# FCC Part 15E
# Measurement and Test Report

**For**

GL Technologies (Hong Kong) Limited

Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T.

HongKong

**FCC ID: 2AFIW-B1300**

| | |
|---|---|
| **FCC Rule(s):** | FCC Part 15E |
| **Product Description:** | **GL.iNet 1300M Home AC Router** |
| **Tested Model:** | **GL-B1300** |
| **Report No.:** | HCT17JR291E-2 |
| **Sample Receipt Date:** | September 28, 2017 |
| **Tested Date:** | November 12~ November 30, 2017 |
| **Issued Date:** | December 1, 2017 |
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM Test Technology Co., Ltd.

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# 1. GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

| **Client Information** | |
|---|---|
| Applicant: | **GL Technologies (Hong Kong) Limited** |
| Address of applicant: | Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T. Hong Kong |
| Manufacturer: | **GL Technologies (Hong Kong) Limited** |
| Address of manufacturer: | Unit 210D, 2/F, Enterprise Place Hong Kong Science Park, Shatin, N.T. Hong Kong |

| **General Description of EUT** | |
|---|---|
| Product Name: | GL.iNet 1300M Home AC Router |
| Trade Name: | GL·iNet |
| Model No.: | GL-B1300 |
| Adding Model(s): | / |
| Hardware Version: | GL-B1300-V1.3 |
| Software Version: | V2.264 |
| Rated Voltage: | Input: AC 100-240V, 50/60Hz ; Output: DC 12V 1.5A |
| Power Adapter Model: | / |
| | |
| *Note: The test data is gathered from a production sample provided by the manufacturer.* | |

| **Technical Characteristics of EUT** | |
|---|---|
| Frequency Range: | IEEE 802.11a: 5180MHz~5240MHz,<br>5745MHz~5825MHz<br>IEEE 802.11 n/ac HT20: 5180MHz~5240MHz,<br>5745MHz~5825MHz<br>IEEE 802.11 n/ac HT40: 5190MHz~5230MHz,<br>5755MHz~5795MHz<br>IEEE 802.11ac HT80: 5210MHz,<br>5775MHz |
| RF Output Power: | 20.44 dBm (Conducted) |
| Data Rate: | maximum of 867Mbps |
| Modulation: | IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11ac HT80: OFDM (64QAM, 16QAM, |

| | |
|---|---|
| | QPSK,BPSK, 256QAM) |
| Quantity of Channels: | 15 |
| Type of Antenna: | PCB Antenna |
| Antenna Gain: | Antenna1: 8.4dBi<br>Antenna1: 8.4dBi |
| Channel List: | As below table |

| 5G Band 5150~5250 MHz (U-NII-1) | | | | |
|---|---|---|---|---|
| **Frequency Band** | **Channel No.** | **Frequency** | **Channel No.** | **Frequency** |
| 5150~5250 MHz Band 1 | 36 | 5180 MHz | 44 | 5220 MHz |
| | 38 | 5190 MHz | 46 | 5230 MHz |
| | 40 | 5200 MHz | 48 | 5240 MHz |
| | 42 | 5210 MHz | | |
| Remark: For 20 MHz Bandwidth, use channel 36, 40, 44, 48.<br>For 40 MHz Bandwidth, use channel 38, 46.<br>For 80 MHz Bandwidth, use channel 38. | | | | |

| 5G Band 5725~5850 MHz | | | | |
|---|---|---|---|---|
| **Frequency Band** | **Channel No.** | **Frequency** | **Channel No.** | **Frequency** |
| 5725~5850 MHz Band 4 | 149 | 5745 MHz | 157 | 5785 MHz |
| | 151 | 5755 MHz | 159 | 5795 MHz |
| | 153 | 5765 MHz | 161 | 5805 MHz |
| | 155 | 5775 MHz | 165 | 5825 MHz |
| Remark: For 20 MHz Bandwidth, use channel 149, 153, 157, 161, 165.<br>For 40 MHz Bandwidth, use channel 151, 159.<br>For 80 MHz Bandwidth, use channel 155. | | | | |

## 1.2 Test Standards

The following report is prepared on behalf of the **GL TECHNOLOGIES (HONG KONG) LIMITED** in accordance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commission rules.

The objective is to determine compliance with FCC Part 15, Subpart C&E, and section 15.203, 15.205, 15.207, 15.209 and 15.407 of the Federal Communication Commission rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard

for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 789033 D02 v01r04 for Unlicensed National Information Infrastructure (U-NII) Devices and KDB 662911 D01 Multiple Transmitter Output v02r01 shall be performed also.

## 1.4 Table for parameters of Test Software setting

The test utility software used during testing was "RPTA1-71W.M4300.01.GD.2015Sep1". During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

| Mode | Test Frequency (MHz) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NCB: 20MHz | | | | | | | | | | | | |
| | 5180 | 5200 | 5240 | 5260 | 5300 | 5320 | 5500 | 5580 | 5700 | 5720 | 5745 | 5785 | 5825 |
| 802.11a 6Mbps | 19 | 19 | 19 | | | | | | | | 15 | 15 | 15 |
| 802.11n-HT20 MCS0 | 19 | 19 | 19 | | | | | | | | 15 | 15 | 15 |

| Mode | NCB: 40MHz | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 5190 | 5230 | 5270 | 5310 | 5510 | 5550 | 5670 | 5710 | 5755 | 5795 |
| 802.11n-HT40 MCS0 | 19 | 19 | | | | | | | 15 | 15 |

| Mode | NCB: 80MHz | | | | | |
|---|---|---|---|---|---|---|
| | 5210 | 5290 | 5530 | 5610 | 5690 | 5775 |
| 802.11ac-HT80 MCS0/Nss2 | 19 | | | | | 15 |

## 1.5 EUT operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under WIN XP were executed.

## 1.6 Test Facility

**FCC – Registration No.: 125990**

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

**Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

## 1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| **Test Mode List** | | |
|---|---|---|
| Test Mode | Description | Remark |
| TM1 | 802.11a | 5180MHz,5200MHz,5240MHz, 5745MHz, 5785MHz,5825MHz |
| TM2 | 802.11n-HT20 | 5180MHz,5200MHz,5240MHz, 5745MHz, 5785MHz,5825MHz |
| TM3 | 802.11n-HT40 | 5190MHz,5230MHz, 5755MHz,5795MHz |
| TM4 | 802.11ac-HT80 | 5210MHz, 5775MHz |
| Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report. | | |

| **EUT Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Core |
| Adapter Cable | 1.45 | Non-Shielded | Without Core |

| **Special Cable List and Details** | | | |
|---|---|---|---|
| Cable Description | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| Cable | 0.80 | Non-Shielded | Without Ferrite |
| USB cable | 0.80 | Non-Shielded | Without Ferrite |

| **Auxiliary Equipment List and Details** | | | |
|---|---|---|---|
| Description | Manufacturer | Model | Serial Number |
| Notebook PC | Lenovo Beijing co. LTD | Lenovo | Lenovo G50-45 |
| / | / | / | / |
| / | / | / | / |
| / | / | / | / |
| / | / | / | / |

## 1.8 Measurement Uncertainty

| Measurement uncertainty | | |
|---|---|---|
| Parameter | Conditions | Uncertainty |
| RF Output Power | Conducted | ±0.42dB |
| Occupied Bandwidth | Conducted | ±1.5% |
| Power Spectral Density | Conducted | ±1.8dB |
| Conducted Spurious Emission | Conducted | ±2.17dB |
| Conducted Emissions | Conducted | ±2.88dB |
| Transmitter Spurious Emissions | Radiated | ±5.1dB |

## 1.9 Test Equipment List and Details

| No. | Description | Manufacturer | Model | Serial No. | Cal Date | Due Date |
|---|---|---|---|---|---|---|
| SEMT-1072 | Spectrum Analyzer | Agilent | E4407B | MY41440400 | 2017-06-12 | 2018-06-11 |
| SEMT-1031 | Spectrum Analyzer | Rohde & Schwarz | FSP30 | 836079/035 | 2017-06-12 | 2018-06-11 |
| SEMT-1007 | EMI Test Receiver | Rohde & Schwarz | ESVB | 825471/005 | 2017-06-12 | 2018-06-11 |
| SEMT-1008 | Amplifier | Agilent | 8447F | 3113A06717 | 2017-06-12 | 2018-06-11 |
| SEMT-1043 | Amplifier | C&D | PAP-1G18 | 2002 | 2017-06-12 | 2018-06-11 |
| SEMT-1011 | Broadband Antenna | Schwarz beck | VULB9163 | 9163-333 | 2017-06-08 | 2018-06-07 |
| SEMT-1042 | Horn Antenna | ETS | 3117 | 00086197 | 2017-06-08 | 2018-06-07 |
| SEMT-1121 | Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170582 | 2017-06-08 | 2018-06-07 |
| SEMT-1069 | Loop Antenna | Schwarz beck | FMZB 1516 | 9773 | 2017-06-08 | 2018-06-07 |
| SEMT-1001 | EMI Test Receiver | Rohde & Schwarz | ESPI | 101611 | 2017-06-12 | 2018-06-11 |
| SEMT-1003 | L.I.S.N | Schwarz beck | NSLK8126 | 8126-224 | 2017-06-12 | 2018-06-11 |
| SEMT-1002 | Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100911 | 2017-06-12 | 2018-06-11 |
| SEMT-1168 | Pre-amplifier | Direction Systems Inc. | PAP-0126 | 14141-12838 | 2017-08-15 | 2018-08-14 |
| SEMT-1169 | Pre-amplifier | Direction Systems Inc. | PAP-2640 | 14145-14153 | 2017-08-15 | 2018-08-14 |
| SEMT-1163 | Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100612 | 2017-06-12 | 2018-06-11 |
| SEMT-1170 | DRG Horn Antenna | A.H. SYSTEMS | SAS-574 | 571 | 2017-03-09 | 2018-03-08 |

# 2. SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test Item | Result |
|---|---|---|
| § 15.203; § 15.405 | Antenna Requirement | Compliant |
| § 15.207; § 15.407(b)(6) | Conducted Emission | Compliant |
| § 15.407(a)(1),(2) | Power Spectral Density | Compliant |
| § 15.407(e) | Emission Bandwidth and Occupied Bandwidth | Compliant |
| § 15.407(a)(1),(2) | Maximum Conducted Output Power | Compliant |
| § 15.407(b)(1),(2),(3) | Conducted Spurious Emission | Compliant |
| § 15.205; § 15.407(b)(1),(2),(3) | Radiated Emission | Compliant |
| § 15.407(g) | Frequency Stability | Compliant |
| § 15.407(h) | Dynamic Frequency Selection (DFS) | N/A |

N/A: not applicable

# 3. RF Exposure

## 3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

## 3.2 Test Result

This product complied with the requirement of the RF exposure, please see the MPE Report.

# 4. Antenna Requirement

## 4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

## 4.2 Evaluation Information

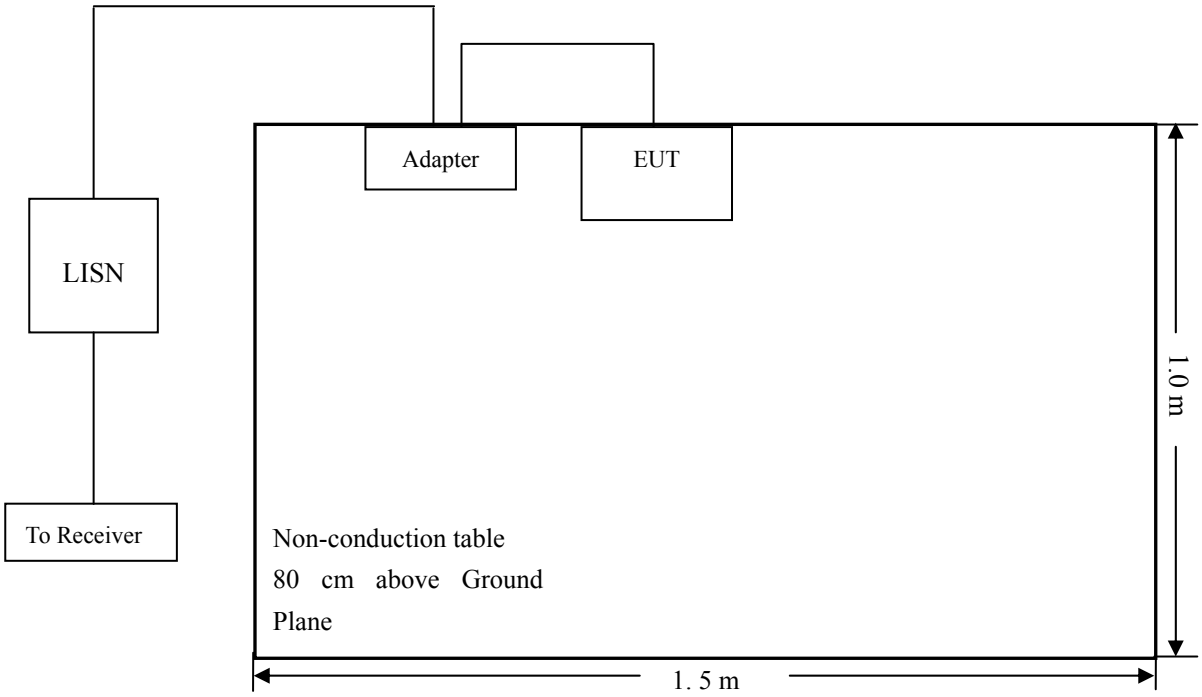
This product has two PCB Antenna, fulfill the requirement of this section.

# 5. Conducted Emissions

## 5.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.

## 5.3 Basic Test Setup Block Diagram



## 5.4 Environmental Conditions

| | |
|---|---|
| Temperature: | 25 °C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

## 5.5 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz
Stop Frequency ..... 30 MHz
Sweep Speed ..... Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth ..... 9 kHz
Quasi-Peak Adapter Mode ..... Normal

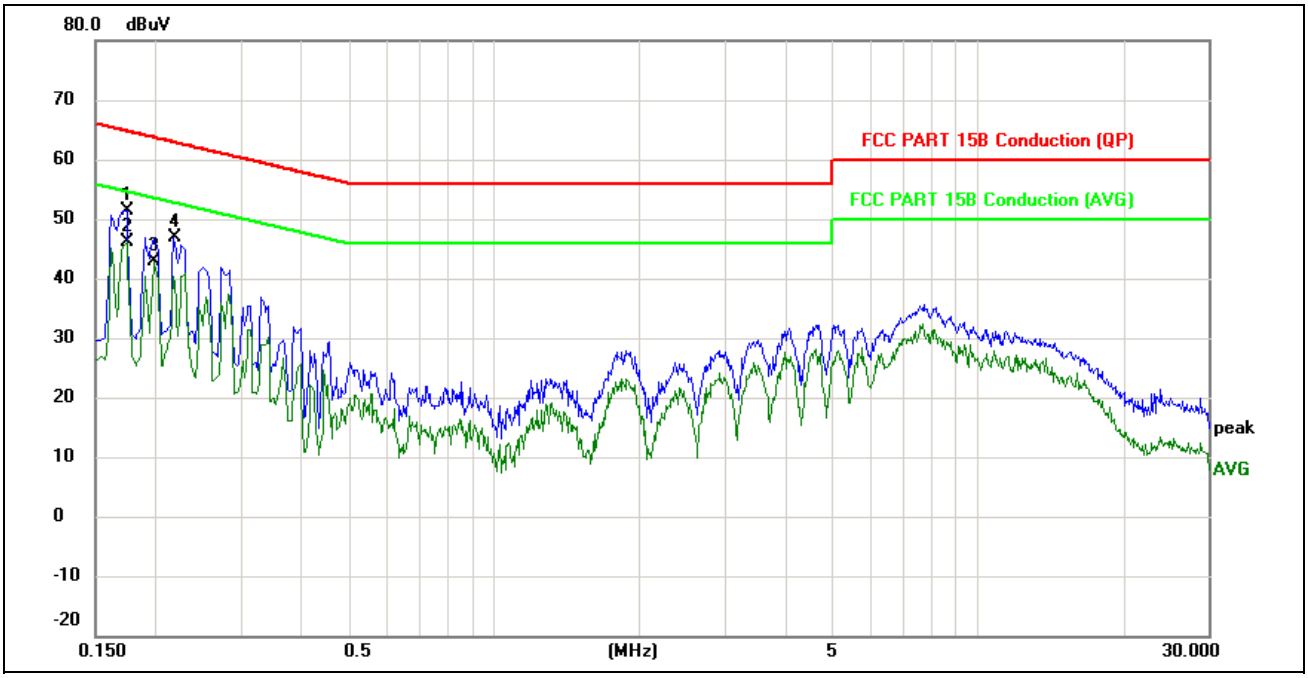
## 5.6 Summary of Test Results/Plots

According to the data in section 3.8, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

## 5.7 Conducted Emissions Test Data

**Plot of Conducted Emissions Test Data**

| | |
|---|---|
| EUT: | GL.iNet 1300M Home AC Router |
| Tested Model: | GL-B1300 |
| Operating Condition: | Transmitting |
| Comment: | AC 120V/60Hz; Adapter DC12V/1.5A |
| Test Specification: | Neutral |

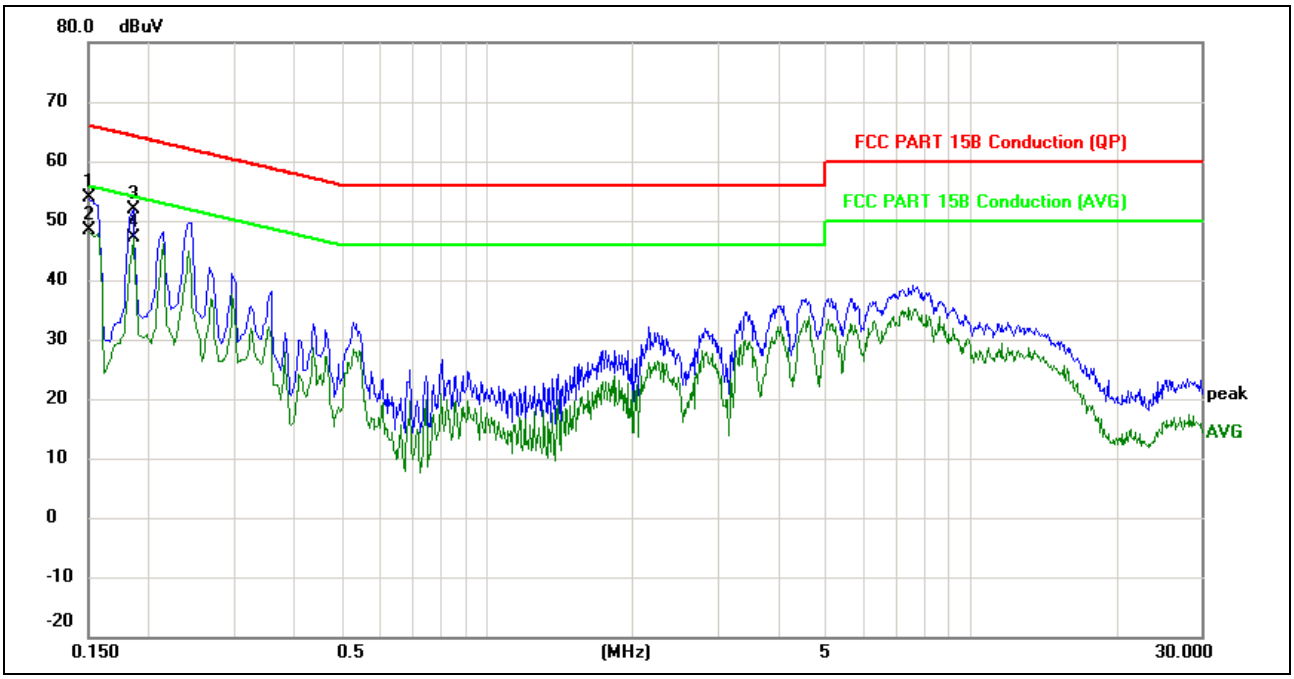



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | dB | (dBuV) | (dBuV) | (dB) | |
| 1 | 0.1740 | 40.29 | 11.04 | 51.33 | 64.77 | -13.44 | QP |
| 2 | 0.1740 | 35.10 | 11.04 | 46.14 | 54.77 | -8.63 | AVG |
| 3 | 0.1980 | 30.91 | 11.88 | 42.79 | 53.69 | -10.90 | AVG |
| 4 | 0.2180 | 34.99 | 11.95 | 46.94 | 62.89 | -15.95 | QP |

Note:

1. Result Level = Reading Level +Correct Factor (LISN Factor + Pulse Limiter Factor + Cable loss).
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz-150 kHz), 9 kHz (150 kHz-30 MHz), Step size: 4 kHz, Scan time: auto.

| | |
|---|---|
| EUT: | GL.iNet 1300M Home AC Router |
| Tested Model: | GL-B1300 |
| Operating Condition: | Transmitting |
| Comment: | AC 120V/60Hz; Adapter DC12V/1.5A |
| Test Specification: | Line |




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | dB | (dBuV) | (dBuV) | (dB) | |
| 1 | 0.1500 | 41.57 | 12.22 | 53.79 | 66.00 | -12.21 | QP |
| 2 | 0.1500 | 36.06 | 12.22 | 48.28 | 56.00 | -7.72 | AVG |
| 3 | 0.1860 | 38.49 | 13.43 | 51.92 | 64.21 | -12.29 | QP |
| 4 | 0.1860 | 33.76 | 13.43 | 47.19 | 54.21 | -7.02 | AVG |

Note:

1. Result Level = Reading Level +Correct Factor (LISN Factor + Pulse Limiter Factor + Cable loss).
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.

# 6. Power Spectral Density

## 6.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

## 6.2 Test Procedure

According to 789033 D02 General UNII Test Procedures New Rules v01r04, the following is the measurement procedure.
For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

## 6.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 20° C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 6.4 Summary of Test Results/Plots

***5150-5250MHz***

| Operating mode | Test Channel | Power Spectral Density dBm/MHz | | | Limit (dBm/MHz) |
|---|---|---|---|---|---|
| | | Chain 1 | Chain 2 | Total | |
| 802.11a | 5180 | 4.612 | 4.015 | 7.33 | 11 |
| | 5200 | 4.618 | 4.257 | 7.45 | 11 |
| | 5240 | 4.672 | 4.747 | 7.72 | 11 |
| 802.11n-HT20 | 5180 | 4.568 | 4.046 | 7.33 | 11 |
| | 5200 | 4.727 | 3.958 | 7.37 | 11 |
| | 5240 | 4.800 | 4.278 | 7.56 | 11 |
| 802.11n-HT40 | 5190 | 1.293 | 0.322 | 3.84 | 11 |
| | 5230 | 1.305 | 0.732 | 4.04 | 11 |
| 802.11ac-HT80 | 5210 | -1.684 | -2.688 | 0.85 | 11 |

***5725-5850MHz***

| Operating mode | Test Channel | RBW = 1MHz Measurement Power Spectral Density (dBm / MHz) | | | Correction Factor 10log(500KHz / RBW) | Power Spectral Density (dBm / 500kHz) | Limit (dBm/500kHz) |
|---|---|---|---|---|---|---|---|
| | | Chain 1 | Chain 2 | Total | Total | Total | |
| 802.11a | 5745 | 5.012 | 4.422 | 7.74 | -3.01 | 4.73 | 30 |
| | 5785 | 4.876 | 4.548 | 7.73 | -3.01 | 4.72 | 30 |
| | 5825 | 4.931 | 4.611 | 7.78 | -3.01 | 4.77 | 30 |
| 802.11n-HT20 | 5745 | 4.901 | 4.586 | 7.76 | -3.01 | 4.75 | 30 |
| | 5785 | 4.832 | 4.564 | 7.71 | -3.01 | 4.70 | 30 |
| | 5825 | 4.942 | 4.495 | 7.73 | -3.01 | 4.72 | 30 |
| 802.11n-HT40 | 5755 | 1.129 | 0.510 | 3.84 | -3.01 | 0.83 | 30 |
| | 5795 | 0.985 | 0.875 | 3.94 | -3.01 | 0.93 | 30 |
| 802.11ac-HT80 | 5775 | -1.564 | -2.153 | 1.16 | -3.01 | -1.85 | 30 |

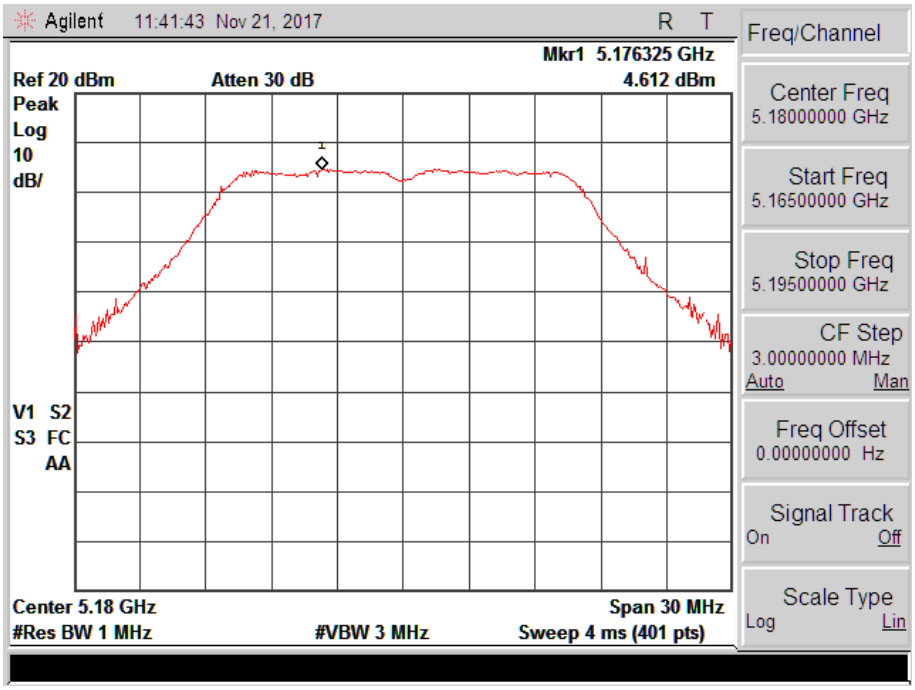
Remark: Power Spectral Density (dBm / 500kHz) = Measurement Power Spectral Density (dBm / MHz) + Correction Factor,

Where, Correction Factor = 10log ( 500KHz / RBW ) = -3.01 dB.

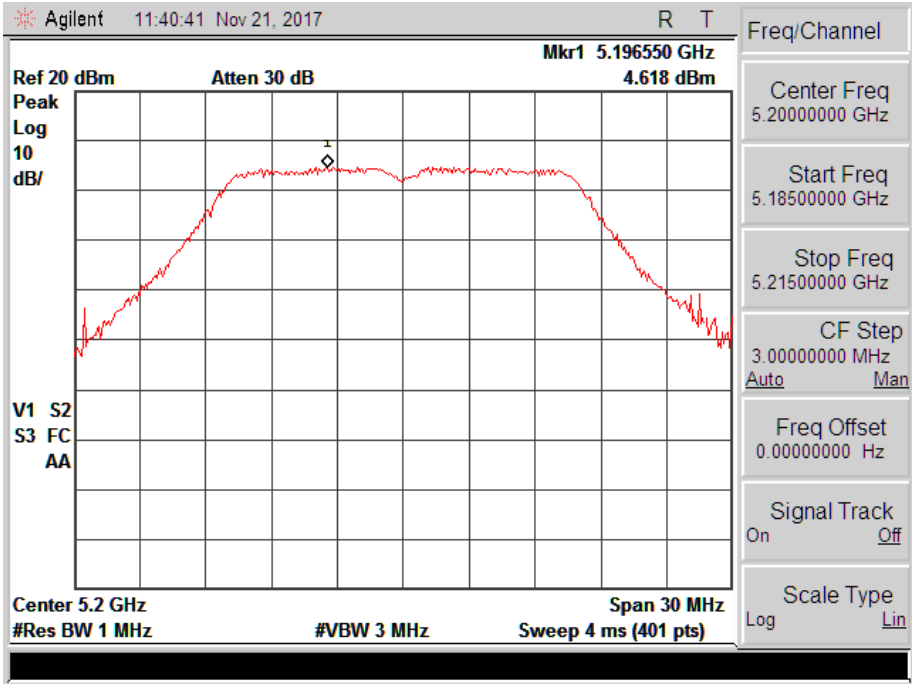
*Test Plots*

**Antenna 1**

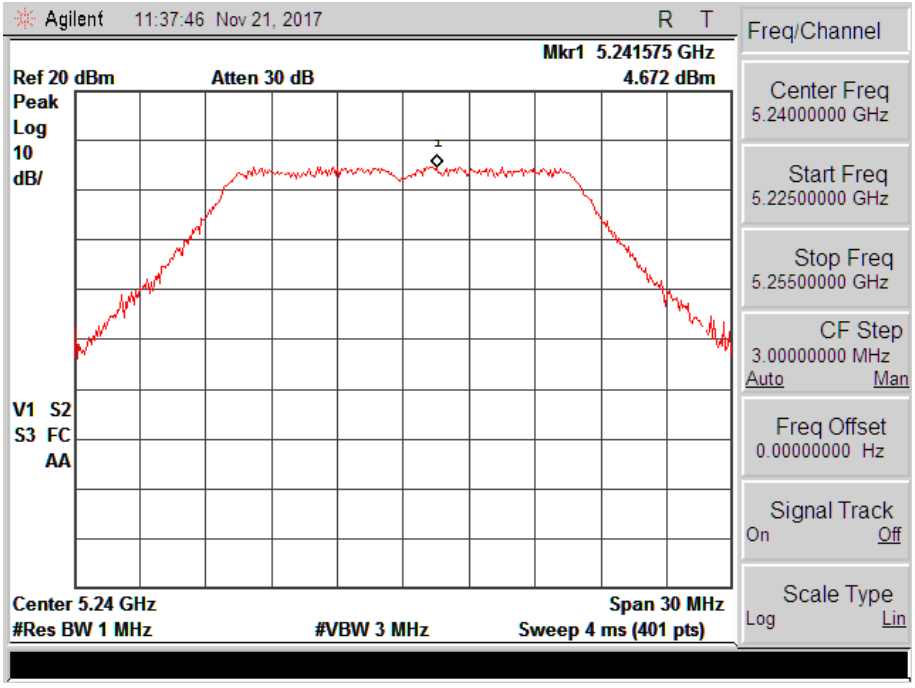
(Plot 4.6.1 A: Channel 36: 5180MHz @ 802.11a)



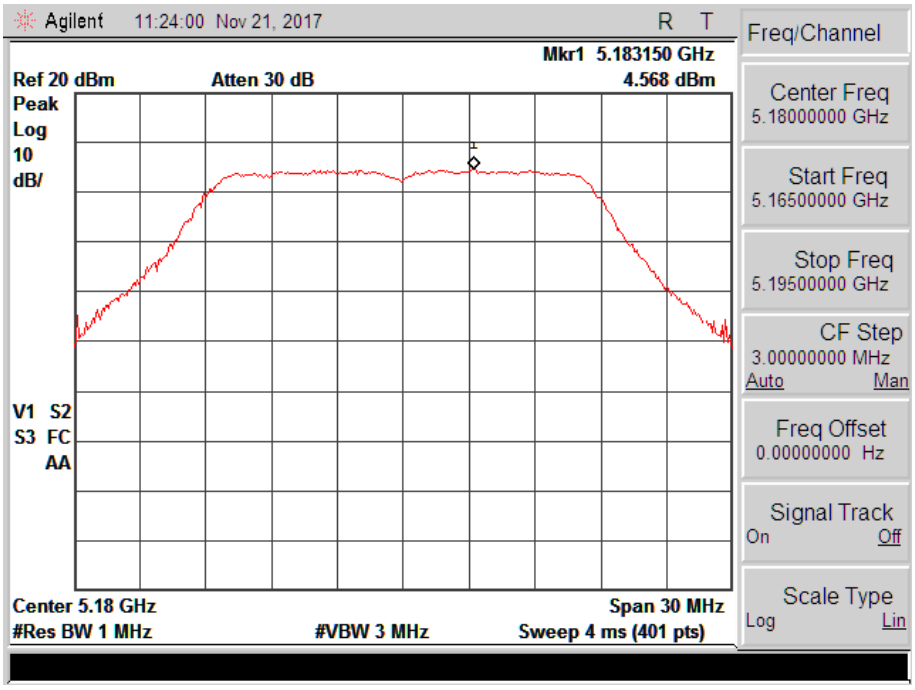

(Plot 4.6.1 B: Channel 40: 5200MHz @ 802.11a)



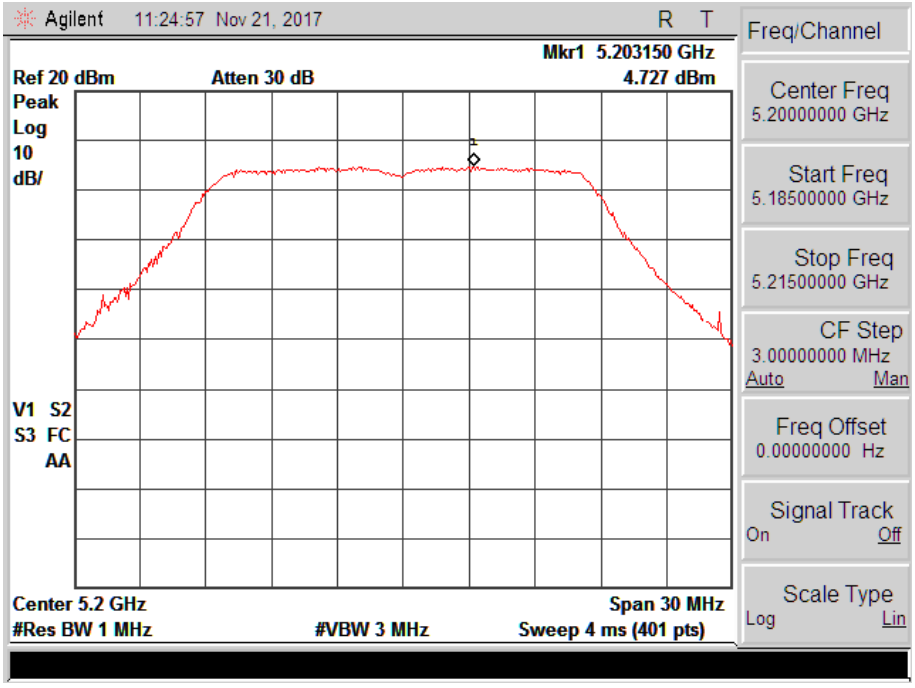
(Plot 4.6.1 C: Channel 48: 5240MHz @ 802.11a)



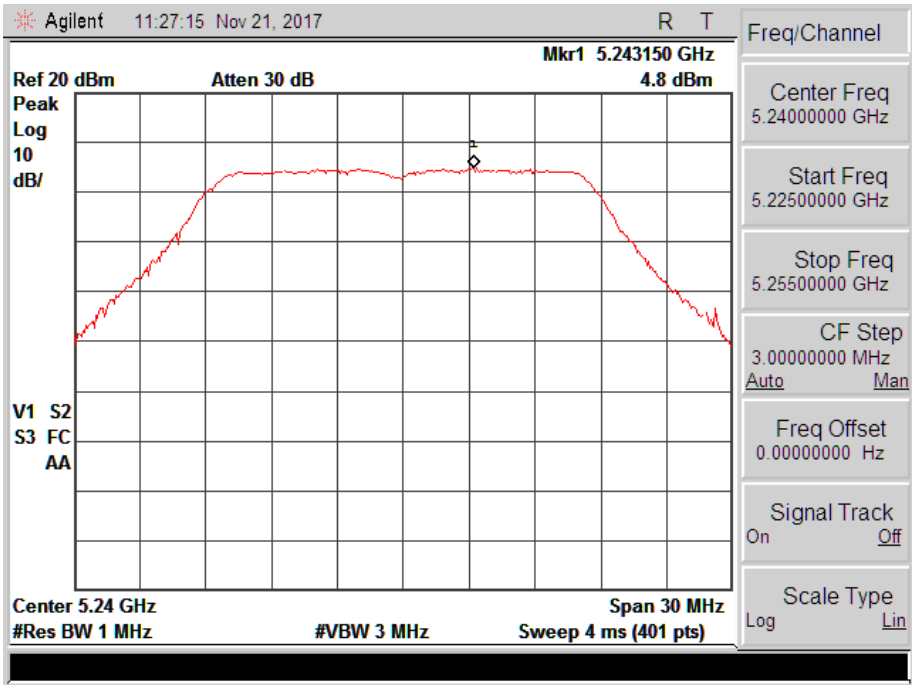

(Plot 4.6.2 A: Channel 36: 5180MHz @ 802.11n HT20)



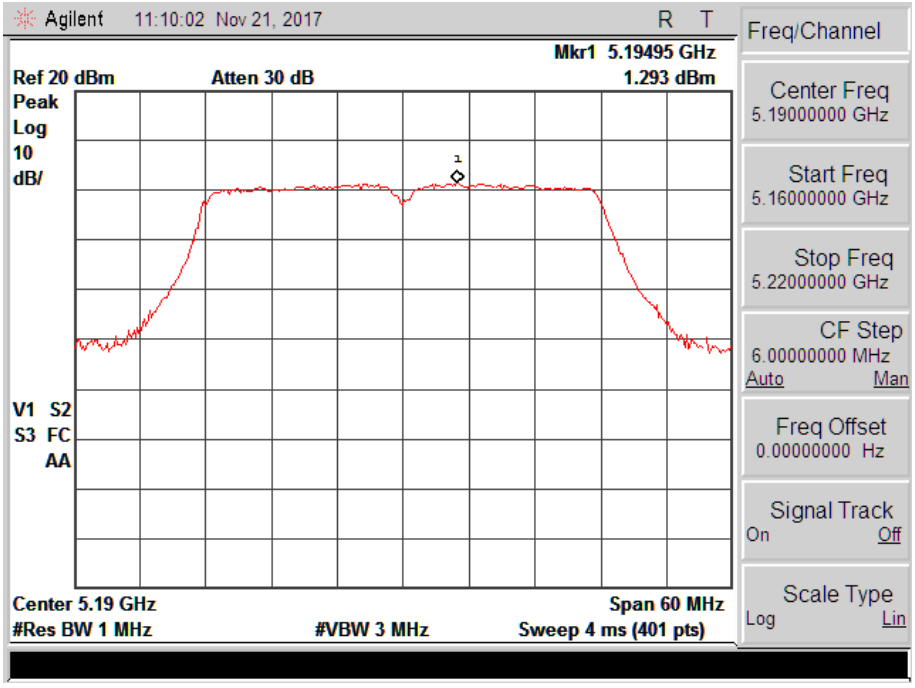
(Plot 4.6.2 B: Channel 40: 5200MHz @ 802.11n HT20)



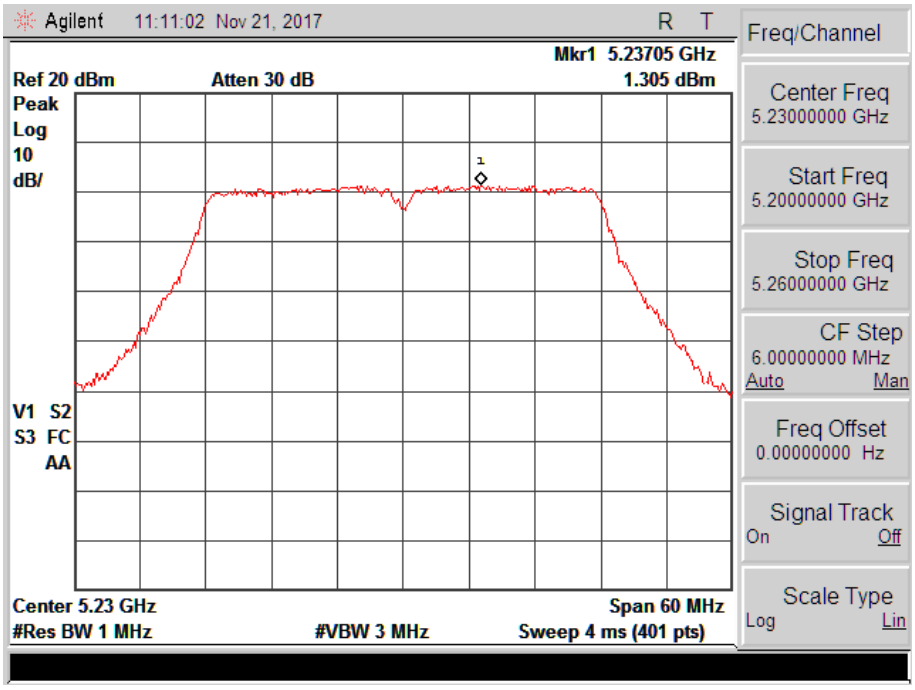

(Plot 4.6.2 C: Channel 48: 5240MHz @ 802.11n HT20)



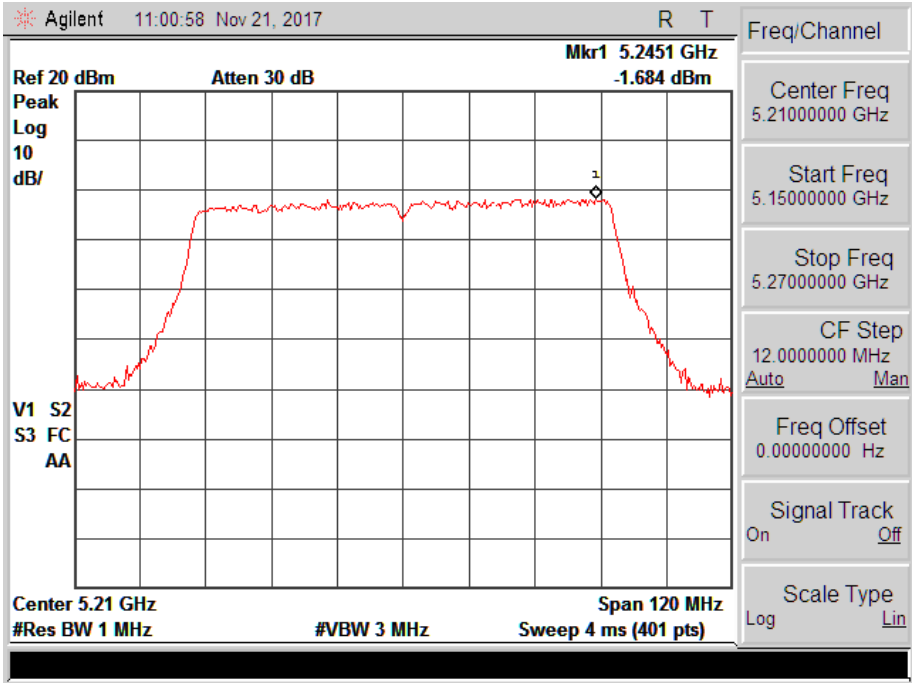
(Plot 4.6.3 A: Channel 38: 5190MHz @ 802.11n HT40)



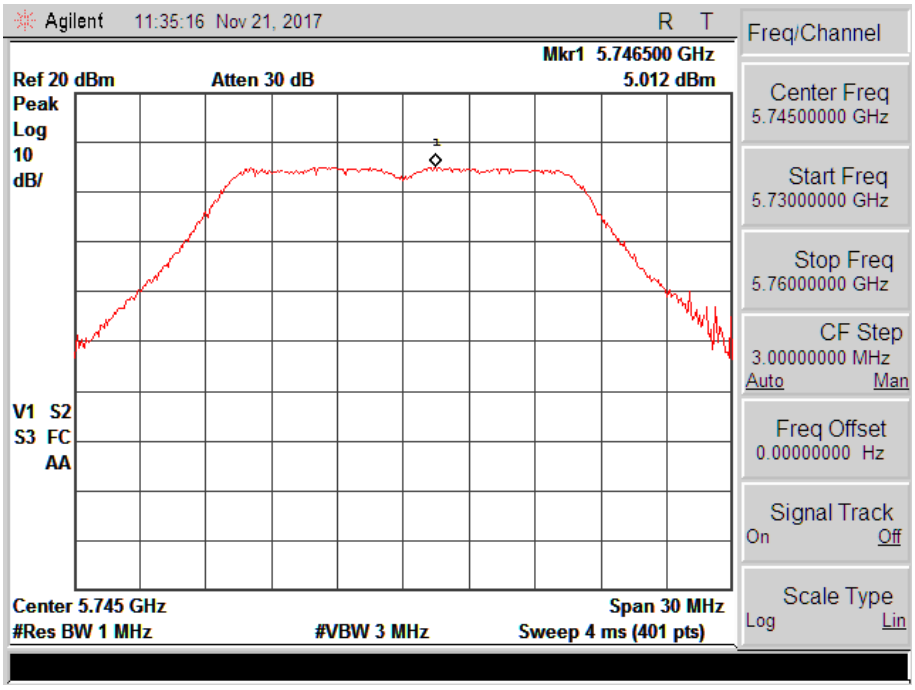

(Plot 4.6.3 B: Channel 46: 5230MHz @ 802.11n HT40)



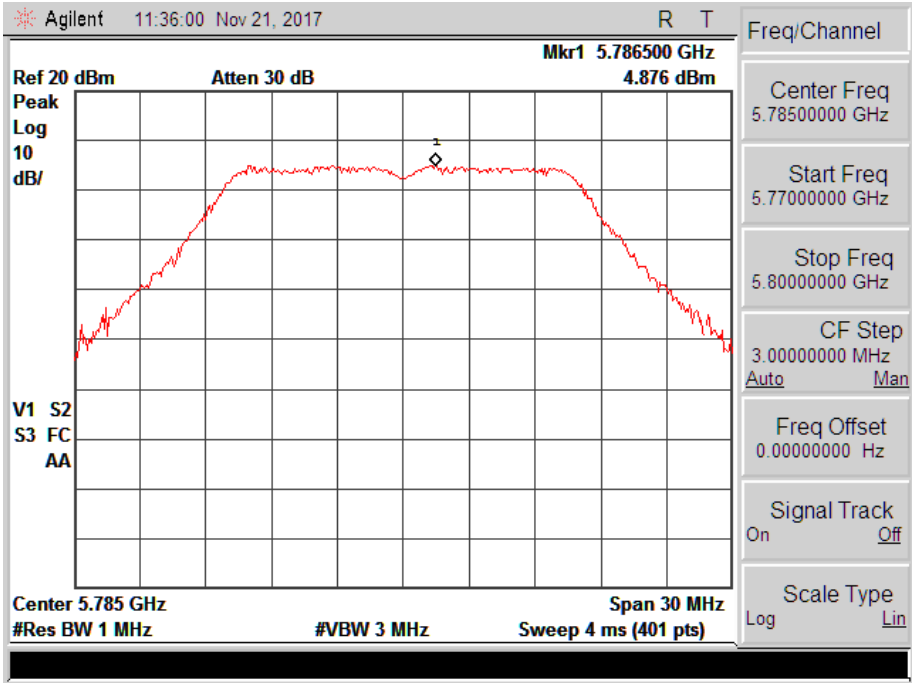
(Plot 4.6.4 A: Channel 42: 5210MHz @ 802.11ac HT80)



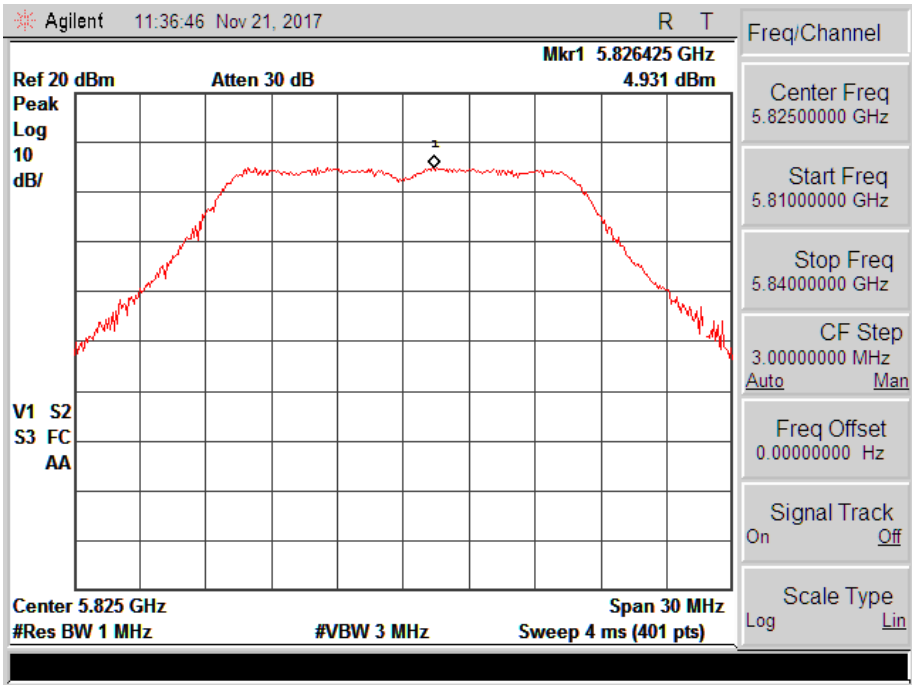

(Plot 4.6.5 A: Channel 149: 5745MHz @ 802.11a)



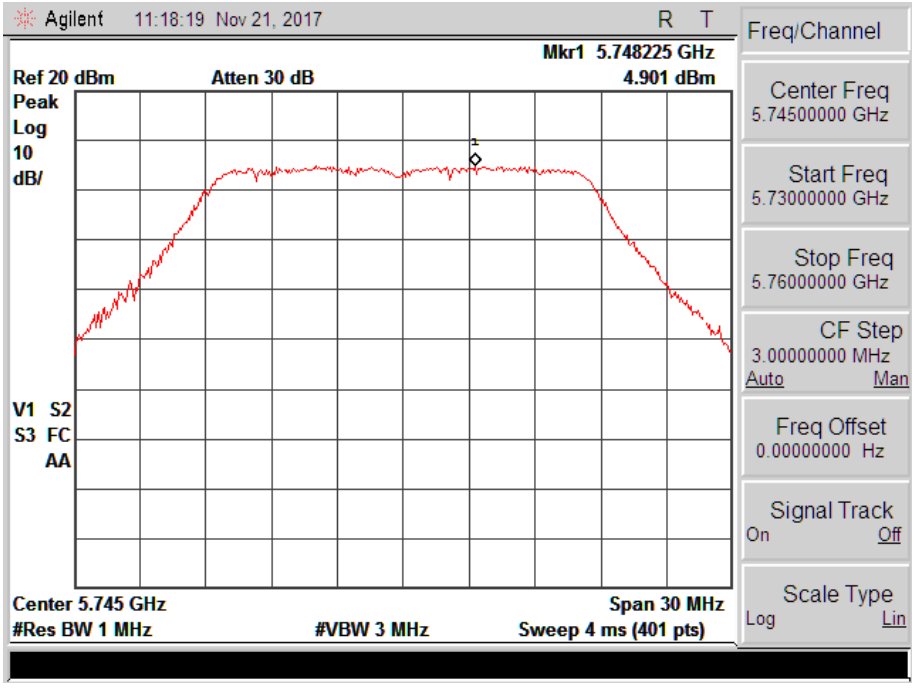
(Plot 4.6.5 B: Channel 157: 5785MHz @ 802.11a)



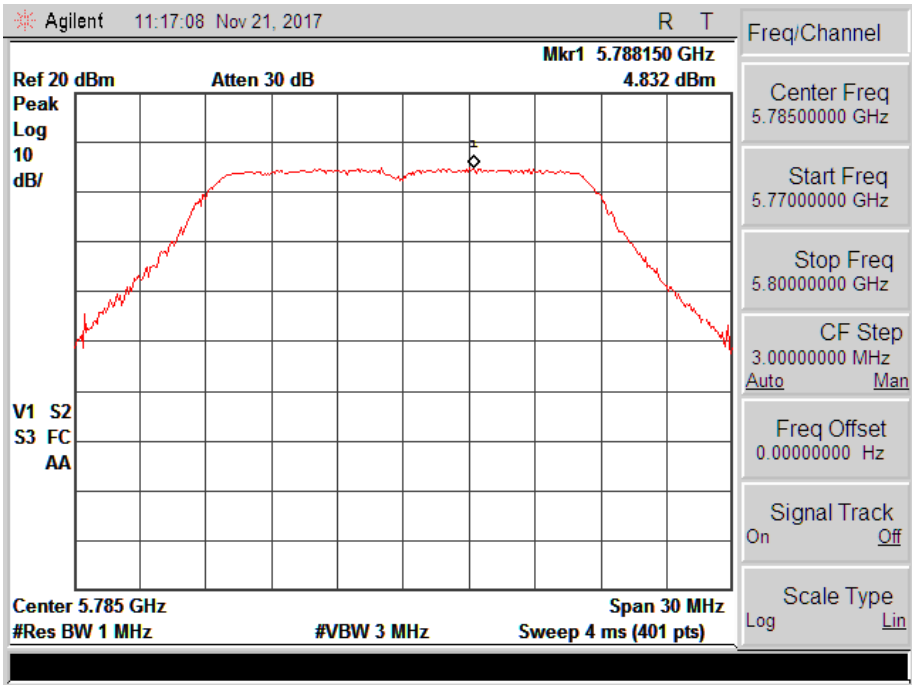

(Plot 4.6.5 C: Channel 165: 5825MHz @ 802.11a)



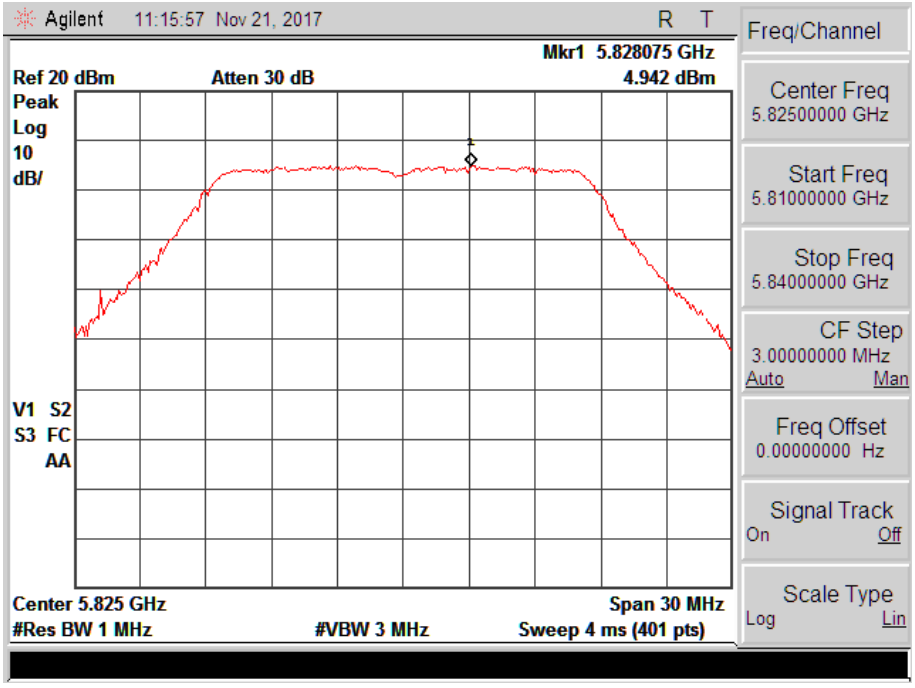
(Plot 4.6.6 A: Channel 149: 5745MHz @ 802.11n HT20)



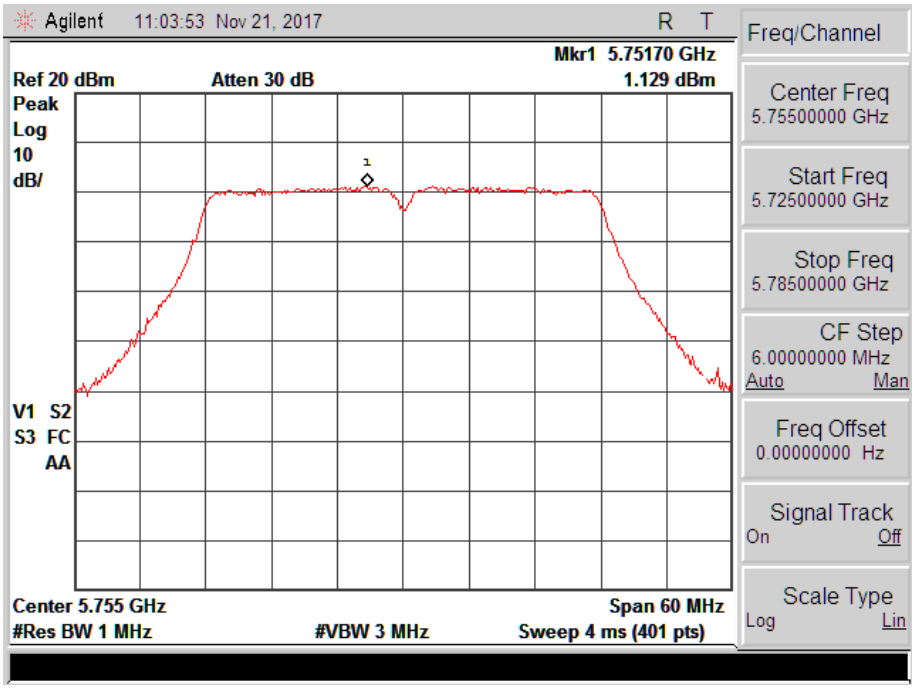

(Plot 4.6.6 B: Channel 157: 5785MHz @ 802.11n HT20)



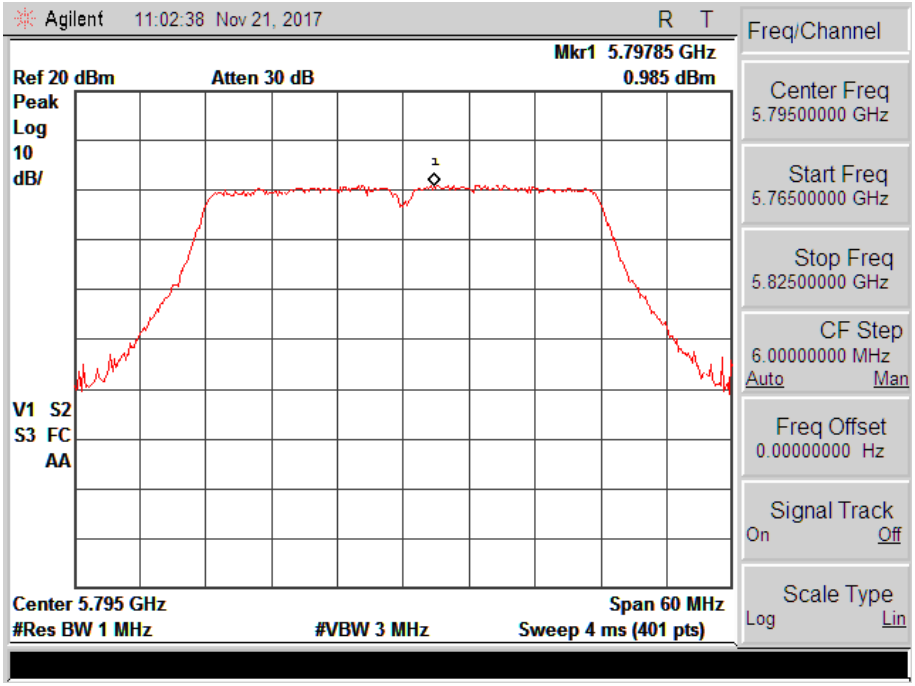
(Plot 4.6.6 C: Channel 165: 5825MHz @ 802.11n HT20)



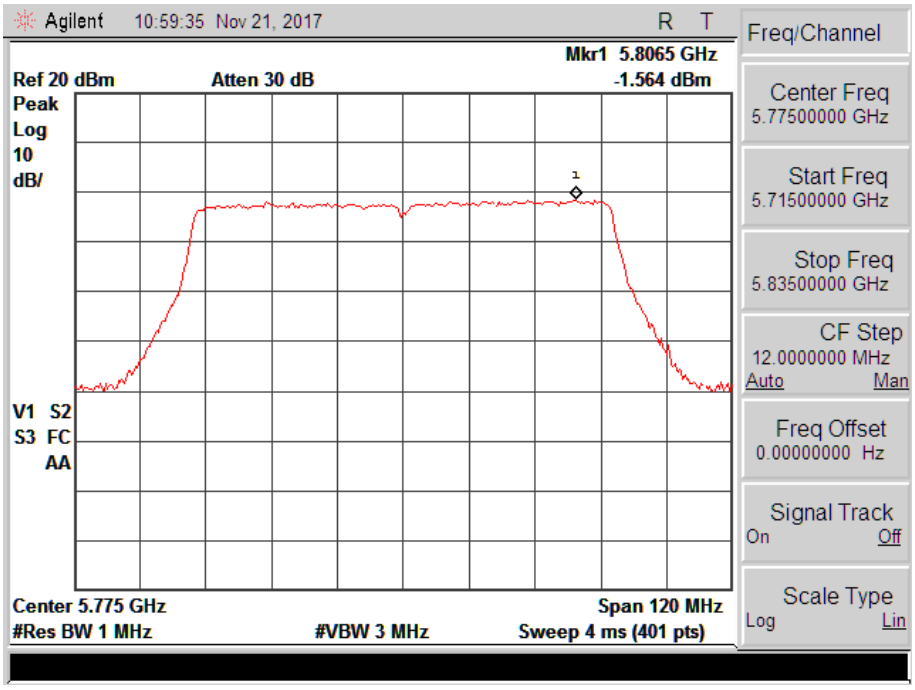

(Plot 4.6.7 A: Channel 151: 5755MHz @ 802.11n HT40)



(Plot 4.6.7 B: Channel 159: 5795MHz @ 802.11n HT40)

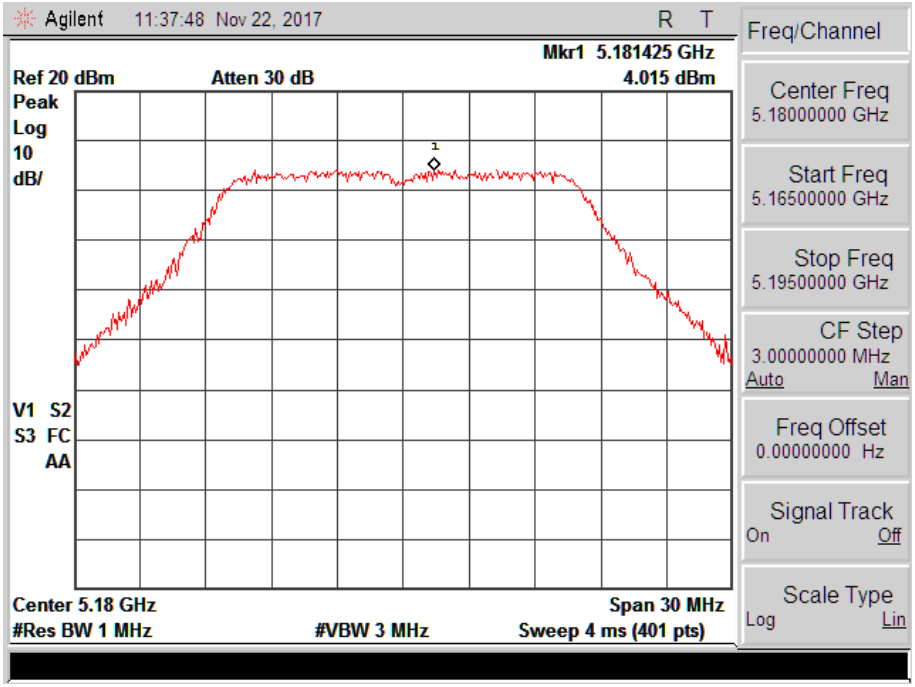



(Plot 4.6.8 A: Channel 155: 5775MHz @ 802.11ac HT80)

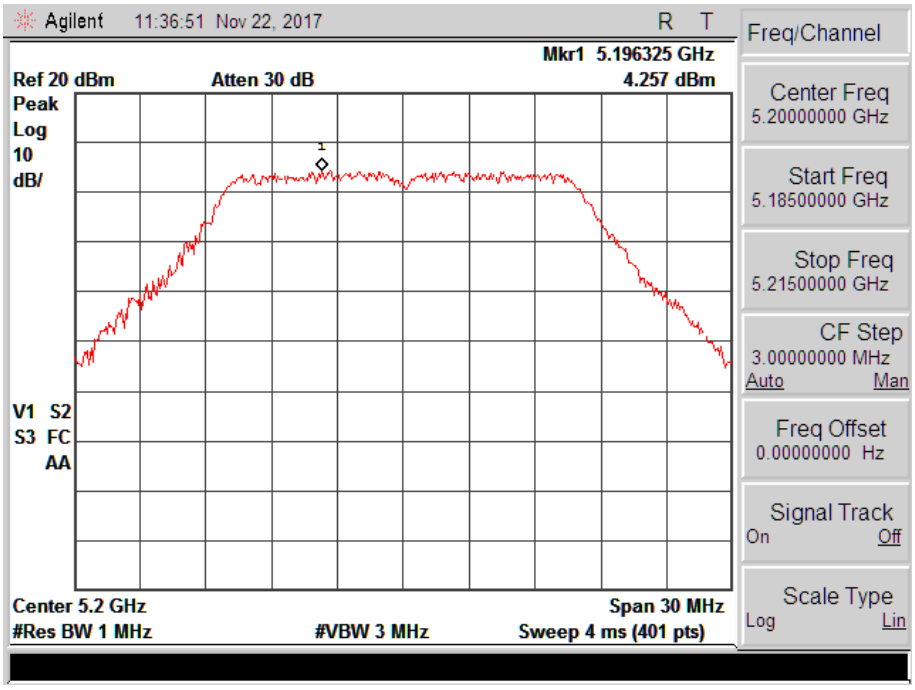


**Antenna 2**

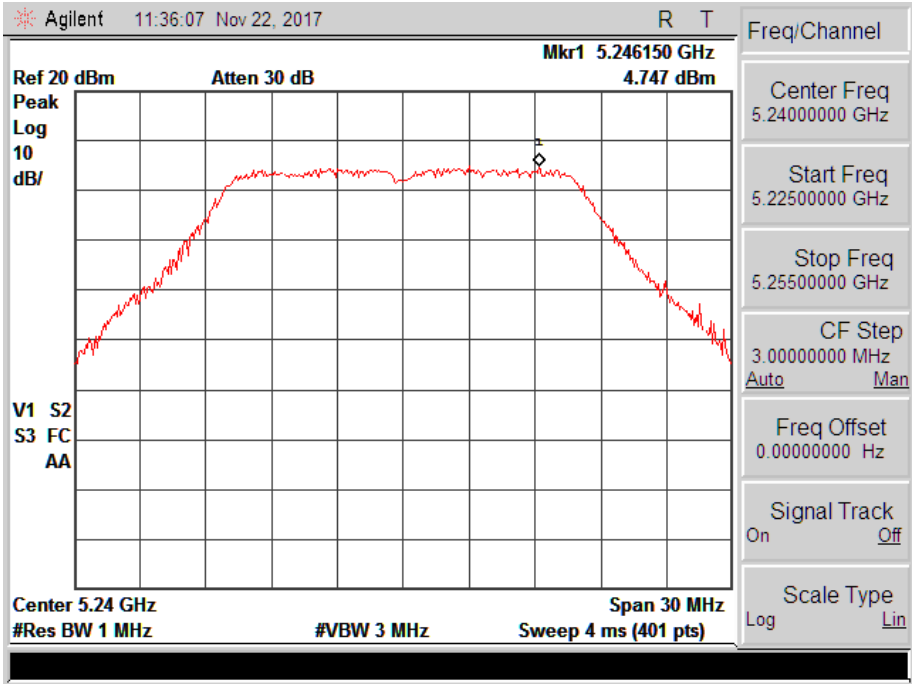
(Plot 4.6.1 A: Channel 36: 5180MHz @ 802.11a)



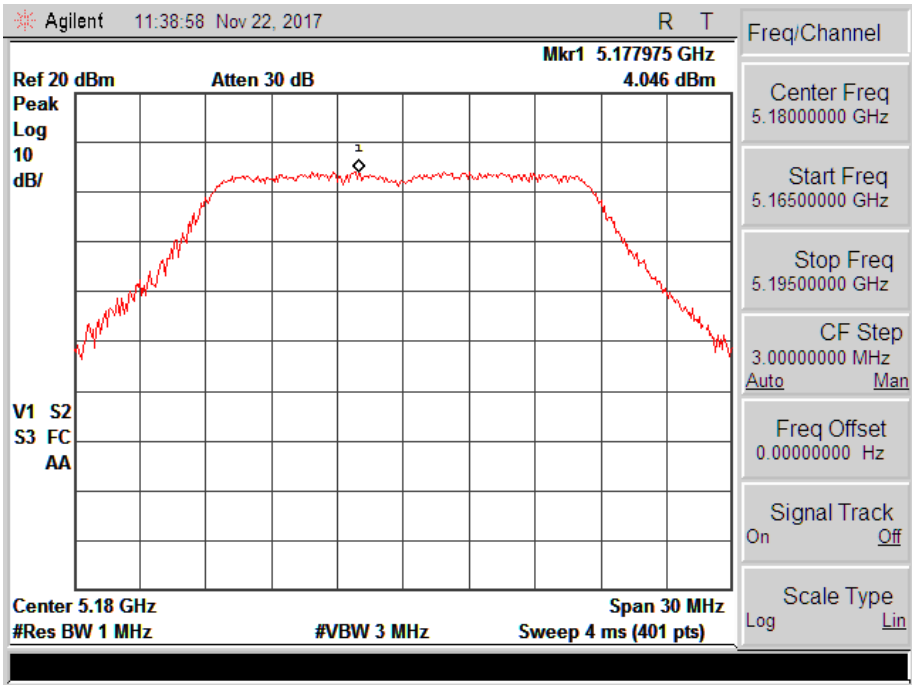

(Plot 4.6.1 B: Channel 40: 5200MHz @ 802.11a)



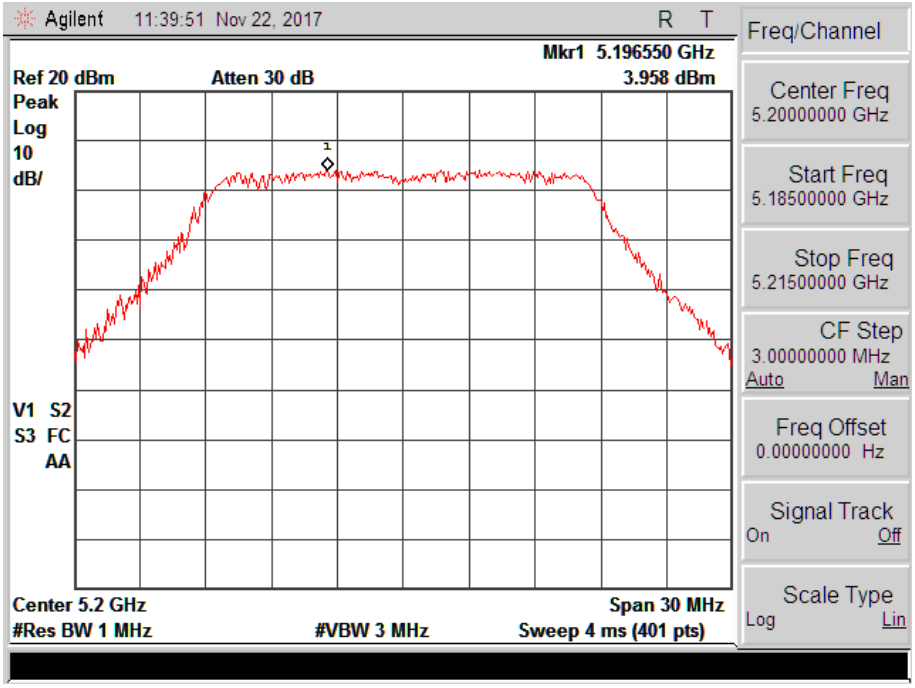
(Plot 4.6.1 C: Channel 48: 5240MHz @ 802.11a)



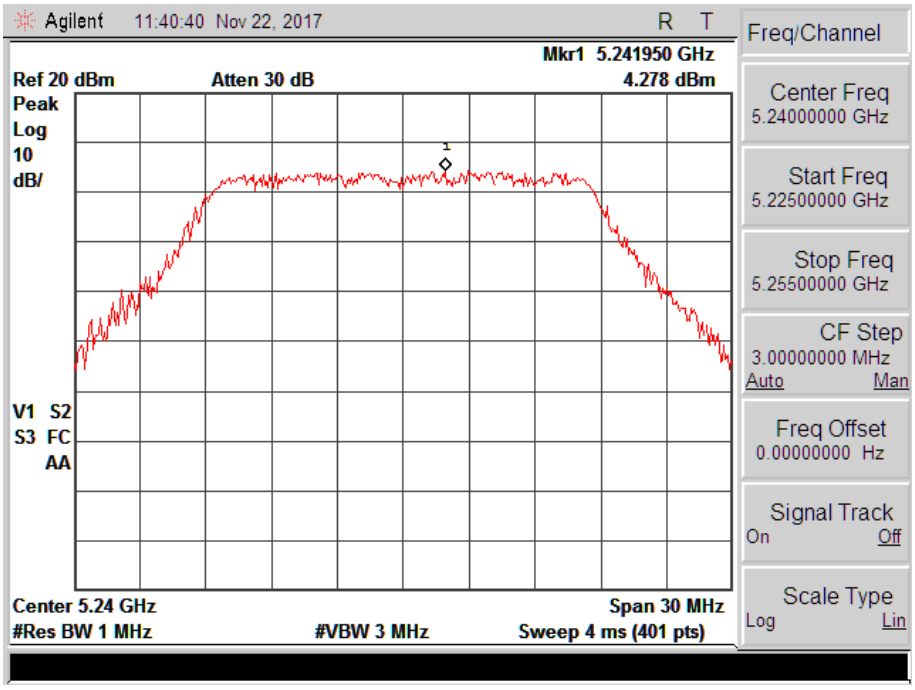

(Plot 4.6.2 A: Channel 36: 5180MHz @ 802.11n HT20)



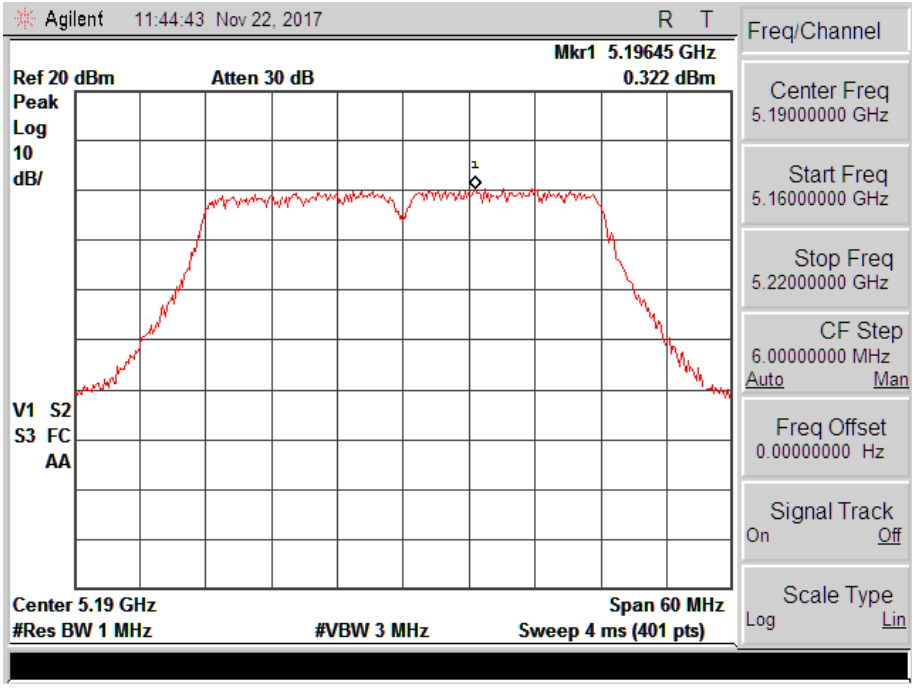
(Plot 4.6.2 B: Channel 40: 5200MHz @ 802.11n HT20)



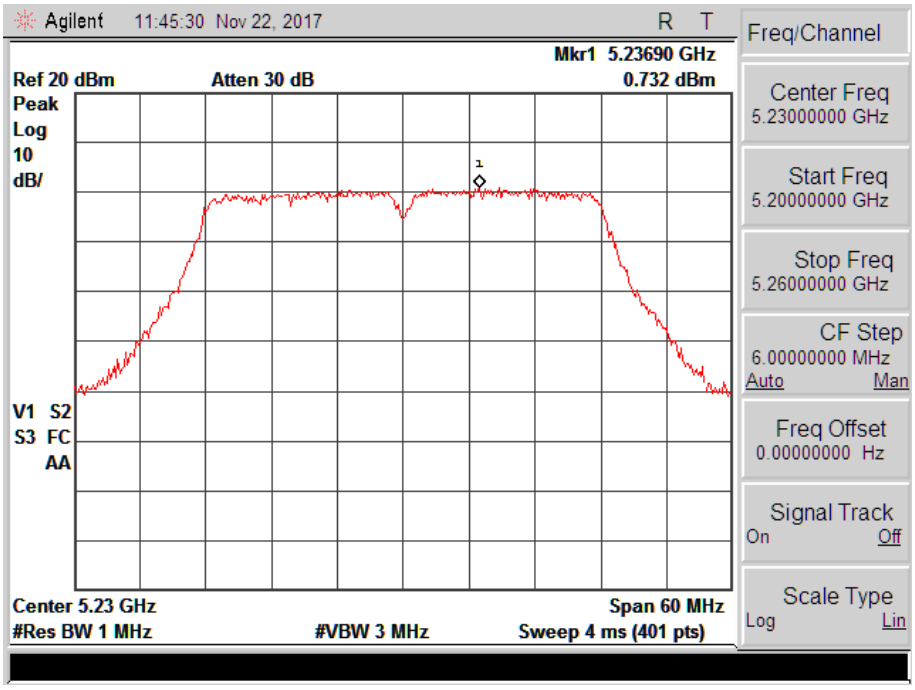

(Plot 4.6.2 C: Channel 48: 5240MHz @ 802.11n HT20)



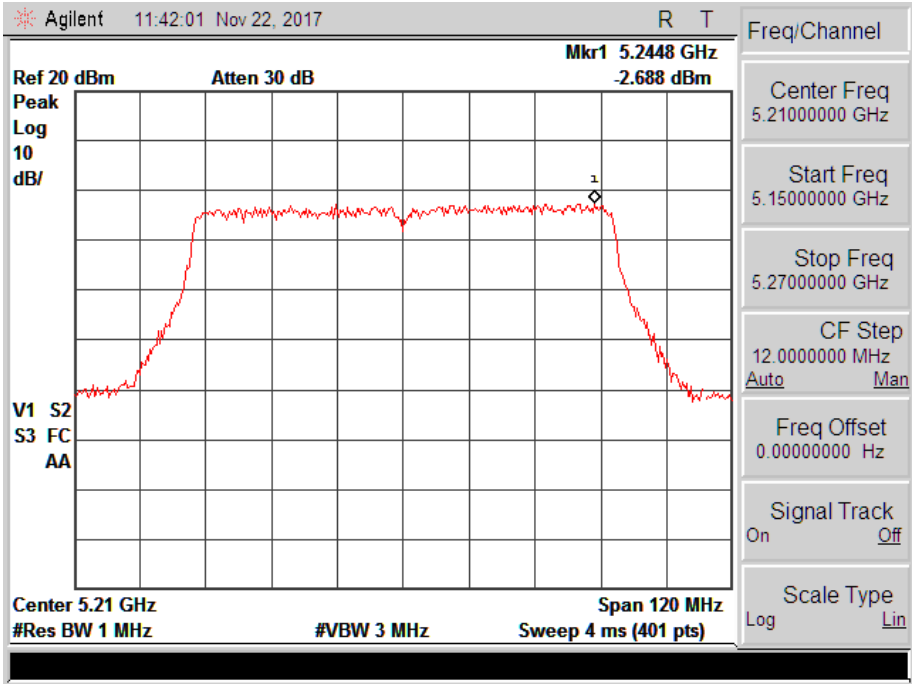
(Plot 4.6.3 A: Channel 38: 5190MHz @ 802.11n HT40)



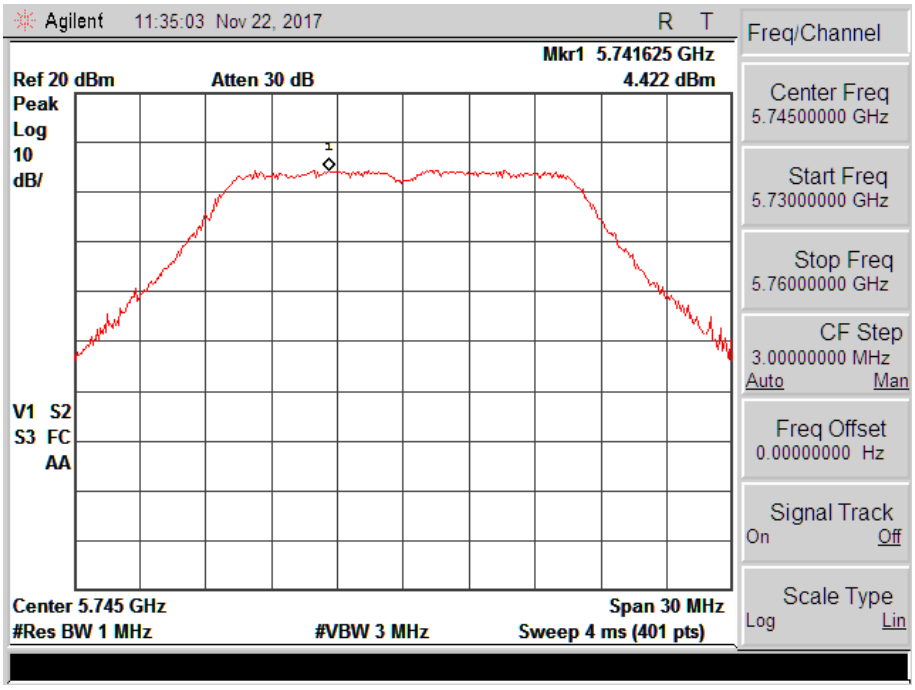

(Plot 4.6.3 B: Channel 46: 5230MHz @ 802.11n HT40)



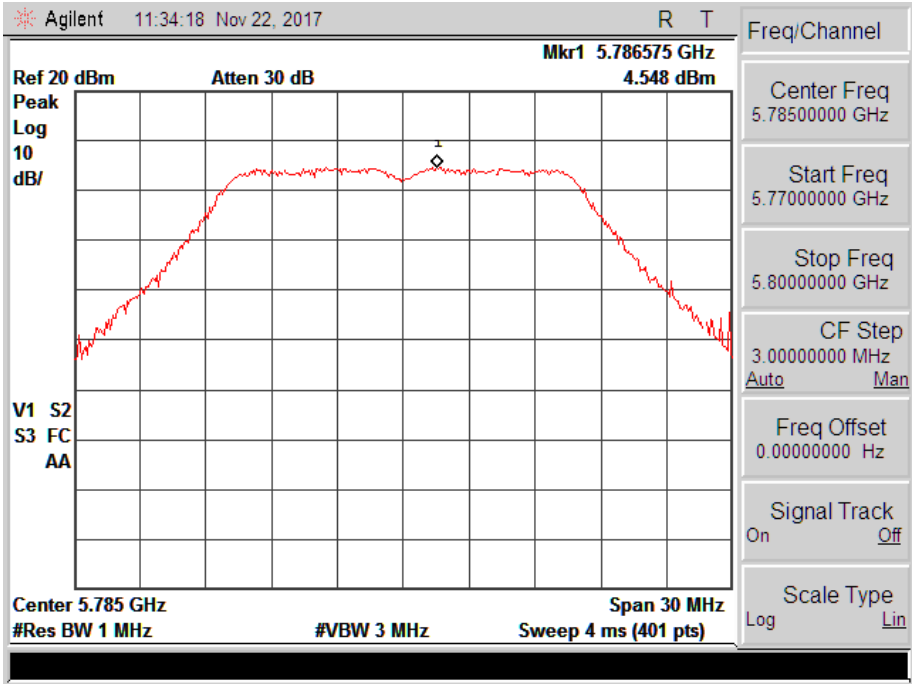
(Plot 4.6.4 A: Channel 42: 5210MHz @ 802.11ac HT80)



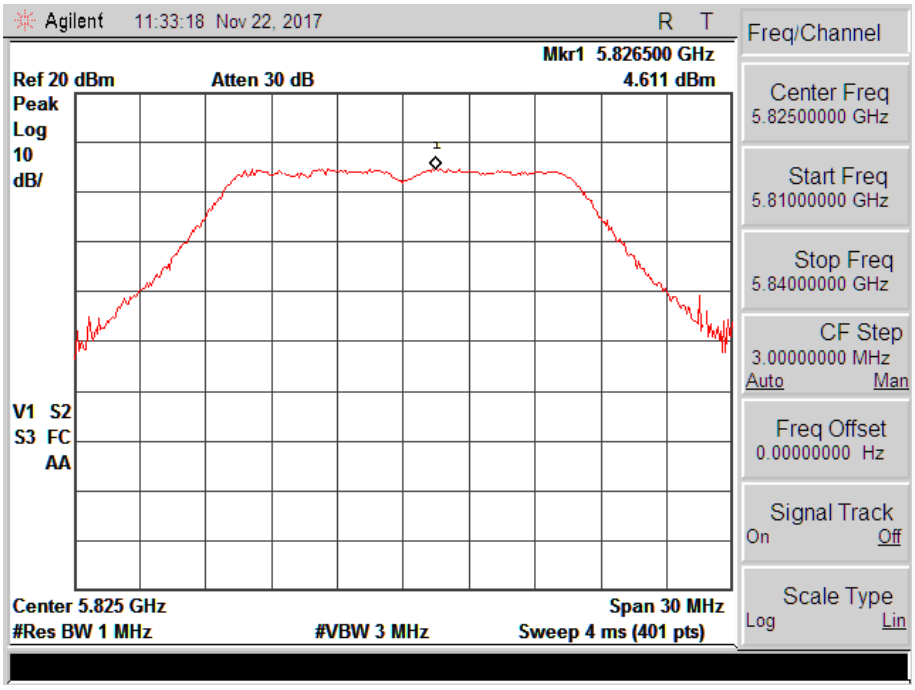

(Plot 4.6.5 A: Channel 149: 5745MHz @ 802.11a)



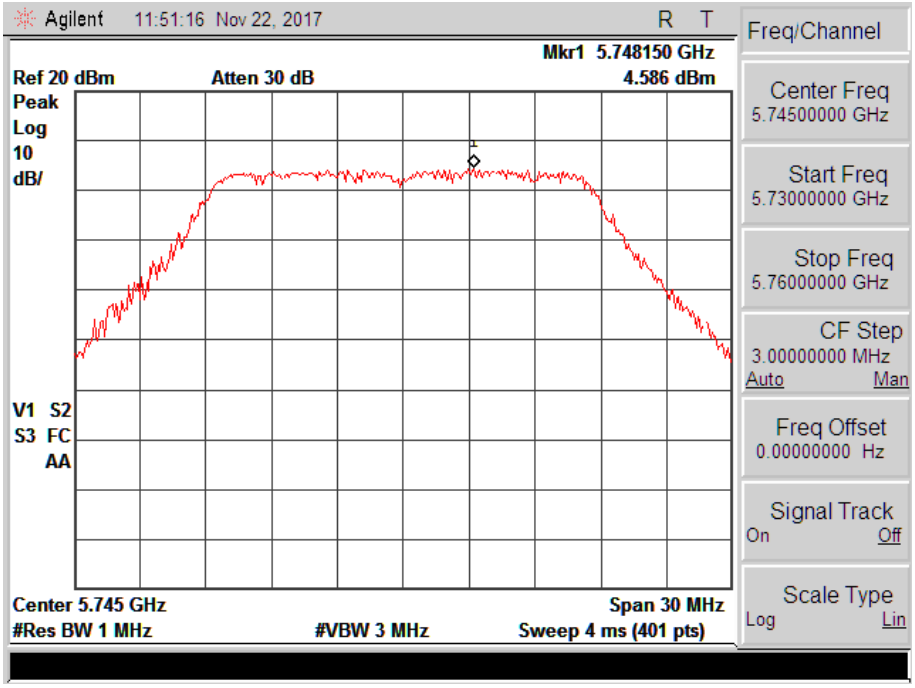
(Plot 4.6.5 B: Channel 157: 5785MHz @ 802.11a)



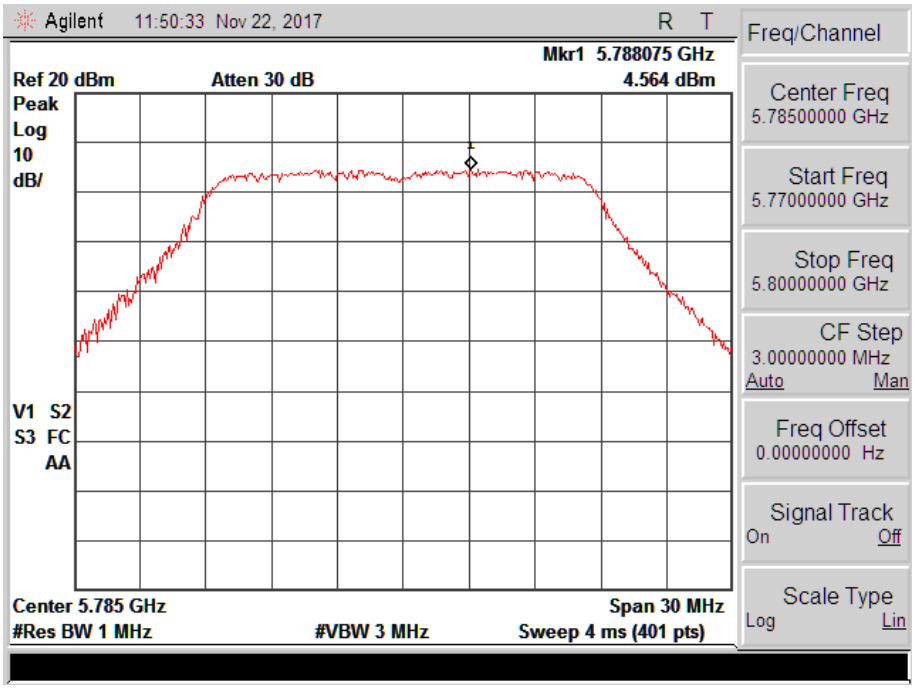

(Plot 4.6.5 C: Channel 165: 5825MHz @ 802.11a)



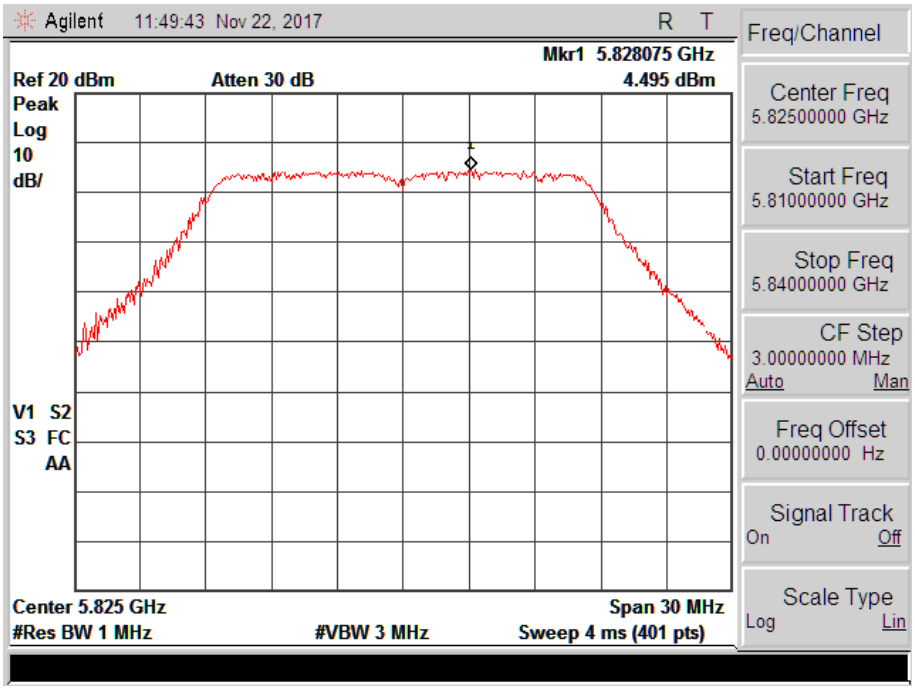
(Plot 4.6.6 A: Channel 149: 5745MHz @ 802.11n HT20)



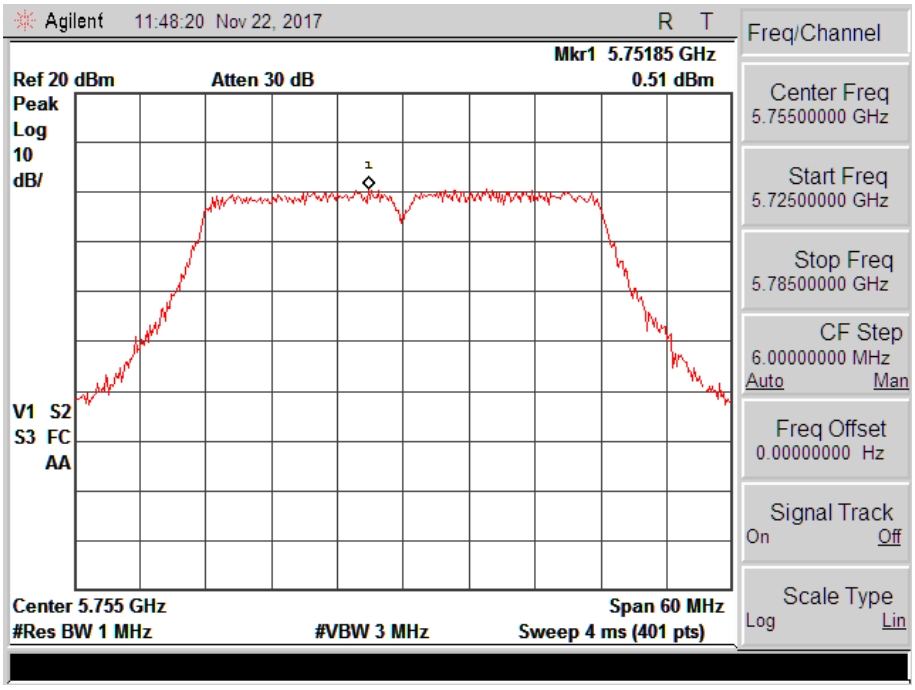

(Plot 4.6.6 B: Channel 157: 5785MHz @ 802.11n HT20)



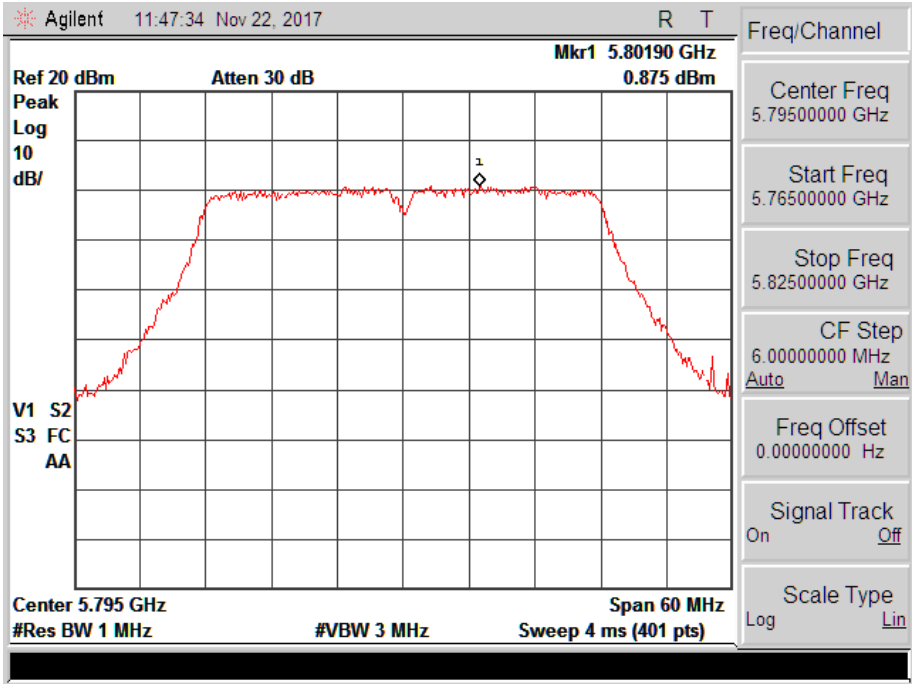
(Plot 4.6.6 C: Channel 165: 5825MHz @ 802.11n HT20)



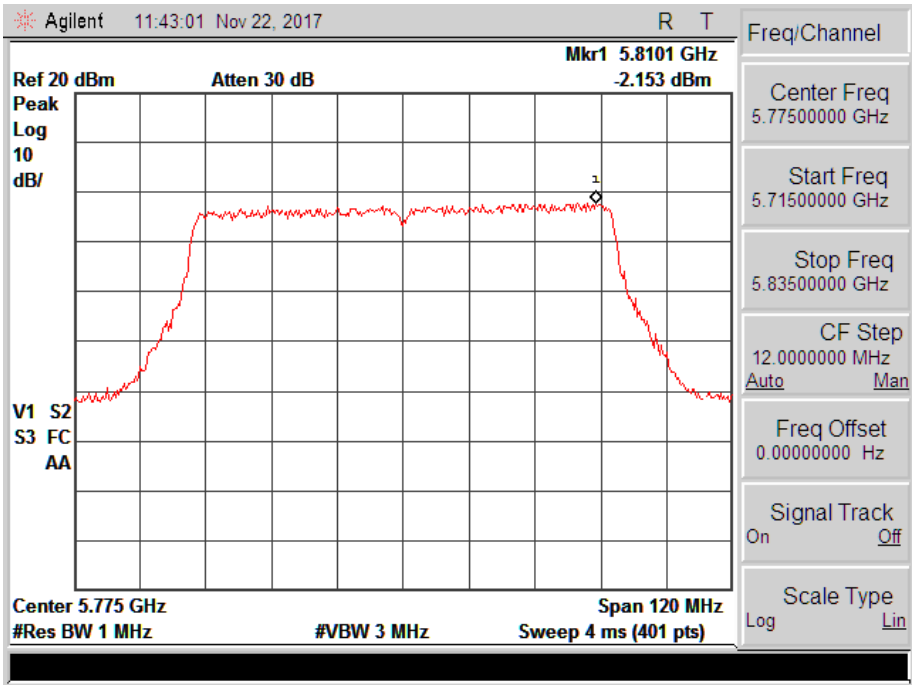

(Plot 4.6.7 A: Channel 151: 5755MHz @ 802.11n HT40)



(Plot 4.6.7 B: Channel 159: 5785MHz @ 802.11n HT40)




(Plot 4.6.8 A: Channel 155: 5755MHz @ 802.11ac HT80)



# 7. Emission Bandwidth and Occupied Bandwidth

## 7.1 Standard Applicable

According to 15.303(c)
for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

According to 15.407 (a) and (e)
(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

## 7.2 Test Procedure

According to 789033 D02 v01r04 section C&D, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ⩾ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth
The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 General UNII Test Procedures New Rules v01r04 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ⩾ 3 • RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are

placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

## 7.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 24° C |
| Relative Humidity: | 53% |
| ATM Pressure: | 1018 mbar |

## 7.4 Summary of Test Results/Plots

**Antenna 1**

***5150-5250MHz***

| Test Mode | Test Channel MHz | 26 dB Bandwidth MHz | 99% Bandwidth MHz | Limit MHz |
|---|---|---|---|---|
| 802.11a | 5180 | 25.0230 | 16.5687 | Pass |
| | 5200 | 20.6670 | 16.4229 | Pass |
| | 5240 | 19.8590 | 16.4412 | Pass |
| 802.11n-HT20 | 5180 | 21.4240 | 17.6519 | Pass |
| | 5200 | 21.2820 | 17.6512 | Pass |
| | 5240 | 21.1160 | 17.6812 | Pass |
| 802.11n-HT40 | 5190 | 45.7180 | 37.0376 | Pass |
| | 5230 | 45.6750 | 37.0921 | Pass |
| 802.11ac-HT80 | 5210 | 89.4350 | 76.5101 | Pass |

***5725-5850MHz***

| Test Mode | Test Channel MHz | 6 dB Bandwidth MHz | 99% Bandwidth MHz | Limit KHz |
|---|---|---|---|---|
| 802.11a | 5745 | 16.4750 | 16.4263 | ≥500 |
| | 5785 | 16.4760 | 16.4297 | ≥500 |
| | 5825 | 16.4930 | 16.4413 | ≥500 |
| 802.11n-HT20 | 5745 | 17.7160 | 17.6529 | ≥500 |
| | 5785 | 17.8180 | 17.6824 | ≥500 |
| | 5825 | 17.6120 | 17.6488 | ≥500 |
| 802.11n-HT40 | 5755 | 36.3020 | 36.0735 | ≥500 |
| | 5795 | 36.0660 | 36.1168 | ≥500 |
| 802.11ac-HT80 | 5775 | 76.3850 | 75.6231 | ≥500 |

**Antenna 2**

***5150-5250MHz***

| Test Mode | Test Channel MHz | 26 dB Bandwidth MHz | 99% Bandwidth MHz | Limit MHz |
|---|---|---|---|---|
| 802.11a | 5180 | 24.9920 | 16.5668 | Pass |
| | 5200 | 25.6090 | 16.6474 | Pass |
| | 5240 | 19.7680 | 16.4259 | Pass |
| 802.11n-HT20 | 5180 | 21.0420 | 17.6639 | Pass |
| | 5200 | 21.0900 | 17.6660 | Pass |
| | 5240 | 21.9520 | 17.6840 | Pass |
| 802.11n-HT40 | 5190 | 40.2250 | 36.1552 | Pass |
| | 5230 | 39.7940 | 36.1213 | Pass |
| 802.11ac-HT80 | 5210 | 81.4510 | 75.8570 | Pass |

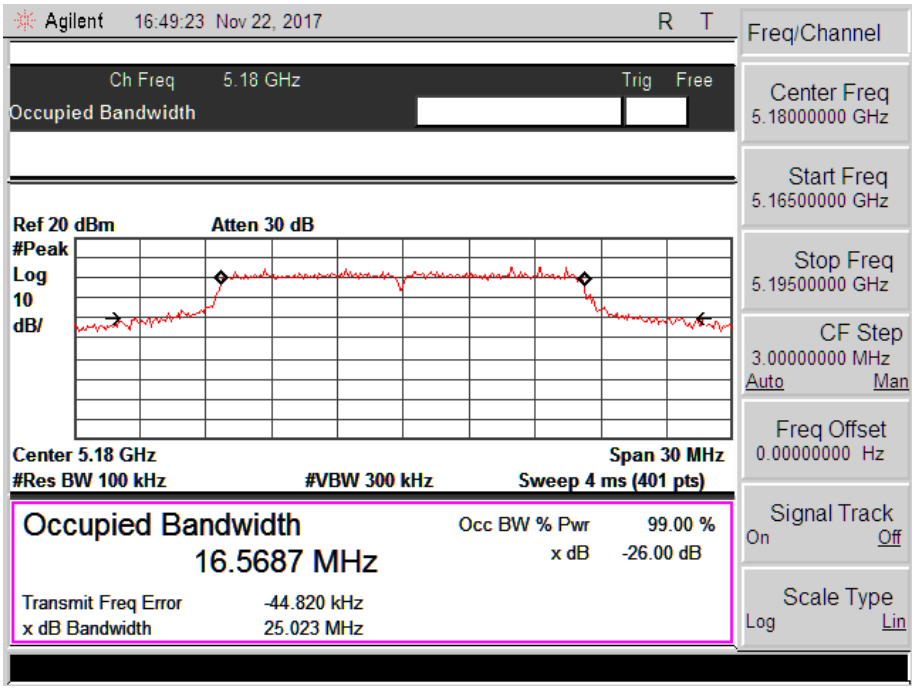
***5725-5850MHz***

| Test Mode | Test Channel MHz | 6 dB Bandwidth MHz | 99% Bandwidth MHz | Limit KHz |
|---|---|---|---|---|
| 802.11a | 5745 | 16.4110 | 16.4279 | ≥500 |
| | 5785 | 16.3600 | 16.4287 | ≥500 |
| | 5825 | 16.4250 | 16.4107 | ≥500 |
| 802.11n-HT20 | 5745 | 17.6360 | 17.6623 | ≥500 |
| | 5785 | 17.6560 | 17.6709 | ≥500 |
| | 5825 | 17.7250 | 17.6703 | ≥500 |
| 802.11n-HT40 | 5755 | 36.3970 | 36.1042 | ≥500 |
| | 5795 | 36.3190 | 36.1268 | ≥500 |
| 802.11ac-HT80 | 5775 | 76.0680 | 75.5655 | ≥500 |

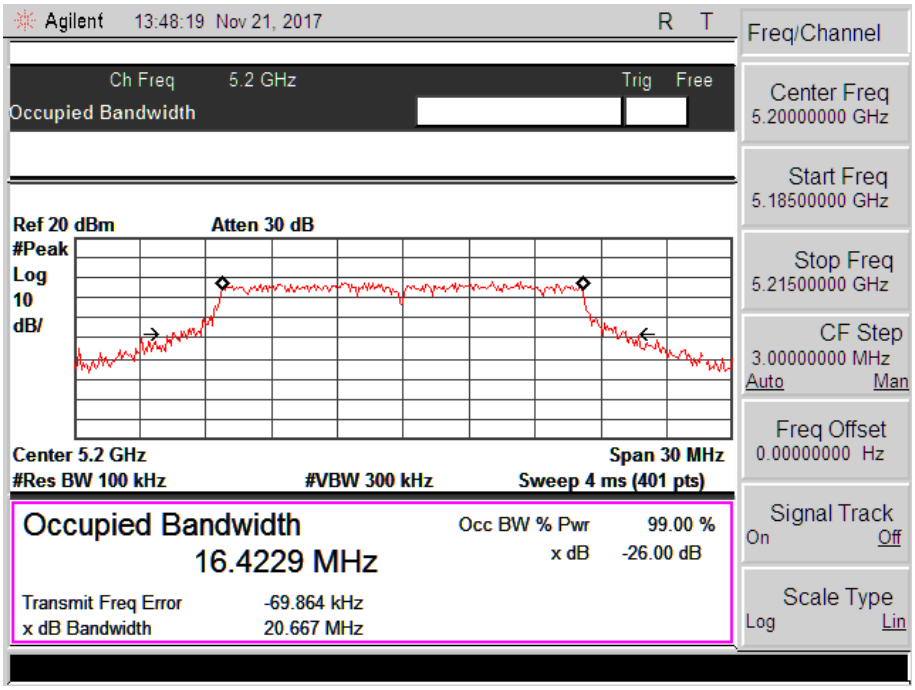
**Antenna 1**

*Test Plots:5150-5250MHz*

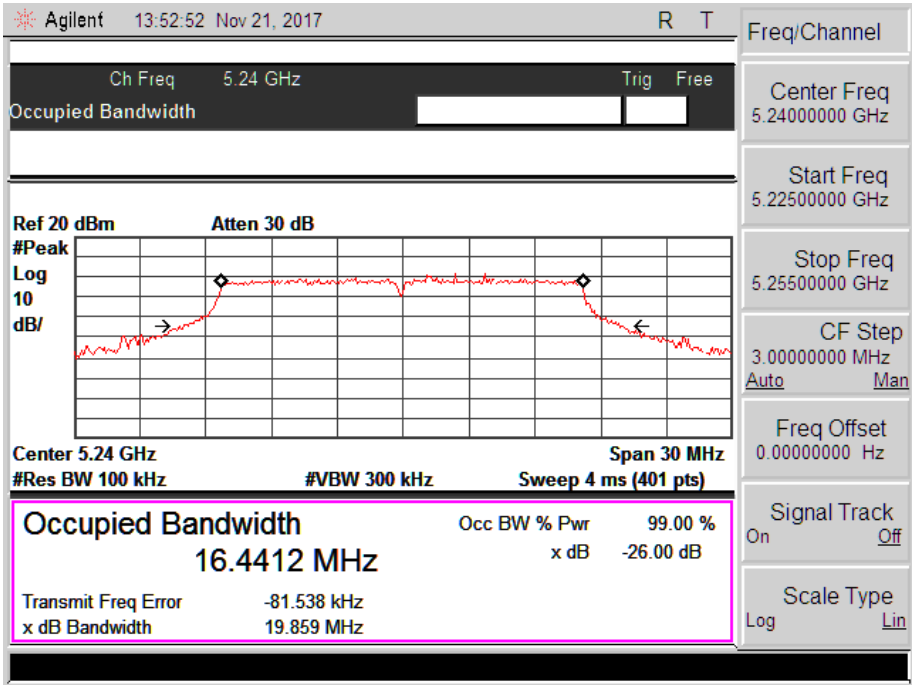
(Plot 4.7.1 A: Channel 36: 5180MHz @ 802.11a)



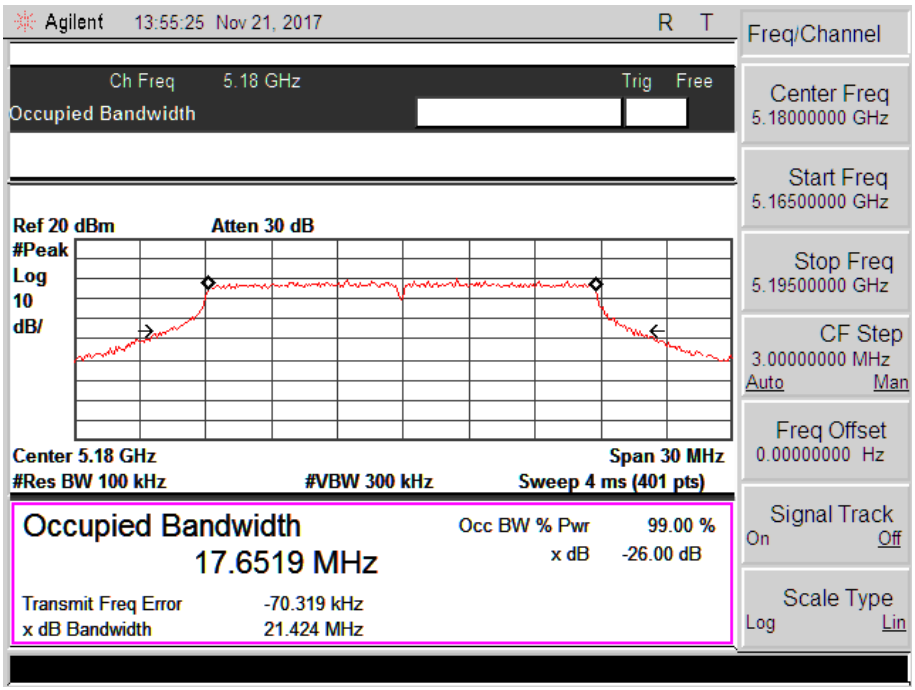

(Plot 4.7.1 B: Channel 40: 5200MHz @ 802.11a)



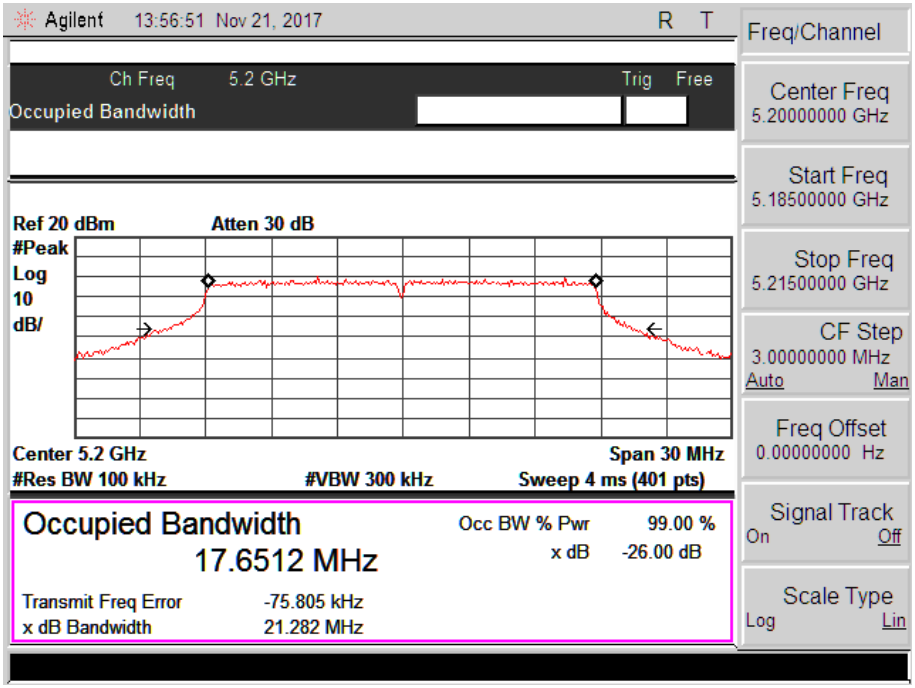
(Plot 4.7.1 C: Channel 48: 5240MHz @ 802.11a)



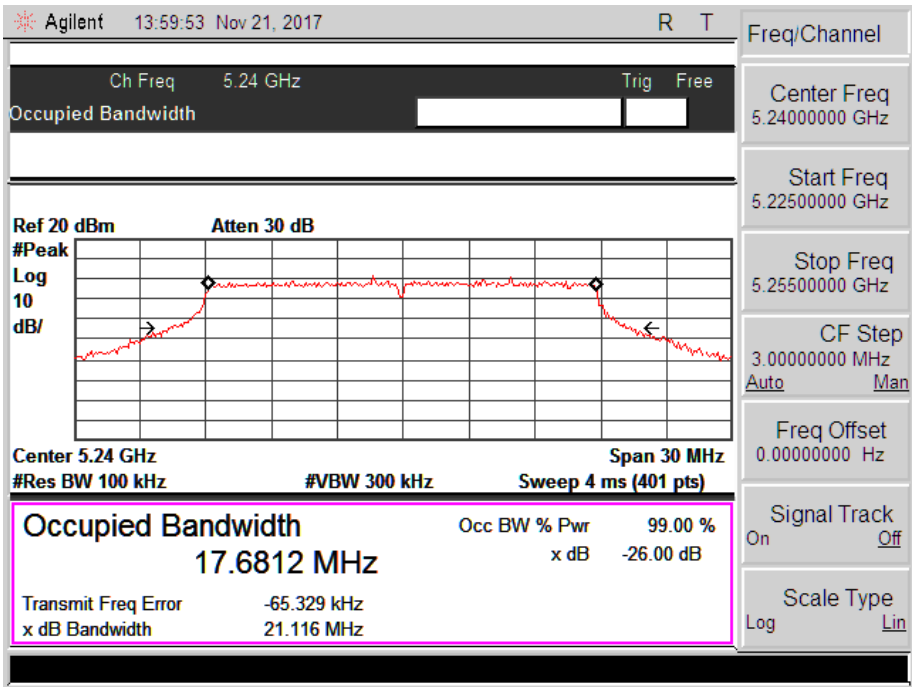

(Plot 4.7.2 A: Channel 36: 5180MHz @ 802.11n HT20)



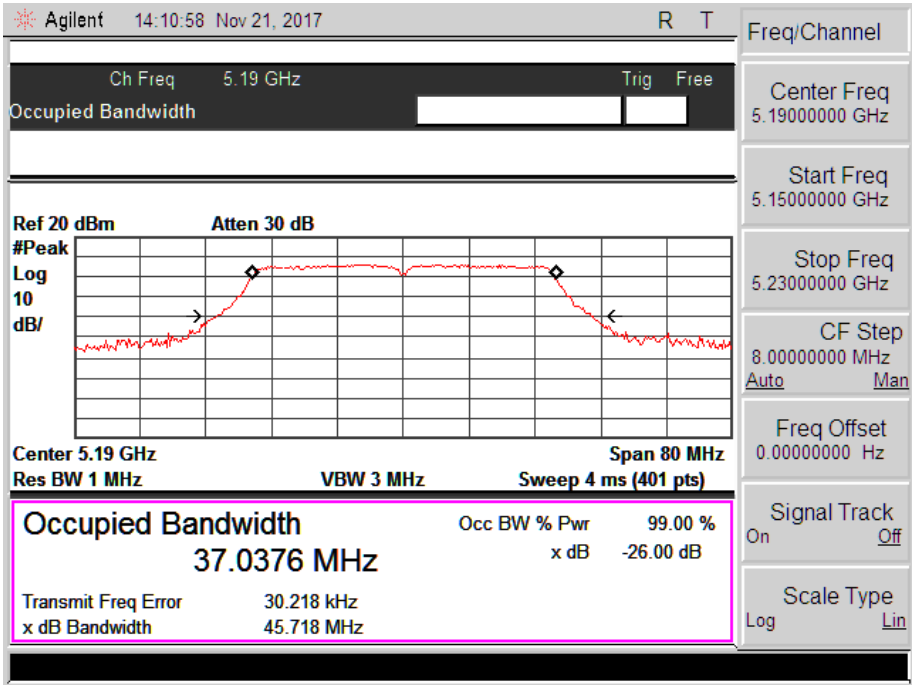
(Plot 4.7.2 B: Channel 40: 5200MHz @ 802.11n HT20)



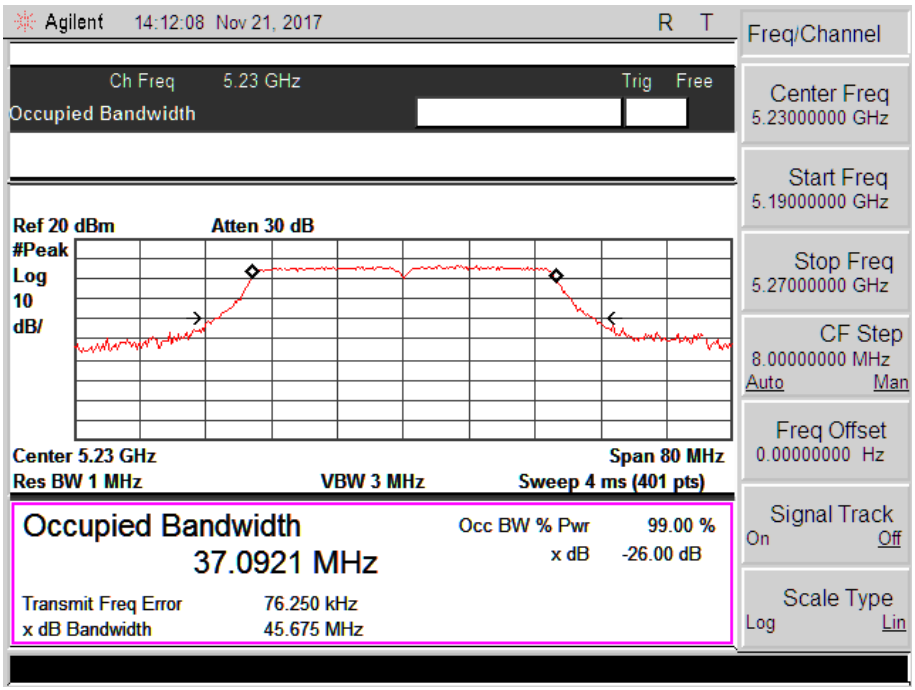

(Plot 4.7.2 C: Channel 48: 5240MHz @ 802.11n HT20)



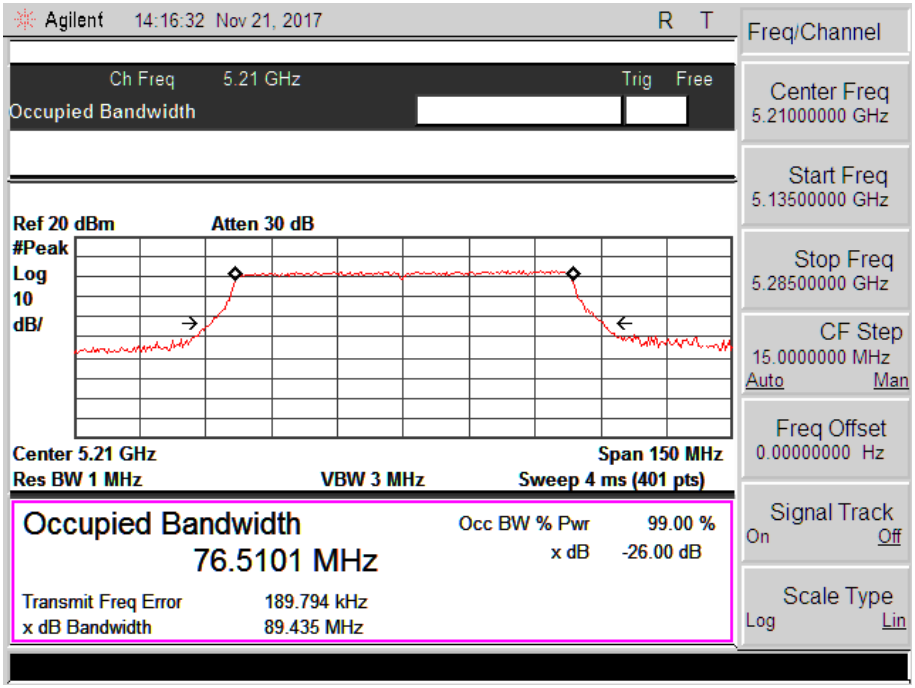
(Plot 4.7.3 A: Channel 38: 5190MHz @ 802.11n HT40)




(Plot 4.7.3 B: Channel 46: 5230MHz @ 802.11n HT40)

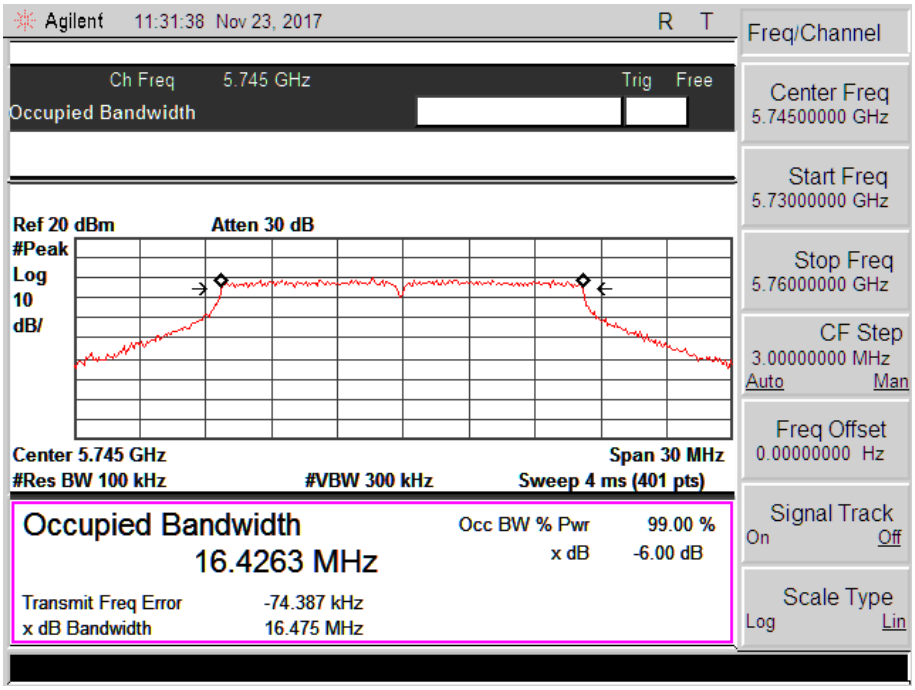


(Plot 4.7.4 A: Channel 42: 5210MHz @ 802.11ac HT80)

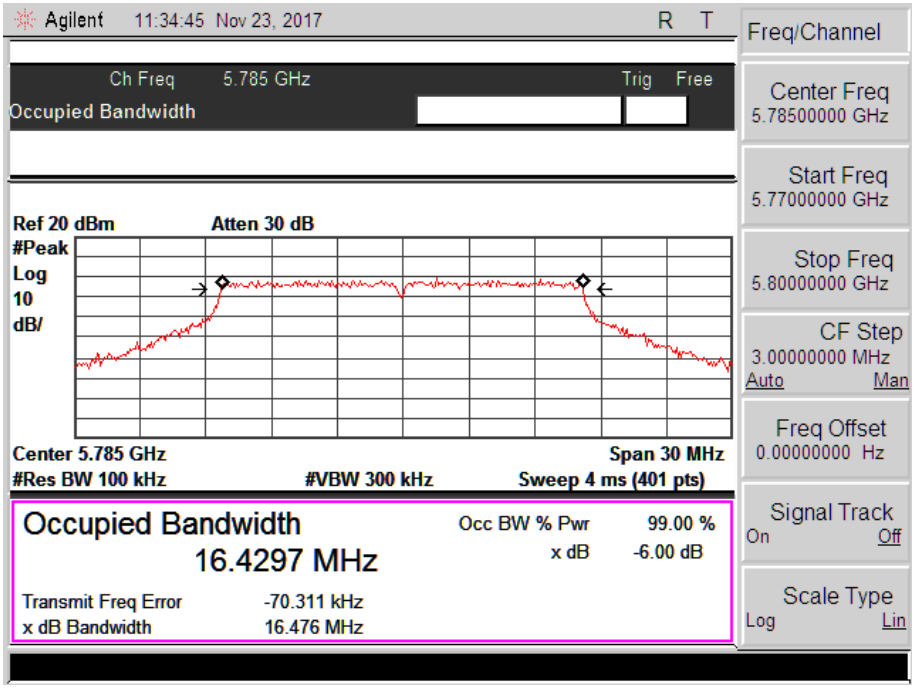



*Test Plots: 5725-5850MHz*

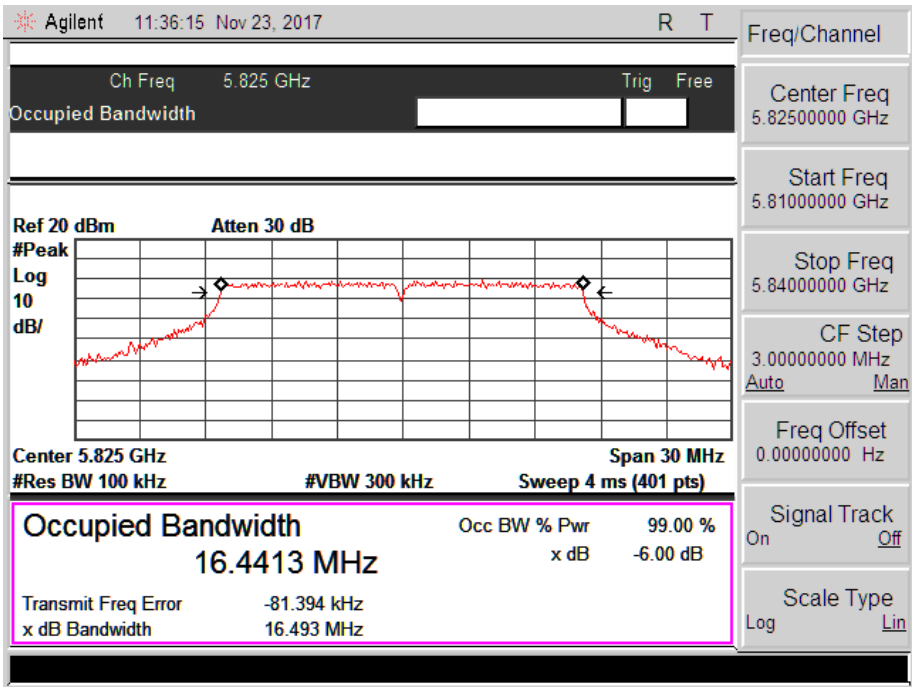
(Plot 4.7.5 A: Channel 149: 5745MHz @ 802.11a)



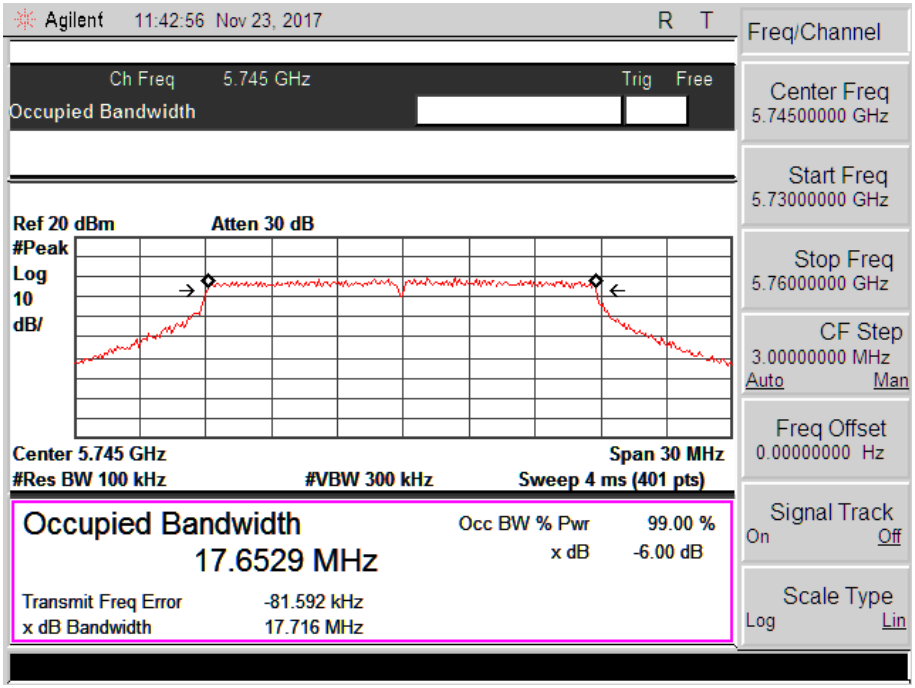
(Plot 4.7.5 B: Channel 157: 5785MHz @ 802.11a)



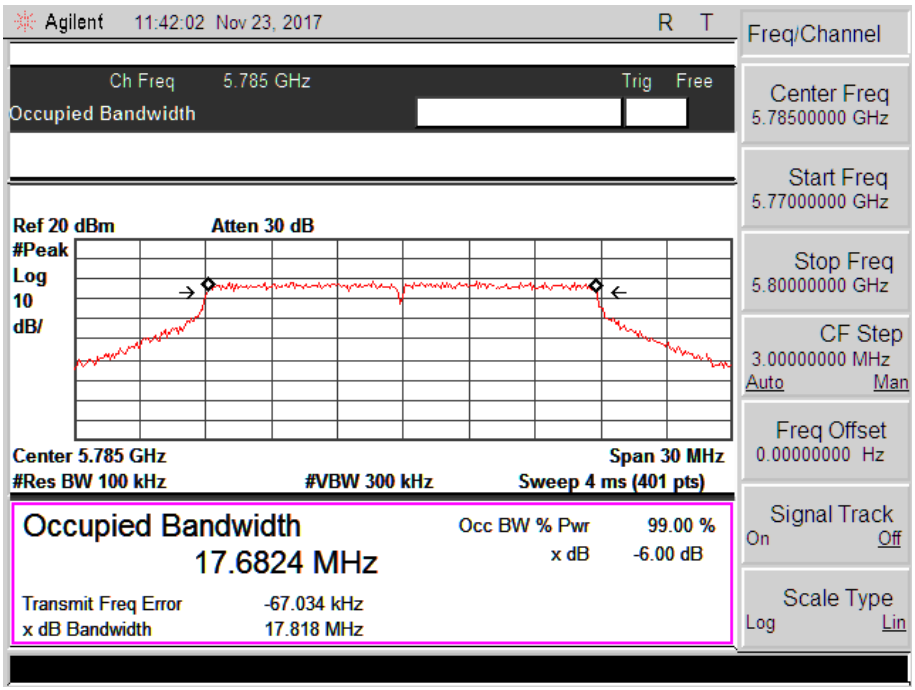

(Plot 4.7.5 C: Channel 165: 5825MHz @ 802.11a)



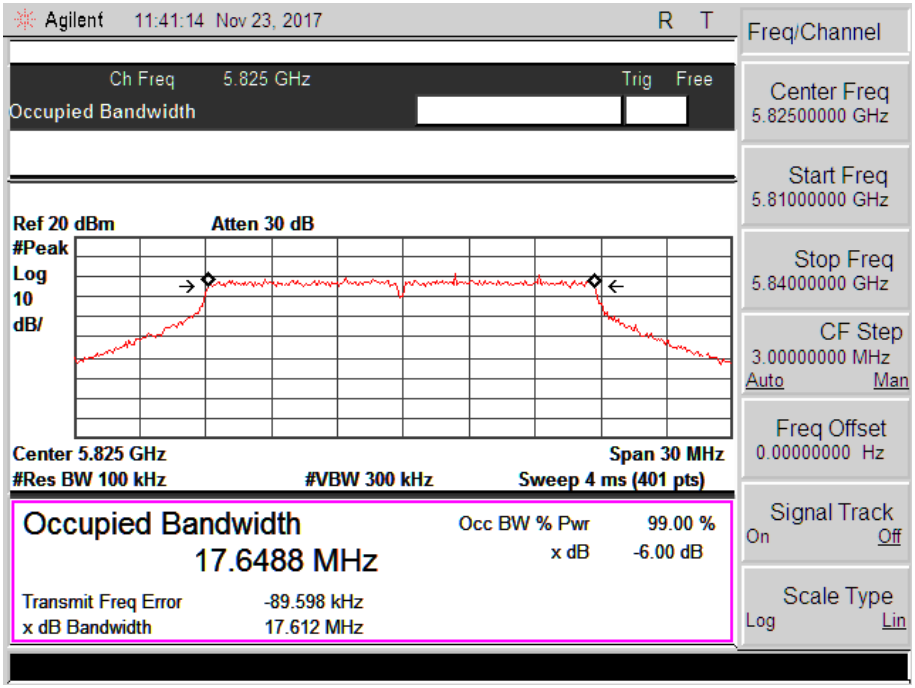
(Plot 4.7.6 A: Channel 149: 5745MHz @ 802.11n HT20)



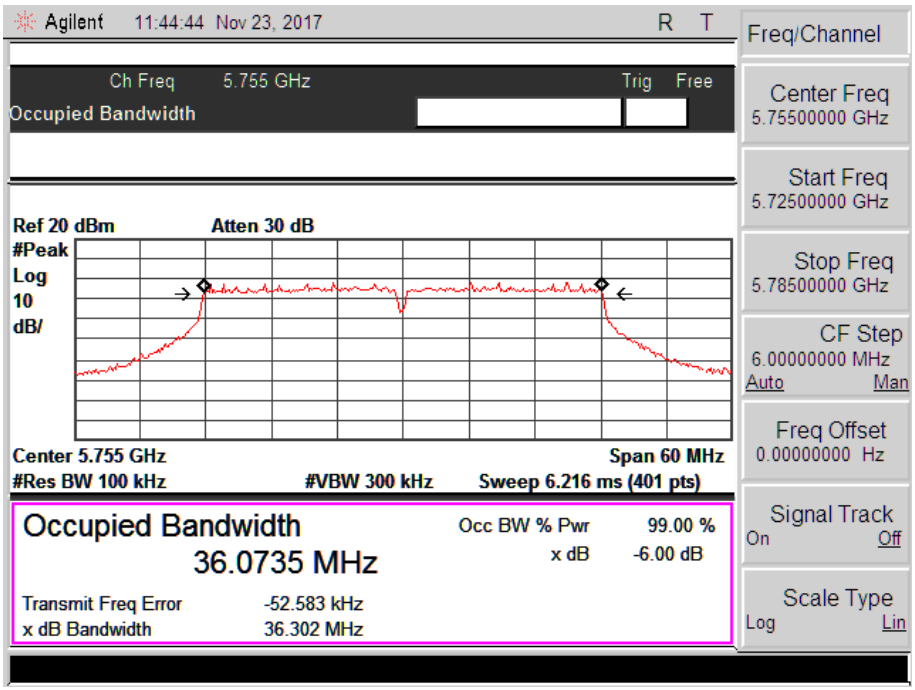

(Plot 4.7.6 B: Channel 157: 5785MHz @ 802.11n HT20)



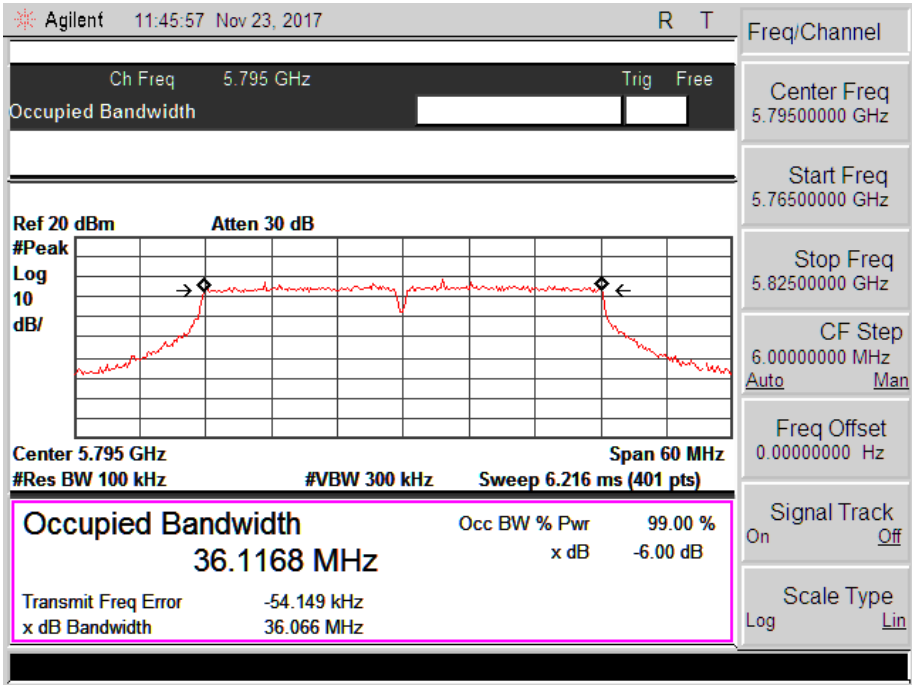
(Plot 4.7.6 C: Channel 165: 5825MHz @ 802.11n HT20)



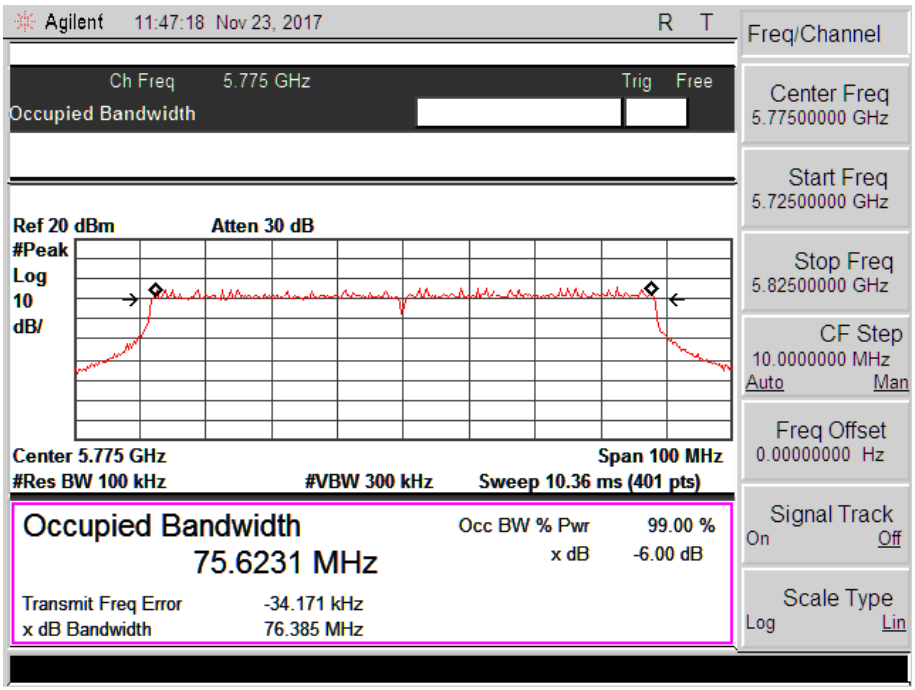

(Plot 4.7.7 A: Channel 151: 5755MHz @ 802.11n HT40)



(Plot 4.7.7 B: Channel 159: 5795MHz @ 802.11n HT40)



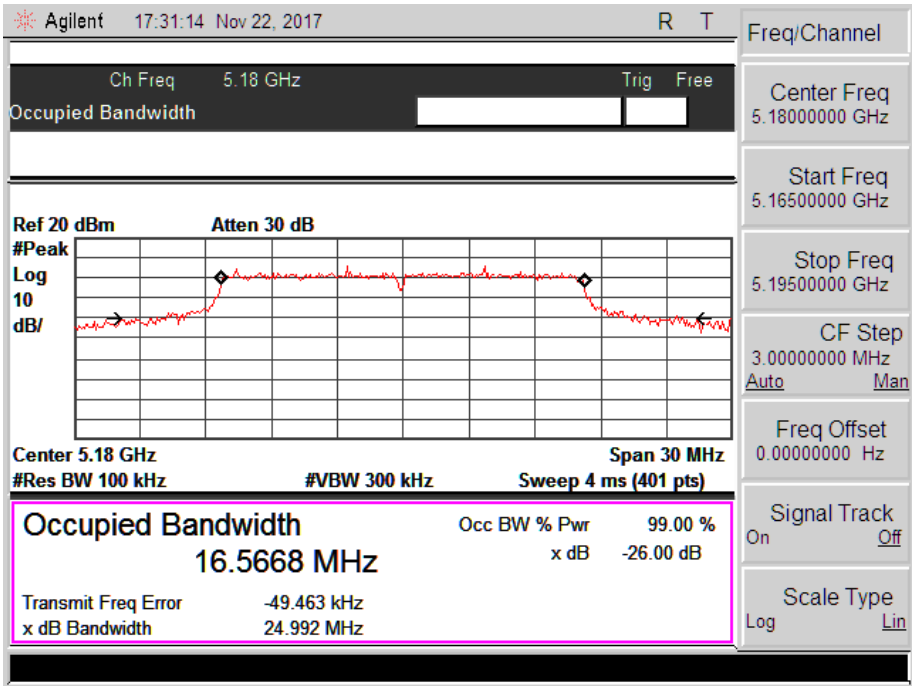

(Plot 4.7.8 A: Channel 155: 5775MHz @ 802.11ac HT80)



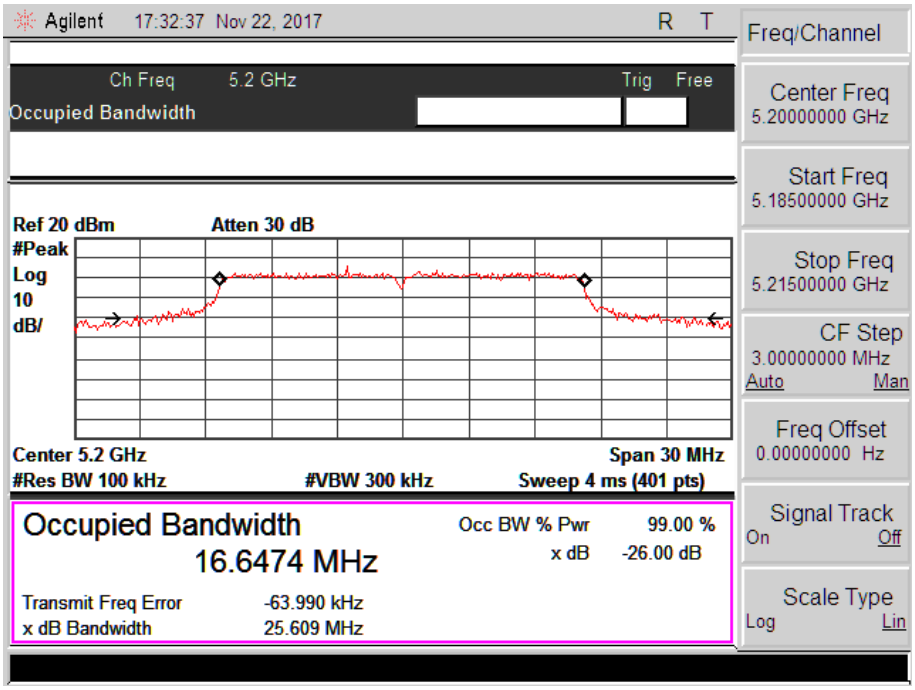
**Antenna 2**

*Test Plots:5150-5250MHz*

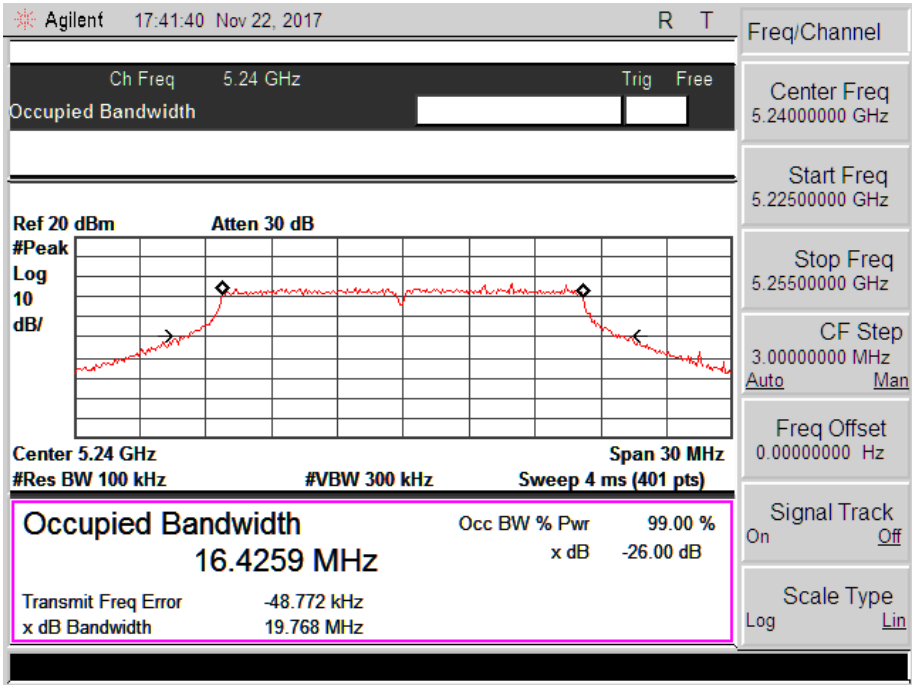
(Plot 4.7.1 A: Channel 36: 5180MHz @ 802.11a)



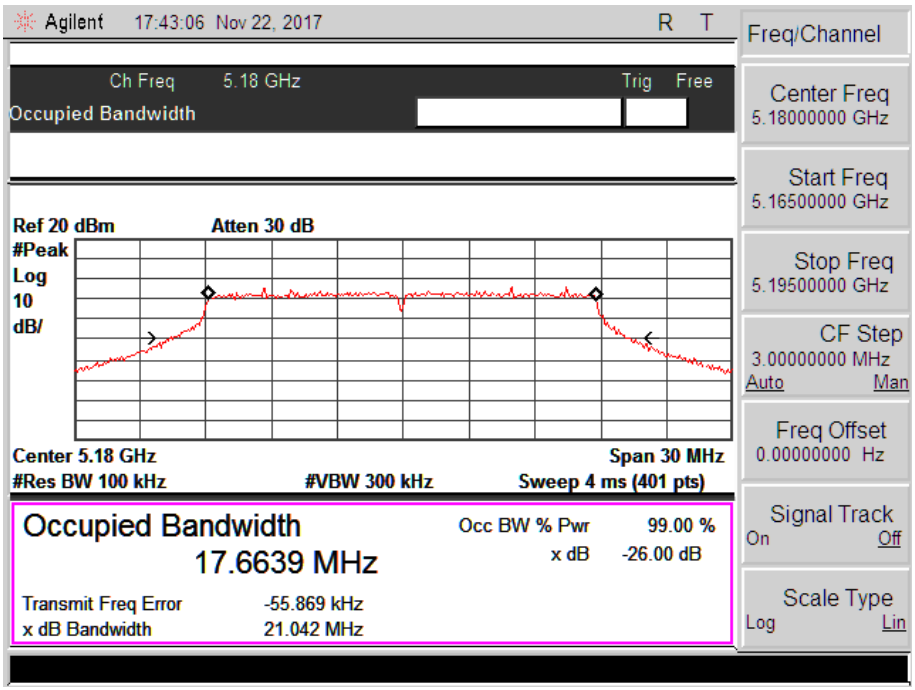

(Plot 4.7.1 B: Channel 40: 5200MHz @ 802.11a)



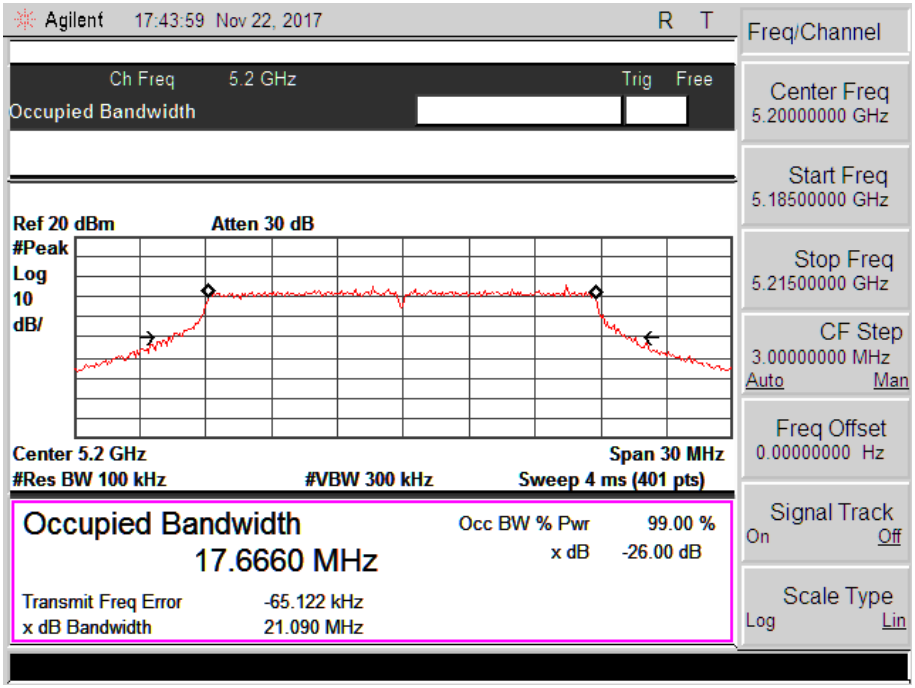
(Plot 4.7.1 C: Channel 48: 5240MHz @ 802.11a)



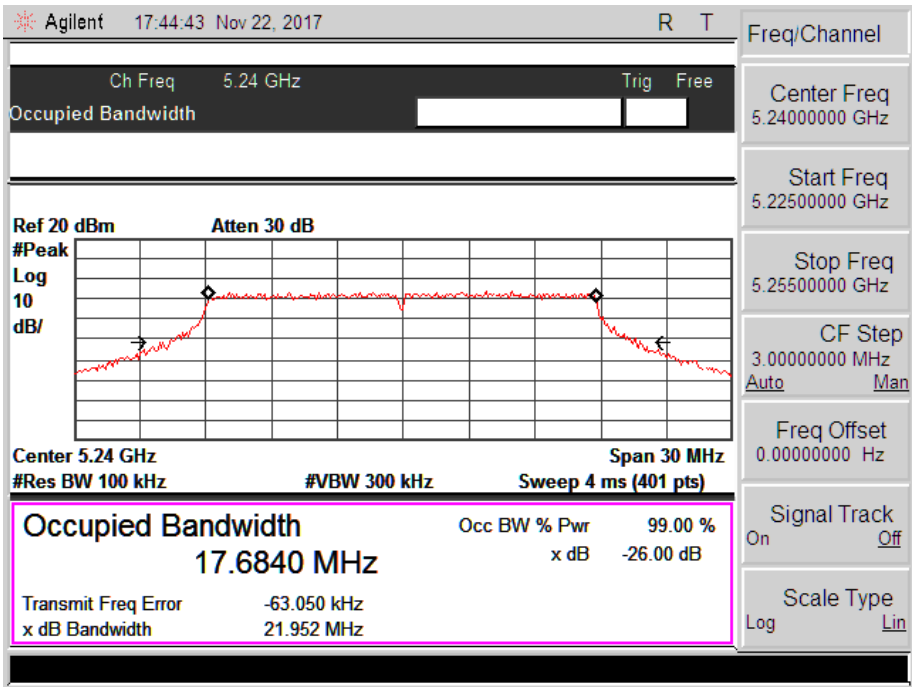

(Plot 4.7.2 A: Channel 36: 5180MHz @ 802.11n HT20)



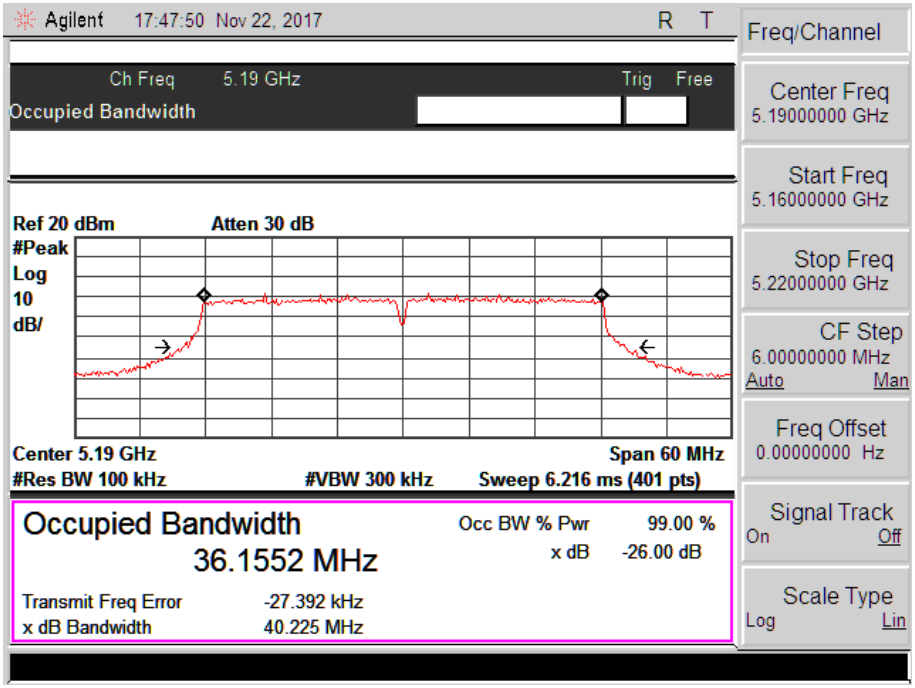
(Plot 4.7.2 B: Channel 40: 5200MHz @ 802.11n HT20)



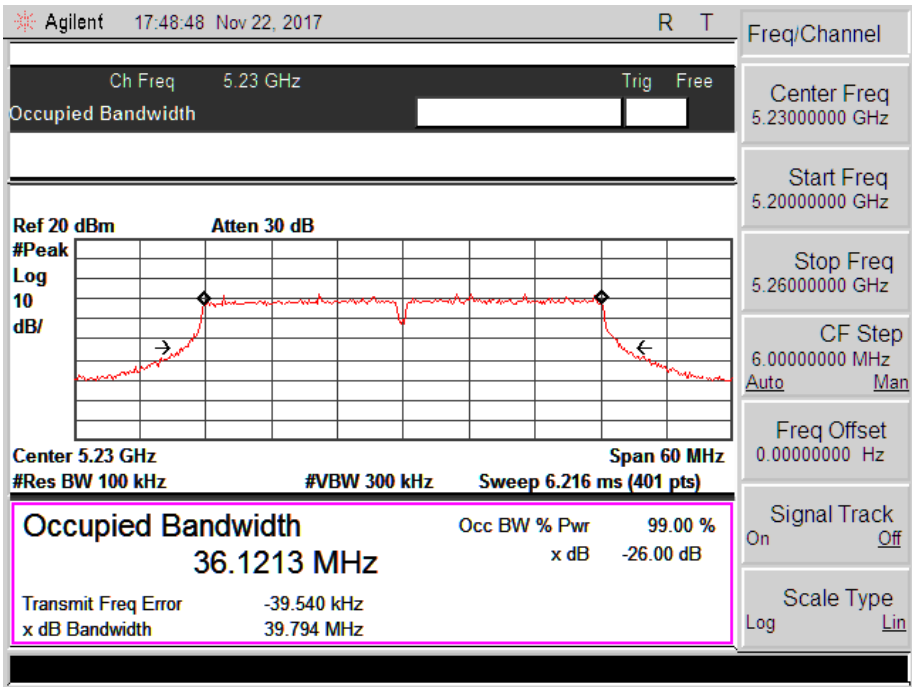

(Plot 4.7.2 C: Channel 40: 5240MHz @ 802.11n HT20)



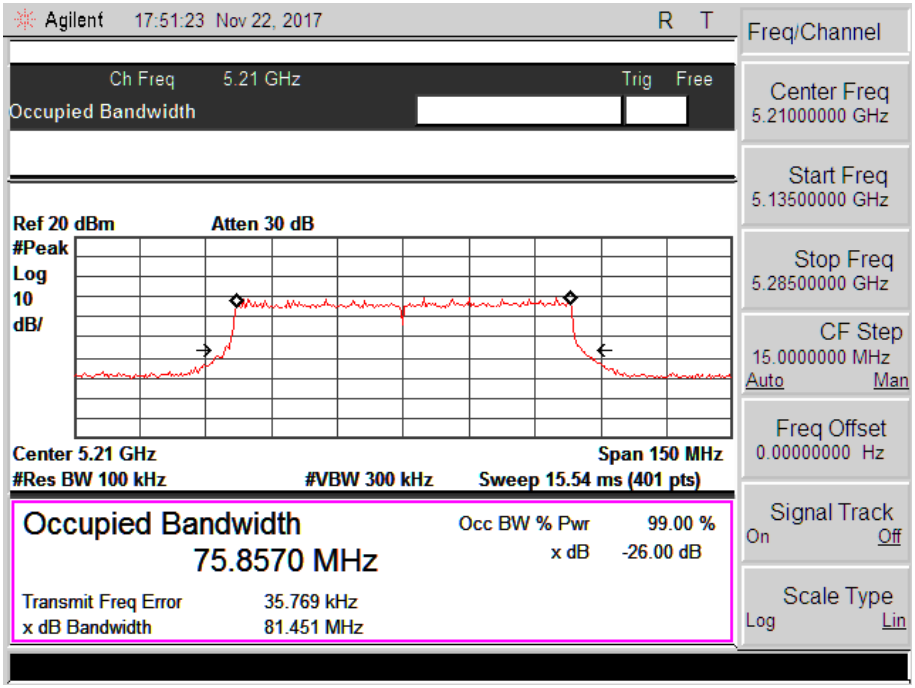
(Plot 4.7.3 A: Channel 38: 5190MHz @ 802.11n HT40)




(Plot 4.7.3 B: Channel 46: 5230MHz @ 802.11n HT40)

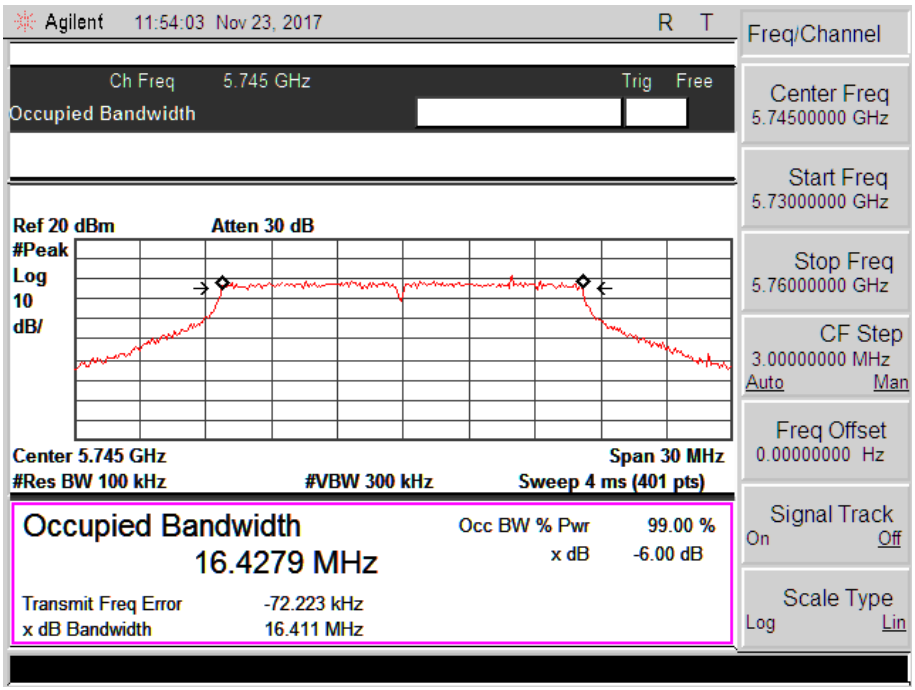


(Plot 4.7.4 A: Channel 42: 5210MHz @ 802.11ac HT80)

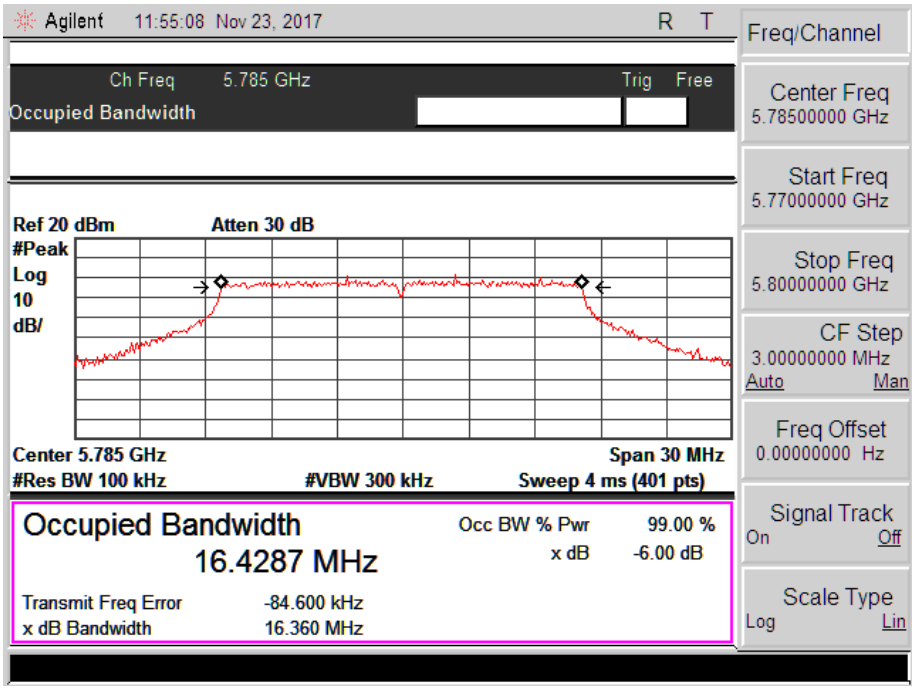



*Test Plots: 5725-5850MHz*

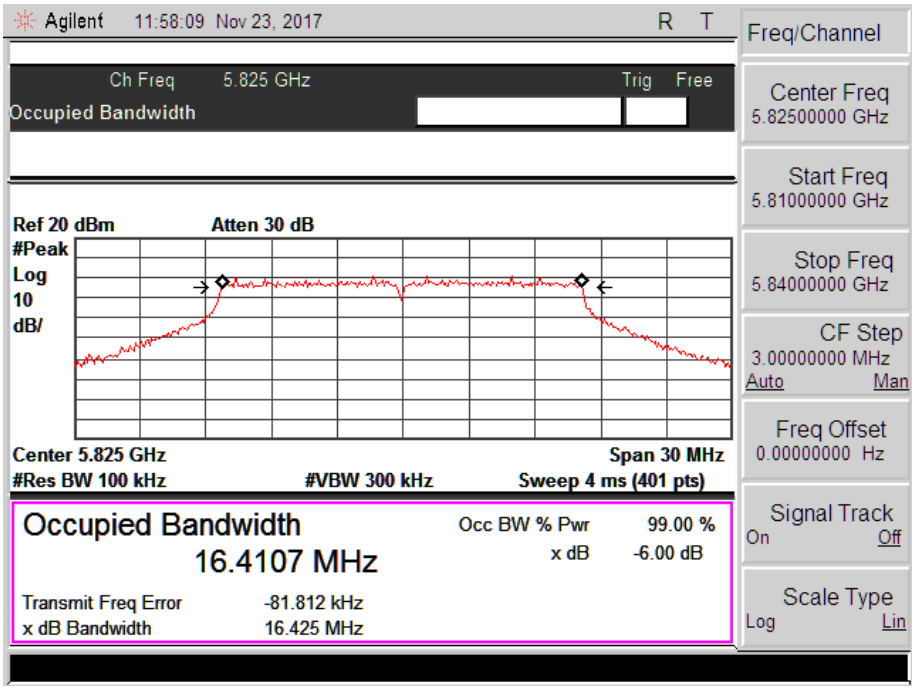
(Plot 4.7.5 A: Channel 149: 5745MHz @ 802.11a)



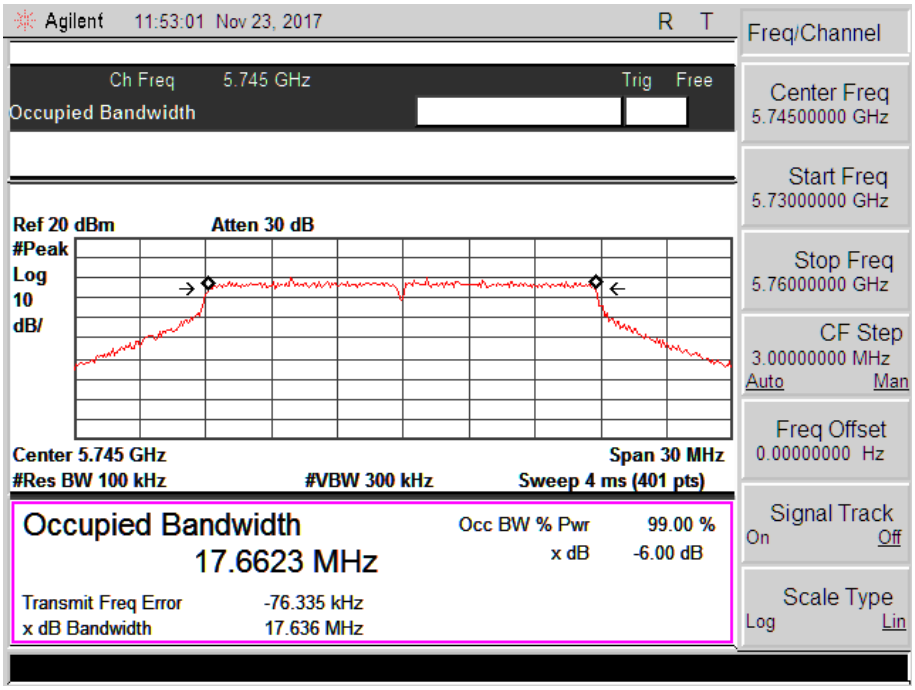
(Plot 4.7.5 B: Channel 157: 5785MHz @ 802.11a)



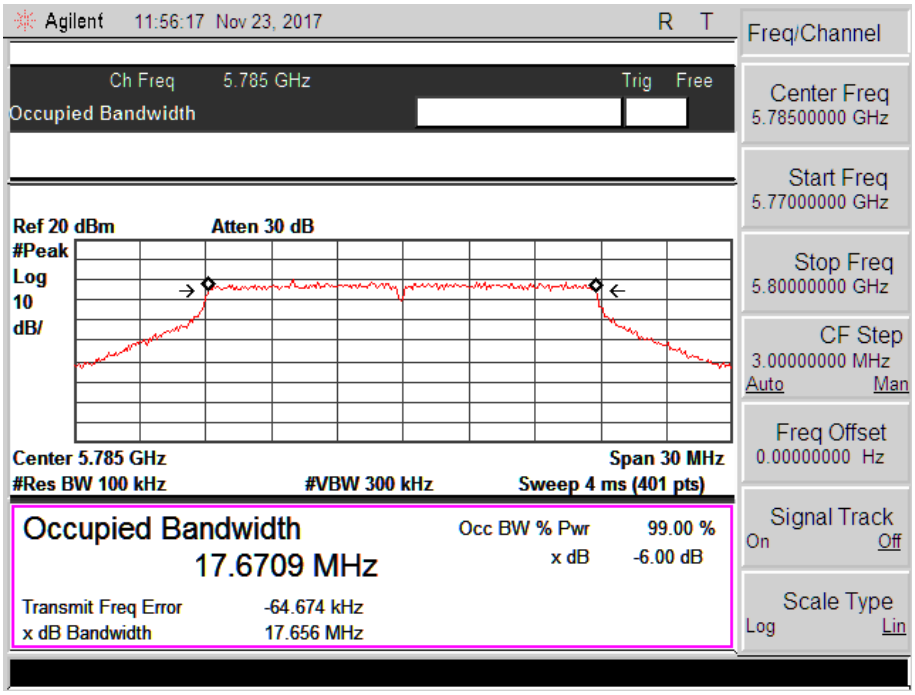

(Plot 4.7.5 C: Channel 165: 5825MHz @ 802.11a)



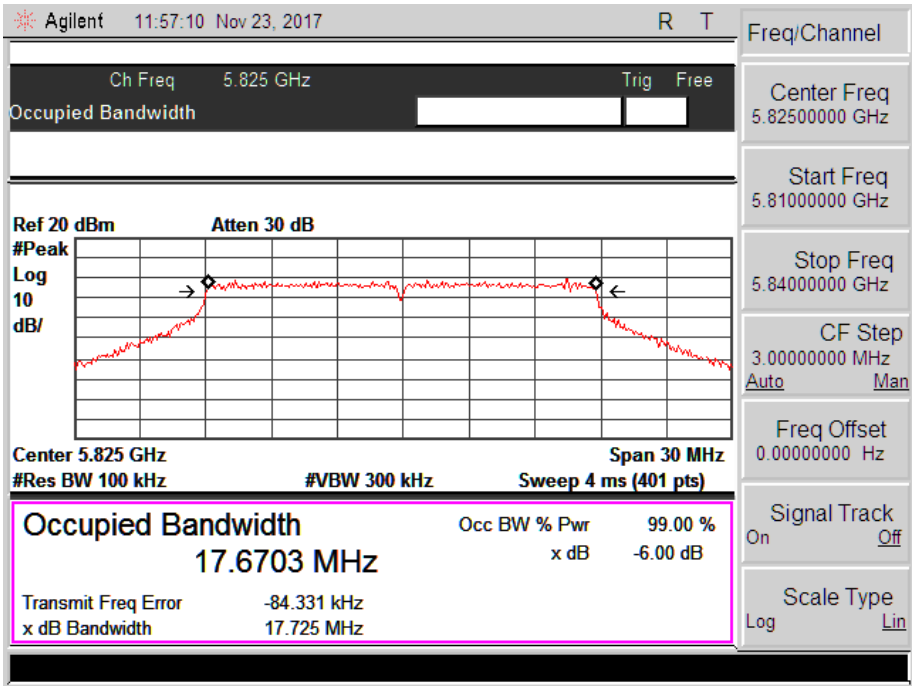
(Plot 4.7.6 A: Channel 149: 5745MHz @ 802.11n HT20)



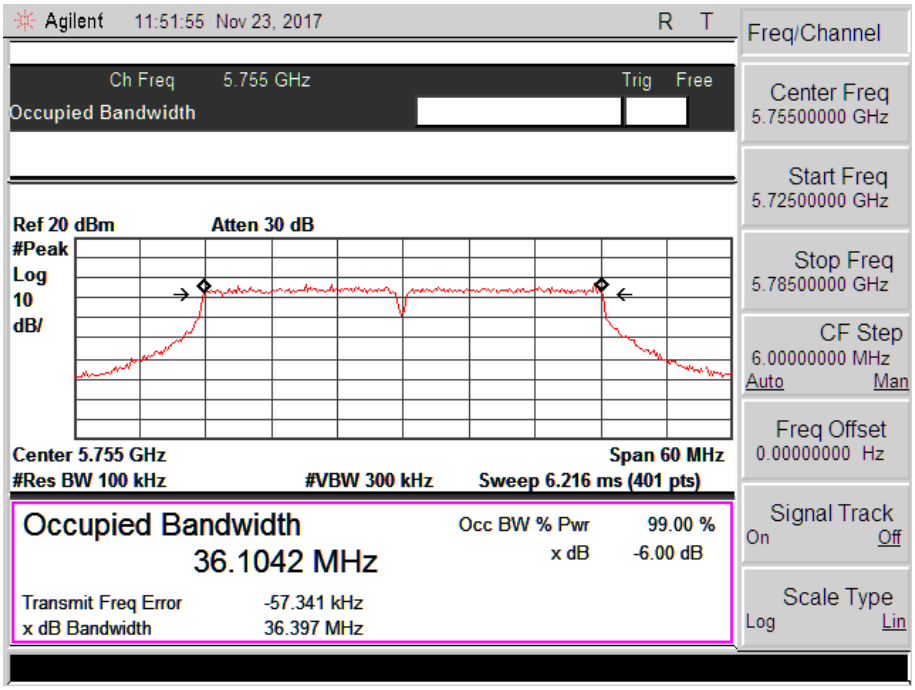

(Plot 4.7.6 B: Channel 157: 5785MHz @ 802.11n HT20)



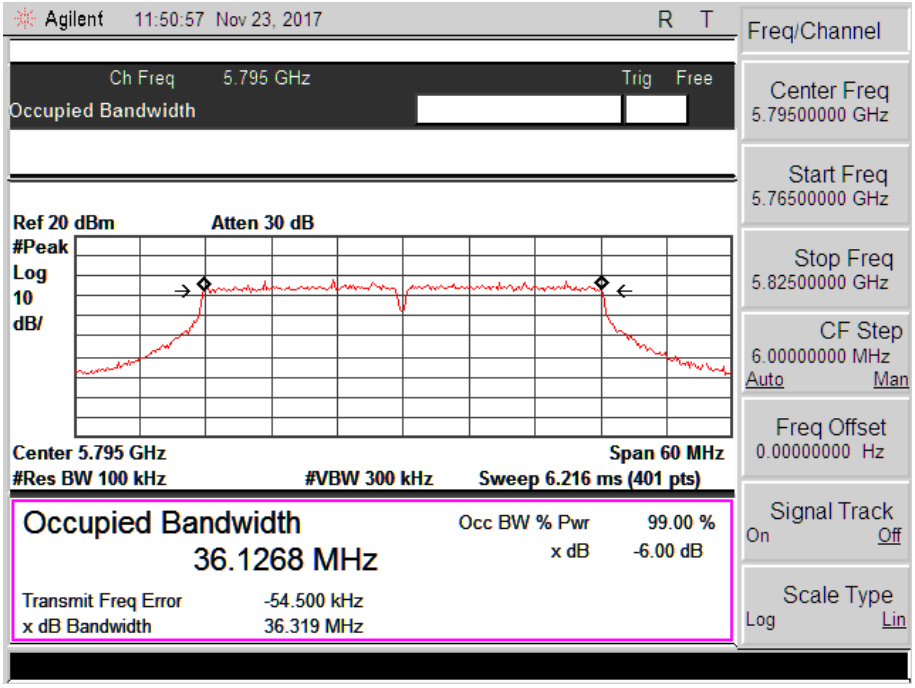
(Plot 4.7.6 C: Channel 165: 5825MHz @ 802.11n HT20)



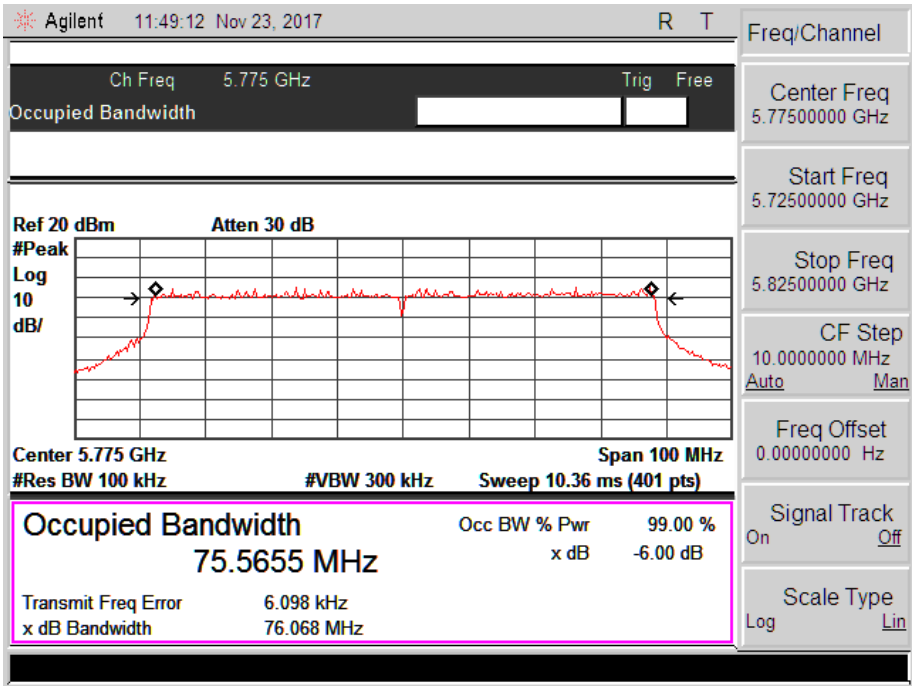

(Plot 4.7.7 A: Channel 151: 5755MHz @ 802.11n HT40)



(Plot 4.7.7 B: Channel 159: 5795MHz @ 802.11n HT40)




(Plot 4.7.8 A: Channel 155: 5775MHz @ 802.11ac HT80)



# 8. Maximum Conducted Output Power

## 8.1 Standard Applicable

Section 15.407(a) Power limits:

(1) For the band 5.15-5.25 GHz.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

## 8.2 Test Procedure

According to KDB789033 D02 v01r04 section E, the following is the measurement procedure.

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.

(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

## 8.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 26° C |
| Relative Humidity: | 65% |
| ATM Pressure: | 1011 mbar |

## 8.4 Summary of Test Results/Plots

*For the frequency band 5.15-5.25GHz, 5725-5850GHz*

| Test mode | Frequency MHz | Output Power 1 (dBm) | Output Power 2 (dBm) | Total Power (dBm) | Output Power mW | Limit mW |
|---|---|---|---|---|---|---|
| 802.11a | 5180 | 10.60 | 10.81 | 13.72 | 23.60 | 250 |
| | 5200 | 10.51 | 10.73 | 13.63 | 23.10 | 250 |
| | 5240 | 10.78 | 10.77 | 13.79 | 23.90 | 250 |
| | 5745 | 10.20 | 10.05 | 13.14 | 20.60 | 1000 |
| | 5785 | 10.42 | 10.13 | 13.29 | 21.30 | 1000 |
| | 5825 | 10.74 | 10.44 | 13.60 | 22.90 | 1000 |
| 802.11n-HT20 | 5180 | 10.60 | 10.55 | 13.59 | 22.90 | 250 |
| | 5200 | 10.45 | 10.72 | 13.60 | 22.90 | 250 |
| | 5240 | 10.73 | 10.59 | 13.67 | 23.30 | 250 |
| | 5745 | 10.01 | 10.02 | 13.03 | 20.10 | 1000 |
| | 5785 | 10.32 | 10.13 | 13.24 | 21.10 | 1000 |
| | 5825 | 10.45 | 10.43 | 13.45 | 22.10 | 1000 |
| 802.11n-HT40 | 5190 | 7.53 | 7.27 | 10.41 | 11.00 | 250 |
| | 5230 | 7.33 | 7.59 | 10.47 | 11.10 | 250 |
| | 5755 | 6.79 | 6.47 | 9.64 | 9.20 | 1000 |
| | 5795 | 7.33 | 6.82 | 10.09 | 10.20 | 1000 |
| 802.11ac-HT80 | 5210 | 4.03 | 4.14 | 7.10 | 5.10 | 250 |
| | 5775 | 4.02 | 3.74 | 6.89 | 4.90 | 1000 |

# 9. Conducted Undesirable Emissions and Band Edge

## 9.1 Standard Applicable

According to §15.407 (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

## 9.2 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer via a RF combiner.
2. Set the spectrum analyzer as RBW = 100kHz/1MHz, VBW=300kHz/3MHz, Sweep = auto
3. Set the Lowest, Middle and Highest Transmitting Channel, observed the outside band of 30MHz to 40GHz, then mark the higher-level emission for comparing with the FCC rules.

## 9.3 Environmental Conditions

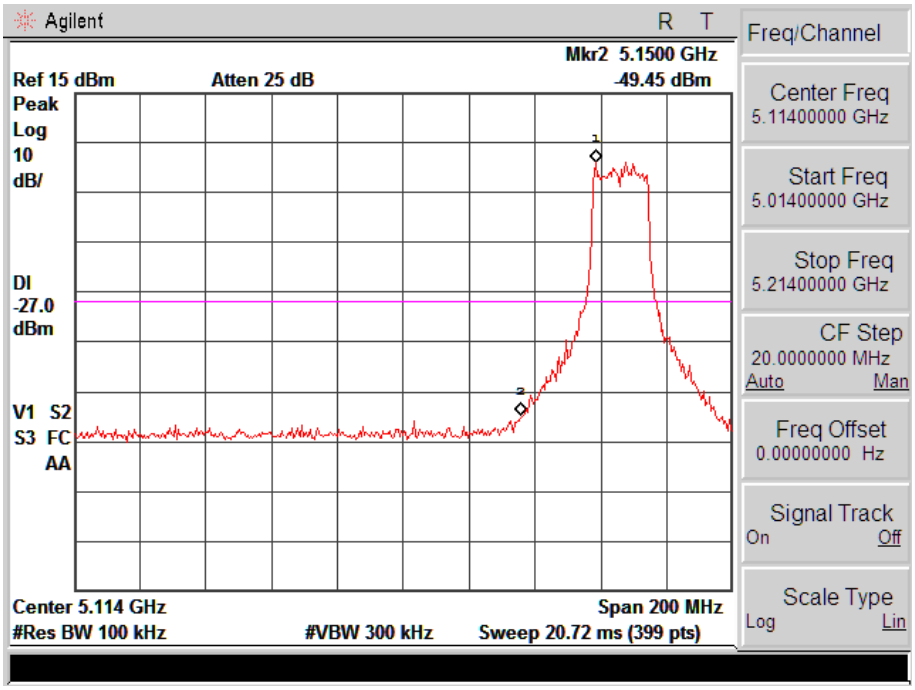
| | |
|---|---|
| Temperature: | 21° C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 9.4 Summary of Test Results/Plots

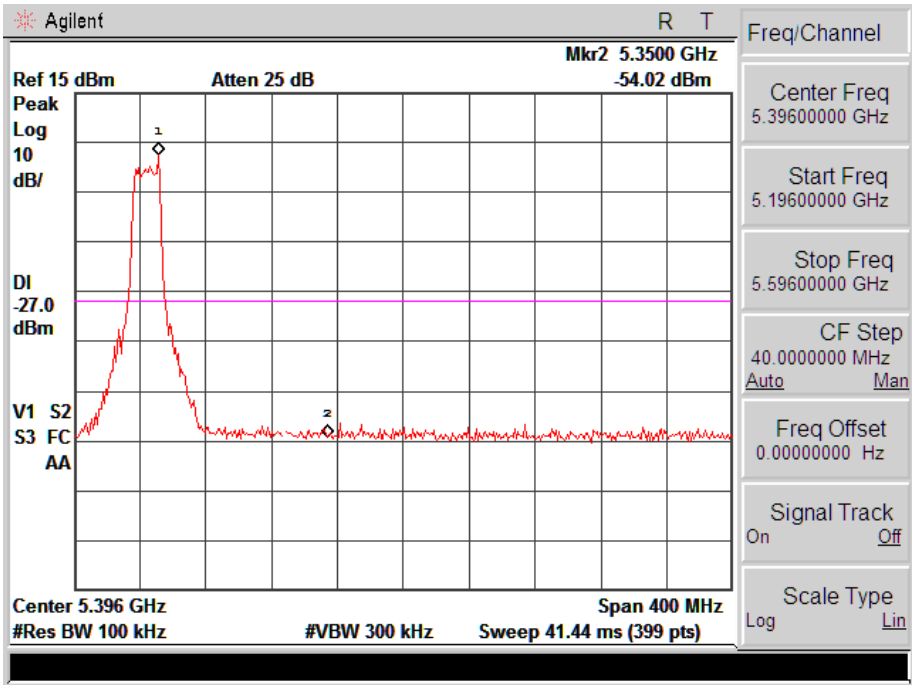
**Antenna 1**

*Test Plots: Conducted Undesirable Emissions and Band Edge for 5.15-5.25GHz*

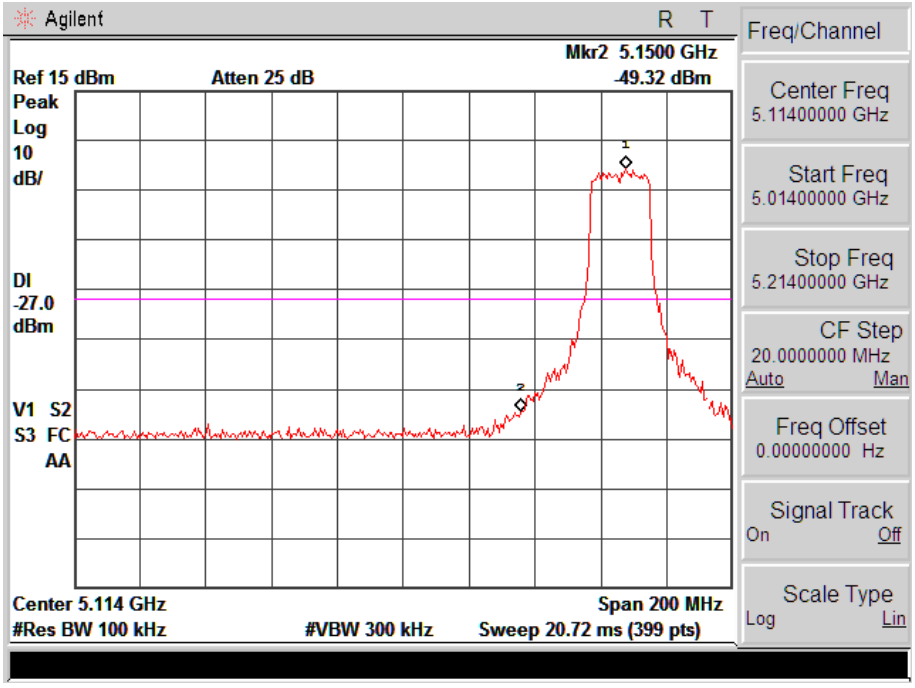
(Plot 4.9.1 A1: Channel 36: 5180MHz @ 802.11a)



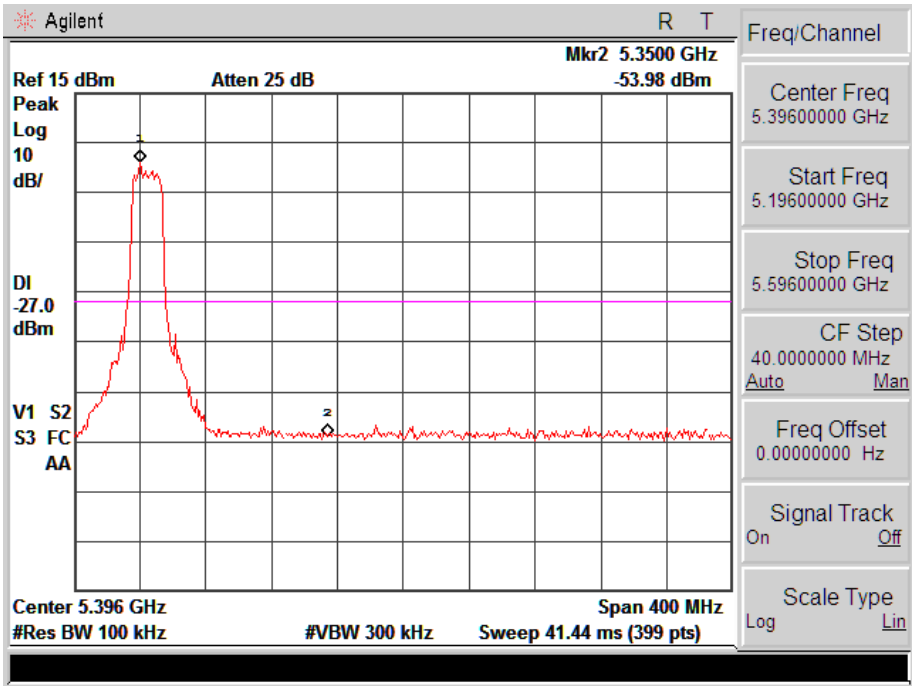

(Plot 4.9.1 B1: Channel 48: 5240MHz @ 802.11a)



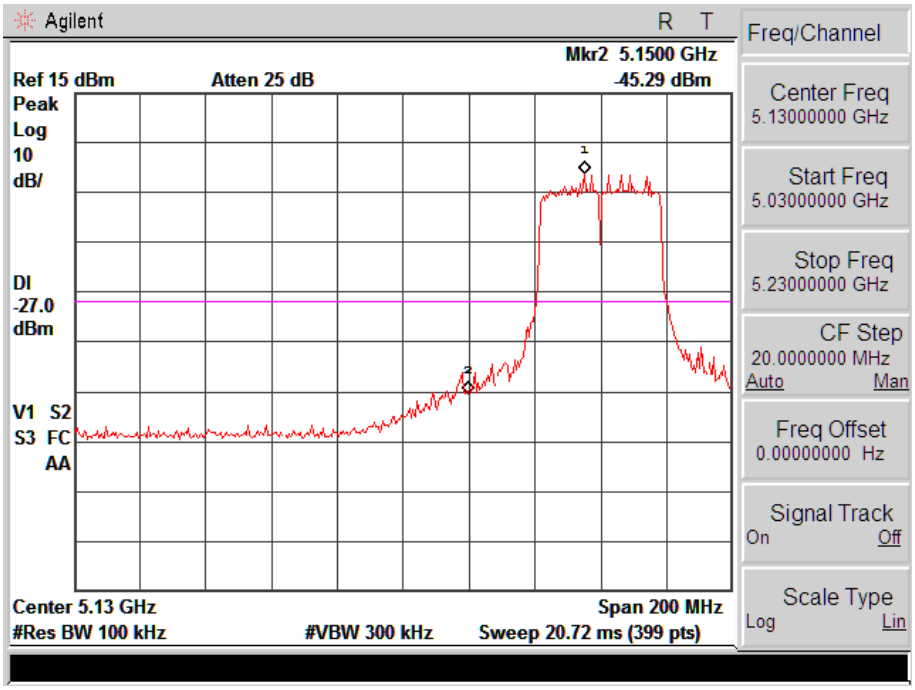
(Plot 4.9.2 A1: Channel 36: 5180MHz @ 802.11n HT20)



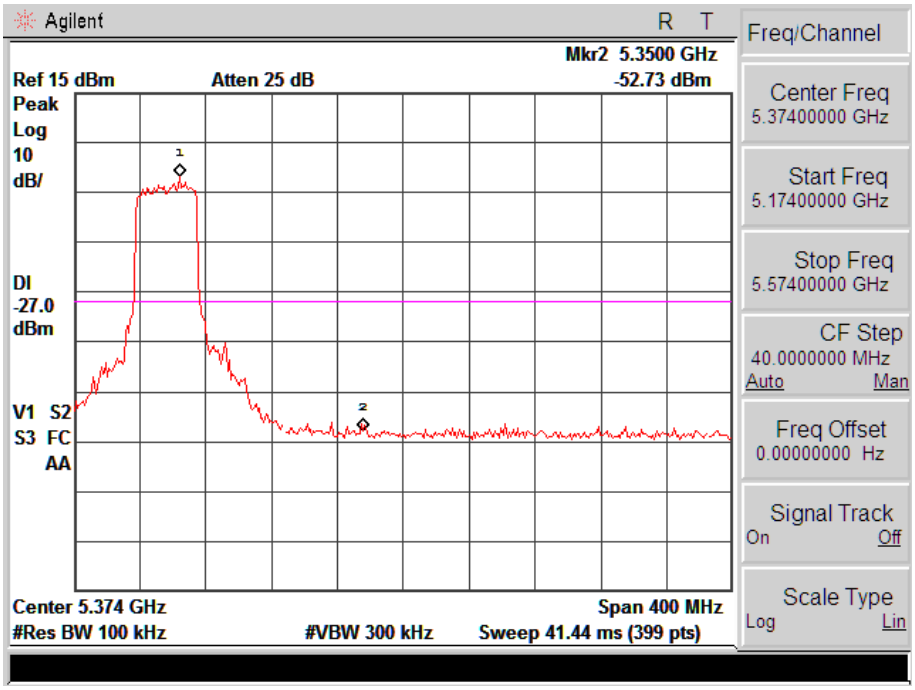

(Plot 4.9.2 B1: Channel 48: 5240MHz @ 802.11n HT20)



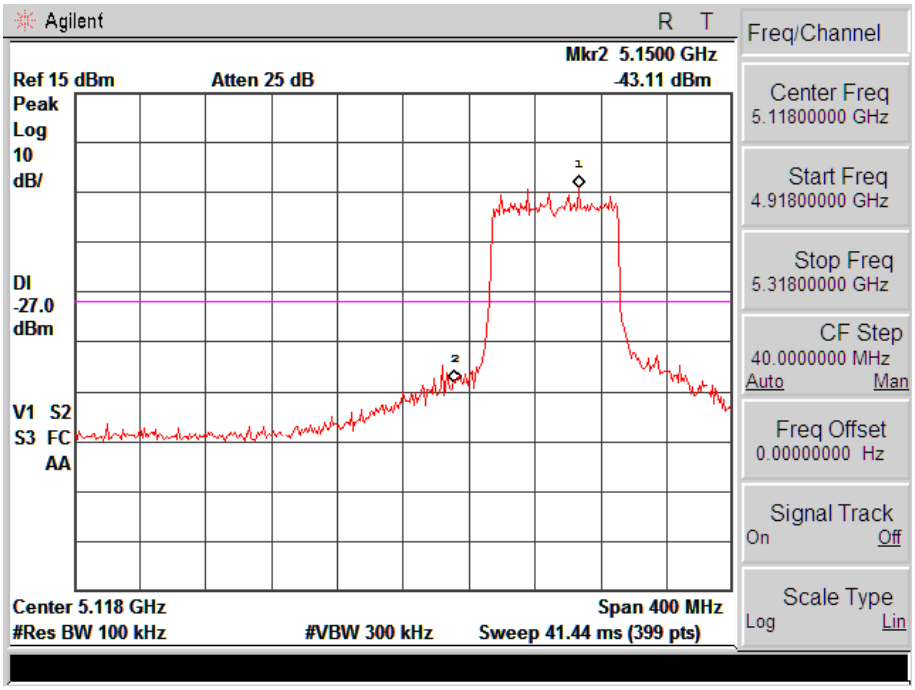
(Plot 4.9.3 A1: Channel 38: 5190MHz @ 802.11n HT40)



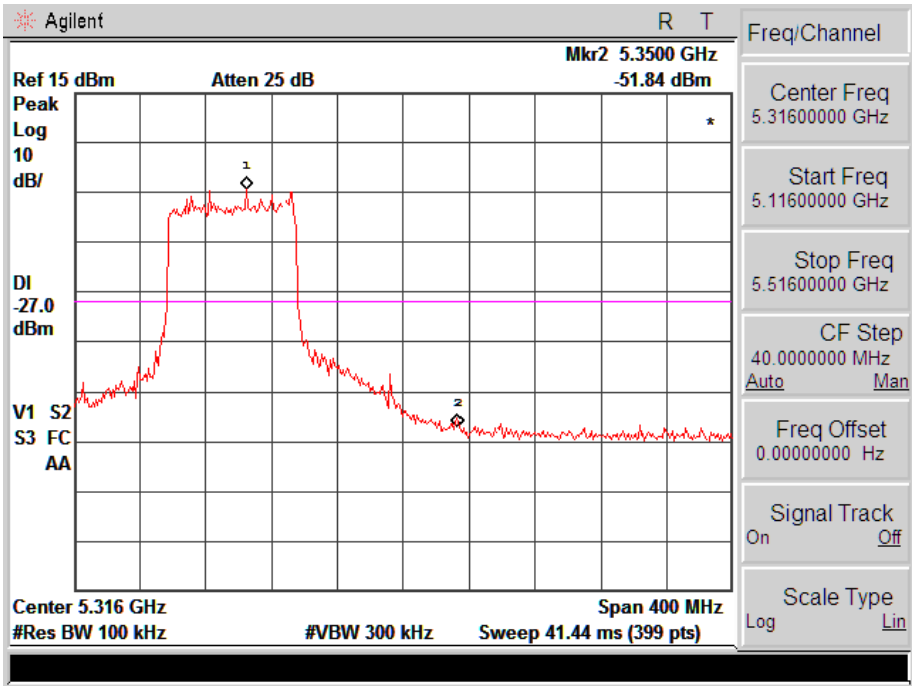

(Plot 4.9.3 B1: Channel 46: 5230MHz @ 802.11n HT40)



(Plot 4.9.4 A1: Channel 42: 5210MHz @ 802.11ac HT80)

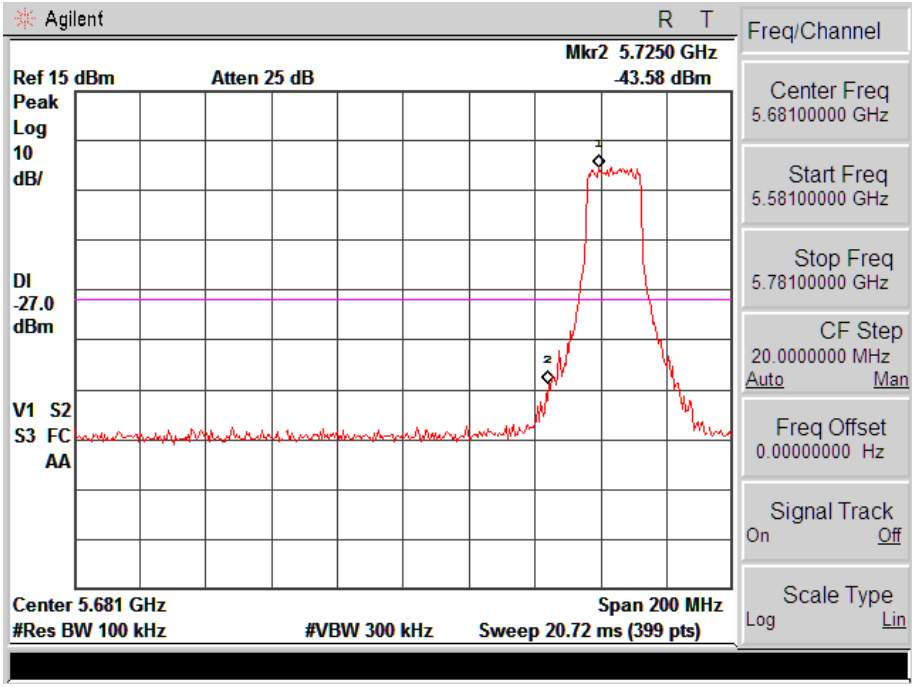



(Plot 4.9.4 B1: Channel 42: 5210MHz @ 802.11ac HT80)

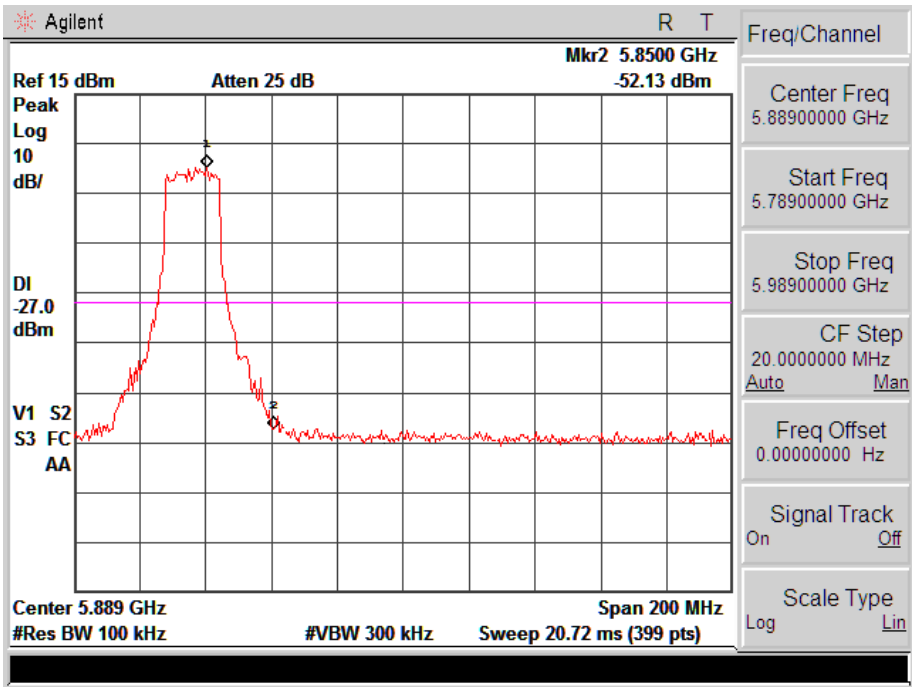


*Test Plots: Conducted Undesirable Emissions and Band Edge for 5725-5850GHz*

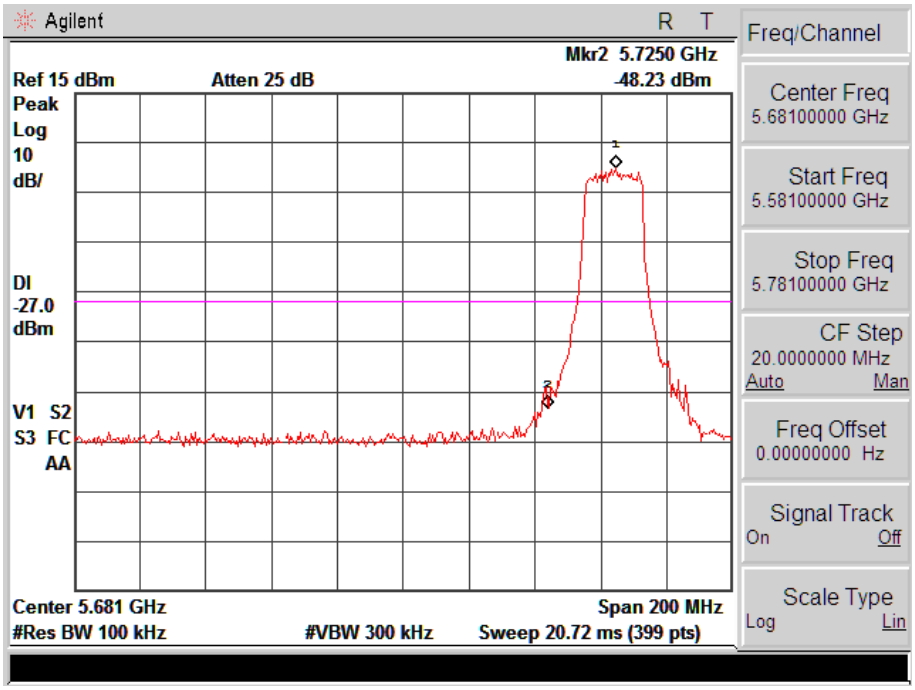
(Plot 4.9.5 A1: Channel 149: 5745MHz @ 802.11a)



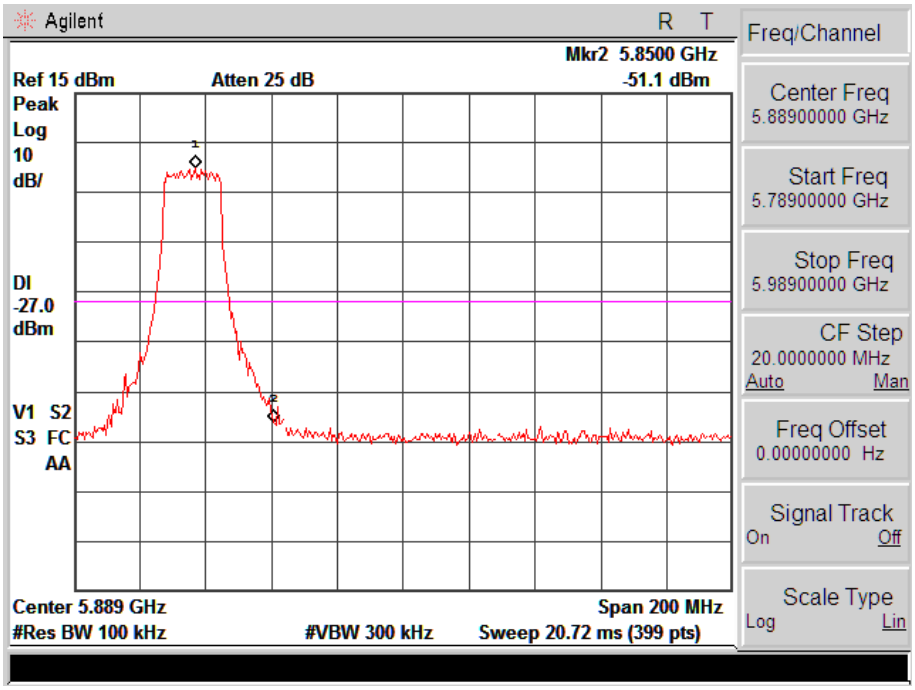

(Plot 4.9.5 B1: Channel 165: 5825MHz @ 802.11a)



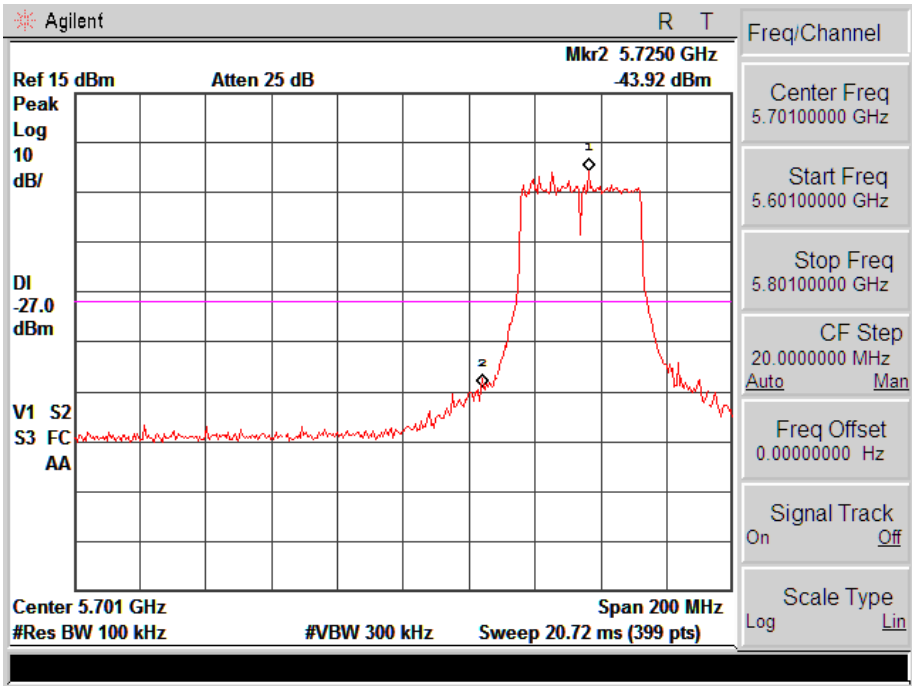
(Plot 4.9.6 A1: Channel 149: 5745MHz @ 802.11n HT20)



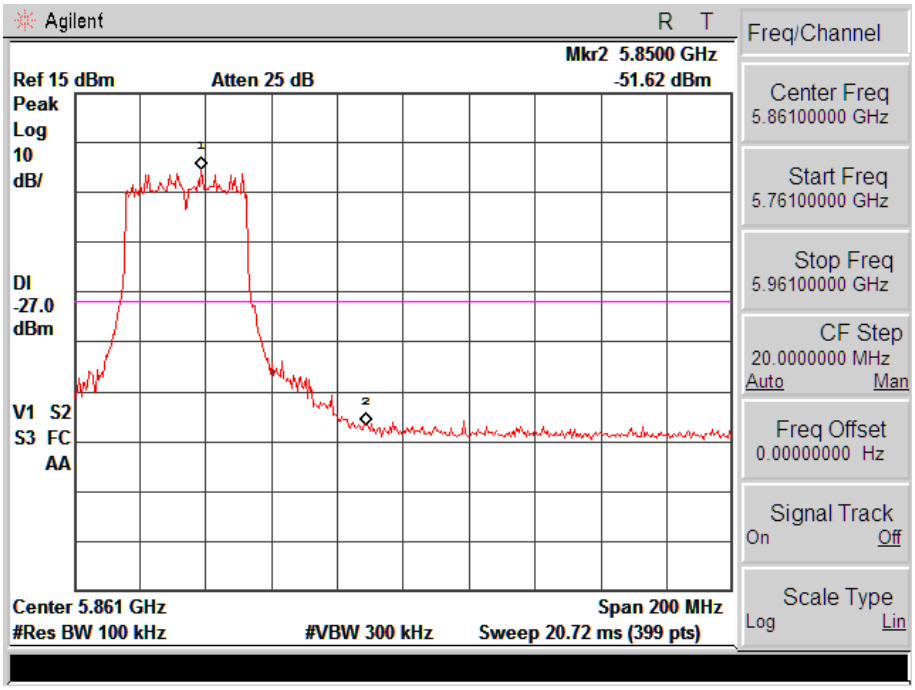

(Plot 4.9.6 B1: Channel 165: 5825MHz @ 802.11n HT20)



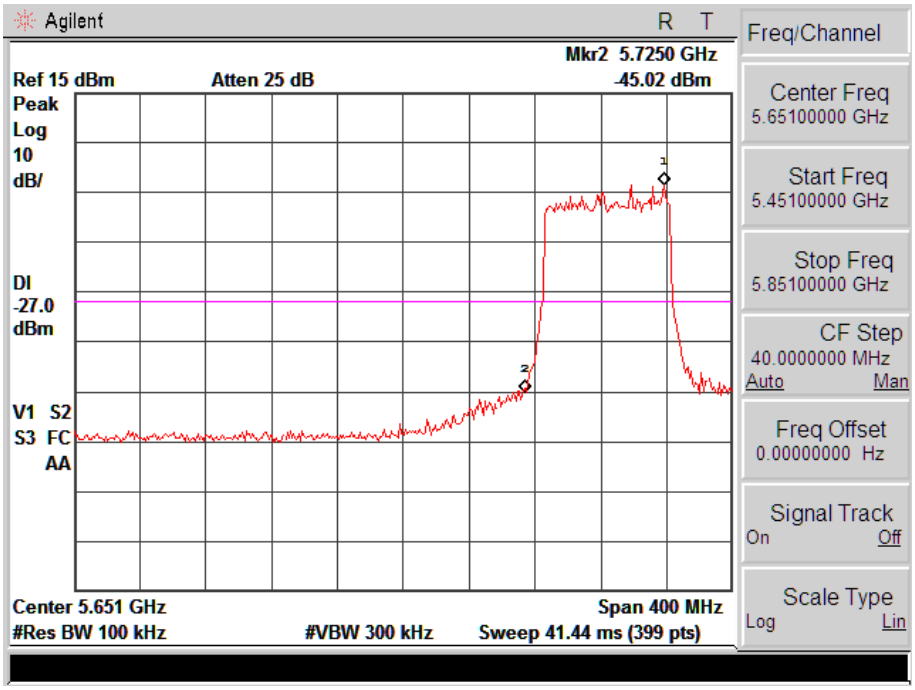
(Plot 4.9.7 A1: Channel 151: 5755MHz @ 802.11n HT40)



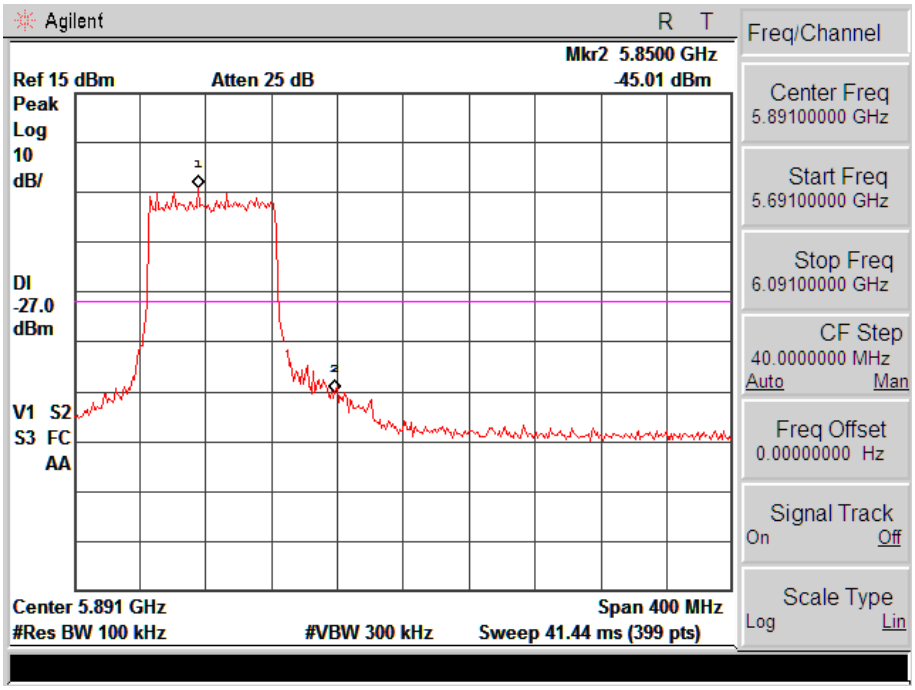

(Plot 4.9.7 B1: Channel 159: 5795MHz @ 802.11n HT40)



(Plot 4.9.8 A1: Channel 155: 5775MHz @ 802.11ac HT80)



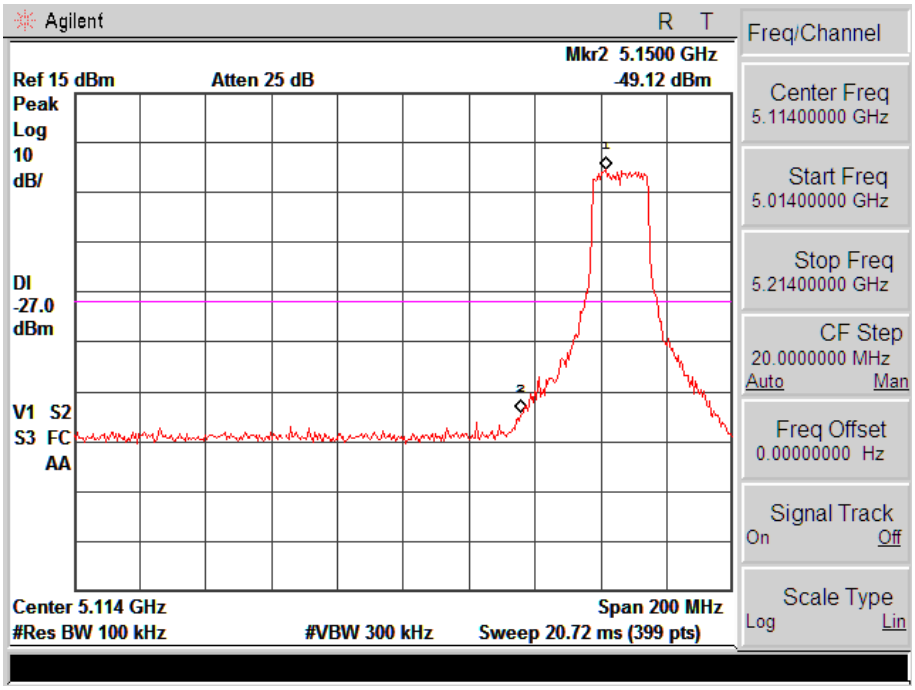

(Plot 4.9.8 B1: Channel 155: 5775MHz @ 802.11ac HT80)



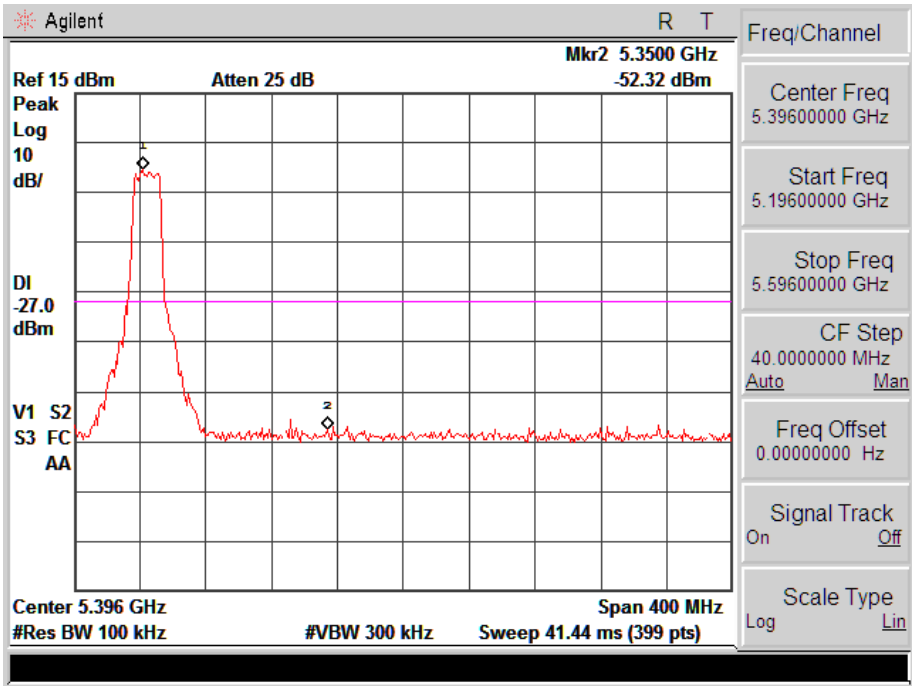
**Antenna 2**

*Test Plots: Conducted Undesirable Emissions and Band Edge for 5.15-5.25GHz*

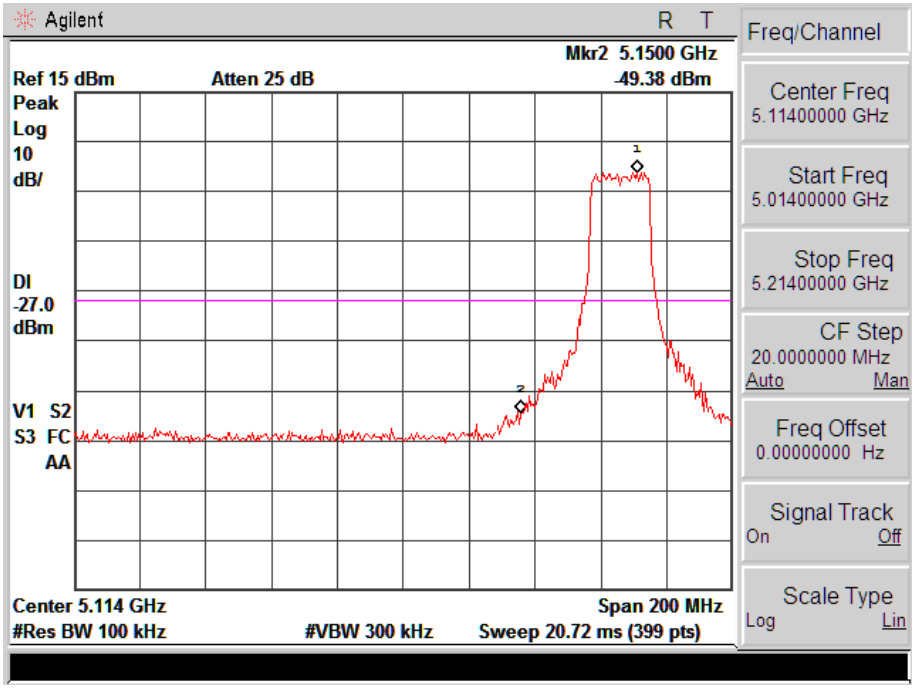
(Plot 4.9.1 A1: Channel 36: 5180MHz @ 802.11a)



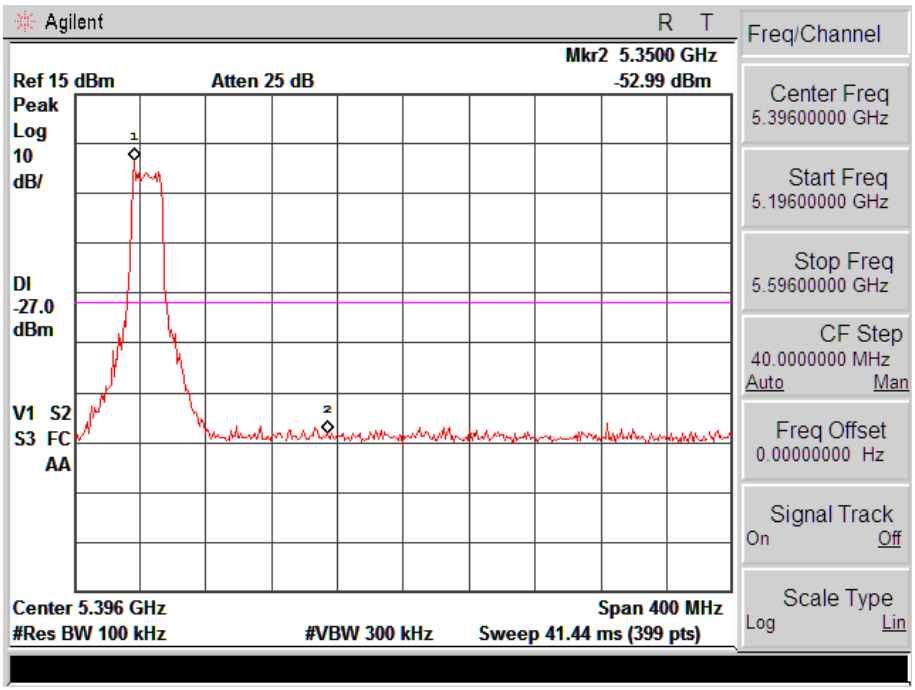

(Plot 4.9.1 B1: Channel 48: 5240MHz @ 802.11a)



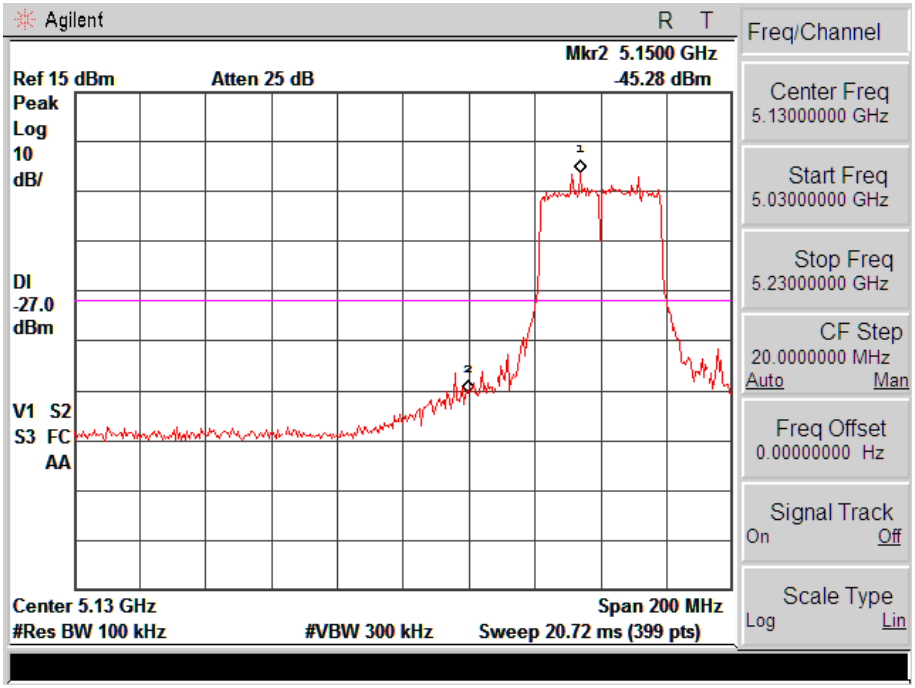
(Plot 4.9.2 A1: Channel 36: 5180MHz @ 802.11n HT20)



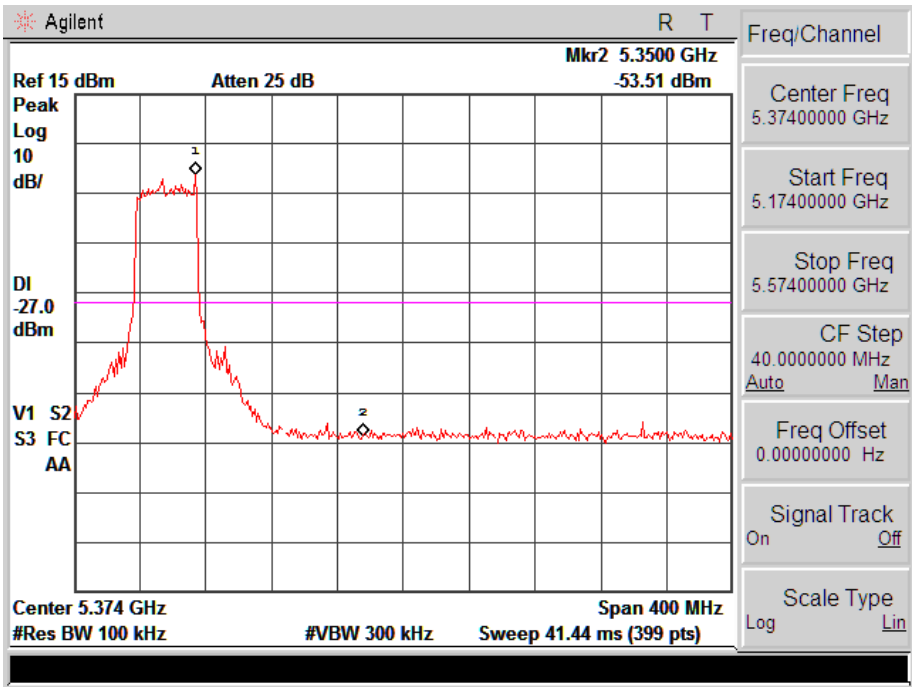

(Plot 4.9.2 B1: Channel 48: 5240MHz @ 802.11n HT20)



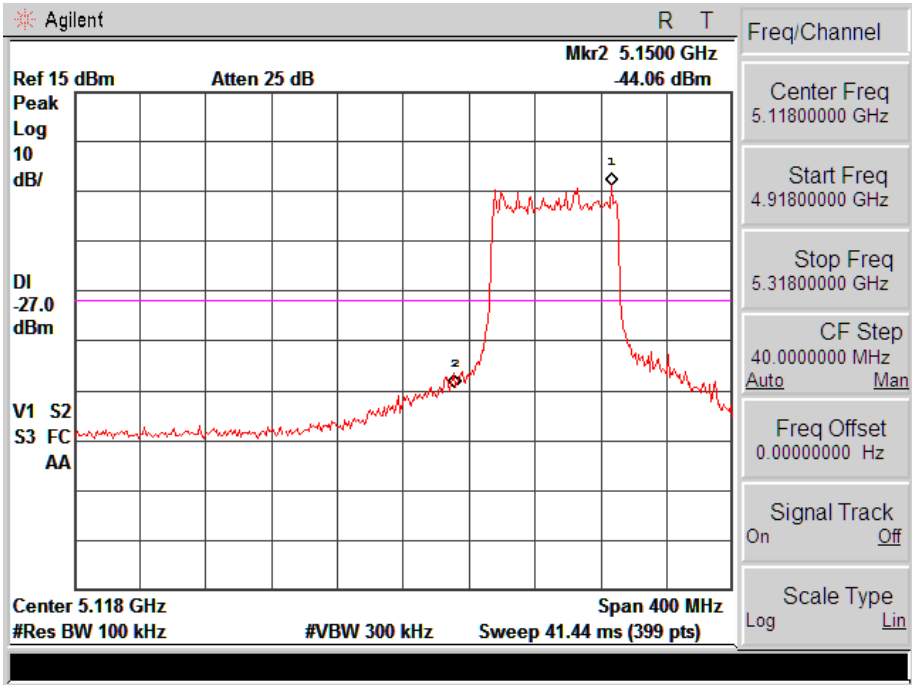
(Plot 4.9.3 A1: Channel 38: 5190MHz @ 802.11n HT40)



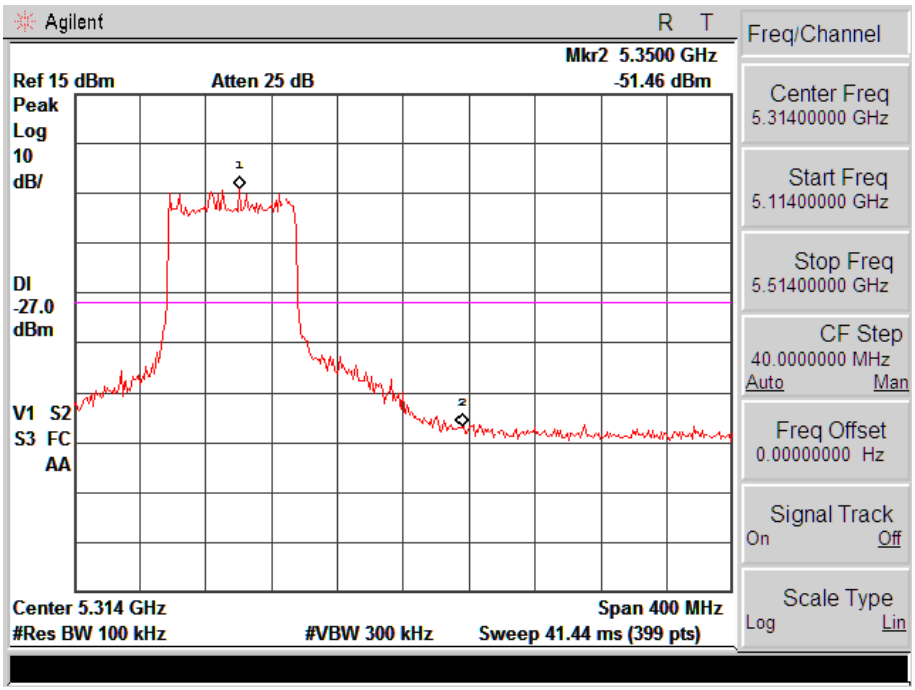

(Plot 4.9.3 B1: Channel 46: 5230MHz @ 802.11n HT40)



(Plot 4.9.4 A1: Channel 42: 5210MHz @ 802.11ac HT80)

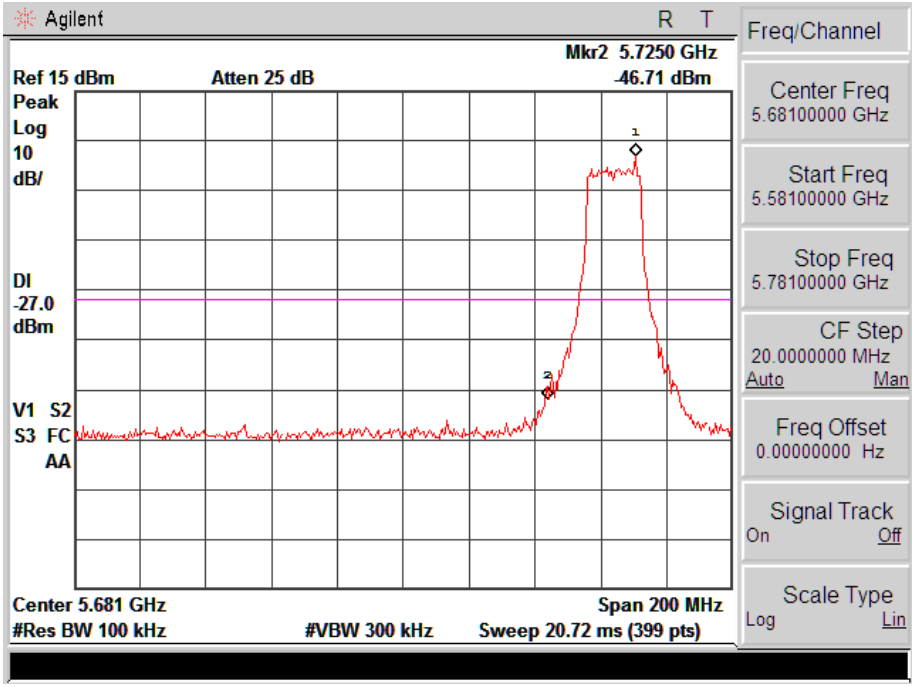



(Plot 4.9.4 B1: Channel 42: 5210MHz @ 802.11ac HT80)

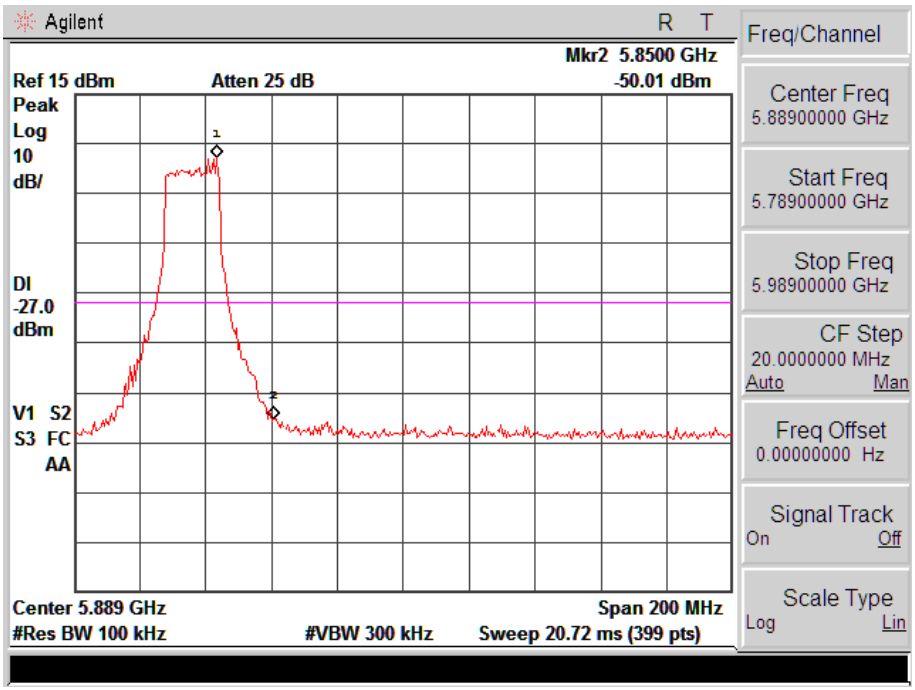


*Test Plots: Conducted Undesirable Emissions and Band Edge for 5725-5850GHz*

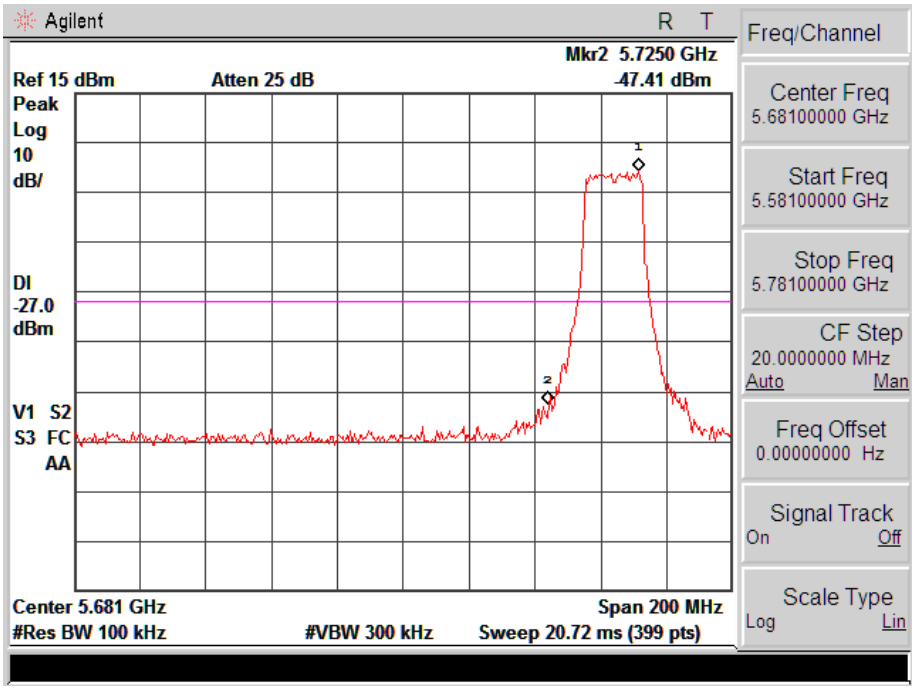
(Plot 4.9.5 A1: Channel 149: 5745MHz @ 802.11a)



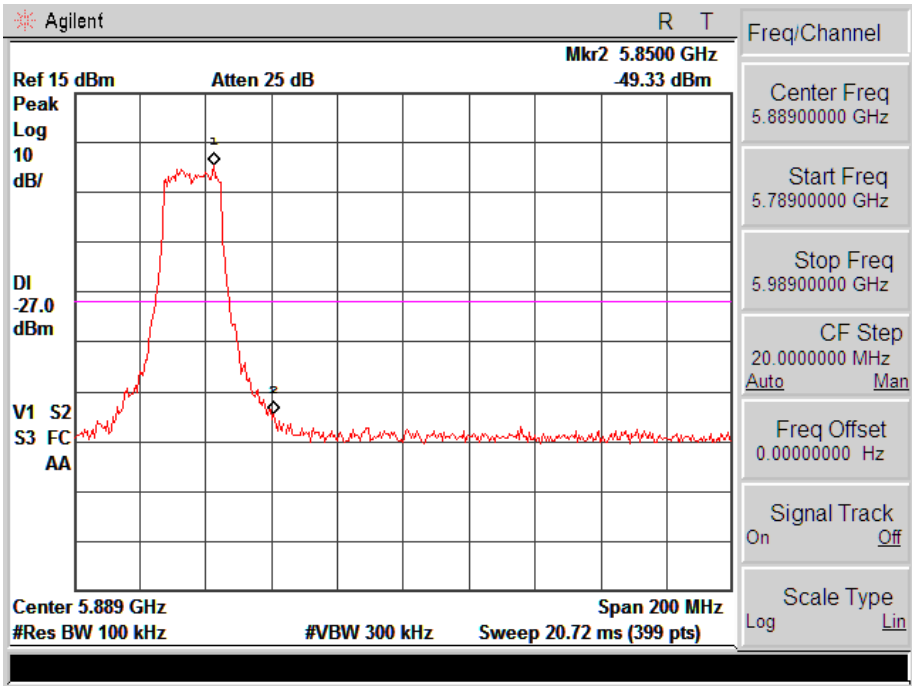

(Plot 4.9.5 B1: Channel 165: 5825MHz @ 802.11a)



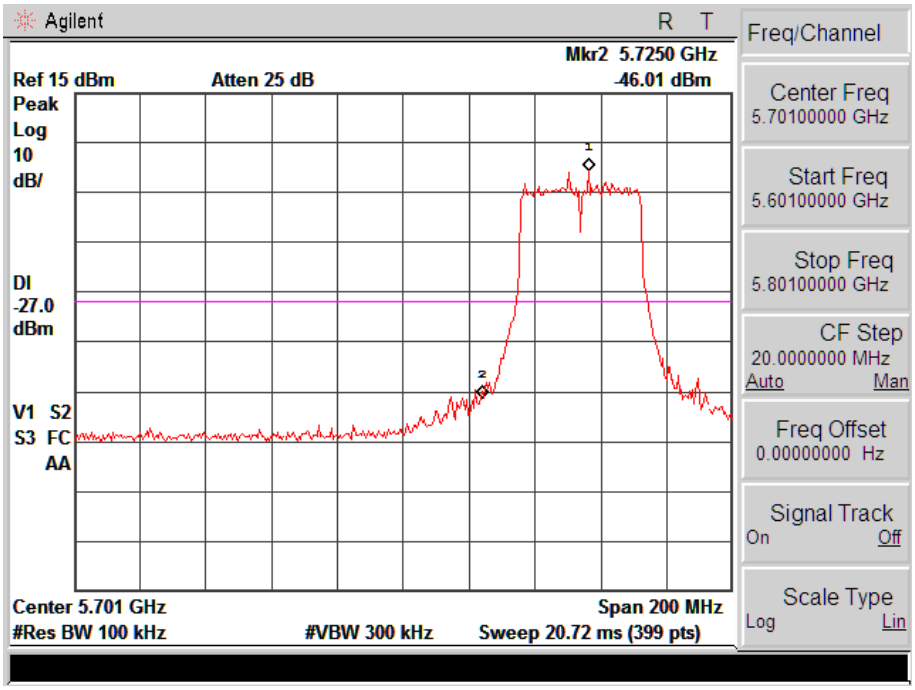
(Plot 4.9.6 A1: Channel 149: 5745MHz @ 802.11n HT20)



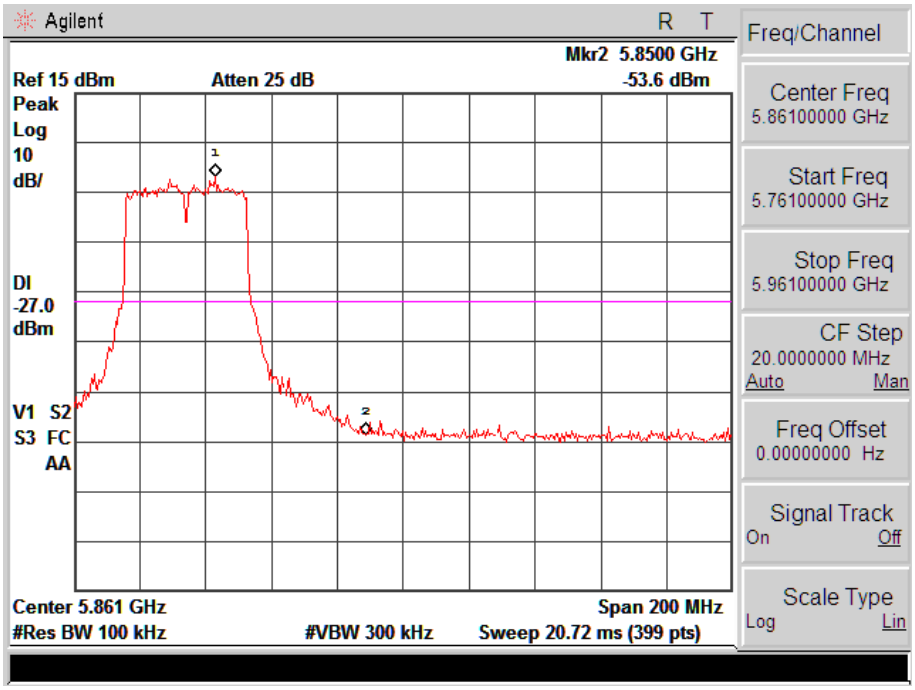

(Plot 4.9.6 B1: Channel 165: 5825MHz @ 802.11n HT20)



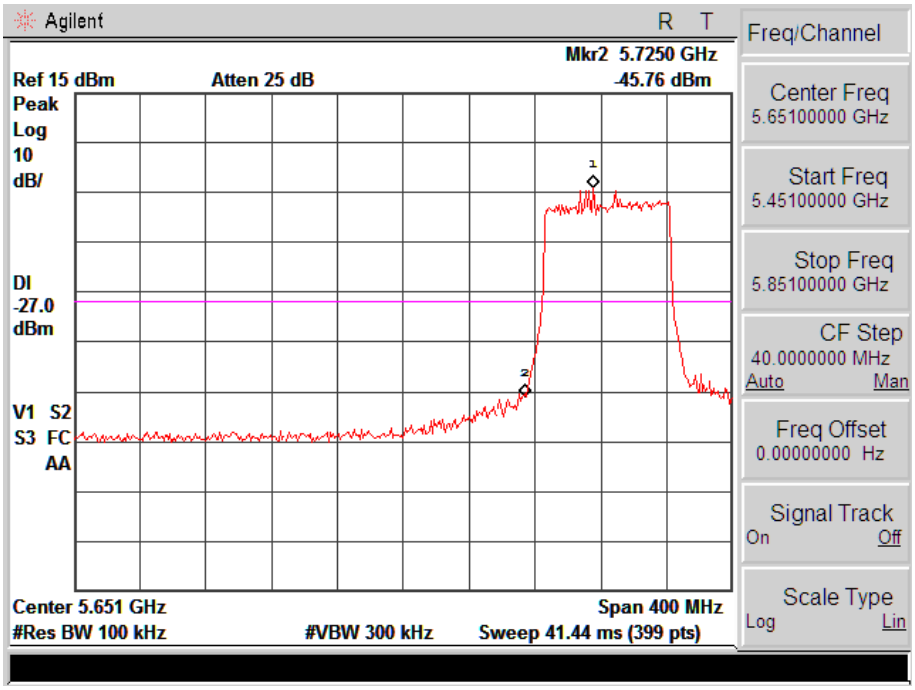
(Plot 4.9.7 A1: Channel 151: 5755MHz @ 802.11n HT40)



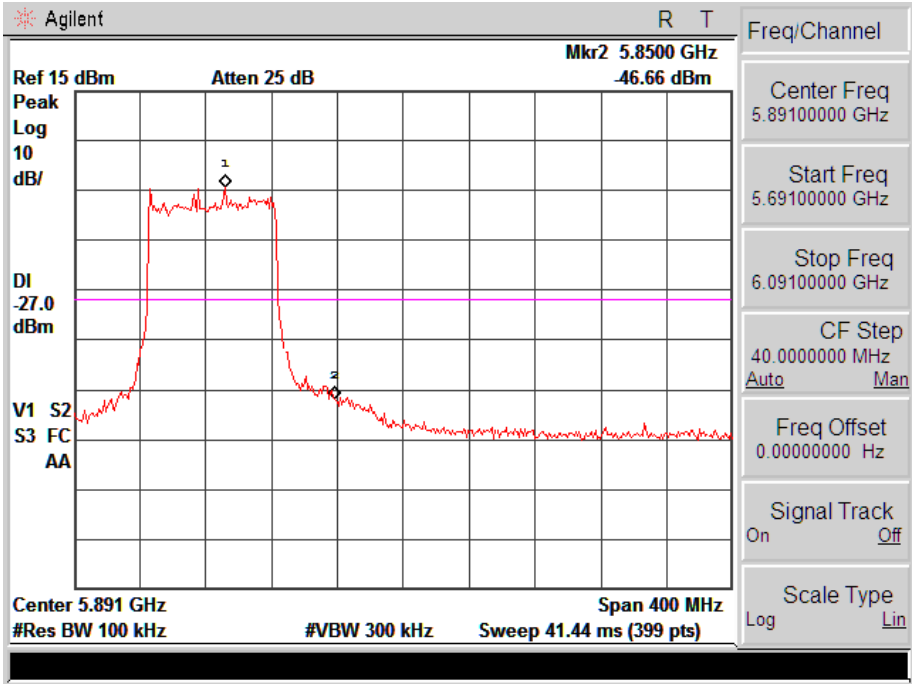

(Plot 4.9.7 B1: Channel 159: 5795MHz @ 802.11n HT40)



(Plot 4.9.8 A1: Channel 155: 5775MHz @ 802.11ac HT80)




(Plot 4.9.8 A1: Channel 155: 5775MHz @ 802.11ac HT80)



# 10. Radiated Spurious Emissions

## 10.1 Standard Applicable

According to §15.407(b)(6), Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209.

According to §15.407(b),The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
As below table:

| Un-restricted band emissions above 1GHz Limit | |
|---|---|
| **Operating Band** | **Limit** |
| 5.15 - 5.25 GHz | e.i.r.p. -27 dBm [68.2 dBuV/m@3m] |
| 5.25 - 5.35 GHz | e.i.r.p. -27 dBm [68.2 dBuV/m@3m] |
| 5.47 - 5.725 GHz | e.i.r.p. -27 dBm [68.2 dBuV/m@3m] |
| 5.725 - 5.850 GHz | All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 |
| Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements). | |

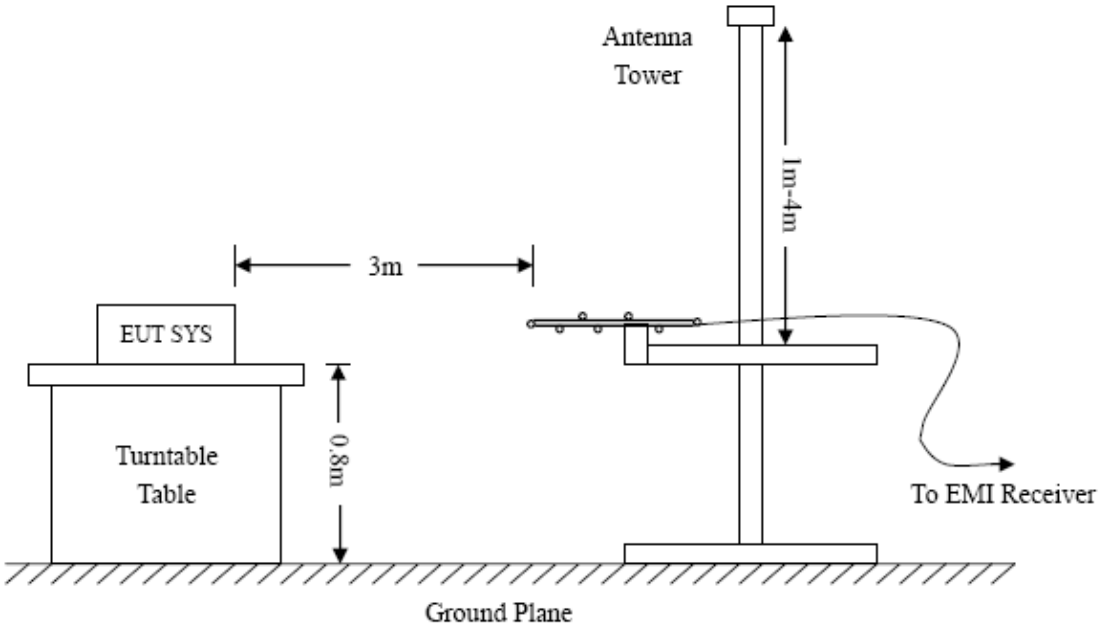
Test procedure used is 789033 D02 General UNII Test Procedures New Rules v01r04

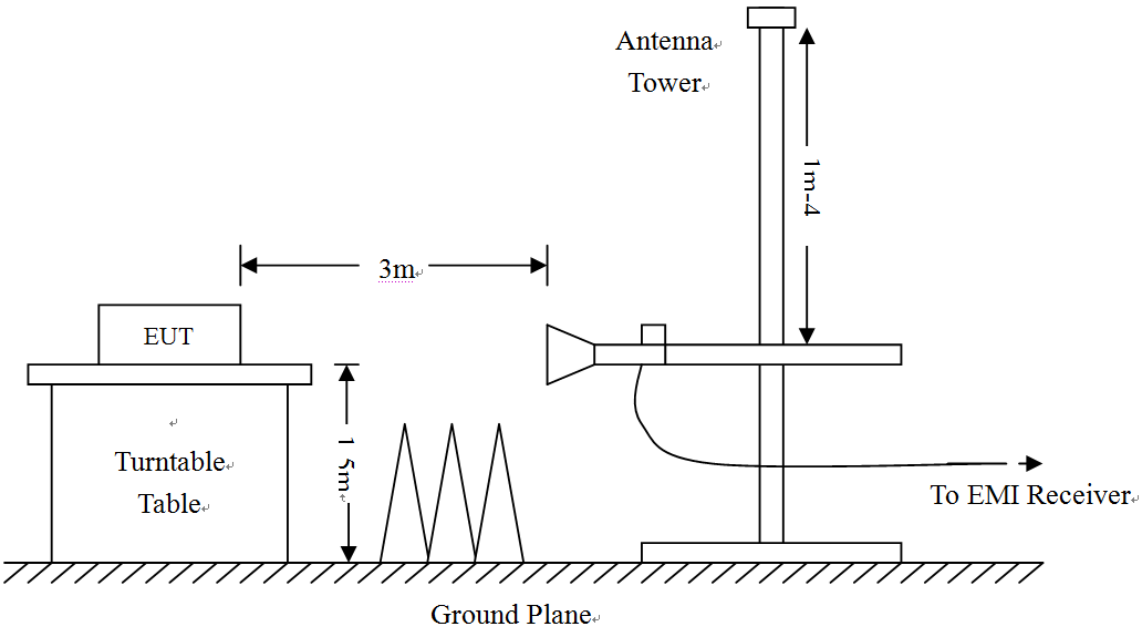
If radiated measurements are performed, field strength is then converted to EIRP as follows:
EIRP = ((E*d)^2) / 30
where:

- E is the field strength in V/m;
- d is the measurement distance in meters;
- EIRP is the equivalent isotropically radiated power in watts.

## 10.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.407(b)(6) and FCC Part 15.209 Limit..
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.
The spacing between the peripherals was 10 cm.



## 10.3 Test Receiver Setup

During the radiated emission test for above 1GHz, the test receiver was set with the following configurations:

For peak detector:
RBW = 1000kHz, VBW = 3000kHz, Sweep Time = Auto

For average detector:
RBW = 1000kHz, VBW = 10Hz, Sweep Time = Auto

## 10.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15 Limit

## 10.5 Environmental Conditions

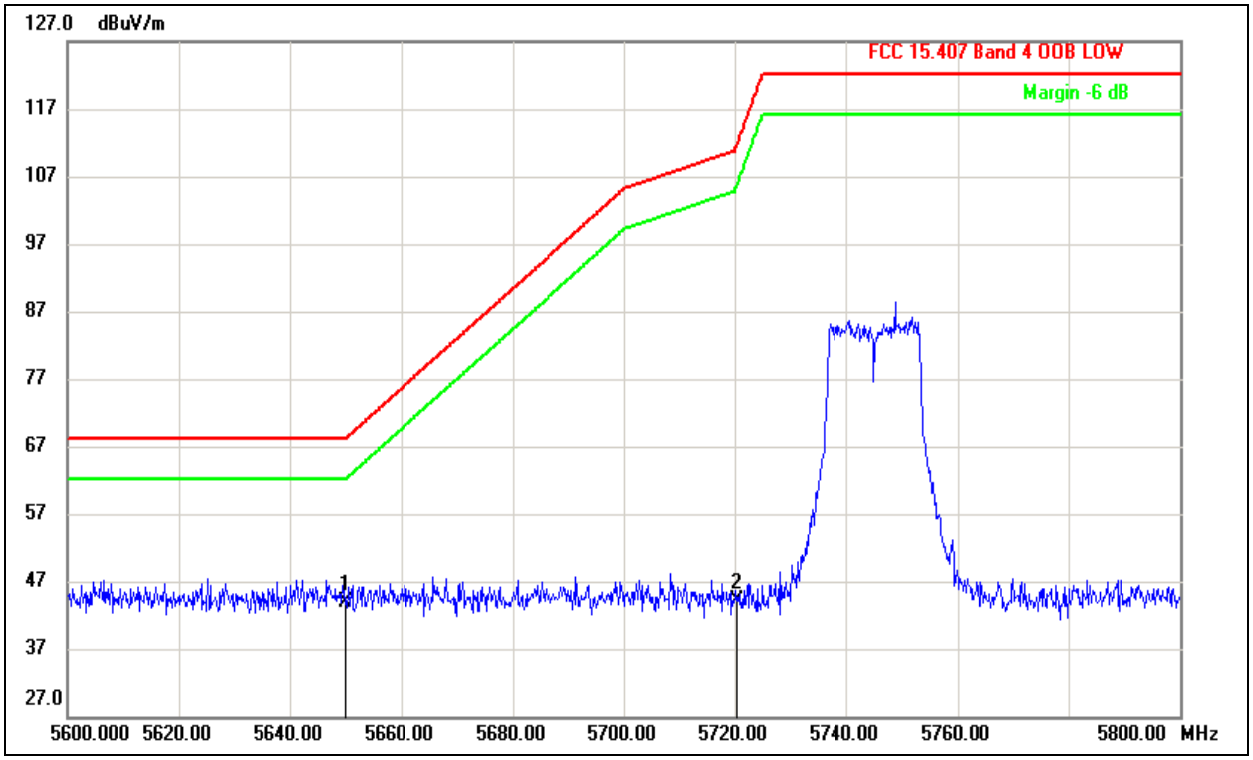
| | |
|---|---|
| Temperature: | 22° C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

## 10.6 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.407(b) standards, and had the worst margin of:

*Test Plots: Radiated Undesirable Emissions and Band Edge for 5.725-5.850GHz*

Channel 149: 5745MHz @ 802.11a mode
Polarization: Horizontal

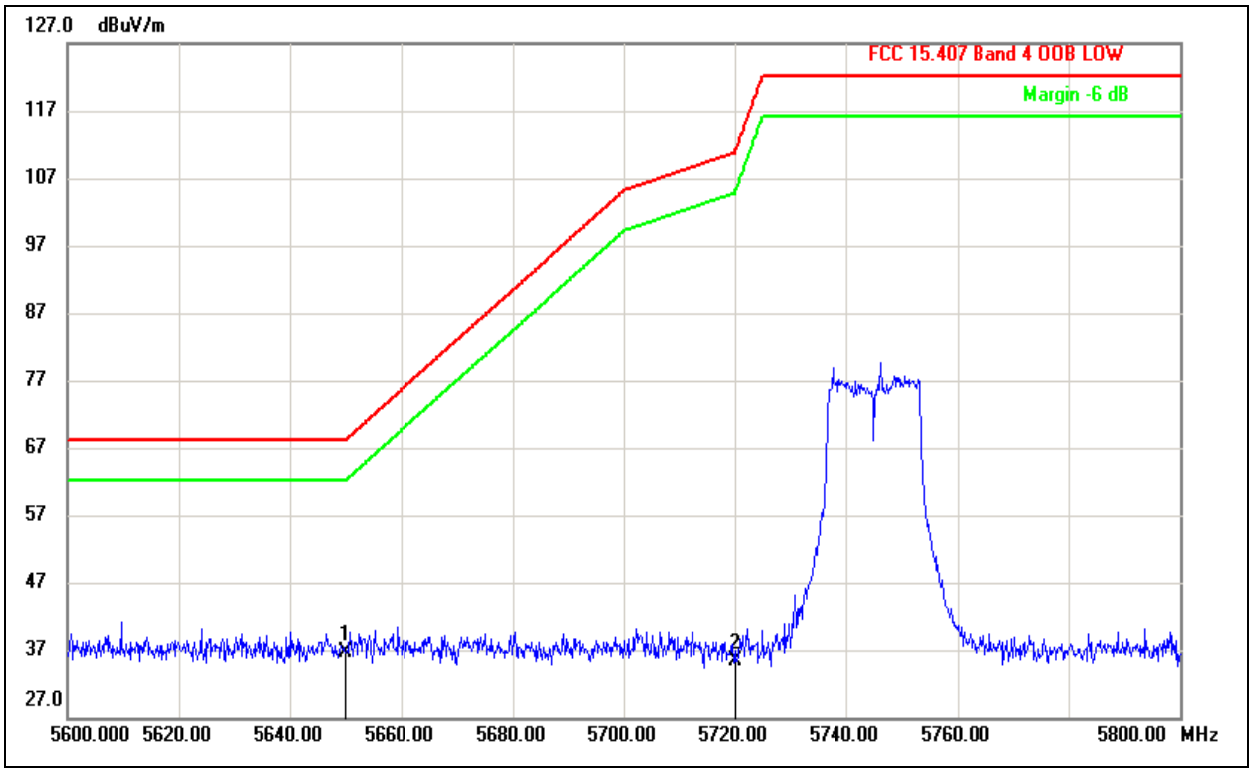



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5650.000 | 25.64 | 18.18 | 43.82 | 68.20 | -24.38 | QP |
| 2 | 5720.400 | 25.69 | 18.32 | 44.01 | 111.71 | -67.70 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 149: 5745MHz @ 802.11a mode
Polarization: Vertical

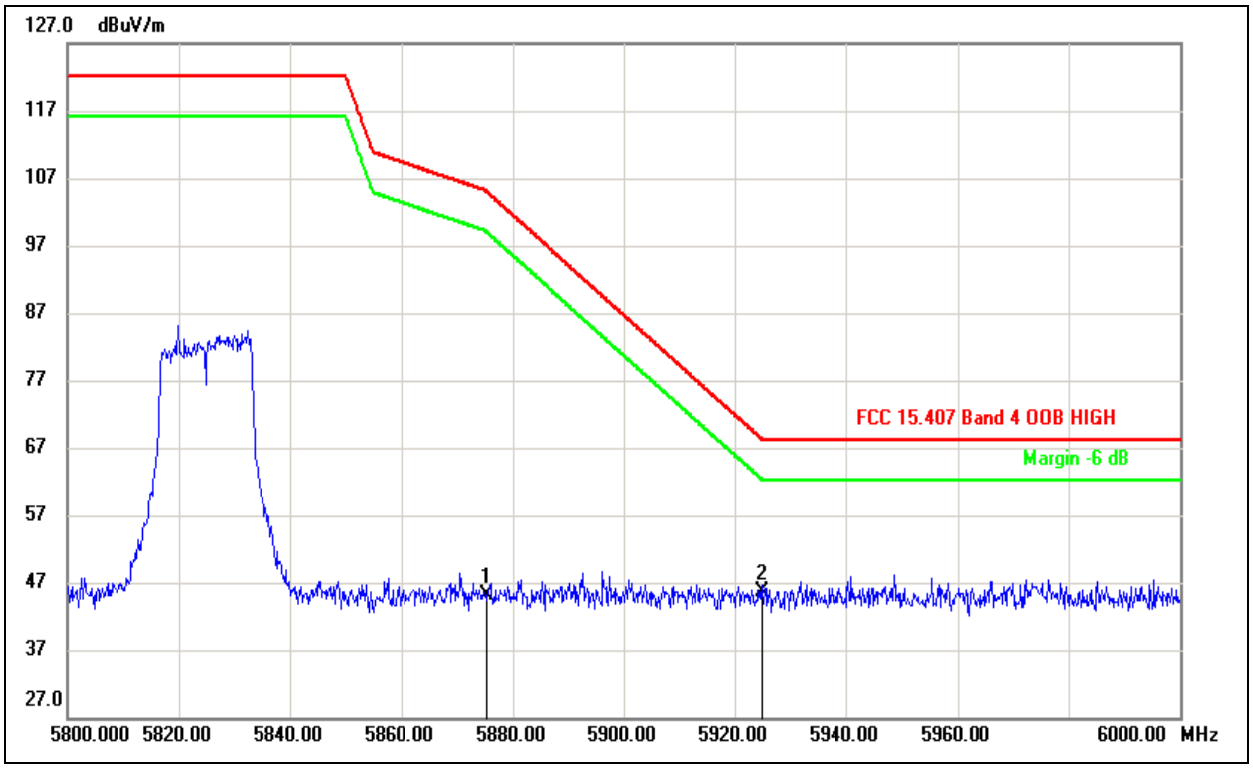



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5650.000 | 27.88 | 8.77 | 36.65 | 68.20 | -31.55 | QP |
| 2 | 5720.200 | 26.51 | 8.81 | 35.32 | 111.26 | -75.94 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 165: 5825MHz @ 802.11a mode
Polarization: Horizontal

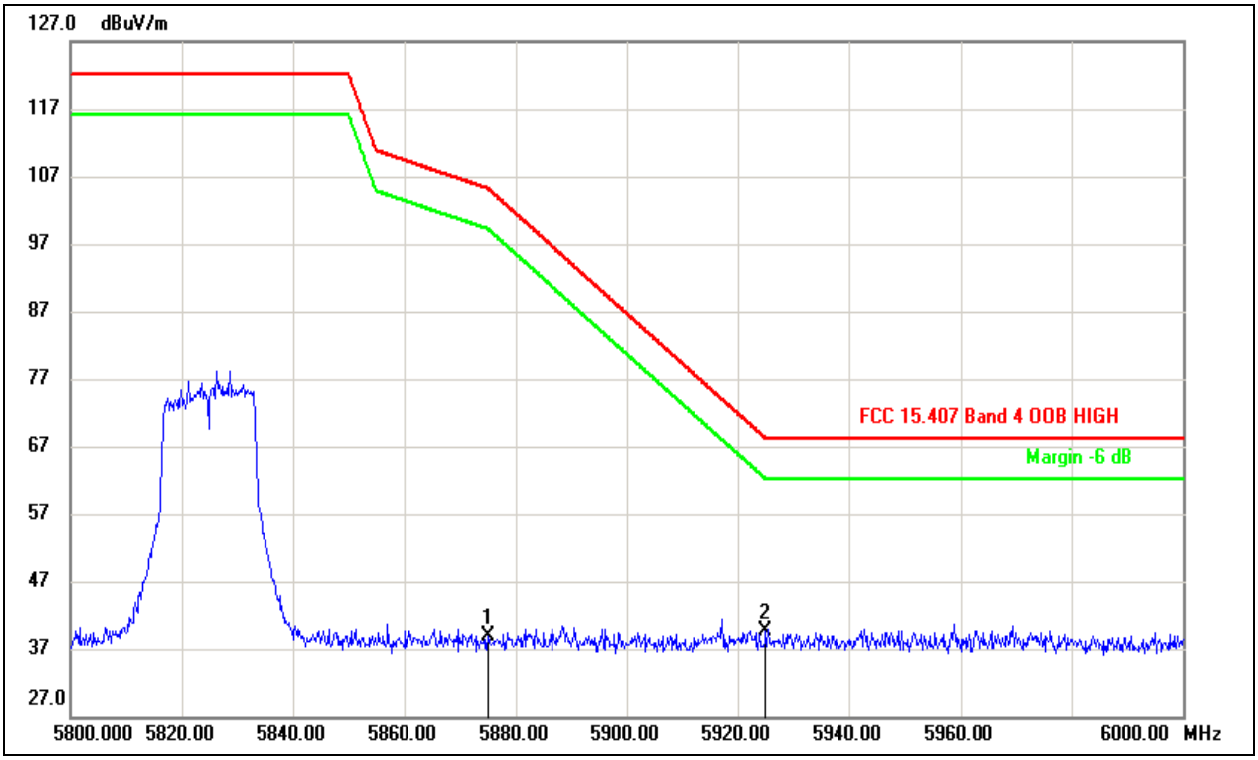



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5875.400 | 26.40 | 18.62 | 45.02 | 104.90 | -59.88 | QP |
| 2 | 5925.000 | 26.96 | 18.70 | 45.66 | 68.20 | -22.54 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 165: 5825MHz @ 802.11a mode
Polarization: Vertical

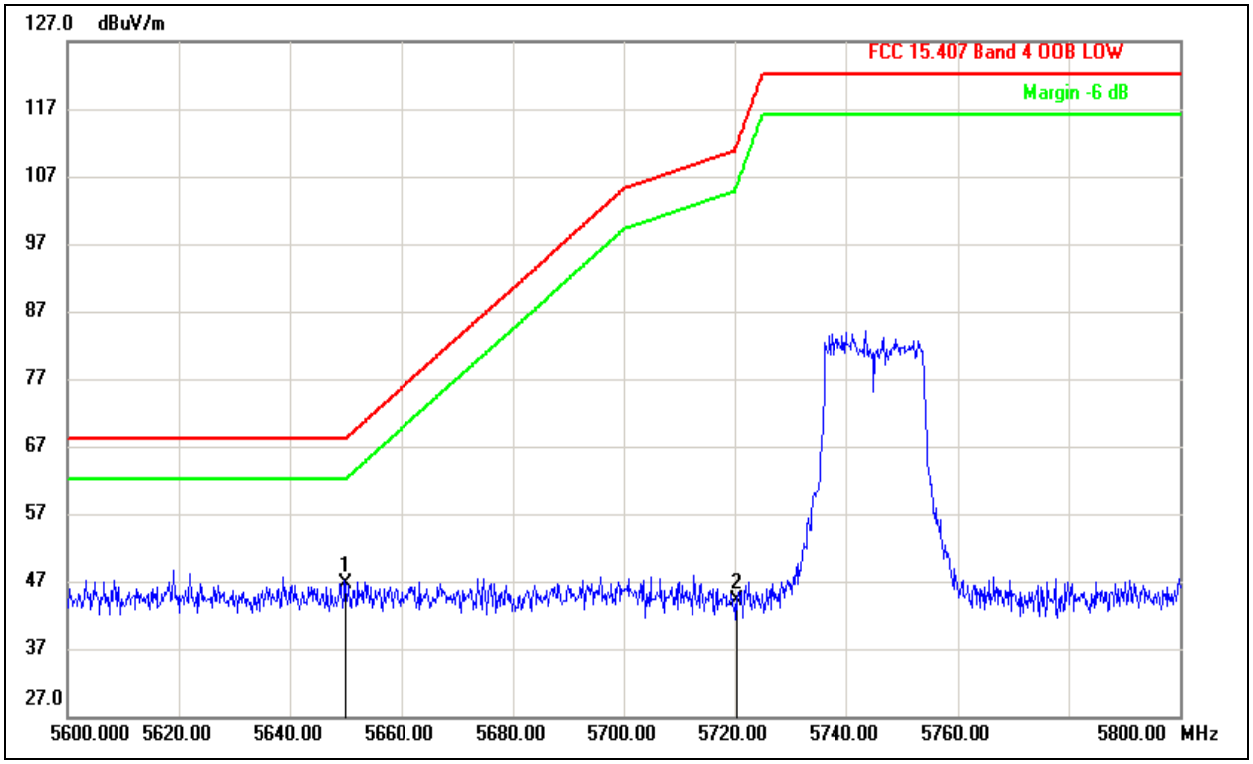



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5875.000 | 29.90 | 8.89 | 38.79 | 105.20 | -66.41 | QP |
| 2 | 5925.000 | 30.65 | 8.91 | 39.56 | 68.20 | -28.64 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 149: 5745MHz @ 802.11n (HT20) mode
Polarization: Horizontal

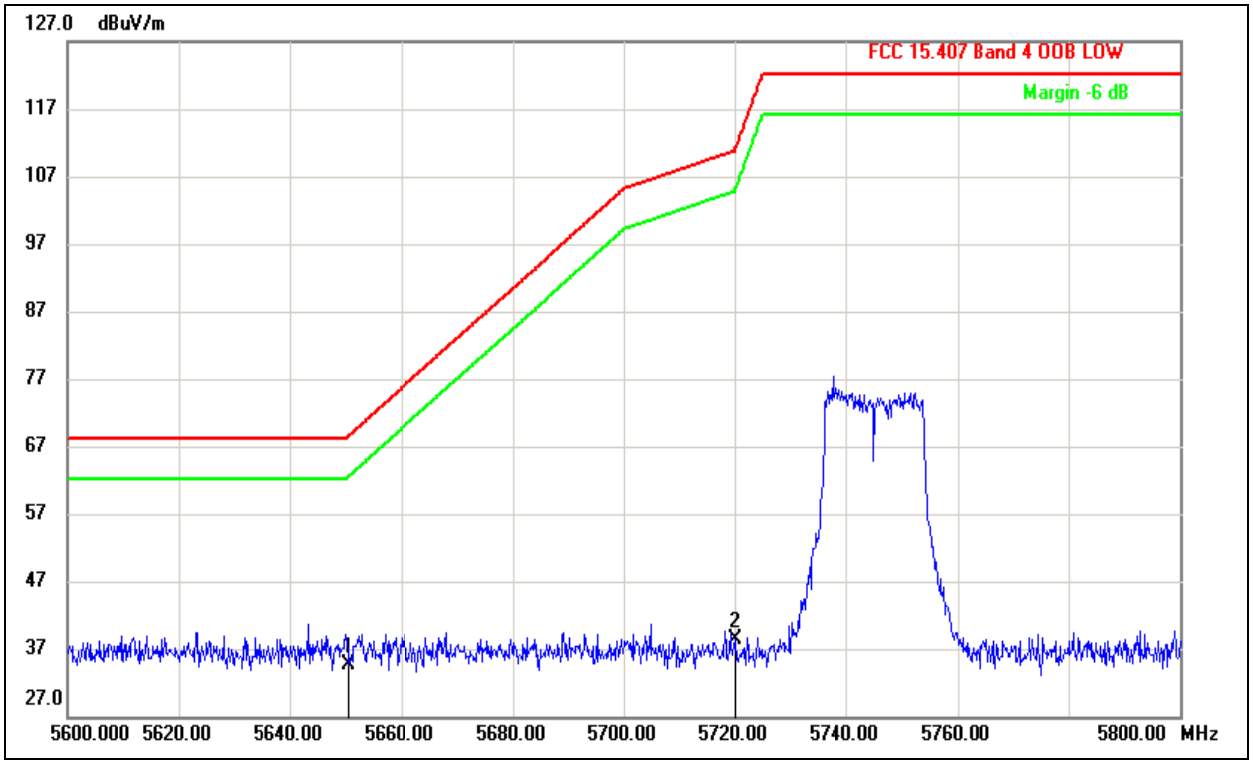



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5650.000 | 28.42 | 18.18 | 46.60 | 68.20 | -21.60 | QP |
| 2 | 5720.400 | 25.89 | 18.32 | 44.21 | 111.71 | -67.50 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 149: 5745MHz @ 802.11n (HT20) mode
Polarization: Vertical

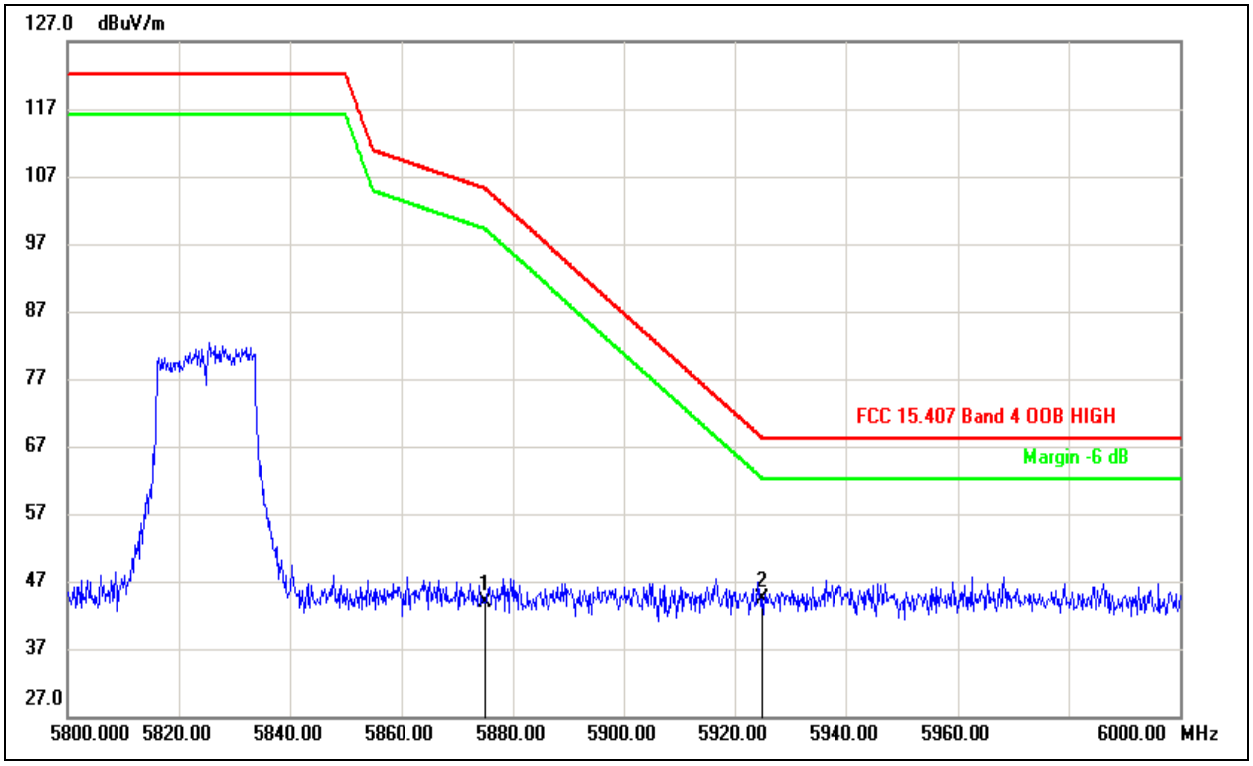



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5650.600 | 25.94 | 8.78 | 34.72 | 68.65 | -33.93 | QP |
| 2 | 5720.200 | 29.60 | 8.81 | 38.41 | 111.26 | -72.85 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 165: 5825MHz @ 802.11n (HT20) mode
Polarization: Horizontal

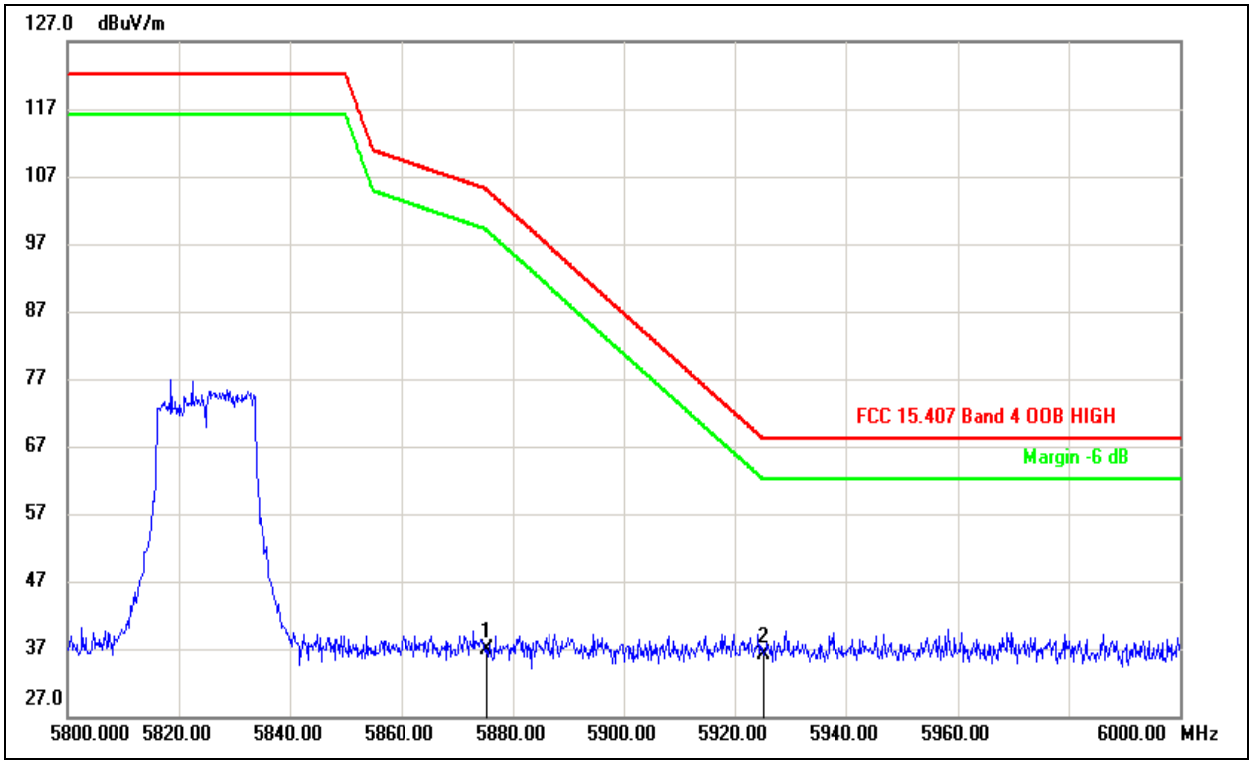



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5875.000 | 25.23 | 18.61 | 43.84 | 105.20 | -61.36 | QP |
| 2 | 5925.000 | 25.63 | 18.70 | 44.33 | 68.20 | -23.87 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Channel 165: 5825MHz @ 802.11n (HT20) mode
Polarization: Vertical



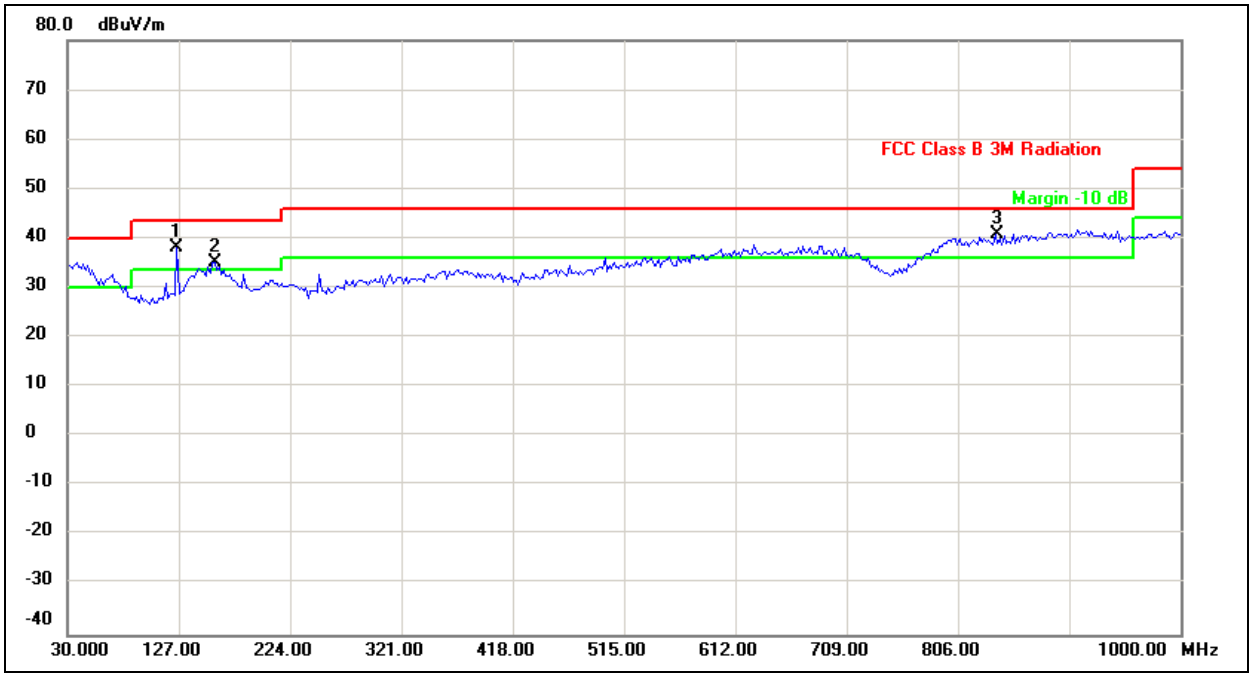

| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 5875.400 | 28.09 | 8.89 | 36.98 | 104.90 | -67.92 | QP |
| 2 | 5925.200 | 27.18 | 8.91 | 36.09 | 68.20 | -32.11 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.

*Radiated Undesirable Emissions (Below 1GHz)*

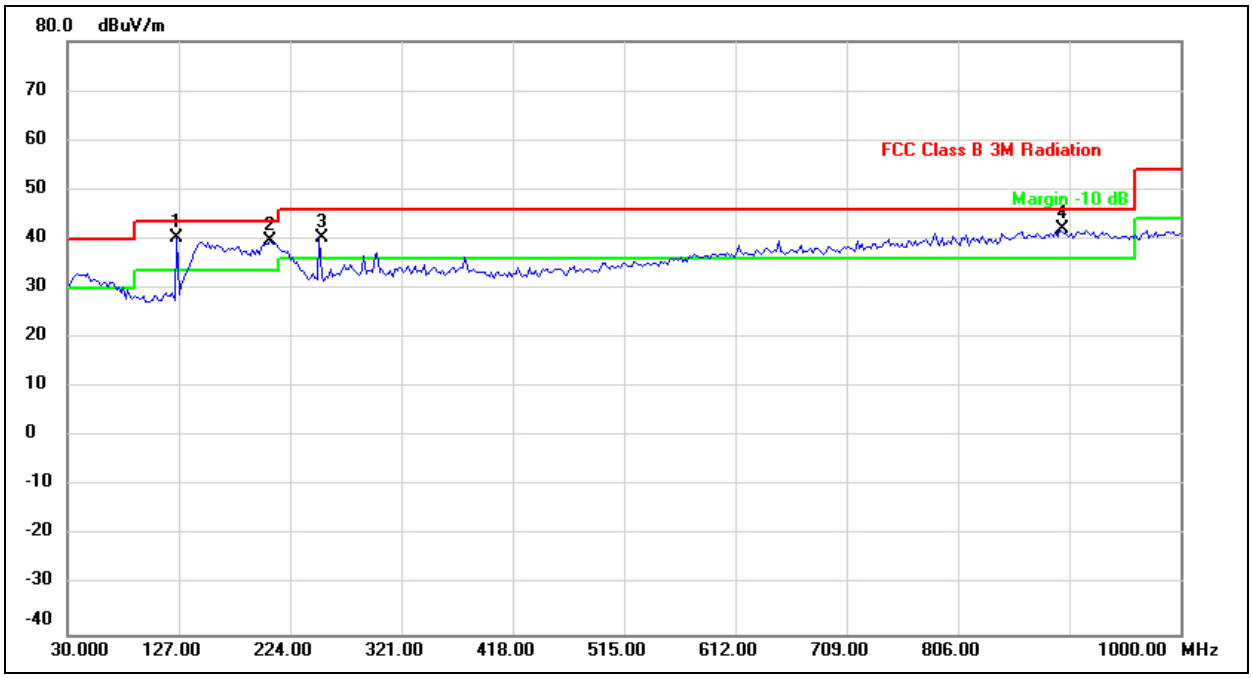
Note:
We test all modes, and only the worst case (802.11a mode, Low, Middle, High) data presented in the report.
Worst case of Channel 165: 5745MHz @ 802.11a mode
Polarization: Vertical




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 125.2505 | 24.31 | 13.70 | 38.01 | 43.50 | -5.49 | QP |
| 2 | 158.2966 | 19.46 | 15.82 | 35.28 | 43.50 | -8.22 | QP |
| 3 | 838.6573 | 16.56 | 24.36 | 40.92 | 46.00 | -5.08 | QP |

Remark:
1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Worst case of Channel 165: 5745MHz @ 802.11a mode
Polarization: Horizontal

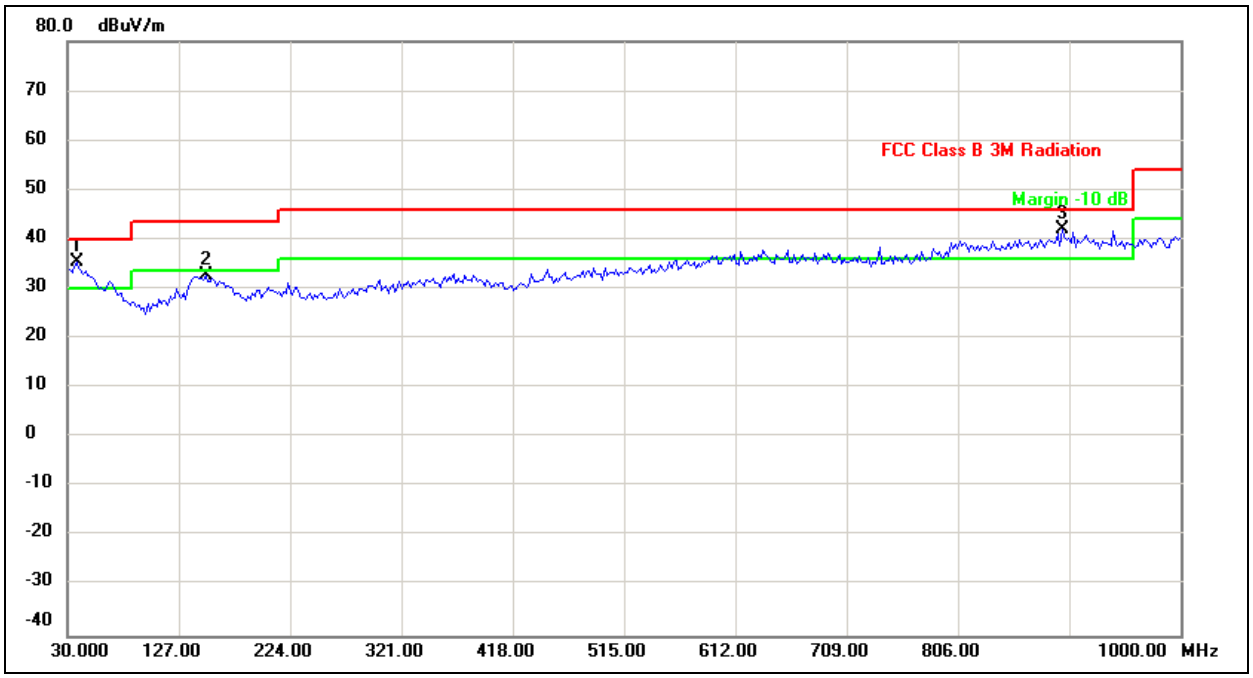



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 125.2505 | 26.69 | 13.70 | 40.39 | 43.50 | -3.11 | QP |
| 2 | 206.8938 | 24.69 | 14.90 | 39.59 | 43.50 | -3.91 | QP |
| 3 | 249.6593 | 25.43 | 14.94 | 40.37 | 46.00 | -5.63 | QP |
| 4 | 895.0301 | 16.31 | 25.65 | 41.96 | 46.00 | -4.04 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Worst case of Channel 165: 5785MHz @ 802.11a mode
Polarization: Vertical

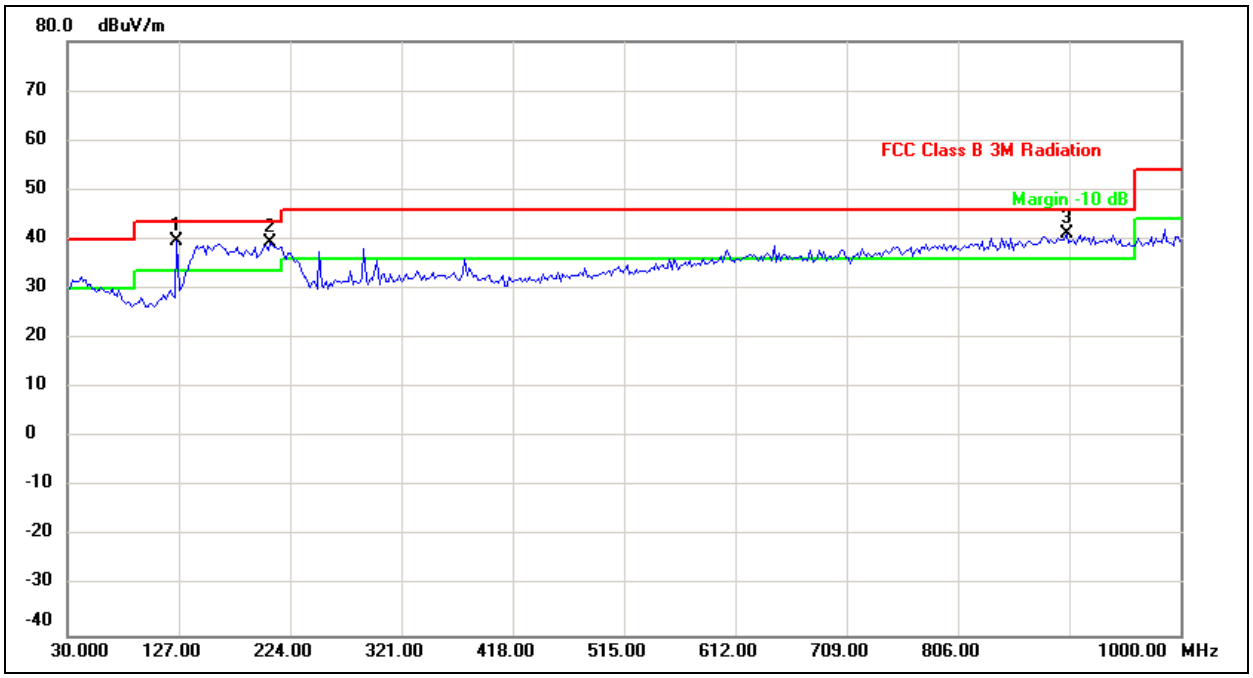



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 37.7756 | 18.09 | 17.31 | 35.40 | 40.00 | -4.60 | QP |
| 2 | 150.5210 | 16.99 | 15.76 | 32.75 | 43.50 | -10.75 | QP |
| 3 | 896.9739 | 16.28 | 25.70 | 41.98 | 46.00 | -4.02 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Worst case of Channel 165: 5785MHz @ 802.11a mode
Polarization: Horizontal

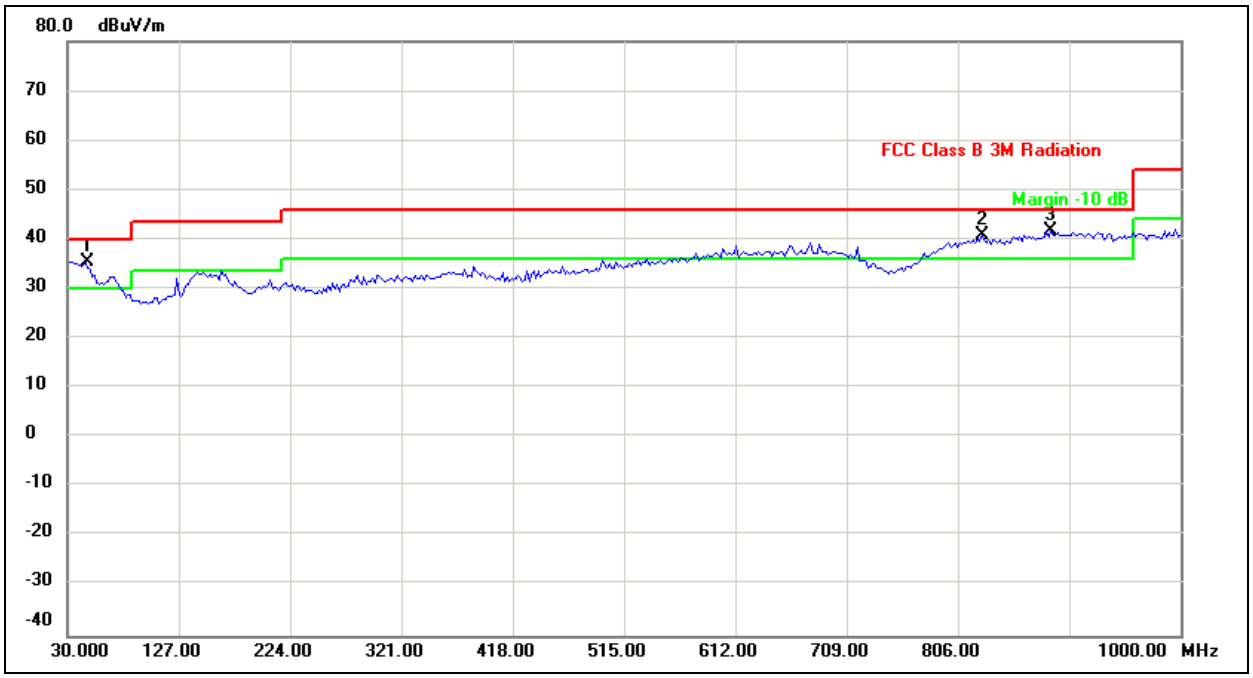



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 125.2505 | 25.87 | 13.70 | 39.57 | 43.50 | -3.93 | QP |
| 2 | 206.8938 | 24.48 | 14.90 | 39.38 | 43.50 | -4.12 | QP |
| 3 | 900.8617 | 15.27 | 25.77 | 41.04 | 46.00 | -4.96 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Worst case of Channel 165: 5825MHz @ 802.11a mode
Polarization: Vertical

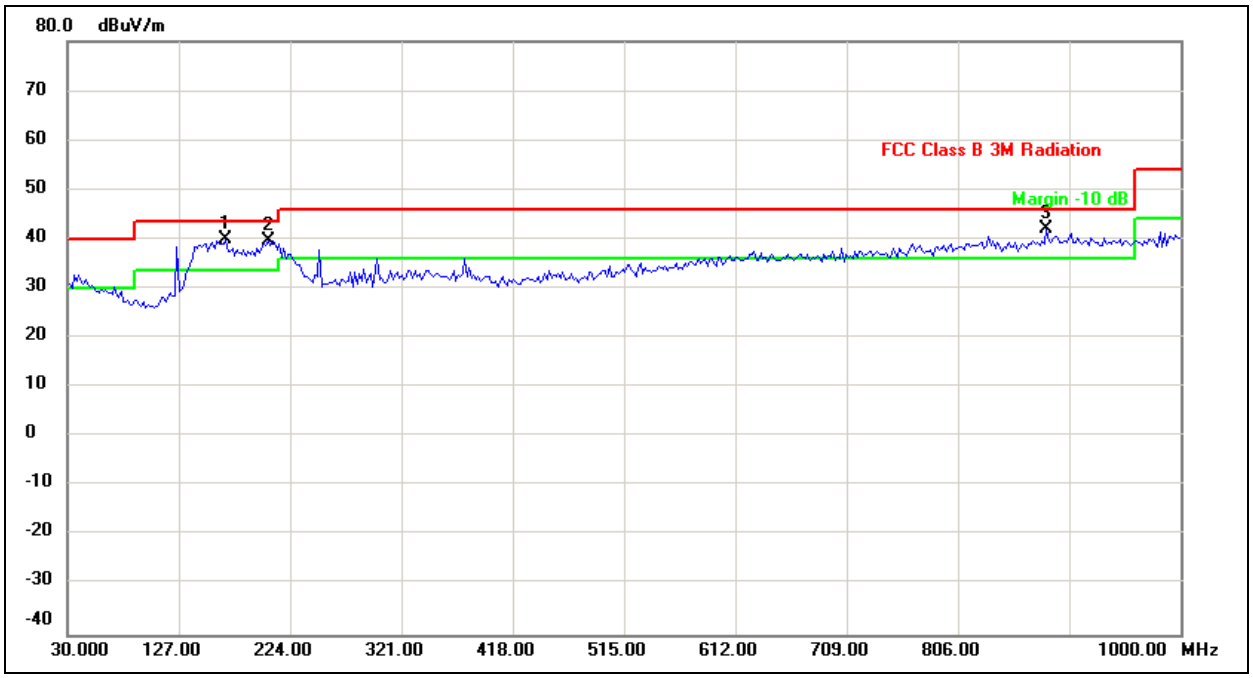



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 45.5511 | 18.54 | 16.94 | 35.48 | 40.00 | -4.52 | QP |
| 2 | 826.9940 | 16.60 | 24.19 | 40.79 | 46.00 | -5.21 | QP |
| 3 | 887.2545 | 16.31 | 25.46 | 41.77 | 46.00 | -4.23 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Worst case of Channel 165: 5825MHz @ 802.11a mode
Polarization: Horizontal




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 168.0160 | 24.79 | 15.13 | 39.92 | 43.50 | -3.58 | QP |
| 2 | 204.9499 | 24.90 | 14.82 | 39.72 | 43.50 | -3.78 | QP |
| 3 | 883.3667 | 16.70 | 25.35 | 42.05 | 46.00 | -3.95 | QP |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

*Radiated Undesirable Emissions (Above 1GHz)*

*Worst case of Hormonics And Spurious Emissions for the frequency band 5.150-5.250GHz (802.11a)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5180MHz) | | | | | | | | | | |
| 10360 | PK | 55.61 | 360 | V | 38.9 | 9.8 | 40.5 | 63.81 | 74 | -10.19 |
| 10360 | PK | 54.93 | 360 | H | 38.9 | 9.8 | 40.5 | 63.13 | 74 | -10.87 |
| 10360 | AV | 38.89 | 360 | V | 38.9 | 9.8 | 40.5 | 47.09 | 54 | -6.91 |
| 10360 | AV | 38.17 | 360 | H | 38.9 | 9.8 | 40.5 | 46.37 | 54 | -7.63 |
| 15540 | PK | 51.05 | 360 | V | 40.7 | 10.9 | 39.6 | 63.05 | 74 | -10.95 |
| 15540 | PK | 49.65 | 360 | H | 40.7 | 10.9 | 39.6 | 61.65 | 74 | -12.35 |
| 15540 | AV | 35.85 | 360 | V | 40.7 | 10.9 | 39.6 | 47.85 | 54 | -6.15 |
| 15540 | AV | 34.95 | 360 | H | 40.7 | 10.9 | 39.6 | 46.95 | 54 | -7.05 |
| 20720 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 25900 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 31080 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 36260 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| High Channel (5240MHz) | | | | | | | | | | |
| 10480 | PK | 54.51 | 360 | V | 38.9 | 9.8 | 40.5 | 62.71 | 74 | -11.29 |
| 10480 | PK | 53.9 | 360 | H | 38.9 | 9.8 | 40.5 | 62.1 | 74 | -11.9 |
| 10480 | AV | 36.83 | 360 | V | 38.9 | 9.8 | 40.5 | 45.03 | 54 | -8.97 |
| 10480 | AV | 35.39 | 360 | H | 38.9 | 9.8 | 40.5 | 43.59 | 54 | -10.41 |
| 15720 | PK | 50.45 | 360 | V | 40.7 | 10.9 | 39.6 | 62.45 | 74 | -11.55 |
| 15720 | PK | 49.9 | 360 | H | 40.7 | 10.9 | 39.6 | 61.9 | 74 | -12.1 |
| 15720 | AV | 36.67 | 360 | V | 40.7 | 10.9 | 39.6 | 48.67 | 54 | -5.33 |
| 15720 | AV | 35.43 | 360 | H | 40.7 | 10.9 | 39.6 | 47.43 | 54 | -6.57 |
| 20960 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 26200 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 31440 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 36680 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

*Worst case of Harmonics And Spurious Emissions for the frequency band 5.725-5.850GHz (802.11a)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5745MHz) | | | | | | | | | | |
| 11490 | PK | 53.83 | 360 | V | 39.1 | 10.1 | 40.2 | 62.83 | 74 | -11.17 |
| 11490 | PK | 53.22 | 360 | H | 39.1 | 10.1 | 40.2 | 62.22 | 74 | -11.78 |
| 11490 | AV | 36.15 | 360 | V | 39.1 | 10.1 | 40.2 | 45.15 | 54 | -8.85 |
| 11490 | AV | 34.71 | 360 | H | 39.1 | 10.1 | 40.2 | 43.71 | 54 | -10.29 |
| 17235 | PK | 49.77 | 360 | V | 41.3 | 11.2 | 39.4 | 62.87 | 74 | -11.13 |
| 17235 | PK | 49.22 | 360 | H | 41.3 | 11.2 | 39.4 | 62.32 | 74 | -11.68 |
| 17235 | AV | 35.99 | 360 | V | 41.3 | 11.2 | 39.4 | 49.09 | 54 | -4.91 |
| 17235 | AV | 34.75 | 360 | H | 41.3 | 11.2 | 39.4 | 47.85 | 54 | -6.15 |
| 22980 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28725 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 34470 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 40000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| High Channel (5825MHz) | | | | | | | | | | |
| 11650 | PK | 53.57 | 360 | V | 39.1 | 10.1 | 40.2 | 62.57 | 74 | -11.43 |
| 11650 | PK | 52.96 | 360 | H | 39.1 | 10.1 | 40.2 | 61.96 | 74 | -12.04 |
| 11650 | AV | 35.89 | 360 | V | 39.1 | 10.1 | 40.2 | 44.89 | 54 | -9.11 |
| 11650 | AV | 34.45 | 360 | H | 39.1 | 10.1 | 40.2 | 43.45 | 54 | -10.55 |
| 17475 | PK | 49.51 | 360 | V | 41.3 | 11.2 | 39.4 | 62.61 | 74 | -11.39 |
| 17475 | PK | 48.96 | 360 | H | 41.3 | 11.2 | 39.4 | 62.06 | 74 | -11.94 |
| 17475 | AV | 35.73 | 360 | V | 41.3 | 11.2 | 39.4 | 48.83 | 54 | -5.17 |
| 17475 | AV | 34.49 | 360 | H | 41.3 | 11.2 | 39.4 | 47.59 | 54 | -6.41 |
| 23300 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 29125 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 34950 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 40000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured

*Worst case of Hormonics And Spurious Emissions for the frequency band 5.150-5.250GHz (802.11n HT20)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5180MHz) | | | | | | | | | | |
| 10360 | PK | 54.16 | 360 | V | 38.9 | 9.8 | 40.5 | 62.36 | 74 | -11.64 |
| 10360 | PK | 53.55 | 360 | H | 38.9 | 9.8 | 40.5 | 61.75 | 74 | -12.25 |
| 10360 | AV | 36.48 | 360 | V | 38.9 | 9.8 | 40.5 | 44.68 | 54 | -9.32 |
| 10360 | AV | 35.04 | 360 | H | 38.9 | 9.8 | 40.5 | 43.24 | 54 | -10.76 |
| 15540 | PK | 50.1 | 360 | V | 40.7 | 10.9 | 39.6 | 62.1 | 74 | -11.9 |
| 15540 | PK | 49.55 | 360 | H | 40.7 | 10.9 | 39.6 | 61.55 | 74 | -12.45 |
| 15540 | AV | 36.32 | 360 | V | 40.7 | 10.9 | 39.6 | 48.32 | 54 | -5.68 |
| 15540 | AV | 35.08 | 360 | H | 40.7 | 10.9 | 39.6 | 47.08 | 54 | -6.92 |
| 20720 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 25900 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 31080 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 36260 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| High Channel (5240MHz) | | | | | | | | | | |
| 10480 | PK | 55.13 | 360 | V | 38.9 | 9.8 | 40.5 | 63.33 | 74 | -10.67 |
| 10480 | PK | 54.52 | 360 | H | 38.9 | 9.8 | 40.5 | 62.72 | 74 | -11.28 |
| 10480 | AV | 37.45 | 360 | V | 38.9 | 9.8 | 40.5 | 45.65 | 54 | -8.35 |
| 10480 | AV | 36.01 | 360 | H | 38.9 | 9.8 | 40.5 | 44.21 | 54 | -9.79 |
| 15720 | PK | 51.07 | 360 | V | 40.7 | 10.9 | 39.6 | 63.07 | 74 | -10.93 |
| 15720 | PK | 50.52 | 360 | H | 40.7 | 10.9 | 39.6 | 62.52 | 74 | -11.48 |
| 15720 | AV | 37.29 | 360 | V | 40.7 | 10.9 | 39.6 | 49.29 | 54 | -4.71 |
| 15720 | AV | 36.05 | 360 | H | 40.7 | 10.9 | 39.6 | 48.05 | 54 | -5.95 |
| 20960 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 26200 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 31440 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 36680 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

*Worst case of Harmonics And Spurious Emissions for the frequency band 5.725-5.850GHz (802.11n HT20)*

| Frequency MHz | Detector | Meter Reading dBuV | Direction Degree | Polar H / V | Antenna Loss dB | Cable loss dB | Amplifier dB | Correction Amplitude dBuV/m | Limit dBuV/m | Margin dB |
|---|---|---|---|---|---|---|---|---|---|---|
| Low Channel (5745MHz) | | | | | | | | | | |
| 11490 | PK | 54.41 | 360 | V | 39.1 | 10.1 | 40.2 | 63.41 | 74 | -10.59 |
| 11490 | PK | 53.80 | 360 | H | 39.1 | 10.1 | 40.2 | 62.80 | 74 | -11.20 |
| 11490 | AV | 36.73 | 360 | V | 39.1 | 10.1 | 40.2 | 45.73 | 54 | -8.27 |
| 11490 | AV | 35.29 | 360 | H | 39.1 | 10.1 | 40.2 | 44.29 | 54 | -9.71 |
| 17235 | PK | 50.35 | 360 | V | 41.3 | 11.2 | 39.4 | 63.45 | 74 | -10.55 |
| 17235 | PK | 49.80 | 360 | H | 41.3 | 11.2 | 39.4 | 62.90 | 74 | -11.10 |
| 17235 | AV | 36.57 | 360 | V | 41.3 | 11.2 | 39.4 | 49.67 | 54 | -4.33 |
| 17235 | AV | 35.33 | 360 | H | 41.3 | 11.2 | 39.4 | 48.43 | 54 | -5.57 |
| 22980 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28725 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 34470 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 40000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| High Channel (5825MHz) | | | | | | | | | | |
| 11650 | PK | 54.90 | 360 | V | 39.1 | 10.1 | 40.2 | 63.90 | 74 | -10.10 |
| 11650 | PK | 54.29 | 360 | H | 39.1 | 10.1 | 40.2 | 63.29 | 74 | -10.71 |
| 11650 | AV | 37.22 | 360 | V | 39.1 | 10.1 | 40.2 | 46.22 | 54 | -7.78 |
| 11650 | AV | 35.78 | 360 | H | 39.1 | 10.1 | 40.2 | 44.78 | 54 | -9.22 |
| 17475 | PK | 50.84 | 360 | V | 41.3 | 11.2 | 39.4 | 63.94 | 74 | -10.06 |
| 17475 | PK | 50.29 | 360 | H | 41.3 | 11.2 | 39.4 | 63.39 | 74 | -10.61 |
| 17475 | AV | 37.06 | 360 | V | 41.3 | 11.2 | 39.4 | 50.16 | 54 | -3.84 |
| 17475 | AV | 35.82 | 360 | H | 41.3 | 11.2 | 39.4 | 48.92 | 54 | -5.08 |
| 23300 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 29125 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 34950 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 40000 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Remark:

1. Margin = Emission level - Limit value
2. "---" states emission level at least lower than limit 20dB, so without recorded any values;
3. Result Level = Reading Level + Correct factor (Antenna Factor + Cable loss - PRM Factor).
4. This EUT was tested in 3 orthogonal positions and the worst case position data was reported.
5. Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

# 11. Frequency Stability

## 11.1 Standard Applicable

According to §15.407(g), 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 users manual.

## 11.2 Test Procedure

According to §2.1055, the following test procedure was performed.
The Frequency Stability is measured directly with a Frequency Domain Analyzer. Frequency Deviation in ppm is calculated from the measured peak to peak value.
The Carrier Frequency Stability over Power Supply Voltage and over Temperature is measured with a Frequency Domain Analyzer in histogram mode

| Temperature: | Supply Voltage |
|---|---|
| 20°C | 85-115% of declared nominal voltage |
| -30°C to +50°C | Normal |

## 11.3 Environmental Conditions

| | |
|---|---|
| Temperature: | 20°C |
| Relative Humidity: | 54% |
| ATM Pressure: | 1011 mbar |

## 11.4 Summary of Test Results/Plots

5150-5250MHz, Worst case @ 802.11a mode:

| 801.11a : 5200 MHz | |
|---|---|
| **Voltage vs. Frequency Stability** | |
| **Voltage (V)** | **Measurement Frequency (MHz)** |
| 132 | 5199.9938 |
| 120 | 5199.9966 |
| 118 | 5199.9974 |
| **Max. Deviation (MHz)** | 0.0074 |
| **Max. Deviation (ppm)** | 1.19 |
| **Temperature vs. Frequency Stability** | |
| **Temperature (℃)** | **Measurement Frequency (MHz)** |
| 0 | 5199.9938 |
| 10 | 5199.9957 |
| 20 | 5199.9976 |
| 30 | 5199.9963 |
| 40 | 5199.9988 |
| 50 | 5199.9978 |
| **Max. Deviation (MHz)** | 0.0072 |
| **Max. Deviation (ppm)** | 1.19 |

| 801.11a : 5200 MHz | |
|---|---|
| **Voltage vs. Frequency Stability** | |
| **Voltage (V)** | **Measurement Frequency (MHz)** |
| 132 | 5199.9925 |
| 120 | 5199.9955 |
| 118 | 5199.9976 |
| **Max. Deviation (MHz)** | 0.0075 |
| **Max. Deviation (ppm)** | 1.44 |
| **Temperature vs. Frequency Stability** | |
| **Temperature (℃)** | **Measurement Frequency (MHz)** |
| 0 | 5199.9923 |
| 10 | 5199.9946 |
| 20 | 5199.9963 |
| 30 | 5199.9975 |
| 40 | 5199.9972 |
| 50 | 5199.9987 |
| **Max. Deviation (MHz)** | 0.0072 |
| **Max. Deviation (ppm)** | 1.48 |

5725-5850MHz, Worst case @ 802.11n HT20 mode:

| 802.11n HT20 : 5745 MHz | |
|---|---|
| **Voltage vs. Frequency Stability** | |
| **Voltage (V)** | **Measurement Frequency (MHz)** |
| 132 | 5745.0087 |
| 120 | 5745.0093 |
| 118 | 5745.0099 |
| **Max. Deviation (MHz)** | 0.0098 |
| **Max. Deviation (ppm)** | 1.72 |
| **Temperature vs. Frequency Stability** | |
| **Temperature (℃)** | **Measurement Frequency (MHz)** |
| 0 | 5745.0024 |
| 10 | 5745.0017 |
| 20 | 5745.0019 |
| 30 | 5745.0025 |
| 40 | 5745.0034 |
| 50 | 5745.0069 |
| **Max. Deviation (MHz)** | 0.0069 |
| **Max. Deviation (ppm)** | 1.20 |

| 802.11n HT20 : 5745 MHz | |
|---|---|
| **Voltage vs. Frequency Stability** | |
| **Voltage (V)** | **Measurement Frequency (MHz)** |
| 132 | 5745.0086 |
| 120 | 5745.0092 |
| 118 | 5745.0098 |
| **Max. Deviation (MHz)** | 0.0098 |
| **Max. Deviation (ppm)** | 1.71 |
| **Temperature vs. Frequency Stability** | |
| **Temperature (℃)** | **Measurement Frequency (MHz)** |
| 0 | 5745.0023 |
| 10 | 5745.0016 |
| 20 | 5745.0018 |
| 30 | 5745.0026 |
| 40 | 5745.0033 |
| 50 | 5745.0088 |
| **Max. Deviation (MHz)** | 0.0068 |
| **Max. Deviation (ppm)** | 1.53 |

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