PCTEST ENGINEERING LABORATORY, INC.
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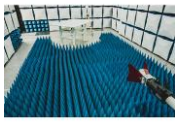

MEASUREMENT REPORT
FCC PART 15.247 / ISED RSS-247 UNII 802.11a/n/ac

Applicant Name:
Apple Inc.
1 Infinite Loop
Cupertino, CA 95014
United States

Date of Testing:
10/31-2/15/2018
Test Site/Location:
PCTEST Lab. Morgan Hill, CA, USA
Test Report Serial No.:
1C1710060006-06.BCG

FCC ID:	**BCGA1954**
IC:	**579C-A1954**
APPLICANT:	**Apple Inc.**

Application Type:	Certification
Model/HVIN:	A1954
EUT Type:	Tablet Device
Frequency Range:	5180 – 5825MHz
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15 Subpart C (15.247)
ISED Specification:	RSS-247 Issue 2
Test Procedure(s):	ANSI C63.10-2013, KDB 789033 D02 v02r01 KDB 662911 D01 v02r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013 and KDB 789033 D02 v02r01. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

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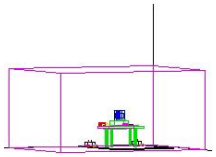
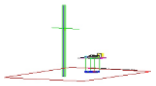


MEASUREMENT REPORT



UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	ANT1		ANT2		MIMO	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	44.668	16.50	44.566	16.49	88.927	19.49
2A		5260 - 5320	50.119	17.00	50.003	16.99	98.635	19.94
2C		5500 - 5720	50.119	17.00	50.119	17.00	100.007	20.00
3		5745 - 5825	44.668	16.50	44.668	16.50	89.125	19.50
1	40	5190 - 5230	43.652	16.40	43.752	16.41	88.320	19.46
2A		5270 - 5310	48.978	16.90	49.204	16.92	98.410	19.93
2C		5510 - 5710	50.119	17.00	48.865	16.89	100.007	20.00
3		5755 - 5795	44.463	16.48	44.157	16.45	88.927	19.49
1	80	5210	19.011	12.79	19.543	12.91	31.337	14.96
2A		5290	19.275	12.85	19.634	12.93	30.446	14.84
2C		5530 - 5690	50.119	17.00	50.119	17.00	100.007	20.00
3		5775	44.668	16.50	43.652	16.40	78.805	18.97

FCC EUT Overview

UNII Band	Channel Bandwidth (MHz)	Tx Frequency (MHz)	ANT1		ANT2		MIMO	
			Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)	Max. Power (mW)	Max. Power (dBm)
1	20	5180 - 5240	31.623	15.00	31.623	15.00	31.623	15.00
2A		5260 - 5320	50.119	17.00	50.003	16.99	98.628	19.94
2C		5500 - 5720	50.119	17.00	50.119	17.00	100.007	20.00
3		5745 - 5825	44.668	16.50	44.668	16.50	89.125	19.50
1	40	5190 - 5230	43.652	16.40	43.752	16.41	50.003	16.99
2A		5270 - 5310	48.978	16.90	49.204	16.92	98.855	19.95
2C		5510 - 5710	50.119	17.00	48.417	16.85	100.007	20.00
3		5755 - 5795	44.463	16.48	44.157	16.45	88.927	19.49
1	80	5210	19.011	12.79	19.543	12.91	31.337	14.96
2A		5290	19.275	12.85	19.634	12.93	30.446	14.84
2C		5530 - 5690	50.119	17.00	50.003	16.99	99.541	19.98
3		5775	44.668	16.50	43.652	16.40	78.805	18.97

ISED EUT Overview

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Morgan Hill, CA, 95037, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Tablet Device FCC ID: BCGA1954**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter.

Test Device Serial No.: F9FVT02RJM50, F9FVT00QJM4W

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE),

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
36	5180	52	5260	100	5500	149	5745
:	:	:	:	:	:	:	:
42	5210	56	5280	116	5580	157	5785
:	:	:	:	:	:	:	:
48	5240	64	5320	144	5720	165	5825

Table 2-1. 802.11a / 802.11n / 802.11ac (20MHz) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
38	5190	54	5270	102	5510	151	5755
:	:	:	:	:	:	:	:
46	5230	62	5310	110	5550	157	5785
				:	:	:	:
				142	5710	161	5805

Table 2-2. 802.11n / 802.11ac (40MHz BW) Frequency / Channel Operations

Band 1		Band 2A		Band 2C		Band 3	
Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
42	5210	58	5290	106	5530	155	5775
				:	:		
				138	5690		

Table 2-3. 802.11ac (80MHz BW) Frequency / Channel Operations

Notes:

1. 5GHz NII operation is possible in 20MHz, and 40MHz, and 80MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section B)2)b) of ANSI C63.10-2013 and KDB 789033 D02 v02r01. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Maximum Achievable Duty Cycles				
802.11 Mode/Band		Duty Cycle [%]		
		ANT1	ANT2	MIMO
5GHz	a	98.8	98.7	
	n (HT20)	98.8	98.8	98.9
	n (HT40)	98.5	98.1	98.3
	ac (HT80)	96.5	96.6	95.6

Table 2-4. Measured Duty Cycles

2. The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		STBC		CDD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
5GHz	11a	✓	✓	×	×	×	×	×	×
	11n (20MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11n (40MHz)	✓	✓	✓	✓	✓	✓	✓	✓
	11ac (80MHz)	✓	✓	✓	✓	✓	✓	✓	✓

✓= Support ; × = NOT Support
SISO = Single Input Single Output
SDM = Spatial Diversity Multiplexing – MIMO function
CDD = Cyclic Delay Diversity - 2Tx Function

Data Rate(s) Tested:

6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)

6.5/7.2, 13/14.4, 19.5/21.7, 26/28.9, 39/43.3, 52/57.8, 58.5/65, 65/72.2 (n – 20MHz)

13.5/15, 27/30, 40.5/45, 54/60, 81/90, 108/120, 121.5/135, 135/150 (n – 40MHz BW)

29.3/32.5, 58.5/65, 87.8/97.5, 117/130, 175.5/195, 234/260, 263.3/292.5, 292.5/325, 351/390, 390/433.3 (ac – 80MHz BW)
13/14.4, 26.28.9, 39/43.3, 52/57.8, 78/86.7, 104/115.6, 117/130, 130/144.4MBps (MIMO n/ac – 20MHz)
156/173Mbps (MIMO ac – 20MHz)
27/30, 54/60, 81/90, 108/120, 162/180, 216/240, 243,270, 270/300Mbps (MIMO n/ac – 40MHz) 324/360, 360/400Mbps (MIMO ac – 40MHz)
58.5/65, 117/130, 175.5/195, 234/260, 351/390, 468/520, 526.5/585, 585/650, 702/780, 780/866.7Mbps (MIMO ac – 80MHz)

3. This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for these configurations is contained in this test report.

Configuration 1: ANT1 transmitting in 2.4GHz mode and ANT2 in 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1	2, 2
Channel	39	44
Operating Frequency (MHz)	2441	5220
Data Rate (Mbps)	1	MCS0
Mode	GFSK_ePA	802.11n_HT20

Table 2-5. Config-1 (ANT1 2.4GHz & ANT2 5GHz)

2.3 Antenna Description

Following antenna was used for the testing.

Frequency [GHz]	Antenna Gain (dBi)	
	Antenna A	Antenna B
5.20	1.27	2.64
5.30	2.24	2.77
5.50	3.39	3.17
5.80	3.54	3.21

Table 2-6. Antenna Peak Gain

2.4 Test Support Equipment

1	Apple MacBook	Model:	A1502	S/N:	C02P4004G1R8
	w/ AC/DC Adapter	Model:	A1435	S/N:	C04325505K1F288BG
2	Apple USB Cable	Model:	Kanzi	S/N:	3251F5
3	Apple Earphone	Model:	N/A	S/N:	N/A
4	USB Lightning Cable	Model:	N/A	S/N:	N/A
5	w/ 12 W AC Adapter	Model:	A1401	S/N:	N/A
6	DC Power Supply	Model:	EP20571-110V	S/N:	N/A

Table 2-7. Test Support Equipment Used

2.5 Test Configuration

The EUT was tested per the guidance of KDB 789033 D02 v01r04. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, and 7.5 for antenna port conducted emissions test setups.

The emissions below 1GHz and above 18GHz were tested with the highest transmitting power channel and the worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report. The worst orientation was found to be Y-orientation (landscape).

For AC line conducted and radiated test below 1GHz, following configuration were investigated and EUT powered by AC/DC was the worst case.

- EUT powered by AC/DC adaptor via USB cable with wire charger
- EUT powered by host PC via USB cable with wire charger

802.11n HT20/40 and acVHT80 2TX CDD mode test data provided in this report covers 802.11n HT20/40 and 802.11acVHT80 2TX STBC mode

802.11n HT20/40 and acVHT80 2TX CDD test data provided in this report covers 802.11n HT20/40 and 802.11acVHT80 2TX SDM. Refer to Table 7-14 for conducted powers for channels where conducted powers were measured with SDM mode instead of worst-case CDD mode.

802.11ac VHT20 and VHT40 mode are different from 802.11n HT20 and HT40 only in control messages and have the same power settings.

2.6 Software and Firmware

The test was conducted with firmware version 15E61570l installed on the EUT.

For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "UNII Automation," Version 3.4.

2.7 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 789033 D02 v02r01 were used in the measurement of the EUT**.**

Deviation from measurement procedure……..…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor**.** Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.8. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"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 antennas of the EUT are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The EUT complies with the requirement of §15.203.

5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the $\mathbf{U}_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	AM WN25	WLAN Cable Set	3/17/2017	Annual	3/17/2018	AM WN25
-	EMI 3117-ESW1	Radiated Cable Set	3/1/2017	Biennial	3/1/2018	N/A
-	EMI HL562E-ESW1	Radiated Cable Set	2/28/2017	Biennial	2/28/2018	N/A
Anritsu	MA2411B	Pulse Power Sensor	11/28/2017	Biennial	11/28/2018	1027293
Anritsu	ML2495A	Power Meter	11/28/2017	Biennial	11/28/2018	1039008
ATM	180-442A-KF	20dB Nominal Gain Horn Antenna(18 -40GHz)	2/24/2017	Annual	2/24/2018	T058701-03
COM-POWER	LIN-120A	LISN	2/22/2017	Annual	2/22/2018	241296
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	3/13/2017	Annual	3/13/2018	MY49430244
Rohde & Schwarz	ESW26	ESW26 EMI Test Receiver	7/15/2017	Annual	7/15/2018	101299
Rohde & Schwarz	FSW43	Signal & Spectrum Analyzer	4/24/2017	Annual	4/24/2018	104093
Rohde & Schwarz	ESW44	EMI Test Receiver	11/14/2017	Annual	11/14/2018	101570
Rohde & Schwarz	HL562E	Bi-Log Antenna (30MHz - 6GHz)	3/27/2017	Annual	3/27/2018	100810
Rohde & Schwarz	SFUNIT-RX	TS-SFUNIT SHIELDED FILTER UNIT	9/11/2017	Annual	9/11/2018	102132
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	2/3/2017	Annual	2/3/2018	101639
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	1/3/2017	Annual	1/3/2018	100052
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	2/3/2017	Annual	2/3/2018	102325
Rohde & Schwarz	TC-TA18	CROSS POL. VIVALDI ANT (400MHz - 18GHz)	11/13/2017	Annual	11/13/2018	101056-AE
Traceable	1208T91	Humidity/Temperature/Dew Point Meter	9/27/2017	Biennial	9/27/2018	160838829

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
FCC ID: BCGA1954
FCC Classification: Unlicensed National Information Infrastructure (UNII)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
N/A	RSS-Gen [6.6]	26dB Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.407(e)	RSS-Gen [6.6]	6dB Bandwidth	>500kHz(5725-5850MHz)		PASS	Section 7.3
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Conducted Output Power	Maximum conducted powers must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.4
15.407 (a.1.iv), (a.2), (a.3)	RSS-247 [6.2]	Maximum Power Spectral Density	Maximum power spectral density must meet the limits detailed in 15.407 (a) (RSS-247 [6.2])		PASS	Section 7.5
15.407(h)	RSS-247 [6.3]	Dynamic Frequency Selection	See DFS Test Report		PASS	See DFS Test Report
15.407(b.1), (2), (3), (4)	RSS-247 [6.2]	Undesirable Emissions	Undesirable emissions must meet the limits detailed in 15.407(b) (RSS-247 [6.2])	RADIATED	PASS	Section 7.6
15.205, 15.407(b.1), (4), (5), (6)	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])		PASS	Section 7.6, 7.7
15.407	RSS-Gen [8.8]	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 (RSS-Gen [8.8]) limits	LINE CONDUCTED	PASS	Section 7.8

Table 7-1. Summary of Test Results

Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "UNII Automation," Version 4.5.
5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.1.5.

7.2 26dB Bandwidth Measurement – 802.11a/n/ac

RSS-Gen [6.2]

Test Overview and Limit

The bandwidth at 26dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013 and KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26dB bandwidth.

The 26dB bandwidth is used to determine the conducted power limits.

Test Procedure Used

ANSI C63.10-2013 – Section 12.4
KDB 789033 D02 v02r01 – Section C

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth
3. VBW $\geq$ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

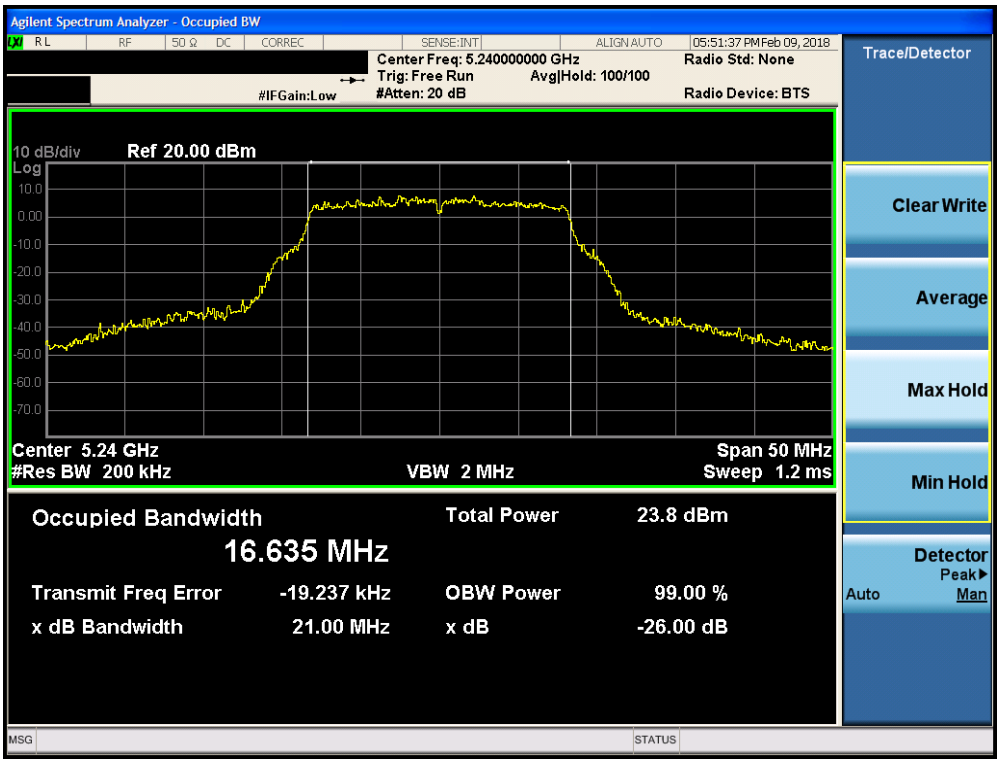
SISO Antenna-1 26 dB Bandwidth Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	a	6	21.03
	5200	40	a	6	21.18
	5240	48	a	6	21.00
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	21.34
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	21.24
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	21.24
	5190	38	n (40MHz)	13.5/15 (MCS0)	39.85
	5230	46	n (40MHz)	13.5/15 (MCS0)	39.57
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	80.62
Band 2A	5260	52	a	6	21.18
	5280	56	a	6	21.07
	5320	64	a	6	21.30
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	21.10
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	21.48
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	21.28
	5270	54	n (40MHz)	13.5/15 (MCS0)	39.71
	5310	62	n (40MHz)	13.5/15 (MCS0)	39.40
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	81.03
Band 2C	5500	100	a	6	20.99
	5580	116	a	6	20.87
	5720	144	a	6	21.24
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	21.46
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	21.37
	5720	144	n (20MHz)	6.5/7.2 (MCS0)	21.51
	5510	102	n (40MHz)	13.5/15 (MCS0)	39.64
	5550	110	n (40MHz)	13.5/15 (MCS0)	39.45
	5710	142	n (40MHz)	13.5/15 (MCS0)	39.55
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	81.42
	5610	122	ac (80MHz)	29.3/32.5 (MCS0)	80.93
	5690	138	ac (80MHz)	29.3/32.5 (MCS0)	83.03

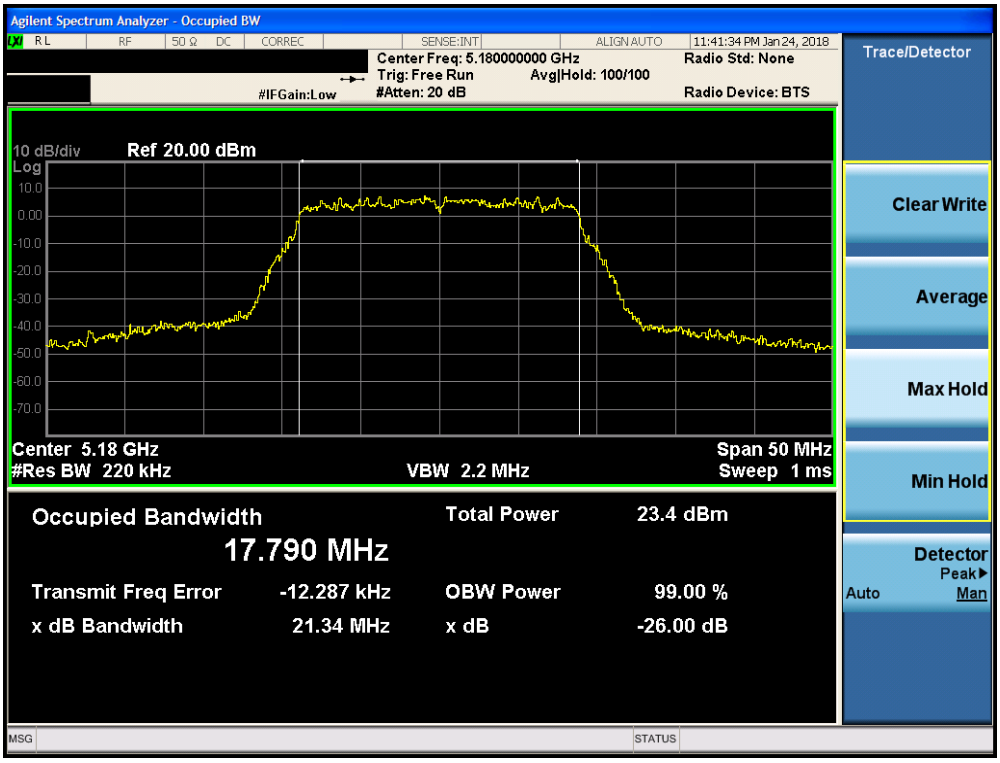
Table 7-2. Conducted Bandwidth Measurements SISO ANT1

Plot 7-1. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 1) – Ch. 36)

Plot 7-2. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 1) – Ch. 40)



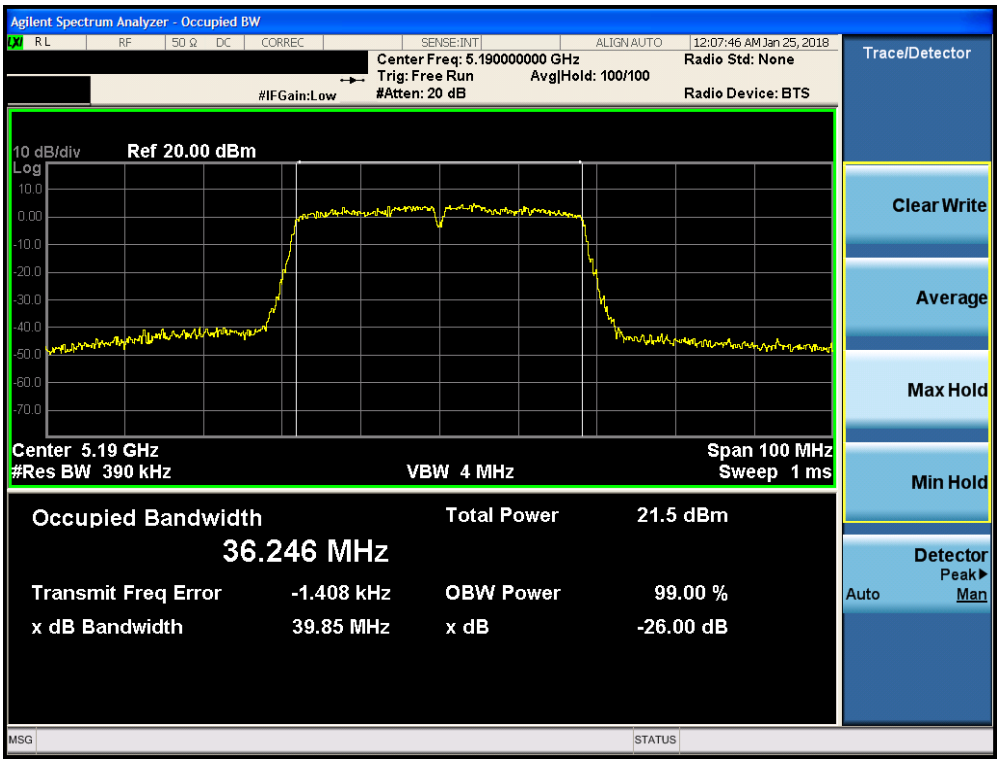
Plot 7-3. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 1) – Ch. 48)



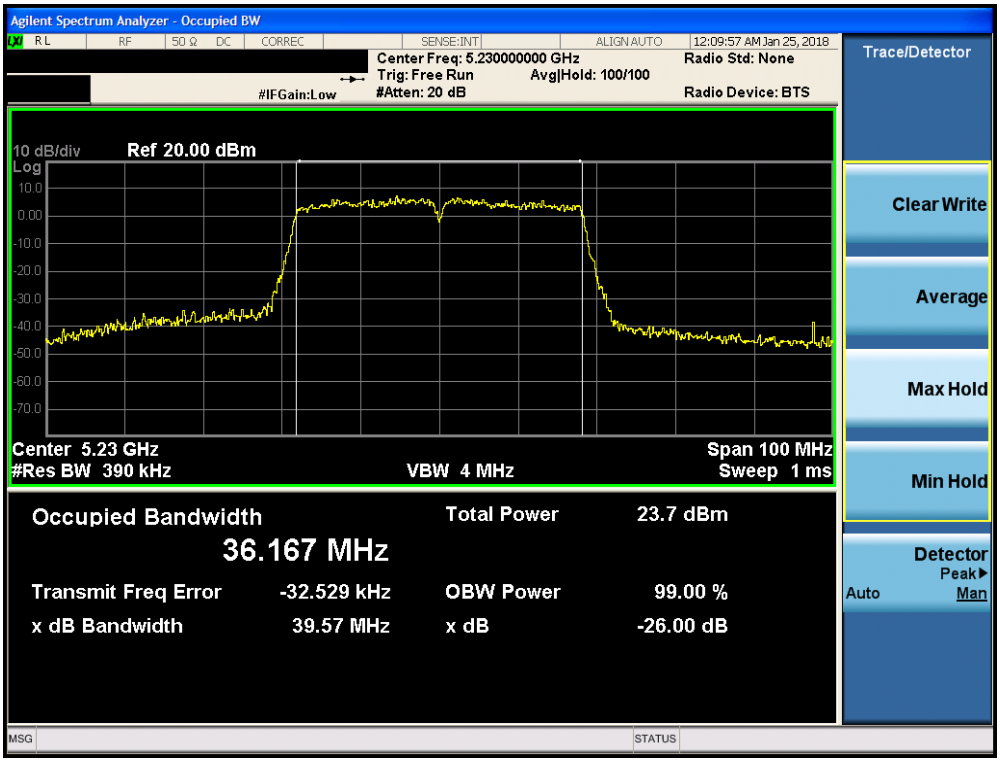
Plot 7-4. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

Plot 7-5. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

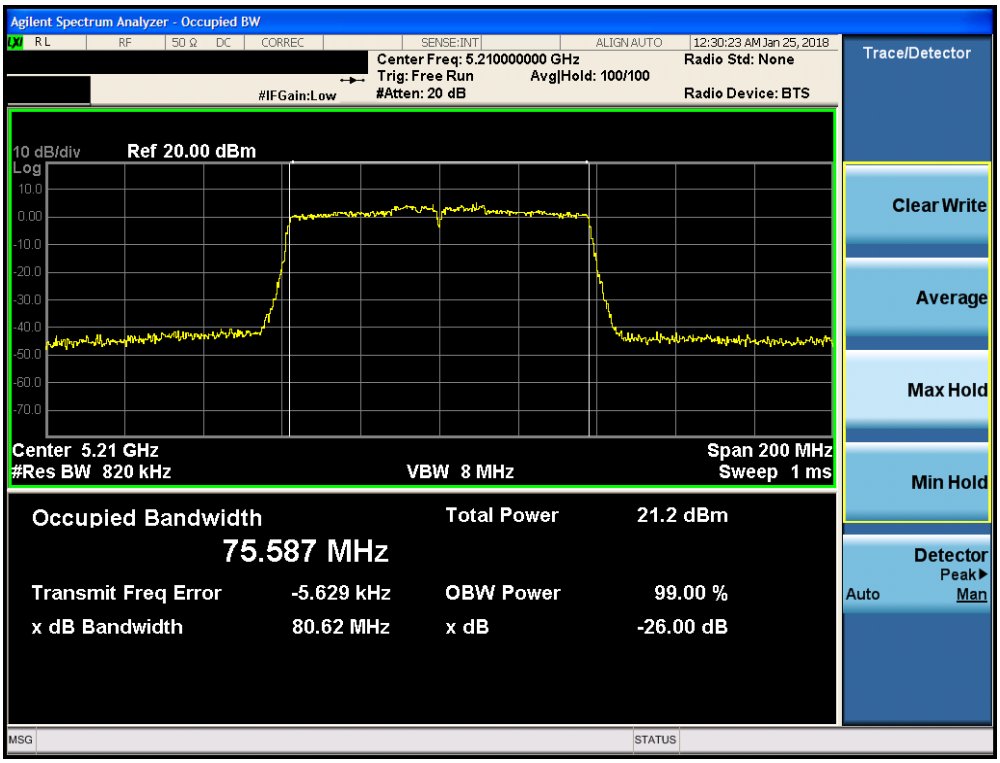
Plot 7-6. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



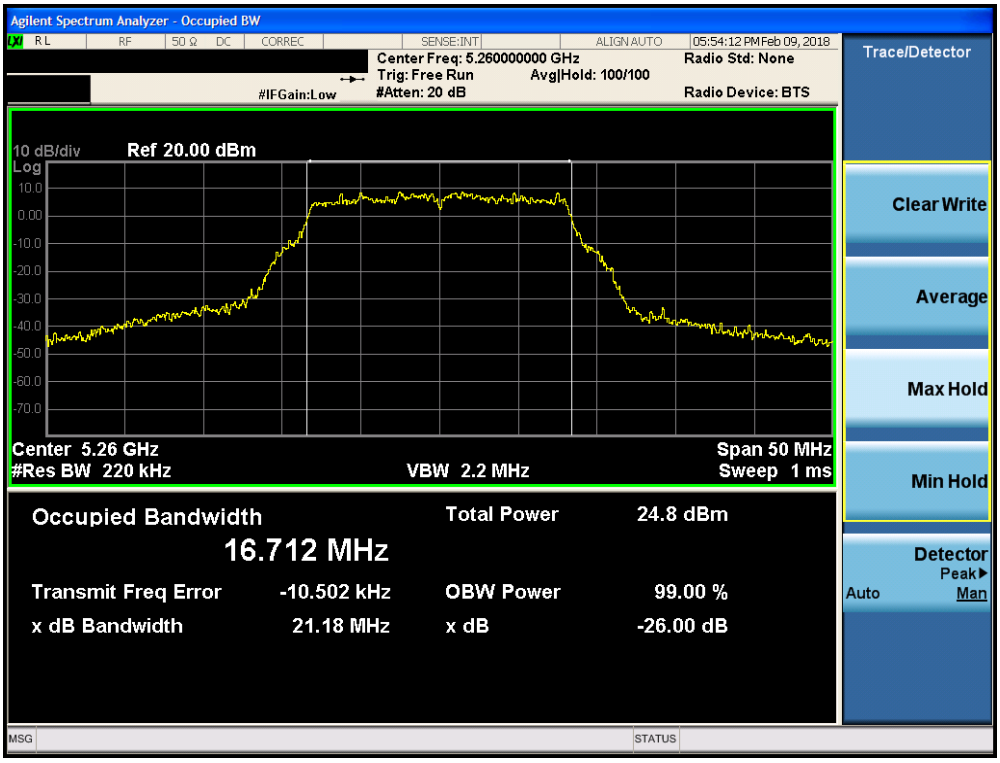
Plot 7-7. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



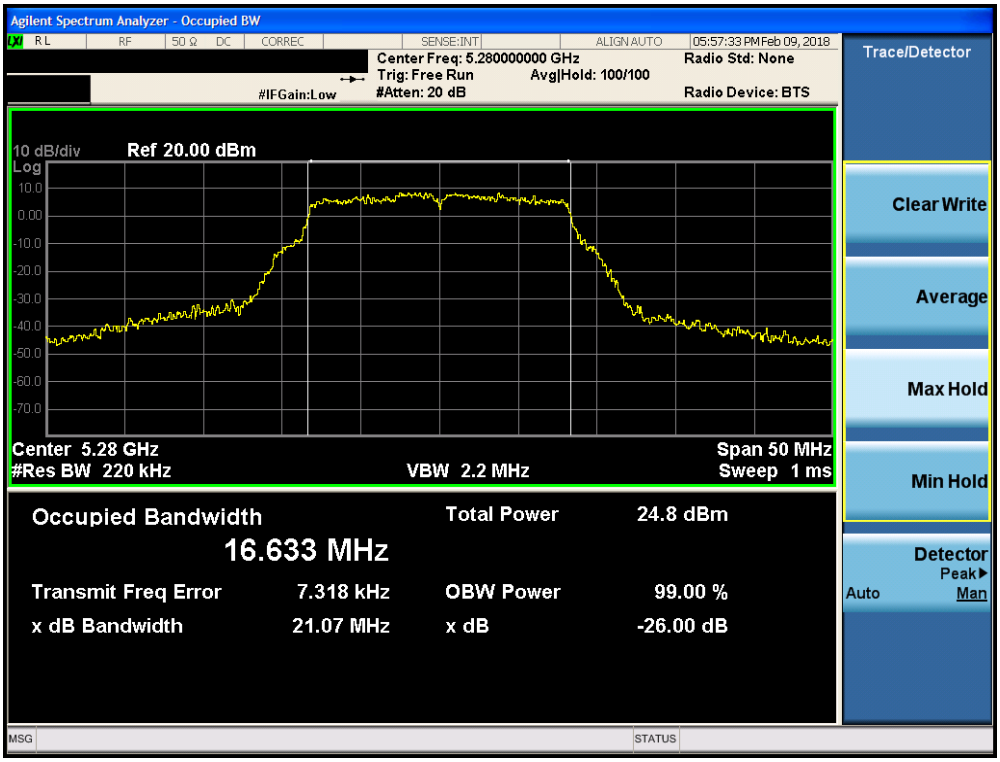
Plot 7-8. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



Plot 7-9. 26dB Bandwidth Plot FCC SISO ANT1 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)

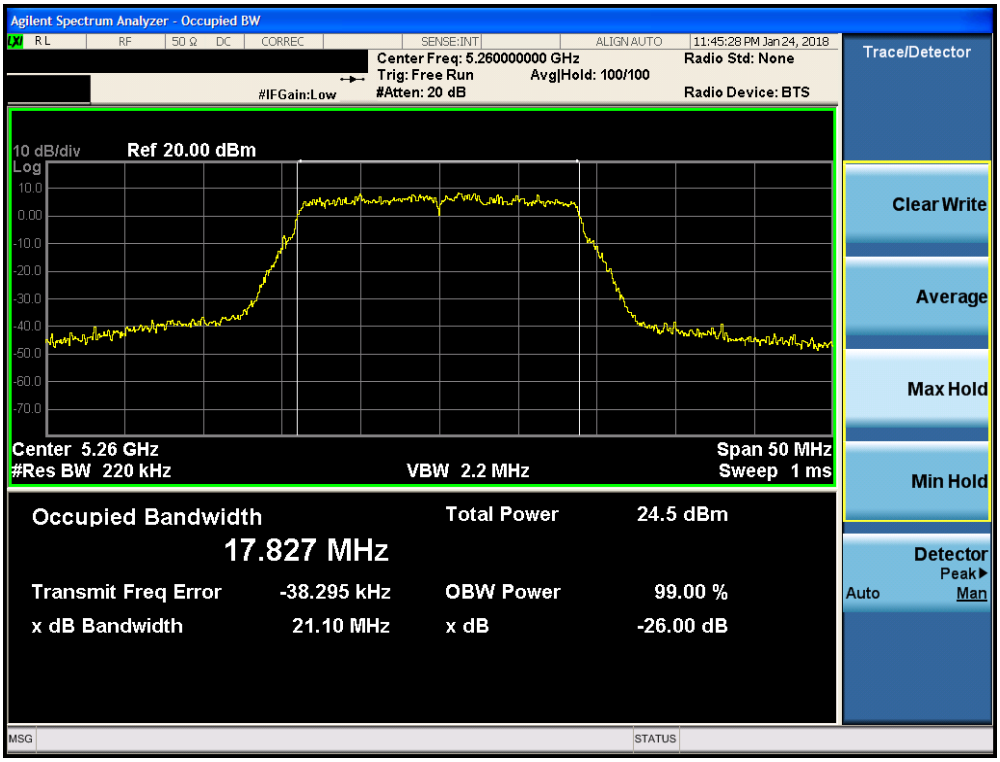


Plot 7-10. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2A) – Ch. 52)

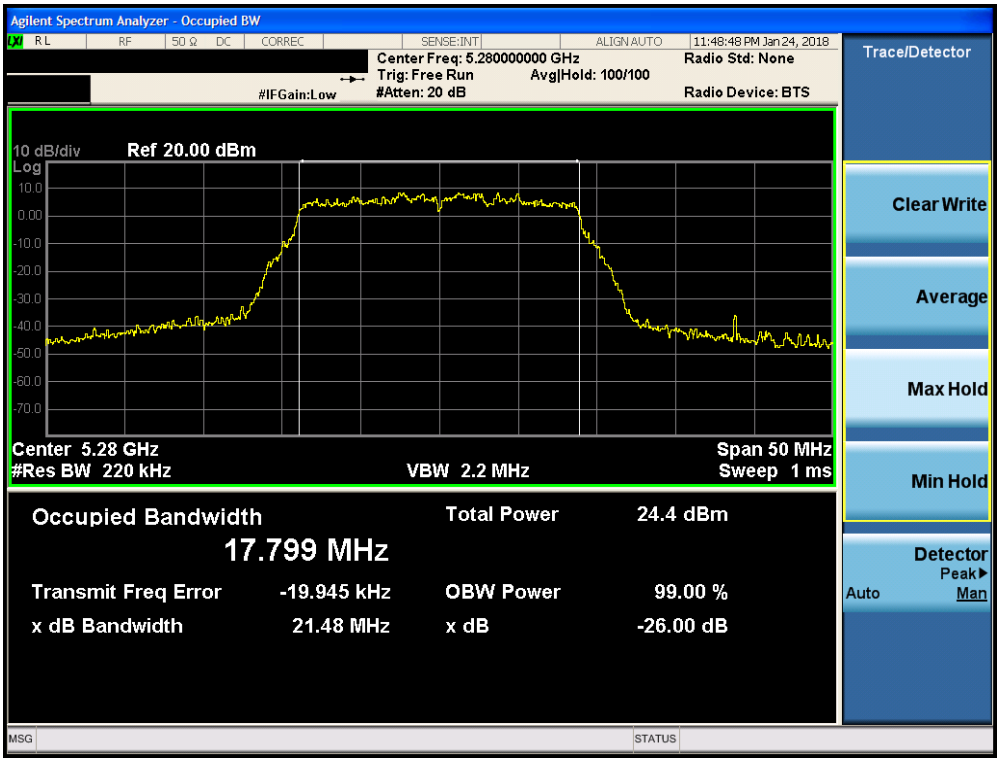


Plot 7-11. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2A) – Ch. 56)

Plot 7-12. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2A) – Ch. 64)

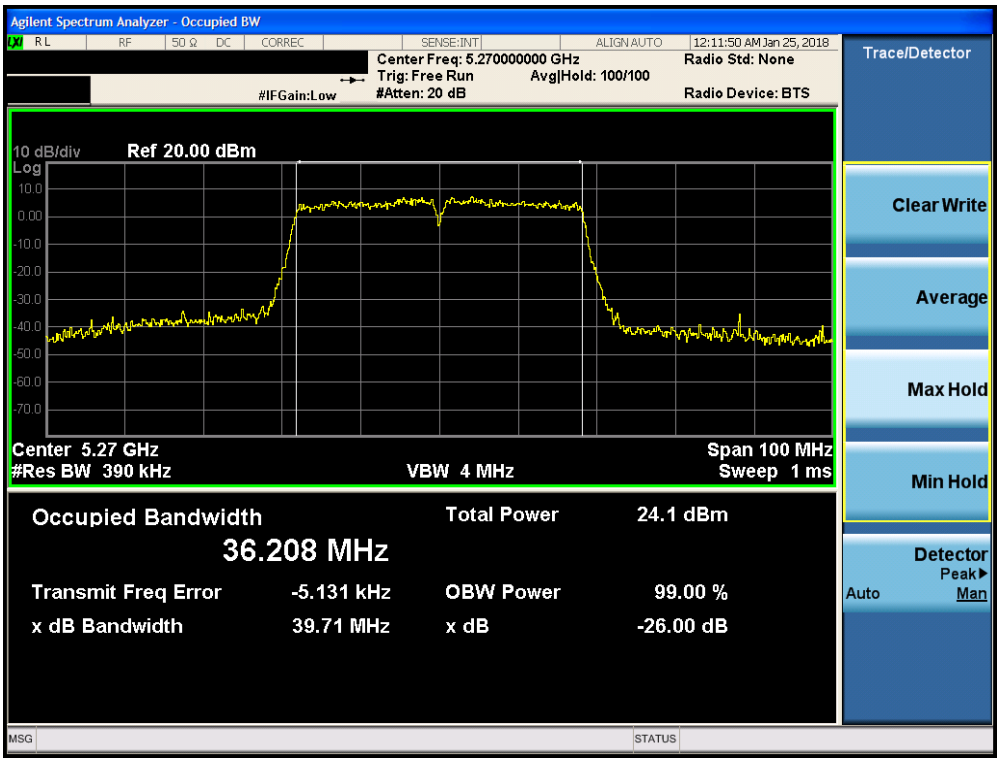


Plot 7-13. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)

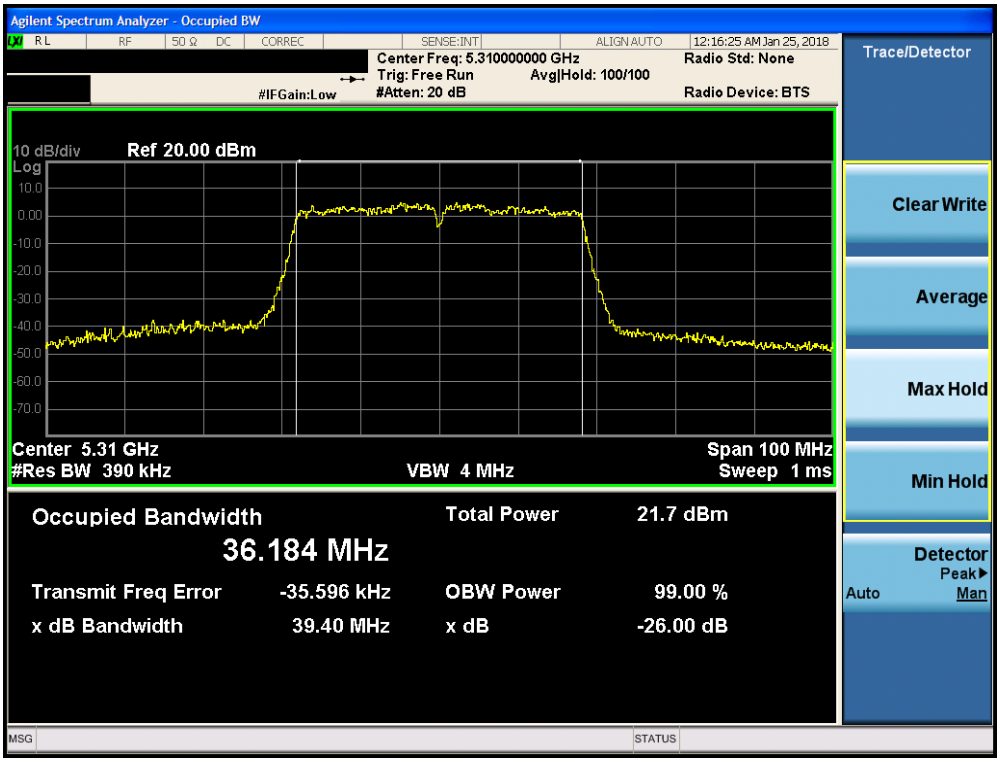


Plot 7-14. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

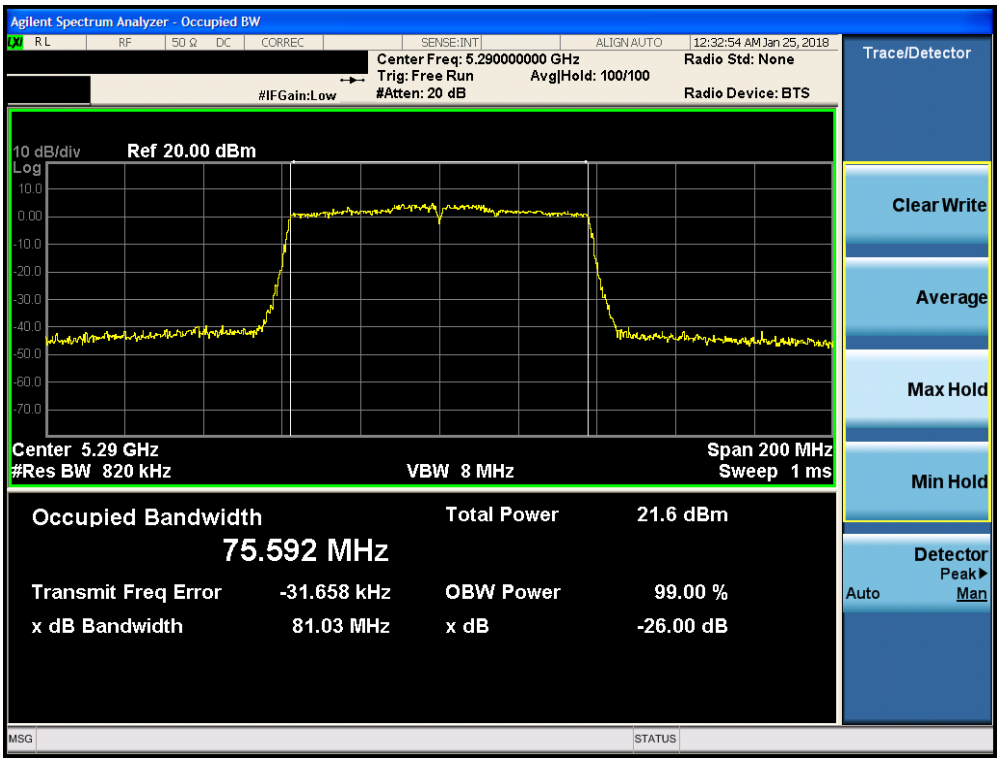
Plot 7-15. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)



Plot 7-16. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)

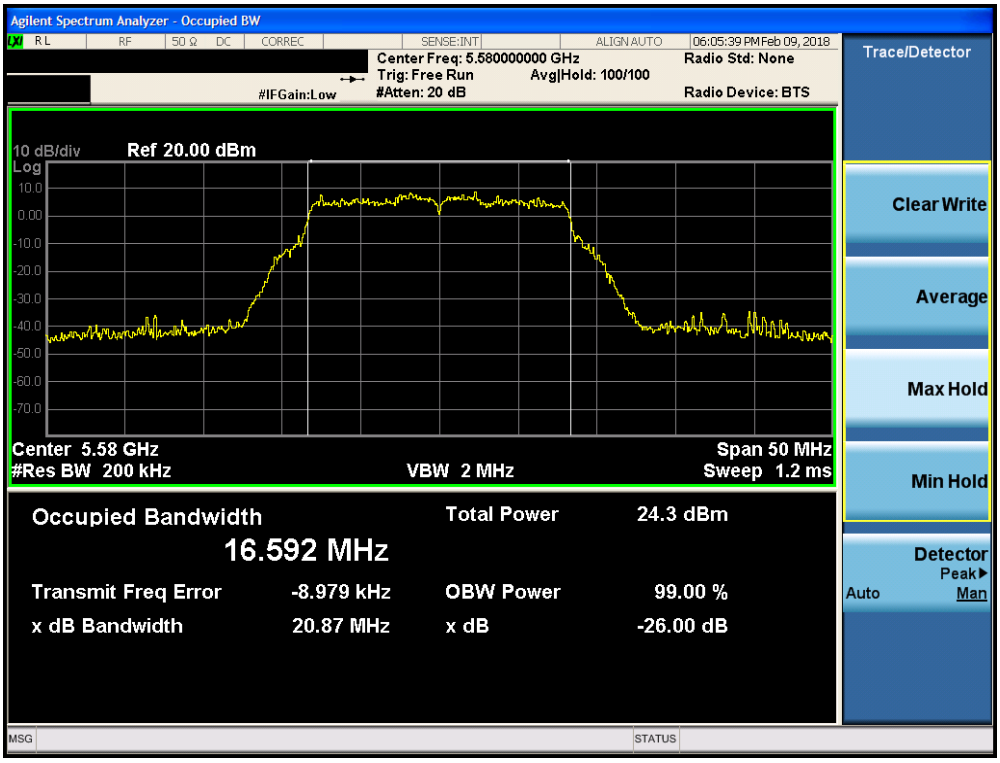


Plot 7-17. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)

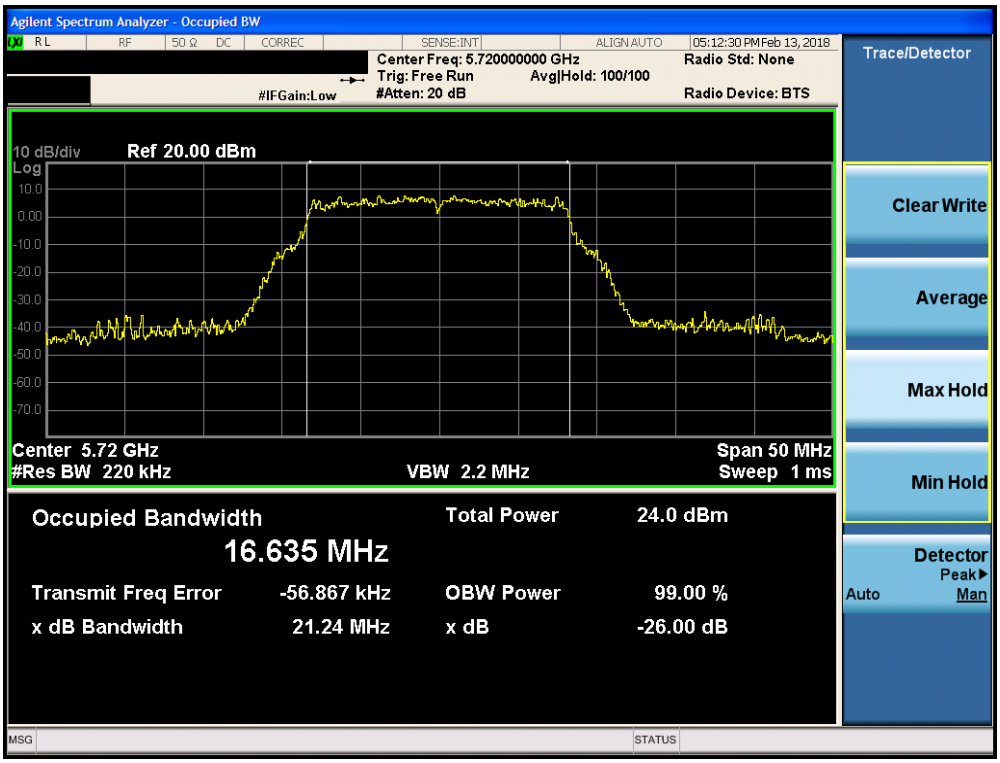


Plot 7-18. 26dB Bandwidth Plot FCC SISO ANT1 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)

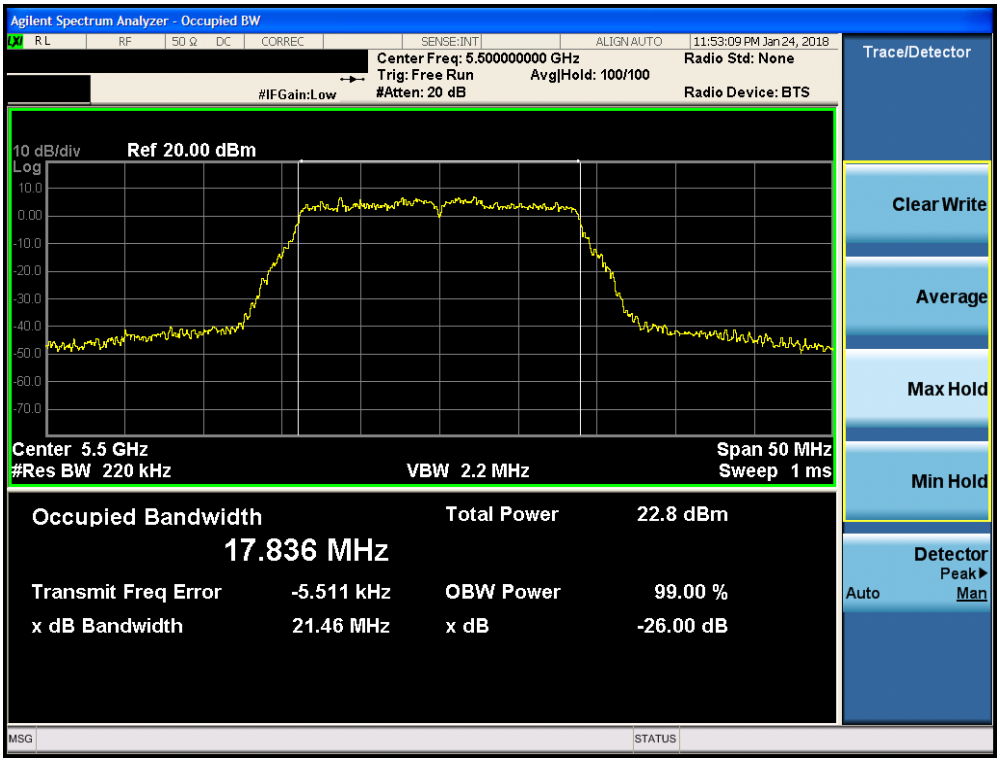
Plot 7-19. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2C) – Ch. 100)



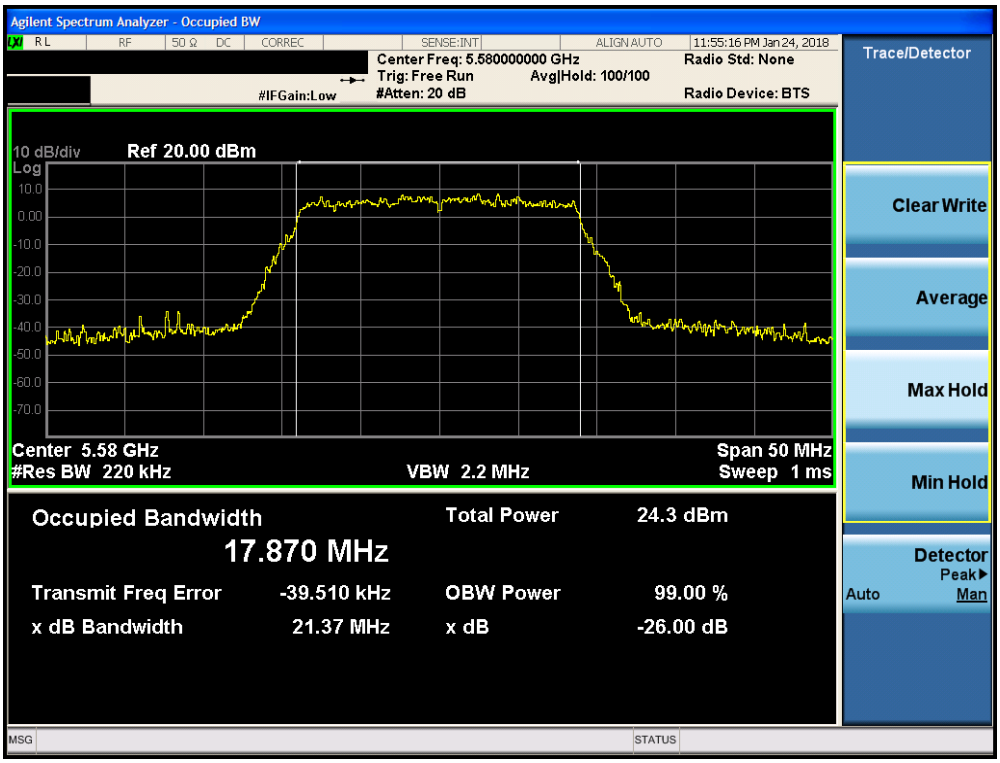
Plot 7-20. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2C) – Ch. 116)



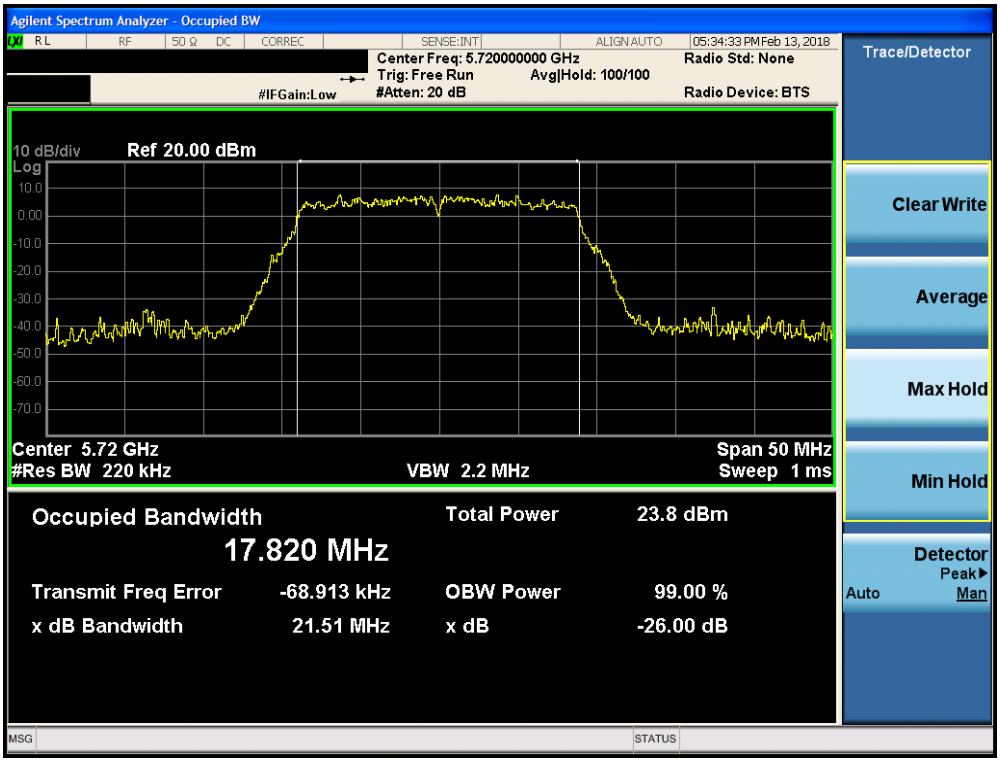
Plot 7-21. 26dB Bandwidth Plot FCC SISO ANT1 (802.11a (UNII Band 2C) – Ch. 144)



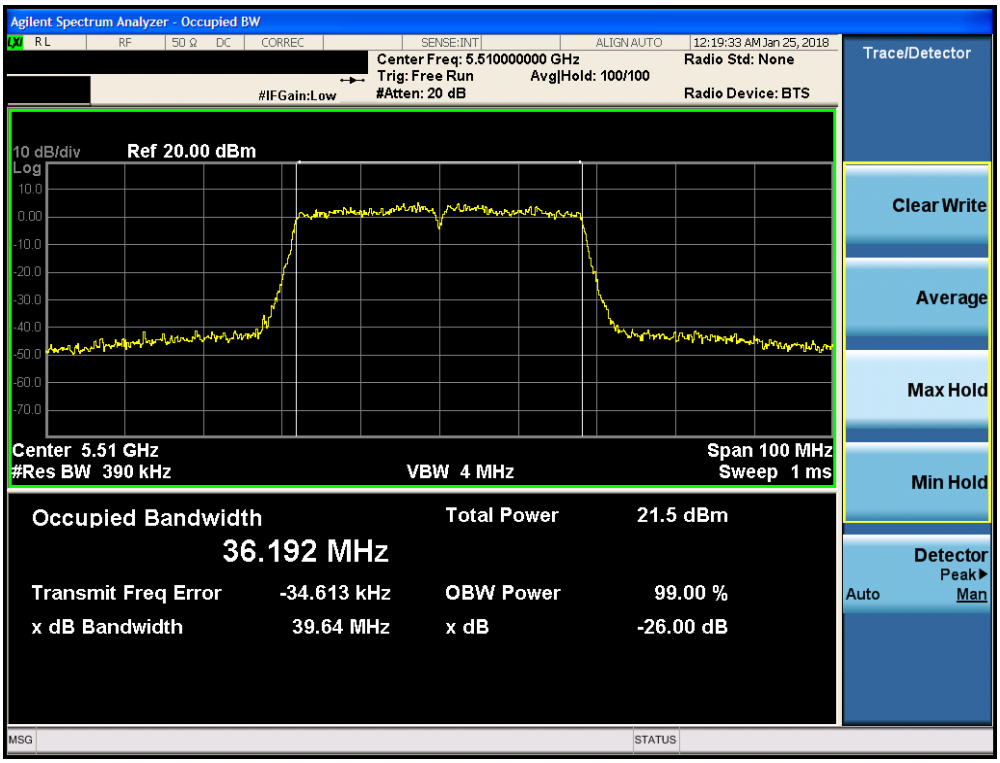
Plot 7-22. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)



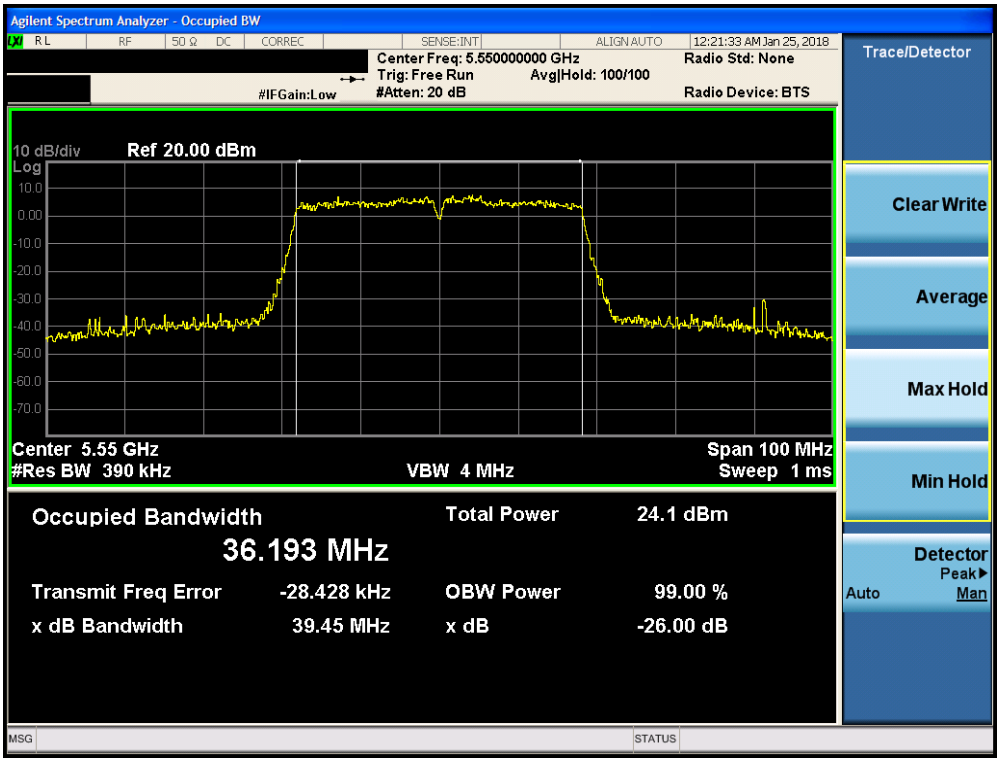
Plot 7-23. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



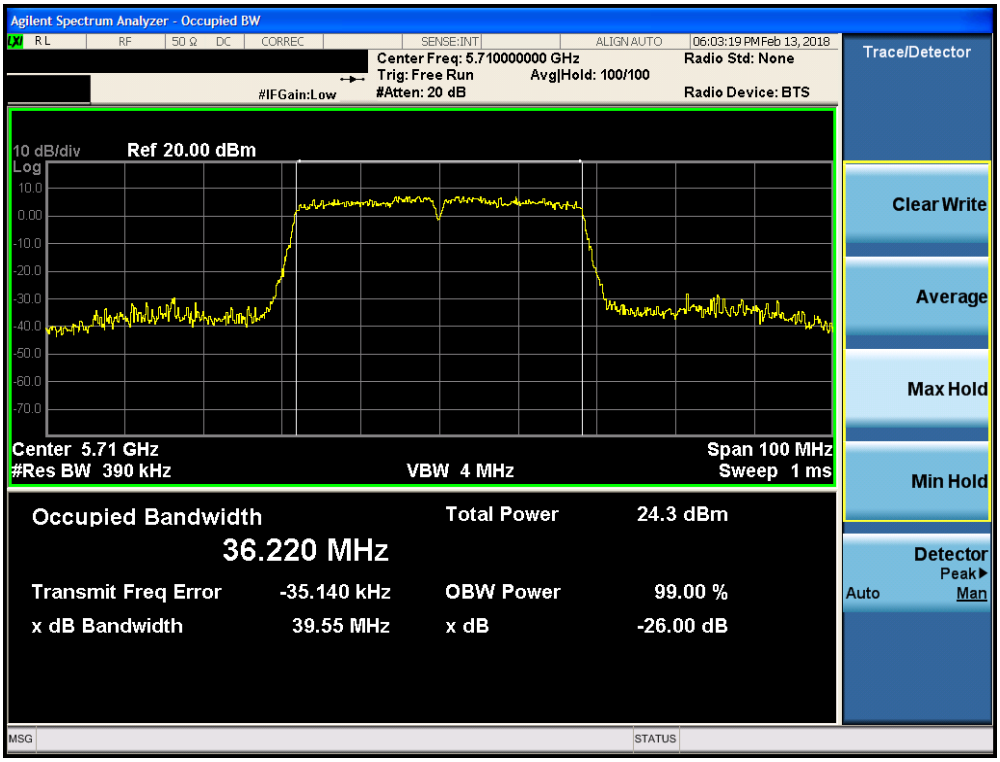
Plot 7-24. 26dB Bandwidth Plot FCC SISO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 144)



Plot 7-25. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)

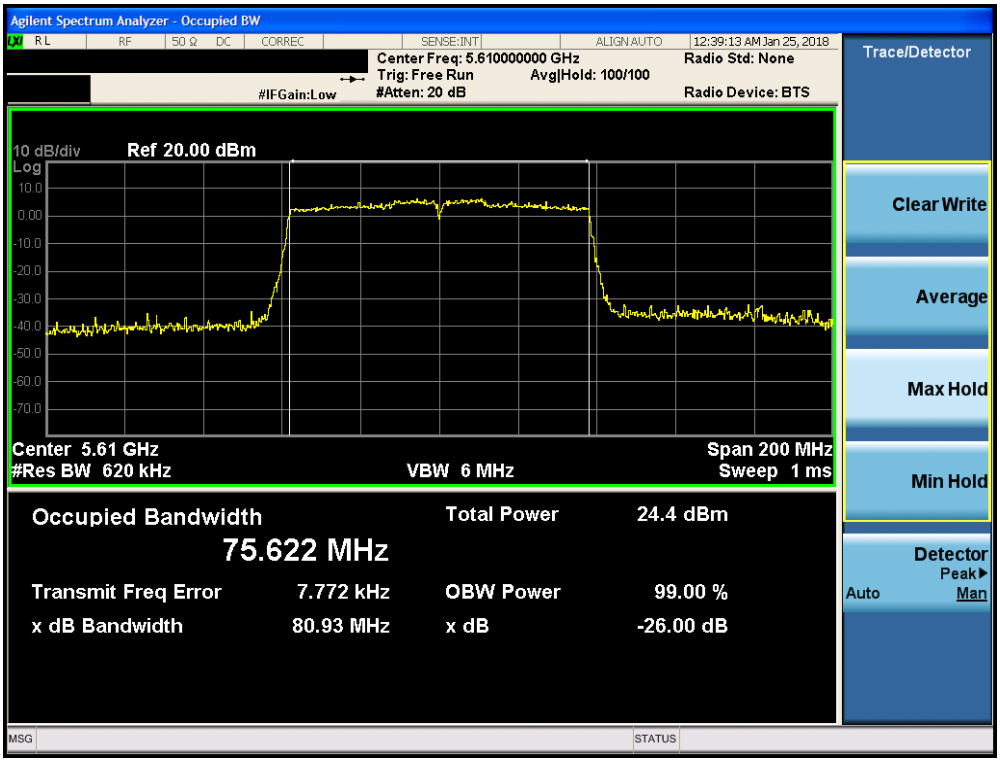


Plot 7-26. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)

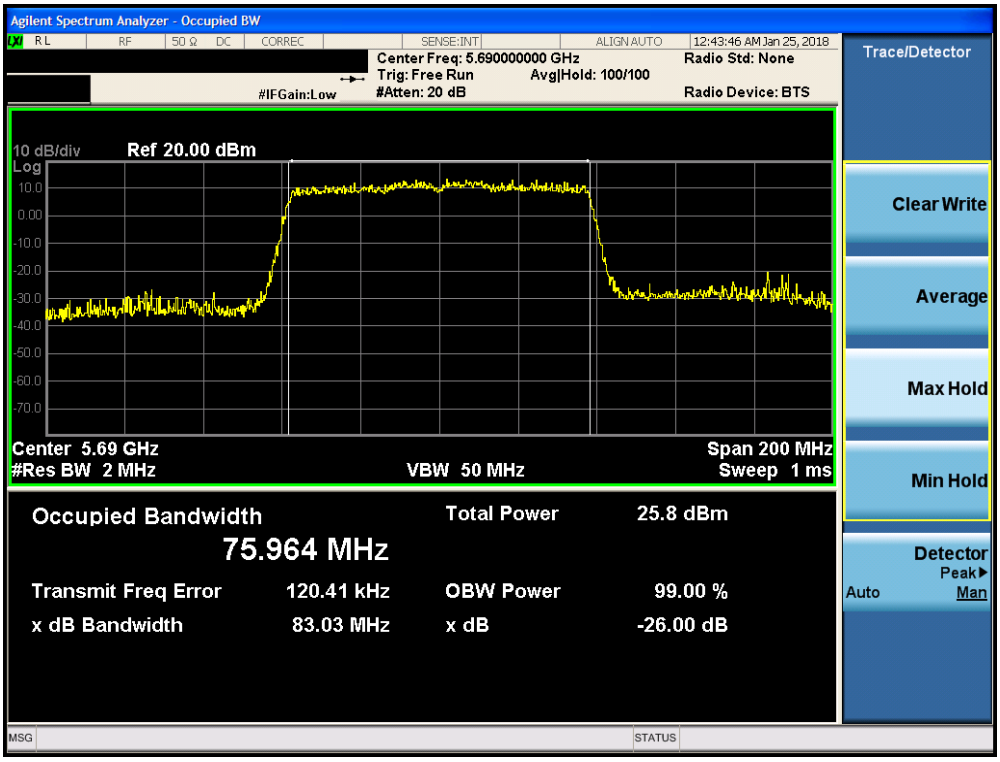


Plot 7-27. 26dB Bandwidth Plot FCC SISO ANT1 (40MHz BW 802.11n (UNII Band 2C) – Ch. 142)

Plot 7-28. 26dB Bandwidth Plot FCC SISO ANT1 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 106)



Plot 7-29. 26dB Bandwidth Plot FCC SISO ANT1 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)



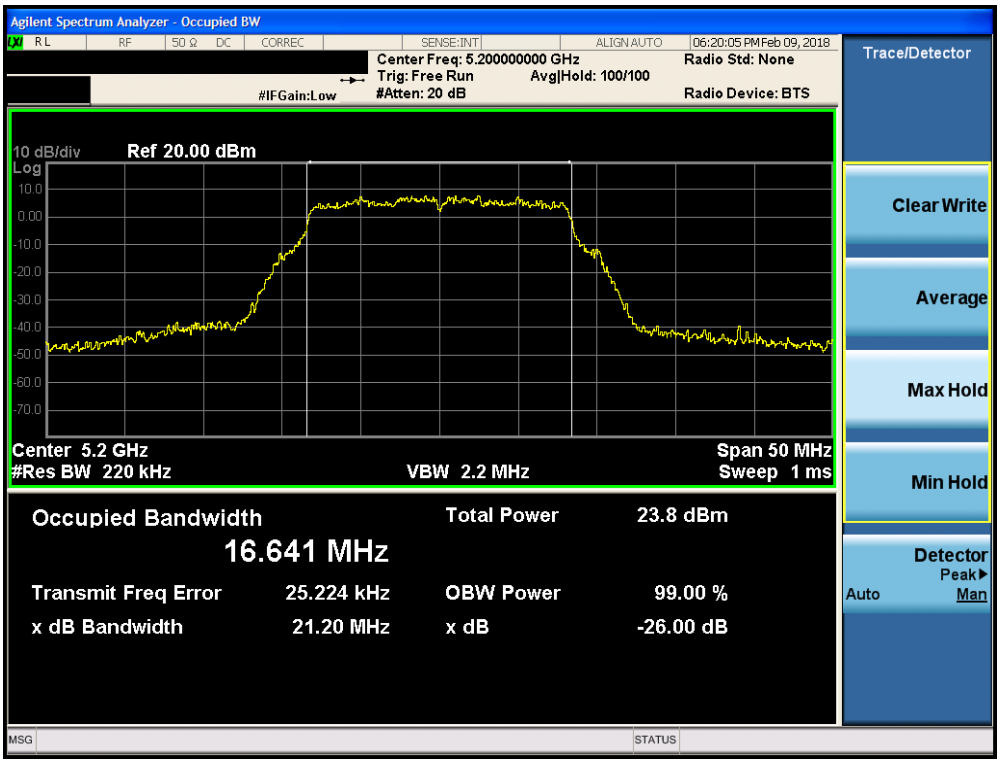
Plot 7-30. 26dB Bandwidth Plot FCC SISO ANT1 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 138)

SISO Antenna-2 26dB Bandwidth Measurements

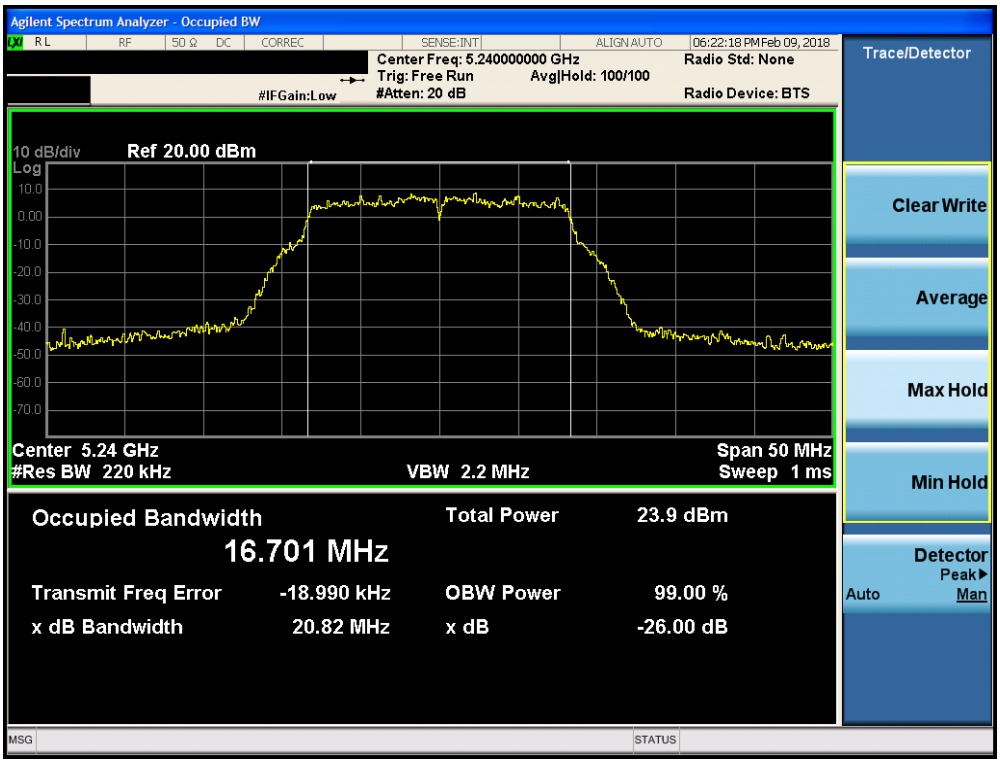
	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth [MHz]
Band 1	5180	36	a	6	20.85
	5200	40	a	6	21.20
	5240	48	a	6	20.82
	5180	36	n (20MHz)	6.5/7.2 (MCS0)	21.30
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	21.17
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	21.64
	5190	38	n (40MHz)	13.5/15 (MCS0)	39.44
	5230	46	n (40MHz)	13.5/15 (MCS0)	39.72
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	80.97
Band 2A	5260	52	a	6	21.27
	5280	56	a	6	21.12
	5320	64	a	6	21.22
	5260	52	n (20MHz)	6.5/7.2 (MCS0)	21.23
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	21.39
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	21.94
	5270	54	n (40MHz)	13.5/15 (MCS0)	39.97
	5310	62	n (40MHz)	13.5/15 (MCS0)	39.59
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	81.42
Band 2C	5500	100	a	6	21.24
	5580	116	a	6	21.27
	5720	144	a	6	20.93
	5500	100	n (20MHz)	6.5/7.2 (MCS0)	21.42
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	21.28
	5720	144	n (20MHz)	6.5/7.2 (MCS0)	21.20
	5510	102	n (40MHz)	13.5/15 (MCS0)	39.64
	5550	110	n (40MHz)	13.5/15 (MCS0)	39.66
	5710	142	n (40MHz)	13.5/15 (MCS0)	39.81
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	81.13
	5610	122	ac (80MHz)	29.3/32.5 (MCS0)	80.69
	5690	138	ac (80MHz)	29.3/32.5 (MCS0)	82.54

Table 7-3. Conducted Bandwidth Measurements SISO ANT2

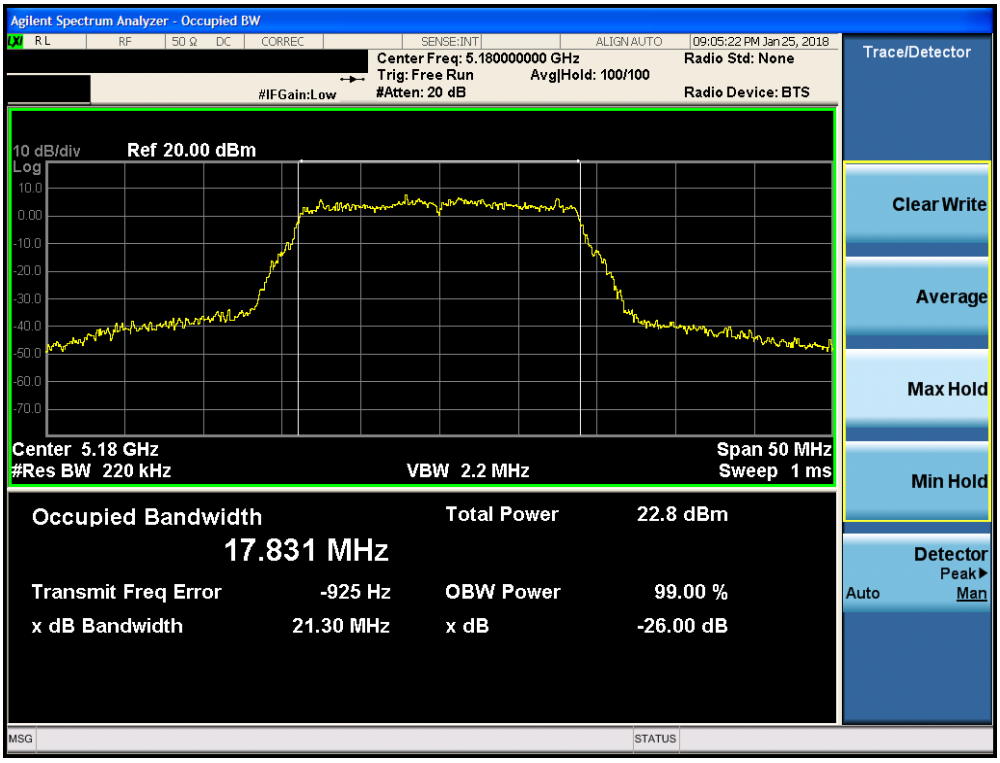
Plot 7-31. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 1) – Ch. 36)



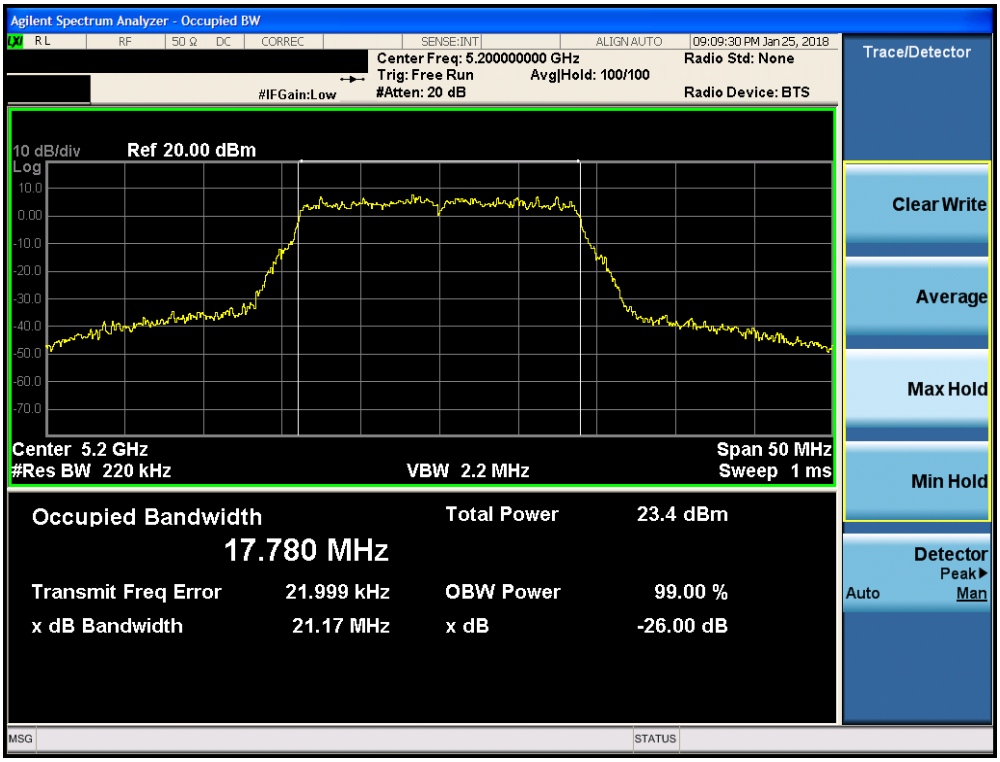
Plot 7-32. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 1) – Ch. 40)



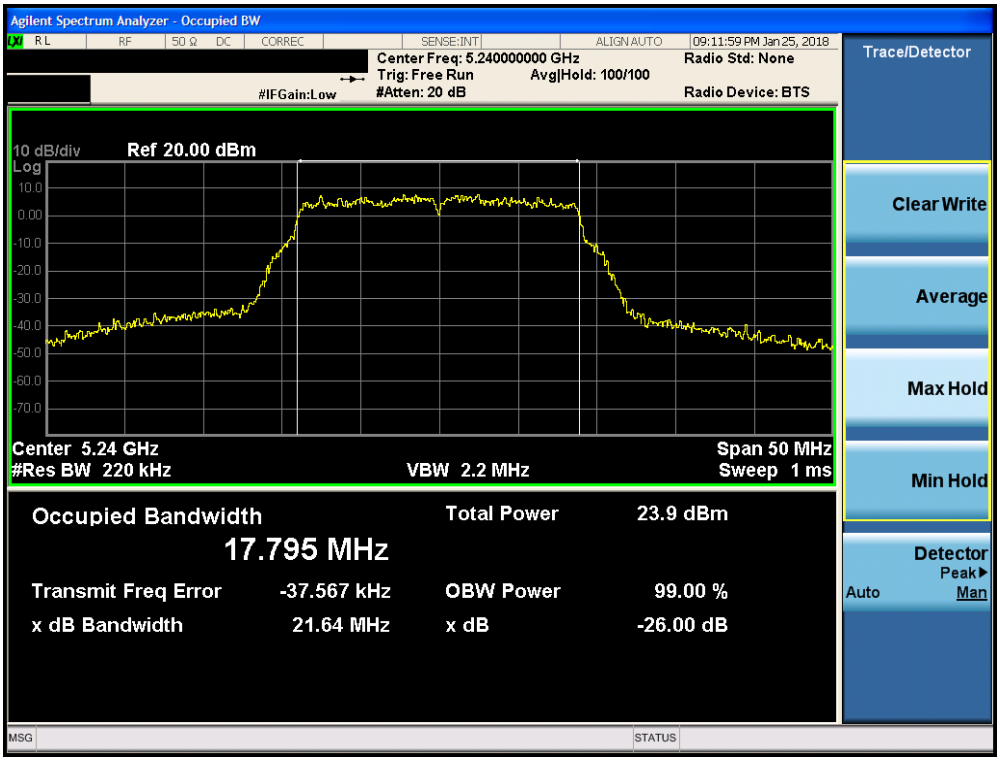
Plot 7-33. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 1) – Ch. 48)



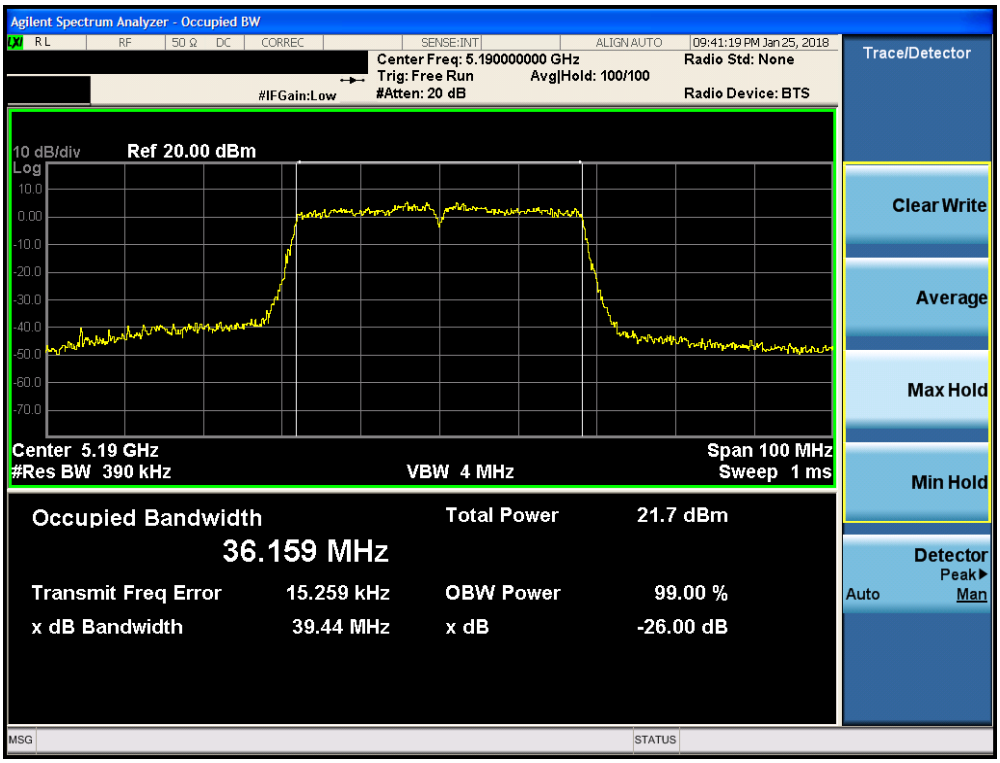
Plot 7-34. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 36)



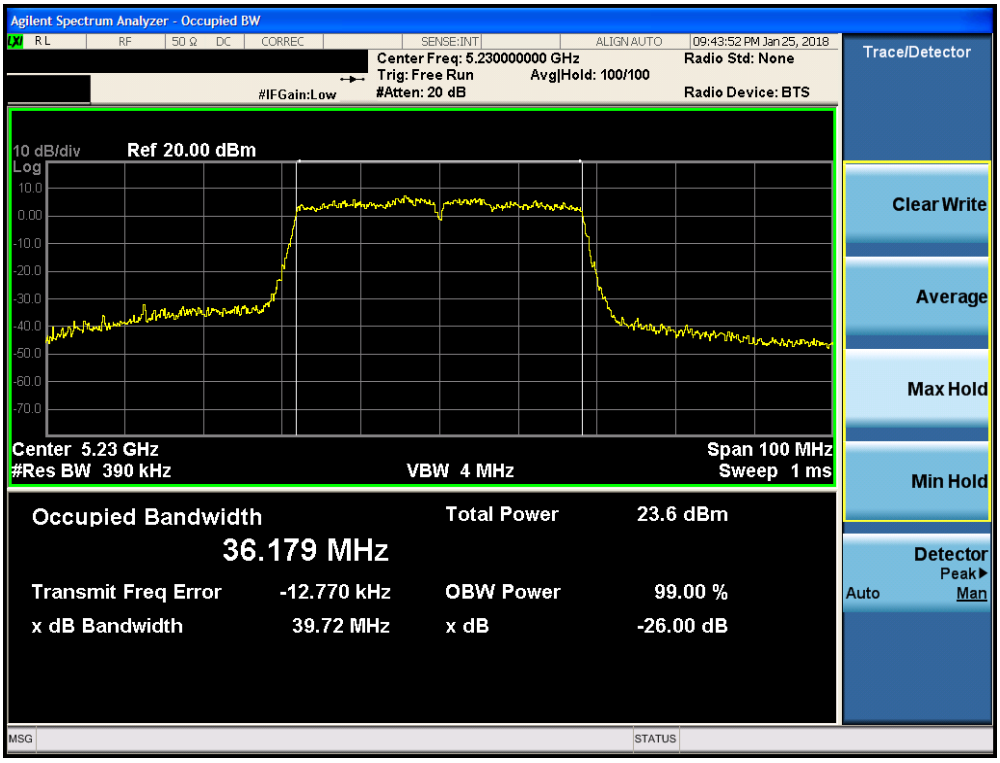
Plot 7-35. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)



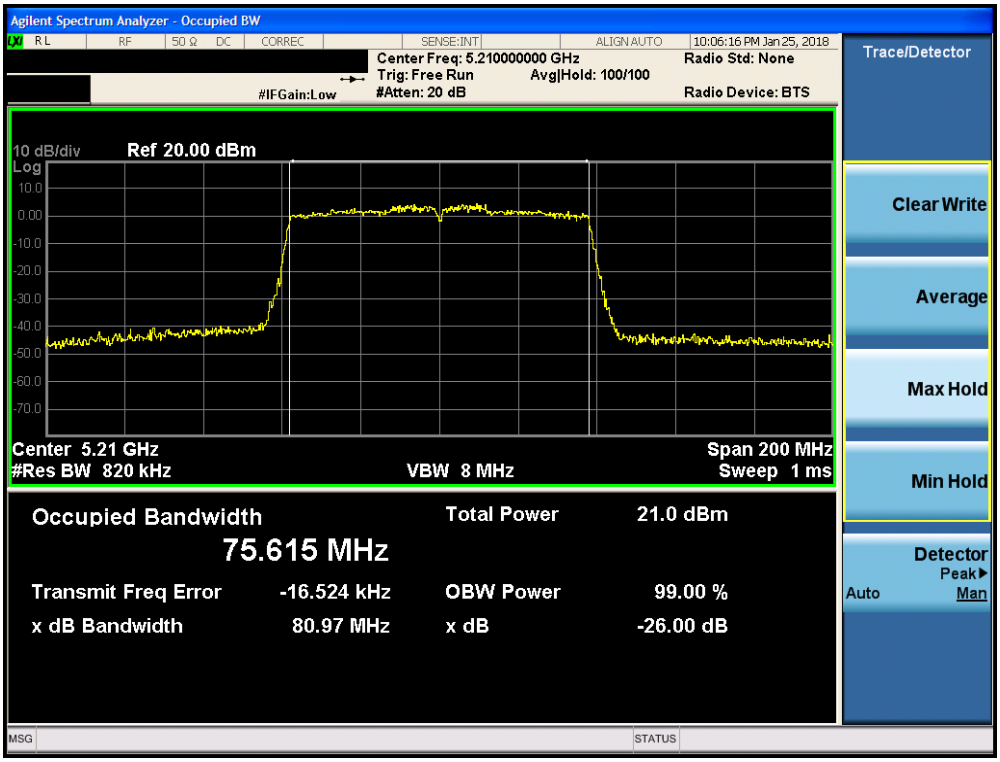
Plot 7-36. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



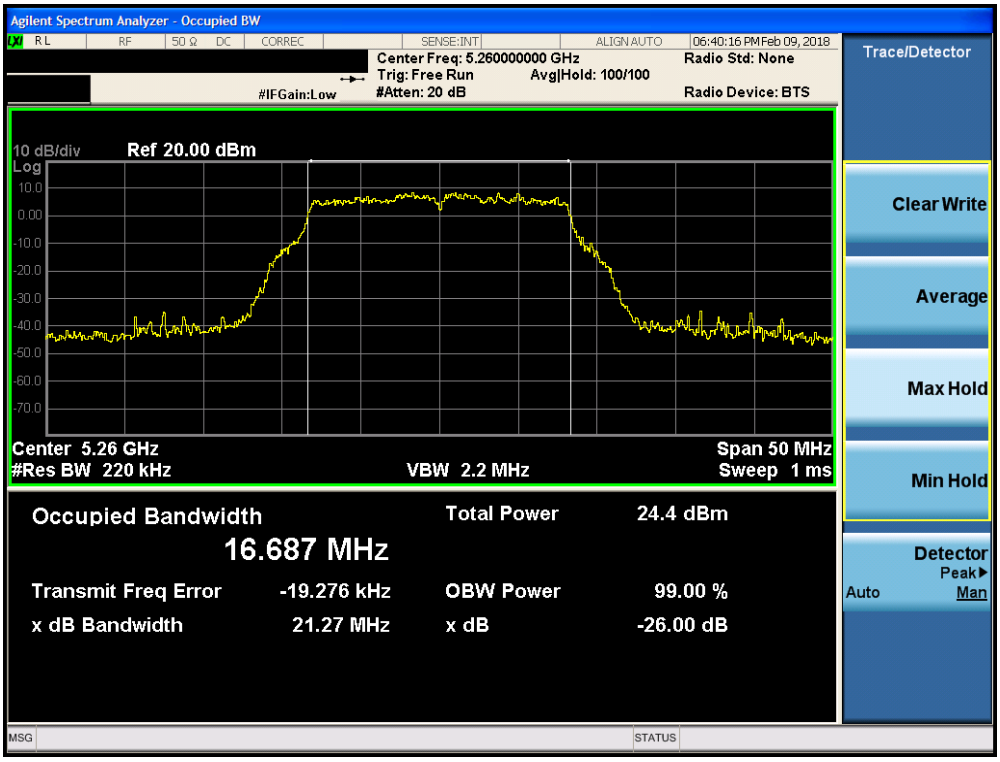
Plot 7-37. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



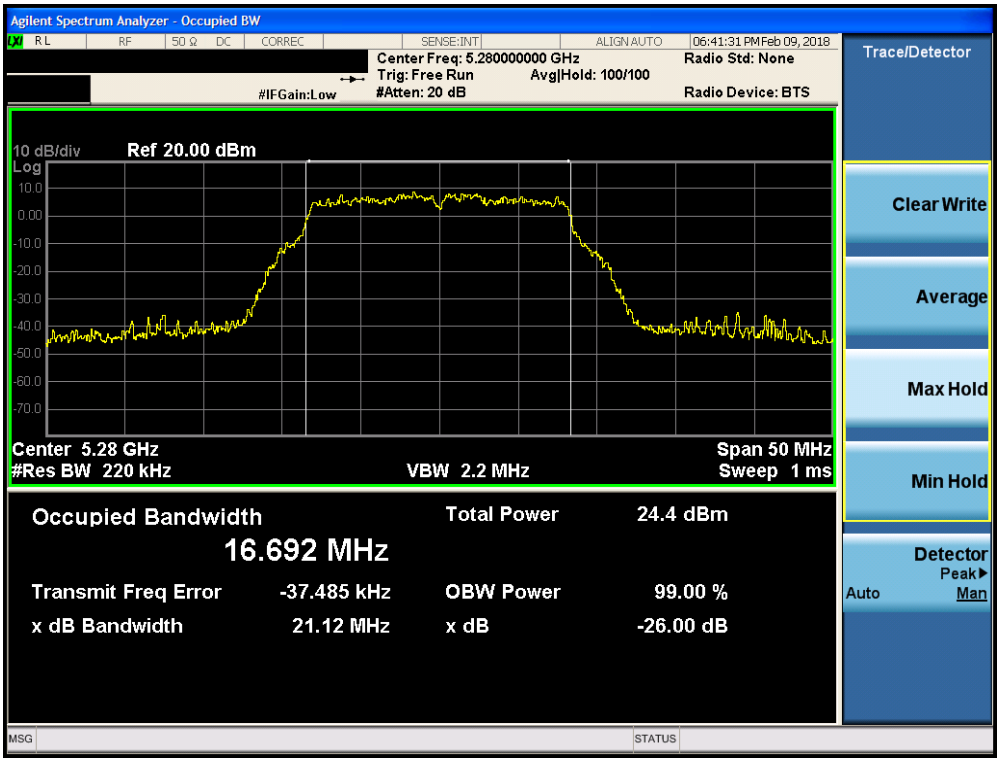
Plot 7-38. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



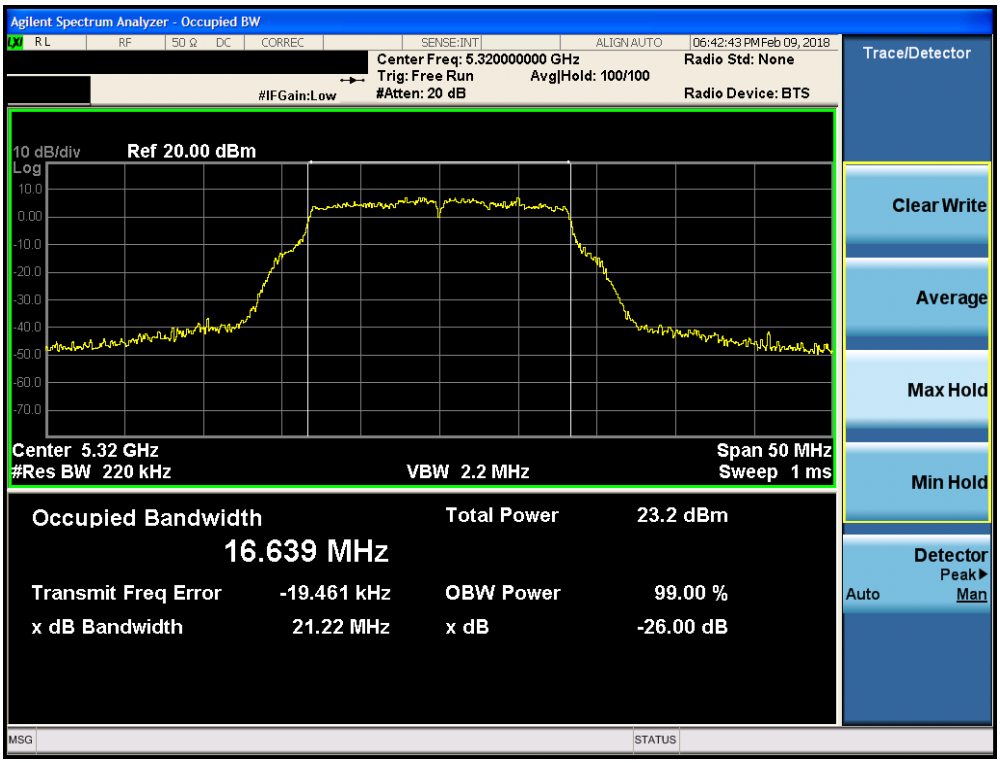
Plot 7-39. 26dB Bandwidth Plot FCC SISO ANT2 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



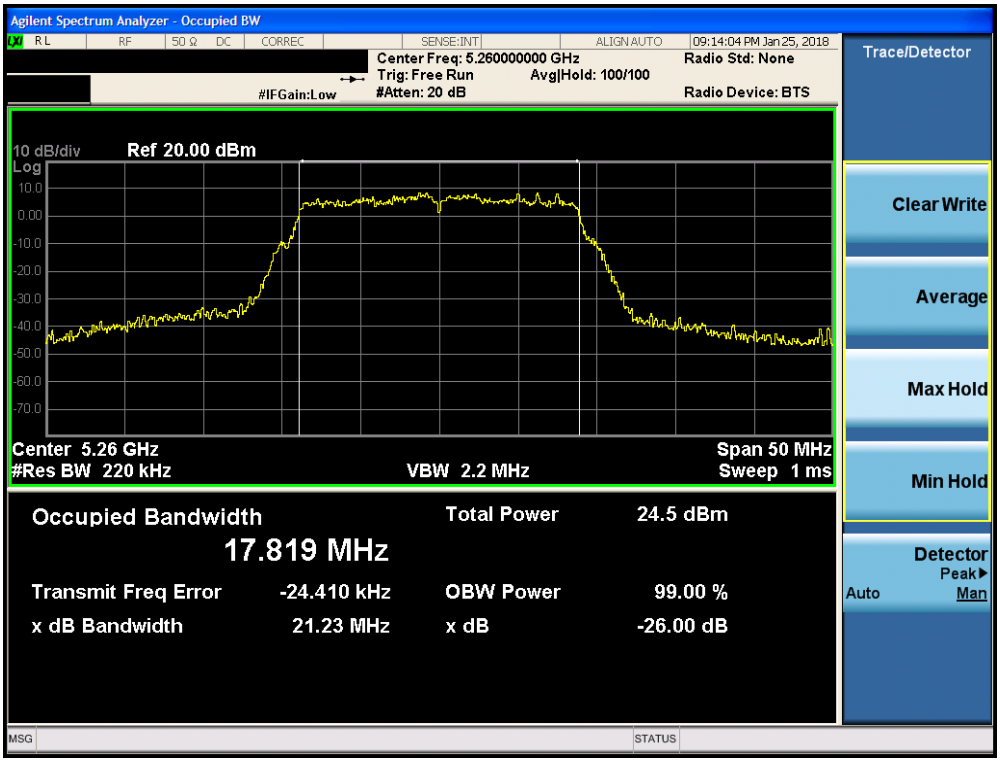
Plot 7-40. 26dB Bandwidth FCC SISO ANT2 Plot (802.11a (UNII Band 2A) – Ch. 52)



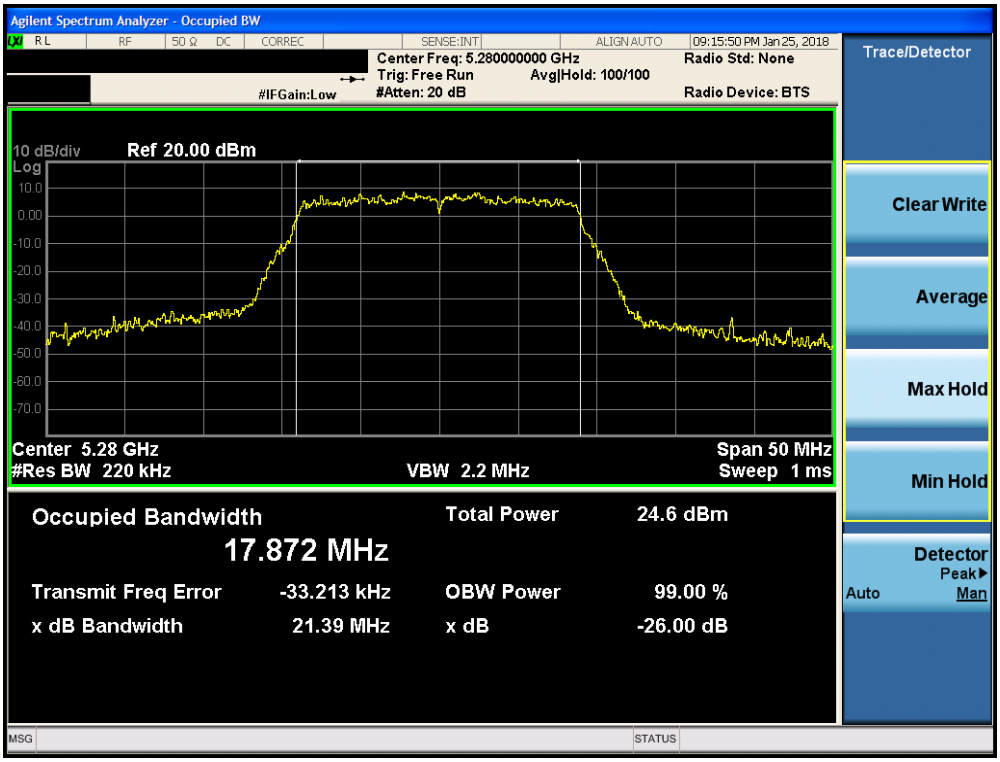
Plot 7-41. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 2A) – Ch. 56)



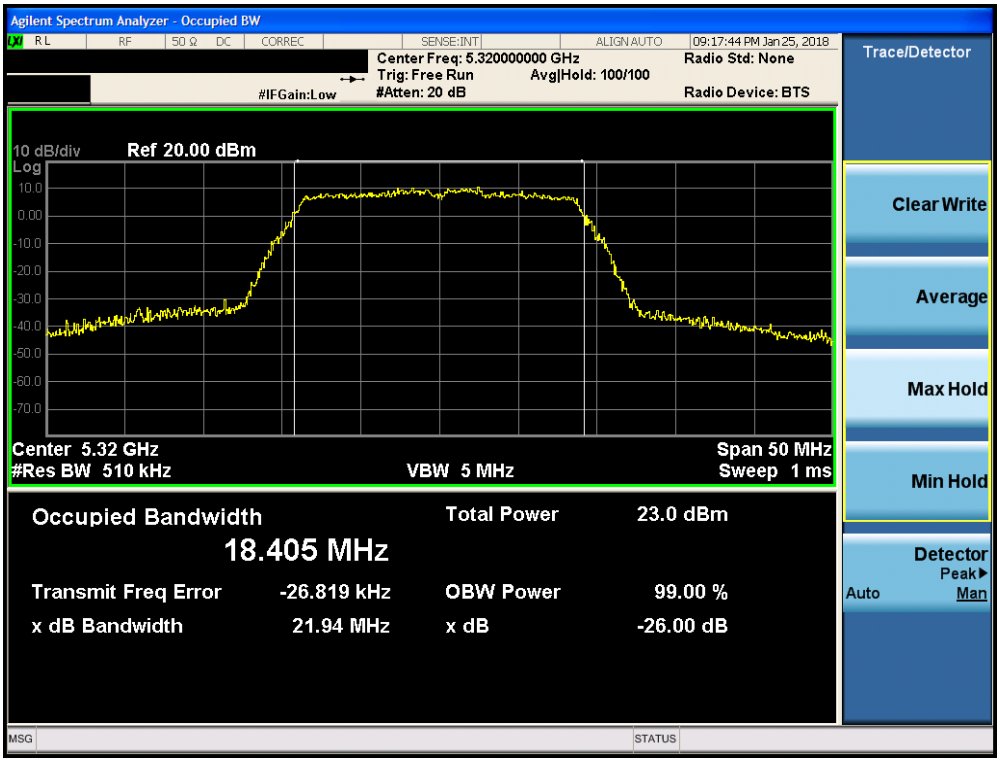
Plot 7-42. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 2A) – Ch. 64)



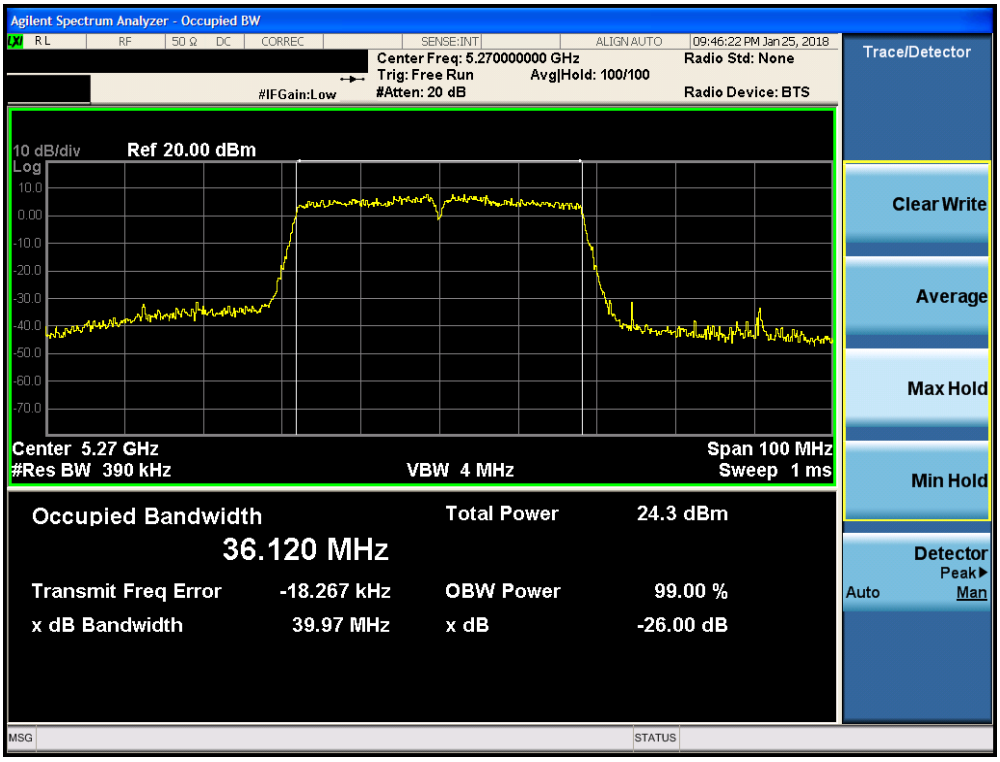
Plot 7-43. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)



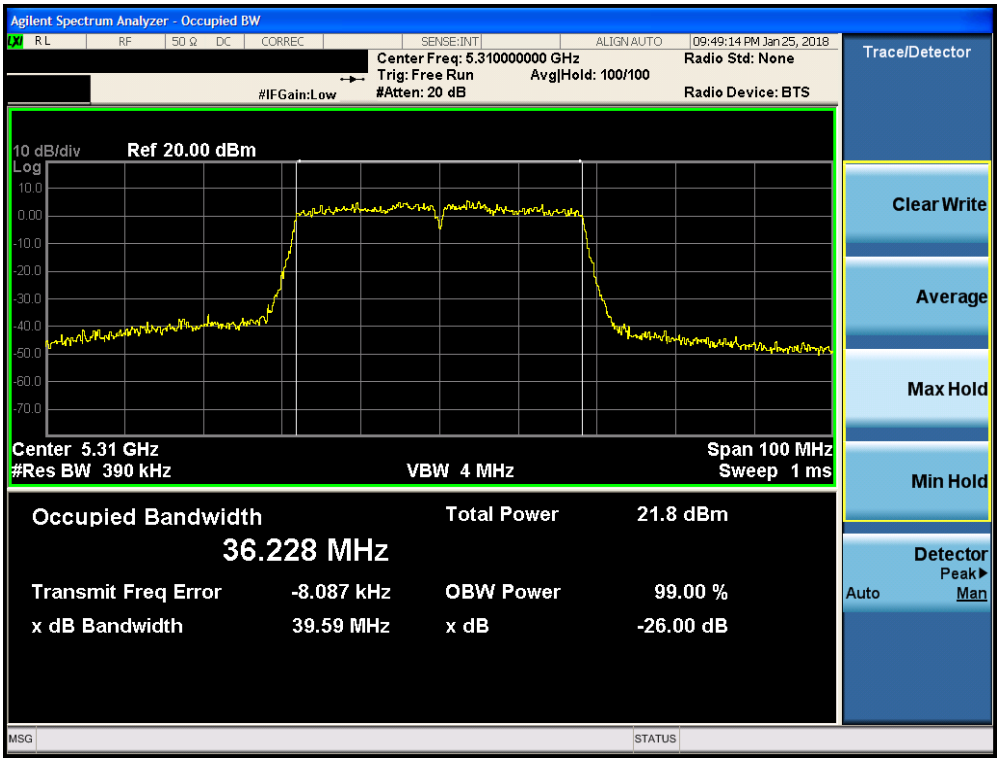
Plot 7-44. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)



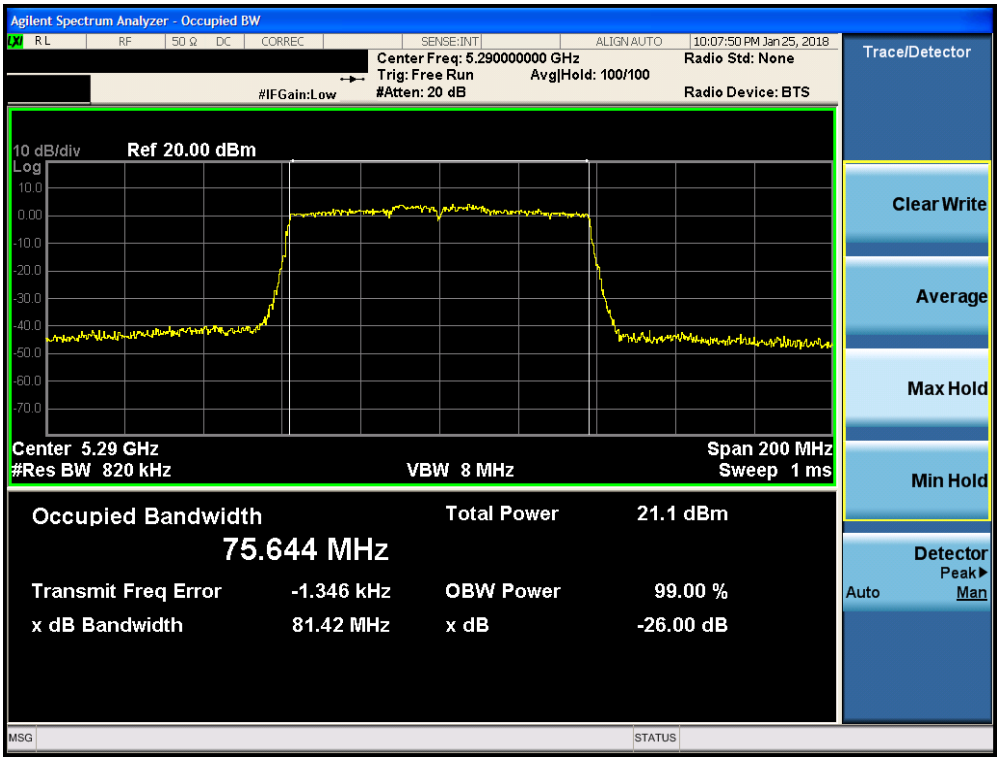
Plot 7-45. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)



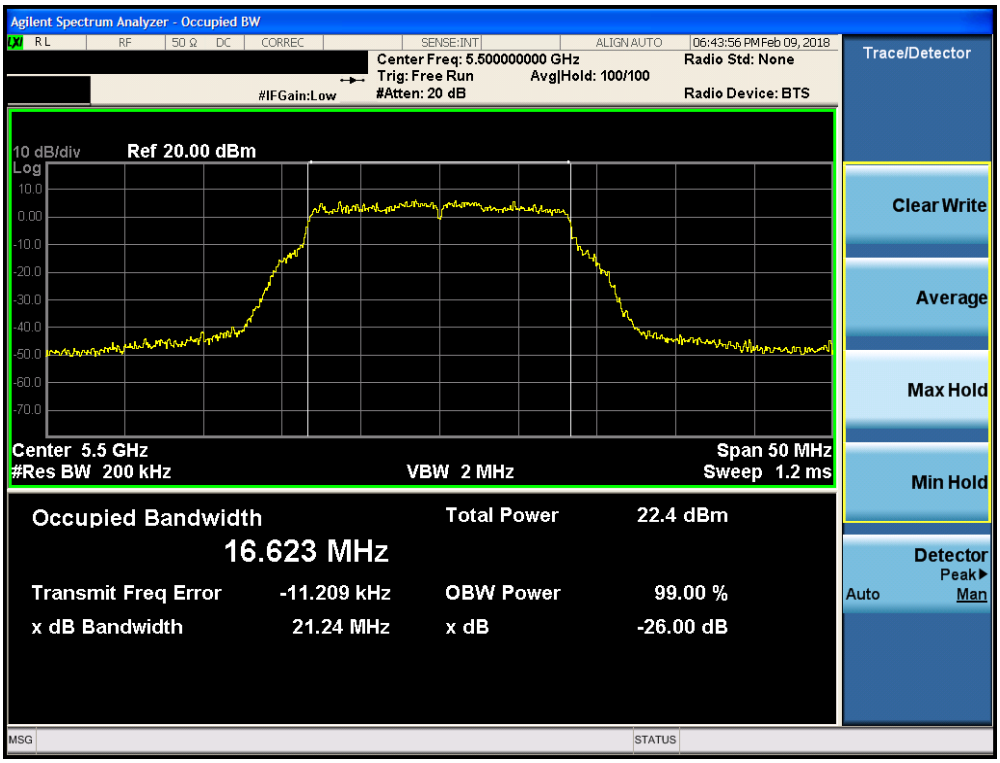
Plot 7-46. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



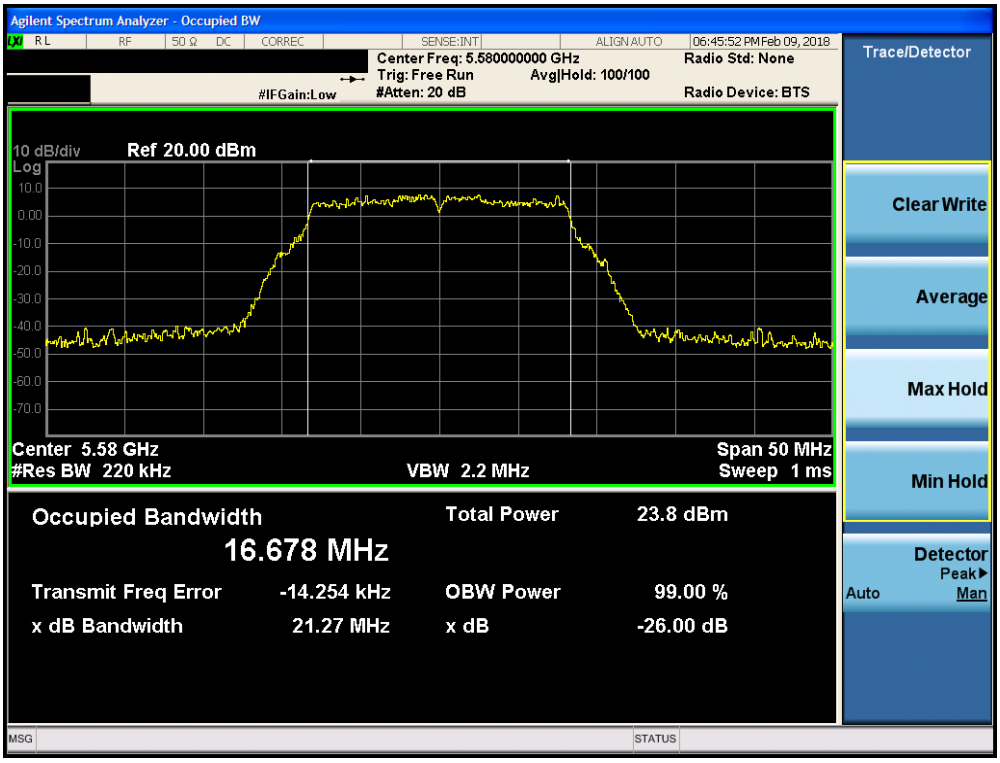
Plot 7-47. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)



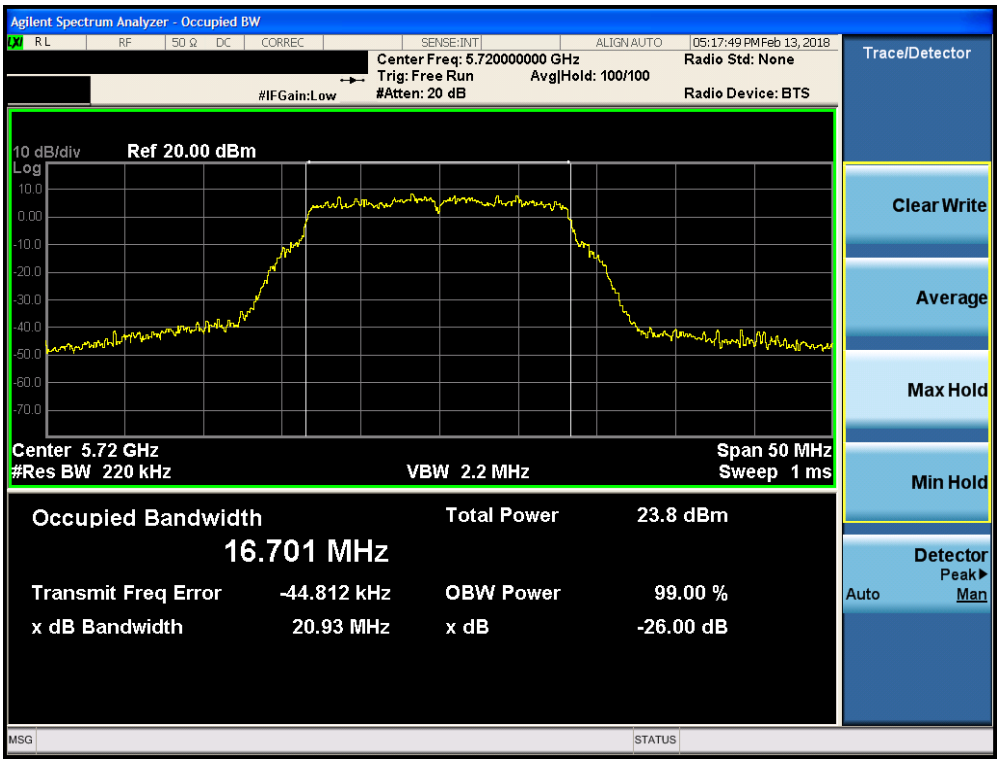
Plot 7-48. 26dB Bandwidth Plot FCC SISO ANT2 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)



Plot 7-49. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 2C) – Ch. 100)

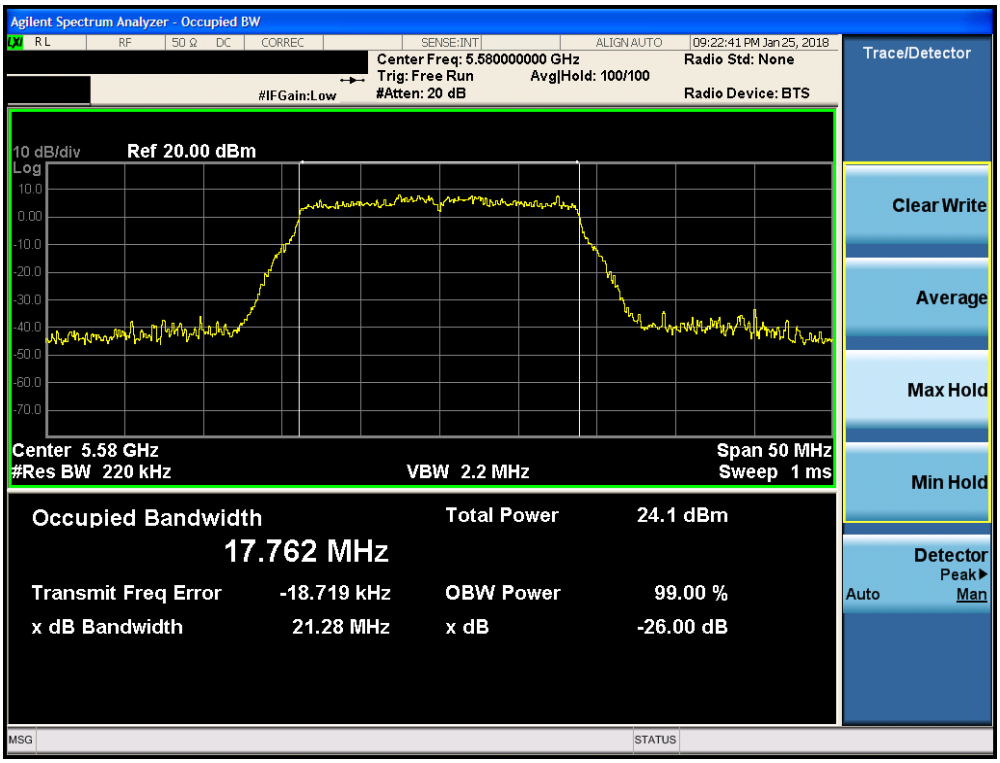


Plot 7-50. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 2C) – Ch. 116)

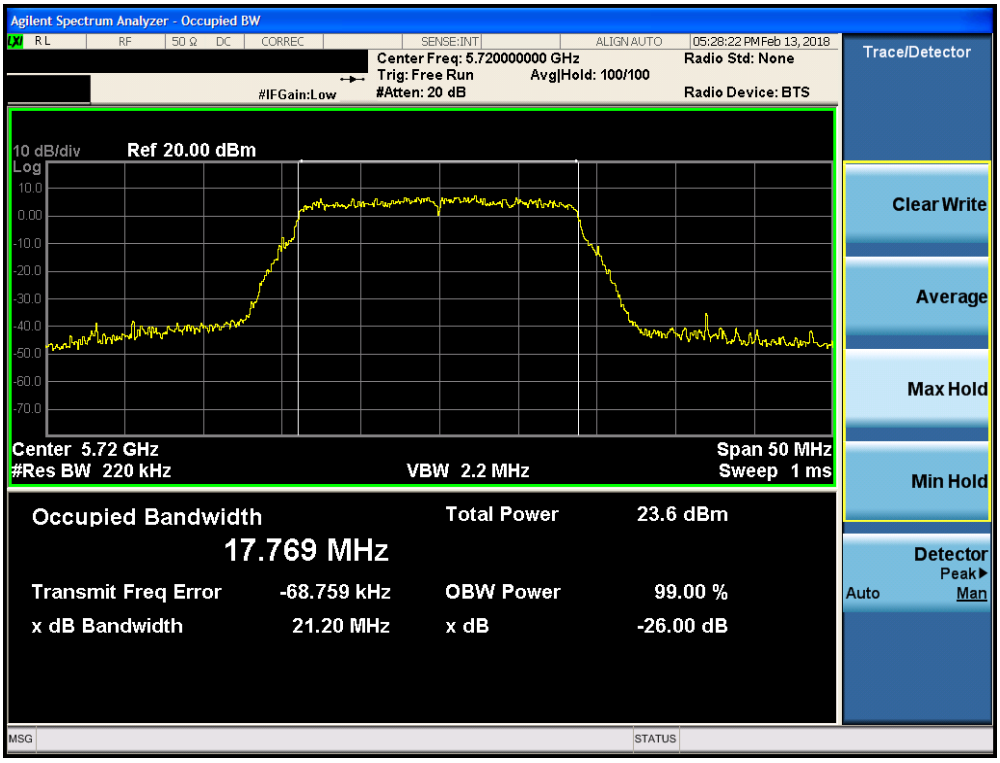


Plot 7-51. 26dB Bandwidth Plot FCC SISO ANT2 (802.11a (UNII Band 2C) – Ch. 144)

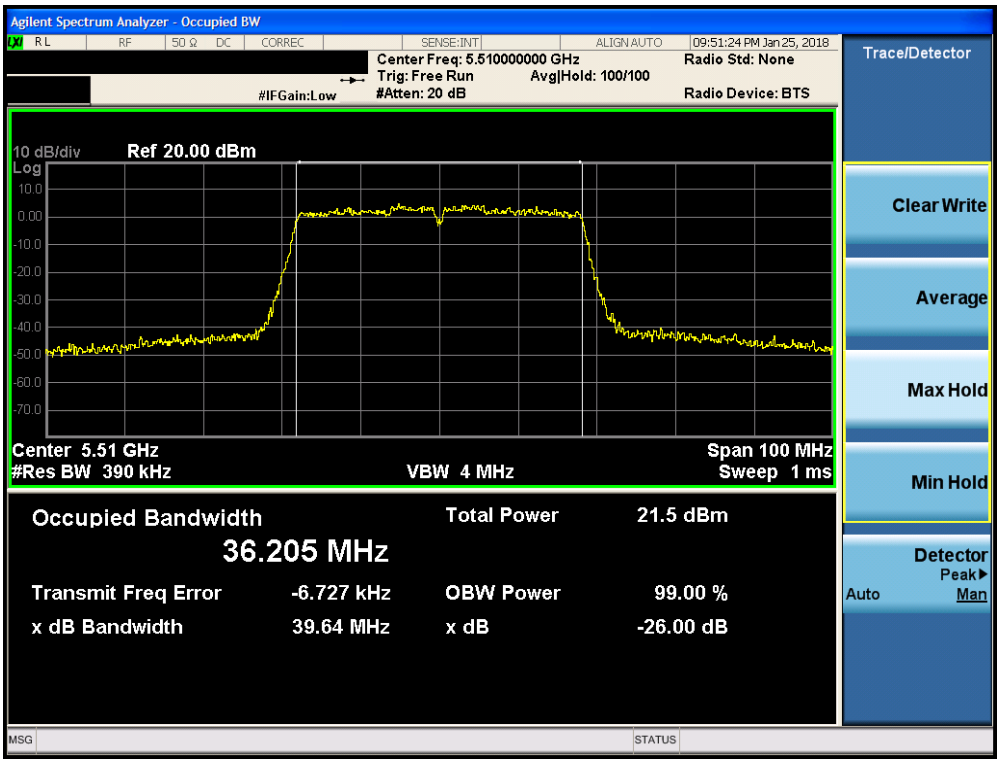
Plot 7-52. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)



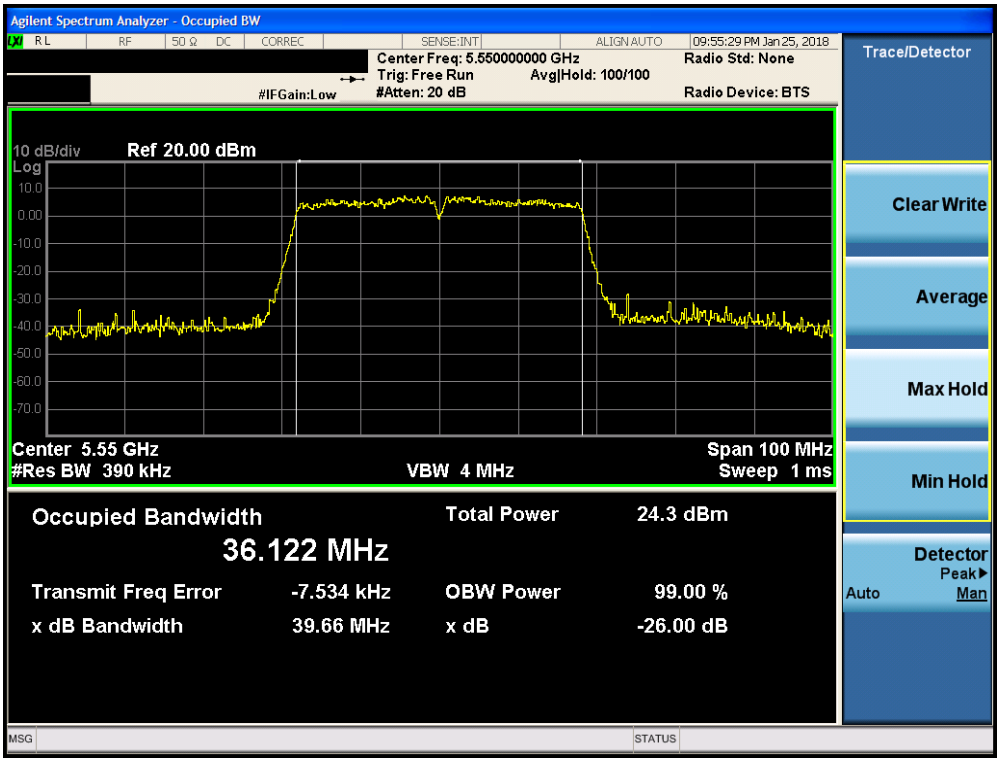
Plot 7-53. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



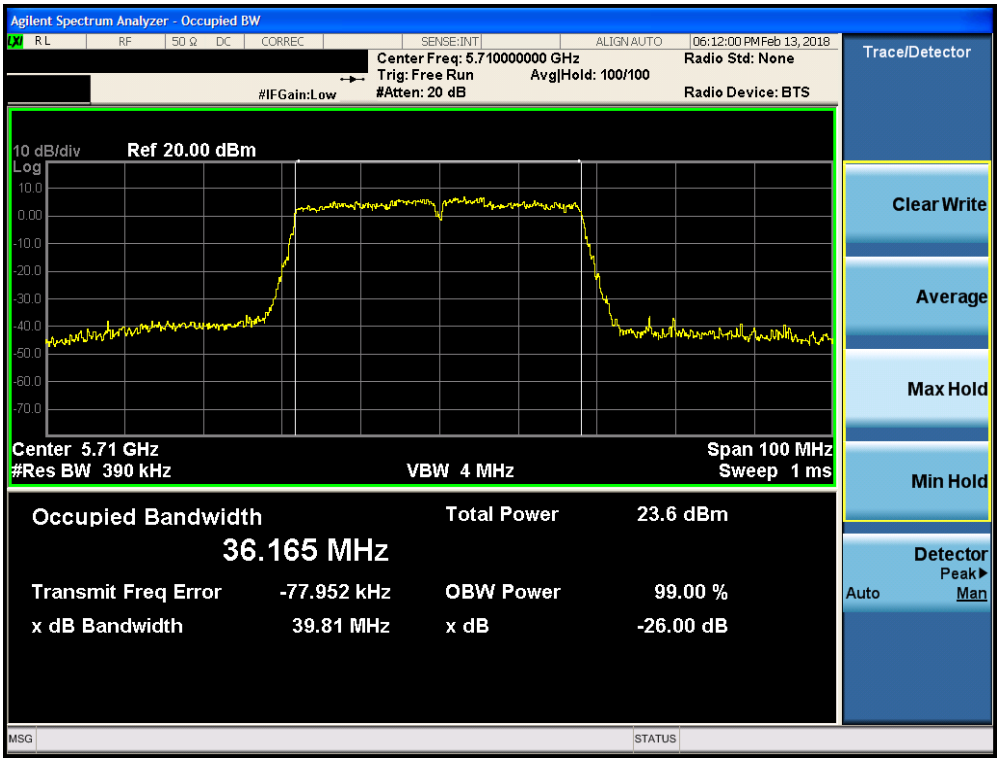
Plot 7-54. 26dB Bandwidth Plot FCC SISO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 144)



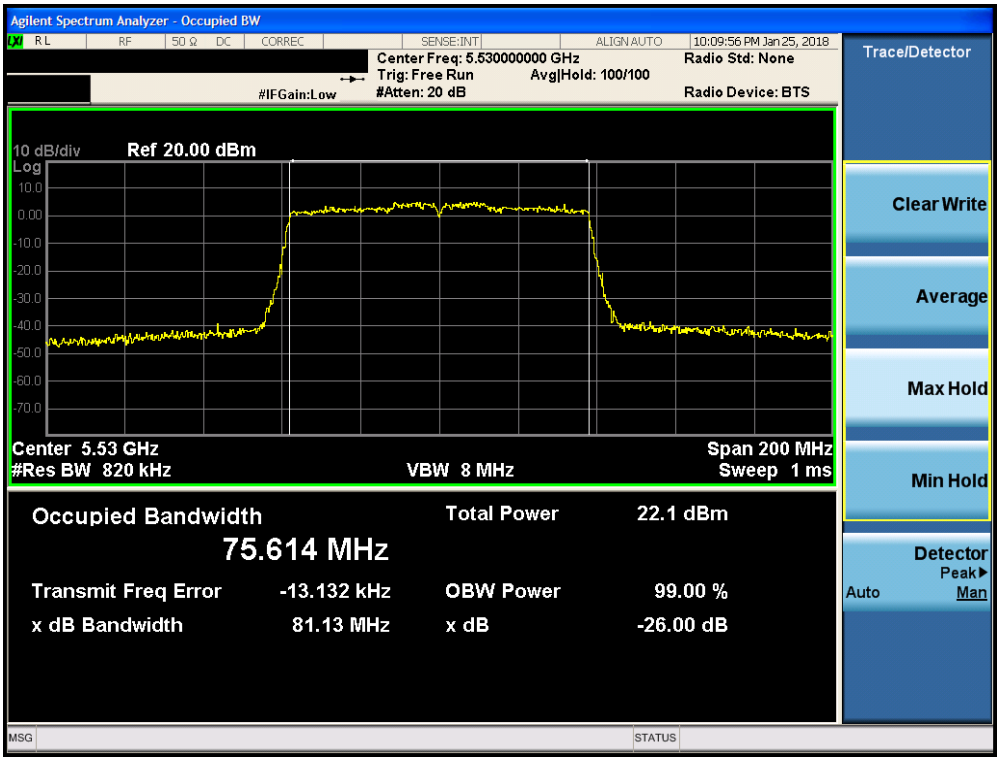
Plot 7-55. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 2C) – Ch. 102)



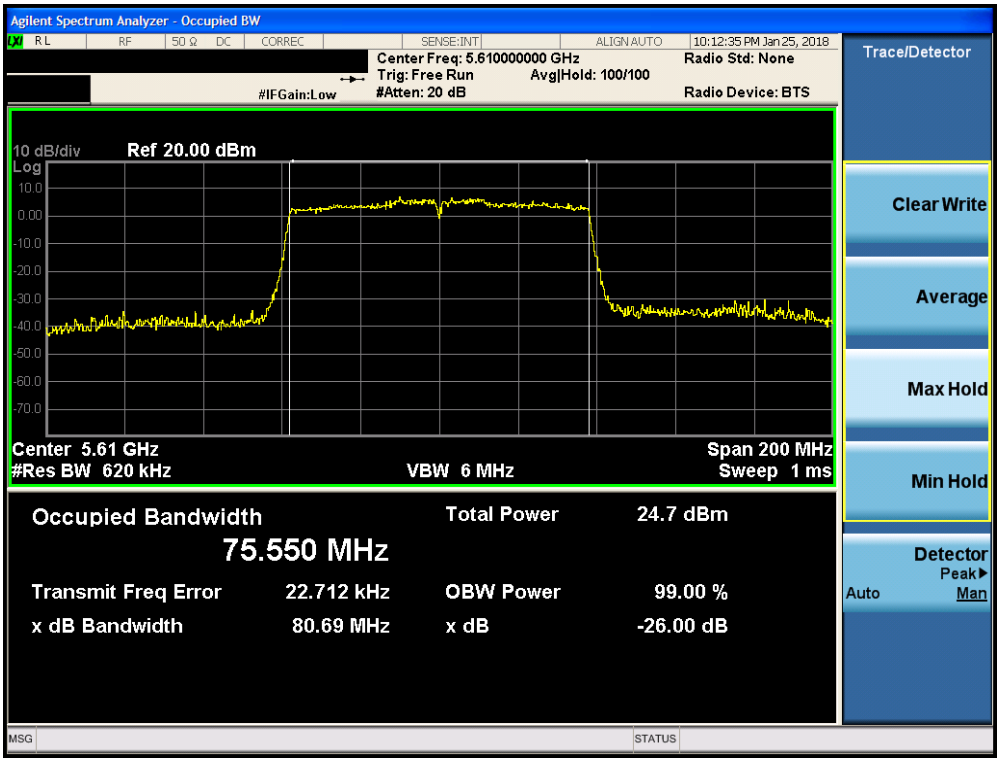
Plot 7-56. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 2C) – Ch. 110)



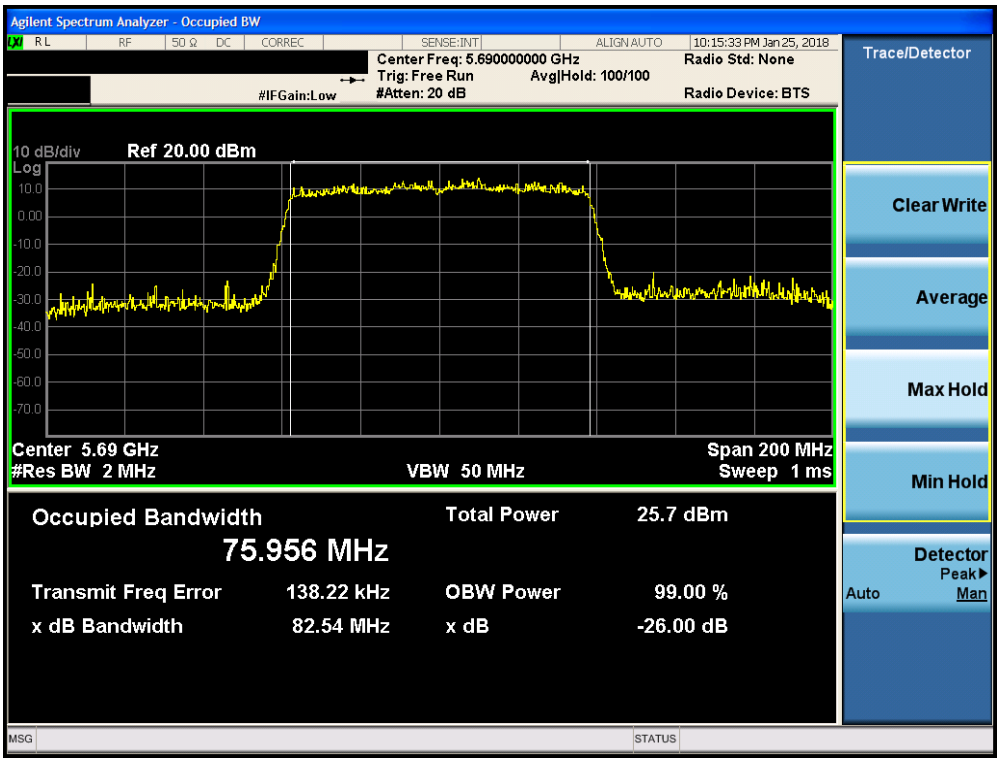
Plot 7-57. 26dB Bandwidth Plot FCC SISO ANT2 (40MHz BW 802.11n (UNII Band 2C) – Ch. 142)



Plot 7-58. 26dB Bandwidth Plot FCC SISO ANT2 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 106)



Plot 7-59. 26dB Bandwidth Plot FCC SISO ANT2 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)

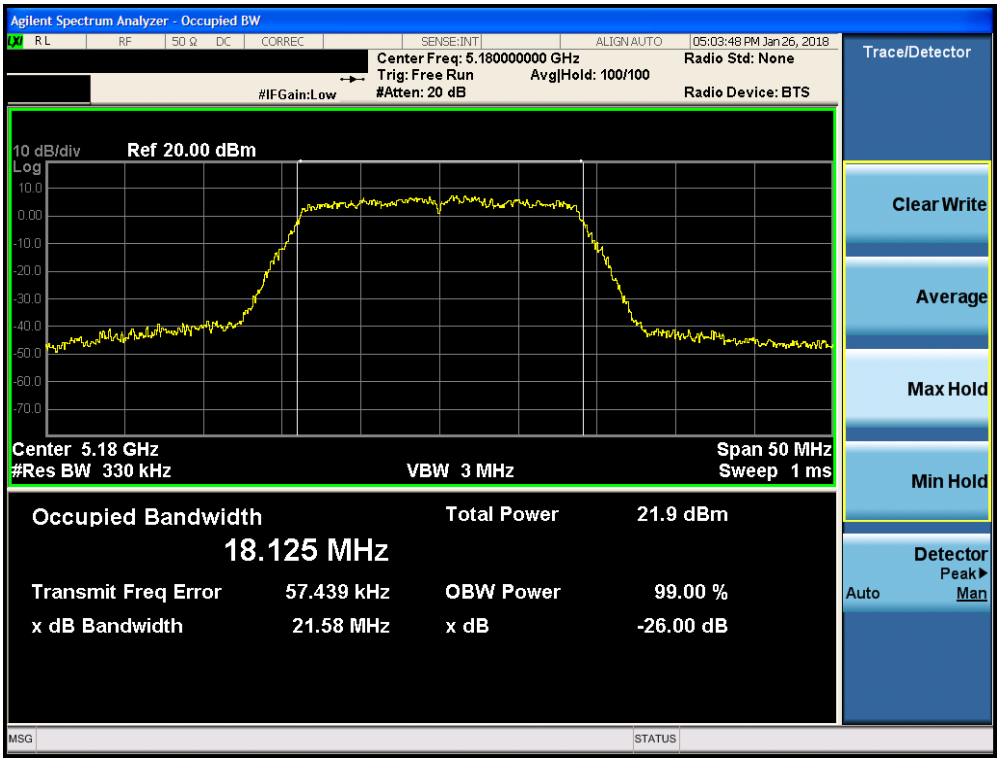


Plot 7-60. 26dB Bandwidth Plot FCC SISO ANT2 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 138)

MIMO 26dB Bandwidth Measurements

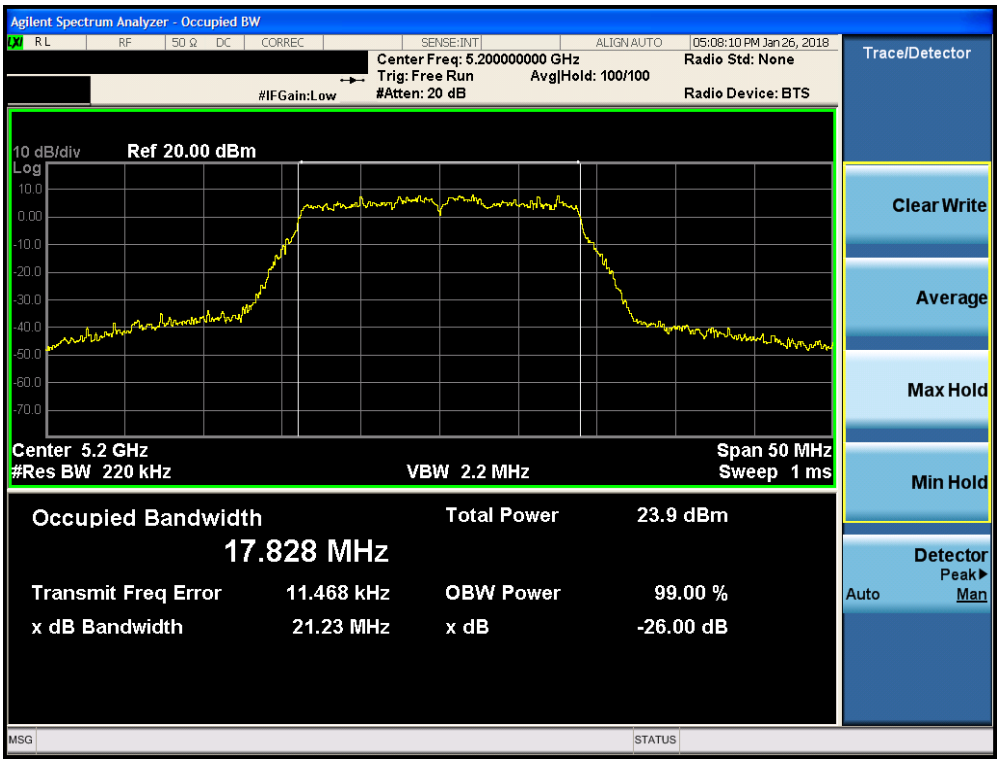
	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate [Mbps]	Measured 26dB Bandwidth [MHz]	
					ANT1	ANT2
Band 1	5180	36	n (20MHz)	6.5/7.2 (MCS0)	21.58	21.19
	5200	40	n (20MHz)	6.5/7.2 (MCS0)	21.23	21.02
	5240	48	n (20MHz)	6.5/7.2 (MCS0)	21.57	21.27
	5190	38	n (40MHz)	13.5/15 (MCS0)	39.36	39.27
	5230	46	n (40MHz)	13.5/15 (MCS0)	39.60	39.59
	5210	42	ac (80MHz)	29.3/32.5 (MCS0)	80.91	80.91
Band 2A	5260	52	n (20MHz)	6.5/7.2 (MCS0)	21.41	21.11
	5280	56	n (20MHz)	6.5/7.2 (MCS0)	21.46	21.10
	5320	64	n (20MHz)	6.5/7.2 (MCS0)	21.30	21.30
	5270	54	n (40MHz)	13.5/15 (MCS0)	39.70	39.46
	5310	62	n (40MHz)	13.5/15 (MCS0)	39.50	38.93
	5290	58	ac (80MHz)	29.3/32.5 (MCS0)	81.39	80.05
Band 2C	5500	100	n (20MHz)	6.5/7.2 (MCS0)	21.24	21.29
	5580	116	n (20MHz)	6.5/7.2 (MCS0)	21.15	21.17
	5720	144	n (20MHz)	6.5/7.2 (MCS0)	21.30	21.23
	5510	102	n (40MHz)	13.5/15 (MCS0)	39.77	39.00
	5550	110	n (40MHz)	13.5/15 (MCS0)	39.53	39.25
	5710	142	n (40MHz)	13.5/15 (MCS0)	39.65	38.87
	5530	106	ac (80MHz)	29.3/32.5 (MCS0)	81.68	80.84
	5610	122	ac (80MHz)	29.3/32.5 (MCS0)	81.04	80.26
	5690	138	ac (80MHz)	29.3/32.5 (MCS0)	82.49	82.30

Table 7-4. Conducted Bandwidth Measurements MIMO



Plot 7-61. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

Plot 7-62. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 36)

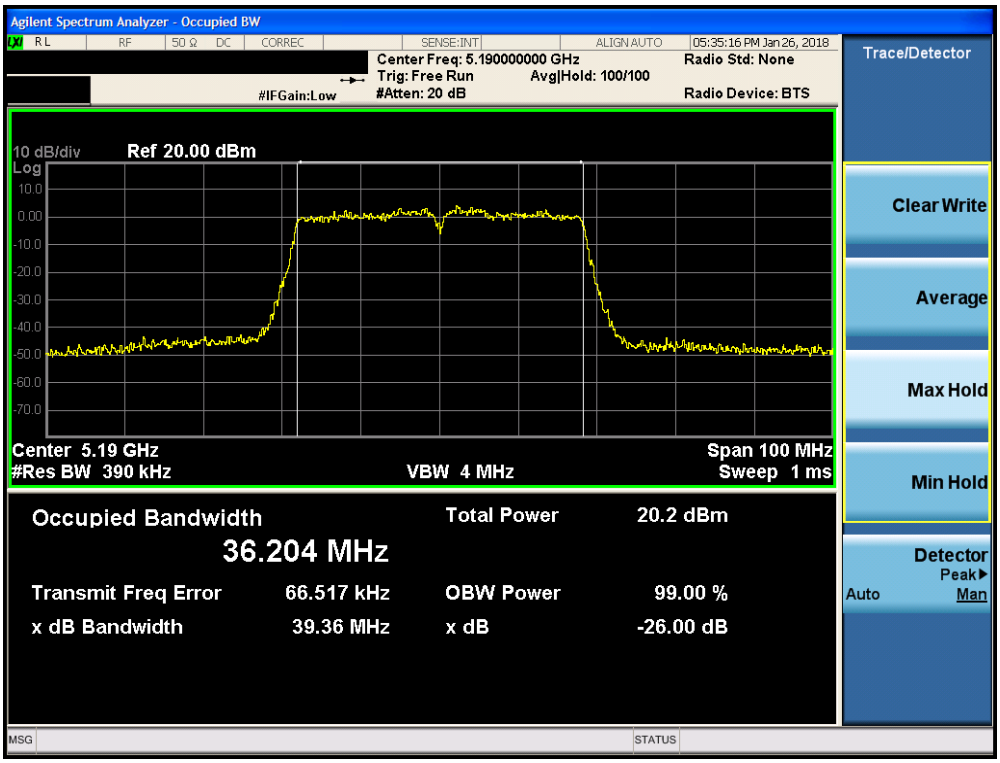


Plot 7-63. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

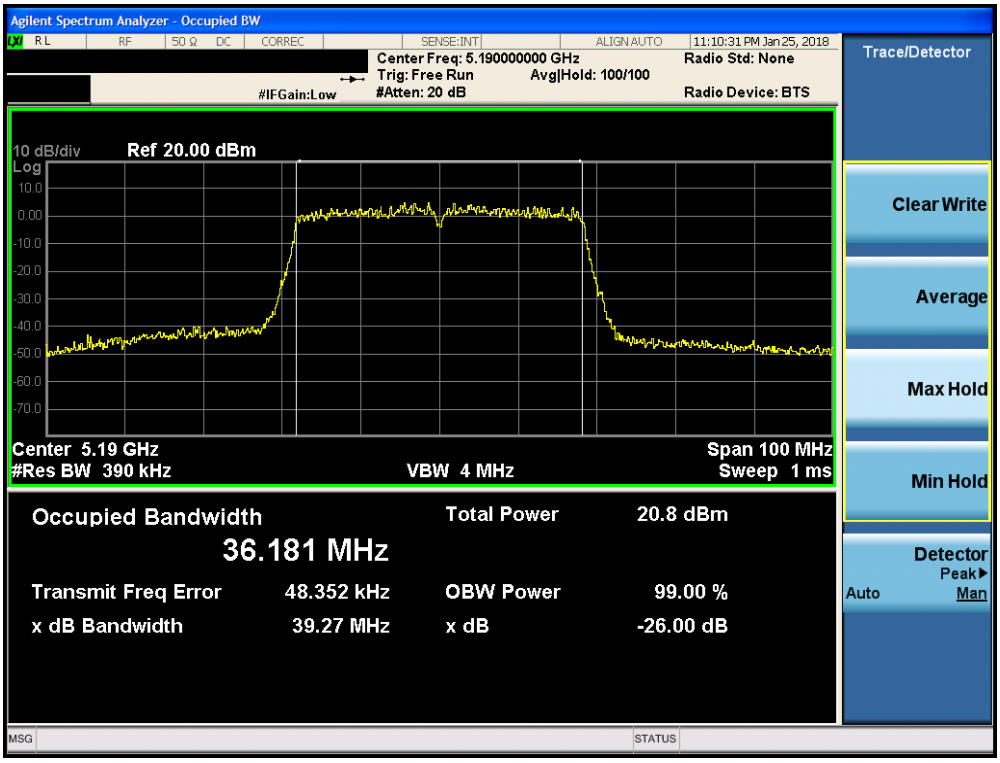
Plot 7-64. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

Plot 7-65. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 1) – Ch. 48)

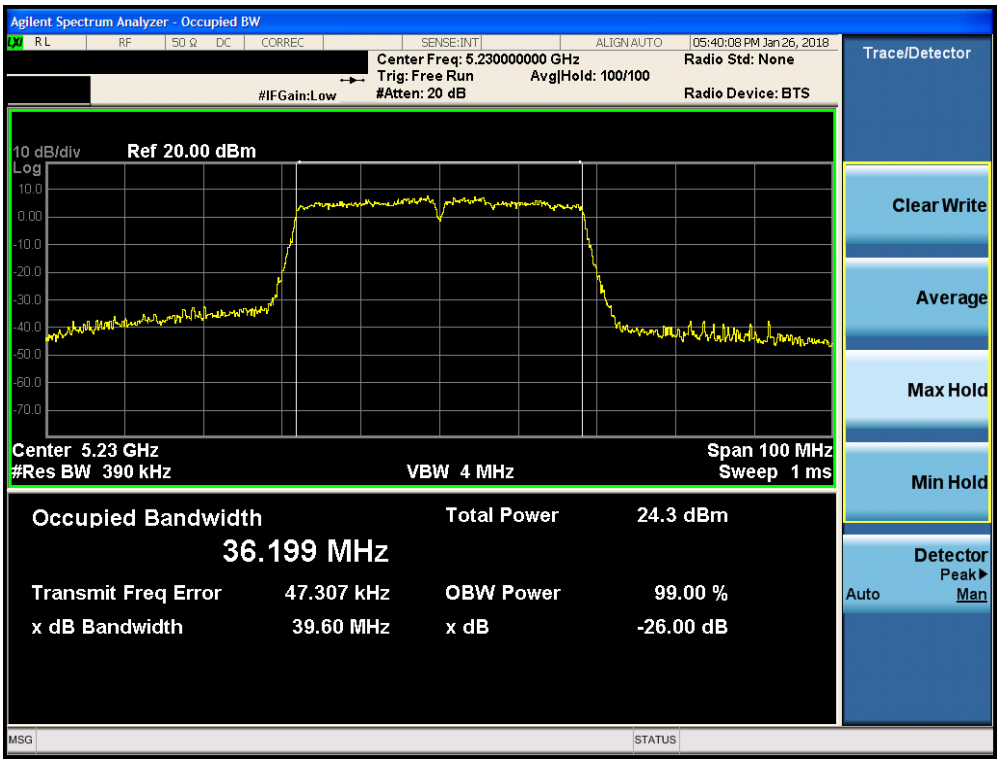
Plot 7-66. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 48)



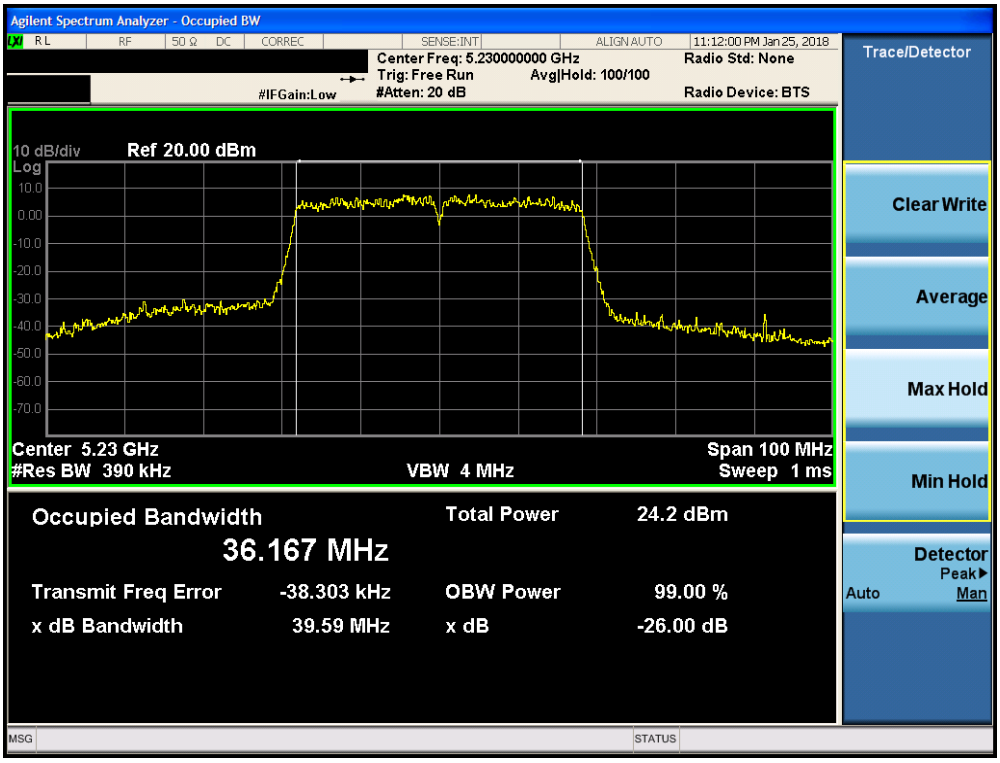
Plot 7-67. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



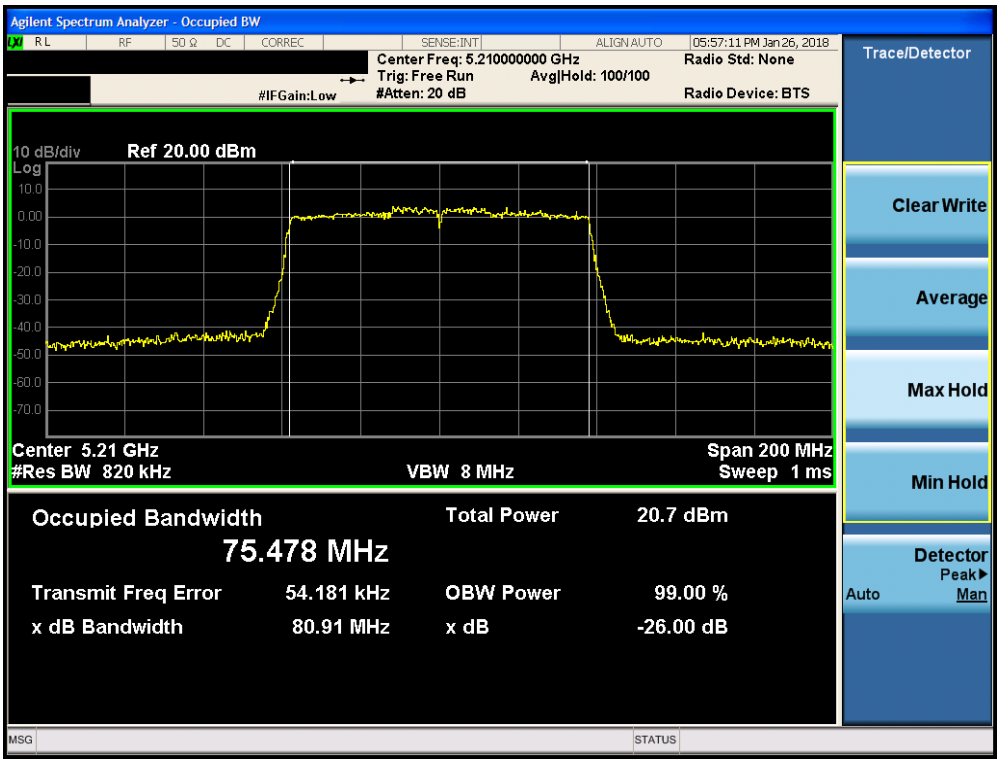
Plot 7-68. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



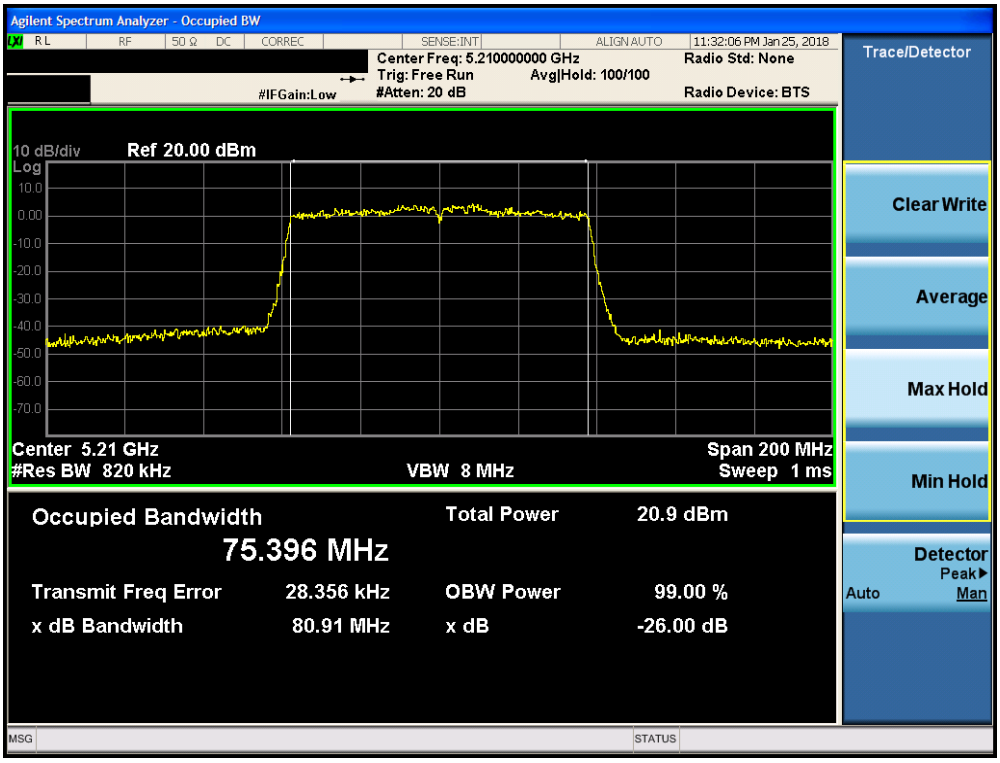
Plot 7-69. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



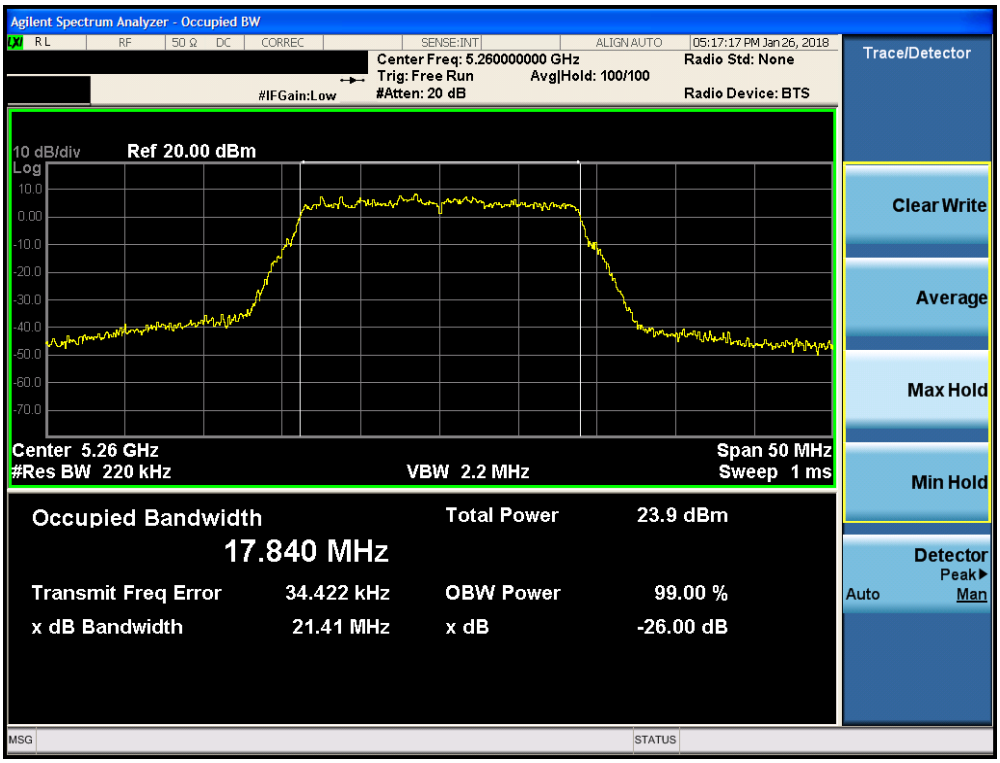
Plot 7-70. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 46)



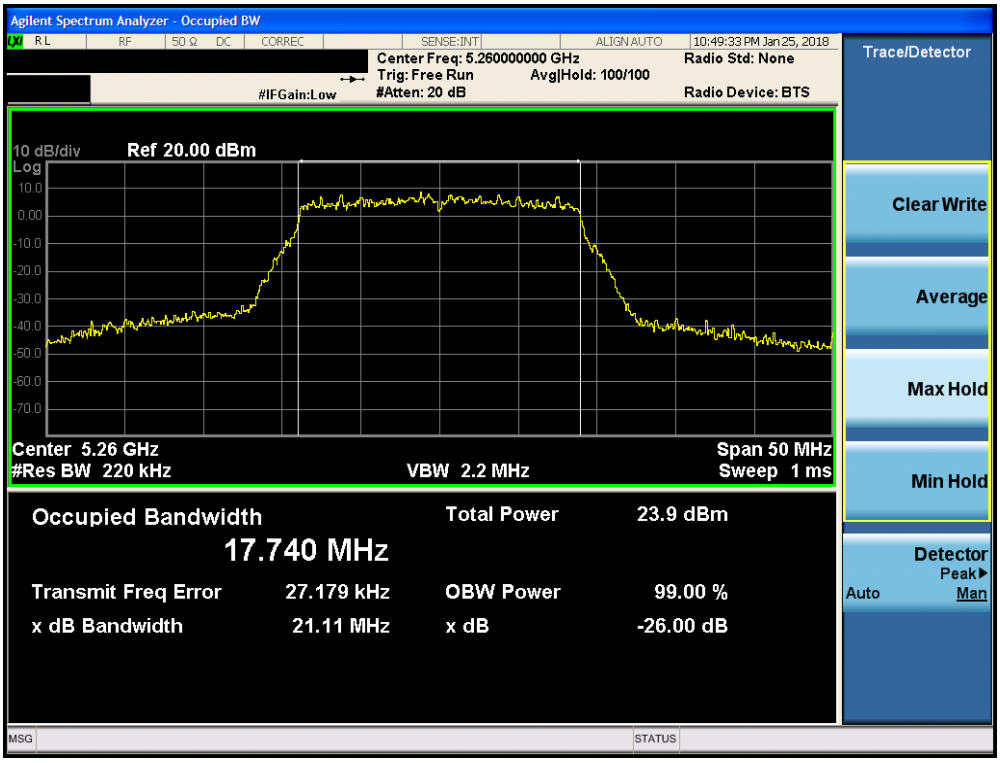
Plot 7-71. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



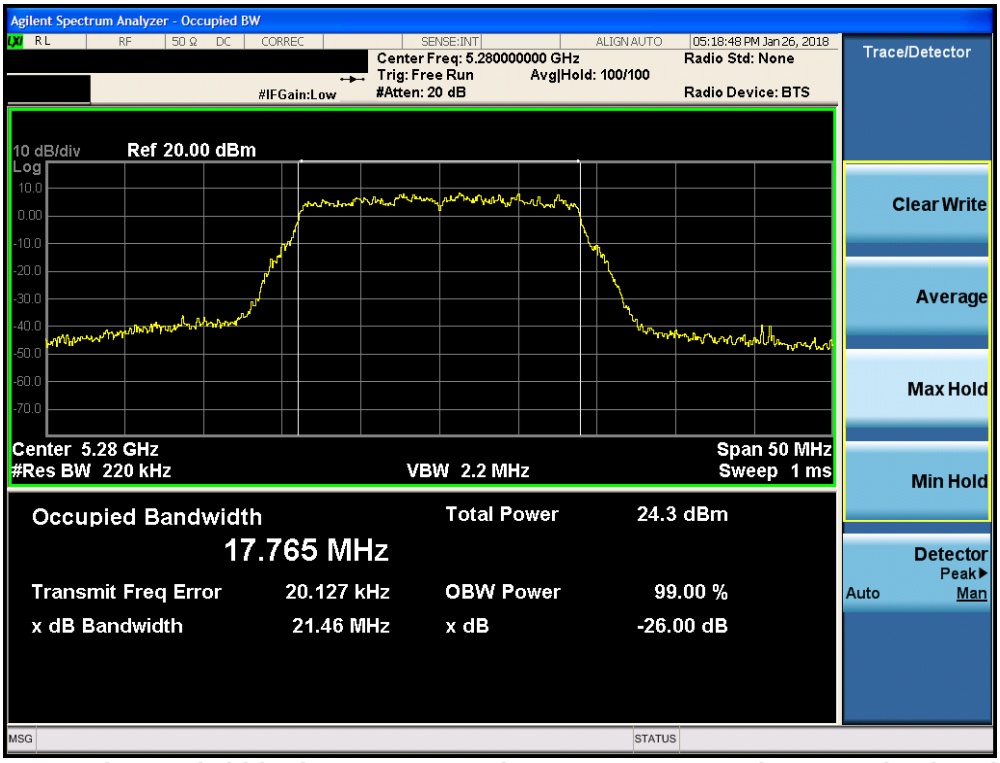
Plot 7-72. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



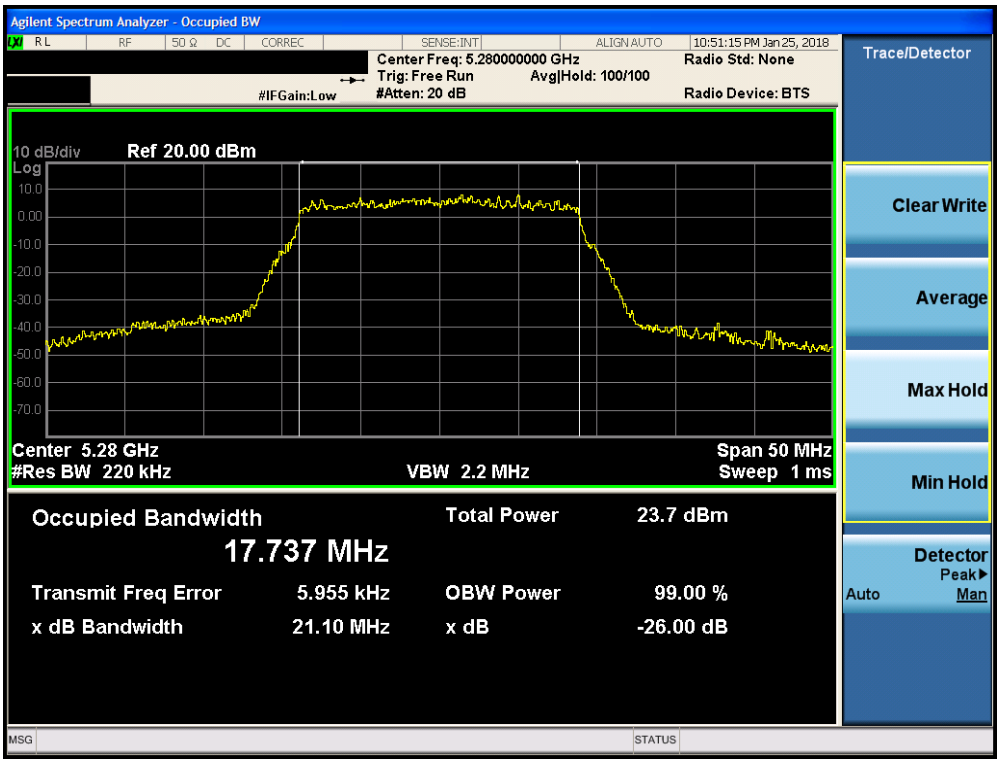
Plot 7-73. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)



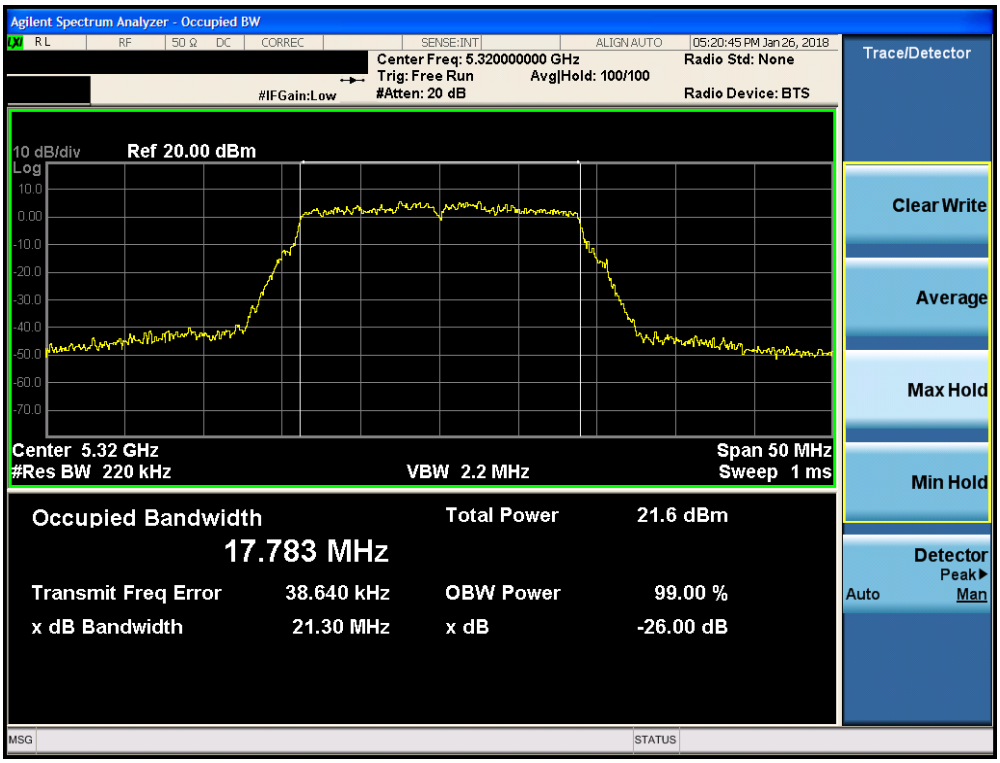
Plot 7-74. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 52)



Plot 7-75. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

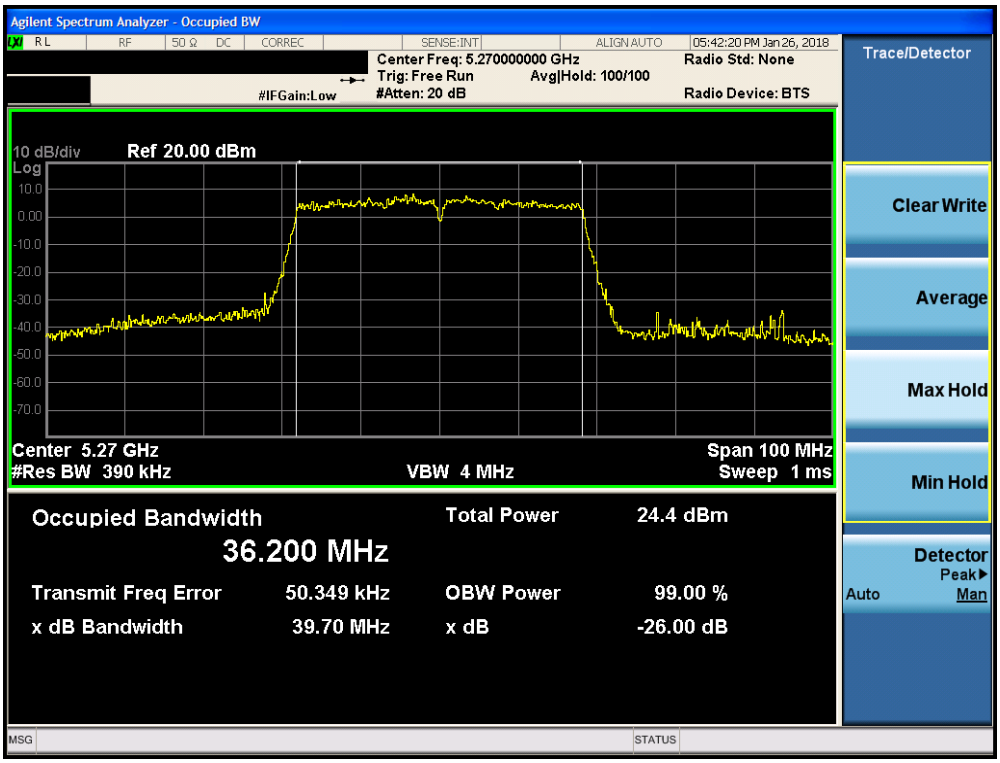


Plot 7-76. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

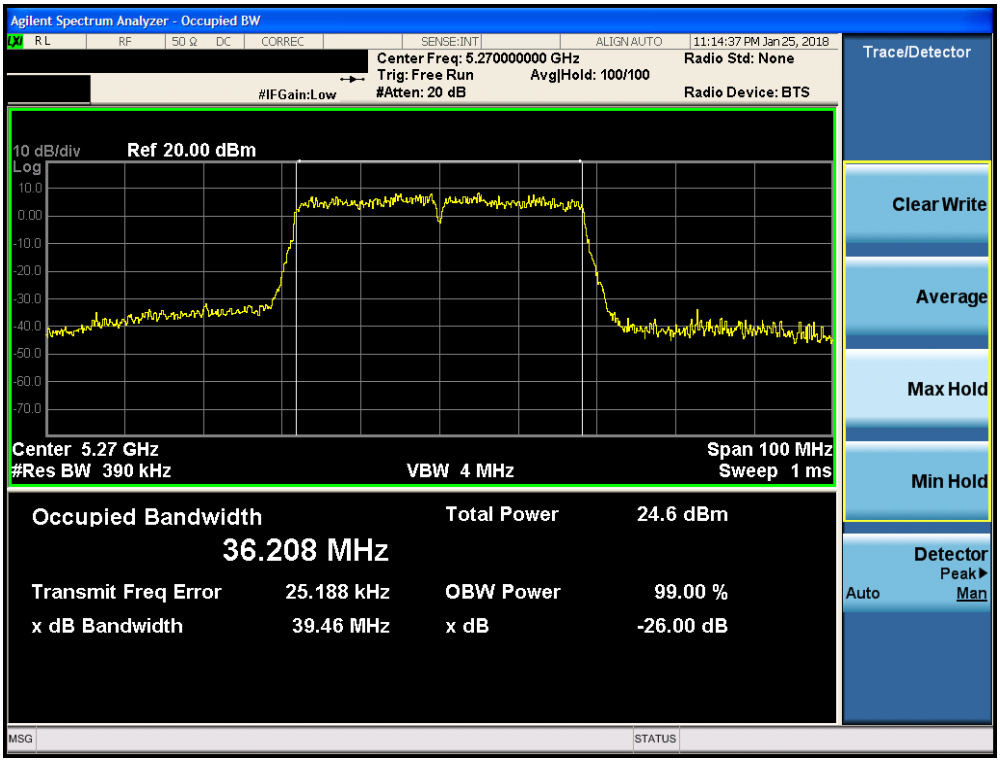


Plot 7-77. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)

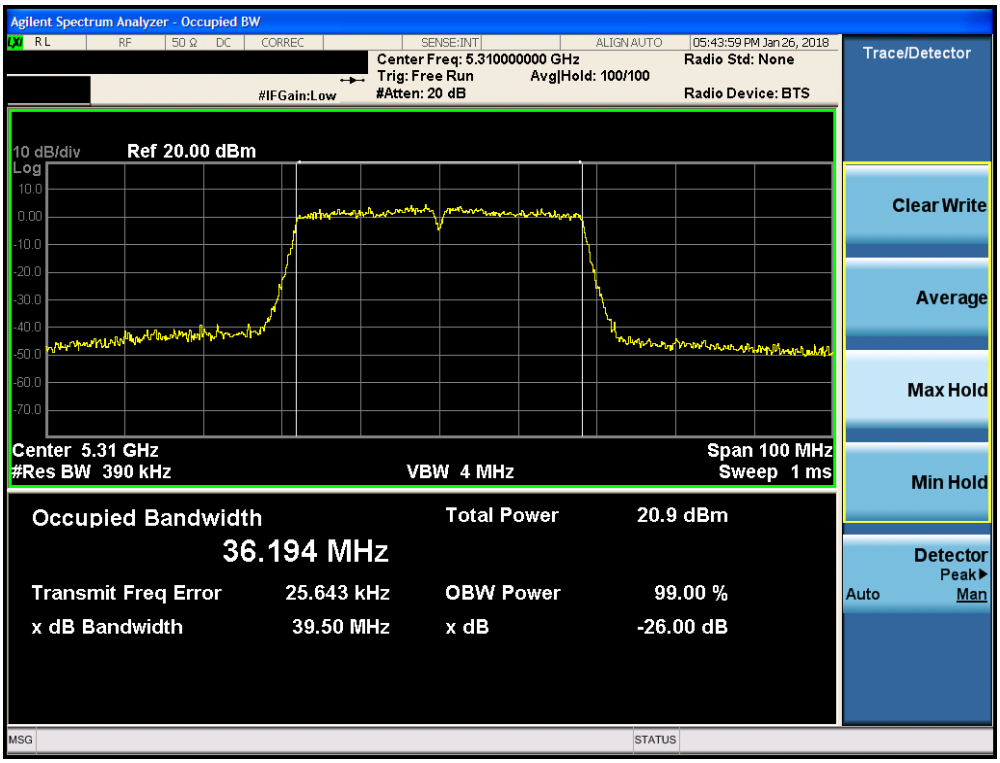
Plot 7-78. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 64)



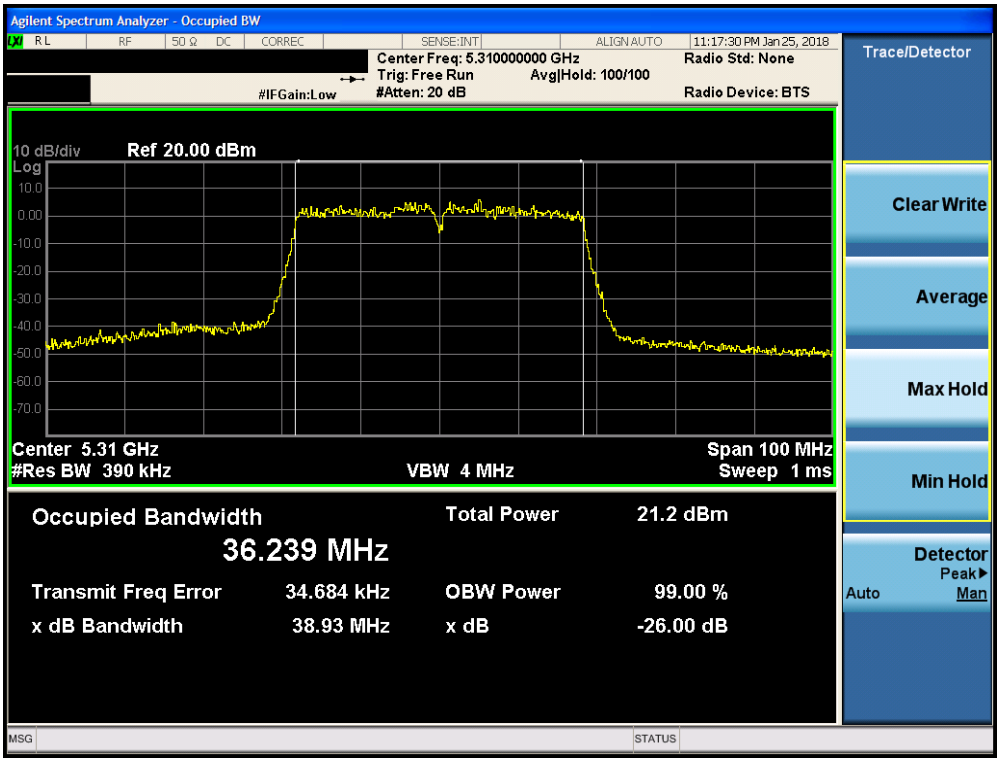
Plot 7-79. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



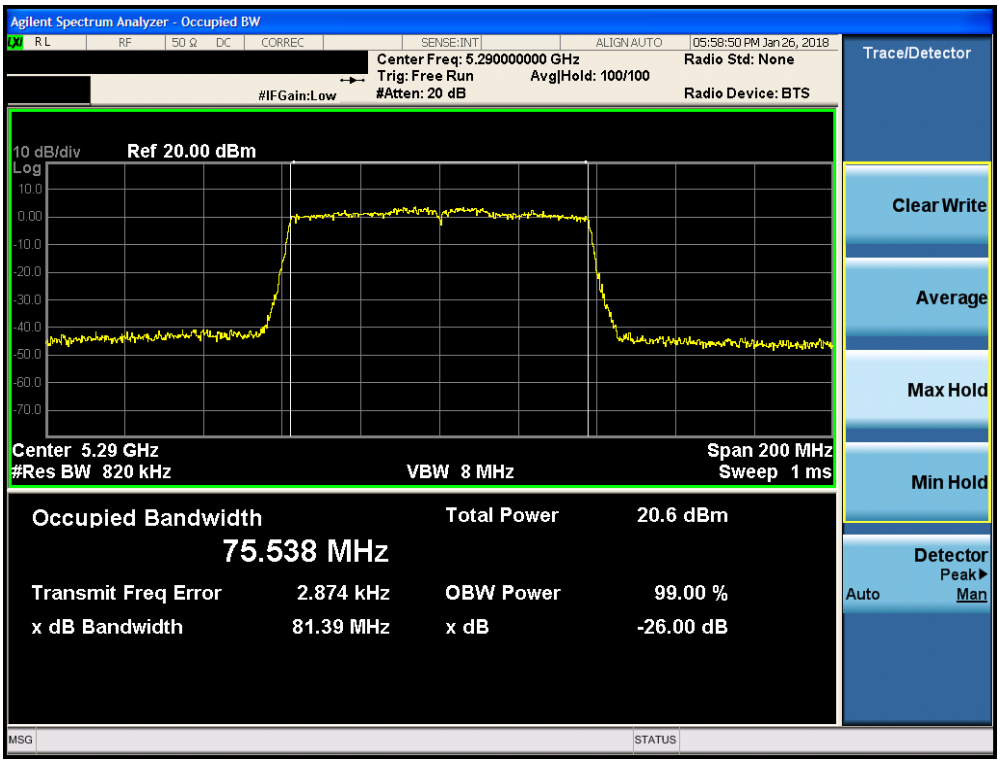
Plot 7-80. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



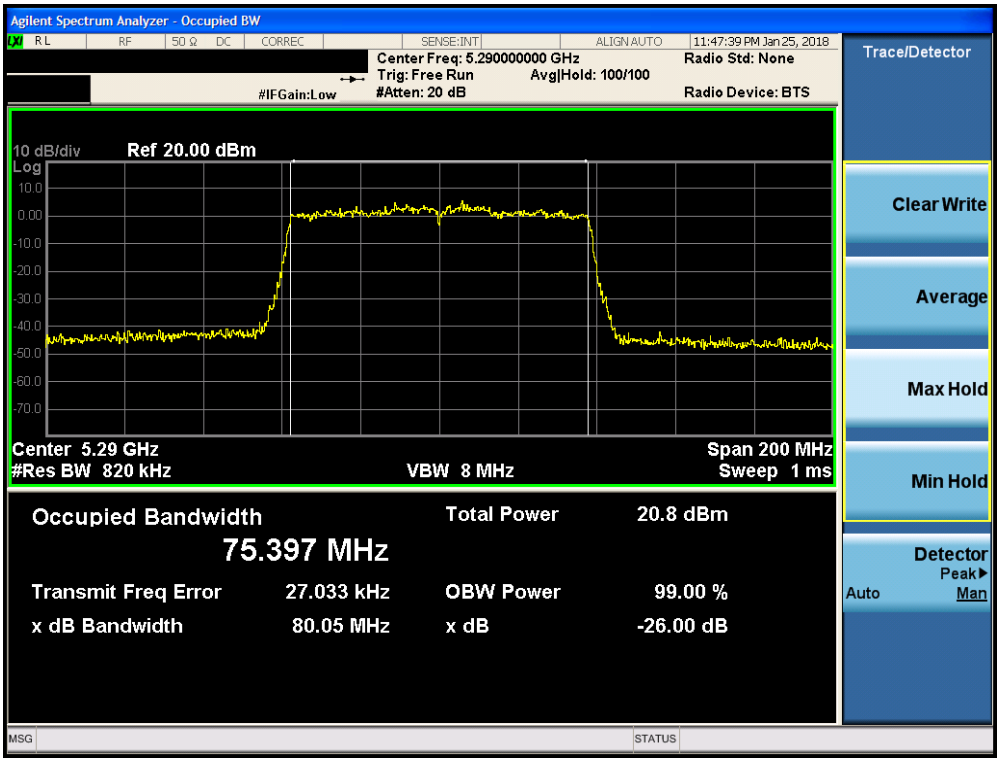
Plot 7-81. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)



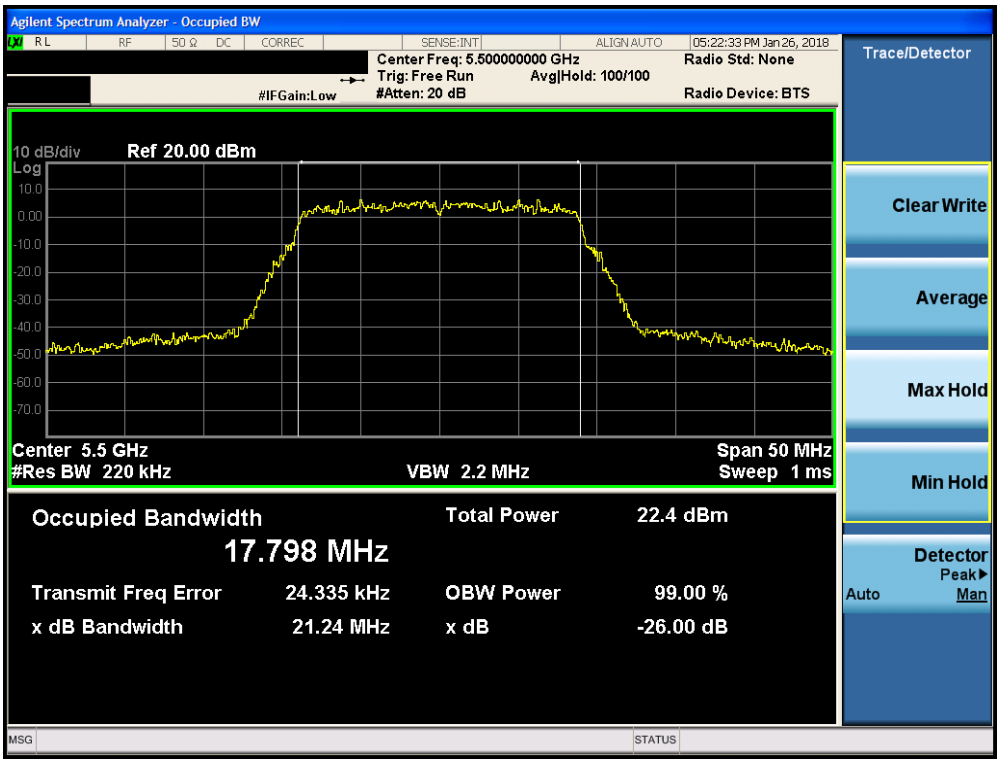
Plot 7-82. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 62)



Plot 7-83. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)



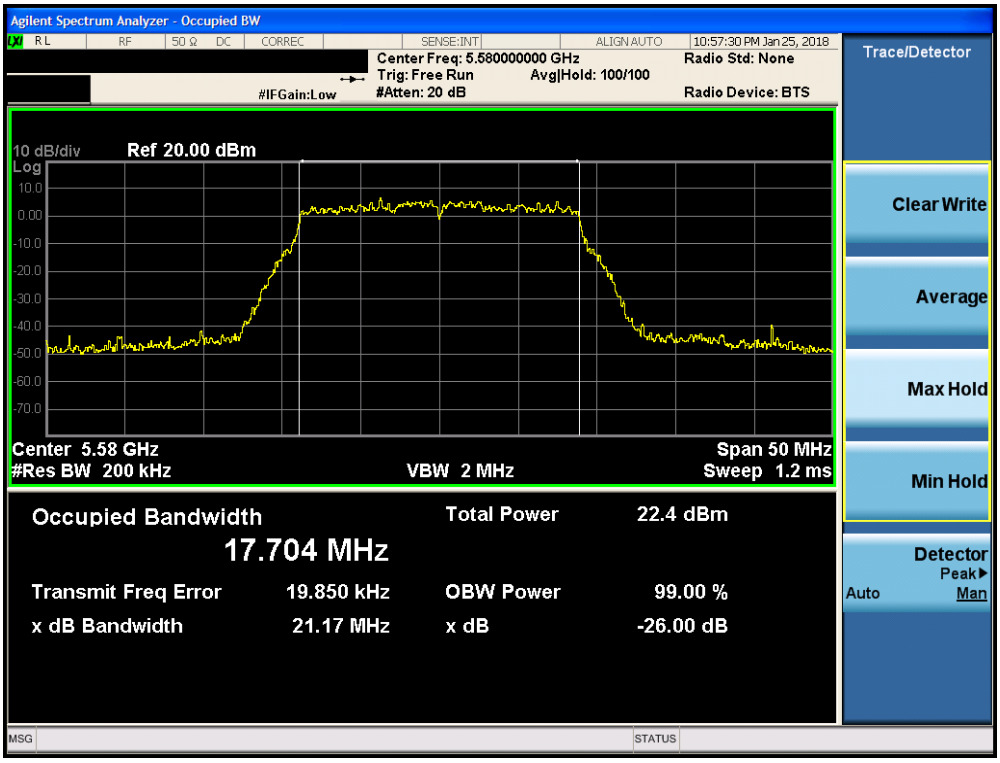
Plot 7-84. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)



Plot 7-85. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

Plot 7-86. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 100)

Plot 7-87. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)



Plot 7-88. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 116)