

TEST REPORT

DT&C Co., Ltd. 42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664	Report No : DRTFCC1609-0125 Pages:(1) / (223) page	
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1. Customer

- Name : LG Electronics USA
- Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey 07632

2. Use of Report : FCC & IC Original Grant

3. Product Name (FCC ID / IC): RF Module (BEJLGSWFAC71 / 2703H-LGSWFAC71)

4. Date of Test : 2016-08-08 ~ 2016-09-02

5. Test Method Used: FCC Part 15.407 Subpart E,
 RSS-247 Issue 1 (2015-05), RSS-GEN Issue 4 (2014-11)

6. Testing Environment : See appended test report

7. Test Result : ☒ Pass ☐ Fail

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Name : JungWoo Kim (Signature)	Technical Manager Name : GeunKi Son (Signature)
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2016. 09. 09

DT&C Co., Ltd.

* If this test report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description
DRTFCC1609-0125	Sep. 09, 2016	Initial issue

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1. EUT DESCRIPTION

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	RF Module
Model Name	LGSWFAC71
Add Model Name	N/A
Software version	1.0
Hardware version	1.0
Power Supply	DC 3.3 V
Frequency Range	U-NII 1(5150 ~ 5250 MHz) 802.11a/n(HT20)/ac(VHT20): 5180 ~ 5240 MHz 802.11n(HT40)/ac(VHT40): 5190 ~ 5230 MHz 802.11ac(VHT80): 5210 MHz U-NII 2A(5250 ~ 5350 MHz) 802.11a/n(HT20)/ac(VHT20): 5260 ~ 5320 MHz 802.11n(HT40)/ac(VHT40): 5270 ~ 5310 MHz 802.11ac(VHT80): 5290 MHz U-NII 2C(5470 ~ 5725 MHz) 802.11a/n(HT20)/ac(VHT20): 5500 ~ 5720 MHz 802.11n(HT40)/ac(VHT40): 5510 ~ 5710 MHz 802.11ac(VHT80): 5530, 5690 MHz U-NII 3(5725 ~ 5850MHz) 802.11a/n(HT20)/ac(VHT20): 5745 ~ 5825 MHz 802.11n(HT40)/ac(VHT40): 5755 ~ 5795 MHz 802.11ac(VHT80): 5775 MHz
Modulation type	OFDM
Antenna Specification	Antenna type: Metal Antenna Antenna gain - U-NII 1 band: ANT 1: 1.34 dBi & ANT 2: 0.91 dBi - U-NII 2A band: ANT 1: 1.40 dBi & ANT 2: 0.97 dBi - U-NII 2C band: ANT 1: 1.42 dBi & ANT 2: 1.37 dBi - U-NII 3 band: ANT 1: 1.38 dBi & ANT 2: 0.72 dBi Antenna Configuration 802.11a: Single Transmitting (ANT 1 or ANT 2) 802.11a: Multiple Transmitting (ANT 1 and ANT 2) 802.11n(MCS 0 ~ 7, HT20/40) : Single Transmitting (ANT 1 or ANT 2) 802.11n(MCS 8 ~ 15, HT20/40) : Multiple Transmitting (ANT 1 and ANT 2) 802.11ac(NSS1 MCS 0 ~ 8, VHT20) : Single Transmitting (ANT 1 or ANT 2) 802.11ac(NSS2 MCS 0 ~ 8, VHT20) : Multiple Transmitting (ANT 1 and ANT 2) 802.11ac(NSS1 MCS 0 ~ 9, VHT40/80) : Single Transmitting (ANT 1 or ANT 2) 802.11ac(NSS2 MCS 0 ~ 9, VHT40/80) : Multiple Transmitting (ANT 1 and ANT 2)

2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate
		Multiple transmitting
U-NII 1	802.11a	6Mbps
	802.11n(HT20)	MCS 8
	802.11n(HT40)	MCS 8
	802.11ac(VHT20)	NSS2 MCS 0
	802.11ac(VHT40)	NSS2 MCS 0
	802.11ac(VHT80)	NSS2 MCS 0
U-NII 2A	802.11a	6Mbps
	802.11n(HT20)	MCS 8
	802.11n(HT40)	MCS 8
	802.11ac(VHT20)	NSS2 MCS 0
	802.11ac(VHT40)	NSS2 MCS 0
	802.11ac(VHT80)	NSS2 MCS 0
U-NII 2C	802.11a	6Mbps
	802.11n(HT20)	MCS 8
	802.11n(HT40)	MCS 8
	802.11ac(VHT20)	NSS2 MCS 0
	802.11ac(VHT40)	NSS2 MCS 0
	802.11ac(VHT80)	NSS2 MCS 0
U-NII 3	802.11a	6Mbps
	802.11n(HT20)	MCS 8
	802.11n(HT40)	MCS 8
	802.11ac(VHT20)	NSS2 MCS 0
	802.11ac(VHT40)	NSS2 MCS 0
	802.11ac(VHT80)	NSS2 MCS 0

Note 1: The worst case data rate is determined as above test mode according to the power measurements.

And all test items were performed at the worst case data rate.

Note 2: In case of radiated test, we have done all tx case. We attached the result of only MIMO mode (Worst case).

2.2 Tested Channel Information

5GHz Band	802.11a/ac(VHT20)		802.11ac(VHT40)		802.11ac(VHT80)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 1	36	5180	38	5190	-	-
	40	5200	-	-	42	5210
	48	5240	46	5230	-	-
U-NII 2A	52	5260	54	5270	-	-
	60	5300	-	-	58	5290
	64	5320	62	5310	-	-
U-NII 2C	100	5500	102	5510	-	-
	116	5580	118	5590	106	5530
	-	-	-	-	-	-
U-NII 3	149	5745	151	5755	-	-
	157	5785	-	-	155	5775
	165	5825	159	5795	-	-

5GHz Band	802.11a/ac(VHT20)		802.11ac(VHT40)		802.11ac(VHT80)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 2C & U-NII 3	144	5720	142	5710	138	5690

Note : Above channel is applied the KDB644545 D03.

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Laptop	X230i	R9-XKTHT	Lenovo	-

2.4 Tested environment

Temperature	: 23 °C ~ 26 °C
Relative humidity content	: 38 % ~ 43 % R.H.
Details of power supply	: DC 3.3 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing

→ None

3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Std.	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.407(a)	-	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(e)	RSS-247[6.2.4]	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5725 ~ 5850 MHz		C
-	RSS GEN[6.6]	Occupied Bandwidth (99%)	N/A		C
15.407(a)	RSS-247[6.2]	Maximum Conducted Output Power	5150 ~ 5250 MHz : < 30 dBm or < 23.97 dBm (FCC) < 200 mW or $10 + 10\log_{10}(B)$ dBm whichever power is less. (IC) 5250 ~ 5350 & 5470 ~ 5725 MHz : < 250 mW or $11 + 10\log_{10}(B)$ dBm, whichever power is less. (FCC & IC) 5725 ~ 5850 MHz : < 30 dBm (FCC & IC) Note: B is the 99 % BW(IC) or 26dB BW(FCC).		C Note 3
15.407(a)	RSS-247[6.2]	Peak Power Spectral Density	5150 ~ 5250 MHz : 11 dBm/MHz or 17 dBm/MHz(FCC) 5150 ~ 5250 MHz: < 10 dBm/MHz (IC) 5250 ~ 5350 & 5470 ~ 5725 MHz: 11 dBm/MHz (FCC & IC) 5725 ~ 5850 MHz: 30 dBm/500kHz(FCC & IC)		C Note 4
15.407(g)	RSS GEN[6.11]	Frequency Stability	N/A		C
15.407(b)	RSS-247[6.2]	Undesirable Emissions	5150 ~ 5725 MHz: < -27 dBm/MHz EIRP 5725 ~ 5850 MHz: < 15.407(b)(4)(i)	Radiated	C
15.205 15.209 15.407(b)	RSS-247[6.2] RSS-GEN[8.9] RSS-GEN[8.10]	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note 5
15.407(h)	RSS-247[6.3]	Dynamic Frequency Selection	FCC 15.407(h)	Conducted	C Note 6
15.207	RSS-GEN[8.8]	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	RSS-GEN[8.3]	Antenna Requirements	FCC 15.203	-	C

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

Note 2: The test items were performed according to the KDB789033 D02 V01r02, KDB662911 D01 v02r01, KDB644545 D03 v01 and ANSI C63.10-2013

Note 3: (i) For access point operating in the band 5.15 - 5.25 GHz: < 30 dBm

(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 23.97 dBm

Note 4: (i) For access point operating in the band 5.15 - 5.25 GHz: < 17 dBm/MHz

(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 11 dBm/MHz

Note 5: These test items were performed in each axis and the worst case data was reported.

Note 6: Refer to the DFS test report.

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB789033 D02 v01r02. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on KDB789033 D02.

The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 1 or 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 Description of test modes

A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.

4.5 Measurement Uncertainty

Test items	Measurement uncertainty
Transmitter Output Power	0.71 dB (The confidence level is about 95 %, k = 2)
Conducted spurious emission	0.94 dB (The confidence level is about 95 %, k = 2)
AC conducted emission	2.36 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783 (FCC) & 5740A-3 (IC)

6.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, loop, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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.

The EUT used two unique antennas.

Therefore this module complies with the requirement of §15.203

7.2 Directional antenna gain(Worst case):

Bands	ANT 1 [dBi]	ANT 2 [dBi]	Directional Gain [dBi]
U-NII 1	1.340	0.910	1.130 Note 2.
U-NII 2A	1.400	0.970	1.190 Note 2.
U-NII 2C	1.420	1.370	1.395 Note 2.
U-NII 3	1.380	0.720	1.063 Note 2.

Note 1. Directional gain(correlated signal with unequal antenna gain and equal transmit power)

$$10 \log [(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N^{ANT}] \text{ dBi}$$

Note 2. Directional gain(completely uncorrelated signal with unequal antenna gain and equal transmit power)

$$10 \log [(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N^{ANT}] \text{ dBi}$$

Note 3. Directional gain(spatial multiplexing)

$$G_{ANT \text{ MAX}} + 10 \log (N_{ANT} / N_{SS}) \text{ dBi}$$

8. TEST RESULT

8.1 Emission Bandwidth (26 dB Bandwidth)

■ Test Requirements

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26 dB bandwidth is used to determine the conducted output power limit.

■ Test Configuration

Refer to the APPENDIX I.

■ Test Procedure

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02**.

1. Set resolution bandwidth (RBW) = approximately **1 %** of the EBW.
2. Set the video bandwidth (**VBW**) > **RBW**.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

Measure the maximum width of the emission that is 26 dB down from the peak 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%.

■ TEST RESULTS: **Comply**

Multiple Transmit

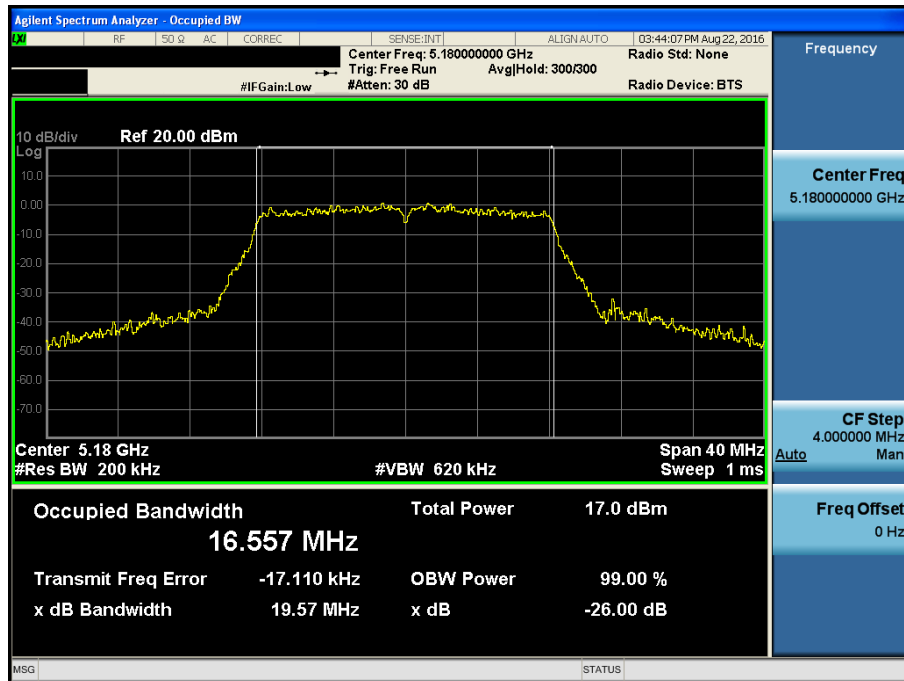
Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11a	U-NII 1	36	5180	19.570	19.580
		40	5200	19.650	19.610
		48	5240	19.730	19.530
	U-NII 2A	52	5260	19.570	19.620
		60	5300	19.710	19.620
		64	5320	19.640	19.640
	U-NII 2C	100	5500	19.740	19.900
		116	5580	19.610	20.810
		-	-	-	-
802.11ac (VHT20)	U-NII 1	36	5180	19.890	19.790
		40	5200	20.090	19.660
		48	5240	19.810	19.750
	U-NII 2A	52	5260	19.920	19.730
		60	5300	20.090	19.730
		64	5320	19.980	19.790
	U-NII 2C	100	5500	19.840	19.910
		116	5580	20.000	19.870
		-	-	-	-
802.11ac (VHT40)	U-NII 1	38	5190	40.570	40.030
		46	5230	41.320	39.770
	U-NII 2A	54	5270	39.920	39.240
		62	5310	40.110	39.630
	U-NII 2C	102	5510	39.920	40.020
		118	5590	40.590	46.160
	U-NII 2C	-	-	-	-
		-	-	-	-
		-	-	-	-
802.11ac (VHT80)	U-NII 1	42	5210	80.260	79.690
		-	-	-	-
	U-NII 2A	58	5290	80.360	79.550
		-	-	-	-
	U-NII 2C	106	5530	80.520	80.070
		-	-	-	-
802.11a	U-NII 2C Cross Band	144	5720	14.775	14.875
		-	-	-	-
802.11ac(VHT20)	U-NII 2C Cross Band	144	5720	15.020	14.830
		-	-	-	-
802.11ac(VHT40)	U-NII 2C Cross Band	142	5710	35.040	34.550
		-	-	-	-
802.11ac (VHT80)	U-NII 2C Cross Band	138	5690	75.380	74.840
		-	-	-	-
802.11a	U-NII 3 Cross Band	144	5720	4.730	4.840
		-	-	-	-
802.11ac(VHT20)	U-NII 3 Cross Band	144	5720	5.085	5.000
		-	-	-	-
802.11ac(VHT40)	U-NII 3 Cross Band	142	5710	5.070	4.550
		-	-	-	-
802.11ac (VHT80)	U-NII 3 Cross Band	138	5690	5.300	4.980
		-	-	-	-

■ Result Plots

Multiple Transmit

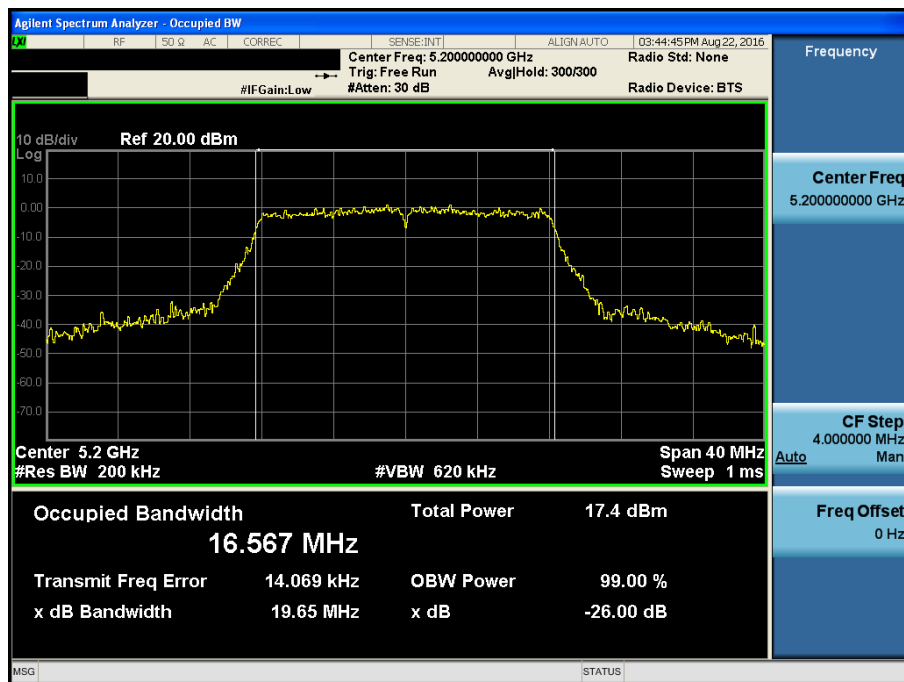
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.36



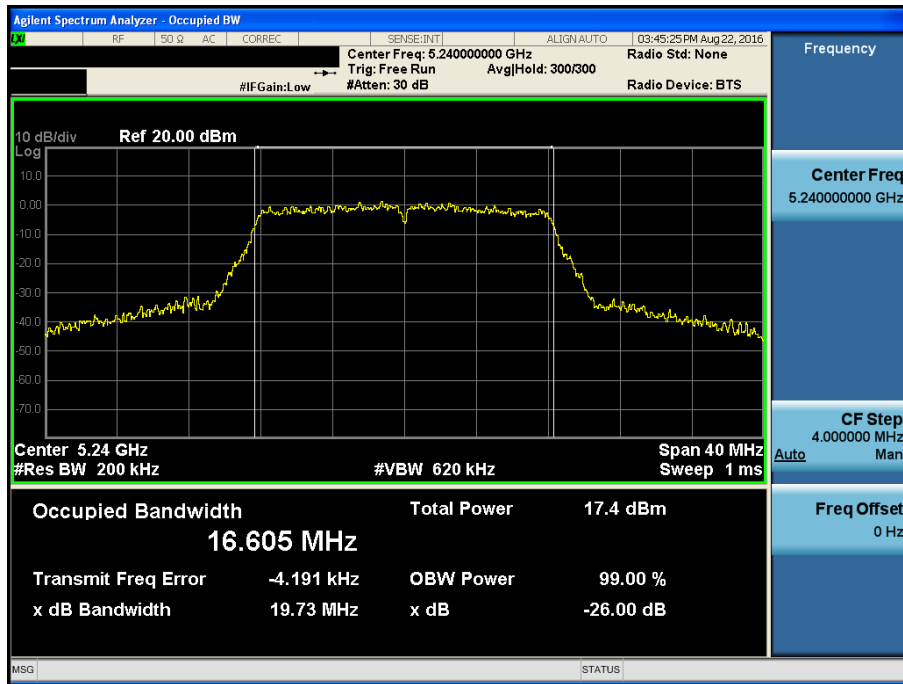
26 dB Bandwidth

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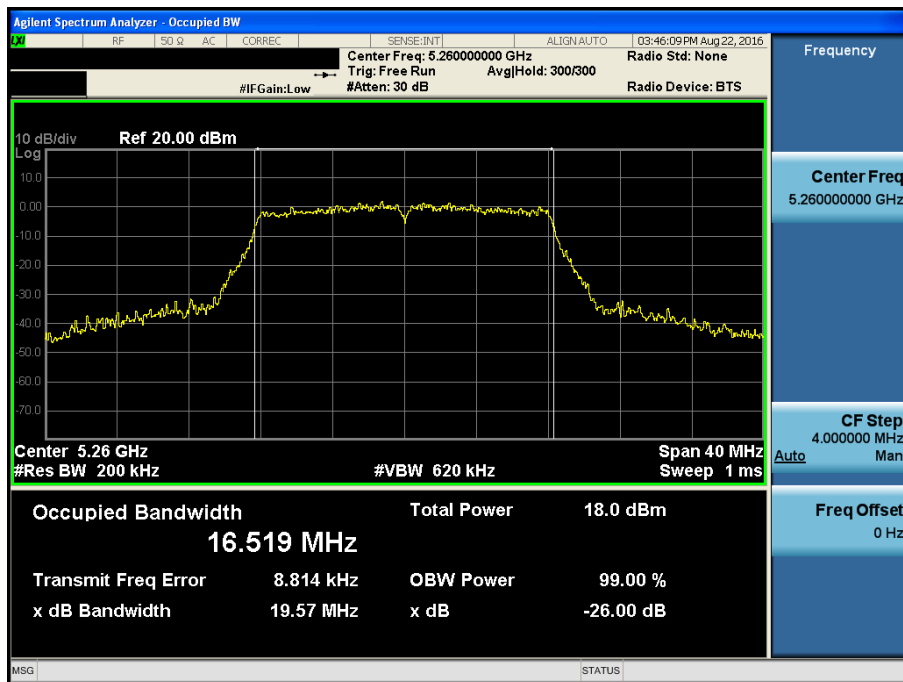
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.48



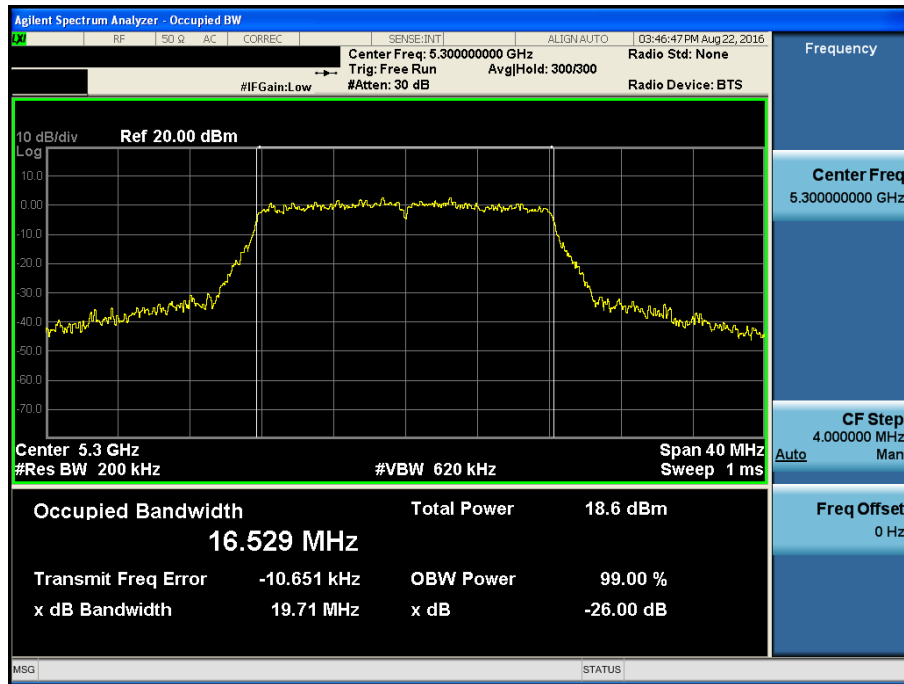
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.52



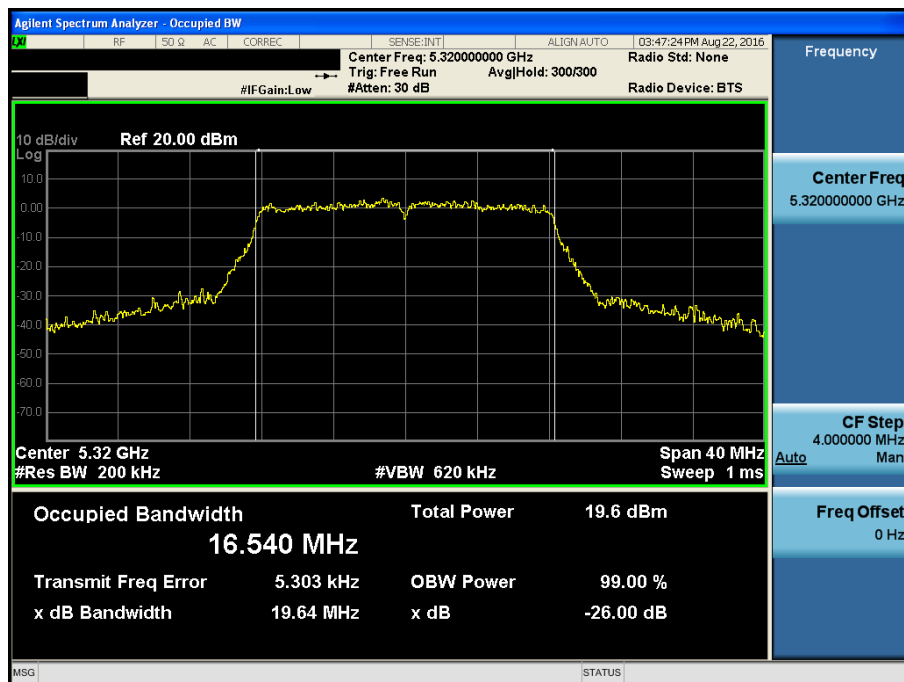
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.60



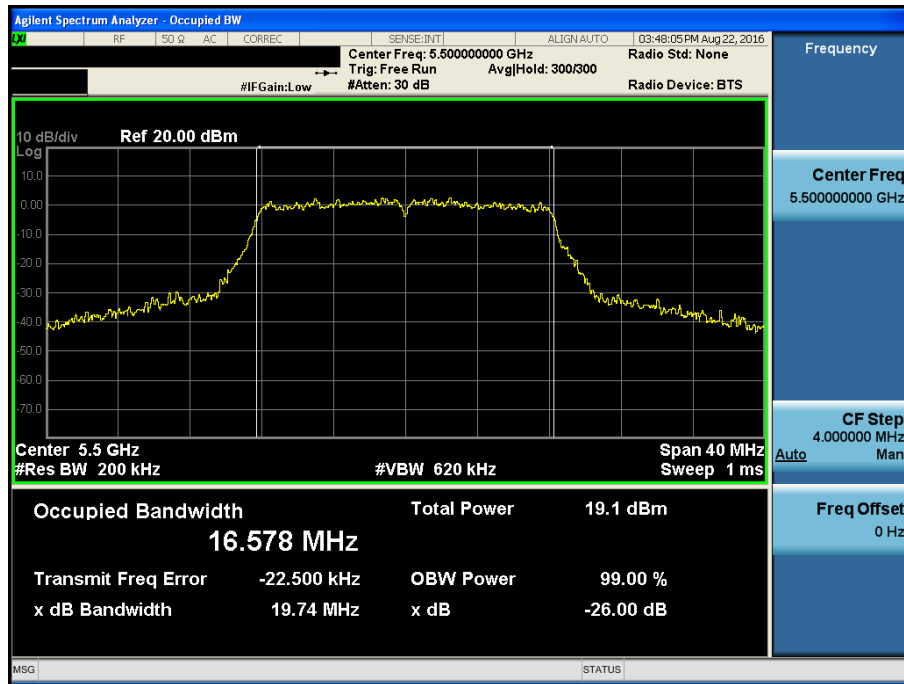
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.64



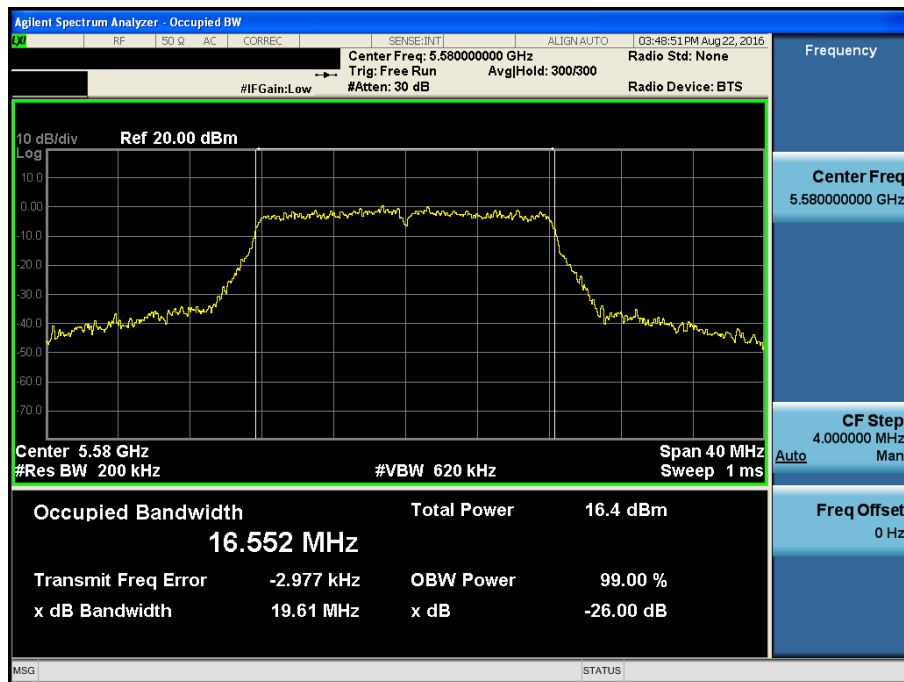
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.100



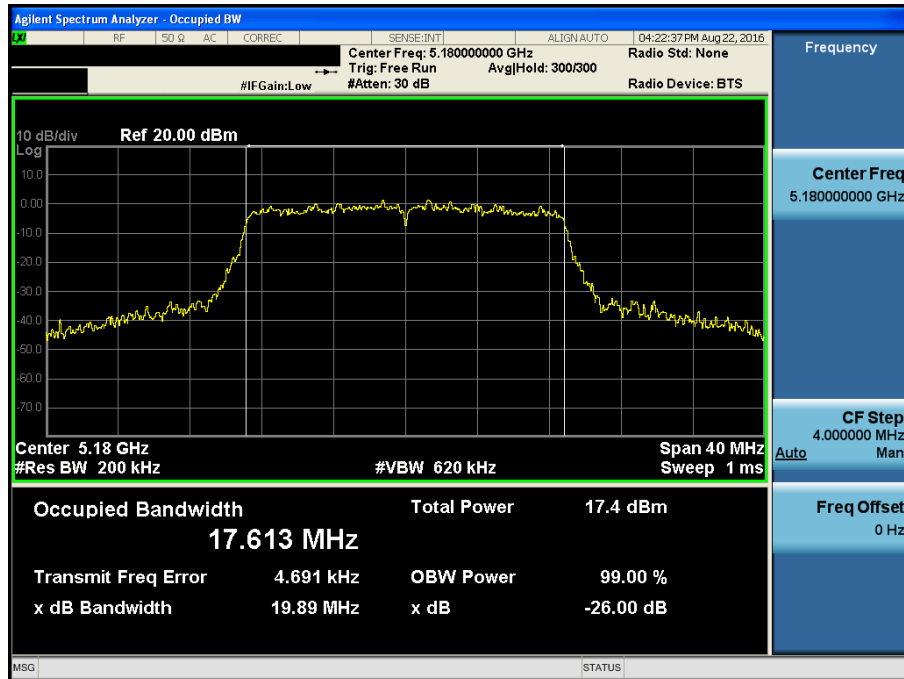
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.116



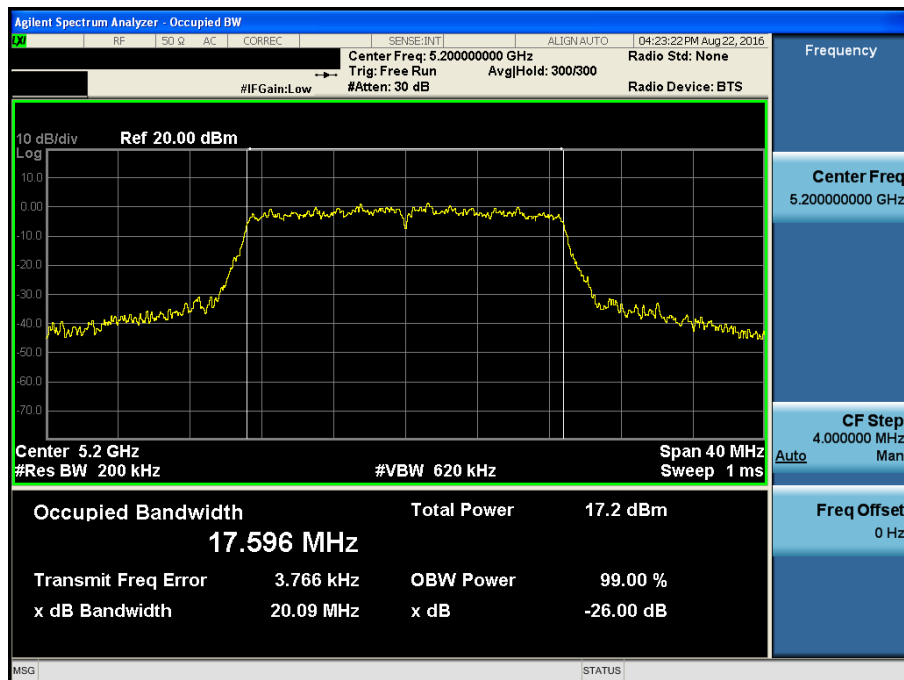
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.36



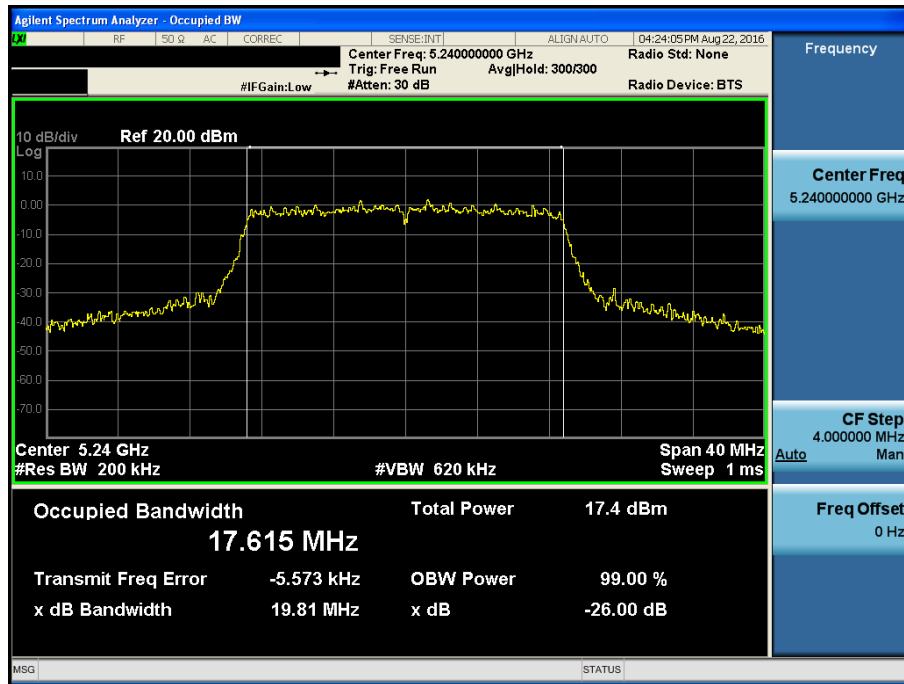
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.40



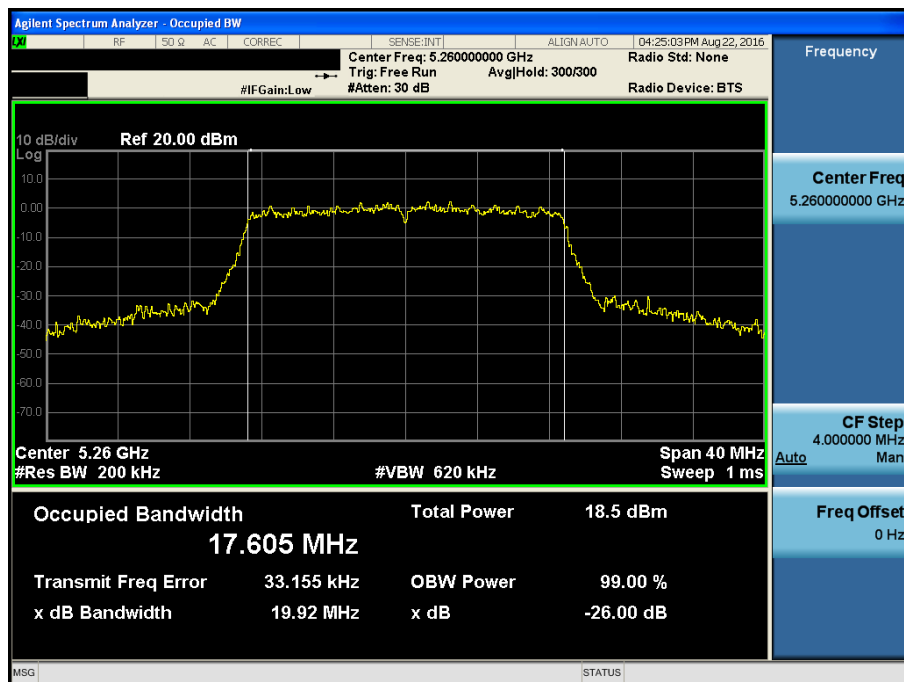
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.48



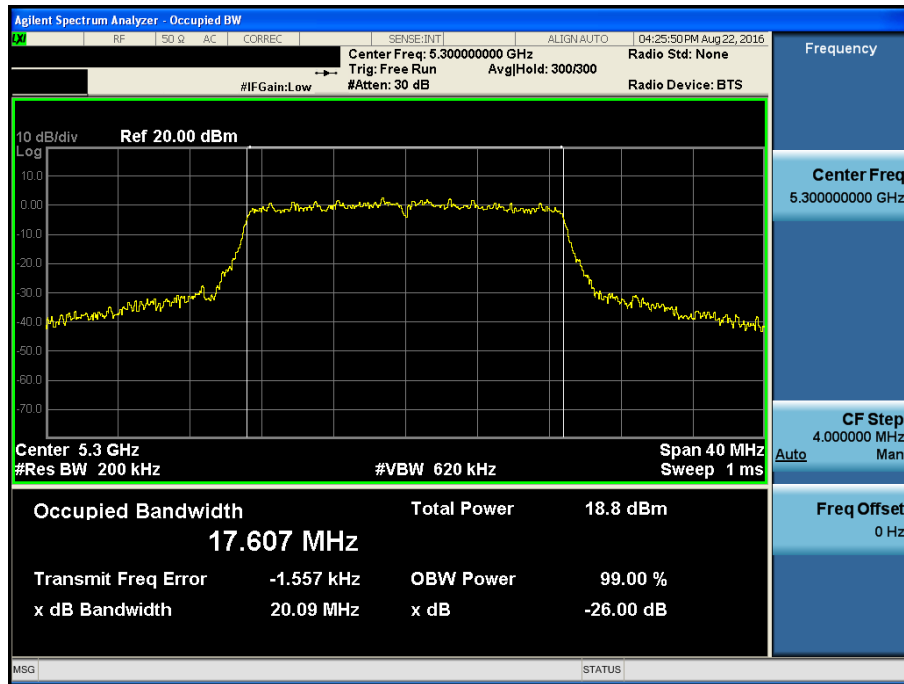
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.52



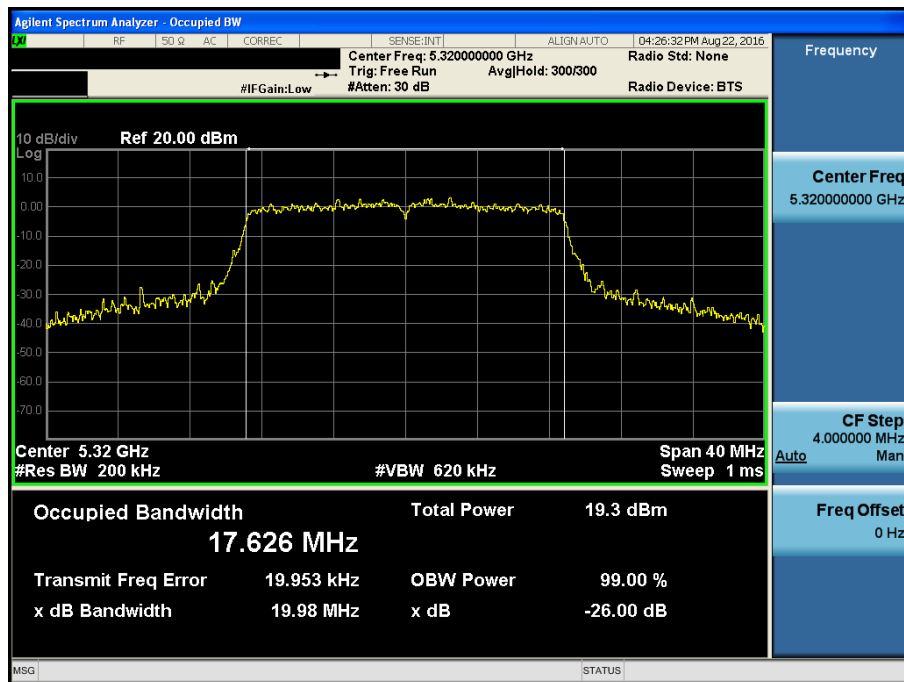
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.60



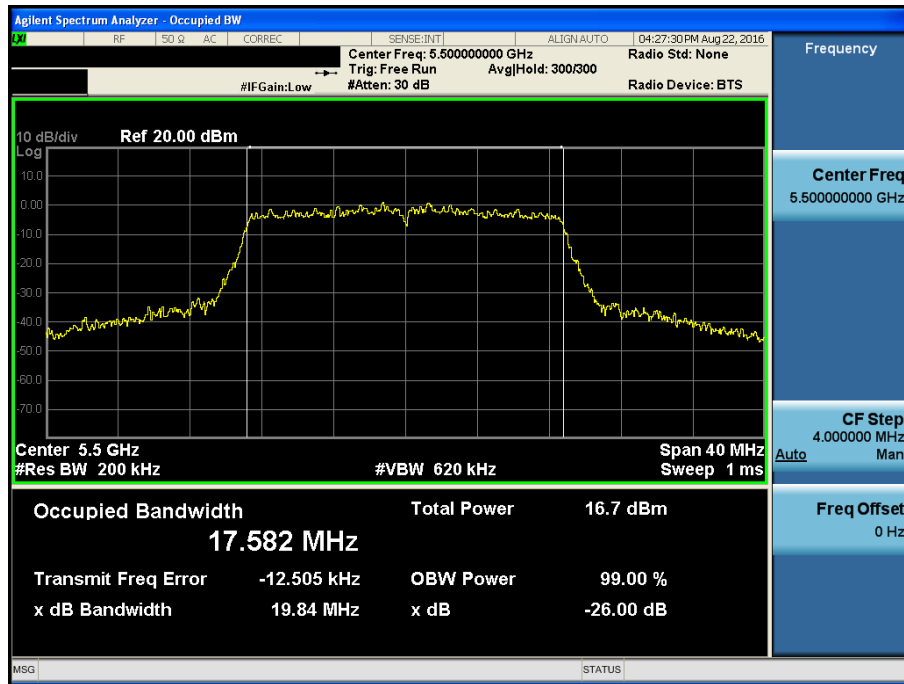
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.64



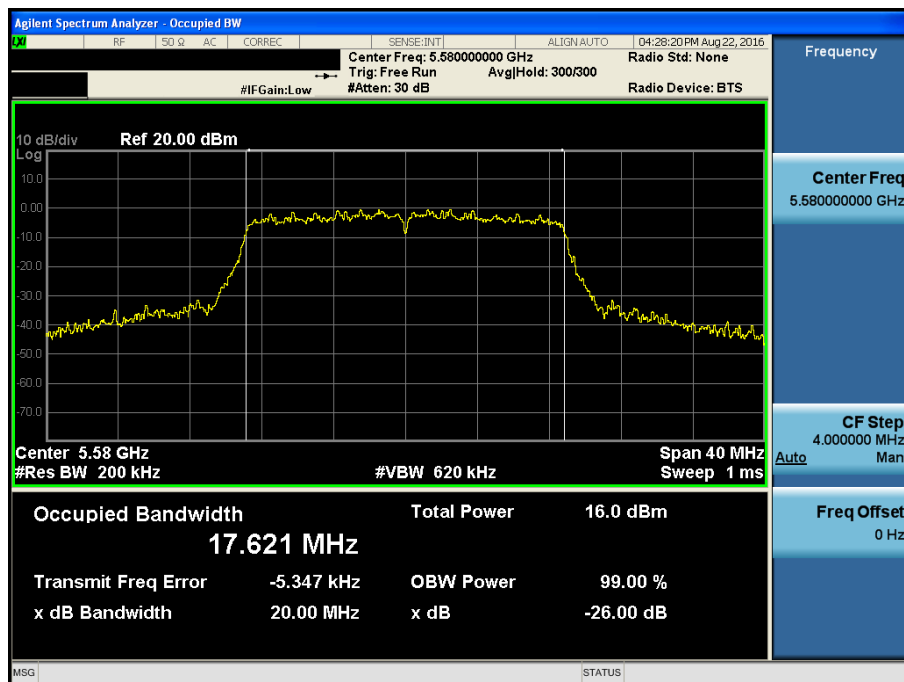
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.100



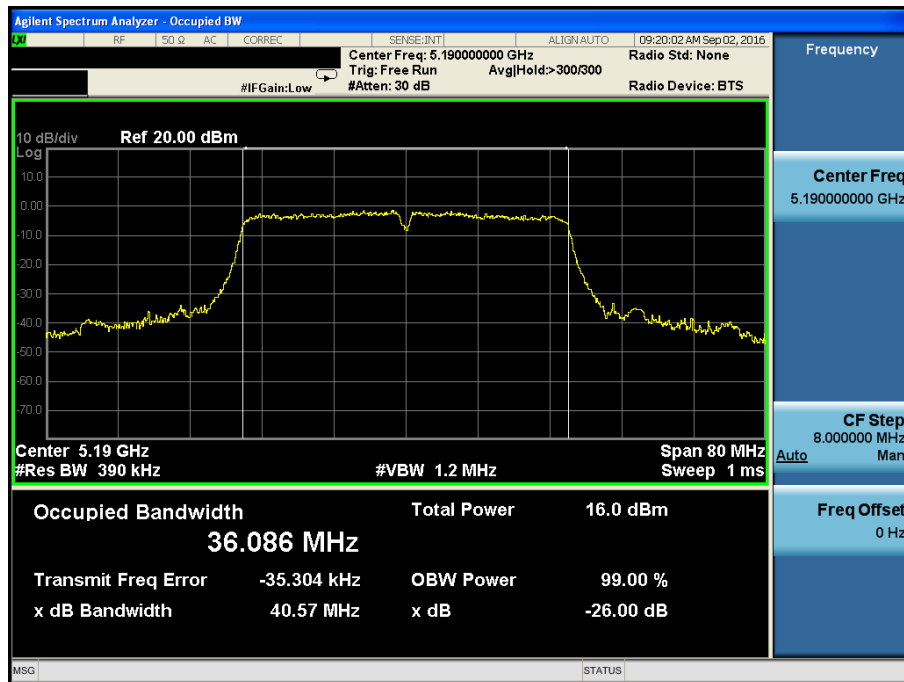
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.116



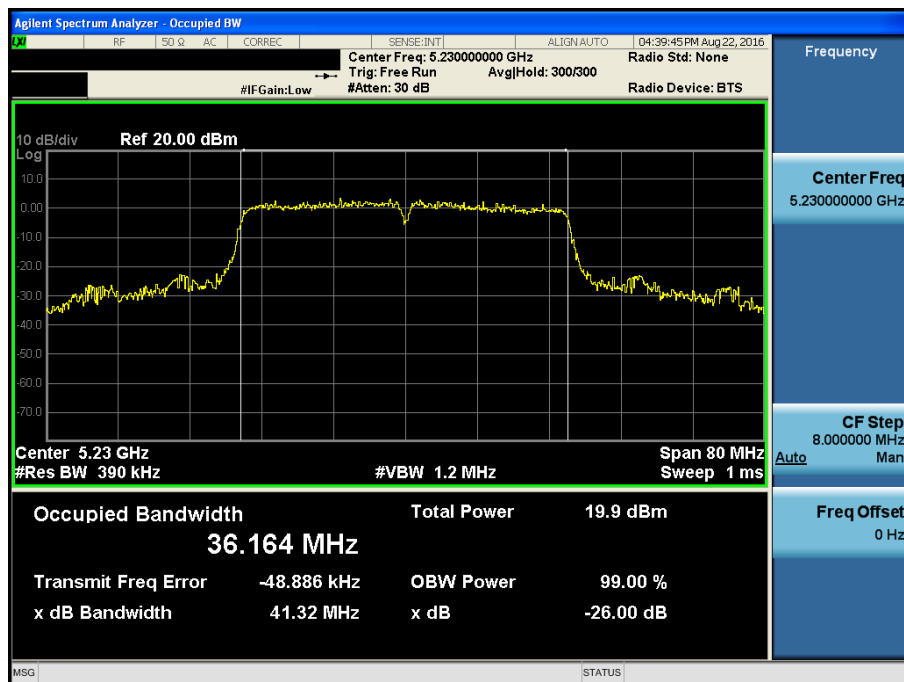
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.38



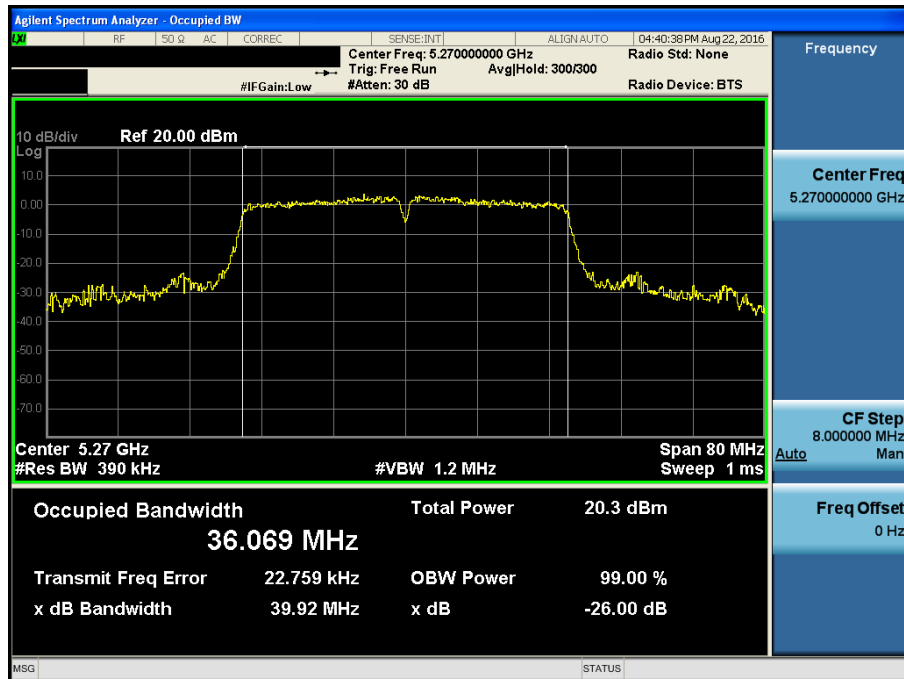
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.46



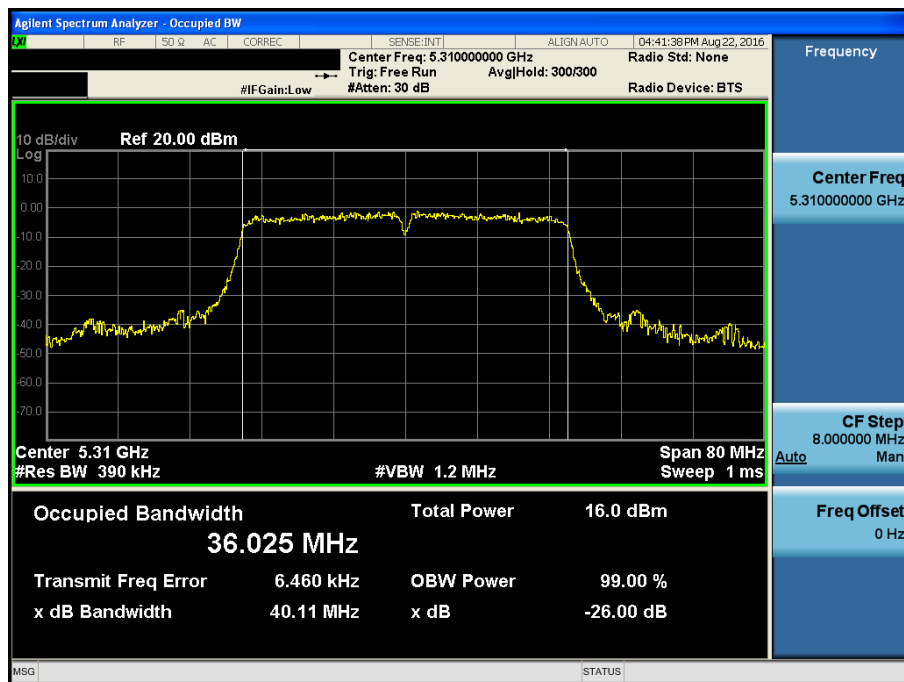
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.54



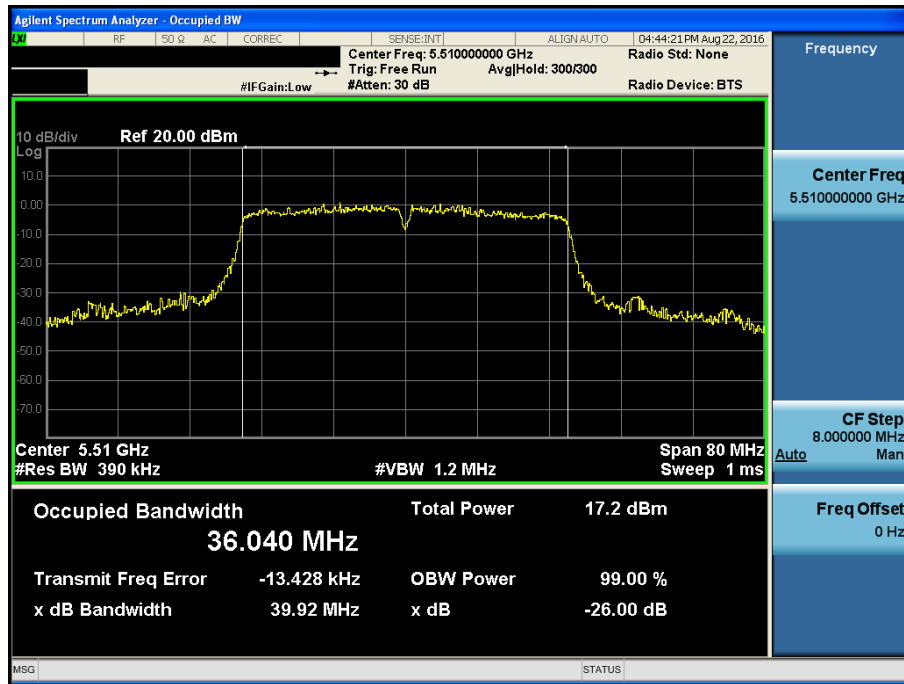
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.62



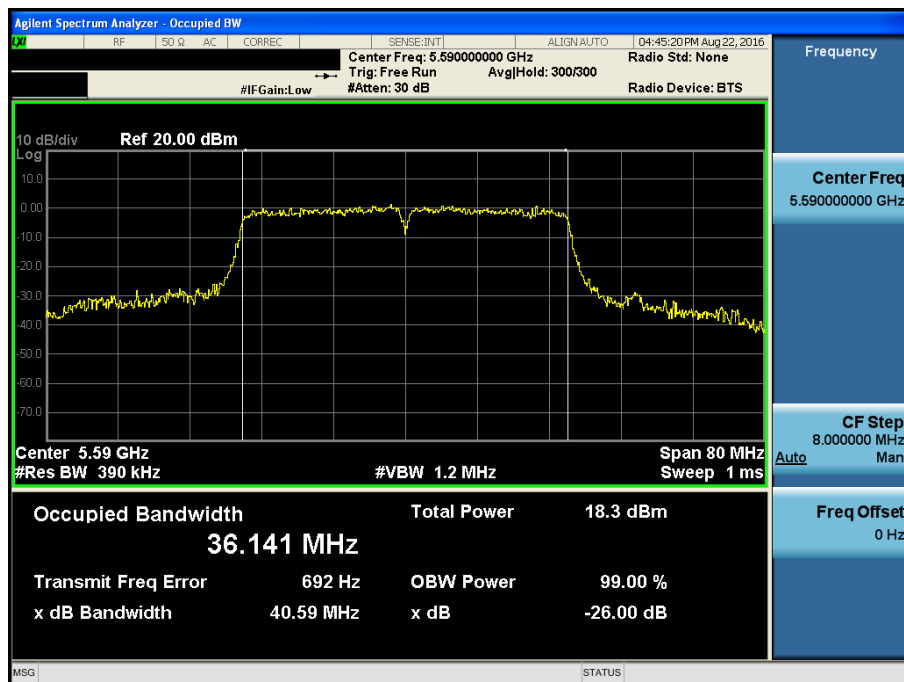
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.102



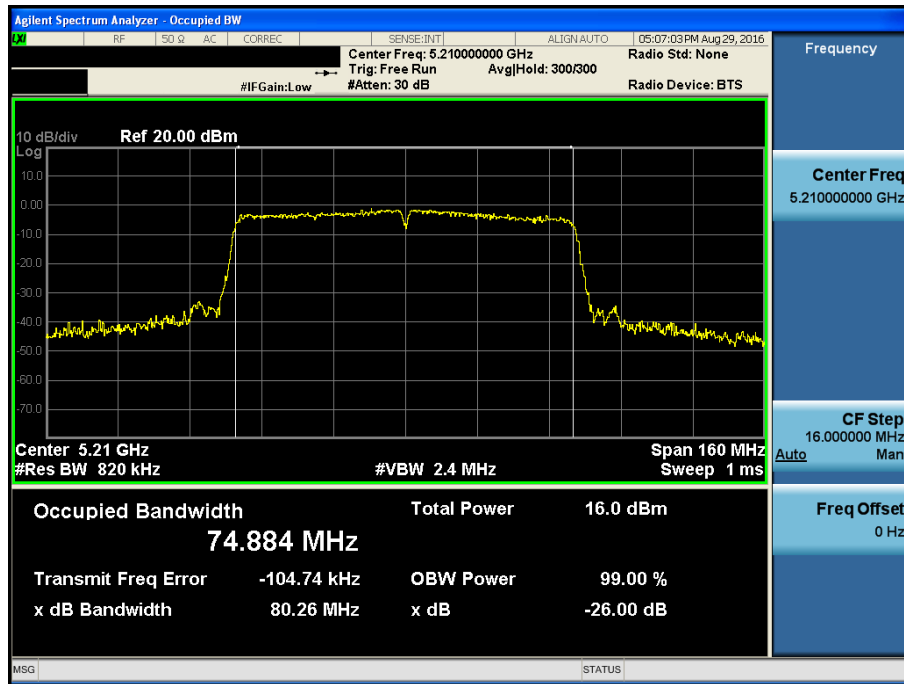
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.118



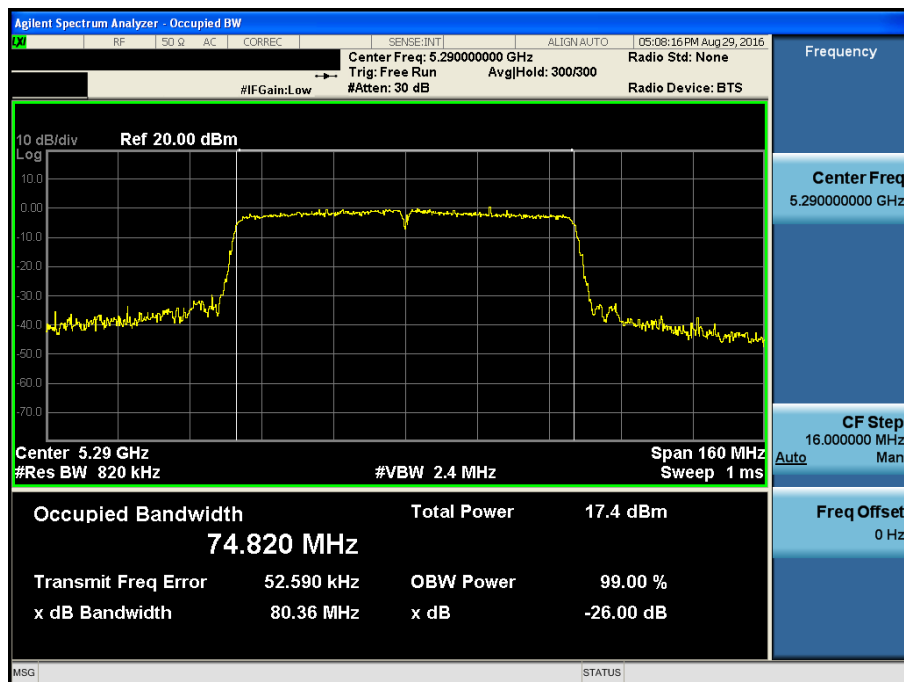
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 1 & Ch.42



26 dB Bandwidth

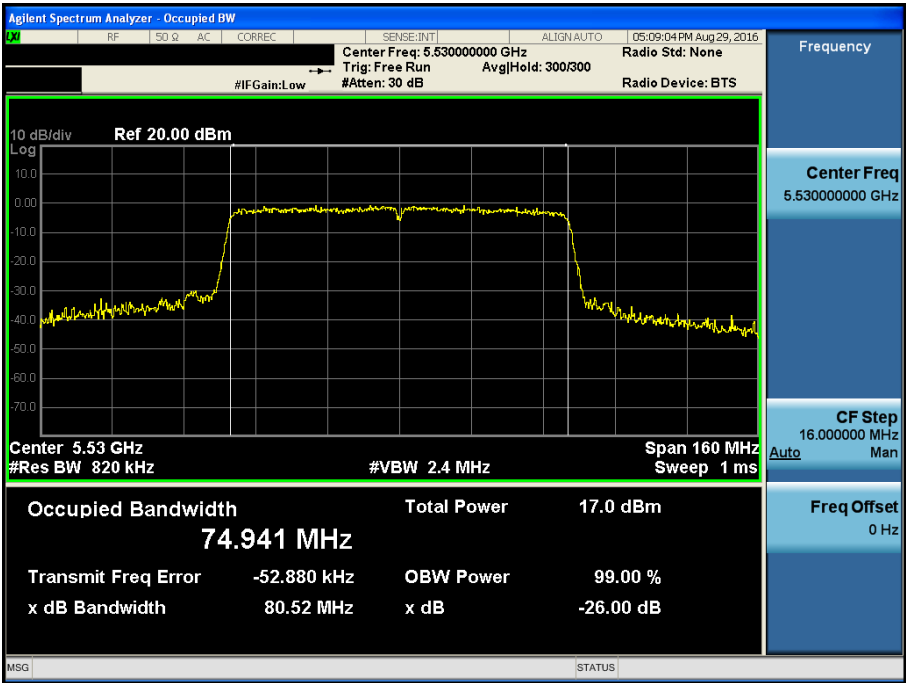
Test Mode: 802.11ac VHT80 & ANT 1 & Ch.58





26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 1 & Ch.106



26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.144



26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 1 & Ch.144



26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 1 & Ch.142



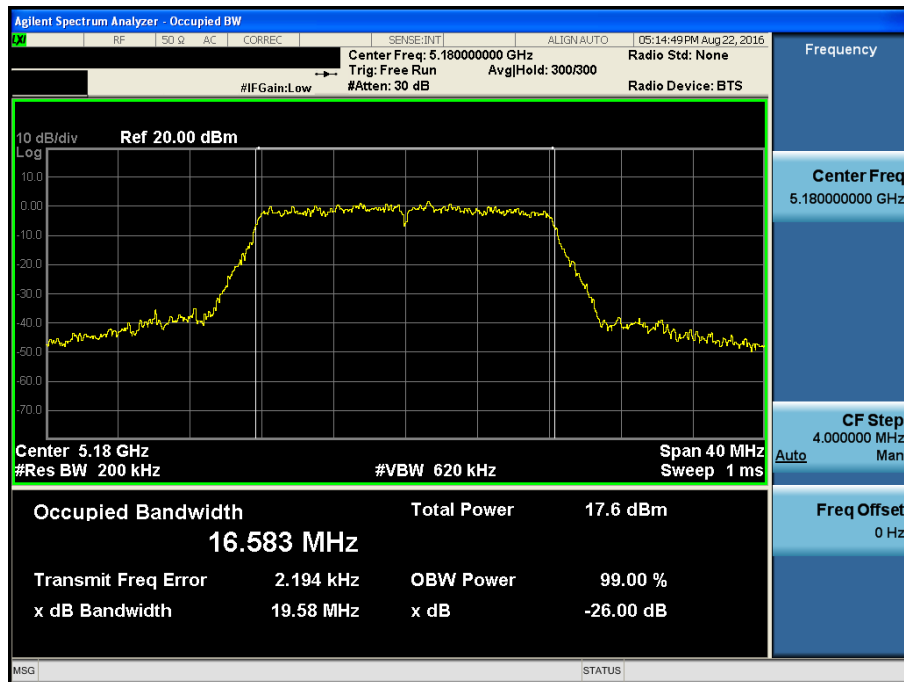
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 1 & Ch.138



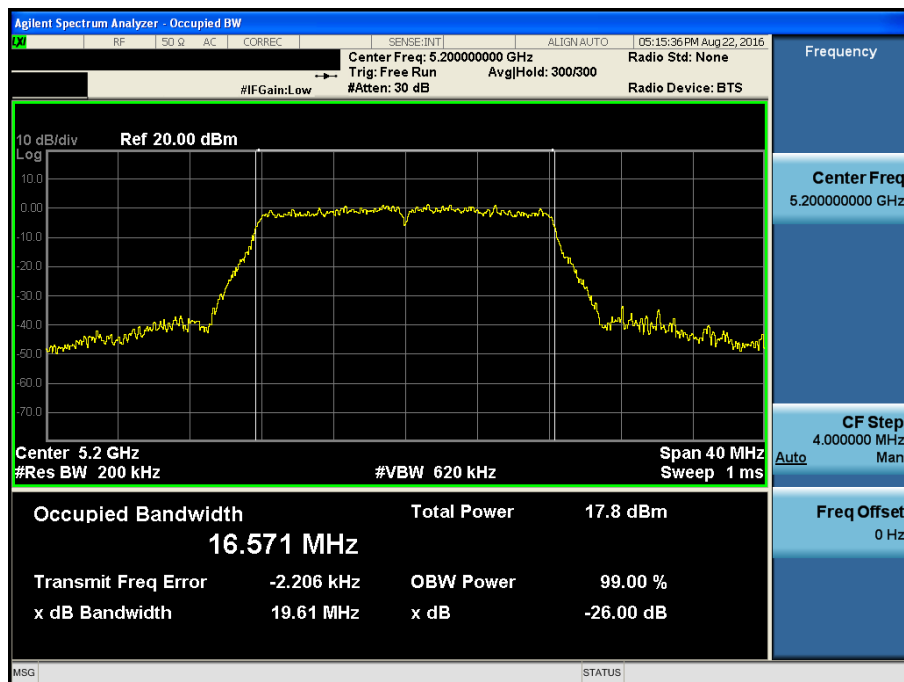
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.36



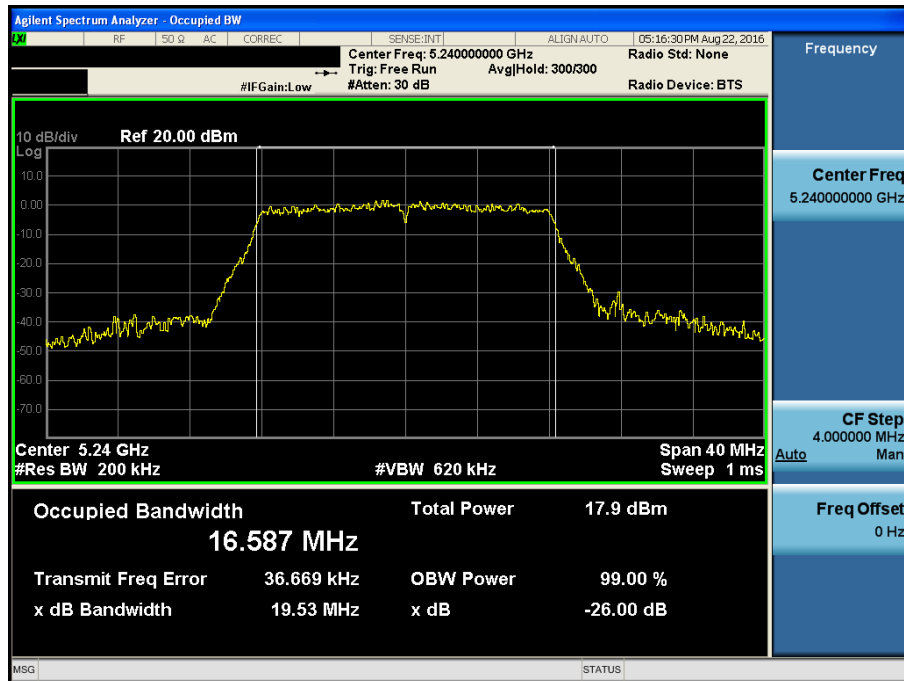
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.40



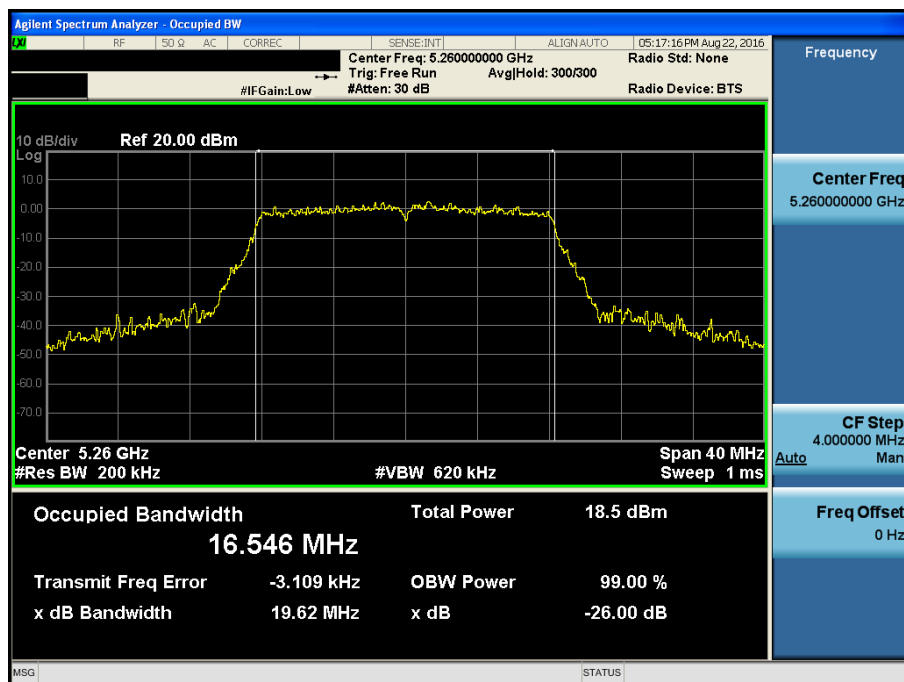
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.48



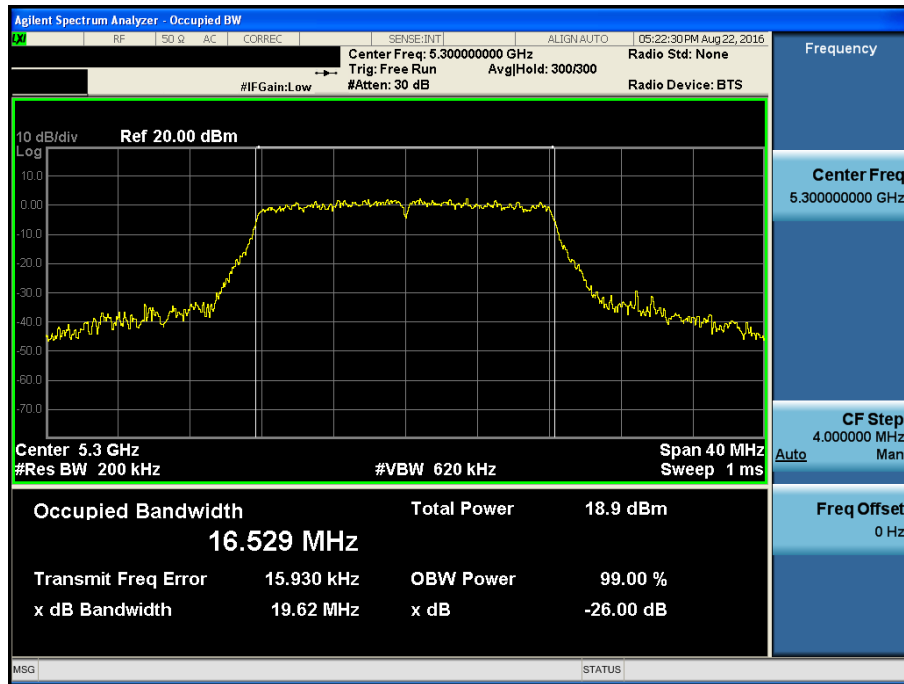
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.52



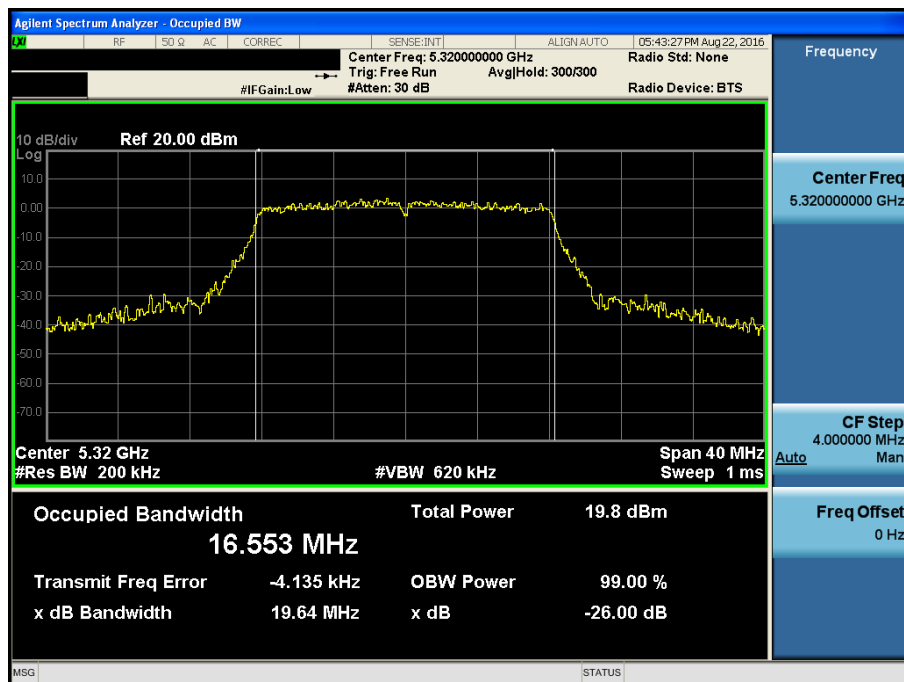
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.60



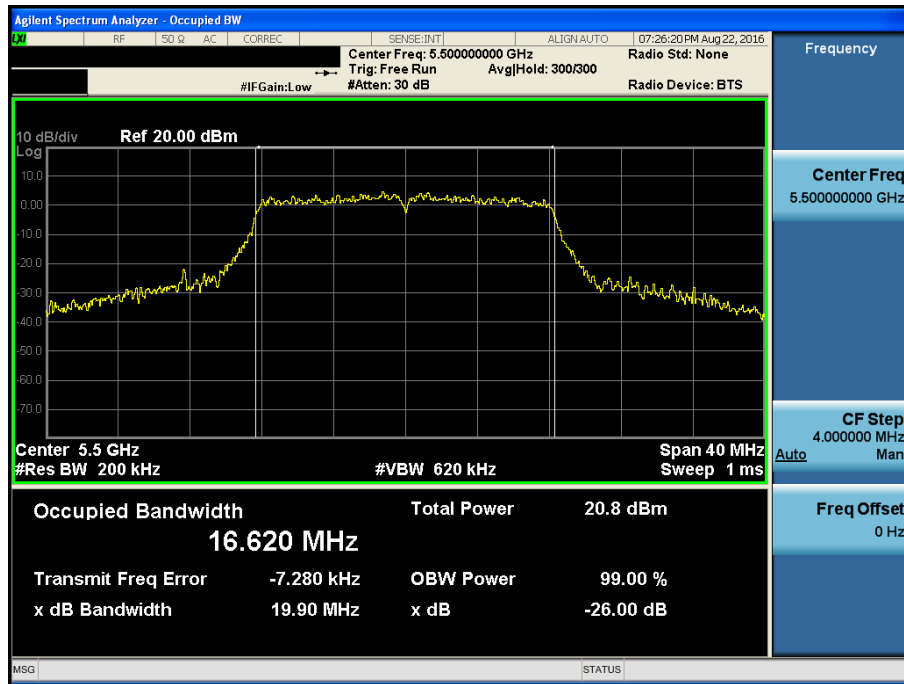
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.64



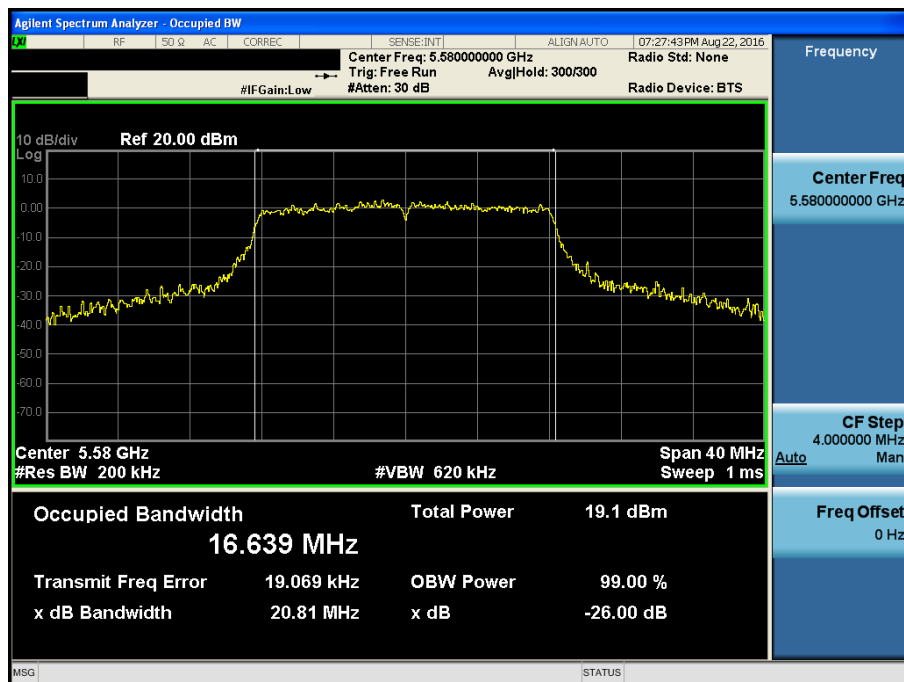
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.100



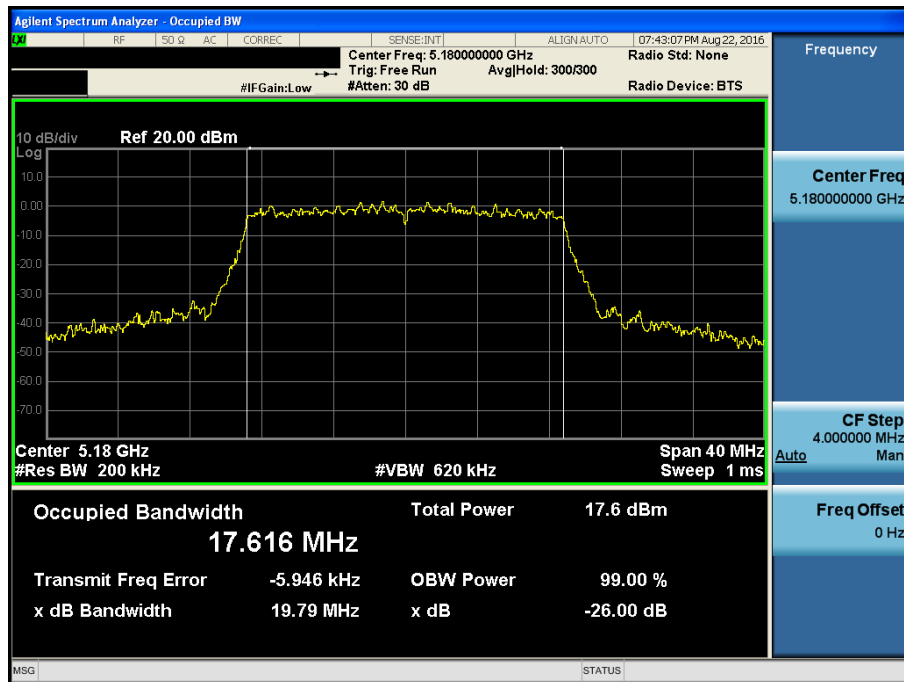
26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.116



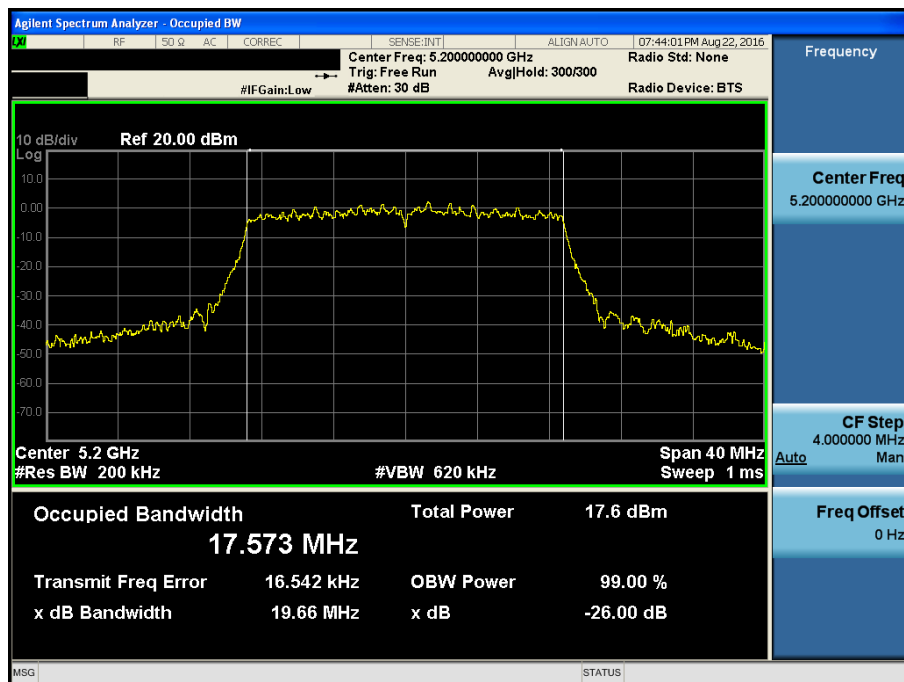
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.36



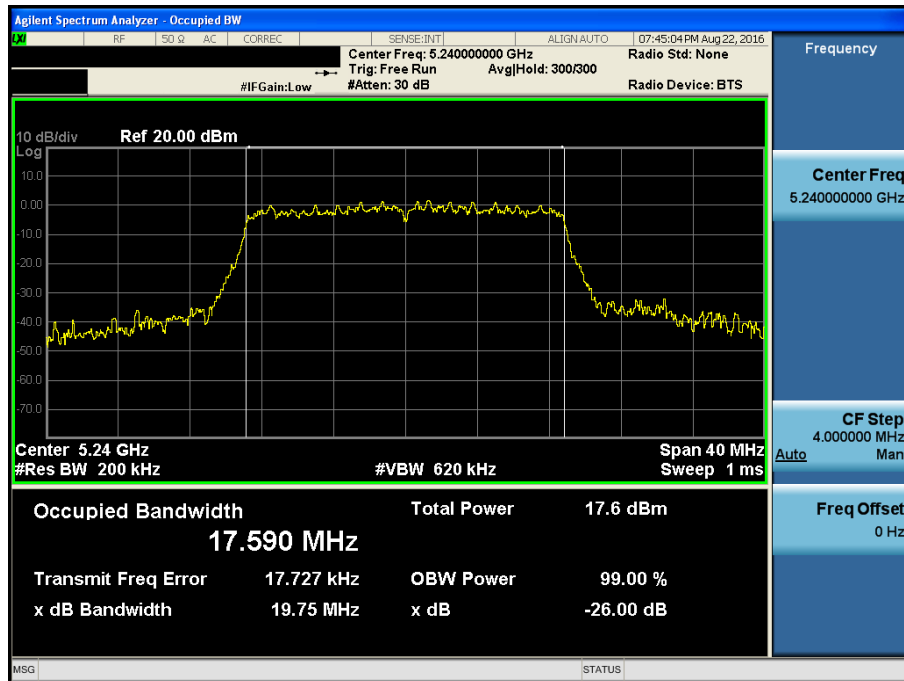
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.40



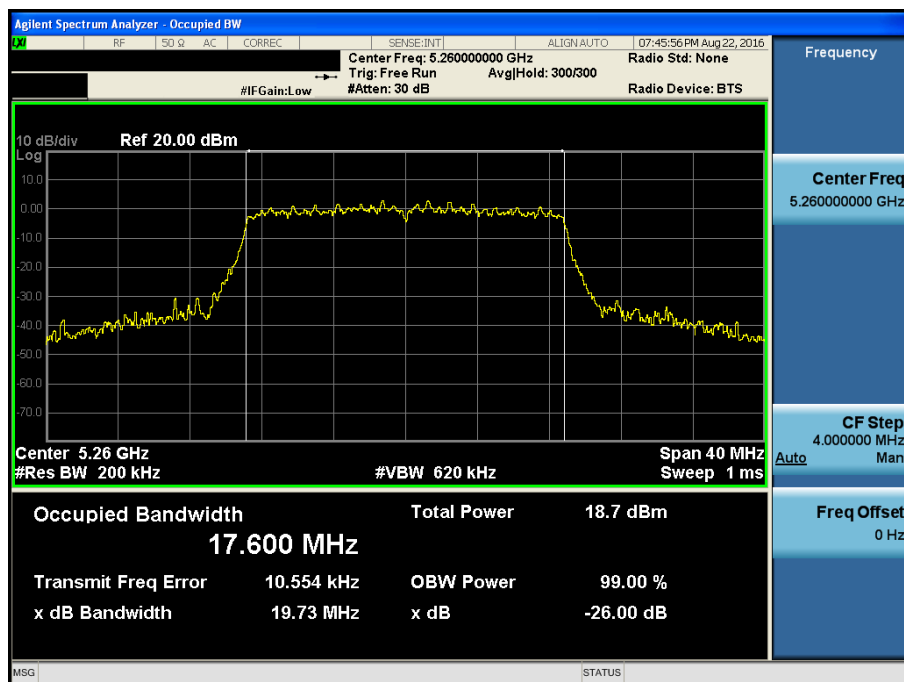
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.48



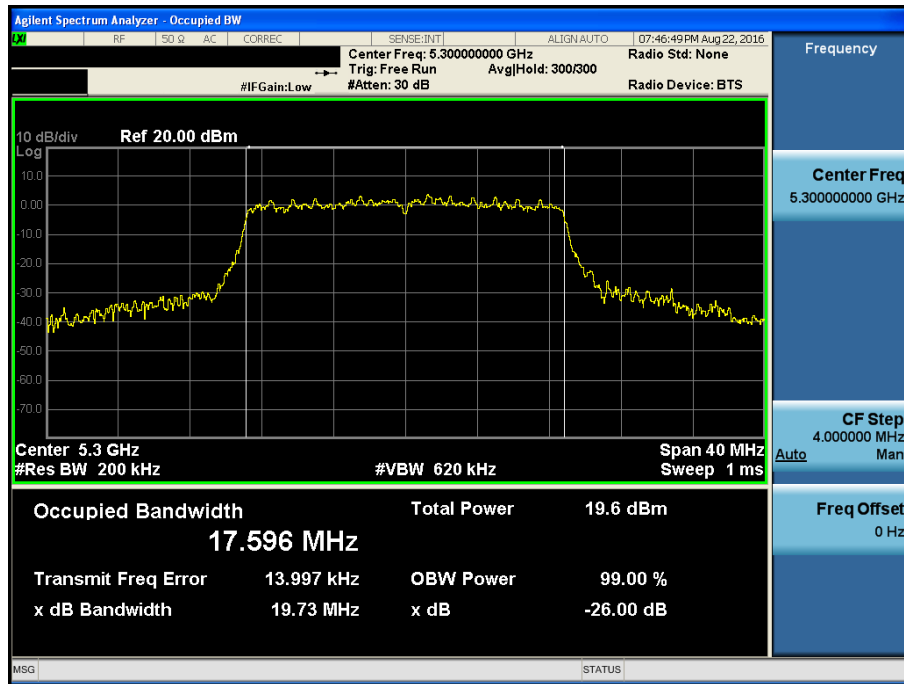
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.52



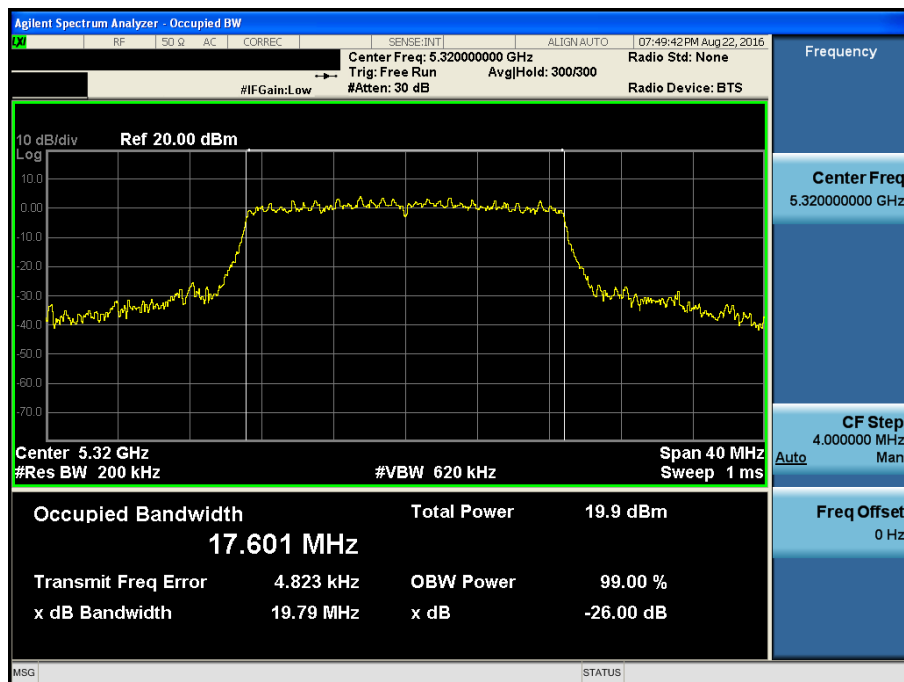
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.60



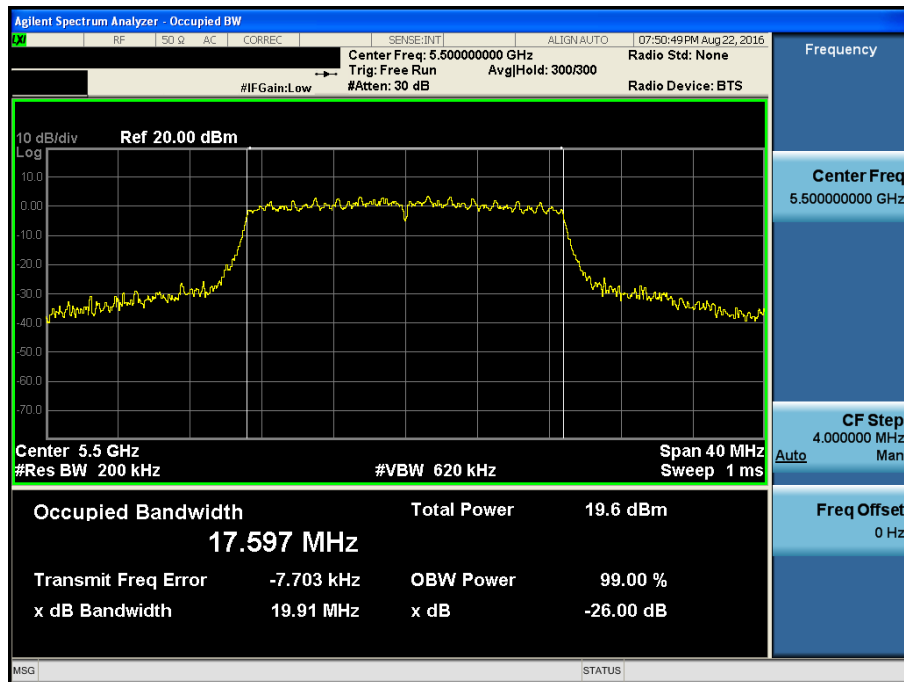
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.64



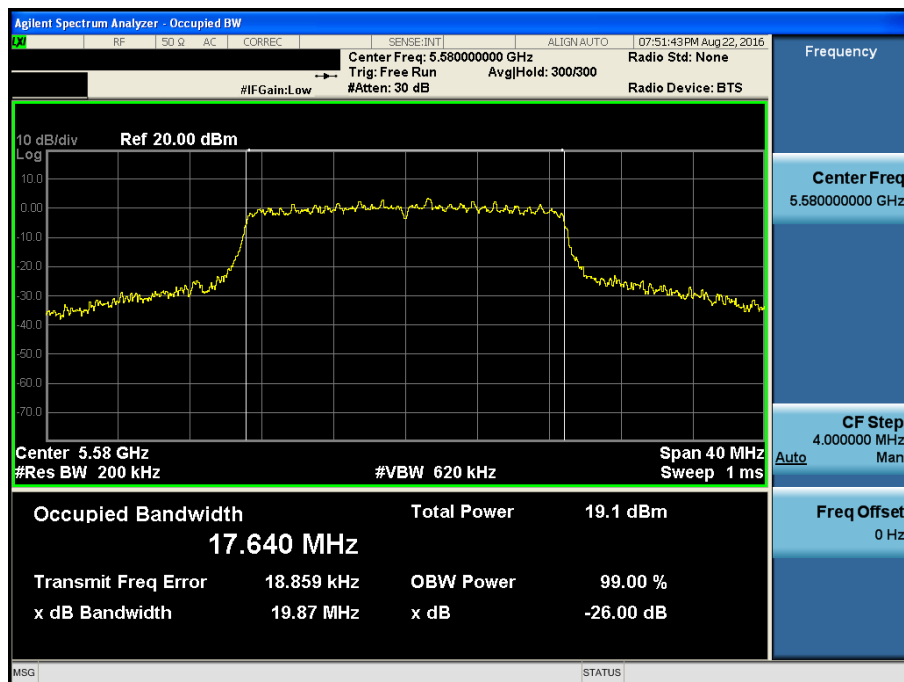
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.100



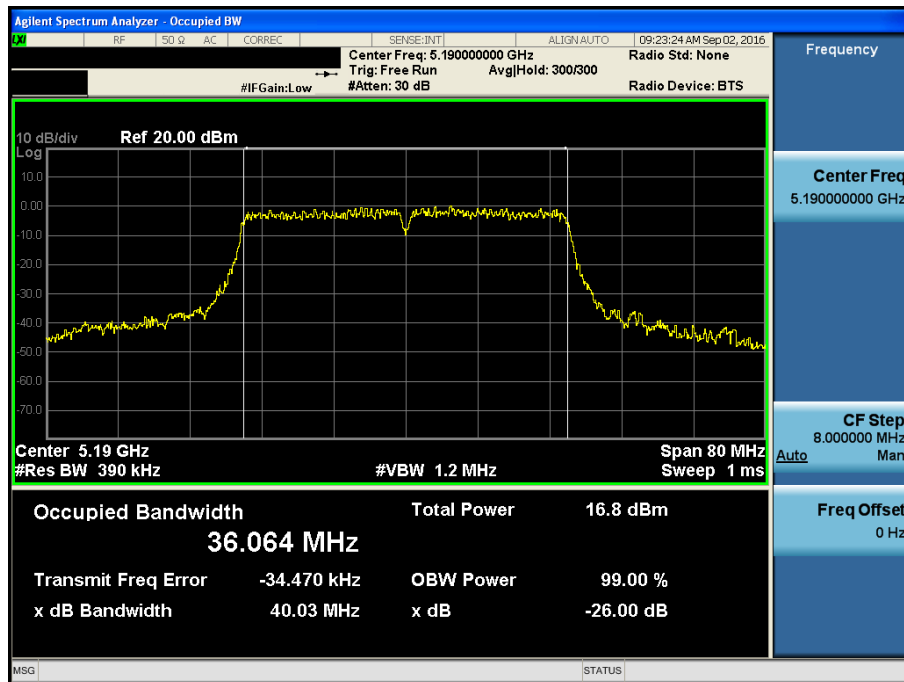
26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.116



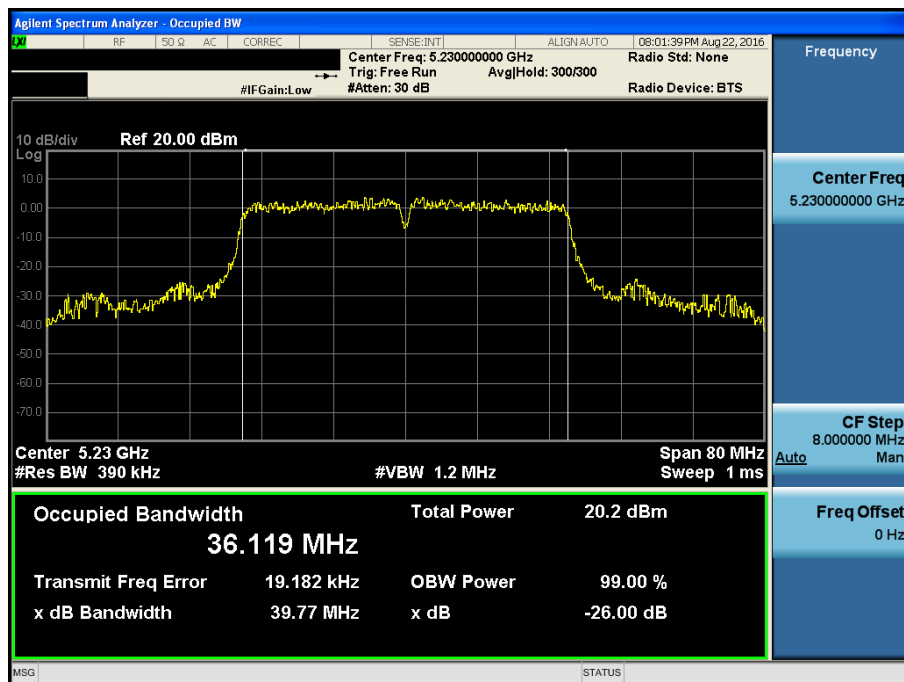
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.38



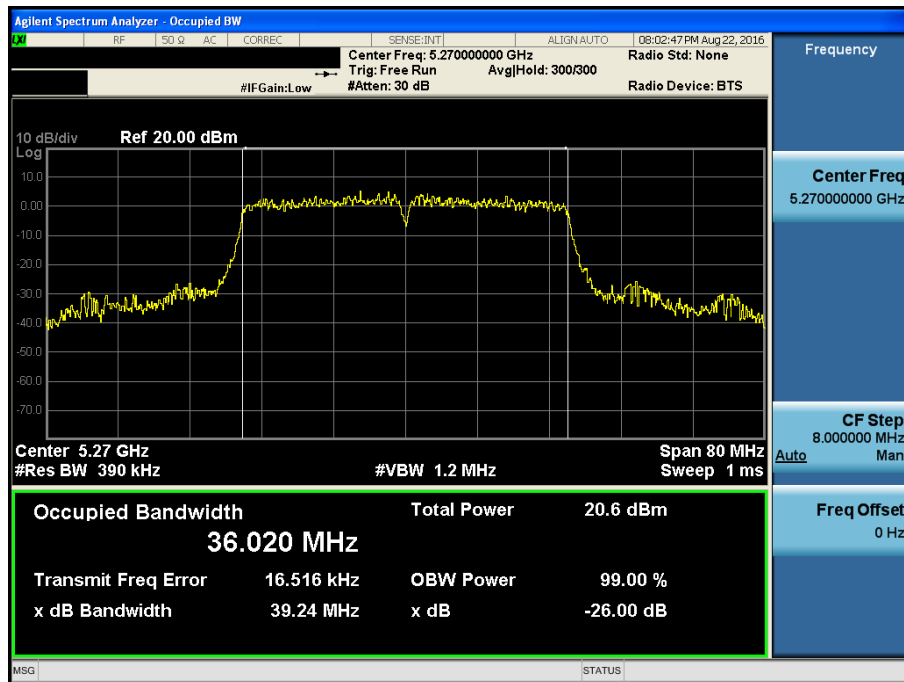
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.46



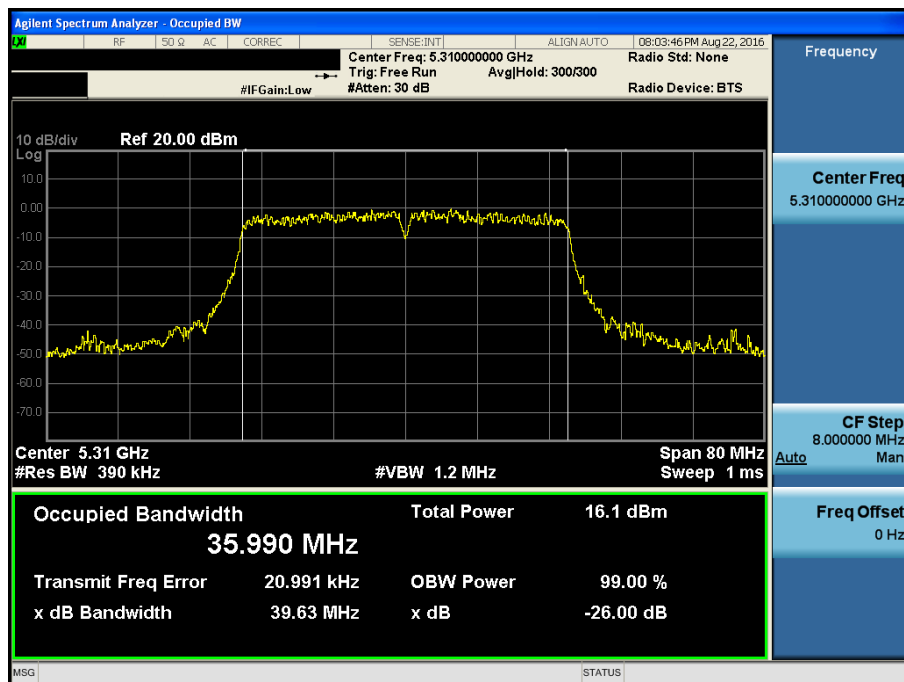
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.54



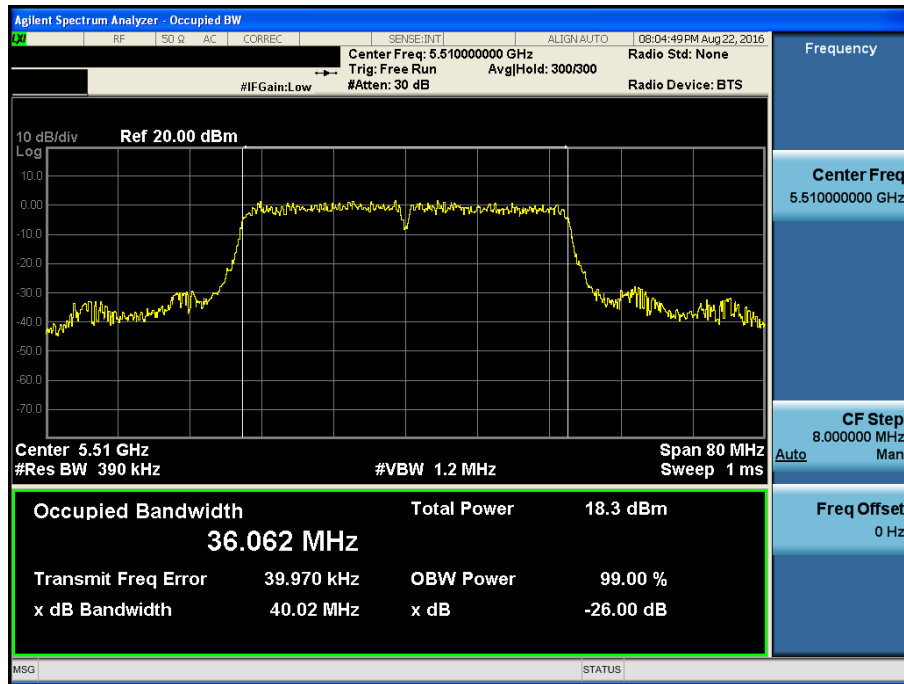
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.62



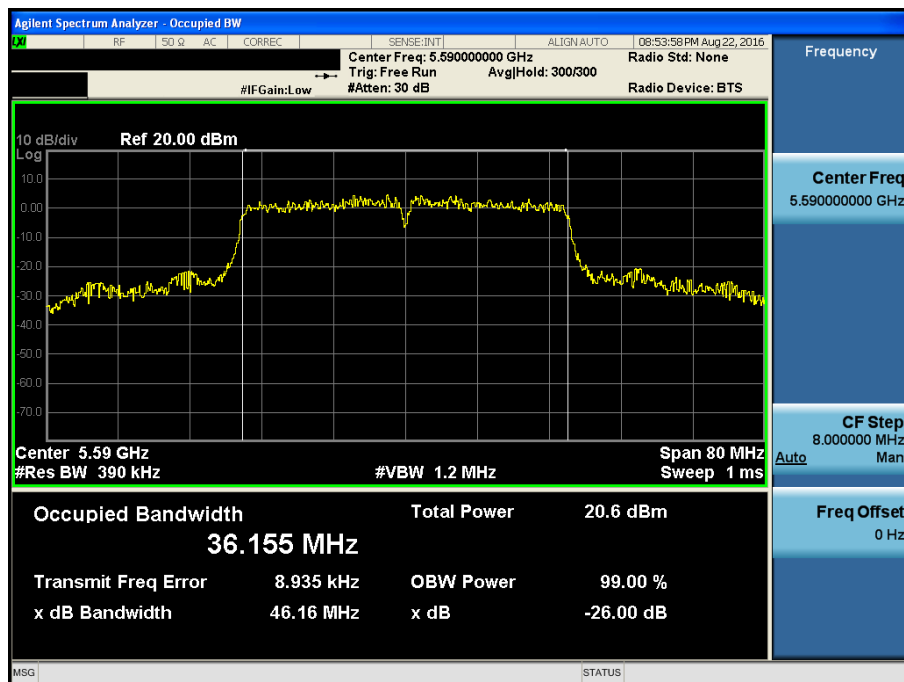
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.102



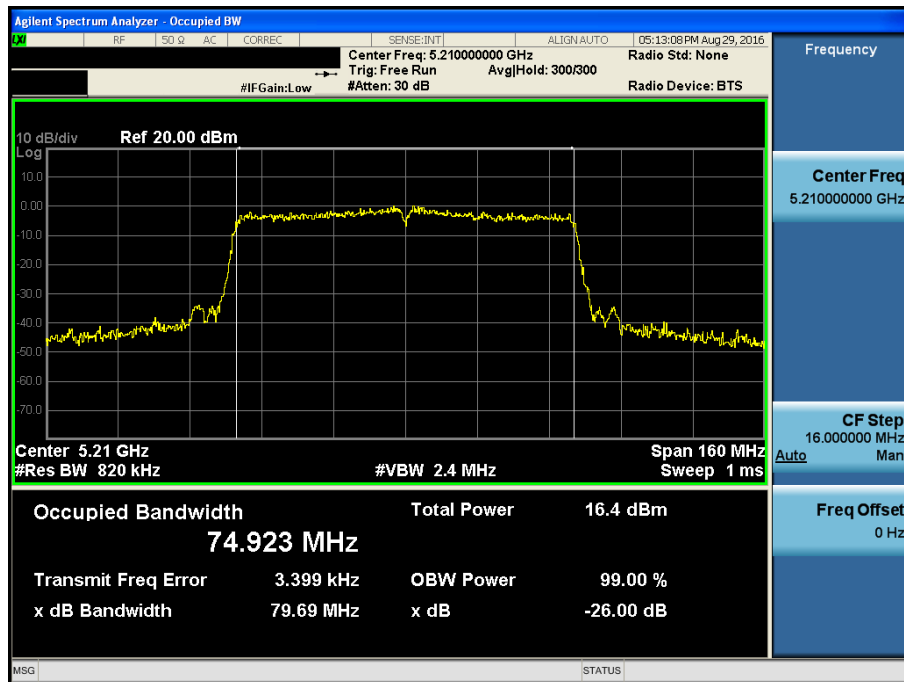
26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.118



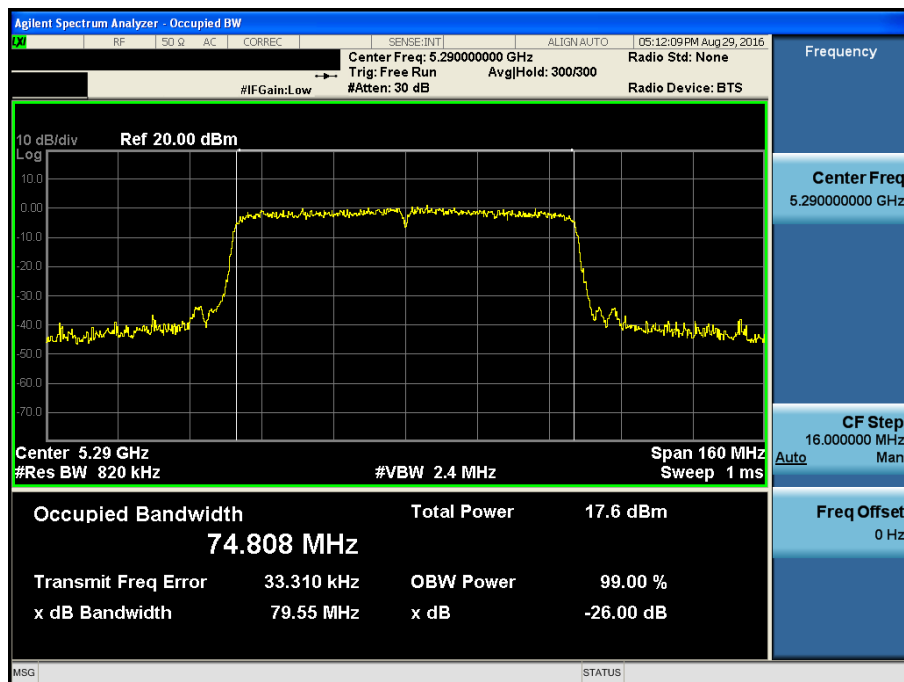
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 2 & Ch.42



26 dB Bandwidth

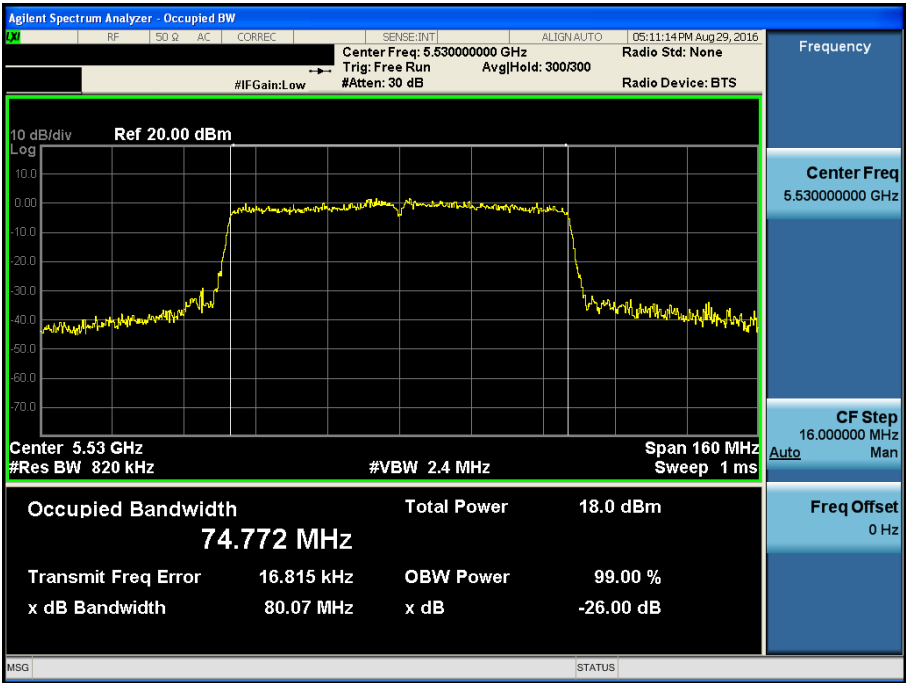
Test Mode: 802.11ac VHT80 & ANT 2 & Ch.58





26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 2 & Ch.106



26 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.144



26 dB Bandwidth

Test Mode: 802.11ac VHT20 & ANT 2 & Ch.144



26 dB Bandwidth

Test Mode: 802.11ac VHT40 & ANT 2 & Ch.142



26 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 2 & Ch.138



8.2 Minimum Emission Bandwidth (6 dB Bandwidth)

■ Test Requirements

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

■ Test Configuration

Refer to the APPENDIX I.

■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth $\geq 3 \times \text{RBW}$.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

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.

■ TEST RESULTS: **Comply**

Multiple Transmit

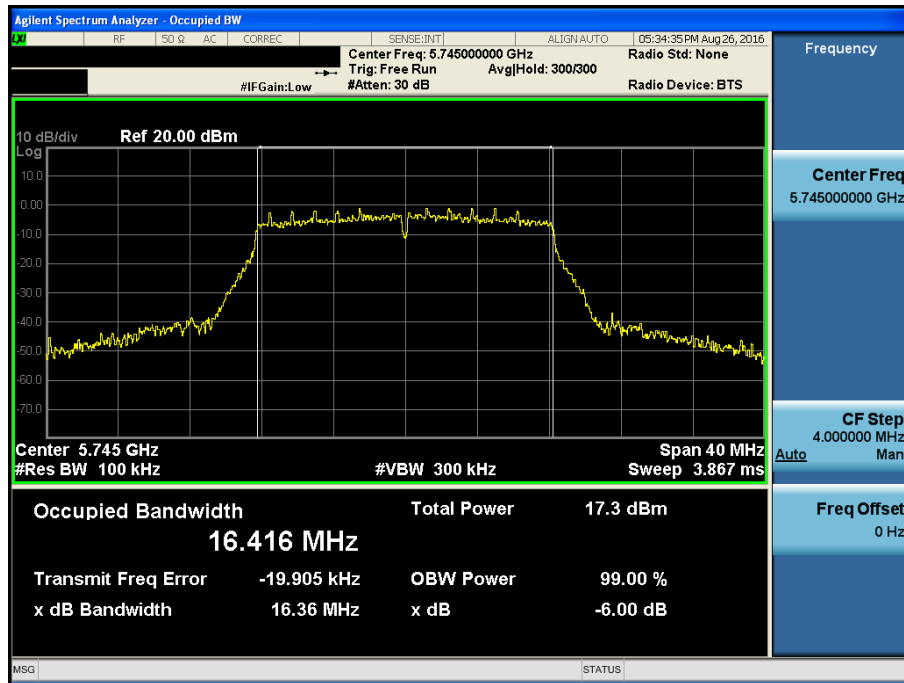
Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11a	U-NII 3	149	5745	16.360	16.050
		157	5785	15.740	16.340
		165	5825	16.370	16.070
802.11n (HT20)	U-NII 3	149	5745	16.010	17.530
		157	5785	16.080	16.950
		165	5825	17.080	17.290
802.11n (HT40)	U-NII 3	151	5755	35.220	35.250
		159	5795	35.210	35.230
802.11ac (VHT80)	U-NII 3	155	5775	75.250	75.200

■ RESULT PLOTS

Multiple Transmit

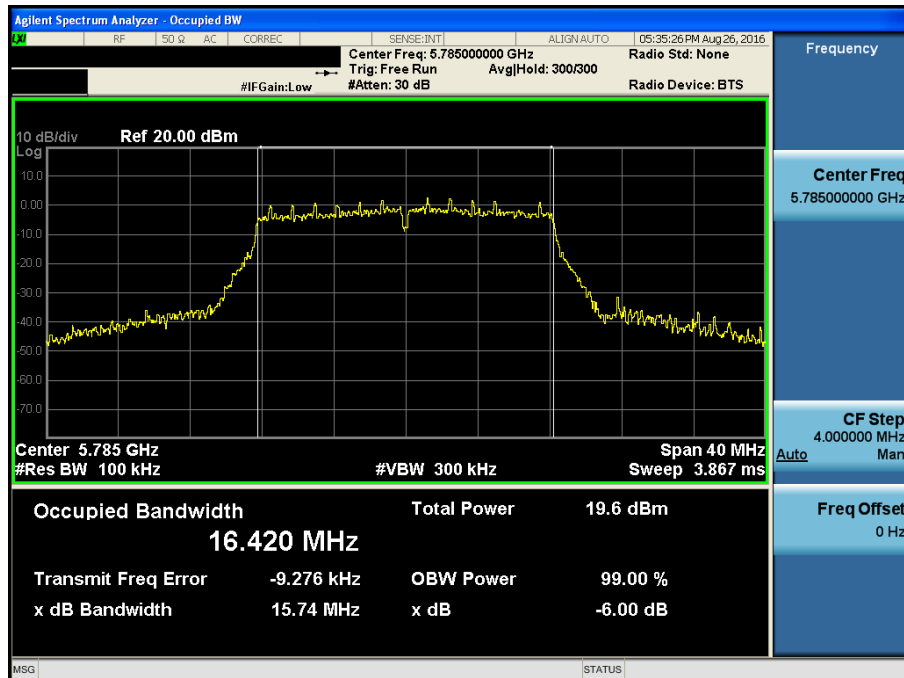
6 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.149



6 dB Bandwidth

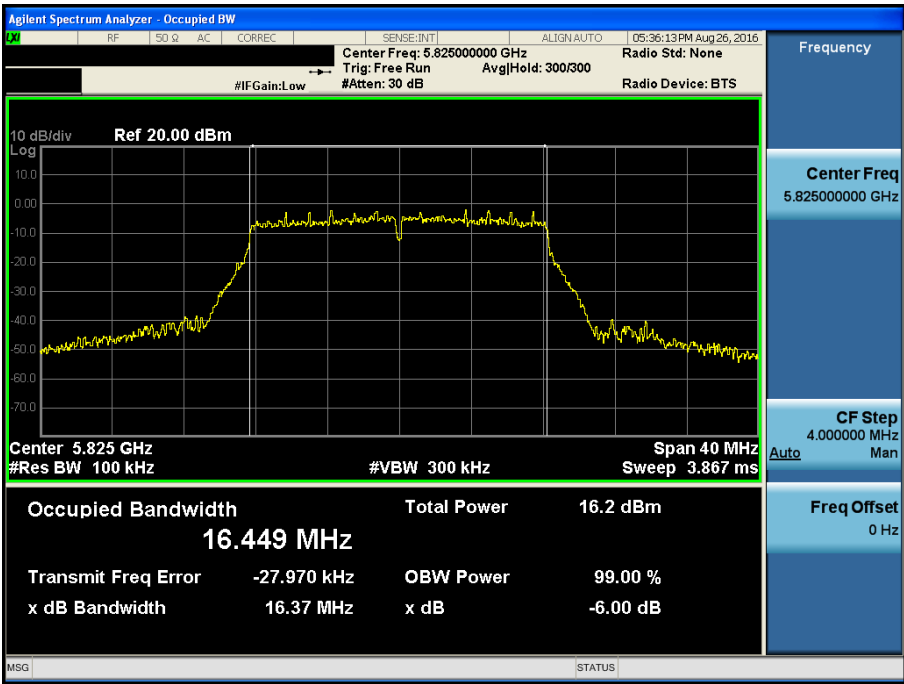
Test Mode: 802.11a & ANT 1 & Ch.157





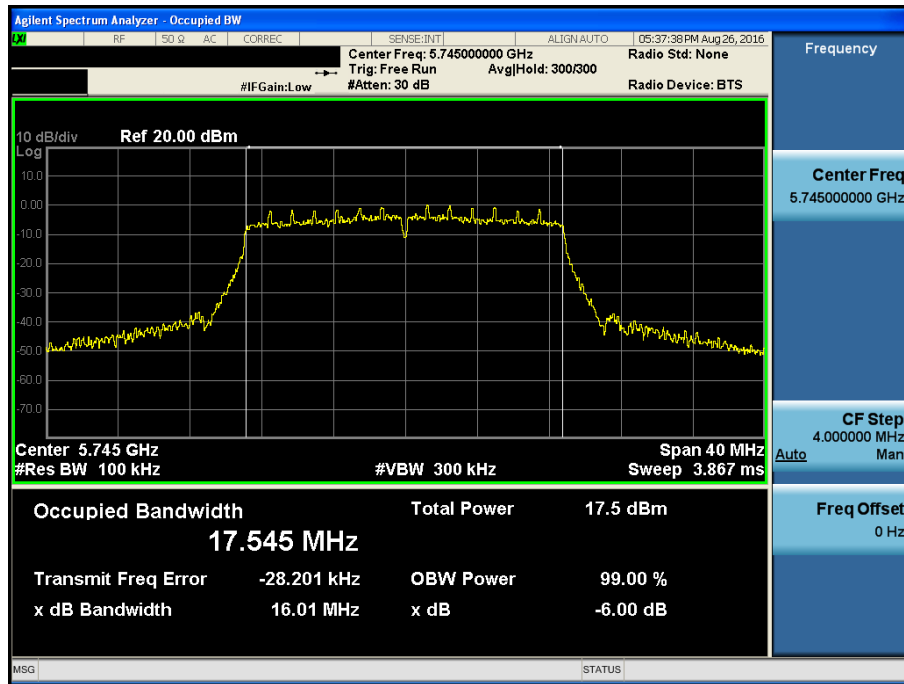
6 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.165



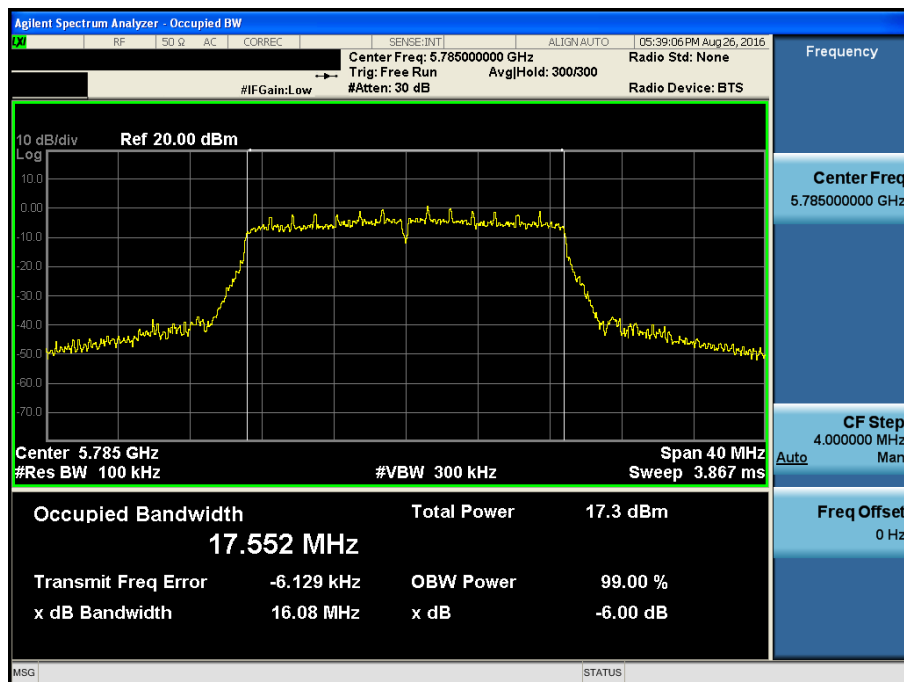
6 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 1 & Ch.149



6 dB Bandwidth

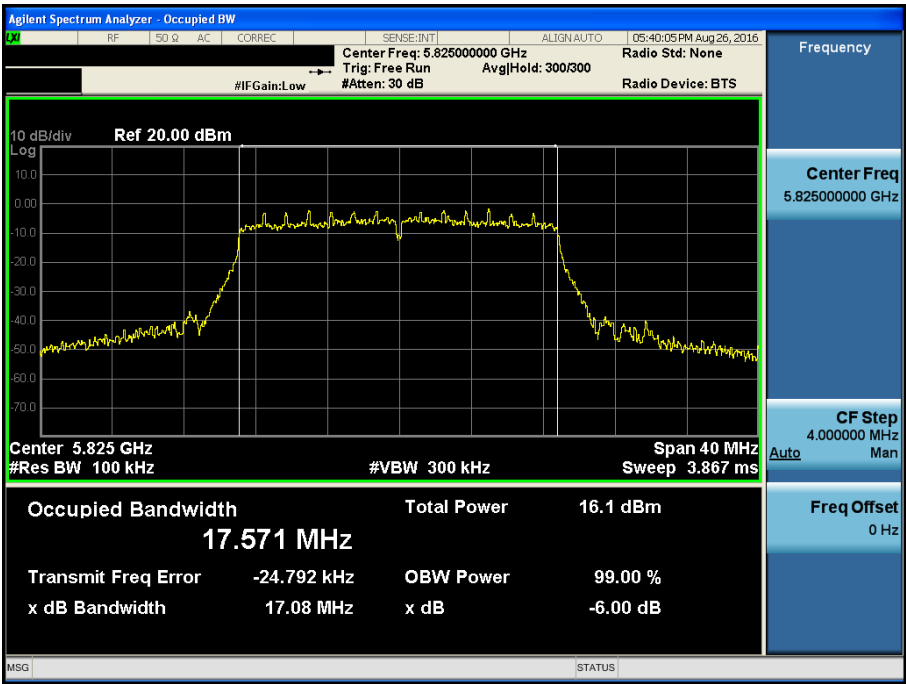
Test Mode: 802.11n HT20 & ANT 1 & Ch.157





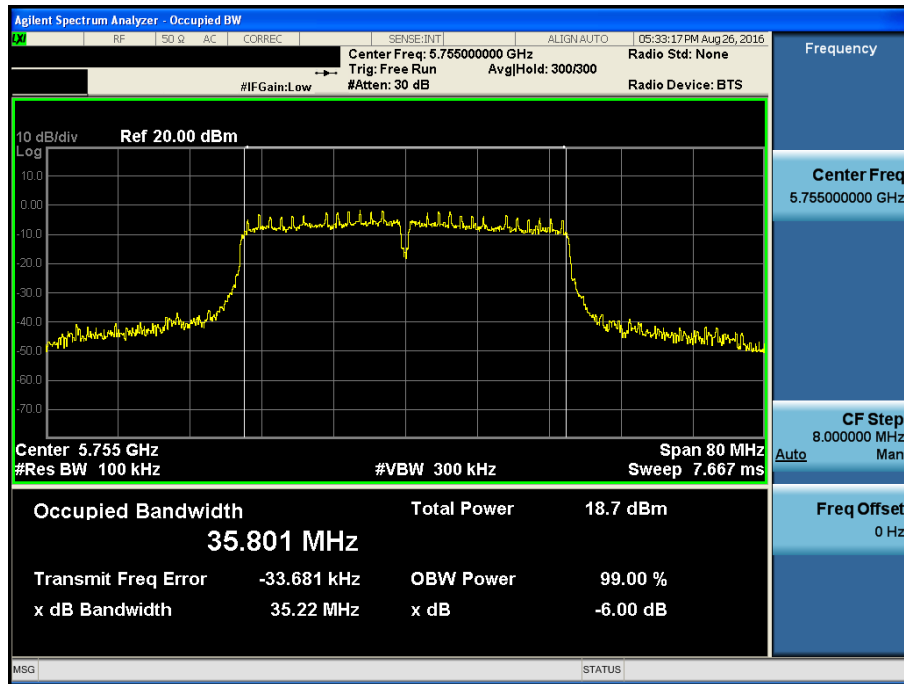
6 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 1 & Ch.165



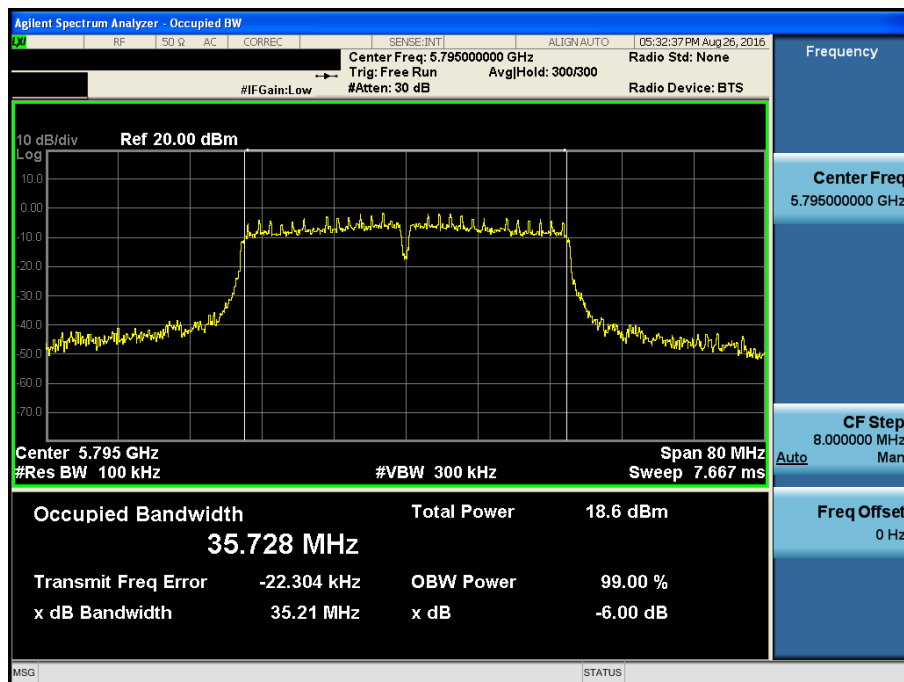
6 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 1 & Ch.151



6 dB Bandwidth

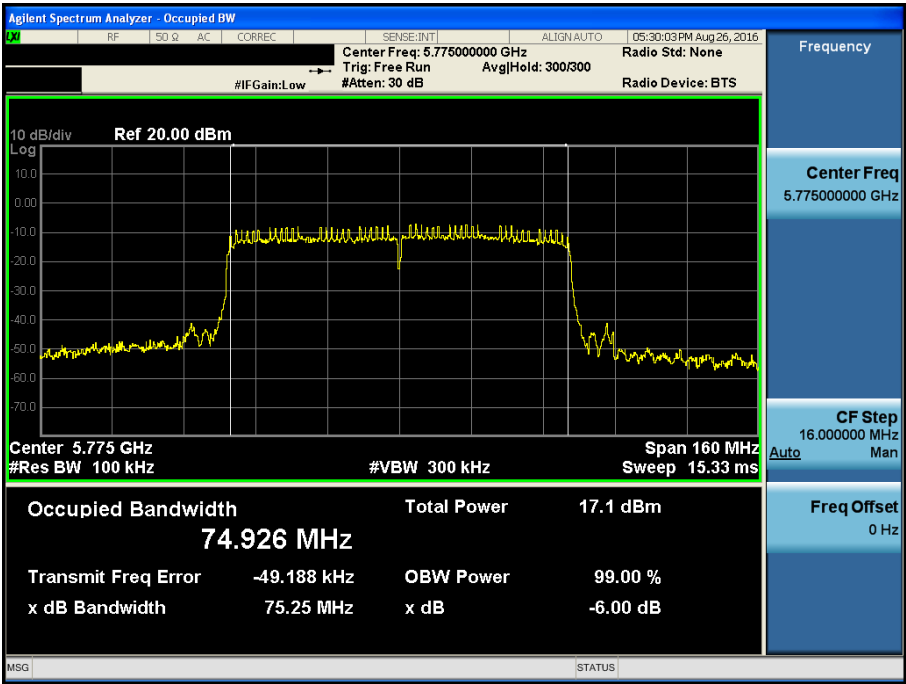
Test Mode: 802.11n HT40 & ANT 1 & Ch.159





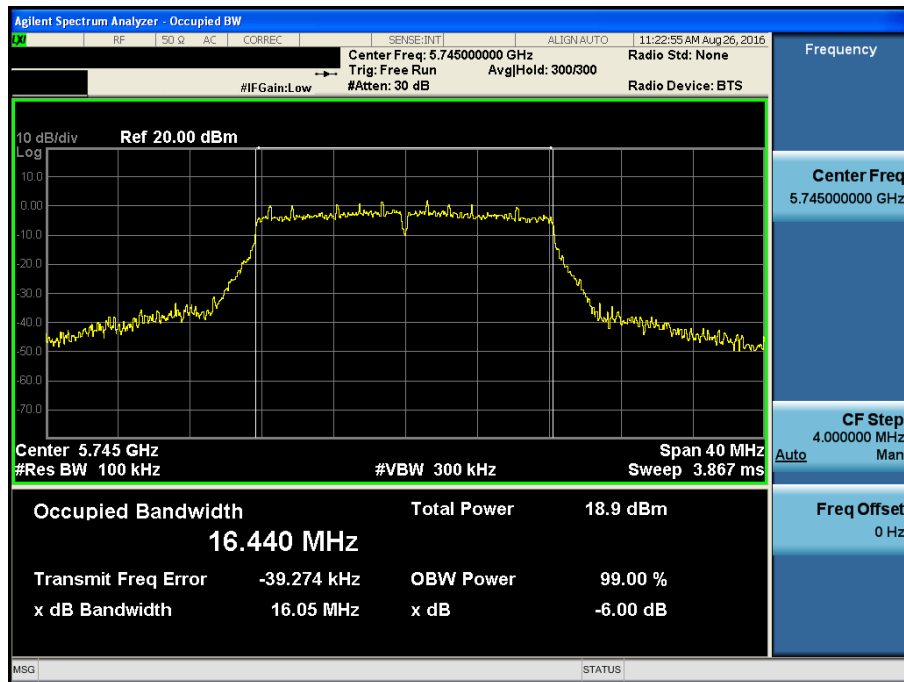
6 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 1 & Ch.155



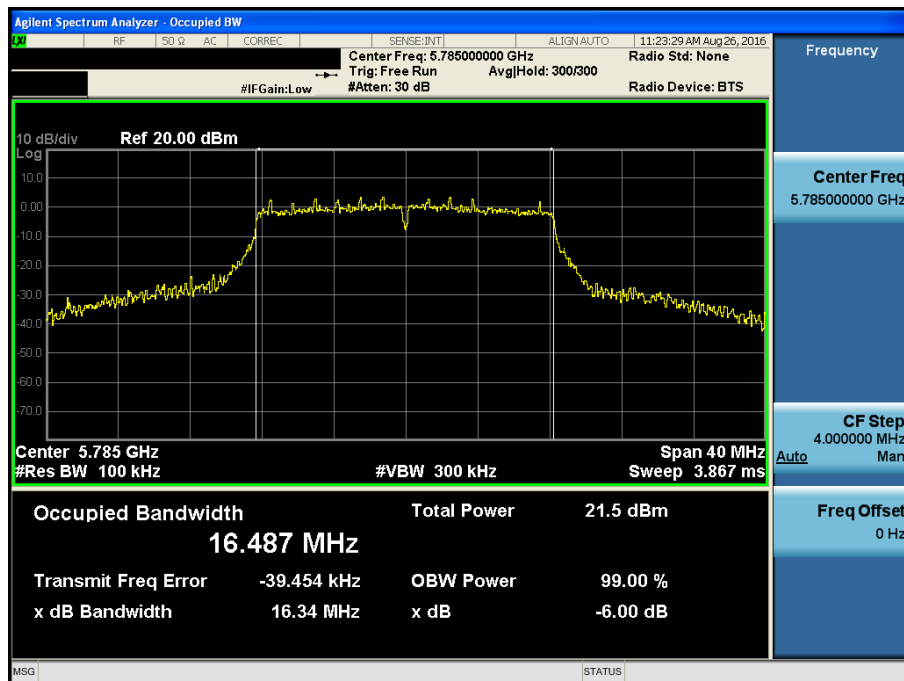
6 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.149



6 dB Bandwidth

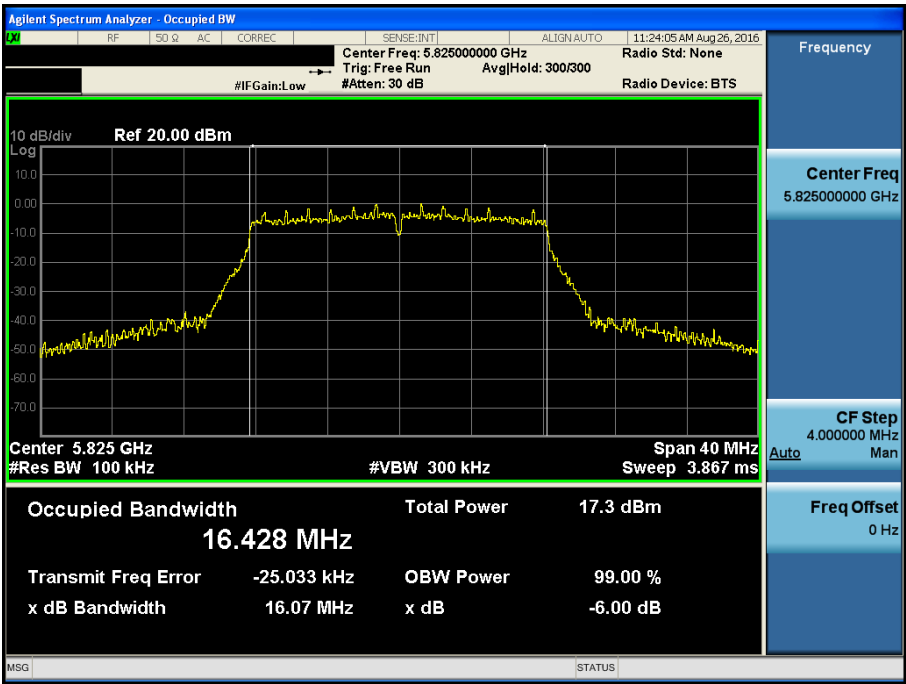
Test Mode: 802.11a & ANT 2 & Ch.157





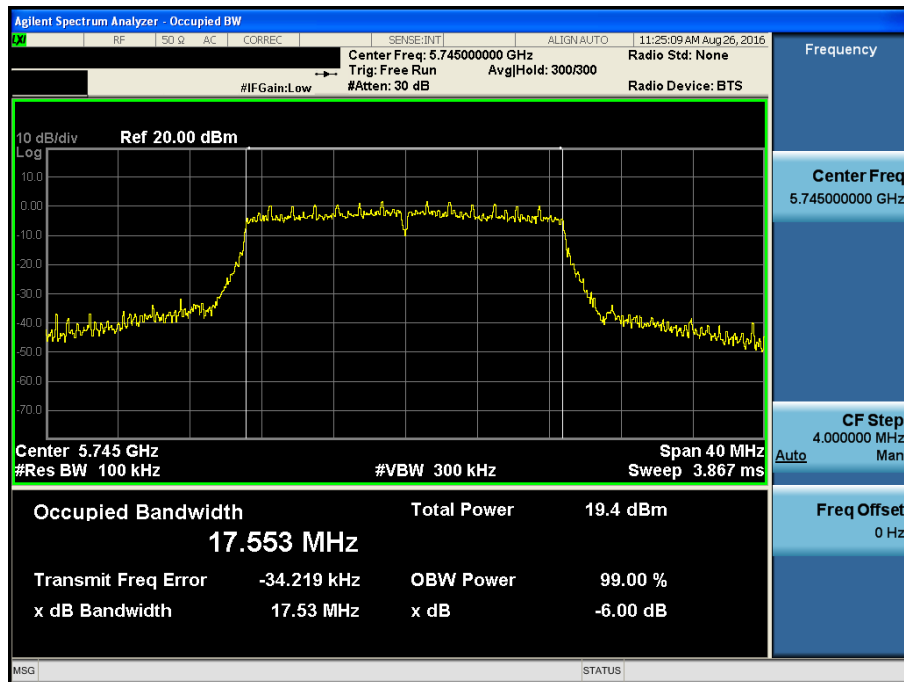
6 dB Bandwidth

Test Mode: 802.11a & ANT 2 & Ch.165



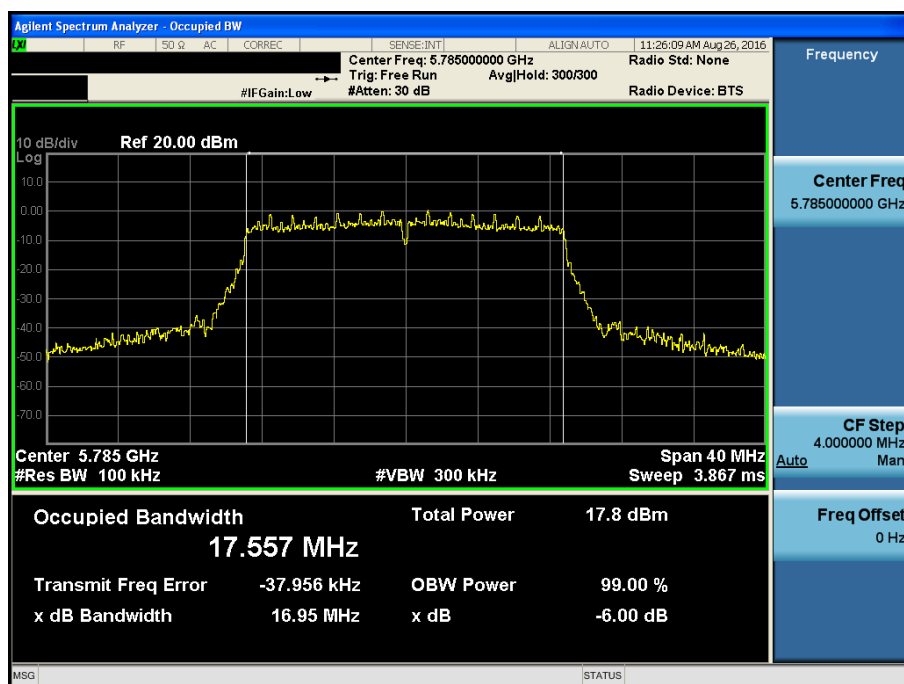
6 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 2 & Ch.149



6 dB Bandwidth

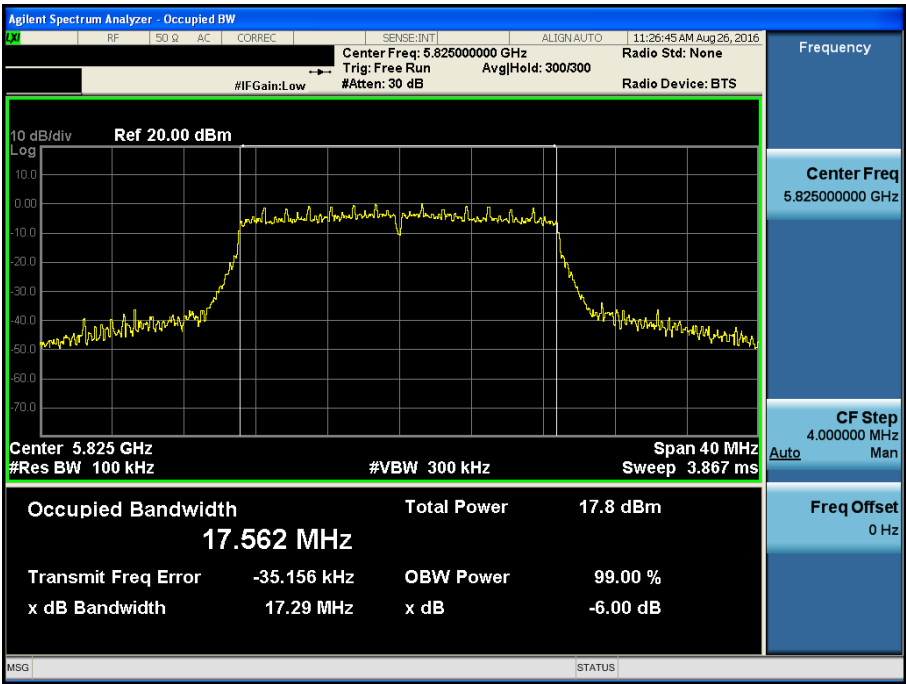
Test Mode: 802.11n HT20 & ANT 2 & Ch.157





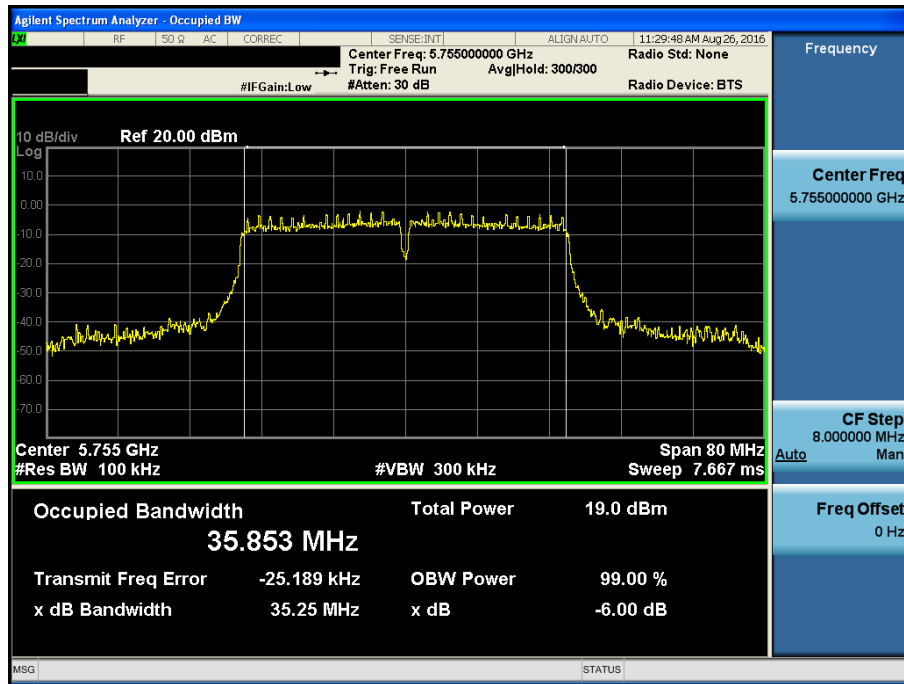
6 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 2 & Ch.165



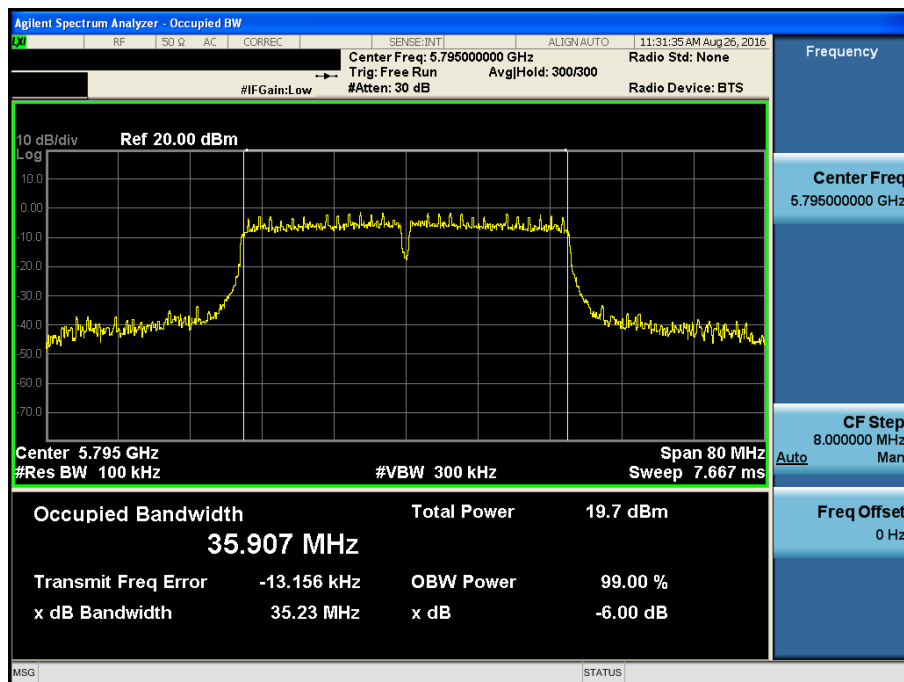
6 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 2 & Ch.151



6 dB Bandwidth

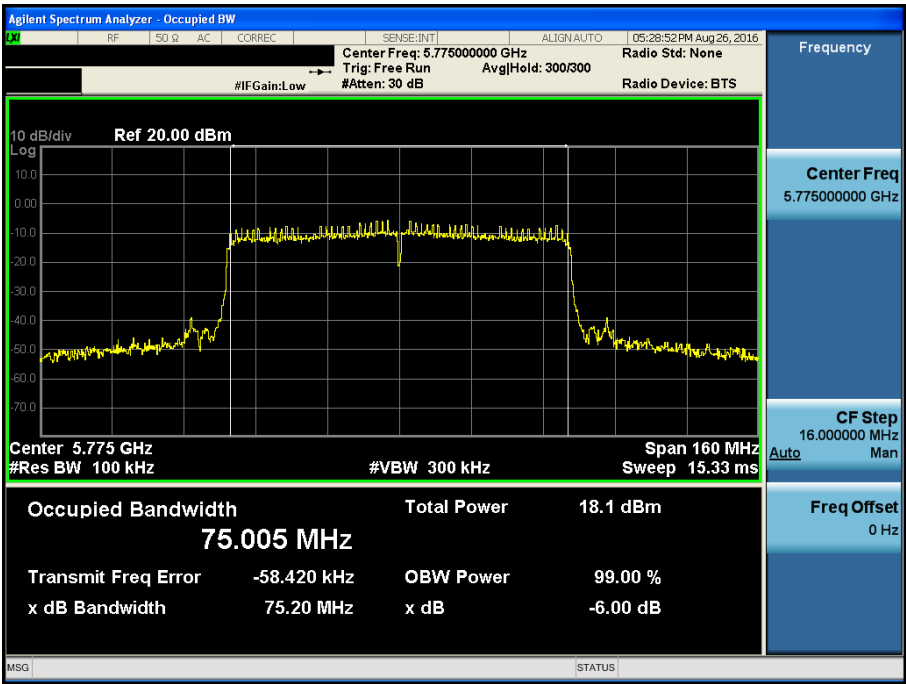
Test Mode: 802.11n HT40 & ANT 2 & Ch.159





6 dB Bandwidth

Test Mode: 802.11ac VHT80 & ANT 2 & Ch.155



8.3 Maximum Conducted Output Power

■ Test Requirements

Part. 15.407(a)

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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.

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. 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.

(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. 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. 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. 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.

- Output power Limit Calculation (FCC)

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	802.11a	250	23.97	1.130	23.97
	802.11ac(VHT20)				
	802.11ac(VHT40)				
	802.11ac(VHT80)				

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 26 dBc BW [MHz]			
U-NII 2A	802.11a	250	23.97	1.190	23.91
		19.57	23.91		
	802.11ac(VHT20)	250	23.97		23.95
		19.73	23.95		
	802.11ac(VHT40)	250	23.97		23.97
		39.24	26.93		
	802.11ac(VHT80)	250	23.97		23.97
		79.55	30.00		
U-NII 2C	802.11a	250	23.97	1.395	23.92
		19.61	23.92		
	802.11ac(VHT20)	250	23.97		23.97
		19.84	23.97		
	802.11ac(VHT40)	250	23.97		23.97
		39.92	27.01		
	802.11ac(VHT80)	250	23.97		23.97
		80.07	30.03		

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 26 dBc BW [MHz]			
U-NII 2C (band-crossing channels)	802.11a	250	23.97	1.139	22.69
		14.775	22.69		
	802.11ac(VHT20)	250	23.97		22.76
		15.020	22.76		
	802.11ac(VHT40)	250	23.97		23.97
		35.04	26.44		
	802.11ac(VHT80)	250	23.97		23.97
		75.38	29.77		
U-NII 3 (band-crossing channels)	802.11a	1000	30.00	1.139	30.00
	802.11ac(VHT20)				
	802.11ac(VHT40)				
	802.11ac(VHT80)				

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 3	802.11a	1000	30.00	1.063	30.00
	802.11n(HT20)				
	802.11n(HT40)				
	802.11ac(VHT80)				

RSS-247[6.11]**(1) For band 5150 - 5250 MHz**

The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log B$, dBm, whichever power is less. B is the 99 % emission bandwidth in MHz.

(2) For band 5250 - 5350 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log B$, dBm, whichever power is less.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99 % emission bandwidth in MHz.

(3) For band 5470 - 5600 MHz and 5650 - 5725 MHz

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log B$, dBm, whichever power is less.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99 % emission bandwidth in MHz.

(4) For band 5725 - 5850 MHz

The maximum conducted output power shall not exceed 1 W.

-Output power Limit Calculation(IC)

Band	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 99 % BW [MHz]			
U-NII 1	802.11a	200	23.01	1.130	22.26
		16.838	22.26		
	802.11ac(VHT20)	200	23.01		22.48
		17.706	22.48		
	802.11ac(VHT40)	200	23.01		23.01
		36.228	25.59		
	802.11ac(VHT80)	200	23.01		23.01
		74.900	28.74		
U-NII 2A	802.11a	250	23.97	1.190	23.26
		16.848	23.26		
	802.11ac(VHT20)	250	23.97		23.47
		17.700	23.47		
	802.11ac(VHT40)	250	23.97		23.97
		36.048	26.56		
	802.11ac(VHT80)	250	23.97		23.97
		74.951	29.74		
U-NII 2C	802.11a	250	23.97	1.395	23.27
		16.867	23.27		
	802.11ac(VHT20)	250	23.97		23.49
		17.746	23.49		
	802.11ac(VHT40)	250	23.97		23.97
		36.135	26.57		
	802.11ac(VHT80)	250	23.97		23.97
		74.985	29.74		

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 99 % BW [MHz]			
U-NII 2C (band-crossing channels)	802.11a	250	23.97	1.123	23.28
		16.937	23.28		
	802.11ac(VHT20)	250	23.97		23.50
		17.812	23.50		
	802.11ac(VHT40)	250	23.97		23.97
		36.093	26.57		
	802.11ac(VHT80)	250	23.97		23.97
		74.943	29.74		

Band	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 3	802.11a	1000	30.00	1.063	30.00
	802.11n(HT20)				
	802.11n(HT40)				
	802.11ac(VHT80)				

■ Test Results: **Comply**

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11a (Multiple Transmit)	36	5180	11.920	12.270	15.109
	40	5200	12.240	12.340	15.301
	48	5240	12.270	12.460	15.376
	52	5260	13.060	13.670	16.386
	60	5300	13.410	13.360	16.395
	64	5320	14.290	14.390	17.351
	100	5500	14.030	15.490	17.831
	116	5580	11.620	13.490	15.665
	-	-	-	-	-
	149	5745	11.630	13.740	15.822
	157	5785	13.820	15.810	17.938
	165	5825	10.260	11.370	13.861

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT20) (Multiple Transmit)	36	5180	11.910	12.240	15.088
	40	5200	12.260	12.620	15.454
	48	5240	12.340	12.820	15.597
	52	5260	13.870	14.190	17.043
	60	5300	14.160	14.640	17.417
	64	5320	14.820	14.710	17.776
	100	5500	14.040	15.090	17.607
	116	5580	12.560	14.130	16.426
	-	-	-	-	-
	149	5745	11.770	13.680	15.839
	157	5785	11.780	13.510	15.741
	165	5825	10.570	12.070	14.395

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT40) (Multiple Transmit)	38	5190	10.650	11.640	14.183
	46	5230	14.740	15.040	17.903
	54	5270	12.380	12.120	15.262
	62	5310	10.590	10.730	13.671
	102	5510	12.370	12.630	15.512
	118	5590	14.590	15.340	17.991
	-	-	-	-	-
	151	5755	12.510	13.230	15.895
	159	5795	12.540	13.510	16.062

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11ac(VHT20) (Multiple Transmit)	36	5180	11.840	12.610	15.252
	40	5200	12.480	12.910	15.711
	48	5240	12.870	13.210	16.054
	52	5260	13.970	13.910	16.950
	60	5300	14.570	14.390	17.491
	64	5320	14.760	15.040	17.913
	100	5500	12.630	14.430	16.633
	116	5580	12.090	13.940	16.123
	-	-	-	-	-
	149	5745	11.690	13.720	15.833
	157	5785	11.710	13.260	15.564
	165	5825	10.490	12.030	14.338

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11ac(VHT40) (Multiple Transmit)	38	5190	10.210	11.320	13.811
	46	5230	14.870	15.070	17.981
	54	5270	15.360	15.310	18.345
	62	5310	11.190	10.260	13.760
	102	5510	12.530	12.600	15.575
	118	5590	13.780	14.810	17.336
	-	-	-	-	-
	151	5755	12.170	13.350	15.810
	159	5795	12.370	13.330	15.887

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11ac(VHT80) (Multiple Transmit)	42	5210	10.410	10.480	13.455
	58	5290	11.680	11.260	14.485
	106	5530	11.170	11.570	14.385
	155	5775	10.490	11.380	13.968

Band-Crossing Channels (U-NII 2C)

Mode	CH	Freq. [MHz]	Reading value [dBm]			DCF [dB]	Test Result [dBm]
			ANT 1	ANT 2	SUM		
802.11a (Multiple Transmit)	144	5720	7.890	10.690	12.522	0.580	13.102
802.11n(HT20) (Multiple Transmit)	144	5720	7.450	9.660	11.704	1.120	12.824
802.11n(HT40) (Multiple Transmit)	142	5710	8.880	10.980	13.066	1.970	15.036
802.11ac(VHT20) (Multiple Transmit)	144	5720	8.080	10.140	12.241	1.130	13.371
802.11ac(VHT40) (Multiple Transmit)	142	5710	9.930	10.990	13.503	1.940	15.443
802.11ac(VHT80) (Multiple Transmit)	138	5690	9.210	8.900	12.068	3.150	15.218

Note: Please refer to Appendix II for the duty correction factor

Band-Crossing Channels (U-NII 3)

Mode	CH	Freq. [MHz]	Reading value [dBm]			DCF [dB]	Test Result [dBm]
			ANT 1	ANT 2	SUM		
802.11a (Multiple Transmit)	144	5720	0.780	4.190	5.822	0.580	6.402
802.11n(HT20) (Multiple Transmit)	144	5720	0.870	3.360	5.301	1.120	6.421
802.11n(HT40) (Multiple Transmit)	142	5710	-2.250	0.460	2.323	1.970	4.293
802.11ac(VHT20) (Multiple Transmit)	144	5720	1.060	3.730	5.607	1.130	6.737
802.11ac(VHT40) (Multiple Transmit)	142	5710	-1.170	0.460	2.731	1.940	4.671
802.11ac(VHT80) (Multiple Transmit)	138	5690	-6.670	-5.790	-3.197	3.150	-0.047

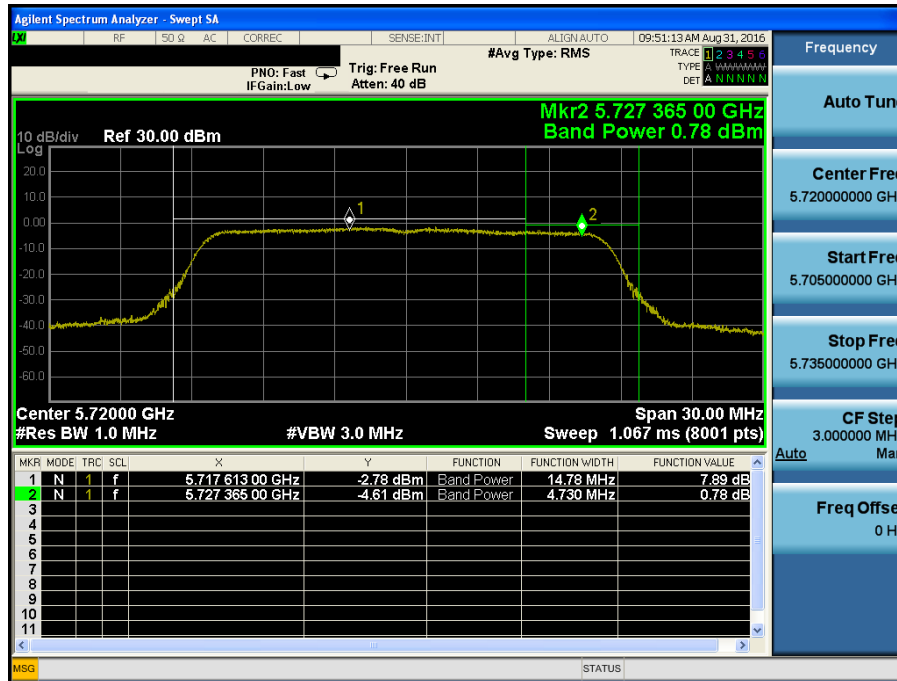
Note1: See next pages for actual measured spectrum plots.

Note2: Please refer to Appendix II for the duty correction factor

■ RESULT PLOTS(U-NII 2C & U-NII 3 & Band-Crossing Channels & Multiple Transmit)

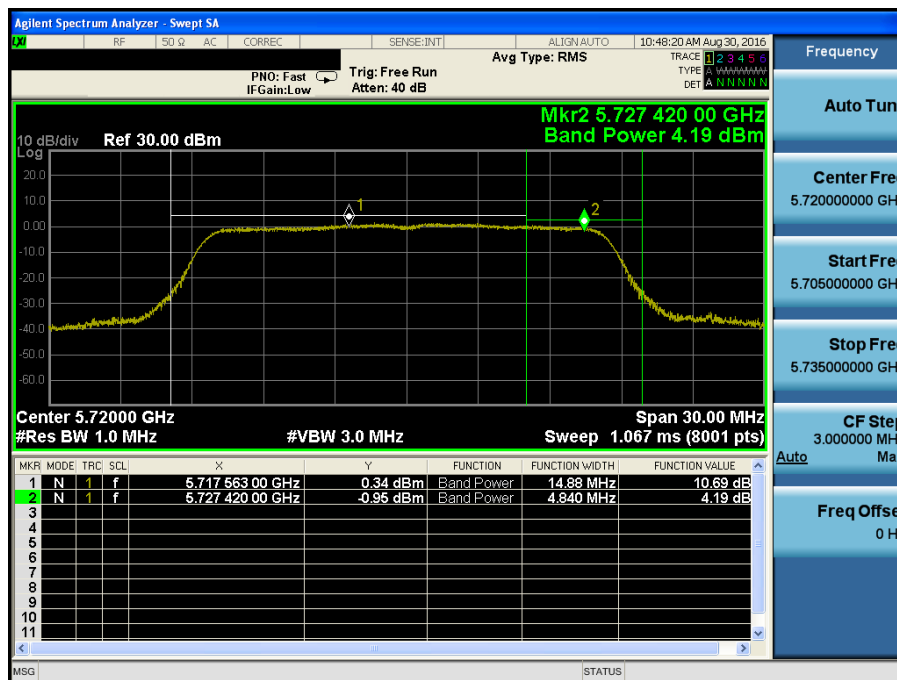
Maximum Conducted Output Power

Test Mode: 802.11a & Ch.144 & ANT 1



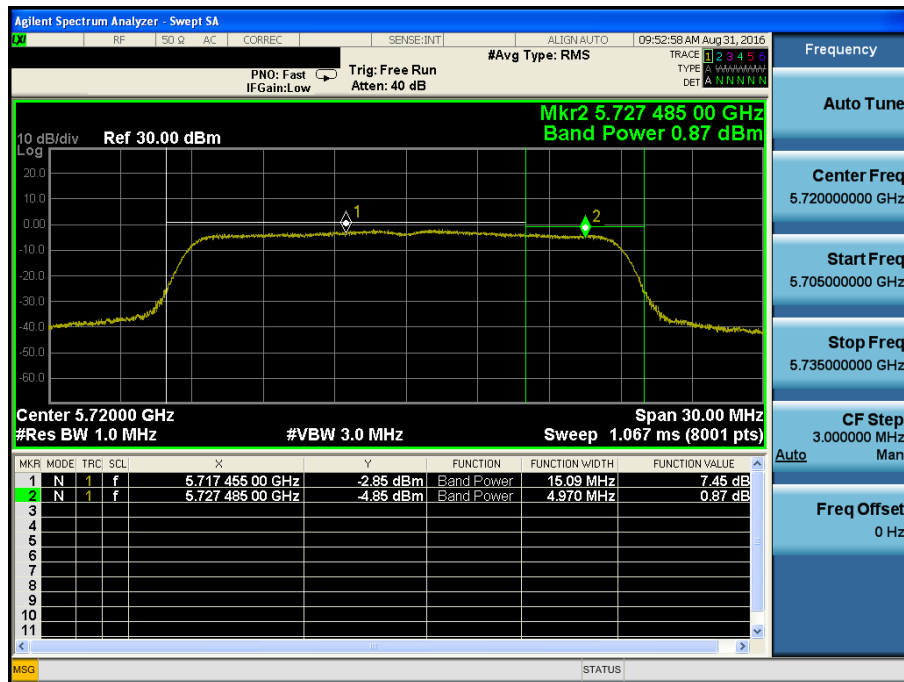
Maximum Conducted Output Power

Test Mode: 802.11a & Ch.144 & ANT 2



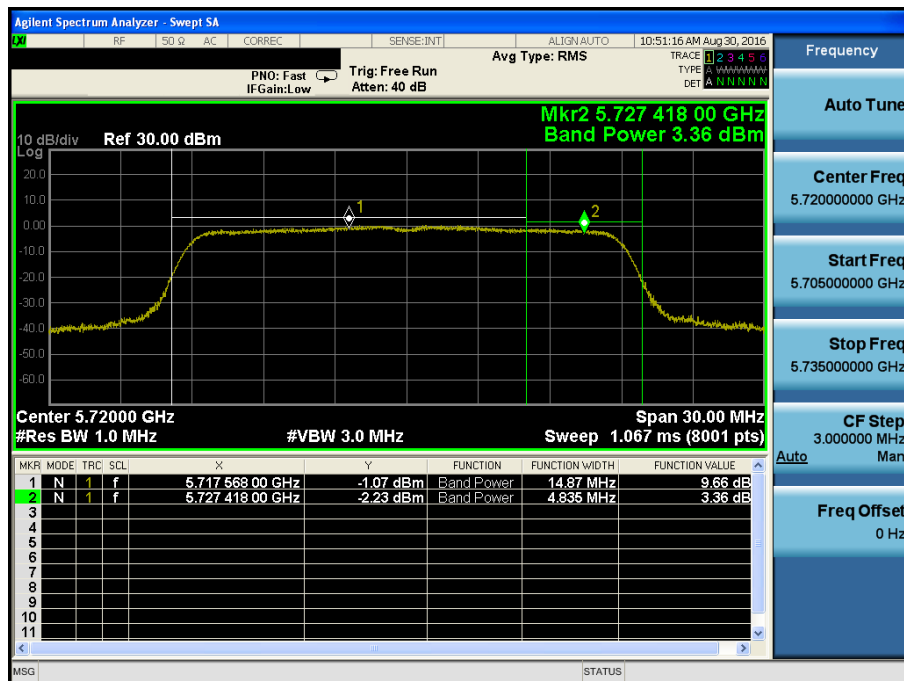
Maximum Conducted Output Power

Test Mode: 802.11n HT20 & Ch.144 & ANT 1



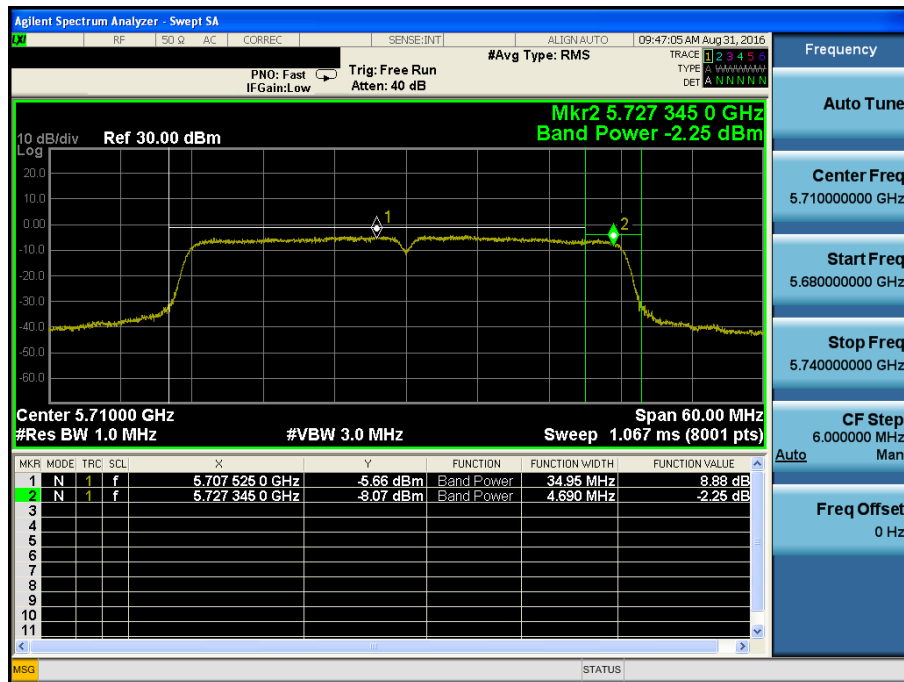
Maximum Conducted Output Power

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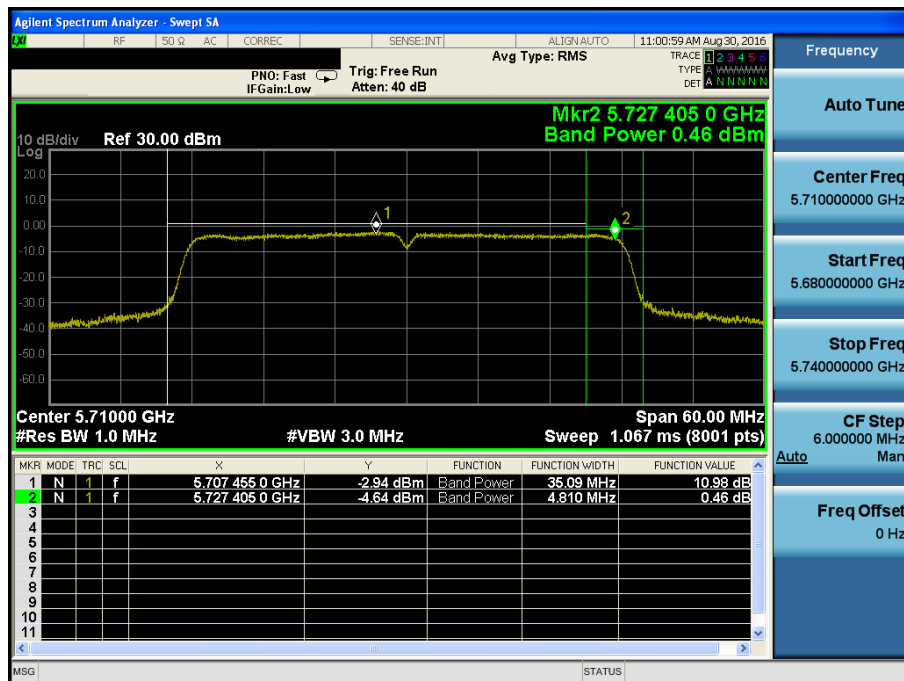
Maximum Conducted Output Power

Test Mode: 802.11n HT40 & Ch.142 & ANT 1



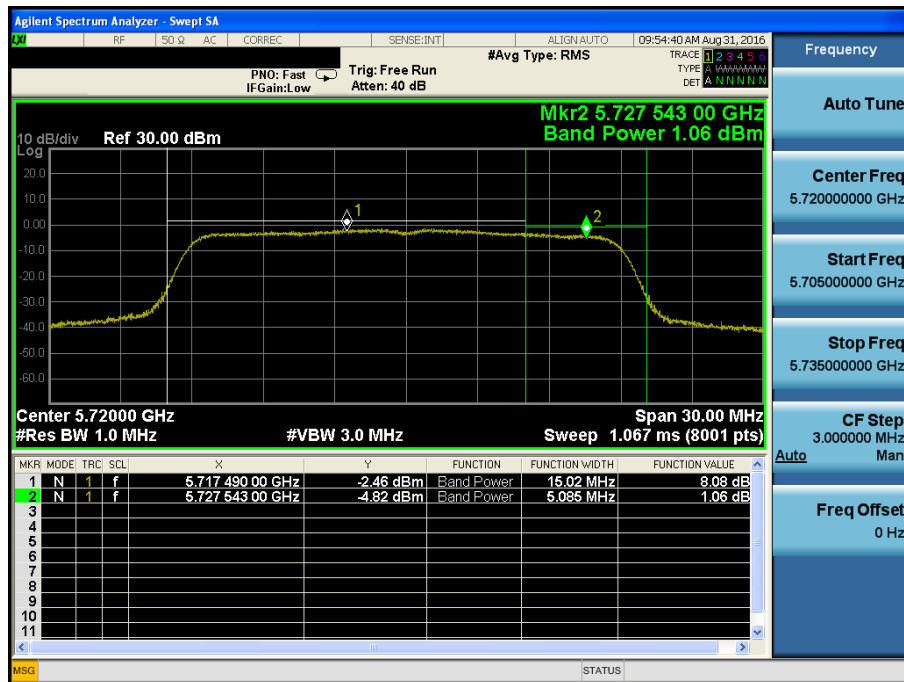
Maximum Conducted Output Power

Test Mode: 802.11n HT40 & Ch.142 & ANT 2



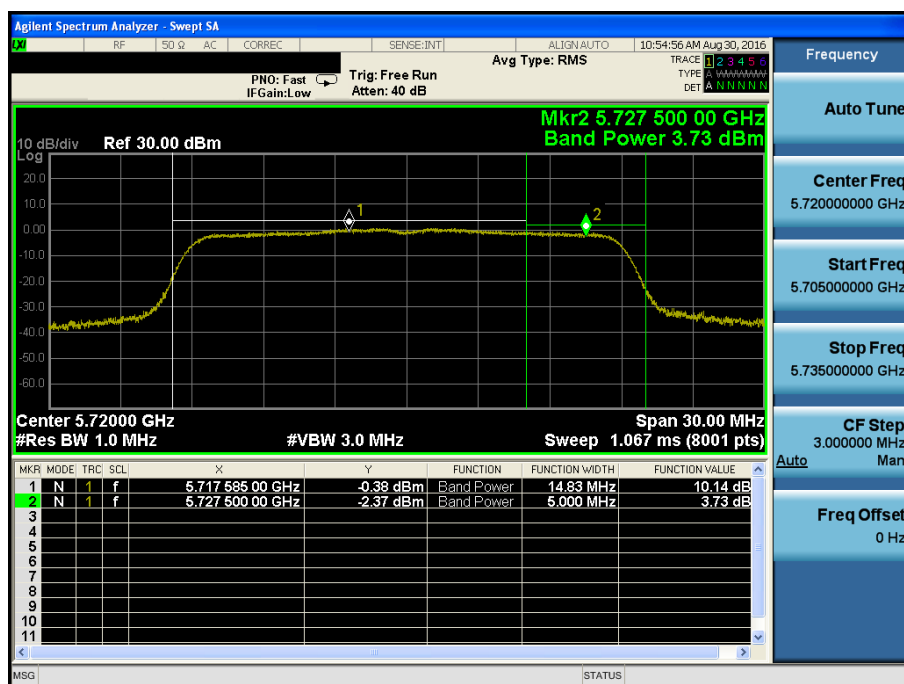
Maximum Conducted Output Power

Test Mode: 802.11ac VHT20 & Ch.144 & ANT 1



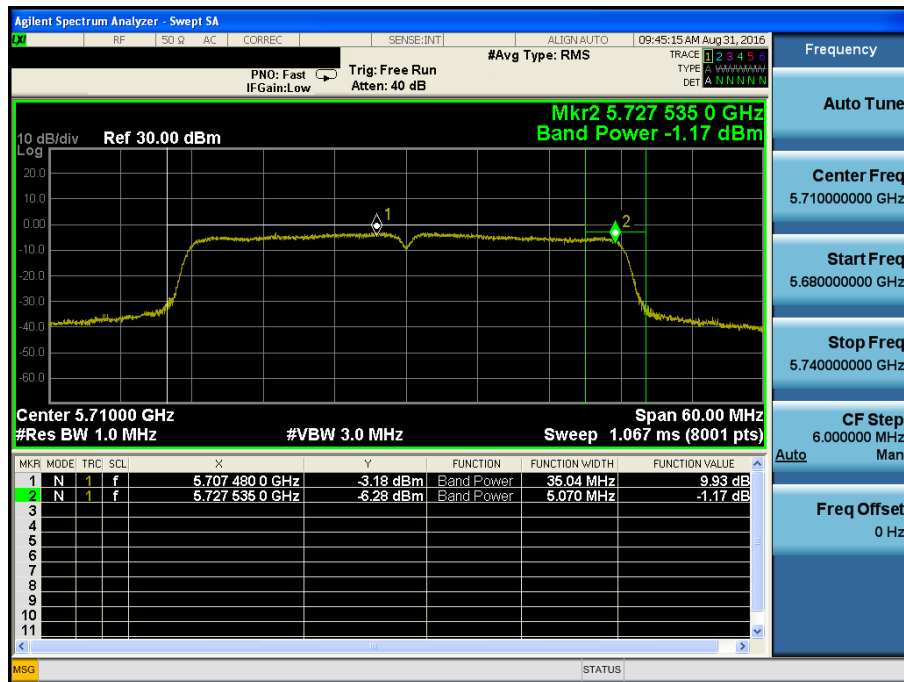
Maximum Conducted Output Power

Test Mode: 802.11ac VHT20 & Ch.144 & ANT 2



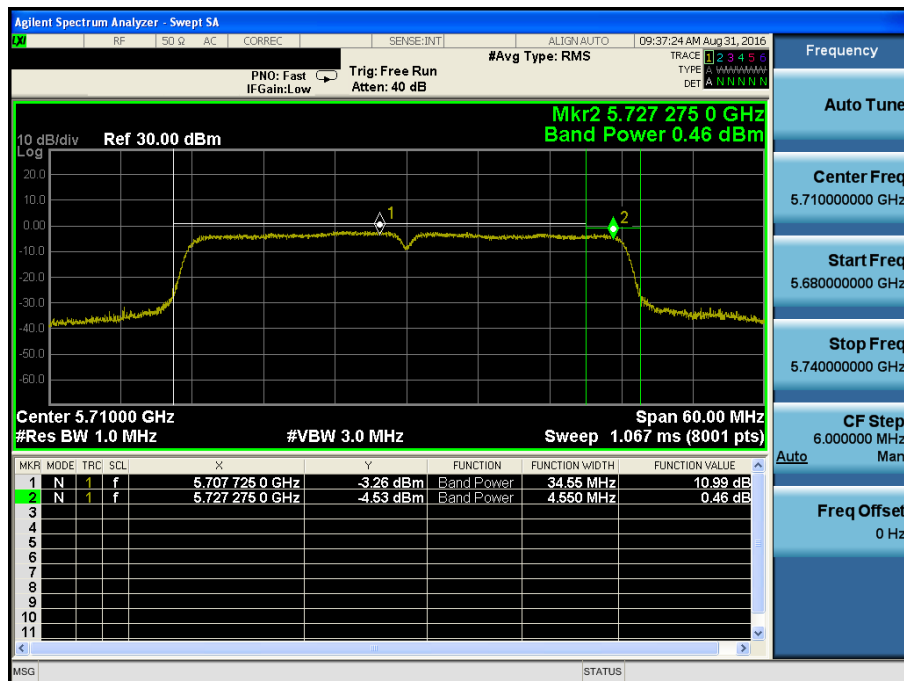
Maximum Conducted Output Power

Test Mode: 802.11ac VHT40 & Ch.142 & ANT 1



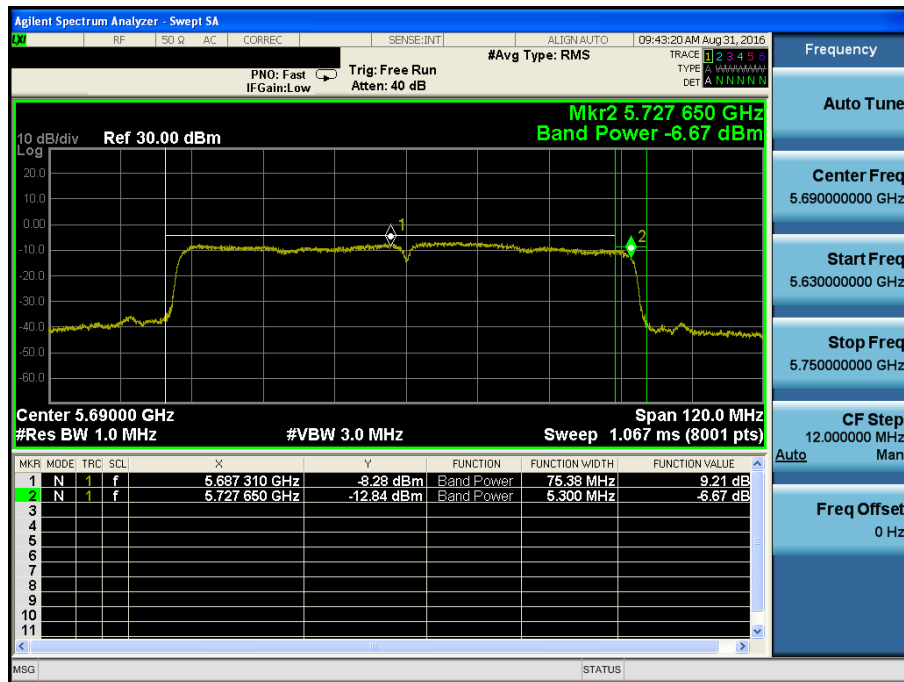
Maximum Conducted Output Power

Test Mode: 802.11ac VHT40 & Ch.142 & ANT 2



Maximum Conducted Output Power

Test Mode: 802.11ac VHT80 & Ch.138 & ANT 1



Maximum Conducted Output Power

Test Mode: 802.11 ac VHT80 & Ch.138 & ANT 2

