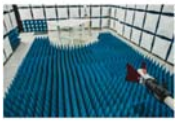
PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



# MEASUREMENT REPORT
## LTE

**Applicant Name:**
LG Electronics USA, Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

**Date of Testing:**
Oct. 30, 2018 - Nov. 12, 2018
**Test Site/Location:**
PCTEST Lab. Columbia, MD, USA
**Test Report Serial No.:**
1M1810290199-05.ZNF

| | |
|---|---|
| **FCC ID:** | **ZNFX212TA** |
| **APPLICANT:** | **LG Electronics USA, Inc.** |

| | |
|---|---|
| **Application Type:** | Class II Permissive Change |
| **Model:** | LM-X220MA |
| **Additional Model(s):** | LMX220MA, X220MA |
| **EUT Type:** | Portable Handset |
| **FCC Classification:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FCC Rule Part(s):** | 22 & 24 |
| **Test Procedure(s):** | ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01 |
| **Class II Permissive Change:** | Please see FCC change document |
| **Original Grant Date:** | March 28, 2018 |

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#2041.01



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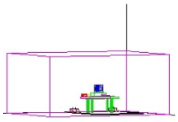
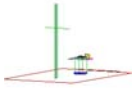


# MEASUREMENT REPORT
## FCC Part 22 & 24



| Mode | FCC Rule Part | Tx Frequency (MHz) | ERP | | EIRP | | Emission Designator | Modulation |
|---|---|---|---|---|---|---|---|---|
| | | | Max. Power (W) | Max. Power (dBm) | Max. Power (W) | Max. Power (dBm) | | |
| LTE Band 26 | 22H | 824.7 - 848.3 | 0.177 | 22.49 | 0.291 | 24.64 | 1M11G7D | QPSK |
| LTE Band 26 | 22H | 824.7 - 848.3 | 0.145 | 21.60 | 0.237 | 23.75 | 1M10W7D | 16QAM |
| LTE Band 26 | 22H | 825.5 - 847.5 | 0.188 | 22.73 | 0.308 | 24.88 | 2M72G7D | QPSK |
| LTE Band 26 | 22H | 825.5 - 847.5 | 0.135 | 21.31 | 0.222 | 23.46 | 2M72W7D | 16QAM |
| LTE Band 26 | 22H | 826.5 - 846.5 | 0.170 | 22.30 | 0.279 | 24.45 | 4M57G7D | QPSK |
| LTE Band 26 | 22H | 826.5 - 846.5 | 0.139 | 21.43 | 0.228 | 23.58 | 4M54W7D | 16QAM |
| LTE Band 26 | 22H | 829 - 844 | 0.181 | 22.57 | 0.296 | 24.72 | 9M05G7D | QPSK |
| LTE Band 26 | 22H | 829 - 844 | 0.154 | 21.87 | 0.252 | 24.02 | 9M04W7D | 16QAM |
| LTE Band 26 | 22H | 831.5 - 841.5 | 0.170 | 22.31 | 0.279 | 24.46 | 13M5G7D | QPSK |
| LTE Band 26 | 22H | 831.5 - 841.5 | 0.155 | 21.90 | 0.254 | 24.05 | 13M5W7D | 16QAM |

**EUT Overview (<1GHz)**

| Mode | FCC Rule Part | Tx Frequency (MHz) | EIRP | | Emission Designator | Modulation |
|---|---|---|---|---|---|---|
| | | | Max. Power (W) | Max. Power (dBm) | | |
| LTE Band 25 | 24E | 1850.7 - 1914.3 | 0.421 | 26.24 | 1M10G7D | QPSK |
| LTE Band 25 | 24E | 1850.7 - 1914.3 | 0.344 | 25.37 | 1M11W7D | 16QAM |
| LTE Band 25 | 24E | 1851.5 - 1913.5 | 0.350 | 25.44 | 2M72G7D | QPSK |
| LTE Band 25 | 24E | 1851.5 - 1913.5 | 0.297 | 24.73 | 2M71W7D | 16QAM |
| LTE Band 25 | 24E | 1852.5 - 1912.5 | 0.352 | 25.47 | 4M55G7D | QPSK |
| LTE Band 25 | 24E | 1852.5 - 1912.5 | 0.284 | 24.53 | 4M54W7D | 16QAM |
| LTE Band 25 | 24E | 1855 - 1910 | 0.338 | 25.29 | 9M01G7D | QPSK |
| LTE Band 25 | 24E | 1855 - 1910 | 0.275 | 24.39 | 8M97W7D | 16QAM |
| LTE Band 25 | 24E | 1857.5 - 1907.5 | 0.349 | 25.43 | 13M5G7D | QPSK |
| LTE Band 25 | 24E | 1857.5 - 1907.5 | 0.323 | 25.10 | 13M5W7D | 16QAM |
| LTE Band 25 | 24E | 1860 - 1905 | 0.349 | 25.43 | 17M9G7D | QPSK |
| LTE Band 25 | 24E | 1860 - 1905 | 0.287 | 24.57 | 17M9W7D | 16QAM |

**EUT Overview (>1GHz)**



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# 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 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 Engineering Lab located in Columbia, MD 21046, U.S.A.**

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

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

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.




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# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFX212TA**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

**Test Device Serial No.:** 02587, 02785

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n UNII, Bluetooth (1x, EDR, LE)

## 2.3 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.

## 2.4 EMI Suppression Device(s)/Modifications

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




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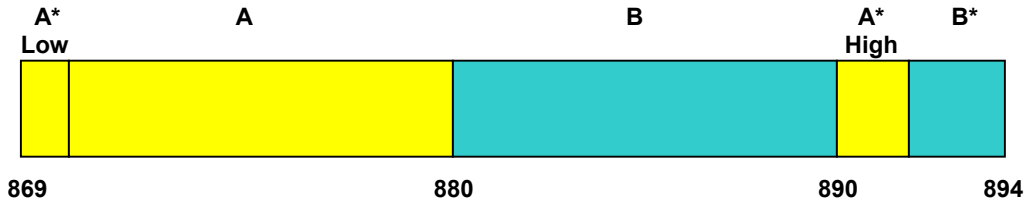
# 3.0 DESCRIPTION OF TESTS

## 3.1 Measurement Procedure

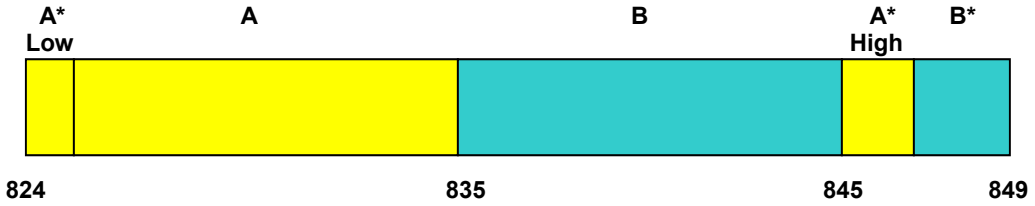
The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission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

## 3.2 Cellular - Base Frequency Blocks



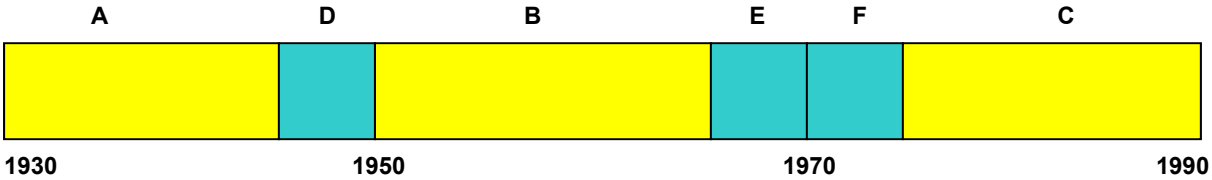

**BLOCK 1: 869 – 880 MHz (A* Low + A)**
**BLOCK 2: 880 – 890 MHz (B)**
**BLOCK 3: 890 – 891.5 MHz (A* High)**
**BLOCK 4: 891.5 – 894 MHz (B*)**

## 3.3 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*)**

## 3.4 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)**

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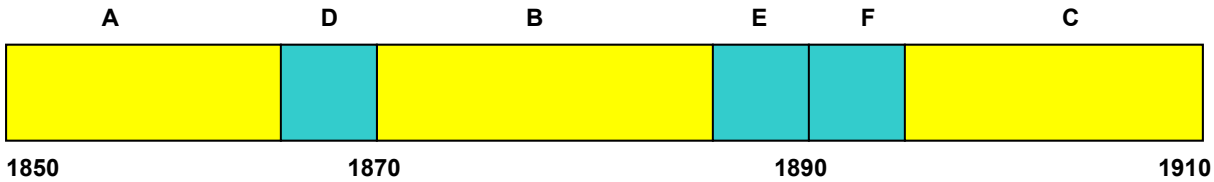
## 3.5 PCS - Mobile Frequency Blocks




**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)**

## 3.6 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. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

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 $_{[Watts]}$).



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# 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 | 1.13 |
| Radiated Disturbance (<1GHz) | 4.98 |
| Radiated Disturbance (>1GHz) | 5.07 |
| Radiated Disturbance (>18GHz) | 5.09 |




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# 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 |
|---|---|---|---|---|---|---|
| - | LTx3 | LIcensed Transmitter Cable Set | 8/23/2018 | Annual | 8/23/2019 | LTx3 |
| Agilent | 8648D | (9kHz-4GHz) Signal Generator | 11/21/2017 | Annual | 11/21/2018 | 3613A00315 |
| Agilent | E5515C | Wireless Communications Test Set | 1/29/2016 | Triennial | 1/29/2019 | GB46310798 |
| Agilent | N9038A | MXE EMI Receiver | 6/11/2018 | Annual | 6/11/2019 | MY51210133 |
| Agilent | N9030A | PXA Signal Analyzer (44GHz) | 5/25/2018 | Annual | 5/25/2019 | MY52350166 |
| Com-Power | PAM-103 | Pre-Amplifier (1-1000MHz) | 9/17/2018 | Annual | 9/17/2019 | 441119 |
| Emco | 3115 | Horn Antenna (1-18GHz) | 3/28/2018 | Biennial | 3/28/2020 | 9704-5182 |
| EMCO | 3160-09 | Small Horn (18 - 26.5GHz) | 8/9/2018 | Biennial | 8/9/2020 | 135427 |
| Espec | ESX-2CA | Environmental Chamber | 3/28/2018 | Annual | 3/28/2019 | 17620 |
| Rohde & Schwarz | CMW500 | Radio Communication Tester | 6/8/2018 | Annual | 6/8/2019 | 112347 |
| Rohde & Schwarz | TS-PR26 | 18-26.5 GHz Pre-Amplifier | 1/24/2018 | Annual | 1/24/2019 | 100040 |
| Rohde & Schwarz | ESU26 | EMI Test Receiver (26.5GHz) | 5/21/2018 | Annual | 5/21/2019 | 100342 |
| Rohde & Schwarz | SFUNIT-Rx | Shielded Filter Unit | 6/18/2018 | Annual | 6/18/2019 | 102134 |
| Schwarzbeck | UHA 9105 | Dipole Antenna (400 - 1GHz) Rx | 4/30/2018 | Biennial | 4/30/2020 | 9105-2404 |
| Schwarzbeck | UHA 9105 | Dipole Antenna (400 - 1GHz) Tx | 4/30/2018 | Biennial | 4/30/2020 | 9105-2403 |
| Seekonk | NC-100 | Torque Wrench (8" lb) | 5/10/2018 | Biennial | 5/10/2020 | N/A |
| Sunol | DRH-118 | Horn Antenna (1-18GHz) | 8/11/2017 | Biennial | 8/11/2019 | A050307 |
| Sunol | DRH-118 | Horn Antenna (1-18 GHz) | 8/11/2017 | Biennial | 8/11/2019 | A042511 |
| Sunol | JB5 | Bi-Log Antenna (30M - 5GHz) | 4/19/2018 | Biennial | 4/19/2020 | A051107 |

**Table 5-1. Test Equipment**



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# 6.0 SAMPLE CALCULATIONS

## Emission Designator

### QPSK Modulation

**Emission Designator = 8M62G7D**

LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

### QAM Modulation

**Emission Designator = 8M45W7D**

LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

## 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).



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# 7.0 TEST RESULTS

## 7.1 Summary

Company Name: LG Electronics USA, Inc.

FCC ID: ZNFX212TA

FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)

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>2.917(a)<br>24.238(a) | Out of Band Emissions | > 43 + 10log$_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions | | | Section 7.3, 7.4 |
| 24.232(d) | Peak-Average Ratio | < 13 dB | | | Section 7.5 |
| 2.1046 | Transmitter Conducted Output Power | N/A | | | See RF Exposure Report |
| 2.1055<br>22.355<br>24.235 | Frequency Stability | < 2.5 ppm (Part 22) and fundamental emissions stay within authorized frequency block (Part 24) | | | Section 7.8 |

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




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| 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) | < 7 Watts max. ERP | RADIATED | PASS | Section 7.6 |
| 24.232(c) | Equivalent Isotropic Radiated Power (Band 25) | < 2 Watts max. EIRP | | | Section 7.6 |
| 2.1053<br>22.917(a)<br>24.238(a) | Undesirable Emissions | > 43 + $10\log_{10}$ (P[Watts]) for all out-of-band emissions | | | 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.
5) For operation <1GHz, the EIRP limits in the table above are referenced to the specifications written in the relevant Radio Standards Specifications for Innovation, Science, and Economic Development Canada.




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## 7.2 Occupied Bandwidth
§2.1049

### 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

None.



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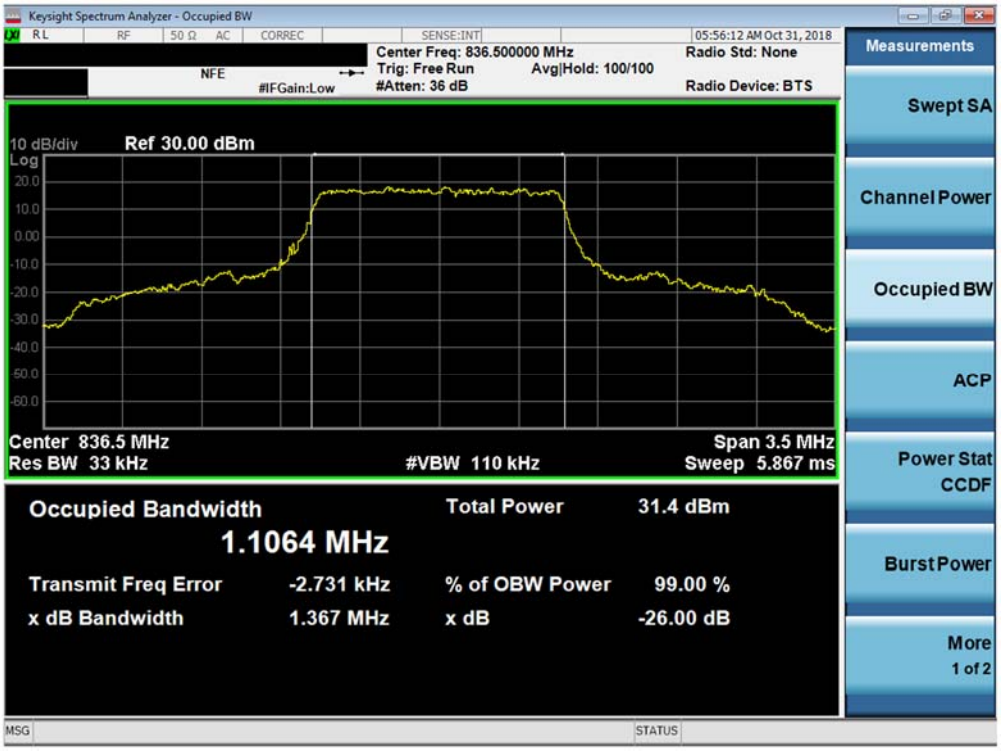
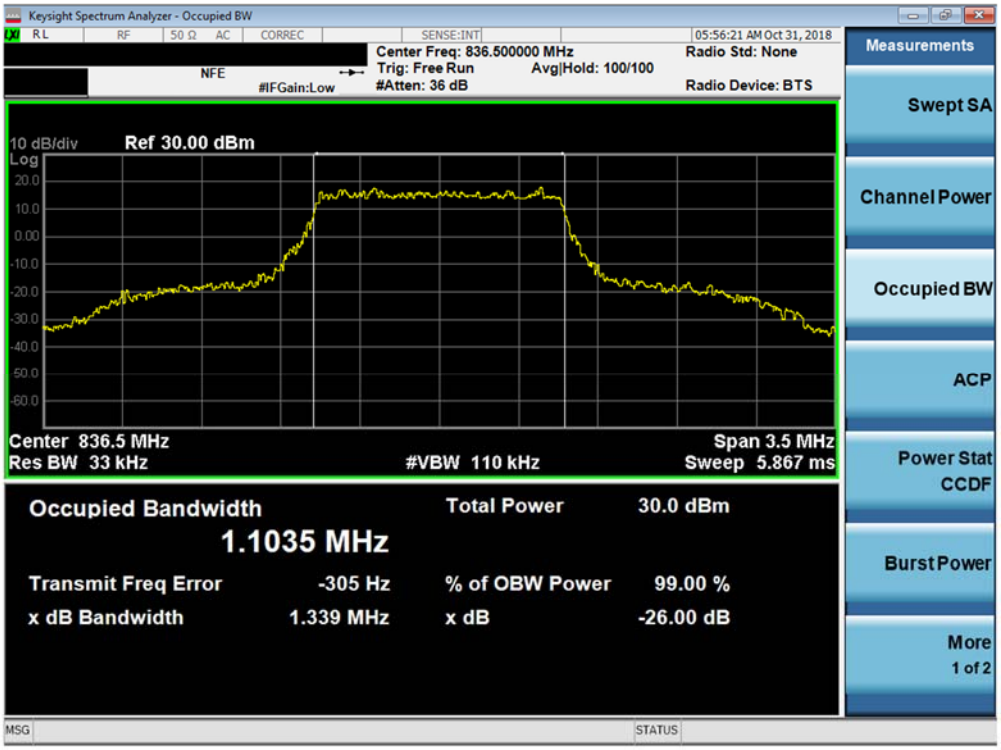
## Band 26




**Plot 7-1. Occupied Bandwidth Plot (Band 26 - 1.4MHz QPSK - Full RB Configuration)**




**Plot 7-2. Occupied Bandwidth Plot (Band 26 - 1.4MHz 16-QAM - Full RB Configuration)**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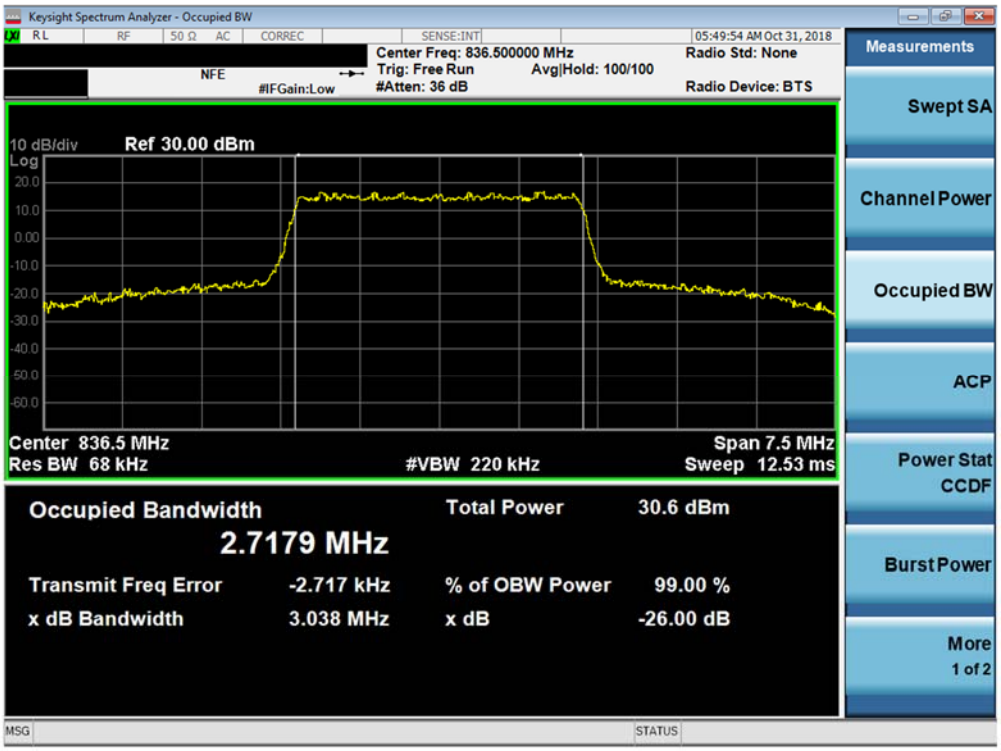
**Plot 7-3. Occupied Bandwidth Plot (Band 26 - 3.0MHz QPSK - Full RB Configuration)**




**Plot 7-4. Occupied Bandwidth Plot (Band 26 - 3.0MHz 16-QAM - Full RB Configuration)**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**Plot 7-5. Occupied Bandwidth Plot (Band 26 - 5.0MHz QPSK - Full RB Configuration)**

**Plot 7-6. Occupied Bandwidth Plot (Band 26 - 5.0MHz 16-QAM - Full RB Configuration)**


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

**Plot 7-8. Occupied Bandwidth Plot (Band 26 - 10.0MHz 16-QAM - Full RB Configuration)**


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**Plot 7-9. Occupied Bandwidth Plot (Band 26 - 15.0MHz QPSK - Full RB Configuration)**

**Plot 7-10. Occupied Bandwidth Plot (Band 26 - 15.0MHz 16-QAM - Full RB Configuration)**




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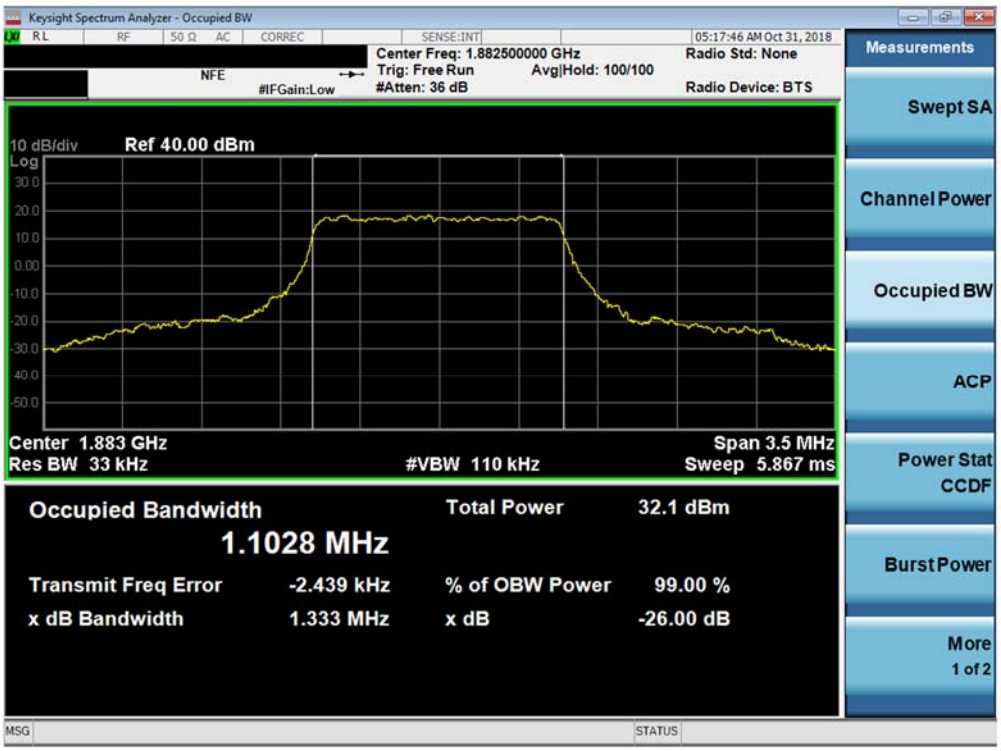
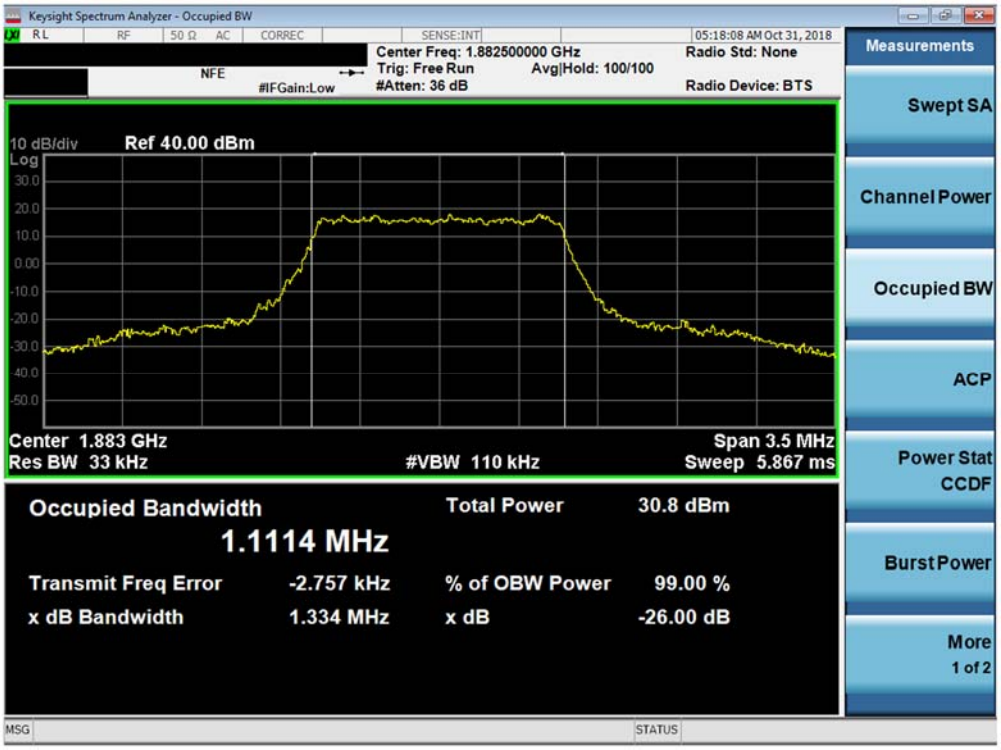
## Band 25




**Plot 7-11. Occupied Bandwidth Plot (Band 25 - 1.4MHz QPSK - Full RB Configuration)**




**Plot 7-12. Occupied Bandwidth Plot (Band 25 - 1.4MHz 16-QAM - Full RB Configuration)**

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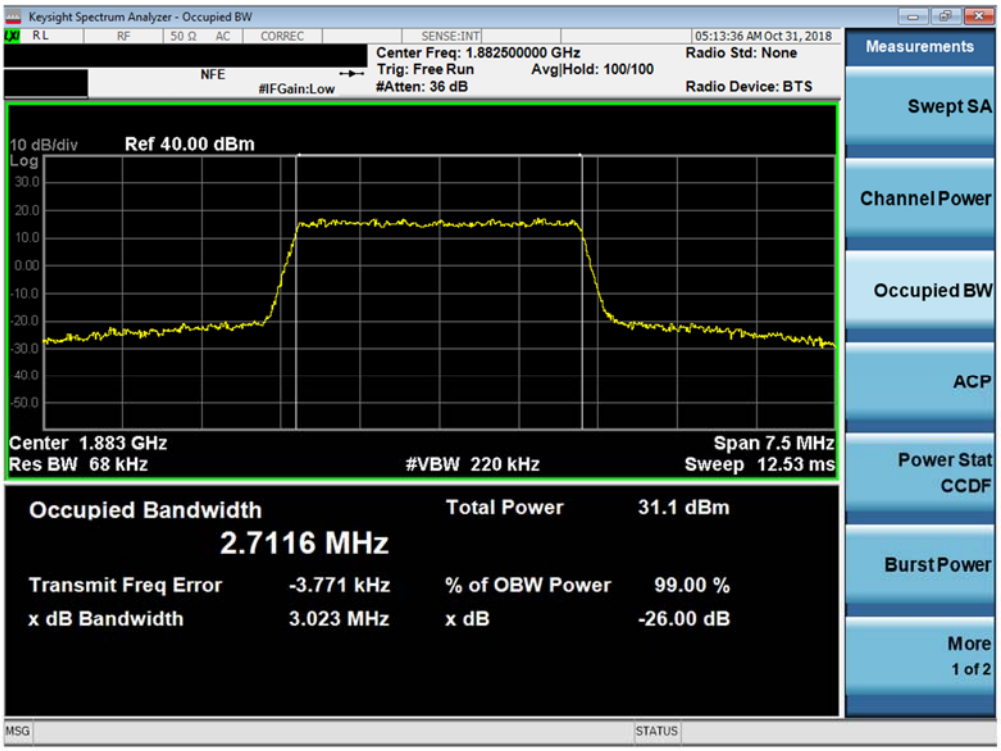
**Plot 7-13. Occupied Bandwidth Plot (Band 25 - 3.0MHz QPSK - Full RB Configuration)**




**Plot 7-14. Occupied Bandwidth Plot (Band 25 - 3.0MHz 16-QAM - Full RB Configuration)**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**Plot 7-15. Occupied Bandwidth Plot (Band 25 - 5.0MHz QPSK - Full RB Configuration)**

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


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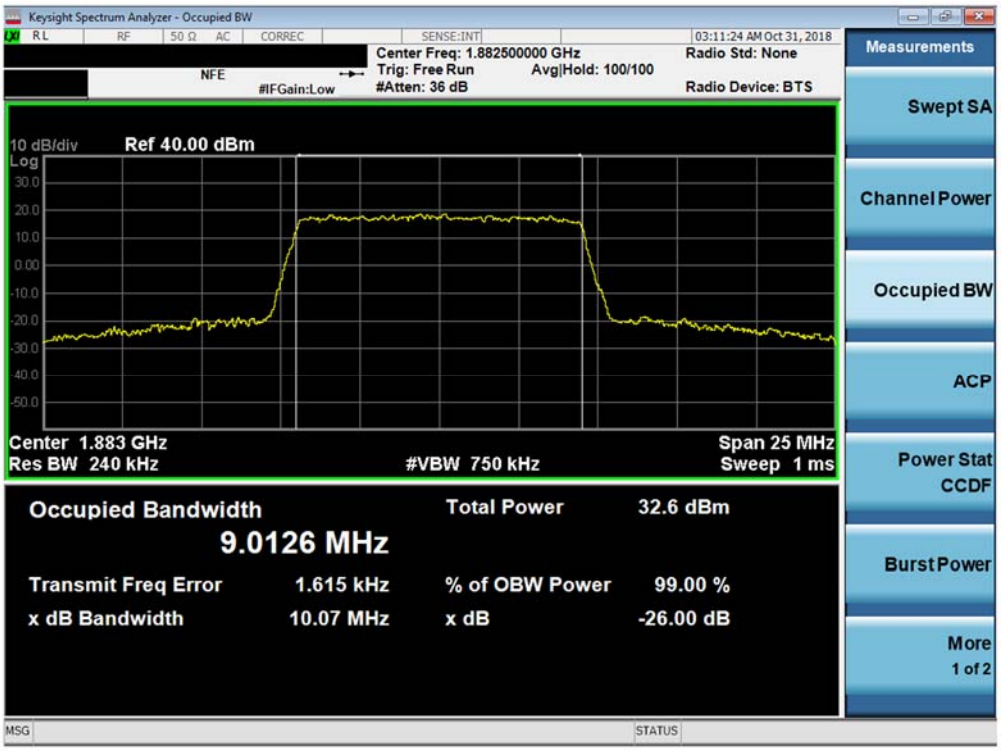


**Plot 7-17. Occupied Bandwidth Plot (Band 25 - 10.0MHz QPSK - Full RB Configuration)**

**Plot 7-18. Occupied Bandwidth Plot (Band 25 - 10.0MHz 16-QAM - Full RB Configuration)**


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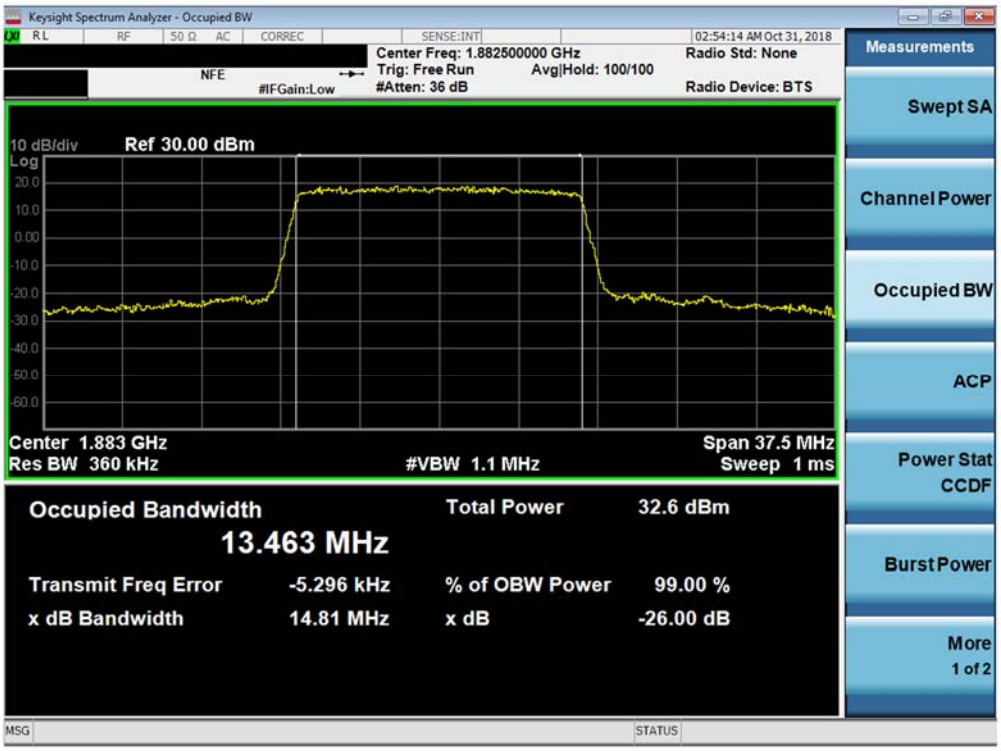


**Plot 7-19. Occupied Bandwidth Plot (Band 25 - 15.0MHz QPSK - Full RB Configuration)**

**Plot 7-20. Occupied Bandwidth Plot (Band 25 - 15.0MHz 16-QAM - Full RB Configuration)**


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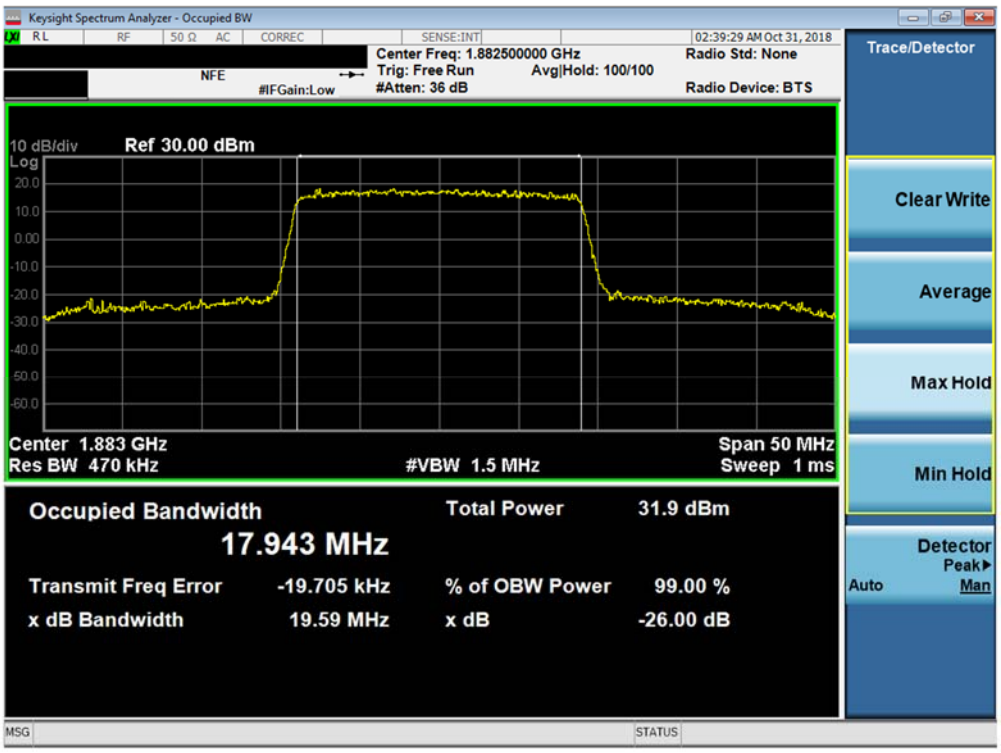
**Plot 7-21. Occupied Bandwidth Plot (Band 25 - 20.0MHz QPSK - Full RB Configuration)**




**Plot 7-22. Occupied Bandwidth Plot (Band 25 - 20.0MHz 16-QAM - Full RB Configuration)**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## 7.3 Spurious and Harmonic Emissions at Antenna Terminal

**§2.1051, §2.917(a), 24.238(a)**

### 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 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in 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
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.

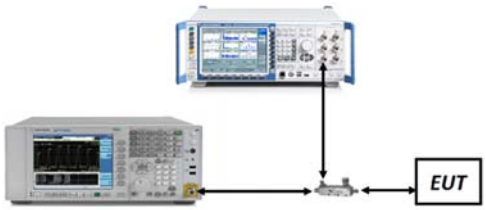


**Figure 7-2. Test Instrument & Measurement Setup**

### 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.




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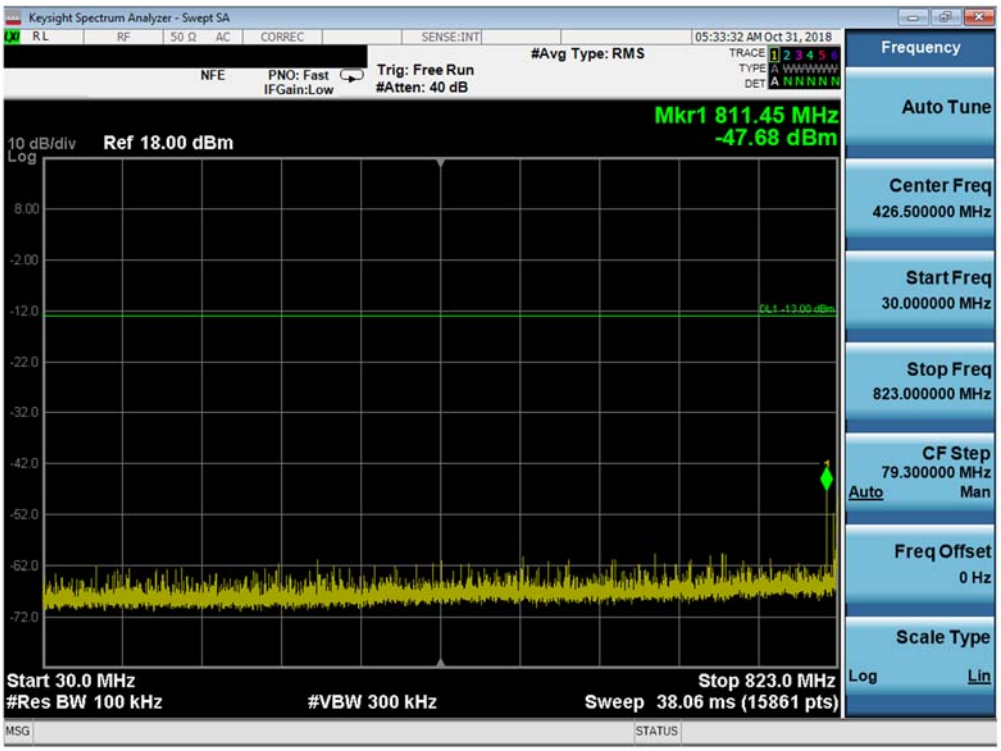
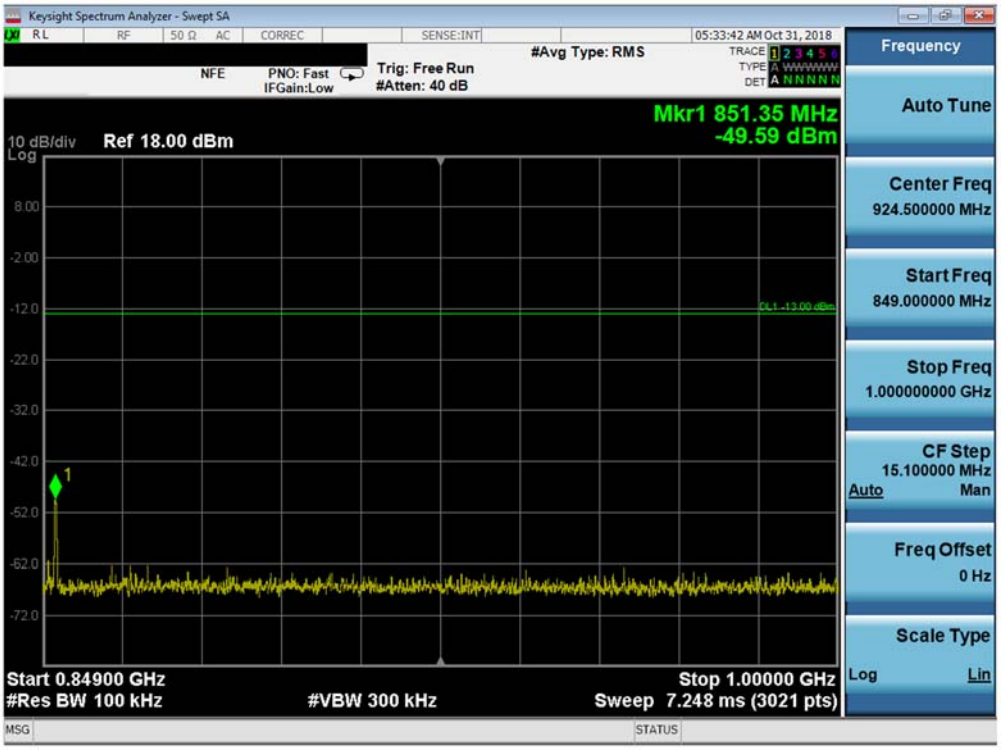
## Band 26




**Plot 7-23. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**




**Plot 7-24. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

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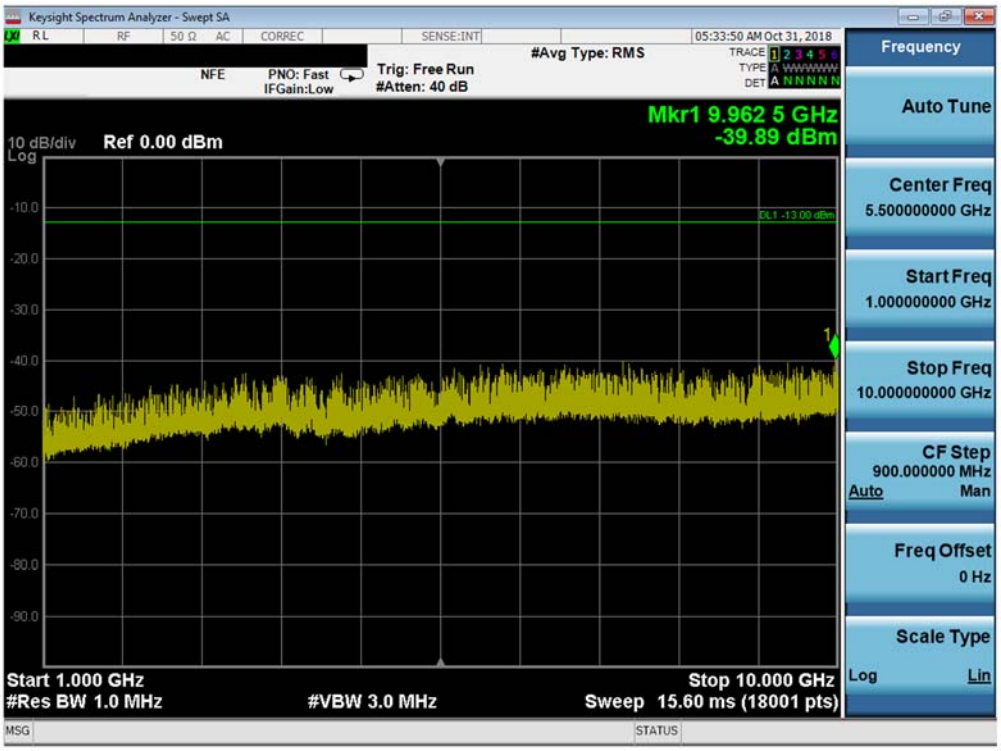
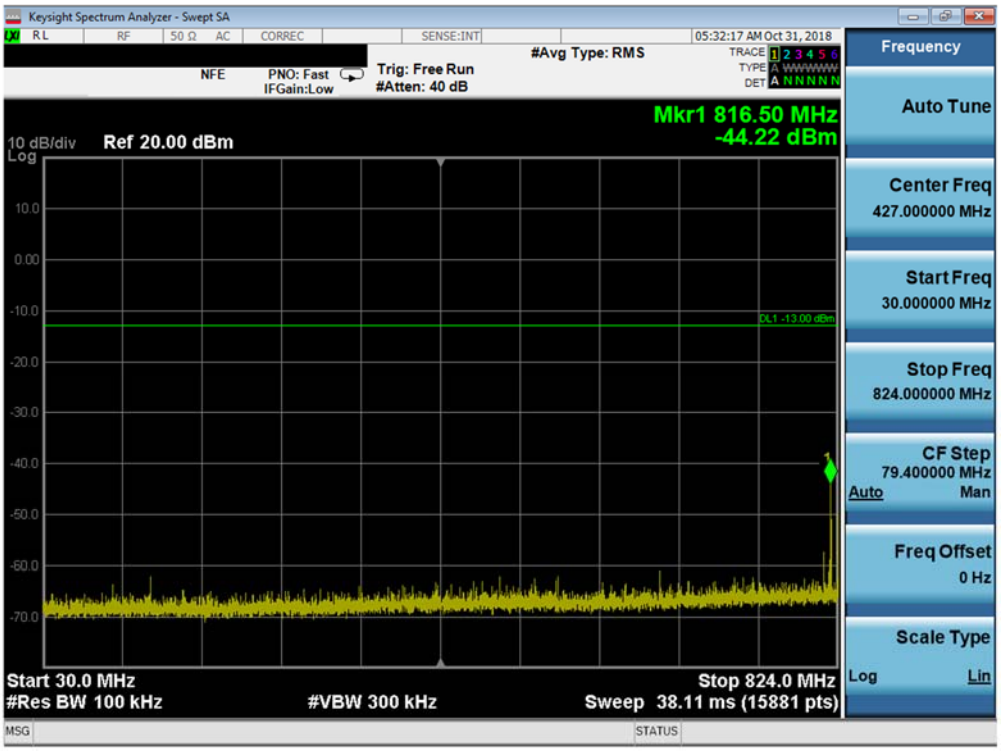



**Plot 7-25. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**




**Plot 7-26. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**

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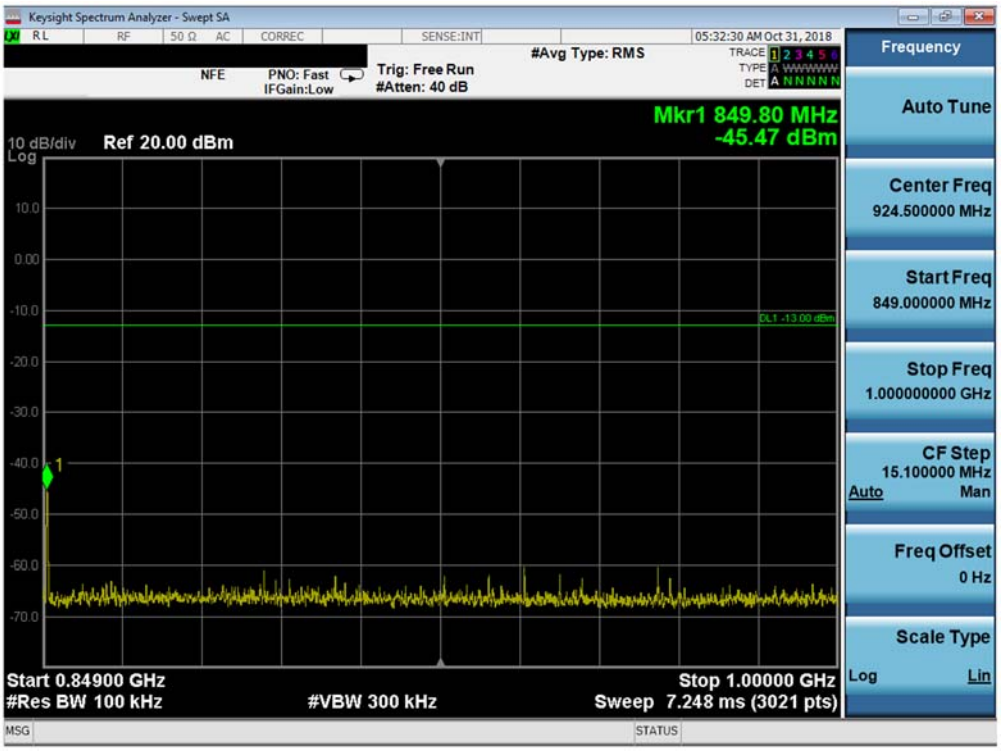
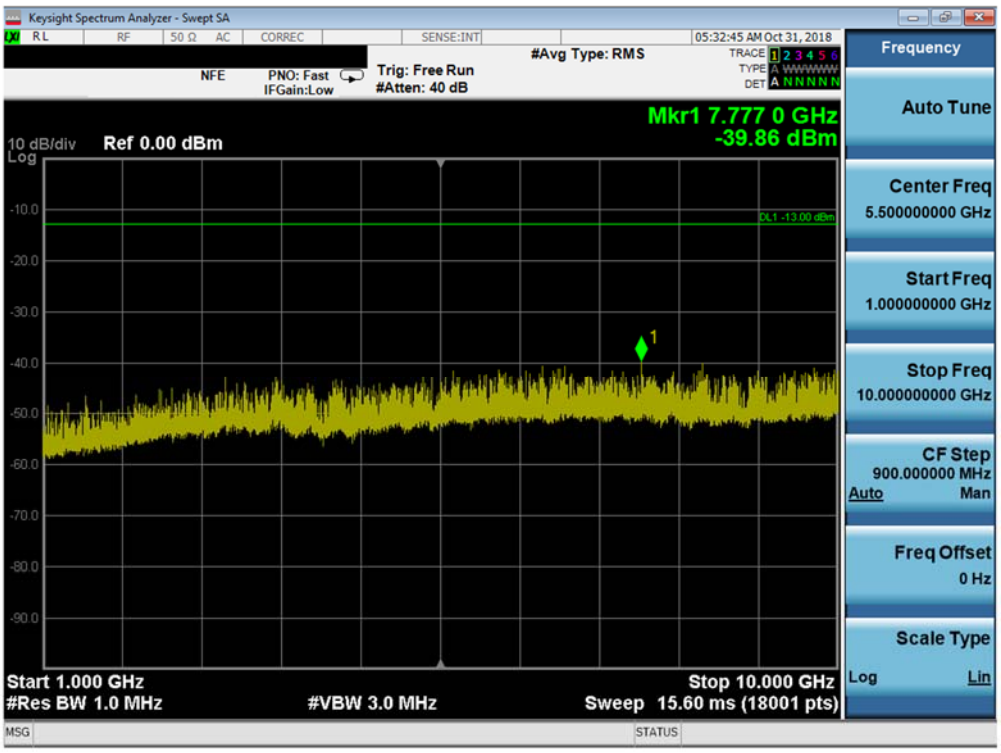



**Plot 7-27. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-28. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**

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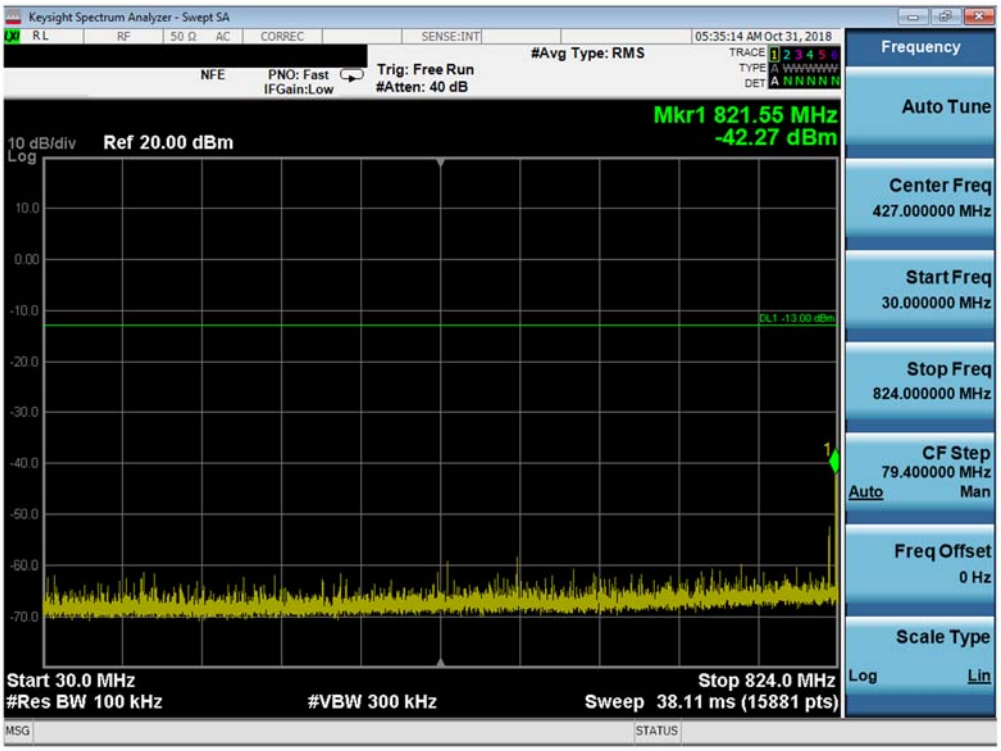
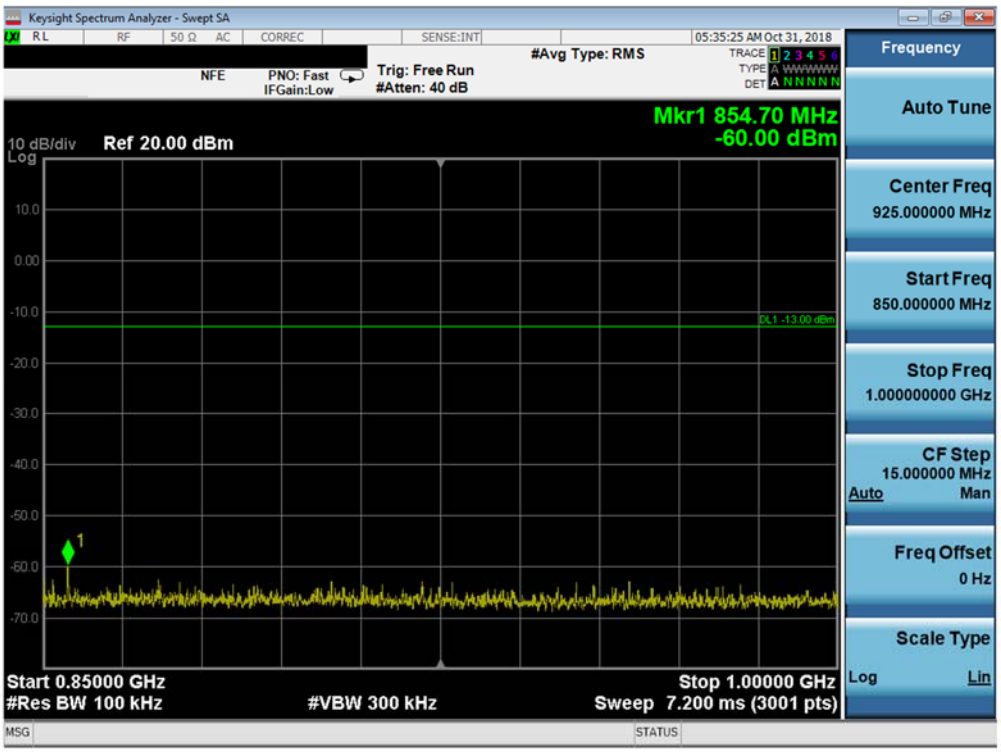



**Plot 7-29. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




**Plot 7-30. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

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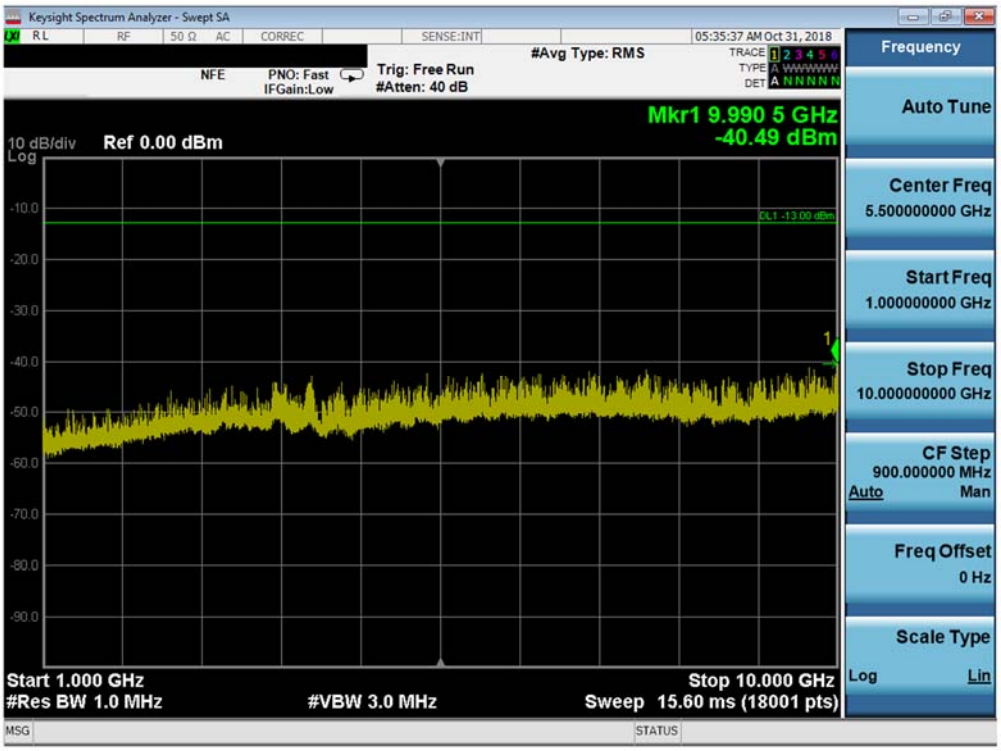


**Plot 7-31. Conducted Spurious Plot (Band 26 - 15.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




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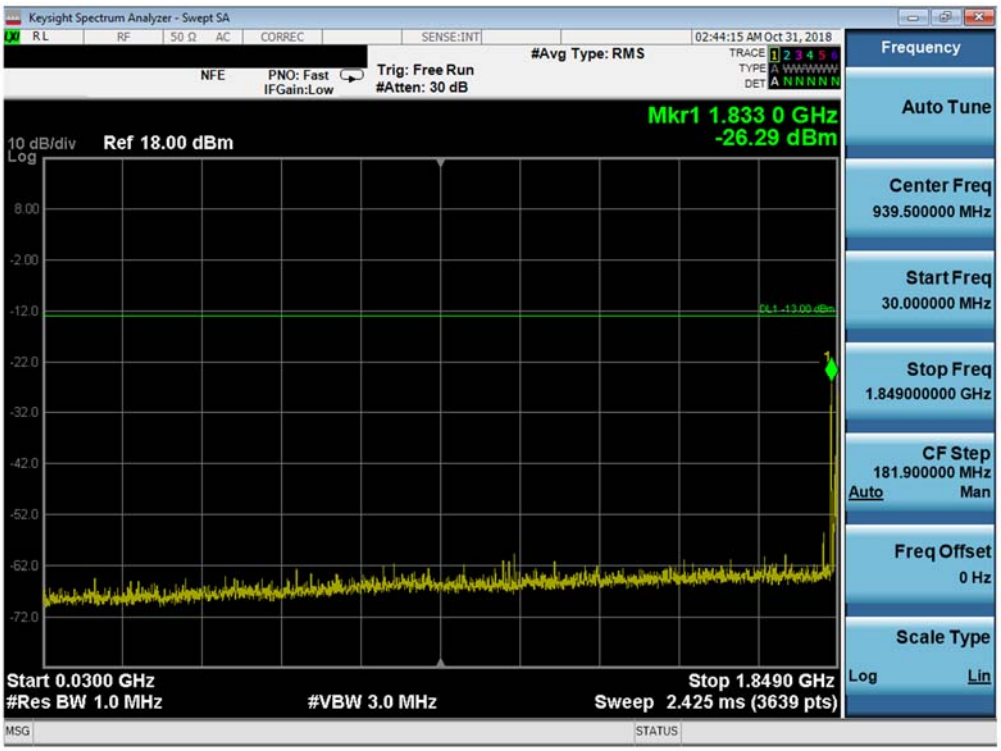
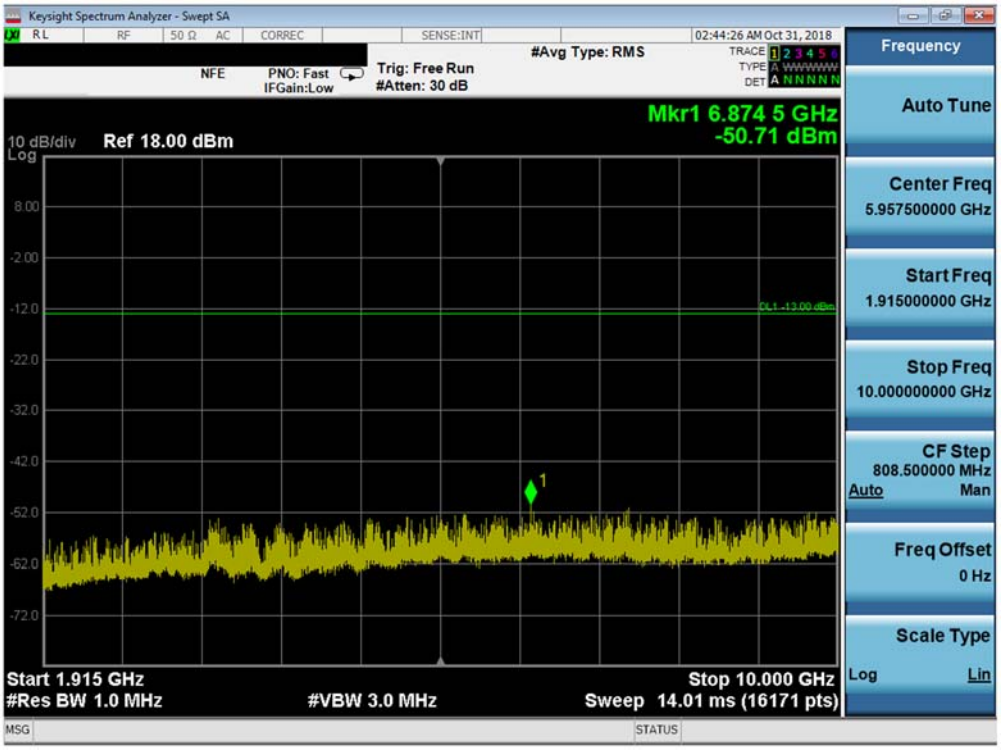
## Band 25




**Plot 7-32. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**




**Plot 7-33. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**

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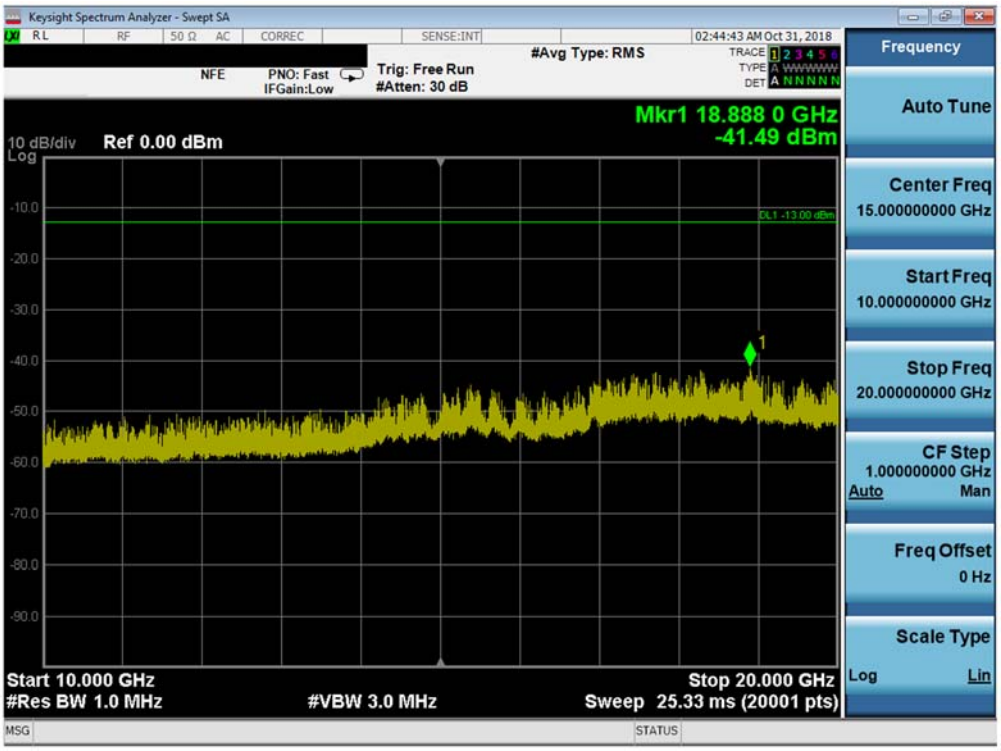
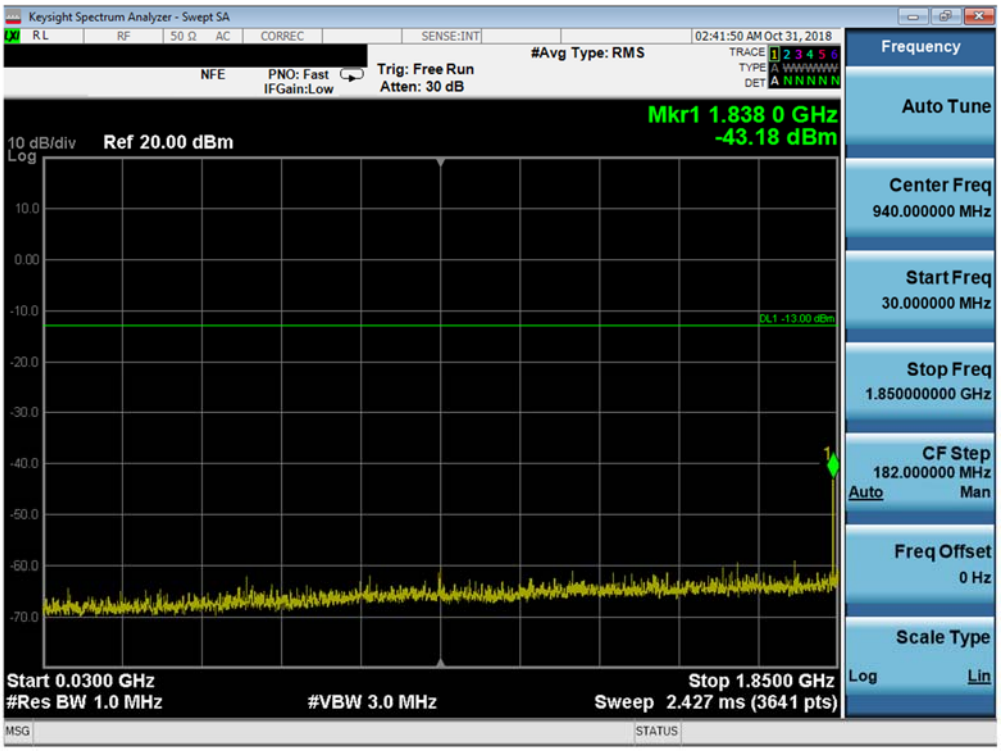



**Plot 7-34. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)**




**Plot 7-35. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**

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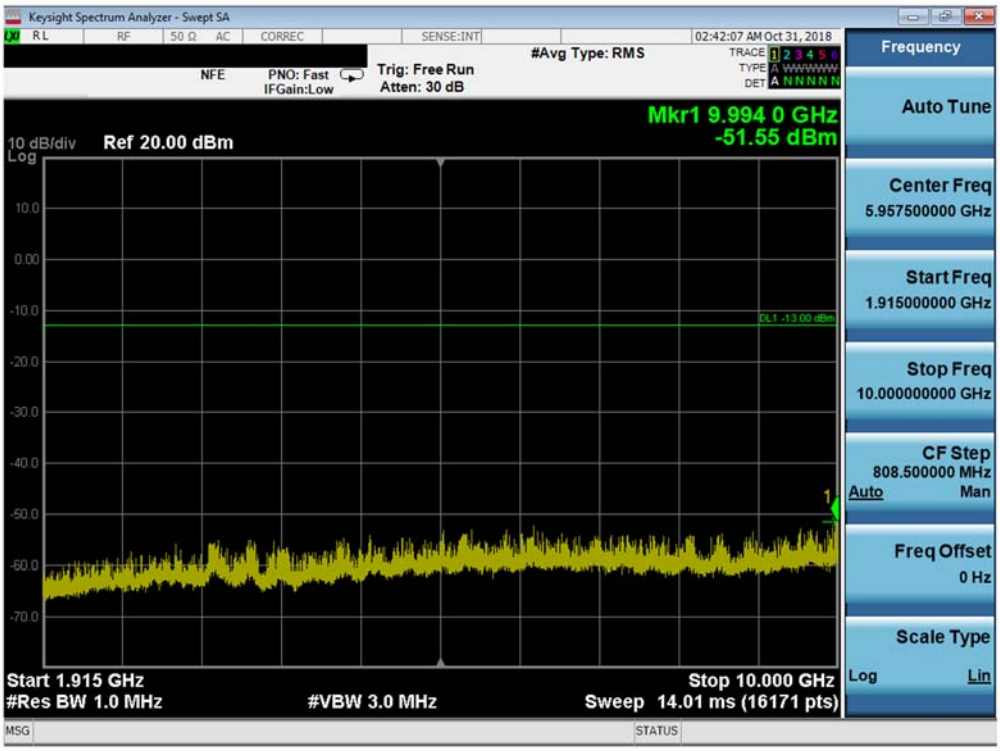
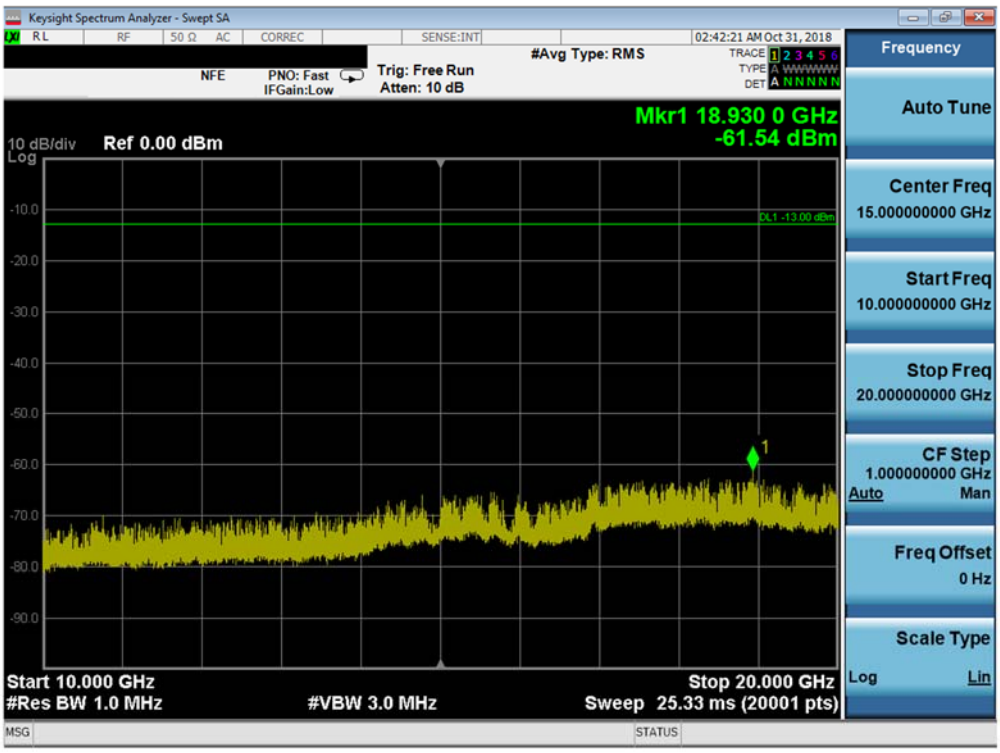



**Plot 7-36. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**




**Plot 7-37. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)**

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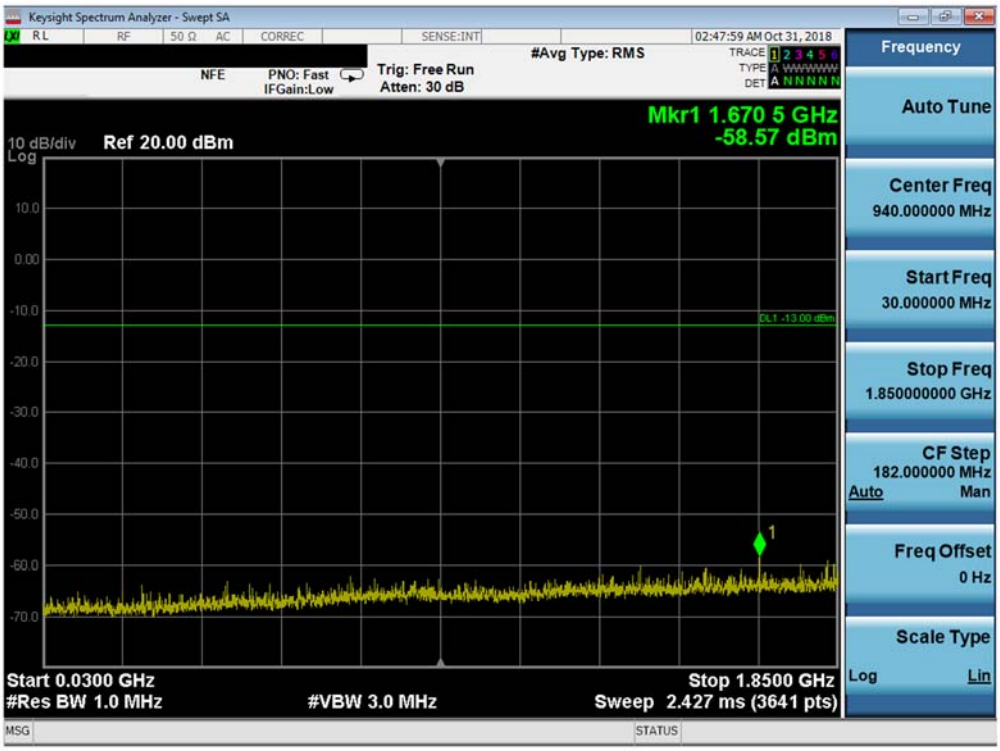
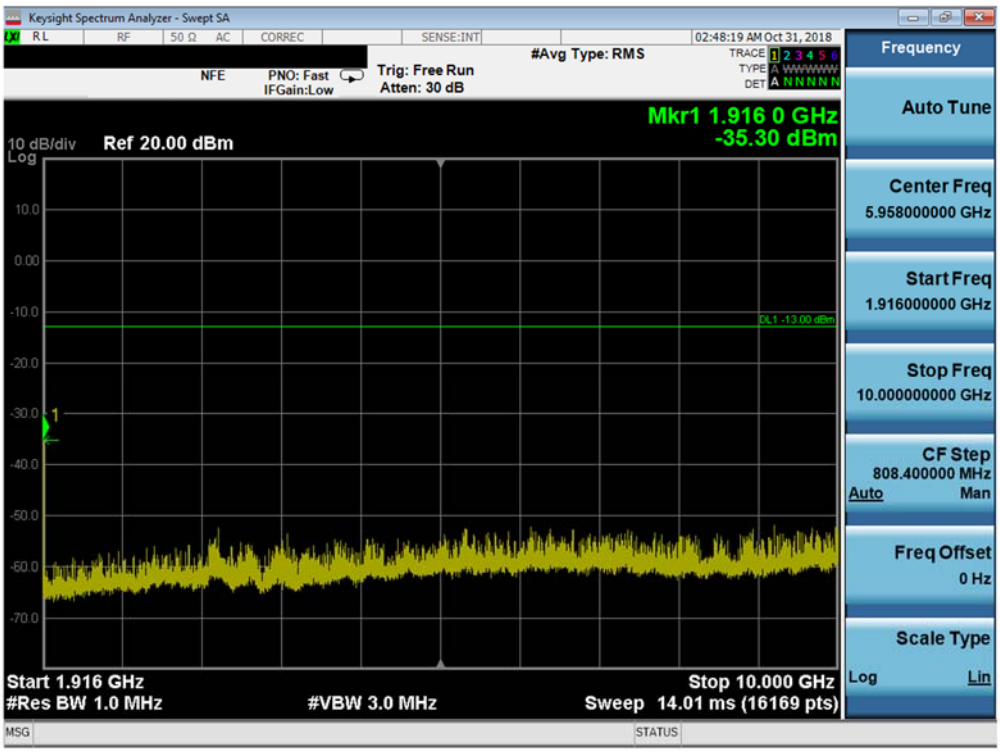



**Plot 7-38. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




**Plot 7-39. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**

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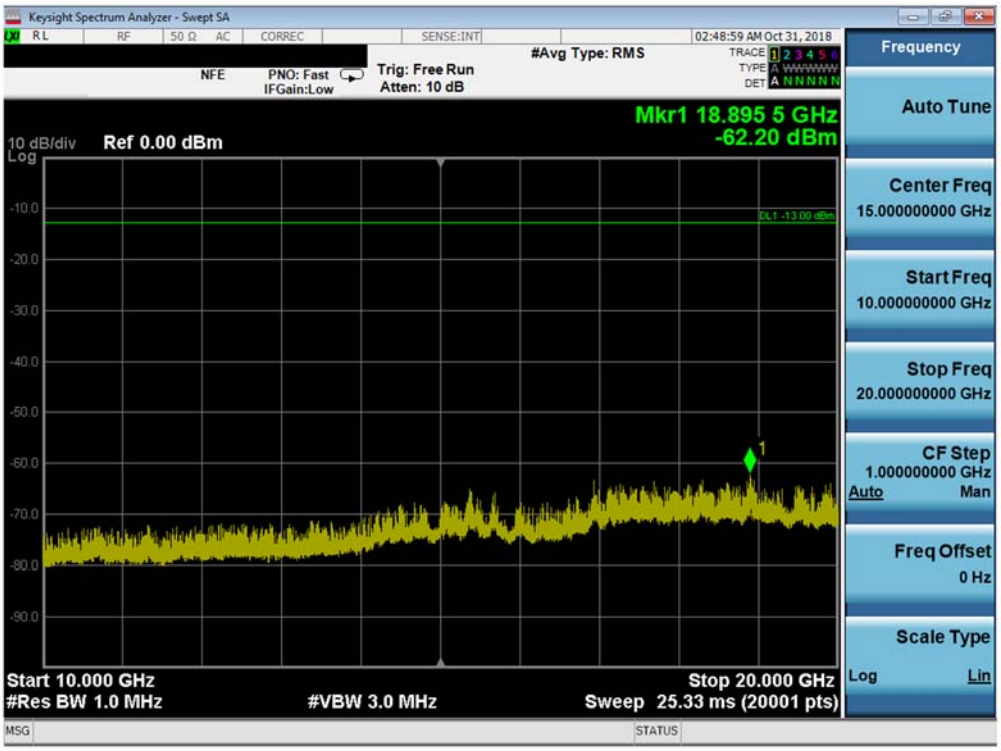


**Plot 7-40. Conducted Spurious Plot (Band 25 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - High Channel)**




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## 7.4 Band Edge Emissions at Antenna Terminal

**§2.1051, §2.917(a), 24.238(a)**

### Test Overview

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 + $\log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.***

### Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

### Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

### Test Setup

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

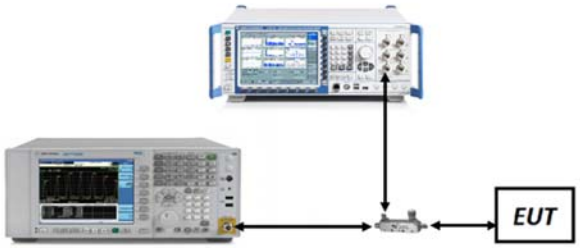


**Figure 7-3. Test Instrument & Measurement Setup**

### Test Notes

Per 22.917(b), 24.238(a) 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 to demonstrate compliance with the out-of-band emissions limit. 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.




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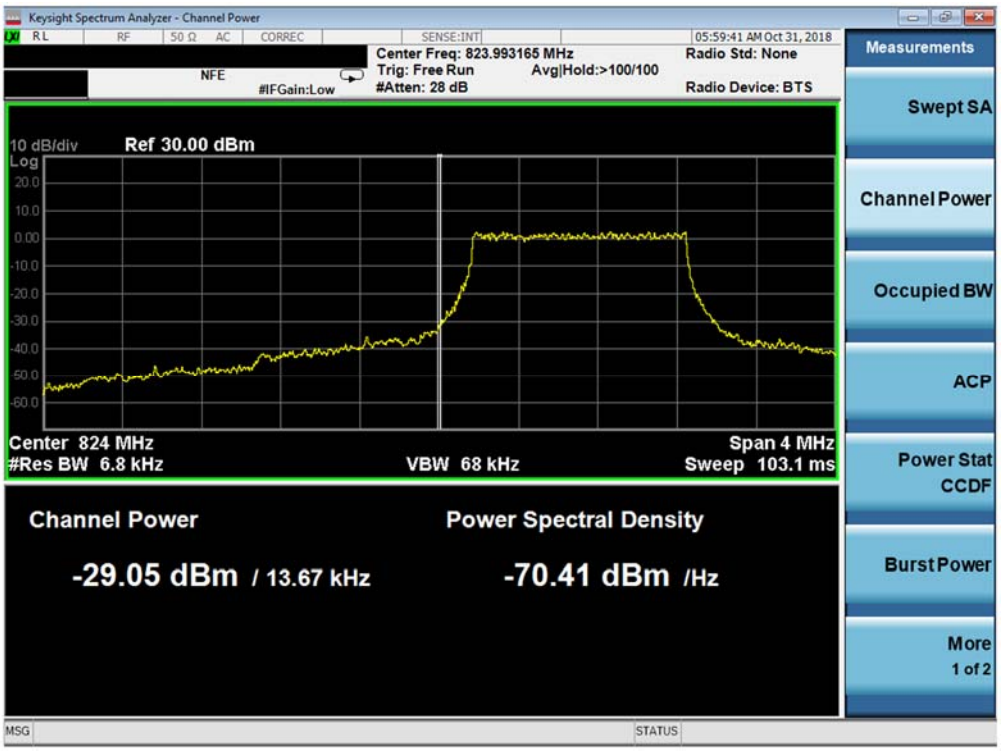
## Band 26




**Plot 7-41. Lower Band Edge Plot (Band 26 - 1.4MHz QPSK - Full RB Configuration)**

**Plot 7-42. Lower Extended Band Edge Plot (Band 26 - 1.4MHz QPSK - Full RB Configuration)**

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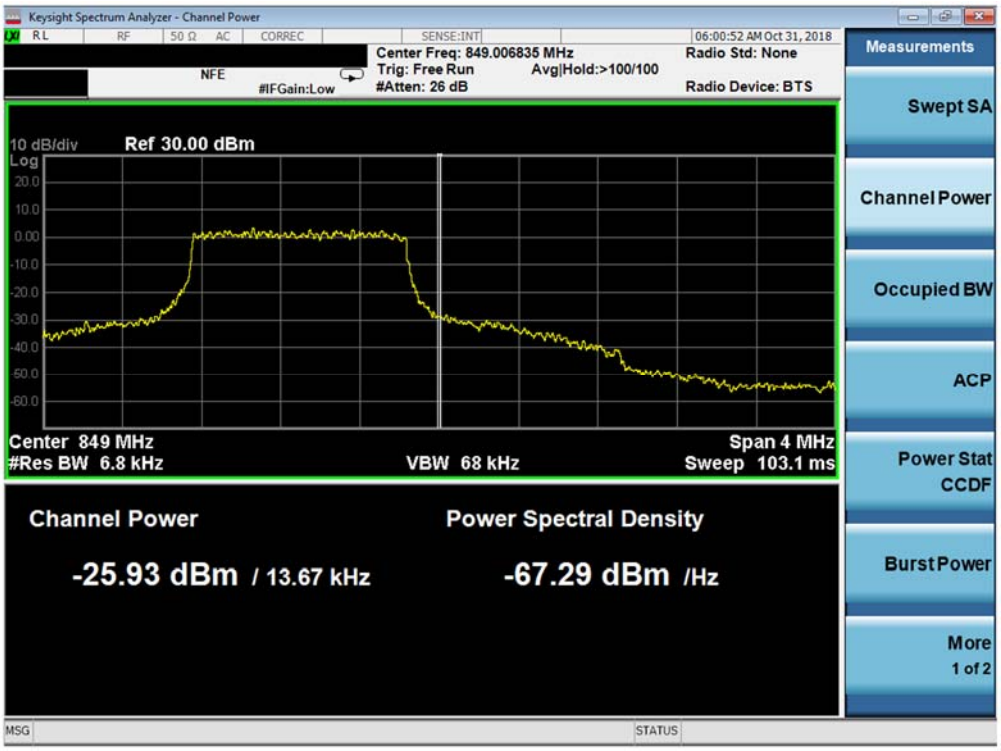


**Plot 7-43. Upper Band Edge Plot (Band 26 - 1.4MHz QPSK - Full RB Configuration)**

**Plot 7-44. Upper Extended Band Band Edge Plot (Band 26 - 1.4MHz QPSK - Full RB Configuration)**



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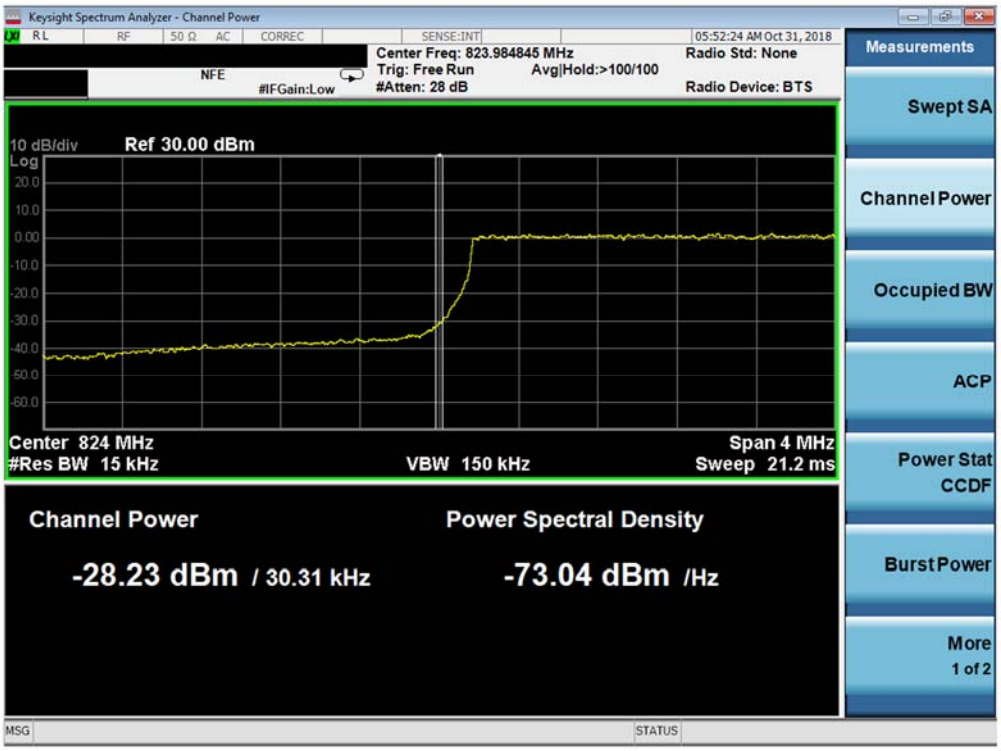
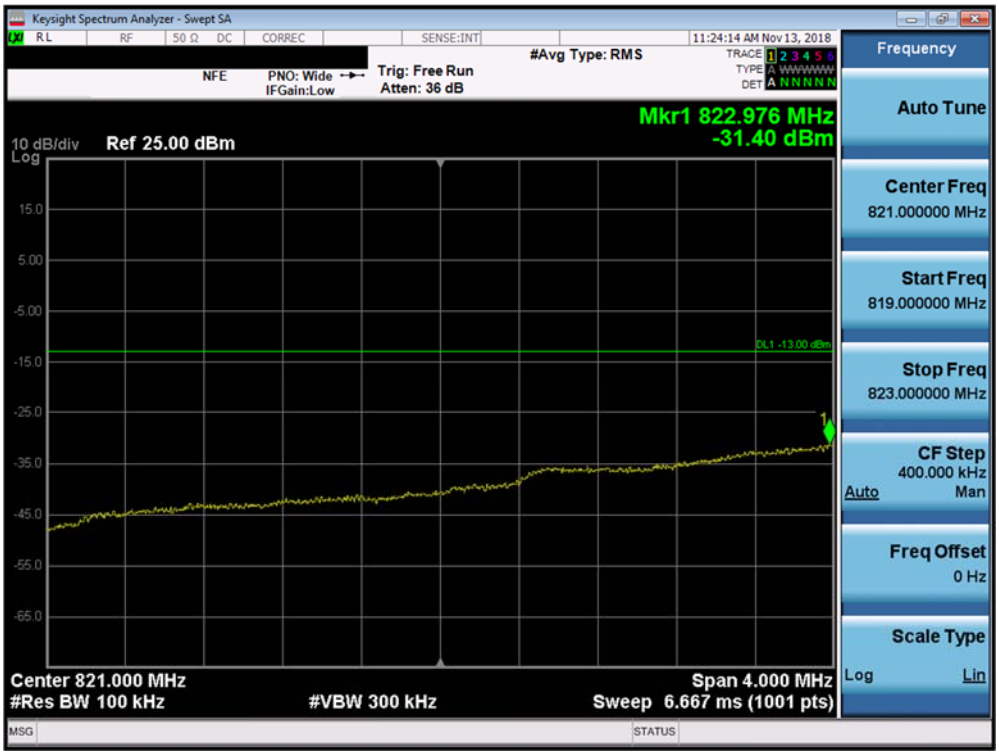



**Plot 7-45. Lower Band Edge Plot (Band 26 - 3.0MHz QPSK - Full RB Configuration)**




**Plot 7-46. Lower Extended Band Edge Plot (Band 26 - 3.0MHz QPSK - Full RB Configuration)**



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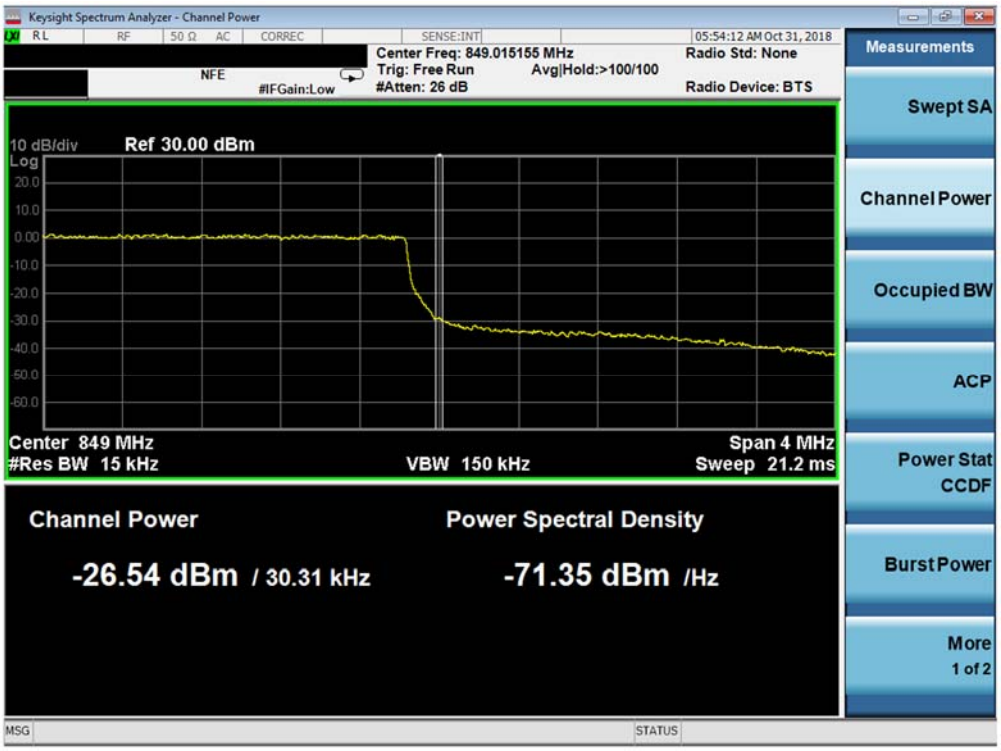
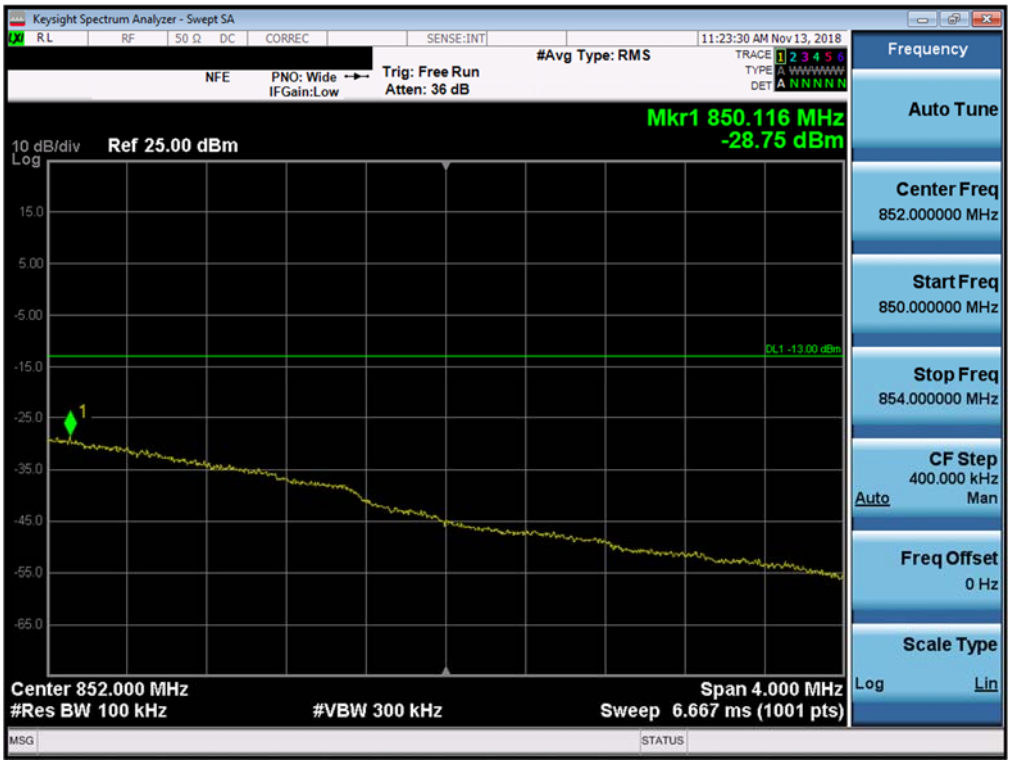



**Plot 7-47. Upper Band Edge Plot (Band 26 - 3.0MHz QPSK - Full RB Configuration)**




**Plot 7-48. Upper Extended Band Band Edge Plot (Band 26 - 3.0MHz QPSK - Full RB Configuration)**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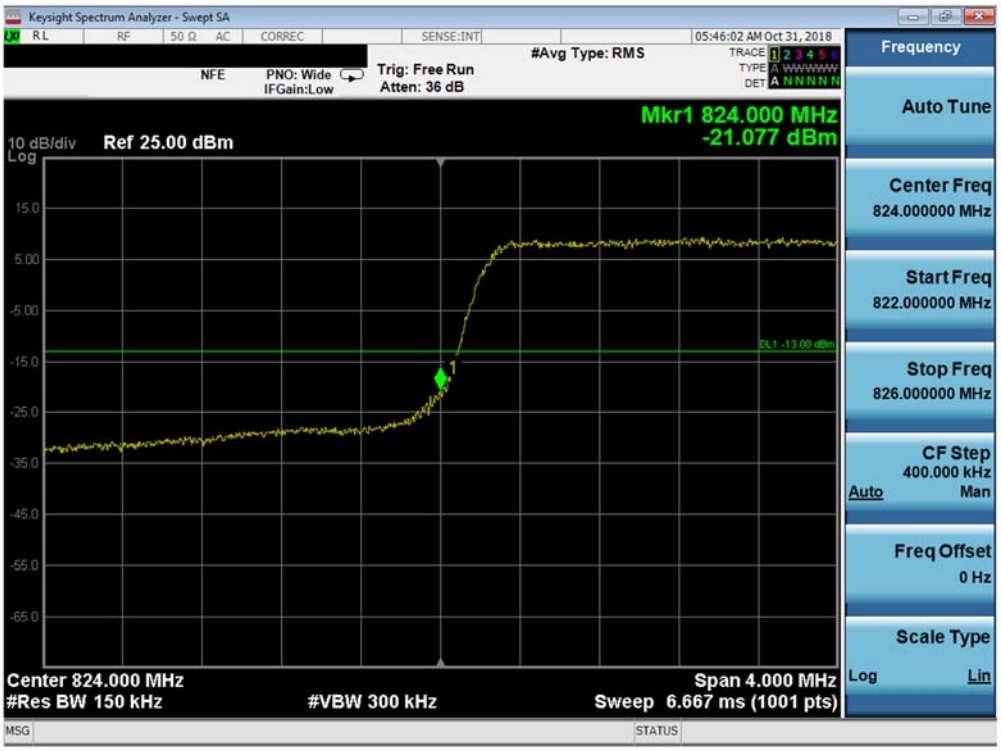
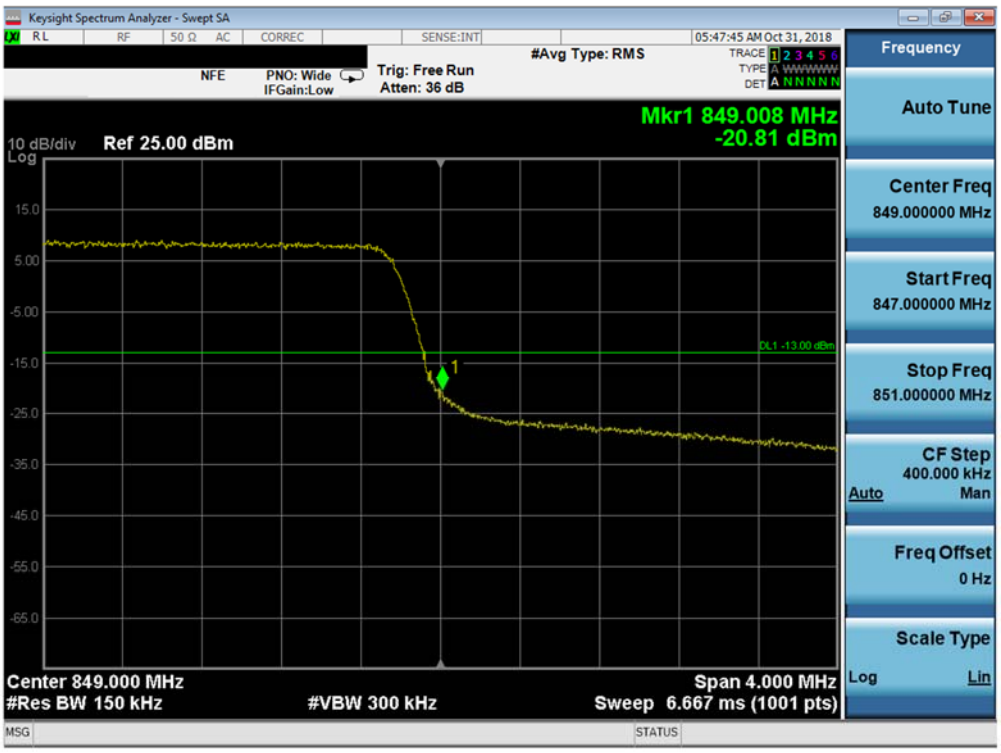



**Plot 7-49. Lower Band Edge Plot (Band 26 - 5.0MHz QPSK - Full RB Configuration)**




**Plot 7-50. Upper Band Edge Plot (Band 26 - 5.0MHz QPSK - Full RB Configuration)**

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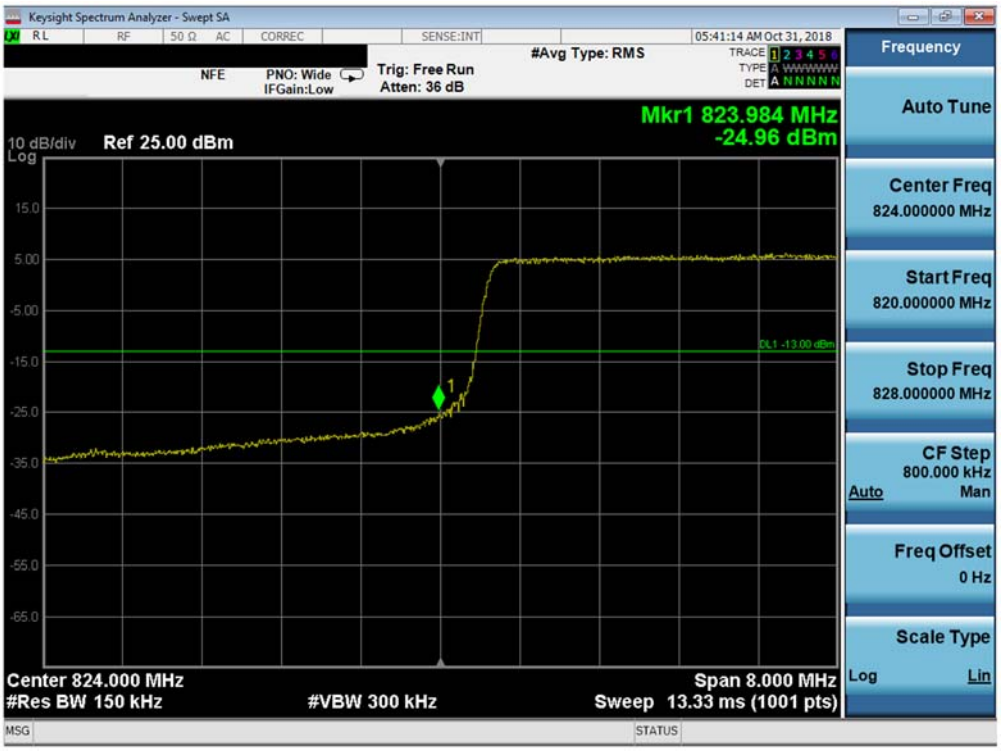
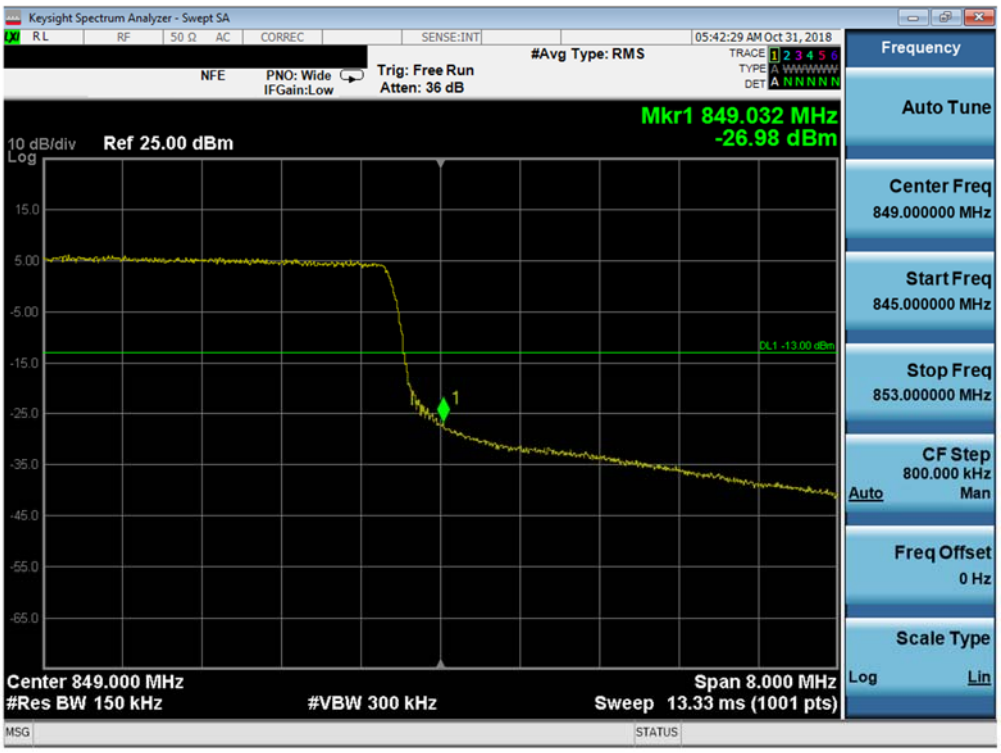



**Plot 7-51. Lower Band Edge Plot (Band 26 - 10.0MHz QPSK - Full RB Configuration)**




**Plot 7-52. Upper Band Edge Plot (Band 26 - 10.0MHz QPSK - Full RB Configuration)**

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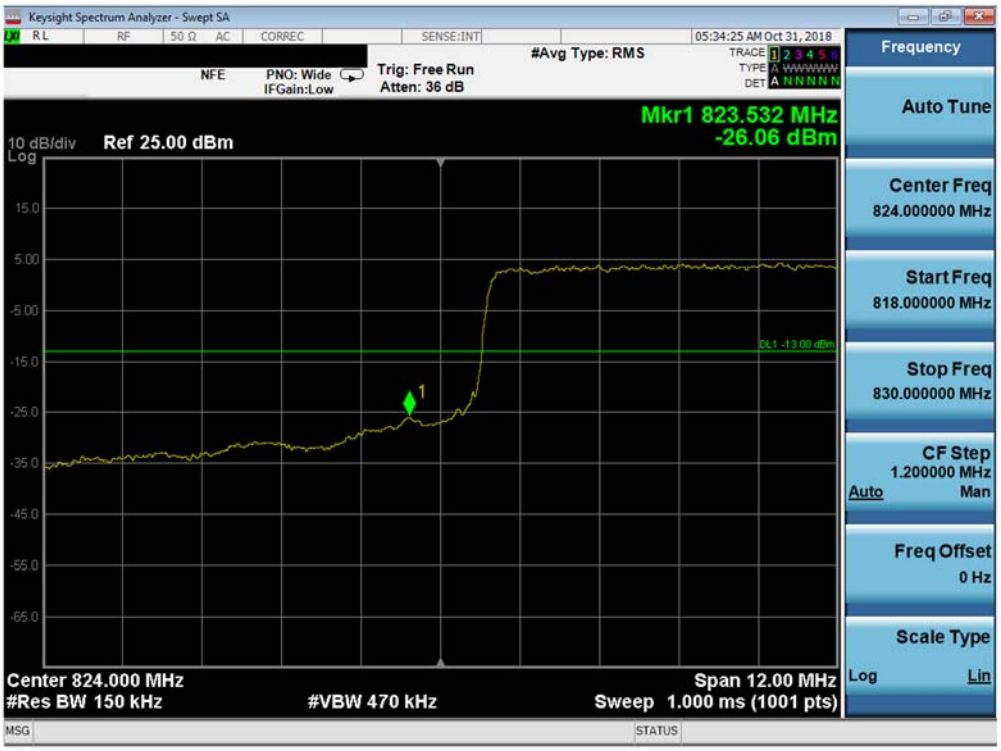


**Plot 7-53. Lower Band Edge Plot (Band 26 - 15.0MHz QPSK - Full RB Configuration)**

**Plot 7-54. Upper Band Edge Plot (Band 26 - 15.0MHz QPSK - Full RB Configuration)**




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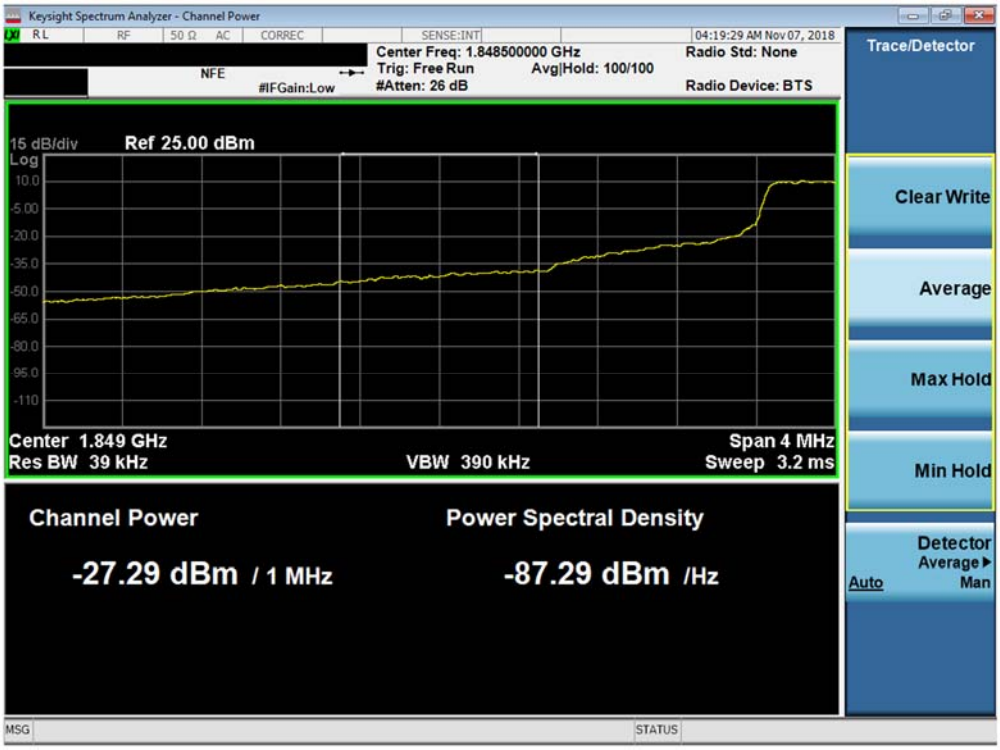
## Band 25

**Plot 7-55. Lower Band Edge Plot (Band 25 - 1.4MHz QPSK - Full RB Configuration)**




**Plot 7-56. Lower Extended Band Edge Plot (Band 25 - 1.4MHz QPSK - Full RB Configuration)**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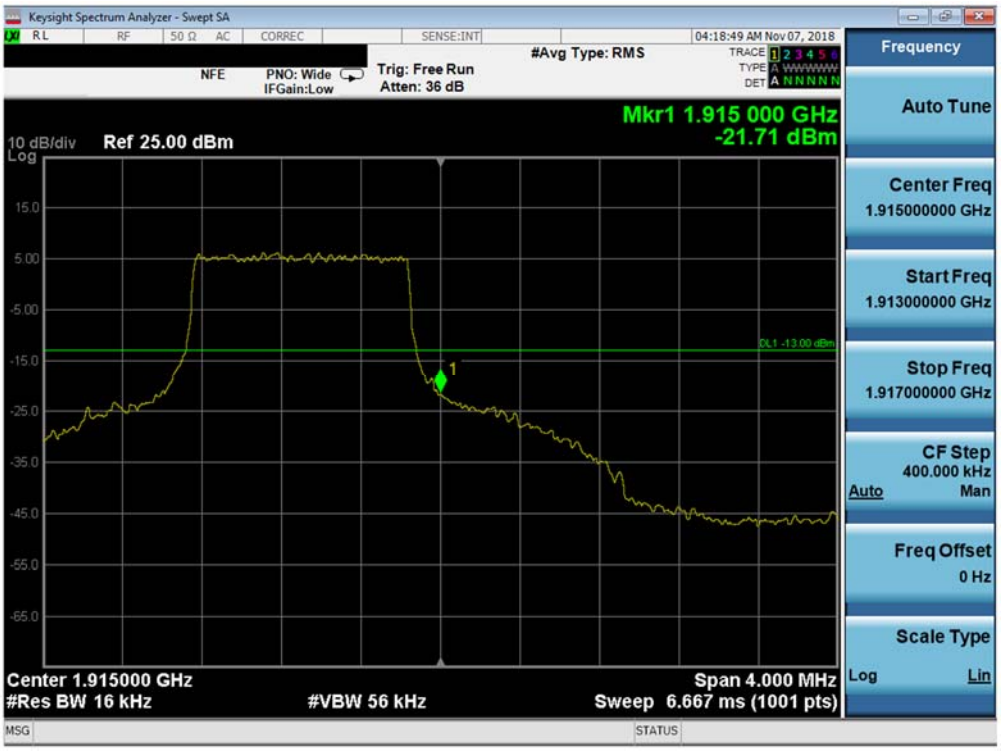
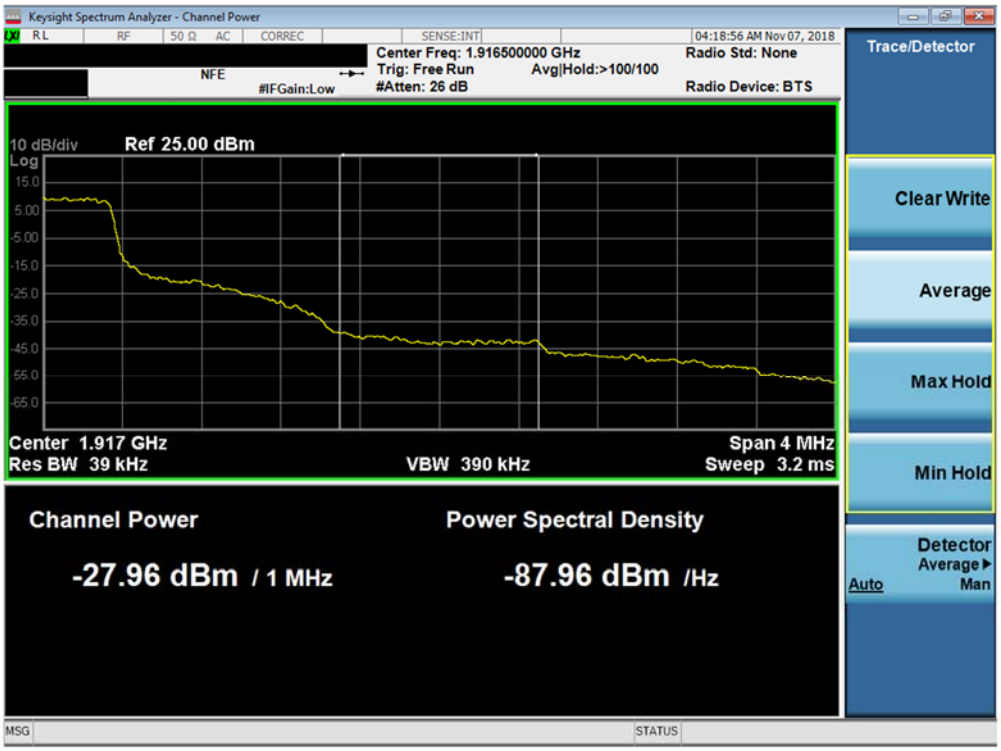



**Plot 7-57. Upper Band Edge Plot (Band 25 - 1.4MHz QPSK - Full RB Configuration)**




**Plot 7-58. Upper Extended Band Edge Plot (Band 25 - 1.4MHz QPSK - Full RB Configuration)**

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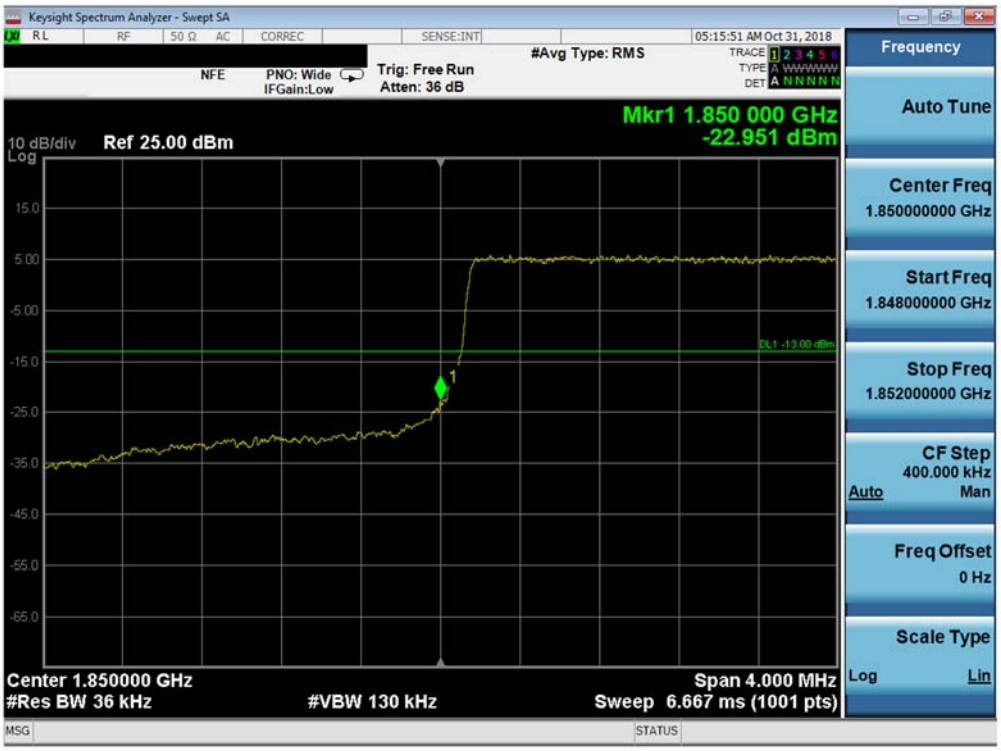
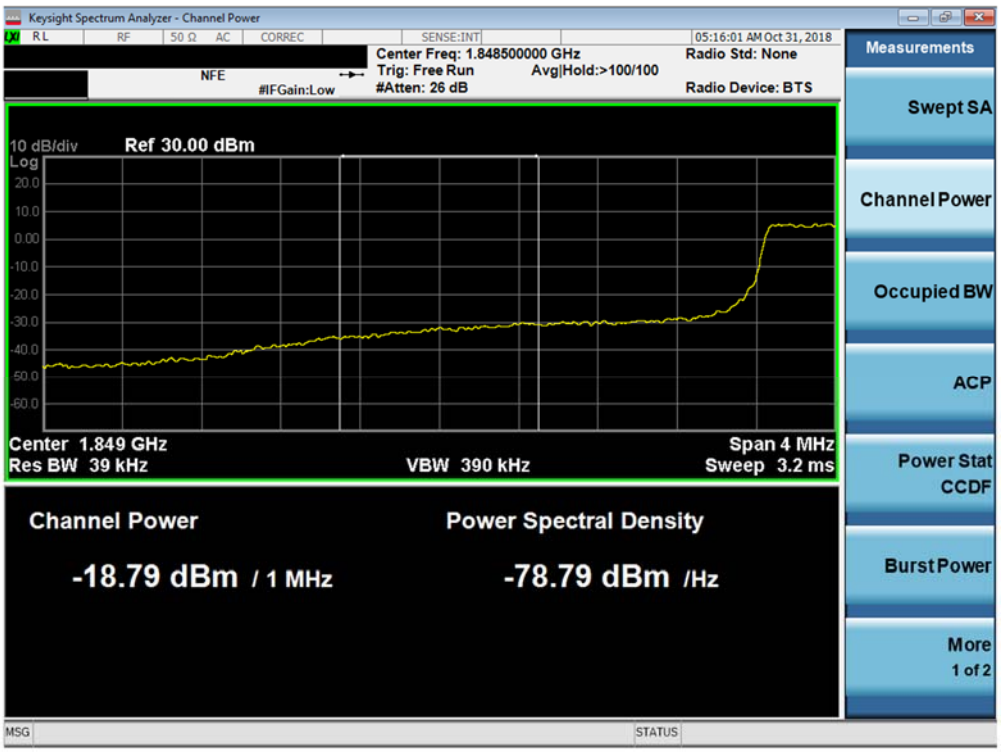



**Plot 7-59. Lower Band Edge Plot (Band 25 - 3.0MHz QPSK - Full RB Configuration)**




**Plot 7-60. Lower Extended Band Edge Plot (Band 25 - 3.0MHz QPSK - Full RB Configuration)**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