PCTEST ENGINEERING LABORATORY, INC.

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MEASUREMENT REPORT

FCC Part 22, 24, & 27 LTE

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

Date of Testing:
12/1 - 12/29/15, 1/26/16
Test Site/Location:
PCTEST Lab., Columbia, MD, USA
Test Report Serial No.:
0Y1512012035-R1.A3L

FCC ID : A3LSMG930US

APPLICANT: SAMSUNG ELECTRONICS CO., LTD.

Application Type: Certification
FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s): §2; §22; §24; §27
Test Procedure(s): ANSI/TIA-603-C-2004, KDB 971168 D01 v02r02, KDB 648474 D03 v01r04
EUT Type: Portable Handset
Model(s): SM-G930V, SM-G930A, SM-G930P, SM-G930T, SM-G930R4
Test Device Serial No.: *identical prototype* [S/N: C3D41, C3D2E, C3D8C, C436C, C3DC0, C3DAD]

Mode	Tx Frequency (MHz)	Emission Designator	Modulation	ERP	
				Max. Power (W)	Max. Power (dBm)
LTE Band 12	699.7 - 715.3	1M11G7D	QPSK	0.073	18.62
LTE Band 12	699.7 - 715.3	1M12W7D	16QAM	0.066	18.19
LTE Band 12	700.5 - 714.5	2M71G7D	QPSK	0.073	18.65
LTE Band 12	700.5 - 714.5	2M72W7D	16QAM	0.068	18.30
LTE Band 12	701.5 - 713.5	4M50G7D	QPSK	0.077	18.88
LTE Band 12	701.5 - 713.5	4M49W7D	16QAM	0.075	18.73
LTE Band 12	704 - 711	8M98G7D	QPSK	0.084	19.24
LTE Band 12	704 - 711	8M95W7D	16QAM	0.076	18.80
LTE Band 13	779.5 - 784.5	4M52G7D	QPSK	0.133	21.23
LTE Band 13	779.5 - 784.5	4M50W7D	16QAM	0.117	20.67
LTE Band 13	782	8M97G7D	QPSK	0.140	21.45
LTE Band 13	782	8M96W7D	16QAM	0.122	20.87
LTE Band 5/26	824.7 - 848.3	1M12G7D	QPSK	0.129	21.09
LTE Band 5/26	824.7 - 848.3	1M11W7D	16QAM	0.103	20.12
LTE Band 5/26	825.5 - 847.5	2M72G7D	QPSK	0.121	20.84
LTE Band 5/26	825.5 - 847.5	2M72W7D	16QAM	0.098	19.91
LTE Band 5/26	826.5 - 846.5	4M53G7D	QPSK	0.081	19.09
LTE Band 5/26	826.5 - 846.5	4M51W7D	16QAM	0.065	18.12
LTE Band 5/26	829 - 844	8M99G7D	QPSK	0.120	20.81
LTE Band 5/26	829 - 844	8M97W7D	16QAM	0.105	20.23
LTE Band 26	831.5 - 841.5	13M5G7D	QPSK	0.134	21.29
LTE Band 26	831.5 - 841.5	13M4W7D	16QAM	0.124	20.93

Mode	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE Band 4	1710.7 - 1754.3	1M11G7D	QPSK	0.226	23.54
LTE Band 4	1710.7 - 1754.3	1M11W7D	16QAM	0.177	22.48
LTE Band 4	1711.5 - 1753.5	2M72G7D	QPSK	0.196	22.92
LTE Band 4	1711.5 - 1753.5	2M72W7D	16QAM	0.198	22.96
LTE Band 4	1712.5 - 1752.5	4M53G7D	QPSK	0.208	23.19
LTE Band 4	1712.5 - 1752.5	4M49W7D	16QAM	0.174	22.40
LTE Band 4	1715 - 1750	8M99G7D	QPSK	0.248	23.94
LTE Band 4	1715 - 1750	8M97W7D	16QAM	0.216	23.33
LTE Band 4	1717.5 - 1747.5	13M5G7D	QPSK	0.120	20.79
LTE Band 4	1717.5 - 1747.5	13M5W7D	16QAM	0.118	20.72
LTE Band 4	1720 - 1745	18M0G7D	QPSK	0.139	21.43
LTE Band 4	1720 - 1745	18M0W7D	16QAM	0.148	21.70
LTE Band 2/25	1850.7 - 1914.3	1M11G7D	QPSK	0.152	21.82
LTE Band 2/25	1850.7 - 1914.3	1M11W7D	16QAM	0.123	20.88
LTE Band 2/25	1851.5 - 1913.5	2M72G7D	QPSK	0.144	21.60
LTE Band 2/25	1851.5 - 1913.5	2M71W7D	16QAM	0.118	20.73
LTE Band 2/25	1852.5 - 1912.5	4M50G7D	QPSK	0.188	22.75
LTE Band 2/25	1852.5 - 1912.5	4M50W7D	16QAM	0.151	21.80
LTE Band 2/25	1855 - 1910	8M98G7D	QPSK	0.158	21.99
LTE Band 2/25	1855 - 1910	8M96W7D	16QAM	0.136	21.35
LTE Band 2/25	1857.5 - 1907.5	13M5G7D	QPSK	0.189	22.77
LTE Band 2/25	1857.5 - 1907.5	13M5W7D	16QAM	0.151	21.78
LTE Band 2/25	1860 - 1905	18M0G7D	QPSK	0.204	23.10
LTE Band 2/25	1860 - 1905	18M0W7D	16QAM	0.161	22.07
LTE Band 30	2307.5 - 2312.5	4M50G7D	QPSK	0.144	21.58
LTE Band 30	2307.5 - 2312.5	4M50W7D	16QAM	0.116	20.63
LTE Band 30	2310	8M98G7D	QPSK	0.123	20.90
LTE Band 30	2310	9M01W7D	16QAM	0.098	19.91
LTE Band 41	2498.5 - 2687.5	4M50G7D	QPSK	0.111	20.46
LTE Band 41	2498.5 - 2687.5	4M49W7D	16QAM	0.082	19.13
LTE Band 41	2501 - 2685	8M95G7D	QPSK	0.165	22.17
LTE Band 41	2501 - 2685	8M99W7D	16QAM	0.128	21.08
LTE Band 41	2503.5 - 2682.5	13M5G7D	QPSK	0.166	22.21
LTE Band 41	2503.5 - 2682.5	13M4W7D	16QAM	0.140	21.46
LTE Band 41	2506 - 2680	18M0G7D	QPSK	0.127	21.03
LTE Band 41	2506 - 2680	18M0W7D	16QAM	0.124	20.94

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.

This revised Test Report (S/N: 0Y1512012035-R1.A3L) supersedes and replaces the previously issued test report (S/N: 0Y1512012035.A3L) on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

Randy Ortanez
President

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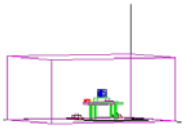
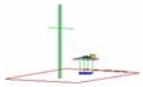


MEASUREMENT REPORT
FCC Part 22, 24, & 27



§2.1033 General Information

APPLICANT:	Samsung Electronics Co., Ltd.
APPLICANT ADDRESS:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	7185 Oakland Mills Road, Columbia, MD 21045 USA
FCC RULE PART(S):	§2; §22; §24; §27
BASE MODEL:	SM-G930V, SM-G930A, SM-G930P, SM-G930T, SM-G930R4
FCC ID:	A3LSMG930US
FCC CLASSIFICATION:	PCS Licensed Transmitter Held to Ear (PCE)
FREQUENCY TOLERANCE:	±0.00025 % (2.5 ppm)
Test Device Serial No.:	C3D41, C3D2E, C3D8C, C436C, C3DC0, C3DAD ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	12/7 - 12/29/15; 01/26/16
TEST REPORT S/N:	0Y1512012035-R1.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.

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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 39º 10'23" N latitude and 76º 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 C63.4-2014 on January 22, 2015.

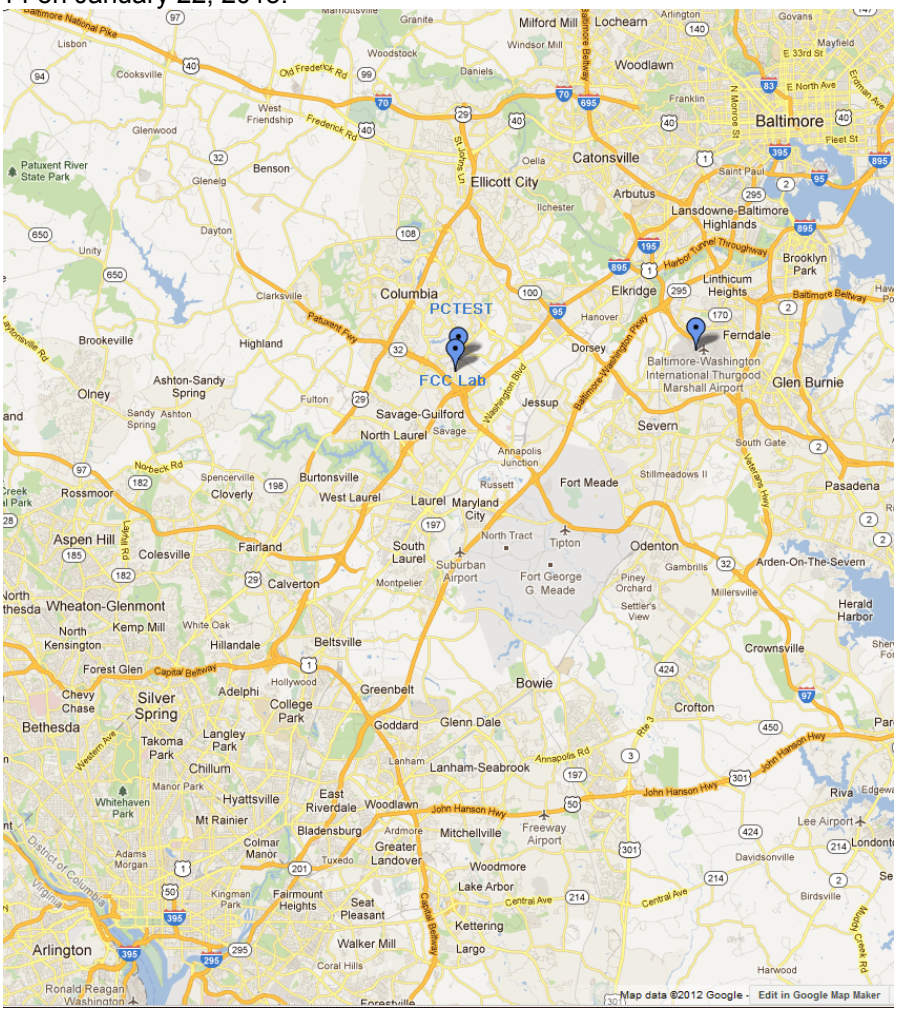

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG930US**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function.

This device uses a closed-loop tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance. The tuner for this device was set to simulate a "free space" condition in which the transmit antenna is matched to the medium into which it is transmitting and, thus, all power is at its maximum level.

This device also employs an antenna switching diversity (ASDiv) mechanism that allows for radiated transmission from one of two antennas at a time for LTE Band 5/26, Band 12, and Band 13. Both antennas cannot transmit simultaneously so dual transmission conditions were not investigated. The two antennas share the same conducted circuitry so only one set of conducted measurements is included. The main transmit antenna data is labeled as "Antenna A" and the secondary transmit antenna data is labeled as "Antenna B" in the radiated section of this report.

2.2 Device Capabilities

This device contains the following capabilities:

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

LTE Band 26 (814.7 – 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 – 849 MHz). Therefore, test data provided in this report covers Band 5 and the portion of Band 26 subject to Part 22.

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

2.3 Test Configuration

The Samsung Portable Handset FCC ID: A3LSMG930US was tested per the guidance of ANSI/TIA-603-C-2004 and KDB 971168 D01 v02r02. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

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

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-C-2004) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v02r02) were used in the measurement of the **Samsung Portable Handset FCC ID: A3LSMG930US.**

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 Block A Frequency Range

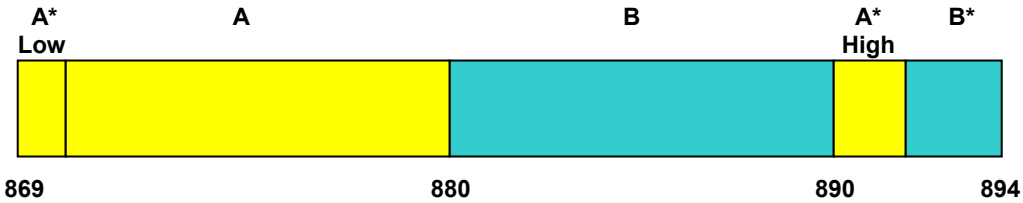
§27.5(c)

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

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

3.3 Cellular - Base Frequency Blocks

§22.905



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

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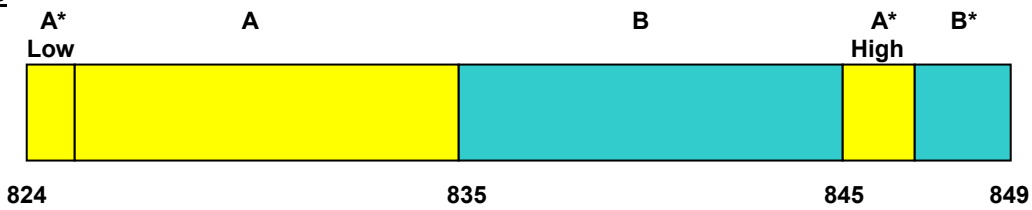
3.4 Cellular - Mobile Frequency Blocks

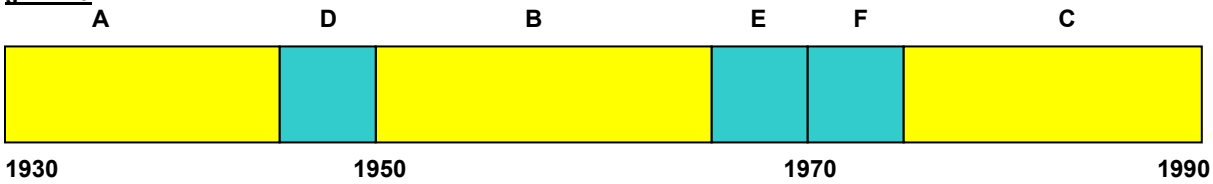
§22.905



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

3.5 PCS - Base Frequency Blocks

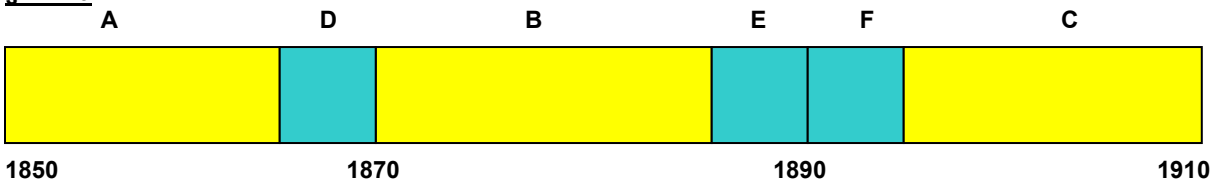
§24.229



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)

3.6 PCS - Mobile Frequency Blocks

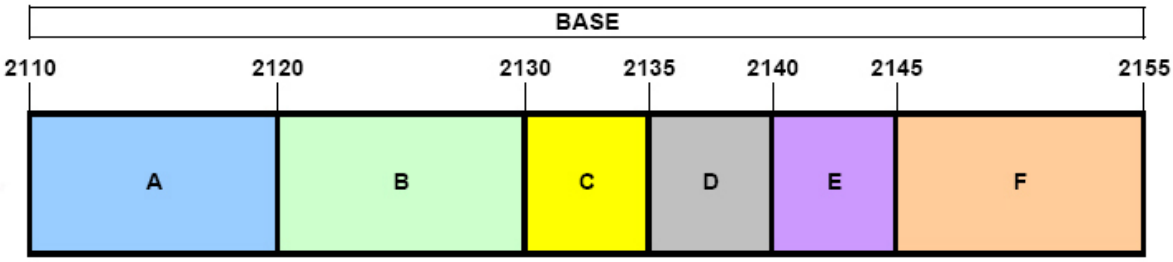
§24.229



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)

3.7 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)

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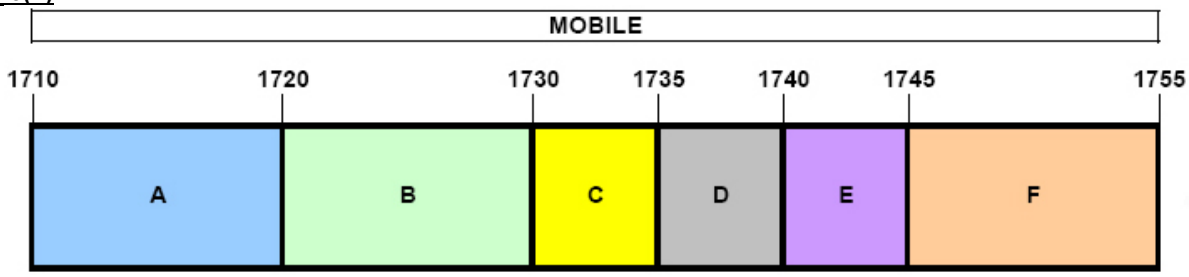
3.8 AWS - Mobile Frequency Blocks

§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)

3.9 WCS – Mobile/Base Frequency Blocks

§27.5(a)

The following frequencies are available for WCS in the 2305-2320 MHz and 2345-2360 MHz bands:

BLOCK 1: 2305-2310 and 2350-2355 MHz (A)

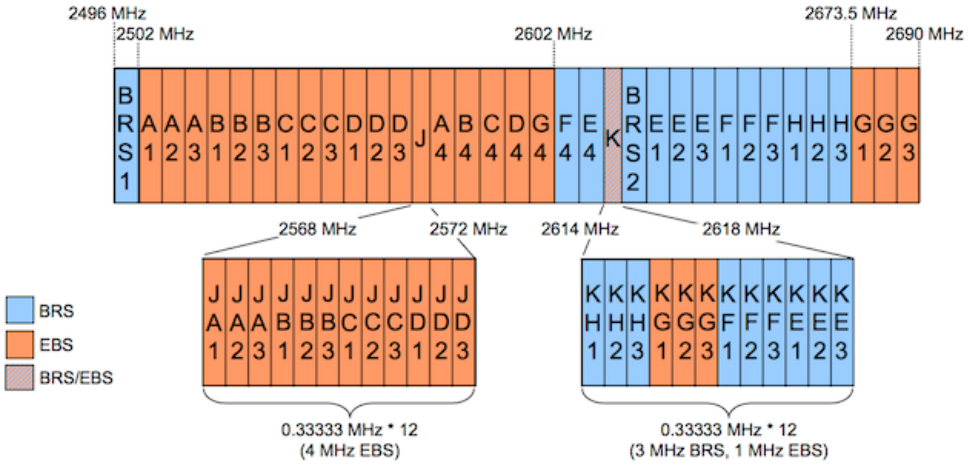
BLOCK 2: 2310-2315 and 2355-236 MHz (B)

BLOCK 3: 2315-2320 MHz (C)

BLOCK 4: 2345-2350 MHz (D)

3.10 BRS/EBS Frequency Block

§27.5



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3.11 Radiated Power and Radiated Spurious Emissions

§2.1053 §22.913(a.2) §22.917(a) §24.232(c) §24.238(a) §27.50(b.10) §27.50(c.10) §27.50(d.4) §27.53(a.4) §27.53(f) §27.53(g) §27.53(h) 27.53(m)

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 turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v02r02.

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 + $10\log_{10}$(Power $_{[Watts]}$). For Band 41, the calculated P_d levels are compared to the absolute spurious emission limit of -25dBm which is equivalent to the required minimum attenuation of 55 + $10\log_{10}$(Power $_{[Watts]}$). For Band 30, the calculated P_d levels are compared to the absolute spurious emission limit of -40dBm which is equivalent to the required minimum attenuation of 70 + $10\log_{10}$(Power $_{[Watts]}$).

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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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

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5.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx1	Licensed Transmitter Cable Set	4/16/2015	Annual	4/16/2016	LTx1
-	RE3	Radiated Emissions Cable Set	4/29/2015	Annual	4/29/2016	RE3
Agilent	8447D	Broadband Amplifier	6/12/2015	Annual	6/12/2016	2443A01900
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Emco	3115	Horn Antenna (1-18GHz)	1/30/2014	Biennial	1/30/2016	9704-5182
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	10/22/2014	Biennial	10/22/2016	128338
K & L	11SH10-3075/U18000	High Pass Filter	7/18/2015	Annual	7/18/2016	11SH10-3075/U18000-2
K & L	11SH10-4000/12000	High Pass Filter	12/1/2014	Annual	12/1/2015	11SH10-4000/12000-2
K & L	13SH10-1000/U1000	N Type High Pass Filter	7/18/2015	Annual	7/18/2016	13SH10-1000/U1000-1
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	3/11/2015	Annual	3/11/2016	11401010036
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini-Circuits	PWR-SENS-4RMS	USB Power Sensor	3/11/2015	Annual	3/11/2016	11210140001
Mini-Circuits	TVA-11-422	RF Power Amp	N/A			QA1303002
Rohde & Schwarz	CMW500	Radio Communication Tester	10/13/2015	Annual	10/13/2016	100976
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	3/12/2015	Annual	3/12/2016	100342
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	3/5/2015	Annual	3/5/2016	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/3/2015	Annual	3/3/2016	100040
Schwarzbeck	UHA 9105	Dipole Antenna (400 - 1GHz) Rx	2/21/2014	Biennial	2/21/2016	9105-2404
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/28/2014	Biennial	1/28/2016	A051107
VWR	62344-734	Thermometer with Clock	2/20/2014	Biennial	2/20/2016	140140336

Table 5-1. Test Equipment

Note:

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

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

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).

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7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LSMG930US
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 7.2
2.1051 22.917(a) 24.238(a) 27.53(c) 27.53(g) 27.53(h)	Out of Band Emissions	> 43 + 10log$_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions		PASS	Section 7.3, 7.4
27.53(m)	Out of Band Emissions	> 43 + 10log$_{10}$ (P[Watts]) at channel edges and > 55 + 10log$_{10}$ (P[Watts]) at 5.5MHz away and beyond channel edges		PASS	Section 7.3, 7.4
27.53(a)	Out of Band Emissions	> 43 + 10log10 (P[Watts]) at (2300-2305MHz, 2345-2360MHz) > 55 + 10log10 (P[Watts]) at (2320-2324MHz, 2341-2345MHz) > 61 + 10log10 (P[Watts]) at (2324-2328MHz, 2337-2341MHz) > 67 + 10log10 (P[Watts]) at (2288-2292MHz, 2328-2337MHz) > 70 + 10log10 (P[Watts]) at (<2288MHz and >2365MHz)		PASS	Section 7.3, 7.4
24.232(d)	Peak-Average Ratio	< 13 dB		PASS	Section 7.5
2.1046	Transmitter Conducted Output Power	N/A		PASS	See RF Exposure Report
2.1055. 22.355 24.235 27.54	Frequency Stability	< 2.5 ppm (Part 22) and fundamental emissions stay within authorized frequency block (Part 24, 27)		PASS	Section 7.8
22.913(a.2)	Effective Radiated Power (Band 5 26)	< 7 Watts max. ERP	RADIATED	PASS	Section 7.6
27.50(b.10) 27.50(c.10)	Effective Radiated Power (Band 12 13)	< 3 Watts max. ERP		PASS	Section 7.6
24.232(c) 27.50(h.2)	Equivalent Isotropic Radiated Power (Band 2 25 41)	< 2 Watts max. EIRP		PASS	Section 7.6
27.50(d.4)	Equivalent Isotropic Radiated Power (Band 4)	< 1 Watts max. EIRP		PASS	Section 7.6
27.50(a.3)	Equivalent Isotropic Radiated Power (Band 30)	< 0.25 Watts max. EIRP		PASS	Section 7.6
2.1053 22.917(a) 24.238(a) 27.53(c) 27.53(g) 27.53(h)	Undesirable Emissions	> 43 + 10log$_{10}$ (P[Watts]) for all out-of-band emissions		PASS	Section 7.7
27.53(f)	Undesirable Emissions (Band 13)	< -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 7.7
27.53(a)	Undesirable Emissions (Band 30)	> 70 + 10log$_{10}$ (P[Watts])		PASS	Section 7.7
27.53(m)	Undesirable Emissions	> 43 + 10log$_{10}$ (P[Watts]) at channel edges > 55 + 10log$_{10}$ (P[Watts]) at 5.5MHz away and beyond channel edges		PASS	Section 7.7

Table 7-1. Summary of Test Results

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Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots (Sections 7.2, 7.3, 7.4, 7.5) were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "LTE Automation," Version 4.0.

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7.2 Occupied Bandwidth

§2.1049

Test Overview

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

Test Procedure Used

KDB 971168 D01 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.

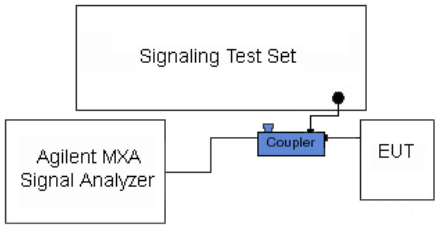

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

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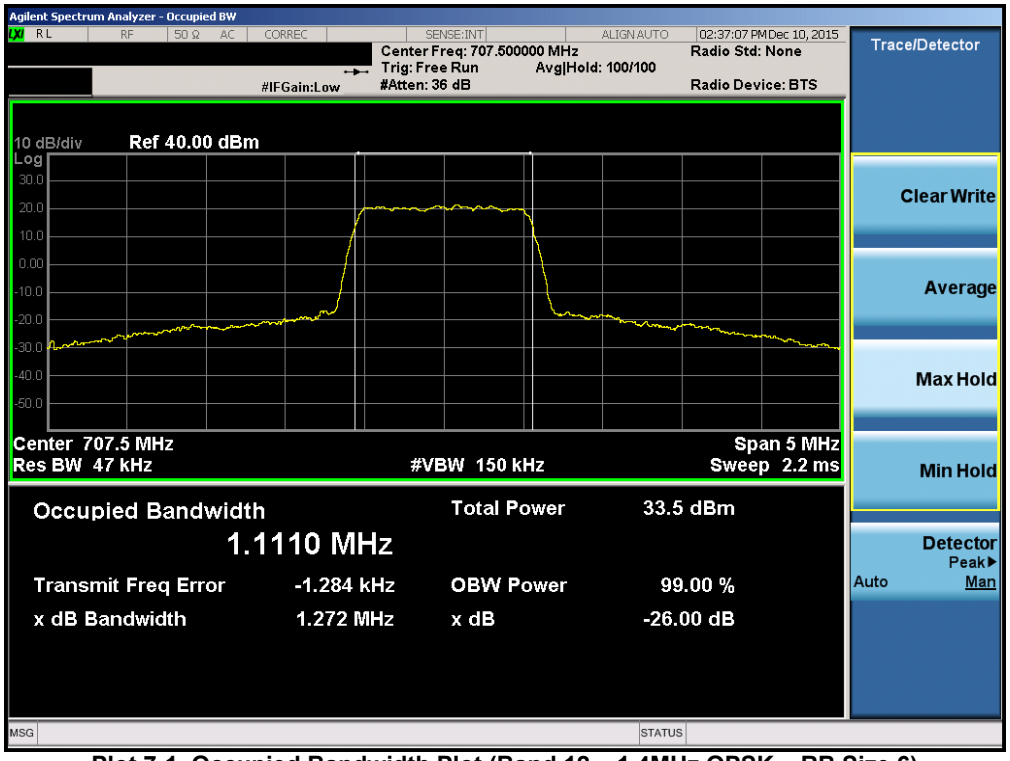
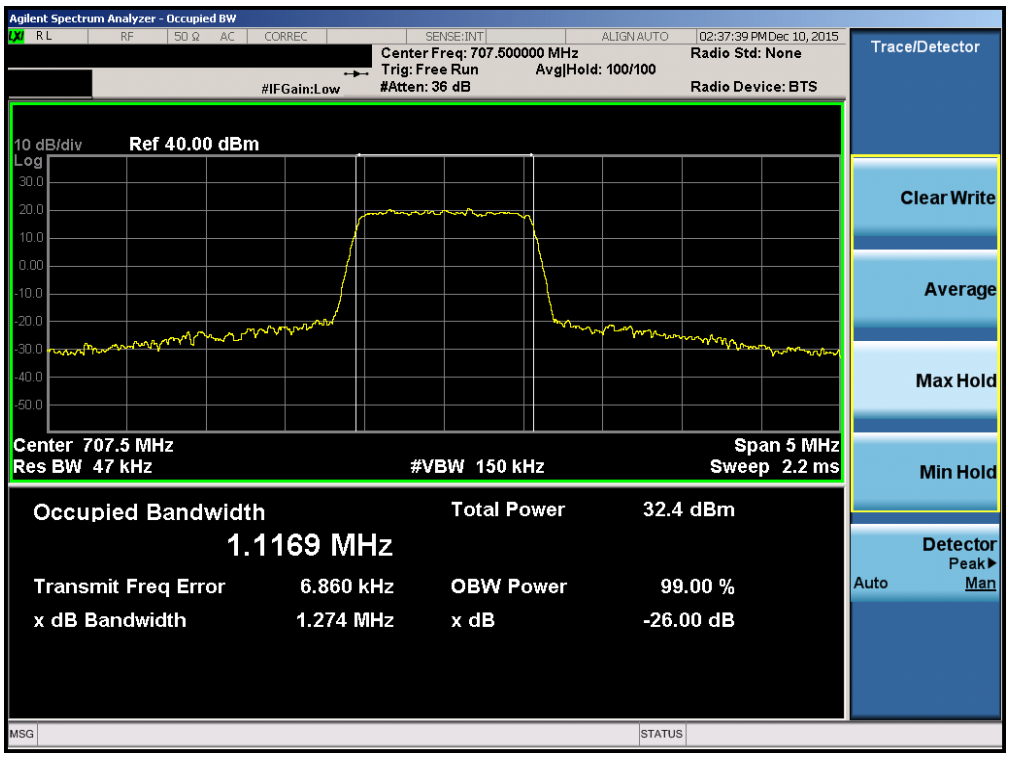


Plot 7-1. Occupied Bandwidth Plot (Band 12 – 1.4MHz QPSK – RB Size 6)



Plot 7-2. Occupied Bandwidth Plot (Band 12 – 1.4MHz 16-QAM – RB Size 6)

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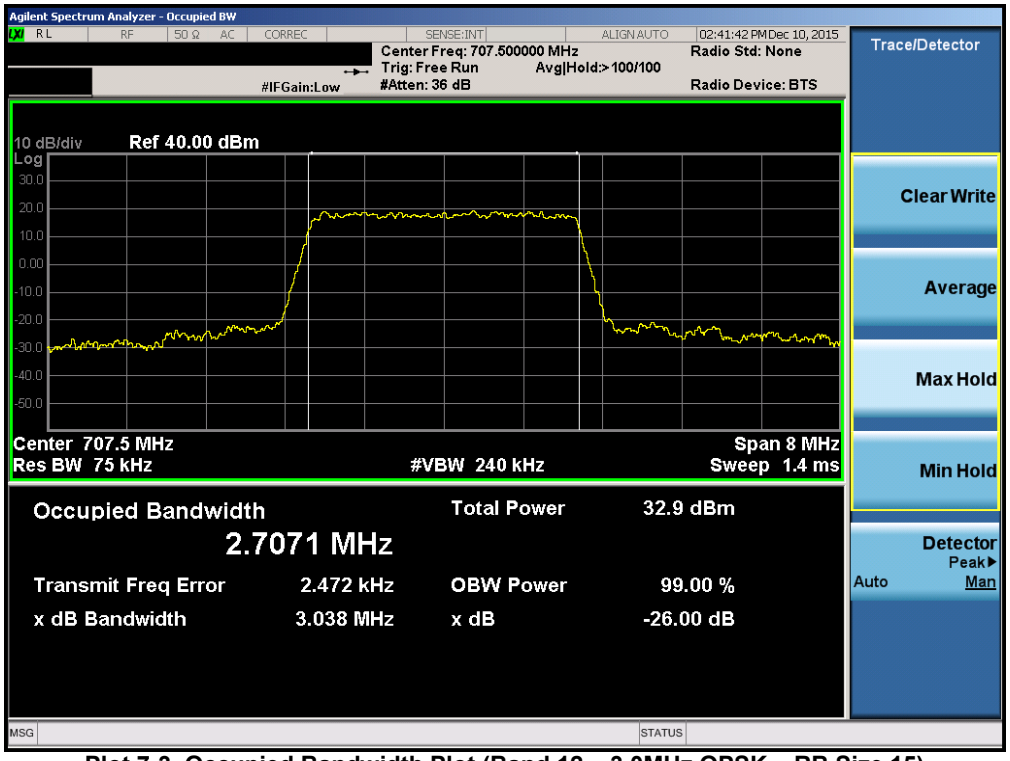

Plot 7-3. Occupied Bandwidth Plot (Band 12 – 3.0MHz QPSK – RB Size 15)

Plot 7-4. Occupied Bandwidth Plot (Band 12 – 3.0MHz 16-QAM – RB Size 15)

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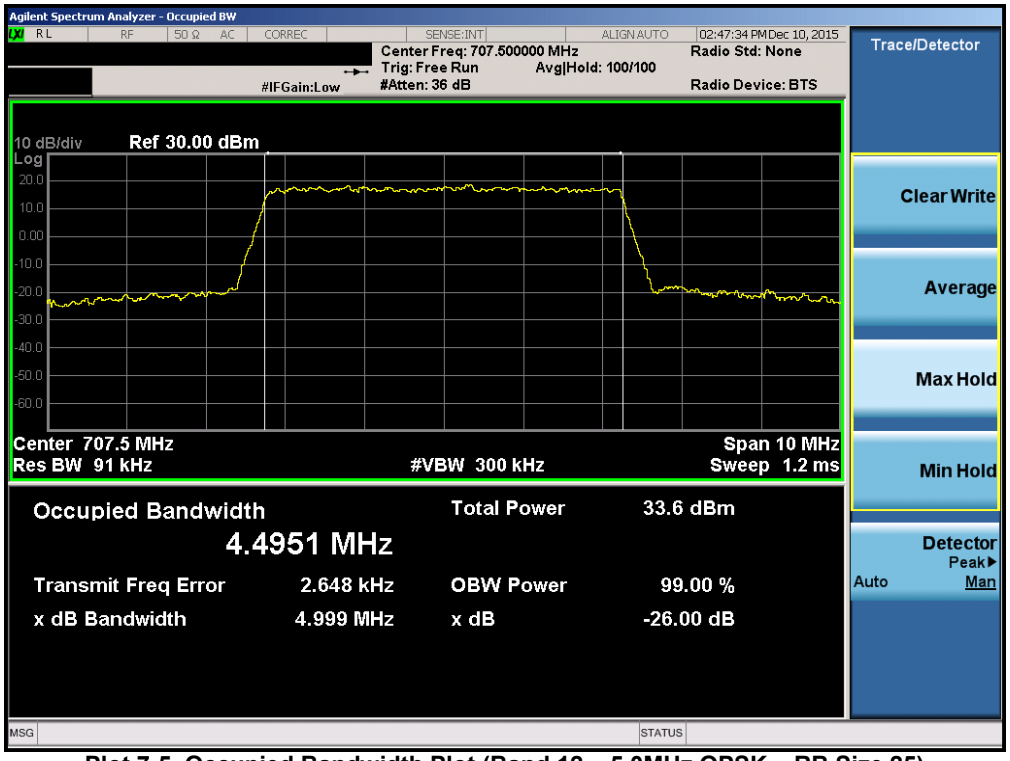

Plot 7-5. Occupied Bandwidth Plot (Band 12 – 5.0MHz QPSK – RB Size 25)

Plot 7-6. Occupied Bandwidth Plot (Band 12 – 5.0MHz 16-QAM – RB Size 25)

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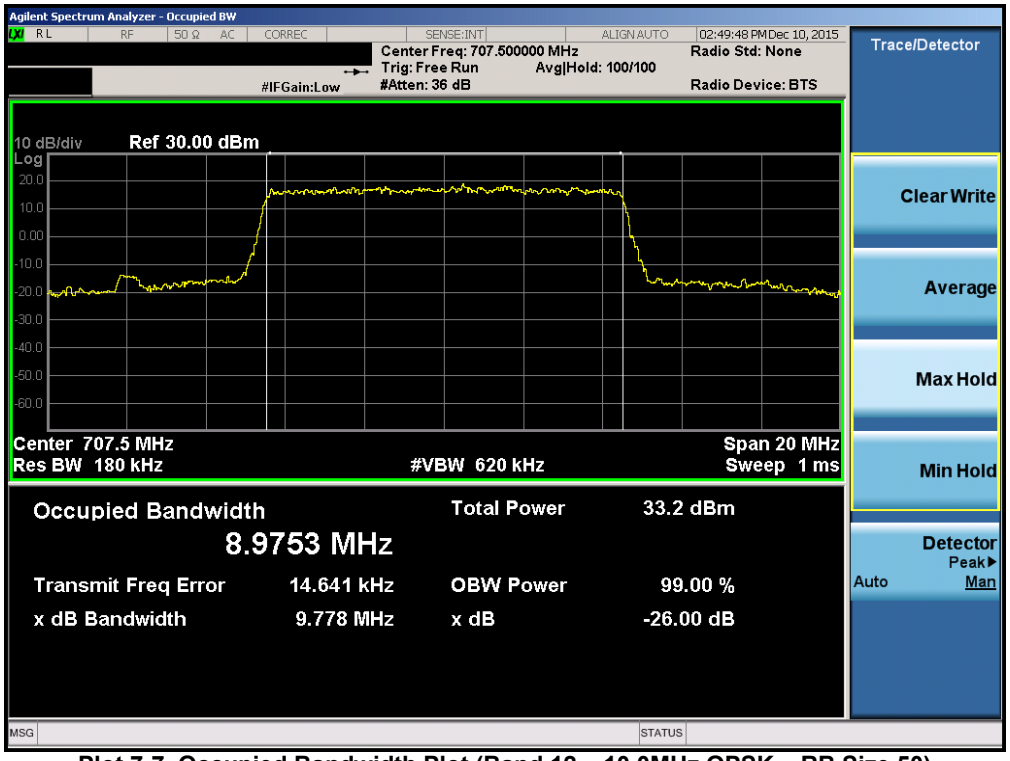

Plot 7-7. Occupied Bandwidth Plot (Band 12 – 10.0MHz QPSK – RB Size 50)

Plot 7-8. Occupied Bandwidth Plot (Band 12 – 10.0MHz 16-QAM – RB Size 50)

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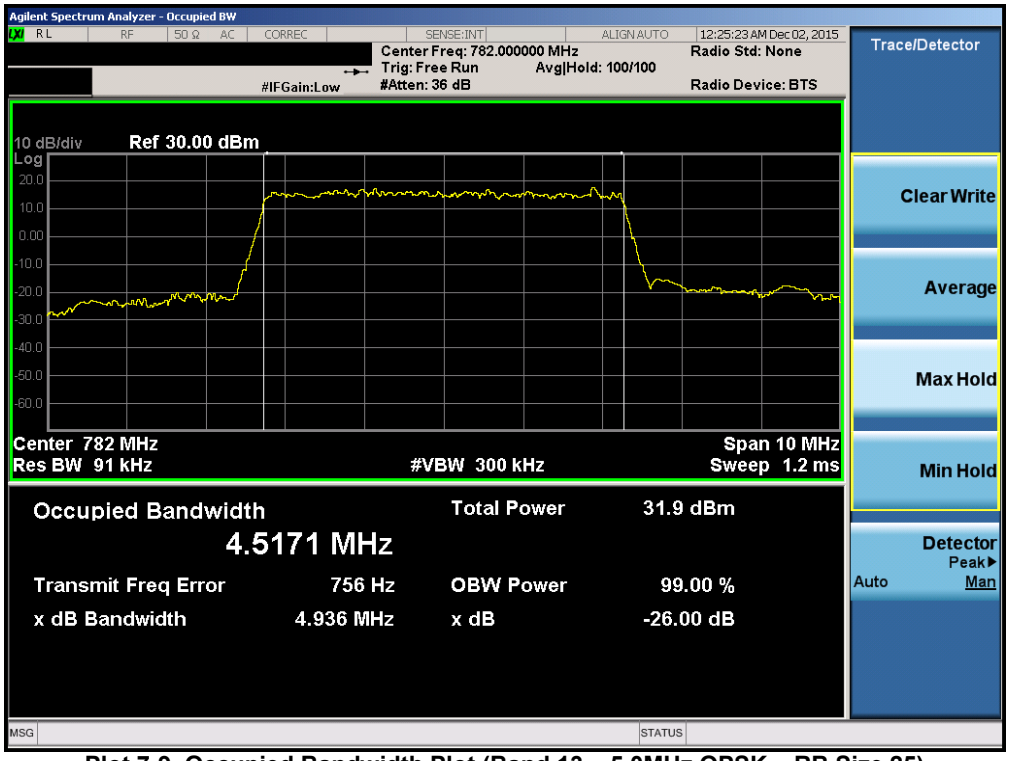

Plot 7-9. Occupied Bandwidth Plot (Band 13 – 5.0MHz QPSK – RB Size 25)

Plot 7-10. Occupied Bandwidth Plot (Band 13 – 5.0MHz 16-QAM – RB Size 25)

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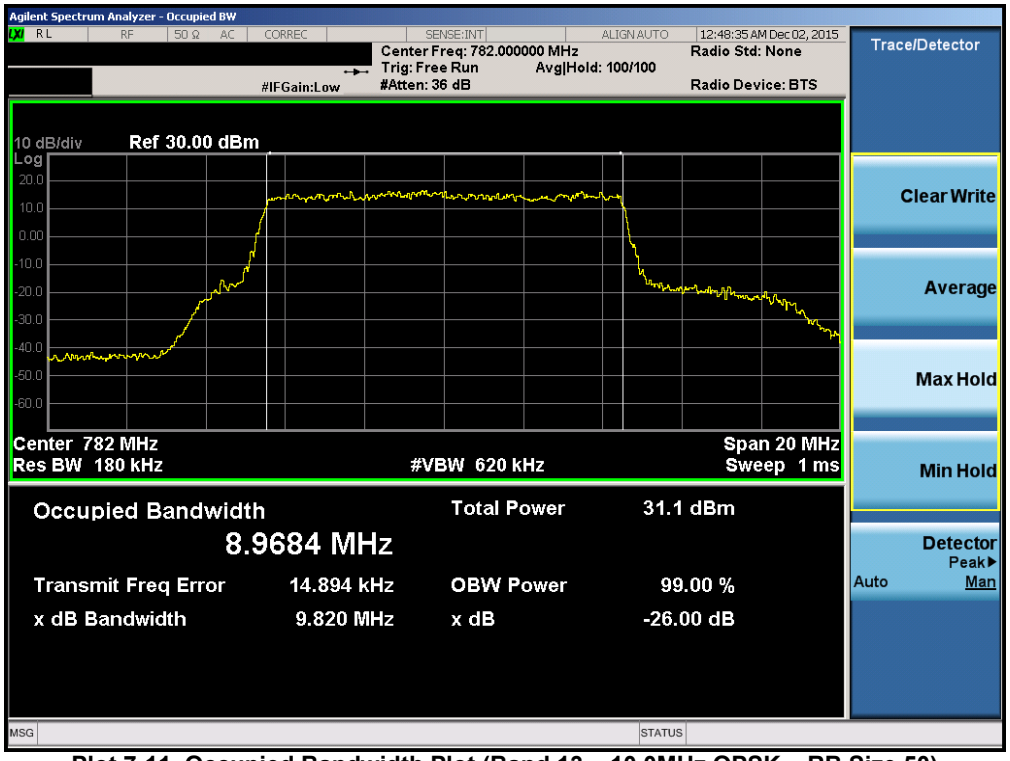
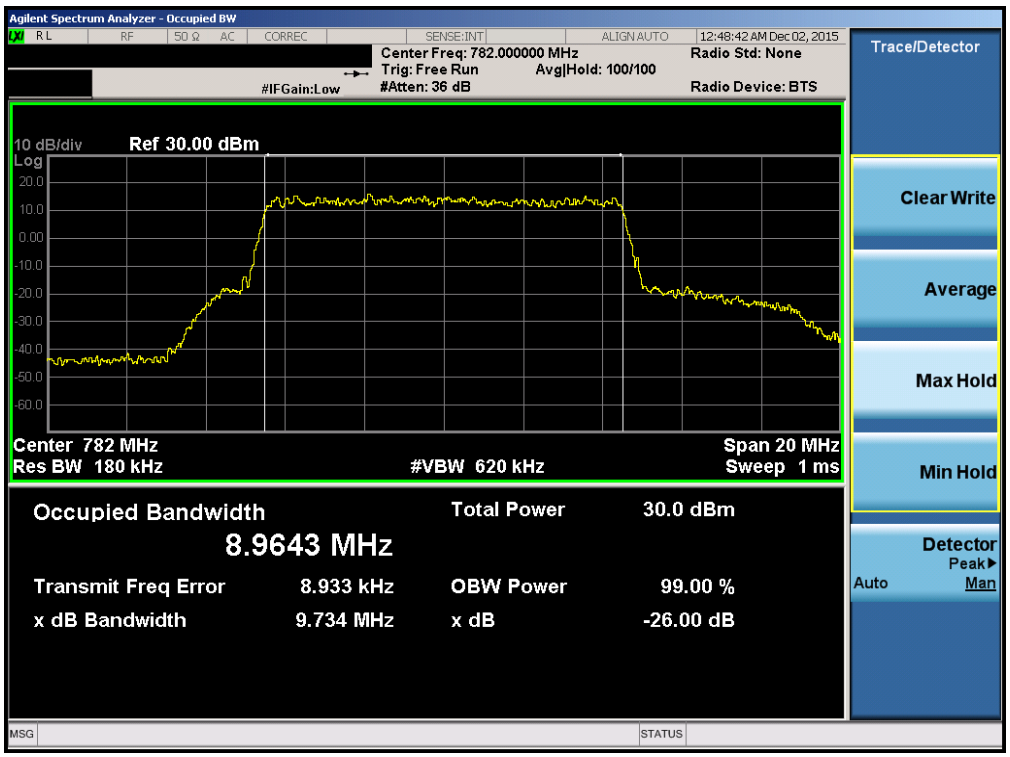


Plot 7-11. Occupied Bandwidth Plot (Band 13 – 10.0MHz QPSK – RB Size 50)



Plot 7-12. Occupied Bandwidth Plot (Band 13 – 10.0MHz 16-QAM – RB Size 50)

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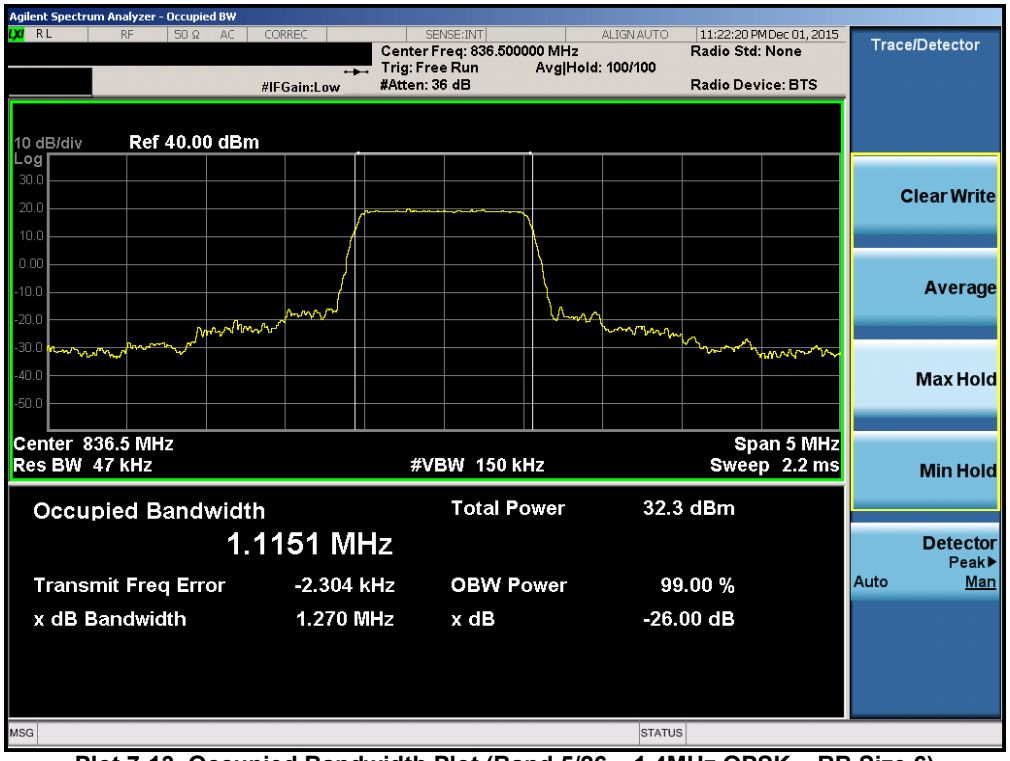
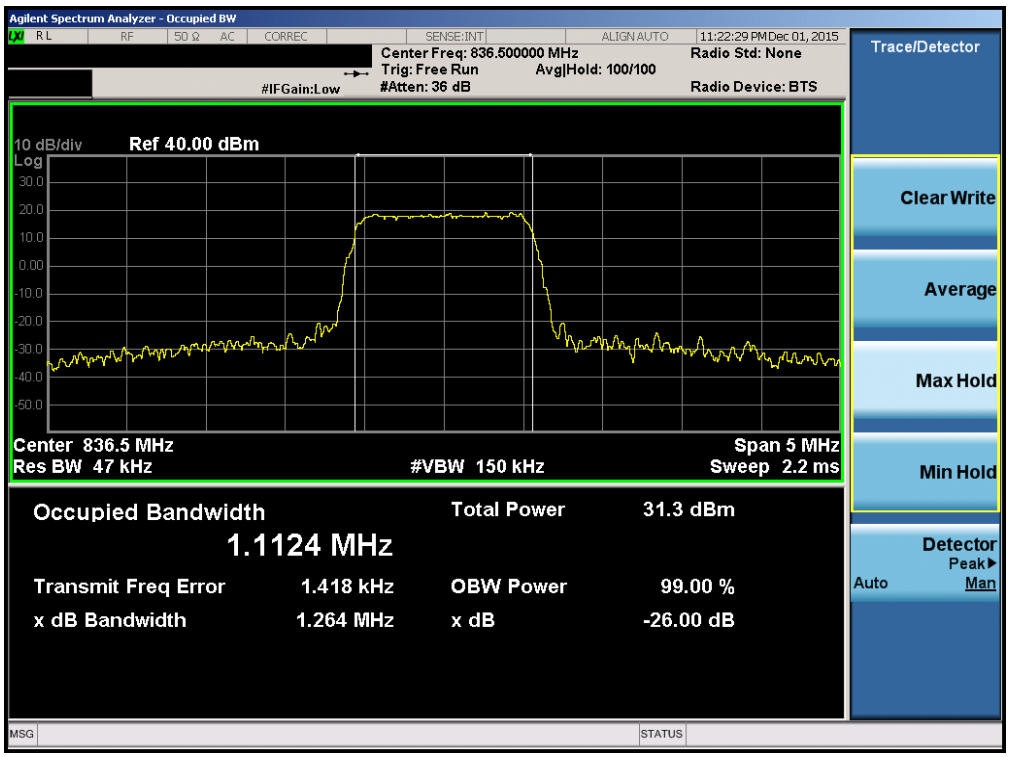


Plot 7-13. Occupied Bandwidth Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)



Plot 7-14. Occupied Bandwidth Plot (Band 5/26 – 1.4MHz 16-QAM – RB Size 6)

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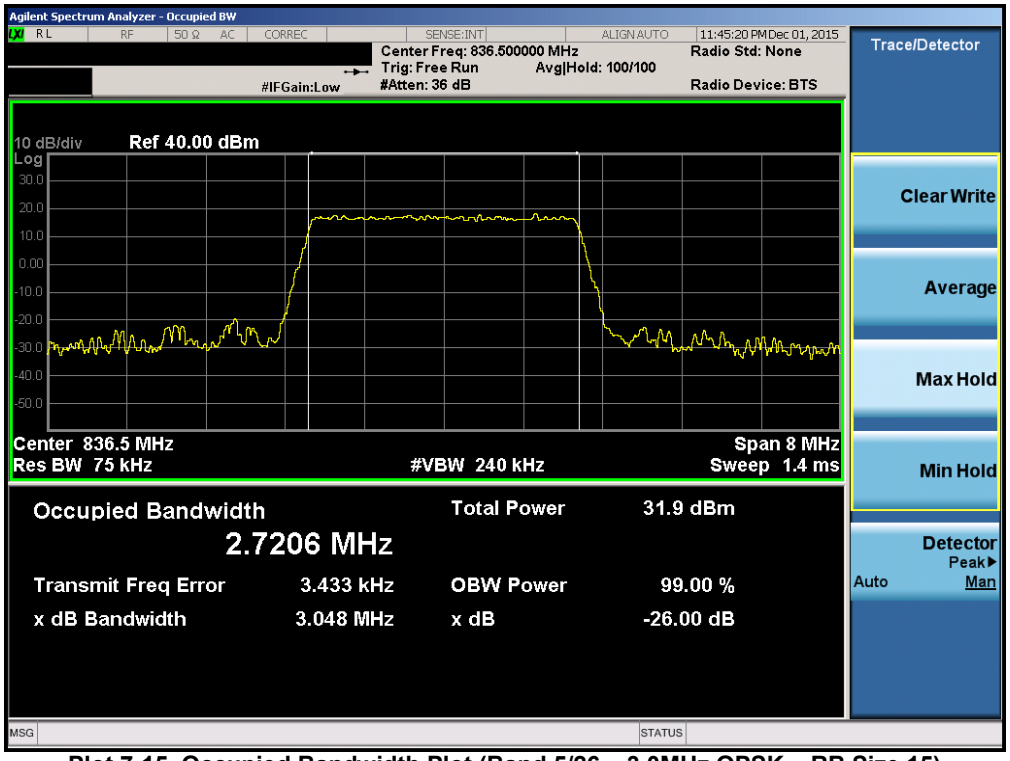
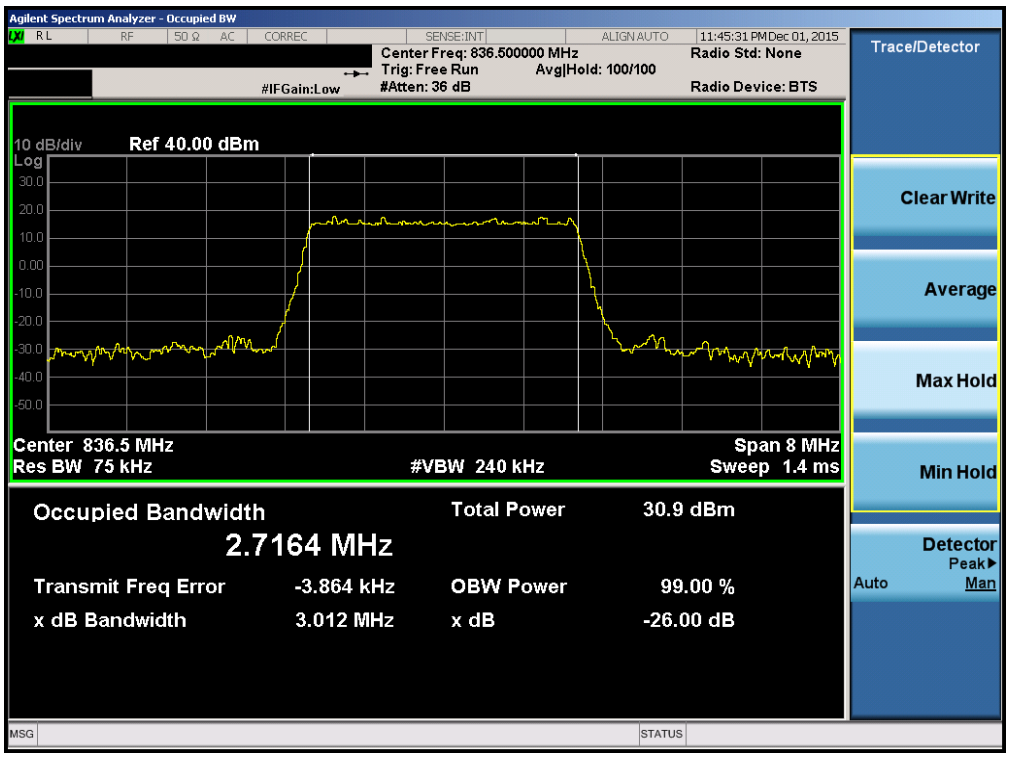


Plot 7-15. Occupied Bandwidth Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)



Plot 7-16. Occupied Bandwidth Plot (Band 5/26 – 3.0MHz 16-QAM – RB Size 15)

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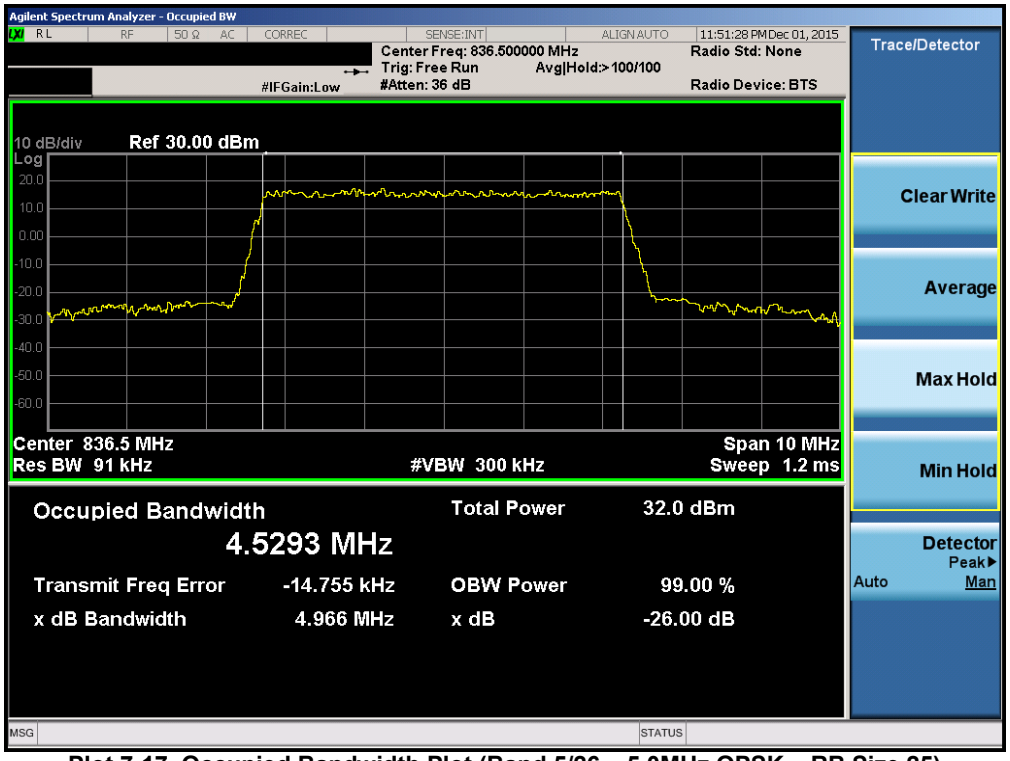

Plot 7-17. Occupied Bandwidth Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)

Plot 7-18. Occupied Bandwidth Plot (Band 5/26 – 5.0MHz 16-QAM – RB Size 25)

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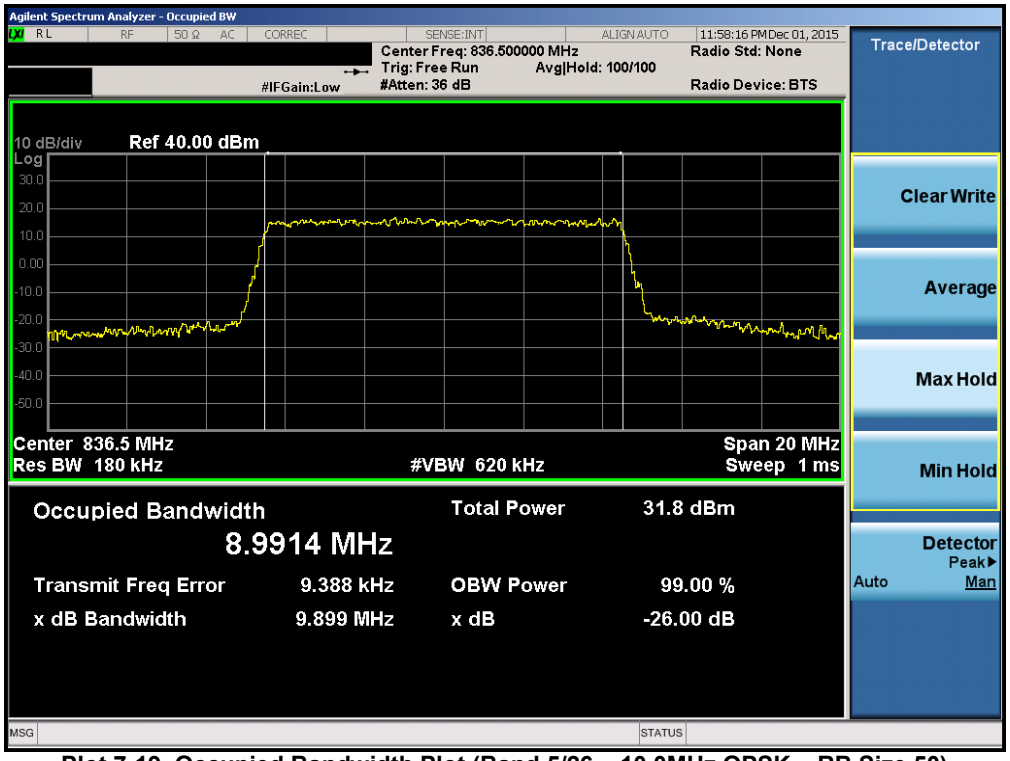

Plot 7-19. Occupied Bandwidth Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)

Plot 7-20. Occupied Bandwidth Plot (Band 5/26 – 10.0MHz 16-QAM – RB Size 50)

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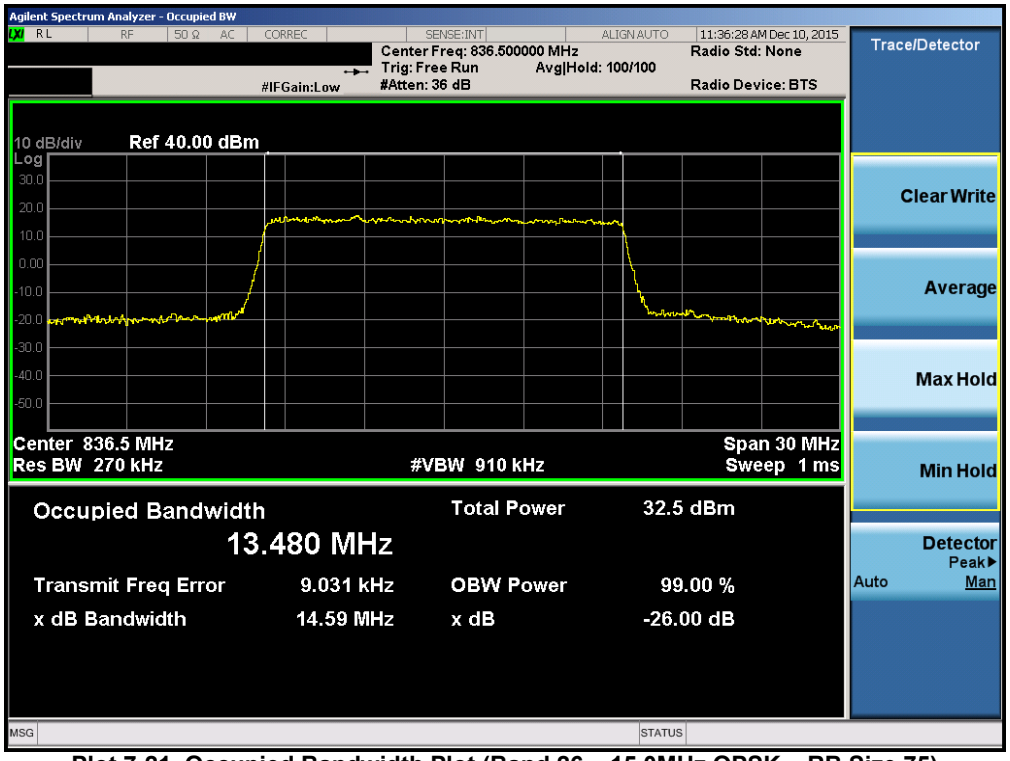

Plot 7-21. Occupied Bandwidth Plot (Band 26 – 15.0MHz QPSK – RB Size 75)

Plot 7-22. Occupied Bandwidth Plot (Band 26 – 15.0MHz 16-QAM – RB Size 75)

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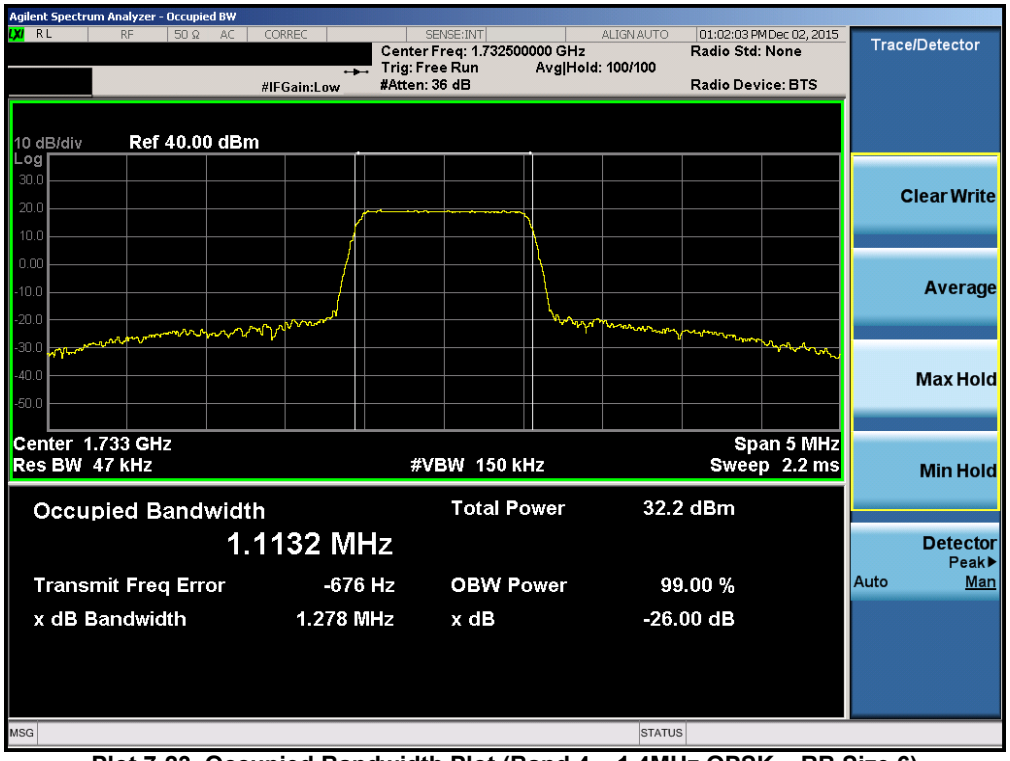
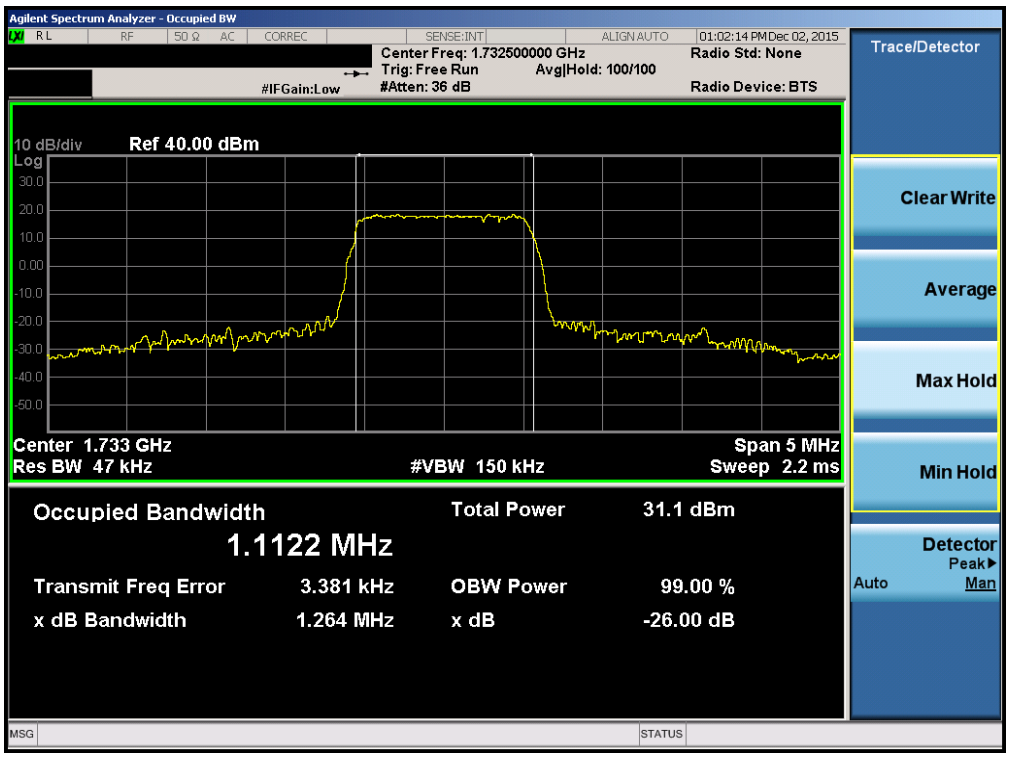


Plot 7-23. Occupied Bandwidth Plot (Band 4 – 1.4MHz QPSK – RB Size 6)



Plot 7-24. Occupied Bandwidth Plot (Band 4 – 1.4MHz 16-QAM – RB Size 6)

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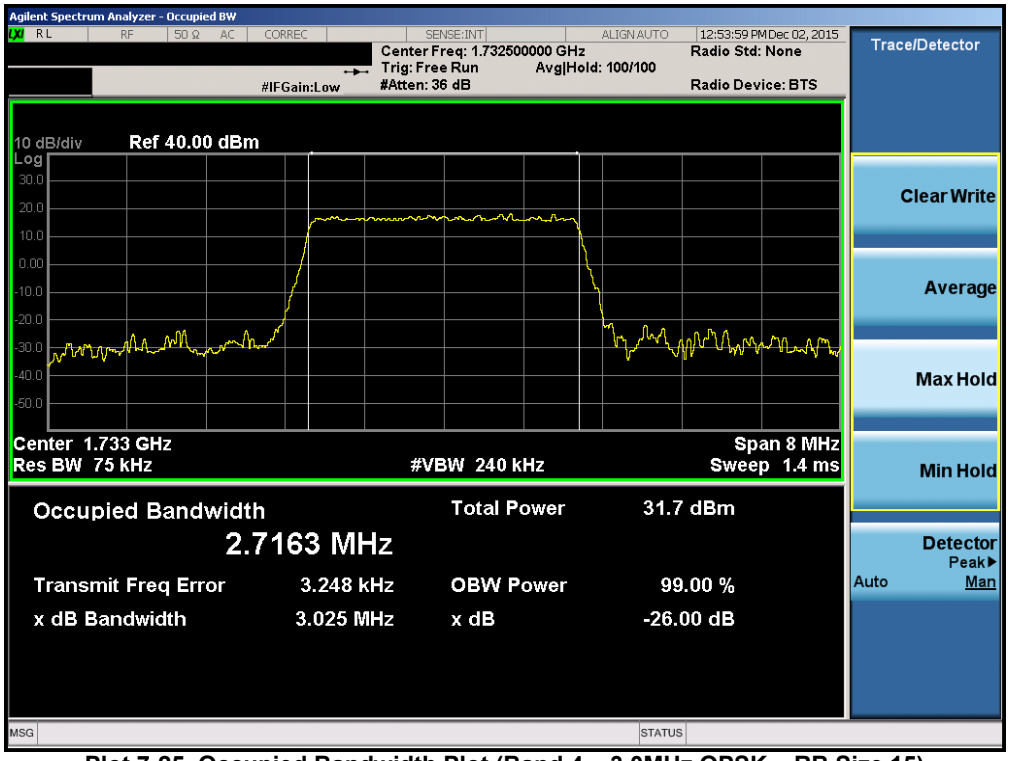

Plot 7-25. Occupied Bandwidth Plot (Band 4 – 3.0MHz QPSK – RB Size 15)

Plot 7-26. Occupied Bandwidth Plot (Band 4 – 3.0MHz 16-QAM – RB Size 15)

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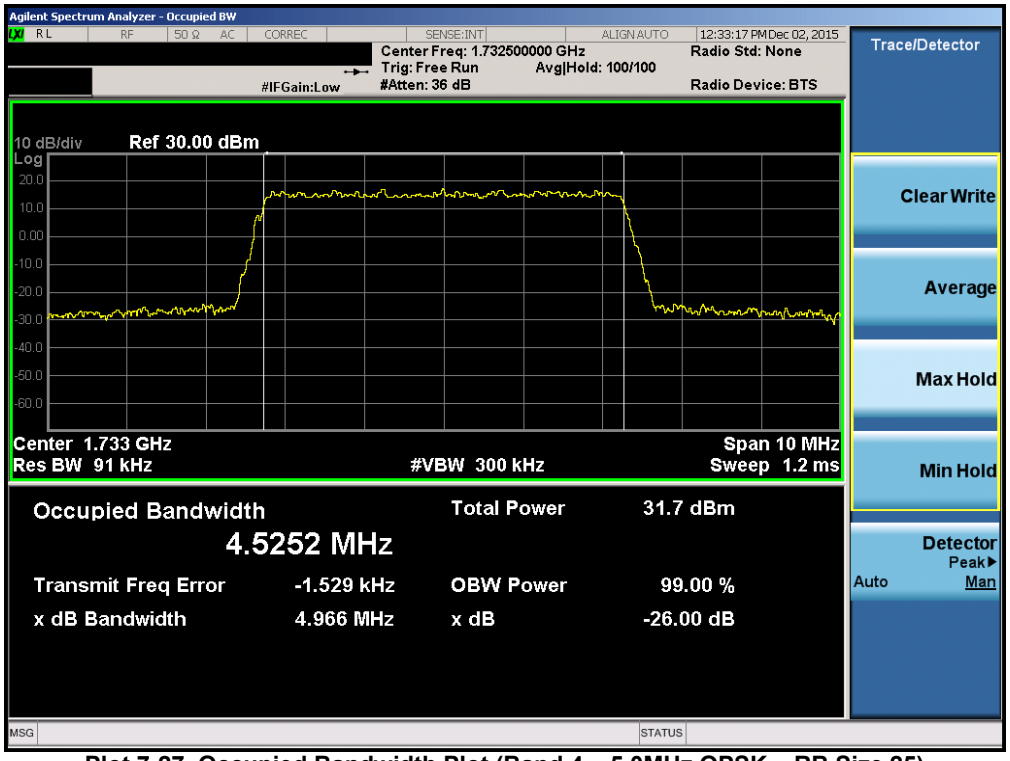
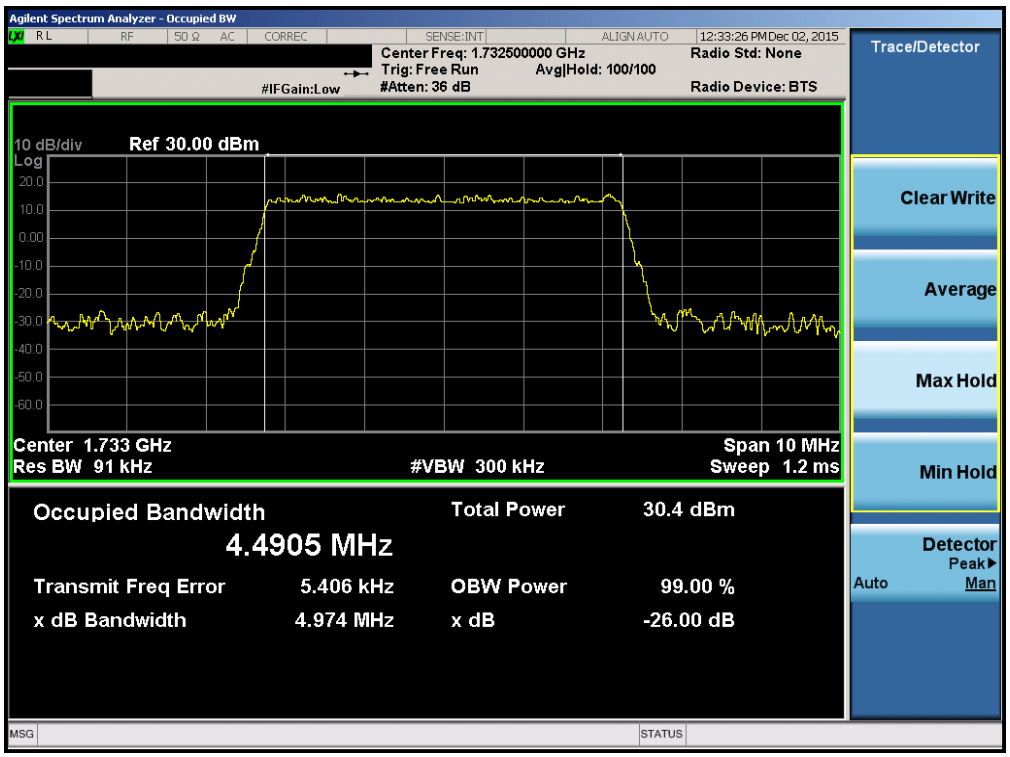


Plot 7-27. Occupied Bandwidth Plot (Band 4 – 5.0MHz QPSK – RB Size 25)



Plot 7-28. Occupied Bandwidth Plot (Band 4 – 5.0MHz 16-QAM – RB Size 25)

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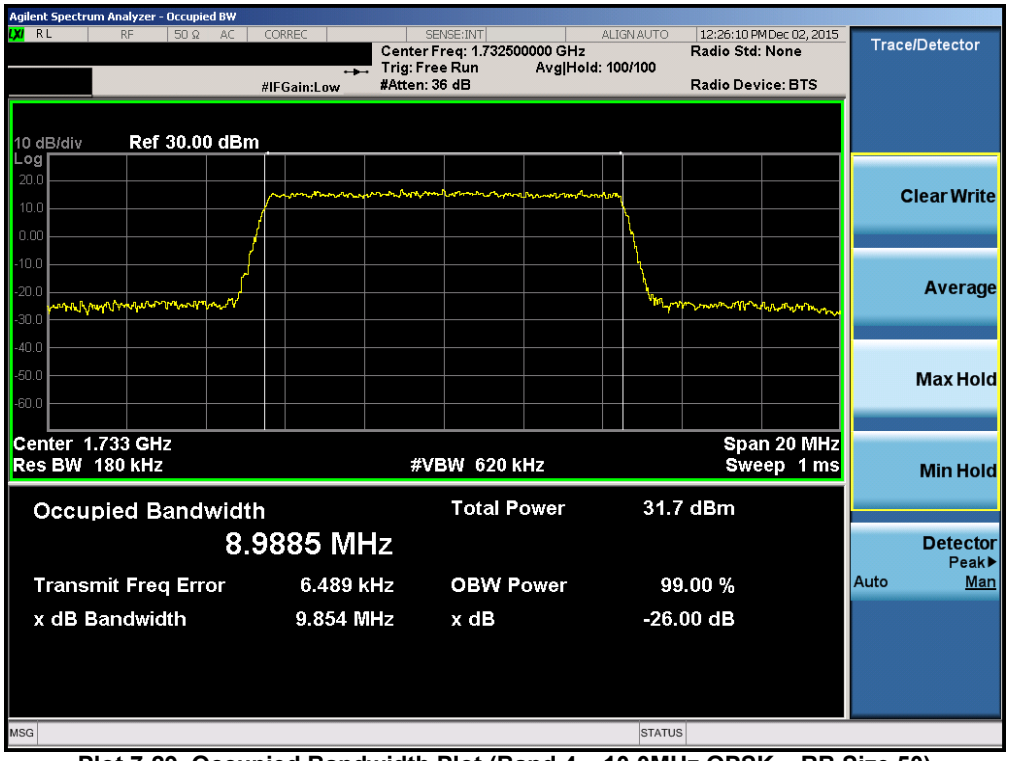

Plot 7-29. Occupied Bandwidth Plot (Band 4 – 10.0MHz QPSK – RB Size 50)

Plot 7-30. Occupied Bandwidth Plot (Band 4 – 10.0MHz 16-QAM – RB Size 50)

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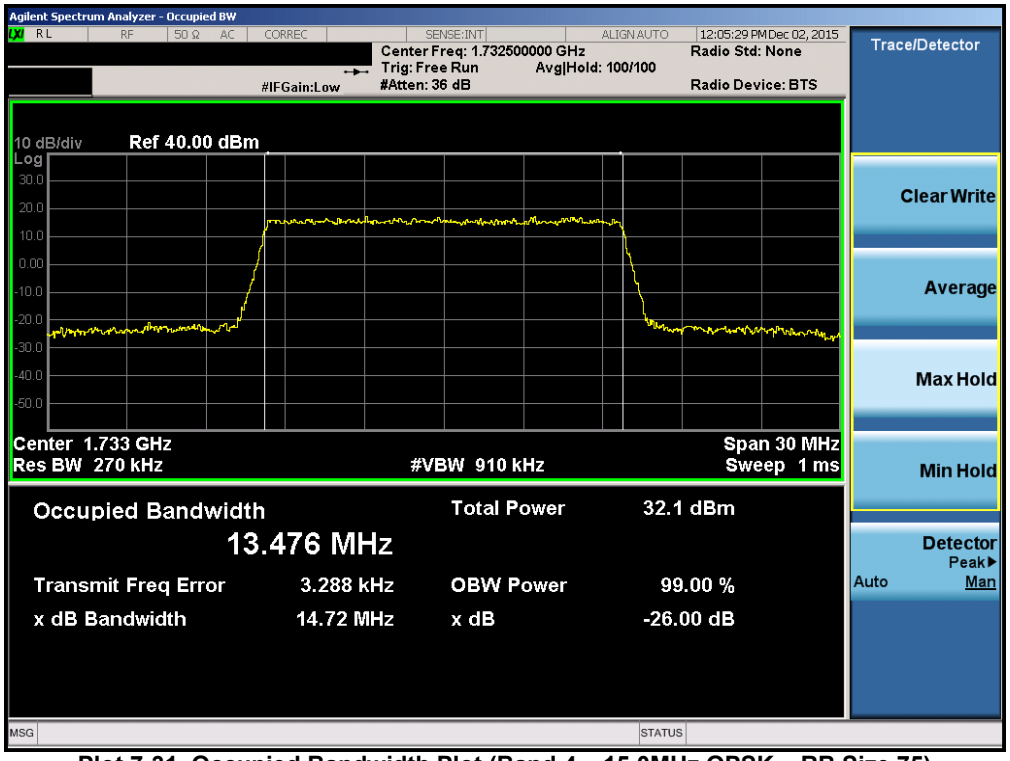
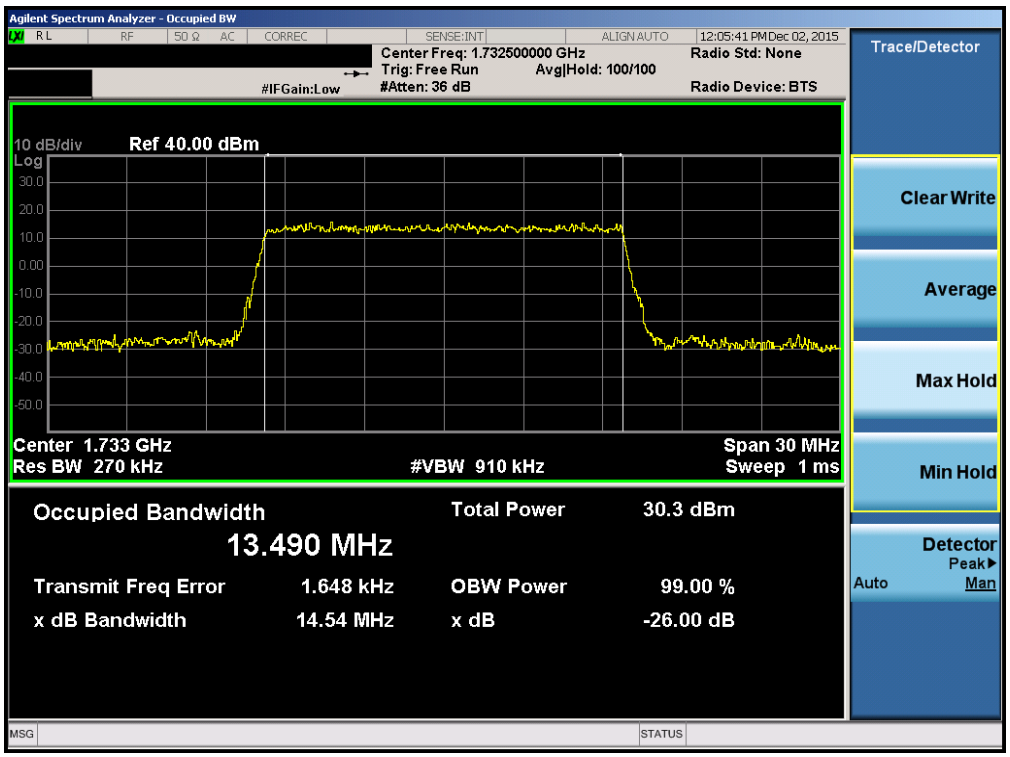


Plot 7-31. Occupied Bandwidth Plot (Band 4 – 15.0MHz QPSK – RB Size 75)



Plot 7-32. Occupied Bandwidth Plot (Band 4 – 15.0MHz 16-QAM – RB Size 75)

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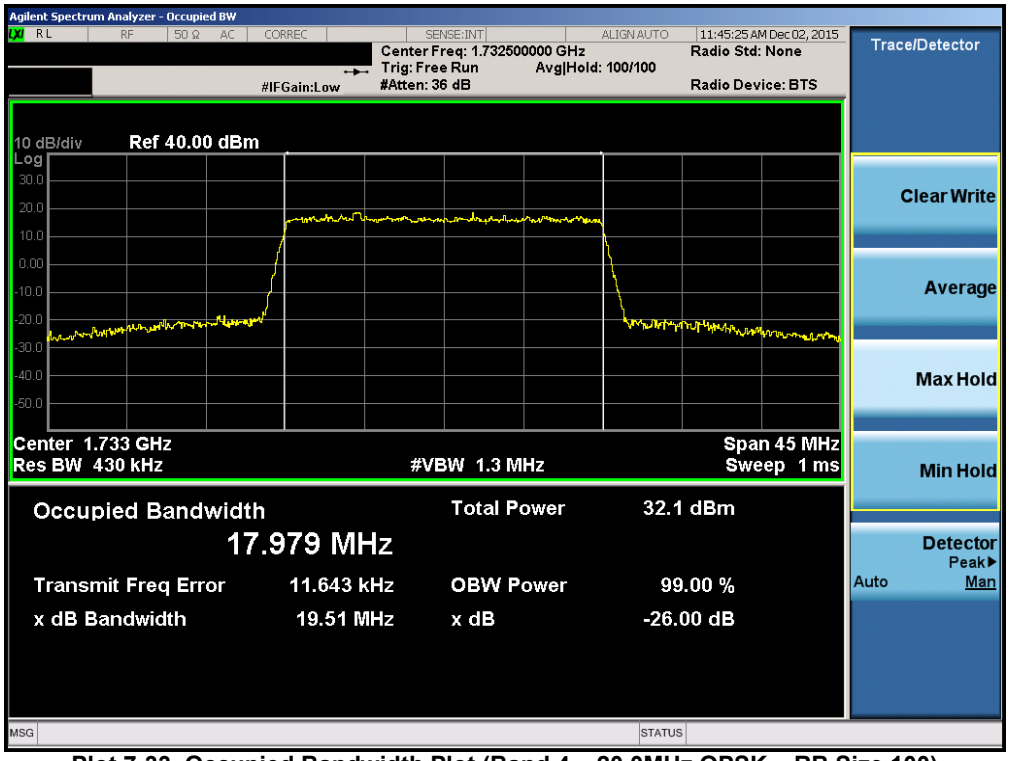

Plot 7-33. Occupied Bandwidth Plot (Band 4 – 20.0MHz QPSK – RB Size 100)

Plot 7-34. Occupied Bandwidth Plot (Band 4 – 20.0MHz 16-QAM – RB Size 100)

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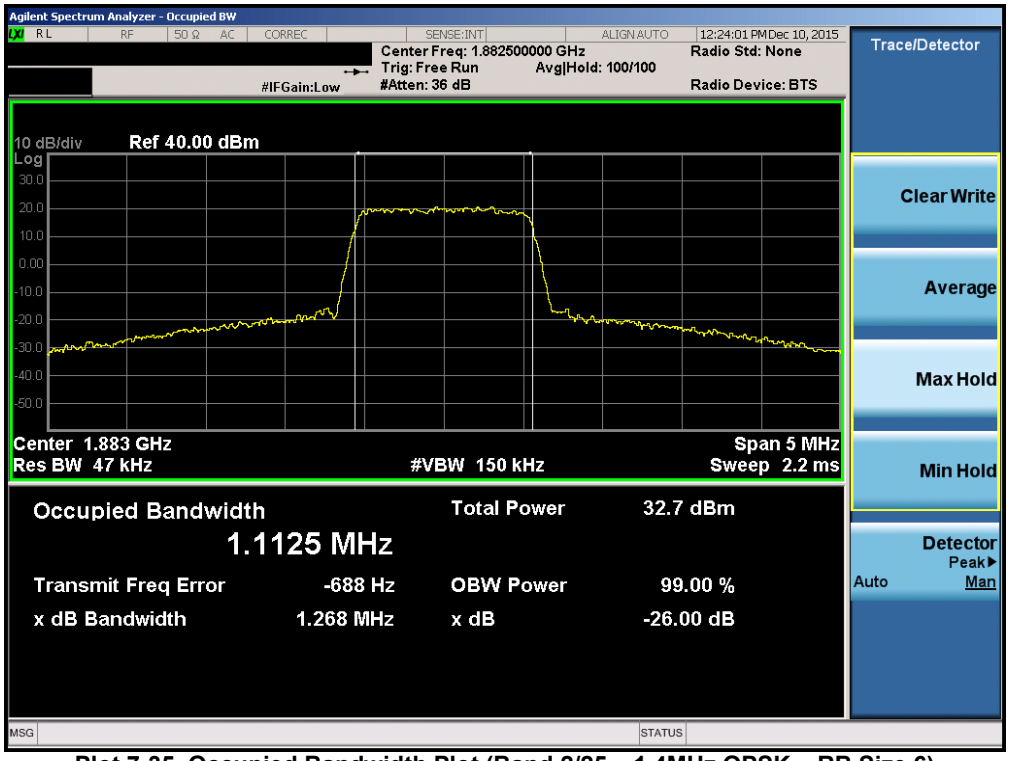

Plot 7-35. Occupied Bandwidth Plot (Band 2/25 – 1.4MHz QPSK – RB Size 6)

Plot 7-36. Occupied Bandwidth Plot (Band 2/25 – 1.4MHz 16-QAM – RB Size 6)

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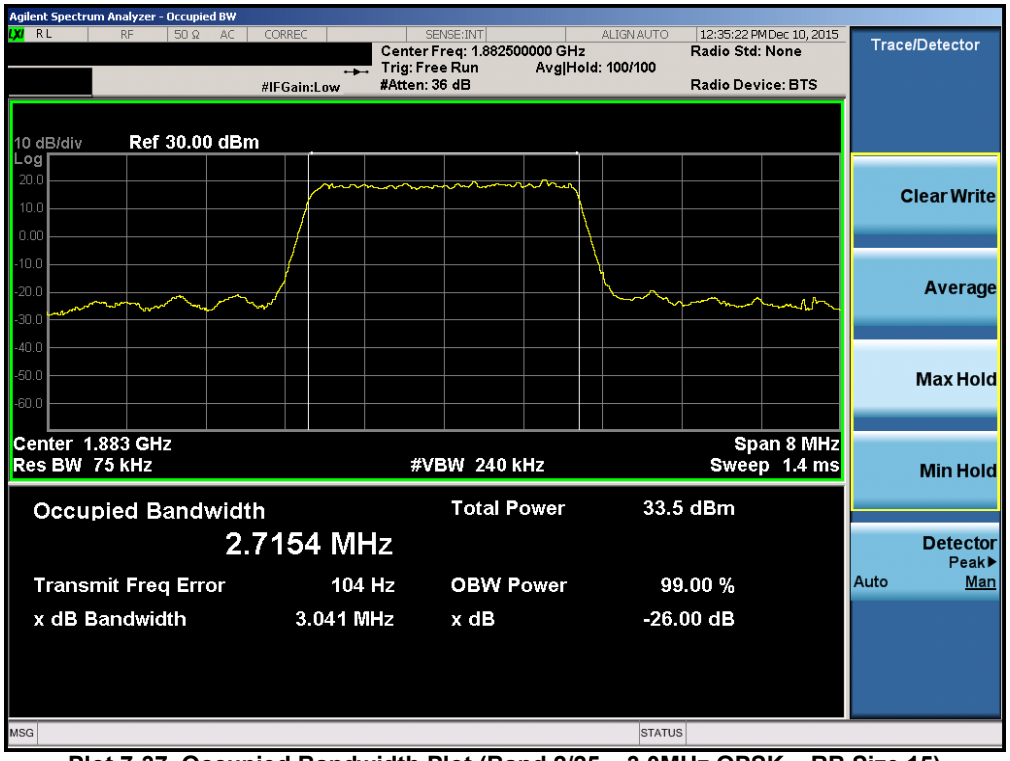

Plot 7-37. Occupied Bandwidth Plot (Band 2/25 – 3.0MHz QPSK – RB Size 15)

Plot 7-38. Occupied Bandwidth Plot (Band 2/25 – 3.0MHz 16-QAM – RB Size 15)

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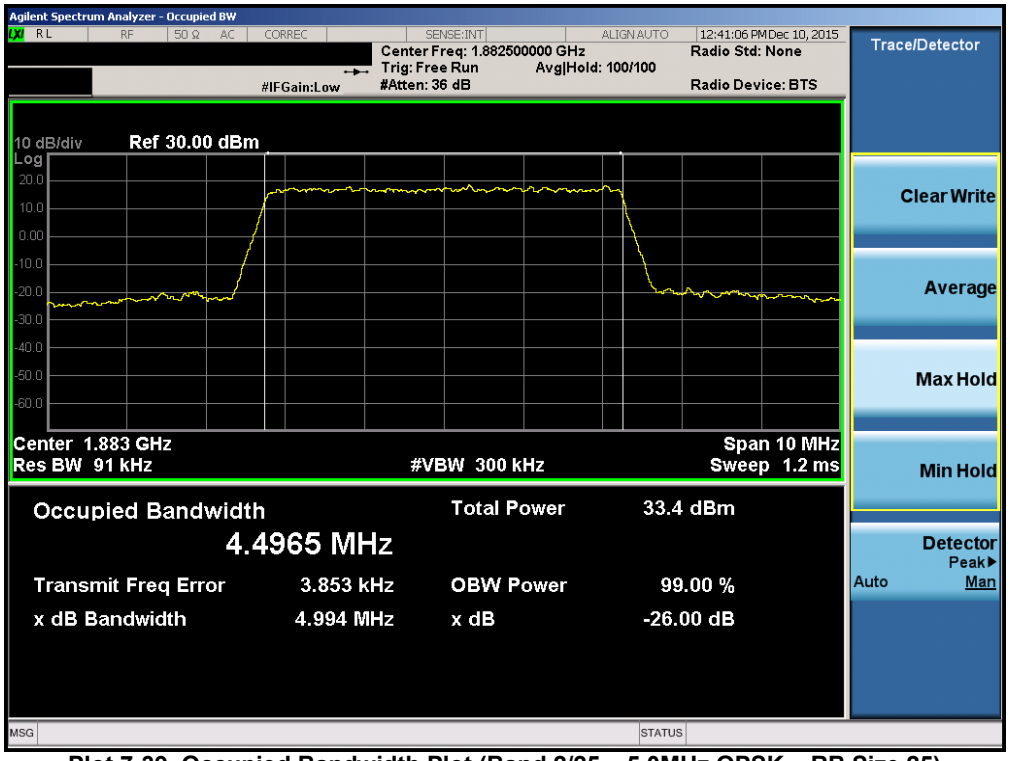

Plot 7-39. Occupied Bandwidth Plot (Band 2/25 – 5.0MHz QPSK – RB Size 25)

Plot 7-40. Occupied Bandwidth Plot (Band 2/25 – 5.0MHz 16-QAM – RB Size 25)

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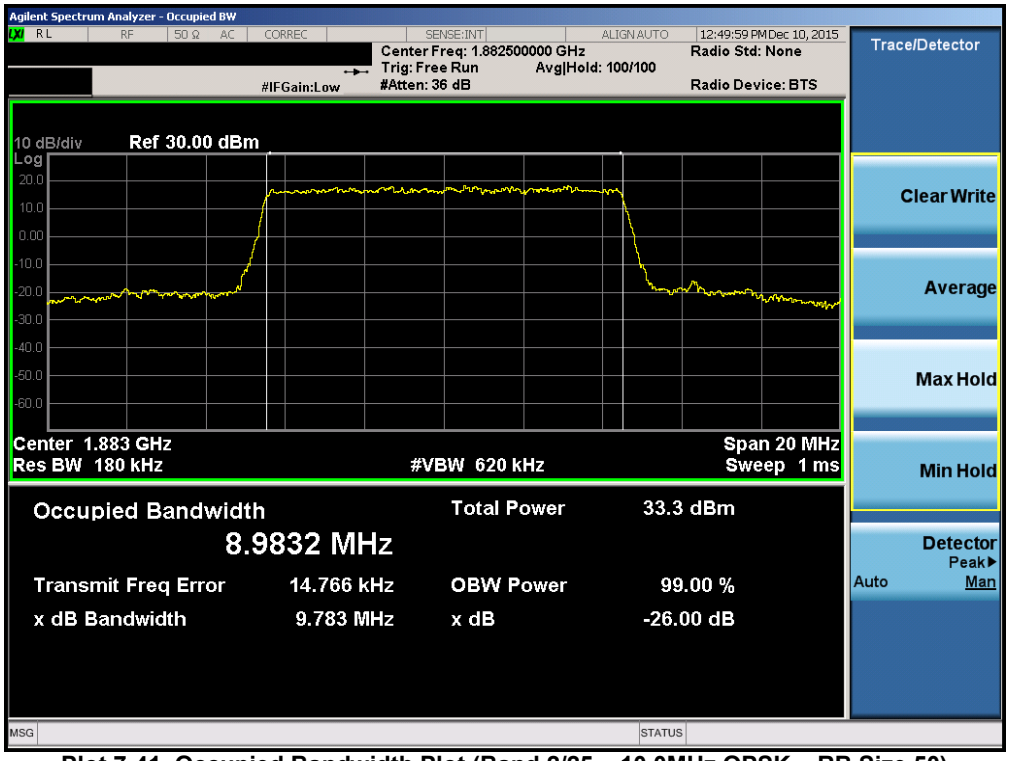

Plot 7-41. Occupied Bandwidth Plot (Band 2/25 – 10.0MHz QPSK – RB Size 50)

Plot 7-42. Occupied Bandwidth Plot (Band 2/25 – 10.0MHz 16-QAM – RB Size 50)

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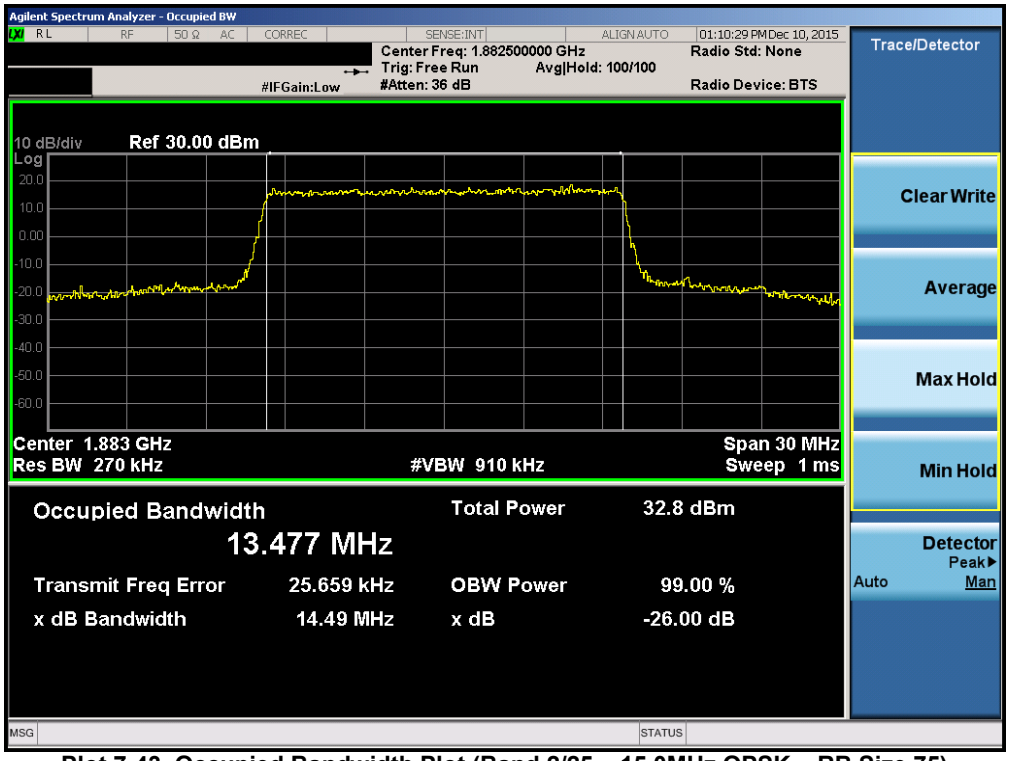
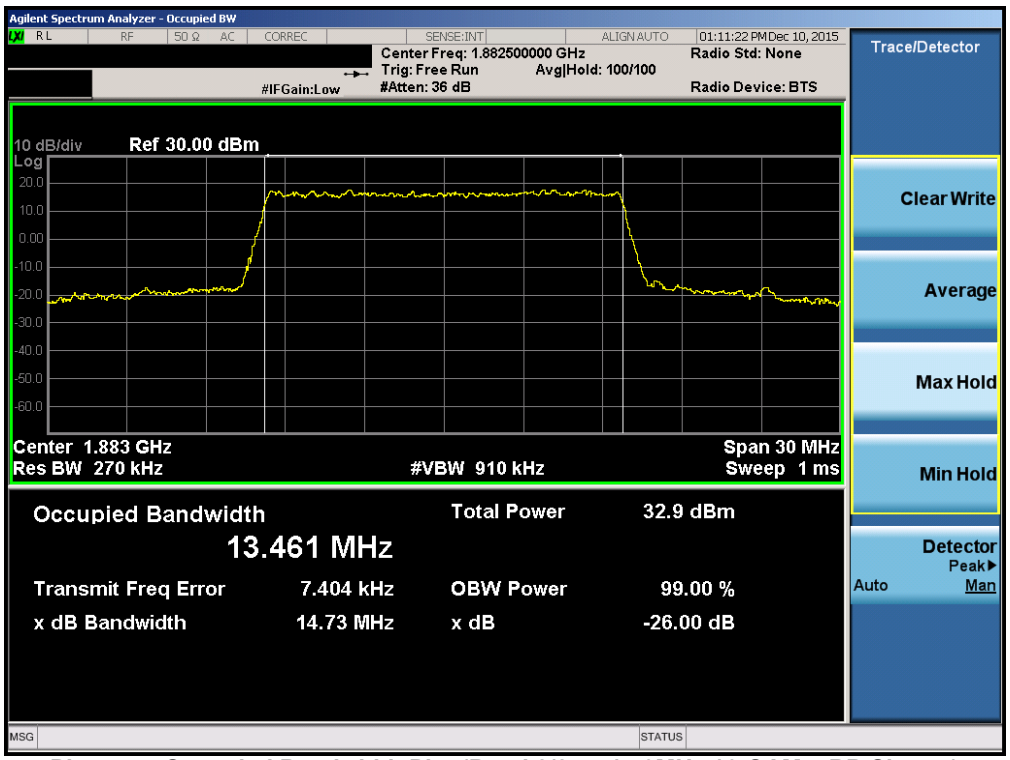


Plot 7-43. Occupied Bandwidth Plot (Band 2/25 – 15.0MHz QPSK – RB Size 75)



Plot 7-44. Occupied Bandwidth Plot (Band 2/25 – 15.0MHz 16-QAM – RB Size 75)

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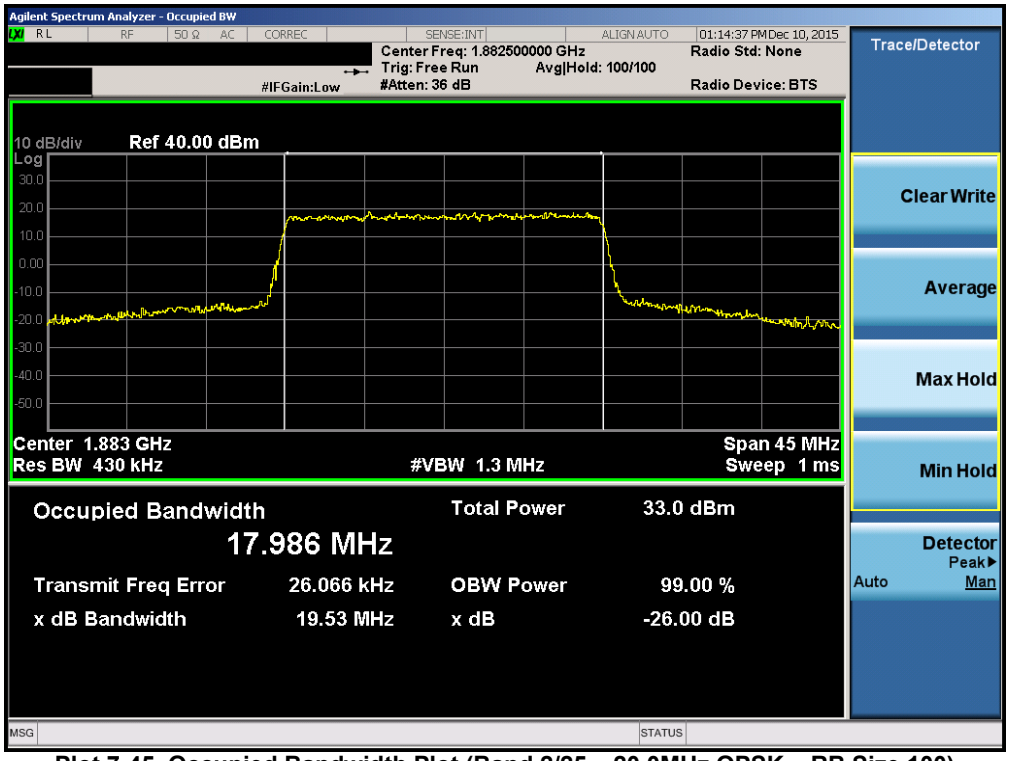
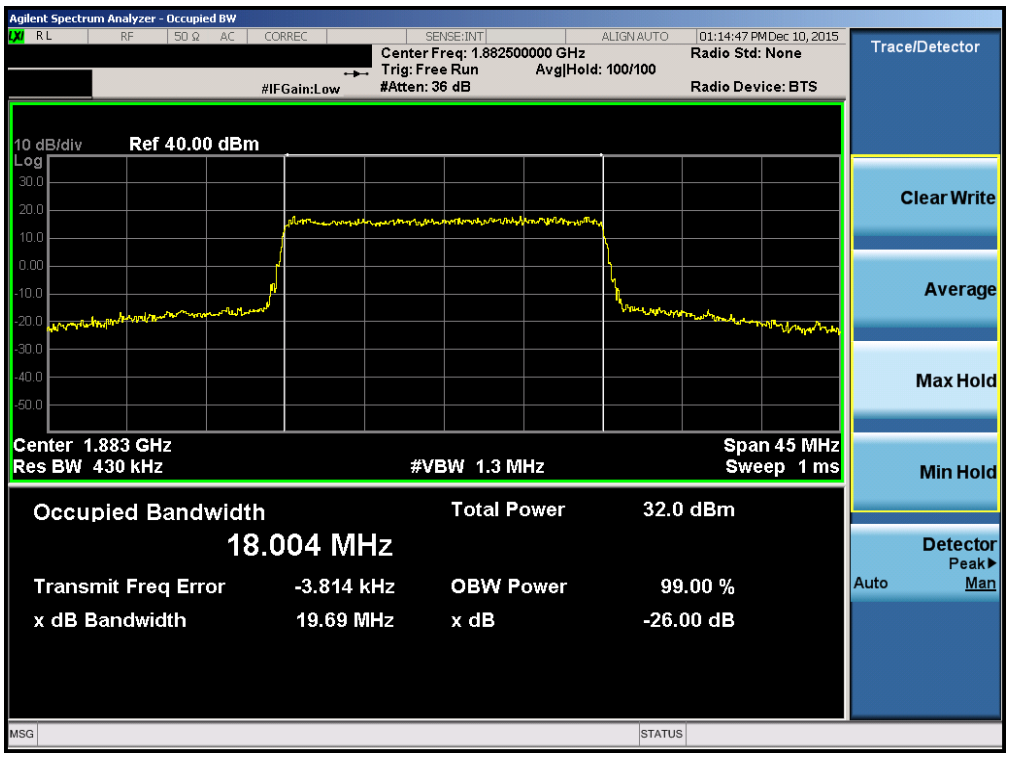


Plot 7-45. Occupied Bandwidth Plot (Band 2/25 – 20.0MHz QPSK – RB Size 100)



Plot 7-46. Occupied Bandwidth Plot (Band 2/25 – 20.0MHz 16-QAM – RB Size 100)

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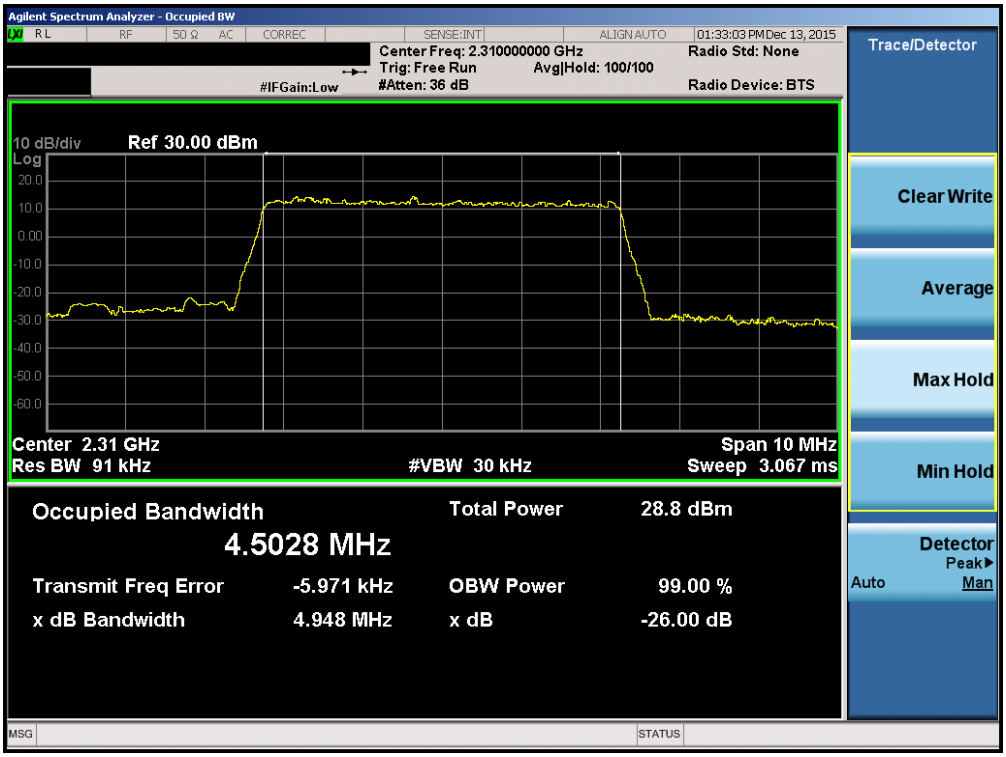
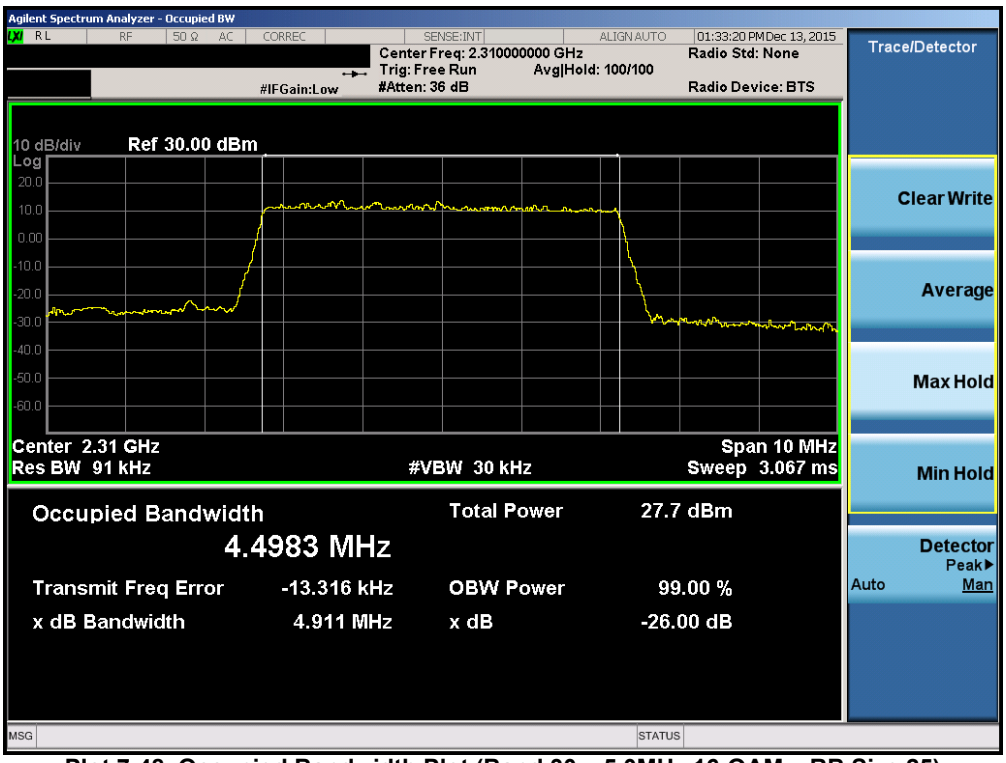


Plot 7-47. Occupied Bandwidth Plot (Band 30 – 5.0MHz QPSK – RB Size 25)



Plot 7-48. Occupied Bandwidth Plot (Band 30 – 5.0MHz 16-QAM – RB Size 25)

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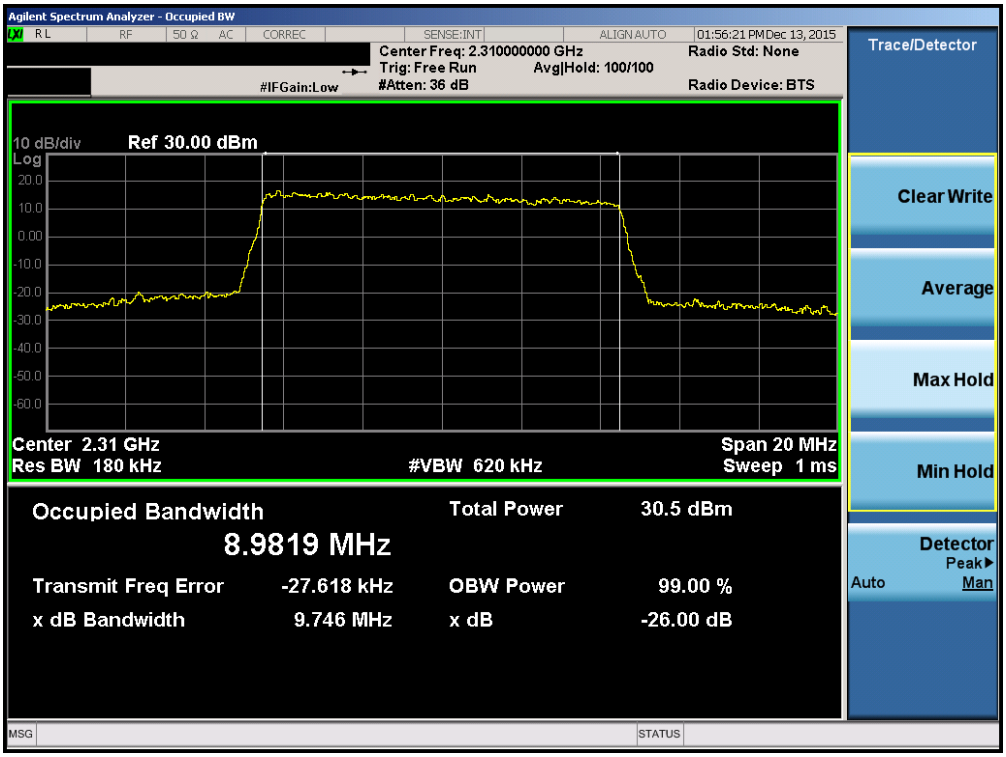
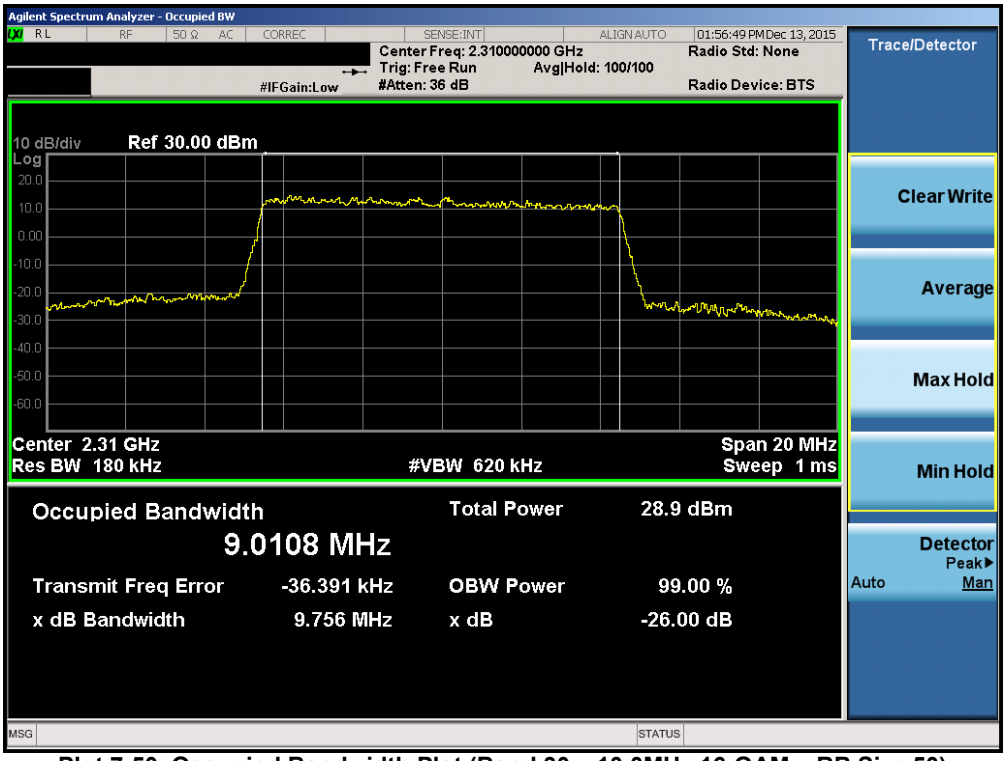


Plot 7-49. Occupied Bandwidth Plot (Band 30 – 10.0MHz QPSK – RB Size 50)



Plot 7-50. Occupied Bandwidth Plot (Band 30 – 10.0MHz 16-QAM – RB Size 50)

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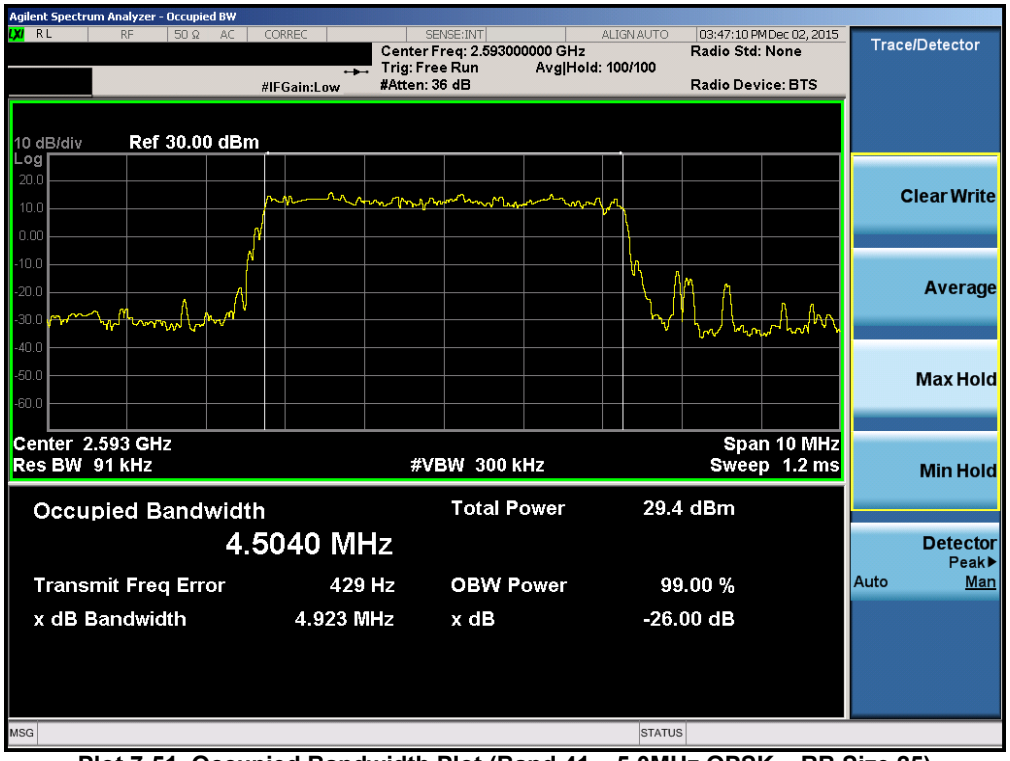

Plot 7-51. Occupied Bandwidth Plot (Band 41 – 5.0MHz QPSK – RB Size 25)

Plot 7-52. Occupied Bandwidth Plot (Band 41 – 5.0MHz 16-QAM – RB Size 25)

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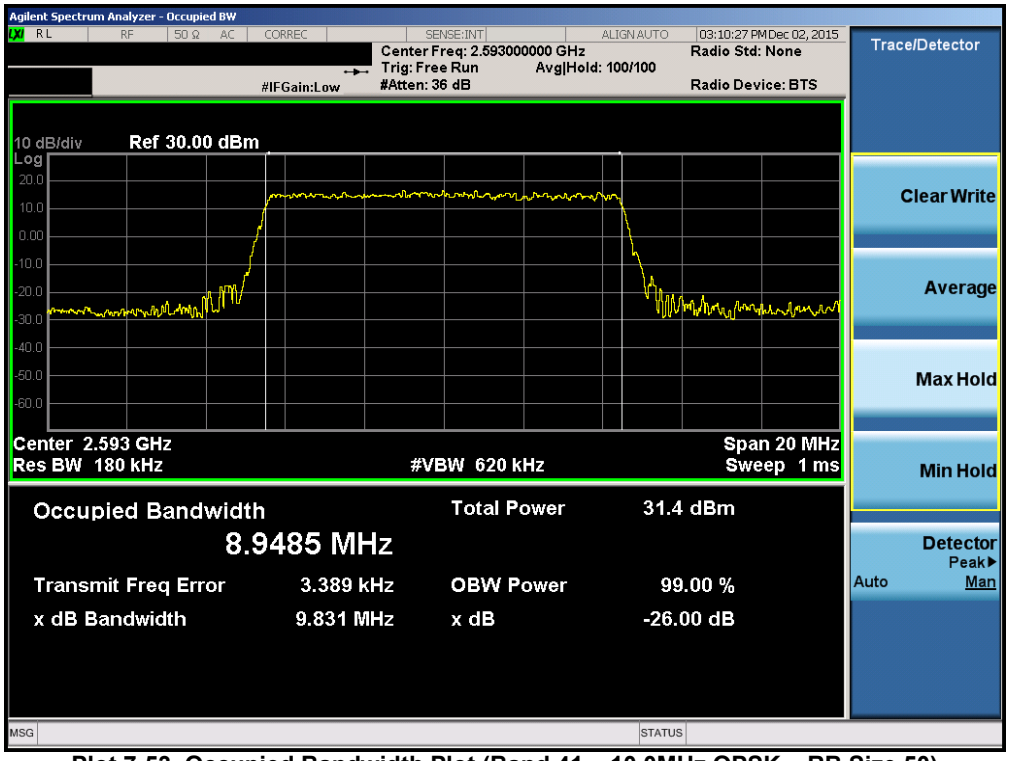

Plot 7-53. Occupied Bandwidth Plot (Band 41 – 10.0MHz QPSK – RB Size 50)

Plot 7-54. Occupied Bandwidth Plot (Band 41 – 10.0MHz 16-QAM – RB Size 50)

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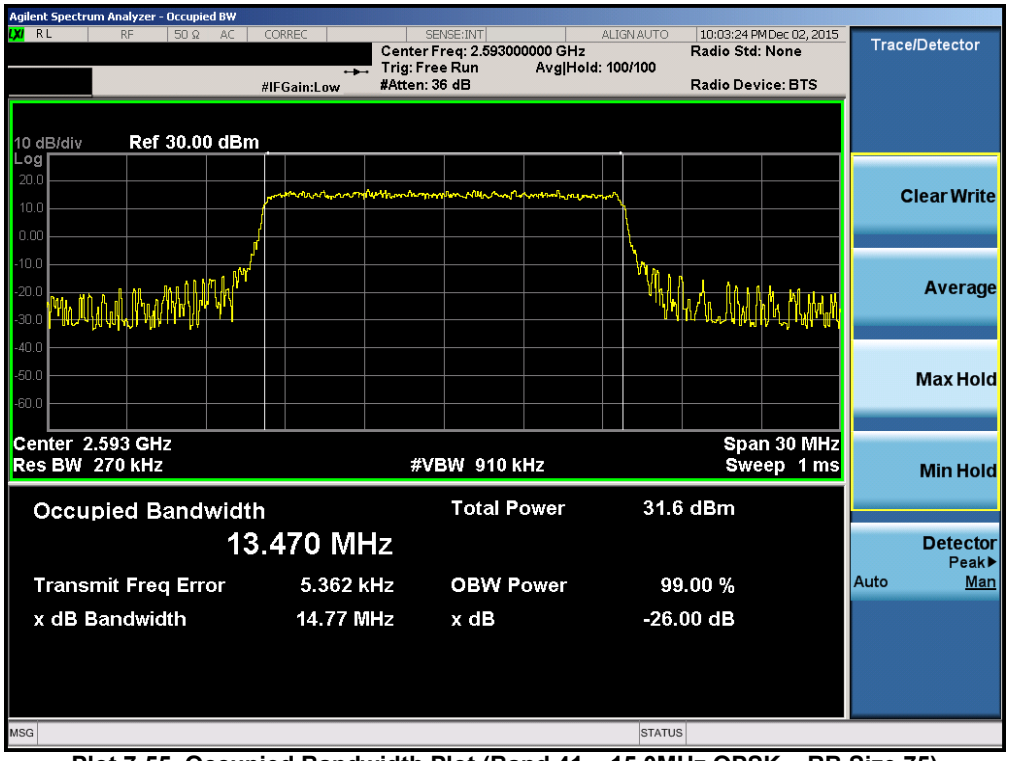
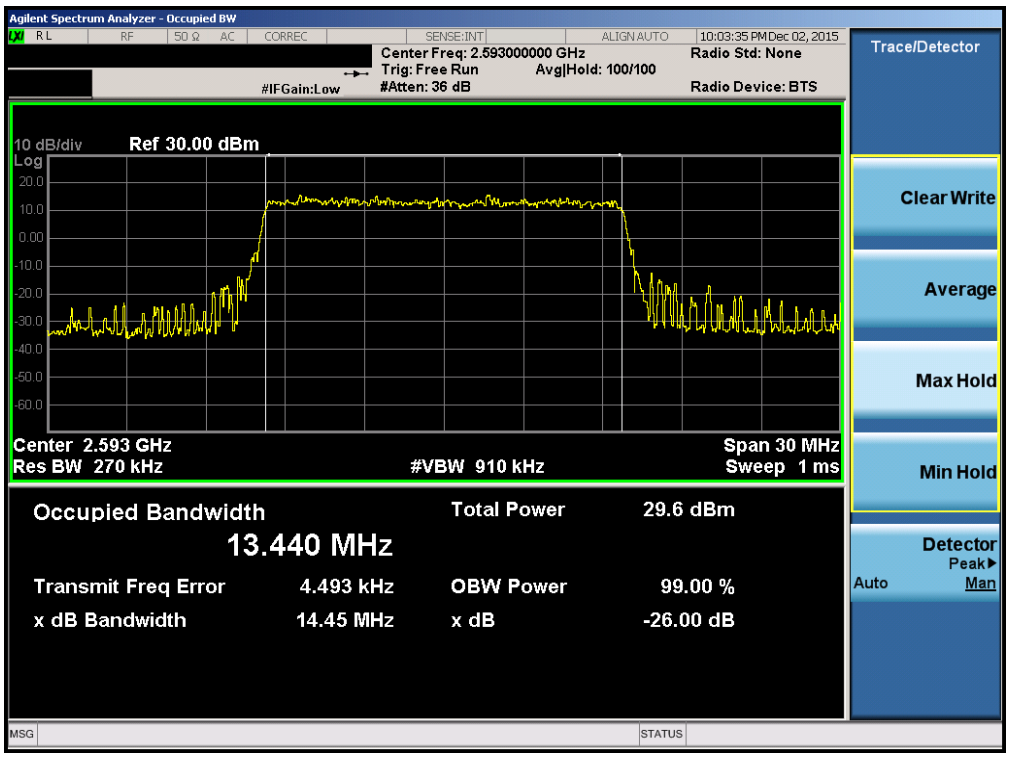


Plot 7-55. Occupied Bandwidth Plot (Band 41 – 15.0MHz QPSK – RB Size 75)



Plot 7-56. Occupied Bandwidth Plot (Band 41 – 15.0MHz 16-QAM – RB Size 75)

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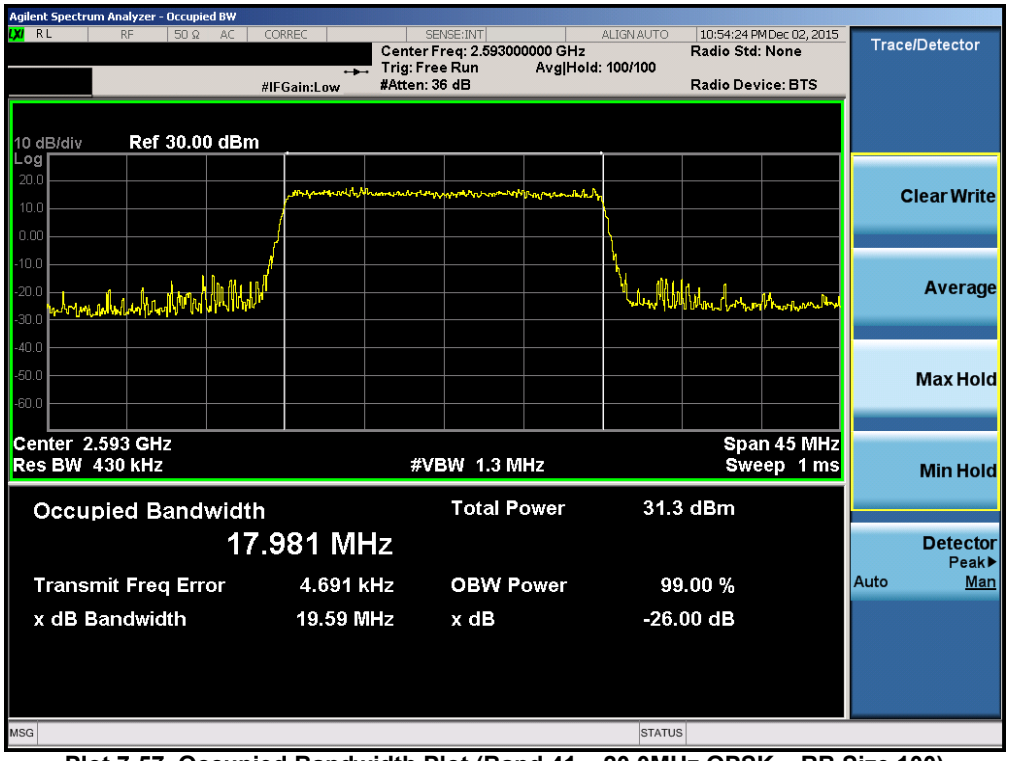
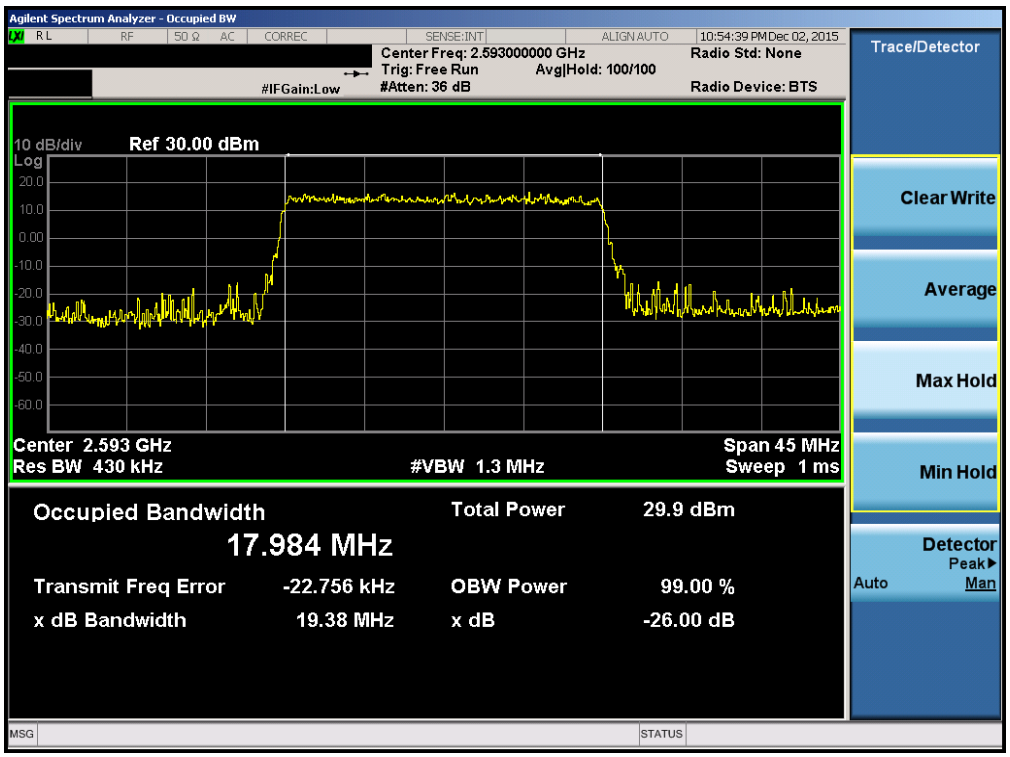


Plot 7-57. Occupied Bandwidth Plot (Band 41 – 20.0MHz QPSK – RB Size 100)



Plot 7-58. Occupied Bandwidth Plot (Band 41 – 20.0MHz 16-QAM – RB Size 100)

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7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §22.917(a) §24.238(a) §27.53(c.2) §27.53(g) §27.53(h) §27.53(m) §27.53(a.4)

Test Overview

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

For Band 30, the minimum permissible attenuation level of any spurious emission <2288MHz and >2365MHz is 70 + $\log_{10}(P_{[Watts]})$.

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

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

Test Procedure Used

KDB 971168 D01 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 = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

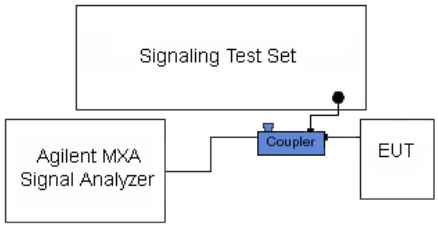

Figure 7-2. Test Instrument & Measurement Setup

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Test Notes

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

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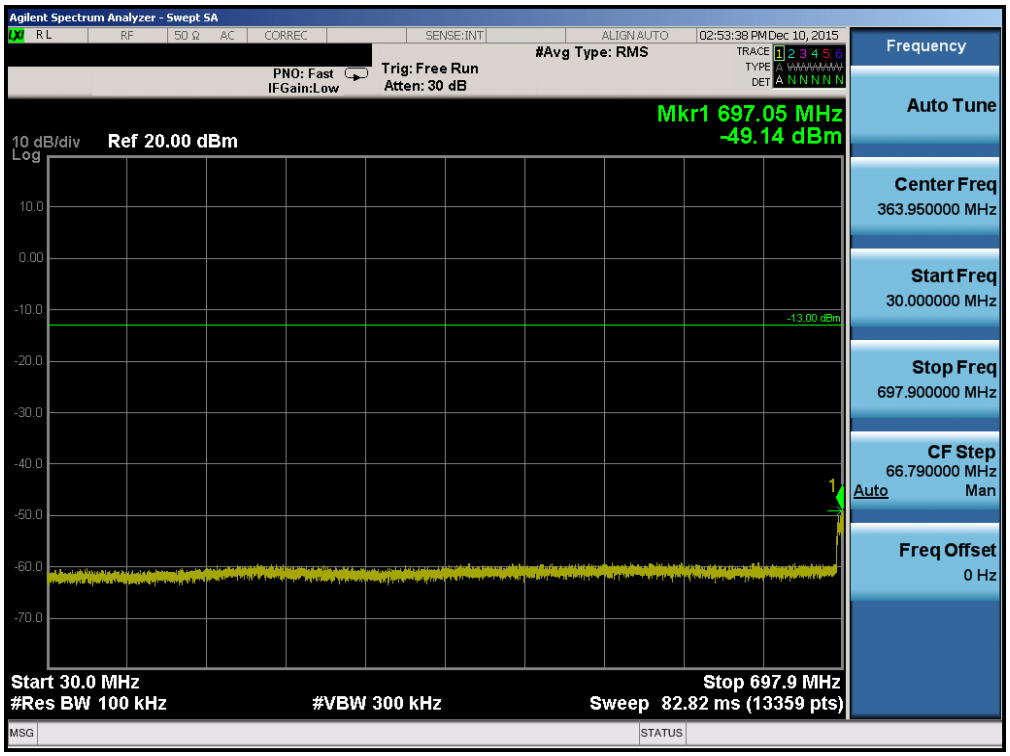
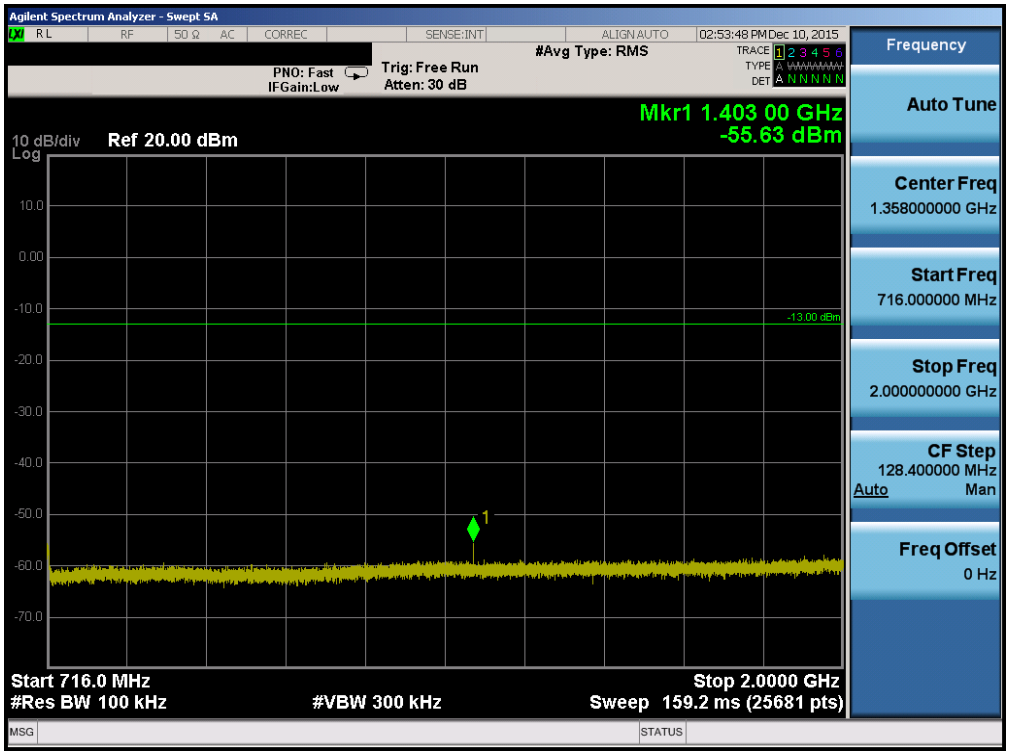


Plot 7-59. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-60. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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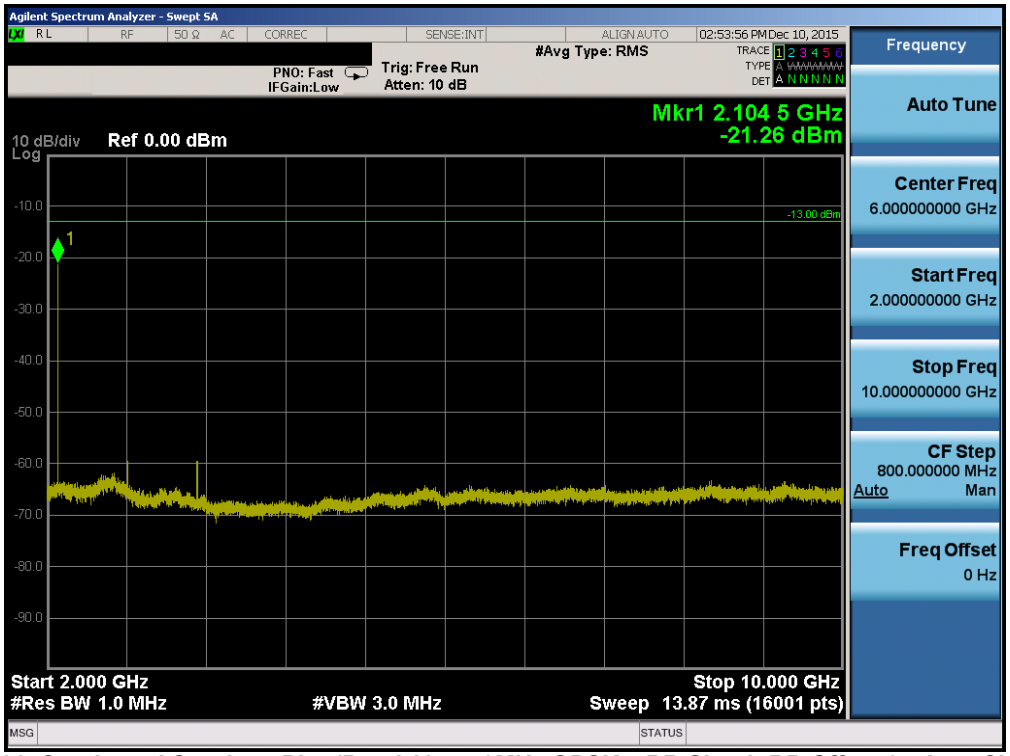
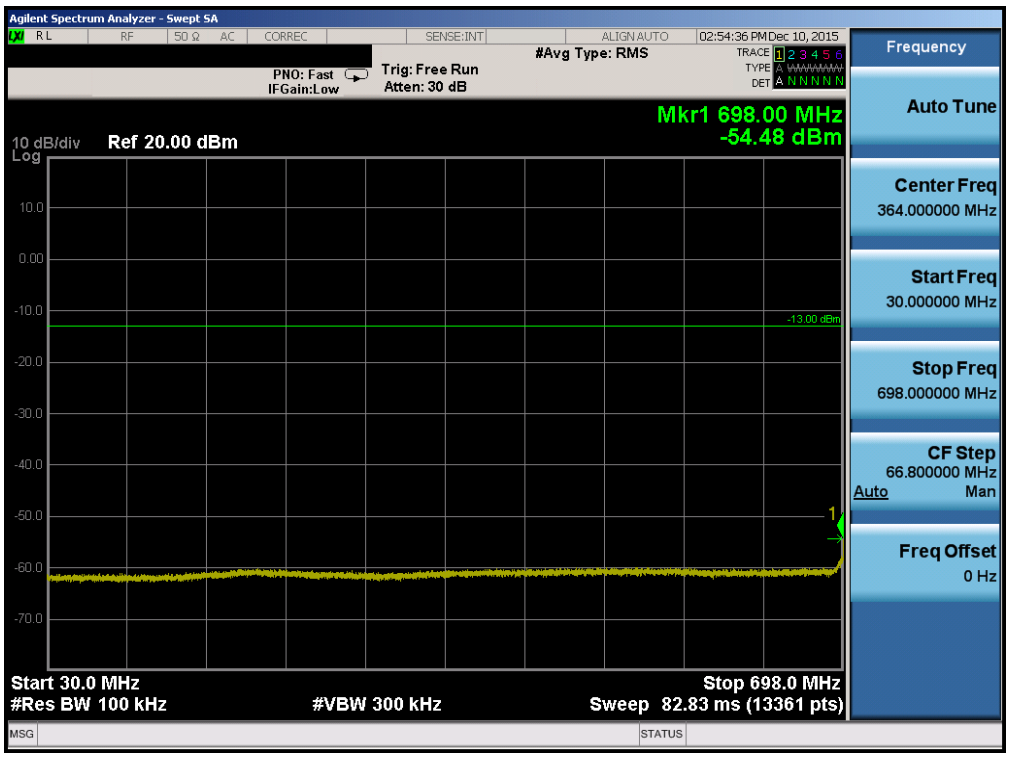


Plot 7-61. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-62. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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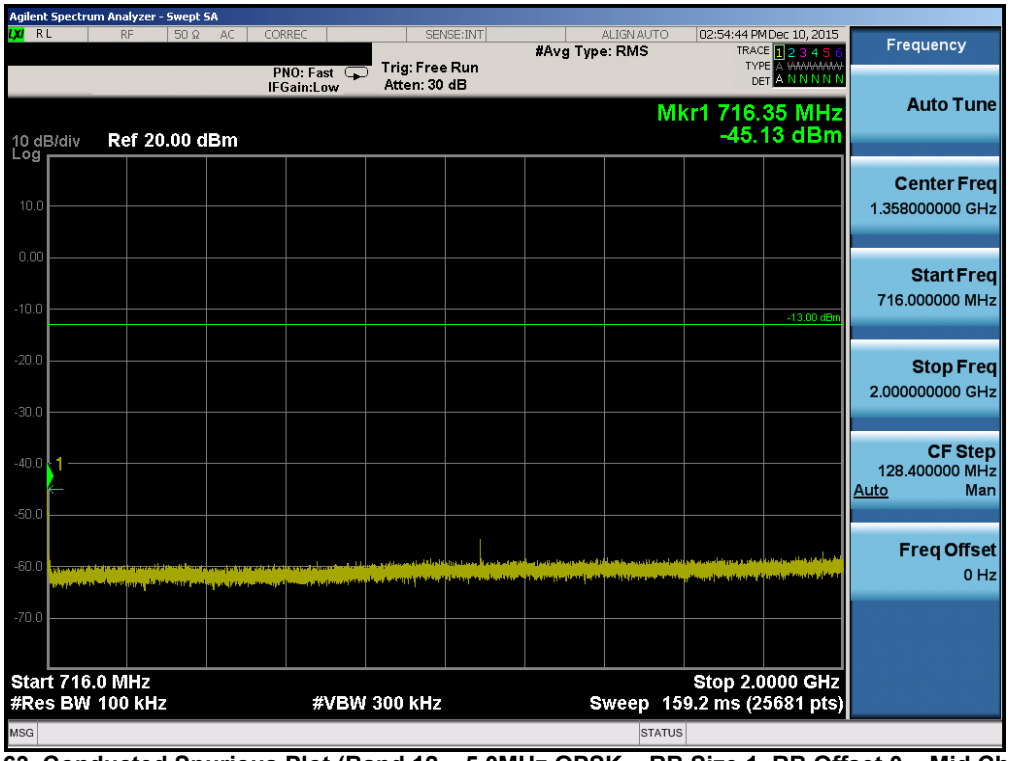
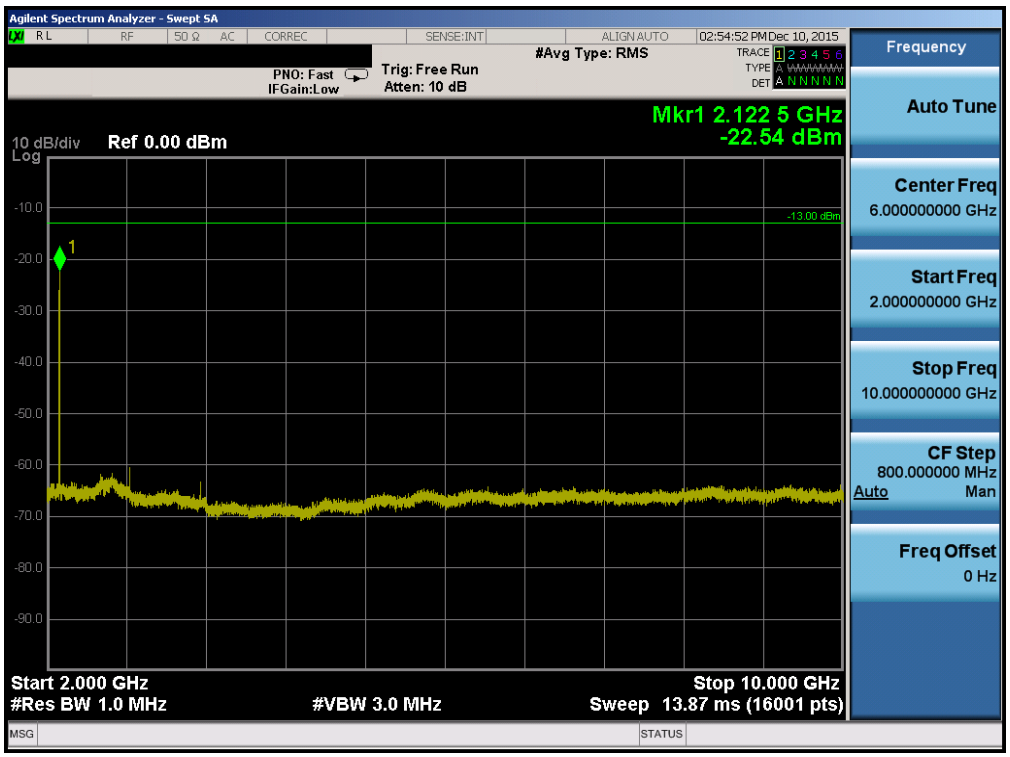


Plot 7-63. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-64. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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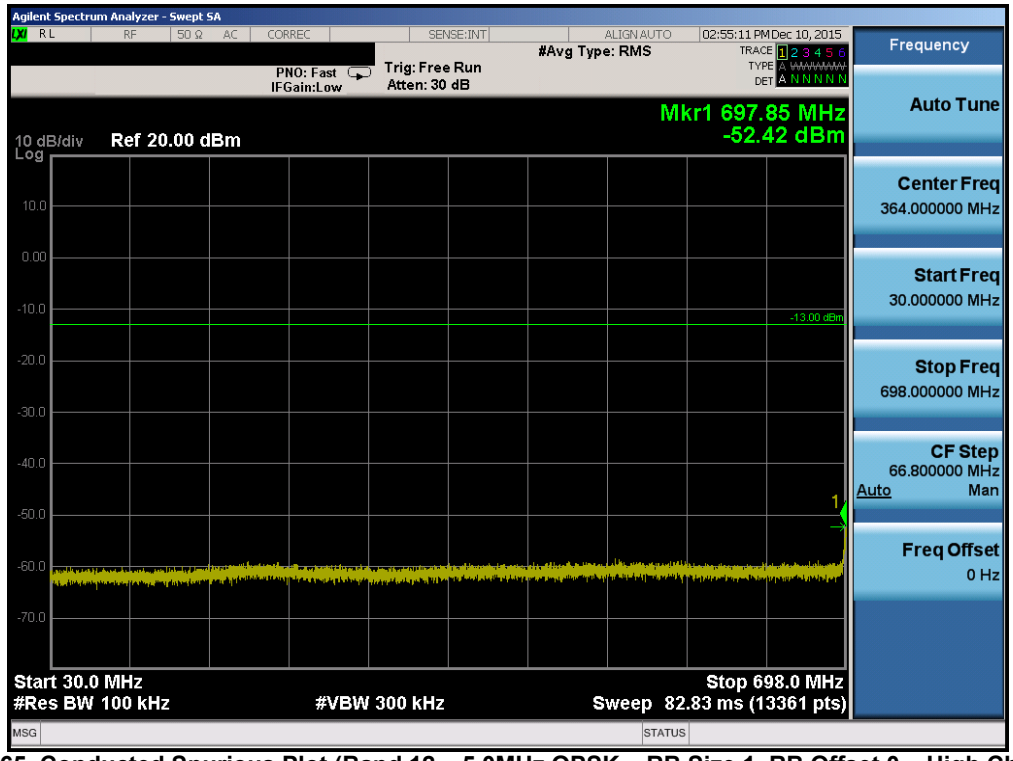
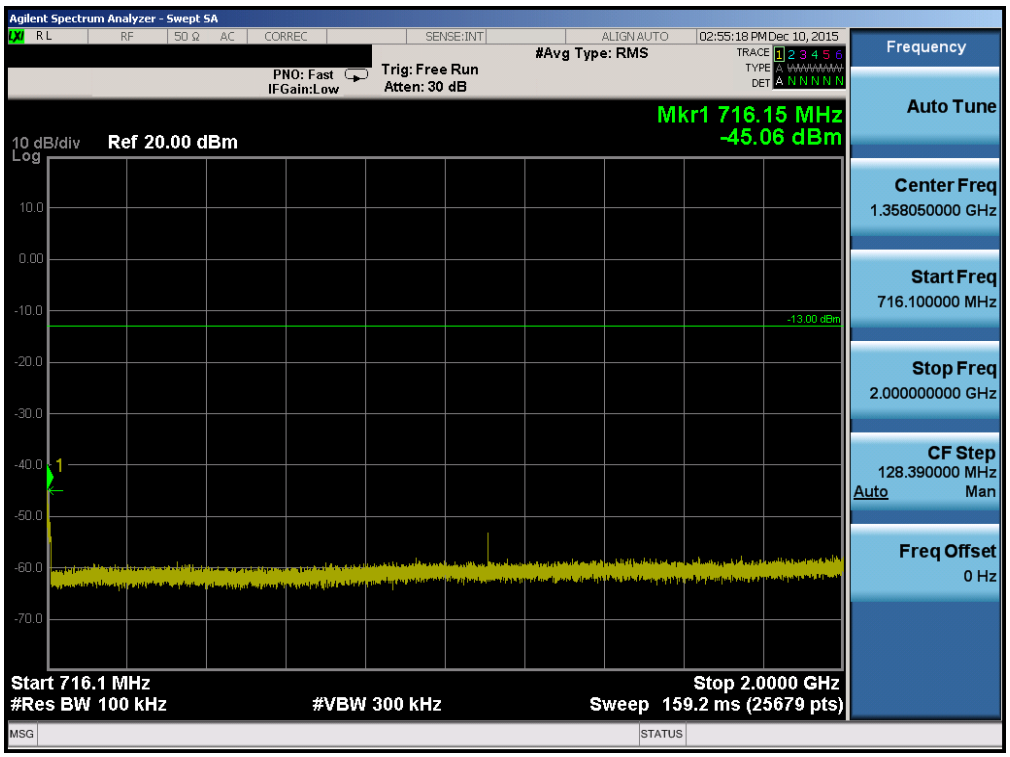


Plot 7-65. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-66. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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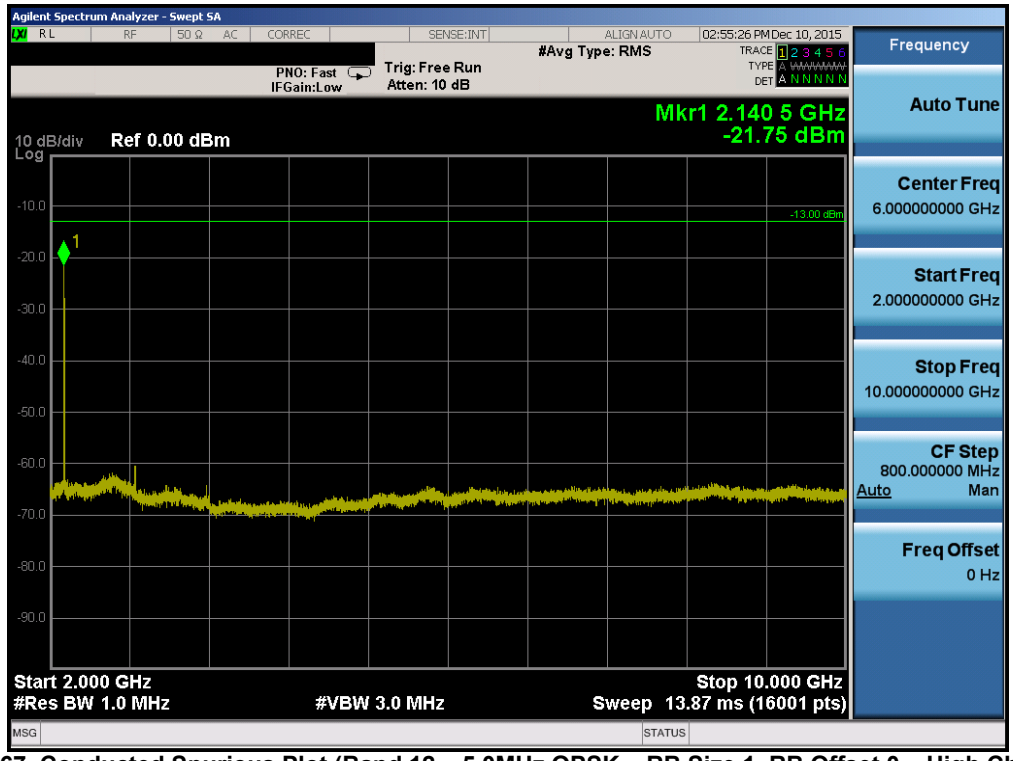
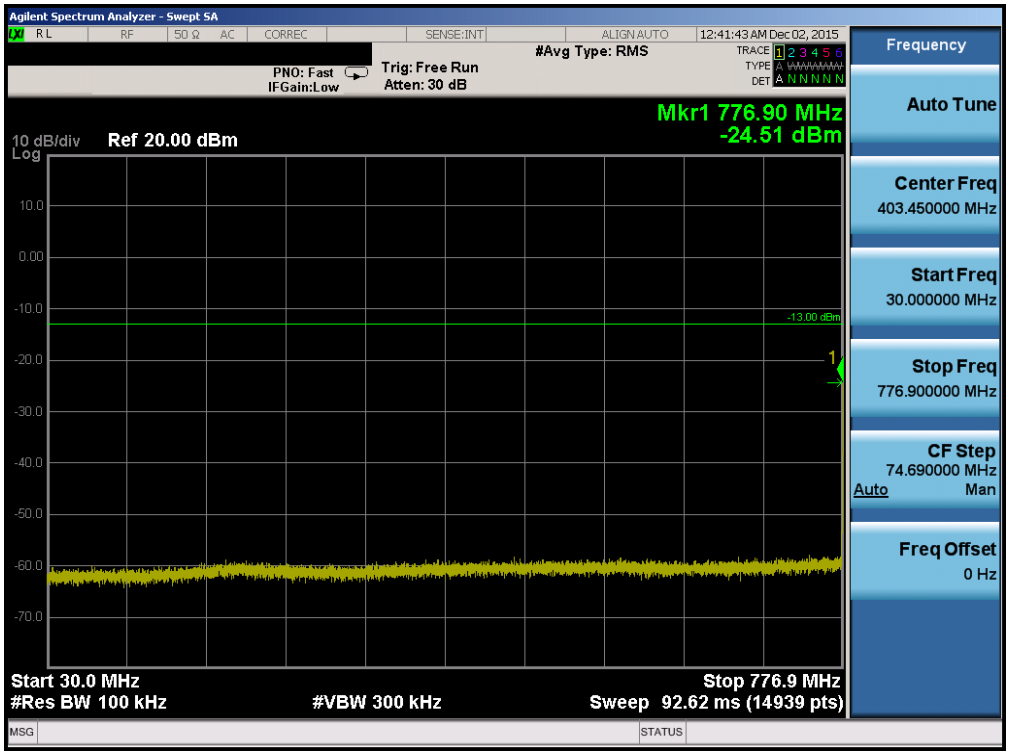


Plot 7-67. Conducted Spurious Plot (Band 12 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-68. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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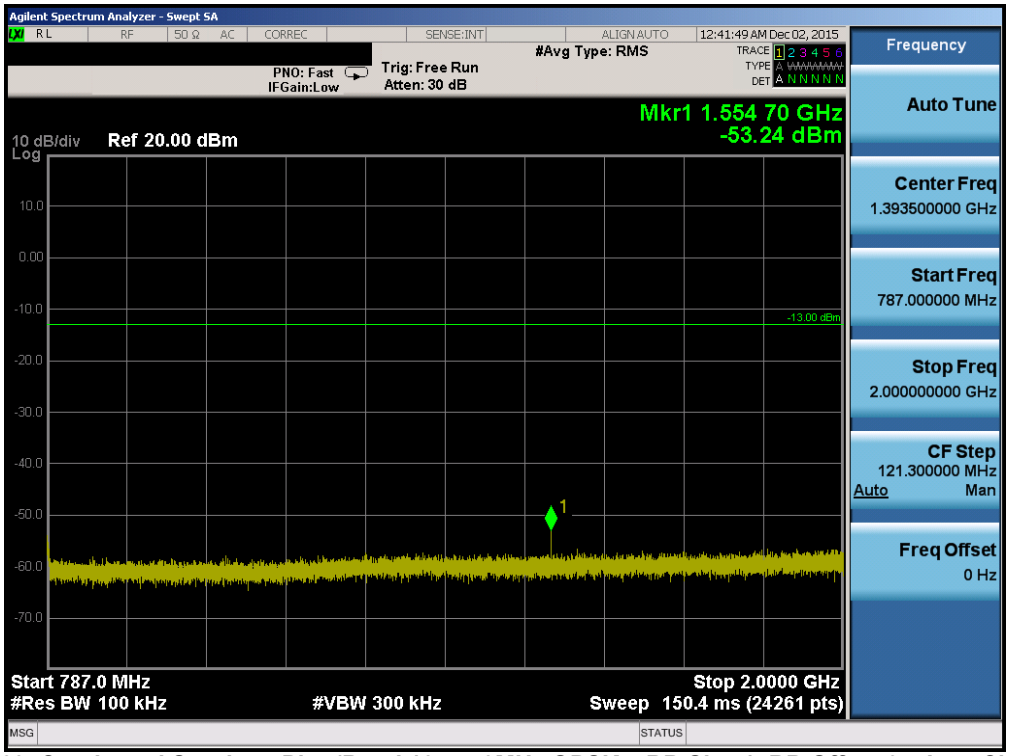
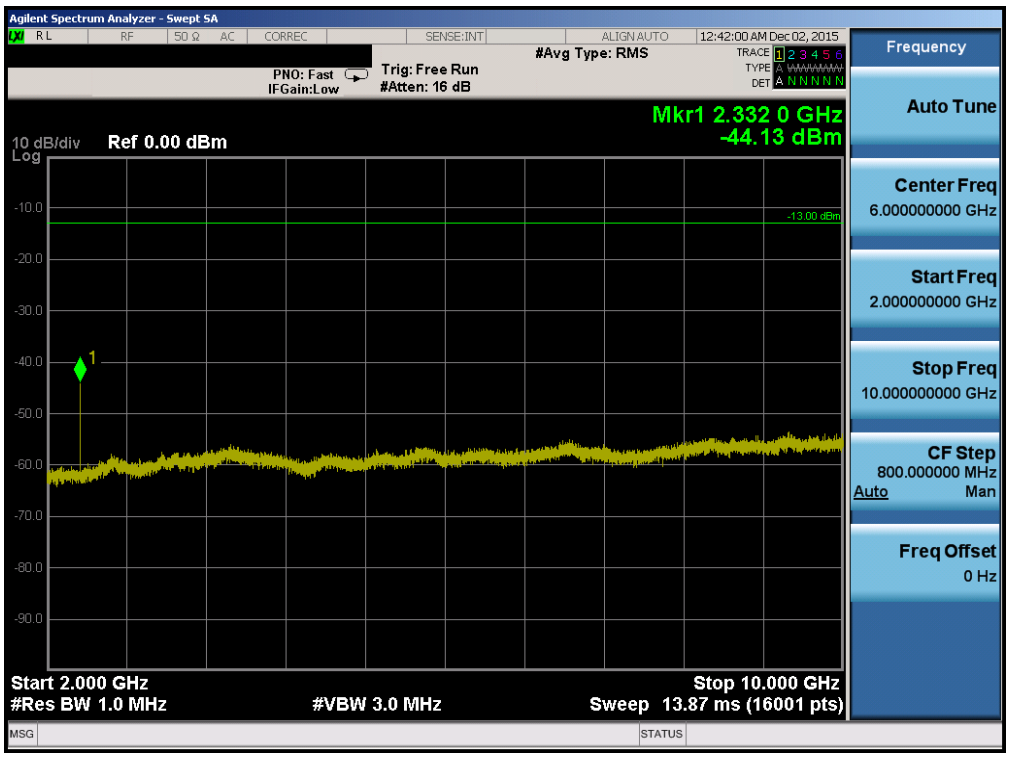


Plot 7-69. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



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

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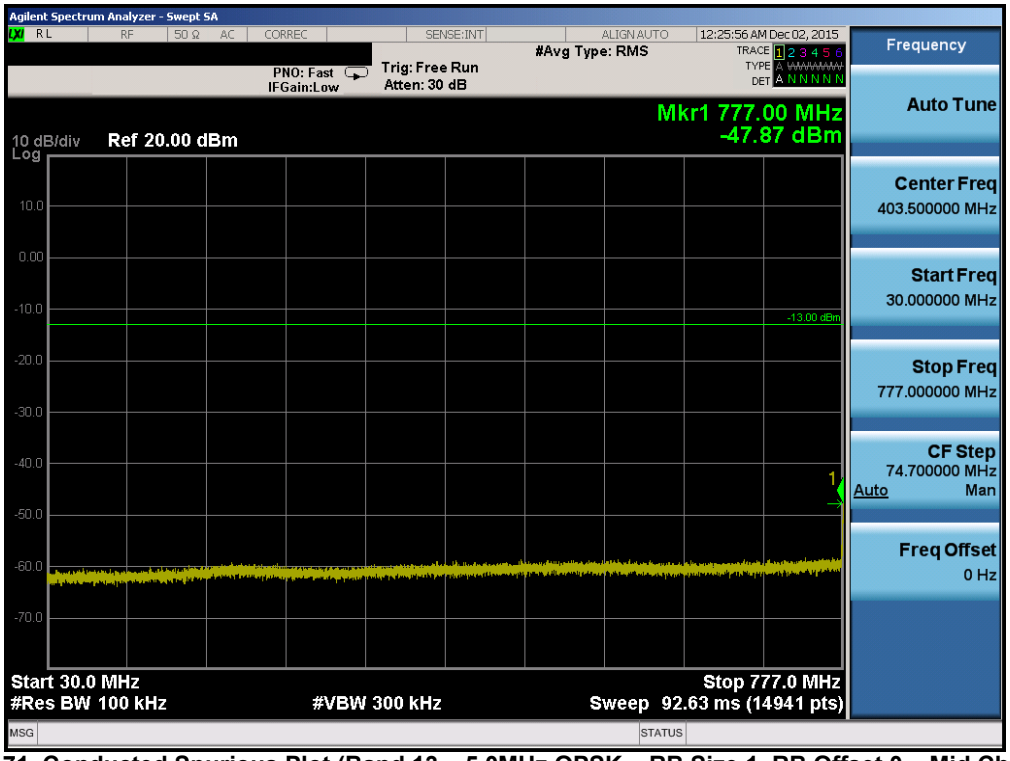
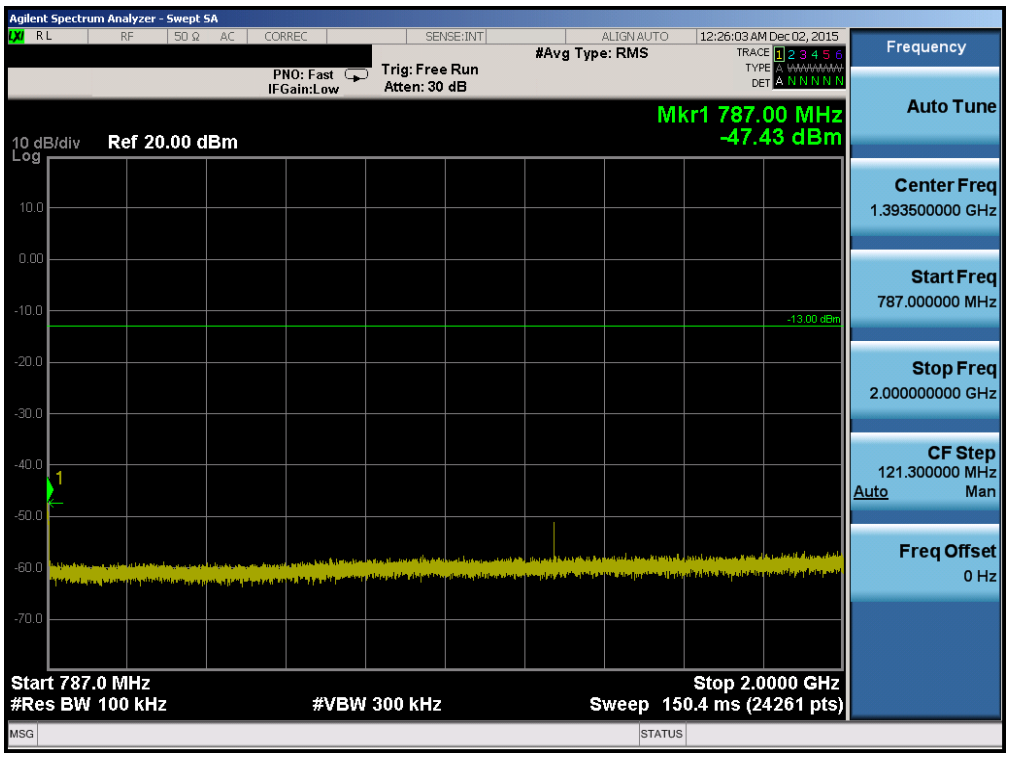


Plot 7-71. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



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

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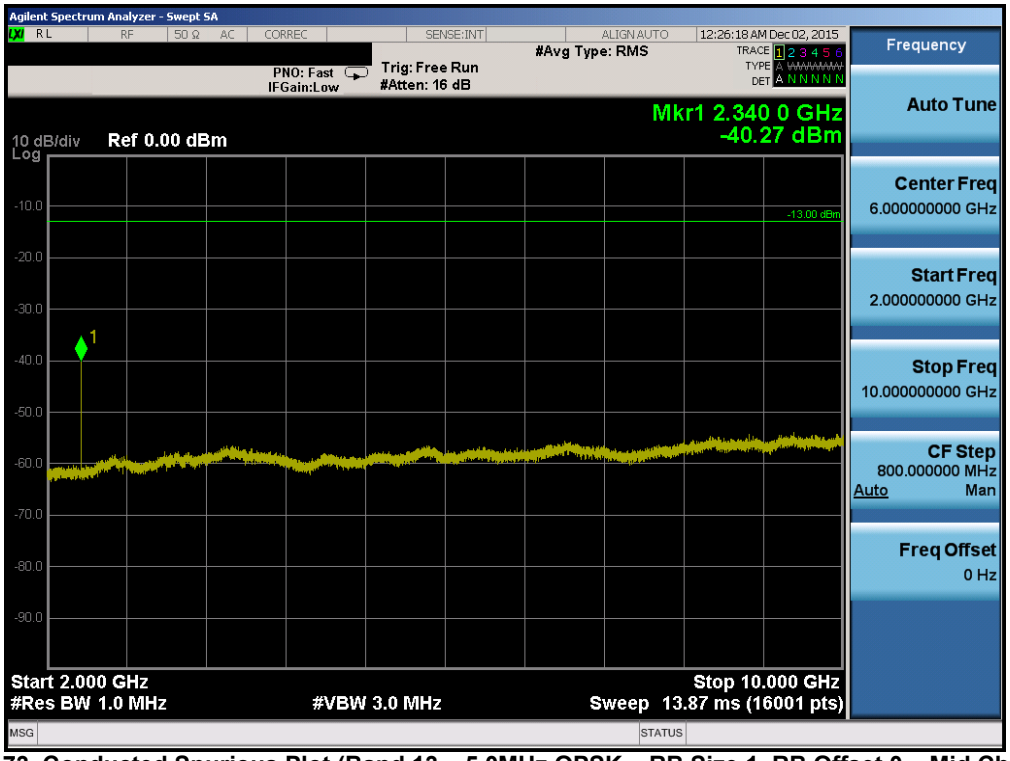
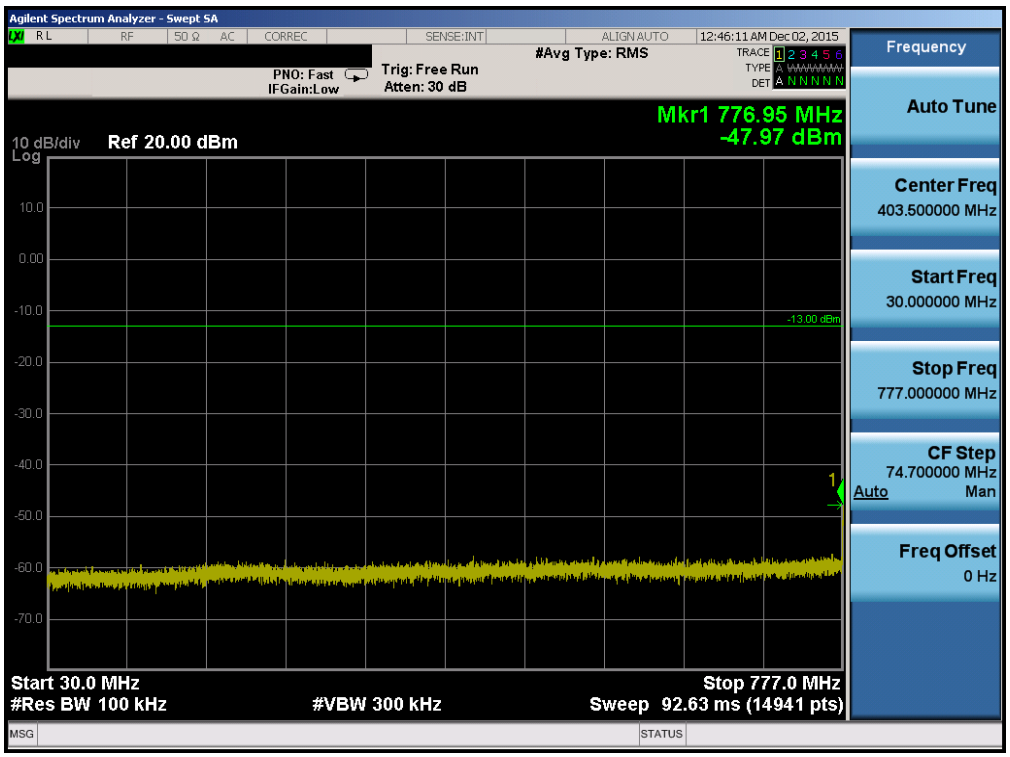


Plot 7-73. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



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

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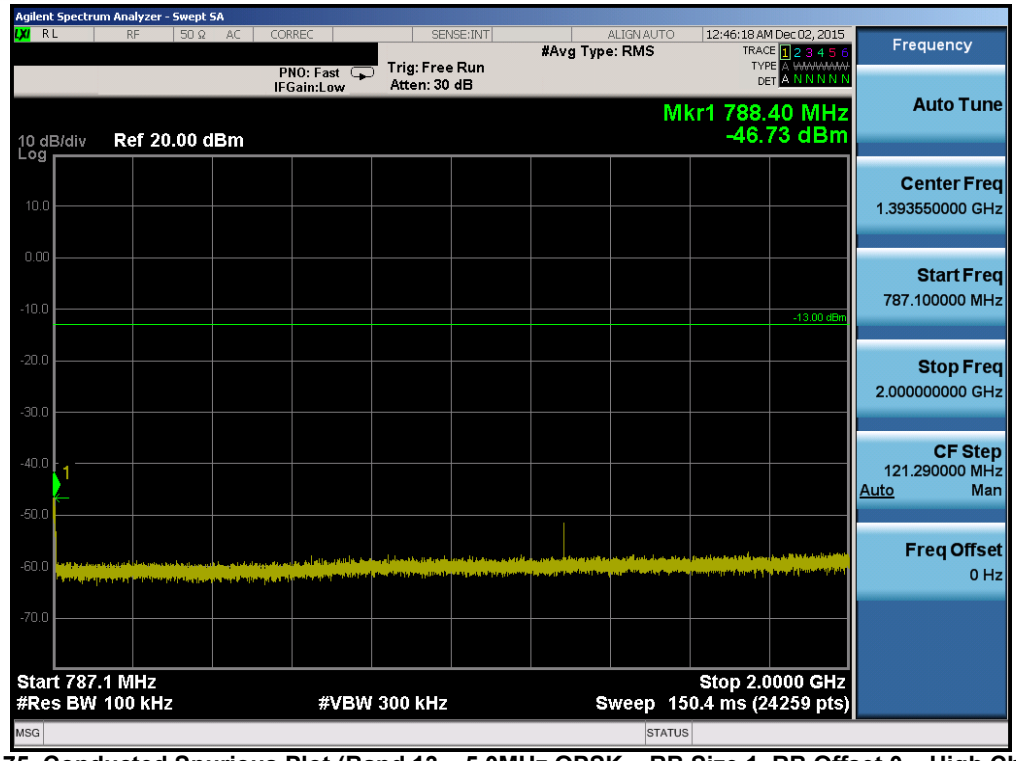
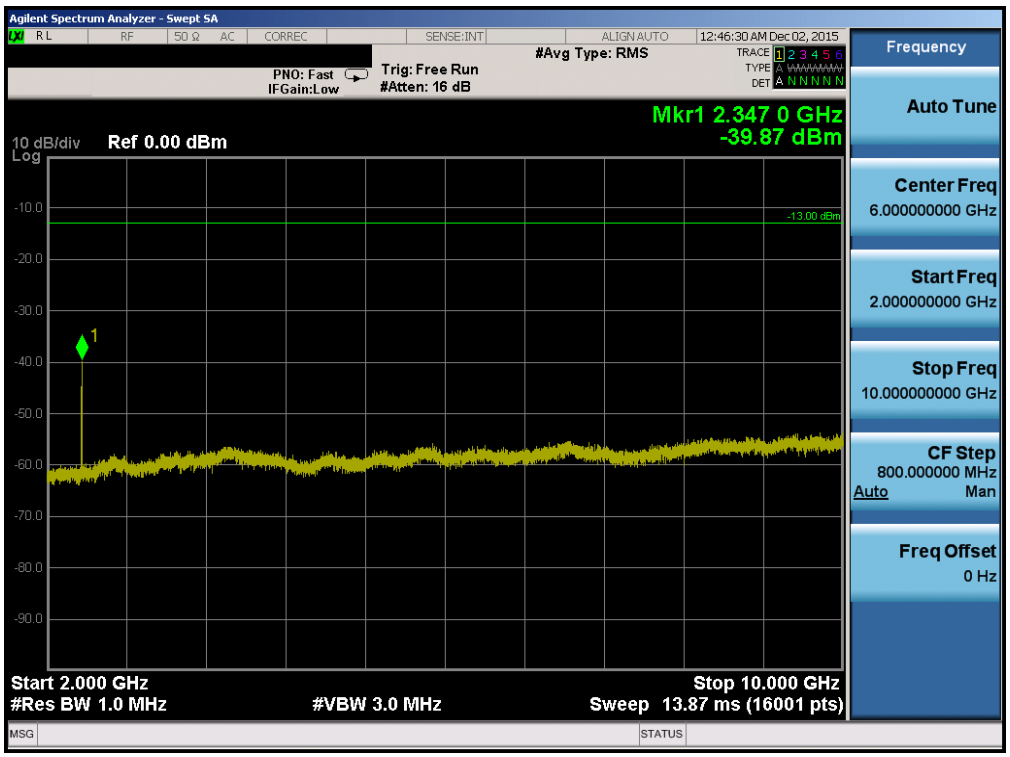


Plot 7-75. Conducted Spurious Plot (Band 13 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



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

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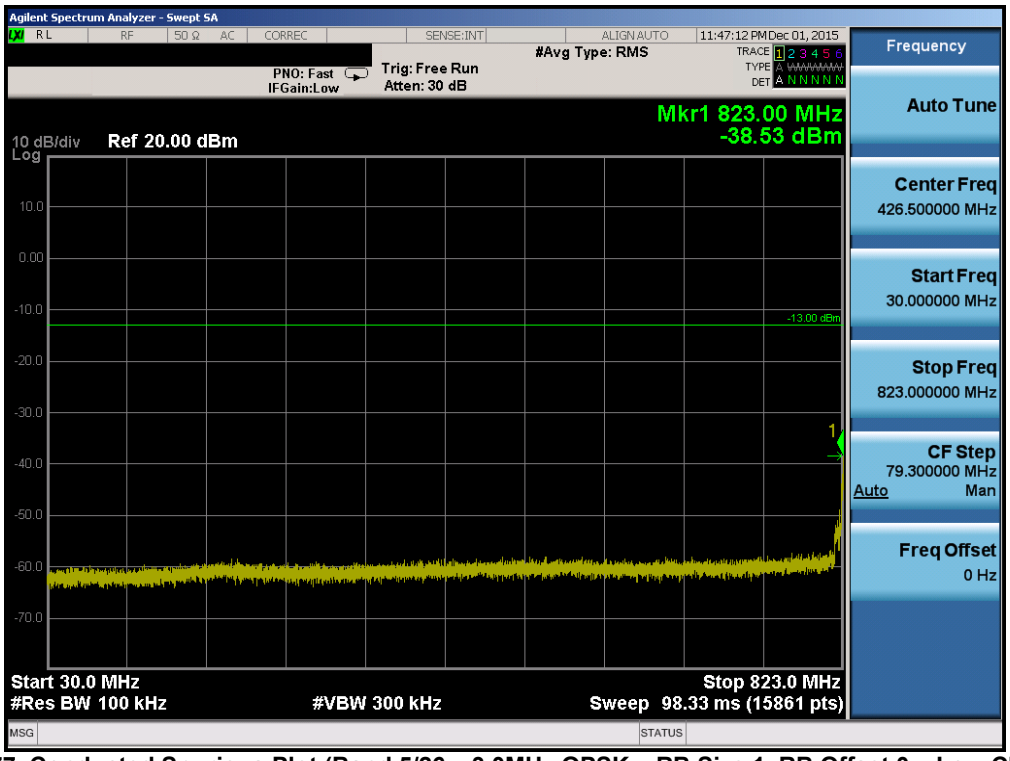
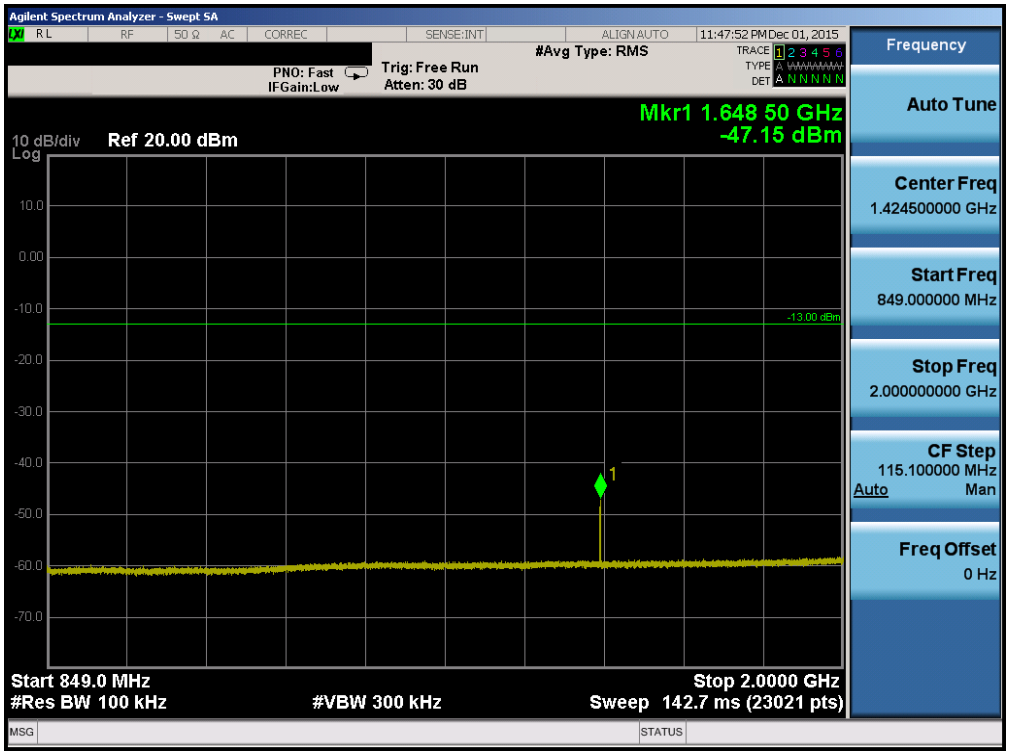


Plot 7-77. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-78. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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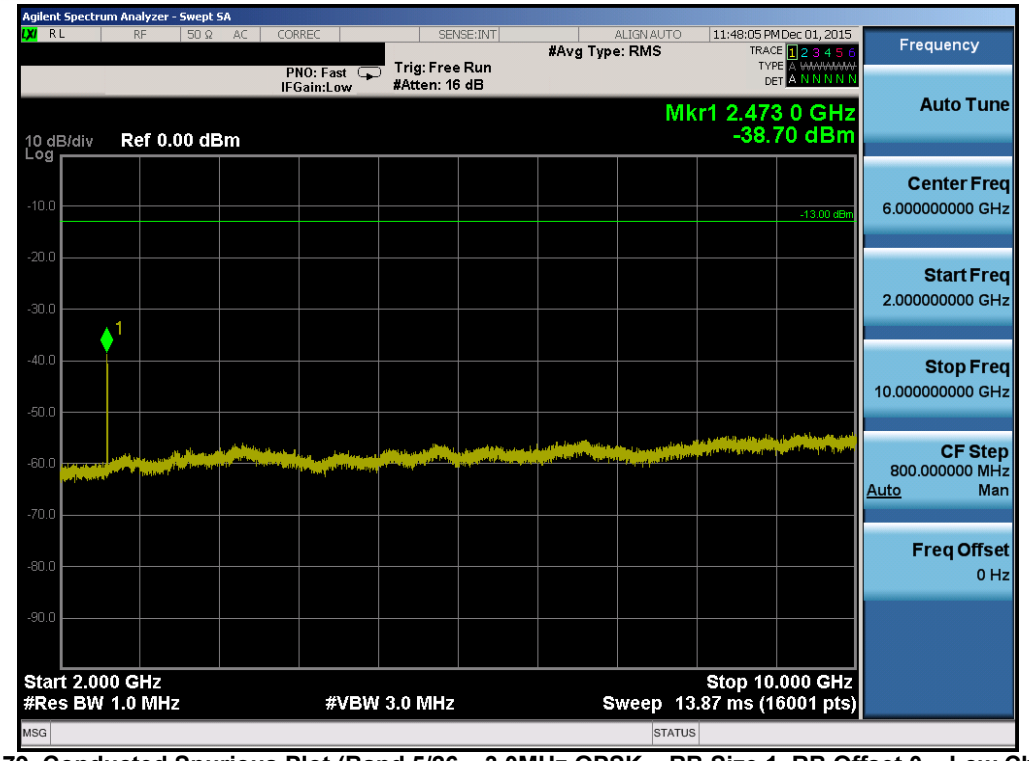
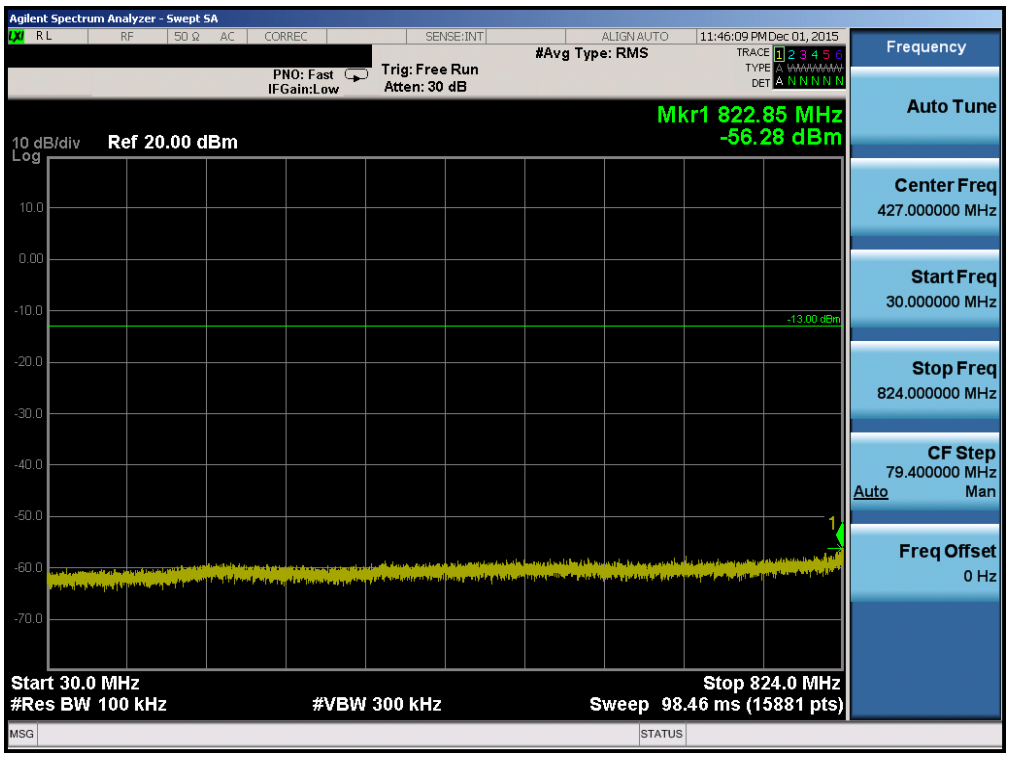


Plot 7-79. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-80. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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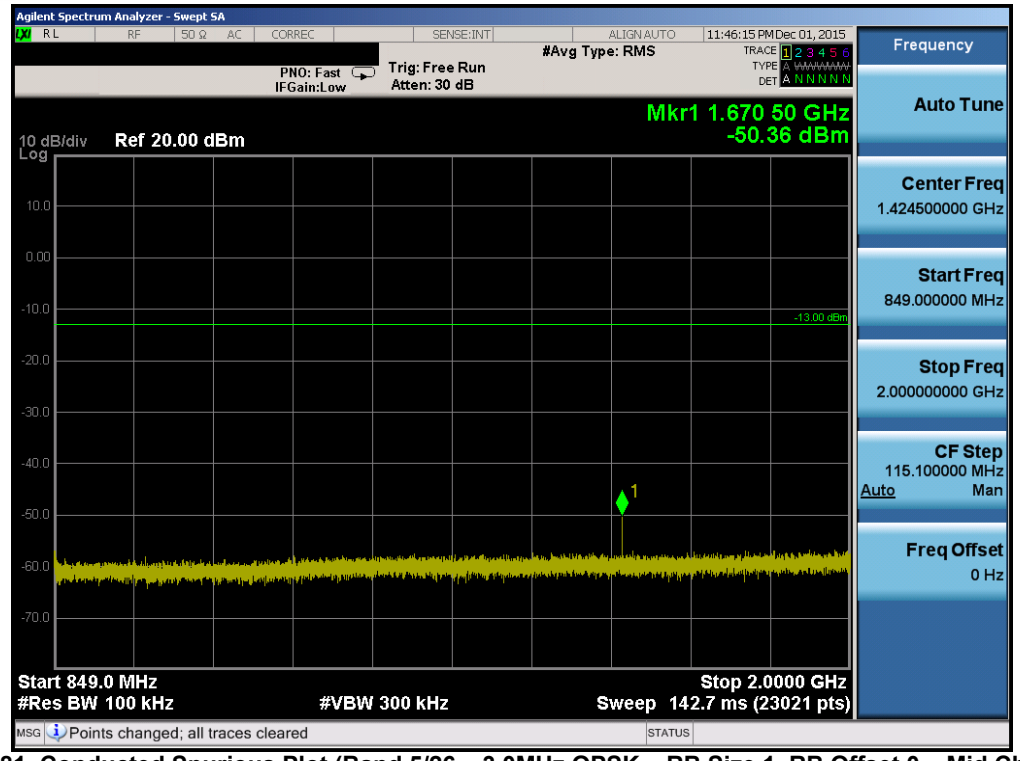
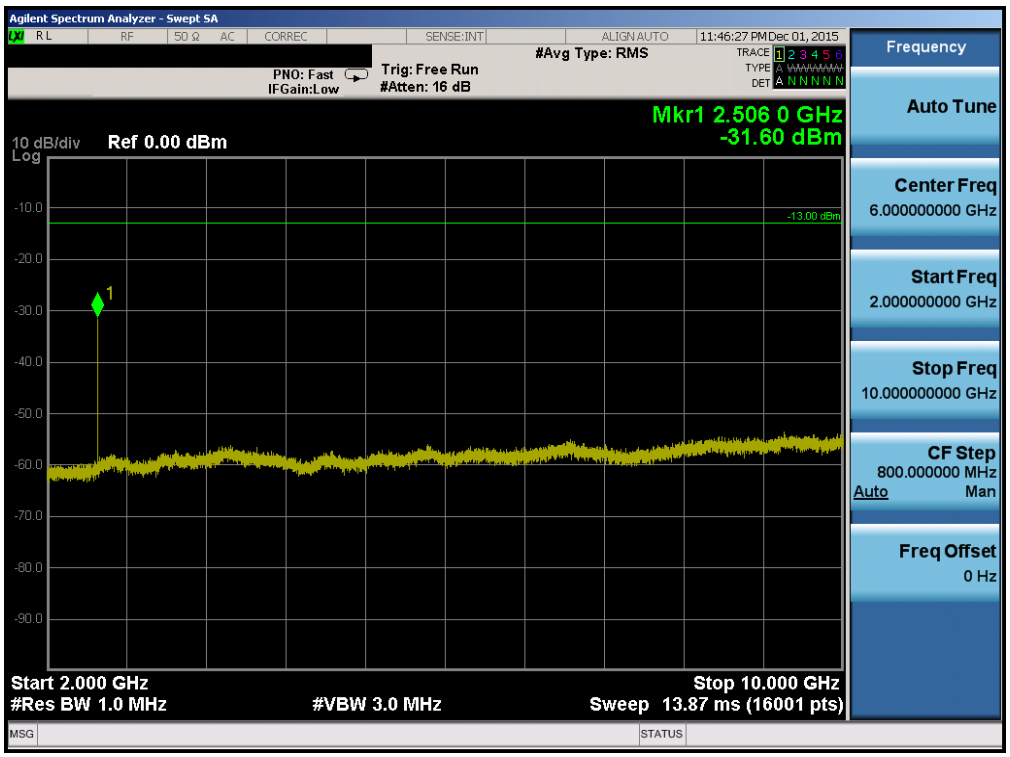


Plot 7-81. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-82. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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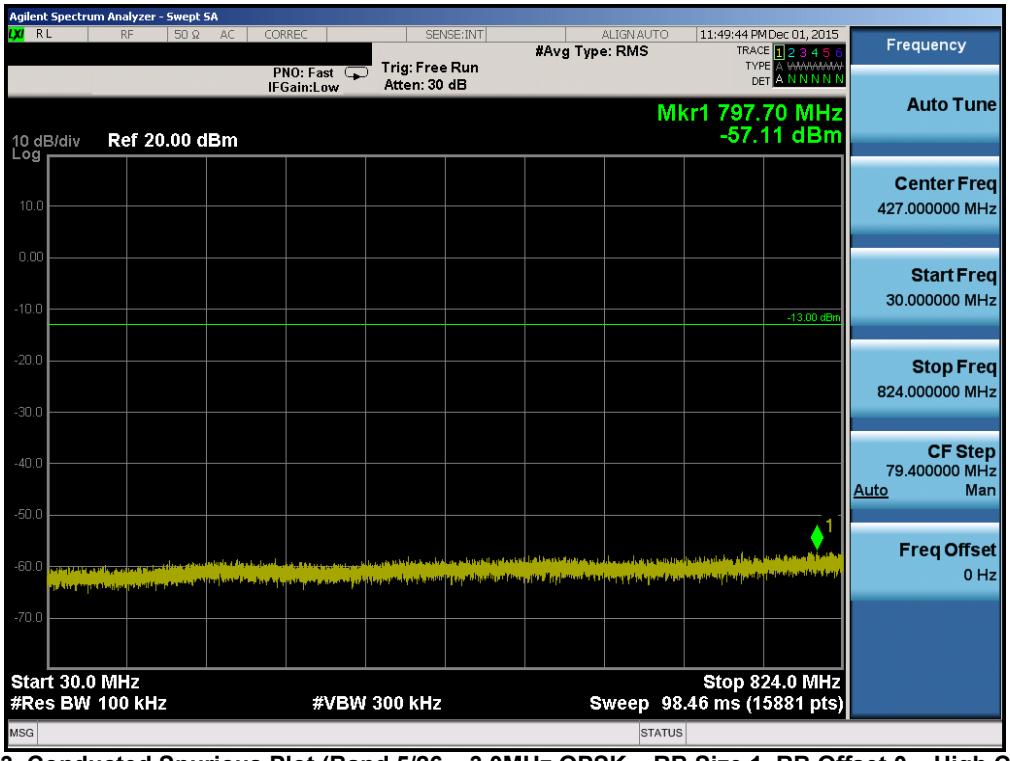
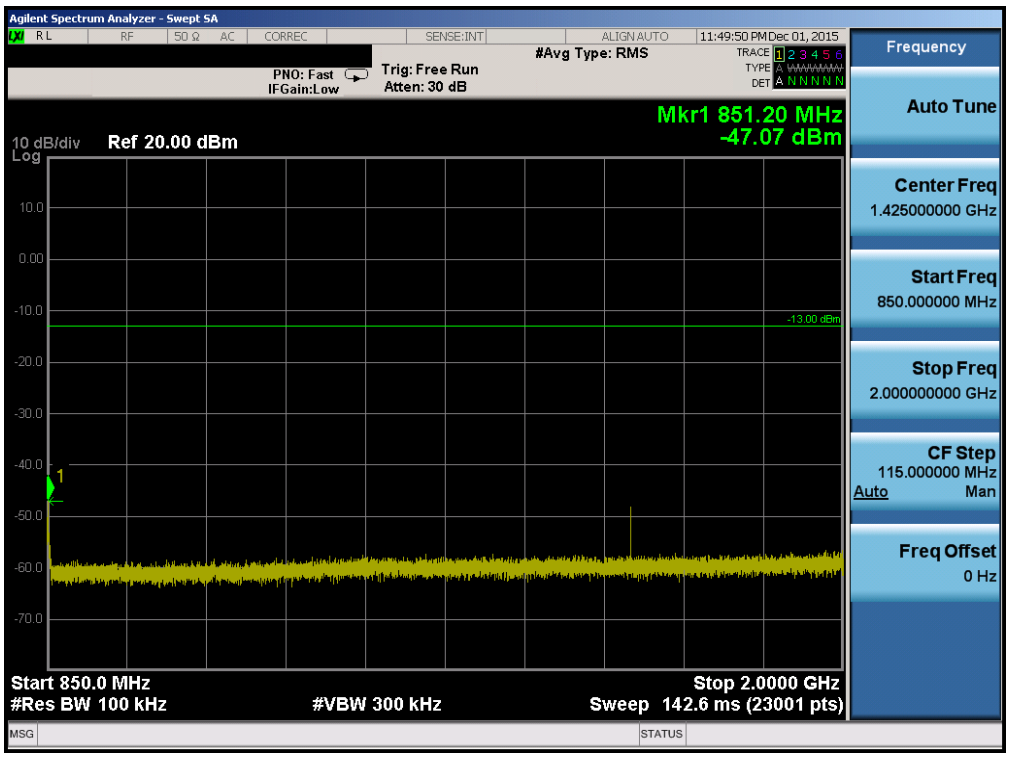


Plot 7-83. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-84. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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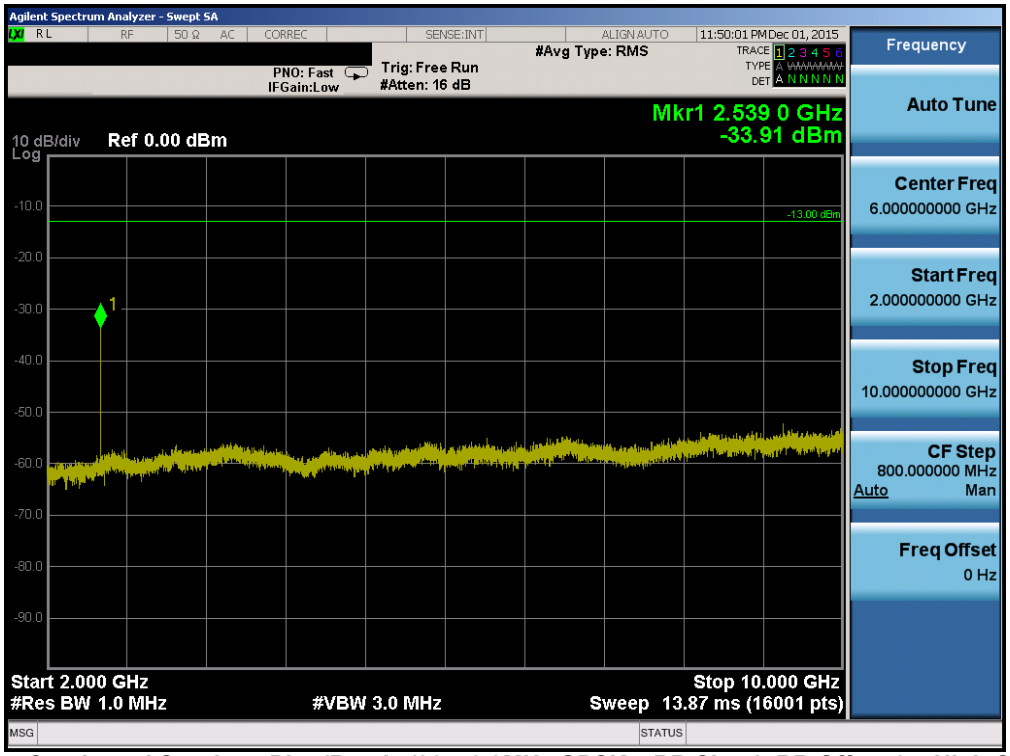
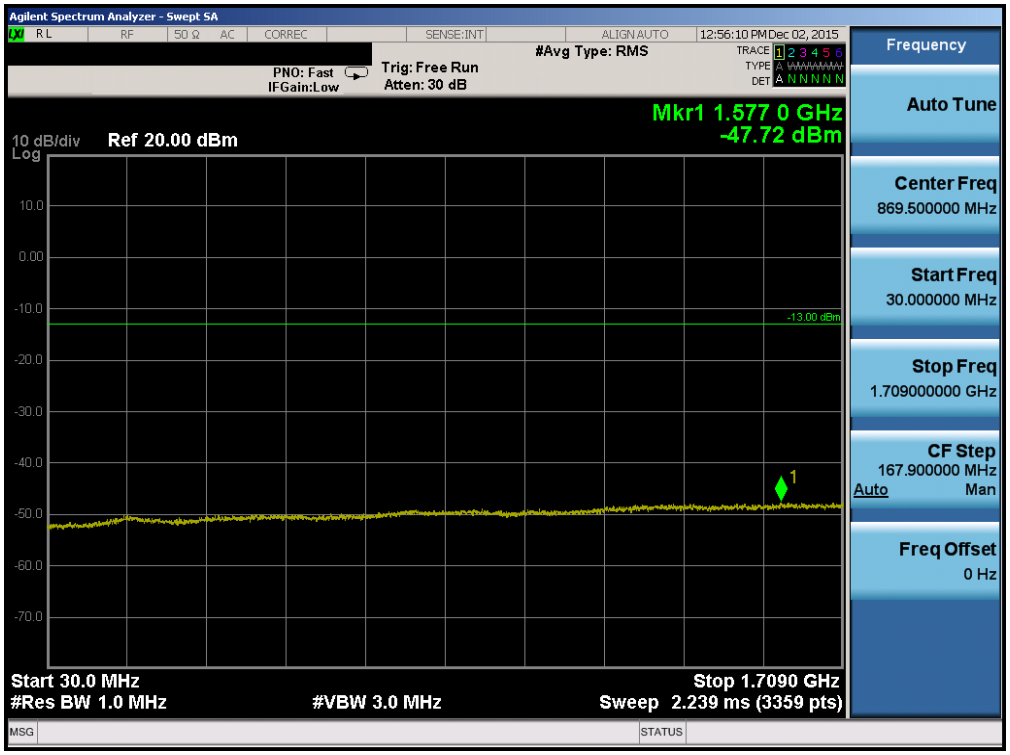


Plot 7-85. Conducted Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-86. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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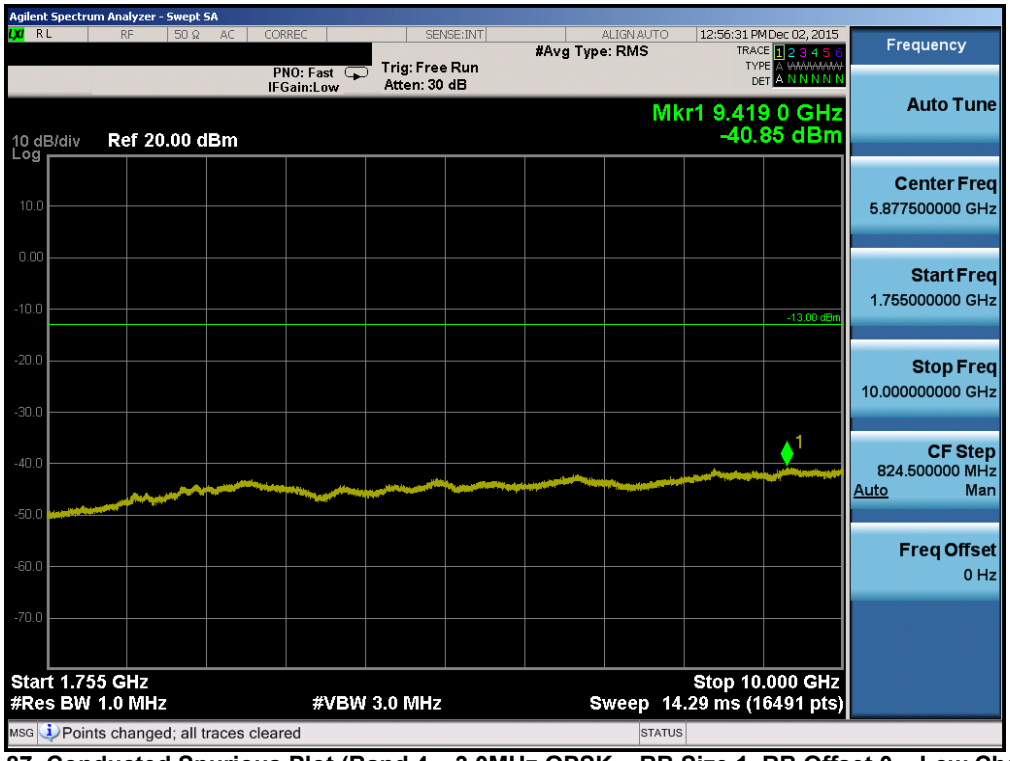
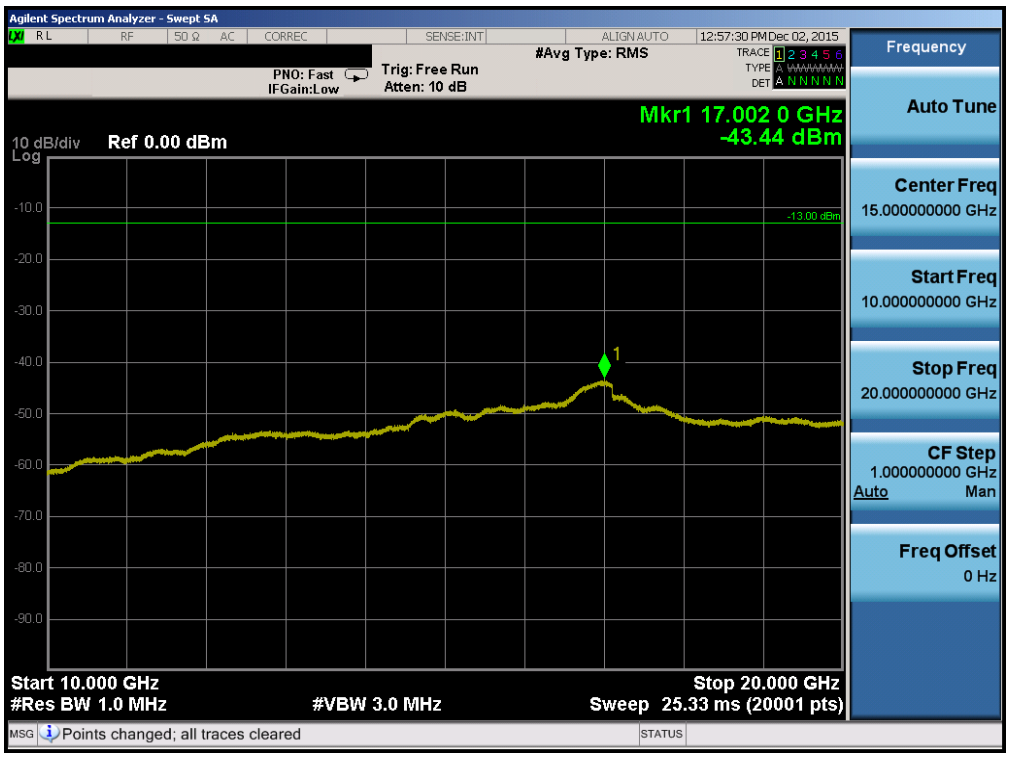


Plot 7-87. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-88. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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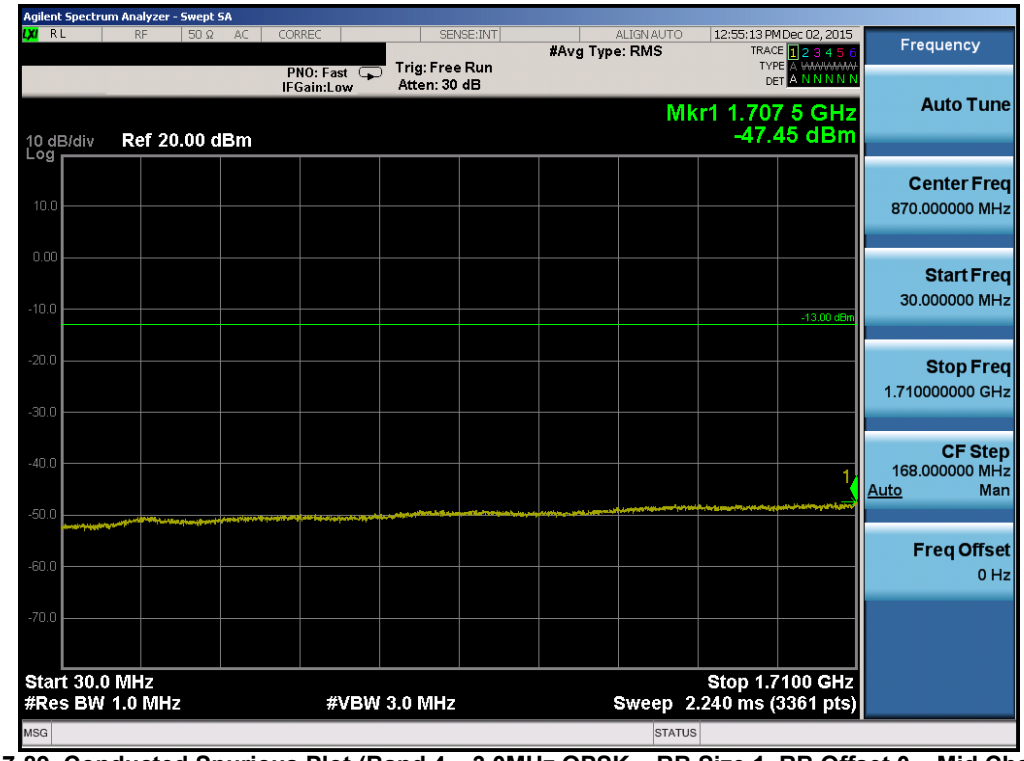
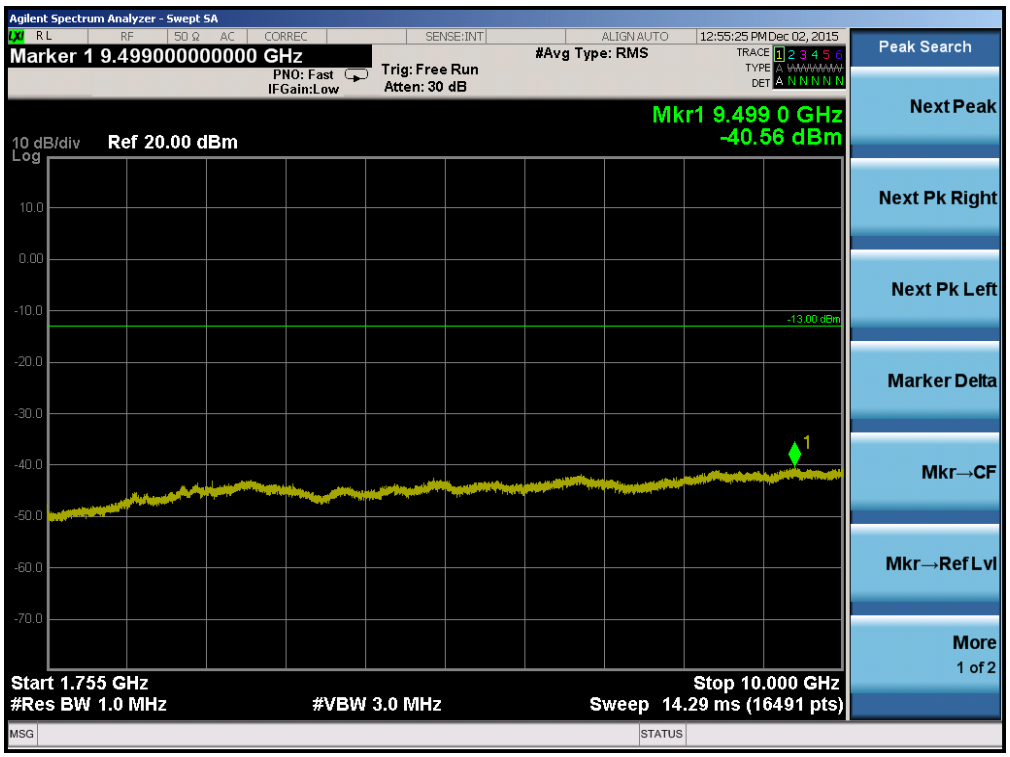


Plot 7-89. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-90. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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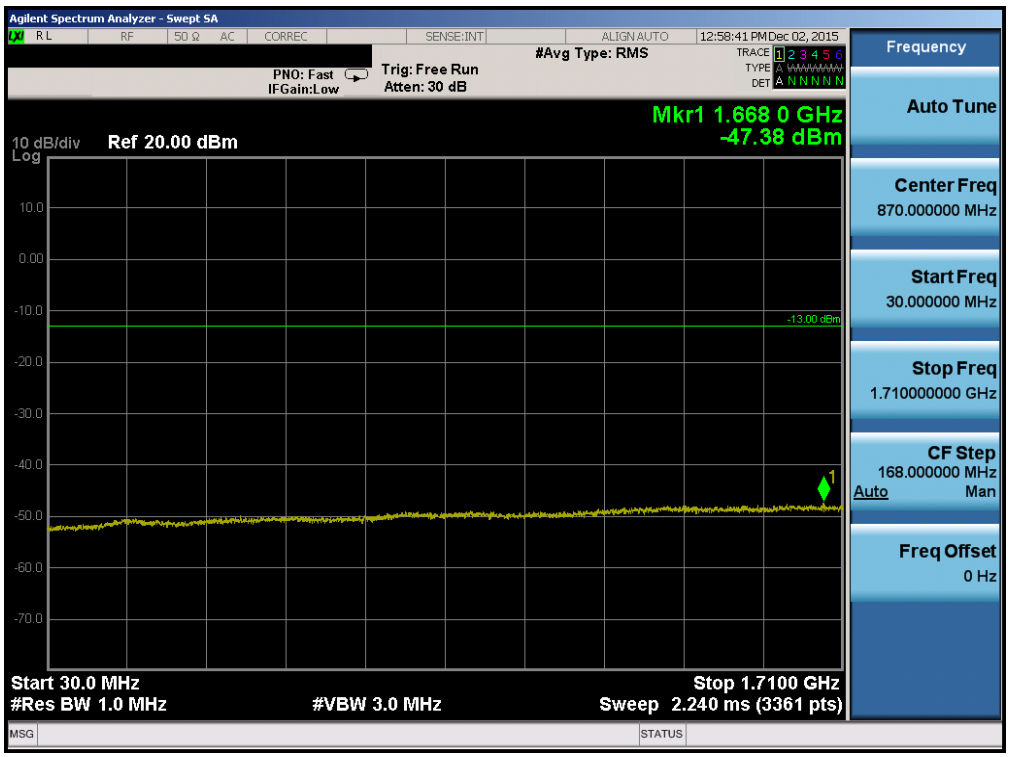
Plot 7-91. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-92. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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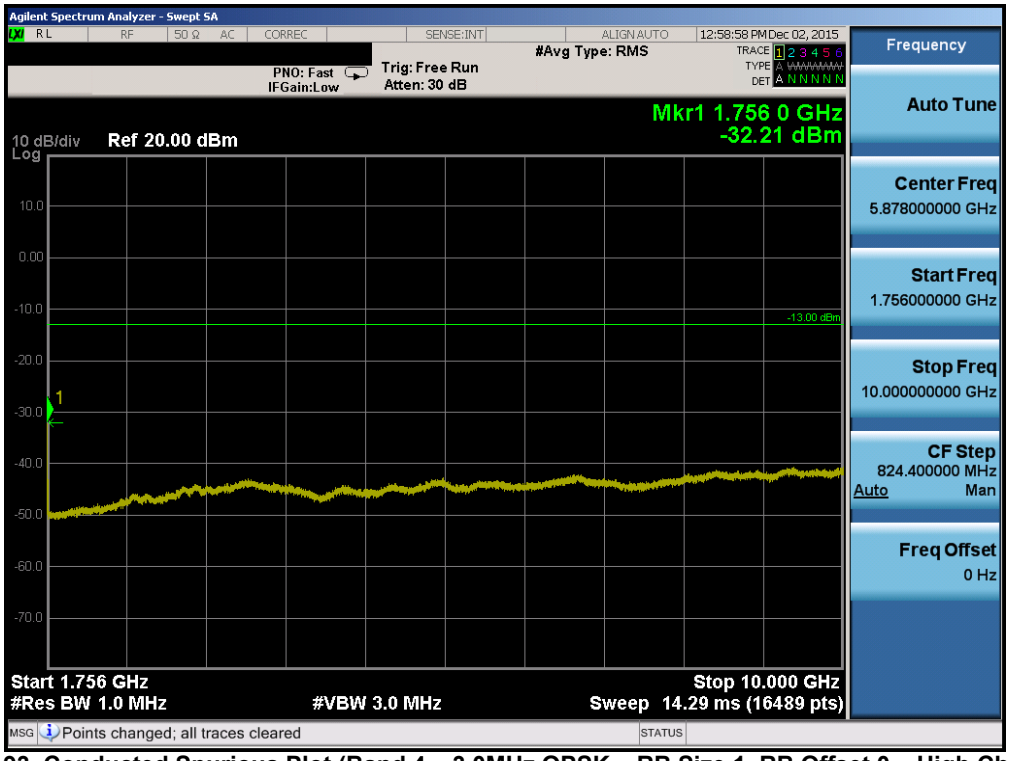
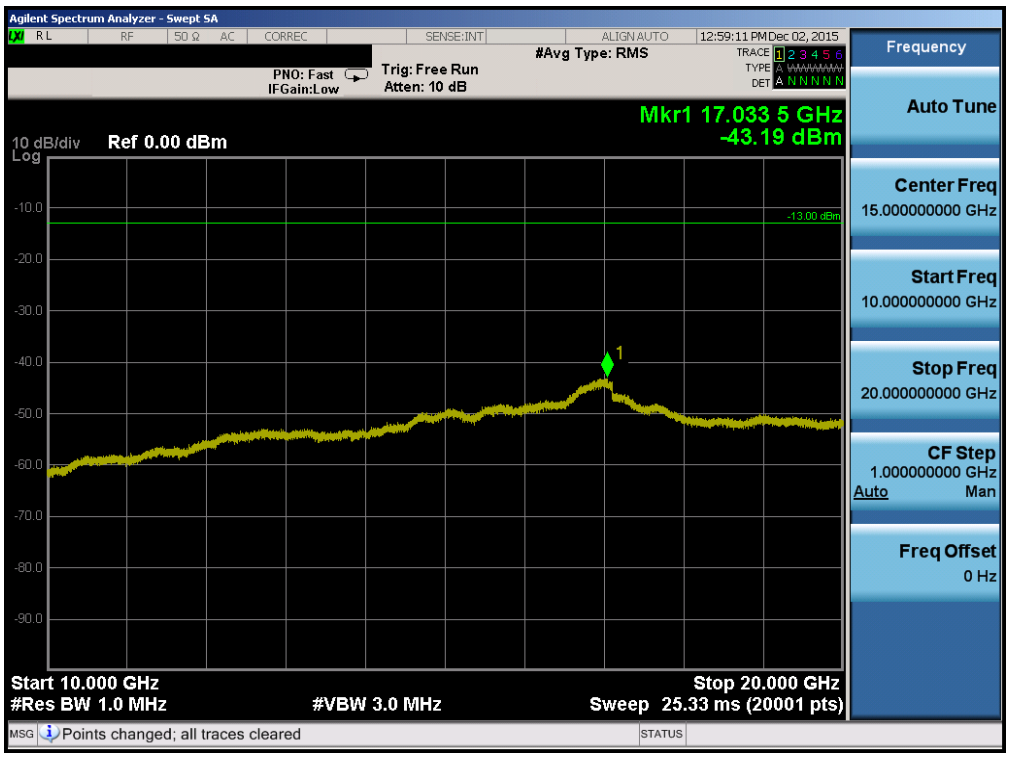


Plot 7-93. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-94. Conducted Spurious Plot (Band 4 – 3.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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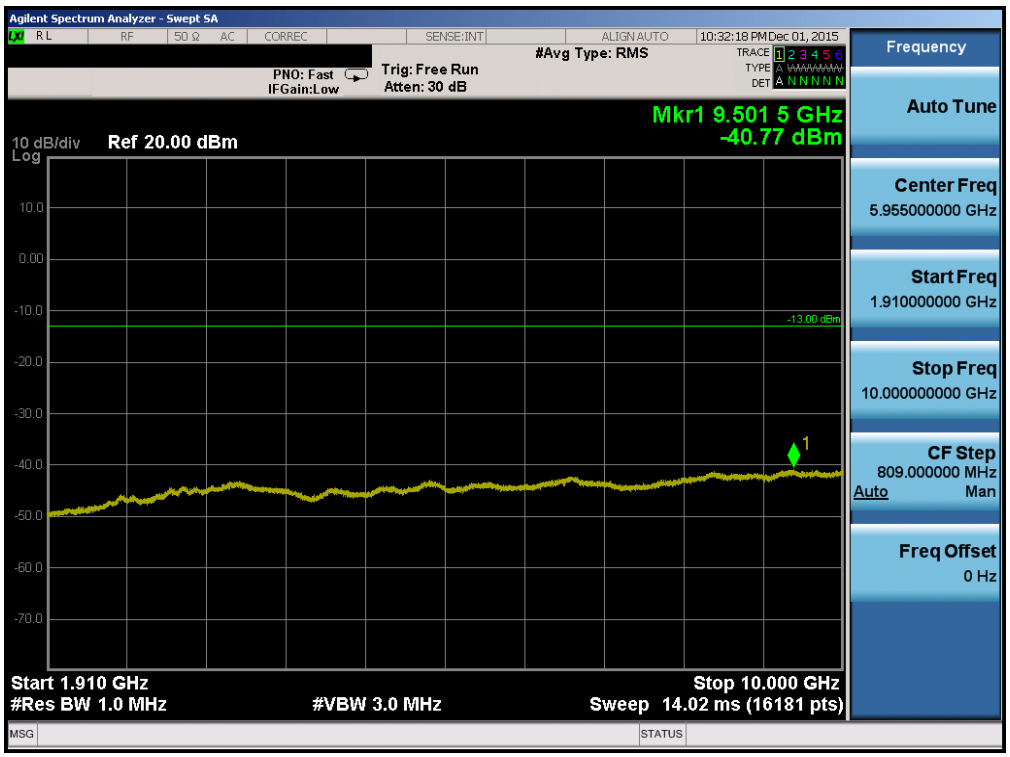
Plot 7-95. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-96. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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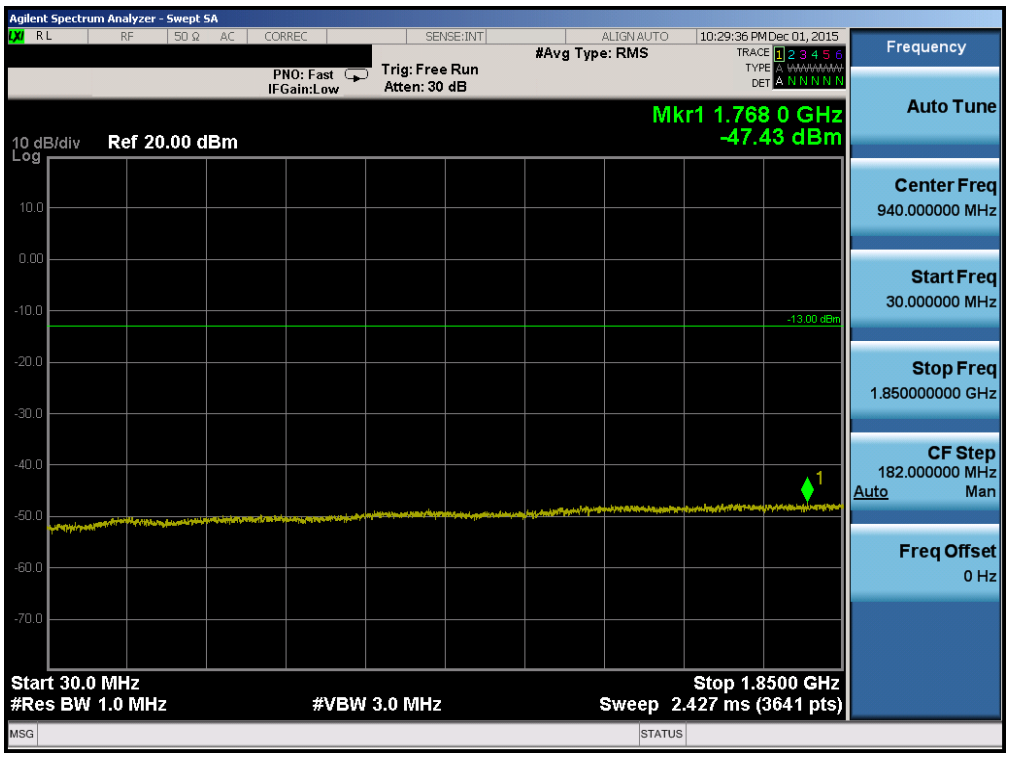
Plot 7-97. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-98. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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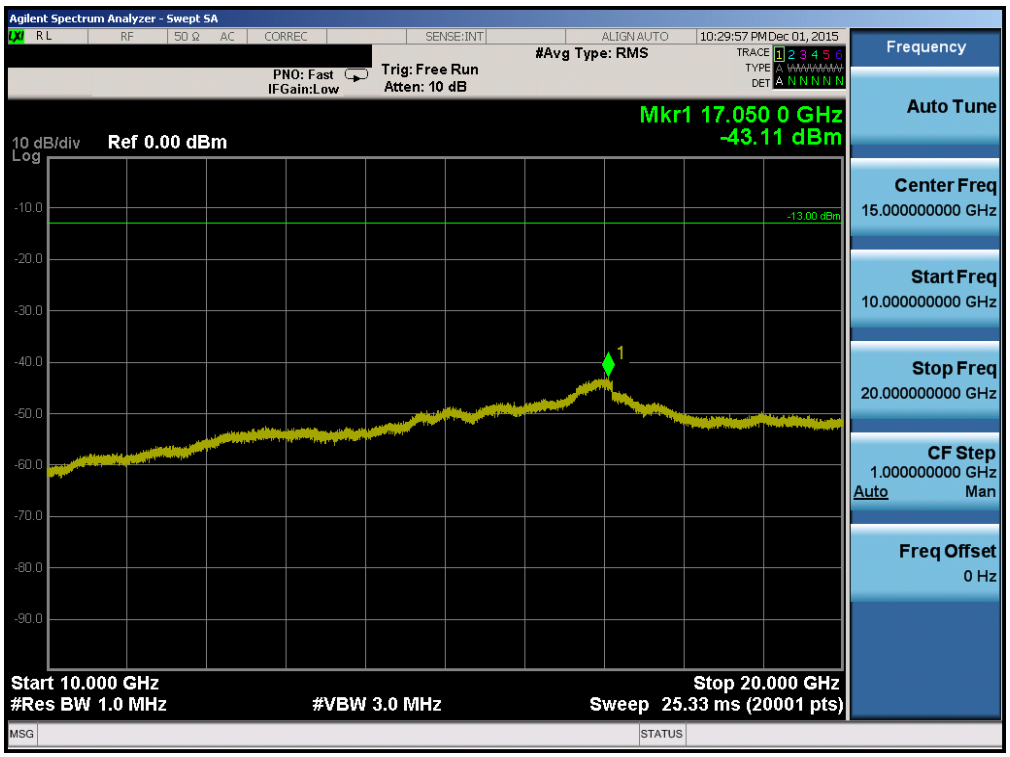
Plot 7-99. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-100. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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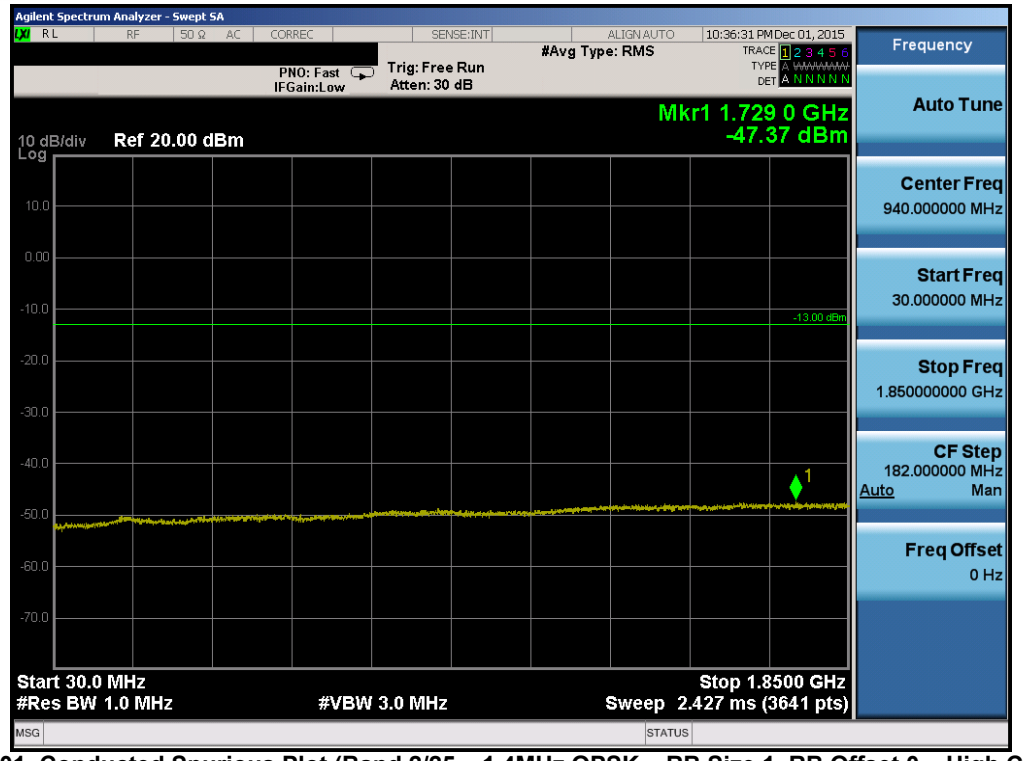
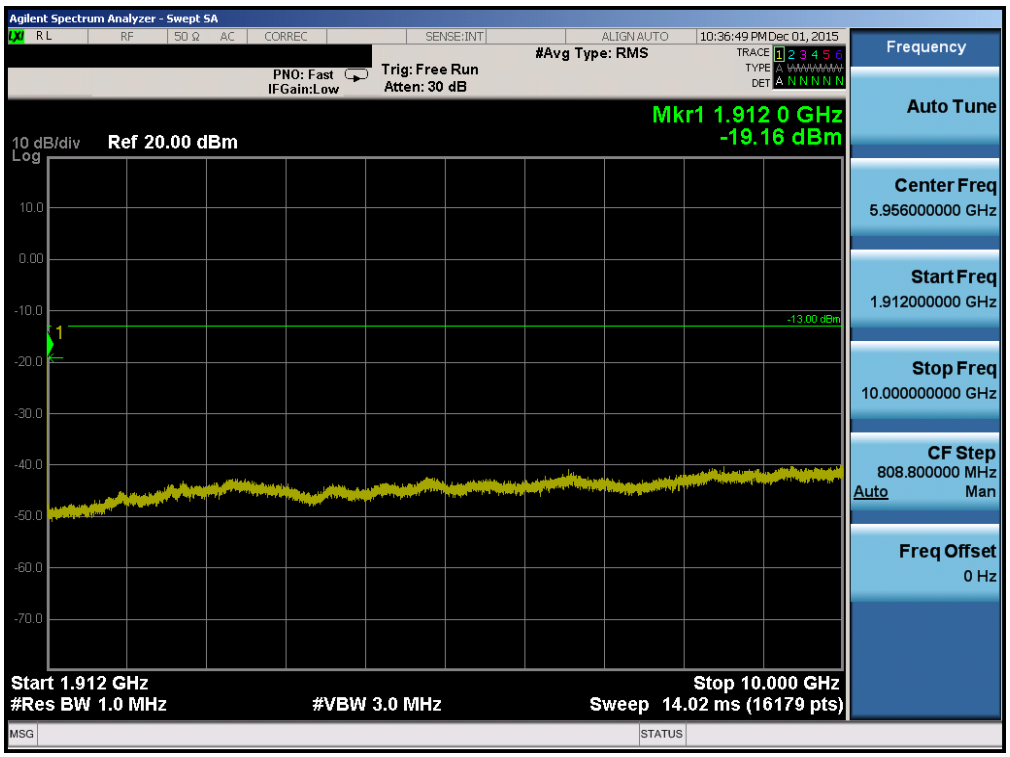


Plot 7-101. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-102. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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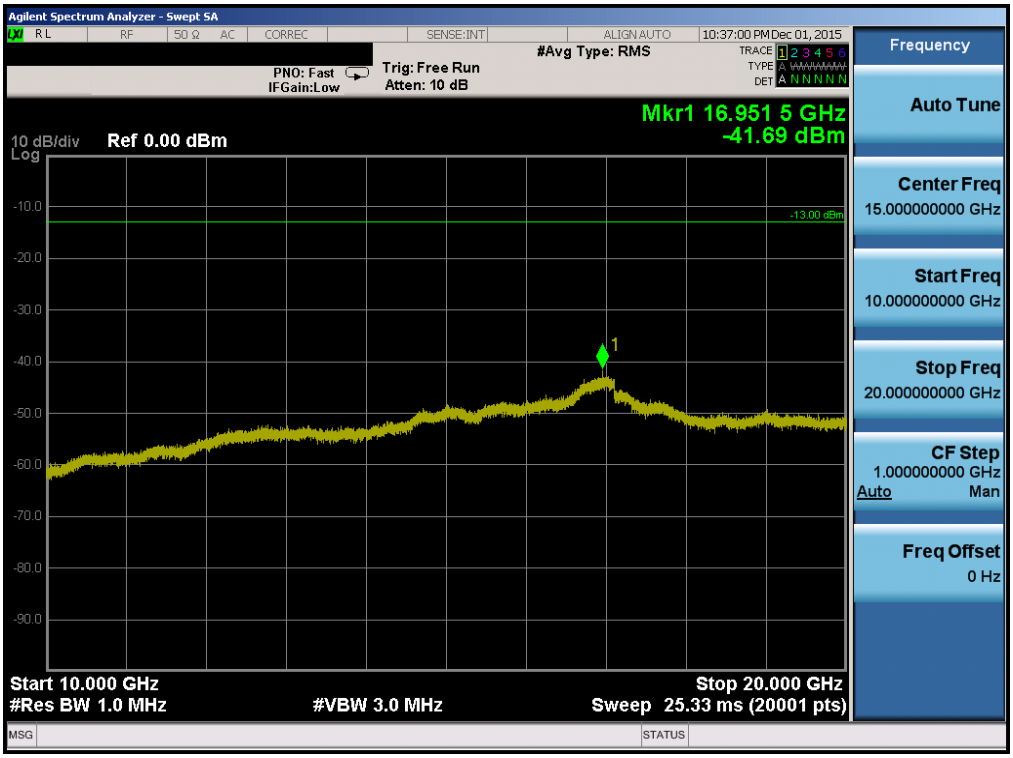
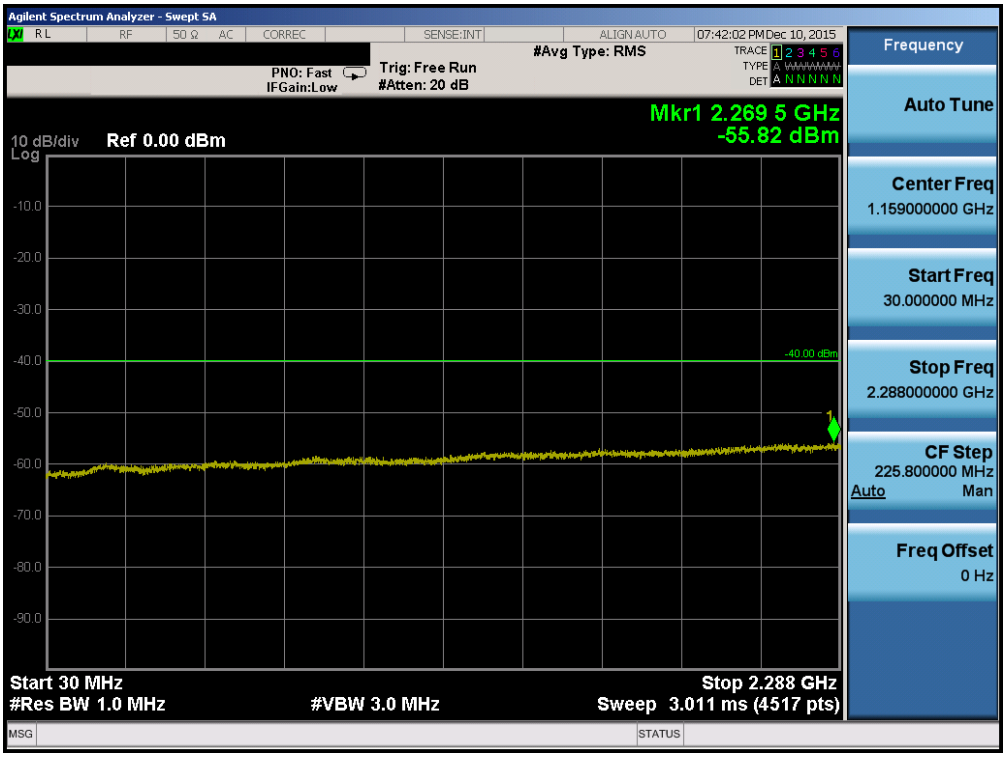


Plot 7-103. Conducted Spurious Plot (Band 2/25 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-104. Conducted Spurious Plot (Band 30 – 10.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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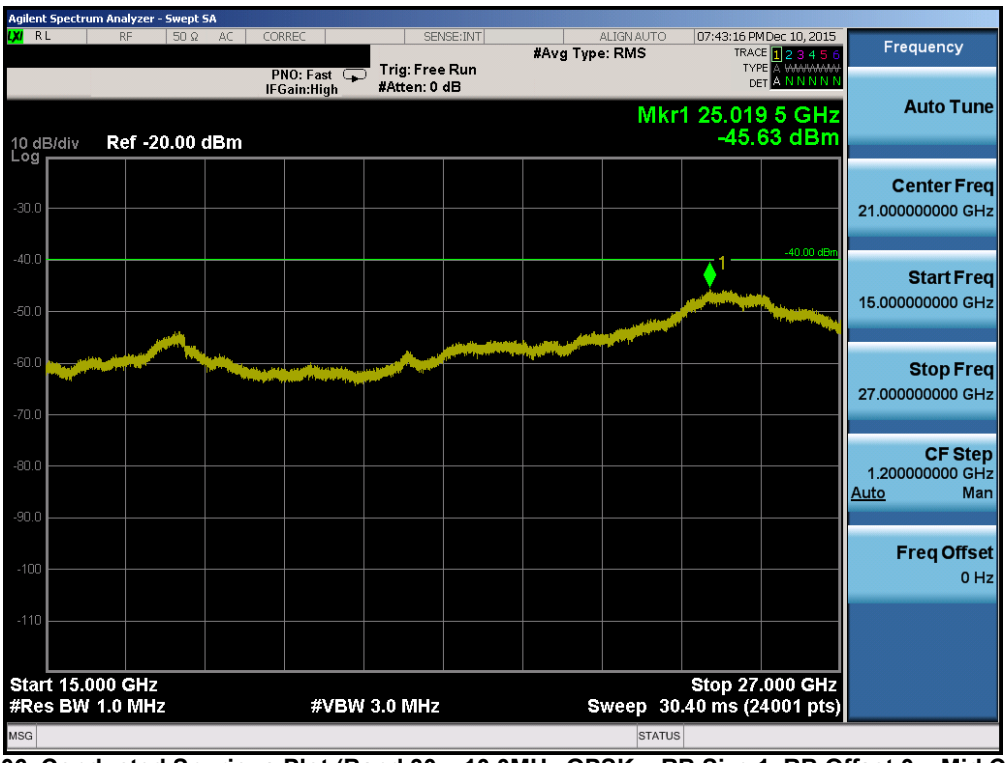
Plot 7-105. Conducted Spurious Plot (Band 30 – 10.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-106. Conducted Spurious Plot (Band 30 – 10.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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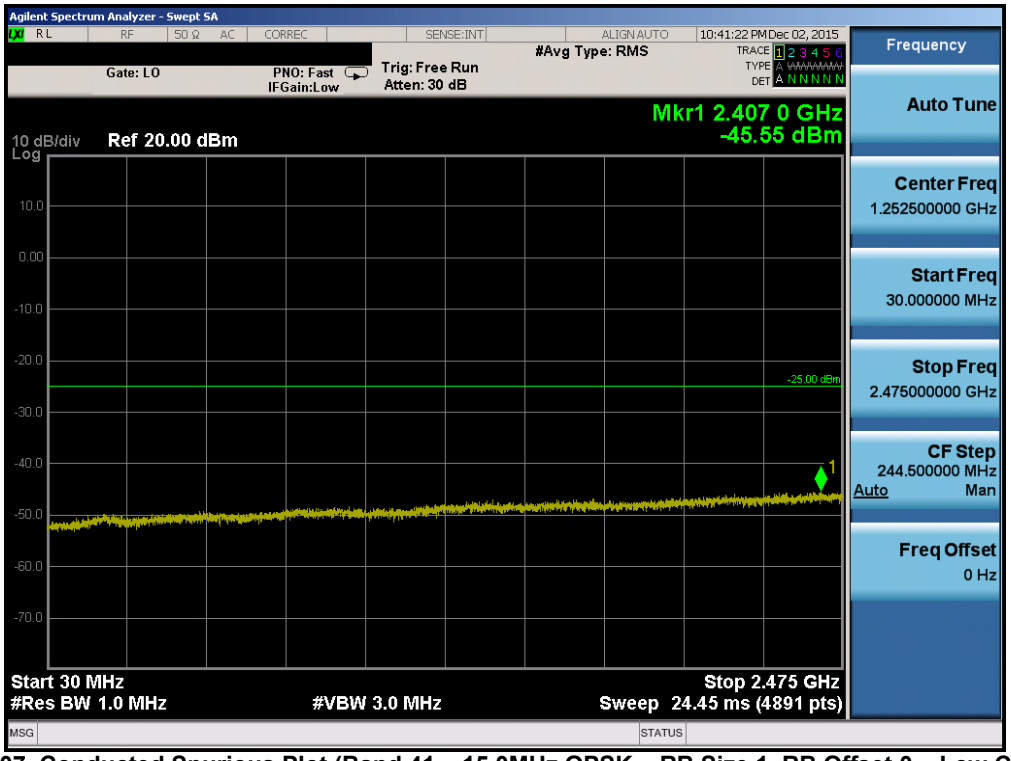

Plot 7-107. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

Plot 7-108. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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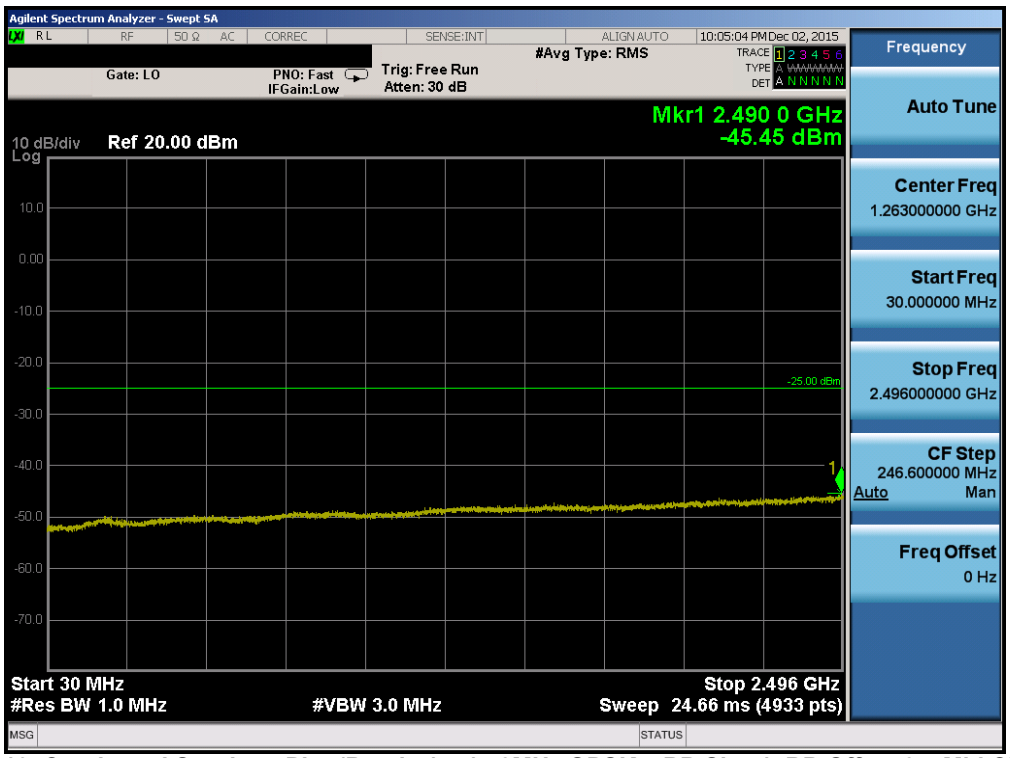
Plot 7-109. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-110. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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Plot 7-111. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

Plot 7-112. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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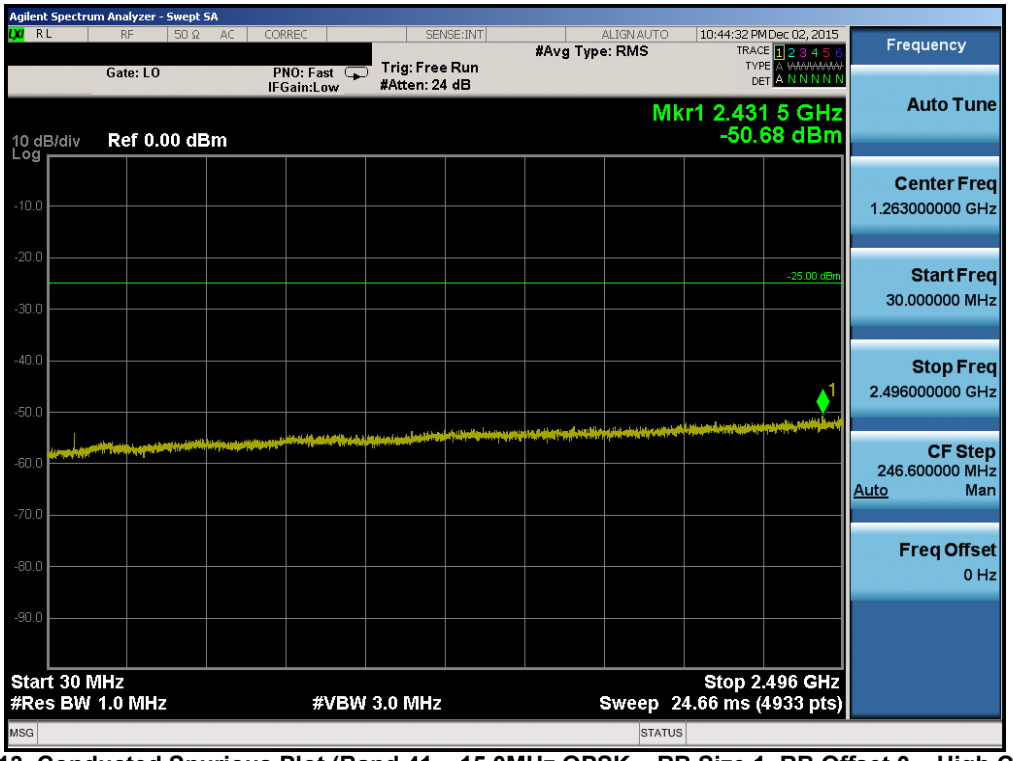
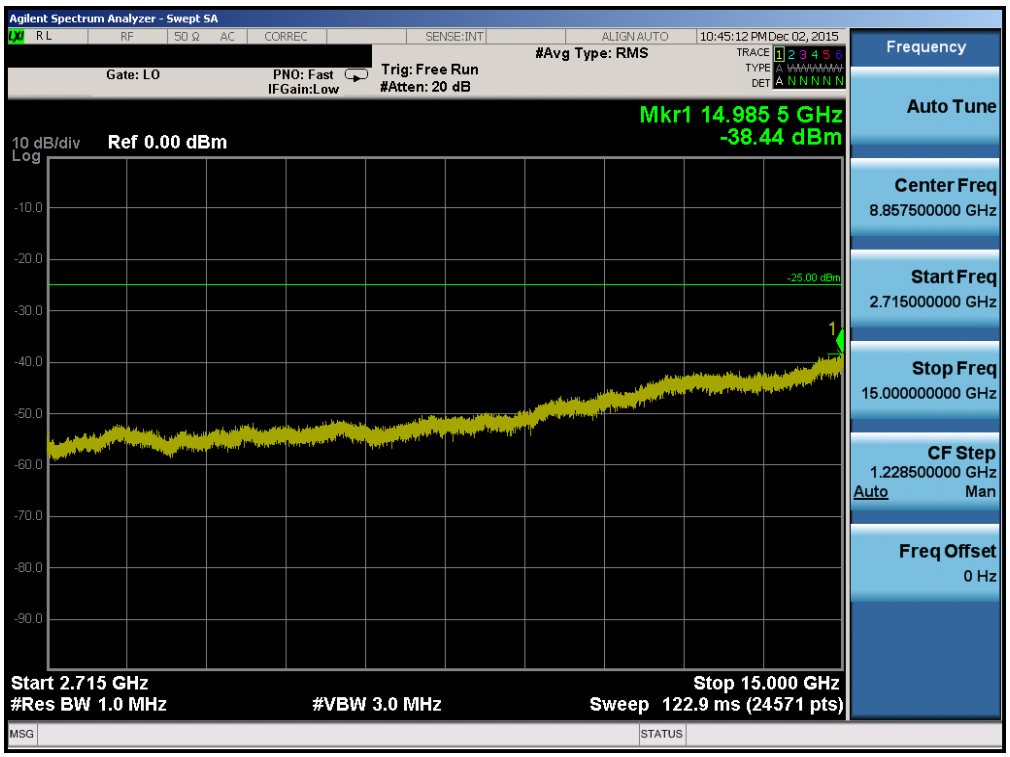


Plot 7-113. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-114. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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Plot 7-115. Conducted Spurious Plot (Band 41 – 15.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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