PCTEST ENGINEERING LABORATORY, INC.
18855 Adams Court, Morgan Hill, CA 95037 USA
Tel. 410.290.6652 / Fax 410.290.6654
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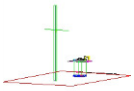

MEASUREMENT REPORT
FCC Part 22 & 27 LTE

Applicant Name:
Apple Inc.
1 Infinite Loop
Cupertino, CA 95014
United States

Date of Testing:
6/9-8/4/2017
Test Site/Location:
PCTEST Lab., Morgan Hill, CA, USA
Test Report Serial No.:
1C1706160002-89-03-R5.BCG

FCC ID :	**BCG-A1889**
APPLICANT:	**APPLE INC.**

Application Type:	Certification
Model:	A1889, A1969
EUT Type:	Watch
FCC Classification:	Licensed Non-Broadcast Transmitter Worn on Body (TNT)
FCC Rule Part(s):	§2; §22; §27
Test Procedure(s):	ANSI/TIA-603-E-2016, KDB 971168 D01 v02r02, KDB 648474 D03 v01r04, KDB 414788 D01 Radiated Test Site v01
Test Device Serial No.:	identical prototype [S/N: FH7TQ008J77T]

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: 1C1706160002-89-03-R5.BCG) supersedes and replaces the previously issued test report (S/N: 1C1706160002-89-03-R4.BCG) 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

ACCREDITED
TESTING CERT#2041.02

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V 6.6
06/06/2017

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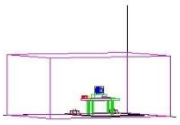
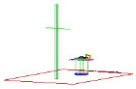


MEASUREMENT REPORT
FCC Part 22 & 27



§2.1033 General Information

APPLICANT:	Apple Inc.
APPLICANT ADDRESS:	1 Infinite Loop
	Cupertino, CA 95014, United States
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	18855 Adams Court, Morgan Hill, CA 95037 USA
FCC RULE PART(S):	§2; §22; §27
BASE MODEL:	A1889, A1969
FCC ID:	BCG-A1889
FCC CLASSIFICATION:	Licensed Non-Broadcast Transmitter Worn on Body (TNT)
FREQUENCY TOLERANCE:	±0.00025 % (2.5 ppm)
Test Device Serial No.:	FH7TQ008J77T ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	6/9-8/4/2017
TEST REPORT S/N:	1C1706160002-89-03-R5.BCG

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Morgan Hill, CA 95037, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

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

- PCTEST facility is a registered (22831) test laboratory with the site description on file with ISED.

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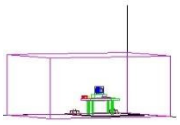
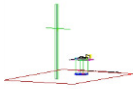


MEASUREMENT REPORT
FCC Part 22 & 27



Mode	FCC Rule Part	Tx Frequency (MHz)	ERP/EIRP		Emission Designator	Modulation
			Max. Power (W)	Max. Power (dBm)		
LTE Band 5	22H	824.7 - 848.3	0.00075	-1.25	1M08G7D	QPSK
LTE Band 5	22H	824.7 - 848.3	0.00061	-2.12	1M07W7D	16QAM
LTE Band 5	22H	825.5 - 847.5	0.00076	-1.17	2M71G7D	QPSK
LTE Band 5	22H	825.5 - 847.5	0.00061	-2.12	2M71W7D	16QAM
LTE Band 5	22H	826.5 - 846.5	0.00074	-1.31	4M52G7D	QPSK
LTE Band 5	22H	826.5 - 846.5	0.00061	-2.12	4M50W7D	16QAM
LTE Band 5	22H	829 - 844	0.00071	-1.49	9M03G7D	QPSK
LTE Band 5	22H	829 - 844	0.00060	-2.20	9M02W7D	16QAM
LTE Band 26	22H	824.7 - 848.3	0.00077	-1.12	1M08G7D	QPSK
LTE Band 26	22H	824.7 - 848.3	0.00061	-2.12	1M07W7D	16QAM
LTE Band 26	22H	825.5 - 847.5	0.00077	-1.12	2M71G7D	QPSK
LTE Band 26	22H	825.5 - 847.5	0.00061	-2.12	2M71W7D	16QAM
LTE Band 26	22H	826.5 - 846.5	0.00077	-1.13	4M52G7D	QPSK
LTE Band 26	22H	826.5 - 846.5	0.00061	-2.12	4M50W7D	16QAM
LTE Band 26	22H	829 - 844	0.00077	-1.12	9M03G7D	QPSK
LTE Band 26	22H	829 - 844	0.00061	-2.12	9M02W7D	16QAM
LTE Band 7	27	2502.5 - 2567.5	0.01462	11.65	4M52G7D	QPSK
LTE Band 7	27	2502.5 - 2567.5	0.01288	11.10	4M53W7D	16QAM
LTE Band 7	27	2505 - 2565	0.01507	11.78	9M02G7D	QPSK
LTE Band 7	27	2505 - 2565	0.01396	11.45	9M04W7D	16QAM
LTE Band 7	27	2507.5 - 2562.5	0.01483	11.71	13M5G7D	QPSK
LTE Band 7	27	2507.5 - 2562.5	0.01274	11.05	13M6W7D	16QAM
LTE Band 7	27	2510 - 2560	0.01503	11.77	18M0G7D	QPSK
LTE Band 7	27	2510 - 2560	0.01253	10.98	18M1W7D	16QAM

EUT Overview

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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 Innovation, Science, and Economic Development Canada.

1.2 Testing Facility

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 18855 Adams Court, Morgan Hill, CA 95037.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Watch FCC ID: BCG-A1889**. The test data contained in this report pertains only to the emissions due to the EUT's LTE function. According to the manufacturer, models A1889 and A1969 are electrically identical. Model A1889 was used for final testing.

2.2 Device Capabilities

This device contains the following capabilities:

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

LTE Band 26 (814 – 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.

2.3 Antenna Configuration

Following antenna gains were used for the testing.

Frequency (MHz)	Antenna Gain (dBi)
824-849	-22.97
2500-2570	-12.02

Table 2-1. Peak Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook	Model:	A1502	S/N:	C02NQ01YG465
	w/ AC/DC Adapter	Model:	A1435	S/N:	C04325505K1F288BG
2	Apple USB Cable	Model:	Kanzi	S/N:	20153D
	w/ Charging Dock	Model:	FAPS61	S/N:	6304000736
	w/ Dock	Model:	X241	S/N:	SJH3002AP2AS
3	USB Cable	Model:	N/A	S/N:	N/A
			Shielded USB Cable		
4	w/ AC Adapter	Model:	B353	S/N:	N/A
5	Test Pathfinder Board	Model:	X988	S/N:	FGH7648700BDHMV323
6	Wireless Charging Pad (WCP)	Model:	A1598	FCC ID:	BCGA1598

Table 2-2. Test Equipment

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2.5 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 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.

The worst case configuration was investigated for all combinations of the three materials, aluminum, ceramic, and stainless steel, and various types of wristbands, metal and non-metal wrist bands. The store display sample was investigated with the three types of EUTs. The EUT was also investigated with and without wireless charger.

The worst case configuration found was used for all testing. The worst case material was aluminum. The worst case accessory was metal wristband but no significant difference was found between various types of wrist bands.

The emissions below 1GHz and above 18GHz were tested with the highest transmitting power channel and the worst case configuration.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report.

2.6 Software and Firmware

The test was conducted with firmware version 15R328 installed on the EUT.

For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "LTE Automation," Version 4.8.

2.7 EMI Suppression Device(s)/Modifications

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

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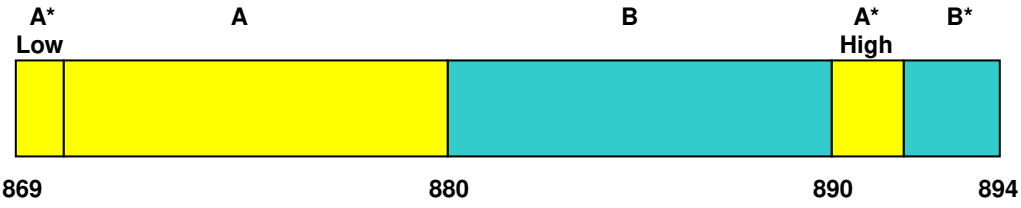
3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems" (KDB 971168 D01 v02r02) were used in the measurement of the EUT.

3.2 Cellular - Base Frequency Blocks

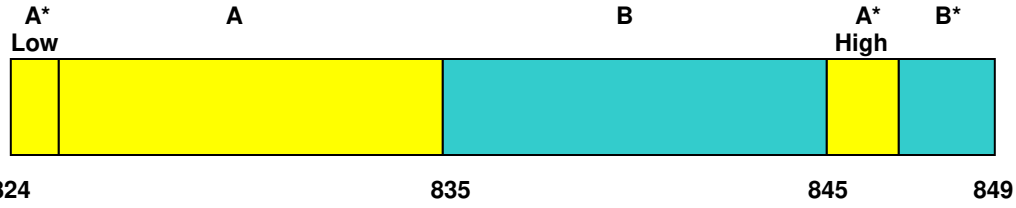
§22.905



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*)

3.3 Cellular - Mobile Frequency Blocks

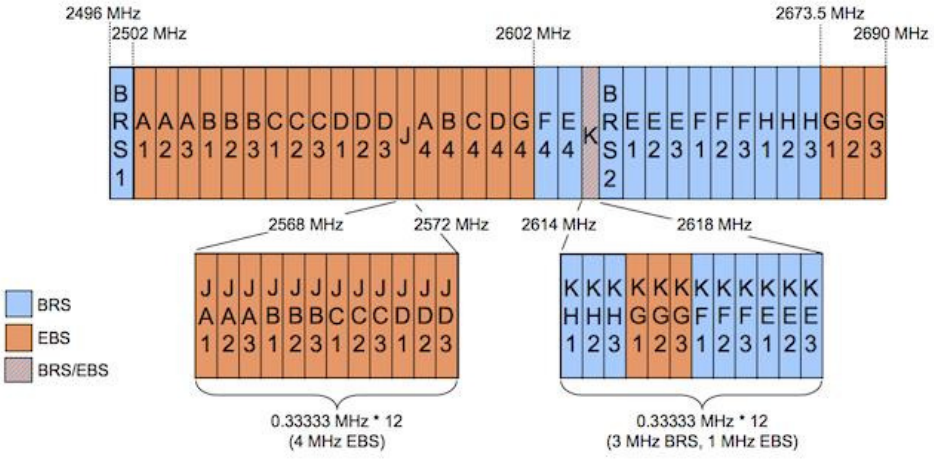
§22.905



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*)

3.4 BRS/EBS Frequency Block

§27.5



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3.5 Radiated Power and Radiated Spurious Emissions

§2.1053 §22.913(a.2) §22.917(a) §27.50(h.2) §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 Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high Styrodur Plastic Test Table is placed on top of the turntable.

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

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

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

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

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4.0 MEASUREMENT UNCERTAINTY

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

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

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2006.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	AM LTX1	Licensed Tramsmitter Cable Set	3/17/2017	Annual	3/17/2018	AM LTX1
-	EMI 3117-ESW1	Radiated Cable Set	3/1/2017	Biennial	3/1/2018	N/A
-	EMI HL562E-ESW1	Radiated Cable Set	2/28/2017	Biennial	2/28/2018	N/A
ESPEC	SU-241	Temperature Chamber	3/10/2017	Annual	3/10/2018	92009574
Keysight Technologies	N9030A	3Hz-44Ghz PXA Signal Analyzer	3/13/2017	Annual	3/13/2018	MY49430244
Pasternack	NC100	Torque Wrench	8/21/2015	Biennial	8/21/2017	81968
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	1/10/2017	Annual	1/10/2018	161675
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	5/8/2017	Annual	5/8/2018	161616-DF
Rohde & Schwarz	ESW26	ESW26 EMI Test Receiver	1/20/2017	Annual	1/20/2018	101299
Rohde & Schwarz	HL562E	Bi-Log Antenna (30MHz - 6GHz)	1/19/2017	Annual	1/19/2018	100610
Rohde & Schwarz	OSP130	Open Switch and control unit	1/18/2017	Annual	1/18/2018	100970
Rohde & Schwarz	SFUNIT-RX	TS-SFUNIT SHIELDED FILTER UNIT	2/3/2017	Annual	2/3/2018	102131
Rohde & Schwarz	TS-PR8	Pre-amplifer (30MHz - 8GHz)	2/3/2017	Annual	2/3/2018	102325
Rohde & Schwarz	TC-TA18	CROSS POL. VIVALDI ANT (400MHz - 18GHz)	11/8/2016	Annual	11/8/2017	101056-AE

Table 5-1. Test Equipment

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

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: Apple Inc.
FCC ID: BCG-A1889
FCC Classification: Licensed Non-Broadcast Transmitter Worn on Body (TNT)
Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051, 22.917(a)	Out of Band Emissions (Band 5/26)	> Maximum out of band emissions must meet the limits detailed in 2.1051and 22.917(a)		PASS	Section 7.3
27.53(m)	Out of Band Emissions (Band 7)	>Maximum out of band emissions must meet the limits detailed in 27.53(m)		PASS	Section 7.3
2.1046	Transmitter Conducted Output Power	N/A		PASS	See RF Exposure Report
22.913(a.2)	Effective Radiated Power (Band 5/26)	< 7 Watts max. ERP		PASS	Section 7.5
27.50(h.2)	Equivalent Isotropic Radiated Power (Band 7)	< 2 Watts max. EIRP		PASS	Section 7.5
2.1055, 22.355, 27.54	Frequency Stability	< 2.5 ppm (Part 22) and fundamental emissions stay within authorized frequency block (Part 27)	RADIATED	PASS	Section 7.8
2.1053, 22.917(a)	Undesirable Emissions (Band 5/26)	> 43 + 10log$_{10}$ (P[Watts]) for all out-of-band emissions		PASS	Section 7.6
27.53(m)	Undesirable Emissions (Band 7)	> 43 + 10log10 (P[Watts]) at channel edges > 55 + 10log10 (P[Watts]) at 5.5MHz away and beyond channel edges		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 (Sections 7.2, 7.3) were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "LTE Automation," Version 4.8.

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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.

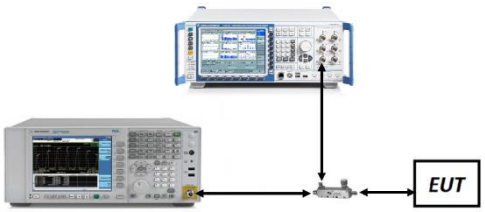

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

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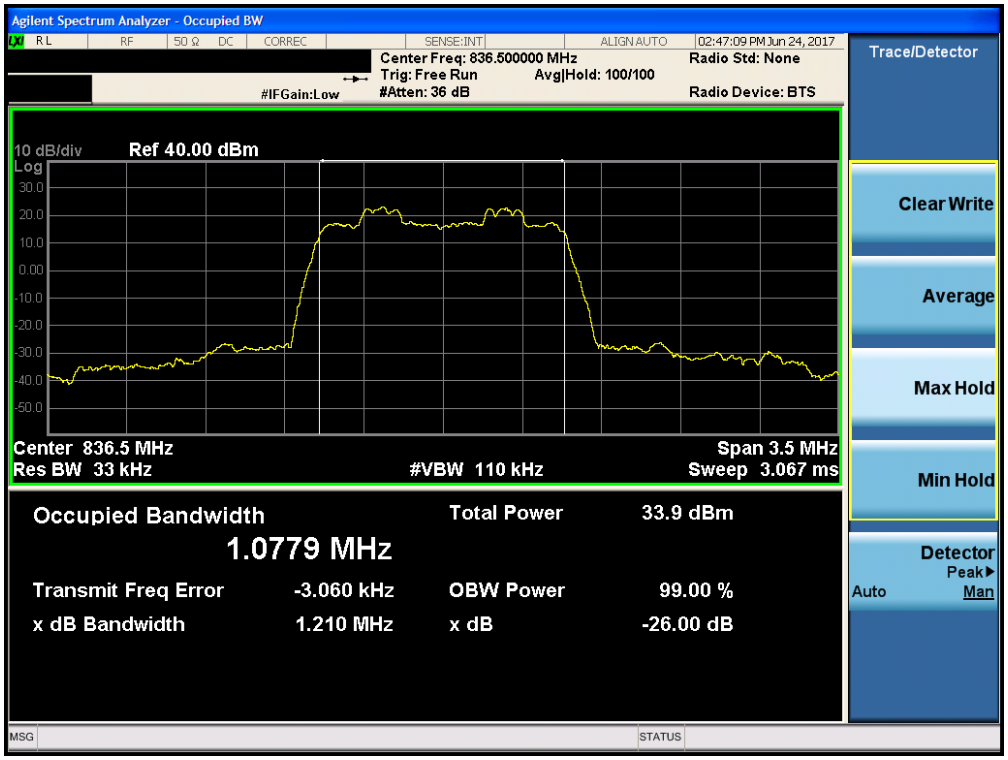
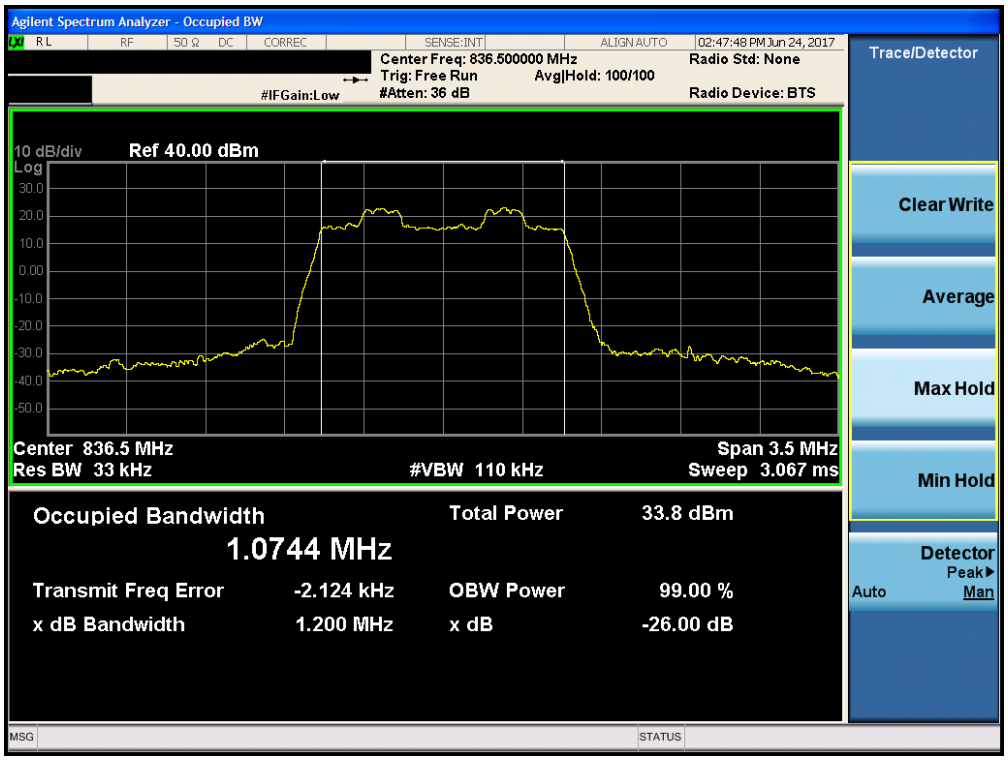


Plot 7-1. Occupied Bandwidth Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)



Plot 7-2. Occupied Bandwidth Plot (Band 5/26 – 1.4MHz 16-QAM – RB Size 6)

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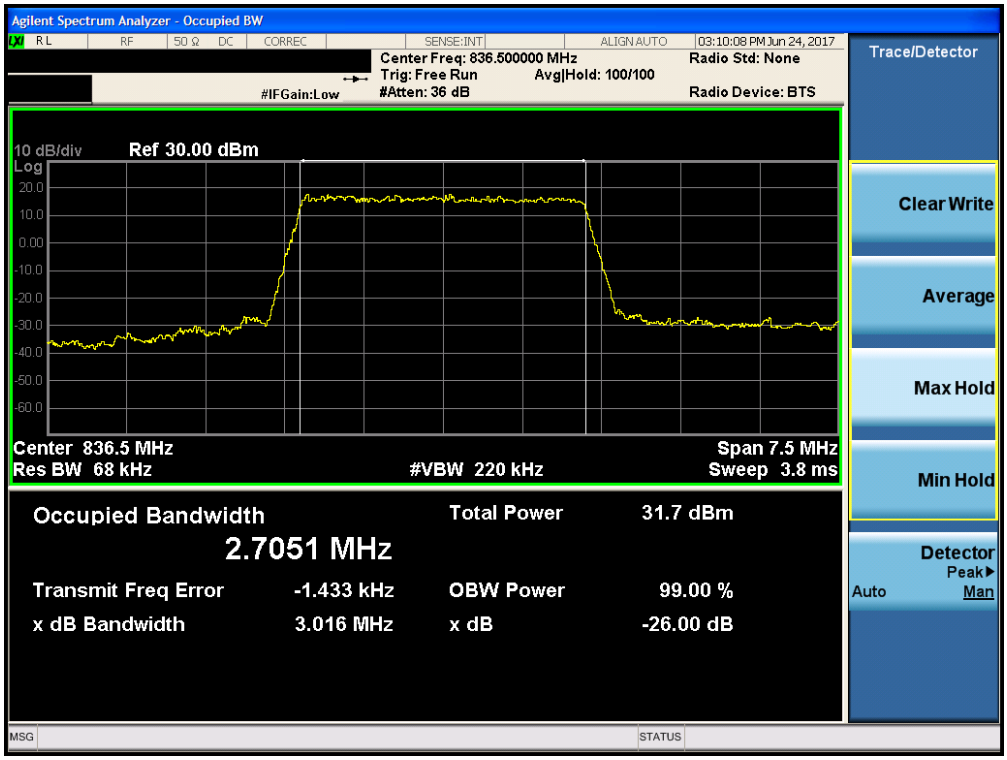
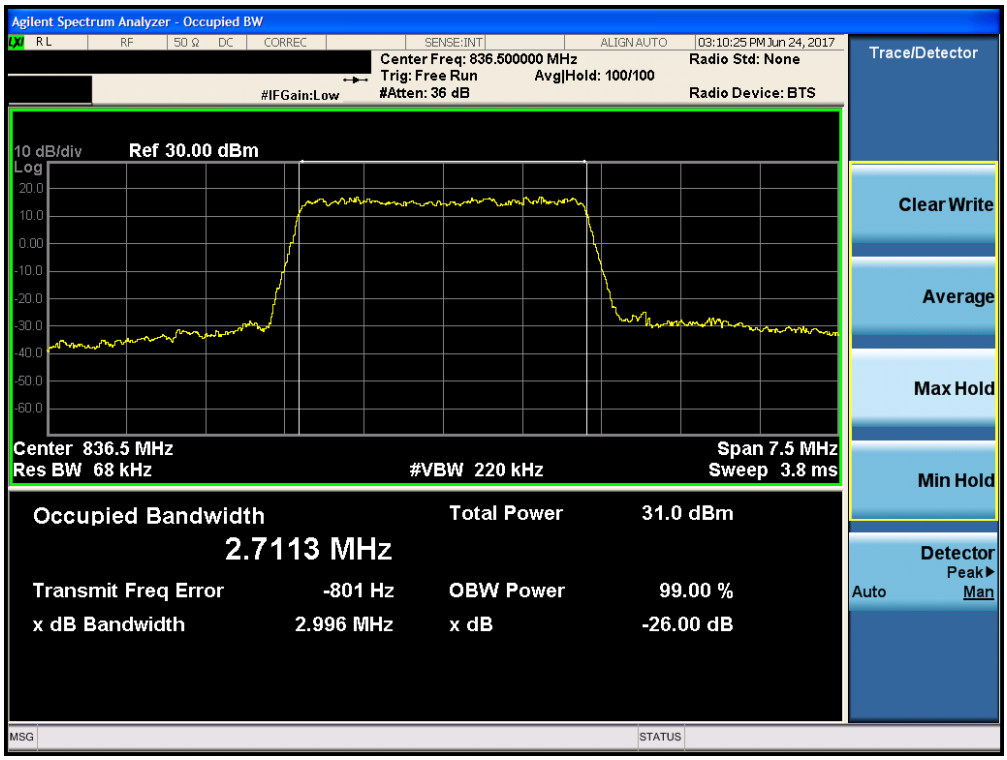


Plot 7-3. Occupied Bandwidth Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)



Plot 7-4. Occupied Bandwidth Plot (Band 5/26 – 3.0MHz 16-QAM – RB Size 15)

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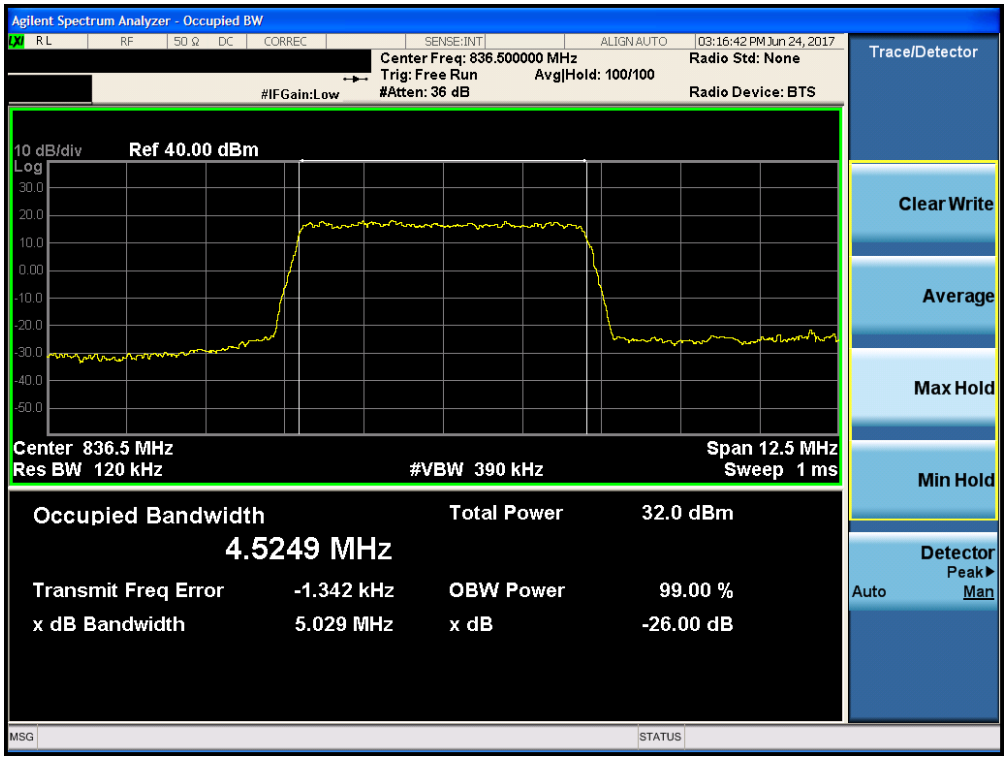
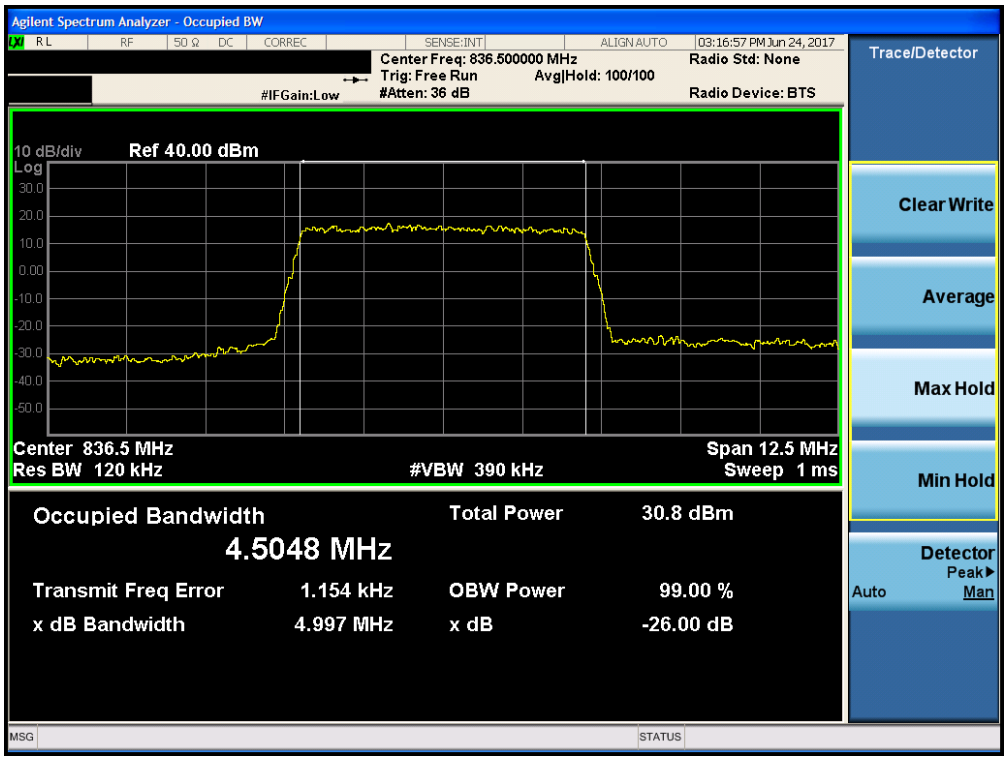


Plot 7-5. Occupied Bandwidth Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)



Plot 7-6. Occupied Bandwidth Plot (Band 5/26 – 5.0MHz 16-QAM – RB Size 25)

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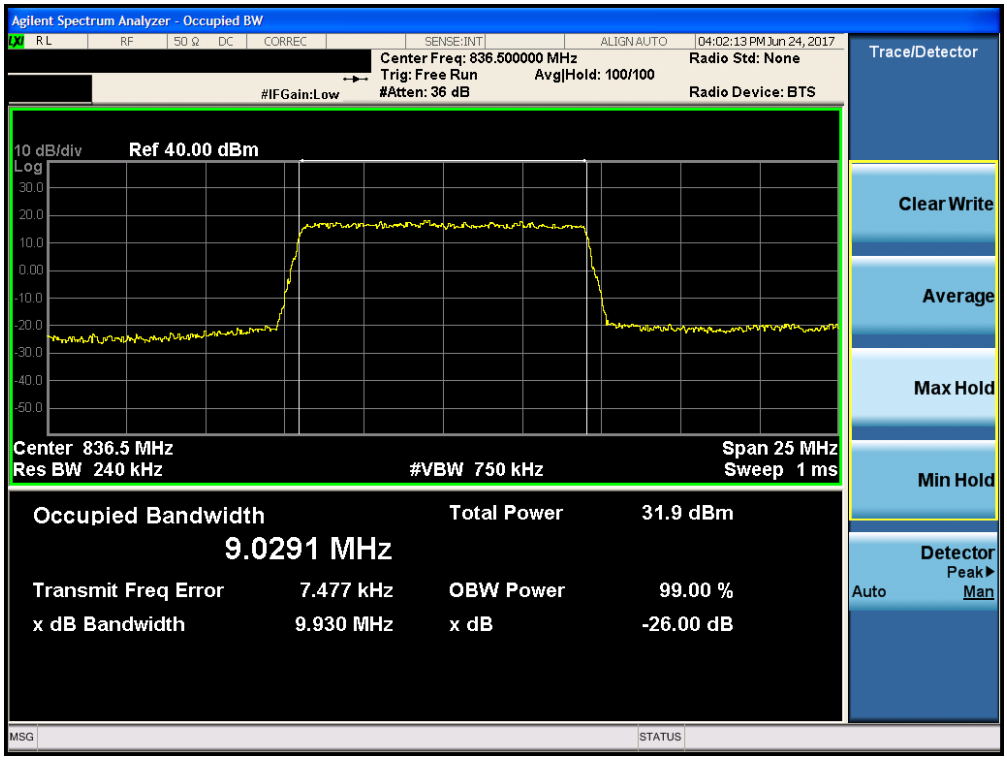
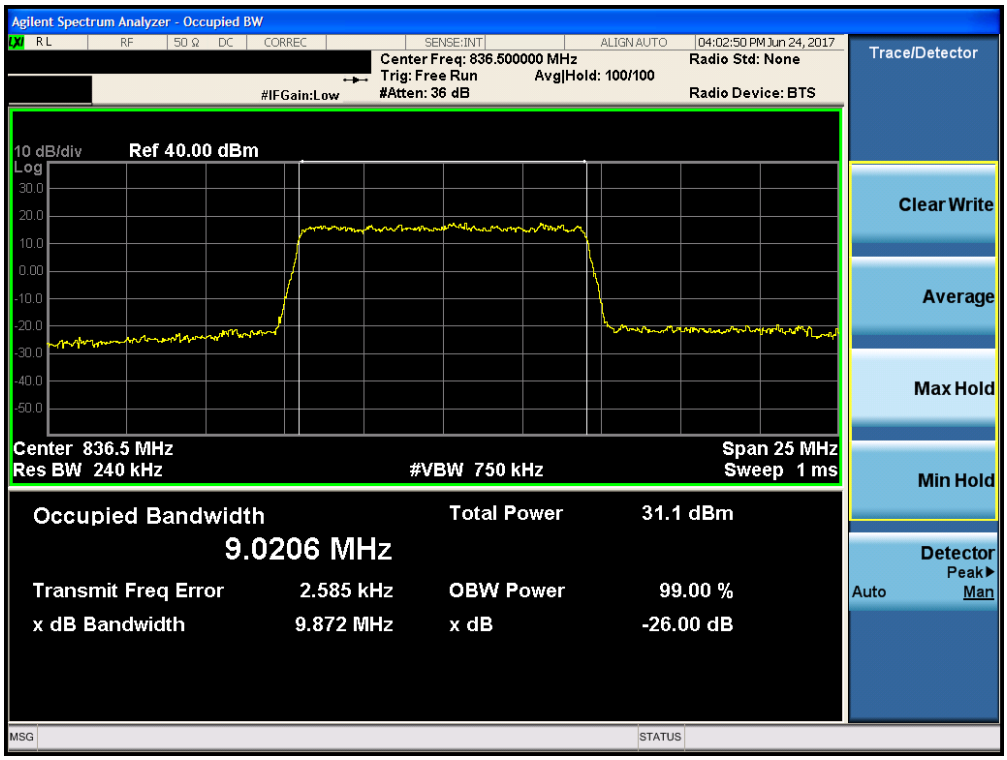


Plot 7-7. Occupied Bandwidth Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)



Plot 7-8. Occupied Bandwidth Plot (Band 5/26 – 10.0MHz 16-QAM – RB Size 50)

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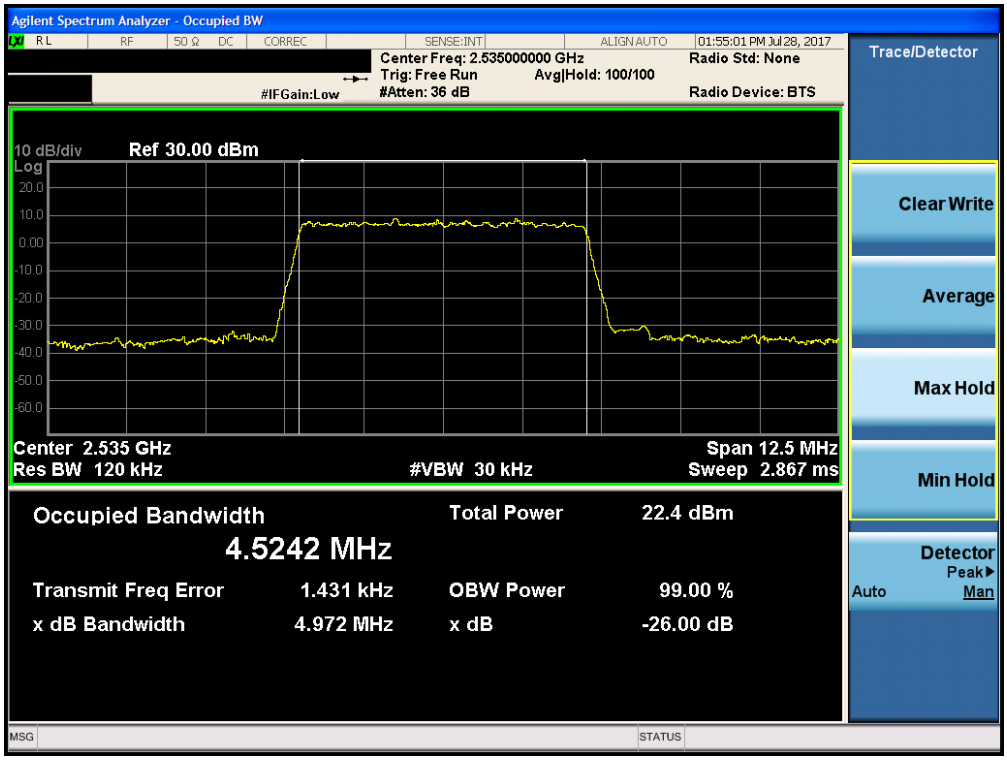
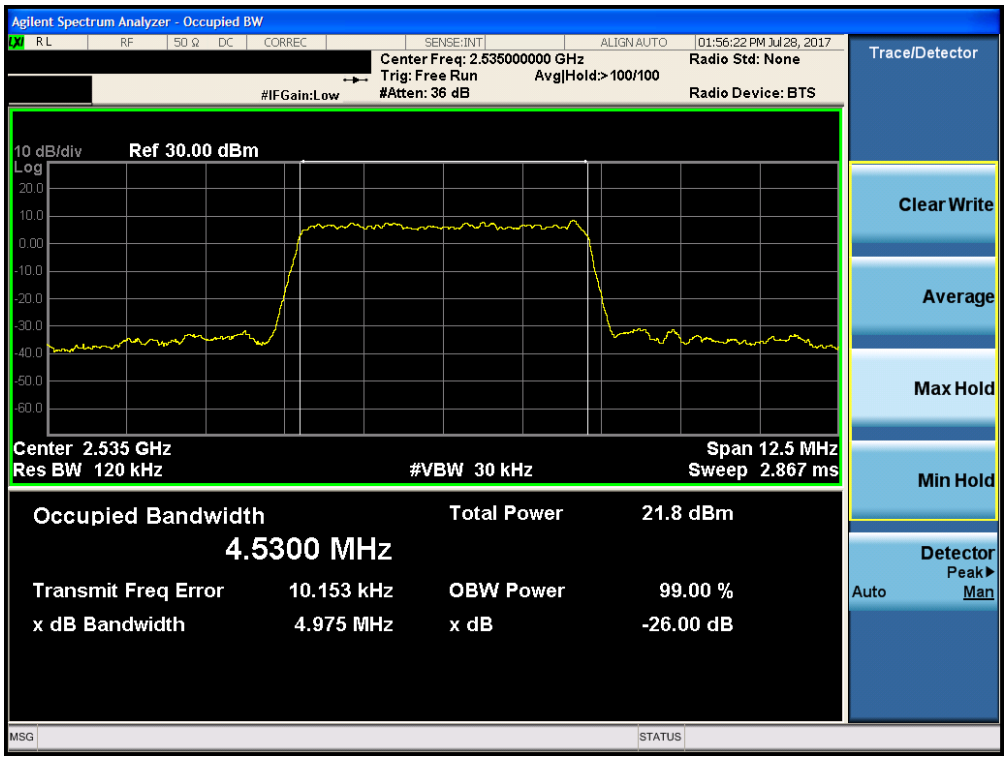


Plot 7-9. Occupied Bandwidth Plot (Band 7 – 5.0MHz QPSK – RB Size 25)



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

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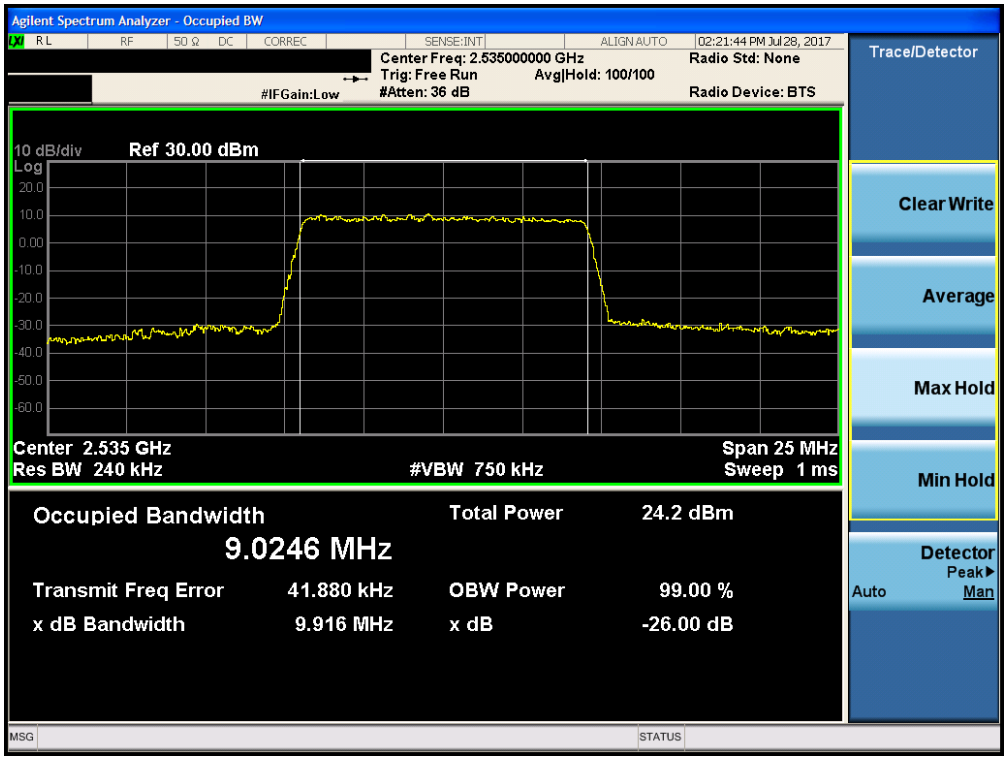
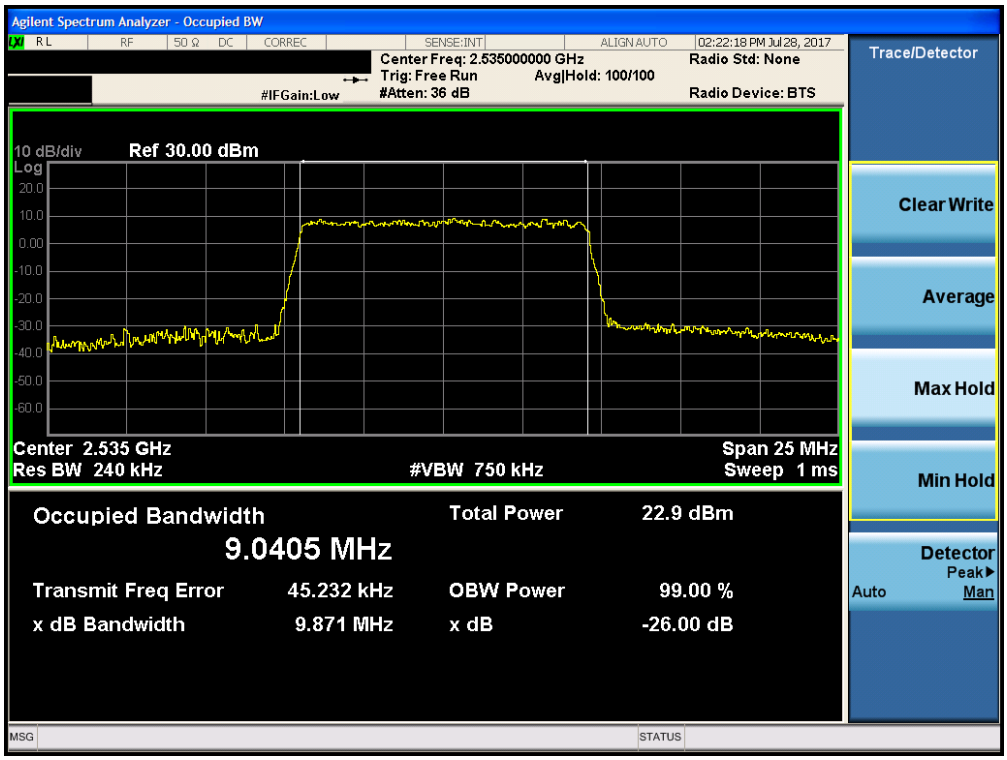


Plot 7-11. Occupied Bandwidth Plot (Band 7 – 10.0MHz QPSK – RB Size 50)



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

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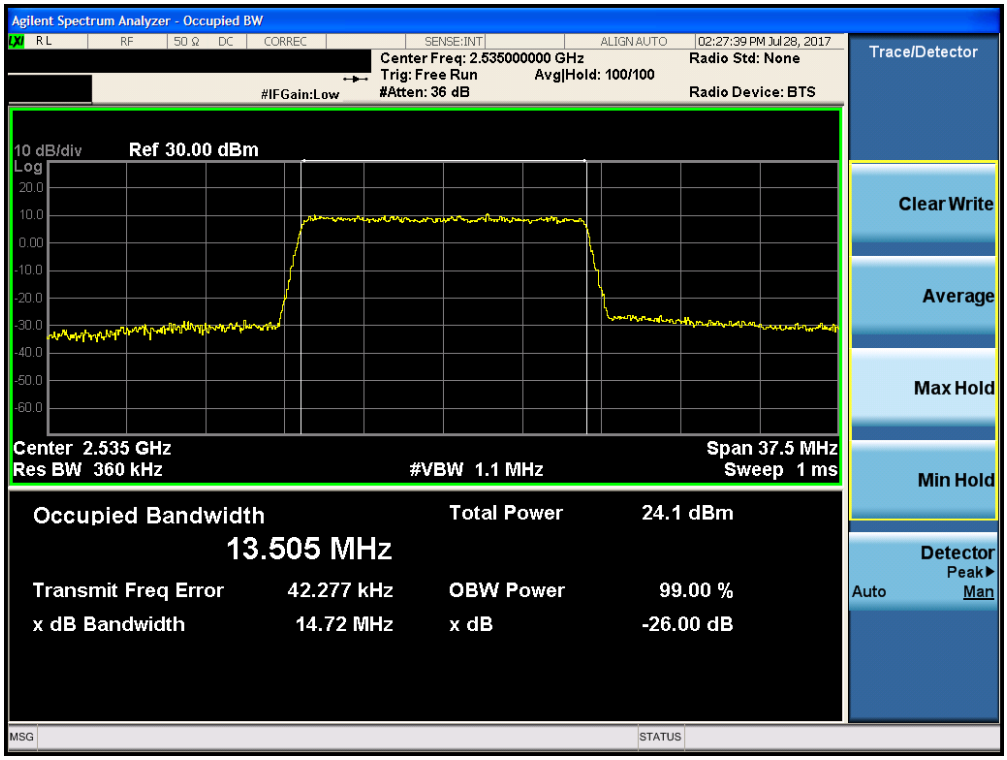
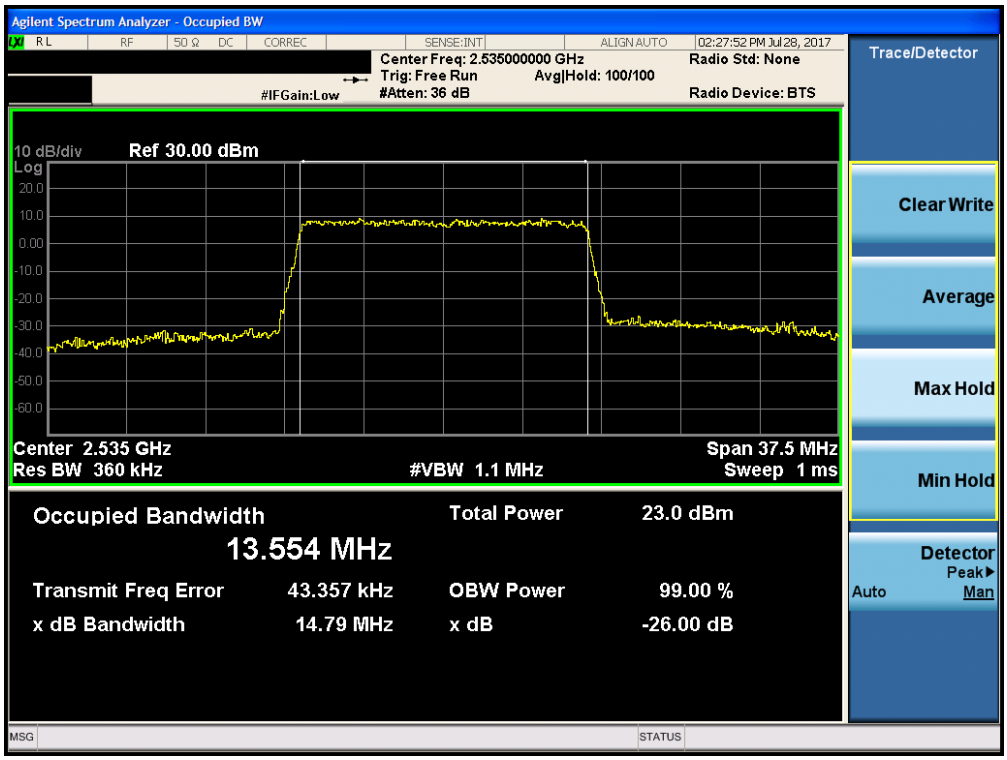


Plot 7-13. Occupied Bandwidth Plot (Band 7 – 15.0MHz QPSK – RB Size 75)



Plot 7-14. Occupied Bandwidth Plot (Band 7 – 15.0MHz 16-QAM – RB Size 75)

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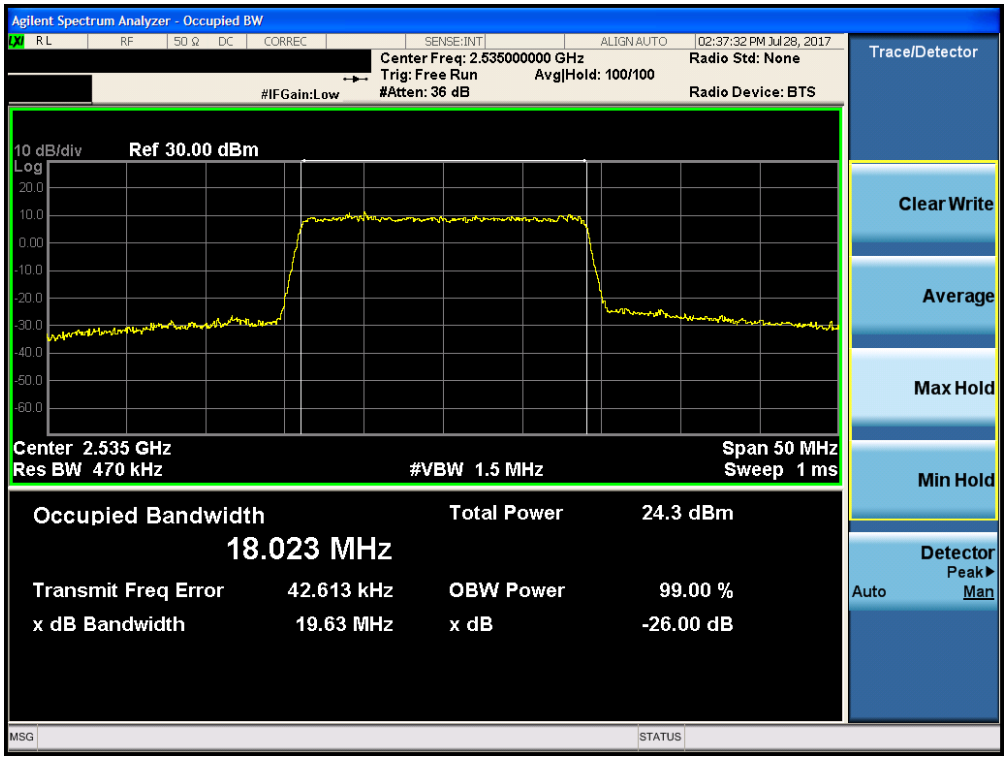
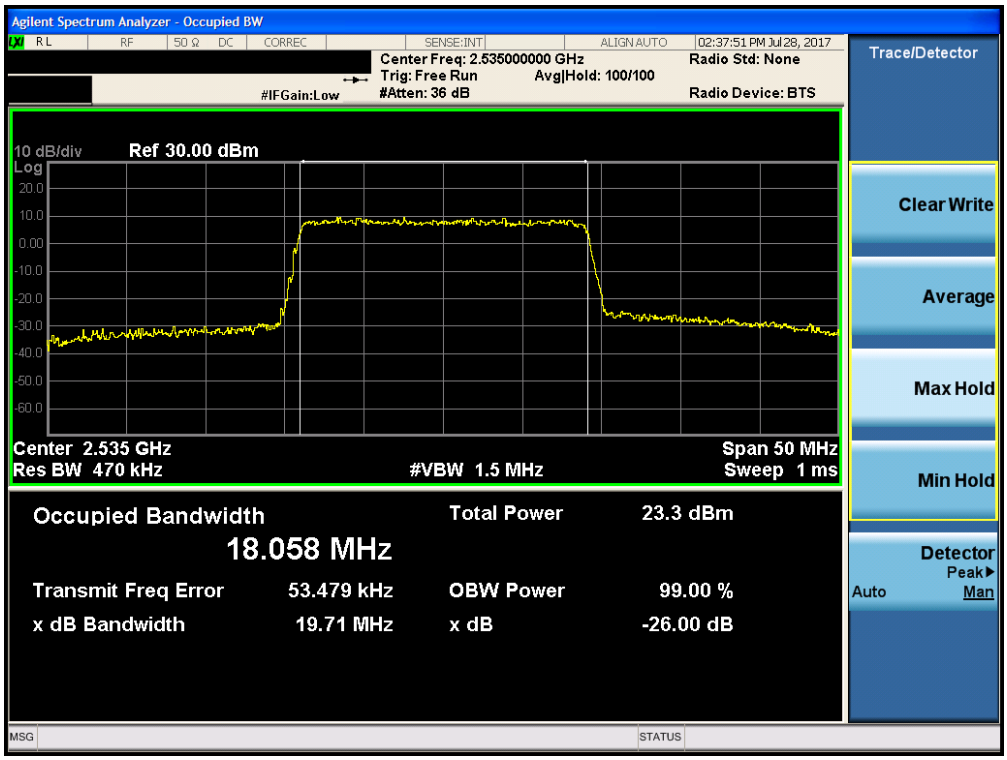


Plot 7-15. Occupied Bandwidth Plot (Band 7 – 20.0MHz QPSK – RB Size 100)



Plot 7-16. Occupied Bandwidth Plot (Band 7 – 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), §27.53(m)

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 7, 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.

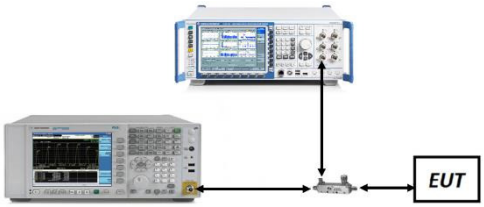

Figure 7-2. Test Instrument & Measurement Setup

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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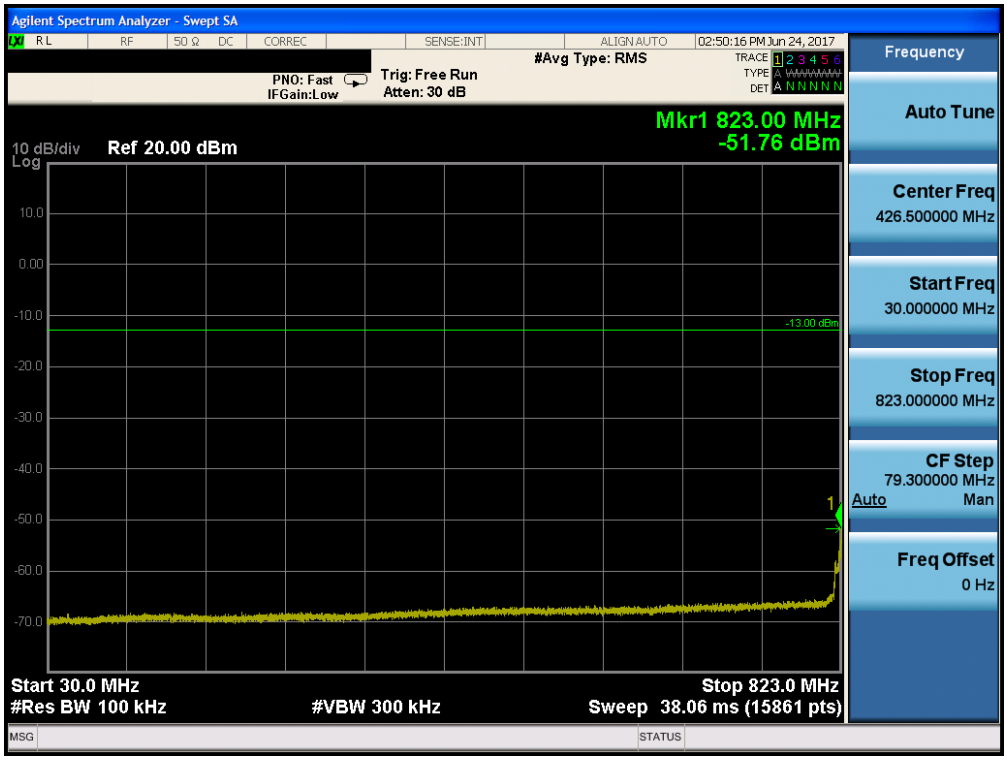
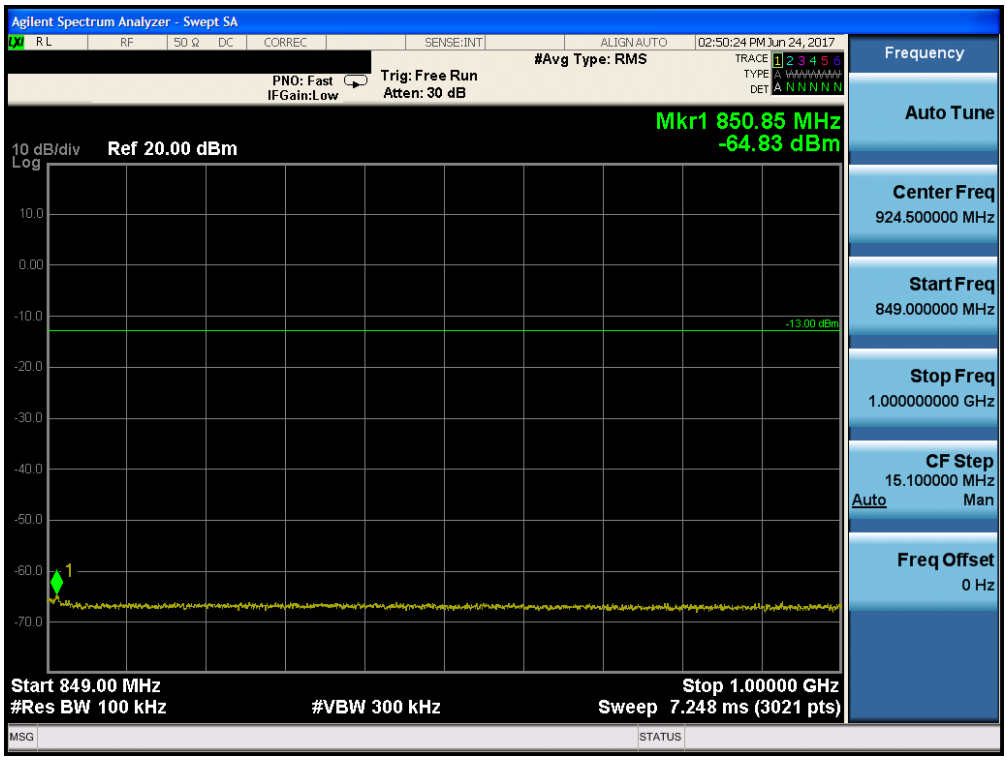


Plot 7-17. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-18. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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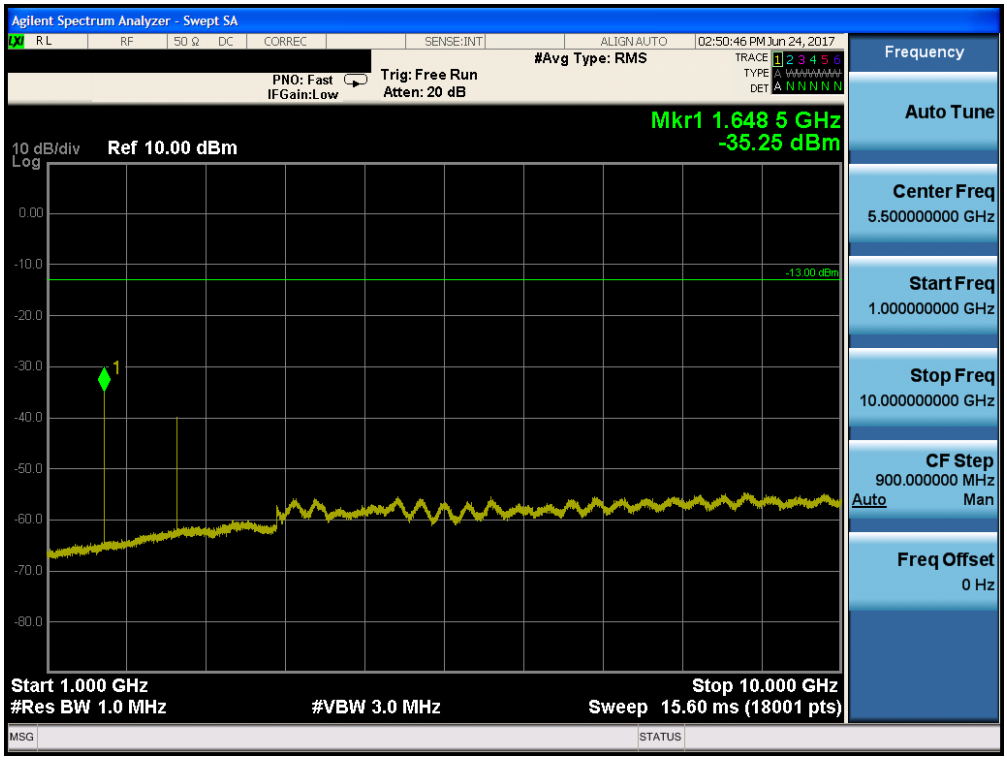
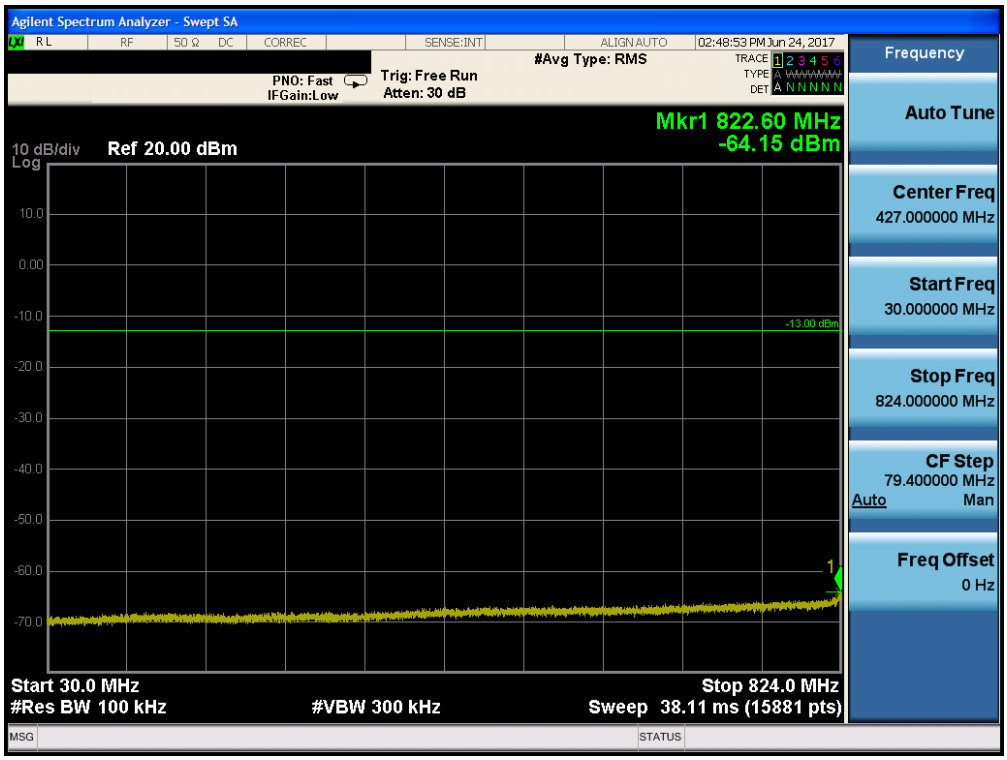


Plot 7-19. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)



Plot 7-20. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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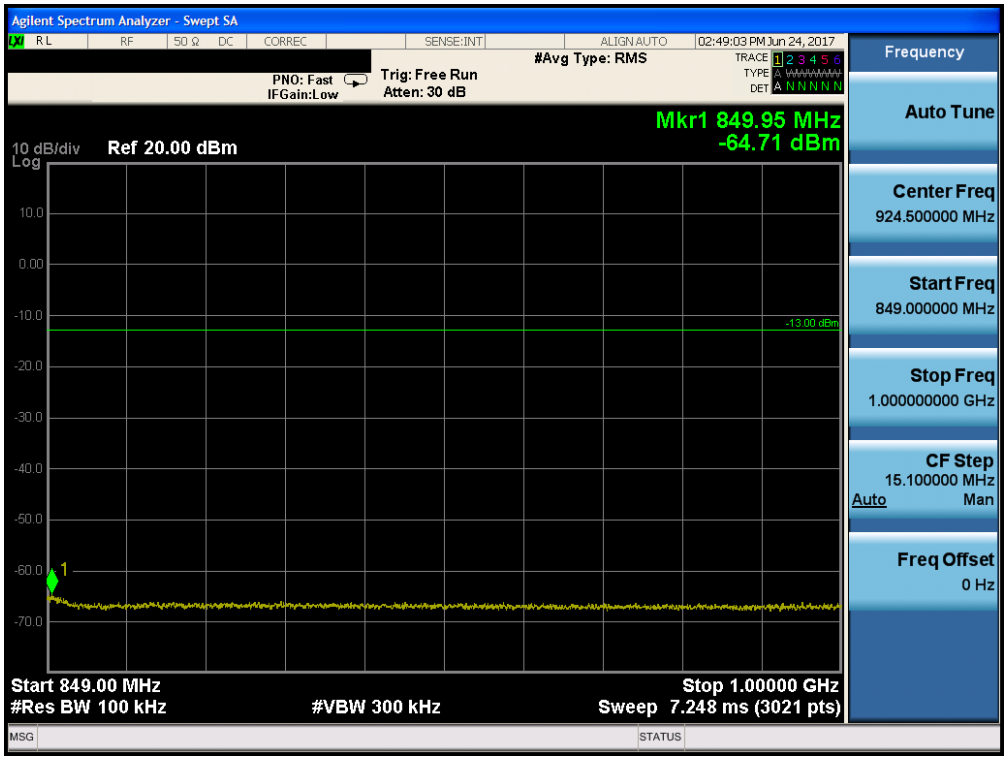
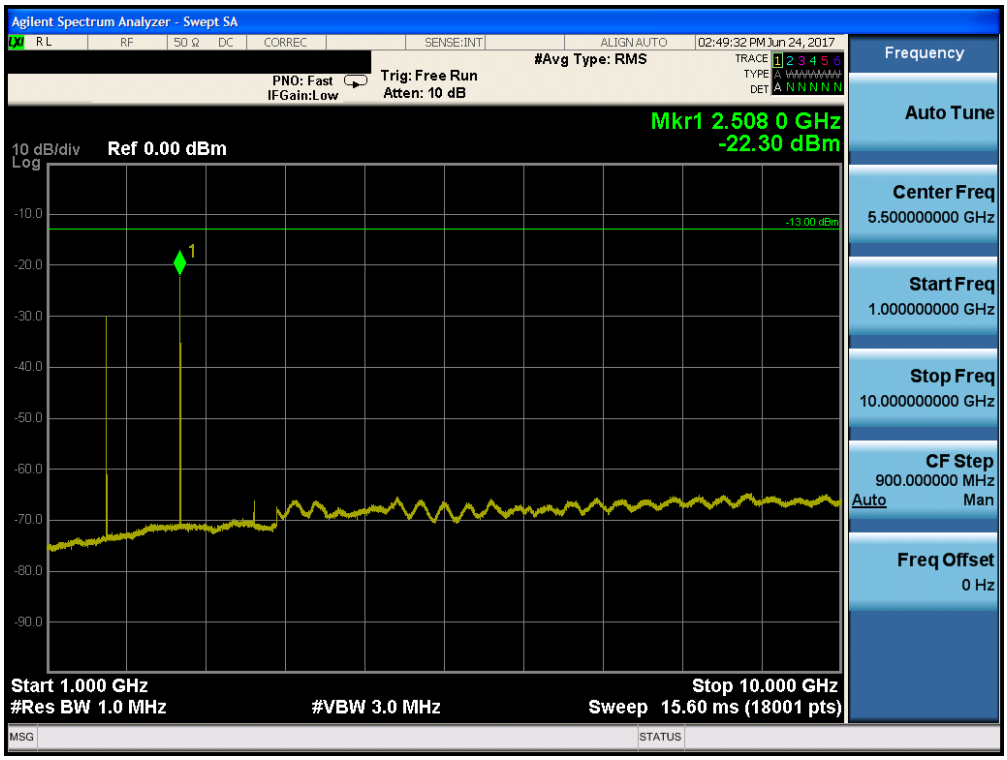


Plot 7-21. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-22. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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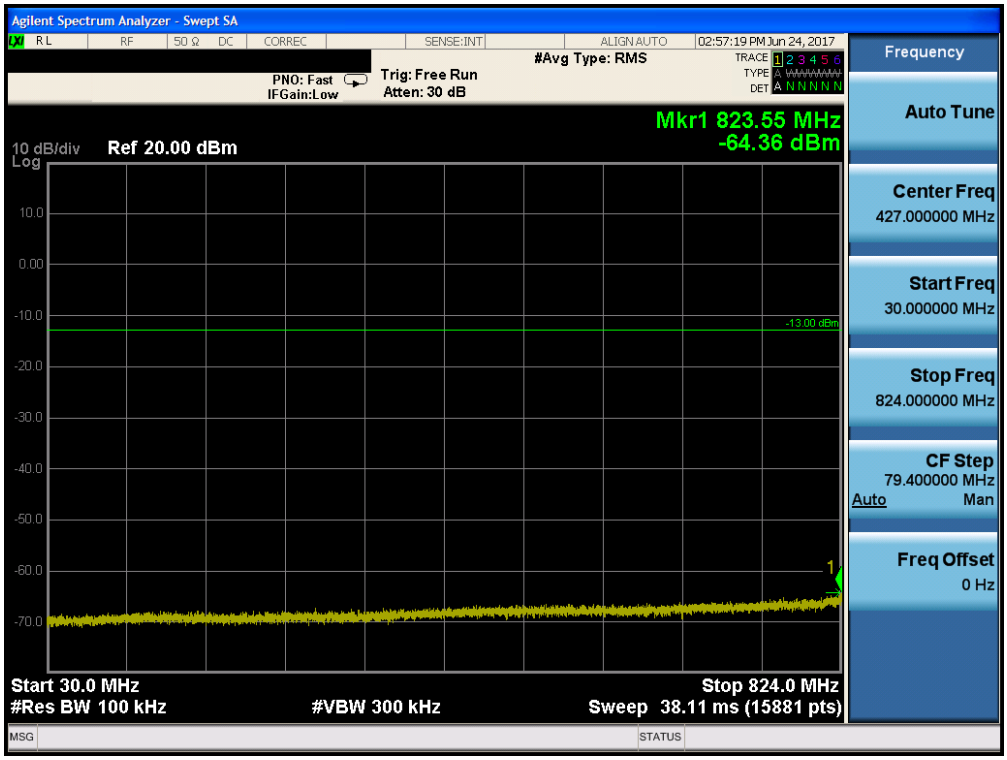
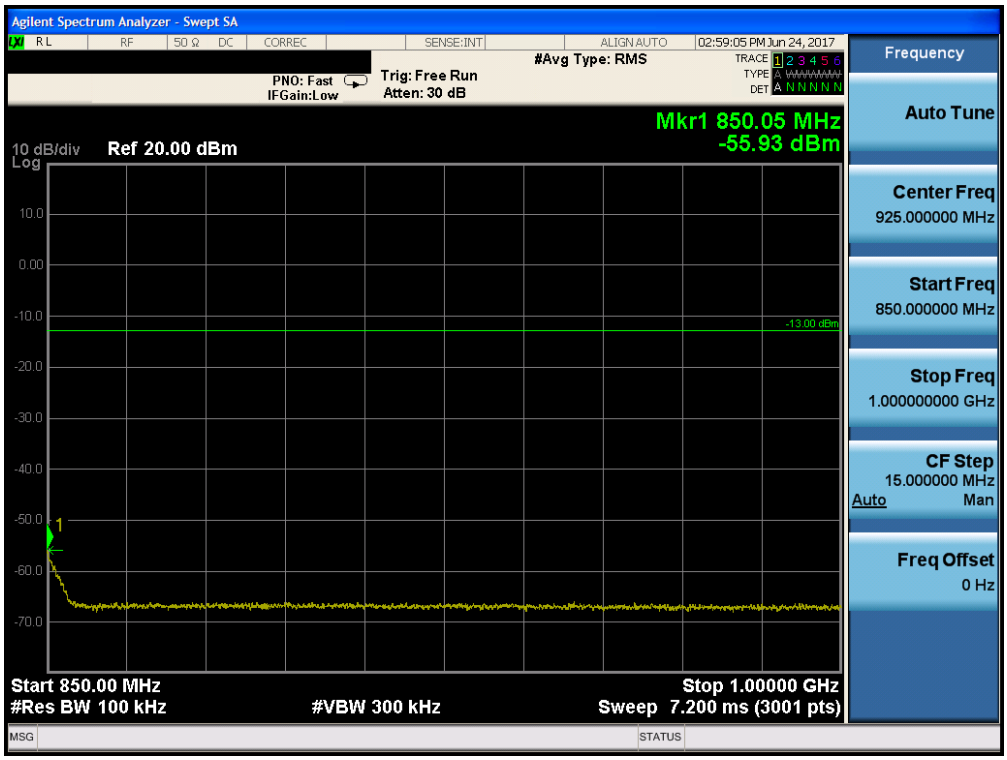


Plot 7-23. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-24. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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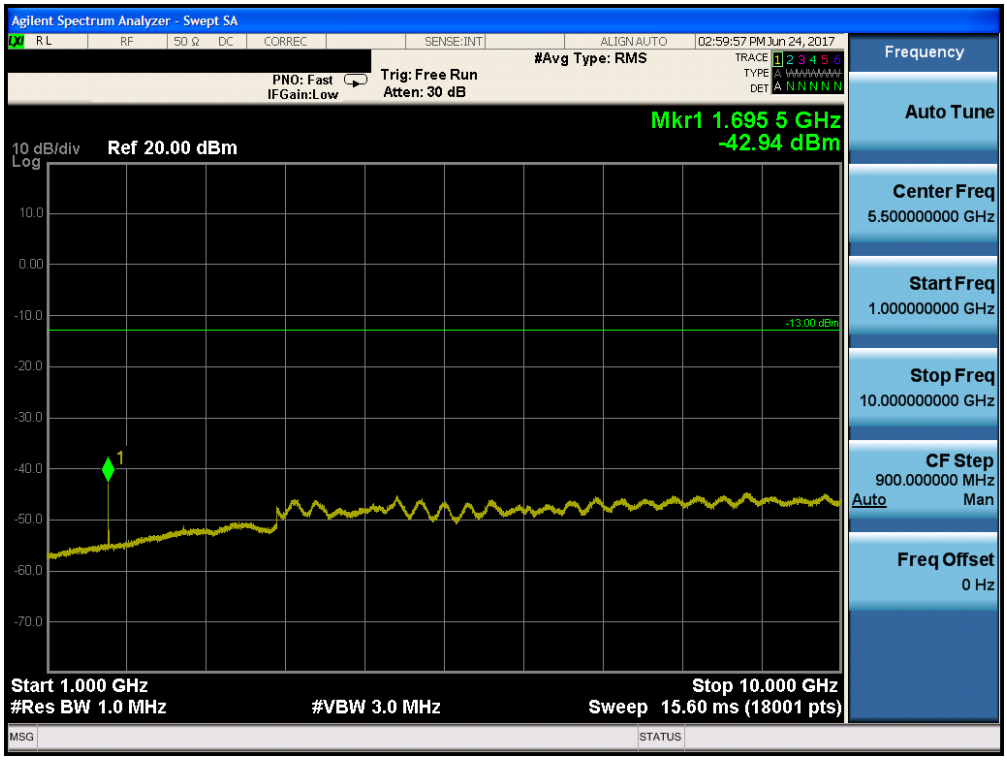
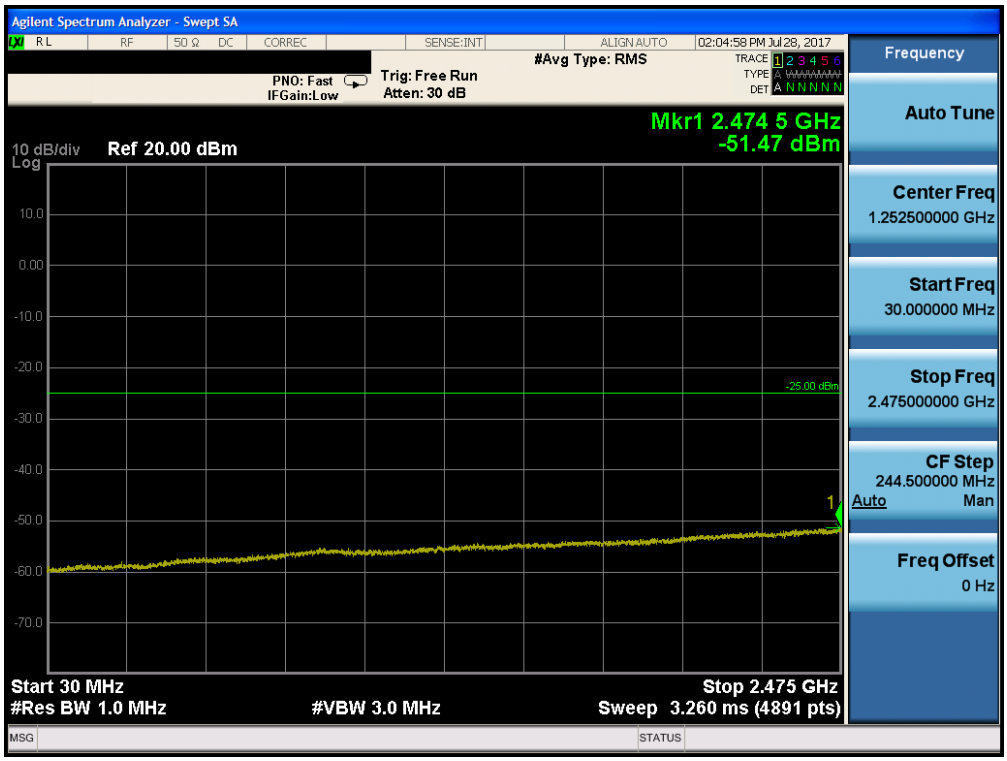


Plot 7-25. Conducted Spurious Plot (Band 5/26 – 1.4MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-26. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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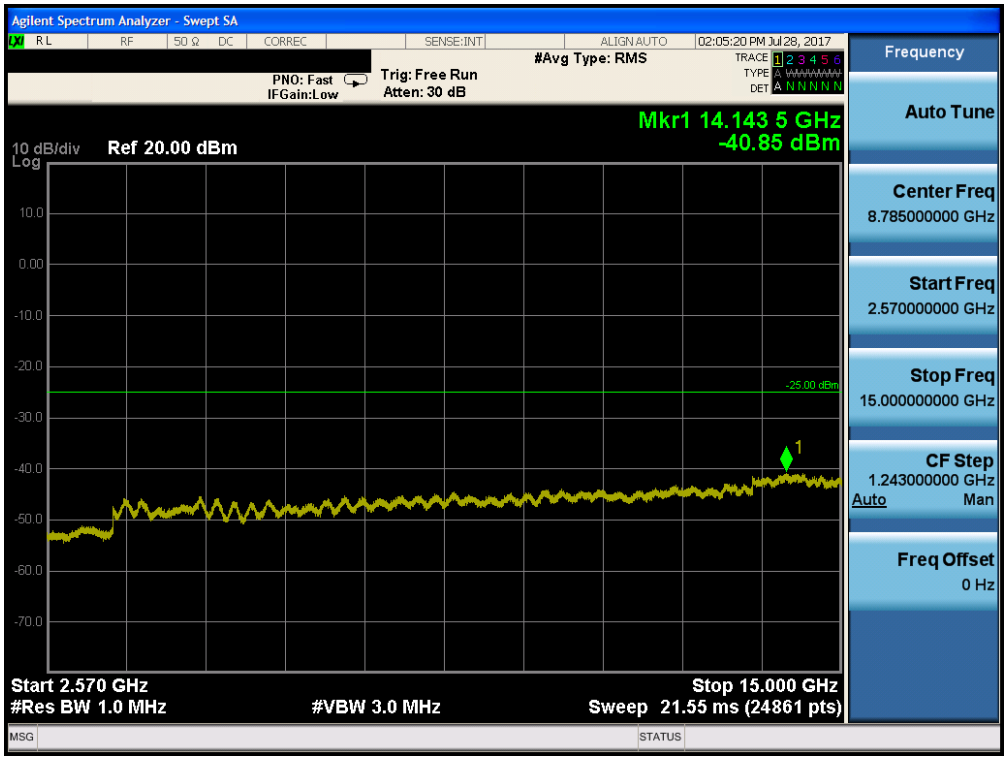

Plot 7-27. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

Plot 7-28. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

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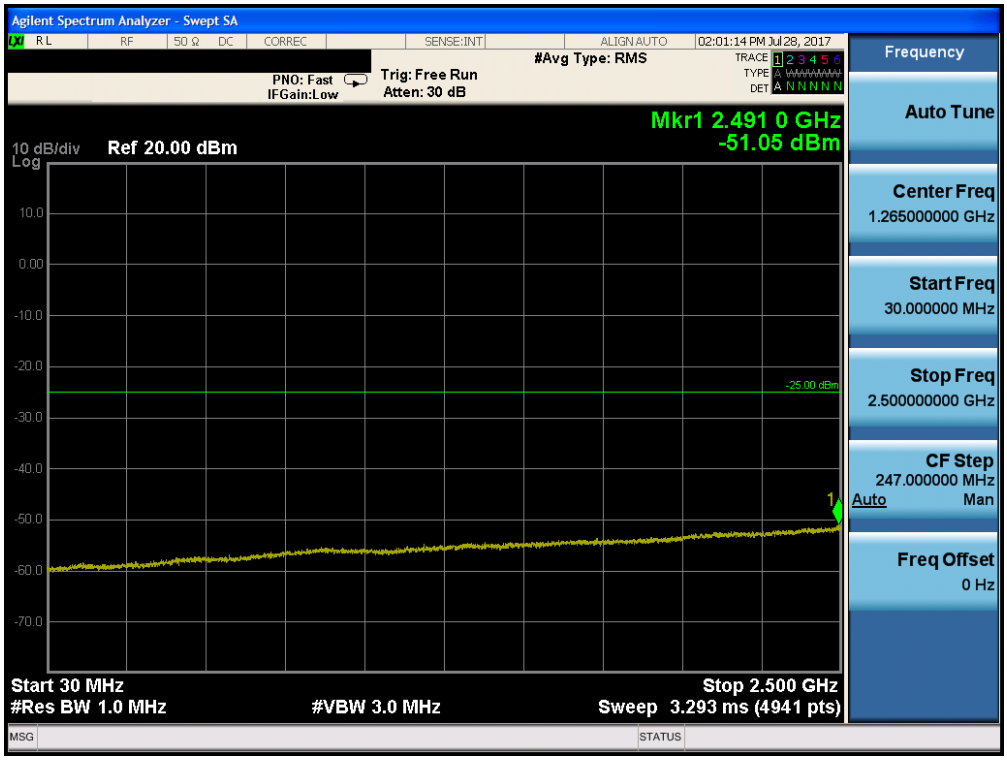
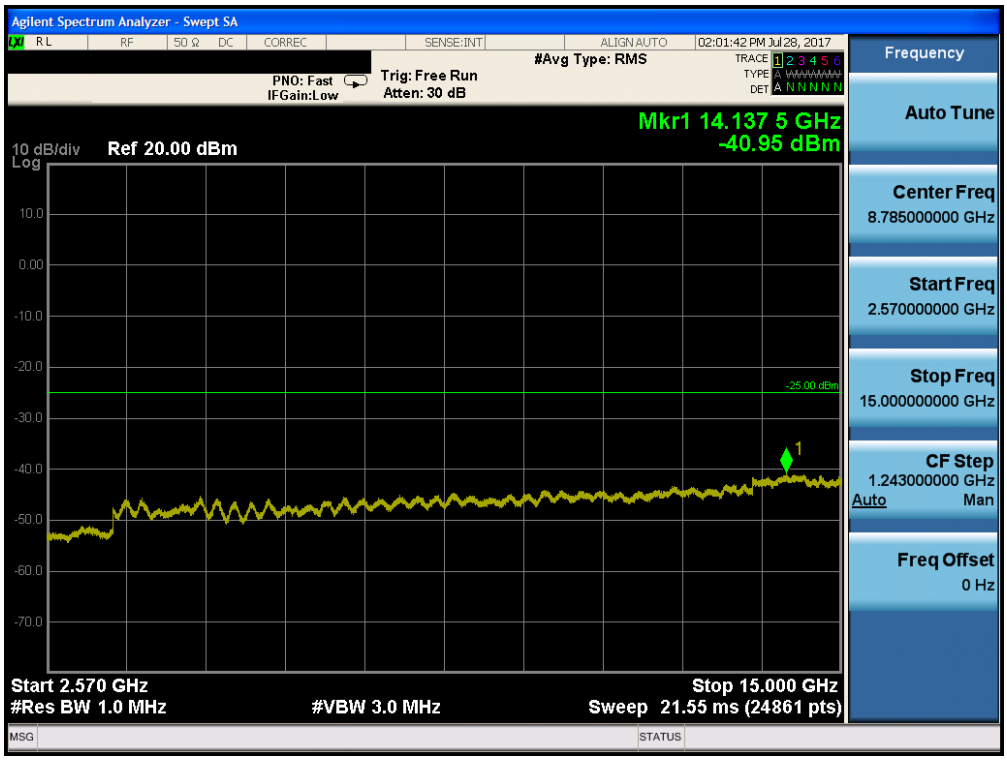


Plot 7-29. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-30. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

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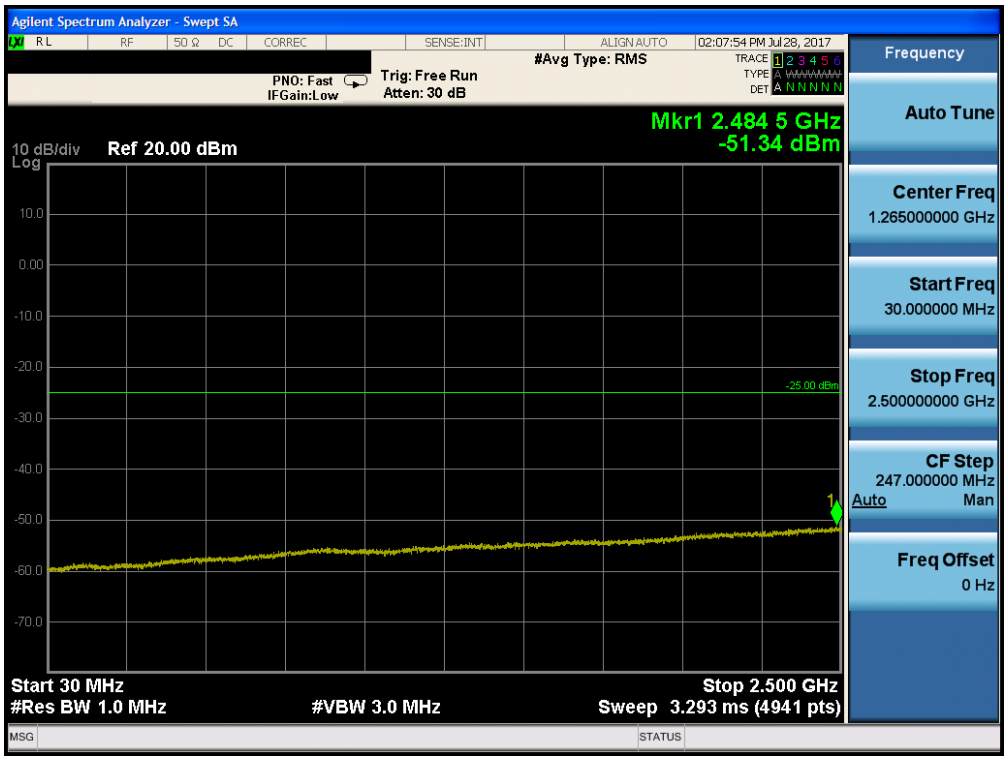
Plot 7-31. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)



Plot 7-32. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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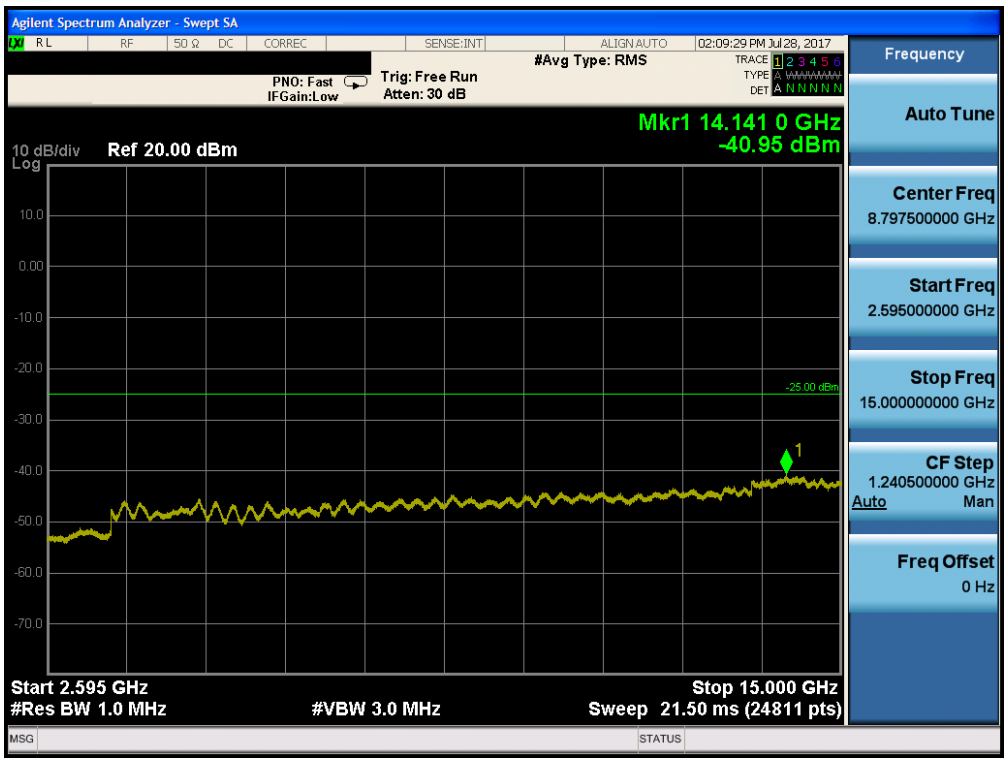

Plot 7-33. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

Plot 7-34. Conducted Spurious Plot (Band 7 – 5.0MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

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7.4 Band Edge Emissions at Antenna Terminal

§2.1051, §22.917(a), §27.53(m)

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level for Band 7 is as noted in the Test Notes on the following page.

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

Test Setup

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

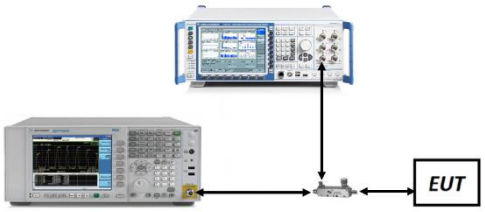

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

Per 22.917(b) in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

Per 27.53(m) for operations in the BRS/EBS bands, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz

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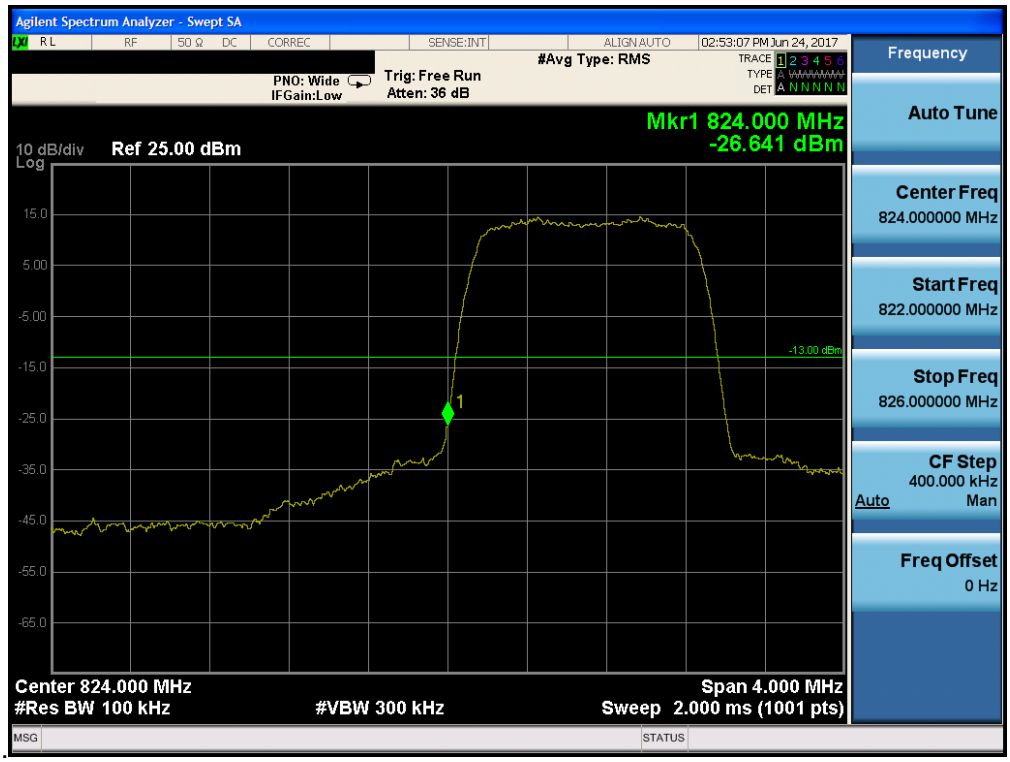

Plot 7-35. Lower Band Edge Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)

Plot 7-36. Upper Band Edge Plot (Band 5/26 – 1.4MHz QPSK – RB Size 6)

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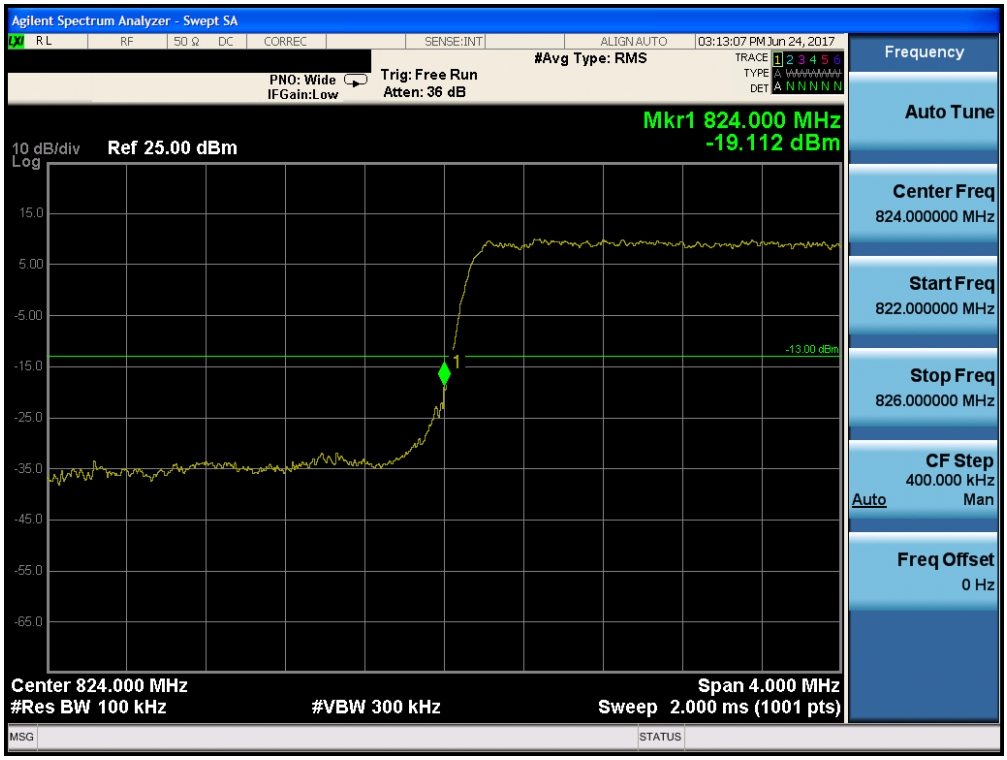
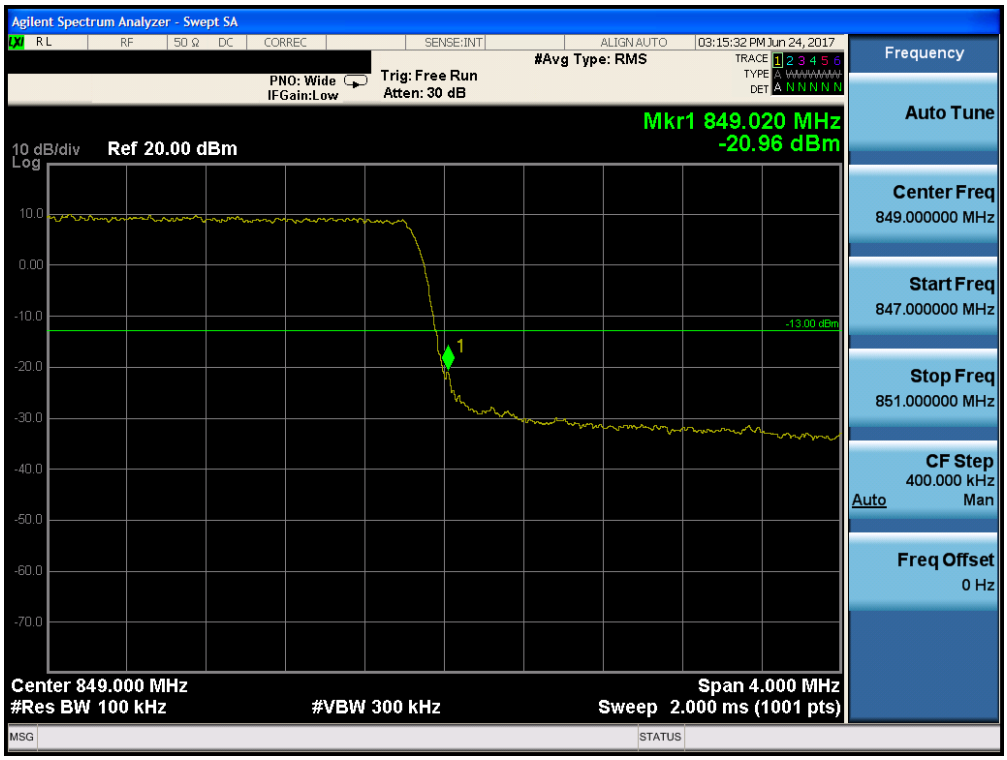


Plot 7-37. Lower Band Edge Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)



Plot 7-38. Upper Band Edge Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)

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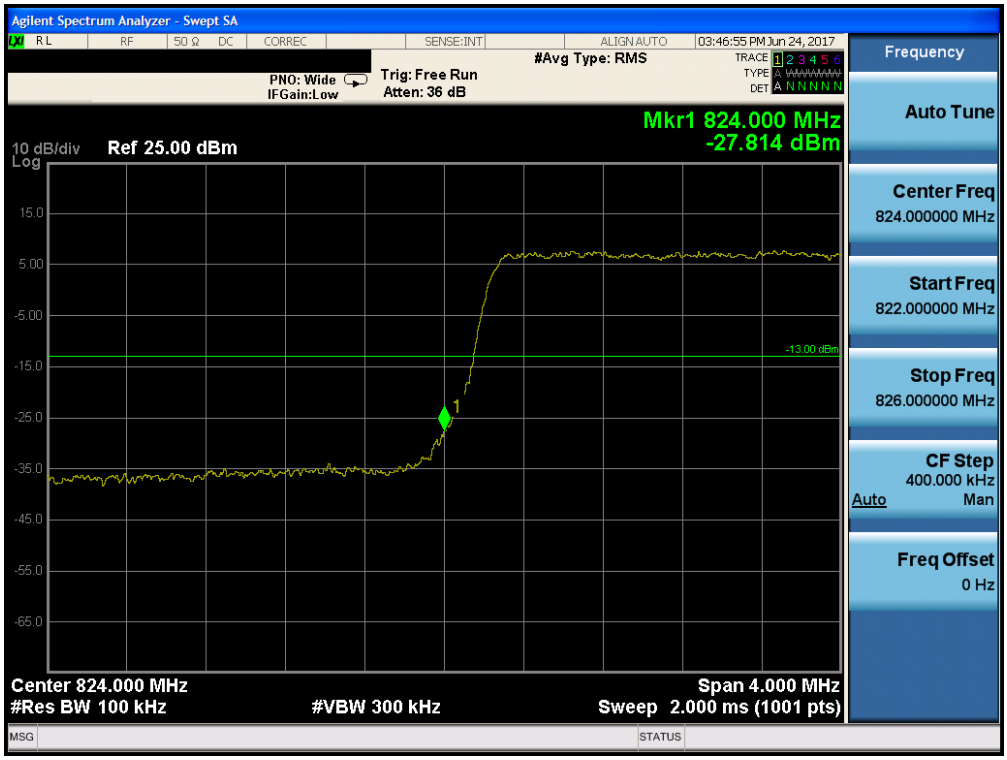
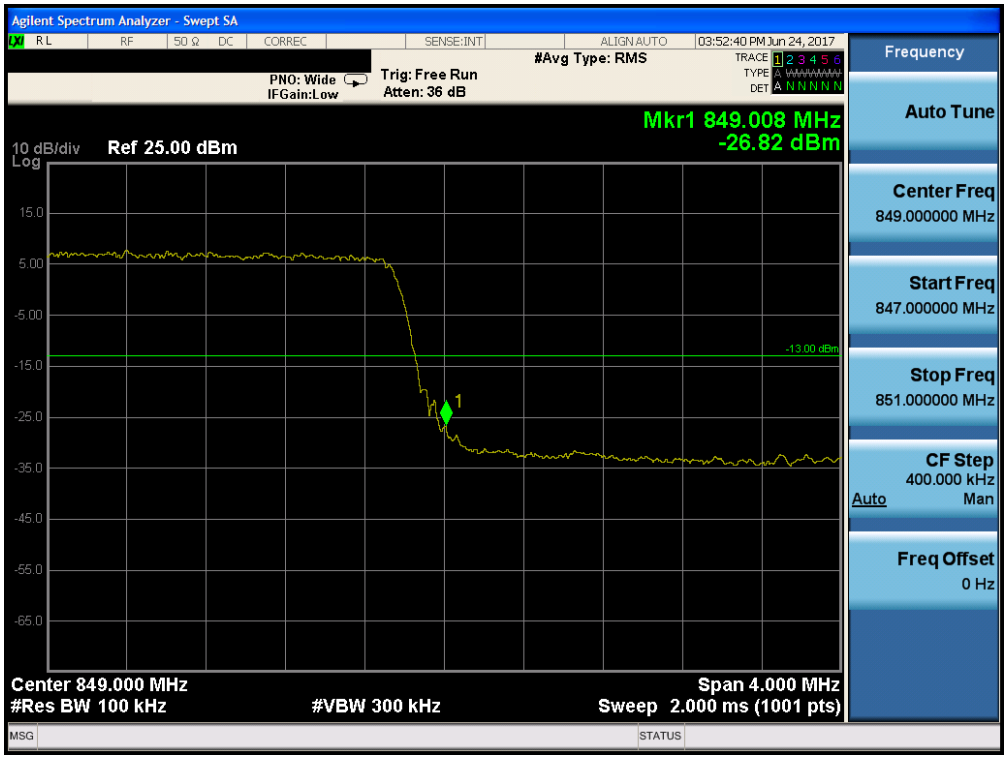


Plot 7-39. Lower Band Edge Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)



Plot 7-40. Upper Band Edge Plot (Band 5/26 – 5.0MHz QPSK – RB Size 25)

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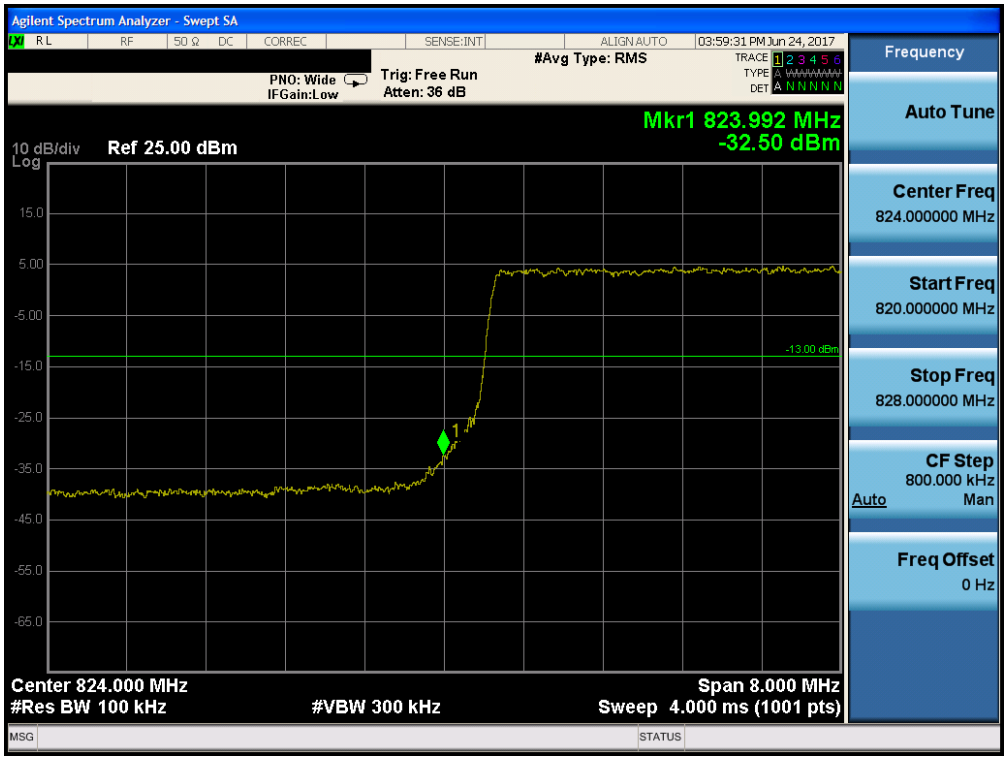
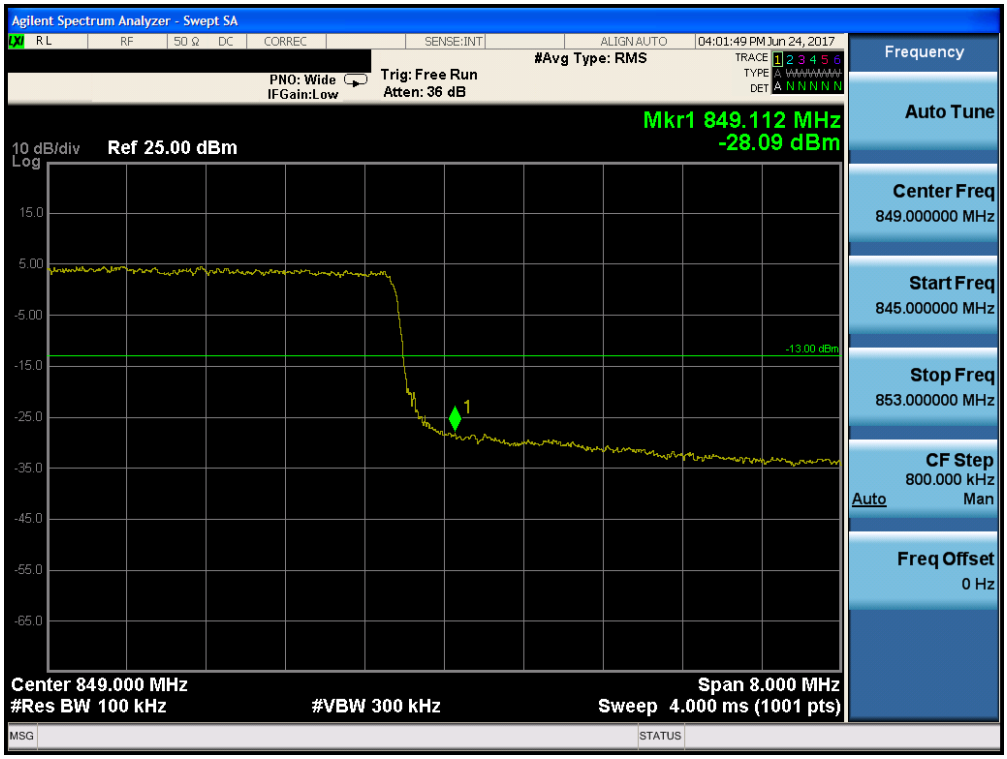


Plot 7-41. Lower Band Edge Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)



Plot 7-42. Upper Band Edge Plot (Band 5/26 – 10.0MHz QPSK – RB Size 50)

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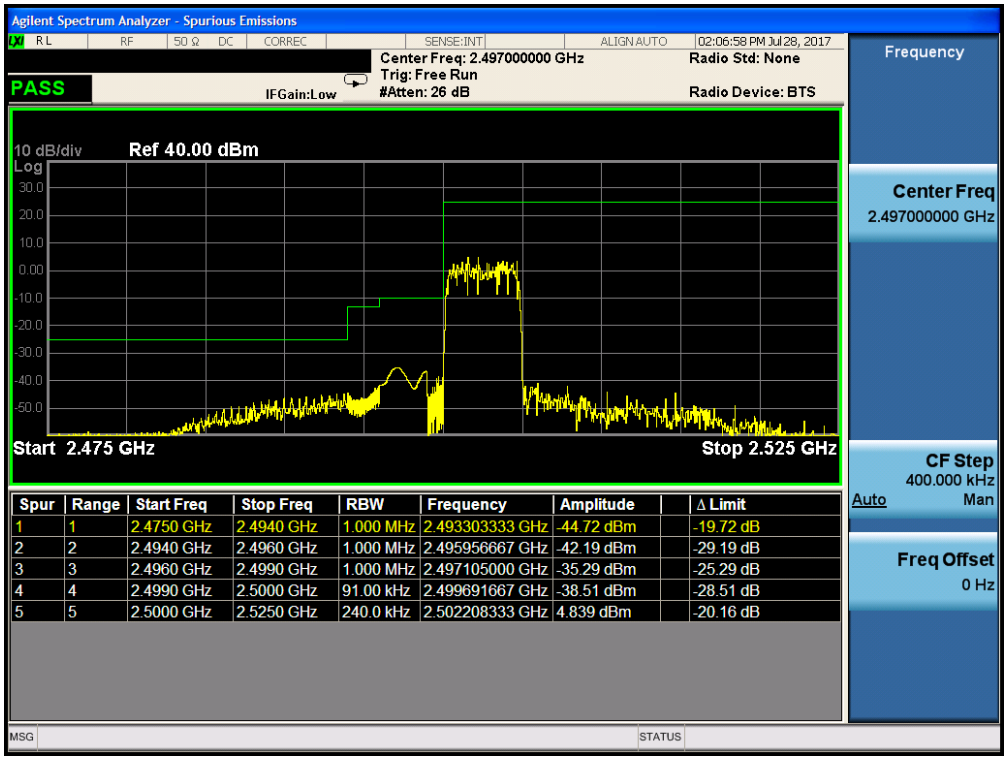
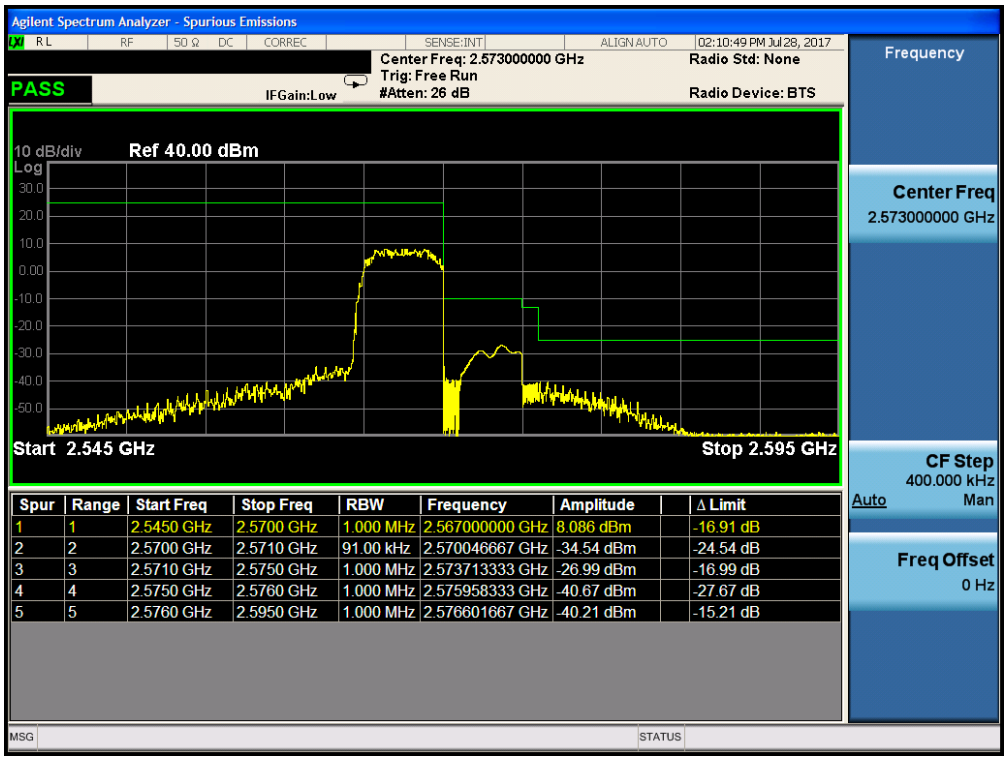


Plot 7-43. Lower ACP Plot (Band 7 – 5.0MHz QPSK – RB Size 25)



Plot 7-44. Upper ACP Plot (Band 7 – 5.0MHz QPSK – RB Size 25)

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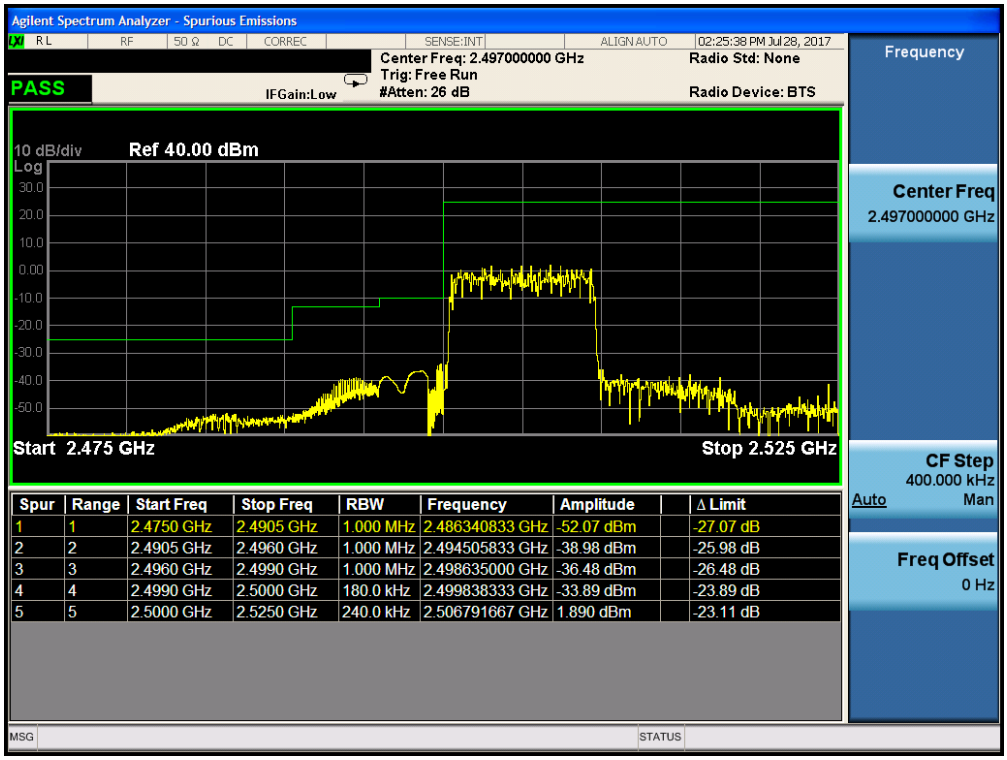
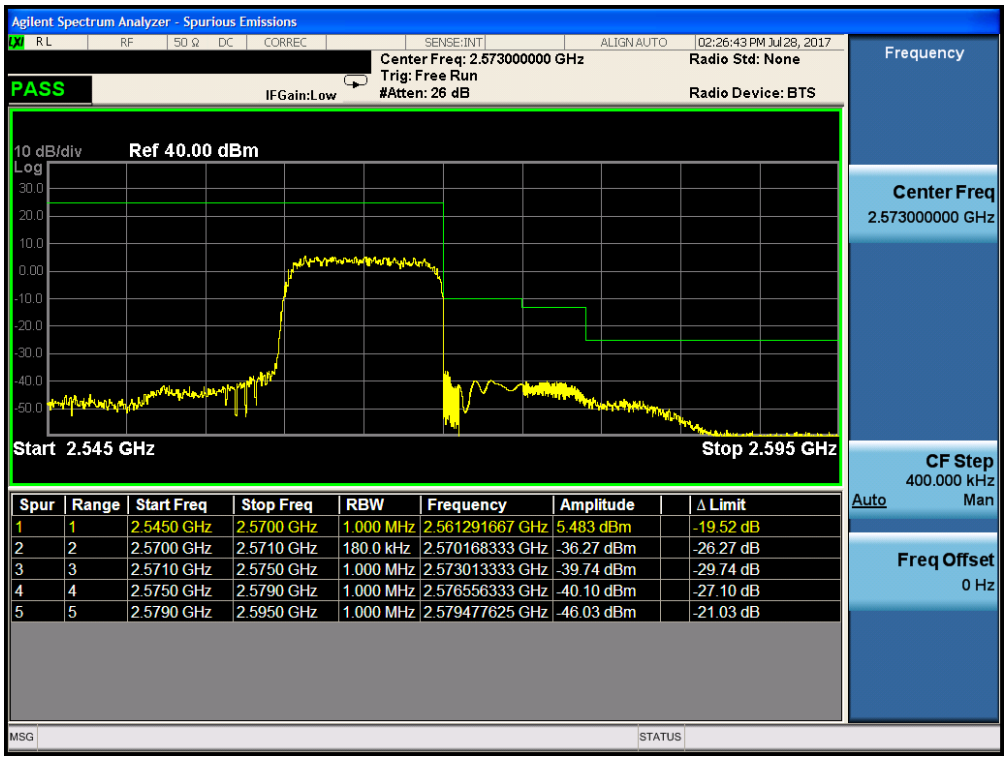


Plot 7-45. Lower ACP Plot (Band 7 – 10.0MHz QPSK – RB Size 50)



Plot 7-46. Upper ACP Plot (Band 7 – 10.0MHz QPSK – RB Size 50)

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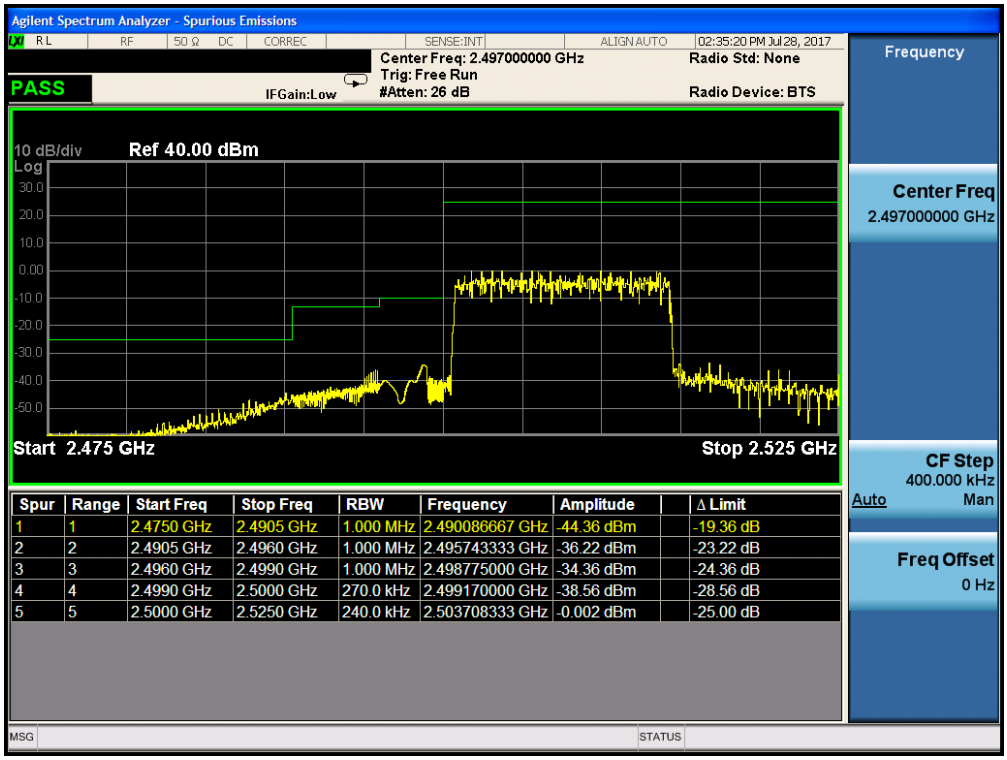
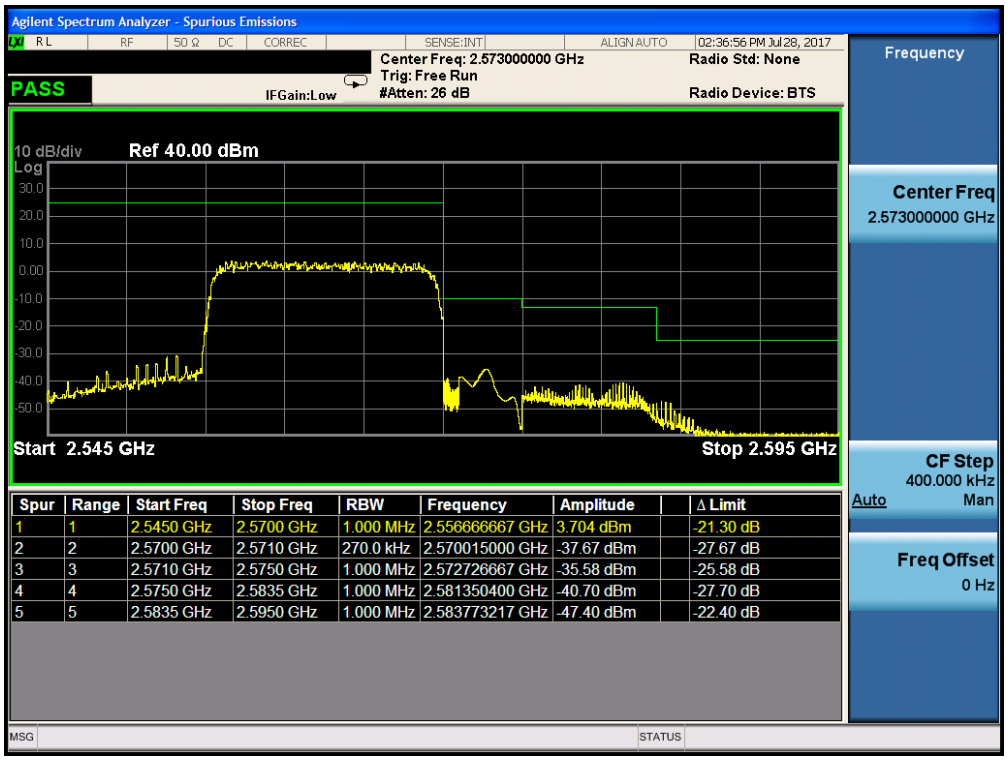


Plot 7-47. Lower ACP Plot (Band 7 – 15.0MHz QPSK – RB Size 75)



Plot 7-48. Upper ACP Plot (Band 7 – 15.0MHz QPSK – RB Size 75)

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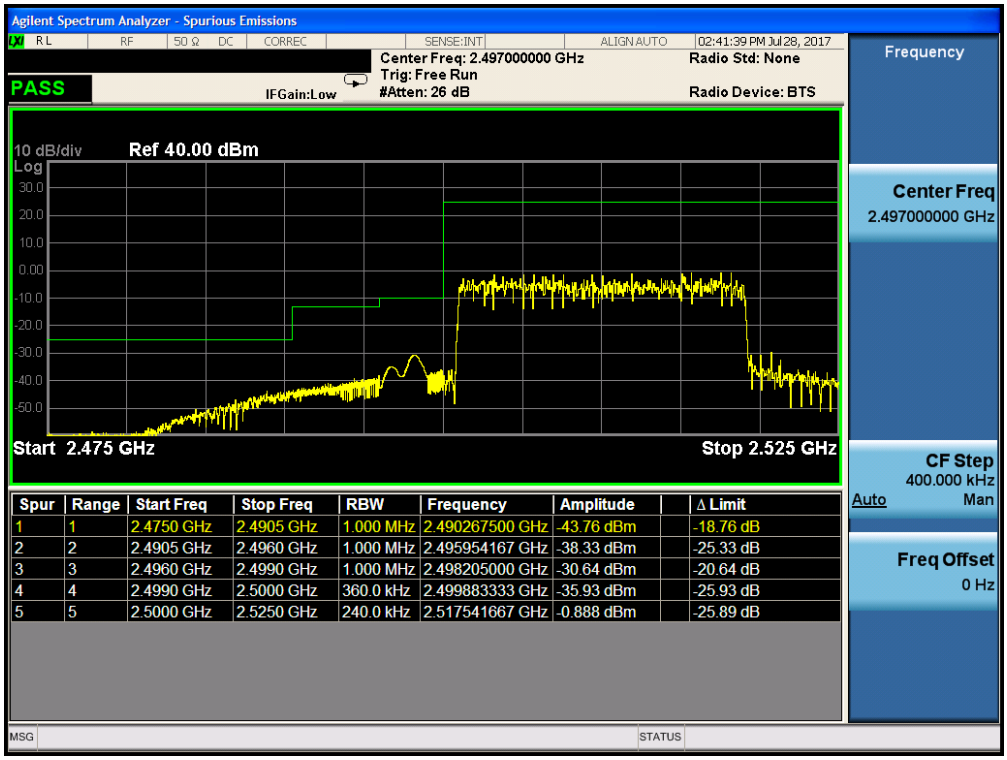
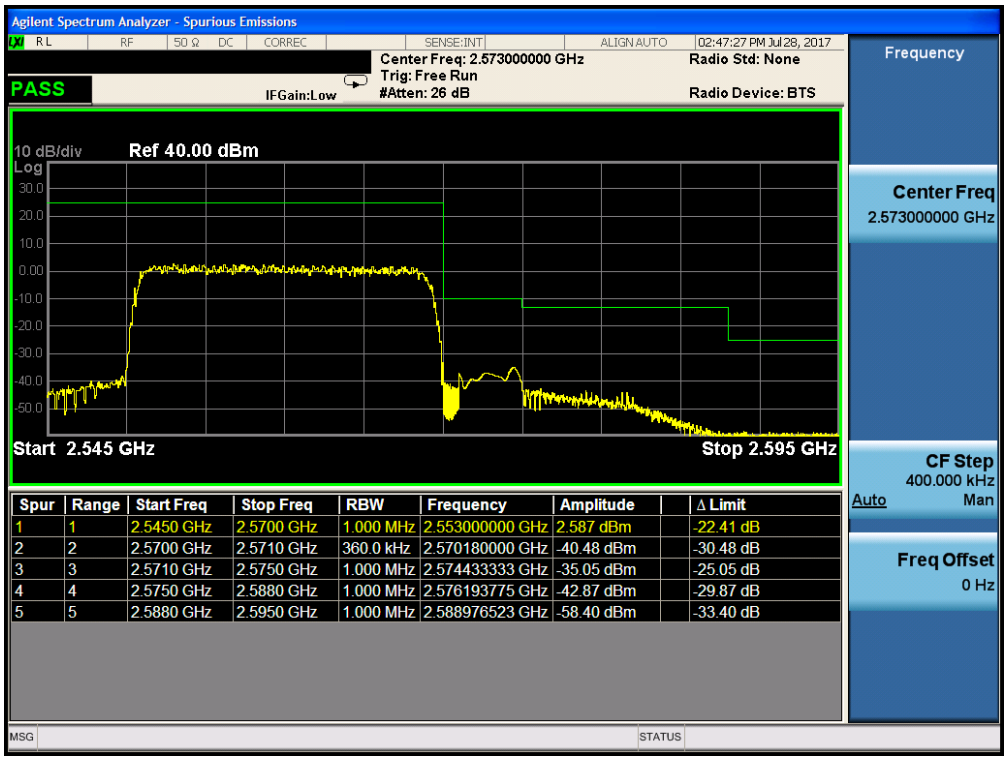


Plot 7-49. Lower ACP Plot (Band 7 – 20.0MHz QPSK – RB Size 100)



Plot 7-50. Upper ACP Plot (Band 7 – 20.0MHz QPSK – RB Size 100)

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7.5 Radiated Power (ERP/EIRP)

§22.913(a.2) §27.50(h.2)

Test Overview

Effective Radiated Power (ERP) is specified when the operating frequency is less than or equal to 1 GHz and Equivalent Isotropic Radiated Power (EIRP) is specified when the operating frequency is greater than 1 GHz. Both are determined by adding the transmit antenna gain to the conducted RF output power with the primary difference between the two being that when determining the ERP, the transmit antenna gain is referenced to a dipole antenna (i.e., dBd) whereas when determining the EIRP, the transmit antenna gain is referenced to an isotropic antenna (dBi).

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.6

Test Settings

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

ERP/EIRP = PMeas − LC + GT

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm);

PMeas = measured transmitter output power or PSD, in dBm or dBW;

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

Test Setup

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

Figure 7-4. ERP/EIRP Measurement Setsup

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Test Notes

1) The worst case emissions are reported with the EUT modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

3) The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.

4) The Ant. Gains (GT) are listed in dBi.

5) The final ERP/EIRP values in dBm values were calculated in column 5.

6) The LC cable loss factor is already included in the measurement system and the conducted power in the table already includes this factor.

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Conducted Power [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
824.70	1.4	QPSK	23.82	-25.12	-1.30	38.45	-39.75
836.50	1.4	QPSK	23.72	-25.12	-1.40	38.45	-39.85
848.30	1.4	QPSK	23.87	-25.12	-1.25	38.45	-39.70
848.30	1.4	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
825.50	3	QPSK	23.95	-25.12	-1.17	38.45	-39.62
836.50	3	QPSK	23.66	-25.12	-1.46	38.45	-39.91
847.50	3	QPSK	23.90	-25.12	-1.22	38.45	-39.67
825.50	3	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
826.50	5	QPSK	23.81	-25.12	-1.31	38.45	-39.76
836.50	5	QPSK	23.63	-25.12	-1.49	38.45	-39.94
846.50	5	QPSK	23.77	-25.12	-1.35	38.45	-39.80
836.50	5	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
829.00	10	QPSK	23.63	-25.12	-1.49	38.45	-39.94
836.50	10	QPSK	23.60	-25.12	-1.52	38.45	-39.97
844.00	10	QPSK	23.61	-25.12	-1.51	38.45	-39.96
829.00	10	16-QAM	22.92	-25.12	-2.20	38.45	-40.65

Table 7-2. ERP Data (Band 5)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Conducted Power [dBm]	Ant. Gain [dBd]	ERP [dBm]	ERP Limit [dBm]	Margin [dB]
824.70	1.4	QPSK	23.93	-25.12	-1.19	38.45	-39.64
836.50	1.4	QPSK	24.00	-25.12	-1.12	38.45	-39.57
848.30	1.4	QPSK	24.00	-25.12	-1.12	38.45	-39.57
836.50	1.4	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
825.50	3	QPSK	24.00	-25.12	-1.12	38.45	-39.57
836.50	3	QPSK	23.97	-25.12	-1.15	38.45	-39.60
847.50	3	QPSK	24.00	-25.12	-1.12	38.45	-39.57
847.50	3	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
826.50	5	QPSK	23.99	-25.12	-1.13	38.45	-39.58
836.50	5	QPSK	23.87	-25.12	-1.25	38.45	-39.70
846.50	5	QPSK	23.95	-25.12	-1.17	38.45	-39.62
826.50	5	16-QAM	23.00	-25.12	-2.12	38.45	-40.57
829.00	10	QPSK	23.98	-25.12	-1.14	38.45	-39.59
836.50	10	QPSK	24.00	-25.12	-1.12	38.45	-39.57
844.00	10	QPSK	23.92	-25.12	-1.20	38.45	-39.65
829.00	10	16-QAM	23.00	-25.12	-2.12	38.45	-40.57

Table 7-3. ERP Data (Band 26)

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Conducted Power [dBm]	Ant. Gain [dBi]	EIRP [dBm]	EIRP Limit [dBm]	Margin [dB]
2502.50	5	QPSK	23.67	-12.02	11.65	33.01	-21.36
2535.00	5	QPSK	23.60	-12.02	11.58	33.01	-21.43
2567.50	5	QPSK	23.60	-12.02	11.58	33.01	-21.43
2502.50	5	16-QAM	23.12	-12.02	11.10	33.01	-21.91
2505.00	10	QPSK	23.80	-12.02	11.78	33.01	-21.23
2535.00	10	QPSK	23.55	-12.02	11.53	33.01	-21.48
2565.00	10	QPSK	23.56	-12.02	11.54	33.01	-21.47
2505.00	10	16-QAM	23.47	-12.02	11.45	33.01	-21.56
2507.50	15	QPSK	23.73	-12.02	11.71	33.01	-21.30
2535.00	15	QPSK	23.65	-12.02	11.63	33.01	-21.38
2562.50	15	QPSK	23.65	-12.02	11.63	33.01	-21.38
2507.50	15	16-QAM	23.07	-12.02	11.05	33.01	-21.96
2510.00	20	QPSK	23.79	-12.02	11.77	33.01	-21.24
2535.00	20	QPSK	23.75	-12.02	11.73	33.01	-21.28
2560.00	20	QPSK	23.58	-12.02	11.56	33.01	-21.45
2560.00	20	16-QAM	23.00	-12.02	10.98	33.01	-22.03

Table 7-4. EIRP Data (Band 7)

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7.6 Radiated Spurious Emissions Measurements – Above 1GHz

§2.1053 §22.917(a) §27.53(m)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 1MHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

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Test Setup

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

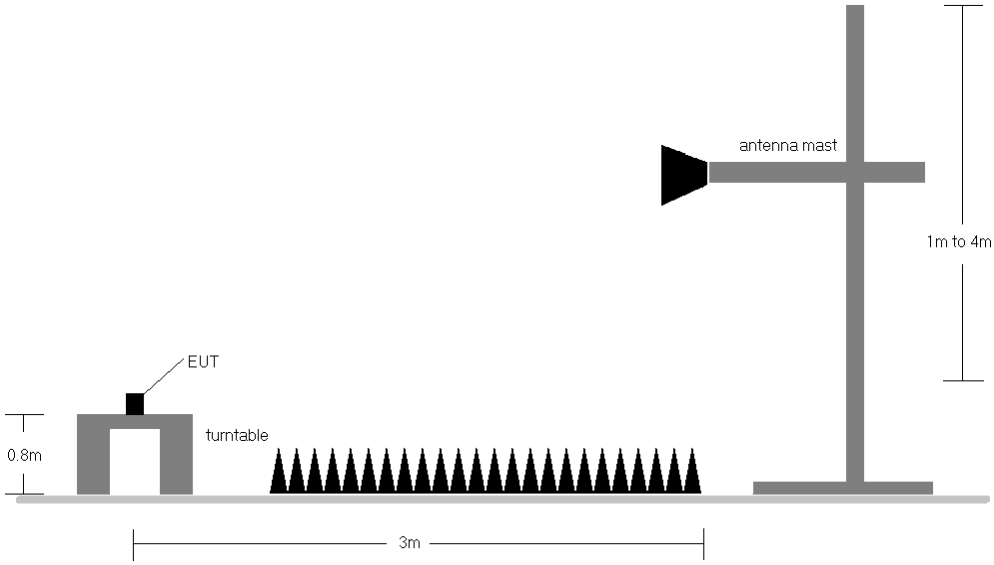

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

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

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

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

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OPERATING FREQUENCY:	826.50	MHz
CHANNEL:	26815	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1653.00	H	125	236	-80.09	6.98	-73.11	-60.1
2479.50	H	-	-	-81.40	6.96	-74.44	-61.4

Table 7-5. Radiated Spurious Data (Band 5/26 – Low Channel)

OPERATING FREQUENCY:	836.50	MHz
CHANNEL:	26915	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1673.00	H	125	264	-77.92	6.85	-71.08	-58.1
2509.50	H	-	-	-81.67	7.07	-74.60	-61.6

Table 7-6. Radiated Spurious Data (Band 5/26 – Mid Channel)

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OPERATING FREQUENCY:	846.50	MHz
CHANNEL:	27015	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-13	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
1693.00	H	112	116	-79.57	6.88	-72.69	-59.7
2539.50	H	-	-	-81.80	7.27	-74.53	-61.5

Table 7-7. Radiated Spurious Data (Band 5/26 – High Channel)

OPERATING FREQUENCY:	2507.50	MHz
CHANNEL:	20825	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	15.0	MHz
DISTANCE:	3	meters
LIMIT:	-25	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
5015.00	V	102	166	-70.22	13.53	-56.69	-31.7
7522.50	V	-	-	-72.19	14.30	-57.89	-32.9

Table 7-8. Radiated Spurious Data (Band 7 – Low Channel)

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OPERATING FREQUENCY:	2535.00	MHz
CHANNEL:	21100	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	15.0	MHz
DISTANCE:	3	meters
LIMIT:	-25	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
5070.00	V	101	113	-70.99	13.62	-57.37	-32.4
7605.00	V	-	-	-72.08	14.34	-57.74	-32.7

Table 7-9. Radiated Spurious Data (Band 7 – Mid Channel)

OPERATING FREQUENCY:	2562.50	MHz
CHANNEL:	21375	
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	15.0	MHz
DISTANCE:	3	meters
LIMIT:	-25	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBd]	Spurious Emission Level [dBm]	Margin [dB]
5125.00	V	100	153	-70.31	13.72	-56.59	-31.6
7687.50	V	-	-	-71.45	14.34	-57.12	-32.1

Table 7-10. Radiated Spurious Data (Band 7 – High Channel)

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7.7 Radiated Spurious Emissions Measurements – Below 1GHz

§2.1053 §22.917(a) §27.53(m)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

Test Procedures Used

KDB 971168 D01 v02r02 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

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Test Setup

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

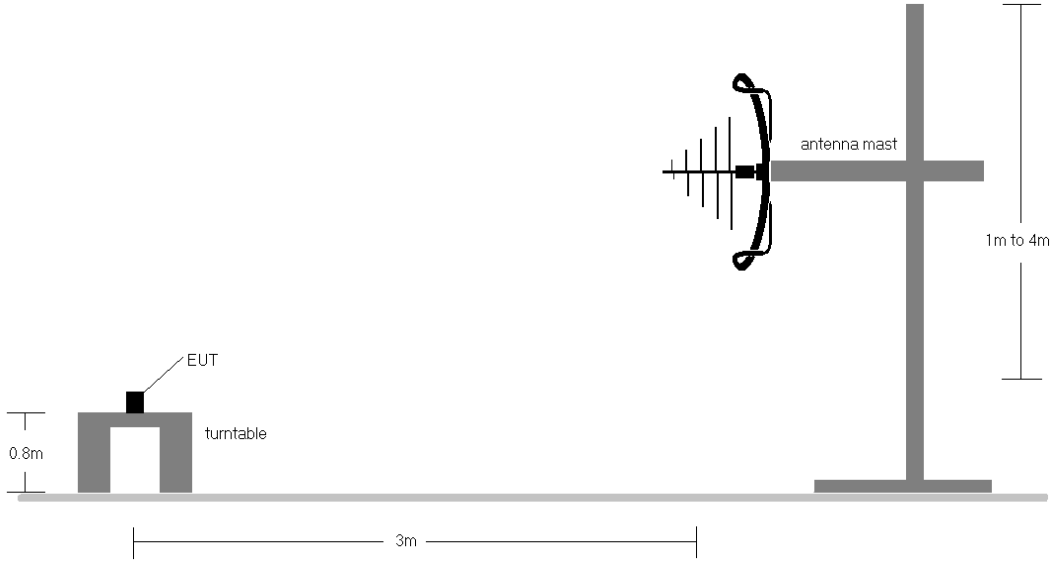

Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

2) This unit was tested with its standard battery.

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

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

5) The spurious emissions 20dB below the limit is not reported.

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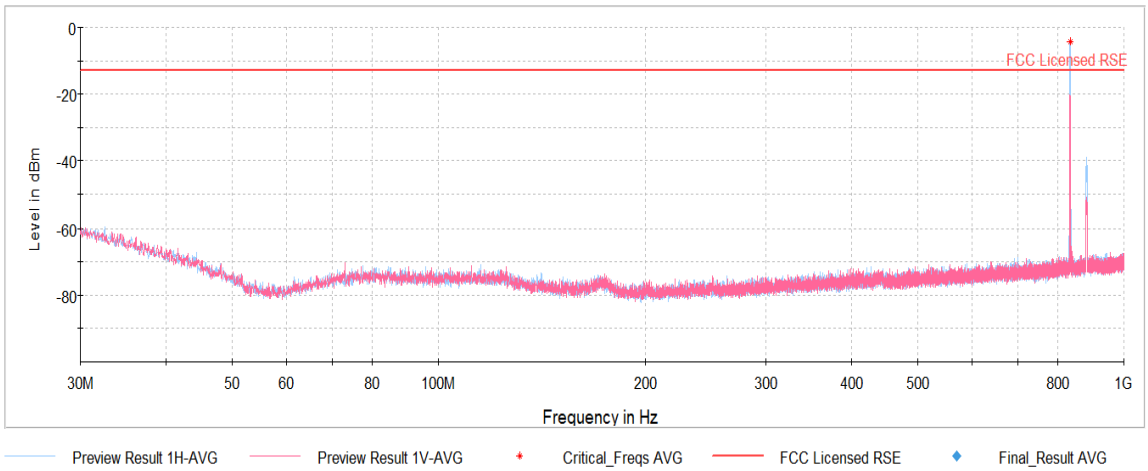
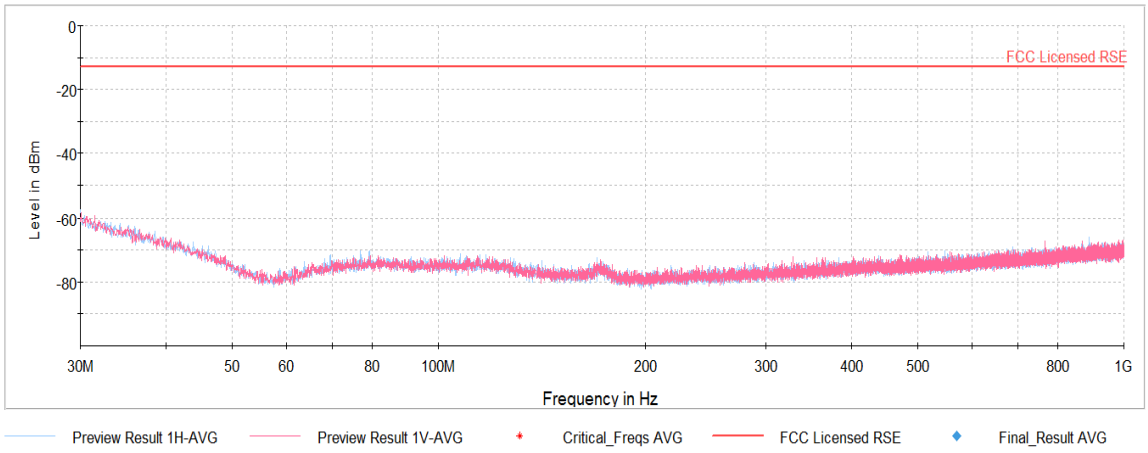


Plot 7-51. Radiated Spurious Plot (Band 5/26 – 3.0MHz QPSK – RB Size 15)



Plot 7-52. Radiated Spurious Plot (Band 7 – 10.0MHz QPSK – RB Size 50)

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7.8 Frequency Stability / Temperature Variation

§2.1055 §22.355 §27.54

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

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

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

For Part 22, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency. For Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure Used

ANSI/TIA-603-E-2016

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

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Band 5/26 Frequency Stability Measurements

§2.1055 §22.355

OPERATING FREQUENCY:	836,500,000	Hz
CHANNEL:	20525	
REFERENCE VOLTAGE:	3.82	VDC
DEVIATION LIMIT:	± 0.00025 % or 2.5 ppm	

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.82	+ 20	836,499,983	-17	-0.0000020
100 %		- 30	836,499,894	-106	-0.0000127
100 %		- 20	836,499,616	-384	-0.0000459
100 %		- 10	836,499,970	-30	-0.0000036
100 %		0	836,499,586	-414	-0.0000495
100 %		+ 10	836,499,885	-115	-0.0000137
100 %		+ 20	836,499,986	-14	-0.0000017
100 %		+ 30	836,500,009	9	0.0000011
100 %		+ 40	836,500,021	21	0.0000025
100 %		+ 50	836,499,973	-27	-0.0000032
BATT. ENDPOINT	3.42	+ 20	836,499,657	-343	-0.0000410

Table 7-11. Frequency Stability Data (Band 5/26)

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Band 5/26 Frequency Stability Measurements

§2.1055 §22.355

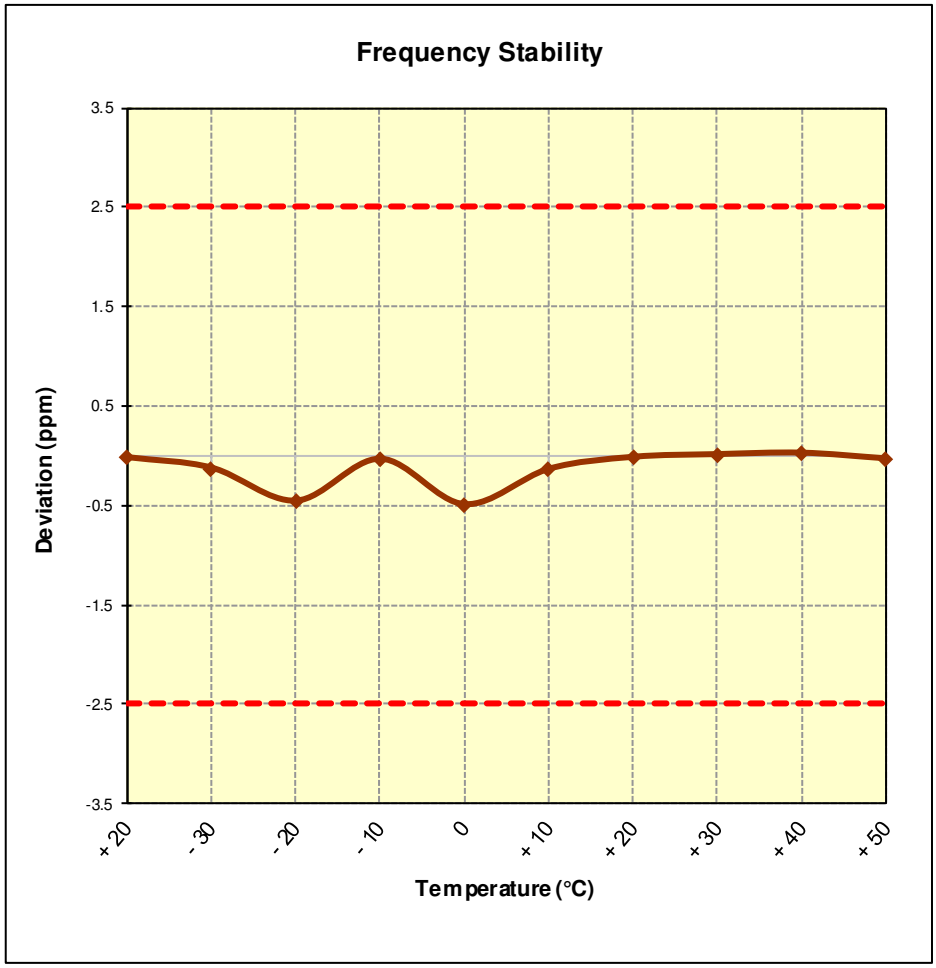

Figure 7-7. Frequency Stability Graph (Band 5/26)

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Band 7 Frequency Stability Measurements

§2.1055 §§27.54

OPERATING FREQUENCY:	2,535,000,000	Hz
CHANNEL:	21100	
REFERENCE VOLTAGE:	3.82	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.82	+ 20	2,534,999,889	-111	-0.0000044
100 %		- 30	2,535,000,038	38	0.0000015
100 %		- 20	2,534,999,922	-78	-0.0000031
100 %		- 10	2,535,000,027	27	0.0000011
100 %		0	2,535,000,331	331	0.0000131
100 %		+ 10	2,534,999,648	-352	-0.0000139
100 %		+ 20	2,535,000,072	72	0.0000028
100 %		+ 30	2,535,000,014	14	0.0000006
100 %		+ 40	2,534,999,968	-32	-0.0000013
100 %		+ 50	2,534,999,597	-403	-0.0000159
BATT. ENDPOINT	3.42	+ 20	2,535,000,052	52	0.0000021

Table 7-12. Frequency Stability Data (Band 7)

Note:

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

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Band 7 Frequency Stability Measurements

§2.1055 §§27.54

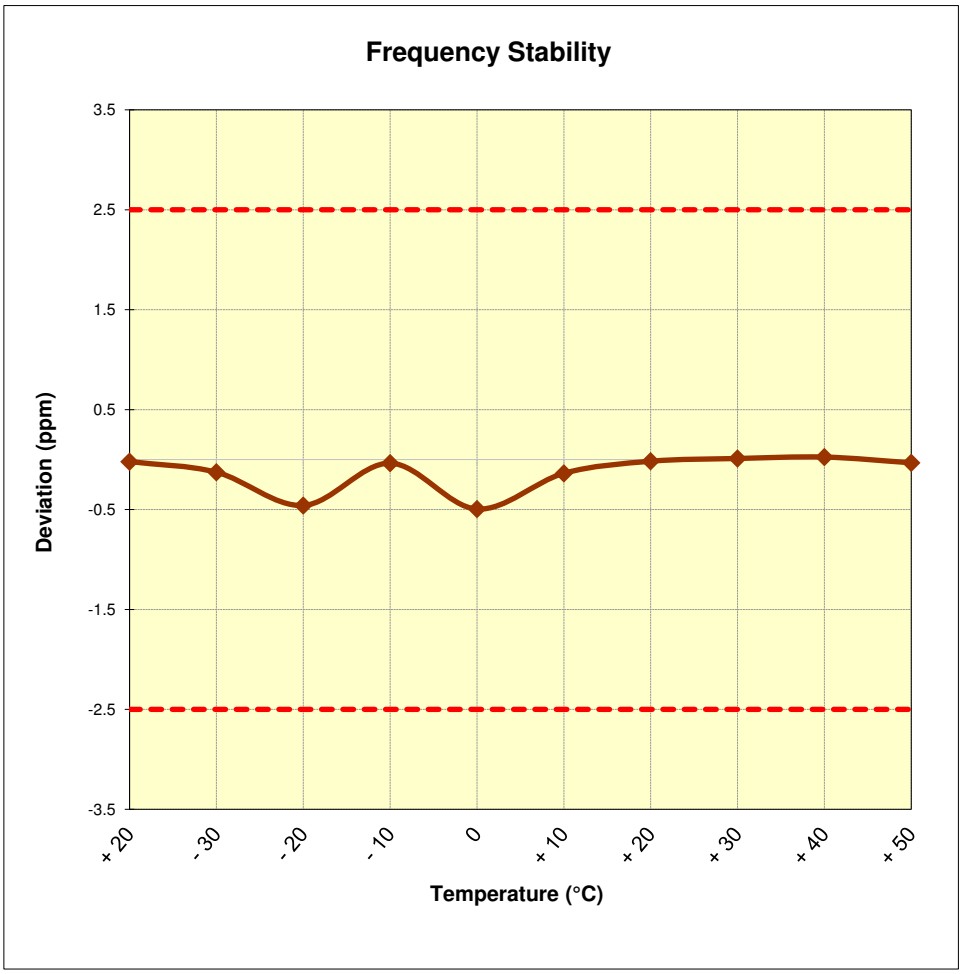

Figure 7-8. Frequency Stability Graph (Band 7)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Apple Watch** **FCC ID: BCG-A1889** complies with all the requirements of Parts 22 & 27 of the FCC rules for LTE operation only.

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