



RADIO TEST REPORT

For

MODEL NO. 1770

FCC ID: C3K1770

IC ID: 3048A-1770

Test Report No. R-TR209-FCCIC-UNII-3

Issue Date: 13 November 2015

FCC CFR47 Part 15 Subpart E
Industry Canada RSS-247 Issue 1

Prepared by

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Test Report Attestation

Microsoft Corporation**Model: 1770****FCC ID: C3K1770****IC ID: 3048A-1770****Applicable Standards**

Specification	Test Result
FCC CFR47 Rule Parts 15.207, 15.209, 15.407	Pass
Industry Canada RSS-247 Issue 1	Pass

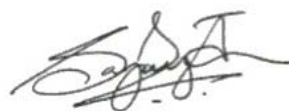
Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertain to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.

This report replaces the previously issued test report #R-TR209-FCCIC-UNII-2 issued by Microsoft EMC Labs on 06 Nov 2015.



Written By: Andy Shen
Radio Test Engineer



Reviewed/ Issued By: Sajay Jose
EMC/RF Compliance Lab Manager

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at Microsoft EMC Laboratory, located at 17760 NE 67th Ct, Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 3048A-1, 3048A-2, 3048A-3, 3048A-4

3.3 Test Equipment

The calibrations of the measuring instruments, including any accessories that may affect such calibration, are checked frequently to assure their accuracy. Adjustments are made and correction factors applied in accordance with instructions contained in the user manual for the measuring equipment.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in CISPR 16-4-2. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$. These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

Test item	Value (dB)
Radiated disturbance (30 MHz to 1 GHz)	5.76
Radiated disturbance (1 GHz to 18 GHz)	4.80
Conducted Disturbance at Mains Port	3.30

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Pamela Galvan
Functional Description of the EUT:	Wireless Input Device
Model:	Model 1770
FCC ID:	C3K1770
IC ID:	3048A-1770
Radio Description:	IEEE WLAN 802.11a/n with 20MHz Signal Bandwidths (SISO only)
Frequency Range of Operation:	5170 – 5250MHz, 5250 – 5330MHz, 5490 – 5710MHz, and 5735 – 5835MHz
Modulation:	BPSK, OFDM, and QAM modulation
Antenna Type:	Internal
EUT Classification:	UNII
Equipment Design State:	Production
Equipment Condition:	Good
Test Sample Details:	RF Conducted Samples: 02980005424513, 02980005874513 RF Radiated Sample: 02980005874513 AC Line Conducted Emissions samples: 02990000583529, 02990000133529, 02990000293529, 02990000723529

5.1 Test Configurations

Test software “Radio Test 2 (ART-GUI)” created by the Chipset Manufacturer was used to program the EUT to transmit continuously. The EUT was tested in 802.11a, and 802.11n modes, at low, middle and high channels in each sub-band.

This report contains the worst case data from the following modes of test in 20MHz signal bandwidth.

802.11a: 6Mbps

802.11n: MCS0

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance and any deviations required from the EUT are reported.

5.3 Antenna Requirements and Gain Information

The antennas are permanently attached and there are no provisions for connection to an external antenna.

Antenna Gain	
Frequency Band (MHz)	Wi-Fi Antenna Peak Gain (dBi)
UNII Band 1- 5150 to 5250	1.95
UNII Band 2a – 5250 to 5350	1.60
UNII Band 2c – 5470 to 5725	0.50
UNII Band 3 – 5725 to 5850	1.80

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Dates of Testing

Testing was performed from October 12th 2015 to November 1st 2015.

6 Test Results Summary

Test Description	FCC CFR 47/ IC Rule Part	Limit	Test Result
26dB Emission Bandwidth	15.407 (h)(2) RSS-247 [6.2.1]	Reporting and Measurement Purposes only	Pass
99% bandwidth	RSS-247 [6.2]	Reporting and Measurement Purposes only	Pass
6 dB Bandwidth	15.407 (e) RSS-247 [6.2.4]	$\geq 500\text{kHz}$	Pass
Output Power	15.407 (a) RSS-247 [6.2]	See Sec 9.5.3 of this report	Pass
Power Spectral Density	15.407 (a) RSS-247 [6.2]	See Sec 9.6.3 of this report	Pass
Conducted Band Edge/Spurious Emissions	15.407 (b) RSS-247 [6.2]	$< 27\text{dBm/MHz}$ e.i.r.p	Pass
Radiated Spurious Emissions/ Restricted Band Emissions	15.407 (b), 15.205, 15.209, RSS-Gen [8.9]	FCC CFR 47 15.209 limits RSS-Gen [8.9]	Pass
AC Power line Conducted Emissions	15.407 (b), 15.207 RSS-Gen [8.8]	FCC CFR 47 15.207 limits RSS-Gen [8.8]	Pass

7 Test Equipment List

The site and related equipment were in conformance with the requirements of ANSI C63.4, CISPR 16-1-1, and other equivalent applicable standards.

Equipment used for Radiated and Conducted Measurements				
Manufacturer	Description	Model #	Asset #	Cal/Ver Due
Keysight	Spectrum Analyzer	N9030A	RF-011	02/29/2016
Keysight	Spectrum Analyzer	N9030A	EMC-605	06/15/2016
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-192	04/14/2016
Rohde & Schwarz	Signal Analyzer	FSV40	RF-228	04/10/2016
Rohde & Schwarz	Pre-Amp	TS-PR40	RF-258	11/14/2015
Rohde & Schwarz	Pre-Amp	TS-PR26	RF-199	11/14/2015
Rohde & Schwarz	Wideband Power Sensor	NRP-Z81	RF-282	04/10/2016
Rohde & Schwarz	Power Meter	NRP2	RF-237	04/11/2016
Rohde & Schwarz	Open Switch and Control Unit	OSP130	RF-249	01/09/2016
Rohde & Schwarz	Open Switch and Control Unit	OSP150	RF-250	01/09/2016
Rohde & Schwarz	Custom Filter Bank	SFUNIT RX	RF-323	04/01/2016
Rohde & Schwarz	Custom Filter Bank	SFUNIT RX	RF-324	04/01/2016
ETS-Lindgren	Antenna	3117	RF-139	04/09/2016
ETS-Lindgren	Antenna	3117	RF-137	03/29/2016
ETS-Lindgren	Antenna - Standard Gain Horn	3160-09	RF-037	05/01/2016
ETS-Lindgren	Antenna - Standard Gain Horn	3160-10	EMC-601	05/01/2016
Sunol Sciences	Antenna - Broadband Hybrid	JB6	RF-039	05/06/2016
Maturo	System Controller	NCD-120	RF-327	N/A
Maturo	Device Positioner	TD1.5	RF-205	N/A
Maturo	Antenna Mast	TAM4.0	RF-225	N/A
Maturo	Antenna Mast	BAM4.5-P/051	RF-328	N/A
Huber & Suhner	RF Cable	SucoFlex 106A	RF-351	03/21/2016
Huber & Suhner	RF Cable	SucoFlex 100	RF-350	03/21/2016
Micro-Coax	RF Cable	UTI Flex	RF-359	12/18/2016
Madge Tech	THP Monitor	PRH Temp 2000	EMC-171	6/28/2016
Rohde & Schwarz	Test Software	EMC 32 V9.22	N/A	N/A

Equipment used for Line Conducted Emissions Measurement				
Manufacturer	Description	Model #	Asset #	Cal/Ver Due
Rohde & Schwarz	EMI Test Receiver	ESR 3	EMC-669	11/3/2015
Teseq	LISN	NNB 51	EMC-057	5/28/2016
Teseq	LISN	NNB 51	EMC-187	9/24/2016
Micro-Coax	RF Cable	UFA210A-1-1800-50U50U	EMC-367	8/6/2016
Rohde & Schwarz	Test Software	EMC 32 V9.22	N/A	N/A
ETS	TILE SW	Ver 7.0	N/A	N/A

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz. For measurements above 1 GHz, absorbers with a 2.4m X 2.4m configuration are laid out on the ground plane between the receiving antenna and the EUT in accordance with the requirements of ANSI C63.4:2009.

8.1.1 Radiated Measurements in 30M- 1000 MHz

The EUT is positioned on a Turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both horizontal and vertical polarizations of the measurement antenna. The EUT was also rotated about its three orthogonal orientations to investigate emissions.

8.1.2 Radiated Measurements above 1GHz

The EUT was positioned on a turntable at a height of 150cm using a device positioner. A linearly polarized antenna was positioned 3m from the EUT periphery. Guidelines in ANSI C63.10 2013 were followed with respect to maximizing the emissions. The turntable is rotated 360 degrees, the antenna height maintained at 150cm and the device positioner rotated about its horizontal axis to determine the highest emissions. This was repeated for both horizontal and vertical polarizations of the measurement antenna. Measurements above 18GHz were performed at a distance of 1m.

8.2 Antenna port conducted measurements

All antenna port conducted measurements were performed on a bench-top setup consisting of a spectrum analyzer, power meter (as necessary), splitters/combiners (as necessary), attenuators, and pre-characterized RF cables.

The correction factors between the EUT and the spectrum analyzer is added internally in the analyzer settings. The plots displayed accounts for these correction factors.

8.3 Test Setup Diagrams

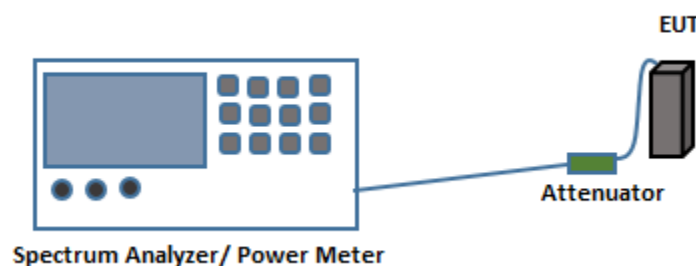


Fig.1. Test Setup for Antenna port conducted measurements

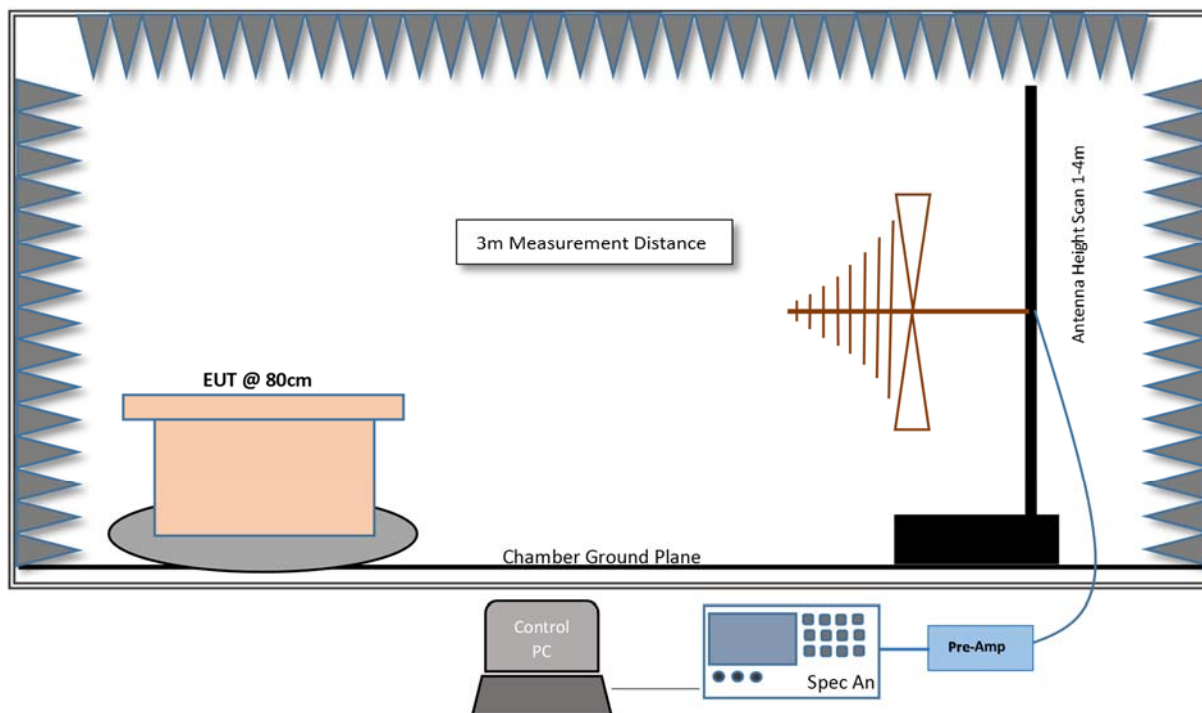


Fig.2. Test Setup for Radiated measurements in 30MHz- 1GHz Range

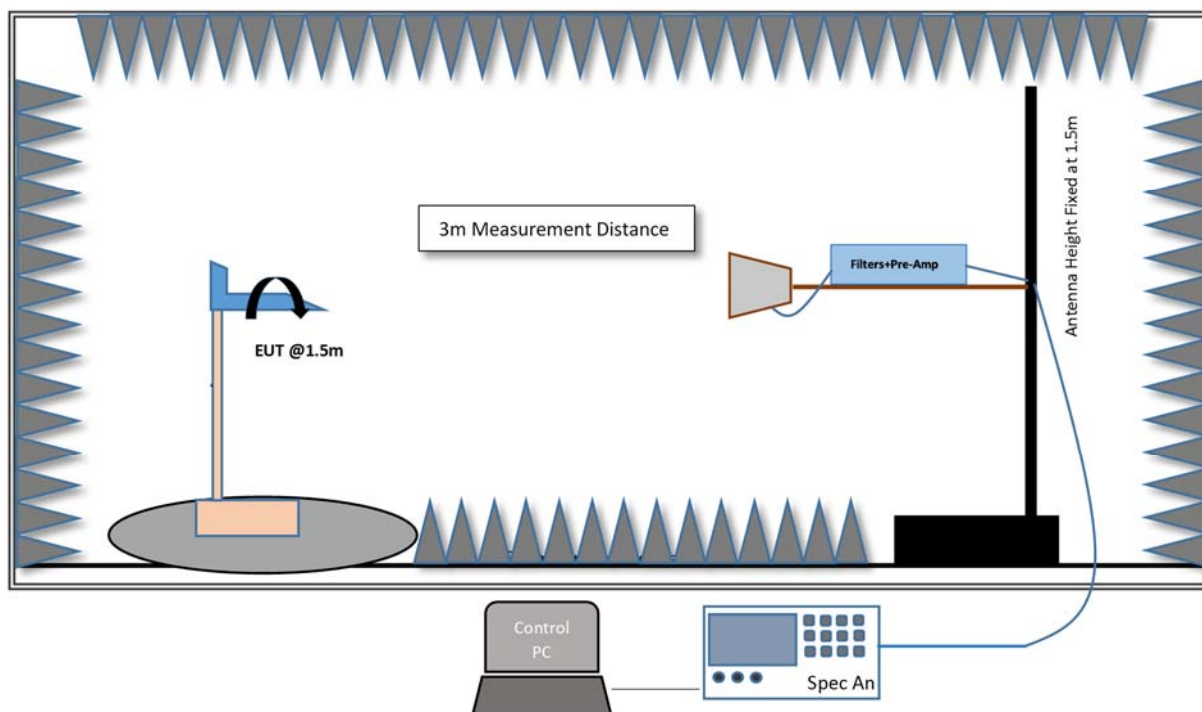


Fig.3. Test Setup for Radiated measurements in 1GHz- 18GHz Range

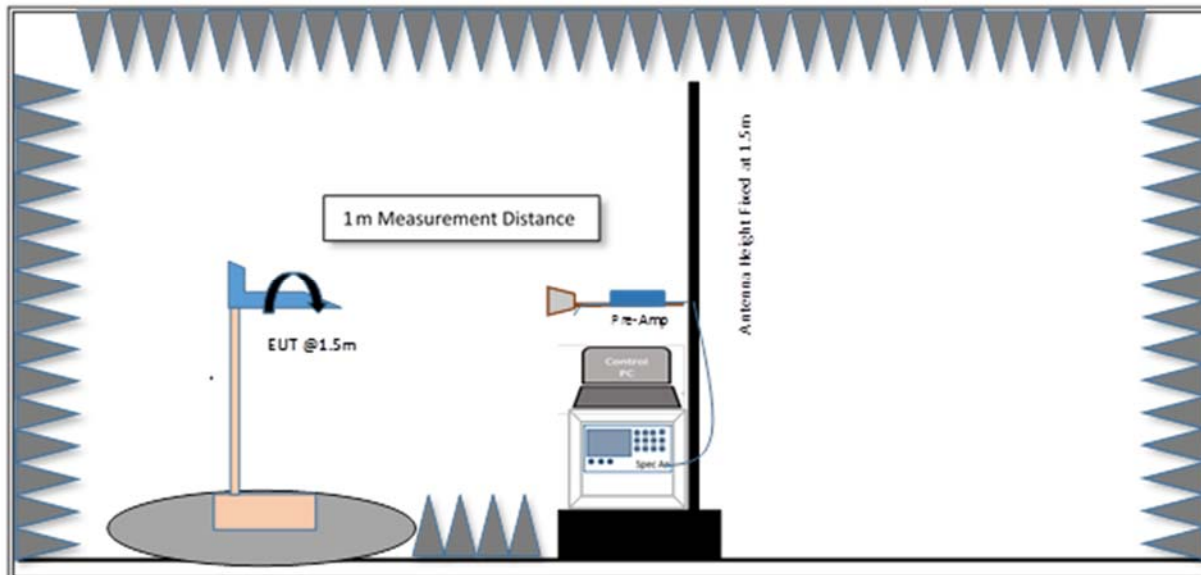


Fig.4. Test Setup for Radiated measurements >18GHz

9 Test Results- Conducted

9.1 Duty Cycle

9.1.1 Test Requirement:

Reporting and measurement purposes only.

9.1.2 Test Method

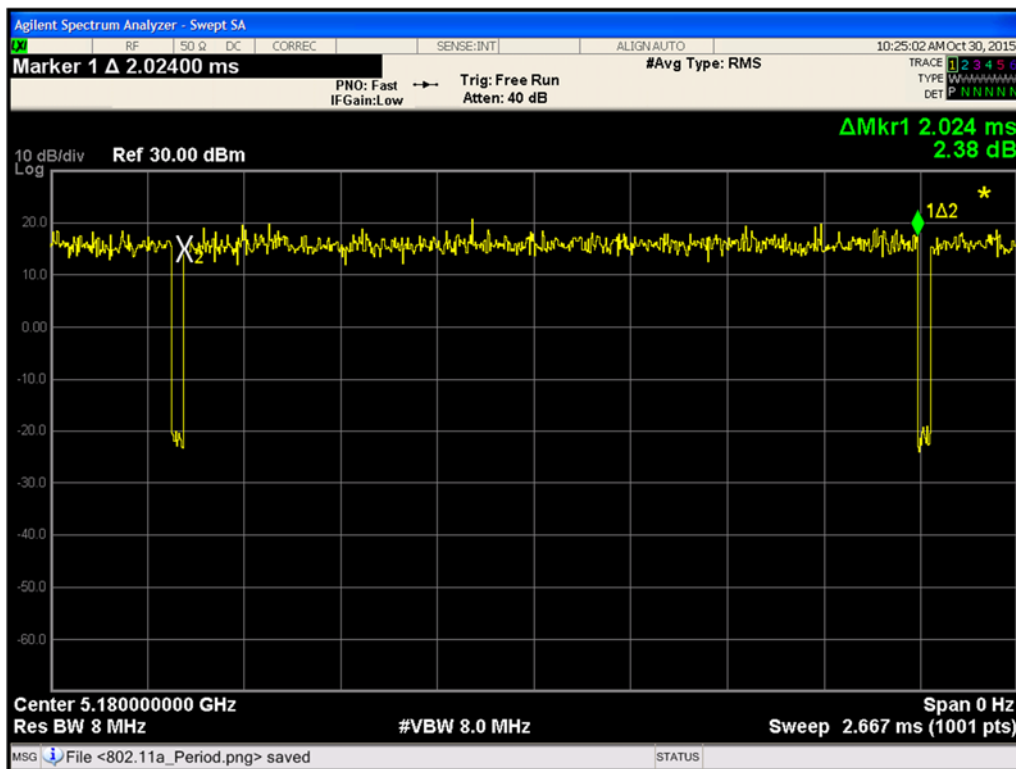
Measurements were performed according to the procedure defined in ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices

9.1.3 Limits:

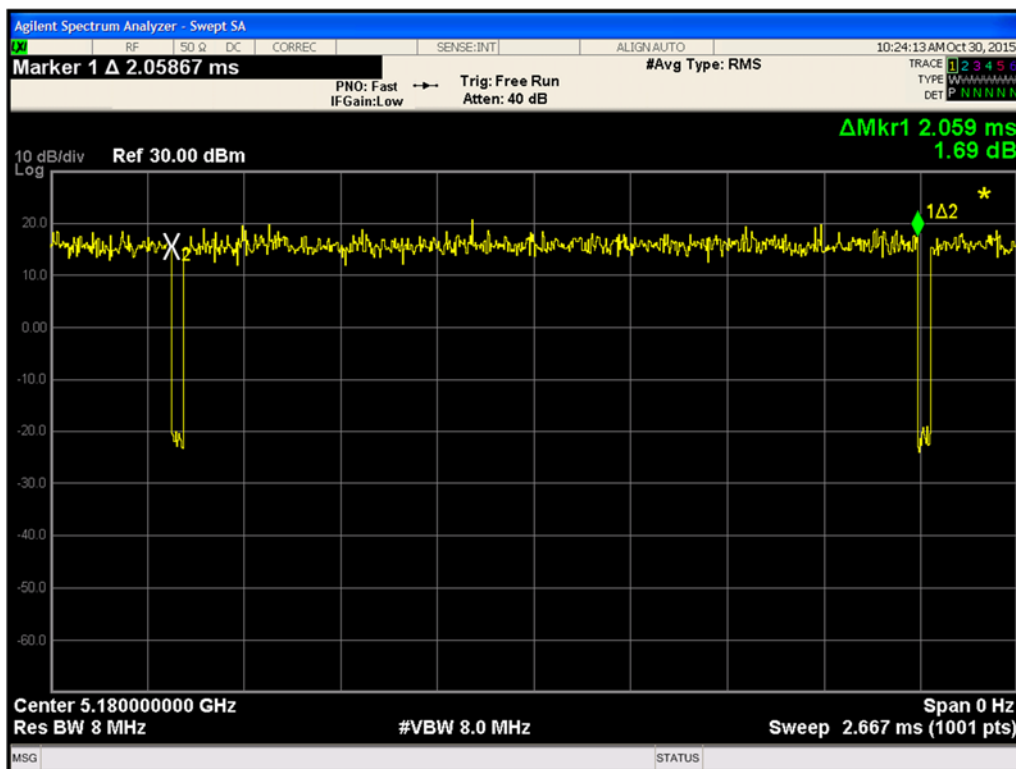
N/A

9.1.4 Test Results:

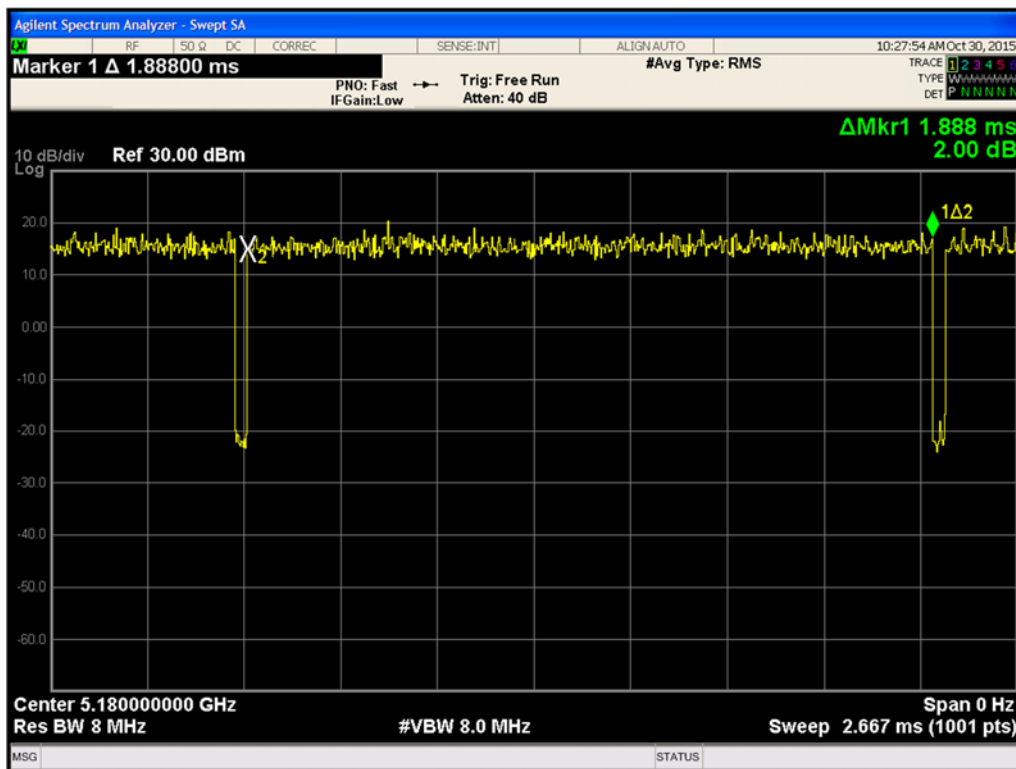
Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11a	2.024	2.059	98.3	0.07
802.11n	1.888	1.923	98.2	0.08



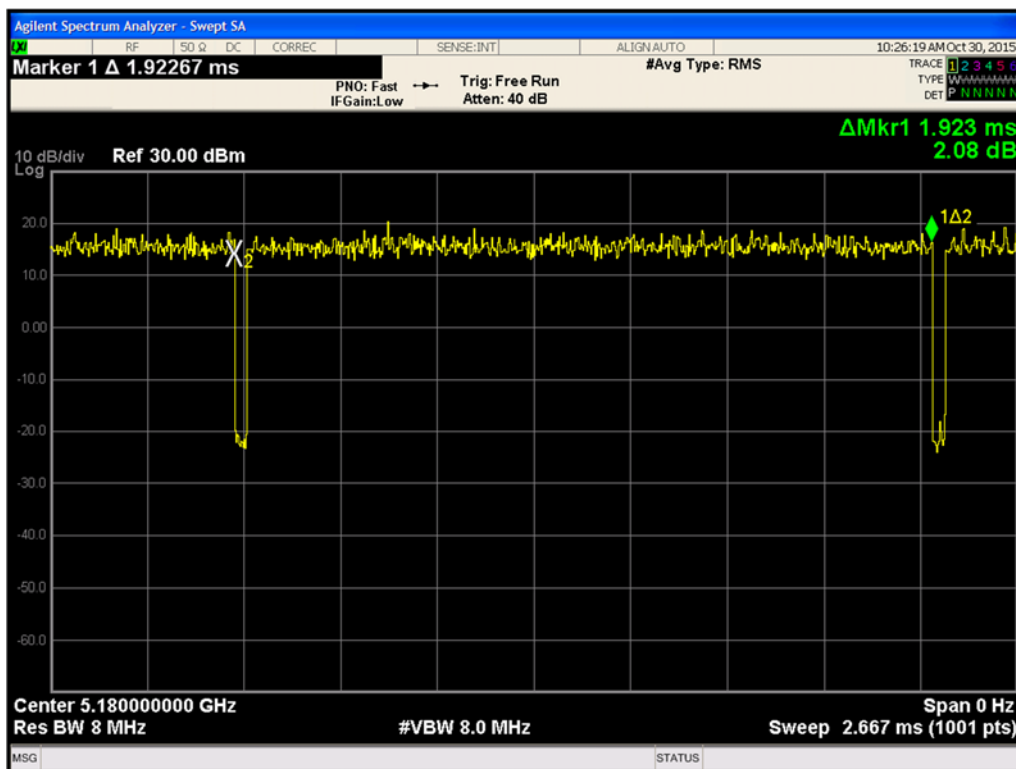
Plot 9-1 ON-time- 802.11a



Plot 9-2 Period- 802.11a



Plot 9-3 ON-time - 802.11n



Plot 9-4 Period - 802.11n

9.2 26-dB Emission Bandwidth

9.2.1 Test Requirement:

FCC CFR 47 Rule Part 15.407 (h)(2)

Industry Canada RSS-247 [6.2.1]

9.2.2 Test Method:

Measurements were performed according to the procedures defined in KDB 789033 D02-General UNII Test Procedures New Rules v01 and ANSI C63.10 (2013) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer settings:

RBW = approximately 1% of the Emissions Bandwidth

VBW $\geq$ 3xRBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

The in-built functionality of the Spectrum Analyzer is used to measure the 26-dB emission bandwidth.

9.2.3 Limits:

The 26-dB bandwidth are required for power limits, measurements and reporting purposes.

9.2.4 Test Results:

Pass.

9.2.5 Test Data:

9.2.5.1 802.11a 26-dB Emission Bandwidth

802.11a 26-dB Emission Bandwidth		
Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)
36	5180	23.90
40	5200	23.38
48	5240	22.61
52	5260	24.61
60	5300	22.87
64	5320	23.93
100	5500	26.99
116	5580	35.03
140	5700	37.21
149	5745	36.86
157	5785	35.56
165	5825	36.86

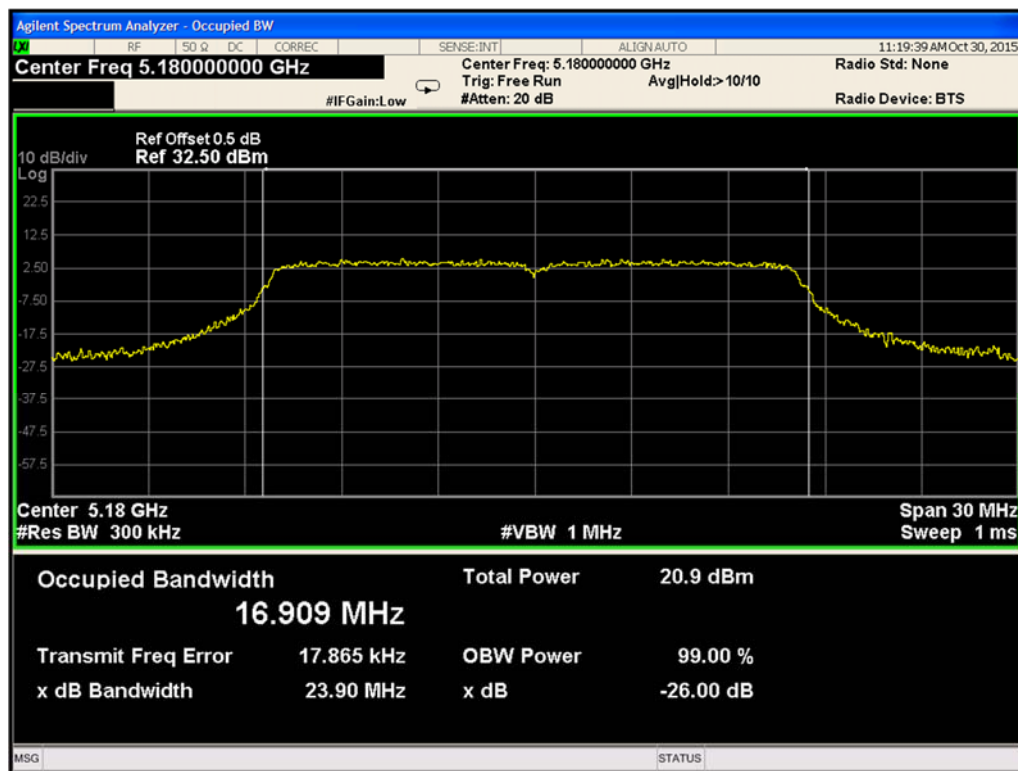


Figure 9-5. 26-dB Emission Bandwidth 802.11a (Ch. 36)

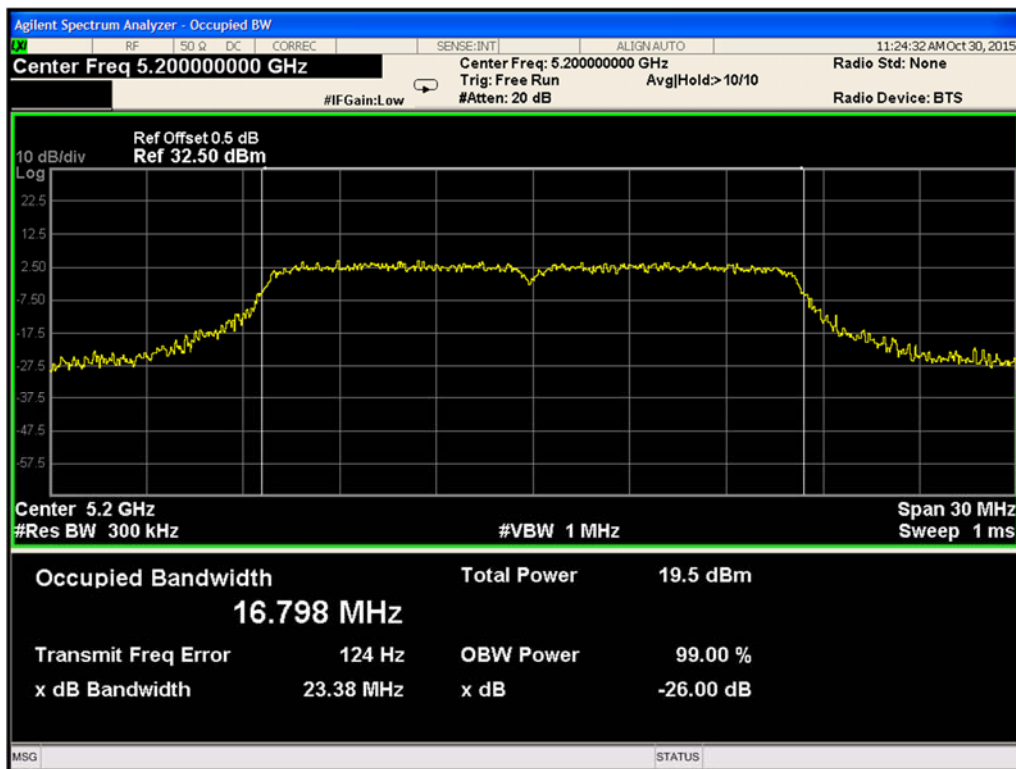


Figure 9-6. 26-dB Emission Bandwidth 802.11a (Ch. 40)

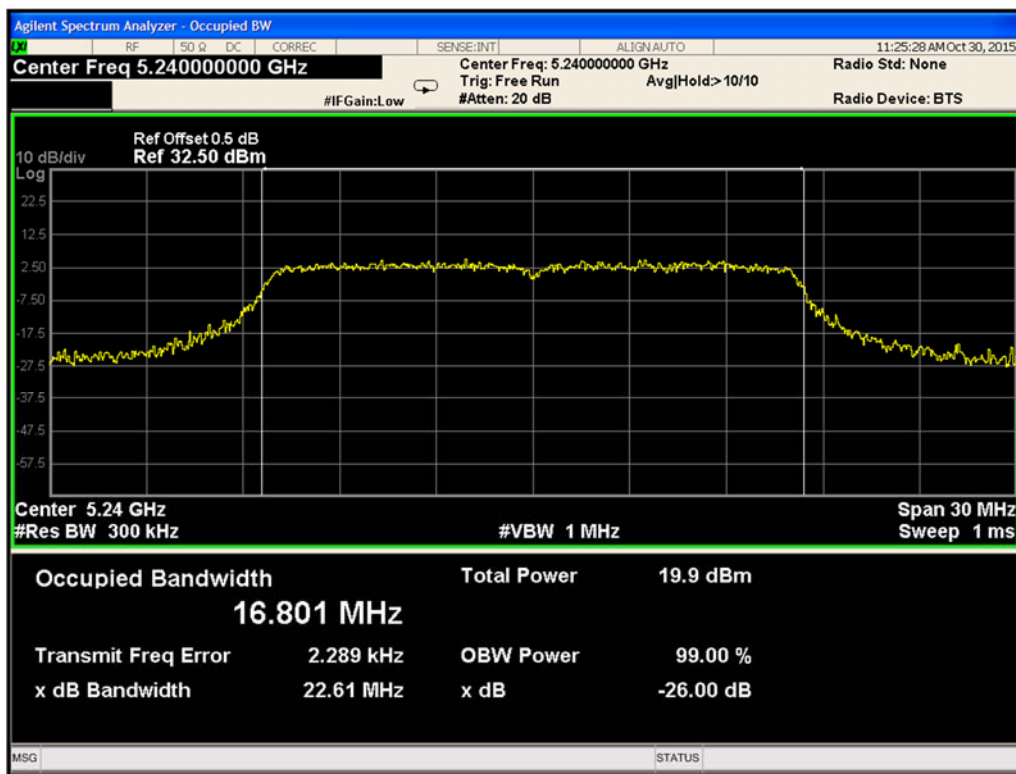


Figure 9-7 26-dB Emission Bandwidth 802.11a (Ch. 48)

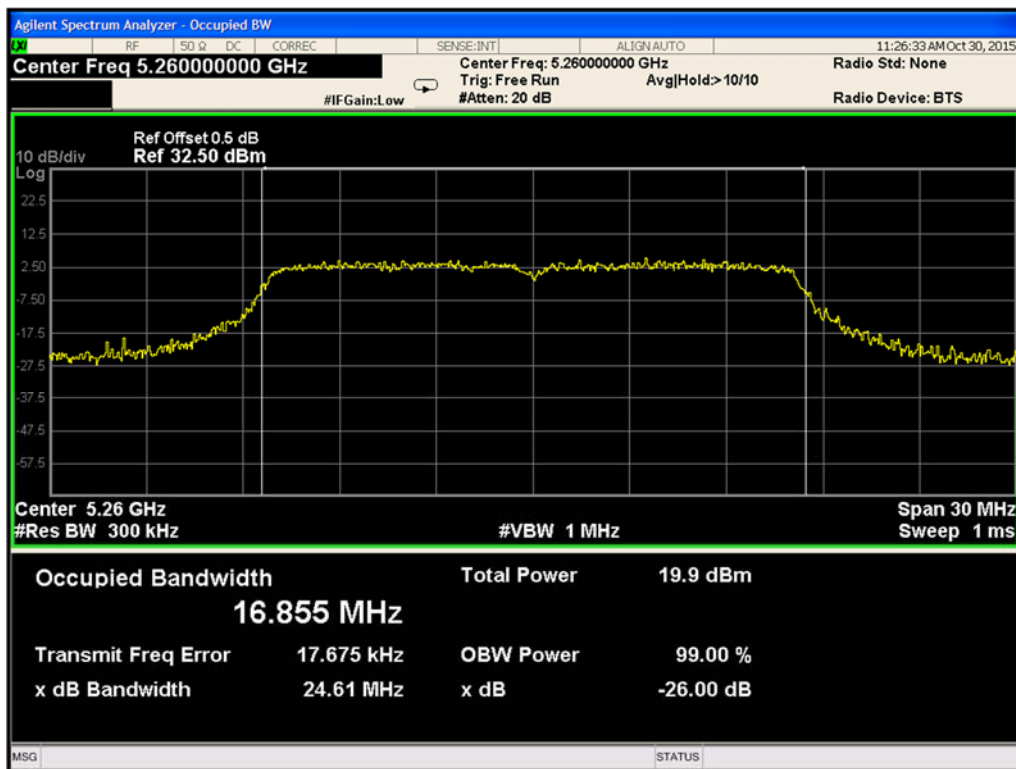


Figure 9-8. 26-dB Emission Bandwidth 802.11a (Ch. 52)

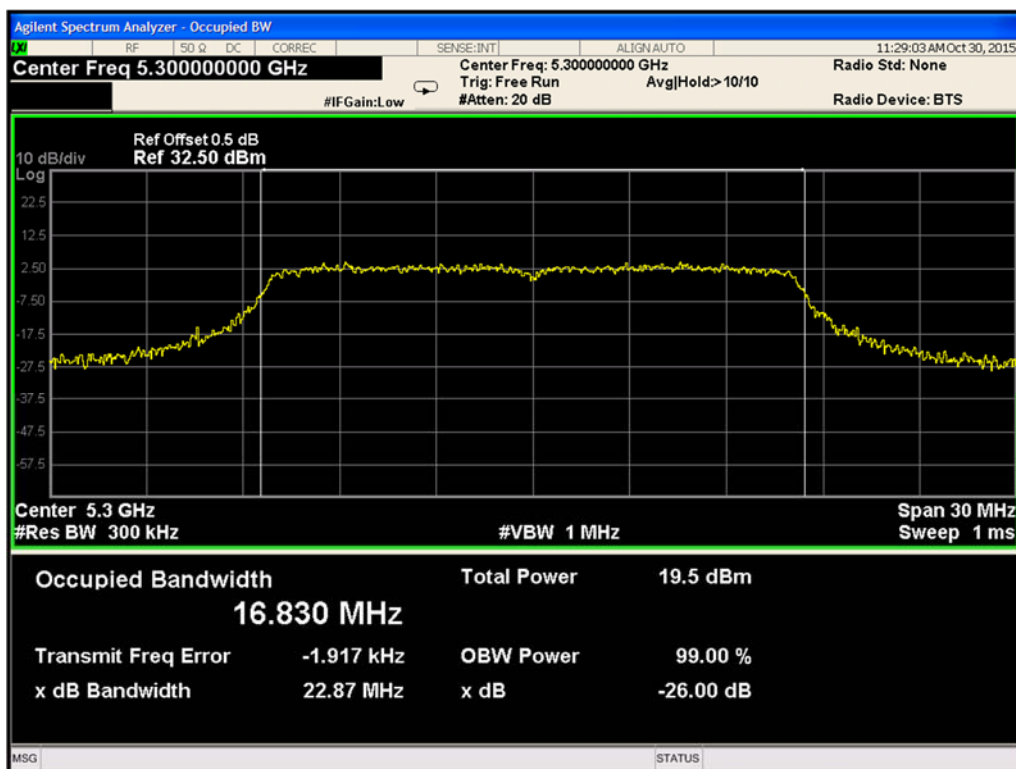


Figure 9-9. 26-dB Emission Bandwidth 802.11a (Ch. 60)

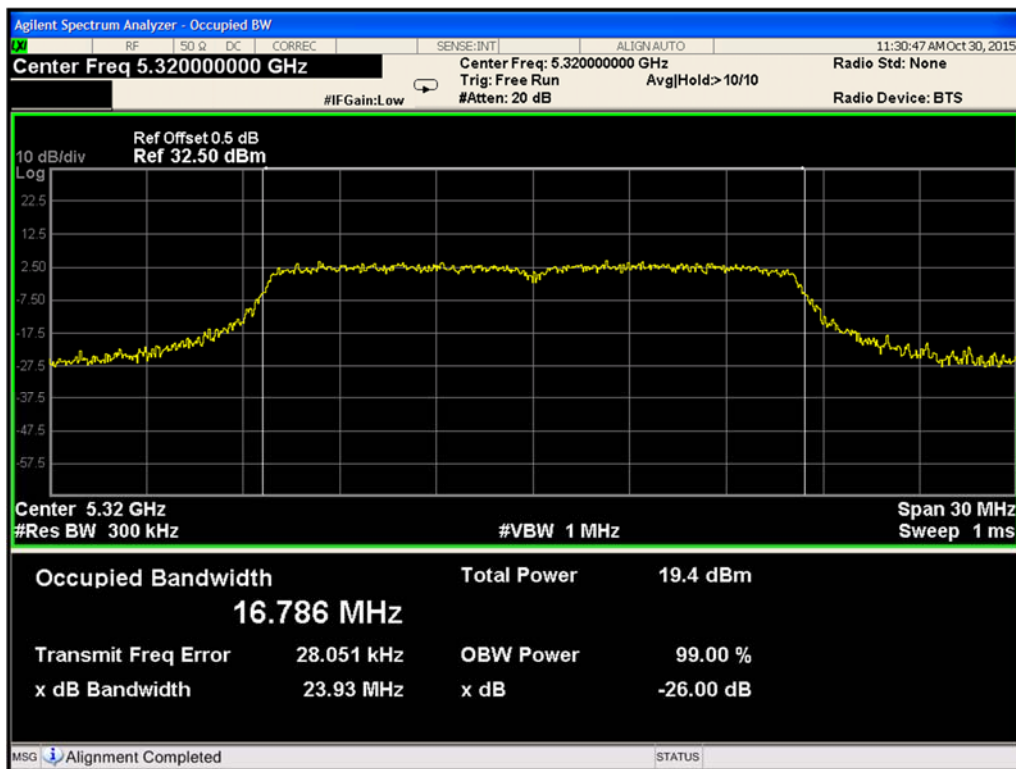


Figure 9-10. 26-dB Emission Bandwidth 802.11a (Ch. 64)

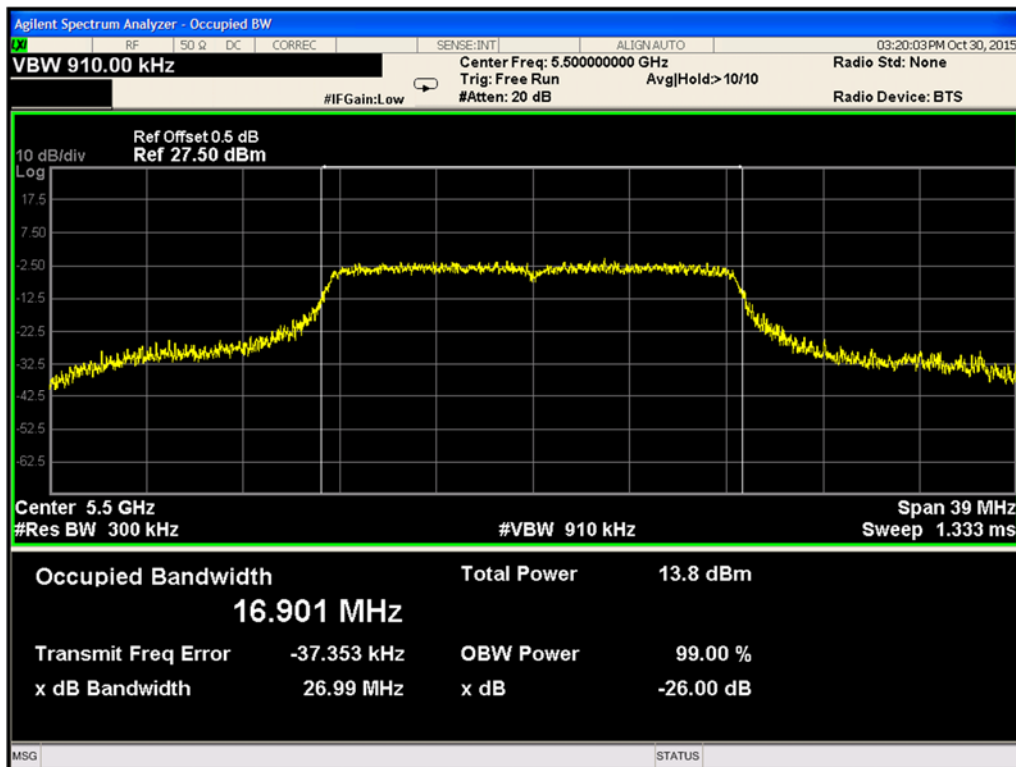


Figure 9-11. 26-dB Emission Bandwidth 802.11a (Ch. 100)

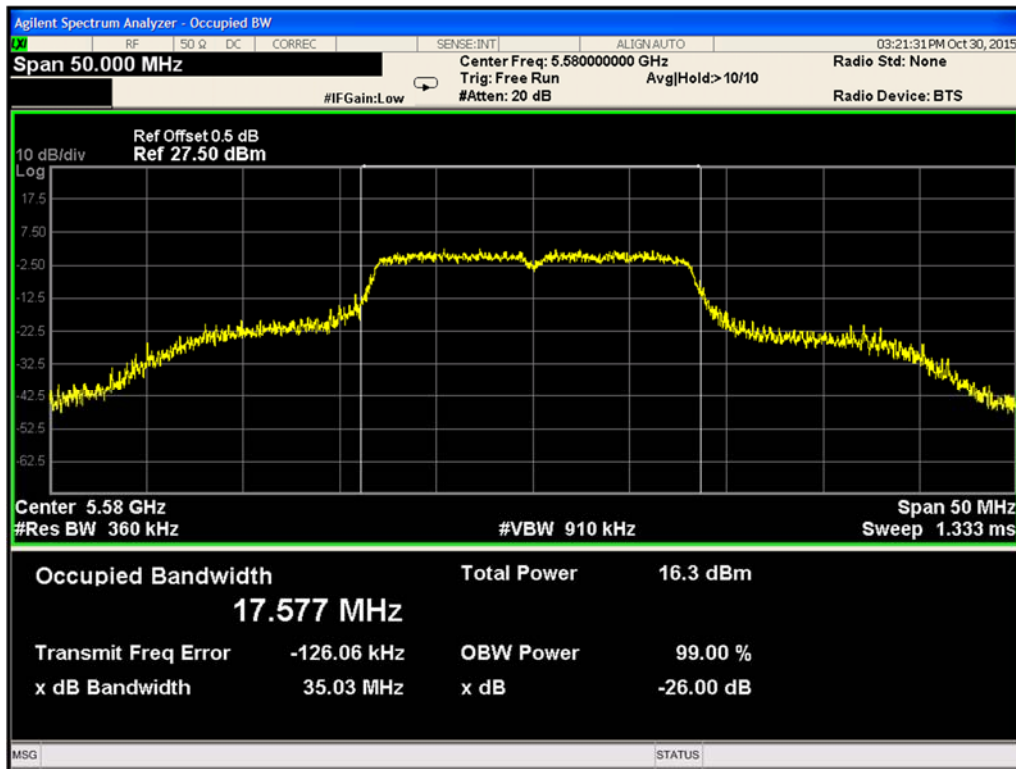


Figure 9-12. 26-dB Emission Bandwidth 802.11a (Ch. 116)

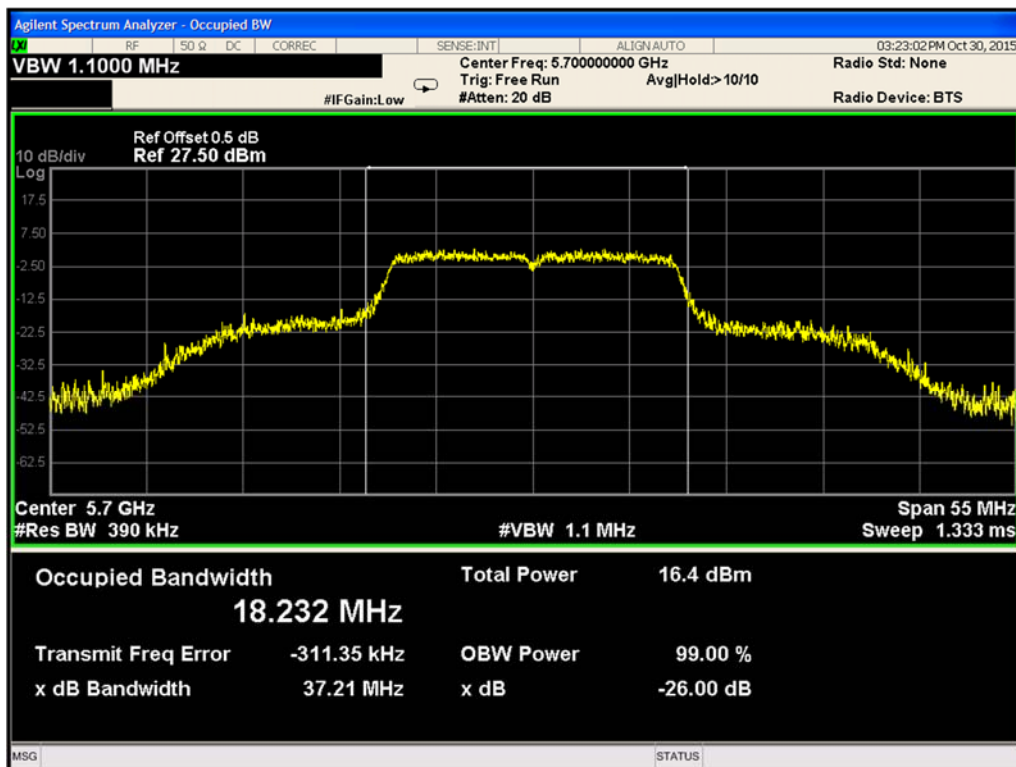


Figure 9-13. 26-dB Emission Bandwidth 802.11a (Ch. 140)

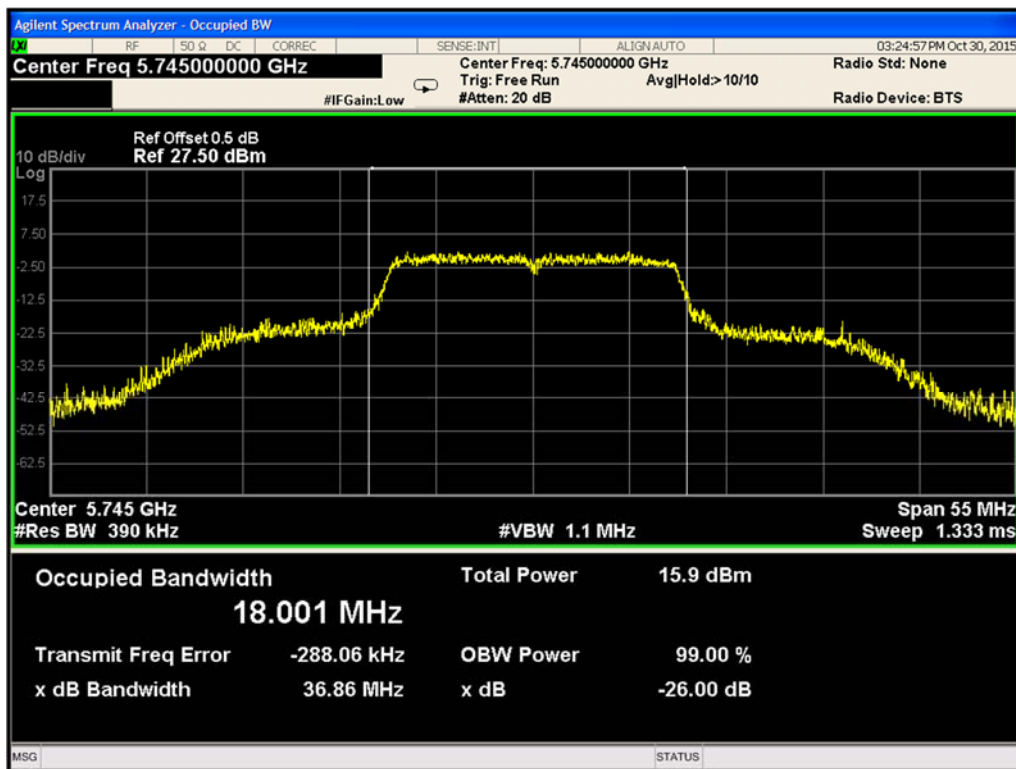


Figure 9-14. 26-dB Emission Bandwidth 802.11a (Ch. 149)

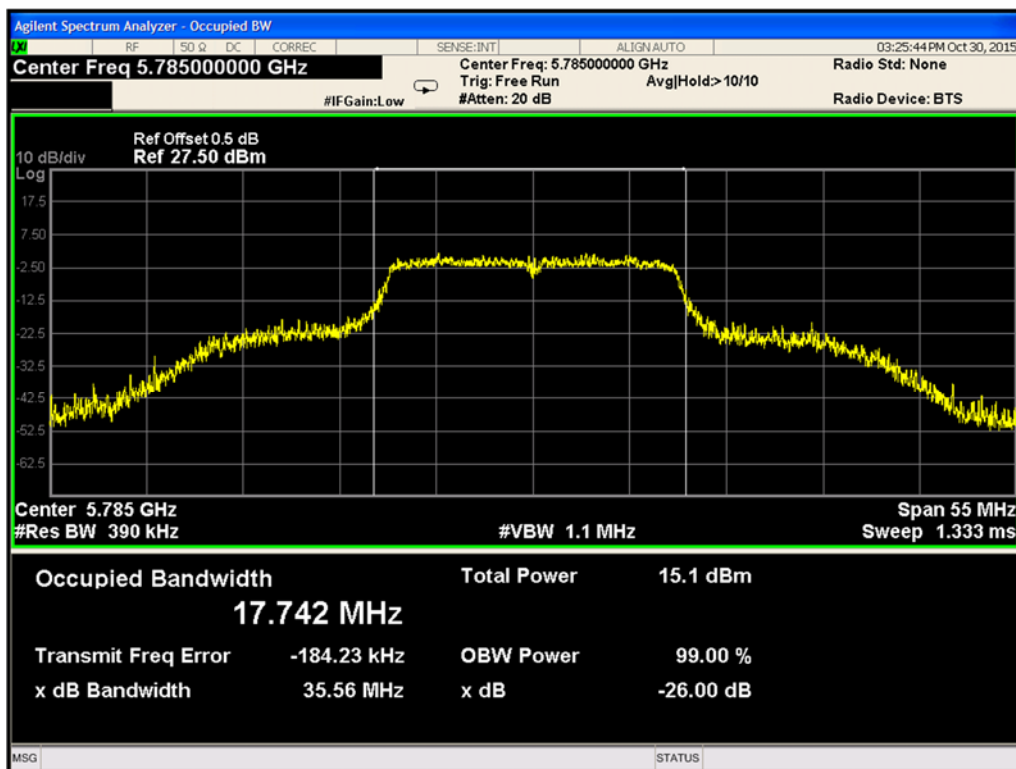


Figure 9-15. 26-dB Emission Bandwidth 802.11a (Ch. 157)

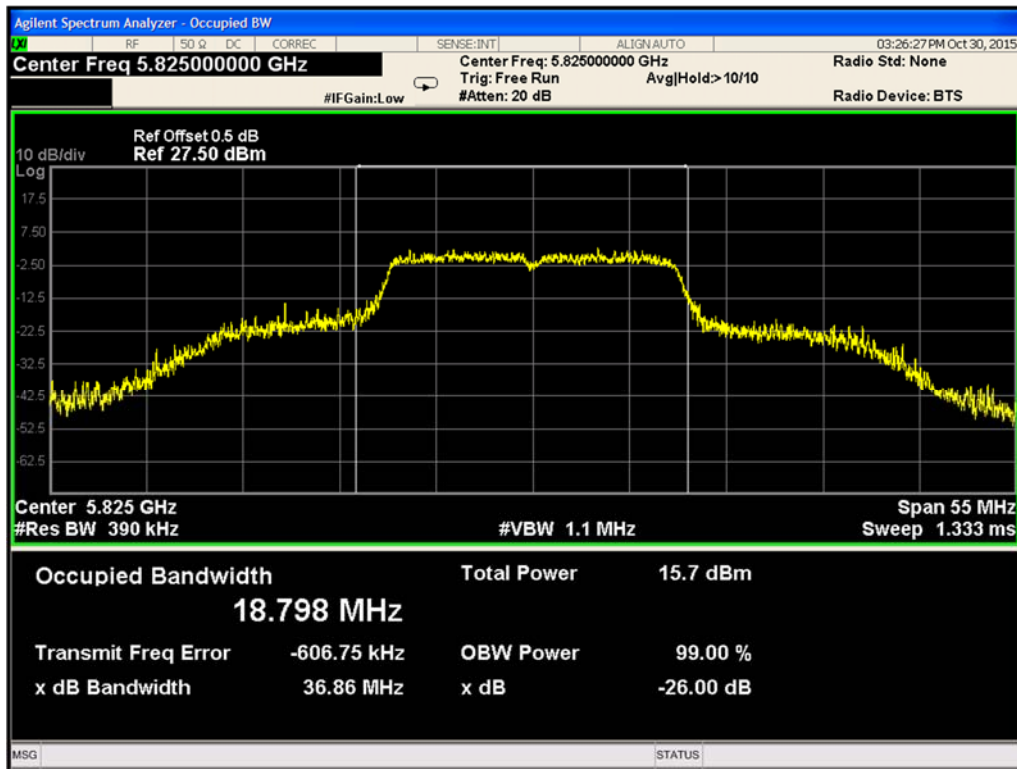


Figure 9-16. 26-dB Emission Bandwidth 802.11a (Ch. 165)

9.2.5.2 802.11n 26-dB Emission Bandwidth

802.11n 26-dB Emission Bandwidth		
Channel No.	Frequency (MHz)	26-dB Emission Bandwidth (MHz)
36	5180	23.41
40	5220	24.37
48	5240	28.46
52	5260	26.33
60	5300	25.30
64	5320	23.69
100	5500	28.79
116	5580	37.28
140	5700	38.04
149	5745	37.72
157	5785	37.27
165	5825	37.86

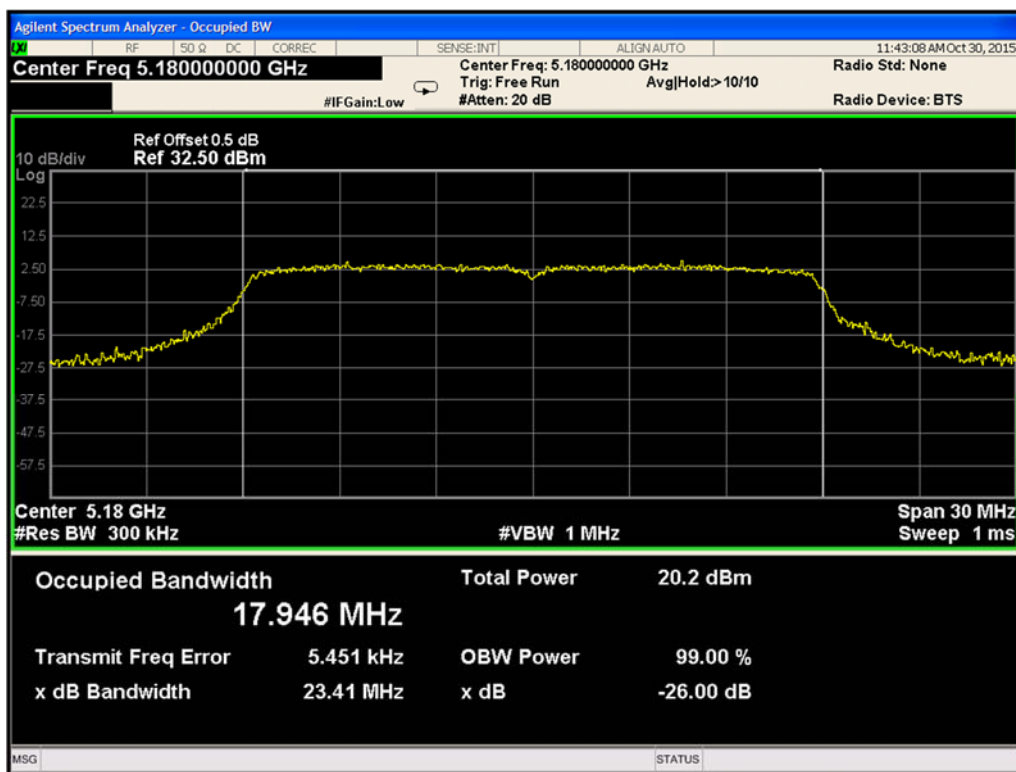


Figure 9-17. 26-dB Emission Bandwidth 802.11n (Ch. 36)

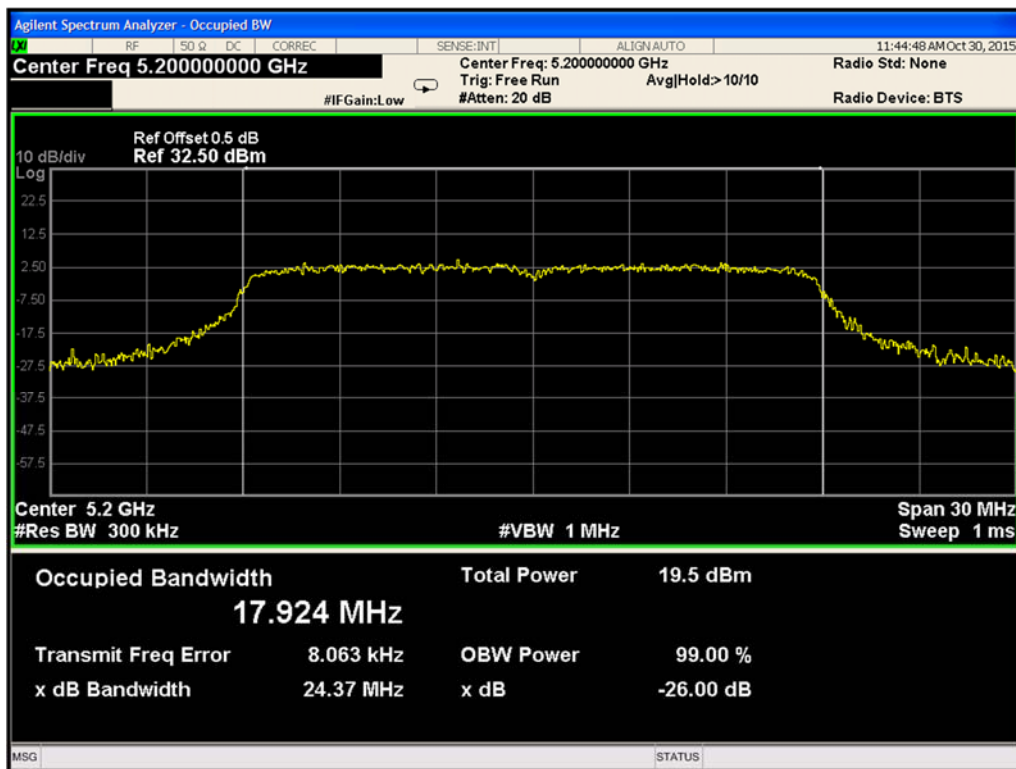


Figure 9-18. 26-dB Emission Bandwidth 802.11n (Ch. 40)

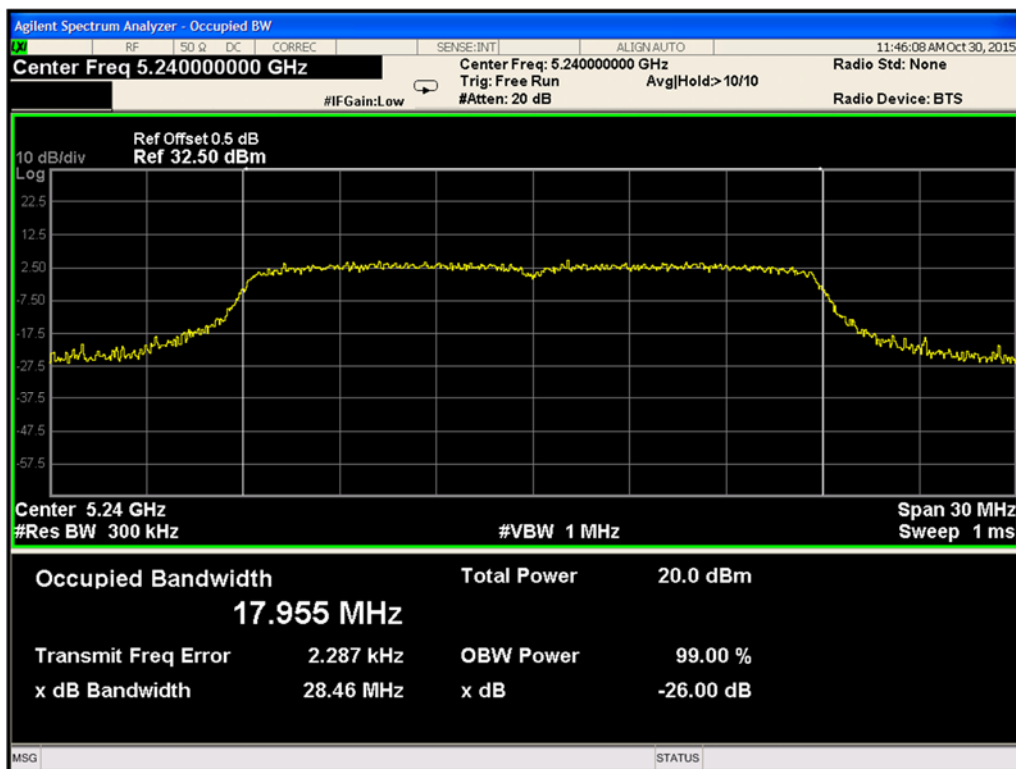


Figure 9-19. 26-dB Emission Bandwidth 802.11n (Ch. 48)

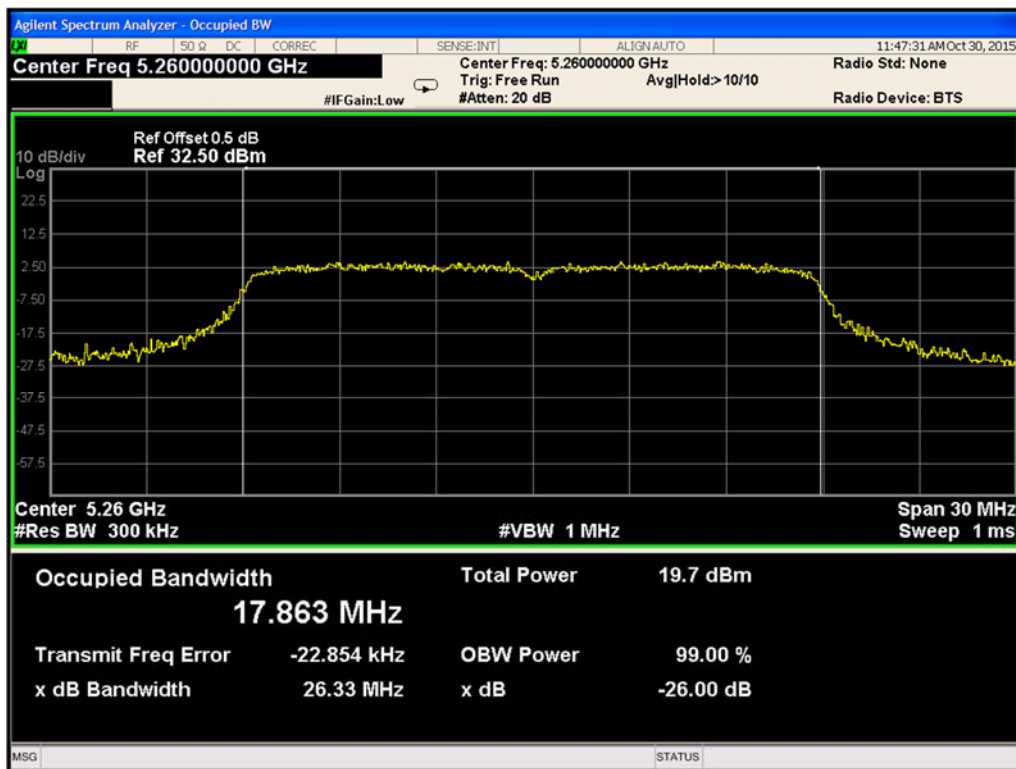


Figure 9-20. 26-dB Emission Bandwidth 802.11n (Ch. 52)

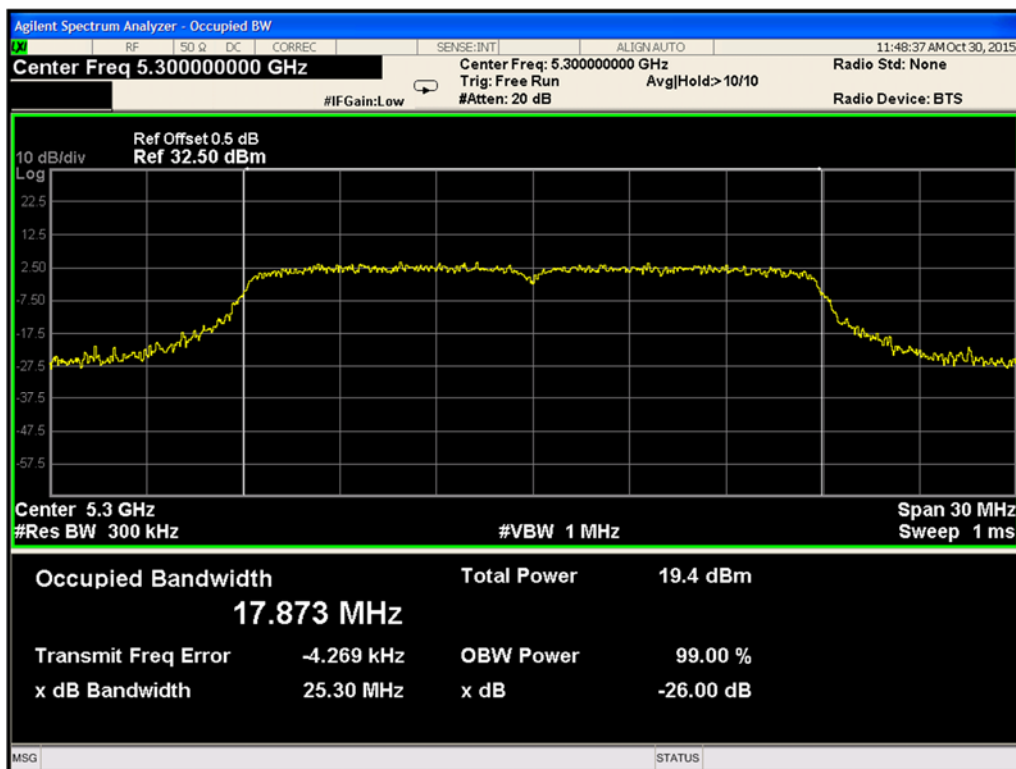


Figure 9-21. 26-dB Emission Bandwidth 802.11n (Ch. 60)

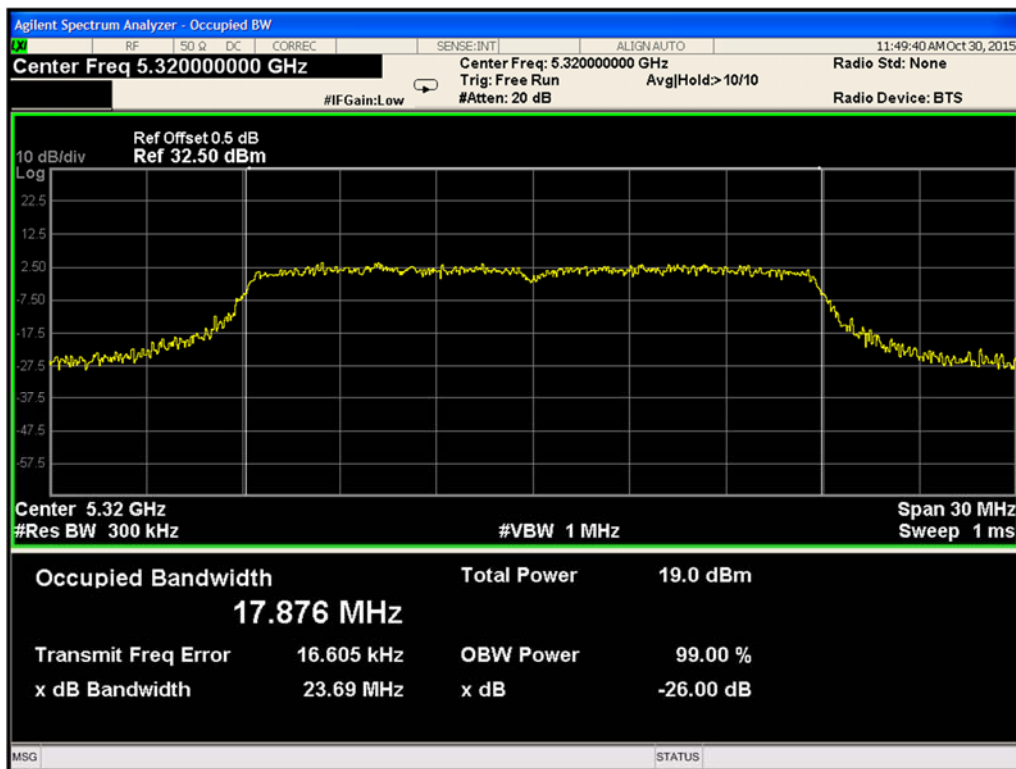


Figure 9-22. 26-dB Emission Bandwidth 802.11n (Ch. 64)

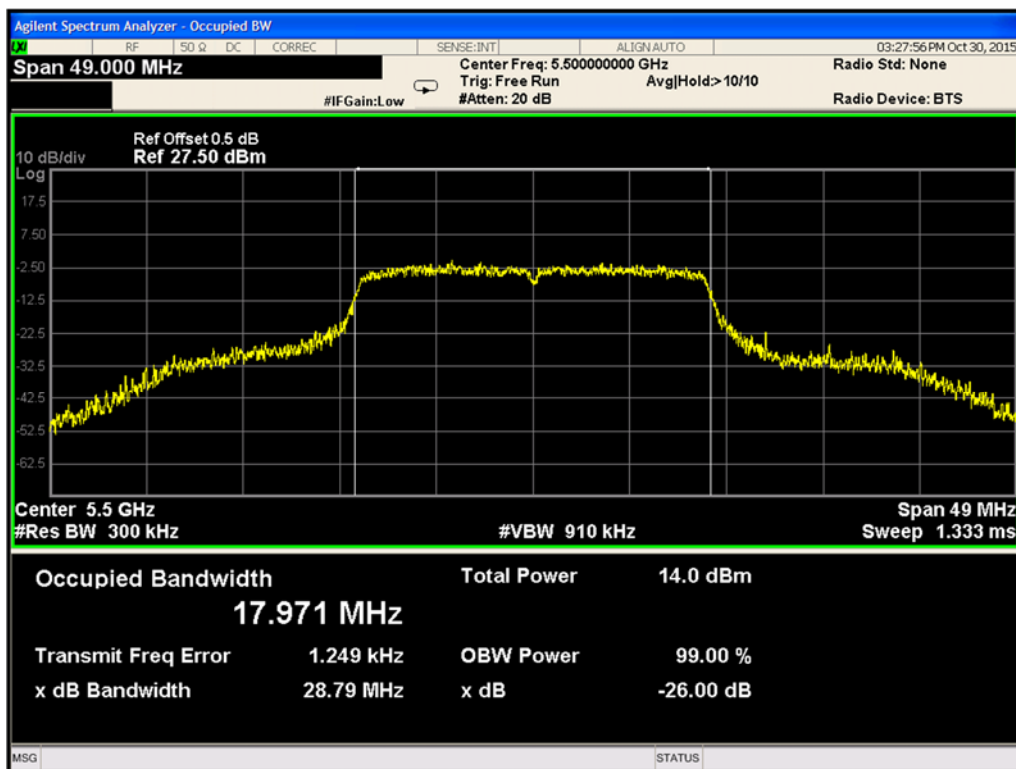


Figure 9-23. 26-dB Emission Bandwidth 802.11n (Ch. 100)

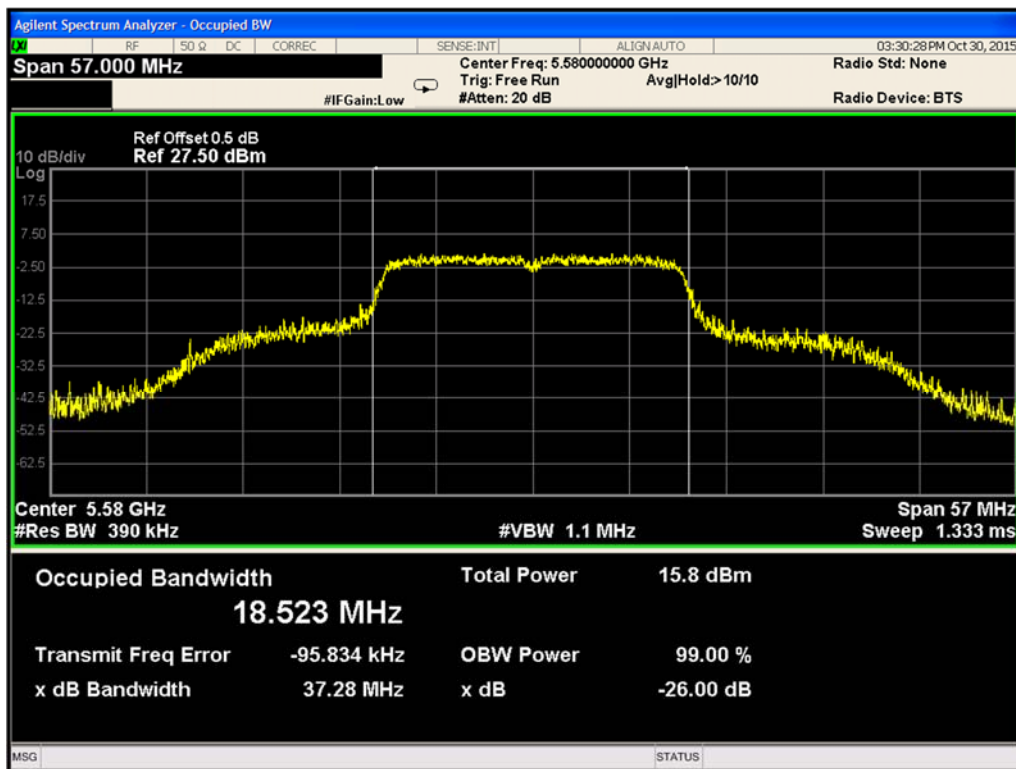


Figure 9-24. 26-dB Emission Bandwidth 802.11n (Ch. 116)

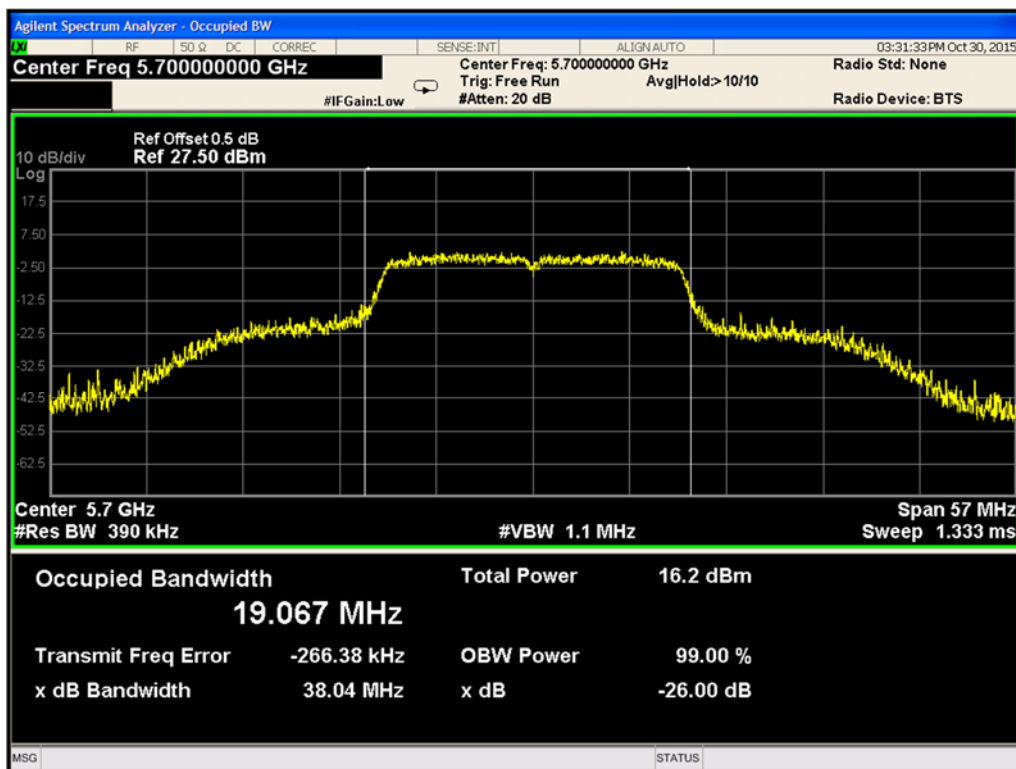


Figure 9-25. 26-dB Emission Bandwidth 802.11n (Ch. 140)

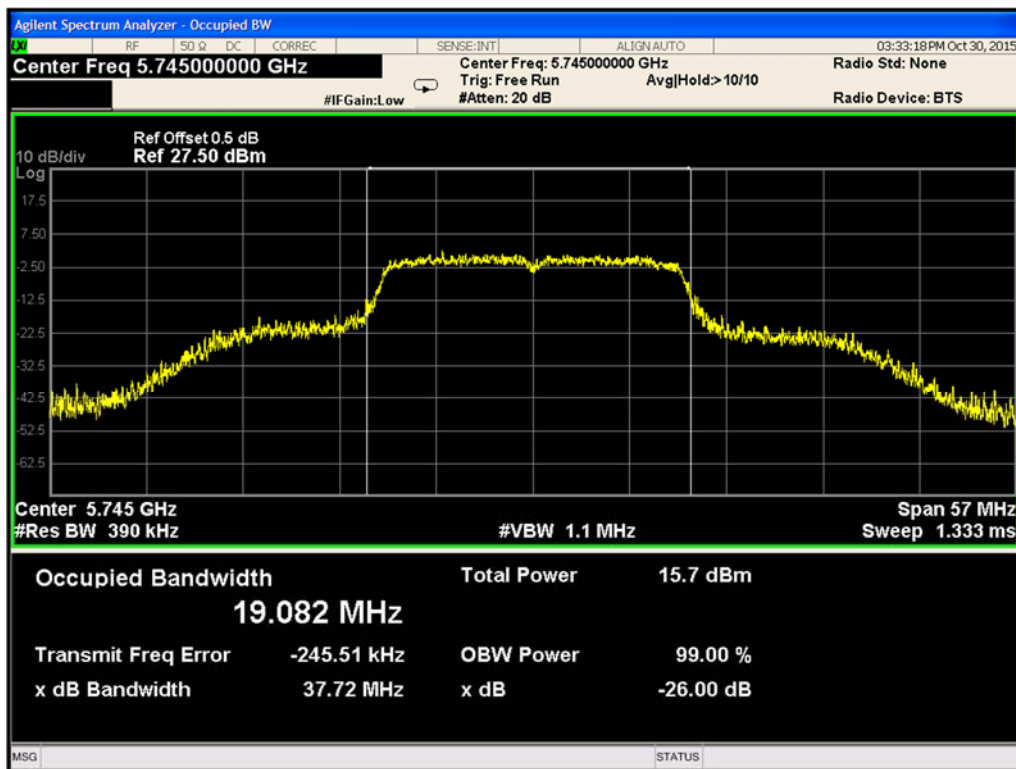


Figure 9-26. 26-dB Emission Bandwidth 802.11n (Ch. 149)

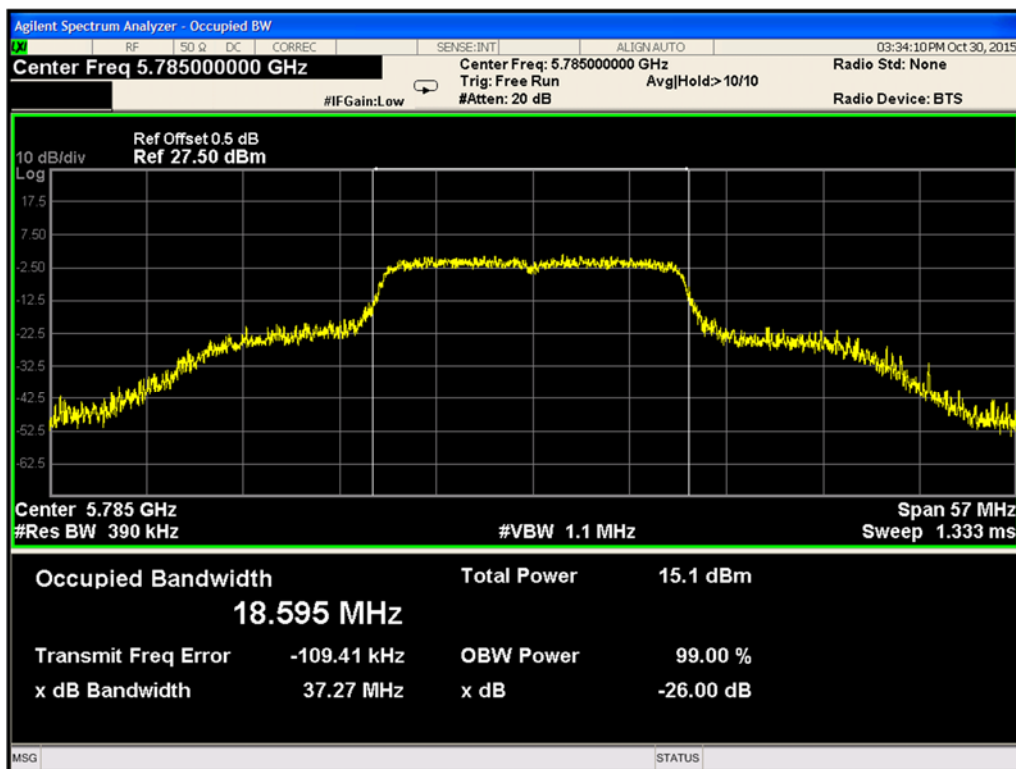


Figure 9-27. 26-dB Emission Bandwidth 802.11n (Ch. 157)

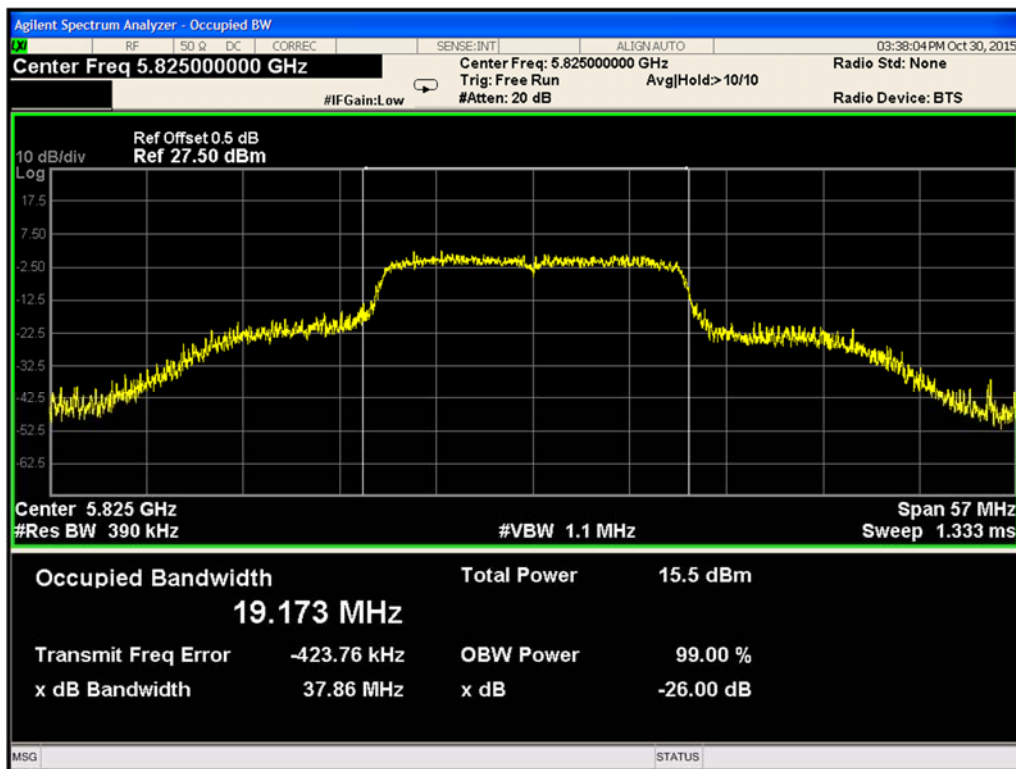


Figure 9-28. 26-dB Emission Bandwidth 802.11n (Ch. 165)