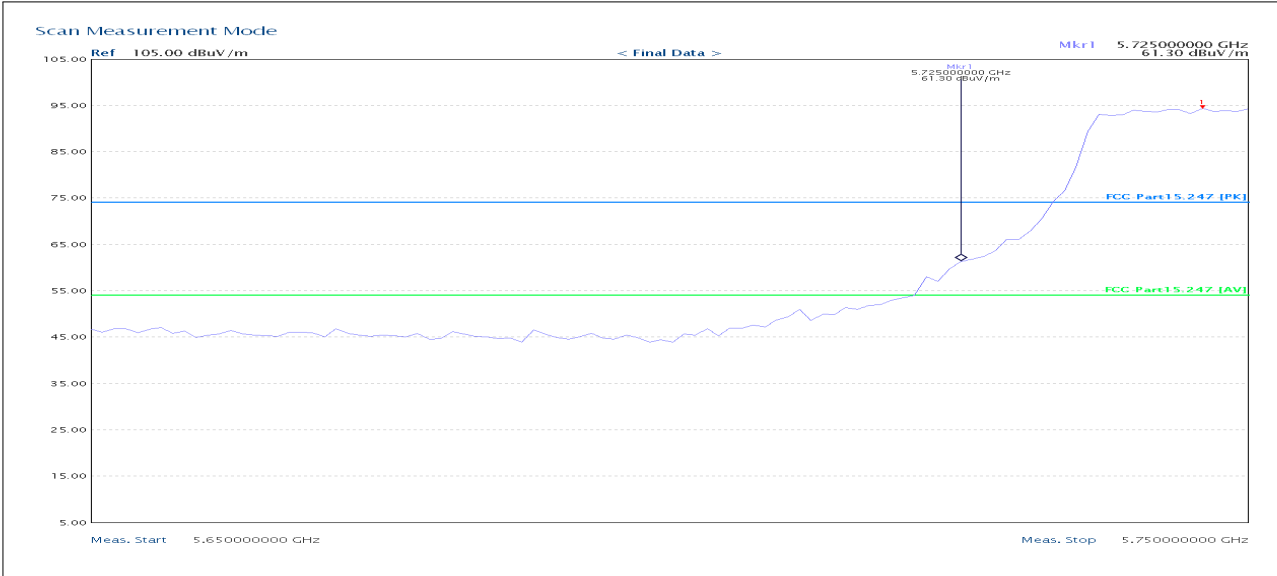
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 49.82           | 54.00          | 4.18        |

Detector mode: Peak

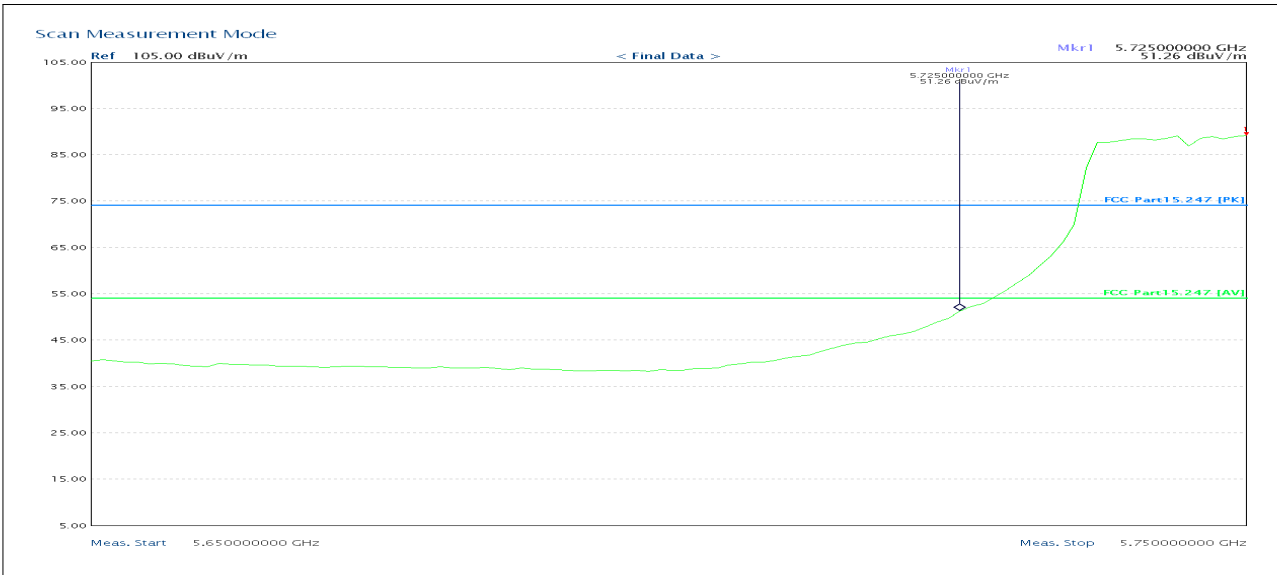
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 61.30           | 74.00          | 12.70       |

Detector mode: Average

Polarity: Horizontal



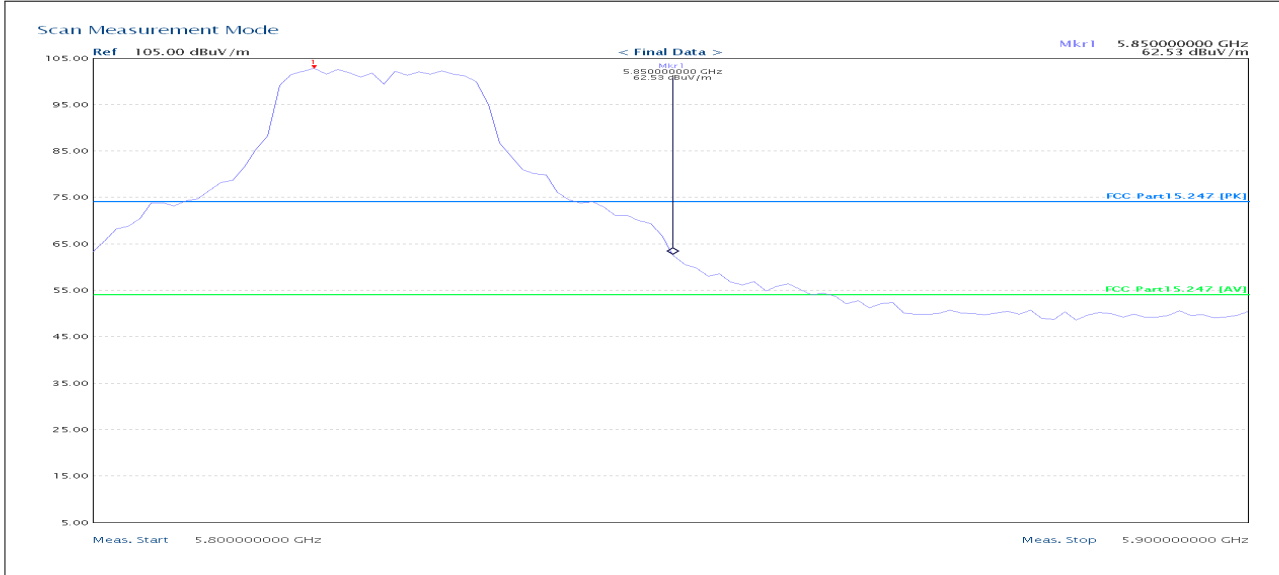
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 51.26           | 54.00          | 2.74        |

Band Edges (draft 802.11n Standard-20 MHz Channel mode) / ANT 1+2

5825MHz

Detector mode: Peak

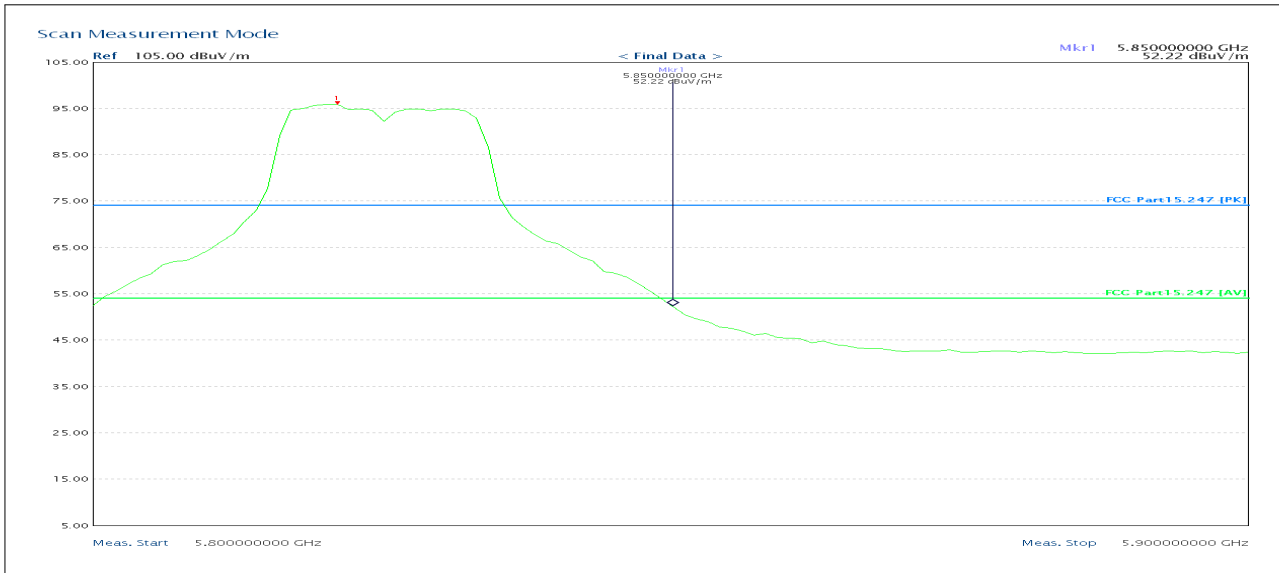
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 62.53           | 74.00          | 11.47       |

Detector mode: Average

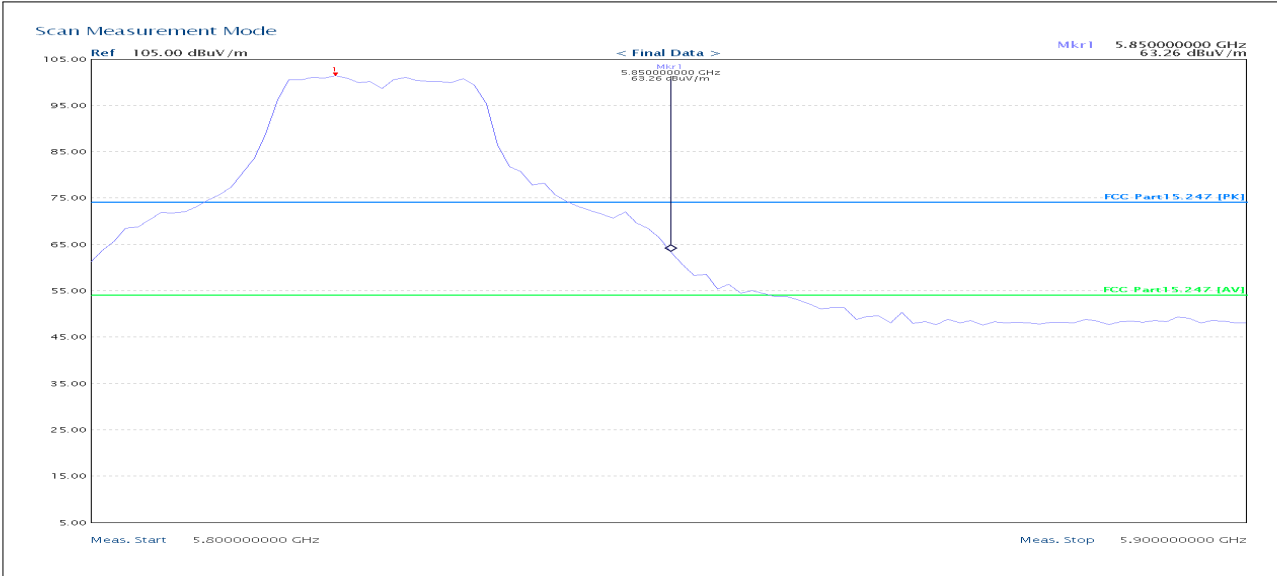
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.22           | 54.00          | 1.78        |

Detector mode: Peak

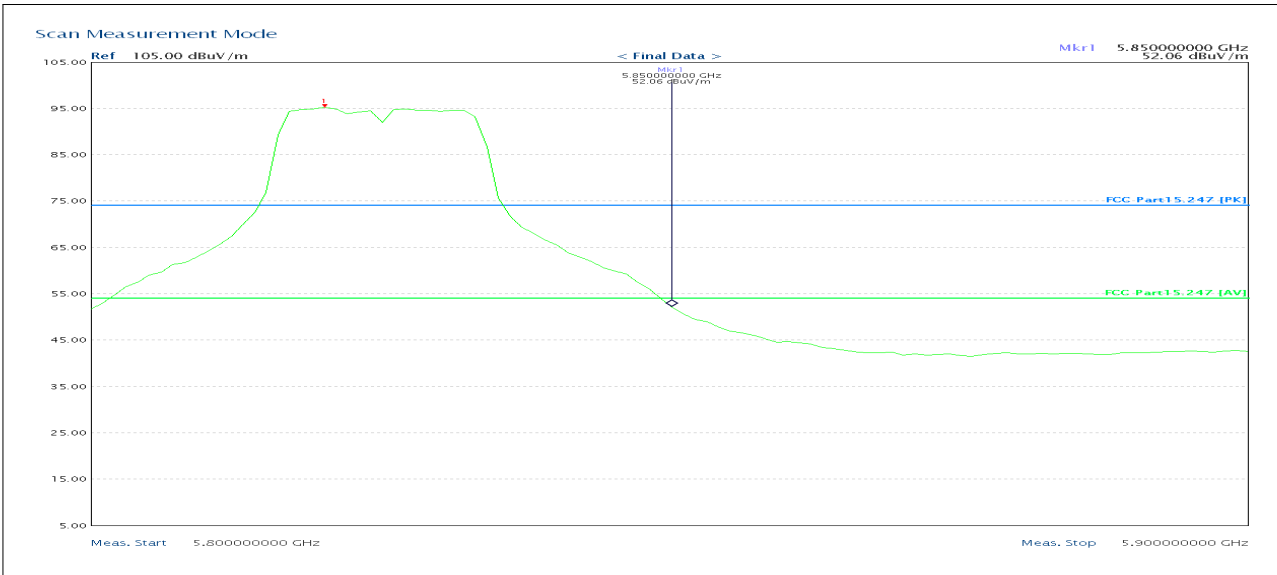
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 63.26           | 74.00          | 10.74       |

Detector mode: Average

Polarity: Horizontal



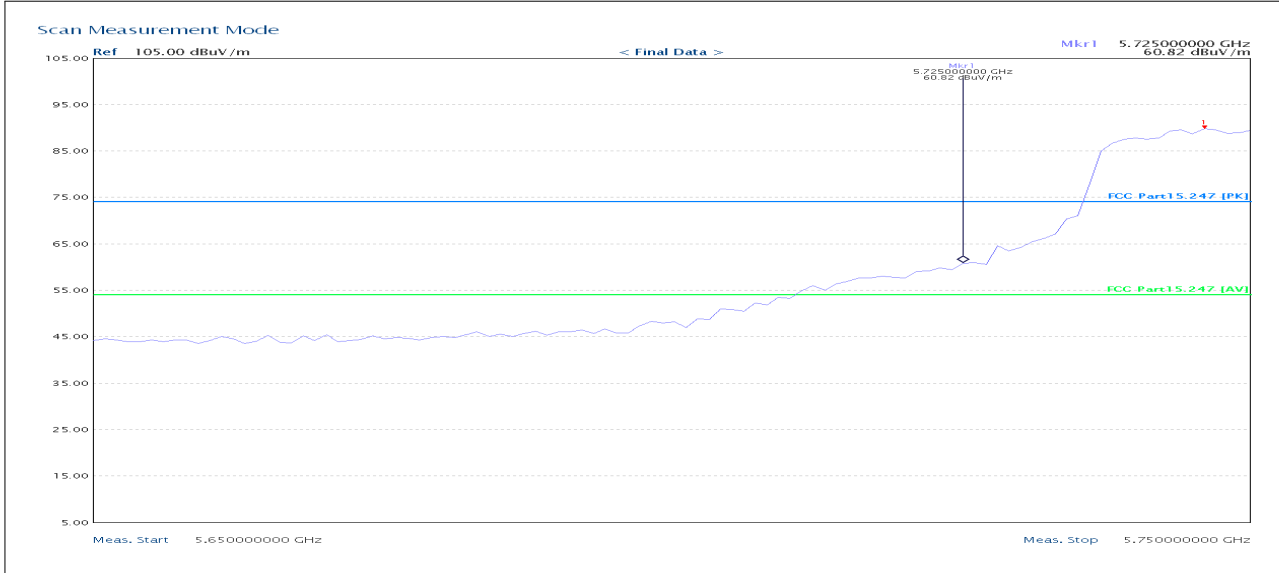
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.06           | 54.00          | 1.94        |

Band Edges (draft 802.11n Wide-40 MHz Channel mode) / ANT 1+2

5755MHz

Detector mode: Peak

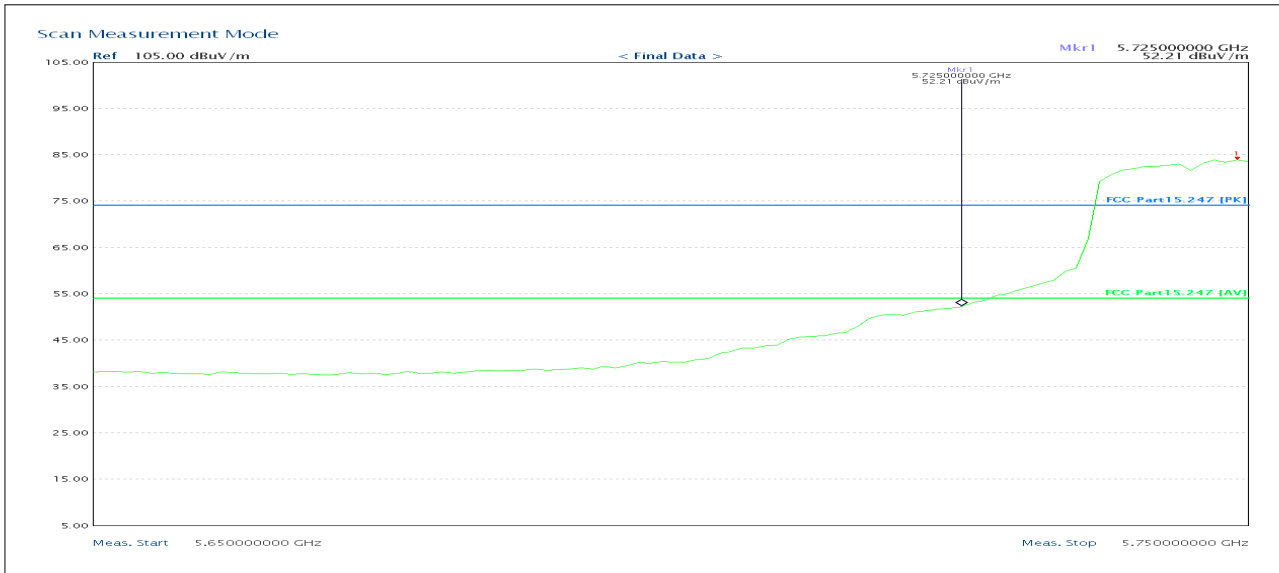
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 60.82           | 74.00          | 13.18       |

Detector mode: Average

Polarity: Vertical

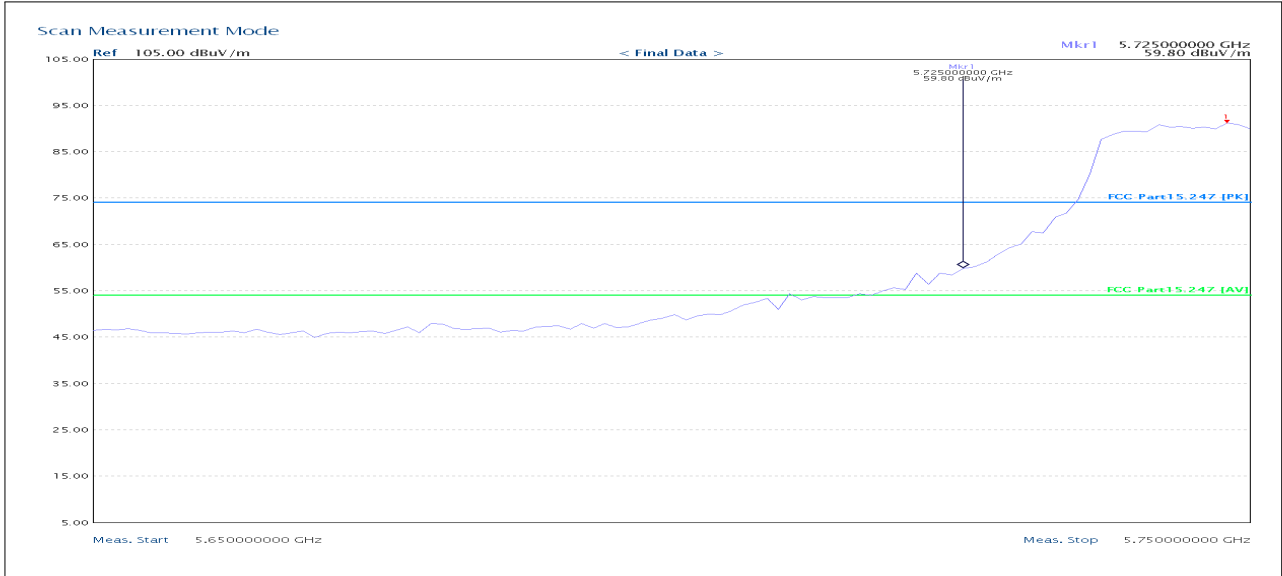


| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 52.21           | 54.00          | 1.79        |



Detector mode: Peak

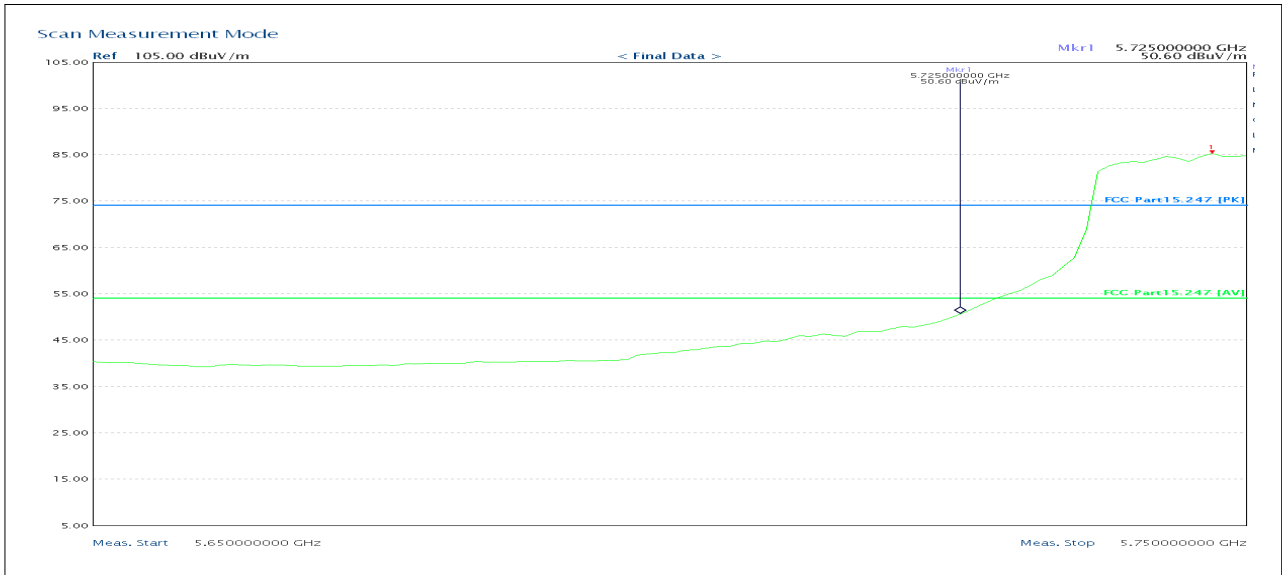
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 59.80           | 74.00          | 14.20       |

Detector mode: Average

Polarity: Horizontal



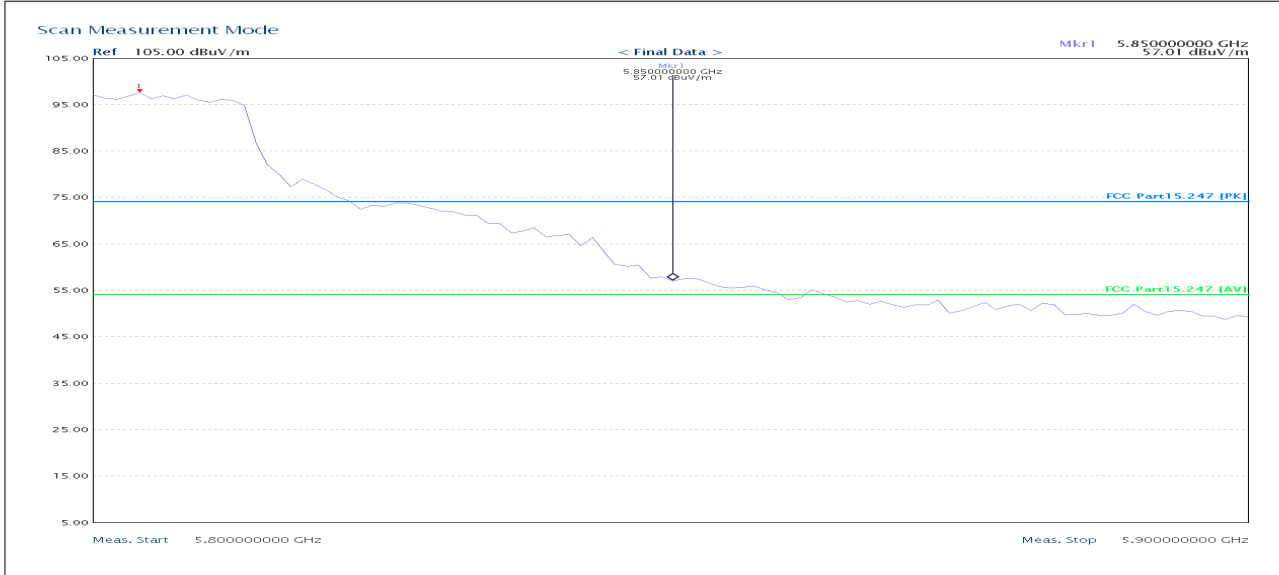
| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 50.60           | 54.00          | 3.40        |

Band Edges (draft 802.11n Wide-40 MHz Channel mode) / ANT 1+2

5795MHz

Detector mode: Peak

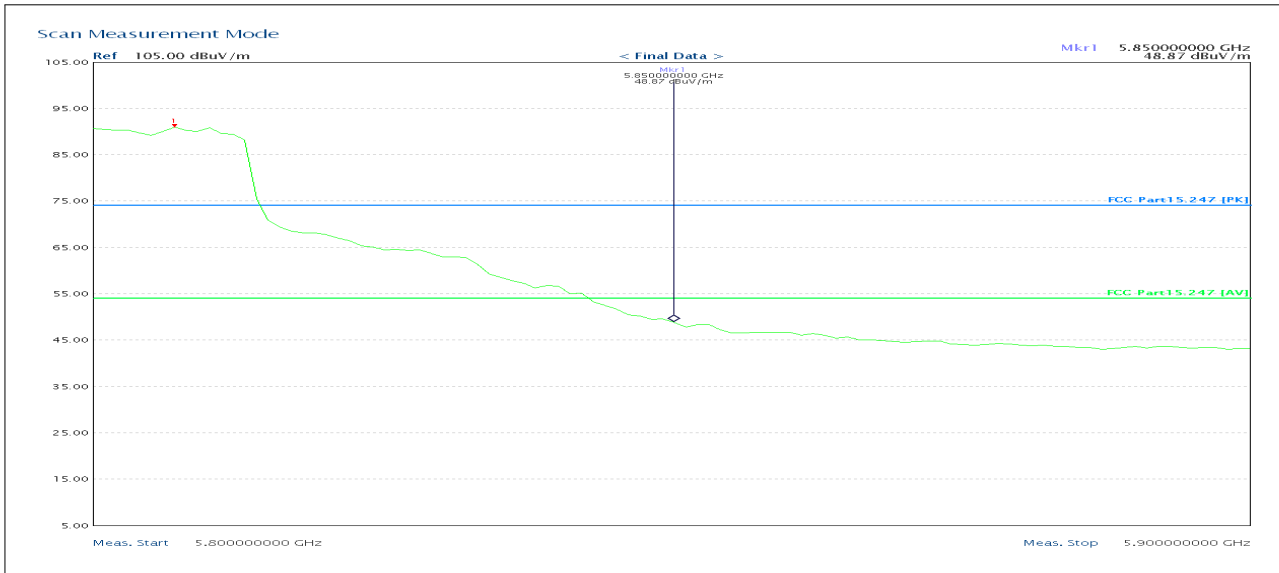
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 57.01           | 74.00          | 16.99       |

Detector mode: Average

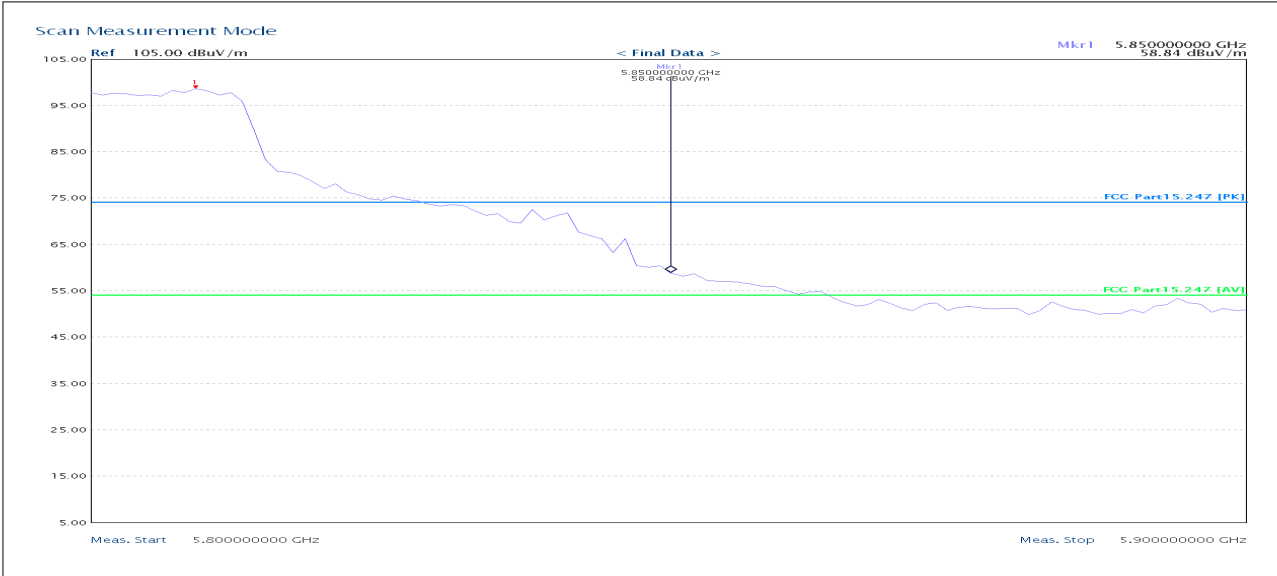
Polarity: Vertical



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 48.87           | 54.00          | 5.13        |

Detector mode: Peak

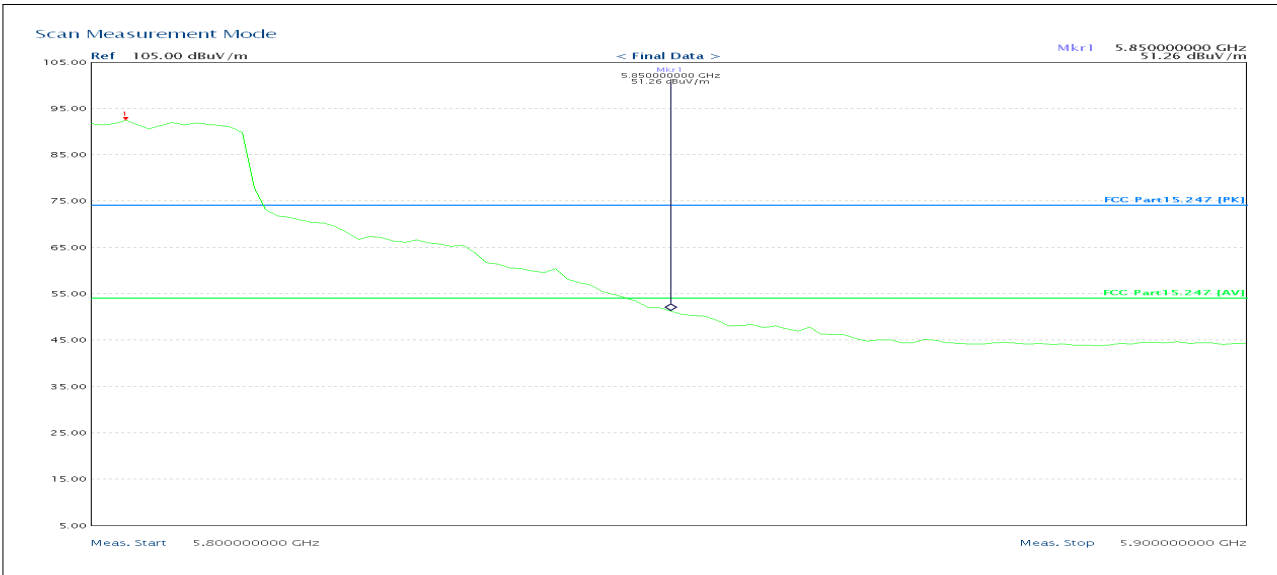
Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 58.84           | 74.00          | 15.16       |

Detector mode: Average

Polarity: Horizontal



| Frequency (MHz) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-----------------|----------------|-------------|
| 5725.00         | 51.26           | 54.00          | 2.74        |

#### 7.4. Power Spectral Density Measurement

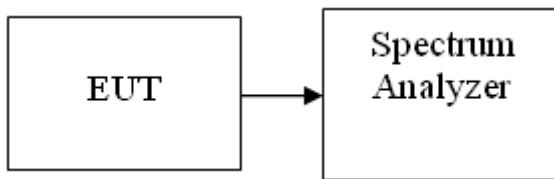
##### LIMIT

According to §15.407(a),

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, both the maximum transmit power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

##### Test Configuration



##### TEST PROCEDURE

1. The testing follows Method SA-2 of FCC KDB 789033 D01 General UNII Test Procedures v01r03.
2. Measure the duty cycle, Set span to encompass the entire emission bandwidth (EBW) of the signal. Set RBW = 300 kHz. Set VBW  $\geq$  1 MHz. Number of points in sweep  $\geq$  2 Span / RBW. Sweep time = auto. Detector = RMS, Trace average at least 100 traces in power averaging mode. Add  $10 \log(500\text{kHz}/\text{RBW})$  to the test result. Add  $10 \log(1/x)$ , where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add  $10 \log(1/0.25) = 6 \text{ dB}$  if the duty cycle is 25 percent.
3. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
4. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (1): Measure and sum the spectra across the outputs. The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

##### TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11a mode /ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.19             | -1.89                 | 17.00                   | PASS   |
| Mid     | 5785            | 0.19             | -2.40                 | 17.00                   | PASS   |
| High    | 5825            | 0.19             | -3.50                 | 17.00                   | PASS   |

Test mode: IEEE 802.11a mode /ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.20             | 0.87                  | 17.00                   | PASS   |
| Mid     | 5785            | 0.20             | -0.29                 | 17.00                   | PASS   |
| High    | 5825            | 0.20             | -1.39                 | 17.00                   | PASS   |

Test mode: IEEE 802.11a mode /ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.18             | 4.41                  | 17.00                   | PASS   |
| Mid     | 5785            | 0.18             | 3.73                  | 17.00                   | PASS   |
| High    | 5825            | 0.18             | 3.11                  | 17.00                   | PASS   |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.20             | -1.95                 | 17.00                   | PASS   |
| Mid     | 5785            | 0.20             | -2.63                 | 17.00                   | PASS   |
| High    | 5825            | 0.20             | -3.50                 | 17.00                   | PASS   |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.20             | 0.97                  | 17.00                   | PASS   |
| Mid     | 5785            | 0.20             | -0.38                 | 17.00                   | PASS   |
| High    | 5825            | 0.20             | -1.49                 | 17.00                   | PASS   |

Test mode: draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5745            | 0.32             | 3.54                  | 17.00                   | PASS   |
| Mid     | 5785            | 0.32             | 2.06                  | 17.00                   | PASS   |
| High    | 5825            | 0.32             | 1.73                  | 17.00                   | PASS   |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5755            | 0.34             | -5.57                 | 17.00                   | PASS   |
| High    | 5795            | 0.34             | -5.95                 | 17.00                   | PASS   |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5755            | 0.35             | -2.60                 | 17.00                   | PASS   |
| High    | 5795            | 0.35             | -3.86                 | 17.00                   | PASS   |

Test mode: draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

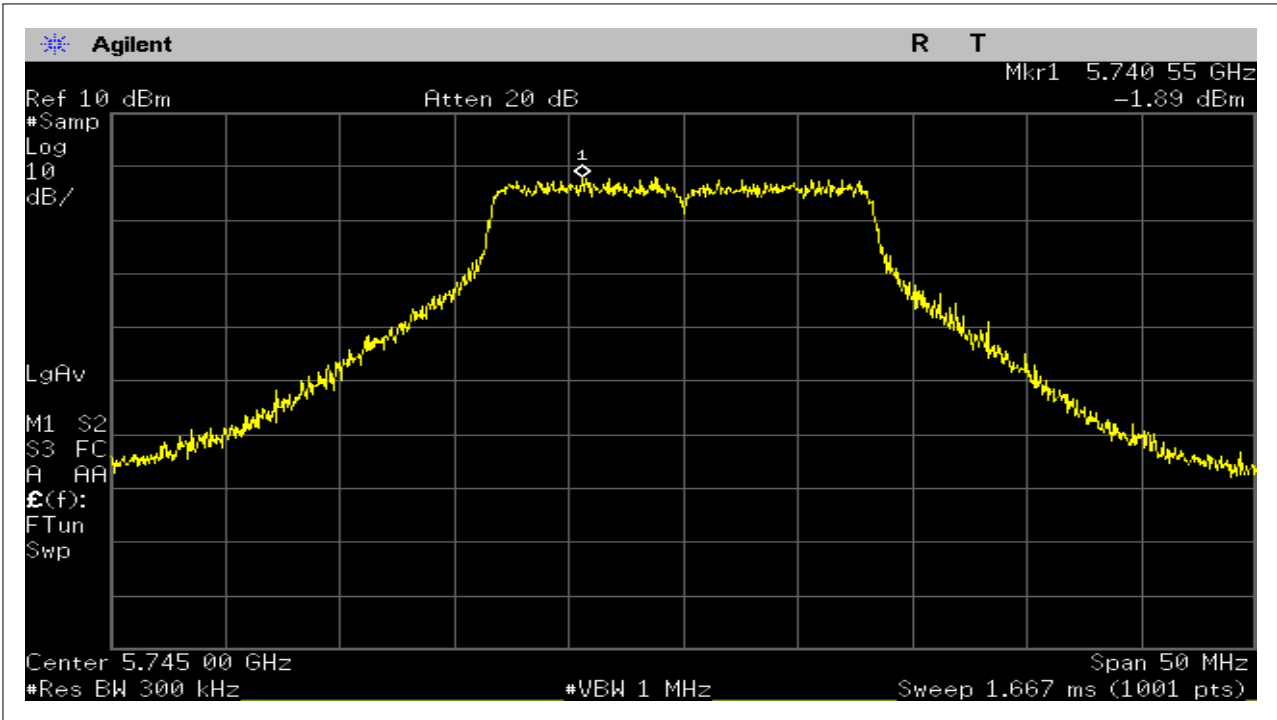
| Channel | Frequency (MHz) | Duty factor (dB) | Average PSD (dBm/MHz) | Average PSD Limit (dBm) | Result |
|---------|-----------------|------------------|-----------------------|-------------------------|--------|
| Low     | 5755            | 0.53             | 0.58                  | 17.00                   | PASS   |
| High    | 5795            | 0.53             | -1.09                 | 17.00                   | PASS   |

Test Plot

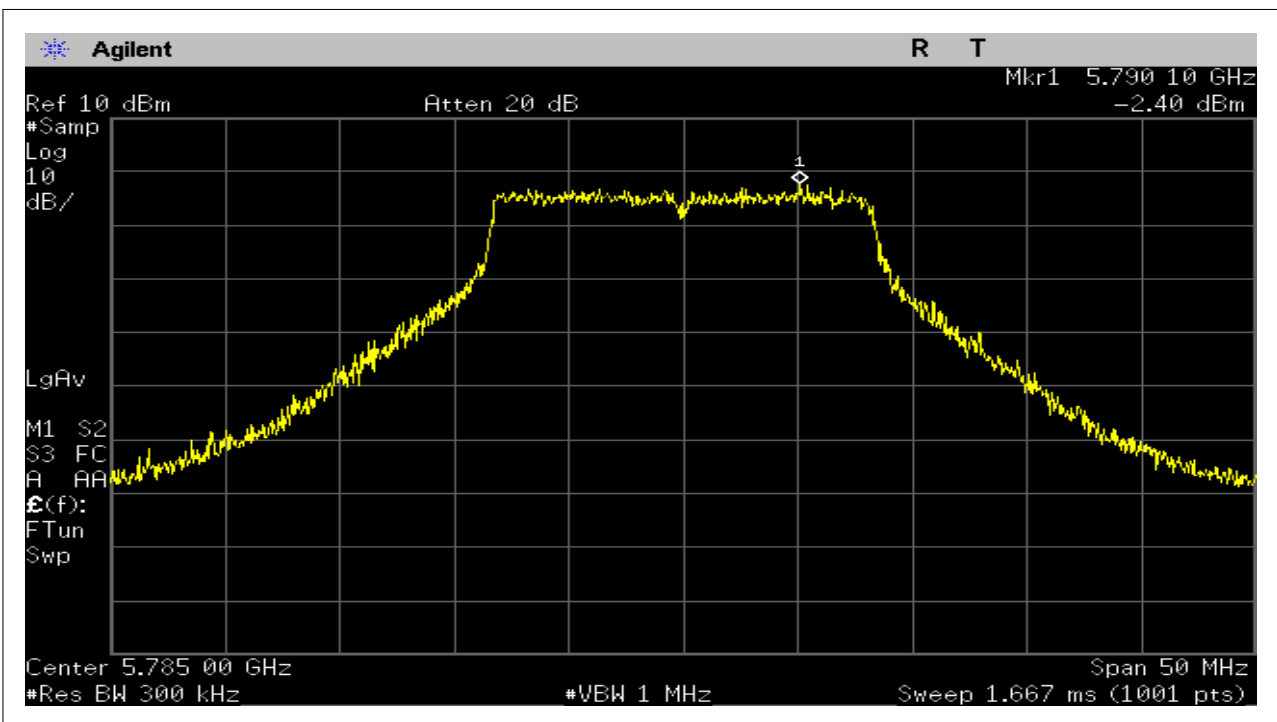
IEEE 802.11a mode/ANT 1:

5745~5850MHz

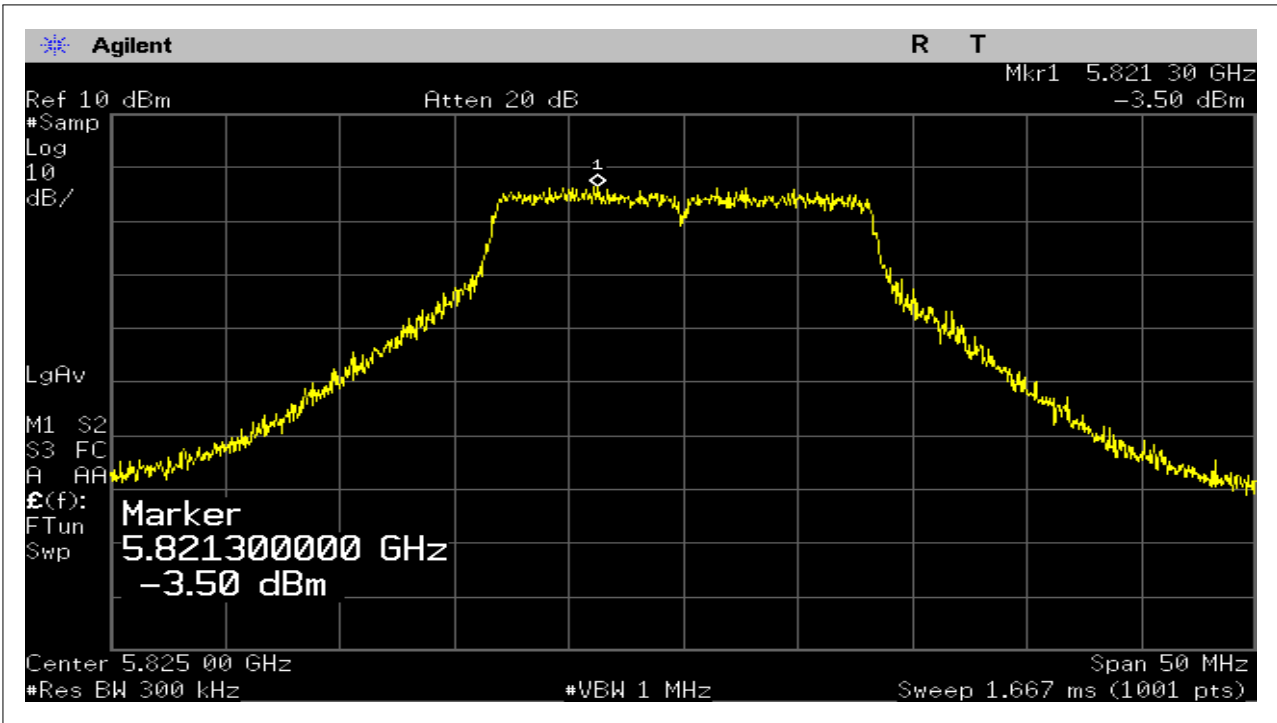
CH Low



CH Mid



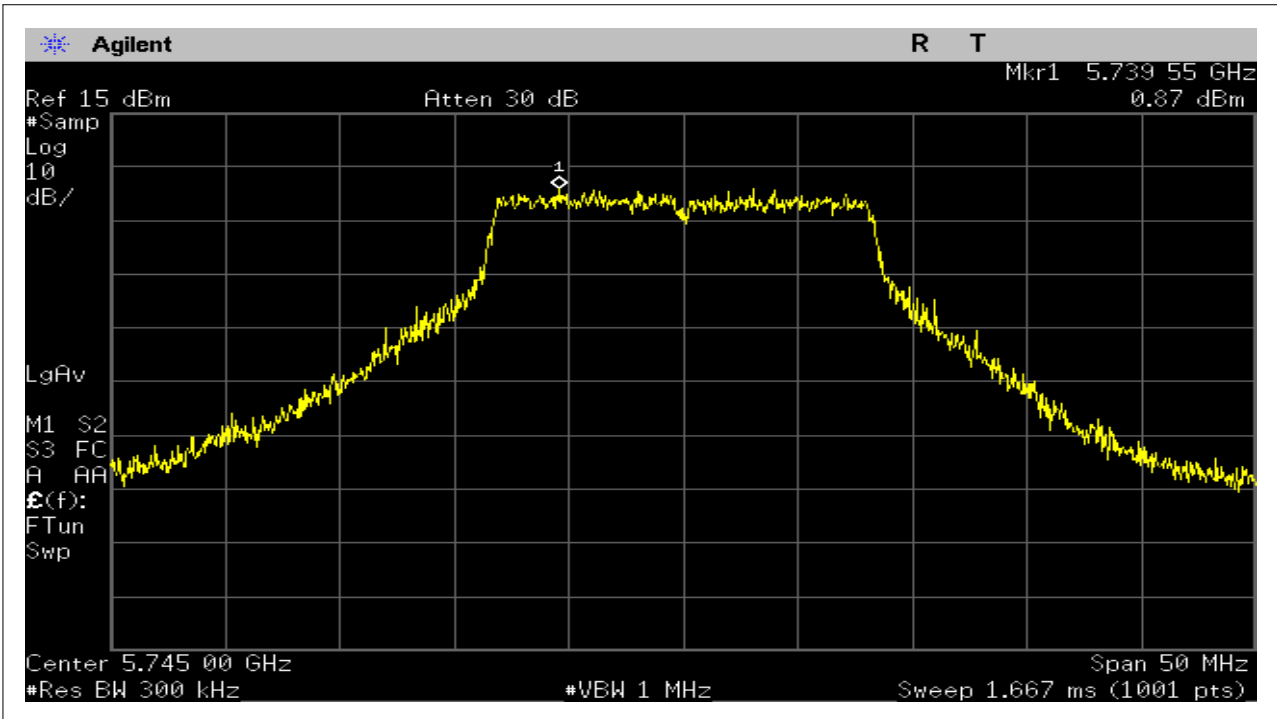
CH High



IEEE 802.11a mode/ANT 2:

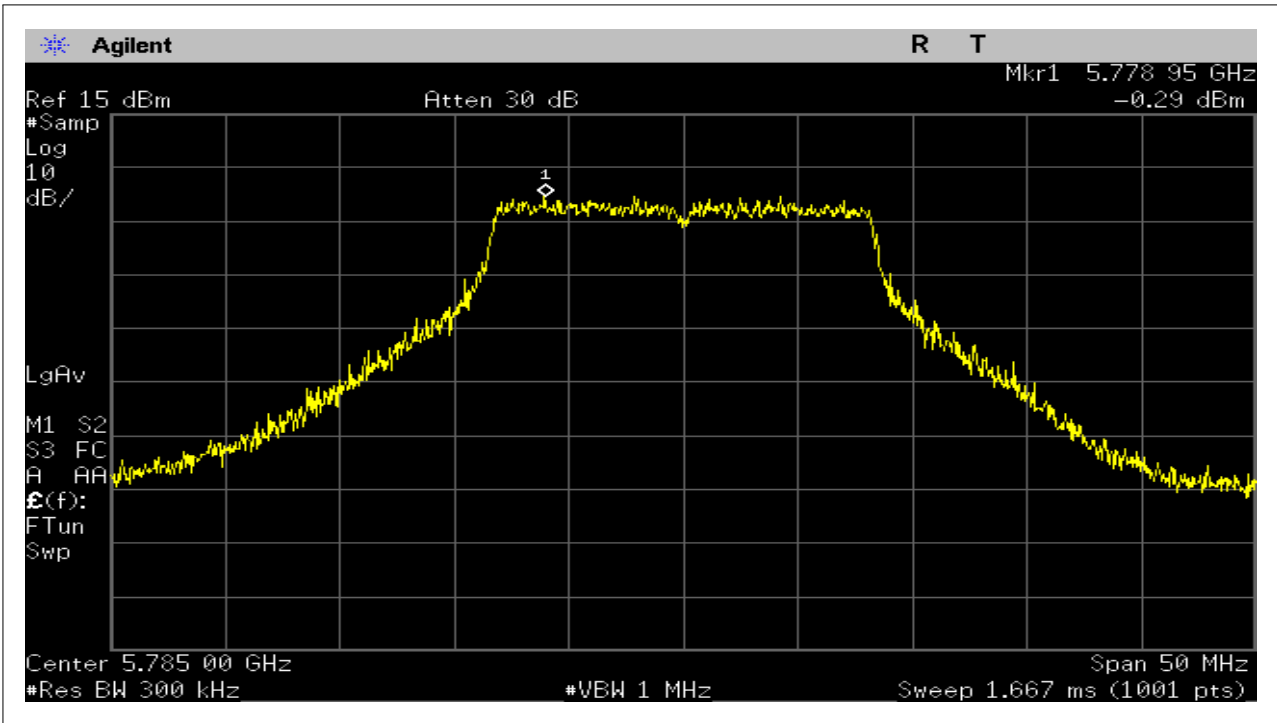
5745~5850MHz

CH Low

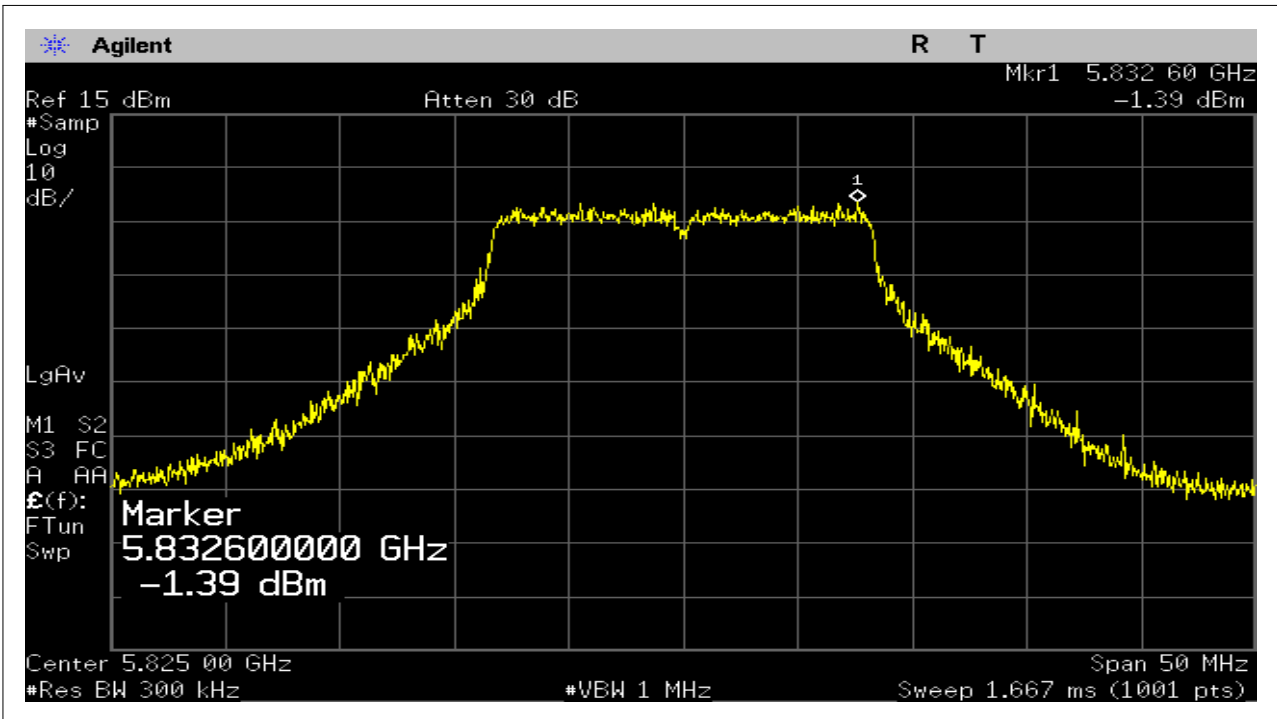




CH Mid



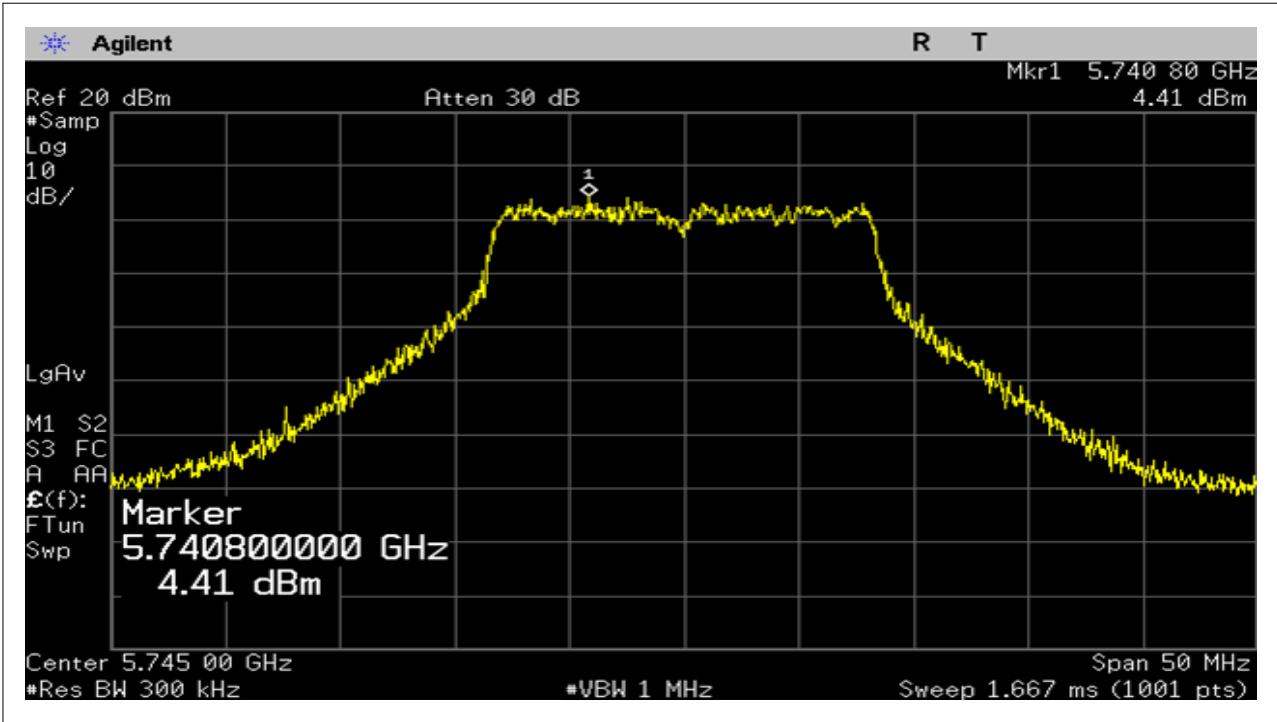
CH High



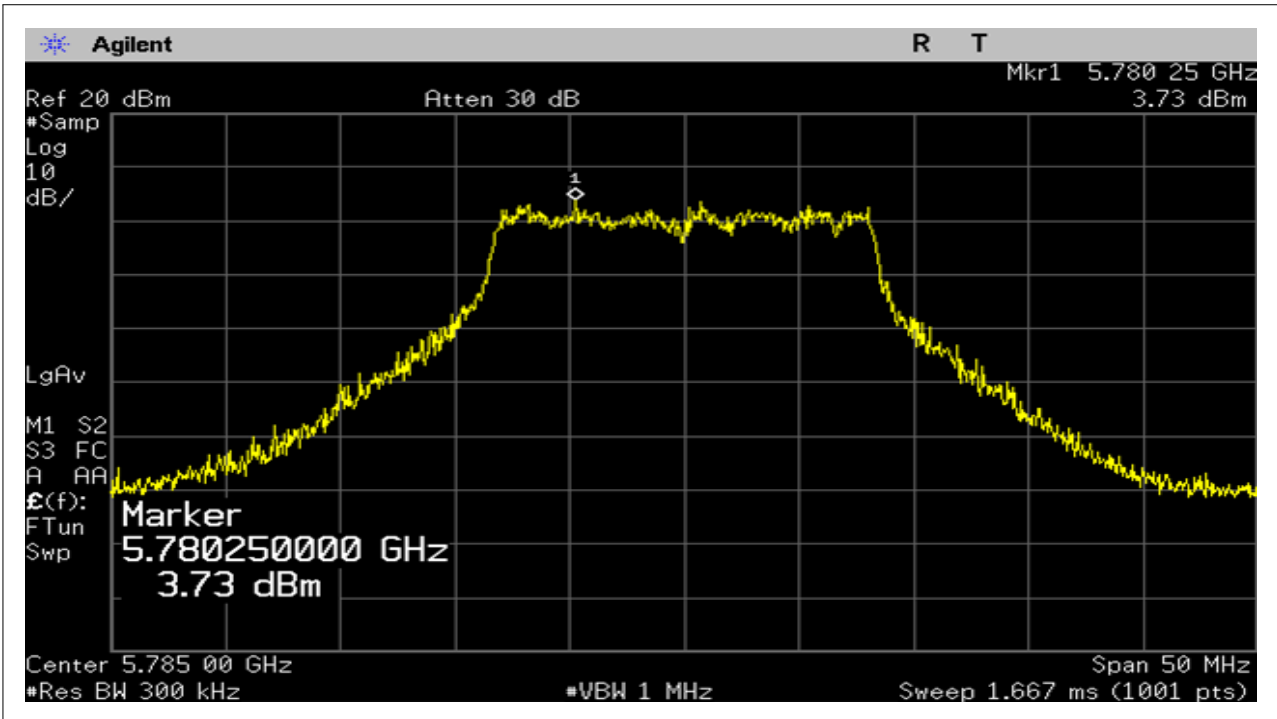
IEEE 802.11a mode/ANT 1+2:

5745~5850MHz

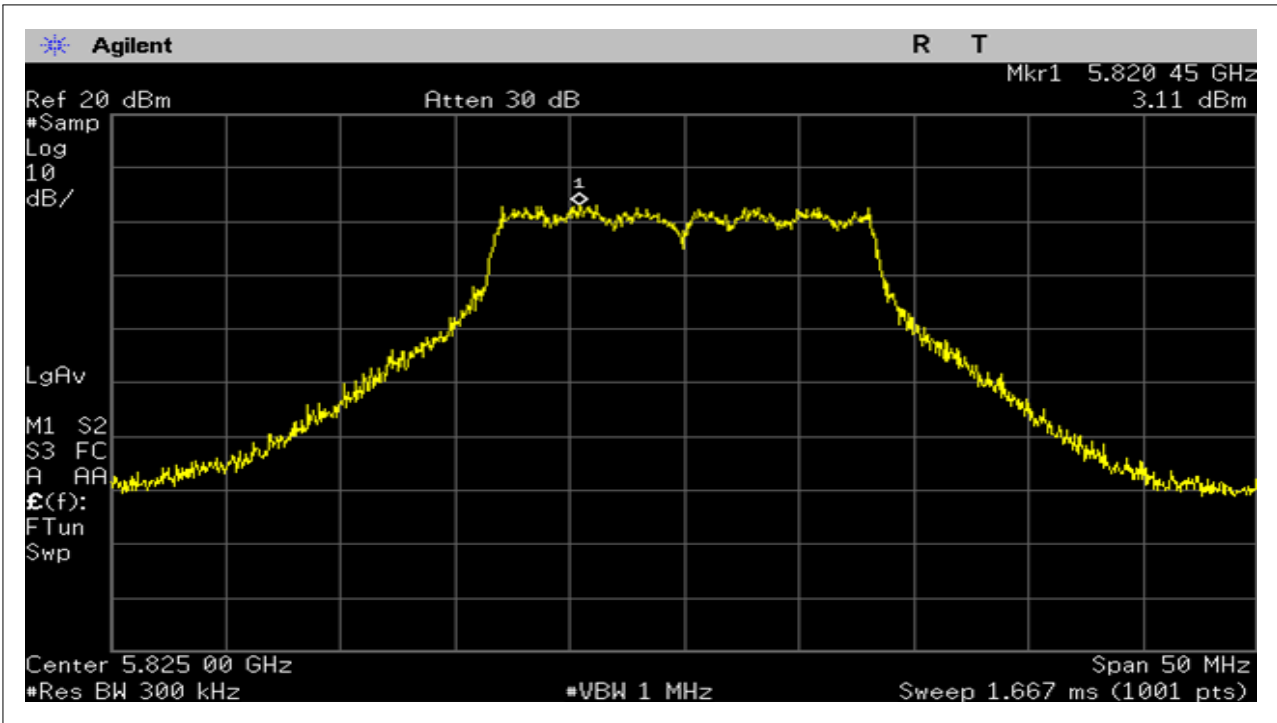
CH Low



CH Mid



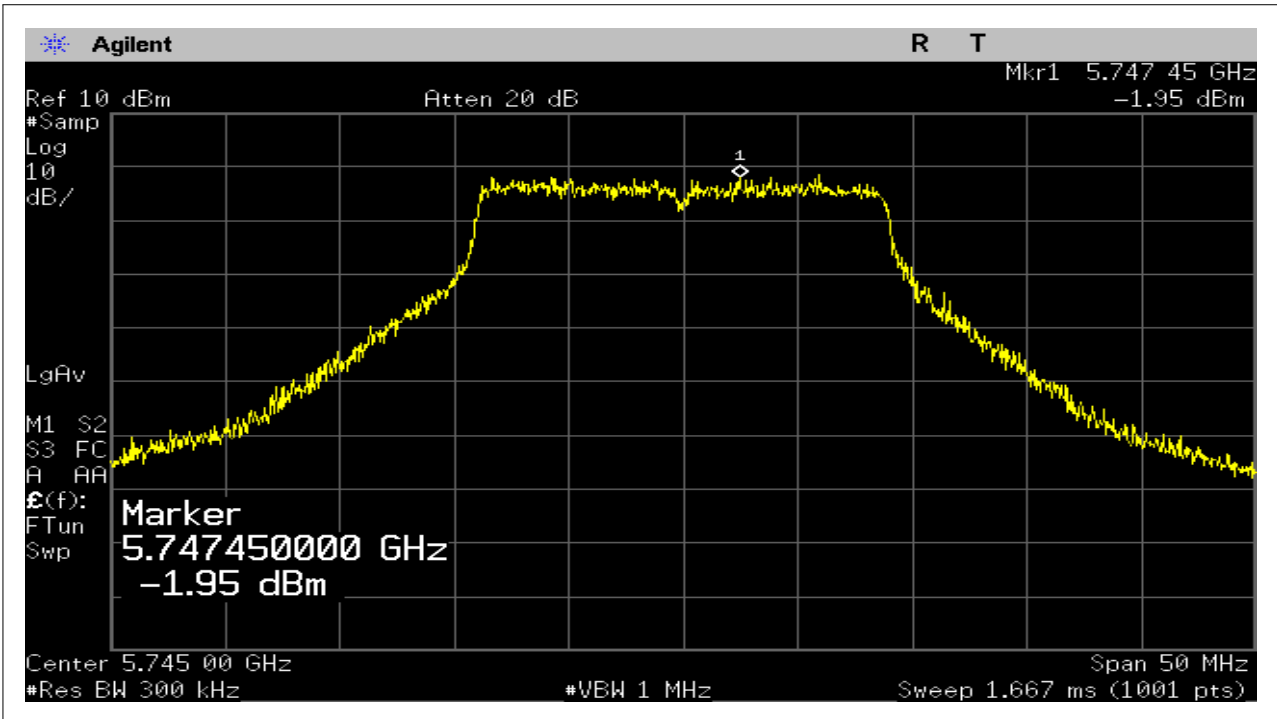
CH High



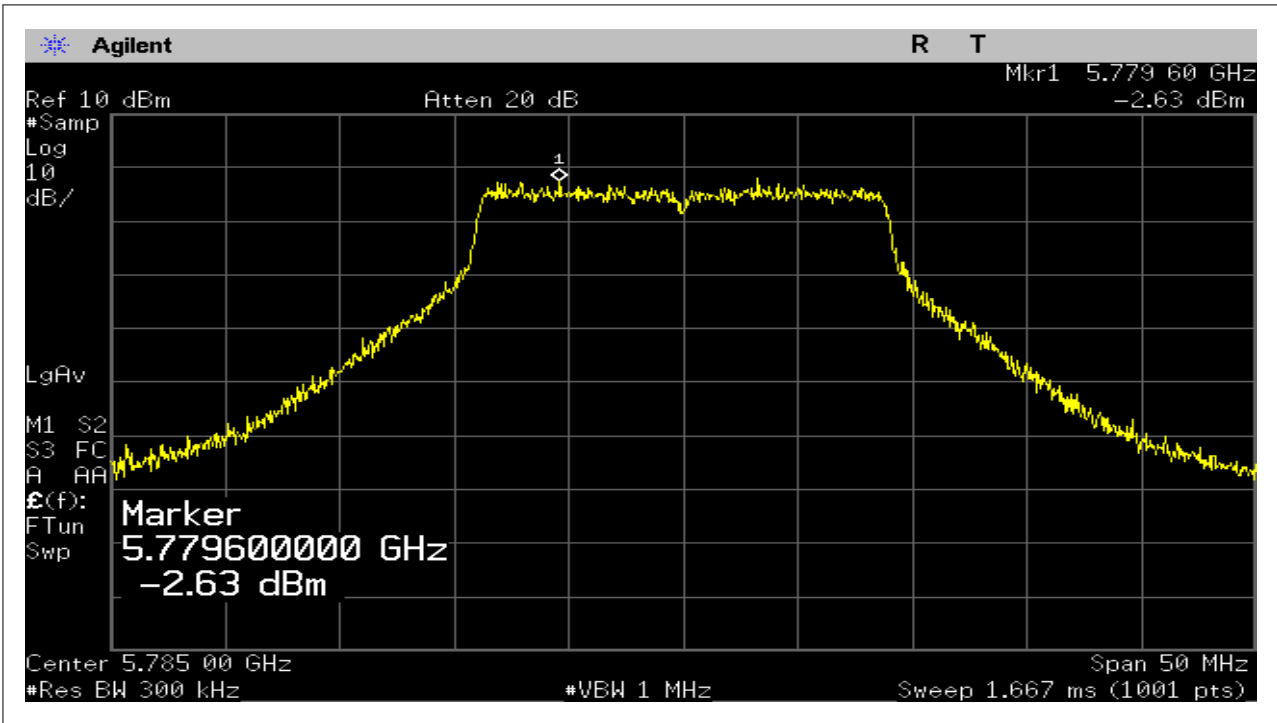
draft 802.11n Standard-20 MHz Channel mode / ANT 1

5745~5850MHz

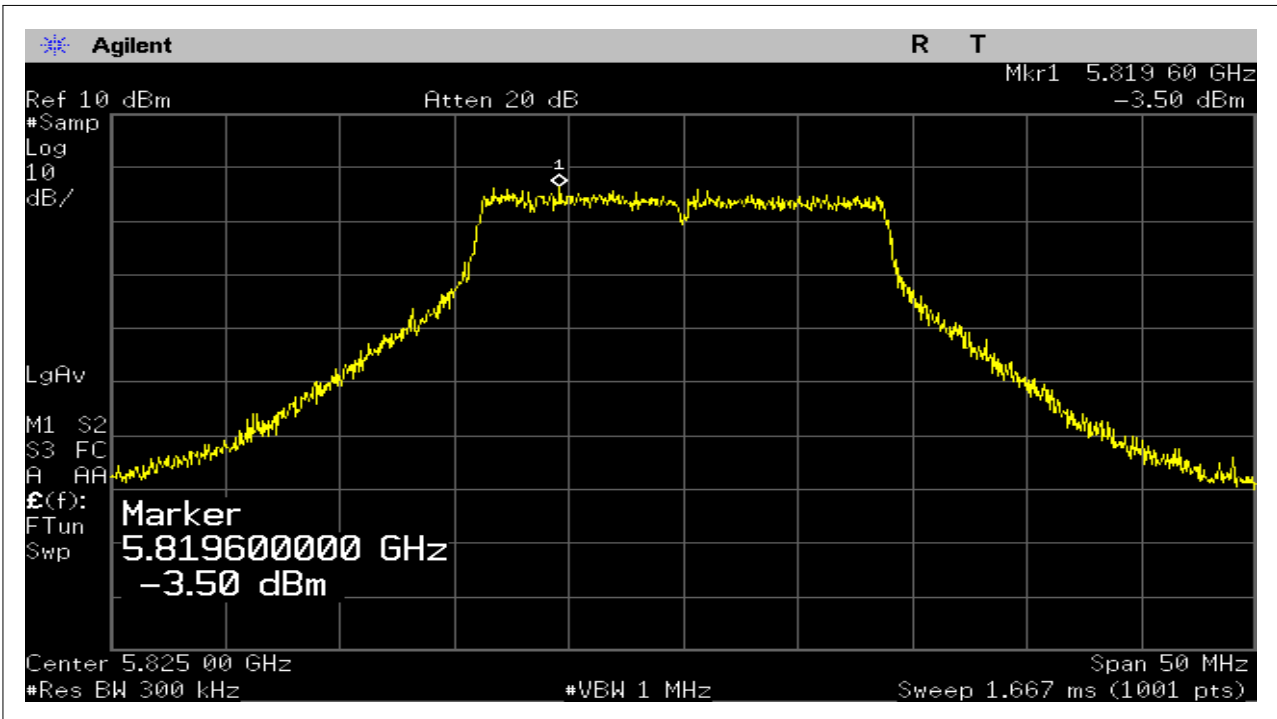
CH Low



CH Mid



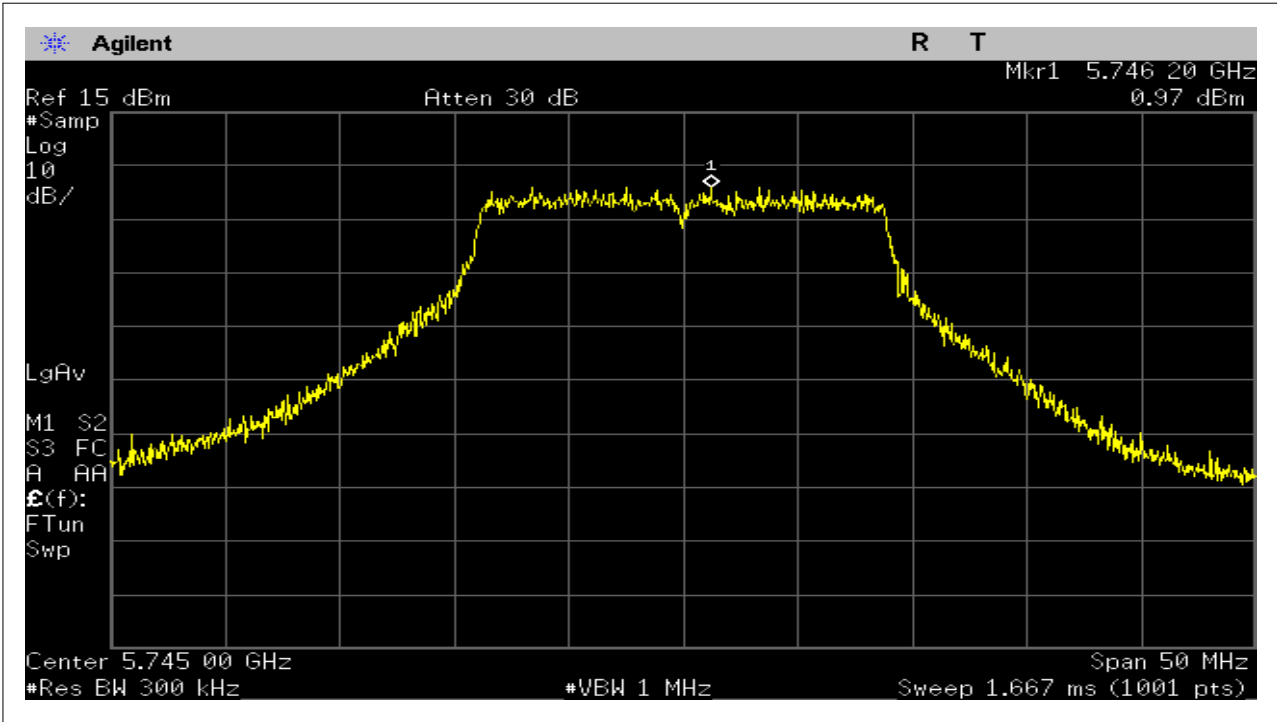
CH High



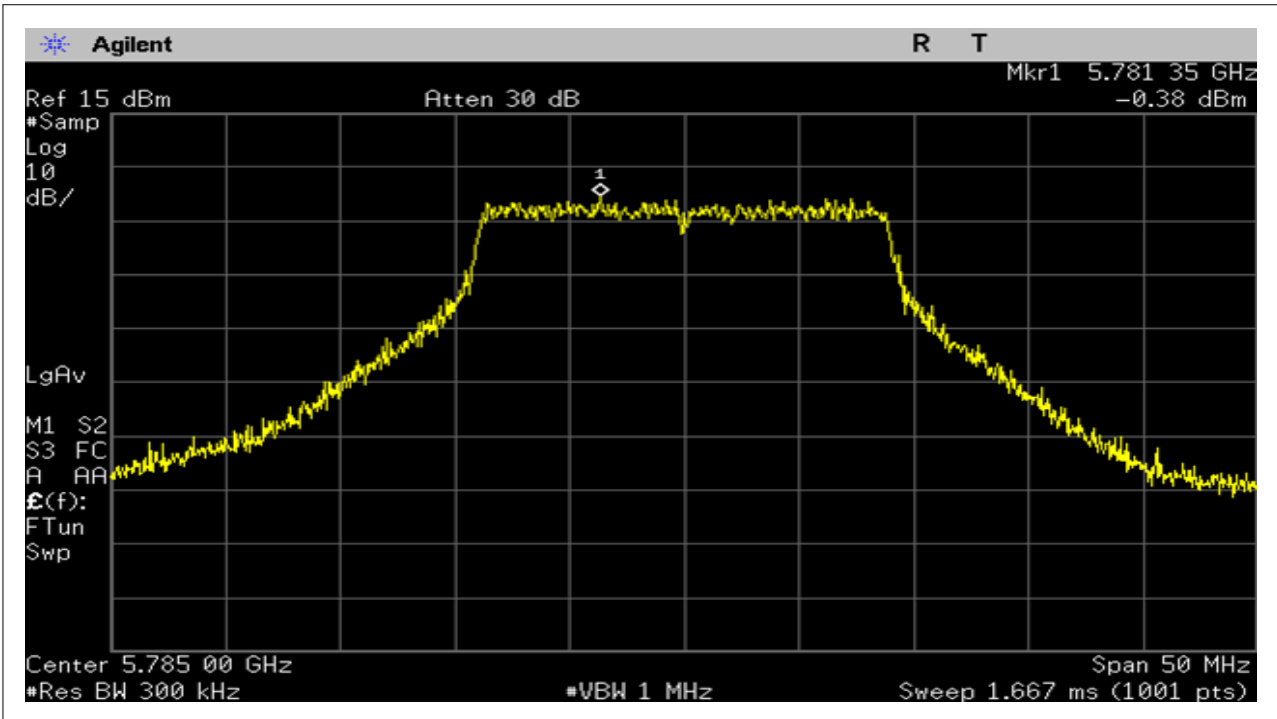
draft 802.11n Standard-20 MHz Channel mode / ANT 2

5745~5850MHz

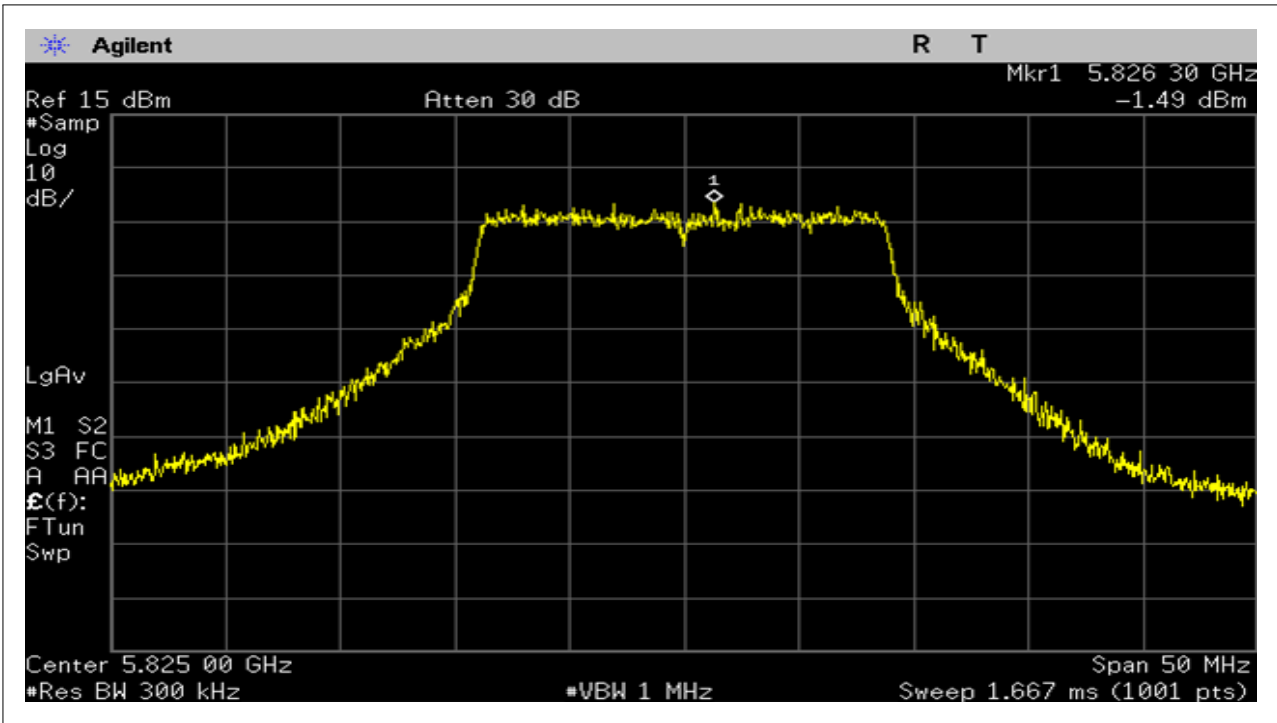
CH Low



CH Mid



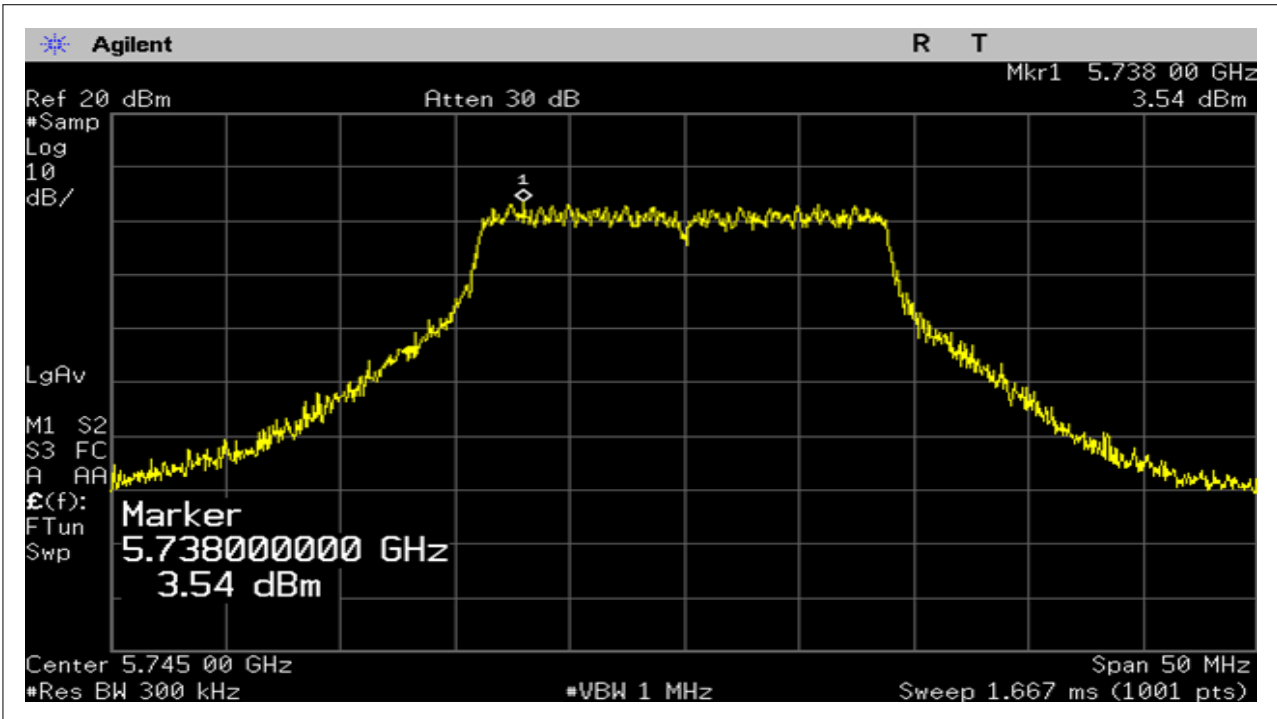
CH High



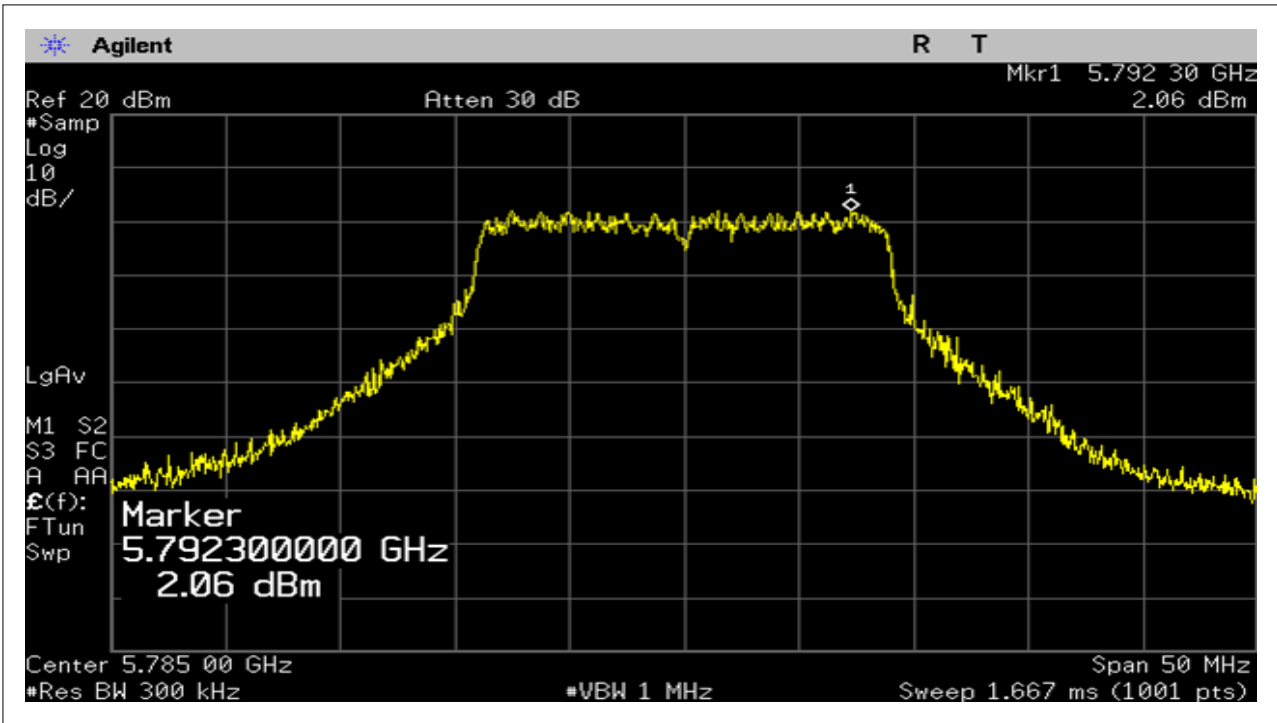
draft 802.11n Standard-20 MHz Channel mode / ANT 1+2

5745~5850MHz

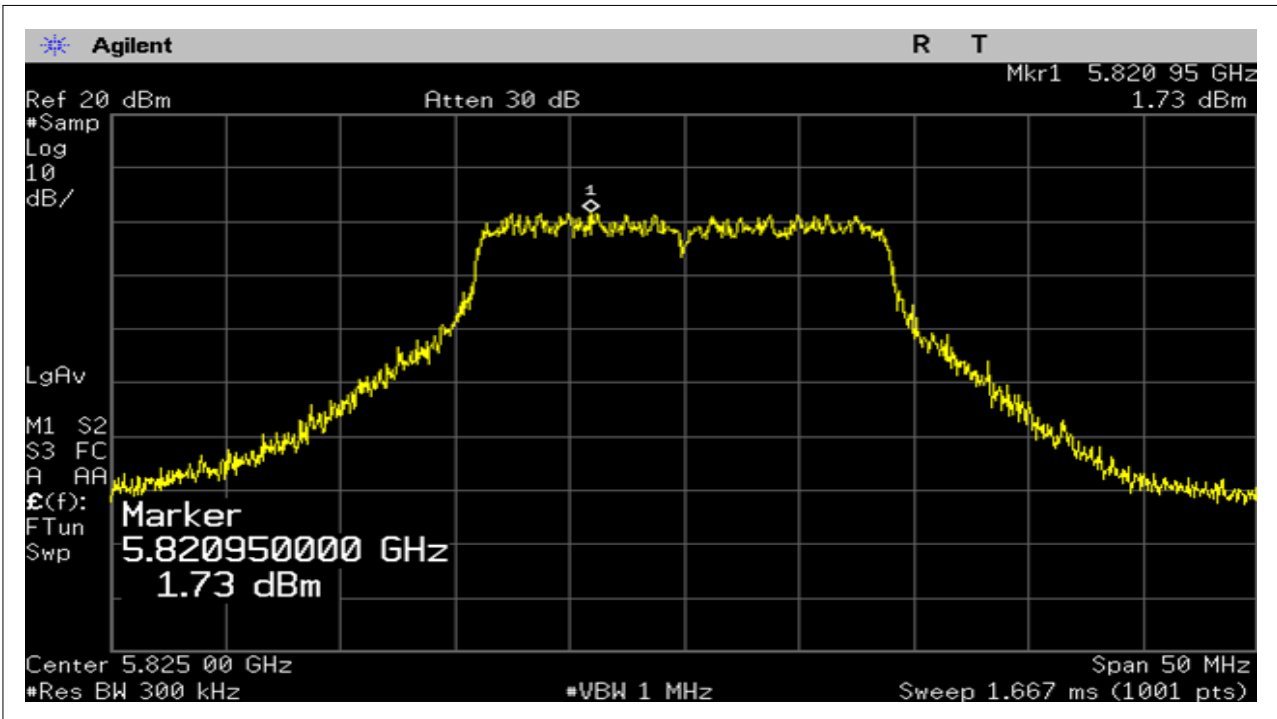
CH Low



CH Mid



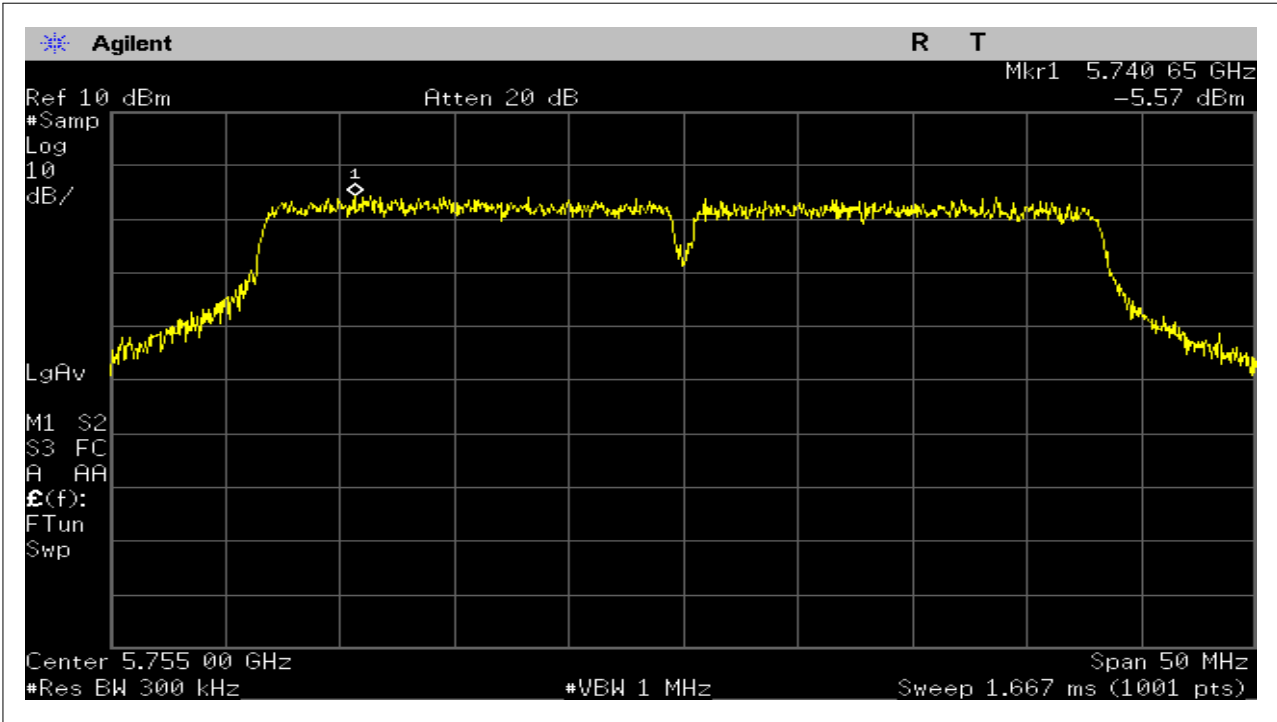
CH High



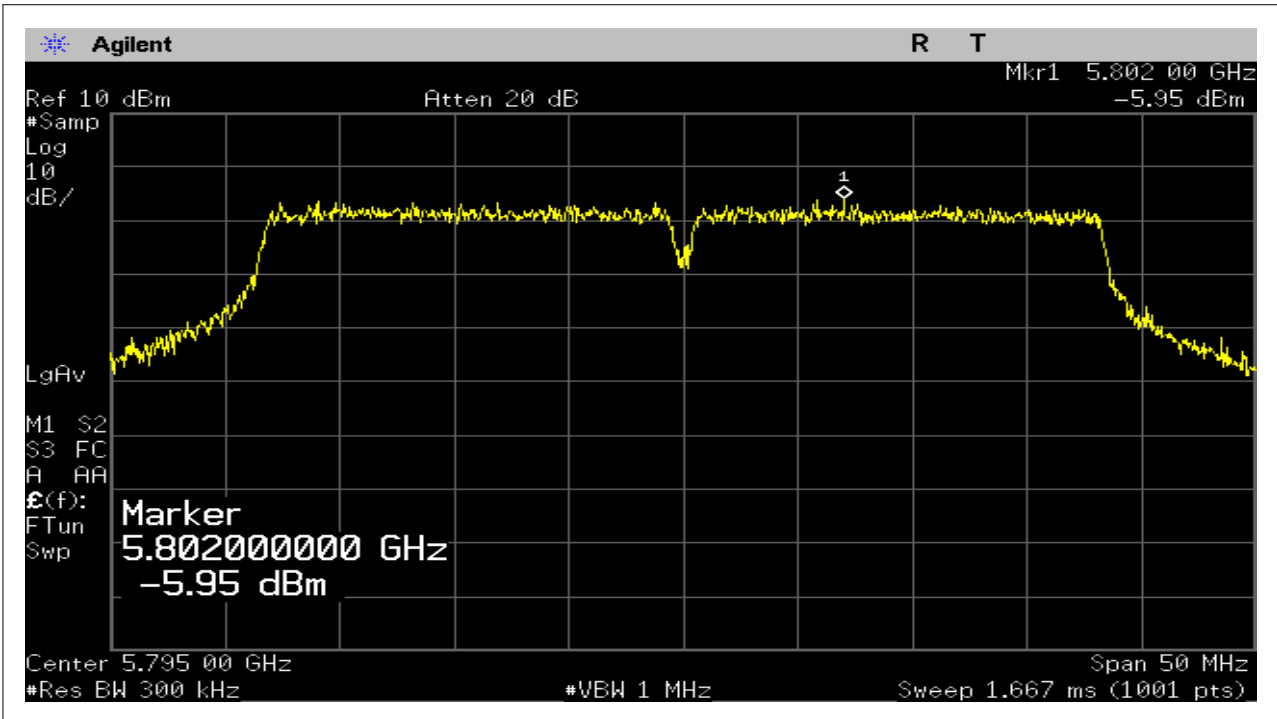
draft 802.11n Wide-40 MHz Channel mode / ANT 1

5745~5850MHz

CH Low



CH High

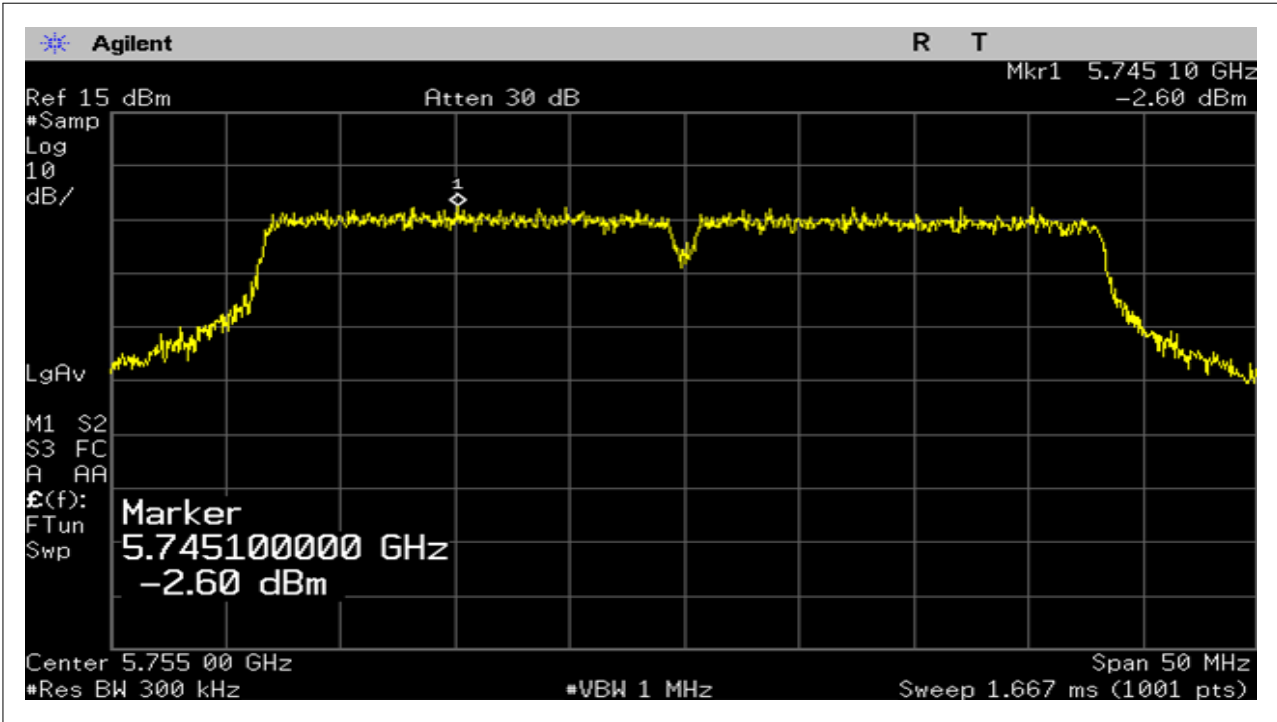




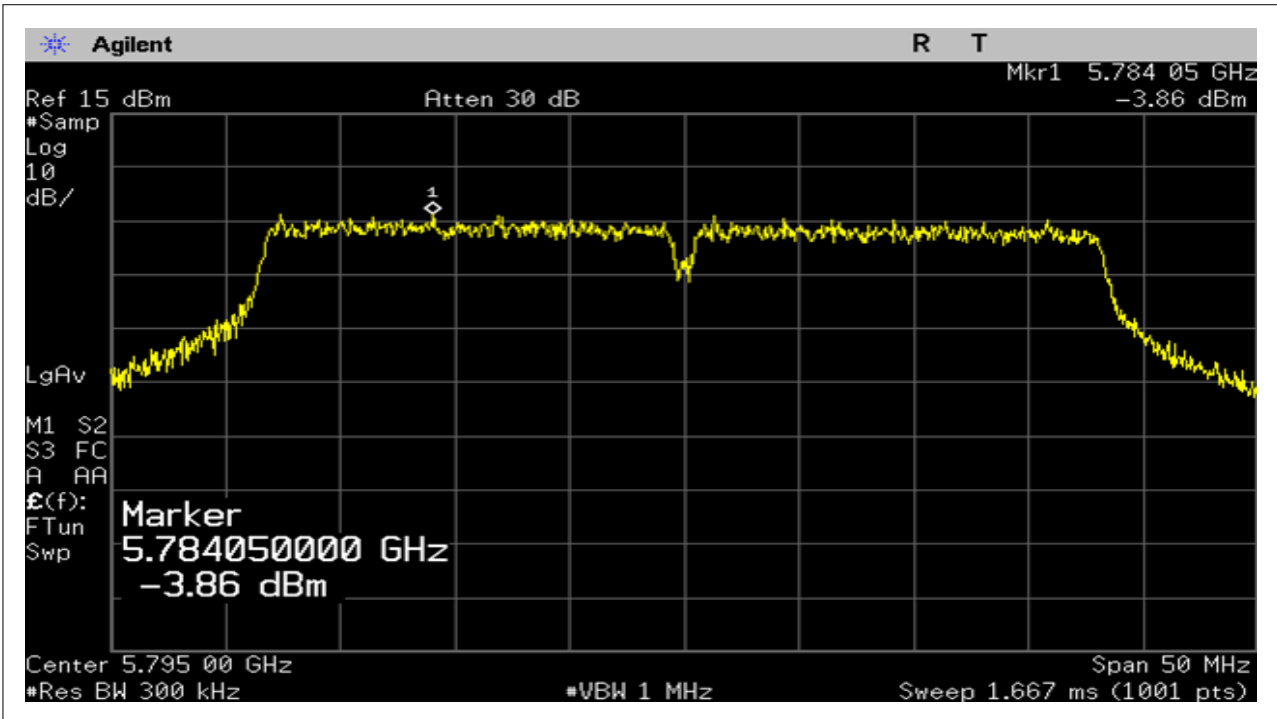
draft 802.11n Wide-40 MHz Channel mode / ANT 2

5745~5850MHz

CH Low



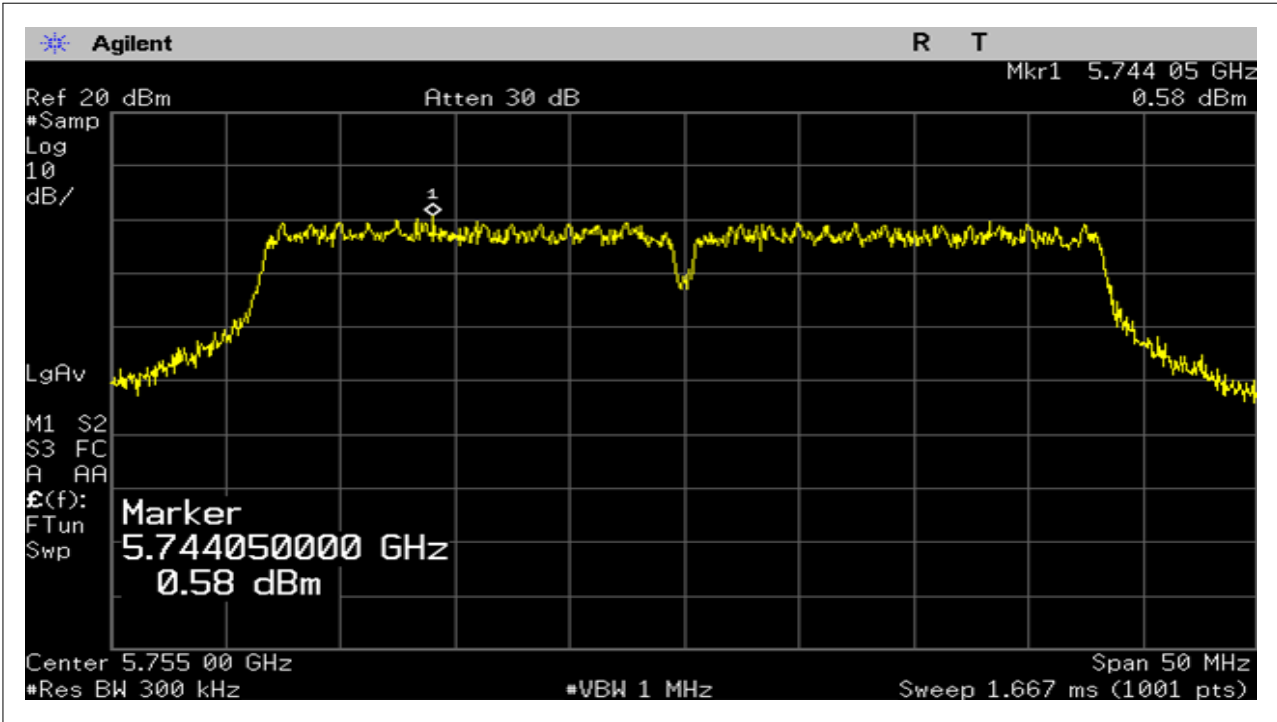
CH High



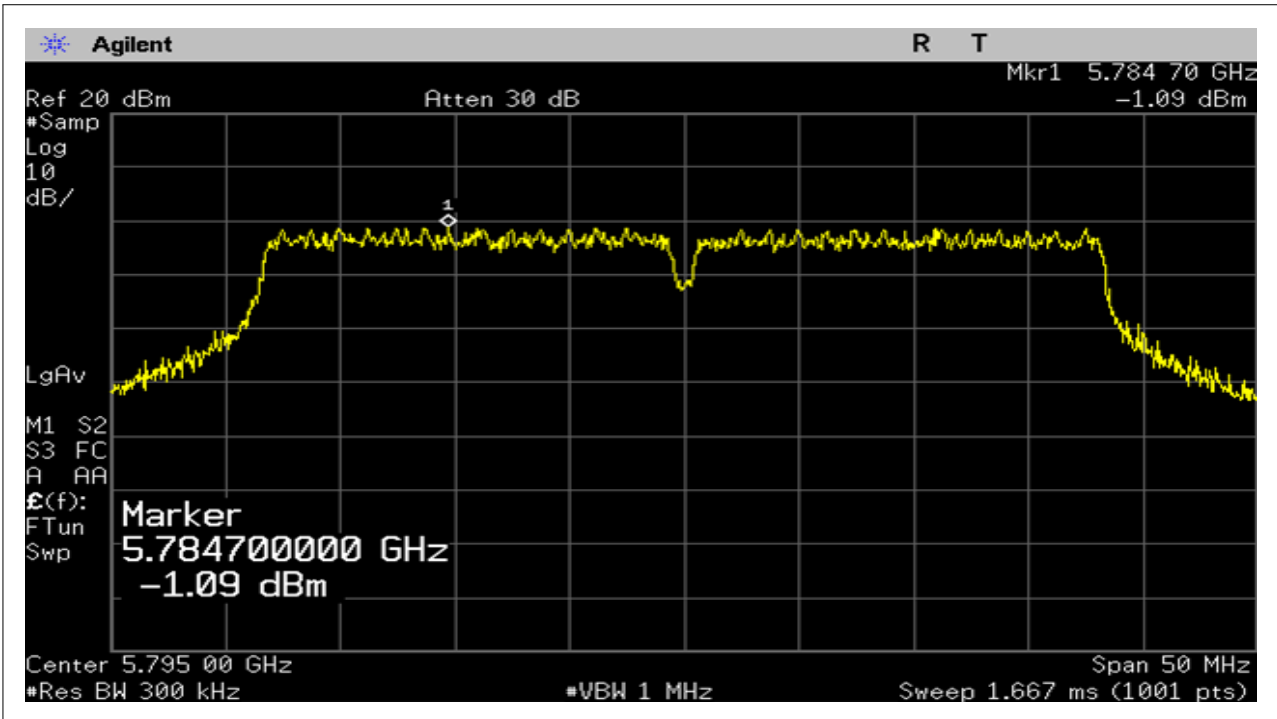
draft 802.11n Wide-40 MHz Channel mode / ANT 1+2

5745~5850MHz

CH Low



CH High



### 7.5. Radiated Undesirable Emission

LIMIT

Radiated emissions from 9 kHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2009. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

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:

| FREQUENCIES<br>(MHz) | FIELD STRENGTH<br>(microvolts/meter) | MEASUREMENT DISTANCE<br>(meters) |
|----------------------|--------------------------------------|----------------------------------|
| 0.009~0.490          | 2400/F(kHz)                          | 300                              |
| 0.490~1.705          | 24000/F(kHz)                         | 30                               |
| 1.705~30.0           | 30                                   | 30                               |
| 30~88                | 100                                  | 3                                |
| 88~216               | 150                                  | 3                                |
| 216~960              | 200                                  | 3                                |
| Above 960            | 500                                  | 3                                |

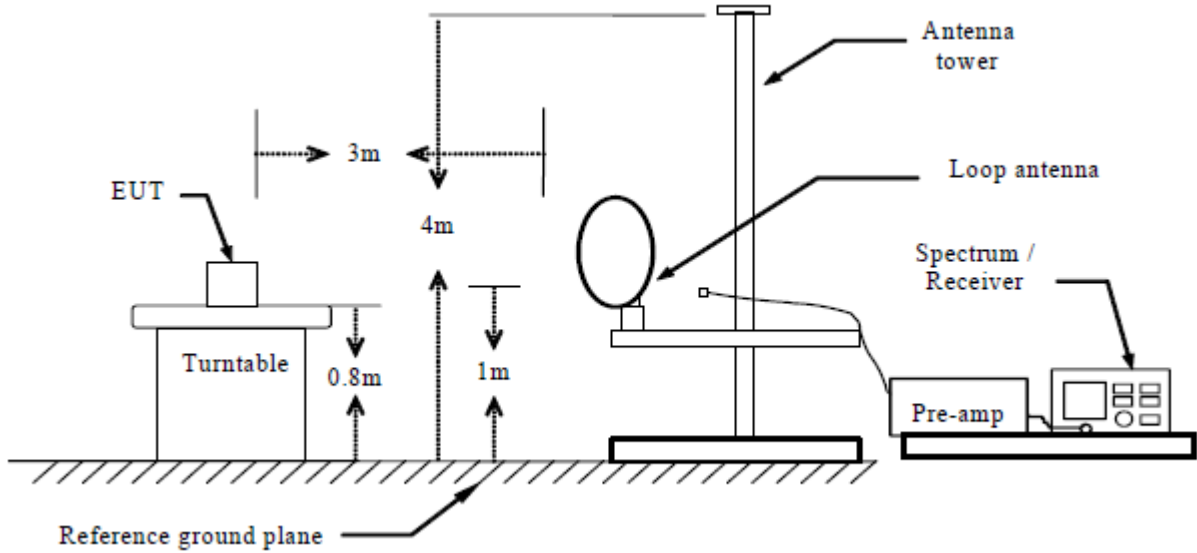
**Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections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

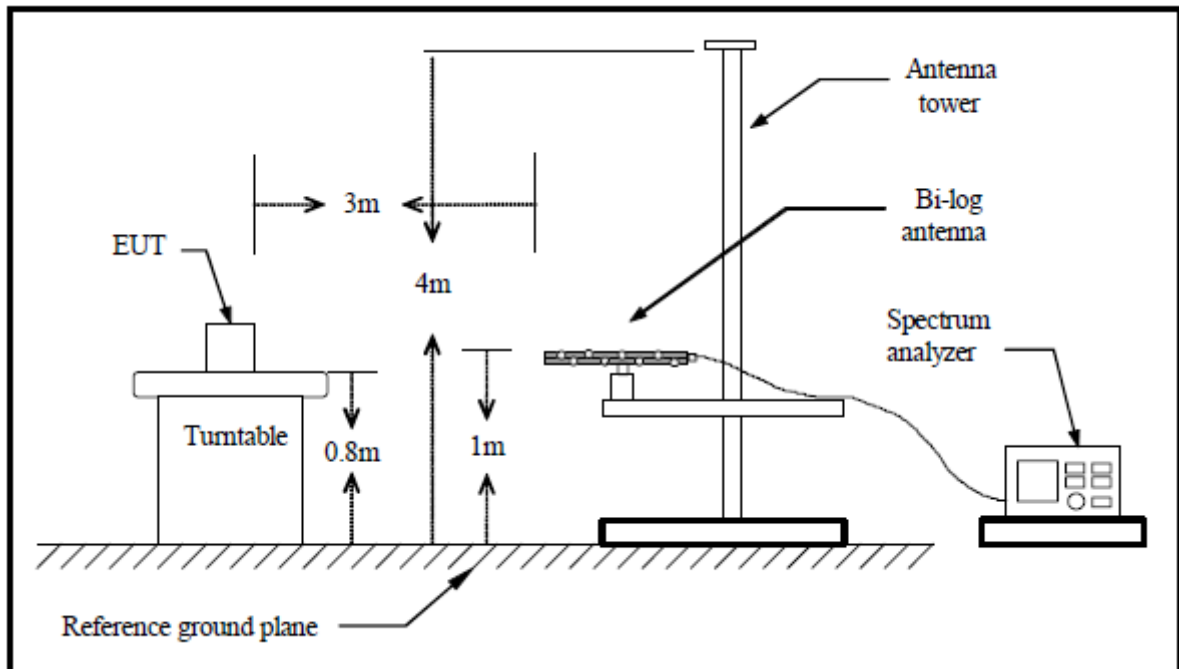
| Frequency<br>(MHz) | Field Strength<br>( $\mu$ V/m at 3-meter) | Field Strength<br>(dB $\mu$ V/m at 3-meter) |
|--------------------|-------------------------------------------|---------------------------------------------|
| 30-88              | 100                                       | 40                                          |
| 88-216             | 150                                       | 43.5                                        |
| 216-960            | 200                                       | 46                                          |
| Above 960          | 500                                       | 54                                          |

Test Configuration

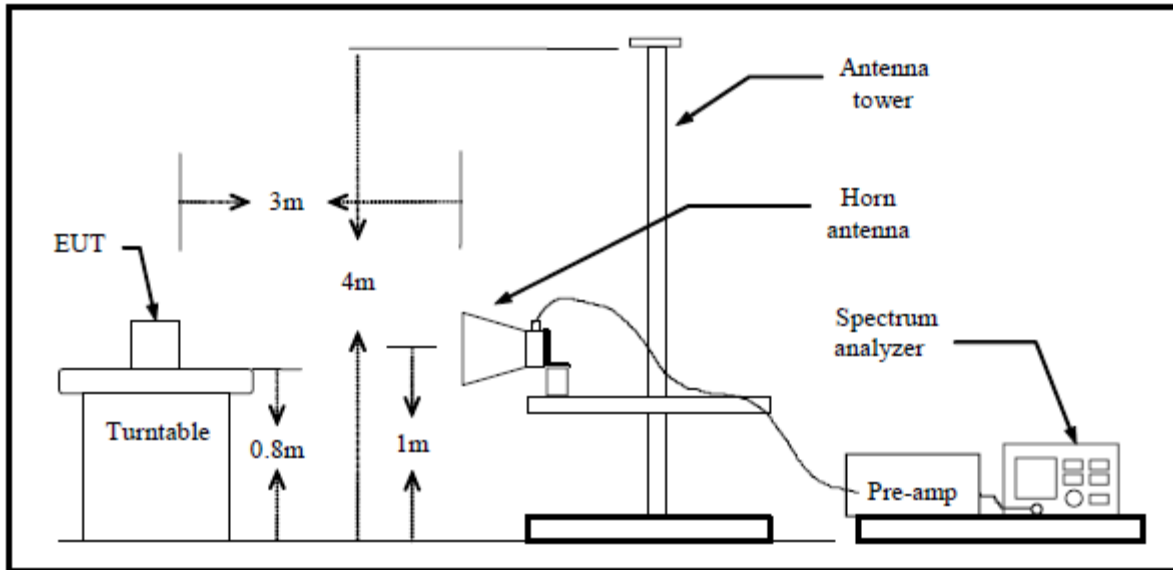
Below 30MHz



Below 1 GHz



Above 1 GHz

**TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m 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 / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

**TEST RESULTS**

Test mode: ANT 1

30 MHz ~ 1 GHz

| Frequency (MHz) | Detect Mode | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|
| 82.93           | PK          | V               | 15.93          | 9.66                     | 25.59           | 40.00          | 14.41       |
| 163.34          | PK          | V               | 11.55          | 15.23                    | 26.78           | 43.5           | 16.72       |
| 271.82          | PK          | V               | 16.95          | 15.59                    | 32.54           | 46.00          | 13.46       |
| 380.41          | PK          | V               | 19.34          | 19.05                    | 38.39           | 46.00          | 7.61        |
| 500.25          | PK          | V               | 8.17           | 22.26                    | 30.43           | 46.00          | 15.57       |
| 720.52          | PK          | V               | 7.50           | 27.16                    | 34.66           | 46.00          | 11.34       |
| 100.46          | PK          | H               | 14.14          | 11.17                    | 25.31           | 43.50          | 18.19       |
| 163.34          | PK          | H               | 15.73          | 15.23                    | 30.96           | 43.50          | 12.54       |
| 233.92          | PK          | H               | 14.34          | 13.78                    | 28.12           | 46.00          | 17.88       |
| 432.40          | PK          | H               | 14.67          | 20.52                    | 35.19           | 46.00          | 10.81       |
| 528.56          | PK          | H               | 12.37          | 23.04                    | 35.41           | 46.00          | 10.59       |
| 801.52          | PK          | H               | 13.00          | 28.73                    | 41.73           | 46.00          | 4.27        |

1 GHz ~ 40 GHz

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Reading (dBuV) | Correct Factor (dB/m) | Amplifier Gain (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|--------------------|----------------|-----------------------|---------------------|-----------------|----------------|-------------|
| 1599.00         | PK          | V                  | 42.50          | 29.96                 | 26.54               | 45.92           | 74.00          | 28.08       |
| 1599.00         | AV          | V                  | 45.24          | 29.96                 | 26.54               | 48.66           | 54.00          | 5.34        |
| 2398.00         | PK          | V                  | 37.52          | 34.59                 | 25.80               | 46.30           | 74.00          | 27.70       |
| 2398.00         | AV          | V                  | 40.06          | 34.59                 | 25.80               | 48.84           | 54.00          | 5.16        |
| 2498.00         | PK          | V                  | 38.94          | 34.30                 | 25.70               | 47.53           | 74.00          | 26.47       |
| 2498.00         | AV          | V                  | 36.81          | 34.30                 | 25.70               | 45.40           | 54.00          | 8.60        |
| 1601.00         | PK          | H                  | 44.42          | 30.33                 | 26.46               | 48.29           | 74.00          | 25.71       |
| 1601.00         | AV          | H                  | 37.41          | 30.33                 | 26.46               | 41.28           | 54.00          | 12.72       |
| 2497.50         | PK          | H                  | 42.60          | 34.30                 | 25.70               | 51.19           | 74.00          | 22.81       |
| 2497.50         | AV          | H                  | 40.76          | 34.30                 | 25.70               | 49.35           | 54.00          | 4.65        |
| 3000.00         | PK          | H                  | 37.43          | 34.51                 | 25.14               | 46.80           | 74.00          | 27.20       |
| 3000.00         | AV          | H                  | 35.02          | 34.51                 | 25.14               | 44.39           | 54.00          | 9.61        |

**Remark:**

- Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

Test mode: ANT 2

30 MHz ~ 1 GHz

| Frequency (MHz) | Detect Mode | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|
| 48.71           | PK          | V               | 13.32          | 13.02                    | 26.34           | 40.00          | 13.66       |
| 163.34          | PK          | V               | 13.14          | 15.23                    | 28.37           | 43.50          | 15.13       |
| 271.82          | PK          | V               | 16.69          | 15.59                    | 32.28           | 46.00          | 13.72       |
| 380.41          | PK          | V               | 18.32          | 19.05                    | 37.37           | 46.00          | 8.63        |
| 500.26          | PK          | V               | 8.66           | 22.26                    | 30.92           | 46.00          | 15.08       |
| 720.52          | PK          | V               | 7.27           | 27.16                    | 34.43           | 46.00          | 11.57       |
|                 |             |                 |                |                          |                 |                |             |
| 40.89           | PK          | H               | 17.26          | 12.67                    | 29.93           | 40.00          | 10.07       |
| 102.71          | PK          | H               | 16.92          | 11.42                    | 28.34           | 43.50          | 15.16       |
| 240.43          | PK          | H               | 13.12          | 14.13                    | 27.25           | 46.00          | 18.75       |
| 380.41          | PK          | H               | 12.72          | 19.05                    | 31.77           | 46.00          | 14.23       |
| 528.56          | PK          | H               | 11.27          | 23.04                    | 34.31           | 46.00          | 11.69       |
| 801.17          | PK          | H               | 8.54           | 28.73                    | 37.27           | 46.00          | 8.73        |

1 GHz ~ 40 GHz

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Reading (dBuV) | Correct Factor (dB/m) | Amplifier Gain (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|--------------------|----------------|-----------------------|---------------------|-----------------|----------------|-------------|
| 1598.50         | PK          | V                  | 43.55          | 29.96                 | 26.54               | 46.97           | 74.00          | 27.03       |
| 1598.50         | AV          | V                  | 36.64          | 29.96                 | 26.54               | 40.06           | 54.00          | 13.94       |
| 2498.50         | PK          | V                  | 40.47          | 34.30                 | 25.70               | 49.06           | 74.00          | 24.94       |
| 2498.50         | AV          | V                  | 38.29          | 34.30                 | 25.70               | 46.88           | 54.00          | 7.12        |
| 4889.00         | PK          | V                  | 30.39          | 39.84                 | 23.51               | 46.72           | 74.00          | 27.28       |
| 4889.00         | AV          | V                  | 25.00          | 39.84                 | 23.51               | 41.33           | 54.00          | 12.67       |
|                 |             |                    |                |                       |                     |                 |                |             |
| 1601.50         | PK          | H                  | 44.82          | 30.33                 | 26.46               | 48.69           | 74.00          | 25.31       |
| 1601.50         | AV          | H                  | 38.84          | 30.33                 | 26.46               | 42.71           | 54.00          | 11.29       |
| 2498.50         | PK          | H                  | 41.73          | 34.30                 | 25.70               | 50.32           | 74.00          | 23.68       |
| 2498.50         | AV          | H                  | 39.61          | 34.30                 | 25.70               | 48.20           | 54.00          | 5.80        |
| 5147.00         | PK          | H                  | 35.10          | 40.21                 | 23.68               | 51.63           | 74.00          | 22.37       |
| 5147.00         | AV          | H                  | 28.18          | 40.21                 | 23.68               | 44.71           | 54.00          | 9.29        |

**Remark:**

- Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

Test mode: ANT 1+2

30 MHz ~ 1 GHz

| Frequency (MHz) | Detect Mode | Ant. Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|
| 78.20           | PK          | V               | 15.08          | 9.92                     | 25.00           | 40.00          | 15.00       |
| 163.34          | PK          | V               | 13.47          | 15.23                    | 28.70           | 43.50          | 14.80       |
| 271.82          | PK          | V               | 16.40          | 15.59                    | 31.99           | 46.00          | 14.01       |
| 380.41          | PK          | V               | 20.03          | 19.05                    | 39.08           | 46.00          | 6.92        |
| 500.25          | PK          | V               | 8.60           | 22.26                    | 30.86           | 46.00          | 15.14       |
| 720.52          | PK          | V               | 7.96           | 27.16                    | 35.12           | 46.00          | 10.88       |
|                 |             |                 |                |                          |                 |                |             |
| 102.00          | PK          | H               | 15.51          | 11.34                    | 26.85           | 43.50          | 16.65       |
| 144.39          | PK          | H               | 10.54          | 14.96                    | 25.50           | 43.50          | 18.00       |
| 233.56          | PK          | H               | 13.52          | 13.76                    | 27.28           | 46.00          | 18.72       |
| 380.41          | PK          | H               | 12.86          | 19.05                    | 31.91           | 46.00          | 14.09       |
| 528.56          | PK          | H               | 10.56          | 23.04                    | 33.60           | 46.00          | 12.40       |
| 799.98          | PK          | H               | 9.05           | 28.71                    | 37.76           | 46.00          | 8.24        |

1 GHz ~ 40 GHz

| Frequency (MHz) | Detect Mode | Polarization (V/H) | Reading (dBuV) | Correct Factor (dB/m) | Amplifier Gain (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|-----------------|-------------|--------------------|----------------|-----------------------|---------------------|-----------------|----------------|-------------|
| 1598.50         | PK          | V                  | 45.51          | 29.96                 | 26.54               | 48.93           | 74.00          | 25.07       |
| 1598.50         | AV          | V                  | 38.62          | 29.96                 | 26.54               | 42.04           | 54.00          | 11.96       |
| 2498.50         | PK          | V                  | 41.16          | 34.30                 | 25.70               | 49.75           | 74.00          | 24.25       |
| 2498.50         | AV          | V                  | 39.53          | 34.30                 | 25.70               | 48.12           | 54.00          | 5.88        |
| 4879.00         | PK          | V                  | 34.88          | 39.84                 | 23.51               | 51.21           | 74.00          | 22.79       |
| 4879.00         | AV          | V                  | 27.98          | 39.84                 | 23.51               | 44.31           | 54.00          | 9.69        |
|                 |             |                    |                |                       |                     |                 |                |             |
| 1601.50         | PK          | H                  | 45.06          | 30.33                 | 26.46               | 48.93           | 74.00          | 25.07       |
| 1601.50         | AV          | H                  | 38.17          | 30.33                 | 26.46               | 42.04           | 54.00          | 11.96       |
| 2498.00         | PK          | H                  | 41.16          | 34.30                 | 25.70               | 49.75           | 74.00          | 24.25       |
| 2498.00         | AV          | H                  | 39.53          | 34.30                 | 25.70               | 48.12           | 54.00          | 5.88        |
| 5194.00         | PK          | H                  | 34.68          | 40.21                 | 23.68               | 51.21           | 74.00          | 22.79       |
| 5194.00         | AV          | H                  | 27.78          | 40.21                 | 23.68               | 44.31           | 54.00          | 9.69        |

**Remark:**

- Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

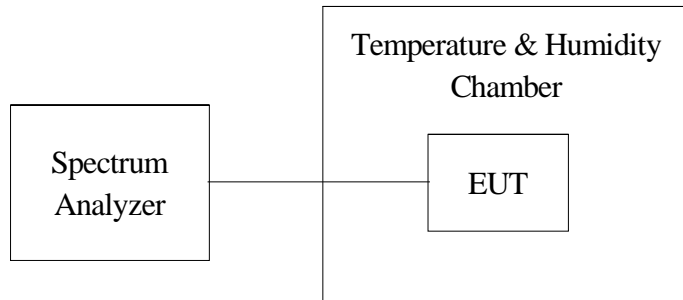


## 7.6. Frequency Stability

### Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### Test Configuration



### Test Procedures

1. The EUT is installed in an environment test chamber with external power source.
2. Set the chamber to operate at 50 centigrade and external power source to output at nominal voltage of EUT.
3. A sufficient stabilization period at each temperature is used prior to each frequency measurement.
4. When temperature is stabled, measure the frequency stability.
5. The test shall be performed under -20 to 50 centigrade and nominal voltage.

**Test Data**

| Frequency:<br>5785 MHz | Frequency Drift (ppm) |                |            |
|------------------------|-----------------------|----------------|------------|
| Temperature (°C)       | 0 minute              | 5 minutes      | 10 minutes |
| T 50 °C Vnom           | -3.25                 | -3.18          | -3.22      |
| T 40 °C Vnom           | -6.32                 | -5.27          | -5.33      |
| T 30 °C Vnom           | -4.52                 | -4.44          | -4.21      |
| T 20 °C Vnom           | -6.63                 | -6.59          | -6.60      |
| T 10 °C Vnom           | 0.71                  | 0.69           | 0.67       |
| T 0 °C Vnom            | 0.92                  | 1.02           | 0.94       |
| T -10 °C Vnom          | 1.33                  | 1.28           | 1.40       |
| T -20 °C Vnom          | 2.36                  | 2.14           | 2.11       |
| Vnom [Vdc]: 3.3        |                       |                |            |
| Tmax [°C]: 50          |                       | Tmin [°C]: -20 |            |

**7.7. Radio Frequency Exposure Procedures**

LIMIT

According to §15.247(i) and § 1.1307(b)(1) , systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

KDB 447498 D01: Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table:

| MHz  | 5  | 10 | 15  | 20  | 25  | mm                                         |
|------|----|----|-----|-----|-----|--------------------------------------------|
| 150  | 39 | 77 | 116 | 155 | 194 | SAR Test<br>Exclusion<br>Threshold<br>(mW) |
| 300  | 27 | 55 | 82  | 110 | 137 |                                            |
| 450  | 22 | 45 | 67  | 89  | 112 |                                            |
| 835  | 16 | 33 | 49  | 66  | 82  |                                            |
| 900  | 16 | 32 | 47  | 63  | 79  |                                            |
| 1500 | 12 | 24 | 37  | 49  | 61  |                                            |
| 1900 | 11 | 22 | 33  | 44  | 54  |                                            |
| 2450 | 10 | 19 | 29  | 38  | 48  |                                            |
| 3600 | 8  | 16 | 24  | 32  | 40  |                                            |
| 5200 | 7  | 13 | 20  | 26  | 33  |                                            |
| 5400 | 6  | 13 | 19  | 26  | 32  |                                            |
| 5800 | 6  | 12 | 19  | 25  | 31  |                                            |

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

Maximum Measured Transmitter Power:

| TEST Mode | Maximum Peak Conducted Output Power |      | Max Antenna Gain (dBi) | Numeric antenna gain (mW) |
|-----------|-------------------------------------|------|------------------------|---------------------------|
|           | (dBm)                               | (mW) |                        |                           |
| ANT 1     | 2.67                                | 1.85 | 4.96                   | 3.13                      |
| ANT 2     | 6.05                                | 4.03 | 4.96                   | 3.13                      |
| ANT 1+2   | 8.97                                | 7.89 | 7.97                   | 6.27                      |

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] = 7.89 / 25 \cdot \sqrt{5.745} = 0.76 \leq 3.0$

Threshold at which no SAR required is 48mW and  $\leq 3.0$  for 1-g SAR, Separation distance is 25mm. Conclusion : The SAR measurement is exempt.