TEST REPORT

Dt&C

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Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC1912-0313
2. Customer
   - Name (FCC) : HYUNDAI MOBIS CO., LTD. / Name (IC) : Hyundai MOBIS Co., Ltd
   - Address (FCC) : 203, Teheran-ro Gangnam-gu, Seoul, South Korea 135-977
     Address (IC) : 203, Teheran-ro Gangnam-gu Seoul 135-977 Korea (Republic Of)
3. Use of Report : FCC & IC Original Grant
4. Product Name / Model Name : DISPLAY CAR SYSTEM / DA330S8AN(FCC), DA330S8KN(IC)
   FCC ID : TQ8-DA330S8AN / IC : 5074A-DA330S8KN
5. Test Method Used : KDB789033 D02v02r01, ANSI C 63.10-2013
   Test Specification : FCC Part 15.407
   RSS-247 Issue 2, RSS-GEN Issue 5
6. Date of Test : 2019.11.04 ~ 2019.11.20
7. Testing Environment : Refer to appended test report.
8. Test Result : Refer to the attached test result.

Affirmation	Tested by Name : JungWoo Kim (Signature)	Reviewed by Name : JaeJin Lee (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.

2019 . 12 . 09 .

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

Test Report Version

Test Report No.	Date	Description	Tested by	Reviewed by
DRTFCC1912-0313	Dec. 09, 2019	Initial issue	JungWoo Kim	JaeJin Lee

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1. EUT DESCRIPTION

Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	DISPLAY CAR SYSTEM
Model Name(FCC)	DA330S8AN
Model Name(IC)	DA330S8KN
Add Model Name(FCC, IC)	NA
Hardware Version	1.0
Software Version	1.0
Serial Number	Radiated: 96160-38710 Conducted: 96160-S8710
Power Supply	DC 14.4 V
Modulation type	OFDM
Antenna Specification	**Antenna type:** PCB Pattern Antenna **Antenna gain** U-NII 1: -0.61 dBi U-NII 2A: -0.18 dBi U-NII 2C: -0.77 dBi U-NII 3: -0.18 dBi

5GHz Band	Mode	Frequency range(MHz)	Max power(dBm)	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
U-NII 1	802.11a	5180 ~ 5240	9.09	-0.61	8.48
	802.11n(HT20)	5180 ~ 5240	**9.23**		**8.62**
	802.11ac(VHT20)	5180 ~ 5240	9.21		8.60
	802.11n(HT40)	5190 ~ 5230	4.97		4.36
	802.11ac(VHT40)	5190 ~ 5230	4.96		4.35
	802.11ac(VHT80)	5210	6.11		5.50
U-NII 2A	802.11a	5260 ~ 5320	**9.28**	-0.18	**9.10**
	802.11n(HT20)	5260 ~ 5320	9.21		9.03
	802.11ac(VHT20)	5260 ~ 5320	9.01		8.83
	802.11n(HT40)	5270 ~ 5310	7.57		7.39
	802.11ac(VHT40)	5270 ~ 5310	7.55		7.37
	802.11ac(VHT80)	5290	7.98		7.80
U-NII 2C	802.11a	5500 ~ 5580, 5660 ~ 5720	**8.28**	-0.77	**7.51**
	802.11n(HT20)	5500 ~ 5580, 5660 ~ 5720	8.02		7.25
	802.11ac(VHT20)	5500 ~ 5580, 5660 ~ 5720	7.96		7.19
	802.11n(HT40)	5510 ~ 5550, 5670 ~ 5710	7.79		7.02
	802.11ac(VHT40)	5510 ~ 5550, 5670 ~ 5710	7.76		6.99
	802.11ac(VHT80)	5530, 5690	7.81		7.04
U-NII 3	802.11a	5745 ~ 5825	7.57	-0.18	7.39
	802.11n(HT20)	5745 ~ 5825	7.54		7.36
	802.11ac(VHT20)	5745 ~ 5825	**7.66**		**7.48**
	802.11n(HT40)	5755 ~ 5795	7.29		7.11
	802.11ac(VHT40)	5755 ~ 5795	7.34		7.16
	802.11ac(VHT80)	5775	7.24		7.06

Note 1: e.i.r.p = Conducted Output Power + Antenna Gain

2. Information about test items

2.1 Transmitting configuration of EUT

Mode	Data rate
802.11a	6~54Mbps
802.11n(HT20)	MCS 0 ~ 7
802.11ac(VHT20)	MCS 0 ~ 8
802.11n(HT40)	MCS 0 ~ 7
802.11ac(VHT40)	MCS 0 ~ 9
802.11ac(VHT80)	MCS 0 ~ 9

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20) /802.11ac(VHT20)		802.11n(HT40) /802.11ac(VHT40)		802.11ac(VHT80)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 1	36	5180	38	5190	42	5210
	40	5200	-	-	-	-
	48	5240	46	5230	-	-
U-NII 2A	52	5260	54	5270	58	5290
	60	5300	-	-	-	-
	64	5320	62	5310	-	-
U-NII 2C	100	5500	102	5510	106	5530
	116	5580	110	5550	-	-
	144	5720	142	5710	138	5690
U-NII 3	149	5745	151	5755	155	5775
	157	5785	-	-	-	-
	165	5825	159	5795	-	-

2.3 Testing Environment

Temperature	:	20 ºC ~ 26 ºC
Relative humidity content	:	38 % ~ 45 %
Details of power supply	:	DC 14.4 V

2.4 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

2.5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of *k* = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power	0.7 dB (The confidence level is about 95 %, k = 2)
Conducted spurious emission	1.0 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)

3. SUMMARY OF TESTS

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
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
15.407(a)	RSS-247[6.2]	Maximum Conducted Output Power	Refer to the section 8.3		C
15.407(a)	RSS-247[6.2]	Peak Power Spectral Density	Refer to the section 8.4		C
-	RSS GEN[6.7]	Occupied Bandwidth (99%)	N/A		C
15.407(h)	RSS-247[6.3]	Dynamic Frequency Selection	FCC 15.407(h)		C Note 3
15.205 15.209 15.407(b)	RSS-247[6.2] RSS-GEN[8.9] RSS-GEN[8.10]	Undesirable Emissions	Refer to the section 8.6	Radiated	C
15.207	RSS-GEN[8.8]	AC Conducted Emissions	FCC 15.207	AC Line Conducted	NA Note 4
15.203	-	Antenna Requirements	FCC 15.203	-	C

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

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: Refer to the DFS test report.

Note 4: This device is installed in a car. Therefore the power source is a battery of car.

4. TEST METHODOLOGY

The measurement procedures described in the ANSI C63.10-2013 and the guidance provided in KDB 7899033 D02v02r01 were used in measurement of the EUT.
The EUT was tested per the guidance of KDB789033 D02v02r01. 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 E.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02v02r01. 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 D02v02r01. 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 D02v02r01.
The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. For emission measurements above 1 GHz, the table height is 1.5 m. 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.

4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics.
A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.
The worst case data rate was determined as below test mode according to the power measurements.

Test mode	Worst case data rate
802.11a	6 Mbps
802.11n(HT20)	MCS 0
802.11n(HT40)	MCS 0
802.11ac(VHT80)	MCS 0

Operation test setup for EUT

- Test Software Version: BI3.GEN.001
- Power setting: Default of EUT

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 equipment , which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

DT&C Co., Ltd.		
The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014. **- FCC MRA Accredited Test Firm No. : KR0034** **- IC Test site No. : 5740A**		
www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

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

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 antenna is printed on the PCB.
Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 Emission Bandwidth (26 dB Bandwidth) & Occupied BW (99%)

▣ Test Requirements

- Emission Bandwidth (26 dB Bandwidth)

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.

- Occupied BW (99%)

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

- Emission Bandwidth (26 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02v02r01**.

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%.

- Occupied BW (99%) : RSS-Gen[6.7]

1. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
2. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
3. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

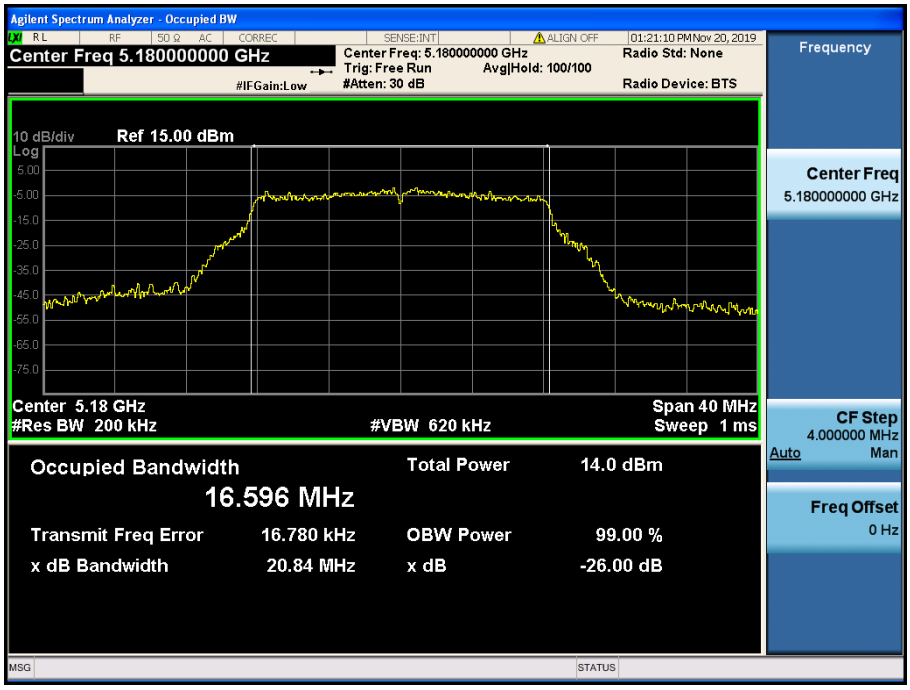
▣ **Test Results: Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result 26dB BW [MHz]	Test Result 99% BW [MHz]
802.11a	U-NII 1	36	5180	20.84	16.60
		40	5200	20.95	16.61
		48	5240	21.07	16.61
	U-NII 2A	52	5260	21.09	16.58
		60	5300	20.69	16.62
		64	5320	20.84	16.63
	U-NII 2C	100	5500	20.56	16.61
		116	5580	20.95	16.63
		144	5720	20.90	16.59
802.11n (HT20)	U-NII 1	36	5180	21.26	17.77
		40	5200	21.35	17.81
		48	5240	21.23	17.72
	U-NII 2A	52	5260	21.19	17.76
		60	5300	21.18	17.77
		64	5320	21.14	17.79
	U-NII 2C	100	5500	21.33	17.74
		116	5580	21.29	17.76
		144	5720	21.35	17.78
802.11n (HT40)	U-NII 1	38	5190	39.31	36.12
		46	5230	39.41	36.15
	U-NII 2A	54	5270	39.22	36.06
		62	5310	39.40	36.08
	U-NII 2C	102	5510	39.15	36.10
		110	5550	39.61	36.19
		142	5710	39.23	36.05
802.11ac (VHT80)	U-NII 1	42	5210	80.56	75.43
	U-NII 2A	58	5290	80.62	75.50
	U-NII 2C	106	5530	81.38	75.47
		-	-	-	-
		138	5690	80.59	75.42

▣ Result Plots

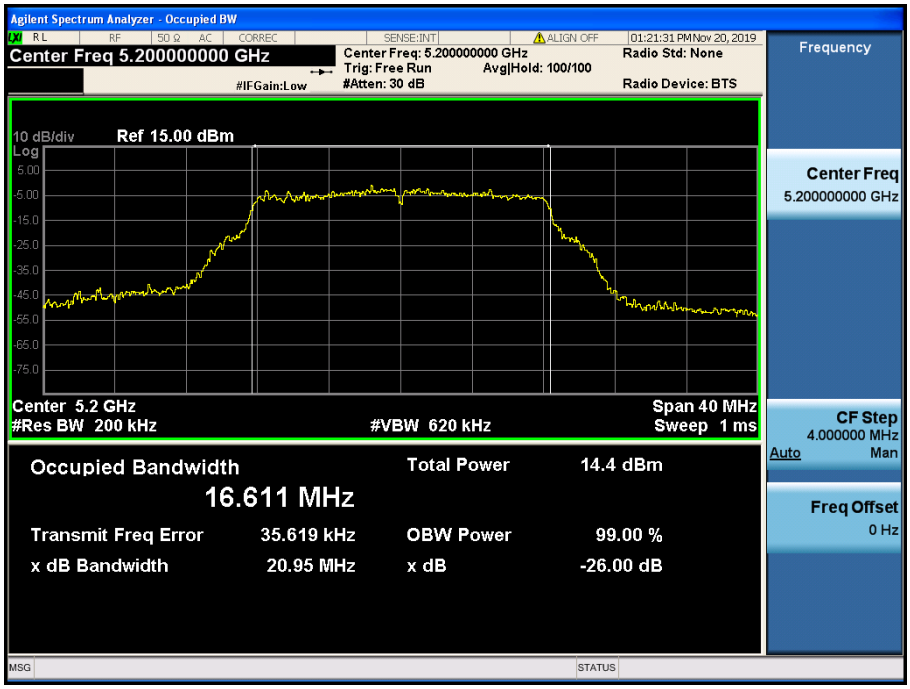
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.36



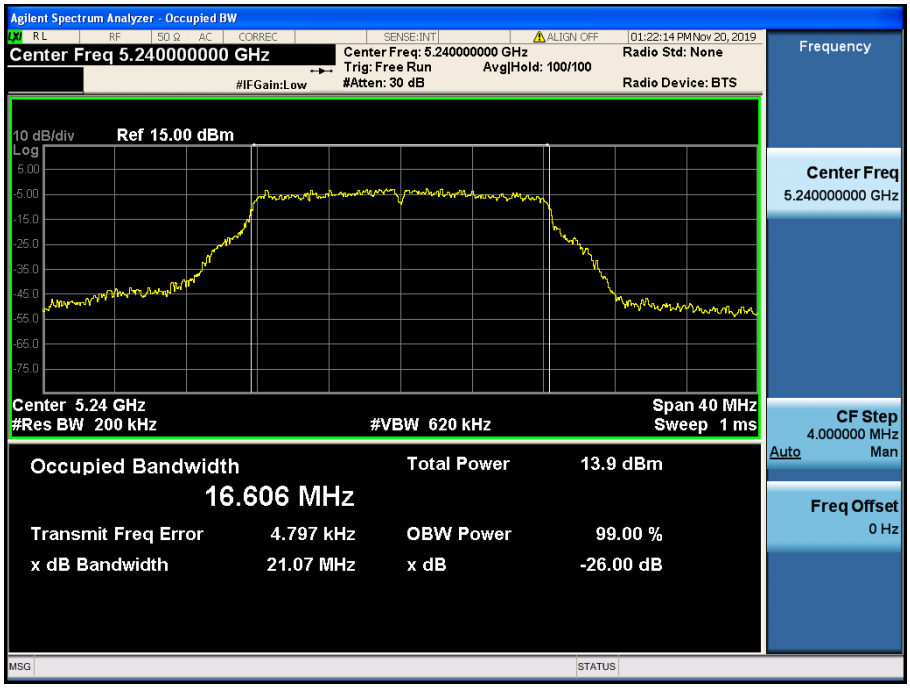
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.40



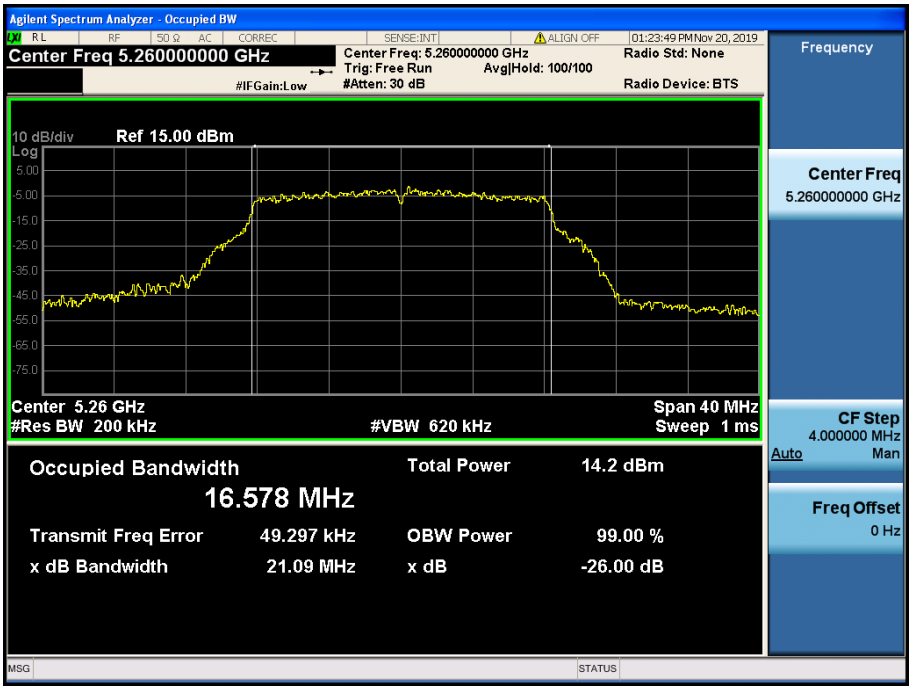
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.48



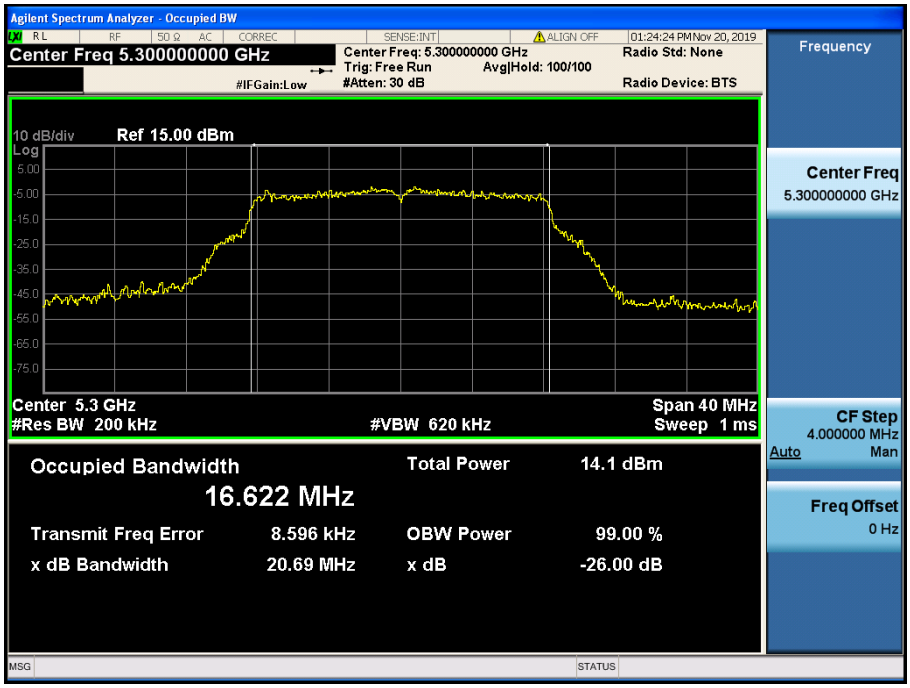
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.52



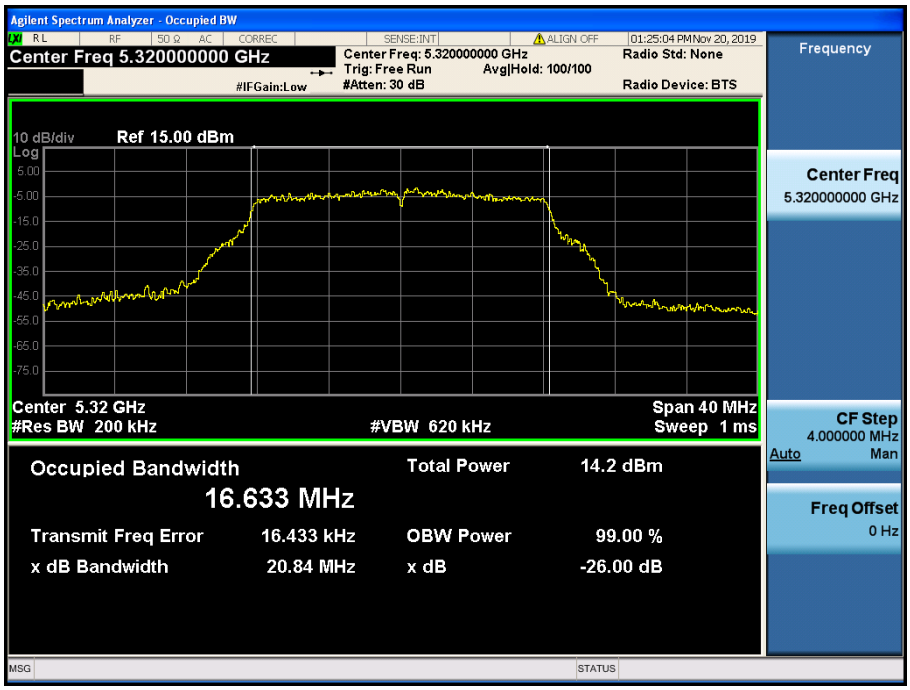
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.60



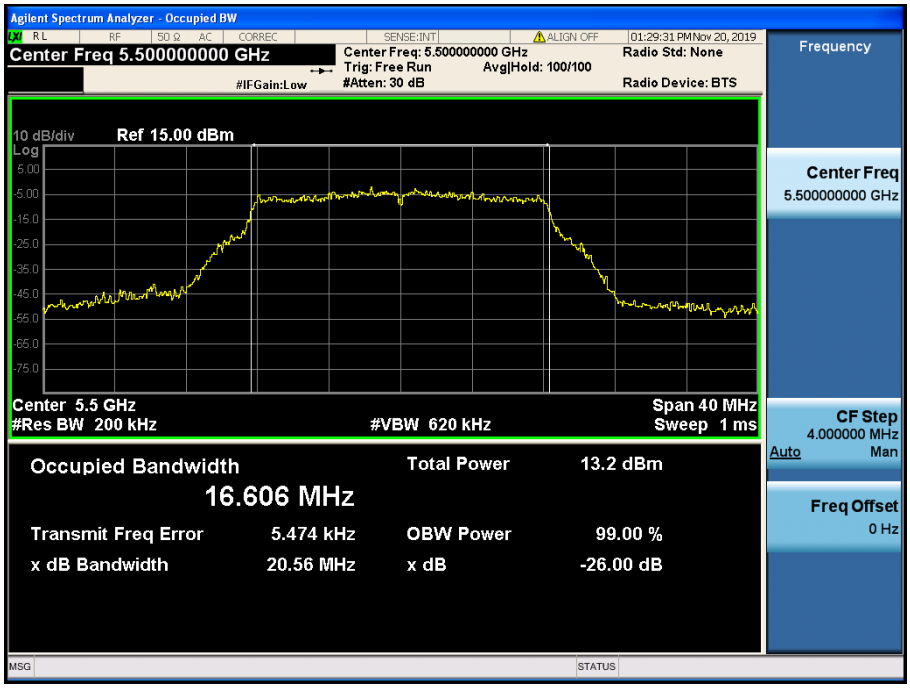
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.64



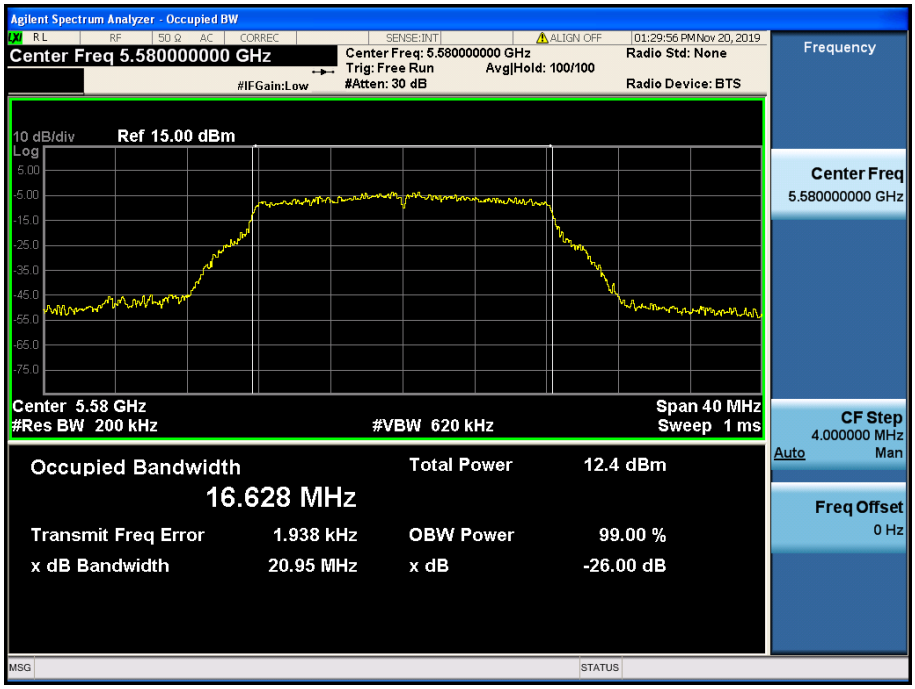
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.100



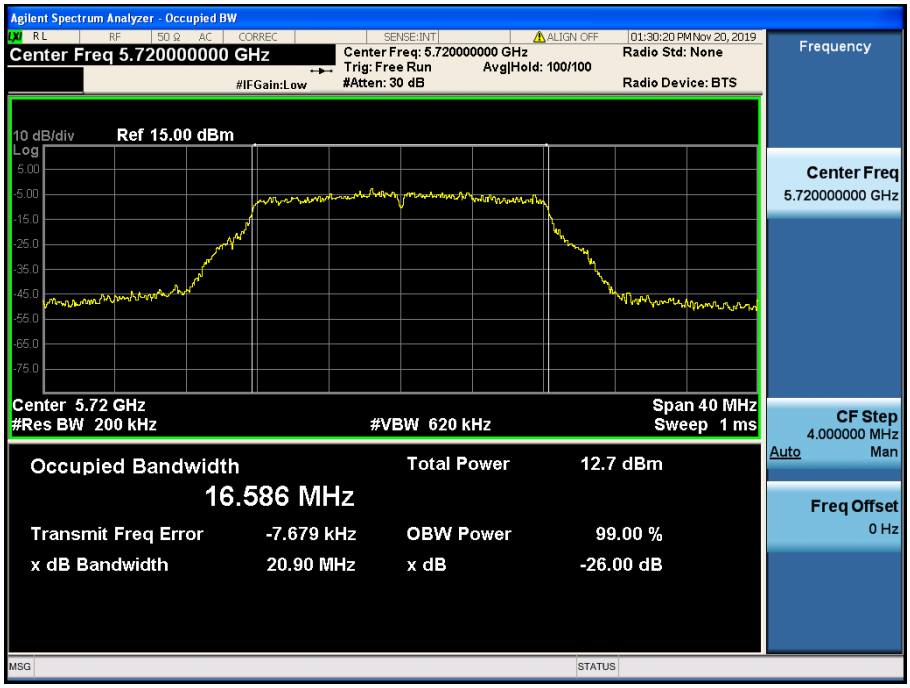
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.116



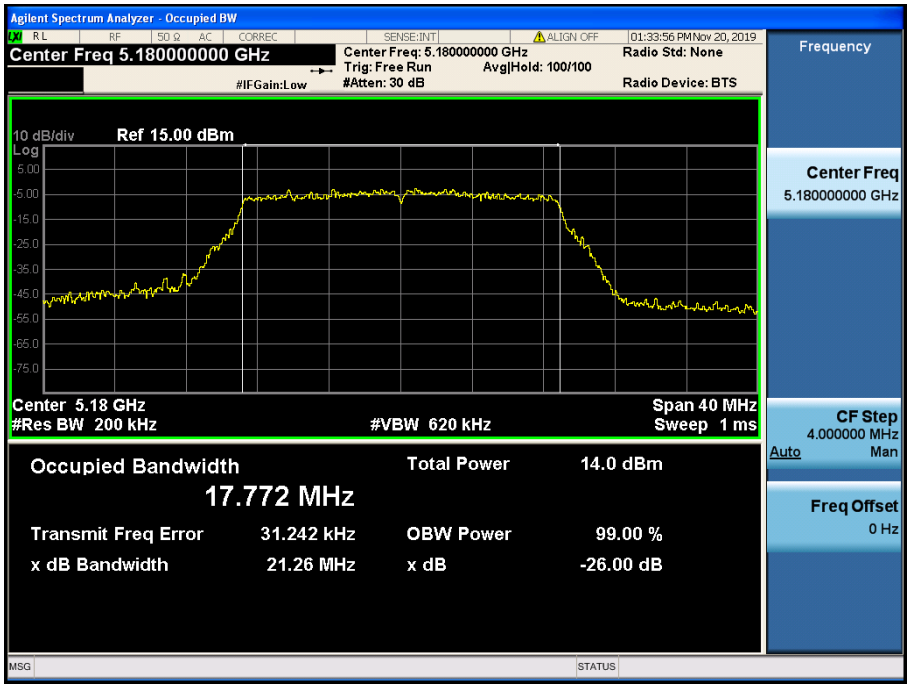
26 dB Bandwidth & Occupied BW

Test Mode: 802.11a & Ch.144



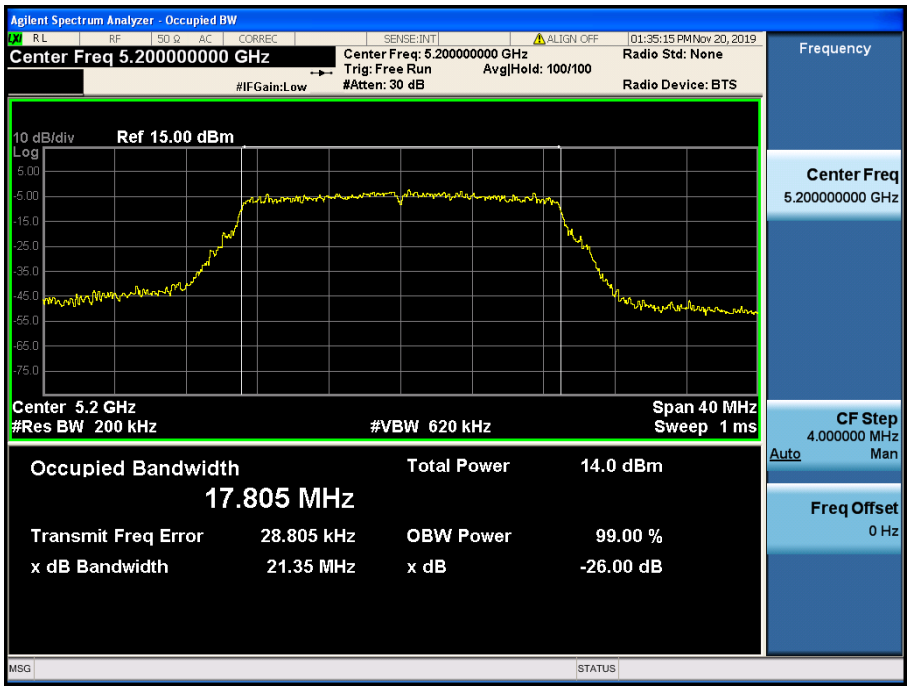
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.36



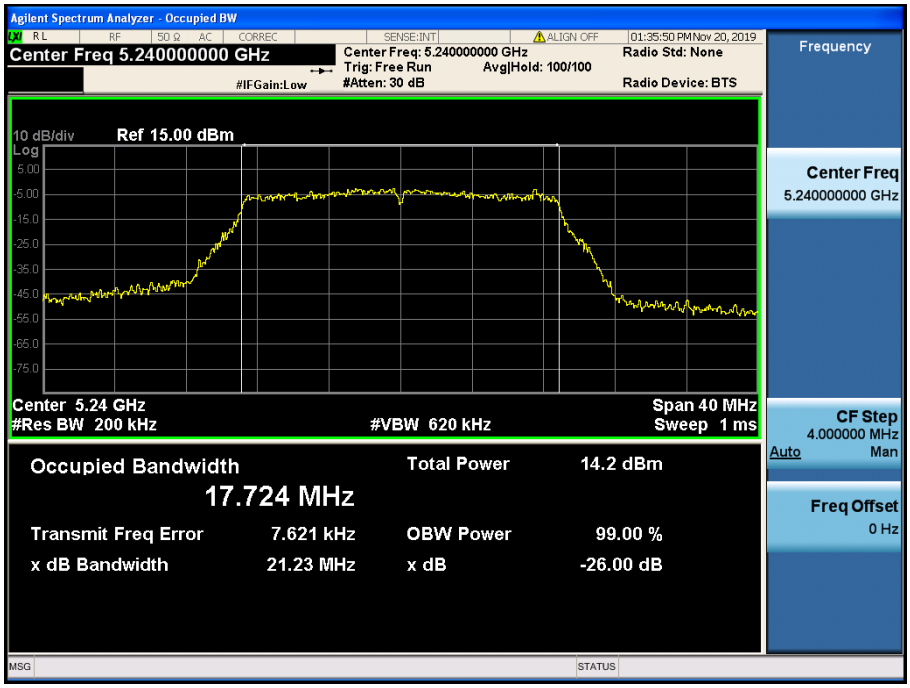
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.40



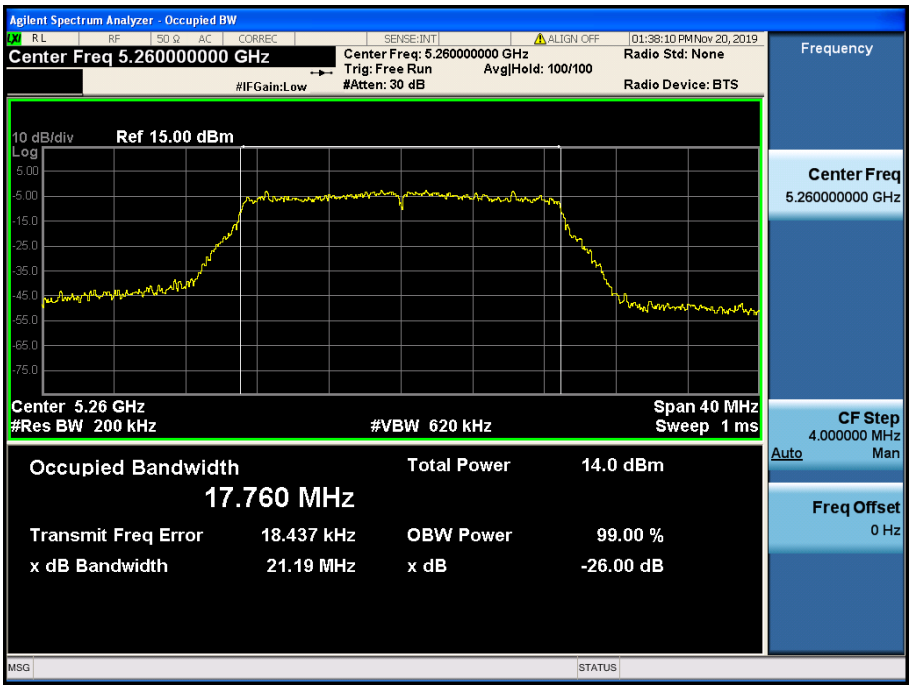
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.48



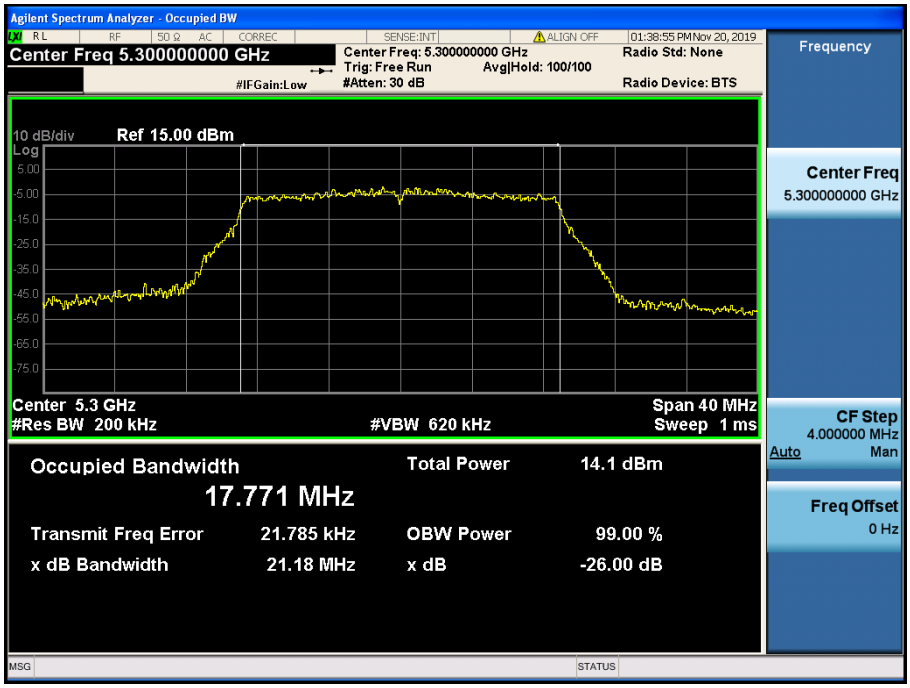
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.52



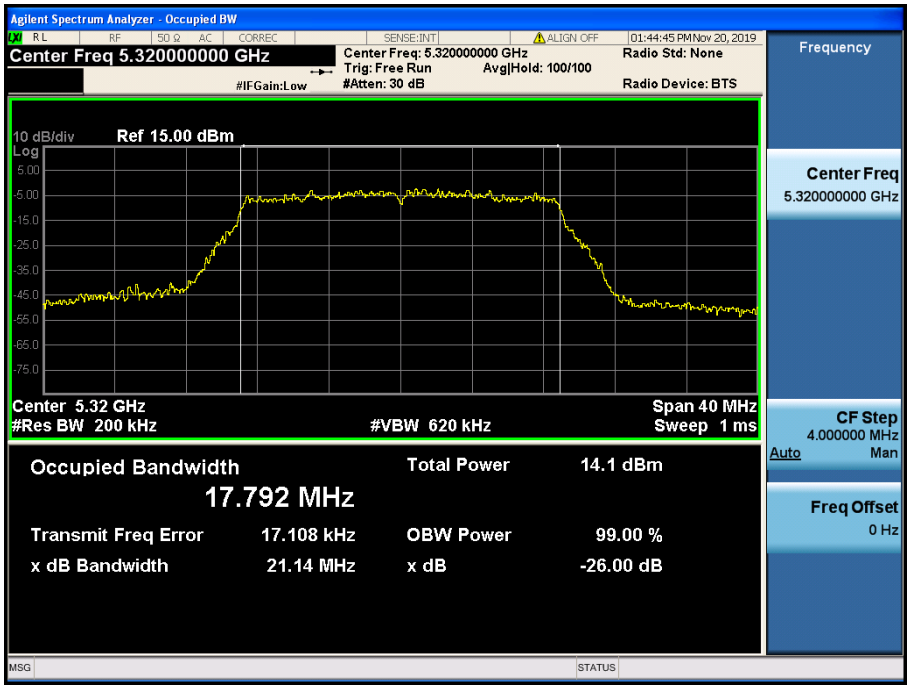
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.60



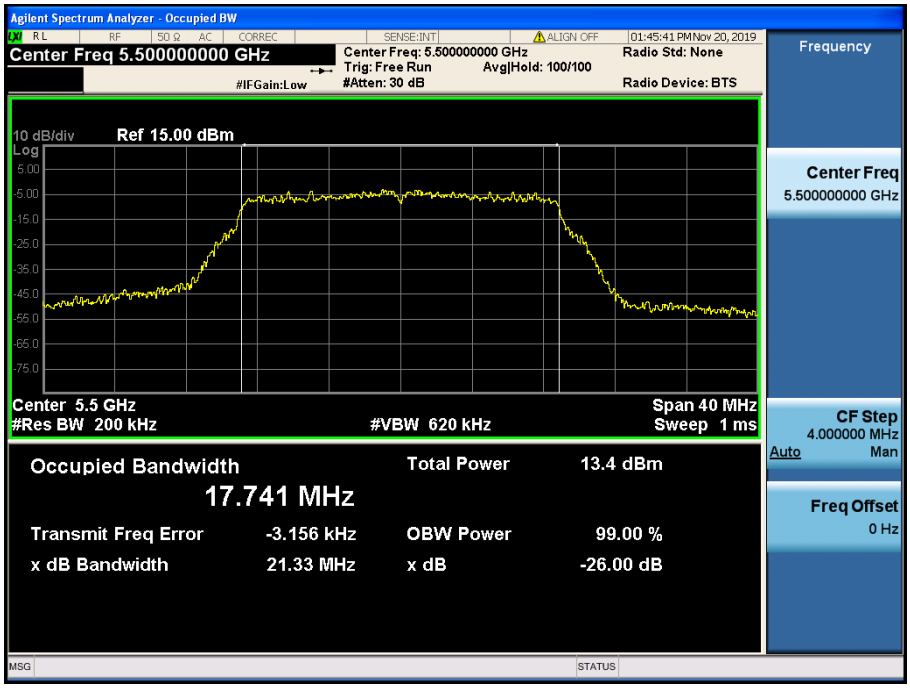
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.64



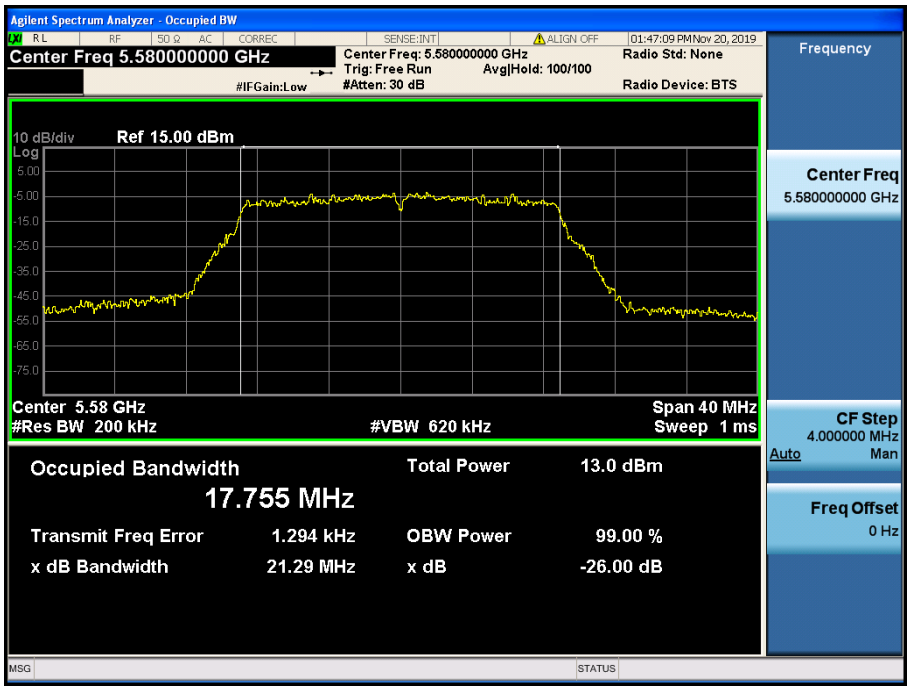
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.100



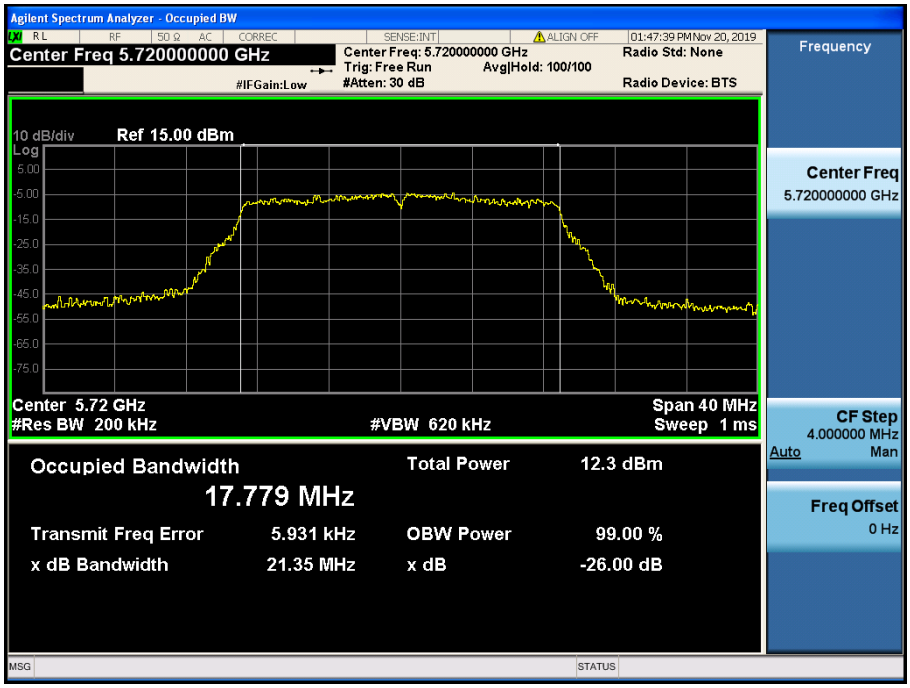
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.116



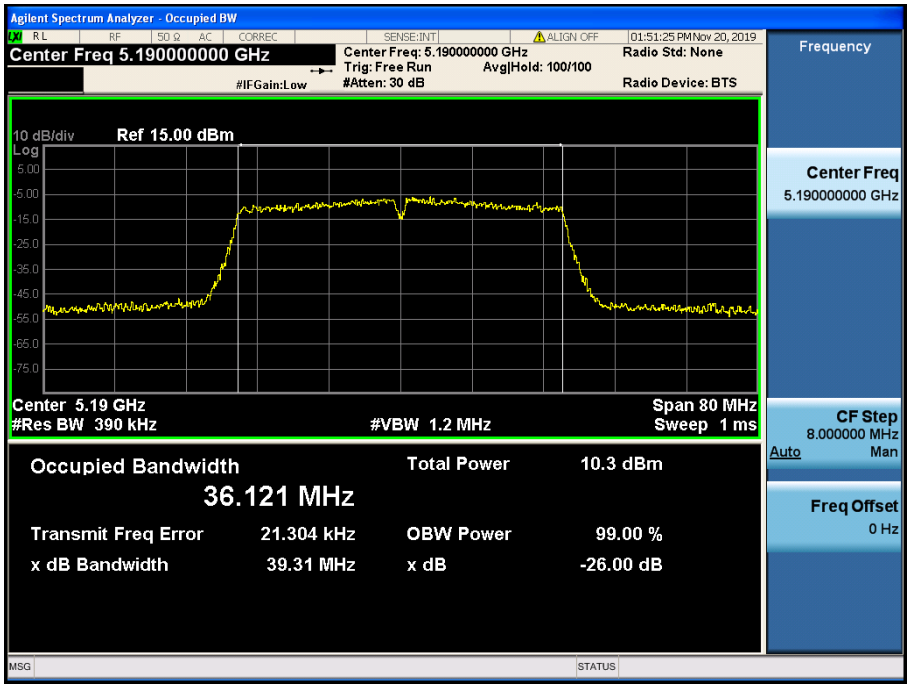
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT20 & Ch.144



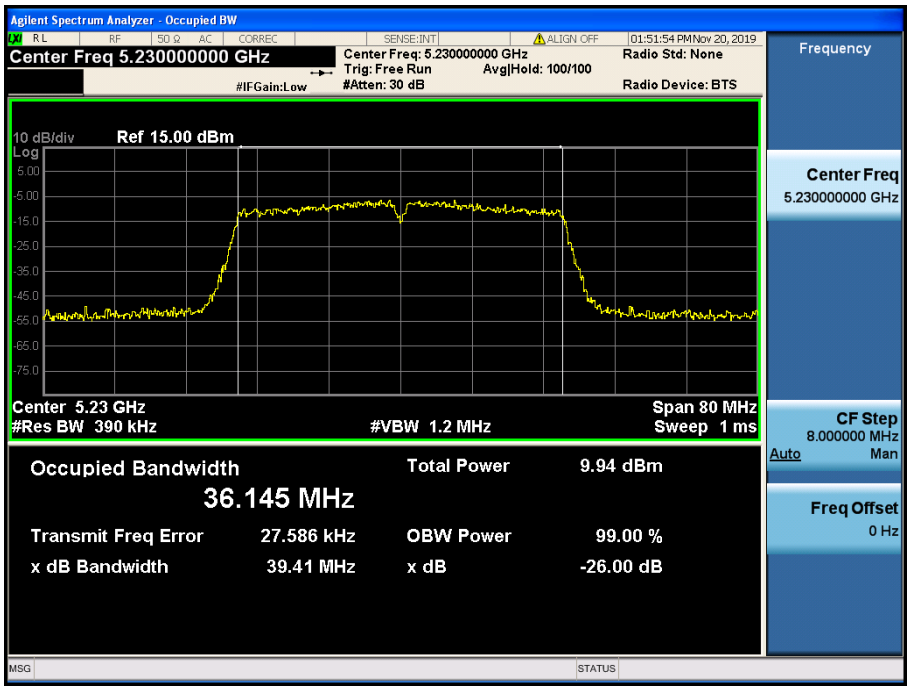
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.38



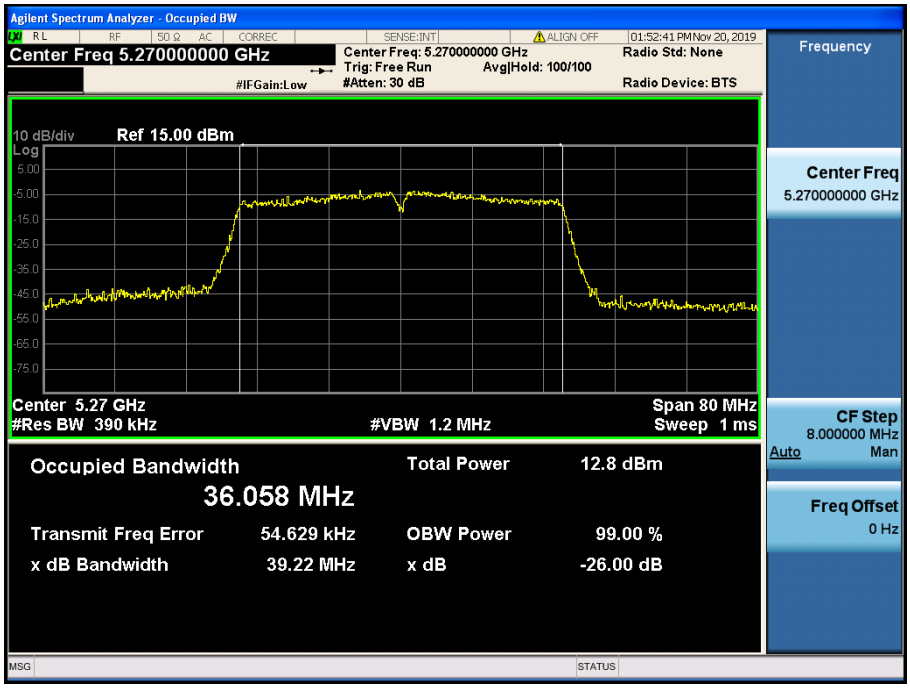
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.46



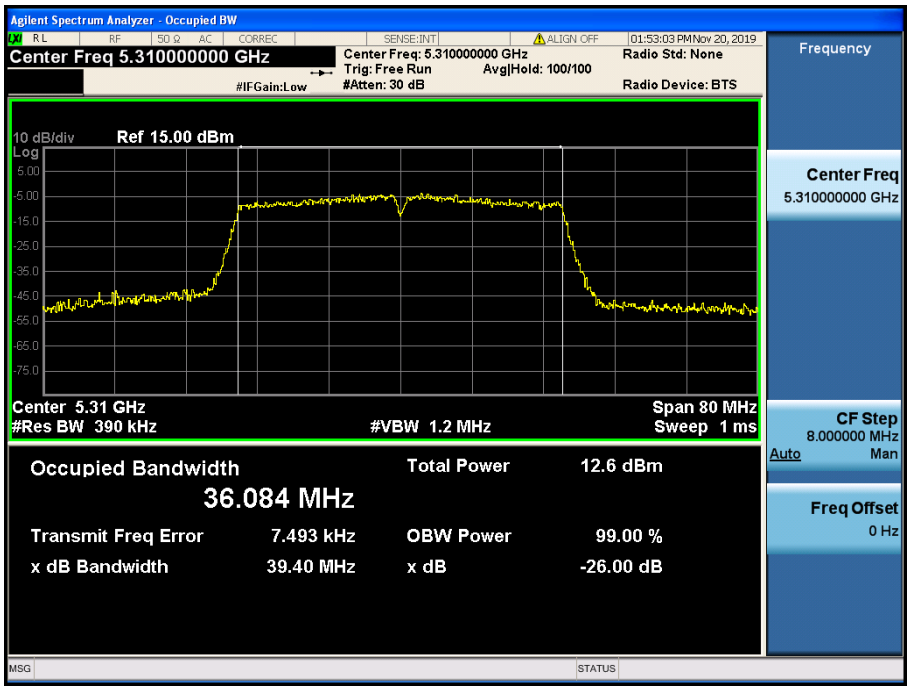
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.54



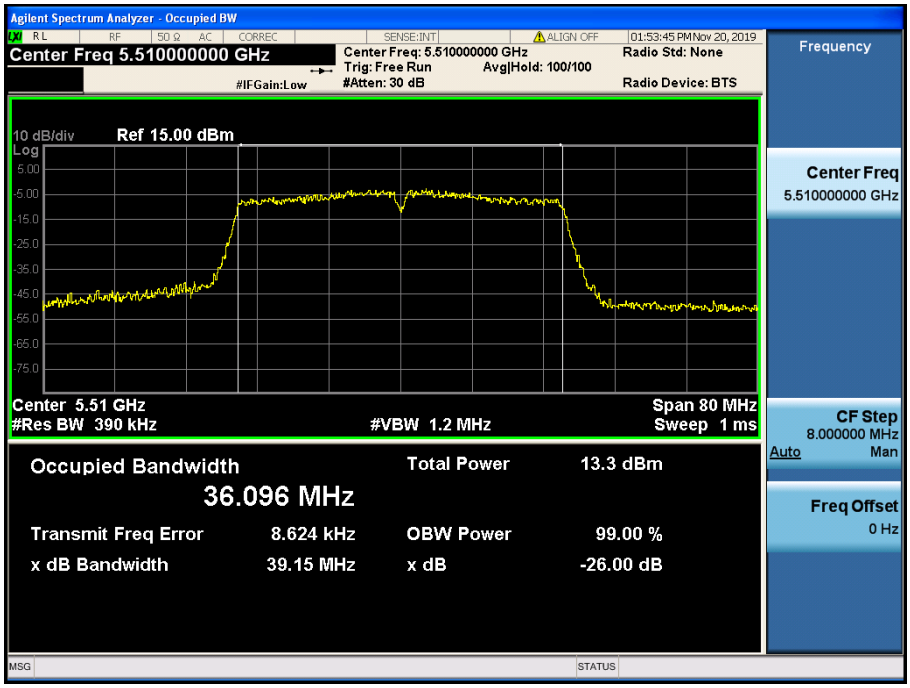
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.62



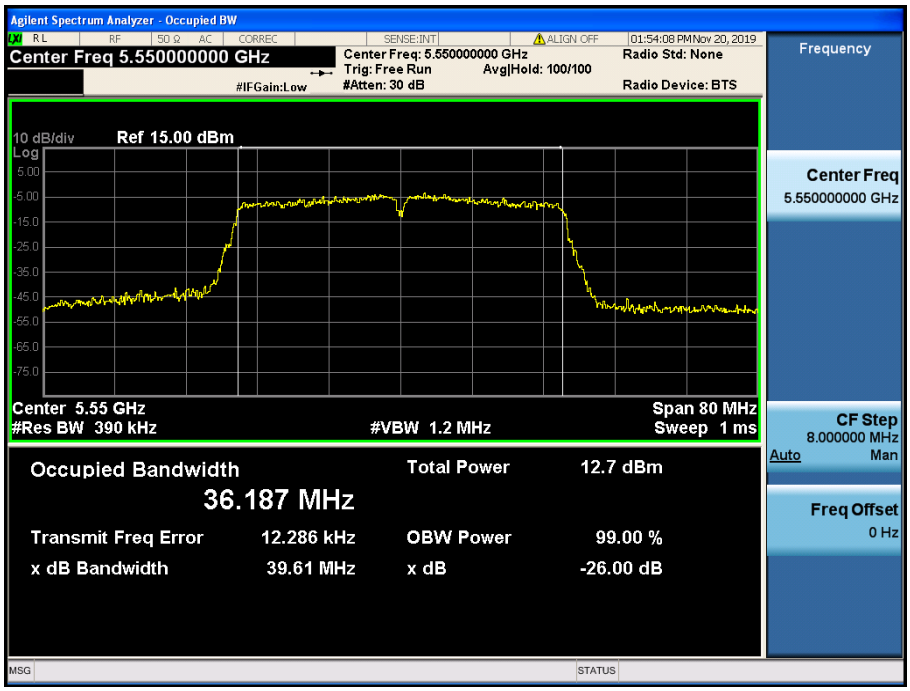
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.102



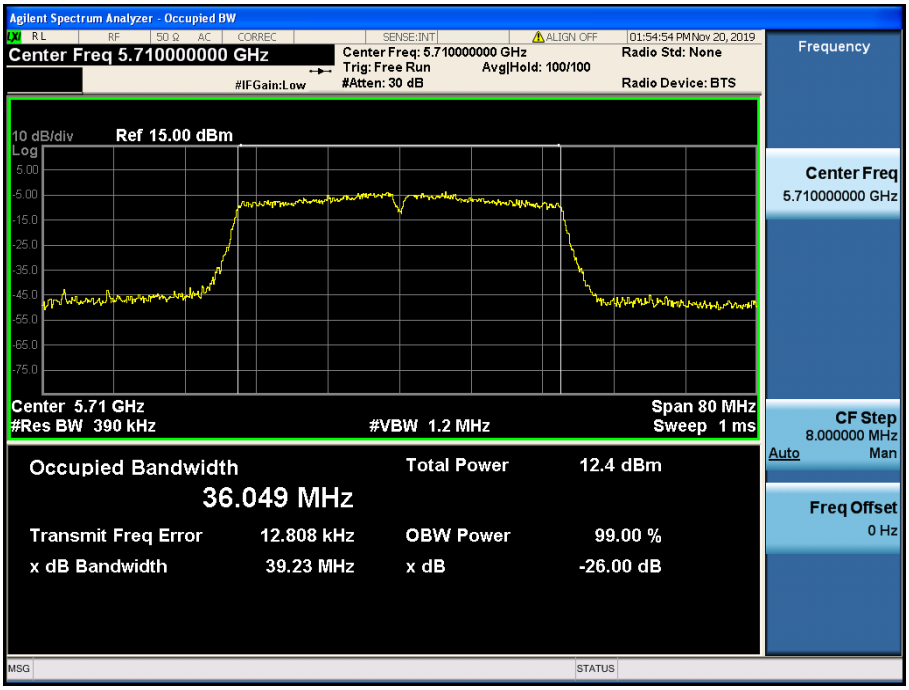
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.110



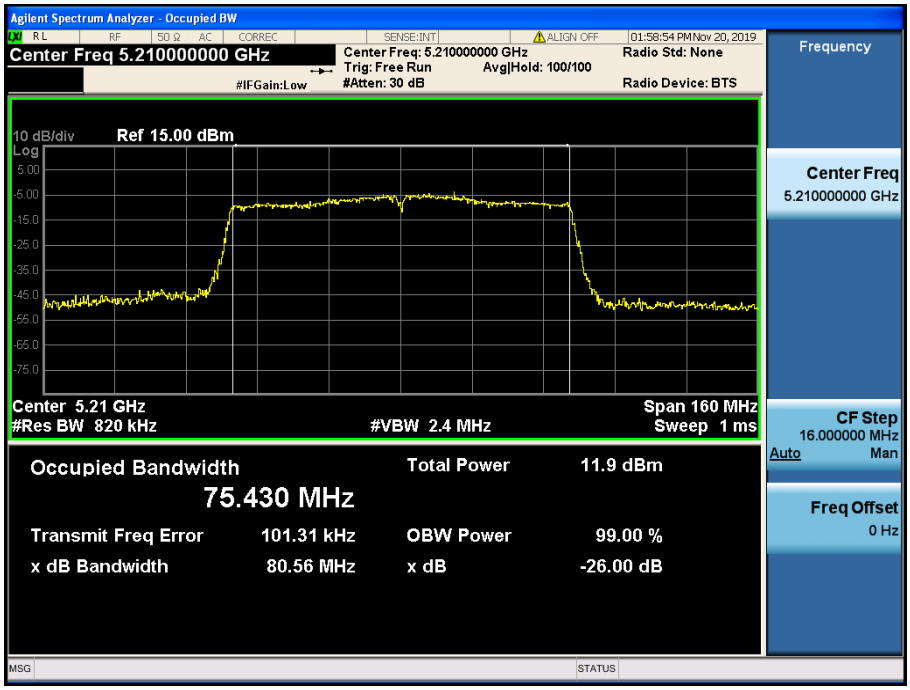
26 dB Bandwidth & Occupied BW

Test Mode: 802.11n HT40 & Ch.142



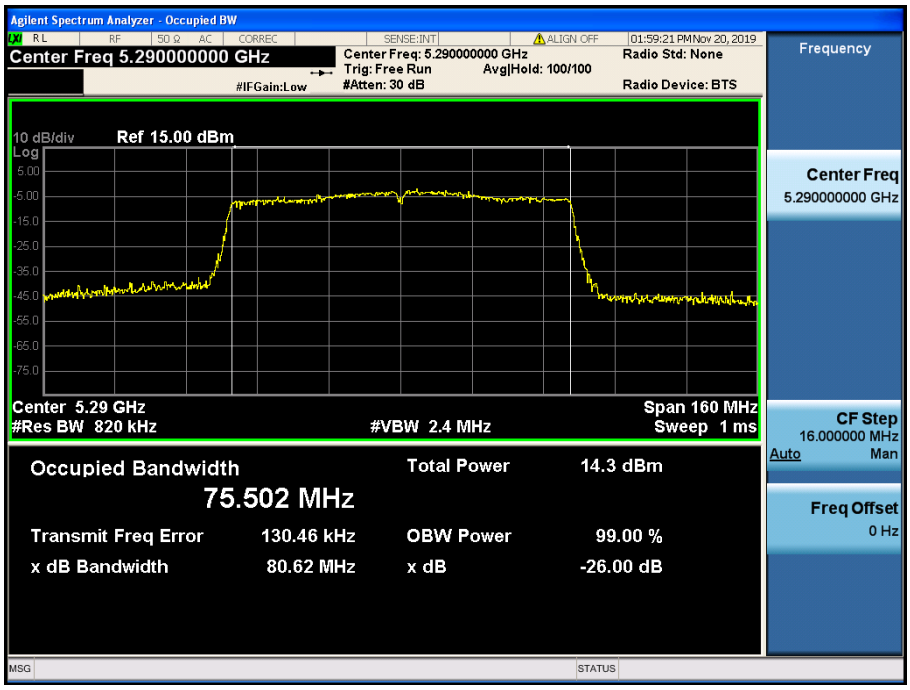
26 dB Bandwidth & Occupied BW

Test Mode: 802.11ac VHT80 & Ch.42



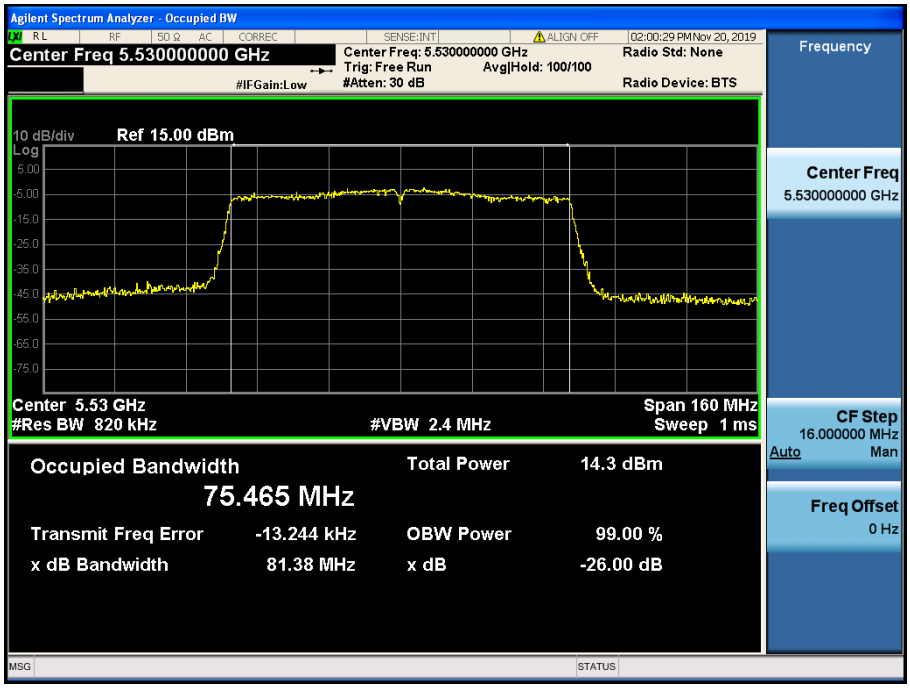
26 dB Bandwidth & Occupied BW

Test Mode: 802.11ac VHT80 & Ch.58



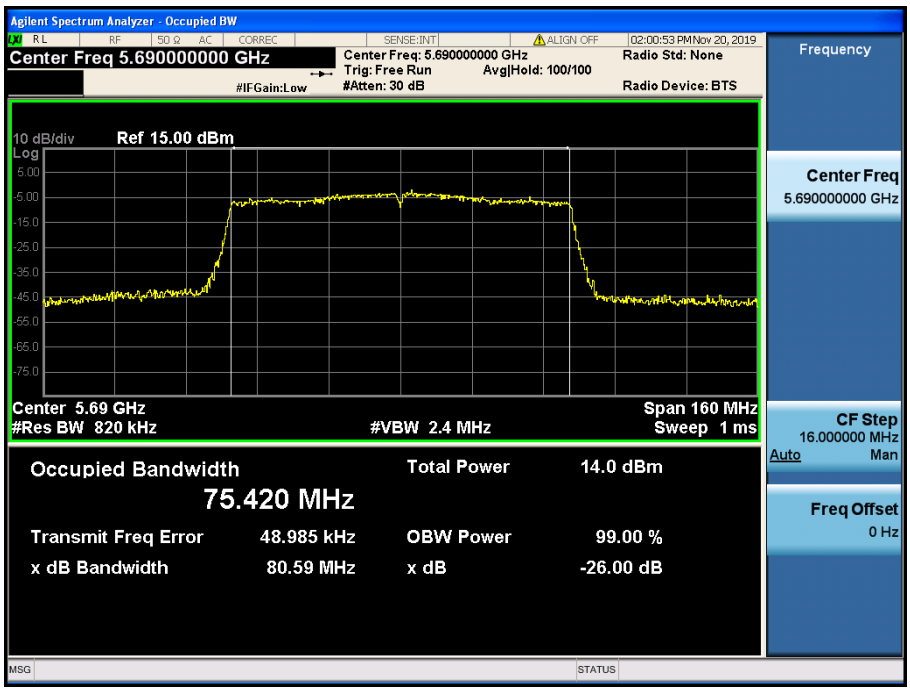
26 dB Bandwidth & Occupied BW

Test Mode: 802.11ac VHT80 & Ch.106



26 dB Bandwidth & Occupied BW

Test Mode: 802.11ac VHT80 & Ch.138



8.2 Minimum Emission Bandwidth (6 dB Bandwidth) & Occupied BW (99%)

▣ Test Requirements

- Emission Bandwidth (6 dB Bandwidth)

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

- Occupied BW (99%)

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

- Emission Bandwidth (6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02v02r01**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth **≥ 3 x 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.

- Occupied BW (99%) : RSS-Gen[6.7]

1. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
2. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
3. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

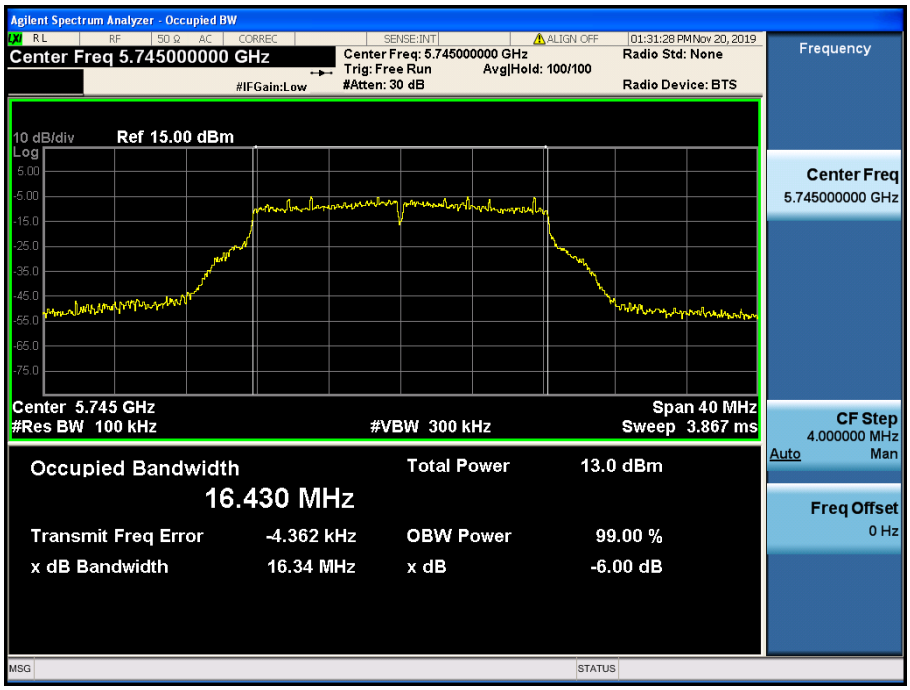
▣ **Test Results: Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result 6dB BW [MHz]	Test Result 99% BW [MHz]
802.11a	U-NII 3	149	5745	16.34	16.61
		157	5785	16.37	16.59
		165	5825	16.37	16.64
802.11n (HT20)	U-NII 3	149	5745	17.57	17.77
		157	5785	17.55	17.73
		165	5825	17.61	17.74
802.11n (HT40)	U-NII 3	151	5755	35.75	36.05
		159	5795	35.33	36.07
802.11ac (VHT80)	U-NII 3	155	5775	74.17	75.38

▣ Result Plots

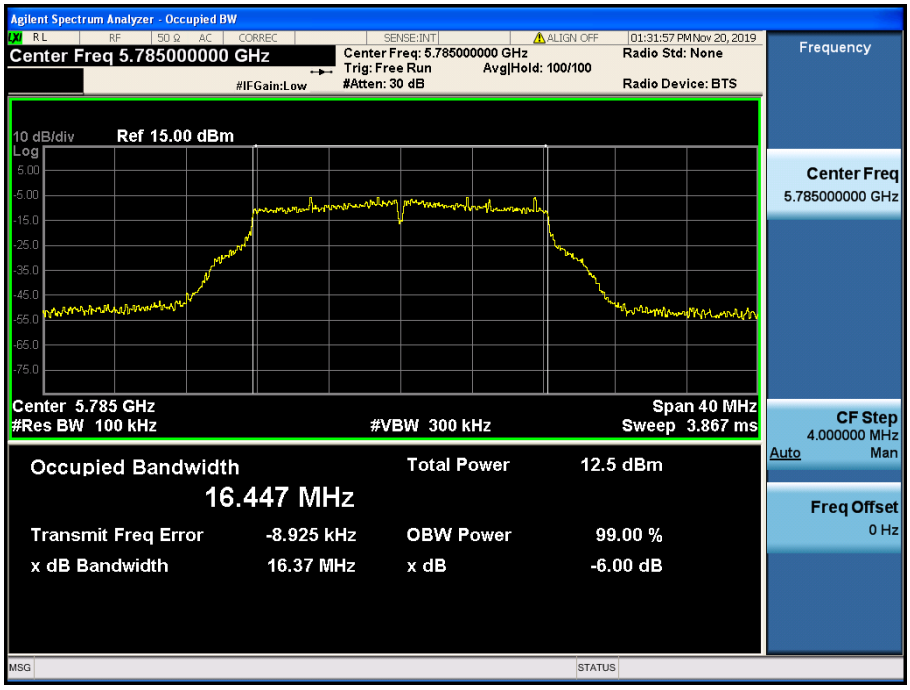
6 dB Bandwidth

Test Mode: 802.11a & Ch.149



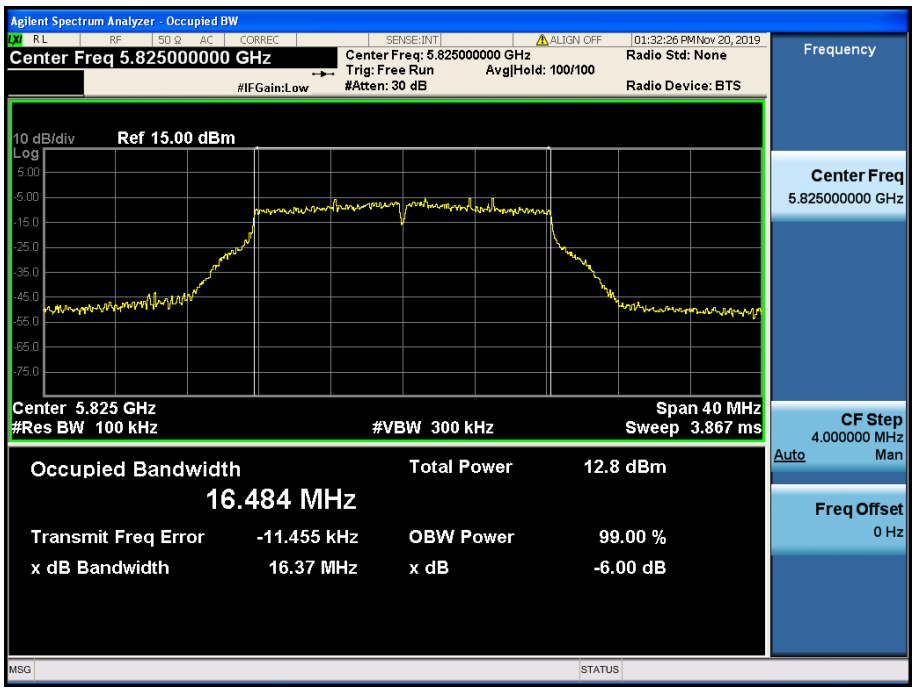
6 dB Bandwidth

Test Mode: 802.11a & Ch.157



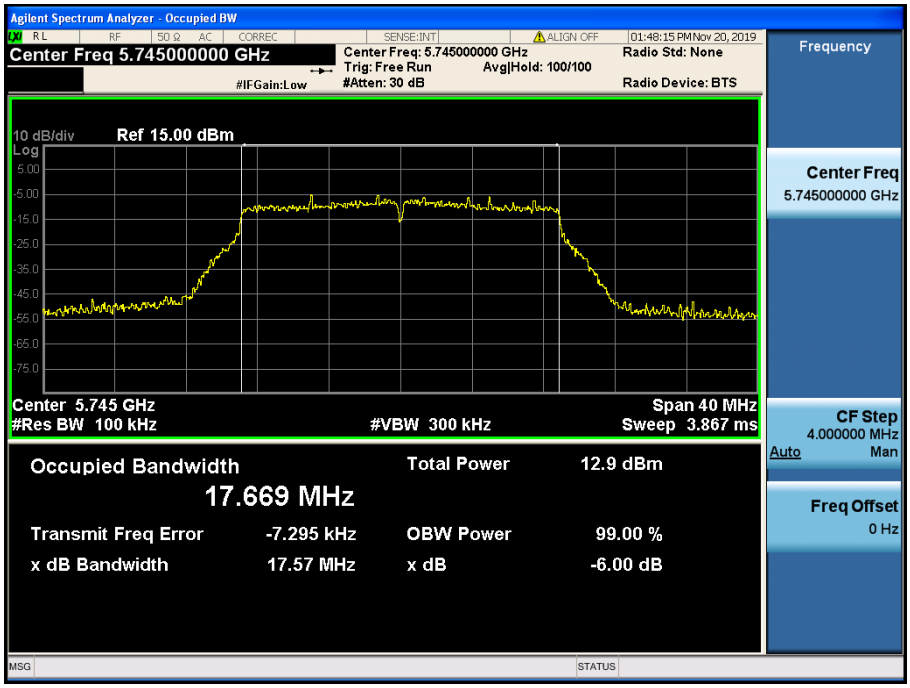
6 dB Bandwidth

Test Mode: 802.11a & Ch.165



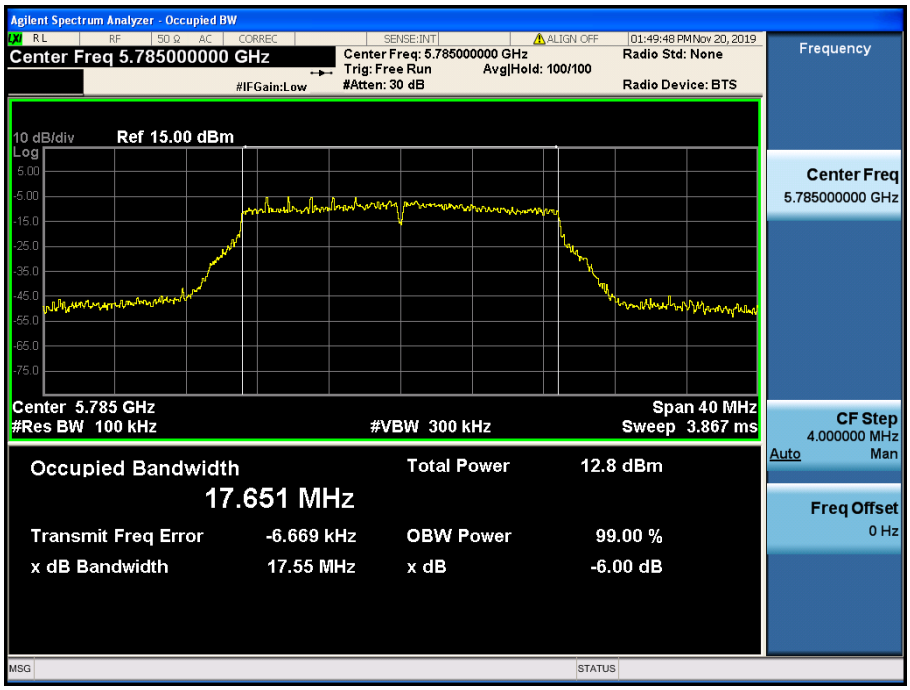
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.149



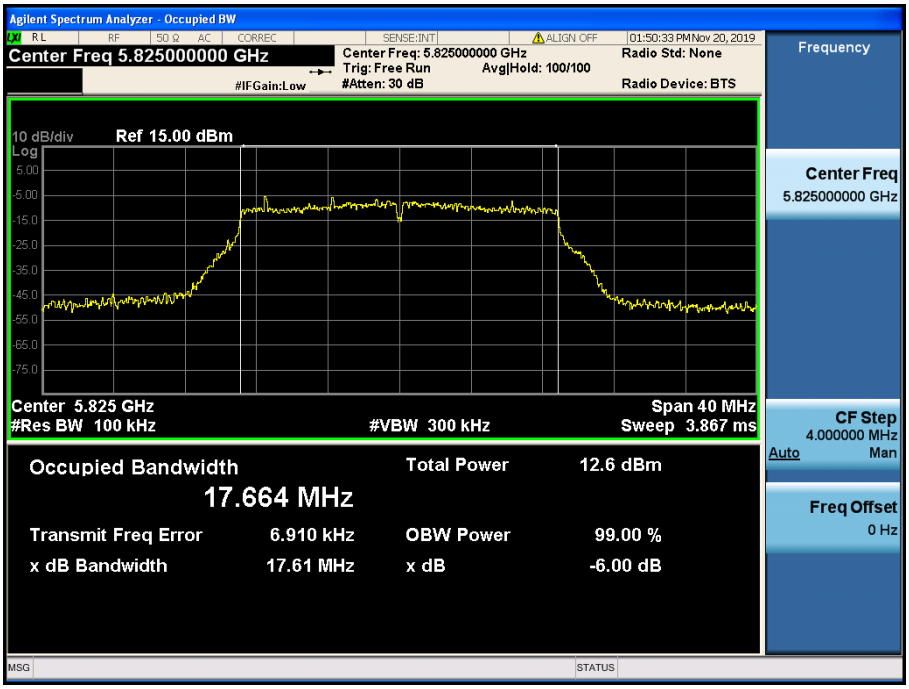
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.157



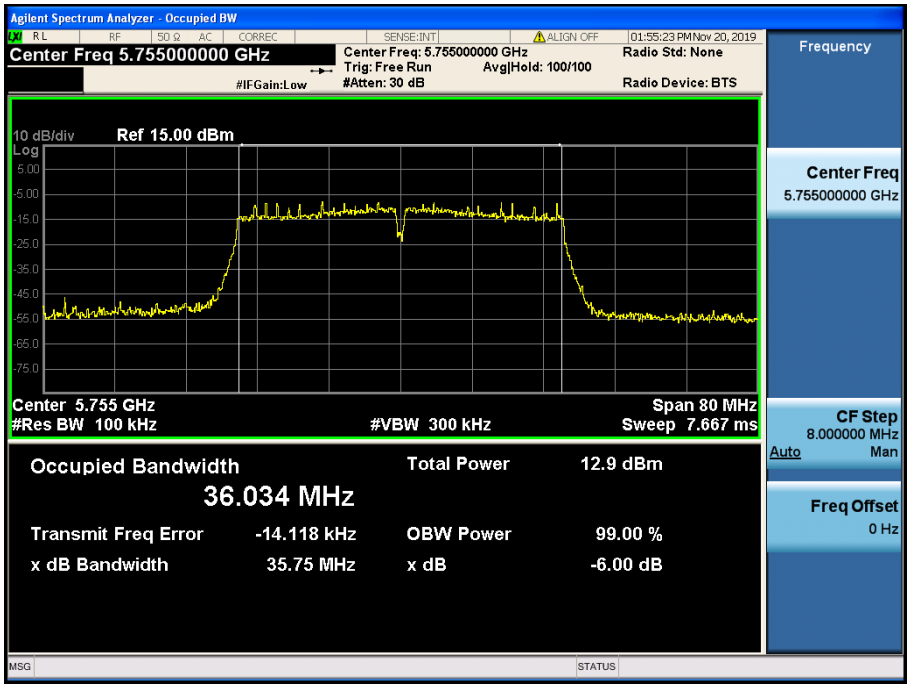
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.165



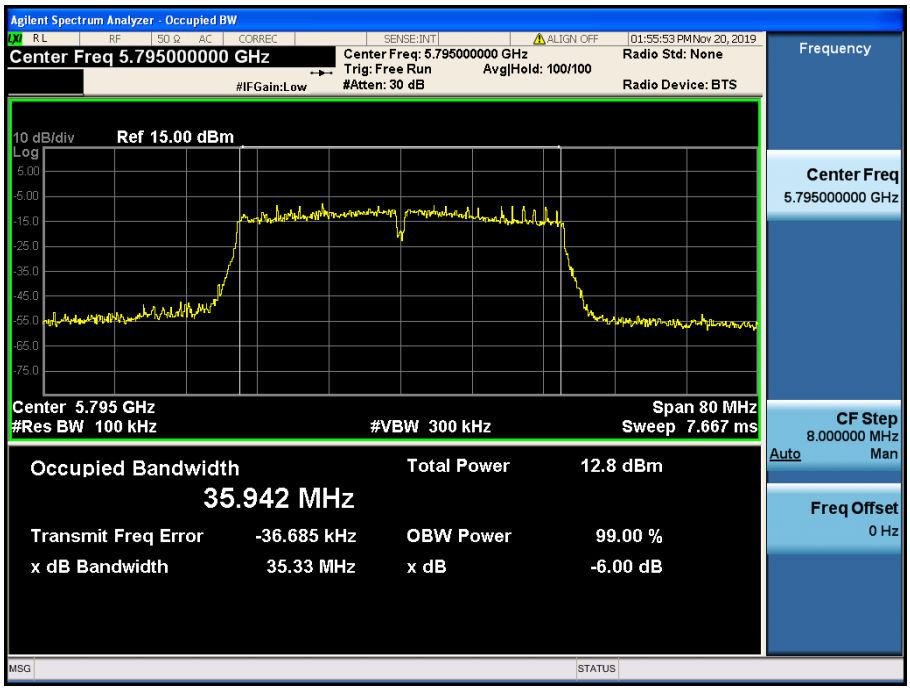
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.151



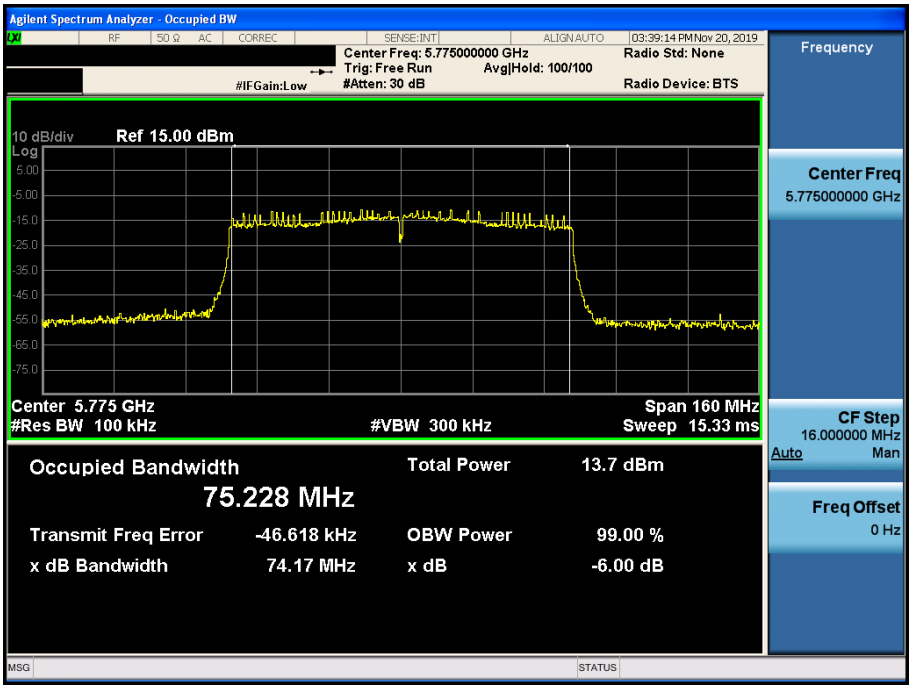
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.159



6 dB Bandwidth

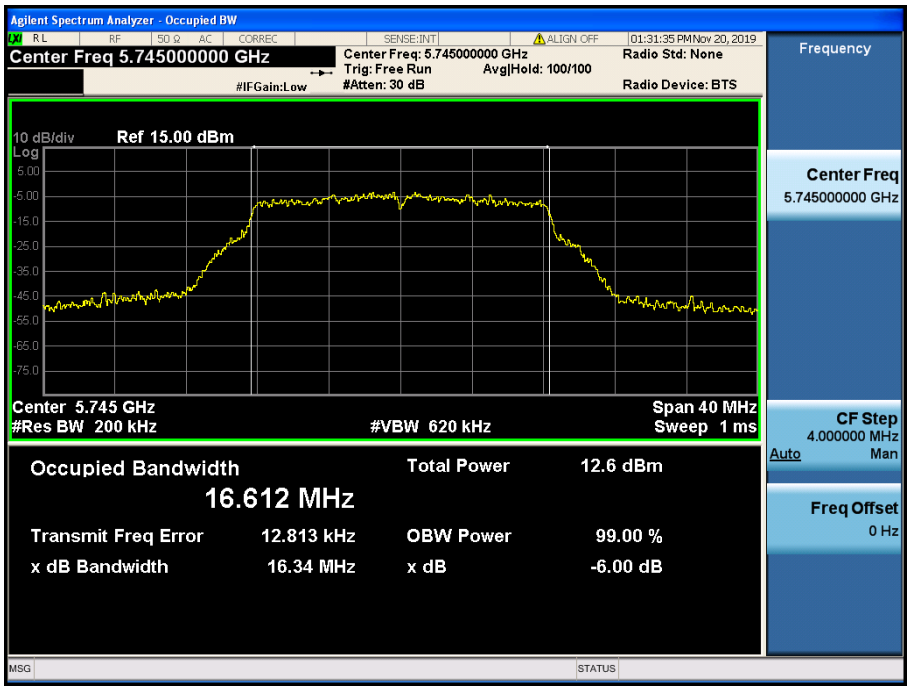
Test Mode: 802.11ac VHT80 & Ch.155



▣ RESULT PLOTS

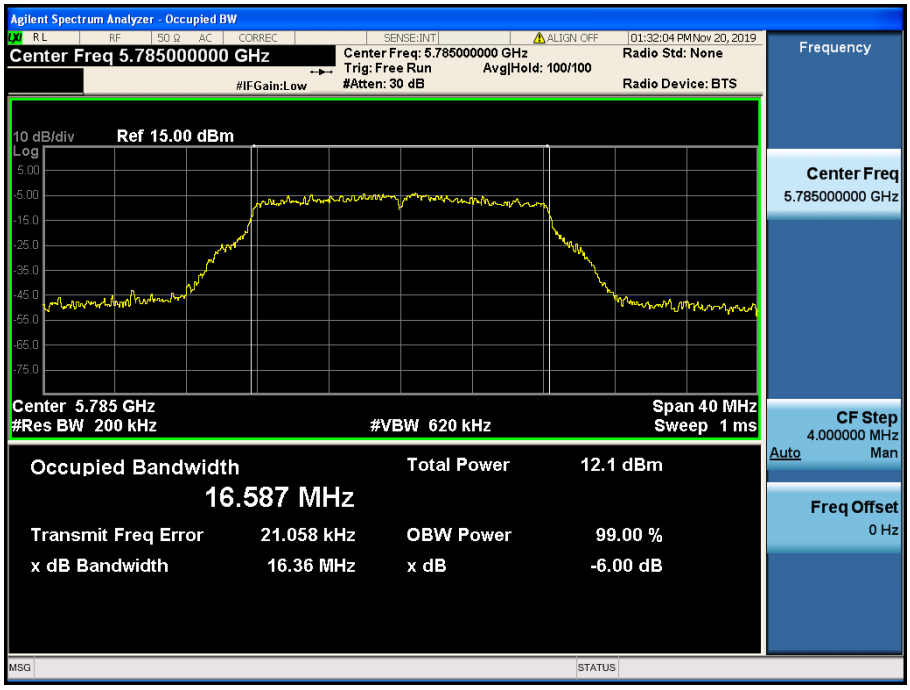
Occupied Bandwidth 99%

Test Mode: 802.11a & Ch.149

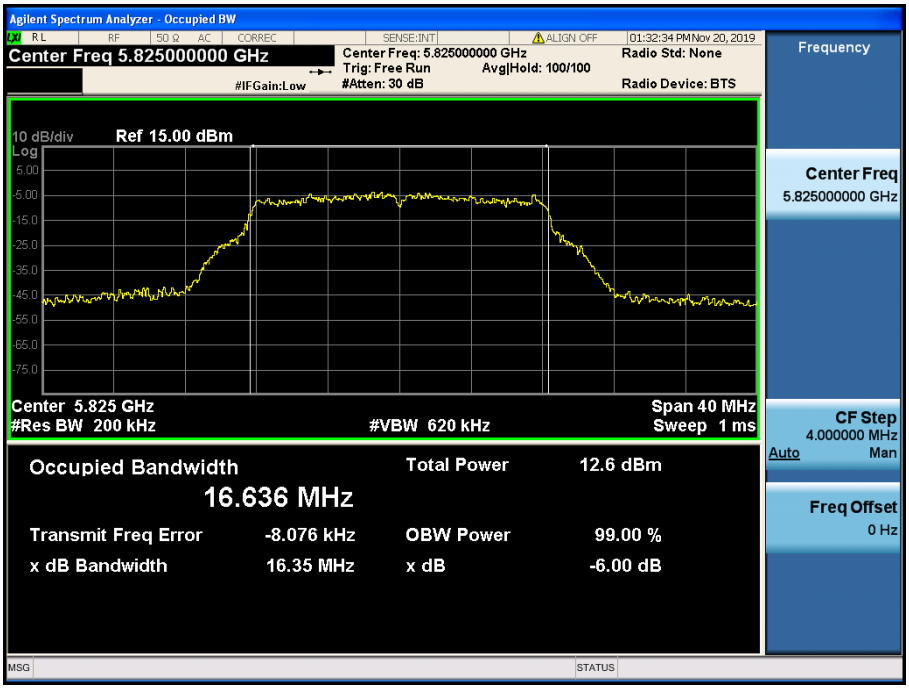


Occupied Bandwidth 99%

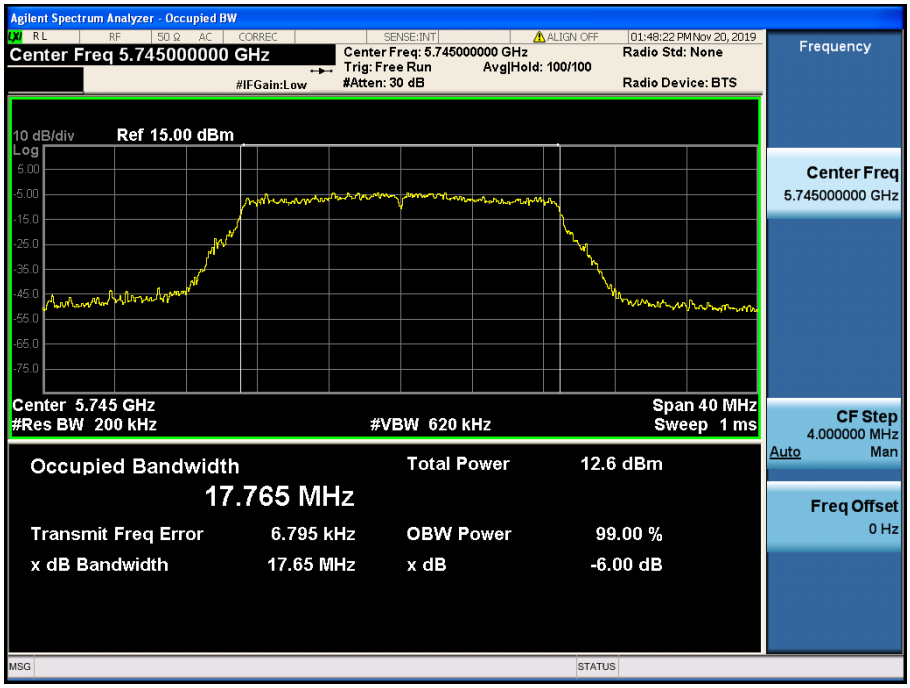
Test Mode: 802.11a & Ch.157



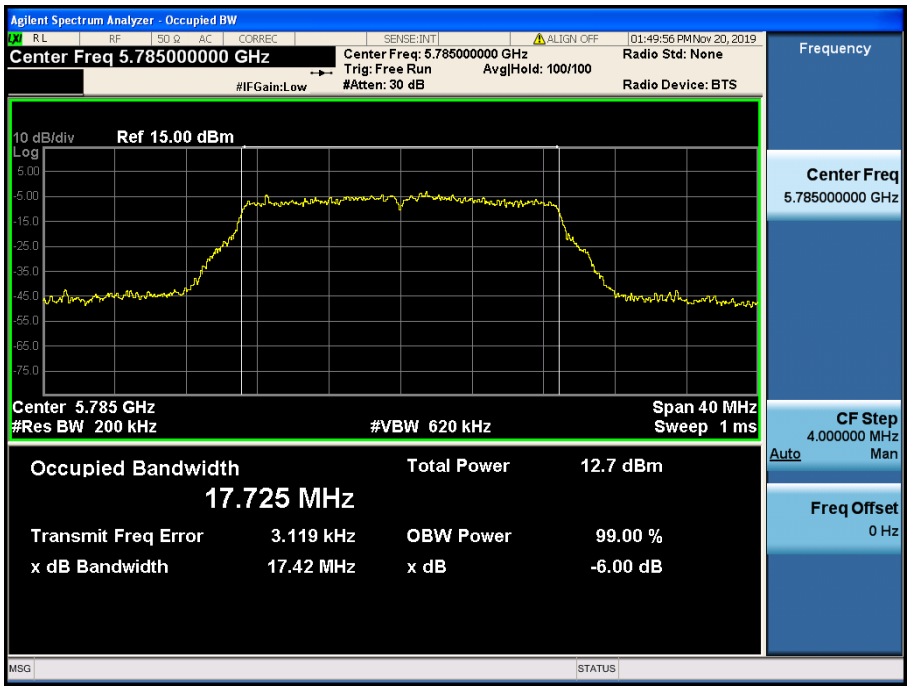
Occupied Bandwidth 99% Test Mode: 802.11a & Ch.165



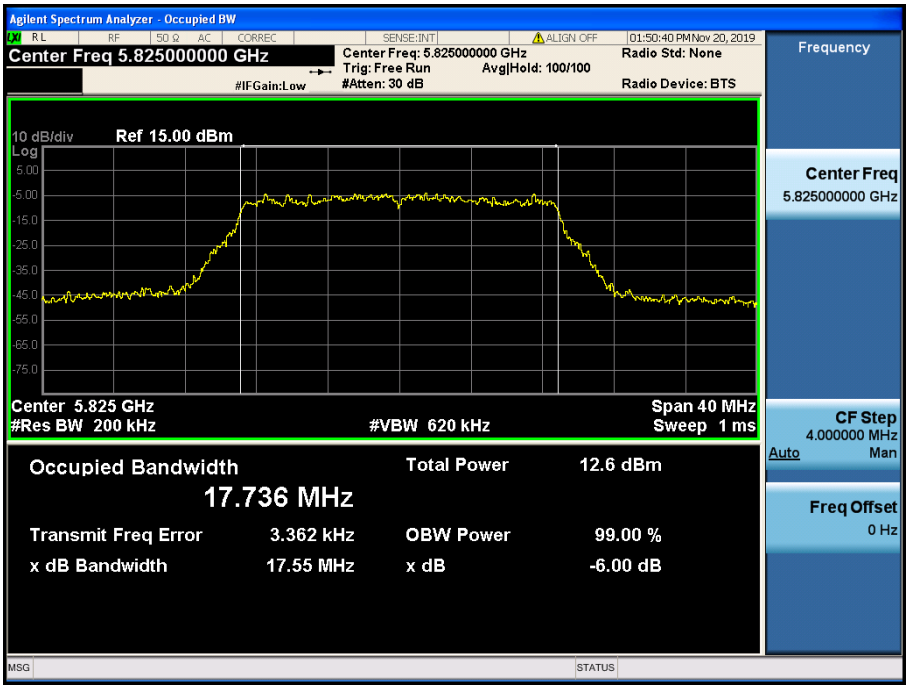
Occupied Bandwidth 99% Test Mode: 802.11n(HT20) & Ch.149



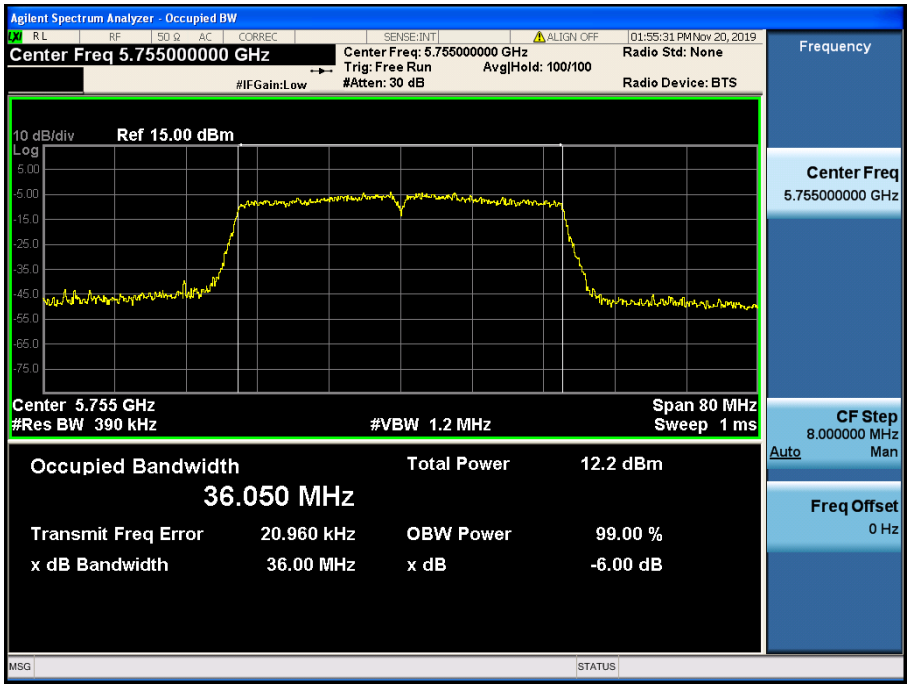
Occupied Bandwidth 99% Test Mode: 802.11n(HT20) & Ch.157



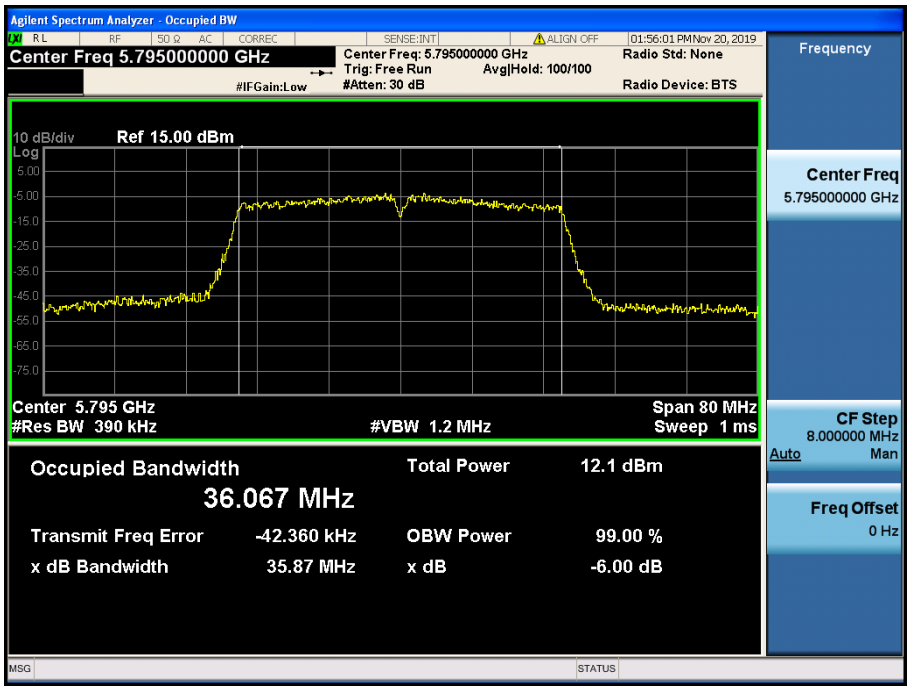
Occupied Bandwidth 99% Test Mode: 802.11n(HT20) & Ch.165



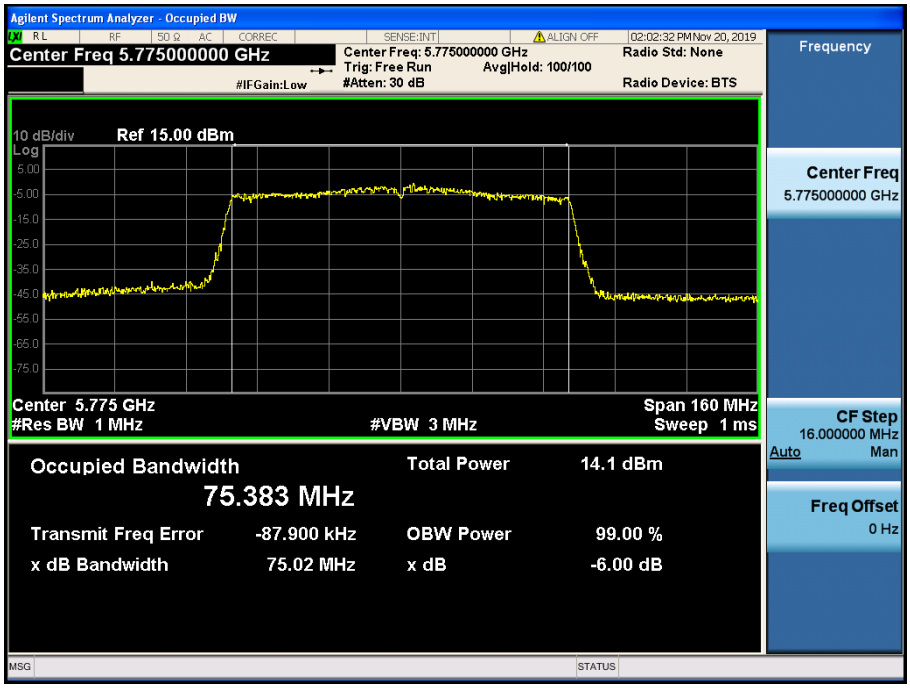
Occupied Bandwidth 99% Test Mode: 802.11n HT40 & Ch.151



Occupied Bandwidth 99% Test Mode: 802.11n HT40 & Ch.159



Occupied Bandwidth 99% Test Mode: 802.11ac VHT80 & 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 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.

RSS-247[6.2]

(1) For band 5150 - 5250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

(2) For band 5250 - 5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other than devices installed in vehicles, shall comply with the following:
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

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

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than
500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(4) For band 5725 - 5850 MHz

The maximum conducted output power shall not exceed 1 W. The output 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 output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

▣ Test Configuration

Method PM-G

▣ Test Procedure

Method PM-G of KDB789033 D02v02r01

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

▣ **Test Results: Comply**

- Output Power

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11a	36	5180	**9.09**	**-0.61**	**8.48**
	40	5200	8.97	**-0.61**	**8.36**
	48	5240	9.06	**-0.61**	**8.45**
	52	5260	9.24	**-0.18**	**9.06**
	60	5300	9.24	**-0.18**	**9.06**
	64	5320	**9.28**	**-0.18**	**9.10**
	100	5500	**8.28**	**-0.77**	**7.51**
	116	5580	7.78	**-0.77**	**7.01**
	144	5720	7.61	**-0.77**	**6.84**
	149	5745	**7.57**	**-0.18**	**7.39**
	157	5785	7.31	**-0.18**	**7.13**
	165	5825	7.32	**-0.18**	**7.14**

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11n(HT20)	36	5180	9.17	**-0.61**	**8.56**
	40	5200	**9.23**	**-0.61**	**8.62**
	48	5240	8.94	**-0.61**	**8.33**
	52	5260	9.02	**-0.18**	**8.84**
	60	5300	8.83	**-0.18**	**8.65**
	64	5320	**9.21**	**-0.18**	**9.03**
	100	5500	**8.02**	**-0.77**	**7.25**
	116	5580	7.61	**-0.77**	**6.84**
	144	5720	7.91	**-0.77**	**7.14**
	149	5745	7.25	**-0.18**	**7.07**
	157	5785	**7.54**	**-0.18**	**7.36**
	165	5825	7.27	**-0.18**	**7.09**

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11ac(VHT20)	36	5180	9.13	**-0.61**	**8.52**
	40	5200	**9.21**	**-0.61**	**8.60**
	48	5240	8.79	**-0.61**	**8.18**
	52	5260	**9.01**	**-0.18**	**8.83**
	60	5300	8.97	**-0.18**	**8.79**
	64	5320	8.92	**-0.18**	**8.74**
	100	5500	7.74	**-0.77**	**6.97**
	116	5580	**7.96**	**-0.77**	**7.19**
	144	5720	7.83	**-0.77**	**7.06**
	149	5745	**7.66**	**-0.18**	**7.48**
	157	5785	7.46	**-0.18**	**7.28**
	165	5825	7.55	**-0.18**	**7.37**

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11n(HT40)	38	5190	4.91	-0.61	4.30
	46	5230	**4.97**	-0.61	4.36
	54	5270	**7.57**	-0.18	7.39
	62	5310	7.47	-0.18	7.29
	102	5510	7.48	-0.77	6.71
	110	5550	7.44	-0.77	6.67
	142	5710	**7.79**	-0.77	7.02
	151	5755	**7.29**	-0.18	7.11
	159	5795	7.03	-0.18	6.85

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11ac(VHT40)	38	5190	4.75	-0.61	4.14
	46	5230	**4.96**	-0.61	4.35
	54	5270	**7.55**	-0.18	7.37
	62	5310	7.41	-0.18	7.23
	102	5510	7.45	-0.77	6.68
	110	5550	7.40	-0.77	6.63
	142	5710	**7.76**	-0.77	6.99
	151	5755	**7.34**	-0.18	7.16
	159	5795	7.13	-0.18	6.95

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]	Antenna Gain[dBi]	e.i.r.p[Note1] [dBm]
802.11ac(VHT80)	42	5210	**6.11**	**-0.61**	**5.50**
	58	5290	**7.98**	**-0.18**	**7.80**
	106	5530	7.76	**-0.77**	**6.99**
	138	5690	**7.81**	**-0.77**	**7.04**
	155	5775	**7.24**	**-0.18**	**7.06**

Note 1: e.i.r.p = Conducted Output Power + Antenna Gain

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.

RSS-247[6.2]

(1) For band 5150 - 5250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

(2) For band 5250 - 5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other than devices installed in vehicles, shall comply with the following:
a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

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

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.
The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than
500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

(4) For band 5725 - 5850 MHz

The maximum conducted output power shall not exceed 1 W. The output 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 output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test procedure

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02v02r01**

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 ≥ 1 / T, where T is defined in section II.B.1.a). (Refer to Appendix II)
   b) Set VBW ≥ 3 RBW.
   c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log(500 kHz / 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 MHz / 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.

▣ **Test results: Comply**

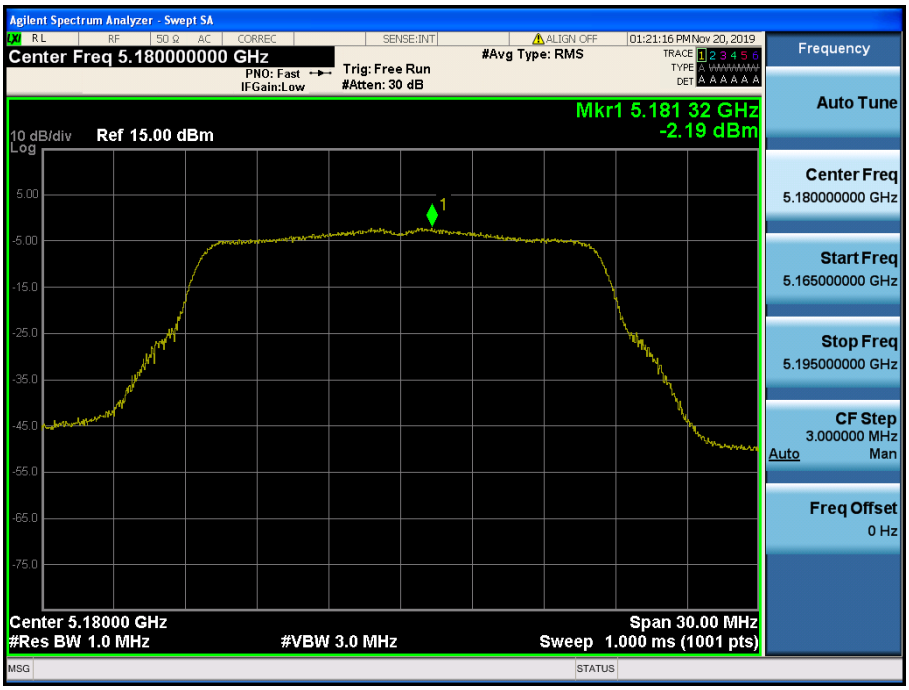
Mode	Channel	Frequency [MHz]	Reading [dBm]	T.F Note 1 [dB]	Power Spectral Density[dBm]	Antenna Gain [dBi]	e.i.r.p Spectral Density [dBm]
802.11a	36	5180	-2.19	0.21	-1.98	-0.61	-2.59
	40	5200	-1.91		-1.70	-0.61	-2.31
	48	5240	-1.99		-1.78	-0.61	-2.39
	52	5260	-2.03		-1.82	-0.18	-2.00
	60	5300	-2.16		-1.95	-0.18	-2.13
	64	5320	-1.89		-1.68	-0.18	-1.86
	100	5500	-3.18		-2.97	-0.77	-3.74
	116	5580	-3.59		-3.38	-0.77	-4.15
	144	5720	-3.44		-3.23	-0.77	-4.00
	149	5745	-11.96	7.20	-4.76	-0.18	-4.94
	157	5785	-12.75		-5.55	-0.18	-5.73
	165	5825	-12.06		-4.86	-0.18	-5.04
802.11n (HT20)	36	5180	-2.49	0.22	-2.27	-0.61	-2.88
	40	5200	-2.35		-2.13	-0.61	-2.74
	48	5240	-2.33		-2.11	-0.61	-2.72
	52	5260	-2.27		-2.05	-0.18	-2.23
	60	5300	-2.60		-2.38	-0.18	-2.56
	64	5320	-2.56		-2.34	-0.18	-2.52
	100	5500	-3.17		-2.95	-0.77	-3.72
	116	5580	-3.59		-3.37	-0.77	-4.14
	144	5720	-3.90		-3.68	-0.77	-4.45
	149	5745	-12.50	7.21	-5.29	-0.18	-5.47
	157	5785	-12.58		-5.37	-0.18	-5.55
	165	5825	-12.83		-5.62	-0.18	-5.80
802.11n (HT40)	38	5190	-9.28	0.44	-8.84	-0.61	-9.45
	46	5230	-9.81		-9.37	-0.61	-9.98
	54	5270	-6.97		-6.53	-0.18	-6.71
	62	5310	-6.96		-6.52	-0.18	-6.70
	102	5510	-6.03		-5.59	-0.77	-6.36
	110	5550	-7.00		-6.56	-0.77	-7.33
	142	5710	-7.07		-6.63	-0.77	-7.40
	151	5755	-16.52	7.43	-9.09	-0.18	-9.27
	159	5795	-16.30		-8.87	-0.18	-9.05
802.11ac (VHT80)	42	5210	-11.97	0.87	-11.10	-0.61	-11.71
	58	5290	-9.74		-8.87	-0.18	-9.05
	106	5530	-9.55		-8.68	-0.77	-9.45
	138	5690	10.70		11.57	-0.77	10.80
	155	5775	-19.46	7.86	-11.60	-0.18	-11.78

Note 1: "U-NII 1, 2A, 2C [T.F] = DCCF"
"U-NII 3 [T.F] = 10*LOG(500kHz/100kHz) + DCCF"
For DCCF(Duty Cycle Correction Factor) please refer to appendix II.
Note 2: Test Result = Measurement Data + T.F
Note 3: e.i.r.p Spectral Density= Power spectral density + Antenna Gain

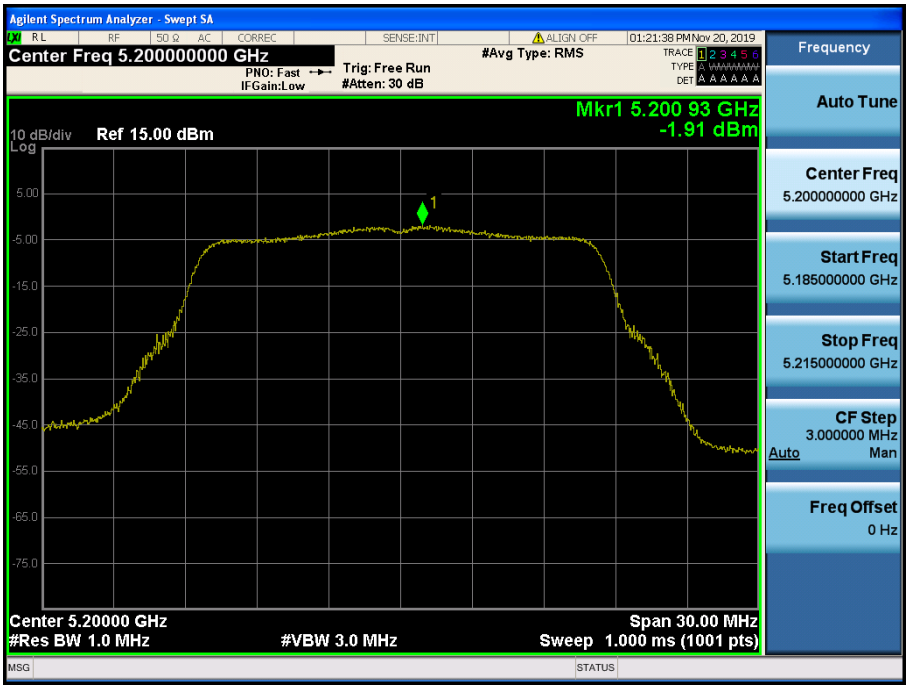
▣ RESULT PLOTS

- Power spectral density

Maximum Power Spectral Density Test Mode: 802.11a & Ch.36



Maximum Power Spectral Density Test Mode: 802.11a & Ch.40



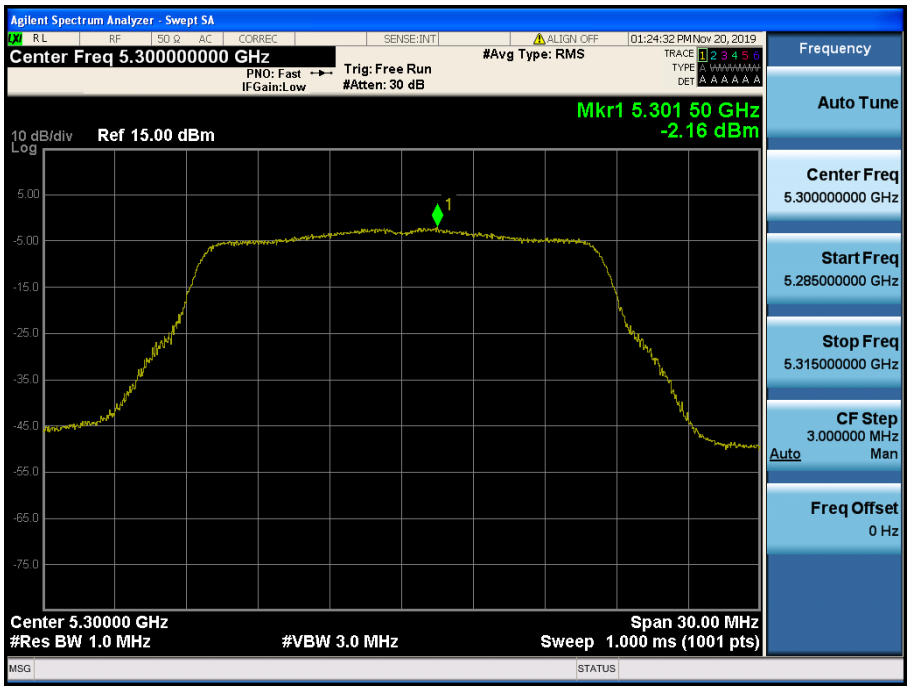
Maximum Power Spectral Density Test Mode: 802.11a & Ch.48

Maximum Power Spectral Density

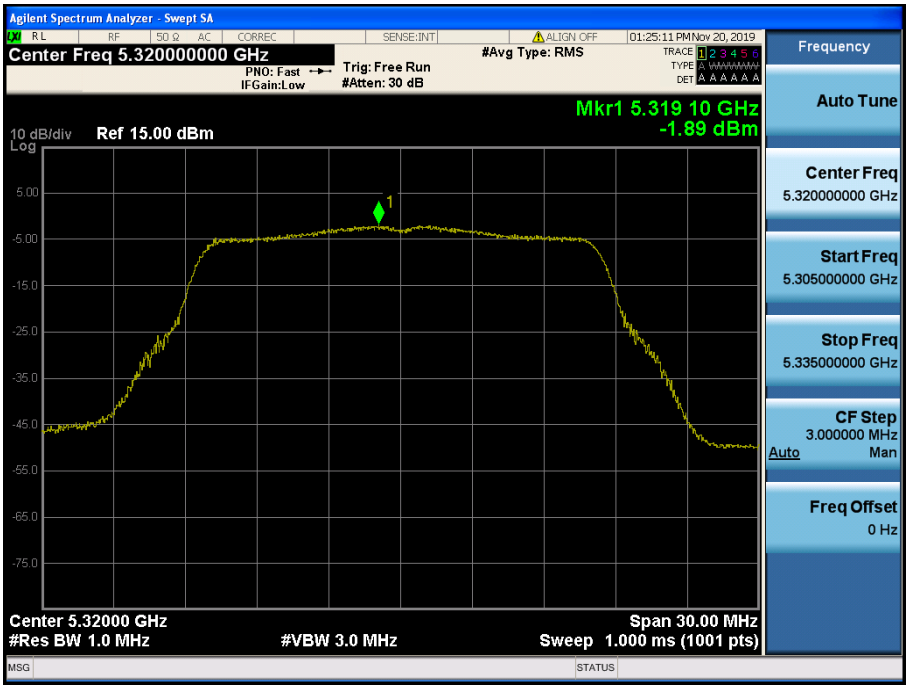
Test Mode: 802.11a & Ch.52

Maximum Power Spectral Density

Test Mode: 802.11a & Ch.60

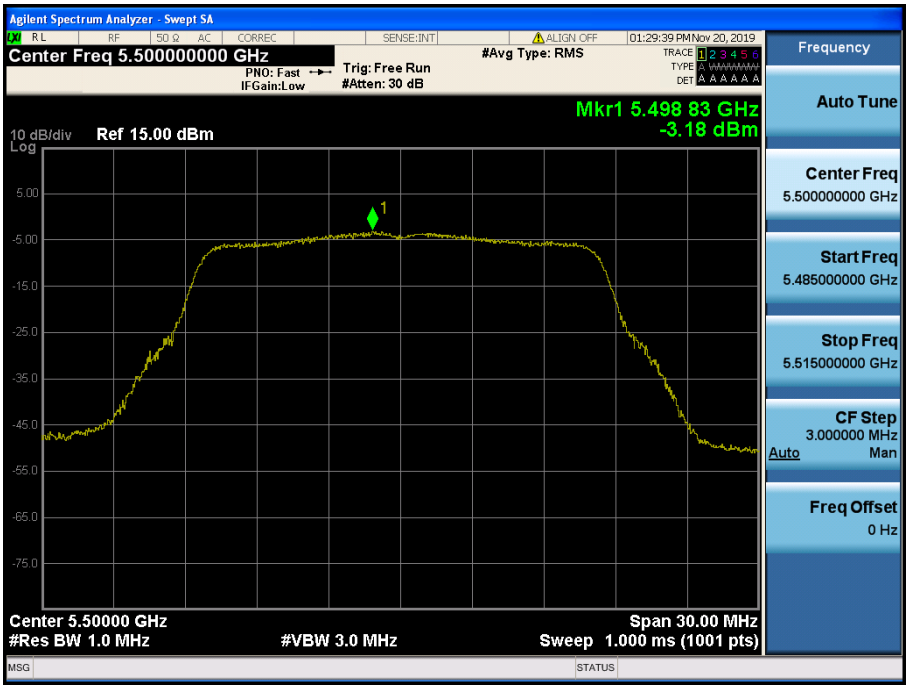


Maximum Power Spectral Density Test Mode: 802.11a & Ch.64



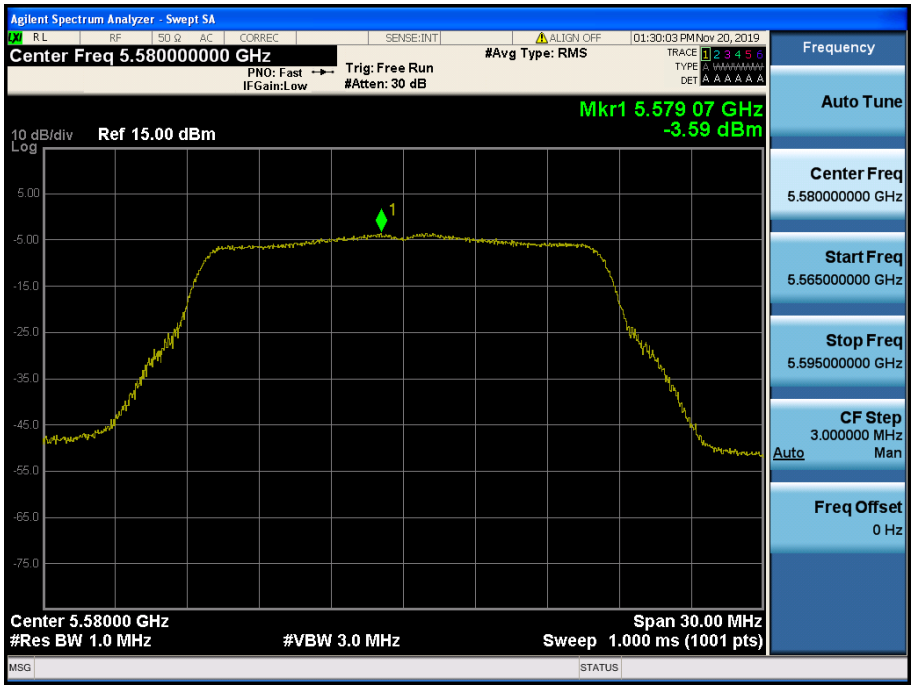
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.100



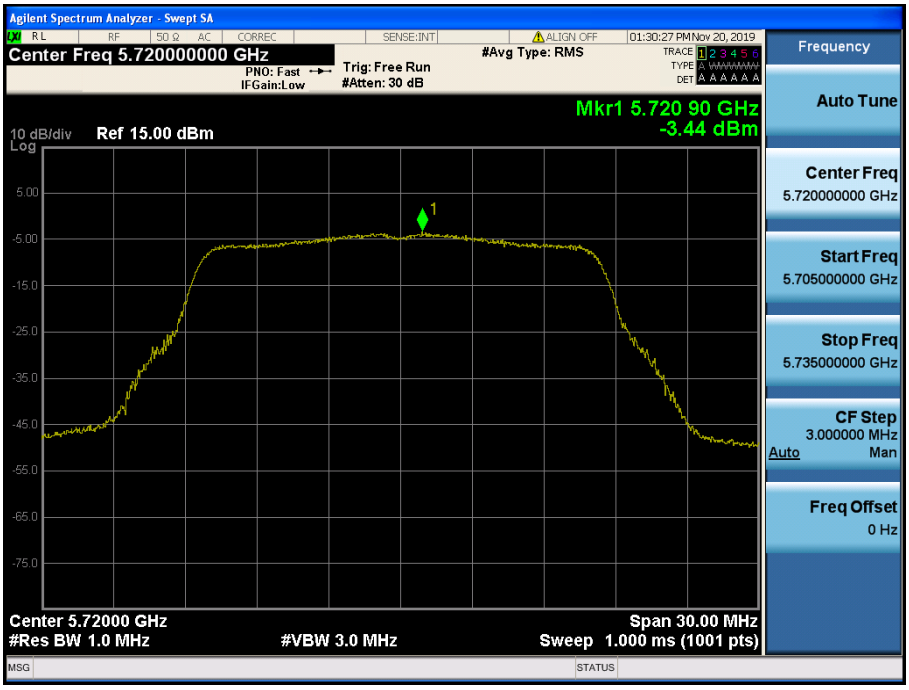
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.116



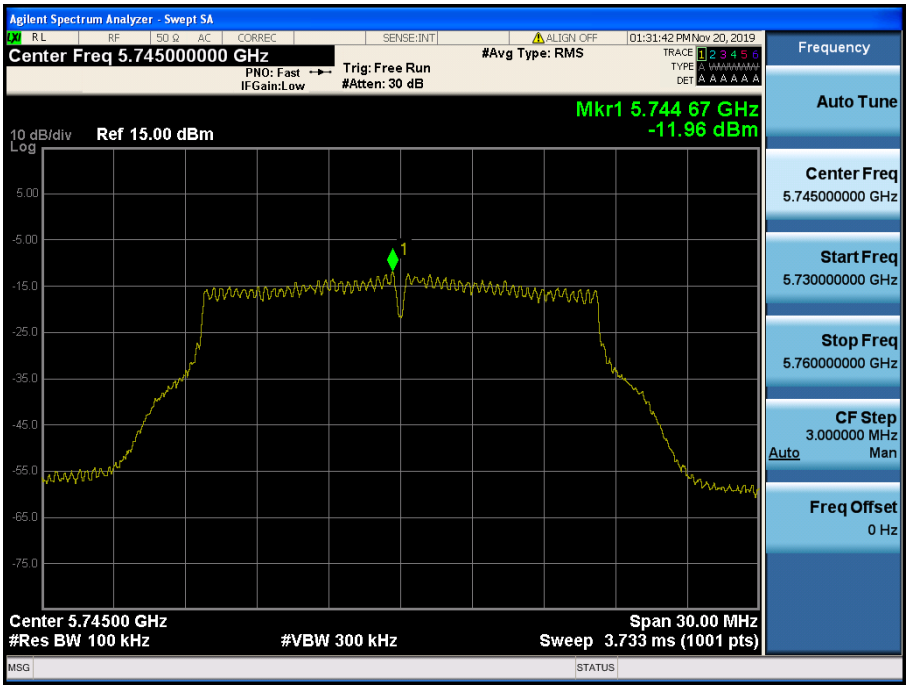
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.144



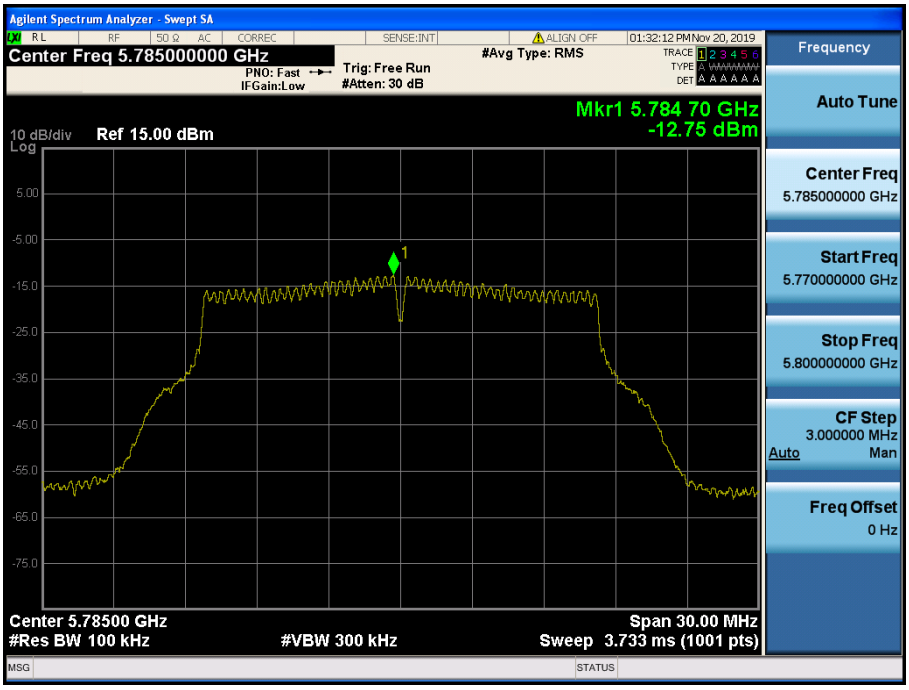
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.149

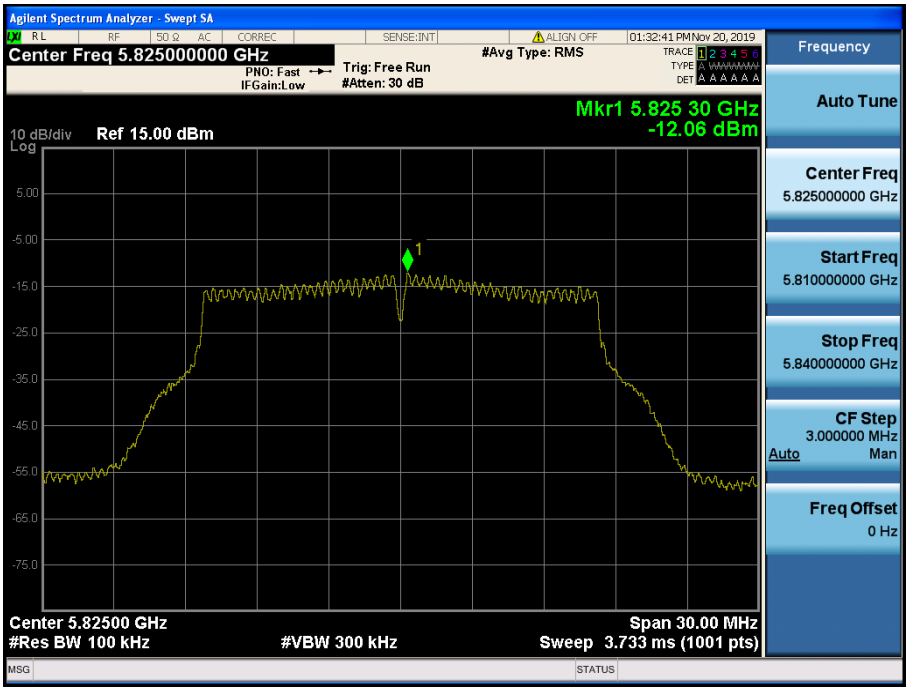


Maximum Power Spectral Density

Test Mode: 802.11a & Ch.157

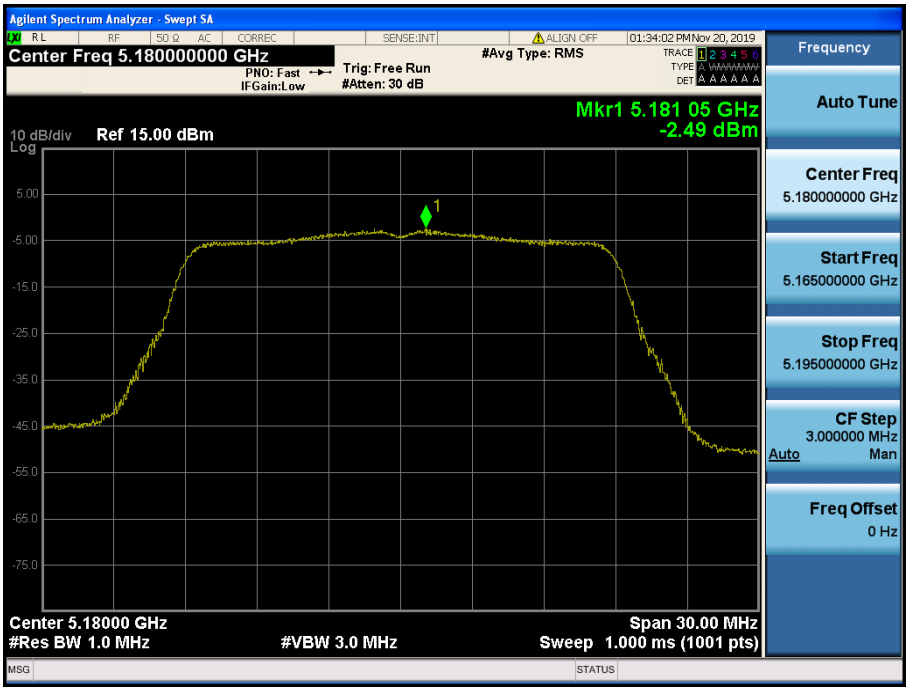


Maximum Power Spectral Density Test Mode: 802.11a & Ch.165



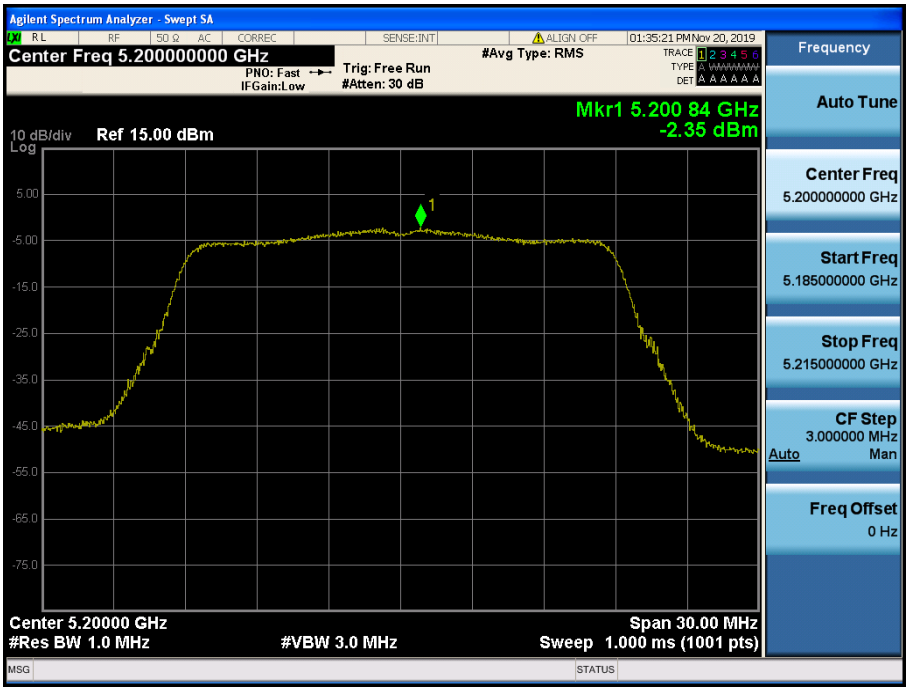
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.36



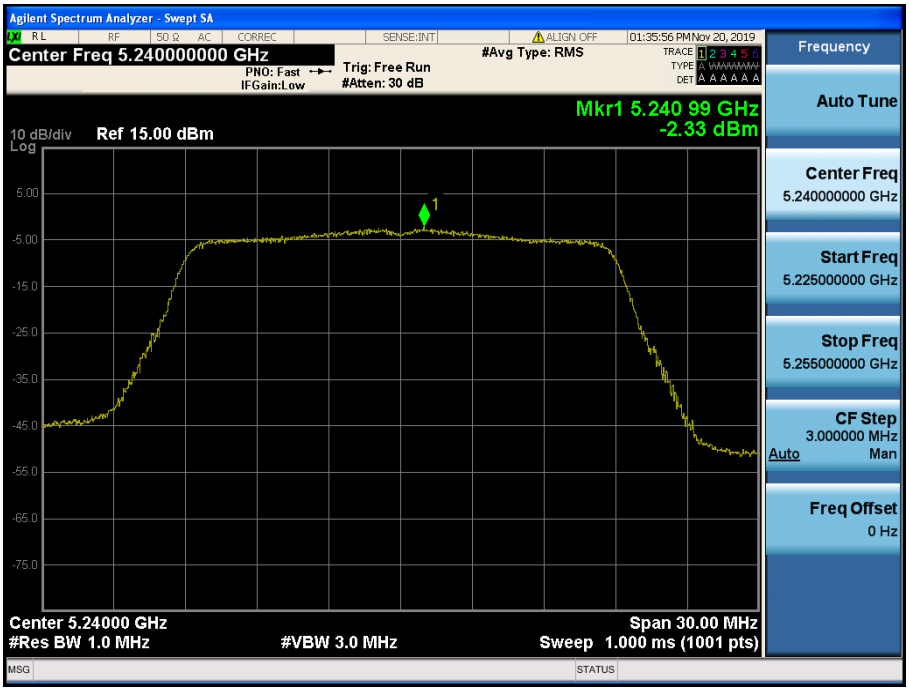
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.40



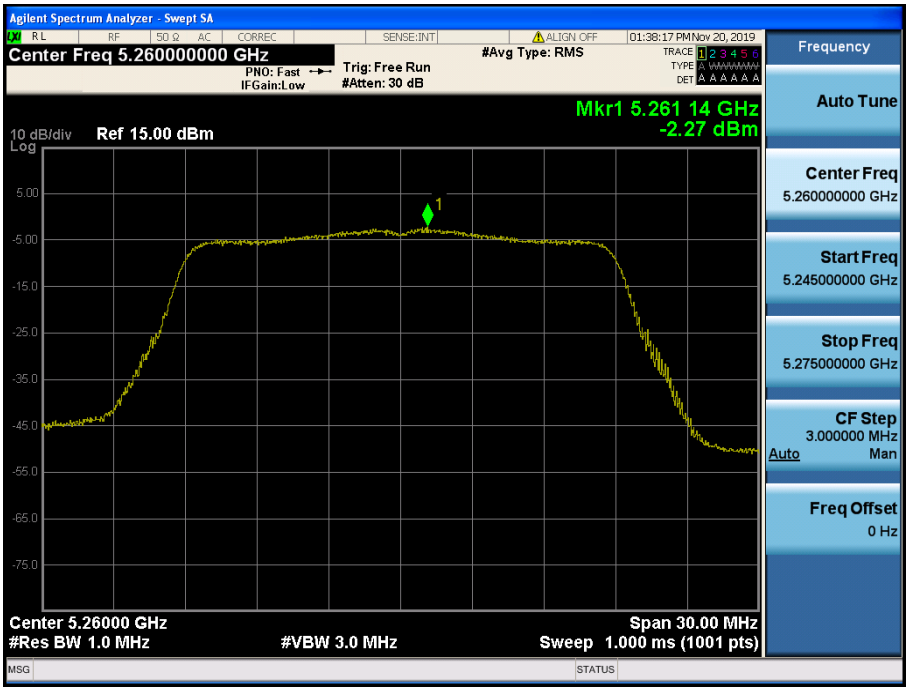
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.48



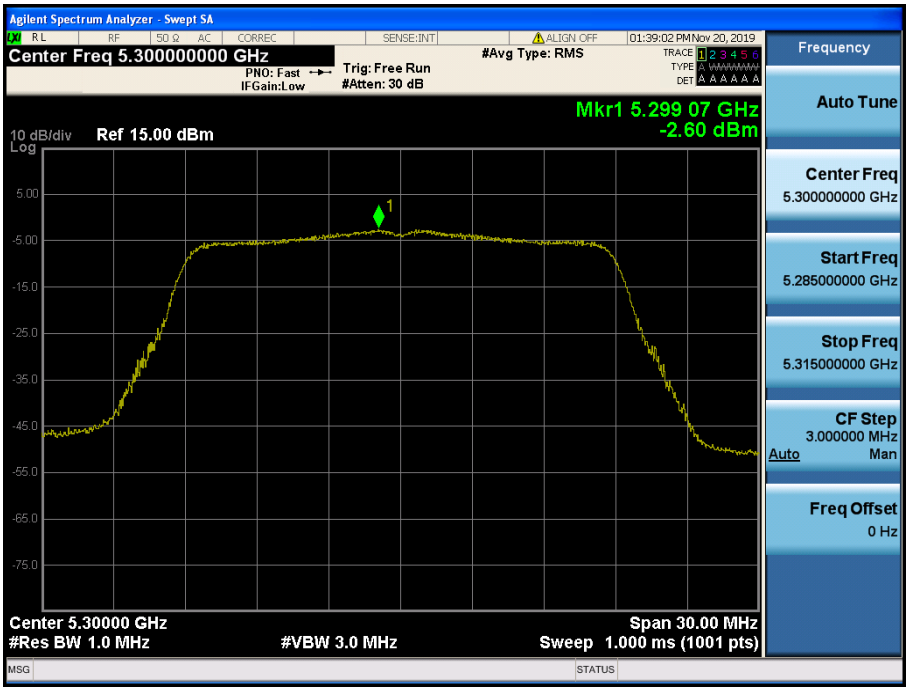
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.52



Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.60



Maximum Power Spectral Density

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