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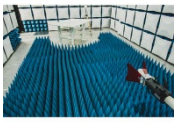

MEASUREMENT REPORT
Part 96 LTE

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

Date of Testing:
9/12 - 10/2/2019
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1909120153-05-R1.ZNF

FCC ID:	**ZNFQ620WA**
APPLICANT:	**LG Electronics USA, Inc.**

Application Type:	Certification
Model:	LM-Q620WA
Additional Models:	LMQ620WA, Q620WA, LM-Q620VA, LMQ620VA, Q620VA, LM-Q620VL, LMQ620VL, Q620VL, LM-Q620QM6, LMQ620QM6, Q620QM6, LM-Q620QM, LMQ620QM, Q620QM
EUT Type:	Portable Handset
FCC Classification:	Citizens Band End User Devices (CBE)
FCC Rule Part(s):	96
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 940660 D01 v02, WINNF-TS-0122 V1.0.0

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.

Note: This revised Test Report (S/N: 1M1909120153-05-R1.ZNF) supersedes and replaces the previously issued test report 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.

Randy Ortanez
President

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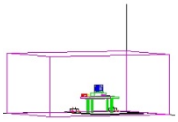
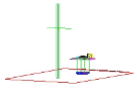


MEASUREMENT REPORT
FCC Part 96



Mode	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
			Max. Power (W)	Max. Power (dBm)		
LTE Band 48	96	3552.5 - 3697.5	0.067	18.27	4M54G7D	QPSK
LTE Band 48	96	3552.5 - 3697.5	0.051	17.09	4M53W7D	16QAM
LTE Band 48	96	3552.5 - 3697.5	0.044	16.46	4M52W7D	64QAM
LTE Band 48	96	3555 - 3695	0.065	18.12	9M01G7D	QPSK
LTE Band 48	96	3555 - 3695	0.043	16.37	9M02W7D	16QAM
LTE Band 48	96	3555 - 3695	0.037	15.71	9M01W7D	64QAM
LTE Band 48	96	3557.5 - 3692.5	0.067	18.25	13M5G7D	QPSK
LTE Band 48	96	3557.5 - 3692.5	0.043	16.29	13M5W7D	16QAM
LTE Band 48	96	3557.5 - 3692.5	0.038	15.79	13M4W7D	64QAM
LTE Band 48	96	3560 - 3690	0.059	17.70	18M0G7D	QPSK
LTE Band 48	96	3560 - 3690	0.038	15.77	17M9W7D	16QAM
LTE Band 48	96	3560 - 3690	0.028	14.53	17M9W7D	64QAM

EUT Overview (LTE B48)

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

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

- PCTEST is a CBRS Alliance (OnGo) Approved Test Lab
- PCTEST is a WInnForum Approved Test Lab
- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for CBRS Alliance Certification Test Plan and WInnForum Conformance and Performance Test Technical Standard.
- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFQ620WA**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 operation in the CBRS band.

Test Device Serial No.: 0022M, 0502M, 0510M, 0367M, 0650M

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n/ac WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE), NFC

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

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

3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions' occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

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

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

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

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

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4.0 MEASUREMENT UNCERTAINTY

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

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

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5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	LTx3	LIcensed Transmitter Cable Set	6/3/2019	Annual	6/3/2020	LTx3
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	135427
ETS-Lindgren	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	4/19/2019	Annual	4/19/2020	11401010036
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/8/2019	Annual	7/8/2020	102133
Rohde & Schwarz	NC-100	Torque Wrench (8" lb)	5/10/2018	Biennial	5/10/2020	N/A
Rohde & Schwarz	3816/2NM	Line Impedance Stabilization Network	6/18/2018	Biennial	6/18/2020	114451
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	10/8/2018	Annual	10/8/2019	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	10/8/2018	Annual	10/8/2019	100037
Seekonk	FSW67	Signal / Spectrum Analyzer	5/6/2019	Annual	5/6/2020	103200

Table 5-1. Test Equipment

Notes:

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

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6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

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

QAM Modulation

Emission Designator = 8M45W7D

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

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analzyer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (-24.80).

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7.0 TEST RESULTS

7.1 Summary

Company Name: LG Electronics USA, Inc.

FCC ID: ZNFQ620WA

FCC Classification: Citizens Band End User Devices (CBE)

Mode(s): LTE

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1046	Transmitter Conducted Output Power	N/A		PASS	See RF Exposure Report
2.1051 96.41(e)	Out of Band Emissions	-13 dBm/Mhz at frequencies within 0-10MHz of channel edge -25 dBm/MHz at frequencies greater than 10MHz above and below channel edge -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz		PASS	Section 7.3, 7.4
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	Section 7.7
96.47	End User Device Additional Requirements (CBSD Protocol)	End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation. An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.		PASS	Section 7.8

Table 7-1. Summary of Conducted Test Results

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FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
96.41(b)	Equivalent Isotropic Radiated Power (EIRP)	23 dBm/10MHz	RADIATED	PASS	Section 7.5
2.1053 96.41(e)	Undesirable Emissions	-40 dBm/MHz		PASS	Section 7.6

Table 7-2. Summary of Radiated Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots 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 5.1.

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7.2 Occupied Bandwidth
§2.1049

Test Overview

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

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

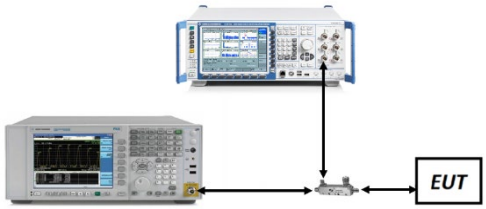

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None.

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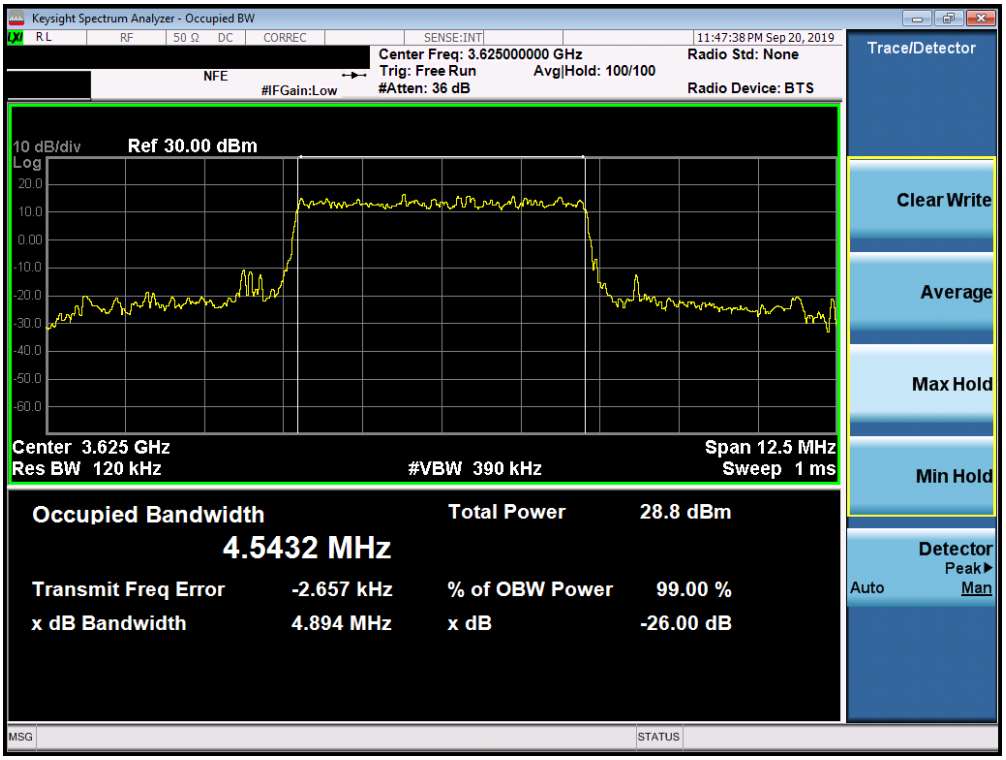
Band 48



Plot 7-1. Occupied Bandwidth Plot (Band 48 - 5.0MHz QPSK - Full RB Configuration)

Plot 7-2. Occupied Bandwidth Plot (Band 48 - 5.0MHz 16-QAM - Full RB Configuration)

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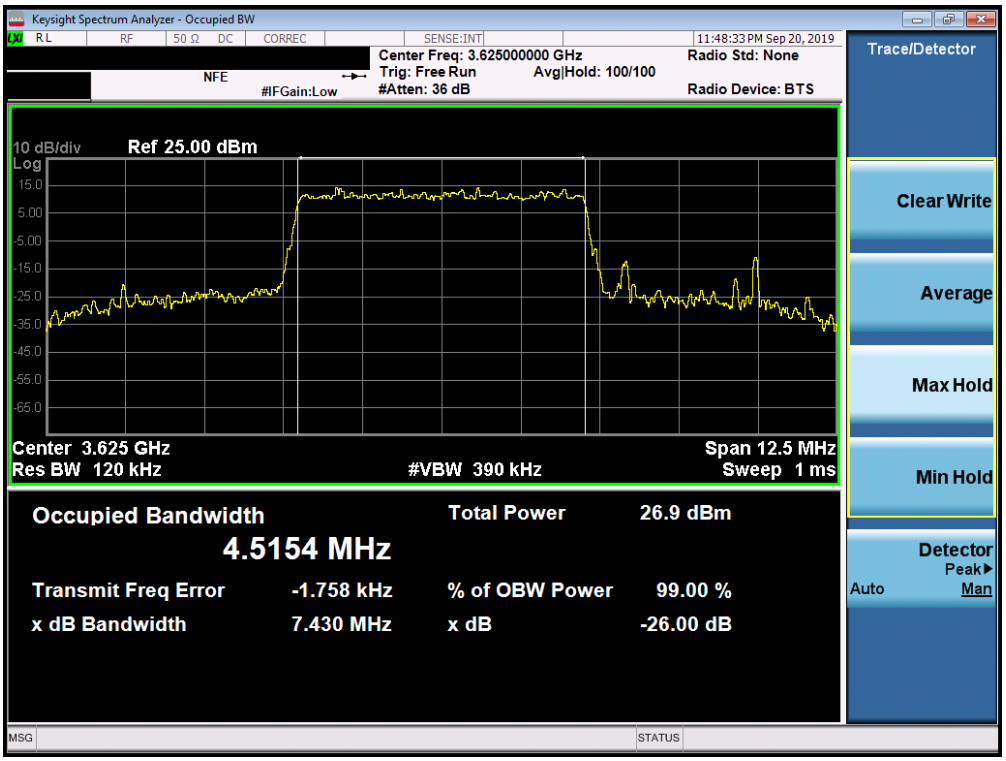
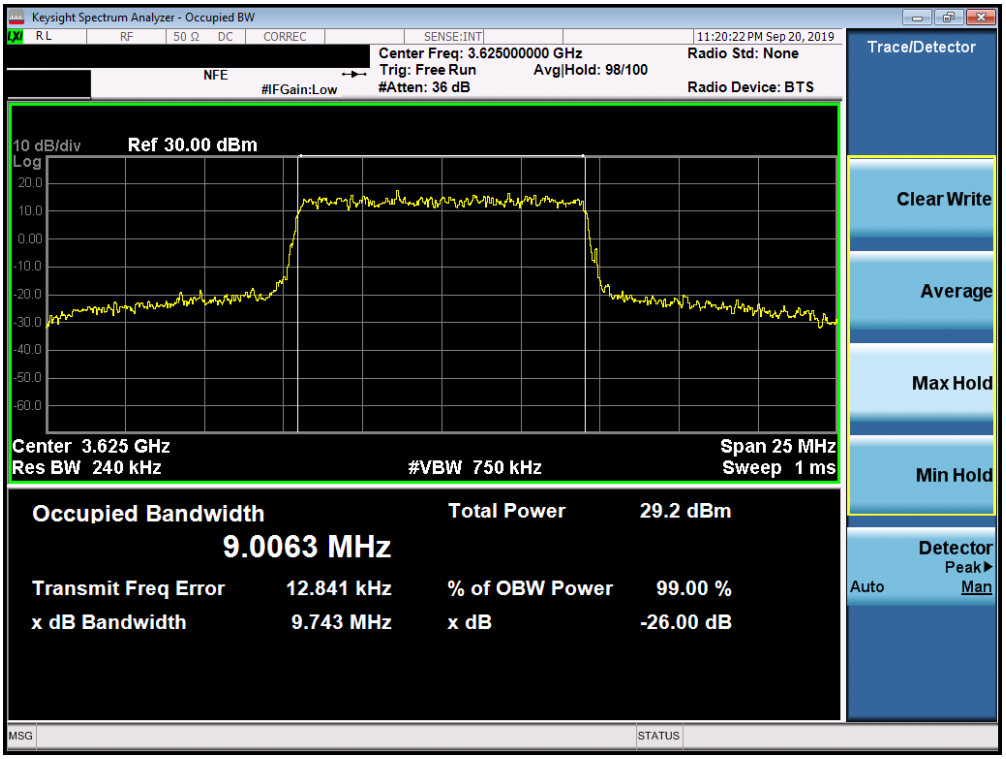


Plot 7-3. Occupied Bandwidth Plot (Band 48 - 5.0MHz 64-QAM - Full RB Configuration)



Plot 7-4. Occupied Bandwidth Plot (Band 48 - 10.0MHz QPSK - Full RB Configuration)

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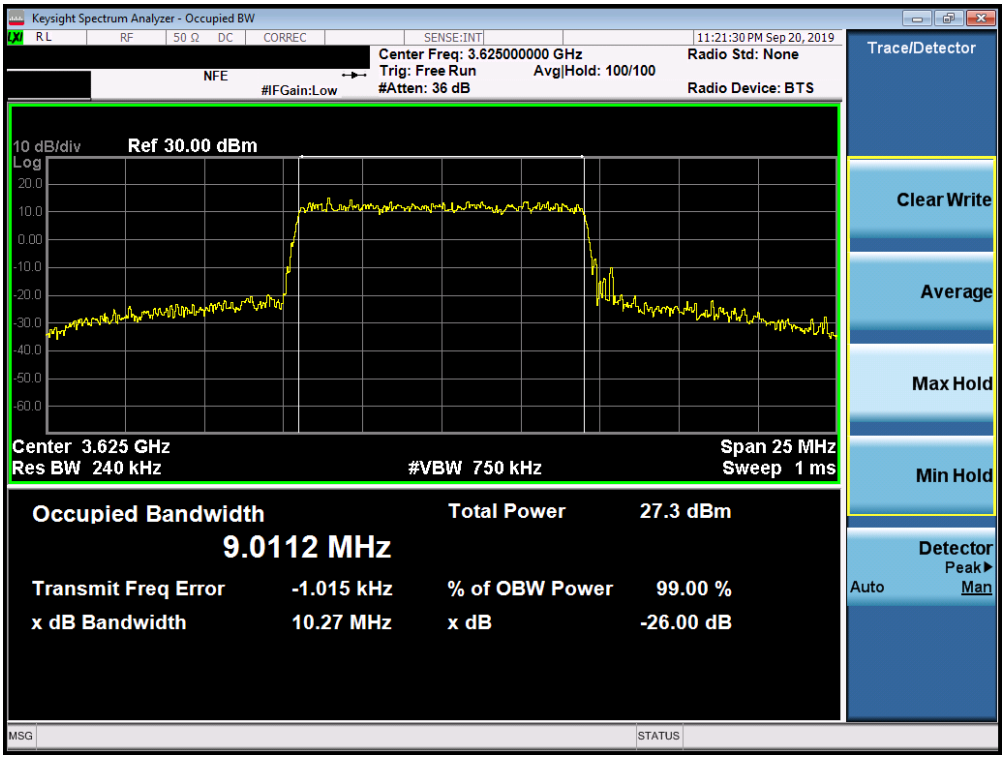
Plot 7-5. Occupied Bandwidth Plot (Band 48 - 10.0MHz 16-QAM - Full RB Configuration)



Plot 7-6. Occupied Bandwidth Plot (Band 48 - 10.0MHz 64-QAM - Full RB Configuration)

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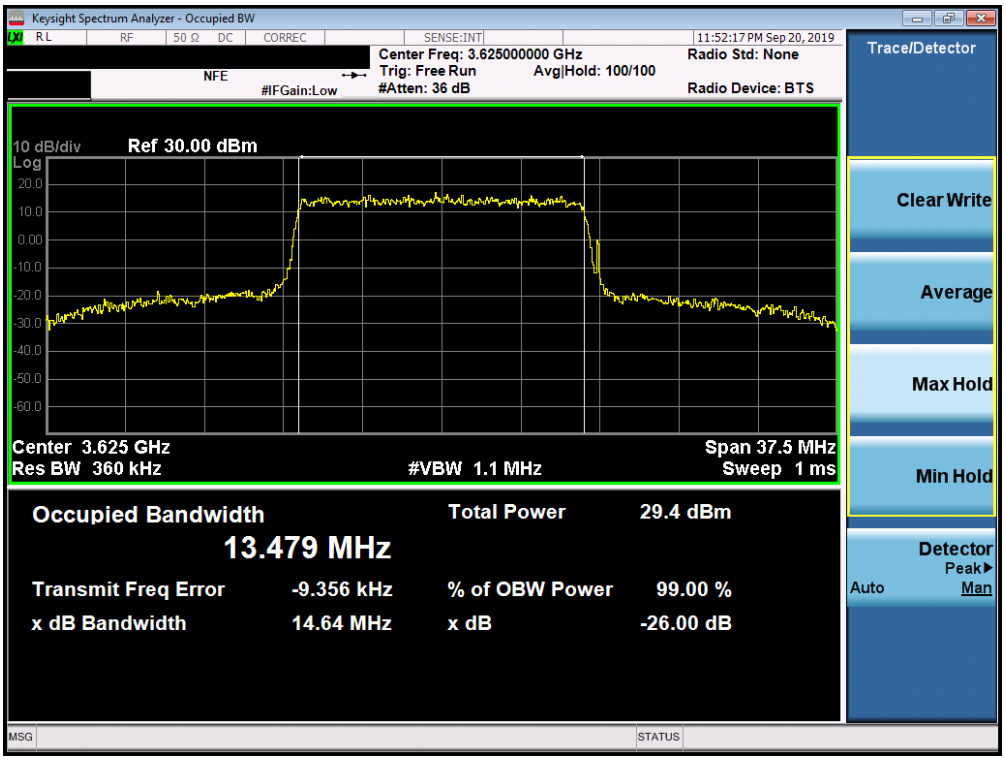
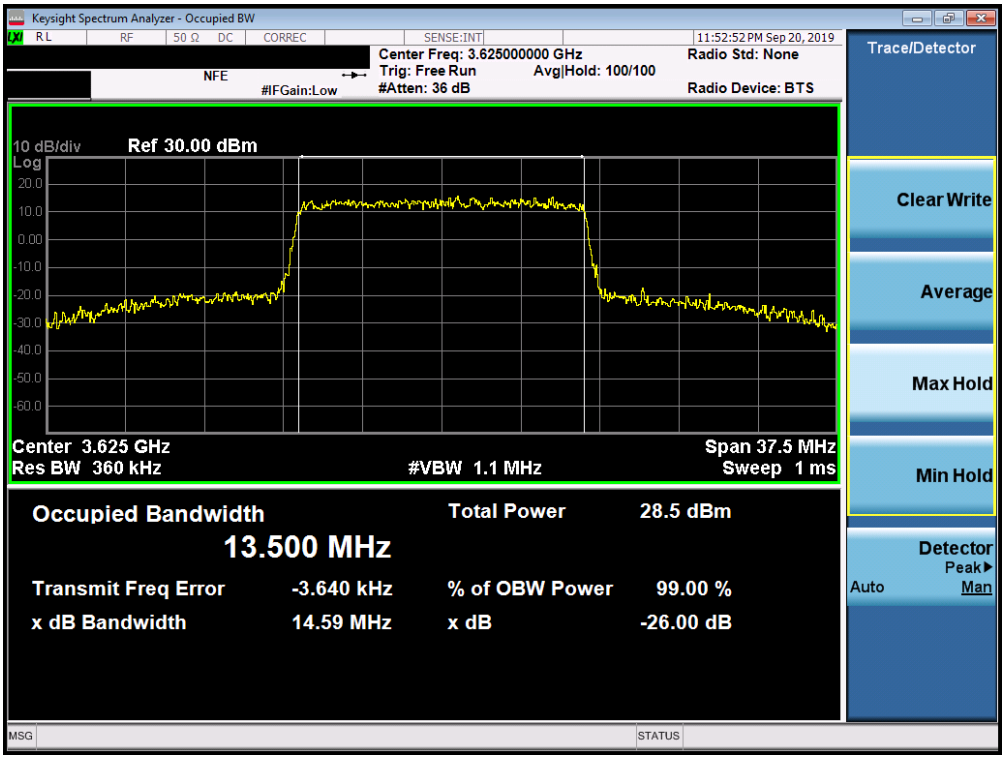


Plot 7-7. Occupied Bandwidth Plot (Band 48 - 15.0MHz QPSK - Full RB Configuration)



Plot 7-8. Occupied Bandwidth Plot (Band 48 - 15.0MHz 16-QAM - Full RB Configuration)

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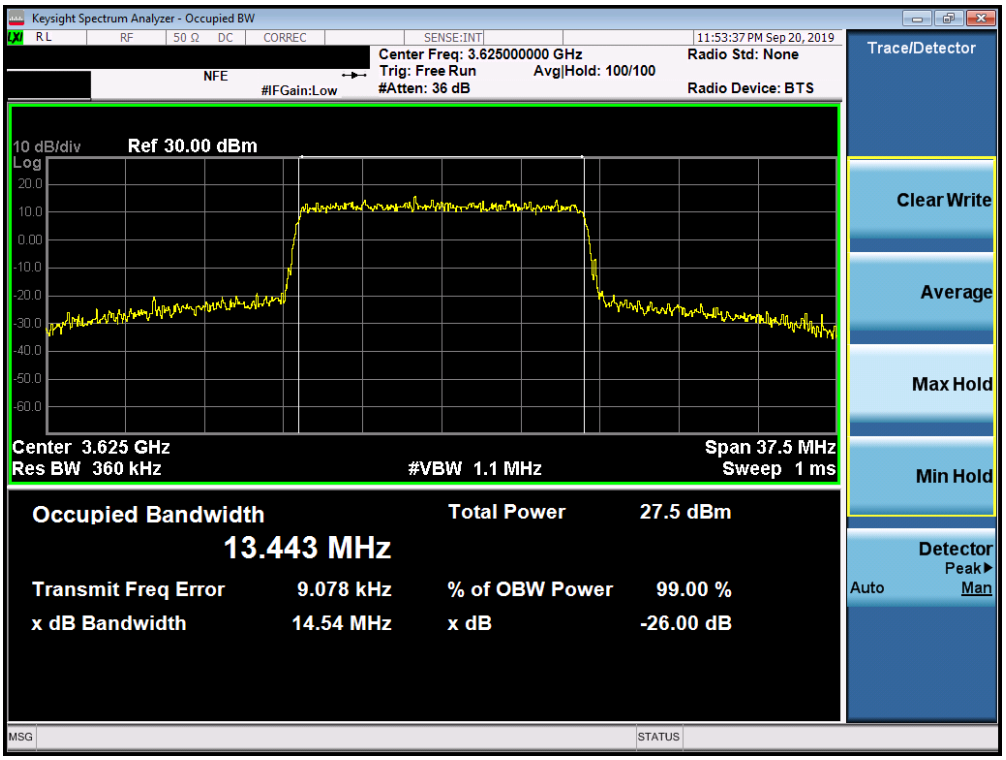
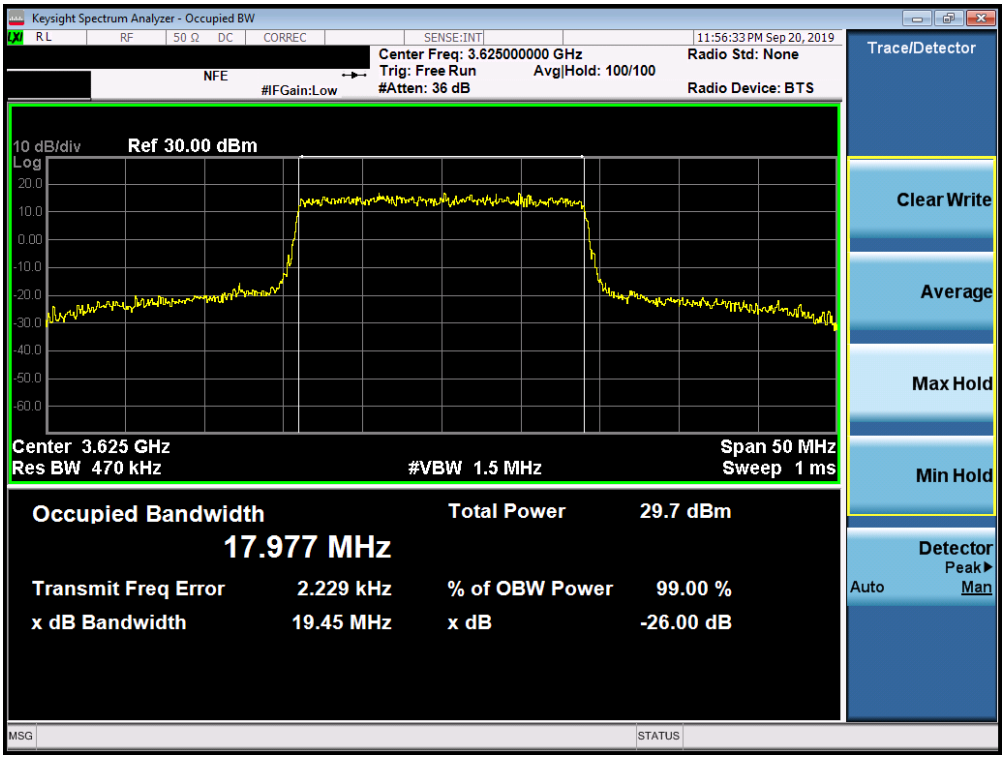


Plot 7-9. Occupied Bandwidth Plot (Band 48 - 15.0MHz 64-QAM - Full RB Configuration)



Plot 7-10. Occupied Bandwidth Plot (Band 48 - 20.0MHz QPSK - Full RB Configuration)

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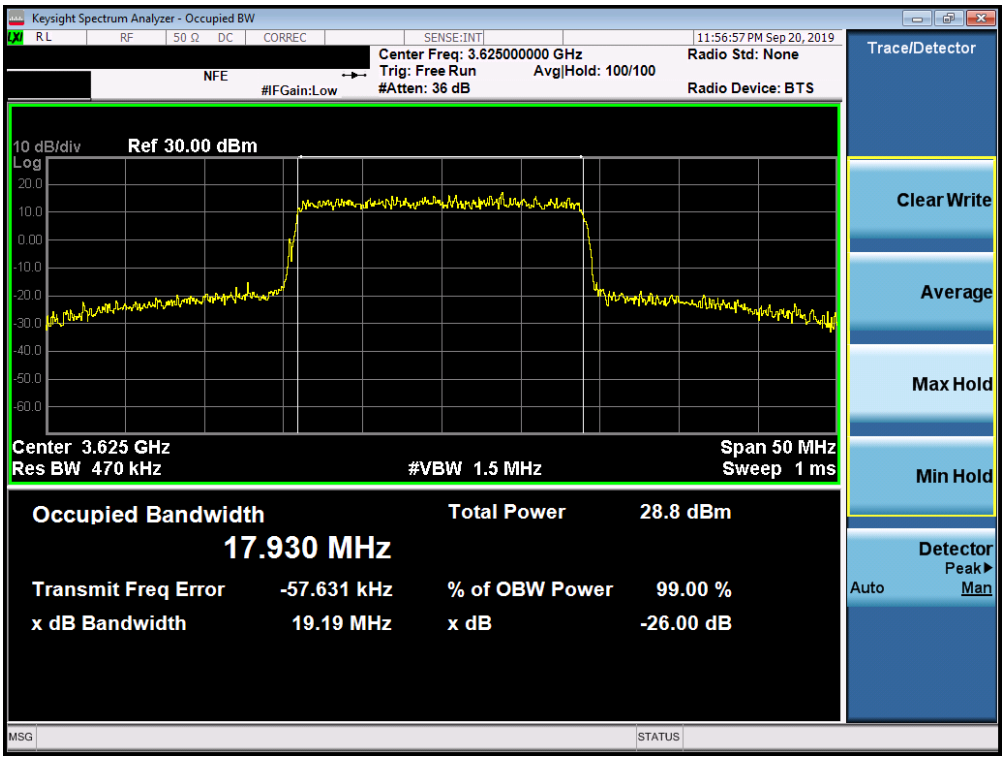
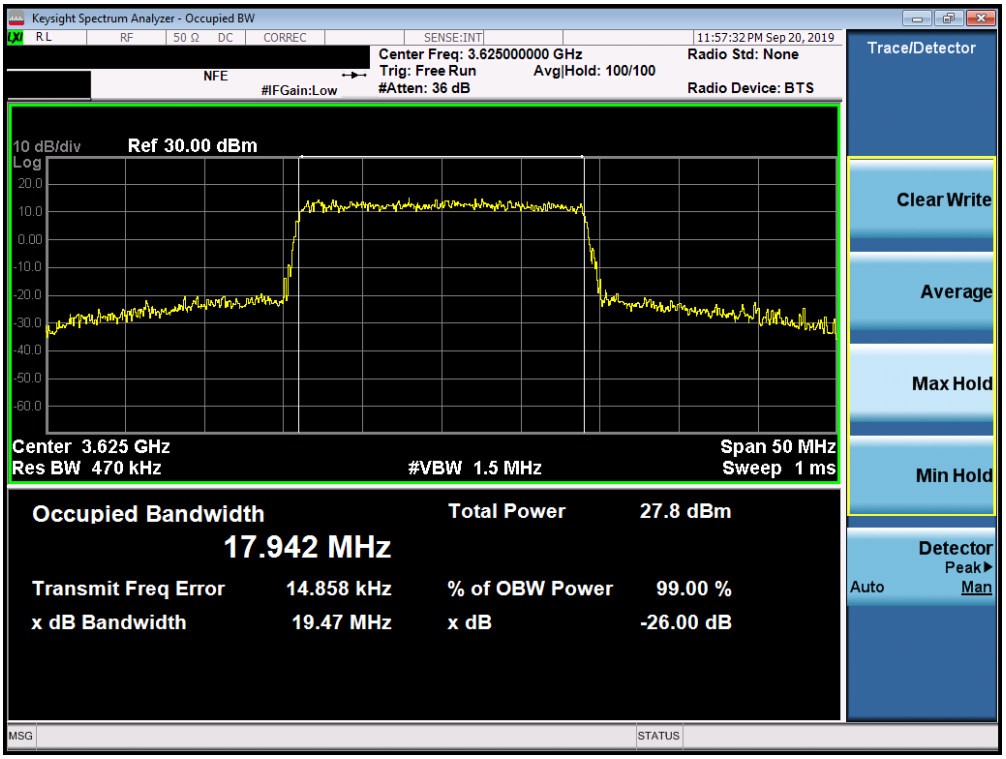


Plot 7-11. Occupied Bandwidth Plot (Band 48 - 20.0MHz 16-QAM - Full RB Configuration)



Plot 7-12. Occupied Bandwidth Plot (Band 48 - 20.0MHz 64-QAM - Full RB Configuration)

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7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §96.41(e)

Test Overview

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

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/Mhz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = Max Hold
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

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

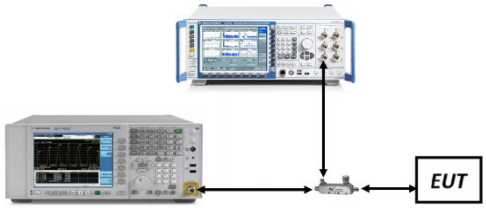

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

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

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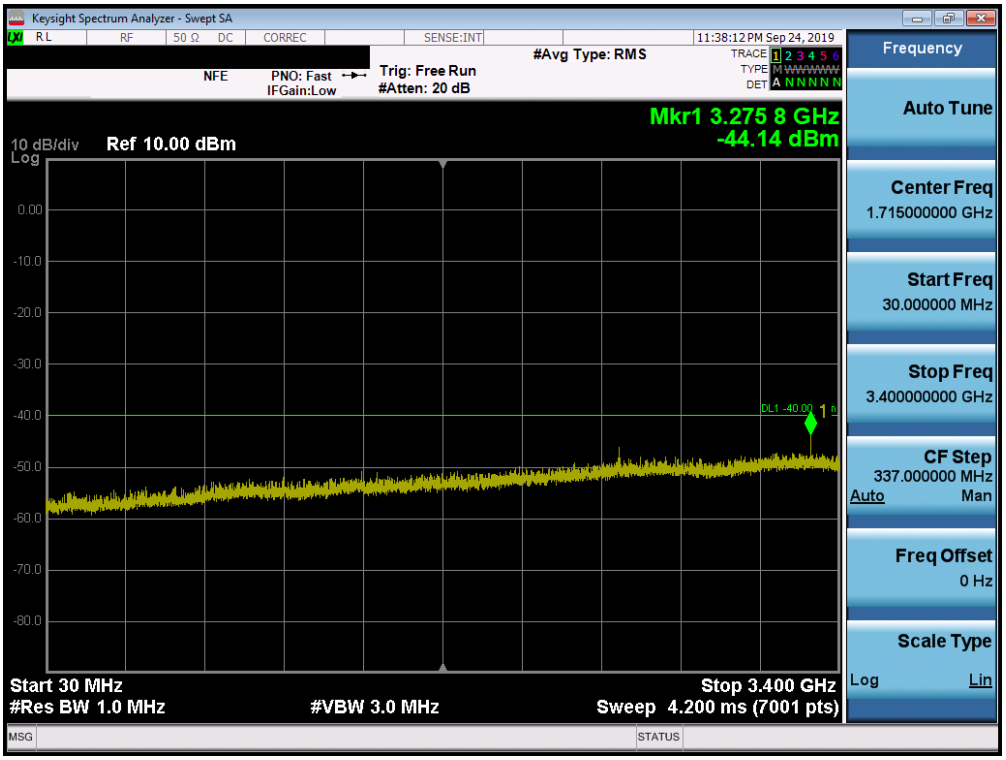
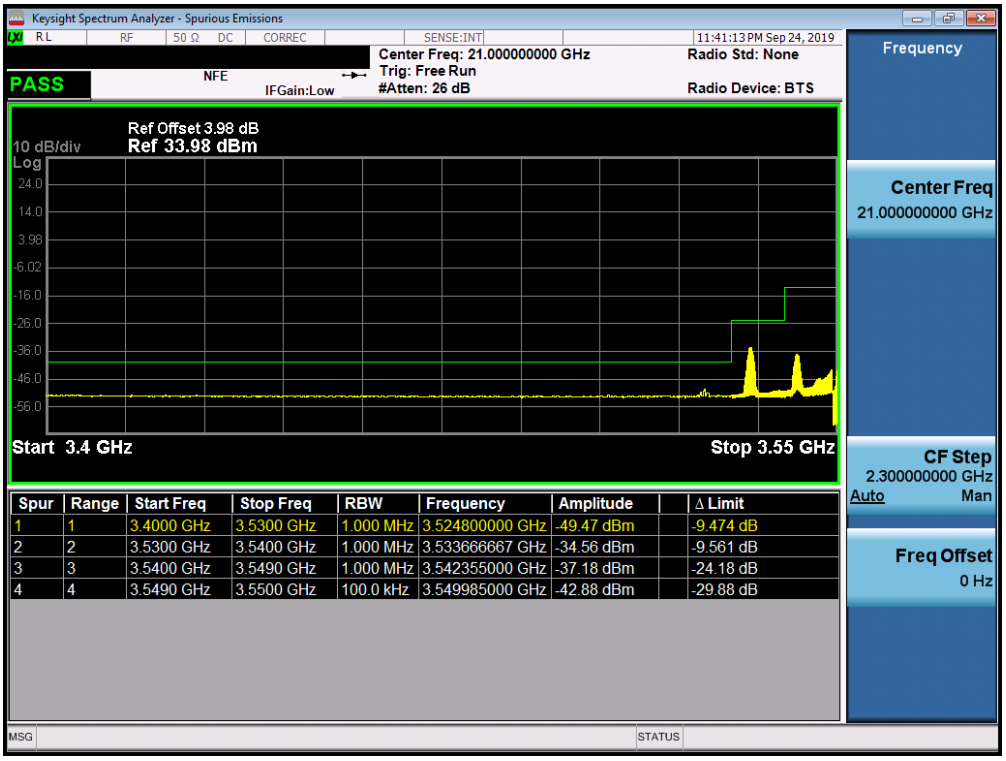
Band 48



Plot 7-13. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude		Δ Limit
1	1	3.4000 GHz	3.5300 GHz	1.000 MHz	3.524800000 GHz	-49.47 dBm		-9.474 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.533666667 GHz	-34.56 dBm		-9.561 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.542355000 GHz	-37.18 dBm		-24.18 dB
4	4	3.5490 GHz	3.5500 GHz	100.0 kHz	3.549985000 GHz	-42.88 dBm		-29.88 dB

Plot 7-14. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

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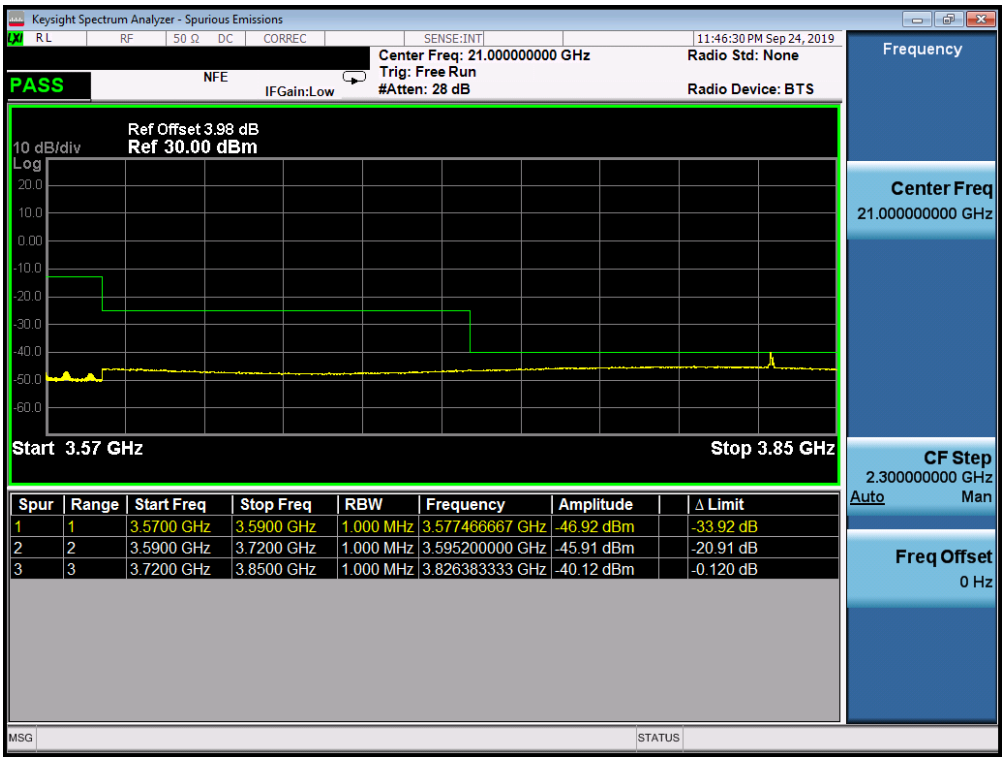
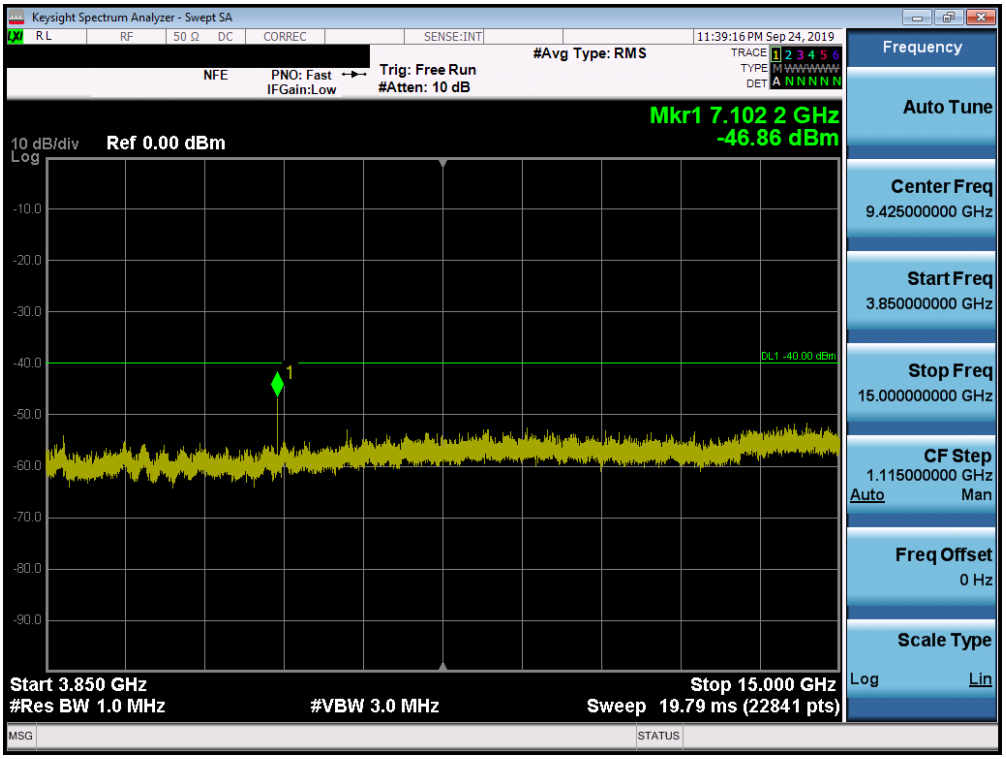


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5700 GHz	3.5900 GHz	1.000 MHz	3.577466667 GHz	-46.92 dBm	-33.92 dB
2	2	3.5900 GHz	3.7200 GHz	1.000 MHz	3.595200000 GHz	-45.91 dBm	-20.91 dB
3	3	3.7200 GHz	3.8500 GHz	1.000 MHz	3.826383333 GHz	-40.12 dBm	-0.120 dB

Plot 7-15. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-16. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)

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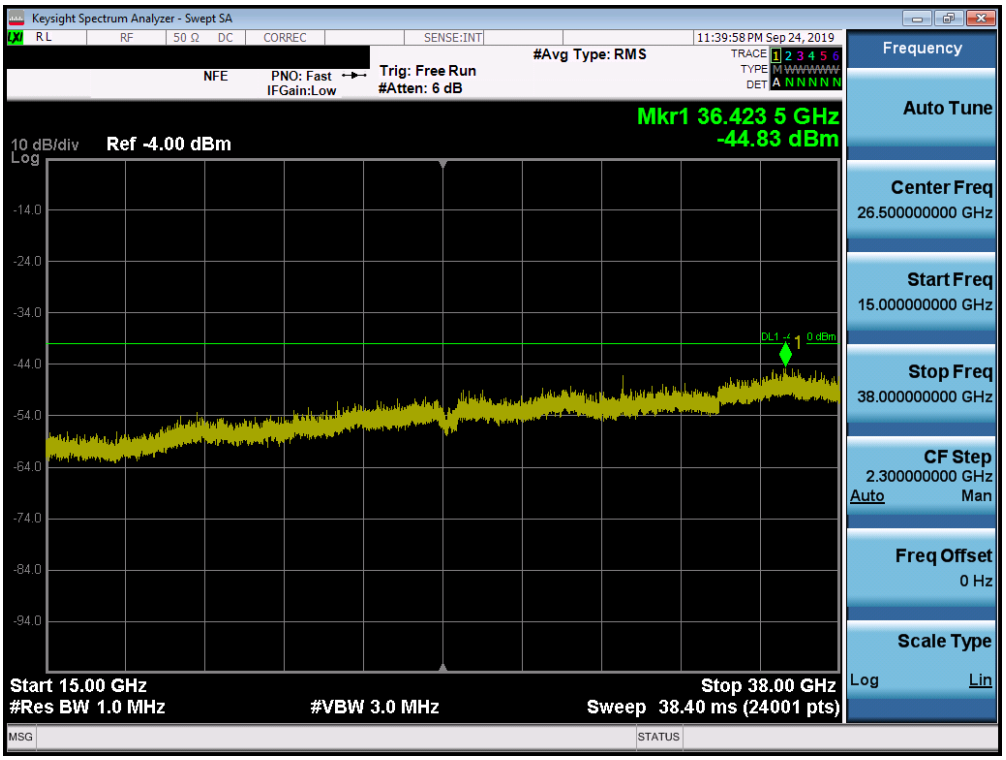
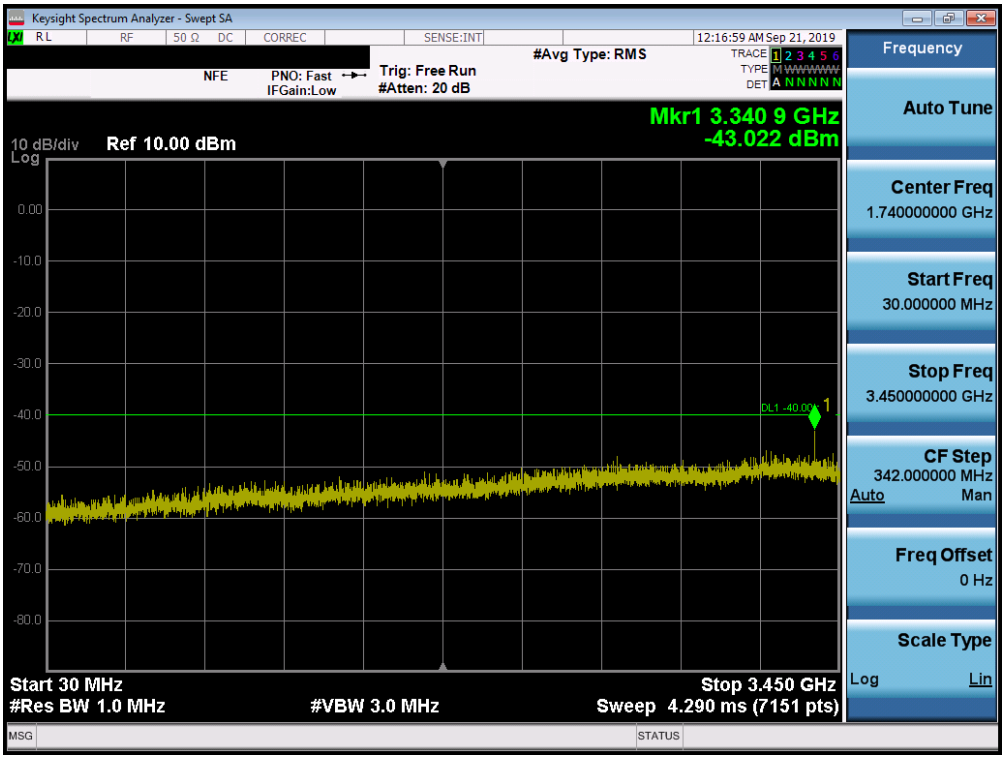


Plot 7-17. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Low Channel)



Plot 7-18. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

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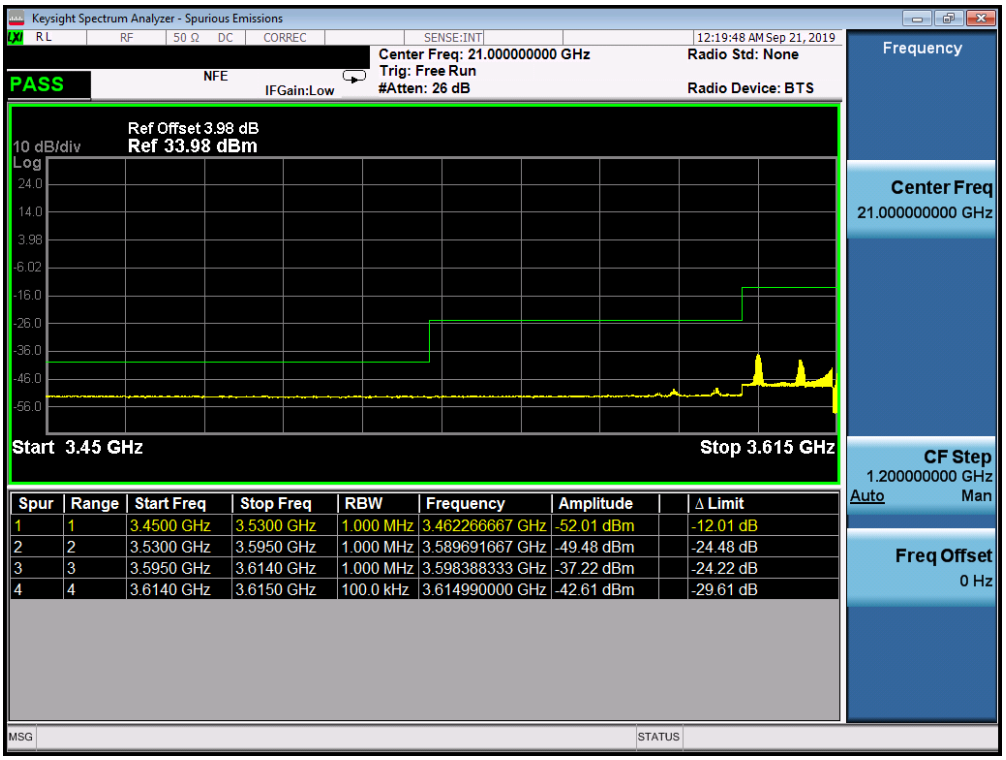
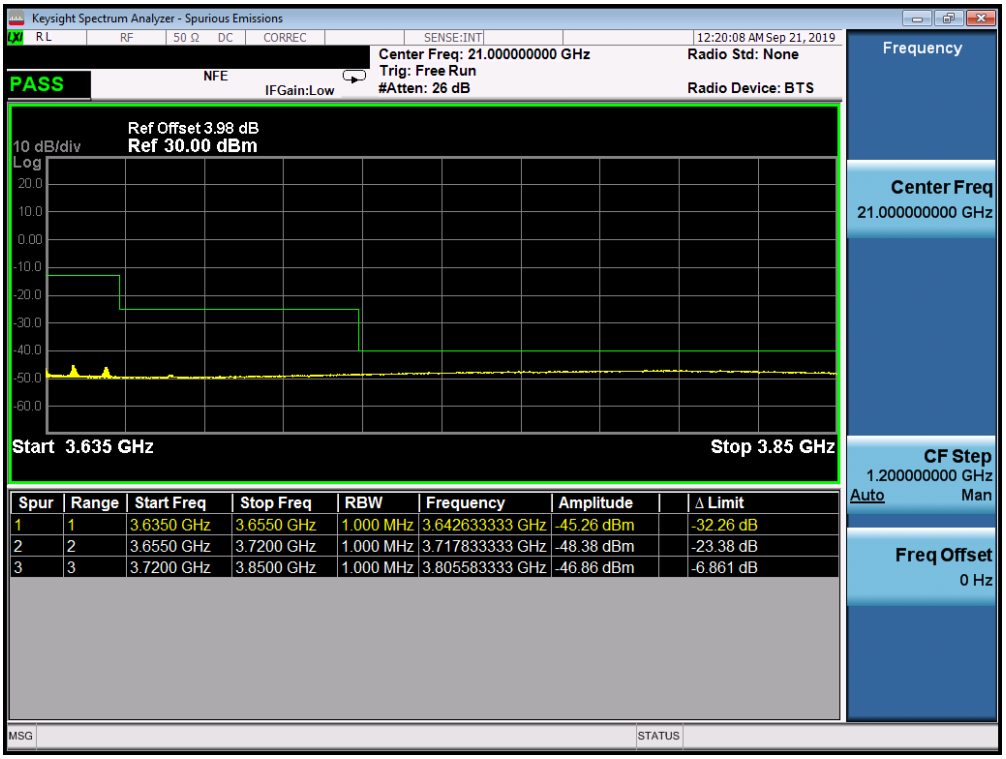


Plot 7-19. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-20. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

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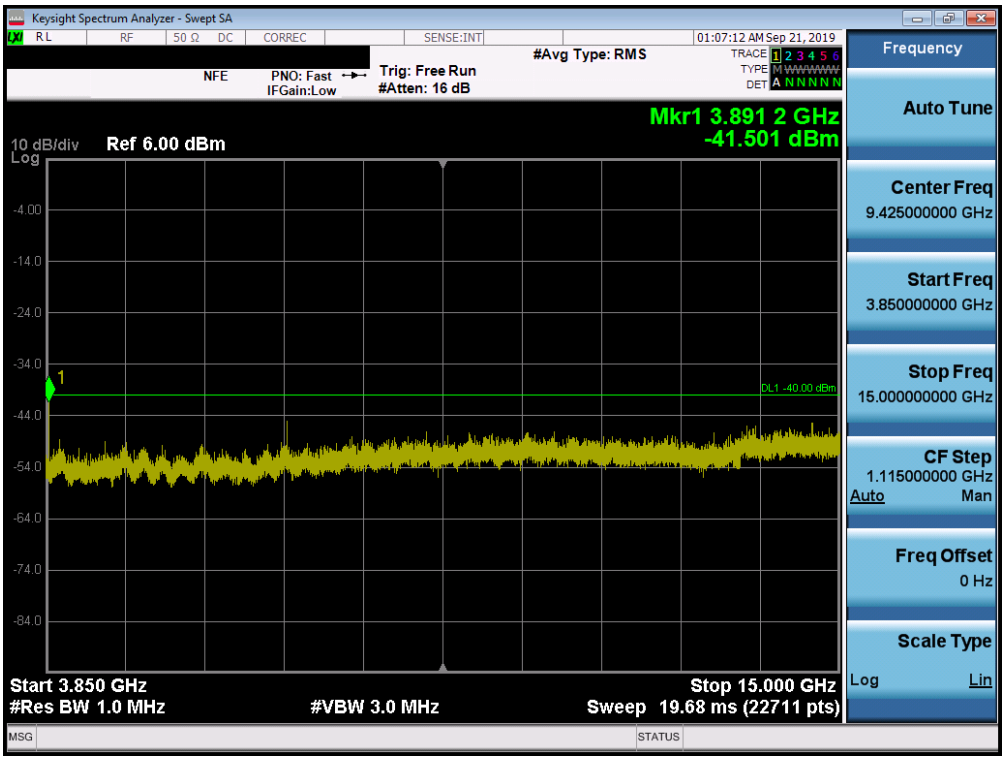
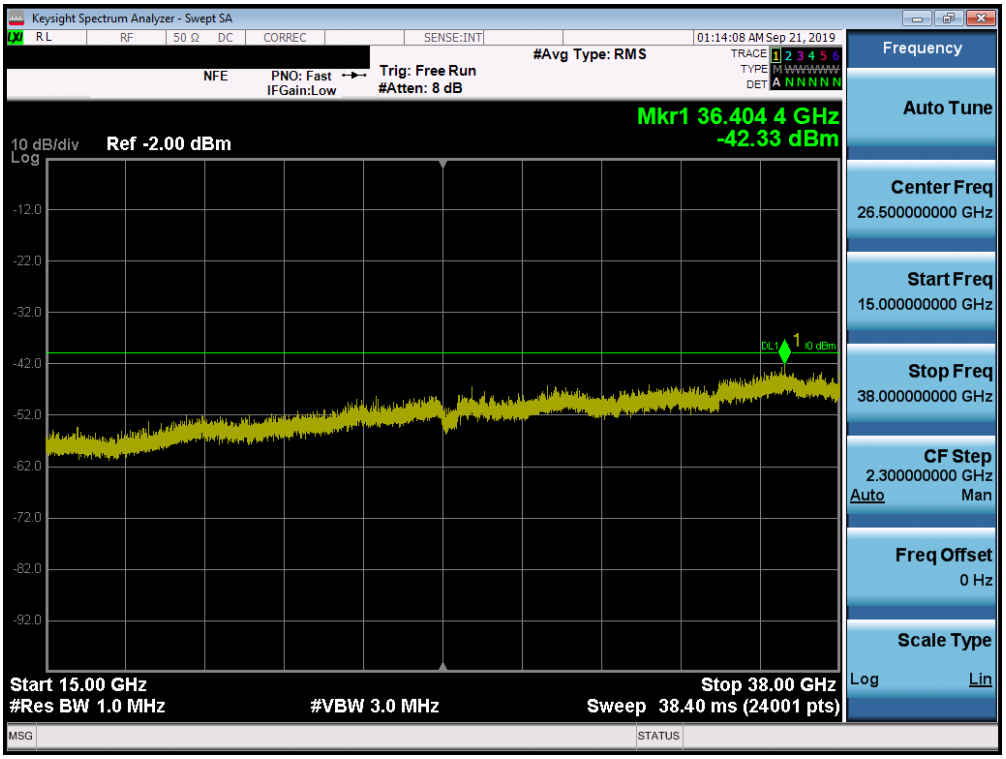


Plot 7-21. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)



Plot 7-22. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 0 - Mid Channel)

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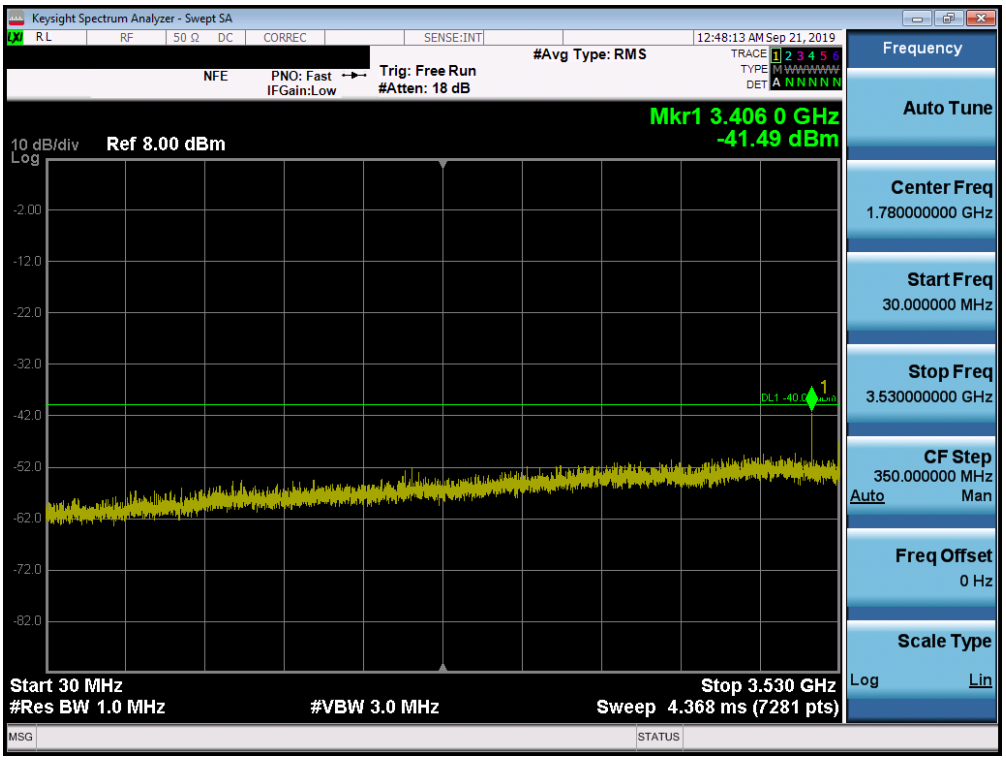
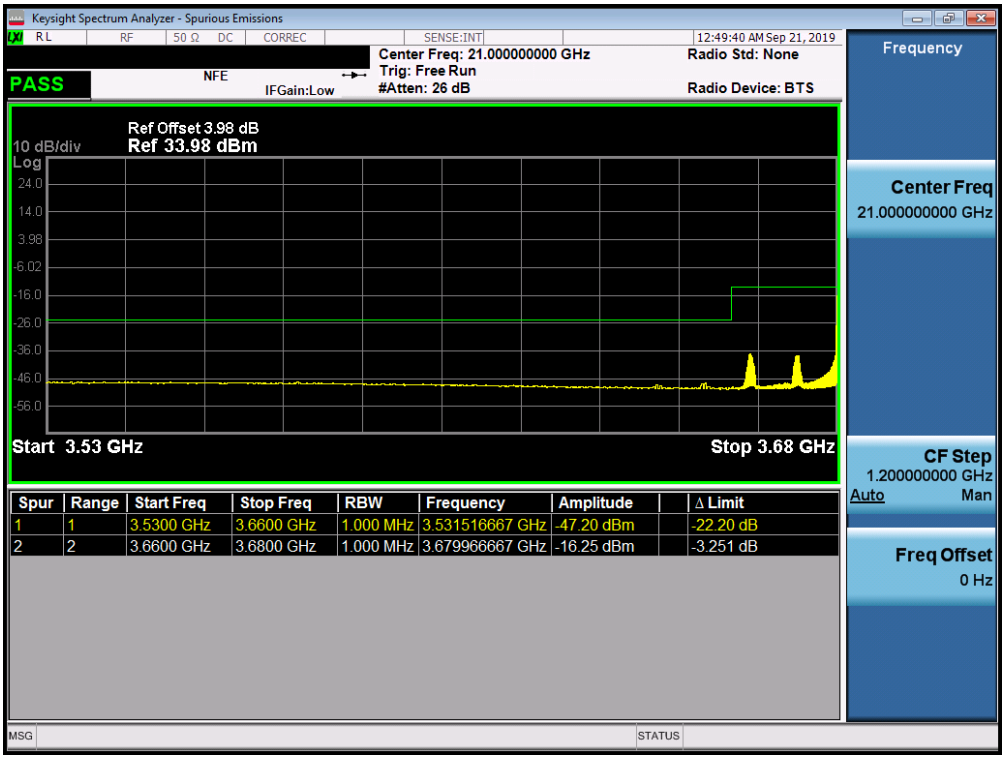


Plot 7-23. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 99 - High Channel)



Plot 7-24. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 99 - High Channel)

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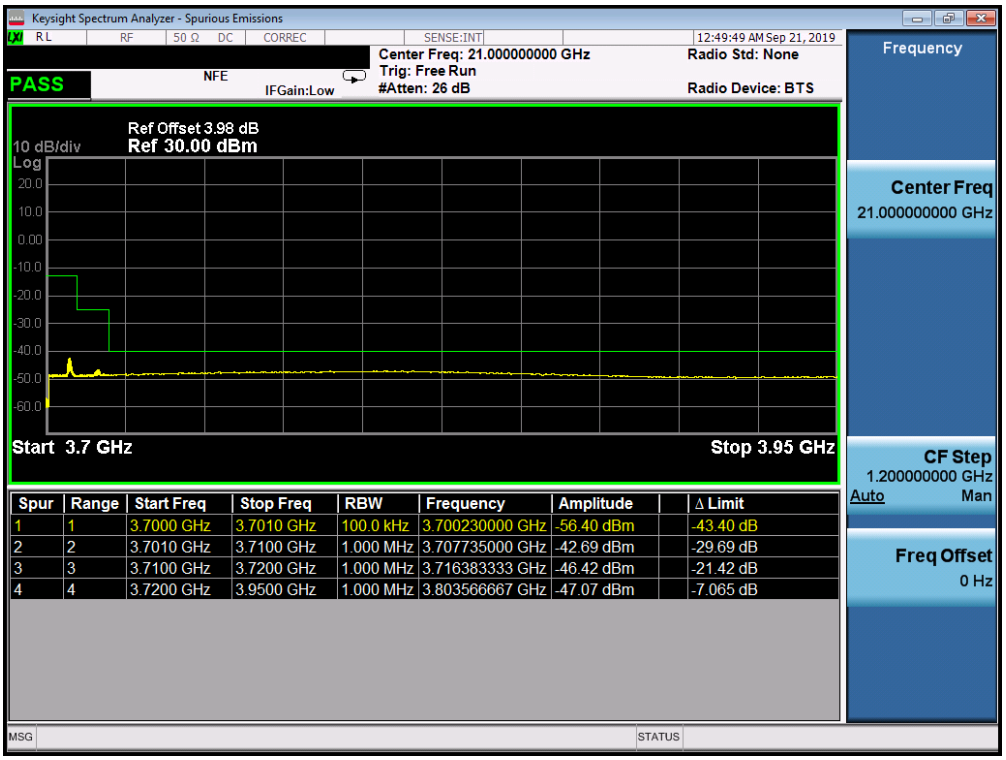
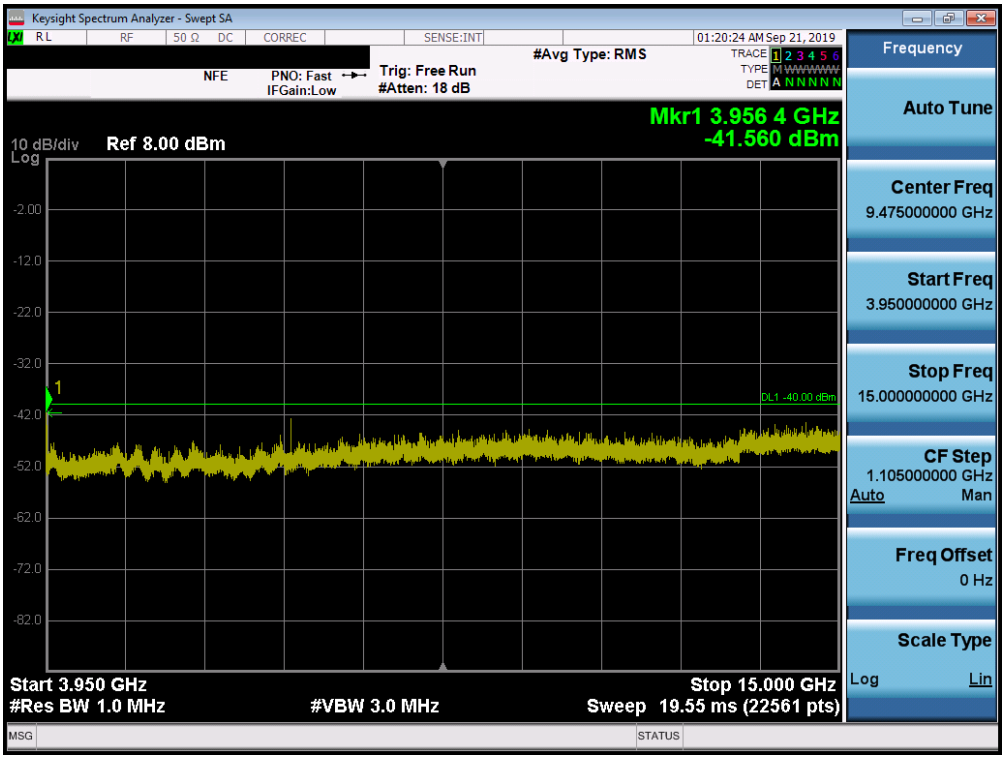


Plot 7-25. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 99 – High Channel)



Plot 7-26. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 99 - High Channel)

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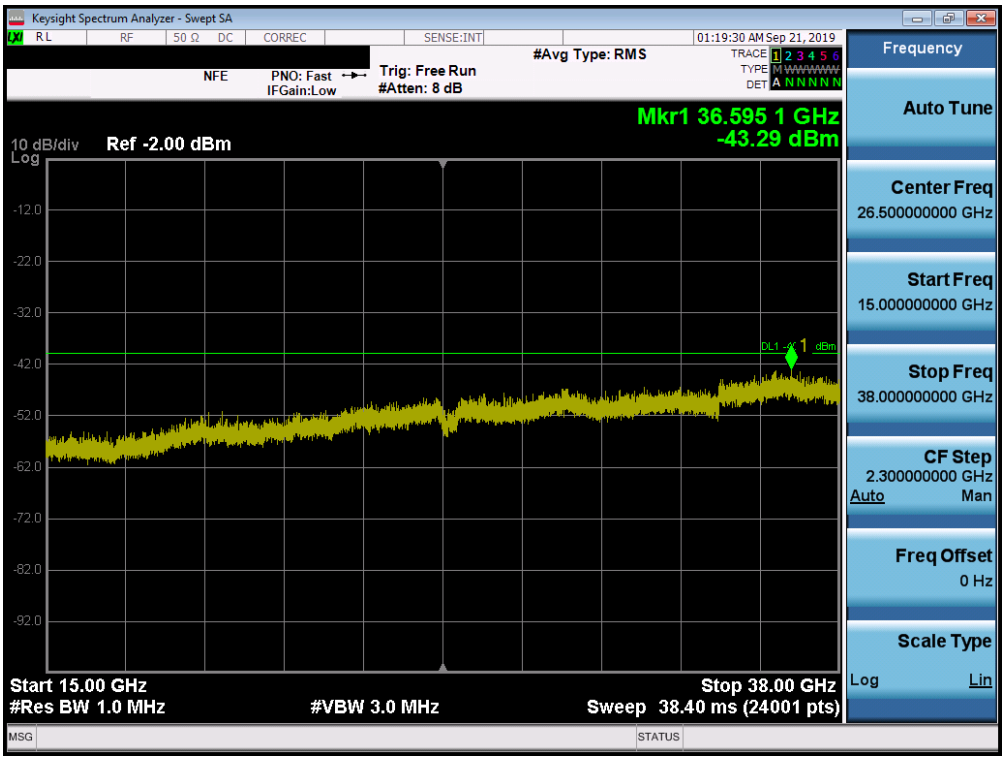

Plot 7-27. Conducted Spurious Plot (Band 48 - 20.0MHz QPSK - RB Size 1, RB Offset 99 - High Channel)

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7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §96.41(e)

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 conducted power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any emission shall not exceed −25 dBm/MHz.

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/Mhz.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

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

Test Setup

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

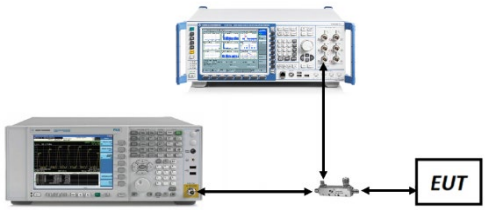

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

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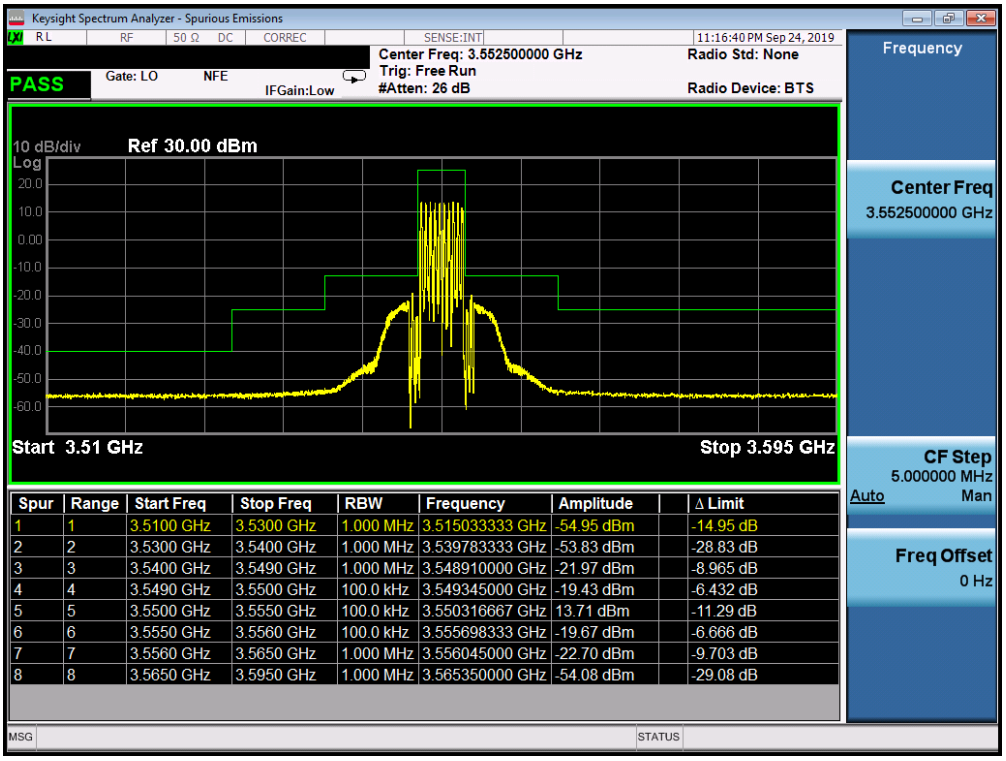
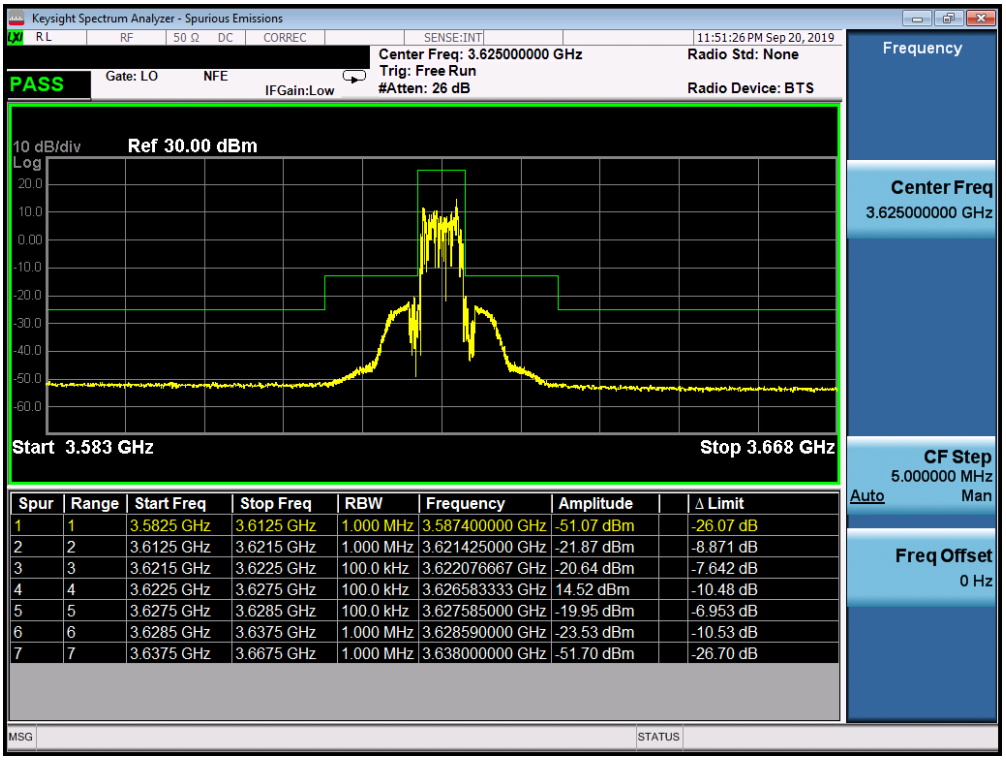
Band 48



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.515033333 GHz	-54.95 dBm	-14.95 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539783333 GHz	-53.83 dBm	-28.83 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548910000 GHz	-21.97 dBm	-8.965 dB
4	4	3.5490 GHz	3.5500 GHz	100.0 kHz	3.549345000 GHz	-19.43 dBm	-6.432 dB
5	5	3.5500 GHz	3.5550 GHz	100.0 kHz	3.550316667 GHz	13.71 dBm	-11.29 dB
6	6	3.5550 GHz	3.5560 GHz	100.0 kHz	3.555698333 GHz	-19.67 dBm	-6.666 dB
7	7	3.5560 GHz	3.5650 GHz	1.000 MHz	3.556045000 GHz	-22.70 dBm	-9.703 dB
8	8	3.5650 GHz	3.5950 GHz	1.000 MHz	3.565350000 GHz	-54.08 dBm	-29.08 dB

Plot 7-28. Lower Channel Edge Plot (Band 48 - 5.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5825 GHz	3.6125 GHz	1.000 MHz	3.587400000 GHz	-51.07 dBm	-26.07 dB
2	2	3.6125 GHz	3.6215 GHz	1.000 MHz	3.621425000 GHz	-21.87 dBm	-8.871 dB
3	3	3.6215 GHz	3.6225 GHz	100.0 kHz	3.622076667 GHz	-20.64 dBm	-7.642 dB
4	4	3.6225 GHz	3.6275 GHz	100.0 kHz	3.626583333 GHz	14.52 dBm	-10.48 dB
5	5	3.6275 GHz	3.6285 GHz	100.0 kHz	3.627585000 GHz	-19.95 dBm	-6.953 dB
6	6	3.6285 GHz	3.6375 GHz	1.000 MHz	3.628590000 GHz	-23.53 dBm	-10.53 dB
7	7	3.6375 GHz	3.6675 GHz	1.000 MHz	3.638000000 GHz	-51.70 dBm	-26.70 dB

Plot 7-29. Mid Channel Edge Plot (Band 48 - 5.0MHz QPSK - Full RB Configuration)

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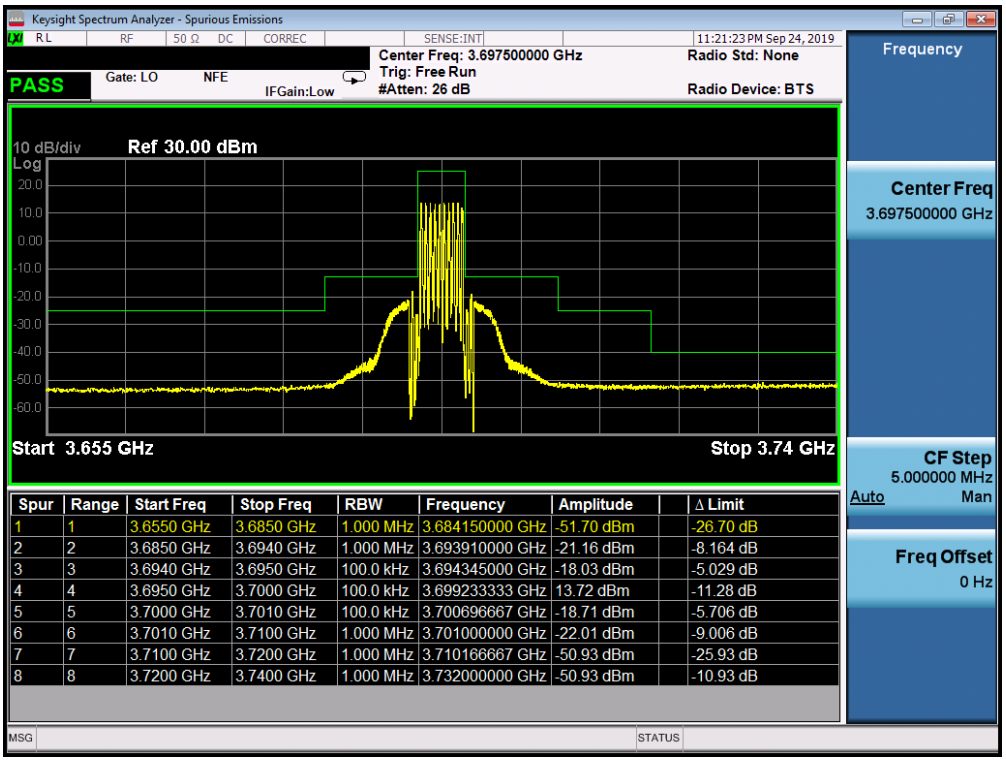
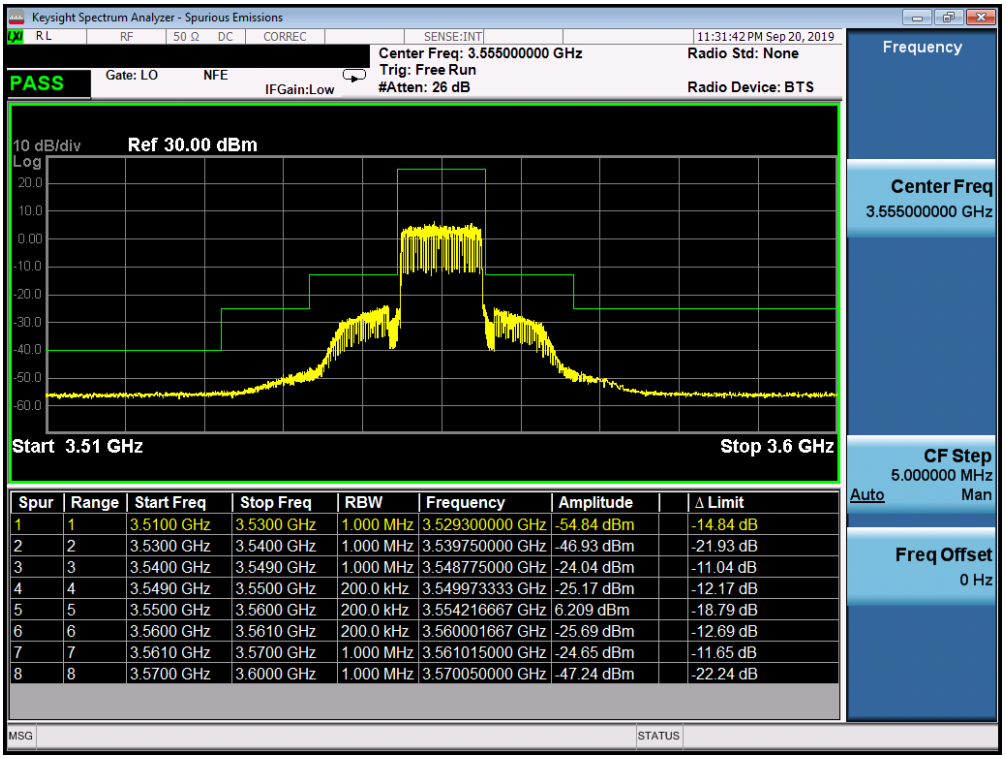


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6550 GHz	3.6850 GHz	1.000 MHz	3.684150000 GHz	-51.70 dBm	-26.70 dB
2	2	3.6850 GHz	3.6940 GHz	1.000 MHz	3.693910000 GHz	-21.16 dBm	-8.164 dB
3	3	3.6940 GHz	3.6950 GHz	100.0 kHz	3.694345000 GHz	-18.03 dBm	-5.029 dB
4	4	3.6950 GHz	3.7000 GHz	100.0 kHz	3.699233333 GHz	13.72 dBm	-11.28 dB
5	5	3.7000 GHz	3.7010 GHz	100.0 kHz	3.700696667 GHz	-18.71 dBm	-5.706 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701000000 GHz	-22.01 dBm	-9.006 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710166667 GHz	-50.93 dBm	-25.93 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.732000000 GHz	-50.93 dBm	-10.93 dB

Plot 7-30. Upper Channel Edge Plot (Band 48 - 5.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529300000 GHz	-54.84 dBm	-14.84 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539750000 GHz	-46.93 dBm	-21.93 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548775000 GHz	-24.04 dBm	-11.04 dB
4	4	3.5490 GHz	3.5500 GHz	200.0 kHz	3.549973333 GHz	-25.17 dBm	-12.17 dB
5	5	3.5500 GHz	3.5600 GHz	200.0 kHz	3.554216667 GHz	6.209 dBm	-18.79 dB
6	6	3.5600 GHz	3.5610 GHz	200.0 kHz	3.560001667 GHz	-25.69 dBm	-12.69 dB
7	7	3.5610 GHz	3.5700 GHz	1.000 MHz	3.561015000 GHz	-24.65 dBm	-11.65 dB
8	8	3.5700 GHz	3.6000 GHz	1.000 MHz	3.570050000 GHz	-47.24 dBm	-22.24 dB

Plot 7-31. Lower Channel Edge Plot (Band 48 - 10.0MHz QPSK - Full RB Configuration)

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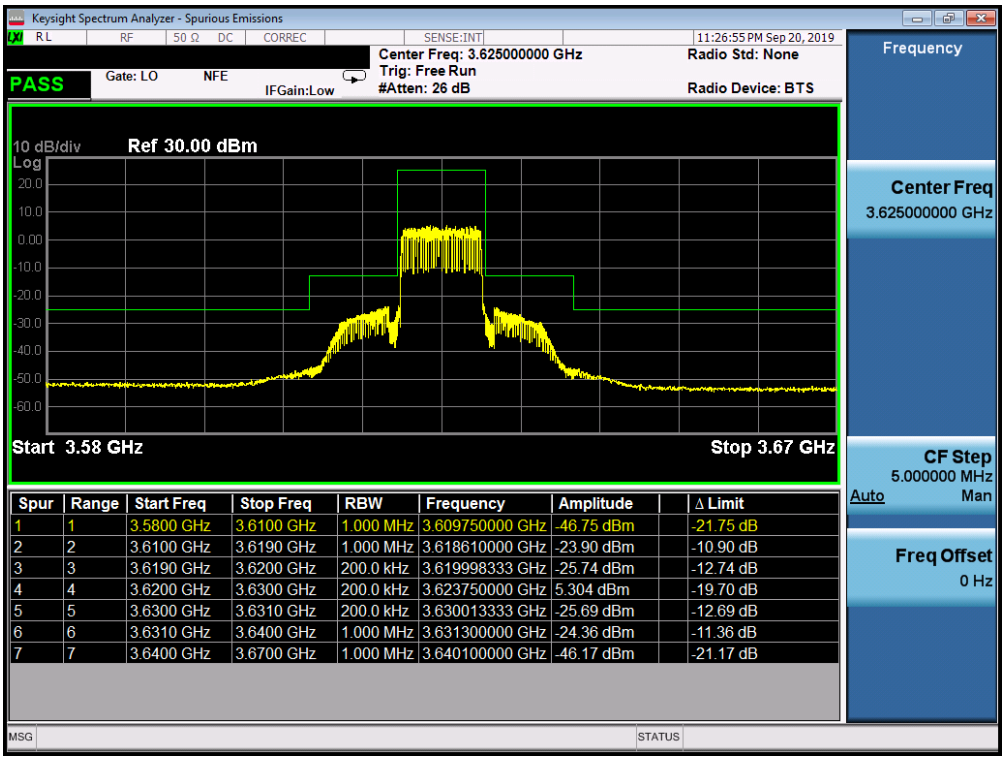
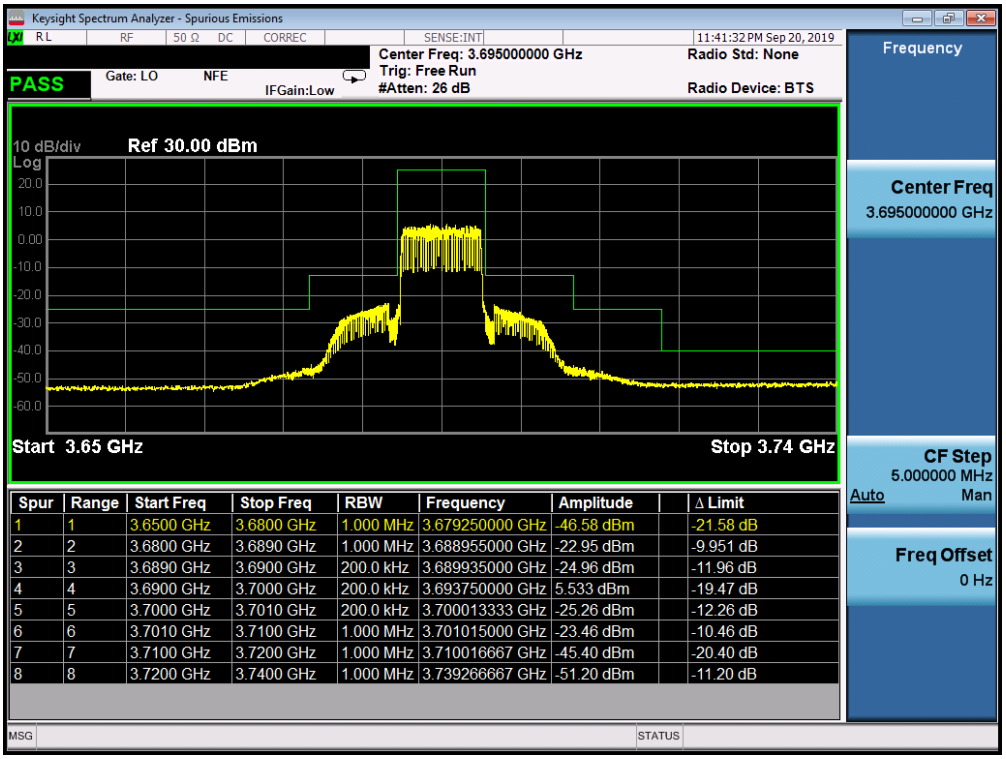


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5800 GHz	3.6100 GHz	1.000 MHz	3.609750000 GHz	-46.75 dBm	-21.75 dB
2	2	3.6100 GHz	3.6190 GHz	1.000 MHz	3.618610000 GHz	-23.90 dBm	-10.90 dB
3	3	3.6190 GHz	3.6200 GHz	200.0 kHz	3.619998333 GHz	-25.74 dBm	-12.74 dB
4	4	3.6200 GHz	3.6300 GHz	200.0 kHz	3.623750000 GHz	5.304 dBm	-19.70 dB
5	5	3.6300 GHz	3.6310 GHz	200.0 kHz	3.630013333 GHz	-25.69 dBm	-12.69 dB
6	6	3.6310 GHz	3.6400 GHz	1.000 MHz	3.631300000 GHz	-24.36 dBm	-11.36 dB
7	7	3.6400 GHz	3.6700 GHz	1.000 MHz	3.640100000 GHz	-46.17 dBm	-21.17 dB

Plot 7-32. Mid Channel Edge Plot (Band 48 - 10.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6500 GHz	3.6800 GHz	1.000 MHz	3.679250000 GHz	-46.58 dBm	-21.58 dB
2	2	3.6800 GHz	3.6890 GHz	1.000 MHz	3.688955000 GHz	-22.95 dBm	-9.951 dB
3	3	3.6890 GHz	3.6900 GHz	200.0 kHz	3.689935000 GHz	-24.96 dBm	-11.96 dB
4	4	3.6900 GHz	3.7000 GHz	200.0 kHz	3.693750000 GHz	5.533 dBm	-19.47 dB
5	5	3.7000 GHz	3.7010 GHz	200.0 kHz	3.700013333 GHz	-25.26 dBm	-12.26 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701015000 GHz	-23.46 dBm	-10.46 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710016667 GHz	-45.40 dBm	-20.40 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.739266667 GHz	-51.20 dBm	-11.20 dB

Plot 7-33. Upper Channel Edge Plot (Band 48 - 10.0MHz QPSK - Full RB Configuration)

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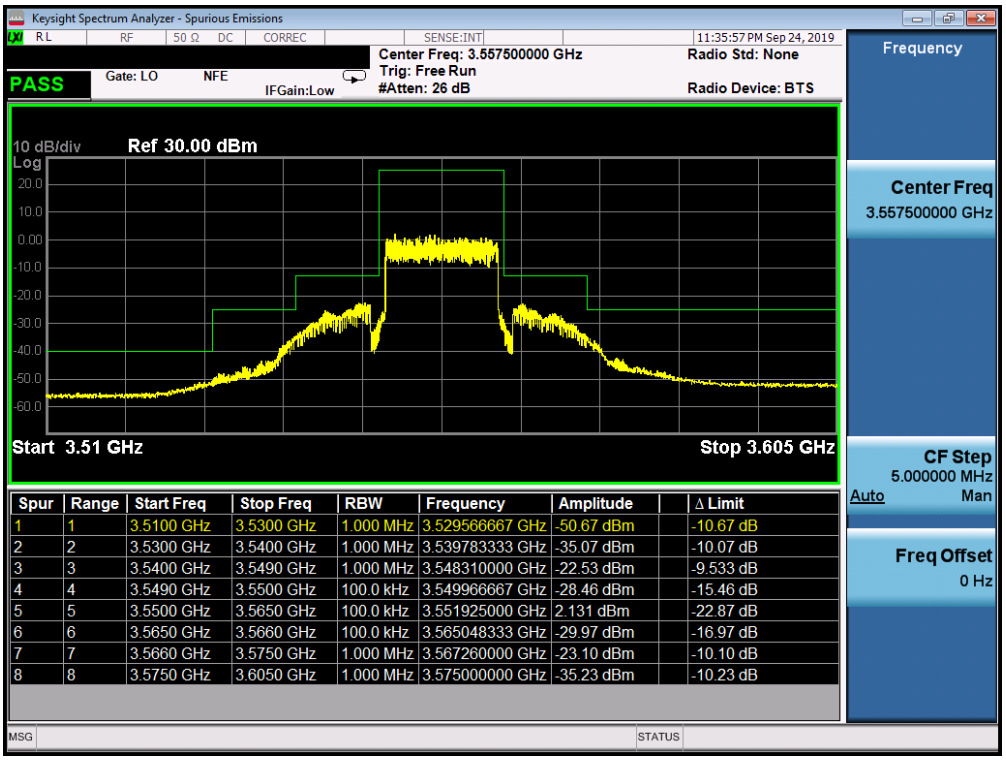
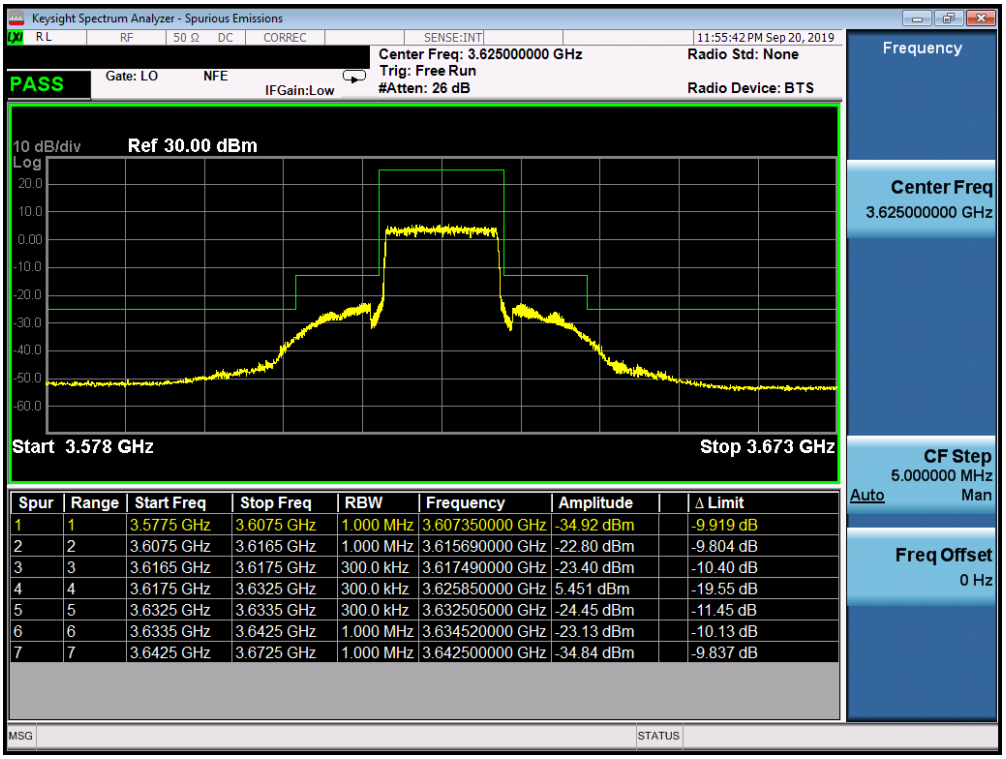


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529566667 GHz	-50.67 dBm	-10.67 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539783333 GHz	-35.07 dBm	-10.07 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548310000 GHz	-22.53 dBm	-9.533 dB
4	4	3.5490 GHz	3.5500 GHz	100.0 kHz	3.549966667 GHz	-28.46 dBm	-15.46 dB
5	5	3.5500 GHz	3.5650 GHz	100.0 kHz	3.551925000 GHz	2.131 dBm	-22.87 dB
6	6	3.5650 GHz	3.5660 GHz	100.0 kHz	3.565048333 GHz	-29.97 dBm	-16.97 dB
7	7	3.5660 GHz	3.5750 GHz	1.000 MHz	3.567260000 GHz	-23.10 dBm	-10.10 dB
8	8	3.5750 GHz	3.6050 GHz	1.000 MHz	3.575000000 GHz	-35.23 dBm	-10.23 dB

Plot 7-34. Lower Channel Edge Plot (Band 48 - 15.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5775 GHz	3.6075 GHz	1.000 MHz	3.607350000 GHz	-34.92 dBm	-9.919 dB
2	2	3.6075 GHz	3.6165 GHz	1.000 MHz	3.615690000 GHz	-22.80 dBm	-9.804 dB
3	3	3.6165 GHz	3.6175 GHz	300.0 kHz	3.617490000 GHz	-23.40 dBm	-10.40 dB
4	4	3.6175 GHz	3.6325 GHz	300.0 kHz	3.625850000 GHz	5.451 dBm	-19.55 dB
5	5	3.6325 GHz	3.6335 GHz	300.0 kHz	3.632505000 GHz	-24.45 dBm	-11.45 dB
6	6	3.6335 GHz	3.6425 GHz	1.000 MHz	3.634520000 GHz	-23.13 dBm	-10.13 dB
7	7	3.6425 GHz	3.6725 GHz	1.000 MHz	3.642500000 GHz	-34.84 dBm	-9.837 dB

Plot 7-35. Mid Channel Edge Plot (Band 48 - 15.0MHz QPSK - Full RB Configuration)

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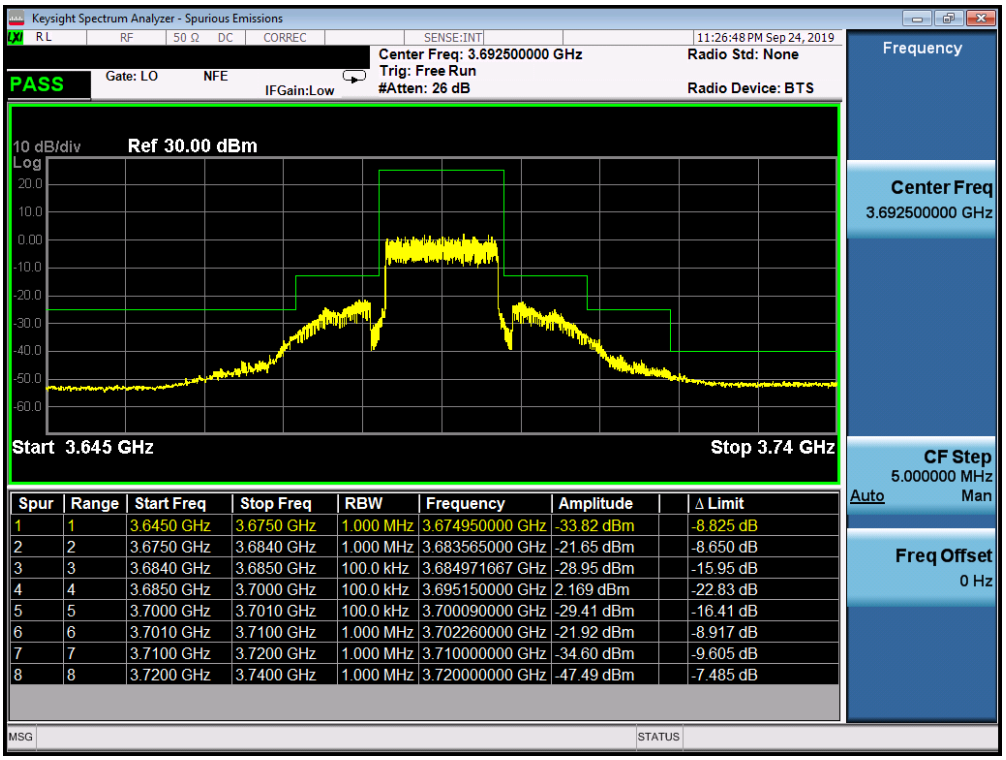
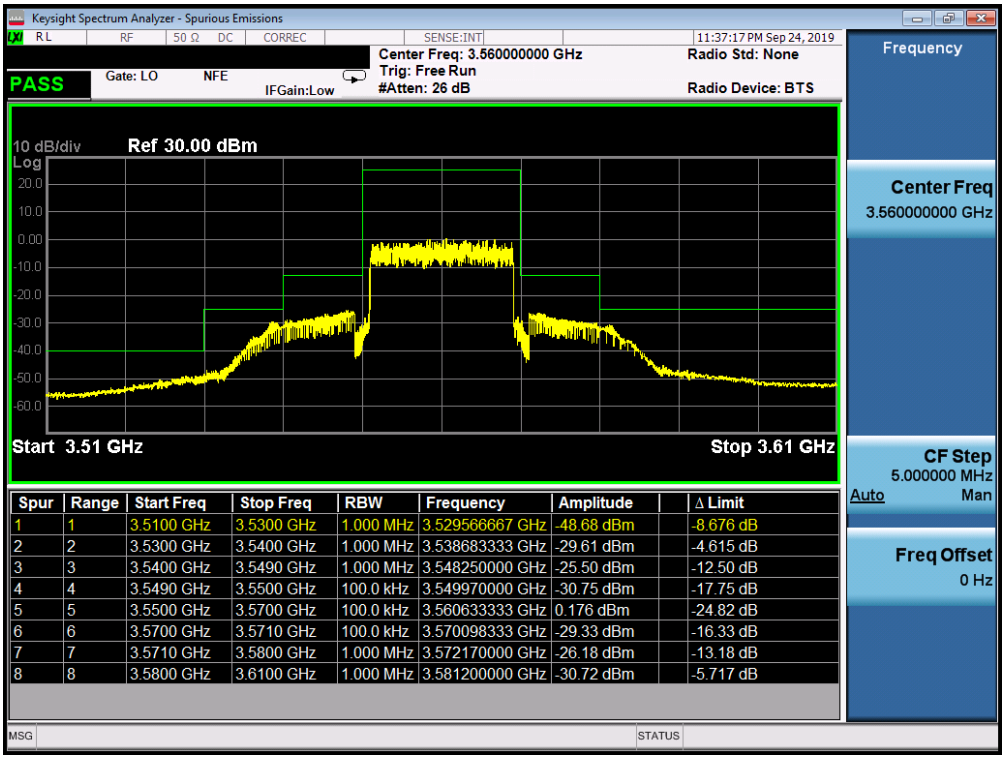


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6450 GHz	3.6750 GHz	1.000 MHz	3.674950000 GHz	-33.82 dBm	-8.825 dB
2	2	3.6750 GHz	3.6840 GHz	1.000 MHz	3.683565000 GHz	-21.65 dBm	-8.650 dB
3	3	3.6840 GHz	3.6850 GHz	100.0 kHz	3.684971667 GHz	-28.95 dBm	-15.95 dB
4	4	3.6850 GHz	3.7000 GHz	100.0 kHz	3.695150000 GHz	2.169 dBm	-22.83 dB
5	5	3.7000 GHz	3.7010 GHz	100.0 kHz	3.700090000 GHz	-29.41 dBm	-16.41 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.702260000 GHz	-21.92 dBm	-8.917 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710000000 GHz	-34.60 dBm	-9.605 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720000000 GHz	-47.49 dBm	-7.485 dB

Plot 7-36. Upper Channel Edge Plot (Band 48 - 15.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529566667 GHz	-48.68 dBm	-8.676 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.538683333 GHz	-29.61 dBm	-4.615 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548250000 GHz	-25.50 dBm	-12.50 dB
4	4	3.5490 GHz	3.5500 GHz	100.0 kHz	3.549970000 GHz	-30.75 dBm	-17.75 dB
5	5	3.5500 GHz	3.5700 GHz	100.0 kHz	3.560633333 GHz	0.176 dBm	-24.82 dB
6	6	3.5700 GHz	3.5710 GHz	100.0 kHz	3.570098333 GHz	-29.33 dBm	-16.33 dB
7	7	3.5710 GHz	3.5800 GHz	1.000 MHz	3.572170000 GHz	-26.18 dBm	-13.18 dB
8	8	3.5800 GHz	3.6100 GHz	1.000 MHz	3.581200000 GHz	-30.72 dBm	-5.717 dB

Plot 7-37. Lower Channel Edge Plot (Band 48 - 20.0MHz QPSK - Full RB Configuration)

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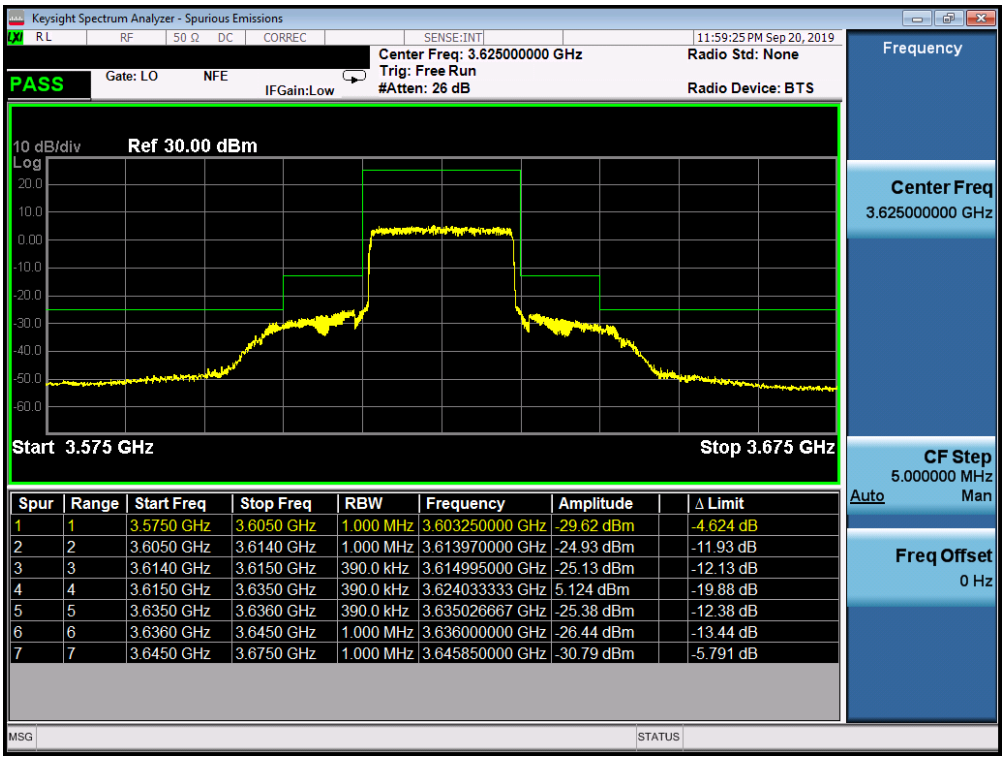
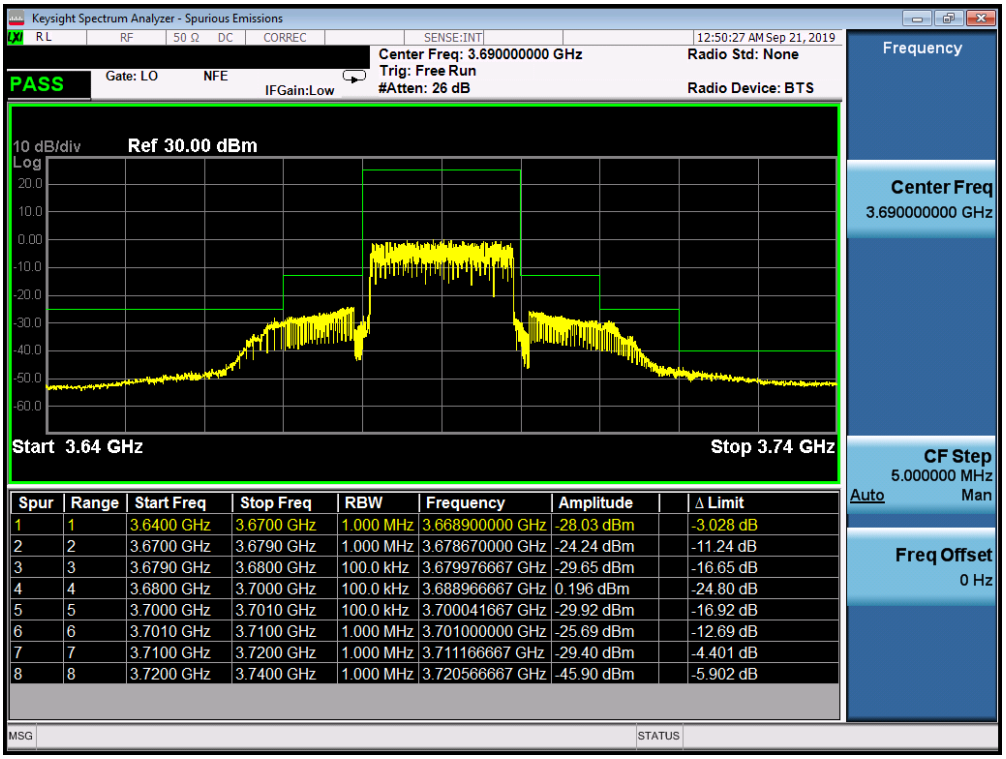


Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5750 GHz	3.6050 GHz	1.000 MHz	3.603250000 GHz	-29.62 dBm	-4.624 dB
2	2	3.6050 GHz	3.6140 GHz	1.000 MHz	3.613970000 GHz	-24.93 dBm	-11.93 dB
3	3	3.6140 GHz	3.6150 GHz	390.0 kHz	3.614995000 GHz	-25.13 dBm	-12.13 dB
4	4	3.6150 GHz	3.6350 GHz	390.0 kHz	3.624033333 GHz	5.124 dBm	-19.88 dB
5	5	3.6350 GHz	3.6360 GHz	390.0 kHz	3.635026667 GHz	-25.38 dBm	-12.38 dB
6	6	3.6360 GHz	3.6450 GHz	1.000 MHz	3.636000000 GHz	-26.44 dBm	-13.44 dB
7	7	3.6450 GHz	3.6750 GHz	1.000 MHz	3.645850000 GHz	-30.79 dBm	-5.791 dB

Plot 7-38. Mid Channel Edge Plot (Band 48 - 20.0MHz QPSK - Full RB Configuration)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6400 GHz	3.6700 GHz	1.000 MHz	3.668900000 GHz	-28.03 dBm	-3.028 dB
2	2	3.6700 GHz	3.6790 GHz	1.000 MHz	3.678670000 GHz	-24.24 dBm	-11.24 dB
3	3	3.6790 GHz	3.6800 GHz	100.0 kHz	3.679976667 GHz	-29.65 dBm	-16.65 dB
4	4	3.6800 GHz	3.7000 GHz	100.0 kHz	3.688966667 GHz	0.196 dBm	-24.80 dB
5	5	3.7000 GHz	3.7010 GHz	100.0 kHz	3.700041667 GHz	-29.92 dBm	-16.92 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701000000 GHz	-25.69 dBm	-12.69 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.711166667 GHz	-29.40 dBm	-4.401 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720566667 GHz	-45.90 dBm	-5.902 dB

Plot 7-39. Upper Channel Edge Plot (Band 48 - 20.0MHz QPSK - Full RB Configuration)

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7.5 Radiated Power (EIRP)

§96.41(b)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) 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 above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

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

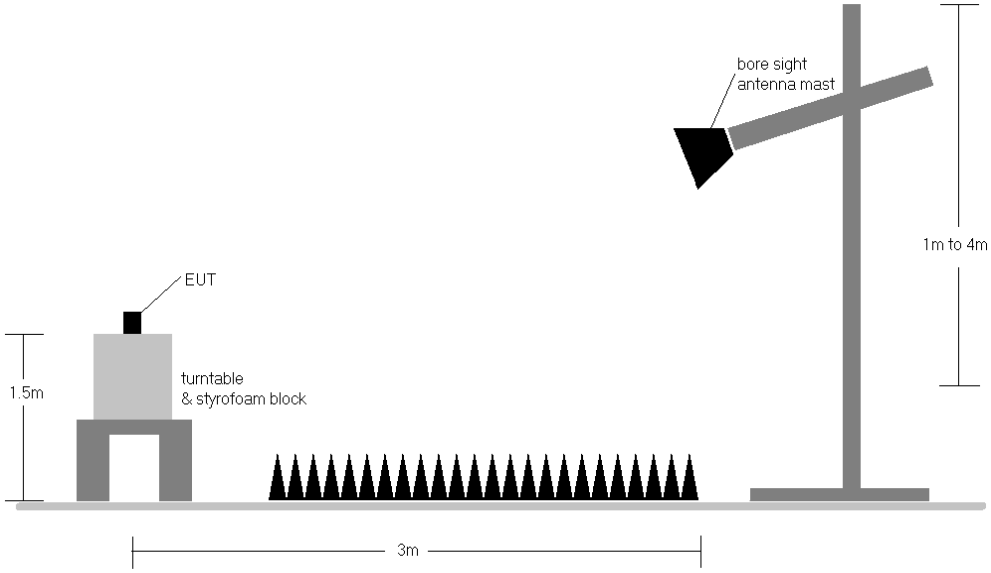

Figure 7-4. Radiated Test Setup >1GHz

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 worst case EIRP shown in this section is found with LTE operating only using 1RB. As such, the EIRP/10MHz and full channel EIRP values will be identical since 1RB is fully contained within all available channel bandwidths for LTE Band 48 (i.e. 5, 10, 15, 20MHz).

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Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	EIRP [dBm/10MHz]	EIRP [Watts/10MHz]	EIRP Limit [dBm/10MHz]	Margin [dB]
3552.50	5	QPSK	H	124	159	1 / 0	11.14	7.13	**18.27**	**0.067**	23.00	-4.73
3625.00	5	QPSK	H	104	151	1 / 0	10.43	6.85	17.28	0.053	23.00	-5.72
3697.50	5	QPSK	H	101	157	1 / 0	10.75	6.26	17.01	0.050	23.00	-5.99
3552.50	5	16-QAM	H	124	159	1 / 0	9.96	7.13	**17.09**	0.051	23.00	-5.91
3552.50	5	64-QAM	H	124	159	1 / 0	9.33	7.13	**16.46**	0.044	23.00	-6.54
3555.00	10	QPSK	H	132	140	1 / 0	10.99	7.13	**18.12**	0.065	23.00	-4.88
3625.00	10	QPSK	H	134	147	1 / 0	10.59	6.85	17.44	0.055	23.00	-5.56
3695.00	10	QPSK	H	137	156	1 / 0	10.62	6.26	16.88	0.049	23.00	-6.12
3625.00	10	16-QAM	H	134	147	1 / 0	9.52	6.85	**16.37**	0.043	23.00	-6.63
3625.00	10	64-QAM	H	134	147	1 / 0	8.86	6.85	**15.71**	0.037	23.00	-7.29
3557.50	15	QPSK	H	148	157	1 / 0	11.12	7.13	**18.25**	0.067	23.00	-4.75
3625.00	15	QPSK	H	148	155	1 / 0	10.44	6.85	17.29	0.054	23.00	-5.71
3692.50	15	QPSK	H	134	155	1 / 0	10.71	6.26	16.97	0.050	23.00	-6.03
3625.00	15	16-QAM	H	148	155	1 / 0	9.44	6.85	**16.29**	0.043	23.00	-6.71
3625.00	15	64-QAM	H	148	155	1 / 0	8.94	6.85	**15.79**	0.038	23.00	-7.21
3560.00	20	QPSK	H	119	162	1 / 0	10.57	7.13	**17.70**	0.059	23.00	-5.30
3625.00	20	QPSK	H	102	177	1 / 99	9.01	6.85	15.86	0.039	23.00	-7.14
3690.00	20	QPSK	H	128	177	1 / 0	9.24	6.26	15.50	0.035	23.00	-7.50
3560.00	20	16-QAM	H	119	162	1 / 0	8.64	7.13	**15.77**	0.038	23.00	-7.23
3560.00	20	64-QAM	H	119	162	1 / 0	7.40	7.13	**14.53**	0.028	23.00	-8.47
3552.50	5	QPSK	V	135	269	1 / 0	9.20	7.21	16.41	0.044	23.00	-6.59

Table 7-3. EIRP Data (Band 48)

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7.6 Radiated Spurious Emissions Measurements

§2.1053 §96.41(e)

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 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – 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 = 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.

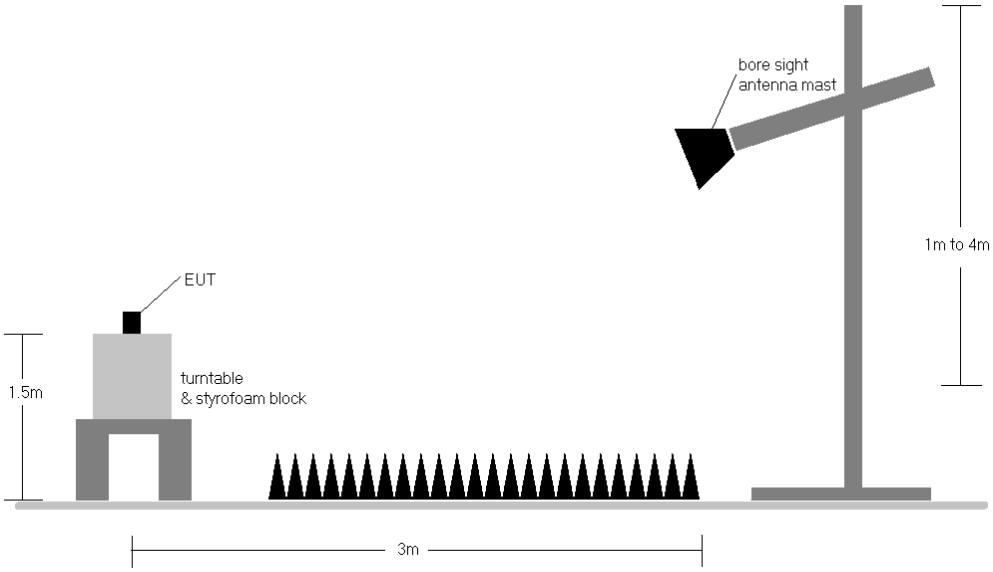

Figure 7-5. Test Instrument & Measurement Setup

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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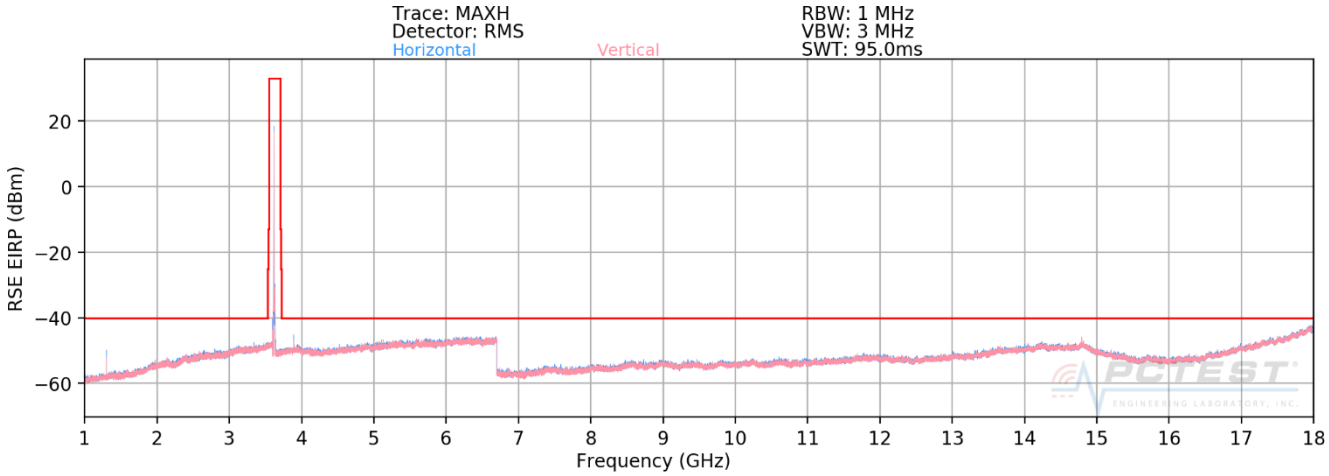
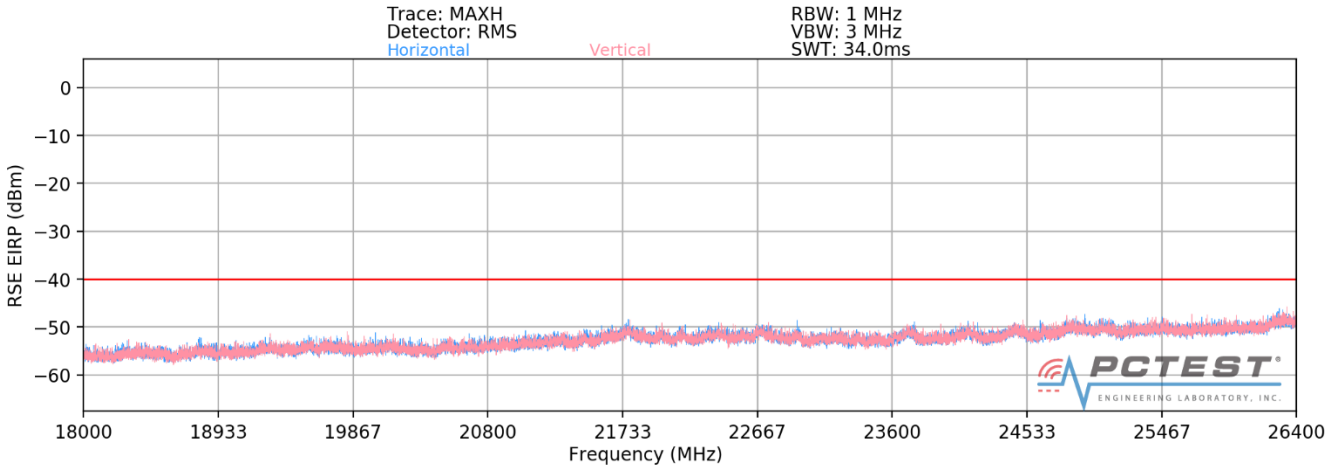
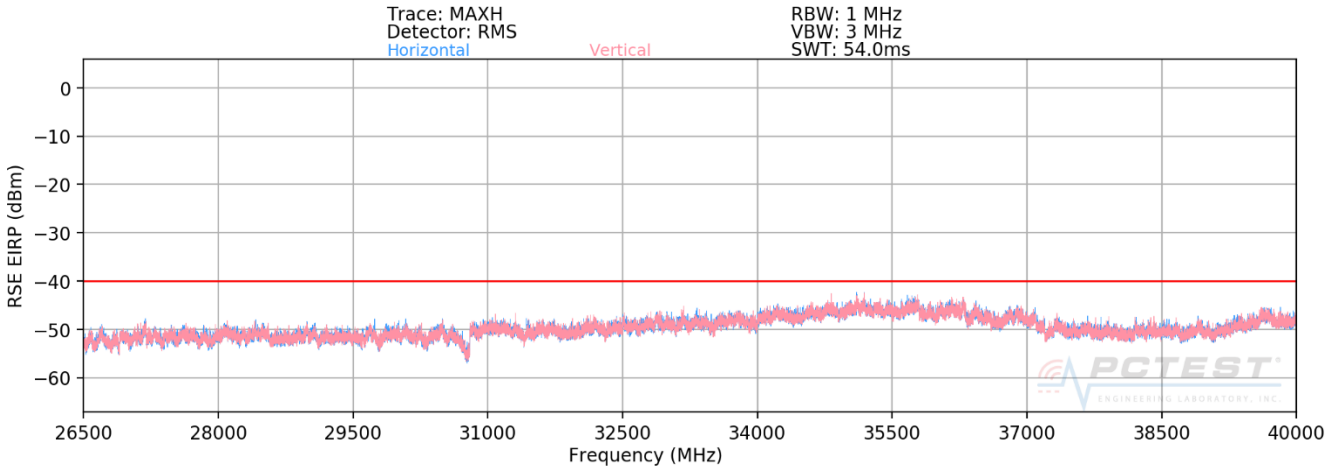
Band 48



Plot 7-40. Radiated Spurious Plot 1 - 18GHz (Band 48)



Plot 7-41. Radiated Spurious Plot 18 - 26.5GHz (Band 48)



Plot 7-42. Radiated Spurious Plot 26.5 - 40GHz (Band 48)

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OPERATING FREQUENCY: 3552.50 MHz
MODULATION SIGNAL: QPSK
BANDWIDTH: 5.0 MHz
DISTANCE: 3 meters
LIMIT: -40 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7105.00	V	116	203	-64.47	11.71	-52.77	-12.8
10657.50	V	-	-	-68.50	12.55	-55.95	-16.0
14210.00	V	117	362	-59.69	11.35	-48.34	-8.3
17762.50	V	-	-	-57.34	10.01	-47.32	-7.3

Table 7-4. Radiated Spurious Data (Band 48 – Low Channel)

OPERATING FREQUENCY: 3625.00 MHz
MODULATION SIGNAL: QPSK
BANDWIDTH: 5.0 MHz
DISTANCE: 3 meters
LIMIT: -40 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7250.00	V	125	221	-65.87	11.32	-54.55	-14.6
10875.00	V	-	-	-69.25	12.71	-56.54	-16.5
14500.00	V	113	326	-61.40	11.61	-49.79	-9.8

Table 7-5. Radiated Spurious Data (Band 48 – Mid Channel)

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OPERATING FREQUENCY:	3697.50	MHz
MODULATION SIGNAL:	QPSK	
BANDWIDTH:	5.0	MHz
DISTANCE:	3	meters
LIMIT:	-40	dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
7395.00	V	115	338	-63.80	10.96	-52.84	-12.8
11092.50	V	-	-	-68.91	12.72	-56.18	-16.2
14790.00	V	-	-	-64.80	12.02	-52.77	-12.8

Table 7-6. Radiated Spurious Data (Band 48 – High Channel)

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7.7 Frequency Stability / Temperature Variation
§2.1055

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 96, 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 48 Frequency Stability Measurements

OPERATING FREQUENCY: 3,625,000,000 Hz

CHANNEL: 55990

REFERENCE VOLTAGE: 4.33 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.33	- 30	3,625,000,130	130	0.0000036
100 %		- 20	3,624,999,789	-211	-0.0000058
100 %		- 10	3,625,000,395	395	0.0000109
100 %		0	3,624,999,844	-156	-0.0000043
100 %		+ 10	3,625,000,035	35	0.0000010
100 %		+ 20	3,625,000,111	111	0.0000031
100 %		+ 30	3,625,000,375	375	0.0000103
100 %		+ 40	3,625,000,062	62	0.0000017
100 %		+ 50	3,625,000,107	107	0.0000030
BATT. ENDPOINT	2.93	+ 20	3,625,000,013	13	0.0000004

Table 7-7. Frequency Stability Data (Band 48)

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 48 Frequency Stability Measurements

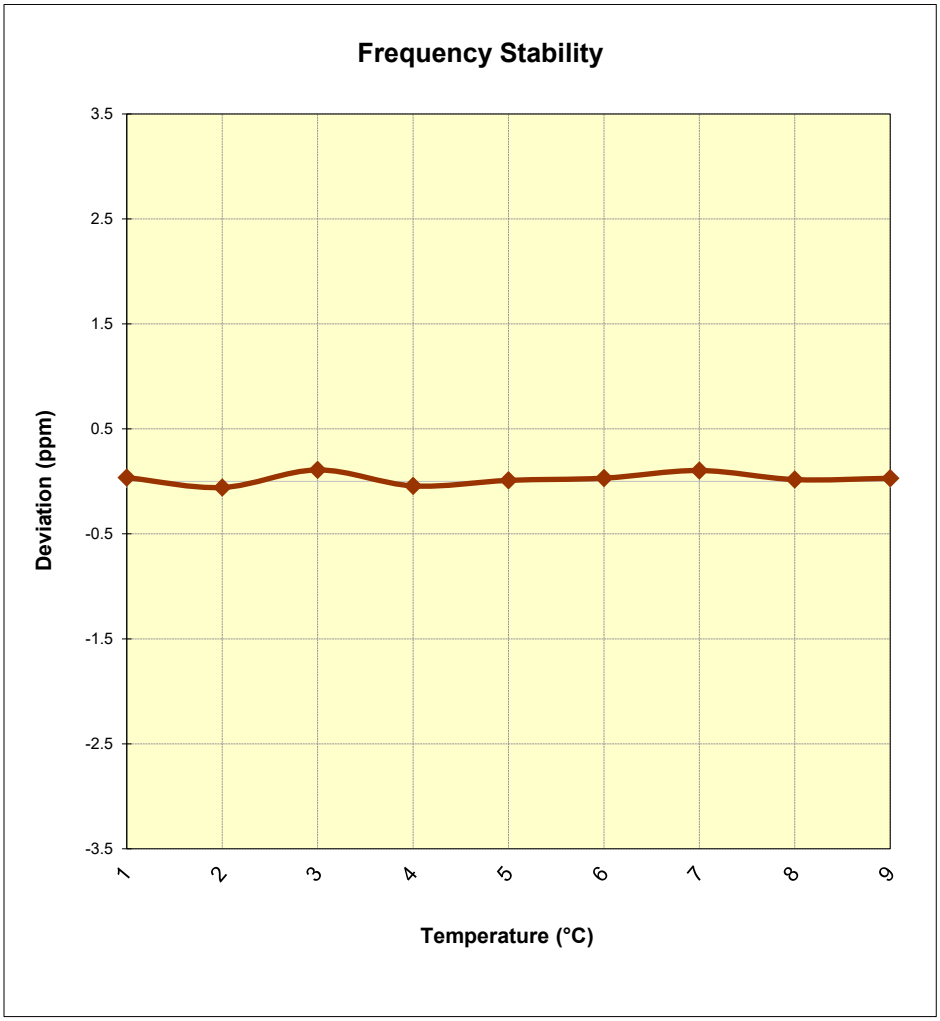

Figure 7-6. Frequency Stability Graph (Band 48)

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7.8 End User Device Additional Requirement (CBSD Protocol)

§96.47

Test Overview and Limit

End user device additional requirements (CBSD Protocol) are tested per the test procedures listed below. During testing, the EUT is connected to a certified CBSD (Ruckus FCC ID: S9GQ910US00) as a companion device to show compliance with Part 96.47.

End User Devices may operate only if they can positively receive and decode an authorization signal transmitted by a CBSD, including the frequencies and power limits for their operation.

An End User Device must discontinue operations, change frequencies, or change its operational power level within 10 seconds of receiving instructions from its associated CBSD.

Test Procedure Used

KDB 940660 D01 v02, WINNF-TS-0122 V1.0.0.

Test Setup/Method

The EUT was connected via an RF cable to a certified CBSD and spectrum analyzer. The following procedure is performed by applying WINNF-TS-0122 CBRS CBSD Test Specification.

1. Run#1:
    a. Setup WINNF.PT.C.HBT.1 with 3610MHz – 3620MHz.
    b. Enable AP service from Ruckus Cloud management.
    c. Check EUT Tx frequency.
    d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.
2. Run#2:
    a. Setup WINNF.PT.C.HBT.1 with 3660MHz – 3680MHz.
    b. Enable AP service from Ruckus Cloud management.
    c. Check EUT Tx frequency.
    d. Disable AP service from Ruckus Cloud management and check EUT stop transmission within 10s.

Test Notes

The EUT is an End User Device.

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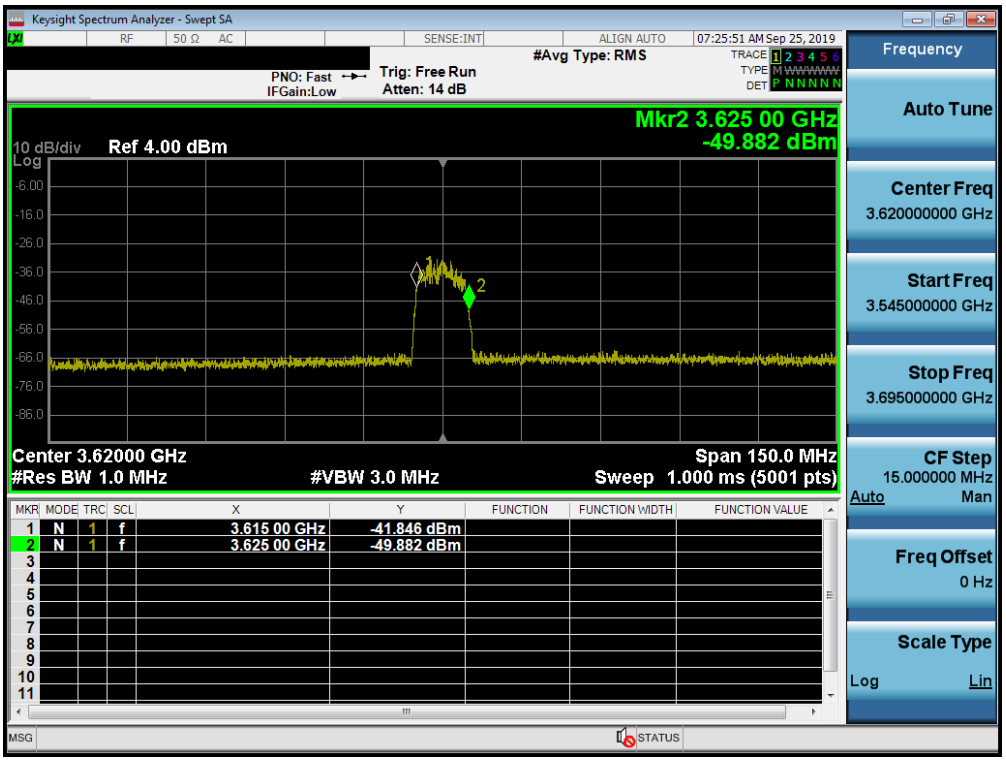
Run#1:

- Tx frequency set: 3610 – 3620MHz.



Plot 7-43. Run#1 End User Device Frequency of Operations

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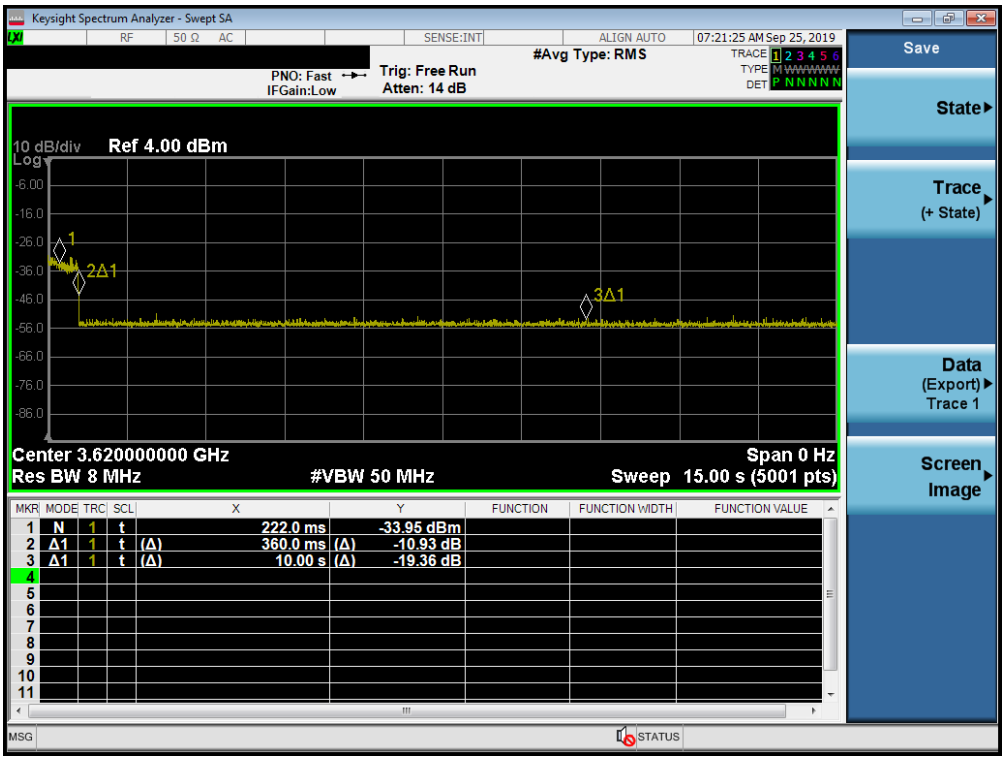

Plot 7-44. Run#1 End User Device Discontinues Operations within 10s

Note:

Marker 1: CBSD sends instructions to discontinue LTE operations.
Marker 2: EUT discontinues operation.
Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

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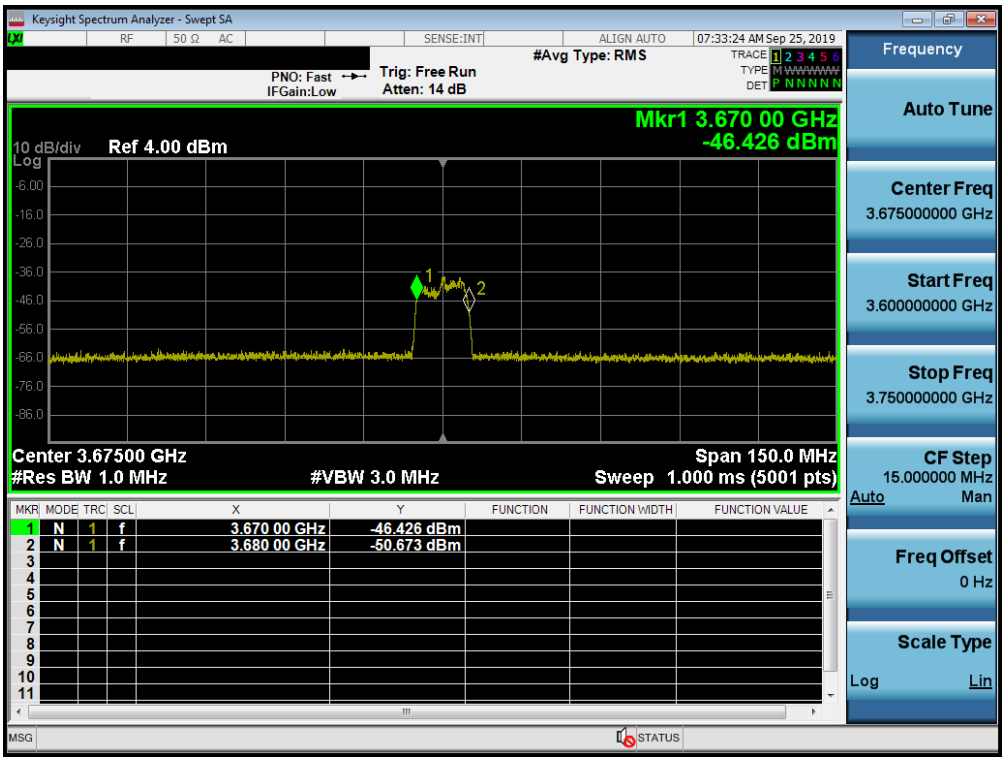
Run#2:

- Tx frequency set: 3660 – 3680MHz.



Plot 7-45. Run#2 End User Device Frequency of Operations

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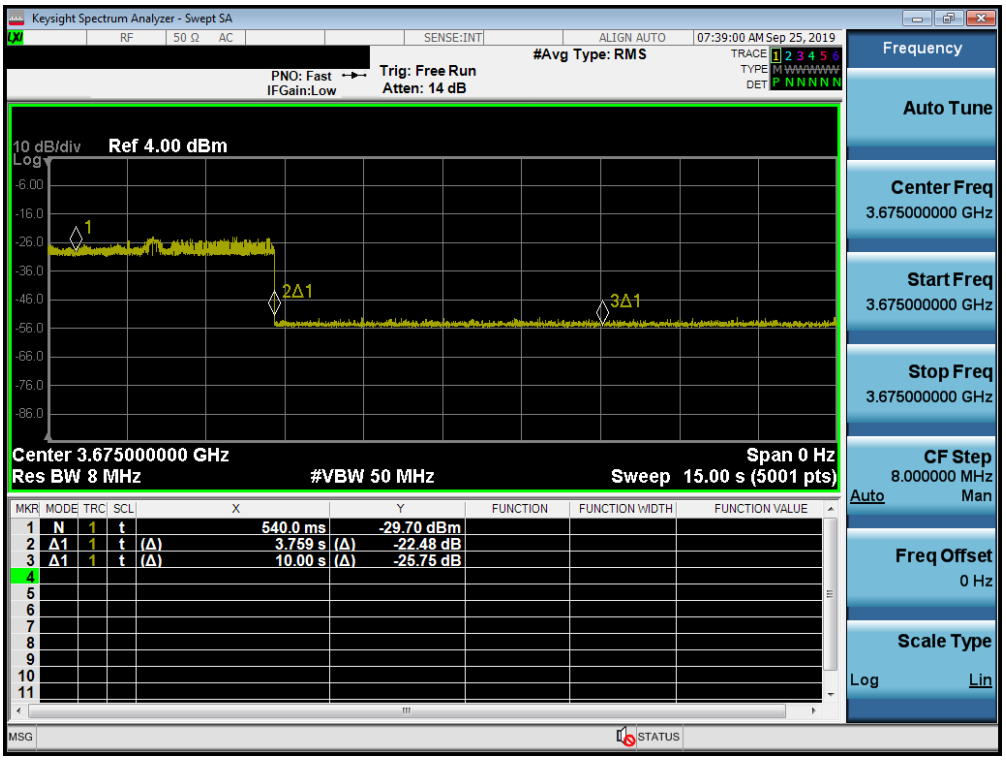

Plot 7-46. Run#2 End User Device Discontinues Operations within 10s

Note:

Marker 1: CBSD sends instructions to discontinue LTE operations.
Marker 2: EUT discontinues operation.
Marker 3: 10 seconds elapsed time from CBSD sending instructions to EUT.

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFQ620WA** complies with all of the End User Device requirements of Part 96 of the FCC Rules.

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