

# FCC Part 15E

## Measurement and Test Report

For

**Trend-tech Technology Co., Limited**

**Room 205, Building No. 5, YaoXing HuaYuan, XinHuiDaDao No. 45,**

**XinHui District, JiangMen City, GuangDong Province,**

**China | Postage Code:529100**

**FCC ID: 2ABM8-WNA015**

<b>FCC Rule(s):</b>	<u>FCC Part 15C</u>	
<b>Product Description:</b>	<u>AC1200 Dual Band WiFi PCI-e Adapter</u>	
<b>Tested Model:</b>	<u>WNA015</u>	
<b>Report No.:</b>	<u>STR16058159I-2</u>	
<b>Tested Date:</b>	<u>2015-05-20 to 2016-06-18</u>	
<b>Issued Date:</b>	<u>2016-06-21</u>	
<b>Tested By:</b>	<u>Irving Liu / Engineer</u>	<i>Irving Liu</i>
<b>Reviewed By:</b>	<u>Suan Su / Engineer</u>	<i>Suan Su</i>
<b>Approved &amp; Authorized By:</b>	<u>Jandy So / PSQ Manager</u>	<i>Jandy So</i>
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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: Trend-tech Technology Co., Limited  
Address of applicant: Room 205, Building No. 5, YaoXing HuaYuan, XinHuiDaDao  
No. 45, XinHui District, JiangMen City, GuangDong  
Province, China | Postage Code:529100

Manufacturer: Trend-tech Technology Co., Limited  
Address of manufacturer: Room 205, Building No. 5, YaoXing HuaYuan, XinHuiDaDao  
No. 45, XinHui District, JiangMen City, GuangDong  
Province, China | Postage Code:529100

General Description of EUT	
Product Name:	AC1200 Dual Band WiFi PCI-e Adapter
Trade Name:	Trend-tech
Model No.:	WNA015
Adding Model(s):	/
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
<b>Wi-Fi(5G/5.8G)</b>	
Support Standards:	802.11n(HT20,HT40), 802.11ac(HT80)
Frequency Range:	5180-5240MHz, 5745-5850MHz
RF Output Power:	18.81dBm (Conducted)
Type of Modulation:	OFDM, 64-QAM,16-QAM, QPSK, BPSK, 256-QAM
Data Rate:	6-54Mbps, up to 867Mbps
Quantity of Channels:	HT20:4 for 5180-5240MHz; 5 for 5745-5825MHz HT40: 2 for 5180-5240MHz; 2 for 5745-5825MHz HT80: 1 for 5180-5240MHz; 1 for 5745-5825MHz
Channel Separation:	20MHz/40MHz/80MHz
Type of Antenna:	Integral Antenna
Antenna Gain:	Antenna 1: 3.5dBi, Antenna 2:3.5 dBi

## 1.2 Test Standards

The following report is prepared on behalf of the e Trend-tech Technology Co., Limited in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions 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 v01r02 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 “REALTEK 11ac 8812AE PCIE WLAN NIC Mass production Kit”. 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	
802.11n-HT20 MCS0	43	43	47	/	/	/	/	/	/	/	44	41	41	
Mode	NCB: 40MHz													
		5190	5230	5270	5310	5510	5550	5670	5710	5755	5795			
802.11n-HT40 MCS0	31	47	/	/	/	/	/	/	44	41				
Mode	NCB: 80MHz													
		5210		5290	5530		5610		5690		5775			
802.11ac-HT80 MCS0/Nss2	35		/	/		/		/		44				

## 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.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

### 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.

### CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2<sup>nd</sup> Road, Bao'an District, Shenzhen, P.R.C (518101).

## 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	802.11n-HT20	5180MHz, 5200MHz, 5240MHz, 5745MHz, 5785MHz,5825MHz
TM2	802.11n-HT40	5190MHz,5230MHz, 5755 MHz,5795 MHz
TM3	802.11ac-HT80	5210MHz,5775MHz

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Core
/	/	/	/

<b>Special Cable List and Details</b>			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
<b>Auxiliary Equipment List and Details</b>			
Description	Manufacturer	Model	Serial Number
PC	Dell	VOSTRO 260S	J1XTC3X

## 1.8 Measurement Uncertainty

<b>Measurement uncertainty</b>		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

## 1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1121	Horn Antenna	ETS	3116B	00088203	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

## 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**

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#### **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 RF Exposure Report.

## **4. Antenna Requirement**

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### **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 SMA-reverse antennas, fulfill the requirement of this section.

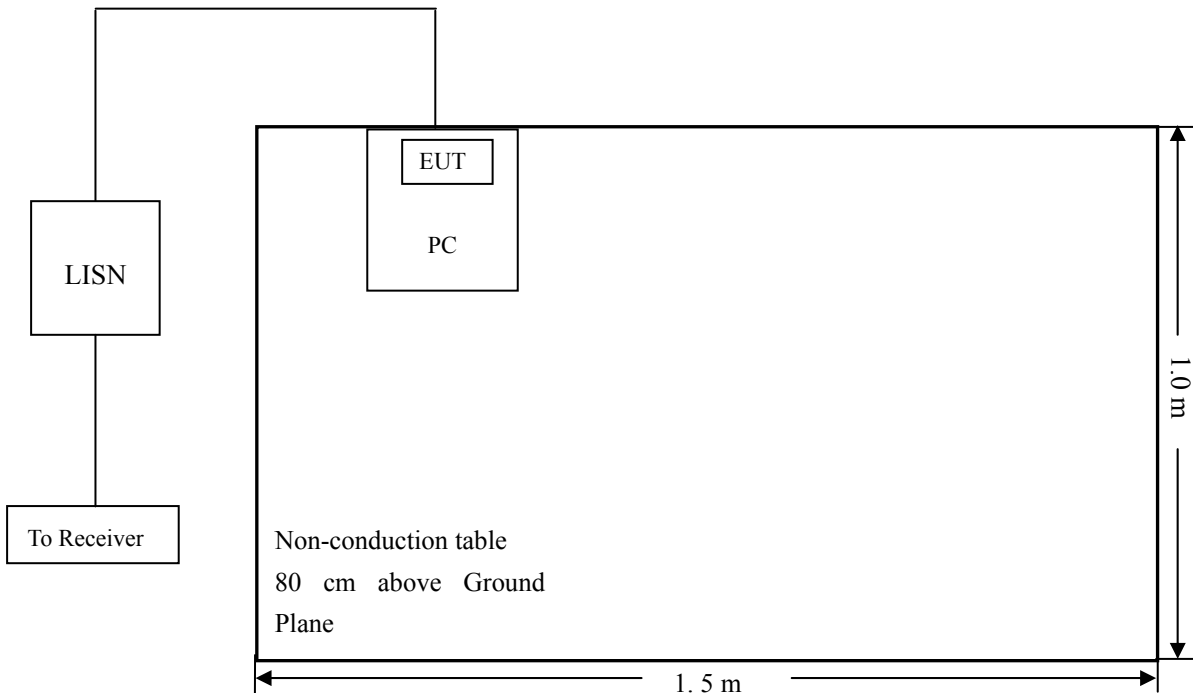
## 5. Conducted Emissions

### 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 5.7, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

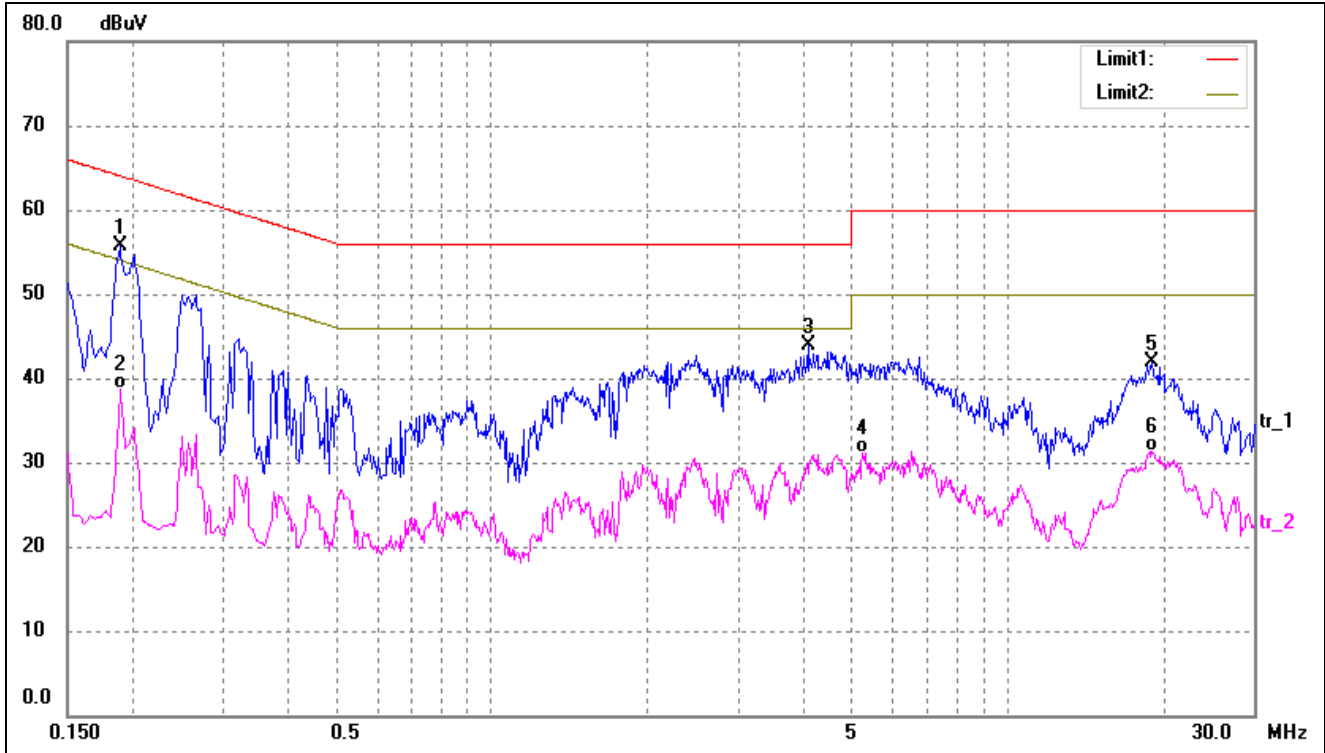
**-8.41 dB at 0.1900 MHz in the Neutral mode, peak detector, 0.15-30MHz**

## 5.7 Conducted Emissions Test Data

**Plot of Conducted Emissions Test Data**

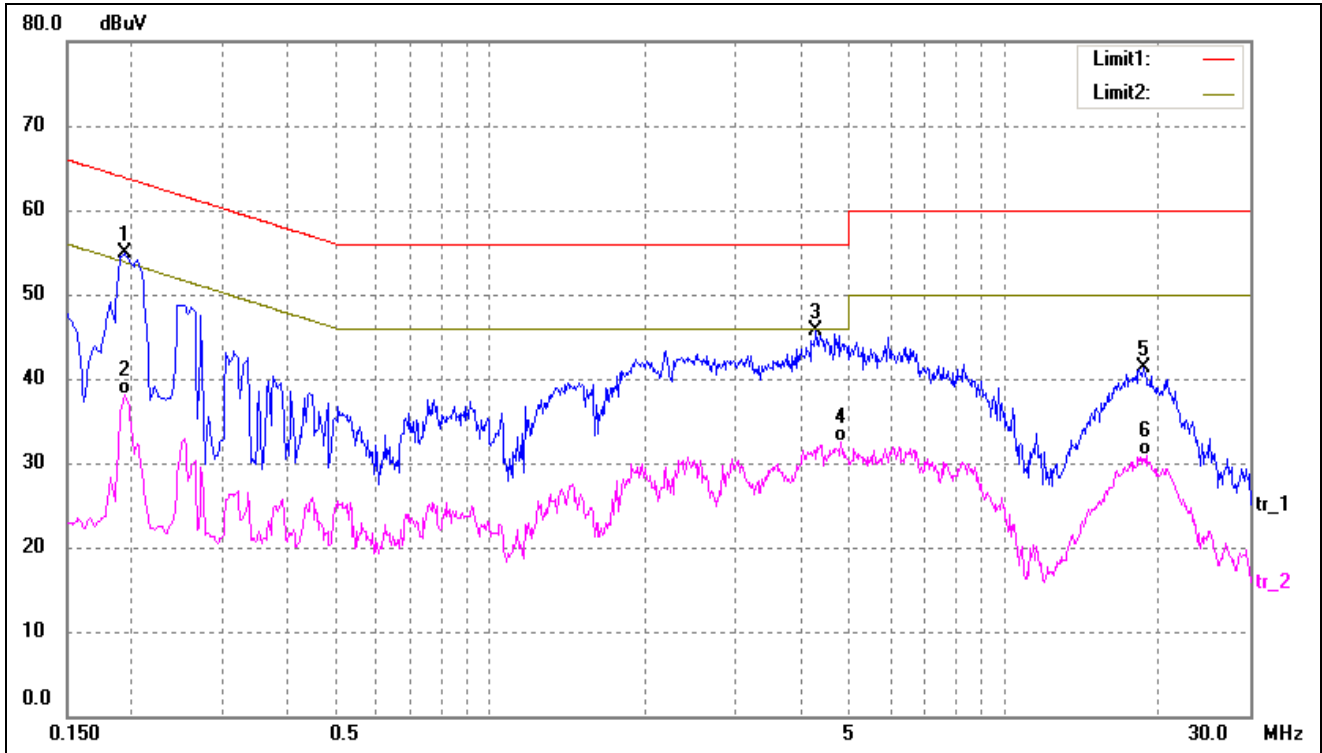
EUT: AC1200 Dual Band WiFi PCI-e Adapter  
 Tested Model: WNA015  
 Operating Condition: Transmitting  
 Comment: AC 120V/60Hz; DC 3.3 from PCI of PC

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1900	46.12	9.50	55.62	64.03	-8.41	peak
2	0.1900	29.23	9.50	38.73	54.03	-15.30	AVG
3	4.0979	33.86	10.00	43.86	56.00	-12.14	peak
4	5.2459	21.17	10.00	31.17	50.00	-18.83	AVG
5	19.0939	30.01	11.82	41.83	60.00	-18.17	peak
6	19.0939	19.55	11.82	31.37	50.00	-18.63	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1940	45.40	9.50	54.90	63.86	-8.96	peak
2	0.1940	28.59	9.50	38.09	53.86	-15.77	AVG
3	4.2939	35.75	10.00	45.75	56.00	-10.25	peak
4	4.8099	22.45	10.00	32.45	46.00	-13.55	AVG
5	18.6539	29.67	11.73	41.40	60.00	-18.60	peak
6	18.8379	19.05	11.77	30.82	50.00	-19.18	AVG

## 6. Power Spectral Density

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### 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  $11 \text{ dBm} + 10 \log B$ , 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 v01, 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  $RBW \geq 1/T$ , where T is defined in section II.B.1.a).
- b) Set  $VBW \geq 3 RBW$ .
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10\log(500\text{kHz}/RBW)$  to the measured result, whereas  $RBW (< 500 \text{ KHz})$  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  $10\log(1\text{MHz}/RBW)$  to the measured result, whereas  $RBW (< 1 \text{ MHz})$  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  $RBW=100 \text{ KHz}$  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	Chain 1 dBm/MHz	Chain 2 dBm/MHz	Total dBm/MHz	Limit (dBm/MHz)
802.11n-HT20	5180	1.670	2.780	5.28	11
	5200	0.523	3.292	5.13	11
	5240	2.821	4.848	6.96	11
802.11n-HT40	5190	0.316	-6.660	1.11	11
	5230	-1.487	0.094	2.38	11
802.11ac-HT80	5210	-5.187	-4.702	-1.94	11

**5725-5850MHz**

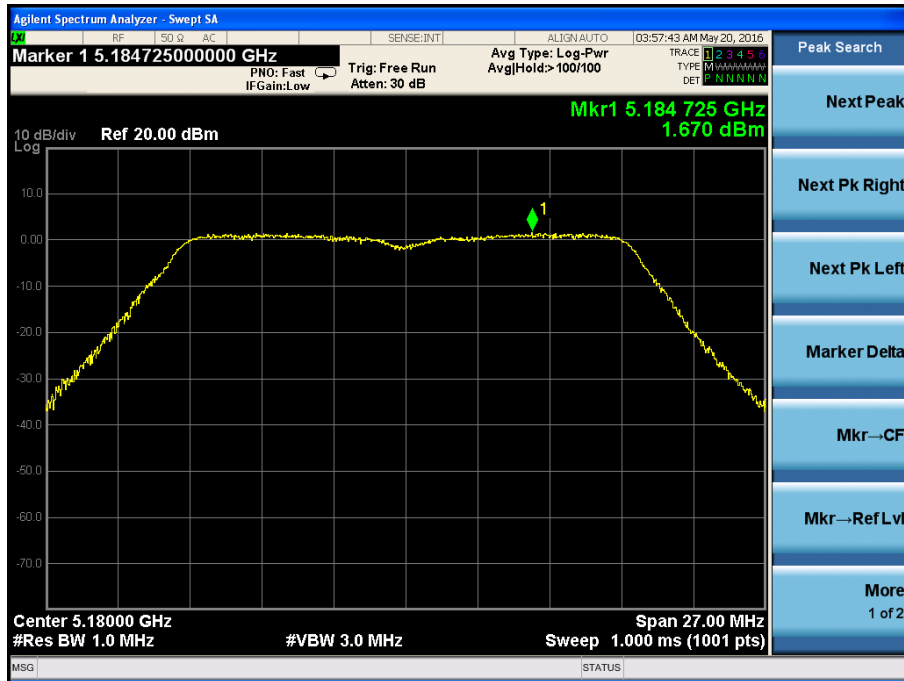
Operating mode	Test Channel	Chain 1 dBm/500KHz	Chain 2 dBm/500KHz	Total dBm/500KHz	Limit (dBm/500KHz)
802.11n-HT20	5745	5.896	8.886	10.65	30
	5785	3.986	7.119	8.84	30
	5825	3.755	7.334	8.92	30
802.11n-HT40	5755	1.470	4.931	6.55	30
	5795	0.326	2.630	4.64	30
802.11ac-HT80	5775	-0.544	2.401	4.18	30

Note: If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10\log(500\text{kHz}/\text{RBW})$  to the measured result, whereas RBW ( $< 500$  KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

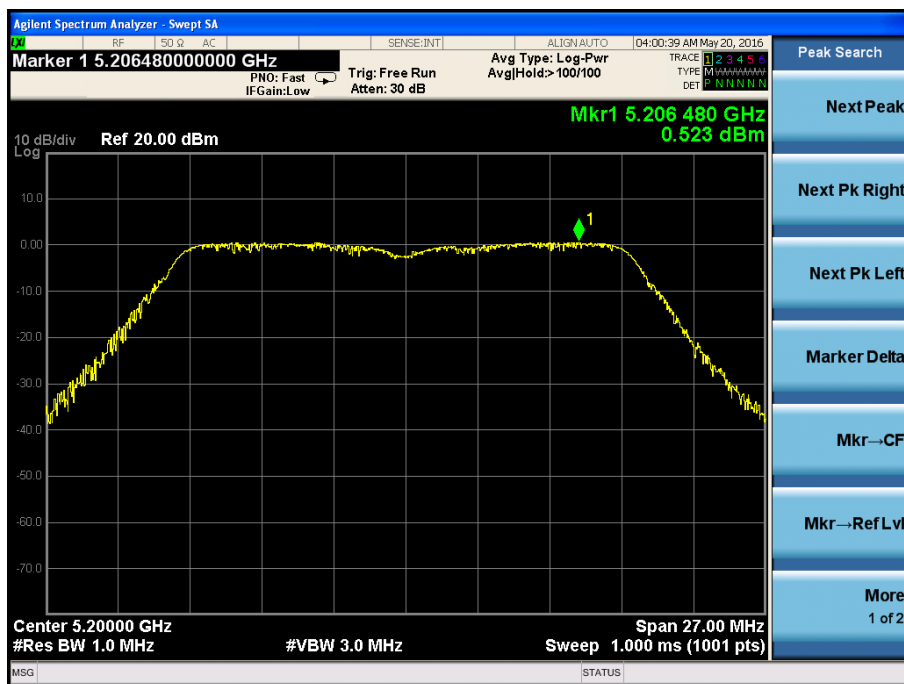
**Antenna 1**

Test Mode: 802.11n-HT20

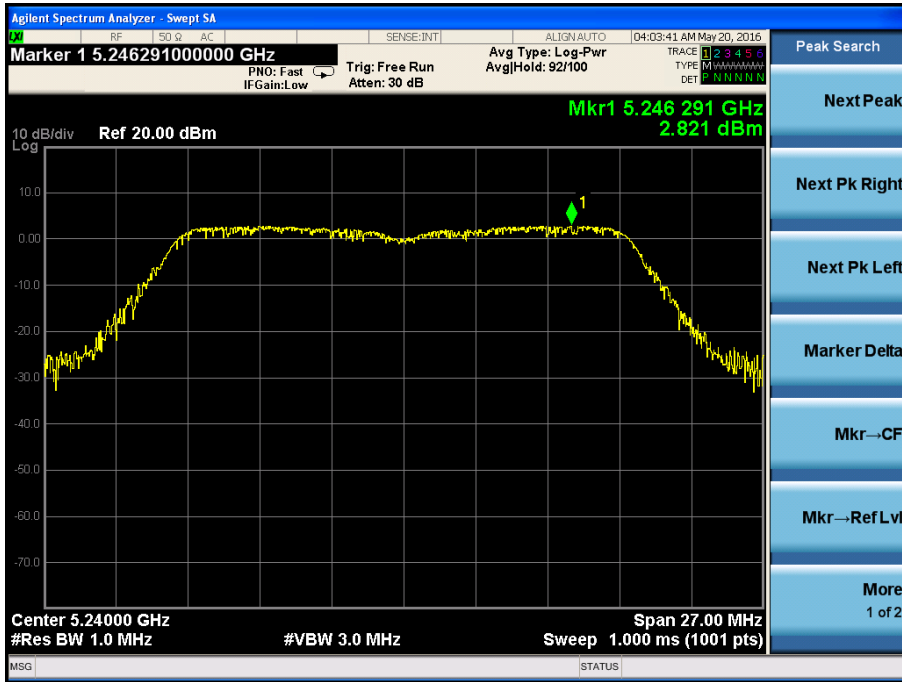
5180MHz



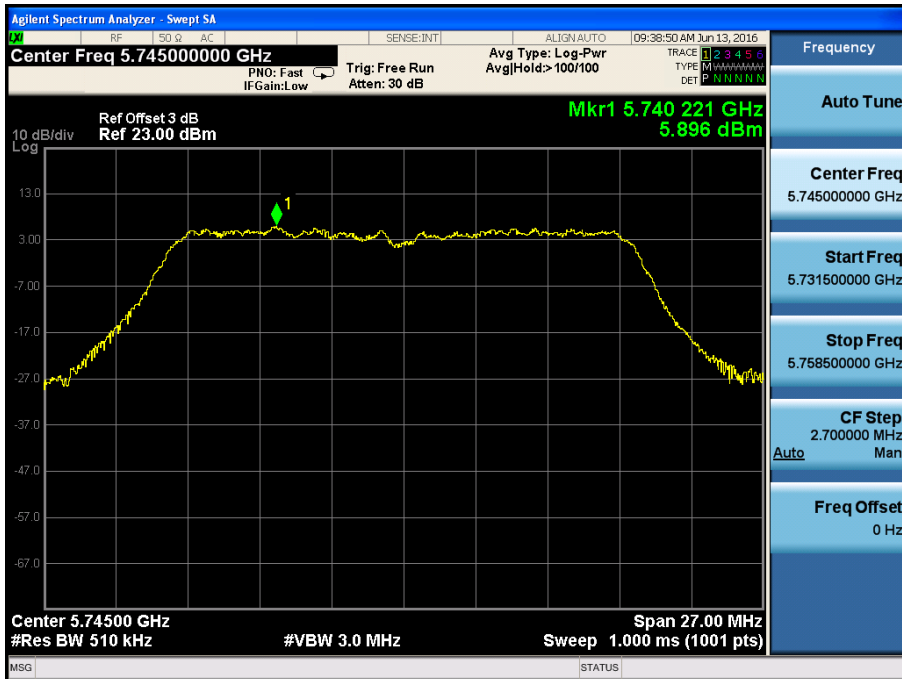
5200MHz



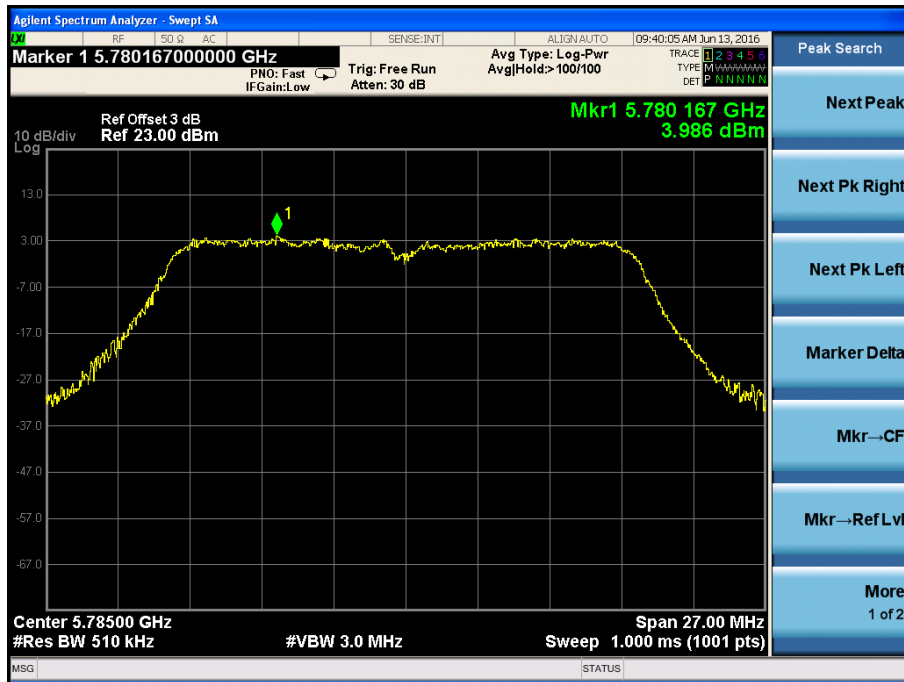
5240MHz



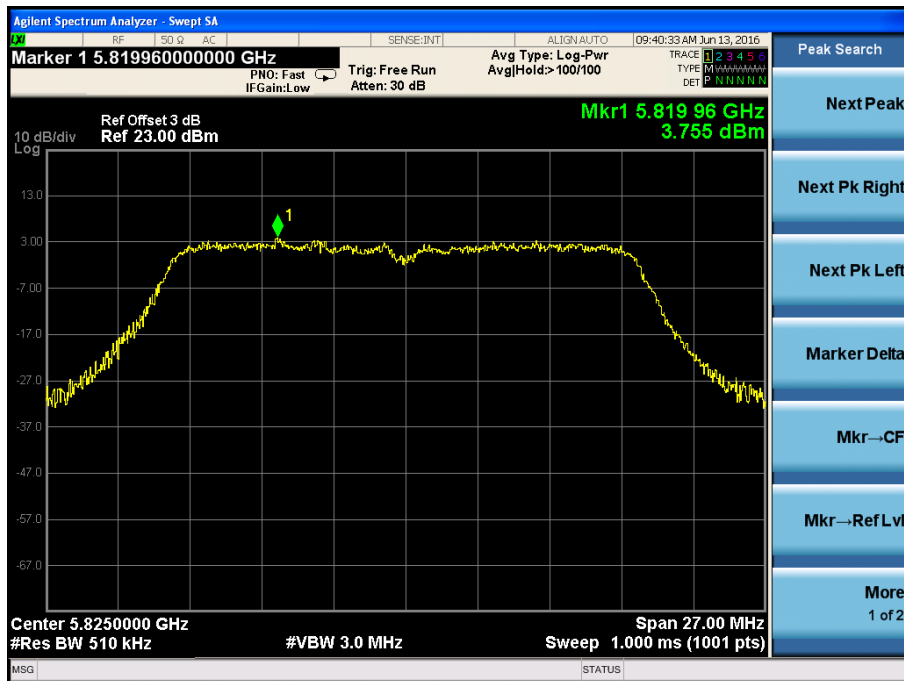
5745MHz



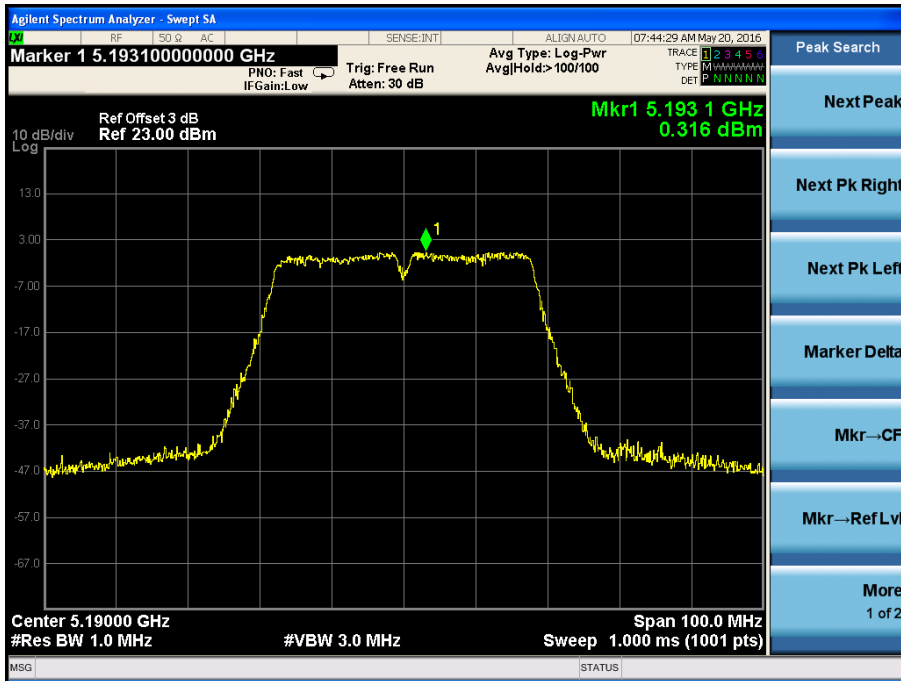
5785MHz



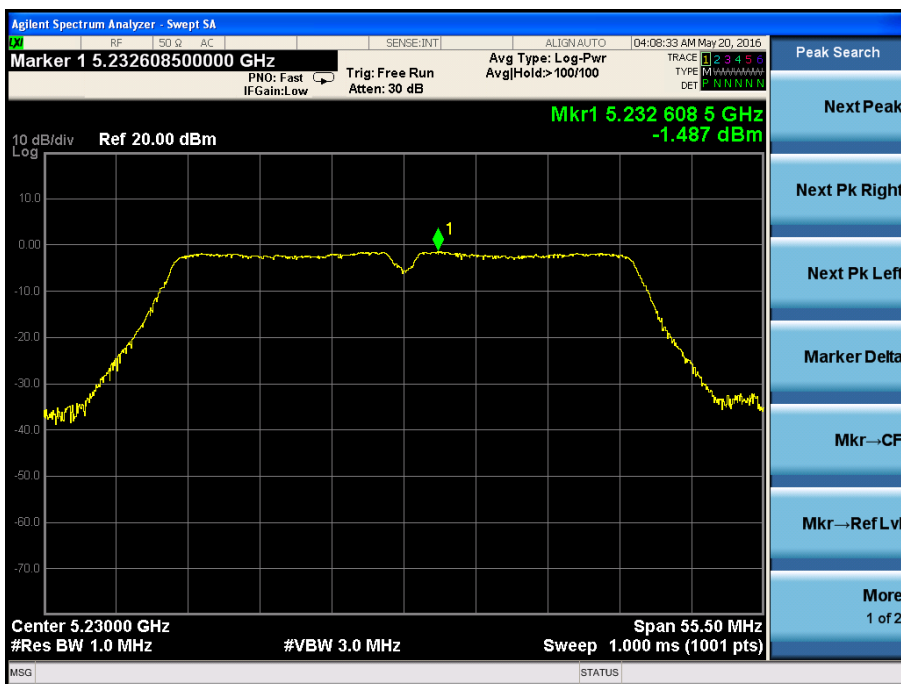
5825MHz



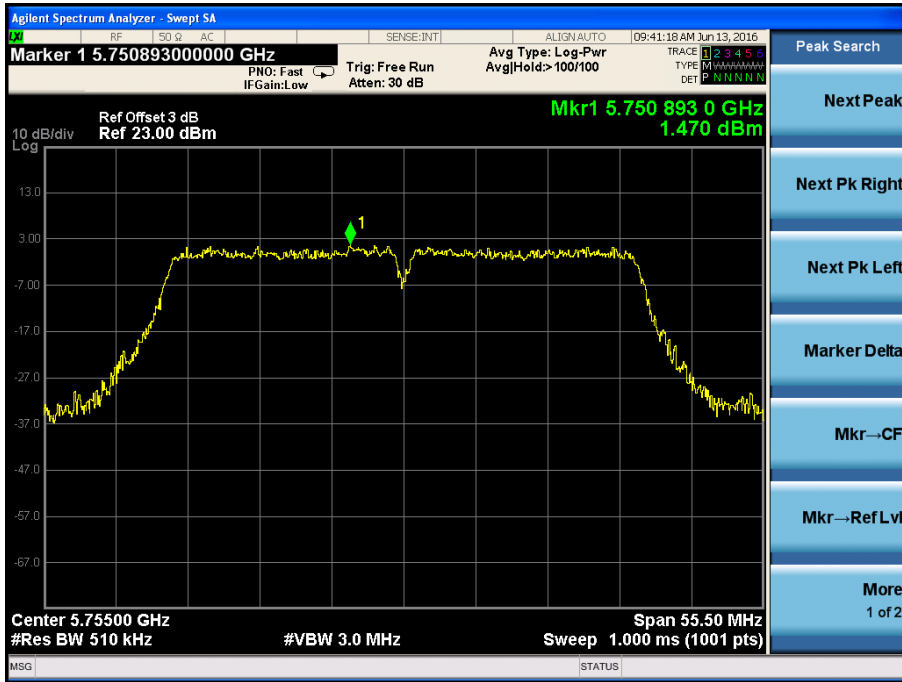
Test Mode: 802.11n-HT40  
5190MHz



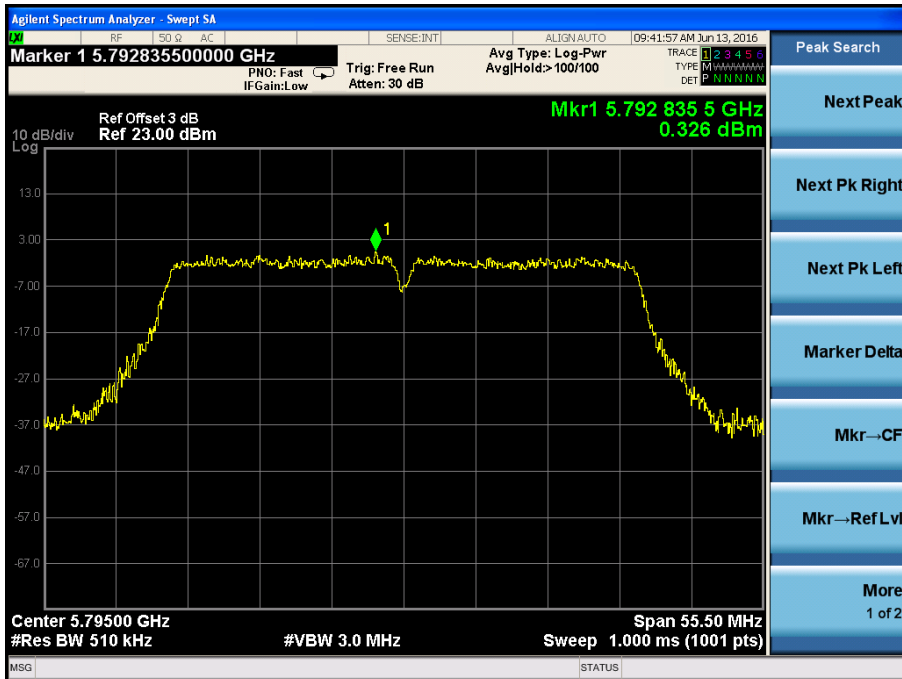
5230MHz



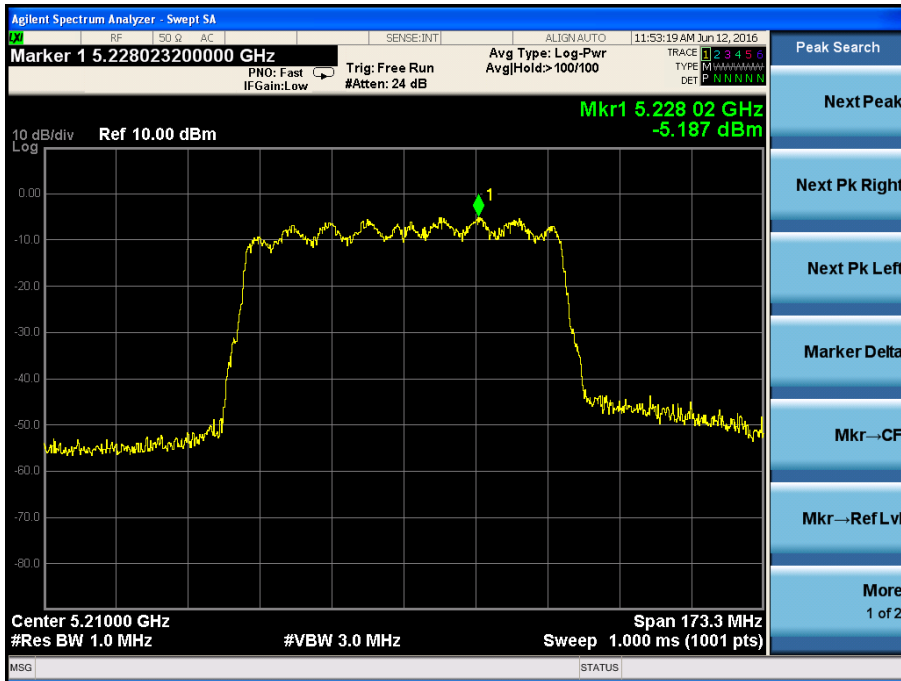
5755MHz



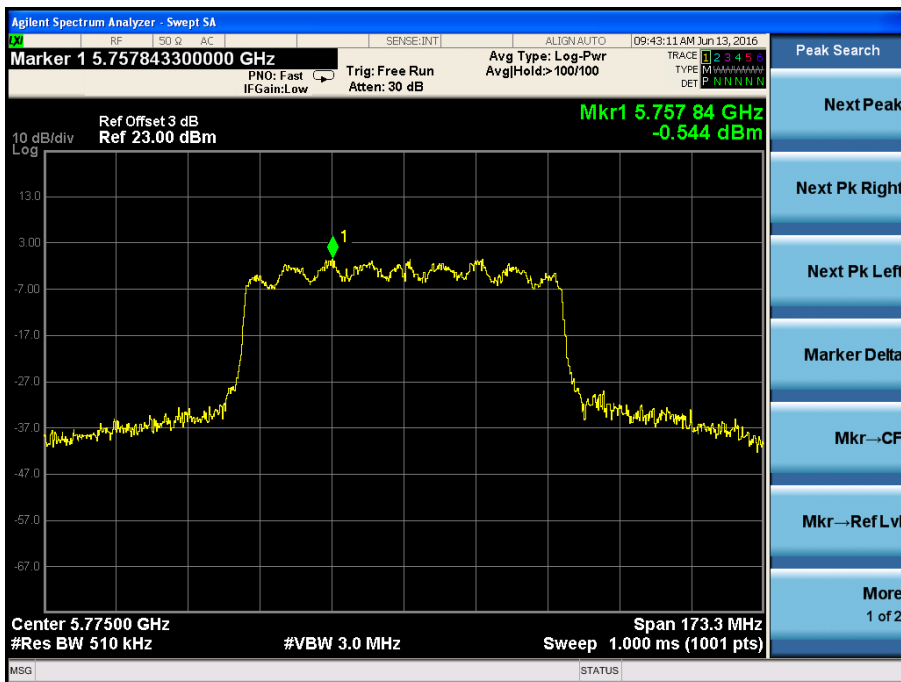
5795MHz



Test Mode: 802.11ac-HT80  
5210MHz



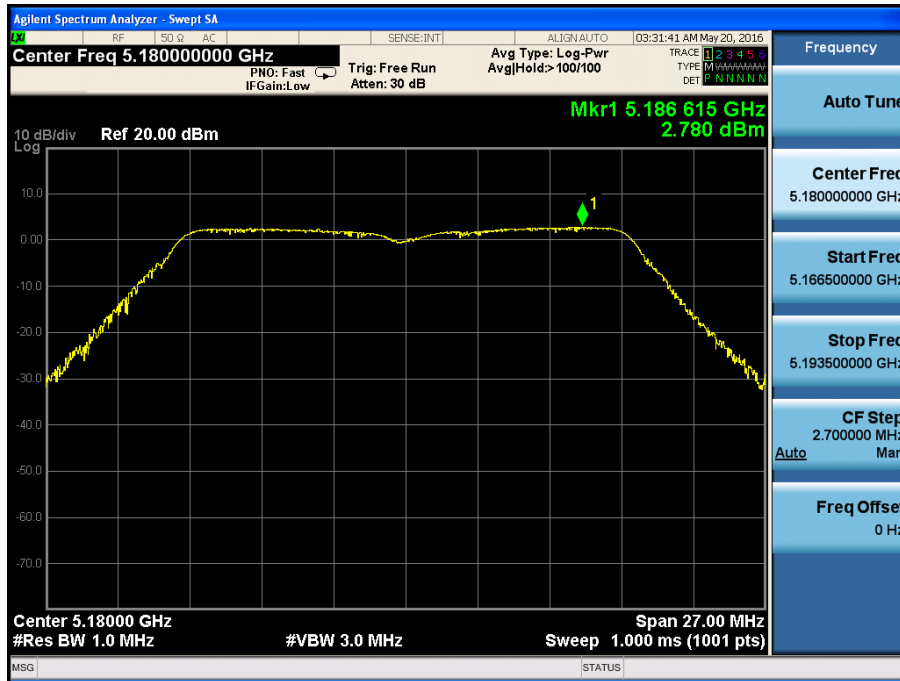
5775MHz



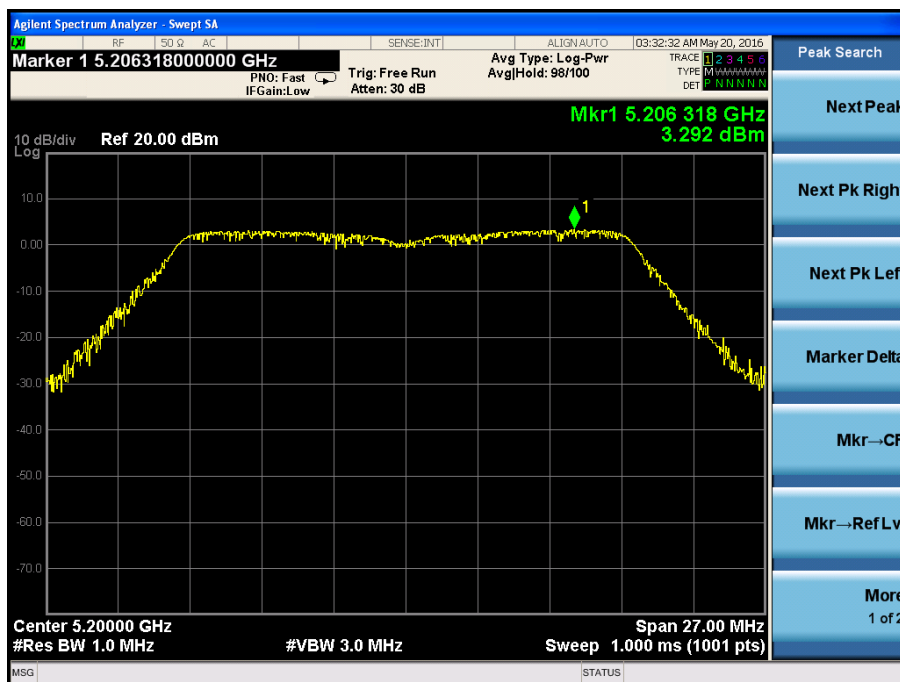
### Antenna 2

Test Mode: 802.11n-HT20

5180MHz



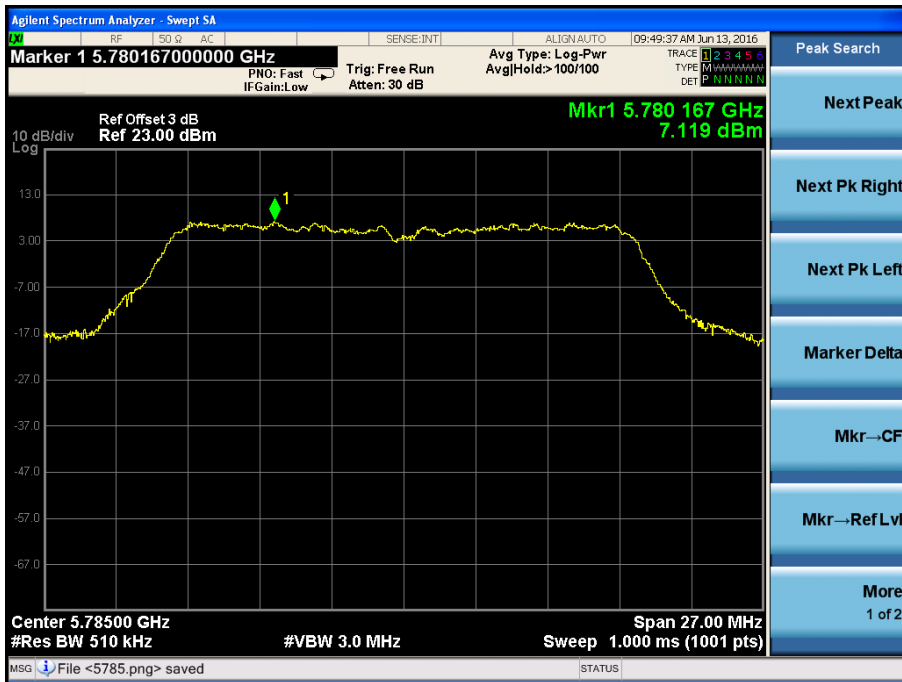
5200MHz







5785MHz

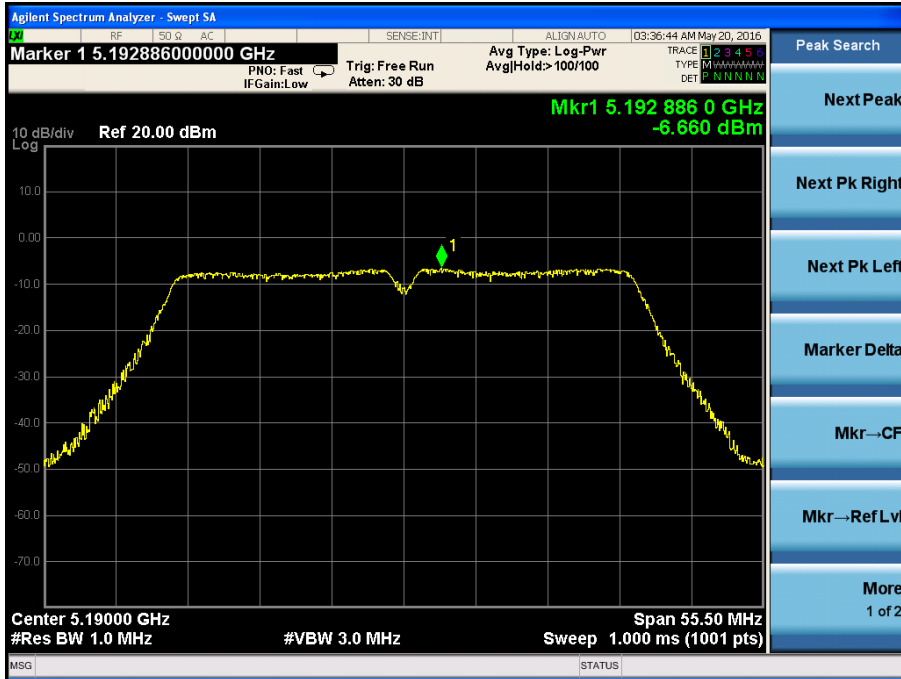


5805MHz

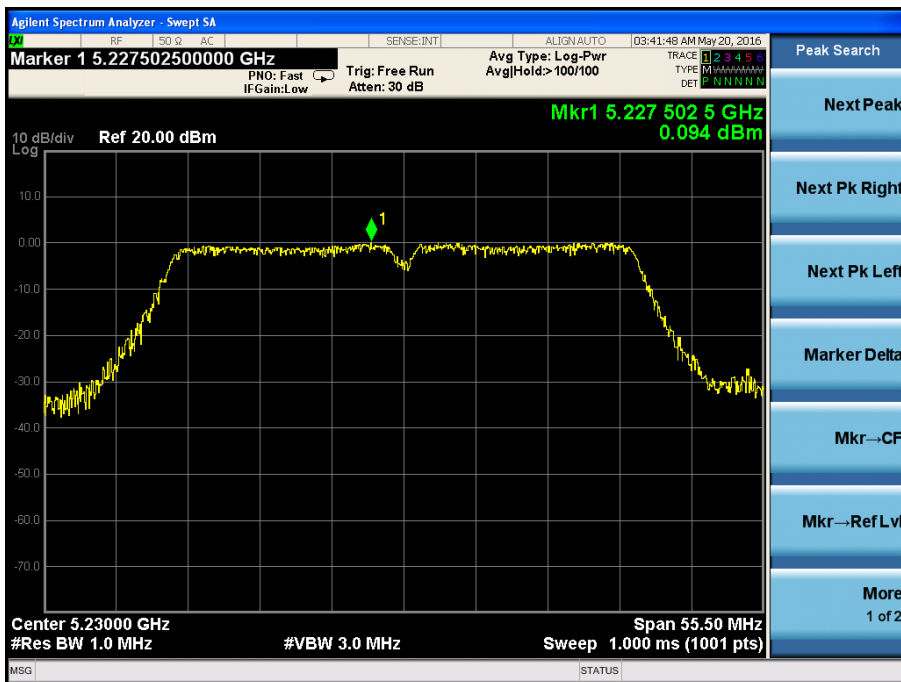


Test Mode: 802.11n-HT40

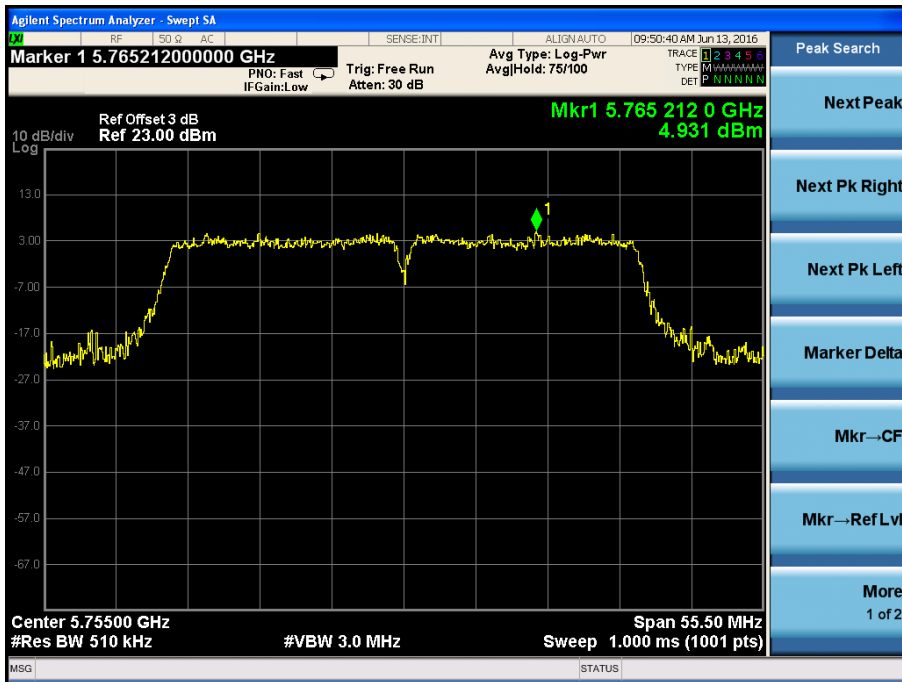
5190MHz



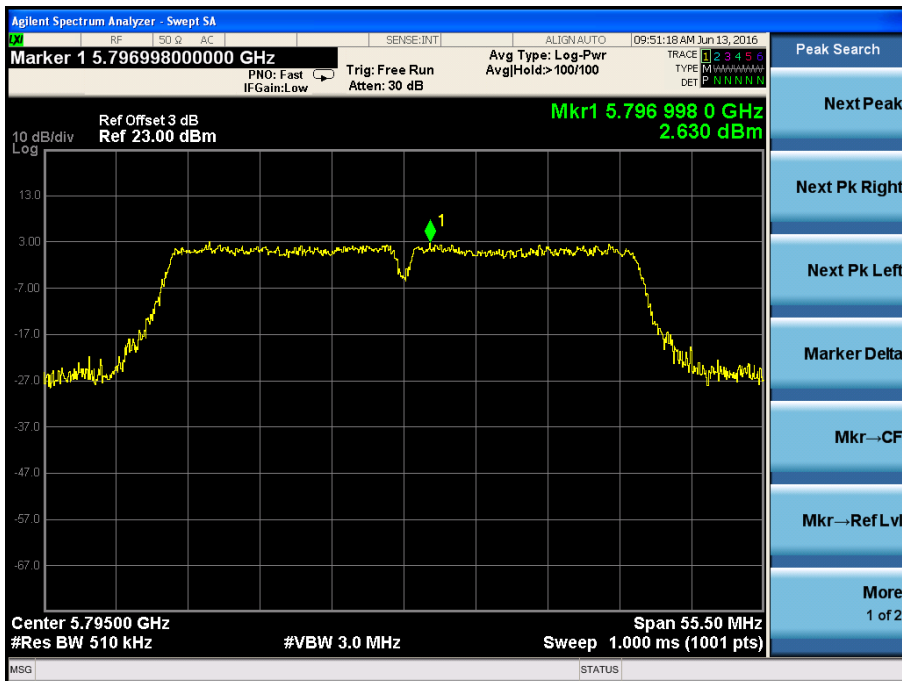
5230MHz



5755MHz

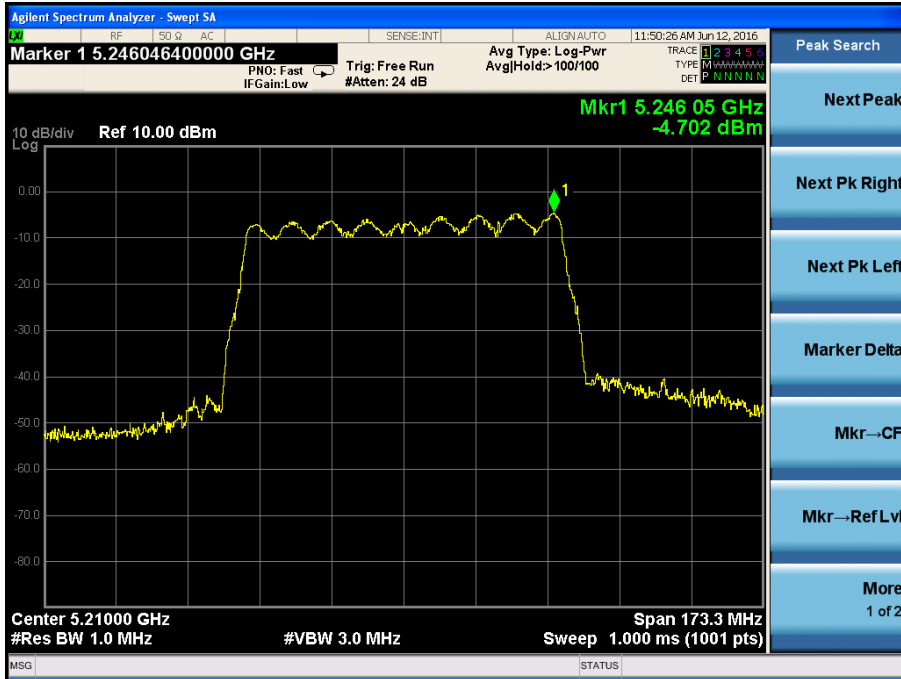


5795MHz

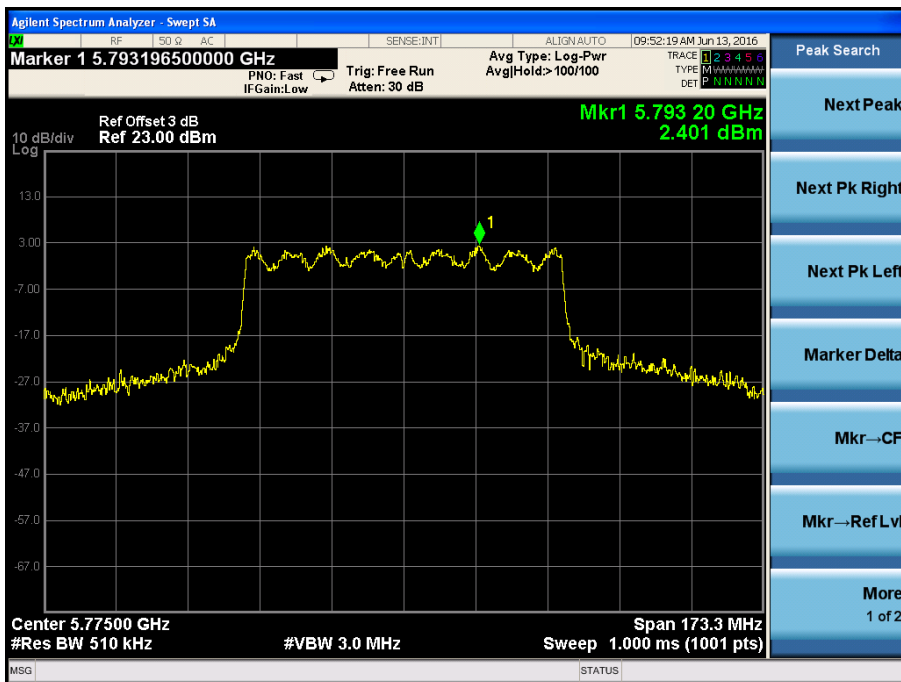


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



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## 7. Emission Bandwidth and Occupied Bandwidth

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### 7.1 Standard Applicable

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  $11 \text{ dBm} + 10 \log B$ , 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 v01r02 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)  $\geq 3 \times$  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 v01r02 General UNII Test Procedures New Rules v01 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  $\geq 3 \cdot$  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
802.11n-HT20	5180	20.540	17.668	--
	5200	20.480	17.671	--
	5240	20.700	17.670	--
802.11n-HT40	5190	40.040	36.136	--
	5230	40.280	36.139	--
802.11ac-HT80	5210	82.390	75.021	--

##### 5725-5850MHz

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11n-HT20	5745	20.630	17.830	17.668	≥500
	5785	20.840	17.800	17.667	≥500
	5825	20.760	17.840	17.669	≥500
802.11n-HT40	5755	40.220	36.600	36.147	≥500
	5795	40.220	36.57	36.136	≥500
802.11ac-HT80	5755	98.080	76.560	75.977	≥500



**Antenna 2**
**5150-5250MHz**

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit MHz
802.11n-HT20	5180	20.570	17.649	--
	5200	20.440	17.632	--
	5240	20.550	17.655	--
802.11n-HT40	5190	40.440	36.194	--
	5230	40.400	36.174	--
802.11ac-HT80	5210	84.540	76.097	--

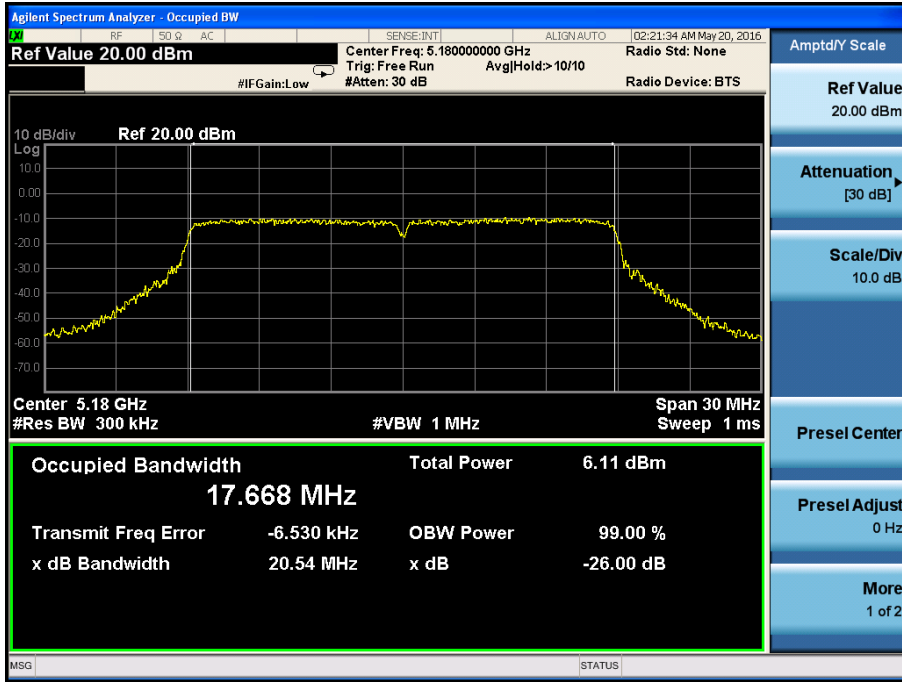
**5725-5850MHz**

Test Mode	Test Channel MHz	26 dB Bandwidth MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11n-HT20	5745	20.530	17.900	17.760	≥500
	5785	20.590	17.860	17.648	≥500
	5825	20.470	17.890	17.638	≥500
802.11n-HT40	5755	40.550	36.590	36.205	≥500
	5795	40.390	36.550	36.164	≥500
802.11ac-HT80	5755	119.700	76.56	76.572	≥500

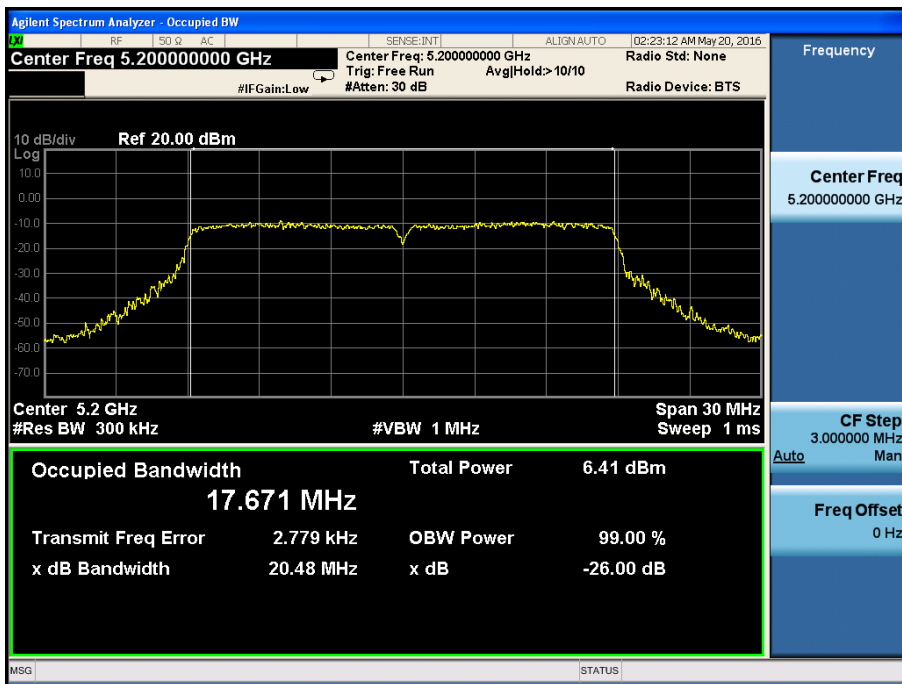
**Antenna 1**

Test Mode: 802.11n-HT20

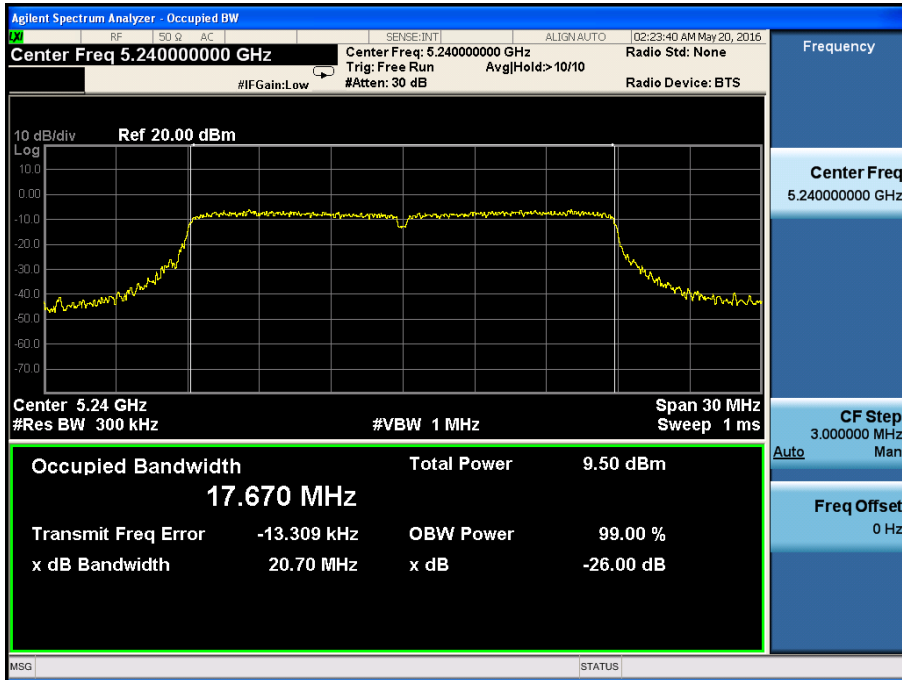
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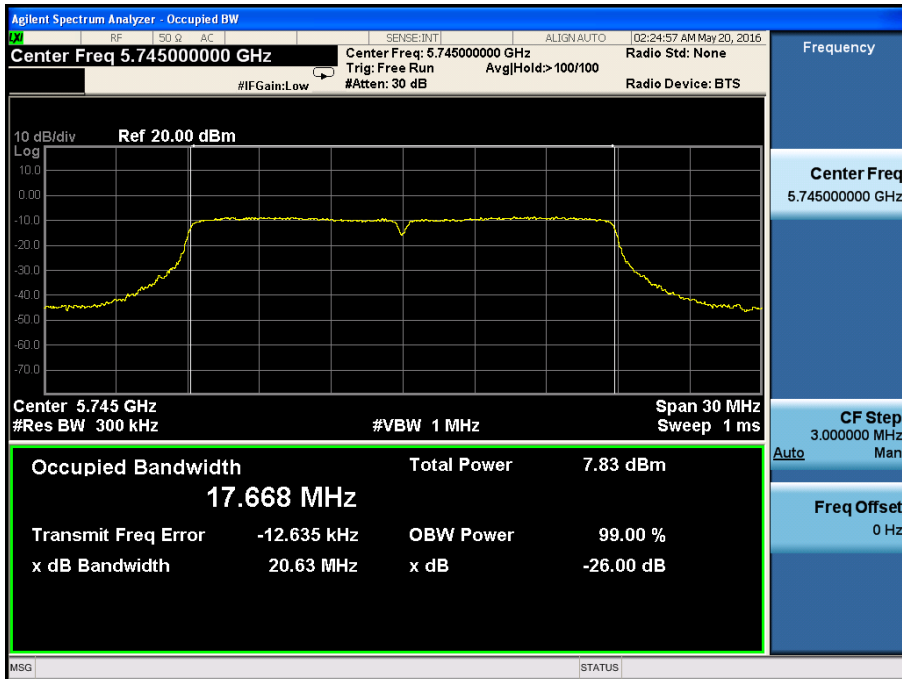
5200MHz

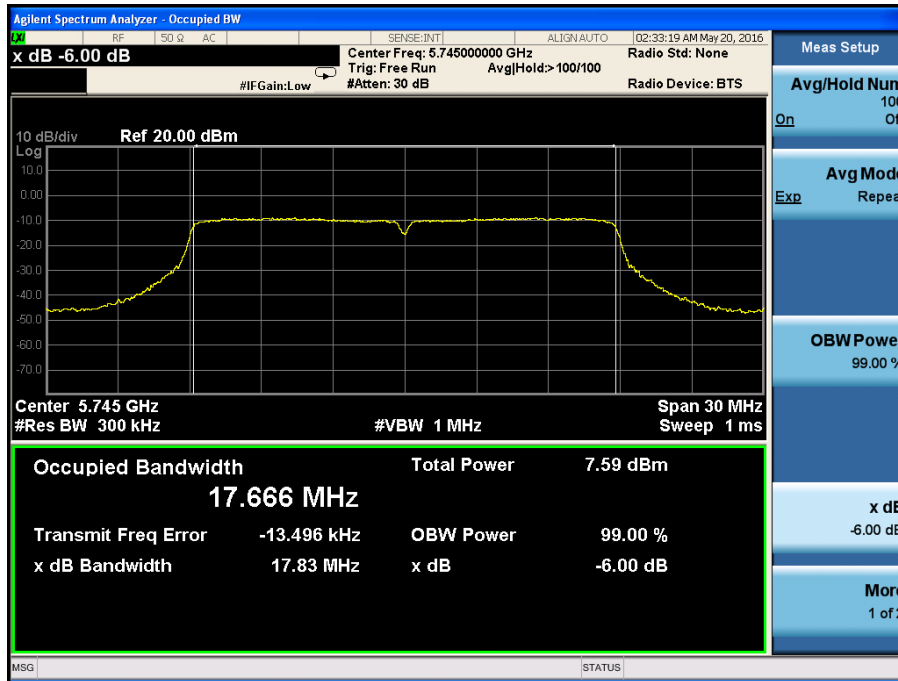


5240MHz

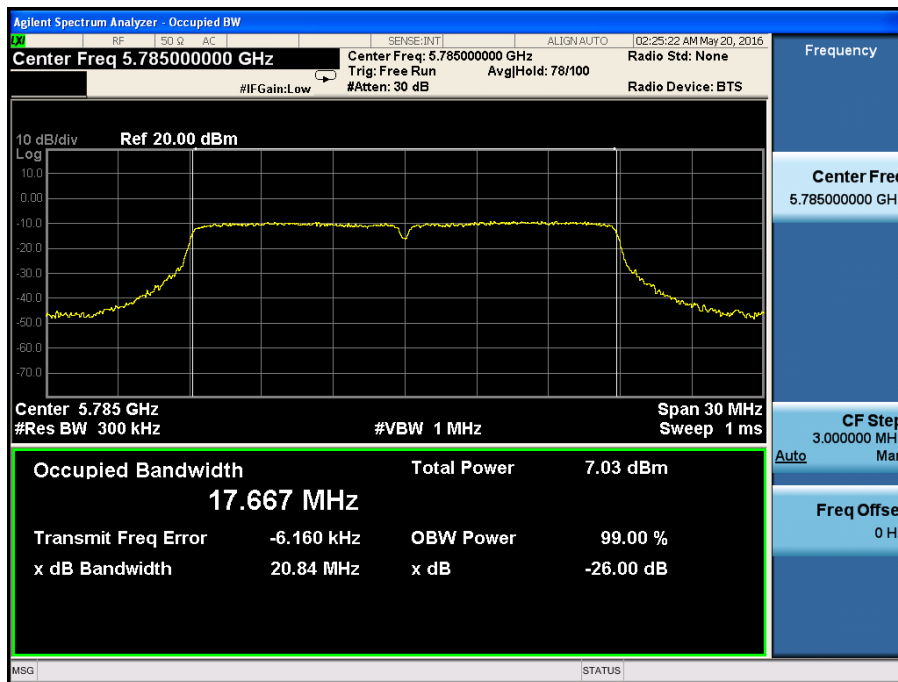


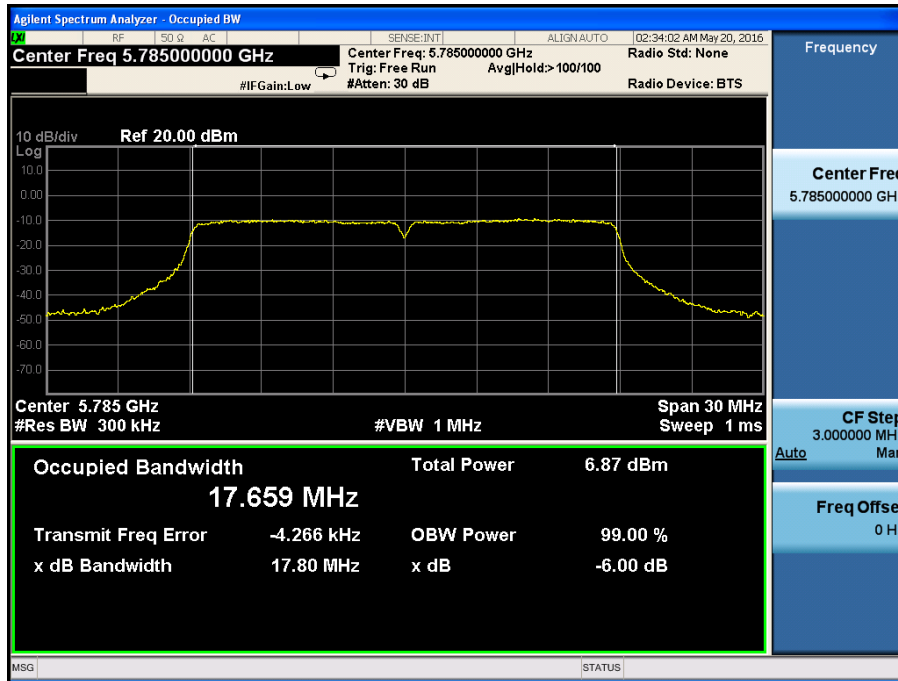
5745MHz



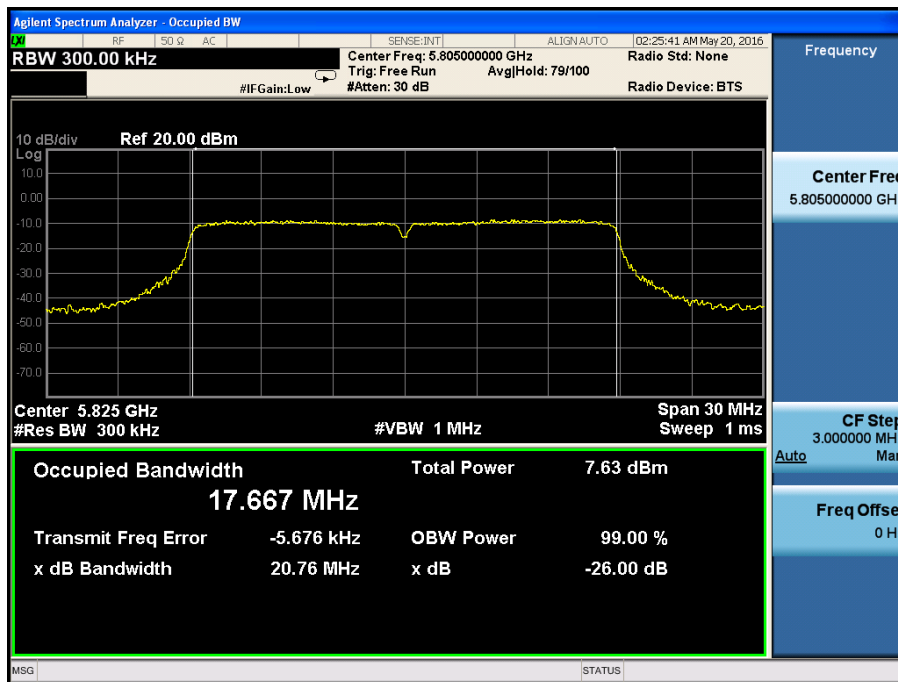


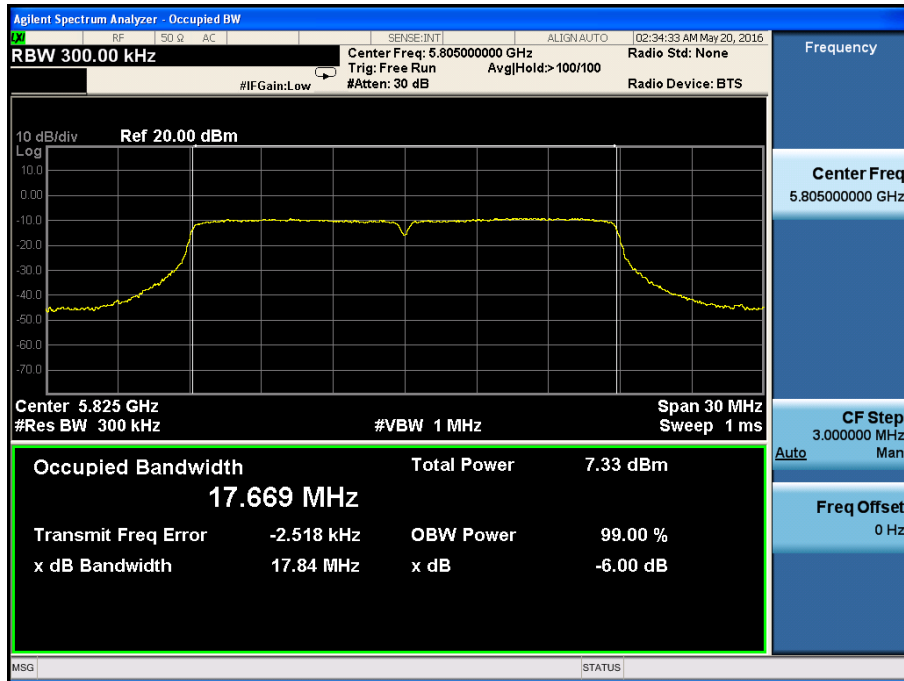
5785MHz





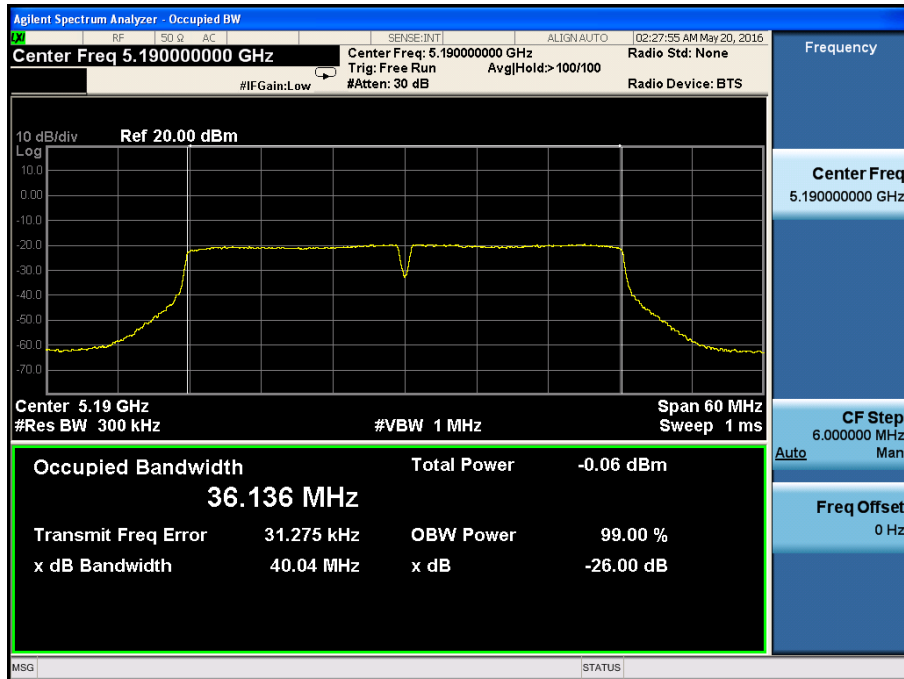
5825MHz



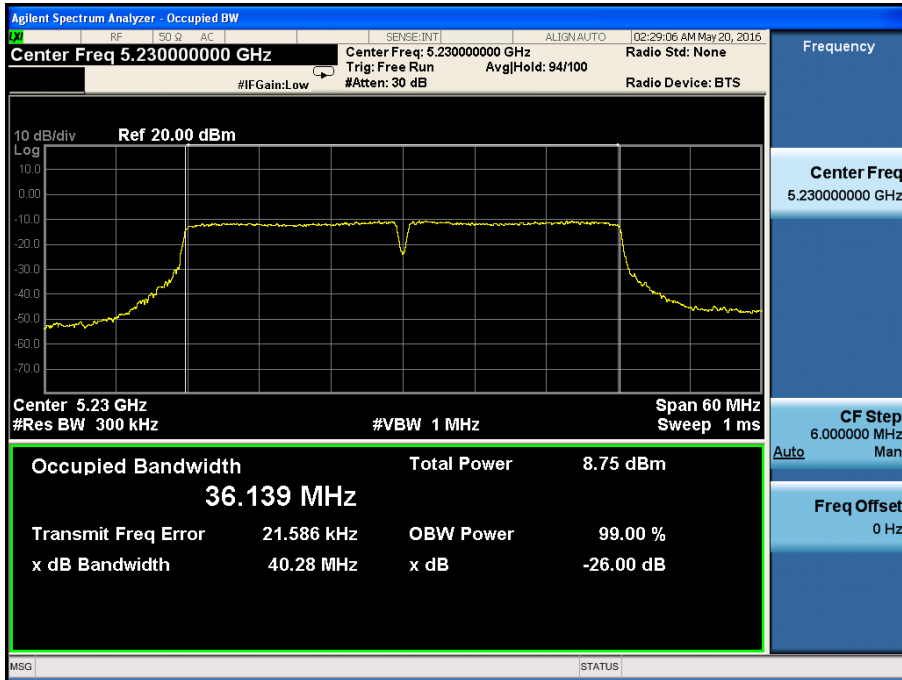


Test Mode: 802.11n-HT40

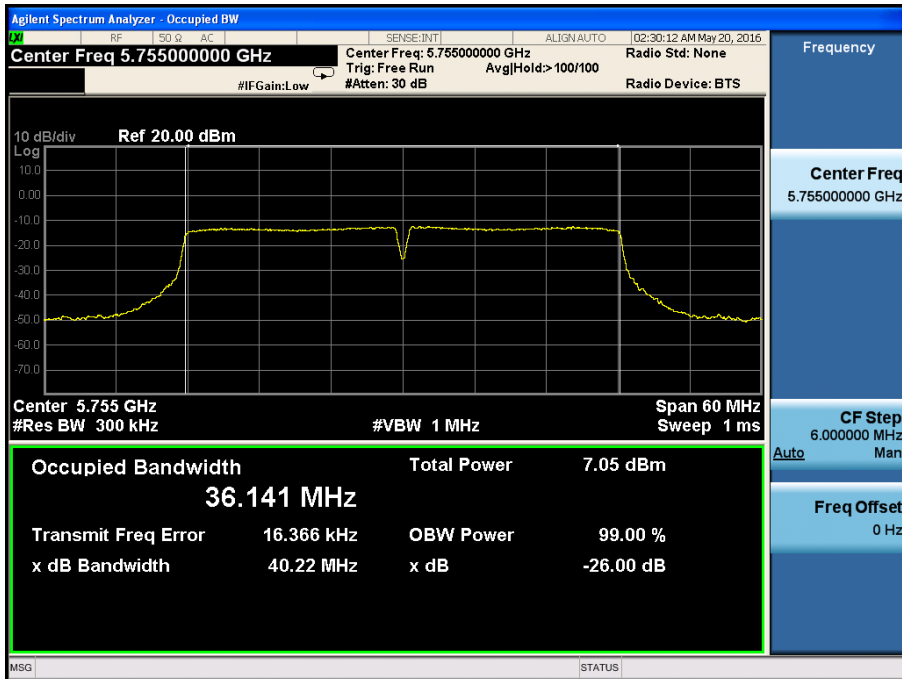
5190MHz

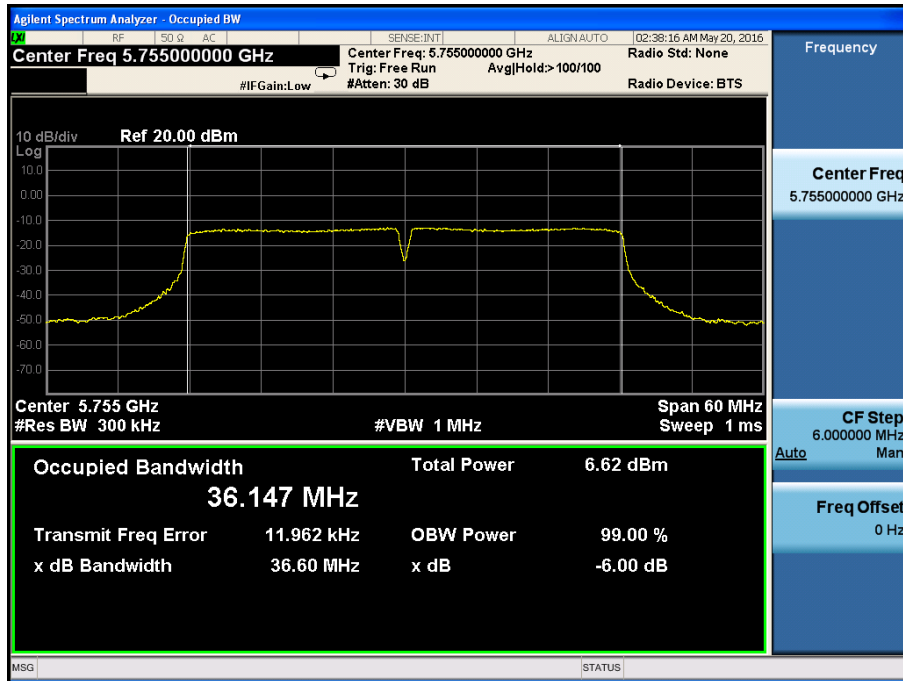


5230MHz

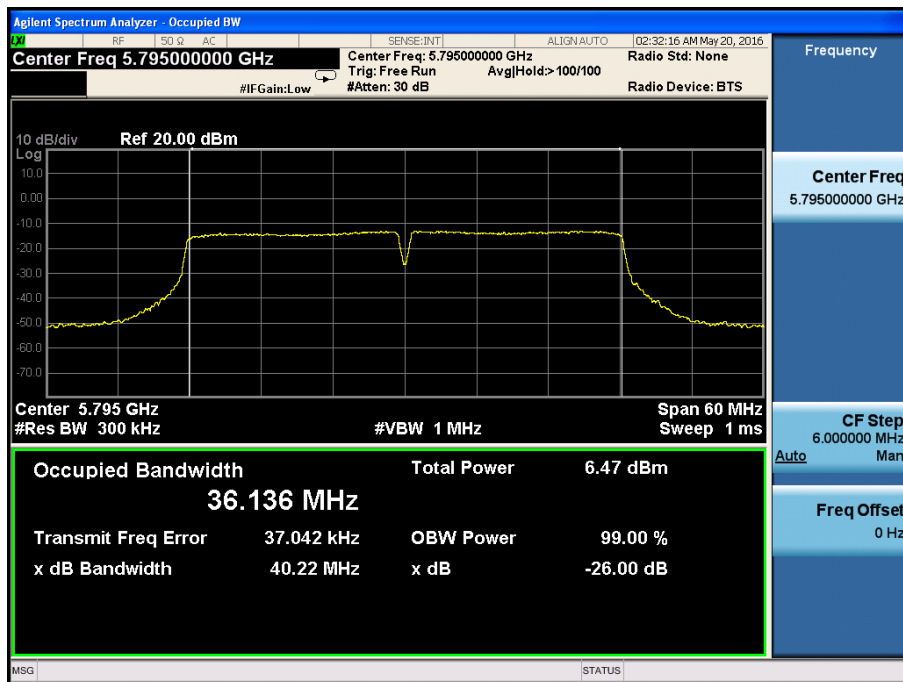


5755MHz

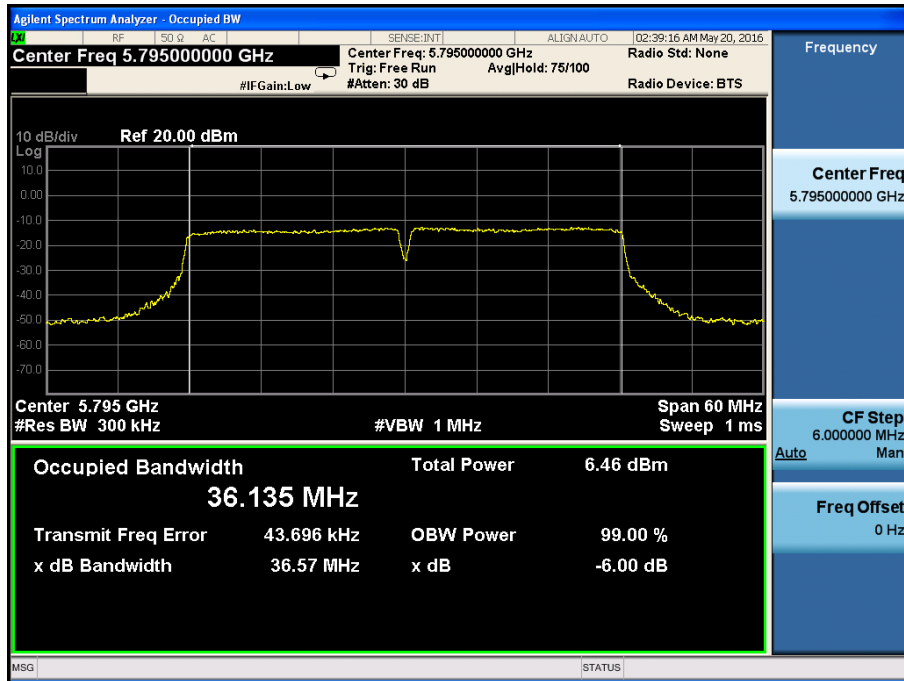




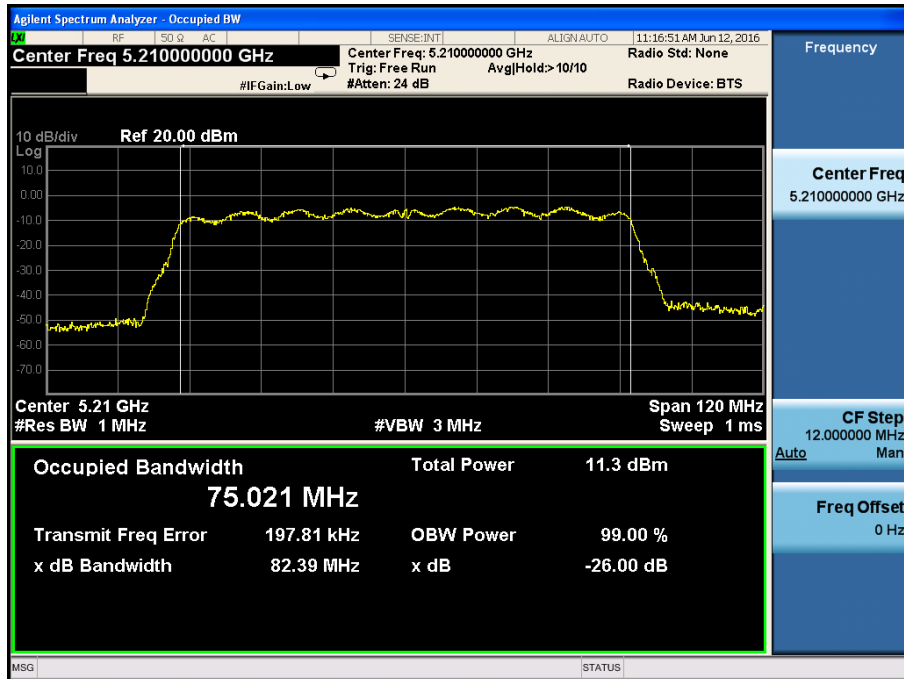
5795MHz



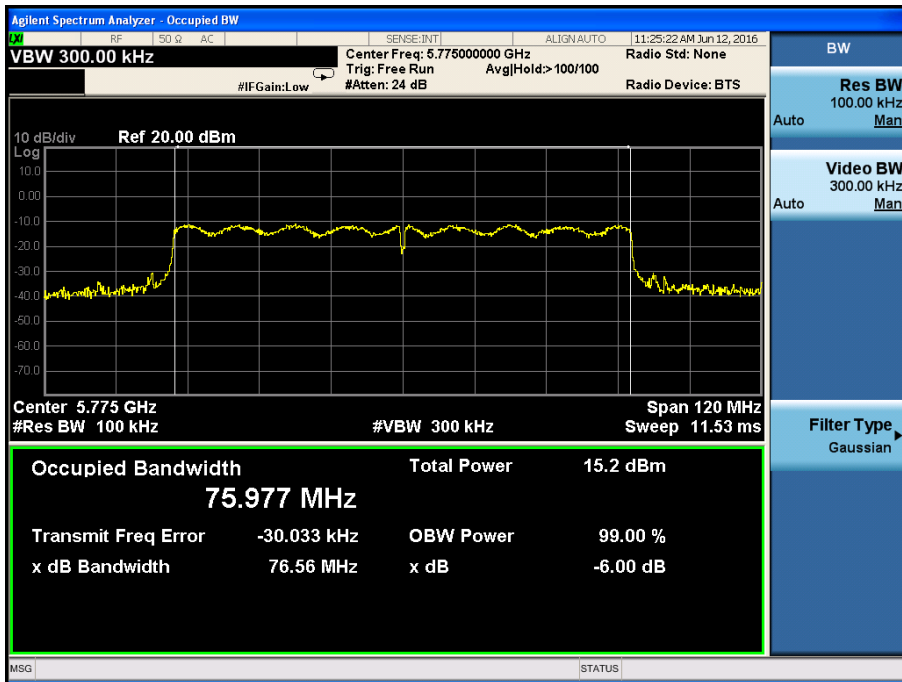
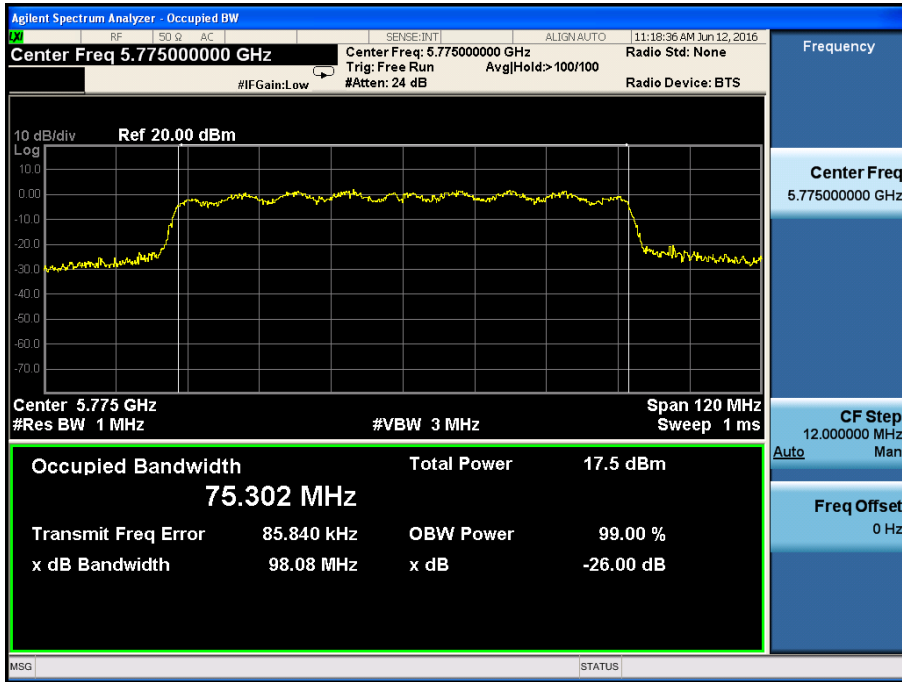




Test Mode: 802.11ac-HT80  
5210MHz



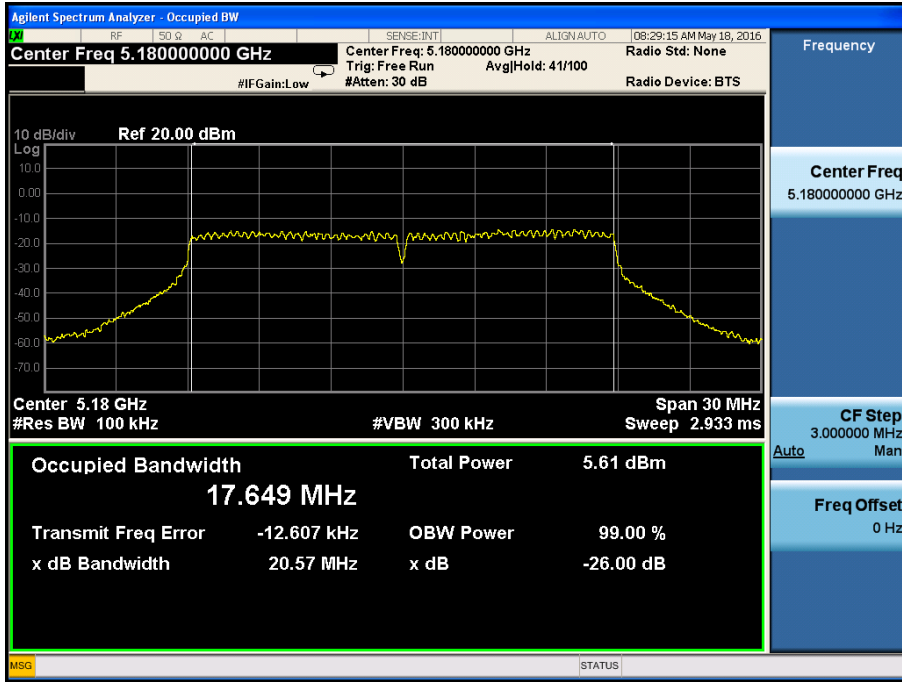
5775MHz



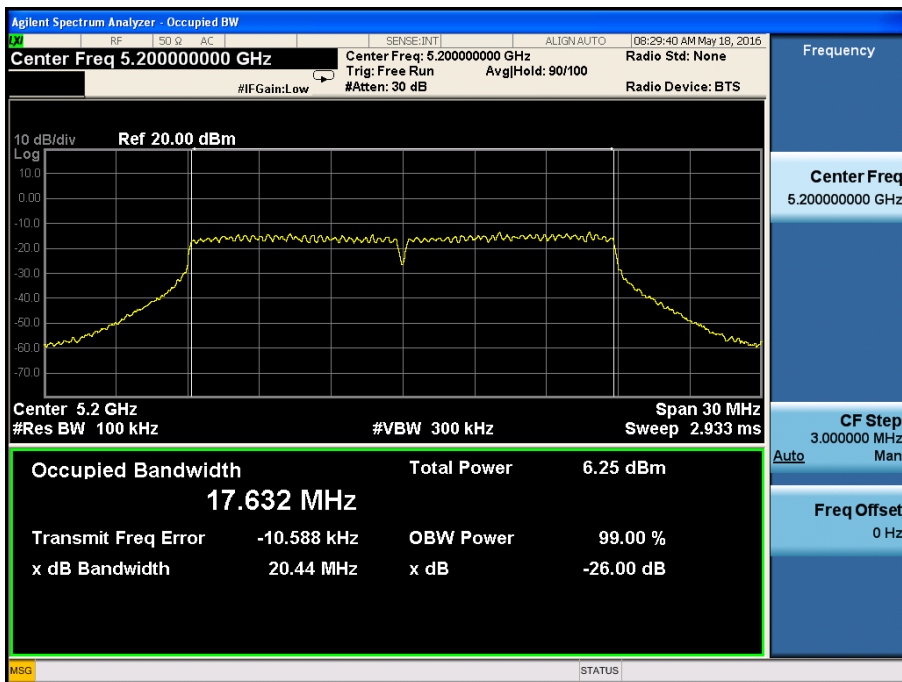
**Antenna 2**

Test Mode: 802.11n-HT20

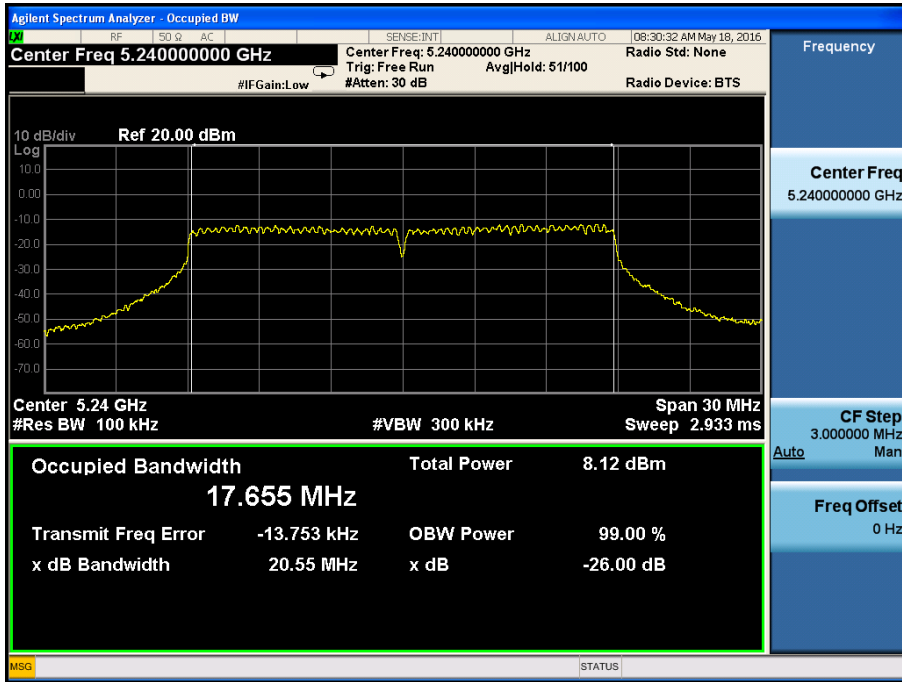
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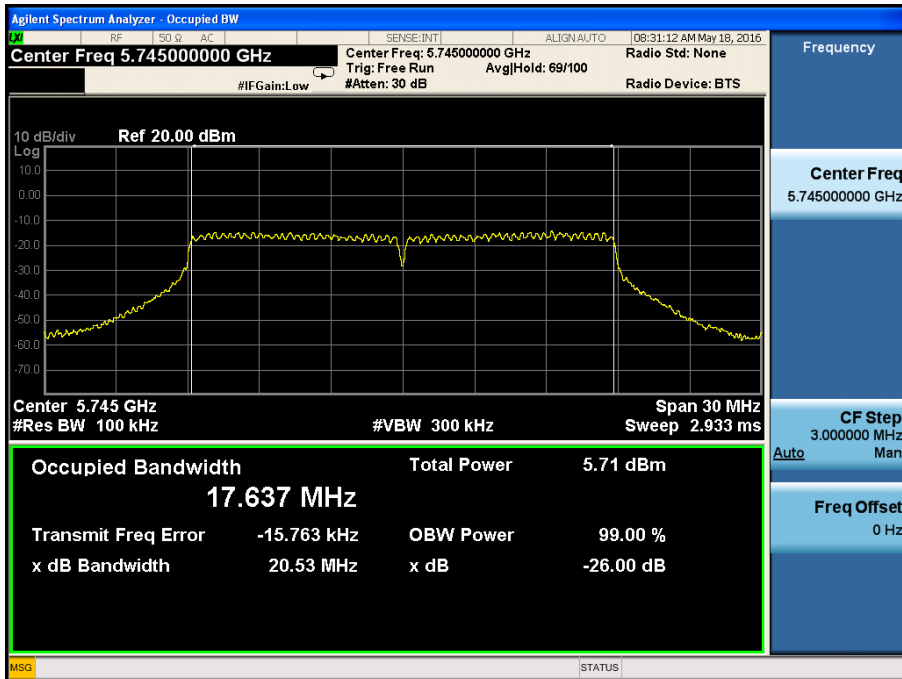
5200MHz

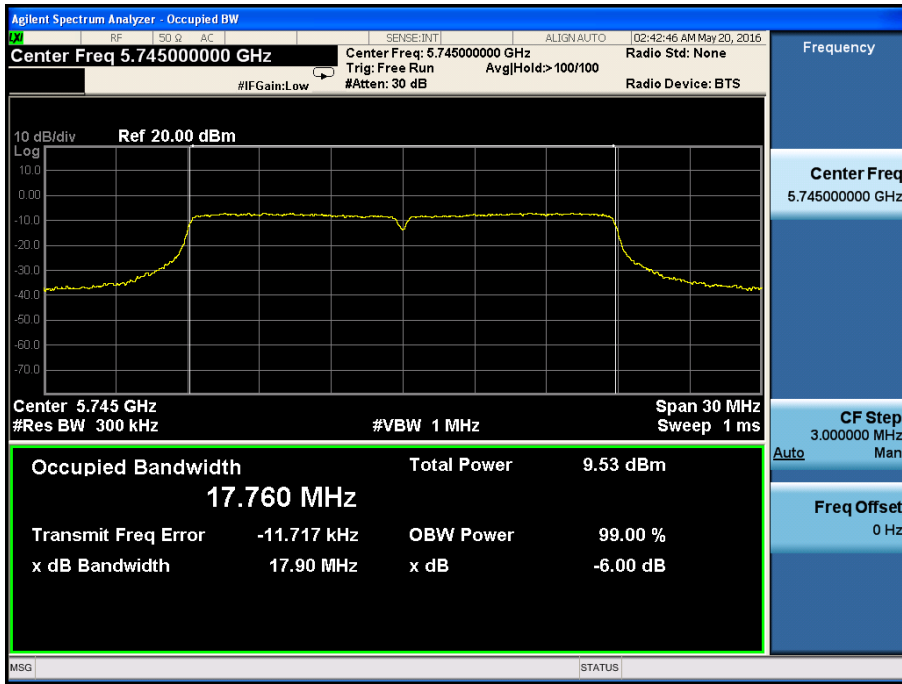


5240MHz

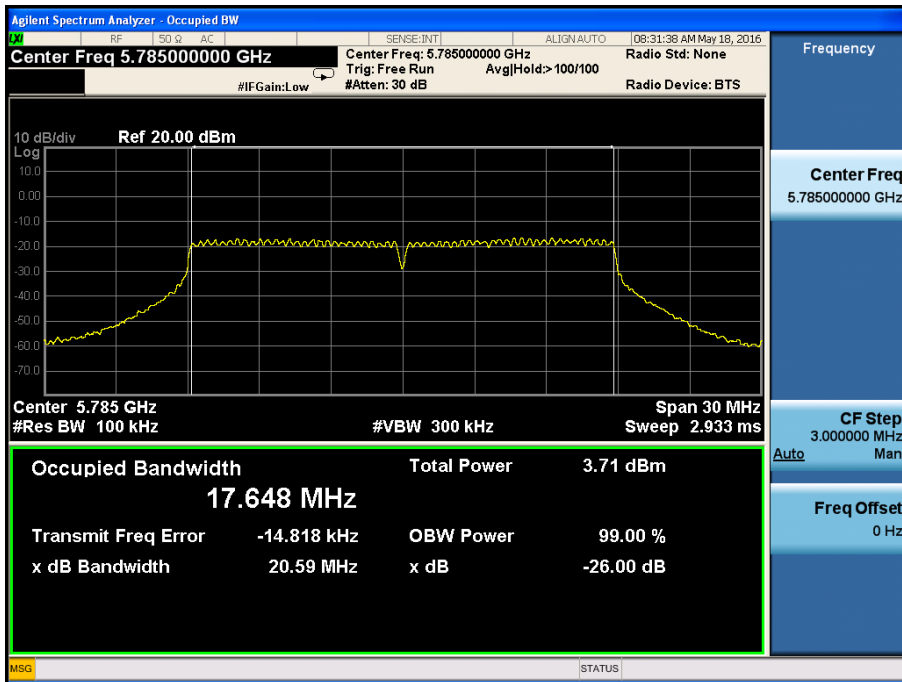


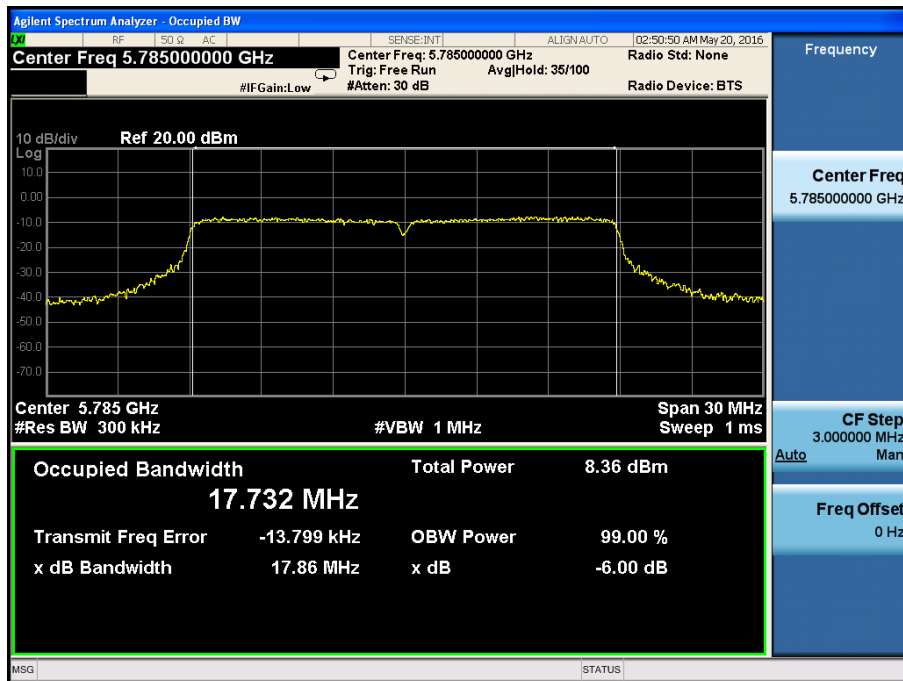
5745MHz





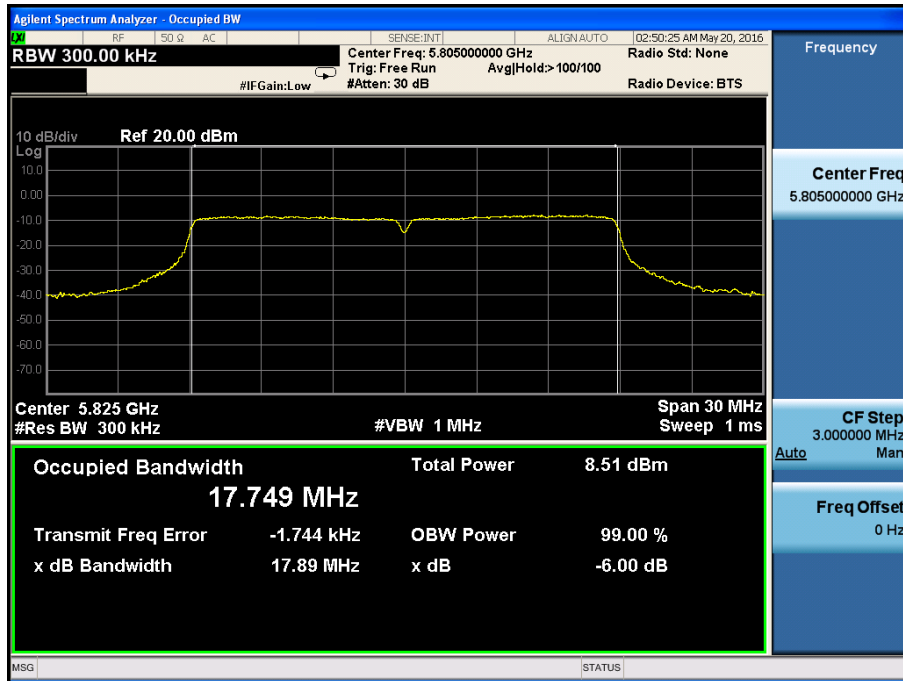
5785MHz





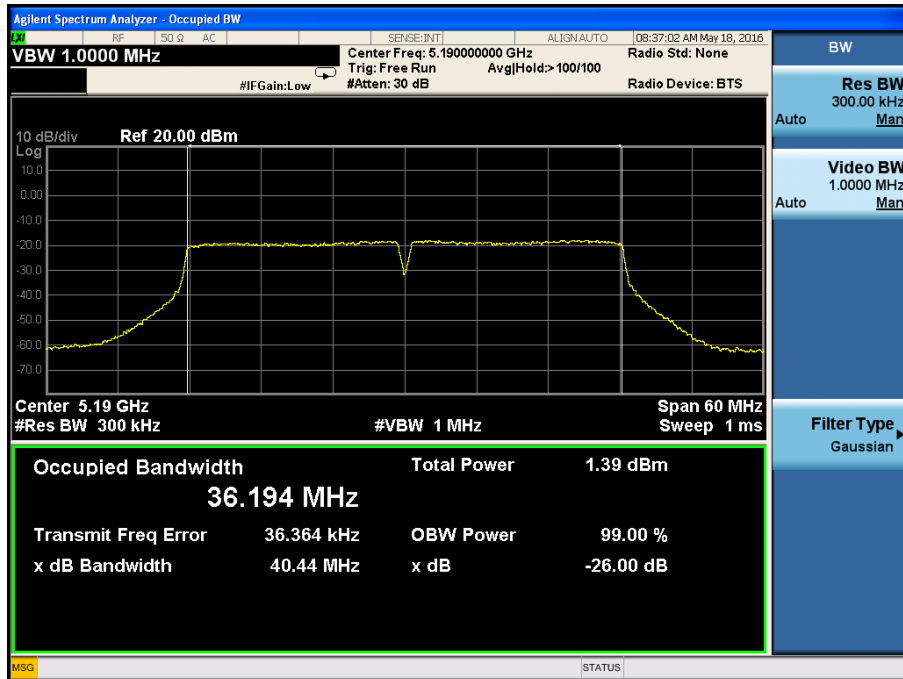
5825MHz



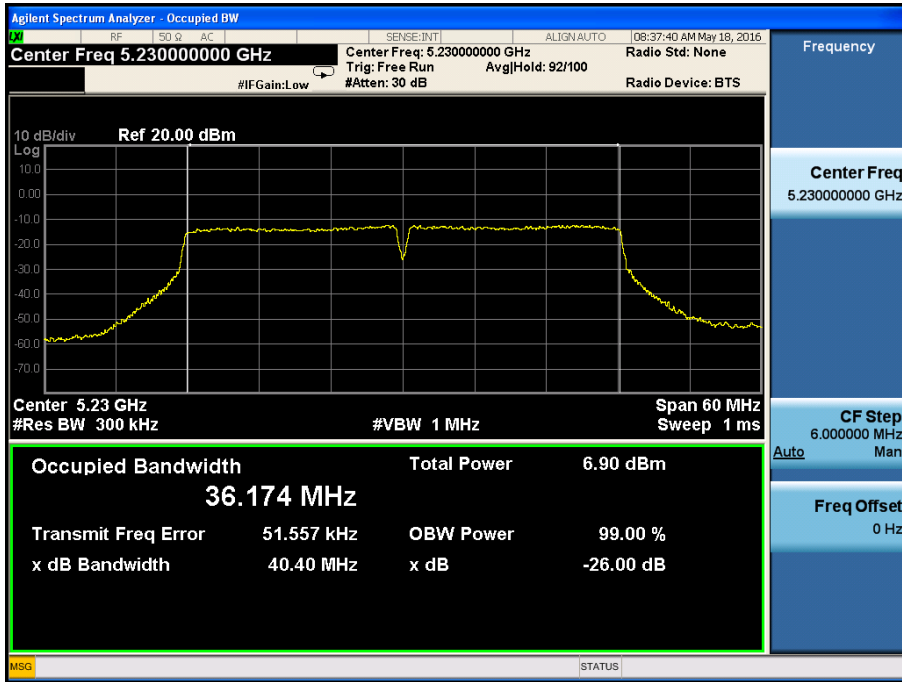


Test Mode: 802.11n-HT40

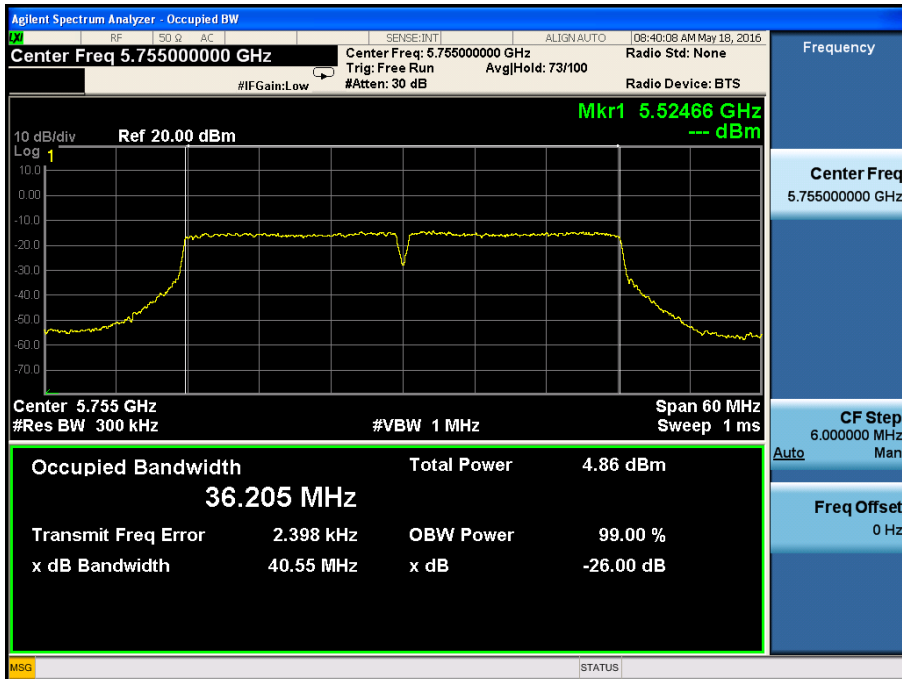
5190MHz



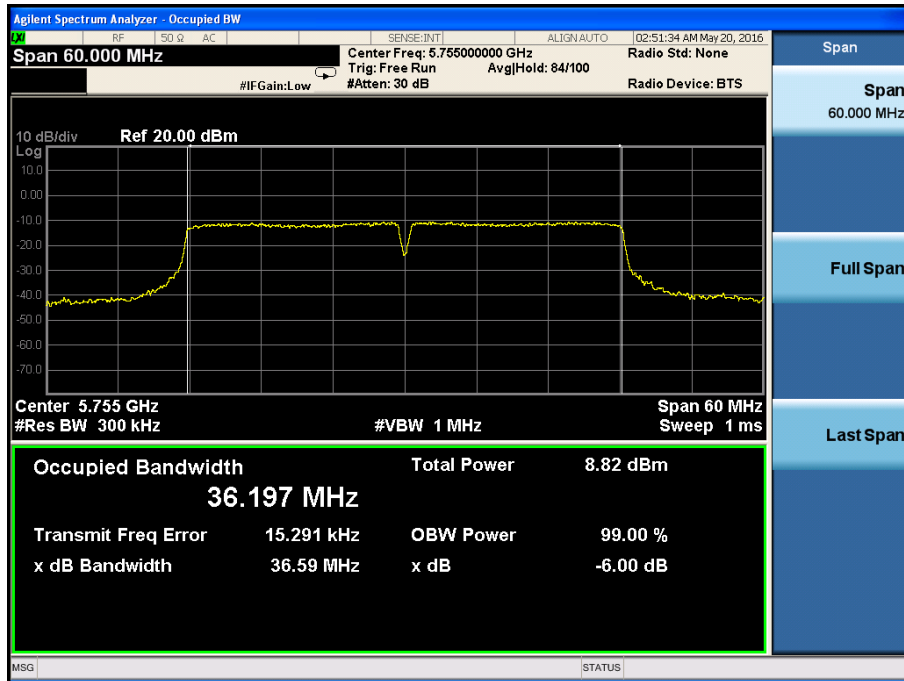
5230MHz



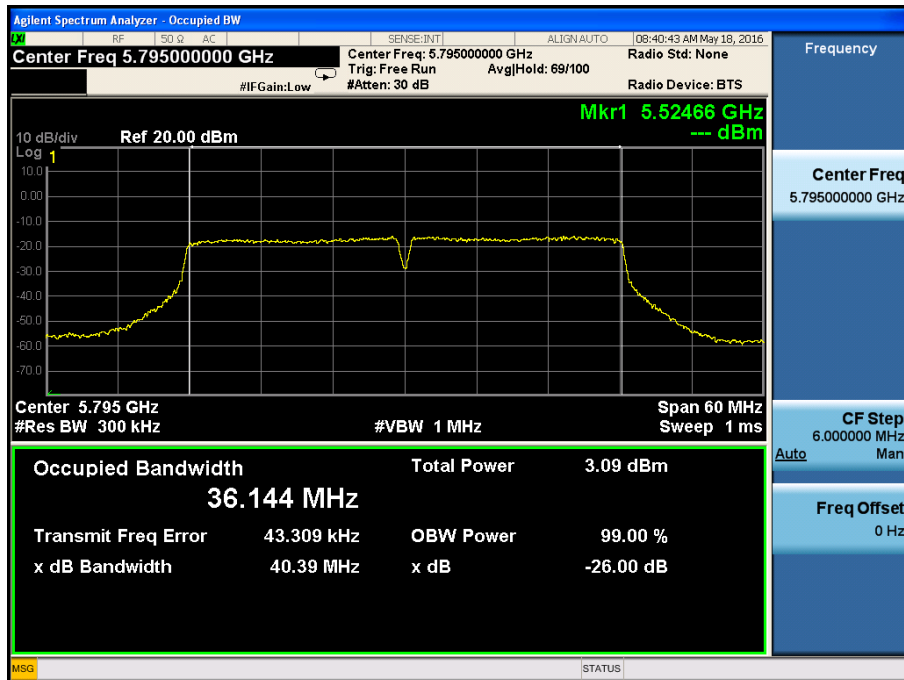
5755MHz

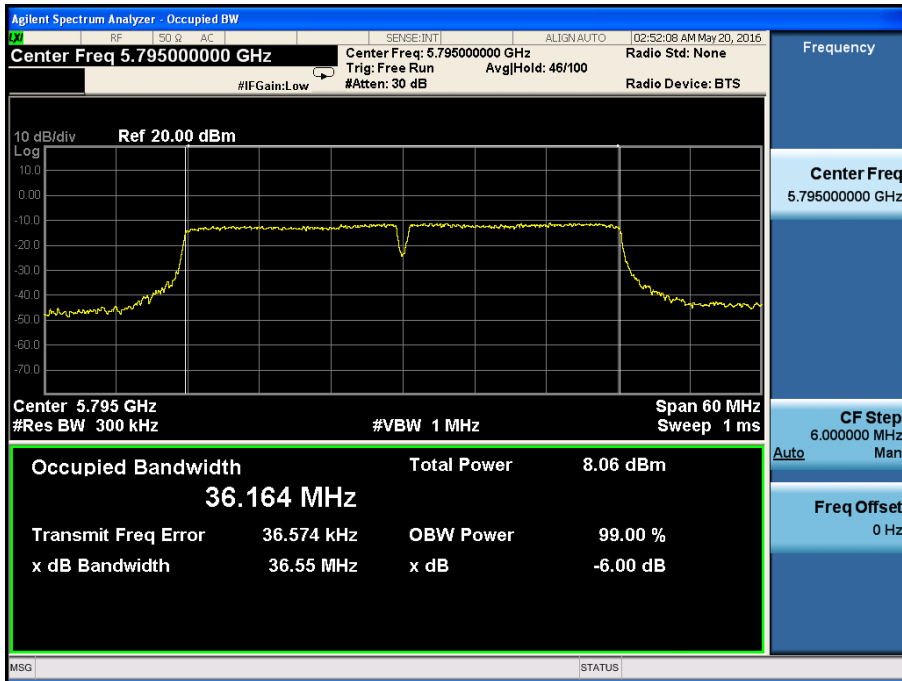






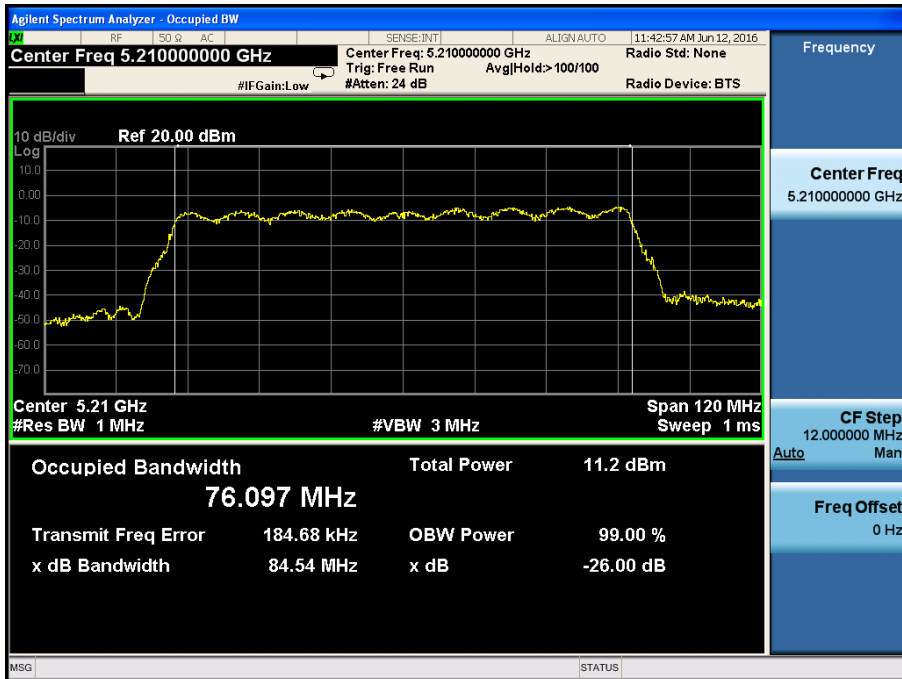
5795MHz



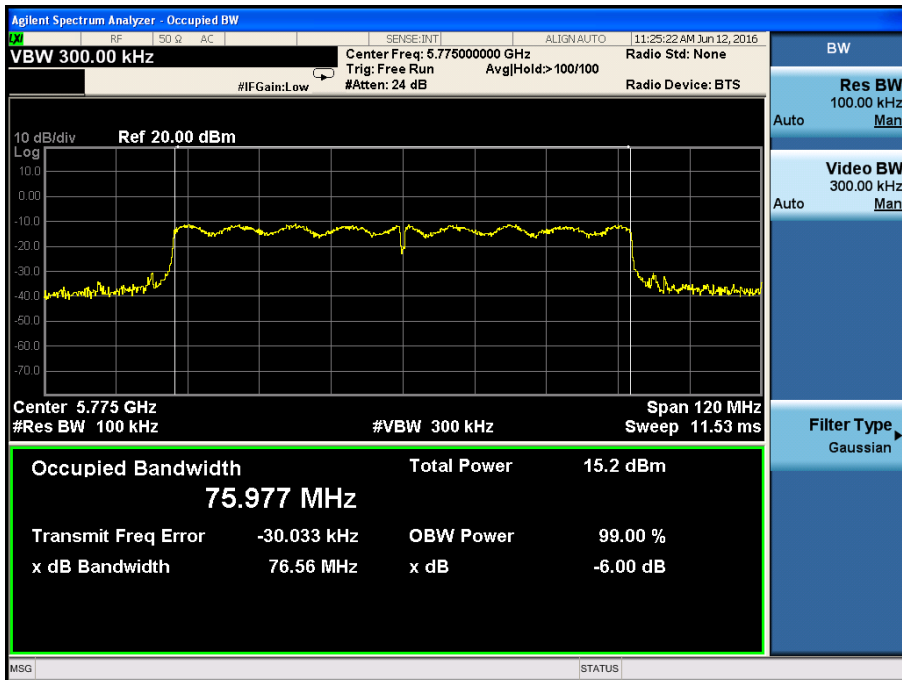
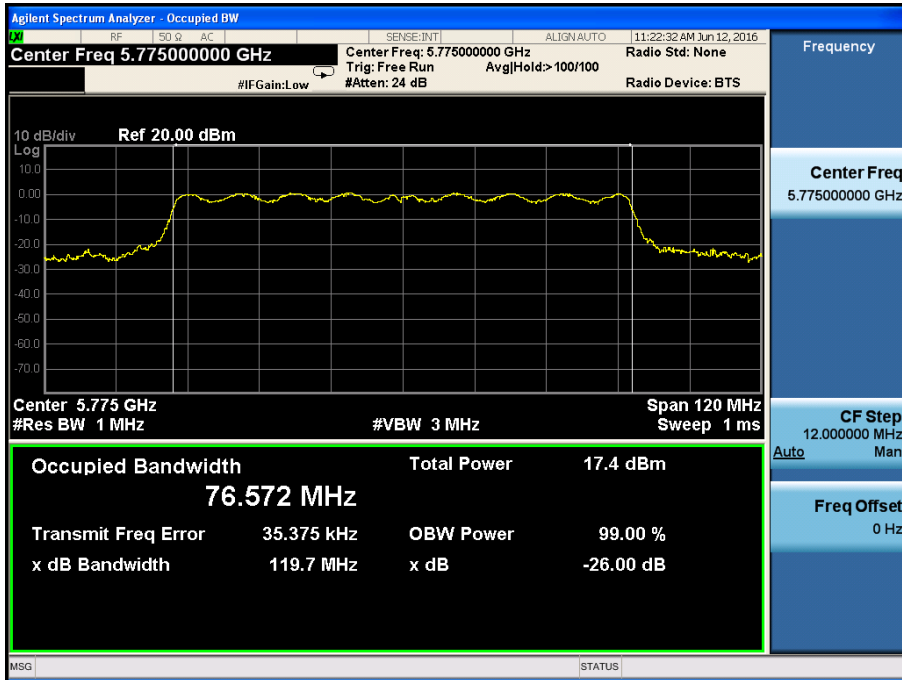


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



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## 8. Maximum Conducted Output Power

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### 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  $11 \text{ dBm} + 10 \log B$ , 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 v01r02 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  $\geq$  3 MHz.
- (iv) Number of points in sweep  $\geq$  2 Span / RBW. (This ensures that bin-to-bin spacing is  $\leq$  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  $\geq$  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

**5150-5250MHz**

Operating mode	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
802.11n-HT20	5180	11.64	16.05	17.39	54.86	250
	5200	11.39	15.64	17.03	50.42	250
	5240	14.25	16.48	18.52	71.07	250
802.11n-HT40	5190	8.36	9.07	11.74	14.93	250
	5230	15.88	15.72	18.81	76.05	250
802.11ac-HT80	5210	8.16	3.35	9.40	8.71	250

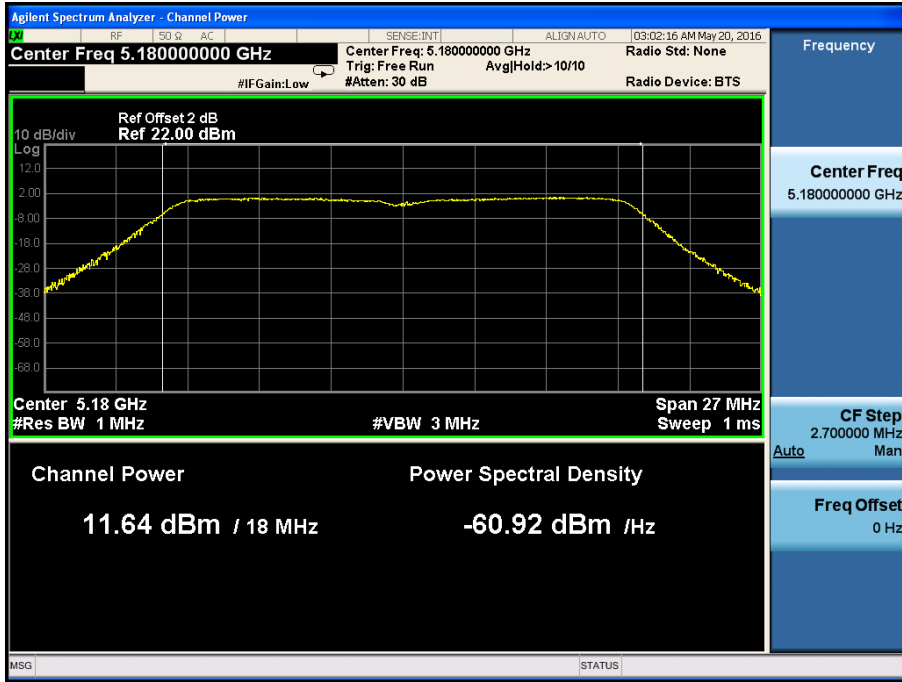
**5725-5850MHz**

Operating mode	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
802.11n-HT20	5745	12.80	14.73	16.88	48.77	1000
	5785	12.14	13.33	15.79	37.90	1000
	5825	12.98	14.54	16.84	48.31	1000
802.11n-HT40	5755	15.08	13.35	17.31	53.84	1000
	5795	13.97	12.65	16.37	43.35	1000
802.11ac-HT80	5775	14.11	8.94	15.26	33.60	1000

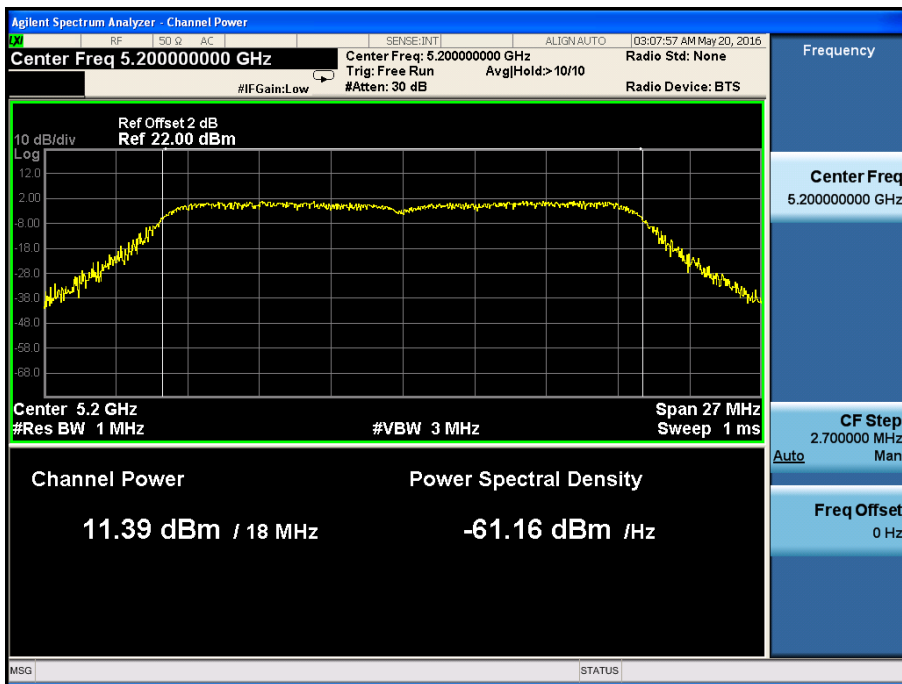
**Antenna 1**

Test Mode: 802.11n-HT20

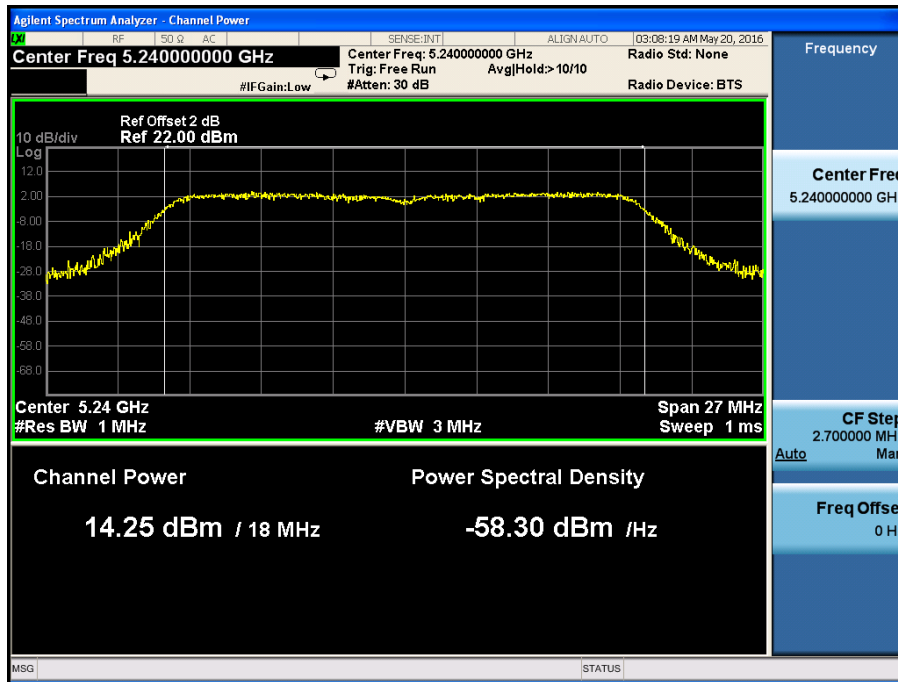
5180MHz



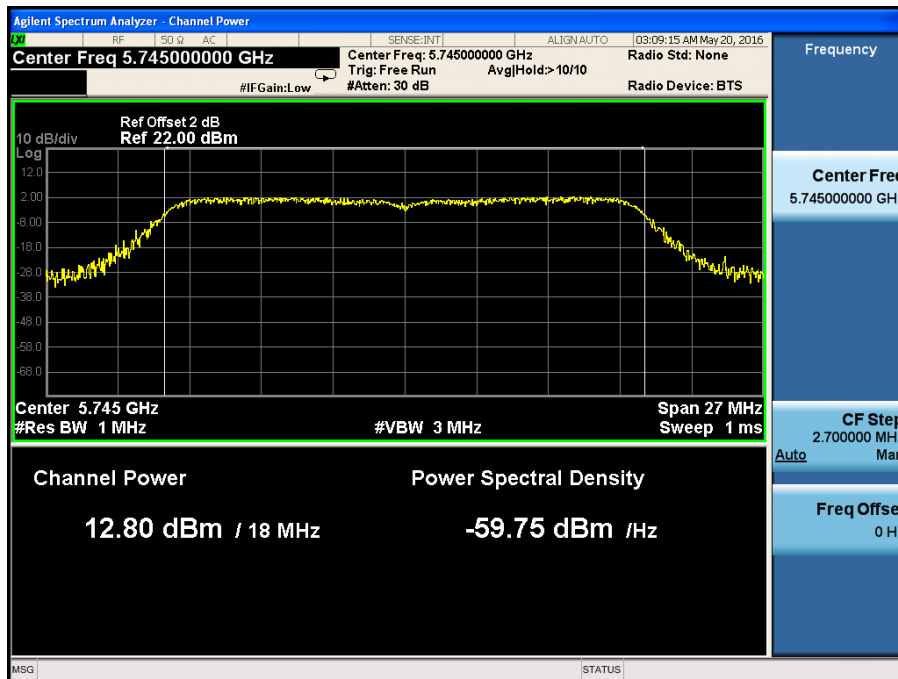
5200MHz



5240MHz

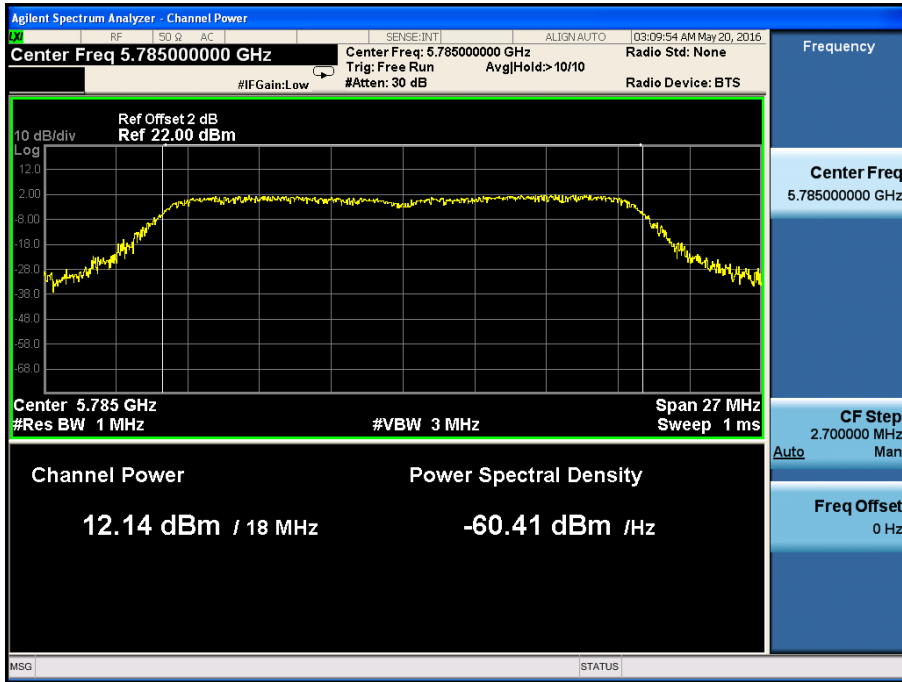


5745MHz

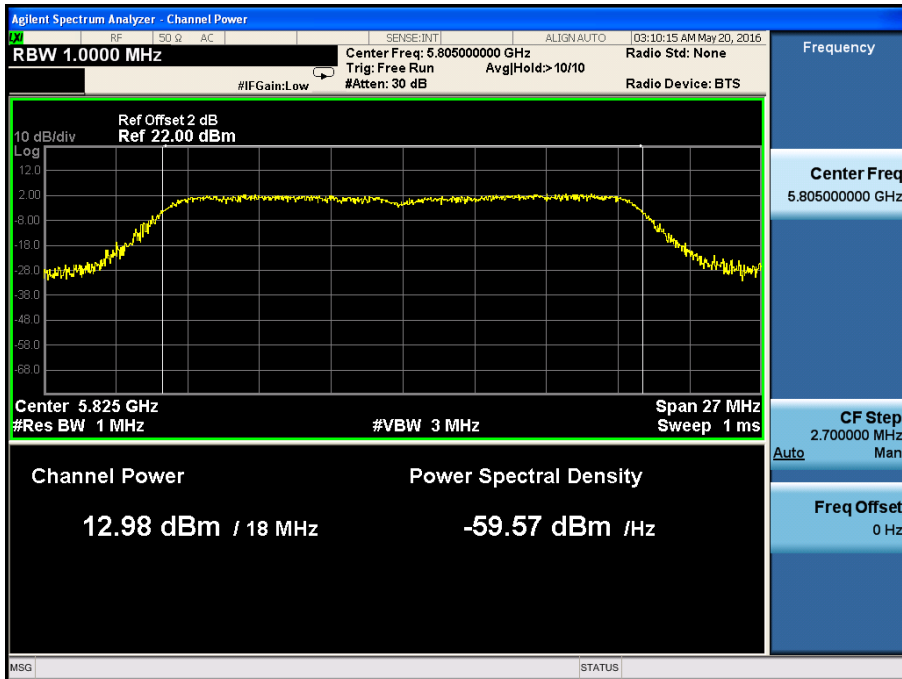




5785MHz

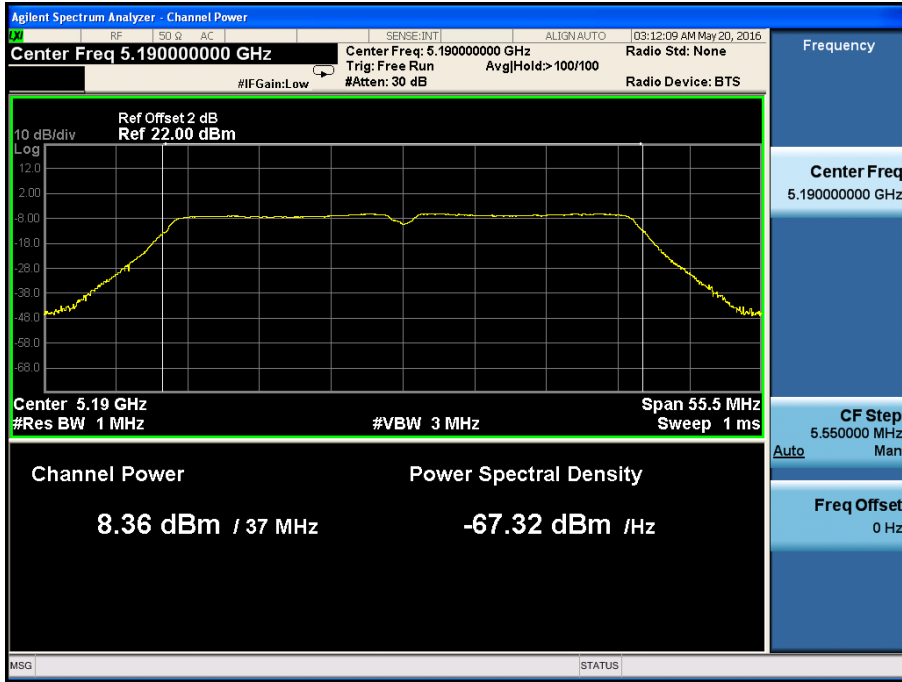


5825MHz

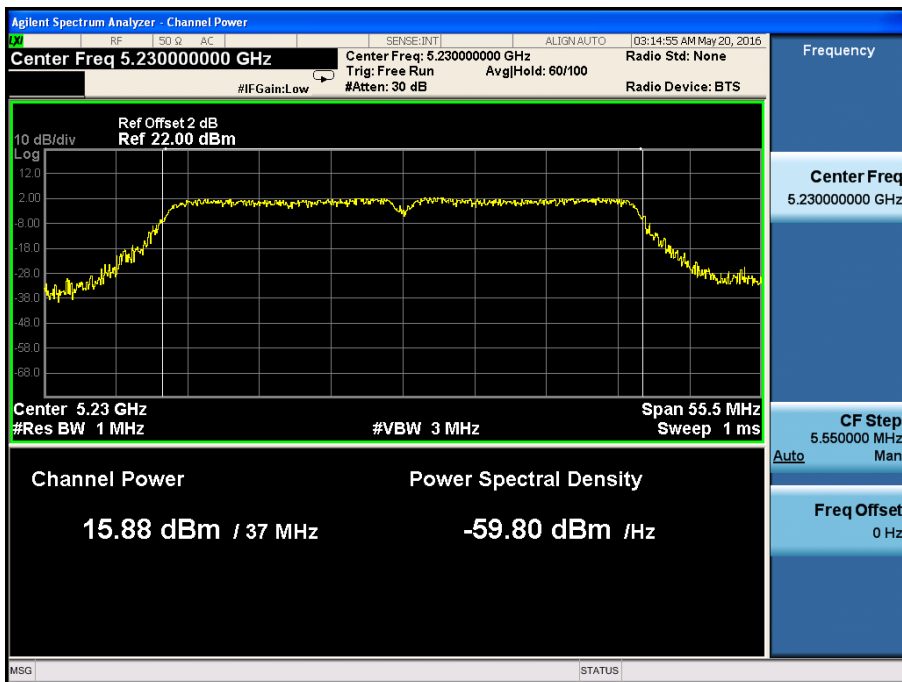


Test Mode: 802.11n-HT40

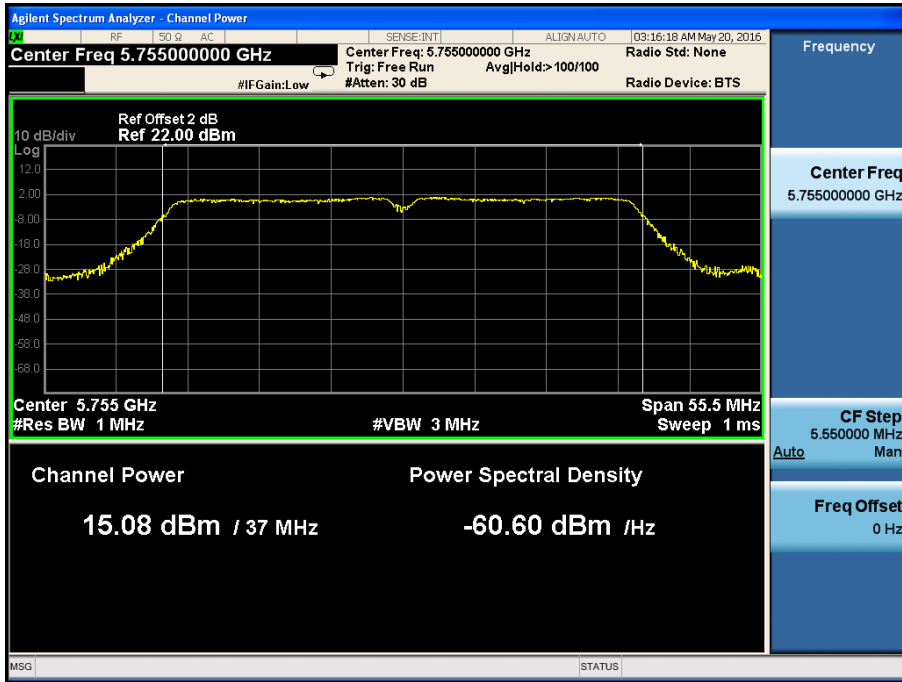
5190MHz



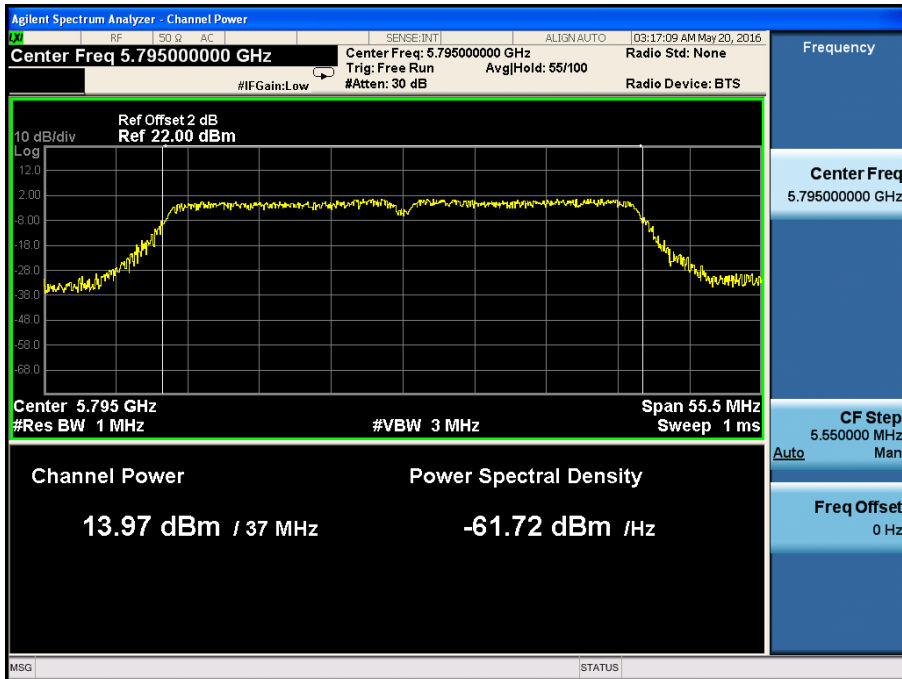
5230MHz



5755MHz

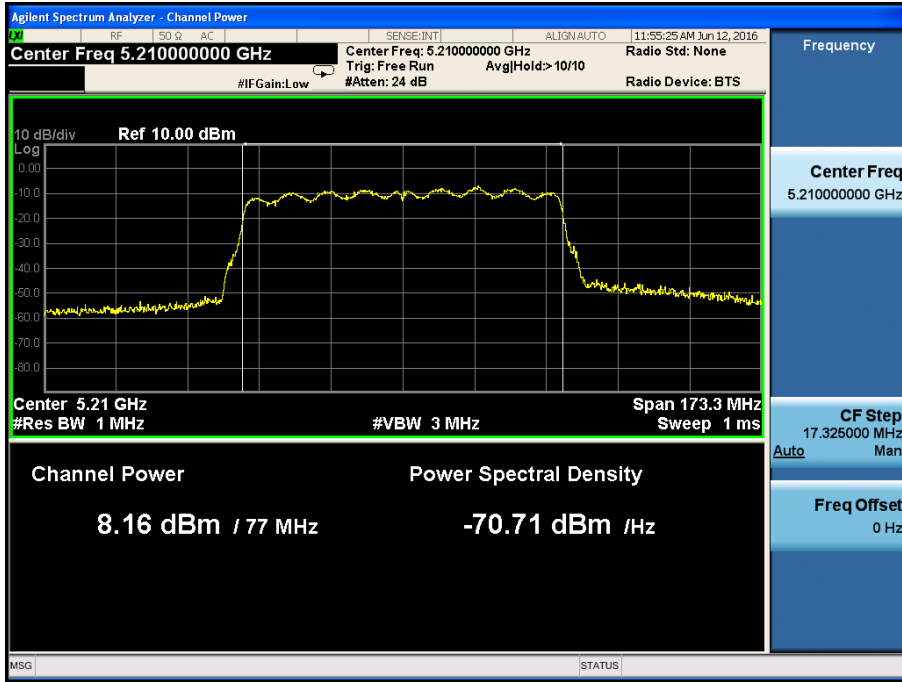


5795MHz

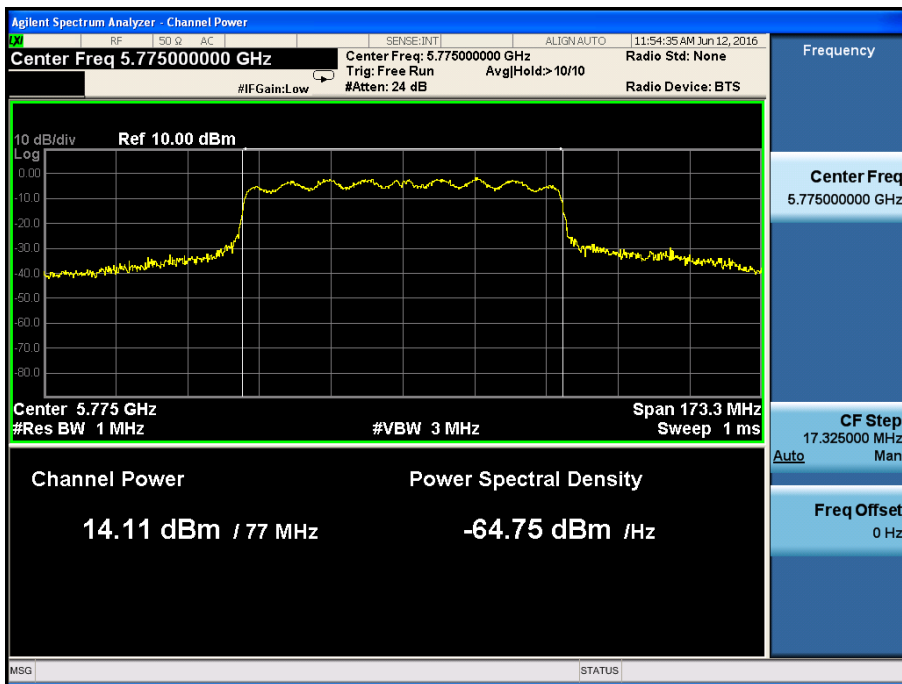


Test Mode: 802.11ac-HT80

5210MHz



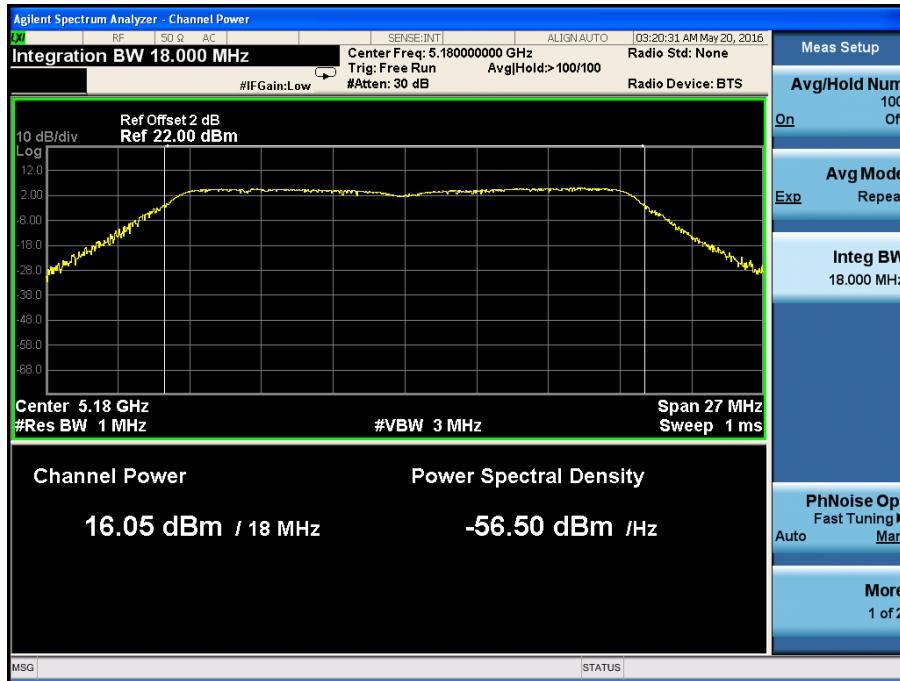
5775MHz



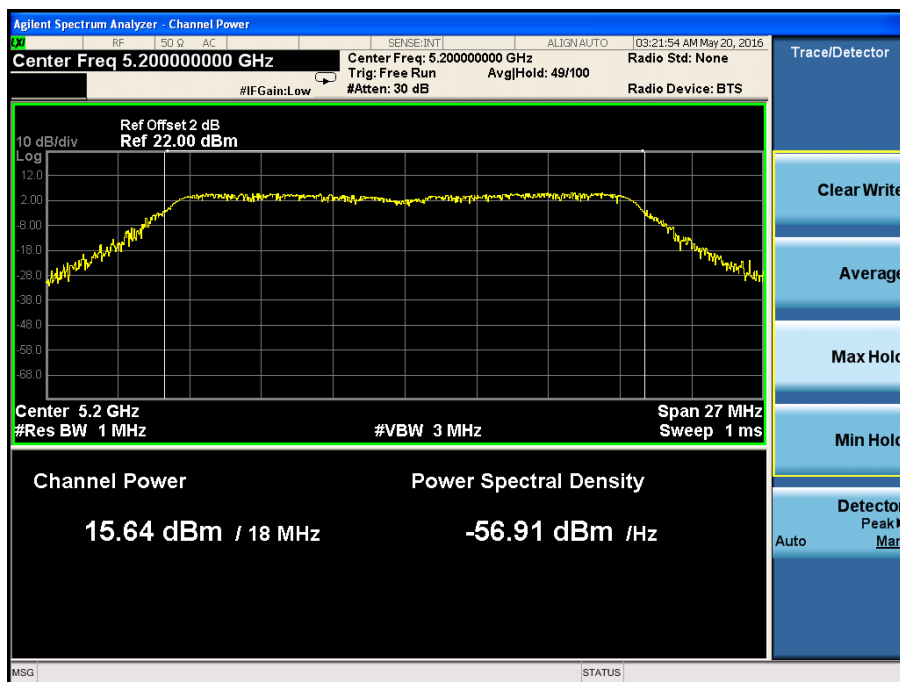
**Antenna 2**

Test Mode: 802.11n-HT20

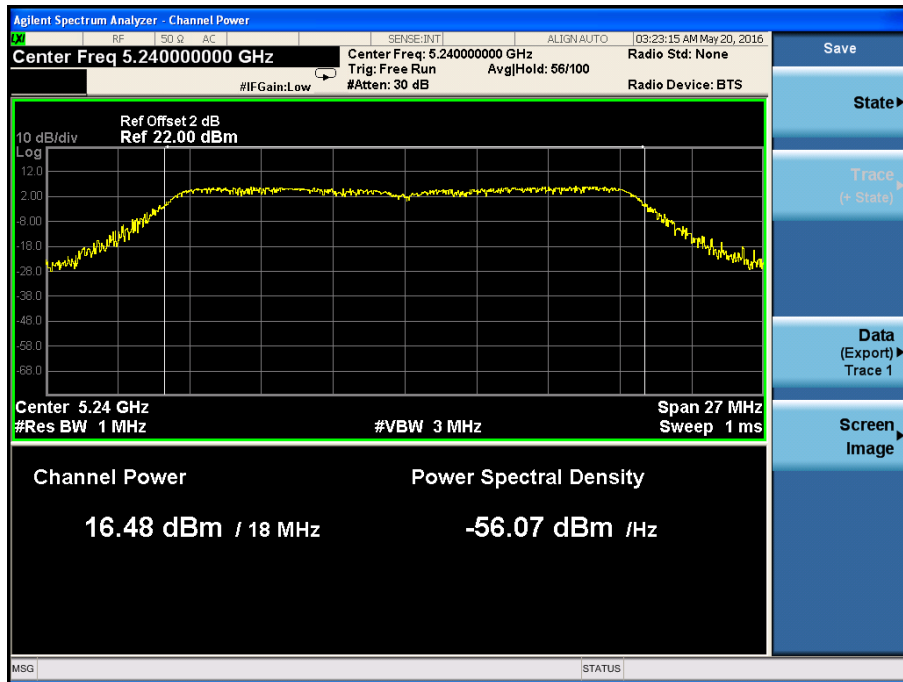
5180MHz



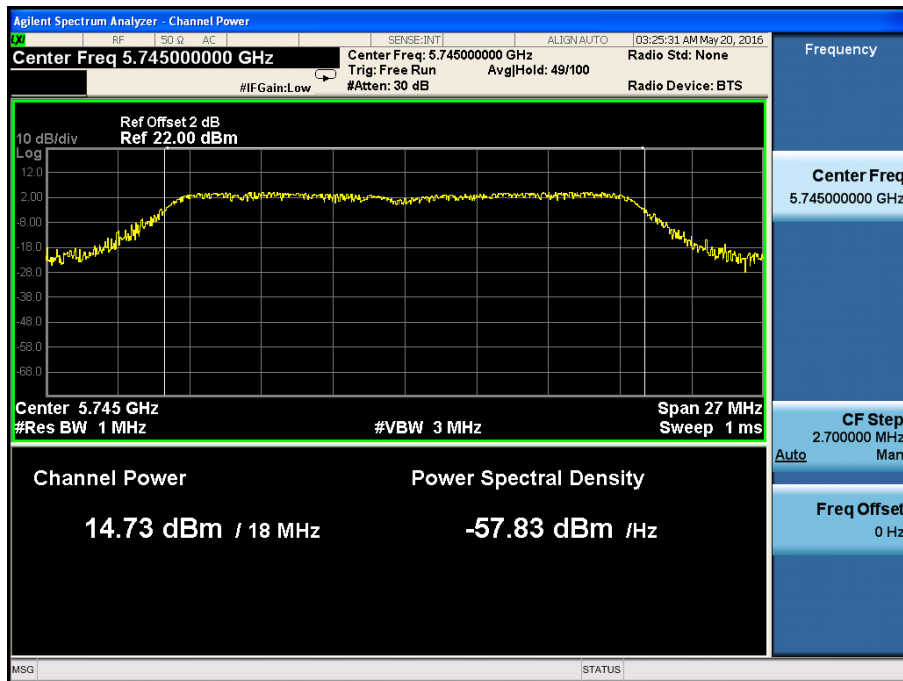
5200MHz



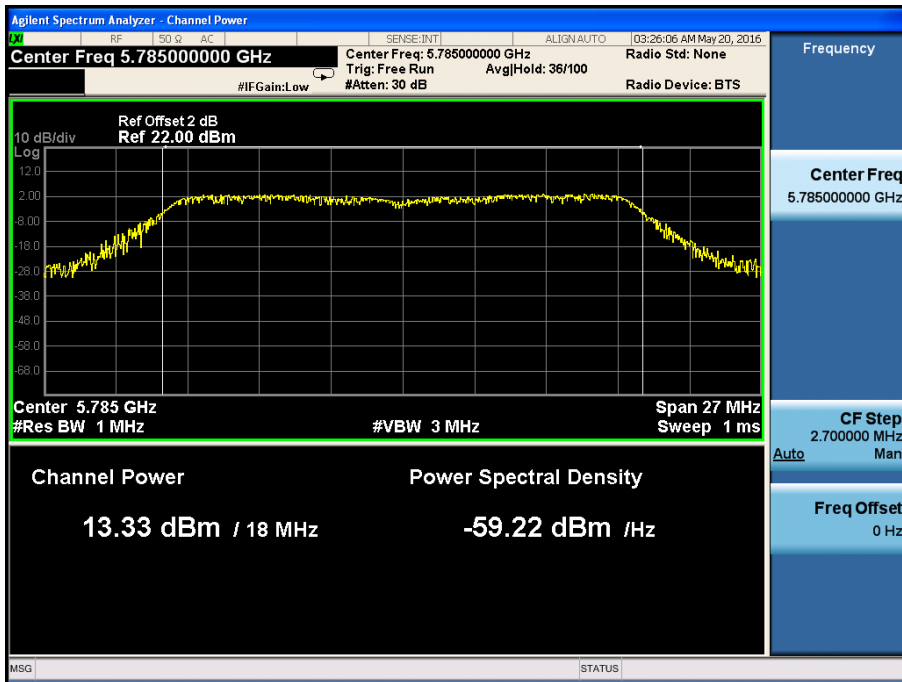
5240MHz



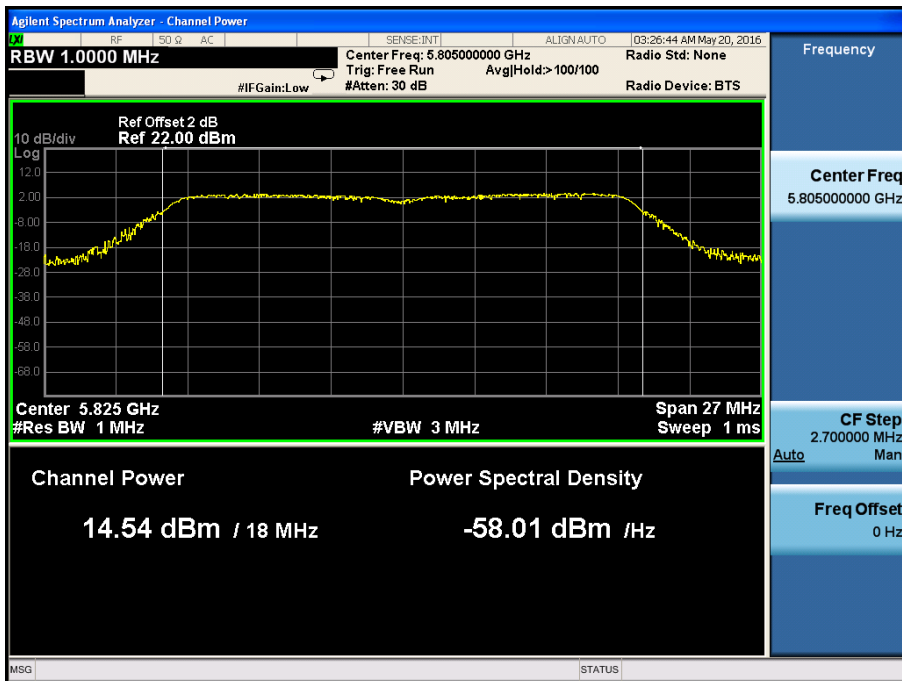
5745MHz



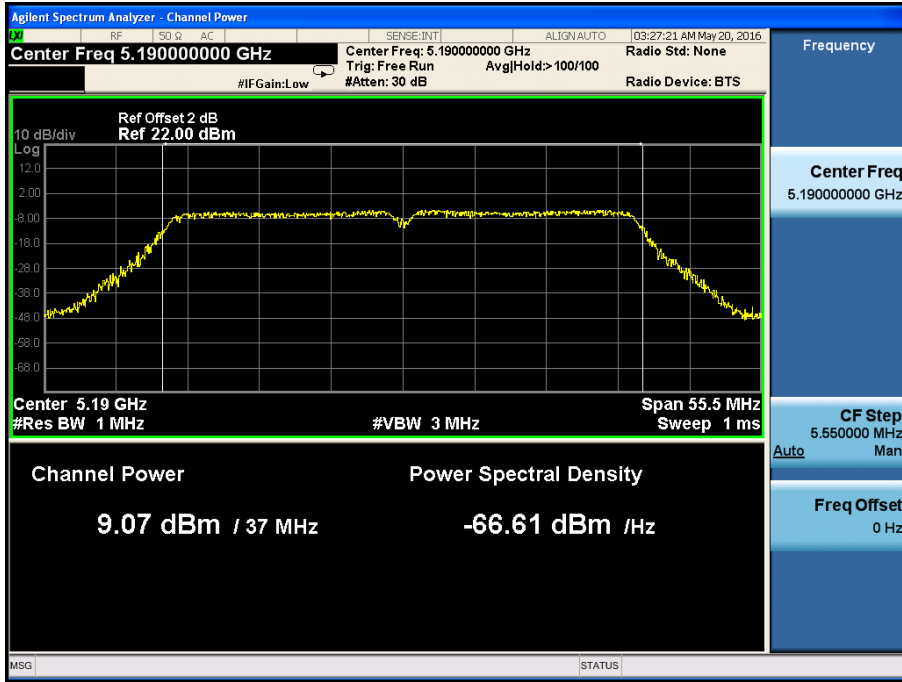
5785MHz



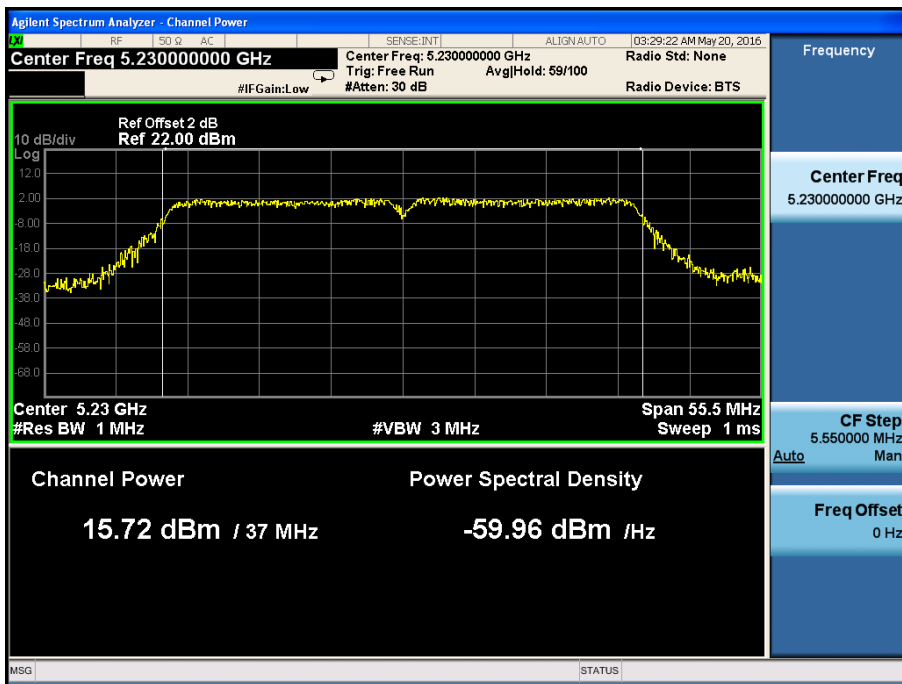
5825MHz



Test Mode: 802.11n-HT40  
5190MHz

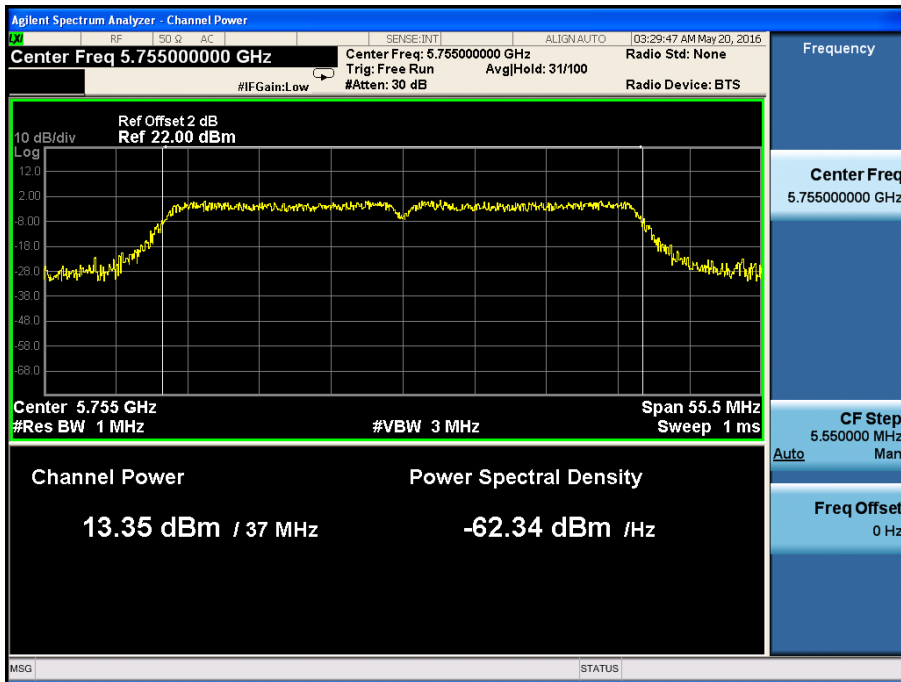


5230MHz

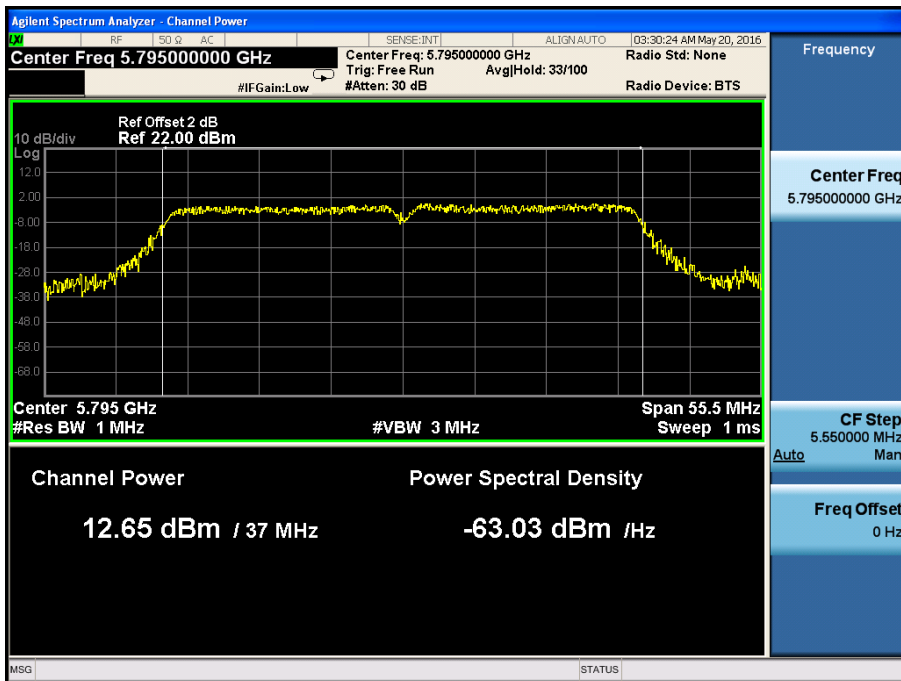




5755MHz

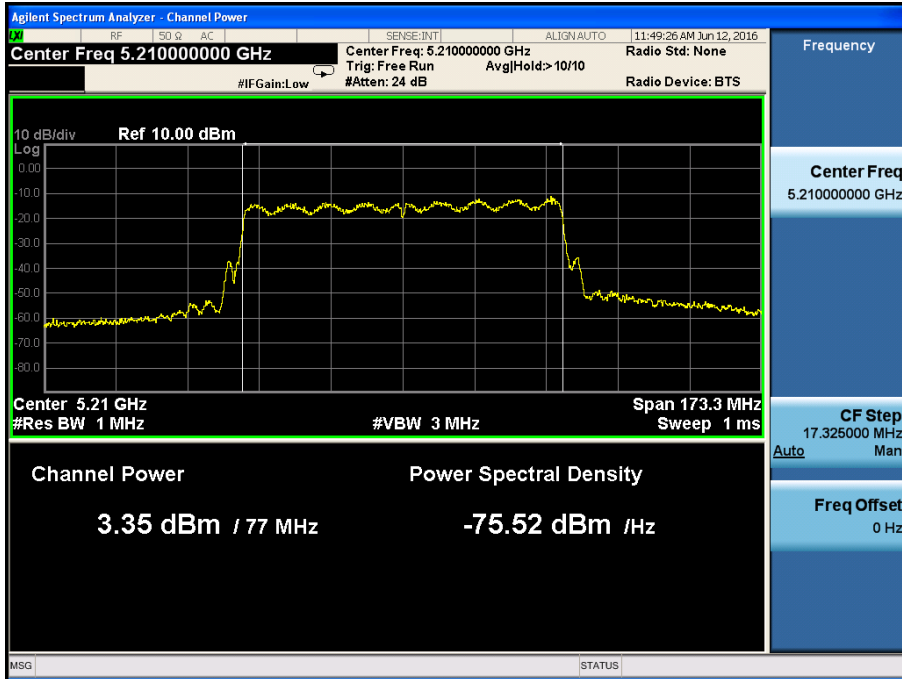


5795MHz

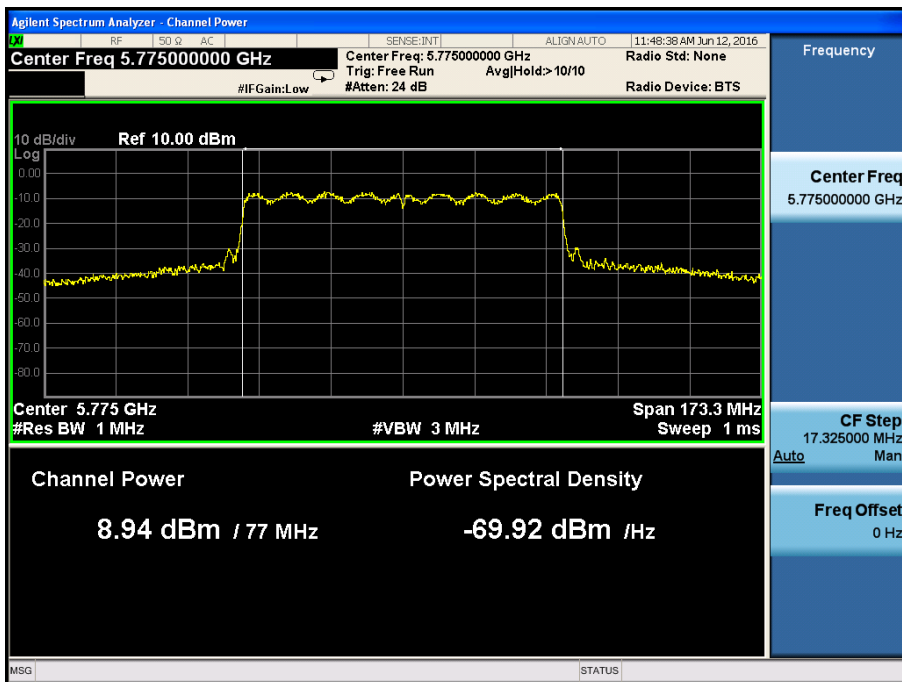


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



## 9. Conducted Spurious Emissions

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### 9.1 Standard Applicable

According to §15.407 (b) (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: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of  $-17$  dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.

### 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

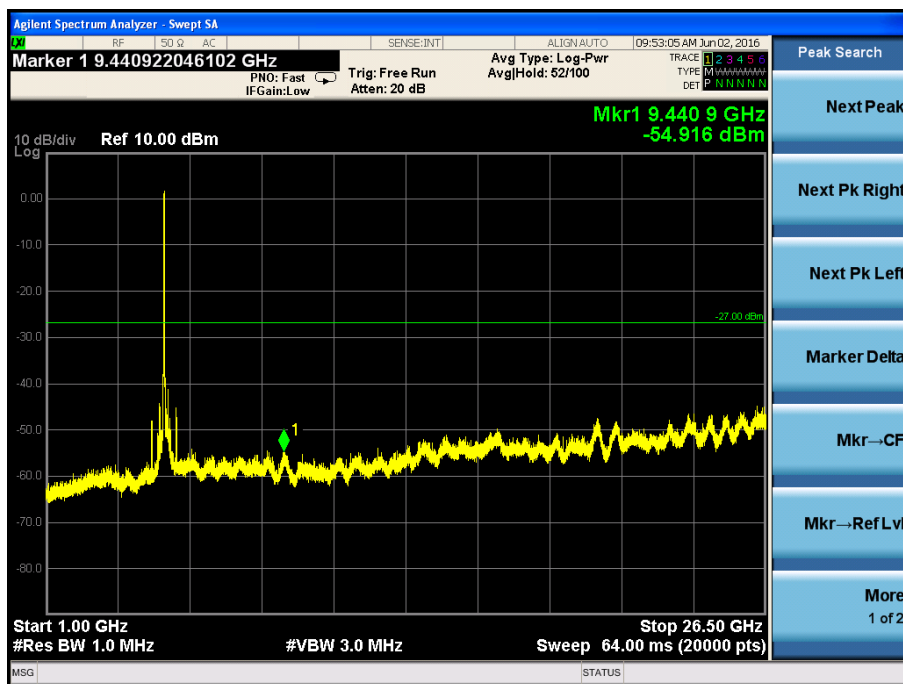
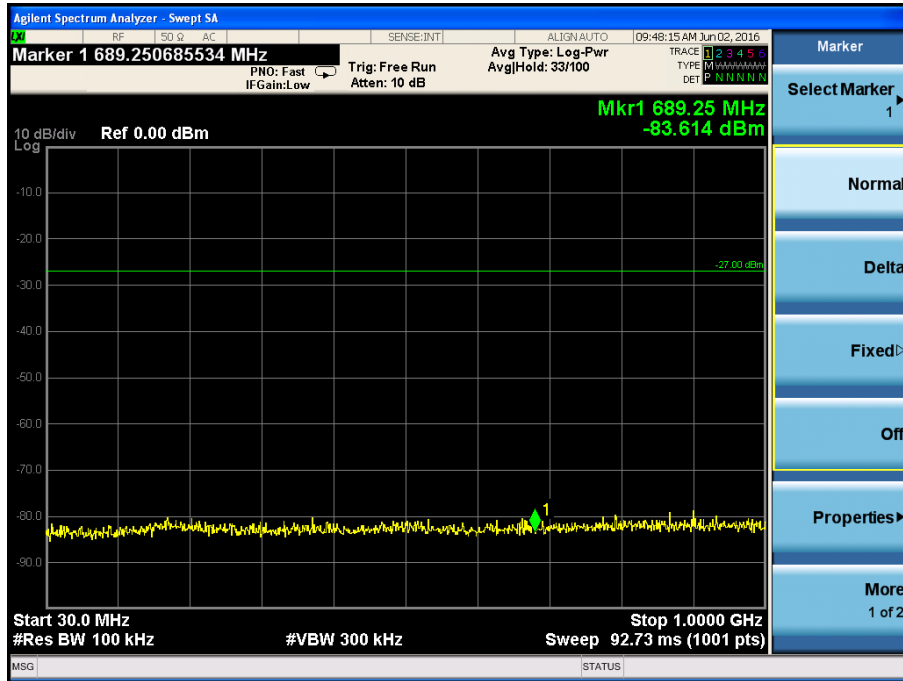
### 10.4 Summary of Test Results/Plots

Emissions above 26.5GHz are attenuated more than 20dB below the permissible limits and test data are not reported.

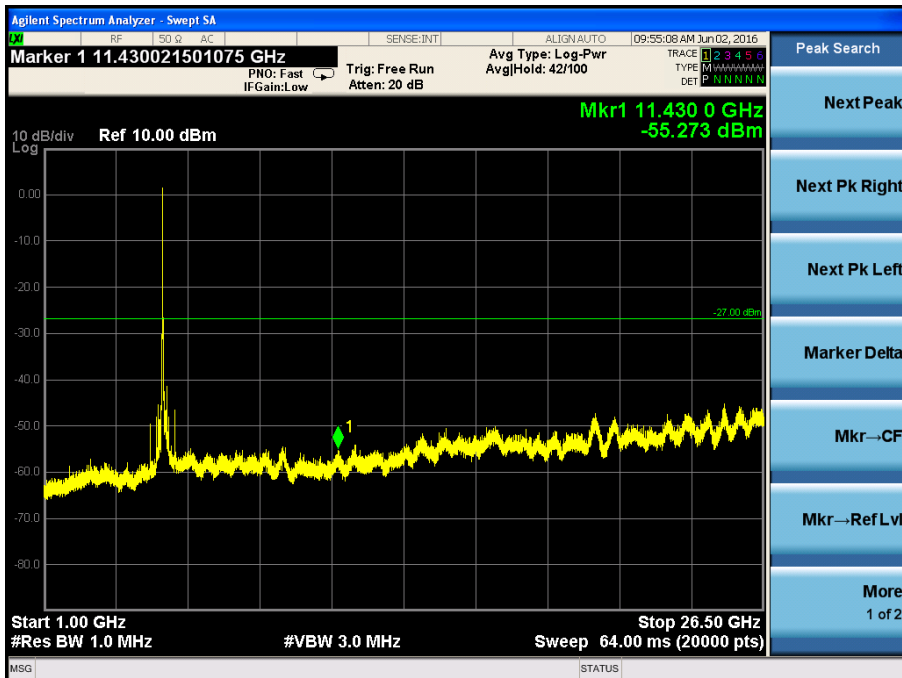
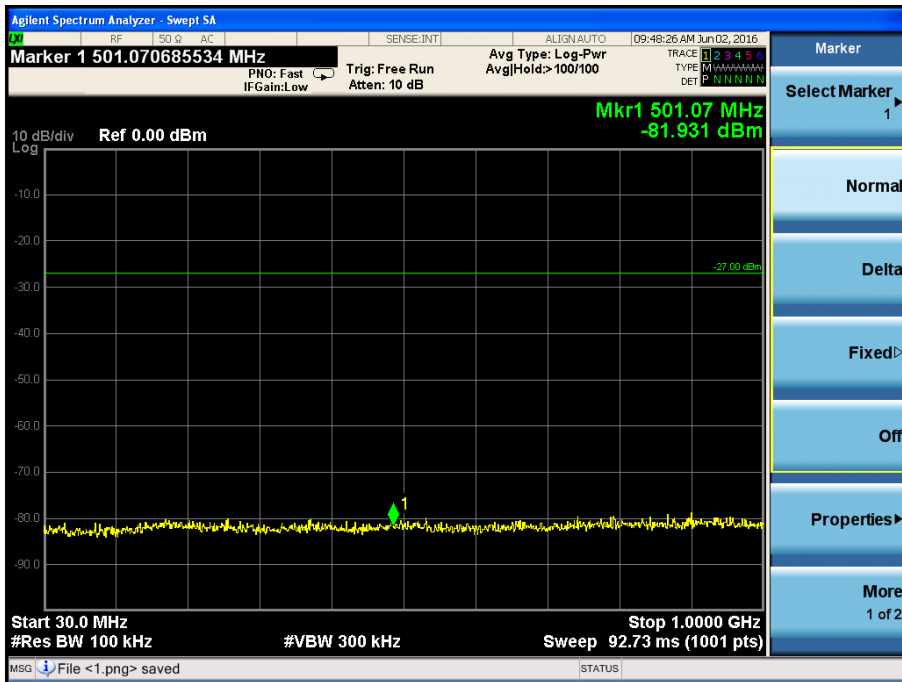
Antenna 1

802.11n-HT20

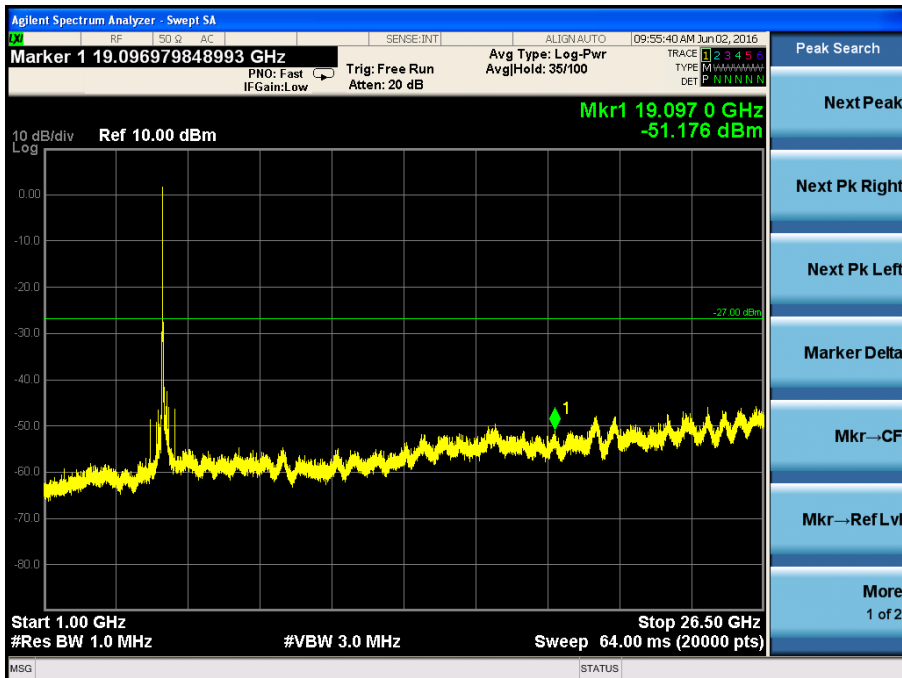
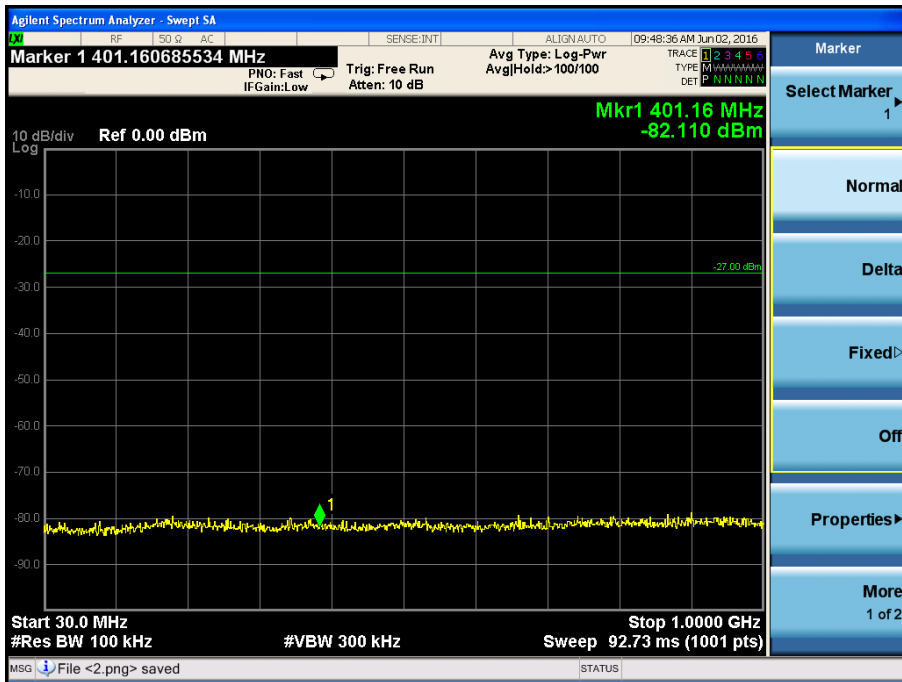
5180MHz



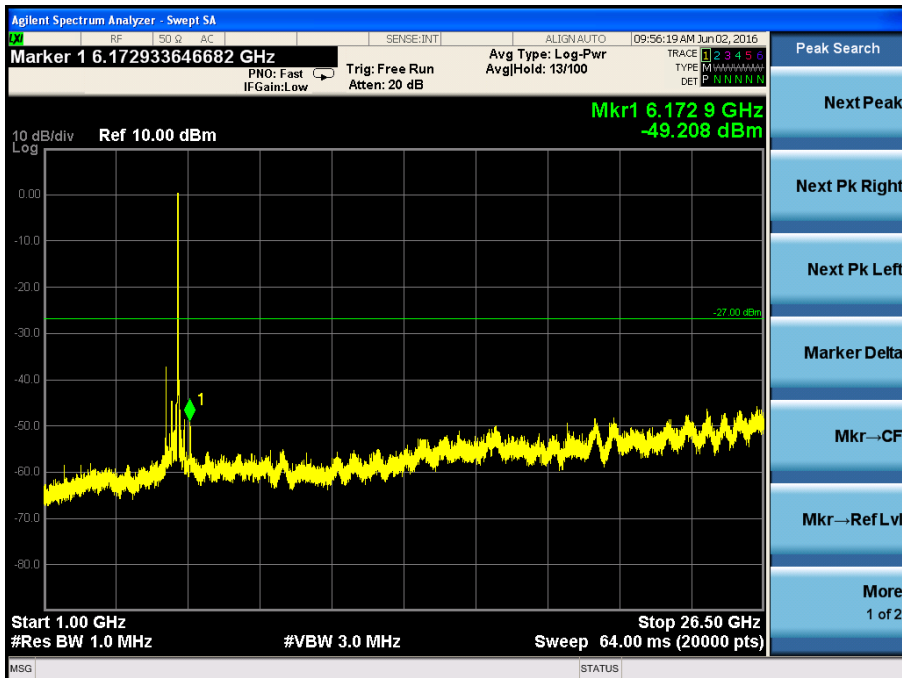
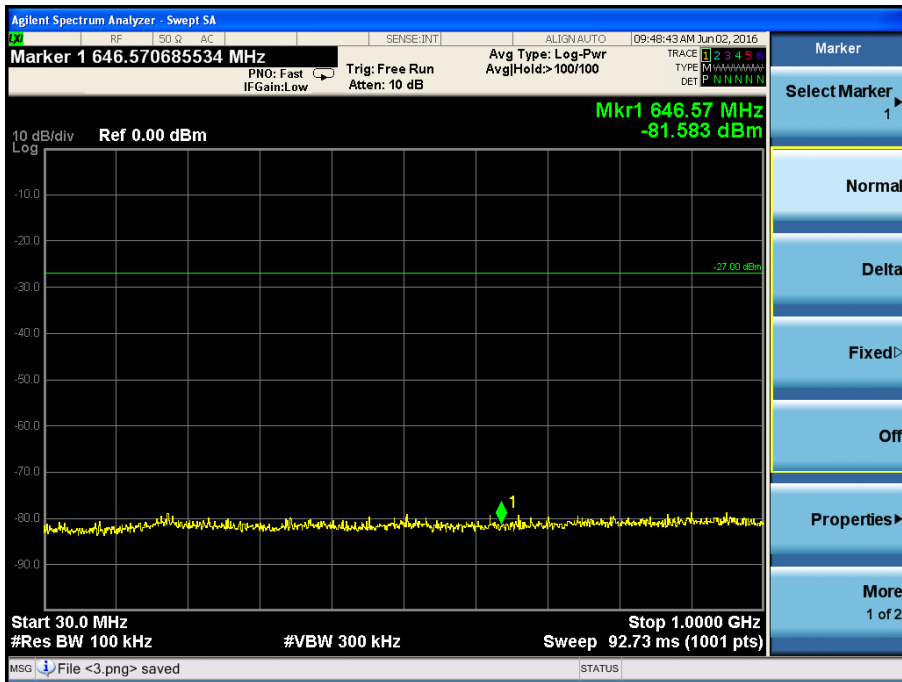
5200MHz



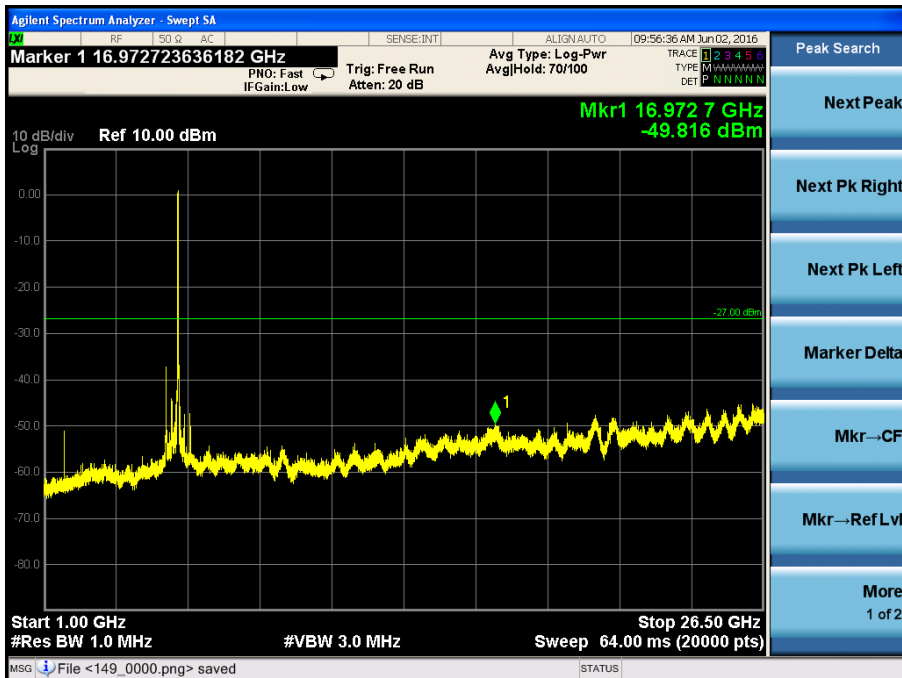
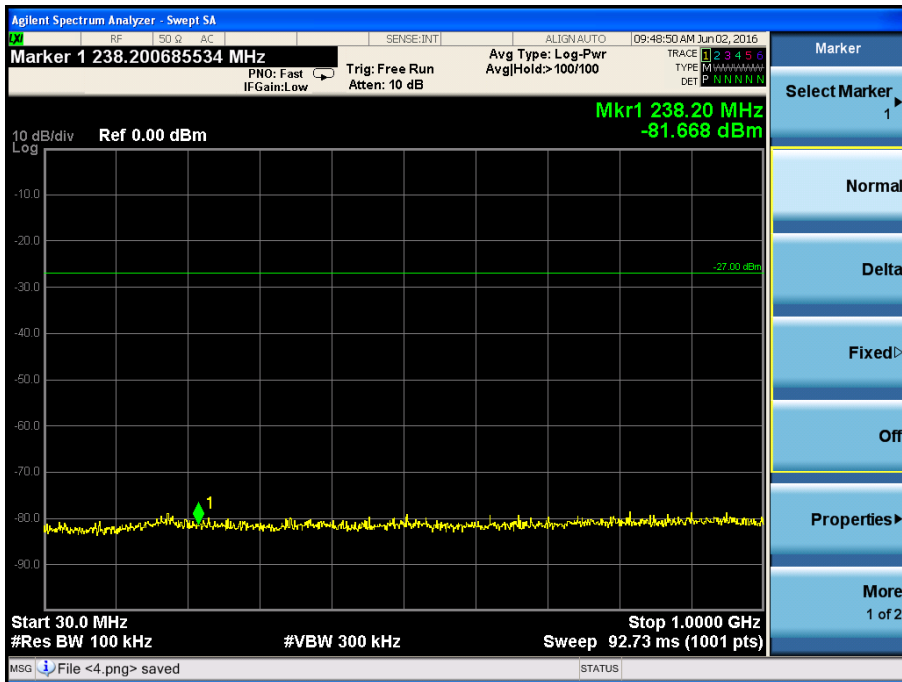
5240MHz



5745MHz

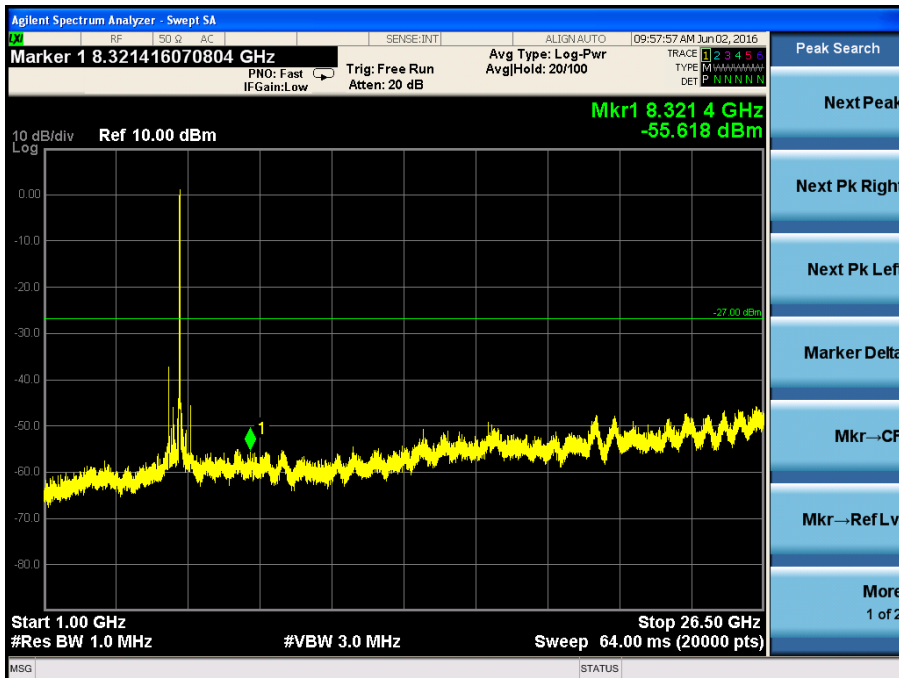
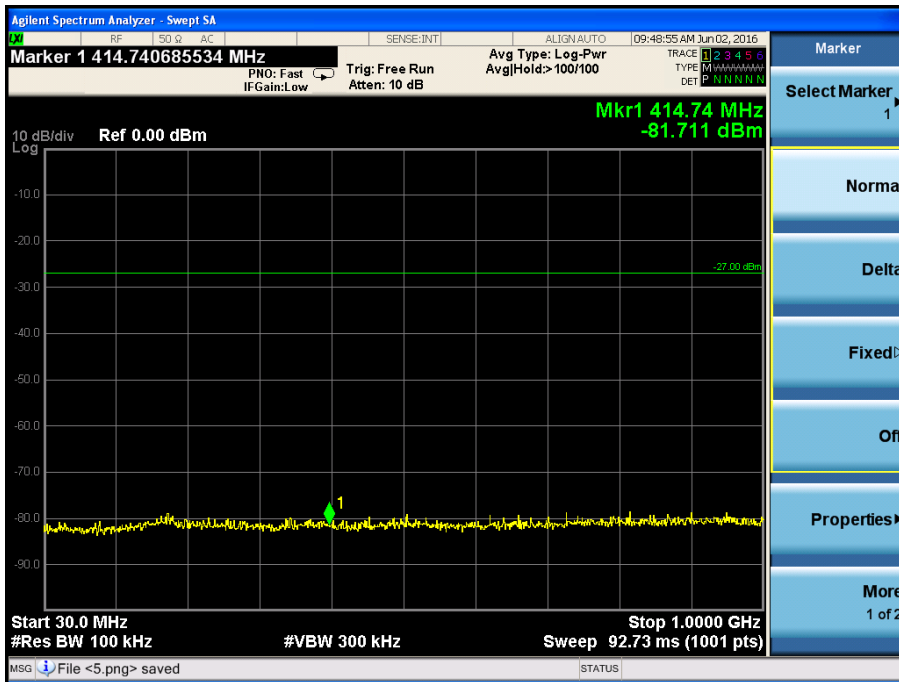


5785MHz

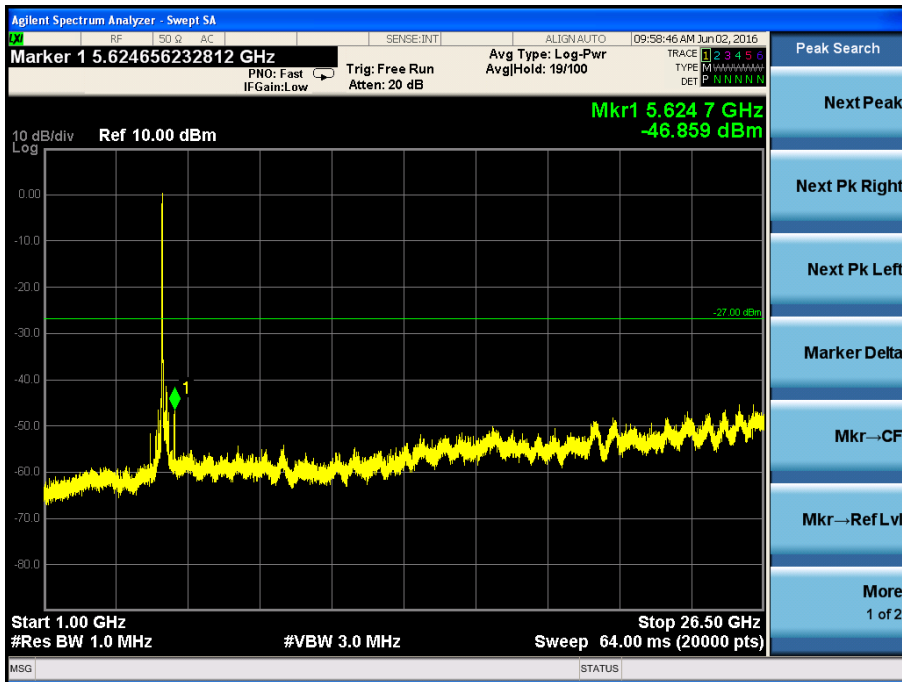
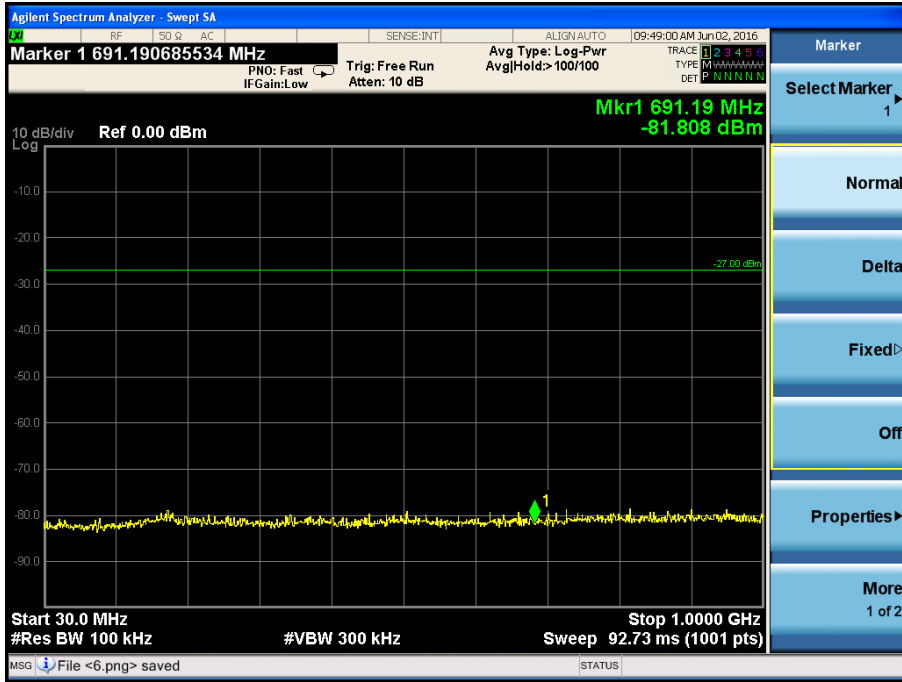




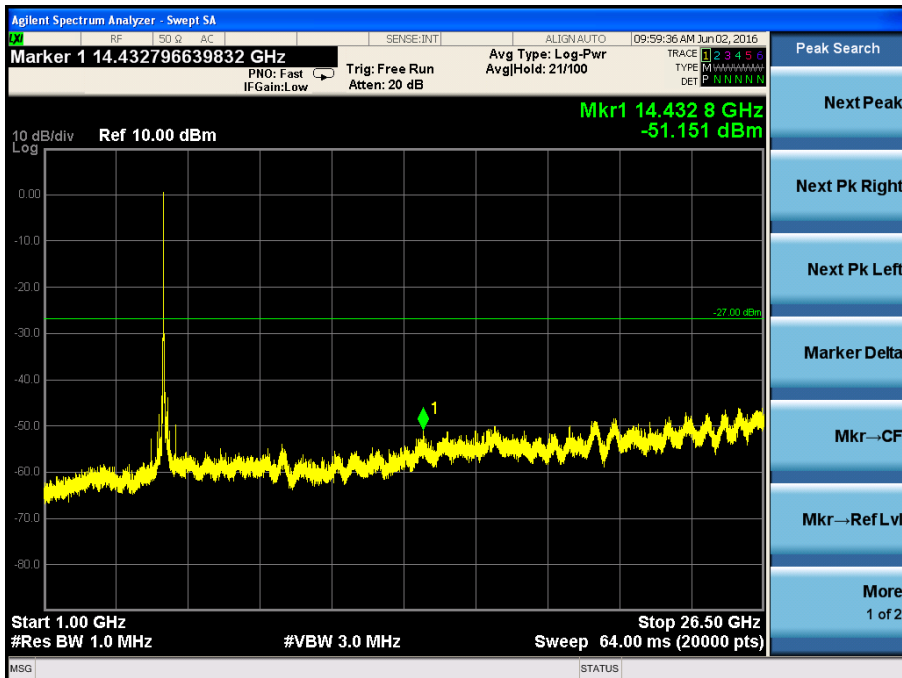
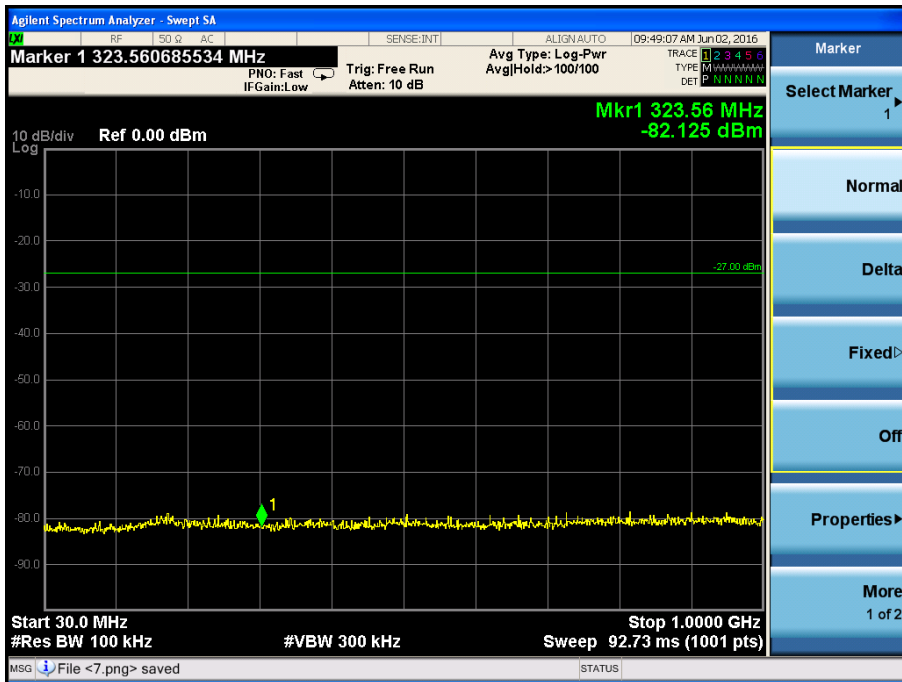
5825MHz



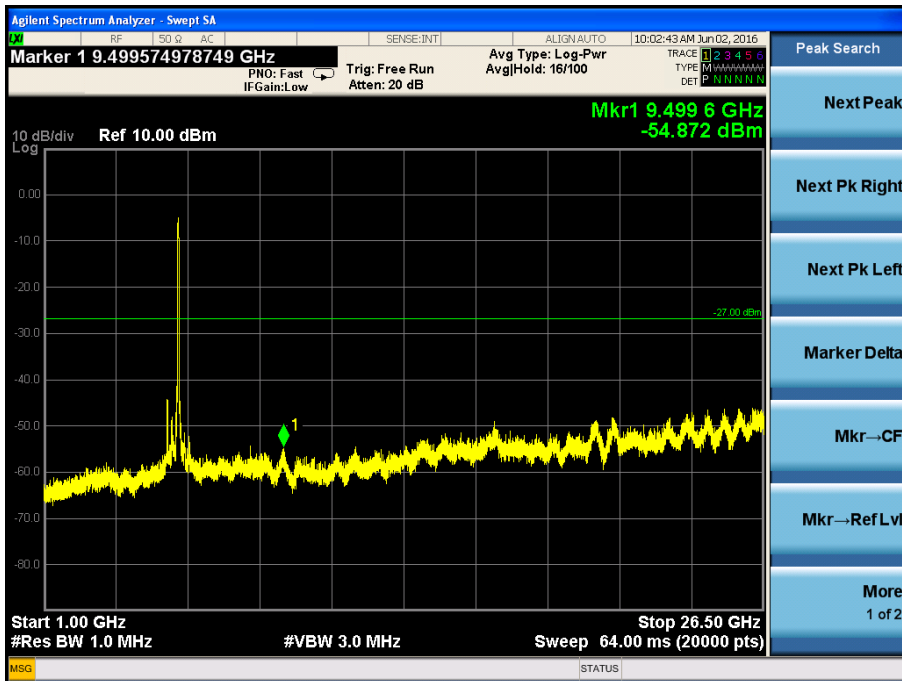
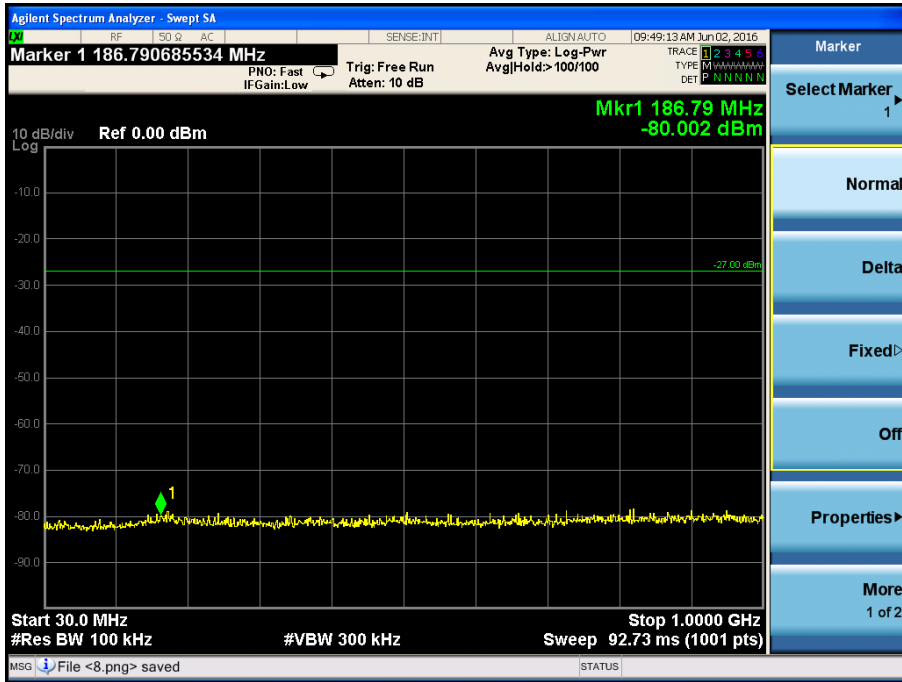
802.11n-HT40  
5190MHz



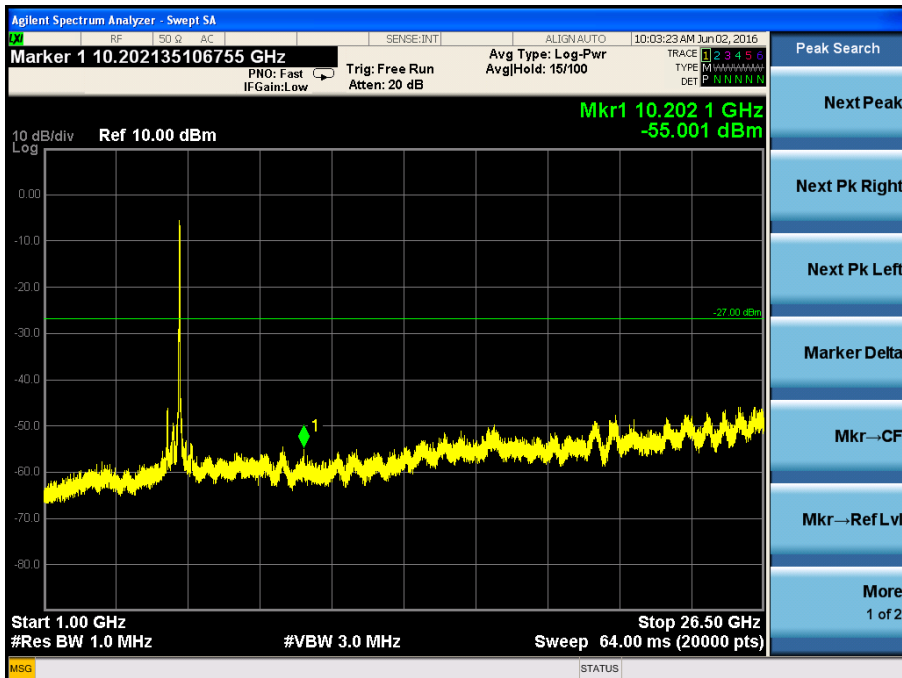
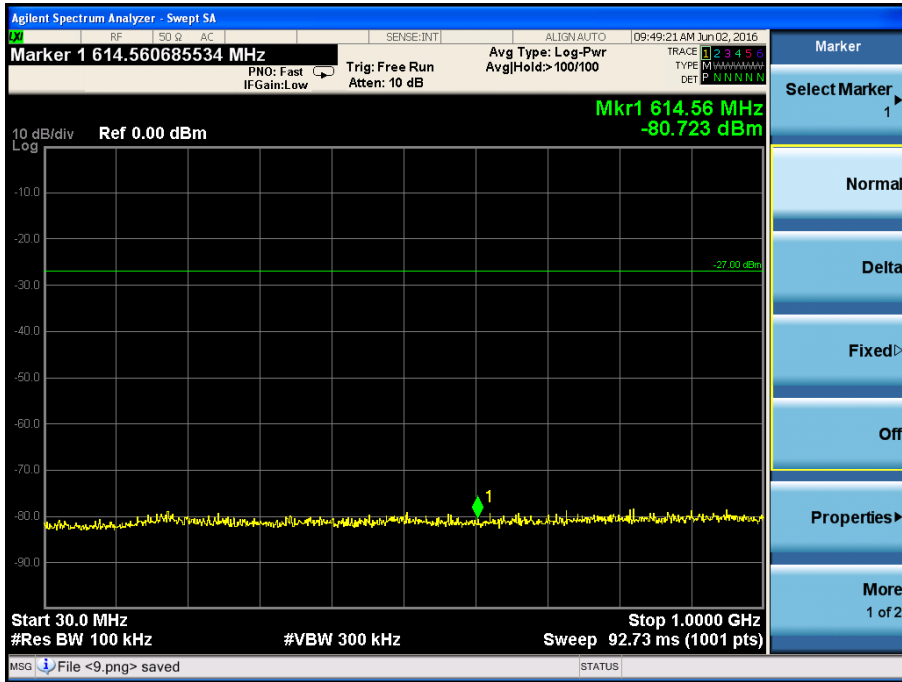
5230MHz



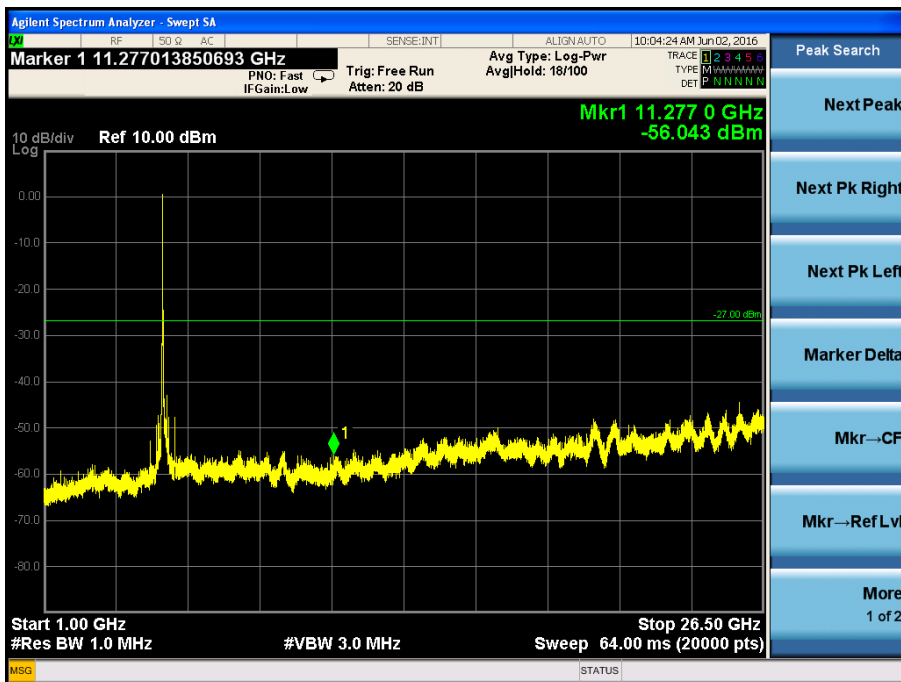
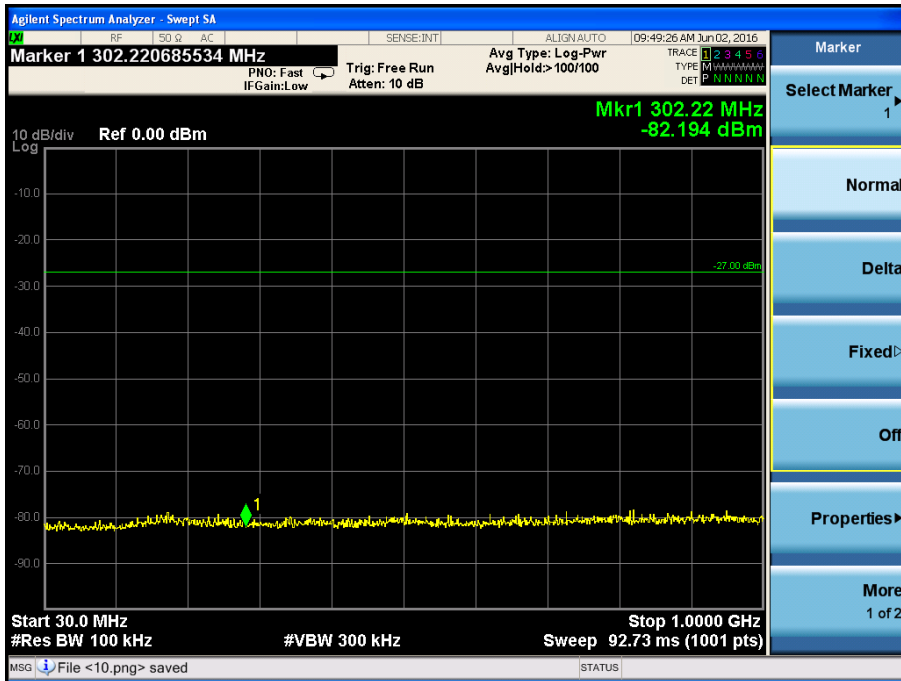
5755MHz



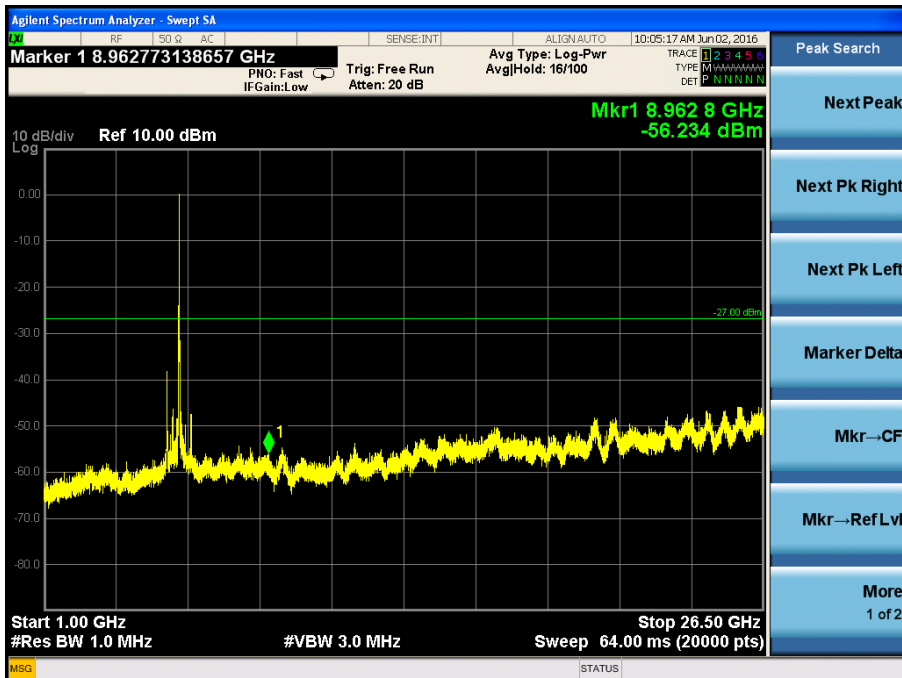
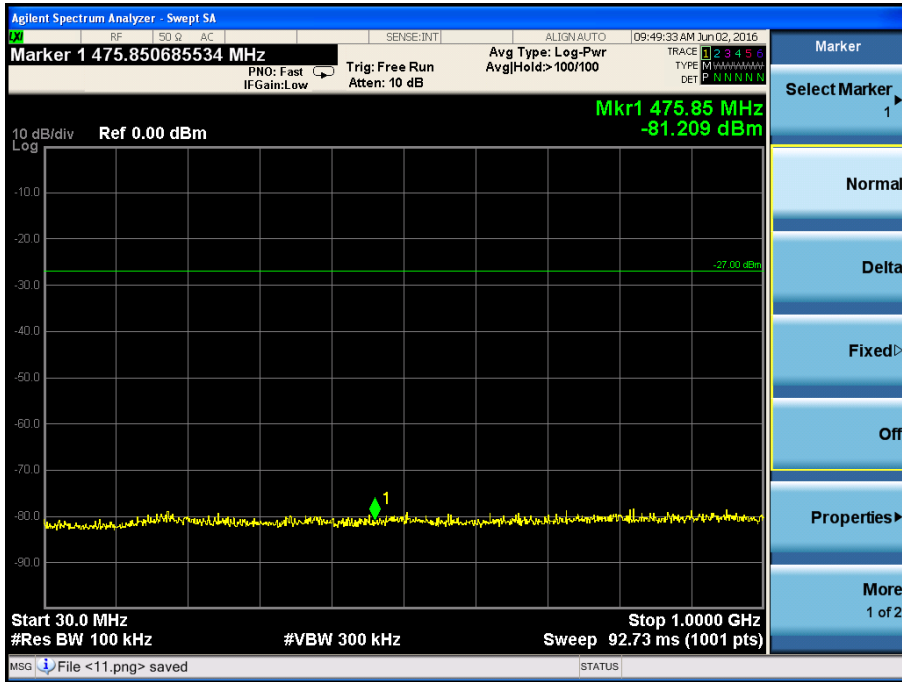
5795MHz



802.11ac-HT80  
5210MHz



5775MHz



Antenna 2  
 802.11n-HT20  
 5180MHz

