

FCC Part 15C

Measurement and Test Report

For

Hui Zhou Gaoshengda Technology Co.,LTD

NO.75 Zhongkai Development Area, Huizhou, Guangdong, China

FCC ID: 2AC23- WC0HR2601

FCC Rule(s):	<u>FCC Part 15E</u>
Product Description:	<u>WIFI Module</u>
Tested Model:	<u>WC0HR2601</u>
Report No.:	<u>FCC-ATL20161220974-2</u>
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Hui Zhou Gaoshengda Technology Co.,LTD
Address of applicant: NO.75 Zhongkai Development Area, Huizhou,
Guangdong, China

Manufacturer: Hui Zhou Gaoshengda Technology Co.,LTD
Address of manufacturer: NO.75 Zhongkai Development Area, Huizhou,
Guangdong, China

General Description of EUT	
Product Name:	WIFI Module
Trade Name:	GSD
Model No.:	WC0HR2601
Adding Model(s):	/
Hardware version:	V 1.1
Software version:	V 1.1

Technical Characteristics of EUT	
Wi-Fi(5G)	
Support Standards:	802.11a, 802.11n (20MHz,40MHz), 802.11ac (80MHz)
Frequency Range:	5180-5240MHz, 5745-5825MHz
RF Output Power:	18.95 dBm (Conducted)
Type of Modulation:	64QAM, 16QAM, QPSK, BPSK
Data Rate:	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to MCS7
Quantity of Channels:	5180 ~ 5240MHz: 4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz), 1 for 2 for 802.11n (80MHz) 5745 ~ 5805MHz: 4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz), 1 for 2 for 802.11ac (80MHz)
Channel Separation:	20MHz/40MHz/80MHz
Type of Antenna:	PIFA Antenna
Antenna Gain:	Antenna 1:3dBi, Antenna 2: 3dBi

1.2 Test Standards

The following report is prepared on behalf of the Hui Zhou Gaoshengda Technology Co.,LTD in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.407 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 15.407 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 v01 for Unlicensed National Information Infrastructure (U-NII) Devices and KDB 662911 D01 Multiple Transmitter Output v02r01 shall be performed also.

1.4 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, 5745 MHz,5785 MHz,5825 MHz	
TM2	802.11n-HT20	5180MHz,5200MHz,5240MHz, 5745MHz,5785MHz,5825MHz	
TM3	802.11n-HT40	5190MHz,5230MHz,5755 MHz,5795 MHz	
TM4	802.11n-HT80	5210 MHz,5755 MHz	

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

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
DC Cable	1.0	Unshielded	Without Core

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.5 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

1.6 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
Spectrum Analyzer	Rohde & Schwarz	FSP	836079/035	2016-06-04	2017-06-03
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
Horn Antenna	ETS	3116B	00088203	2016-06-04	2017-06-03
Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03
Power Meter	R&S	NRVS	100444	2016-06-18	2017-06-17

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 RF Exposure 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 integral antennas, fulfill the requirement of this section.

5. Power Spectral Density

5.1 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.

5.2 Test Procedure

According to 789033 D02 v01 section F, 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 ≥ 3 RBW.
- c) 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.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1\text{MHz}/\text{RBW})$ 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.

5.3 Environmental Conditions

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

5.4 Summary of Test Results/Plots

802.11a

5150-5250:

Channel	Channel frequency(MHz)	Chain 1 dBm/MHz	Chain 2 dBm/MHz	Total dBm/MHz	Limit (dBm/MHz)
36	5180	6.923	2.780	8.34	11
40	5200	7.250	3.292	8.72	11
48	5240	7.272	4.848	9.24	11

5725-5825:

Channel	Channel frequency(MHz)	Chain 1 dBm/500KHz	Chain 2 dBm/500KHz	Total dBm/500KHz	Limit (dBm/500KHz)
149	5745	1.382	0.291	3.87	30
157	5785	1.109	0.088	3.64	30
165	5825	1.363	-0.129	3.69	30

802.11n20

5150-5250:

Channel	Channel frequency(MHz)	Chain 1 dBm/MHz	Chain 2 dBm/MHz	Total dBm/MHz	Limit (dBm/MHz)
36	5180	7.383	1.670	8.42	11
40	5200	6.906	0.523	7.80	11
48	5240	6.872	2.821	8.31	11

5725-5825:

Channel	Channel frequency(MHz)	Chain 1 dBm/500KHz	Chain 2 dBm/500KHz	Total dBm/500KHz	Limit (dBm/500KHz)
149	5745	1.072	0.019	3.58	30
157	5785	0.948	0.525	3.75	30
165	5825	1.055	1.025	4.05	30

802.11n40

5150-5250:

Channel	Channel frequency(MHz)	Chain 1 dBm/MHz	Chain 2 dBm/MHz	Total dBm/MHz	Limit (dBm/MHz)
38	5190	4.045	7.329	9.00	11
46	5230	5.569	6.805	9.24	11

5725-5825:

Channel	Channel frequency(MHz)	Chain 1 dBm/500KHz	Chain 2 dBm/500KHz	Total dBm/500KHz	Limit (dBm/500KHz)
151	5755	1.269	-2.656	2.74	30
159	5795	-5.716	-2.605	-0.86	30

802.11ac80

5150-5250:

Channel	Channel frequency(MHz)	Chain 1 dBm/MHz	Chain 2 dBm/MHz	Total dBm/MHz	Limit (dBm/MHz)
42	5210	-2.496	2.842	0.34	11

5725-5825:

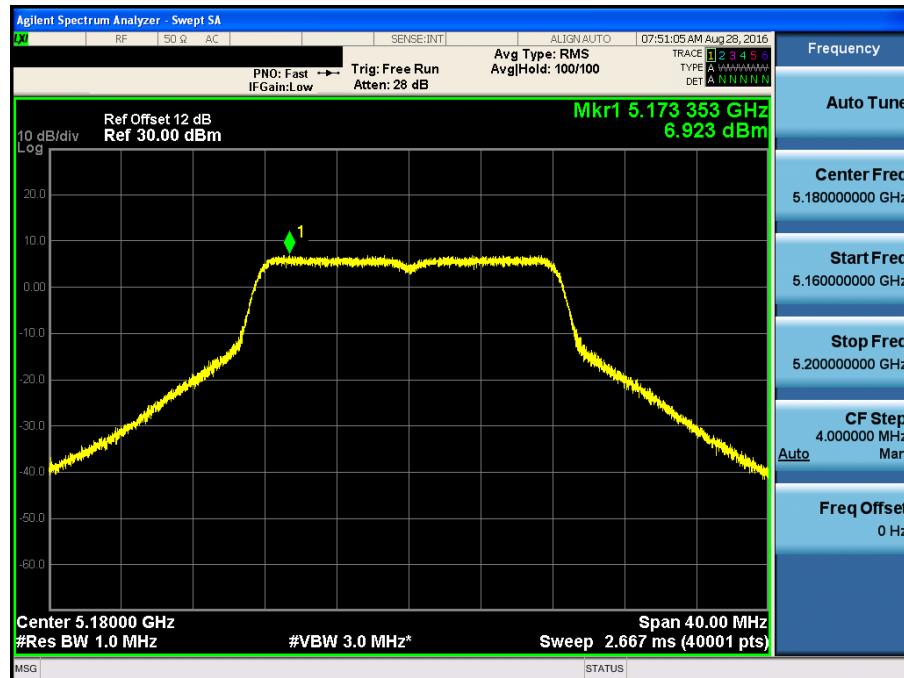
Channel	Channel frequency(MHz)	Chain 1 dBm/500KHz	Chain 2 dBm/500KHz	Total dBm/500KHz	Limit (dBm/500KHz)
155	5775	-5.183	-4.528	-1.87	30

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.

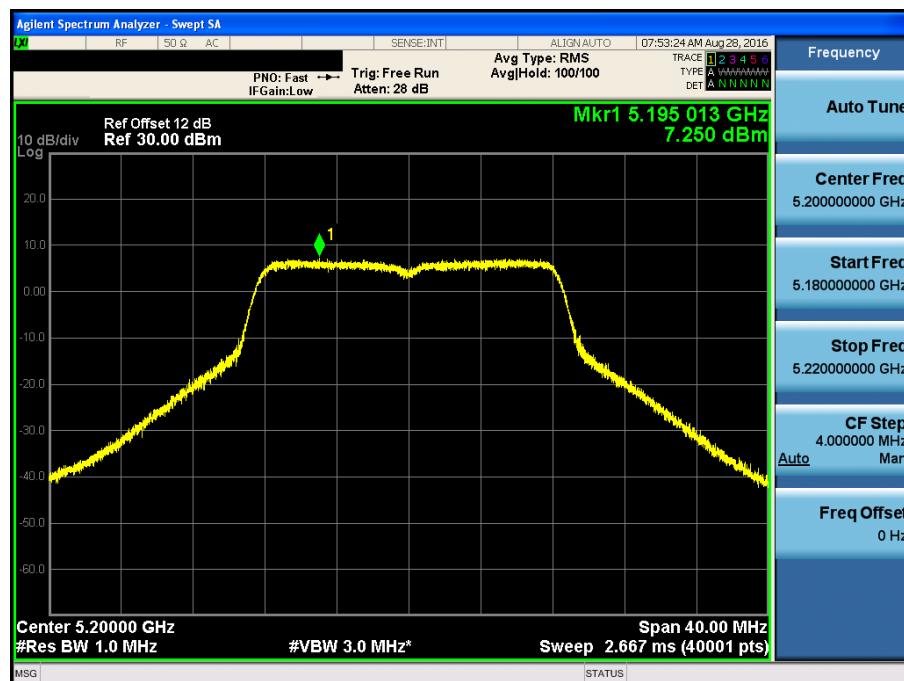
Antenna 1

Test Mode: 802.11a

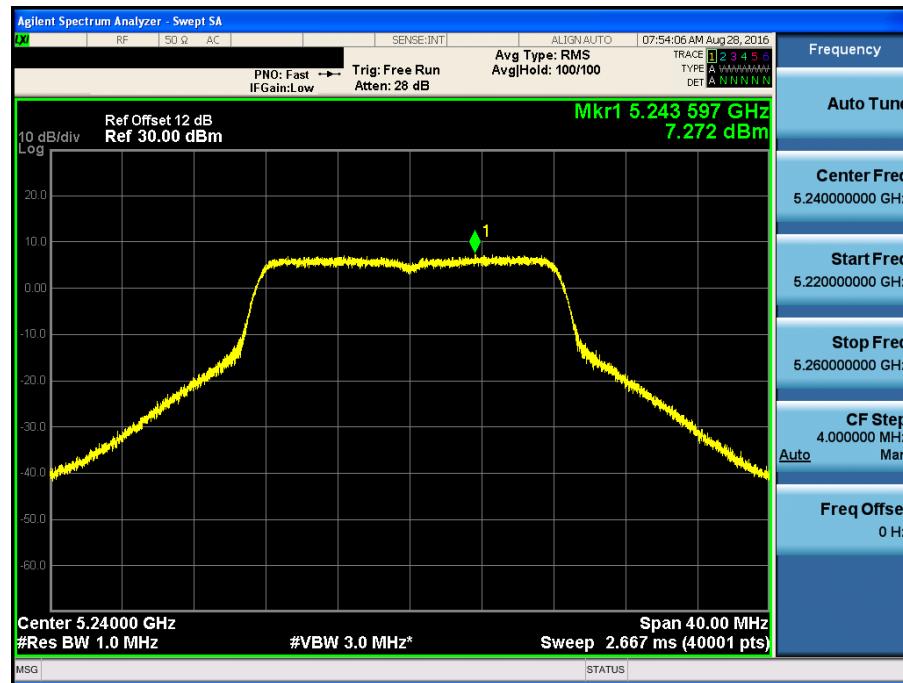
5180MHz



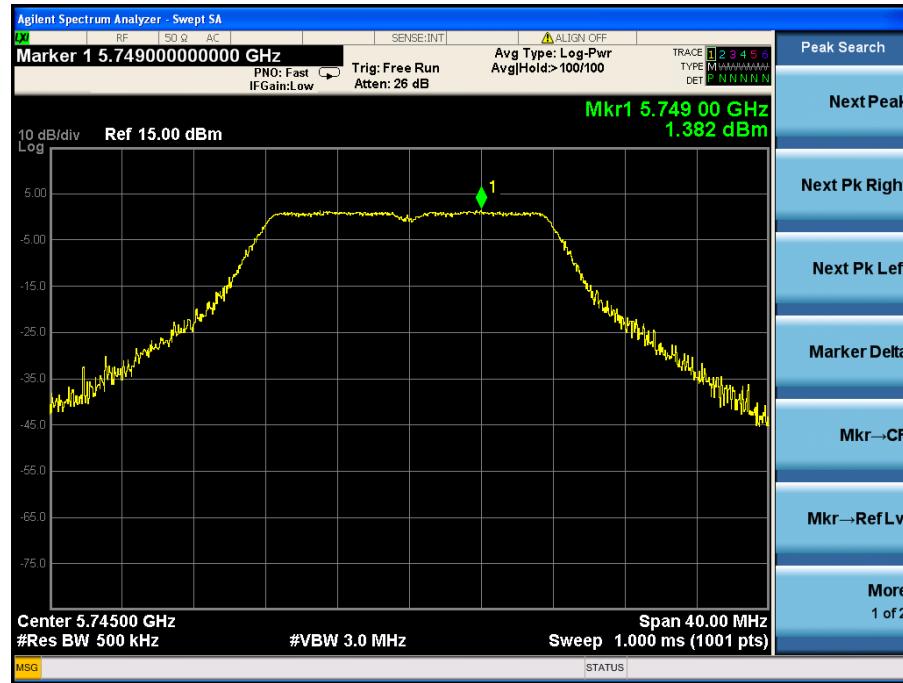
5200MHz



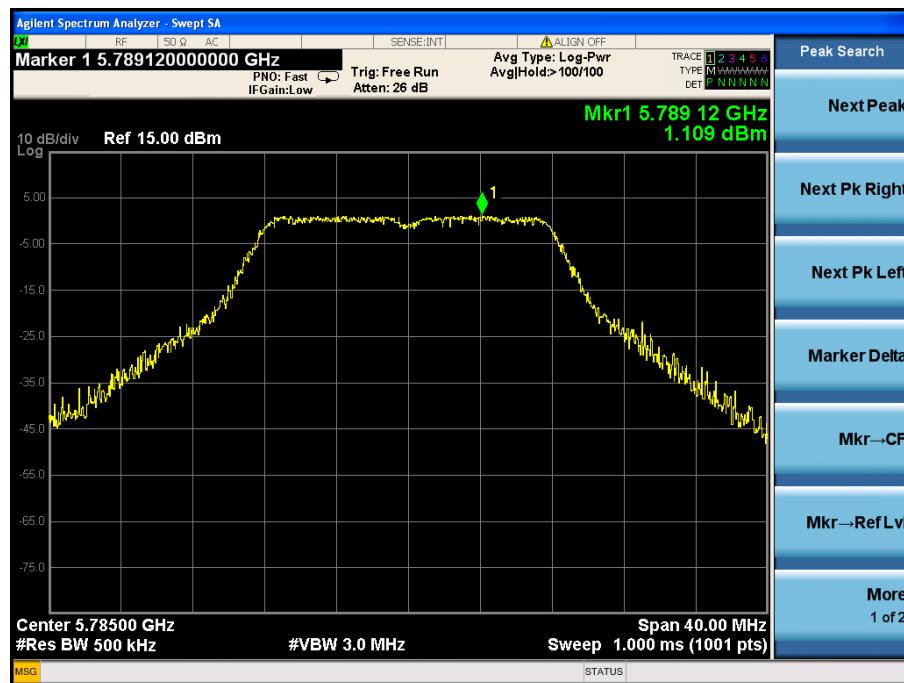
5240MHz



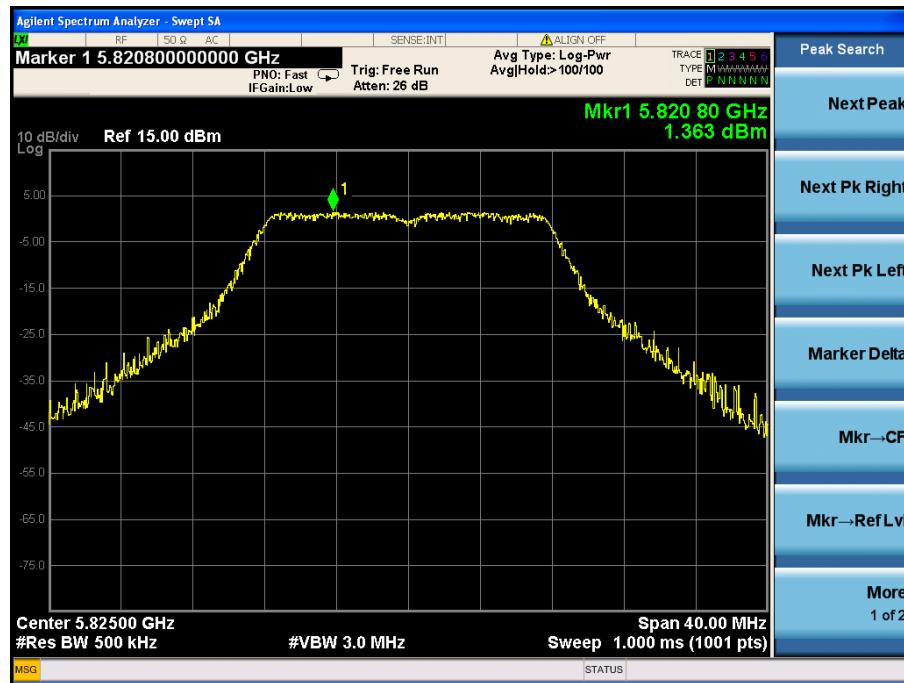
5745MHz



5785MHz

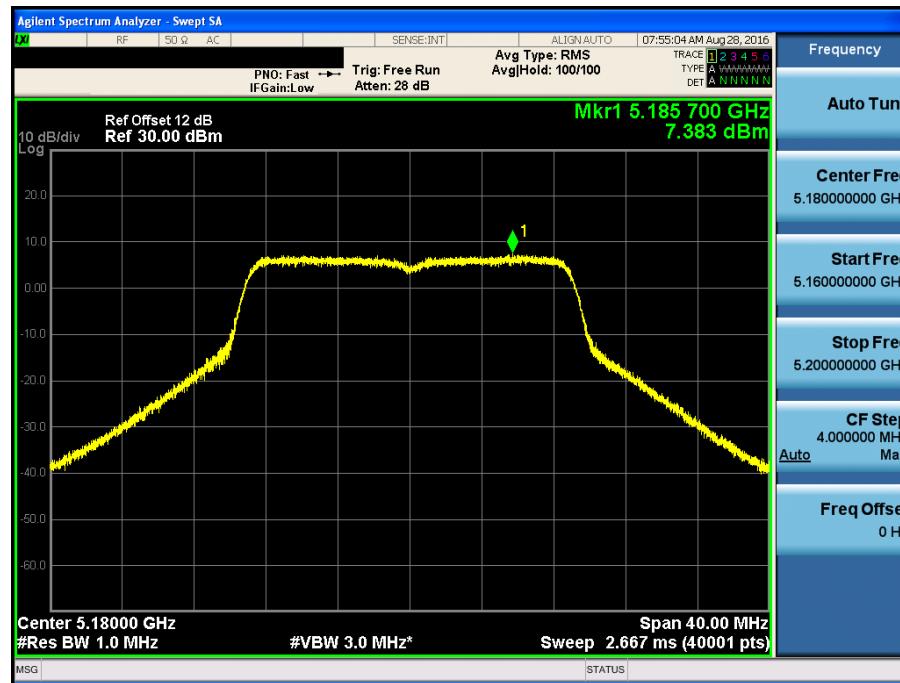


5825MHz

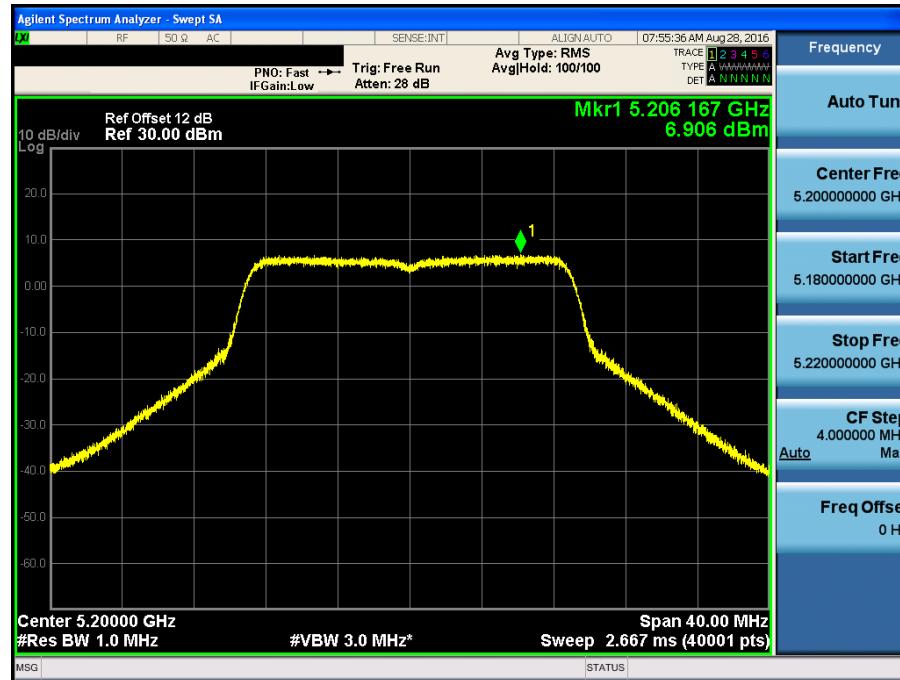


Test Mode: 802.11n20

5180MHz



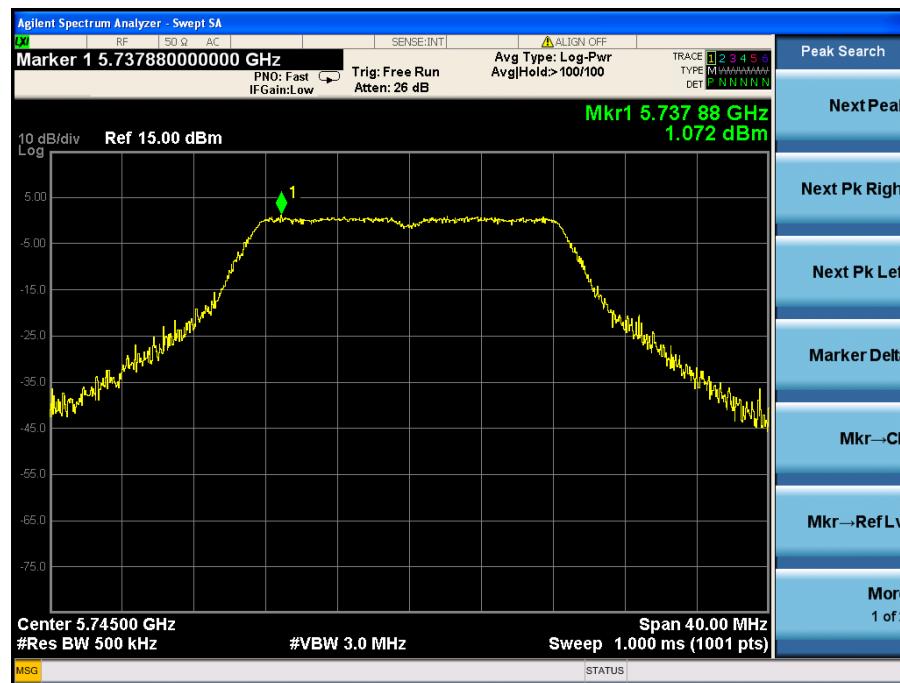
5200MHz



5240MHz



5745MHz



5785MHz



5825MHz



Test Mode: 802.11n-HT40

5190MHz



5230MHz



5755MHz



5795MHz



Test Mode: 802.11ac 80

5210MHz



5775MHz



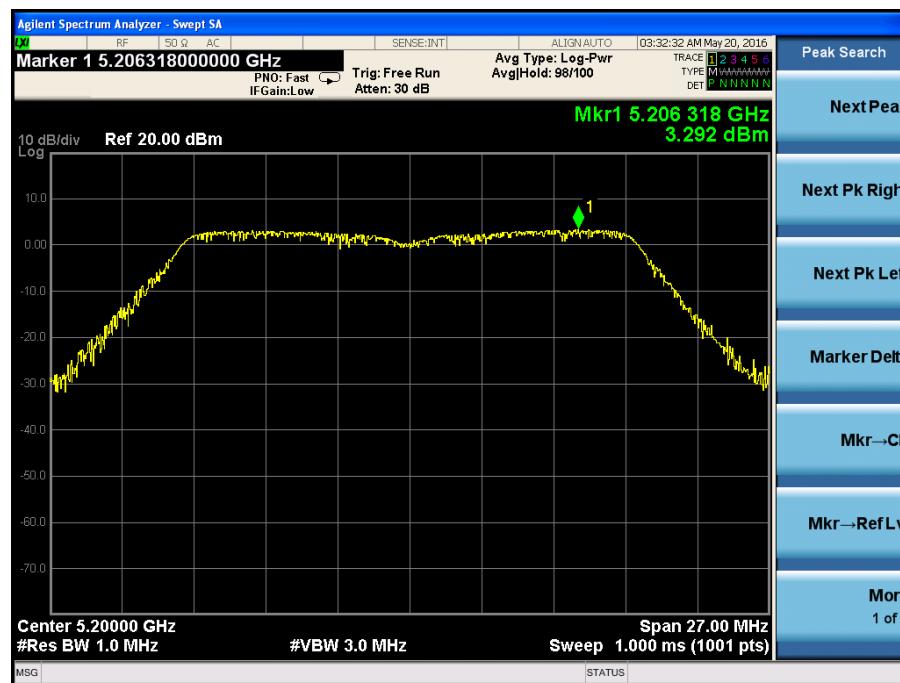
Antenna 2

Test Mode: 802.11a

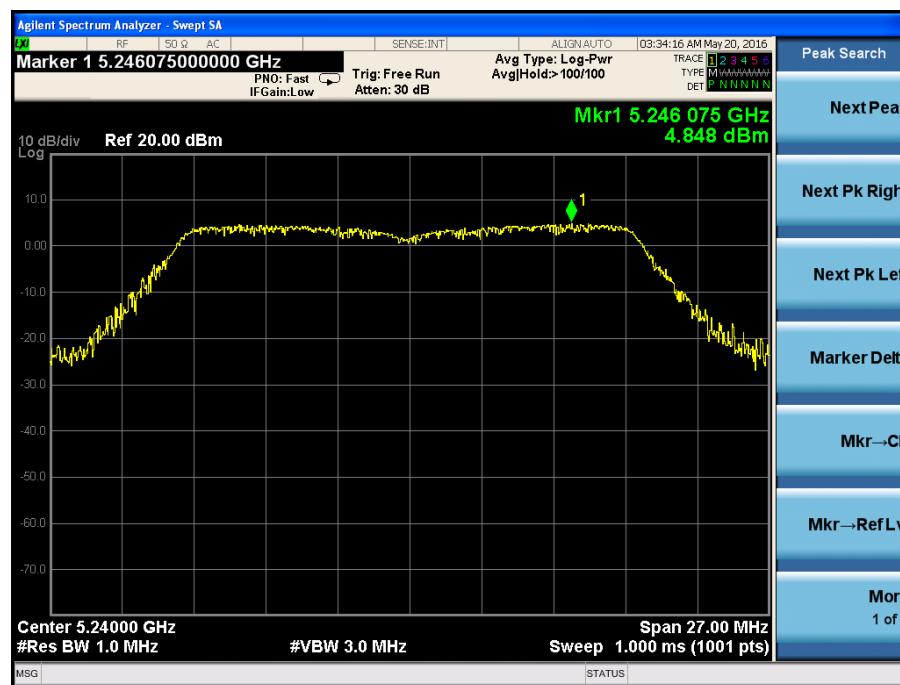
5180MHz



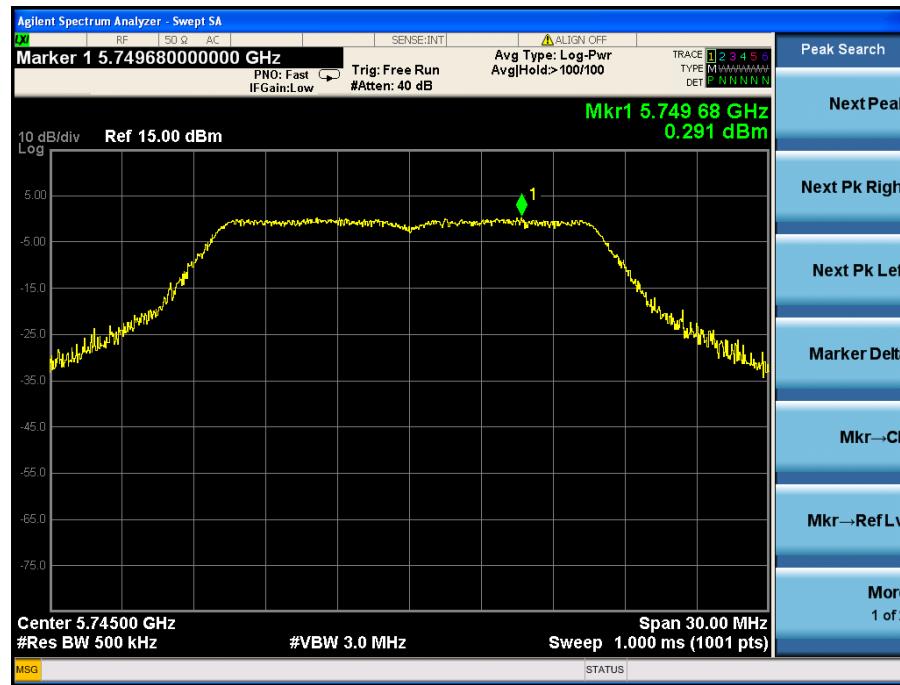
5200MHz



5240MHz



5745MHz



5785MHz

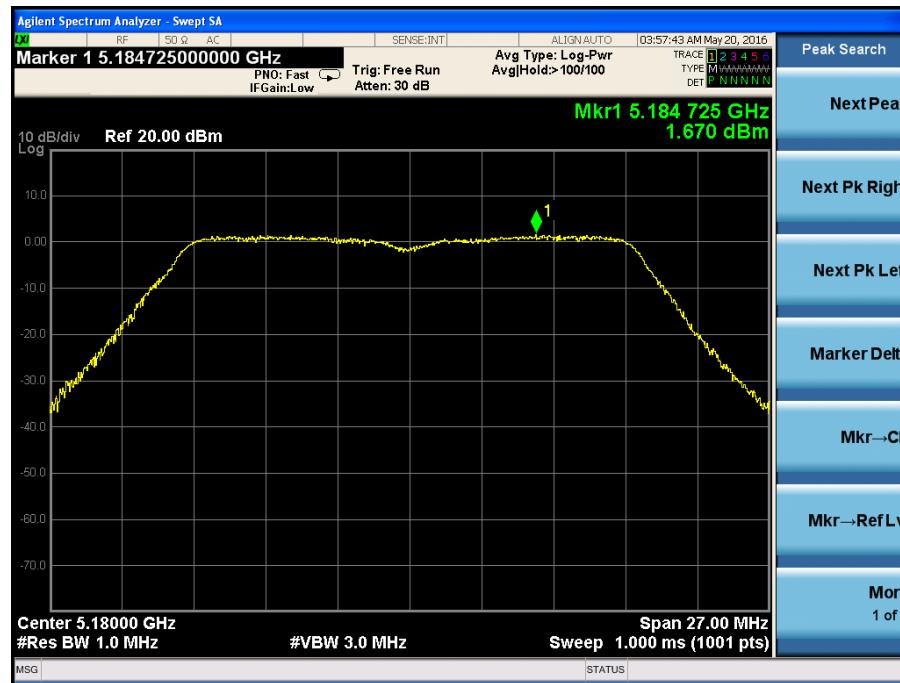


5825MHz

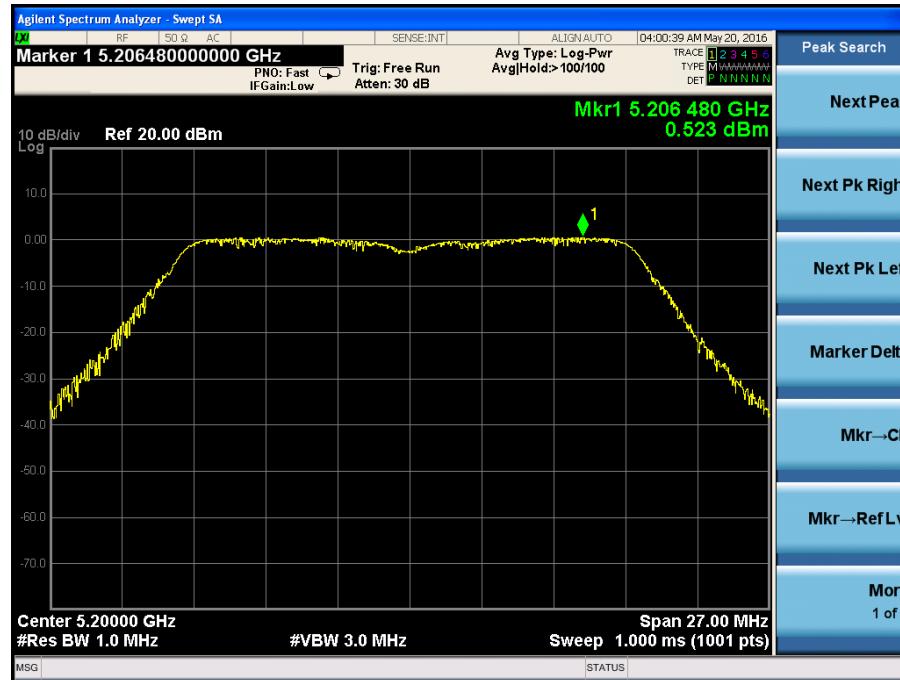


Test Mode: 802.11n20

5180MHz



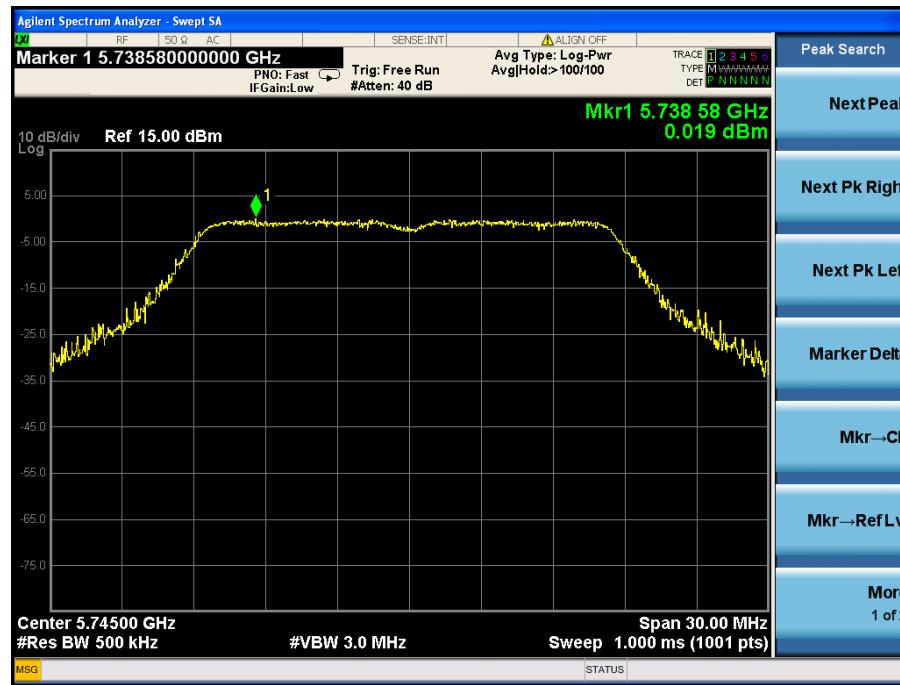
5200MHz



5240MHz



5745MHz



5785MHz



5825MHz

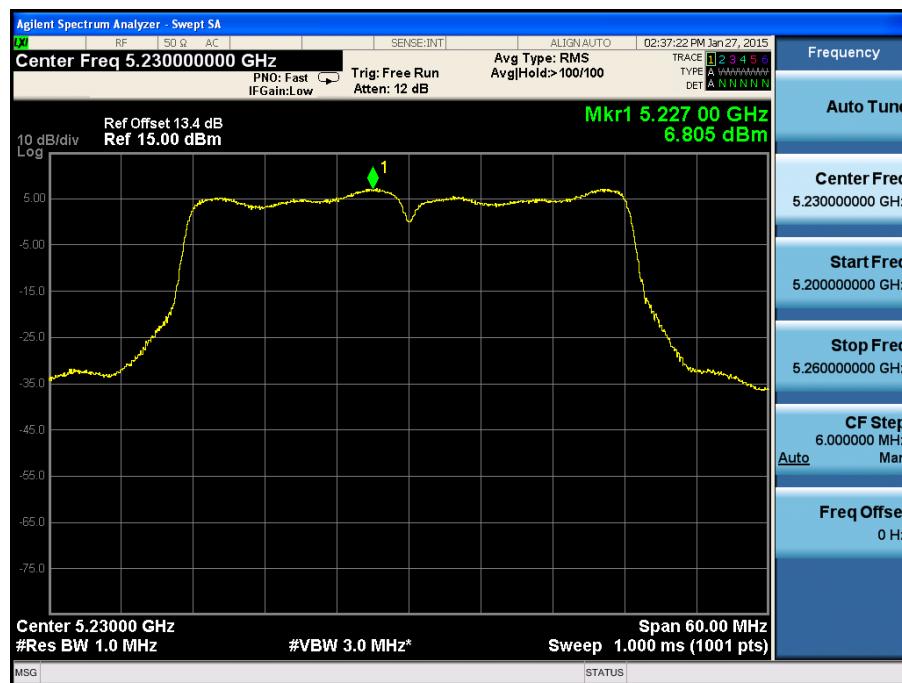


Test Mode: 802.11n-HT40

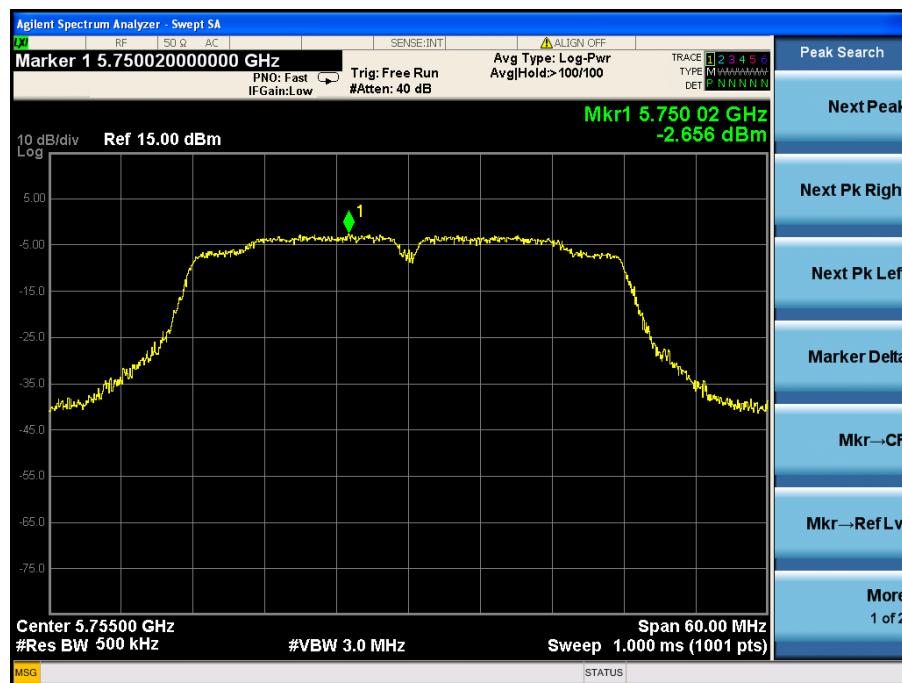
5190MHz



5230MHz



5755MHz



5795MHz

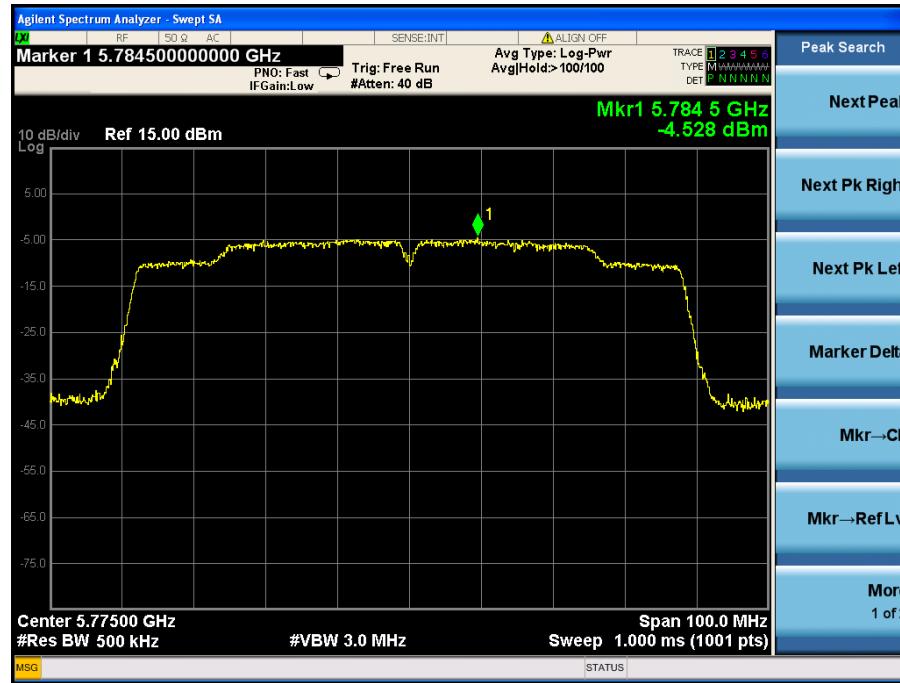


Test Mode: 802.11ac-HT80

5210MHz



5775MHz



6. Emission Bandwidth and Occupied Bandwidth

6.1 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.

6.2 Test Procedure

According to 789033 D02 v01 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 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 $\geq 3 \times$ 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.

6.3 Environmental Conditions

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

6.4 Summary of Test Results/Plots

Antenna 1

802.11a

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99 % Bandwidth MHz	Limit (dBm/MHz)
36	5180	21.692	17.1313	--
40	5200	21.509	17.0913	--
48	5240	21.433	17.0429	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
149	5745	16.45	16.441	≥500
157	5785	16.46	16.432	≥500
161	5805	16.40	16.411	≥500

802.11n20

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99 % Bandwidth MHz	Limit (dBm/MHz)
36	5180	21.517	18.0071	--
40	5200	21.619	17.9150	--
48	5240	21.466	17.9344	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
149	5745	17.61	17.677	≥500
157	5785	17.60	17.742	≥500
165	5825	17.02	17.691	≥500

802.11n40

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
38	5190	40.467	36.5855	--
46	5230	40.029	36.5097	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
151	5755	36.30	36.252	≥500
159	5795	36.34	36.261	≥500

802.11ac80

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
42	5210	81.385	75.5739	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
155	5755	75.15	75.028	≥500

Antenna 2
802.11a

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
36	5180	21.82	17.151	--
40	5200	21.65	17.027	--
48	5240	21.44	16.936	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
149	5745	16.36	16.516	≥500
157	5785	16.36	16.520	≥500
165	5825	16.37	16.520	≥500

802.11n20

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
36	5180	21.72	18.091	--
40	5200	22.29	18.079	--
48	5240	21.83	18.051	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
149	5745	17.60	17.700	≥500
157	5785	17.59	17.705	≥500
165	5825	17.62	17.729	≥500

802.11n40

Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
38	5190	55.15	36.884	--
46	5230	50.62	36.661	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
151	5755	36.35	36.163	≥500
159	5795	36.36	36.153	≥500

802.11ac80

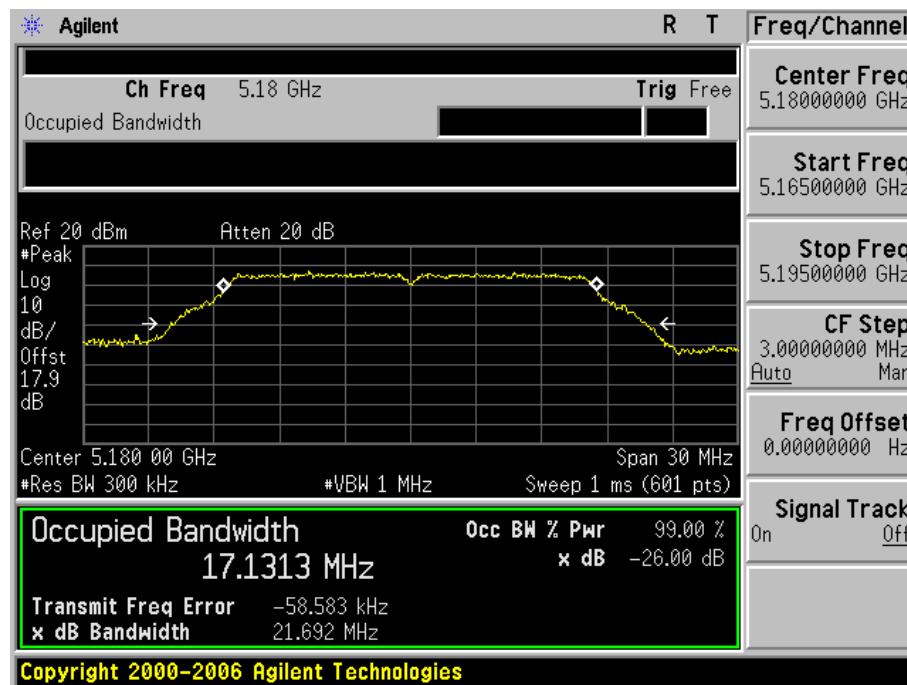
Channel	Channel frequency(MHz)	26 dB Bandwidth MHz	99% Bandwidth MHz	Limit (dBm/MHz)
42	5210	102.6	75.907	--

Channel	Channel frequency(MHz)	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
155	5755	76.12	75.575	≥500

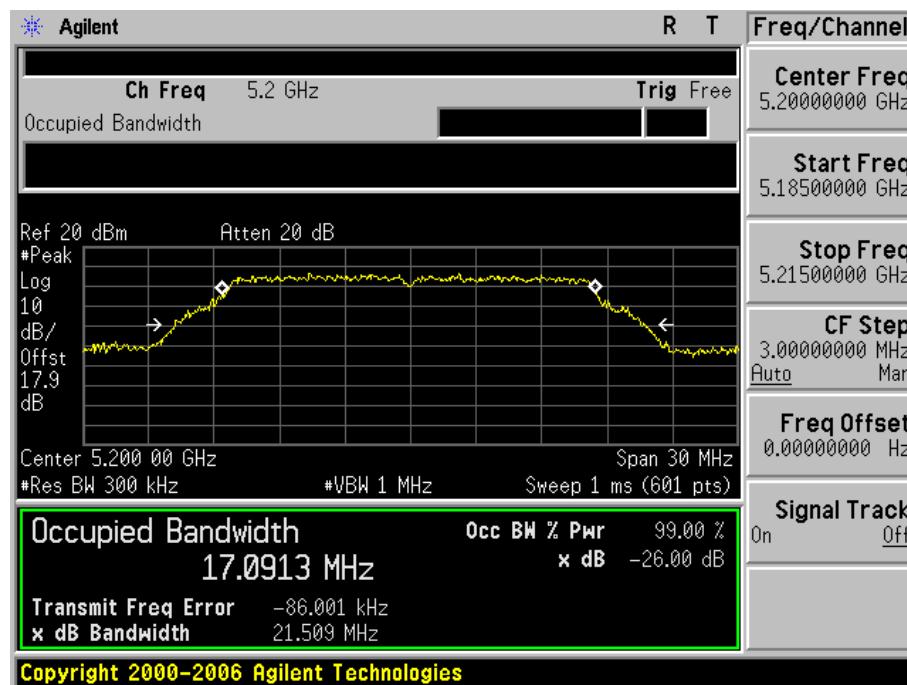
Antenna 1

Test Mode: 802.11a

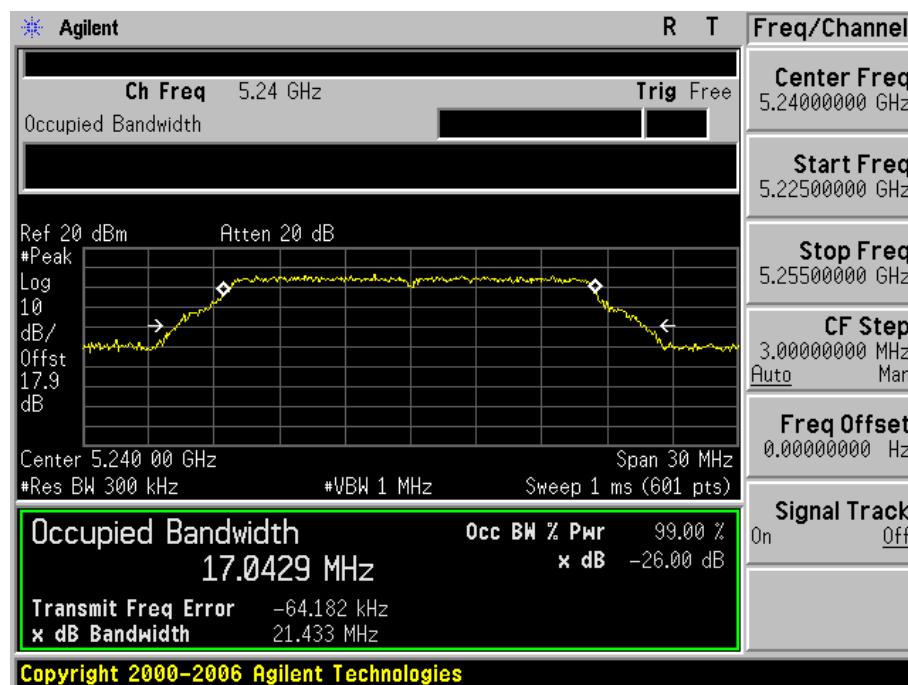
5180MHz



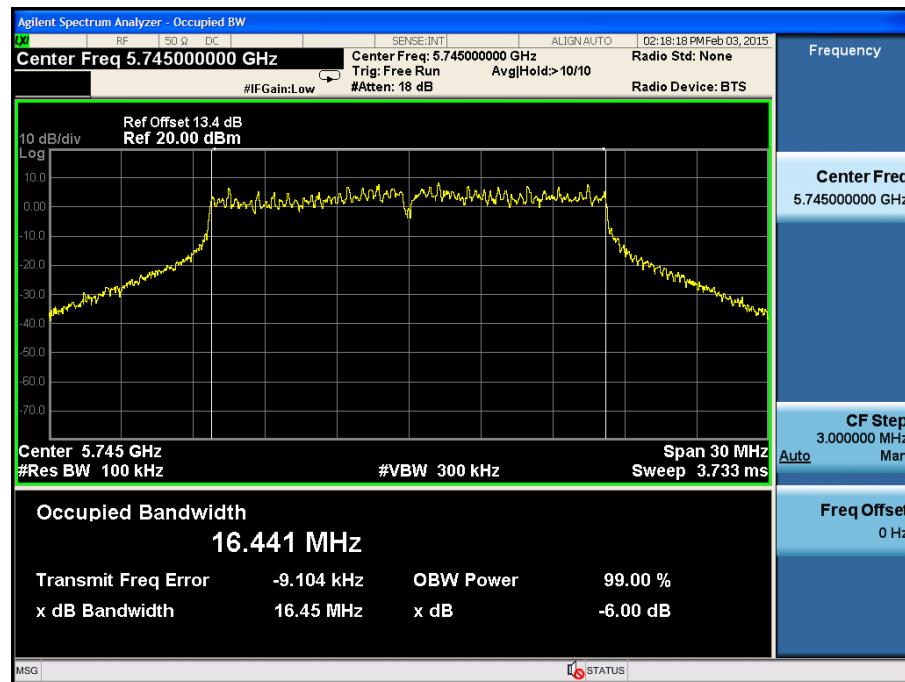
5200MHz



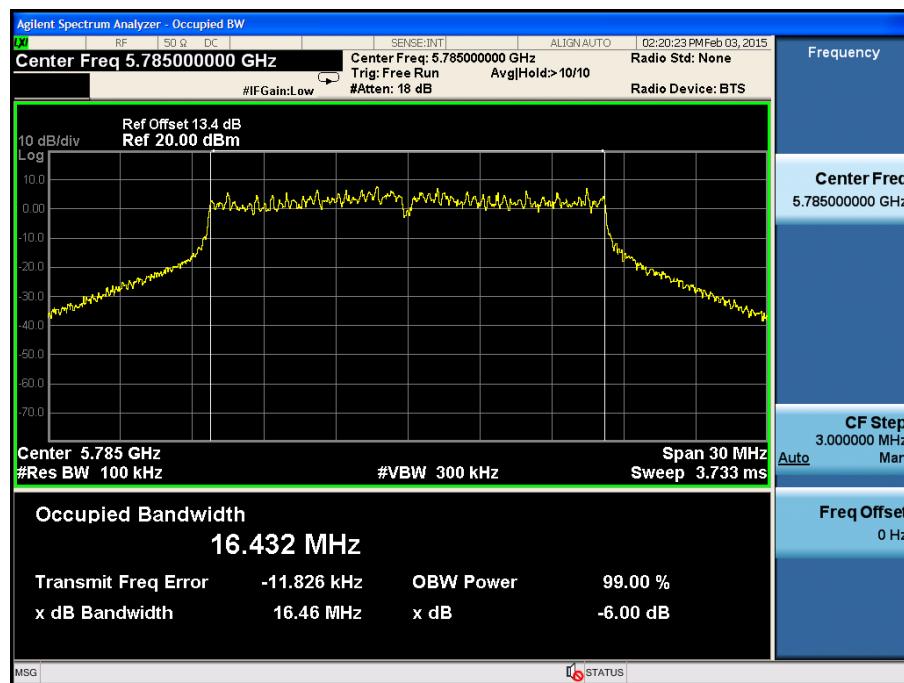
5240MHz



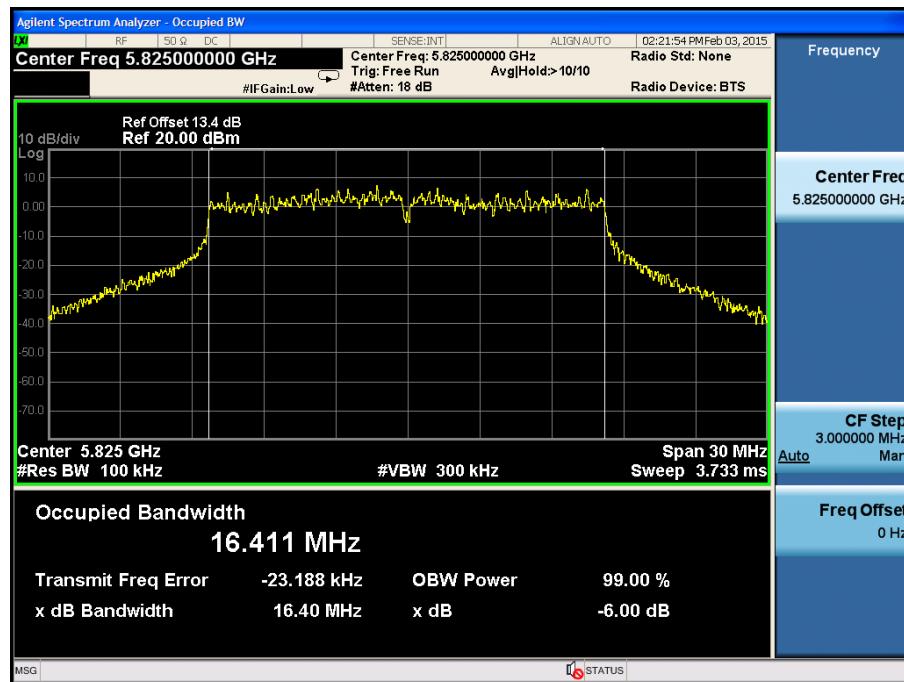
5745MHz



5785MHz

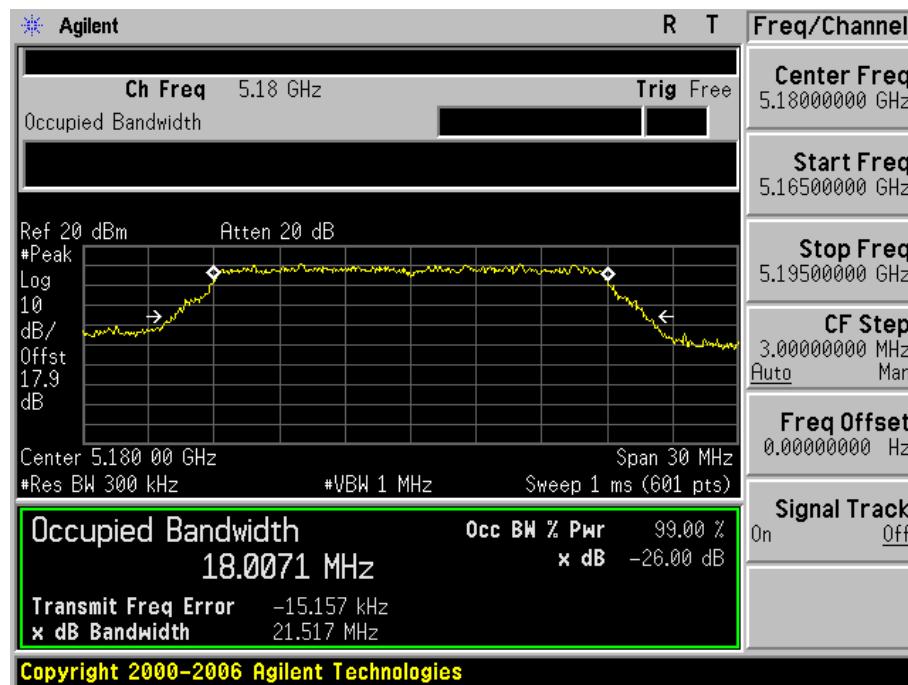


5825MHz

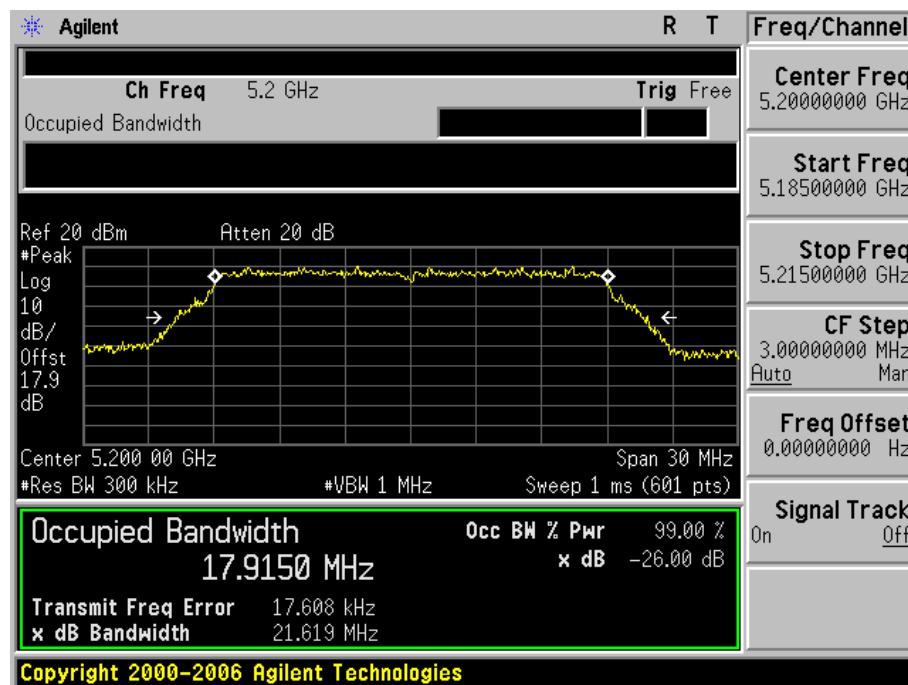


Test Mode: 802.11n20

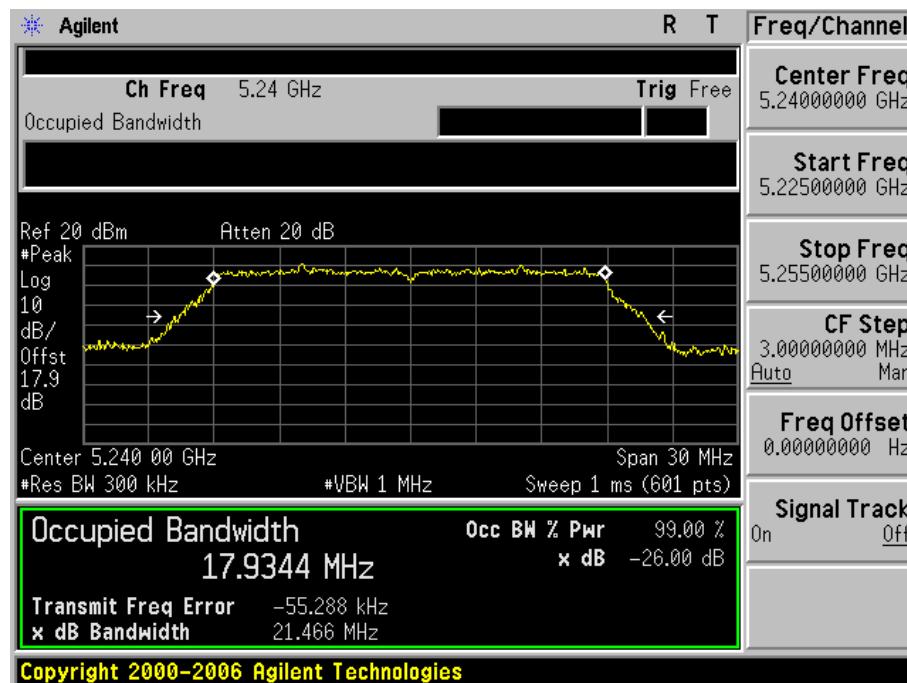
5180MHz



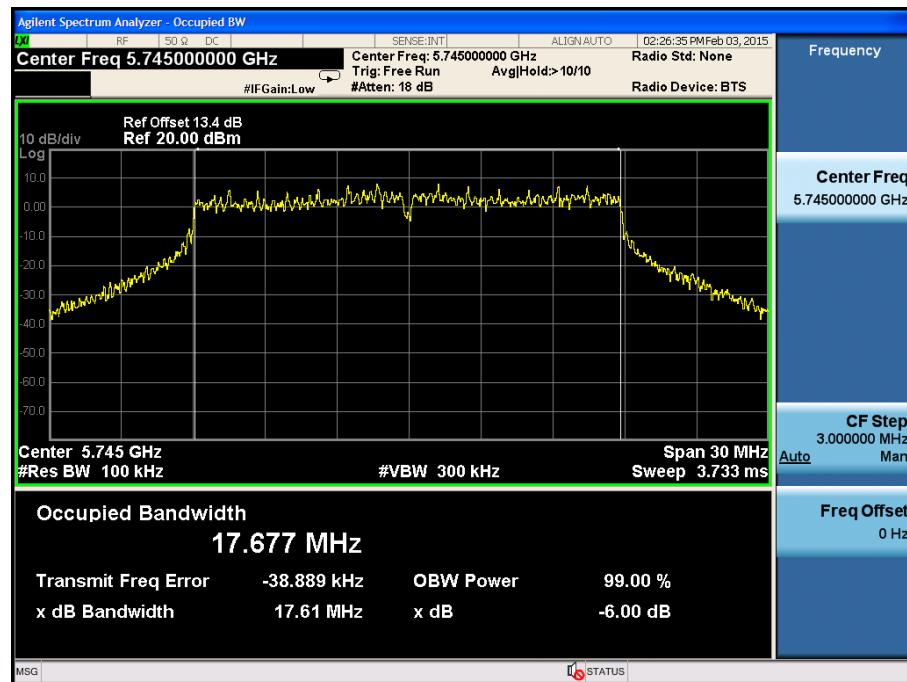
5200MHz



5240MHz



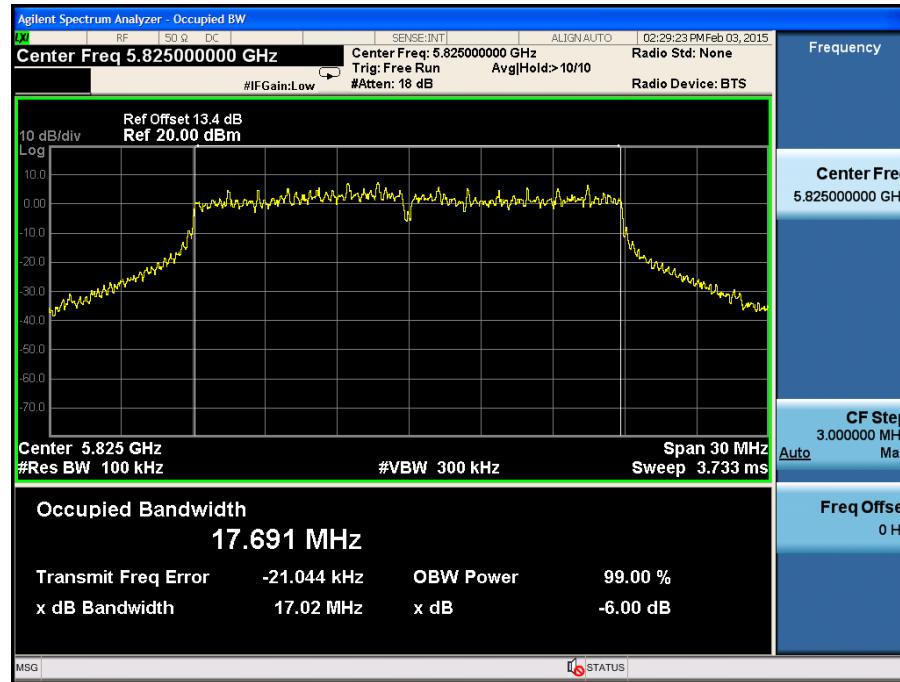
5745MHz



5785MHz

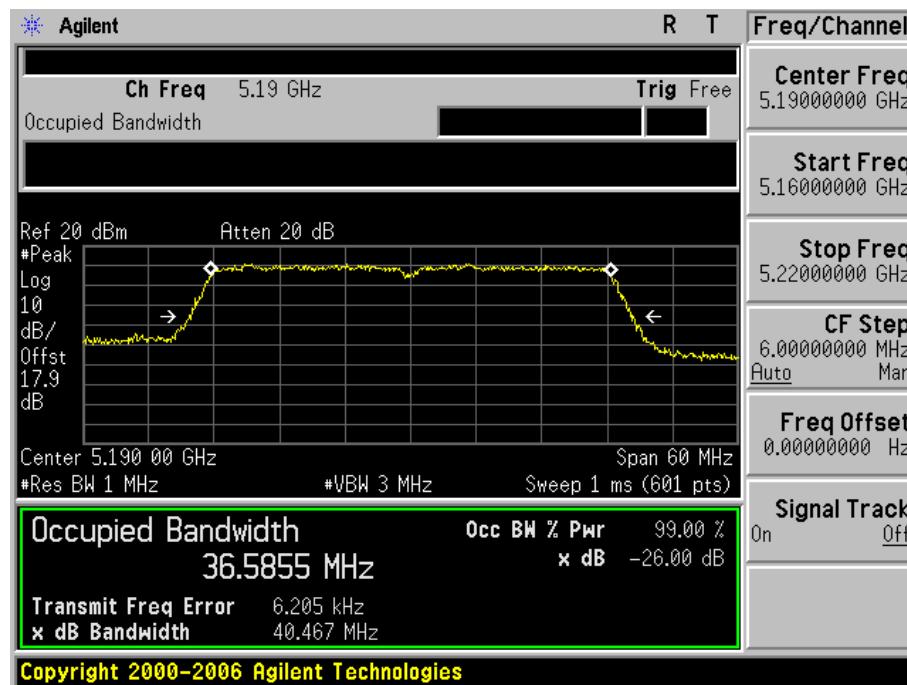


5825MHz

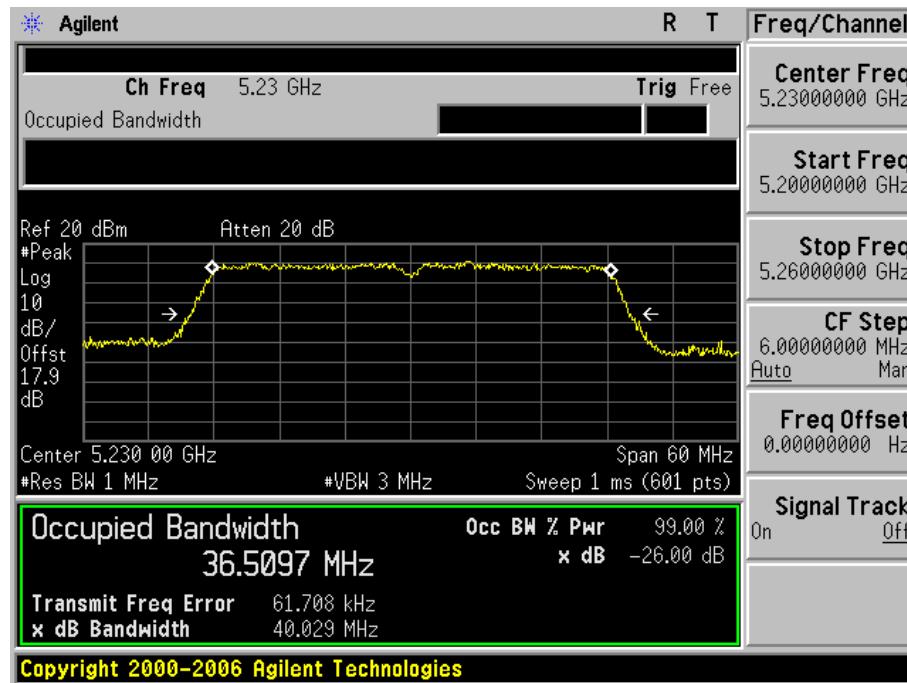


Test Mode: 802.11n-HT40

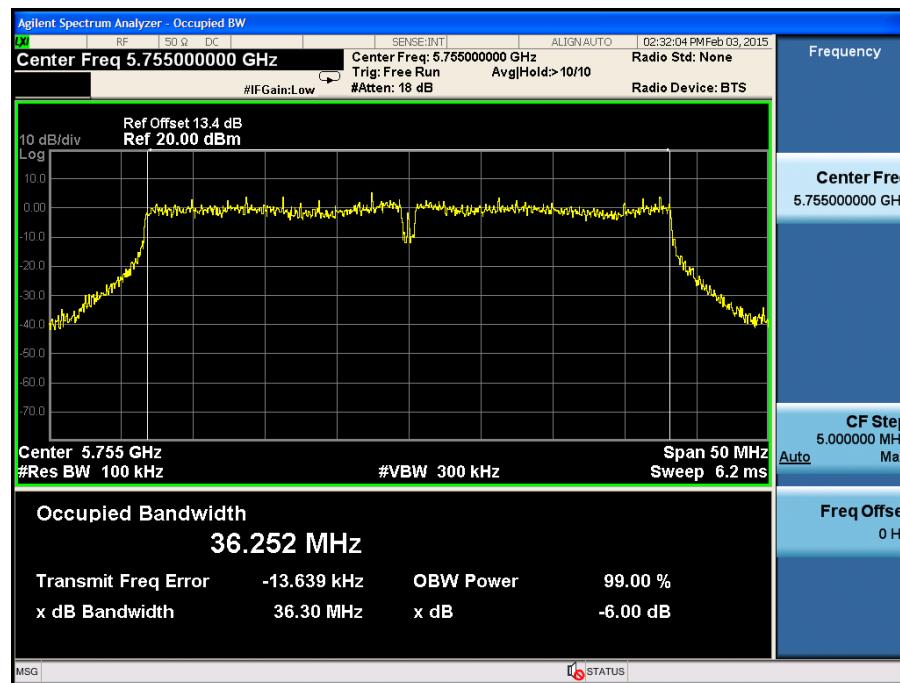
5190MHz



5230MHz



5755MHz

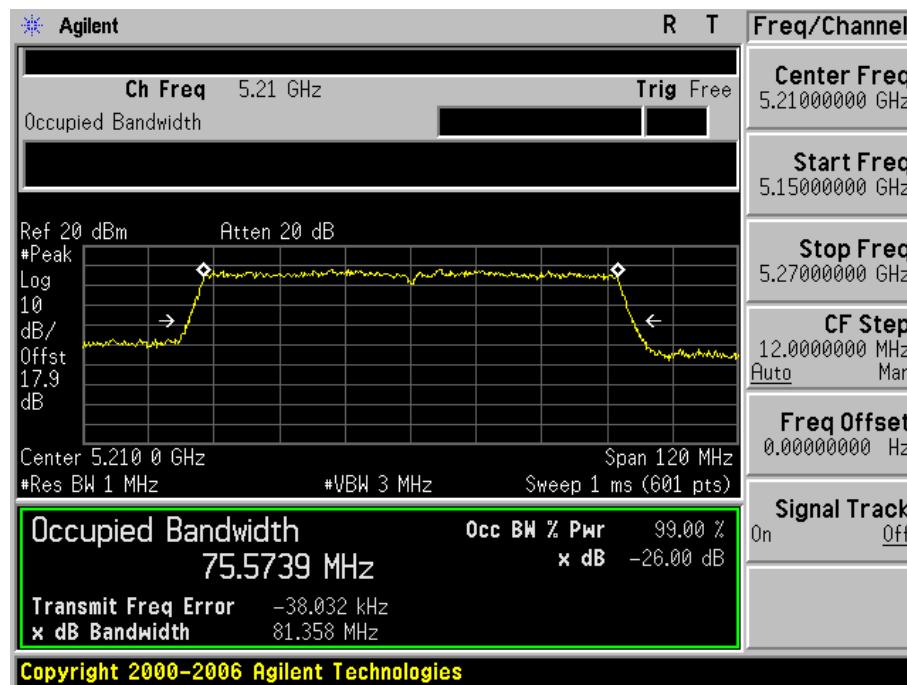


5795MHz

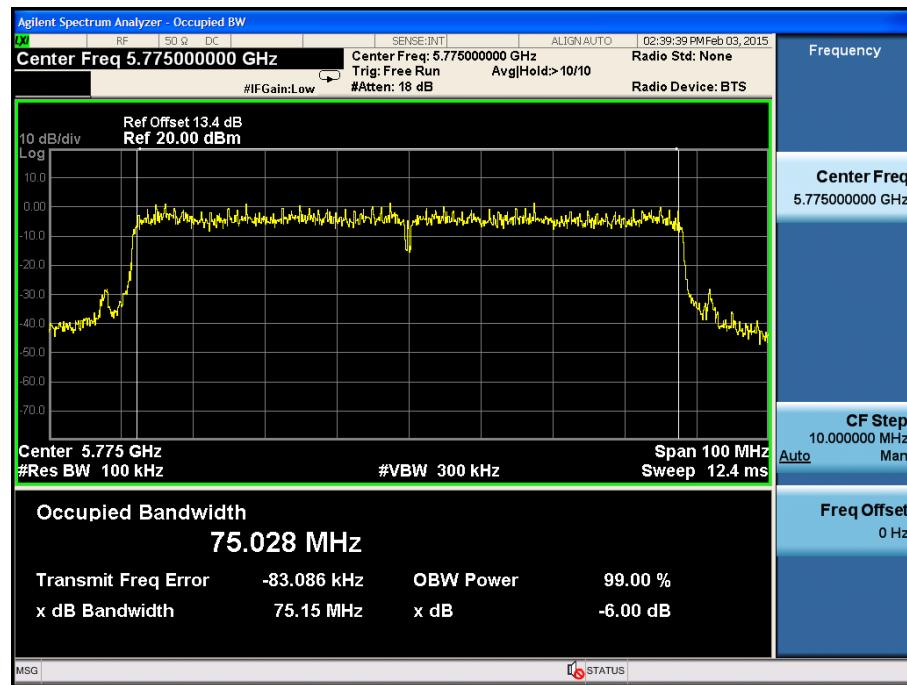


Test Mode: 802.11ac80

5210MHz



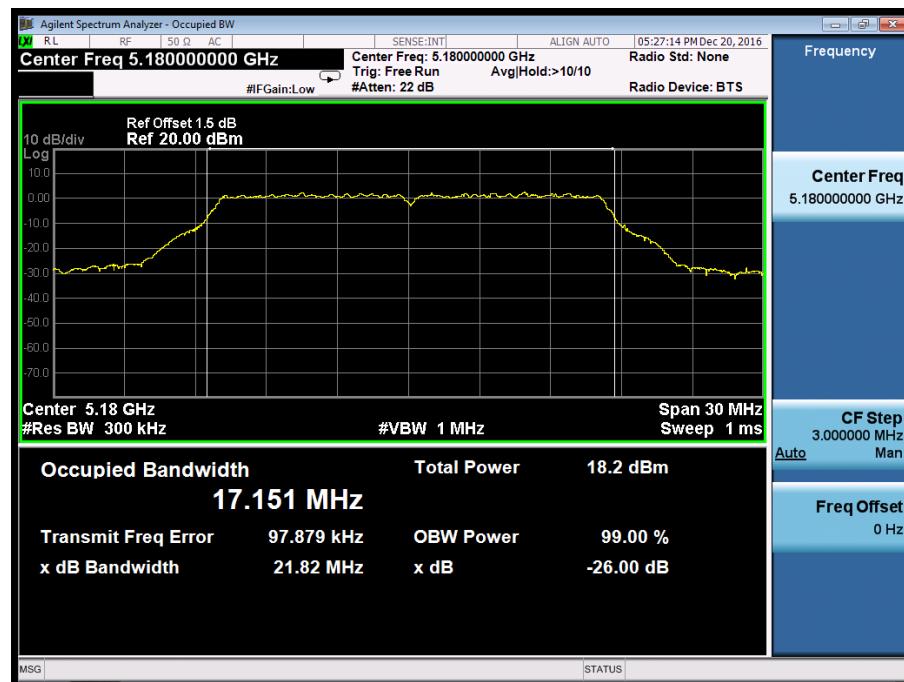
5775MHz



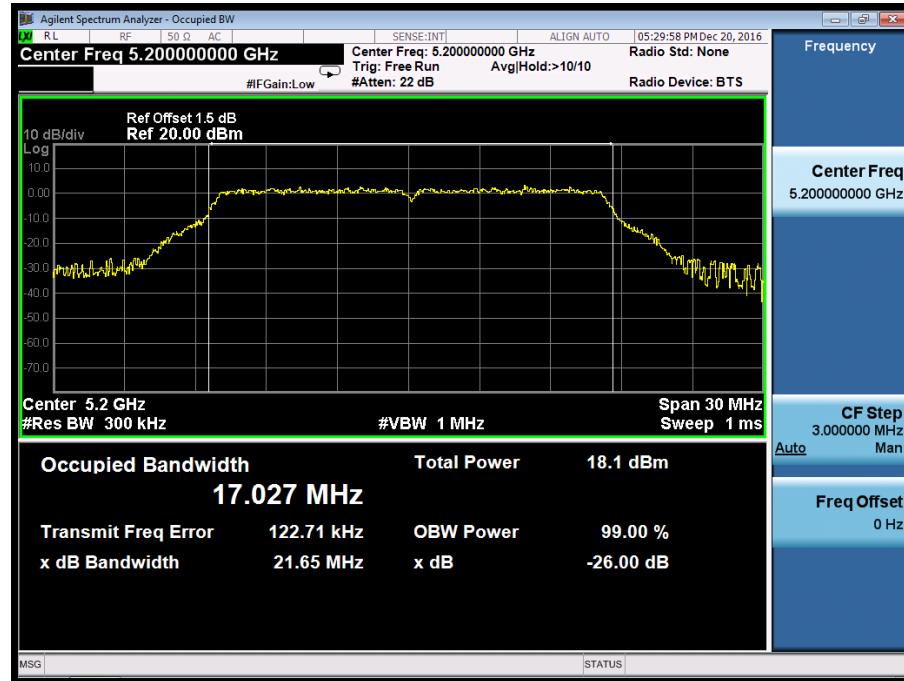
Antenna 2

Test Mode: 802.11a

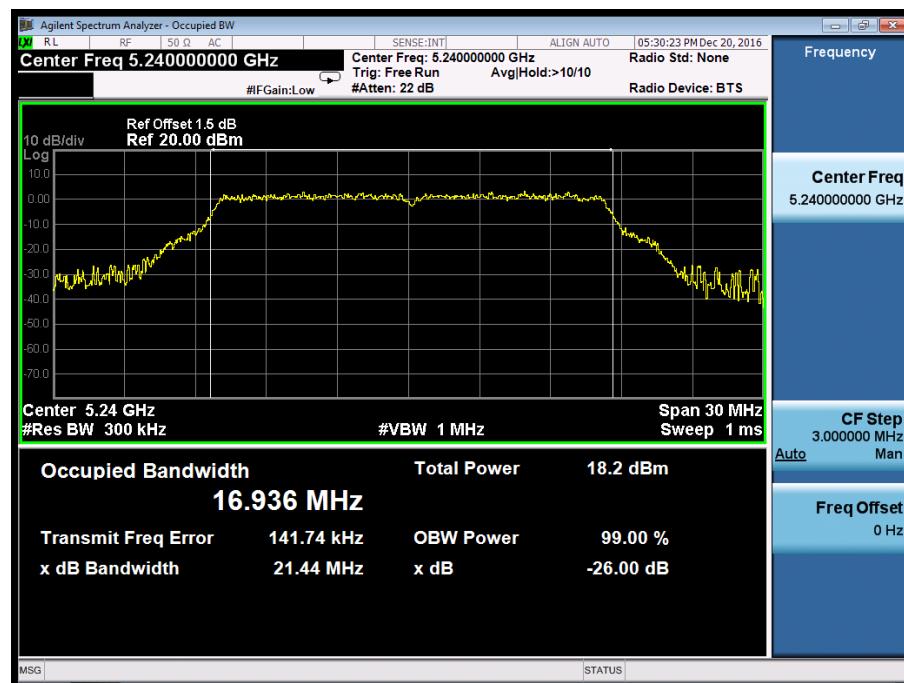
5180MHz



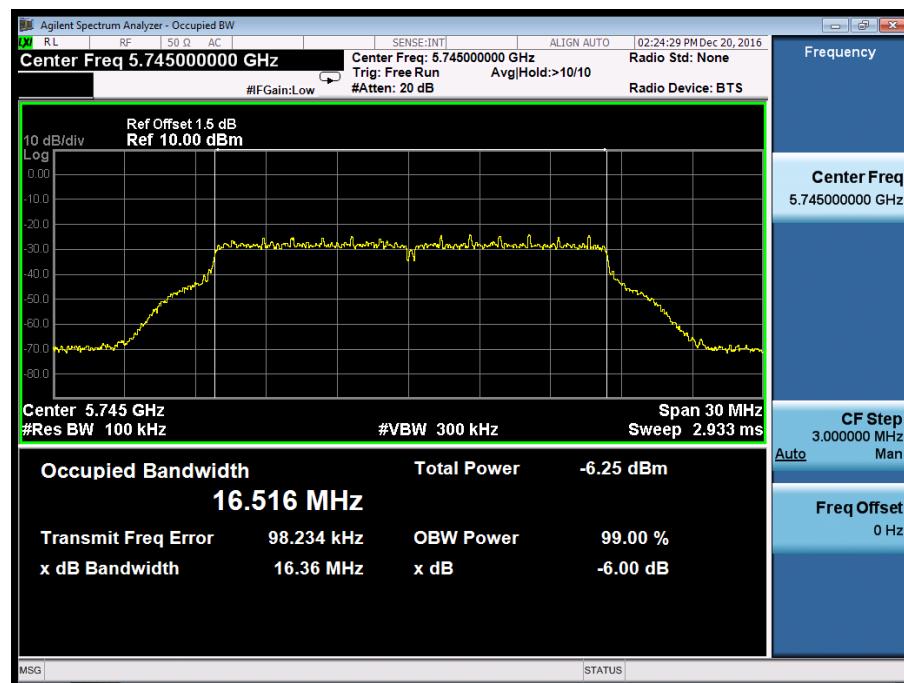
5200MHz



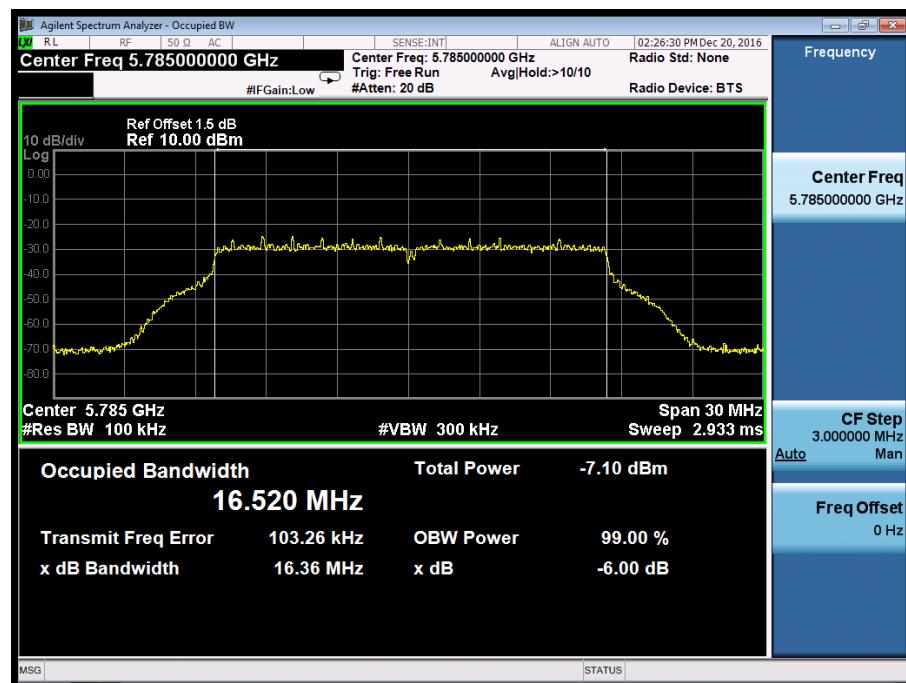
5240MHz



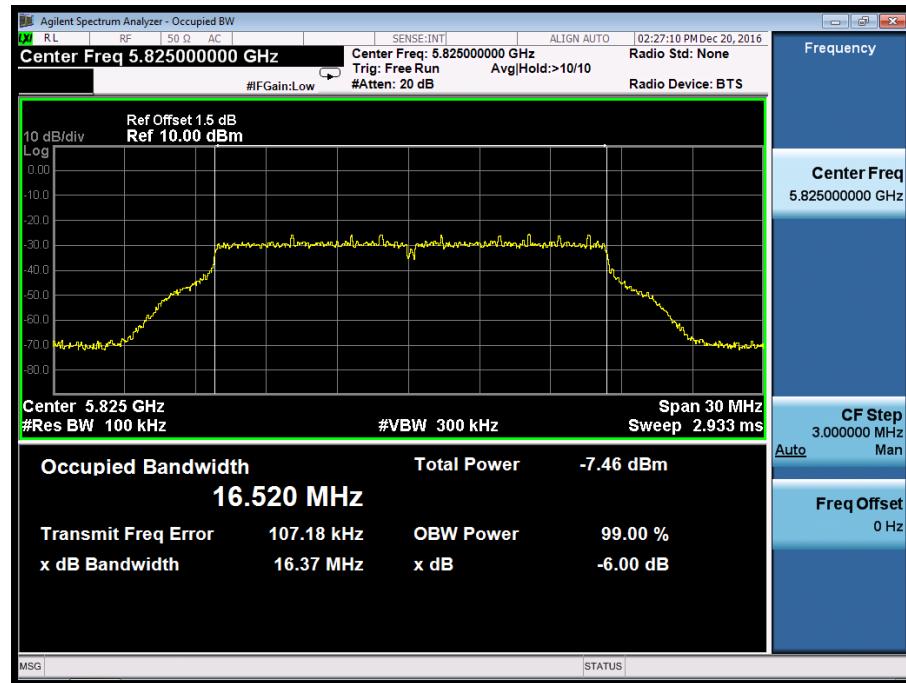
5745MHz



5785MHz

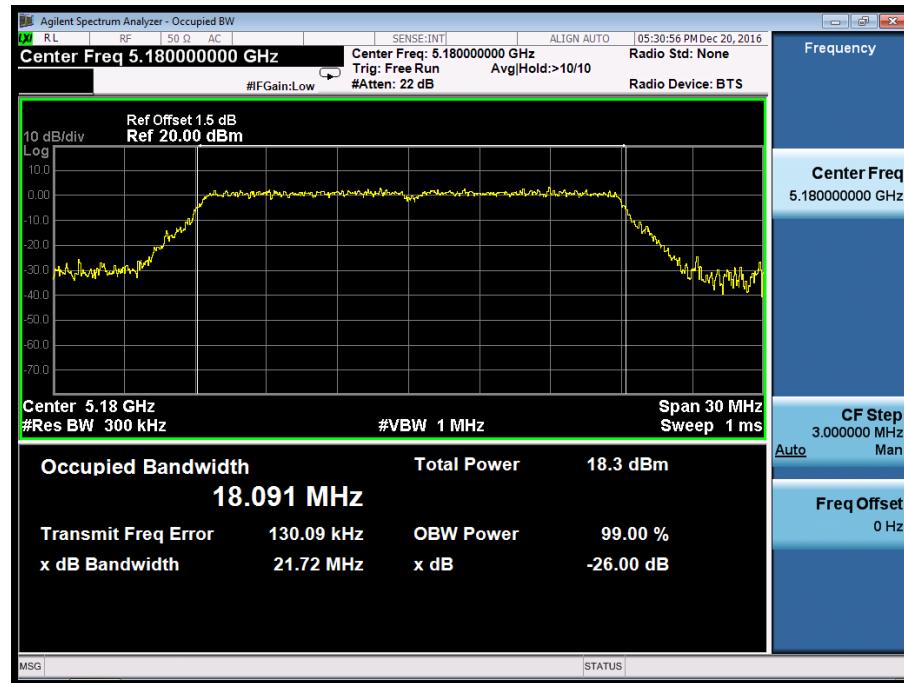


5825MHz

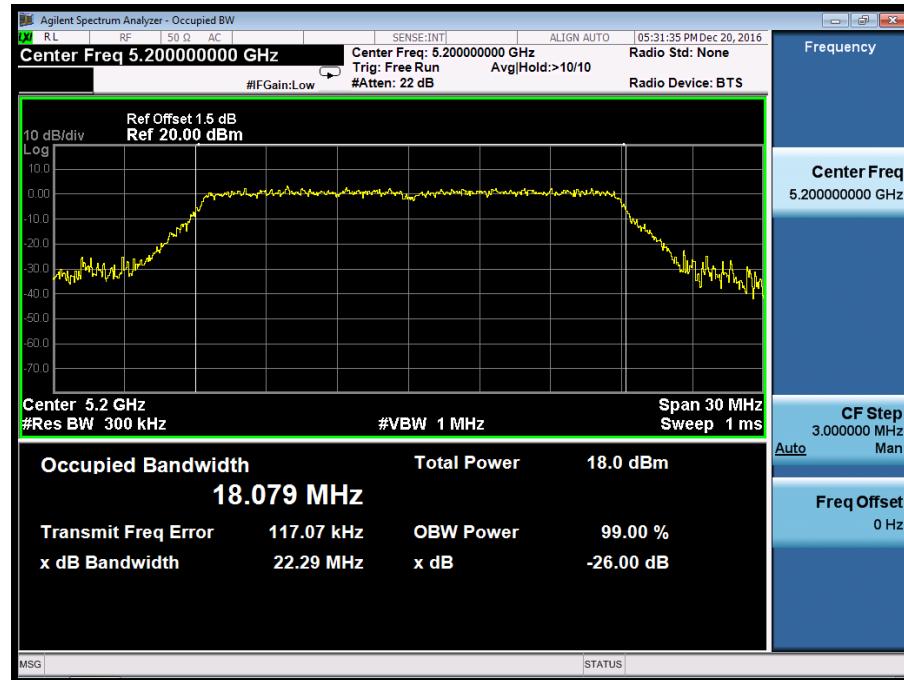


Test Mode: 802.11n20

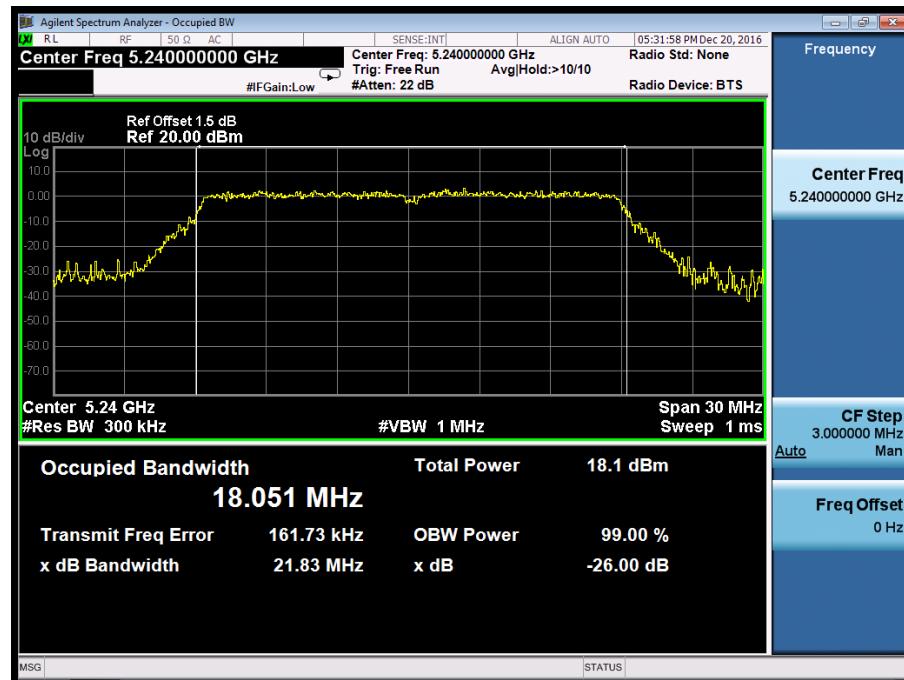
5180MHz



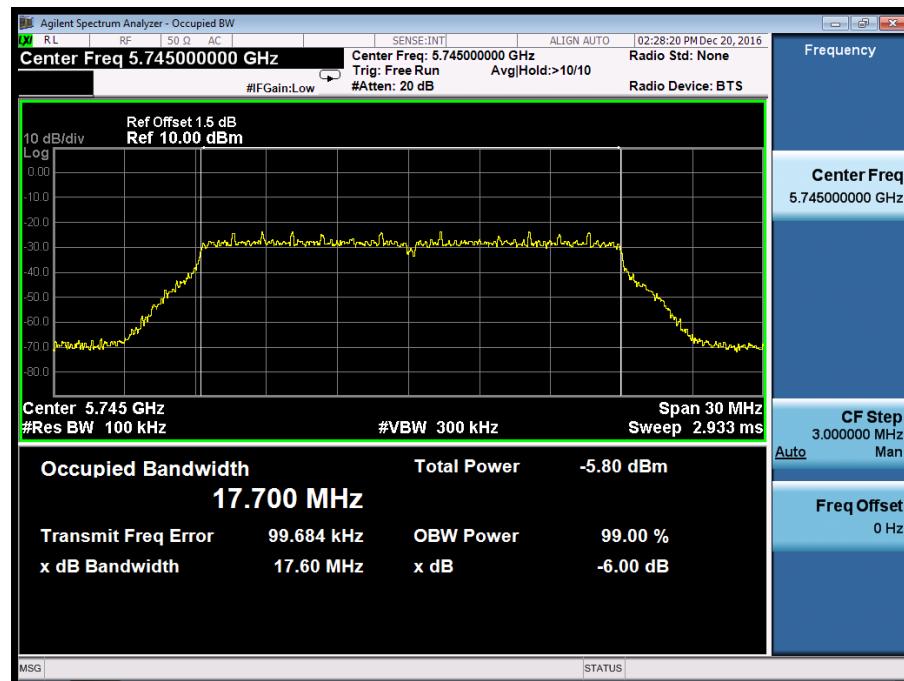
5200MHz



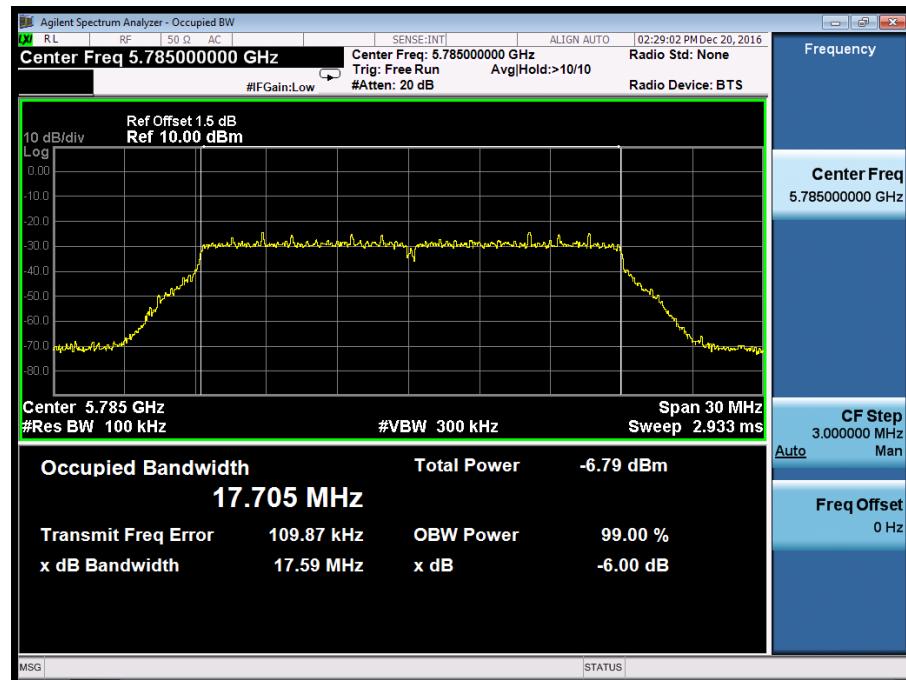
5240MHz



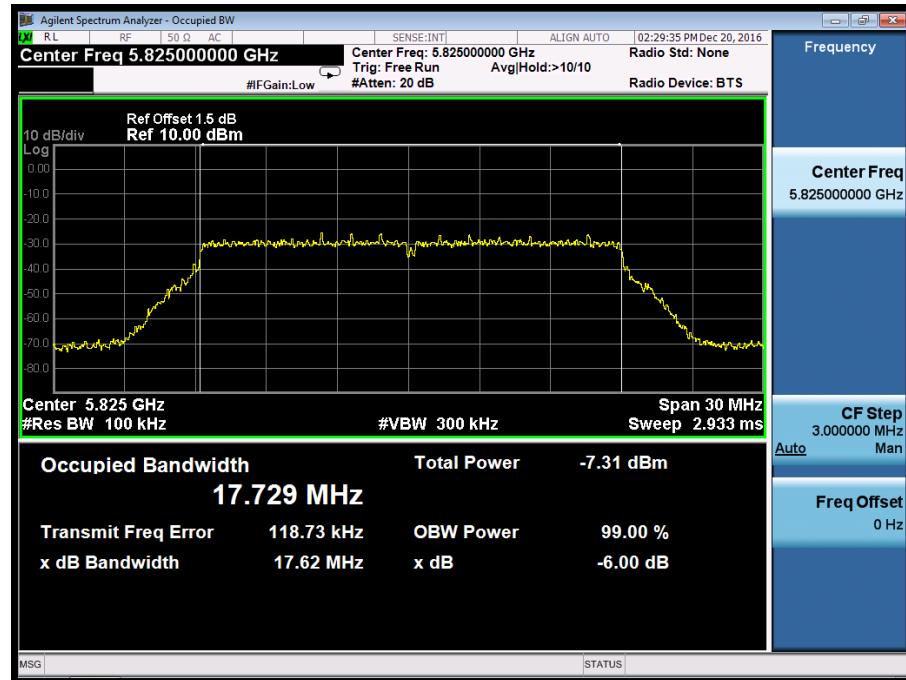
5745MHz



5785MHz

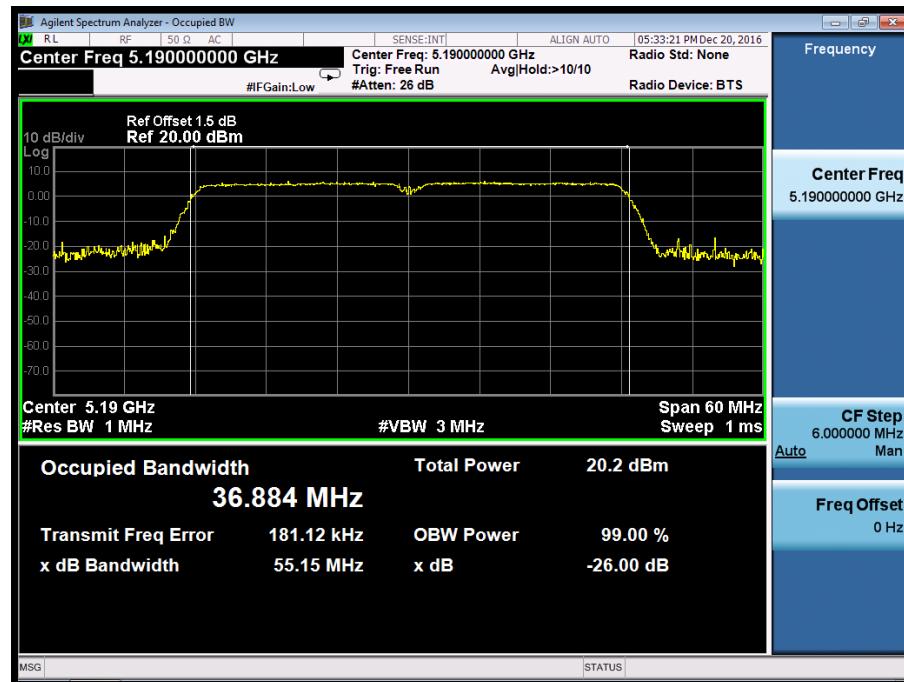


5825MHz

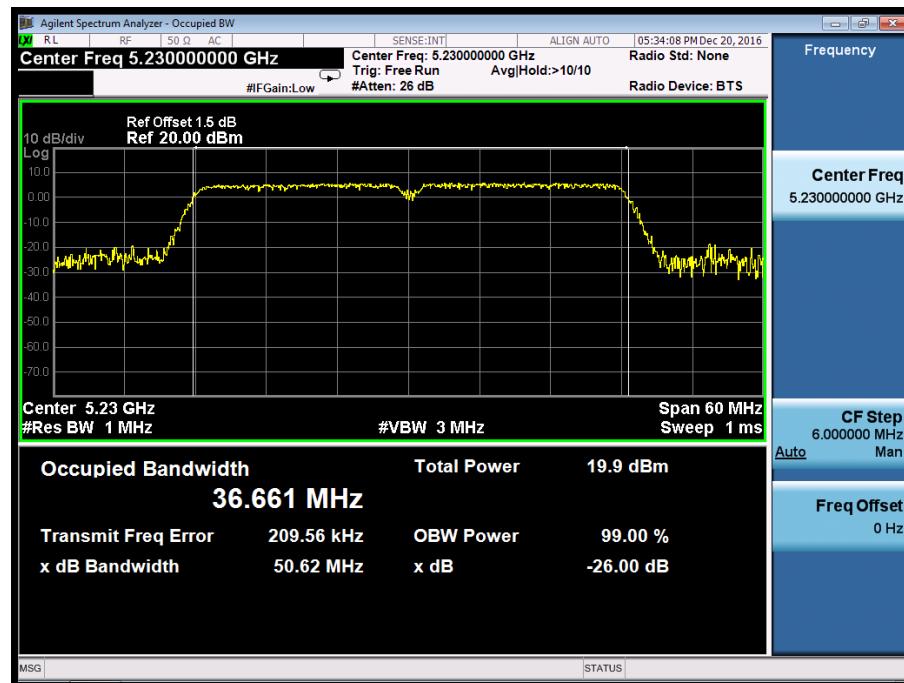


Test Mode: 802.11n-HT40

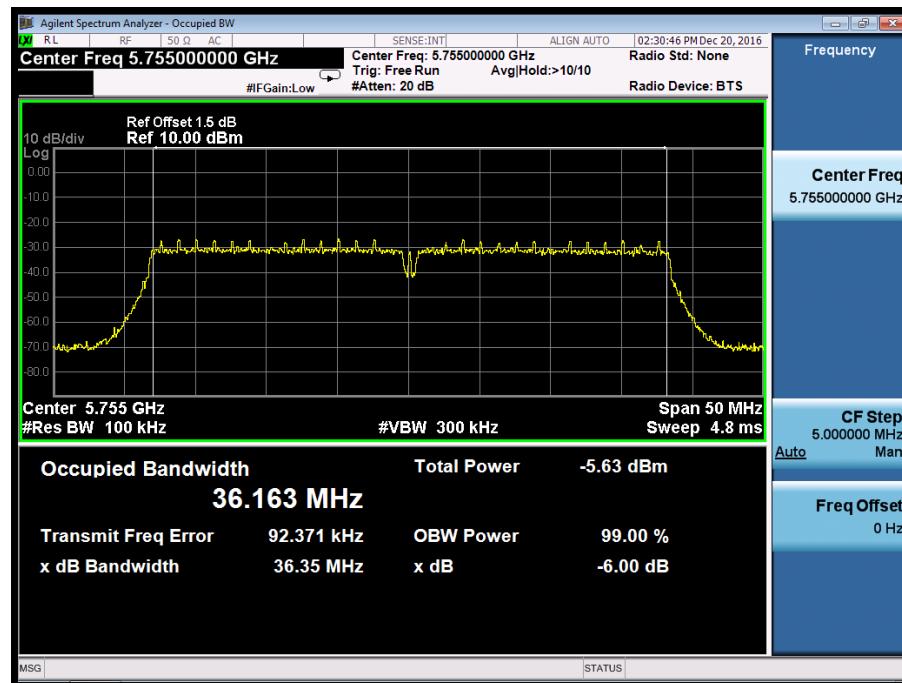
5190MHz



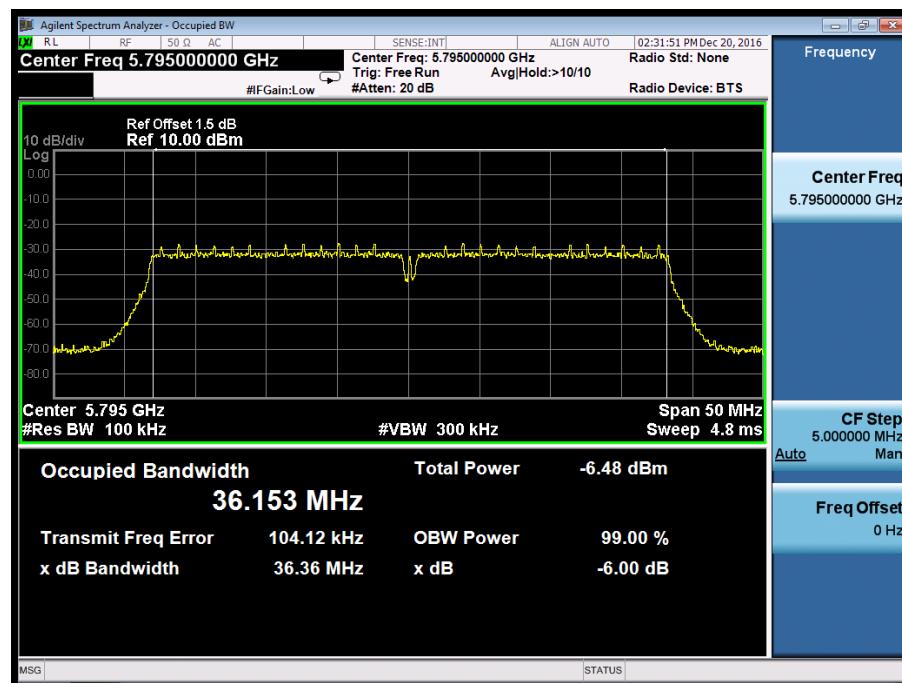
5230MHz



5755MHz

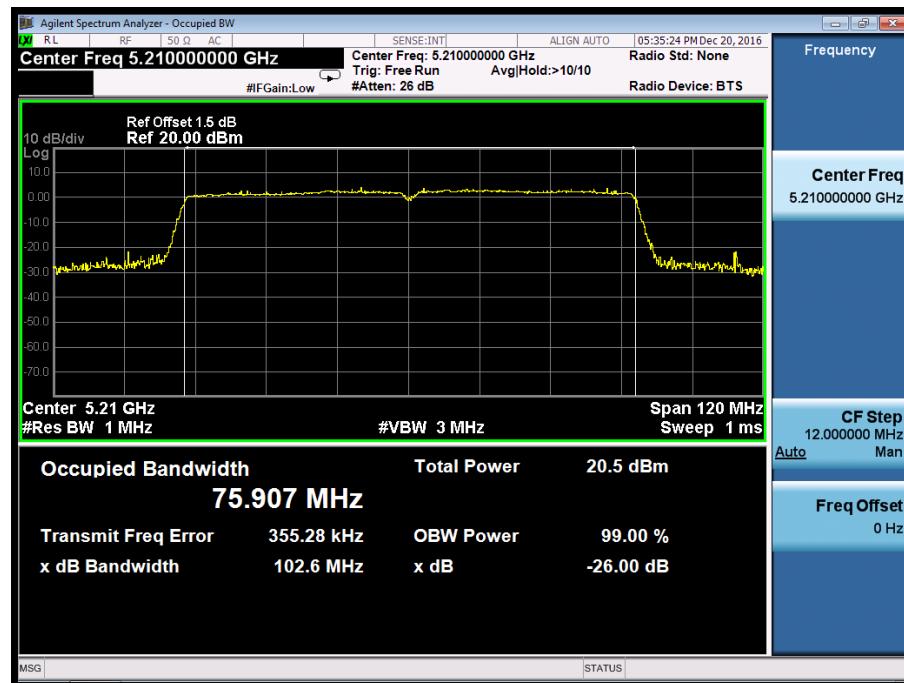


5795MHz

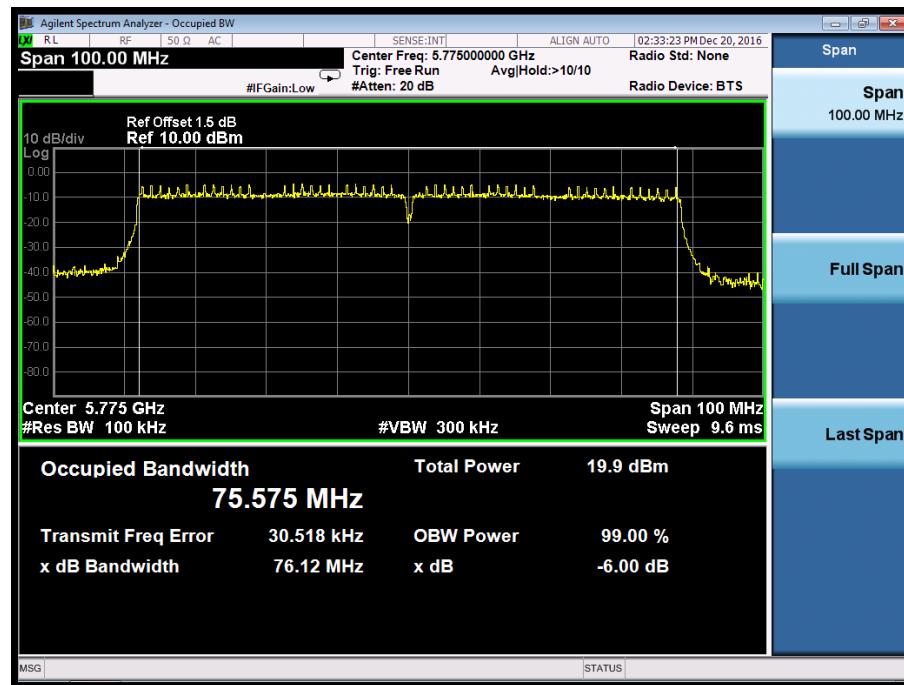


Test Mode: 802.11ac80

5210MHz



5775MHz



7. Maximum Conducted Output Power

7.1 Standard Applicable

According to 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.

7.2 Test Procedure

According to KDB789033 D02 v01 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.

7.3 Environmental Conditions

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

7.4 Summary of Test Results/Plots

Power output:
802.11a

channel	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
36	5180	14.65	14.34	17.51	56.34	250
40	5200	15.17	15.73	18.47	70.30	250
48	5240	15.58	14.18	17.95	62.32	250
149	5745	15.78	16.09	18.95	78.49	1000
157	5785	15.36	15.85	18.62	72.81	1000
165	5825	15.54	14.97	18.27	67.21	1000

802.11n20

channel	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
36	5180	15.47	15.32	18.41	69.28	250
40	5200	15.19	14.97	18.09	64.44	250
48	5240	14.86	14.90	17.89	61.52	250
149	5745	16.01	14.43	18.30	67.64	1000
157	5785	13.96	14.06	17.02	50.36	1000
165	5825	13.65	13.96	16.82	48.06	1000

802.11n40

channel	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
38	5190	13.54	13.94	16.75	47.37	250
46	5230	13.86	14.75	17.34	54.18	250
151	5755	13.86	15.33	17.67	58.44	1000
159	5795	13.07	15.12	17.23	52.79	1000

802.11ac80

channel	Frequency MHz	Power 1 dBm	Power 2 dBm	Total Power dBm	Total Power mW	Limit mW
42	5210	12.76	12.76	15.77	37.76	250
155	5775	13.38	12.17	15.83	38.26	1000

8. Conducted Spurious Emissions

8.1 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: 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.

8.2 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.

8.3 Environmental Conditions

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

8.4 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

802.11a

5180MHz



5200MHz



5240MHz



5745MHz



5785MHz



5825MHz



802.11n-HT20

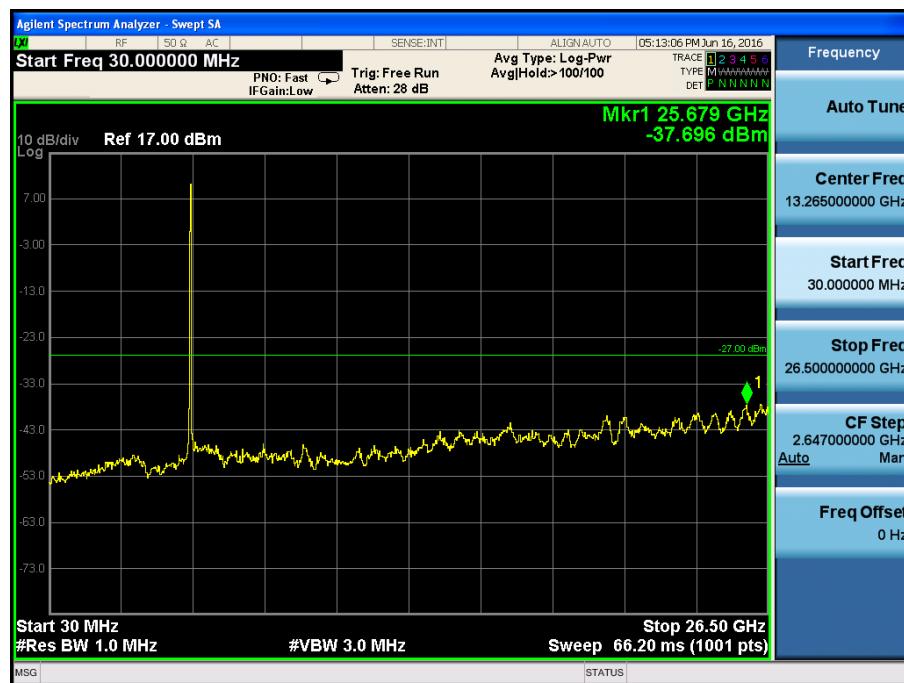
5180MHz



5200MHz



5240MHz



5745MHz



5785MHz



5825MHz



802.11n-HT40

5190MHz



5230MHz

