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

# MEASUREMENT REPORT
## FCC Part 24 & 27 LTE

**Applicant Name:**
Samsung Electronics, Co. Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do 443-742, Korea

**Date of Testing:**
11/5 - 12/1/2014
**Test Site/Location:**
PCTEST Lab., Columbia, MD, USA
**Test Report Serial No.:**
0Y1411052084.A3L

**FCC ID : A3LSMG360V**

**APPLICANT: SAMSUNG ELECTRONICS, CO. LTD.**

**Application Type:** Certification
**FCC Classification:** PCS Licensed Transmitter Held to Ear (PCE)
**FCC Rule Part(s):** §2; §24; §27
**Test Procedure(s):** ANSI/TIA-603-C-2004, KDB 971168 v02r02
**EUT Type:** Portable Handset
**Model(s):** SM-G360V, SM-S820L
**Test Device Serial No.:** *identical prototype* [S/N: 28NOV-1]

| Mode | Tx Frequency (MHz) | Emission Designator | Modulation | ERP/EIRP | |
|---|---|---|---|---|---|
| | | | | Max. Power (W) | Max. Power (dBm) |
| LTE Band 13 | 779.5 - 784.5 | 4M52G7D | QPSK | 0.320 | 25.05 |
| LTE Band 13 | 779.5 - 784.5 | 4M51W7D | 16QAM | 0.268 | 24.28 |
| LTE Band 13 | 782 | 9M02G7D | QPSK | 0.268 | 24.27 |
| LTE Band 13 | 782 | 9M00W7D | 16QAM | 0.227 | 23.56 |
| LTE Band 4 | 1710.7 - 1754.3 | 1M12G7D | QPSK | 0.516 | 27.13 |
| LTE Band 4 | 1710.7 - 1754.3 | 1M12W7D | 16QAM | 0.396 | 25.98 |
| LTE Band 4 | 1711.5 - 1753.5 | 2M72G7D | QPSK | 0.654 | 28.16 |
| LTE Band 4 | 1711.5 - 1753.5 | 2M72W7D | 16QAM | 0.571 | 27.57 |
| LTE Band 4 | 1712.5 - 1752.5 | 4M50G7D | QPSK | 0.547 | 27.38 |
| LTE Band 4 | 1712.5 - 1752.5 | 4M50W7D | 16QAM | 0.450 | 26.54 |
| LTE Band 4 | 1715 - 1750 | 9M02G7D | QPSK | 0.728 | 28.62 |
| LTE Band 4 | 1715 - 1750 | 8M97W7D | 16QAM | 0.578 | 27.62 |
| LTE Band 4 | 1717.5 - 1747.5 | 13M5G7D | QPSK | 0.685 | 28.36 |
| LTE Band 4 | 1717.5 - 1747.5 | 13M5W7D | 16QAM | 0.648 | 28.12 |
| LTE Band 4 | 1720 - 1745 | 17M9G7D | QPSK | 0.744 | 28.72 |
| LTE Band 4 | 1720 - 1745 | 17M9W7D | 16QAM | 0.499 | 26.98 |
| LTE Band 2 | 1850.7 - 1909.3 | 1M12G7D | QPSK | 0.303 | 24.81 |
| LTE Band 2 | 1850.7 - 1909.3 | 1M12W7D | 16QAM | 0.268 | 24.28 |
| LTE Band 2 | 1851.5 - 1908.5 | 2M73G7D | QPSK | 0.295 | 24.69 |
| LTE Band 2 | 1851.5 - 1908.5 | 2M72W7D | 16QAM | 0.265 | 24.23 |
| LTE Band 2 | 1852.5 - 1907.5 | 4M52G7D | QPSK | 0.321 | 25.06 |
| LTE Band 2 | 1852.5 - 1907.5 | 4M52W7D | 16QAM | 0.232 | 23.66 |
| LTE Band 2 | 1855 - 1905 | 9M04G7D | QPSK | 0.332 | 25.21 |
| LTE Band 2 | 1855 - 1905 | 9M03W7D | 16QAM | 0.284 | 24.53 |
| LTE Band 2 | 1857.5 - 1902.5 | 13M5G7D | QPSK | 0.293 | 24.67 |
| LTE Band 2 | 1857.5 - 1902.5 | 13M5W7D | 16QAM | 0.246 | 23.90 |
| LTE Band 2 | 1860 - 1900 | 18M0G7D | QPSK | 0.299 | 24.76 |
| LTE Band 2 | 1860 - 1900 | 18M0W7D | 16QAM | 0.261 | 24.16 |

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

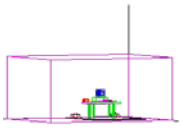

© 2014 PCTEST Engineering Laboratory, Inc.

# TABLE OF CONTENTS

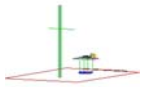

FCC PART 24 & 27 MEASUREMENT REPORT ..... 3
1.0 INTRODUCTION ..... 4
1.1 SCOPE ..... 4
1.2 TESTING FACILITY ..... 4
2.0 PRODUCT INFORMATION ..... 5
2.1 EQUIPMENT DESCRIPTION ..... 5
2.2 DEVICE CAPABILITIES ..... 5
2.3 EMI SUPPRESSION DEVICE(S)/MODIFICATIONS ..... 5
2.4 LABELING REQUIREMENTS ..... 5
3.0 DESCRIPTION OF TESTS ..... 6
3.1 MEASUREMENT PROCEDURE ..... 6
3.1 BLOCK C FREQUENCY RANGE ..... 6
3.2 PCS - BASE FREQUENCY BLOCKS ..... 6
3.3 PCS - MOBILE FREQUENCY BLOCKS ..... 6
3.4 AWS - BASE FREQUENCY BLOCKS ..... 7
3.5 AWS - MOBILE FREQUENCY BLOCKS ..... 7
3.6 RADIATED POWER AND RADIATED SPURIOUS EMISSIONS ..... 7
4.0 TEST EQUIPMENT CALIBRATION DATA ..... 9
5.0 SAMPLE CALCULATIONS ..... 10
6.0 TEST RESULTS ..... 11
6.1 SUMMARY ..... 11
6.2 OCCUPIED BANDWIDTH ..... 12
6.3 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL ..... 27
6.4 BAND EDGE EMISSIONS AT ANTENNA TERMINAL ..... 37
6.5 PEAK-AVERAGE RATIO ..... 68
6.6 RADIATED POWER (ERP/EIRP) ..... 75
6.7 RADIATED SPURIOUS EMISSIONS MEASUREMENTS ..... 79
6.8 FREQUENCY STABILITY / TEMPERATURE VARIATION ..... 85
7.0 CONCLUSION ..... 92




© 2014 PCTEST Engineering Laboratory, Inc.



# MEASUREMENT REPORT
## FCC Part 24 & 27



## §2.1033 General Information

| | |
|---|---|
| **APPLICANT:** | Samsung Electronics, Co. Ltd. |
| **APPLICANT ADDRESS:** | 129, Samsung-ro, Maetan dong, |
| | Yeongtong-gu, Suwon-si, Gyeonggi-do 443-742, Korea |
| **TEST SITE:** | PCTEST ENGINEERING LABORATORY, INC. |
| **TEST SITE ADDRESS:** | 7185 Oakland Mills Road, Columbia, MD 21045 USA |
| **FCC RULE PART(S):** | §2; §24; §27 |
| **MODEL(S):** | SM-G360V, SM-S820L |
| **FCC ID:** | A3LSMG360V |
| **FCC CLASSIFICATION:** | PCS Licensed Transmitter Held to Ear (PCE) |
| **FREQUENCY TOLERANCE:** | ±0.00025 % (2.5 ppm) |
| **Test Device Serial No.:** | 28NOV-1 ☐ Production ☒ Pre-Production ☐ Engineering |
| **DATE(S) OF TEST:** | 11/5 - 12/1/2014 |
| **TEST REPORT S/N:** | 0Y1411052084.A3L |

## Test Facility / Accreditations

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

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.


© 2014 PCTEST Engineering Laboratory, Inc.

# 1.0 INTRODUCTION

## 1.1 Scope

Measurement and determination of electromagnetic emissions (EME) 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 Industry Canada Certification and Engineering Bureau.

## 1.2 Testing Facility

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on February 15, 2012.

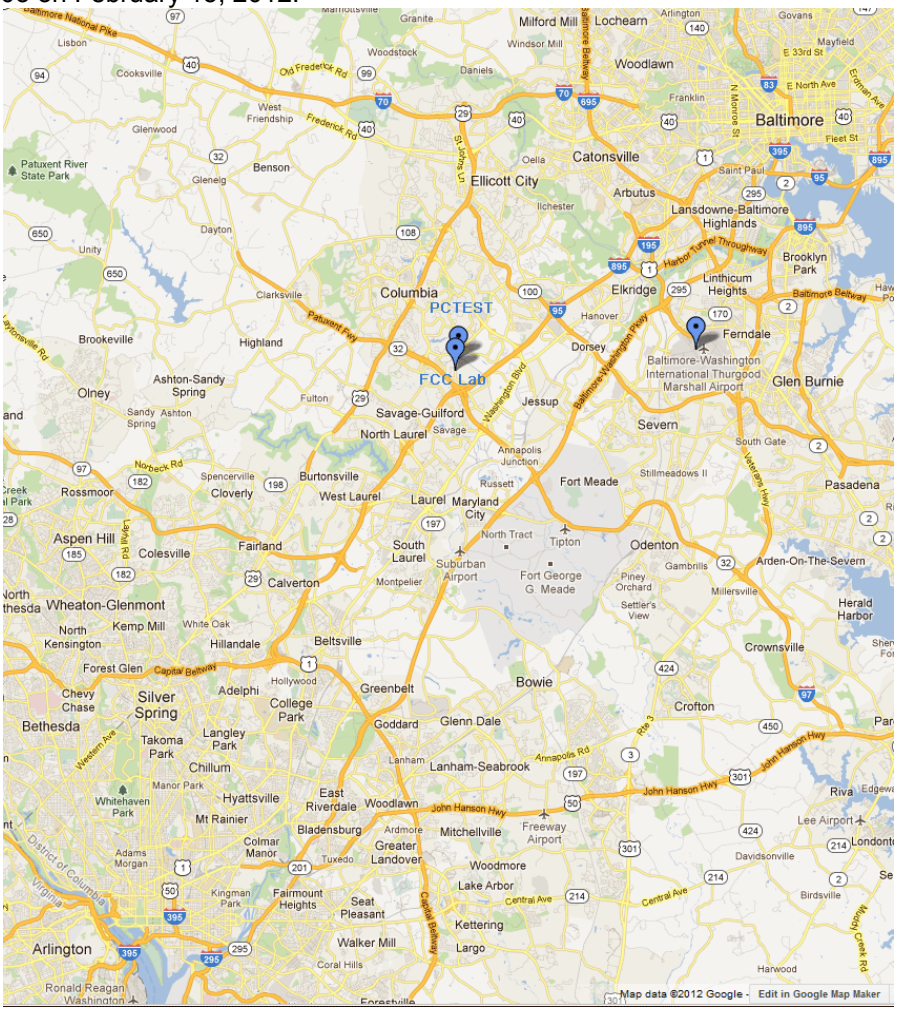



**Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area**


© 2014 PCTEST Engineering Laboratory, Inc.

# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG360V**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

## 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev 0 (BC0, BC1), Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, LE)

## 2.3 EMI Suppression Device(s)/Modifications

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

## 2.4 Labeling Requirements

Per 2.925

The FCC identifier shall be permanently affixed to the equipment and shall be readily visible to the purchaser at the time of purchase.


© 2014 PCTEST Engineering Laboratory, Inc.

# 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-C-2004) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168) were used in the measurement of the **Samsung Portable Handset FCC ID: A3LSMG360V.**

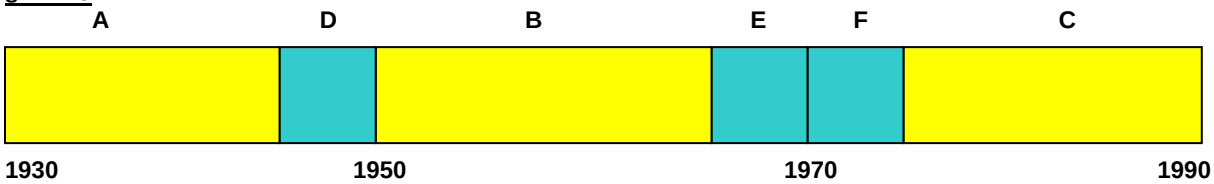
## 3.1 Block C Frequency Range

**§27.5(b)(3)**

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.

## 3.2 PCS - Base Frequency Blocks

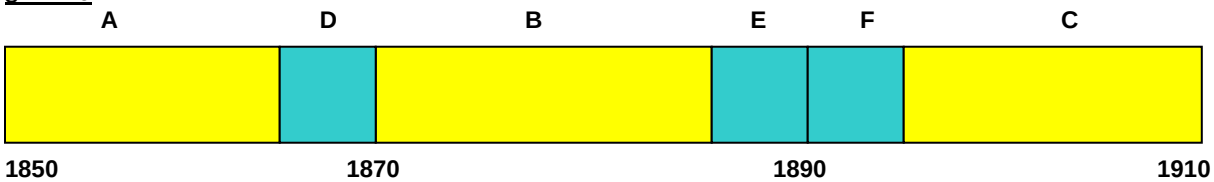
**§24.229**




**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)**

## 3.3 PCS - Mobile Frequency Blocks

**§24.229**

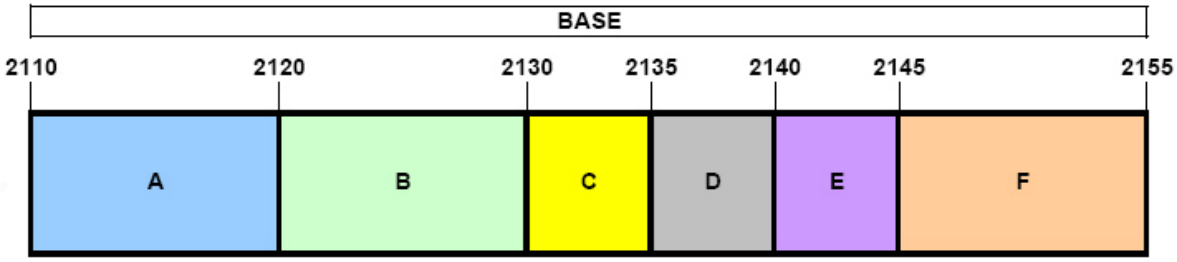



**BLOCK 1: 1850 – 1865 MHz (A)**
**BLOCK 2: 1865 – 1870 MHz (D)**
**BLOCK 3: 1870 – 1885 MHz (B)**
**BLOCK 4: 1885 – 1890 MHz (E)**
**BLOCK 5: 1890 – 1895 MHz (F)**
**BLOCK 6: 1895 – 1910 MHz (C)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 3.4 AWS - Base Frequency Blocks

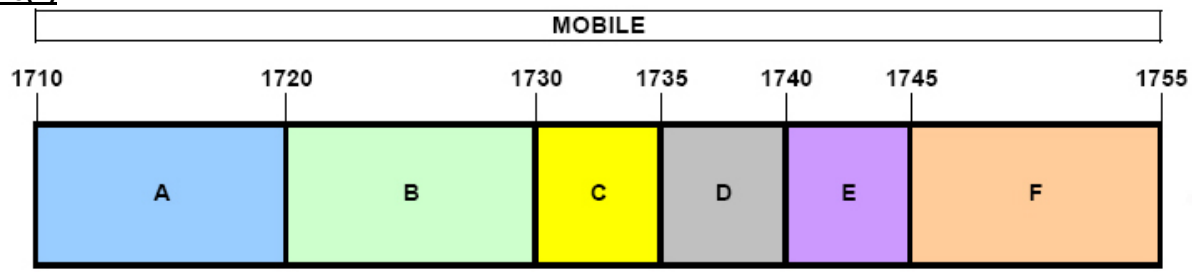
§27.5(h)




**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)**

## 3.5 AWS - Mobile Frequency Blocks

§27.5(h)




**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)**

## 3.6 Radiated Power and Radiated Spurious Emissions

§2.1053 §24.232(c) §24.238(a) §27.50(b.10) §27.50(d.4) §27.53(f) §27.53(h)

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 Clause 5, Figure 5.7 of ANSI C63.4-2009. For measurements above 1GHz 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 below 1GHz, the absorbers are removed. An ETS Lindgren Model 2188 raised turntable is used for radiated measurement. It 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. A 78cm high PVC support structure is placed on top of the turntable. A ¾" (~1.9cm) sheet of high density polyethylene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 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


© 2014 PCTEST Engineering Laboratory, Inc.

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.

Per the guidance of ANSI/TIA-603-C-2004, 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 $43 + 10\log_{10}(\text{Power}_{\ [Watts]})$.


© 2014 PCTEST Engineering Laboratory, Inc.

# 4.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

| Manufacturer | Model | Description | Cal Date | Cal Interval | Cal Due | Serial Number |
|---|---|---|---|---|---|---|
| - | LTx1 | Licensed Transmitter Cable Set | 1/29/2014 | Annual | 1/29/2015 | N/A |
| - | RE1 | Radiated Emissions Cable Set (UHF/EHF) | 5/29/2014 | Annual | 5/29/2015 | N/A |
| Agilent | 8447D | Broadband Amplifier | 5/30/2014 | Annual | 5/30/2015 | 2443A01900 |
| Agilent | N9020A | MXA Signal Analyzer | 10/27/2014 | Annual | 10/27/2015 | US46470561 |
| Emco | 3115 | Horn Antenna (1-18GHz) | 1/30/2014 | Biennial | 1/30/2016 | 9704-5182 |
| Espec | ESX-2CA | Environmental Chamber | 4/16/2014 | Annual | 4/16/2015 | 17620 |
| ETS Lindgren | 3160-09 | 18-26.5 GHz Standard Gain Horn | 6/17/2014 | Biennial | 6/17/2016 | 135427 |
| ETS Lindgren | 3164-08 | Quad Ridge Horn Antenna | 3/12/2014 | Biennial | 3/12/2016 | 128337 |
| K & L | 13SH10-1000/U1000 | N Type High Pass Filter | 12/1/2014 | Annual | 12/1/2015 | 4 |
| K & L | 11SH10-3075/U18000 | High Pass Filter | 12/1/2014 | Annual | 12/1/2015 | 1 |
| Mini-Circuits | PWR-SENS-4RMS | USB Power Sensor | 4/17/2014 | Annual | 4/17/2015 | 11210140001 |
| Mini-Circuits | TVA-11-422 | RF Power Amp | N/A | | | QA1303002 |
| Rohde & Schwarz | CMW500 | Radio Communication Tester | N/A | | | 100976 |
| Rohde & Schwarz | TS-PR18 | 1-18 GHz Pre-Amplifier | 3/5/2014 | Annual | 3/5/2015 | 100071 |
| Rohde & Schwarz | TS-PR26 | 18-26.5 GHz Pre-Amplifier | 3/12/2014 | Annual | 3/12/2015 | 100040 |
| Rohde & Schwarz | ESU26 | EMI Test Receiver (26.5GHz) | 1/27/2014 | Annual | 1/27/2015 | 100342 |
| Schwarzbeck | UHA 9105 | Dipole Antenna (400 - 1GHz) Rx | 11/1/2013 | Biennial | 11/1/2015 | 91052523RX |
| Seekonk | NC-100 | Torque Wrench 5/16", 8" lbs | 3/18/2014 | Biennial | 3/18/2016 | N/A |
| Sunol | JB5 | Bi-Log Antenna (30M - 5GHz) | 1/28/2014 | Biennial | 1/28/2016 | A051107 |

**Table 4-1. Test Equipment**

**Note:**

Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.


© 2014 PCTEST Engineering Laboratory, Inc.

# 5.0 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

### 16QAM 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).


© 2014 PCTEST Engineering Laboratory, Inc.

# 6.0 TEST RESULTS

## 6.1 Summary

Company Name: Samsung Electronics, Co. Ltd.
FCC ID: A3LSMG360V
FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
Mode(s): LTE

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Result | Reference |
|---|---|---|---|---|---|
| **TRANSMITTER MODE (TX)** | | | | | |
| 2.1049 | Occupied Bandwidth | N/A | CONDUCTED | PASS | Section 6.2 |
| 2.1051 24.238(a) 27.53(c) 27.53(h) | Out of Band Emissions | > 43 + 10log$_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions | | PASS | Section 6.3, 6.4 |
| 24.232(d) | Peak-Average Ratio | < 13 dB | | PASS | Section 6.5 |
| 2.1046 | Transmitter Conducted Output Power | N/A | | PASS | See RF Exposure Report |
| 2.1055. 24.235 27.54 | Frequency Stability | Fundamental emissions stay within authorized frequency block (Part 24, 27) | | PASS | Section 6.8 |
| 27.50(b.10) | Effective Radiated Power (Band 13) | < 3 Watts max. ERP | RADIATED | PASS | Section 6.6 |
| 24.232(c) | Equivalent Isotropic Radiated Power (Band 2) | < 2 Watts max. EIRP | | PASS | Section 6.6 |
| 27.50(d.4) | Equivalent Isotropic Radiated Power (Band 4) | < 1 Watts max. EIRP | | PASS | Section 6.6 |
| 2.1053 24.238(a) 27.53(c) 27.53(h) | Undesirable Emissions | > 43 + 10log$_{10}$ (P[Watts]) for all out-of-band emissions | | PASS | Section 6.7 |
| 27.53(f) | Undesirable Emissions in GPS band | < -70 dBW/MHz (for wideband signals) < -80 dBW (for discrete emissions less than 700Hz BW) For all emissions in the band 1559 – 1610 MHz | | PASS | Section 6.7 |

**Table 6-1. Summary of 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 6.2, 6.3, 6.4, 6.5) 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 2.8.


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.2 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 v02r02 – 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.

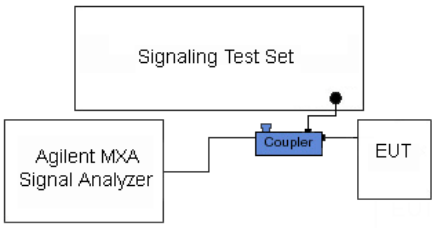
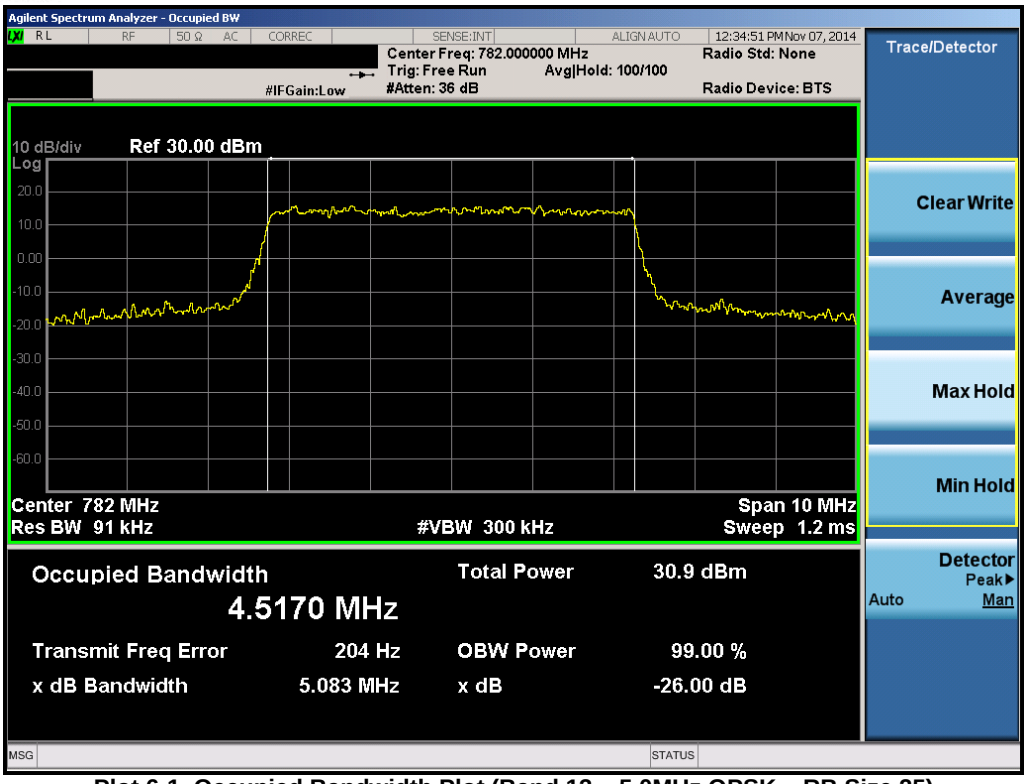



**Figure 6-1. Test Instrument & Measurement Setup**

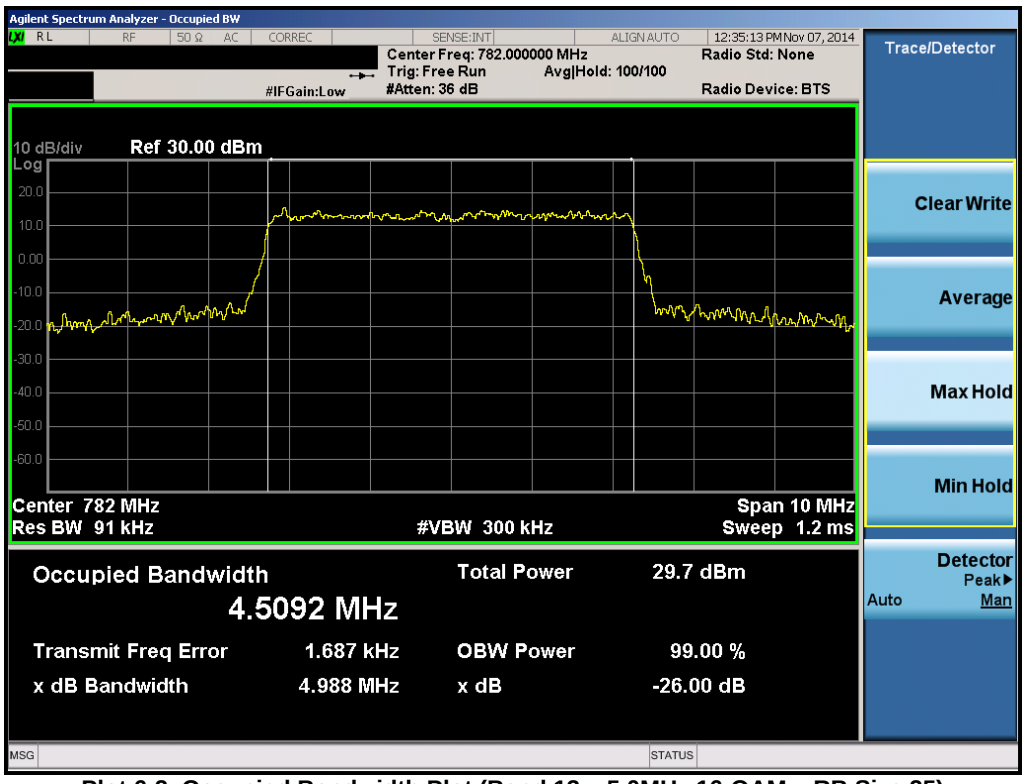
**Test Notes**

None.


© 2014 PCTEST Engineering Laboratory, Inc.

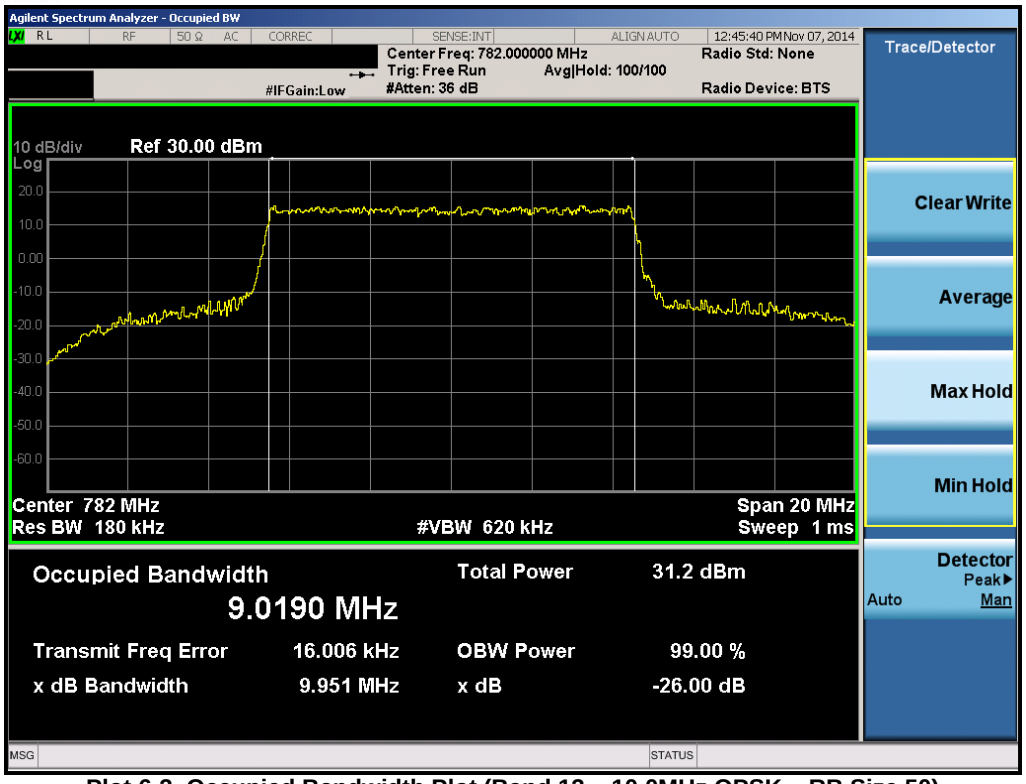



**Plot 6-1. Occupied Bandwidth Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

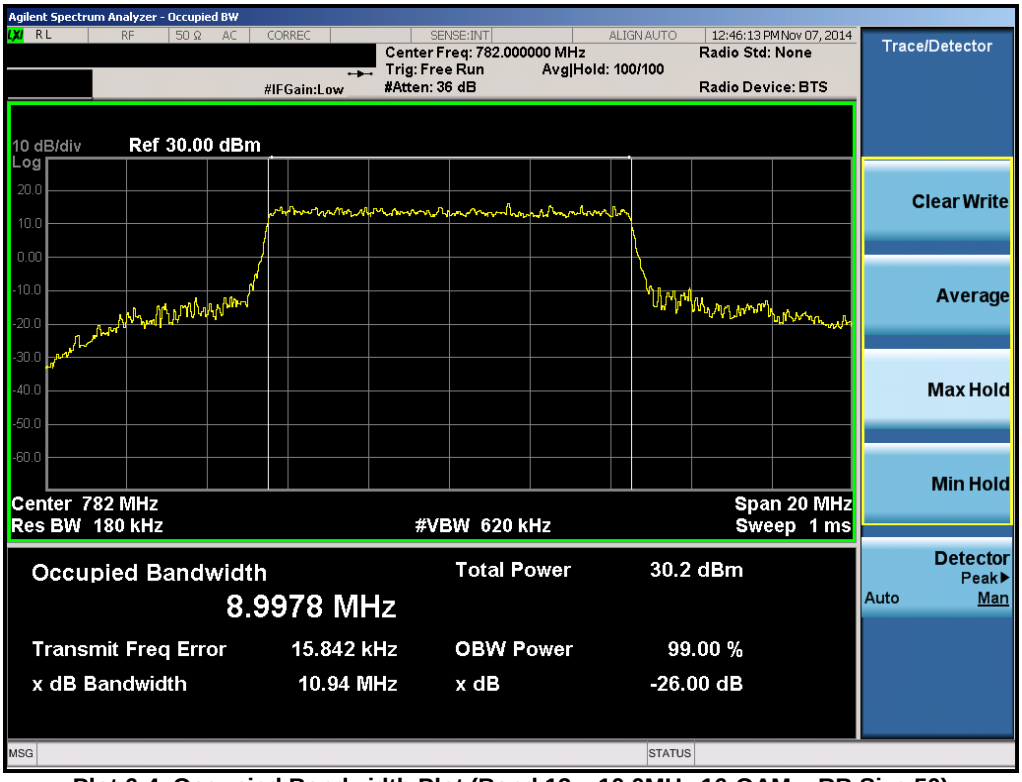



**Plot 6-2. Occupied Bandwidth Plot (Band 13 – 5.0MHz 16-QAM – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.

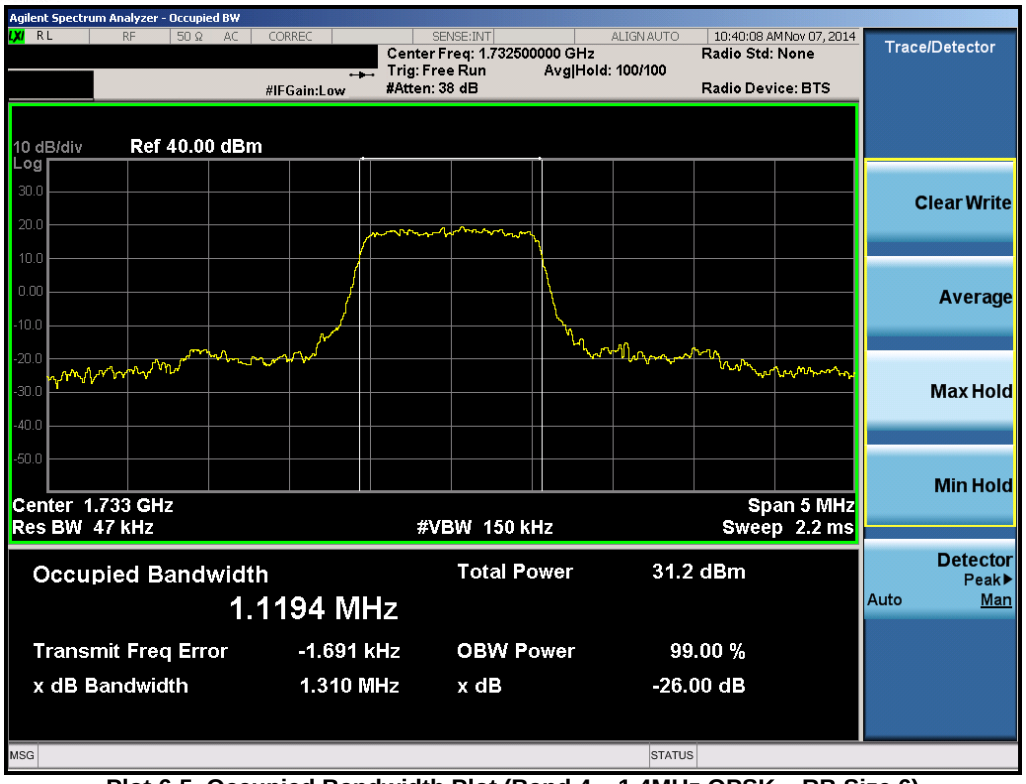



**Plot 6-3. Occupied Bandwidth Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**

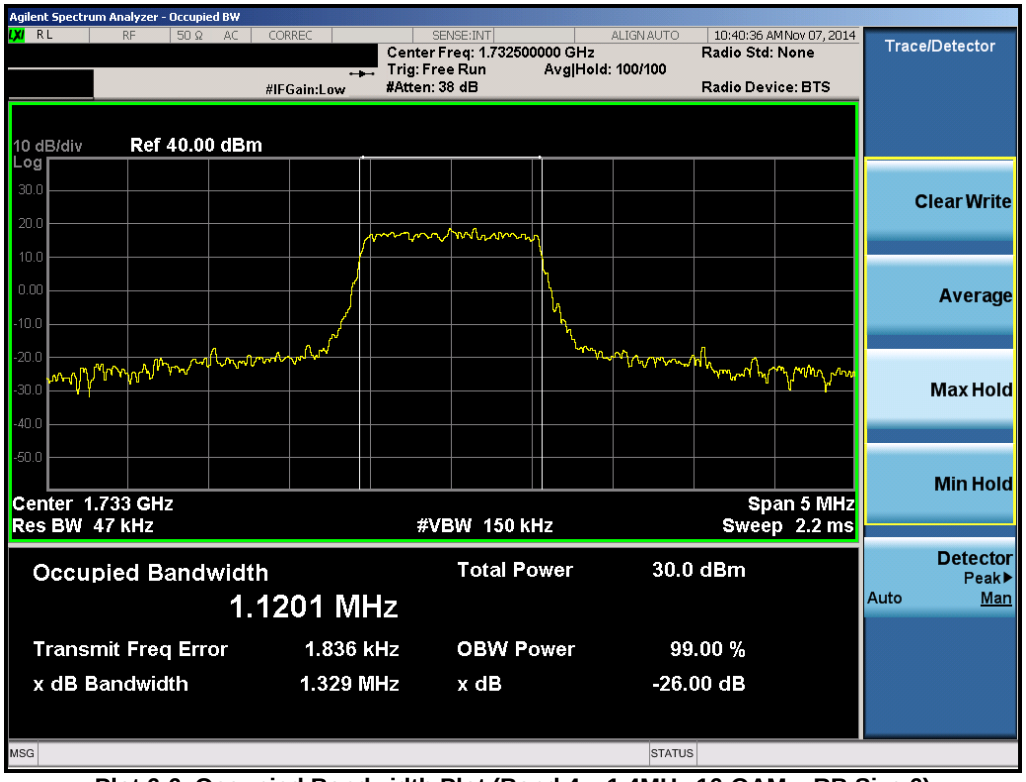



**Plot 6-4. Occupied Bandwidth Plot (Band 13 – 10.0MHz 16-QAM – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

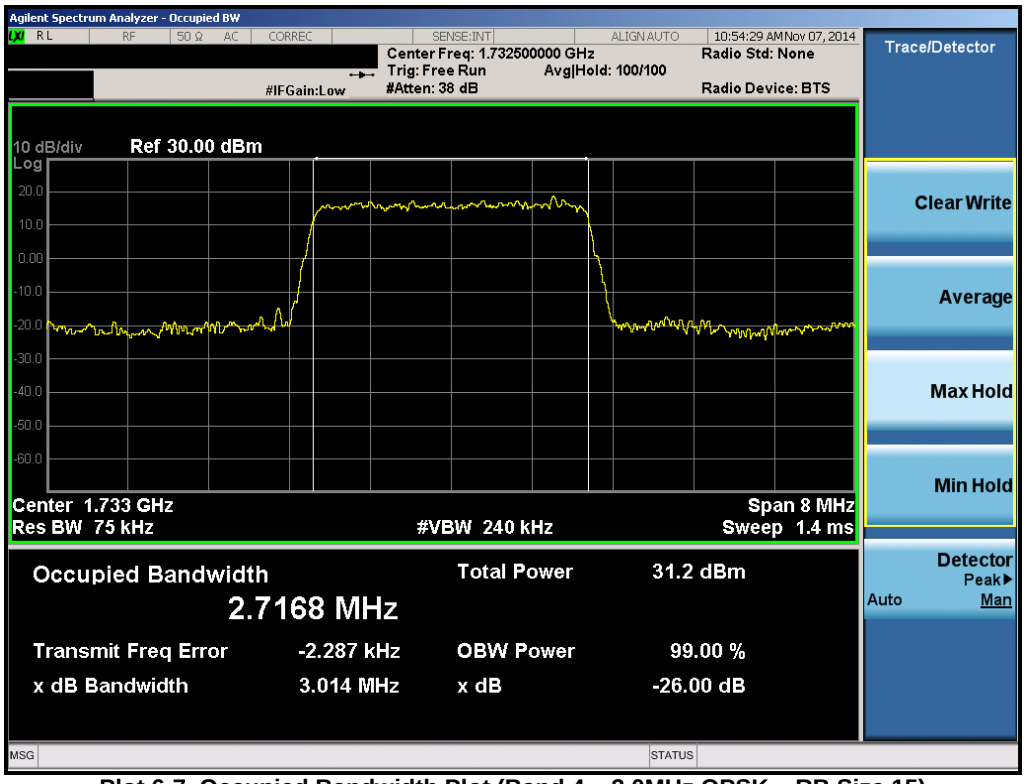



**Plot 6-5. Occupied Bandwidth Plot (Band 4 – 1.4MHz QPSK – RB Size 6)**

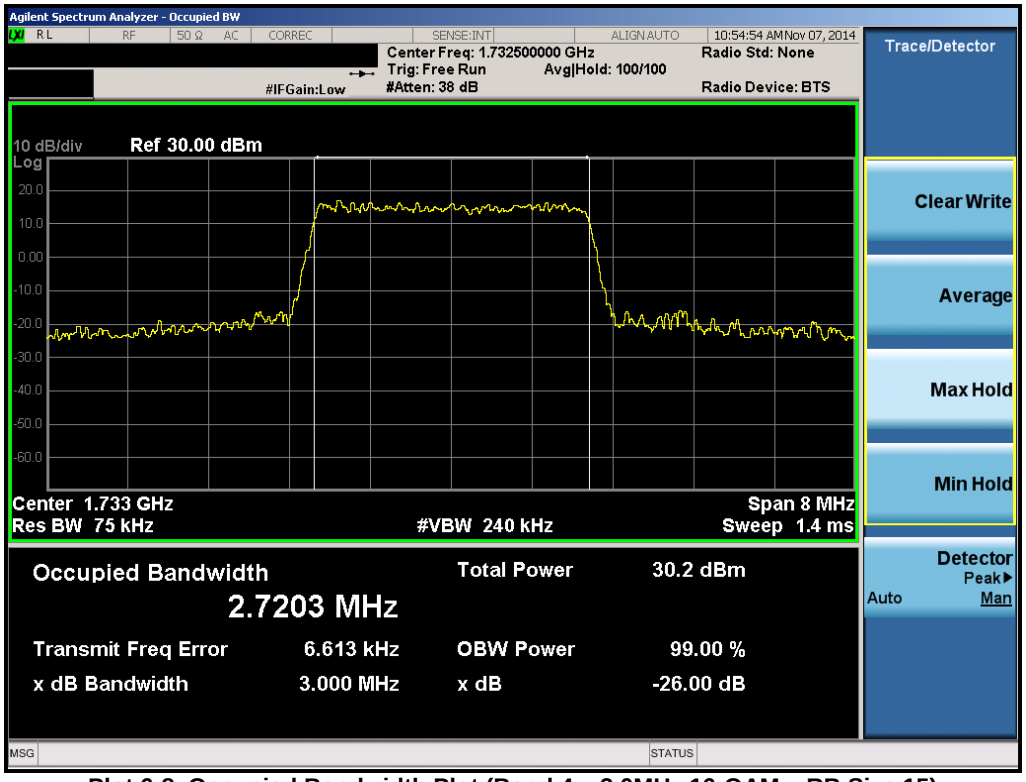



**Plot 6-6. Occupied Bandwidth Plot (Band 4 – 1.4MHz 16-QAM – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.

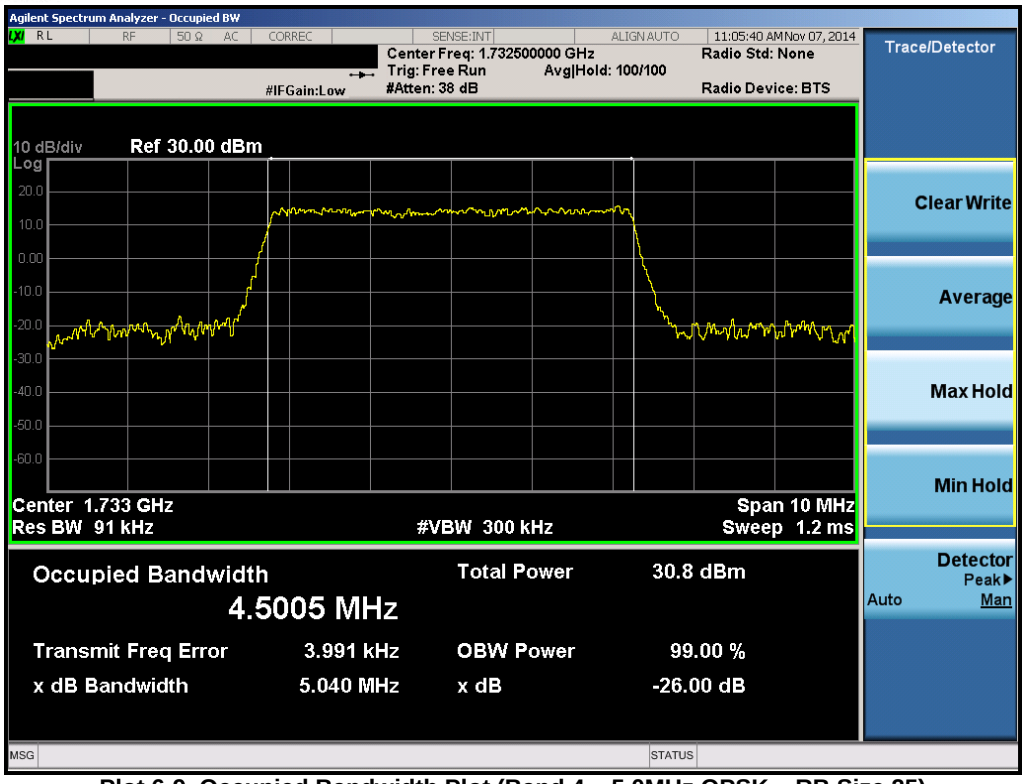



**Plot 6-7. Occupied Bandwidth Plot (Band 4 – 3.0MHz QPSK – RB Size 15)**

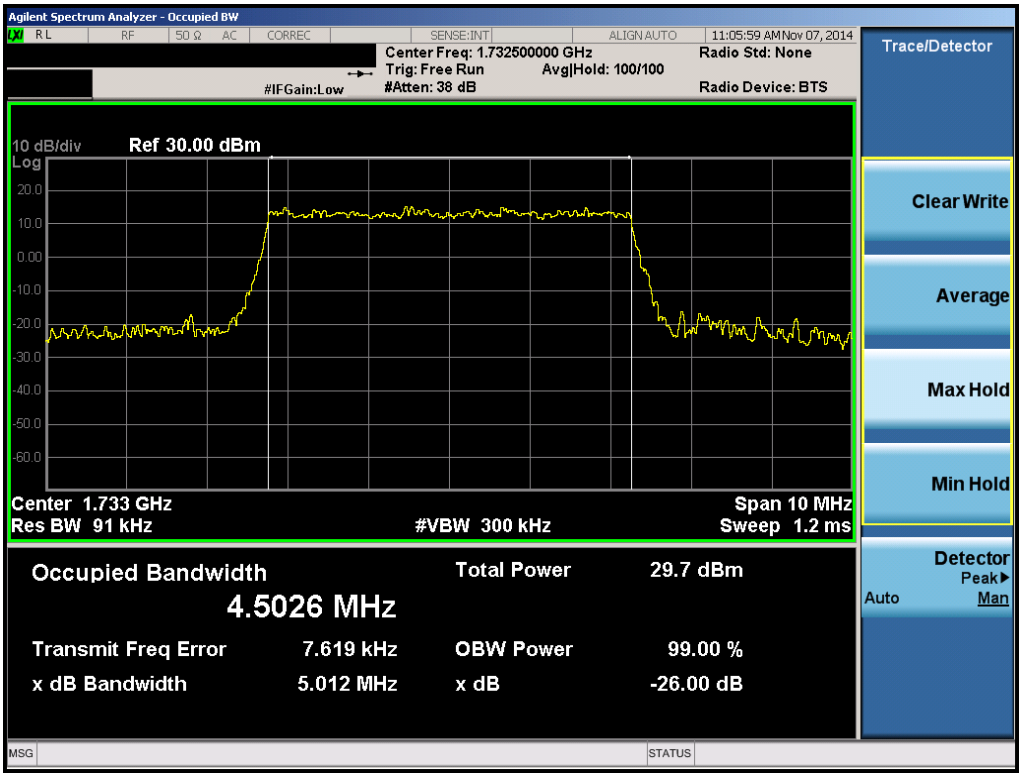



**Plot 6-8. Occupied Bandwidth Plot (Band 4 – 3.0MHz 16-QAM – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.

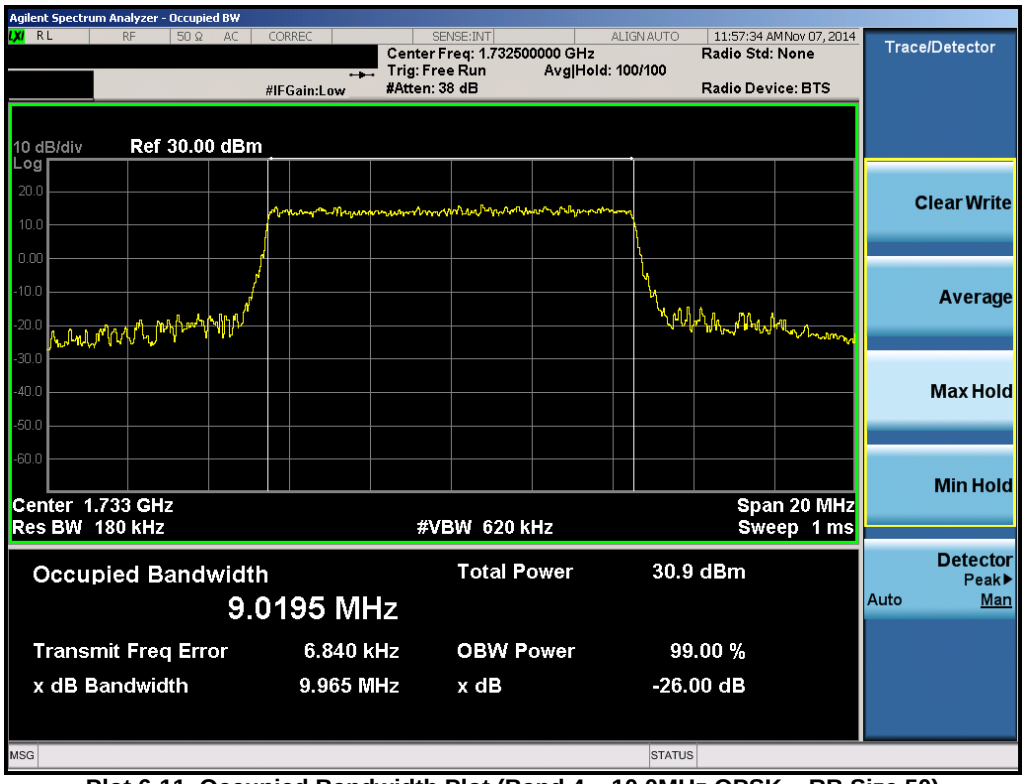



**Plot 6-9. Occupied Bandwidth Plot (Band 4 – 5.0MHz QPSK – RB Size 25)**

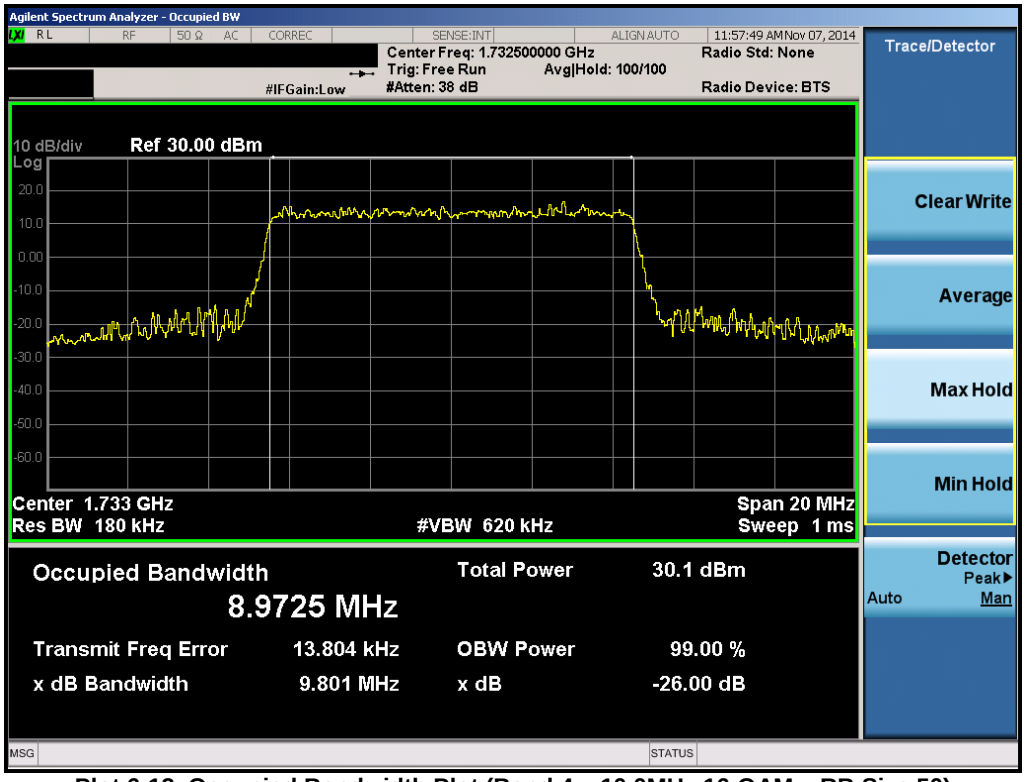



**Plot 6-10. Occupied Bandwidth Plot (Band 4 – 5.0MHz 16-QAM – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.

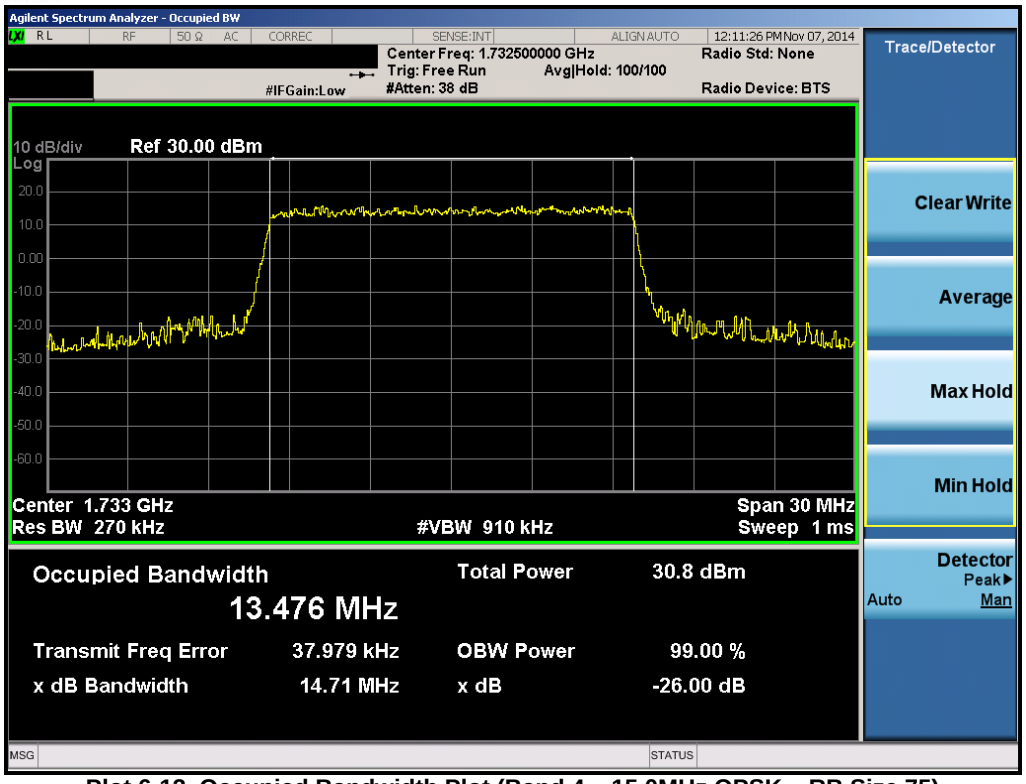



**Plot 6-11. Occupied Bandwidth Plot (Band 4 – 10.0MHz QPSK – RB Size 50)**

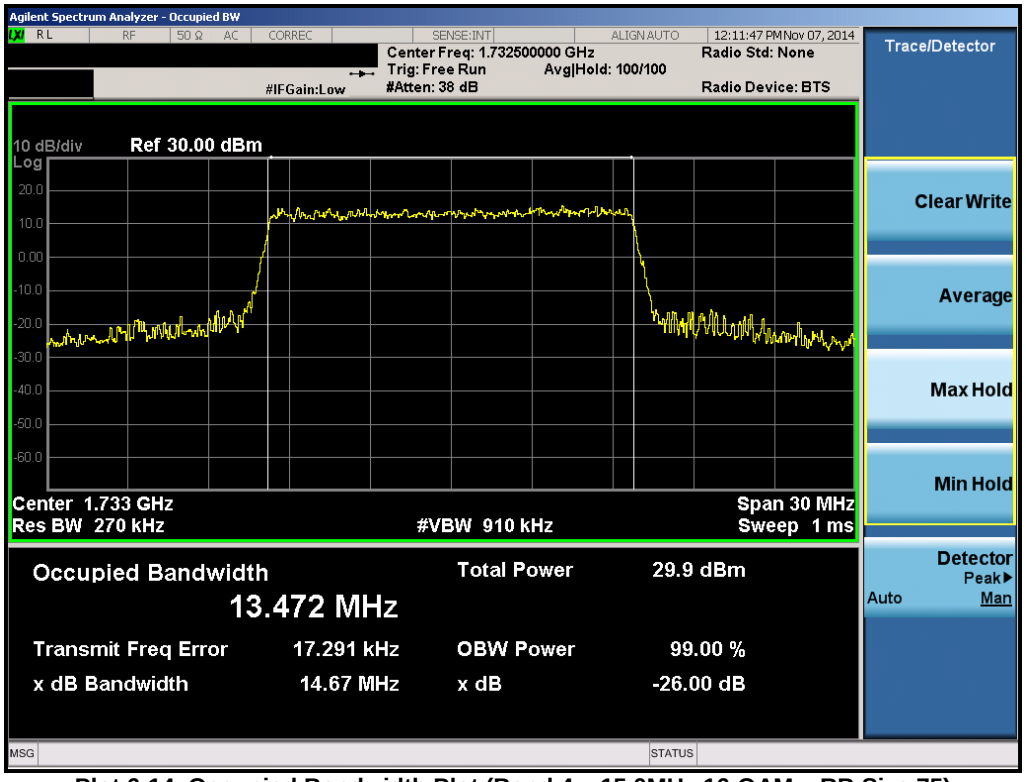



**Plot 6-12. Occupied Bandwidth Plot (Band 4 – 10.0MHz 16-QAM – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

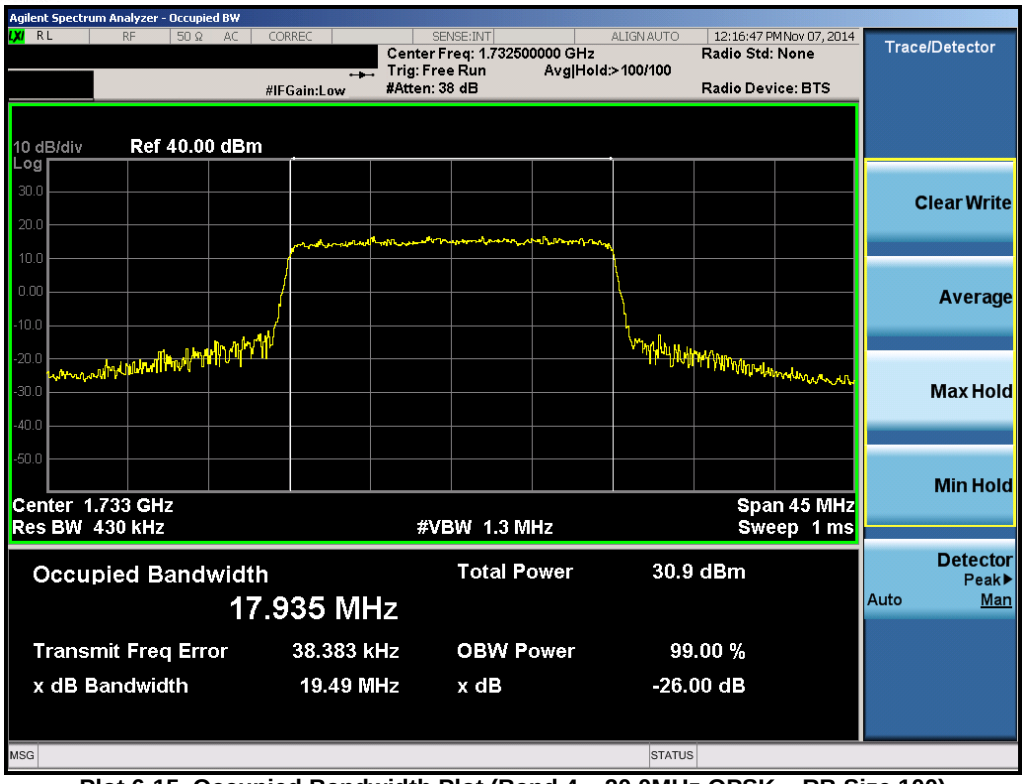



**Plot 6-13. Occupied Bandwidth Plot (Band 4 – 15.0MHz QPSK – RB Size 75)**

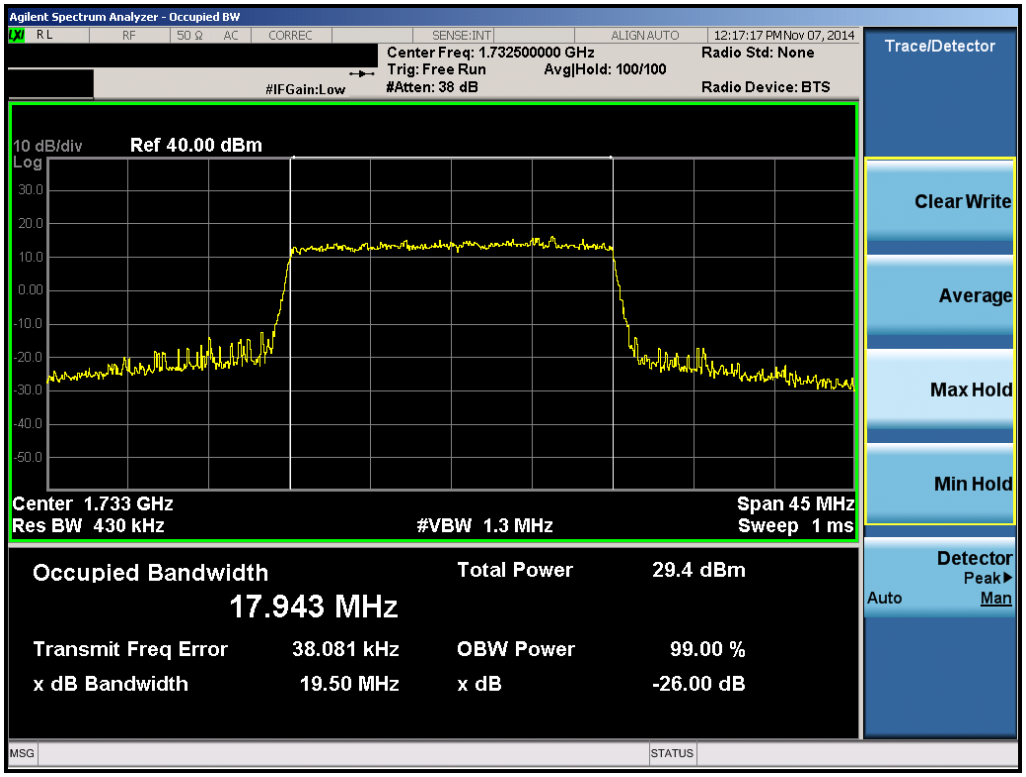



**Plot 6-14. Occupied Bandwidth Plot (Band 4 – 15.0MHz 16-QAM – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.

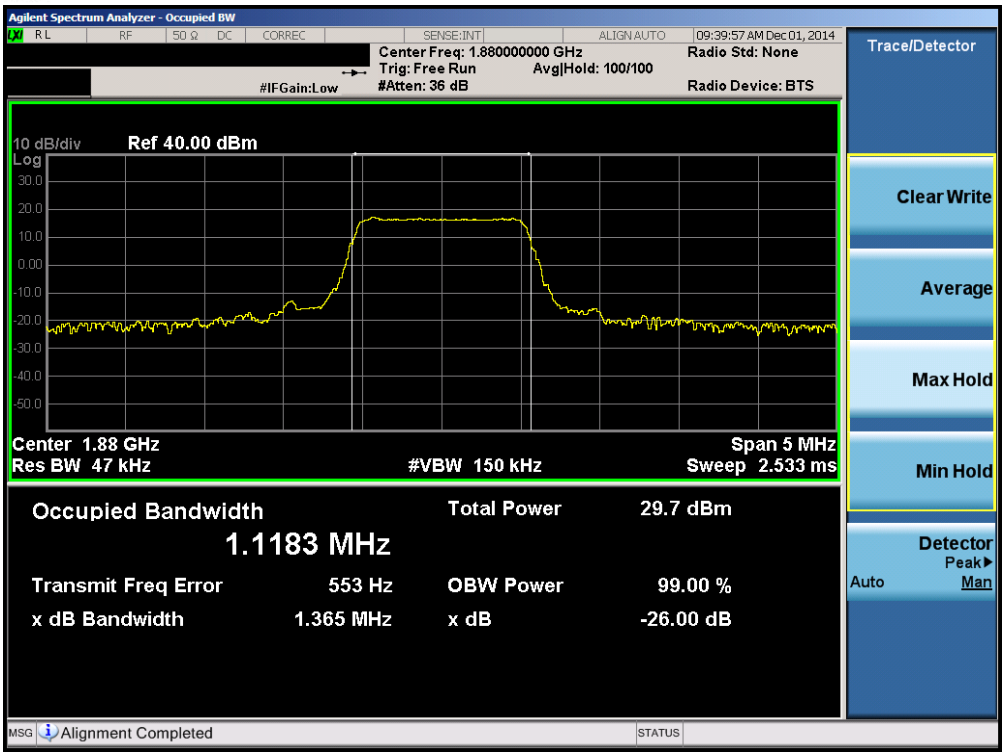



**Plot 6-15. Occupied Bandwidth Plot (Band 4 – 20.0MHz QPSK – RB Size 100)**

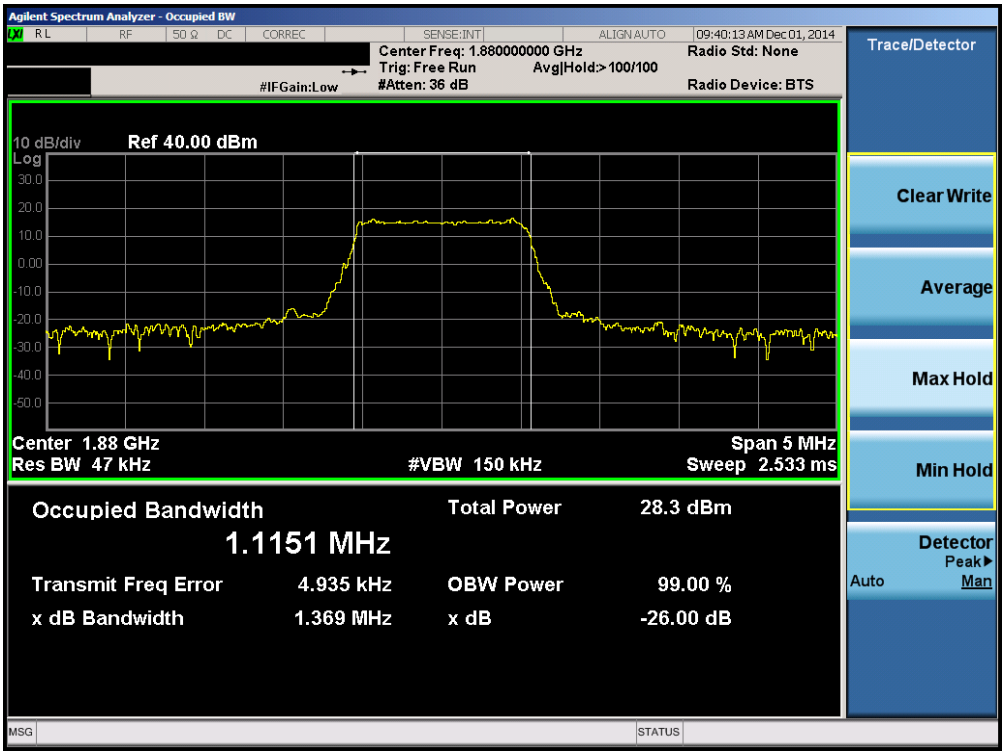



**Plot 6-16. Occupied Bandwidth Plot (Band 4 – 20.0MHz 16-QAM – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.

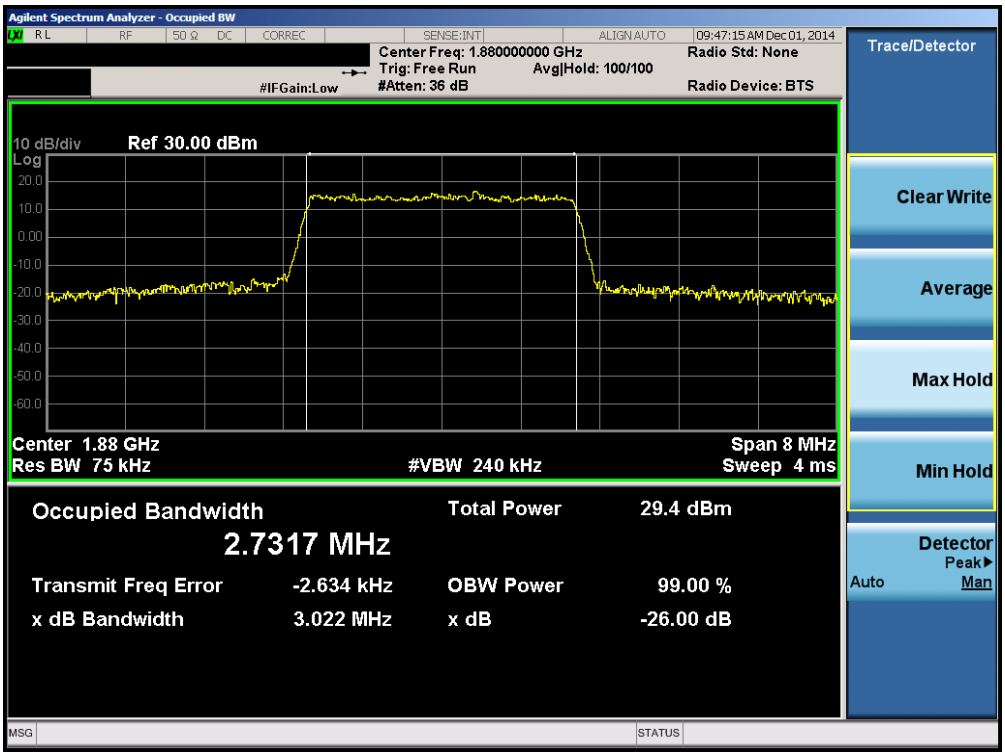



**Plot 6-17. Occupied Bandwidth Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**

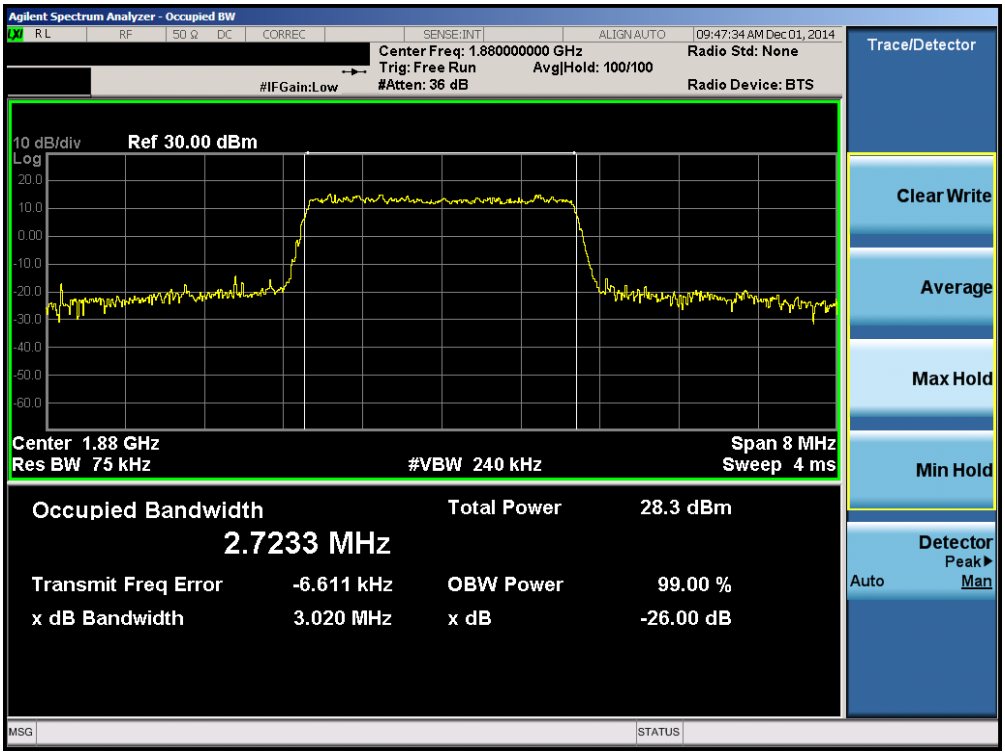



**Plot 6-18. Occupied Bandwidth Plot (Band 2 – 1.4MHz 16-QAM – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.

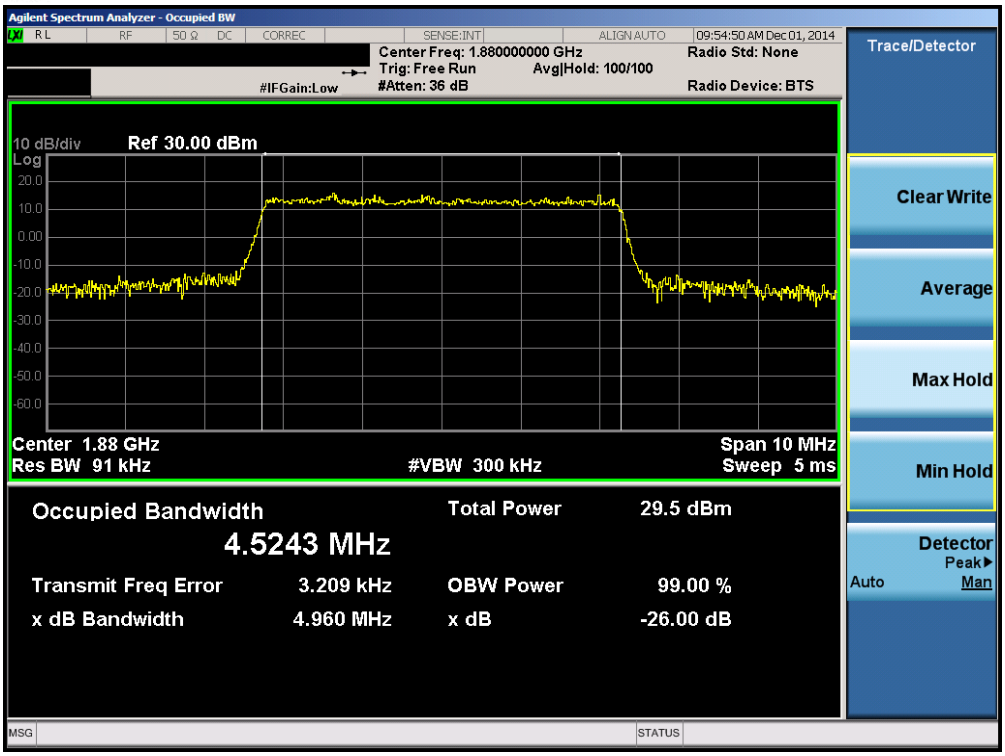



**Plot 6-19. Occupied Bandwidth Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**

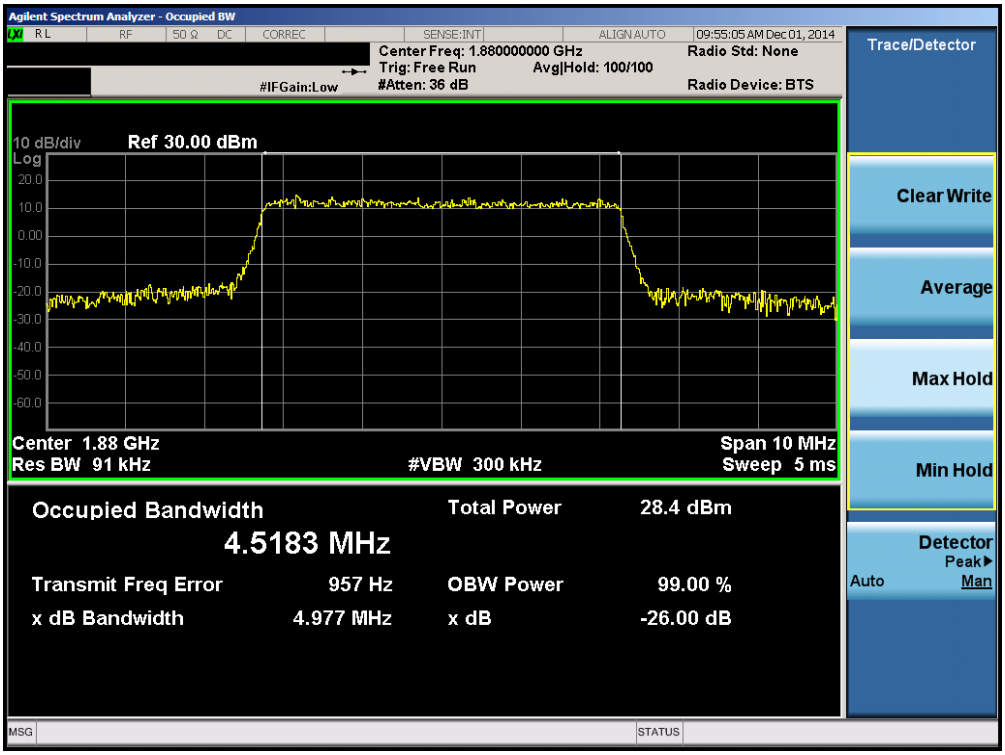



**Plot 6-20. Occupied Bandwidth Plot (Band 2 – 3.0MHz 16-QAM – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.

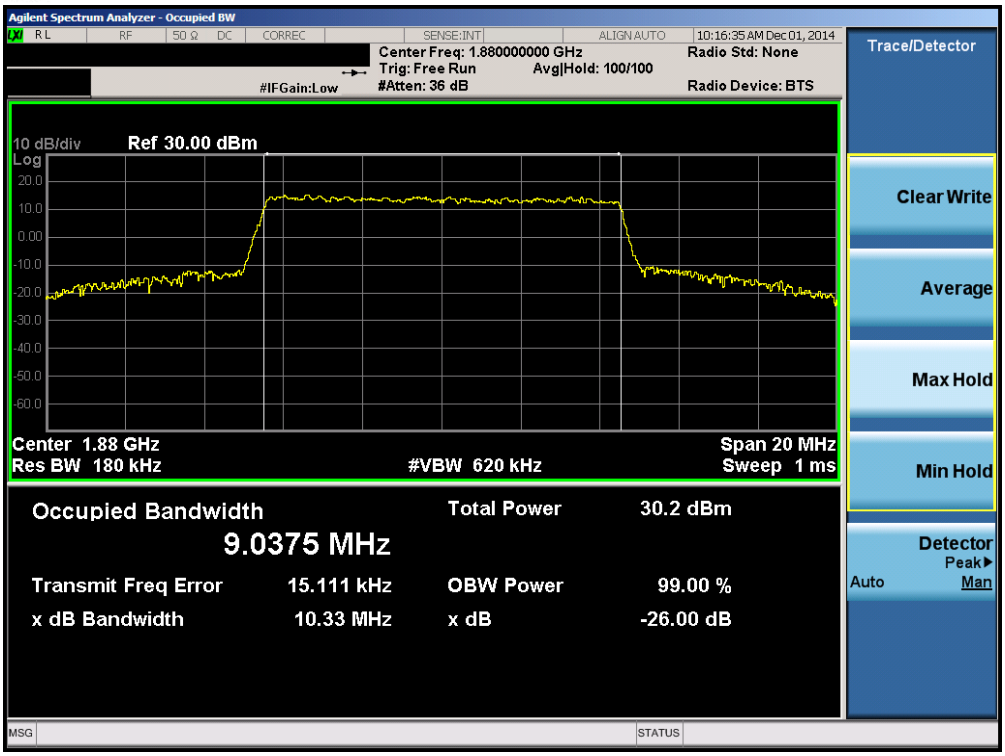



**Plot 6-21. Occupied Bandwidth Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**

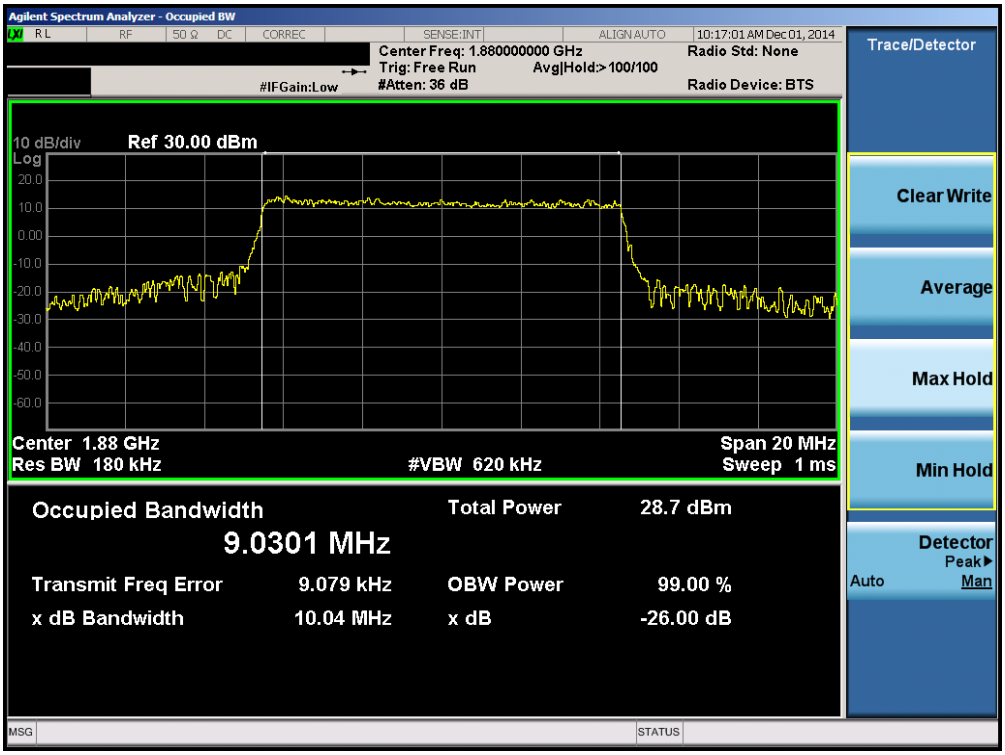



**Plot 6-22. Occupied Bandwidth Plot (Band 2 – 5.0MHz 16-QAM – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.



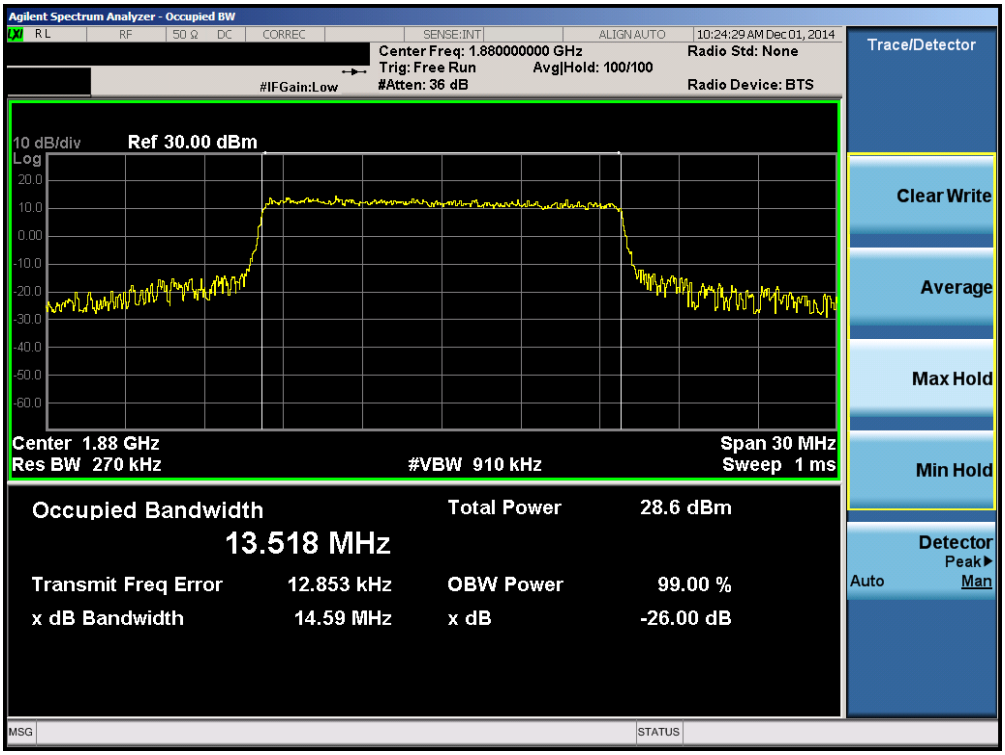

**Plot 6-23. Occupied Bandwidth Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**




**Plot 6-24. Occupied Bandwidth Plot (Band 2 – 10.0MHz 16-QAM – RB Size 50)**

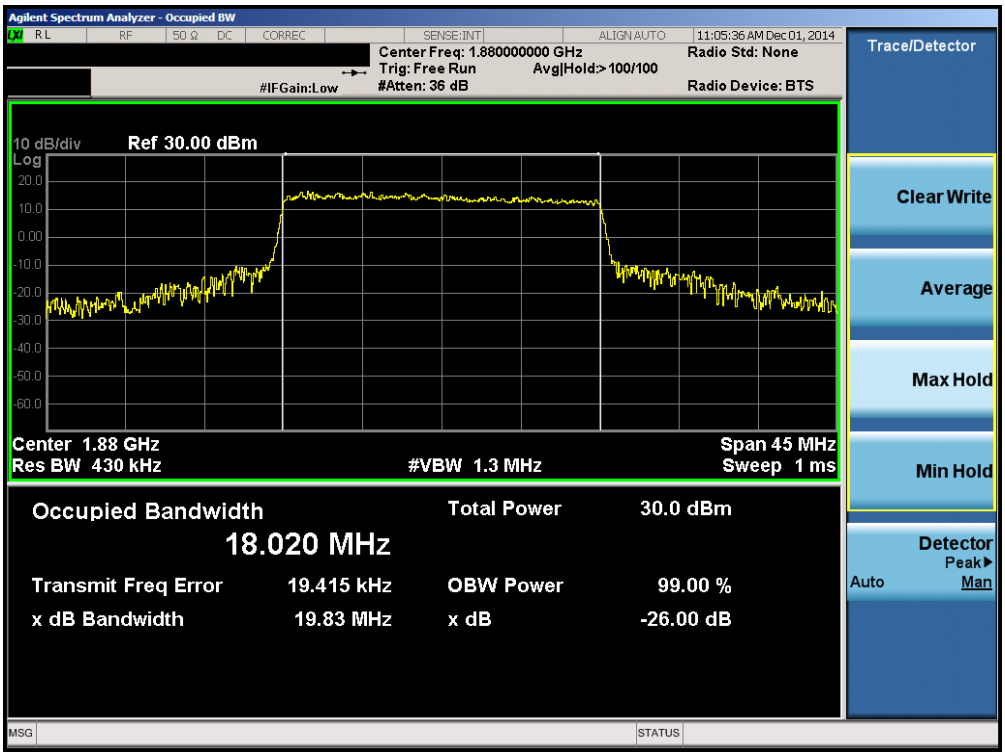

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-25. Occupied Bandwidth Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**

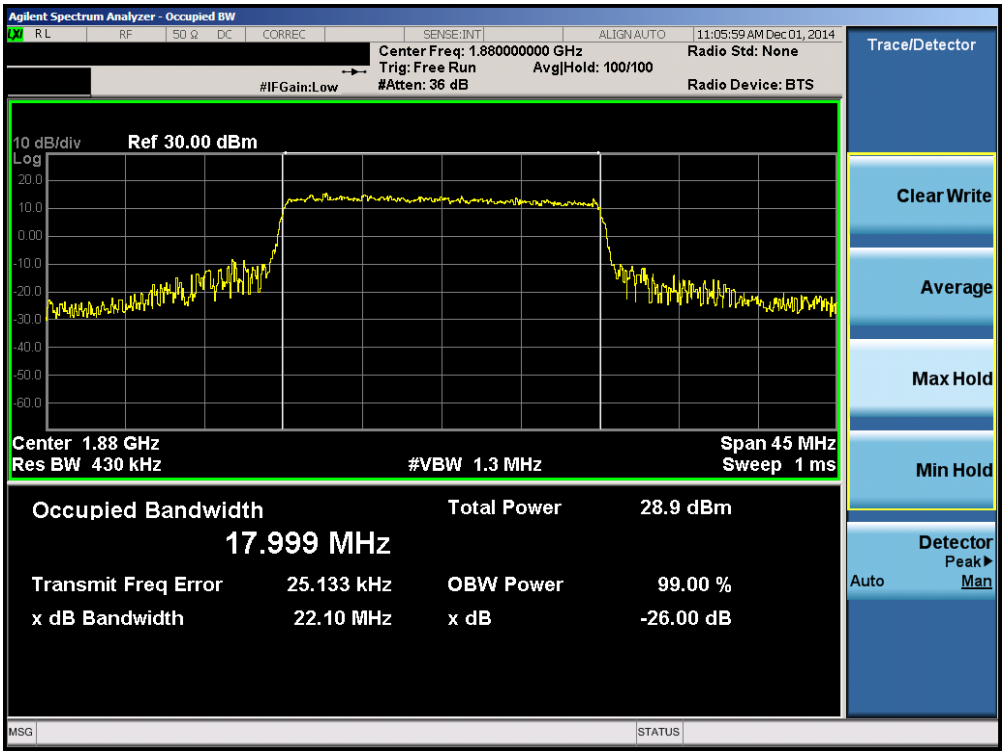



**Plot 6-26. Occupied Bandwidth Plot (Band 2 – 15.0MHz 16-QAM – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.




**Plot 6-27. Occupied Bandwidth Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**




**Plot 6-28. Occupied Bandwidth Plot (Band 2 – 20.0MHz 16-QAM – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.3 Spurious and Harmonic Emissions at Antenna Terminal

**§2.1051 §24.238(a) §27.53(c.2) §27.53(f) §27.53(h)**

### 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 $10^{th}$ 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 v02r02 – 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 = max hold
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.

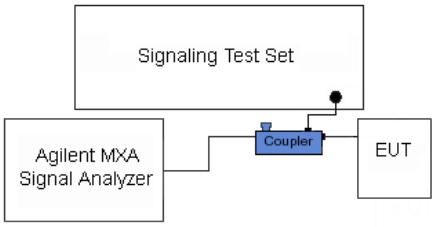
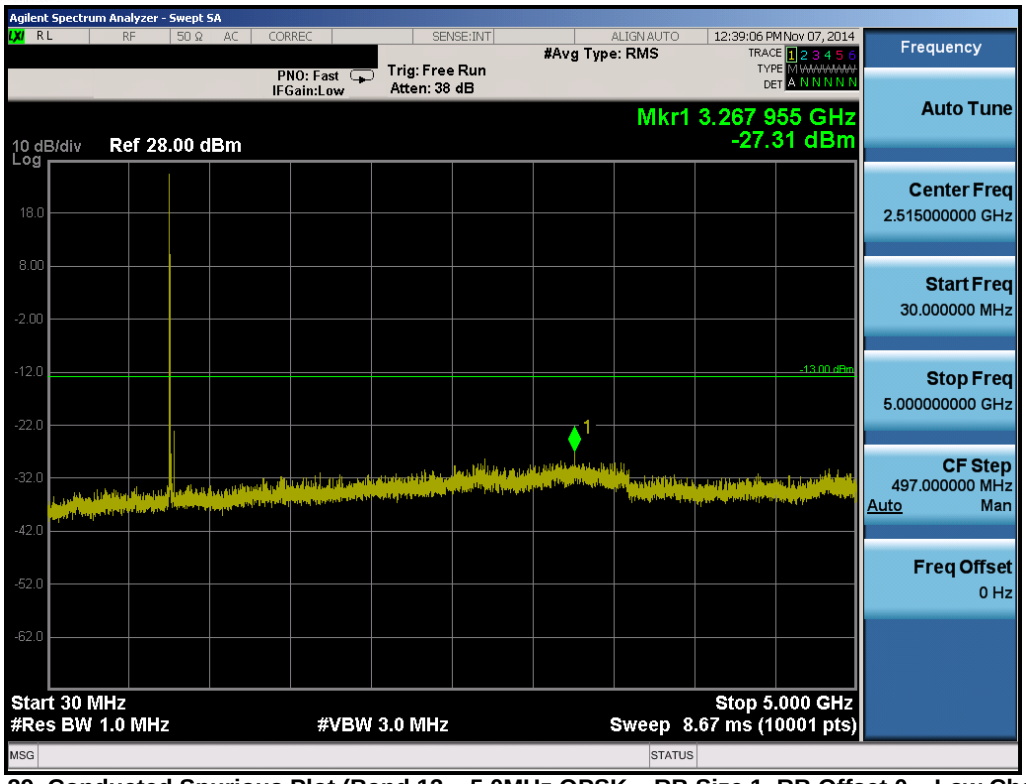



**Figure 6-2. Test Instrument & Measurement Setup**

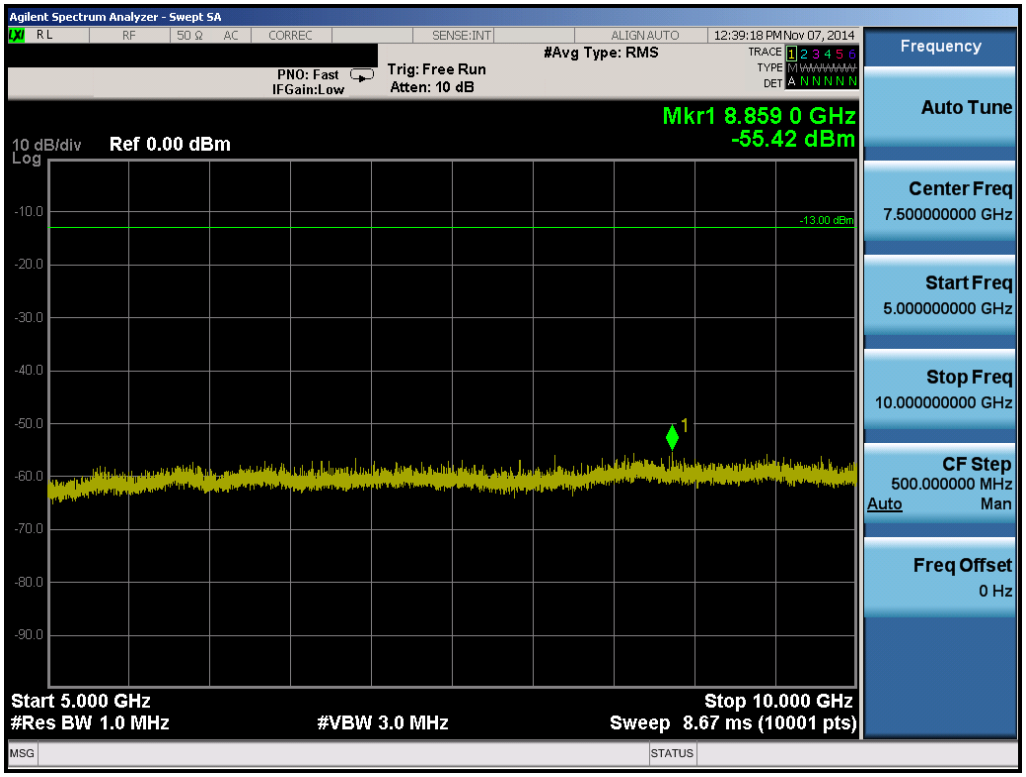
### Test Notes

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.


© 2014 PCTEST Engineering Laboratory, Inc.

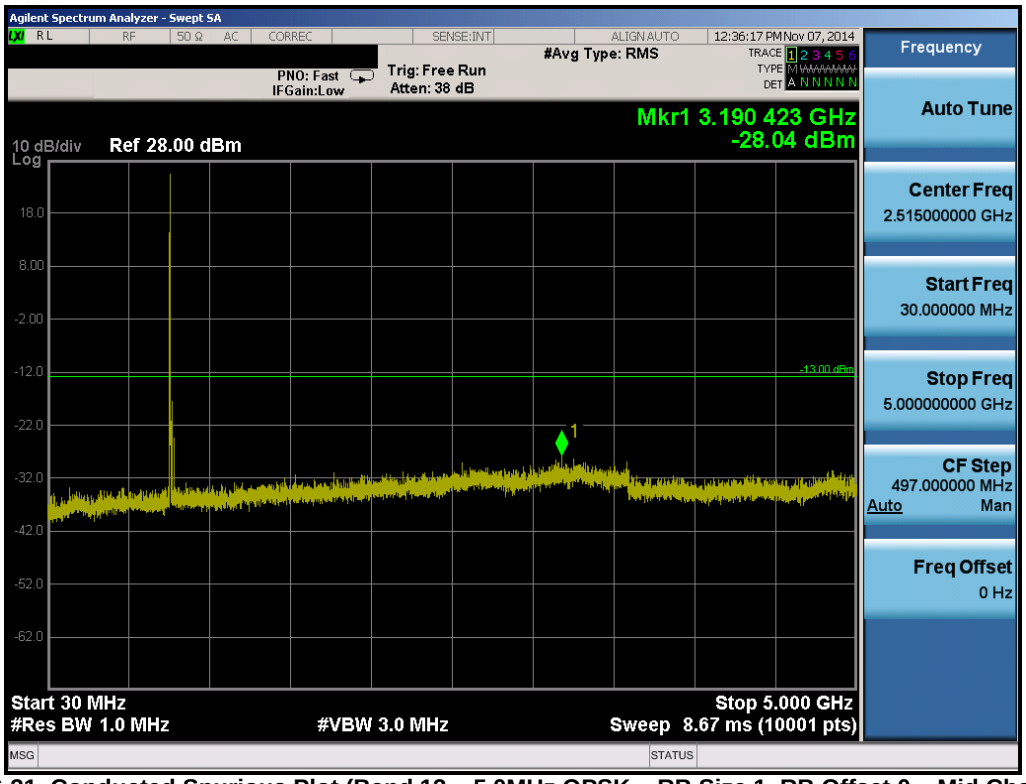



**Plot 6-29. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**

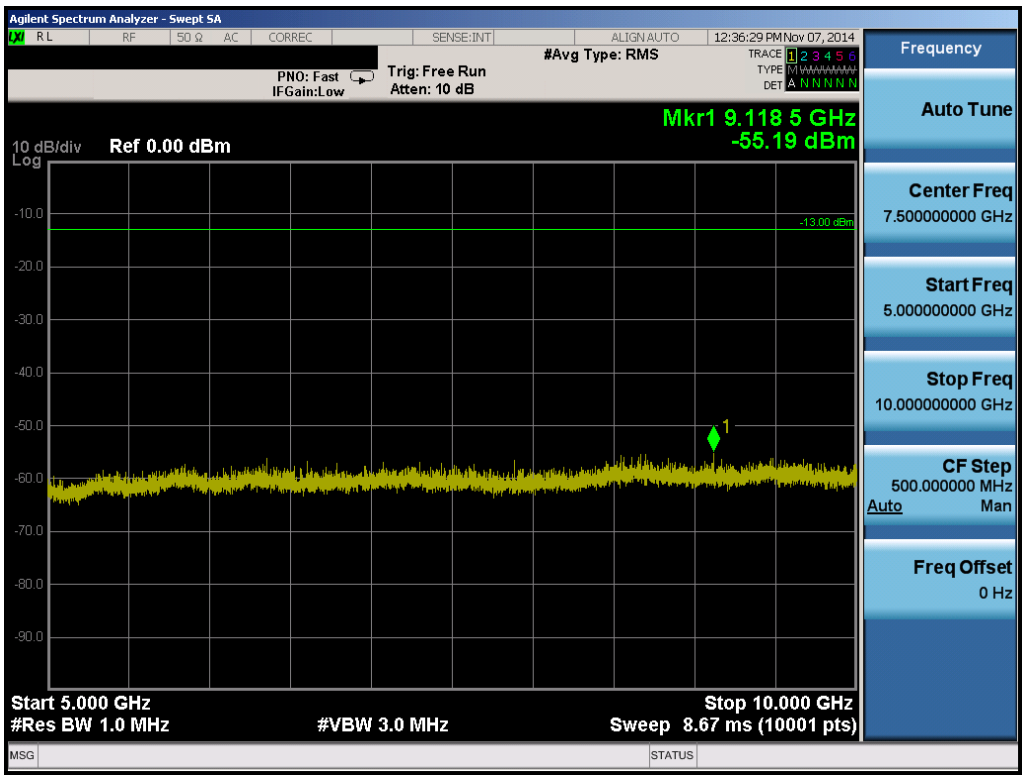



**Plot 6-30. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

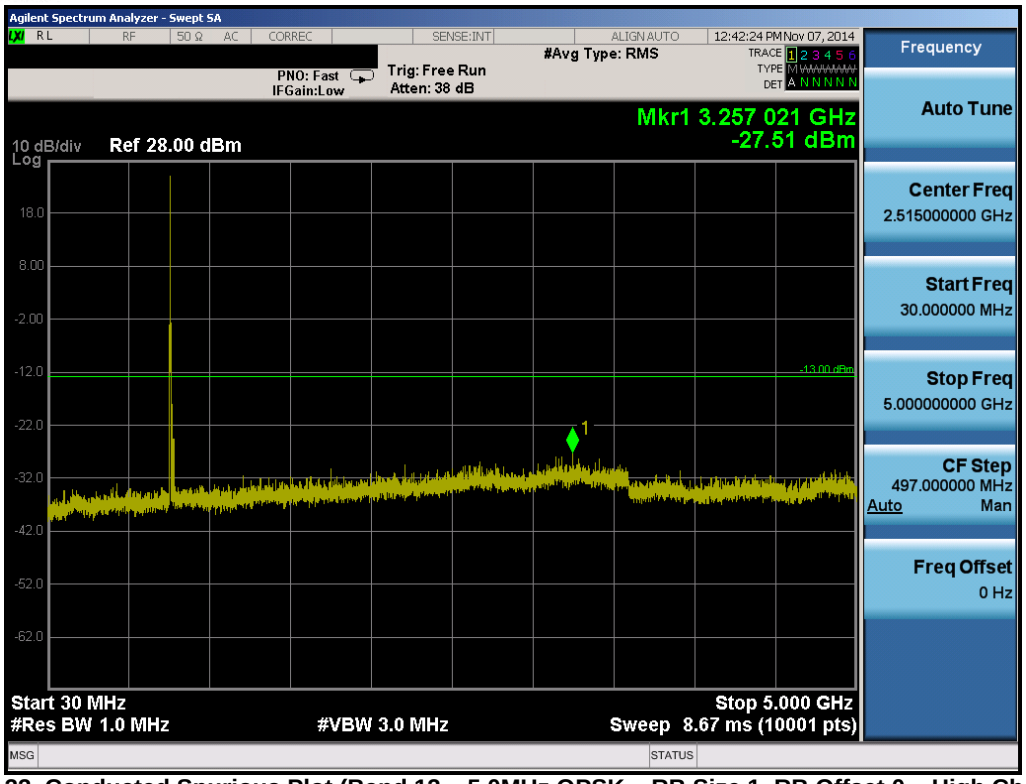



**Plot 6-31. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**

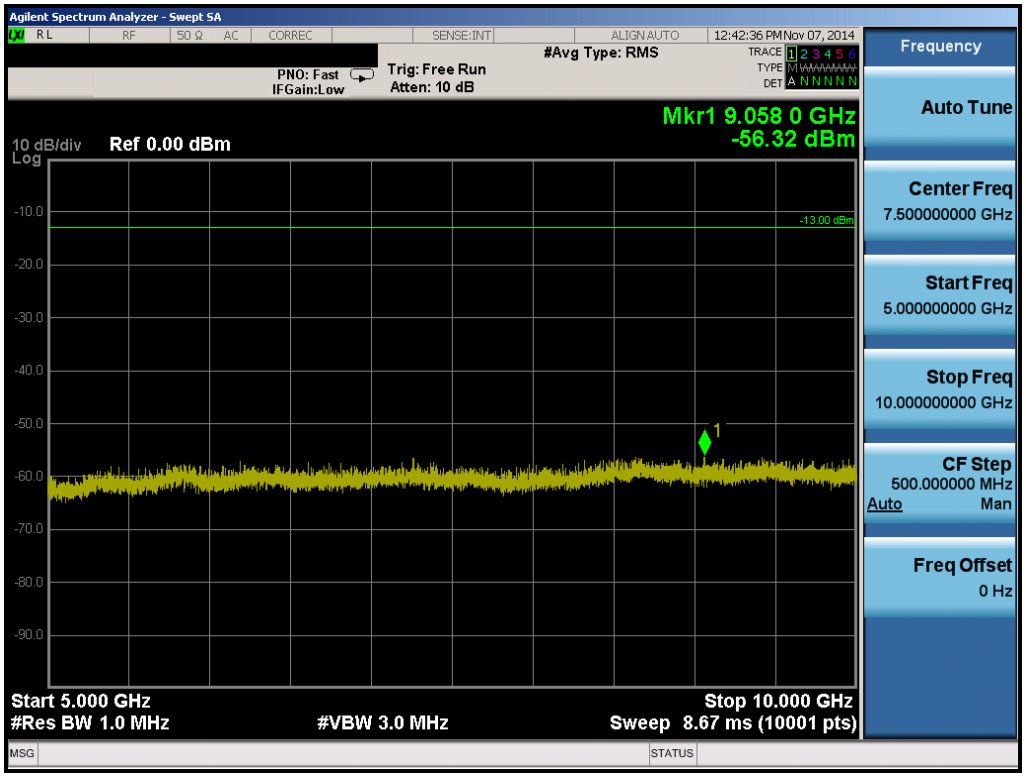



**Plot 6-32. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

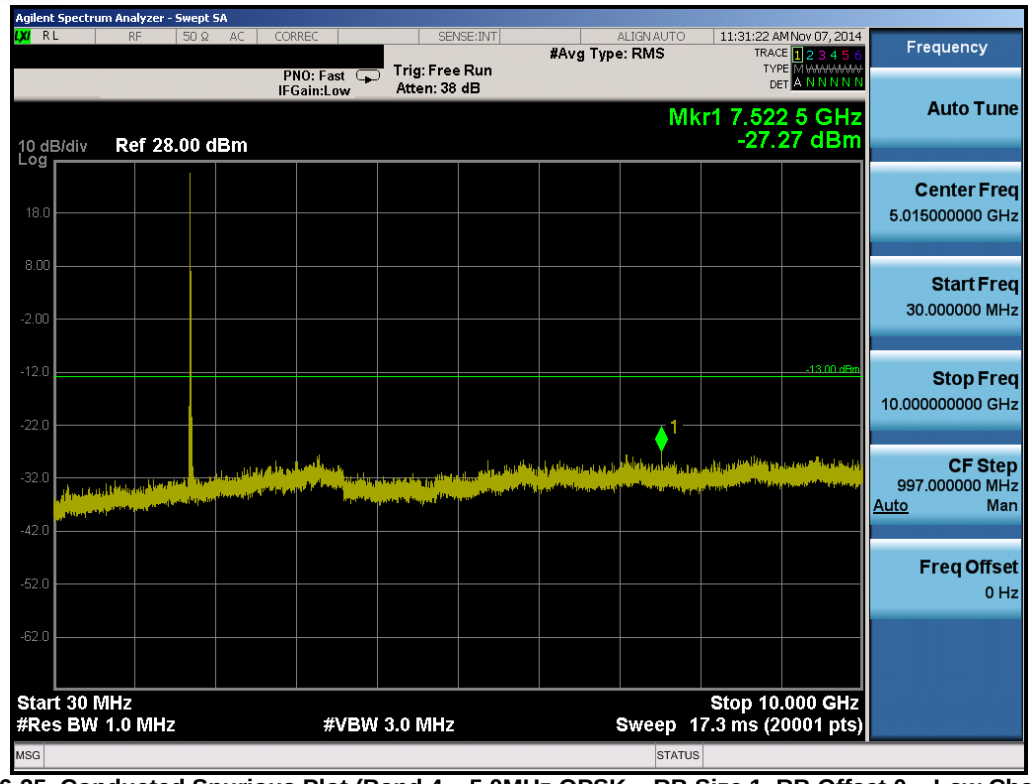



**Plot 6-33. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**

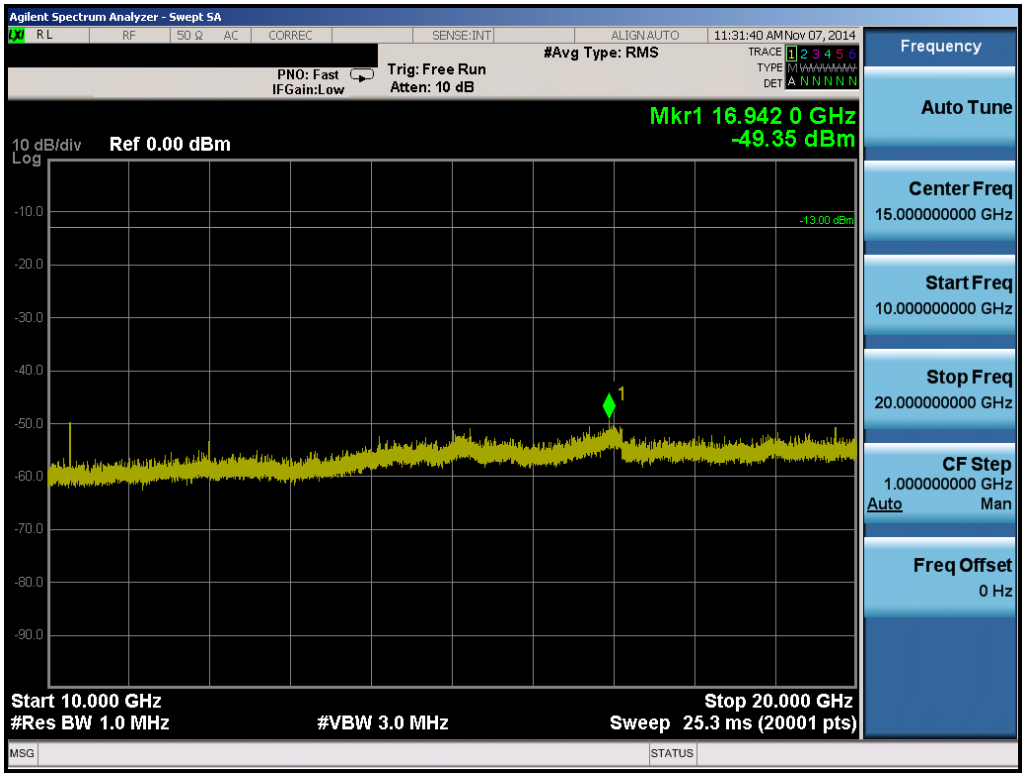



**Plot 6-34. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

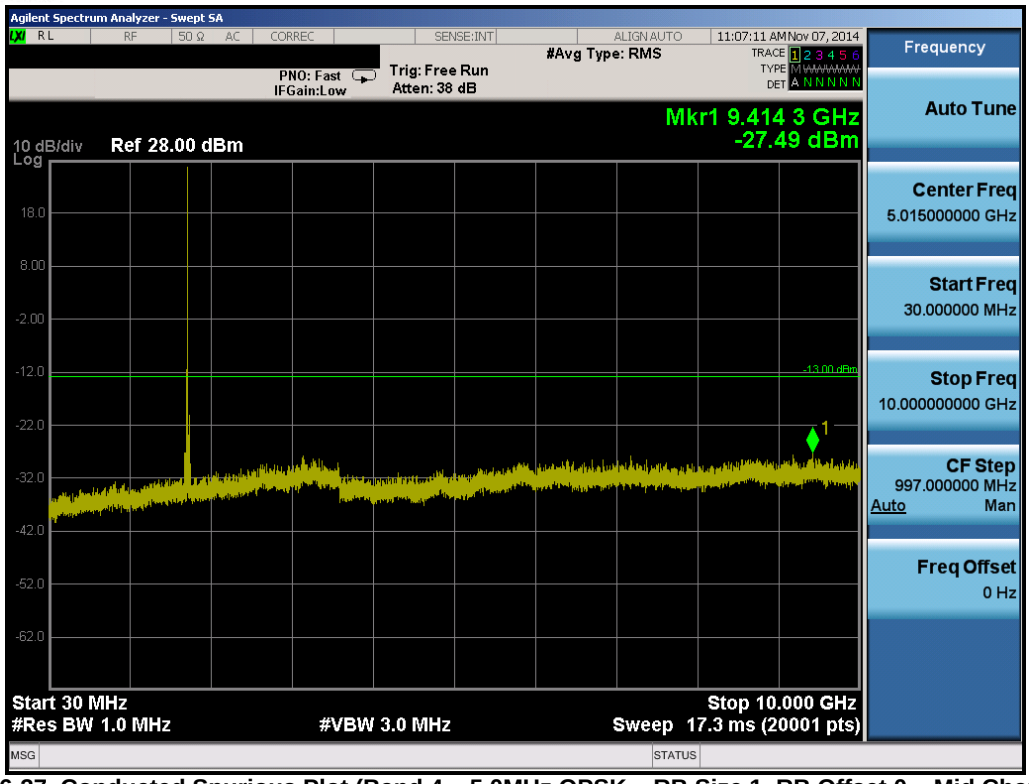



**Plot 6-35. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**

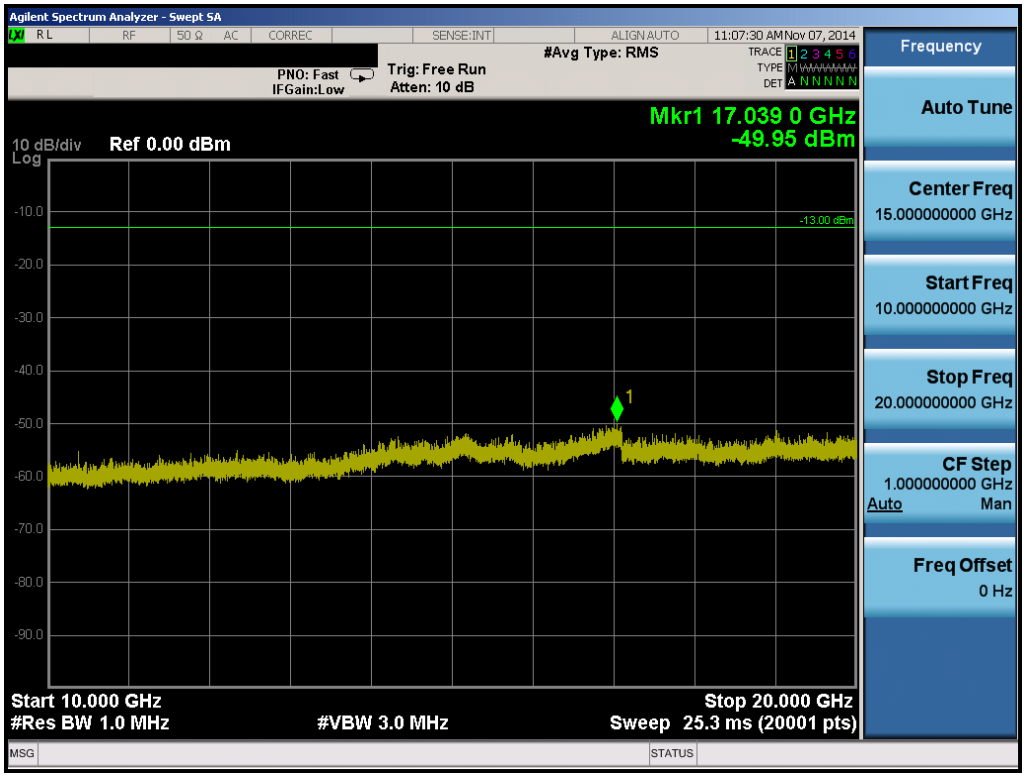



**Plot 6-36. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

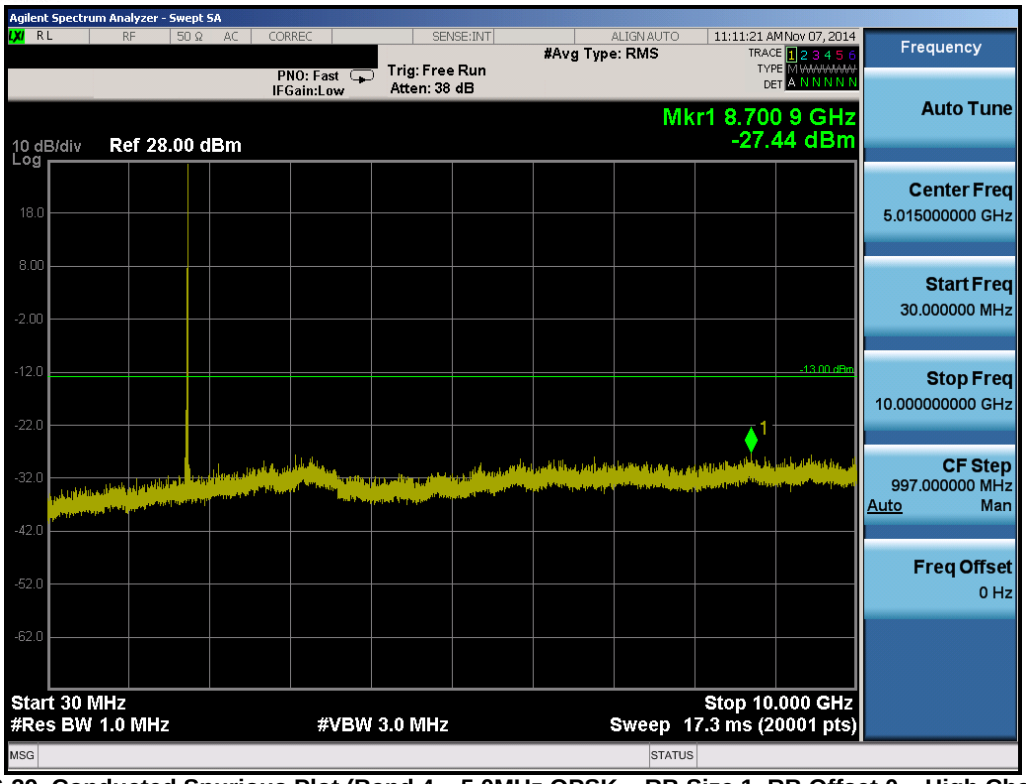



**Plot 6-37. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**

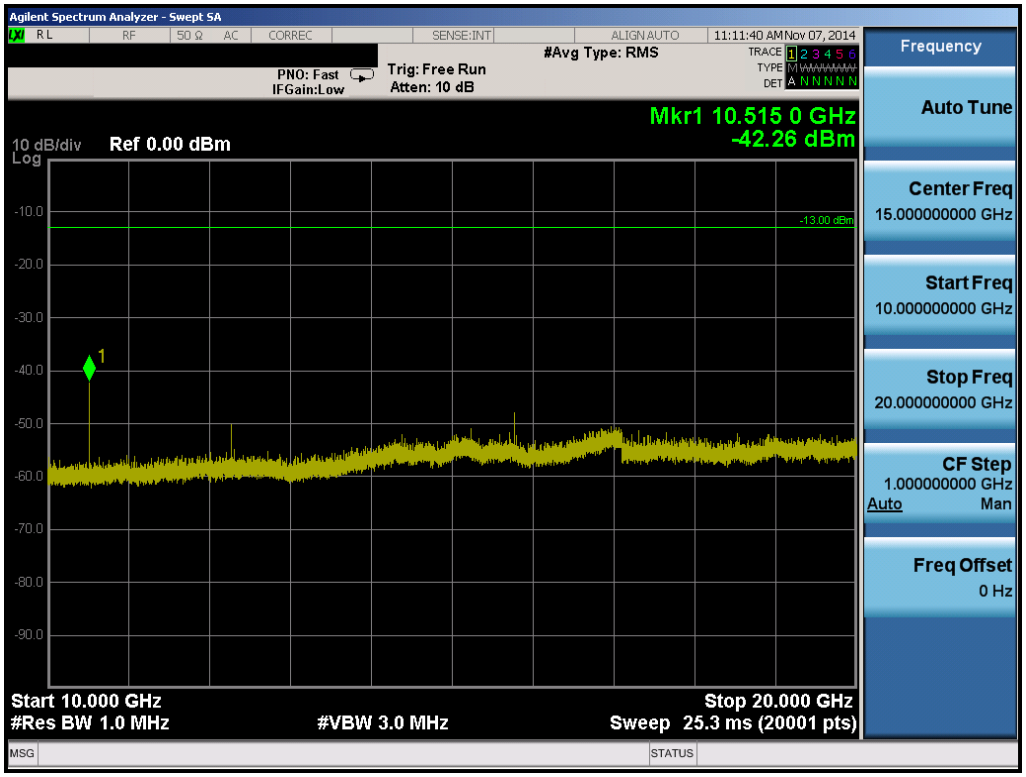



**Plot 6-38. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

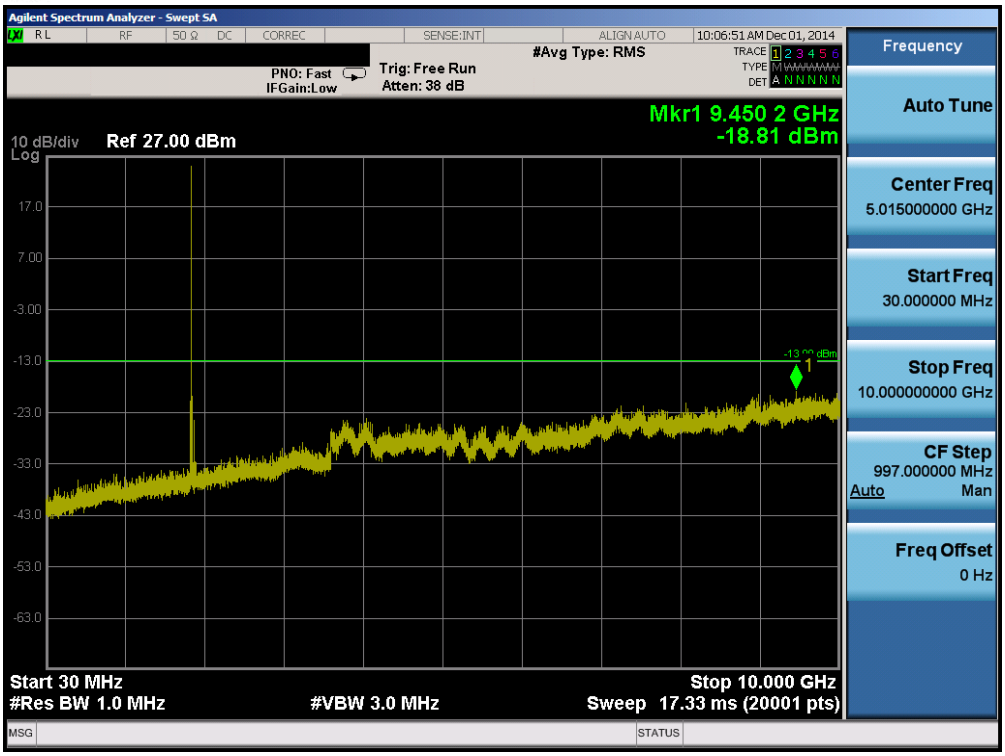



**Plot 6-39. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**

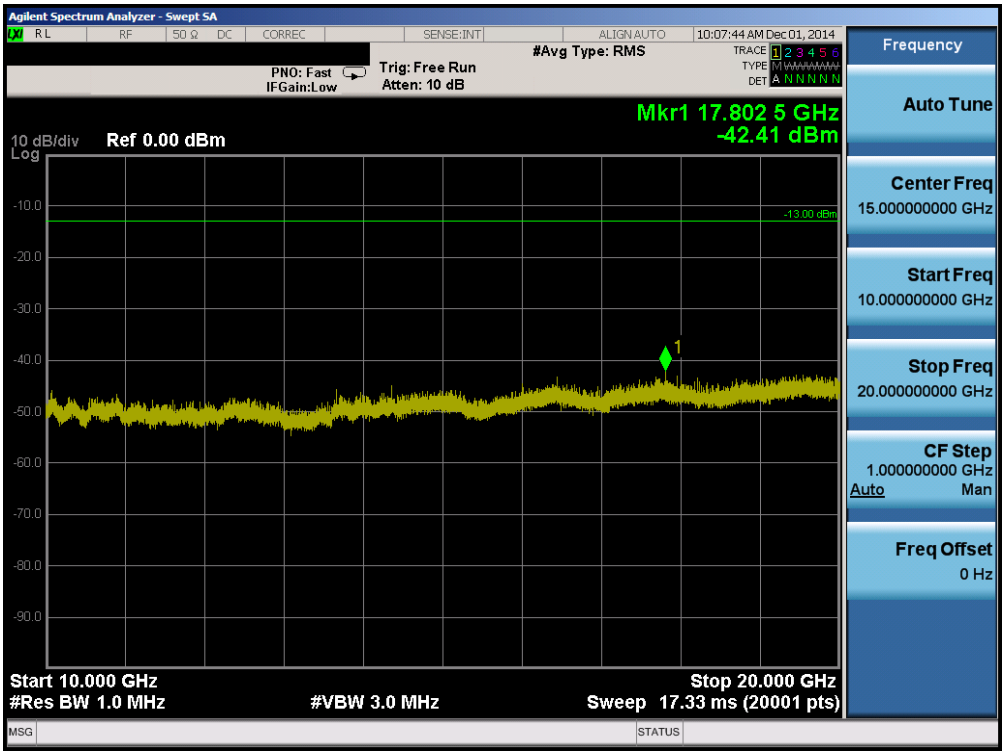



**Plot 6-40. Conducted Spurious Plot (Band 4 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

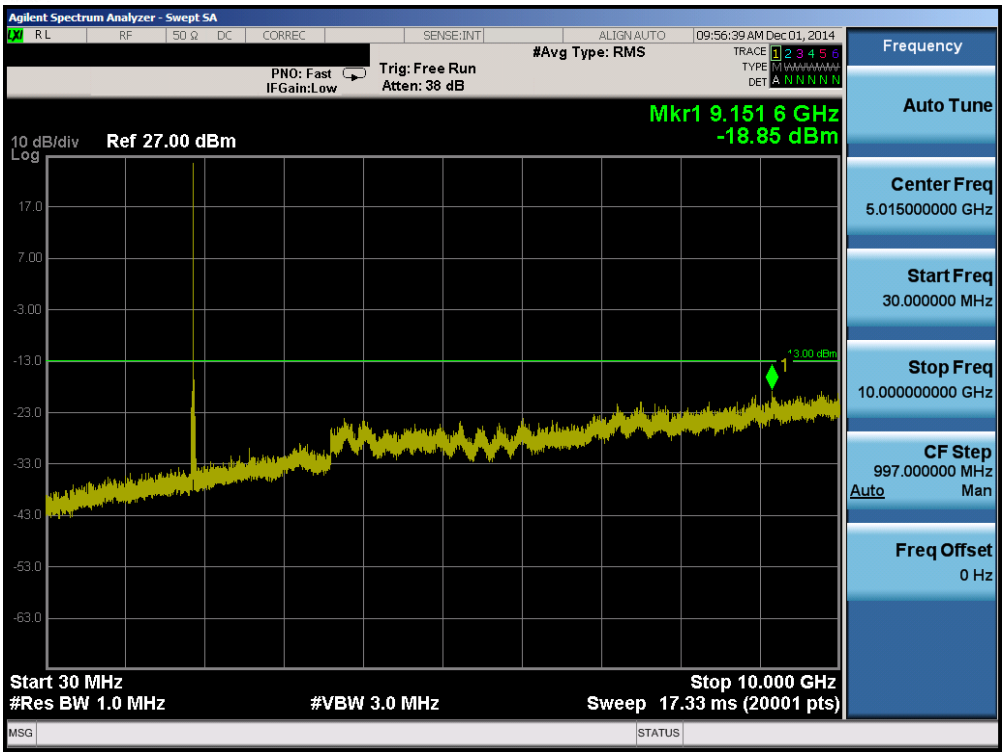



**Plot 6-41. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**

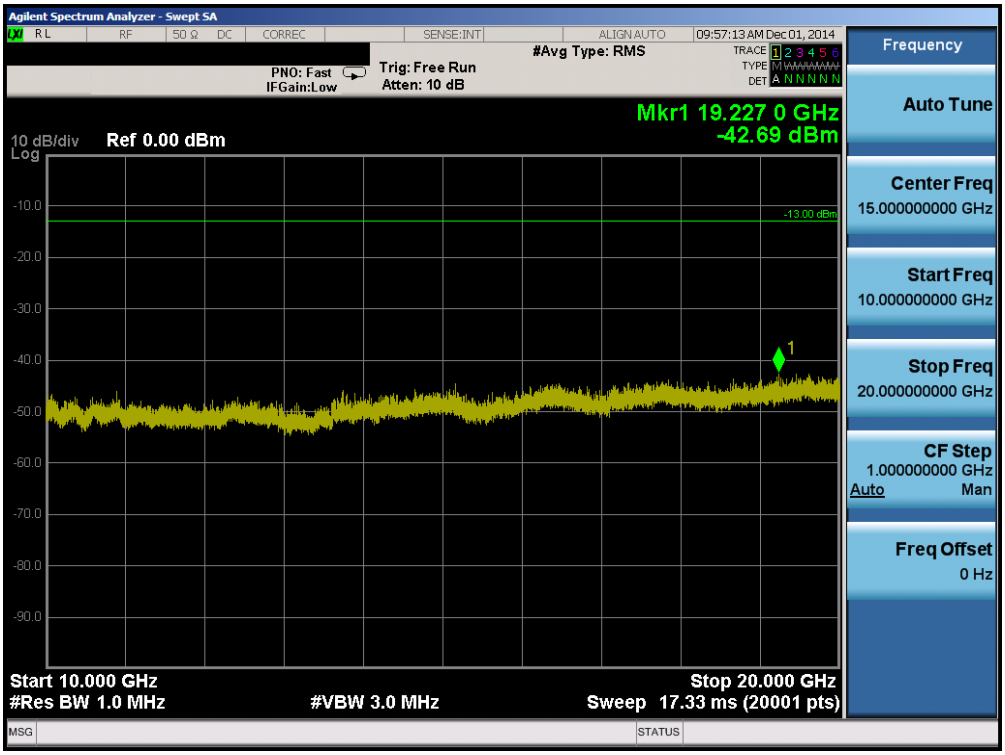



**Plot 6-42. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

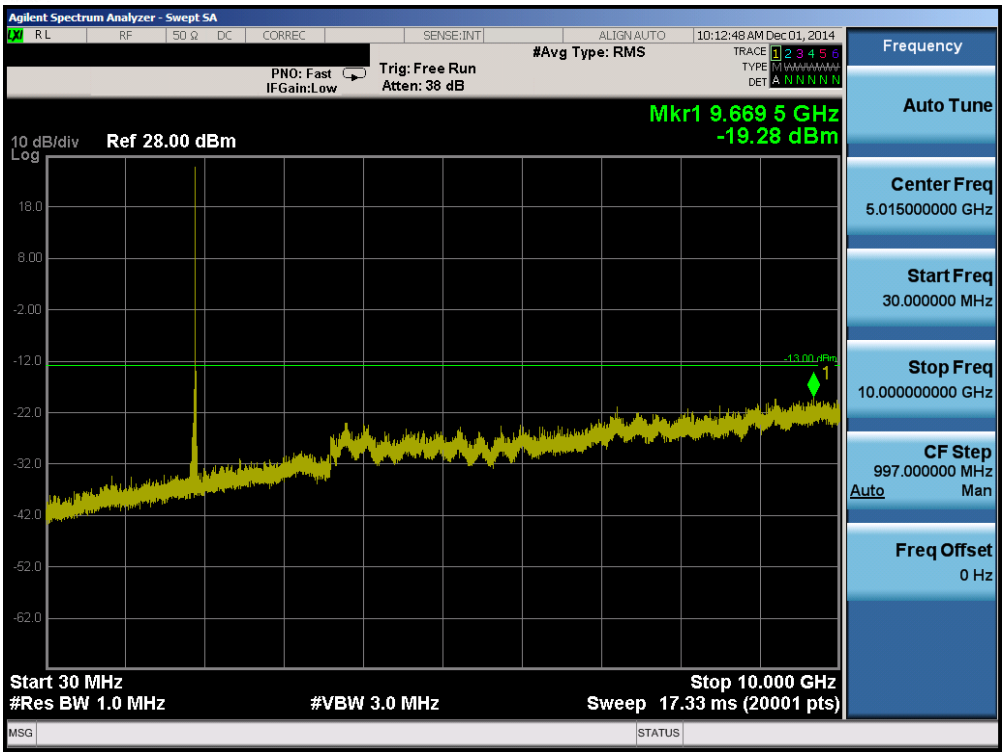



**Plot 6-43. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**

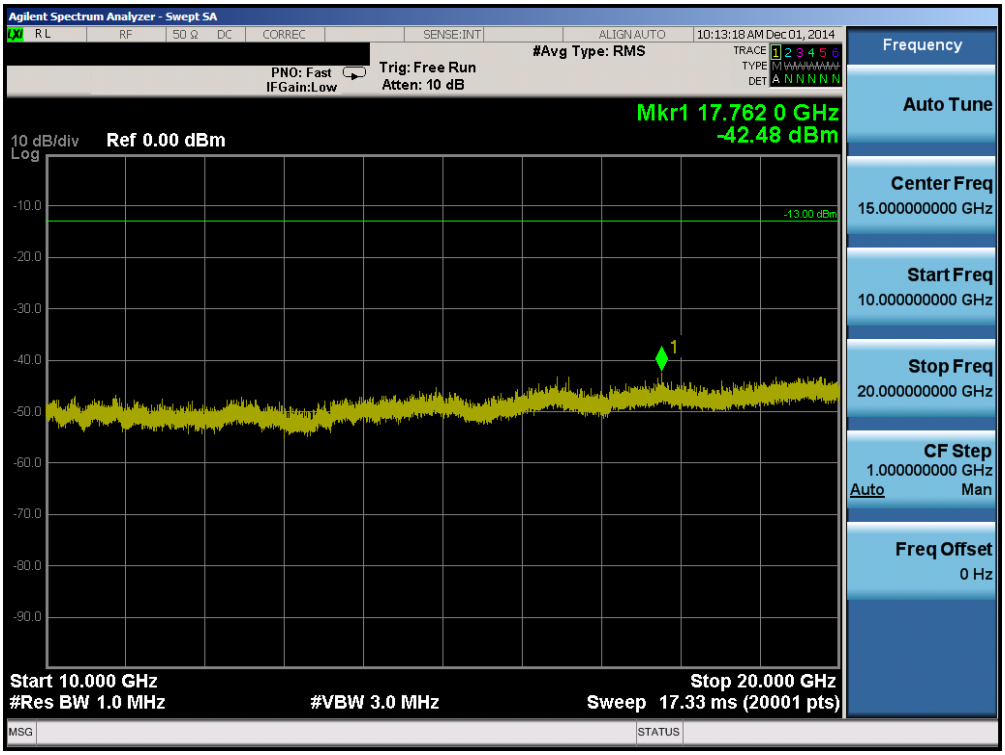



**Plot 6-44. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.




**Plot 6-45. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**




**Plot 6-46. Conducted Spurious Plot (Band 2 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.4 Band Edge Emissions at Antenna Terminal

**§2.1051 §24.238(a) §27.53(c) §27.53(h)**

**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 v02r02 – 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 = max hold
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.

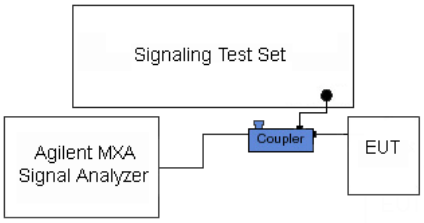



**Figure 6-3. Test Instrument & Measurement Setup**

**Test Notes**

Per 24.238(a) and 27.53(h), 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.

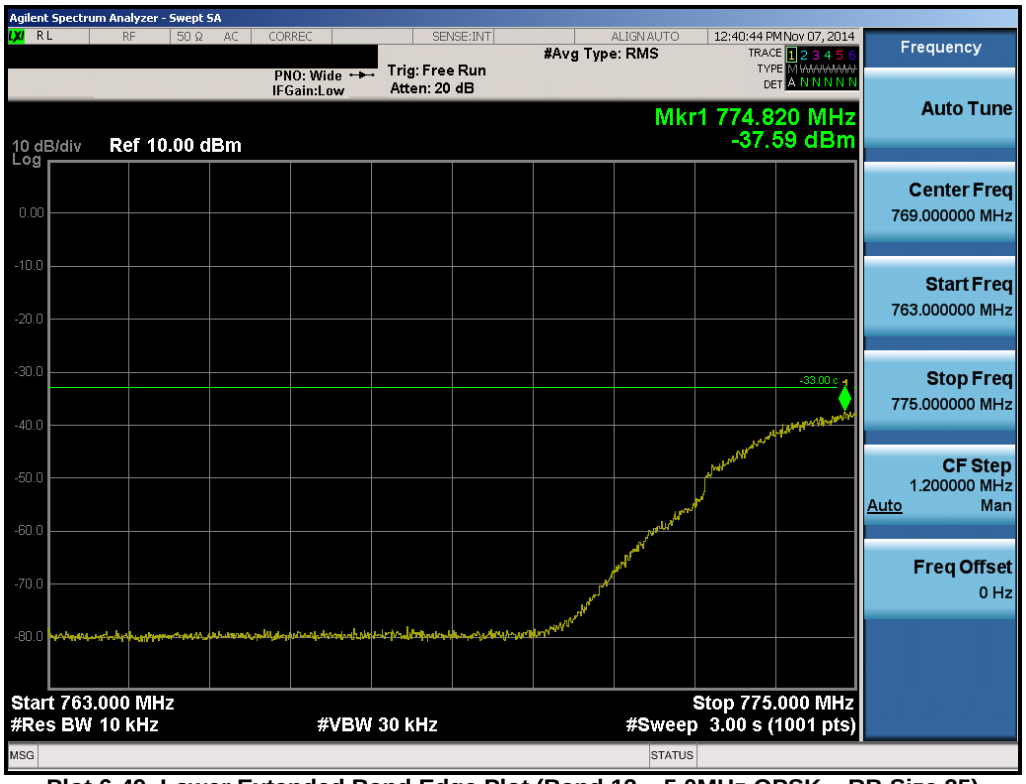
For all plots showing emissions in the 763 – 775MHz and 793 – 805MHz band, the FCC limit per 27.53(c.4) is 65 + $10\log_{10}(P)$ = -35dBm in a 6.25kHz bandwidth. Since it was not possible to set the resolution bandwidth to 6.25kHz with the available equipment, a bandwidth of 10kHz was used instead to show compliance. By using a 10kHz bandwidth, the limit was adjusted by $10\log_{10}(10kHz/6.25kHz)$ = 2dB. Thus, the limit shown in all plots in the 763 – 775mHz and 793 – 805MHz bands for all available modulation types was -35dBm + 2dB = -33dBm.


© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-47. Lower Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

**Plot 6-48. Lower Extended Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.




**Plot 6-49. Lower Extended Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

**Plot 6-50. Upper Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

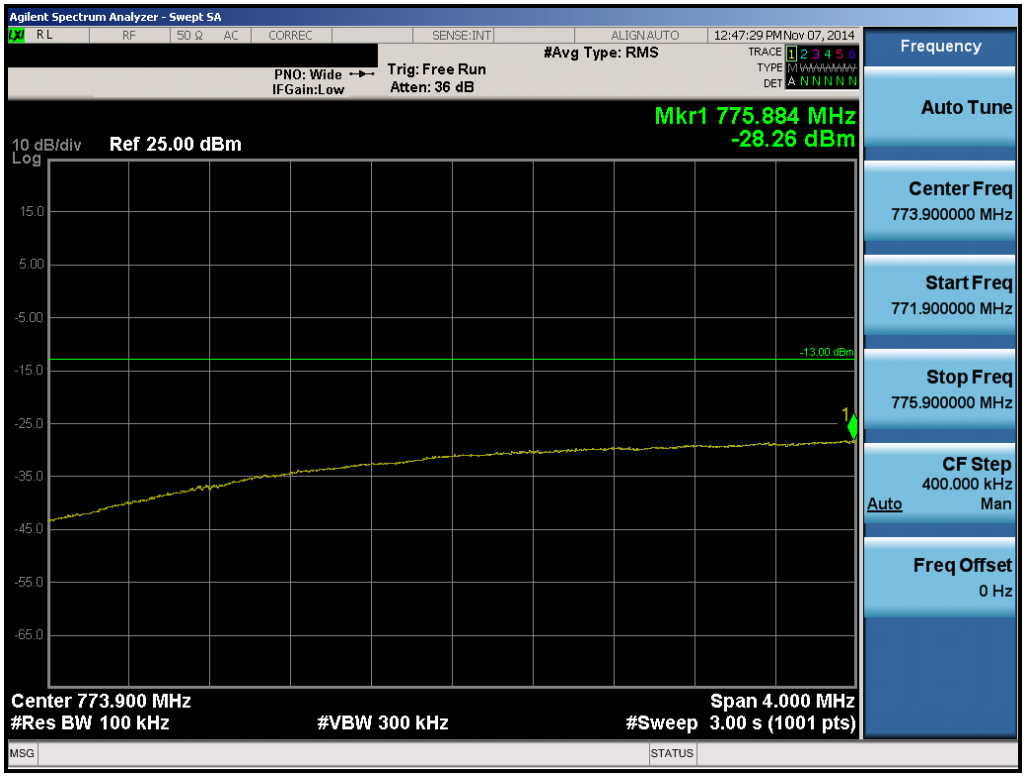

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-51. Upper Extended Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

**Plot 6-52. Upper Extended Band Edge Plot (Band 13 – 5.0MHz QPSK – RB Size 25)**

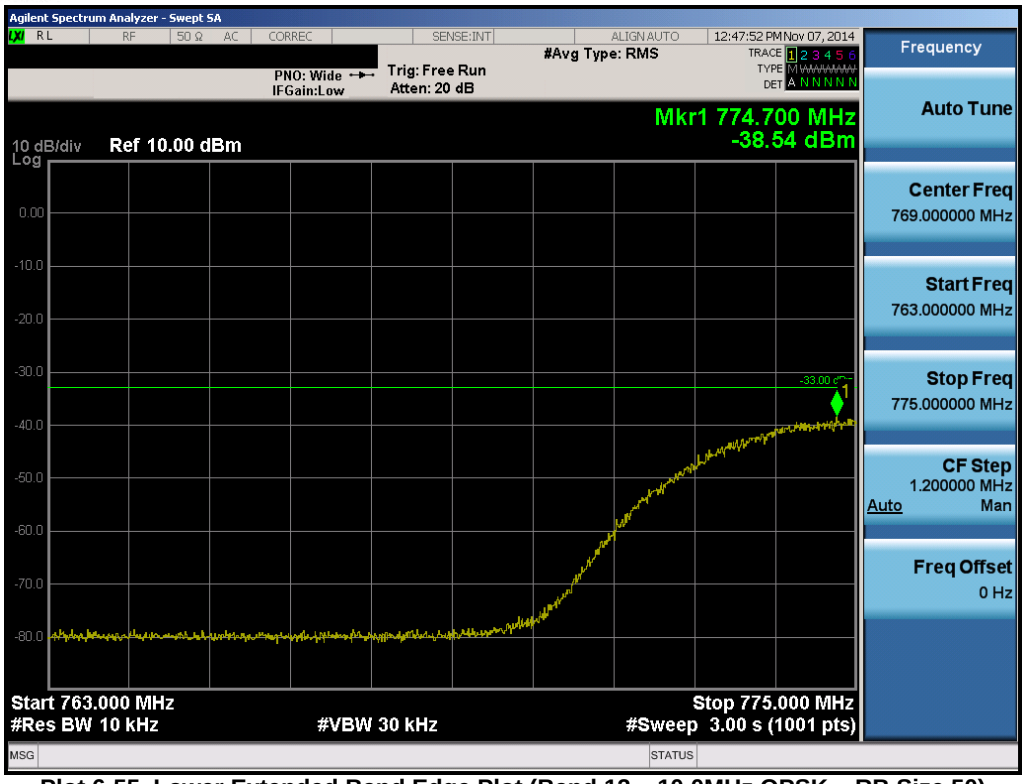

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-53. Lower Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**




**Plot 6-54. Lower Extended Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**

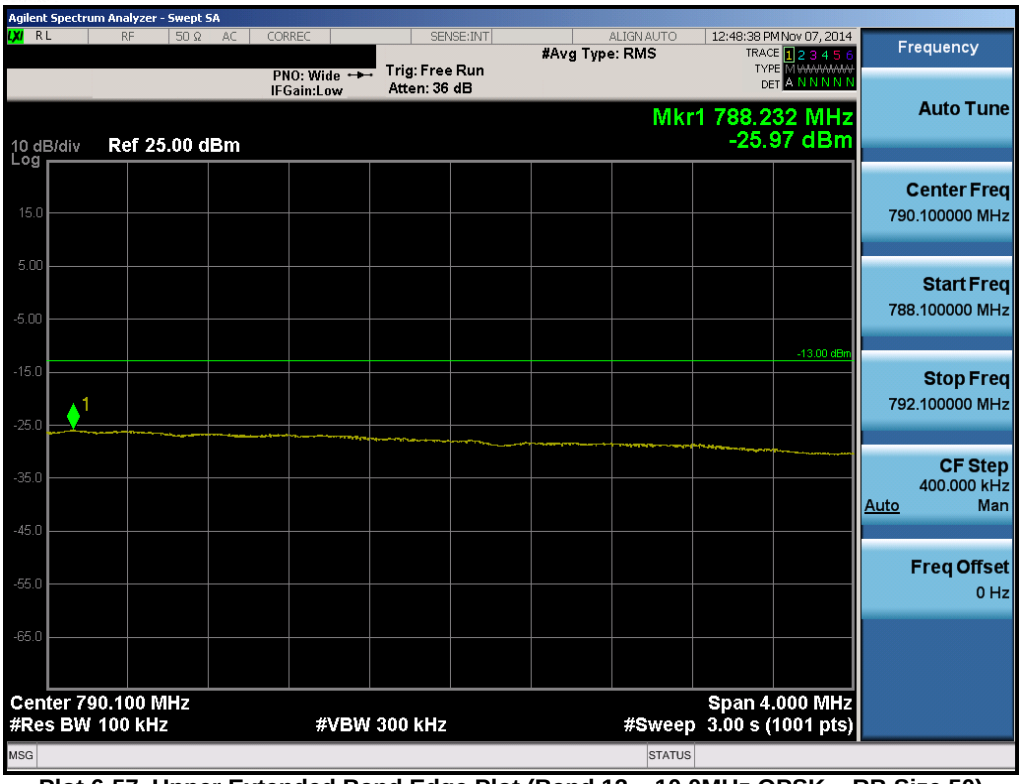

© 2014 PCTEST Engineering Laboratory, Inc.



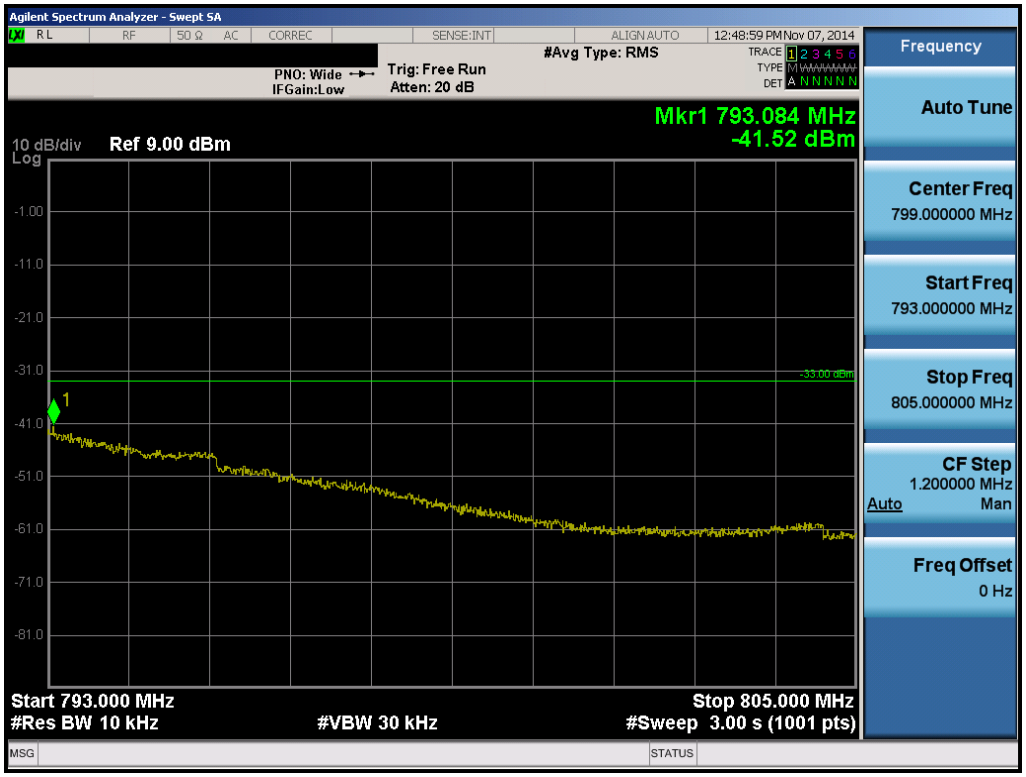

**Plot 6-55. Lower Extended Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**

**Plot 6-56. Upper Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

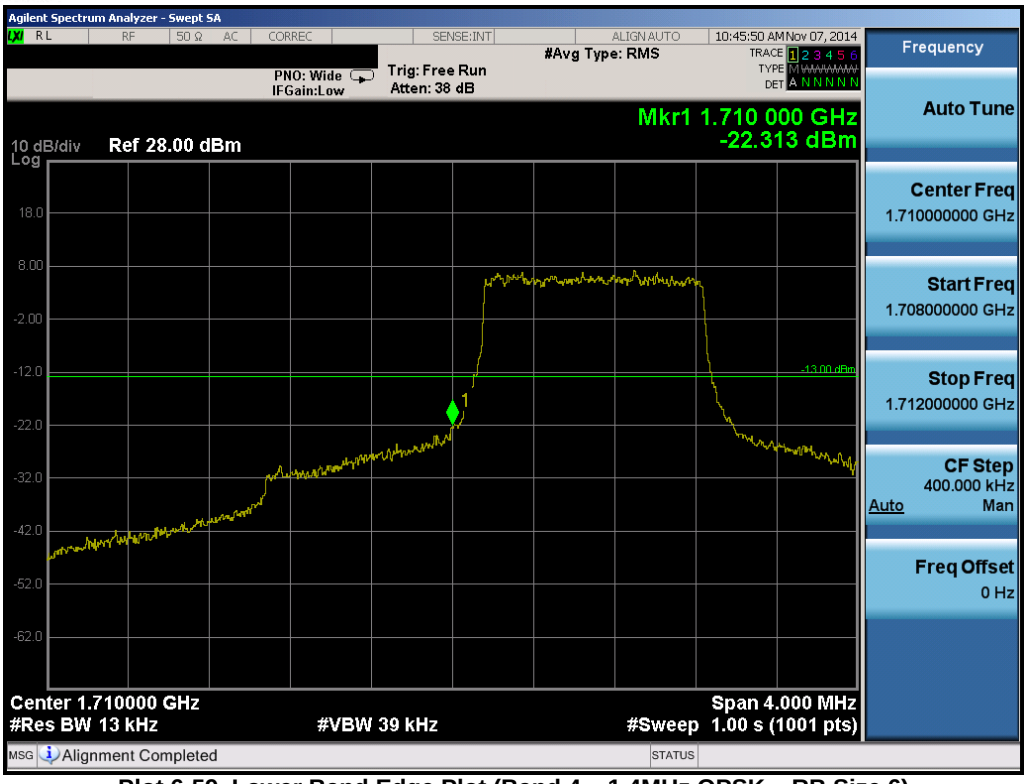



**Plot 6-57. Upper Extended Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**

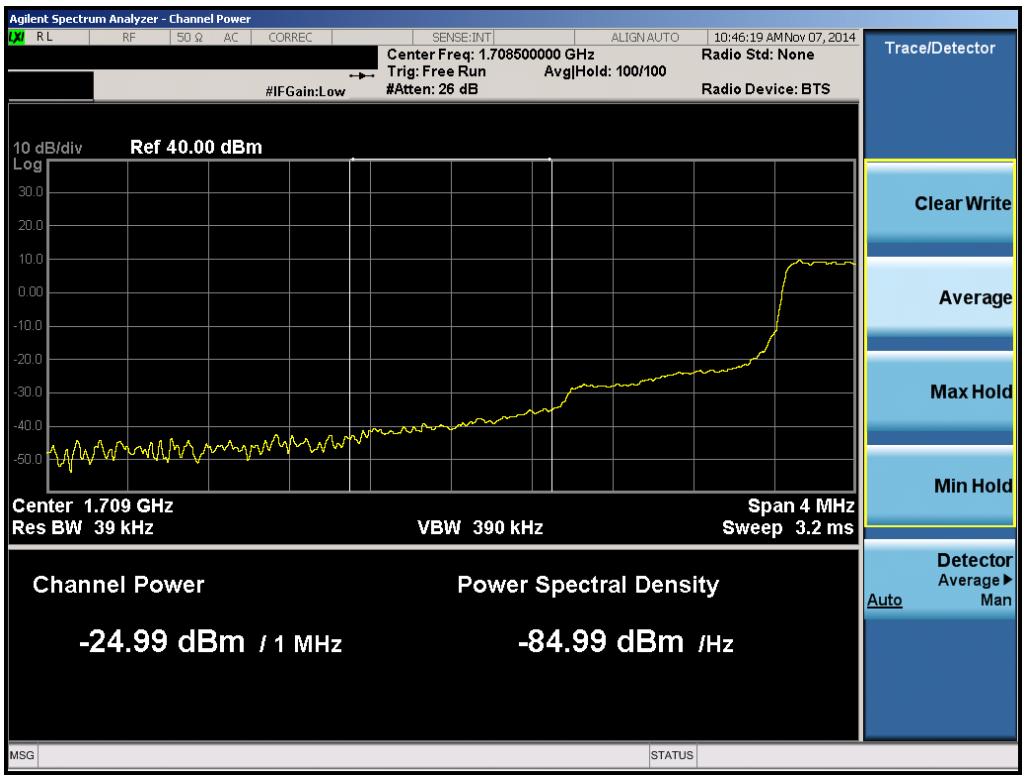



**Plot 6-58. Upper Extended Band Edge Plot (Band 13 – 10.0MHz QPSK – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.



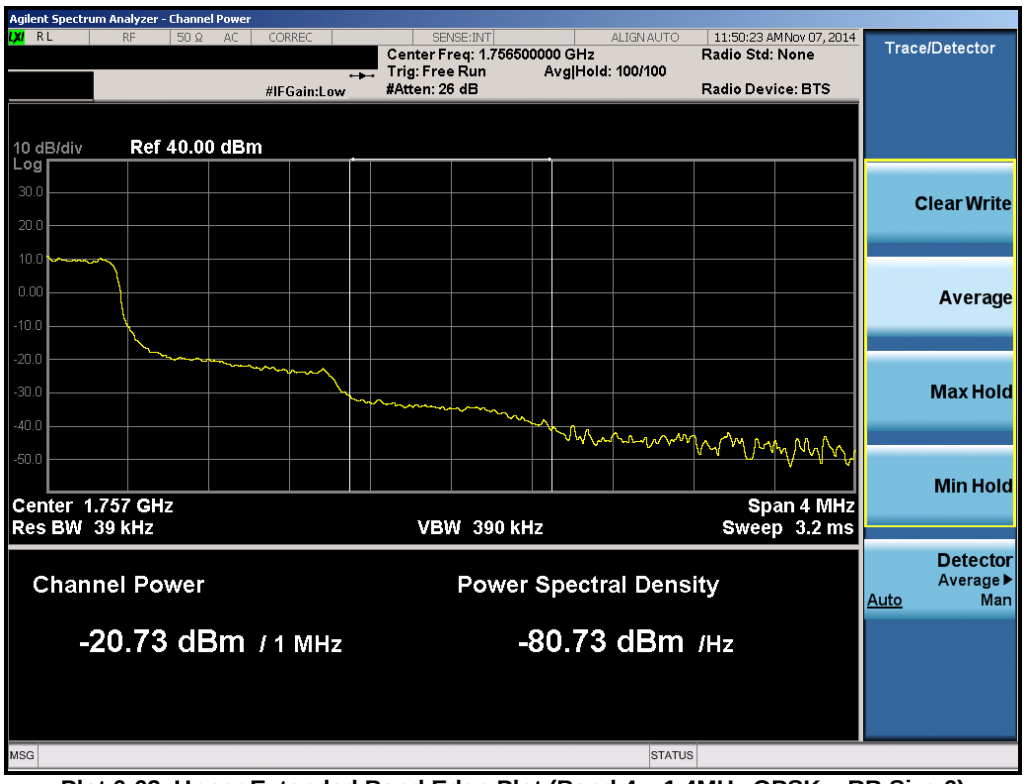

**Plot 6-59. Lower Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)**




**Plot 6-60. Lower Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)**

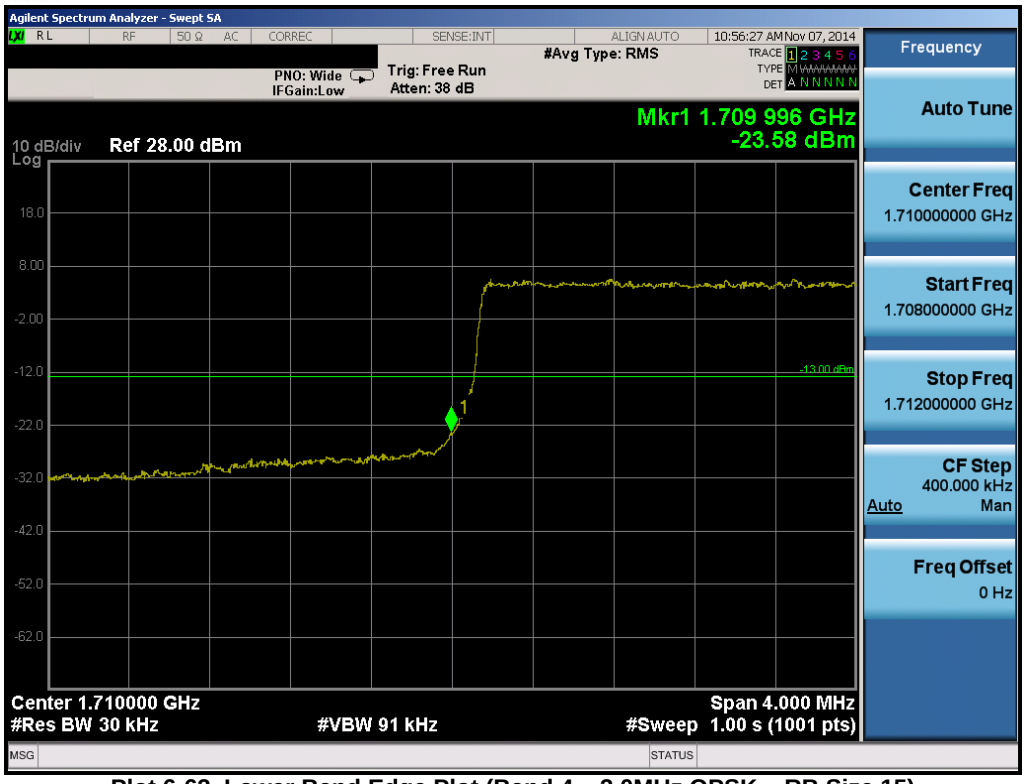

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-61. Upper Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)**

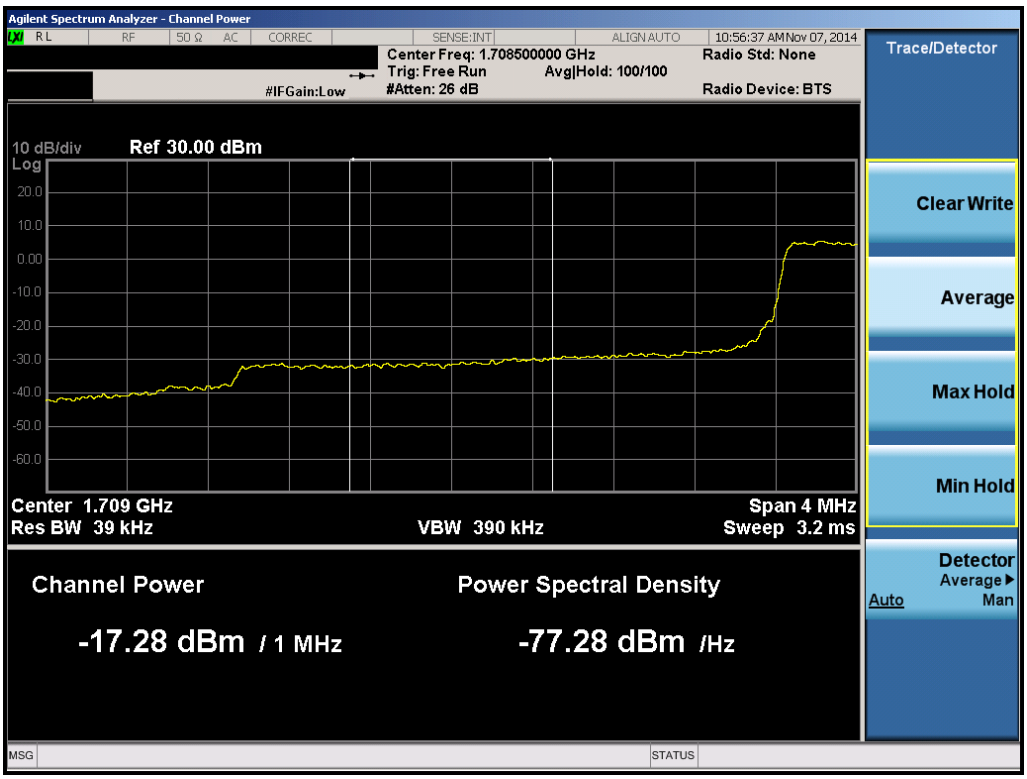



**Plot 6-62. Upper Extended Band Edge Plot (Band 4 – 1.4MHz QPSK – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.



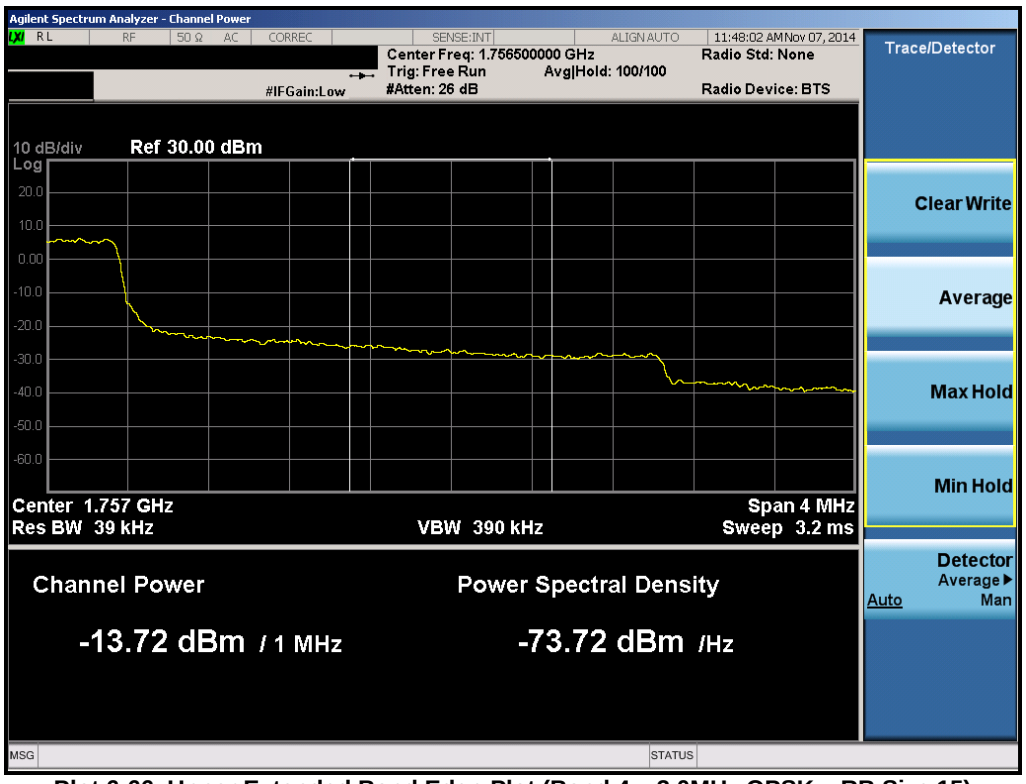

**Plot 6-63. Lower Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)**




**Plot 6-64. Lower Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)**

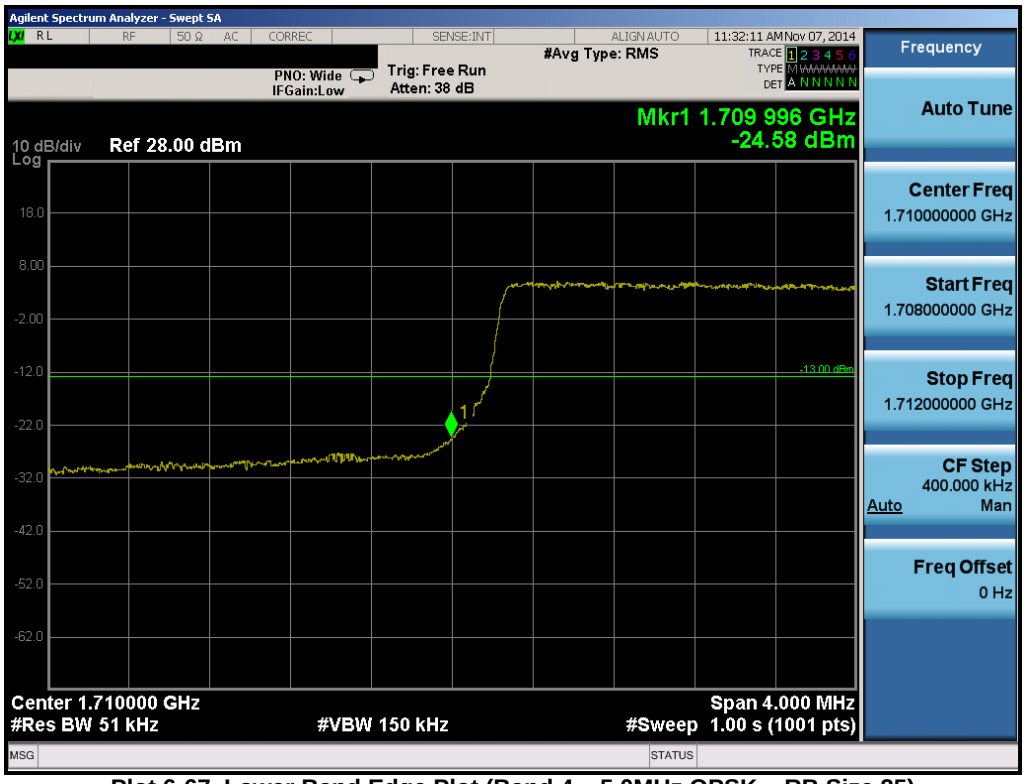

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-65. Upper Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)**

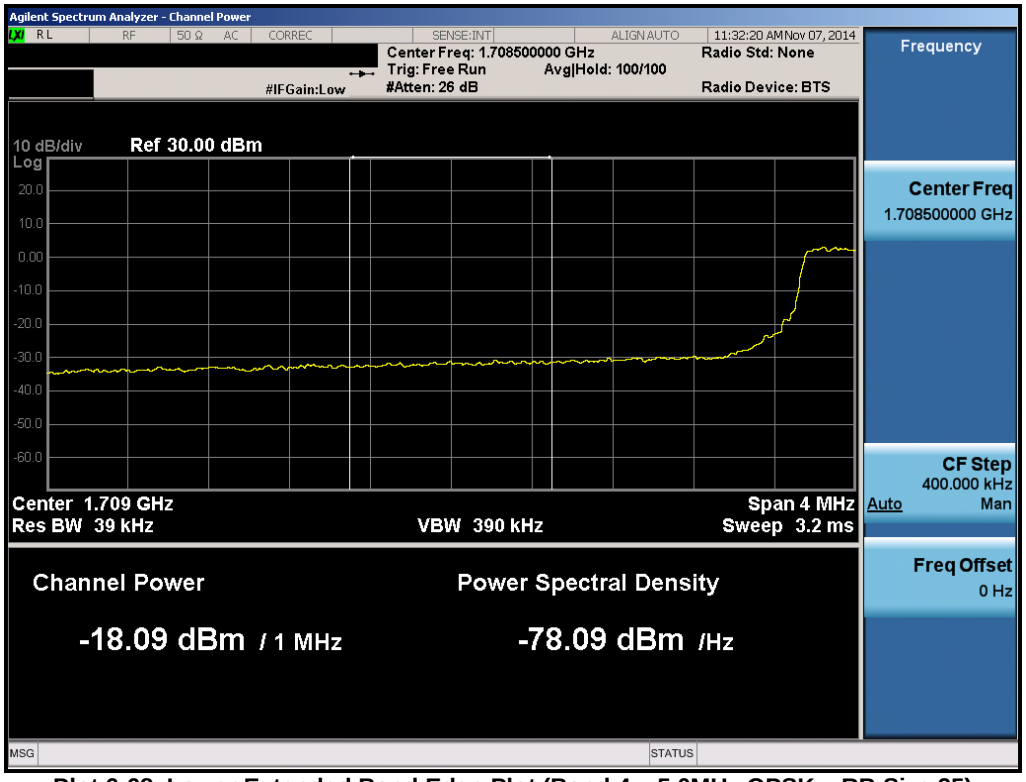



**Plot 6-66. Upper Extended Band Edge Plot (Band 4 – 3.0MHz QPSK – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.



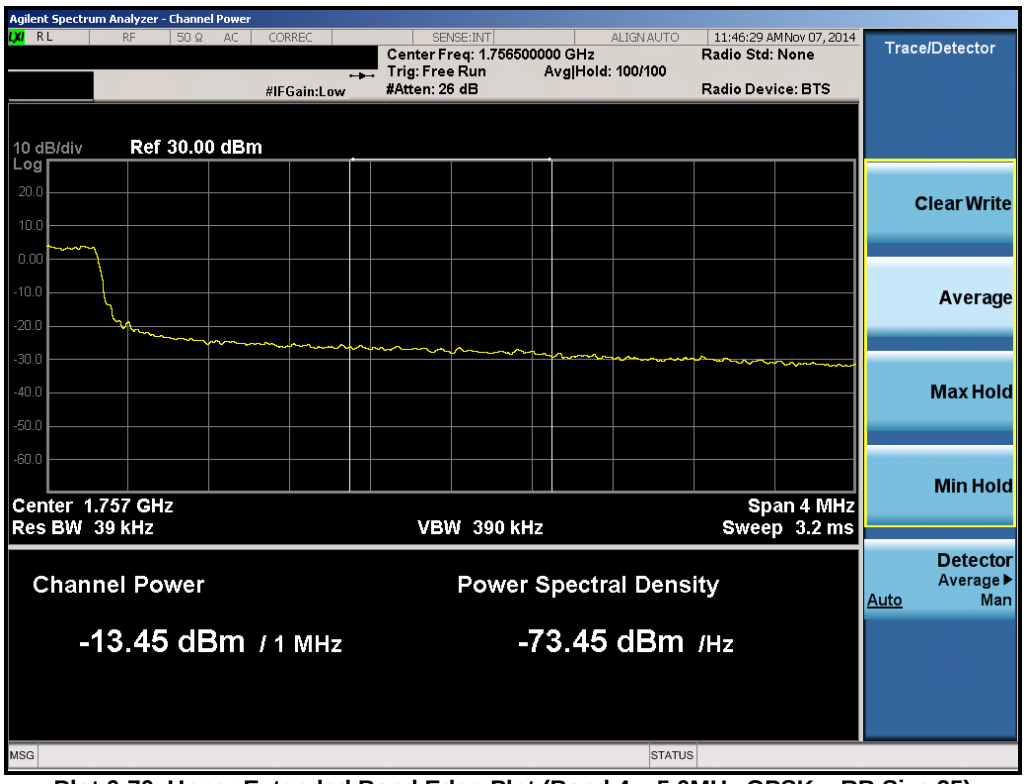

**Plot 6-67. Lower Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)**




**Plot 6-68. Lower Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)**

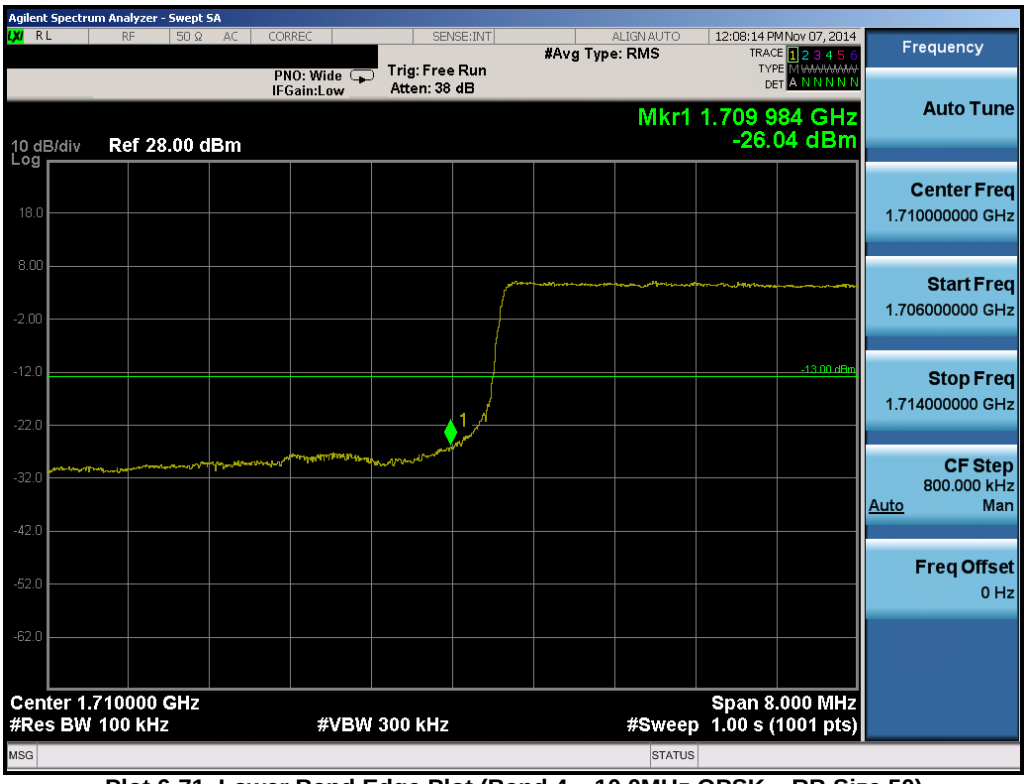

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-69. Upper Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)**

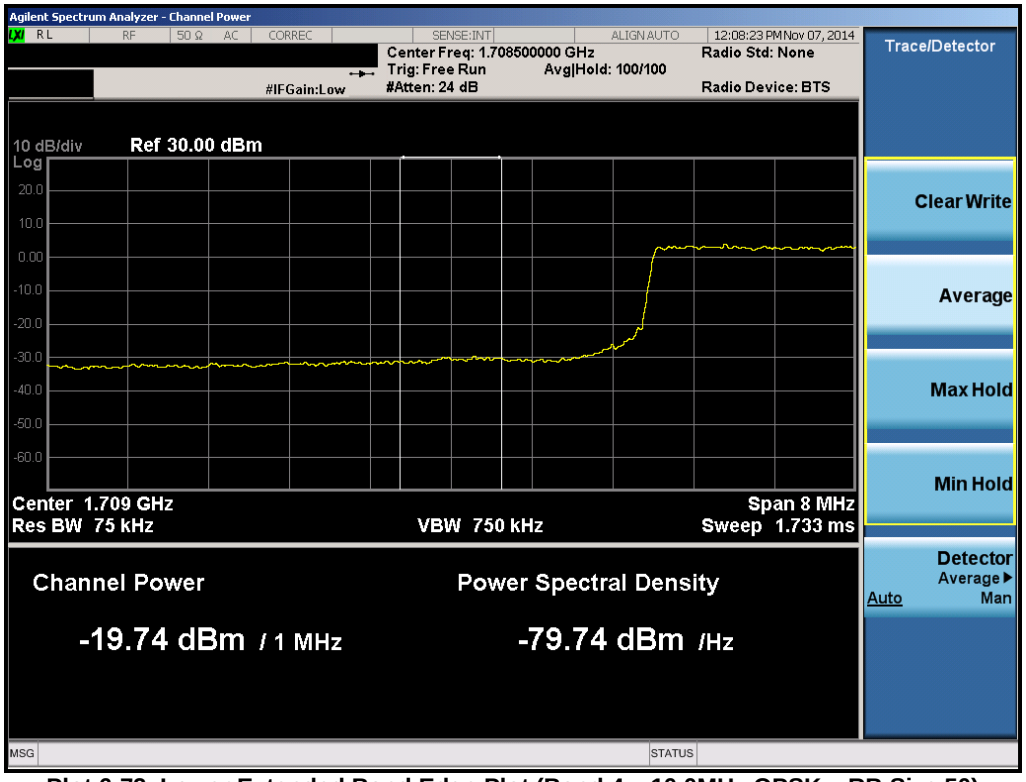



**Plot 6-70. Upper Extended Band Edge Plot (Band 4 – 5.0MHz QPSK – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.



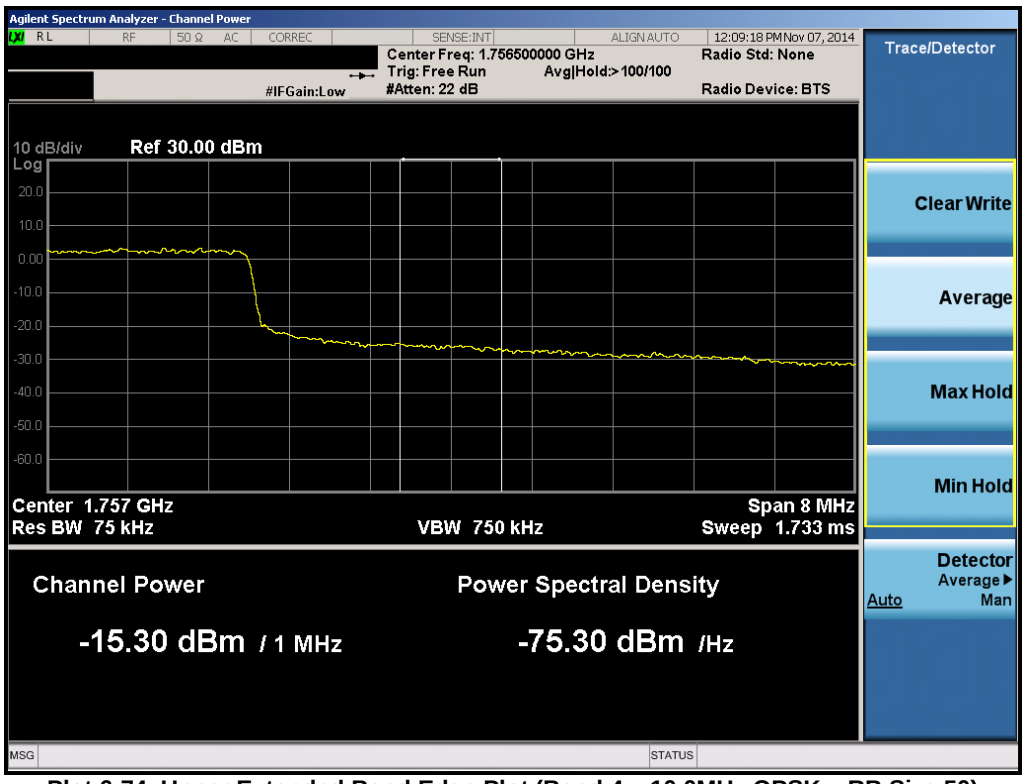

**Plot 6-71. Lower Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)**




**Plot 6-72. Lower Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)**

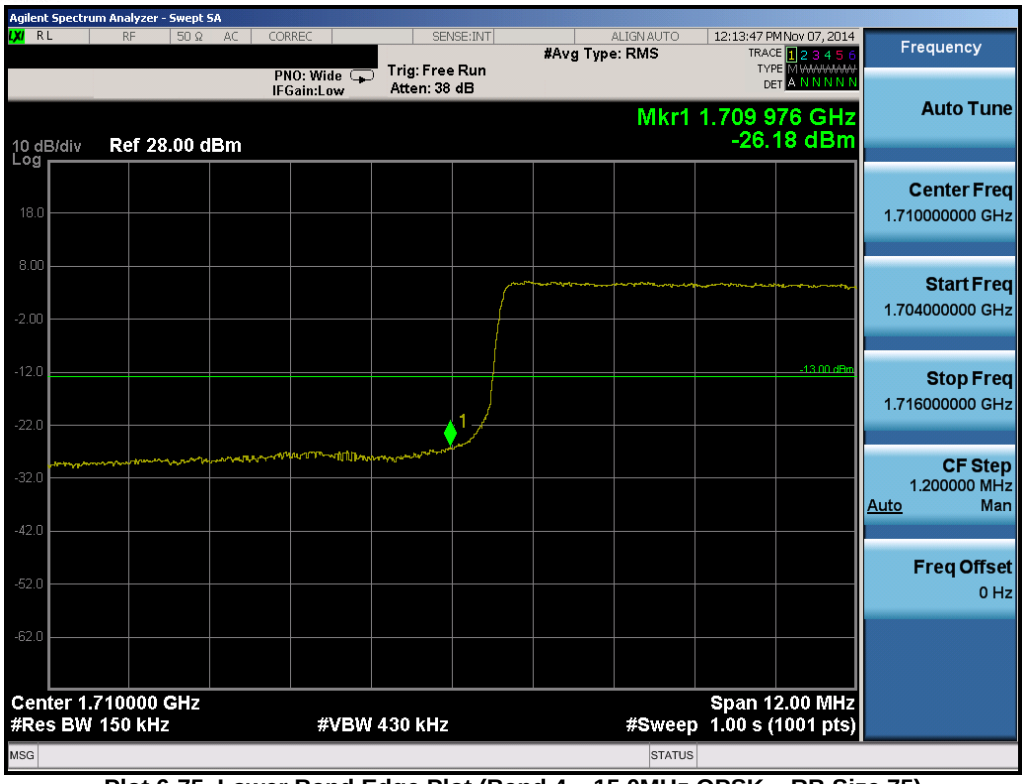

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-73. Upper Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)**

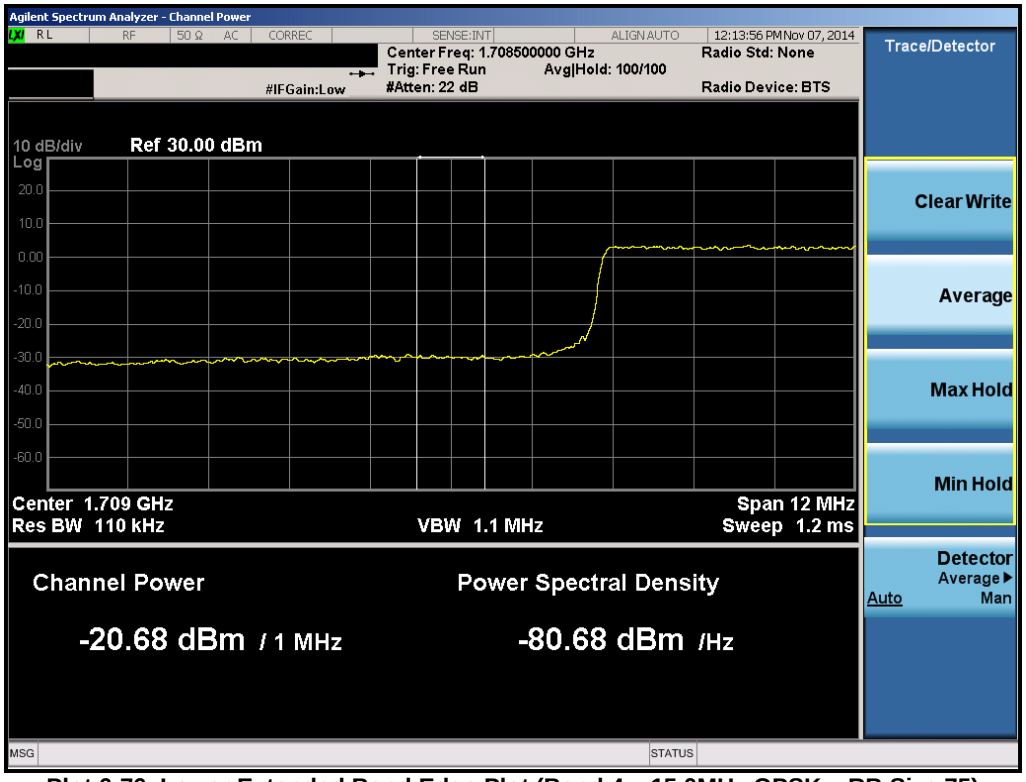



**Plot 6-74. Upper Extended Band Edge Plot (Band 4 – 10.0MHz QPSK – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.



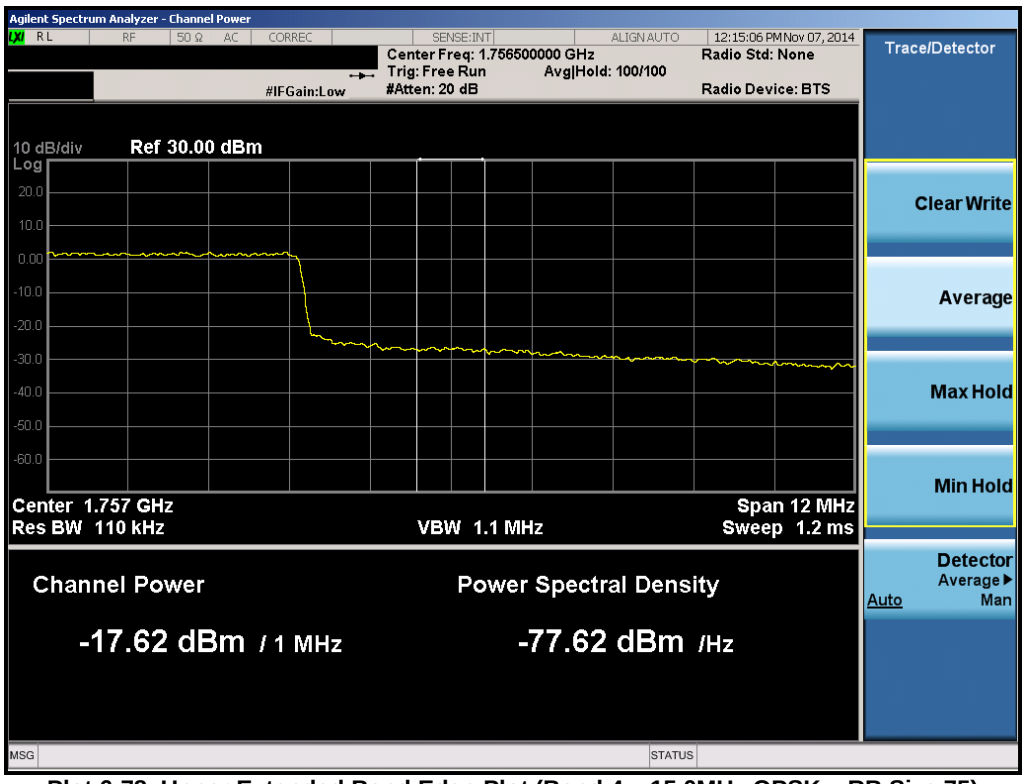

**Plot 6-75. Lower Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)**




**Plot 6-76. Lower Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)**

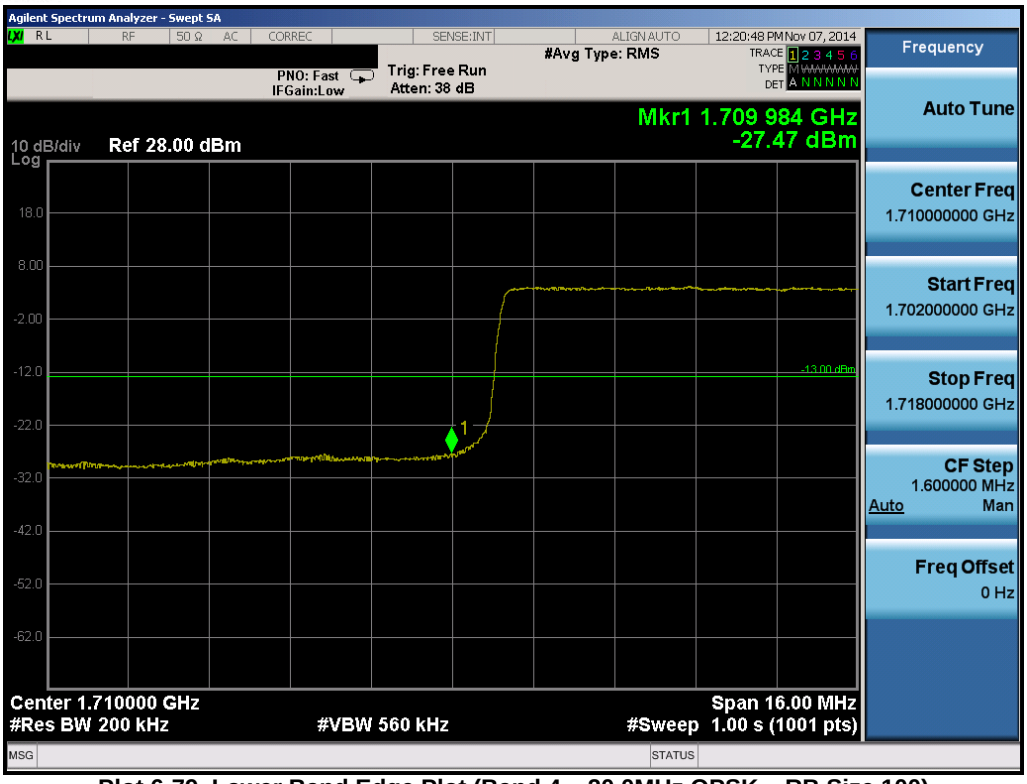

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-77. Upper Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)**

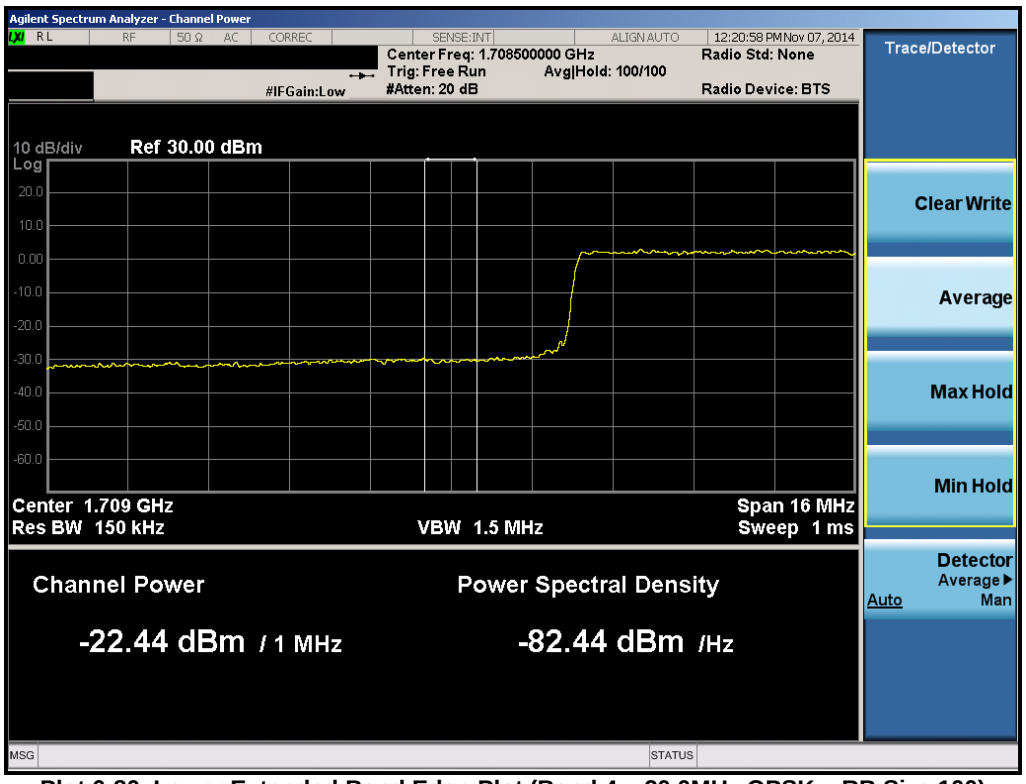



**Plot 6-78. Upper Extended Band Edge Plot (Band 4 – 15.0MHz QPSK – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.



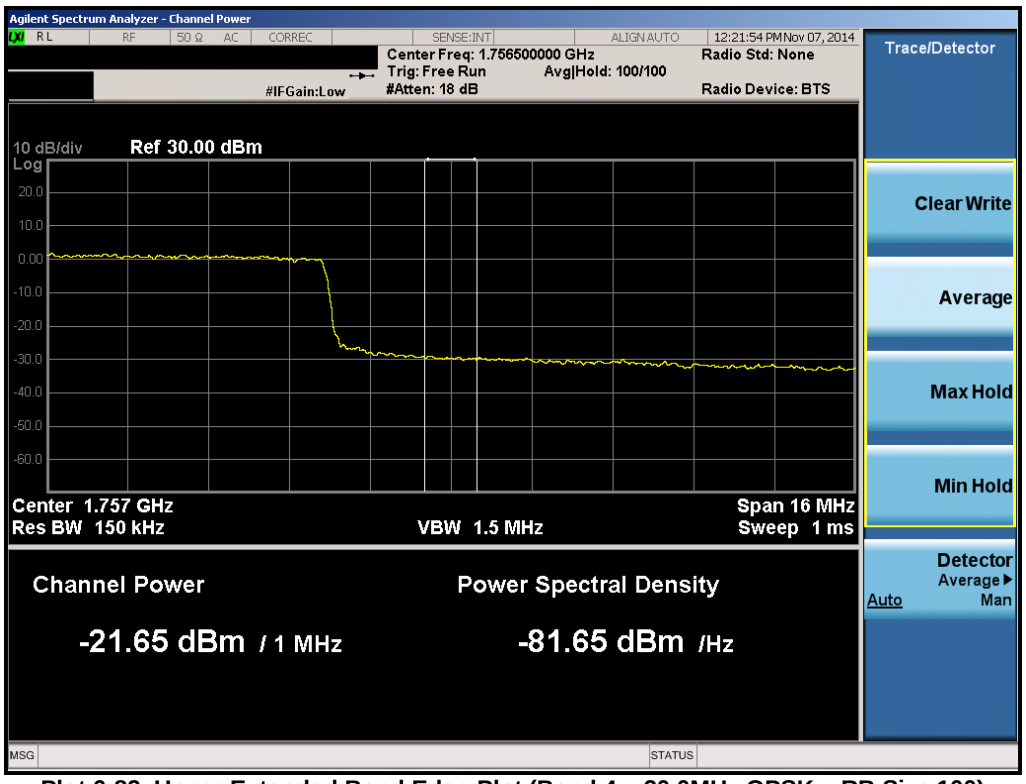

**Plot 6-79. Lower Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)**




**Plot 6-80. Lower Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)**

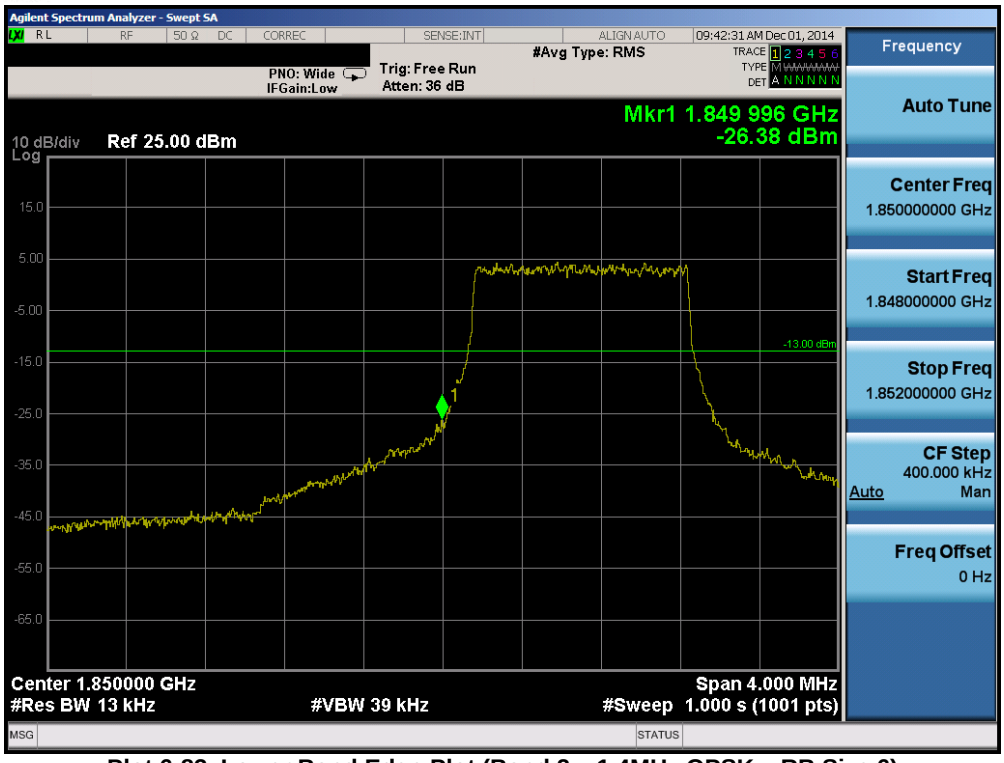

© 2014 PCTEST Engineering Laboratory, Inc.

**Plot 6-81. Upper Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)**

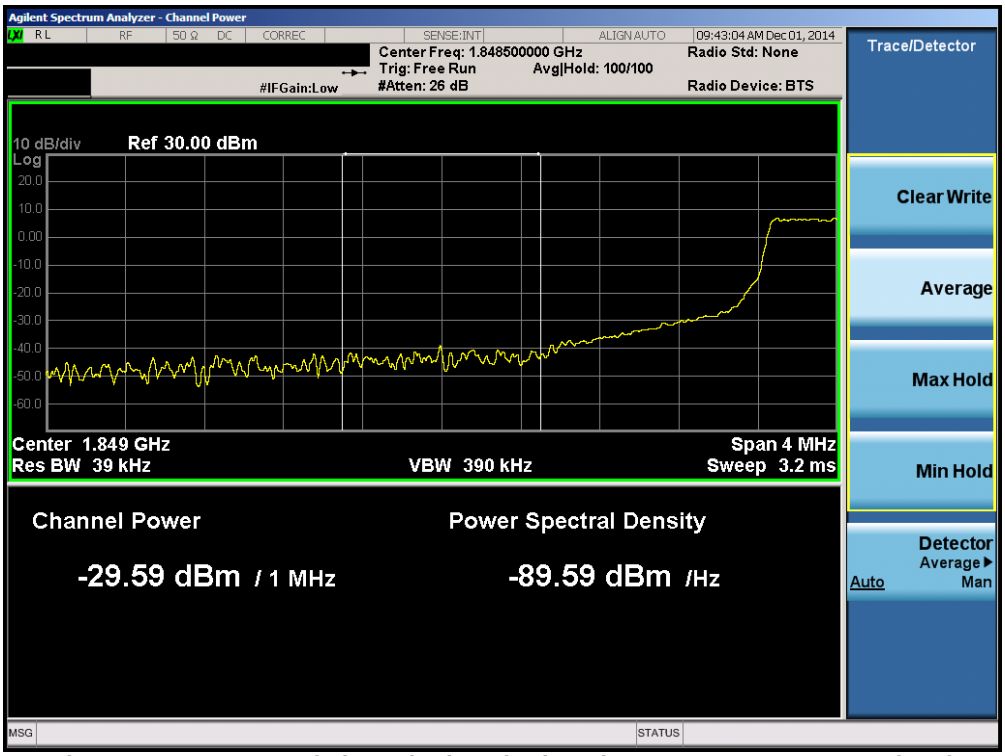



**Plot 6-82. Upper Extended Band Edge Plot (Band 4 – 20.0MHz QPSK – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.

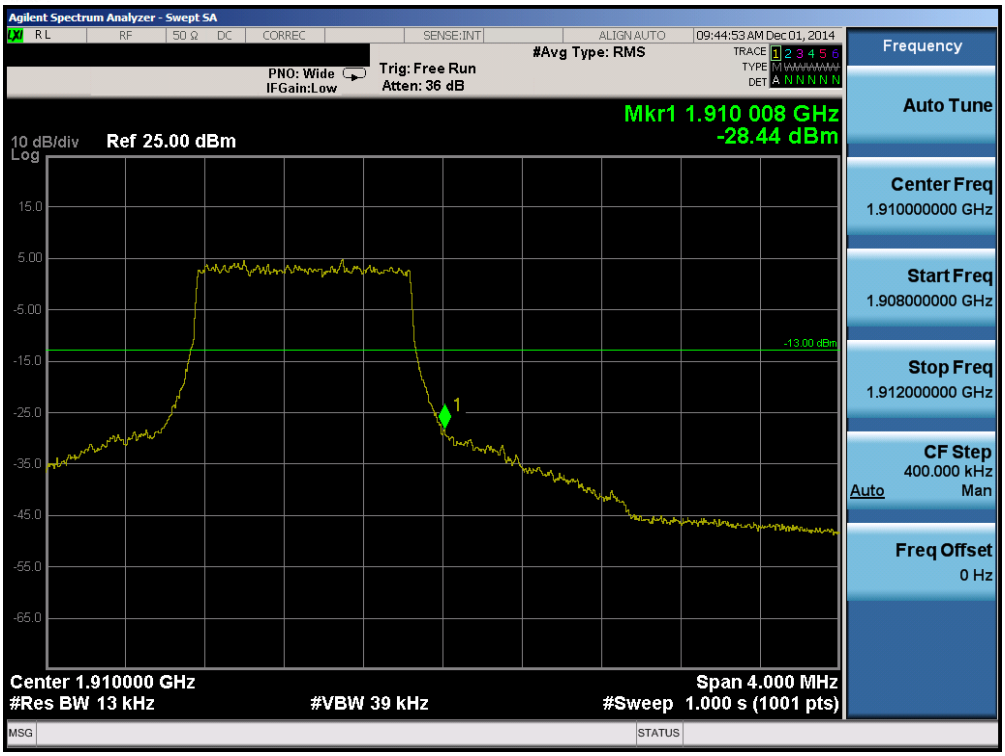



**Plot 6-83. Lower Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**

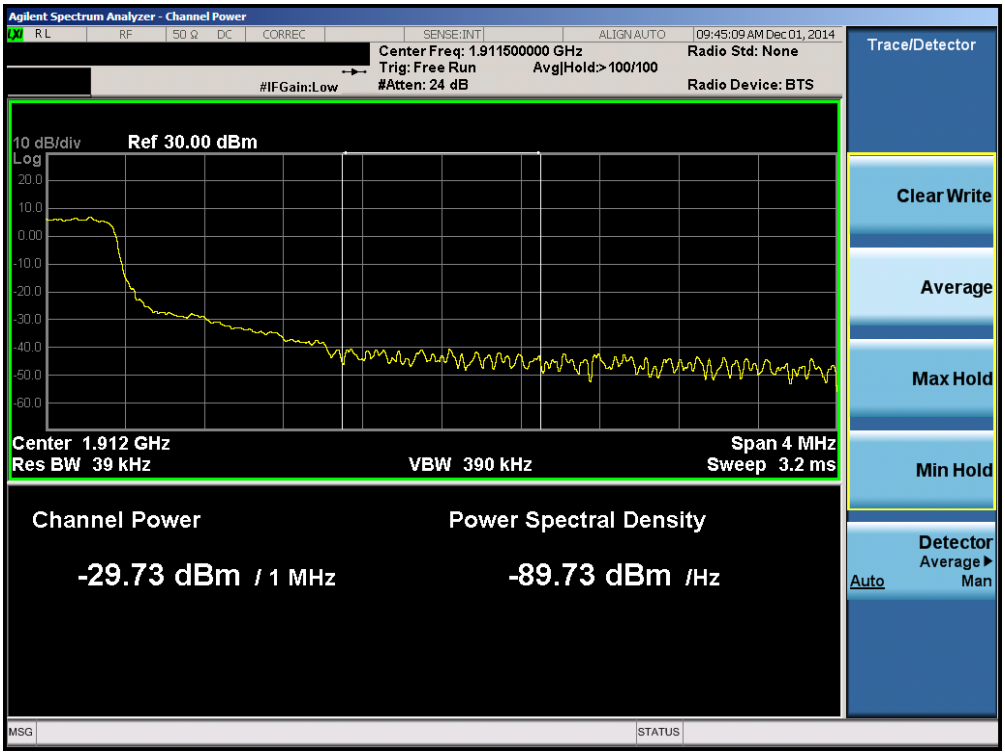



**Plot 6-84. Lower Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.

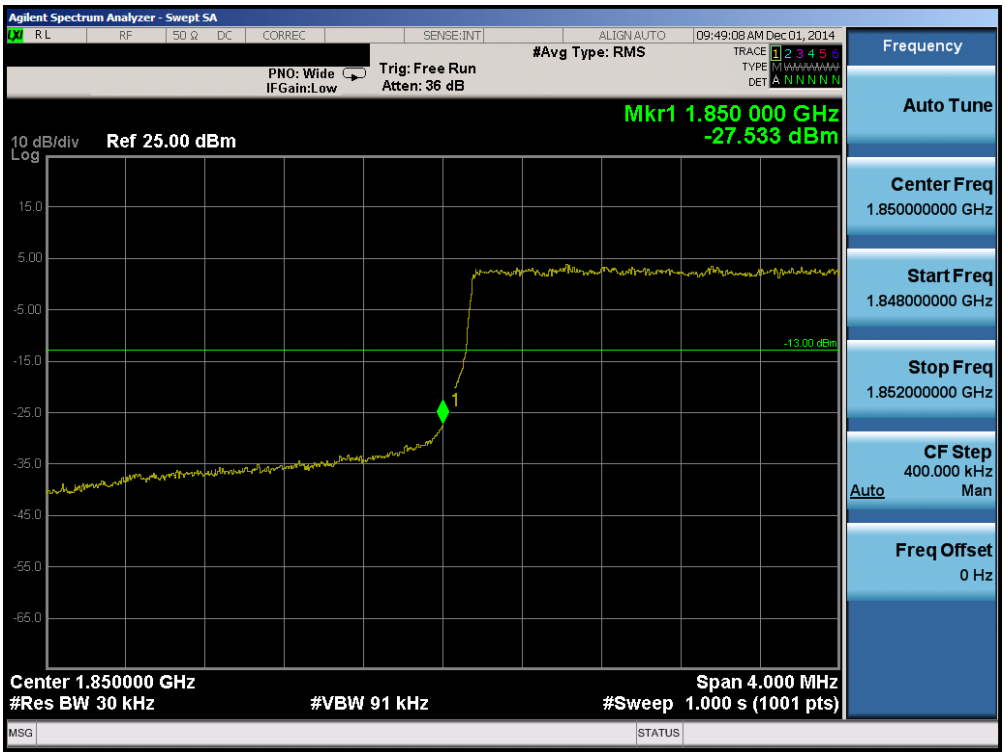



**Plot 6-85. Upper Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**

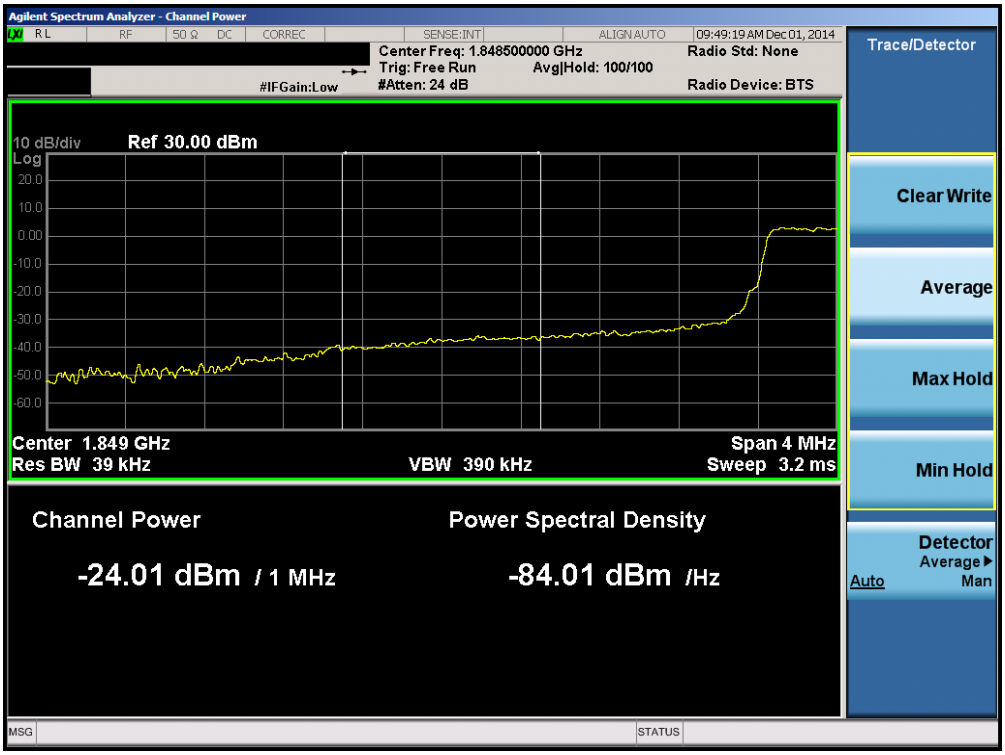



**Plot 6-86. Upper Extended Band Edge Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.

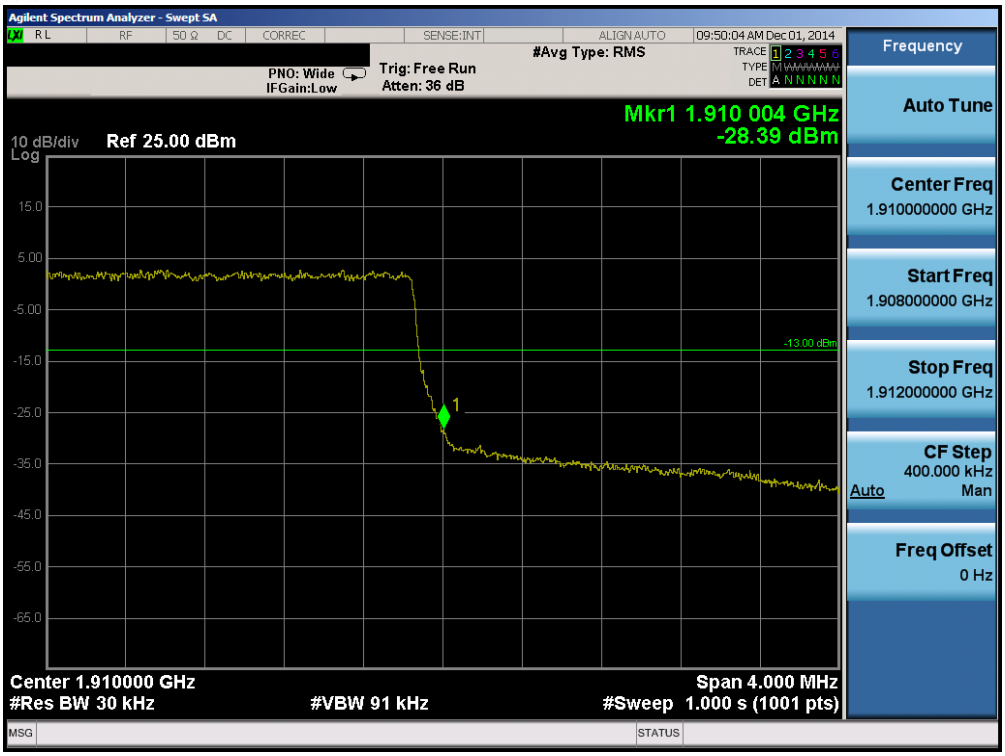



**Plot 6-87. Lower Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**

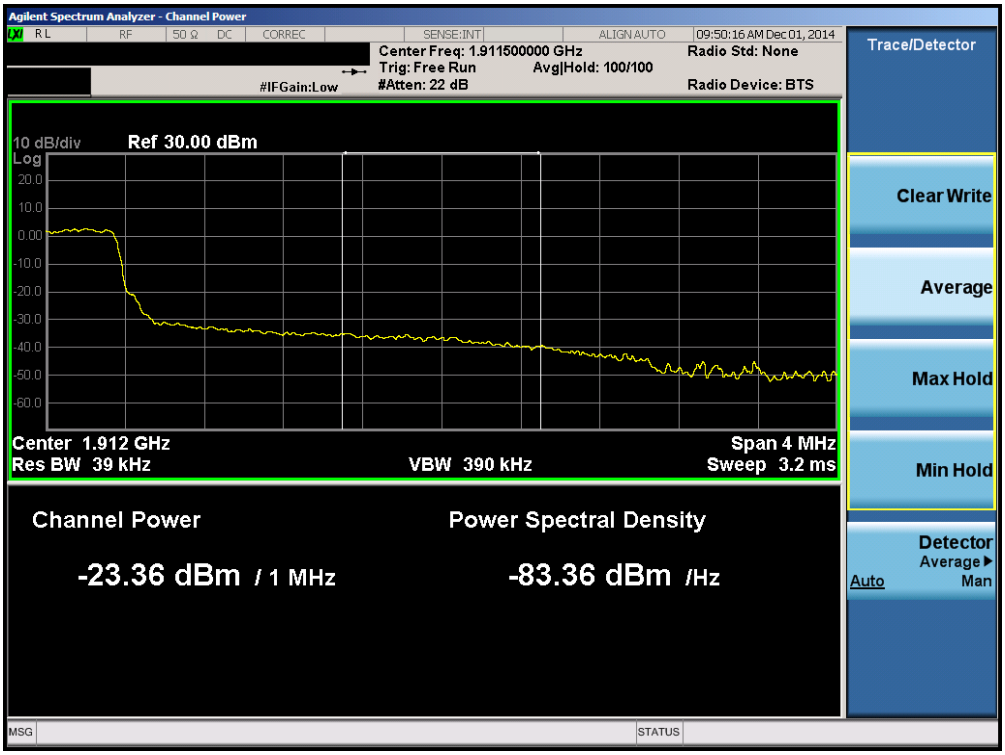



**Plot 6-88. Lower Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.

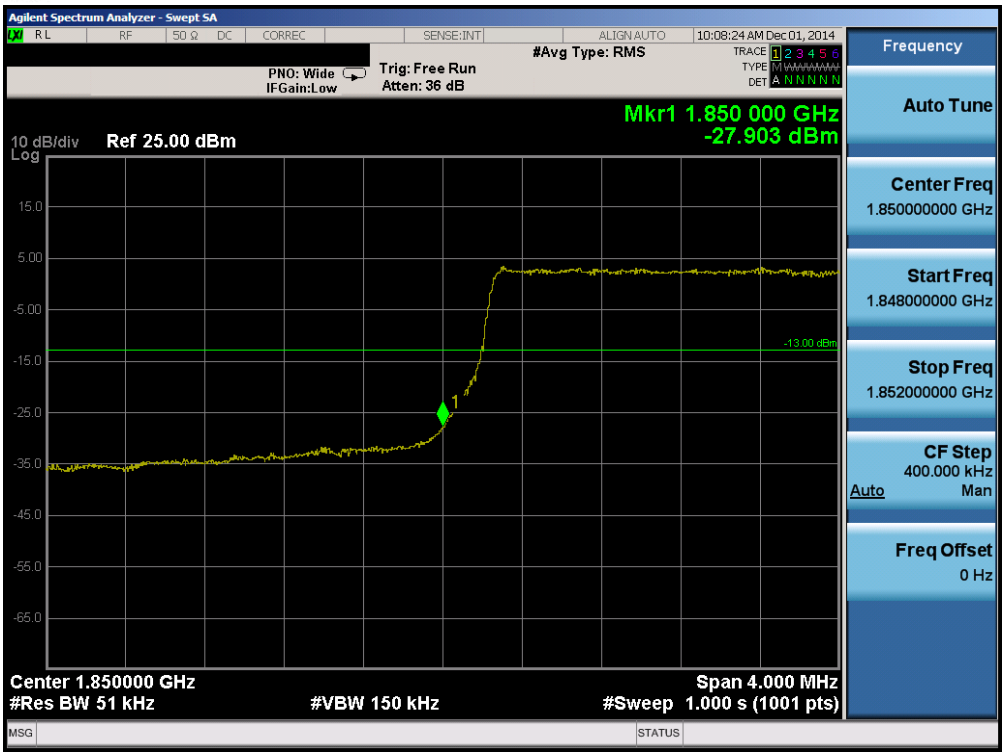



**Plot 6-89. Upper Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**

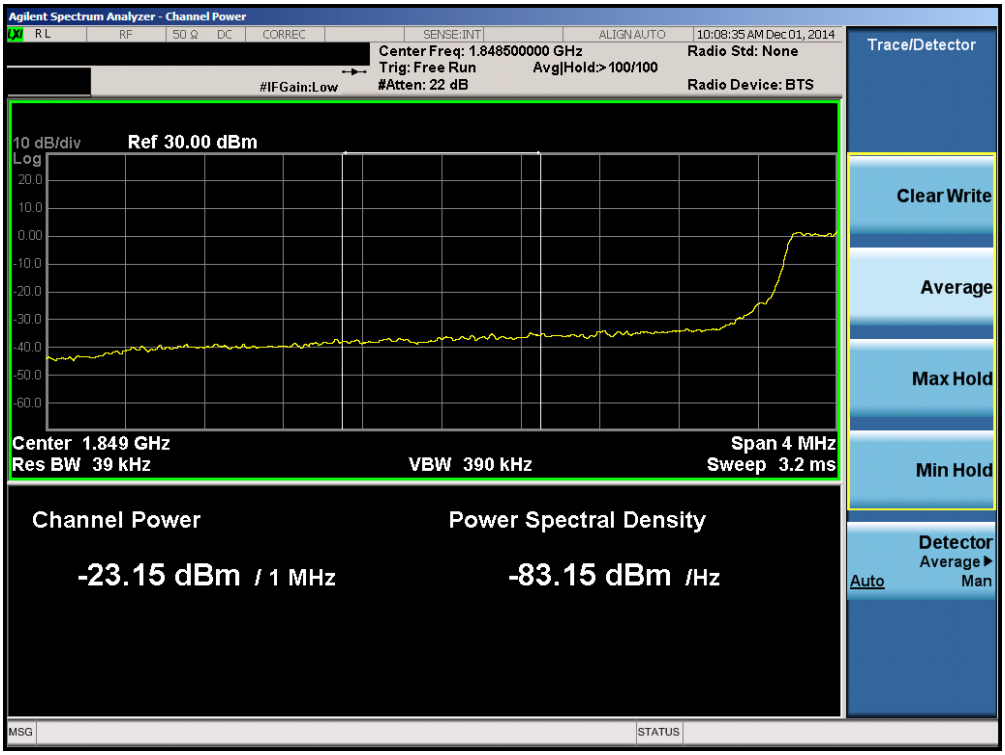



**Plot 6-90. Upper Extended Band Edge Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.



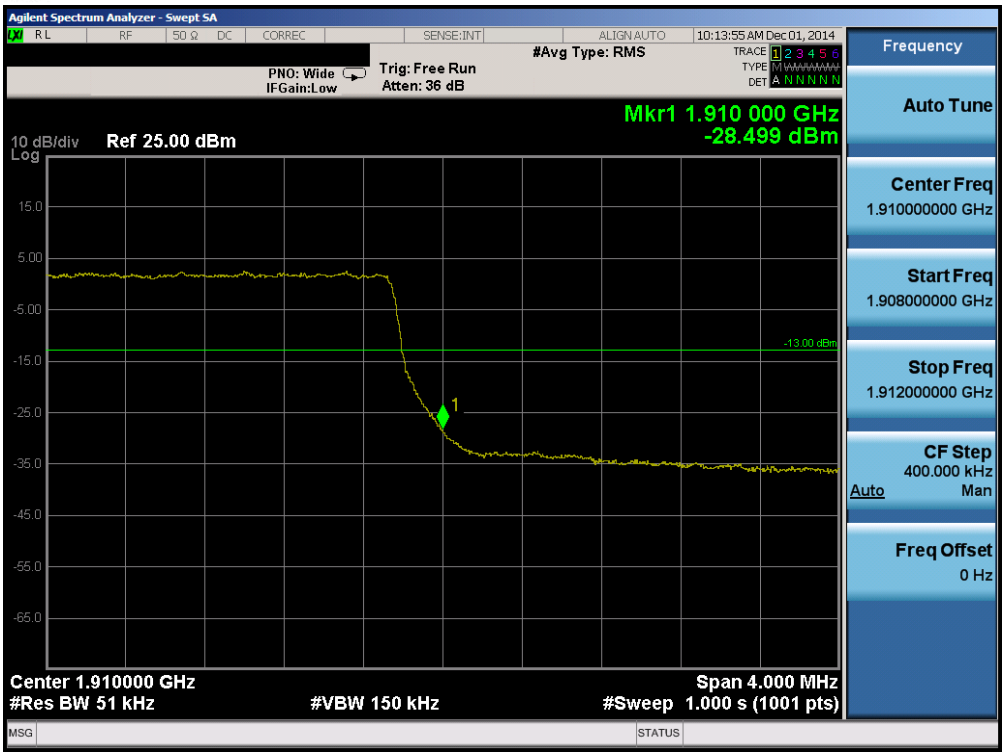

**Plot 6-91. Lower Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**



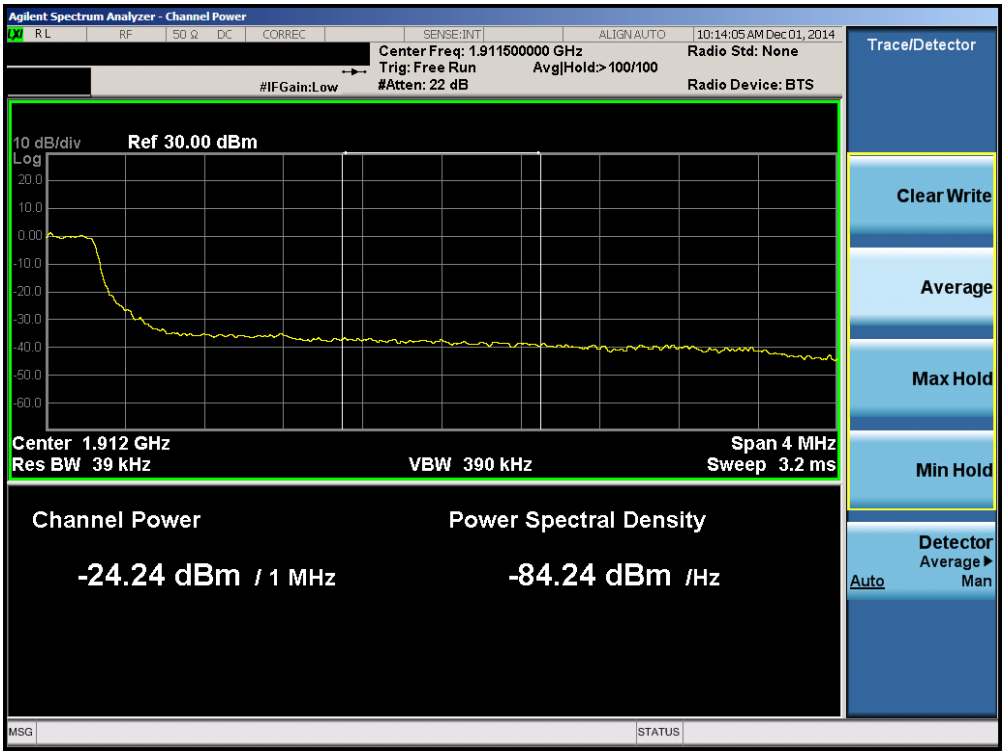

**Plot 6-92. Lower Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**



© 2014 PCTEST Engineering Laboratory, Inc.

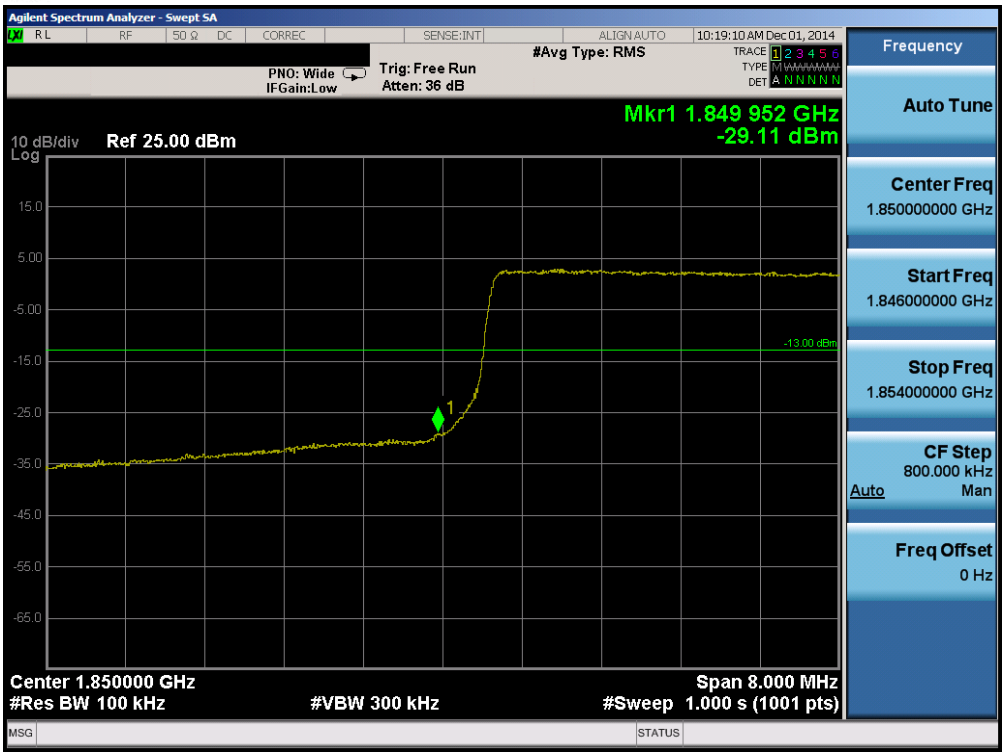



**Plot 6-93. Upper Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**

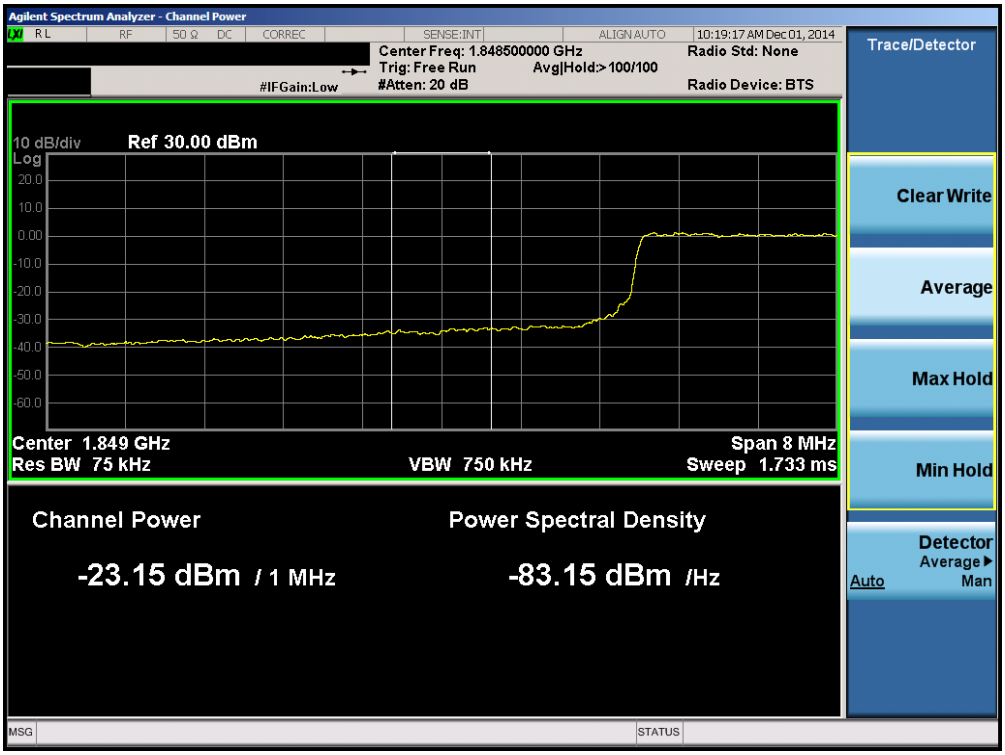



**Plot 6-94. Upper Extended Band Edge Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.

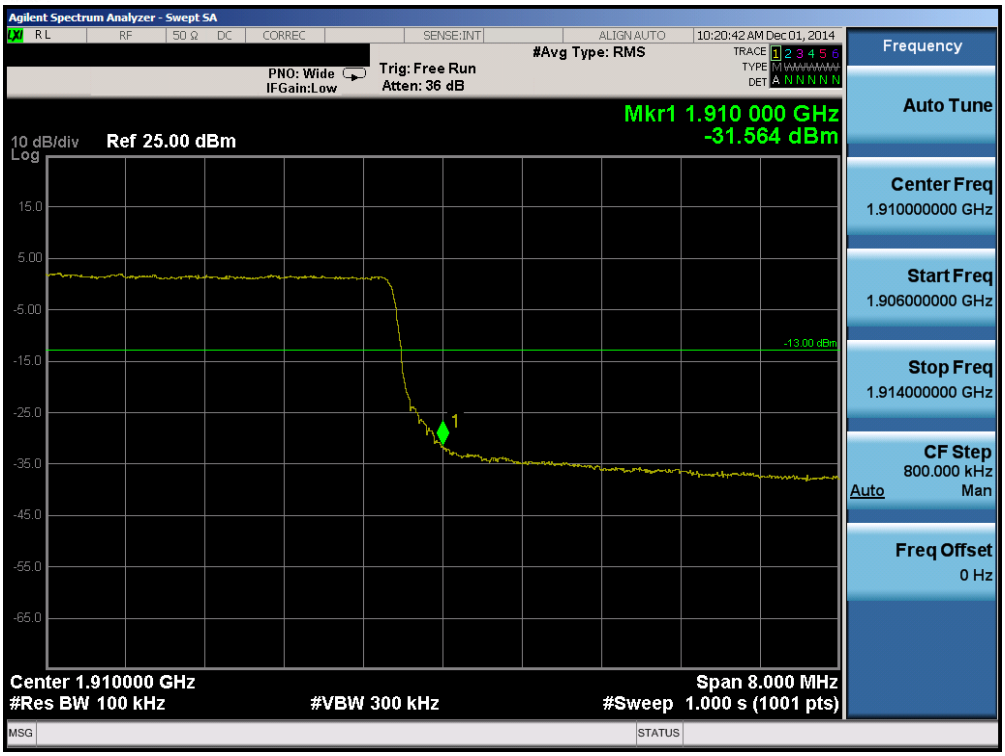



**Plot 6-95. Lower Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**

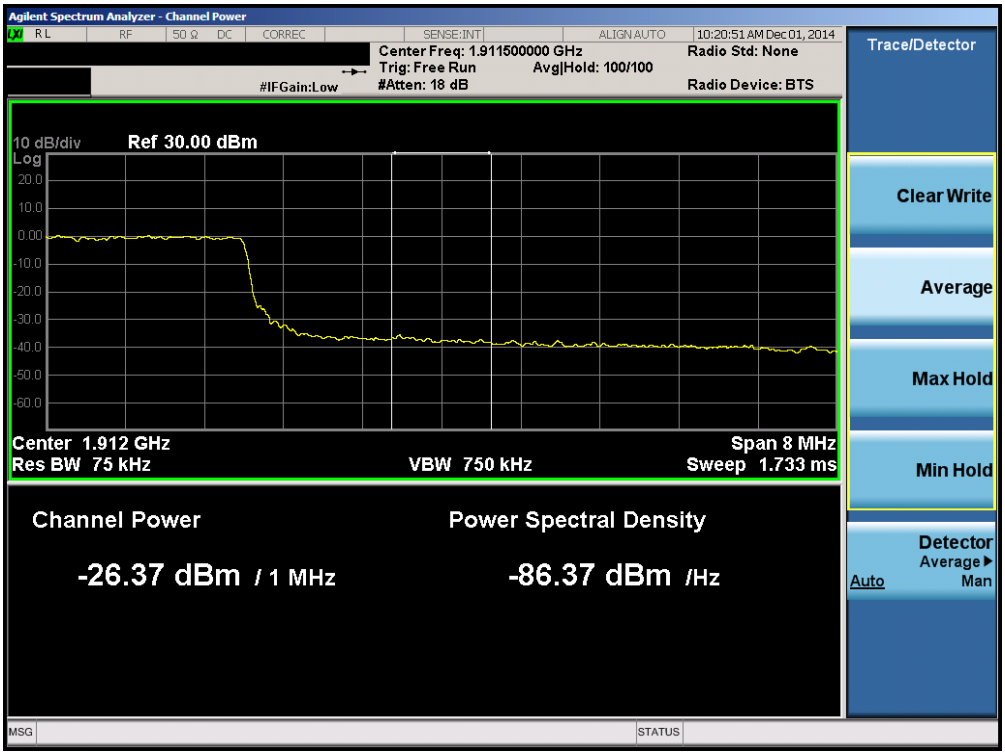



**Plot 6-96. Lower Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

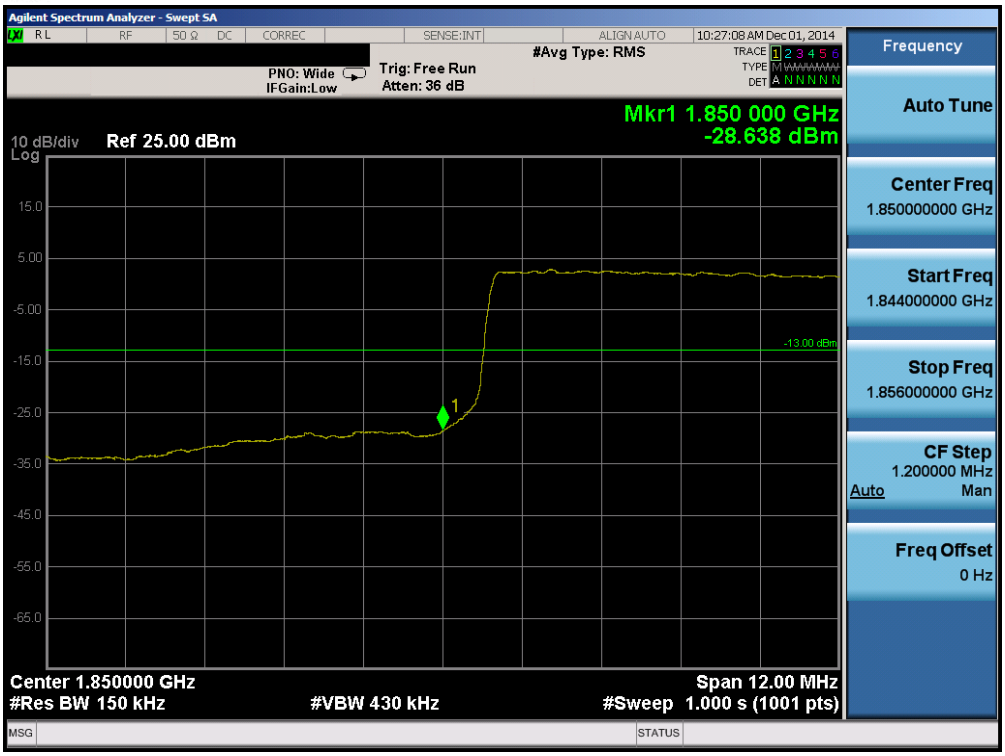



**Plot 6-97. Upper Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**

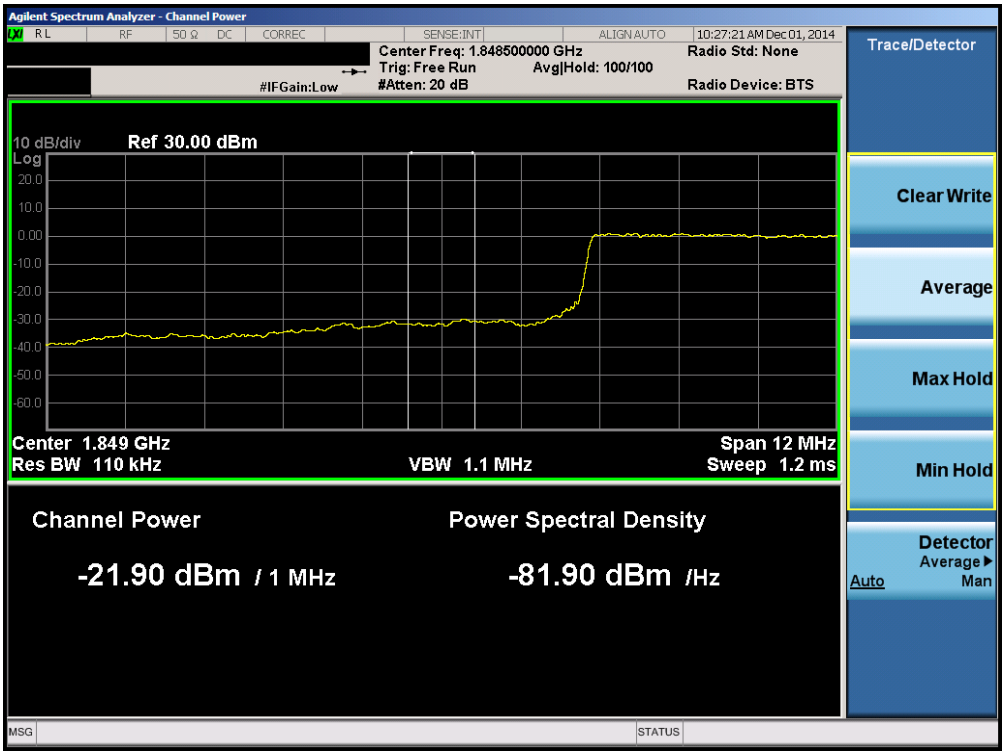



**Plot 6-98. Upper Extended Band Edge Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

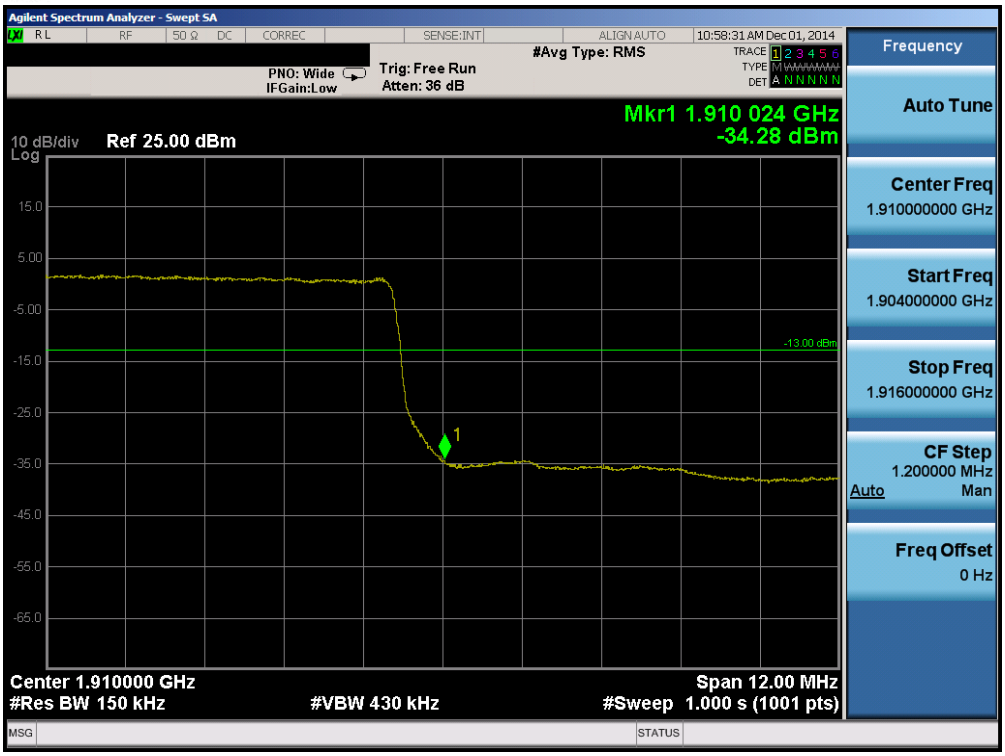



**Plot 6-99. Lower Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**

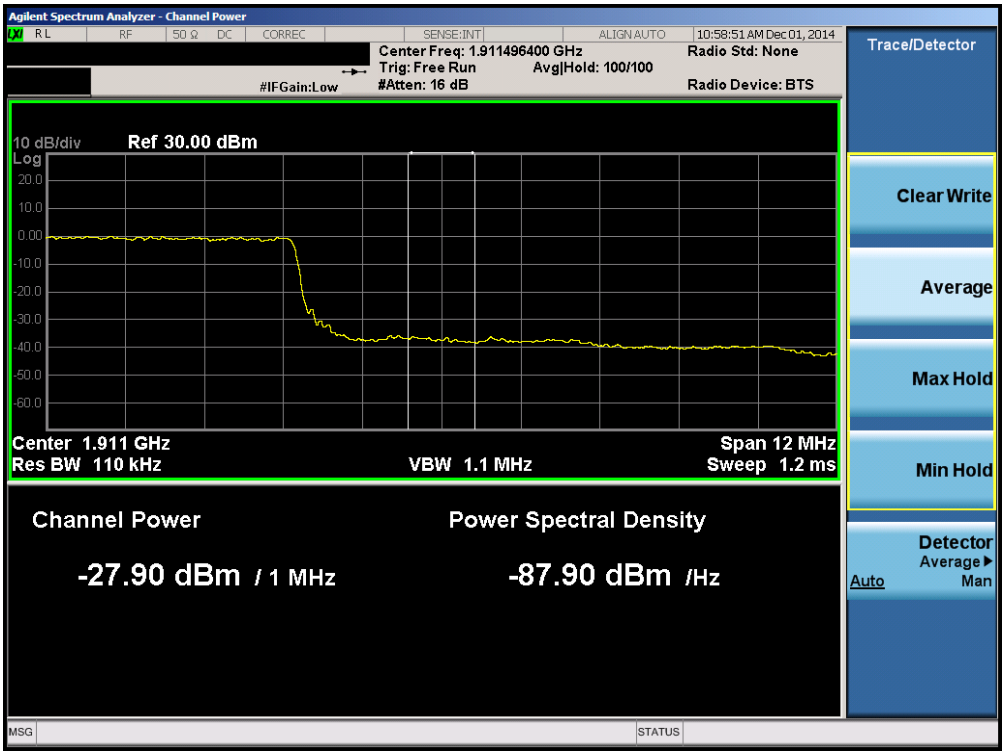



**Plot 6-100. Lower Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.

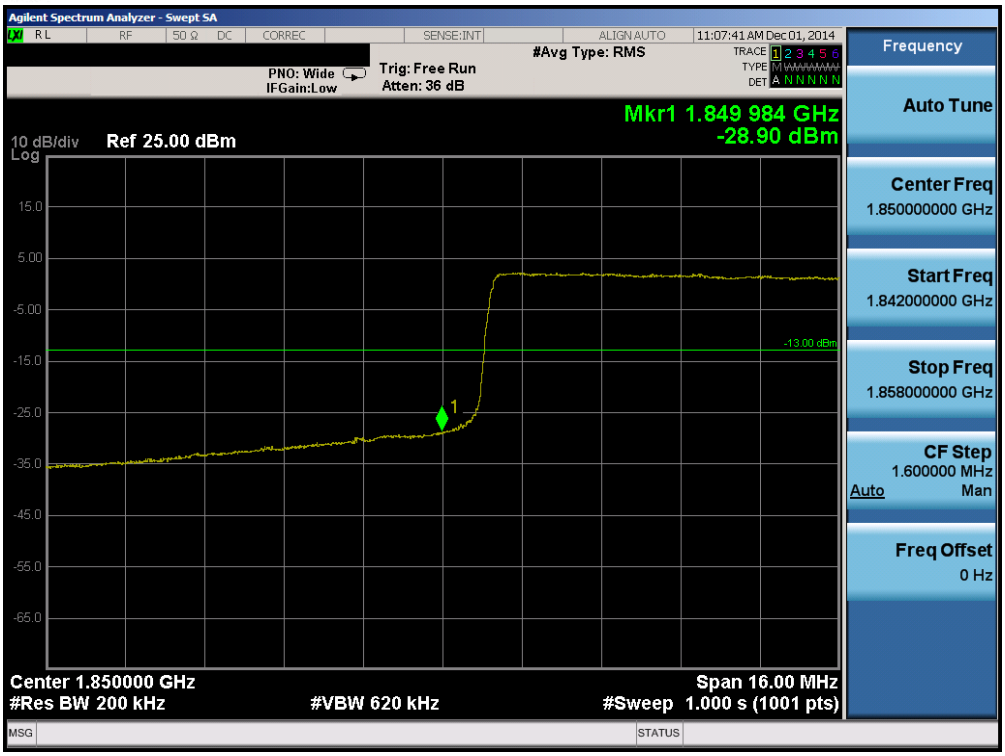



**Plot 6-101. Upper Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**

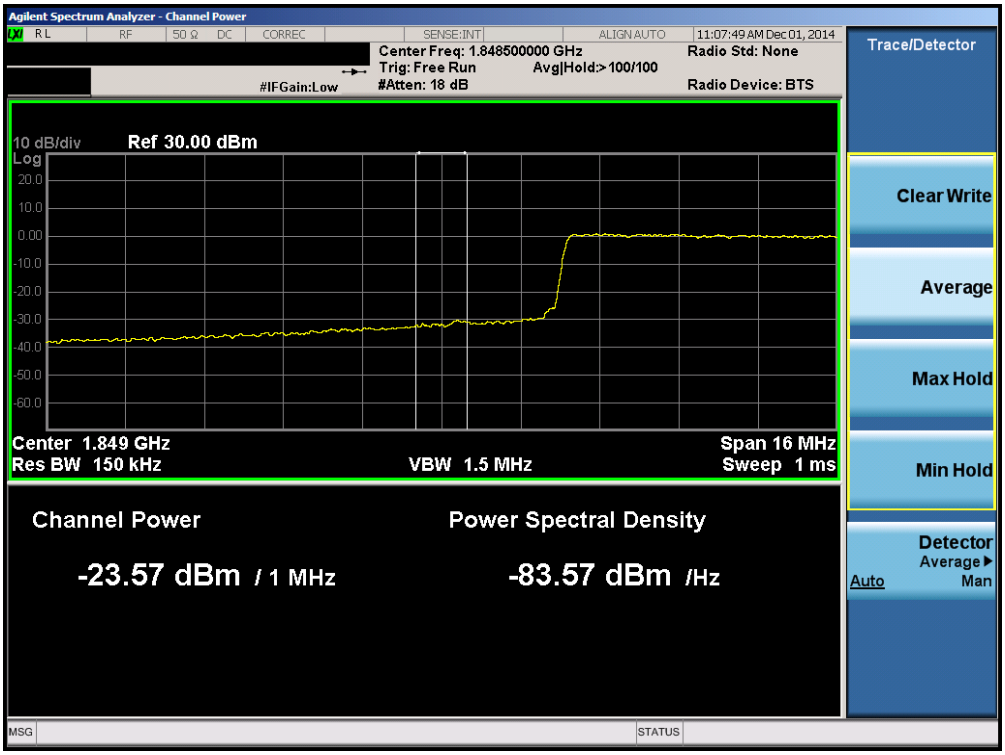



**Plot 6-102. Upper Extended Band Edge Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.

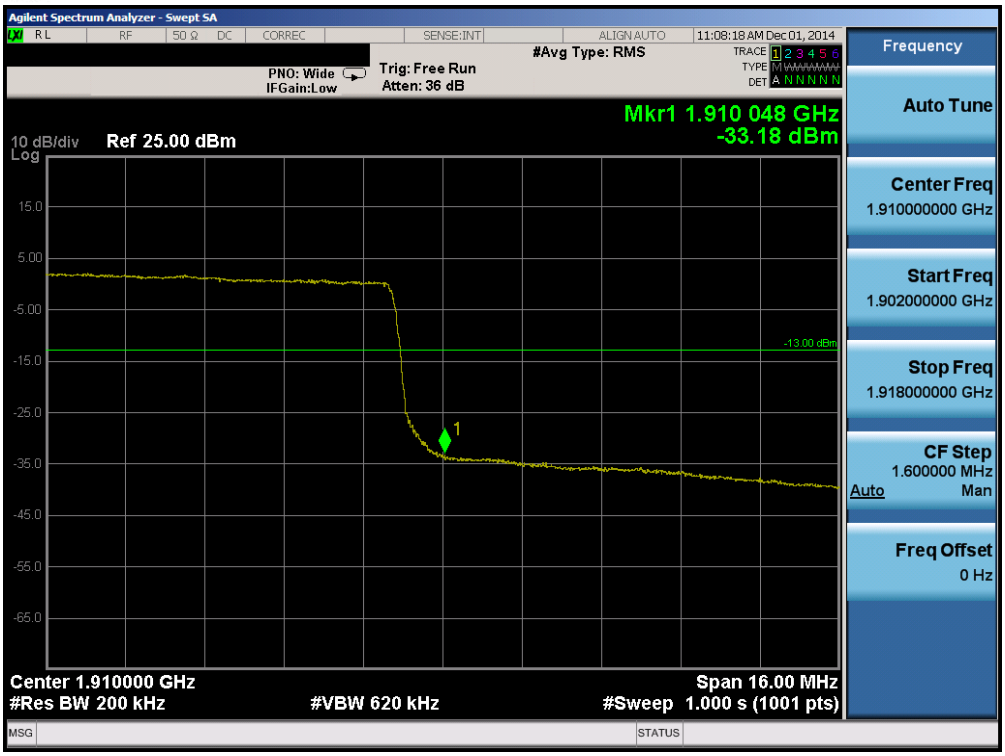



**Plot 6-103. Lower Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**

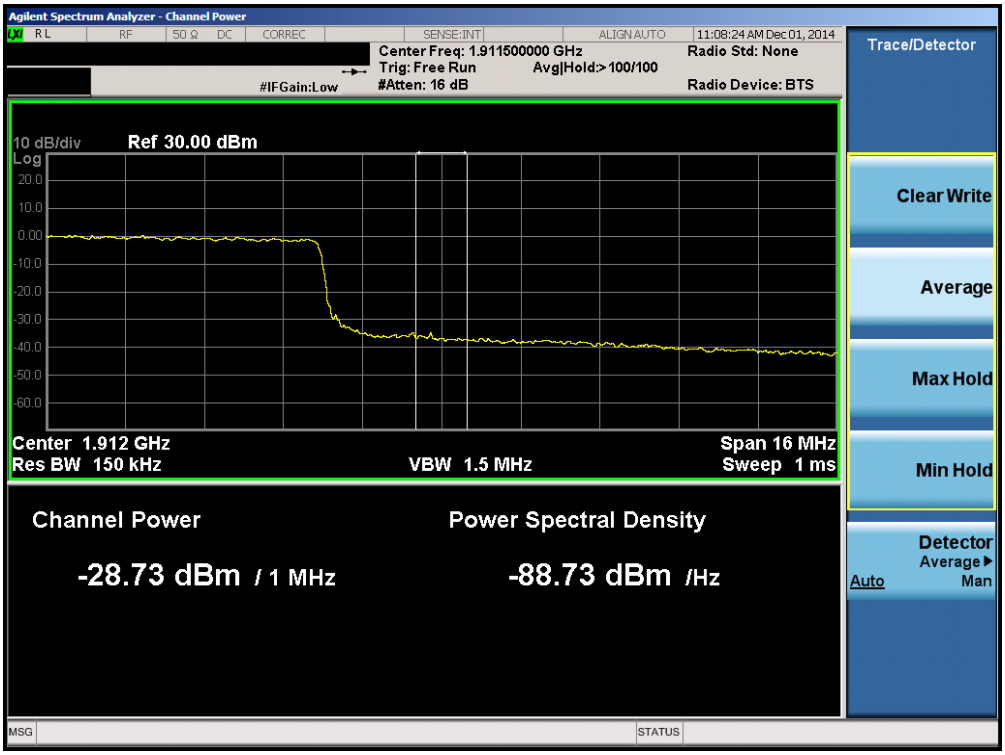



**Plot 6-104. Lower Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.




**Plot 6-105. Upper Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**




**Plot 6-106. Upper Extended Band Edge Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.5 Peak-Average Ratio

**§24.232(d)**

### Test Overview

A peak to average ratio measurement is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

### Test Procedure Used

KDB 971168 v02r02 – Section 5.7.1

### Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms.

### Test Setup

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

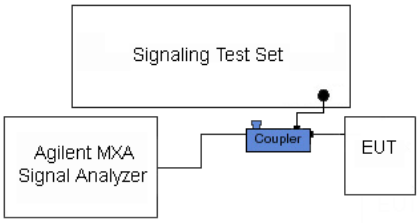
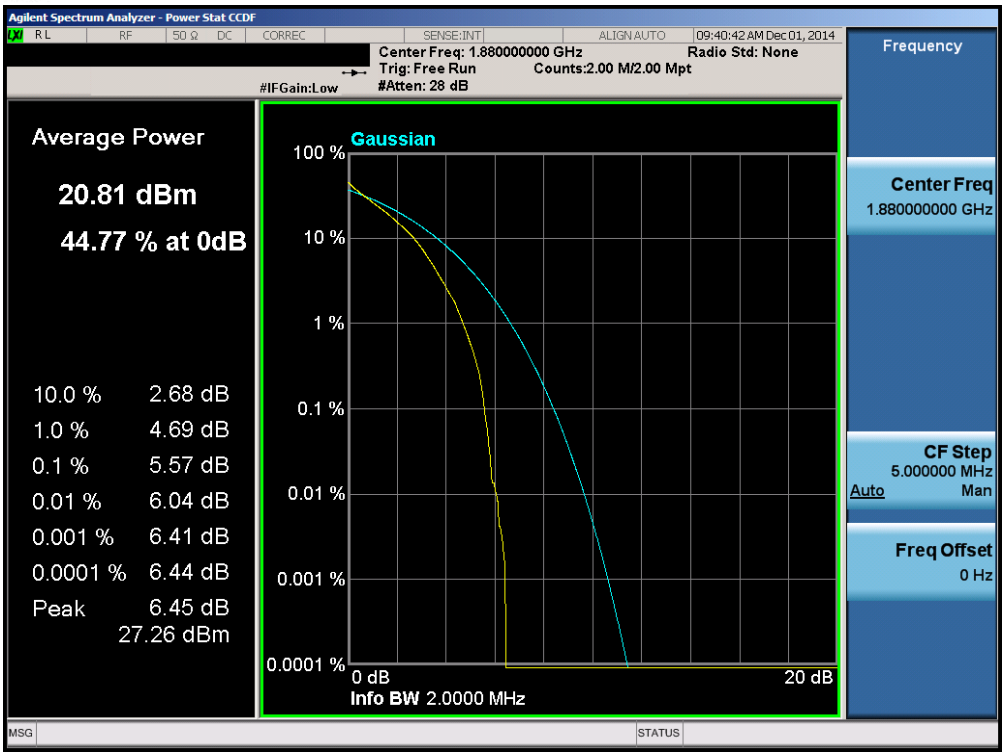



**Figure 6-4. Test Instrument & Measurement Setup**

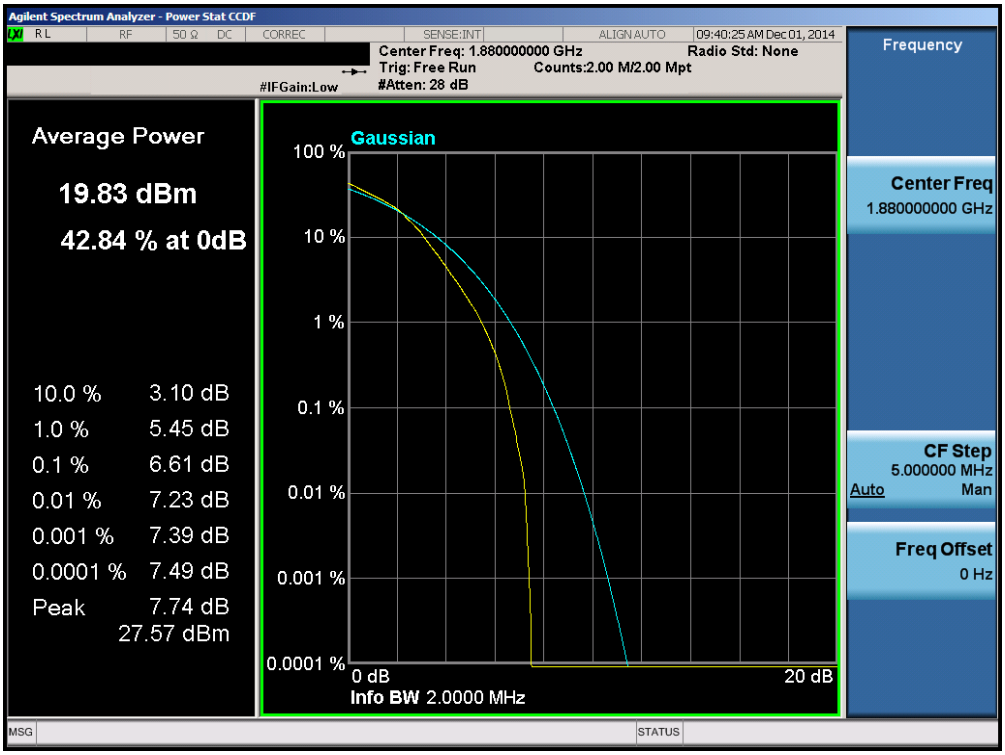
### Test Notes

None.


© 2014 PCTEST Engineering Laboratory, Inc.

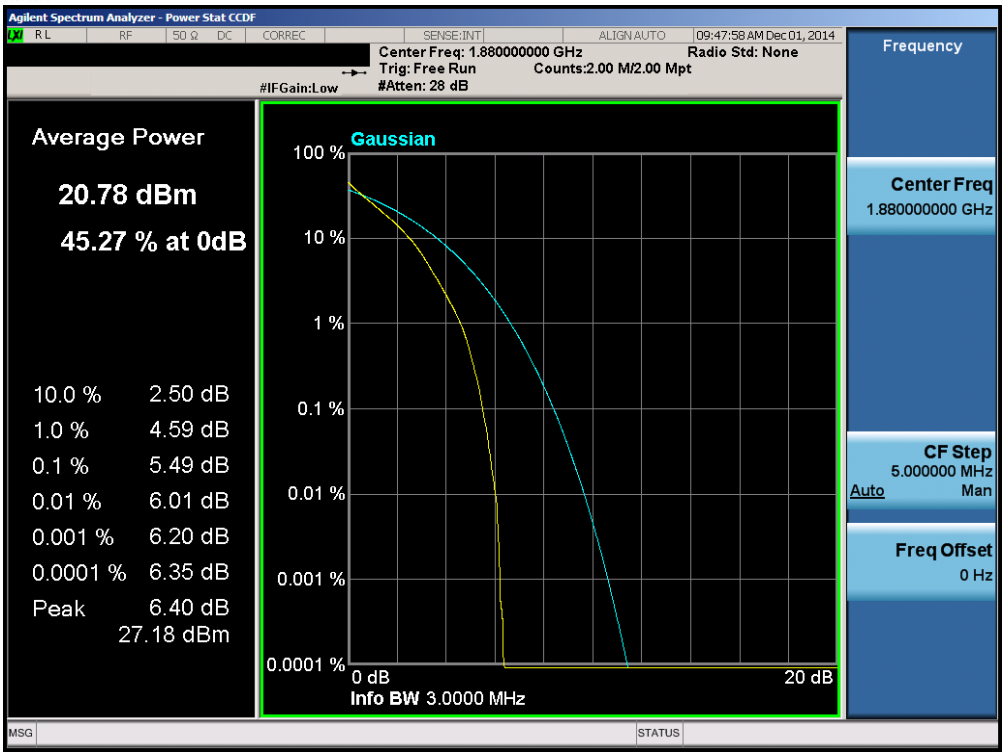



**Plot 6-107. PAR Plot (Band 2 – 1.4MHz QPSK – RB Size 6)**

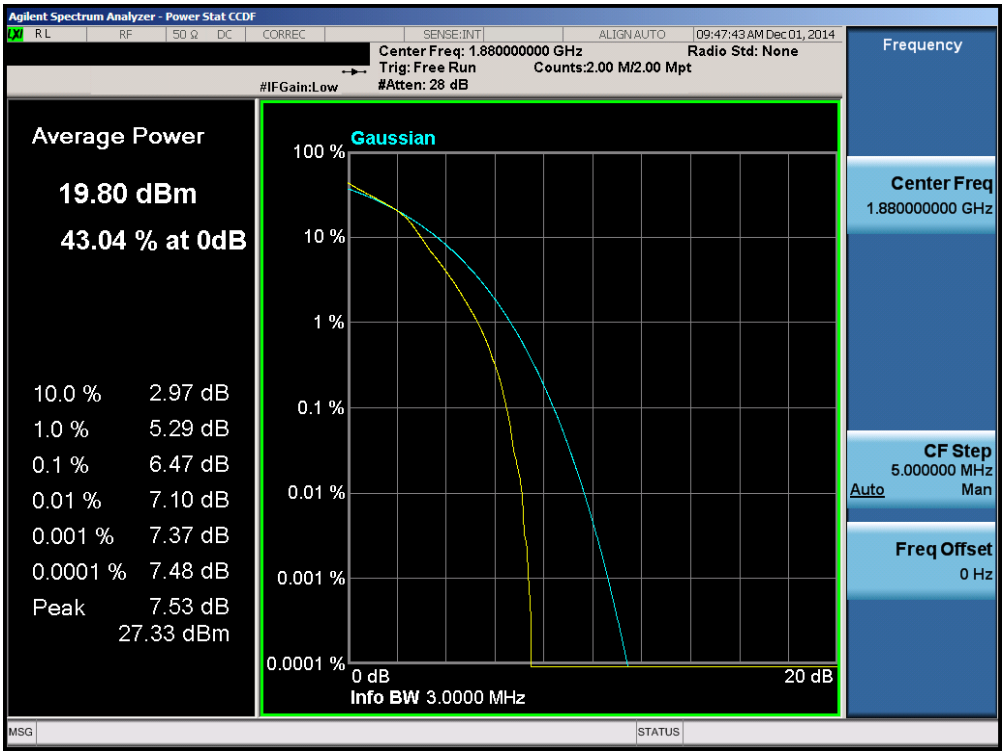



**Plot 6-108. PAR Plot (Band 2 – 1.4MHz 16-QAM – RB Size 6)**


© 2014 PCTEST Engineering Laboratory, Inc.

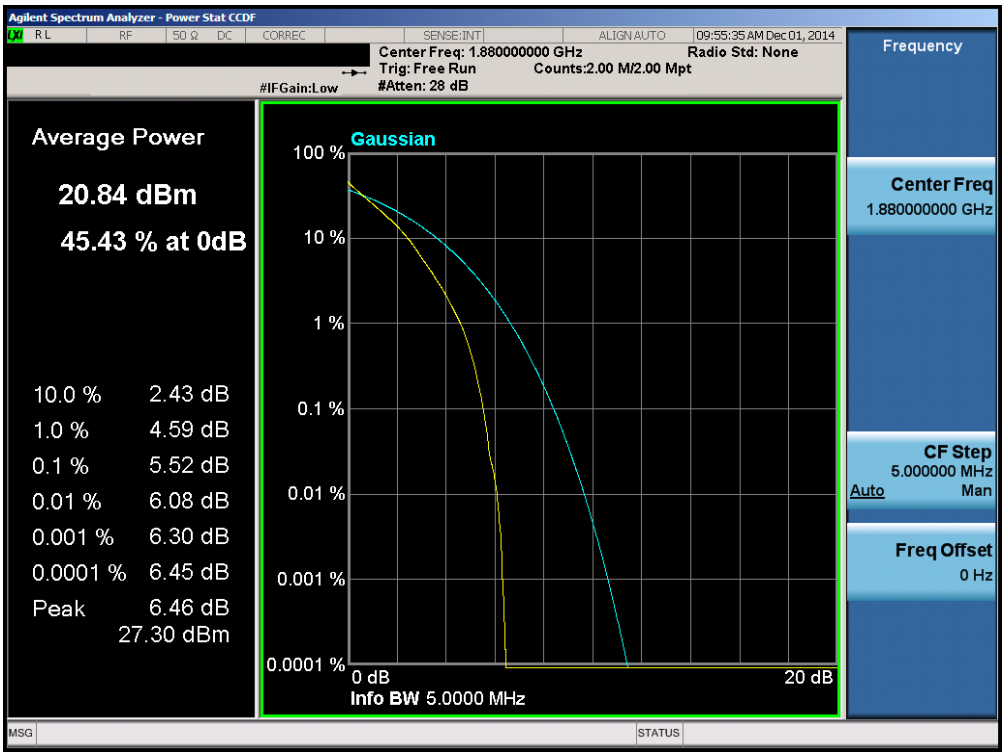



**Plot 6-109. PAR Plot (Band 2 – 3.0MHz QPSK – RB Size 15)**

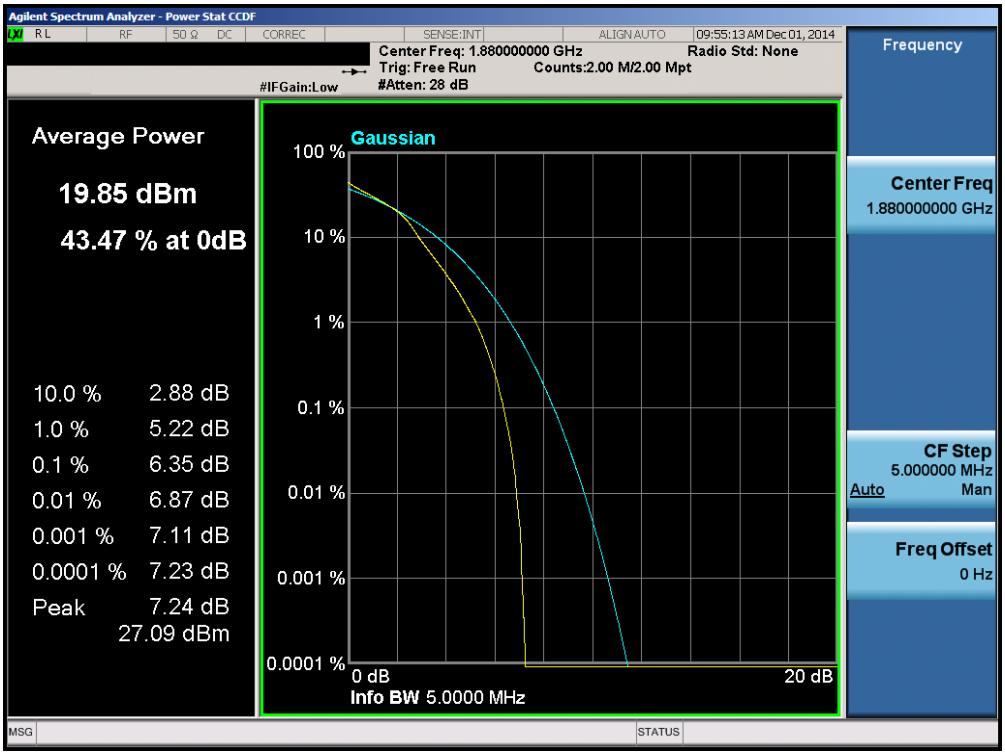



**Plot 6-110. PAR Plot (Band 2 – 3.0MHz 16-QAM – RB Size 15)**


© 2014 PCTEST Engineering Laboratory, Inc.

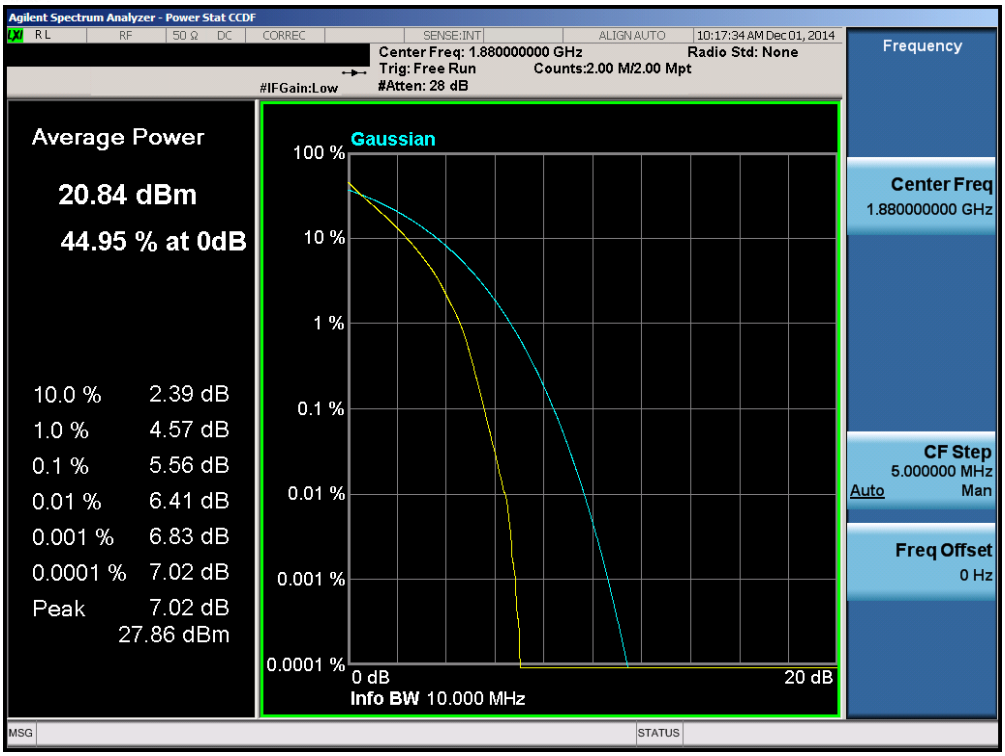



**Plot 6-111. PAR Plot (Band 2 – 5.0MHz QPSK – RB Size 25)**

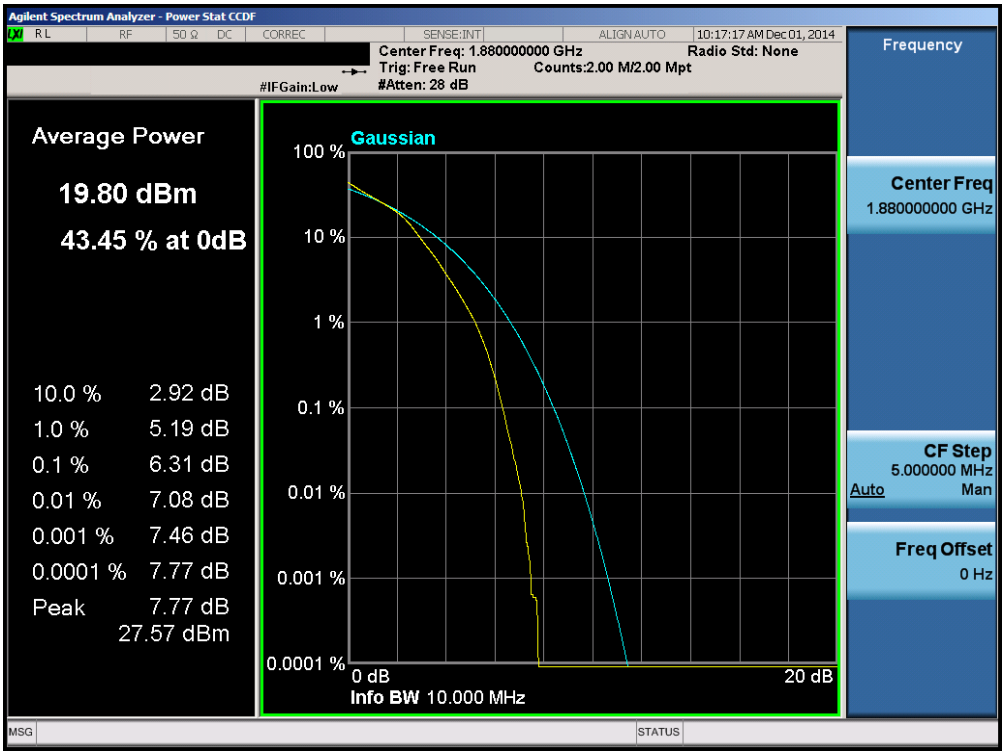



**Plot 6-112. PAR Plot (Band 2 – 5.0MHz 16-QAM – RB Size 25)**


© 2014 PCTEST Engineering Laboratory, Inc.

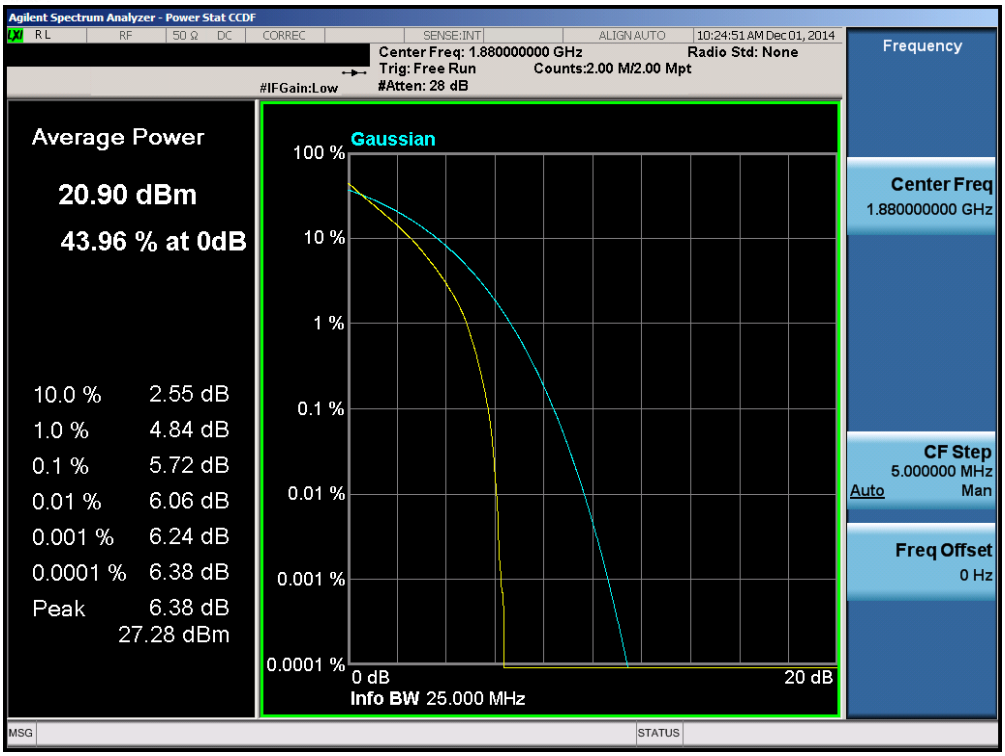



**Plot 6-113. PAR Plot (Band 2 – 10.0MHz QPSK – RB Size 50)**

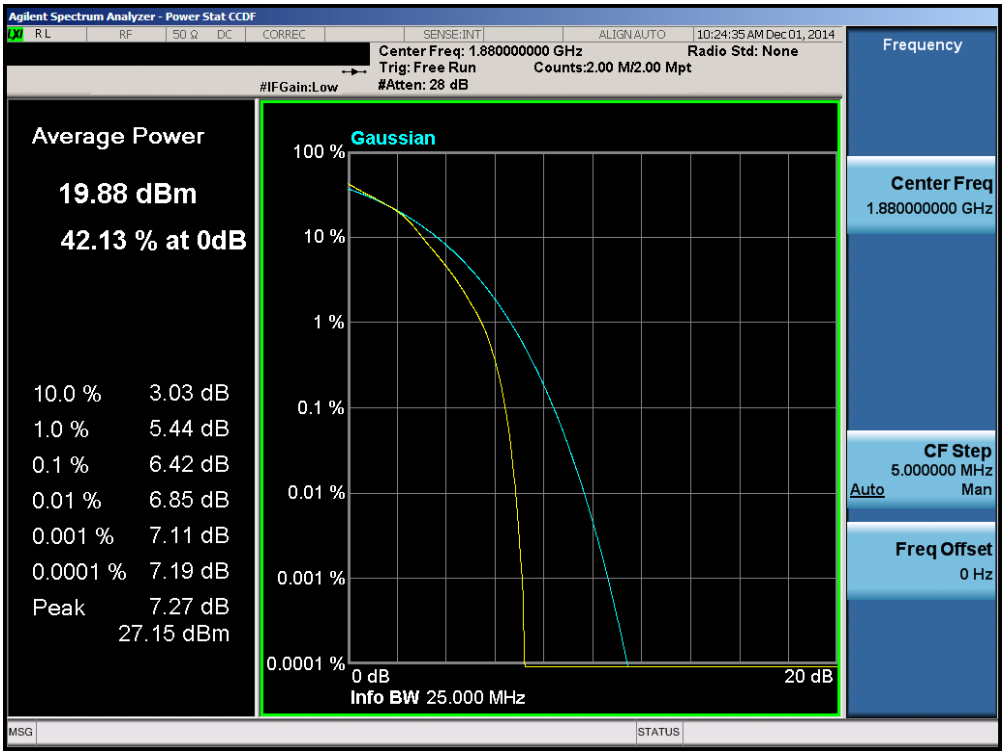



**Plot 6-114. PAR Plot (Band 2 – 10.0MHz 16-QAM – RB Size 50)**


© 2014 PCTEST Engineering Laboratory, Inc.

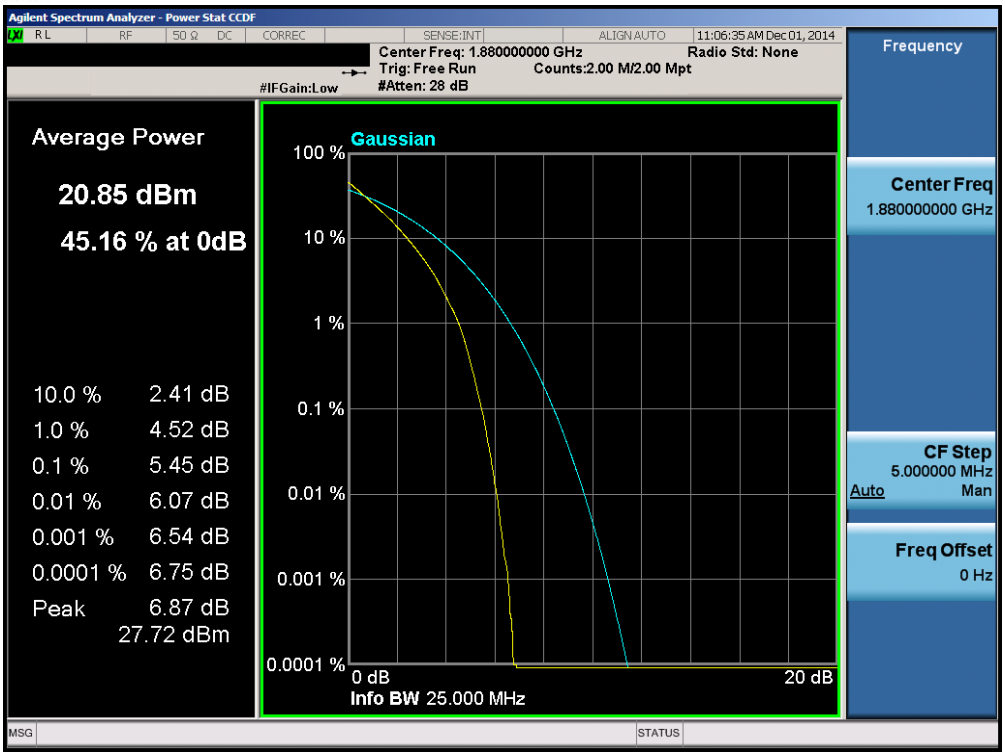



**Plot 6-115. PAR Plot (Band 2 – 15.0MHz QPSK – RB Size 75)**

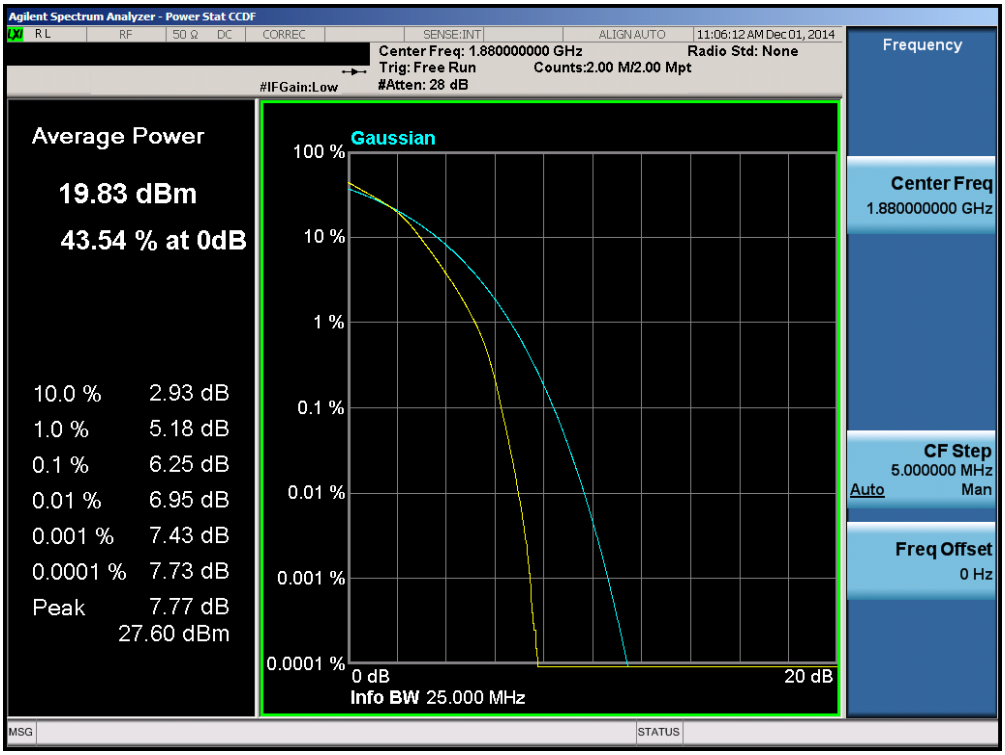



**Plot 6-116. PAR Plot (Band 2 – 15.0MHz 16-QAM – RB Size 75)**


© 2014 PCTEST Engineering Laboratory, Inc.




**Plot 6-117. PAR Plot (Band 2 – 20.0MHz QPSK – RB Size 100)**




**Plot 6-118. PAR Plot (Band 2 – 20.0MHz 16-QAM – RB Size 100)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.6 Radiated Power (ERP/EIRP)

**§24.232(c.2) §27.50(b.10) §27.50(d.4)**

### Test Overview

Effective Radiated Power (ERP) and Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the substitution method described in ANSI/TIA-603-C-2004 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

### Test Procedures Used

KDB 971168 v02r02 – Section 5.2.1

ANSI/TIA-603-C-2004 – Section 2.2.17

### Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize


© 2014 PCTEST Engineering Laboratory, Inc.

## Test Setup

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

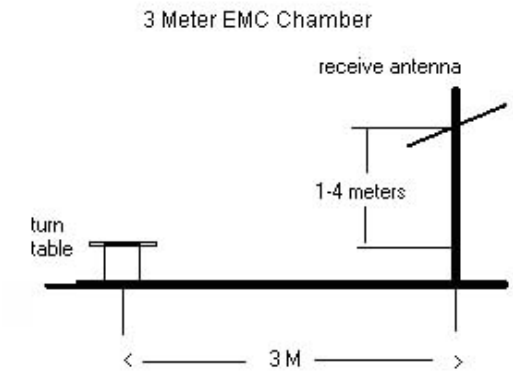



**Figure 6-5. Test Instrument & Measurement Setup**

## Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The "H" positioning is defined with the EUT lying flat on the test surface, the "H2" positioning is defined with the EUT standing up on its side, and the "V" positioning is defined with the EUT standing upright. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

| Frequency [MHz] | Channel Bandwidth [MHz] | Mod. | Battery | RB Size/Offset | Substitute Level [dBm] | Ant. Gain [dBd] | Ant. Pol. [H/V] | ERP [dBm] | ERP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 779.50 | 5 | QPSK | Standard | 1 / 0 | 22.58 | 2.47 | V | 25.05 | 34.771 | -9.72 |
| 782.00 | 5 | QPSK | Standard | 1 / 24 | 21.27 | 2.51 | V | 23.78 | 34.771 | -10.99 |
| 784.50 | 5 | QPSK | Standard | 1 / 24 | 21.80 | 2.56 | V | 24.36 | 34.771 | -10.41 |
| 779.50 | 5 | 16QAM | Standard | 1 / 0 | 21.81 | 2.47 | V | 24.28 | 34.771 | -10.49 |
| 782.00 | 5 | 16QAM | Standard | 1 / 24 | 20.71 | 2.51 | V | 23.22 | 34.771 | -11.55 |
| 784.50 | 5 | 16QAM | Standard | 1 / 24 | 21.22 | 2.56 | V | 23.78 | 34.771 | -10.99 |
| 782.00 | 10 | QPSK | Standard | 1 / 0 | 21.76 | 2.51 | V | 24.27 | 34.771 | -10.50 |
| 782.00 | 10 | 16QAM | Standard | 1 / 0 | 21.05 | 2.51 | V | 23.56 | 34.771 | -11.21 |

**Table 6-2. ERP Data (Band 13)**


© 2014 PCTEST Engineering Laboratory, Inc.

| Frequency [MHz] | Channel Bandwidth [MHz] | Mod. | Battery | RB Size/Offset | Substitute Level [dBm] | Ant. Gain [dBi] | Ant. Pol. [H/V] | EIRP [dBm] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1710.70 | 1.4 | QPSK | Standard | 1 / 3 | 17.85 | 9.28 | V | 27.13 | 30.000 | -2.87 |
| 1732.50 | 1.4 | QPSK | Standard | 1 / 3 | 16.98 | 9.00 | V | 25.98 | 30.000 | -4.02 |
| 1754.30 | 1.4 | QPSK | Standard | 1 / 3 | 17.92 | 8.72 | V | 26.64 | 30.000 | -3.36 |
| 1710.70 | 1.4 | 16-QAM | Standard | 1 / 3 | 16.70 | 9.28 | V | 25.98 | 30.000 | -4.02 |
| 1732.50 | 1.4 | 16-QAM | Standard | 1 / 3 | 15.93 | 9.00 | V | 24.93 | 30.000 | -5.07 |
| 1754.30 | 1.4 | 16-QAM | Standard | 1 / 3 | 16.52 | 8.72 | V | 25.24 | 30.000 | -4.76 |
| 1711.50 | 3 | QPSK | Standard | 1 / 0 | 18.89 | 9.27 | V | 28.16 | 30.000 | -1.84 |
| 1732.50 | 3 | QPSK | Standard | 1 / 7 | 18.71 | 9.00 | V | 27.71 | 30.000 | -2.29 |
| 1753.50 | 3 | QPSK | Standard | 1 / 0 | 18.40 | 8.73 | V | 27.13 | 30.000 | -2.87 |
| 1711.50 | 3 | 16-QAM | Standard | 1 / 0 | 17.51 | 9.27 | V | 26.78 | 30.000 | -3.22 |
| 1732.50 | 3 | 16-QAM | Standard | 1 / 7 | 18.57 | 9.00 | V | 27.57 | 30.000 | -2.43 |
| 1753.50 | 3 | 16-QAM | Standard | 1 / 0 | 17.12 | 8.73 | V | 25.85 | 30.000 | -4.15 |
| 1712.50 | 5 | QPSK | Standard | 1 / 0 | 17.85 | 9.26 | V | 27.11 | 30.000 | -2.89 |
| 1732.50 | 5 | QPSK | Standard | 1 / 0 | 18.38 | 9.00 | V | 27.38 | 30.000 | -2.62 |
| 1752.50 | 5 | QPSK | Standard | 1 / 0 | 17.95 | 8.74 | V | 26.69 | 30.000 | -3.31 |
| 1712.50 | 5 | 16-QAM | Standard | 1 / 0 | 16.94 | 9.26 | V | 26.20 | 30.000 | -3.80 |
| 1732.50 | 5 | 16-QAM | Standard | 1 / 0 | 17.54 | 9.00 | V | 26.54 | 30.000 | -3.46 |
| 1752.50 | 5 | 16-QAM | Standard | 1 / 0 | 17.39 | 8.74 | V | 26.13 | 30.000 | -3.87 |
| 1715.00 | 10 | QPSK | Standard | 1 / 0 | 19.40 | 9.22 | V | 28.62 | 30.000 | -1.38 |
| 1732.50 | 10 | QPSK | Standard | 1 / 0 | 19.32 | 9.00 | V | 28.32 | 30.000 | -1.68 |
| 1750.00 | 10 | QPSK | Standard | 1 / 0 | 18.77 | 8.77 | V | 27.54 | 30.000 | -2.46 |
| 1715.00 | 10 | 16-QAM | Standard | 1 / 0 | 18.24 | 9.22 | V | 27.46 | 30.000 | -2.54 |
| 1732.50 | 10 | 16-QAM | Standard | 1 / 0 | 18.62 | 9.00 | V | 27.62 | 30.000 | -2.38 |
| 1750.00 | 10 | 16-QAM | Standard | 1 / 0 | 17.55 | 8.77 | V | 26.32 | 30.000 | -3.68 |
| 1717.50 | 15 | QPSK | Standard | 1 / 74 | 19.13 | 9.19 | V | 28.32 | 30.000 | -1.68 |
| 1732.50 | 15 | QPSK | Standard | 1 / 0 | 19.36 | 9.00 | V | 28.36 | 30.000 | -1.64 |
| 1747.50 | 15 | QPSK | Standard | 1 / 0 | 18.75 | 8.80 | V | 27.55 | 30.000 | -2.45 |
| 1717.50 | 15 | 16-QAM | Standard | 1 / 74 | 17.74 | 9.19 | V | 26.93 | 30.000 | -3.07 |
| 1732.50 | 15 | 16-QAM | Standard | 1 / 0 | 19.12 | 9.00 | V | 28.12 | 30.000 | -1.88 |
| 1747.50 | 15 | 16-QAM | Standard | 1 / 0 | 18.37 | 8.80 | V | 27.17 | 30.000 | -2.83 |
| 1720.00 | 20 | QPSK | Standard | 1 / 99 | 18.17 | 9.16 | V | 27.33 | 30.000 | -2.67 |
| 1732.50 | 20 | QPSK | Standard | 1 / 50 | 19.72 | 9.00 | V | 28.72 | 30.000 | -1.28 |
| 1745.00 | 20 | QPSK | Standard | 1 / 0 | 18.86 | 8.83 | V | 27.69 | 30.000 | -2.31 |
| 1720.00 | 20 | 16-QAM | Standard | 1 / 99 | 17.47 | 9.16 | V | 26.63 | 30.000 | -3.37 |
| 1732.50 | 20 | 16-QAM | Standard | 1 / 0 | 17.98 | 9.00 | V | 26.98 | 30.000 | -3.02 |
| 1745.00 | 20 | 16-QAM | Standard | 1 / 0 | 18.15 | 8.83 | V | 26.98 | 30.000 | -3.02 |

**Table 6-3. EIRP Data (Band 4)**


© 2014 PCTEST Engineering Laboratory, Inc.

| Frequency [MHz] | Channel Bandwidth [MHz] | Mod. | Battery | RB Size/Offset | Substitute Level [dBm] | Ant. Gain [dBi] | Ant. Pol. [H/V] | EIRP [dBm] | EIRP Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1850.70 | 1.4 | QPSK | Standard | 1 / 0 | 14.66 | 9.38 | V | 24.04 | 33.010 | -8.97 |
| 1880.00 | 1.4 | QPSK | Standard | 1 / 0 | 15.48 | 9.33 | V | 24.81 | 33.010 | -8.20 |
| 1909.30 | 1.4 | QPSK | Standard | 1 / 0 | 14.26 | 9.29 | V | 23.55 | 33.010 | -9.46 |
| 1850.70 | 1.4 | 16-QAM | Standard | 1 / 0 | 14.07 | 9.38 | V | 23.45 | 33.010 | -9.56 |
| 1880.00 | 1.4 | 16-QAM | Standard | 1 / 0 | 14.95 | 9.33 | V | 24.28 | 33.010 | -8.73 |
| 1909.30 | 1.4 | 16-QAM | Standard | 1 / 0 | 13.44 | 9.29 | V | 22.73 | 33.010 | -10.28 |
| 1851.50 | 3 | QPSK | Standard | 1 / 0 | 14.64 | 9.38 | V | 24.02 | 33.010 | -8.99 |
| 1880.00 | 3 | QPSK | Standard | 1 / 14 | 15.36 | 9.33 | V | 24.69 | 33.010 | -8.32 |
| 1908.50 | 3 | QPSK | Standard | 1 / 0 | 14.33 | 9.29 | V | 23.62 | 33.010 | -9.39 |
| 1851.50 | 3 | 16-QAM | Standard | 1 / 0 | 14.20 | 9.38 | V | 23.58 | 33.010 | -9.43 |
| 1880.00 | 3 | 16-QAM | Standard | 1 / 14 | 14.90 | 9.33 | V | 24.23 | 33.010 | -8.78 |
| 1908.50 | 3 | 16-QAM | Standard | 1 / 0 | 13.35 | 9.29 | V | 22.64 | 33.010 | -10.37 |
| 1852.50 | 5 | QPSK | Standard | 1 / 0 | 14.74 | 9.38 | V | 24.12 | 33.010 | -8.89 |
| 1880.00 | 5 | QPSK | Standard | 1 / 12 | 13.93 | 9.33 | V | 23.26 | 33.010 | -9.75 |
| 1907.50 | 5 | QPSK | Standard | 1 / 0 | 15.77 | 9.29 | V | 25.06 | 33.010 | -7.95 |
| 1852.50 | 5 | 16-QAM | Standard | 1 / 0 | 14.03 | 9.38 | V | 23.41 | 33.010 | -9.60 |
| 1880.00 | 5 | 16-QAM | Standard | 1 / 12 | 12.81 | 9.33 | V | 22.14 | 33.010 | -10.87 |
| 1907.50 | 5 | 16-QAM | Standard | 1 / 0 | 14.37 | 9.29 | V | 23.66 | 33.010 | -9.35 |
| 1855.00 | 10 | QPSK | Standard | 1 / 0 | 15.23 | 9.37 | V | 24.60 | 33.010 | -8.41 |
| 1880.00 | 10 | QPSK | Standard | 1 / 49 | 15.88 | 9.33 | V | 25.21 | 33.010 | -7.80 |
| 1905.00 | 10 | QPSK | Standard | 1 / 25 | 14.50 | 9.29 | V | 23.79 | 33.010 | -9.22 |
| 1855.00 | 10 | 16-QAM | Standard | 1 / 0 | 14.98 | 9.37 | V | 24.35 | 33.010 | -8.66 |
| 1880.00 | 10 | 16-QAM | Standard | 1 / 49 | 15.20 | 9.33 | V | 24.53 | 33.010 | -8.48 |
| 1905.00 | 10 | 16-QAM | Standard | 1 / 25 | 13.41 | 9.29 | V | 22.70 | 33.010 | -10.31 |
| 1857.50 | 15 | QPSK | Standard | 1 / 0 | 15.00 | 9.37 | V | 24.37 | 33.010 | -8.64 |
| 1880.00 | 15 | QPSK | Standard | 1 / 37 | 15.34 | 9.33 | V | 24.67 | 33.010 | -8.34 |
| 1902.50 | 15 | QPSK | Standard | 1 / 0 | 14.37 | 9.30 | V | 23.67 | 33.010 | -9.34 |
| 1857.50 | 15 | 16-QAM | Standard | 1 / 0 | 14.51 | 9.37 | V | 23.88 | 33.010 | -9.13 |
| 1880.00 | 15 | 16-QAM | Standard | 1 / 37 | 14.57 | 9.33 | V | 23.90 | 33.010 | -9.11 |
| 1902.50 | 15 | 16-QAM | Standard | 1 / 0 | 13.35 | 9.30 | V | 22.65 | 33.010 | -10.36 |
| 1860.00 | 20 | QPSK | Standard | 1 / 0 | 15.08 | 9.37 | V | 24.45 | 33.010 | -8.56 |
| 1880.00 | 20 | QPSK | Standard | 1 / 50 | 15.43 | 9.33 | V | 24.76 | 33.010 | -8.25 |
| 1900.00 | 20 | QPSK | Standard | 1 / 0 | 14.51 | 9.30 | V | 23.81 | 33.010 | -9.20 |
| 1860.00 | 20 | 16-QAM | Standard | 1 / 0 | 14.59 | 9.37 | V | 23.96 | 33.010 | -9.05 |
| 1880.00 | 20 | 16-QAM | Standard | 1 / 50 | 14.83 | 9.33 | V | 24.16 | 33.010 | -8.85 |
| 1900.00 | 20 | 16-QAM | Standard | 1 / 0 | 13.56 | 9.30 | V | 22.86 | 33.010 | -10.15 |

**Table 6-4. EIRP Data (Band 2)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.7 Radiated Spurious Emissions Measurements

**§2.1053 §24.238(a) §27.53(c) §27.53(f) §27.53(h)**

### Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-C-2004 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

### Test Procedures Used

KDB 971168 v02r02 – Section 5.8

ANSI/TIA-603-C-2004 – Section 2.2.12

### Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

### Test Setup

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

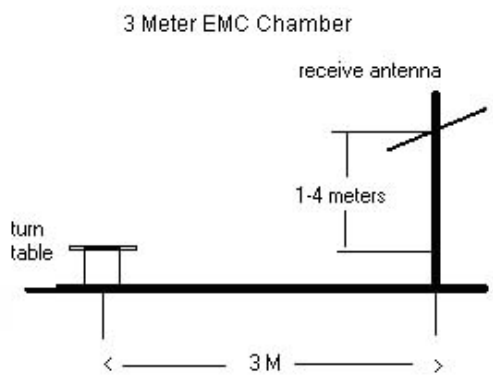



**Figure 6-6. Test Instrument & Measurement Setup**


© 2014 PCTEST Engineering Laboratory, Inc.

**Test Notes**

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The "H" positioning is defined with the EUT lying flat on the test surface, the "H2" positioning is defined with the EUT standing up on its side, and the "V" positioning is defined with the EUT standing upright. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

| | | | | |
|---|---|---|---|---|
| OPERATING FREQUENCY: | 779.50 | MHz | | |
| CHANNEL: | 23205 | | | |
| MEASURED OUTPUT POWER: | 25.05 | dBm | = | 0.320 W |
| MODULATION SIGNAL: | QPSK | | | |
| BANDWIDTH: | 5.0 | MHz | | |
| DISTANCE: | 3 | meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.05 | dBc | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | EUT Pol. [H/H2/V] | [dBc] |
|---|---|---|---|---|---|---|
| 2338.50 | -67.39 | 7.25 | -60.14 | V | V | 85.2 |
| 3118.00 | -65.00 | 7.26 | -57.74 | V | V | 82.8 |

**Table 6-5. Radiated Spurious Data (Band 13 – Low Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 784.50 | MHz | | | |
| CHANNEL: | 23255 | | | | |
| MEASURED OUTPUT POWER: | 24.36 | dBm | = | 0.273 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 5.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.36 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | EUT Pol. [H/H2/V] | [dBc] |
|---|---|---|---|---|---|---|
| 2353.50 | -66.29 | 7.23 | -59.06 | V | V | 83.4 |
| 3138.00 | -65.19 | 7.28 | -57.90 | V | V | 82.3 |

**Table 6-6. Radiated Spurious Data (Band 13 – High Channel)**

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 782.00 | MHz | | | |
| CHANNEL: | 23230 | | | | |
| MEASURED OUTPUT POWER: | 23.78 | dBm | = | 0.239 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| DISTANCE: | 3 | meters | | | |
| NARROWBAND EMISSION LIMIT: | -50 | dBm | | | |
| WIDEBAND EMISSION LIMIT: | -40 | dBm/MHz | | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBd] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | Margin [dBm] |
|---|---|---|---|---|---|
| 1564.00 | -67.16 | 6.48 | -60.68 | V | -20.7 |

**Table 6-7. Radiated Spurious Data (Band 13 – 1559-1610MHz Band)**


© 2014 PCTEST Engineering Laboratory, Inc.

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1720.00 | MHz | | | |
| CHANNEL: | 20050 | | | | |
| MEASURED OUTPUT POWER: | 27.33 | dBm | = | 0.541 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 20.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 40.33 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3440.00 | -48.02 | 9.69 | -38.33 | H | 65.7 |
| 5160.00 | -47.53 | 10.64 | -36.89 | H | 64.2 |
| 6880.00 | -63.90 | 11.75 | -52.16 | H | 79.5 |
| 8600.00 | -54.16 | 11.04 | -43.12 | H | 70.4 |
| 10320.00 | -58.35 | 12.31 | -46.04 | H | 73.4 |

**Table 6-8. Radiated Spurious Data (Band 4 – Low Channel)**

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1732.50 | MHz | | | |
| CHANNEL: | 20175 | | | | |
| MEASURED OUTPUT POWER: | 28.72 | dBm | = | 0.744 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 20.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 41.72 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3465.00 | -45.48 | 9.71 | -35.77 | H | 64.5 |
| 5197.50 | -53.17 | 10.59 | -42.58 | H | 71.3 |
| 6930.00 | -62.88 | 11.75 | -51.13 | H | 79.8 |
| 8662.50 | -53.80 | 11.06 | -42.74 | H | 71.5 |
| 10395.00 | -59.09 | 12.37 | -46.72 | H | 75.4 |

**Table 6-9. Radiated Spurious Data (Band 4 – Mid Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1745.00 | MHz | | | |
| CHANNEL: | 20300 | | | | |
| MEASURED OUTPUT POWER: | 27.69 | dBm | = | 0.588 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 20.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 40.69 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3490.00 | -48.23 | 9.72 | -38.51 | H | 66.2 |
| 5235.00 | -58.36 | 10.62 | -47.75 | H | 75.4 |
| 6980.00 | -61.76 | 11.76 | -50.01 | H | 77.7 |
| 8725.00 | -54.26 | 11.05 | -43.21 | H | 70.9 |

**Table 6-10. Radiated Spurious Data (Band 4 – High Channel)**

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1855.00 | MHz | | | |
| CHANNEL: | 18650 | | | | |
| MEASURED OUTPUT POWER: | 24.60 | dBm | = | 0.289 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 10.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 37.60 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3710.00 | -55.84 | 9.41 | -46.43 | H | 71.0 |
| 5565.00 | -61.99 | 10.82 | -51.18 | H | 75.8 |
| 7420.00 | -58.69 | 10.74 | -47.96 | H | 72.6 |

**Table 6-11. Radiated Spurious Data (Band 2 – Low Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1880.00 | MHz | | | |
| CHANNEL: | 18900 | | | | |
| MEASURED OUTPUT POWER: | 25.21 | dBm | = | 0.332 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 10.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.21 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3760.00 | -52.66 | 9.28 | -43.38 | H | 68.6 |
| 5640.00 | -62.07 | 11.03 | -51.04 | H | 76.3 |
| 7520.00 | -59.55 | 10.97 | -48.57 | H | 73.8 |

**Table 6-12. Radiated Spurious Data (Band 2 – Mid Channel)**

| | | | | | |
|---|---|---|---|---|---|
| OPERATING FREQUENCY: | 1905.00 | MHz | | | |
| CHANNEL: | 19150 | | | | |
| MEASURED OUTPUT POWER: | 23.79 | dBm | = | 0.240 | W |
| MODULATION SIGNAL: | QPSK | | | | |
| BANDWIDTH: | 10.0 | MHz | | | |
| DISTANCE: | 3 | meters | | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 36.79 | dBc | | |

| Frequency [MHz] | Level at Antenna Terminals [dBm] | Substitute Antenna Gain [dBi] | Spurious Emission Level [dBm] | Ant. Pol. [H/V] | [dBc] |
|---|---|---|---|---|---|
| 3810.00 | -54.92 | 9.19 | -45.73 | H | 69.5 |
| 5715.00 | -62.12 | 11.26 | -50.86 | H | 74.7 |
| 7620.00 | -60.22 | 11.16 | -49.06 | H | 72.9 |

**Table 6-13. Radiated Spurious Data (Band 2 – High Channel)**


© 2014 PCTEST Engineering Laboratory, Inc.

## 6.8 Frequency Stability / Temperature Variation

**§2.1055 §24.235 §27.54**

**Test Overview and Limit**

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-C-2004. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

***For LTE Band 13, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 24 and Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.***

**Test Procedure Used**

ANSI/TIA-603-C-2004

**Test Settings**

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

**Test Setup**

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

**Test Notes**

None


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 13 Frequency Stability Measurements

**§2.1055 §27.54**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 782,000,000 | Hz |
| CHANNEL: | 23230 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 781,999,949 | -51 | -0.0000065 |
| 100 % | | - 30 | 782,000,181 | 181 | 0.0000231 |
| 100 % | | - 20 | 781,999,637 | -363 | -0.0000464 |
| 100 % | | - 10 | 781,999,935 | -65 | -0.0000083 |
| 100 % | | 0 | 782,000,356 | 356 | 0.0000455 |
| 100 % | | + 10 | 781,999,868 | -132 | -0.0000169 |
| 100 % | | + 20 | 781,999,962 | -38 | -0.0000049 |
| 100 % | | + 30 | 781,999,776 | -224 | -0.0000286 |
| 100 % | | + 40 | 781,999,722 | -278 | -0.0000355 |
| 100 % | | + 50 | 781,999,642 | -358 | -0.0000458 |
| BATT. ENDPOINT | 3.40 | + 20 | 782,000,183 | 183 | 0.0000234 |

**Table 6-14. Frequency Stability Data (Band 13)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 13 Frequency Stability Measurements

**§2.1055 §27.54**

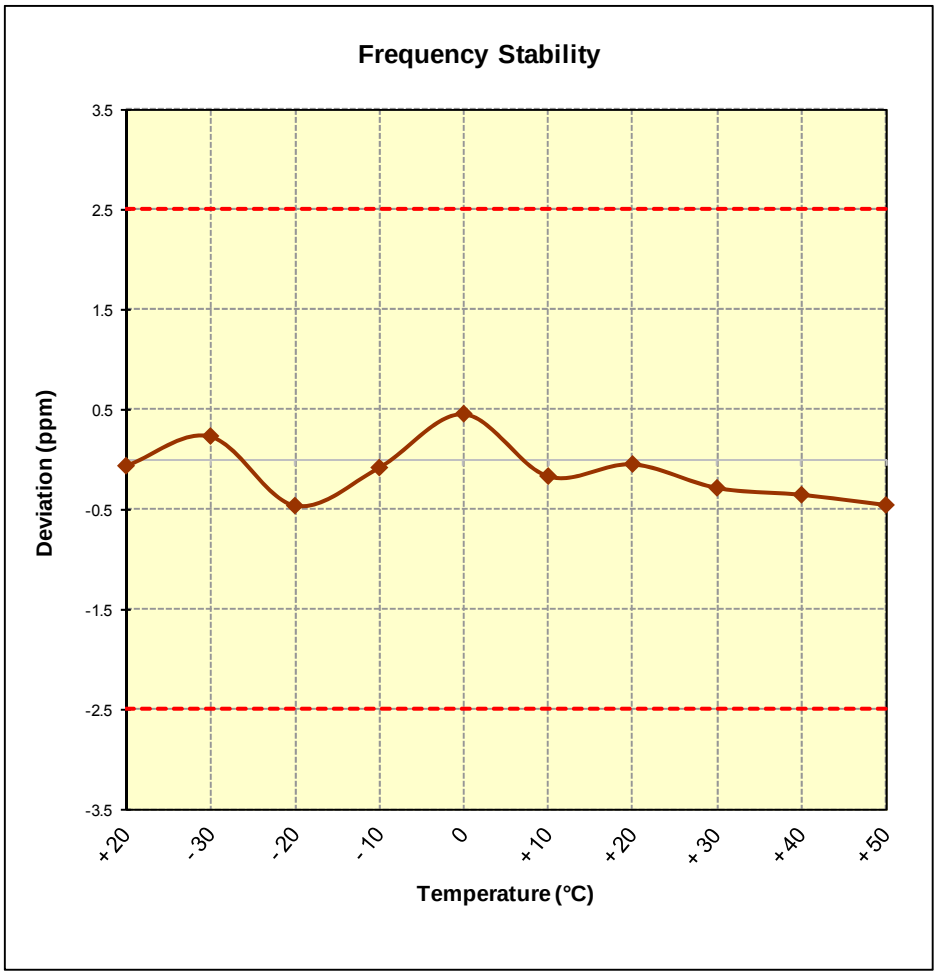



**Figure 6-7. Frequency Stability Graph (Band 13)**


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 4 Frequency Stability Measurements

**§2.1055 §§27.54**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 1,732,500,000 | Hz |
| CHANNEL: | 20175 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 1,732,499,526 | -474 | -0.0000274 |
| 100 % | | - 30 | 1,732,500,069 | 69 | 0.0000040 |
| 100 % | | - 20 | 1,732,499,860 | -140 | -0.0000081 |
| 100 % | | - 10 | 1,732,500,121 | 121 | 0.0000070 |
| 100 % | | 0 | 1,732,499,908 | -92 | -0.0000053 |
| 100 % | | + 10 | 1,732,500,215 | 215 | 0.0000124 |
| 100 % | | + 20 | 1,732,499,774 | -226 | -0.0000130 |
| 100 % | | + 30 | 1,732,500,247 | 247 | 0.0000143 |
| 100 % | | + 40 | 1,732,500,139 | 139 | 0.0000080 |
| 100 % | | + 50 | 1,732,499,573 | -427 | -0.0000246 |
| BATT. ENDPOINT | 3.40 | + 20 | 1,732,500,040 | 40 | 0.0000023 |

**Table 6-15. Frequency Stability Data (Band 4)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 4 Frequency Stability Measurements

**§2.1055 §§27.54**

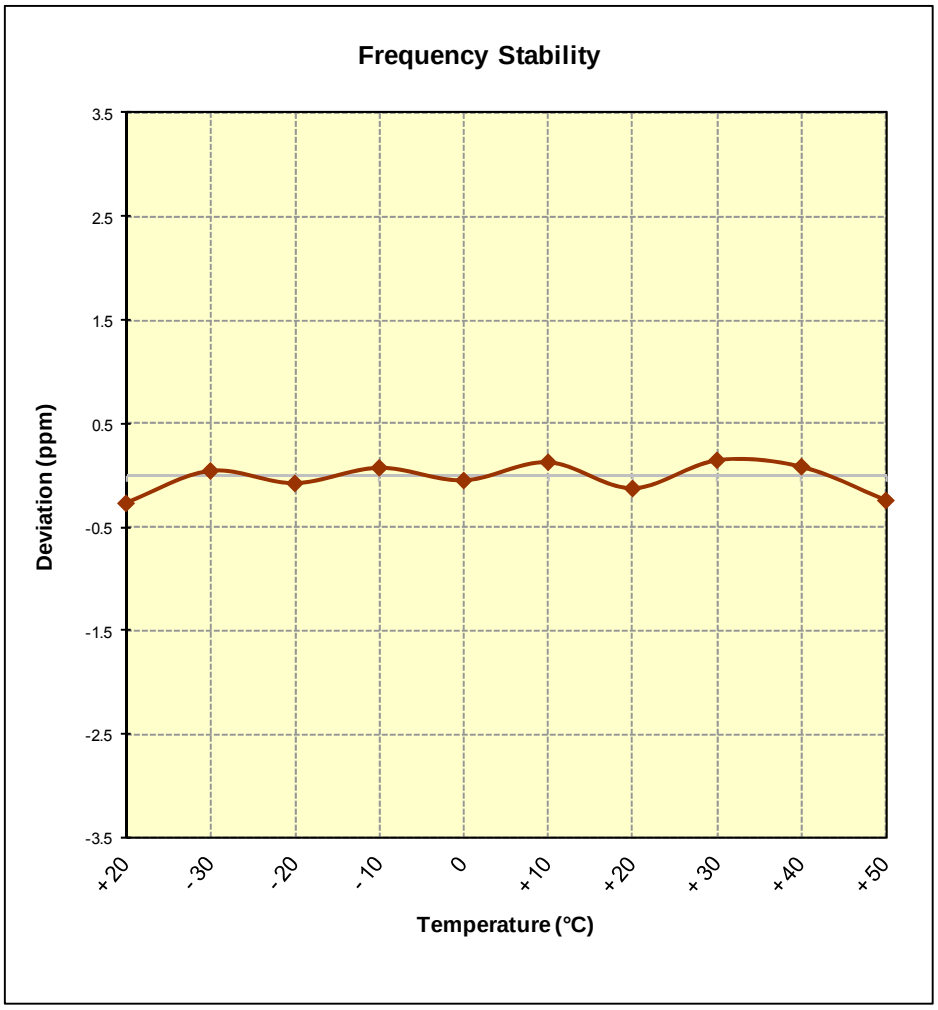



**Figure 6-8. Frequency Stability Graph (Band 4)**


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 2 Frequency Stability Measurements

**§2.1055 §24.235**

| | | |
|---|---|---|
| OPERATING FREQUENCY: | 1,880,000,000 | Hz |
| CHANNEL: | 18900 | |
| REFERENCE VOLTAGE: | 3.85 | VDC |

| VOLTAGE (%) | POWER (VDC) | TEMP (°C) | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|---|---|---|---|---|---|
| 100 % | 3.85 | + 20 (Ref) | 1,880,000,007 | 7 | 0.0000004 |
| 100 % | | - 30 | 1,880,000,054 | 54 | 0.0000029 |
| 100 % | | - 20 | 1,879,999,956 | -44 | -0.0000023 |
| 100 % | | - 10 | 1,879,999,770 | -230 | -0.0000122 |
| 100 % | | 0 | 1,879,999,925 | -75 | -0.0000040 |
| 100 % | | + 10 | 1,880,000,079 | 79 | 0.0000042 |
| 100 % | | + 20 | 1,880,000,086 | 86 | 0.0000046 |
| 100 % | | + 30 | 1,879,999,896 | -104 | -0.0000055 |
| 100 % | | + 40 | 1,880,000,053 | 53 | 0.0000028 |
| 100 % | | + 50 | 1,880,000,063 | 63 | 0.0000034 |
| BATT. ENDPOINT | 3.40 | + 20 | 1,879,999,737 | -263 | -0.0000140 |

**Table 6-16. Frequency Stability Data (Band 2)**

**Note:**

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.


© 2014 PCTEST Engineering Laboratory, Inc.

## Band 2 Frequency Stability Measurements

**§2.1055 §24.235**

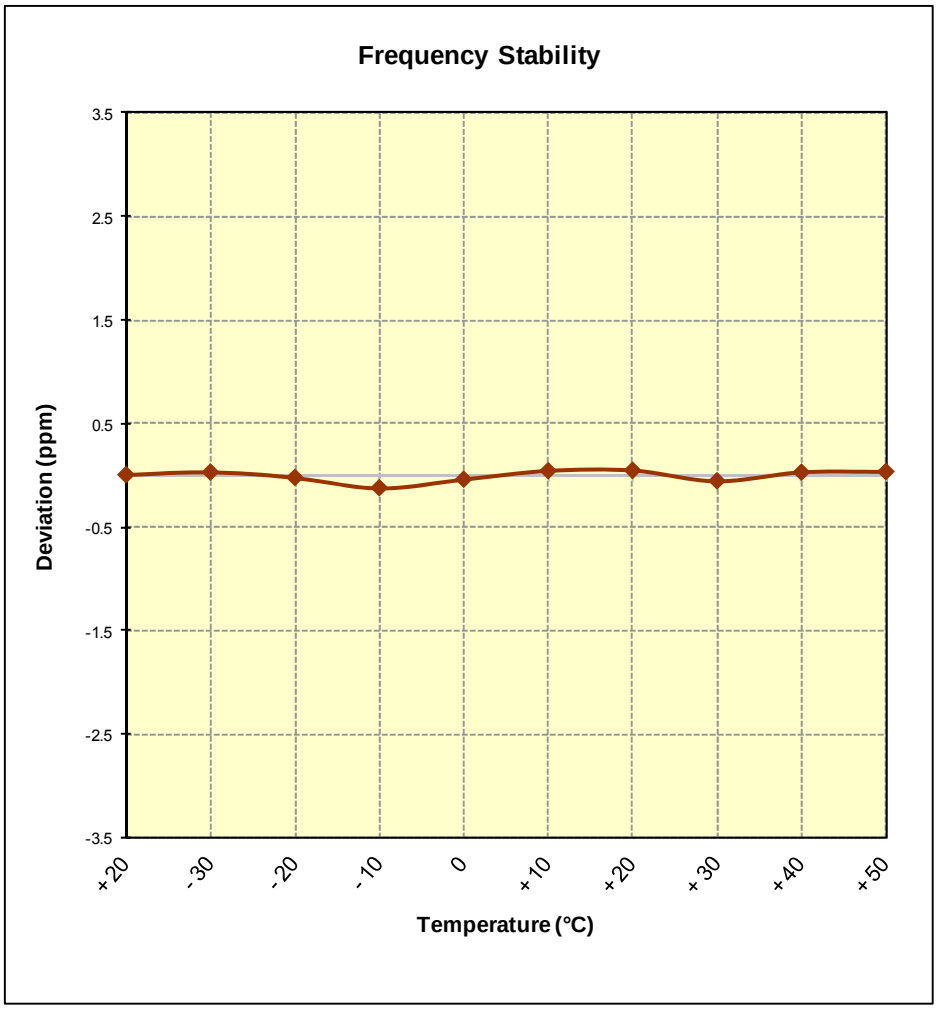



**Figure 6-9. Frequency Stability Graph (Band 2)**



© 2014 PCTEST Engineering Laboratory, Inc.

# 7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMG360V** complies with all the requirements of Parts 24 & 27 of the FCC rules for LTE operation only.


© 2014 PCTEST Engineering Laboratory, Inc.