TEST REPORT

Dt&C

DT&C Co., Ltd.

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

1. Report No : DRTFCC2010-0312
2. Customer
   - Name : HYUNDAI MOBIS CO., LTD.
   - Address : 203, Teheran-ro Gangnam-gu, Seoul, South Korea 135-977
3. Use of Report : FCC Original Grant
4. Product Name / Model Name : DIGITAL CAR AVN SYSTEM / VT240GKAN
   FCC ID : TQ8-VT240GKAN
5. FCC Regulation(s): Part 15.407
   Test Method used: KDB789033 D02v02r01, ANSI C 63.10-2013
6. Date of Test : 2020.07.10 ~ 2020.08.14
7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing
8. Testing Environment : Refer to appended test report.
9. Test Result : Refer to the attached test result.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

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

2020 . 10 . 14 .

DT&C Co., Ltd.

Unconnected with KS Q ISO / IEC 17025 and KOLAS accreditation

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

Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2010-0312	Oct. 14, 2020	Initial issue	JungWoo Kim	JaeJin Lee

CONTENTS

1. EUT DESCRIPTION

Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	DIGITAL CAR AVN SYSTEM
Model Name	VT240GKAN
Add model name	VT240I3AN
EUT Serial Number	Conducted sample: 0646385692 Radiated sample: 0646385694
Power Supply	DC 14.4 V
Modulation type	OFDM
Antenna Specification	**Antenna type**: PCB Pattern Antenna **Antenna gain** U-NII 1: 0.59 dBi U-NII 2A: 2.00 dBi U-NII 2C: 4.58 dBi U-NII 3: 4.19 dBi

5GHz Band	Mode	Frequency range(MHz)	Max power(dBm)
U-NII 1	802.11a	5 180 ~ 5 240	**8.26**
	802.11n(HT20)	5 180 ~ 5 240	8.26
	802.11ac(VHT20)	5 180 ~ 5 240	8.23
	802.11n(HT40)	5 190 ~ 5 230	3.56
	802.11ac(VHT40)	5 190 ~ 5 230	3.75
	802.11ac(VHT80)	5 210	3.58
U-NII 2A	802.11a	5 260 ~ 5 320	**8.11**
	802.11n(HT20)	5 260 ~ 5 320	7.88
	802.11ac(VHT20)	5 260 ~ 5 320	7.86
	802.11n(HT40)	5 270 ~ 5 310	7.71
	802.11ac(VHT40)	5 270 ~ 5 310	7.41
	802.11ac(VHT80)	5 290	6.43
U-NII 2C	802.11a	5 500 ~ 5 580, 5 660 ~ 5 720	**6.41**
	802.11n(HT20)	5 500 ~ 5 580, 5 660 ~ 5 720	6.28
	802.11ac(VHT20)	5 500 ~ 5 580, 5 660 ~ 5 720	6.27
	802.11n(HT40)	5 510 ~ 5 550, 5 670 ~ 5 710	6.36
	802.11ac(VHT40)	5 510 ~ 5 550, 5 670 ~ 5 710	6.40
	802.11ac(VHT80)	5 530, 5 690	6.24
U-NII 3	802.11a	5 745 ~ 5 825	6.61
	802.11n(HT20)	5 745 ~ 5 825	**6.81**
	802.11ac(VHT20)	5 745 ~ 5 825	6.69
	802.11n(HT40)	5 755 ~ 5 795	6.15
	802.11ac(VHT40)	5 755 ~ 5 795	6.19
	802.11ac(VHT80)	5 775	6.03

2. Information about test items

2.1 Transmitting configuration of EUT

Mode	Data rate
802.11a	6 Mbps ~ 54 Mbps
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	5 180	38	5 190	42	5 210
	40	5 200	-	-	-	-
	48	5 240	46	5 230	-	-
U-NII 2A	52	5 260	54	5 270	58	5 290
	60	5 300	-	-	-	-
	64	5 320	62	5 310	-	-
U-NII 2C	100	5 500	102	5 510	106	5 530
	116	5 580	110	5 550	-	-
	144	5 720	142	5 710	138	5 690
U-NII 3	149	5 745	151	5 755	155	5 775
	157	5 785	-	-	-	-
	165	5 825	159	5 795	-	-

2.3 Testing Environment

Temperature	:	20 ºC ~ 25 ºC
Relative humidity content	:	37 % ~ 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	0.9 dB (The confidence level is about 95 %, k = 2)
AC conducted emission	3.6 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.1 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 5 725 MHz ~ 5 850 MHz		C
15.407(a)	RSS-247[6.2]	Maximum Conducted Output Power	5 150 MHz ~ 5 250 MHz : < 23.97 dBm 5 250 MHz ~ 5 350 MHz & 5 470 MHz ~ 5 725 MHz : < 250 mW or < 11 + 10 log10(B) dBm, whichever power is less. (B is the 26 dB BW.) 5 725 MHz ~ 5 850 MHz : < 30 dBm		C
15.407(a)	RSS-247[6.2]	Peak Power Spectral Density	5 150 MHz ~ 5 250 MHz : 11 dBm/MHz 5 250 MHz ~ 5 350 MHz : 11 dBm/MHz 5 470 MHz ~ 5 725 MHz : 11 dBm/MHz 5 725 MHz ~ 5 850 MHz : 30 dBm/500 kHz		C
-	RSS GEN[6.7]	Occupied Bandwidth (99%)	N/A		NA
15.407(h)	RSS-247[6.3]	Dynamic Frequency Selection	Part 15.407(h)		C Note 2
15.407(b)	RSS-247[6.2] RSS-GEN[8.9] RSS-GEN[8.10]	Undesirable Emissions	5 150 MHz ~ 5 725 MHz: < -27 dBm/MHz EIRP 5 725 MHz ~ 5 850 MHz: < -27 dBm/MHz or < 10 dBm/MHz or 15.6 dBm/MHz < 27 dBm/MHz EIRP	Radiated	C
15.205 15.209 15.407(b)	RSS-247[6.2] RSS-GEN[8.9] RSS-GEN[8.10]	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Part 15.209, 15.407(b) (Reference to section 8.5)		C
15.207	RSS-GEN[8.8]	AC Conducted Emissions	Part 15.207 (Reference to section 8.6)	AC Line Conducted	NT Note 3
15.203	-	Antenna Requirements	Part 15.203 (Reference to section 7)	-	C

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

Note 2: Refer to the DFS test report.

Note 3: 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. 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

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.

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 & IC MRA Designation No.: KR0034** **- ISED#: 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

Directional antenna gain:

Bands	ANT Gain [dBi]
U-NII 1	0.59
U-NII 2A	2.00
U-NII 2C	4.58
U-NII 3	4.19

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 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%.

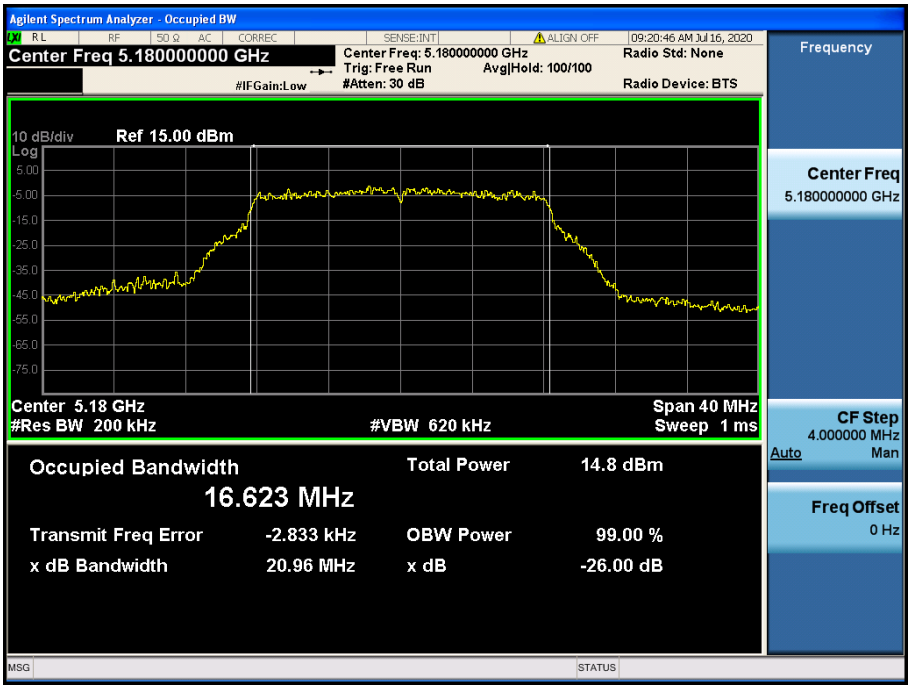
▣ **Test Results: Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	U-NII 1	36	5 180	20.96
		40	5 200	21.30
		48	5 240	20.77
	U-NII 2A	52	5 260	20.76
		60	5 300	21.08
		64	5 320	21.18
	U-NII 2C	100	5 500	21.06
		116	5 580	20.81
		144	5 720	20.93
802.11n (HT20)	U-NII 1	36	5 180	21.30
		40	5 200	20.83
		48	5 240	21.12
	U-NII 2A	52	5 260	21.37
		60	5 300	21.50
		64	5 320	21.32
	U-NII 2C	100	5 500	21.19
		116	5 580	21.21
		144	5 720	21.16
802.11n (HT40)	U-NII 1	38	5 190	39.77
		46	5 230	39.53
	U-NII 2A	54	5 270	39.25
		62	5 310	39.23
	U-NII 2C	102	5 510	39.14
		110	5 550	39.53
		142	5 710	39.15
802.11ac (VHT80)	U-NII 1	42	5 210	81.03
	U-NII 2A	58	5 290	80.47
	U-NII 2C	106	5 530	80.80
		138	5 690	80.40

▣ Result Plots

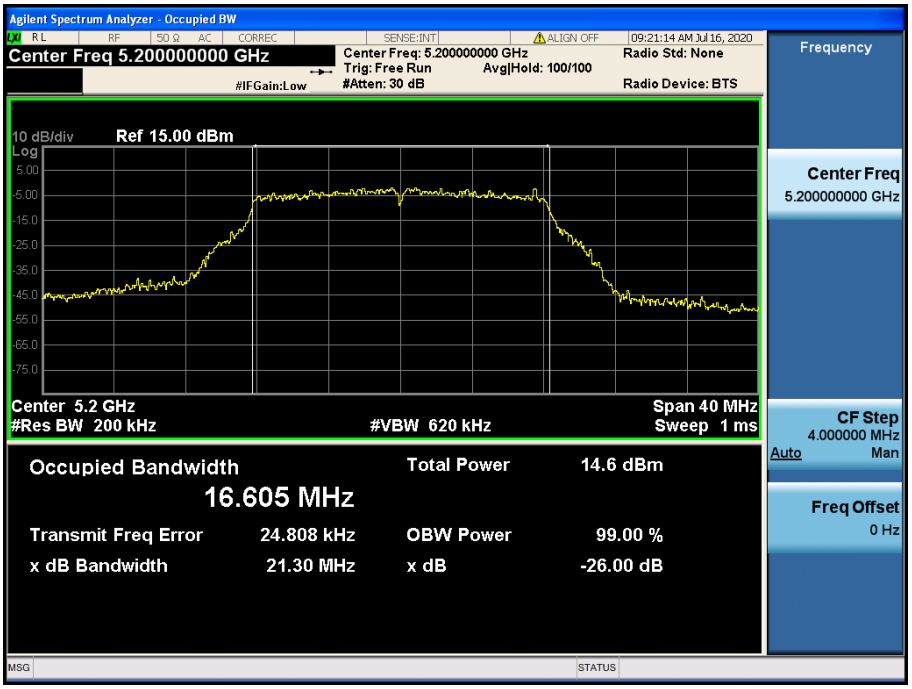
26 dB Bandwidth

Test Mode: 802.11a & Ch.36



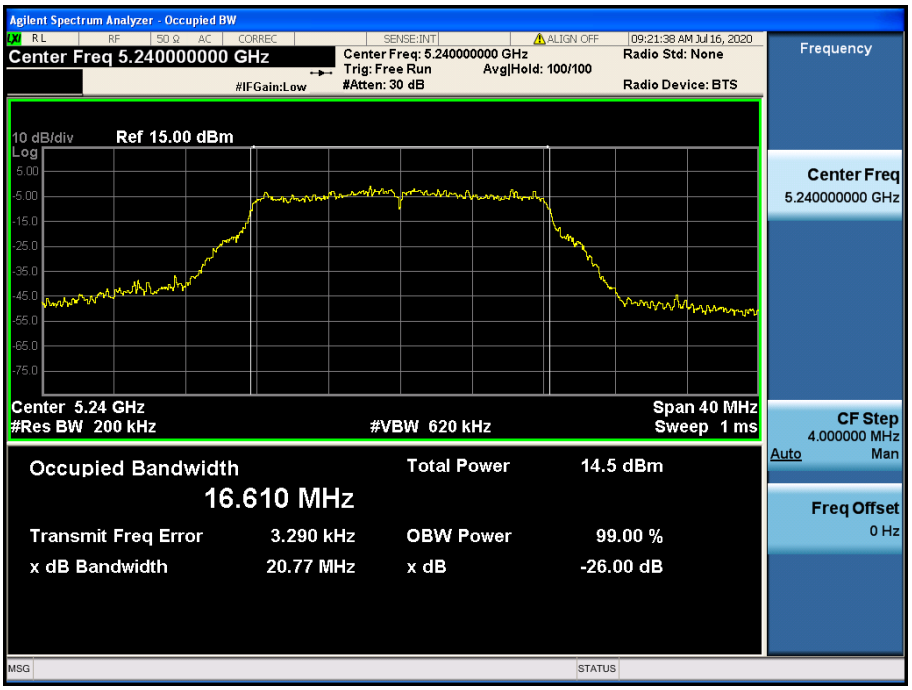
26 dB Bandwidth

Test Mode: 802.11a & Ch.40



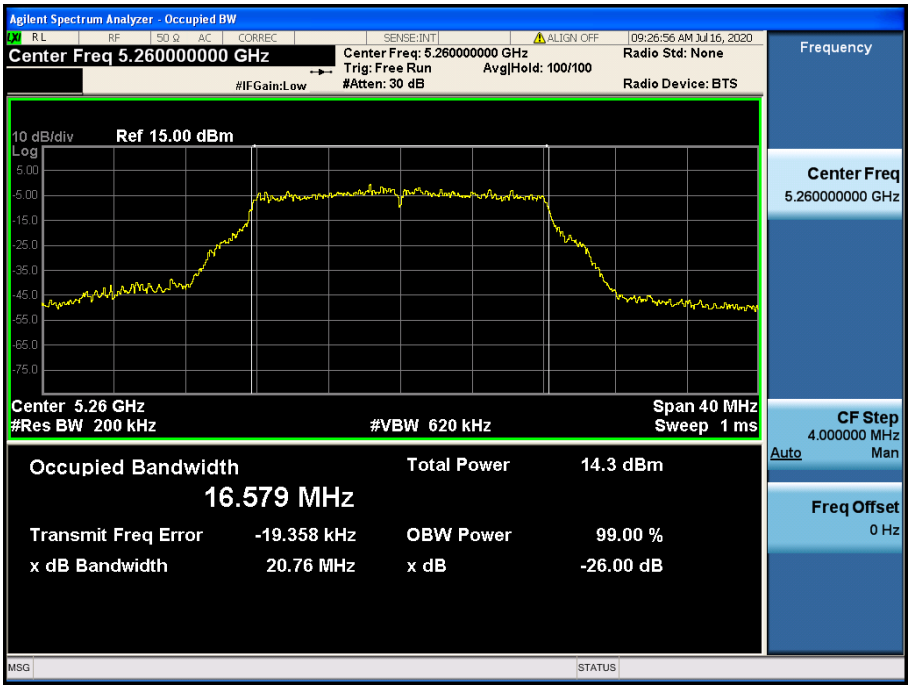
26 dB Bandwidth

Test Mode: 802.11a & Ch.48



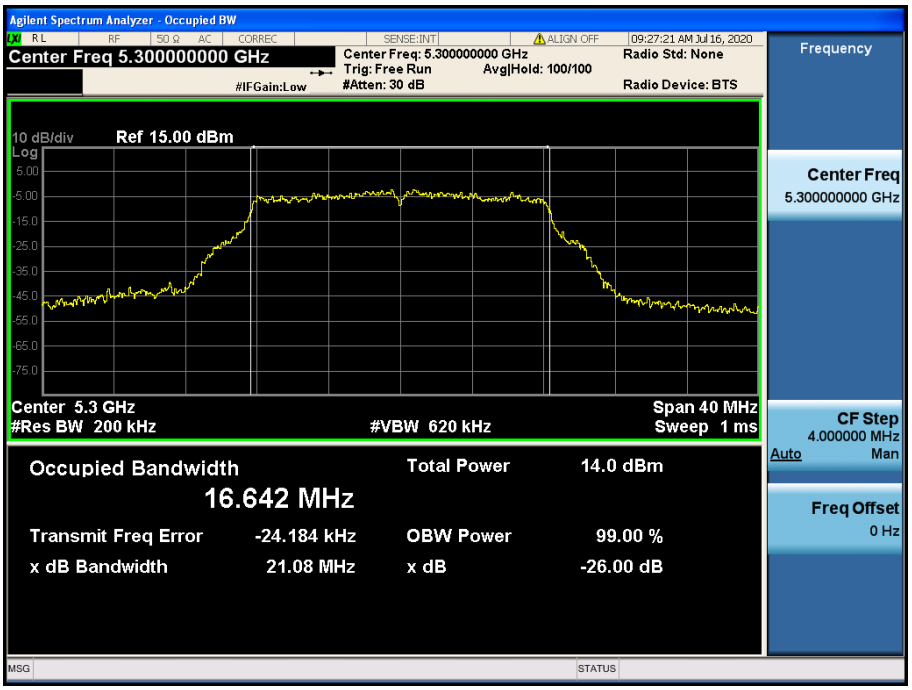
26 dB Bandwidth

Test Mode: 802.11a & Ch.52



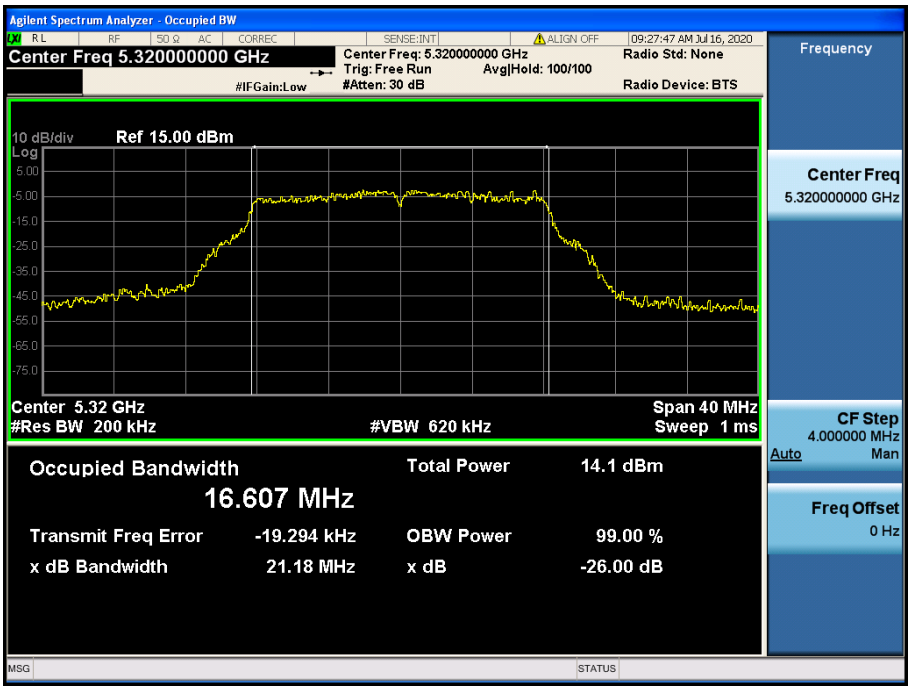
26 dB Bandwidth

Test Mode: 802.11a & Ch.60



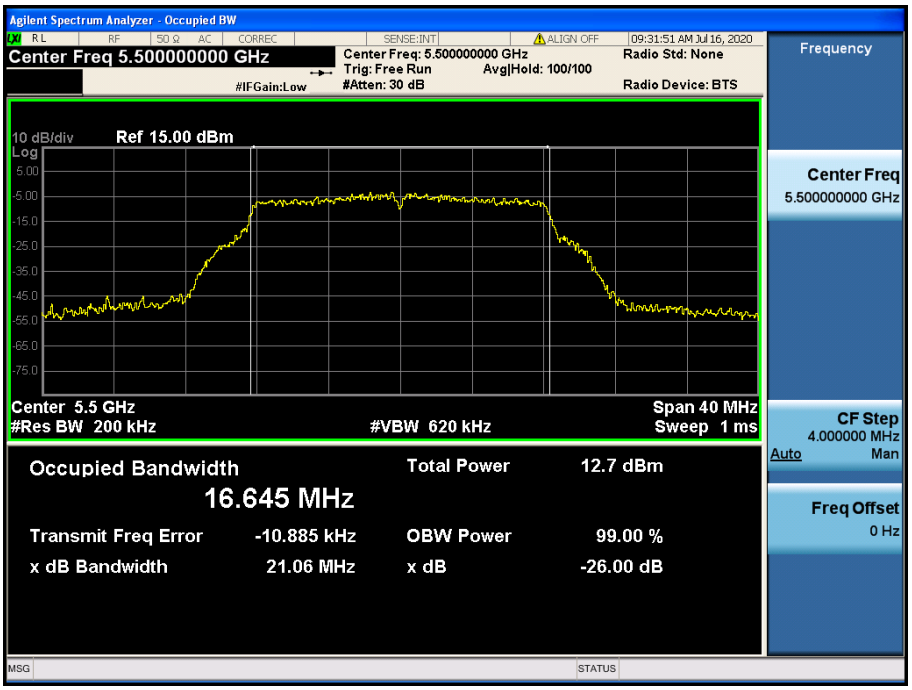
26 dB Bandwidth

Test Mode: 802.11a & Ch.64



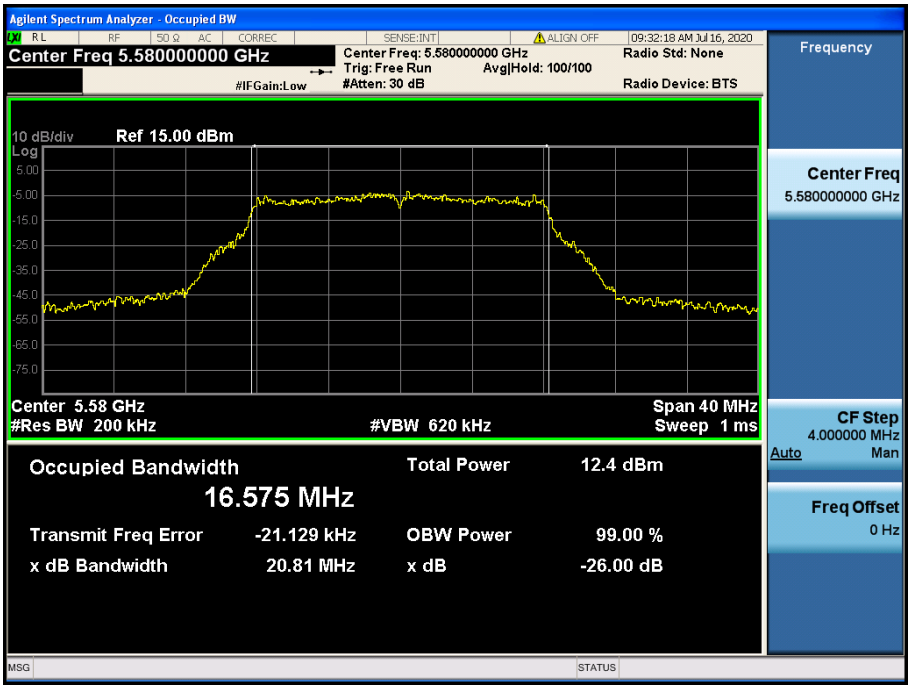
26 dB Bandwidth

Test Mode: 802.11a & Ch.100



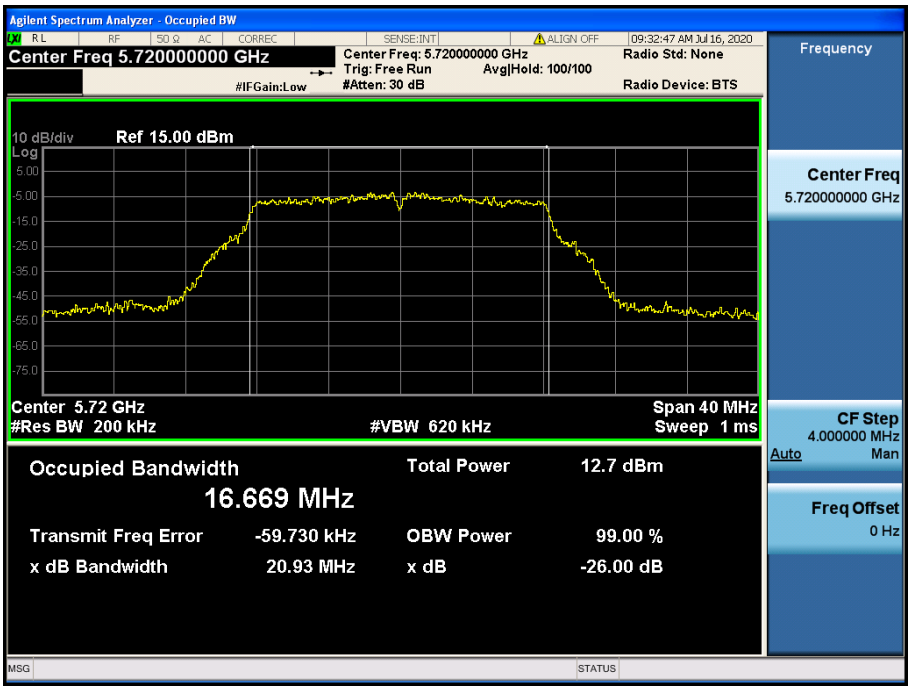
26 dB Bandwidth

Test Mode: 802.11a & Ch.116



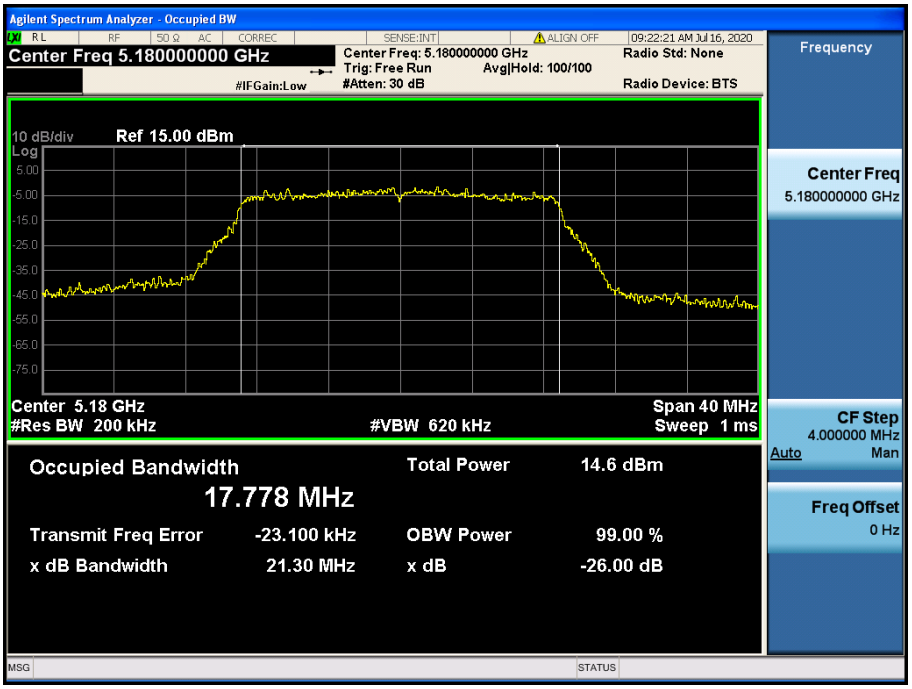
26 dB Bandwidth

Test Mode: 802.11a & Ch.144



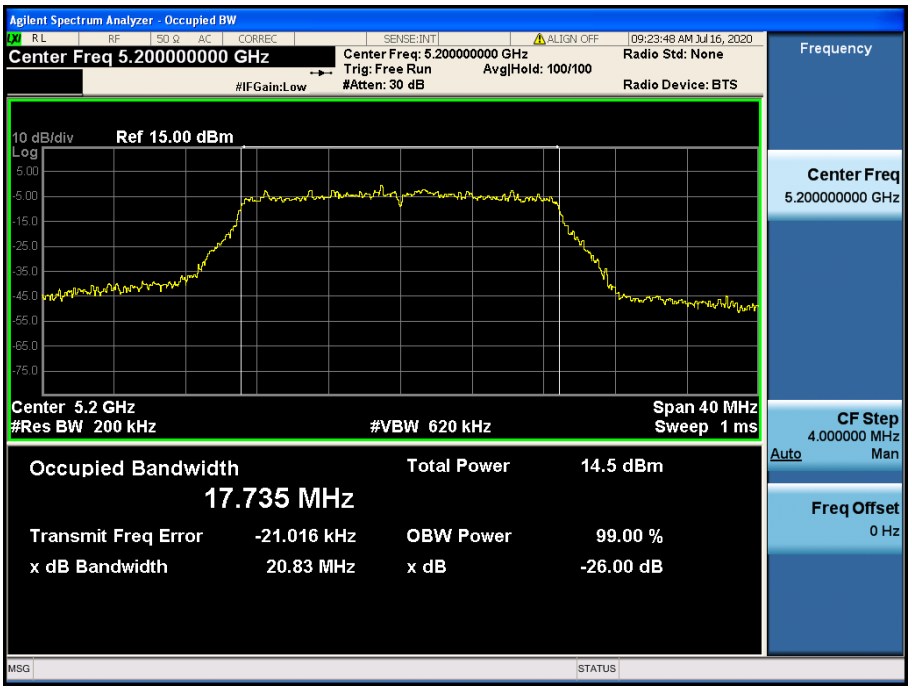
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.36



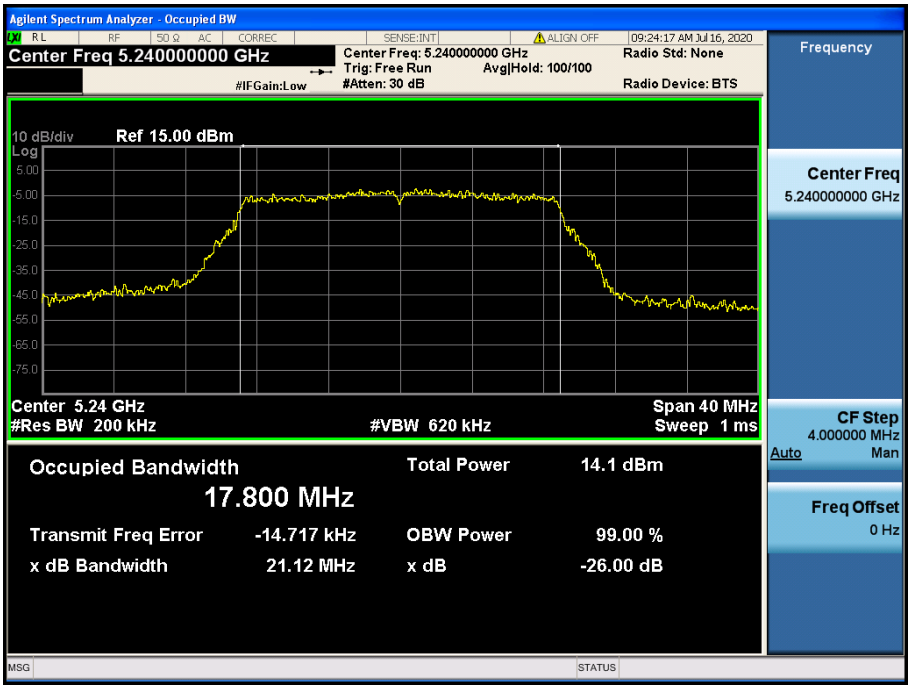
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.40



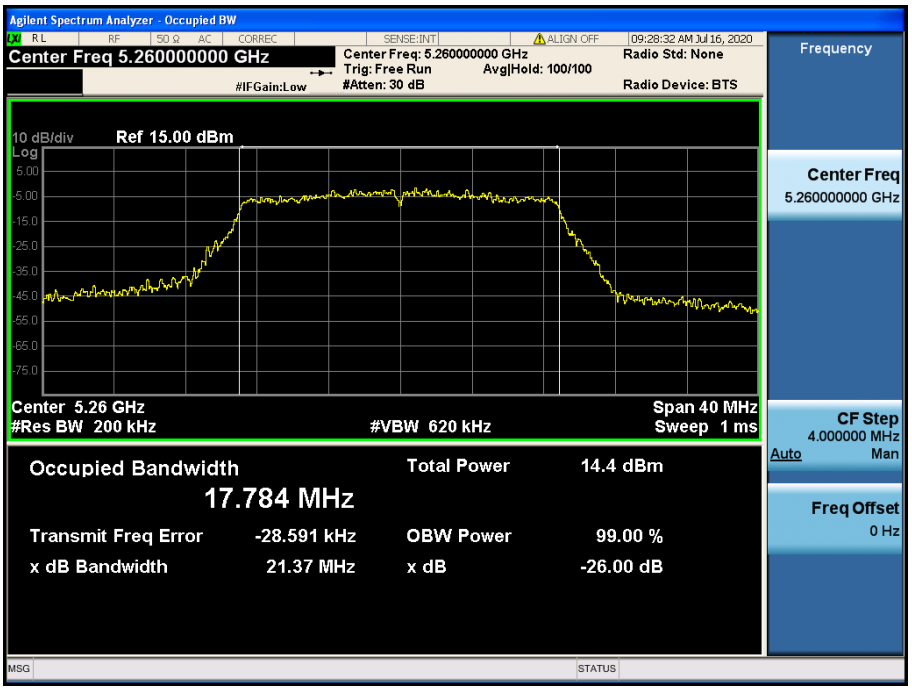
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.48



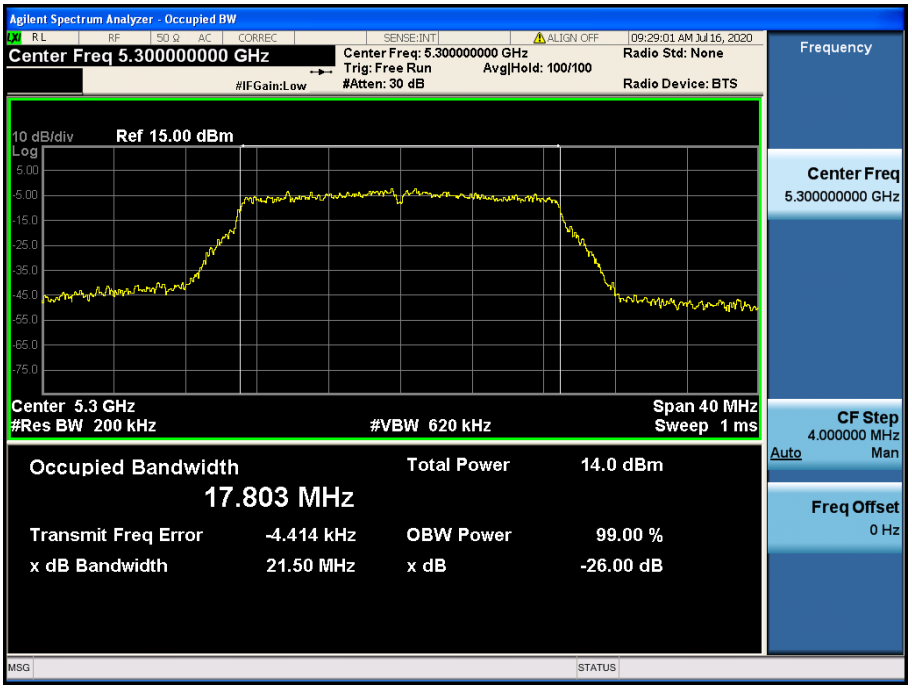
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.52



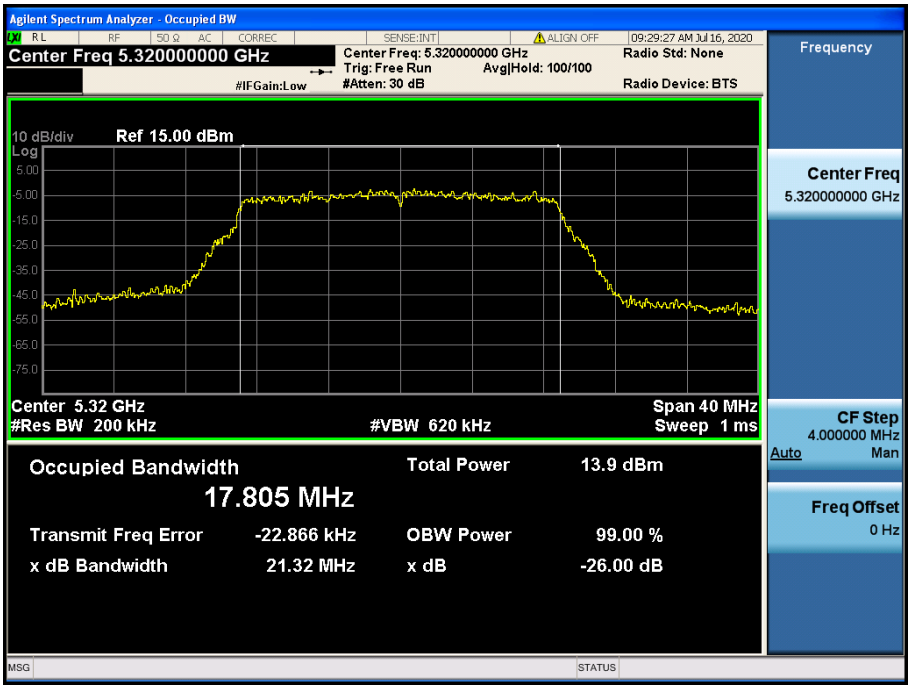
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.60



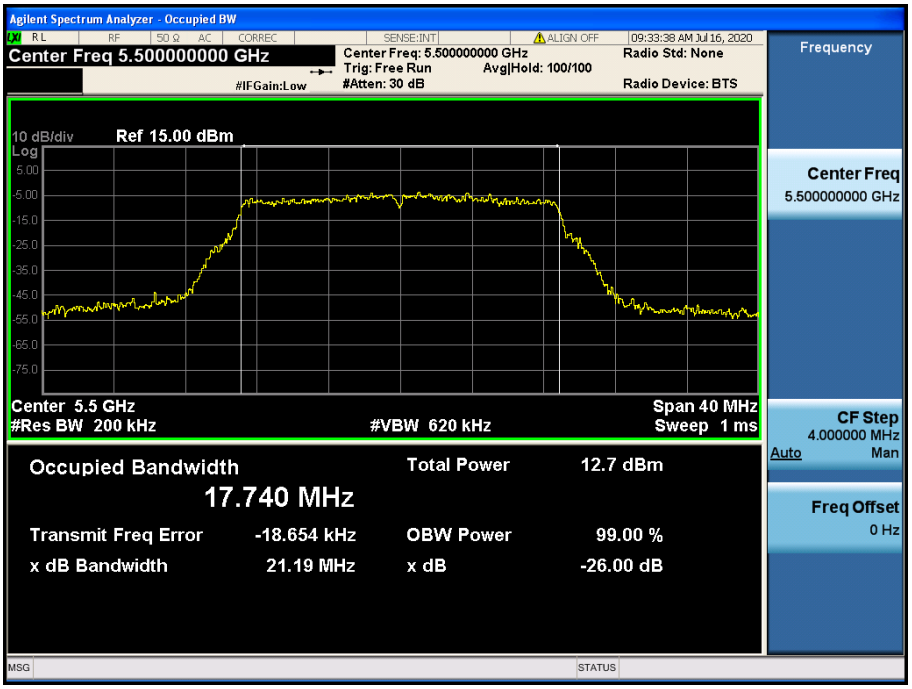
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.64



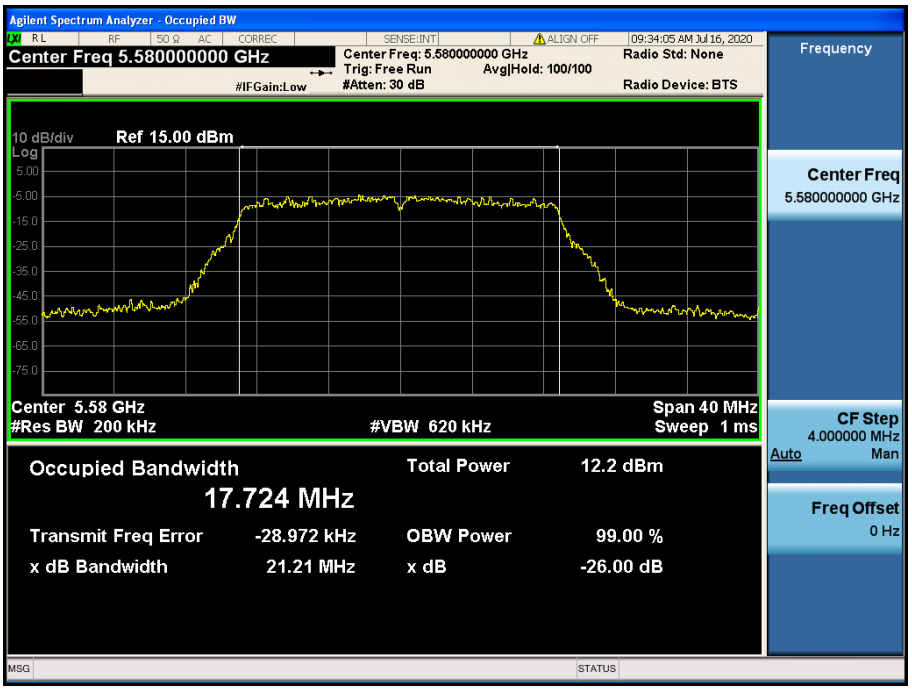
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.100



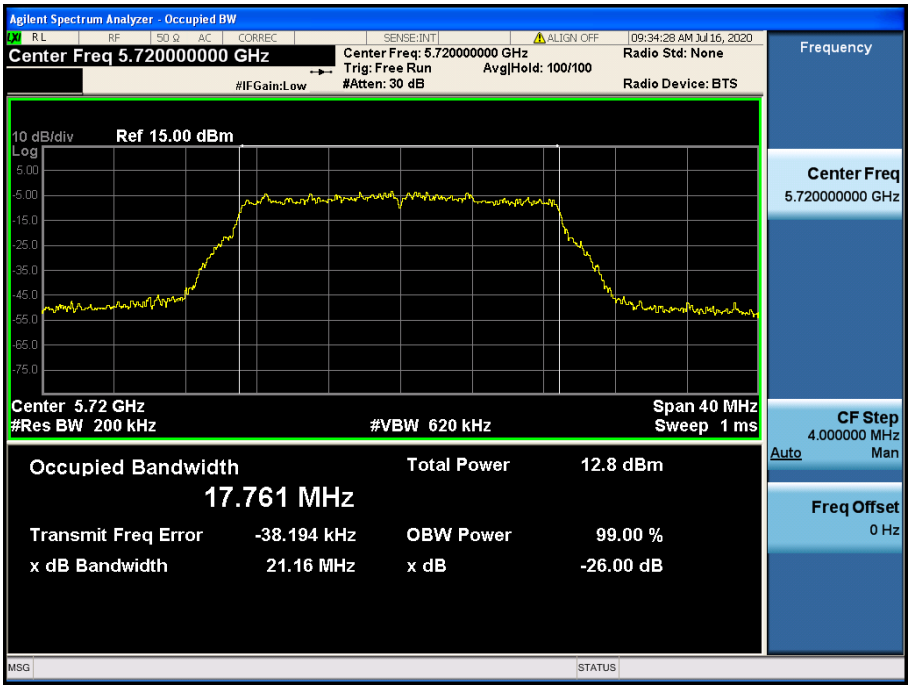
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.116



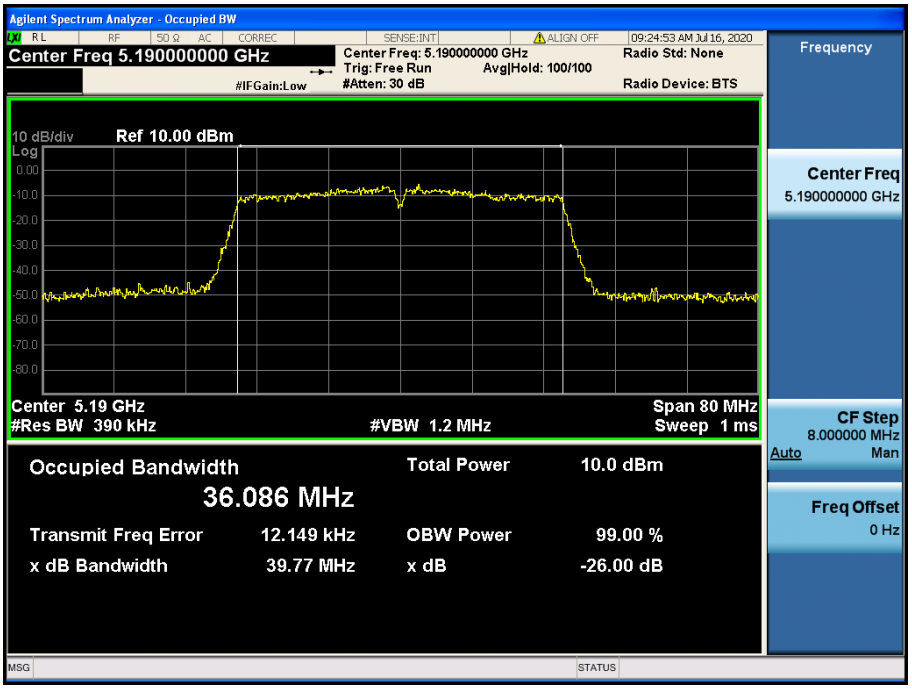
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.144



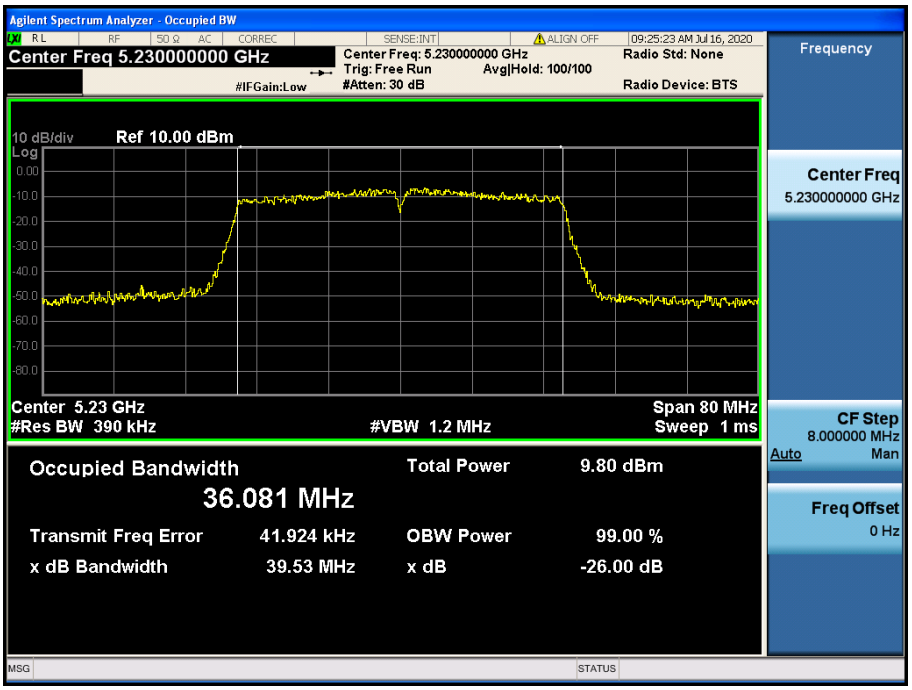
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.38



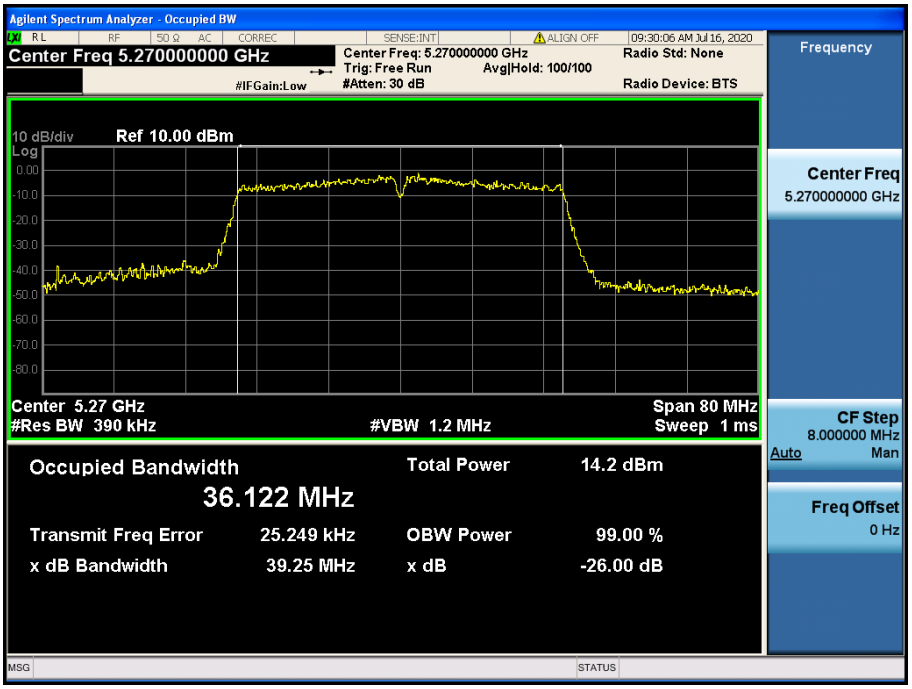
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.46



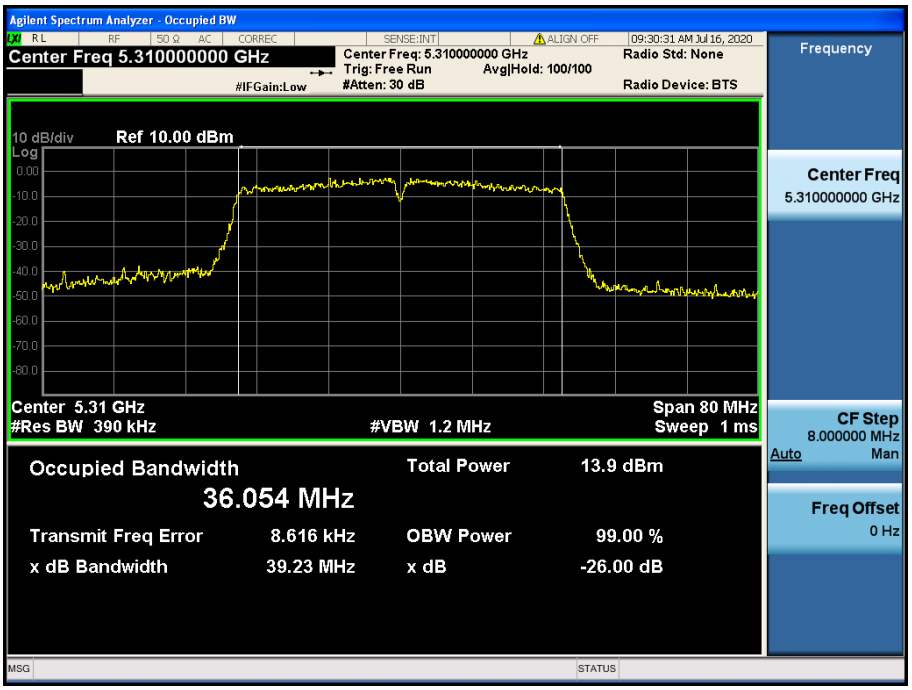
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.54



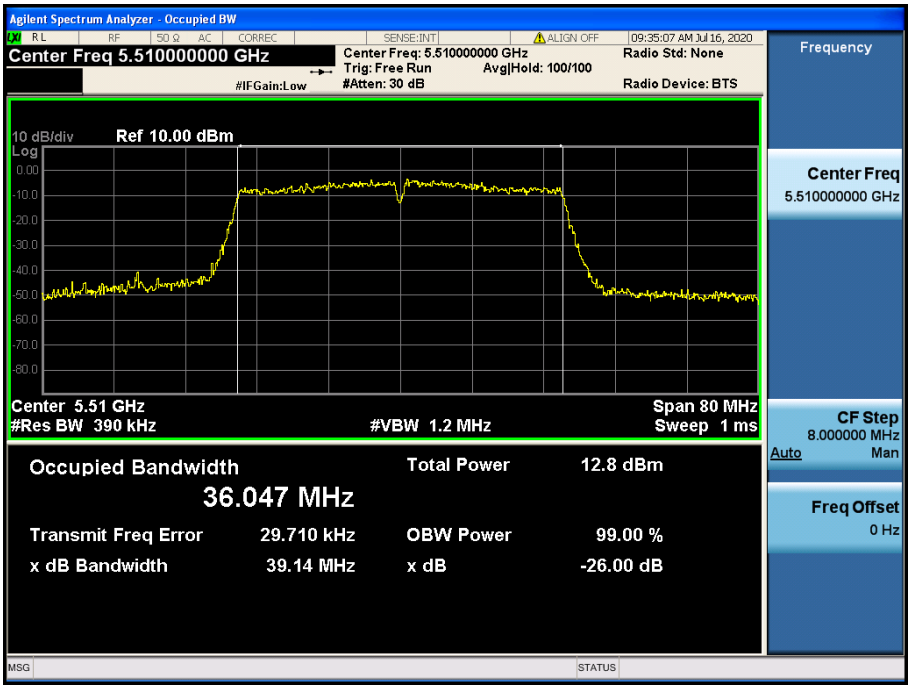
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.62



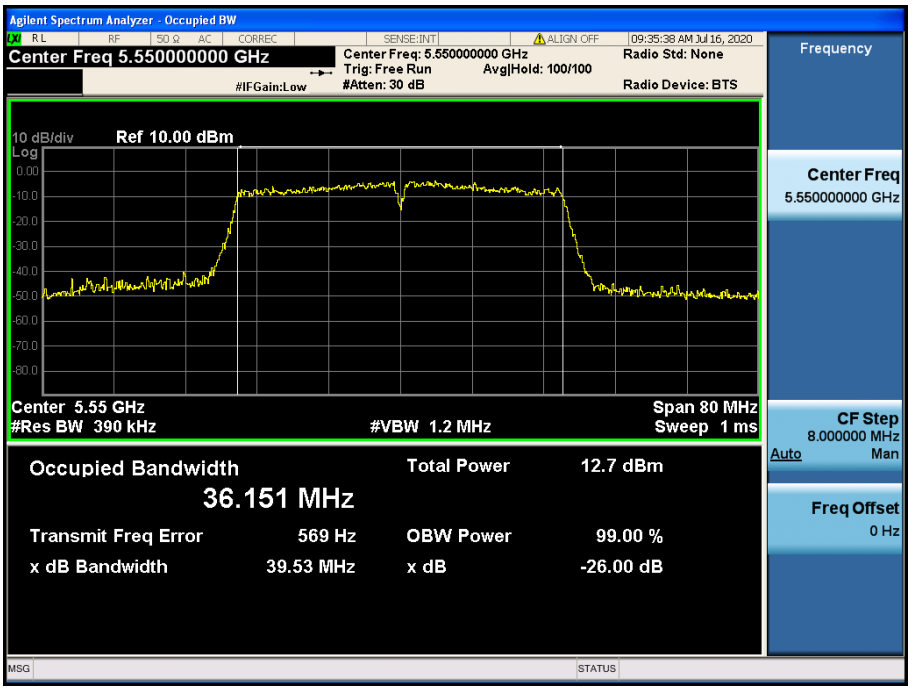
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.102



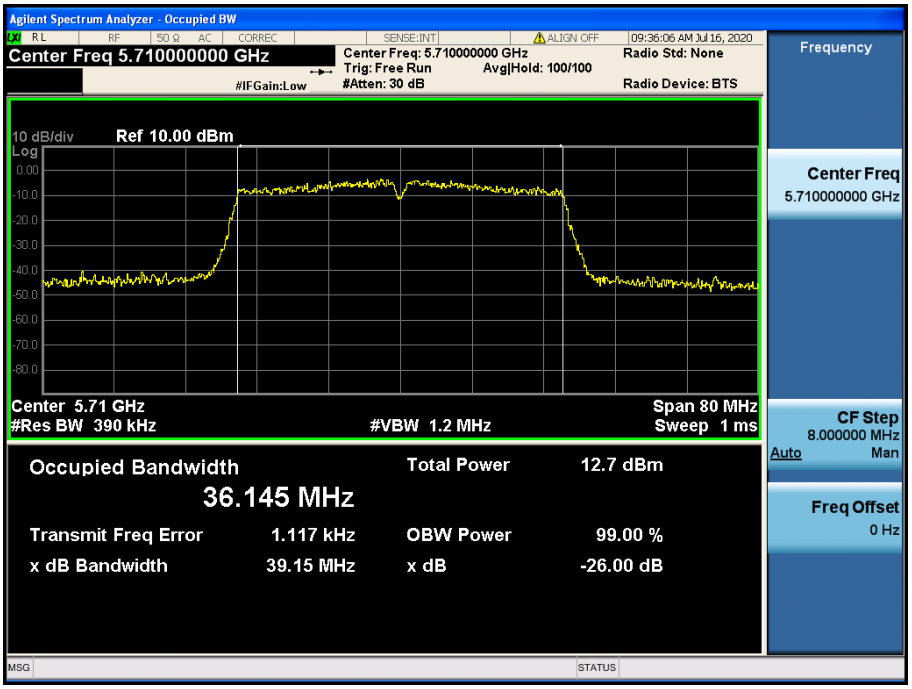
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.110



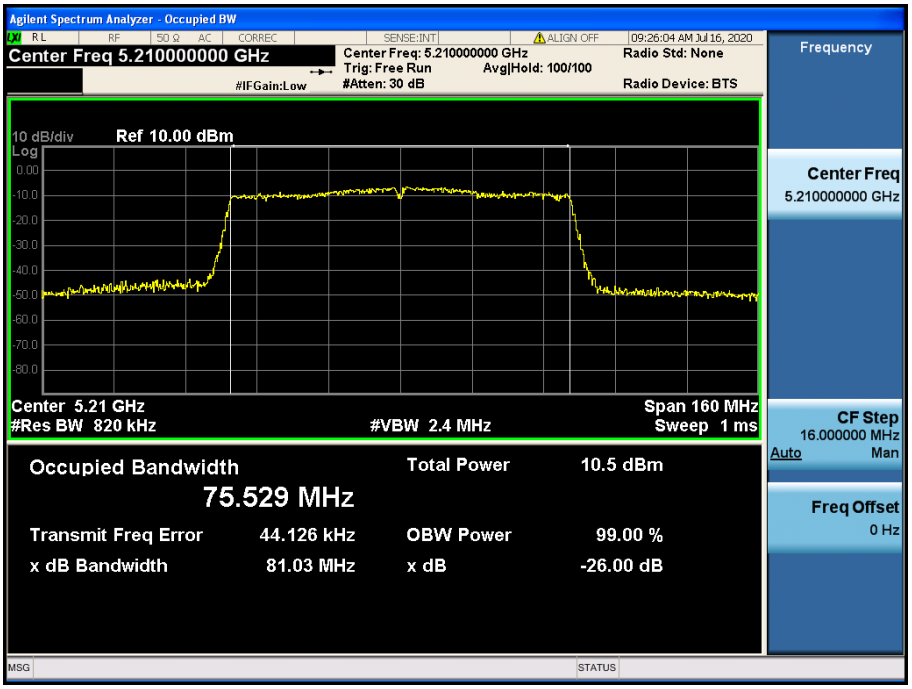
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.142



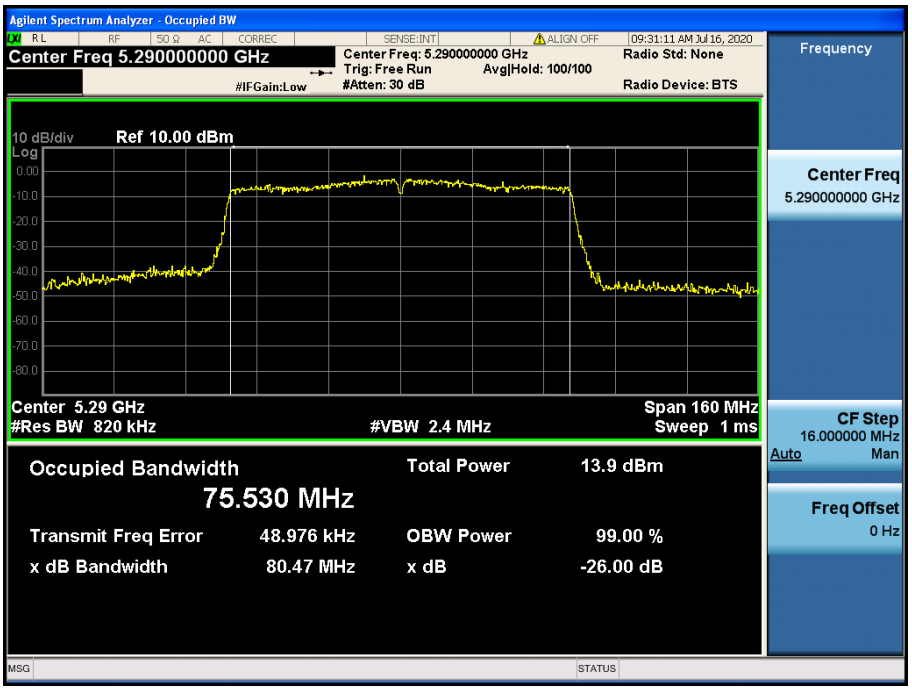
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.42



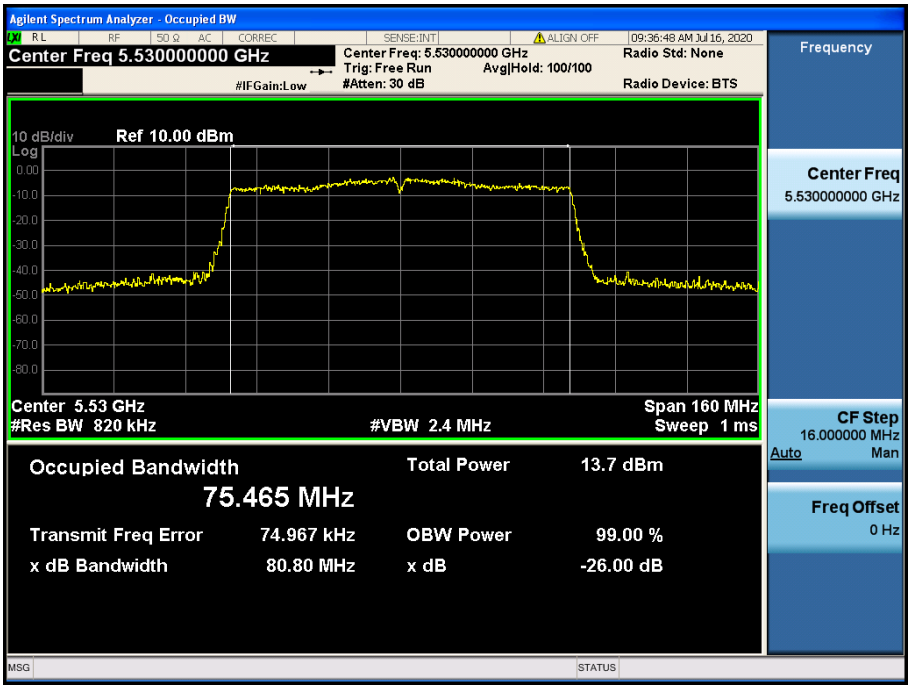
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.58



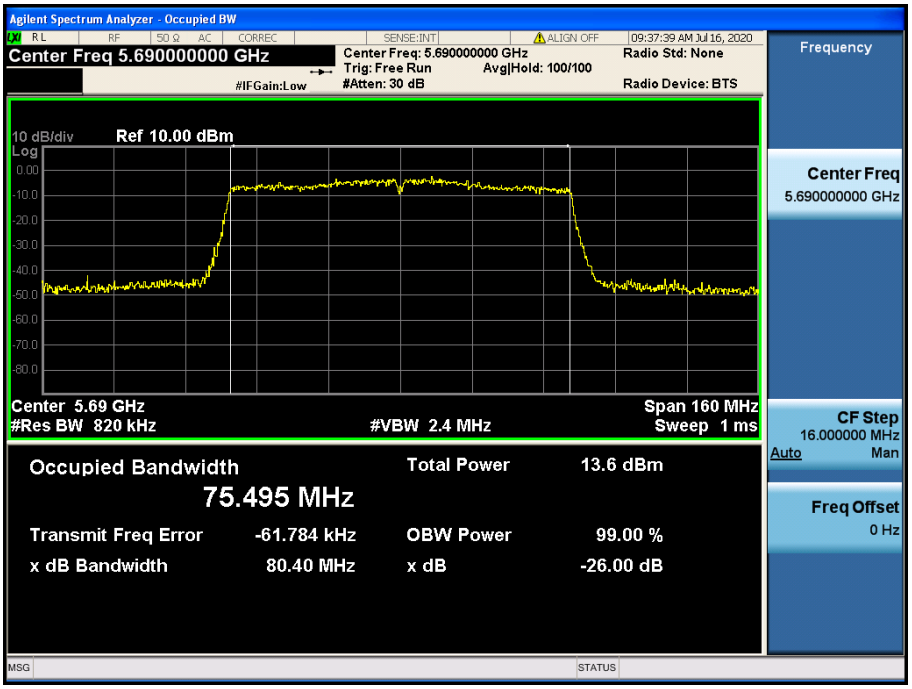
26 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.106



26 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.138



8.2 Minimum Emission Bandwidth (6 dB Bandwidth)

▣ Test Requirements

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

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

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

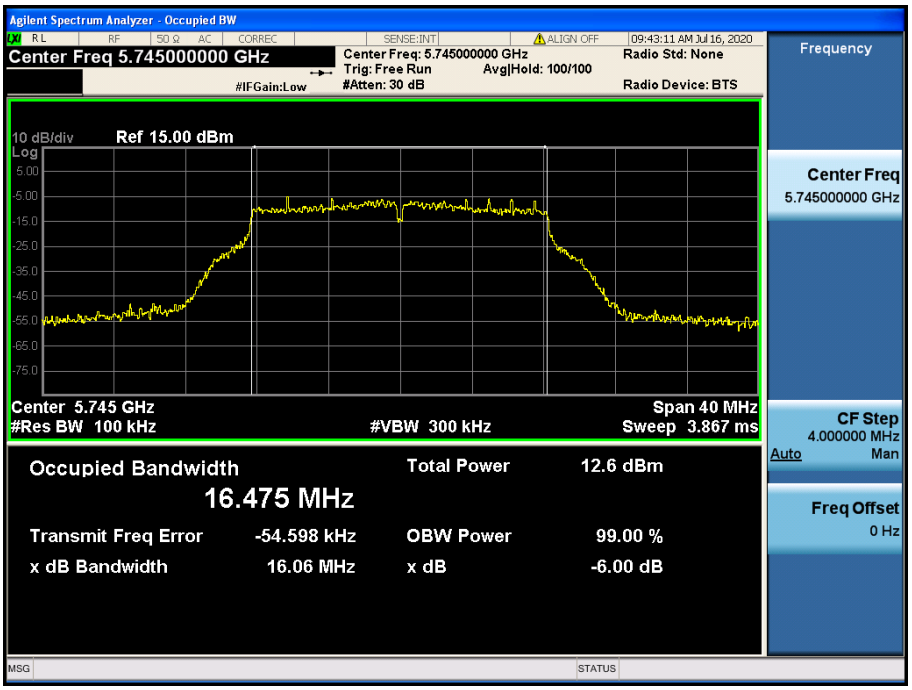
▣ Test Results: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	U-NII 3	149	5 745	16.06
		157	5 785	16.35
		165	5 825	16.37
802.11n (HT20)	U-NII 3	149	5 745	17.32
		157	5 785	17.60
		165	5 825	17.60
802.11n (HT40)	U-NII 3	151	5 755	35.25
		159	5 795	35.23
802.11ac (VHT80)	U-NII 3	155	5 775	75.50

▣ Result Plots

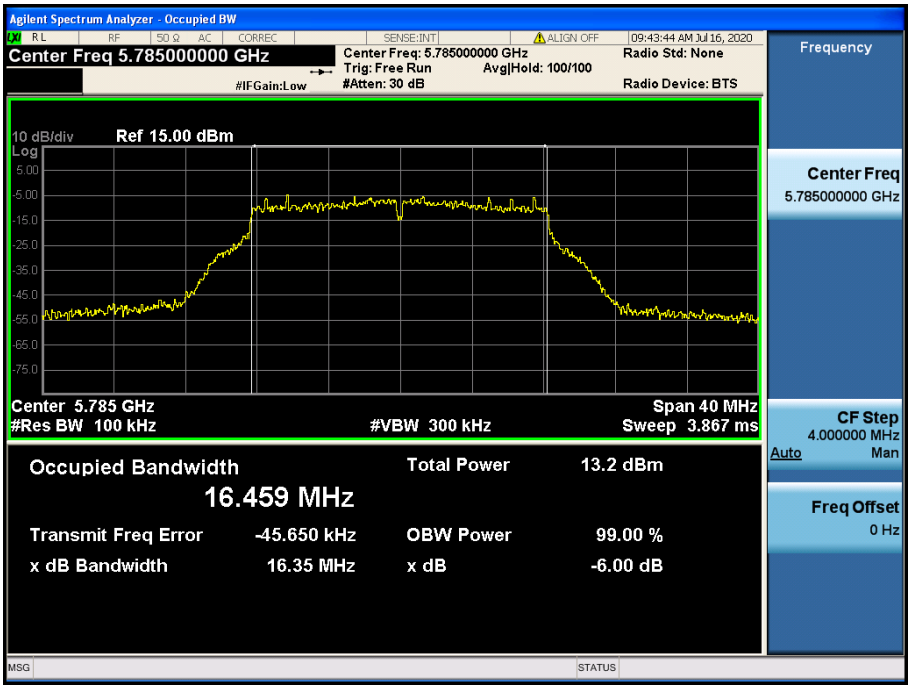
6 dB Bandwidth

Test Mode: 802.11a & Ch.149



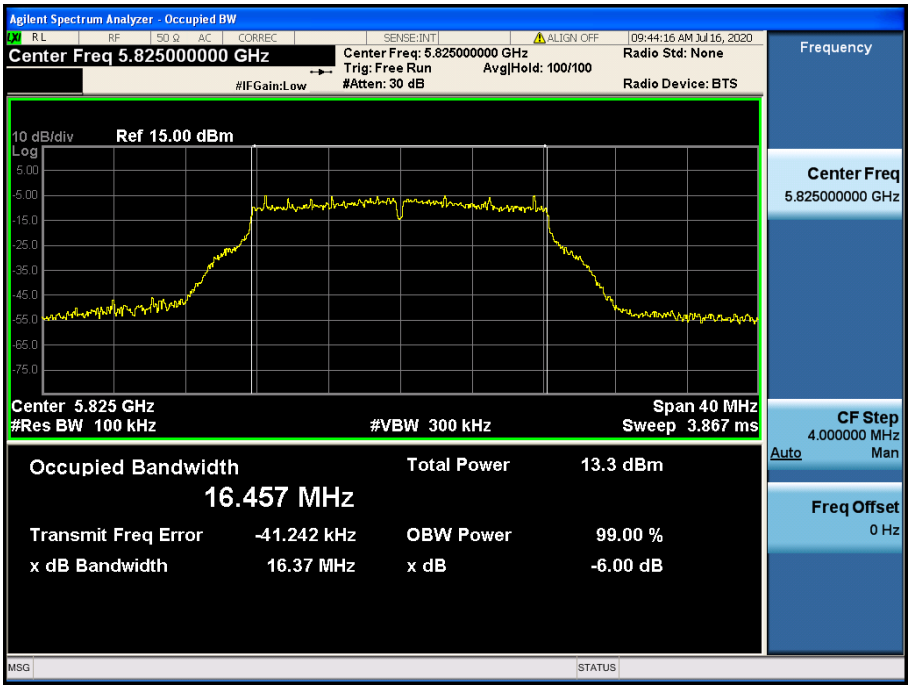
6 dB Bandwidth

Test Mode: 802.11a & Ch.157

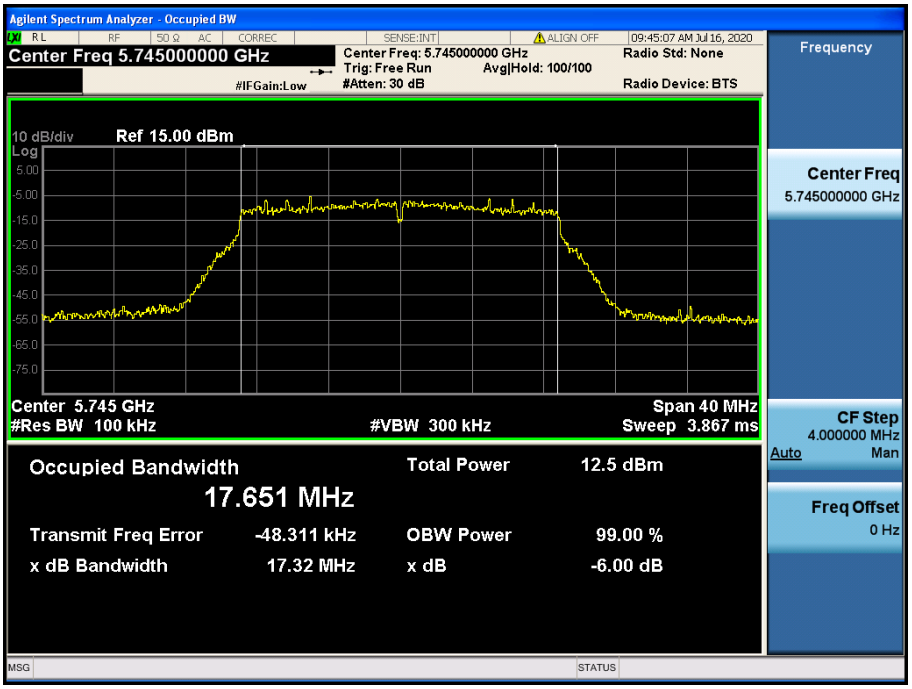


6 dB Bandwidth

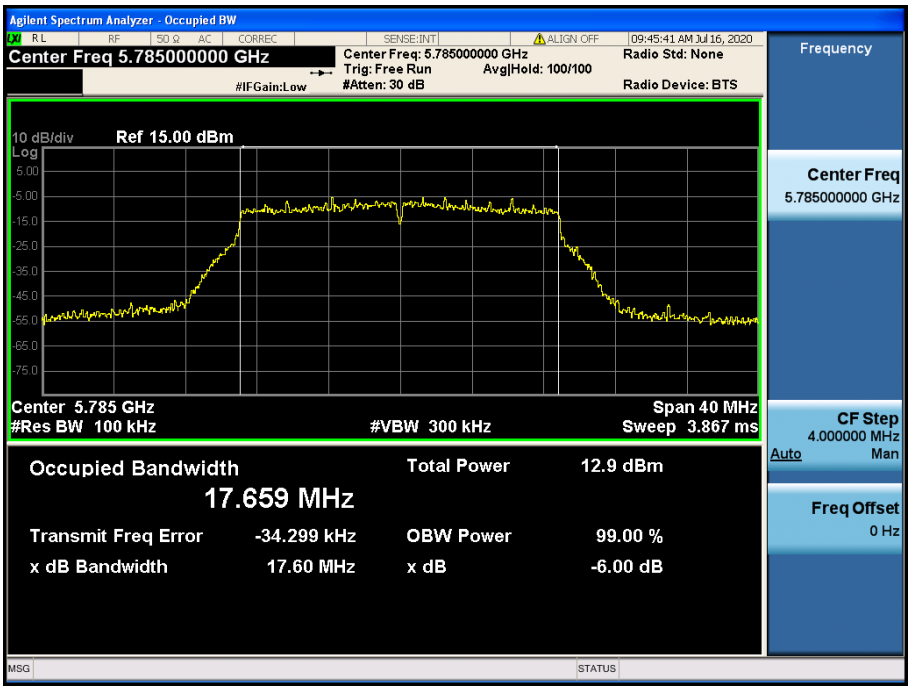
Test Mode: 802.11a & Ch.165



6 dB Bandwidth Test Mode: 802.11n HT20 & Ch.149

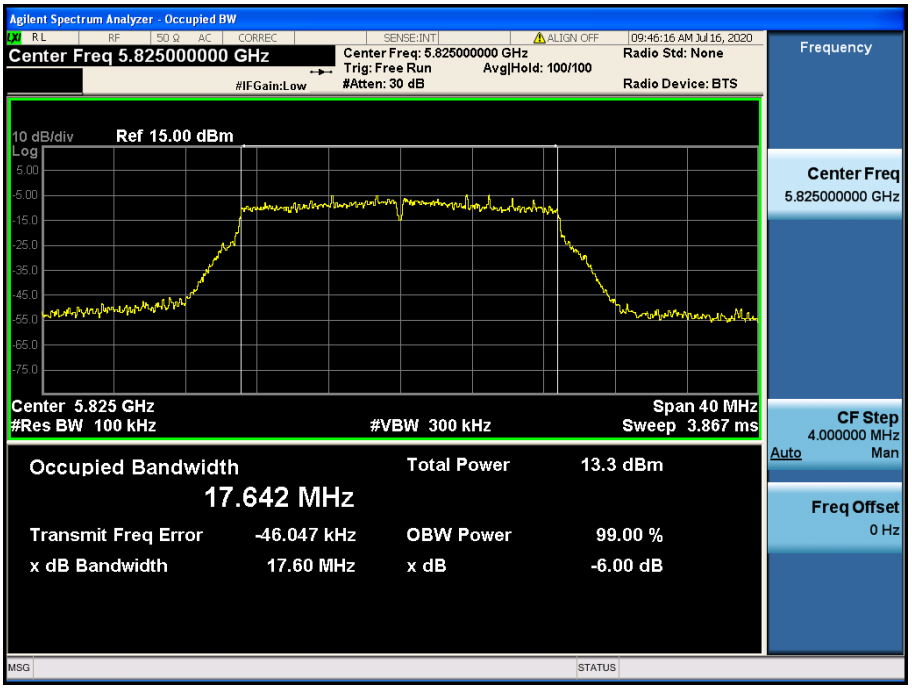


6 dB Bandwidth Test Mode: 802.11n HT20 & Ch.157

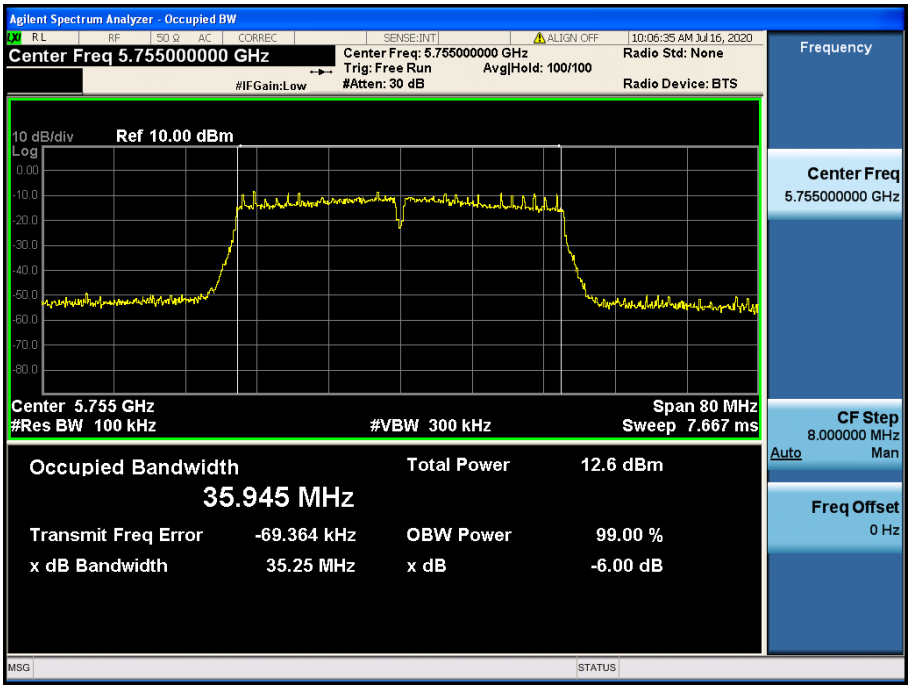


6 dB Bandwidth

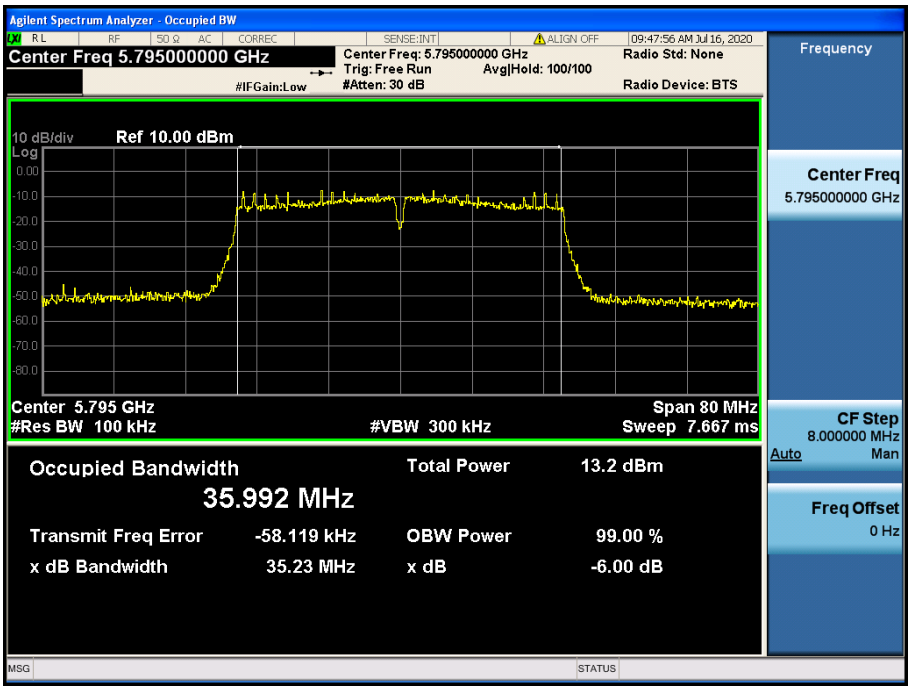
Test Mode: 802.11n HT20 & Ch.165



6 dB Bandwidth Test Mode: 802.11n HT40 & Ch.151

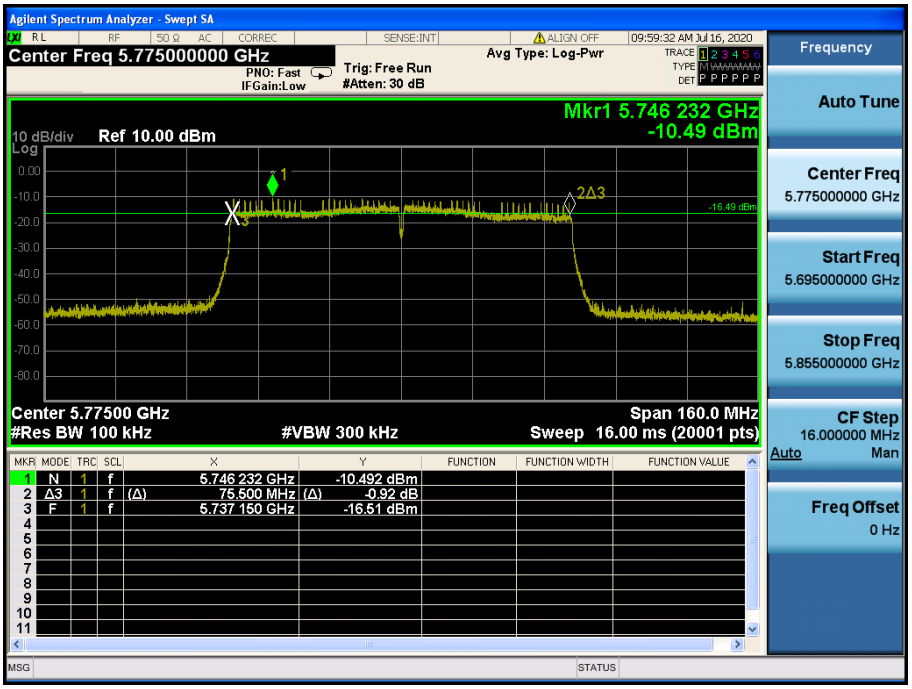


6 dB Bandwidth Test Mode: 802.11n HT40 & Ch.159



6 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.155



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.

- Output power Limit Calculation

Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
U-NII 1	250	23.97	0.59	**23.97**

Band	Power Limit [mW] / Least 26 dBc BW [MHz]	Calculated Limit [dBm]	Antenna Gain (Worst case) [dBi]	Determined Limit [dBm]
U-NII 2A	250	23.97	2.00	**23.97**
	20.76	24.17		
U-NII 2C	250	23.97	4.58	**23.97**
	20.81	24.18		

Band	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain [dBi]	Determined Limit [dBm]
U-NII 3	1000	30.00	4.19	**30.00**

▣ 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]
802.11a	36	5 180	8.18
	40	5 200	8.26
	48	5 240	7.98
	52	5 260	8.11
	60	5 300	7.42
	64	5 320	7.55
	100	5 500	6.09
	116	5 580	6.08
	144	5 720	6.41
	149	5 745	6.61
	157	5 785	6.50
	165	5 825	6.59

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]
802.11n(HT20)	36	5 180	8.26
	40	5 200	8.03
	48	5 240	7.73
	52	5 260	7.88
	60	5 300	7.62
	64	5 320	7.76
	100	5 500	6.28
	116	5 580	6.20
	144	5 720	6.01
	149	5 745	6.12
	157	5 785	6.68
	165	5 825	6.81

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]
802.11ac(VHT20)	36	5 180	8.23
	40	5 200	7.96
	48	5 240	8.19
	52	5 260	7.86
	60	5 300	7.52
	64	5 320	7.63
	100	5 500	6.25
	116	5 580	6.27
	144	5 720	6.04
	149	5 745	6.19
	157	5 785	6.67
	165	5 825	6.69

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]
802.11n(HT40)	38	5 190	3.49
	46	5 230	3.56
	54	5 270	7.71
	62	5 310	7.01
	102	5 510	6.17
	110	5 550	6.36
	142	5 710	5.58
	151	5 755	6.15
	159	5 795	5.98

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]
802.11ac(VHT40)	38	5 190	3.45
	46	5 230	3.75
	54	5 270	7.41
	62	5 310	7.13
	102	5 510	5.93
	110	5 550	6.40
	142	5 710	6.34
	151	5 755	6.19
	159	5 795	6.13

Mode	CH	Freq.[MHz]	Conducted Output Power[dBm]
802.11ac(VHT80)	42	5 210	3.58
	58	5 290	6.43
	106	5 530	6.24
	138	5 690	5.87
	155	5 775	6.03

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) [dBi]	Determined Limit [dBm]
U-NII 1	11	0.59	11
U-NII 2A	11	2.00	11
U-NII 2C	11	4.58	11
U-NII 3	30	4.19	30

▣ 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**

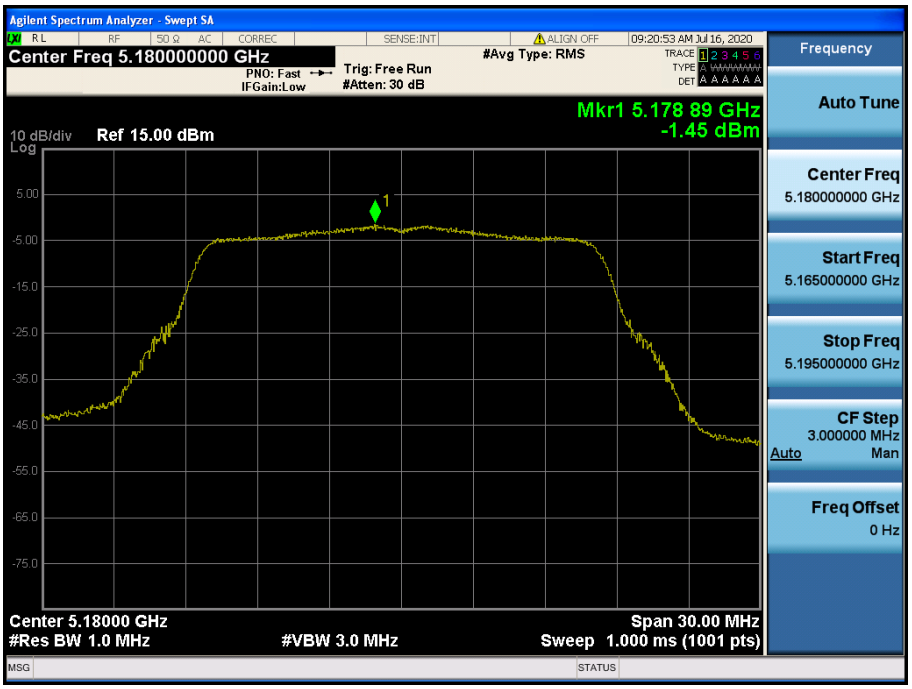
Mode	Channel	Frequency [MHz]	Reading [dBm]	T.F Note 1 [dB]	Power Spectral Density[dBm]	Limit [dBm]
802.11a	36	5 180	-1.45	0.29	-1.16	11.00
	40	5 200	-1.91		-1.62	11.00
	48	5 240	-1.79		-1.50	11.00
	52	5 260	-2.02		-1.73	11.00
	60	5 300	-2.40		-2.11	11.00
	64	5 320	-2.33		-2.04	11.00
	100	5 500	-3.71		-3.42	11.00
	116	5 580	-4.16		-3.87	11.00
	144	5 720	-3.66		-3.37	11.00
	149	5 745	-12.21	7.28	-4.93	30.00
	157	5 785	-12.33		-5.05	30.00
	165	5 825	-12.22		-4.94	30.00
802.11n (HT20)	36	5 180	-2.11	0.31	-1.80	11.00
	40	5 200	-2.27		-1.96	11.00
	48	5 240	-2.75		-2.44	11.00
	52	5 260	-2.27		-1.96	11.00
	60	5 300	-2.63		-2.32	11.00
	64	5 320	-2.65		-2.34	11.00
	100	5 500	-3.91		-3.60	11.00
	116	5 580	-4.46		-4.15	11.00
	144	5 720	-3.85		-3.54	11.00
	149	5 745	-12.94	7.30	-5.64	30.00
	157	5 785	-12.49		-5.19	30.00
	165	5 825	-12.41		-5.11	30.00
802.11n (HT40)	38	5 190	-9.70	0.61	-9.09	11.00
	46	5 230	-9.91		-9.30	11.00
	54	5 270	-5.52		-4.91	11.00
	62	5 310	-6.34		-5.73	11.00
	102	5 510	-6.48		-5.87	11.00
	110	5 550	-7.49		-6.88	11.00
	142	5 710	-7.05		-6.44	11.00
	151	5 755	-16.27	7.60	-8.67	30.00
	159	5 795	-15.96		-8.36	30.00
802.11ac (VHT80)	42	5 210	-13.82	1.15	-12.67	11.00
	58	5 290	-10.20		-9.05	11.00
	106	5 530	-10.37		-9.22	11.00
	138	5 690	-10.82		-9.67	11.00
	155	5 775	-19.71	8.14	-11.57	30.00

Note 1: "U-NII 1, 2A, 2C [T.F] = DCCF"
"U-NII 3 [T.F] = 10*LOG(500 kHz / 100 kHz) + DCCF"
For DCCF(Duty Cycle Correction Factor) please refer to appendix II.
Note 2: Test Result = Measurement Data + T.F

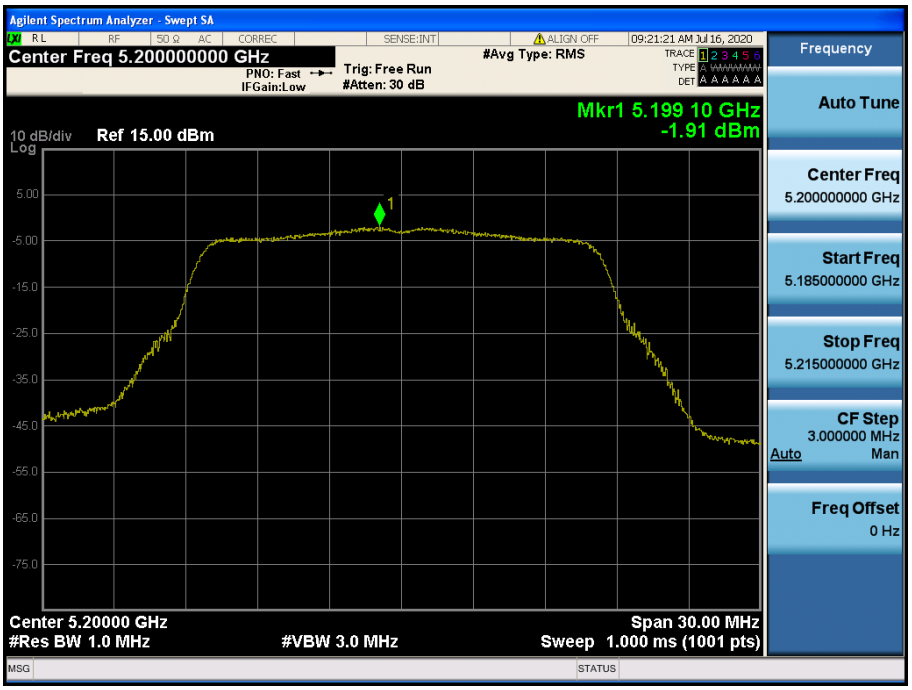
▣ RESULT PLOTS

- Power spectral density

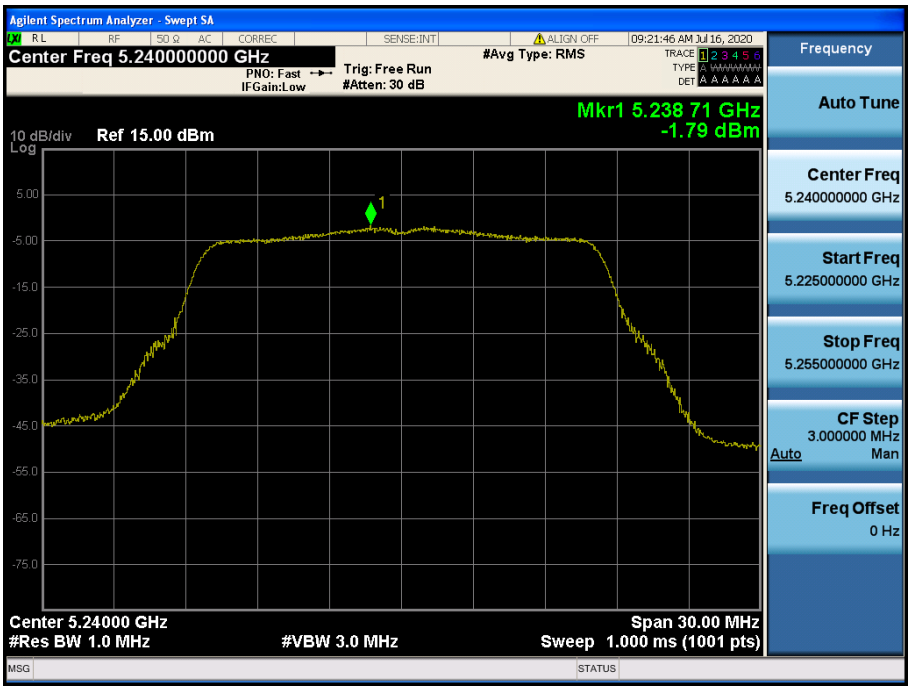
Maximum Power Spectral Density Test Mode: 802.11a & Ch.36



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

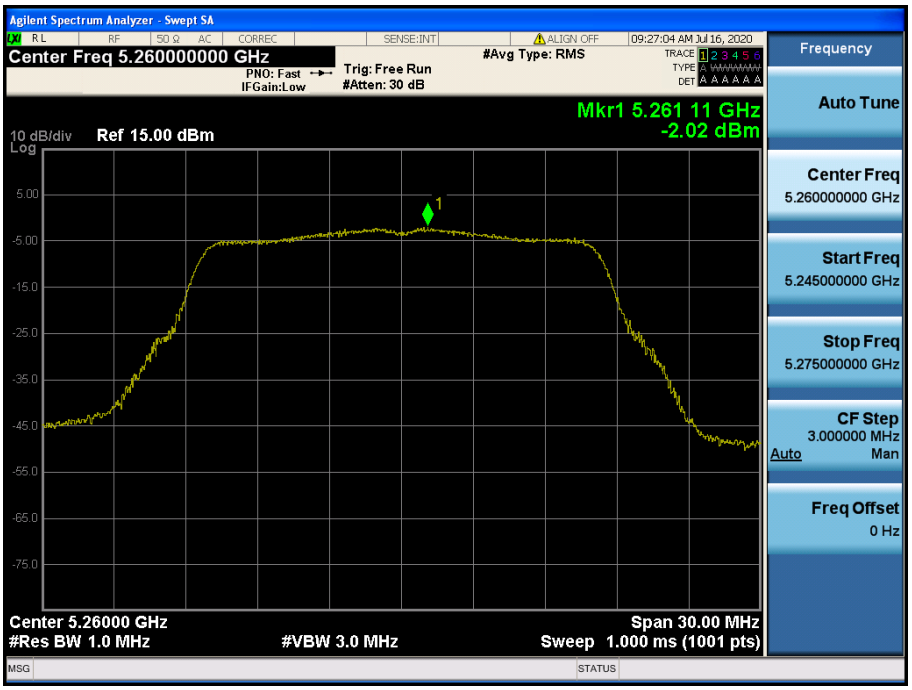


Maximum Power Spectral Density Test Mode: 802.11a & Ch.48



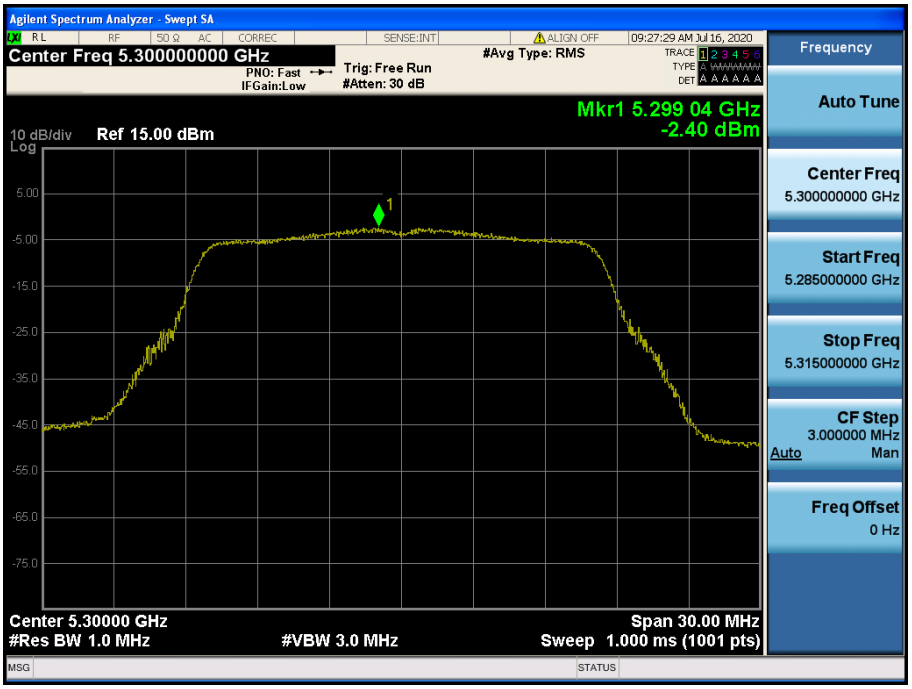
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.52

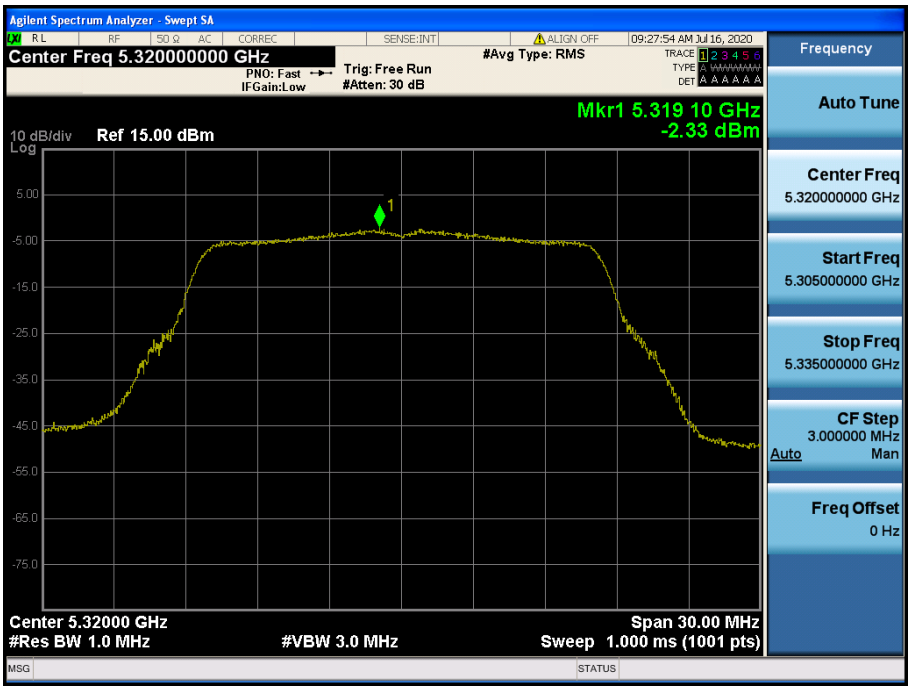


Maximum Power Spectral Density

Test Mode: 802.11a & Ch.60

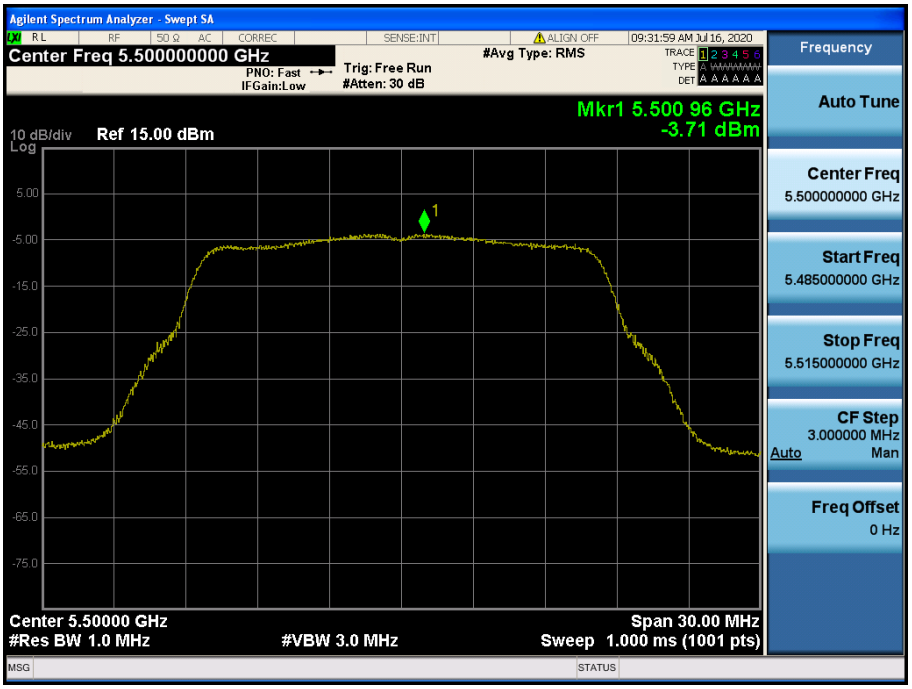


Maximum Power Spectral Density Test Mode: 802.11a & Ch.64



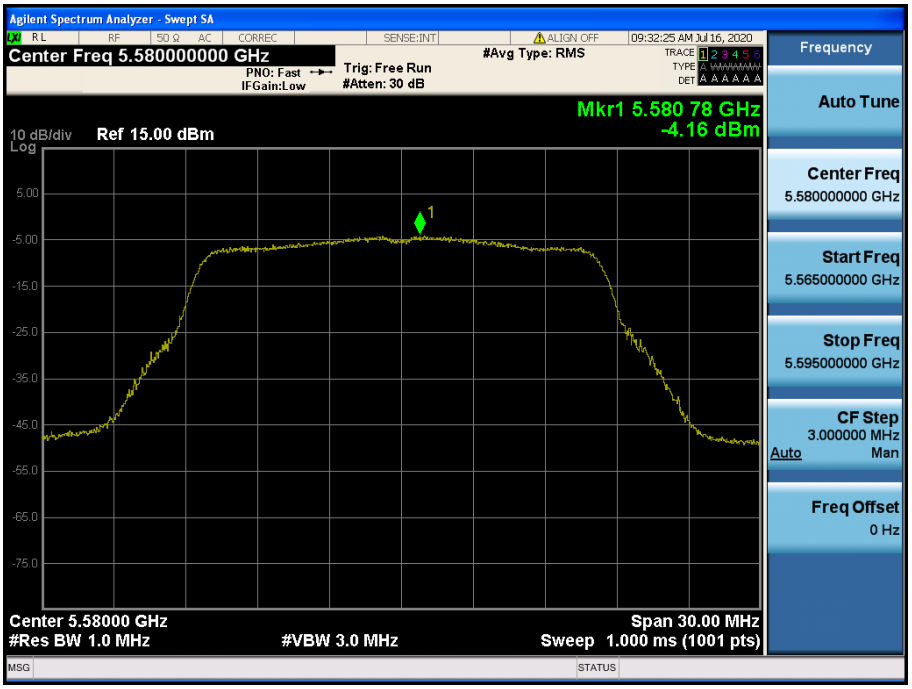
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.100

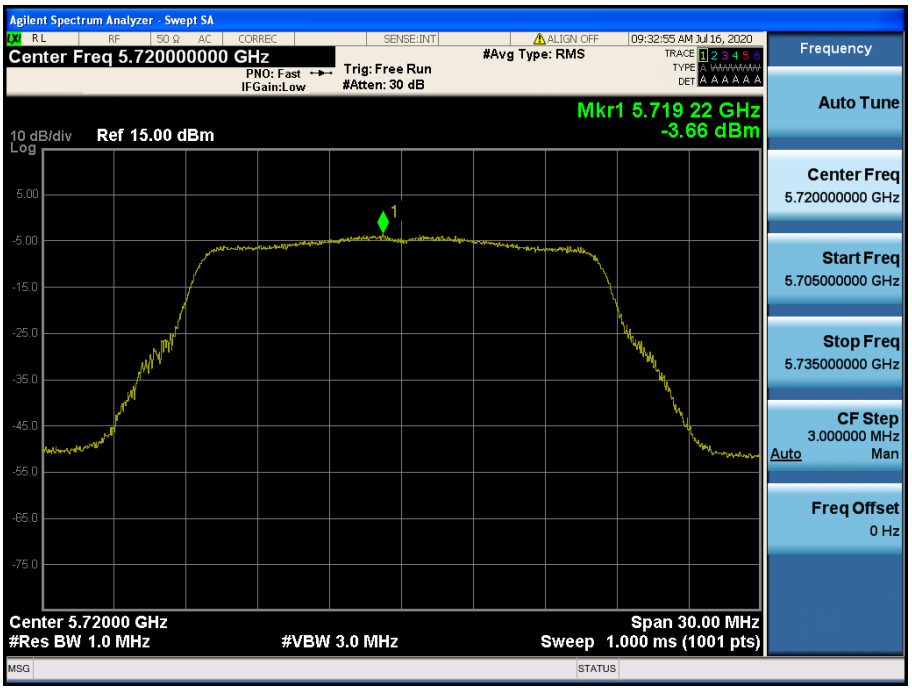


Maximum Power Spectral Density

Test Mode: 802.11a & Ch.116

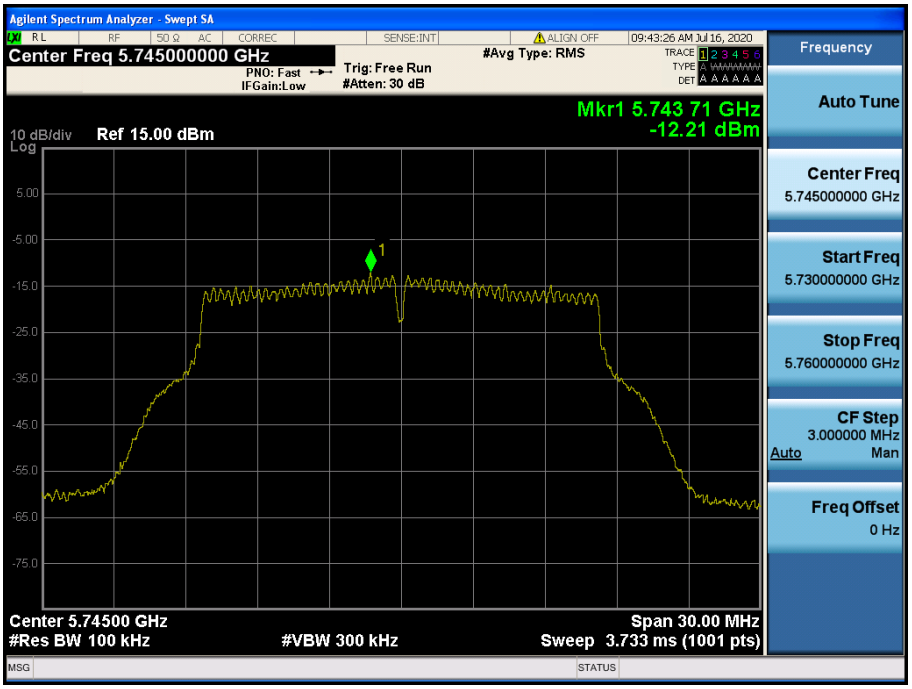


Maximum Power Spectral Density Test Mode: 802.11a & Ch.144



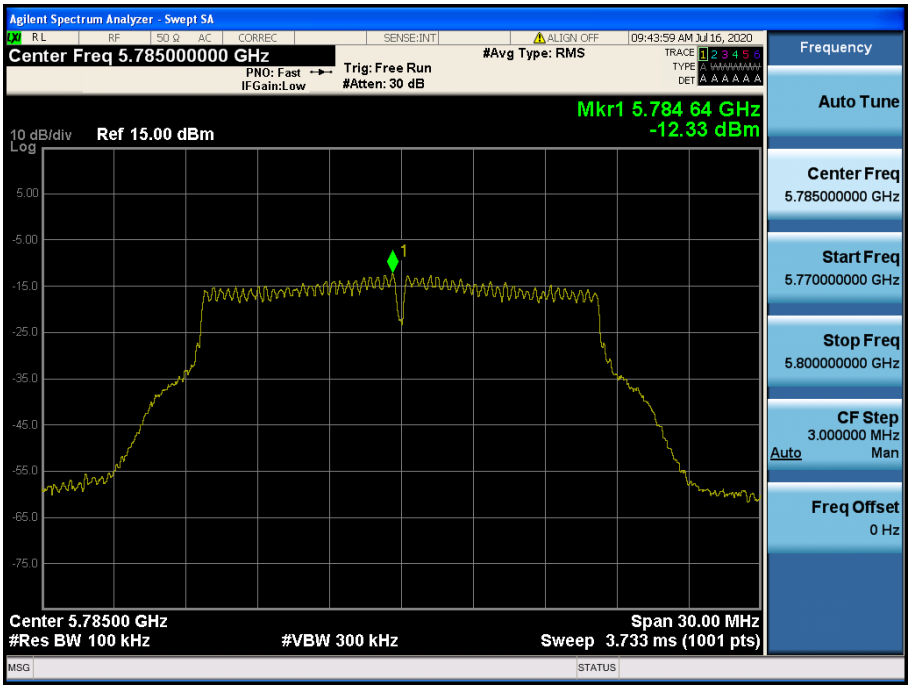
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.149

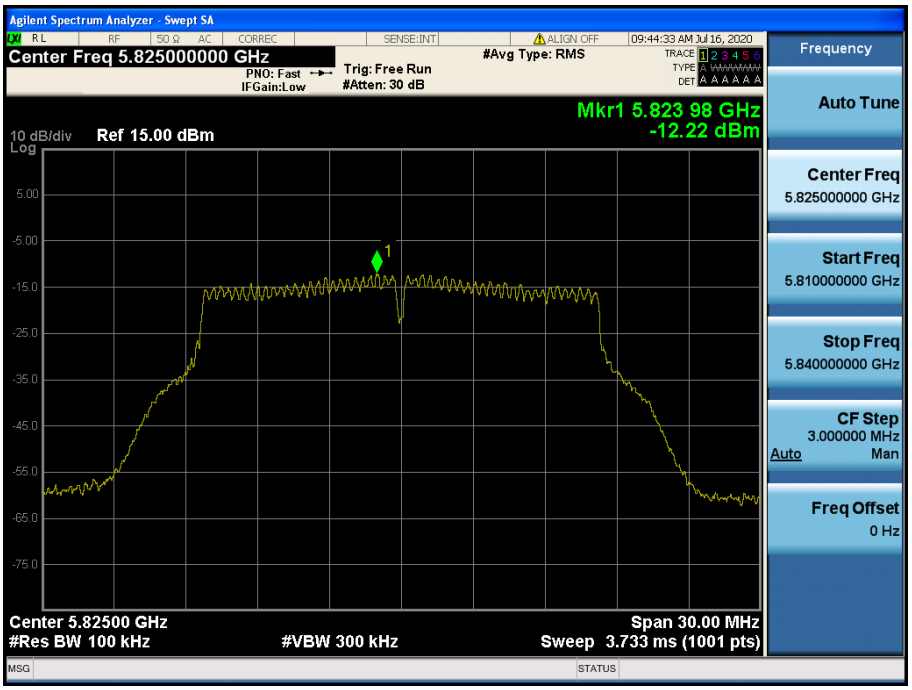


Maximum Power Spectral Density

Test Mode: 802.11a & Ch.157

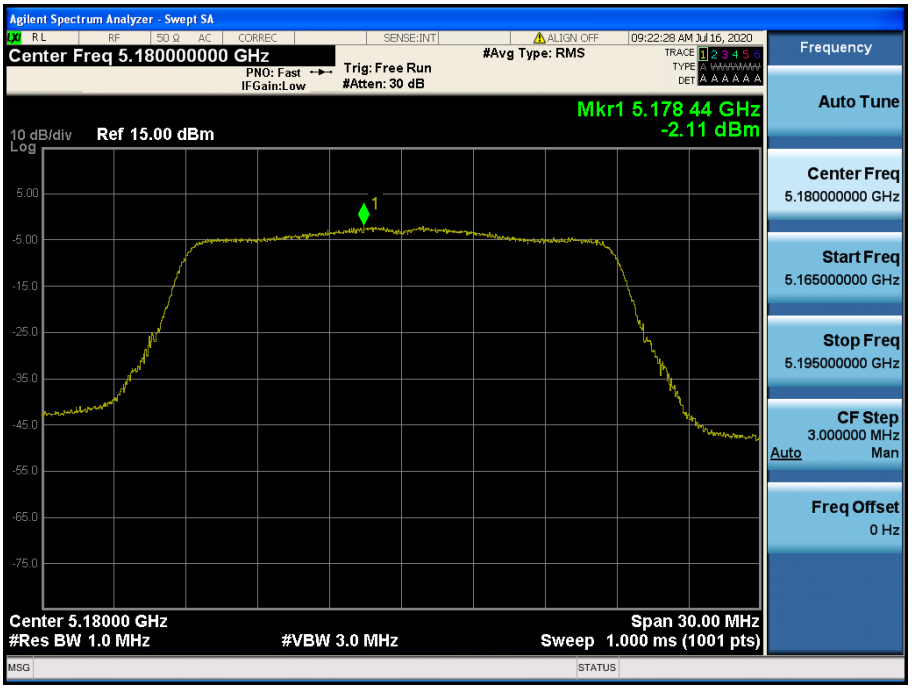


Maximum Power Spectral Density Test Mode: 802.11a & Ch.165



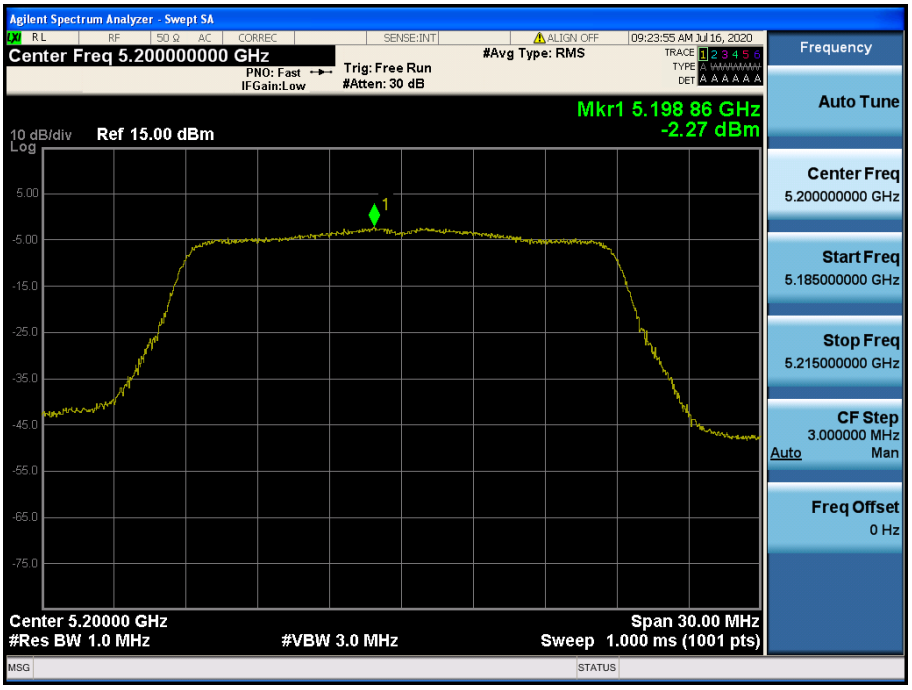
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.36

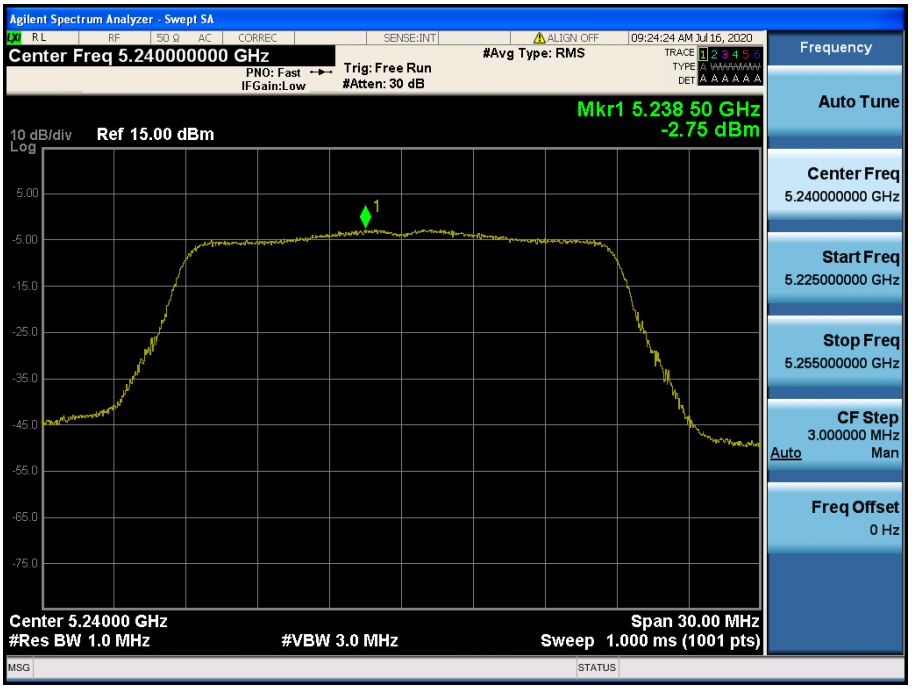


Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.40

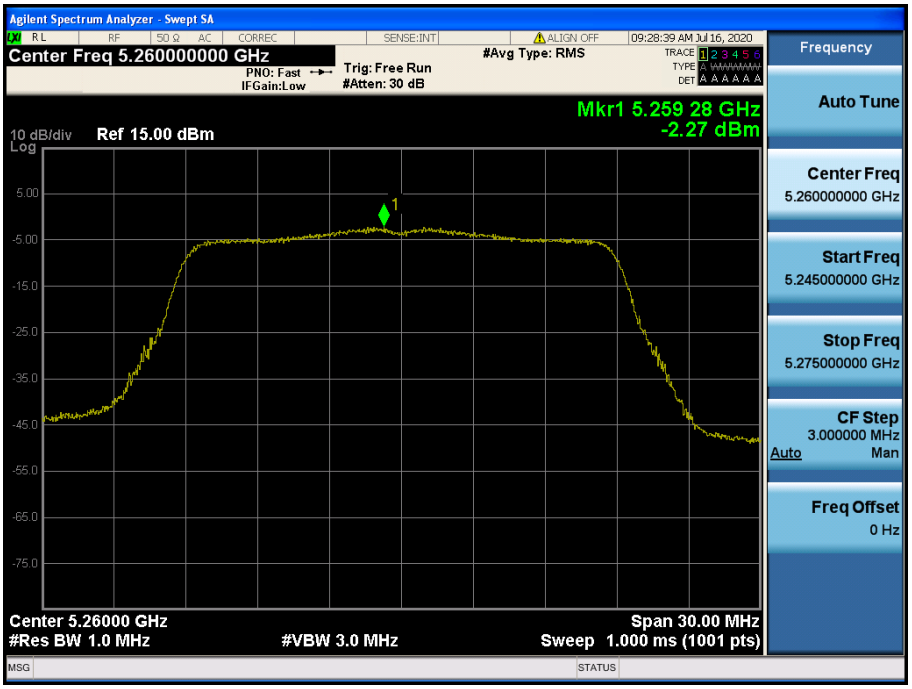


Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.48



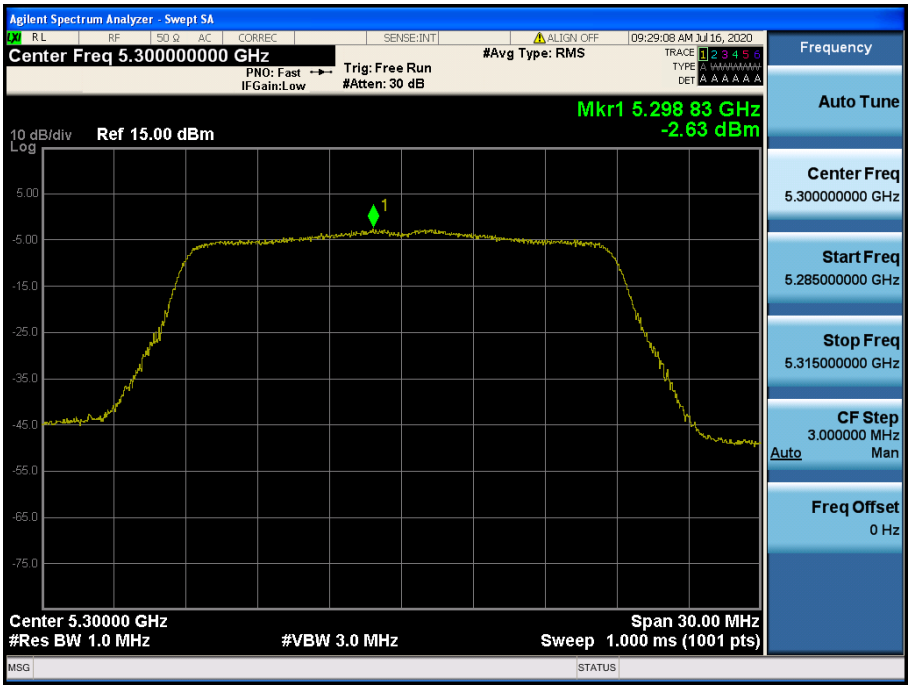
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.52

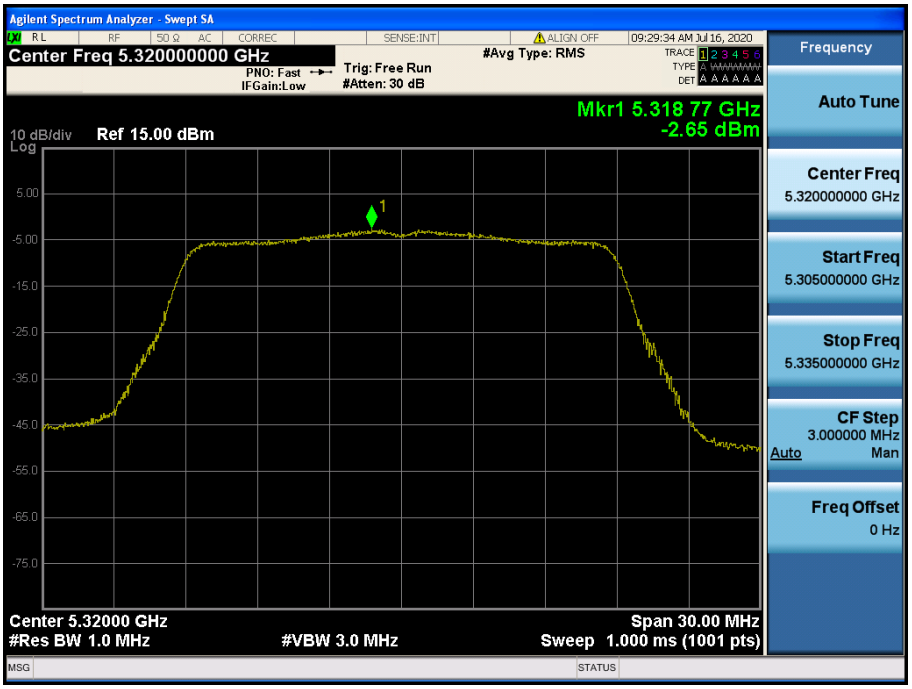


Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.60

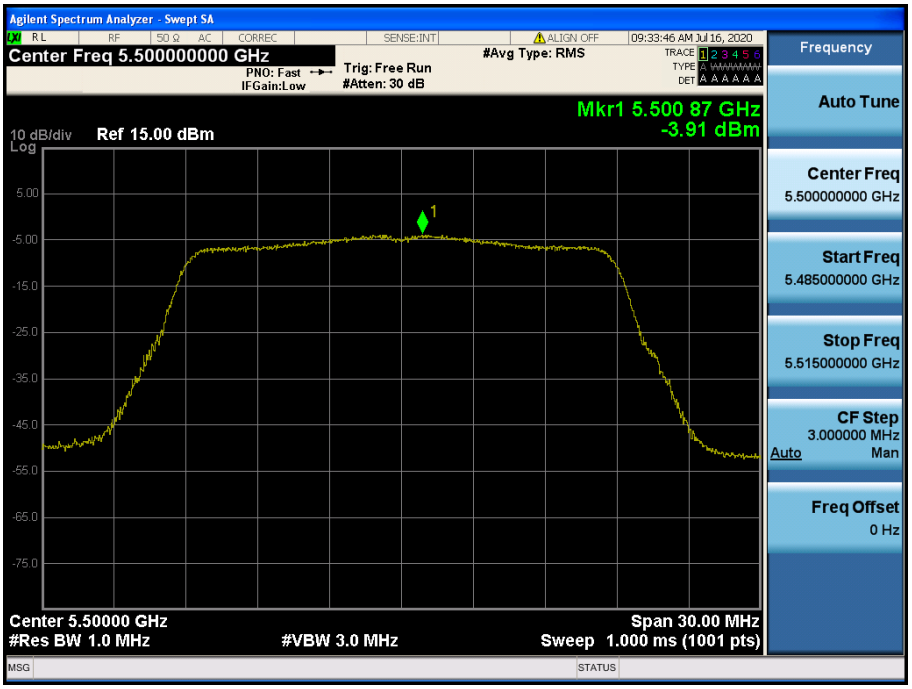


Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.64



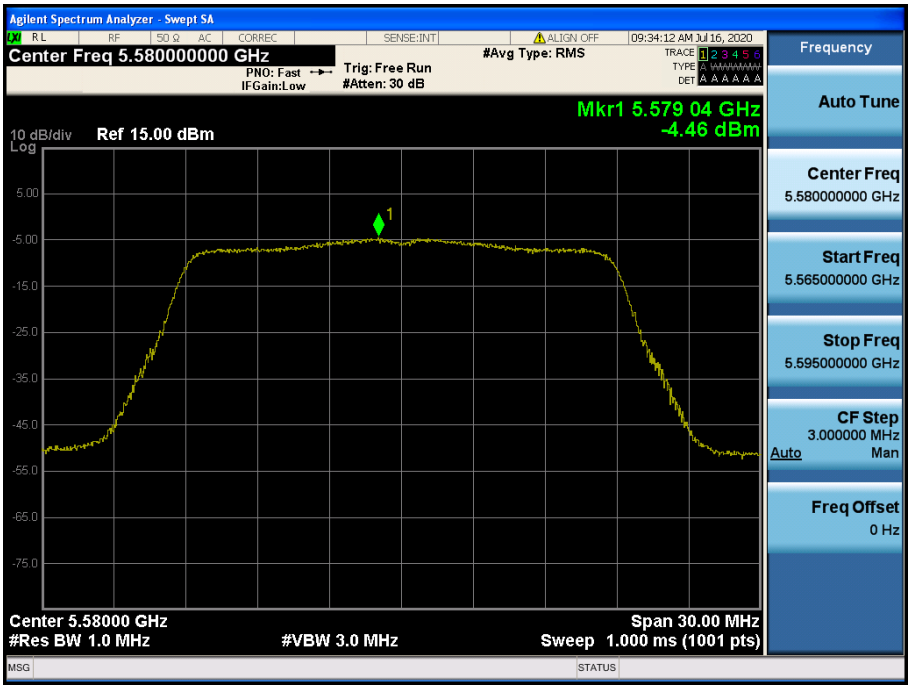
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.100



Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.116



Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.144