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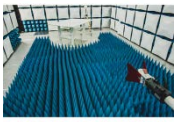

# MEASUREMENT REPORT
## FCC Part 15.407 802.11ax WIFI 6E

**Applicant Name:**
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

**Date of Testing:**
9/9 – 11/18/2021
**Test Report Issue Date:**
12/22/2021
**Test Site/Location:**
PCTEST Lab. Columbia, MD, USA
**Test Report Serial No.:**
1M2109220110-12-R1.A3L

| | |
|---|---|
| **FCC ID:** | **A3LSMS908E** |
| **APPLICANT:** | **Samsung Electronics Co., Ltd.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | SM-S908E/DS |
| **Additional Model(s):** | SM-S908E |
| **EUT Type:** | Portable Handset |
| **Frequency Range:** | 5935 – 7115MHz |
| **Modulation Type:** | OFDMA |
| **FCC Classification:** | 15E 6GHz Low Power Indoor Client (6XD) |
| **Test Procedure(s):** | ANSI C63.10-2013, KDB 789033 D02 v02r01, KDB 648474 D03 v01r04, KDB 662911 D01 v02r01, KDB 987594 D02 V01R01 |

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.

Note: This revised Test Report (S/N: 1M2109220110-12-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

ACCREDITED
TESTING CERT#2041.01

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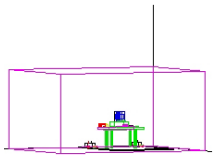
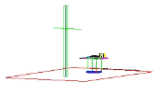


# MEASUREMENT REPORT



| Channel Bandwidth [MHz] | UNII Band | Tx Frequency [MHz] | MIMO | |
|---|---|---|---|---|
| | | | Max. Power [mW] | Max. Power [dBm] |
| 20 | 5 | 5935 - 6415 | 19.377 | 12.87 |
| | 6 | 6435 - 6515 | 31.470 | 14.98 |
| | 7 | 6535 - 6875 | 30.190 | 14.80 |
| | 8 | 6895 - 7115 | 31.328 | 14.96 |
| 40 | 5 | 5965 - 6405 | 36.736 | 15.65 |
| | 6 | 6445 - 6525 | 38.712 | 15.88 |
| | 7 | 6565 - 6845 | 39.716 | 15.99 |
| | 8 | 6885 - 7085 | 36.405 | 15.61 |
| 80 | 5 | 5985 - 6385 | 39.621 | 15.98 |
| | 6 | 6465 | 38.078 | 15.81 |
| | 7 | 6545 - 6865 | 39.056 | 15.92 |
| | 8 | 6945 - 7025 | 38.391 | 15.84 |
| 160 | 5 | 6025 - 6345 | 39.727 | 15.99 |
| | 6 | 6505 | 39.742 | 15.99 |
| | 7 | 6665 - 6825 | 39.489 | 15.96 |
| | 8 | 6985 | 38.791 | 15.89 |

**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 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

## 1.3 Test Facility / Accreditations

**Measurements were performed at PCTEST located in Columbia, MD 21046, U.S.A.**

- PCTEST is an ISO 17025-2017 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 (2451B) 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 **Samsung Portable Handset FCC ID: A3LSMS908E**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter while operating in the 6GHz band.

**Test Device Serial No.:** *0501M, 0579M, 3922M, 0299M, 0545M*

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer, UWB

| Band 5 | | Band 6 | | Band 7 | | Band 8 | |
|---|---|---|---|---|---|---|---|
| **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** |
| 2 | 5935 | 97 | 6435 | 117 | 6535 | 189 | 6895 |
| : | : | : | : | : | : | : | : |
| 45 | 6175 | 105 | 6475 | 149 | 6695 | 209 | 6995 |
| : | : | : | : | : | : | : | : |
| 93 | 6415 | 113 | 6515 | 185 | 6875 | 233 | 7115 |

**Table 2-1. 802.11a / 802.11ax (20MHz) Frequency / Channel Operations**

| Band 5 | | Band 6 | | Band 7 | | Band 8 | |
|---|---|---|---|---|---|---|---|
| **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** |
| 3 | 5965 | 99 | 6445 | 123 | 6565 | 187 | 6885 |
| : | : | : | : | : | : | : | : |
| 43 | 6165 | 107 | 6485 | 155 | 6725 | 211 | 7005 |
| : | : | : | : | : | : | : | : |
| 91 | 6405 | 115 | 6525 | 179 | 6845 | 227 | 7085 |

**Table 2-2. 802.11ax (40MHz BW) Frequency / Channel Operations**

| Band 5 | | Band 6 | | Band 7 | | Band 8 | |
|---|---|---|---|---|---|---|---|
| **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** | **Ch.** | **Frequency (MHz)** |
| 7 | 5985 | 103 | 6465 | 119 | 6545 | 199 | 6945 |
| : | : | | | : | : | : | : |
| 39 | 6145 | | | 151 | 6705 | 215 | 7025 |
| : | : | | | : | : | | |
| 87 | 6385 | | | 183 | 6865 | | |

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

| Band 5 | |
|---|---|
| **Ch.** | **Frequency (MHz)** |
| 15 | 6025 |
| : | : |
| 47 | 6185 |
| : | : |
| 79 | 6345 |

| Band 6 | |
|---|---|
| **Ch.** | **Frequency (MHz)** |
| 111 | 6505 |

| Band 7 | |
|---|---|
| **Ch.** | **Frequency (MHz)** |
| 143 | 6665 |
| : | : |
| 175 | 6825 |

| Band 8 | |
|---|---|
| **Ch.** | **Frequency (MHz)** |
| 207 | 6985 |

**Table 2-4. 802.11ax (160MHz BW) Frequency / Channel Operations**

**Notes:**

1. 6GHz NII operation is possible in 20MHz, and 40MHz, and 80MHz and 160MHz 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:

| 802.11 Mode | Bandwidth [MHz] | Tone | Duty Cycle |
|---|---|---|---|
| 6GHz | 20 | 26T | 99.0 |
| | | 52T | 98.2 |
| | | 106T | 96.1 |
| | | 242T | 96.8 |
| | 40 | 26T | 99.0 |
| | | 52T | 98.0 |
| | | 106T | 98.2 |
| | | 242T | 96.7 |
| | | 484T | 94.3 |
| | 80 | 26T | 98.9 |
| | | 52T | 97.9 |
| | | 106T | 95.4 |
| | | 242T | 96.6 |
| | | 484T | 93.5 |
| | | 996T | 90.8 |
| | 160 1st | 26T | 98.9 |
| | | 52T | 97.9 |
| | | 106T | 97.9 |
| | | 242T | 96.7 |
| | | 484T | 94.2 |
| | | 996T | 90.6 |
| | 160 2nd | 26T | 99.6 |
| | | 52T | 97.9 |
| | | 106T | 95.9 |
| | | 242T | 96.6 |
| | | 484T | 94.1 |
| | | 996T | 90.4 |

**Table 2-5. Measured Duty Cycles**

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

| WiFi Configurations | | CDD | | SDM | |
|---|---|---|---|---|---|
| | | ANT1 | ANT2 | ANT1 | ANT2 |
| 6 GHz | 11ax (20MHz) | ✓ | ✓ | ✓ | ✓ |
| | 11ax (40MHz) | ✓ | ✓ | ✓ | ✓ |
| | 11ax (80MHz) | ✓ | ✓ | ✓ | ✓ |
| | 11ax (160MHz) | ✓ | ✓ | ✓ | ✓ |

**Table 2-6. Frequency / Channel Operations**

✓= Support; = NOT Support
**SDM** = Spatial Diversity Multiplexing – MIMO function
**CDD** = Cyclic Delay Diversity - 2Tx Function

3. This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz (WLAN & BT), 5GHz, and 6GHz bands simultaneously on each antenna.

## 2.3 Antenna Description

Following antenna gain was used for the testing.

| Frequency Band | Antenna-1 Gain [dBi] | Antenna-2 Gain [dBi] | Directional Gain [dBi] |
|---|---|---|---|
| **Band 5** | -6.31 | -5.56 | -2.92 |
| **Band 6** | -11.39 | -6.32 | -5.48 |
| **Band 7** | -7.00 | -7.37 | -4.17 |
| **Band 8** | -7.00 | -10.56 | -5.59 |

**Table 2-7. Antenna Peak Gain**

## 2.4 Test Configuration

The EUT was tested per the guidance of KDB 987594 D02 and KDB 789033 D02 v02r01. 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 0, 7.3, 7.4, 7.5 and 7.6 for antenna port conducted emissions test setups.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

## 2.5 Software and Firmware

The test was conducted with firmware version F926USQ0AUCE installed on the EUT.

## 2.6 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.

## 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 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.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

## 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 $U_{CISPR}$ 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 |
|---|---|---|---|---|---|---|
| - | WL25-1 | Conducted Cable Set (25GHz) | 9/7/2021 | Annual | 9/7/2022 | WL25-1 |
| - | WL25-2 | Conducted Cable Set (25GHz) | 9/7/2021 | Annual | 9/7/2022 | WL25-2 |
| - | WL25-3 | Conducted Cable Set (25GHz) | 9/7/2021 | Annual | 9/7/2022 | WL25-3 |
| - | WL40-1 | Conducted Cable Set (40GHz) | 9/10/2021 | Annual | 9/10/2022 | WL40-1 |
| Agilent | N9038A | MXE EMI Receiver | 8/11/2020 | Annual | 12/1/2021 | MY51210133 |
| Agilent | N9030A | PXA Signal Analyzer (44GHz) | 7/21/2021 | Annual | 7/21/2022 | MY49430494 |
| Anritsu | ML2495A | Power Meter | 1/18/2021 | Annual | 1/18/2022 | 941001 |
| Anritsu | MA2411B | Pulse Power Sensor | 3/8/2021 | Annual | 3/8/2022 | 1339007 |
| Emco | 3115 | Horn Antenna (1-18GHz) | 6/18/2020 | Biennial | 6/18/2022 | 9704-5182 |
| Emco | 3116C | Horn Antenna (18 - 40GHz) | 5/112021 | Biennial | 5/11/2023 | 218893 |
| ETS-Lindgren | 3816/2NM | Line Impedance Stabilization Network | 7/9/2020 | Biennial | 7/9/2022 | 114451 |
| Keysight Technologies | N9030A | PXA Signal Analyzer (44GHz) | 8/17/2020 | Annual | 12/17/2021 | MY52350166 |
| Pasternack | NMLC-2 | Line Conducted Emissions Cable (NM) | 9/10/2021 | Annual | 9/10/2022 | NMLC-2 |
| Keysight Technologies | N9030A | PXA Signal Analyzer (44GHz) | 7/21/2021 | Annual | 7/12/2022 | MY49430494 |
| Rohde & Schwarz | ESU26 | EMI Test Receiver (26.5GHz) | 8/3/2021 | Annual | 8/3/2022 | 100342 |
| Rohde & Schwarz | ESW44 | EMI Test Receiver 2Hz to 44GHz | 1/21/2021 | Annual | 1/21/2022 | 101716 |
| Rohde & Schwarz | FSW67 | Signal / Spectrum Analyzer | 8/25/2021 | Annual | 8/25/2022 | 103200 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 9/3/2021 | Annual | 9/3/2022 | 102138 |
| Solar Electronics | 8012-50-R-24-BNC | Line Impedance Stabilization Network | 9/21/2021 | Biennial | 9/21/2023 | 310233 |
| Schwarzbeck | VULB9162 | Bilog Antenna | 4/17/2020 | Biennial | 4/17/2022 | 00301 |

**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: Samsung Electronics Co., Ltd.
FCC ID: A3LSMS908E
FCC Classification: 15E 6 GHz Low Power Indoor Client (6XD)

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| 2.1046, 15.407(a)(11) | Maximum Conducted Output Power | N/A | CONDUCTED | PASS | Section 7.3 |
| 2.1049, 15.407(a)(10) | Occupied Bandwidth/ 26dB Bandwidth | 99% of the occupied bandwidth of any channel must be contained within each of its respective U-NII sub bands<br><br>The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz. | | PASS | Section 7.2 |
| 15.407(a)(8) | Maximum Power Spectral Density | < -1dBm/MHz e.i.r.p. | | PASS | Section 7.4 |
| 15.407(a)(8) | Maximum Radiated Output Power | < 24dBm over the frequency band of operation | | PASS | Section 7.3 |
| 15.407(b)(6) | In-Band Emissions | EUT must meet the limits detailed in 15.407(b)(6) | | PASS | Section 7.5 |
| 15.407(d)(6) | Contention Based Protocol | EUT must detect AWGN signal with 90% (or better) certainty | | PASS | Section 7.6 |
| 15.407(b)(5) | Undesirable Emissions | < -27dBm/MHz e.i.r.p. outside of the 5.925 – 7.125GHz band | RADIATED | PASS | Section 7.7 |
| 15.205, 15.209 | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Emissions in restricted bands must meet the radiated limits detailed in 15.209 | | PASS | Section 7.7, 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 4.7.
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 1.3.1.

## 7.2 26dB Bandwidth Measurement – 802.11ax

**2.1049, 15.407(a)(10)**

### 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
KDB 987594 D02 V01R01

### 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 ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold

### Test Setup

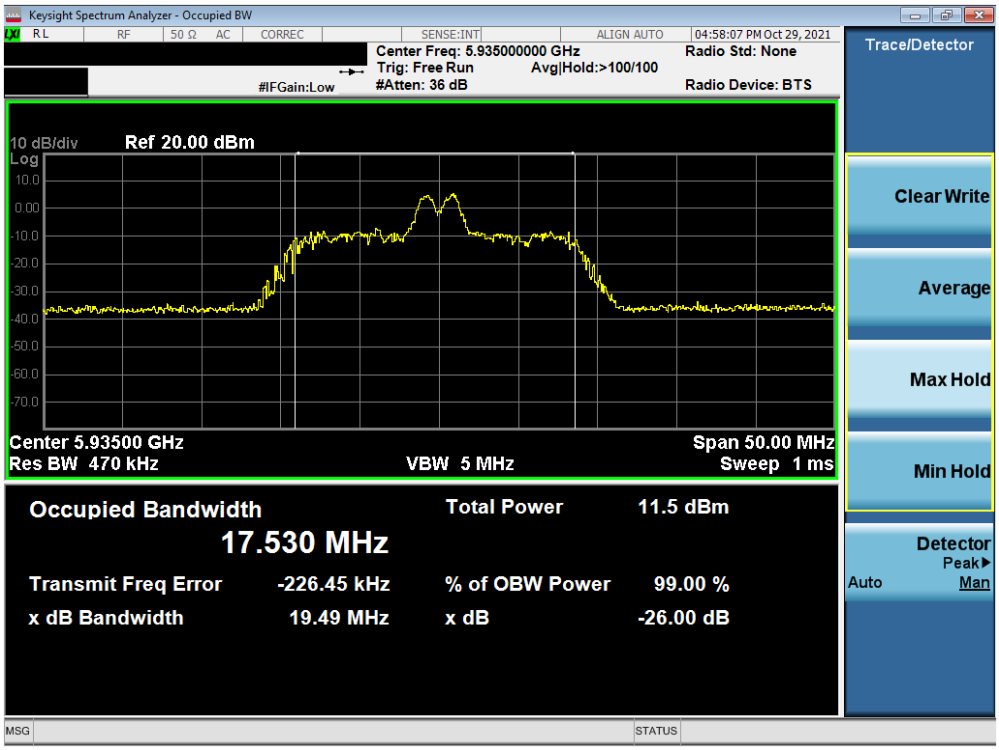
The EUT and measurement equipment were set up as shown in the diagram below.


**Figure 7-1. Test Instrument & Measurement Setup**

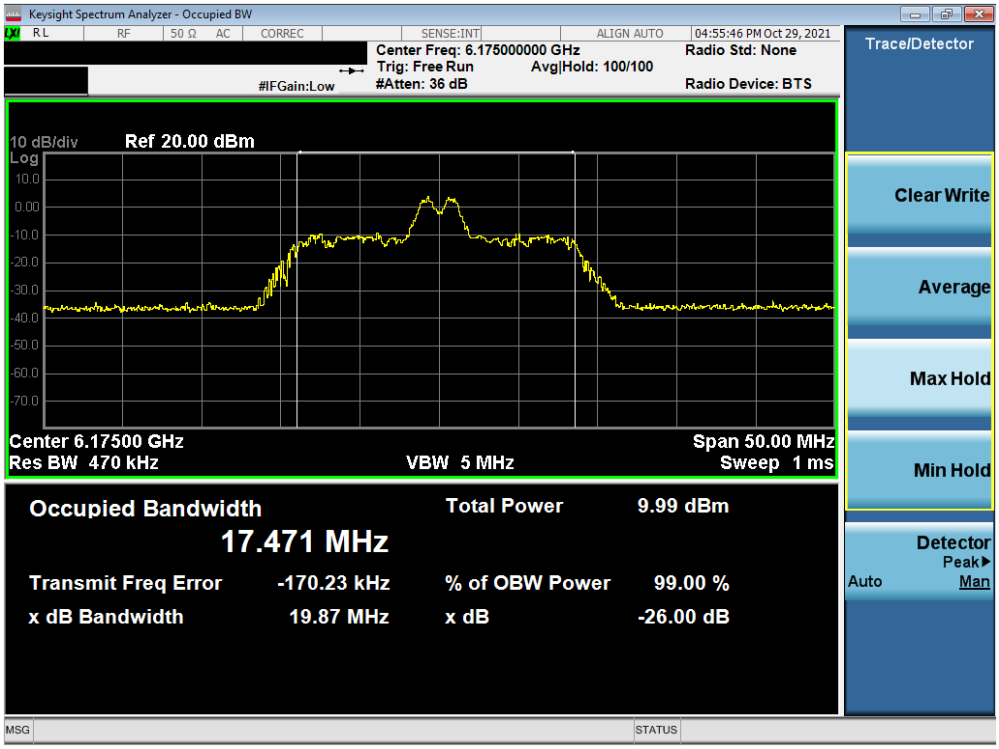
### Test Notes

None.

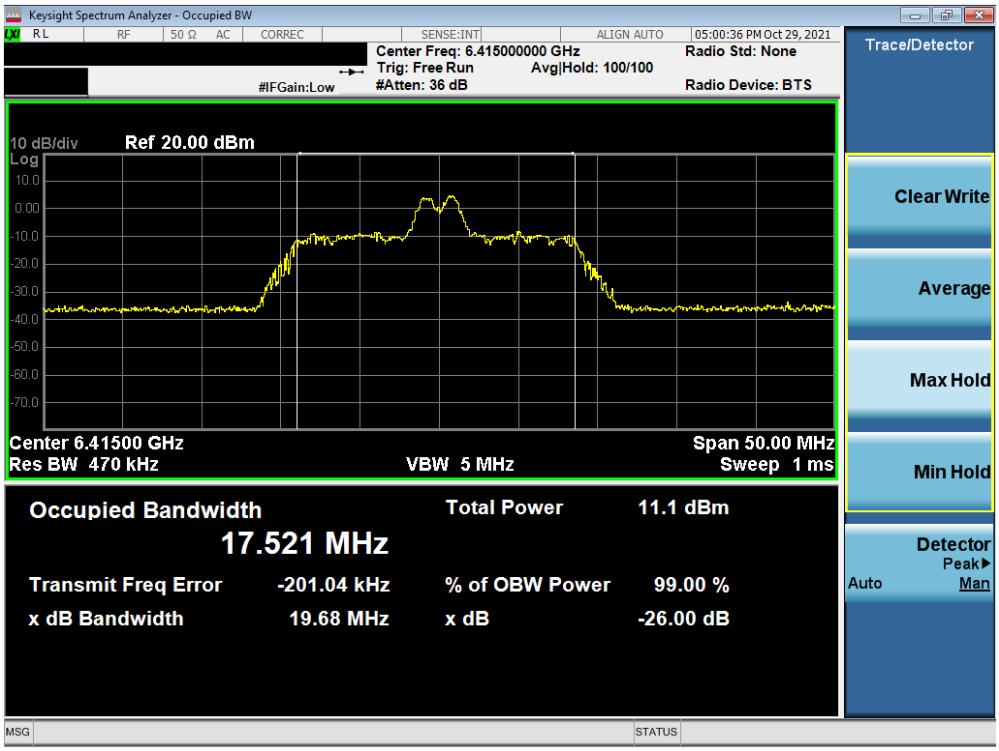
## MIMO Antenna-1 26dB Bandwidth Measurements (26 Tones)



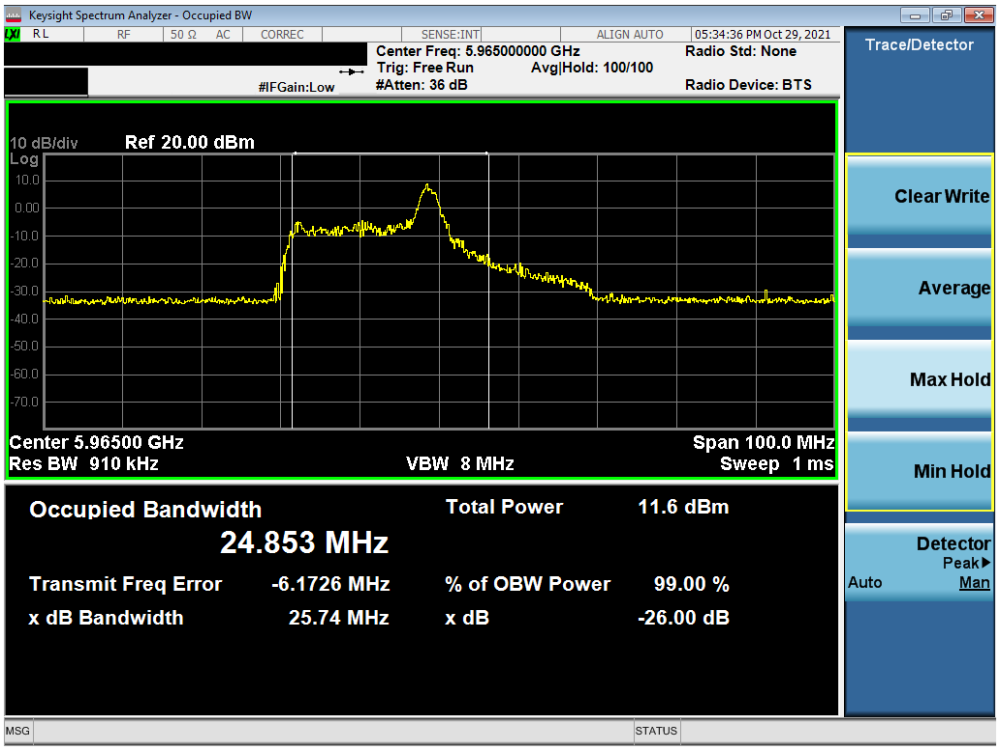

**Plot 7-1. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 2)**



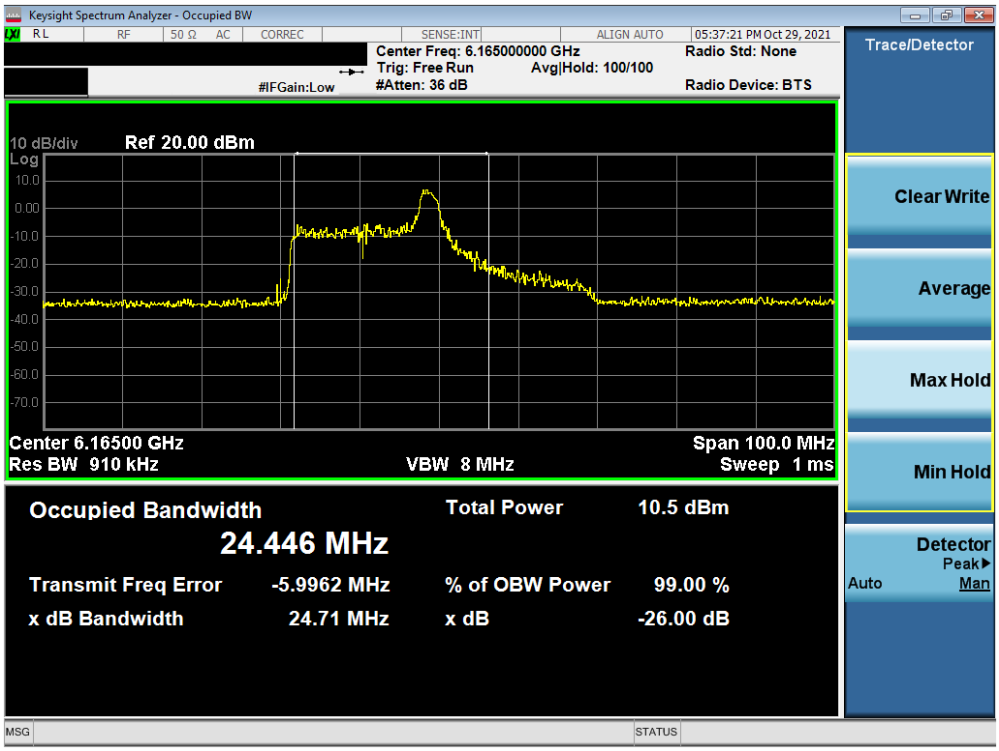

**Plot 7-2. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 45)**



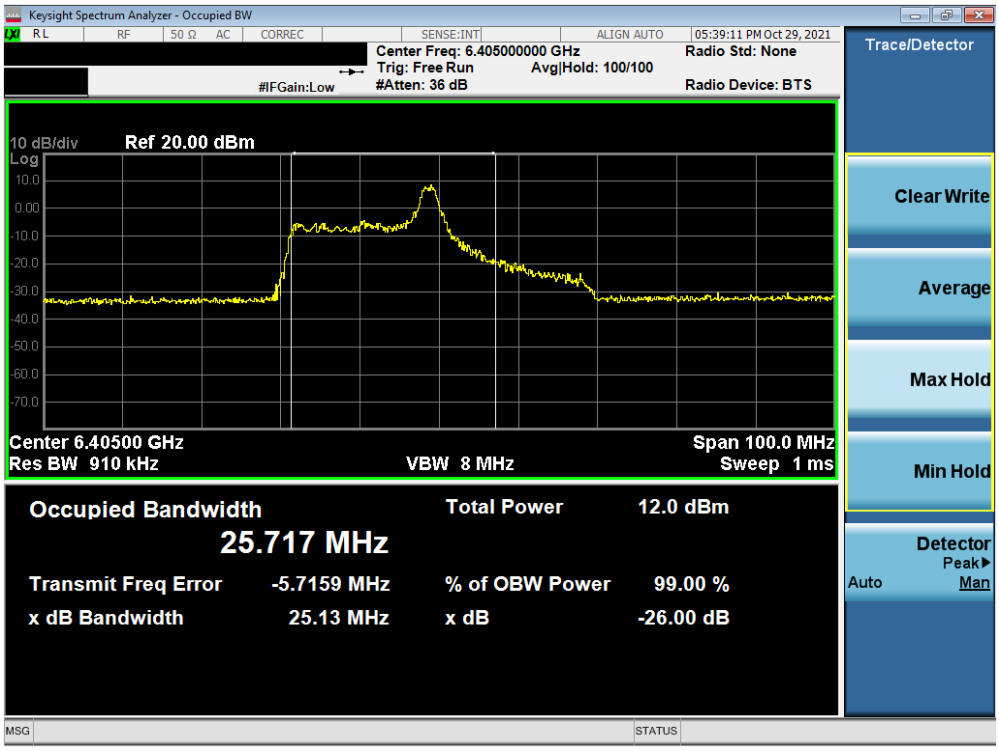

**Plot 7-3. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) UNII Band 5) – Ch. 93)**



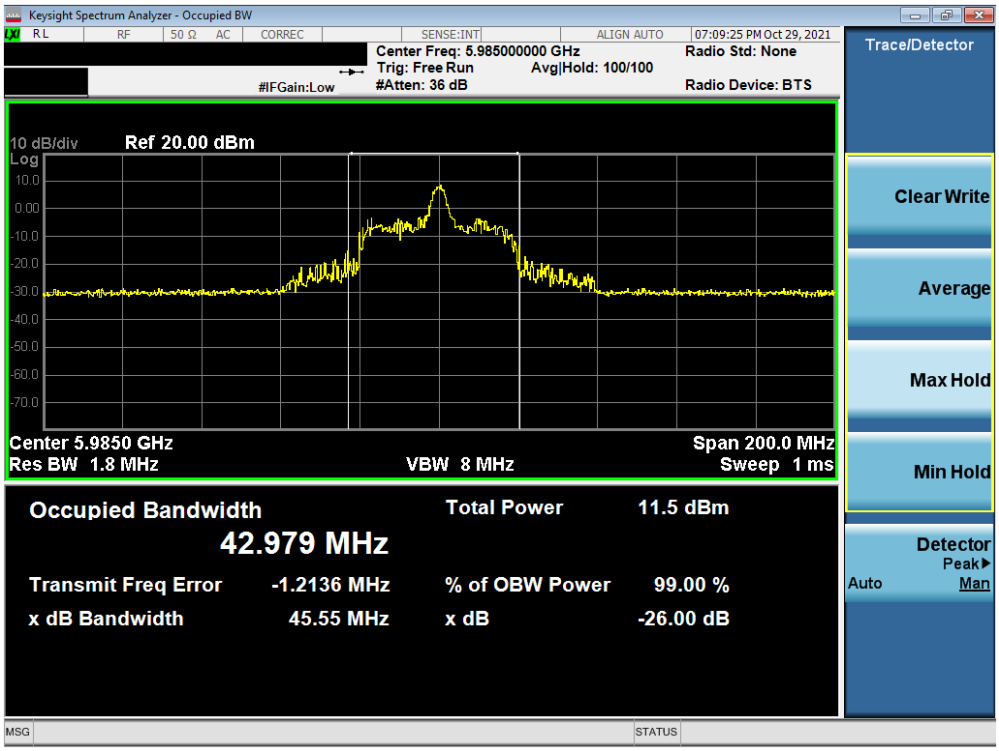

**Plot 7-4. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 3)**



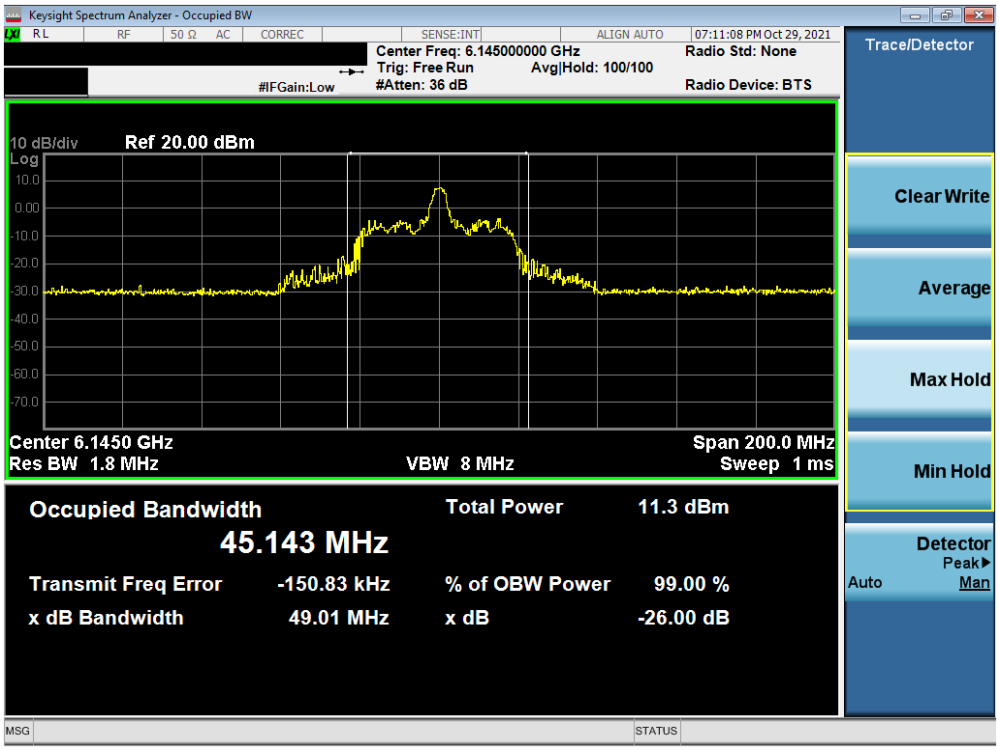

**Plot 7-5. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 43)**



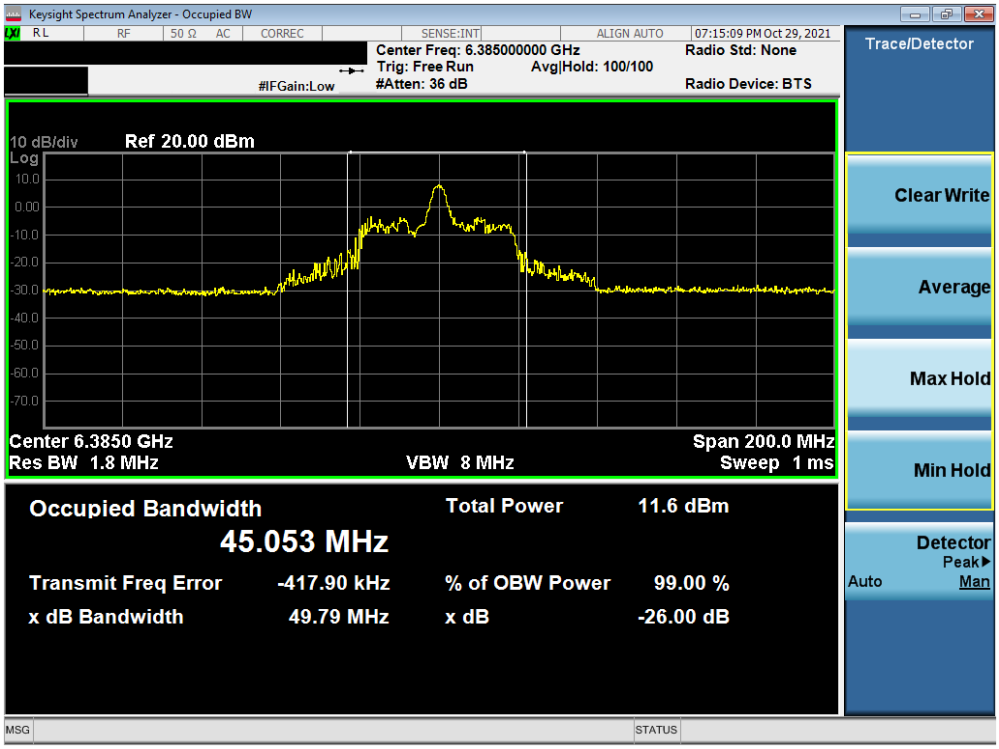

**Plot 7-6. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 91)**



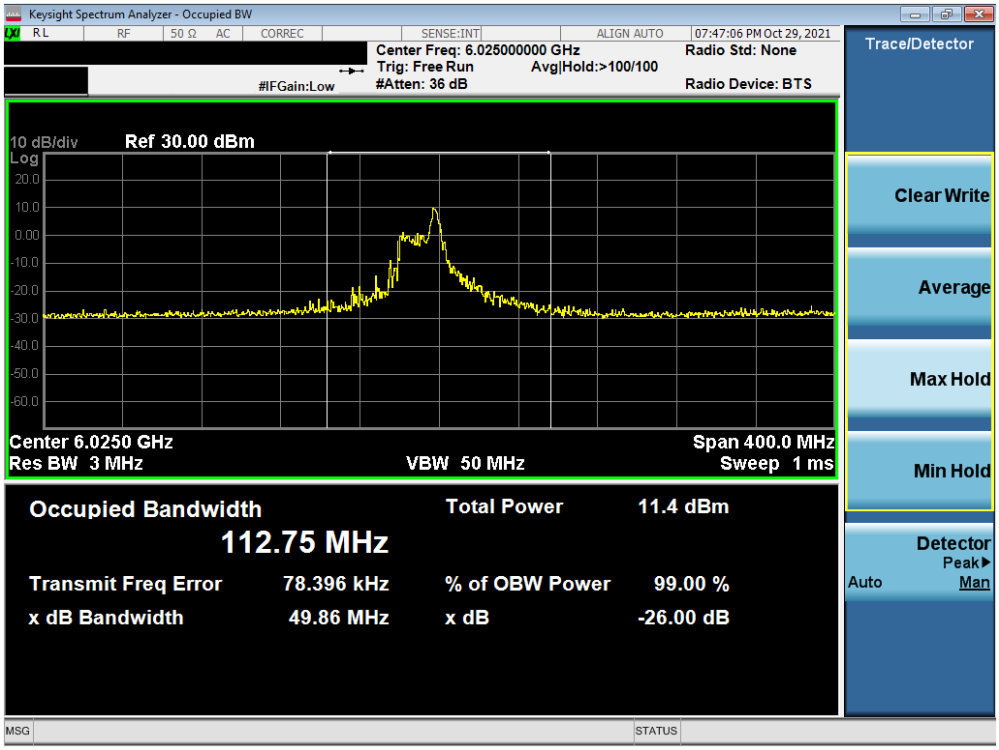

**Plot 7-7. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 7)**



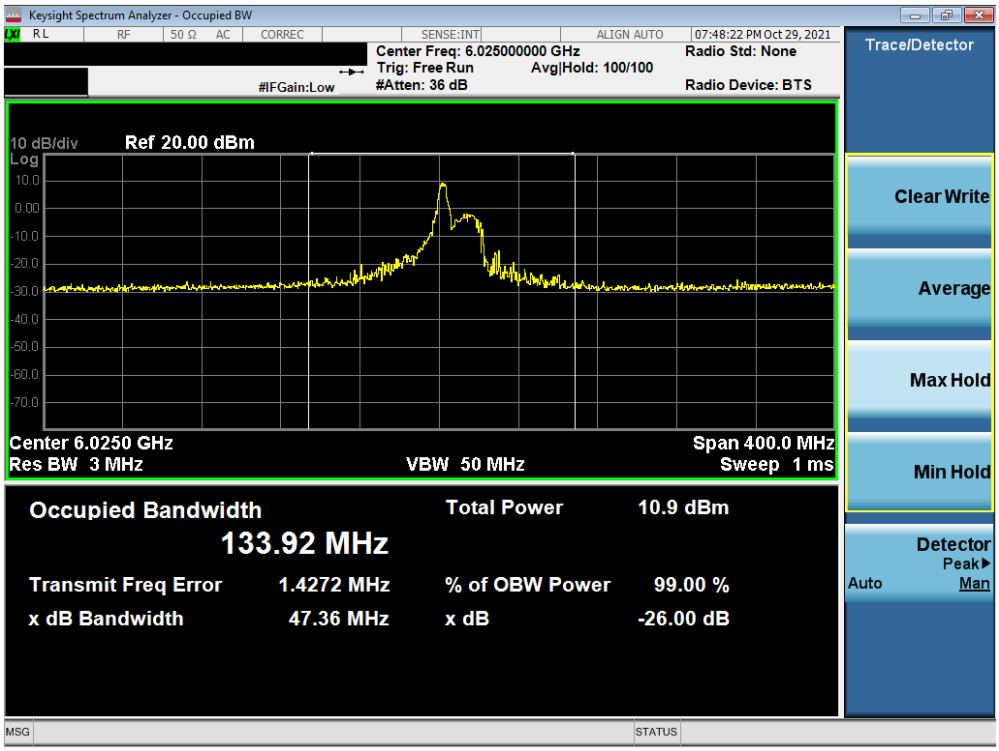

**Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 39)**



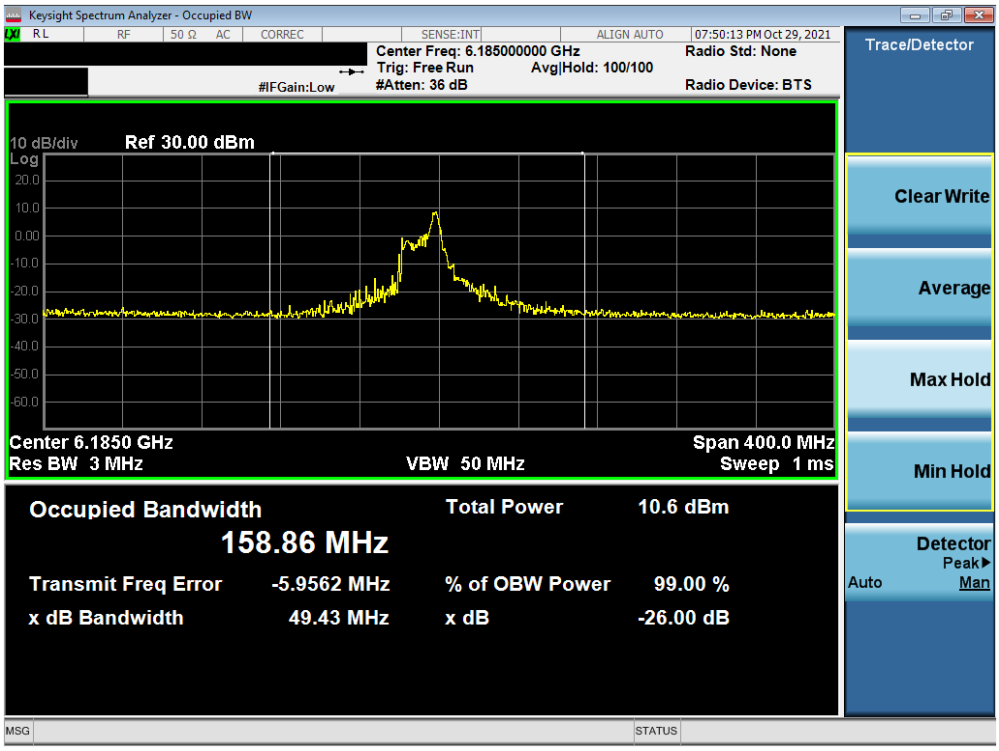

**Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 87)**



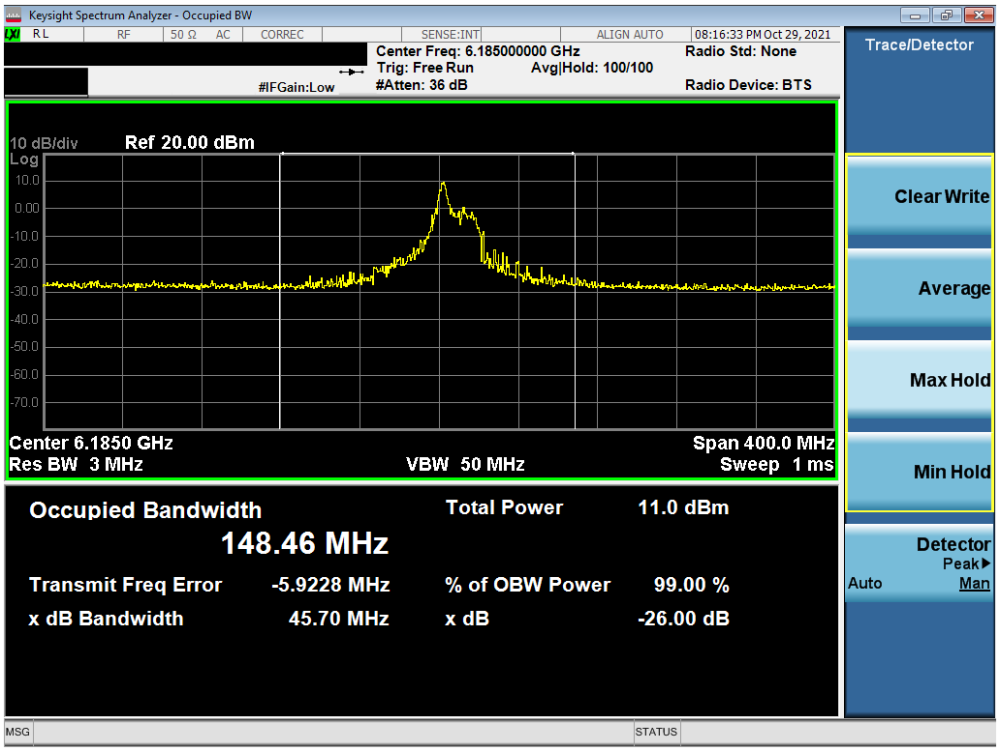

**Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 15)**



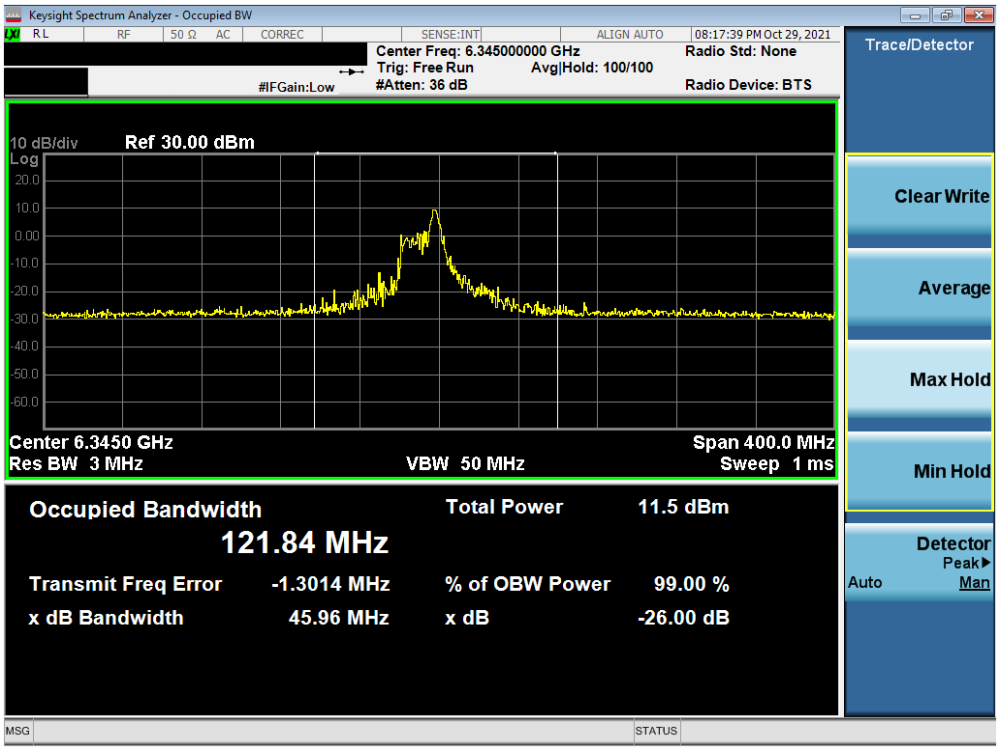

**Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 15)**



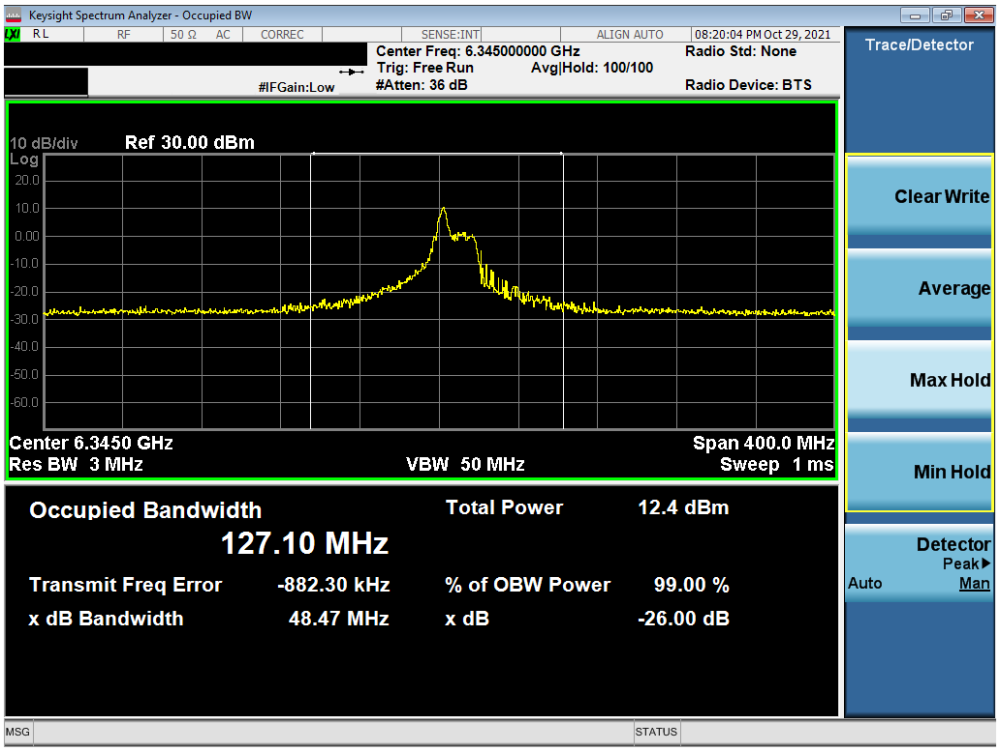

**Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 47)**



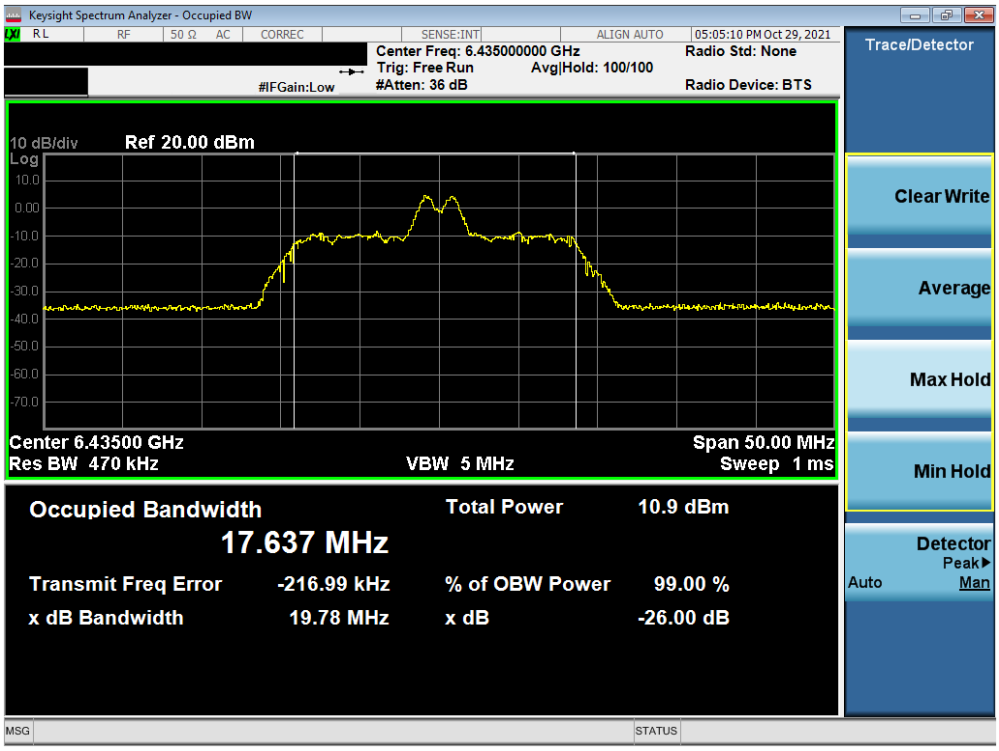

**Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 47)**



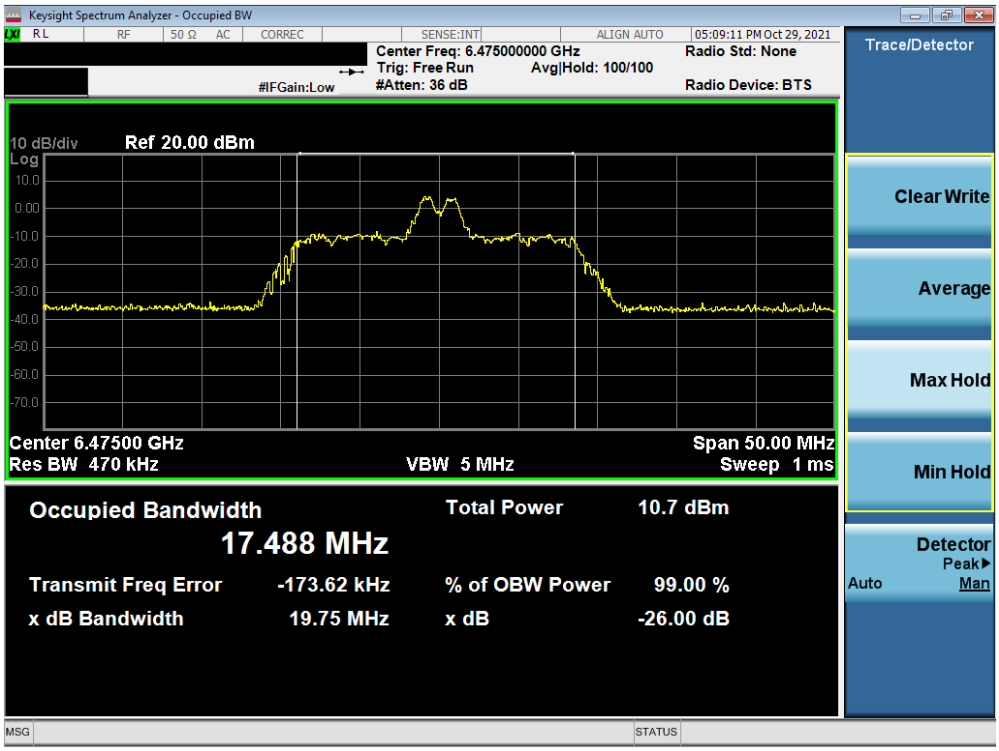

**Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 79)**



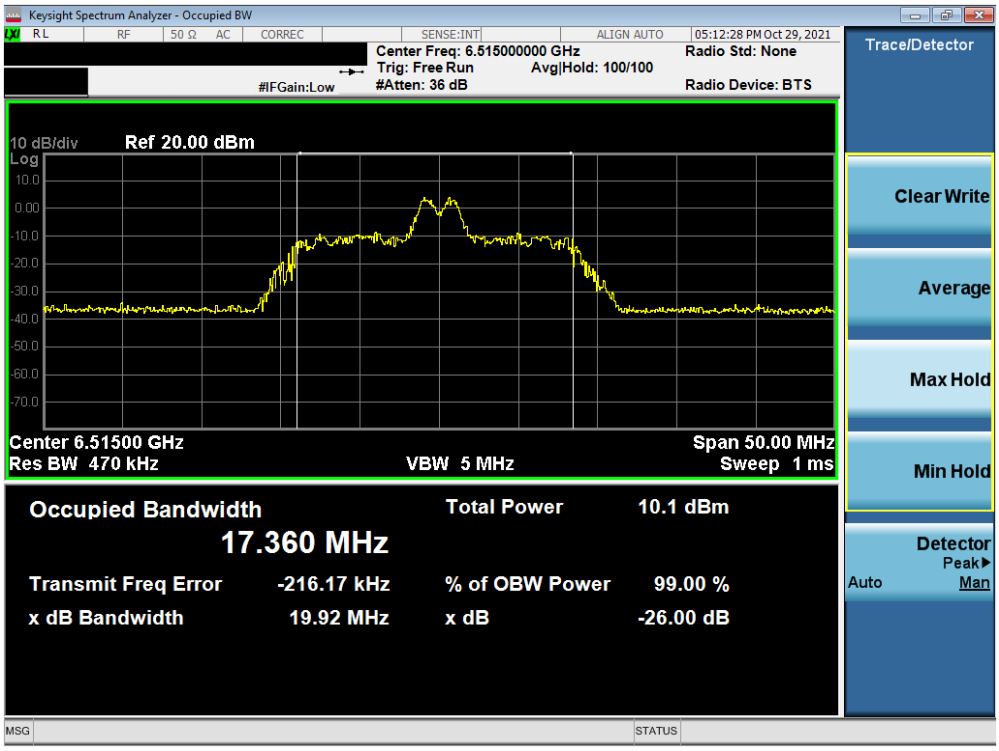

**Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 79)**



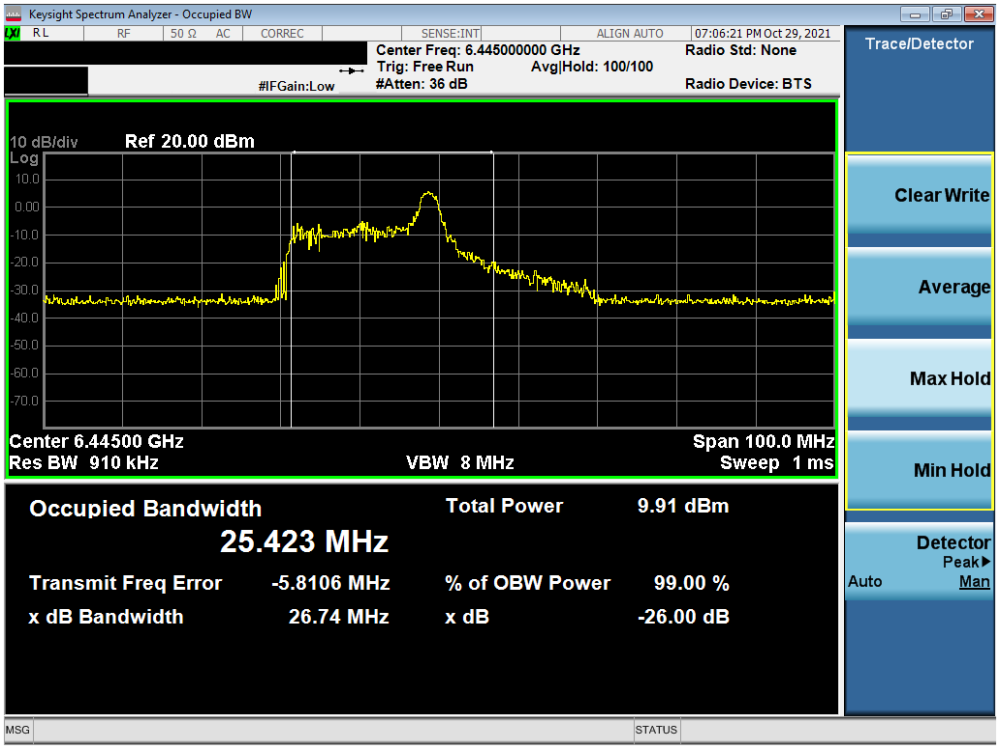

**Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 97)**



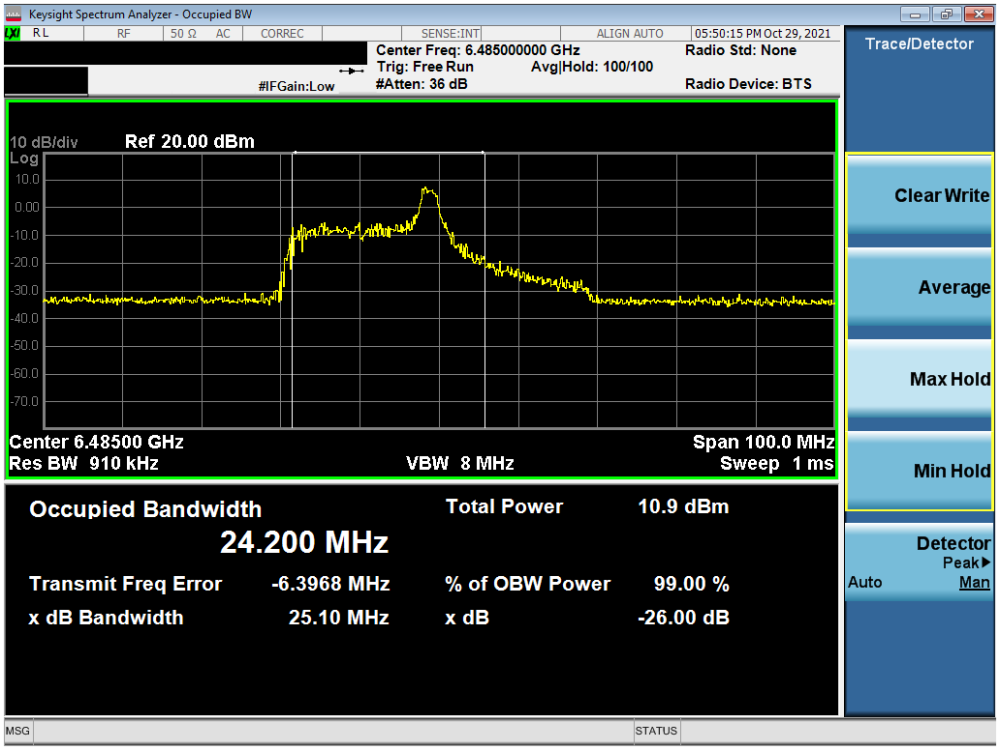

**Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 105)**



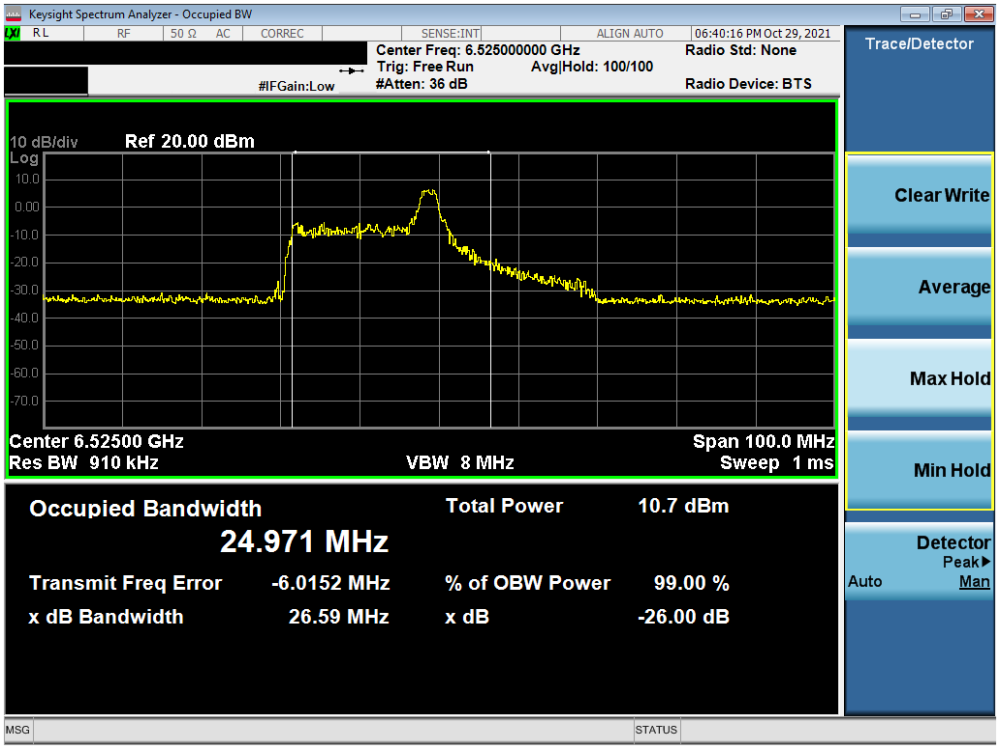

**Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 113)**



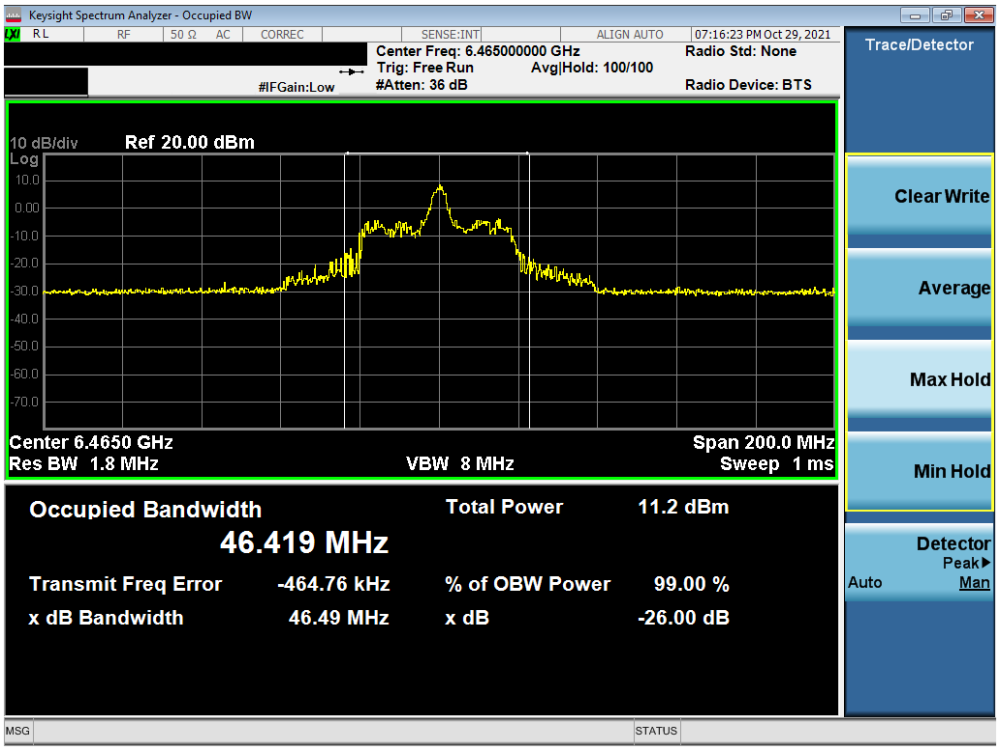

**Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 99)**



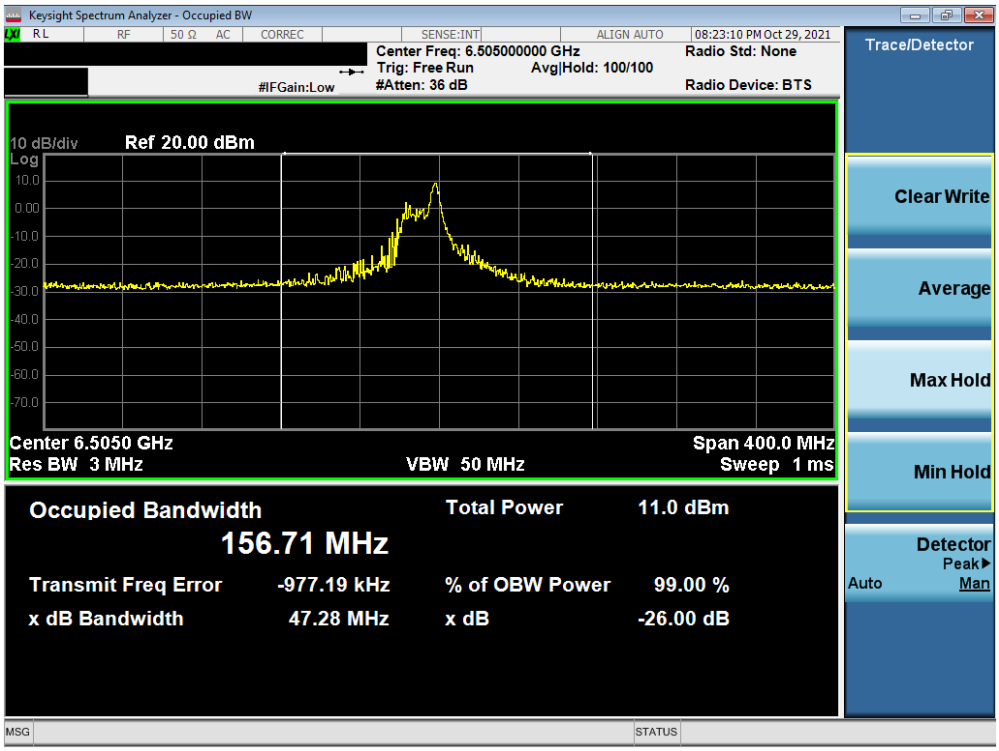

**Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 107)**



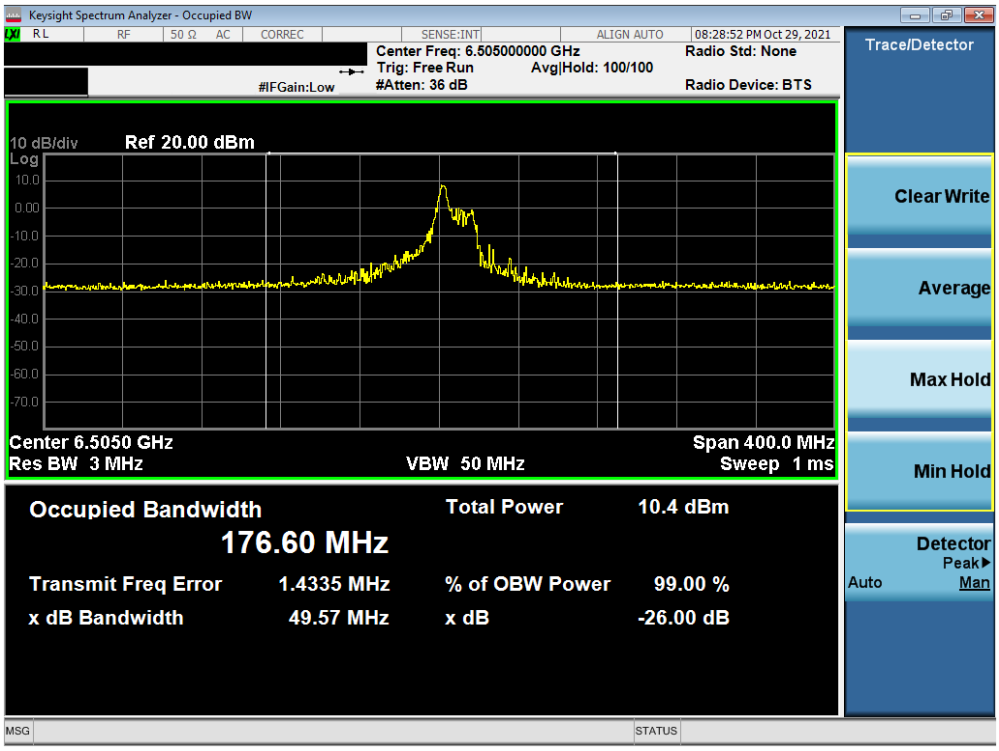

**Plot 7-21. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 115)**



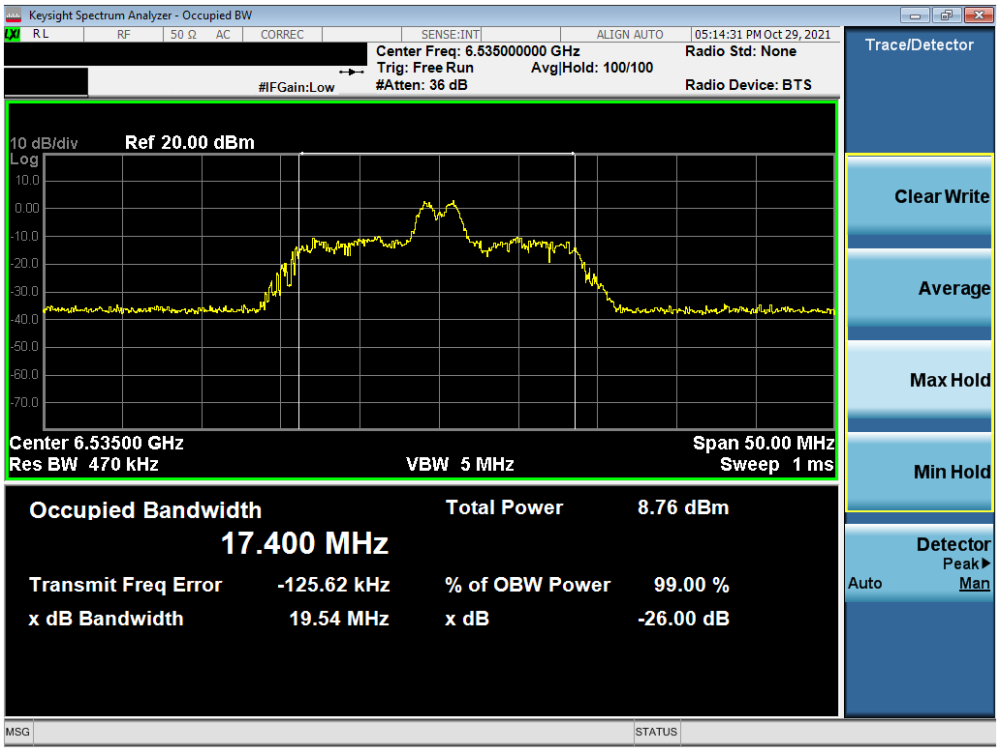

**Plot 7-22. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 103)**



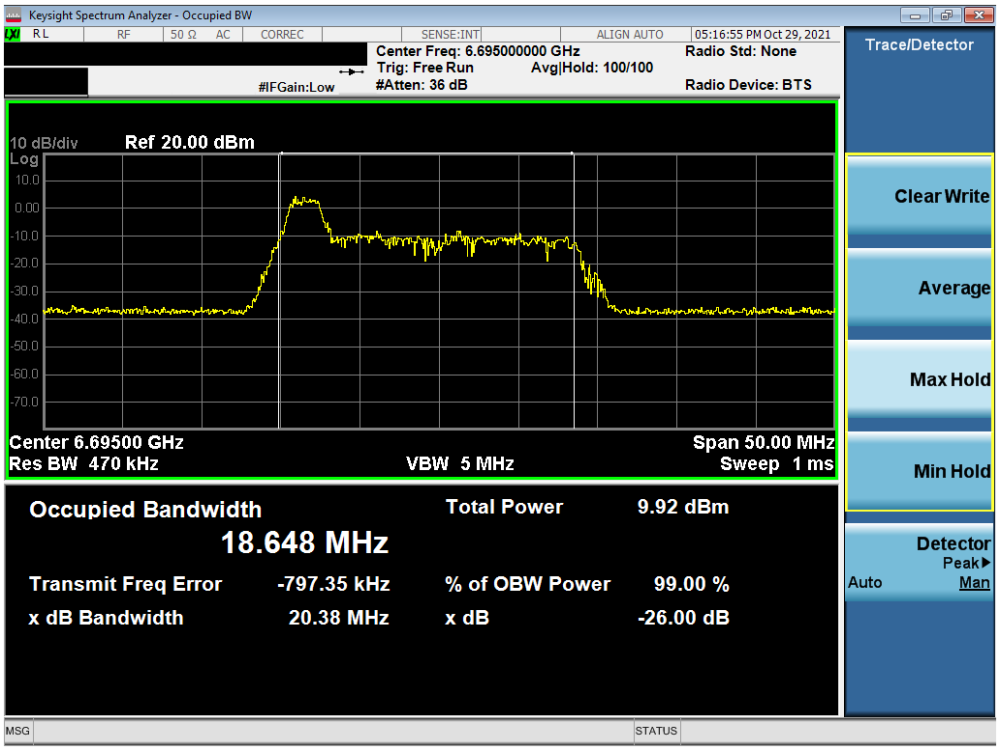

**Plot 7-23. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 6) – Ch. 111)**



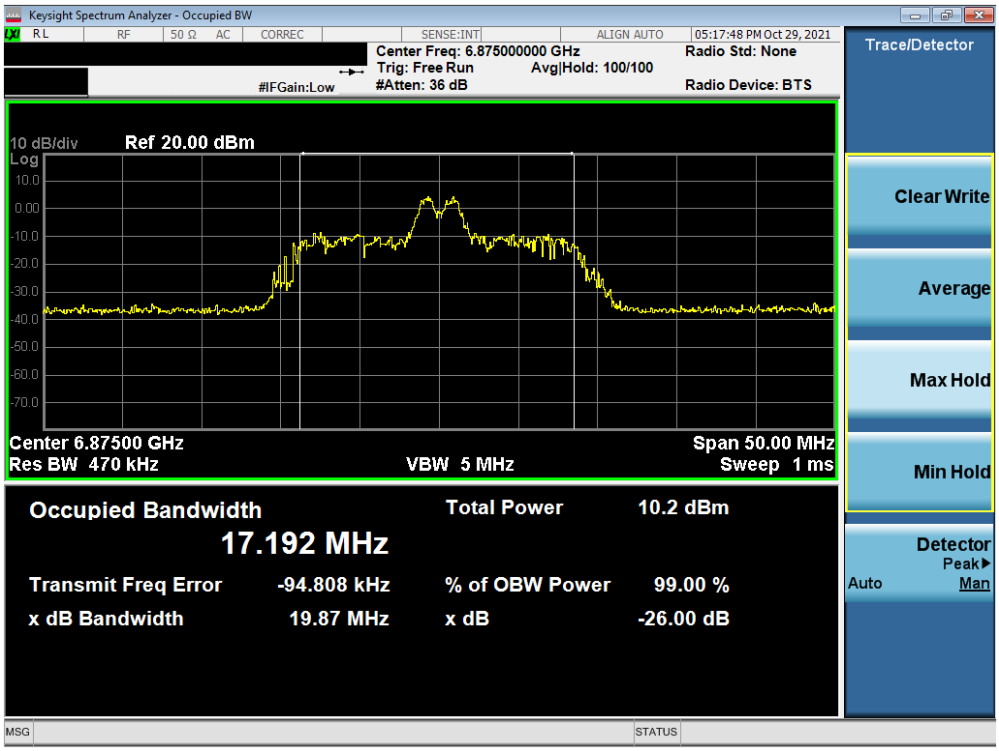

**Plot 7-24. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 6) – Ch. 111)**



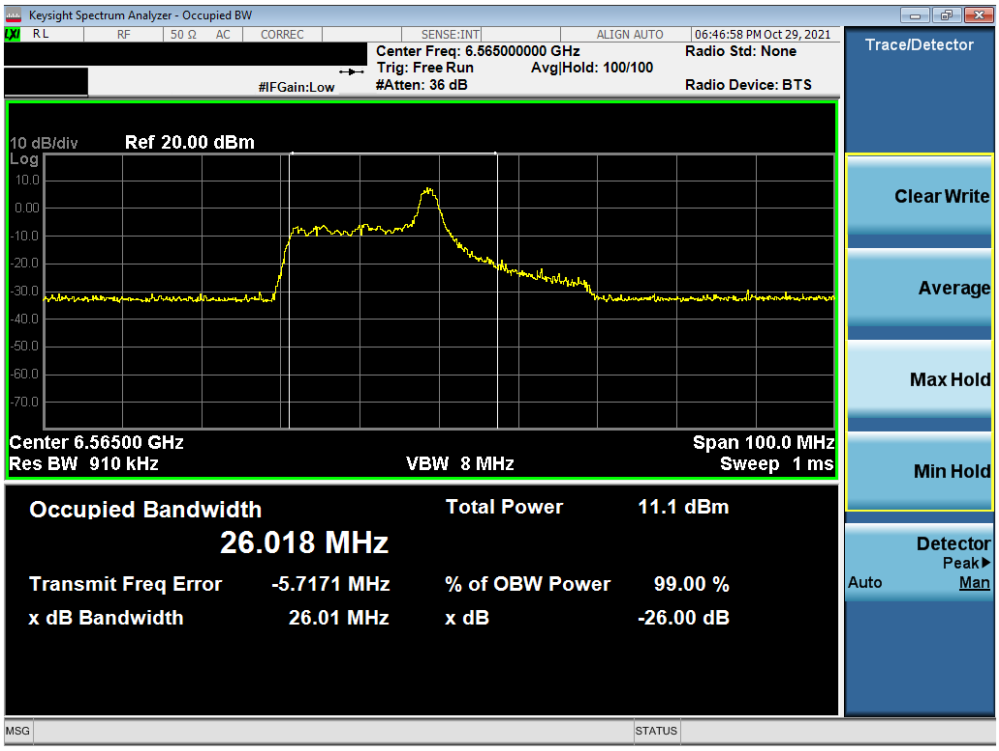

**Plot 7-25. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 117)**



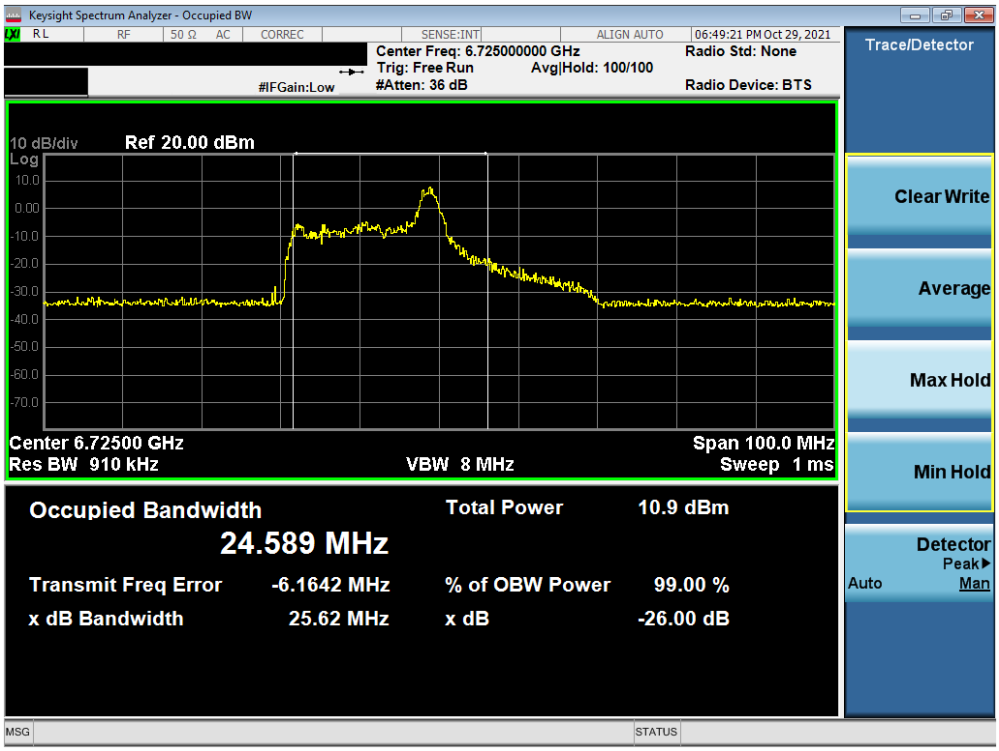

**Plot 7-26. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 149)**



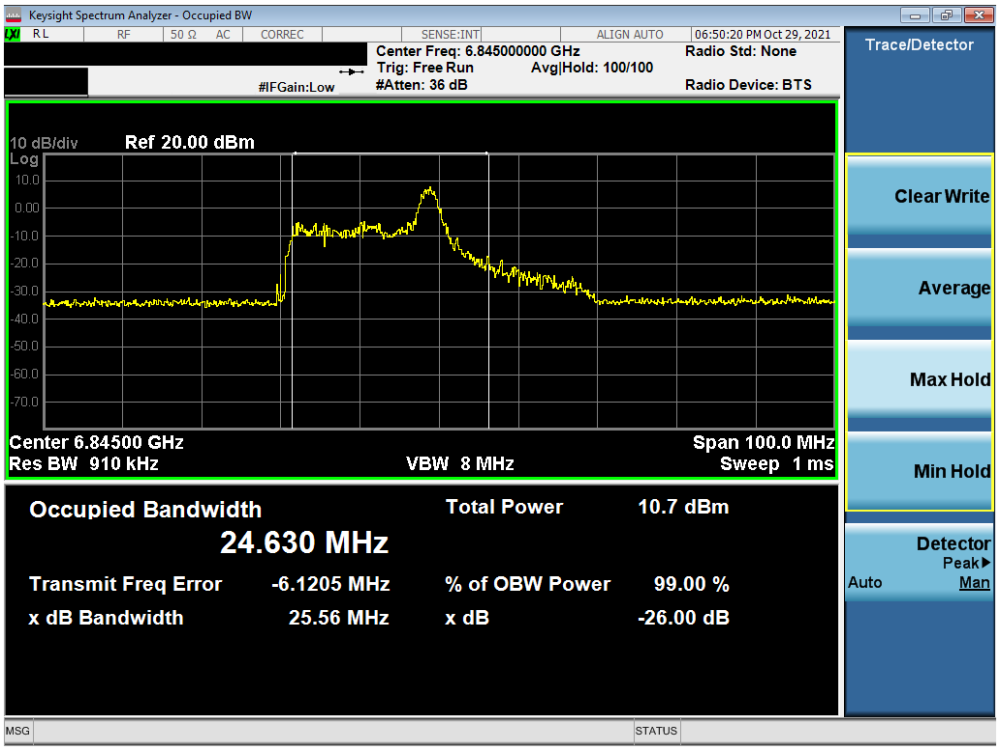

**Plot 7-27. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 185)**



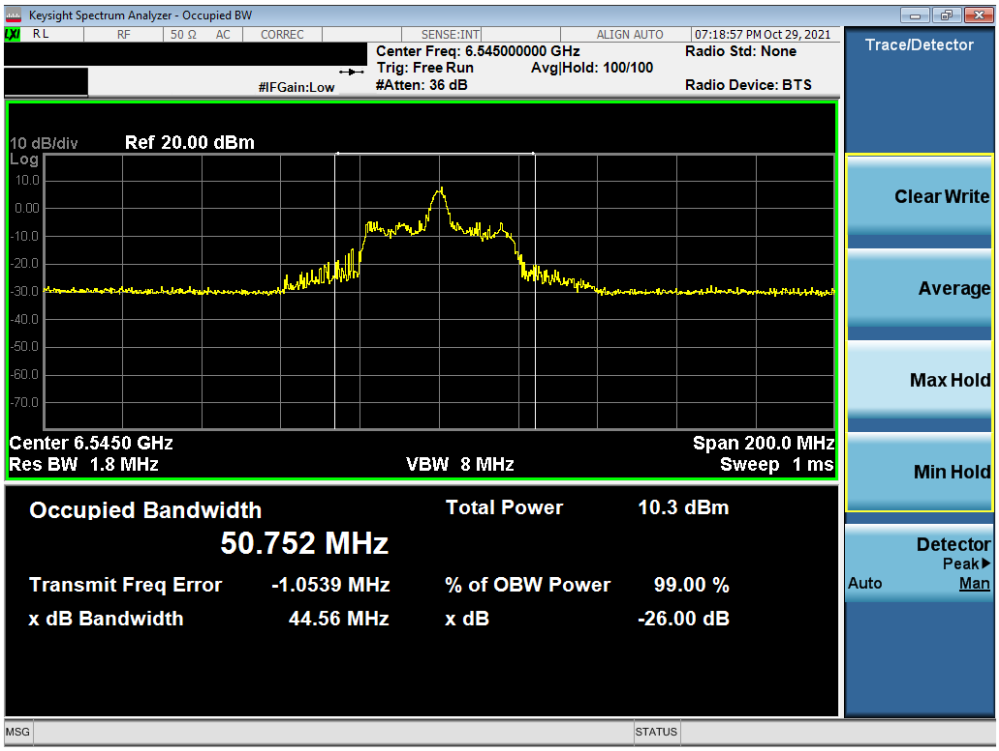

**Plot 7-28. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 123)**



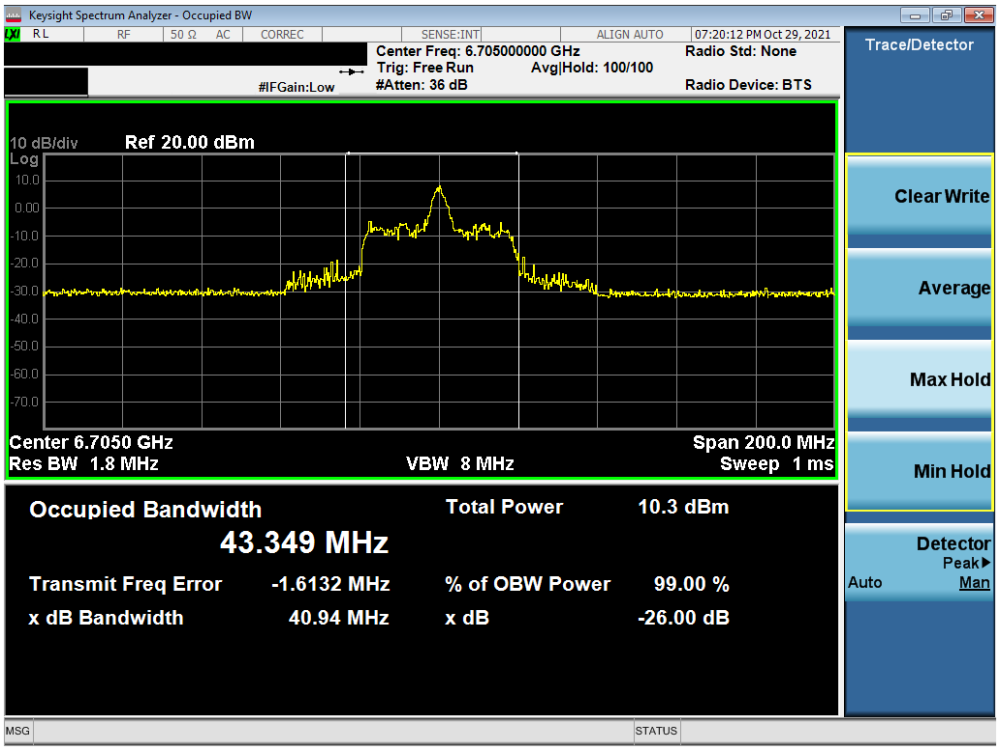

**Plot 7-29. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 155)**



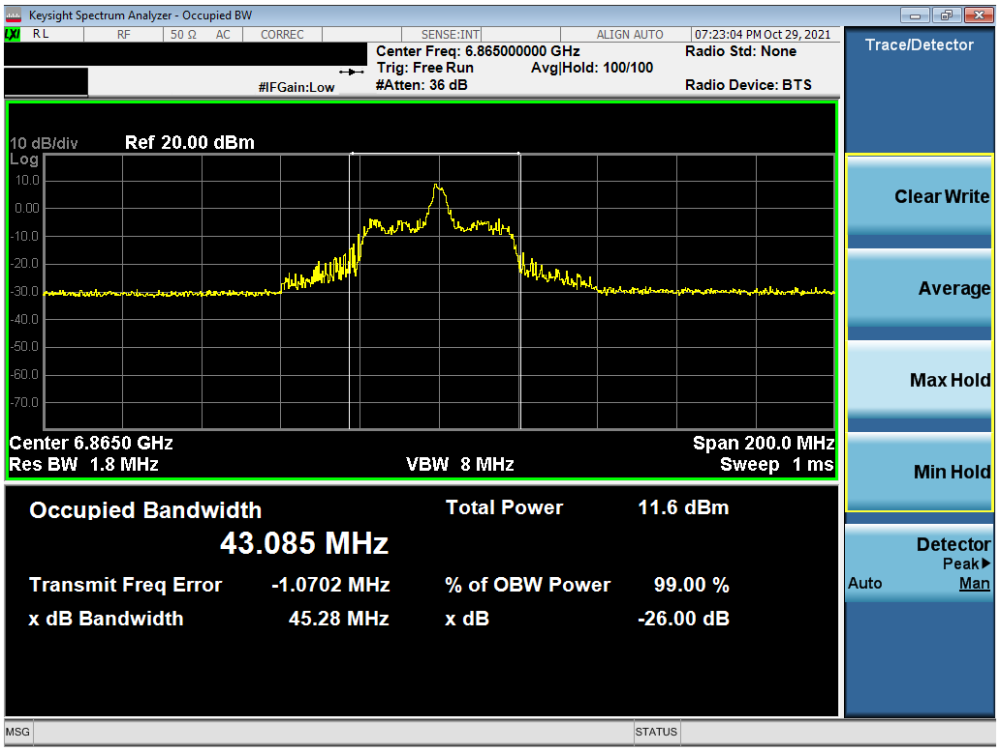

**Plot 7-30. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 179)**



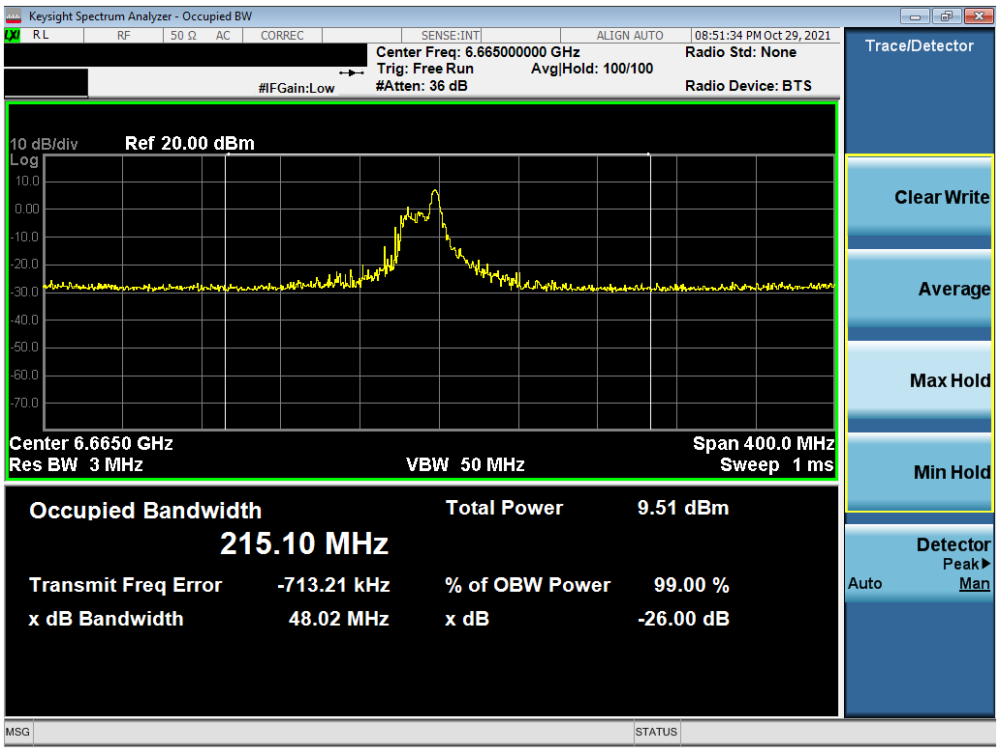

**Plot 7-31. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 119)**



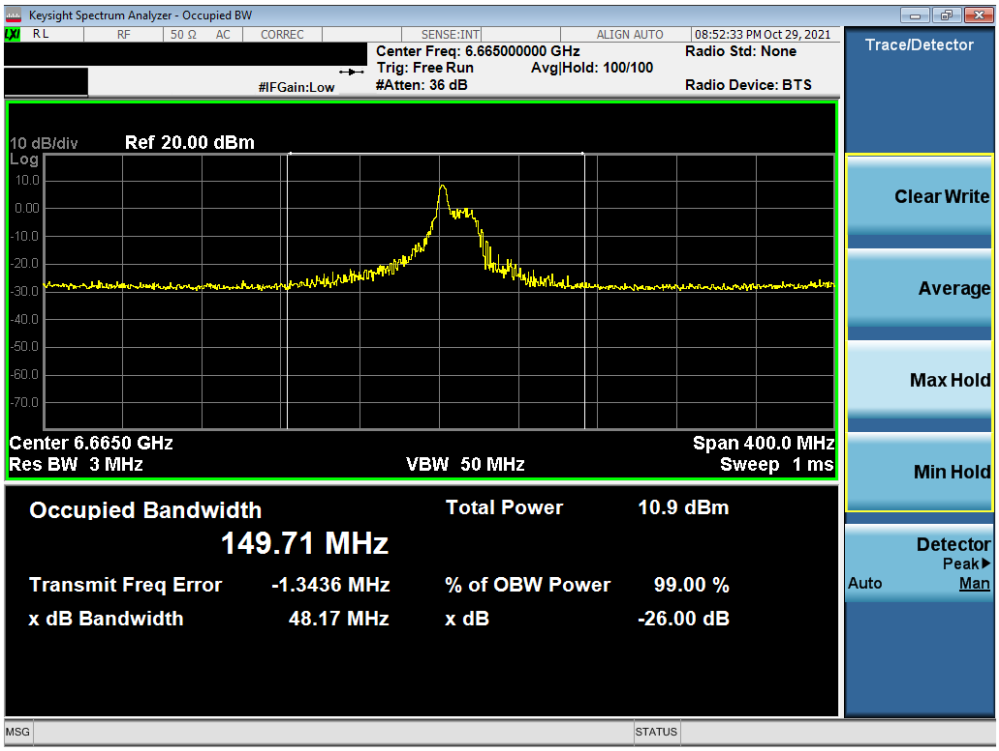

**Plot 7-32. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 151)**



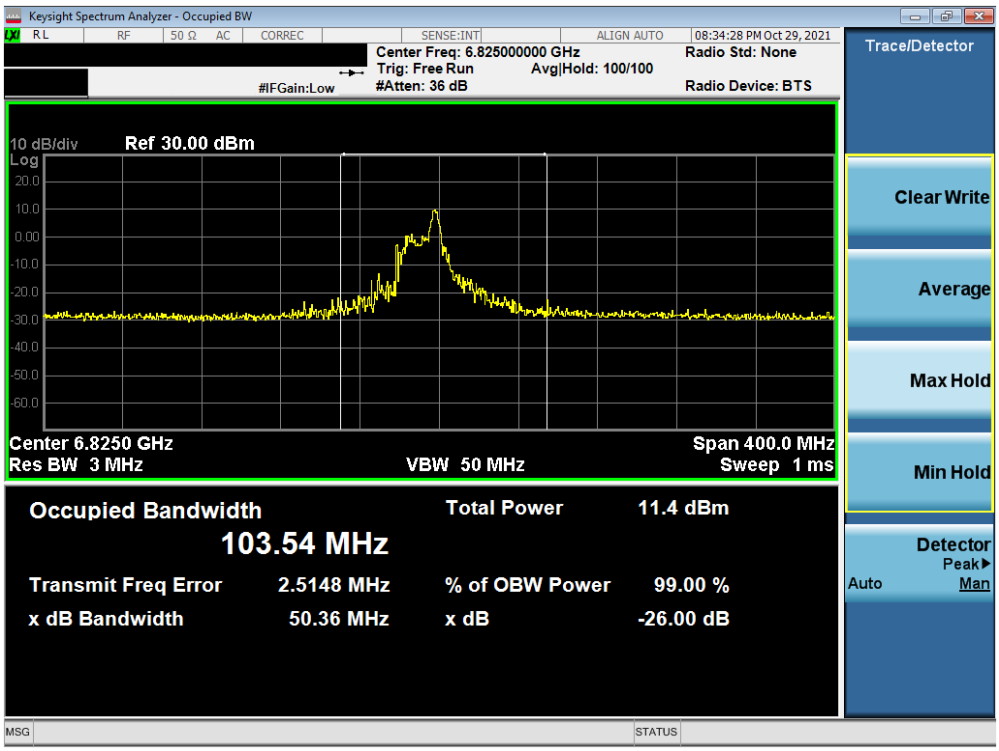

**Plot 7-33. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 183)**



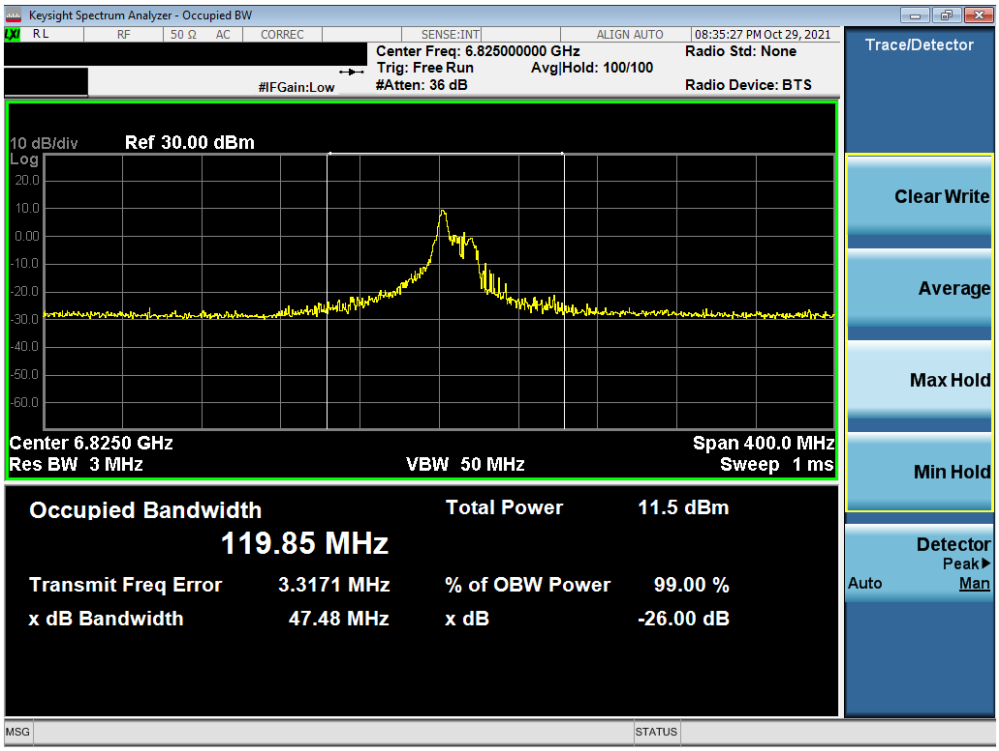

**Plot 7-34. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 7) – Ch. 143)**



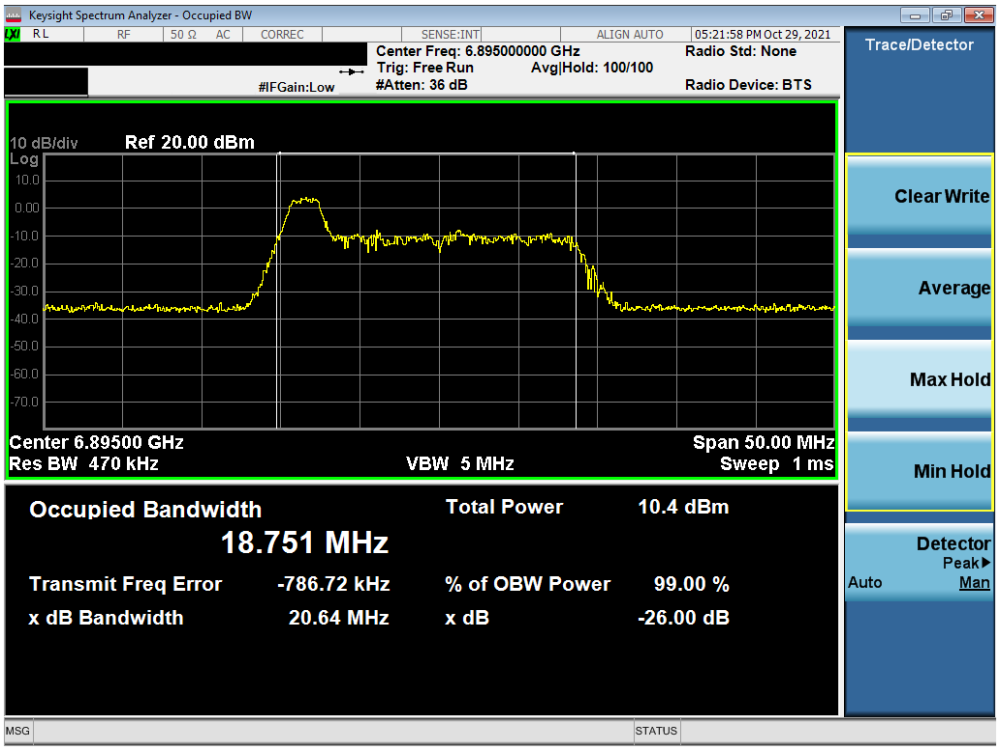

**Plot 7-35. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 7) – Ch. 143)**



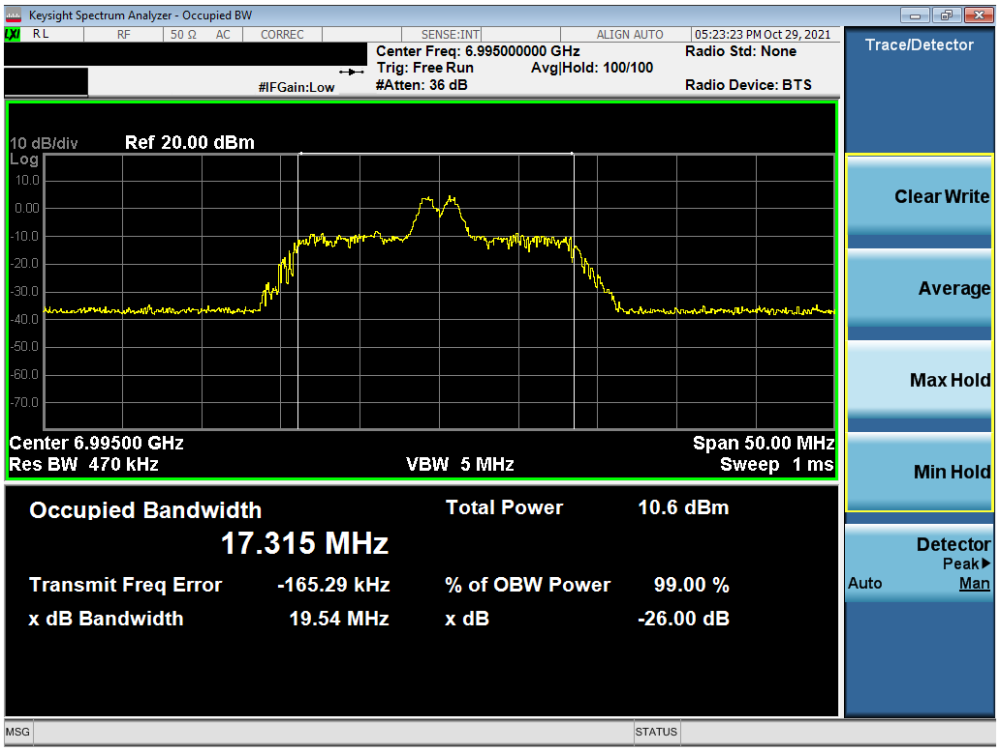

**Plot 7-36. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 7) – Ch. 175)**



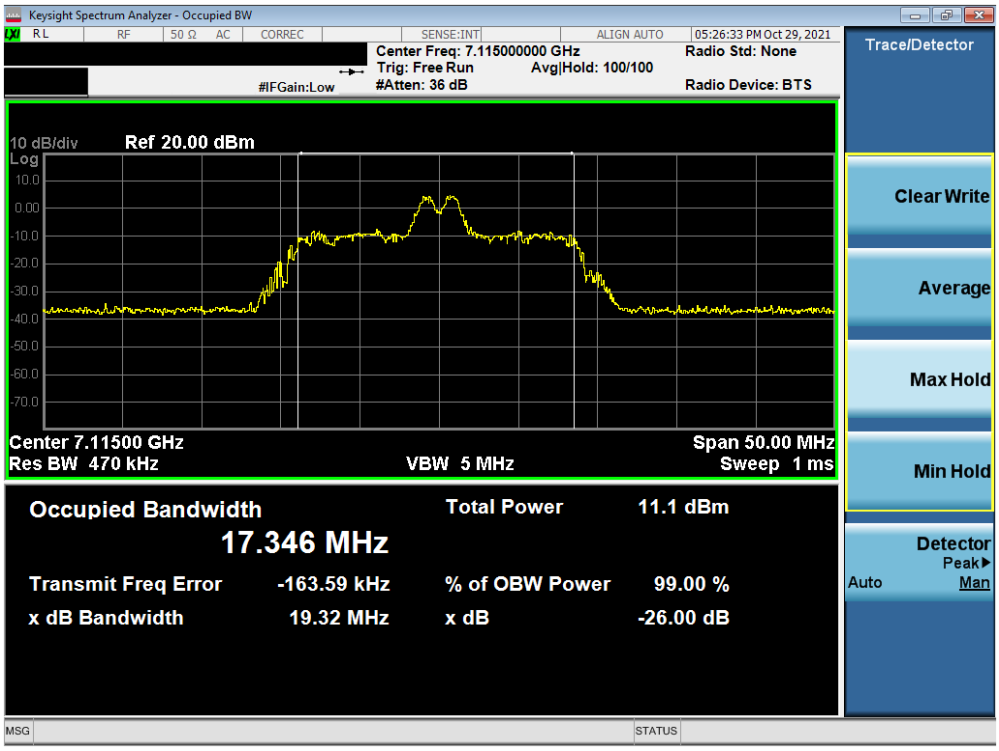

**Plot 7-37. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 7) – Ch. 175)**



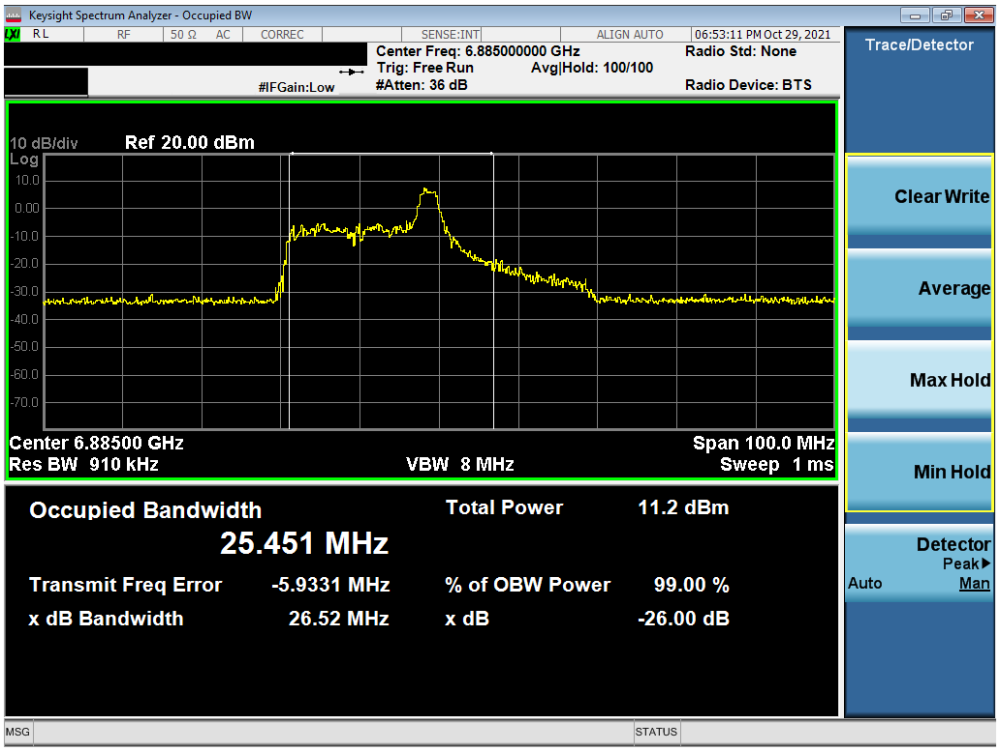

**Plot 7-38. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 189)**



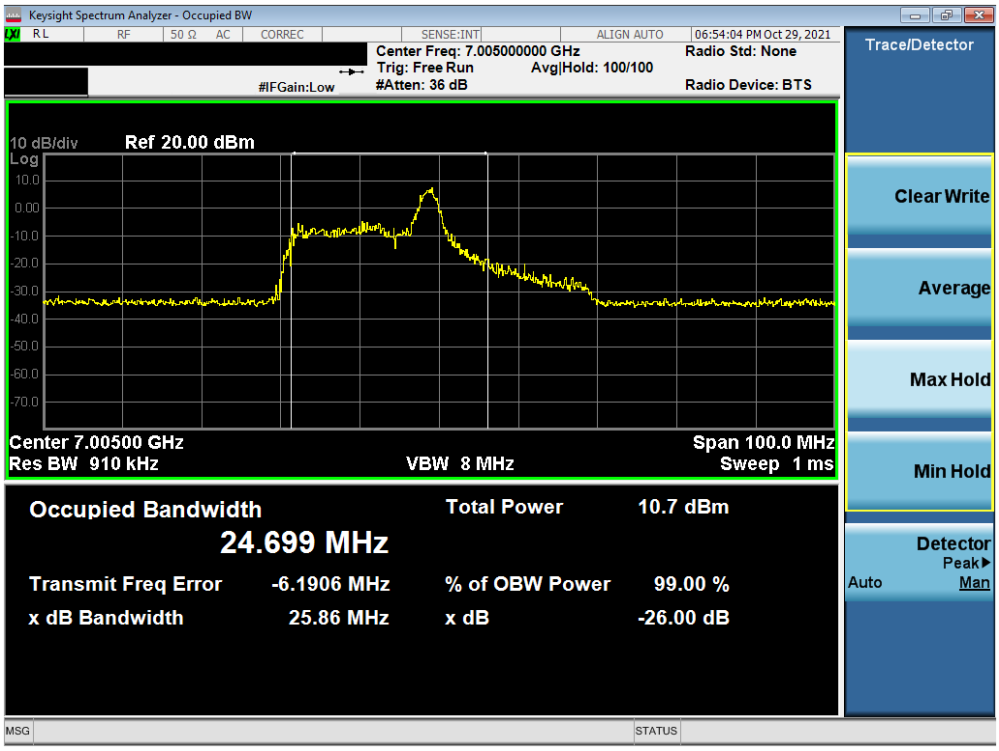

**Plot 7-39. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 209)**



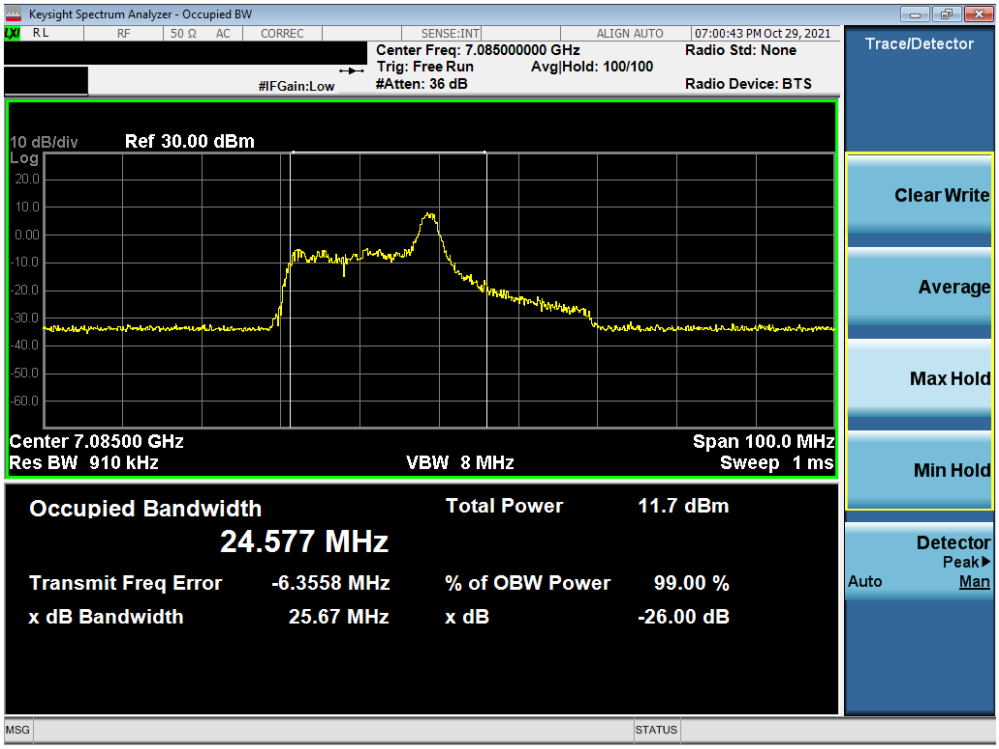

**Plot 7-40. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 233)**



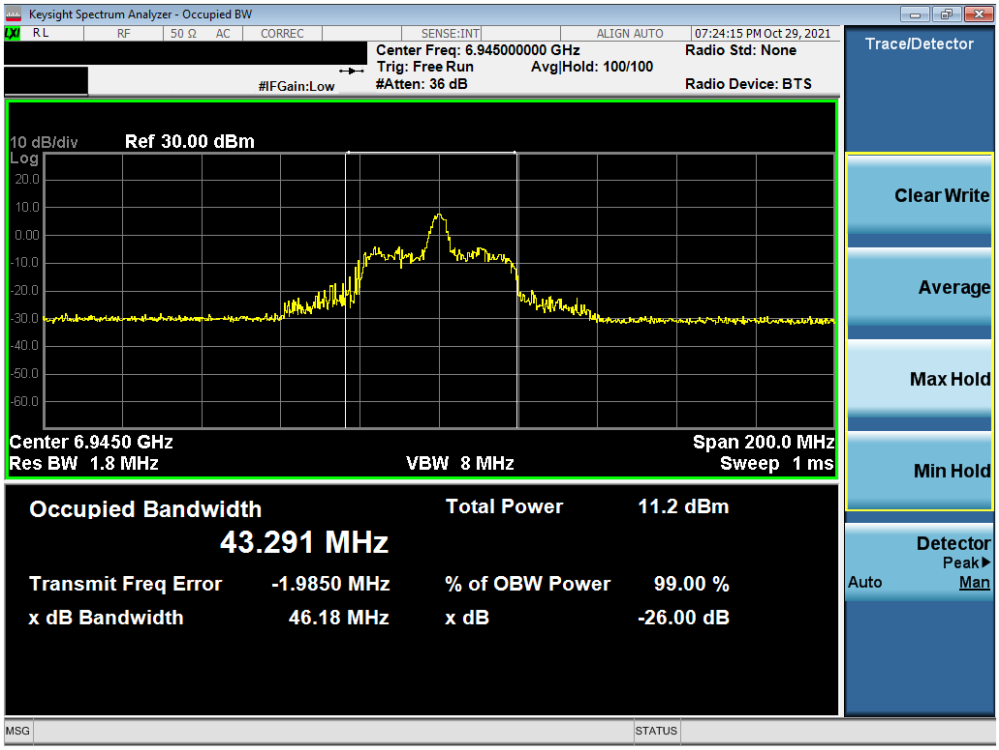

**Plot 7-41. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 187)**



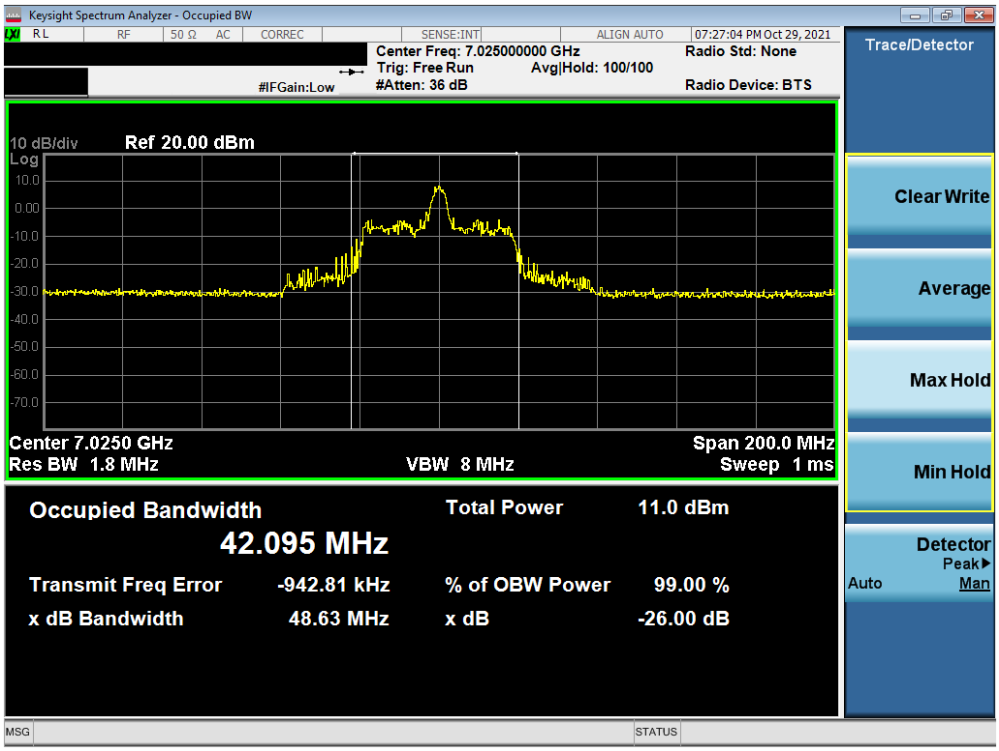

**Plot 7-42. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 211)**



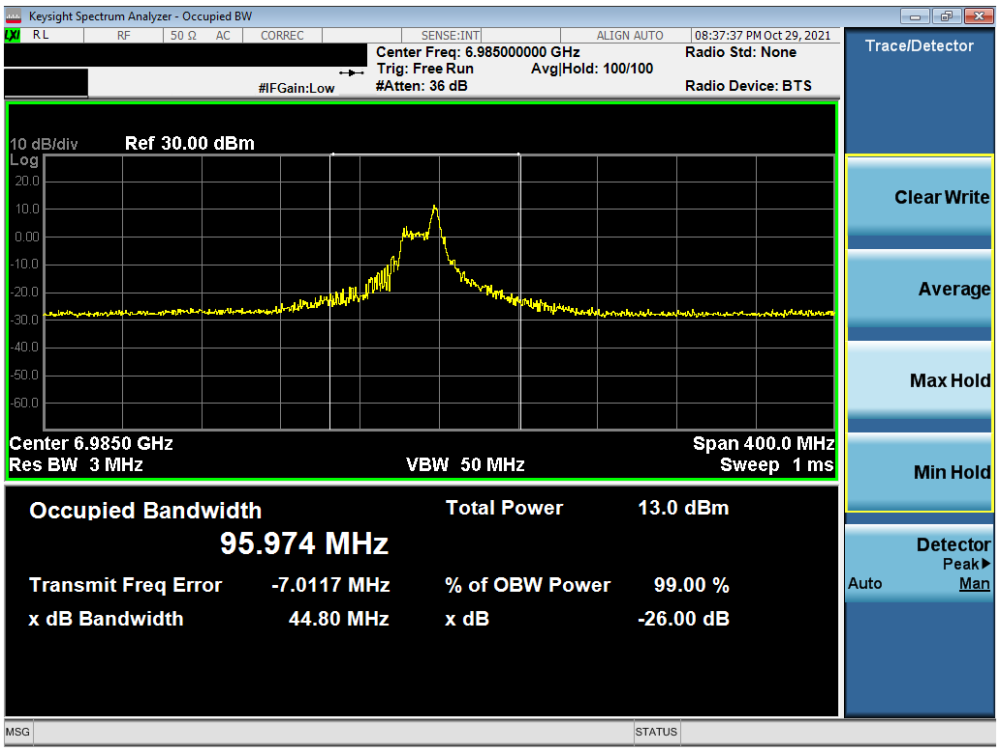

**Plot 7-43. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 227)**



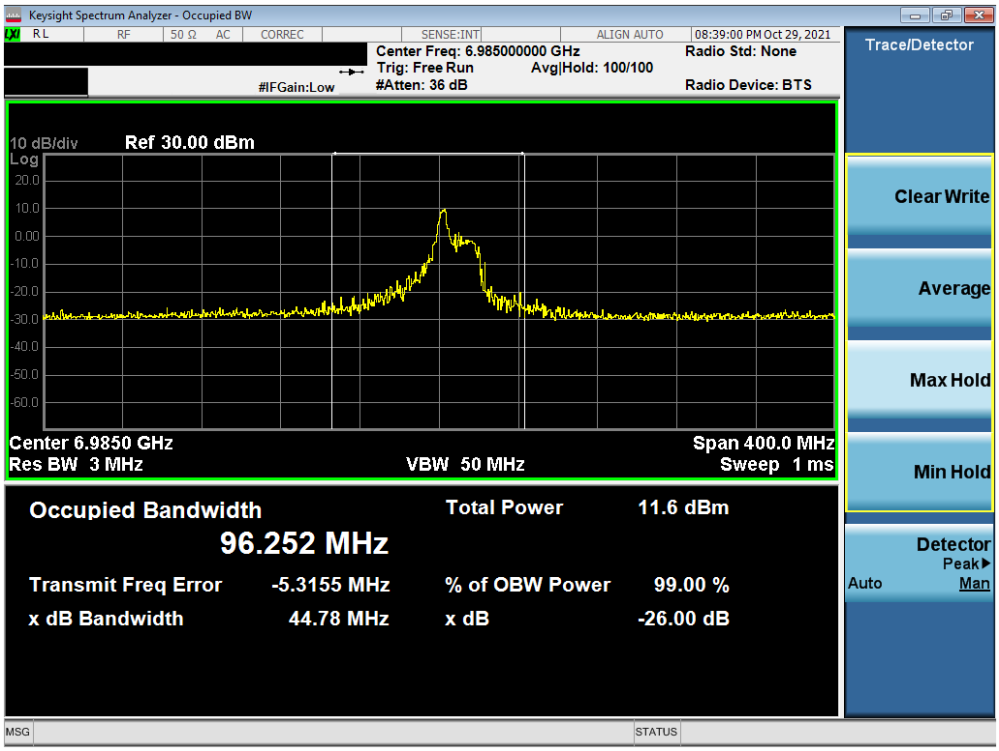

**Plot 7-44. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 199)**




**Plot 7-45. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 215)**

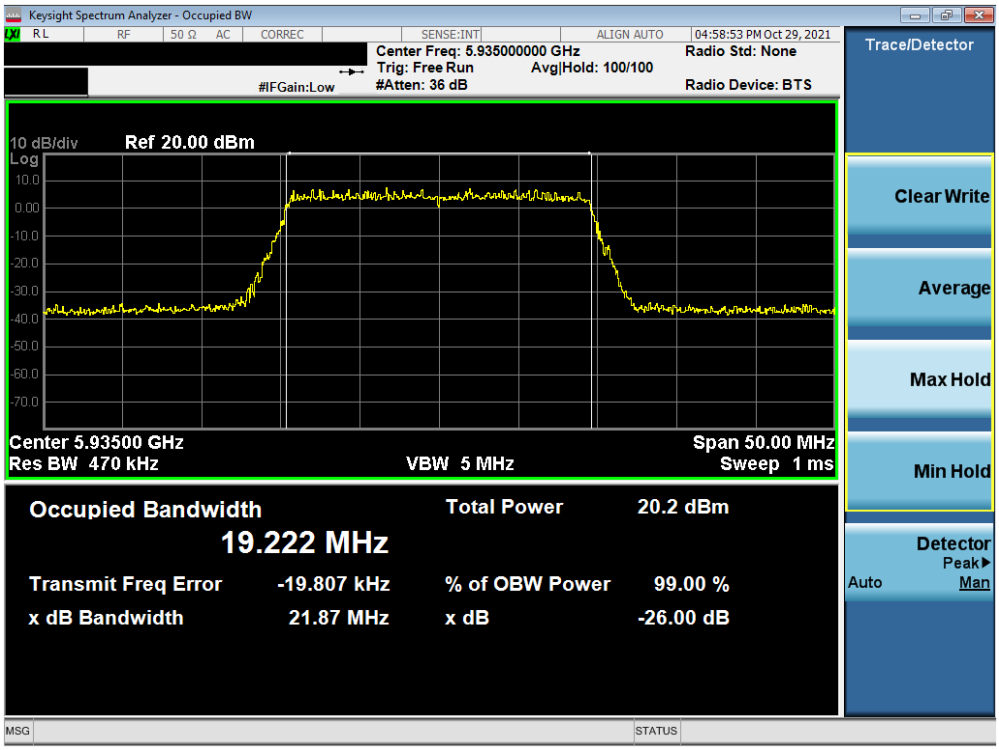



**Plot 7-46. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 8) – Ch. 207)**

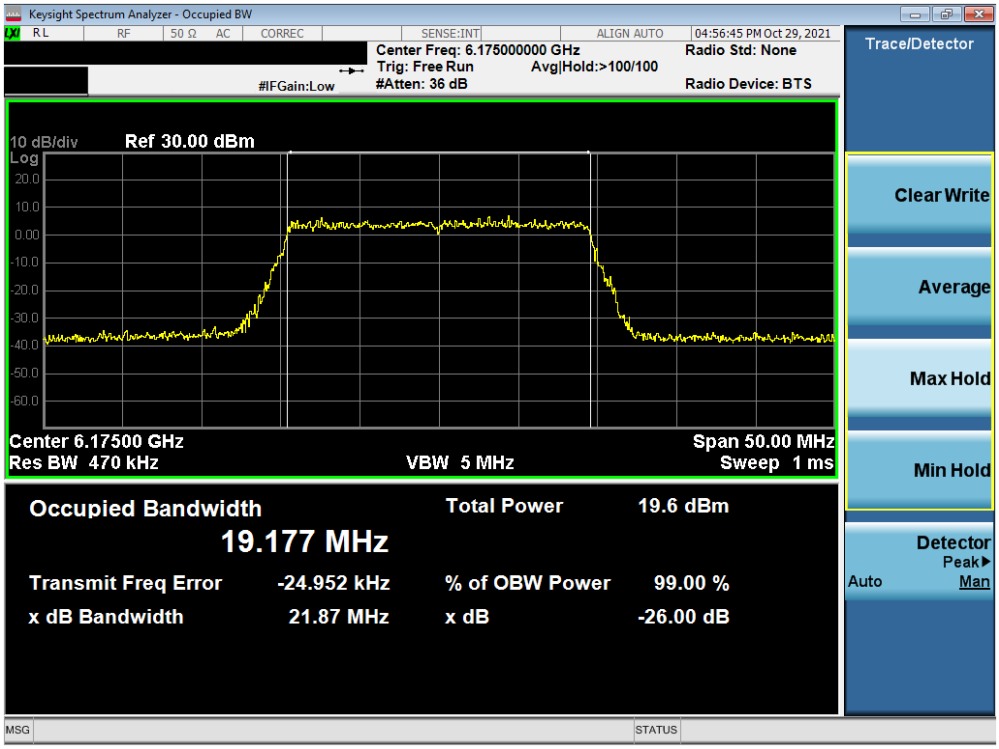



**Plot 7-47. 26dB Bandwidth Plot MIMO ANT1 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 8) – Ch. 207)**

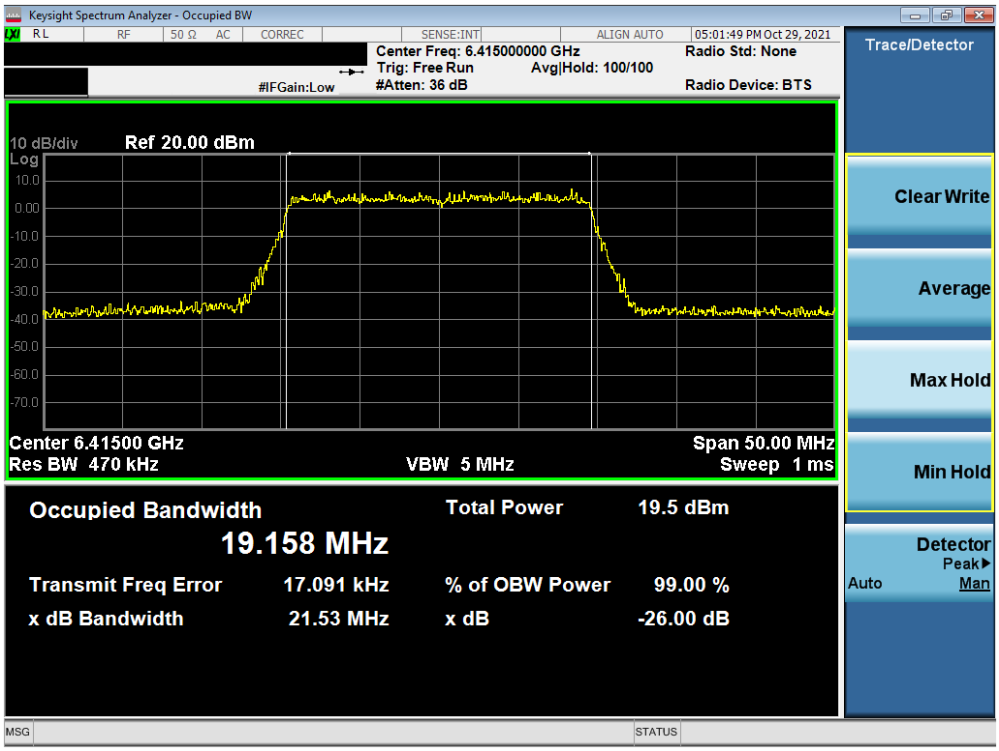
## MIMO Antenna-1 26dB Bandwidth Measurements (FULL Tones)



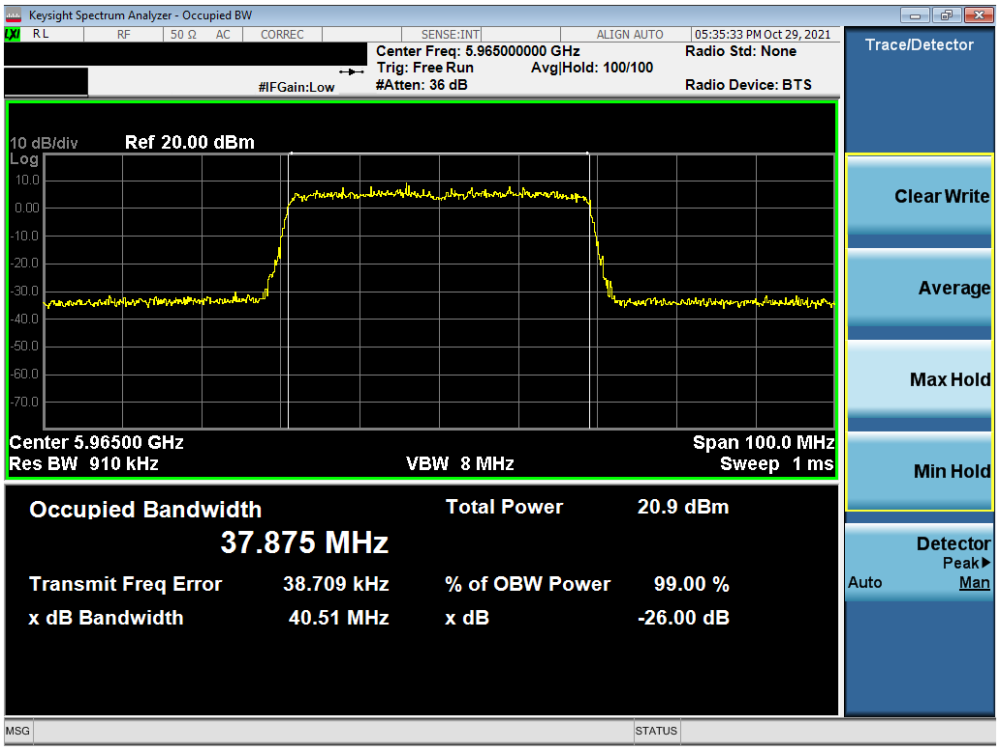

**Plot 7-48. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (FULL Tones) (UNII Band 5) – Ch. 2)**



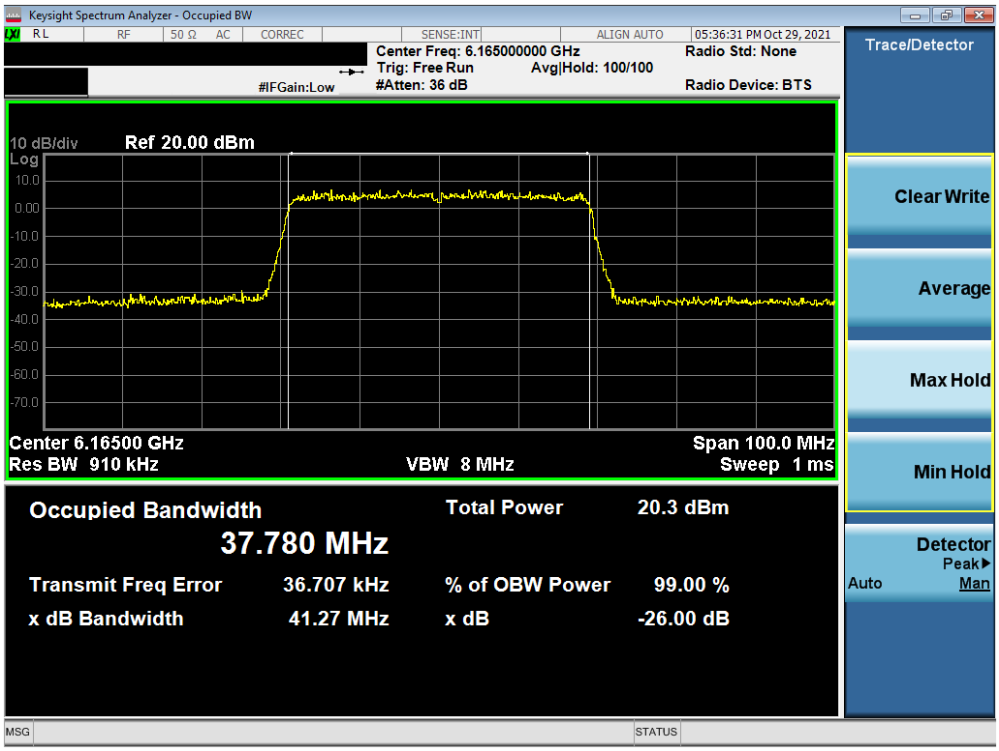

**Plot 7-49. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 45)**



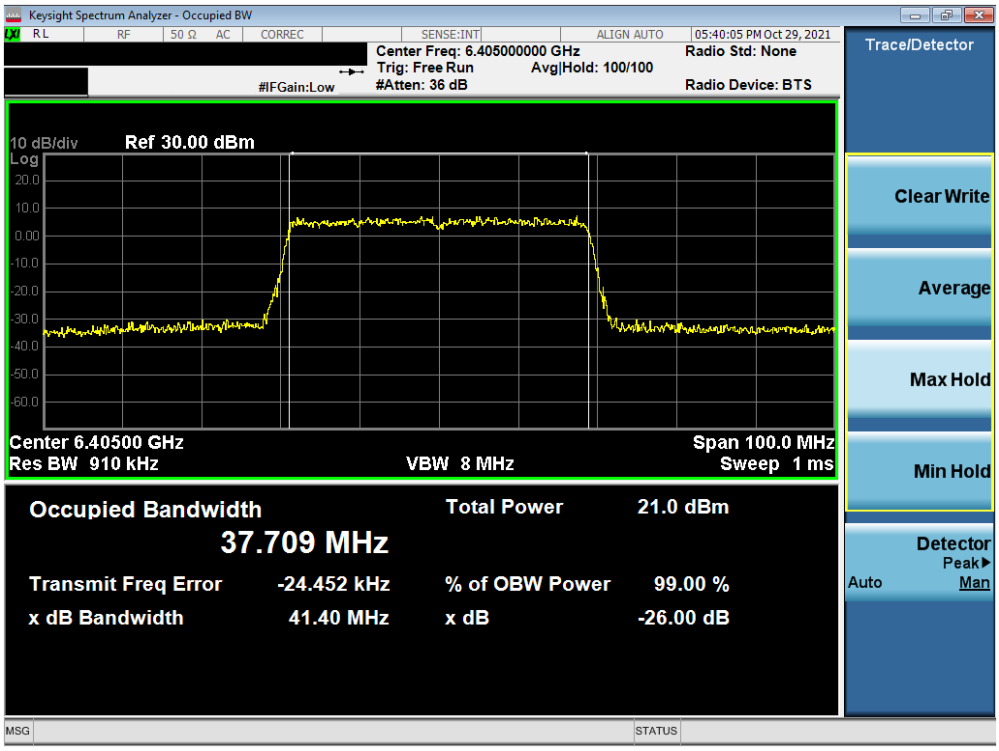

**Plot 7-50. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) UNII Band 5) – Ch. 93)**



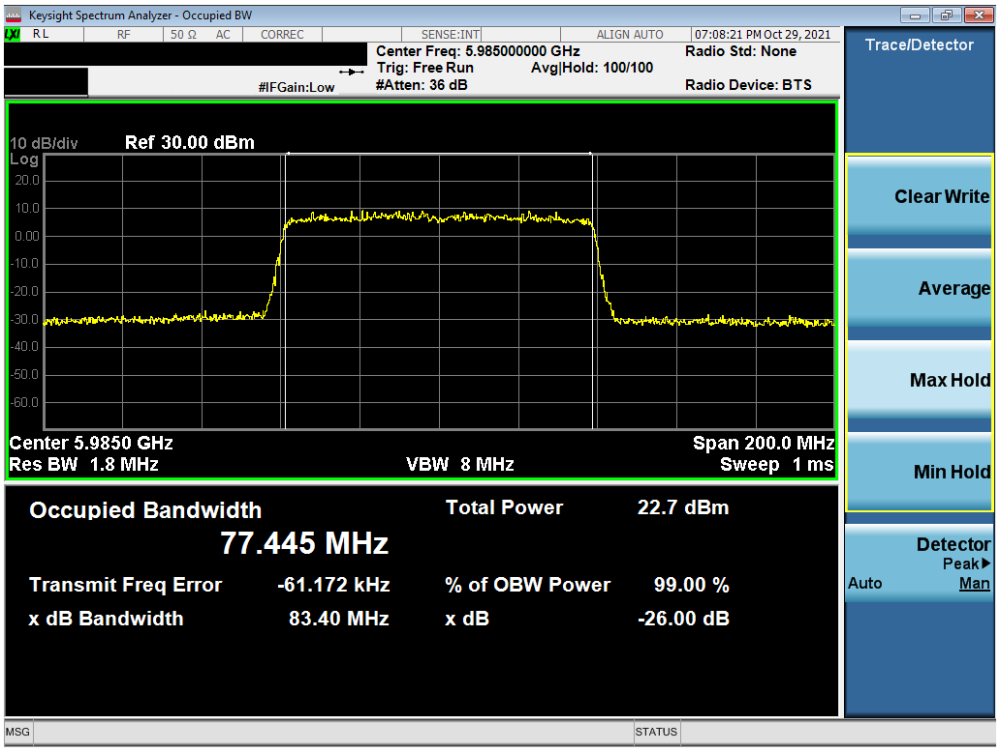

**Plot 7-51. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 3)**



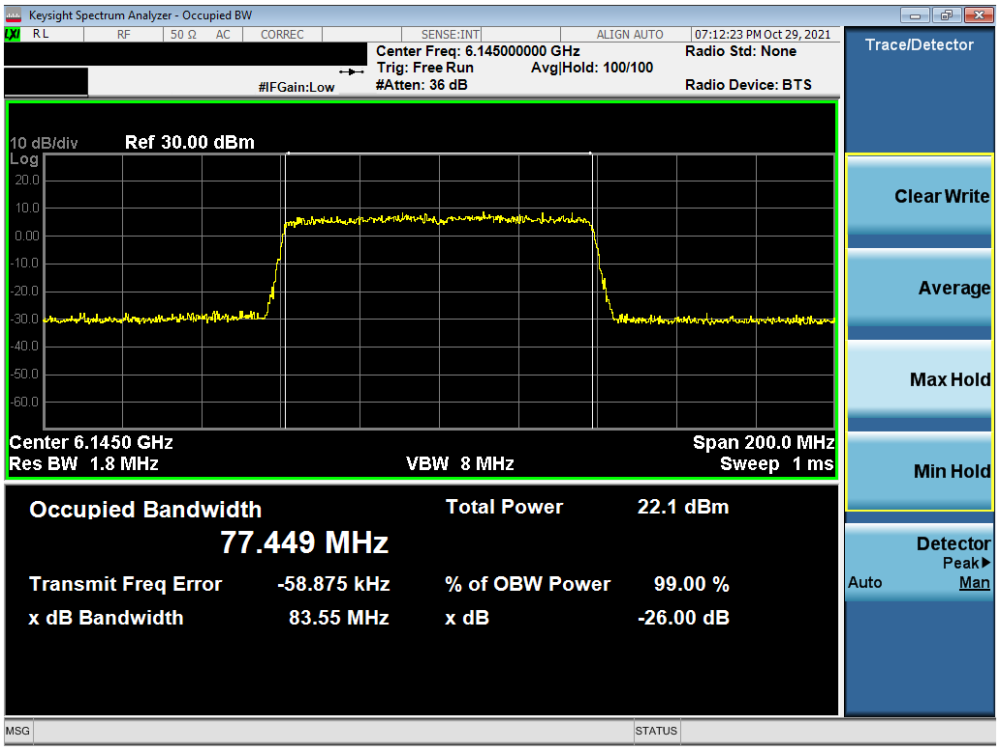

**Plot 7-52. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 43)**



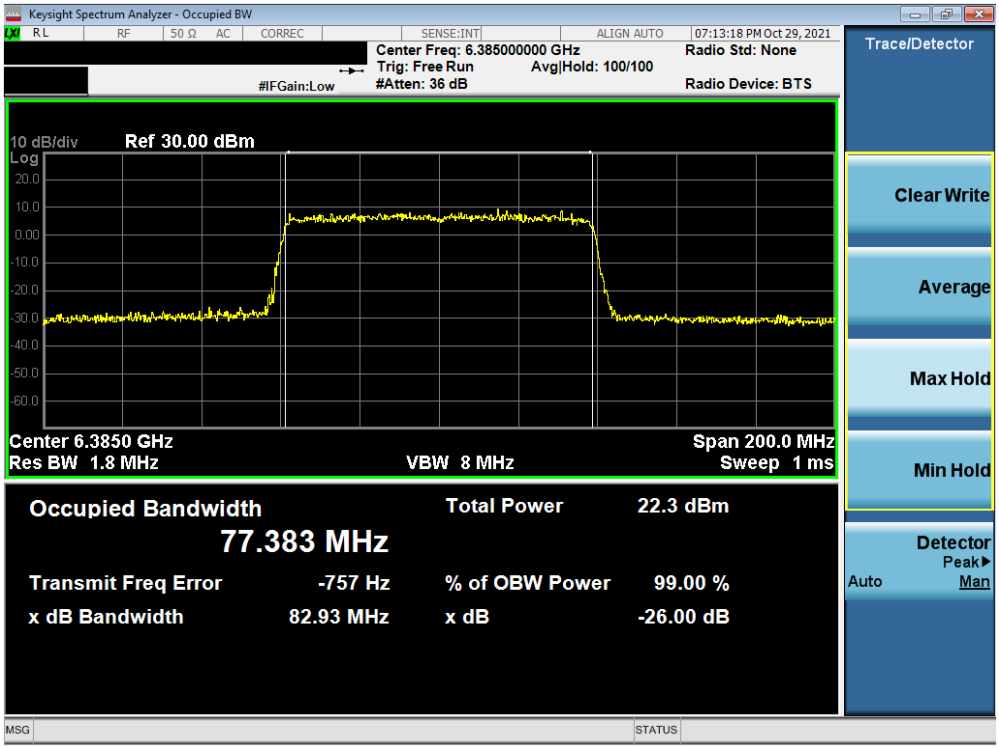

**Plot 7-53. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 91)**



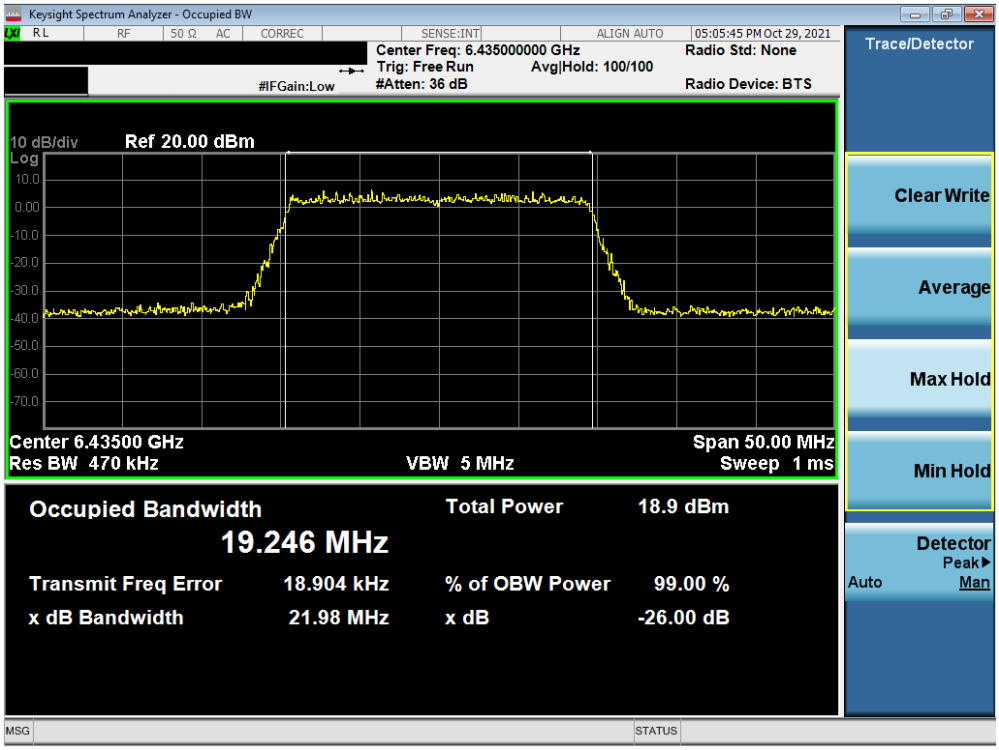

**Plot 7-54. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 7)**



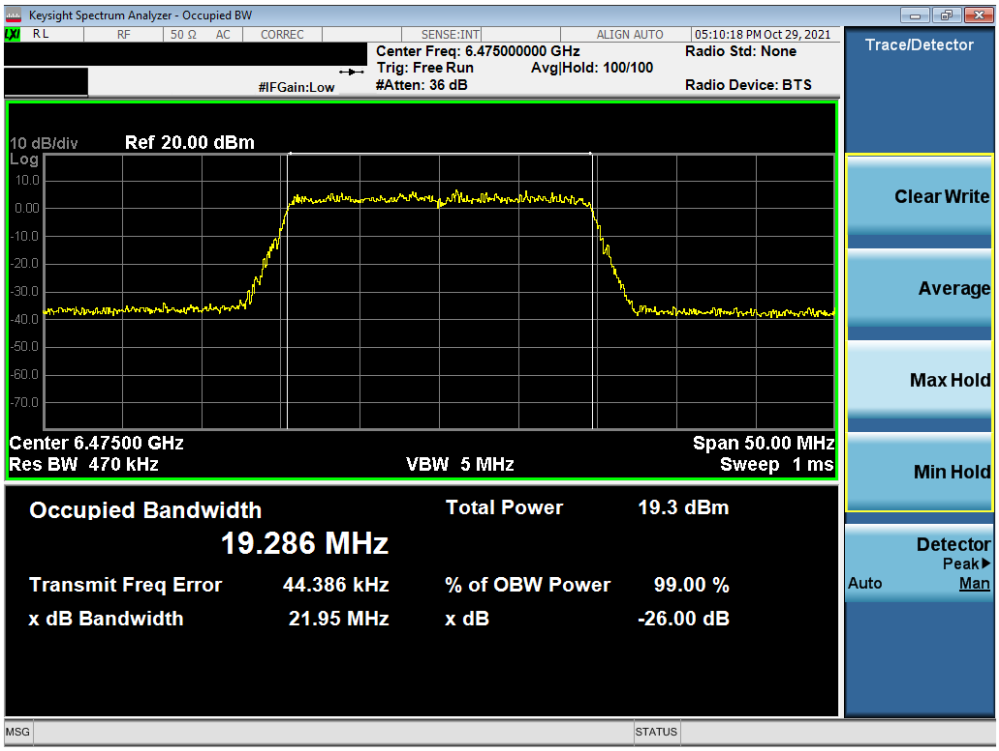

**Plot 7-55. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 39)**



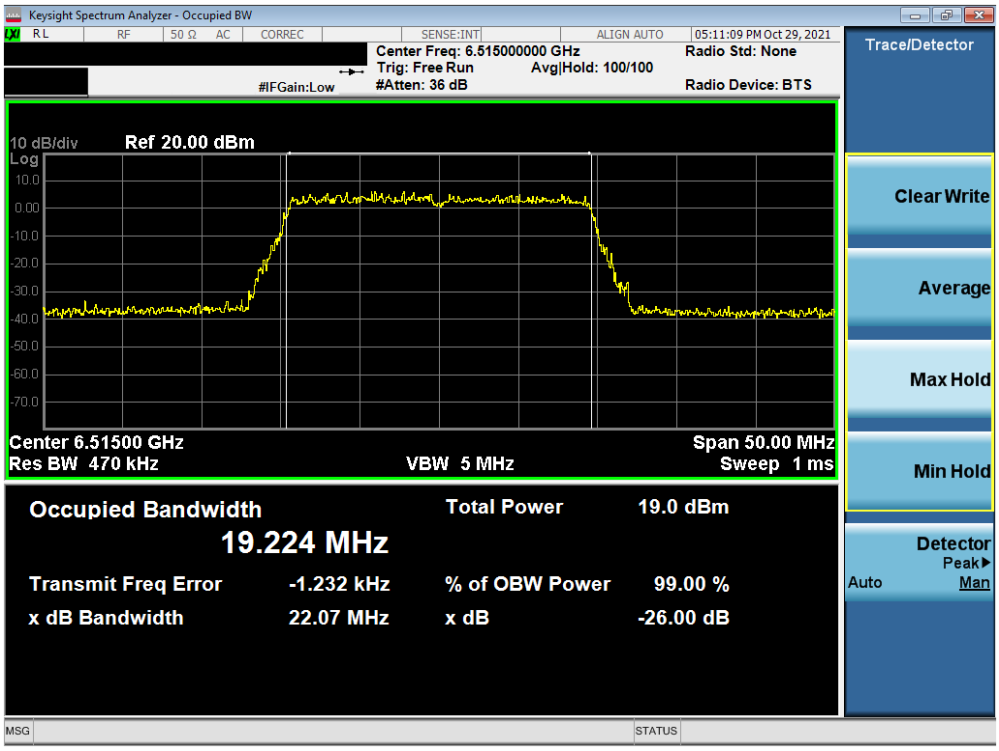

**Plot 7-56. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 87)**



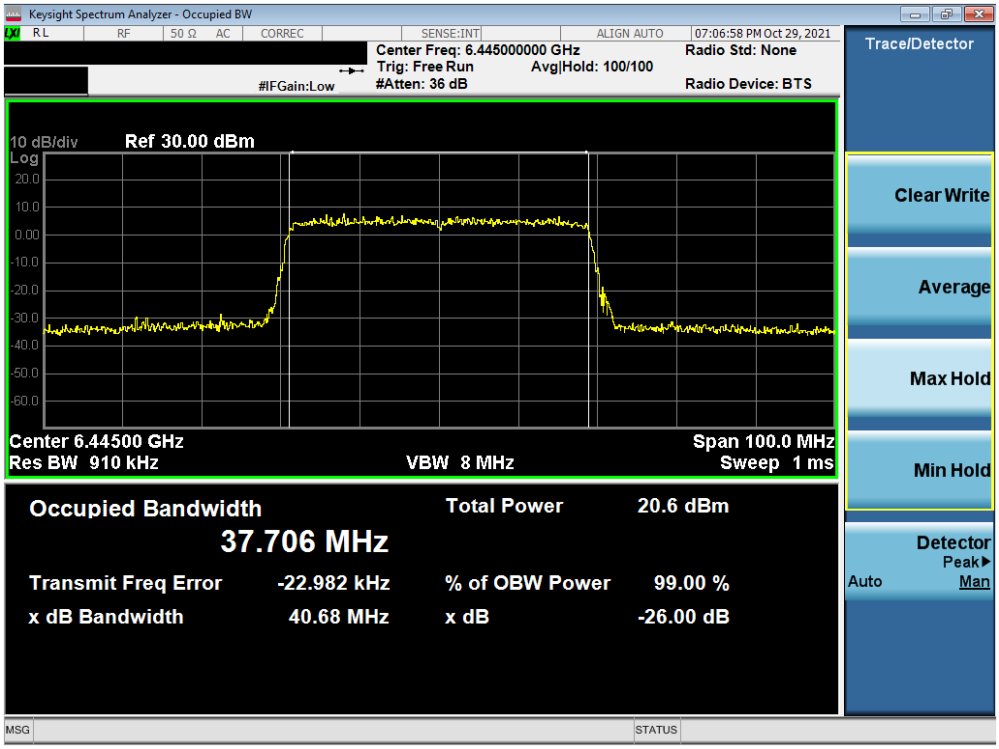

**Plot 7-57. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 97)**



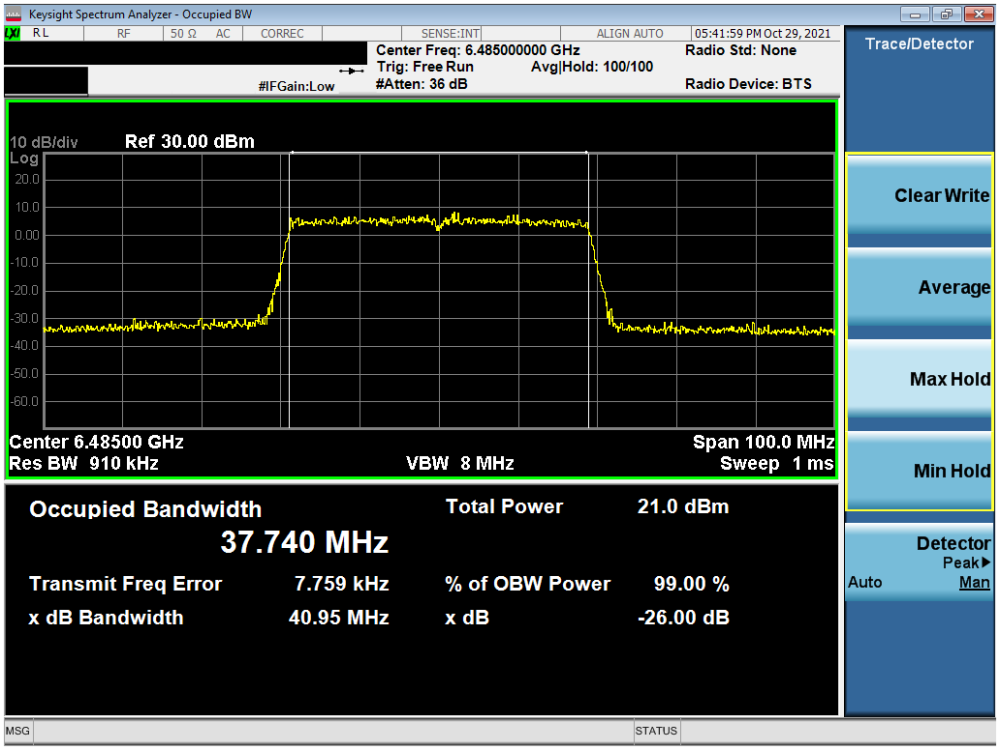

**Plot 7-58. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 105)**



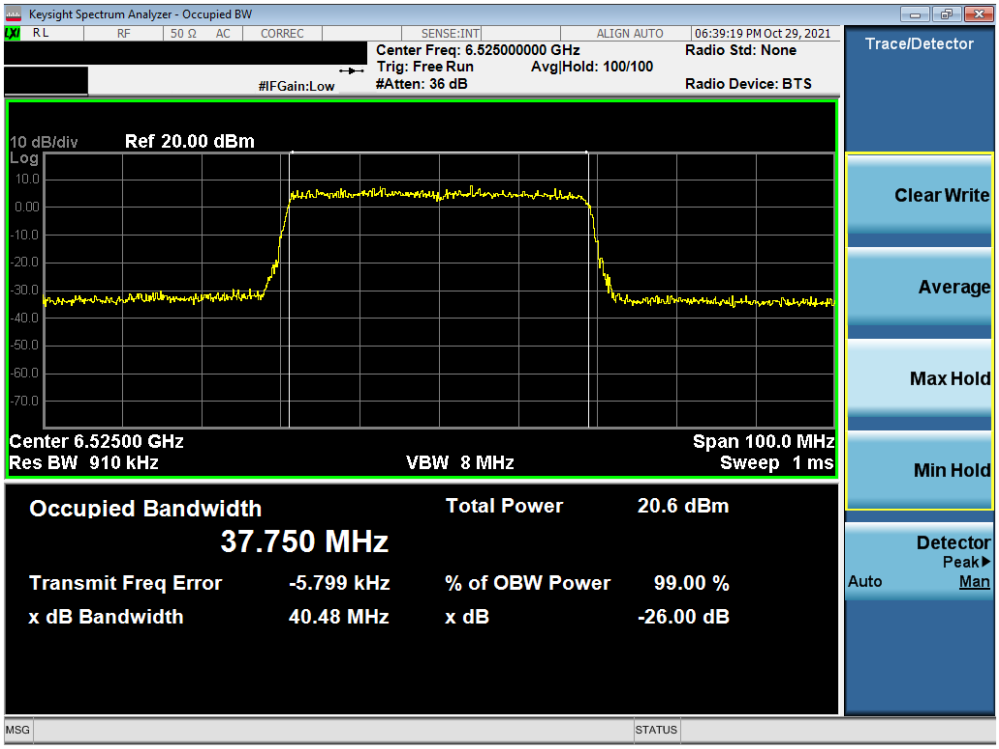

**Plot 7-59. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 113)**



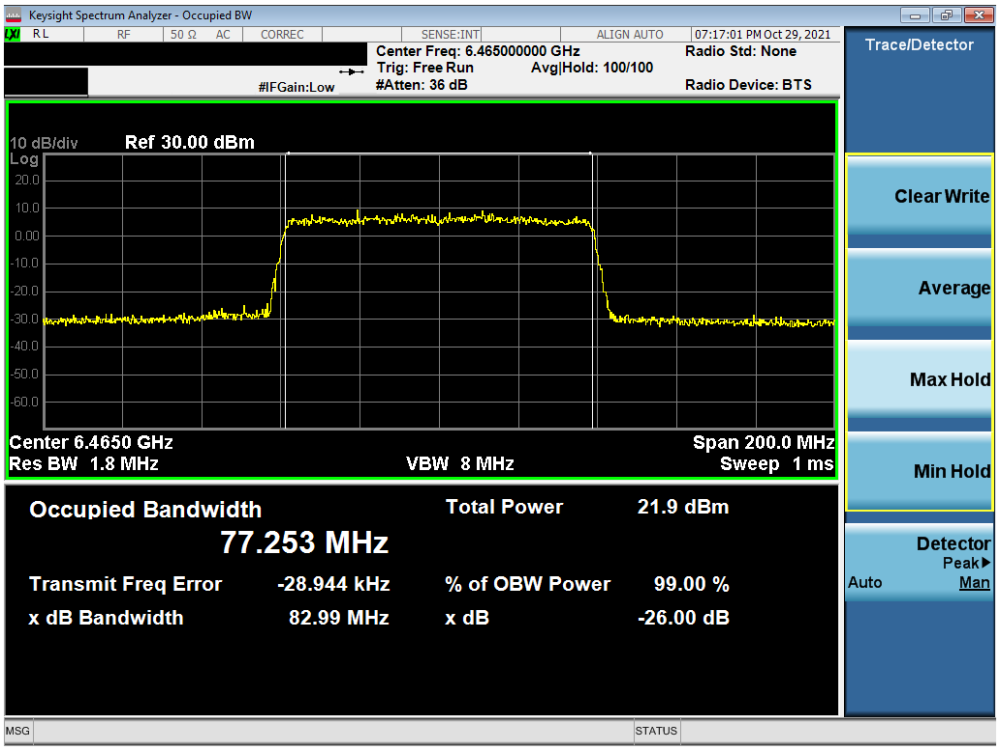

**Plot 7-60. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 99)**



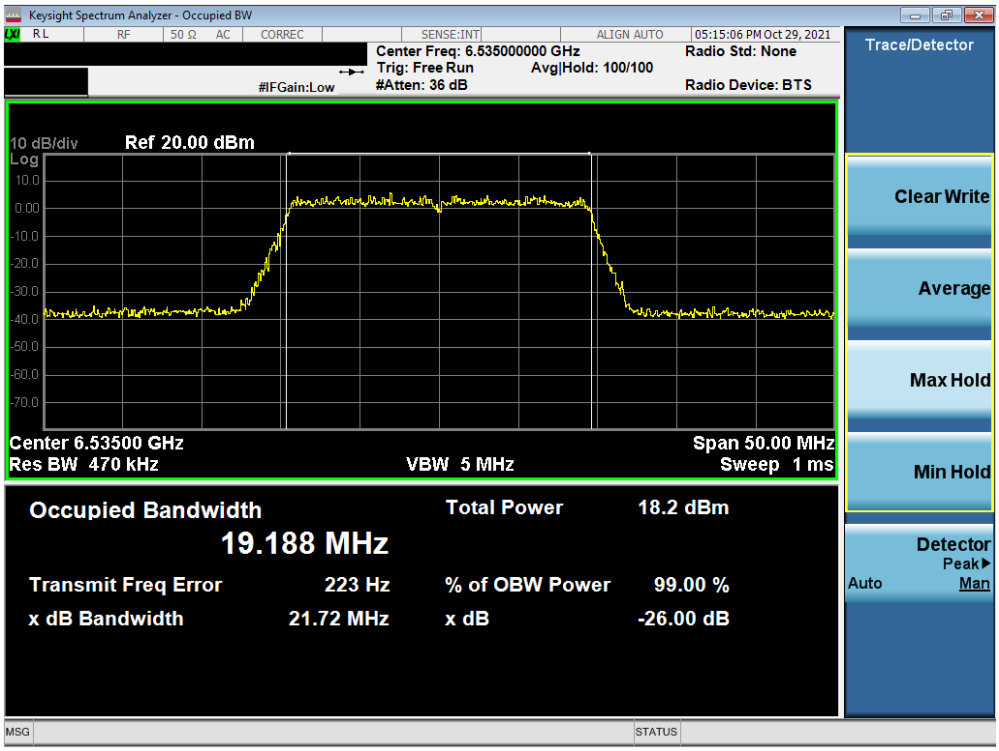

**Plot 7-61. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 107)**



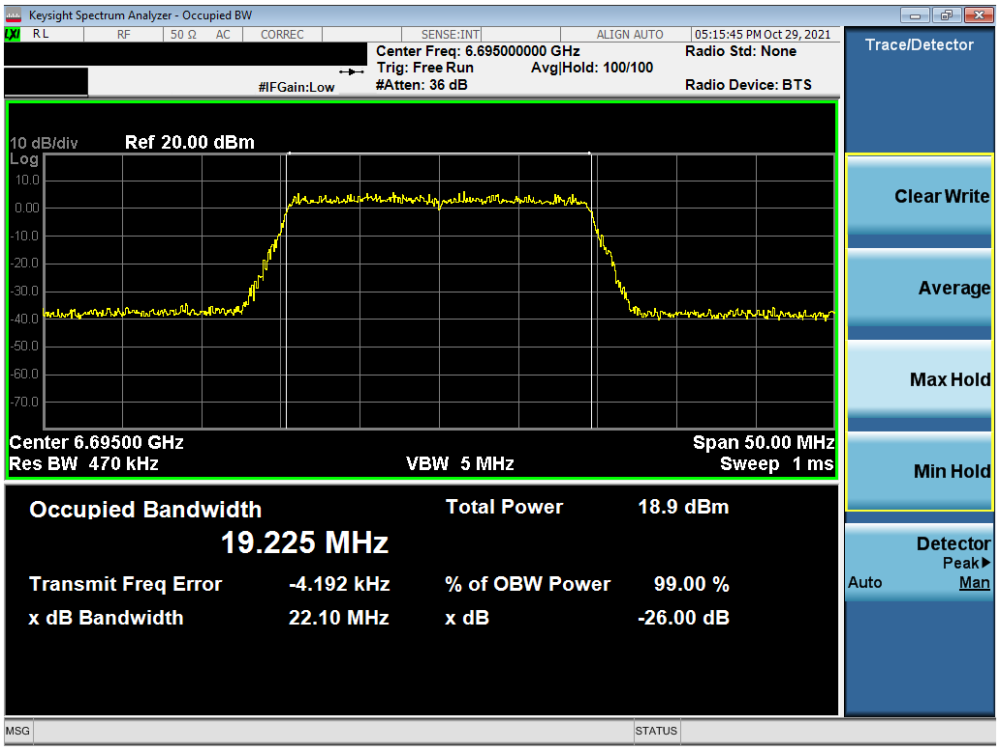

**Plot 7-62. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 115)**



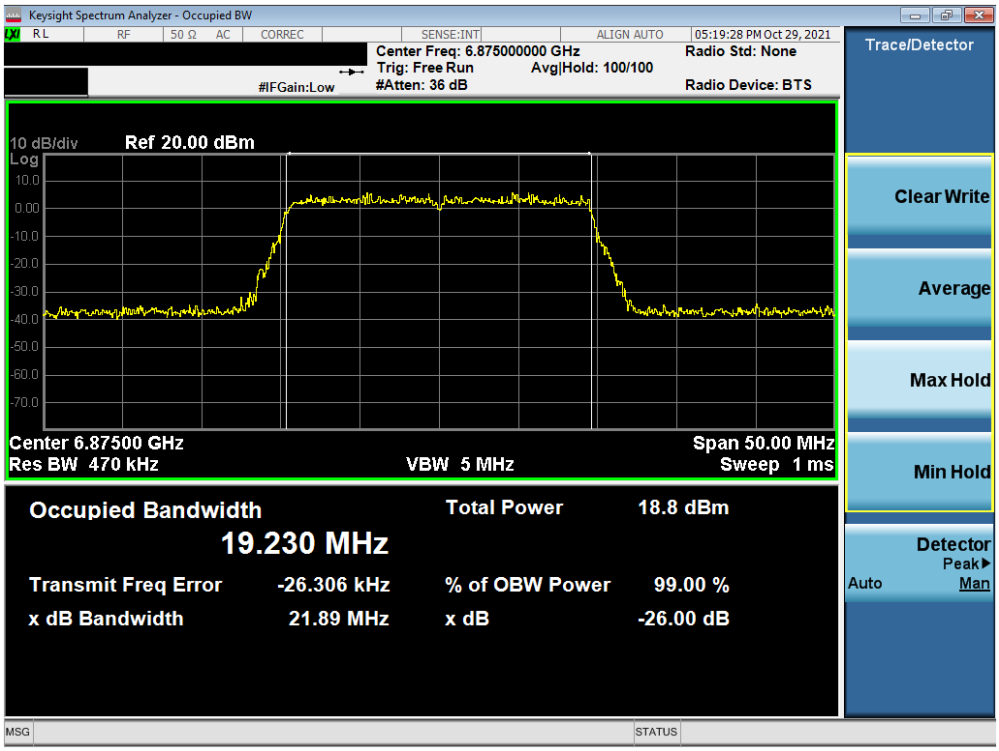

**Plot 7-63. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 6) – Ch. 103)**



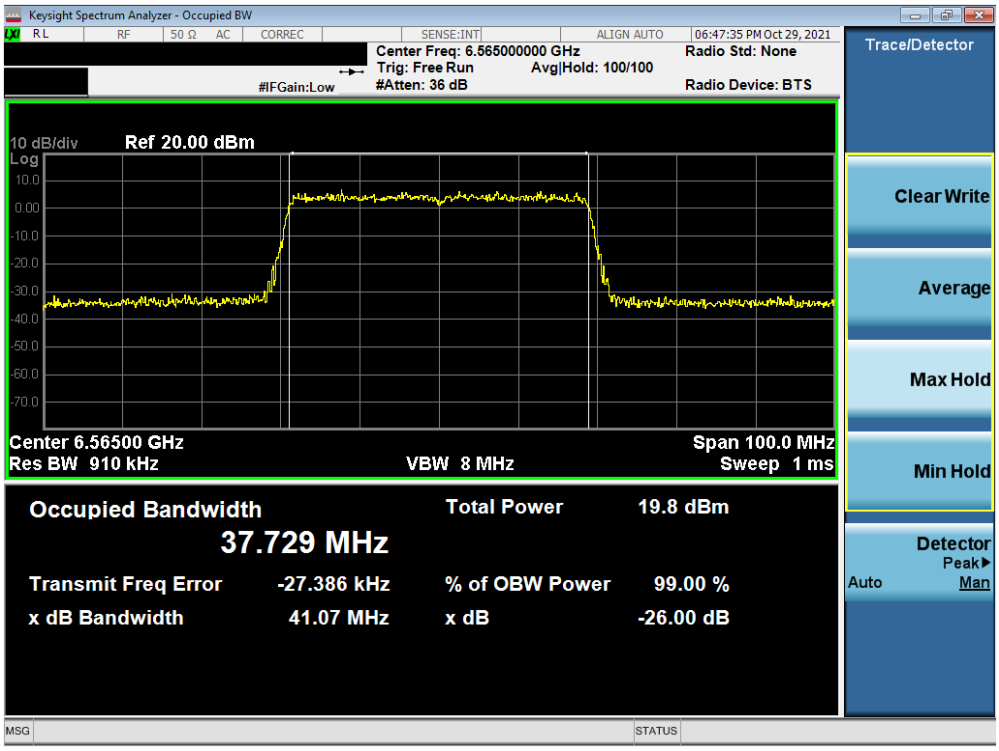

**Plot 7-64. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 117)**



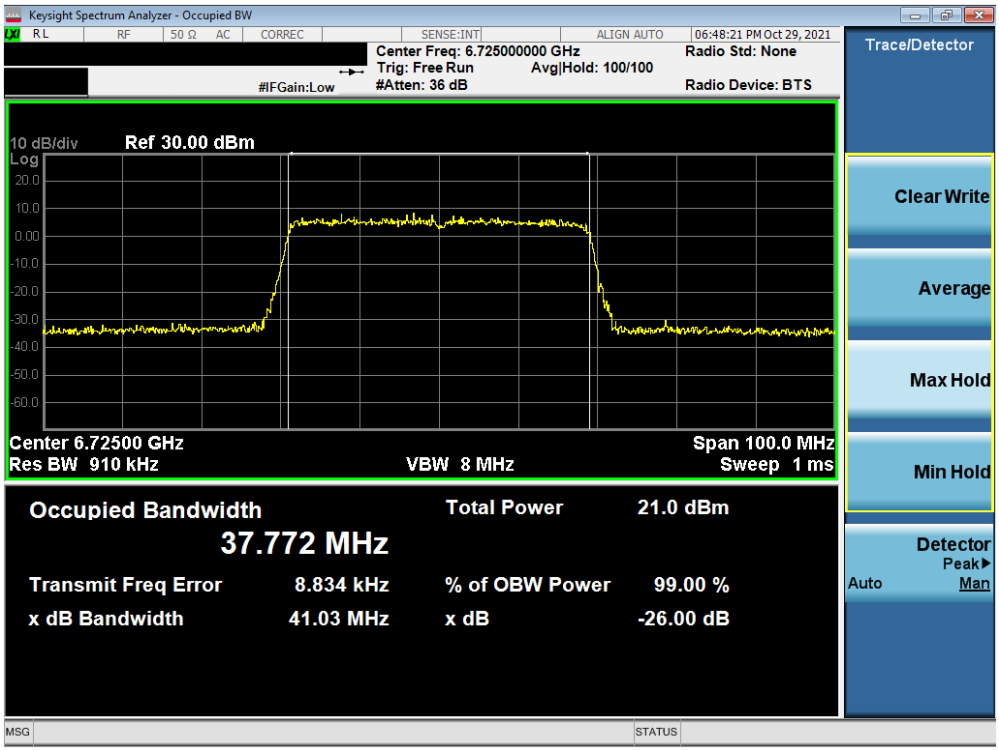

**Plot 7-65. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 149)**



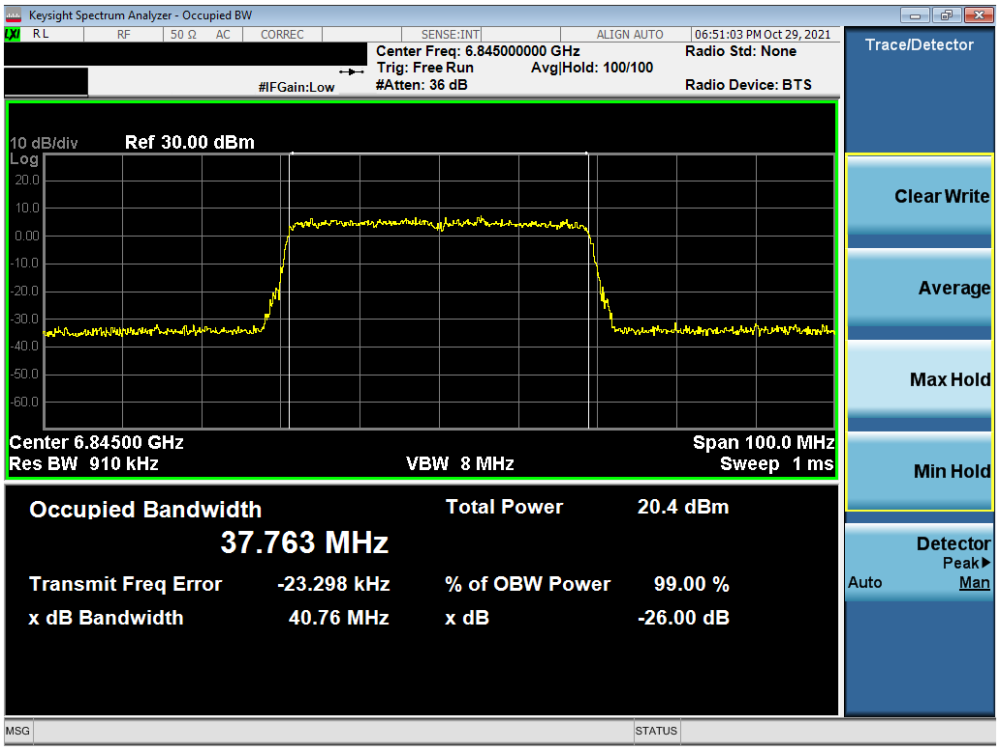

**Plot 7-66. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 185)**



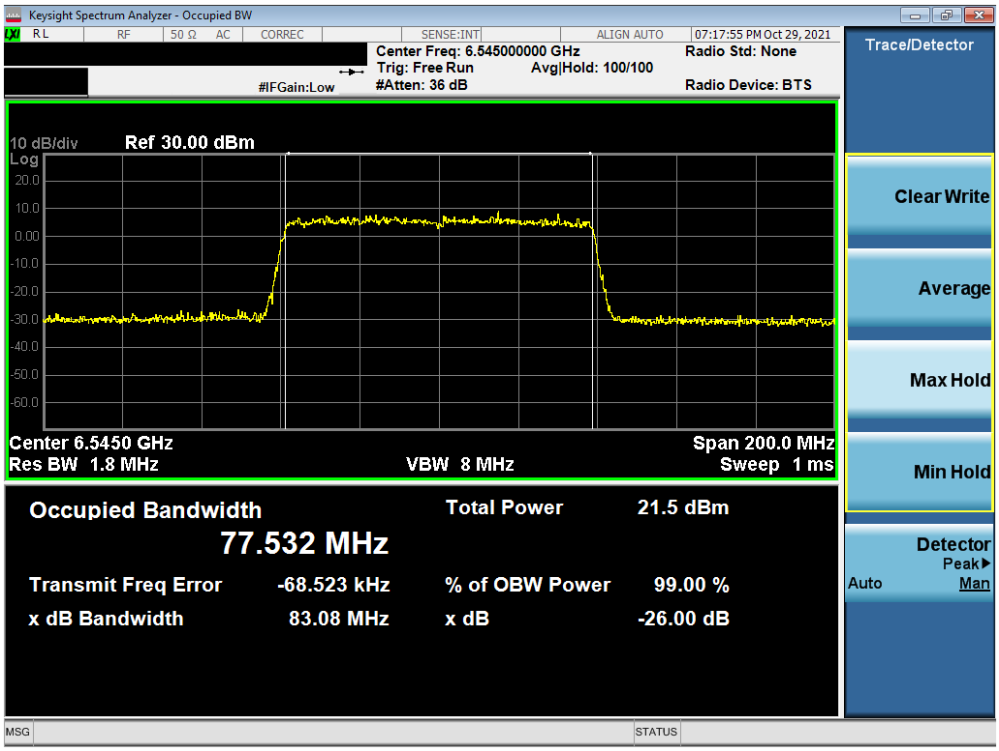

**Plot 7-67. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 123)**



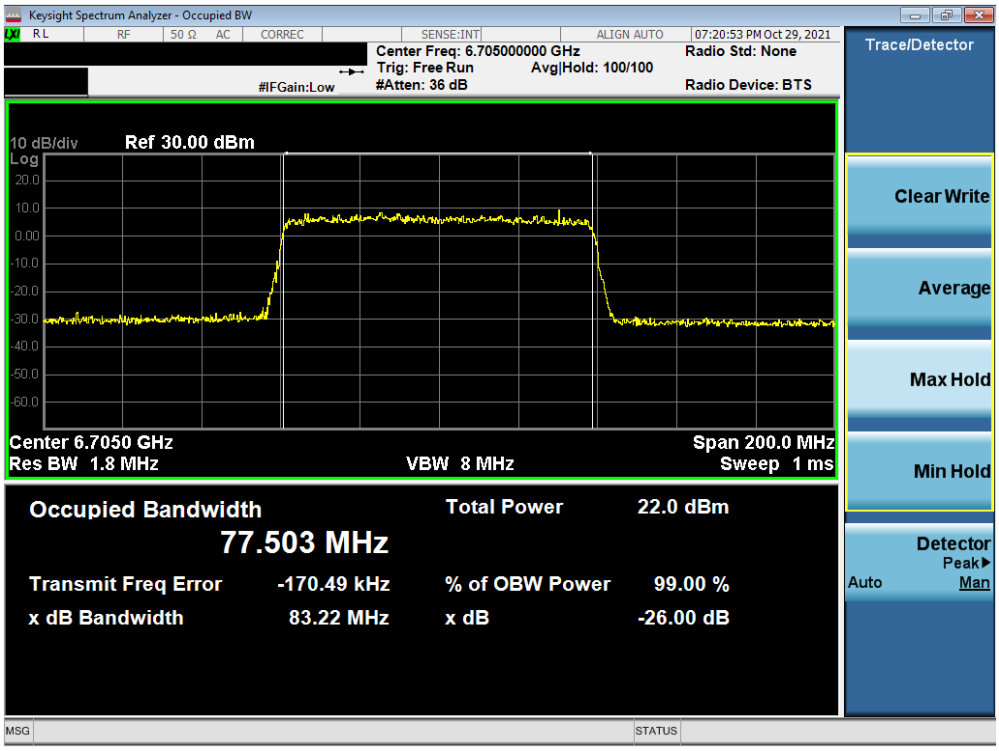

**Plot 7-68. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 155)**



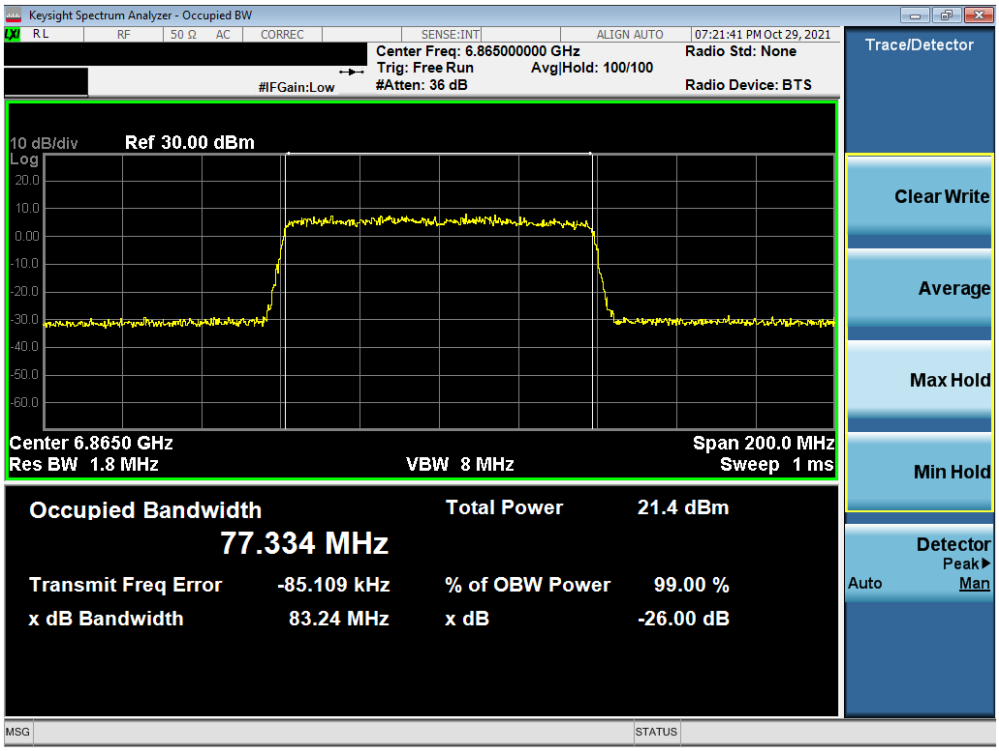

**Plot 7-69. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 179)**



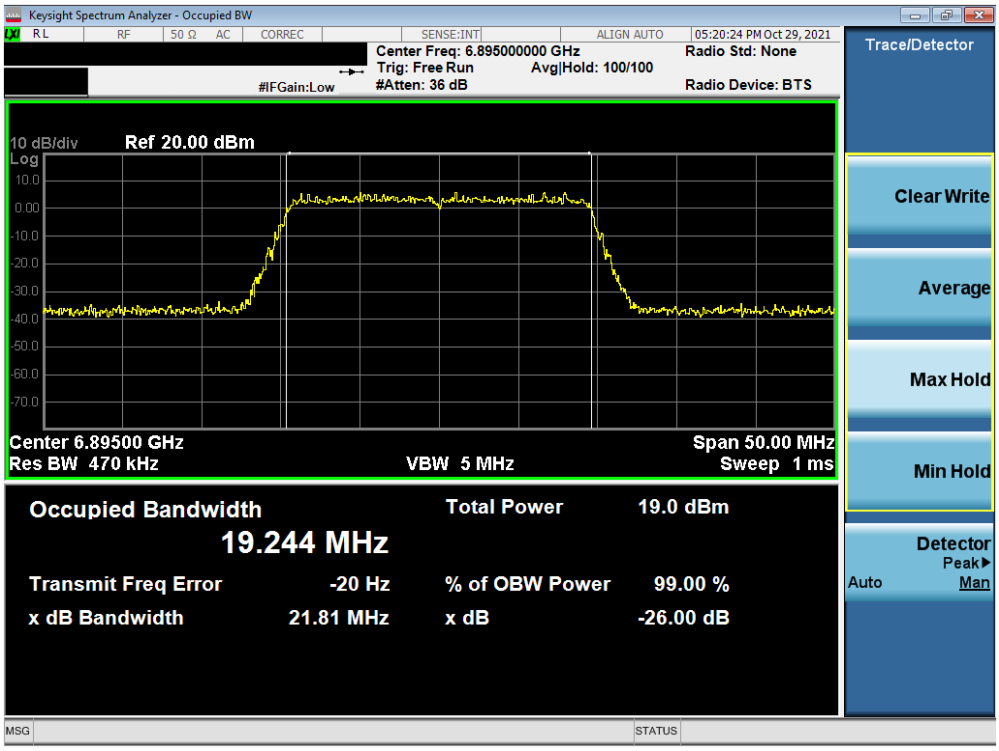

**Plot 7-70. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 119)**



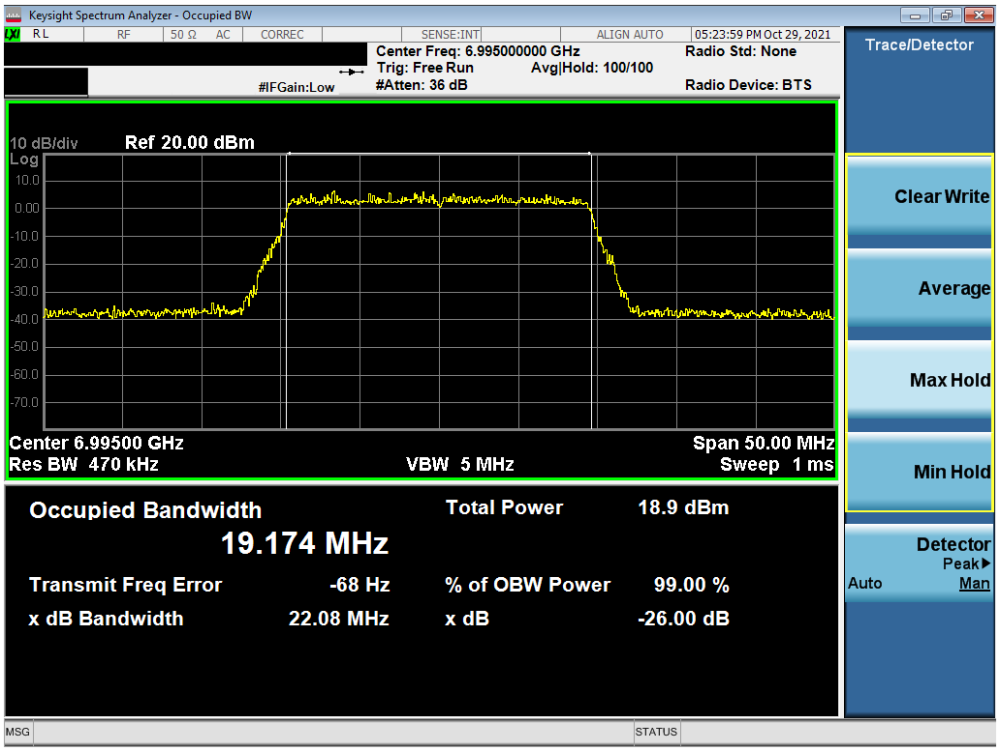

**Plot 7-71. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 151)**



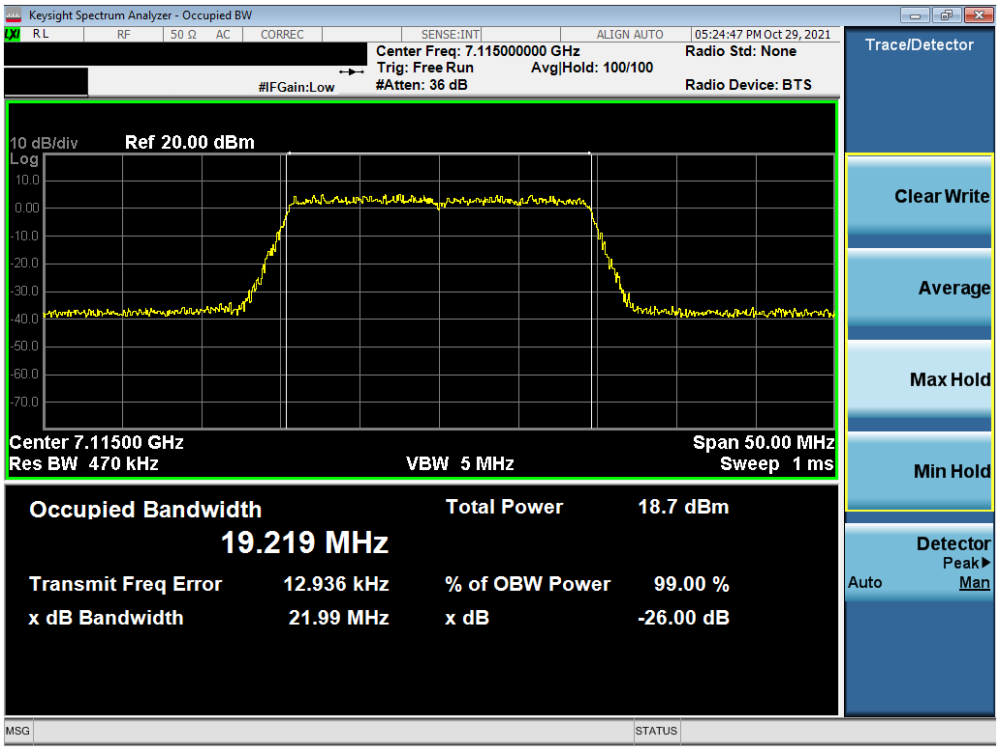

**Plot 7-72. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 7) – Ch. 183)**



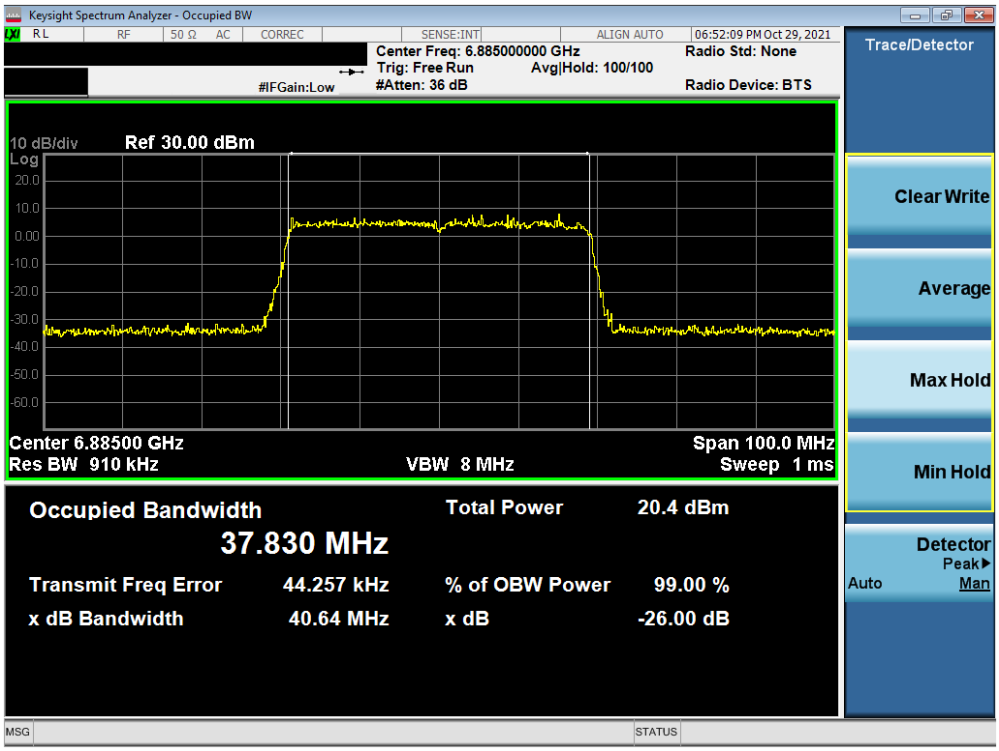

**Plot 7-73. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 189)**



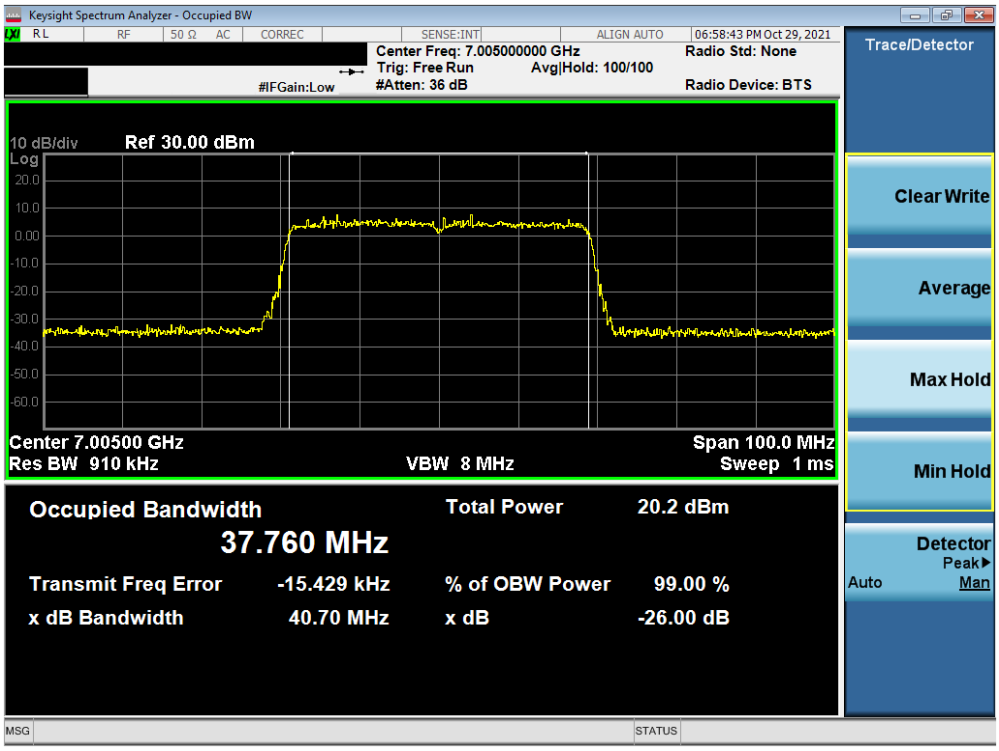

**Plot 7-74. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 209)**



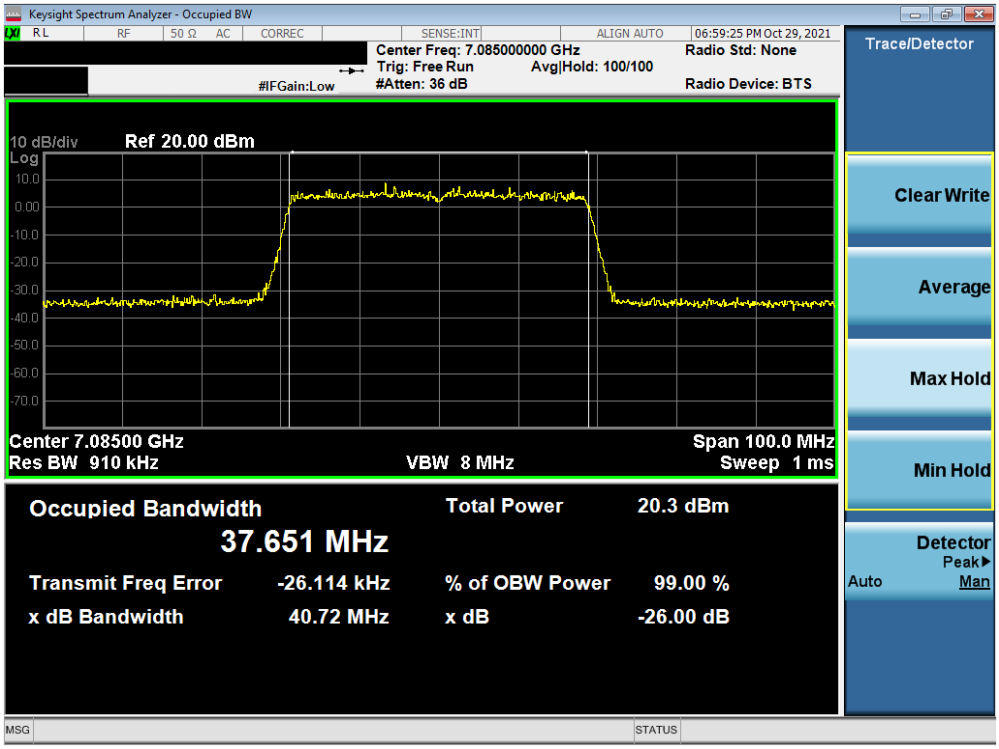

**Plot 7-75. 26dB Bandwidth Plot MIMO ANT1 (20MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 233)**



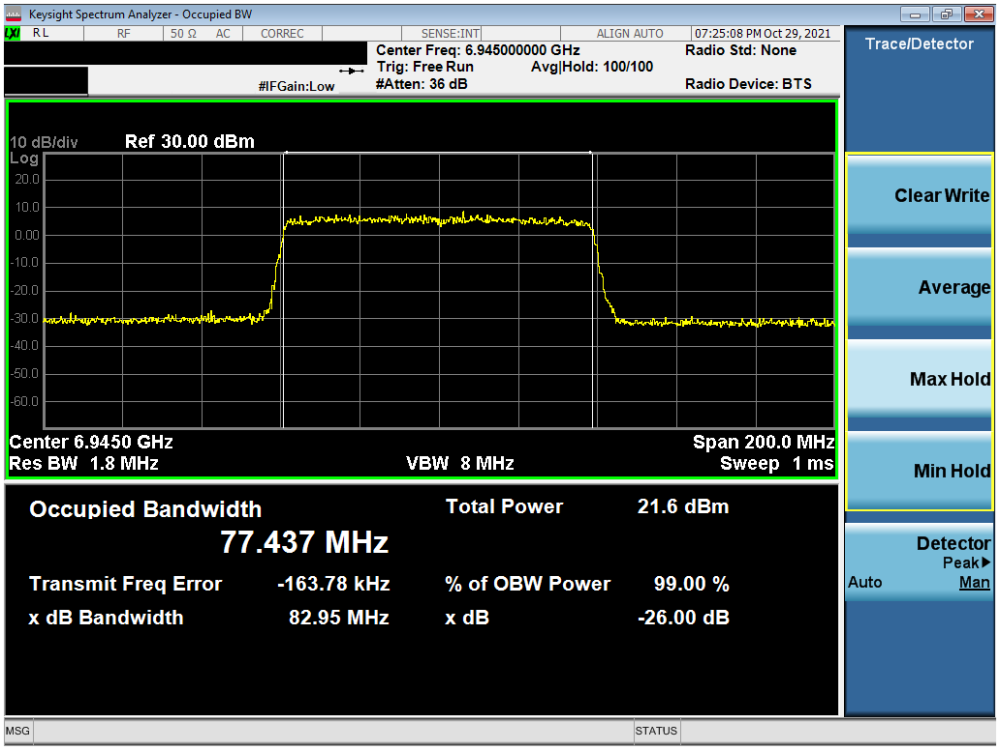

**Plot 7-76. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 187)**



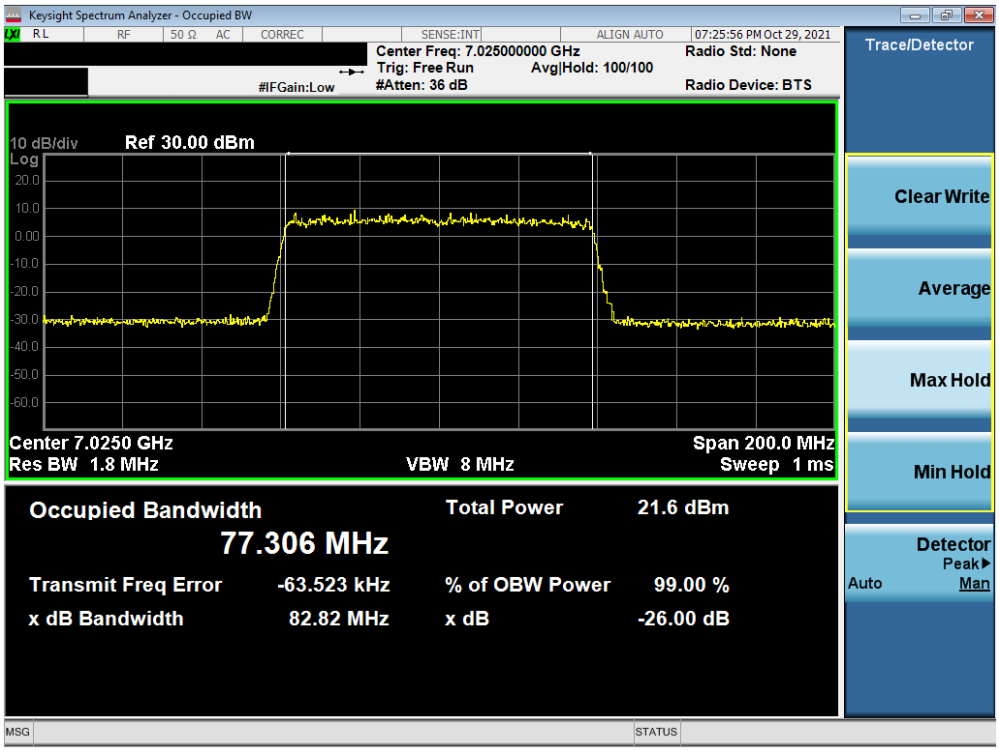

**Plot 7-77. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 211)**




**Plot 7-78. 26dB Bandwidth Plot MIMO ANT1 (40MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 227)**

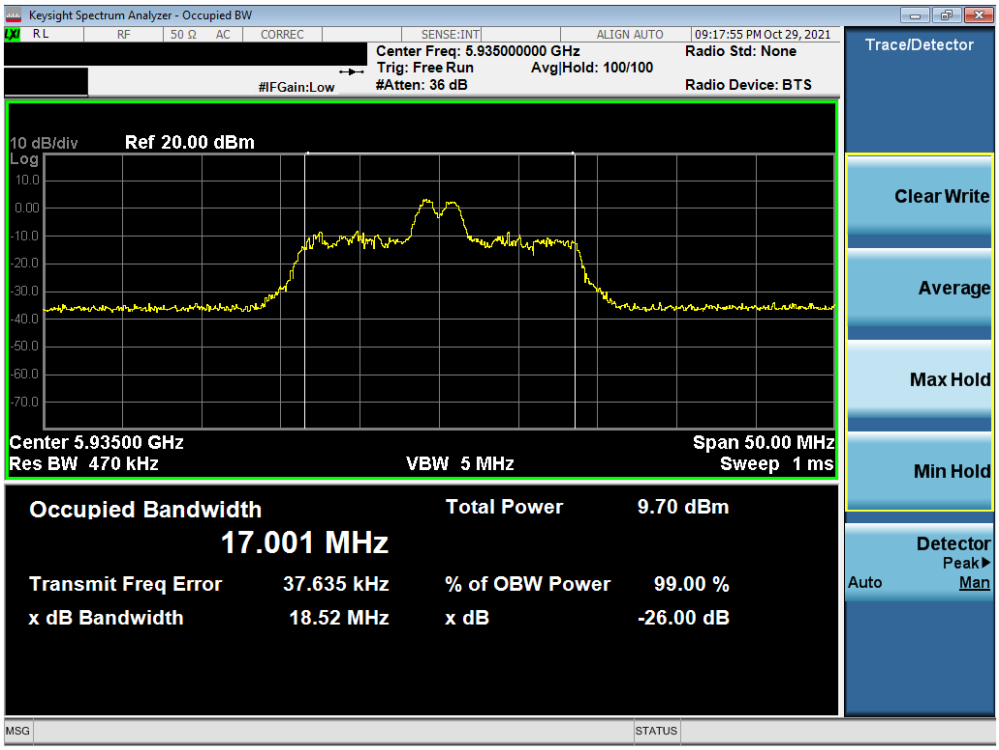



**Plot 7-79. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 199)**

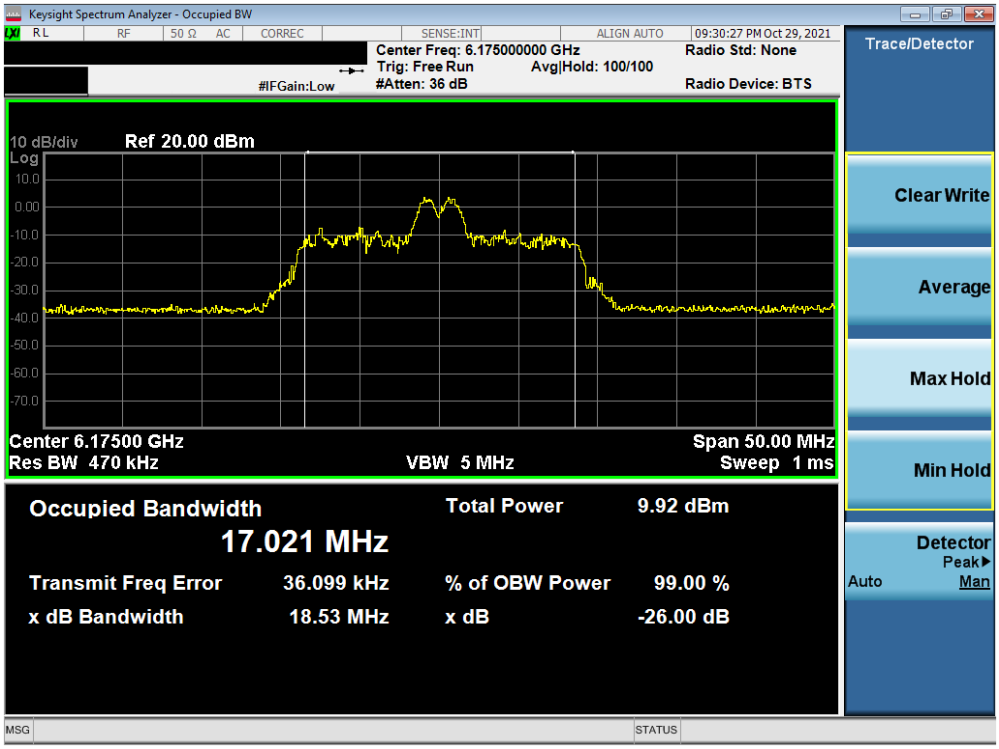



**Plot 7-80. 26dB Bandwidth Plot MIMO ANT1 (80MHz BW 802.11ax (FULL Tones) (UNII Band 8) – Ch. 215)**

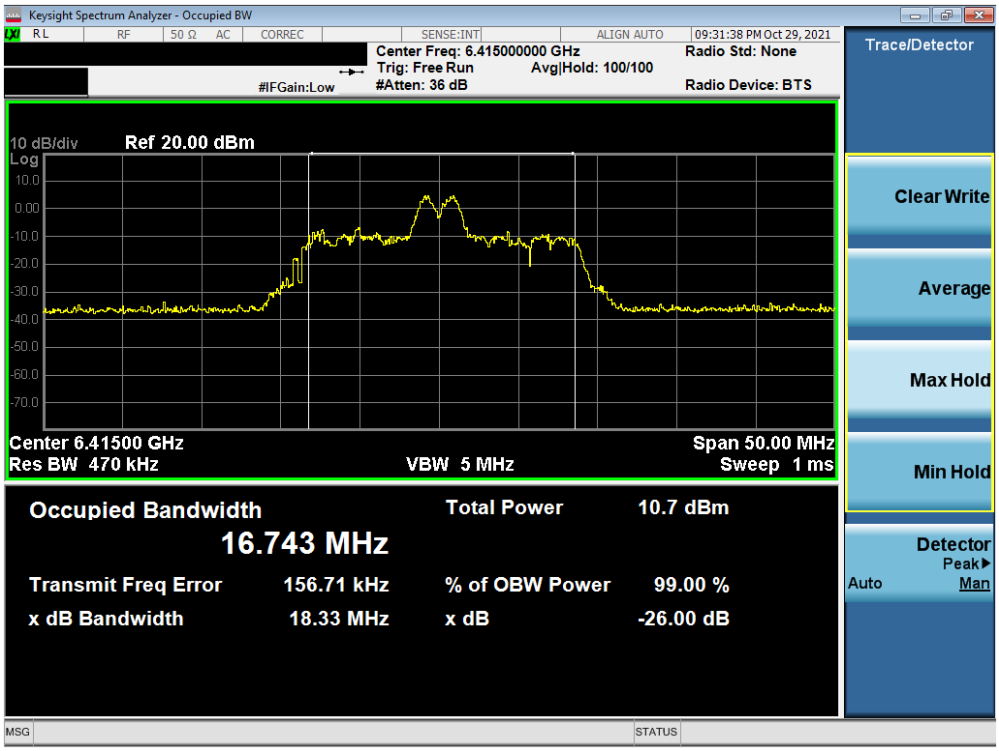
## MIMO Antenna-2 26dB Bandwidth Measurements (26 Tones)



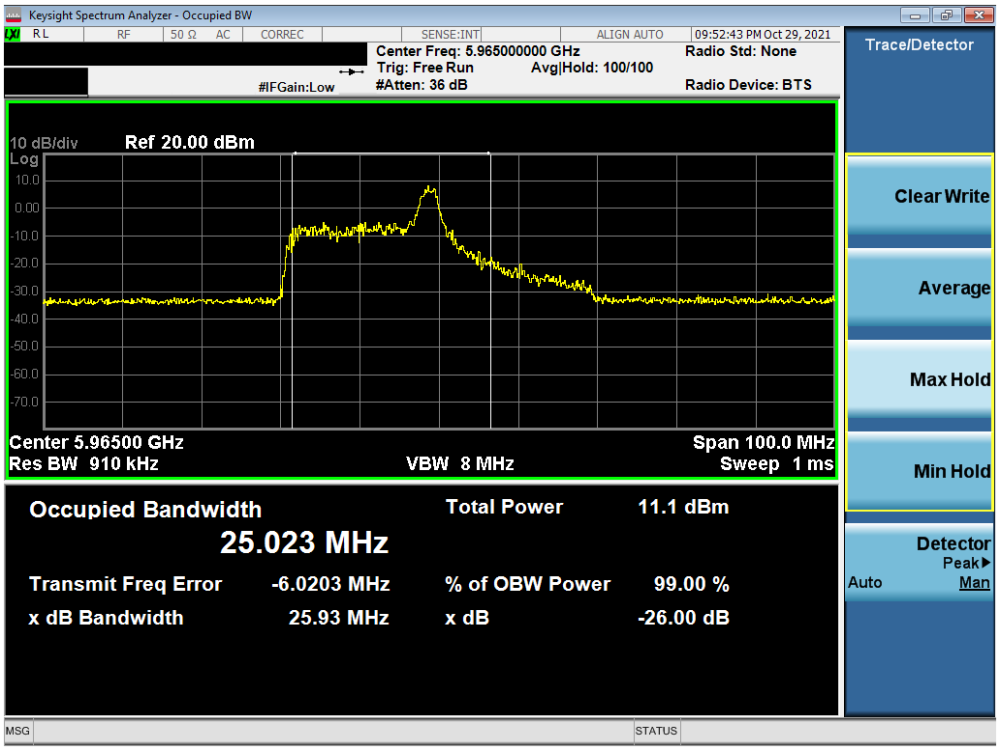

**Plot 7-81. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (26 Tones) (UNII Band 5) – Ch. 2)**



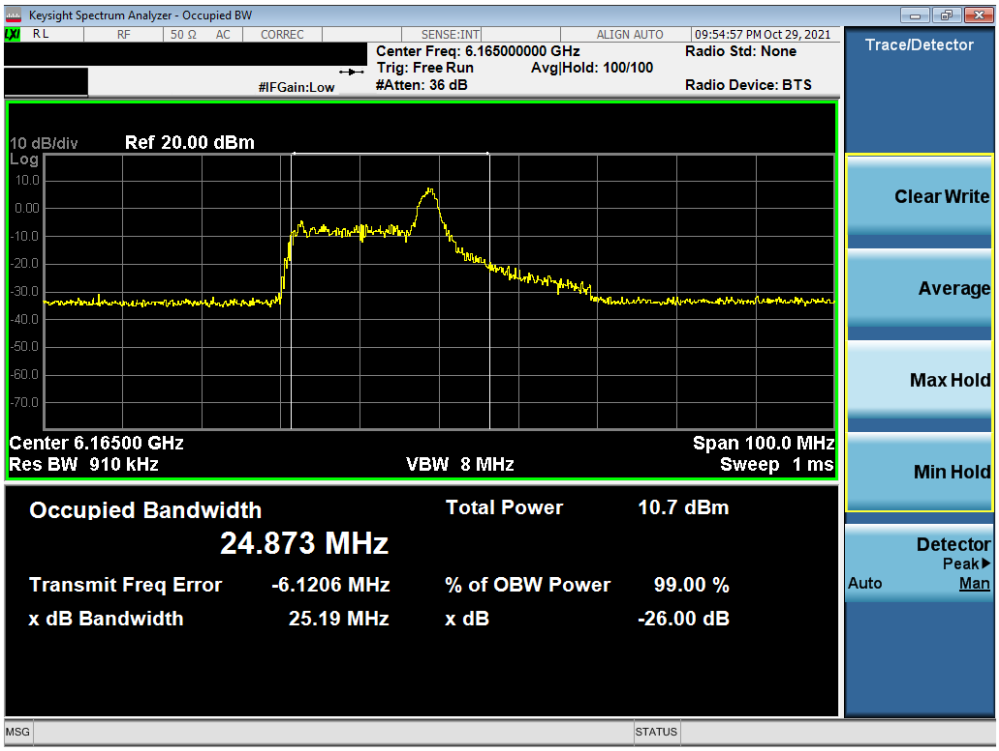

**Plot 7-82. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 45)**



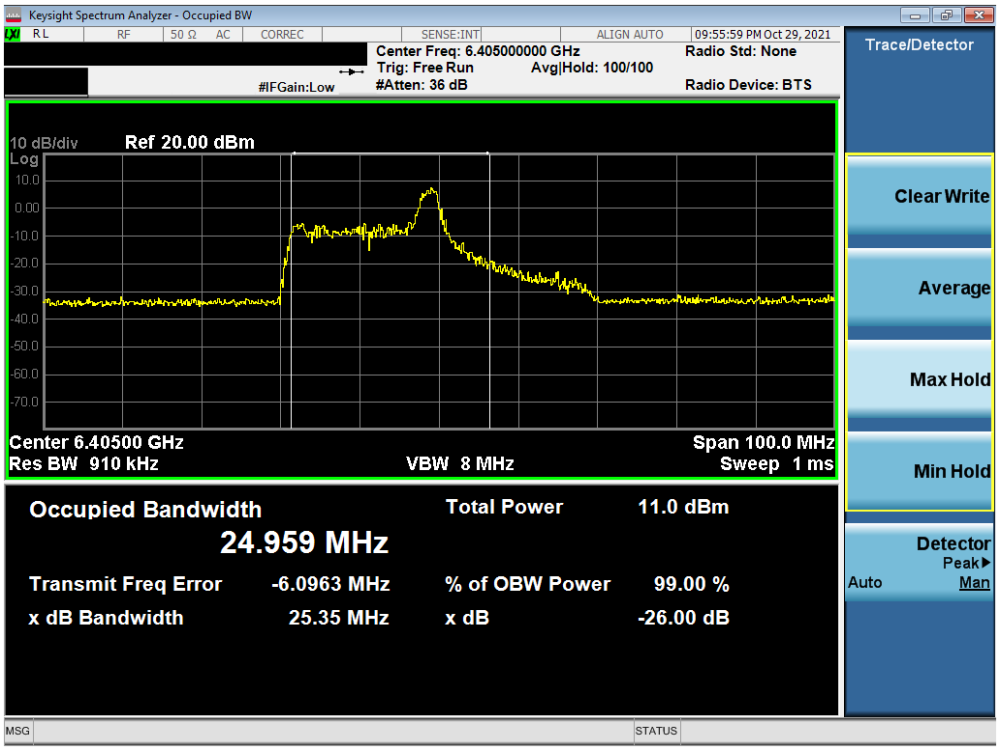

**Plot 7-83. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) UNII Band 5) – Ch. 93)**



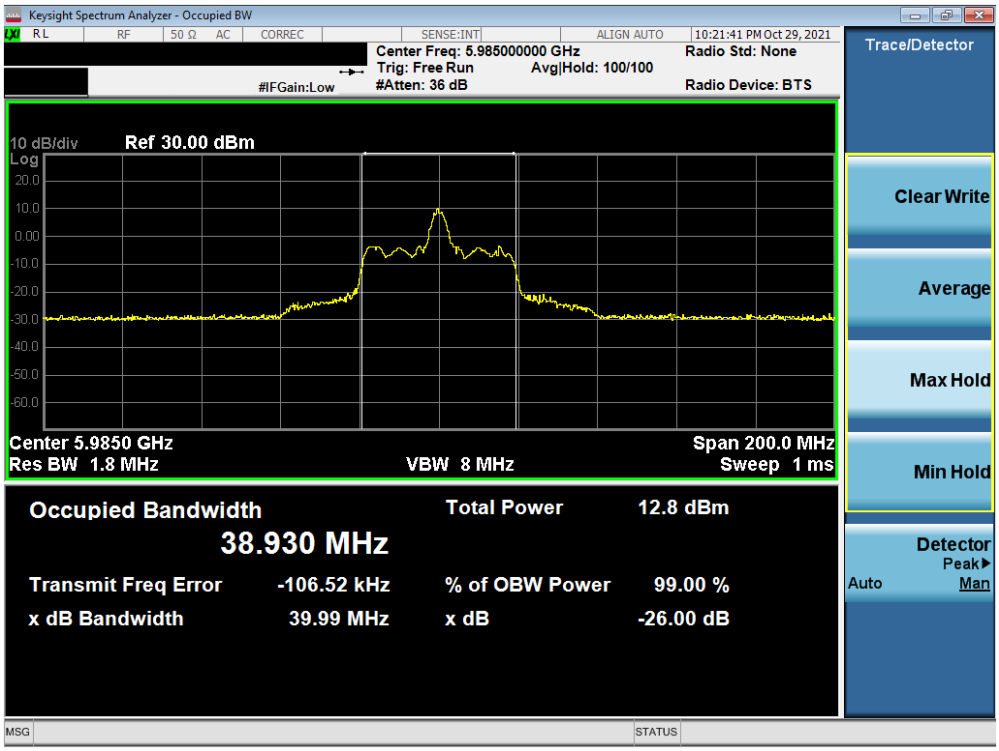

**Plot 7-84. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 3)**



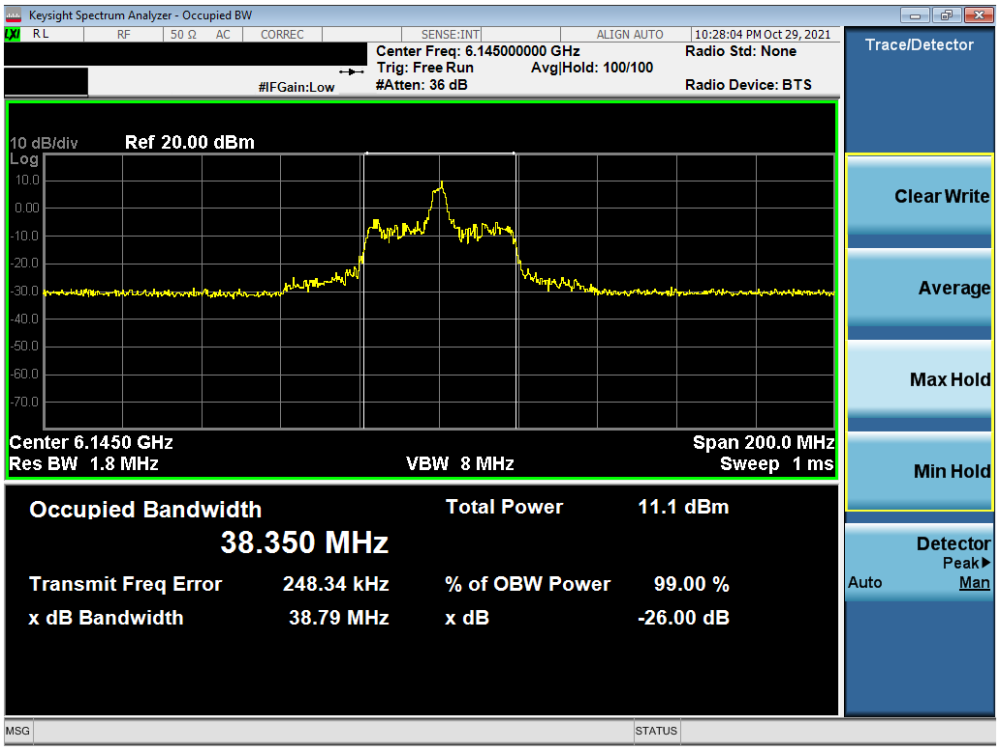

**Plot 7-85. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 43)**



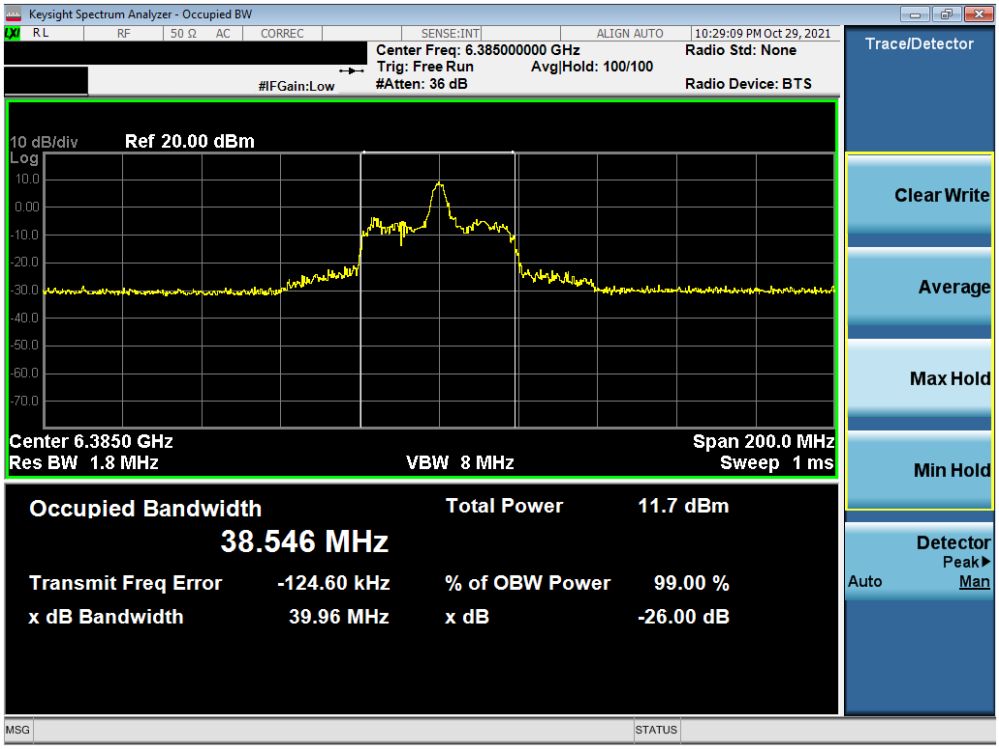

**Plot 7-86. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 91)**



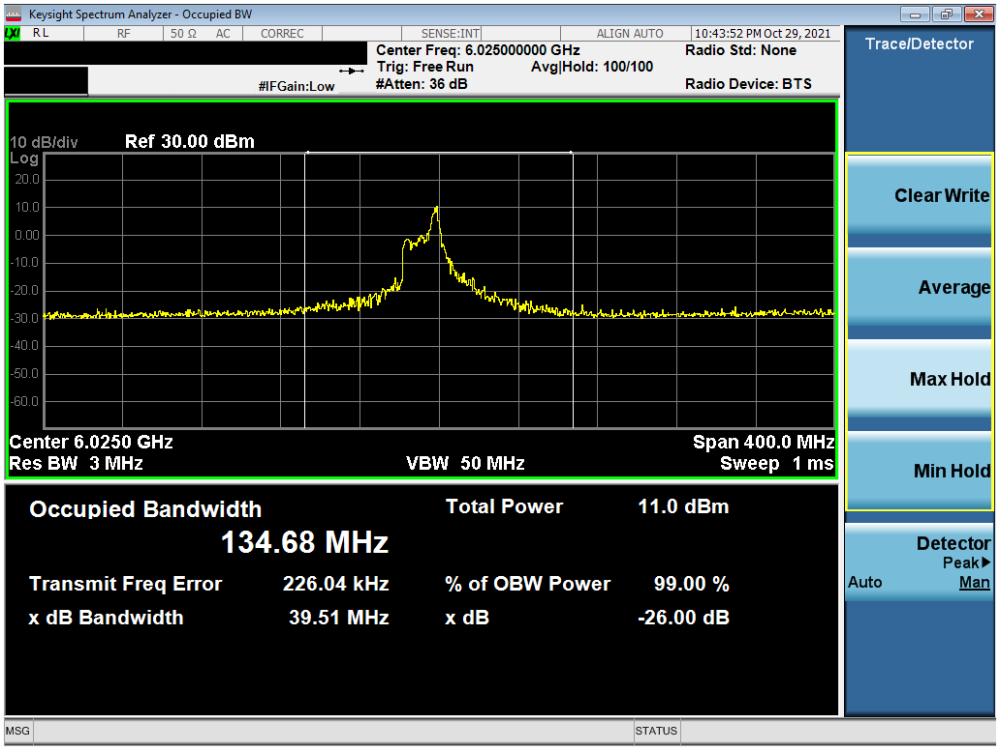

**Plot 7-87. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 7)**



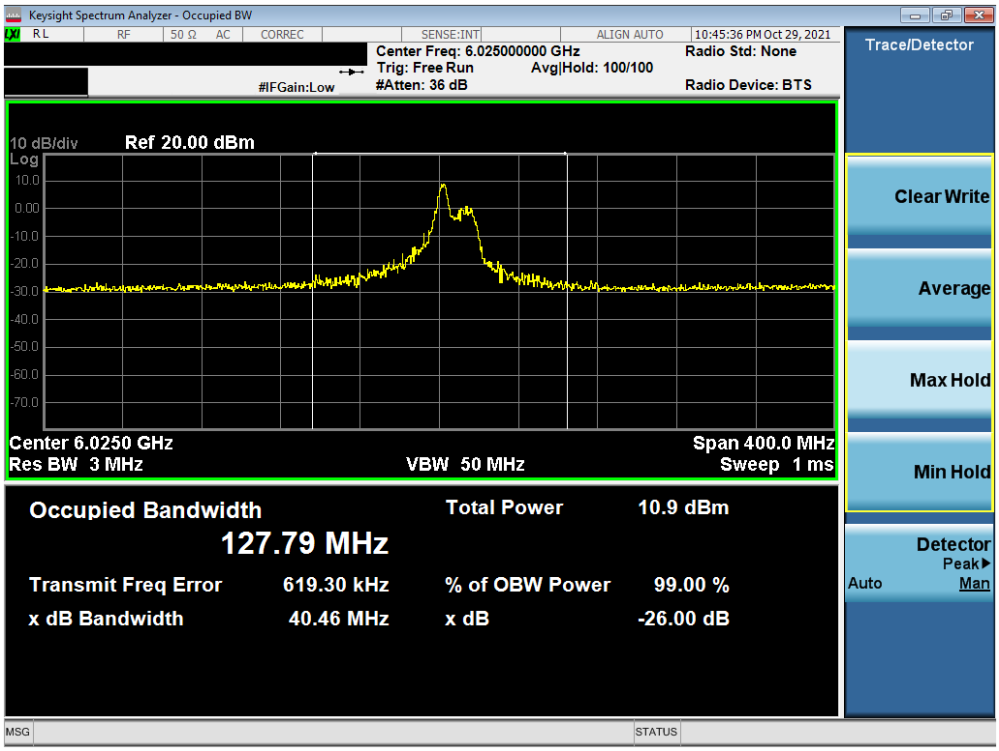

**Plot 7-88. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 39)**



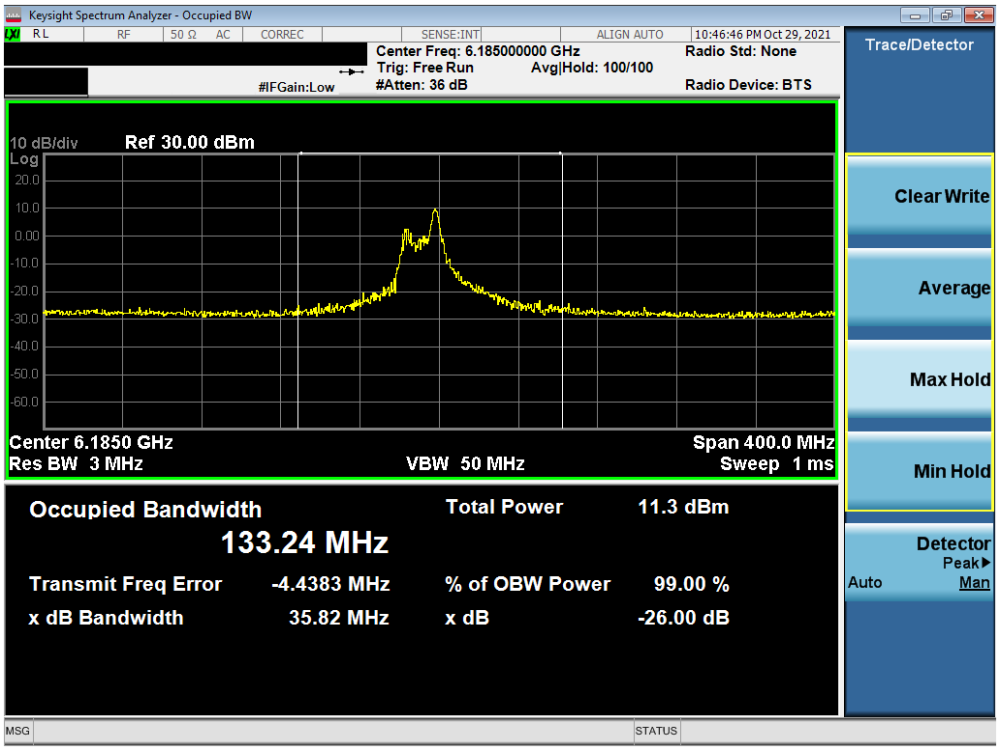

**Plot 7-89. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 5) – Ch. 87)**



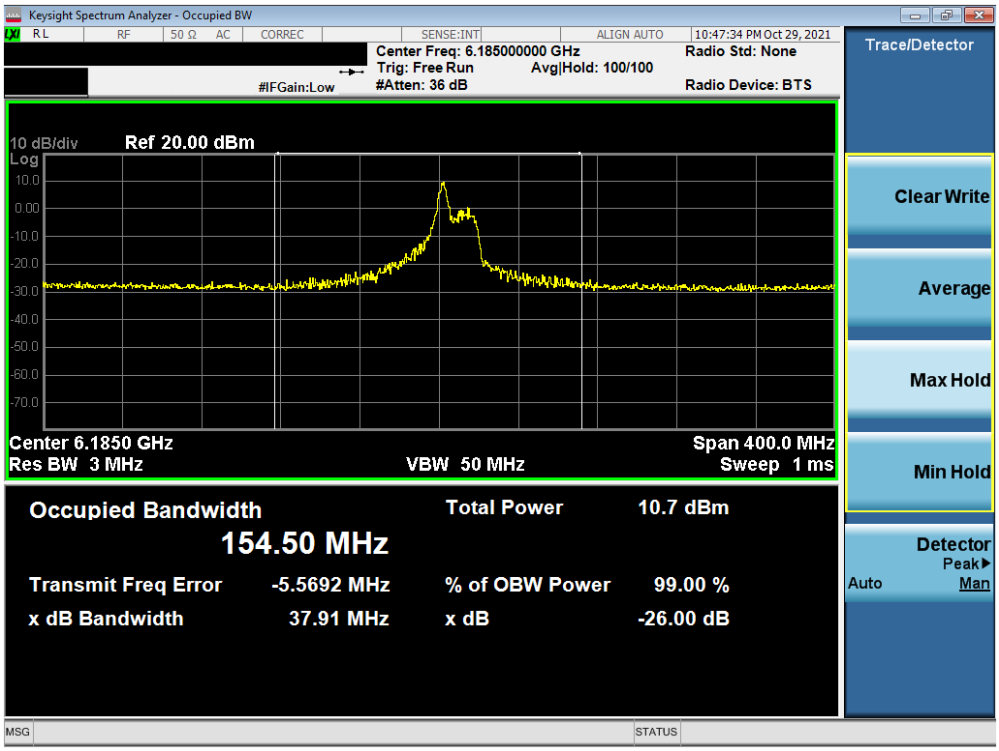

**Plot 7-90. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 15)**



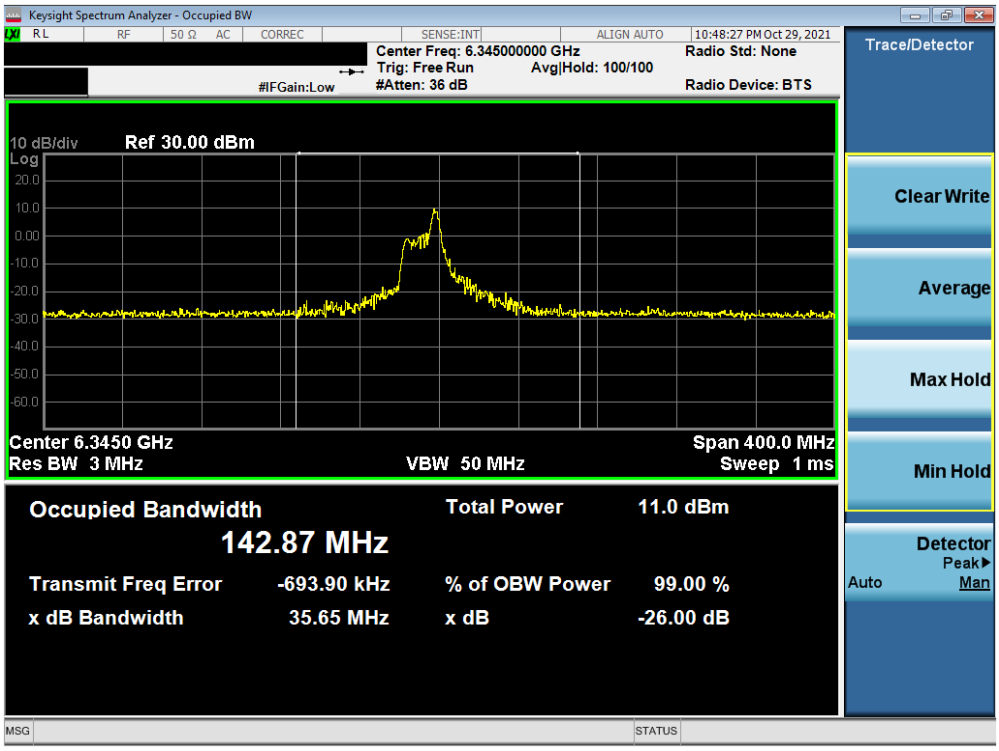

**Plot 7-91. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 15)**



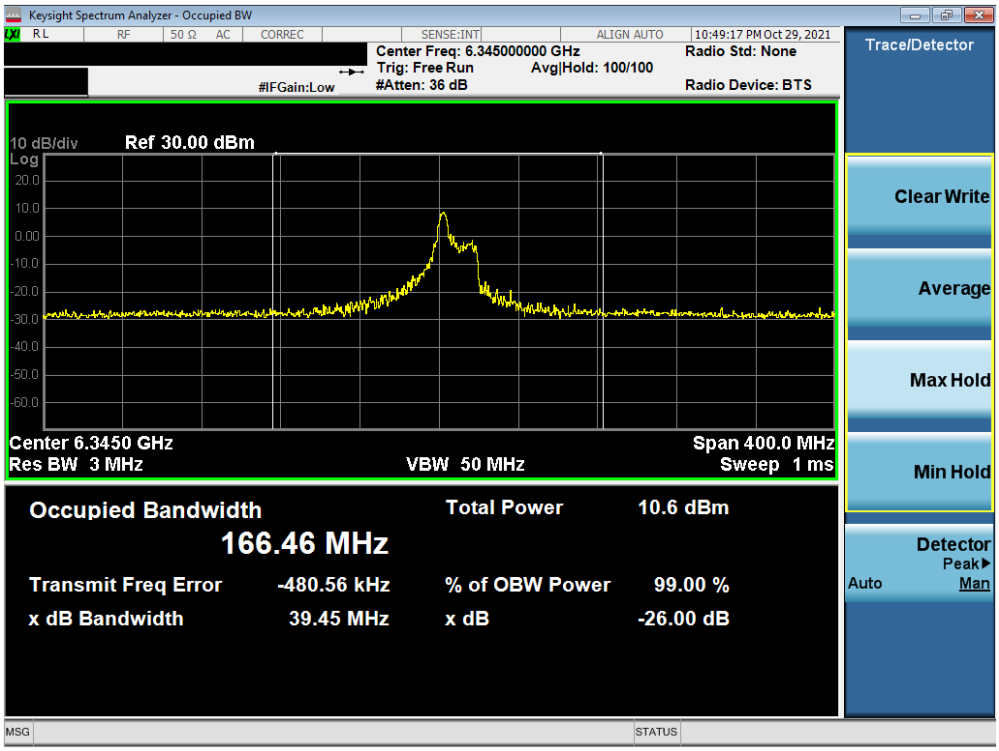

**Plot 7-92. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 47)**



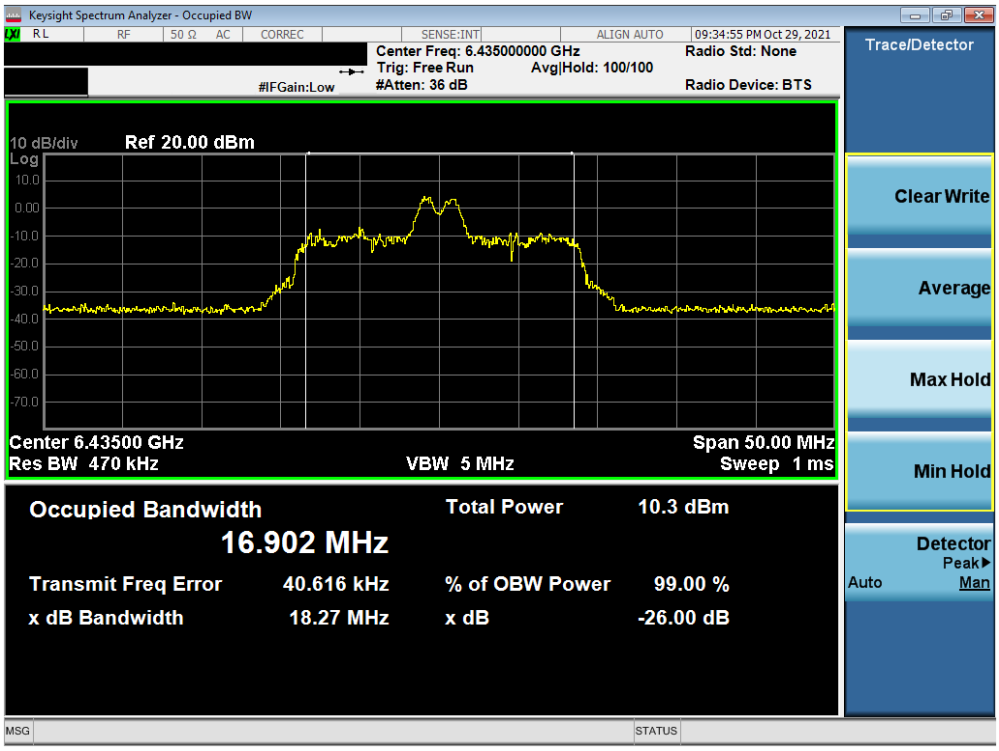

**Plot 7-93. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 47)**



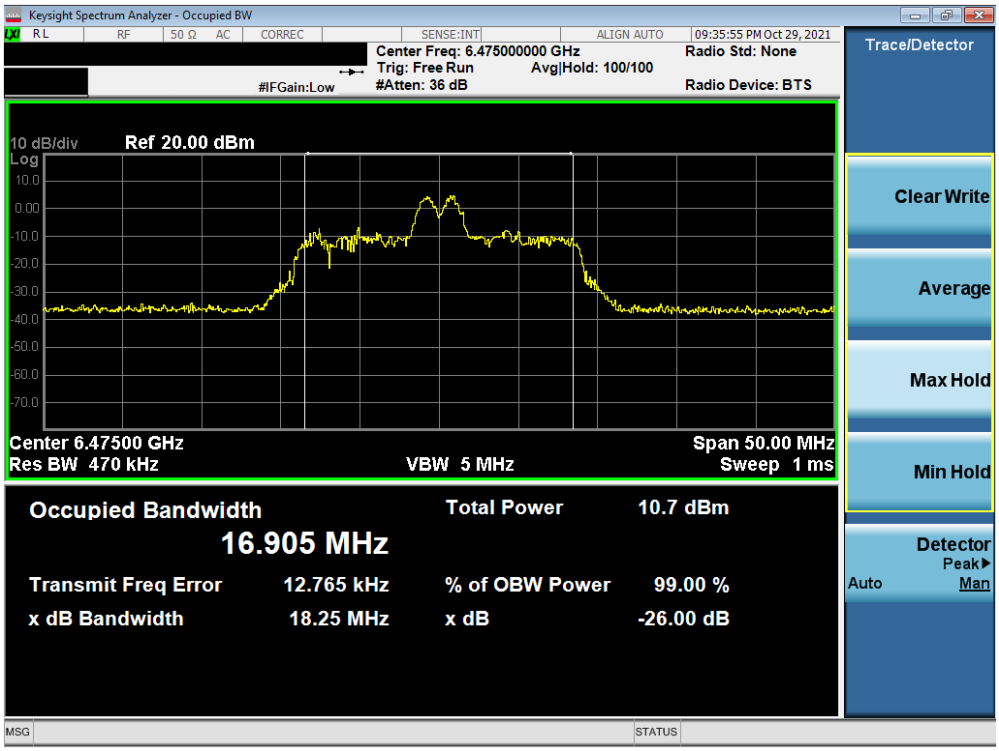

**Plot 7-94. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 5) – Ch. 79)**



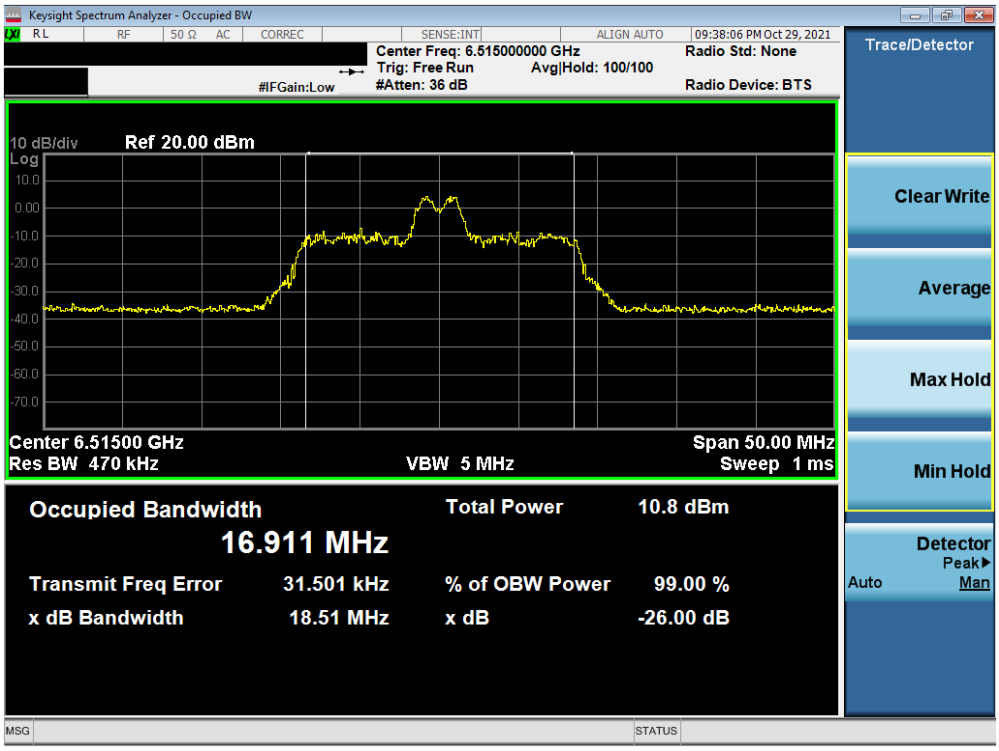

**Plot 7-95. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 5) – Ch. 79)**



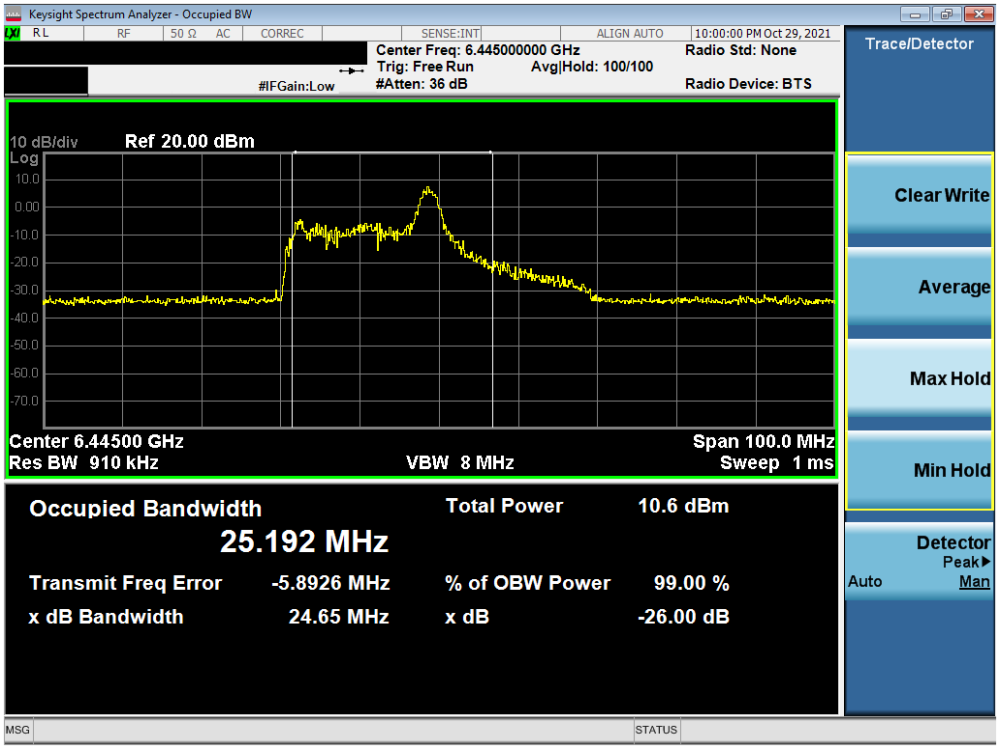

**Plot 7-96. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 97)**



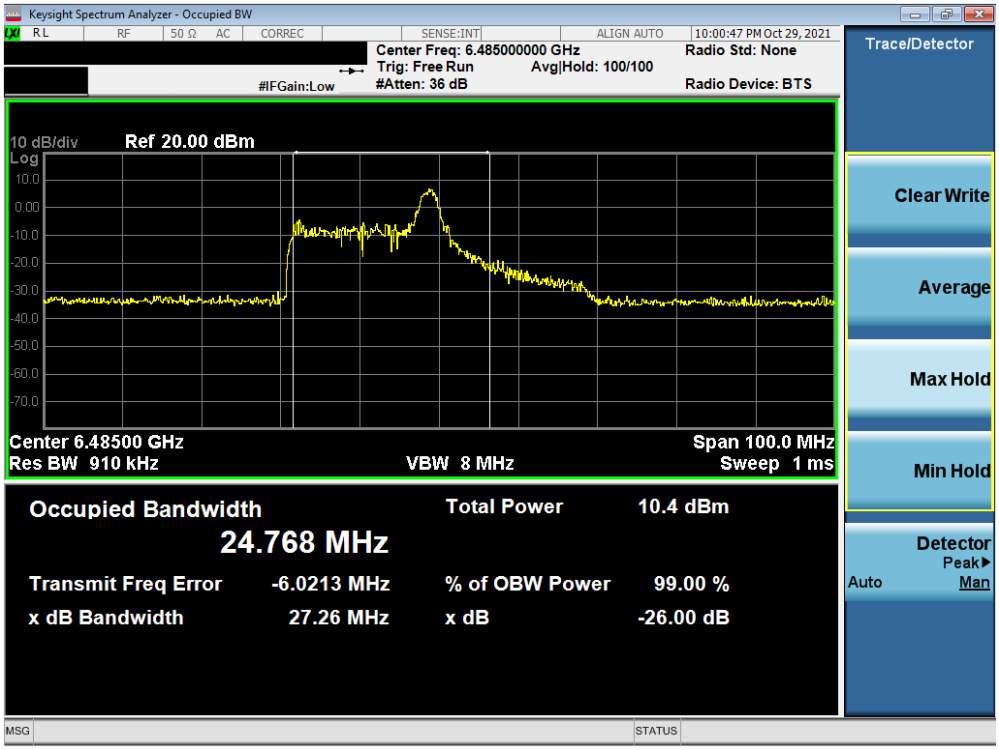

**Plot 7-97. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 105)**



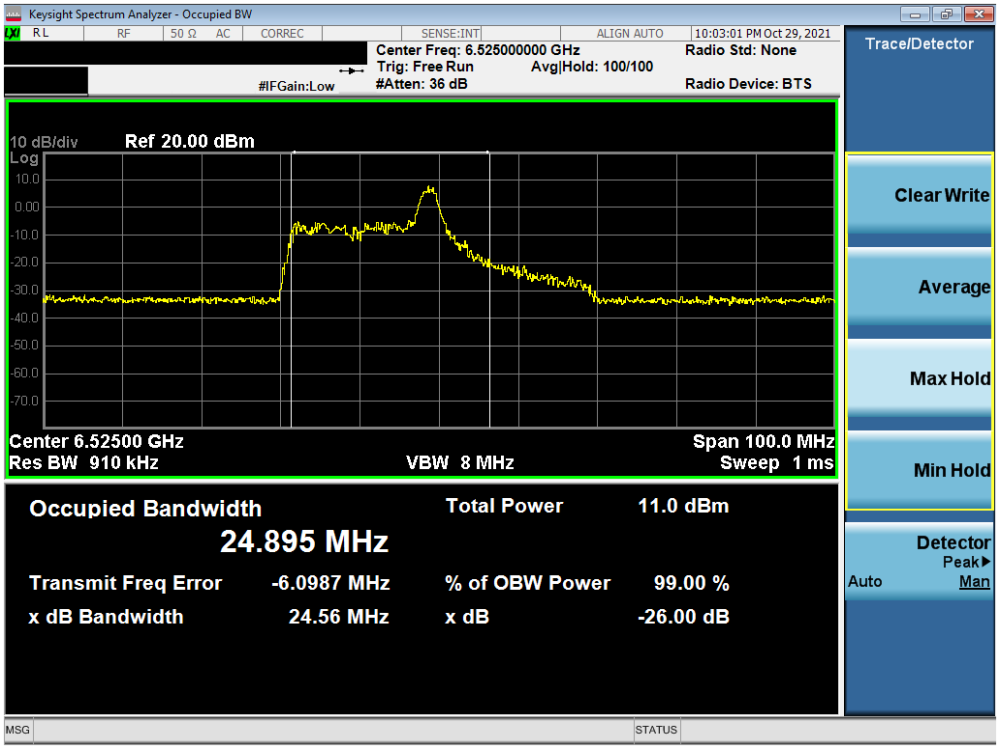

**Plot 7-98. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 113)**



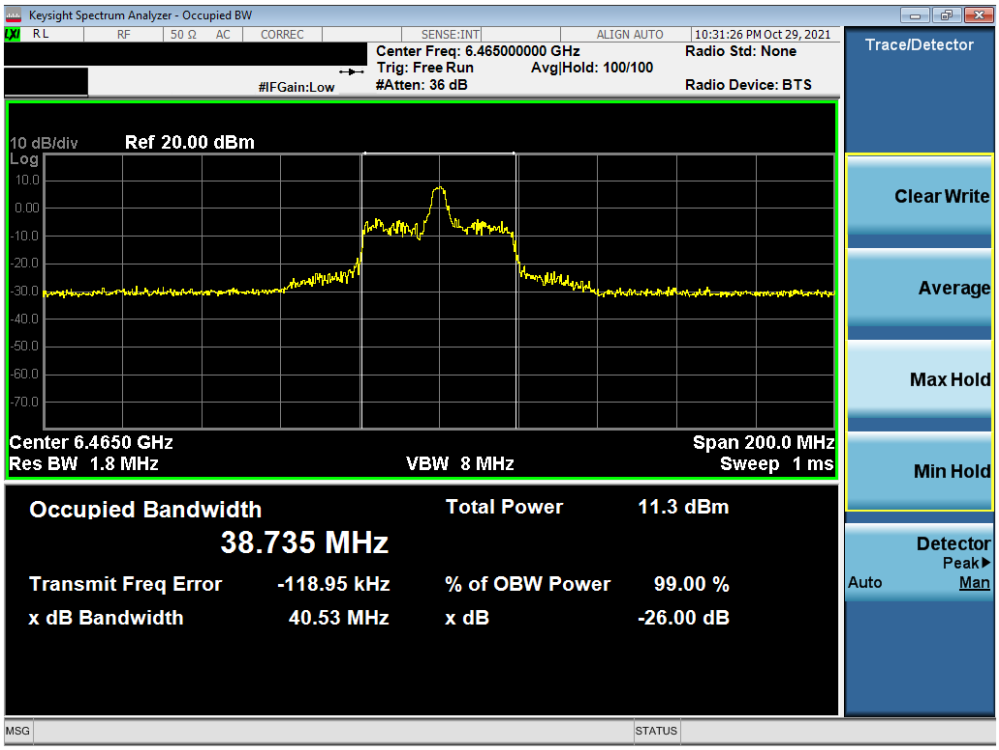

**Plot 7-99. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 99)**



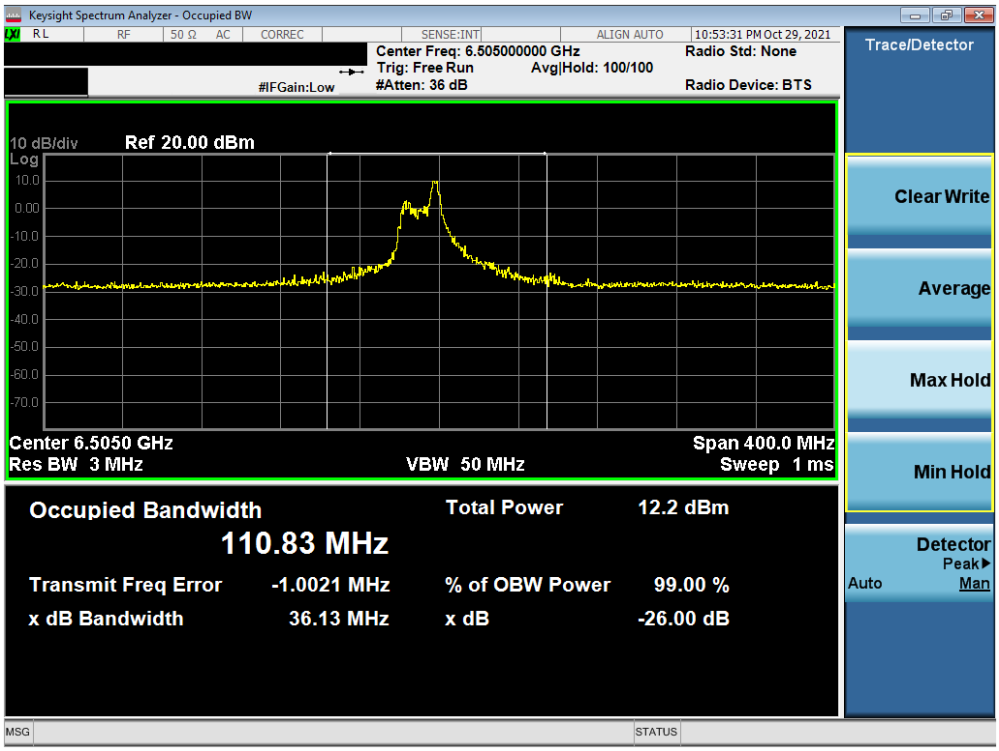

**Plot 7-100. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 107)**



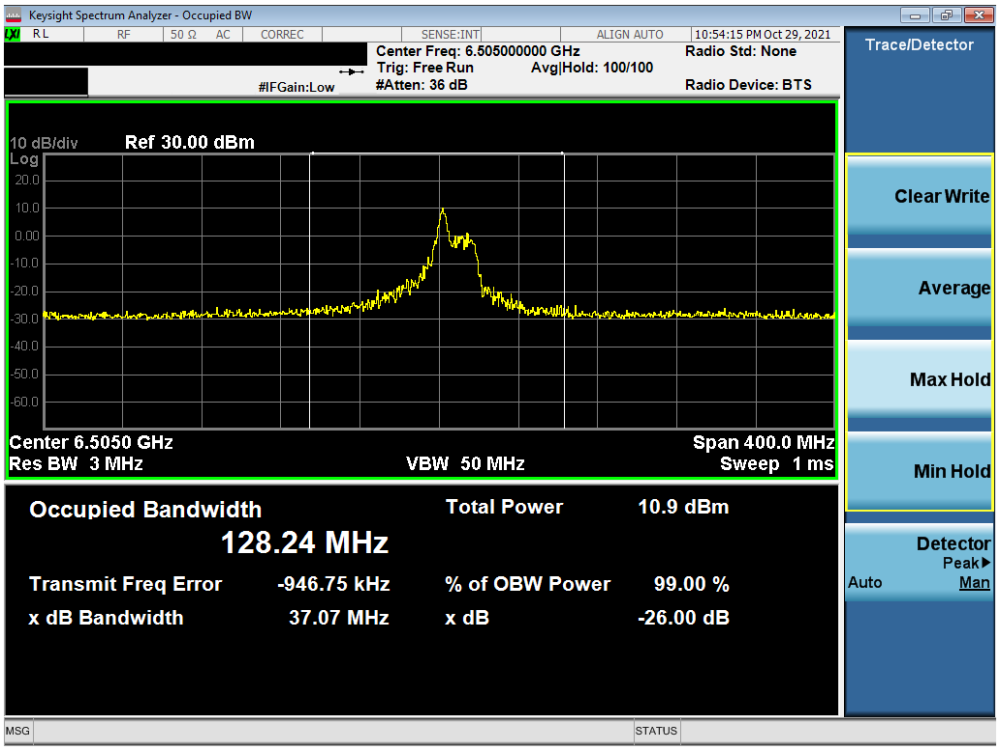

**Plot 7-101. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 115)**



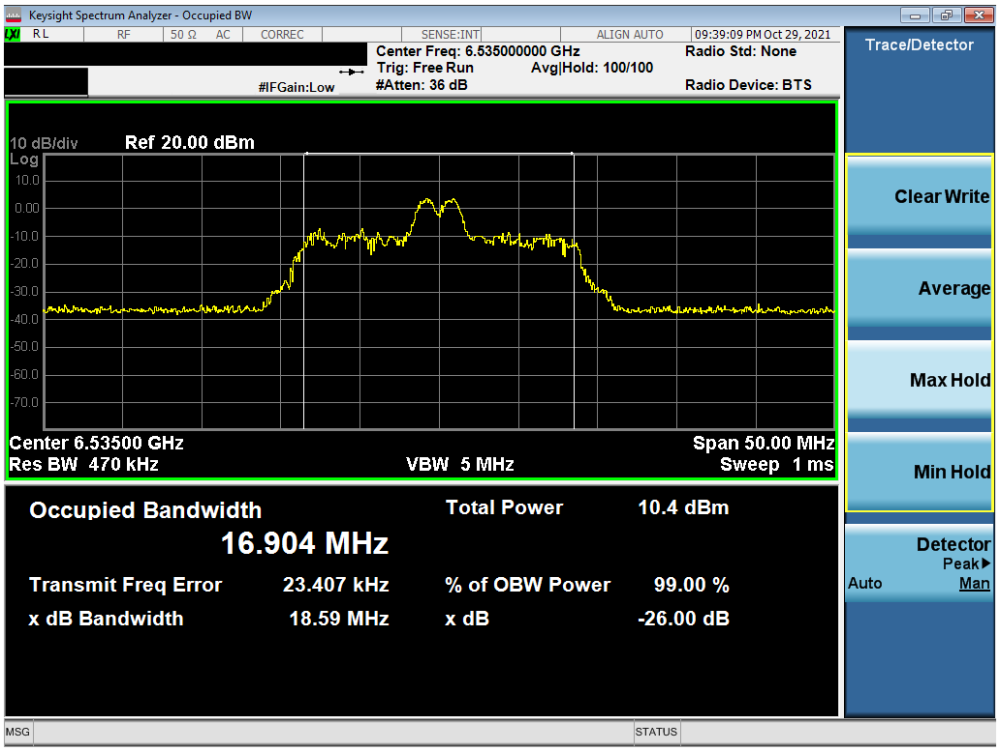

**Plot 7-102. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 6) – Ch. 103)**



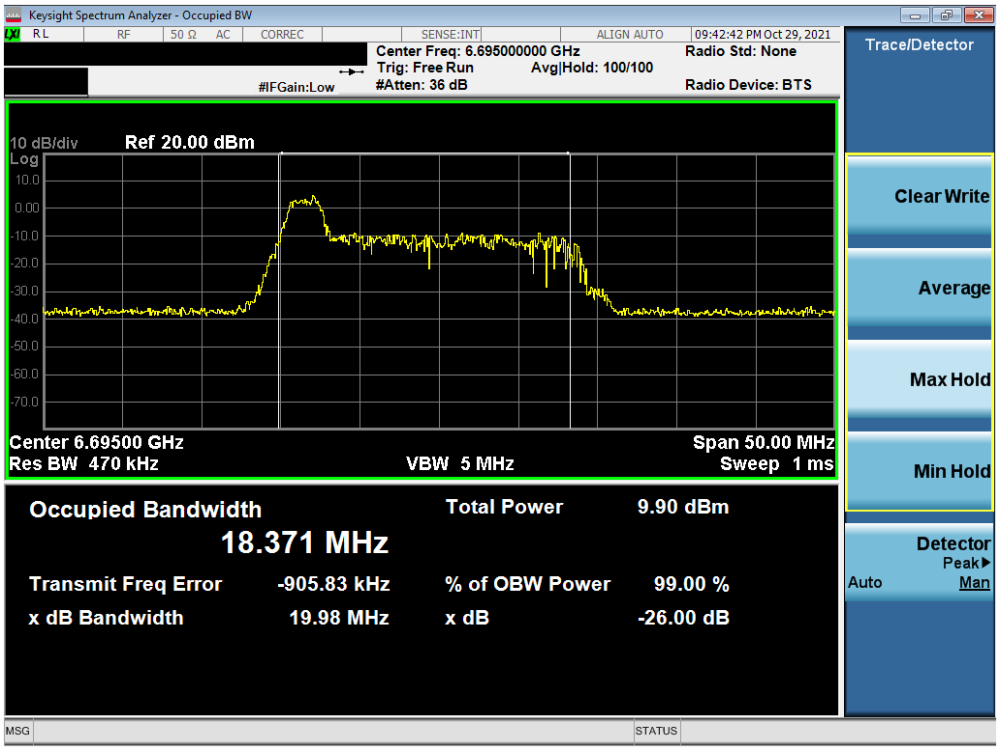

**Plot 7-103. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 6) – Ch. 111)**



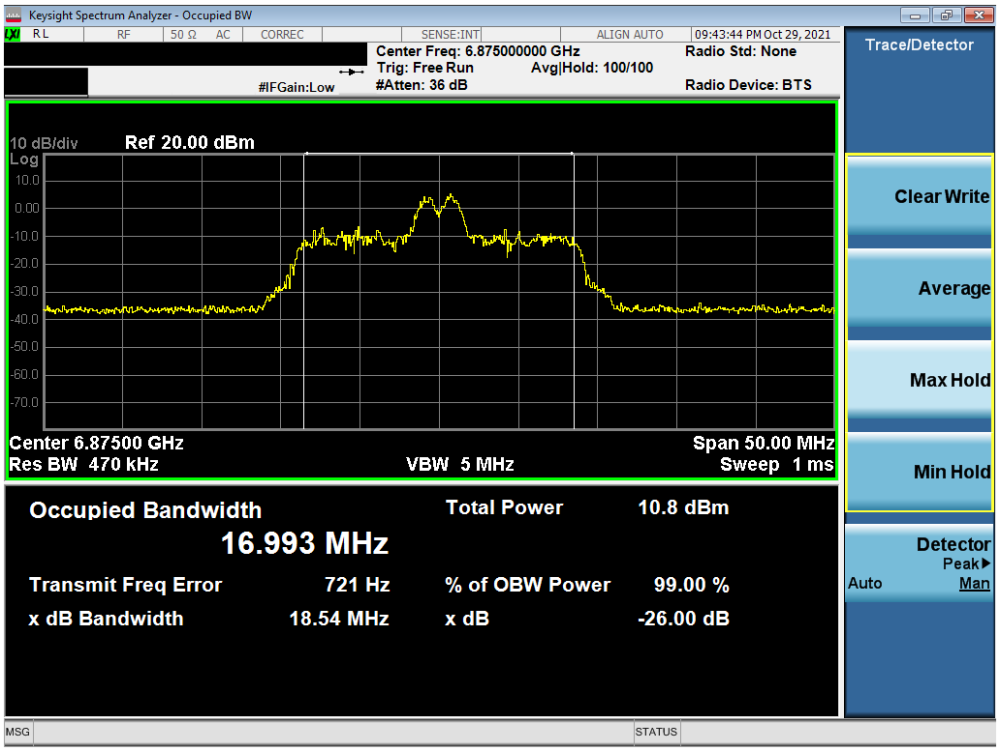

**Plot 7-104. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 6) – Ch. 111)**



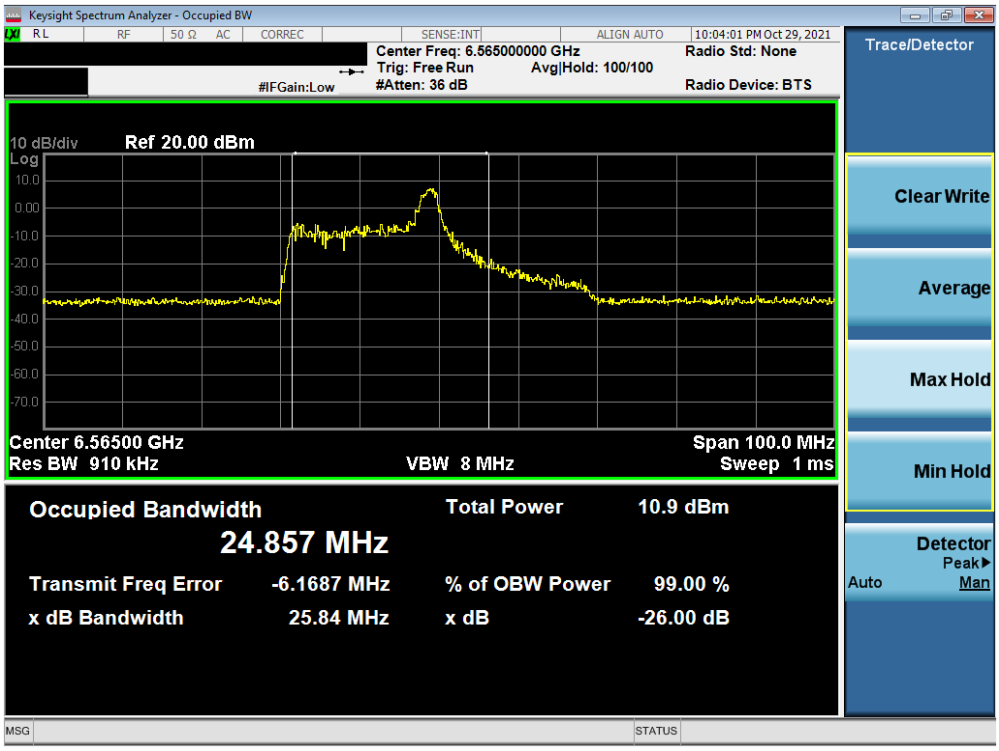

**Plot 7-105. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 117)**



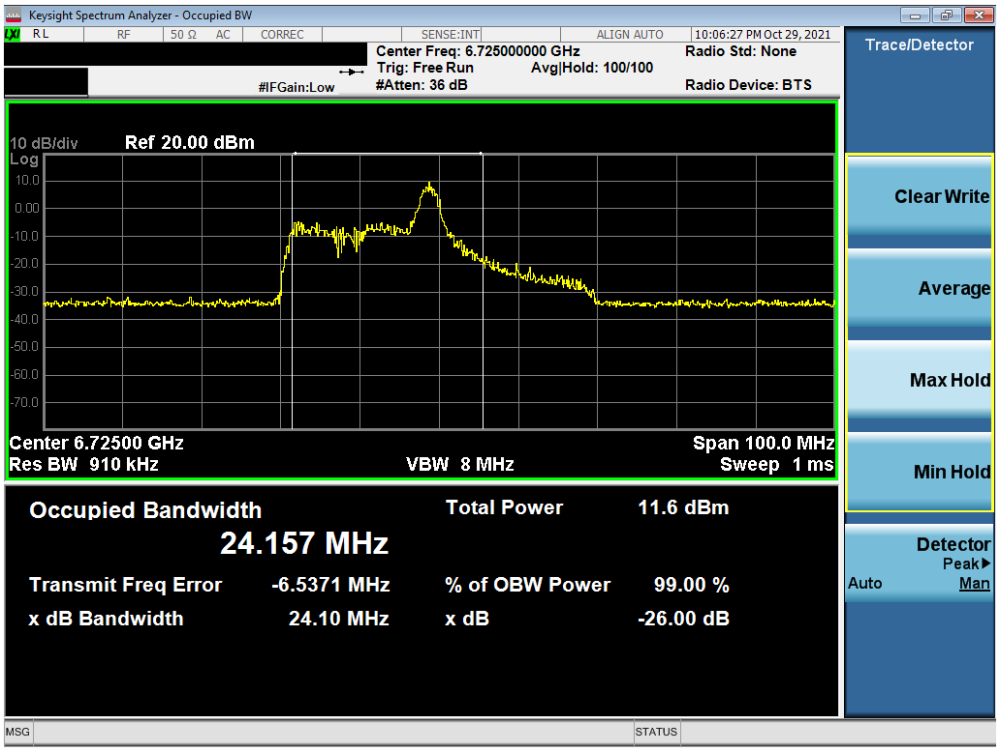

**Plot 7-106. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 149)**



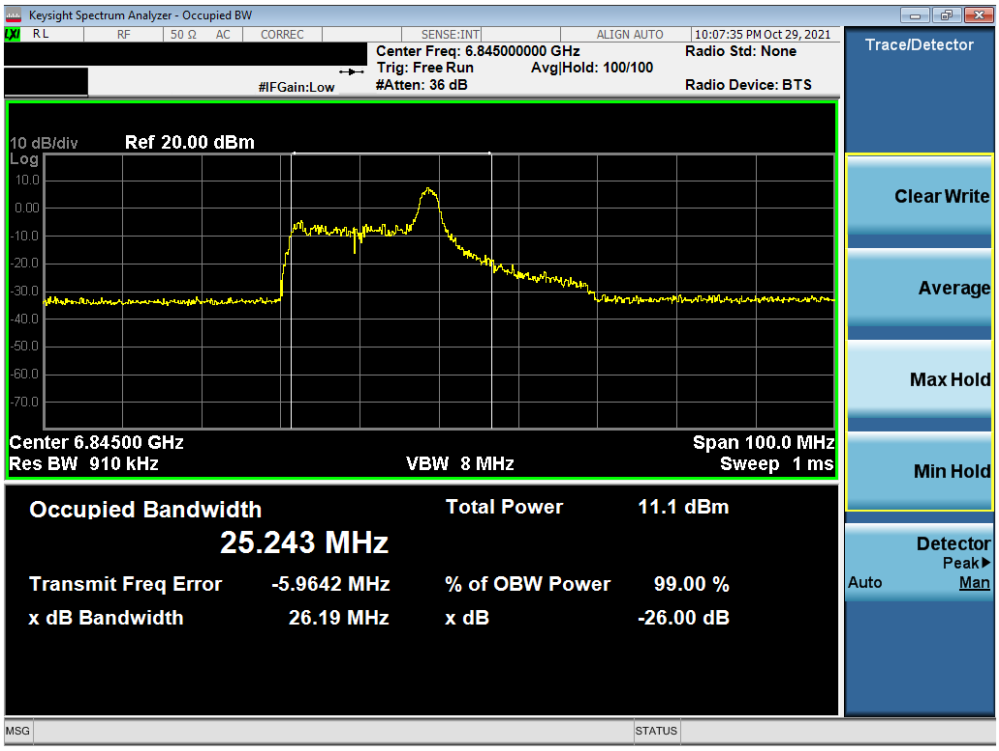

**Plot 7-107. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 185)**



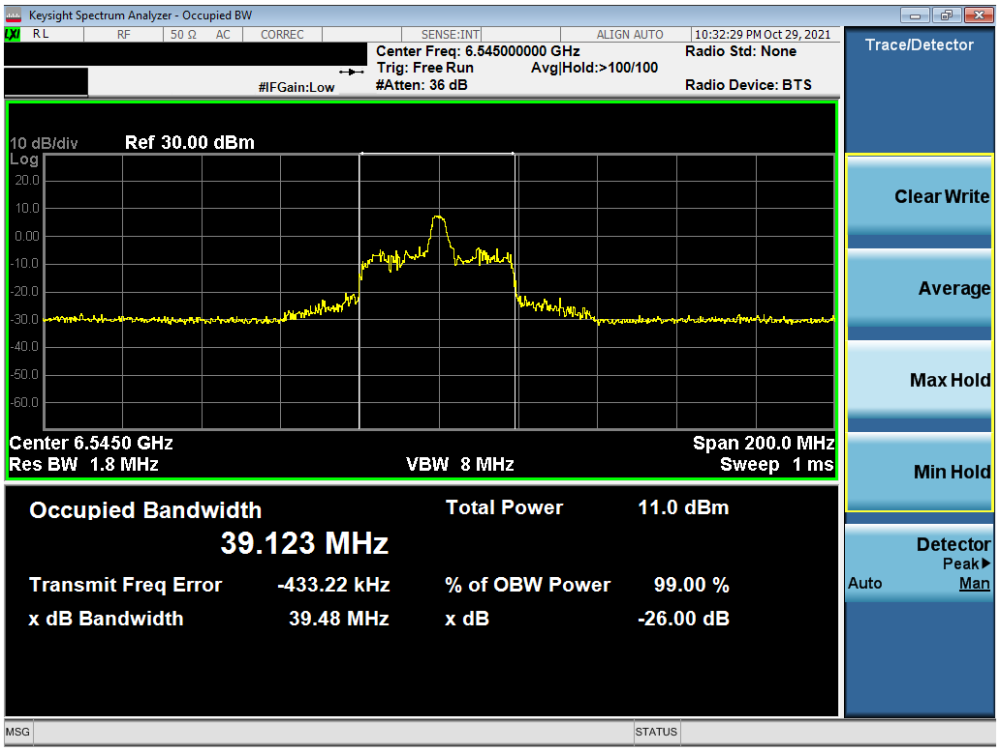

**Plot 7-108. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 123)**



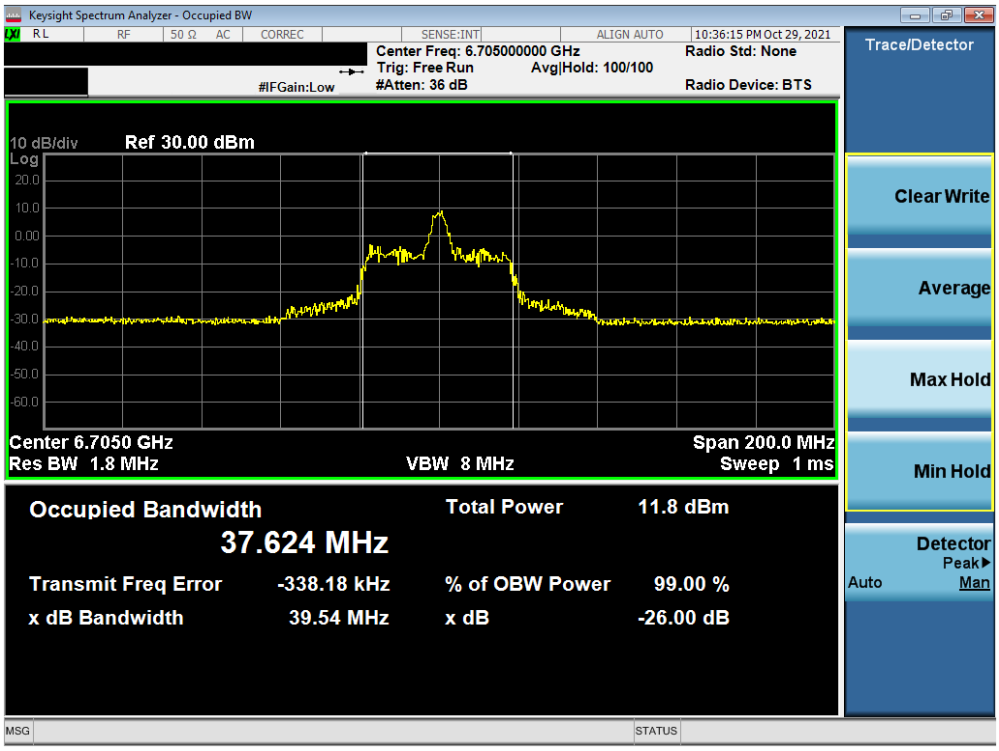

**Plot 7-109. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 155)**



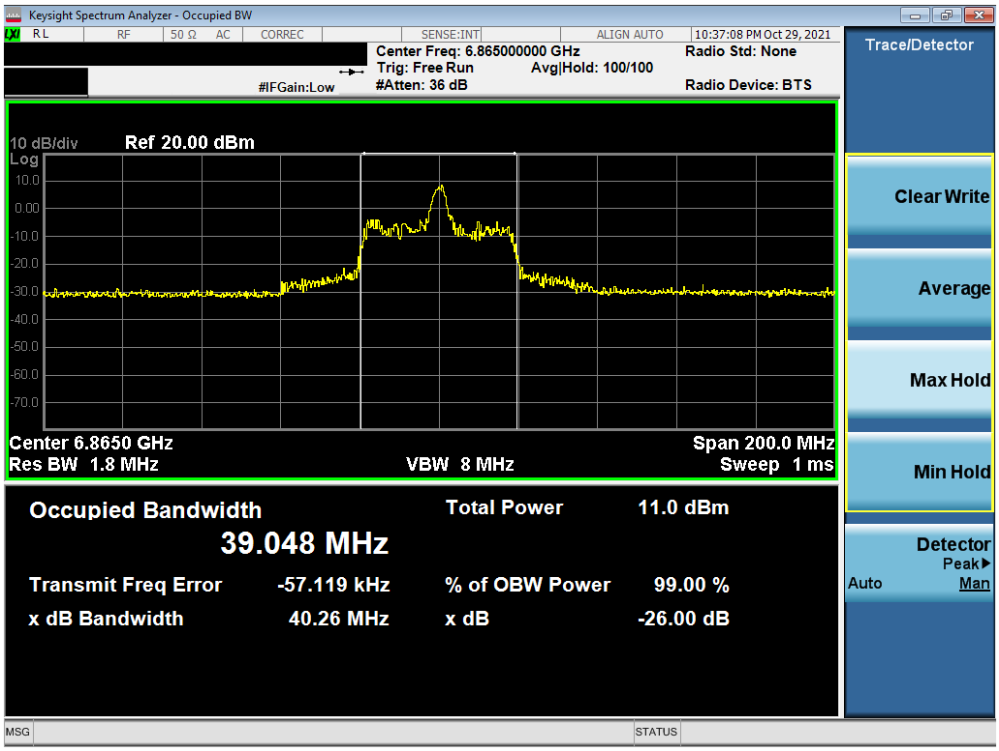

**Plot 7-110. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 179)**



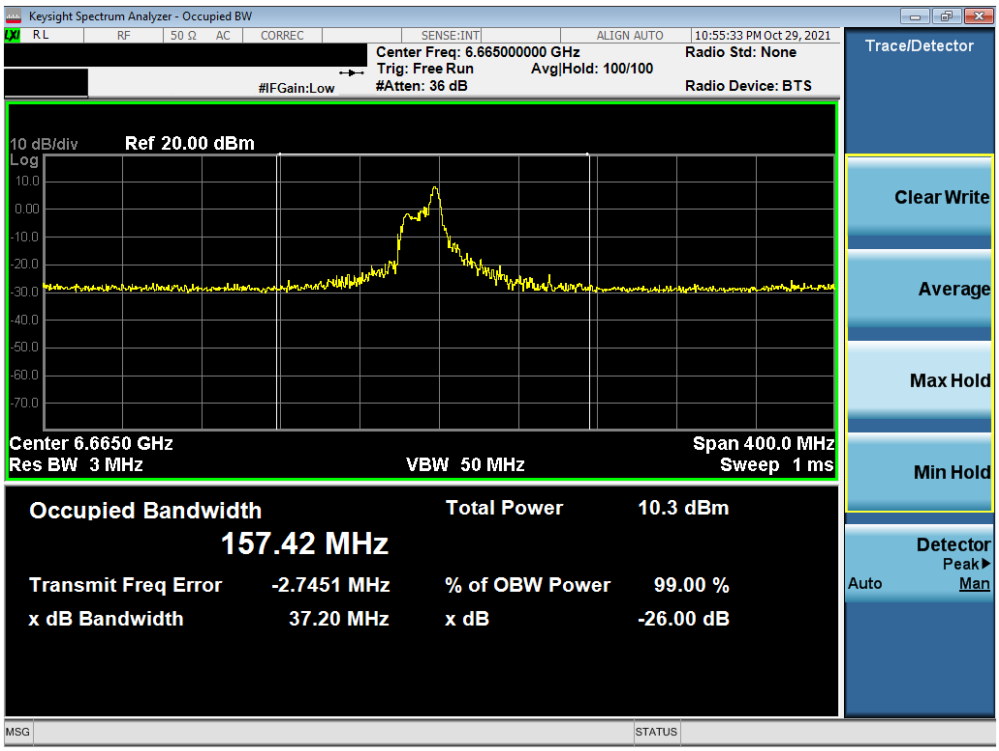

**Plot 7-111. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 119)**



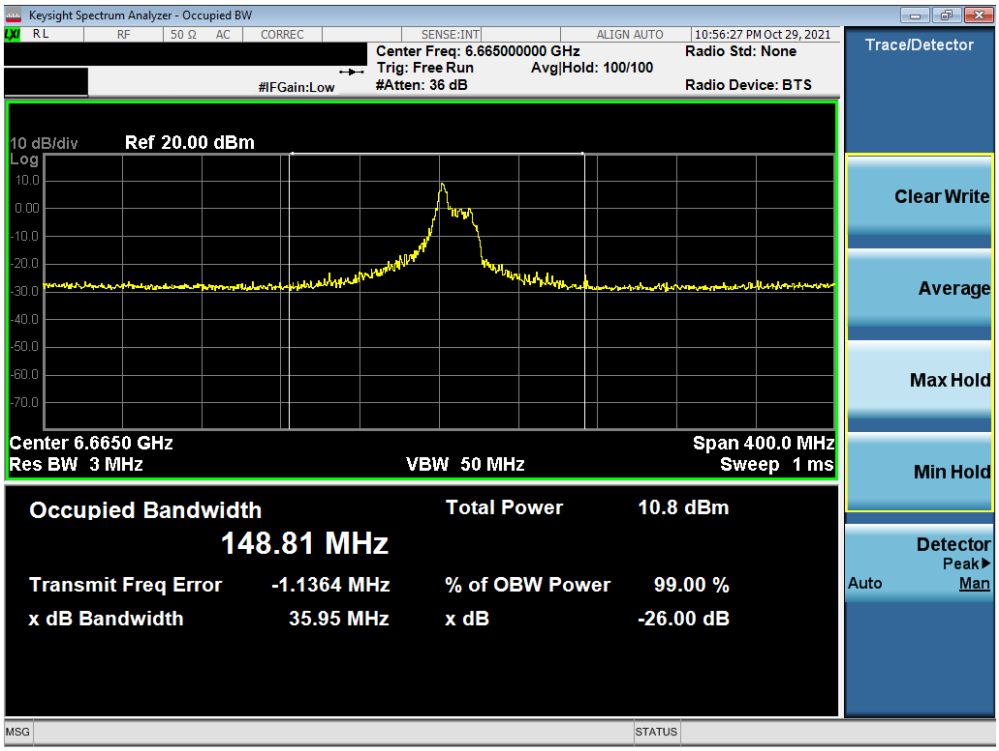

**Plot 7-112. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 151)**



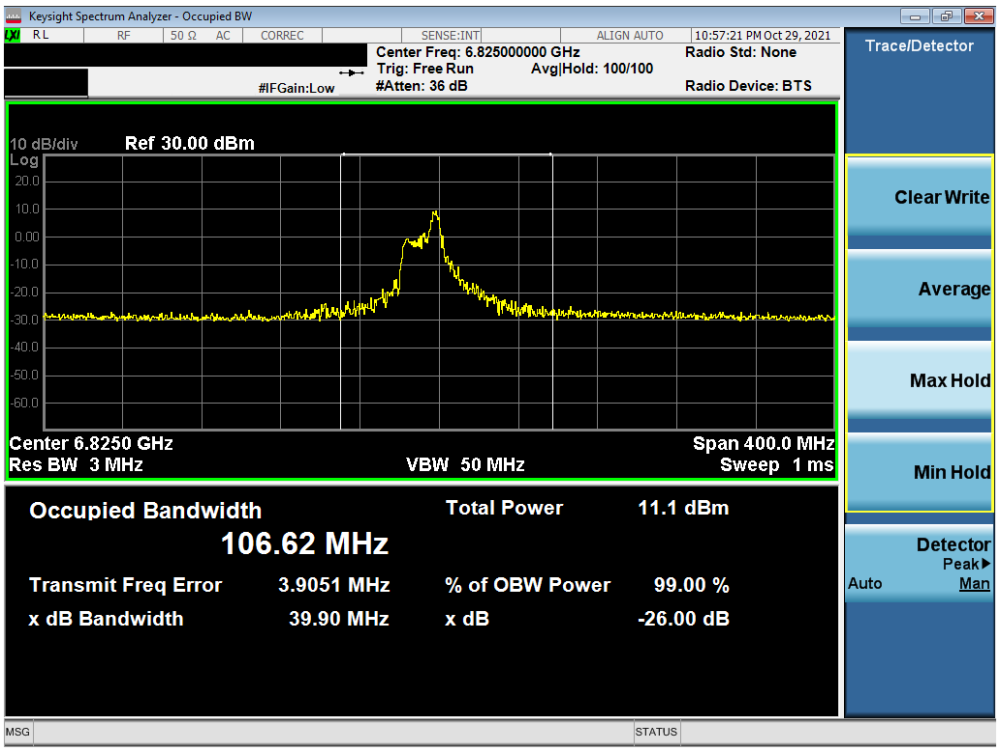

**Plot 7-113. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 7) – Ch. 183)**



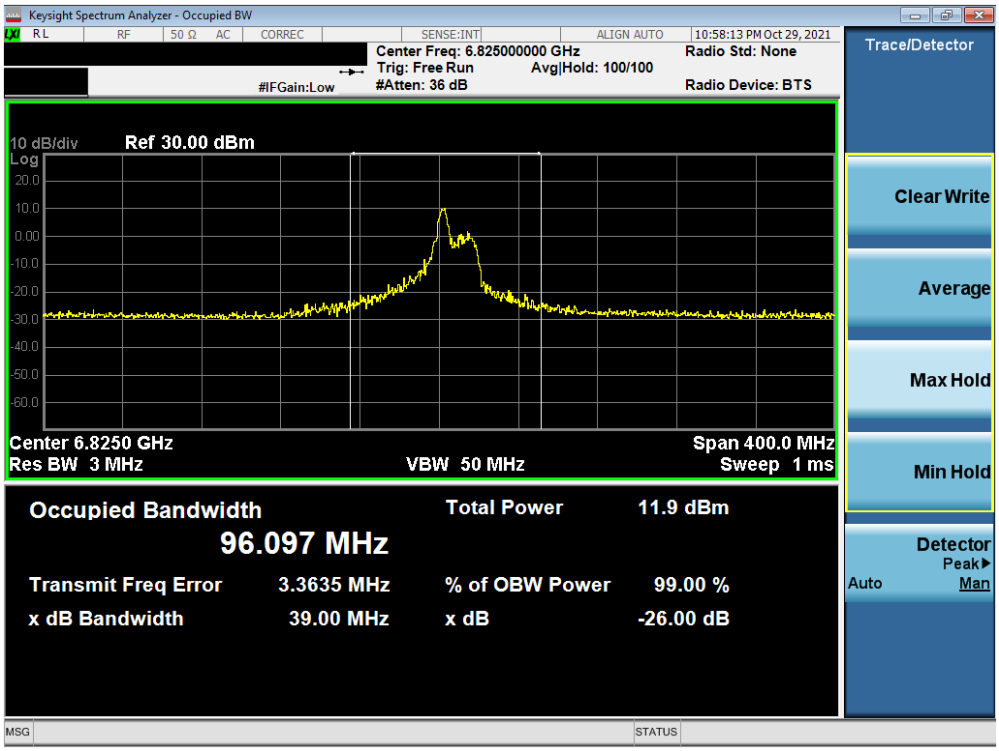

**Plot 7-114. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 7) – Ch. 143)**



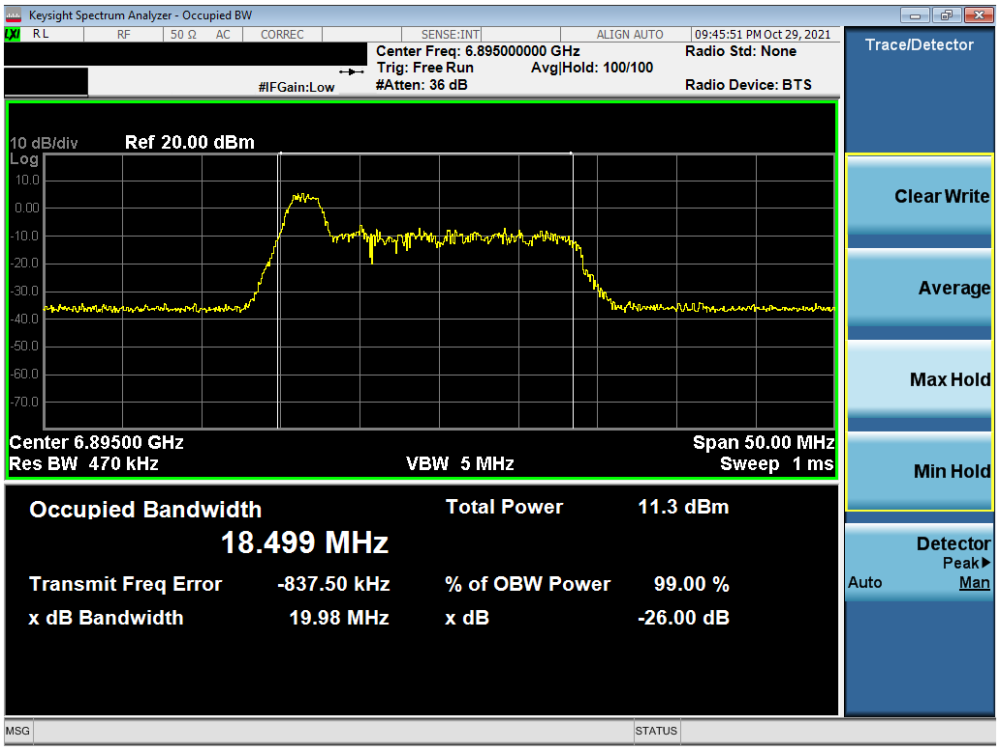

**Plot 7-115. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 7) – Ch. 143)**



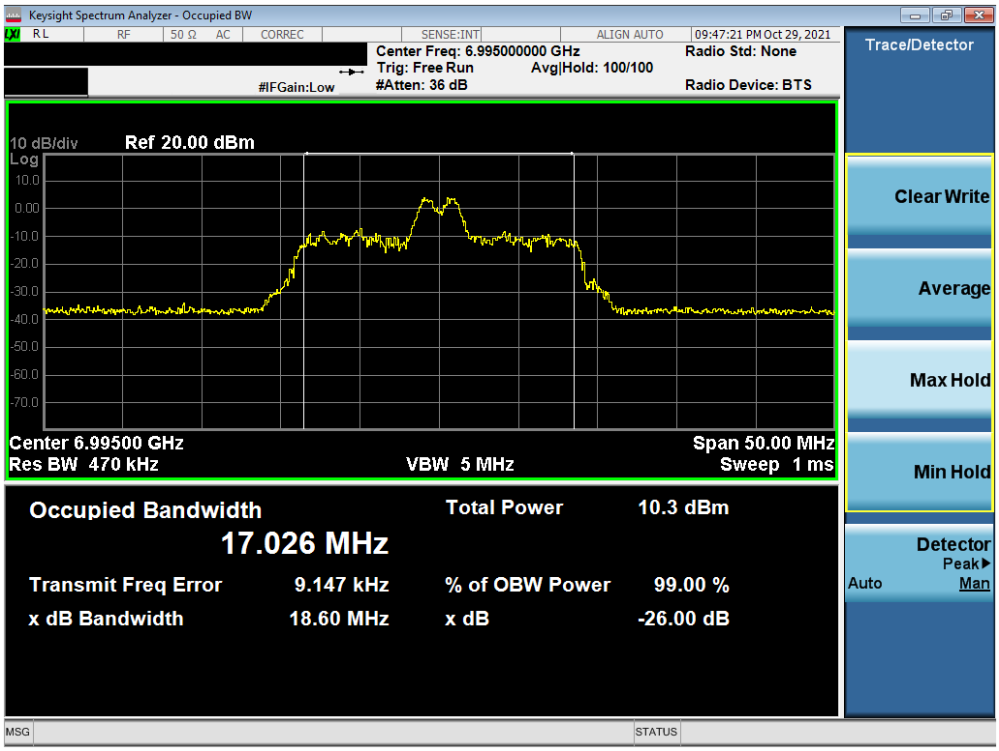

**Plot 7-116. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 7) – Ch. 175)**



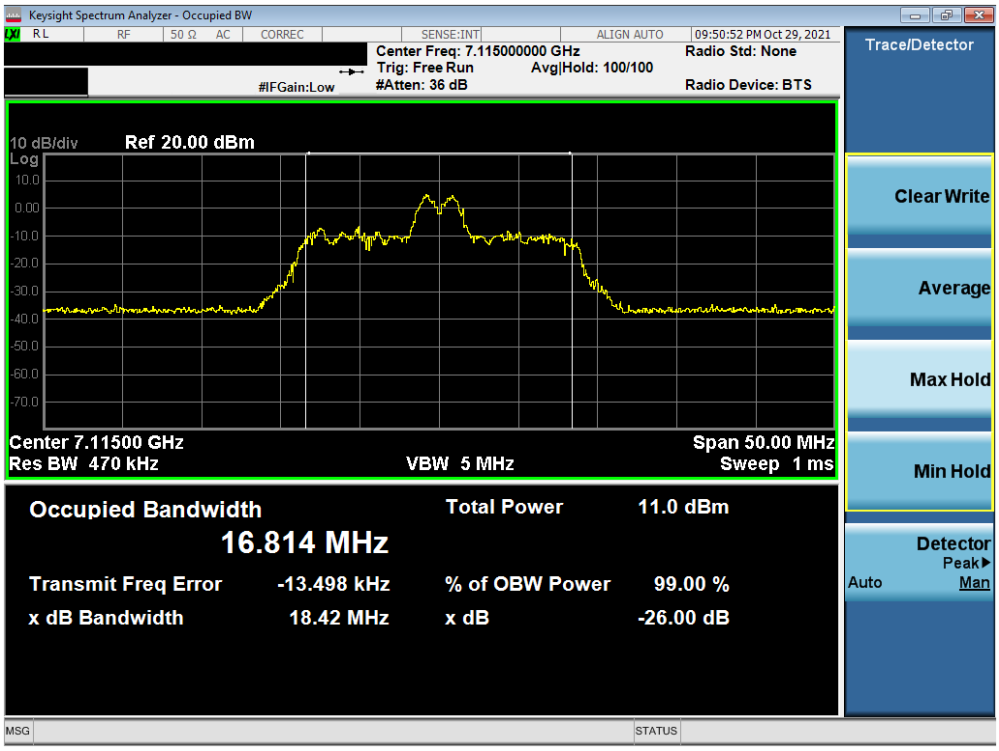

**Plot 7-117. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 7) – Ch. 175)**



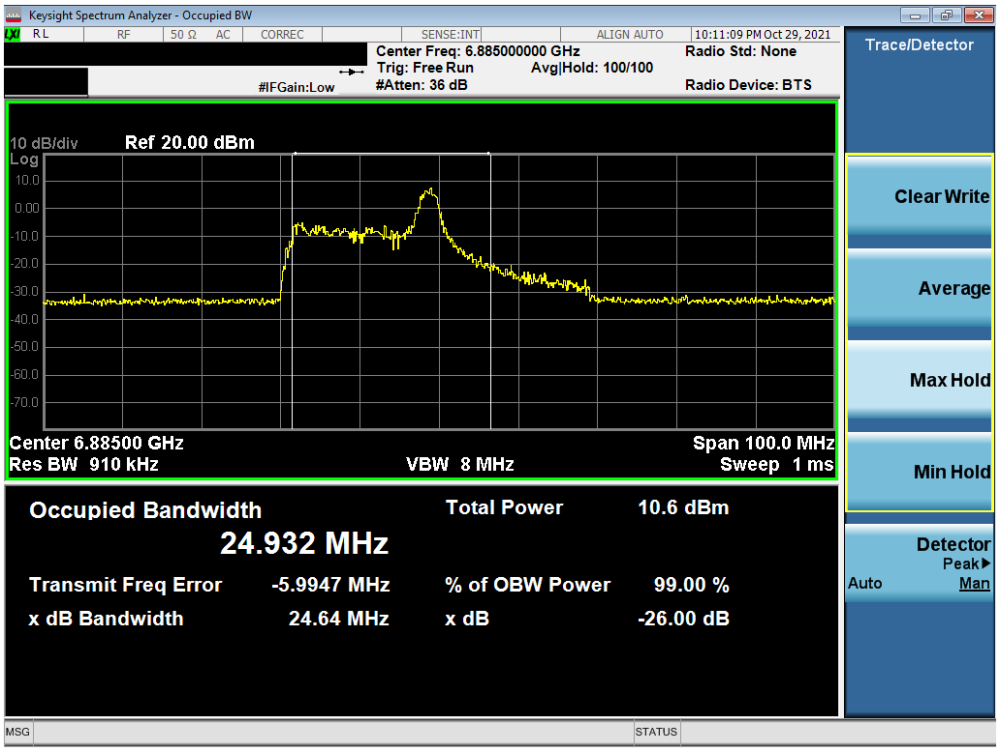

**Plot 7-118. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 189)**



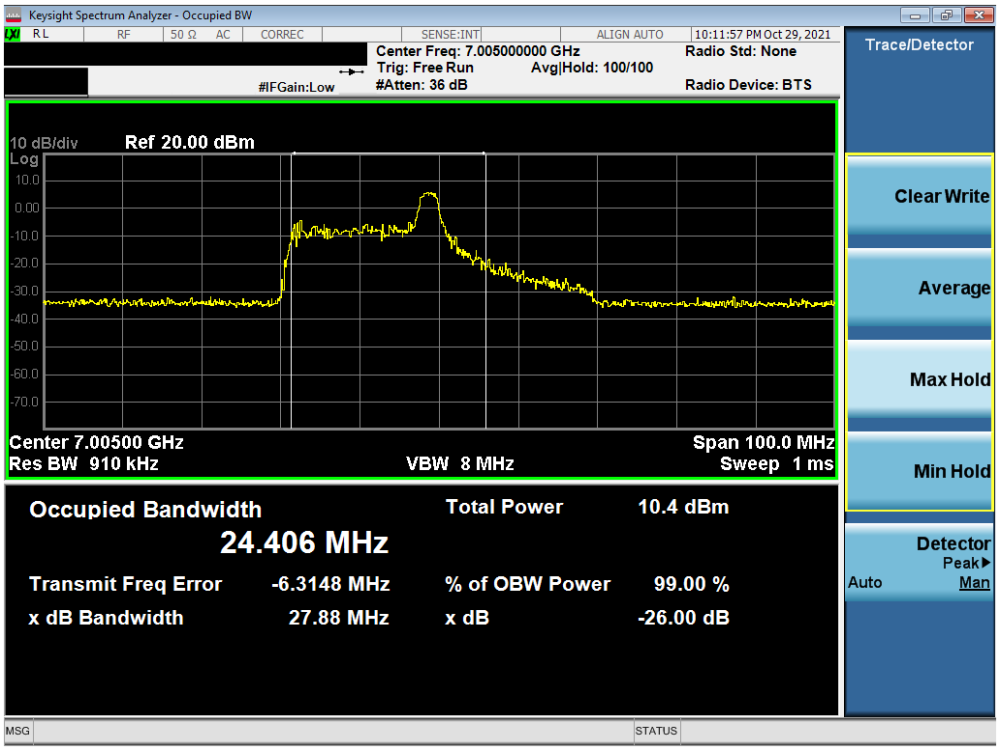

**Plot 7-119. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 209)**



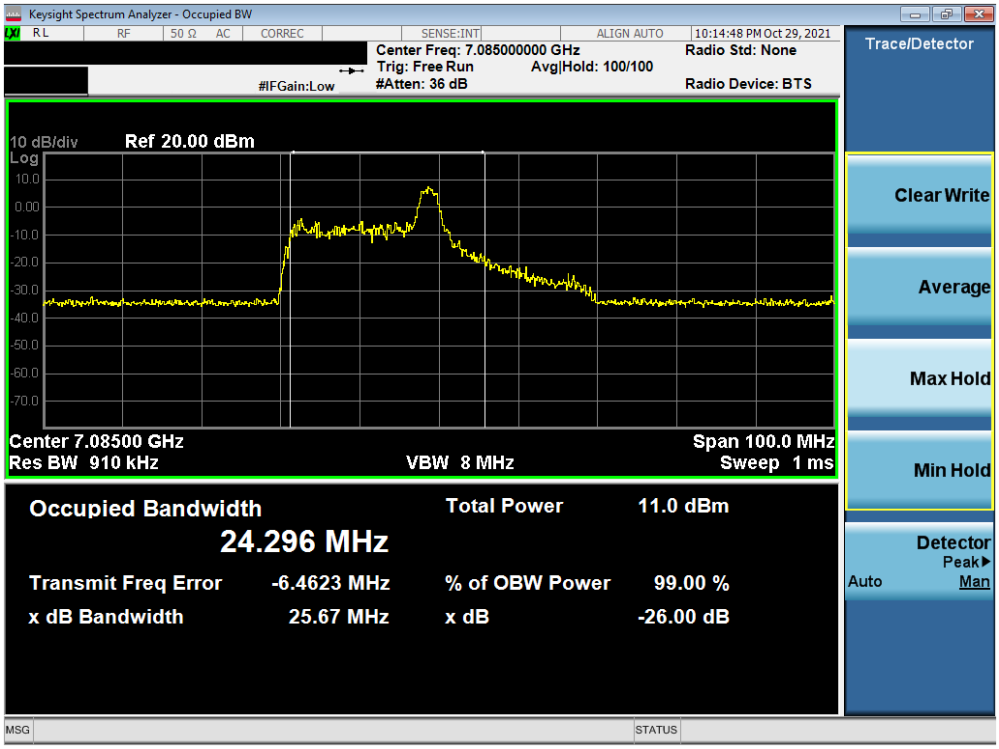

**Plot 7-120. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 233)**



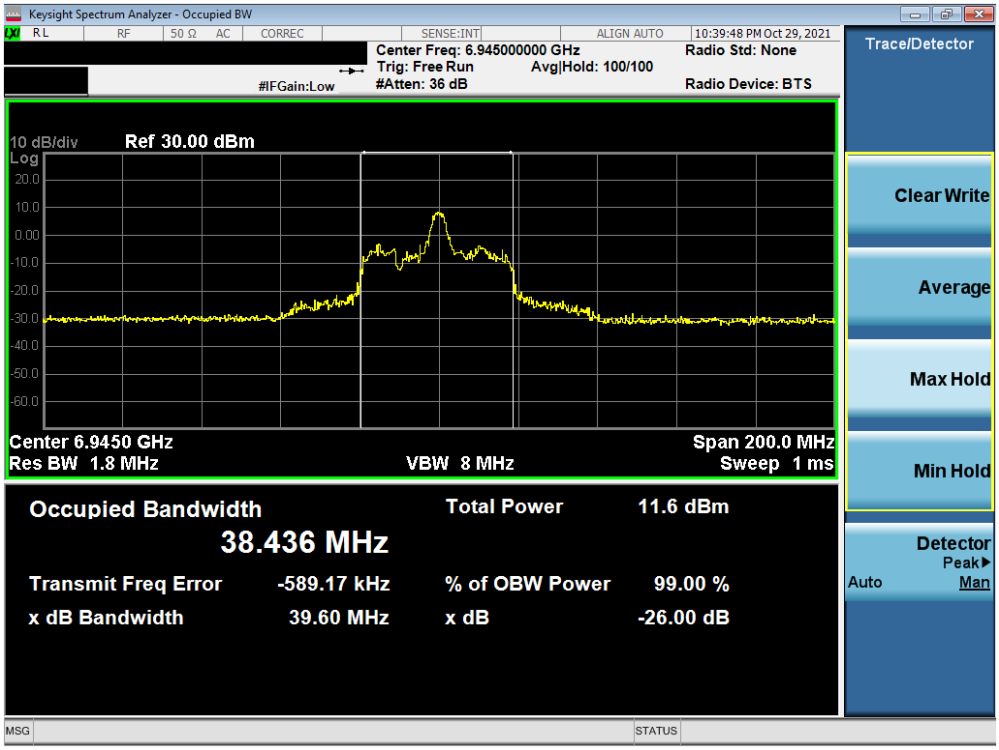

**Plot 7-121. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 187)**



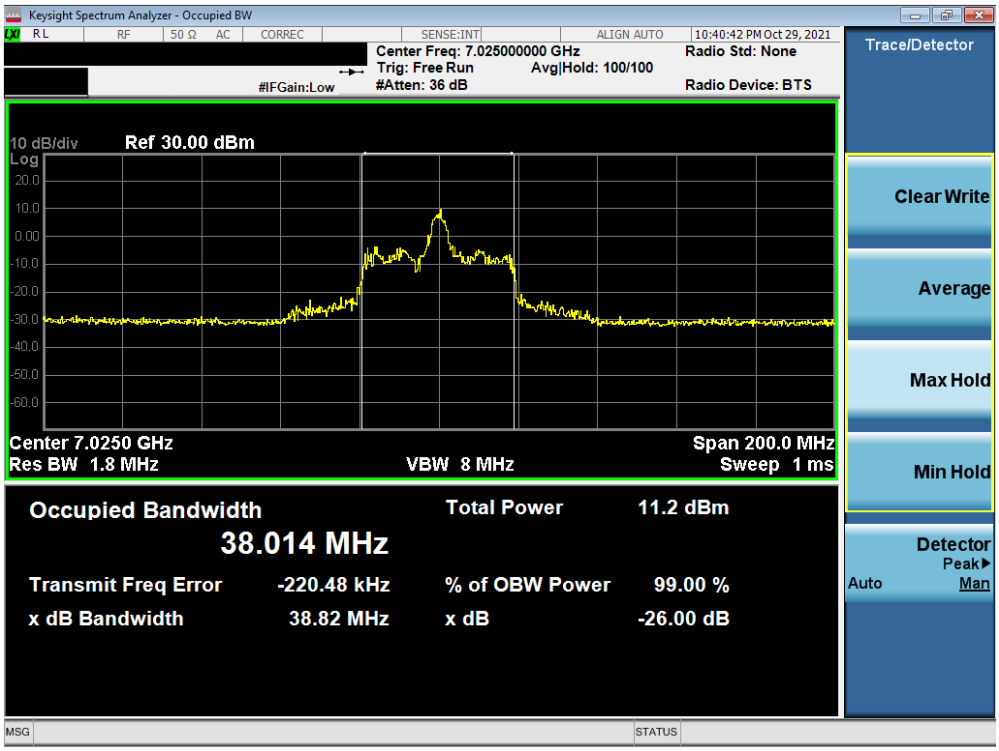

**Plot 7-122. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 211)**



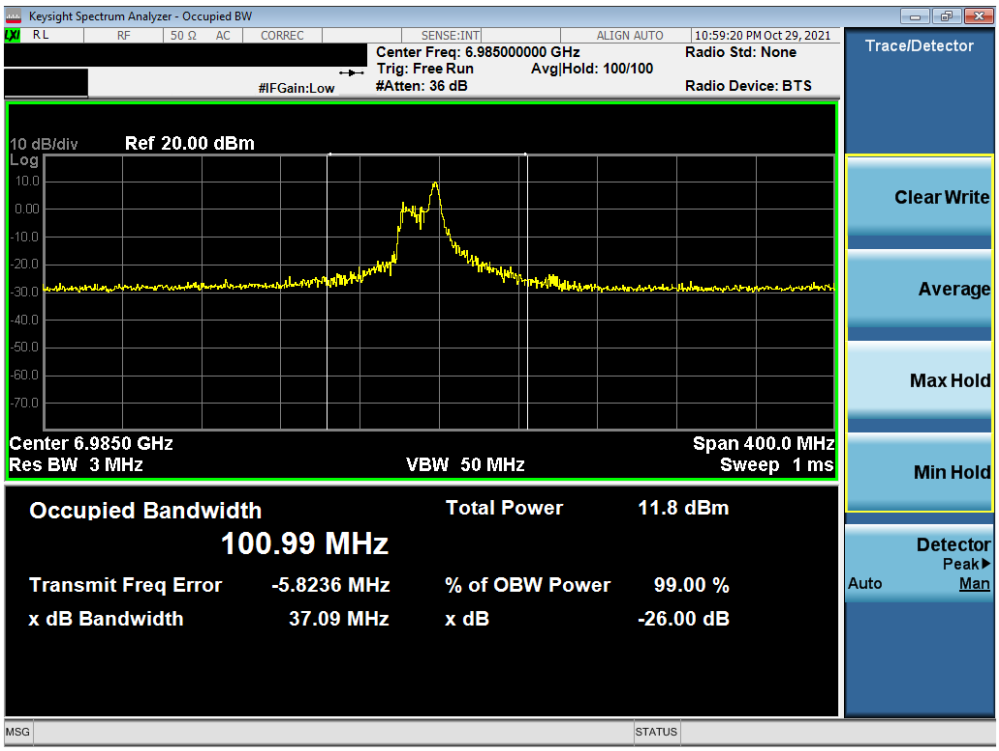

**Plot 7-123. 26dB Bandwidth Plot MIMO ANT2 (40MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 227)**



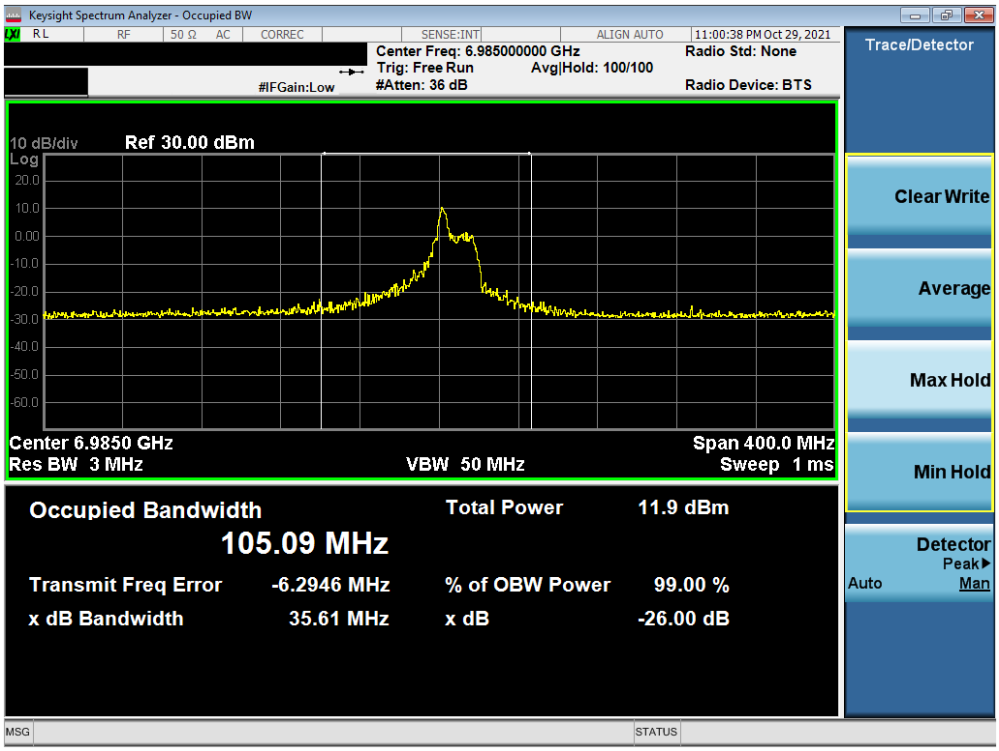

**Plot 7-124. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 199)**




**Plot 7-125. 26dB Bandwidth Plot MIMO ANT2 (80MHz BW 802.11ax (26 Tones) (UNII Band 8) – Ch. 215)**

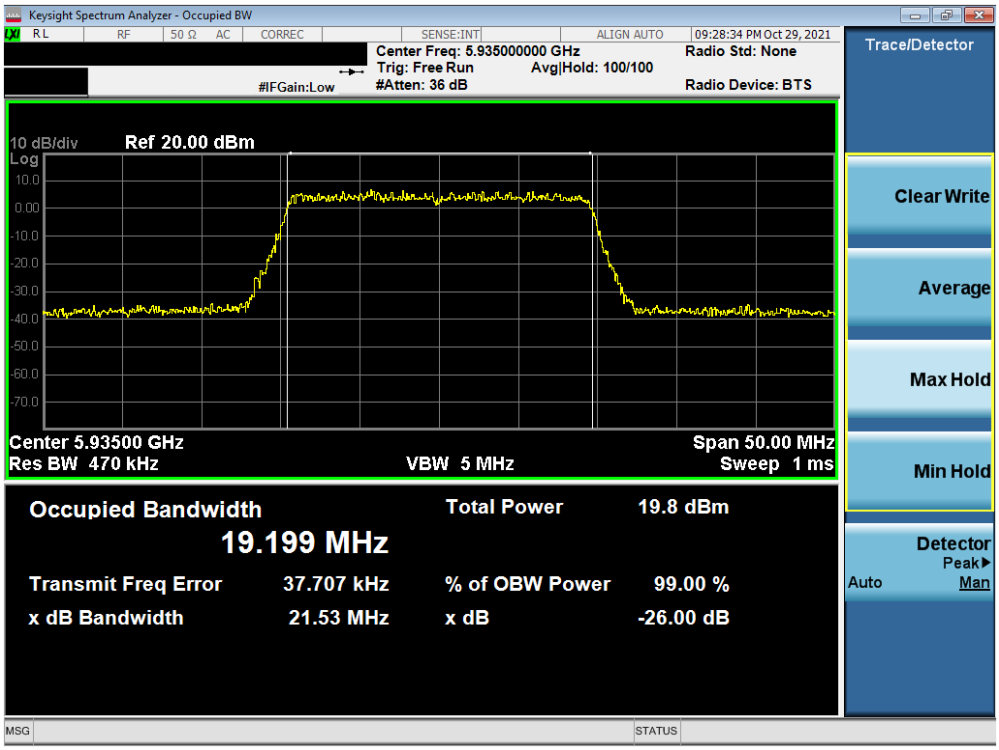



**Plot 7-126. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (L) 802.11ax (26 Tones) (UNII Band 8) – Ch. 207)**

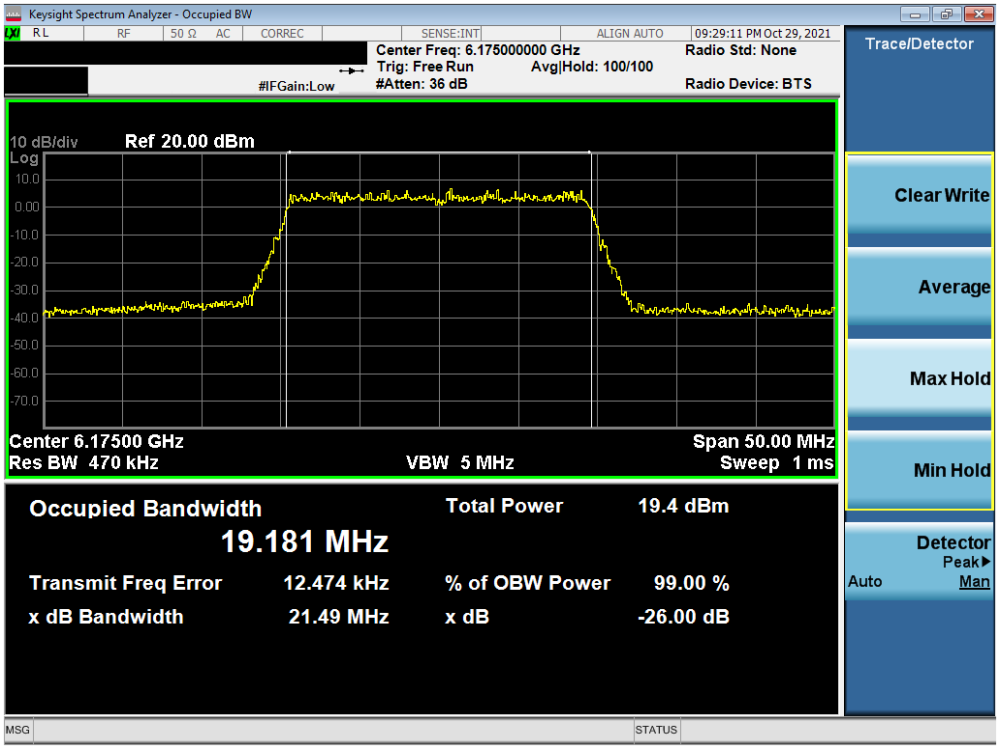



**Plot 7-127. 26dB Bandwidth Plot MIMO ANT2 (160MHz BW (U) 802.11ax (26 Tones) (UNII Band 8) – Ch. 207)**

## MIMO Antenna-2 26dB Bandwidth Measurements (FULL Tones)




**Plot 7-128. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (FULL Tones) (UNII Band 5) – Ch. 2)**




**Plot 7-129. 26dB Bandwidth Plot MIMO ANT2 (20MHz BW 802.11ax (FULL Tones) (UNII Band 5) – Ch. 45)**