PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctestlab.com

MEASUREMENT REPORT
FCC Part 90

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

Date of Testing:
12/22/2015-1/11/2016
Test Site/Location:
PCTEST Lab., Columbia, MD, USA
Test Report Serial No.:
0Y1512212174.A3L

FCC ID:	**A3LSMG930F**
APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD.**

Applicant Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	§90.691
Test Procedure(s):	KDB 971168 v02r02, KDB 648474 D03 v01r04
EUT Type:	Portable Handset
Model(s):	SM-G930F
Test Device Serial No.:	*identical prototype* [S/N: B4060]

Mode	Tx Frequency (MHz)	Emission Designator	Cond. PWR	
			Max. Power (W)	Max. Power (dBm)
LTE Band 26	814.7 - 823.3	1M09G7D	0.209	23.20
LTE Band 26	814.7 - 823.3	1M09W7D	0.136	21.32
LTE Band 26	815.5 - 822.5	2M70G7D	0.207	23.17
LTE Band 26	815.5 - 822.5	2M70W7D	0.156	21.94
LTE Band 26	816.5 - 821.5	4M53G7D	0.201	23.04
LTE Band 26	816.5 - 821.5	4M53W7D	0.151	21.79
LTE Band 26	819	8M99G7D	0.208	23.18
LTE Band 26	819	8M99W7D	0.161	22.08

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

© 2016 PCTEST Engineering Laboratory, Inc.

TABLE OF CONTENTS

FCC PART 90 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 Test Configuration 5

2.4 EMI Suppression Device(s)/Modifications 5

3.0 DESCRIPTION OF TESTS 6

3.1 Evaluation Procedure 6

3.2 Occupied Bandwidth 6

3.3 Spurious and Harmonic Emissions at Antenna Terminal 6

3.4 Radiated Power and Radiated Spurious Emissions 7

3.5 Frequency Stability / Temperature Variation 8

4.0 MEASUREMENT UNCERTAINTY 9

5.0 TEST EQUIPMENT CALIBRATION DATA 10

6.0 SAMPLE CALCULATIONS 11

7.0 TEST RESULTS 12

7.1 Summary 12

7.2 Occupied Bandwidth 13

7.3 Spurious and Harmonic Emissions at Antenna Terminal 21

7.4 Band Edge Emissions at Antenna Terminal 24

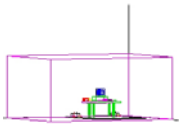
7.5 Conducted Power Output Data 29

7.6 Radiated Spurious Emissions Measurements 30

7.7 Frequency Stability / Temperature Variation 34

8.0 CONCLUSION 37

© 2016 PCTEST Engineering Laboratory, Inc.



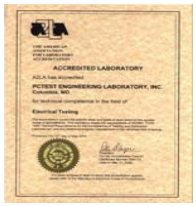
MEASUREMENT REPORT
FCC Part 90 LTE Band 26

§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
BASE MODEL:	SM-G930F
FCC CLASSIFICATION:	PCS Licensed Transmitter Held to Ear (PCE)
MODE:	LTE
FREQUENCY TOLERANCE:	±0.00025 % (2.5 ppm)
Test Device Serial No.:	B4060 ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	12/22/2015-1/11/2016
TEST REPORT S/N:	0Y1512212174.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.
- 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.

- 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.
- 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.

© 2016 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 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.

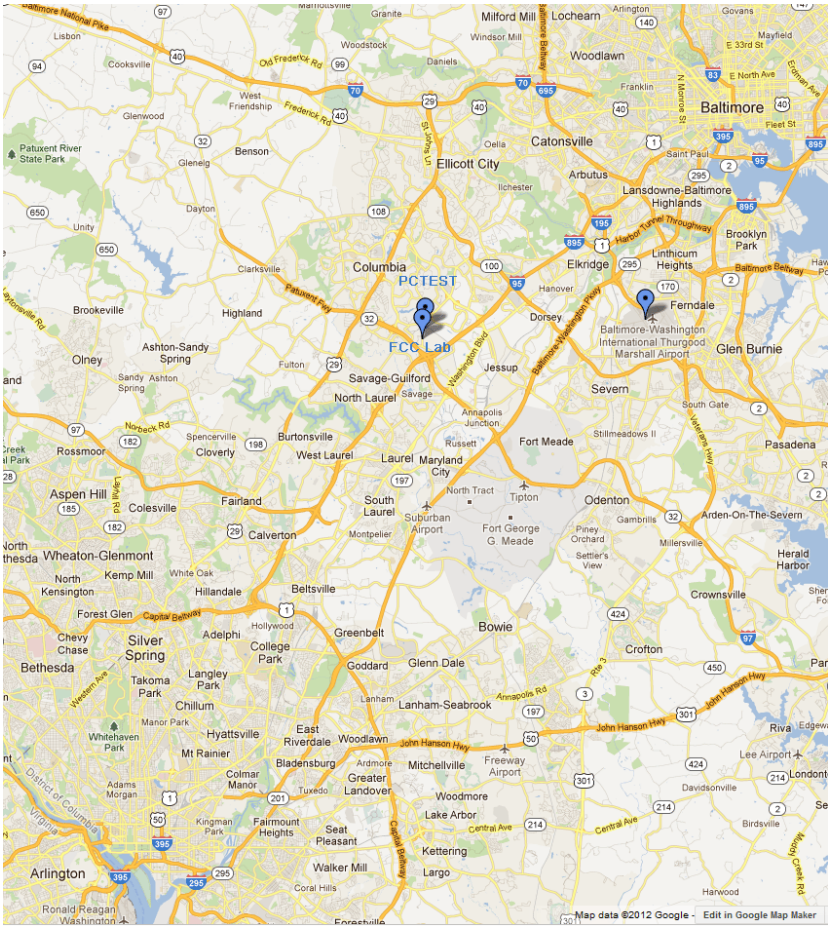


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

© 2016 PCTEST Engineering Laboratory, Inc.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMG930F**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 90.691.

2.2 Device Capabilities

This device contains the following capabilities:

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

2.3 Test Configuration

The Samsung Portable Handset FCC ID: A3LSMG930F was tested per the guidance of ANSI/TIA-603-C-2004 and KDB 971168 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.

© 2016 PCTEST Engineering Laboratory, Inc.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation 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 v02r02) were used in the measurement of the **Samsung Portable Handset FCC ID: A3LSMG930F.**

3.2 Occupied Bandwidth

§2.1049

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. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth in accordance with KDB 971168.

3.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051, §90.691

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.

Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 $Log_{10}(f/6.1)$ decibels or 50 + 10 $Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + $10Log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

© 2016 PCTEST Engineering Laboratory, Inc.

3.4 Radiated Power and Radiated Spurious Emissions

§2.1053, §90.635, §90.691

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 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 $43 + 10\log_{10}(\text{Power}_{[\text{Watts}]})$ specified in 90.691.

For fundamental radiated power measurements, the guidance of KDB 971168 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-C-2004.

© 2016 PCTEST Engineering Laboratory, Inc.

3.5 Frequency Stability / Temperature Variation

§2.1055, 90.213(a)

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.

Specification – For Part 90.213, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

Time Period and Procedure:

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 sufficient stabilization period at each temperature shall be used prior to each frequency requirement.

© 2016 PCTEST Engineering Laboratory, Inc.

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

© 2016 PCTEST Engineering Laboratory, Inc.

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
-	LTx3	LIcensed Transmitter Cable Set	6/12/2015	Annual	6/12/2016	LTx3
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	4/28/2015	Annual	4/28/2016	RE1
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/24/2015	Annual	3/24/2016	MY52350166
Anritsu	MT8820C	Radio Communication Analyzer	7/24/2015	Annual	7/24/2016	6200901190
Emco	3115	Horn Antenna (1-18GHz)	1/30/2014	Biennial	1/30/2016	9704-5182
Espec	ESX-2CA	Environmental Chamber	3/17/2015	Annual	3/17/2016	17620
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
Mini-Circuits	PWR-SENS-4RMS	USB Power Sensor	3/11/2015	Annual	3/11/2016	11210140001
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
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

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.

© 2016 PCTEST Engineering Laboratory, Inc.

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).

© 2016 PCTEST Engineering Laboratory, Inc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMG930F

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

Mode(s): LTE

Band: Band Class 10 / Band 26

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 90.691	Conducted Band Edge / Spurious Emissions	> 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions except > 50 + 10$\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge		PASS	Sections 7.3, 7.4
2.1055 90.213	Frequency Stability	< 2.5 ppm		PASS	Section 7.7
2.1046 90.635	Conducted Power	< 100 Watts		PASS	Section 7.5
2.1053 90.691	Radiated Spurious Emissions	> 43 + $\log_{10}$ (P[Watts]) for all out-of-band emissions except > 50 + 10$\log_{10}$ (P[Watts]) at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge	RADIATED	PASS	Section 7.6

Table 7-1. 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 shown in Section 7.0 were 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 "2G/3G Automation," Version 3.2.

© 2016 PCTEST Engineering Laboratory, Inc.

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 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.

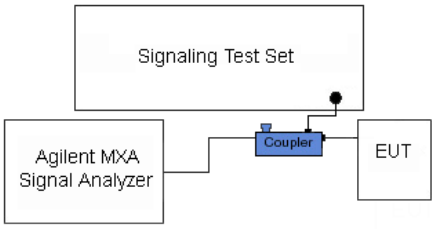
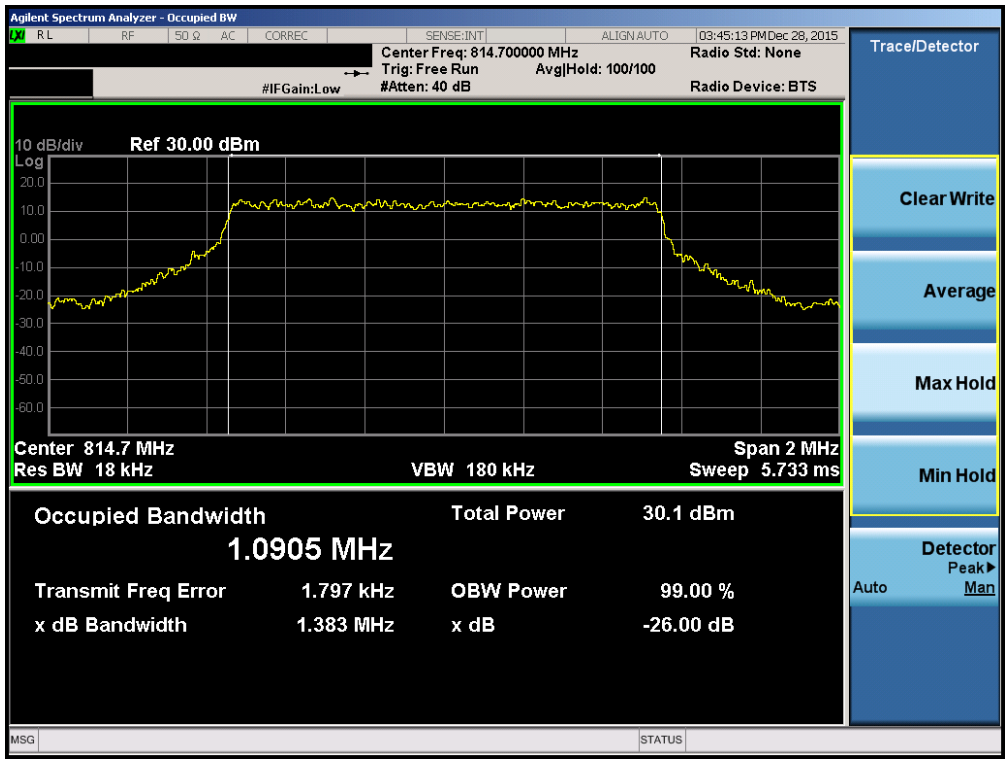


Figure 7-1. Test Instrument & Measurement Setup

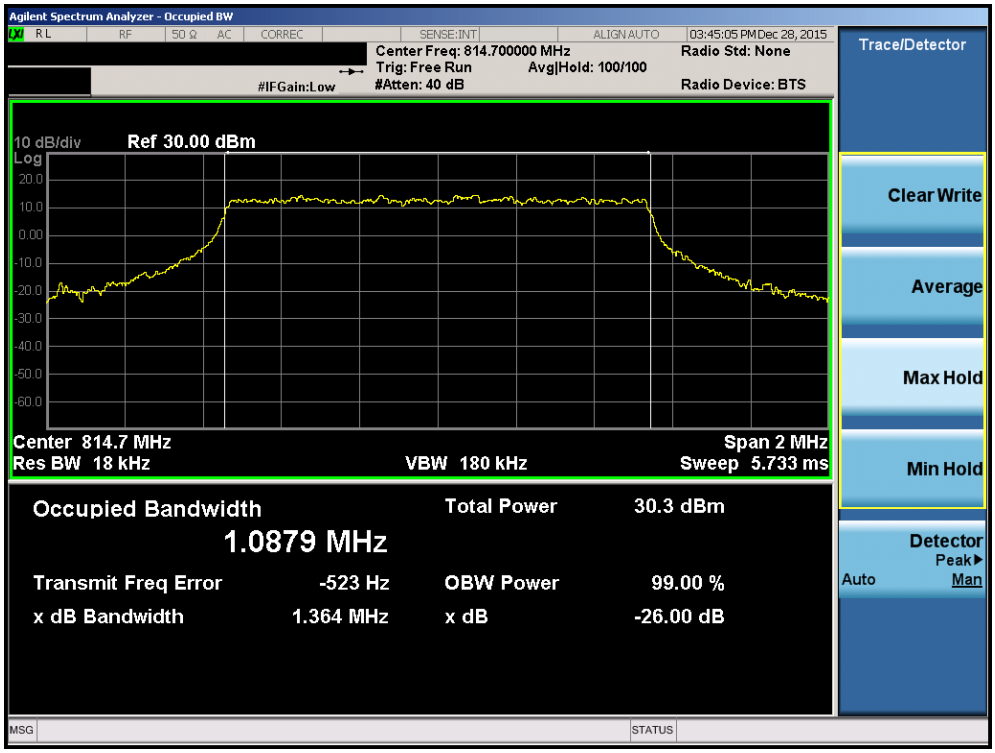
Test Notes

None.

© 2016 PCTEST Engineering Laboratory, Inc.

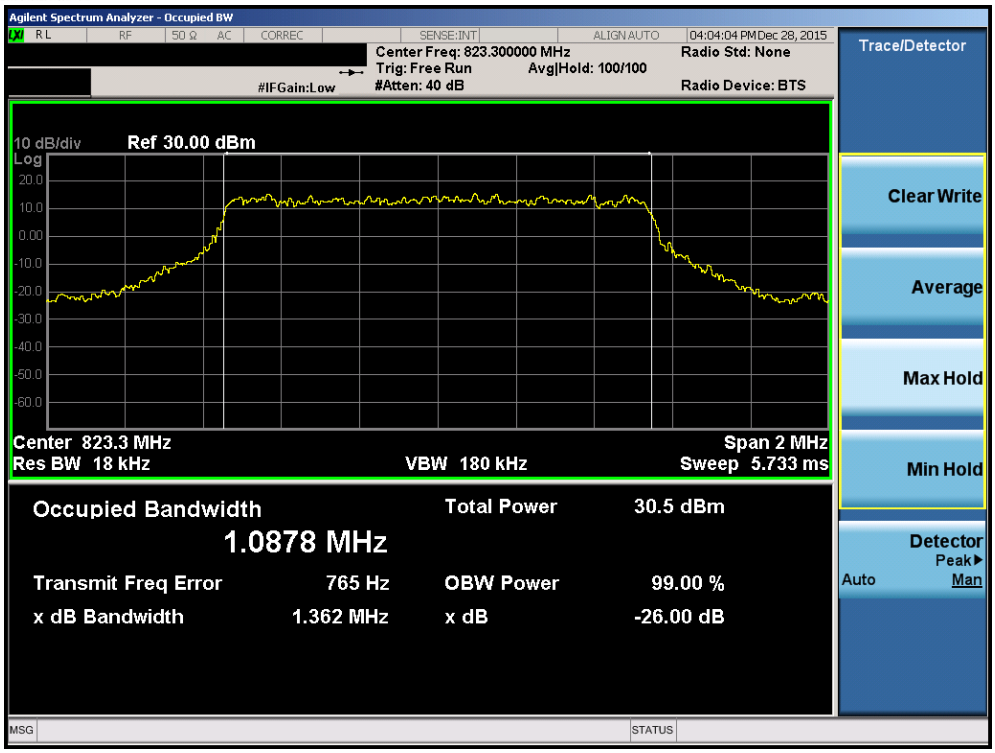


Plot 7-1. Occupied Bandwidth Plot (1.4MHz QPSK – RB Size 6– Low Channel)

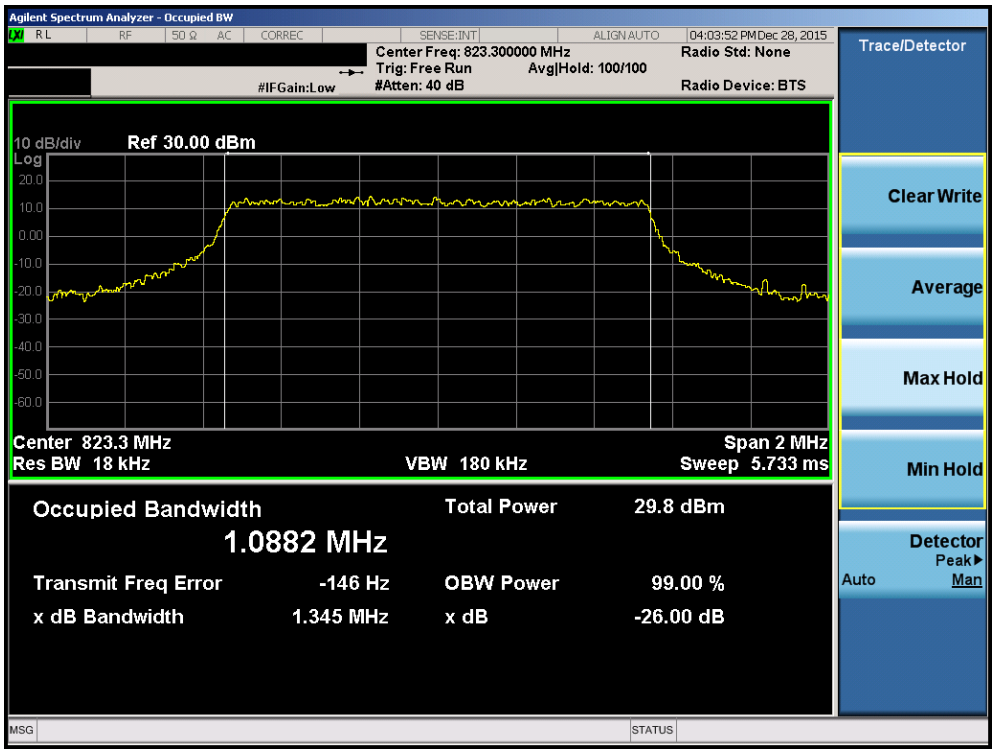


Plot 7-2. Occupied Bandwidth Plot (1.4MHz 16-QAM – RB Size 6– Low Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

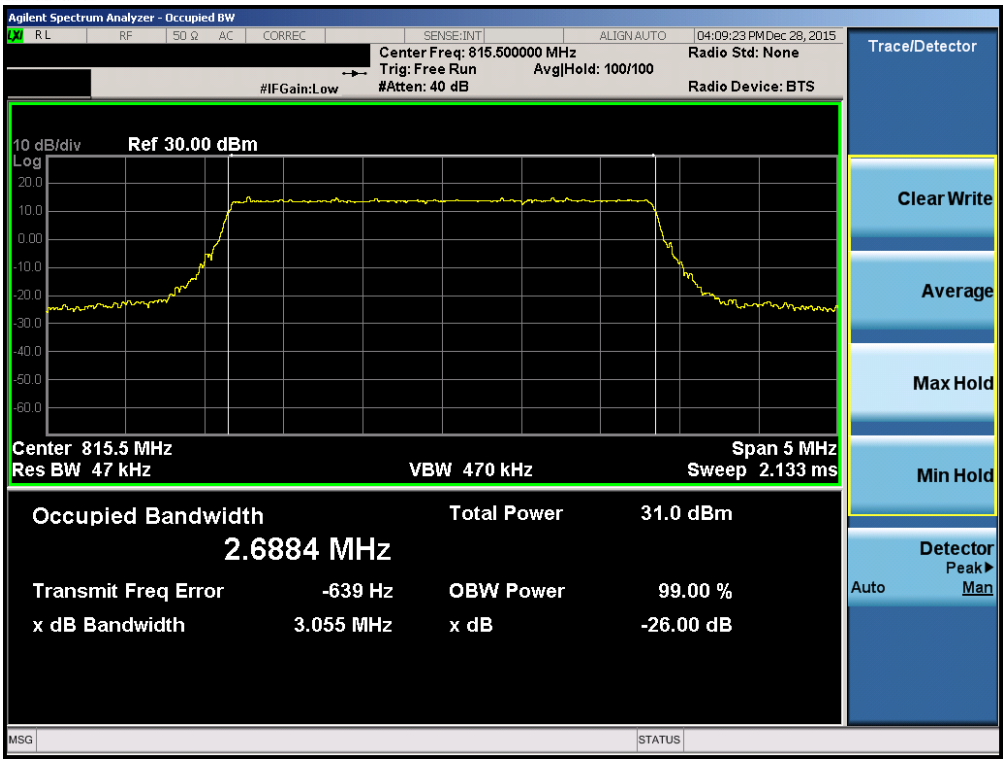


Plot 7-3. Occupied Bandwidth Plot (1.4MHz QPSK – RB Size 6– High Channel)

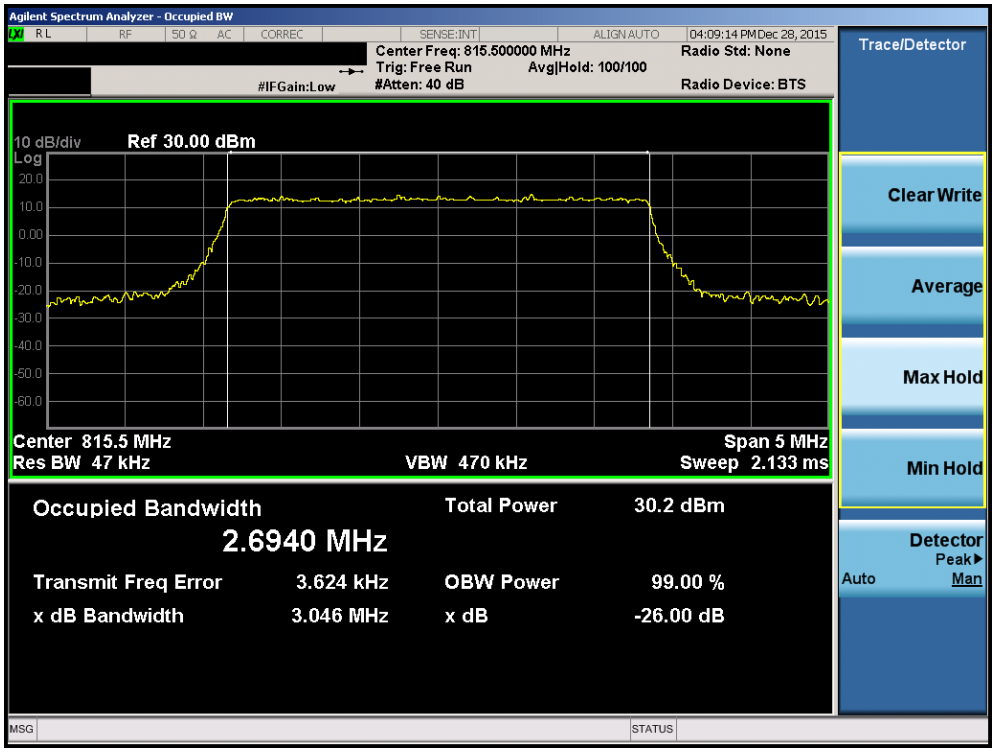


Plot 7-4. Occupied Bandwidth Plot (1.4MHz 16-QAM – RB Size 6– High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

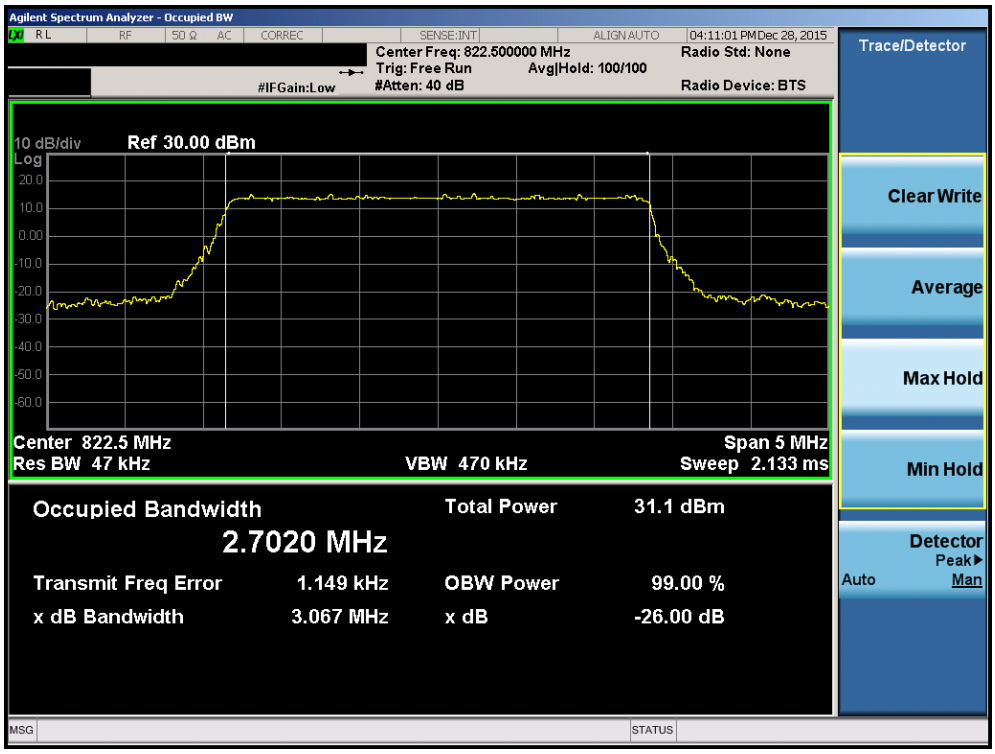


Plot 7-5. Occupied Bandwidth Plot (3MHz QPSK – RB Size 15– Low Channel)

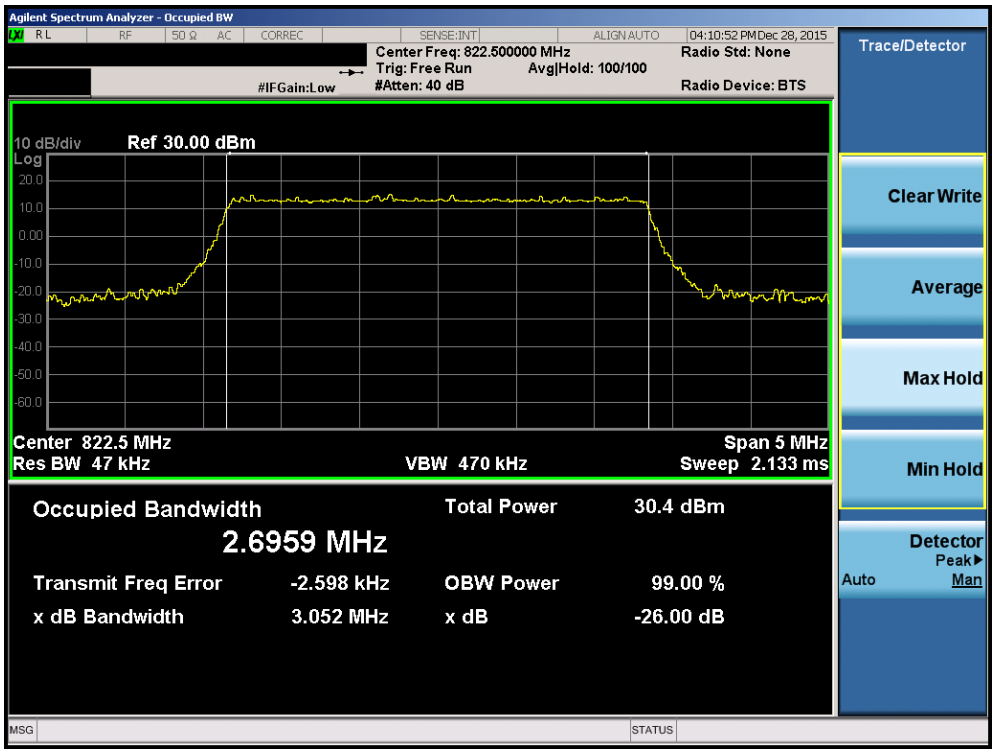


Plot 7-6. Occupied Bandwidth Plot (3MHz 16-QAM – RB Size 15– Low Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

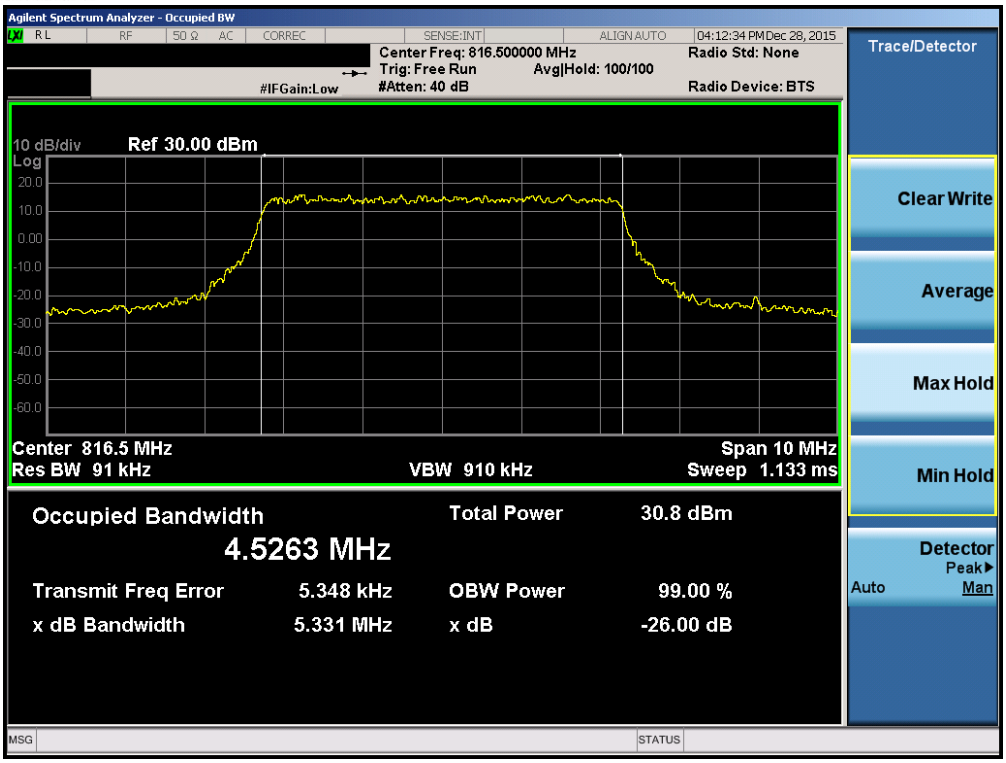


Plot 7-7. Occupied Bandwidth Plot (3MHz QPSK – RB Size 15– High Channel)



Plot 7-8. Occupied Bandwidth Plot (3MHz 16-QAM – RB Size 15– High Channel)

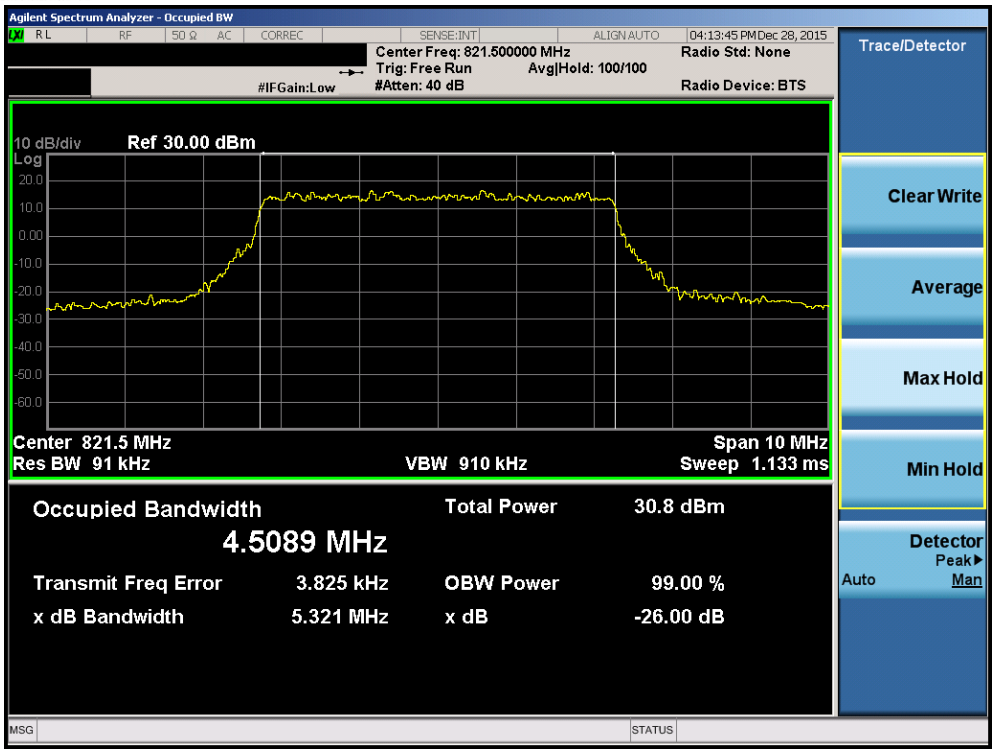
© 2016 PCTEST Engineering Laboratory, Inc.



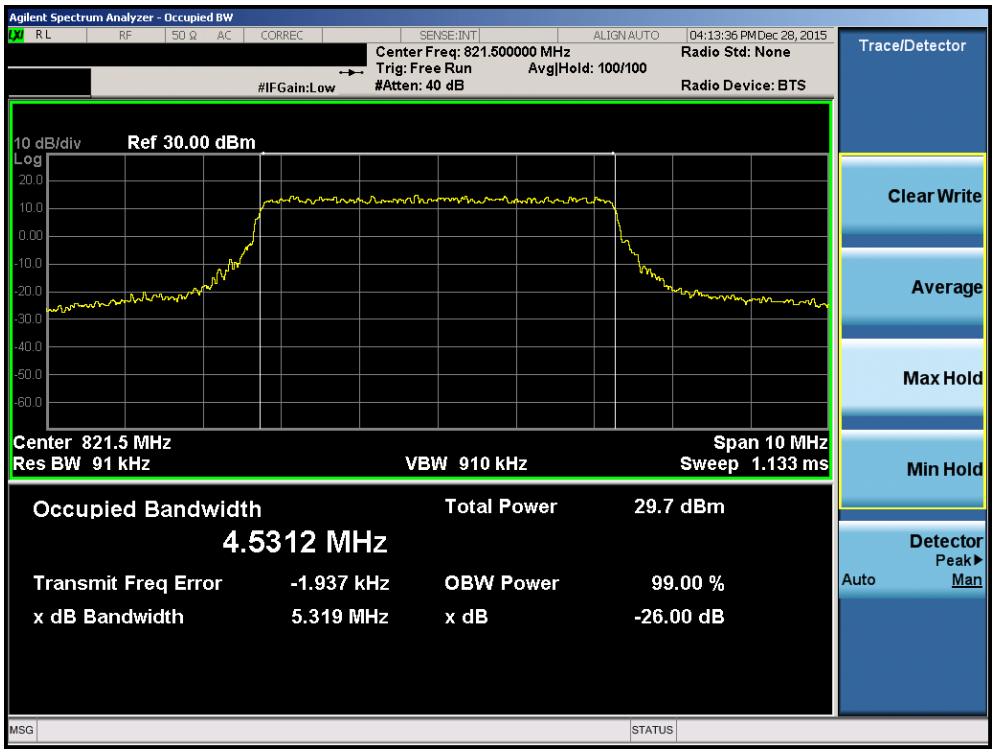
Plot 7-9. Occupied Bandwidth Plot (5MHz QPSK – RB Size 25– Low Channel)

Plot 7-10. Occupied Bandwidth Plot (5MHz 16-QAM – RB Size 25– Low Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

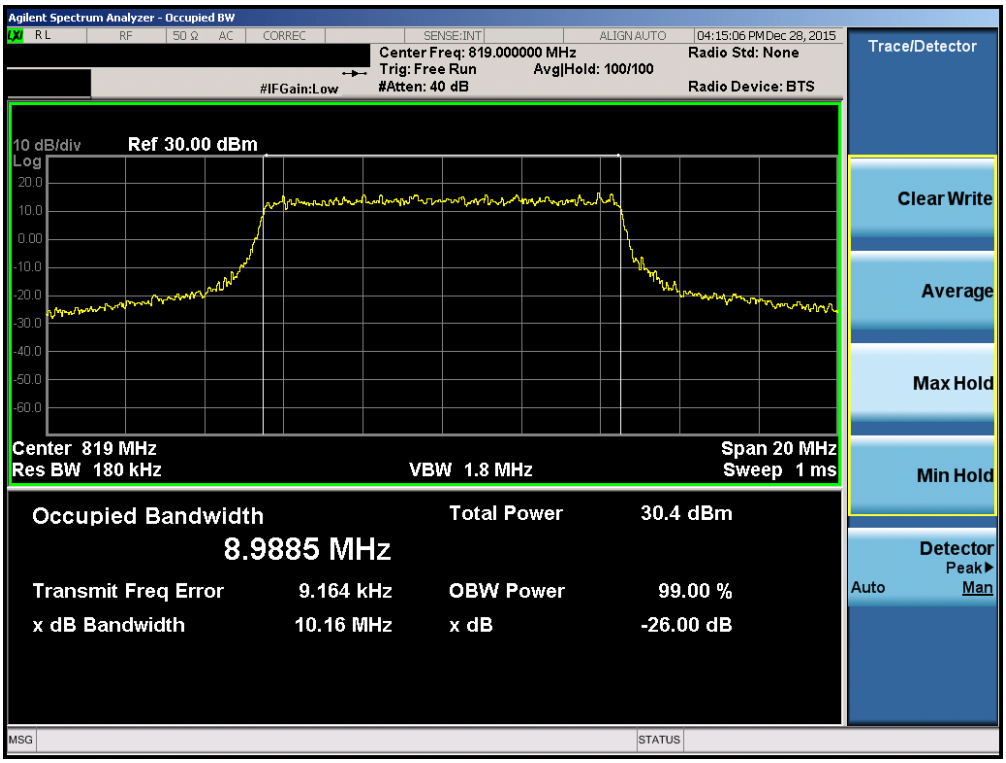


Plot 7-11. Occupied Bandwidth Plot (5MHz QPSK – RB Size 25– High Channel)



Plot 7-12. Occupied Bandwidth Plot (5MHz 16-QAM – RB Size 25– High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.



Plot 7-13. Occupied Bandwidth Plot (10MHz QPSK – RB Size 50)

Plot 7-14. Occupied Bandwidth Plot (10MHz 16-QAM – RB Size 50)

© 2016 PCTEST Engineering Laboratory, Inc.

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §90.691

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 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 10GHz (separated into at least two plots per channel)
2. RBW ≥ 1MHz
3. VBW ≥ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

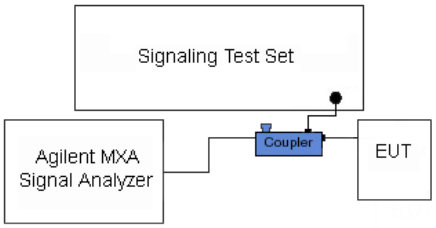
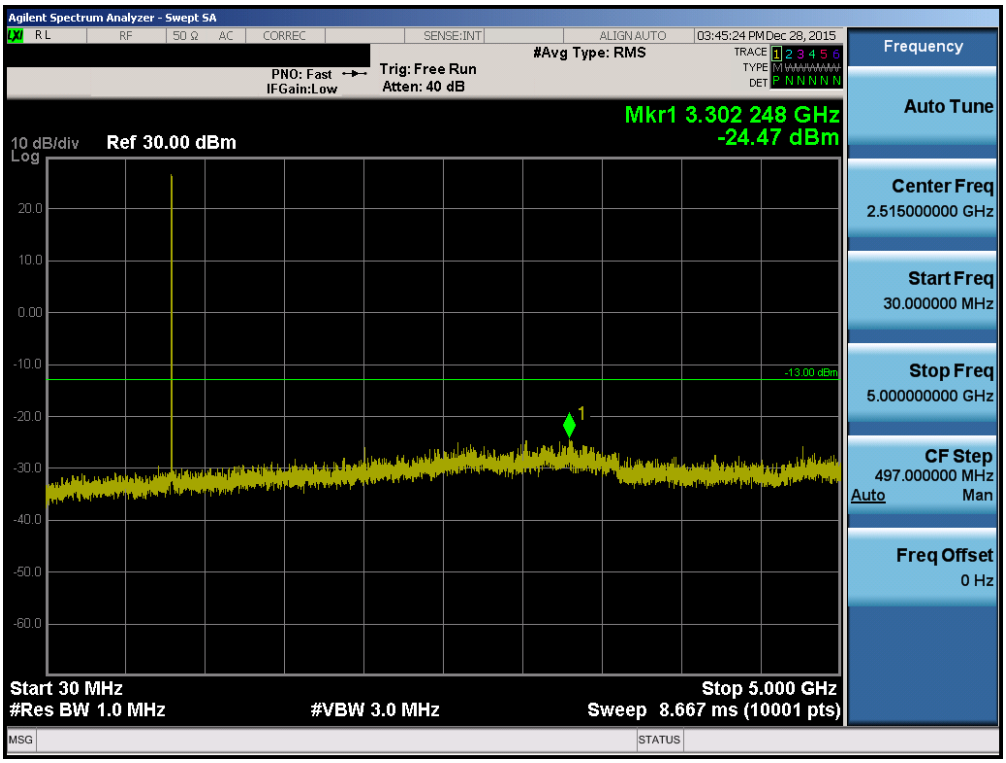


Figure 7-2. Test Instrument & Measurement Setup

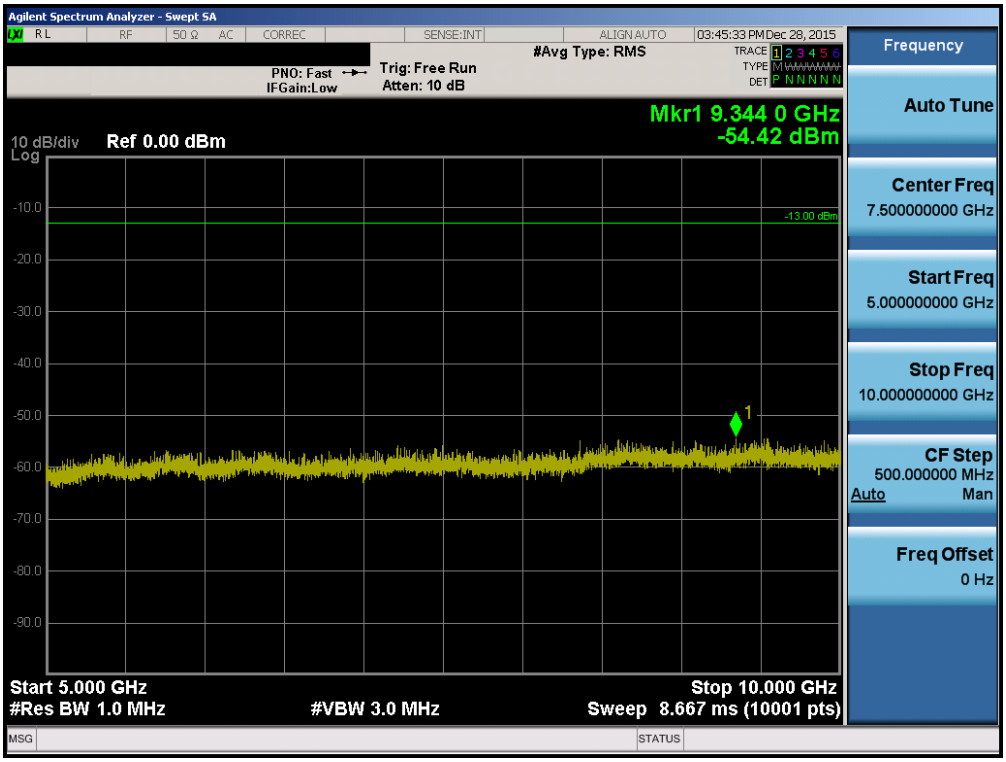
Test Notes

None.

© 2016 PCTEST Engineering Laboratory, Inc.

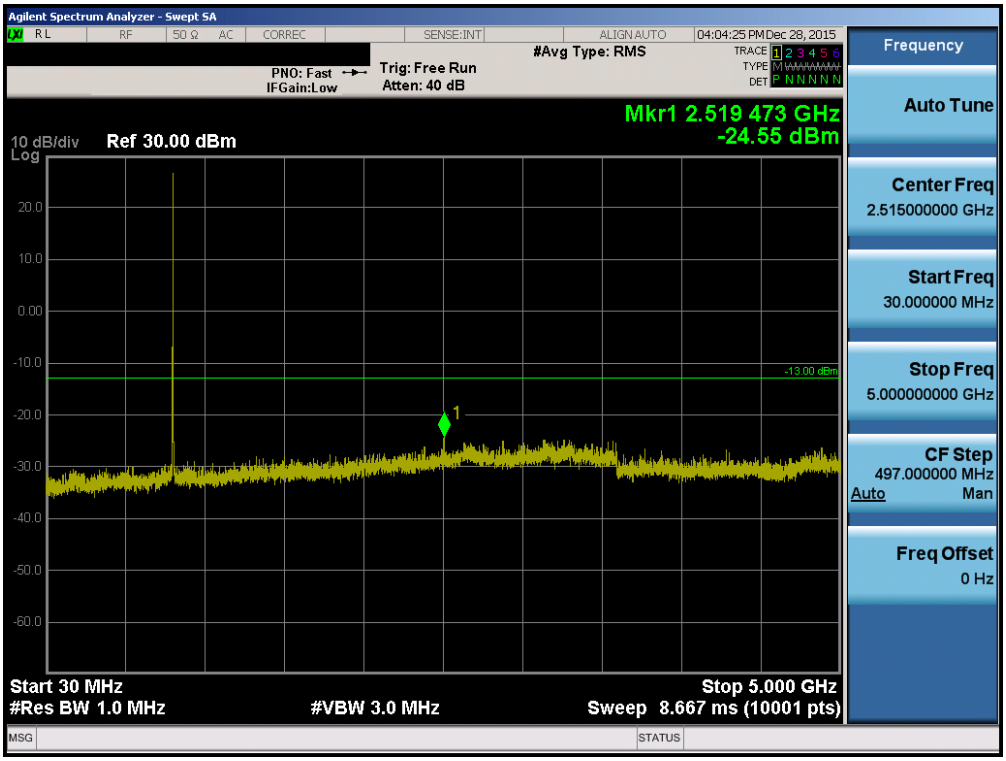


Plot 7-15. Conducted Spurious Plot (1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

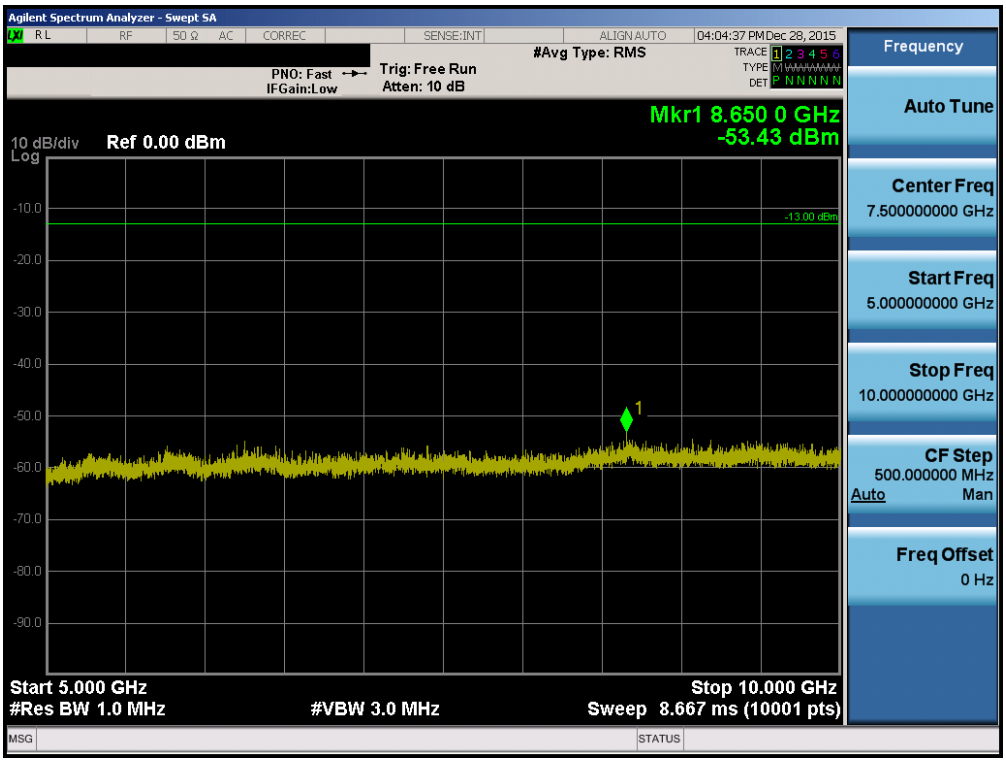


Plot 7-16. Conducted Spurious Plot (1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

© 2016 PCTEST Engineering Laboratory, Inc.



Plot 7-17. Conducted Spurious Plot (1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-18. Conducted Spurious Plot (1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90.691

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 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 removed from the EA licensee's frequency block by greater than 37.5 kHz is 43 + $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is 50 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 v02r02 – Section 6.0

Test Settings

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

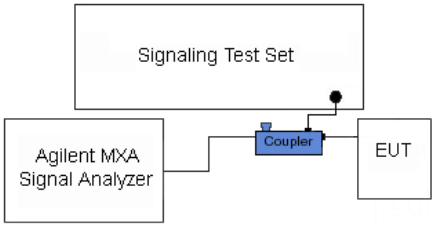
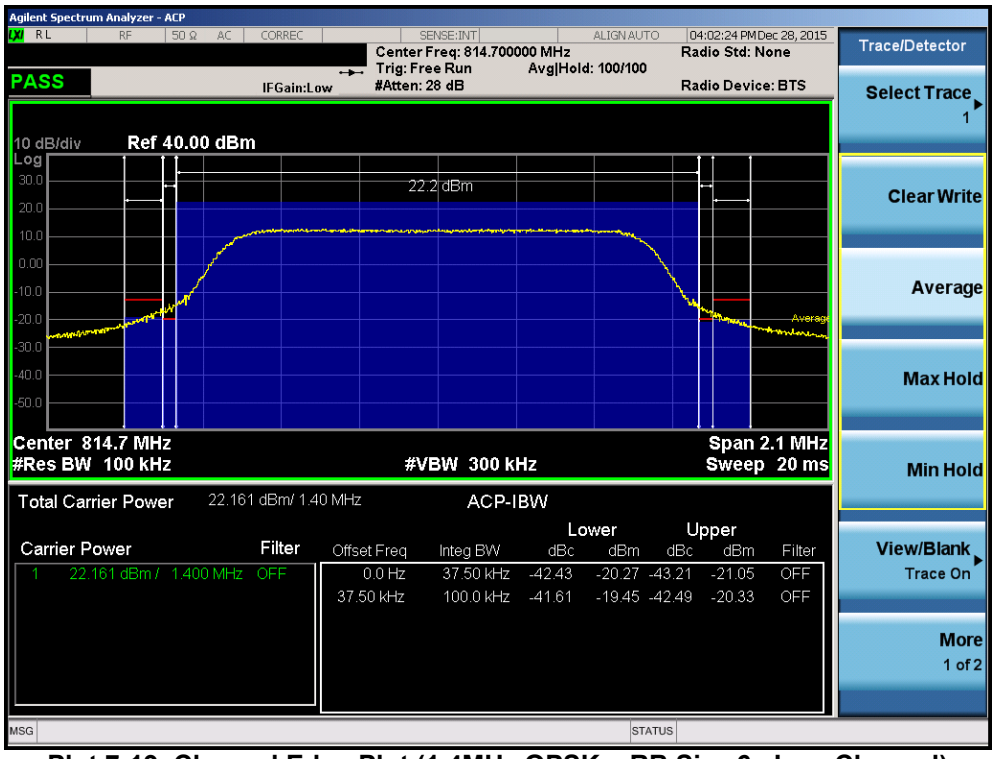


Figure 7-3. Test Instrument & Measurement Setup

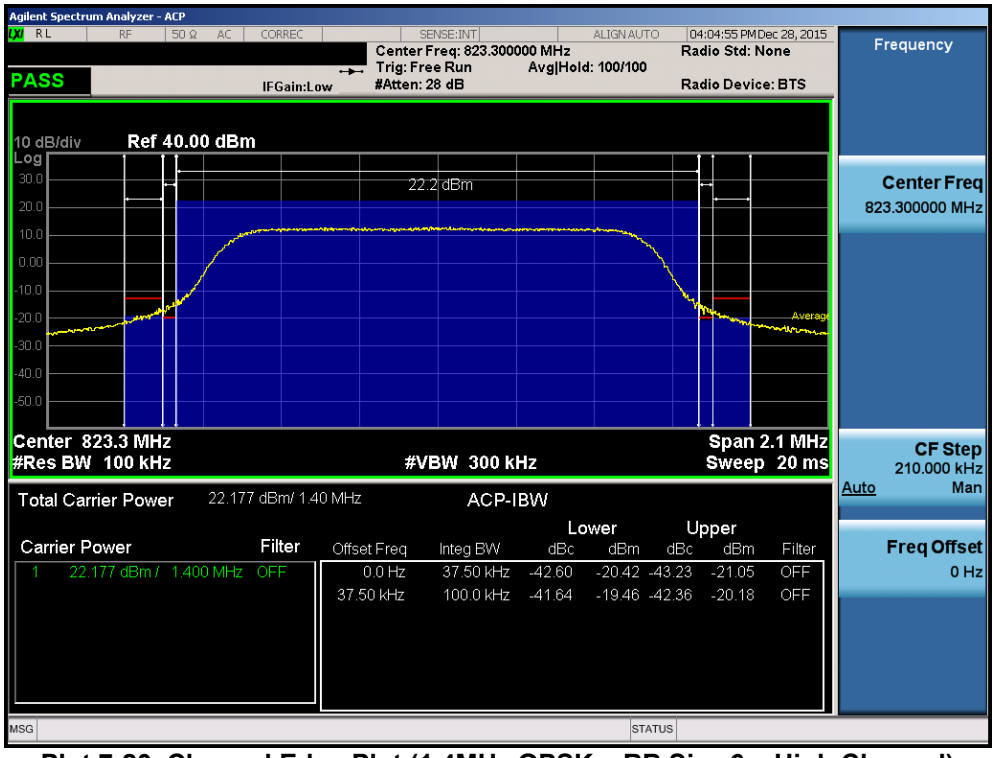
Test Notes

For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

© 2016 PCTEST Engineering Laboratory, Inc.

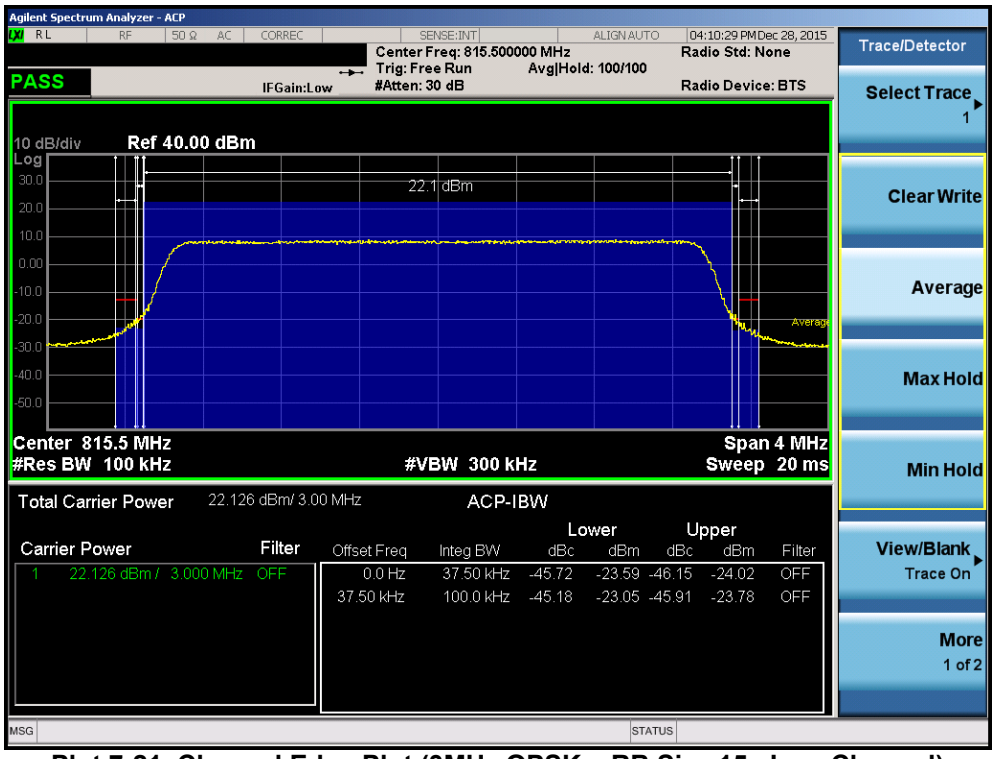


Plot 7-19. Channel Edge Plot (1.4MHz QPSK – RB Size 6– Low Channel)

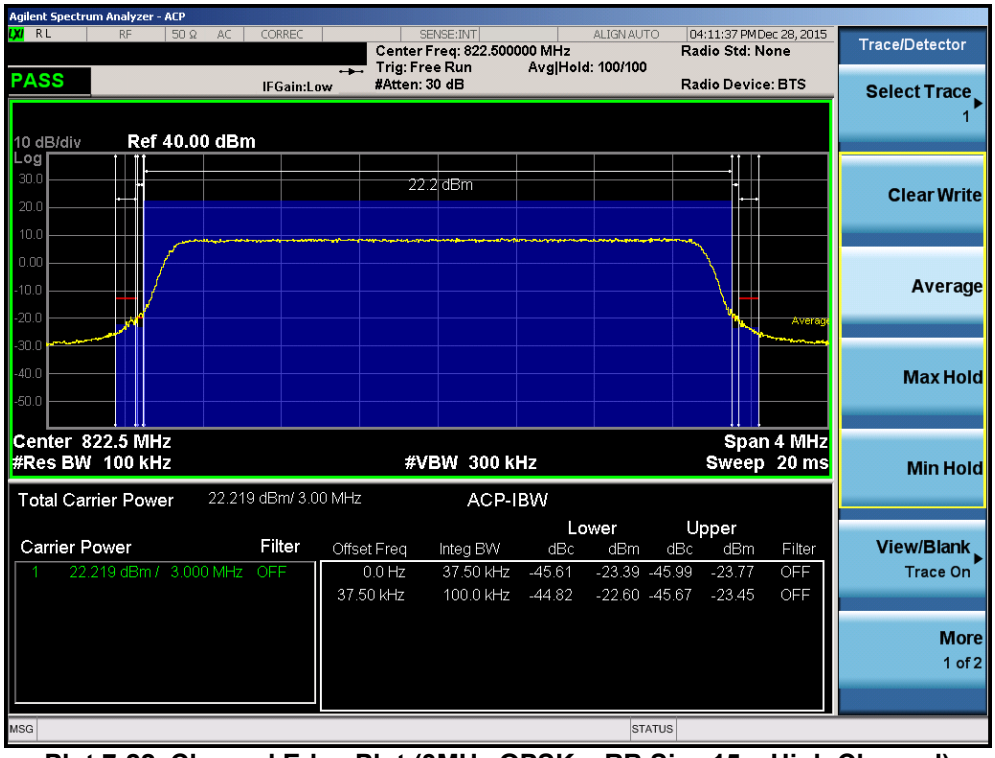


Plot 7-20. Channel Edge Plot (1.4MHz QPSK – RB Size 6 – High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

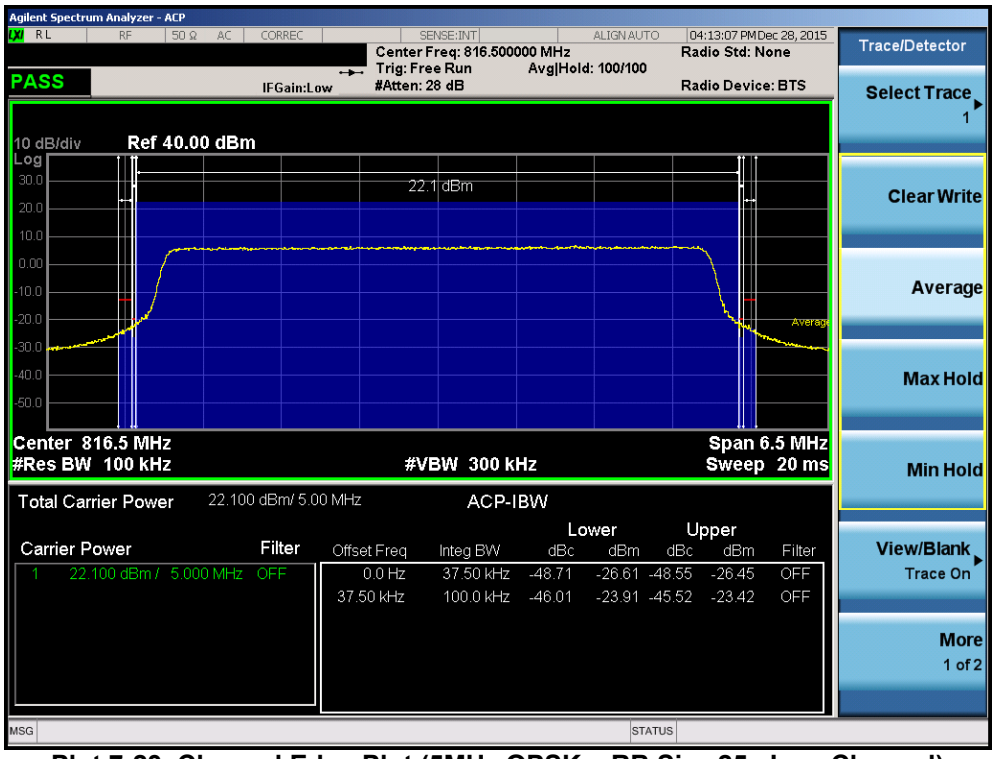


Plot 7-21. Channel Edge Plot (3MHz QPSK – RB Size 15– Low Channel)

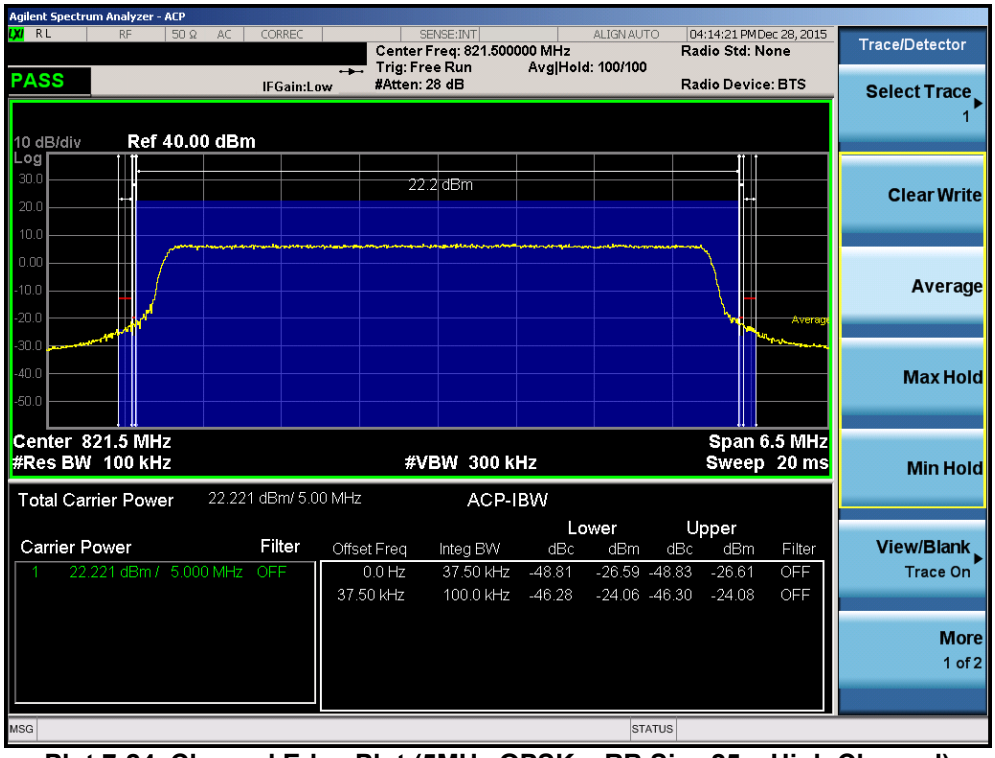


Plot 7-22. Channel Edge Plot (3MHz QPSK – RB Size 15 – High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.

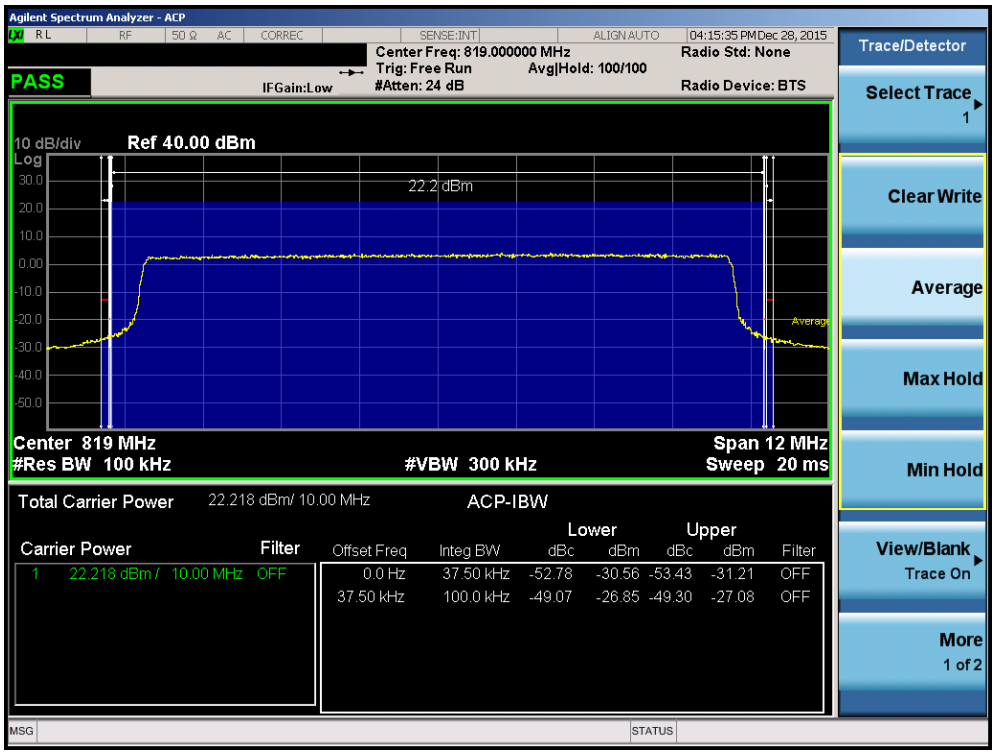


Plot 7-23. Channel Edge Plot (5MHz QPSK – RB Size 25– Low Channel)



Plot 7-24. Channel Edge Plot (5MHz QPSK – RB Size 25 – High Channel)

© 2016 PCTEST Engineering Laboratory, Inc.



Plot 7-25. Channel Edge Plot (10MHz QPSK – RB Size 50)

© 2016 PCTEST Engineering Laboratory, Inc.

7.5 Conducted Power Output Data

§90.635

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Cond. PWR [dBm]	Cond. PWR [Watts]	Cond. PWR Limit [dBm]	Margin [dB]
814.70	1.4	QPSK	23.2	0.209	50.00	-26.80
823.30	1.4	QPSK	23.15	0.207	50.00	-26.85
814.70	1.4	16-QAM	21.32	0.136	50.00	-28.68
823.30	1.4	16-QAM	20.33	0.108	50.00	-29.67
815.50	3	QPSK	23.07	0.203	50.00	-26.93
822.50	3	QPSK	23.17	0.207	50.00	-26.83
815.50	3	16-QAM	21.94	0.156	50.00	-28.06
822.50	3	16-QAM	21.86	0.153	50.00	-28.14
816.50	5	QPSK	23.04	0.201	50.00	-26.96
821.50	5	QPSK	22.92	0.196	50.00	-27.08
816.50	5	16-QAM	21.79	0.151	50.00	-28.21
821.50	5	16-QAM	21.50	0.141	50.00	-28.50
819.00	10	QPSK	23.18	0.208	50.00	-26.82
819.00	10	16-QAM	22.08	0.161	50.00	-27.92

Table 7-2. LTE Band 26 Conducted Power Output Data

NOTES:

1. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

2. This unit was tested with its standard battery.

© 2016 PCTEST Engineering Laboratory, Inc.

7.6 Radiated Spurious Emissions Measurements

§2.1053, §90.691

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 horizontally and vertically 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 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

© 2016 PCTEST Engineering Laboratory, Inc.

Test Setup

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

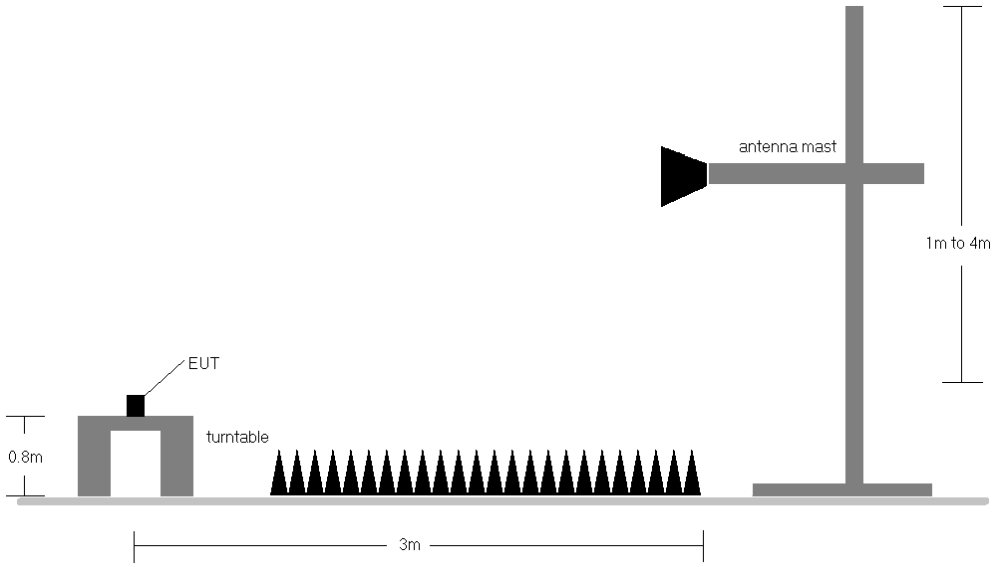


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. For LTE mode, the device was tested under all modulations, RB sizes and offsets, and channel bandwidth configurations and the worst case emissions are reported with 1 RB.

2. This unit was tested with its standard battery.

3. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.

4. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

© 2016 PCTEST Engineering Laboratory, Inc.

OPERATING FREQUENCY:	814.70	MHz		
CHANNEL:	26697			
MEASURED OUTPUT POWER:	23.20	dBm	=	0.209 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	1.4	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	-13.00	dBm	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1629.40	H	-	-	-59.68	3.69	-56.00	-43.0
2444.10	H	-	-	-55.79	3.60	-52.19	-39.2

Table 7-3. Radiated Spurious Data (Ch. 26697)

OPERATING FREQUENCY:	823.30	MHz		
CHANNEL:	26783			
MEASURED OUTPUT POWER:	23.15	dBm	=	0.207 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	1.4	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	-13.00	dBm	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1646.60	H	1.00	177	-58.79	3.62	-55.17	-42.2
2469.90	H	-	-	-57.30	3.58	-53.72	-40.7

Table 7-4. Radiated Spurious Data (Ch. 26783)

© 2016 PCTEST Engineering Laboratory, Inc.

OPERATING FREQUENCY:	823.30	MHz		
CHANNEL:	26783			
MEASURED OUTPUT POWER:	23.15	dBm	=	0.207 W
MODULATION SIGNAL:	QPSK			
BANDWIDTH:	1.4	MHz		
DISTANCE:	3	meters		
LIMIT:	43 + 10 $\log_{10}$ (W) =	-13.00	dBm	

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1646.60	H	-	-	-61.23	3.62	-57.61	-44.6
2469.90	H	-	-	-58.37	3.58	-54.79	-41.8

Table 7-5. Radiated Spurious Data with WCP (Ch. 26783)

© 2016 PCTEST Engineering Laboratory, Inc.

7.7 Frequency Stability / Temperature Variation

§2.1055 §90.213

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.

The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

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

© 2016 PCTEST Engineering Laboratory, Inc.

Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY:	814,700,000	Hz
CHANNEL:	26697	
REFERENCE VOLTAGE:	3.85	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	817,900,000	246	0.0000302
100 %		- 30	817,900,000	111	0.0000136
100 %		- 20	817,900,000	-264	-0.0000324
100 %		- 10	817,900,000	-51	-0.0000063
100 %		0	817,900,000	-108	-0.0000133
100 %		+ 10	817,900,000	-57	-0.0000070
100 %		+ 20	817,900,000	111	0.0000136
100 %		+ 30	817,900,000	-57	-0.0000070
100 %		+ 40	817,900,000	-294	-0.0000361
100 %		+ 50	817,900,000	39	0.0000048
BATT. ENDPOINT	3.45	+ 20	817,900,000	116	0.0000142

Table 7-6. LTE Band 26 Frequency Stability Data (Ch. 26697)

© 2016 PCTEST Engineering Laboratory, Inc.

Frequency Stability / Temperature Variation

§2.1055, §90.213

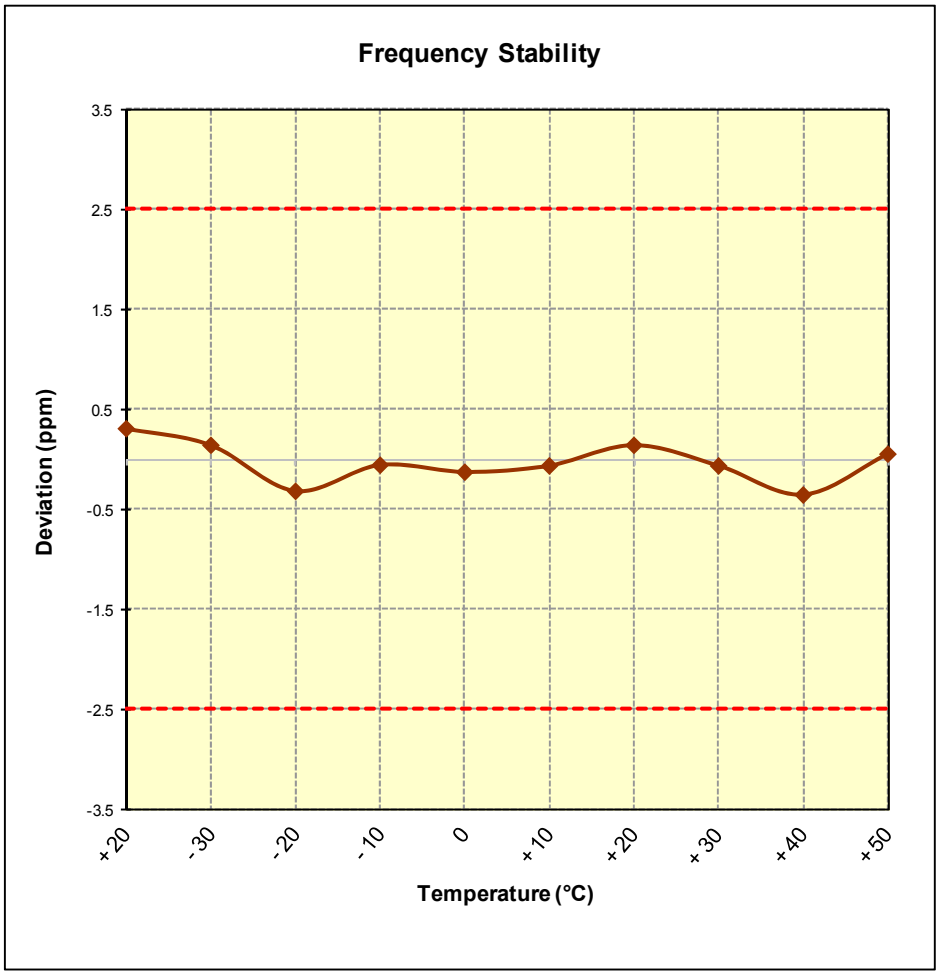


Table 7-7. LTE Band 26 Frequency Stability Data (Ch. 26697)

© 2016 PCTEST Engineering Laboratory, Inc.

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMG930F** complies with all the requirements of Part 90 of the FCC rules.

© 2016 PCTEST Engineering Laboratory, Inc.