

TEST REPORT



DT&C Co., Ltd.

42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1704-0063

2. Customer

• Name : DRTECH Corporation

• Address : Suite No.2, 3 Floor, 29, Dunchon-daero 541beon-gil Seongnam-si, Gyeonggi-do,
Republic of Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : Flat Panel Digital X-ray Detector / EVS 2430Wi

FCC ID : RNH-EVS2430WI

5. Test Method Used : KDB 789033, ANSI C63.10-2013

Test Specification : FCC Part 15.407 Subpart E

6. Date of Test : 2016.12.26 ~ 2017.02.10

7. Testing Environment : See appended test report.

8. Test Result : Refer to the attached test result.

Affirmation	Tested by	Technical Manager
	Name : JungWoo Kim (Signature)	Name : HyunSu Son (Signature)

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

2017 . 04 . 24 .

DT&C Co., Ltd.

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

Test Report Version

Test Report No.	Date	Description
DRTFCC1704-0063	Apr. 24, 2017	Initial issue

CONTENTS

1. EUT DESCRIPTION.....	4
2. Information about test items	5
2.1 Test mode / Channel Information	5
2.2 Tested Channel Information.....	5
2.3 Auxiliary equipment	5
2.4 Tested environment	6
2.5 EMI Suppression Device(s)/Modifications	6
3. SUMMARY OF TESTS.....	7
4. TEST METHODOLOGY	8
4.1 EUT configuration.....	8
4.2 EUT exercise	8
4.3 General test procedures	8
4.4 Description of test modes	8
4.5 Measurement Uncertainty	8
5. INSTRUMENT CALIBRATION.....	9
6. FACILITIES AND ACCREDITATIONS	9
6.1 Facilities	9
6.2 Equipment	9
7. ANTENNA REQUIREMENTS	9
8. TEST RESULT	10
8.1 Emission Bandwidth (26 dB Bandwidth)	10
8.2 Minimum Emission Bandwidth (6 dB Bandwidth).....	22
8.3 Maximum Conducted Output Power	33
8.4 Maximum Power Spectral Density	36
8.5 Frequency Stability	59
8.6 Radiated Spurious Emission Measurements	61
8.7 AC Conducted Emissions.....	67
8.8 Occupied Bandwidth	72
9. LIST OF TEST EQUIPMENT	73
APPENDIX I	74
APPENDIX II	74
APPENDIX III	78

1. EUT DESCRIPTION

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	Flat Panel Digital X-ray Detector
Model Name	EVS 2430Wi
Add Model Name	EVS 2430GWi
Software version	0.0.07
Hardware version	EVS_2430W V0.1
Power Supply	DC 7.4 V
Frequency Range	U-NII 1(5150 ~ 5250 MHz) 802.11a/n(HT20): 5180 ~ 5240 MHz 802.11n(HT40)/ac: 5190 ~ 5230 MHz U-NII 3(5725 ~ 5850MHz) 802.11a/n(HT20): 5745 ~ 5825 MHz 802.11n(HT40): 5755 ~ 5795 MHz
Modulation type	OFDM
Antenna Specification	Antenna type: Internal Antenna Antenna gain - U-NII 1 band: ANT 1: 0.70 dBi & ANT 2: 0.70 dBi - U-NII 3 band: ANT 1: 1.10 dBi & ANT 2: 1.10 dBi Antenna Configuration 802.11a: Single Transmitting (ANT 1 or 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)

2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate	
		Single transmitting	Multiple transmitting
U-NII 1	802.11a	6Mbps	-
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8
U-NII 3	802.11a	6Mbps	-
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8

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) for 802.11n(HT20)/802.11n(HT40).

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20)		802.11n(HT40)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 1	36	5180	38	5190
	40	5200	-	-
	48	5240	46	5230
U-NII 3	149	5745	151	5755
	157	5785	-	-
	165	5825	159	5795

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
Notebook	Compaq 6530b	CNU8313PMW	HP	-

2.4 Tested environment

Temperature	: 22 °C ~ 25 °C
Relative humidity content	: 42 % ~ 48 % R.H.
Details of power supply	: DC 7.4 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)	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)	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5725 ~ 5850 MHz		C
-	Occupied Bandwidth (99%)	N/A		NA
15.407(a)	Maximum Conducted Output Power	5150 ~ 5250 MHz : < 30 dBm or < 23.97 dBm 5250 ~ 5350 & 5470 ~ 5725 MHz : < 250 mW or < 11 + 10 log ₁₀ (B) dBm, whichever power is less. 5725 ~ 5850 MHz : < 30 dBm Note: B is the 26dB BW.		C Note 3
15.407(a)	Peak Power Spectral Density	5150 ~ 5250 MHz : 11 dBm/MHz or 17 dBm/MHz 5250 ~ 5350 & 5470 ~ 5725 MHz: 11 dBm/MHz 5725 ~ 5850 MHz: 30 dBm/500kHz		C Note 4
15.407(g)	Frequency Stability	N/A		C
15.407(b)	Undesirable Emissions	5150 ~ 5725 MHz: < -27 dBm/MHz EIRP 5725 ~ 5850 MHz: < -27 dBm/MHz or < 10 dBm/MHz or 15.6 dBm/MHz < 27dBm/MHz EIRP	Radiated	C Note 5
15.205 15.209 15.407(b)	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 6
15.407(h)	Dynamic Frequency Selection	FCC 15.407(h)	Conducted	NA
15.207	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	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: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. Note 6: These test items were performed in each axis and the worst case data was reported.				

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB789033 D02 v01r03. 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)
AC conducted emission	2.4 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

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	0.70	0.70	0.70 Note 2.
U-NII 3	1.10	1.10	1.10 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

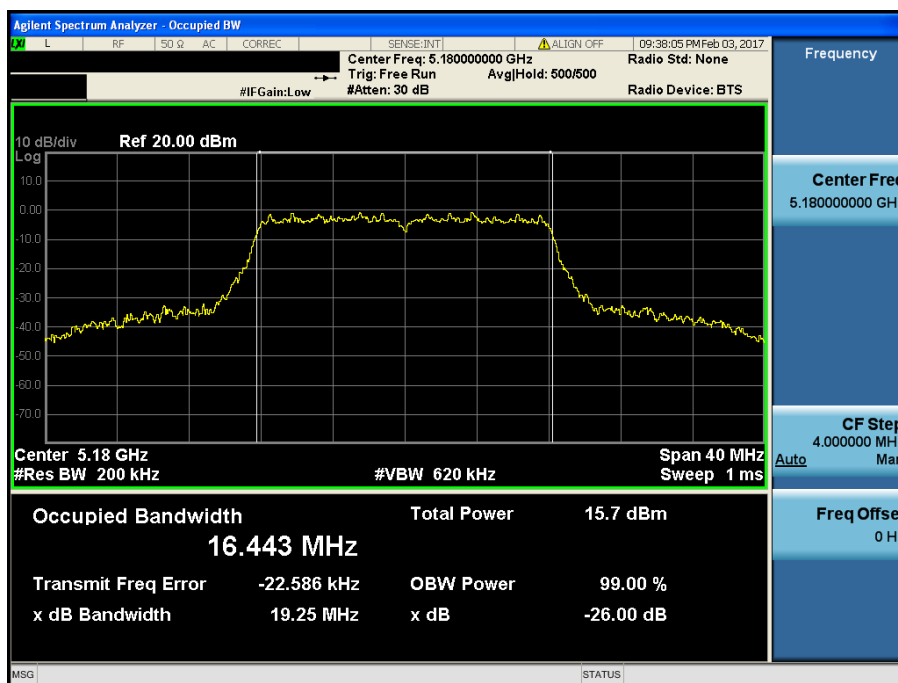
Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11a	U-NII 1	36	5180	19.250	19.970
		40	5200	19.260	19.480
		48	5240	19.270	19.310
802.11n (HT20)	U-NII 1	36	5180	19.220	19.410
		40	5200	19.400	19.410
		48	5240	19.080	19.360
802.11n (HT40)	U-NII 1	38	5190	39.400	40.760
		46	5230	39.290	40.390

Result Plots

Multiple Transmit

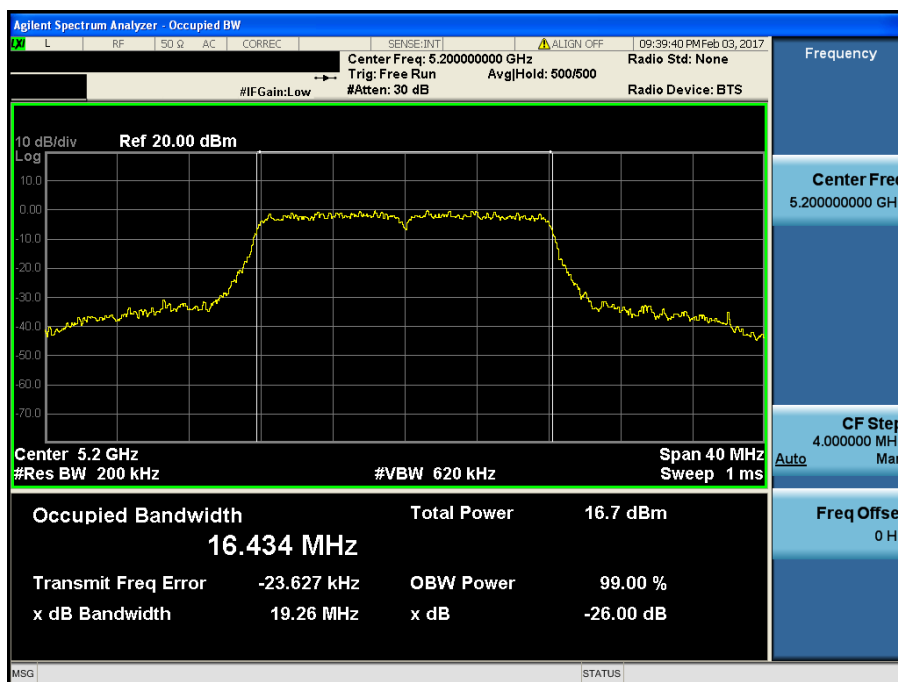
26 dB Bandwidth

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



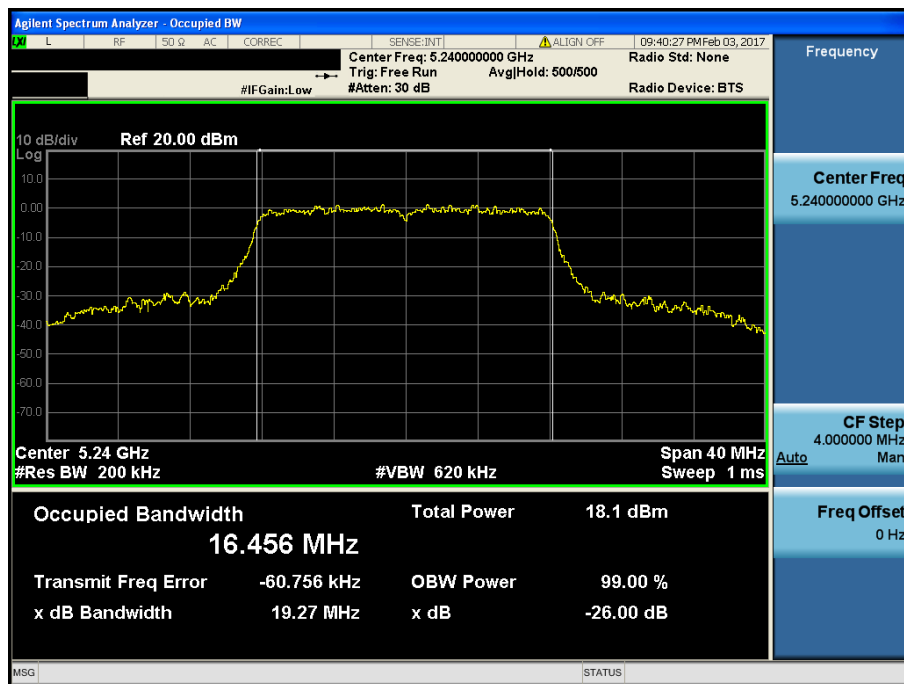
26 dB Bandwidth

Test Mode: 802.11a & ANT 1 & Ch.40



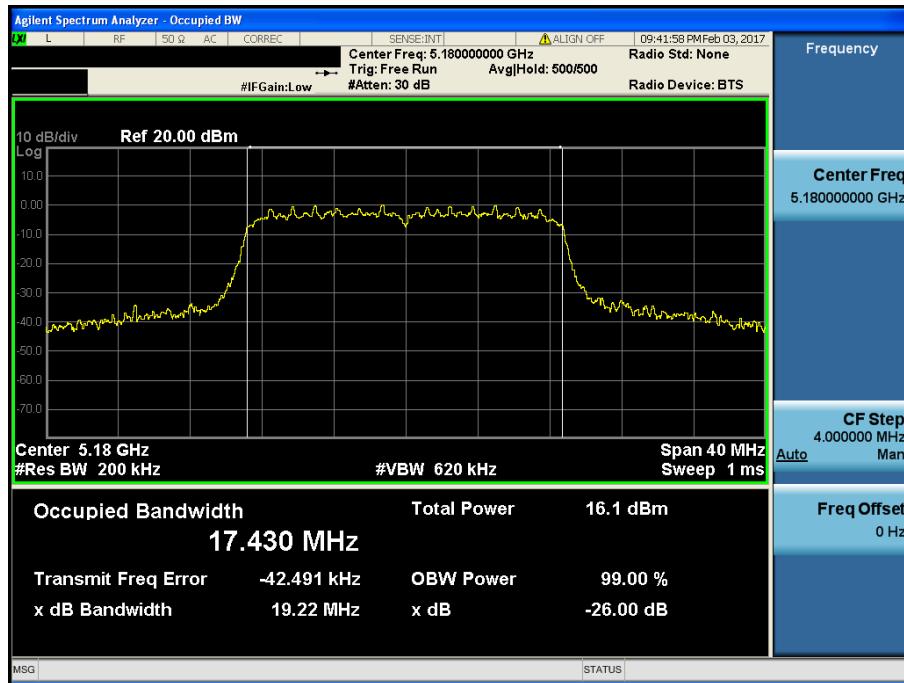
26 dB Bandwidth

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



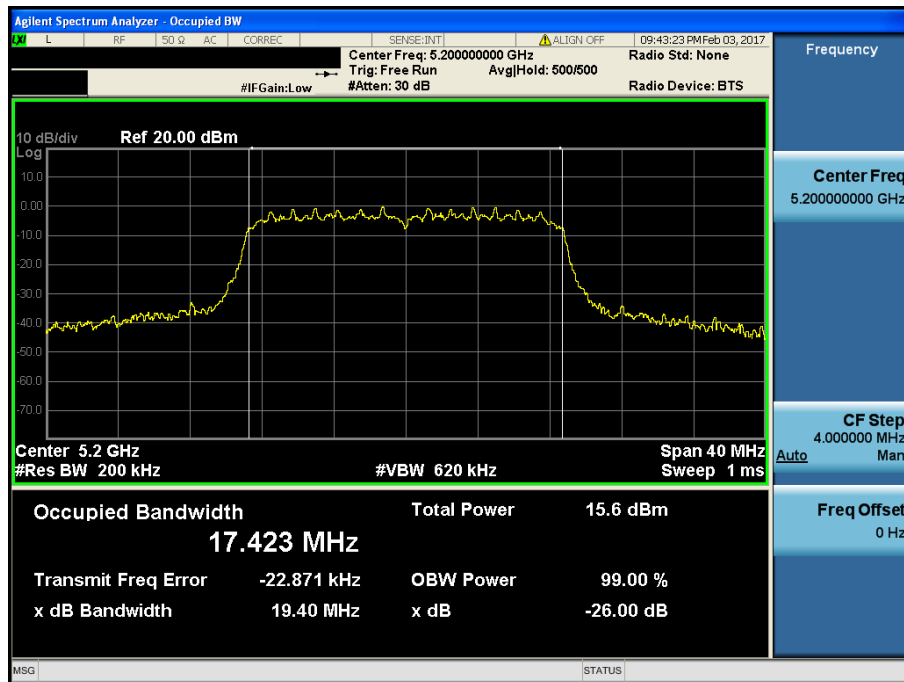
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 1 & Ch.36



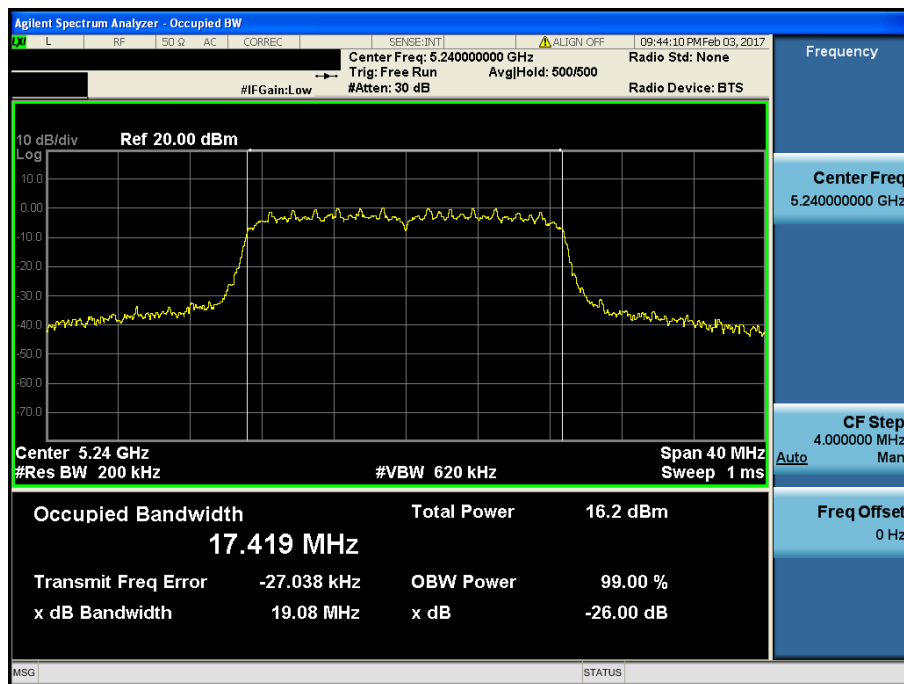
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 1 & Ch.40



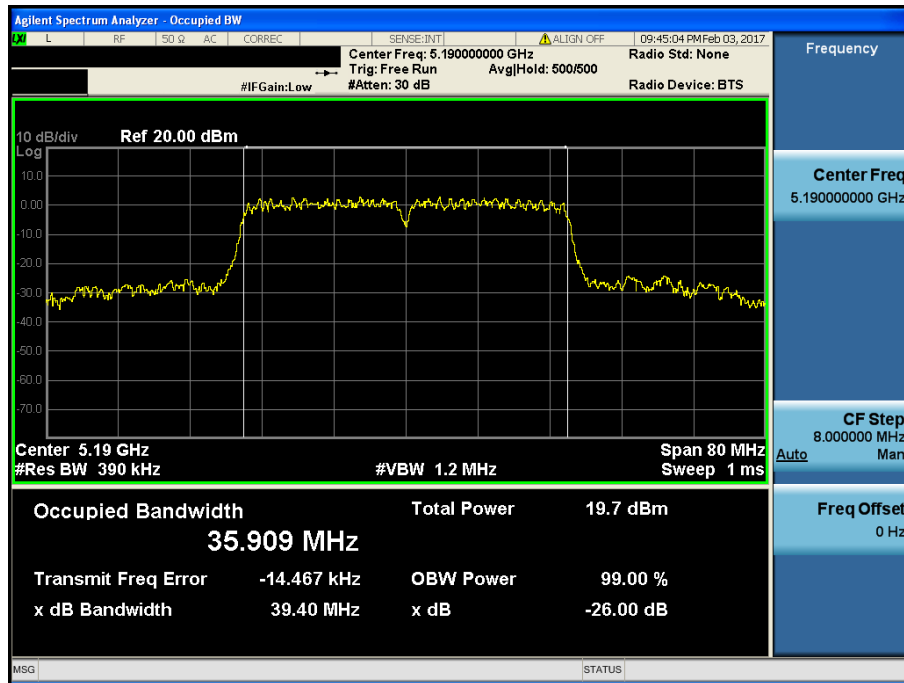
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 1 & Ch.48



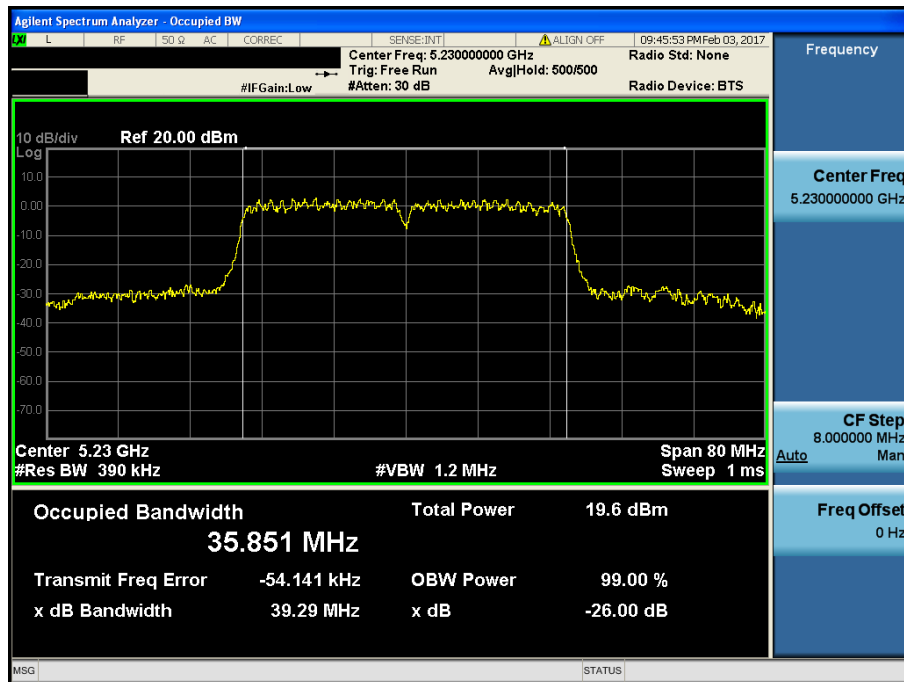
26 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 1 & Ch.38



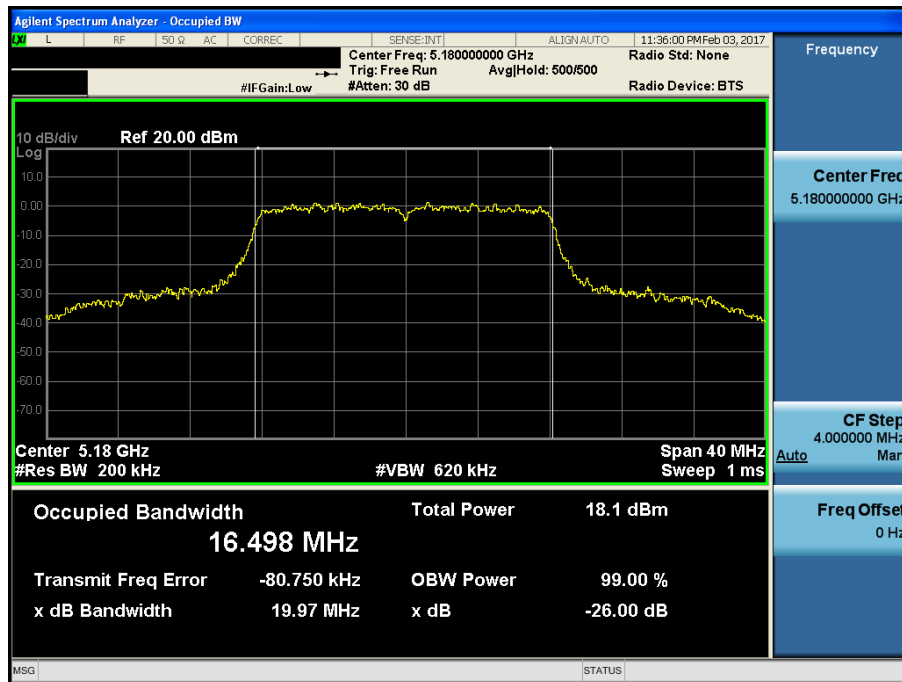
26 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 1 & Ch.46



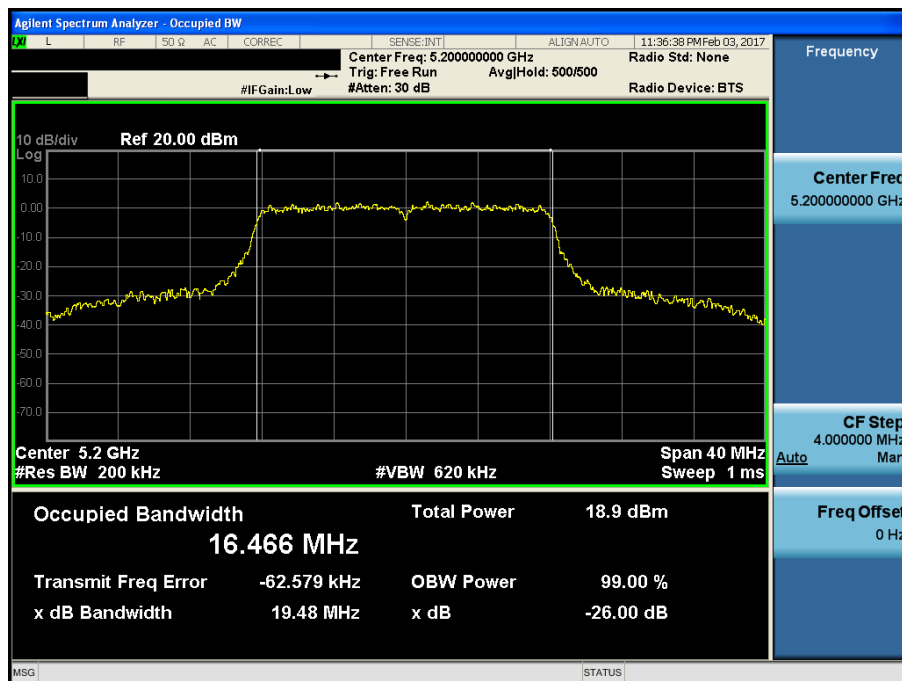
26 dB Bandwidth

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



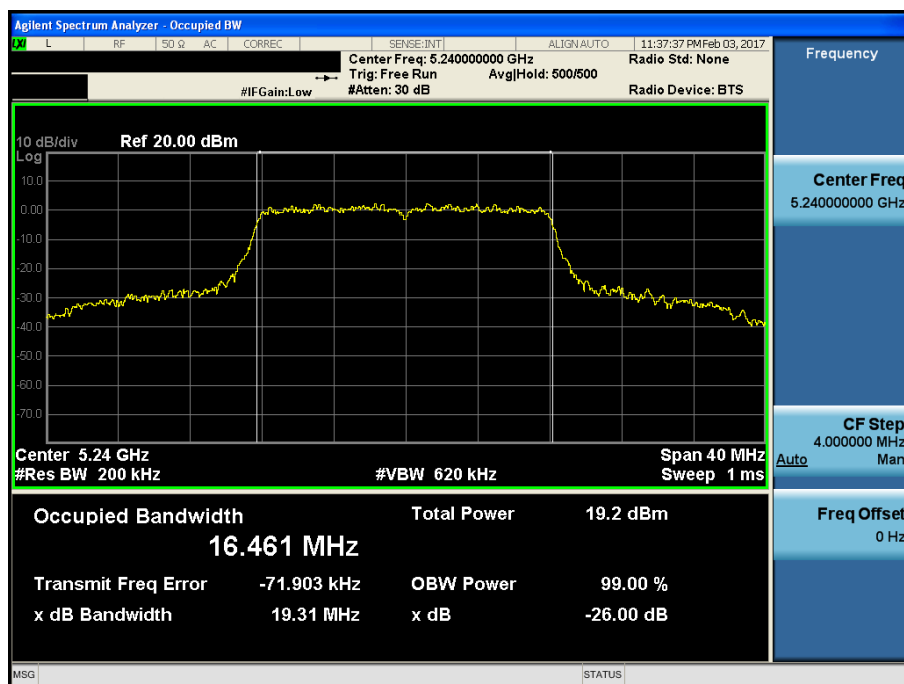
26 dB Bandwidth

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



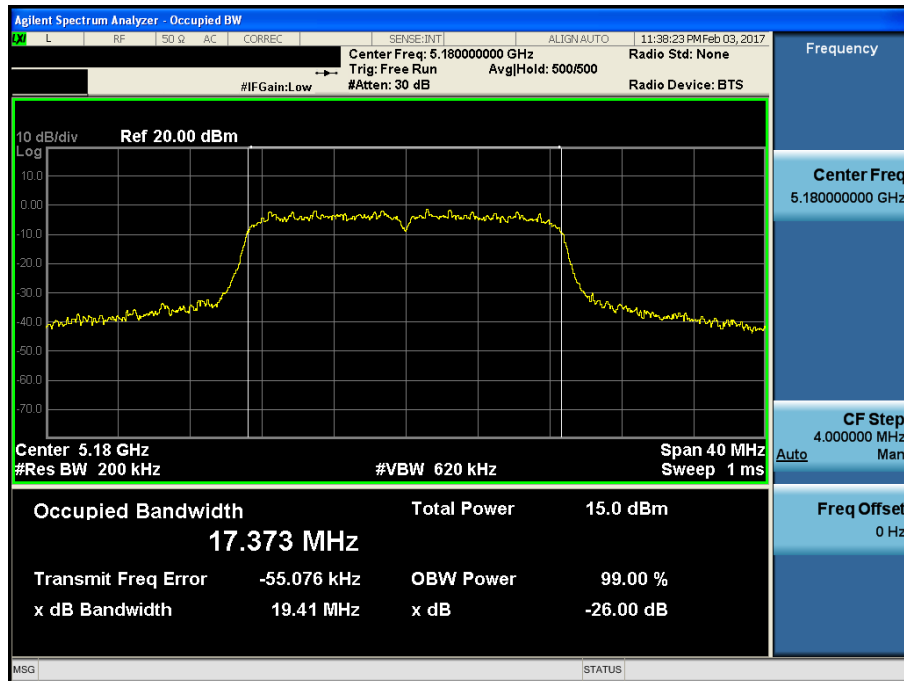
26 dB Bandwidth

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



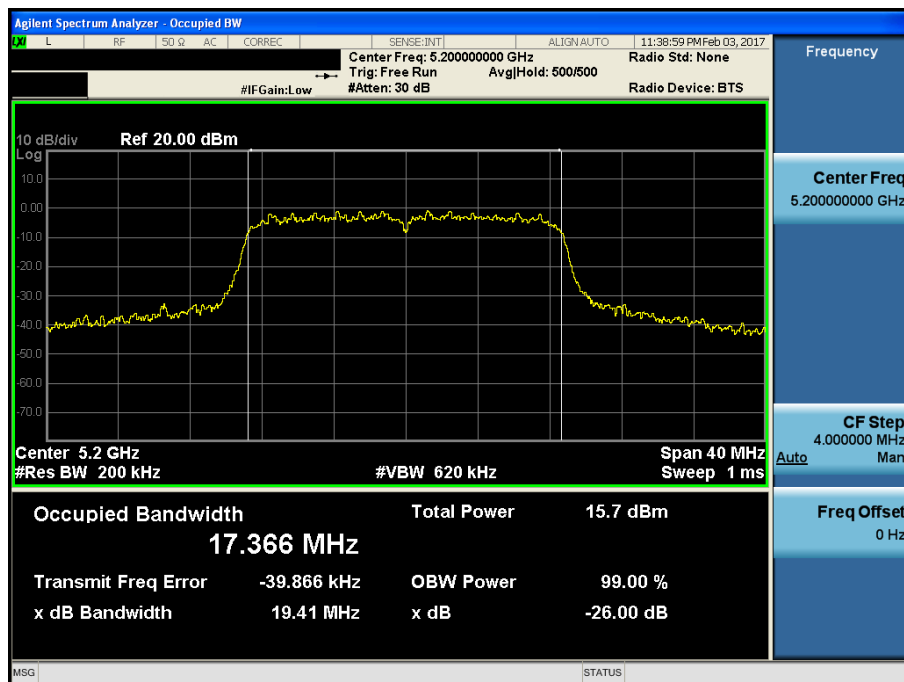
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 2 & Ch.36



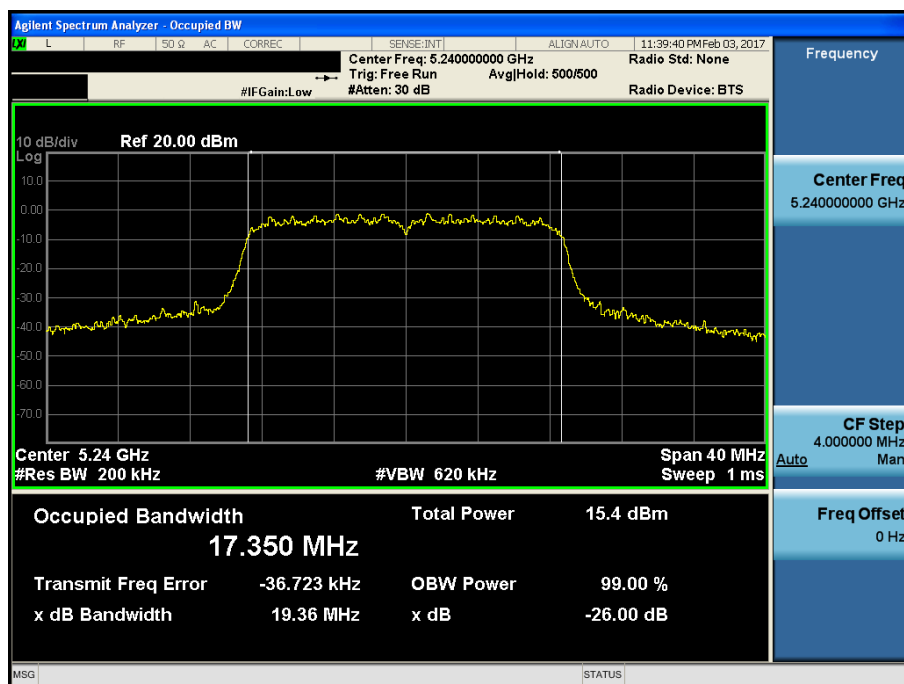
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 2 & Ch.40



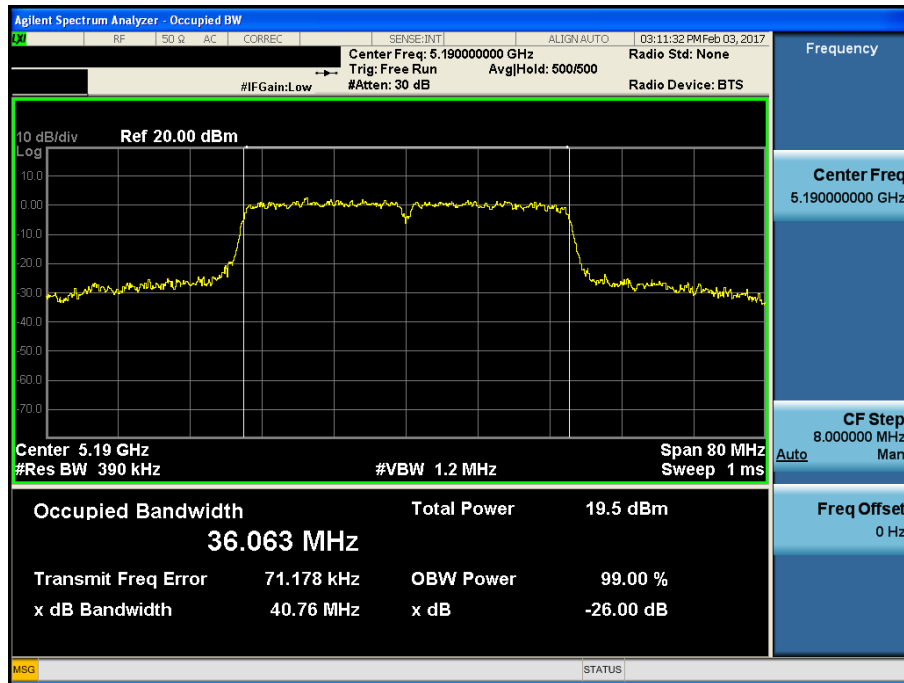
26 dB Bandwidth

Test Mode: 802.11n HT20 & ANT 2 & Ch.48



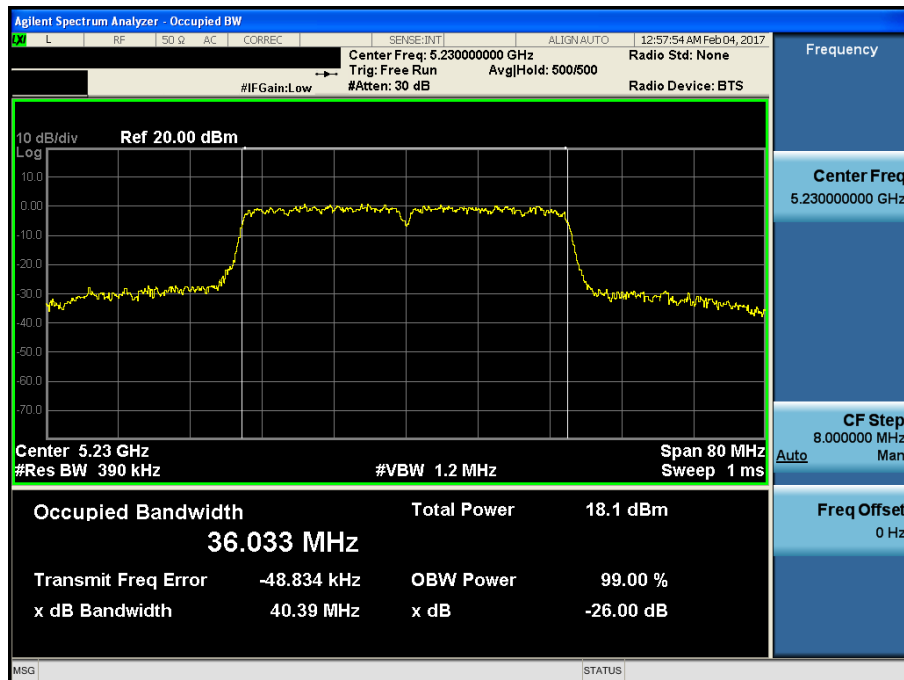
26 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 2 & Ch.38



26 dB Bandwidth

Test Mode: 802.11n HT40 & ANT 2 & Ch.46



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

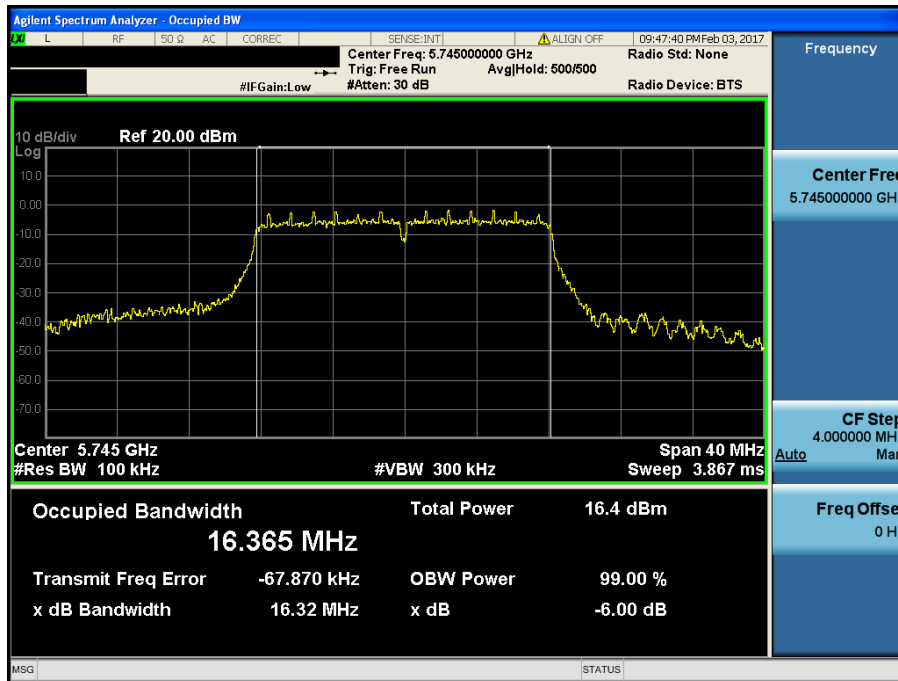
Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11a	U-NII 3	149	5745	16.320	15.740
		157	5785	16.130	15.850
		165	5825	16.320	16.110
802.11n (HT20)	U-NII 3	149	5745	15.400	15.200
		157	5785	16.360	16.050
		165	5825	16.350	16.330
802.11n (HT40)	U-NII 3	151	5755	35.200	35.210
		159	5795	35.220	35.220

RESULT PLOTS

Multiple Transmit

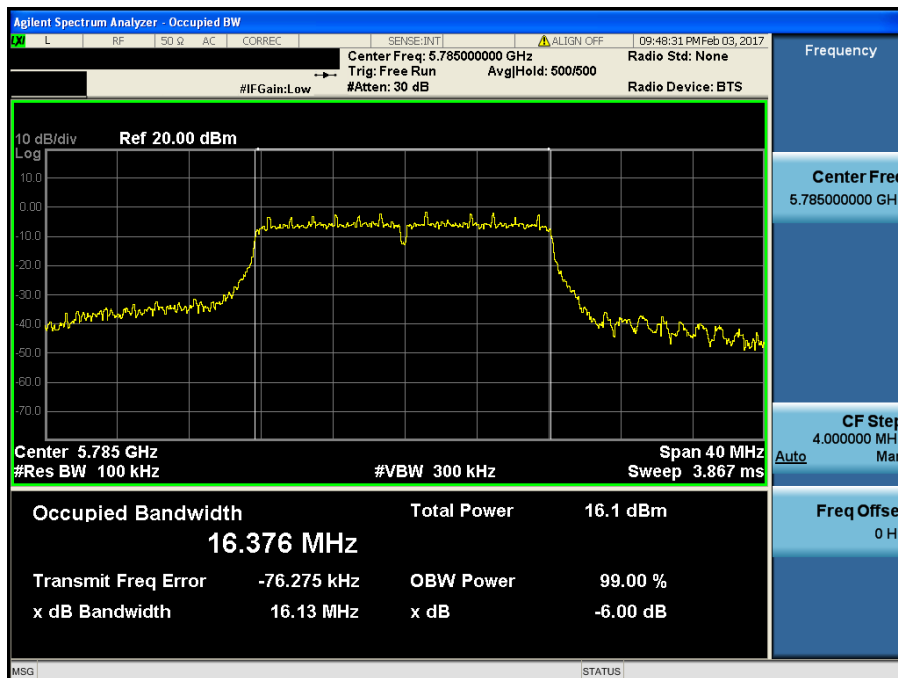
6 dB Bandwidth

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



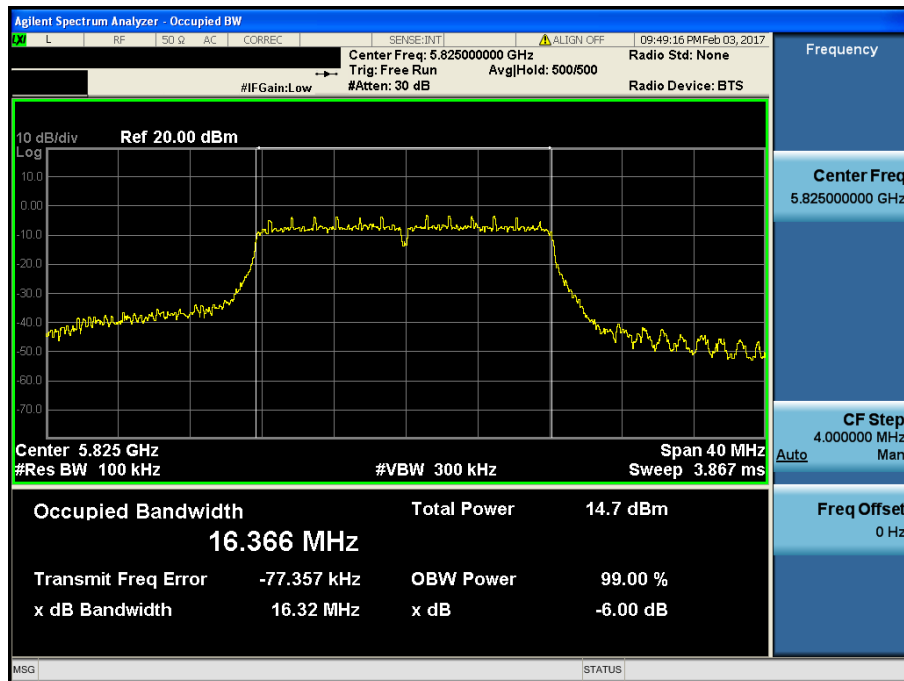
6 dB Bandwidth

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



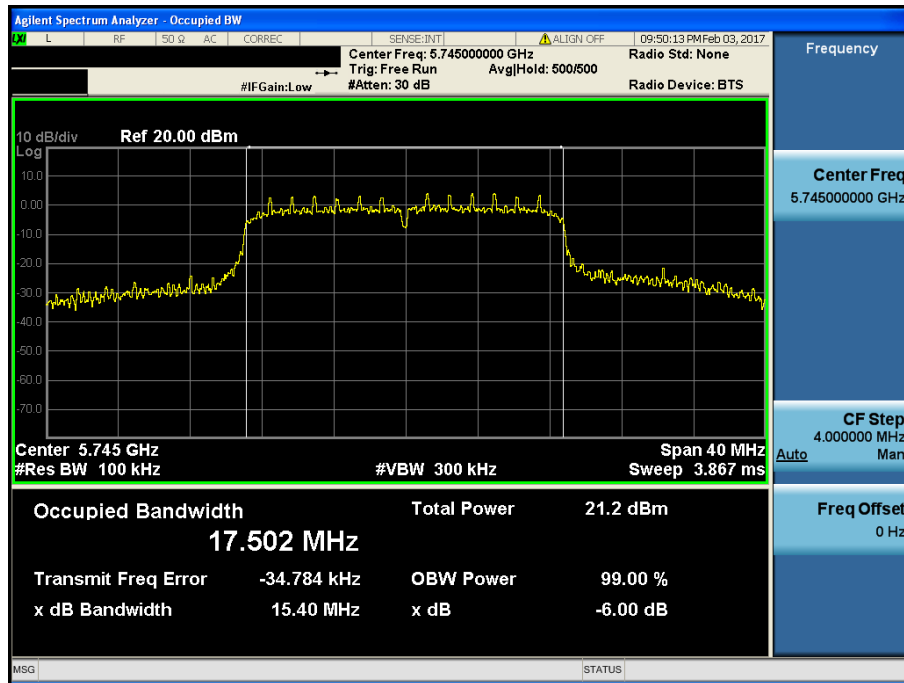
6 dB Bandwidth

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



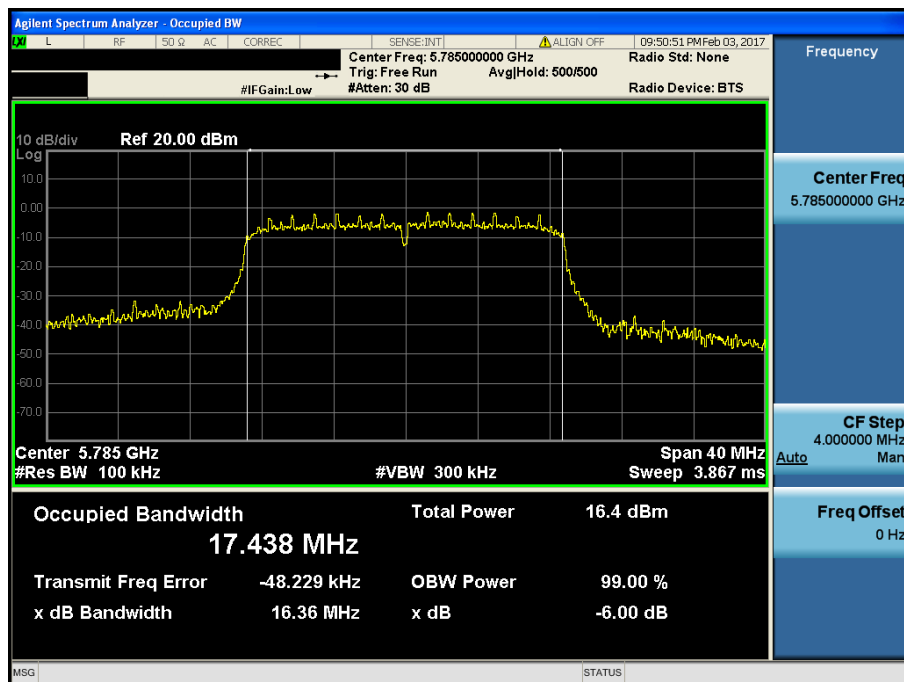
6 dB Bandwidth

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



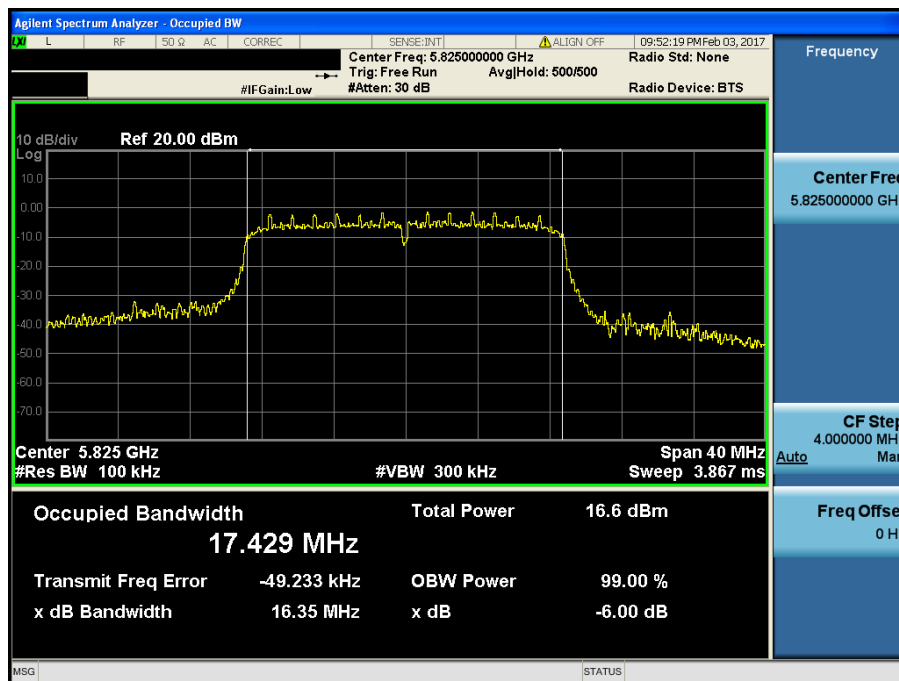
6 dB Bandwidth

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



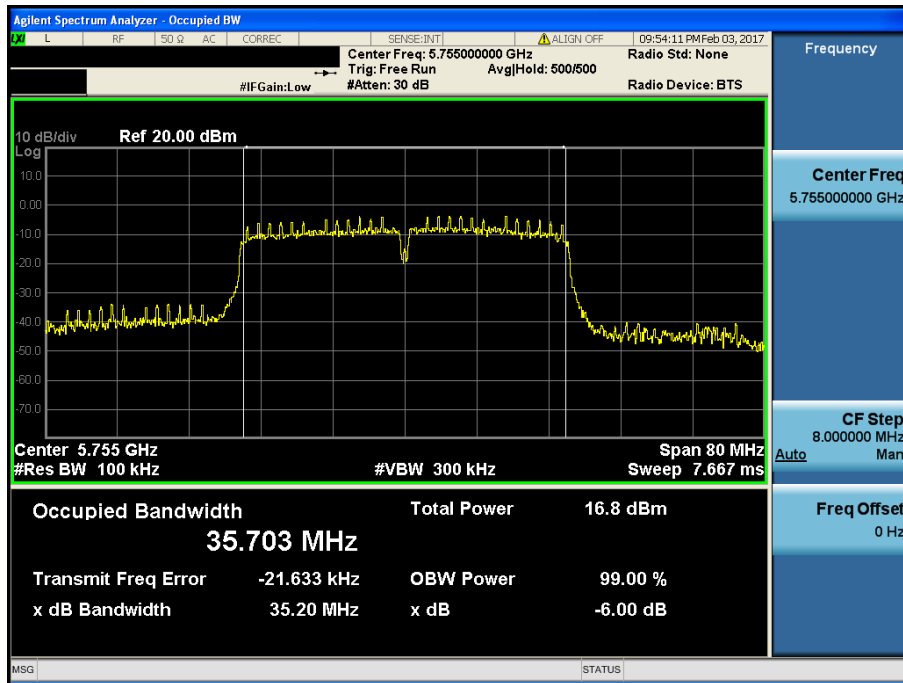
6 dB Bandwidth

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



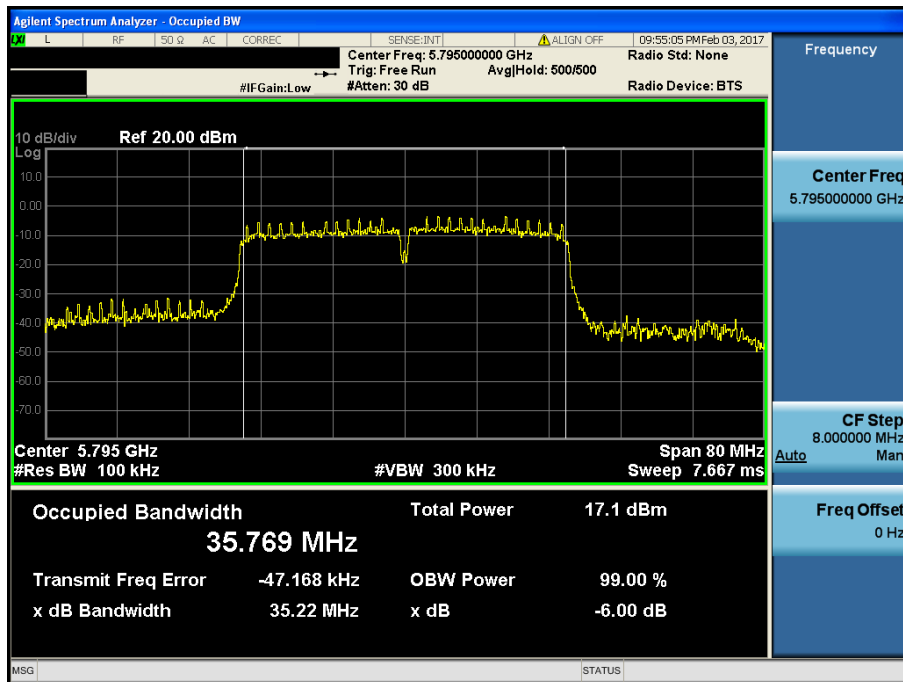
6 dB Bandwidth

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



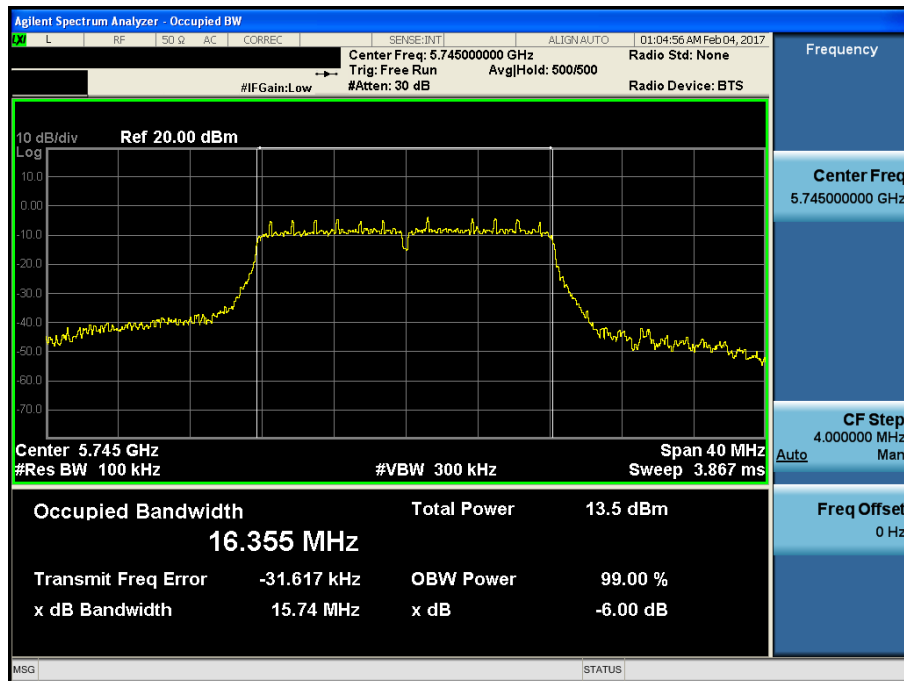
6 dB Bandwidth

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



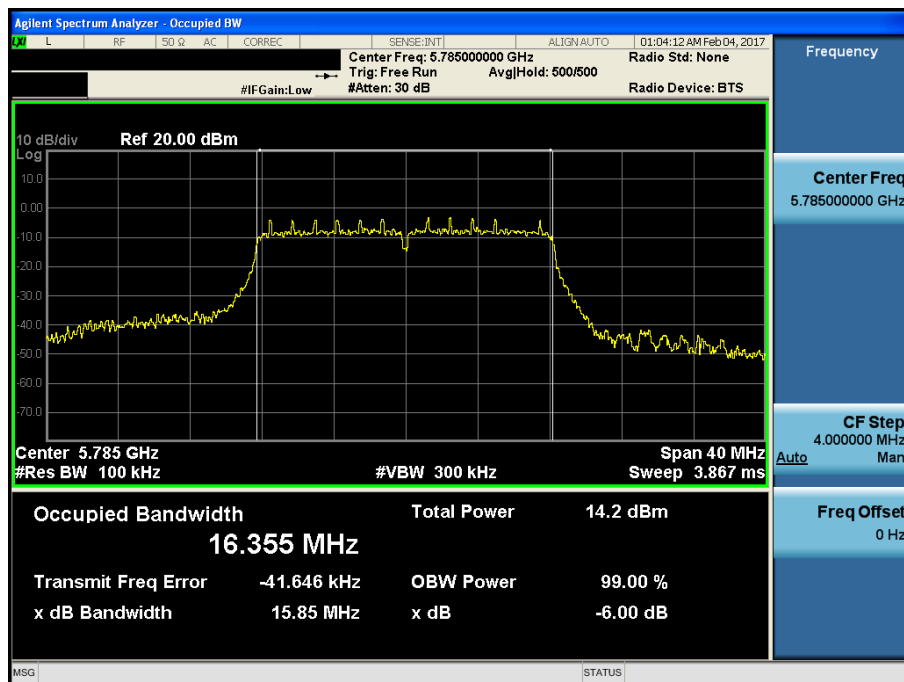
6 dB Bandwidth

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



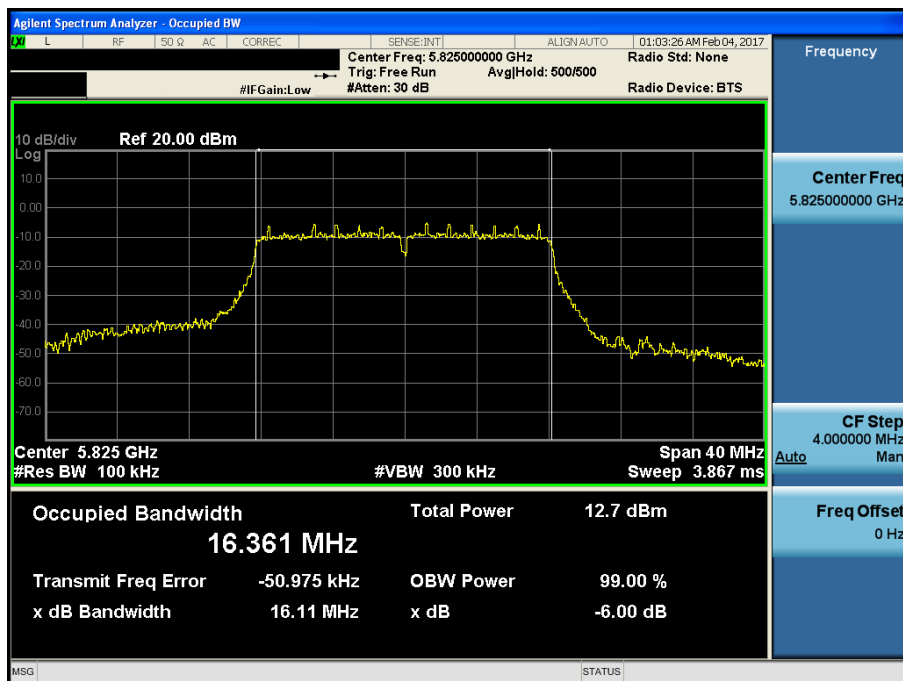
6 dB Bandwidth

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



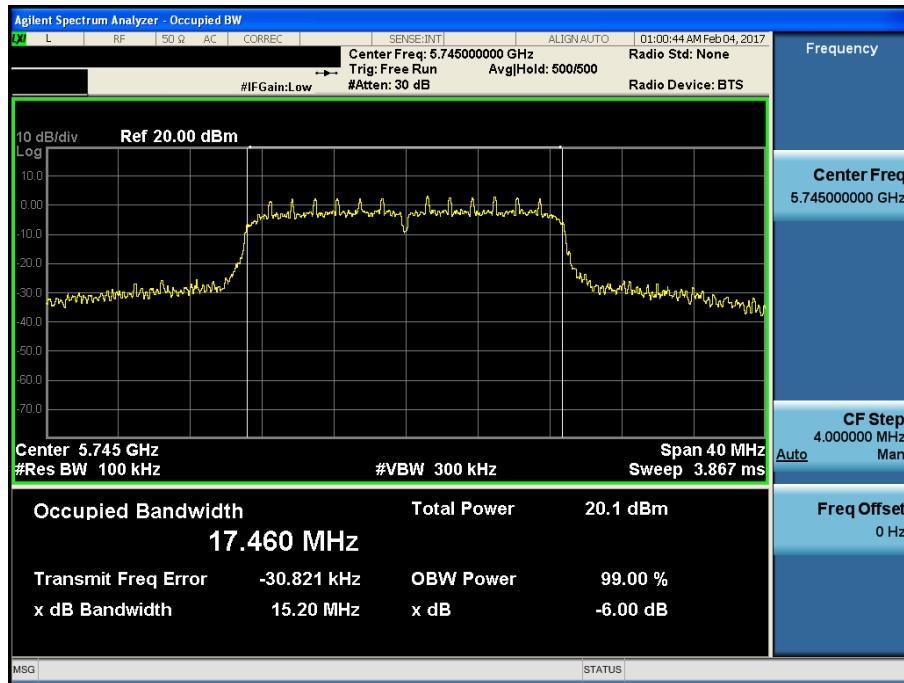
6 dB Bandwidth

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



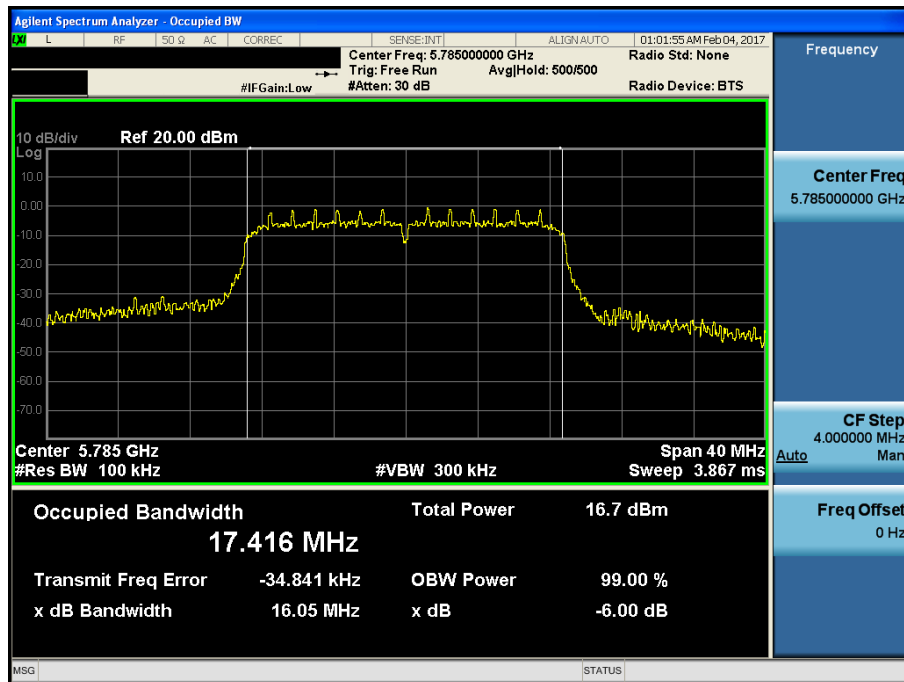
6 dB Bandwidth

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



6 dB Bandwidth

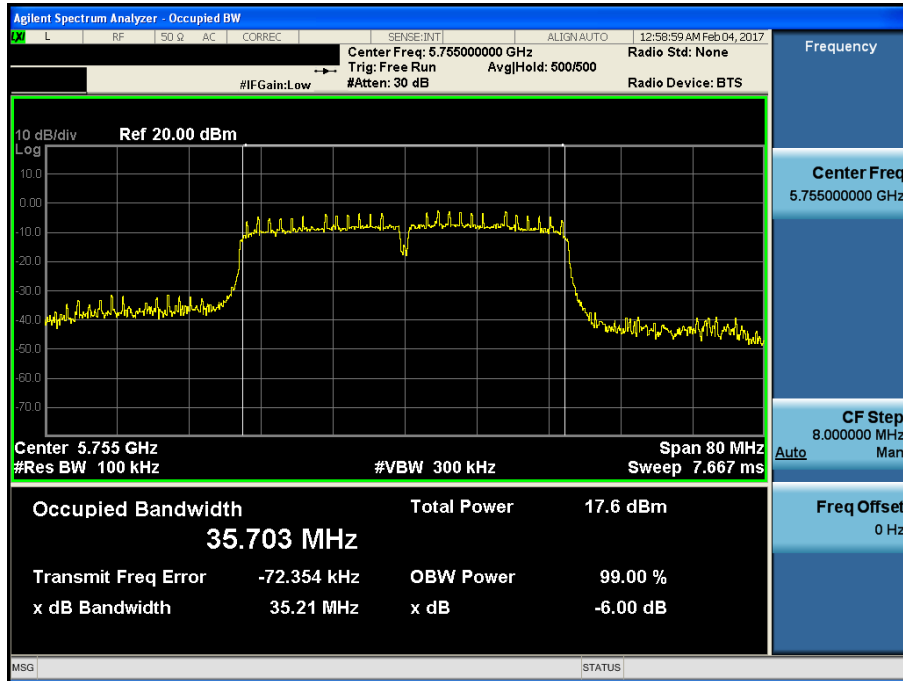
Test Mode: 802.11n HT20 & ANT 2 & Ch.157



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

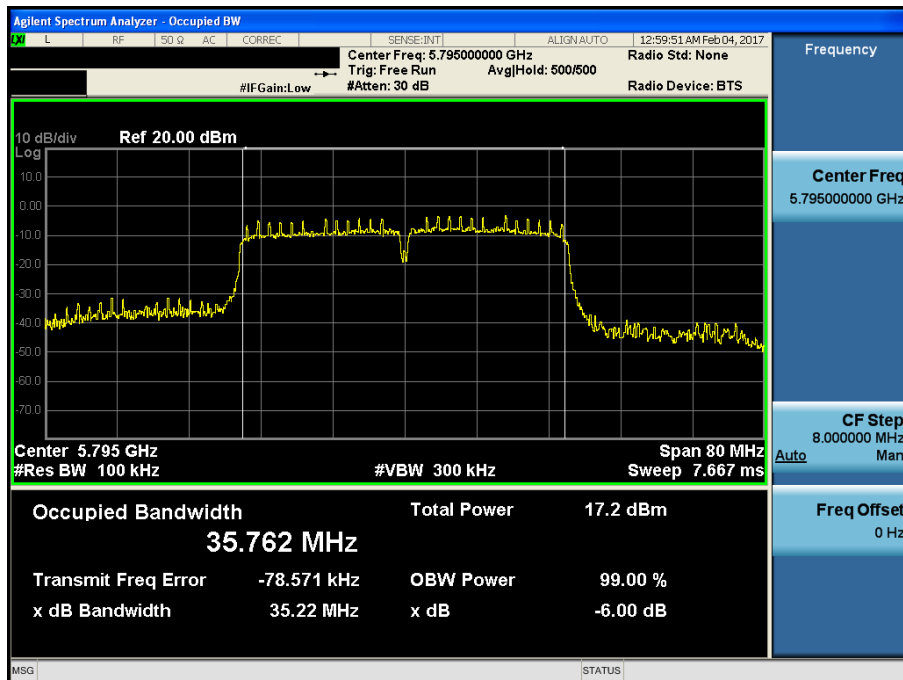
6 dB Bandwidth

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



6 dB Bandwidth

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



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

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	802.11a	250	23.97	0.70	23.97
	802.11n(HT20)				
	802.11n(HT40)				

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 3	802.11a	1000	30.00	0.50	30.00
	802.11n(HT20)				
	802.11n(HT40)				

■ Test Results: **Comply**

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11a (Single Transmit)	36	5180	13.04	12.69	-
	40	5200	12.71	12.52	-
	48	5240	12.47	12.39	-
	149	5745	9.87	9.67	-
	157	5785	9.61	9.26	-
	165	5825	8.37	7.98	-

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT20) (Multiple Transmit)	36	5180	9.61	8.41	12.06
	40	5200	9.87	9.04	12.49
	48	5240	9.71	8.37	12.10
	149	5745	12.47	12.46	15.48
	157	5785	8.22	9.64	12.00
	165	5825	8.76	8.47	11.63

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT40) (Multiple Transmit)	38	5190	12.13	12.87	15.53
	46	5230	11.53	11.57	14.56
	151	5755	9.94	10.03	13.00
	159	5795	9.51	9.14	12.34

8.4 Maximum Power Spectral Density

■ 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 power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. ^{note1}

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. ^{note1}

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. ^{note1,note2}

Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: 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.

- Peak Power Spectral Density Limit Calculation

Band	Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	11	0.70	11
U-NII 3	30	0.50	30

■ Test Configuration

Refer to the APPENDIX I.

■ Test procedure

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02**

- 1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA - 1, SA - 2, SA - 3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
- 2) Use the peak search function on the instrument to find the peak of the spectrum and record its value.
- 3) Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) **If Method SA - 2 or SA - 2 Alternative was used, add $10 \log(1 / x)$, where x is the duty cycle, to the peak of the spectrum.**
 - b) If Method SA - 3 Alternative was used and the linear mode was used in step II.E.2.g (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
- 4) The result is the Maximum PSD over 1 MHz reference bandwidth.
- 5) 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). (Refer to Appendix II)
 - 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 kHz is available on nearly all spectrum analyzers.

■ Test results: **Comply**

Multiple Transmit

Mode	Channel	Frequency [MHz]	Reading [dBm]			T.F [dB] Note 1	Test Result [dBm]		
			ANT 1	ANT 2	SUM		ANT 1	ANT 2	SUM
802.11a	36	5180	-8.950	-9.150	-	10.61	1.660	1.460	-
	40	5200	-9.030	-8.160	-		1.580	2.450	-
	48	5240	-8.110	-7.930	-		2.500	2.680	-
	149	5745	-11.140	-11.570	-	7.60	-3.540	-3.970	-
	157	5785	-11.440	-10.920	-		-3.840	-3.320	-
	165	5825	-12.220	-12.870	-		-4.620	-5.270	-
802.11n HT20	36	5180	-10.560	-13.870	-8.897	11.14	0.580	-2.730	2.243
	40	5200	-11.010	-13.000	-8.882		0.130	-1.860	2.258
	48	5240	-11.490	-12.420	-8.920		-0.350	-1.280	2.220
	149	5745	-8.740	-7.820	-5.245	8.13	-0.610	0.310	2.884
	157	5785	-12.680	-11.680	-9.141		-4.550	-3.550	-1.011
	165	5825	-12.040	-12.190	-9.104		-3.910	-4.060	-0.974
802.11n HT40	38	5190	-11.990	-10.510	-8.177	12.01	0.020	1.500	3.833
	46	5230	-12.160	-12.120	-9.130		-0.150	-0.110	2.880
	151	5755	-13.650	-13.020	-10.313	9.00	-4.650	-4.020	-1.314
	159	5795	-13.620	-13.510	-10.554		-4.620	-4.510	-1.555

Note 1: "Band 1, 2A, 2C [T.F] = 10*LOG(1000/100) + D.C.F"

"Band 3 [T.F] = 10*LOG(500/100) + D.C.F"

For D.C.F., please refer to appendix II.

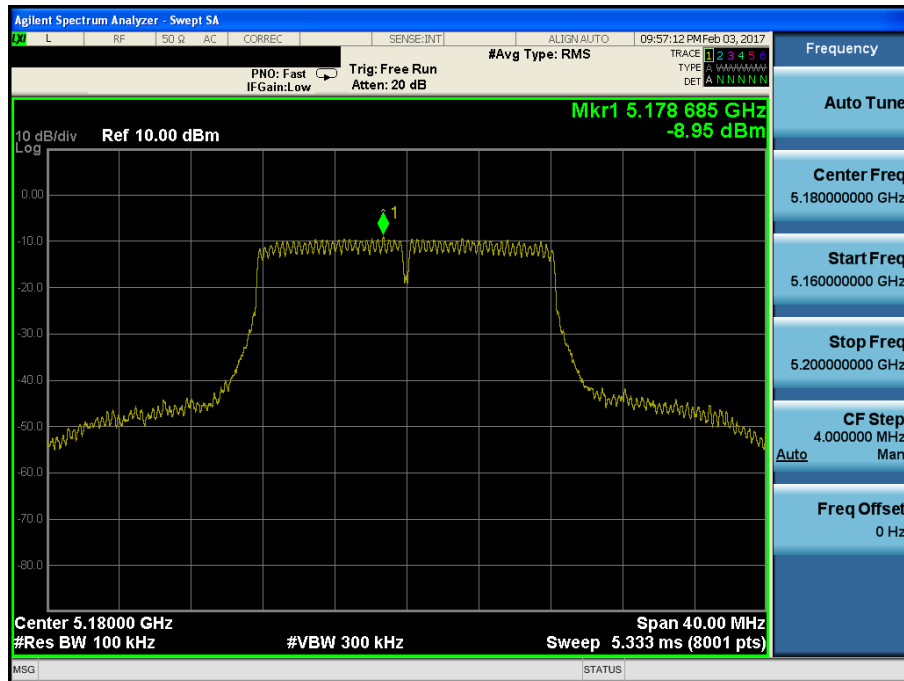
Note 2: Test Result = Measurement Data + T.F

RESULT PLOTS

Multiple Transmit

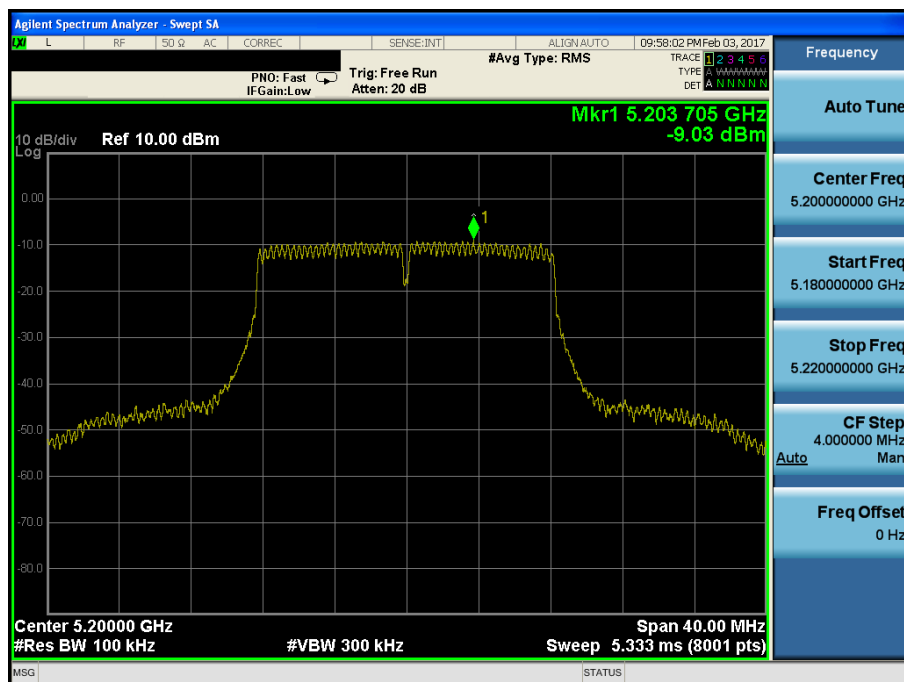
Maximum Power Spectral Density

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



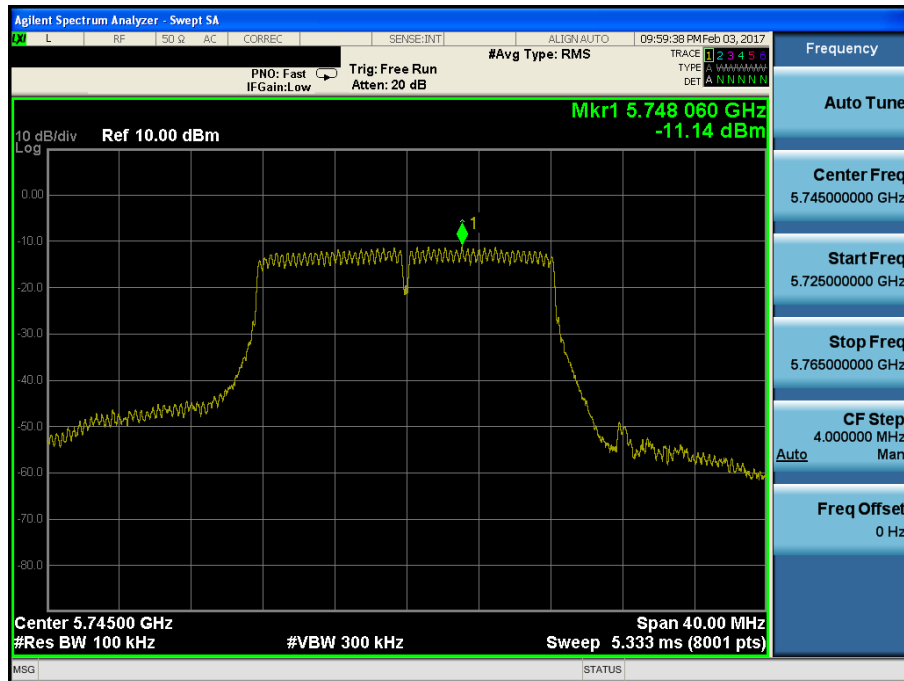
Maximum Power Spectral Density

Test Mode: 802.11a & ANT 1 & Ch.40



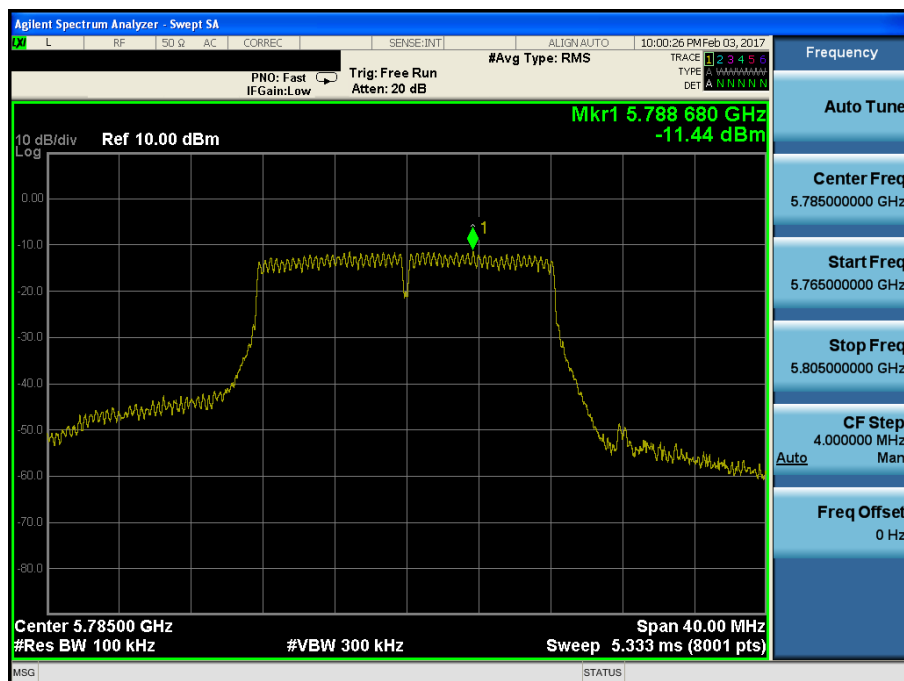
Maximum Power Spectral Density

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



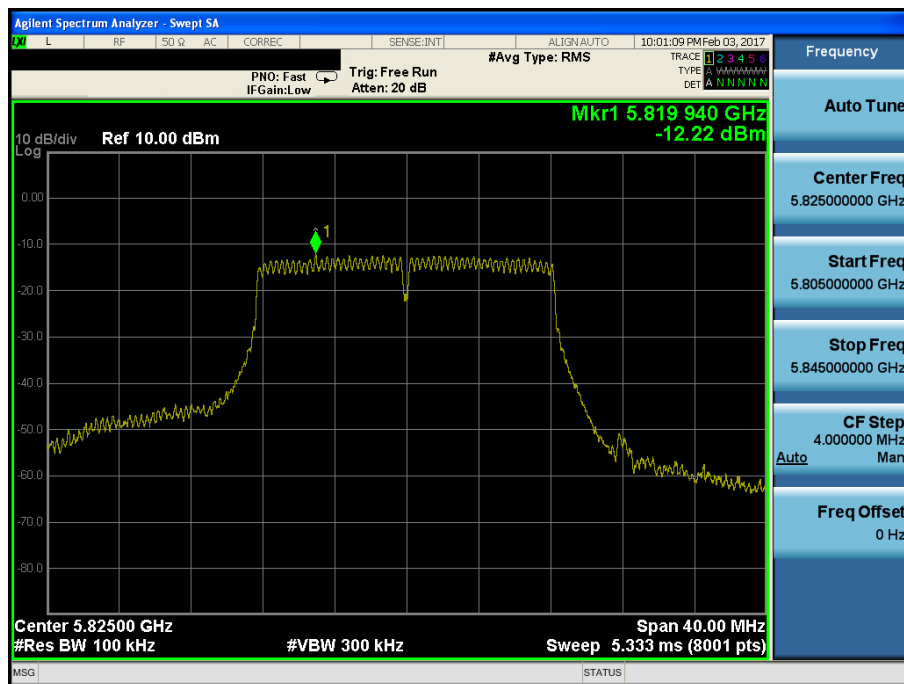
Maximum Power Spectral Density

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



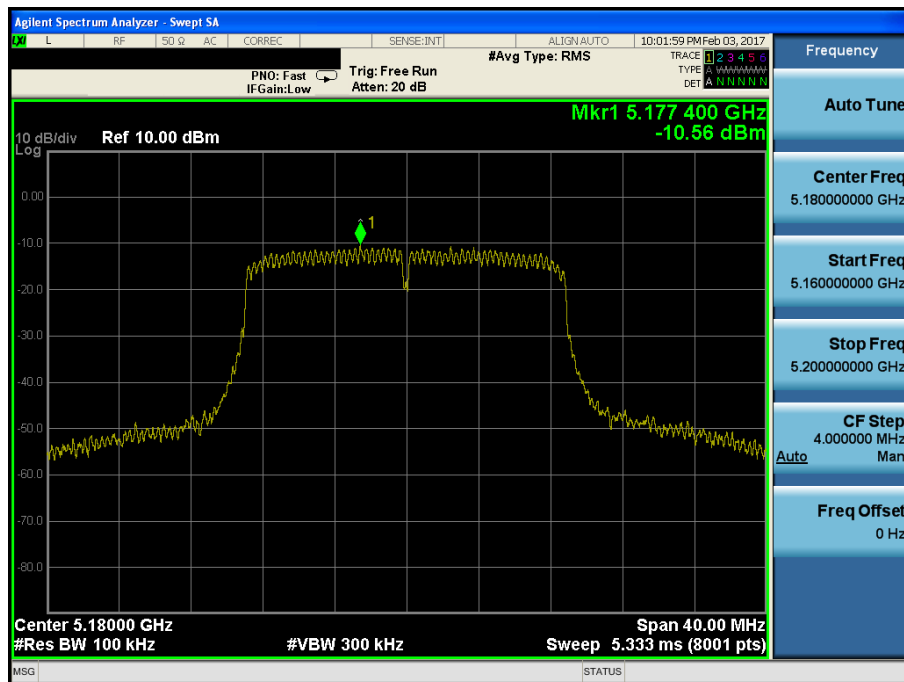
Maximum Power Spectral Density

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



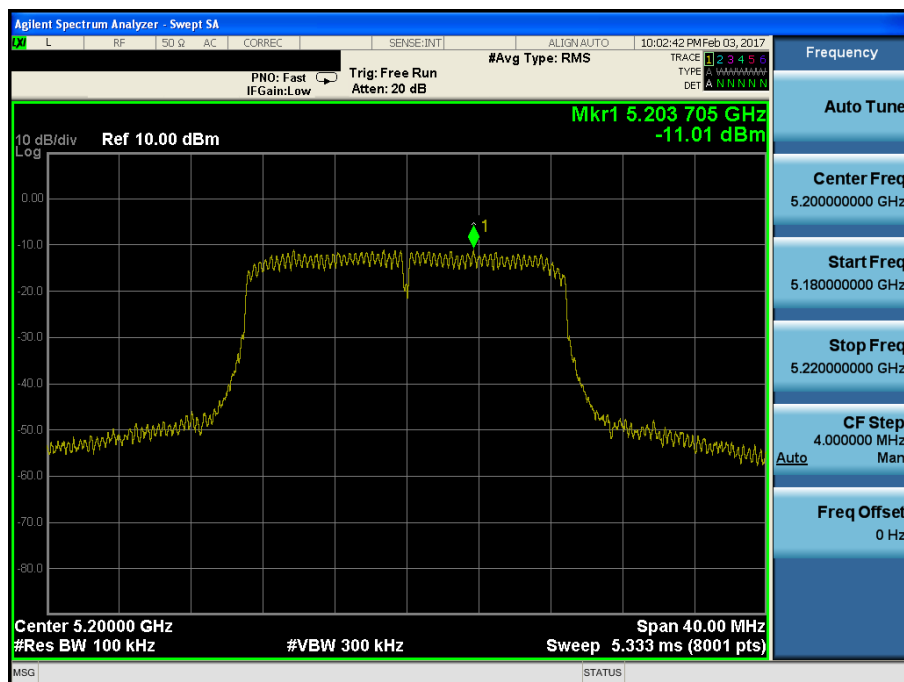
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & ANT 1 & Ch.36



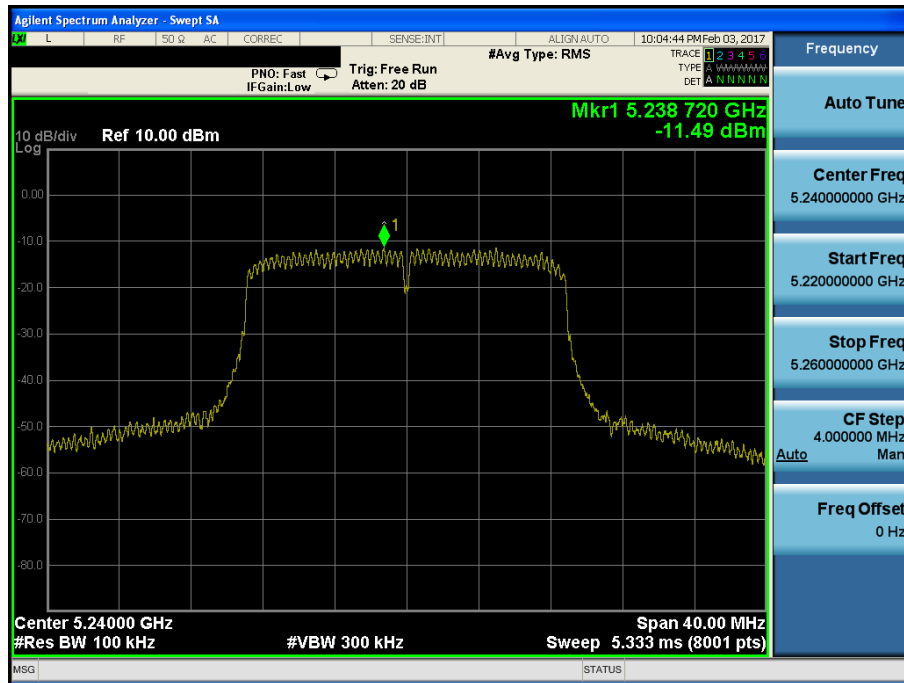
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & ANT 1 & Ch.40



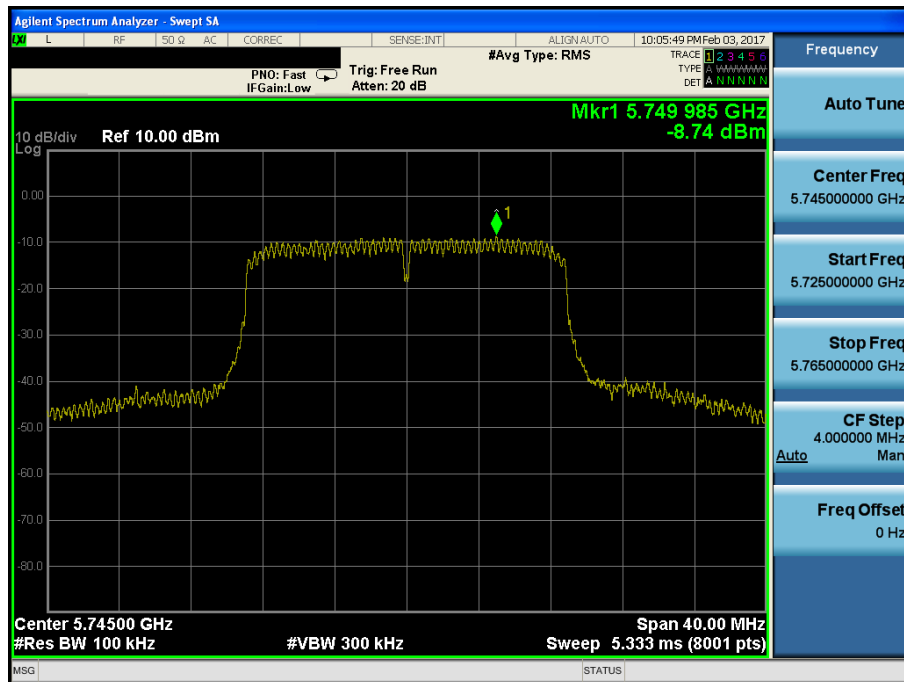
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & ANT 1 & Ch.48



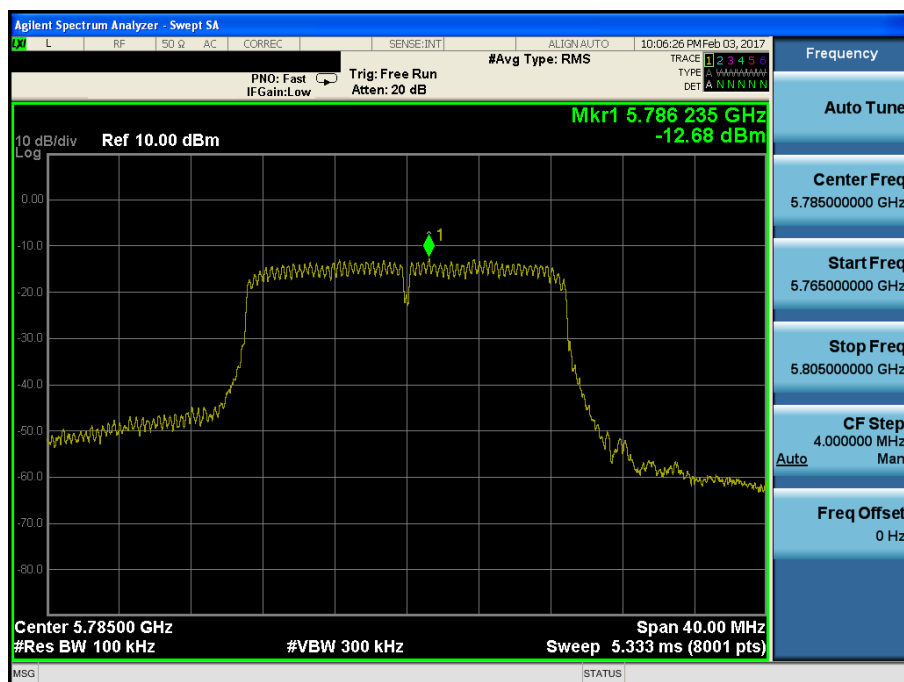
Maximum Power Spectral Density

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



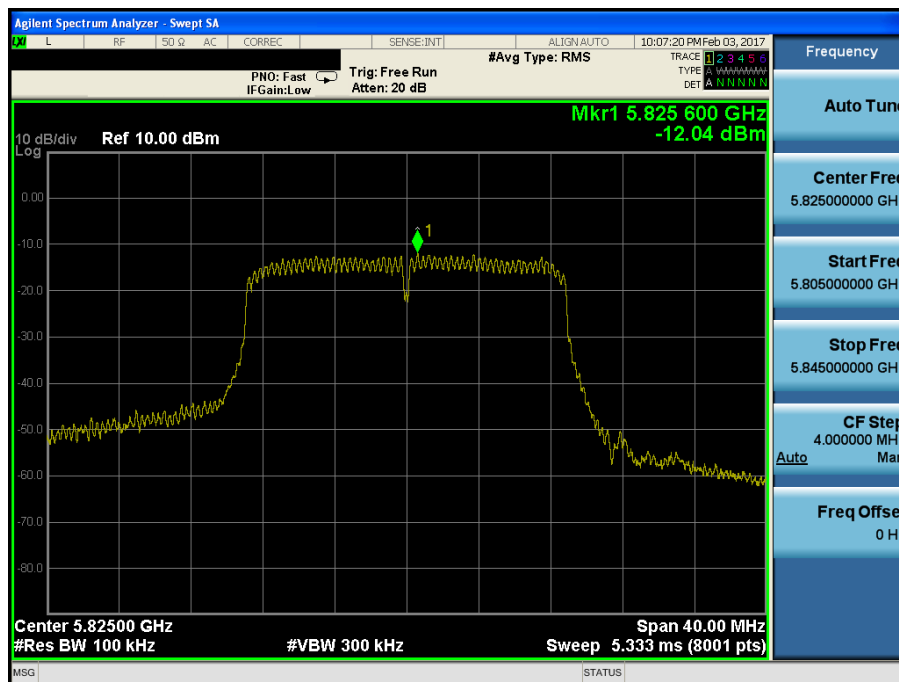
Maximum Power Spectral Density

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



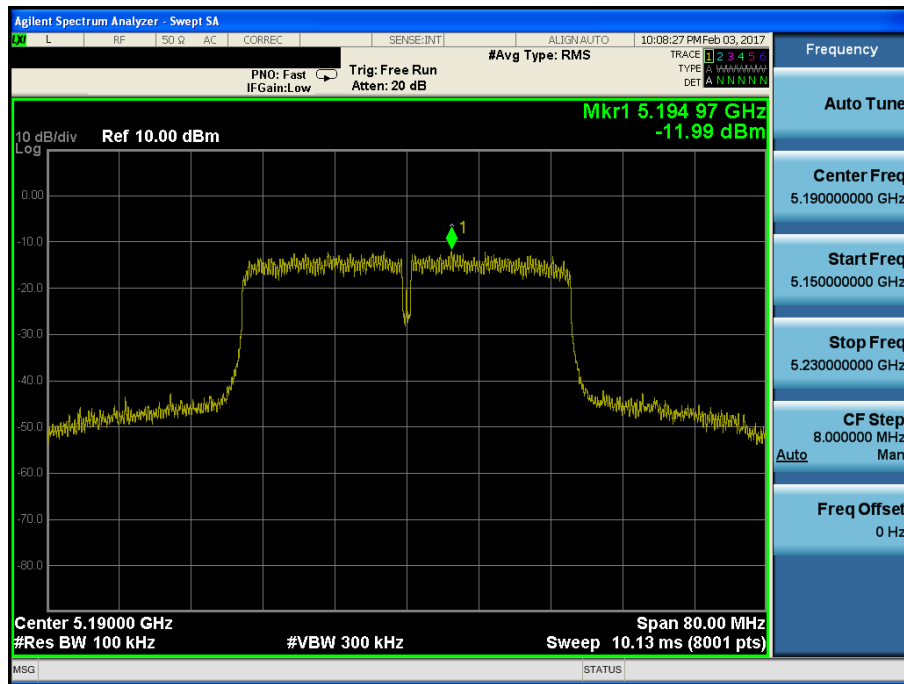
Maximum Power Spectral Density

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



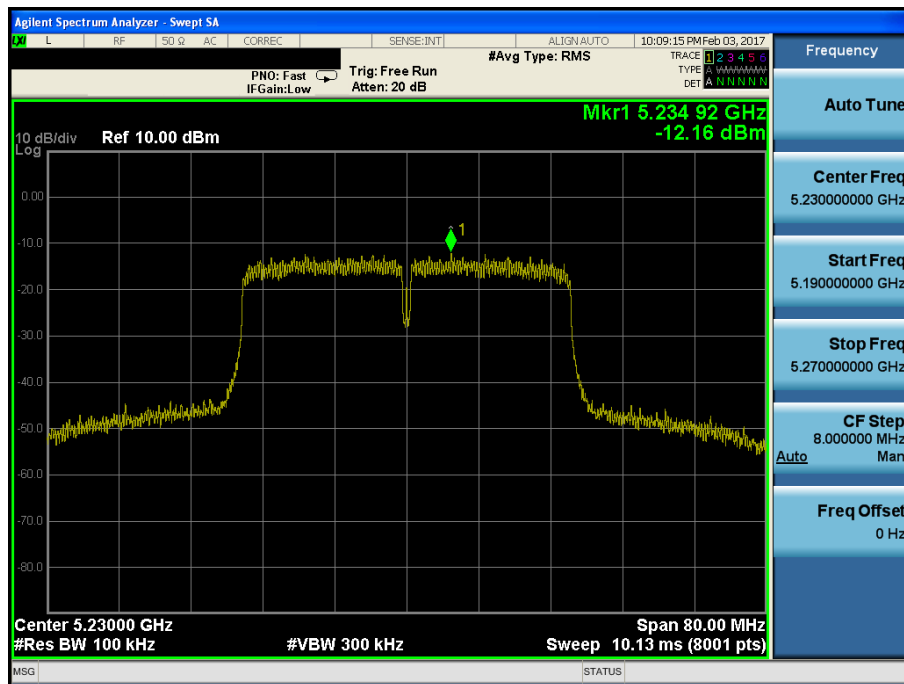
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & ANT 1 & Ch.38



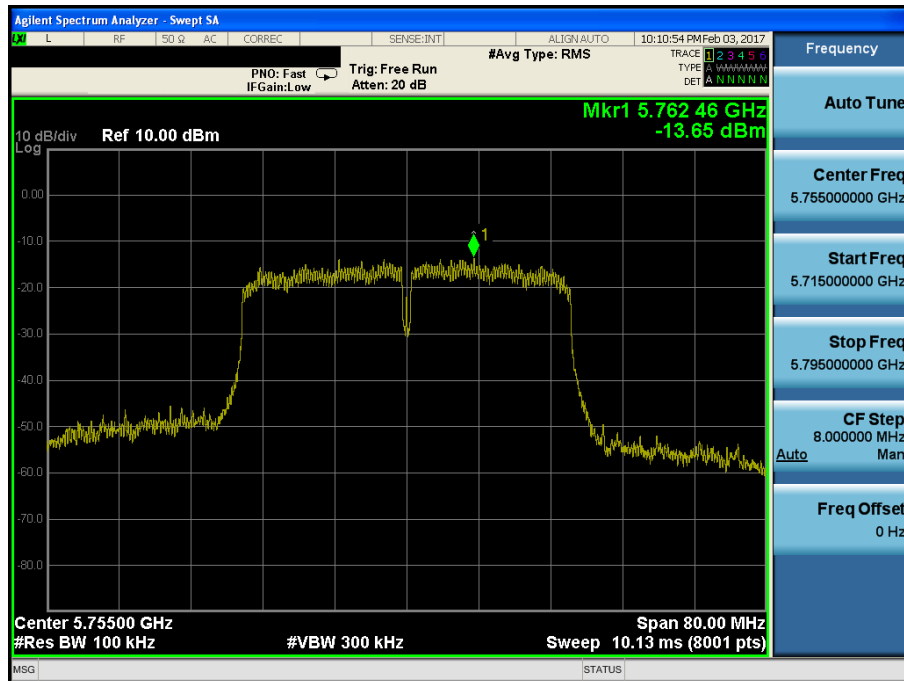
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & ANT 1 & Ch.46



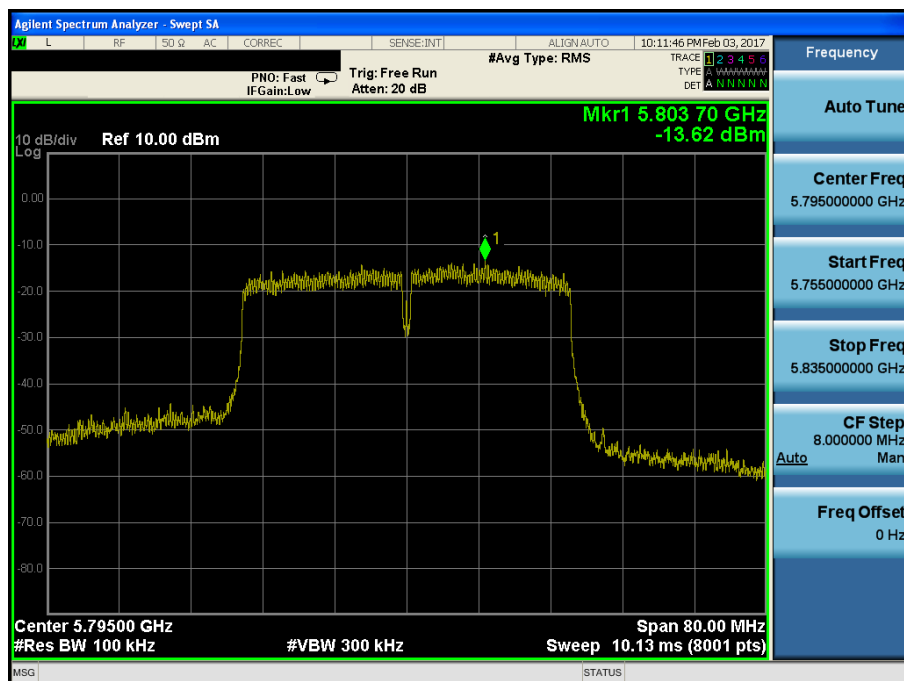
Maximum Power Spectral Density

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



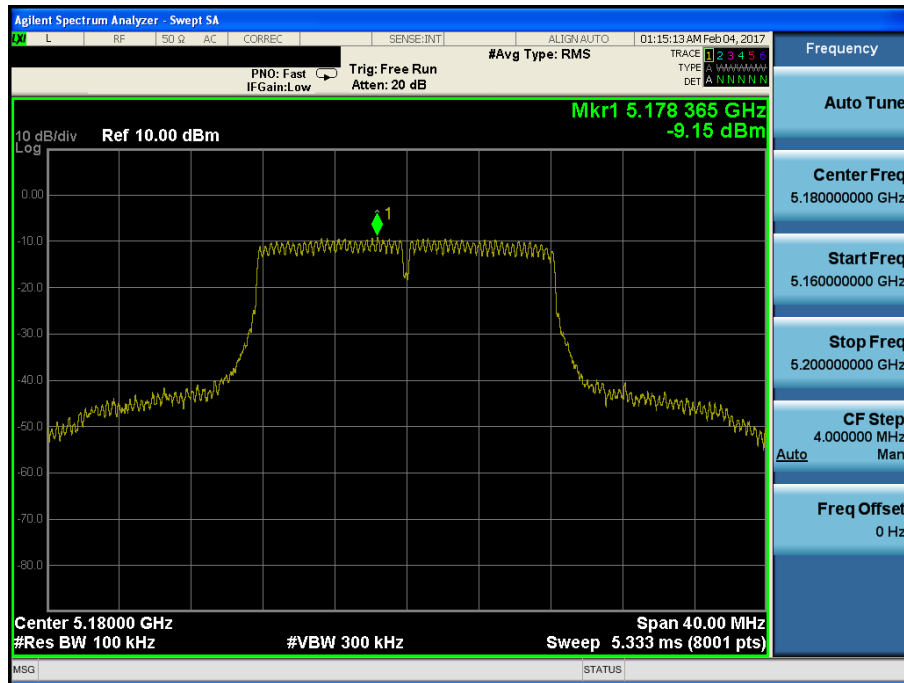
Maximum Power Spectral Density

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



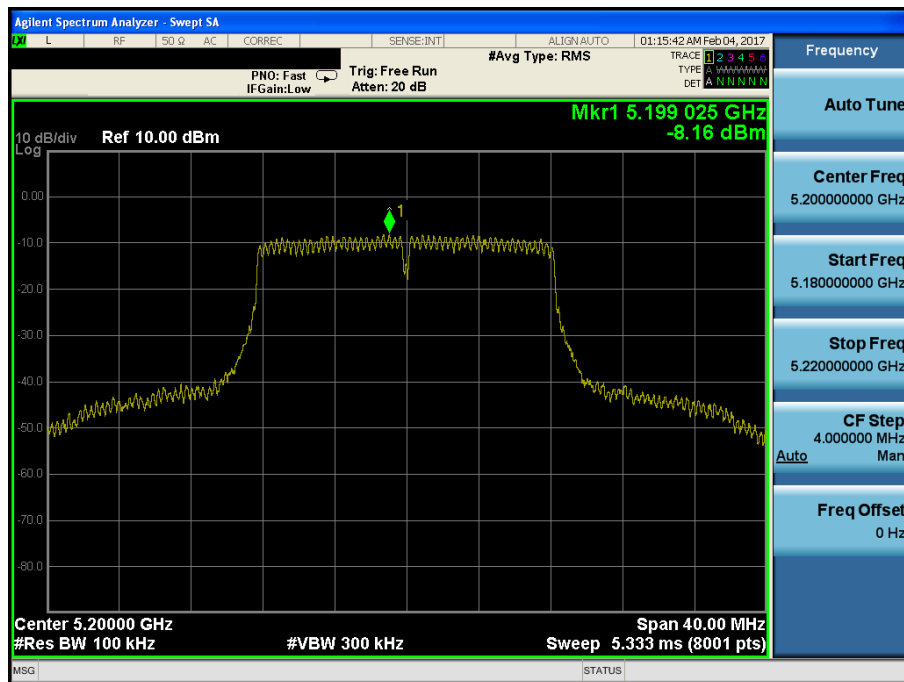
Maximum Power Spectral Density

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



Maximum Power Spectral Density

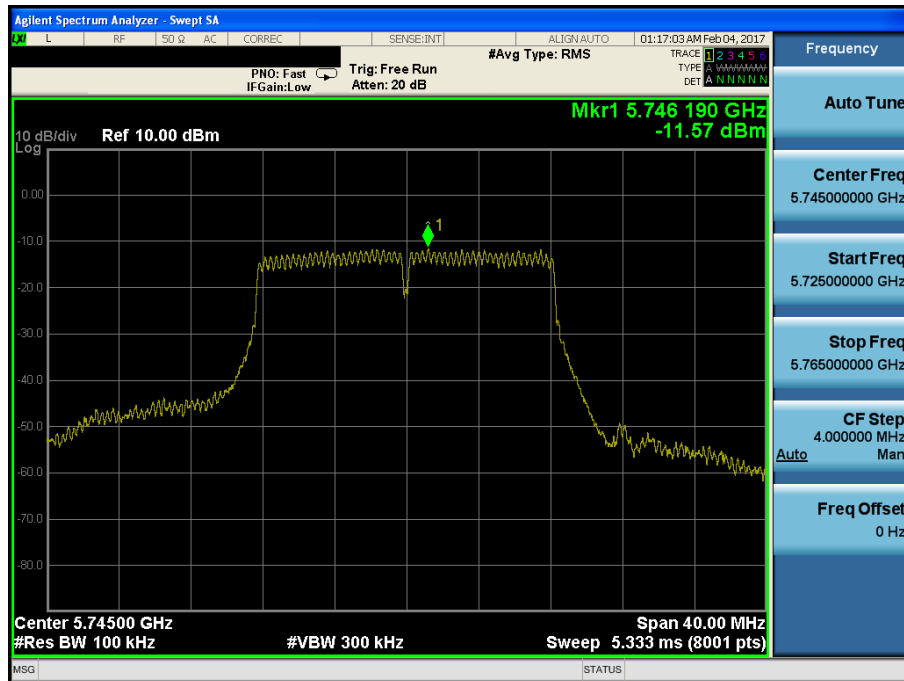
Test Mode: 802.11a & ANT 2 & Ch.40



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

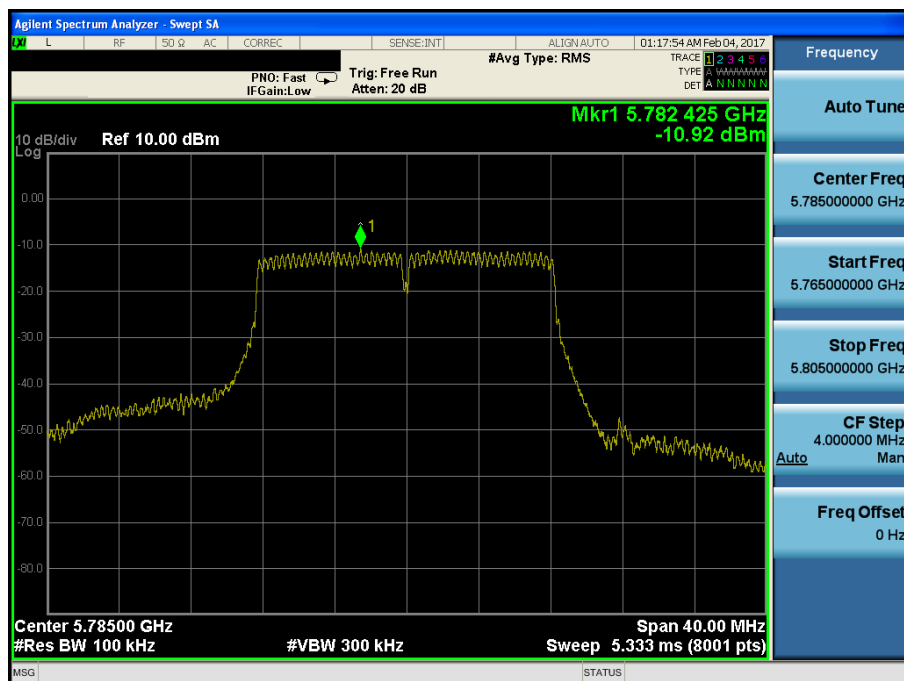
Maximum Power Spectral Density

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



Maximum Power Spectral Density

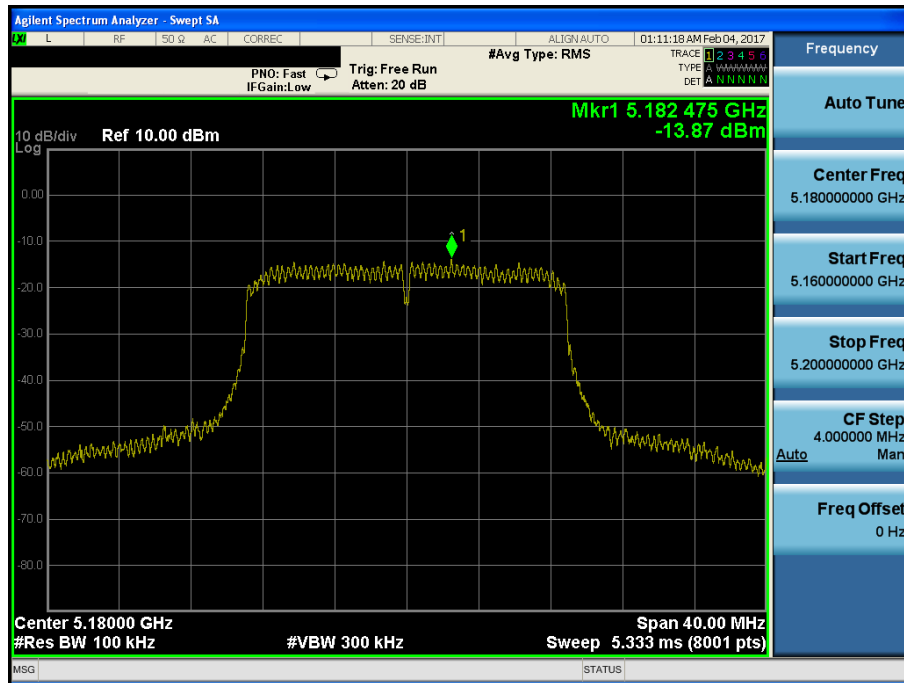
Test Mode: 802.11a & ANT 2 & Ch.157



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

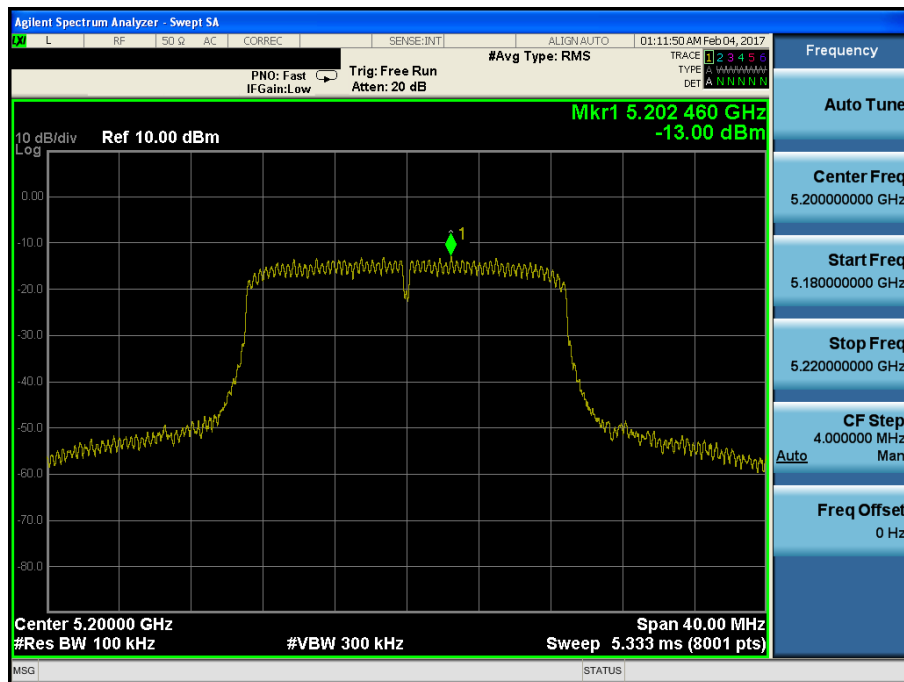
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & ANT 2 & Ch.36



Maximum Power Spectral Density

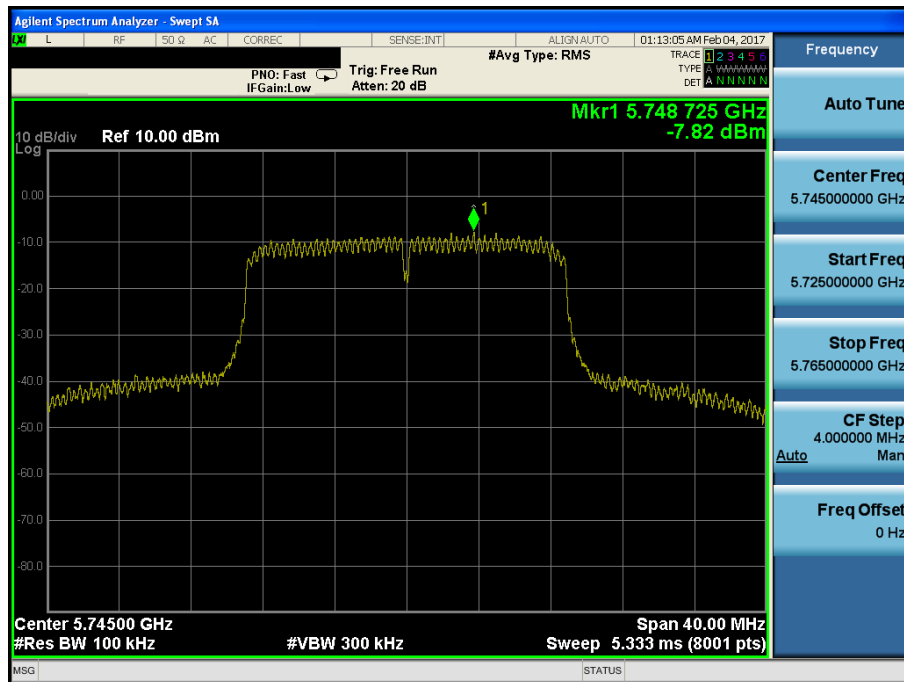
Test Mode: 802.11n HT20 & ANT 2 & Ch.40



Test Mode: 802.11n HT20 & ANT 2 & Ch.48

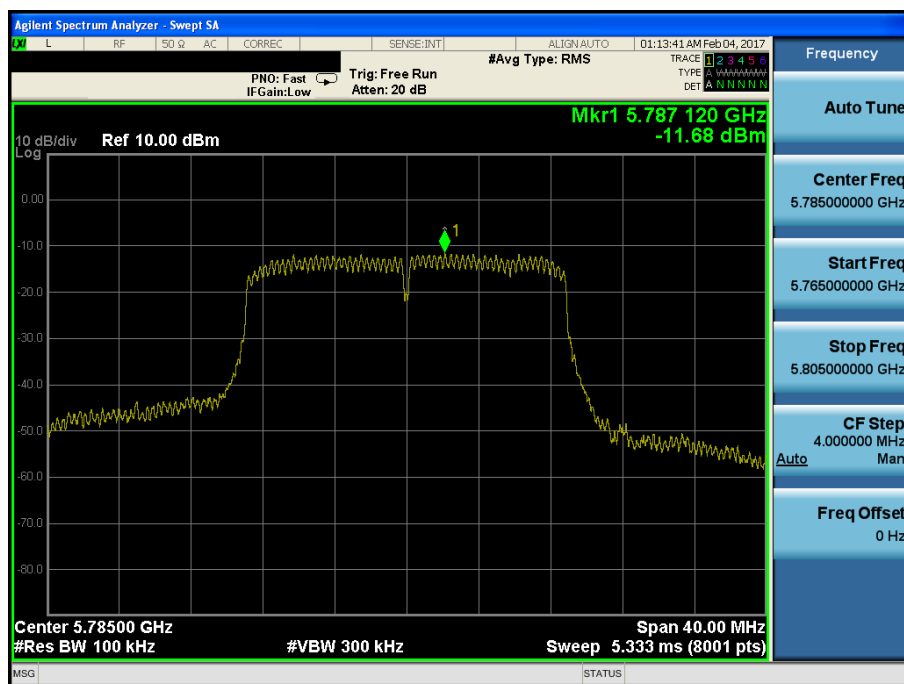
Maximum Power Spectral Density

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



Maximum Power Spectral Density

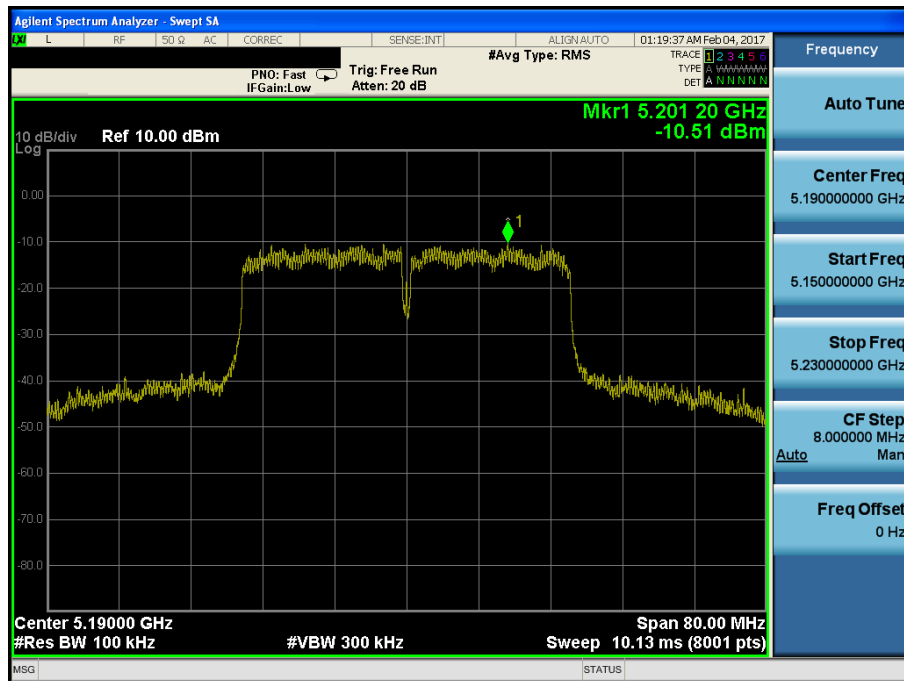
Test Mode: 802.11n HT20 & ANT 2 & Ch.157



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

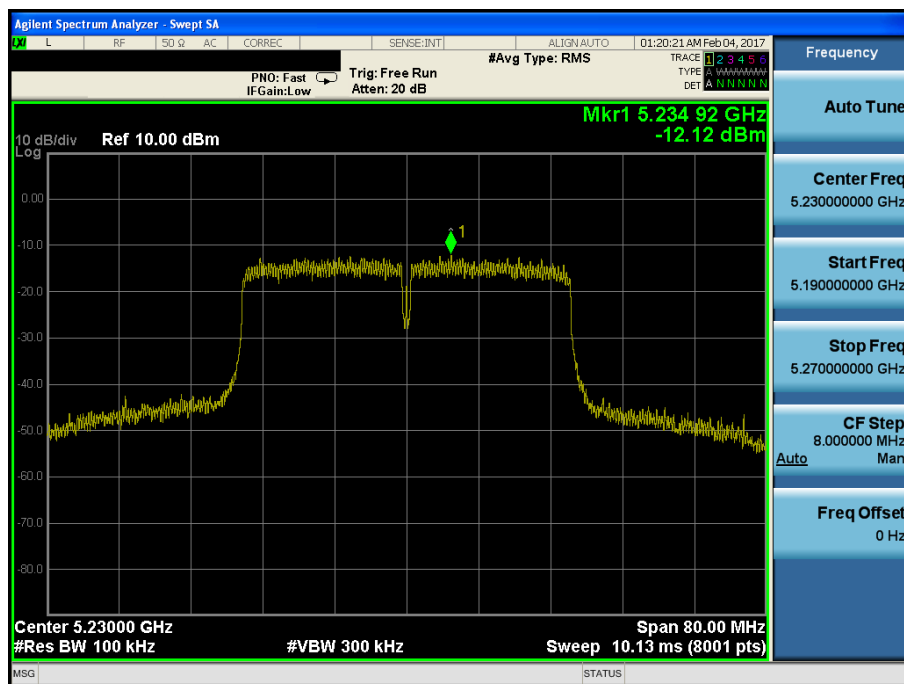
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & ANT 2 & Ch.38



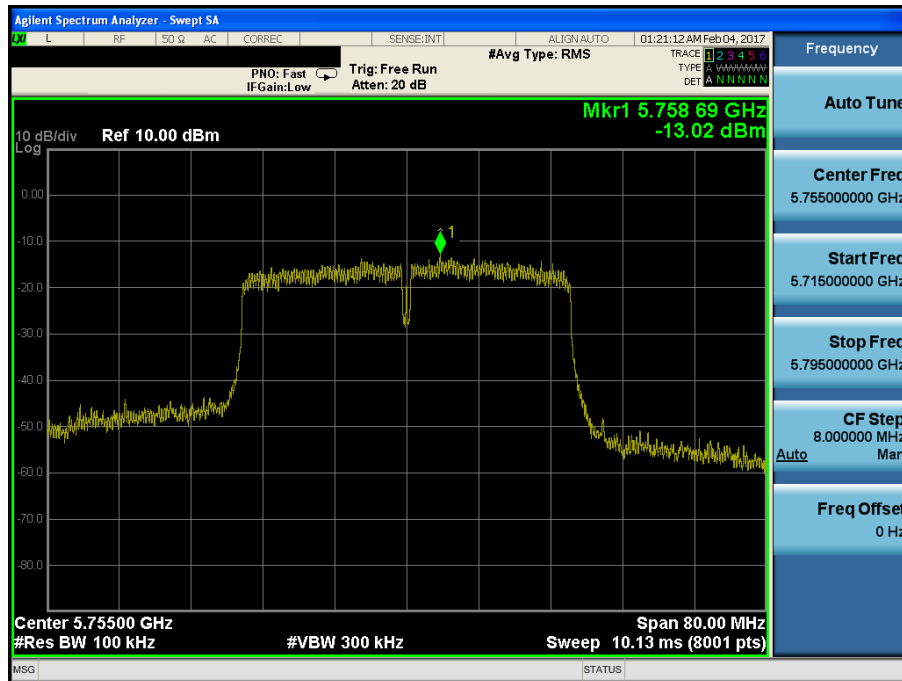
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & ANT 2 & Ch.46



Maximum Power Spectral Density

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



Maximum Power Spectral Density

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

