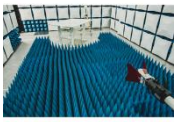
PCTEST ENGINEERING LABORATORY, INC.
18855 Adams Court, Morgan Hill, CA 95037 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



# MEASUREMENT REPORT
## LTE

**Applicant Name:**
Apple Inc.
One Apple Park Way
Cupertino, CA 95014
United States

**Date of Testing:**
05/01/2019 - 08/01/2019
**Test Site/Location:**
PCTEST Lab. Morgan Hill, CA, USA
**Test Report Serial No.:**
1C1905130008-03.BCG

| | |
|---|---|
| **FCC ID:** | **BCG-A2094** |
| **APPLICANT:** | **Apple Inc.** |

| | |
|---|---|
| **Application Type:** | Certification |
| **Model:** | A2094 |
| **EUT Type:** | Watch |
| **FCC Classification:** | PCS Licensed Transmitter Worn on Body (PCT) |
| **FCC Rule Part(s):** | 22, 24, & 27 |
| **Test Procedure(s):** | ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01 |

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 §2.947. 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

ACCREDITED
TESTING CERT#2041.02

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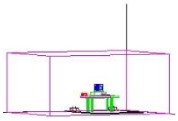
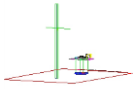


# MEASUREMENT REPORT
## FCC Part 22, 24, & 27



| Mode | FCC Rule Part | Tx Frequency (MHz) | ERP | | EIRP | | Emission Designator | Modulation |
|---|---|---|---|---|---|---|---|---|
| | | | Max. Power (mW) | Max. Power (dBm) | Max. Power (mW) | Max. Power (dBm) | | |
| LTE Band 12 | 27 | 699.7 - 715.3 | 0.305 | -5.15 | 0.501 | -3.00 | 1M11G7W | QPSK |
| LTE Band 12 | 27 | 699.7 - 715.3 | 0.269 | -5.70 | 0.442 | -3.55 | 1M11D7W | 16QAM |
| LTE Band 12 | 27 | 700.5 - 714.5 | 0.305 | -5.16 | 0.500 | -3.01 | 2M73G7W | QPSK |
| LTE Band 12 | 27 | 700.5 - 714.5 | 0.274 | -5.63 | 0.449 | -3.48 | 2M73D7W | 16QAM |
| LTE Band 12 | 27 | 701.5 - 713.5 | 0.305 | -5.16 | 0.500 | -3.01 | 4M58G7W | QPSK |
| LTE Band 12 | 27 | 701.5 - 713.5 | 0.266 | -5.75 | 0.437 | -3.60 | 4M57D7W | 16QAM |
| LTE Band 12 | 27 | 704 - 711 | 0.299 | -5.24 | 0.491 | -3.09 | 9M11G7W | QPSK |
| LTE Band 12 | 27 | 704 - 711 | 0.269 | -5.70 | 0.442 | -3.55 | 5M43D7W | 16QAM |
| LTE Band 17 | 27 | 706.5 - 713.5 | 0.305 | -5.15 | 0.501 | -3.00 | 4M58G7W | QPSK |
| LTE Band 17 | 27 | 706.5 - 713.5 | 0.271 | -5.67 | 0.445 | -3.52 | 4M57D7W | 16QAM |
| LTE Band 17 | 27 | 709 - 711 | 0.304 | -5.17 | 0.499 | -3.02 | 9M11G7W | QPSK |
| LTE Band 17 | 27 | 709 - 711 | 0.269 | -5.71 | 0.441 | -3.56 | 5M43D7W | 16QAM |
| LTE Band 13 | 27 | 779.5 - 784.5 | 0.442 | -3.55 | 0.724 | -1.40 | 4M57G7W | QPSK |
| LTE Band 13 | 27 | 779.5 - 784.5 | 0.422 | -3.75 | 0.692 | -1.60 | 4M56D7W | 16QAM |
| LTE Band 13 | 27 | 782 | 0.442 | -3.55 | 0.724 | -1.40 | 9M09G7W | QPSK |
| LTE Band 13 | 27 | 782 | 0.396 | -4.02 | 0.650 | -1.87 | 5M53D7W | 16QAM |
| LTE Band 5 | 22H | 824.7 - 848.3 | 0.451 | -3.46 | 0.740 | -1.31 | 1M11G7W | QPSK |
| LTE Band 5 | 22H | 824.7 - 848.3 | 0.403 | -3.95 | 0.661 | -1.80 | 1M11D7W | 16QAM |
| LTE Band 5 | 22H | 825.5 - 847.5 | 0.444 | -3.53 | 0.728 | -1.38 | 2M72G7W | QPSK |
| LTE Band 5 | 22H | 825.5 - 847.5 | 0.397 | -4.01 | 0.652 | -1.86 | 2M73D7W | 16QAM |
| LTE Band 5 | 22H | 826.5 - 846.5 | 0.452 | -3.45 | 0.741 | -1.30 | 4M57G7W | QPSK |
| LTE Band 5 | 22H | 826.5 - 846.5 | 0.406 | -3.92 | 0.665 | -1.77 | 4M56D7W | 16QAM |
| LTE Band 5 | 22H | 829 - 844 | 0.444 | -3.53 | 0.728 | -1.38 | 9M14G7W | QPSK |
| LTE Band 5 | 22H | 829 - 844 | 0.405 | -3.93 | 0.664 | -1.78 | 5M41D7W | 16QAM |
| LTE Band 26 | 22H | 824.7 - 848.3 | 0.449 | -3.48 | 0.736 | -1.33 | 1M11G7W | QPSK |
| LTE Band 26 | 22H | 824.7 - 848.3 | 0.401 | -3.97 | 0.658 | -1.82 | 1M11D7W | 16QAM |
| LTE Band 26 | 22H | 825.5 - 847.5 | 0.434 | -3.63 | 0.711 | -1.48 | 2M72G7W | QPSK |
| LTE Band 26 | 22H | 825.5 - 847.5 | 0.397 | -4.01 | 0.652 | -1.86 | 2M73D7W | 16QAM |
| LTE Band 26 | 22H | 826.5 - 846.5 | 0.452 | -3.45 | 0.741 | -1.30 | 4M57G7W | QPSK |
| LTE Band 26 | 22H | 826.5 - 846.5 | 0.403 | -3.95 | 0.661 | -1.80 | 4M56D7W | 16QAM |
| LTE Band 26 | 22H | 829 - 844 | 0.442 | -3.55 | 0.724 | -1.40 | 9M14G7W | QPSK |
| LTE Band 26 | 22H | 829 - 844 | 0.404 | -3.94 | 0.662 | -1.79 | 5M41D7W | 16QAM |

**EUT Overview (Low Bands)**

| Mode | FCC Rule Part | Tx Frequency (MHz) | EIRP | | Emission Designator | Modulation |
|---|---|---|---|---|---|---|
| | | | Max. Power (mW) | Max. Power (dBm) | | |
| LTE Band 4 | 27 | 1710.7 - 1754.3 | 10.000 | 10.00 | 1M10G7W | QPSK |
| LTE Band 4 | 27 | 1710.7 - 1754.3 | 8.933 | 9.51 | 1M11D7W | 16QAM |
| LTE Band 4 | 27 | 1711.5 - 1753.5 | 10.000 | 10.00 | 2M72G7W | QPSK |
| LTE Band 4 | 27 | 1711.5 - 1753.5 | 8.913 | 9.50 | 2M73D7W | 16QAM |
| LTE Band 4 | 27 | 1712.5 - 1752.5 | 10.000 | 10.00 | 4M56G7W | QPSK |
| LTE Band 4 | 27 | 1712.5 - 1752.5 | 8.770 | 9.43 | 4M56D7W | 16QAM |
| LTE Band 4 | 27 | 1715 - 1750 | 10.000 | 10.00 | 9M15G7W | QPSK |
| LTE Band 4 | 27 | 1715 - 1750 | 8.750 | 9.42 | 5M51D7W | 16QAM |
| LTE Band 4 | 27 | 1717.5 - 1747.5 | 10.000 | 10.00 | 13M7G7W | QPSK |
| LTE Band 4 | 27 | 1717.5 - 1747.5 | 8.810 | 9.45 | 6M25D7W | 16QAM |
| LTE Band 4 | 27 | 1720 - 1745 | 10.000 | 10.00 | 18M3G7W | QPSK |
| LTE Band 4 | 27 | 1720 - 1745 | 8.770 | 9.43 | 7M58D7W | 16QAM |
| LTE Band 66 | 27 | 1710.7 - 1779.3 | 9.908 | 9.96 | 1M10G7W | QPSK |
| LTE Band 66 | 27 | 1710.7 - 1779.3 | 8.610 | 9.35 | 1M11D7W | 16QAM |
| LTE Band 66 | 27 | 1711.5 - 1778.5 | 9.572 | 9.81 | 2M72G7W | QPSK |
| LTE Band 66 | 27 | 1711.5 - 1778.5 | 8.710 | 9.40 | 2M73D7W | 16QAM |
| LTE Band 66 | 27 | 1712.5 - 1777.5 | 9.683 | 9.86 | 4M56G7W | QPSK |
| LTE Band 66 | 27 | 1712.5 - 1777.5 | 8.954 | 9.52 | 4M56D7W | 16QAM |
| LTE Band 66 | 27 | 1715 - 1775 | 9.550 | 9.80 | 9M15G7W | QPSK |
| LTE Band 66 | 27 | 1715 - 1775 | 9.016 | 9.55 | 5M51D7W | 16QAM |
| LTE Band 66 | 27 | 1717.5 - 1772.5 | 10.000 | 10.00 | 13M7G7W | QPSK |
| LTE Band 66 | 27 | 1717.5 - 1772.5 | 8.913 | 9.50 | 6M25D7W | 16QAM |
| LTE Band 66 | 27 | 1720 - 1770 | 9.977 | 9.99 | 18M3G7W | QPSK |
| LTE Band 66 | 27 | 1720 - 1770 | 8.710 | 9.40 | 7M58D7W | 16QAM |
| LTE Band 2 | 24E | 1850.7 - 1909.3 | 14.093 | 11.49 | 1M11G7W | QPSK |
| LTE Band 2 | 24E | 1850.7 - 1909.3 | 12.503 | 10.97 | 1M11D7W | 16QAM |
| LTE Band 2 | 24E | 1851.5 - 1908.5 | 13.583 | 11.33 | 2M73G7W | QPSK |
| LTE Band 2 | 24E | 1851.5 - 1908.5 | 12.331 | 10.91 | 2M73D7W | 16QAM |
| LTE Band 2 | 24E | 1852.5 - 1907.5 | 13.740 | 11.38 | 4M57G7W | QPSK |
| LTE Band 2 | 24E | 1852.5 - 1907.5 | 12.388 | 10.93 | 4M55D7W | 16QAM |
| LTE Band 2 | 24E | 1855 - 1905 | 13.804 | 11.40 | 9M09G7W | QPSK |
| LTE Band 2 | 24E | 1855 - 1905 | 12.503 | 10.97 | 5M46D7W | 16QAM |
| LTE Band 2 | 24E | 1857.5 - 1902.5 | 13.868 | 11.42 | 13M6G7W | QPSK |
| LTE Band 2 | 24E | 1857.5 - 1902.5 | 12.677 | 11.03 | 6M07D7W | 16QAM |
| LTE Band 2 | 24E | 1860 - 1900 | 14.388 | 11.58 | 18M2G7W | QPSK |
| LTE Band 2 | 24E | 1860 - 1900 | 12.706 | 11.04 | 7M77D7W | 16QAM |
| LTE Band 25 | 24E | 1850.7 - 1914.3 | 14.028 | 11.47 | 1M11G7W | QPSK |
| LTE Band 25 | 24E | 1850.7 - 1914.3 | 12.246 | 10.88 | 1M11D7W | 16QAM |
| LTE Band 25 | 24E | 1851.5 - 1913.5 | 14.028 | 11.47 | 2M73G7W | QPSK |
| LTE Band 25 | 24E | 1851.5 - 1913.5 | 12.503 | 10.97 | 2M73D7W | 16QAM |
| LTE Band 25 | 24E | 1852.5 - 1912.5 | 13.964 | 11.45 | 4M57G7W | QPSK |
| LTE Band 25 | 24E | 1852.5 - 1912.5 | 12.503 | 10.97 | 4M55D7W | 16QAM |
| LTE Band 25 | 24E | 1855 - 1910 | 13.646 | 11.35 | 9M09G7W | QPSK |
| LTE Band 25 | 24E | 1855 - 1910 | 12.503 | 10.97 | 5M46D7W | 16QAM |
| LTE Band 25 | 24E | 1857.5 - 1907.5 | 14.093 | 11.49 | 13M6G7W | QPSK |
| LTE Band 25 | 24E | 1857.5 - 1907.5 | 12.589 | 11.00 | 6M07D7W | 16QAM |
| LTE Band 25 | 24E | 1860 - 1905 | 13.964 | 11.45 | 18M2G7W | QPSK |
| LTE Band 25 | 24E | 1860 - 1905 | 12.417 | 10.94 | 7M77D7W | 16QAM |

**EUT Overview (Mid Bands)**

| Mode | FCC Rule Part | Tx Frequency (MHz) | EIRP | | Emission Designator | Modulation |
|---|---|---|---|---|---|---|
| | | | Max. Power (mW) | Max. Power (dBm) | | |
| LTE Band 7 | 27 | 2502.5 - 2567.5 | 10.914 | 10.38 | 4M56G7W | QPSK |
| LTE Band 7 | 27 | 2502.5 - 2567.5 | 9.727 | 9.88 | 4M56D7W | 16QAM |
| LTE Band 7 | 27 | 2505 - 2565 | 10.471 | 10.20 | 9M12G7W | QPSK |
| LTE Band 7 | 27 | 2505 - 2565 | 9.954 | 9.98 | 5M51D7W | 16QAM |
| LTE Band 7 | 27 | 2507.5 - 2562.5 | 10.257 | 10.11 | 13M7G7W | QPSK |
| LTE Band 7 | 27 | 2507.5 - 2562.5 | 9.727 | 9.88 | 6M07D7W | 16QAM |
| LTE Band 7 | 27 | 2510 - 2560 | 10.233 | 10.10 | 18M3G7W | QPSK |
| LTE Band 7 | 27 | 2510 - 2560 | 9.772 | 9.90 | 7M71D7W | 16QAM |
| LTE Band 41 | 27 | 2498.5 - 2687.5 | 11.220 | 10.50 | 4M59G7W | QPSK |
| LTE Band 41 | 27 | 2498.5 - 2687.5 | 9.290 | 9.68 | 4M57D7W | 16QAM |
| LTE Band 41 | 27 | 2501 - 2685 | 11.220 | 10.50 | 9M11G7W | QPSK |
| LTE Band 41 | 27 | 2501 - 2685 | 9.183 | 9.63 | 5M48D7W | 16QAM |
| LTE Band 41 | 27 | 2503.5 - 2682.5 | 11.169 | 10.48 | 13M6G7W | QPSK |
| LTE Band 41 | 27 | 2503.5 - 2682.5 | 9.183 | 9.63 | 6M36D7W | 16QAM |
| LTE Band 41 | 27 | 2506 - 2680 | 11.220 | 10.50 | 18M2G7W | QPSK |
| LTE Band 41 | 27 | 2506 - 2680 | 9.183 | 9.63 | 7M94D7W | 16QAM |

**EUT Overview (High Bands)**

# 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 Engineering Laboratory, Inc. facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

## 1.3 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 2041.02 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 Watch FCC ID: BCG-A2094**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

**Test Device Serial No.:** D92F00DM950, D92YD04FM94X, D92YD032M8CF, D92YD001M94V, FN6911200JFK6RL5C

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, HDR4, HDR8, LE), NFC

LTE Band 12 (698 - 716 MHz) overlaps the entire frequency range of LTE Band 17 (704 - 716 MHz). Therefore, test data provided in this report covers Band 17 as well as Band 12.

LTE Band 26 (814.7 – 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 – 849 MHz). Therefore, test data provided in this report covers Band 5 as well as Band 26.

LTE Band 66 (1710 - 1780 MHz) overlaps the entire frequency range of LTE Band 4 (1710 - 1755 MHz). Therefore, test data provided in this report covers Band 4 as well as Band 66.

LTE Band 25 (1850 - 1915 MHz) overlaps the entire frequency range of LTE Band 2 (1850 - 1910 MHz). Therefore, test data provided in this report covers Band 2 as well as Band 25.

This device supports simultaneous transmission operation, which allows for two transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.

| Simultaneous Tx Configurations | Antenna | | | |
|---|---|---|---|---|
| | FCM | | | |
| | Configuration 1 | Configuration 2 | Configuration 3 | Configuration 4 |
| WIFI 2.4GHz | ✓ | ✓ | × | × |
| Bluetooth | × | × | ✓ | ✓ |
| LTE Mid Bands | ✓ | × | ✓ | × |
| LTE High Bands | × | ✓ | × | ✓ |

**Table 2-1. Simultaneous Tx Configurations**

✓= Support ; × = NOT Support

**Worst Case Configuration**

| Description | WIFI 2.4GHz | LTE |
|---|---|---|
| Antenna | FCM | FCM |
| Channel | 6 | 41490 |
| Operating Frequency (MHz) | 2437 | 2680 |
| Mode/Modulation | 802.11b | QPSK/1RB/20MHz |

**Table 2-2. Worst Case Configuration**

## 2.3 Antenna Description

Following antenna was used for the testing.

| Frequency [MHz] | Antenna Gain (dBi) | |
|---|---|---|
| | BCM | FCM |
| 698-716 | -28.0 | N/A |
| 777-787 | -26.4 | N/A |
| 814-849 | -26.3 | N/A |
| 1710-1785 | N/A | -14.0 |
| 1850-1915 | N/A | -12.4 |
| 2496-2690 | N/A | -13.0 |
| 2500-2570 | N/A | -13.1 |

**Table 2-3. Highest Antenna Gain**

## 2.4 Test Support Equipment

| | | | | | |
|---|---|---|---|---|---|
| 1 | Apple MacBook | Model: | A1398 | S/N: | C2QKP008F6F3 |
| | w/AC/DC Adapter | Model: | A1435 | S/N: | N/A |
| | | | | | |
| 2 | Apple USB Cable | Model: | Kanzi | S/N: | 311C81 |
| | w/ Charging Dock | Model: | FAPS73 | S/N: | 17481001022 |
| | w/ Dock | Model: | X241 | S/N: | GW17F01ST22 |
| | | | | | |
| 3 | USB Lightning Cable | Model: | N/A | S/N: | N/A |
| | w/ AC Adapter | Model: | A1385 | S/N: | N/A |
| | | | | | |
| 4 | Wireless Charging Pad (WCP) | Model: | EVT | S/N: | DLC915600ECLNWL3K |
| | Wireless Charging Pad (WCP) | Model: | EVT | S/N: | DLC9156006TLNWK3V |
| | | | | | |
| 5 | Test Pathfinder Sinsa Board | Model: | X1456 | S/N: | 920-062535-01 |
| | w/ SiP Cradle | Model: | P1 X1454S | S/N: | 920-06373-02 |
| | | | | | |
| 6 | DC Power Supply | Model: | KPS3010D | S/N: | N/A |
| | | | | | |
| 7 | Mobile Comm DC Source | Model: | 66321D | S/N: | MY52000555 |

**Table 2-4. Test Support Equipment Used**

## 2.5 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The worst case configuration was investigated for all combinations of the four materials, aluminum, stainless steel, ceramic, and aluminum/ceramic mix, and various types of wristbands, metal and non-metal wristbands. The store display sample was investigated and determined as not the worst case. The EUT was also investigated with and without wireless charger. The worst case configuration found was used for all testing.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. 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.

This device only supports 27RBs or less for 16-QAM uplink.

## 2.6 Software and Firmware

The test was conducted with firmware version wOS 6.0 installed on the EUT.

## 2.7 EMI Suppression Device(s)/Modifications

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

# 3.0 DESCRIPTION OF TESTS

## 3.1 Measurement Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

## 3.2 Block C Frequency Range

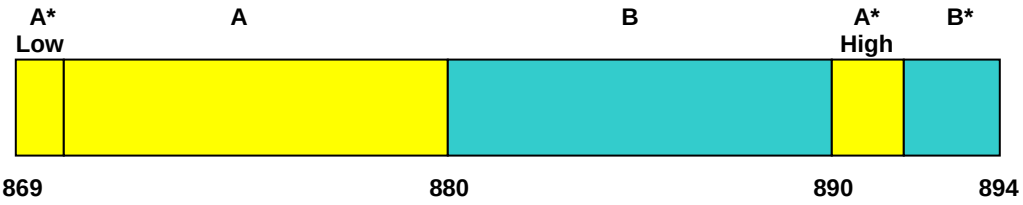
Two paired channels of 11 megahertz each are available for assignment in Block C in the 746-757 MHz and 776-787 MHz bands. In the event that no licenses for two channels in this Block C are assigned based on the results of the first auction in which such licenses were offered because the auction results do not satisfy the applicable reserve price, the spectrum in the 746-757 MHz and 776-787 MHz bands will instead be made available for assignment at a subsequent auction as follows: (i) Two paired channels of 6 megahertz each available for assignment in Block C1 in the 746-752 MHz and 776-782 MHz bands. (ii) Two paired channels of 5 megahertz each available for assignment in Block C2 in the 752-757 MHz and 782-787 MHz bands.

## 3.3 Block A Frequency Range

698-746 MHz band. The following frequencies are available for licensing pursuant to this part in the 698-746 MHz band: (1) Three paired channel blocks of 12 megahertz each are available for assignment as follows:

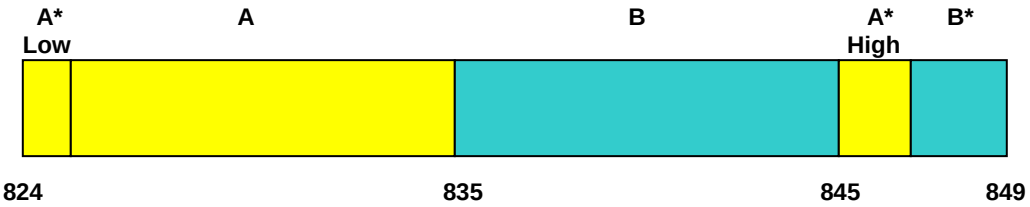
Block A: 698-704 MHz and 728-734 MHz;
Block B: 704-710 MHz and 734-740 MHz; and
Block C: 710-716 MHz and 740-746 MHz.

## 3.4 Cellular - Base Frequency Blocks



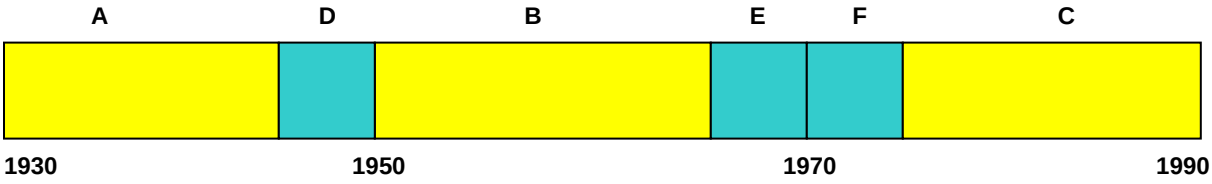

**BLOCK 1: 869 – 880 MHz (A* Low + A)**
**BLOCK 2: 880 – 890 MHz (B)**
**BLOCK 3: 890 – 891.5 MHz (A* High)**
**BLOCK 4: 891.5 – 894 MHz (B*)**

## 3.5 Cellular - Mobile Frequency Blocks



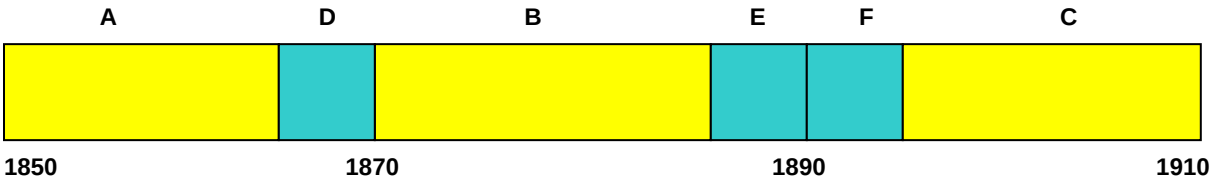

**BLOCK 1: 824 – 835 MHz (A* Low + A)**
**BLOCK 2: 835 – 845 MHz (B)**
**BLOCK 3: 845 – 846.5 MHz (A* High)**
**BLOCK 4: 846.5 – 849 MHz (B*)**

## 3.6 PCS - Base Frequency Blocks



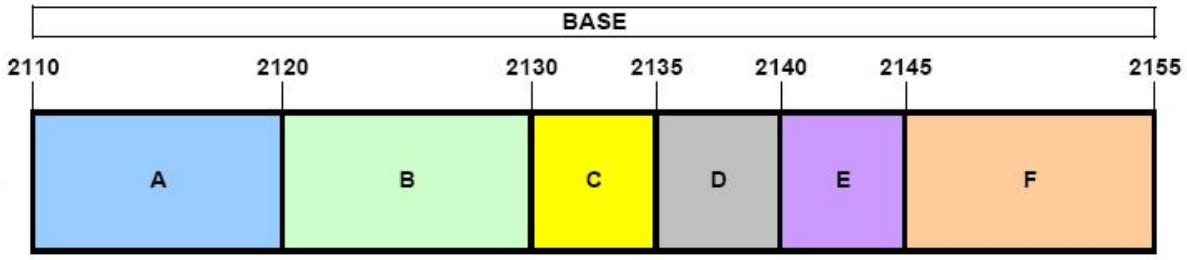

BLOCK 1: 1930 – 1945 MHz (A)
BLOCK 2: 1945 – 1950 MHz (D)
BLOCK 3: 1950 – 1965 MHz (B)
BLOCK 4: 1965 – 1970 MHz (E)
BLOCK 5: 1970 – 1975 MHz (F)
BLOCK 6: 1975 – 1990 MHz (C)

## 3.7 PCS - Mobile Frequency Blocks



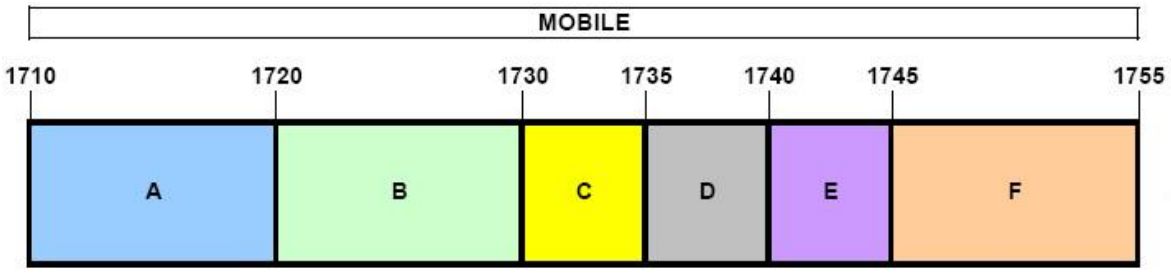

BLOCK 1: 1850 – 1865 MHz (A)
BLOCK 2: 1865 – 1870 MHz (D)
BLOCK 3: 1870 – 1885 MHz (B)
BLOCK 4: 1885 – 1890 MHz (E)
BLOCK 5: 1890 – 1895 MHz (F)
BLOCK 6: 1895 – 1910 MHz (C)

## 3.8 AWS - Base Frequency Blocks



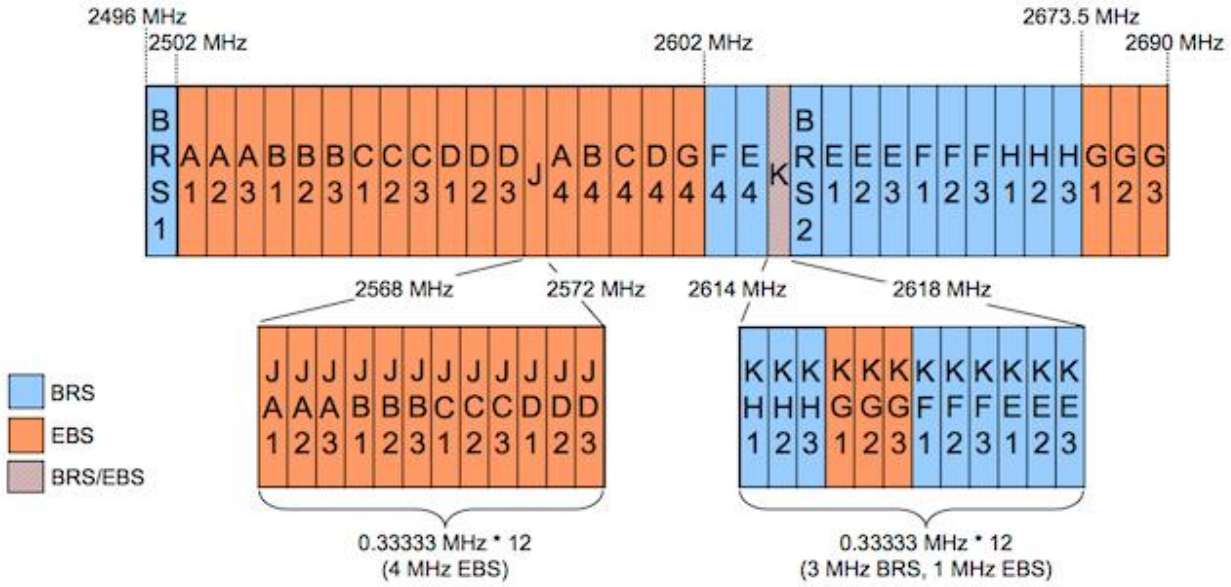

BLOCK 1: 2110 – 2120 MHz (A)
BLOCK 2: 2120 – 2130 MHz (B)
BLOCK 3: 2130 – 2135 MHz (C)
BLOCK 4: 2135 – 2140 MHz (D)
BLOCK 5: 2140 – 2145 MHz (E)
BLOCK 6: 2145 – 2155 MHz (F)

## 3.9 AWS - Mobile Frequency Blocks




BLOCK 1: 1710 – 1720 MHz (A)
BLOCK 2: 1720 – 1730 MHz (B)
BLOCK 3: 1730 – 1735 MHz (C)
BLOCK 4: 1735 – 1740 MHz (D)
BLOCK 5: 1740 – 1745 MHz (E)
BLOCK 6: 1745 – 1755 MHz (F)

## 3.10 BRS/EBS Frequency Block



## 3.11 Radiated Power and Radiated Spurious 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. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Per the guidelines of KDB 412172 D01 v01r01, radiated power levels are measured using the following formula:

$$\text{ERP or EIRP} = P_T + G_T - L_C$$

Where $P_T$ is the transmitter output power, expressed in dBm, $G_T$ is the gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP), and $L_C$ signal attenuation in the connecting cable between the transmitter and antenna in dB.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]}$$

Where, $P_d$ is the dipole equivalent power, $P_g$ is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

The calculated $P_d$ levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10 $\log_{10}$(Power $_{[Watts]}$). For Band 7 and 41, the calculated $P_d$ levels are compared to the absolute spurious emission limit of -25dBm which is equivalent to the required minimum attenuation of 55 + 10 $\log_{10}$(Power $_{[Watts]}$).

# 4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. 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 | 1.29 |
| Radiated Disturbance (<1GHz) | 4.15 |
| Radiated Disturbance (>1GHz) | 4.70 |
| Radiated Disturbance (>18GHz) | 5.01 |
| Temperature | 0.01 |

# 5.0 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 |
|---|---|---|---|---|---|---|
| Agilent Technologies | N9030A | 3Hz-44GHz PXA Signal Analyzer | 3/13/2019 | Annual | 3/13/2020 | MY49430244 |
| ATM | 180-442A-KF | 20dB Nominal Gain Horn Antenna | 9/10/2018 | Annual | 9/10/2019 | T058701-03 |
| ESPEC | SU-241 | Tabletop Temperature Chamber | 8/10/2018 | Annual | 8/10/2019 | 92009574 |
| ETS-Lindgren | 118490 | Pre-Amplifier (30MHz - 6GHz) | 8/31/2018 | Annual | 8/31/2019 | 213236 |
| ETS-Lindgren | 3142E | BiConiLog Antenna (30MHz - 6GHz) | 12/11/2018 | Annual | 12/11/2019 | 224569 |
| Rohde & Schwarz | FSV40 | Signal Analyzer (10Hz-40GHz) | 2/27/2019 | Annual | 2/27/2020 | 101619 |
| Rohde & Schwarz | ESW26 | EMI Test Receiver | 5/21/2019 | Annual | 5/21/2020 | 101299 |
| Rohde & Schwarz | ESW44 | EMI Test Receiver | 11/20/2018 | Annual | 11/20/2019 | 101570 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 8/10/2018 | Annual | 8/10/2019 | 161616 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 11/16/2018 | Annual | 11/16/2019 | 164715 |
| Rohde & Schwarz | CMW500 | Wideband Radio Communication Tester | 1/8/2019 | Annual | 1/8/2020 | 166869 |
| Rohde & Schwarz | TS-PR1840 | Pre-Amplifier (18GHz - 40GHz) | 9/5/2018 | Annual | 9/5/2019 | 100050 |
| Rohde & Schwarz | TC-TA18 | Cross Polarized Vivaldi Antenna (400MHz-18GHz) | 11/21/2018 | Annual | 11/21/2019 | 101057 |
| Rohde & Schwarz | TC-TA18 | Cross Polarized Vivaldi Antenna (400MHz-18GHz) | 12/7/2018 | Annual | 12/7/2019 | 101063 |
| Rohde & Schwarz | HFH2-Z2 | Loop Antenna | 3/21/2019 | Annual | 3/21/2020 | 100519 |

**Table 5-1. Test Equipment**

**Notes:**

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.

# 6.0 SAMPLE CALCULATIONS

## Emission Designator

### QPSK Modulation

**Emission Designator = 8M62G7W**

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination of Any

### QAM Modulation

**Emission Designator = 8M45D7W**

LTE BW = 8.45 MHz
D = Amplitude/Angle Modulated
7 = Quantized/Digital Info
W = Combination of Any

## Spurious Radiated Emission – LTE Band

**Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)**

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: Apple Inc.

FCC ID: BCG-A2094

FCC Classification: PCS Licensed Transmitter Worn on Body (PCT)

Mode(s): LTE

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| 2.1049 | Occupied Bandwidth | N/A | CONDUCTED | PASS | Section 7.2 |
| 2.1051<br>22.917(a)<br>24.238(a)<br>27.53(c)<br>27.53(g)<br>27.53(h) | Out of Band Emissions | > 43 + 10 $\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions | | | Section 7.3, 7.4 |
| 27.53(m) | Out of Band Emissions | Undesirable emissions must meet the limits detailed in 27.53(m) | | | Section 7.3, 7.4 |
| 24.232(d)<br>27.50(d)(5) | Peak-Average Ratio | < 13 dB | | | Section 7.5 |
| 2.1046 | Transmitter Conducted Output Power | N/A | | | Section 7.6 |
| 2.1055<br>22.355<br>24.235<br>27.54 | Frequency Stability | < 2.5 ppm (Part 22) and fundamental emissions stay within authorized frequency block (Part 24, 27) | | | Section 7.8 |

**Table 7-1. Summary of Conducted Test Results**

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| 22.913(a)(5) | Effective Radiated Power / Equivalent Isotropic Radiated Power (Band 26/5) | < 7 Watts max. ERP | RADIATED | PASS | Section 7.6 |
| 27.50(b)(10)<br>27.50(c)(10) | Effective Radiated Power / Equivalent Isotropic Radiated Power (Band 12/17, 13) | < 3 Watts max. ERP | | | Section 7.6 |
| 24.232(c)<br>27.50(h)(2) | Equivalent Isotropic Radiated Power (Band 25/2, 7, 41) | < 2 Watts max. EIRP | | | Section 7.6 |
| 27.50(d)(4) | Equivalent Isotropic Radiated Power (Band 66/4) | < 1 Watts max. EIRP | | | Section 7.6 |
| 2.1053<br>22.917(a)<br>24.238(a)<br>27.53(c)<br>27.53(g)<br>27.53(h) | Undesirable Emissions | > 43 + 10 $\log_{10}$ (P[Watts]) for all out-of-band emissions | | | Section 7.7 |
| 27.53(f) | Undesirable Emissions (Band 13) | < -70 dBW/MHz (for wideband signals)<br>< -80 dBW (for discrete emissions less than 700Hz BW)<br>For all emissions in the band 1559 – 1610 MHz | | | Section 7.7 |
| 27.53(m) | Undesirable Emissions | Undesirable emissions must meet the limits detailed in 27.53(m) | | | Section 7.7 |

**Table 7-2. Summary of Radiated Test Results**

**Notes:**

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots (Sections 7.2, 7.3, 7.4, 7.5) were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT 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, attenuators, and couplers.
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 "LTE Automation," Version 4.8.

## 7.2 Occupied Bandwidth

### Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

### Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

### Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

### Test Setup

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

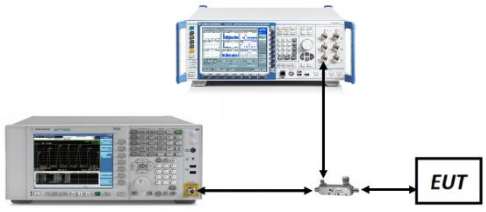



**Figure 7-1. Test Instrument & Measurement Setup**

### Test Notes

This device only supports 27RBs or less for 16-QAM uplink.

| Mode | BW (MHz) | Modulation | Occupied BW [kHz] |
|---|---|---|---|
| LTE Band 12 | 1.4 | QPSK | 1105.7 |
| LTE Band 12 | 1.4 | 16QAM | 1109.0 |
| LTE Band 12 | 3 | QPSK | 2727.7 |
| LTE Band 12 | 3 | 16QAM | 2727.1 |
| LTE Band 12 | 5 | QPSK | 4578.1 |
| LTE Band 12 | 5 | 16QAM | 4571.2 |
| LTE Band 12 | 10 | QPSK | 9112.4 |
| LTE Band 12 | 10 | 16QAM | 5431.7 |
| LTE Band 17 | 5 | QPSK | 4578.1 |
| LTE Band 17 | 5 | 16QAM | 4571.2 |
| LTE Band 17 | 10 | QPSK | 9112.4 |
| LTE Band 17 | 10 | 16QAM | 5431.7 |
| LTE Band 13 | 5 | QPSK | 4566.5 |
| LTE Band 13 | 5 | 16QAM | 4564.0 |
| LTE Band 13 | 10 | QPSK | 9093.1 |
| LTE Band 13 | 10 | 16QAM | 5527.1 |
| LTE Band 5 | 1.4 | QPSK | 1108.9 |
| LTE Band 5 | 1.4 | 16QAM | 1108.9 |
| LTE Band 5 | 3 | QPSK | 2723.9 |
| LTE Band 5 | 3 | 16QAM | 2727.6 |
| LTE Band 5 | 5 | QPSK | 4572.6 |
| LTE Band 5 | 5 | 16QAM | 4558.8 |
| LTE Band 5 | 10 | QPSK | 9136.7 |
| LTE Band 5 | 10 | 16QAM | 5408.9 |
| LTE Band 26 | 1.4 | QPSK | 1108.9 |
| LTE Band 26 | 1.4 | 16QAM | 1108.9 |
| LTE Band 26 | 3 | QPSK | 2723.9 |
| LTE Band 26 | 3 | 16QAM | 2727.6 |
| LTE Band 26 | 5 | QPSK | 4572.6 |
| LTE Band 26 | 5 | 16QAM | 4558.8 |
| LTE Band 26 | 10 | QPSK | 9136.7 |
| LTE Band 26 | 10 | 16QAM | 5408.9 |

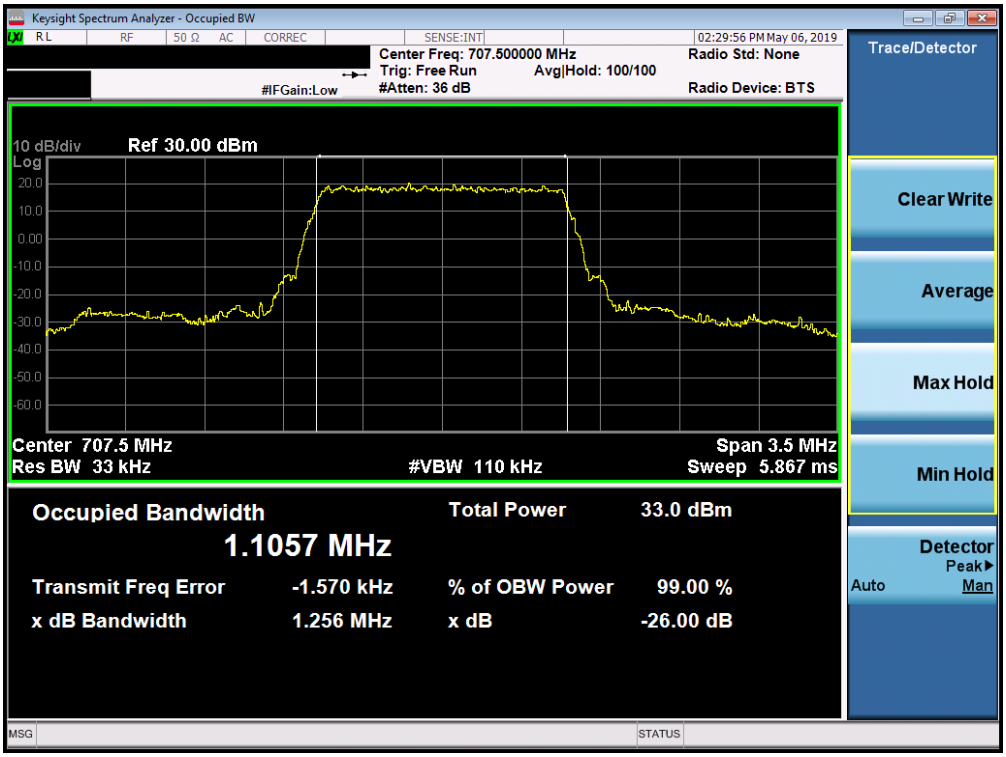
**Table 7-3. Occupied Band Width Results (Low Bands)**

| Mode | BW (MHz) | Modulation | Occupied BW [kHz] |
|---|---|---|---|
| LTE Band 4 | 1.4 | QPSK | 1103.1 |
| LTE Band 4 | 1.4 | 16QAM | 1106.9 |
| LTE Band 4 | 3 | QPSK | 2724.4 |
| LTE Band 4 | 3 | 16QAM | 2728.7 |
| LTE Band 4 | 5 | QPSK | 4559.3 |
| LTE Band 4 | 5 | 16QAM | 4560.3 |
| LTE Band 4 | 10 | QPSK | 9154.3 |
| LTE Band 4 | 10 | 16QAM | 5508.8 |
| LTE Band 4 | 15 | QPSK | 13676.5 |
| LTE Band 4 | 15 | 16QAM | 6249.9 |
| LTE Band 4 | 20 | QPSK | 18313.8 |
| LTE Band 4 | 20 | 16QAM | 7582.9 |
| LTE Band 66 | 1.4 | QPSK | 1103.1 |
| LTE Band 66 | 1.4 | 16QAM | 1106.9 |
| LTE Band 66 | 3 | QPSK | 2724.4 |
| LTE Band 66 | 3 | 16QAM | 2728.7 |
| LTE Band 66 | 5 | QPSK | 4559.3 |
| LTE Band 66 | 5 | 16QAM | 4560.3 |
| LTE Band 66 | 10 | QPSK | 9154.3 |
| LTE Band 66 | 10 | 16QAM | 5508.8 |
| LTE Band 66 | 15 | QPSK | 13676.5 |
| LTE Band 66 | 15 | 16QAM | 6249.9 |
| LTE Band 66 | 20 | QPSK | 18313.8 |
| LTE Band 66 | 20 | 16QAM | 7582.9 |
| LTE Band 2 | 1.4 | QPSK | 1108.0 |
| LTE Band 2 | 1.4 | 16QAM | 1105.2 |
| LTE Band 2 | 3 | QPSK | 2726.0 |
| LTE Band 2 | 3 | 16QAM | 2729.1 |
| LTE Band 2 | 5 | QPSK | 4574.4 |
| LTE Band 2 | 5 | 16QAM | 4553.9 |
| LTE Band 2 | 10 | QPSK | 9092.0 |
| LTE Band 2 | 10 | 16QAM | 5457.8 |
| LTE Band 2 | 15 | QPSK | 13640.6 |
| LTE Band 2 | 15 | 16QAM | 6067.4 |
| LTE Band 2 | 20 | QPSK | 18228.2 |
| LTE Band 2 | 20 | 16QAM | 7774.4 |
| LTE Band 25 | 1.4 | QPSK | 1108.0 |
| LTE Band 25 | 1.4 | 16QAM | 1105.2 |
| LTE Band 25 | 3 | QPSK | 2726.0 |
| LTE Band 25 | 3 | 16QAM | 2729.1 |
| LTE Band 25 | 5 | QPSK | 4574.4 |
| LTE Band 25 | 5 | 16QAM | 4553.9 |
| LTE Band 25 | 10 | QPSK | 9092.0 |
| LTE Band 25 | 10 | 16QAM | 5457.8 |
| LTE Band 25 | 15 | QPSK | 13640.6 |
| LTE Band 25 | 15 | 16QAM | 6067.4 |
| LTE Band 25 | 20 | QPSK | 18228.2 |
| LTE Band 25 | 20 | 16QAM | 7774.4 |

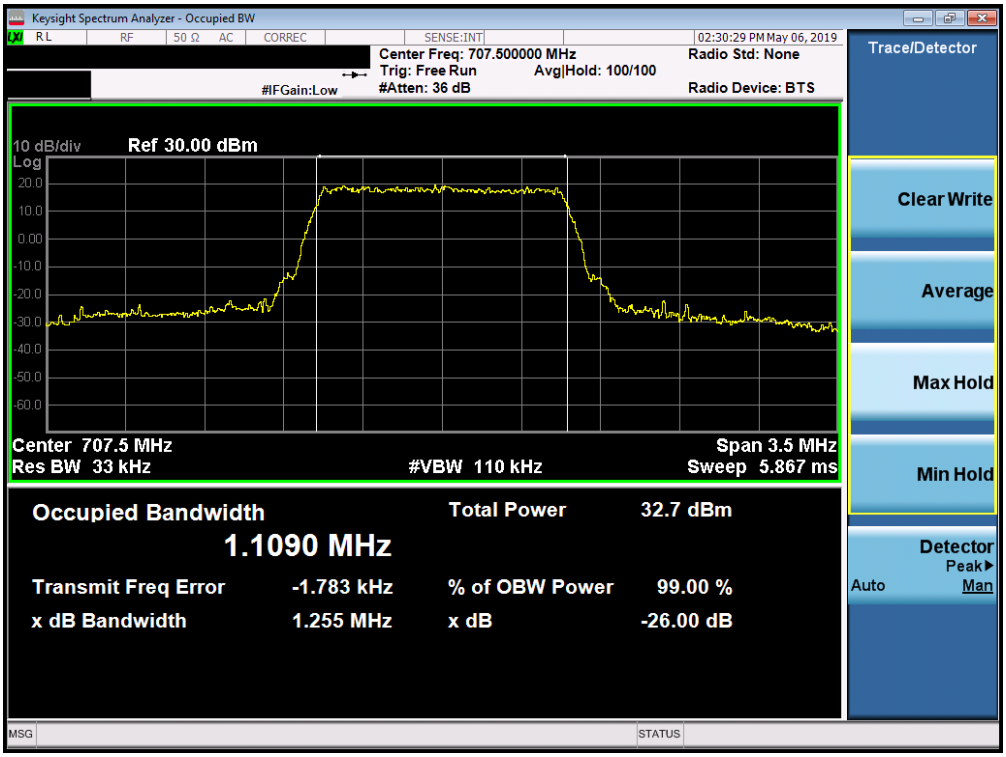
**Table 7-4. Occupied Band Width Results (Mid Bands)**

| Mode | BW (MHz) | Modulation | Occupied BW [kHz] |
|---|---|---|---|
| LTE Band 7 | 5 | QPSK | 4563.2 |
| LTE Band 7 | 5 | 16QAM | 4562.1 |
| LTE Band 7 | 10 | QPSK | 9120.0 |
| LTE Band 7 | 10 | 16QAM | 5511.5 |
| LTE Band 7 | 15 | QPSK | 13670.8 |
| LTE Band 7 | 15 | 16QAM | 6070.1 |
| LTE Band 7 | 20 | QPSK | 18287.2 |
| LTE Band 7 | 20 | 16QAM | 7707.8 |
| LTE Band 41 | 5 | QPSK | 4587.3 |
| LTE Band 41 | 5 | 16QAM | 4573.5 |
| LTE Band 41 | 10 | QPSK | 9107.7 |
| LTE Band 41 | 10 | 16QAM | 5477.3 |
| LTE Band 41 | 15 | QPSK | 13637.1 |
| LTE Band 41 | 15 | 16QAM | 6355.3 |
| LTE Band 41 | 20 | QPSK | 18181.7 |
| LTE Band 41 | 20 | 16QAM | 7939.1 |

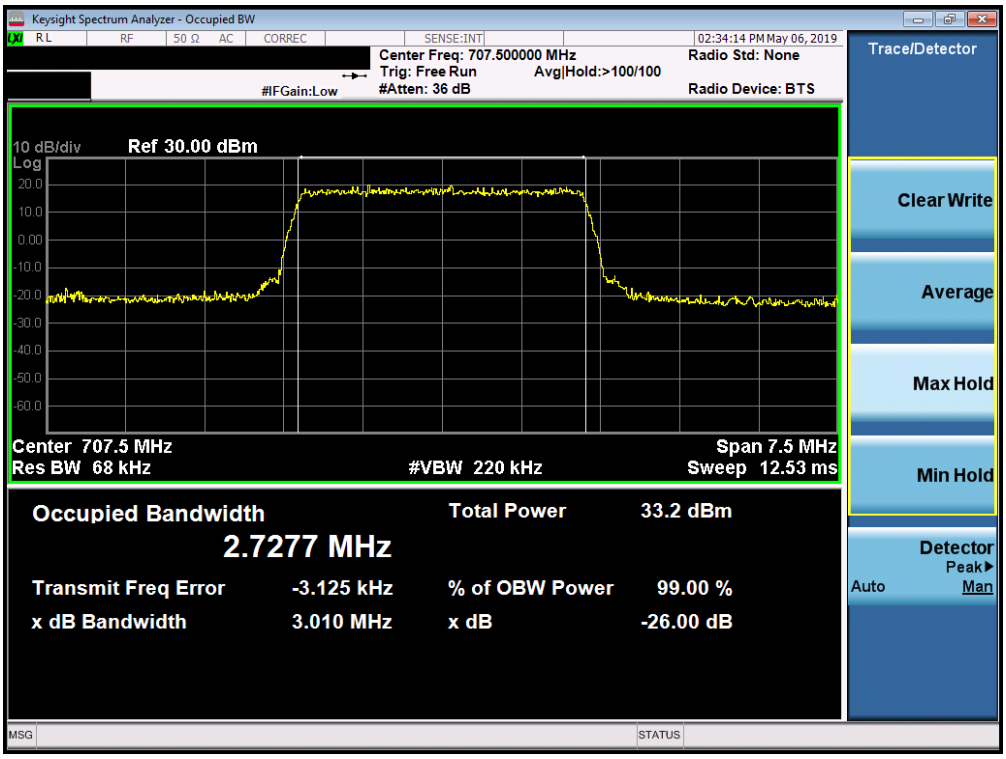
**Table 7-5. Occupied Band Width Results (High Bands)**



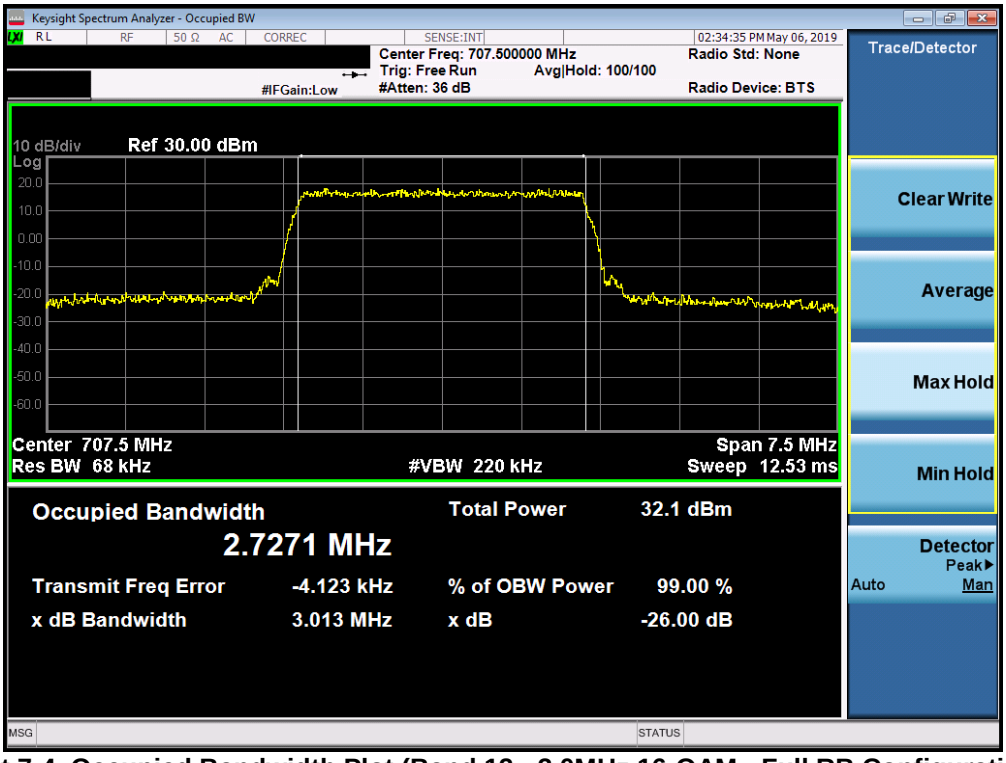

**Plot 7-1. Occupied Bandwidth Plot (Band 12 - 1.4MHz QPSK - Full RB Configuration)**



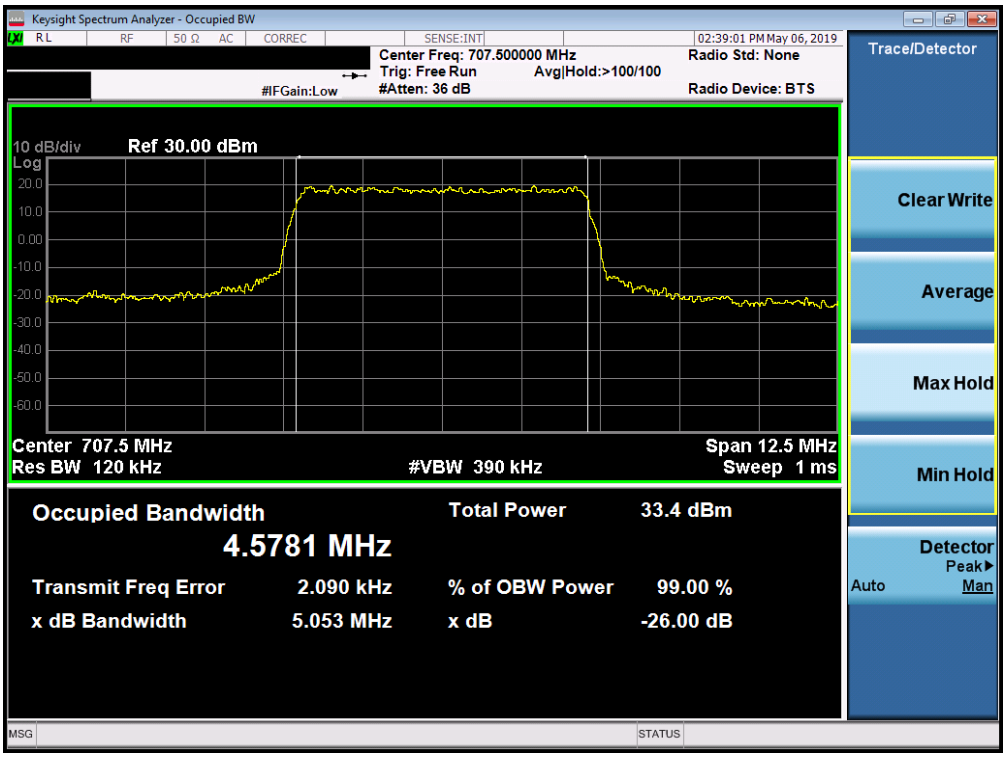

**Plot 7-2. Occupied Bandwidth Plot (Band 12 - 1.4MHz 16-QAM - Full RB Configuration)**



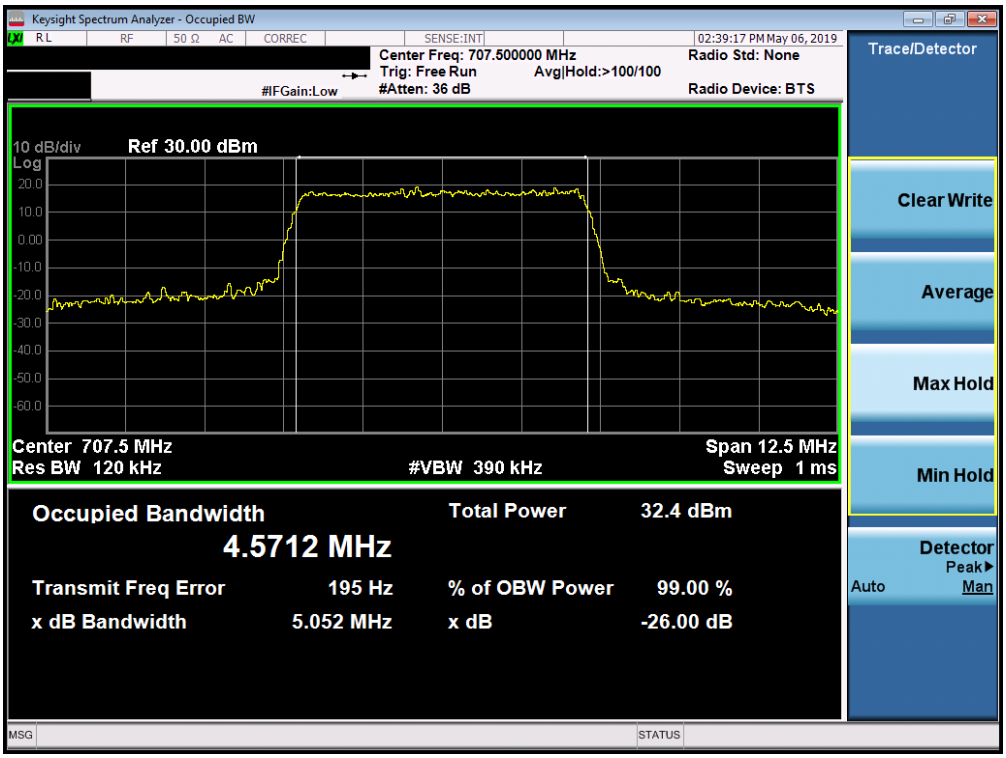

**Plot 7-3. Occupied Bandwidth Plot (Band 12 - 3.0MHz QPSK - Full RB Configuration)**



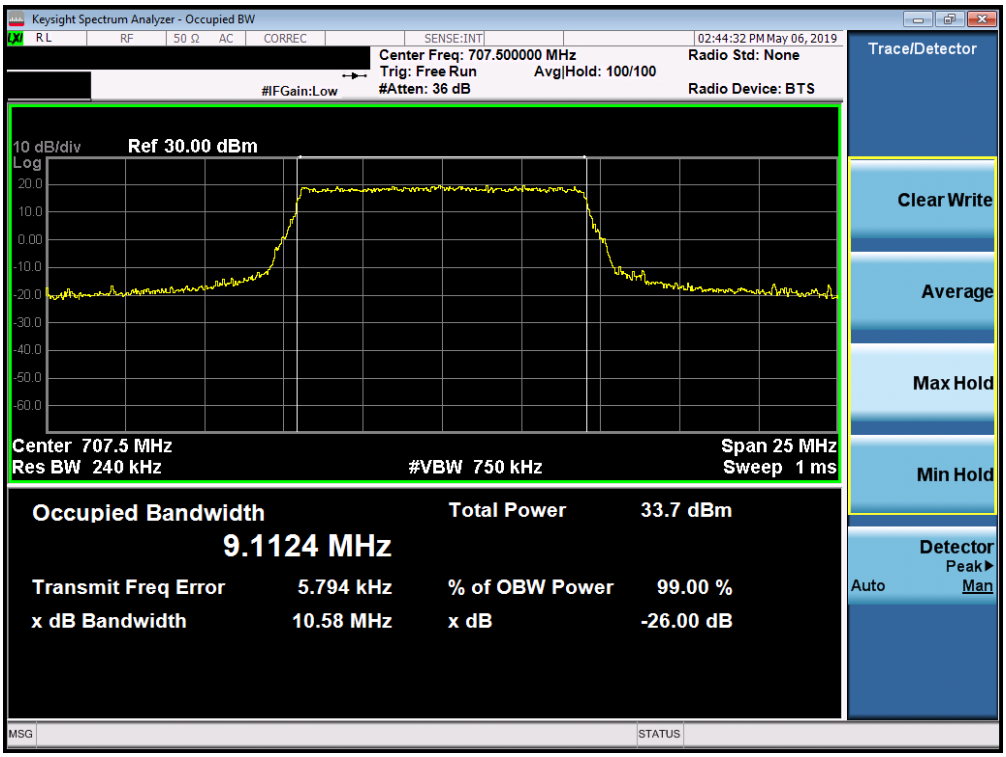

**Plot 7-4. Occupied Bandwidth Plot (Band 12 - 3.0MHz 16-QAM - Full RB Configuration)**



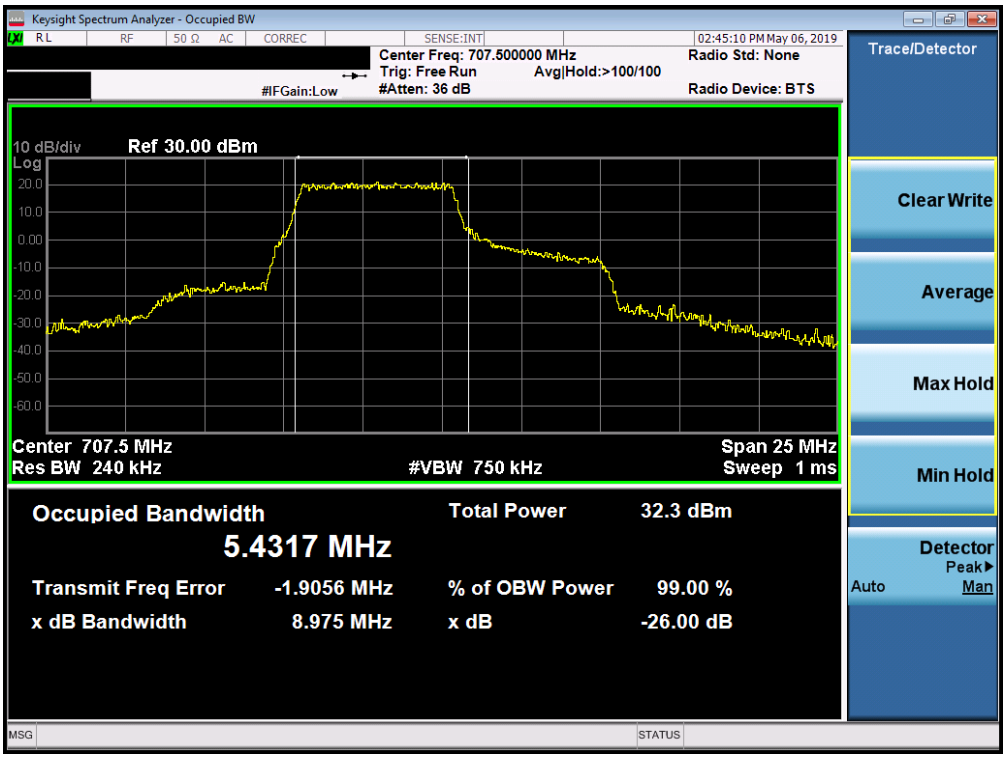

**Plot 7-5. Occupied Bandwidth Plot (Band 12/17 - 5.0MHz QPSK - Full RB Configuration)**




**Plot 7-6. Occupied Bandwidth Plot (Band 12/17 - 5.0MHz 16-QAM - Full RB Configuration)**

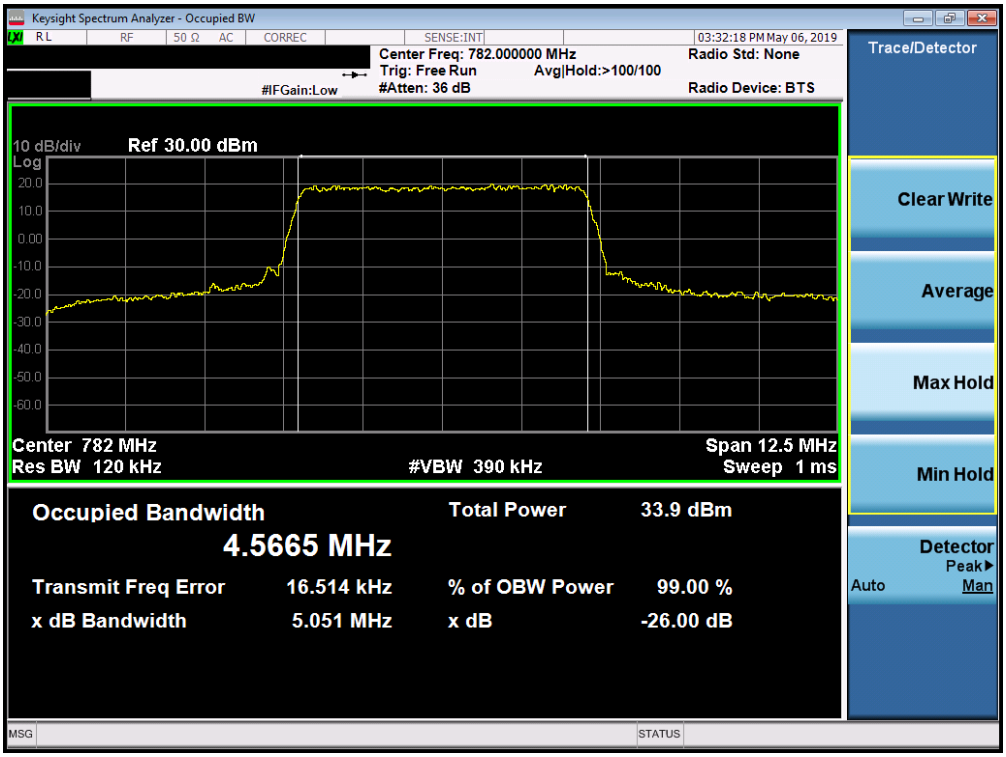



**Plot 7-7. Occupied Bandwidth Plot (Band 12/17 - 10.0MHz QPSK - Full RB Configuration)**

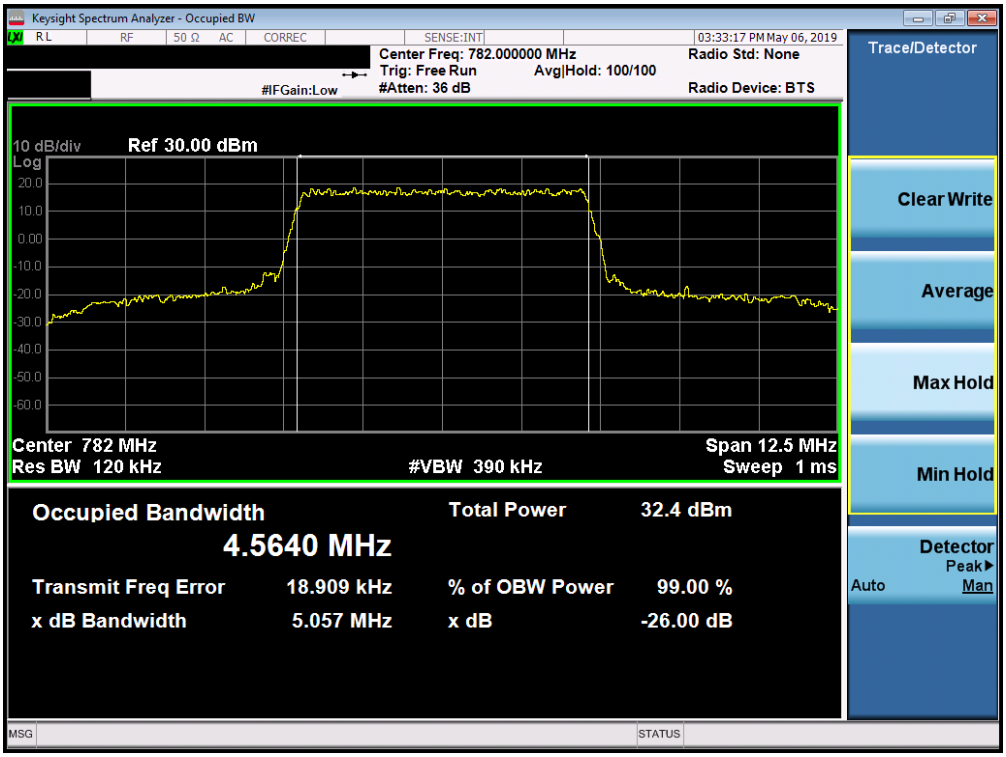



**Plot 7-8. Occupied Bandwidth Plot (Band 12/17 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**

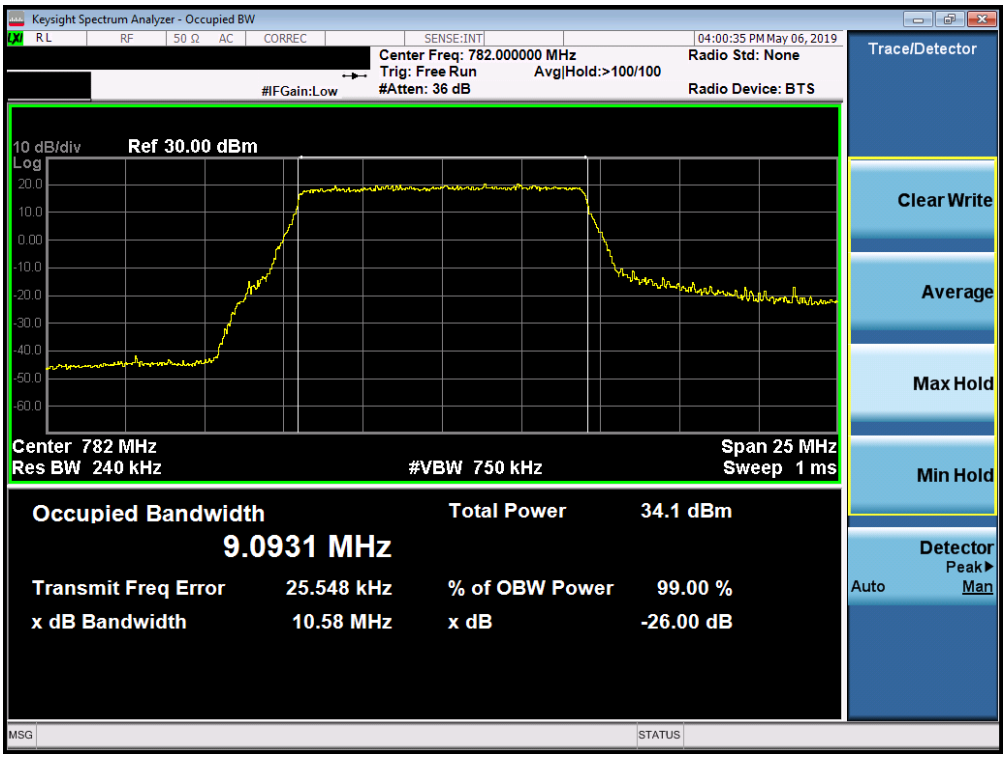
## Band 13




**Plot 7-9. Occupied Bandwidth Plot (Band 13 - 5.0MHz QPSK - Full RB Configuration)**



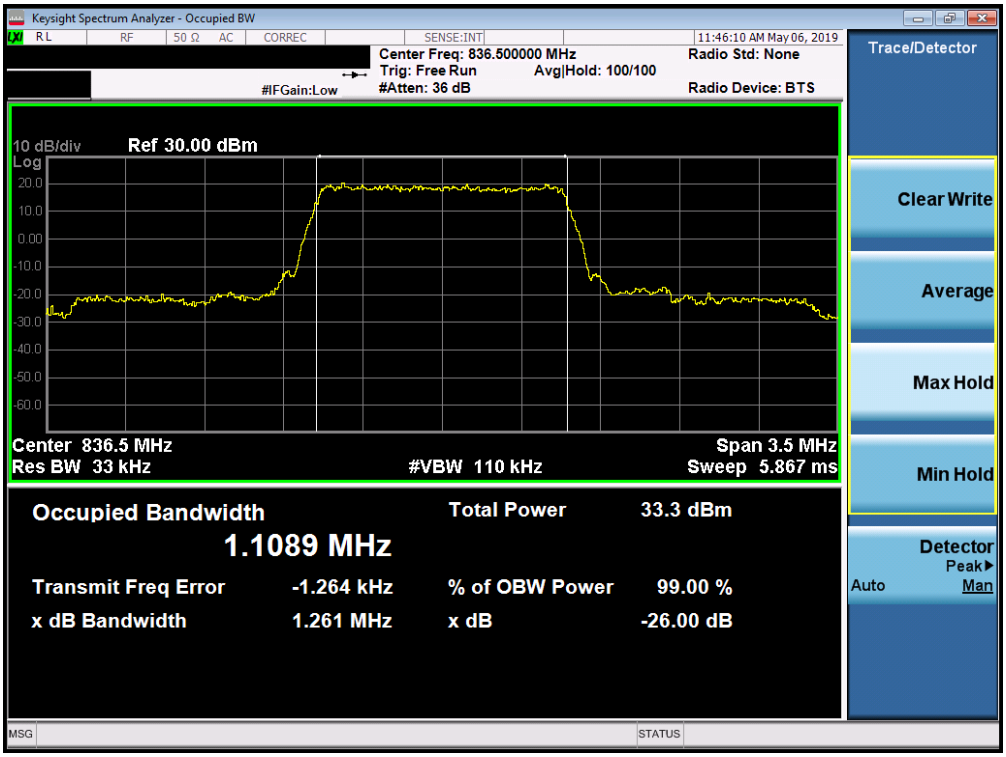

**Plot 7-10. Occupied Bandwidth Plot (Band 13 - 5.0MHz 16-QAM - Full RB Configuration)**



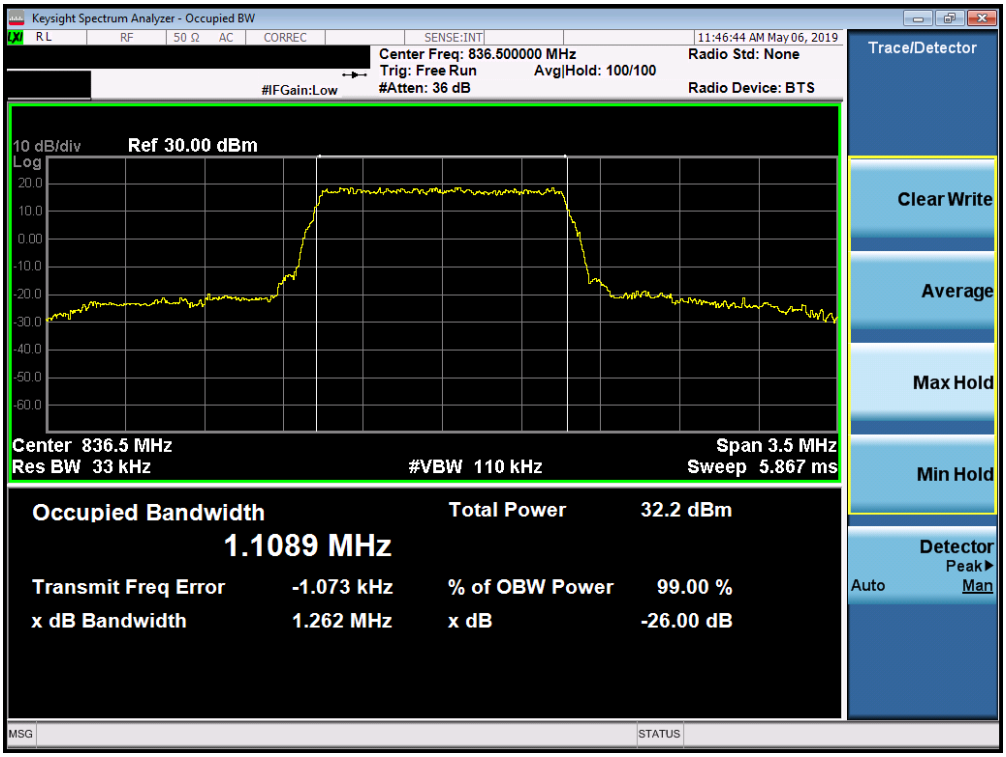

**Plot 7-11. Occupied Bandwidth Plot (Band 13 - 10.0MHz QPSK - Full RB Configuration)**


**Plot 7-12. Occupied Bandwidth Plot (Band 13 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**

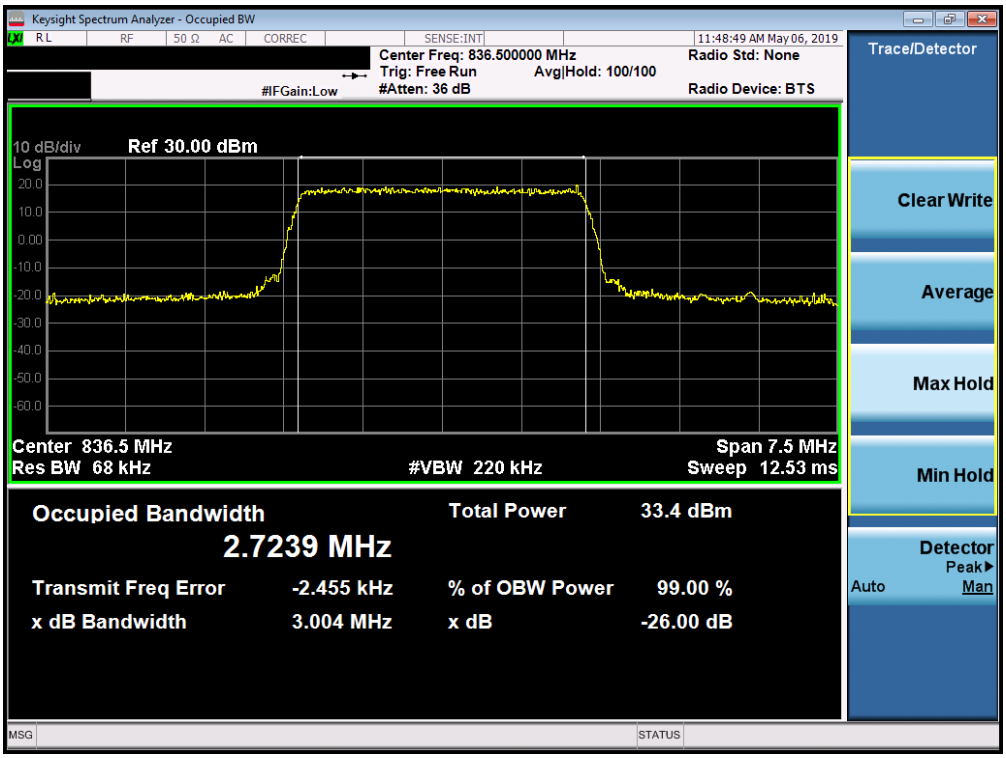
## Band 26/5



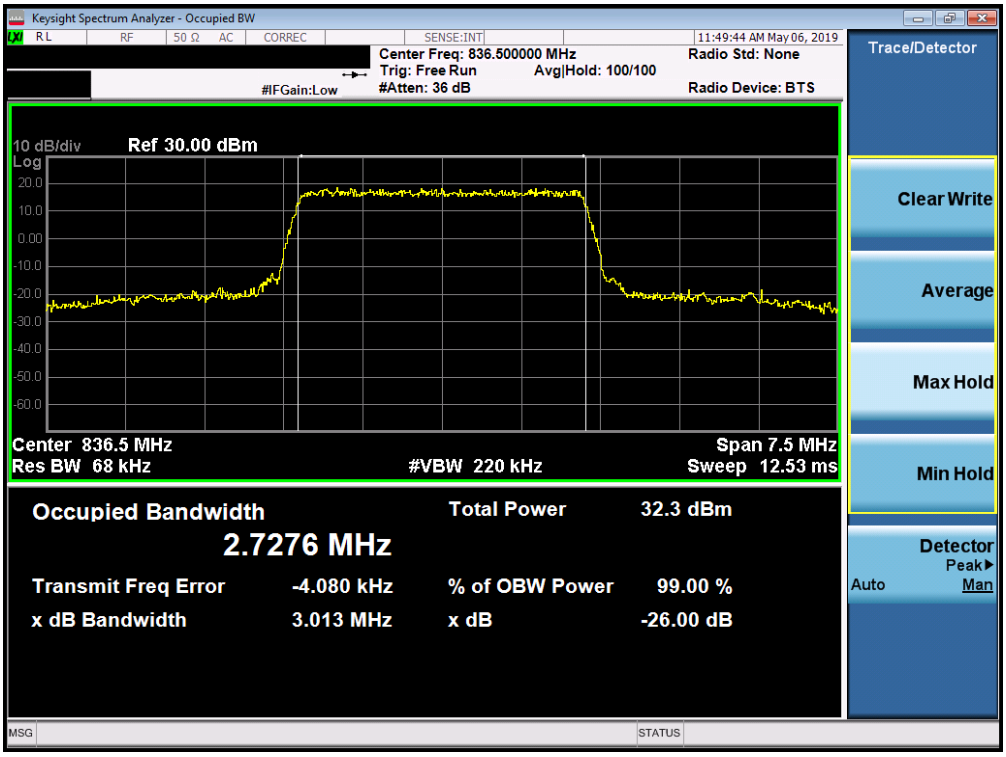

**Plot 7-13. Occupied Bandwidth Plot (Band 26/5 - 1.4MHz QPSK - Full RB Configuration)**



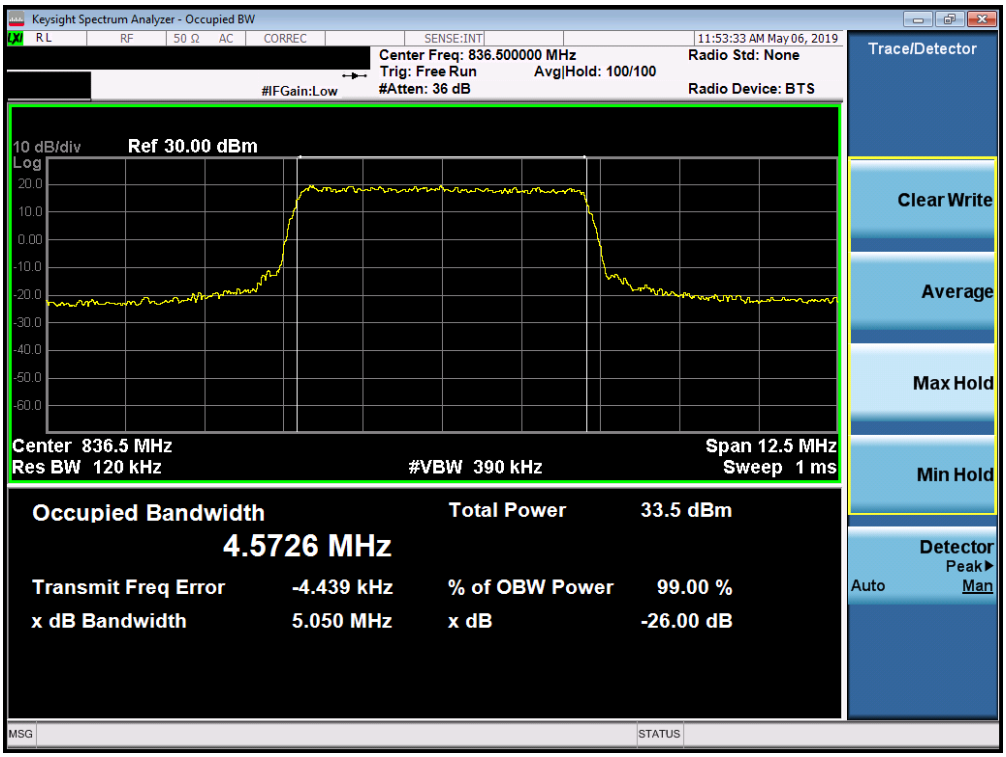

**Plot 7-14. Occupied Bandwidth Plot (Band 26/5 - 1.4MHz 16-QAM - Full RB Configuration)**



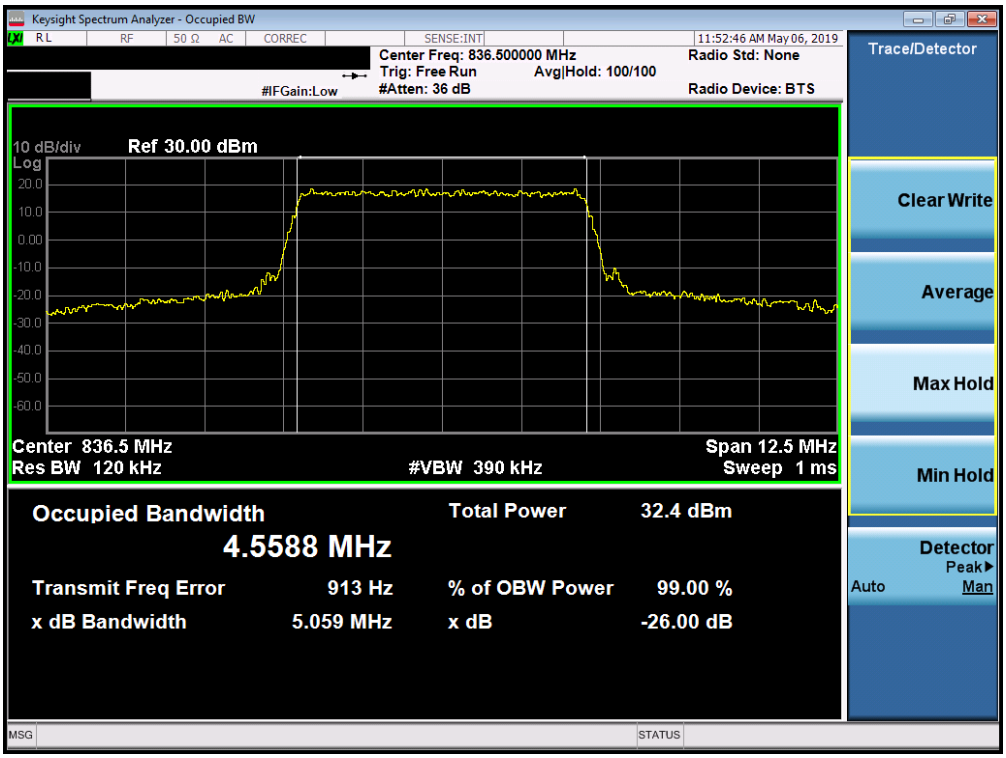

**Plot 7-15. Occupied Bandwidth Plot (Band 26/5 - 3.0MHz QPSK - Full RB Configuration)**



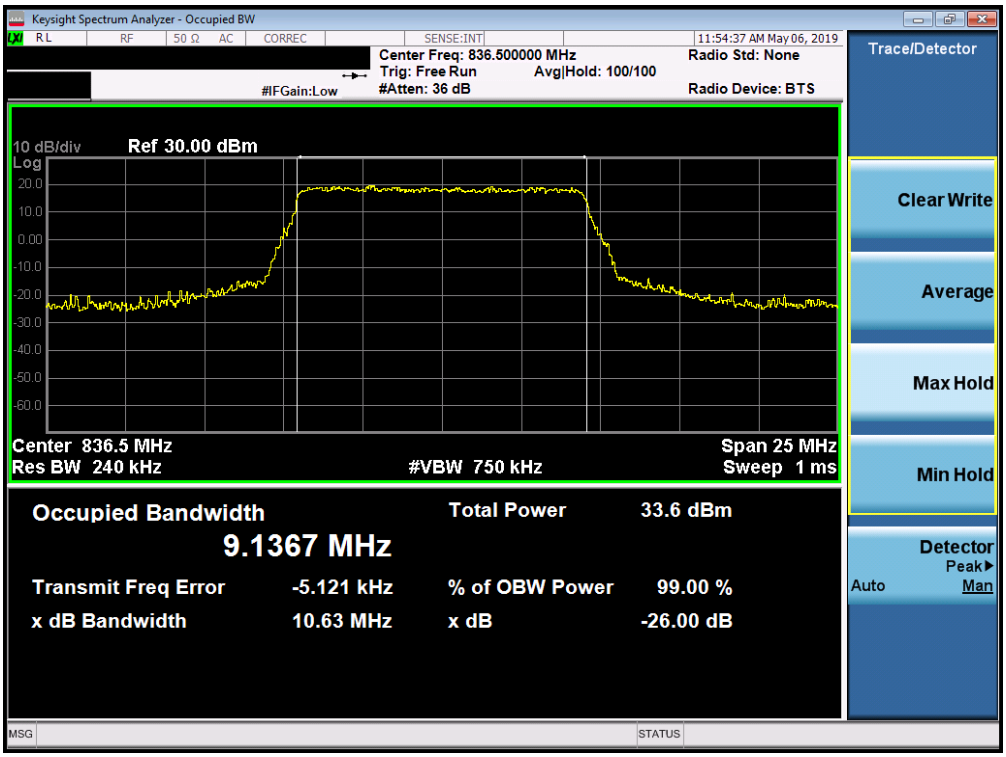

**Plot 7-16. Occupied Bandwidth Plot (Band 26/5 - 3.0MHz 16-QAM - Full RB Configuration)**




**Plot 7-17. Occupied Bandwidth Plot (Band 26/5 - 5.0MHz QPSK - Full RB Configuration)**

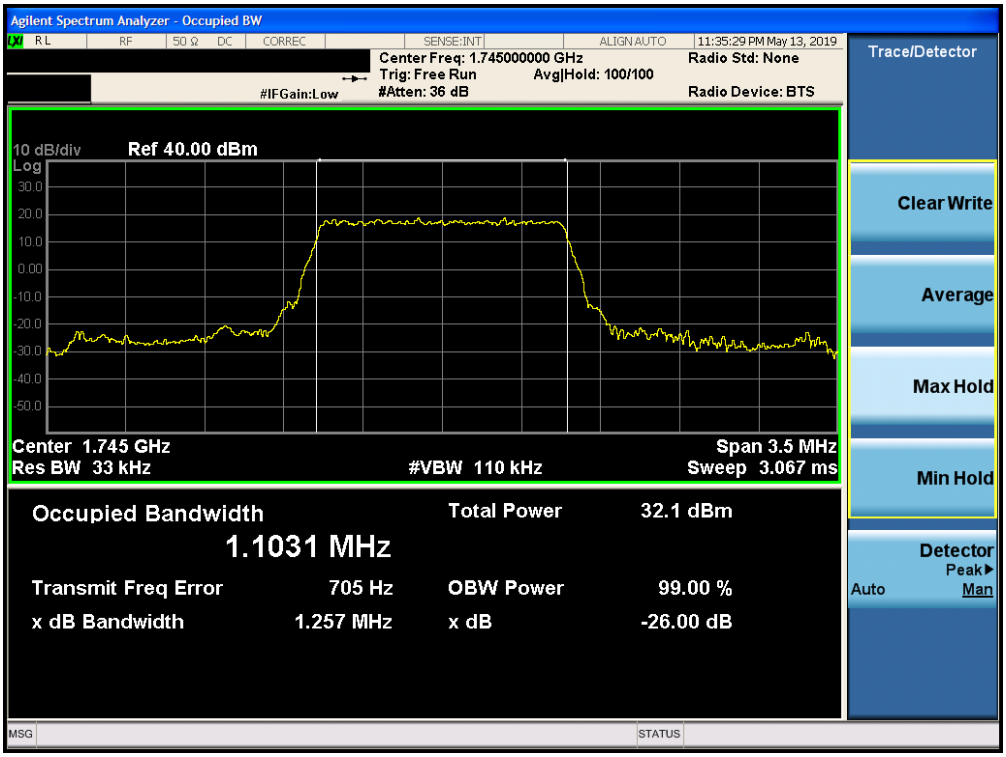



**Plot 7-18. Occupied Bandwidth Plot (Band 26/5 - 5.0MHz 16-QAM - Full RB Configuration)**

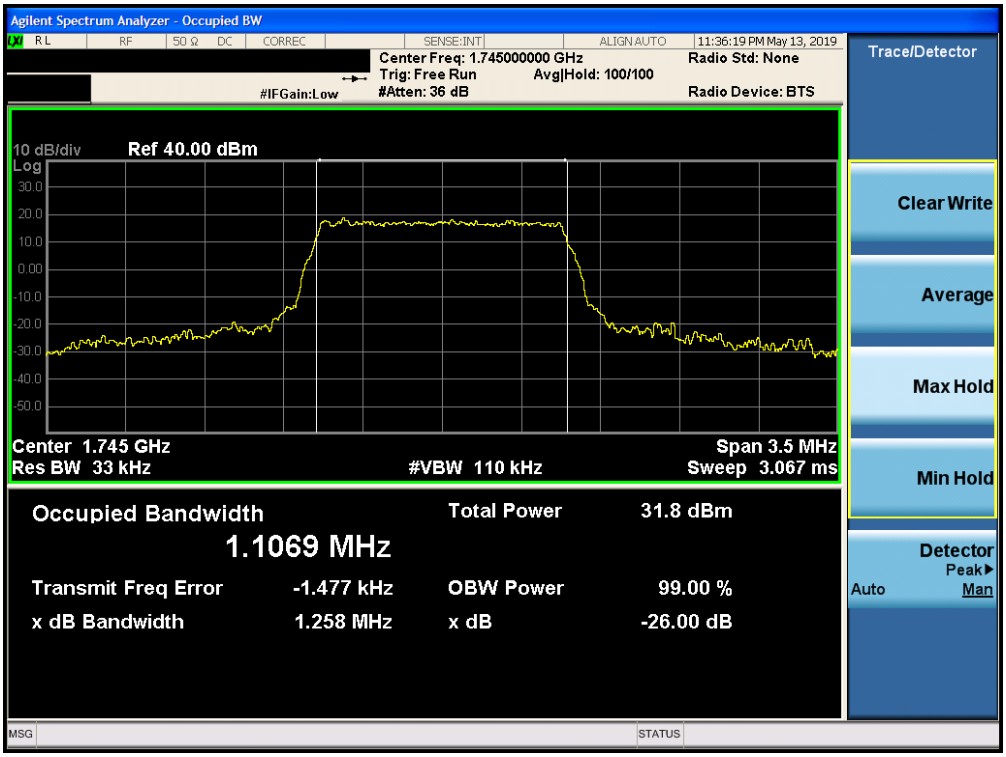



**Plot 7-19. Occupied Bandwidth Plot (Band 26/5 - 10.0MHz QPSK - Full RB Configuration)**

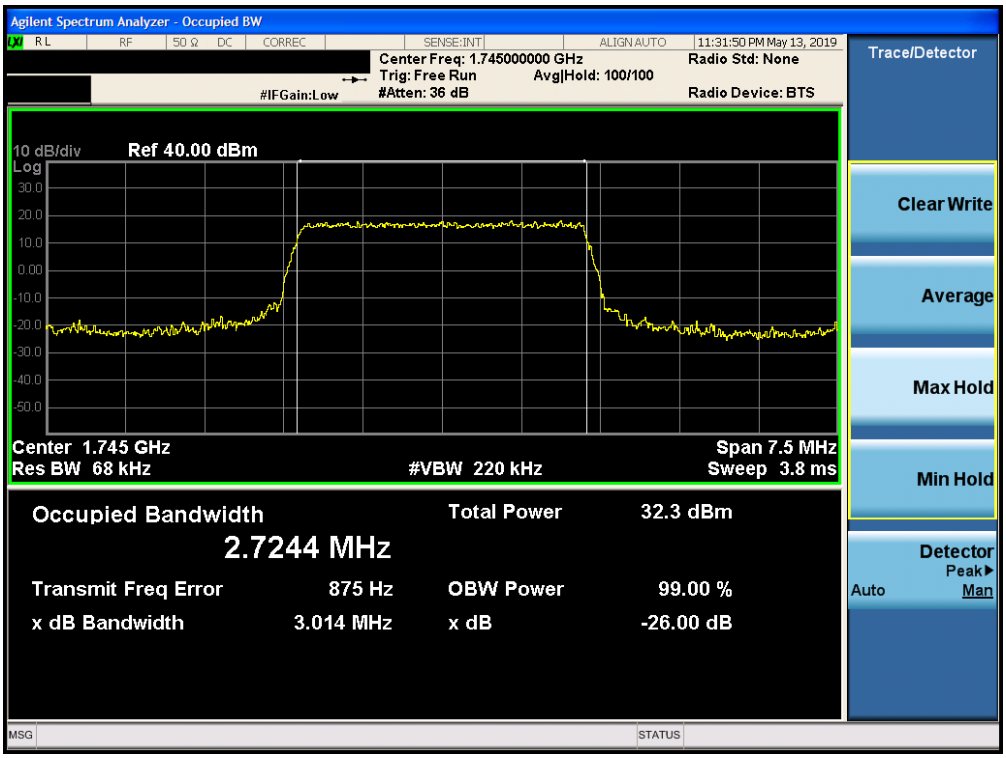

**Plot 7-20. Occupied Bandwidth Plot (Band 26/5 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**



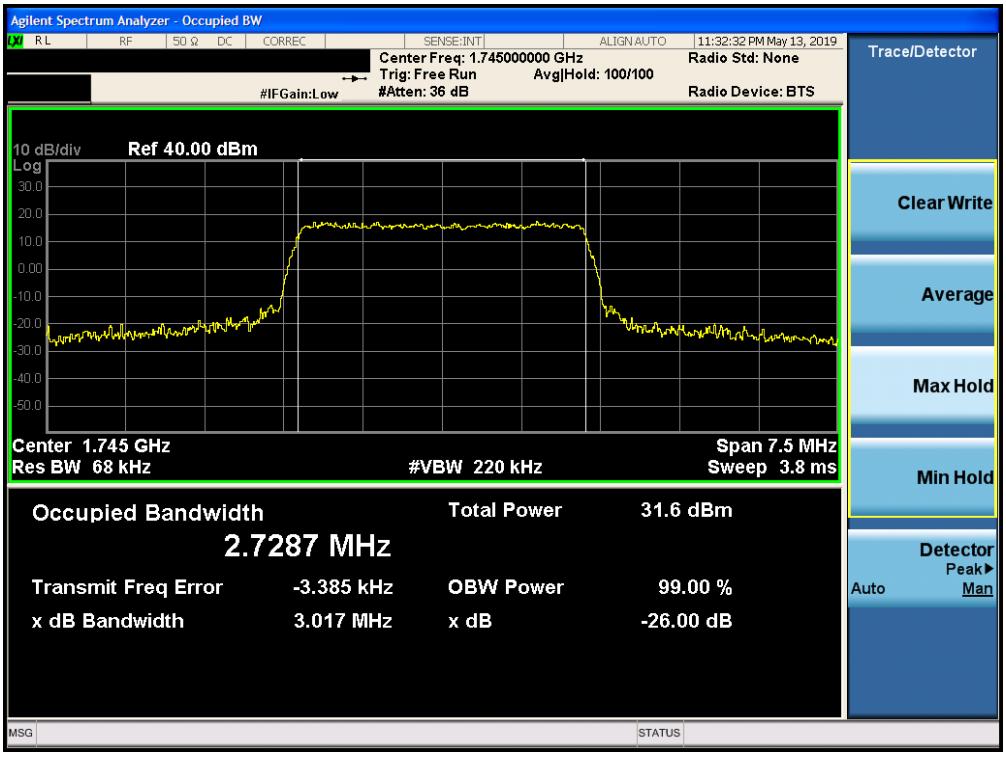

**Plot 7-21. Occupied Bandwidth Plot (Band 66/4 - 1.4MHz QPSK - Full RB Configuration)**



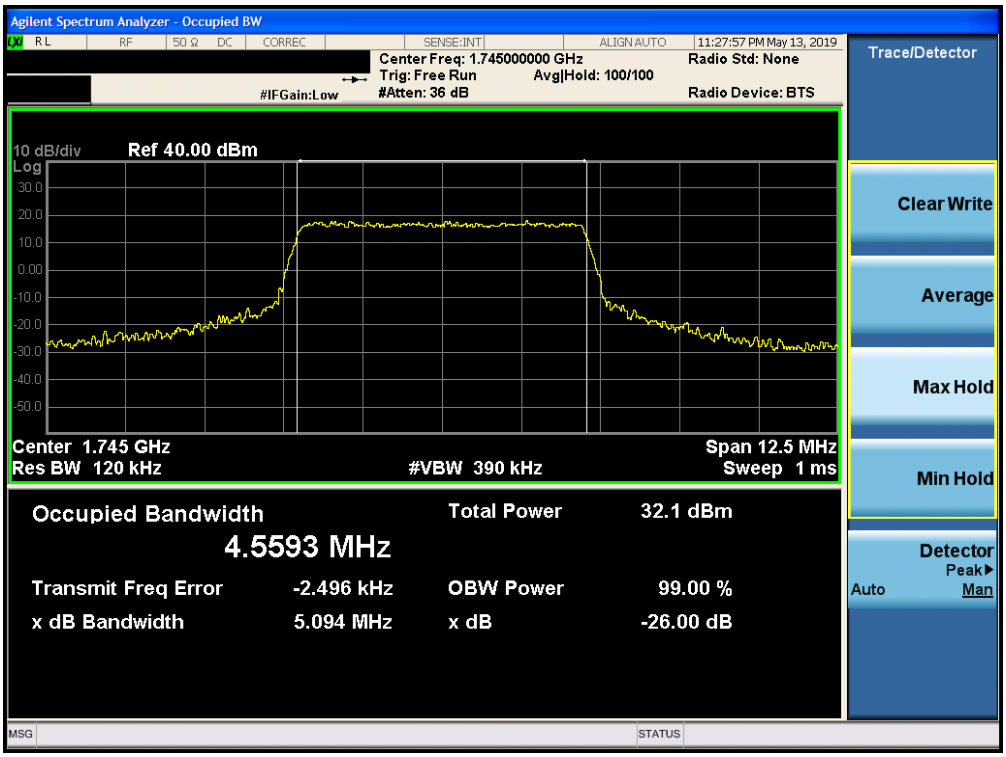

**Plot 7-22. Occupied Bandwidth Plot (Band 66/4 - 1.4MHz 16-QAM - Full RB Configuration)**



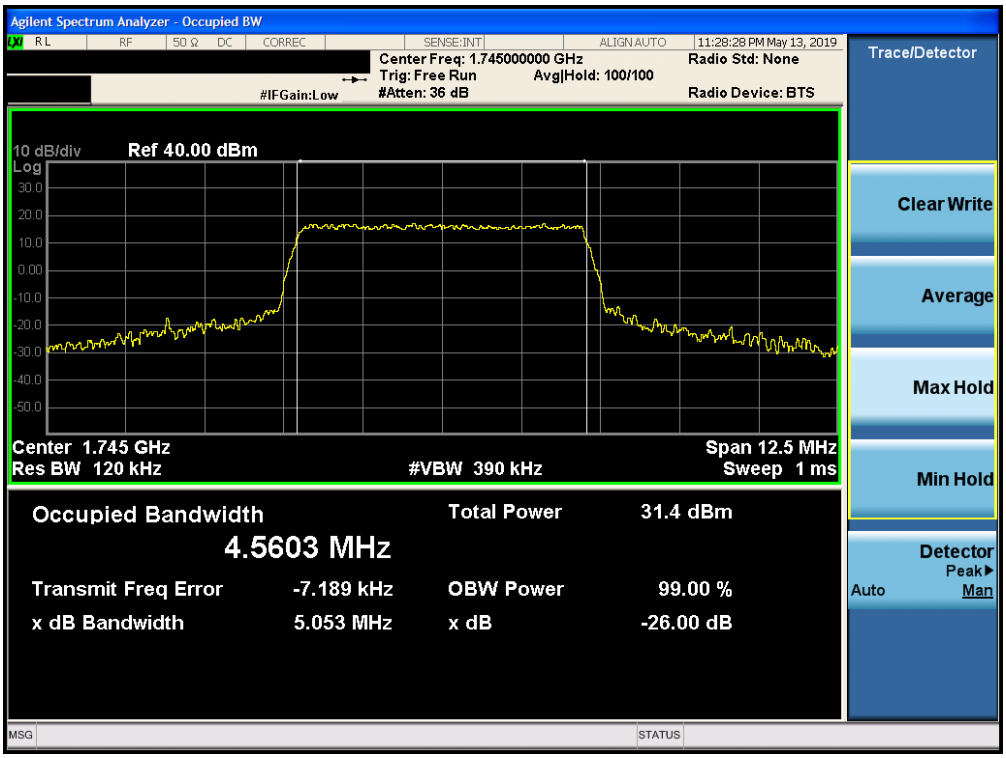

**Plot 7-23. Occupied Bandwidth Plot (Band 66/4 - 3.0MHz QPSK - Full RB Configuration)**



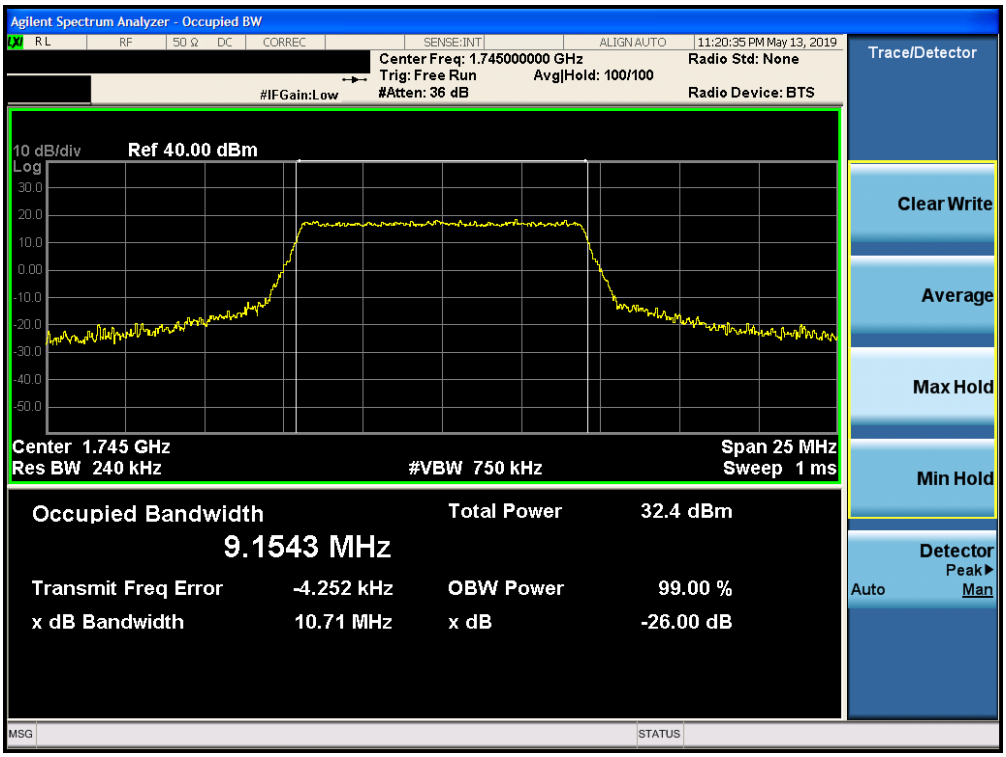

**Plot 7-24. Occupied Bandwidth Plot (Band 66/4 - 3.0MHz 16-QAM - Full RB Configuration)**




**Plot 7-25. Occupied Bandwidth Plot (Band 66/4 - 5.0MHz QPSK - Full RB Configuration)**

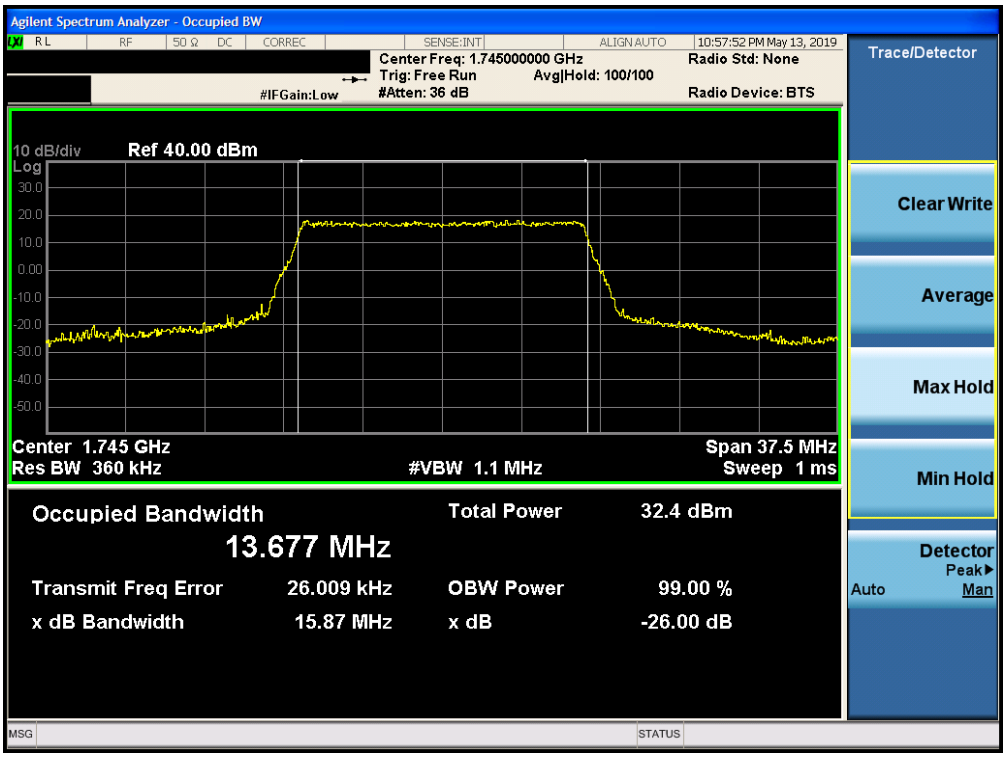



**Plot 7-26. Occupied Bandwidth Plot (Band 66/4 - 5.0MHz 16-QAM - Full RB Configuration)**



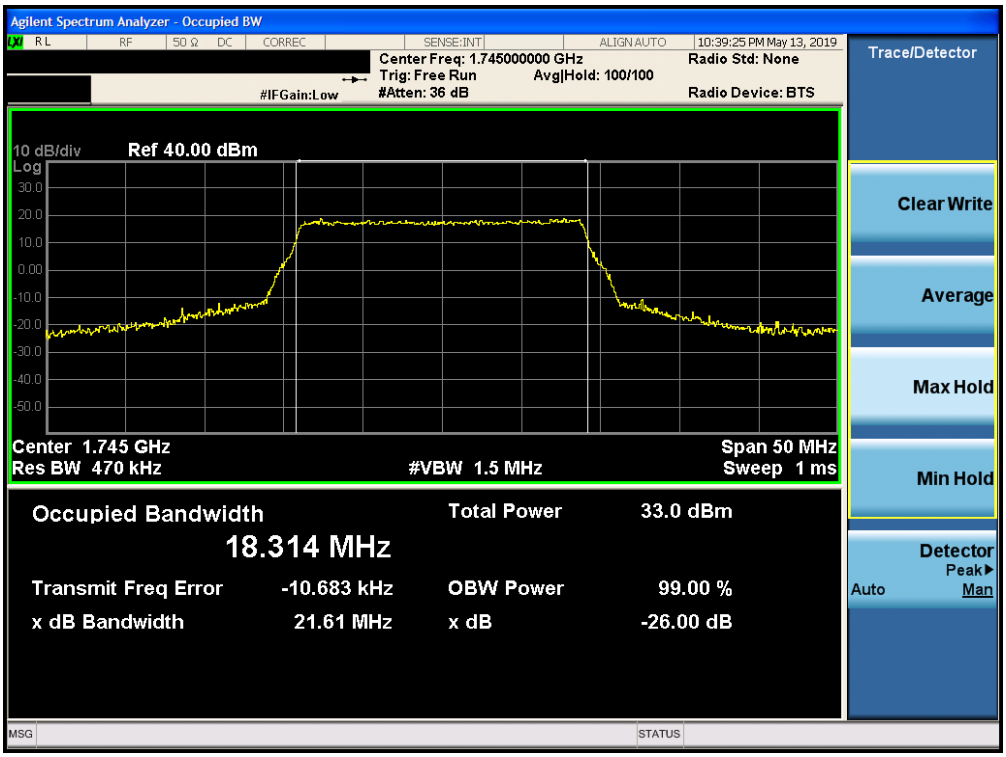

**Plot 7-27. Occupied Bandwidth Plot (Band 66/4 - 10.0MHz QPSK - Full RB Configuration)**


**Plot 7-28. Occupied Bandwidth Plot (Band 66/4 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**

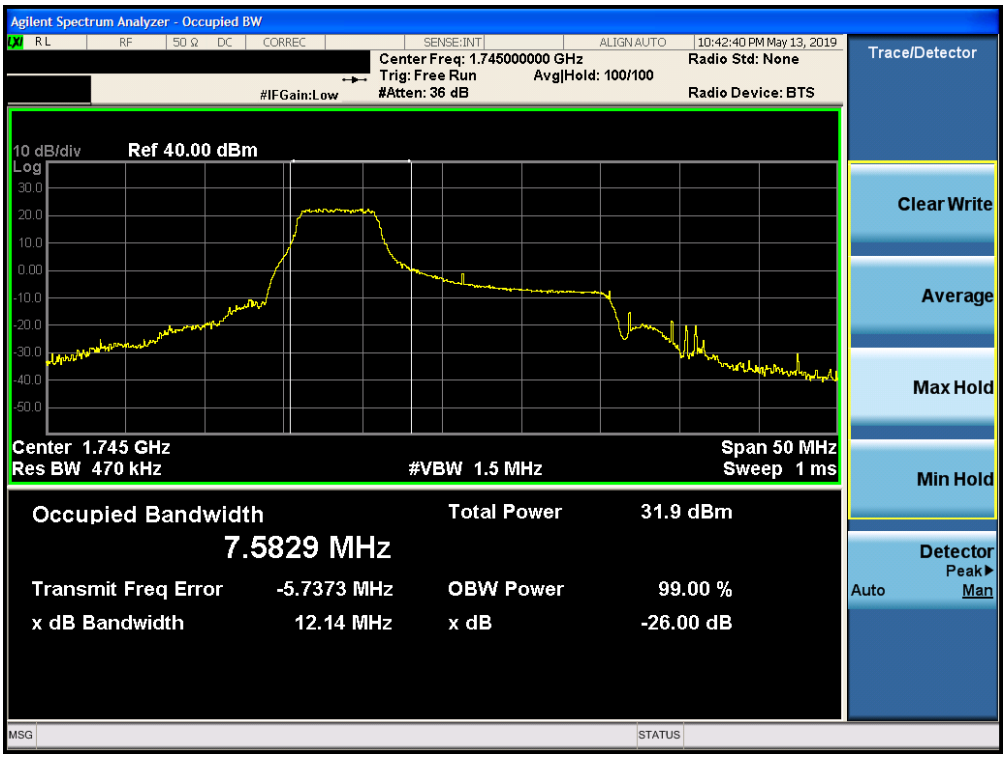



**Plot 7-29. Occupied Bandwidth Plot (Band 66/4 - 15.0MHz QPSK - Full RB Configuration)**

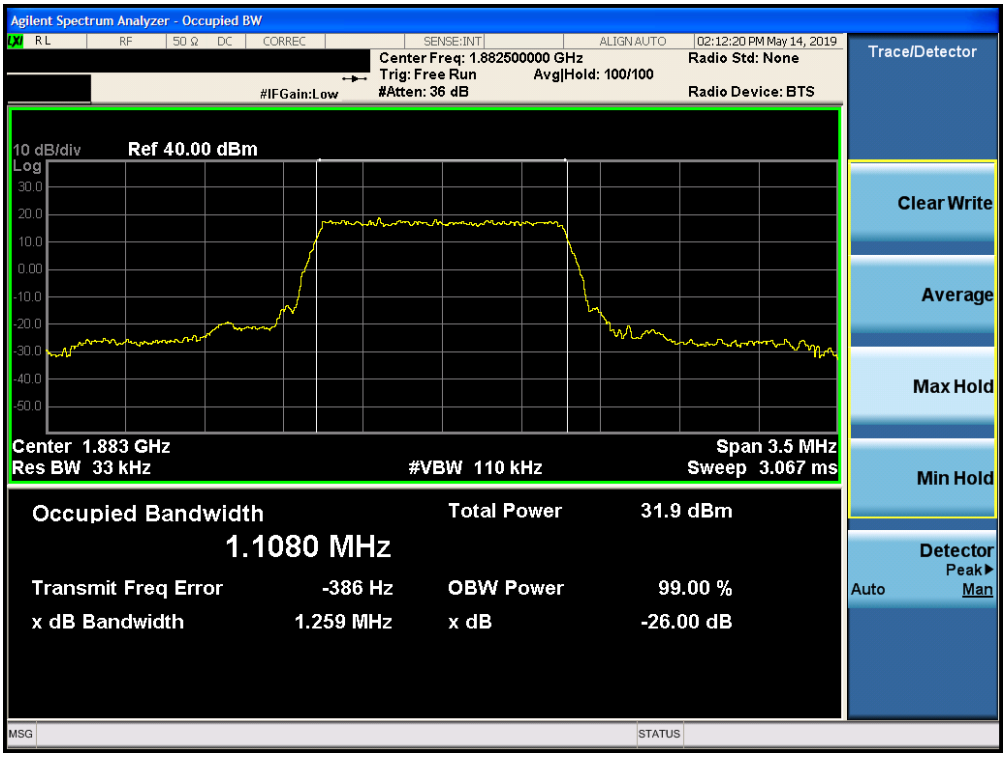

**Plot 7-30. Occupied Bandwidth Plot (Band 66/4 - 15.0MHz 16-QAM – Full RB (27/0) Configuration)**



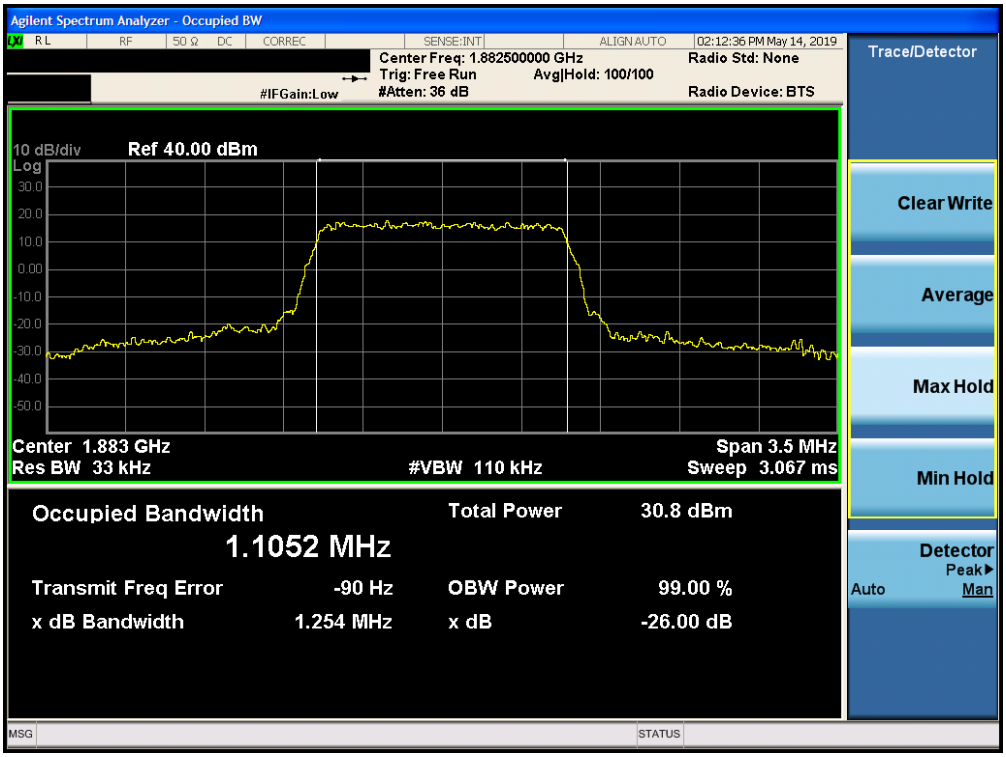

**Plot 7-31. Occupied Bandwidth Plot (Band 66/4 - 20.0MHz QPSK - Full RB Configuration)**



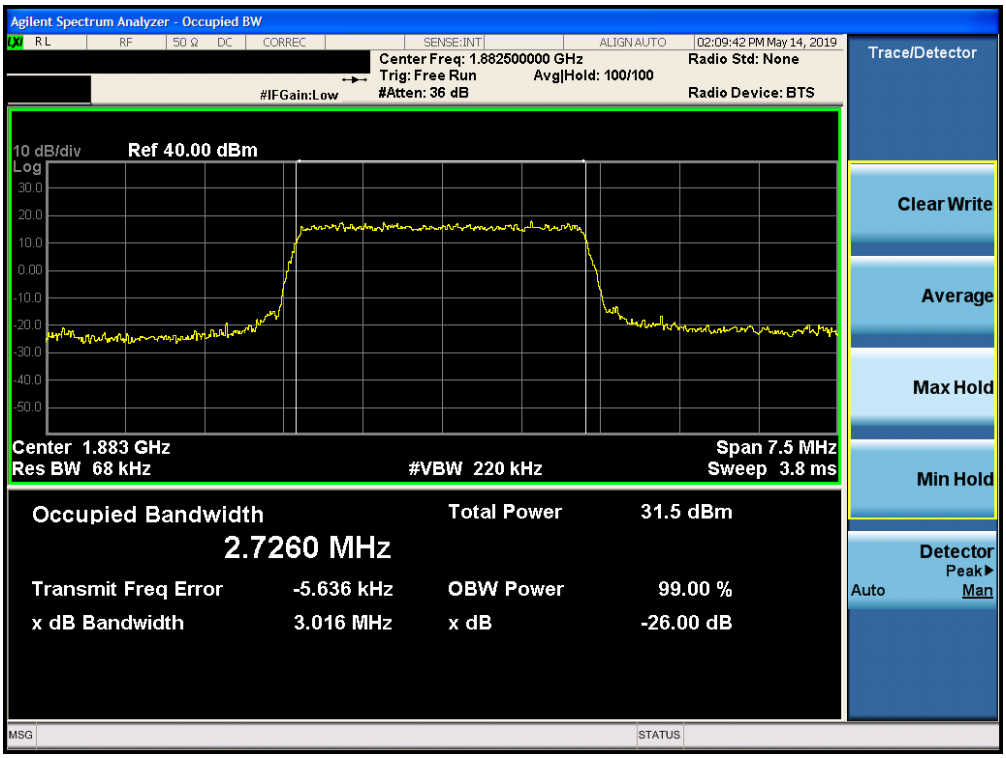

**Plot 7-32. Occupied Bandwidth Plot (Band 66/4 - 20.0MHz 16-QAM – Full RB (27/0) Configuration)**



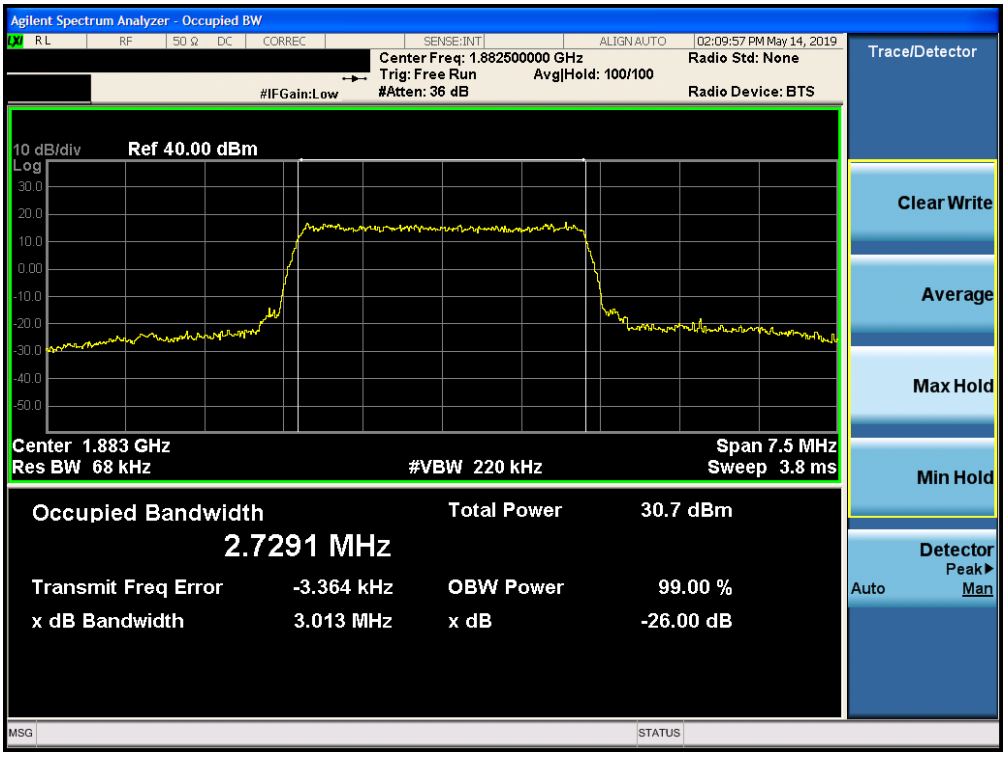

**Plot 7-33. Occupied Bandwidth Plot (Band 25/2 - 1.4MHz QPSK - Full RB Configuration)**



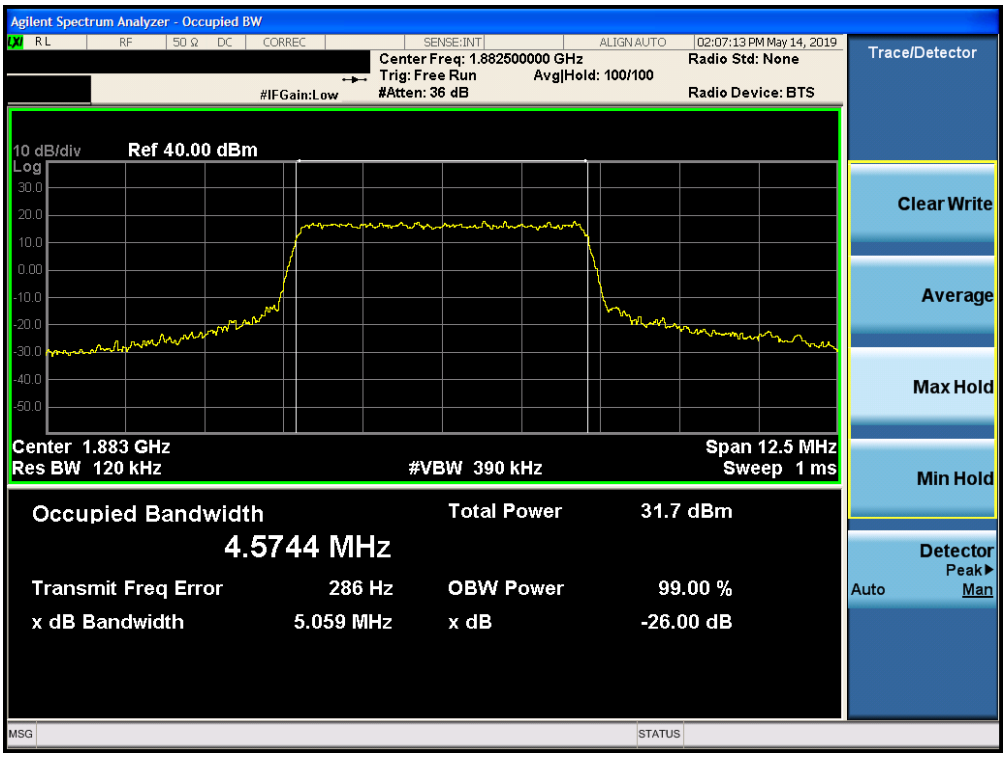

**Plot 7-34. Occupied Bandwidth Plot (Band 25/2 - 1.4MHz 16-QAM - Full RB Configuration)**



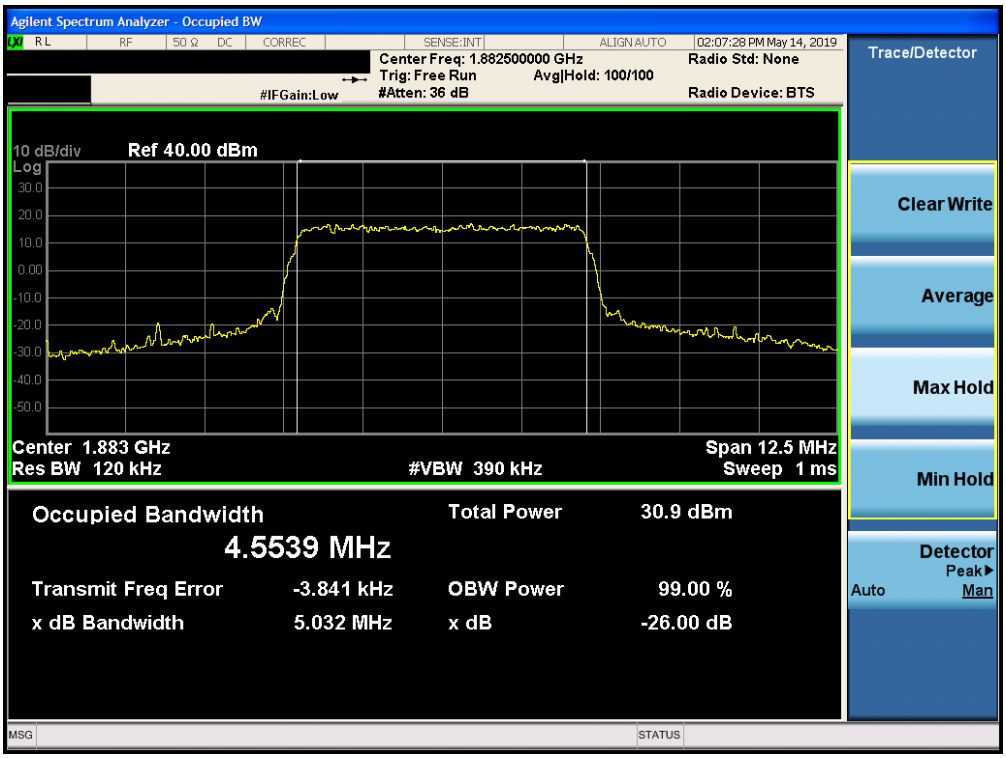

**Plot 7-35. Occupied Bandwidth Plot (Band 25/2 - 3.0MHz QPSK - Full RB Configuration)**



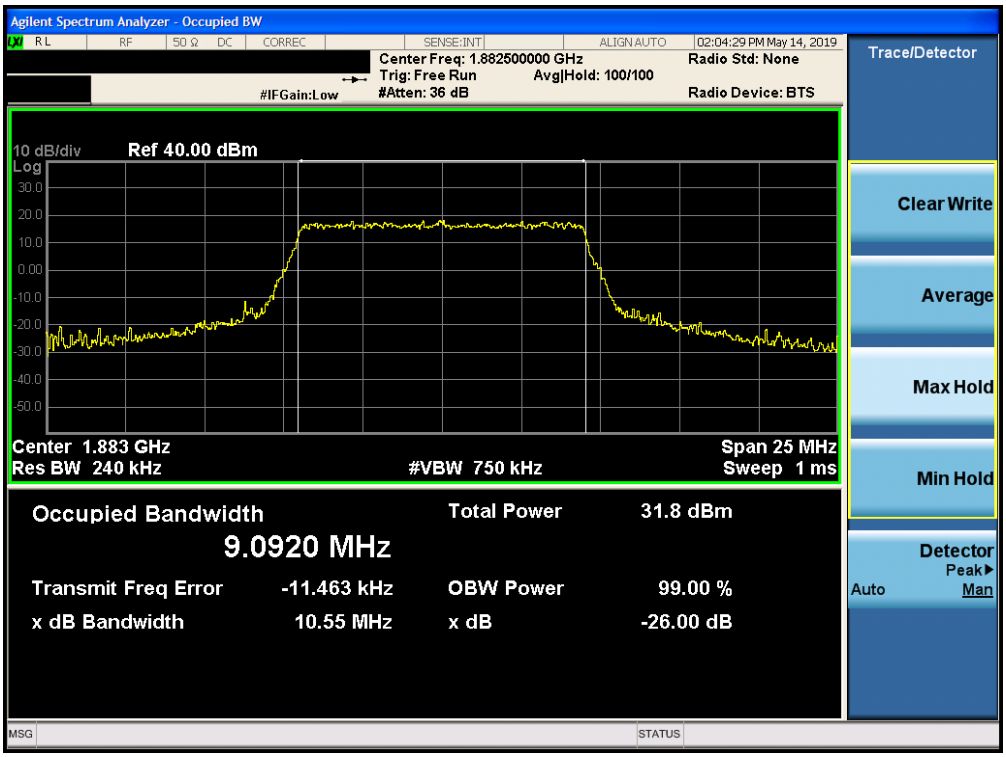

**Plot 7-36. Occupied Bandwidth Plot (Band 25/2 - 3.0MHz 16-QAM - Full RB Configuration)**




**Plot 7-37. Occupied Bandwidth Plot (Band 25/2 - 5.0MHz QPSK - Full RB Configuration)**

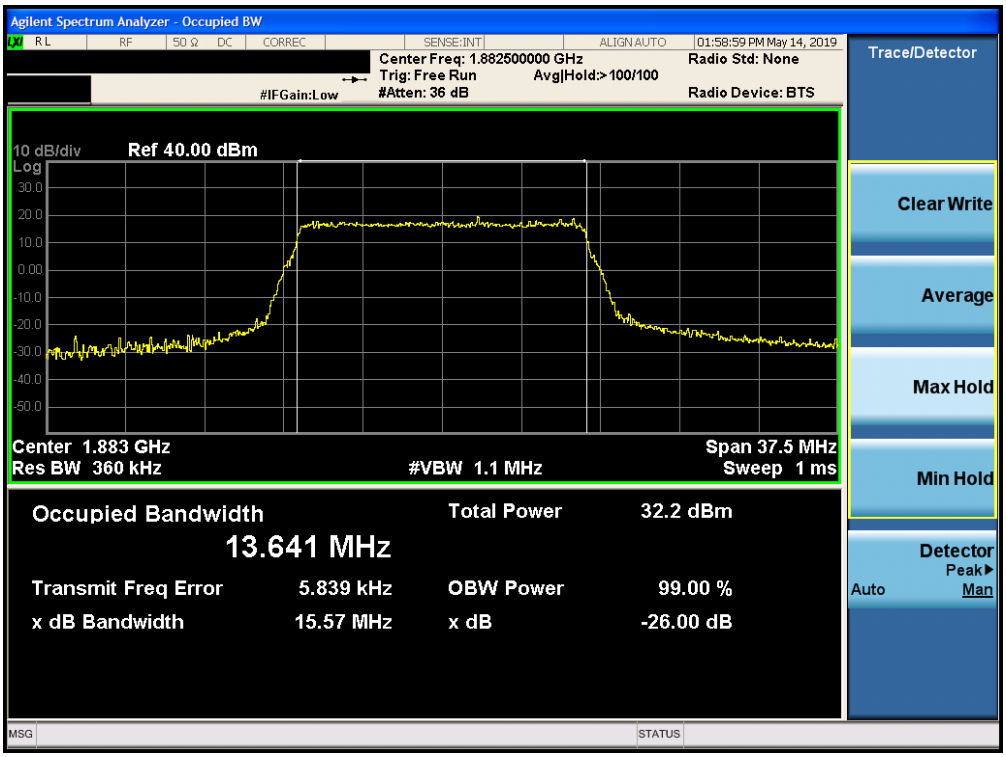



**Plot 7-38. Occupied Bandwidth Plot (Band 25/2 - 5.0MHz 16-QAM - Full RB Configuration)**



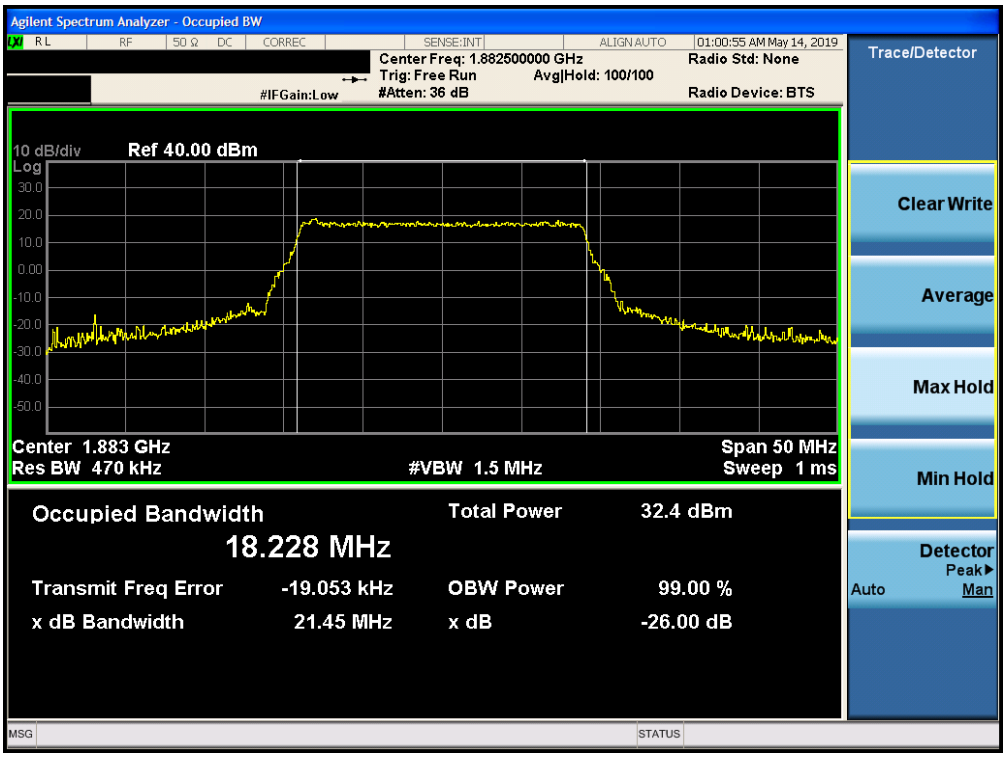

**Plot 7-39. Occupied Bandwidth Plot (Band 25/2 - 10.0MHz QPSK - Full RB Configuration)**


**Plot 7-40. Occupied Bandwidth Plot (Band 25/2 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**

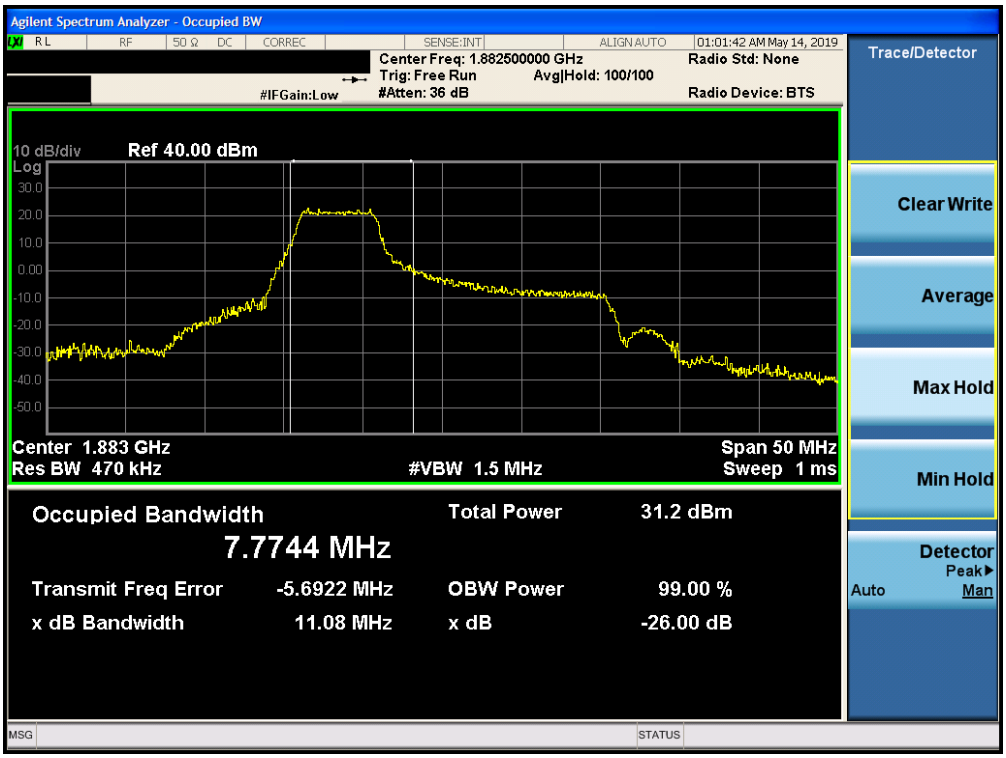



**Plot 7-41. Occupied Bandwidth Plot (Band 25/2 - 15.0MHz QPSK - Full RB Configuration)**


**Plot 7-42. Occupied Bandwidth Plot (Band 25/2 - 15.0MHz 16-QAM – Full RB (27/0) Configuration)**

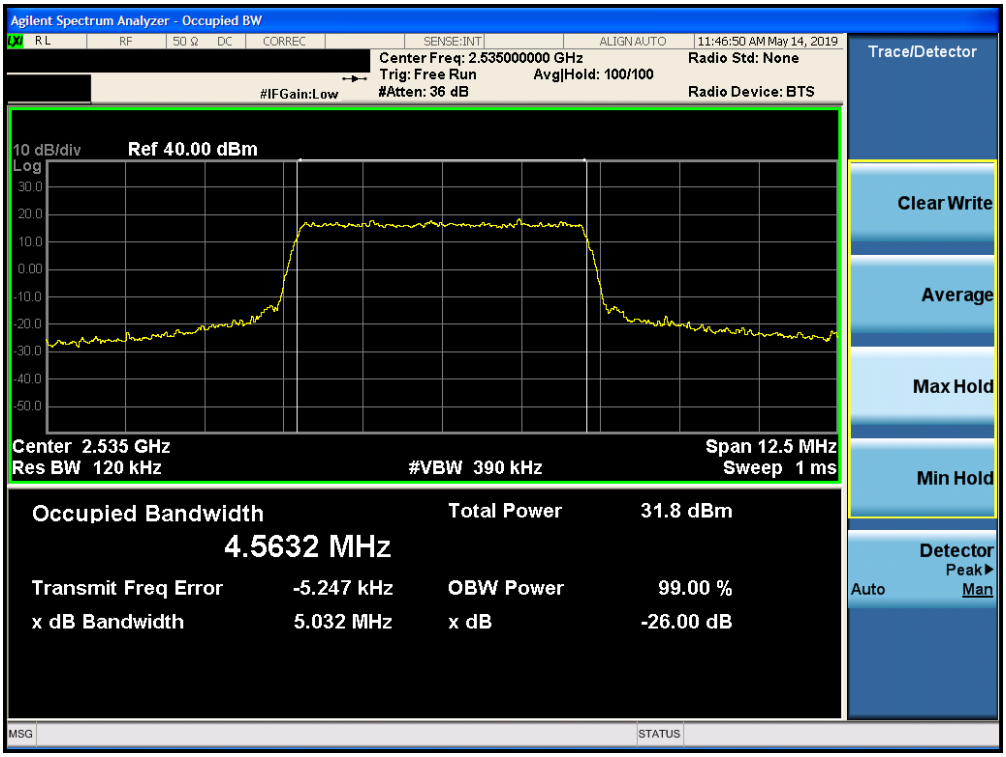



**Plot 7-43. Occupied Bandwidth Plot (Band 25/2 - 20.0MHz QPSK - Full RB Configuration)**

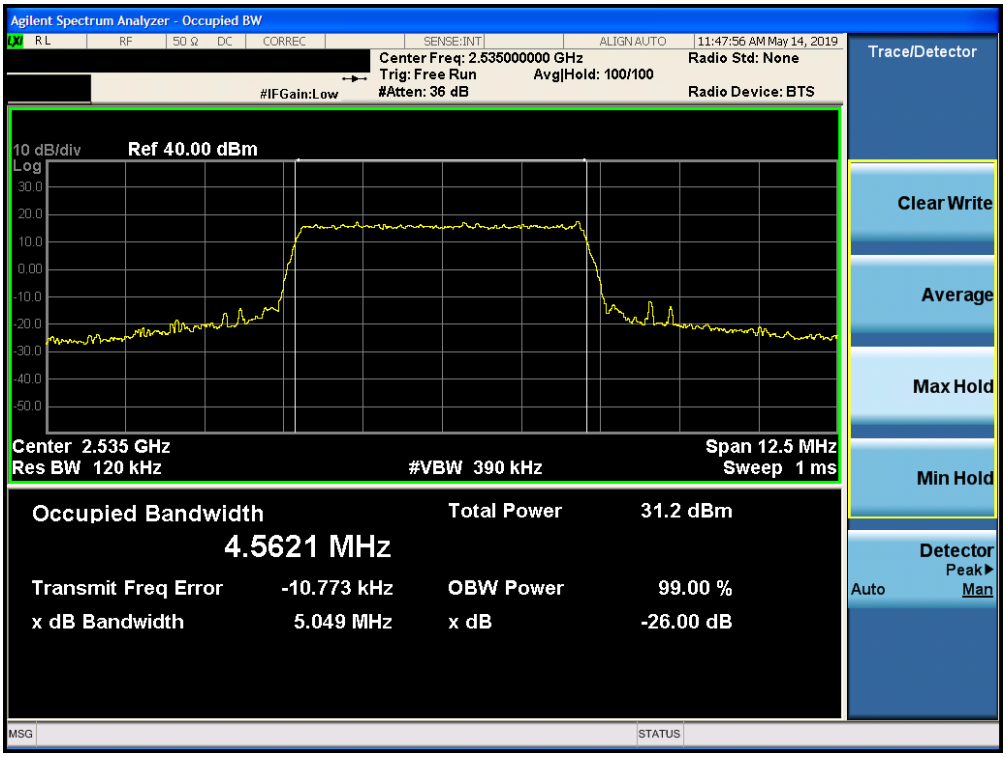



**Plot 7-44. Occupied Bandwidth Plot (Band 25/2 - 20.0MHz 16-QAM – Full RB (27/0) Configuration)**

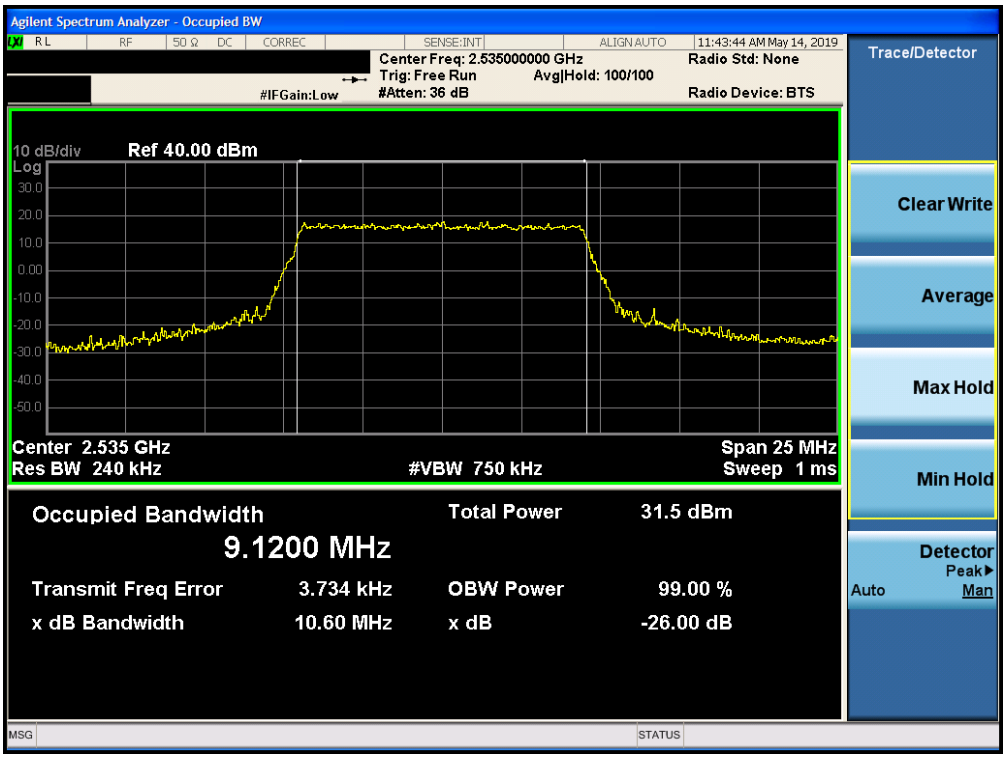
## Band 7




**Plot 7-45. Occupied Bandwidth Plot (Band 7 - 5.0MHz QPSK - Full RB Configuration)**

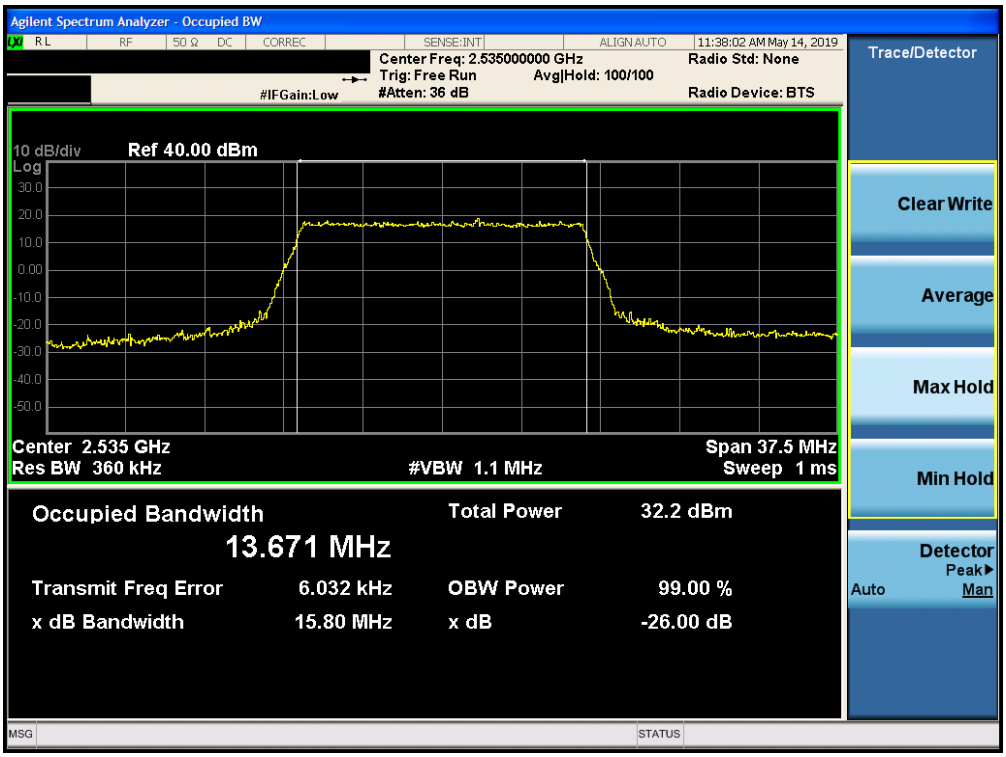



**Plot 7-46. Occupied Bandwidth Plot (Band 7 - 5.0MHz 16-QAM - Full RB Configuration)**



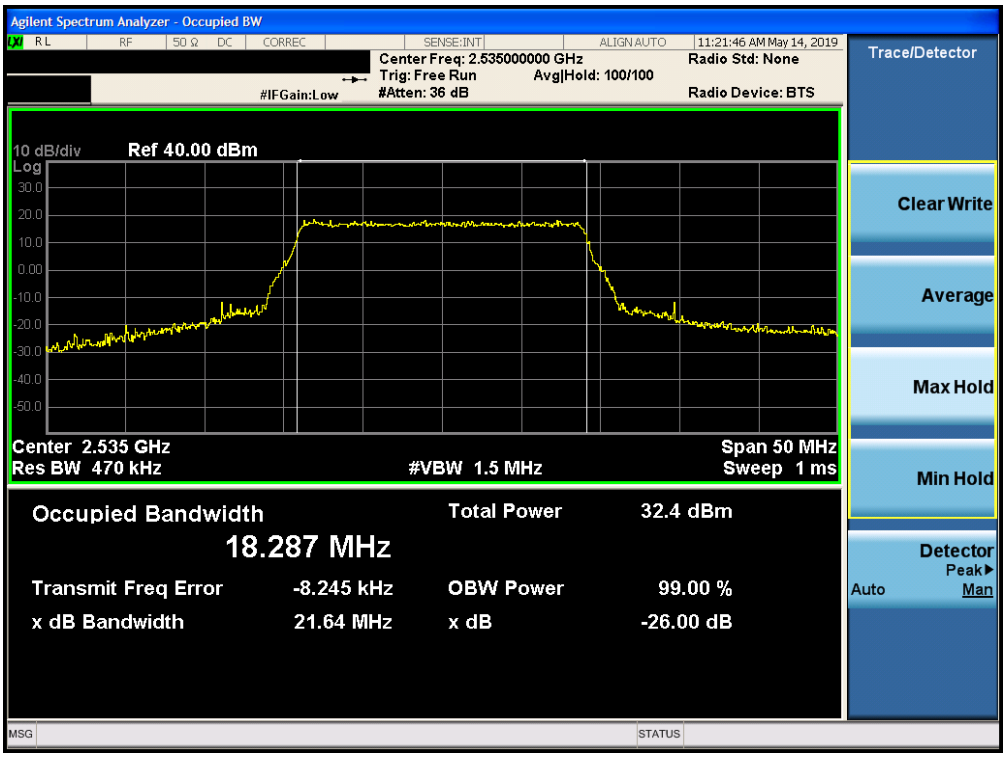

**Plot 7-47. Occupied Bandwidth Plot (Band 7 - 10.0MHz QPSK - Full RB Configuration)**


**Plot 7-48. Occupied Bandwidth Plot (Band 7 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**

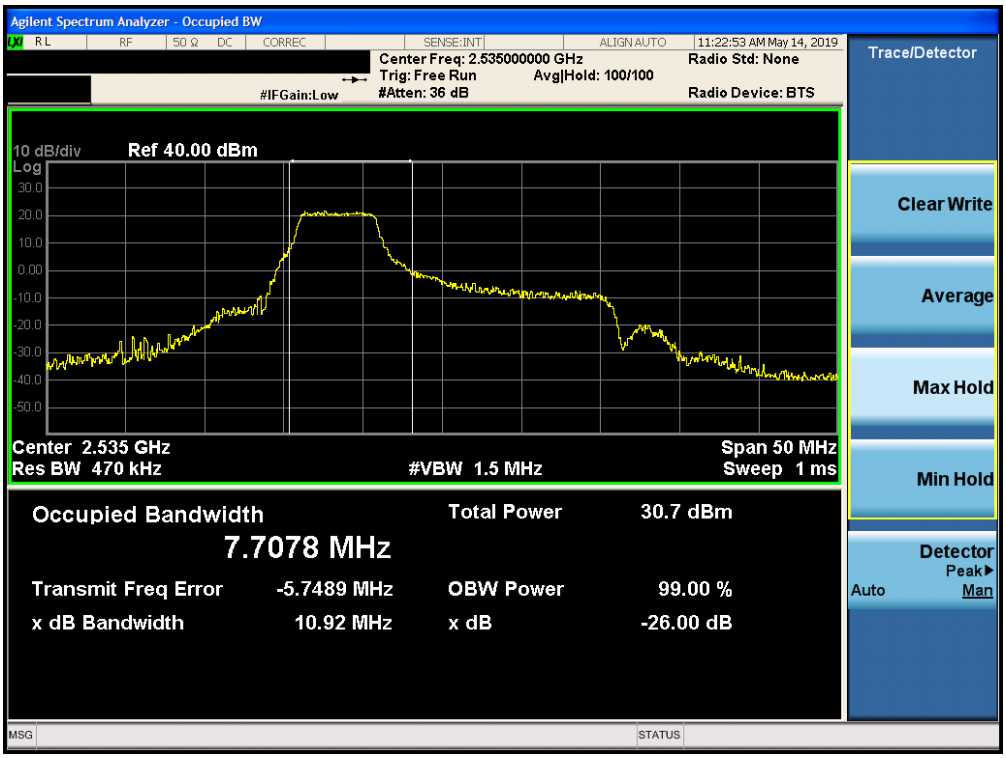



**Plot 7-49. Occupied Bandwidth Plot (Band 7 - 15.0MHz QPSK - Full RB Configuration)**

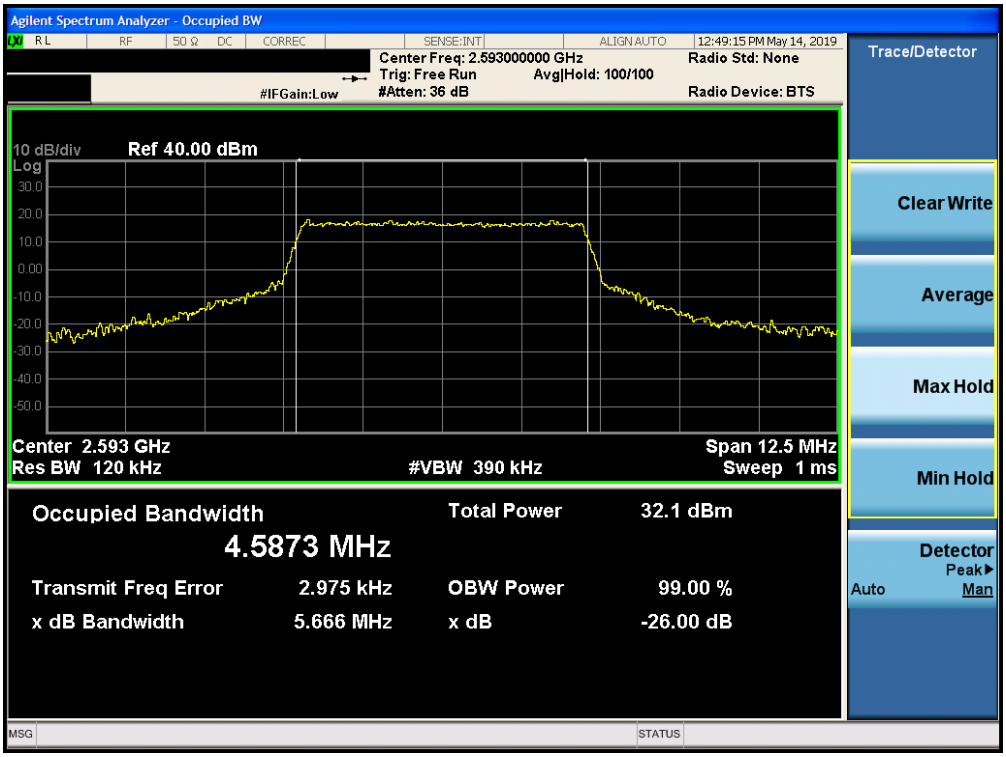

**Plot 7-50. Occupied Bandwidth Plot (Band 7 - 15.0MHz 16-QAM – Full RB (27/0) Configuration)**



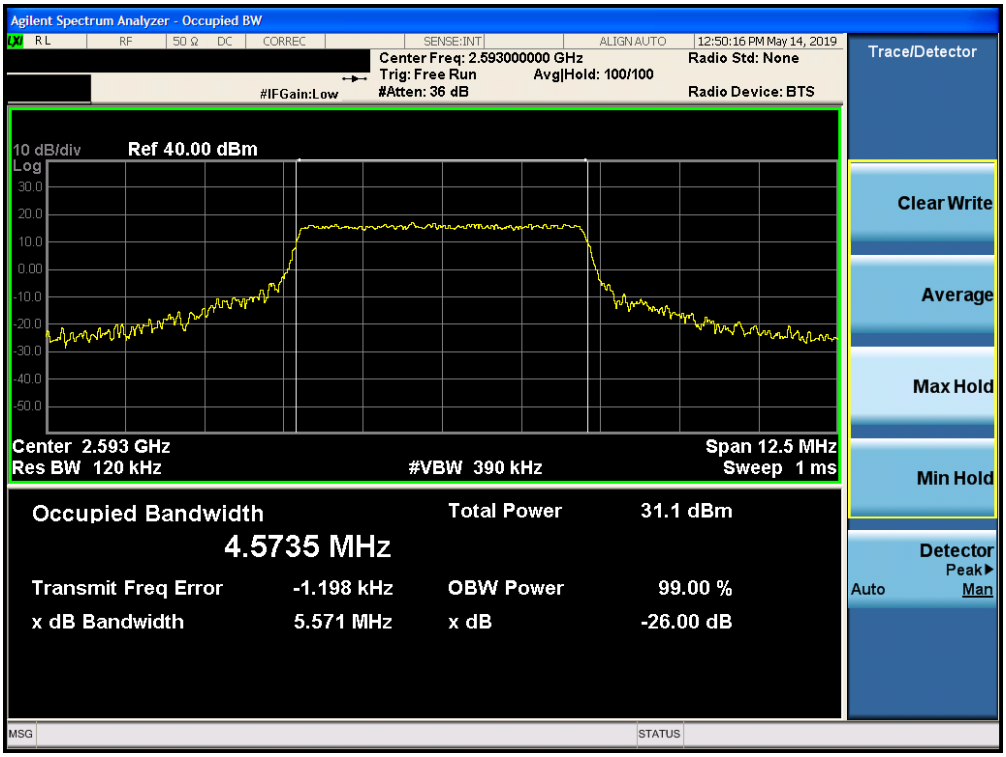

**Plot 7-51. Occupied Bandwidth Plot (Band 7 - 20.0MHz QPSK - Full RB Configuration)**



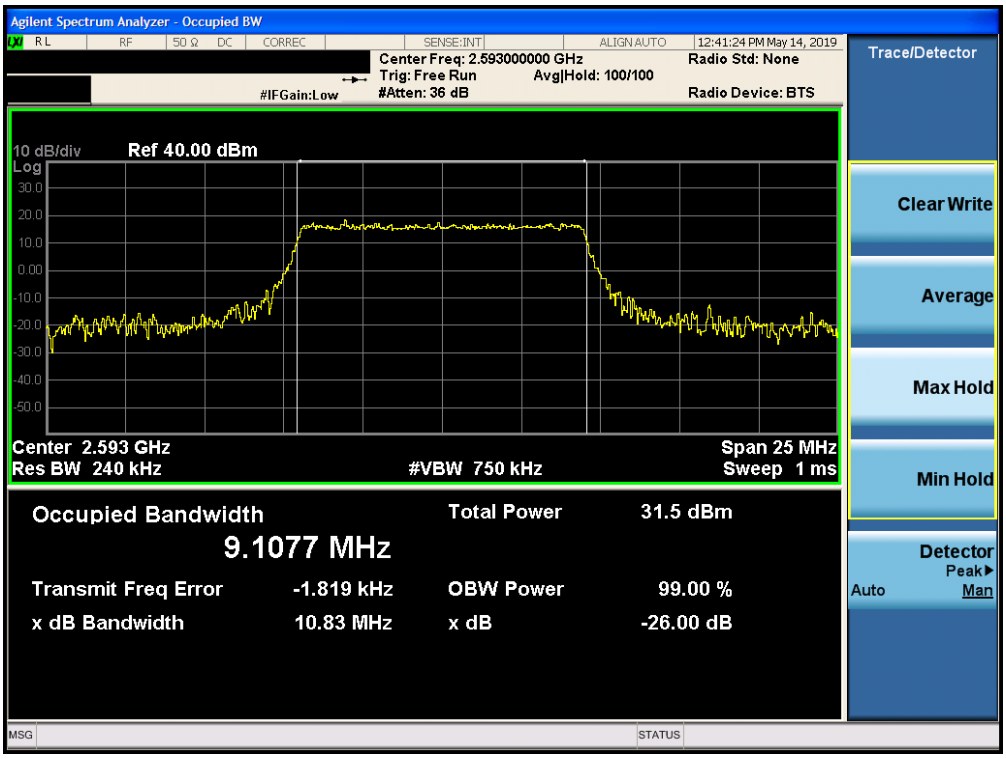

**Plot 7-52. Occupied Bandwidth Plot (Band 7 - 20.0MHz 16-QAM – Full RB (27/0) Configuration)**



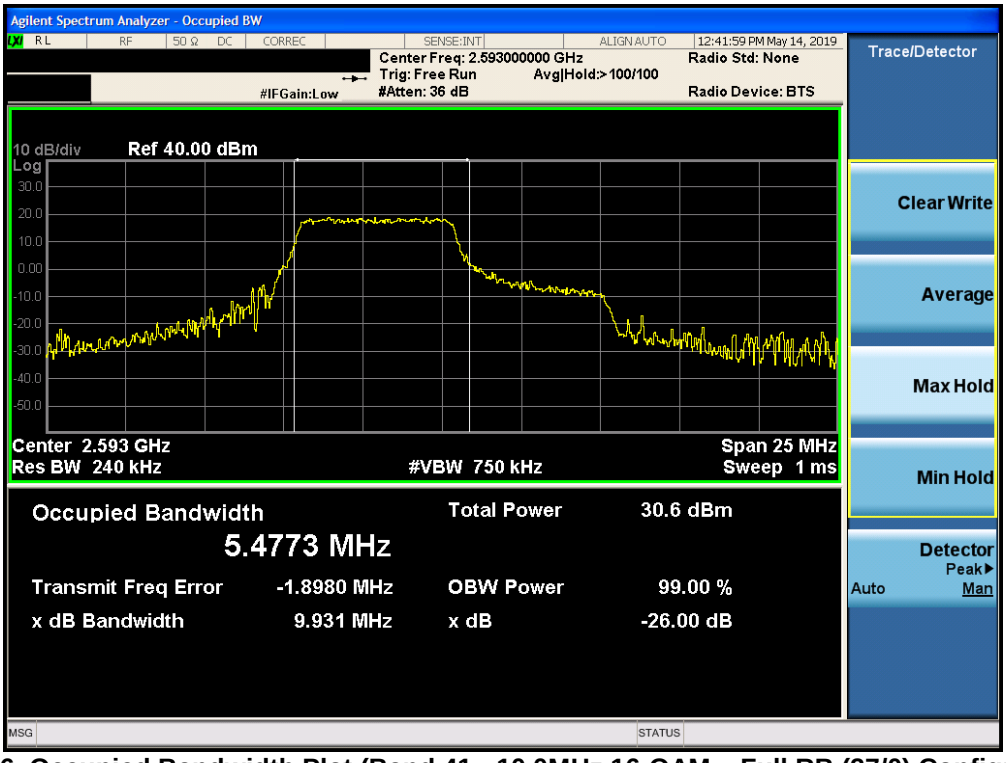

**Plot 7-53. Occupied Bandwidth Plot (Band 41 - 5.0MHz QPSK - Full RB Configuration)**



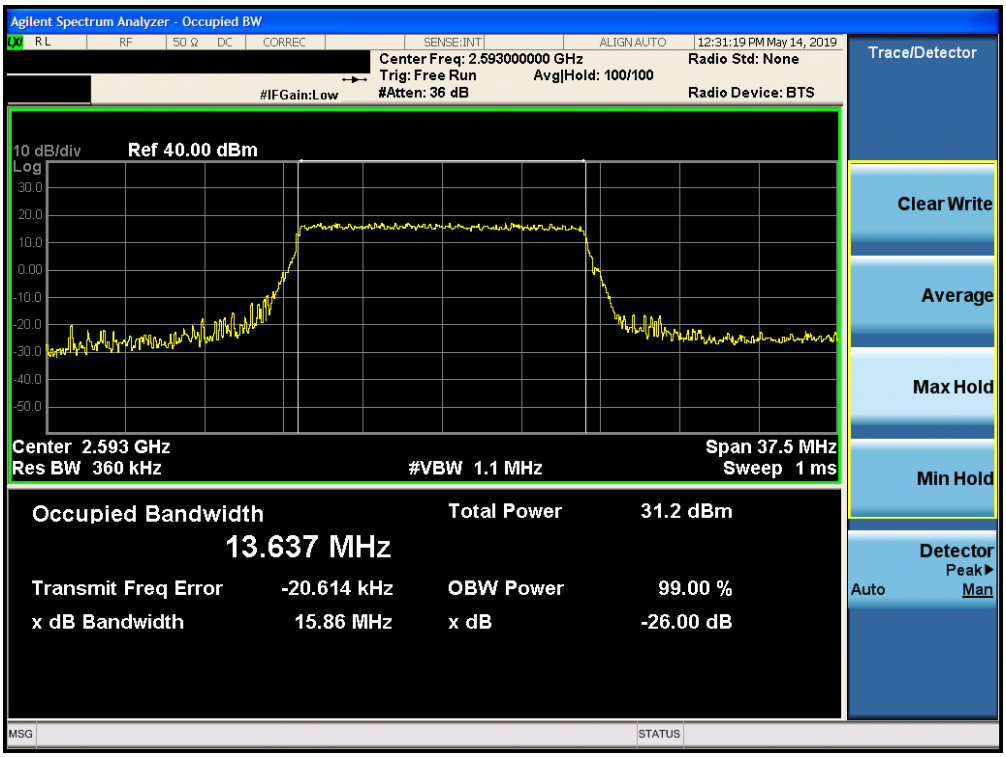

**Plot 7-54. Occupied Bandwidth Plot (Band 41 - 5.0MHz 16-QAM - Full RB Configuration)**



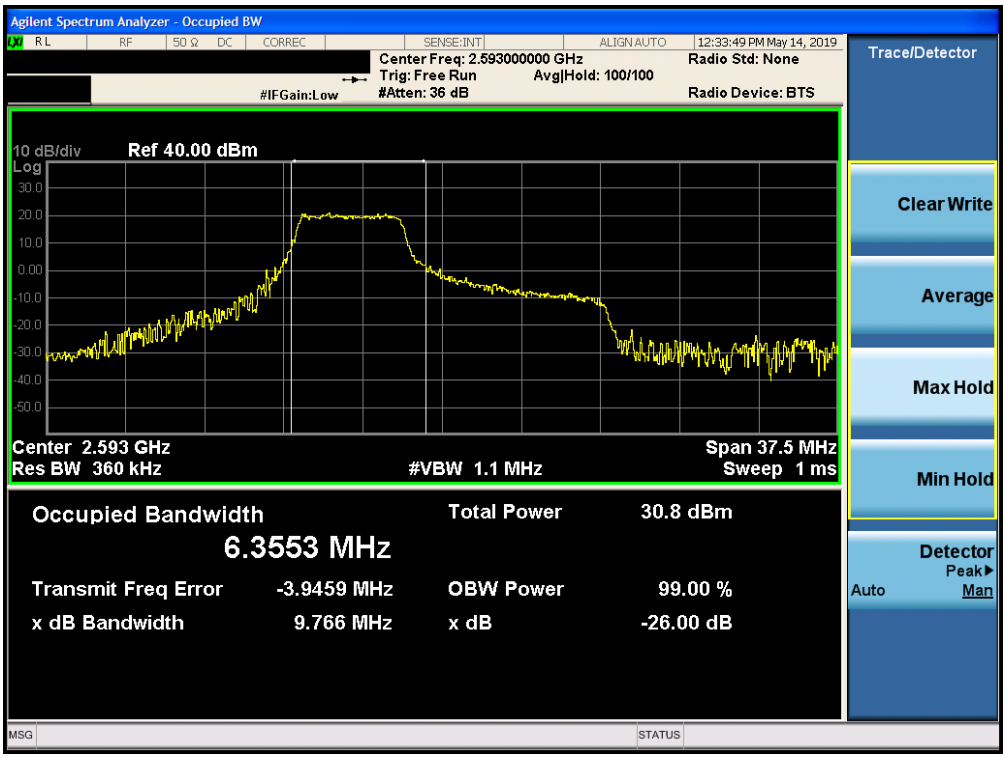

**Plot 7-55. Occupied Bandwidth Plot (Band 41 - 10.0MHz QPSK - Full RB Configuration)**



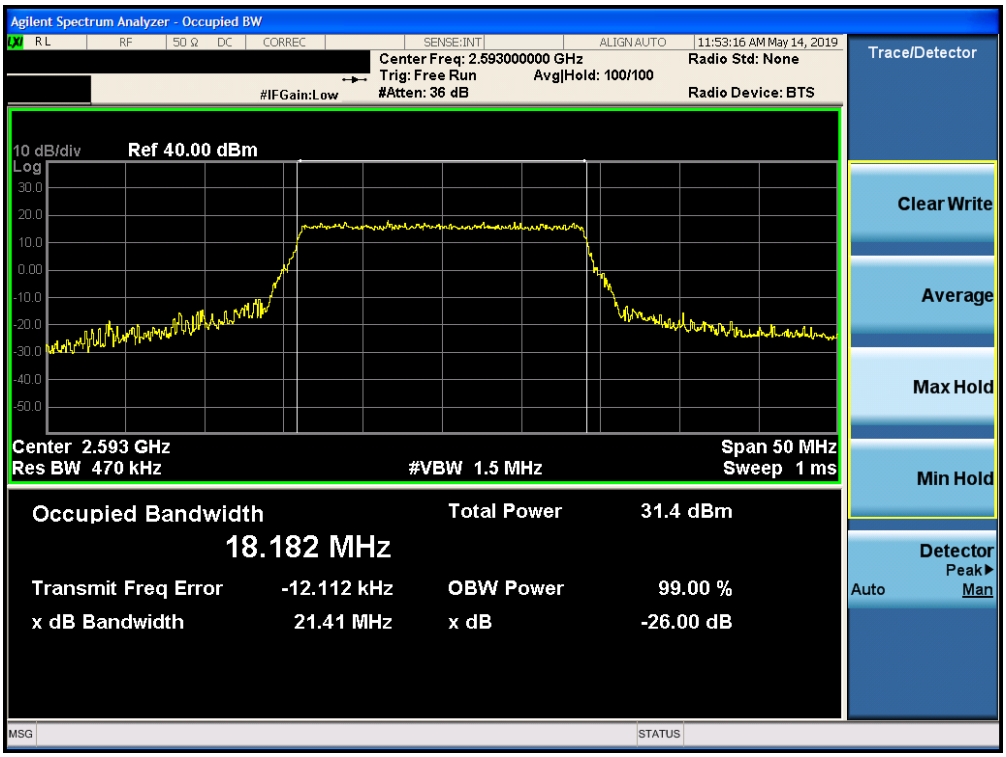

**Plot 7-56. Occupied Bandwidth Plot (Band 41 - 10.0MHz 16-QAM – Full RB (27/0) Configuration)**



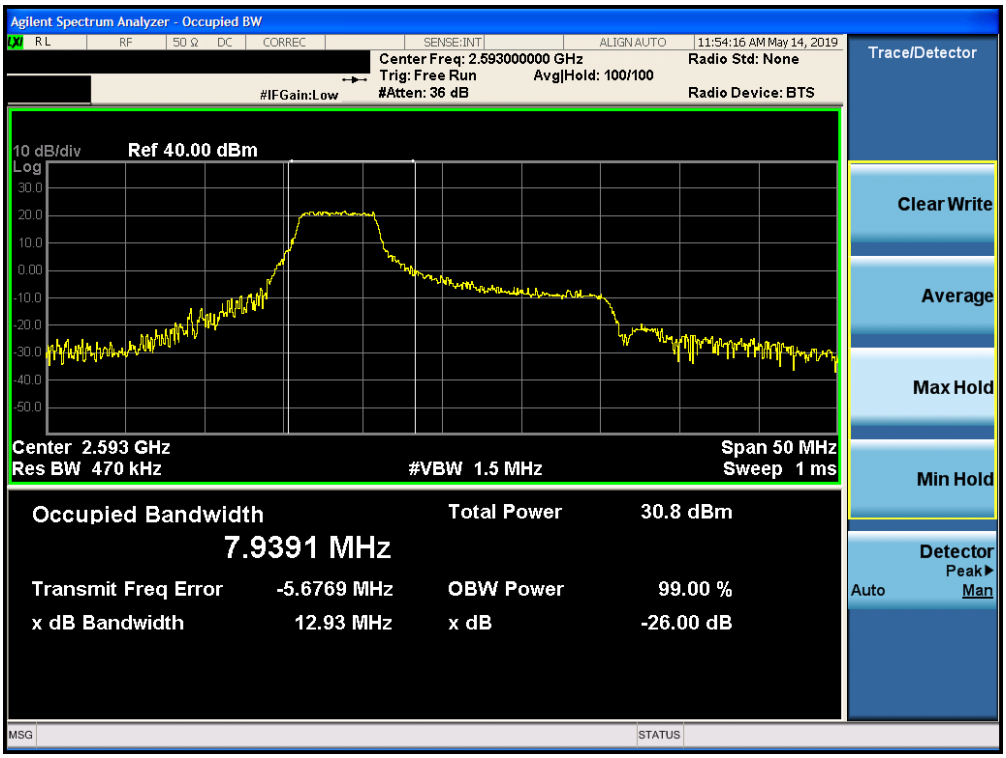

**Plot 7-57. Occupied Bandwidth Plot (Band 41 - 15.0MHz QPSK - Full RB Configuration)**




**Plot 7-58. Occupied Bandwidth Plot (Band 41 - 15.0MHz 16-QAM – Full RB (27/0) Configuration)**




**Plot 7-59. Occupied Bandwidth Plot (Band 41 - 20.0MHz QPSK - Full RB Configuration)**




**Plot 7-60. Occupied Bandwidth Plot (Band 41 - 20.0MHz 16-QAM – Full RB (27/0) Configuration)**

## 7.3 Spurious and Harmonic Emissions at Antenna Terminal

### Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

***The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

***For Band 7 and 41, the minimum permissible attenuation level of any spurious emission is 55 + 10 $log_{10}(P_{[Watts]})$.***

### Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

### Test Setup

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

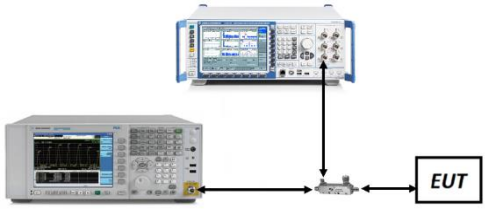
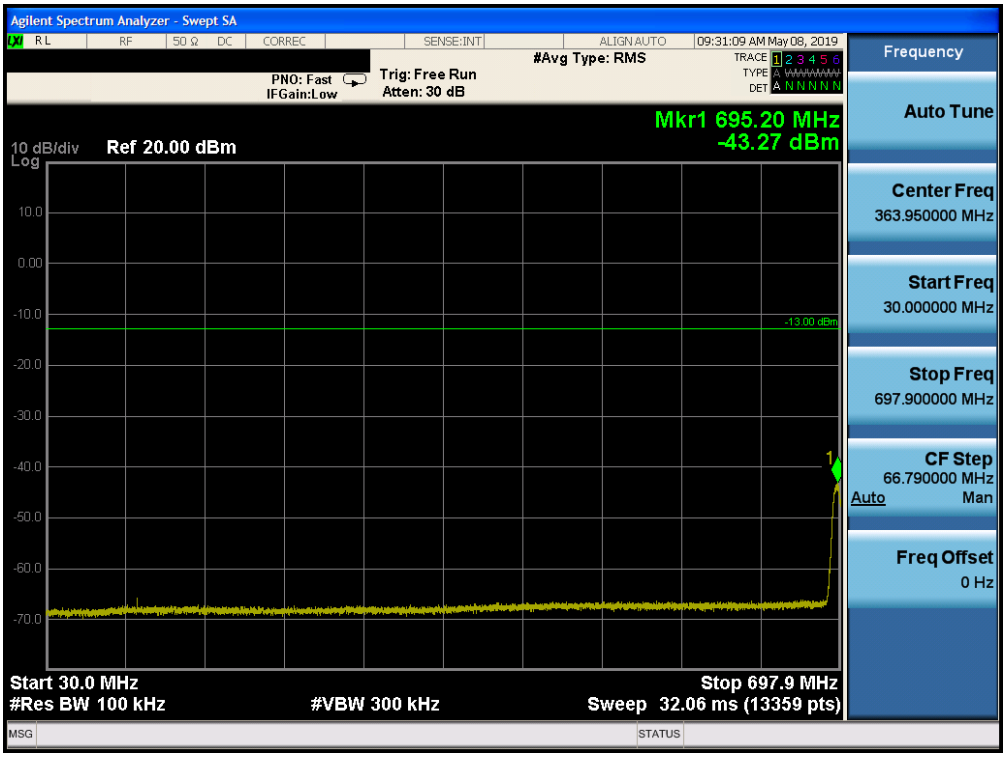


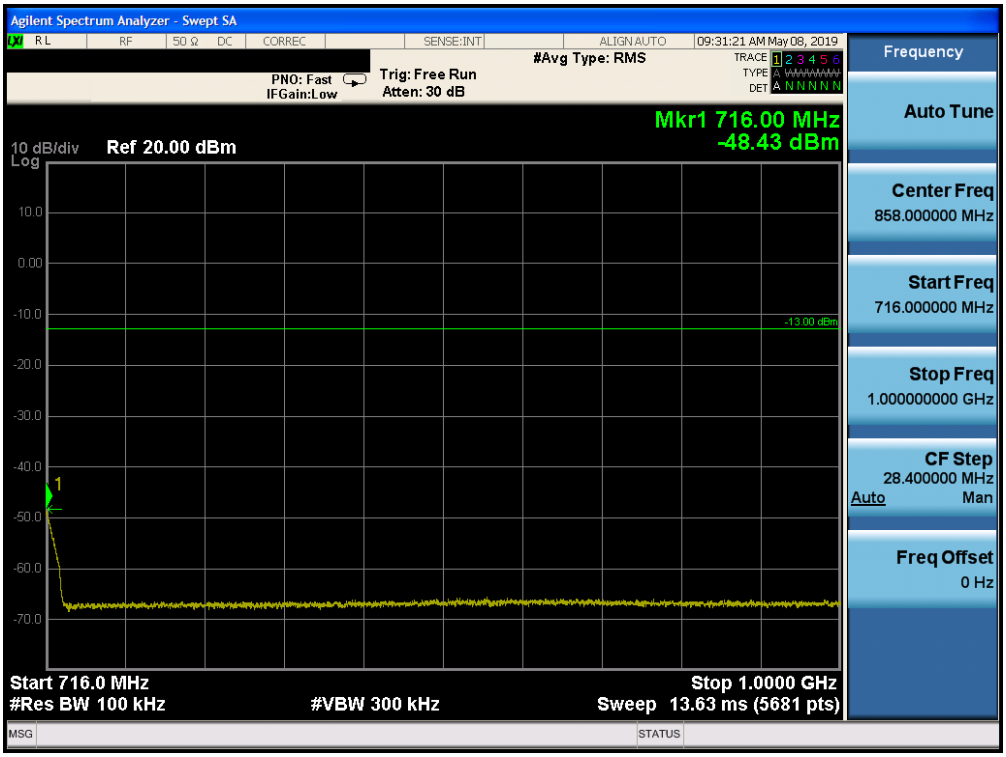

**Figure 7-2. Test Instrument & Measurement Setup**

### Test Notes

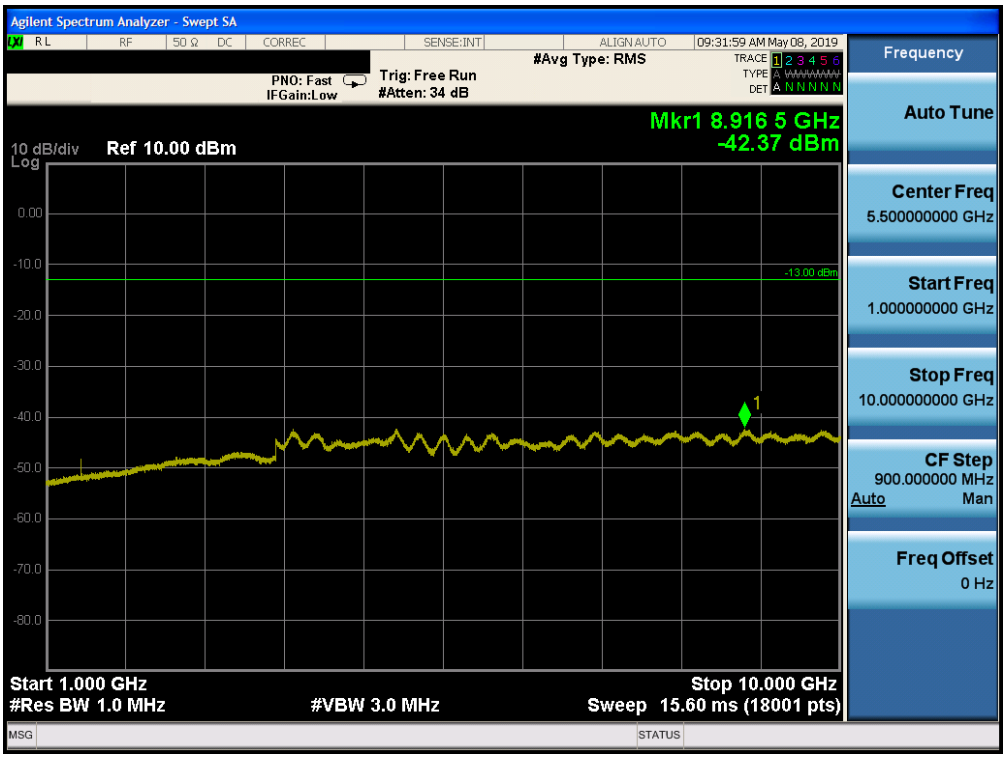
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.



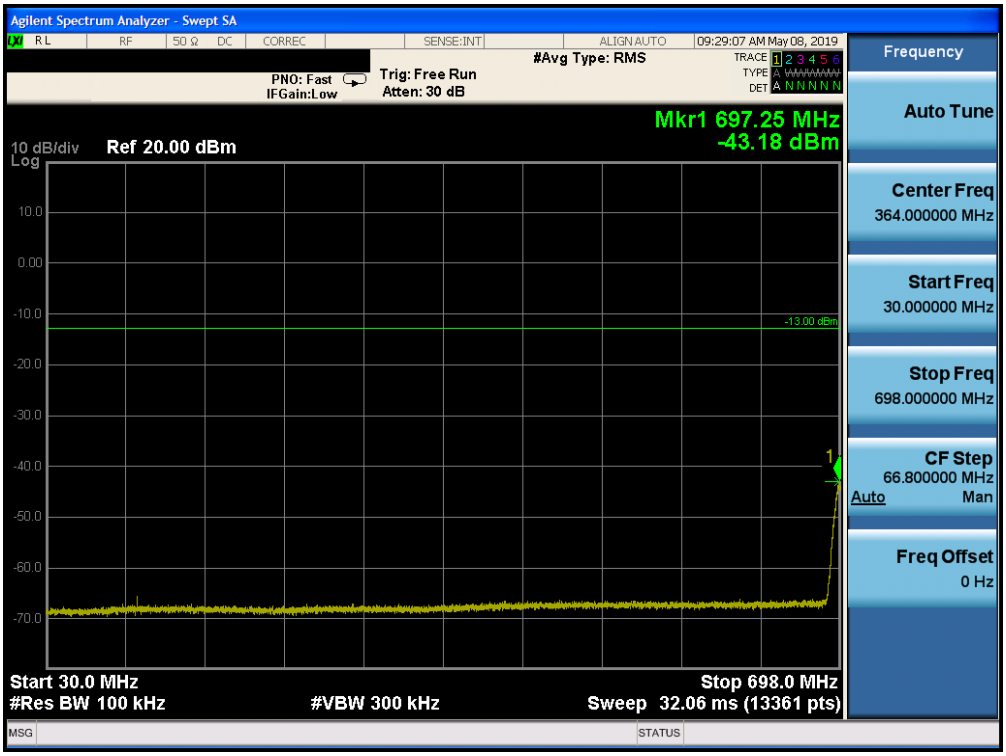

**Plot 7-61. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



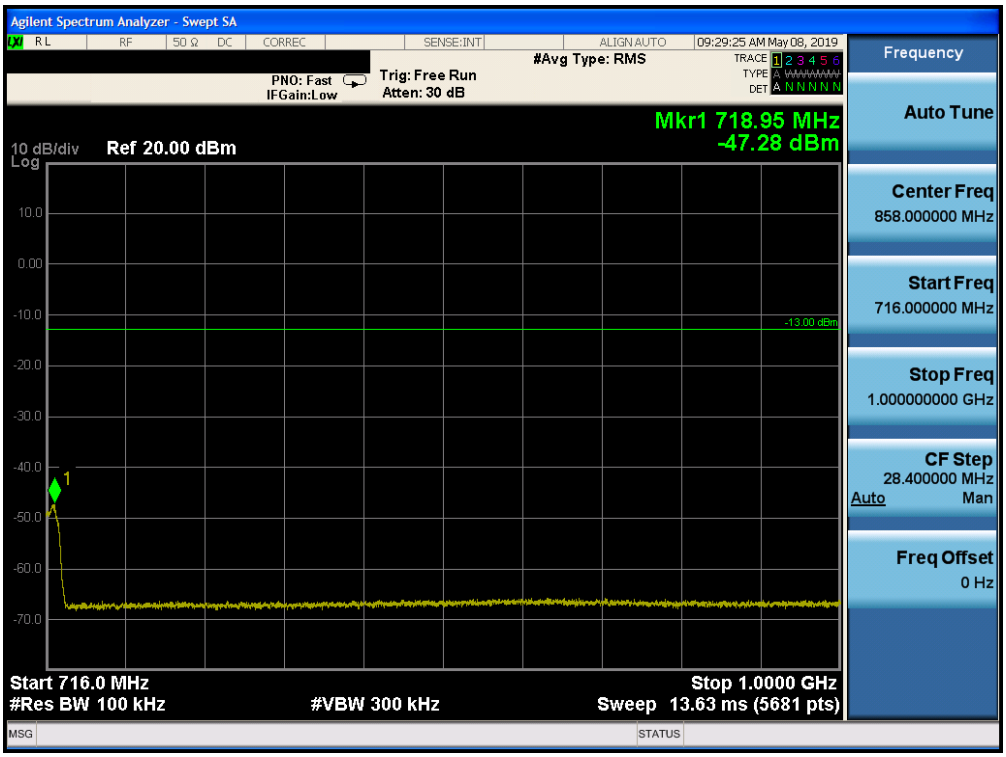

**Plot 7-62. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



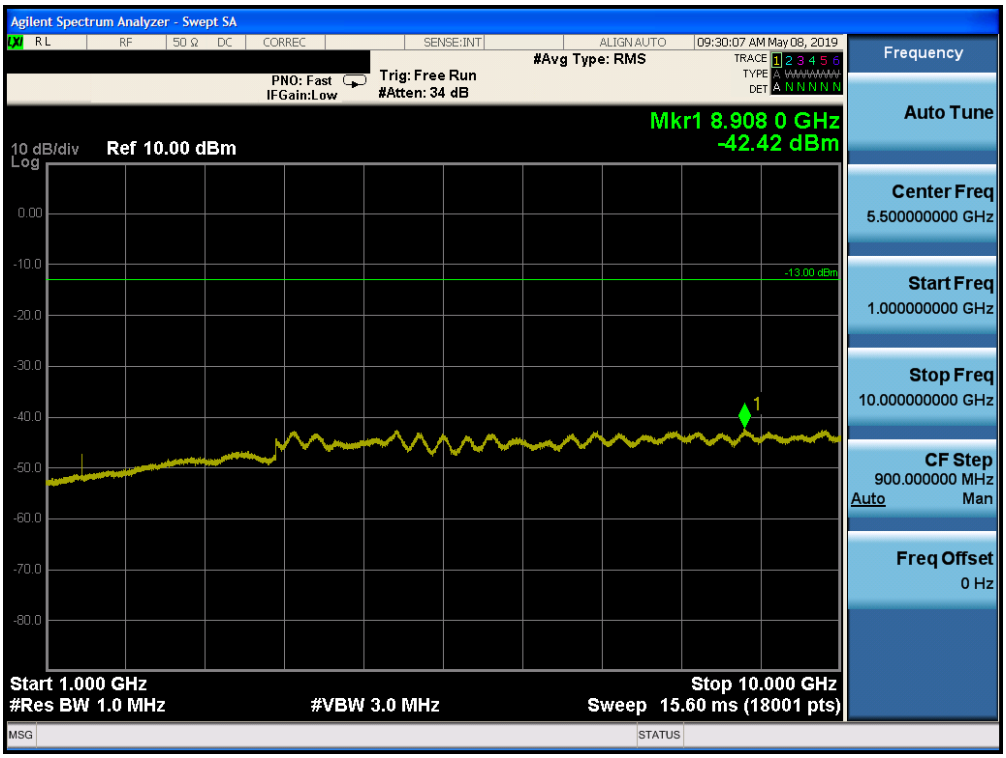

**Plot 7-63. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



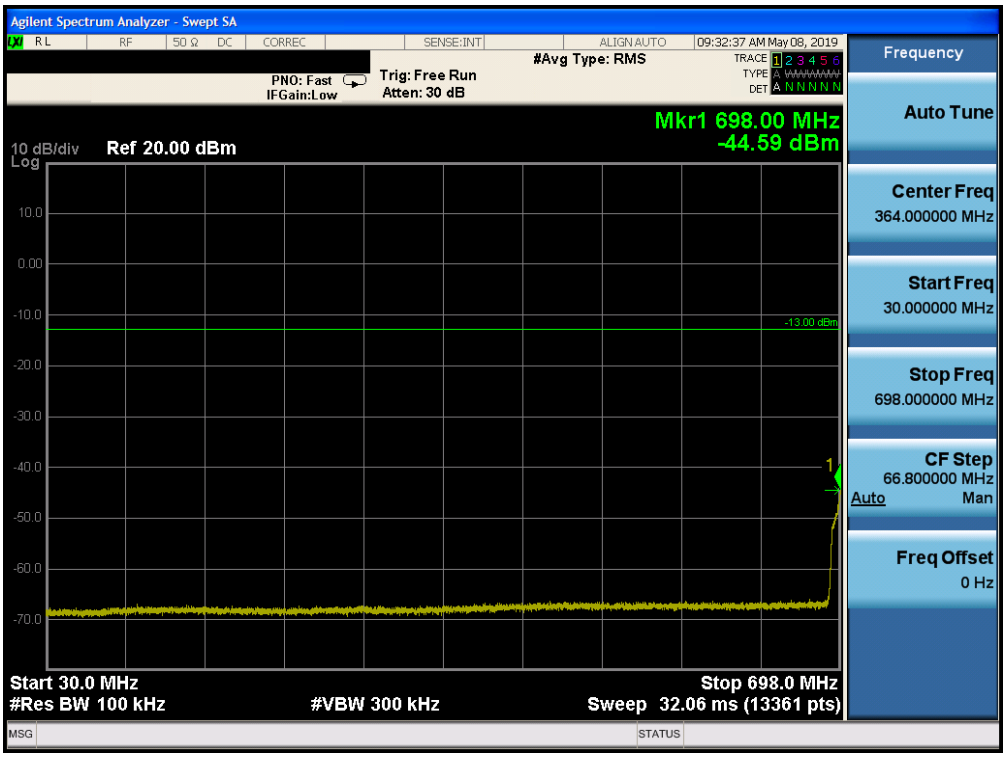

**Plot 7-64. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



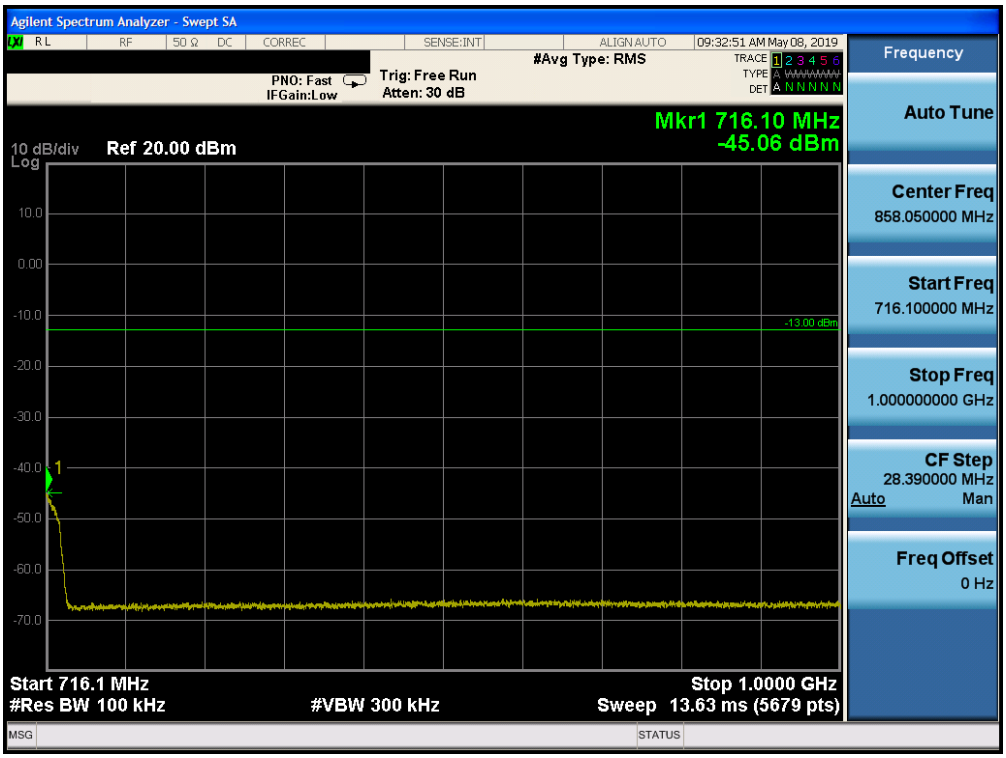

**Plot 7-65. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



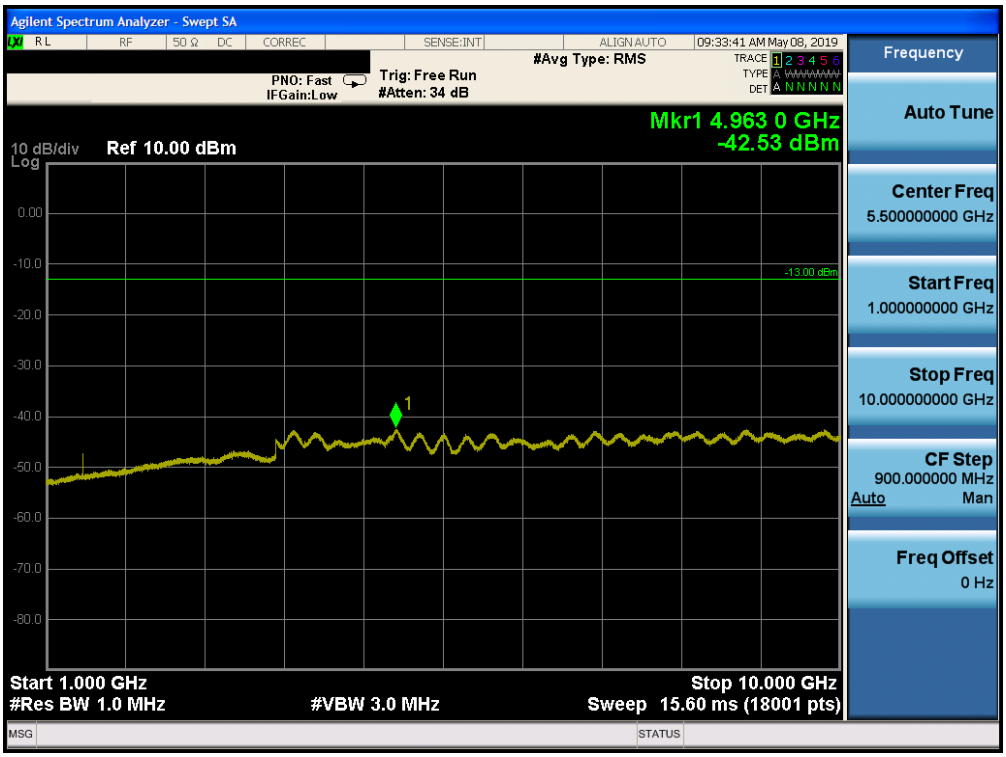

**Plot 7-66. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



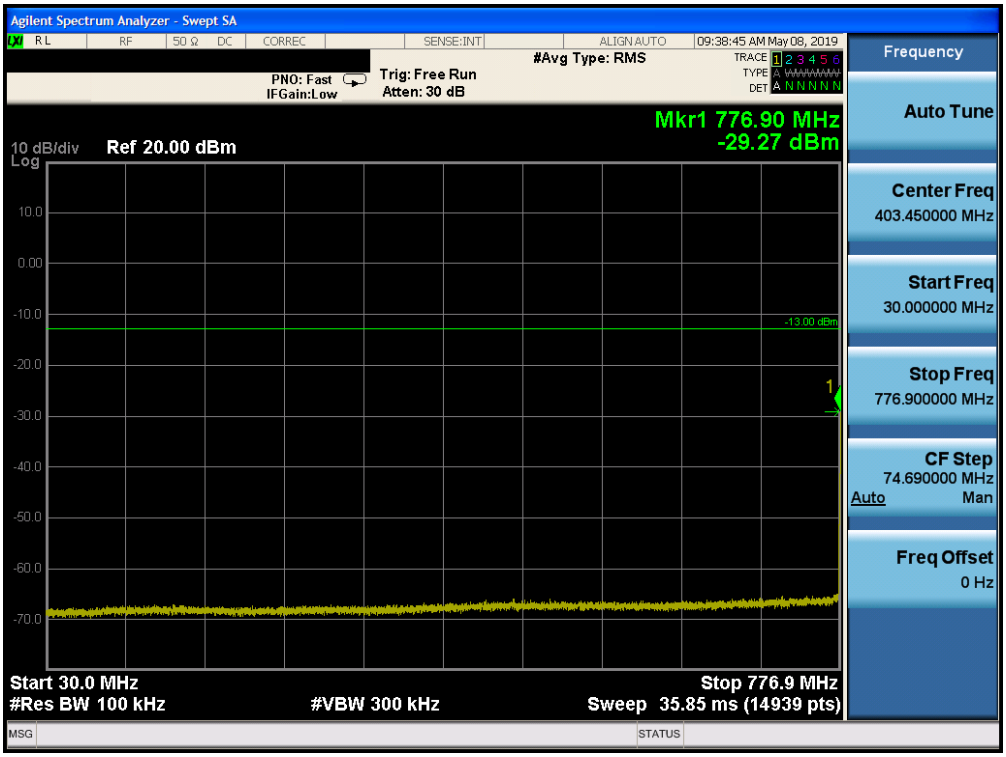

**Plot 7-67. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**



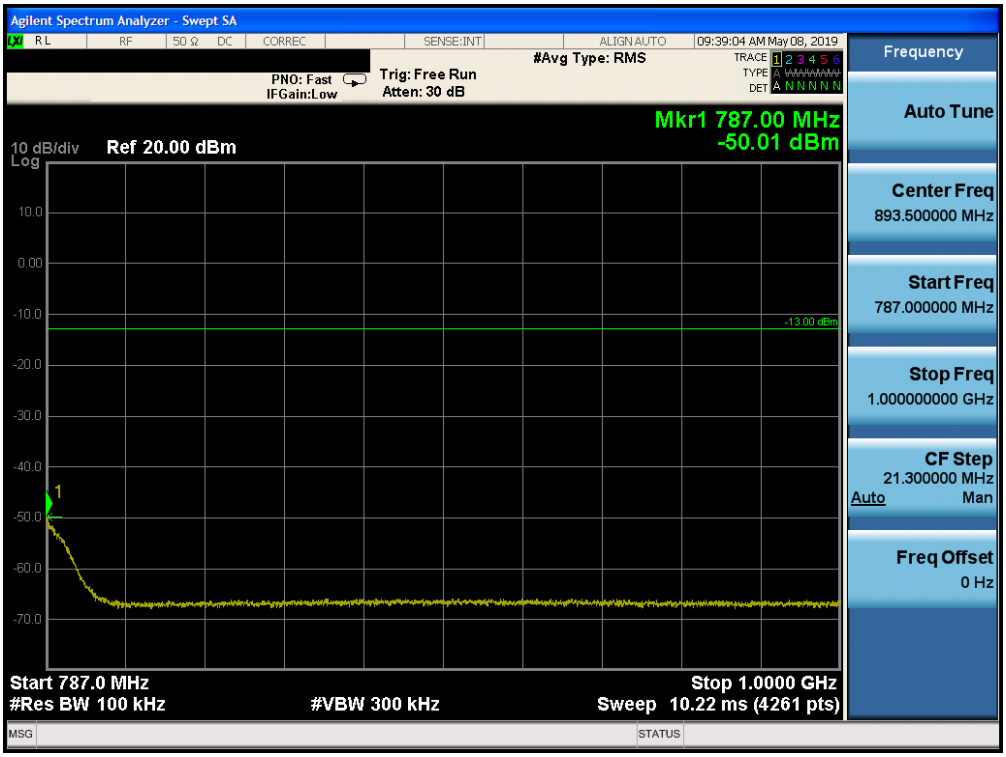

**Plot 7-68. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**



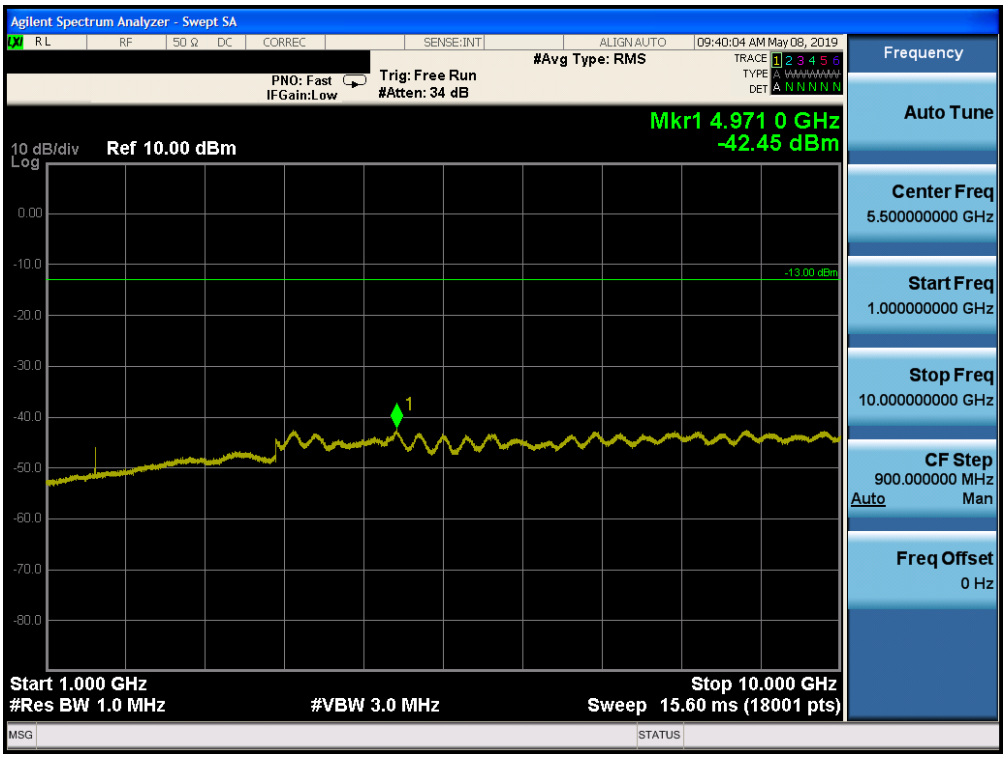

**Plot 7-69. Conducted Spurious Plot (Band 12/17 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**



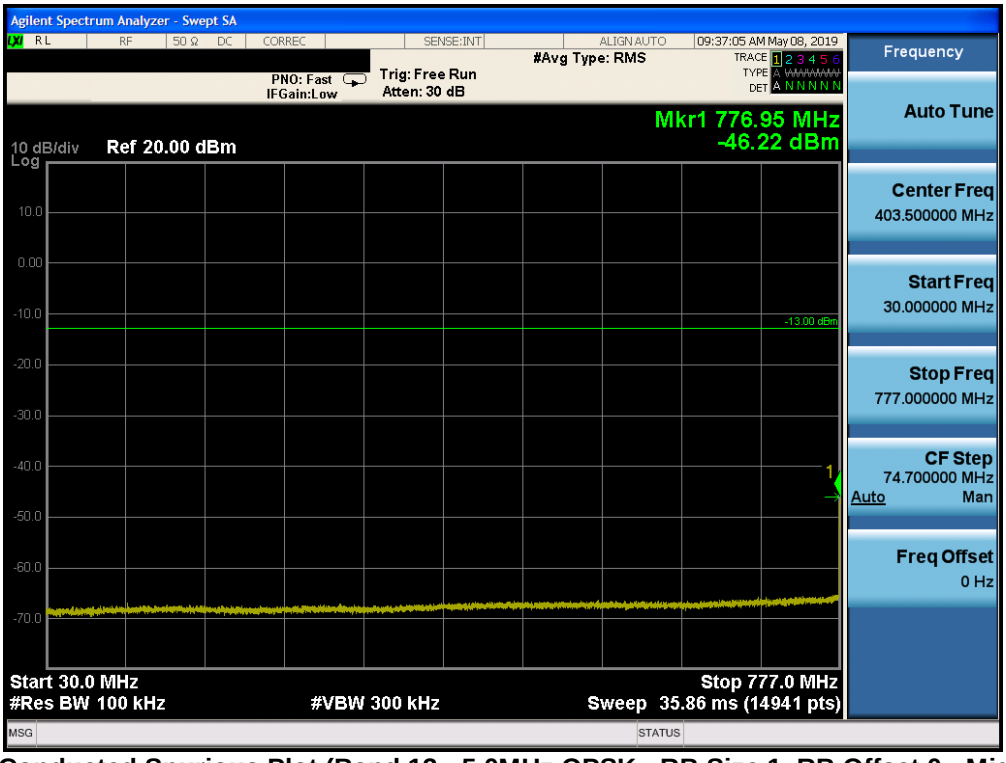

**Plot 7-70. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



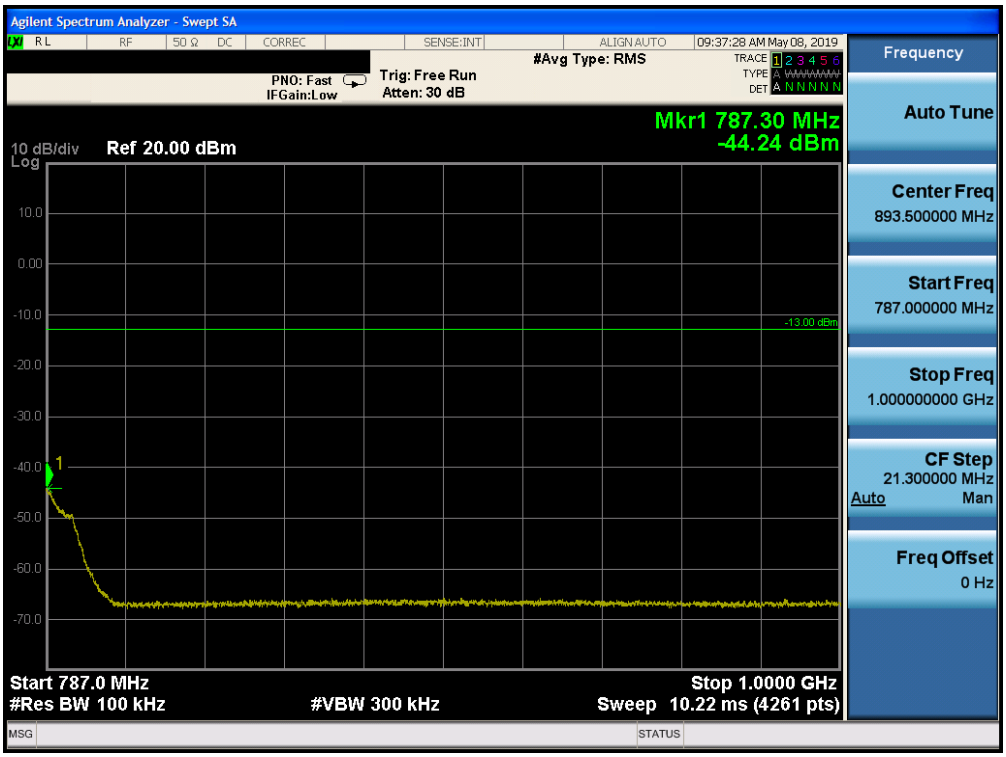

**Plot 7-71. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



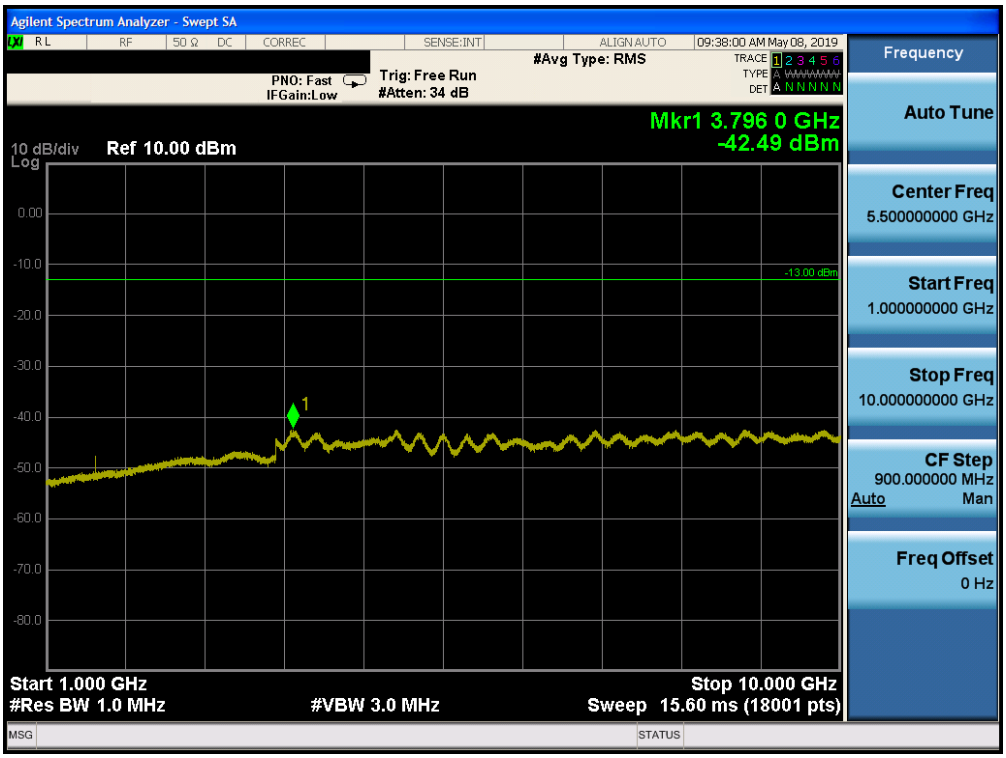

**Plot 7-72. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



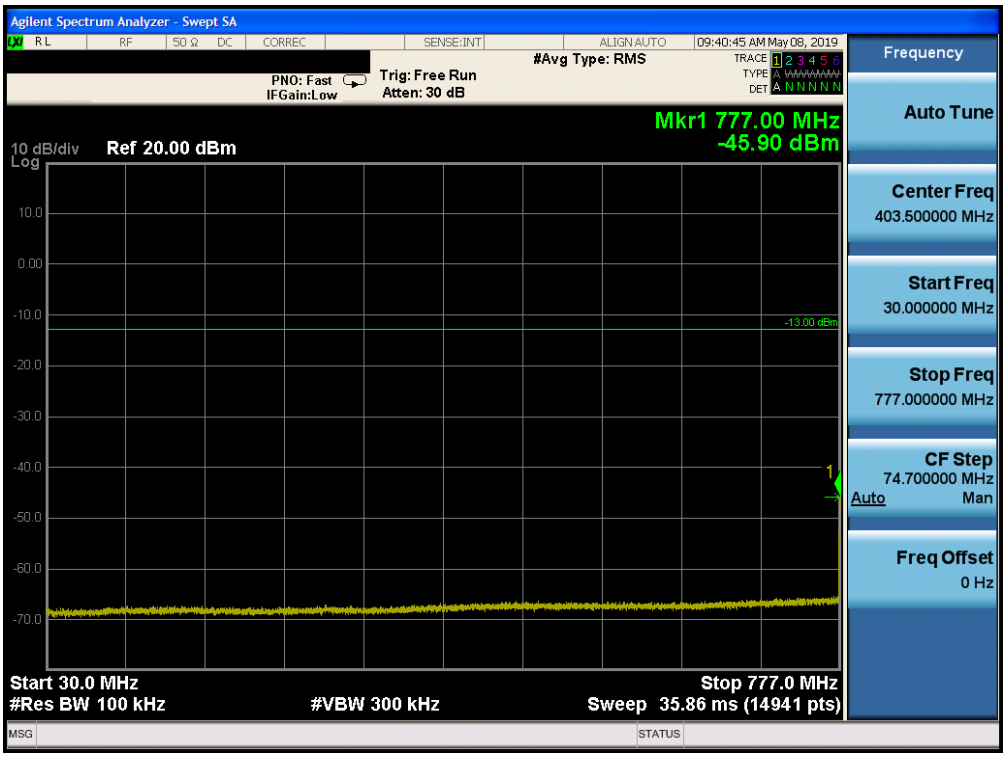

**Plot 7-73. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



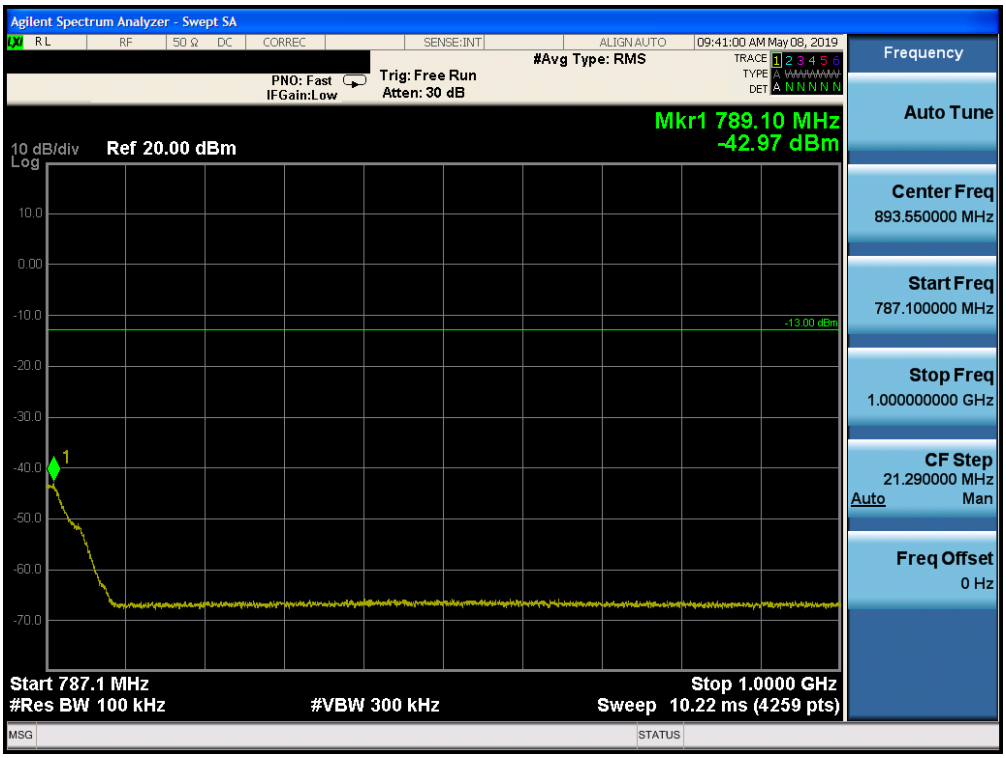

**Plot 7-74. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



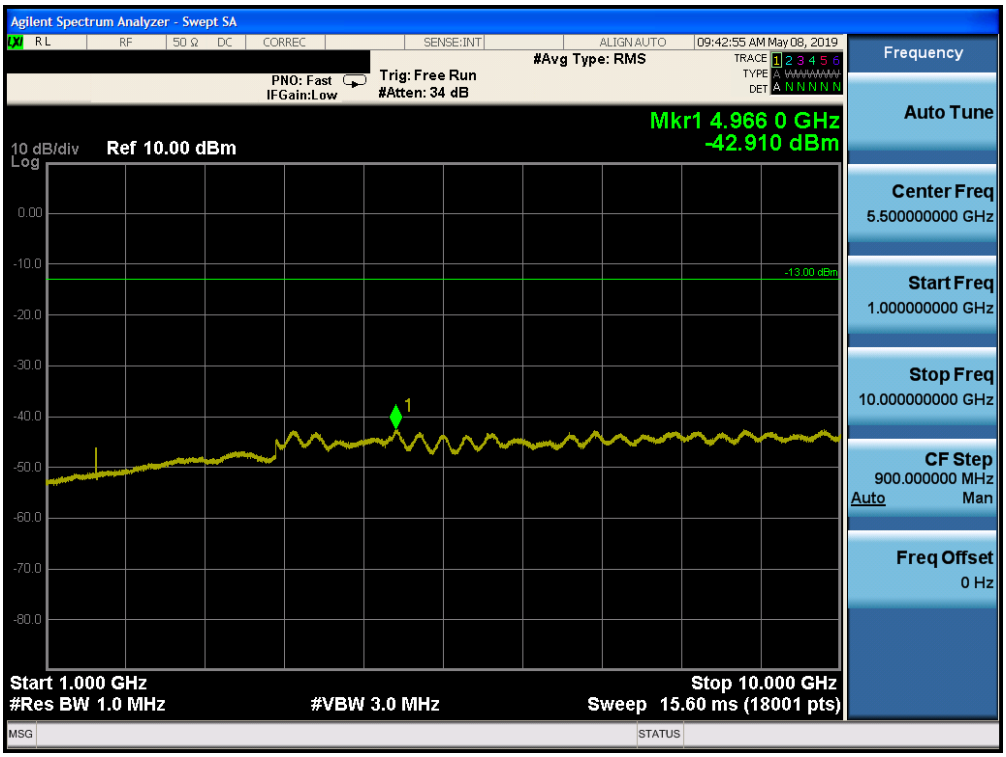

**Plot 7-75. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-76. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

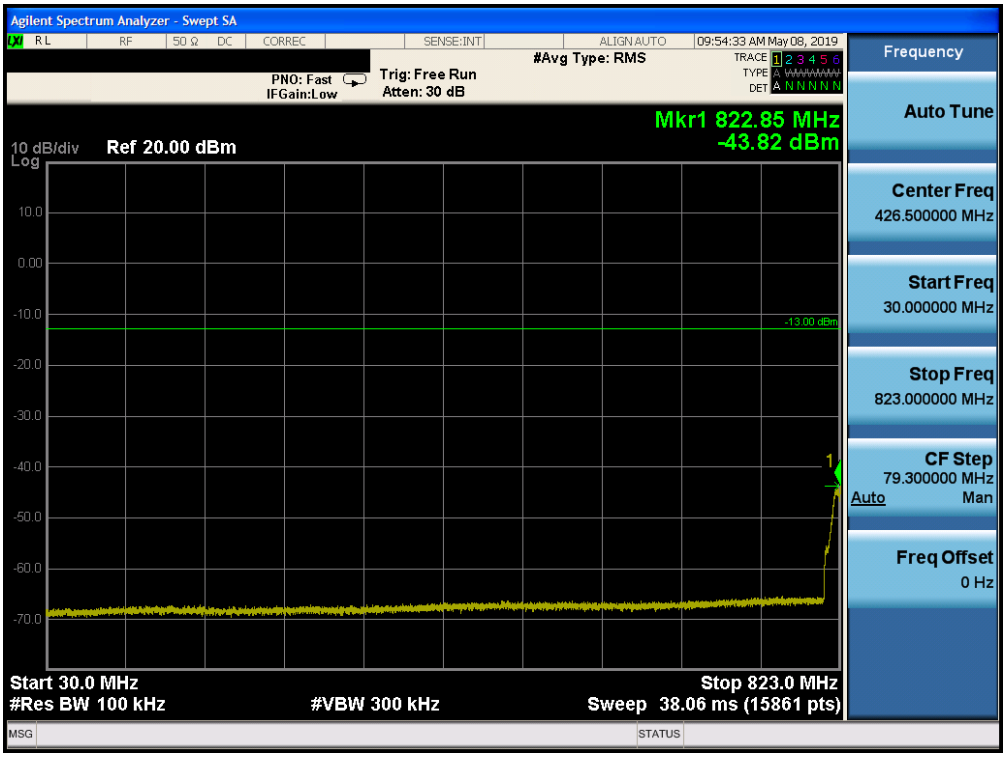



**Plot 7-77. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

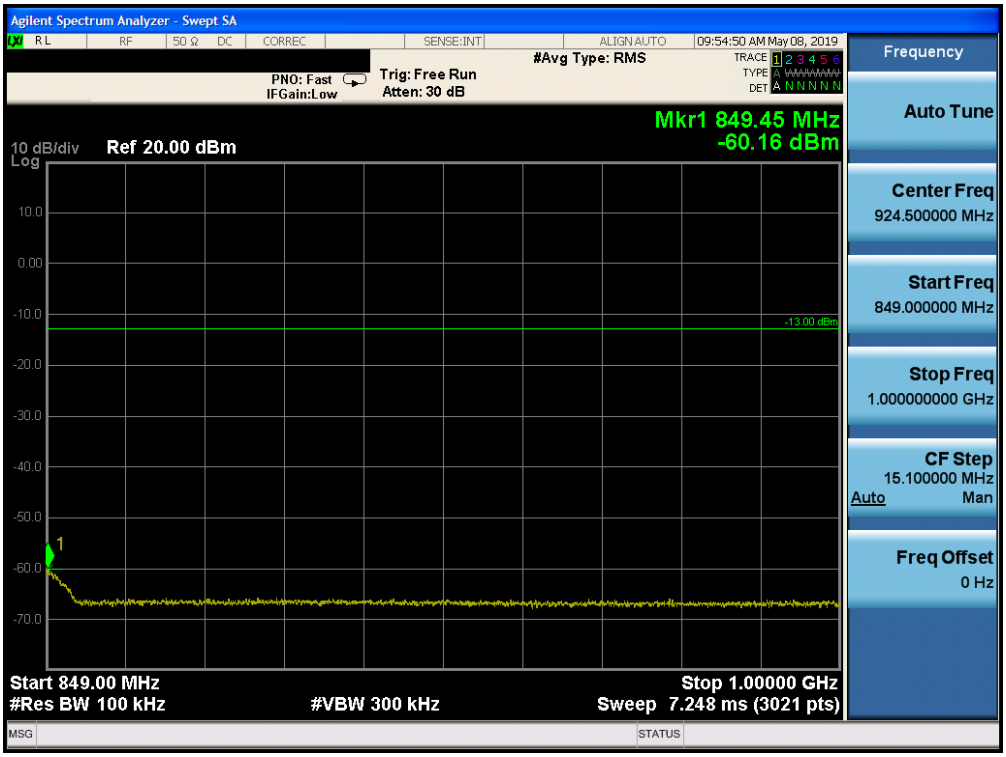



**Plot 7-78. Conducted Spurious Plot (Band 13 - 5.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

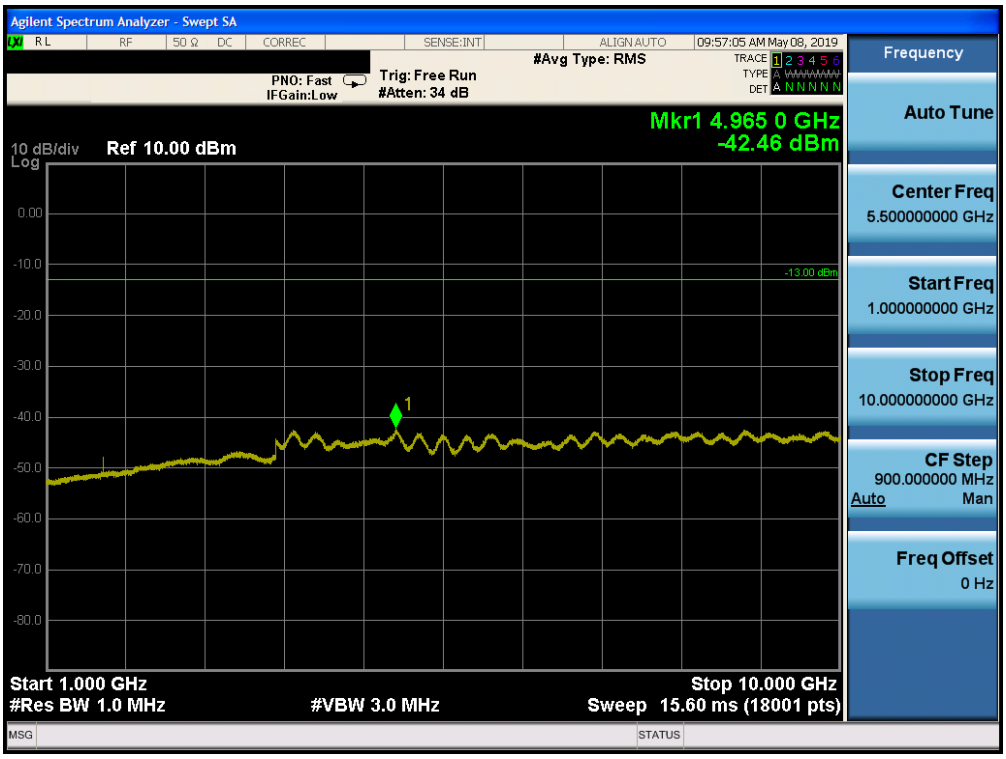
## Band 26/5



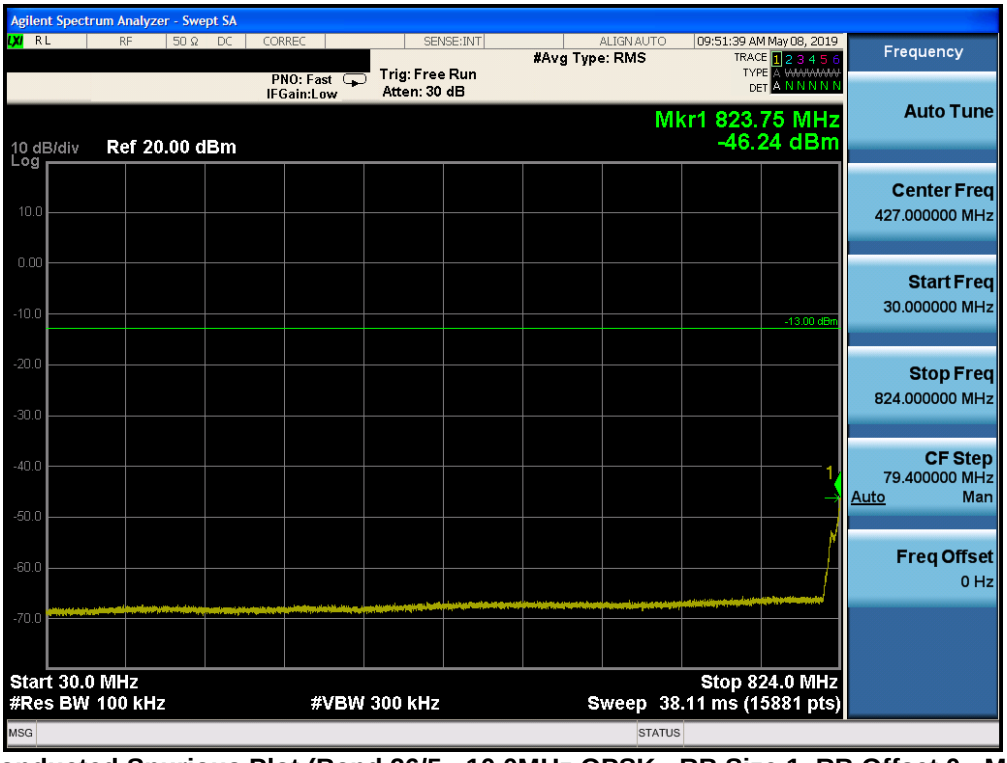

**Plot 7-79. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



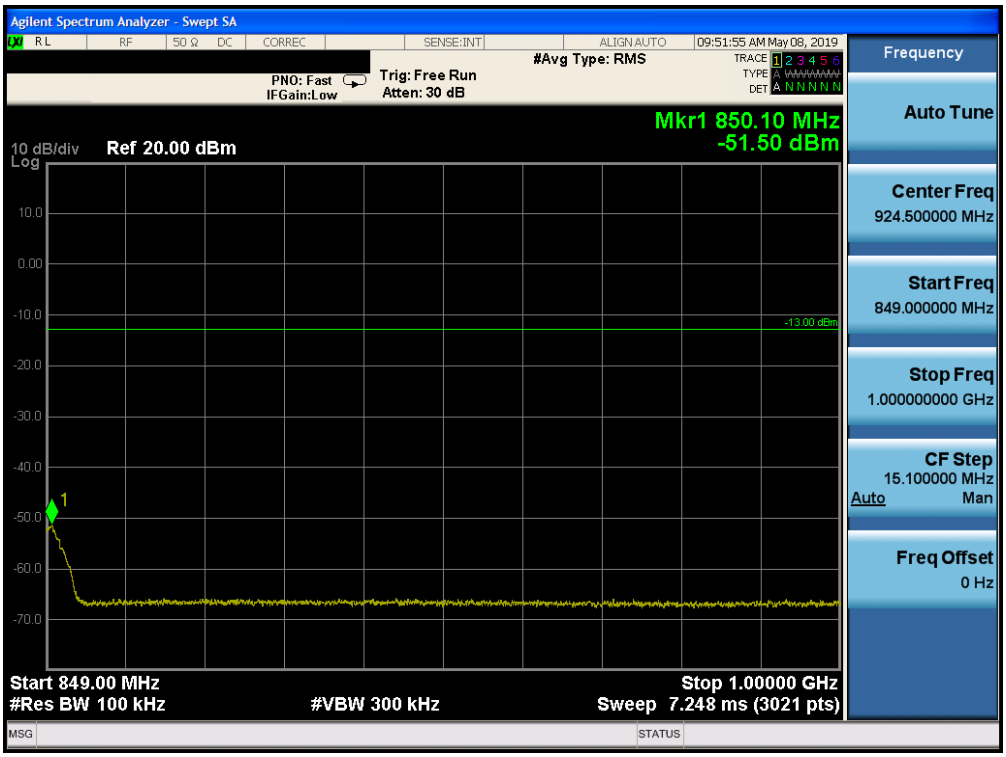

**Plot 7-80. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



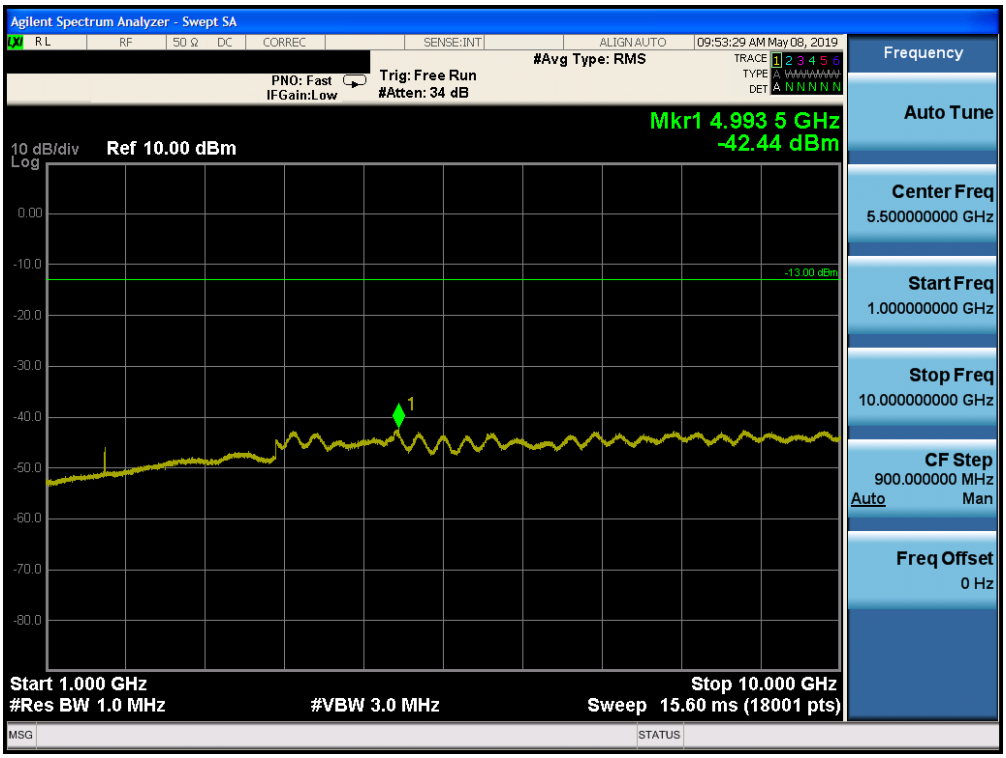

**Plot 7-81. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



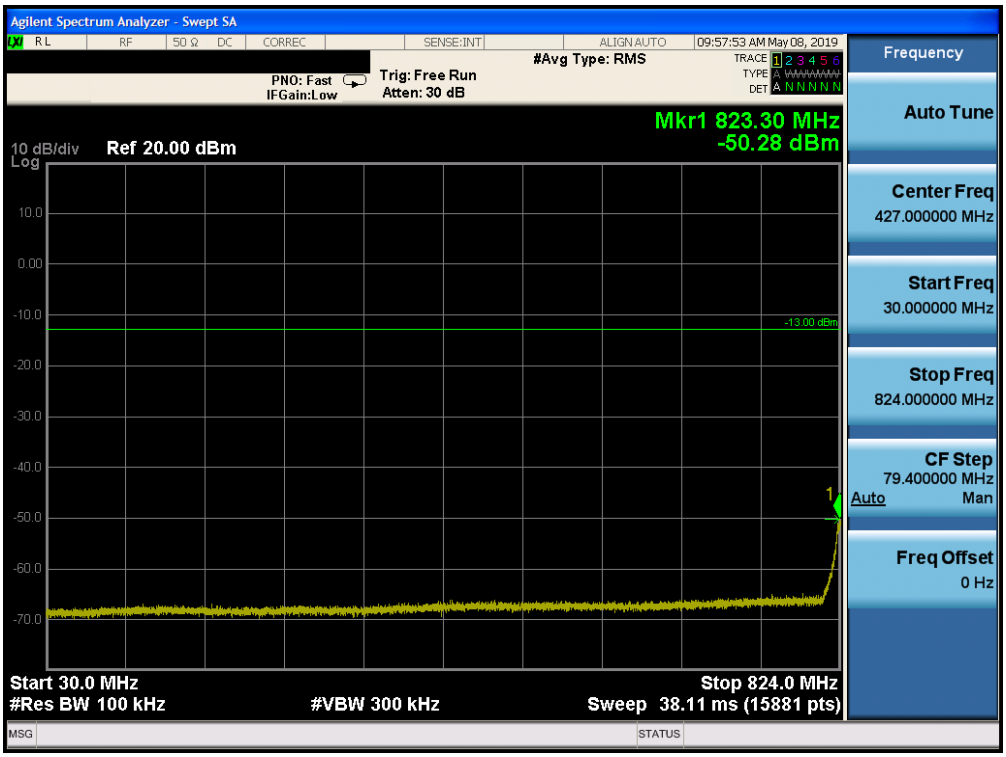

**Plot 7-82. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



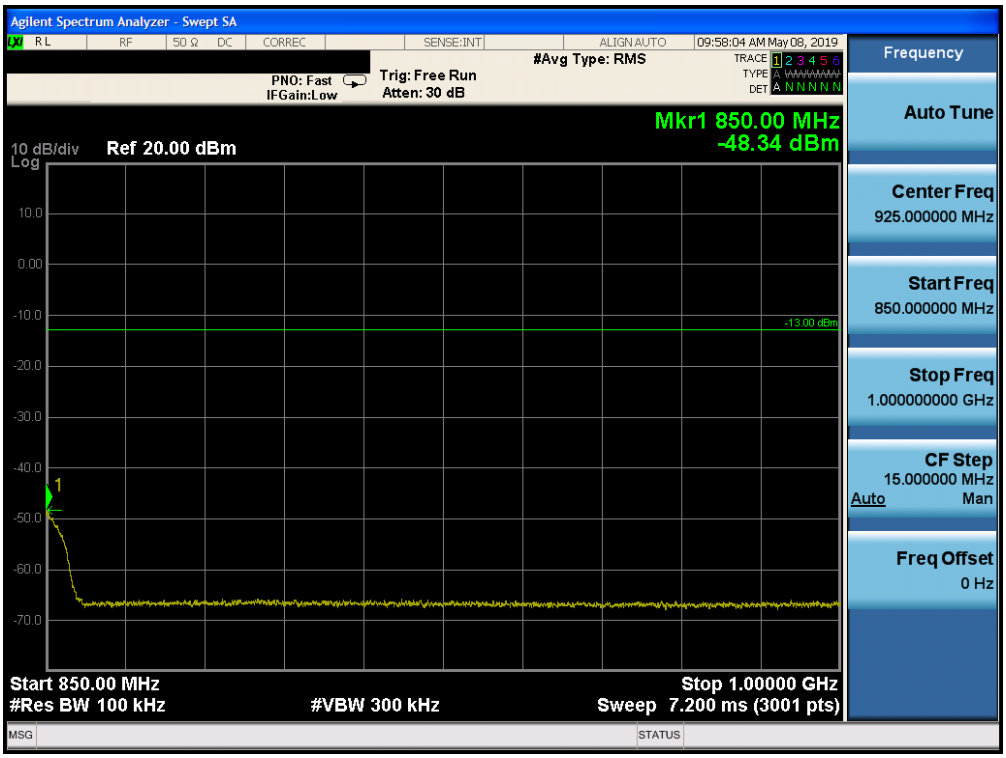

**Plot 7-83. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



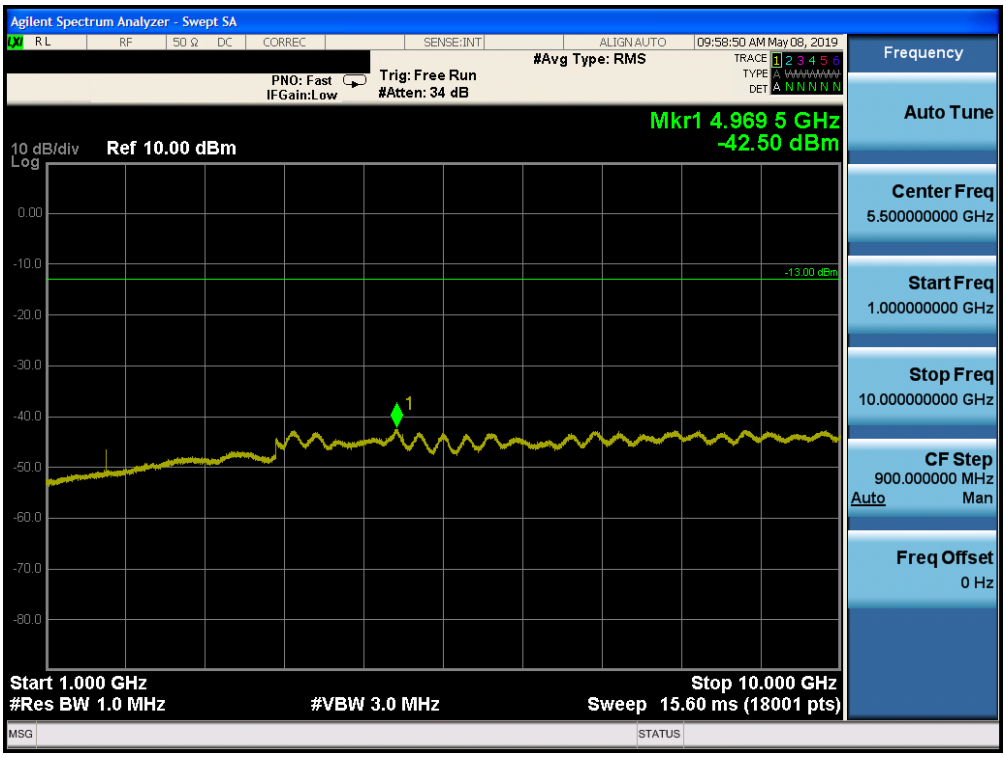

**Plot 7-84. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-85. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

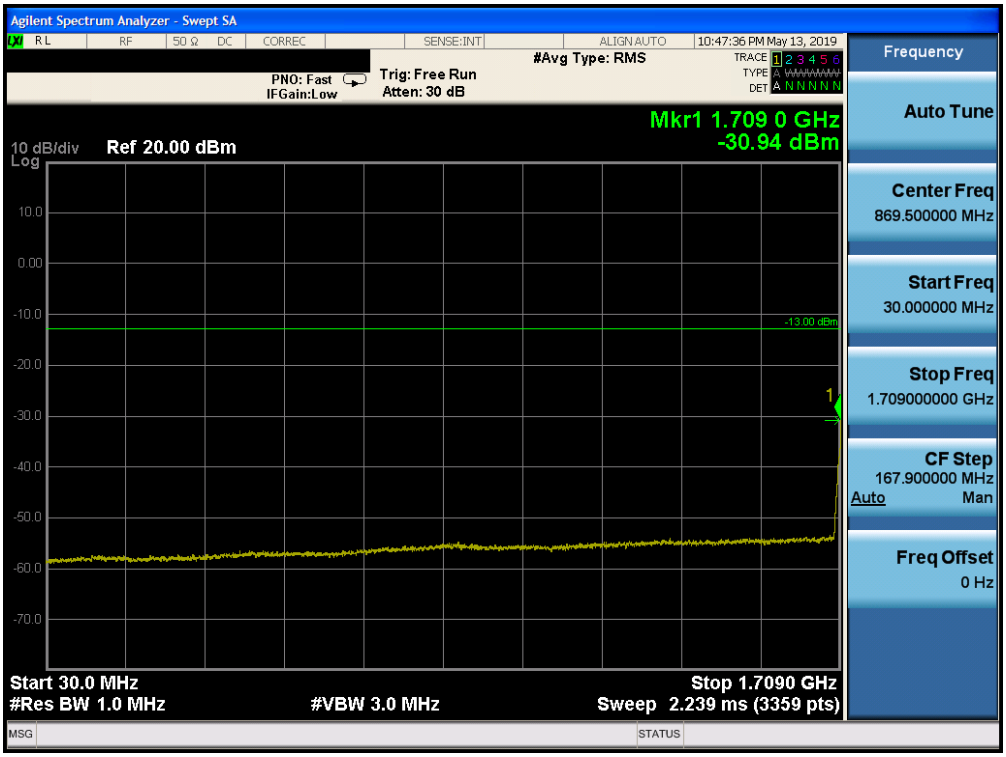



**Plot 7-86. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

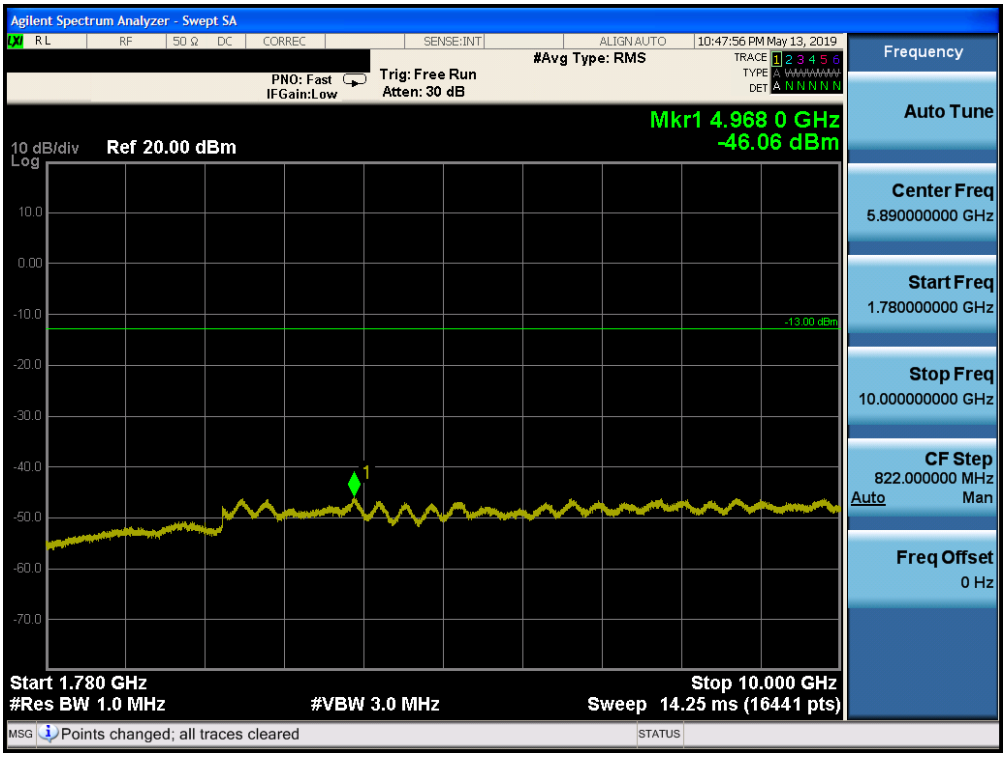



**Plot 7-87. Conducted Spurious Plot (Band 26/5 - 10.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

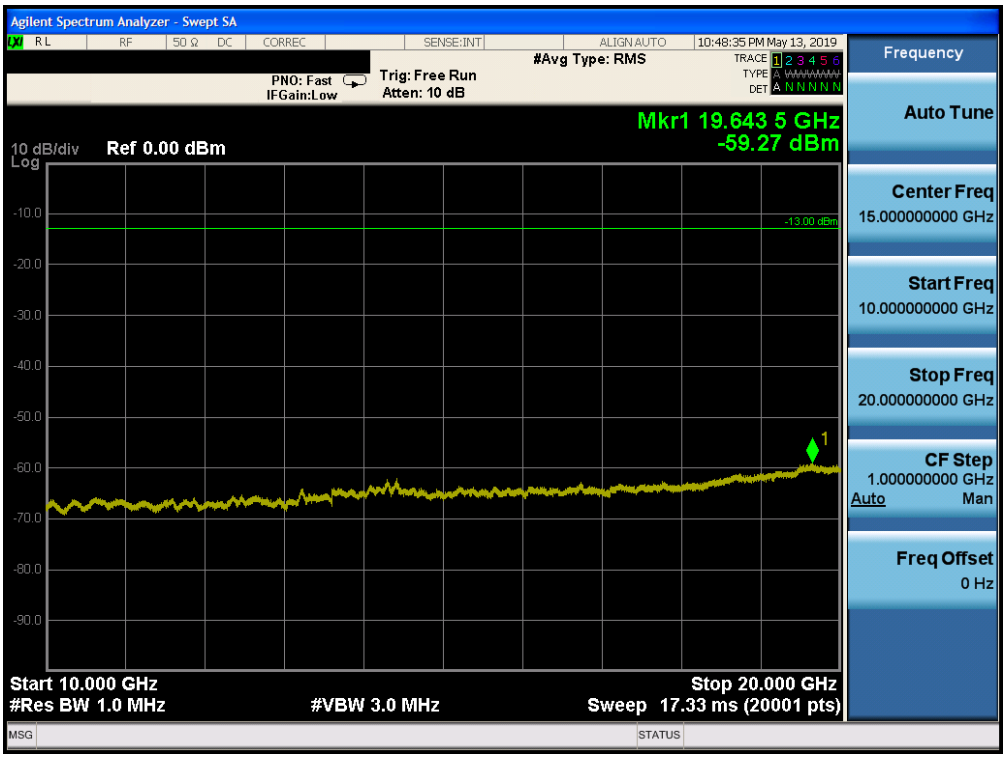
## Band 66/4




**Plot 7-88. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

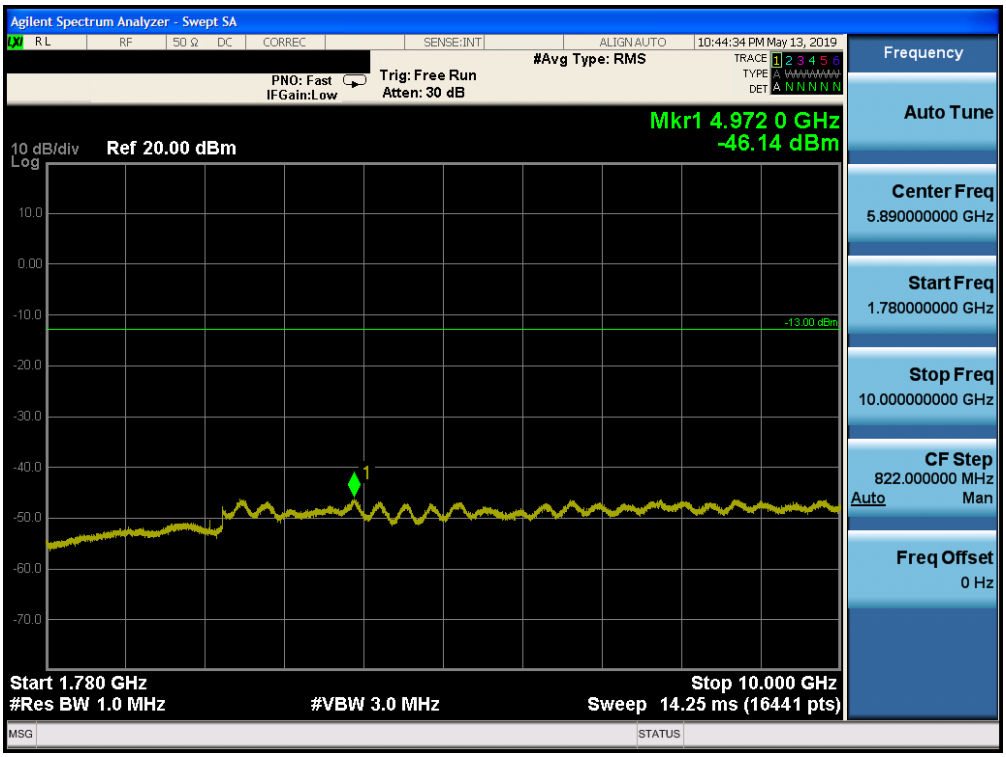



**Plot 7-89. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

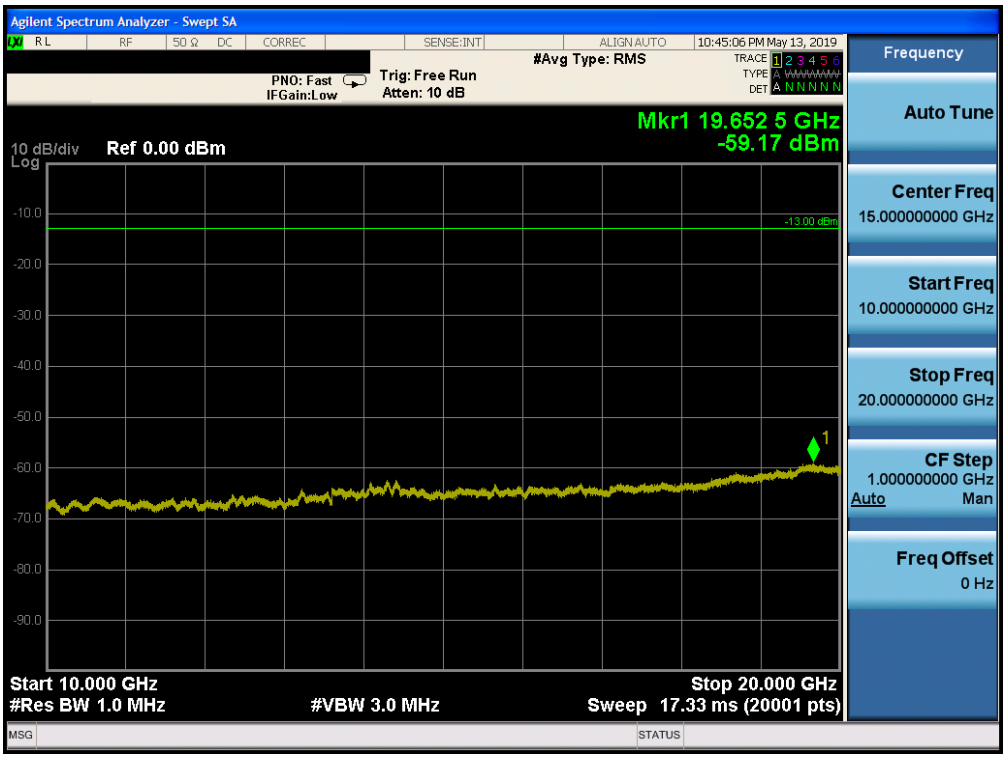



**Plot 7-90. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

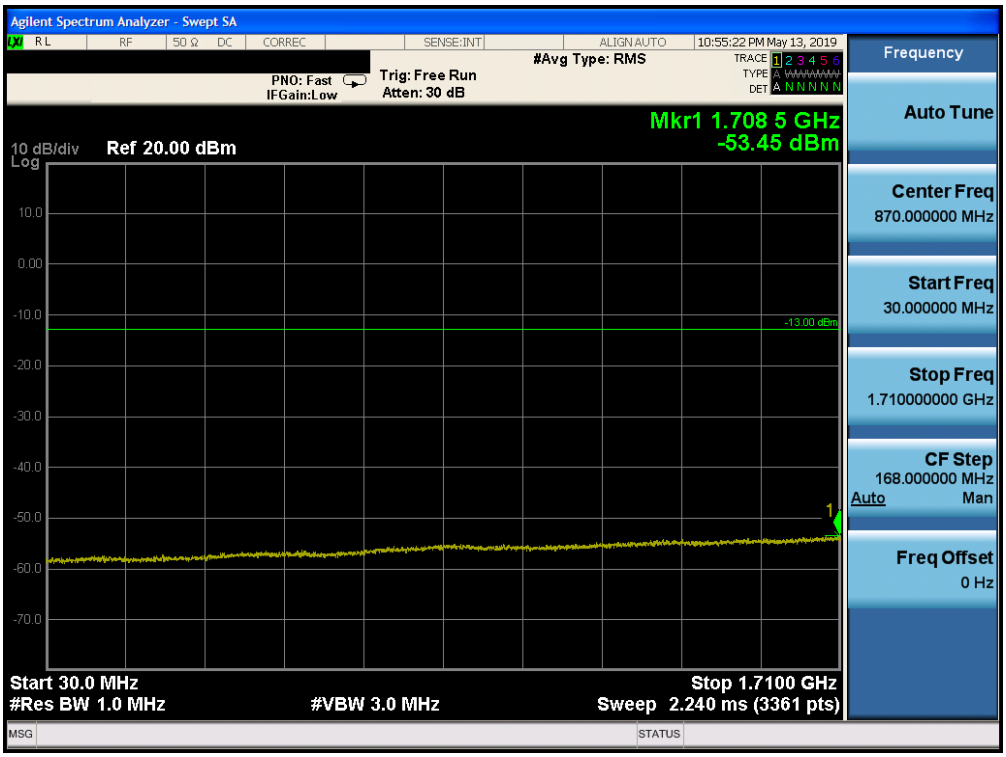

**Plot 7-91. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



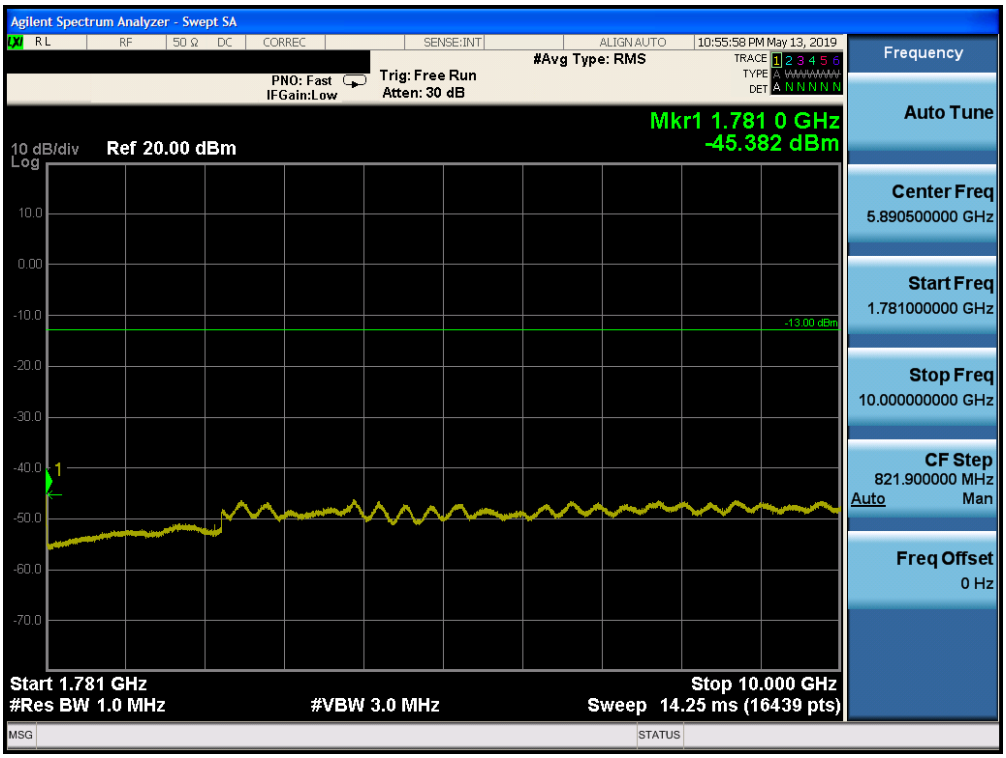

**Plot 7-92. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



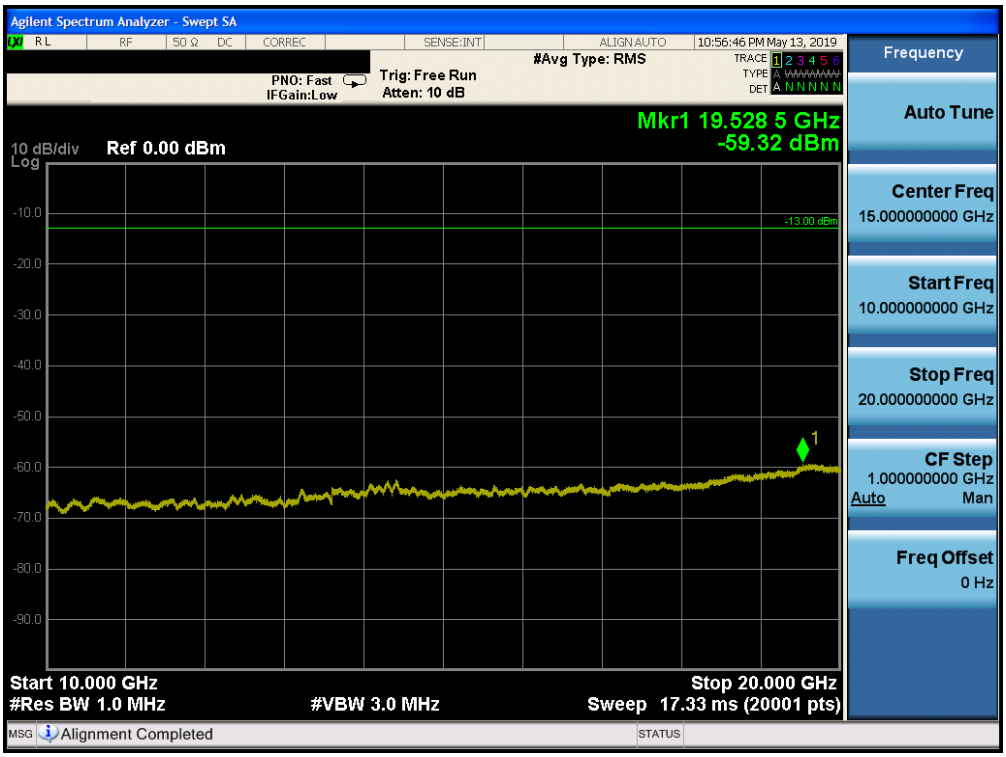

**Plot 7-93. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-94. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

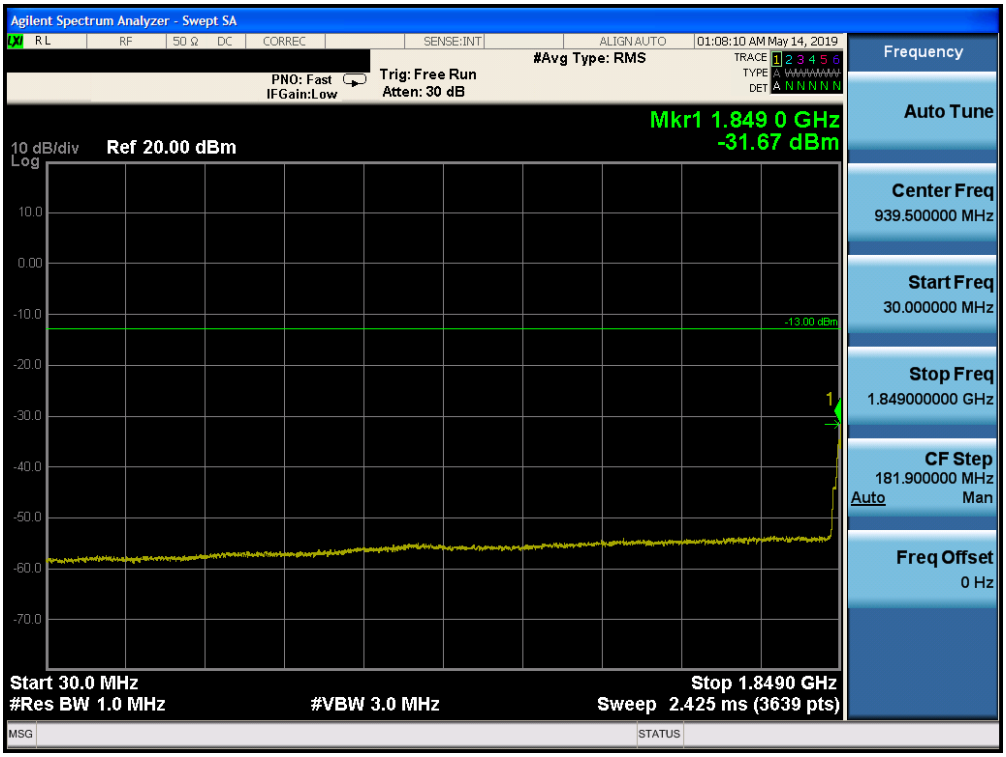



**Plot 7-95. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

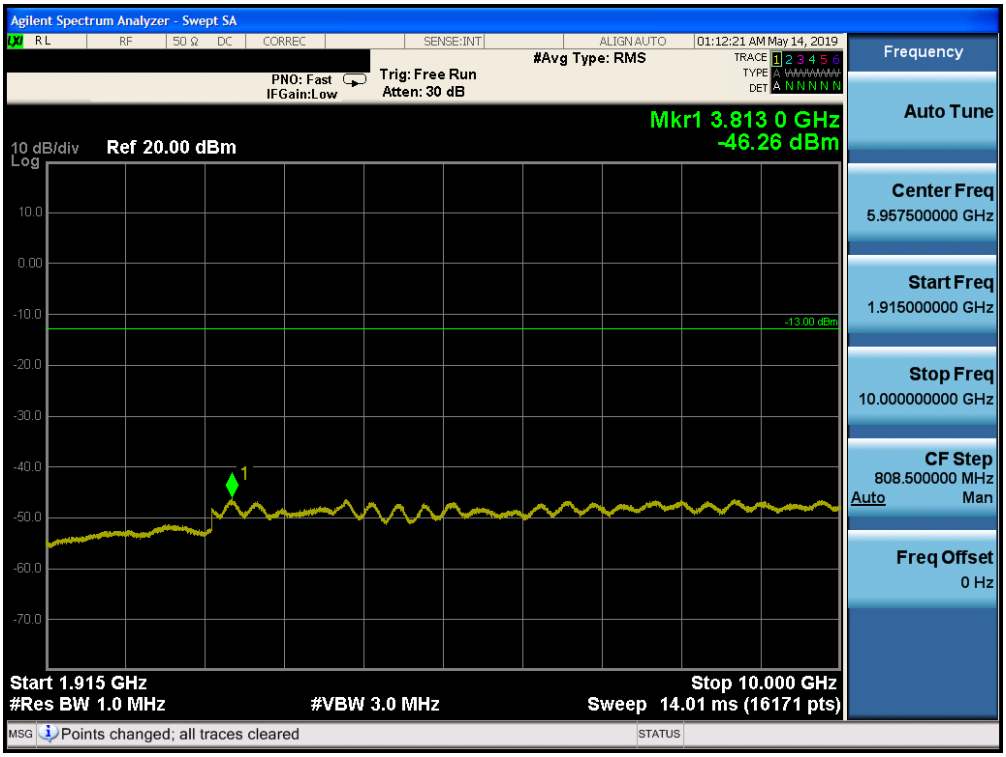



**Plot 7-96. Conducted Spurious Plot (Band 66/4 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

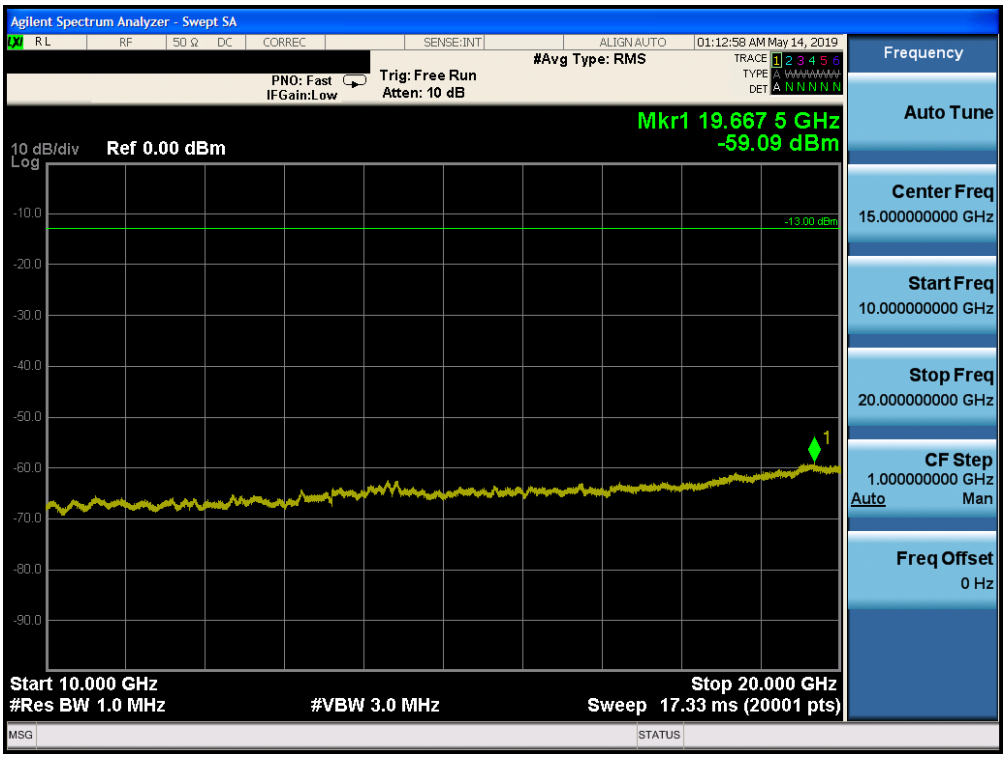
## Band 25/2



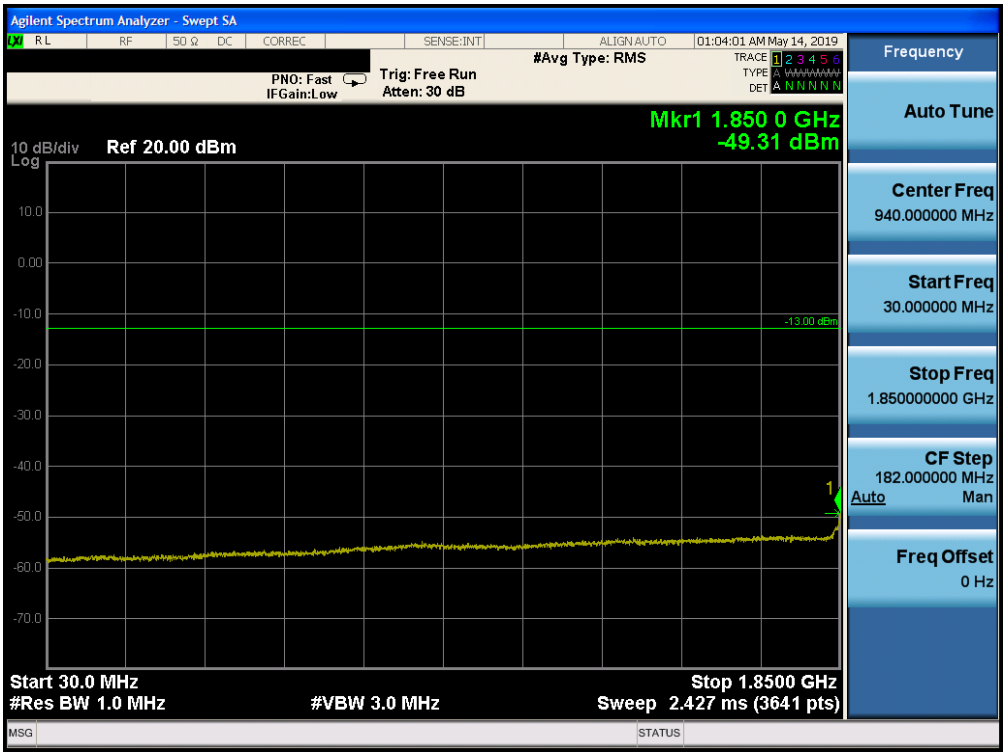

**Plot 7-97. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



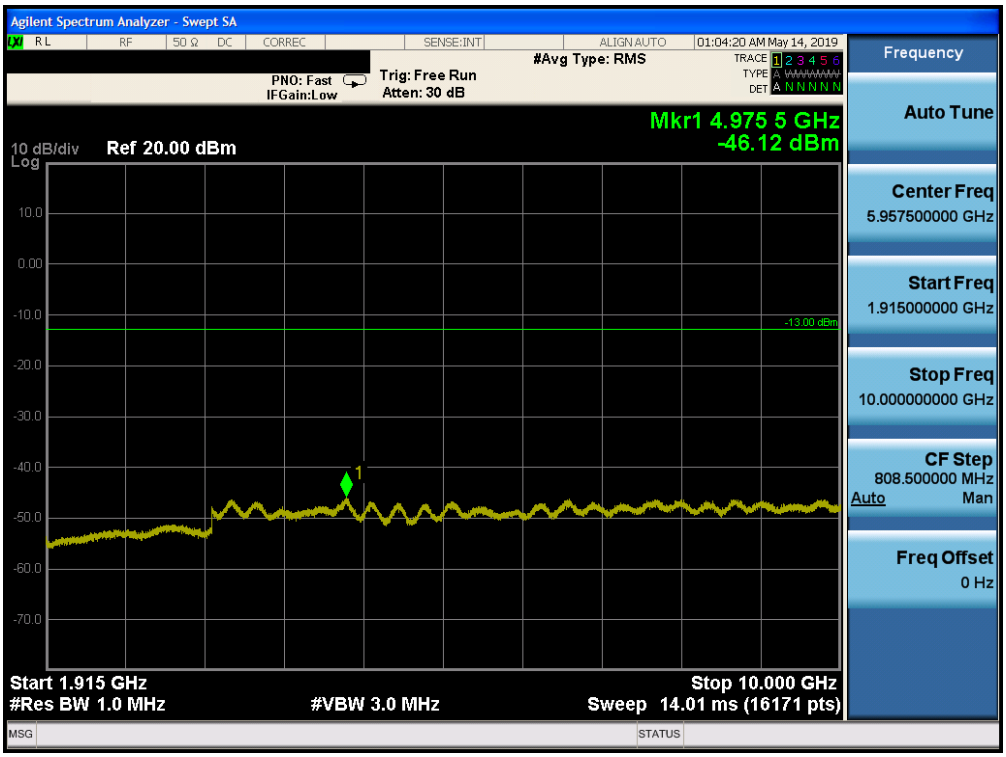

**Plot 7-98. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



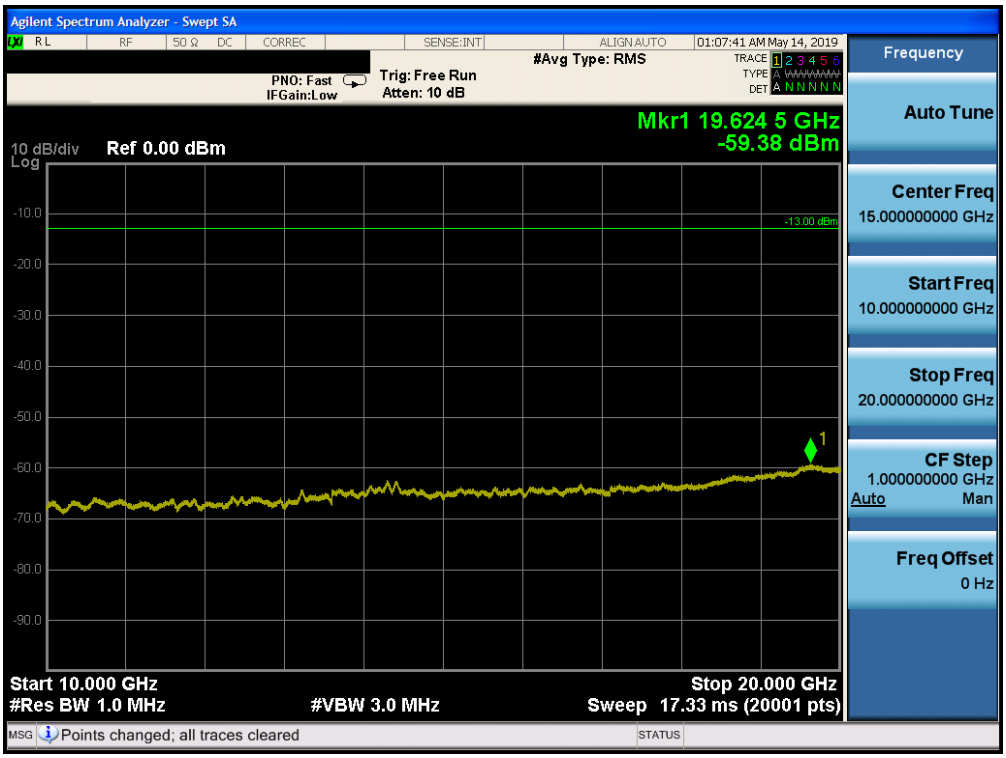

**Plot 7-99. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**



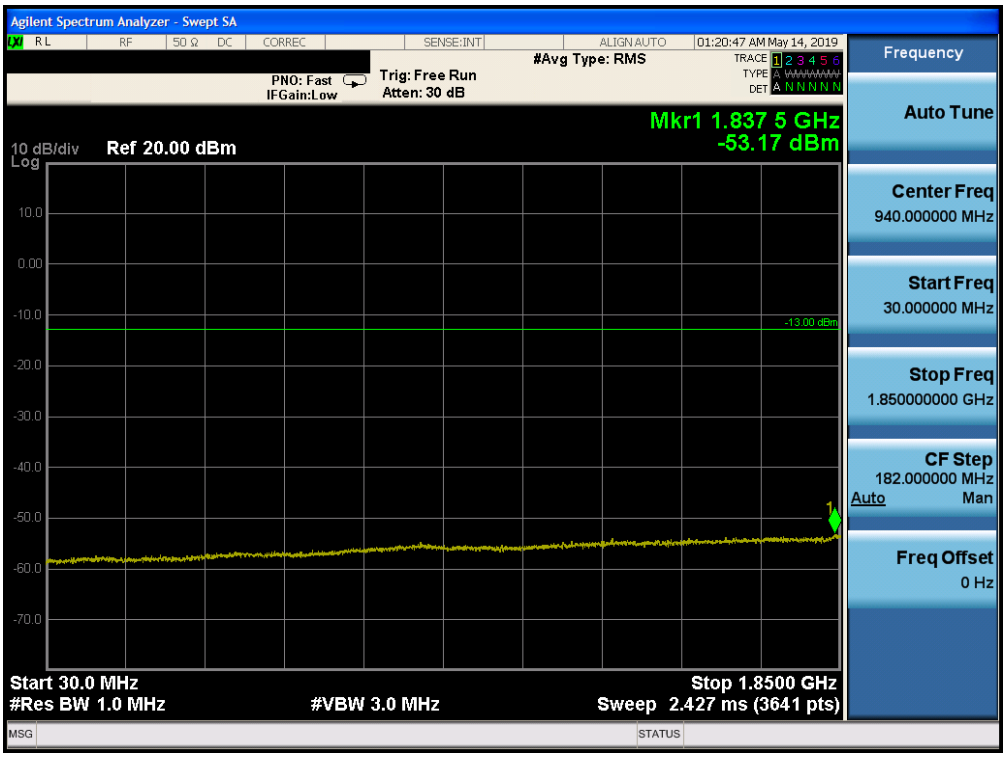

**Plot 7-100. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



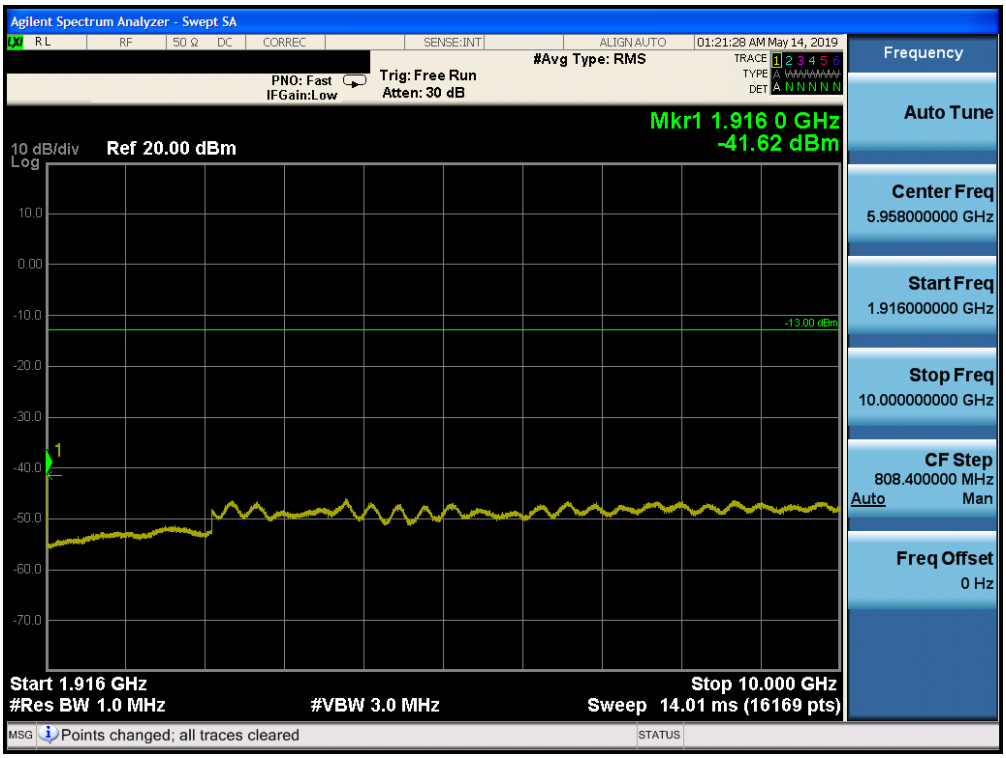

**Plot 7-101. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



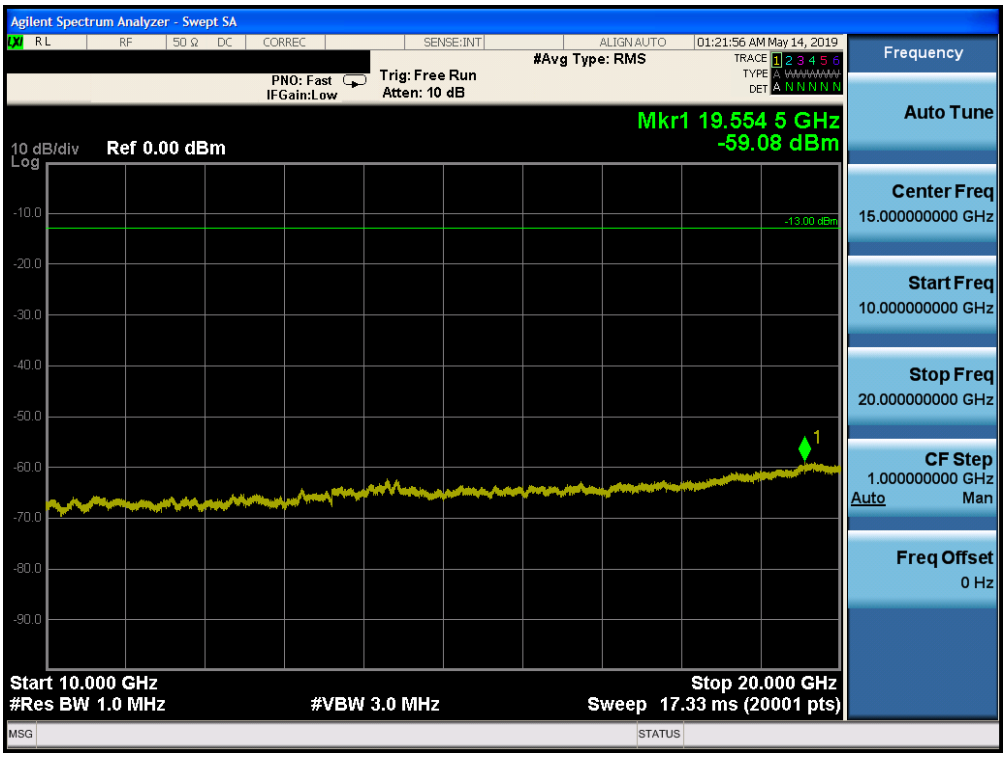

**Plot 7-102. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**



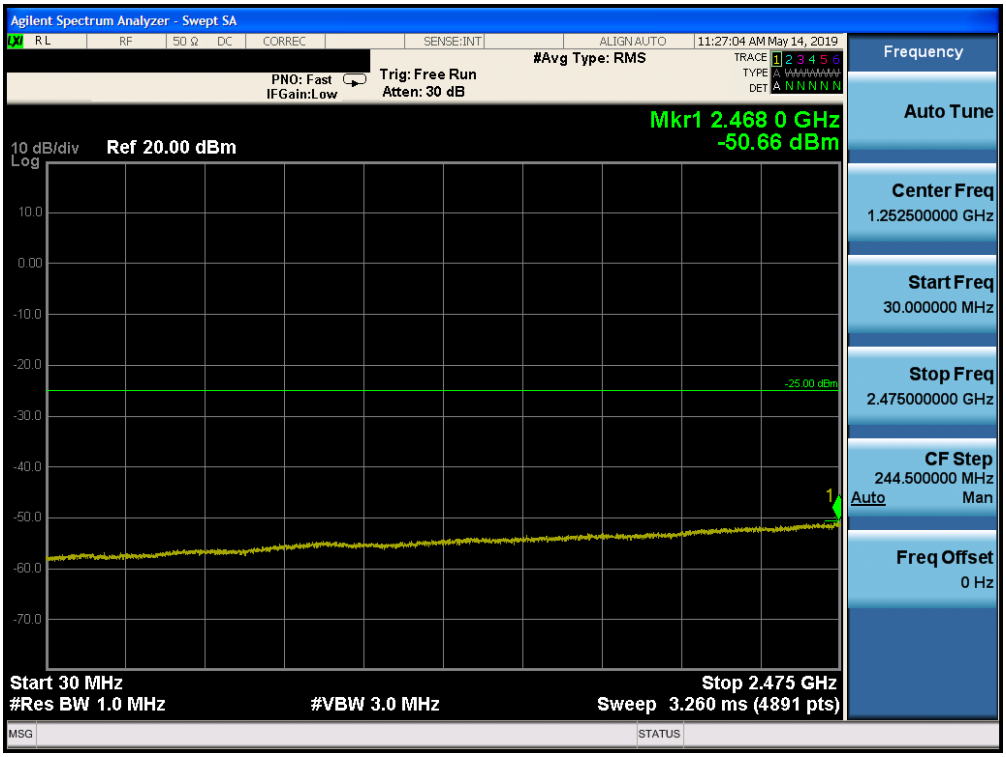

**Plot 7-103. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**



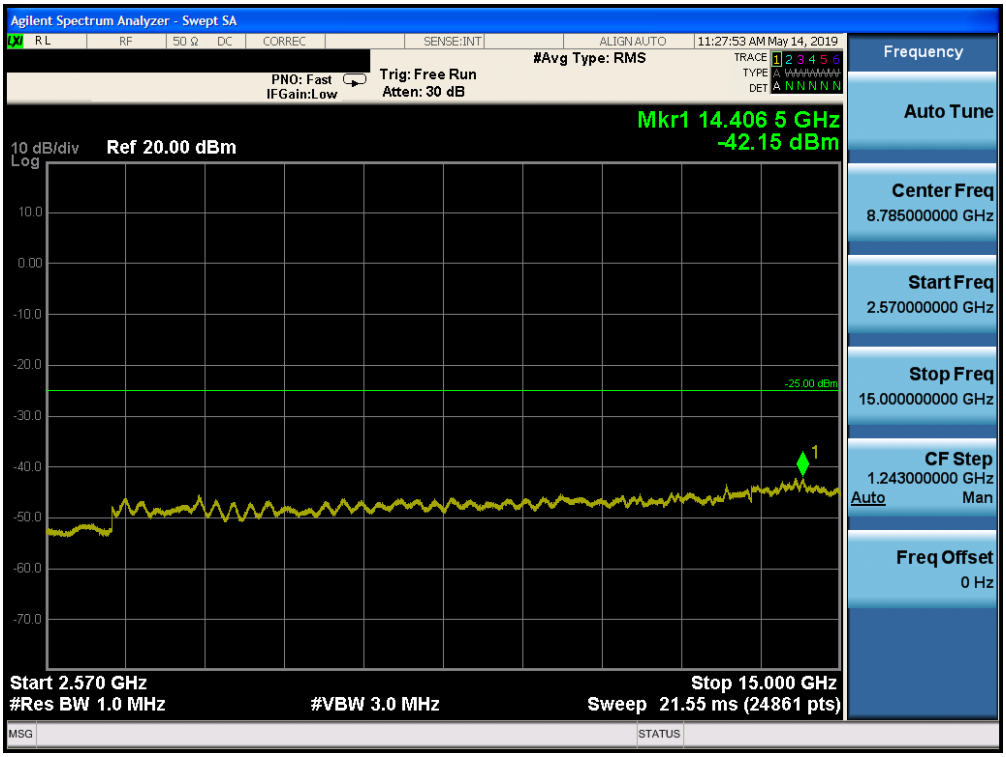

**Plot 7-104. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**



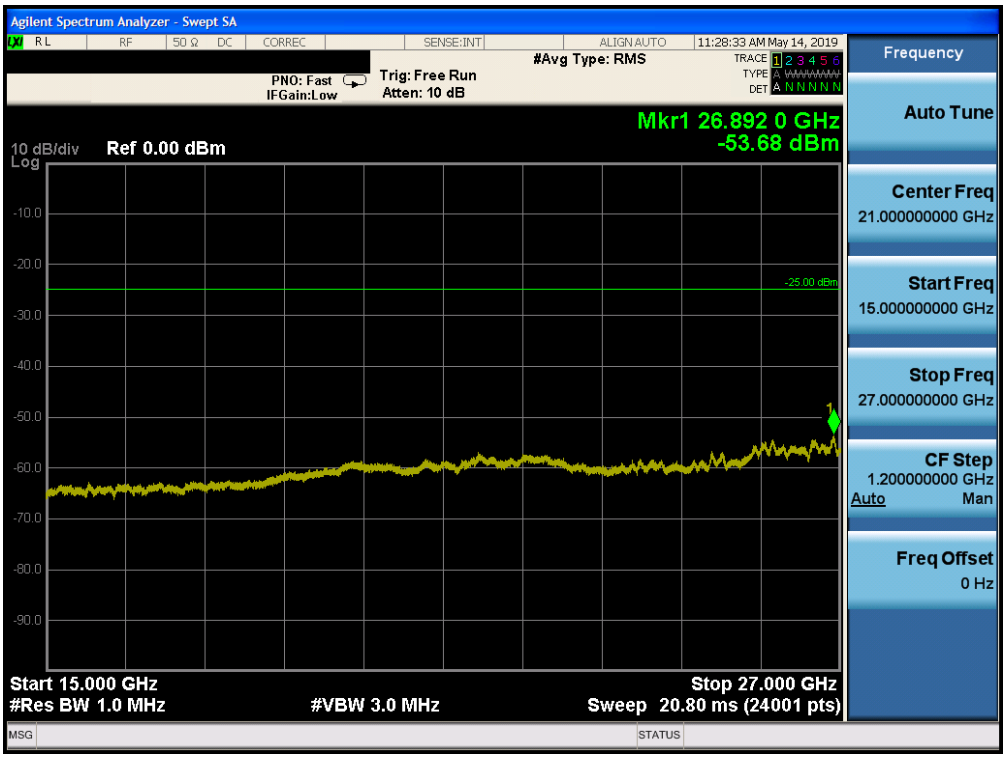

**Plot 7-105. Conducted Spurious Plot (Band 25/2 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




**Plot 7-106. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

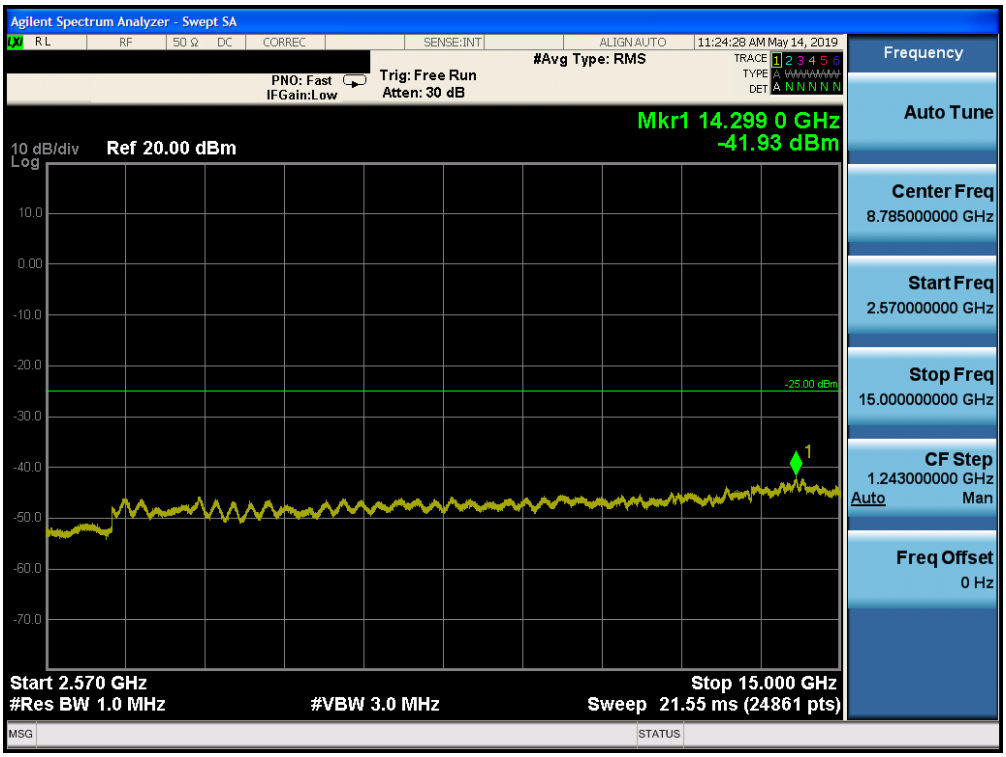



**Plot 7-107. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

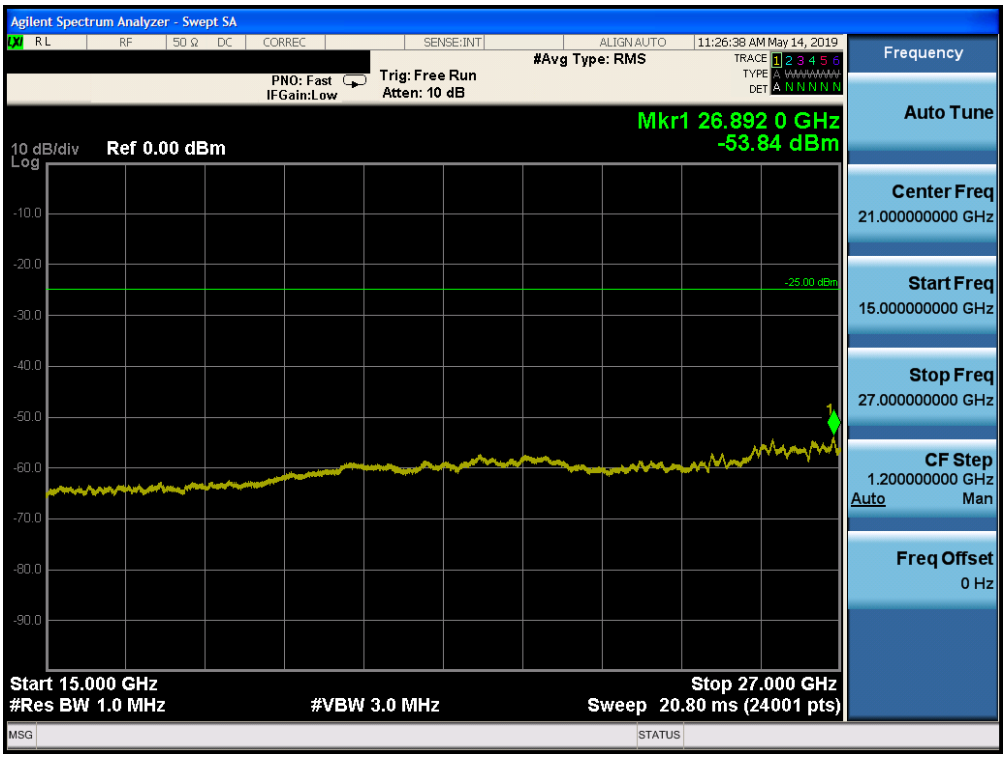



**Plot 7-108. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**


**Plot 7-109. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-110. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-111. Conducted Spurious Plot (Band 7 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**