TEST REPORT

DT&C Co., Ltd. 42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664	Report No : DRTFCC1512-0259 Pages:(1) / (147) page	Dt&C

1. Customer

   • Name : BLUEBIRD INC.

   • Address : (Dogok-dong, SEI Tower 13,14) 39, Eonjuro30-gil, Gangnam-gu, Seoul, South Korea

2. Use of Report : FCC Original Grant

3. Product Name (FCC ID): Enterprise Handheld Computer (SS4EF400)

4. Date of Test : 2015-10-26 ~ 2015-11-19

5. Test Method Used : FCC Part 15.407 Subpart E

6. Testing Environment : See appended test report

7. Test Result : ☒ Pass ☐ Fail

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

Affirmation	Tested by Name : Hoonpyo Lee (Signature)	Technical Manager Name : WonJung Lee (Signature)

2015 . 12 . 15 .

DT&C Co., Ltd.

Test Report Version

Test Report No.	Date	Description
DRTFCC1512-0259	Dec. 15, 2015	Initial issue

CONTENTS

1. EUT Description

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	Enterprise Handheld Computer
Model Name	EF400
Add Model Name	NA
Hardware version	Rev0.2
Software version	R1.03
Power Supply	DC 3.8 V
Frequency Range	**U-NII 1(5150 ~ 5250MHz)** ▪ 802.11a/n(HT20): 5180 ~ 5240 MHz ▪ 802.11n(HT40): 5190 ~ 5230 MHz **U-NII 2(5250 ~ 5350MHz)** ▪ 802.11a/n(HT20): 5260 ~ 5320 MHz ▪ 802.11n(HT40): 5270 ~ 5310 MHz **U-NII 3(5470 ~ 5725MHz)** ▪ 802.11a/n(HT20): 5500 ~ 5700 MHz ▪ 802.11n(HT40): 5510 ~ 5670 MHz **U-NII 4(5725 ~ 5850MHz)** ▪ 802.11a/n(HT20): 5745 ~ 5825 MHz ▪ 802.11n(HT40): 5755 ~ 5795 MHz
Max. RF Output Power	**U-NII 1** ▪ 802.11a: 11.38 dBm ▪ 802.11n(HT20): 11.45 dBm ▪ 802.11n(HT40): 11.43 dBm **U-NII 2** ▪ 802.11a: 10.73 dBm ▪ 802.11n(HT20): 10.87 dBm ▪ 802.11n(HT40): 11.10 dBm **U-NII 3** ▪ 802.11a: 10.66 dBm ▪ 802.11n(HT20): 10.81 dBm ▪ 802.11n(HT40): 10.77 dBm **U-NII 4** ▪ 802.11a: 10.19 dBm ▪ 802.11n(HT20): 10.29 dBm ▪ 802.11n(HT40): 10.37 dBm
Modulation type	64-QAM, 16QAM, QPSK BPSK for OFDM
Antenna Specification	**Antenna type** : Internal Antenna **Antenna gain** ▪ U-NII 1 : -0.617 dBi ▪ U-NII 2 : -0.229 dBi ▪ U-NII 3 : 0.325 dBi ▪ U-NII 4 : -0.873 dBi

2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate
U-NII 1	802.11a	48 Mbps
	802.11n(HT20)	MCS 6
	802.11n(HT40)	MCS 6
U-NII 2	802.11a	48 Mbps
	802.11n(HT20)	MCS 6
	802.11n(HT40)	MCS 6
U-NII 3	802.11a	48 Mbps
	802.11n(HT20)	MCS 6
	802.11n(HT40)	MCS 6
U-NII 4	802.11a	48 Mbps
	802.11n(HT20)	MCS 6
	802.11n(HT40)	MCS 6

Note 1: The worst case data rate is determined as above test mode according to the power measurements. And all test items were performed at the worst case data rate.

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20)		802.11n(HT40)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 1	36	5180	38	5190
	40	5200	-	-
	48	5240	46	5230
U-NII 2	52	5260	54	5270
	60	5300	-	-
	64	5320	62	5310
U-NII 3	100	5500	102	5510
	116	5580	110	5550
	140	5700	134	5670
U-NII 4	149	5745	151	5755
	157	5785	-	-
	165	5825	159	5795

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.4 Tested environment

Temperature	:	21 ºC ~ 24 ºC
Relative humidity content	:	41 % ~ 44 % R.H.
Details of power supply	:	DC 3.8 V

2.5 EMI Suppression Device(s) / Modifications

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

3. Summary of Tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)				
15.407(a)	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(e)	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5725 ~ 5850 MHz		C
15.407(a)	Maximum Conducted Output Power	5150 ~ 5250 MHz : < 30 dBm or < 23.97 dBm 5250 ~ 5350 MHz & 5470 ~ 5725 MHz : 250 mW or < 11 + 10 $\log_{10}$(B) dBm, whichever power is less. 5725 ~ 5850 MHz : < 30 dBm		C Note 3
15.407(a)	Peak Power Spectral Density	5150 ~ 5250 MHz : 11 dBm/MHz or 17 dBm/MHz 5250 ~ 5350 MHz & 5470 ~ 5725 MHz: 11 dBm/MHz 5725 ~ 5850 MHz: 30 dBm/500kHz		C Note 4
15.407(g)	Frequency Stability	N/A		C
15.407(b)	Undesirable Emissions	5150 ~ 5725 MHz: < -27 dBm/MHz EIRP 5725 ~ 5850 MHz: < -17 dBm/MHz EIRP or < -27 dBm/MHz EIRP	Radiated	C Note 5
15.205 15.209 15.407(b)	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note 6
15.407(h)	Dynamic Frequency Selection	FCC 15.407(h)	Conducted	C Note 7
15.207	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

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

Note 2: The test items were performed according to the KDB789033 D02 V01 and ANSI C63.10-2013

Note 3: (i) For access point operating in the band 5.15 - 5.25 GHz: < 30 dBm
(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 23.97 dBm

Note 4: (i) For access point operating in the band 5.15 - 5.25 GHz: < 17 dBm/MHz
(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 11 dBm/MHz

Note 5: For transmitters operating in the 5.725 - 5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz

Note 6: These test items were performed in each axis and the worst case data was reported.

Note 7: Refer to the DFS test report.

4. Test Methodology

Generally the tests were performed according to the KDB789033 D02 v01. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

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

4.2 EUT exercise

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

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02 v01. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

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

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02 v01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on KDB789033 D02 v01.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. 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

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 equipments, which is traceable to recognized national standards.

6. Facilities and Accreditations

6.1 Facilities

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

- Semi anechoic chamber registration Number : 165783

6.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, 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 internal antenna is attached on rear case using LDS method. (Refer to Internal Photo file.)

Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 Emission Bandwidth (26 dB Bandwidth)

▣ Test Requirements

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

▣ Test Configuration

Refer to the Appendix I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

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	5180	20.82
		40	5200	21.37
		48	5240	21.70
	U-NII 2	52	5260	20.96
		60	5300	20.96
		64	5320	21.12
	U-NII 3	100	5500	21.11
		116	5580	20.98
		140	5700	21.41
802.11n (HT20)	U-NII 1	36	5180	21.81
		40	5200	21.39
		48	5240	21.69
	U-NII 2	52	5260	21.21
		60	5300	22.00
		64	5320	21.47
	U-NII 3	100	5500	21.41
		116	5580	21.40
		140	5700	21.45
802.11n (HT40)	U-NII 1	38	5190	41.96
		46	5230	42.34
	U-NII 2	54	5270	42.32
		62	5310	42.26
	U-NII 3	102	5510	42.03
		110	5550	42.03
		134	5670	41.35

▣ 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

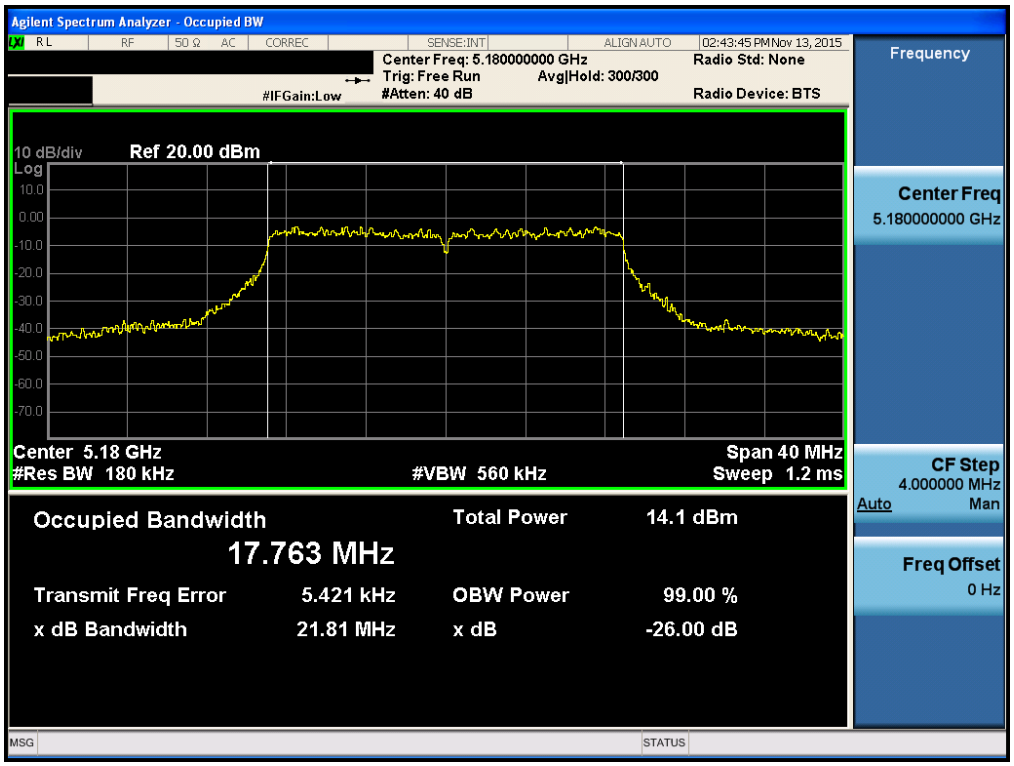
Test Mode: 802.11a & Ch.116

26 dB Bandwidth

Test Mode: 802.11a & Ch.140

26 dB Bandwidth

Test Mode: 802.11n(HT20) & Ch.36



26 dB Bandwidth

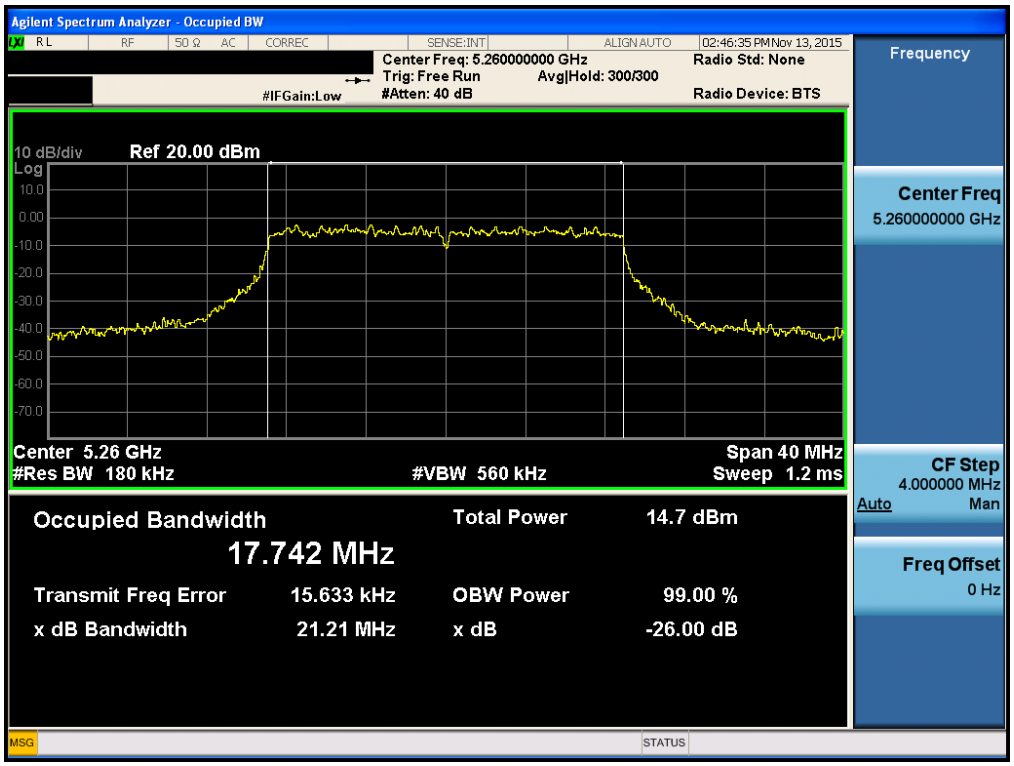
Test Mode: 802.11n(HT20) & Ch.40

26 dB Bandwidth

Test Mode: 802.11n(HT20) & Ch.48

26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.52

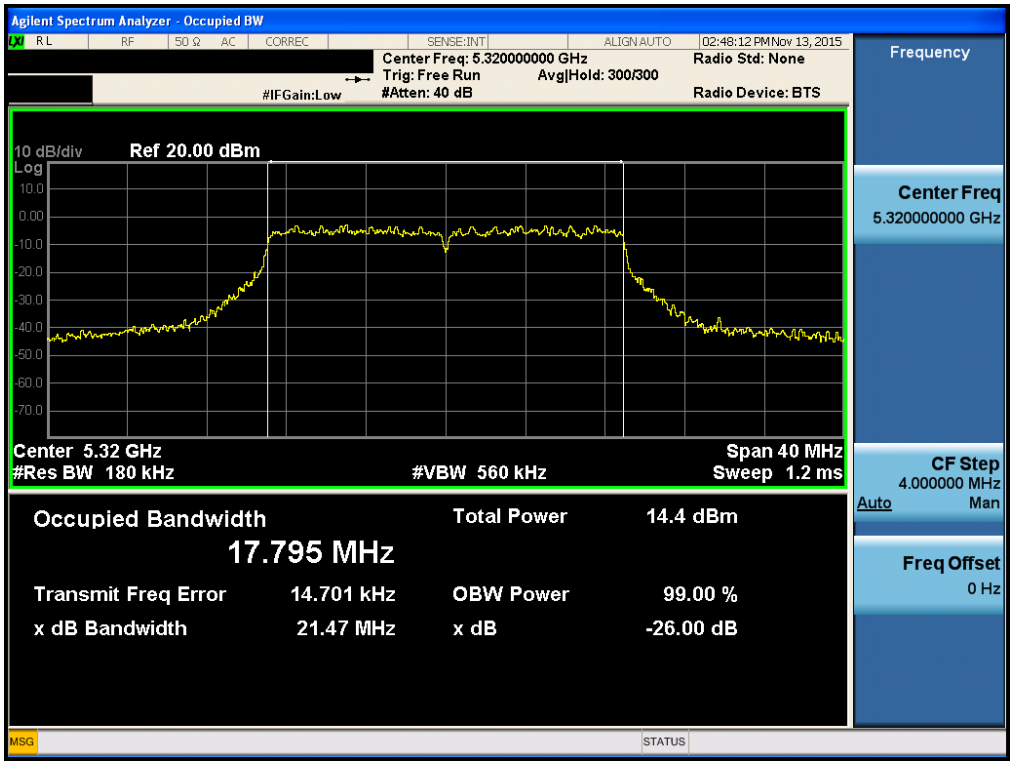


26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.60

26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.64

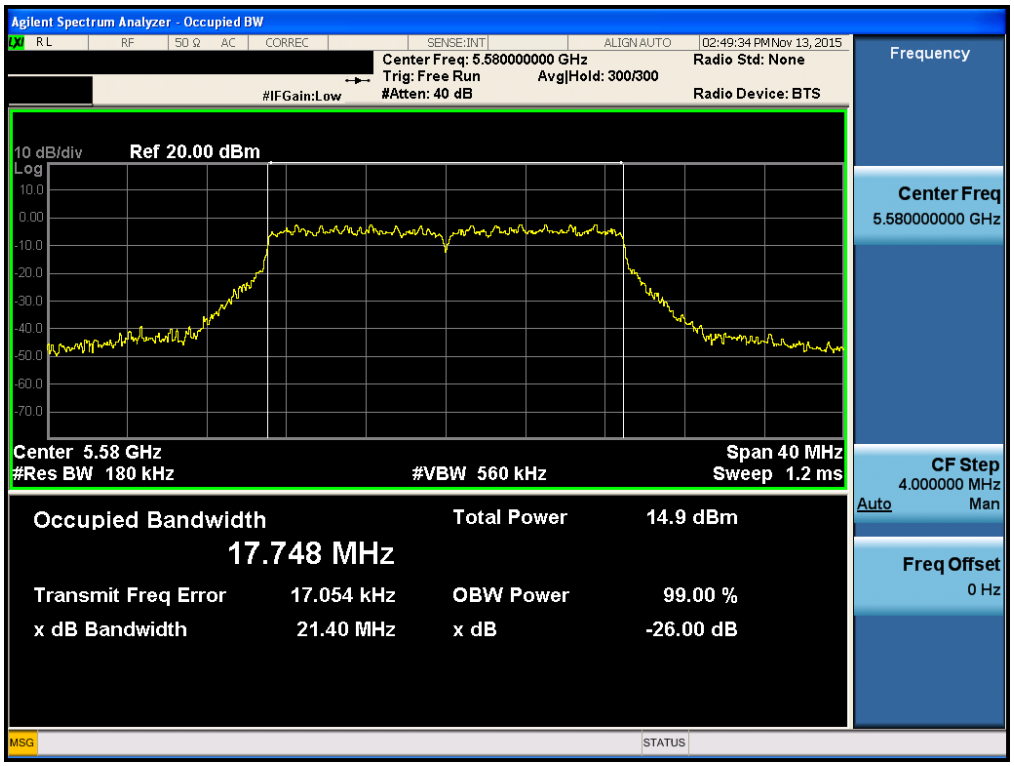


26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.100

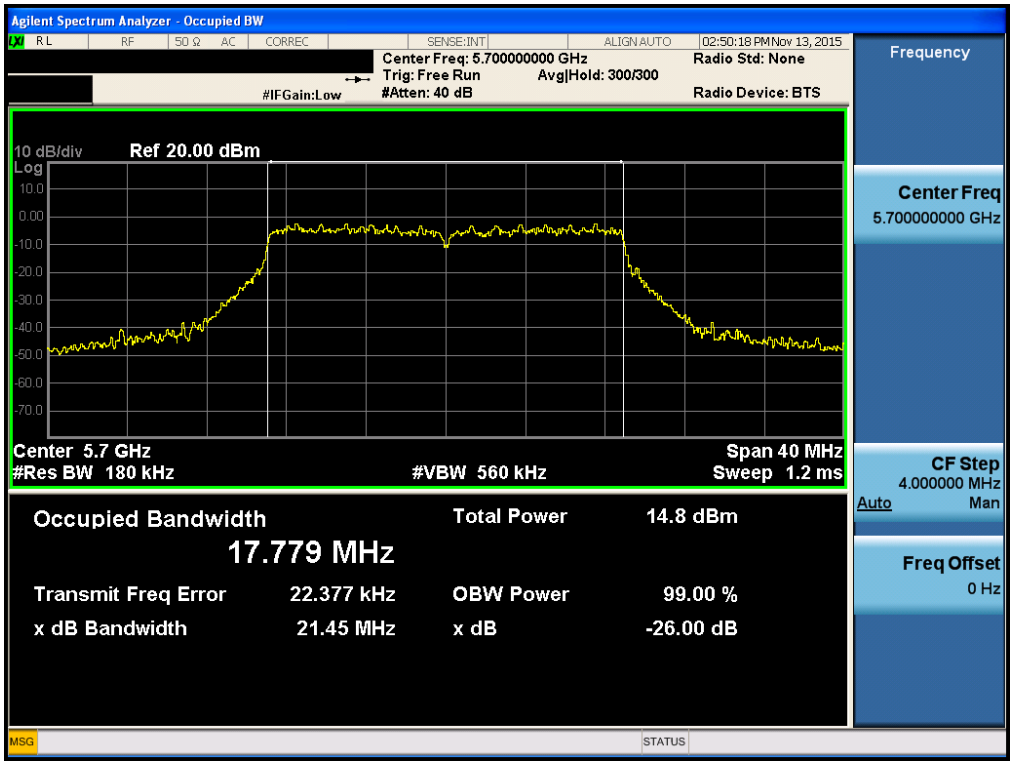
26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.116



26 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.140



26 dB Bandwidth

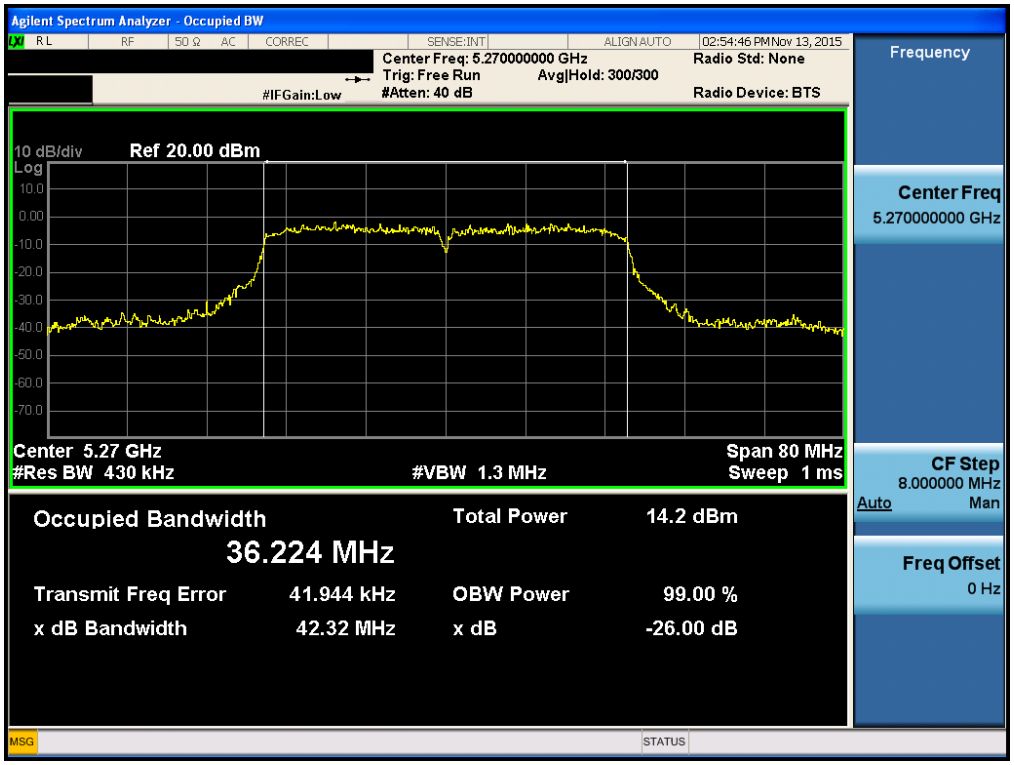
Test Mode: 802.11n HT40 & Ch.38

26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.46

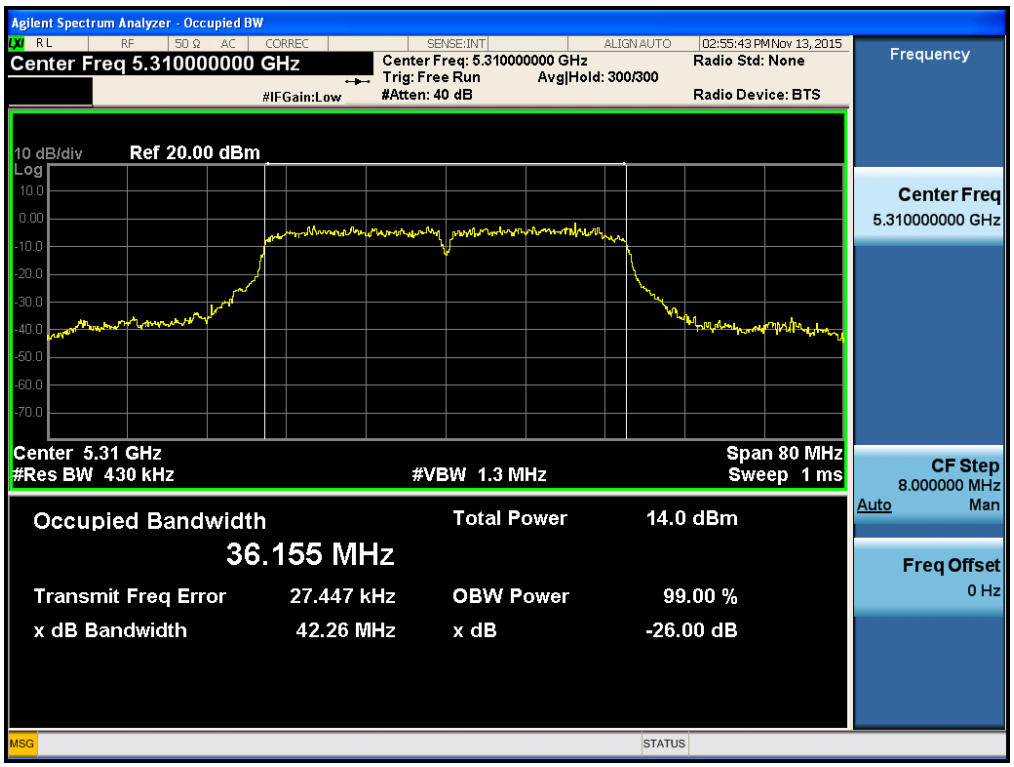
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.54



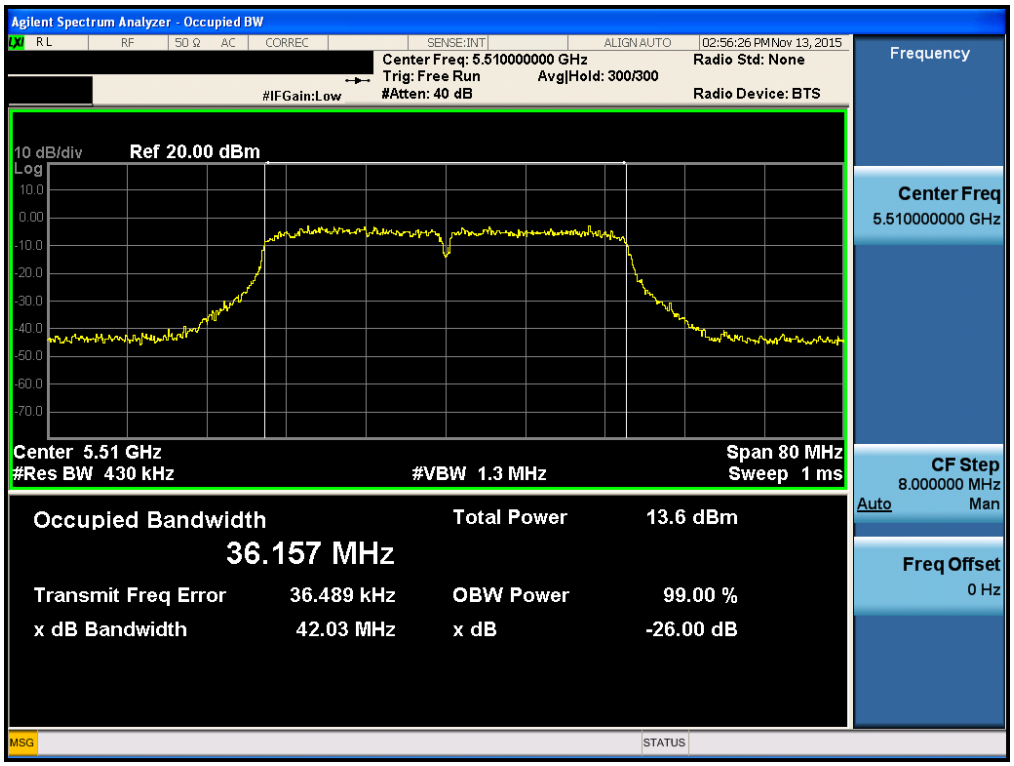
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.62



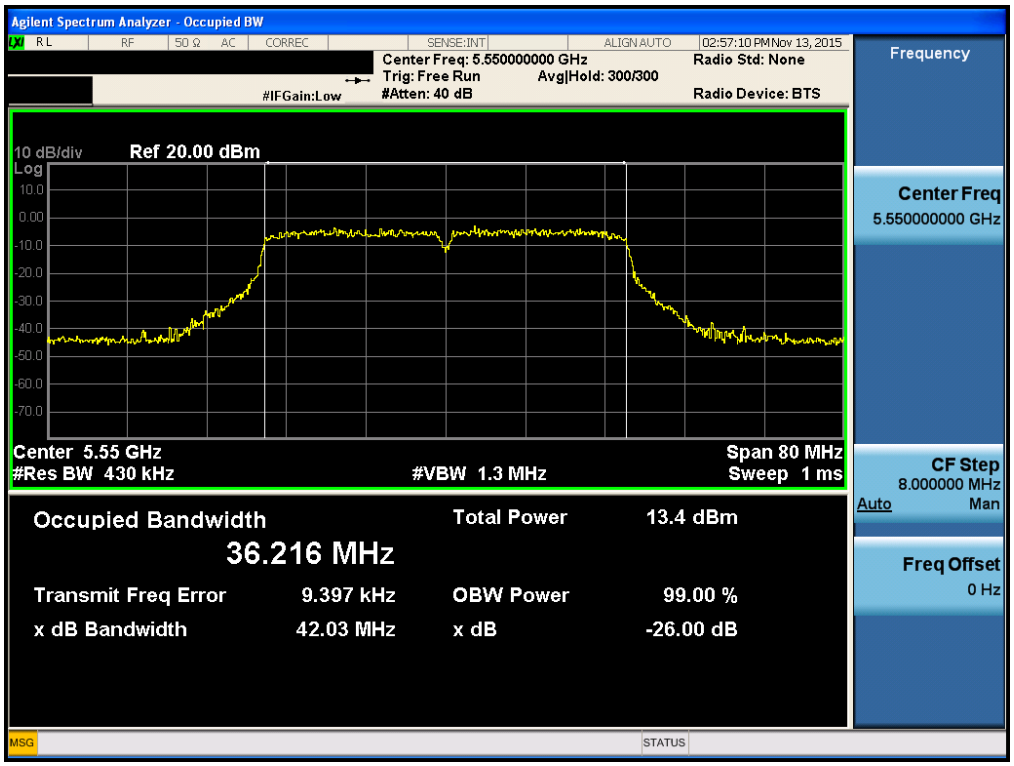
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.102



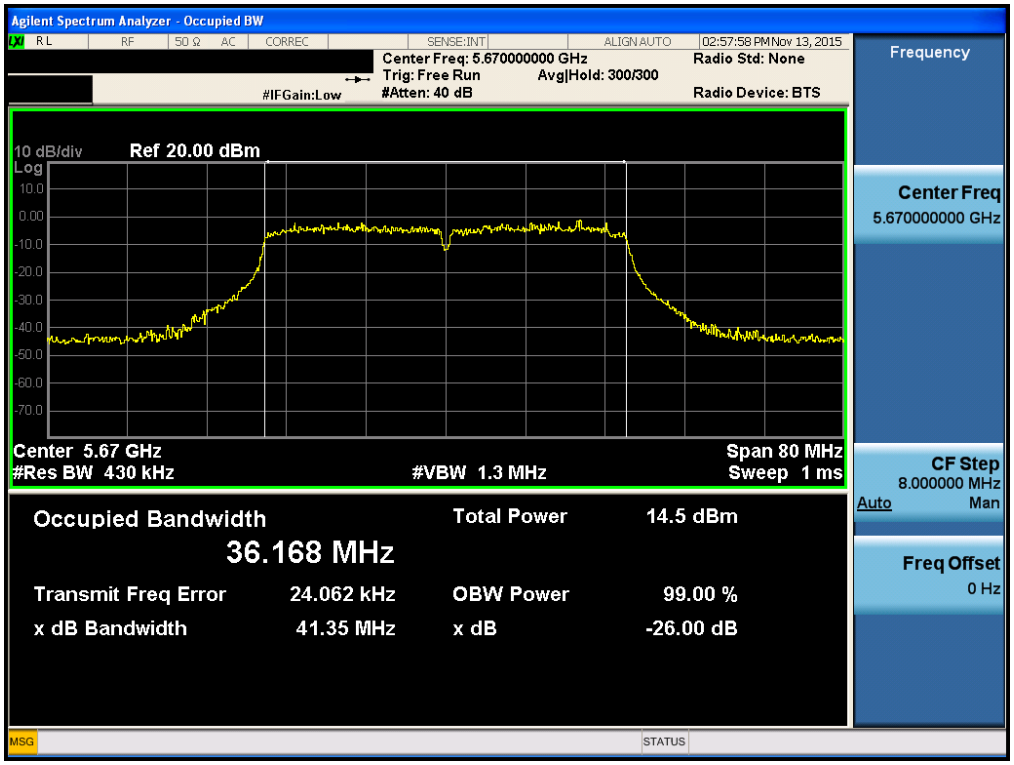
26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.110



26 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.134



8.2 Minimum Emission Bandwidth (6 dB Bandwidth)

▣ Test Requirements

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

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

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 4	149	5745	16.50
		157	5785	16.54
		165	5825	16.50
802.11n (HT20)	U-NII 4	149	5745	17.70
		157	5785	17.74
		165	5825	17.73
802.11n (HT40)	U-NII 4	151	5755	36.04
		159	5795	35.41

▣ RESULT PLOTS

6 dB Bandwidth

Test Mode: 802.11a & Ch.149

6 dB Bandwidth

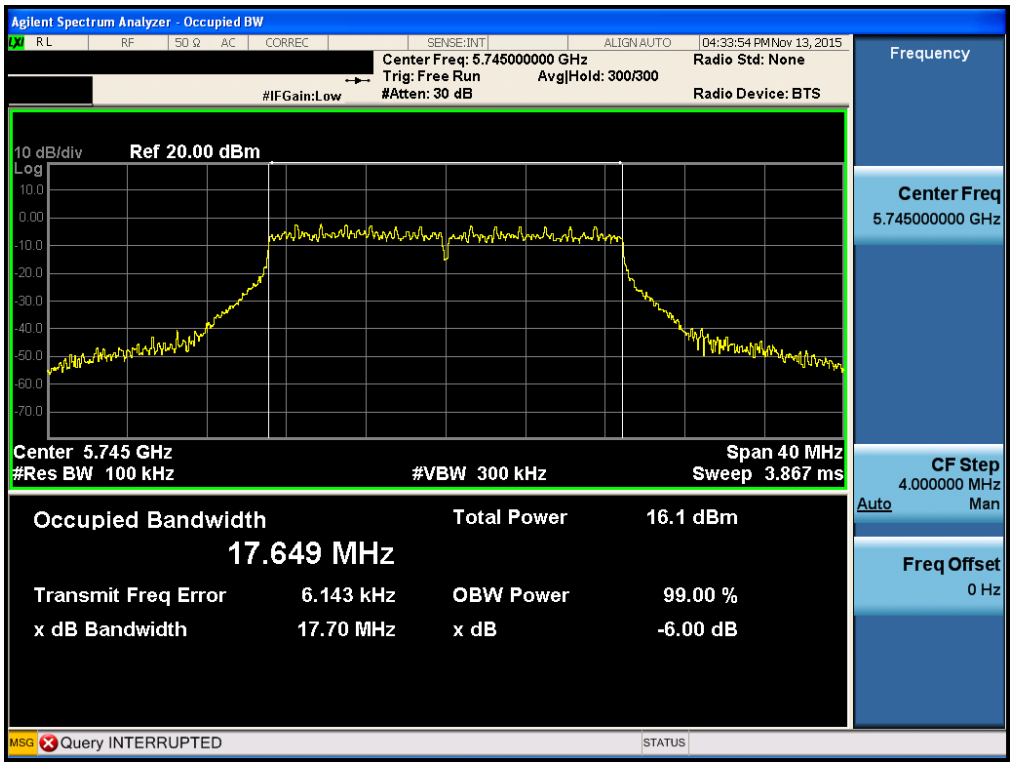
Test Mode: 802.11a & Ch.157

6 dB Bandwidth

Test Mode: 802.11a & Ch.165

6 dB Bandwidth

Test Mode: 802.11n(HT20) & Ch.149

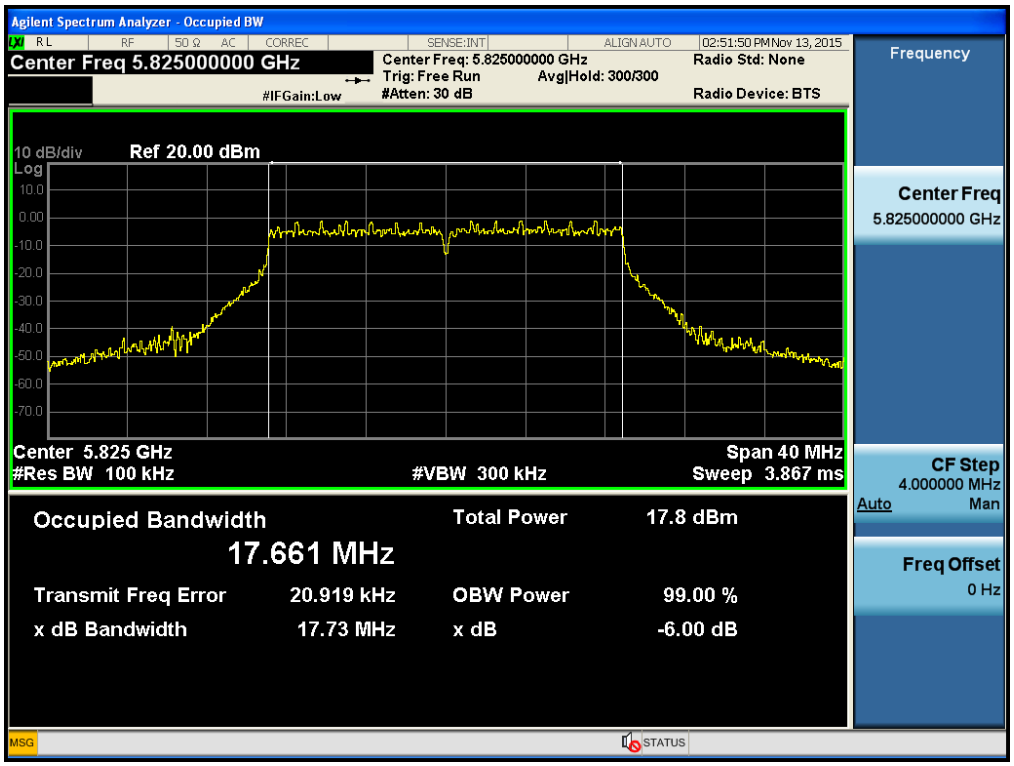


6 dB Bandwidth

Test Mode: 802.11n(HT20) & Ch.157

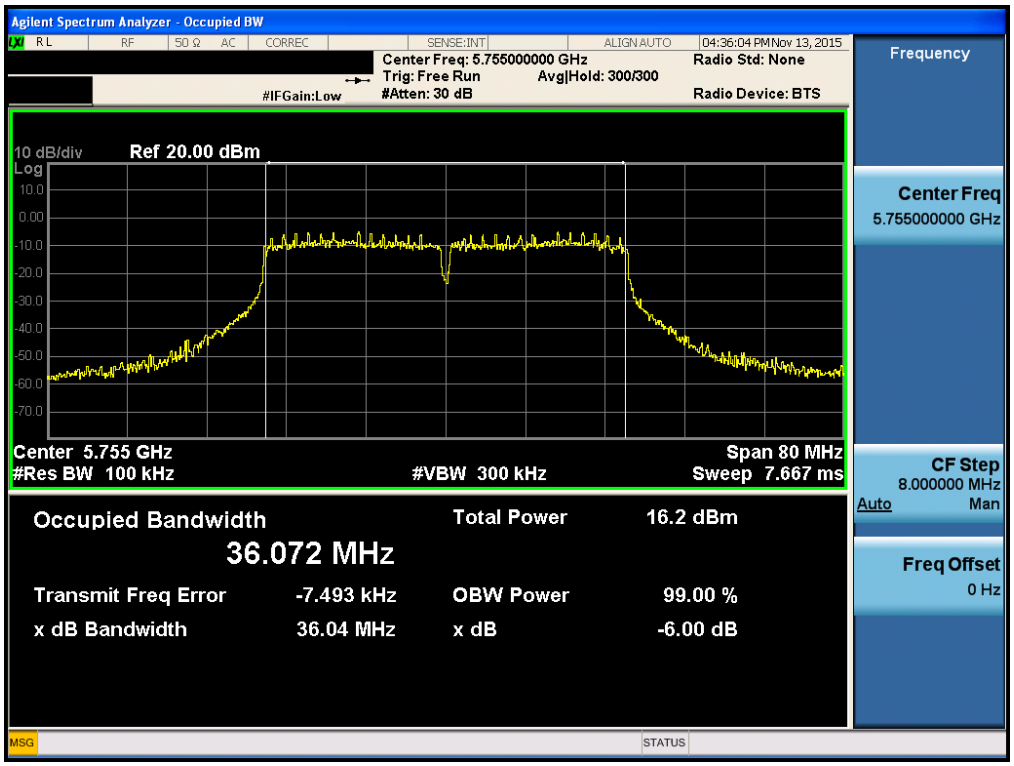
6 dB Bandwidth

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

8.3 Maximum Conducted Output Power

▣ Test Requirements

(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, the maximum conducted output power 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, the maximum conducted output power 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. 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 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, the maximum conducted output power 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, the maximum conducted output power 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, the maximum conducted output power 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

- Output power Limit Calculation

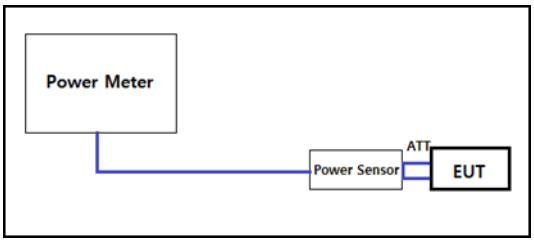
Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	802.11a	250	**23.97**	**-0.617**	**23.97**
	802.11n(HT20)	250	**23.97**	**-0.617**	**23.97**
	802.11n(HT40)	250	**23.97**	**-0.617**	**23.97**

Bands	Mode	Power Limit [mW] / Least 26 dBc BW [MHz]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 2	802.11a	250	**23.97**	**-0.229**	**23.97**
		20.960	**24.21**		
	802.11n(HT20)	250	**23.97**	**-0.229**	**23.97**
		21.210	**24.26**		
	802.11n(HT40)	250	**23.97**	**-0.229**	**23.97**
		42.260	**27.25**		

Bands	Mode	Power Limit [mW] / Least 26 dBc BW [MHz]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 3	802.11a	250	**23.97**	**0.325**	**23.97**
		20.980	**24.21**		
	802.11n(HT20)	250	**23.97**	**0.325**	**23.97**
		21.400	**24.30**		
	802.11n(HT40)	250	**23.97**	**0.325**	**23.97**
		41.350	**27.16**		

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 4	802.11a	1000	**30.00**	**-0.873**	**30.00**
	802.11n(HT20)	1000	**30.00**	**-0.873**	**30.00**
	802.11n(HT40)	1000	**30.00**	**-0.873**	**30.00**

▣ Test Configuration



▣ Test Procedure

Maximum Conducted Output Power is measured using Measurement Procedure **Method PM - G of KDB789033 D02 V01**

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**

Mode	Bands	Channel	Frequency [MHz]	Test Result [dBm]
802.11a	U-NII 1	**36**	**5180**	**11.380**
		40	5200	10.950
		48	5240	11.060
	U-NII 2	52	5260	10.730
		60	5300	10.560
		64	5320	10.730
	U-NII 3	100	5500	10.340
		116	5580	9.990
		140	5700	10.660
	U-NII 4	149	5745	10.190
		157	5785	10.030
		165	5825	9.650
802.11n HT20	U-NII 1	**36**	**5180**	**11.450**
		40	5200	10.870
		48	5240	11.040
	U-NII 2	52	5260	10.840
		60	5300	10.720
		64	5320	10.870
	U-NII 3	100	5500	10.390
		116	5580	9.970
		140	5700	10.810
	U-NII 4	149	5745	10.290
		157	5785	10.290
		165	5825	10.170
802.11n HT40	U-NII 1	**38**	**5190**	**11.430**
		46	5230	10.620
	U-NII 2	54	5270	10.850
		62	5310	11.100
	U-NII 3	102	5510	10.450
		110	5550	9.540
		134	5670	10.770
	U-NII 4	151	5755	10.370
		159	5795	10.250

8.4 Maximum Power Spectral Density

▣ **Test requirements**

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. **note1**

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

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

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

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

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

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

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

- Peak Power Spectral Density Limit Calculation

Band	Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	11	-0.617	11
U-NII 2	11	-0.229	11
U-NII 3	11	0.325	11
U-NII 4	30	-0.873	30

▣ **TEST CONFIGURATION**

Refer to the APPENDIX I.

▣ **Test procedure**

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02 V01**

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 result: Comply**

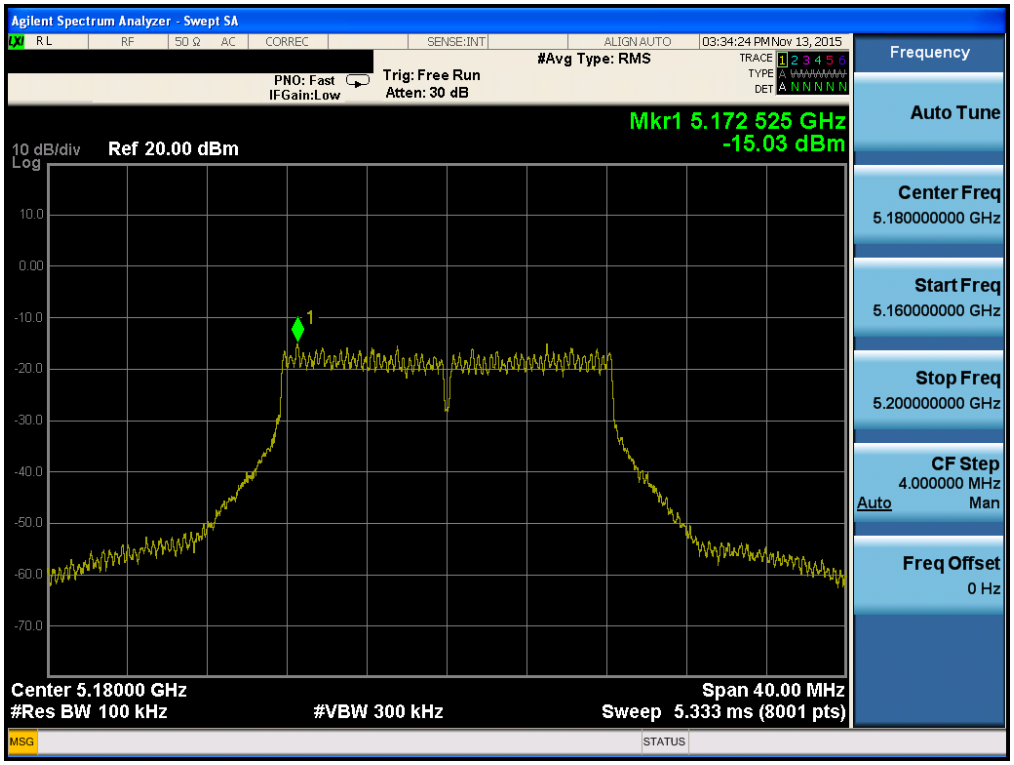
Mode	Channel	Frequency [MHz]	Reading [dBm]	DCF [dB] Note 1	Test Result [dBm]
802.11a	36	5180	-5.030	3.190	-1.840
	40	5200	-4.380		-1.190
	48	5240	-5.360		-2.170
	52	5260	-4.590		-1.400
	60	5300	-4.660		-1.470
	64	5320	-4.980		-1.790
	100	5500	-5.310		-2.120
	116	5580	-3.860		-0.670
	140	5700	-3.310		-0.120
	149	5745	-6.640		-3.450
	157	5785	-6.900		-3.710
	165	5825	-6.230		-3.040
802.11n HT20	36	5180	-5.690	3.380	-2.310
	40	5200	-4.430		-1.050
	48	5240	-4.380		-1.000
	52	5260	-4.320		-0.940
	60	5300	-5.090		-1.710
	64	5320	-5.280		-1.900
	100	5500	-5.170		-1.790
	116	5580	-3.570		-0.190
	140	5700	-4.570		-1.190
	149	5745	-5.960		-2.580
	157	5785	-5.350		-1.970
	165	5825	-5.130		-1.750
802.11n HT40	38	5190	-7.930	4.820	-3.110
	46	5230	-8.280		-3.460
	54	5270	-7.470		-2.650
	62	5310	-8.330		-3.510
	102	5510	-7.000		-2.180
	110	5550	-6.870		-2.050
	134	5670	-6.950		-2.130
	151	5755	-9.680		-4.860
	159	5795	-9.500		-4.680

Note 1: **Refer to Appendix II. Only applied when Duty cycle < 0.98**
And correction factor of reduced RBW was included in the DCF.
Note 2: Test Result = Measurement Data + DCF
Note 3: "Band 1, 2, 3 [Result] = Reading + 10*LOG(1000/100) + DCF"
"Band 4 [Result] = Reading + 10*LOG(500/100) + DCF"

▣ RESULT PLOTS

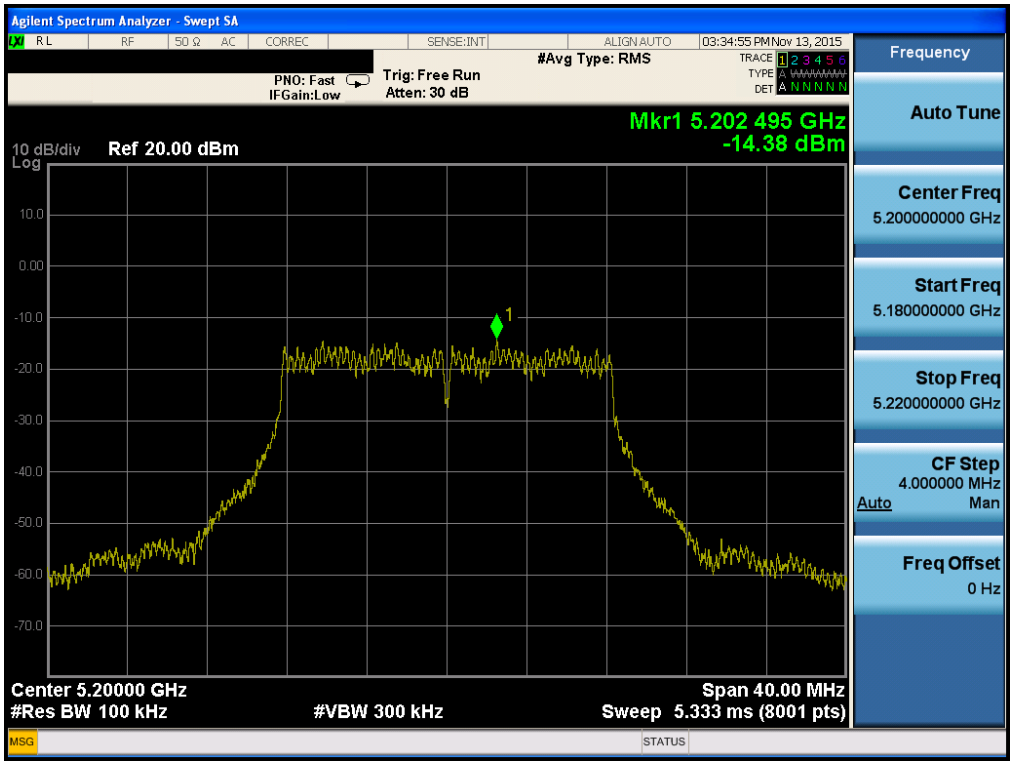
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.36



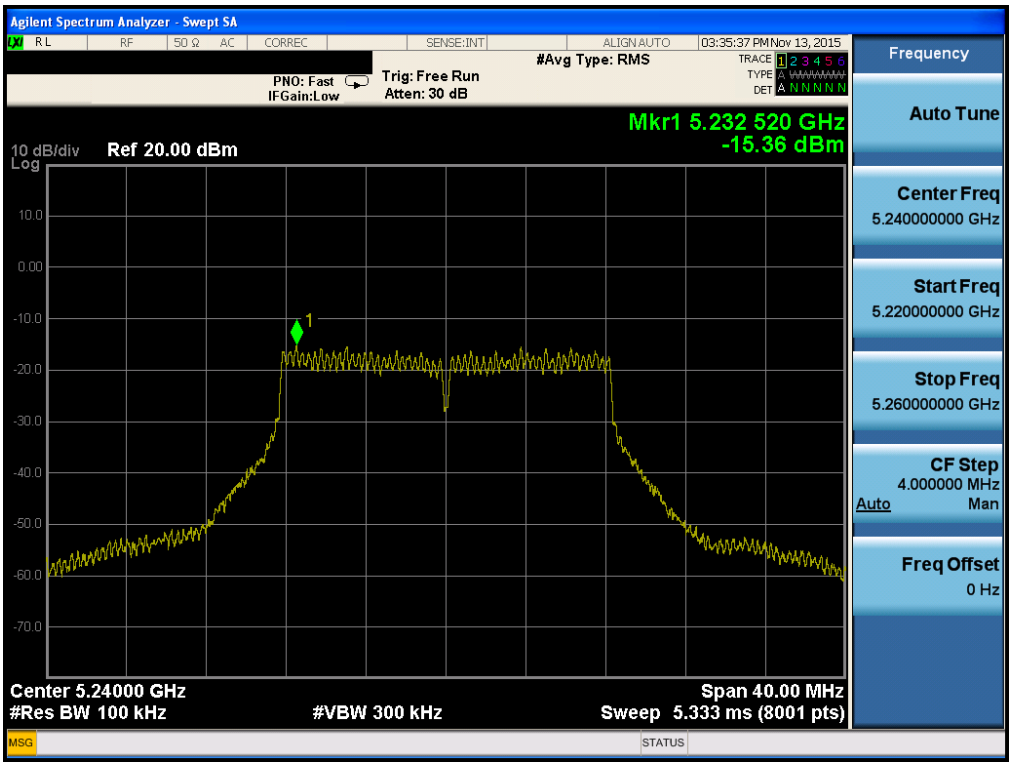
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.40



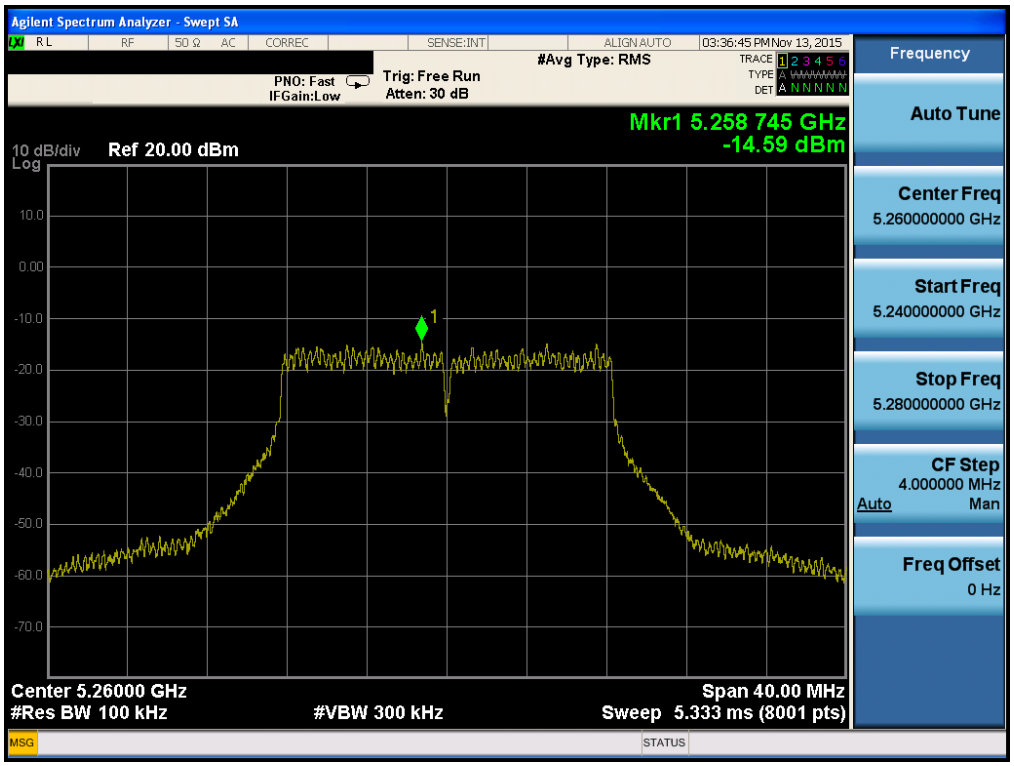
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.48



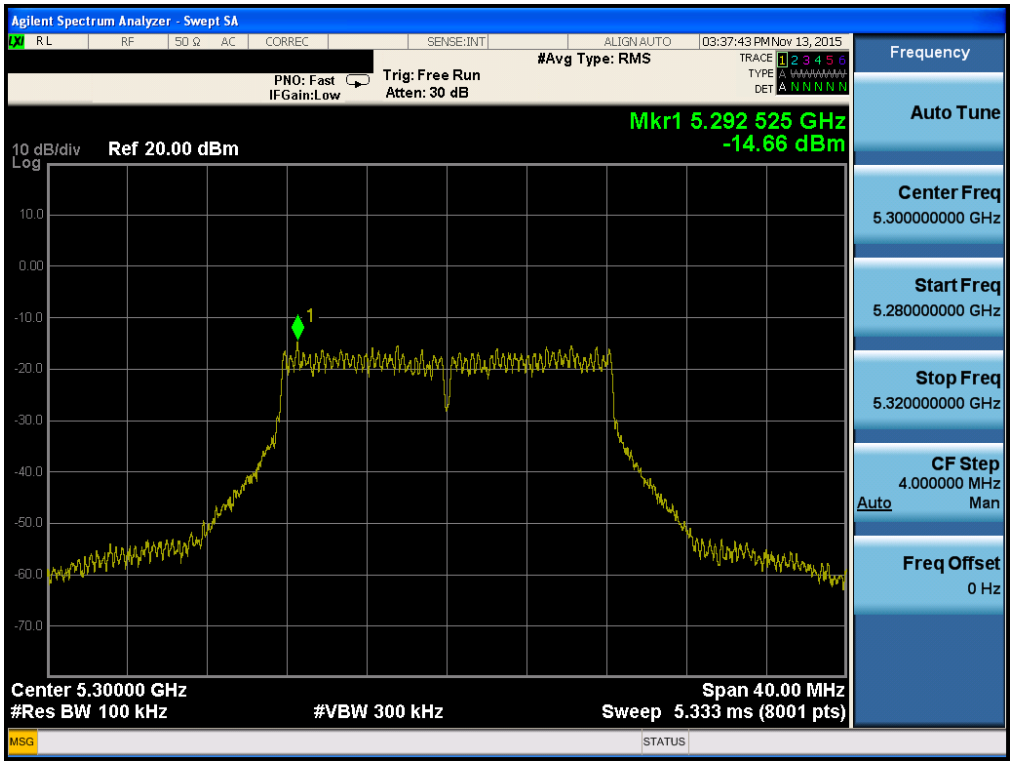
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.52



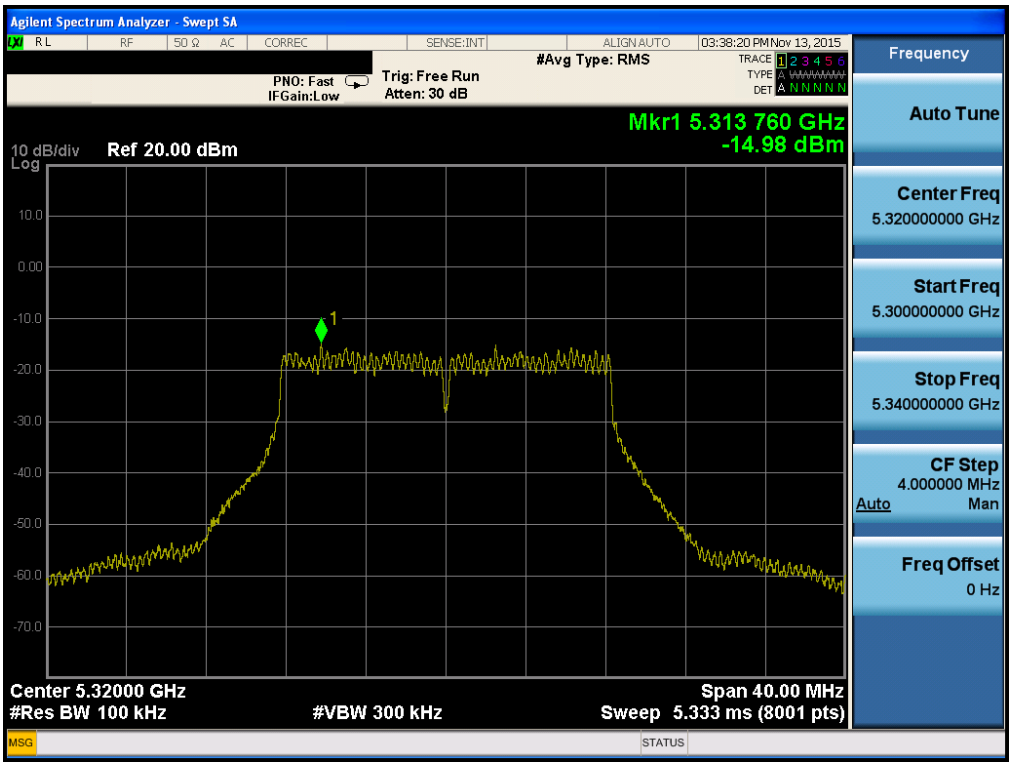
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.60



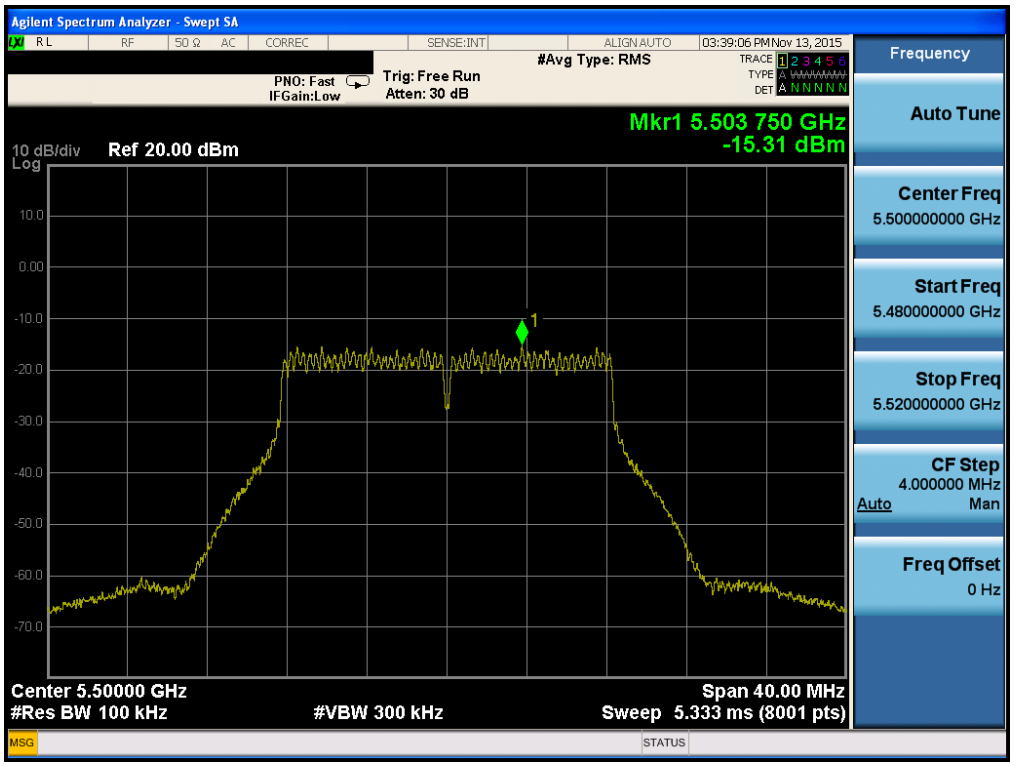
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.64



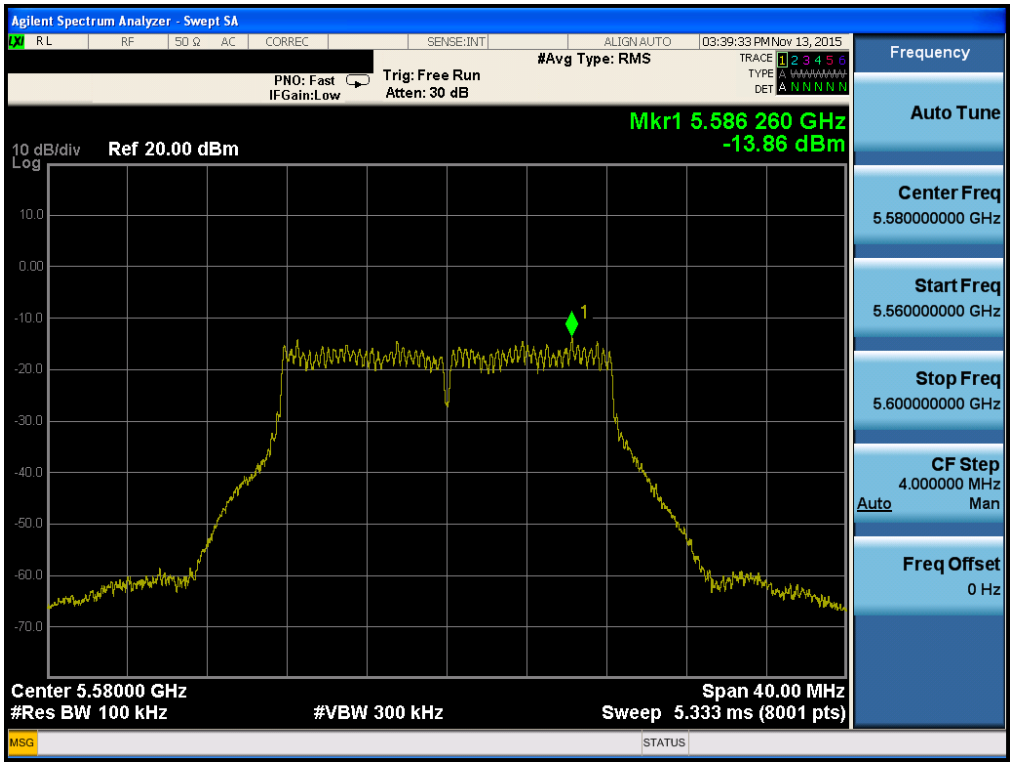
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.100



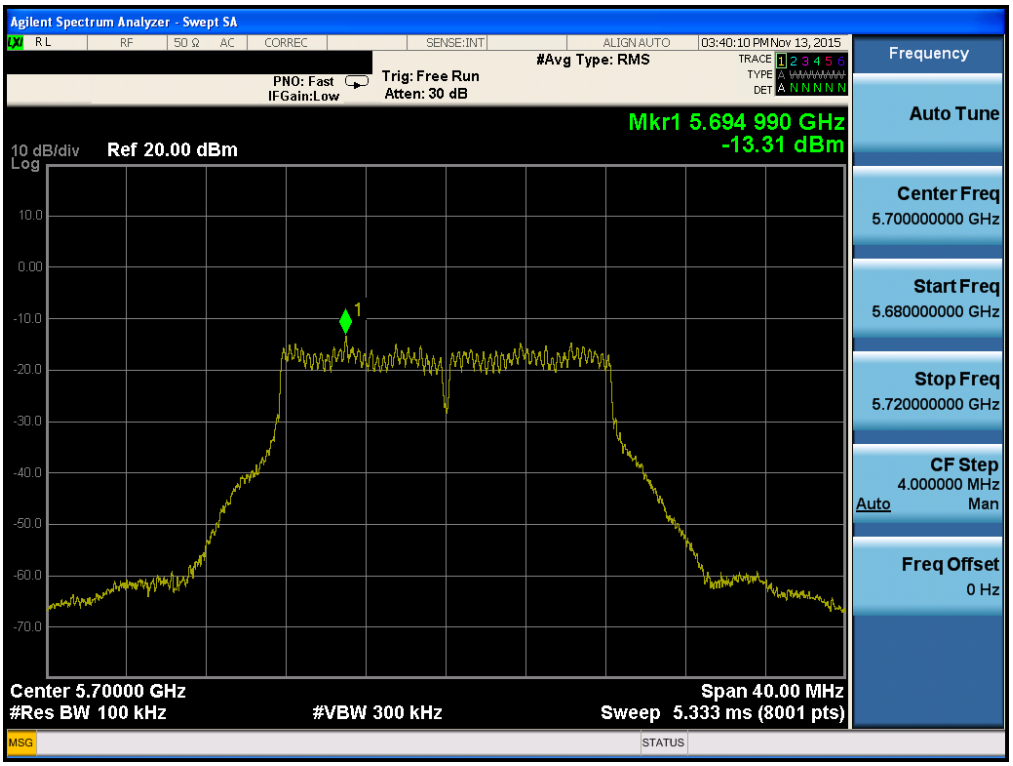
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.116



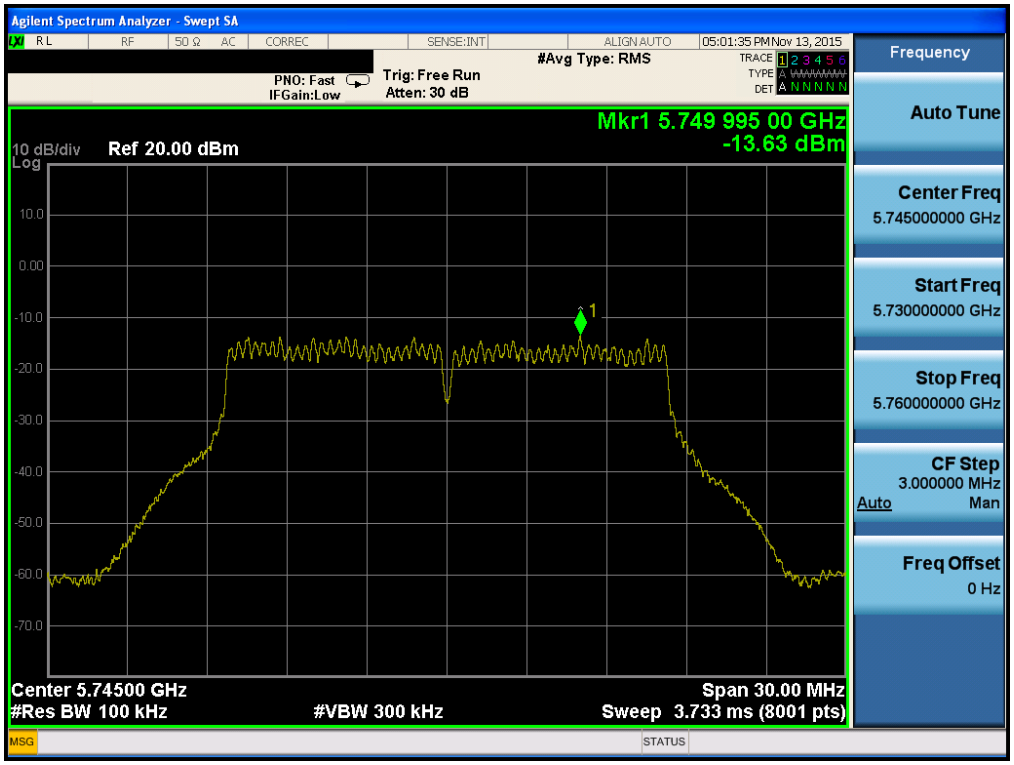
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.140



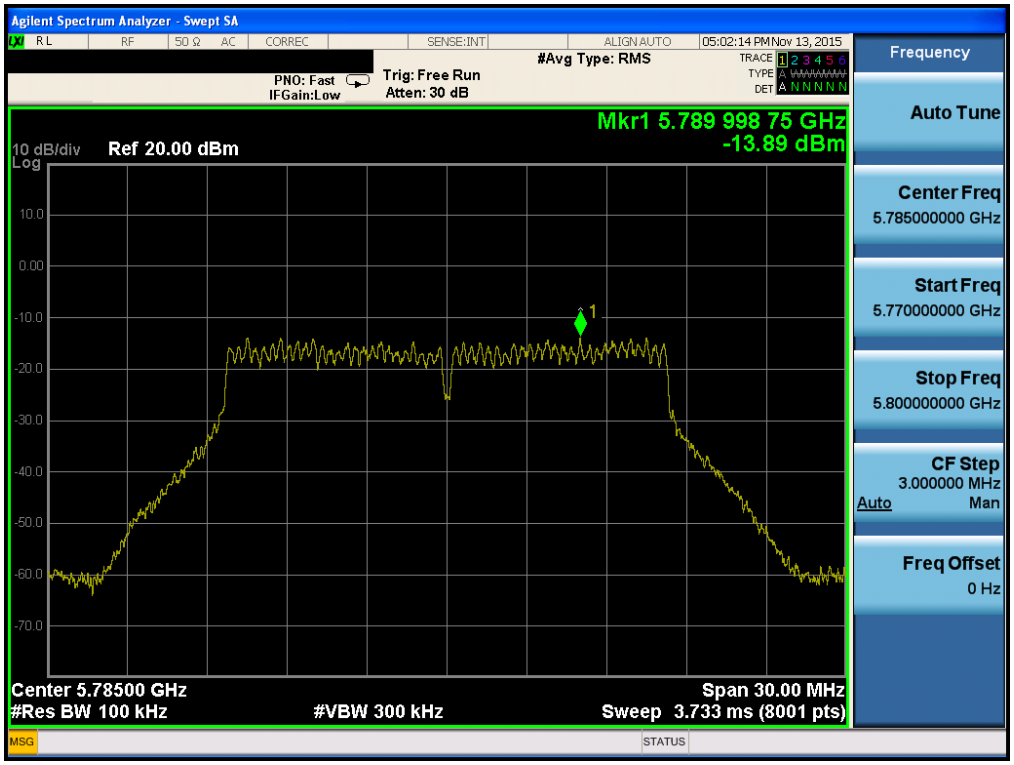
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.149



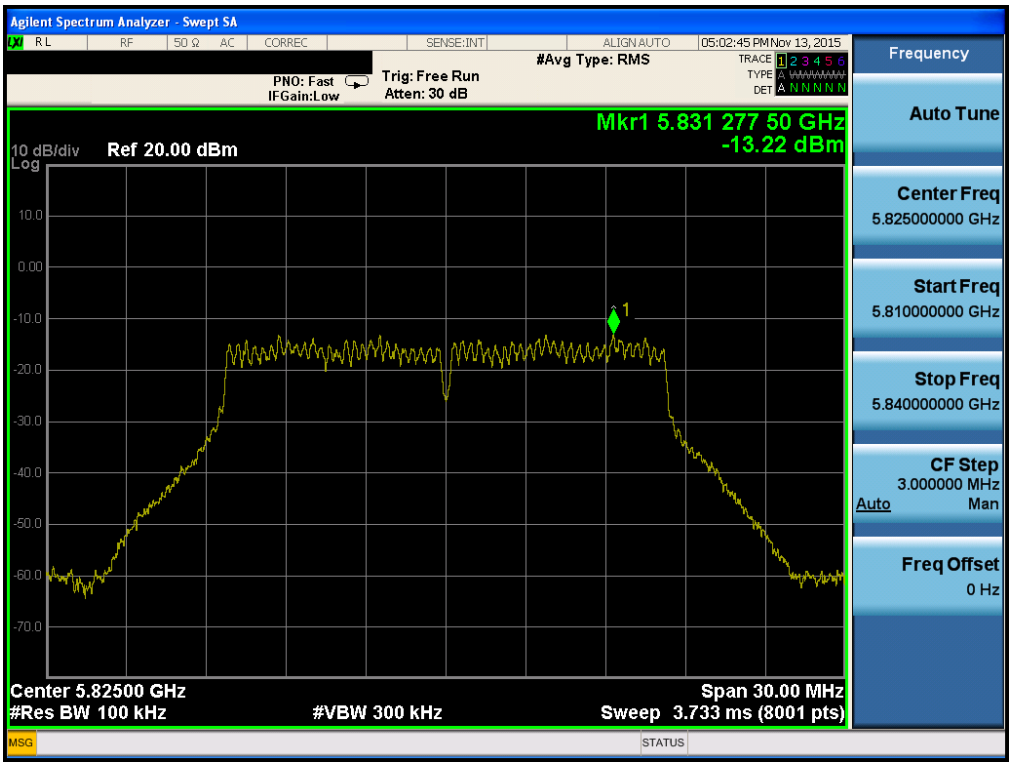
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.157

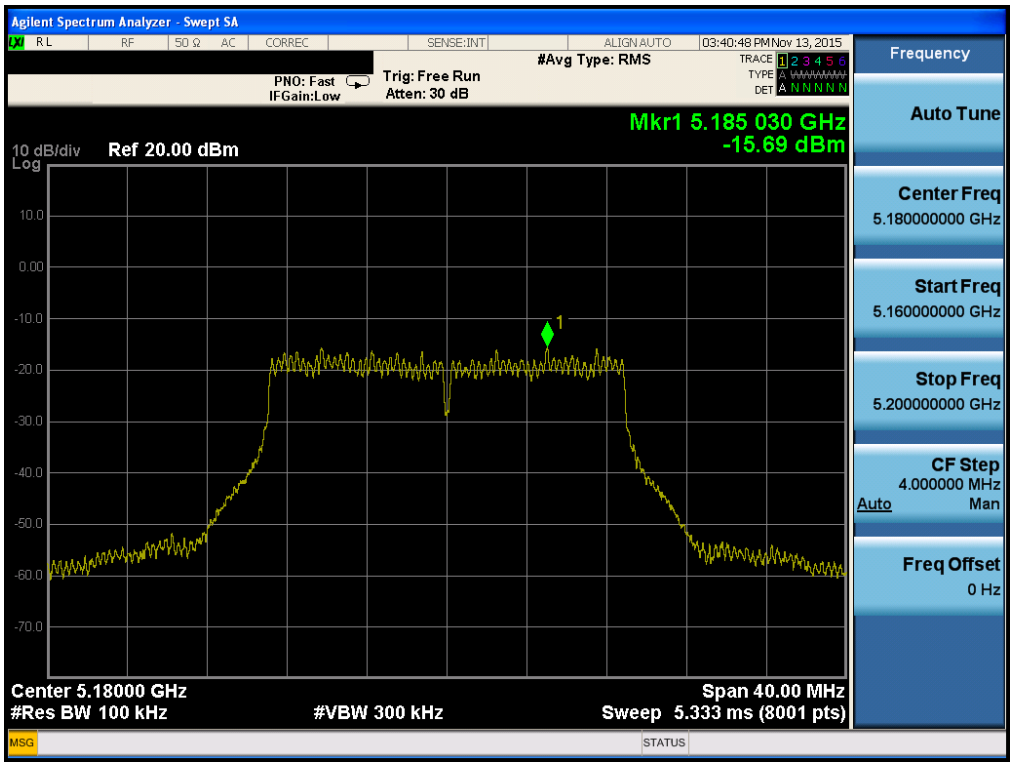


Maximum Power Spectral Density

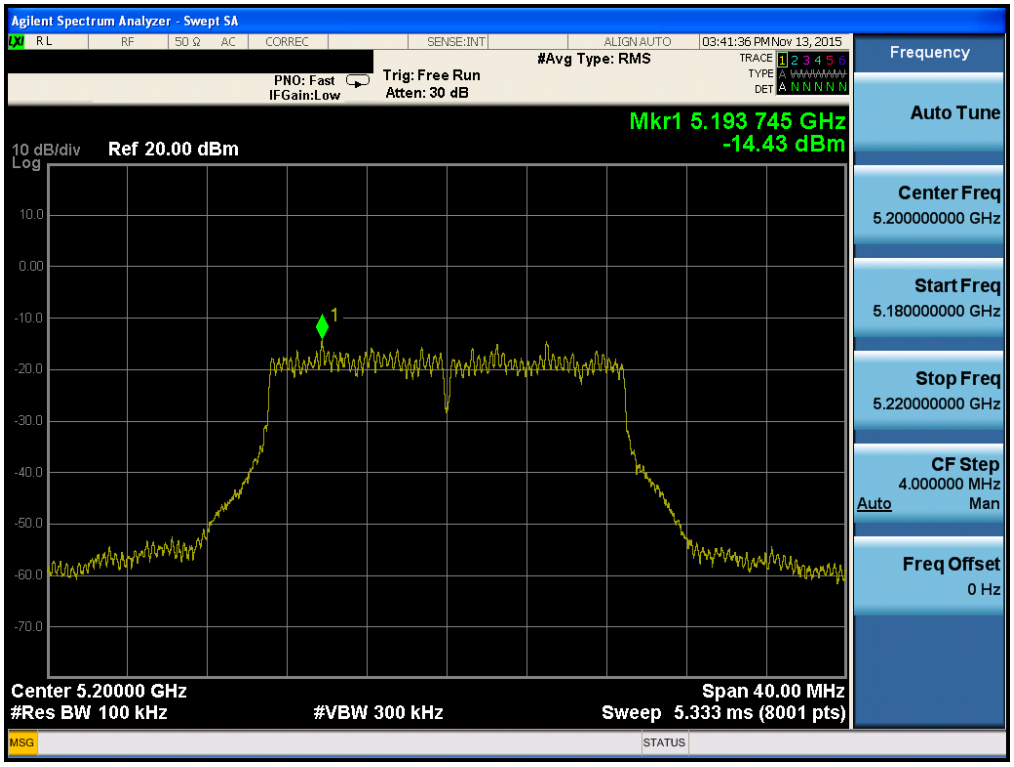
Test Mode: 802.11a & Ch.165



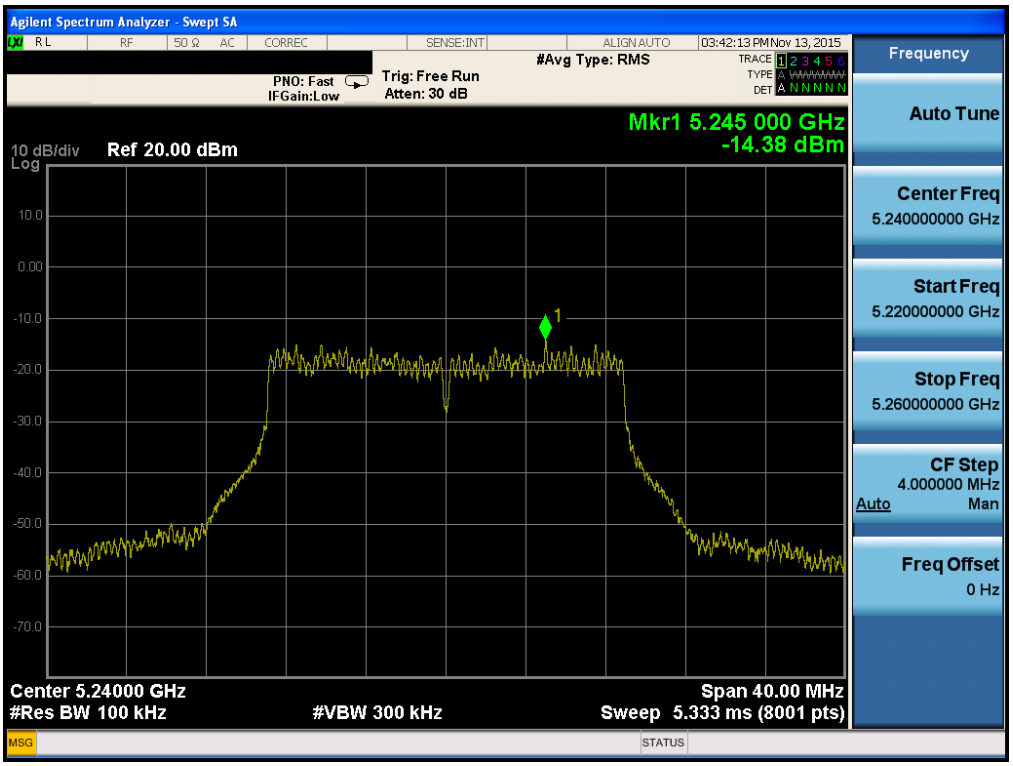
Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.36



Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.40

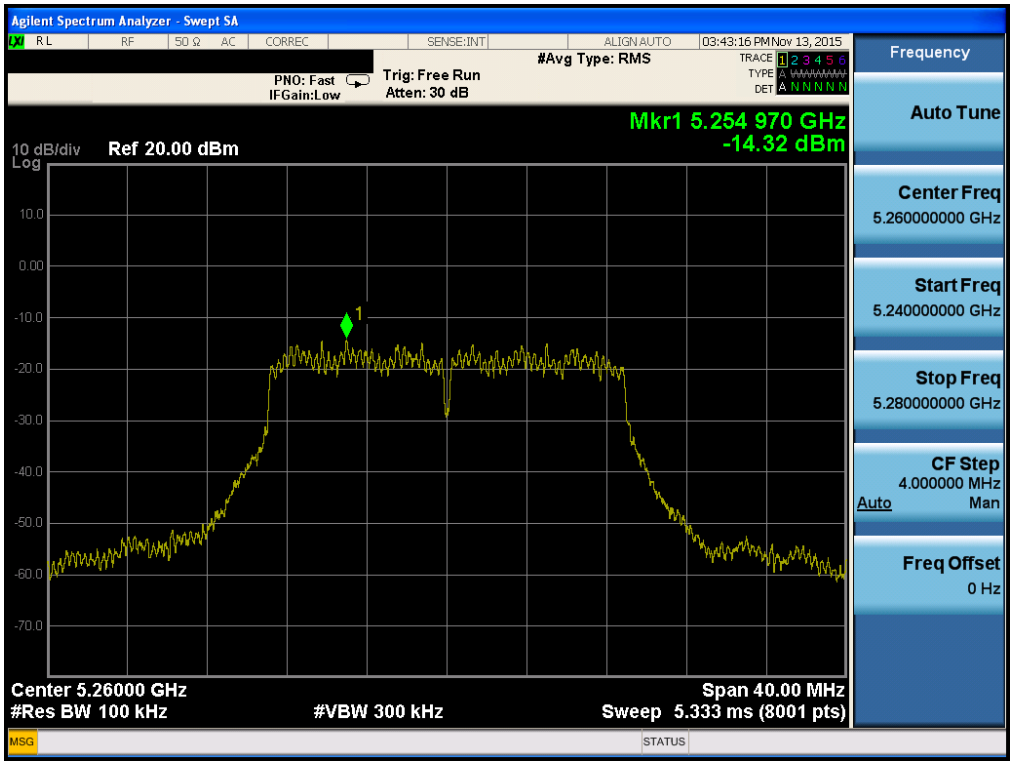


Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.48



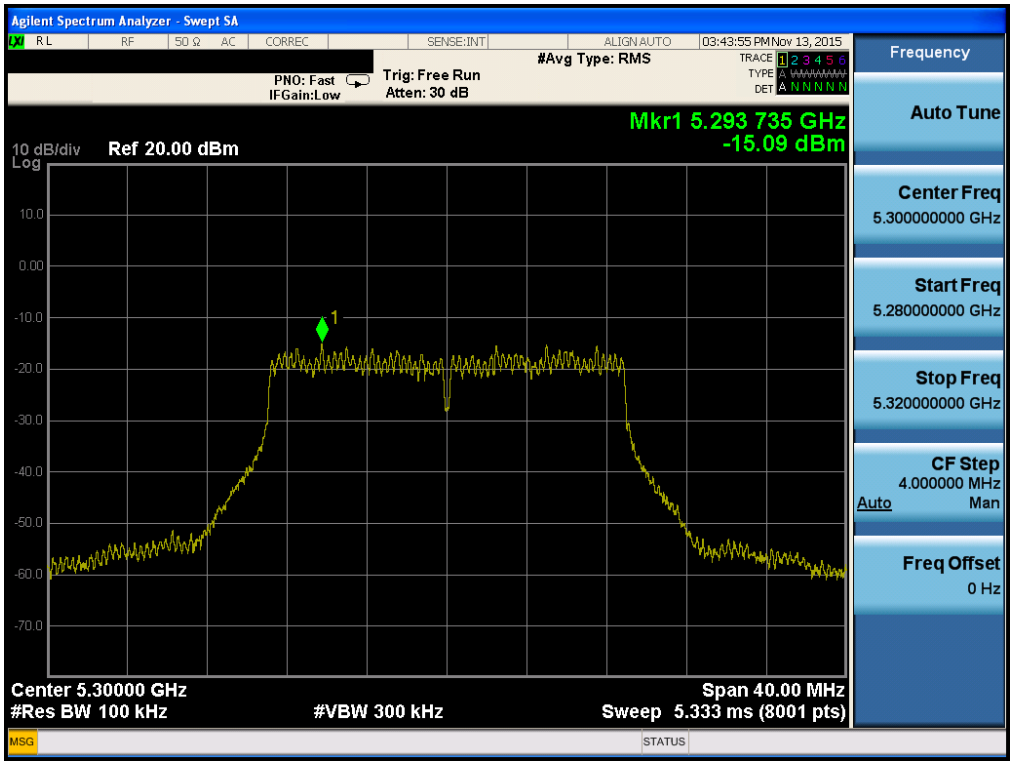
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.52



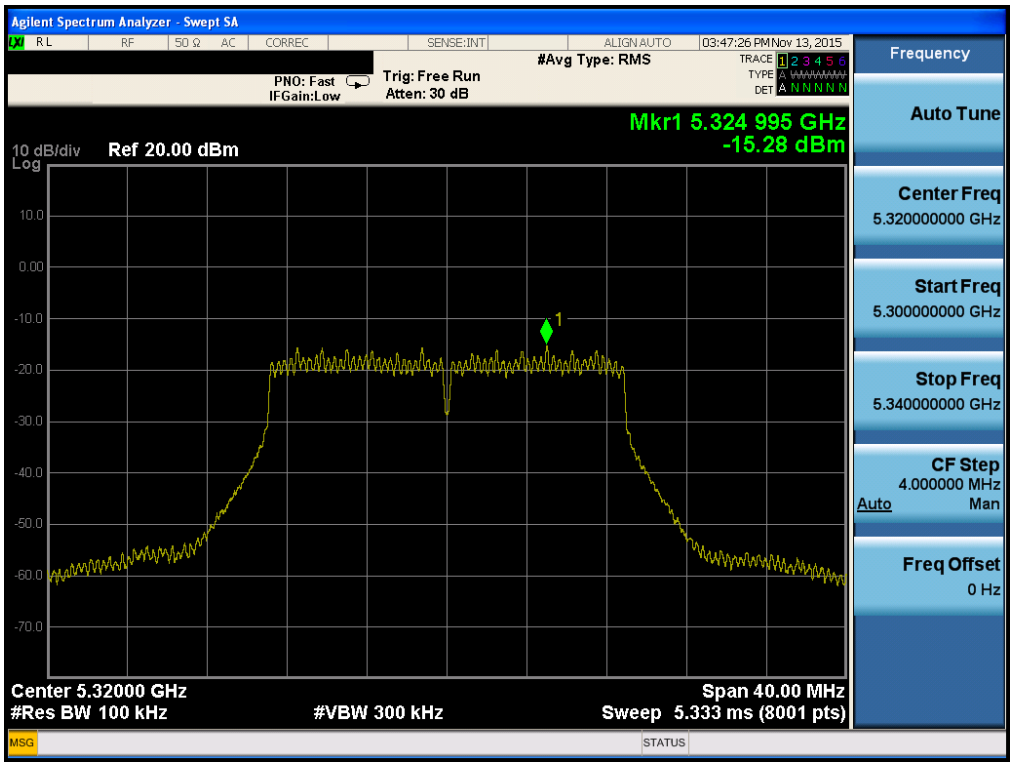
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.60



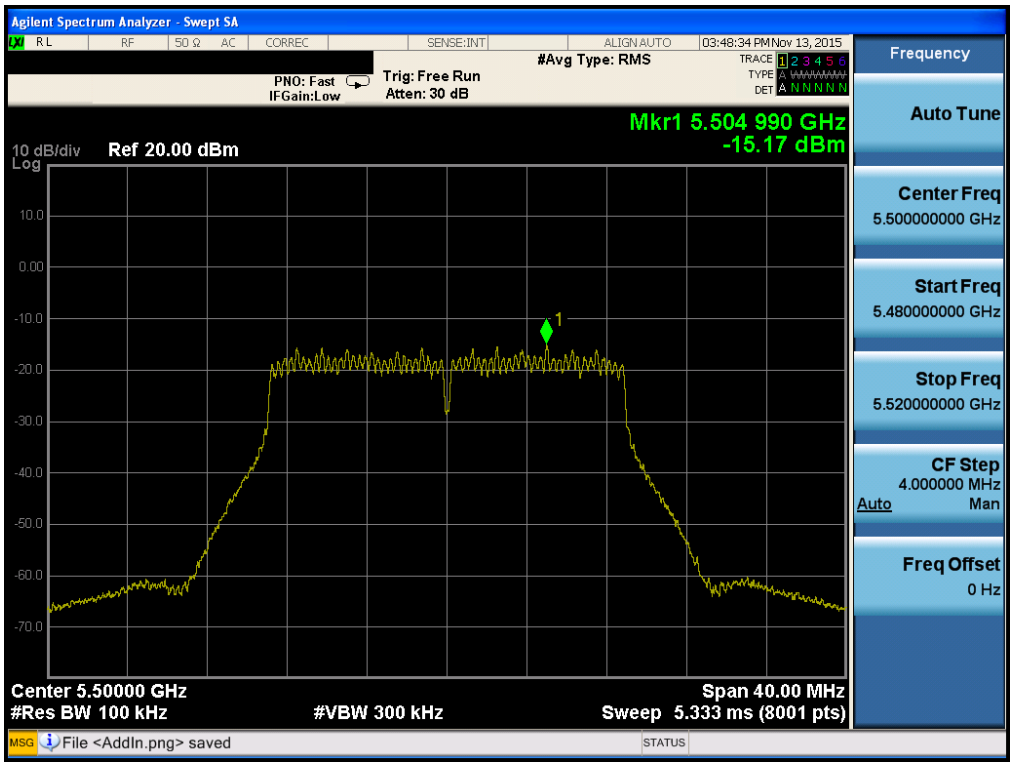
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.64



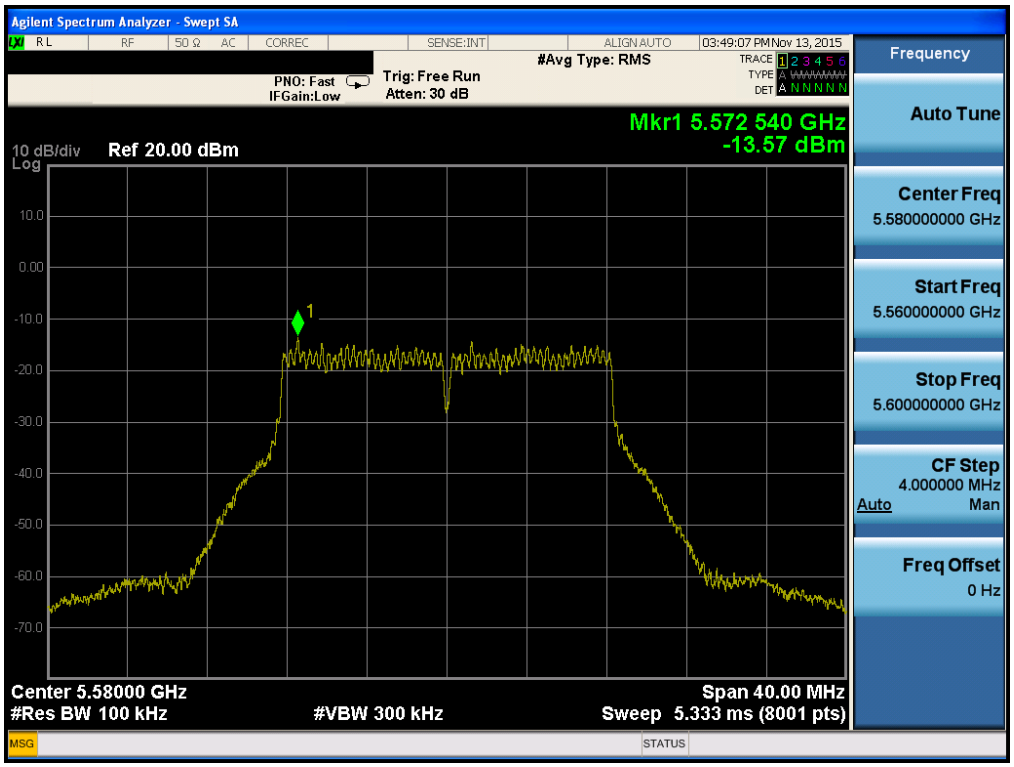
Maximum Power Spectral Density

Test Mode: 802.11n HT20 & Ch.100

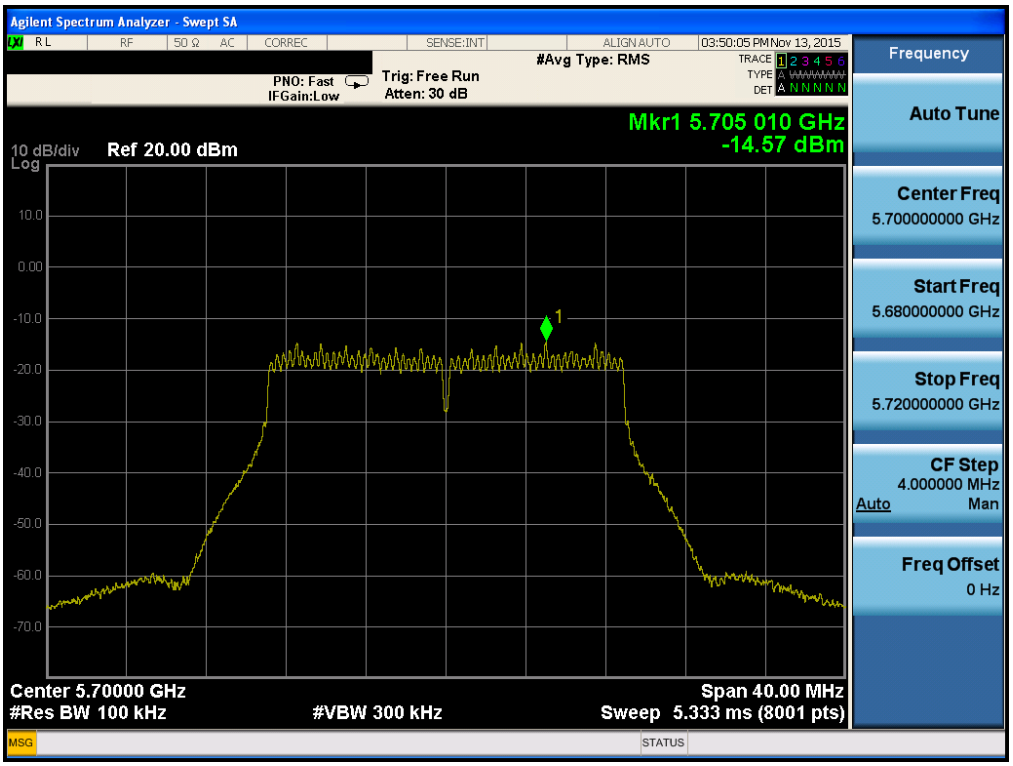


Maximum Power Spectral Density

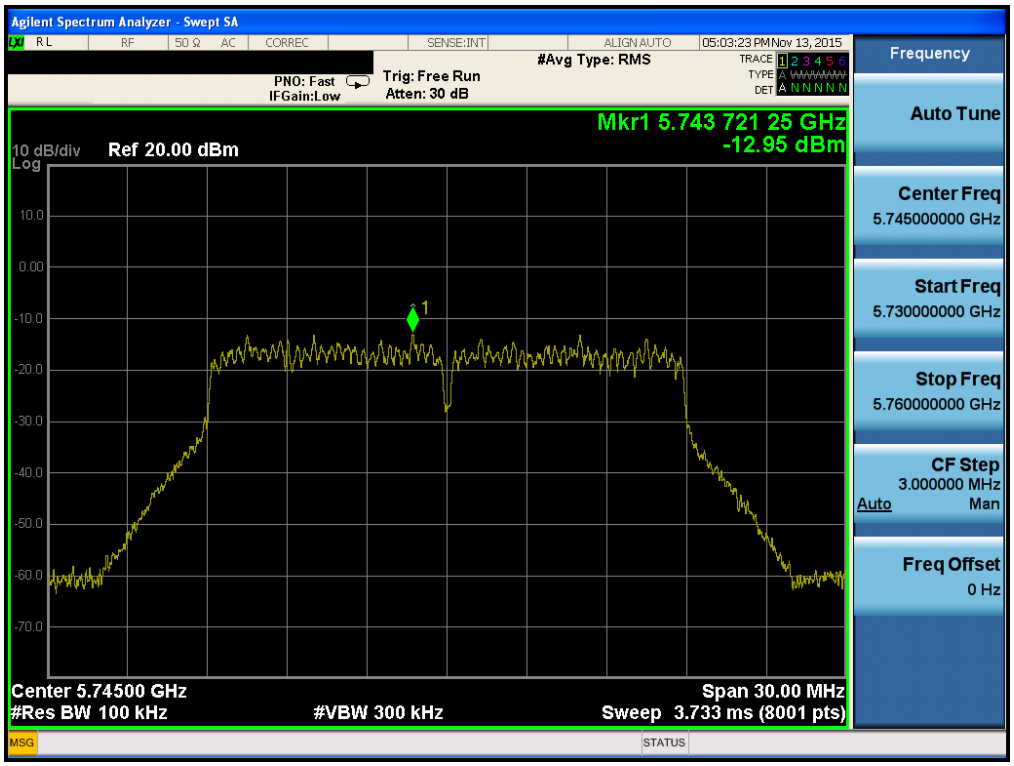
Test Mode: 802.11n HT20 & Ch.116



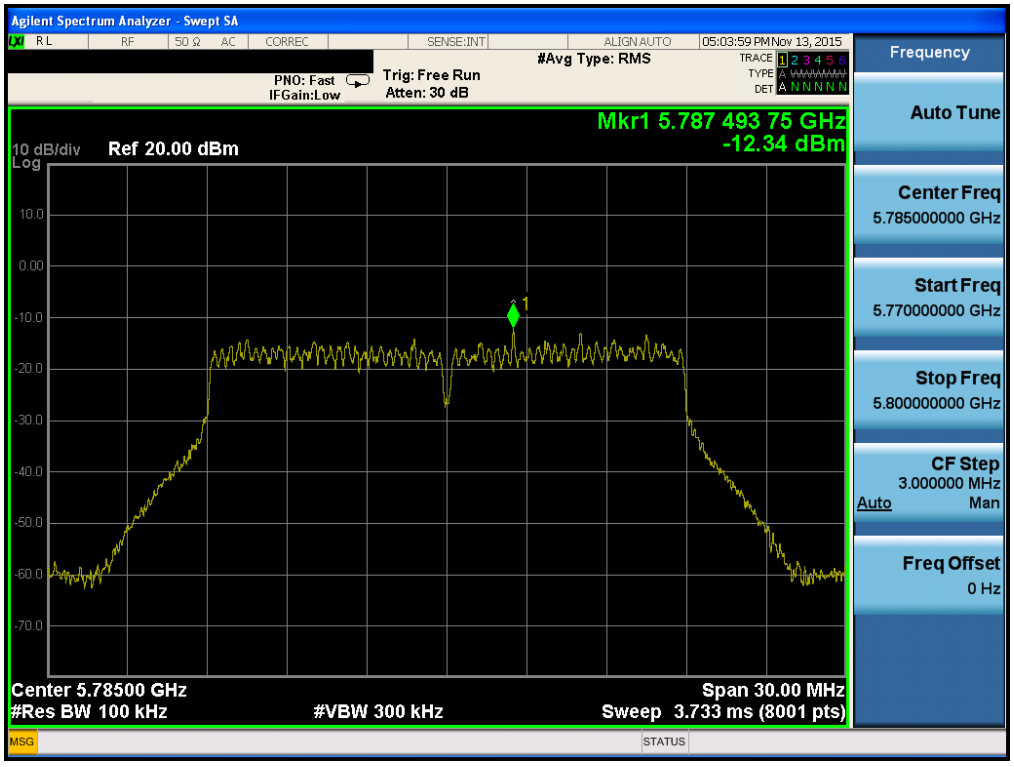
Maximum Power Spectral Density Test Mode: 802.11n HT20 & Ch.140



Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.149

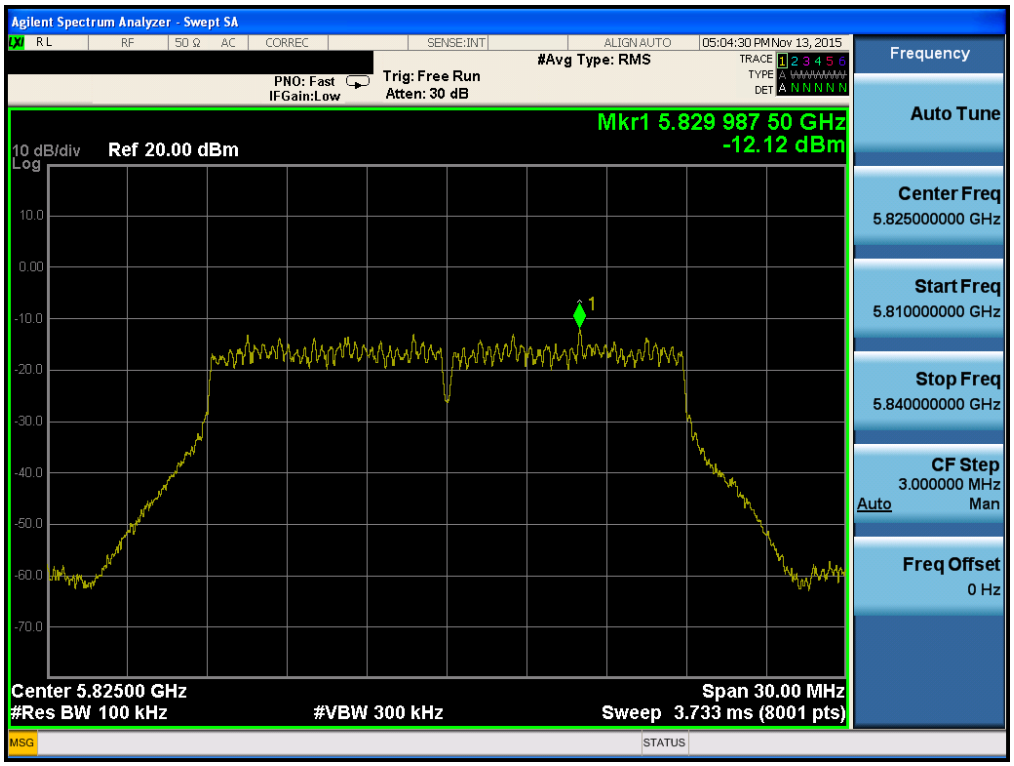


Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.157



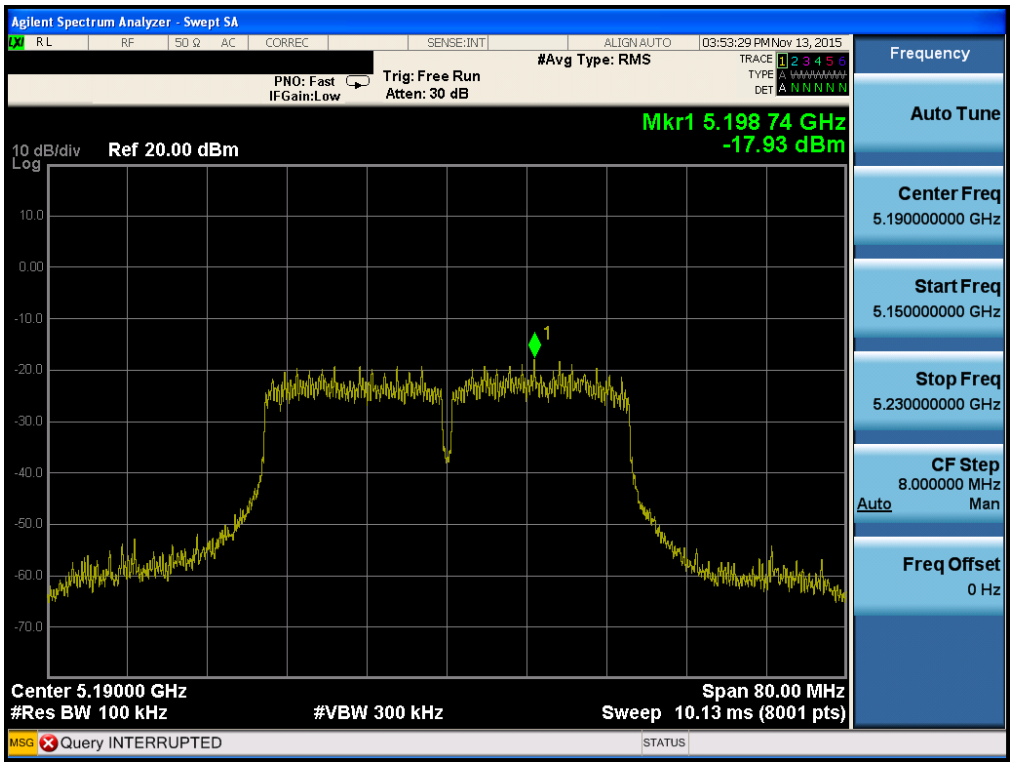
Maximum Power Spectral Density

Test Mode: 802.11n(HT20) & Ch.165



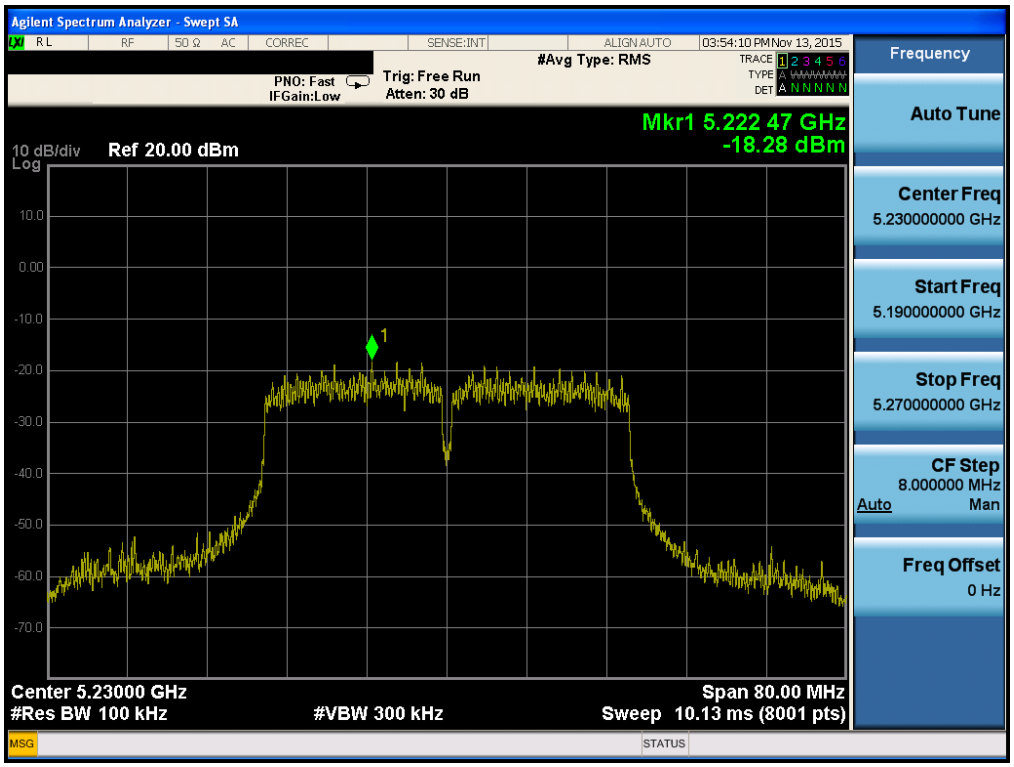
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.38



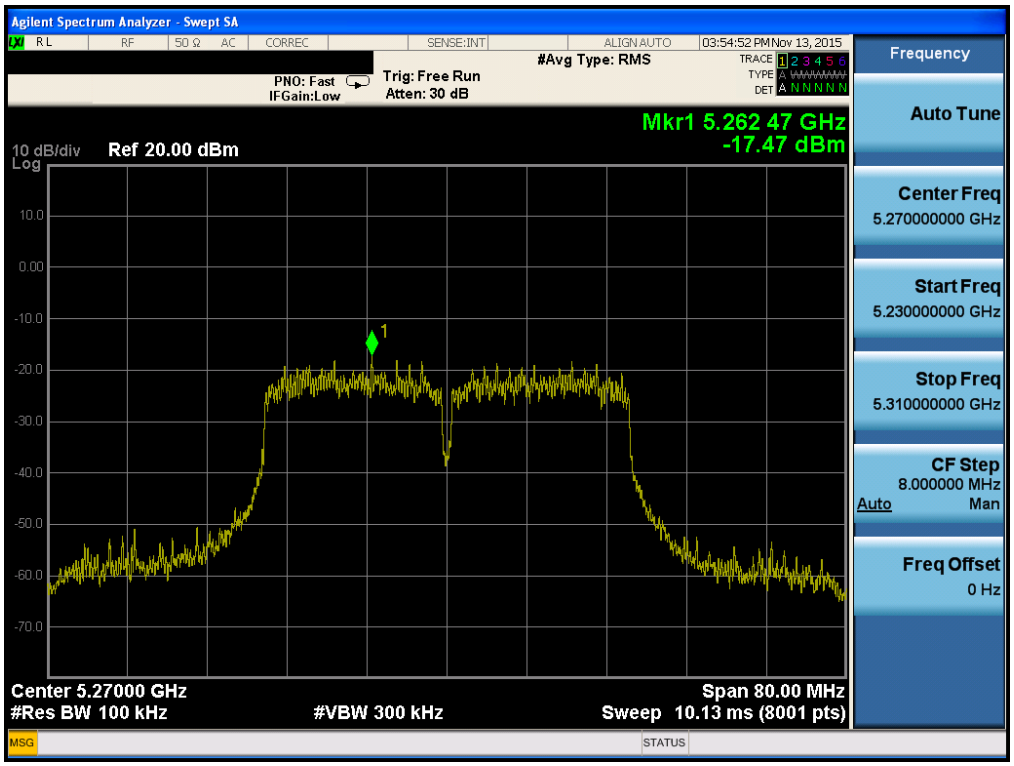
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.46



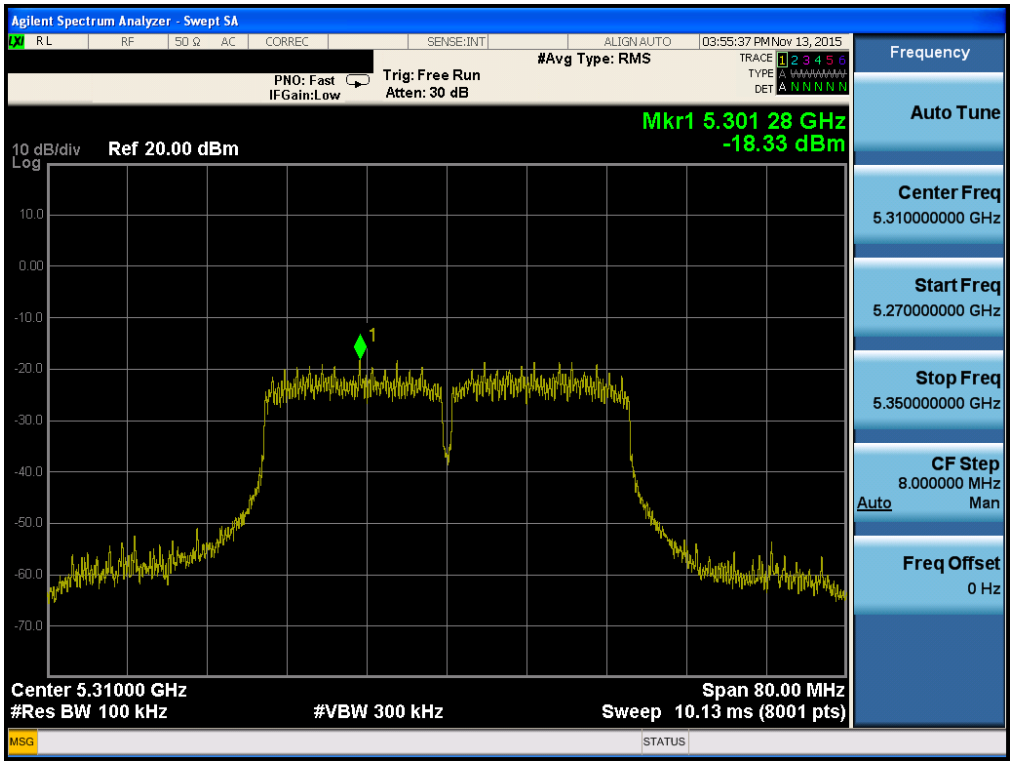
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.54



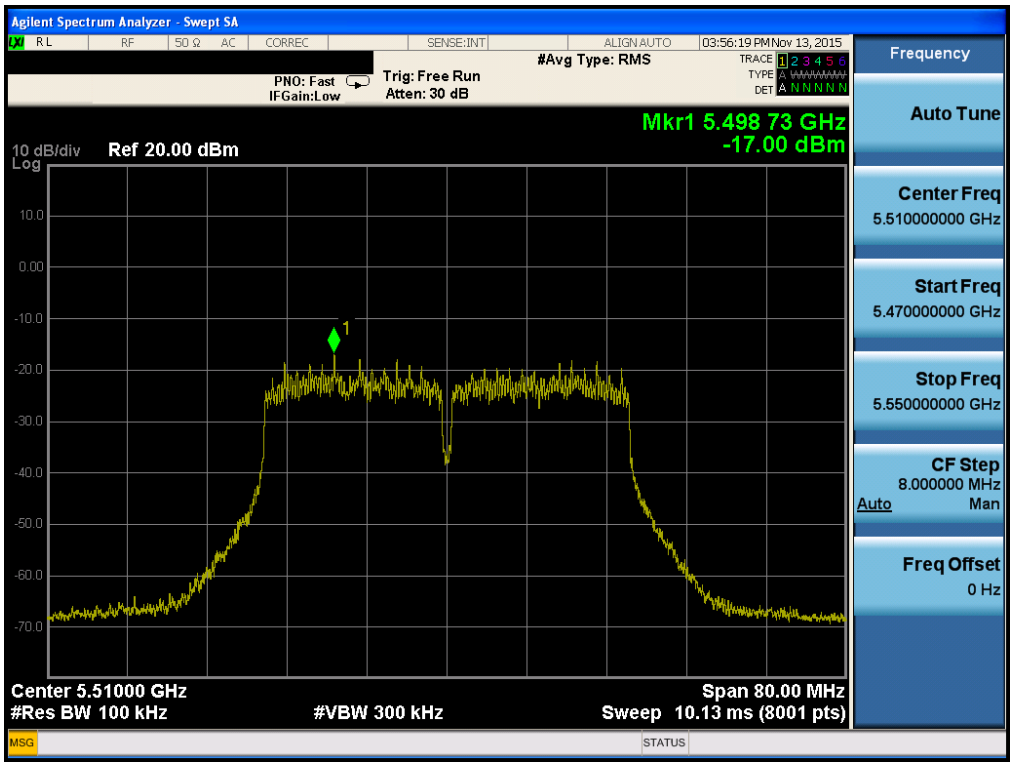
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.62



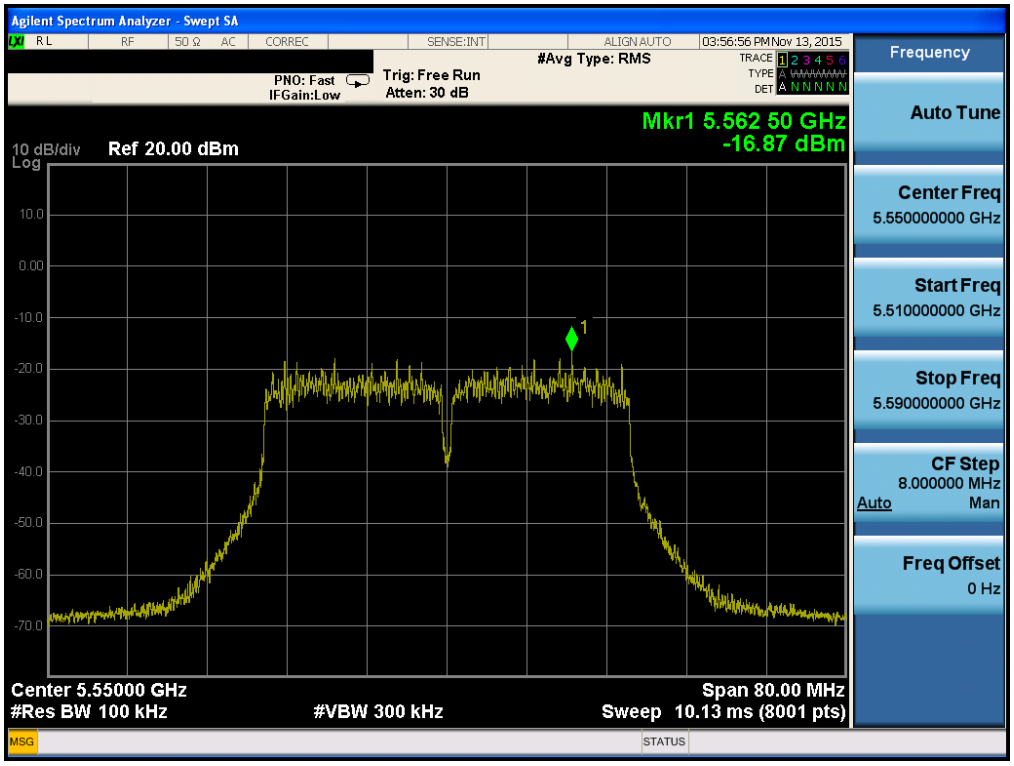
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.102



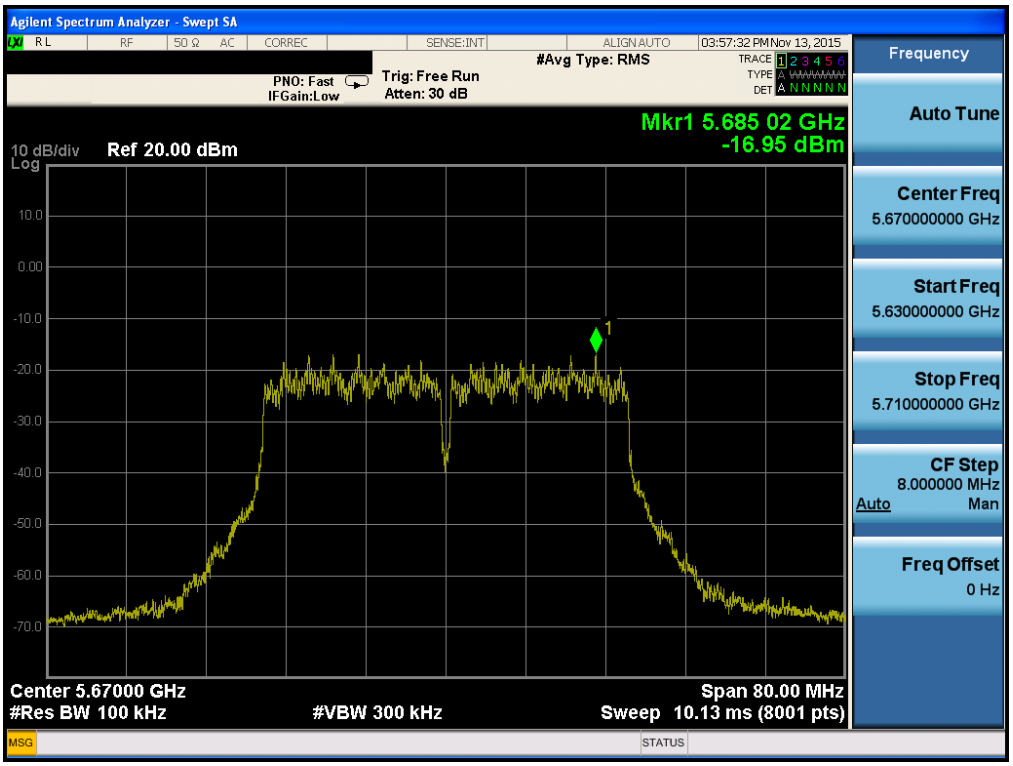
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.110



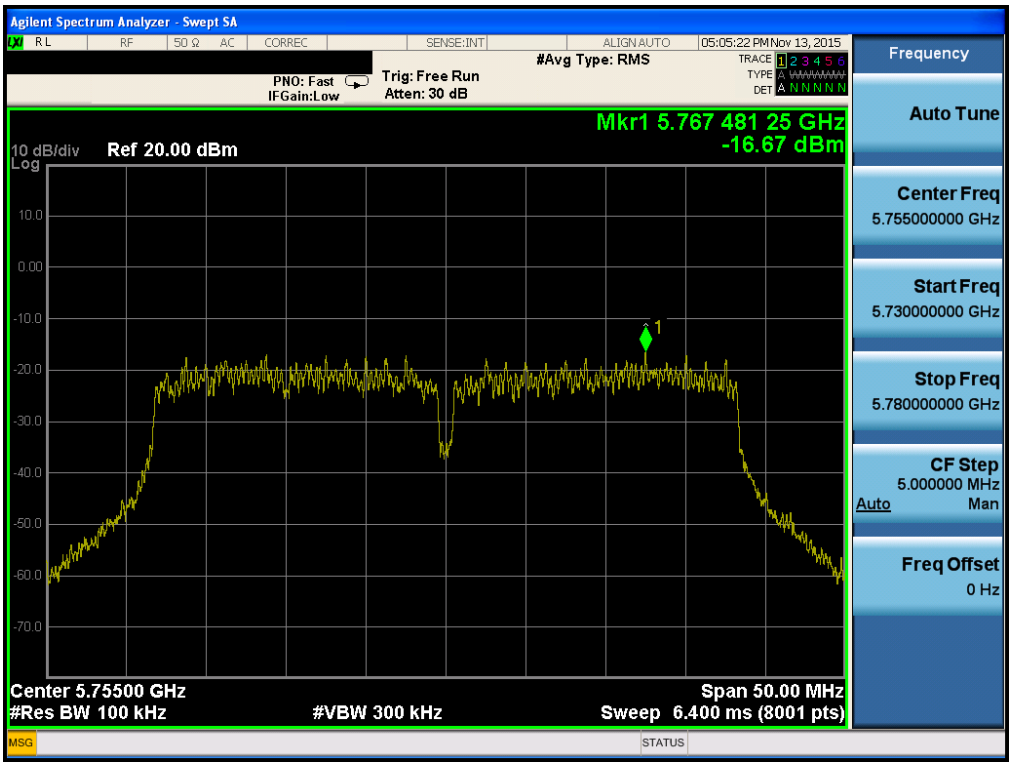
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.134



Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.151



Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.159