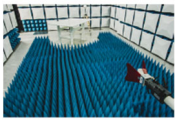
PCTEST
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



PART 96 MEASUREMENT REPORT

Applicant Name:
Microsoft Corporation
One Microsoft way
Redmond, WA, 98052
United States

Date of Testing:
5/25/2021 - 9/2/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2105200048-07-R1.C3K

FCC ID:	**C3K1995**
APPLICANT:	**Microsoft Corporation**

Application Type:	Certification
Model:	1995
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.

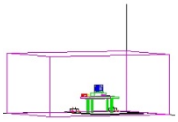
Note: This revised Test Report (S/N: 1M2105060048-07-R1.C3K) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly

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.

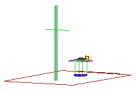
Randy Ortanez
President

ACCREDITED
CERT #2041.01

TABLE OF CONTENTS



MEASUREMENT REPORT
FCC Part 96



Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 48	40 MHz	QPSK	3560.0 - 3690.0	0.093	19.68	37M7G7D
		16QAM	3560.0 - 3690.0	0.072	18.55	37M7W7D
	35 MHz	QPSK	3560.0 - 3690.0	0.102	20.09	32M7G7D
		16QAM	3560.0 - 3690.0	0.078	18.91	32M7W7D
	30 MHz	QPSK	3560.0 - 3690.0	0.085	19.30	27M9G7D
		16QAM	3560.0 - 3690.0	0.067	18.27	27M8W7D
	25 MHz	QPSK	3560.0 - 3690.0	0.087	19.38	23M0G7D
		16QAM	3560.0 - 3690.0	0.068	18.34	23M0W7D
	20 MHz	QPSK	3560.0 - 3690.0	0.101	20.04	18M0G7D
		16QAM	3560.0 - 3690.0	0.080	19.02	18M0W7D
	15 MHz	QPSK	3557.5 - 3692.5	0.100	20.00	13M5G7D
		16QAM	3557.5 - 3692.5	0.078	18.90	13M4W7D
	10 MHz	QPSK	3555.0 - 3695.0	0.100	20.02	9M02G7D
		16QAM	3555.0 - 3695.0	0.080	19.03	9M02W7D
	5 MHz	QPSK	3552.5 - 3697.5	0.101	20.06	4M52G7D
		16QAM	3552.5 - 3697.5	0.079	18.96	4M51W7D

EUT Overview

Note: EIRP levels shown in the table above are measured over the full channel bandwidth. These values will appear on the Grant of Authorization.

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 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 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 17025-2017 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 17025-2017 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.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Microsoft Corporation Portable Handset FCC ID:C3K1995**. 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. Per FCC Part 96, this device is evaluated under Citizens Band End User Devices (CBE).

Test Device Serial No.: M4211, LM211, 48084, 50387

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS, 850/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR, 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz), 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.

This device supports open and closed configurations. Multiple angles are tested and the worst case radiated emissions data is shown in the report.

2.4 EMI Suppression Device(s)/Modifications

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

2.5 Software and Firmware

The firmware installed during testing was Build number developer - generic 2021.728.20.

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/MHz for End User Devices.

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 414788 D01.

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

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
-	ETS	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	ETS
-	LTx4	Licensed Transmitter Cable Set	3/12/2021	Annual	3/12/2022	LTx4
-	LTx5	LIcensed Transmitter Cable Set	3/3/2021	Annual	3/3/2022	LTx5
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201525694
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
Keysight Technologies	N9030A	PXA Signal Analyzer	10/16/2020	Annual	10/16/2021	MY54490576
Keysight Technologies	N9030A	PXA Signal Analyzer	9/2/2020	Annual	9/2/2021	MY55410501
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	9/17/2020	Annual	9/17/2021	MY57141001
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	9/9/2020	Annual	9/9/2021	100348
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	1/21/2021	Annual	1/21/2022	101716
Rohde & Schwarz	FSW26	2Hz-26.5GHz Signal and Spectrum Analyzer	2/10/2021	Annual	2/10/2022	103187
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

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

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 (7250 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).

7.0 TEST RESULTS

7.1 Summary

Company Name: Microsoft Corporation

FCC ID: C3K1995

FCC Classification: Citizens Band End User Devices (CBE)

Mode(s): LTE

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Conducted Power	2.1046	N/A	PASS	Section 7.2
	Occupied Bandwidth	2.1049	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions	2.1051, 96.41(e)(ii)	-13 dBm/MHz at frequencies within 0-B MHz of channel edge (where B is the bandwidth of the assigned channel) -25 dBm/MHz at frequencies greater than B MHz above and below channel edge -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz	PASS	Sections 7.4, 7.5
	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	Section 7.10
	End User Device Additional Requirements (CBSD Protocol)	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.	PASS	Section 7.11
	Uplink Carrier Aggregation	96.41(e)	> 43 + 10log(P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Section 7.2, 7.3, 7.4, 7.5
RADIATED	Equivalent Isotropic Radiated Power (EIRP)	96.41(b)	23 dBm/10MHz	PASS	Section 7.8
	Radiated Spurious Emissions	2.1053, 96.41(e)	-40 dBm/MHz	PASS	Section 7.9

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 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 Software Tool v1.0, Chamber Control v1.3.1.

7.2 Conducted Power Output Data

Test Overview

The EUT is set up to transmit at maximum power for LTE. All power levels 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.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Span = 2 x OBW to 3 x OBW
2. RBW = 1% to 5% of the OBW
3. Number of measurement points in sweep ≥ 2 x span / RBW
4. Sweep = auto-couple (less than transmission burst duration)
5. Detector = RMS (power)
6. Trigger was set to enable power measurements only on full power bursts
7. Trace was allowed to stabilize
8. Spectrum analyzer's "Channel Power" function was used to compute the power by integrating the spectrum across the OBW of the signal

Test Setup

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

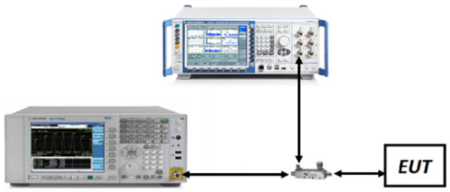


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. 1 -7RB allocations on QPSK modulation have additional power reduction from the target.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	55340	3560.0	100 / 0	21.61
		55990	3625.0	100 / 0	21.75
		56640	3690.0	100 / 0	21.74
	16-QAM	55990	3625.0	100 / 0	20.80
15 MHz	QPSK	55315	3557.5	75 / 0	21.58
		55990	3625.0	75 / 0	21.74
		56665	3692.5	75 / 0	21.76
	16-QAM	55990	3625.0	75 / 0	20.72
10 MHz	QPSK	55290	3555.0	50 / 0	21.58
		55990	3625.0	50 / 0	21.74
		56690	3695.0	50 / 0	21.84
	16-QAM	55990	3625.0	50 / 0	20.76
5 MHz	QPSK	55265	3552.5	25 / 0	21.52
		55990	3625.0	25 / 0	21.73
		56715	3697.5	25 / 0	21.86
	16-QAM	55990	3625.0	25 / 0	20.71

Table 7-2. Conducted Power Output Data (LTE Band 48 – FULL RB Case)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	55340	3560.0	1 / 99	20.52
		55990	3625.0	1 / 99	20.58
		56640	3690.0	1 / 99	20.68
	16-QAM	55990	3625.0	1 / 99	20.89
15 MHz	QPSK	55315	3557.5	1 / 74	20.57
		55990	3625.0	1 / 74	20.64
		56665	3692.5	1 / 0	20.66
	16-QAM	55990	3625.0	1 / 74	20.78
10 MHz	QPSK	55290	3555.0	1 / 49	20.56
		55990	3625.0	1 / 49	20.61
		56690	3695.0	1 / 0	20.74
	16-QAM	55990	3625.0	1 / 25	20.71
5 MHz	QPSK	55265	3552.5	1 / 12	20.60
		55990	3625.0	1 / 24	20.68
		56715	3697.5	1 / 24	20.78
	16-QAM	55990	3625.0	1 / 24	20.92

Table 7-3. Conducted Power Output Data (LTE Band 48 – 1 RB Case)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	55340	3560.0	8 / 92	22.50
		55990	3625.0	8 / 0	22.68
		56640	3690.0	8 / 0	22.68
	16-QAM	55990	3625.0	8 / 0	21.86
15 MHz	QPSK	55315	3557.5	8 / 67	22.48
		55990	3625.0	8 / 34	22.64
		56665	3692.5	8 / 0	22.74
	16-QAM	55990	3625.0	8 / 67	21.74
10 MHz	QPSK	55290	3555.0	8 / 42	22.54
		55990	3625.0	8 / 42	22.66
		56690	3695.0	8 / 21	22.81
	16-QAM	55990	3625.0	8 / 42	21.87
5 MHz	QPSK	55265	3552.5	8 / 0	22.52
		55990	3625.0	8 / 17	22.70
		56715	3697.5	8 / 9	22.80
	16-QAM	55990	3625.0	8 / 9	21.80

Table 7-4. Conducted Power Output Data (LTE Band 48 – 8 RB Case)

Bandwidth	Modulation	PCC			SCC			Conducted Power [dBm]
		Bandwidth [MHz]	Frequency [MHz]	RB / Offset	Bandwidth [MHz]	Frequency [MHz]	RB / Offset	
40 MHz	QPSK	20	3560.0	100 / 0	20	3579.8	100 / 0	18.88
		20	3625.0	100 / 0	20	3644.8	100 / 0	19.07
		20	3690.0	100 / 0	20	3670.2	100 / 0	18.85

Table 7-5. Conducted Power Output Data (ULCA LB48 – FULL RB Case)

Bandwidth	Modulation	PCC			SCC			Conducted Power [dBm]
		Bandwidth [MHz]	Frequency [MHz]	RB / Offset	Bandwidth [MHz]	Frequency [MHz]	RB / Offset	
40 MHz	QPSK	20	3560.0	1 / 99	20	3579.8	1 / 0	21.04
		20	3625.0	1 / 99	20	3644.8	1 / 0	21.34
		20	3690.0	1 / 0	20	3670.2	1 / 99	21.21
	16-QAM	20	3690.0	1 / 0	20	3670.2	1 / 99	22.34
	64-QAM	20	3690.0	1 / 0	20	3670.2	1 / 99	21.44
35 MHz	QPSK	20	3560.0	1 / 99	15	3577.1	1 / 0	21.19
		20	3625.0	1 / 99	15	3642.1	1 / 0	21.43
		20	3690.0	1 / 0	15	3672.9	1 / 74	21.40
	16-QAM	20	3690.0	1 / 0	15	3672.9	1 / 74	22.57
	64-QAM	20	3690.0	1 / 0	15	3672.9	1 / 74	21.57
30 MHz	QPSK	20	3560.0	1 / 99	10	3574.4	1 / 0	21.21
		20	3625.0	1 / 99	10	3639.4	1 / 0	21.44
		20	3690.0	1 / 0	10	3675.6	1 / 49	21.41
	16-QAM	20	3690.0	1 / 0	10	3675.6	1 / 49	22.59
	64-QAM	20	3690.0	1 / 0	10	3675.6	1 / 49	21.59
25 MHz	QPSK	20	3560.0	1 / 99	5	3571.7	1 / 0	21.24
		20	3625.0	1 / 99	5	3636.7	1 / 0	21.42
		20	3690.0	1 / 0	5	3678.3	1 / 24	21.43
	16-QAM	20	3690.0	1 / 0	5	3678.3	1 / 24	22.61
	64-QAM	20	3690.0	1 / 0	5	3678.3	1 / 24	21.58

Table 7-6. Conducted Power Output Data (ULCA LB48 – 1 RB Case)

Bandwidth	Modulation	PCC			SCC			Conducted Power [dBm]
		Bandwidth [MHz]	Frequency [MHz]	RB / Offset	Bandwidth [MHz]	Frequency [MHz]	RB / Offset	
40 MHz	QPSK	20	3560.0	8 / 92	20	3579.8	8 / 0	22.48
		20	3625.0	8 / 92	20	3644.8	8 / 0	22.68
		20	3690.0	8 / 0	20	3670.2	8 / 92	22.67
	16-QAM	20	3625.0	8 / 92	20	3644.8	8 / 0	21.83
	64-QAM	20	3625.0	8 / 92	20	3644.8	8 / 0	20.01
35 MHz	QPSK	20	3560.0	8 / 92	15	3577.1	8 / 0	22.91
		20	3625.0	8 / 92	15	3642.1	8 / 0	23.09
		20	3690.0	8 / 0	15	3672.9	8 / 67	22.61
	16-QAM	20	3625.0	8 / 92	15	3642.1	8 / 0	22.13
	64-QAM	20	3690.0	8 / 0	15	3672.9	8 / 67	20.72
30 MHz	QPSK	20	3560.0	8 / 92	10	3574.4	8 / 0	22.16
		20	3625.0	8 / 92	10	3639.4	8 / 0	22.30
		20	3690.0	8 / 0	10	3675.6	8 / 42	22.33
	16-QAM	20	3625.0	8 / 92	10	3639.4	8 / 0	21.46
	64-QAM	20	3690.0	8 / 0	10	3675.6	8 / 42	20.39
25 MHz	QPSK	20	3560.0	8 / 92	5	3571.7	8 / 0	22.34
		20	3625.0	8 / 92	5	3636.7	8 / 0	22.38
		20	3690.0	8 / 0	5	3678.3	1 / 17	22.38
	16-QAM	20	3625.0	8 / 92	5	3636.7	8 / 0	21.51
	64-QAM	20	3690.0	8 / 0	5	3678.3	1 / 17	20.48

Table 7-7. Conducted Power Output Data (ULCA LB48 – 8 RB Case)

7.3 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.

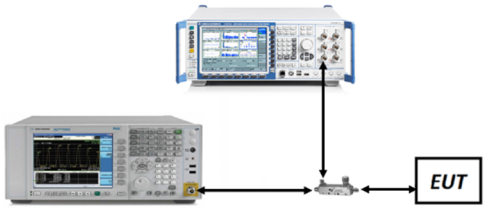
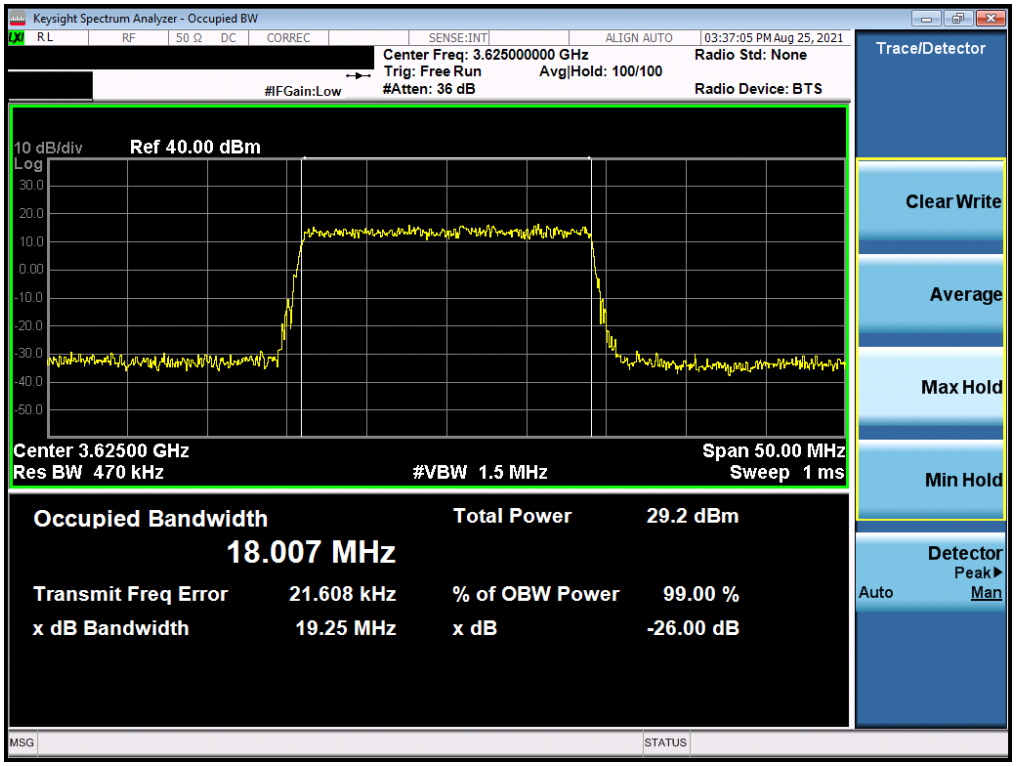


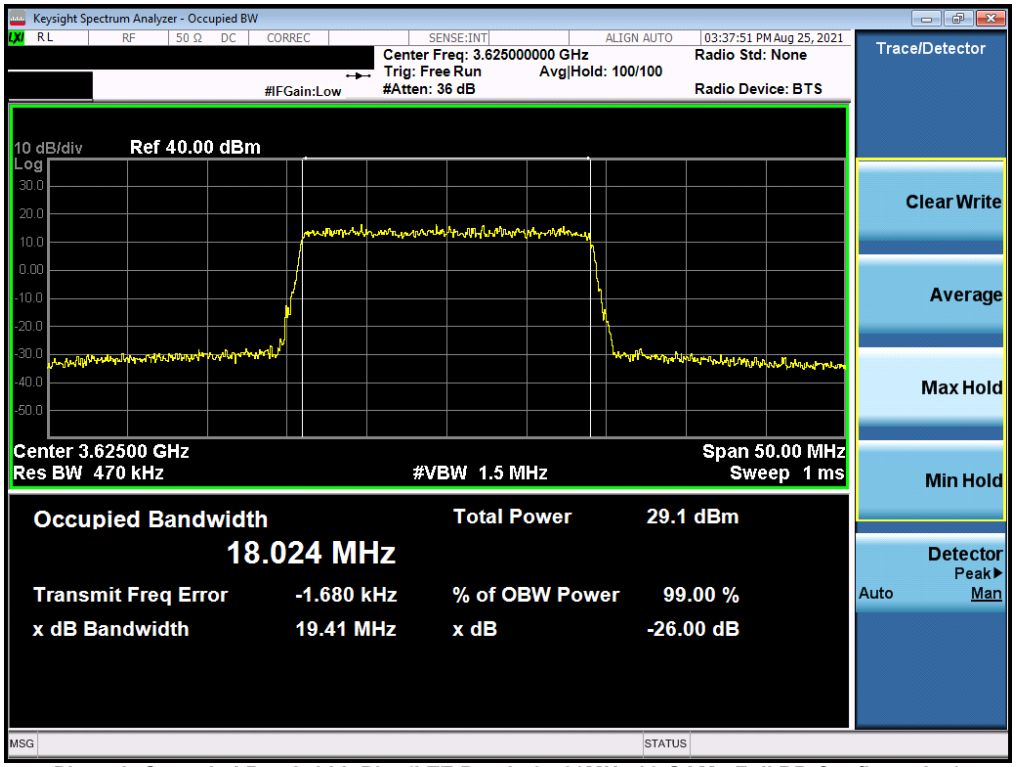
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

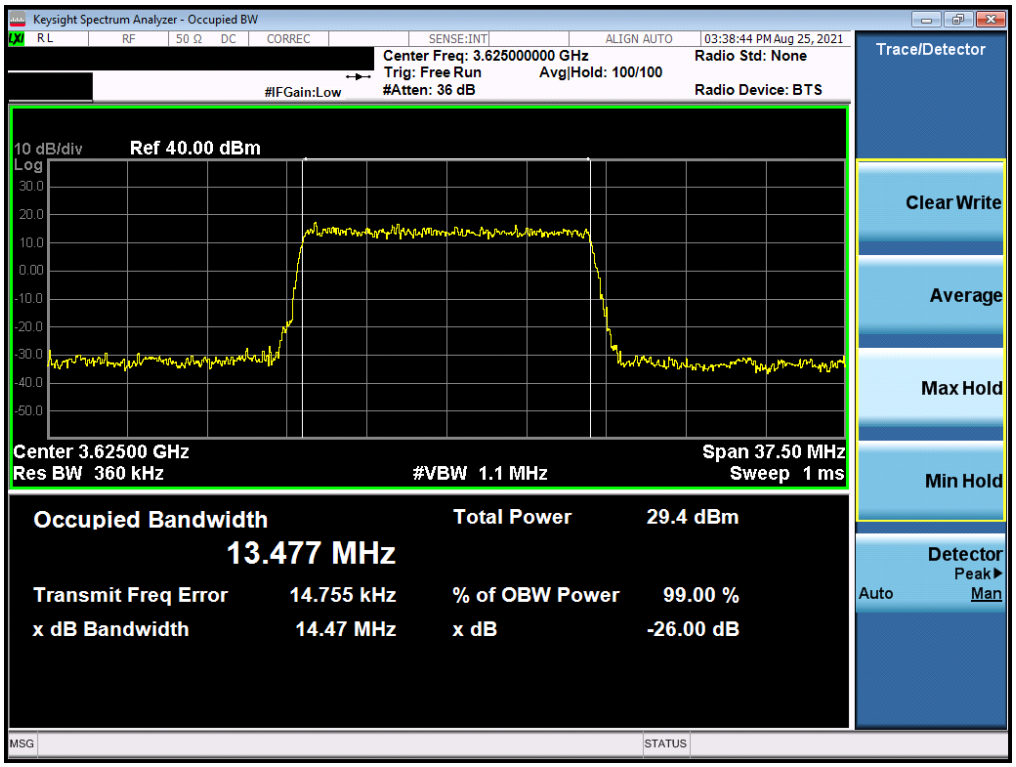
LTE Band 48



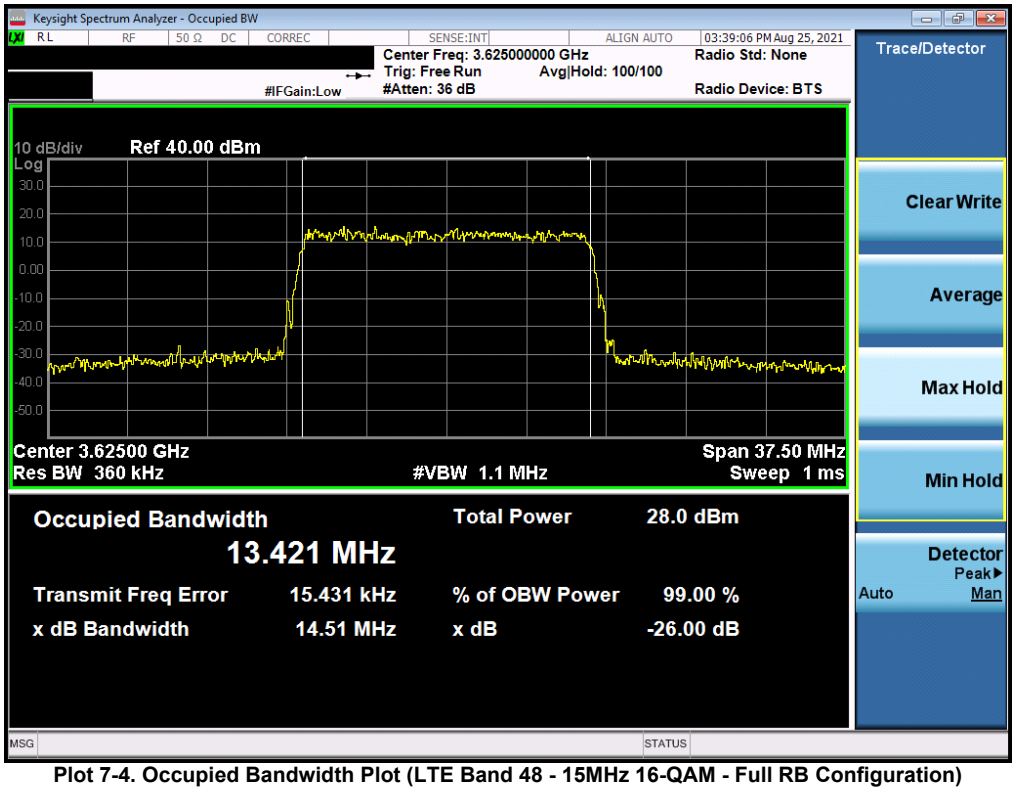
Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)



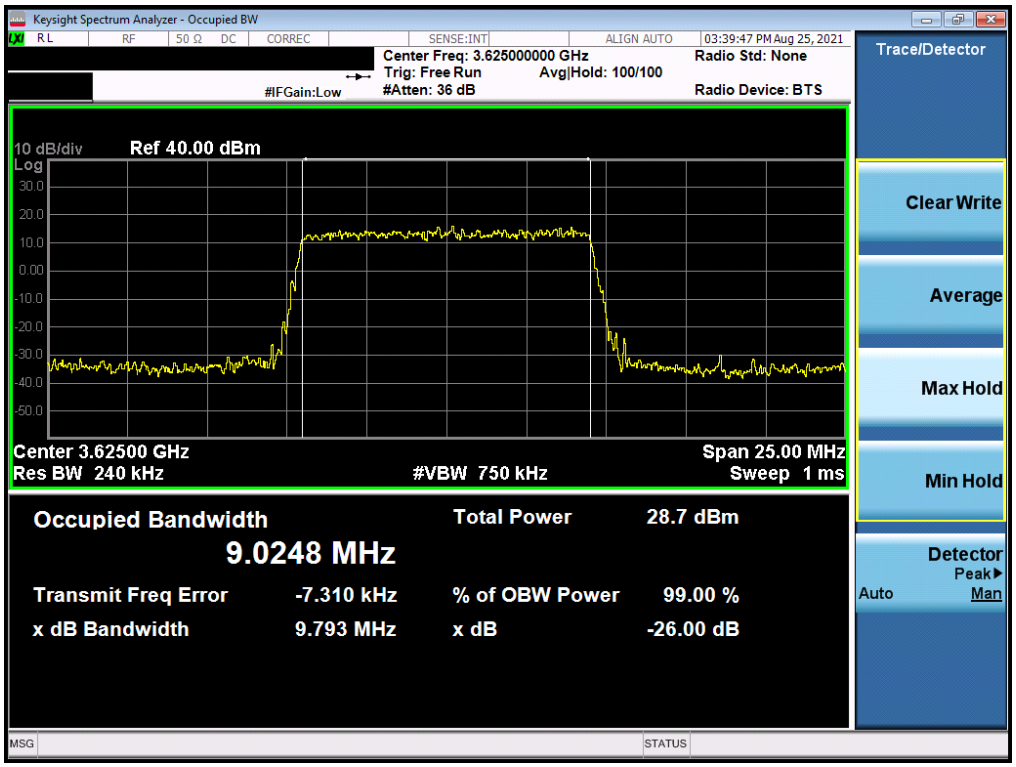
Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)



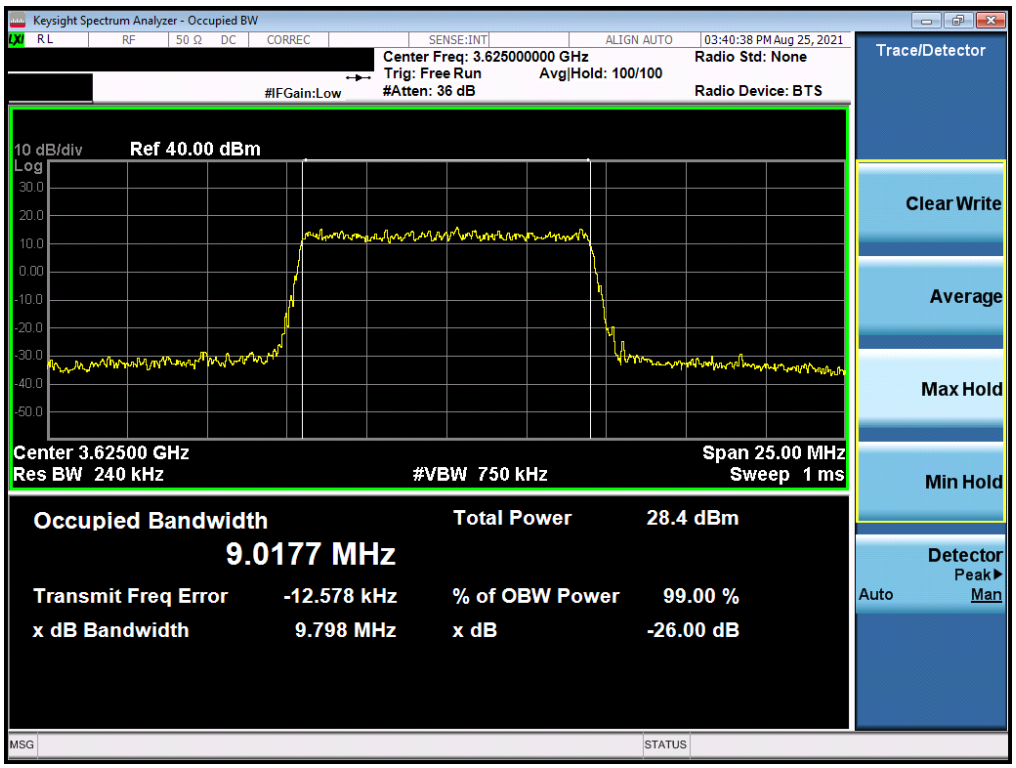
Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)



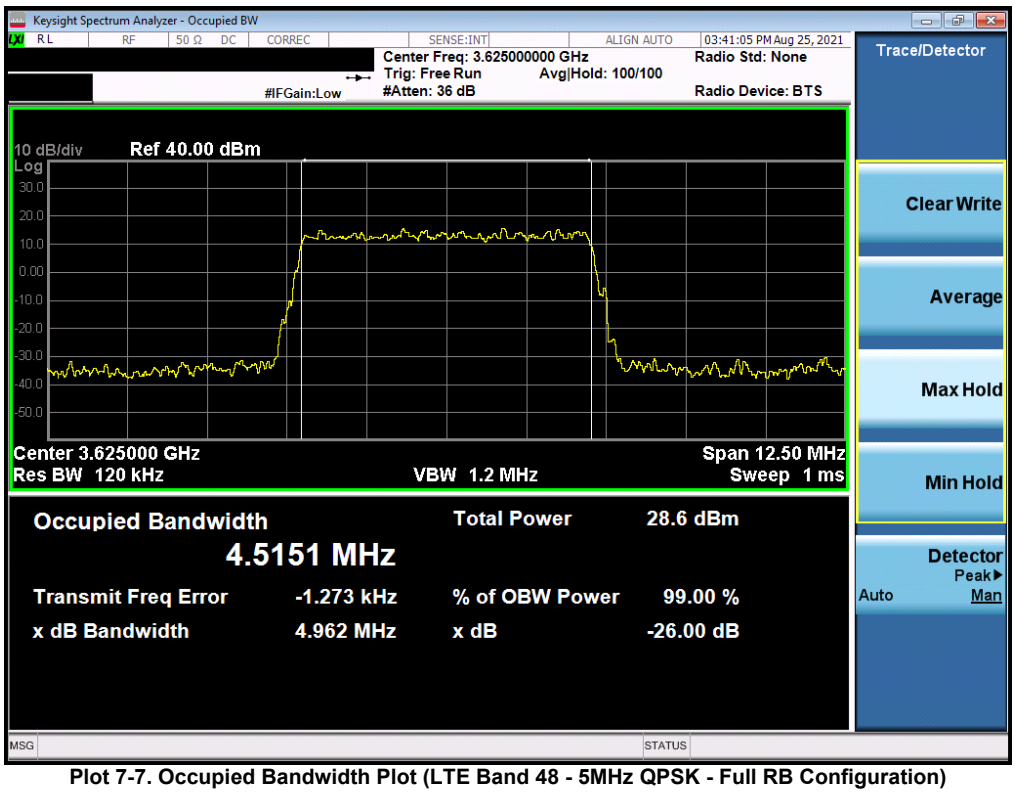
Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)



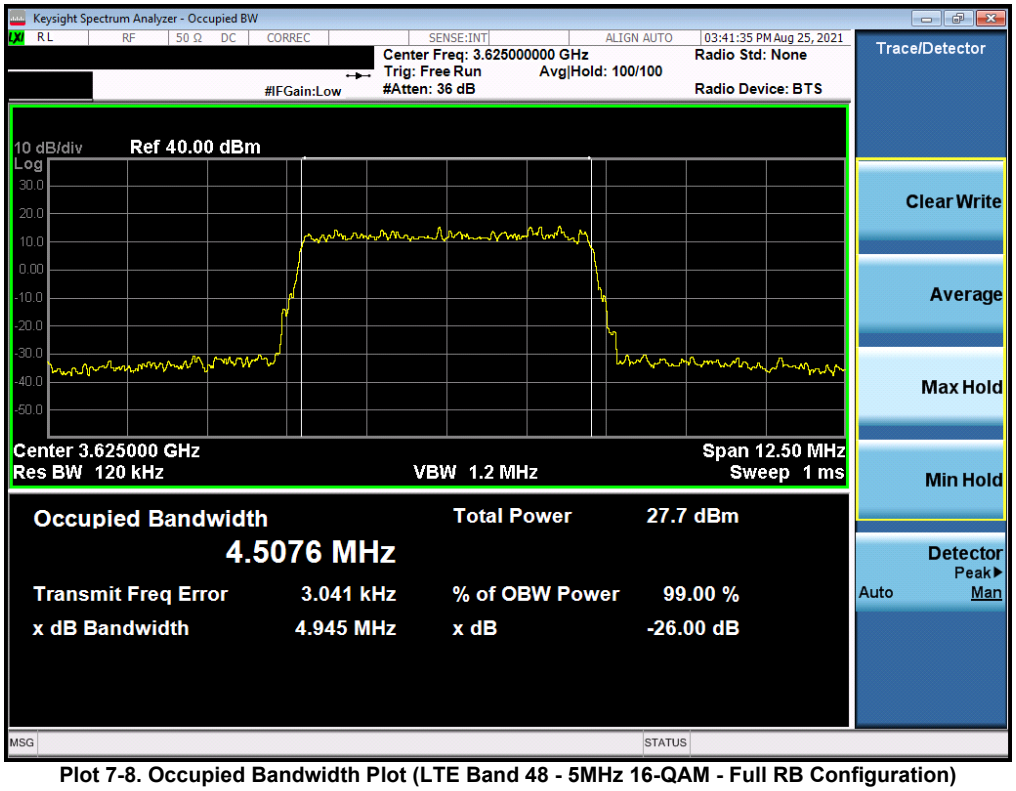
Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)



Plot 7-6. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 16-QAM - Full RB Configuration)

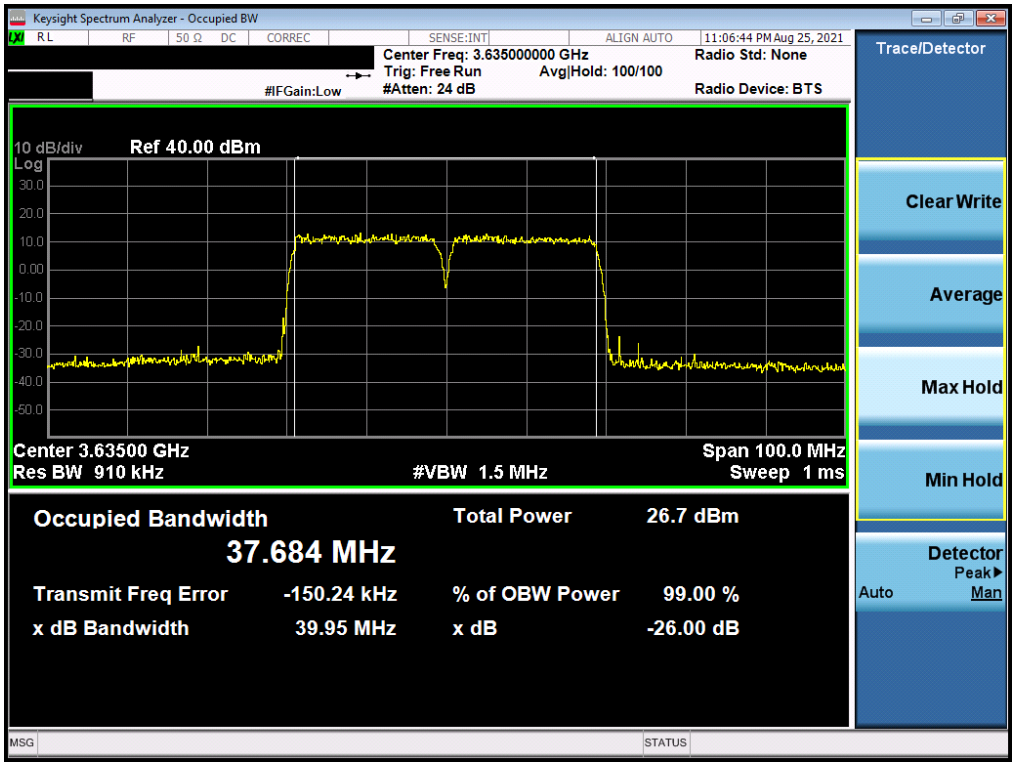


Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

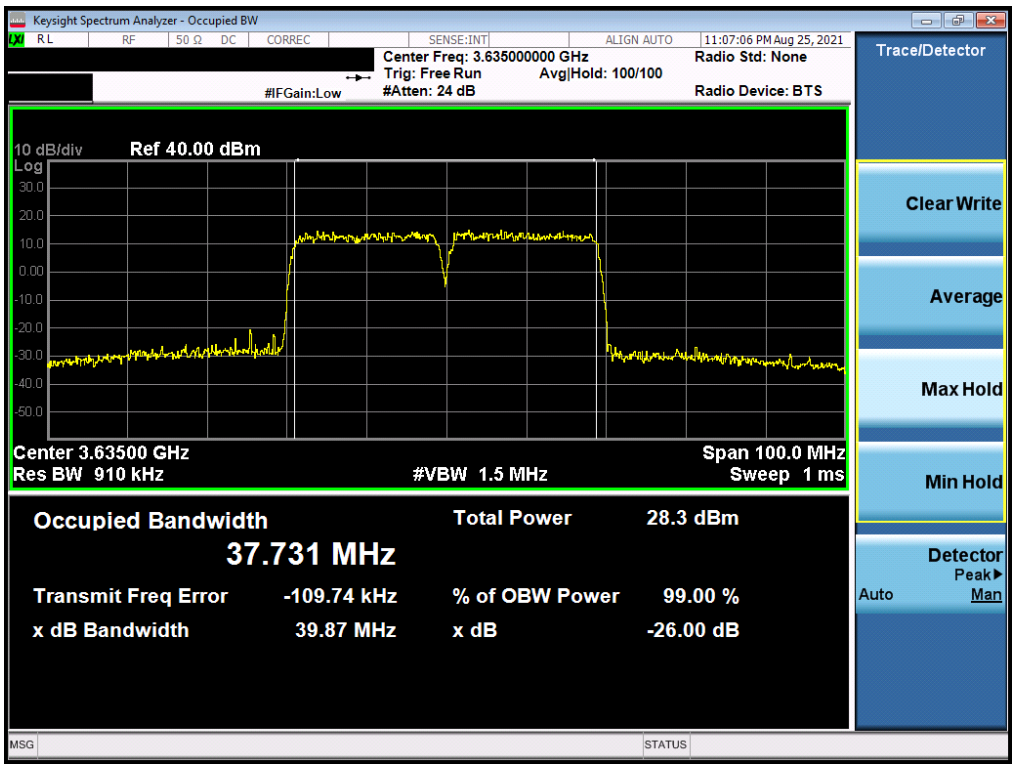


Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

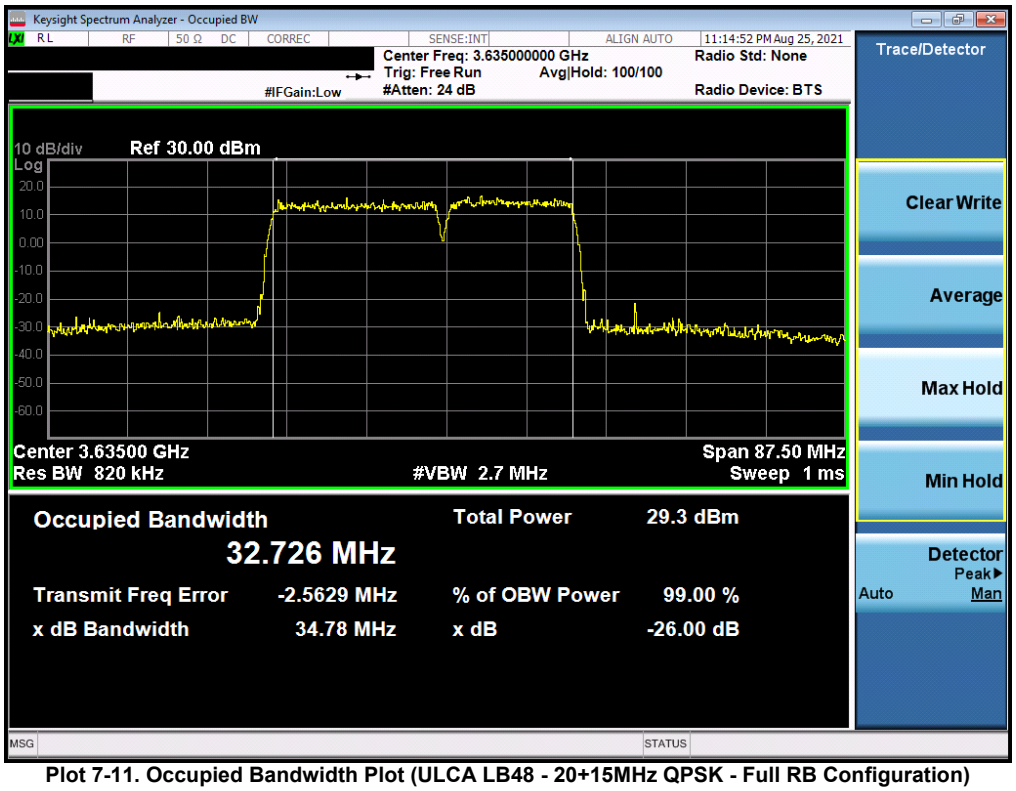
ULCA LTE Band 48



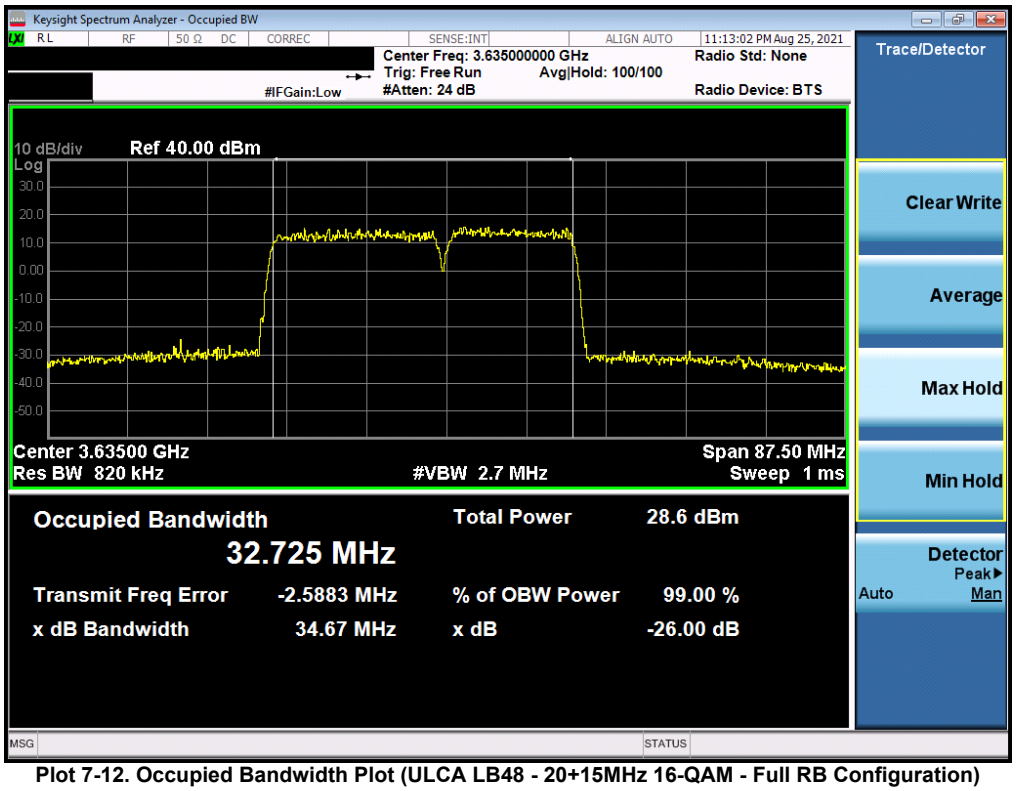
Plot 7-9. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz QPSK - Full RB Configuration)



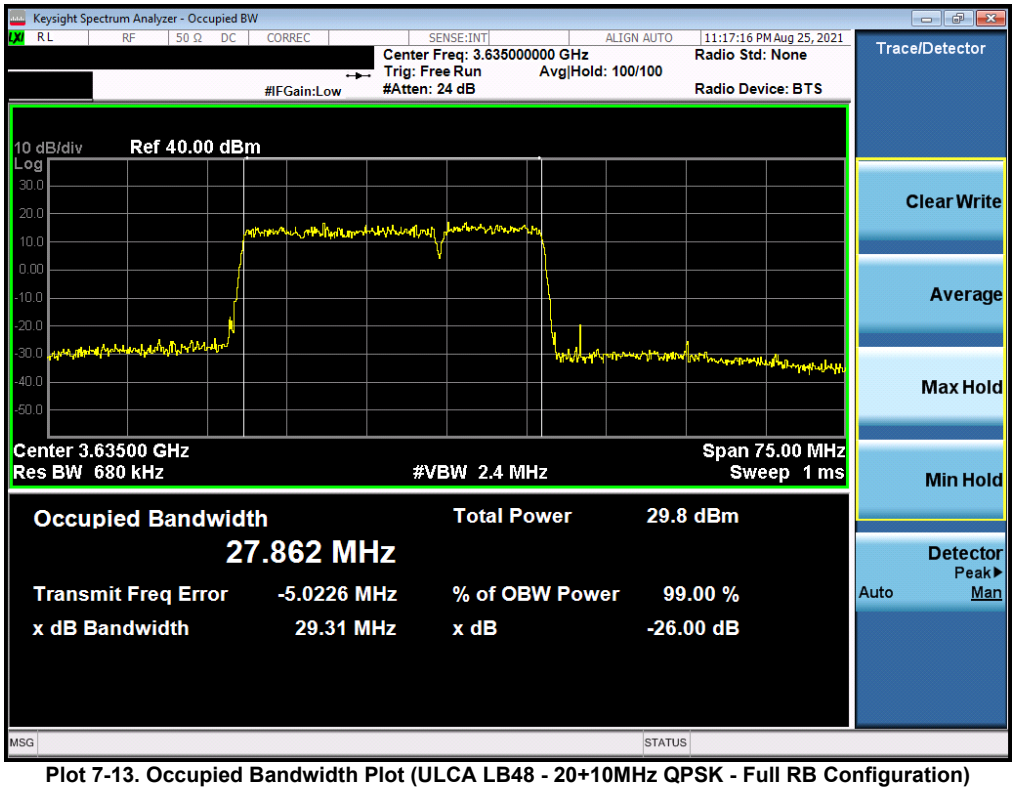
Plot 7-10. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz 16-QAM - Full RB Configuration)



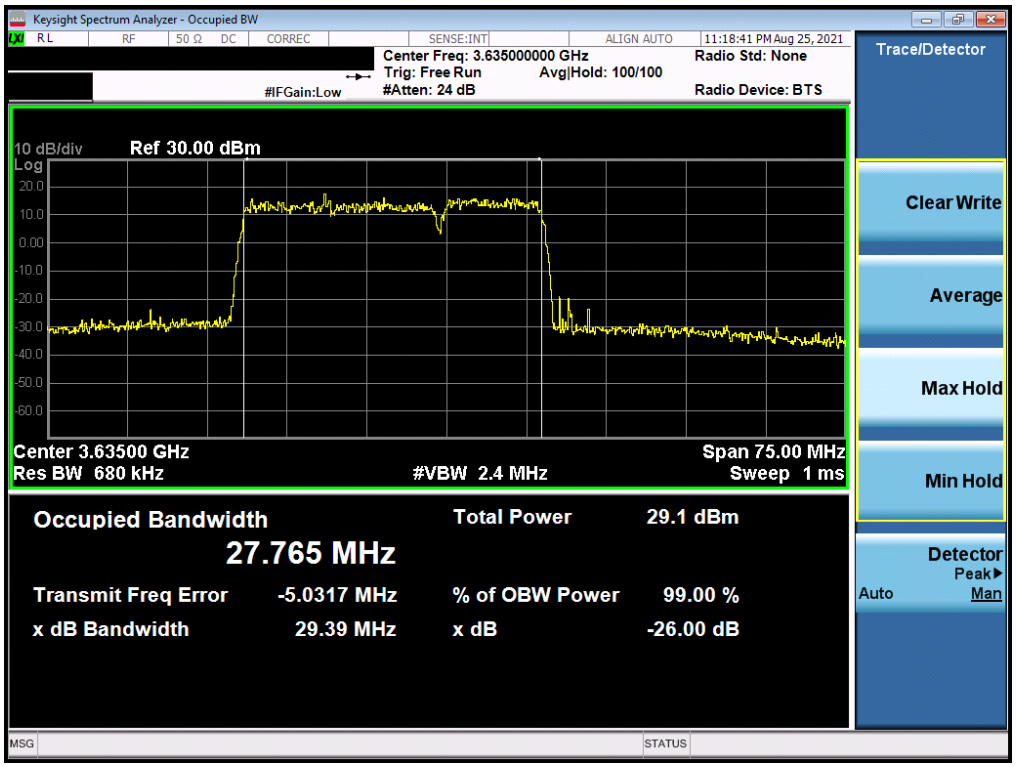
Plot 7-11. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz QPSK - Full RB Configuration)



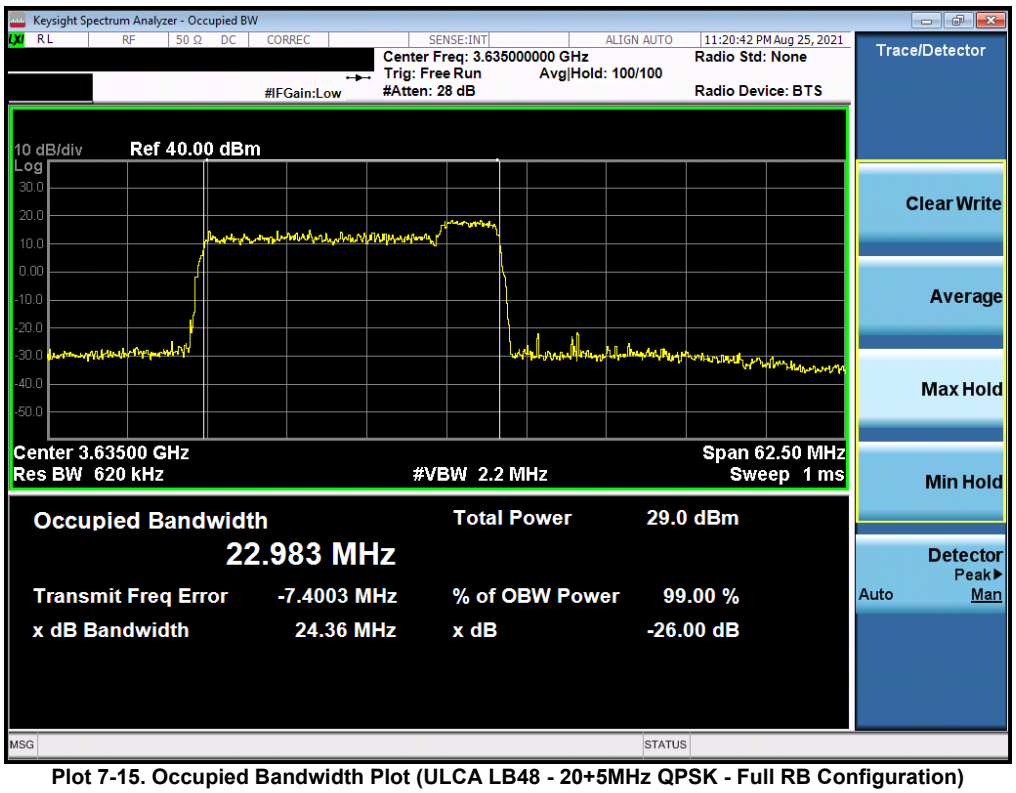
Plot 7-12. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz 16-QAM - Full RB Configuration)



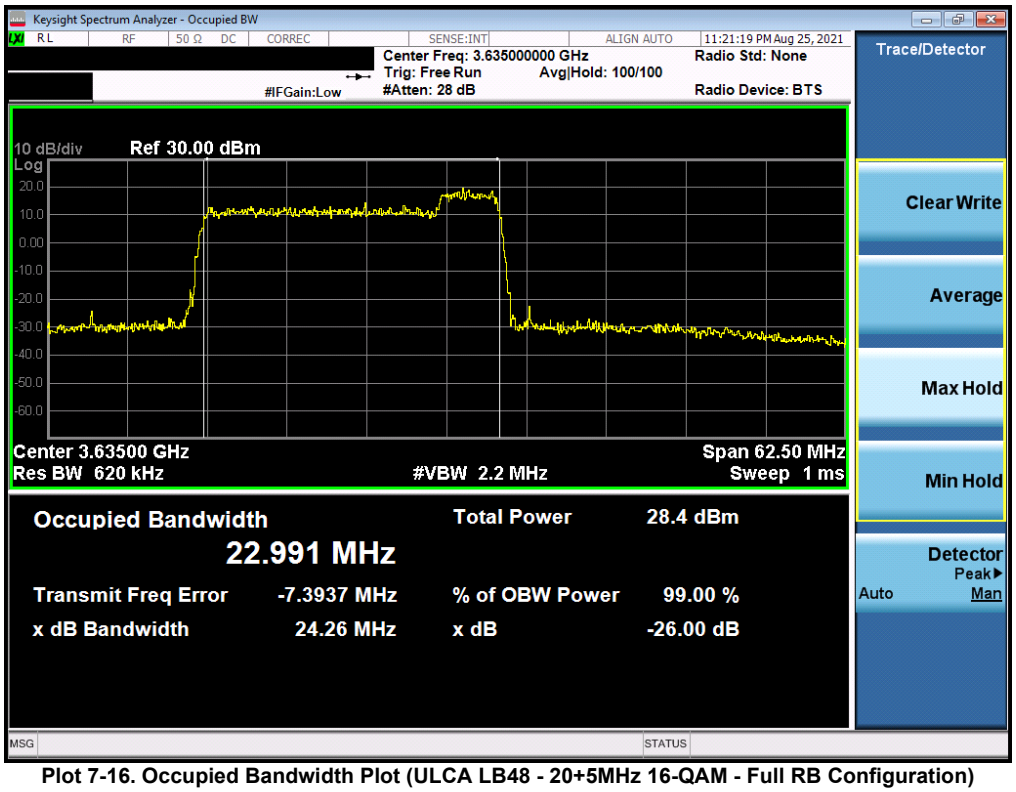
Plot 7-13. Occupied Bandwidth Plot (ULCA LB48 - 20+10MHz QPSK - Full RB Configuration)



Plot 7-14. Occupied Bandwidth Plot (ULCA LB48 - 20+10MHz 16-QAM - Full RB Configuration)



Plot 7-15. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz QPSK - Full RB Configuration)



Plot 7-16. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz 16-QAM - Full RB Configuration)

7.4 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.

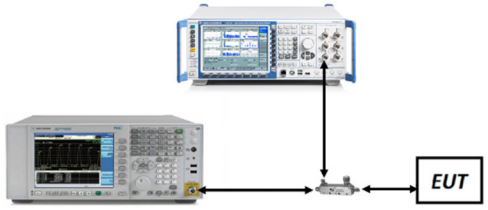
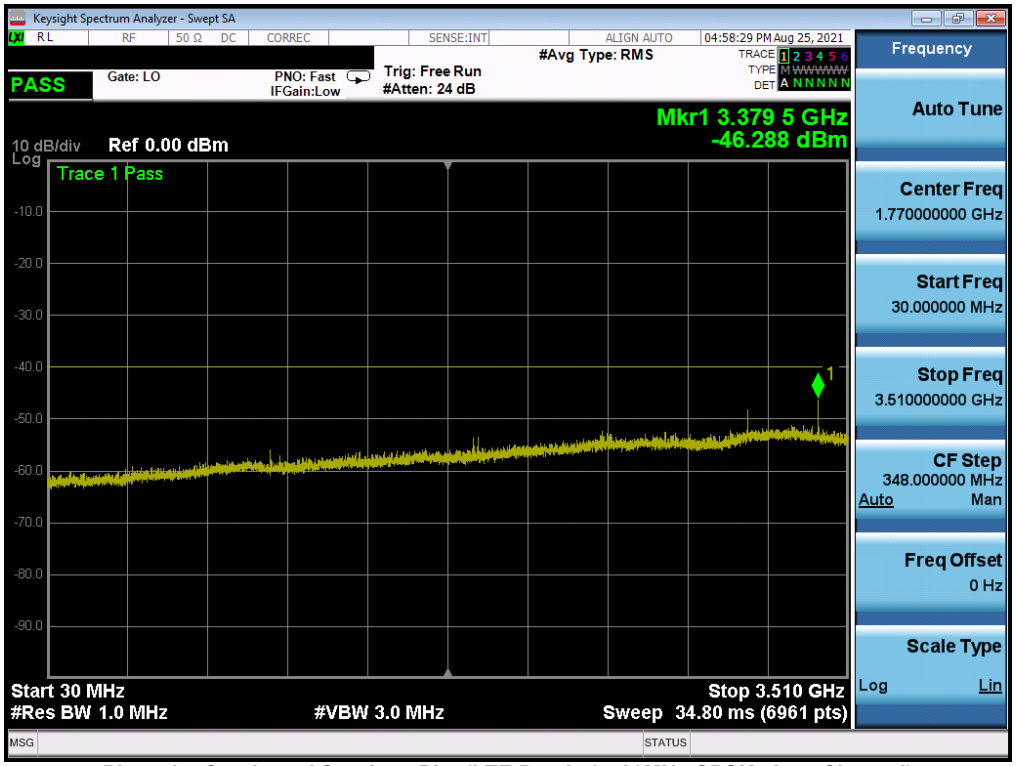


Figure 7-3. Test Instrument & Measurement Setup

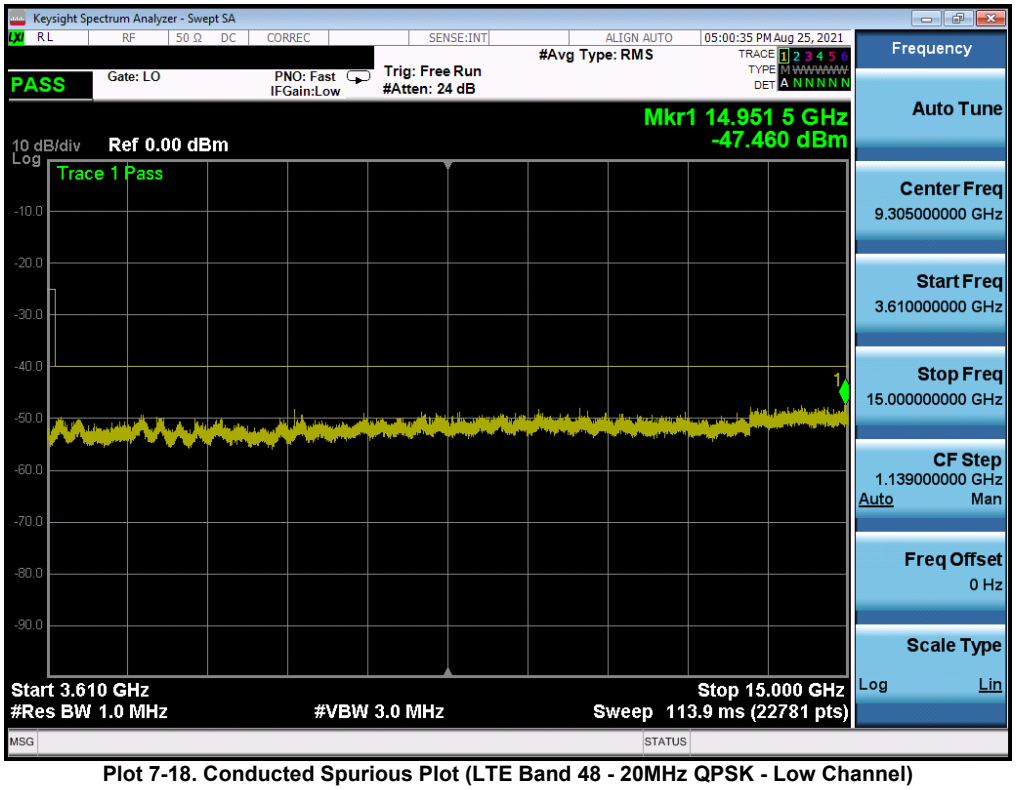
Test Notes

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.

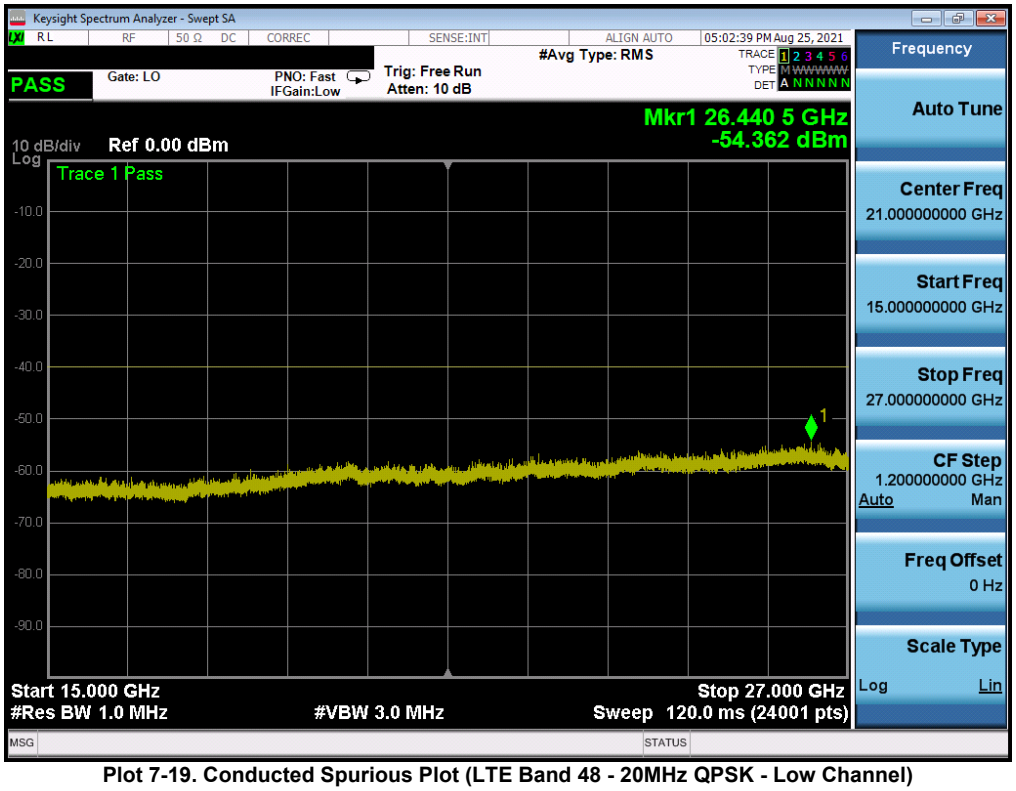
LTE Band 48



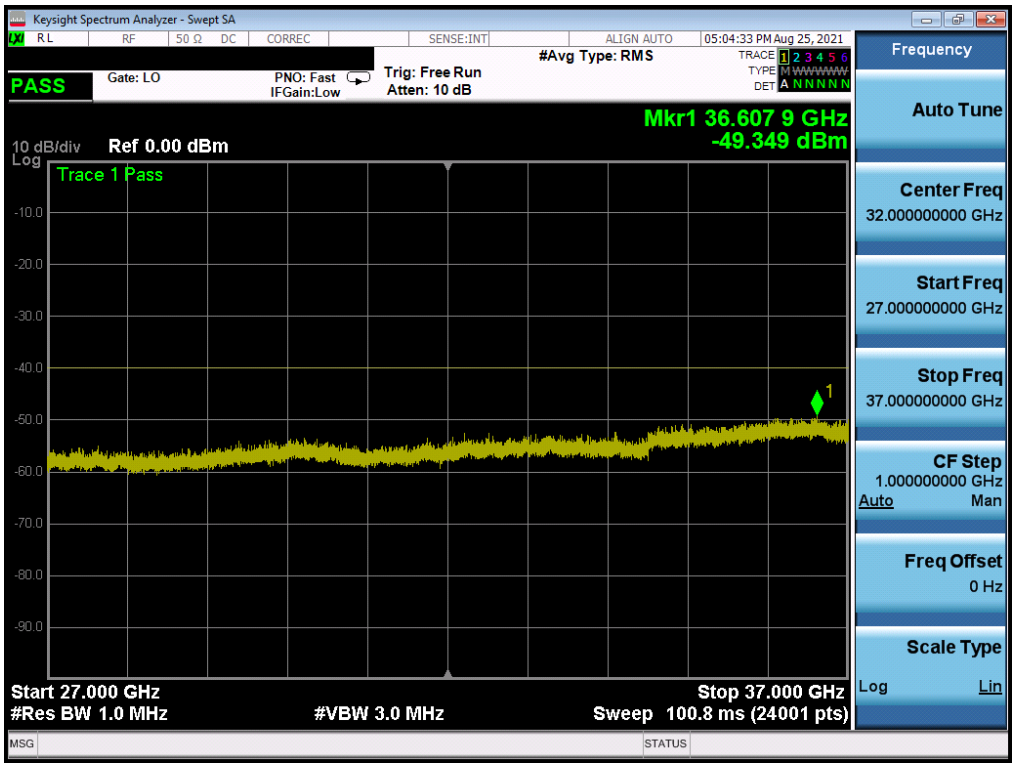
Plot 7-17. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)



Plot 7-18. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

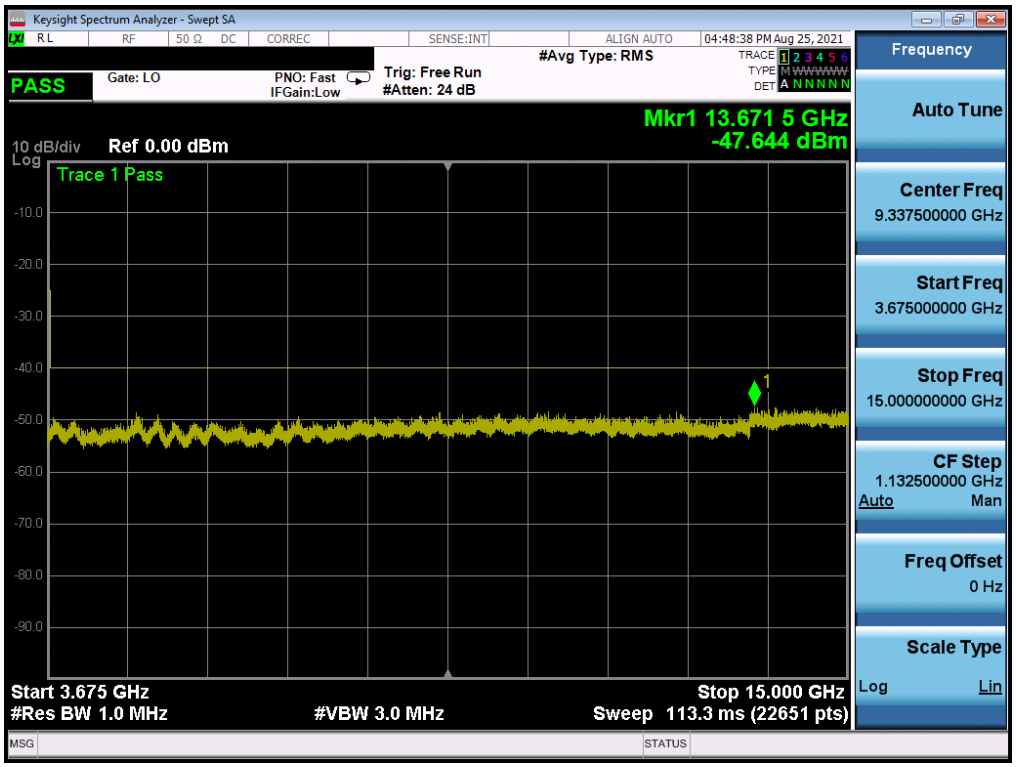


Plot 7-19. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)



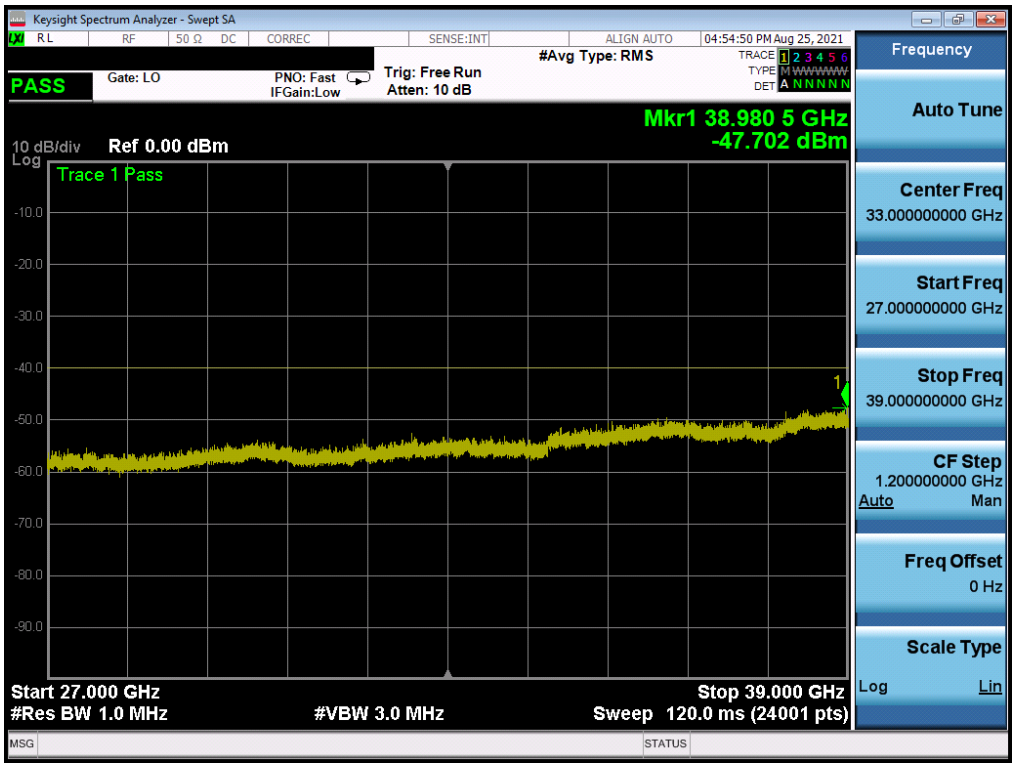
Plot 7-20. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

Plot 7-21. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)



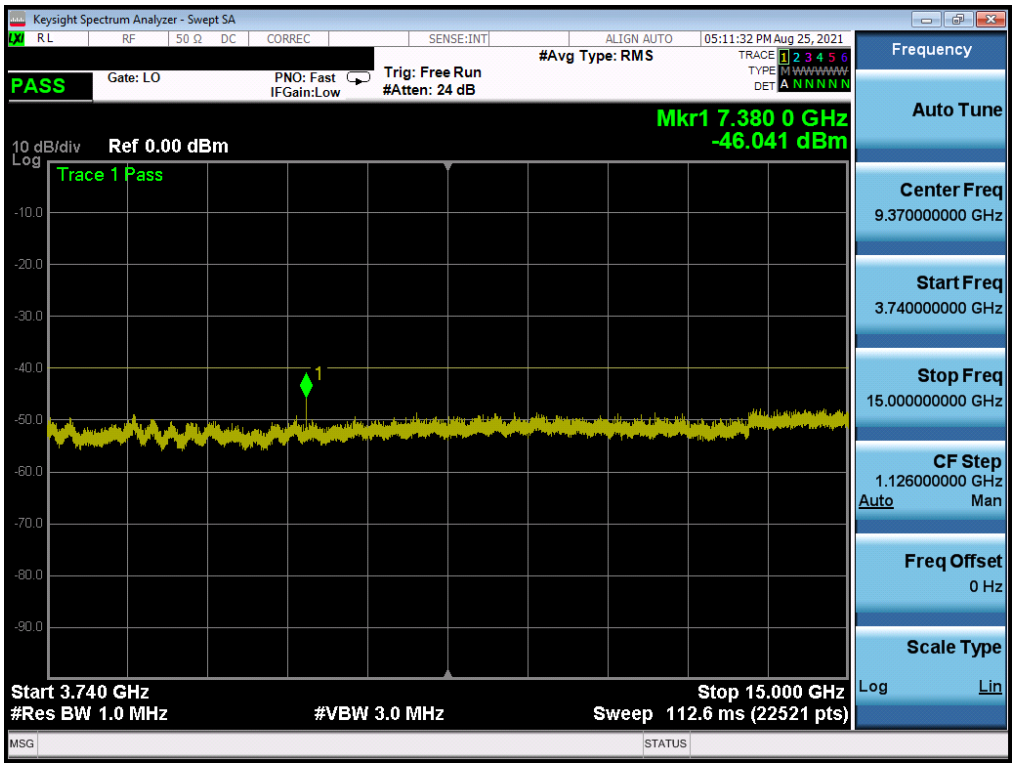
Plot 7-22. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

Plot 7-23. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)



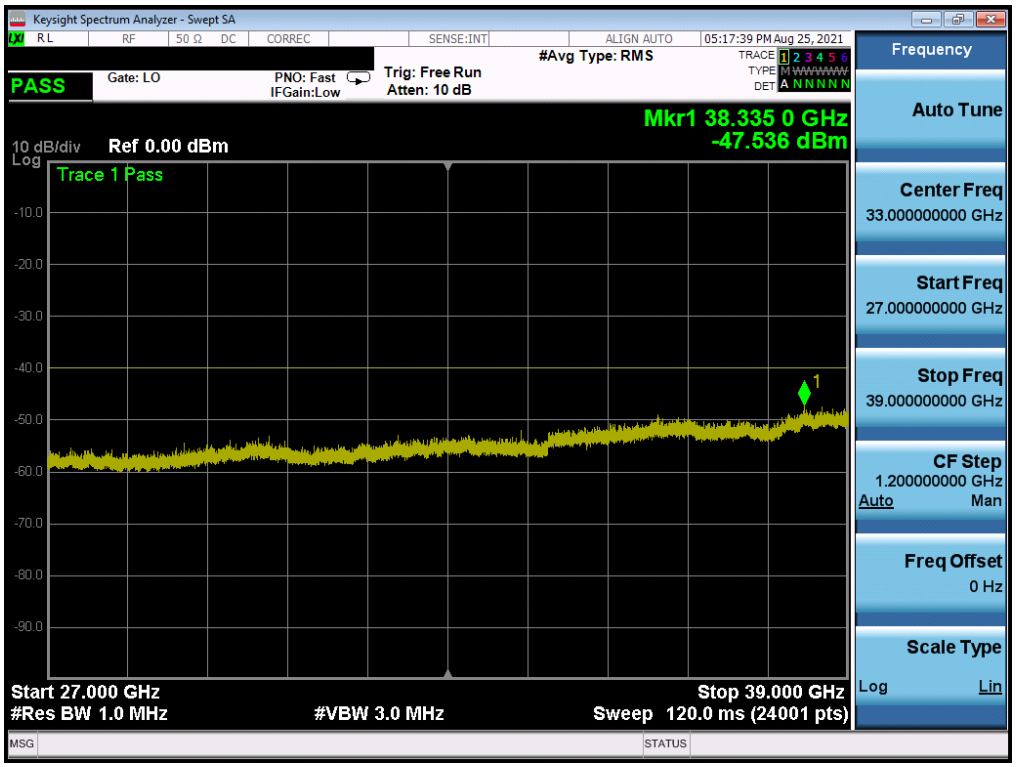
Plot 7-24. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

Plot 7-25. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)



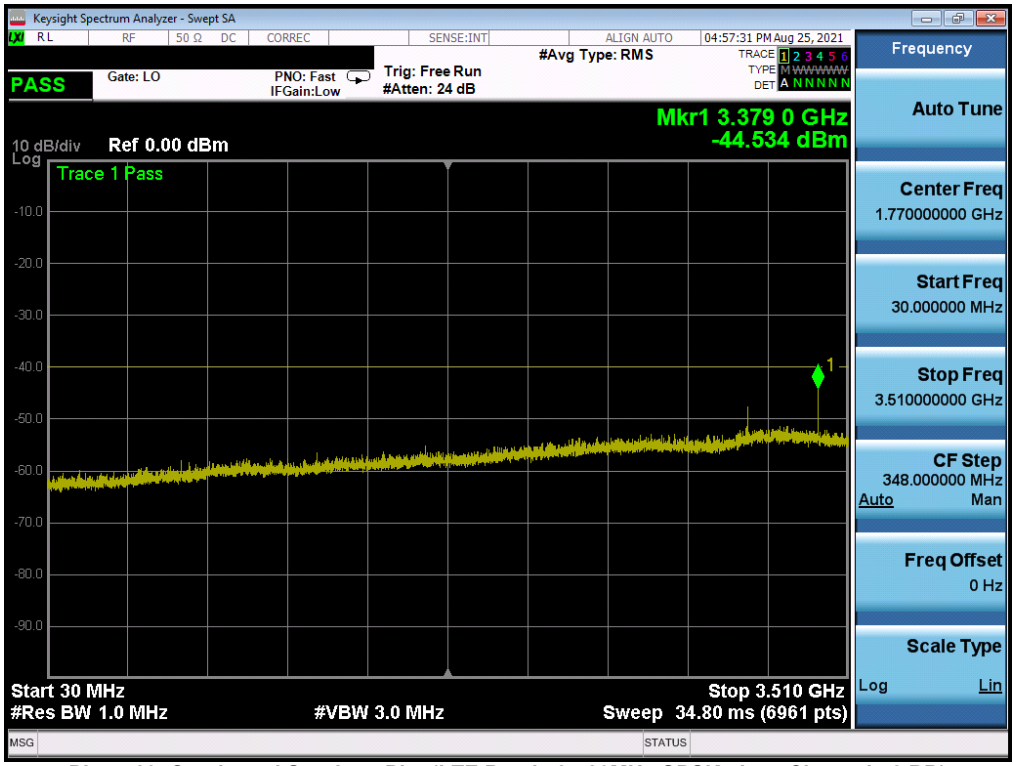
Plot 7-26. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

Plot 7-27. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

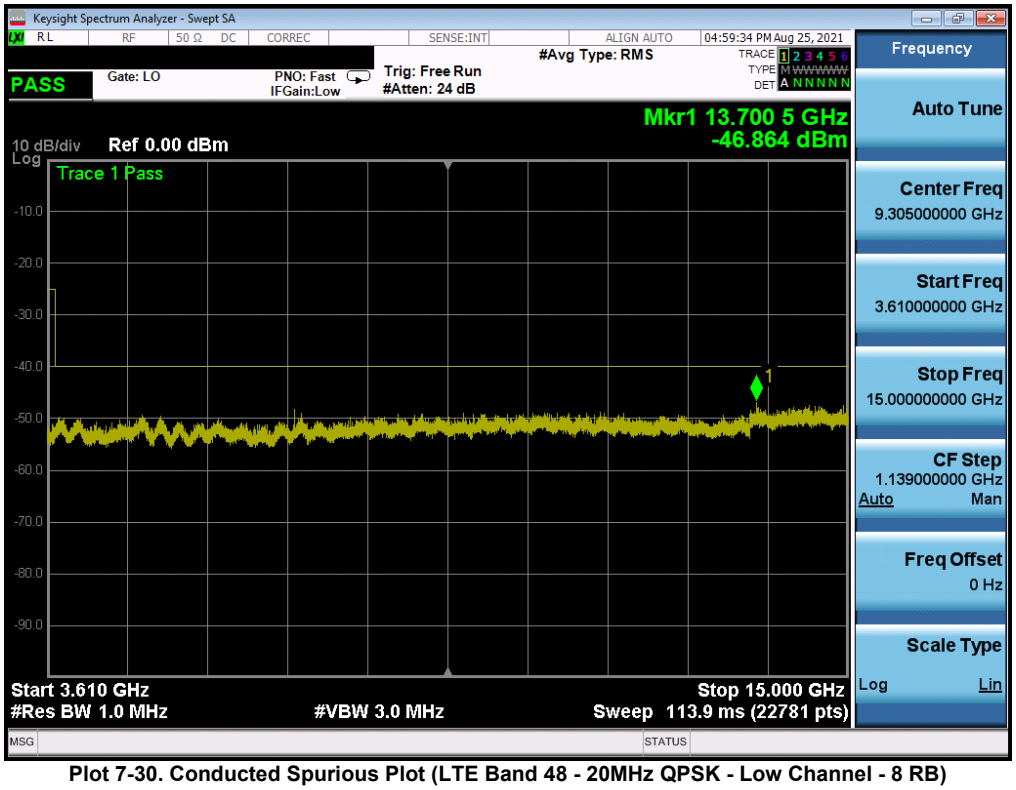


Plot 7-28. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

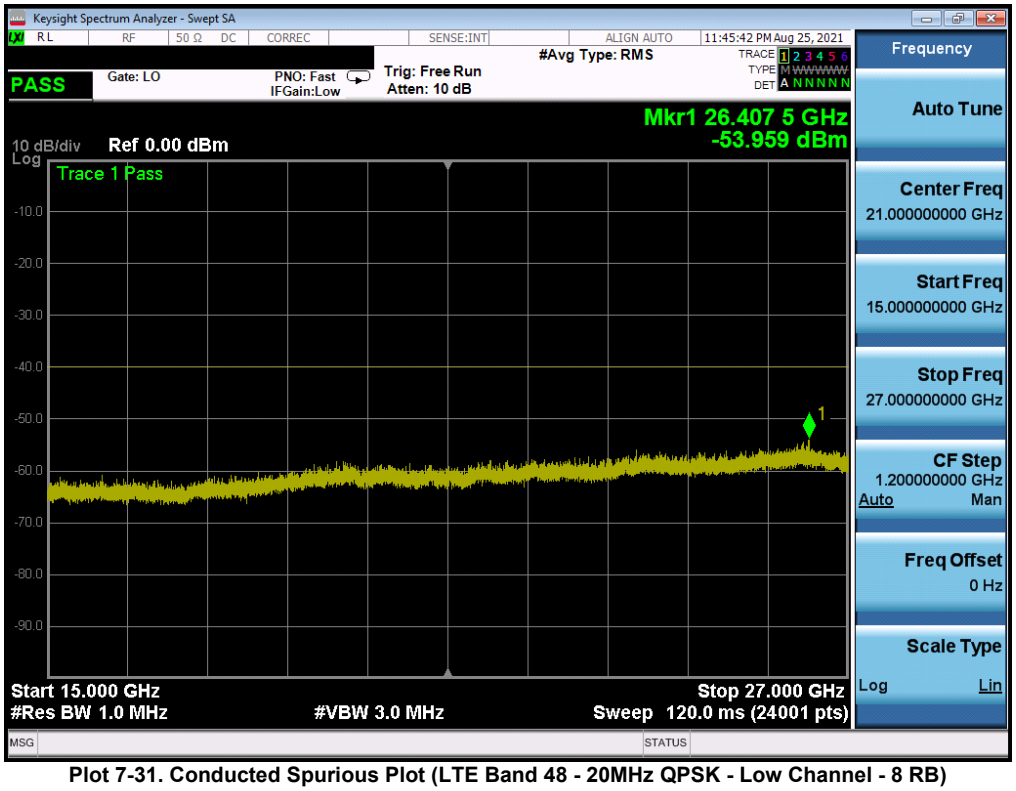
LTE Band 48 - 8 RB Case



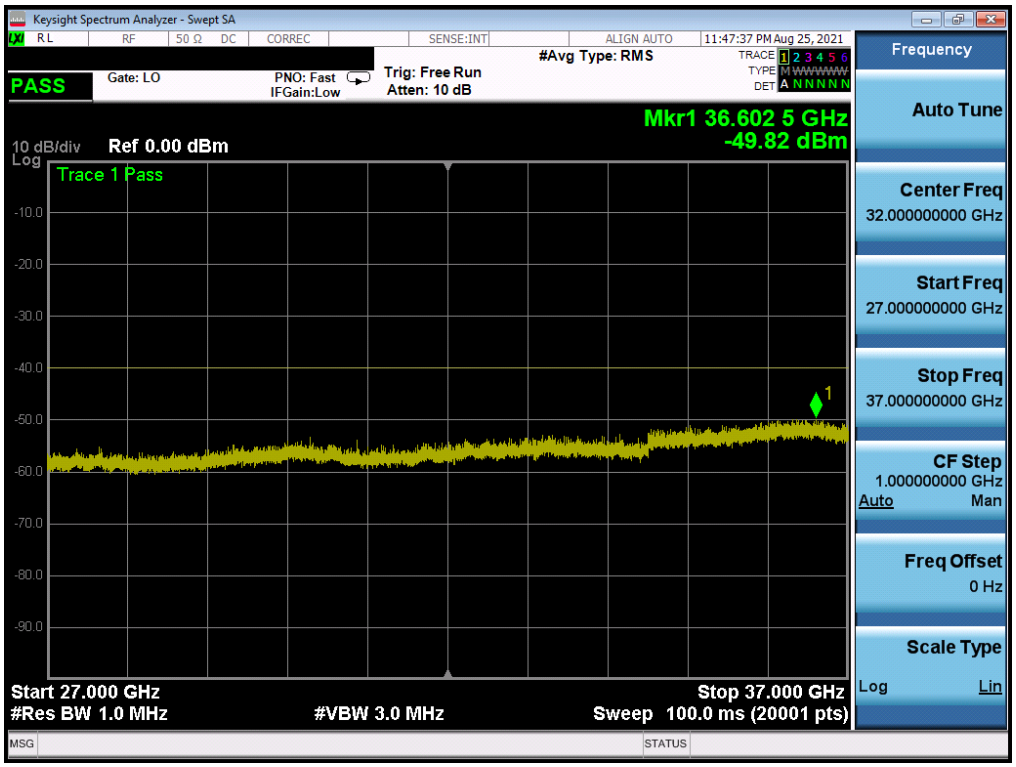
Plot 7-29. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - 8 RB)



Plot 7-30. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - 8 RB)

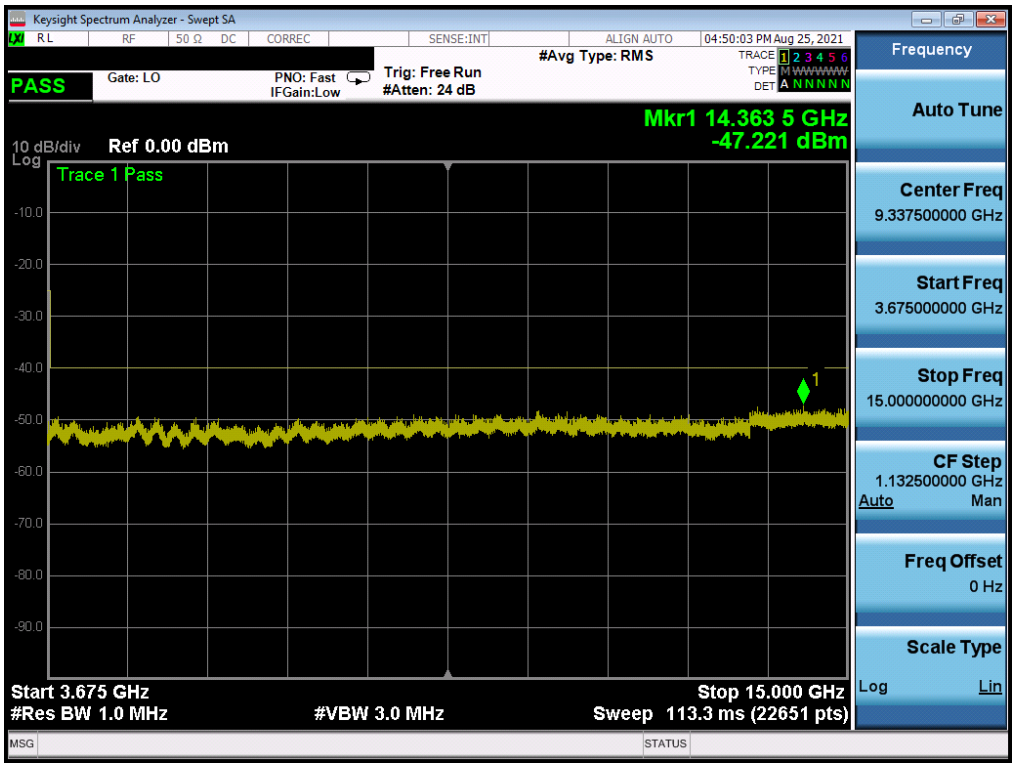


Plot 7-31. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - 8 RB)

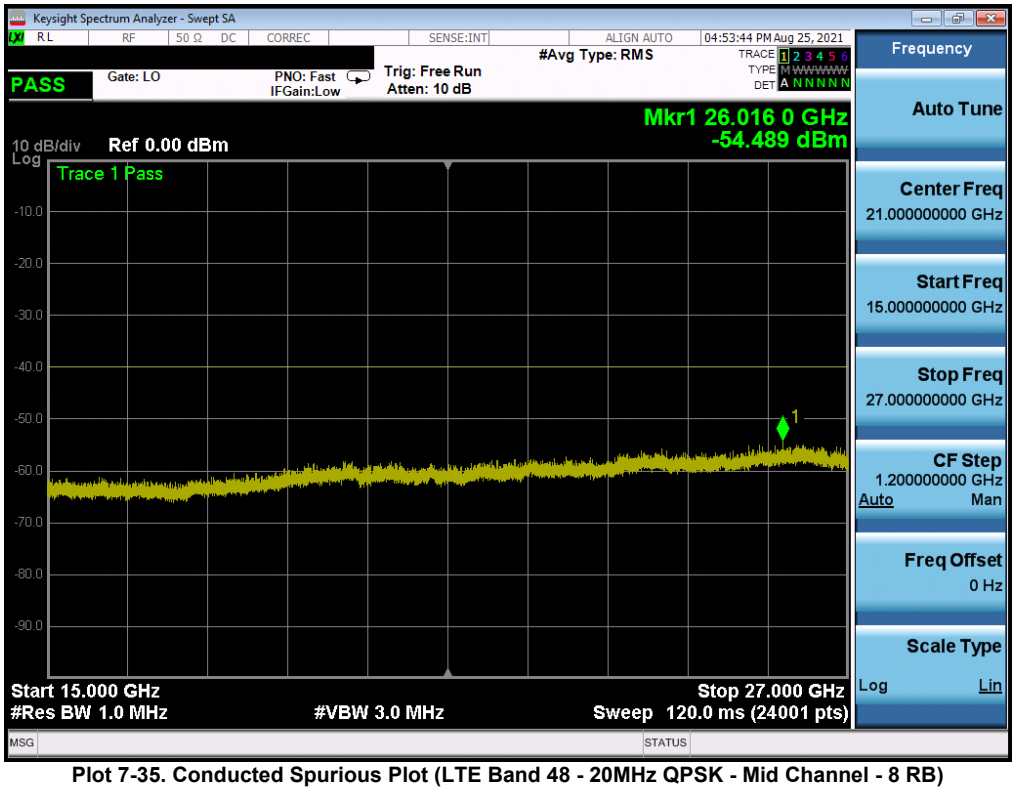


Plot 7-32. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - 8 RB)

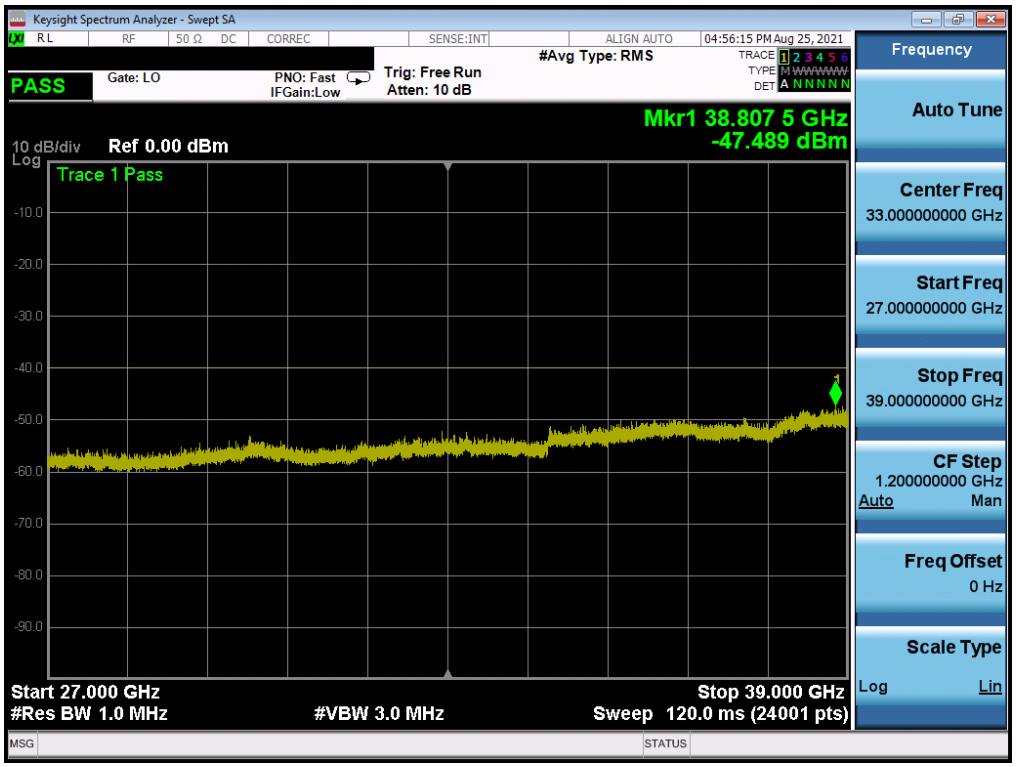
Plot 7-33. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - 8 RB)



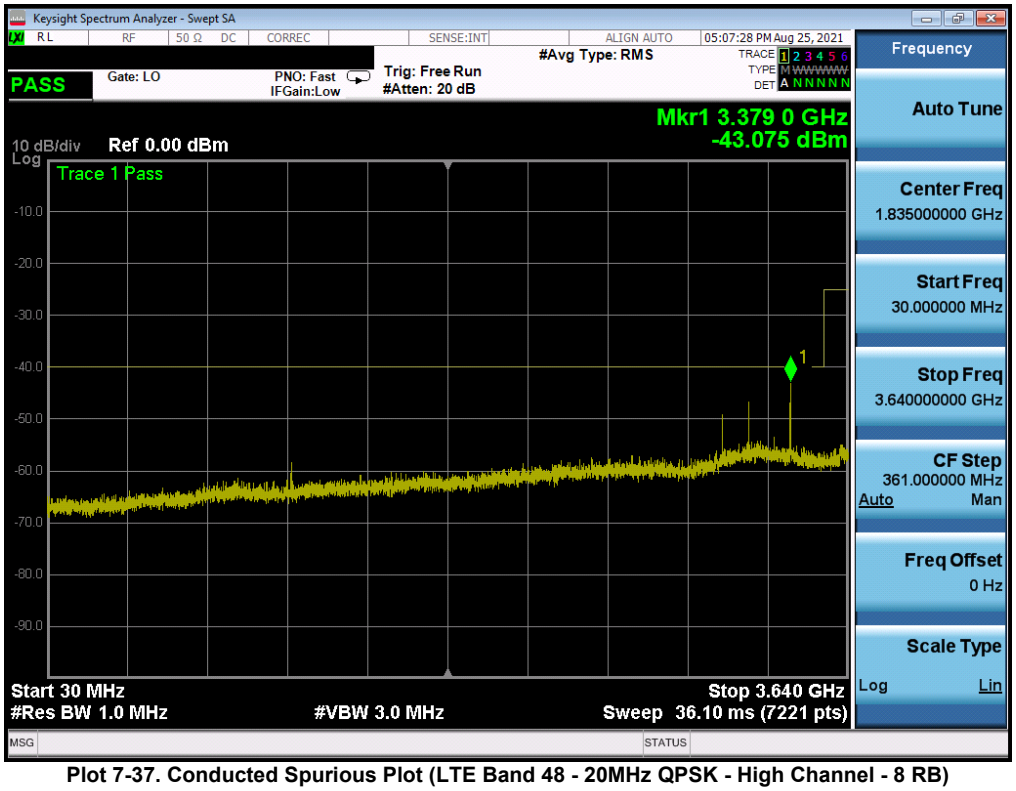
Plot 7-34. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - 8 RB)



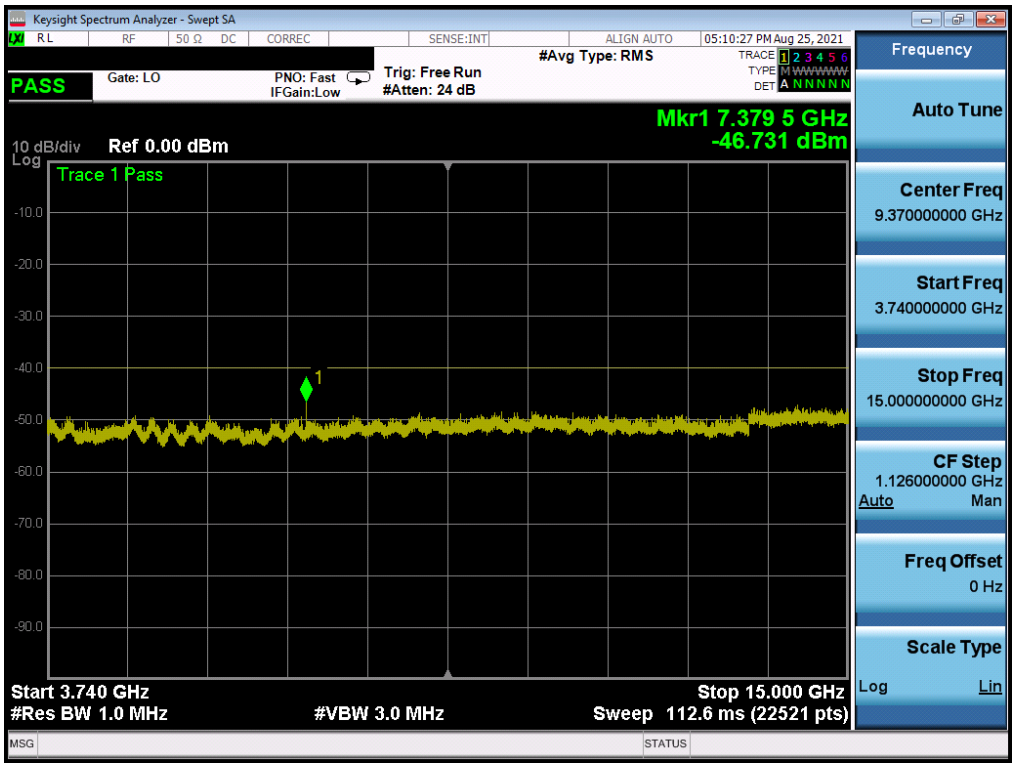
Plot 7-35. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - 8 RB)



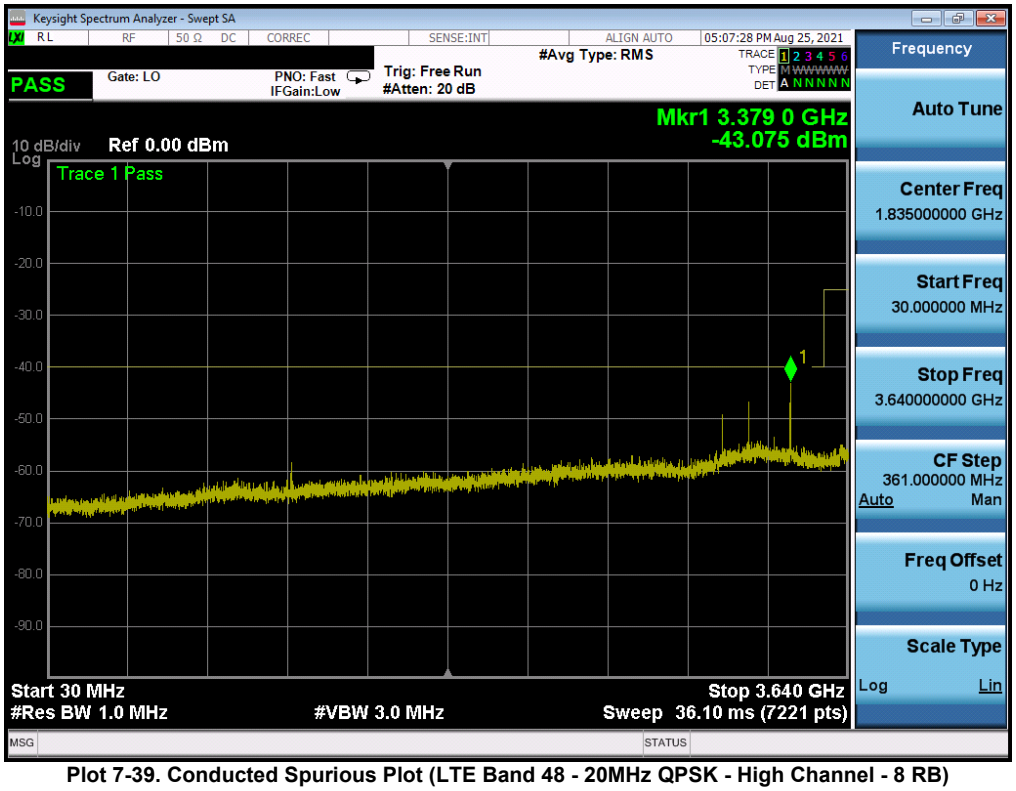
Plot 7-36. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - 8 RB)



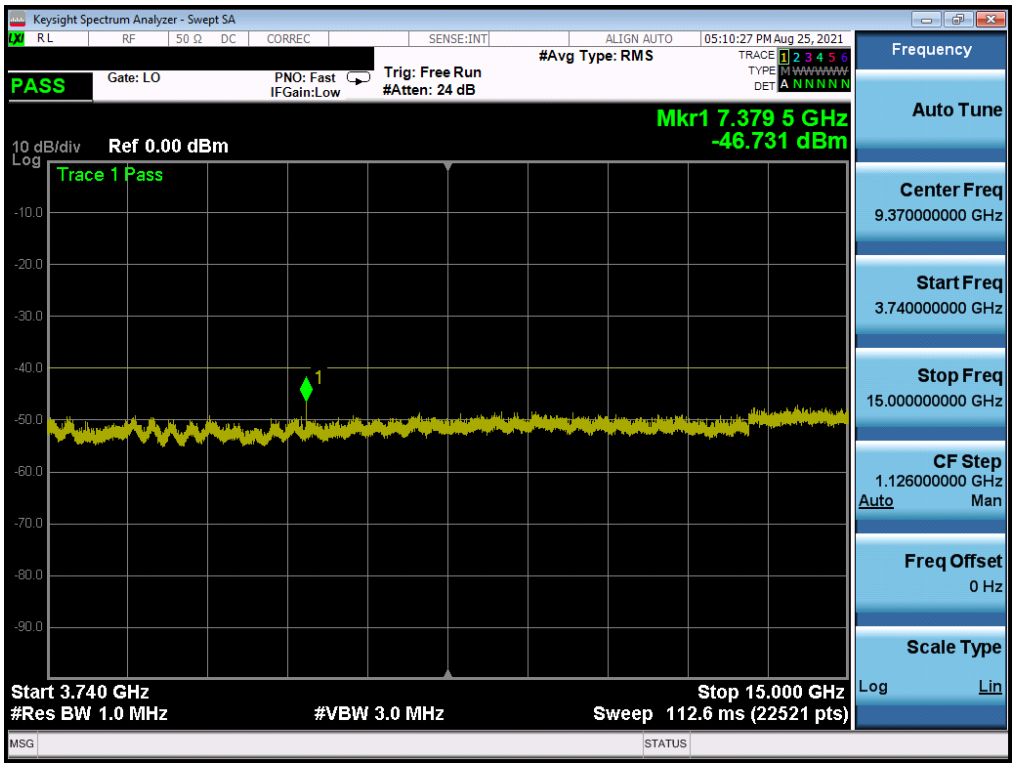
Plot 7-37. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - 8 RB)



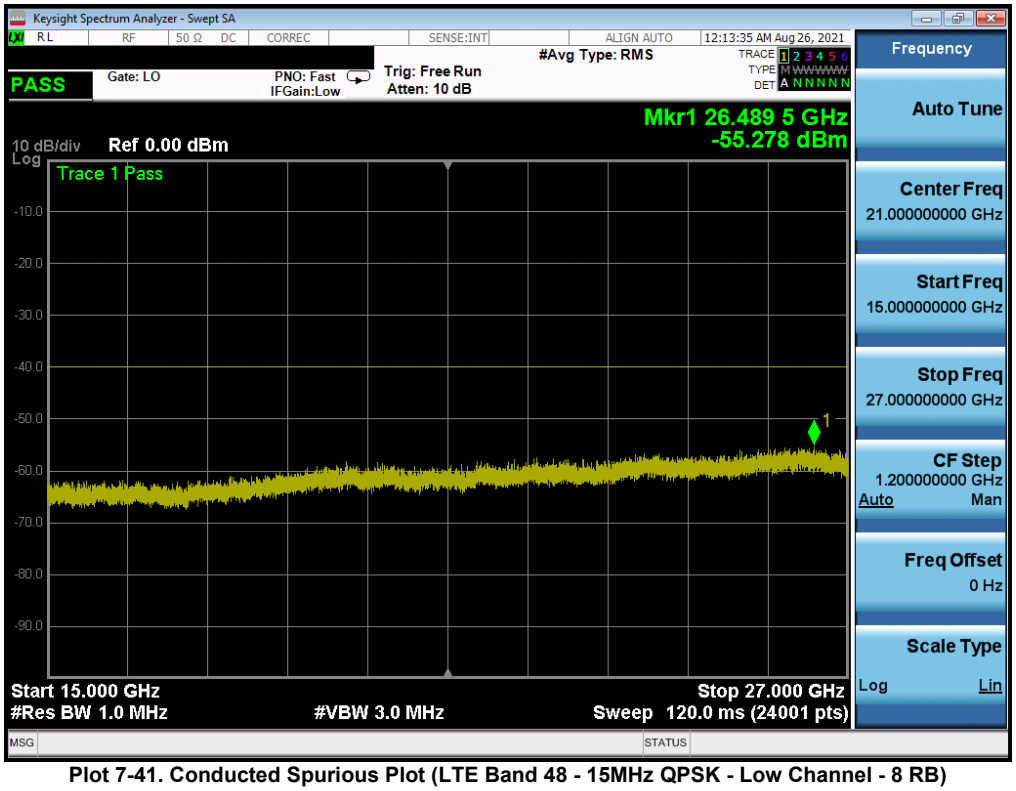
Plot 7-38. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - 8 RB)



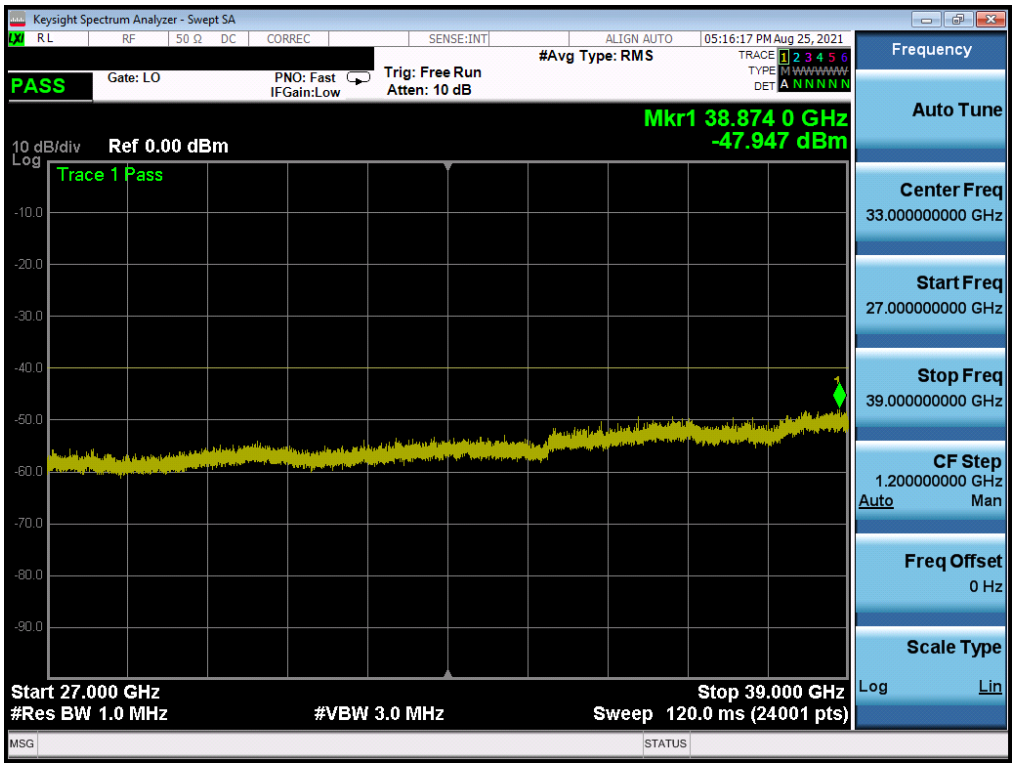
Plot 7-39. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - 8 RB)



Plot 7-40. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - 8 RB)

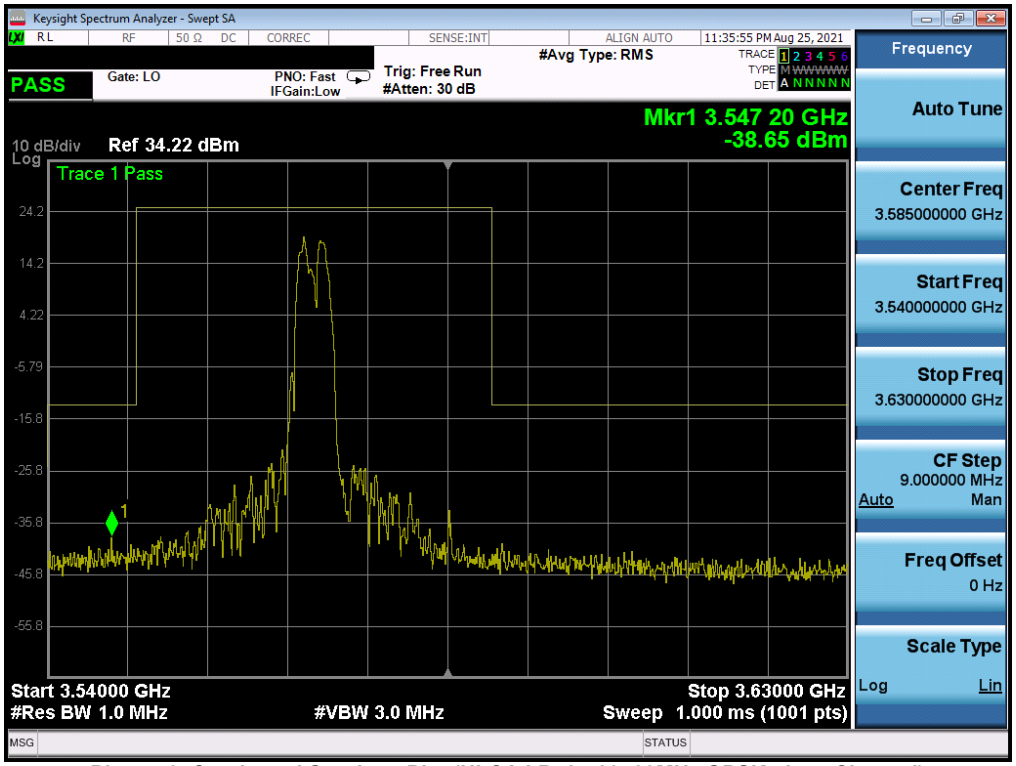


Plot 7-41. Conducted Spurious Plot (LTE Band 48 - 15MHz QPSK - Low Channel - 8 RB)

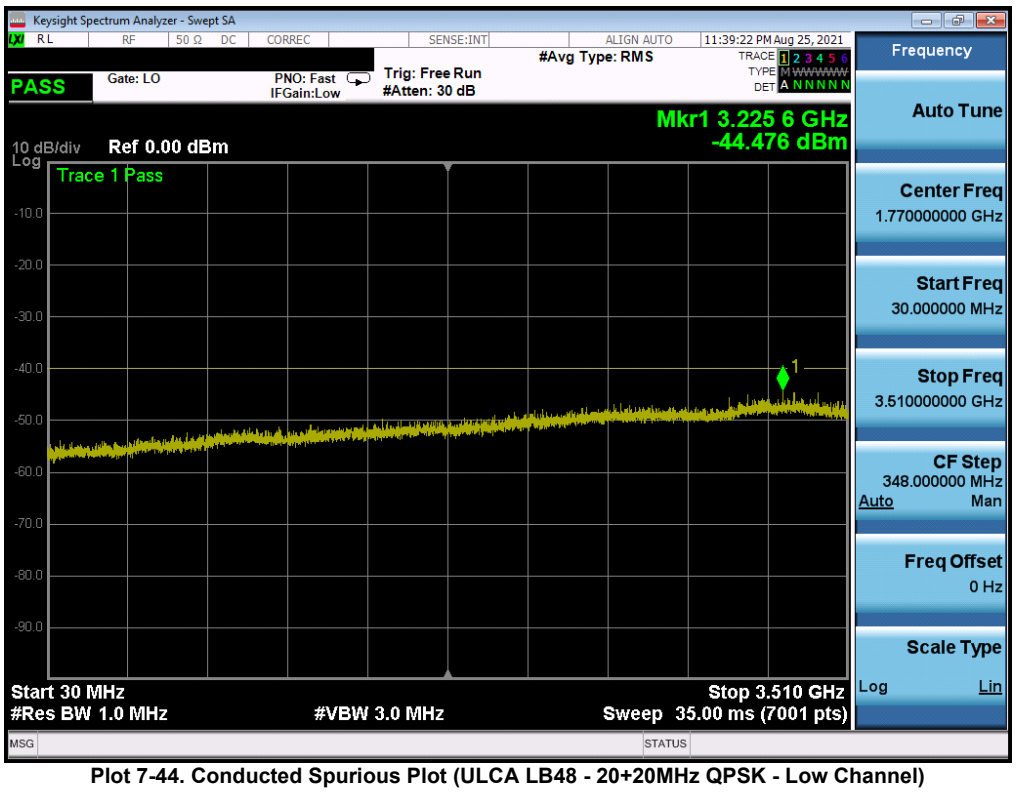


Plot 7-42. Conducted Spurious Plot (LTE Band 48 - 15MHz QPSK - Low Channel - 8 RB)

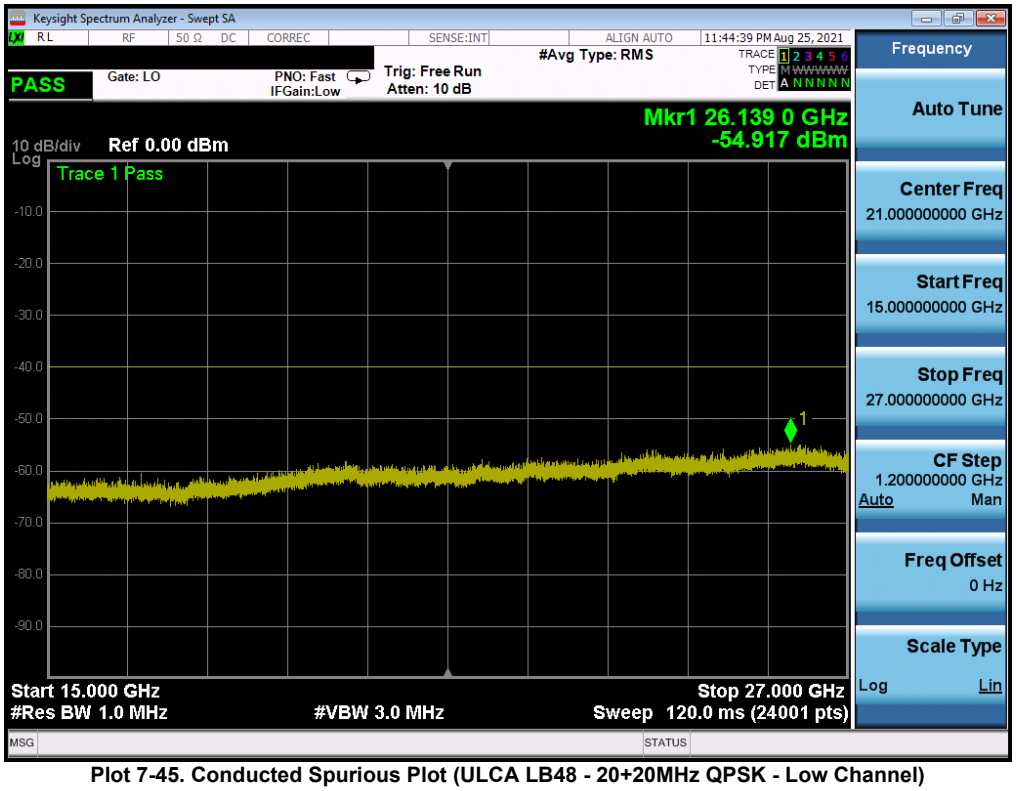
ULCA LB48



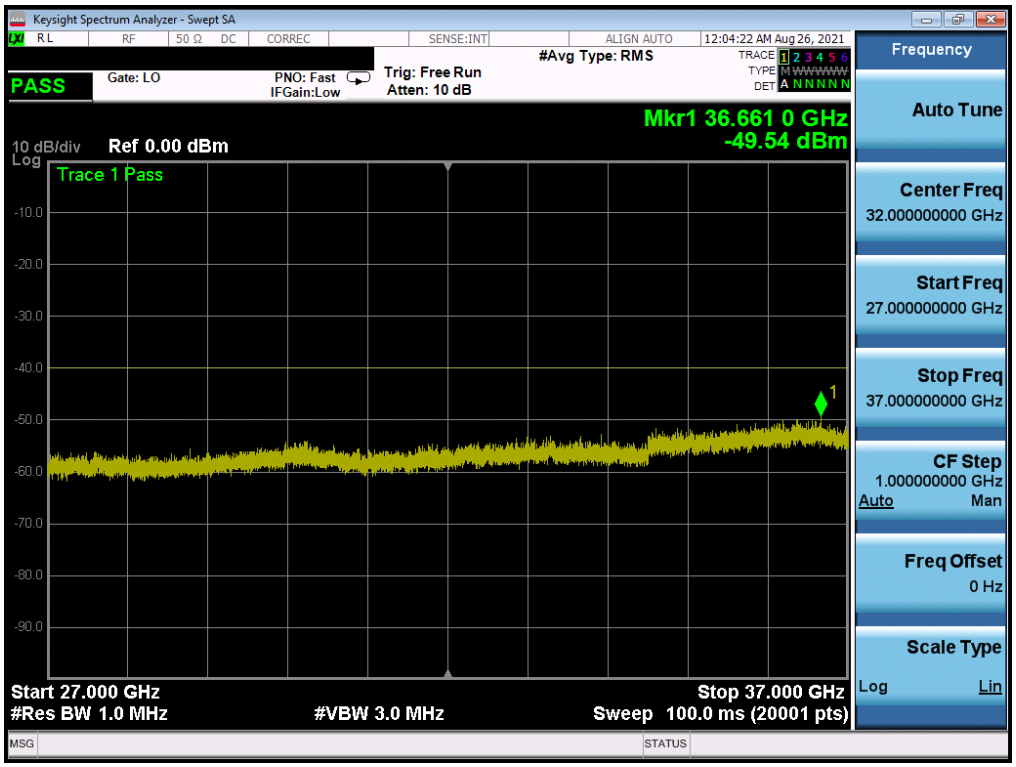
Plot 7-43. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



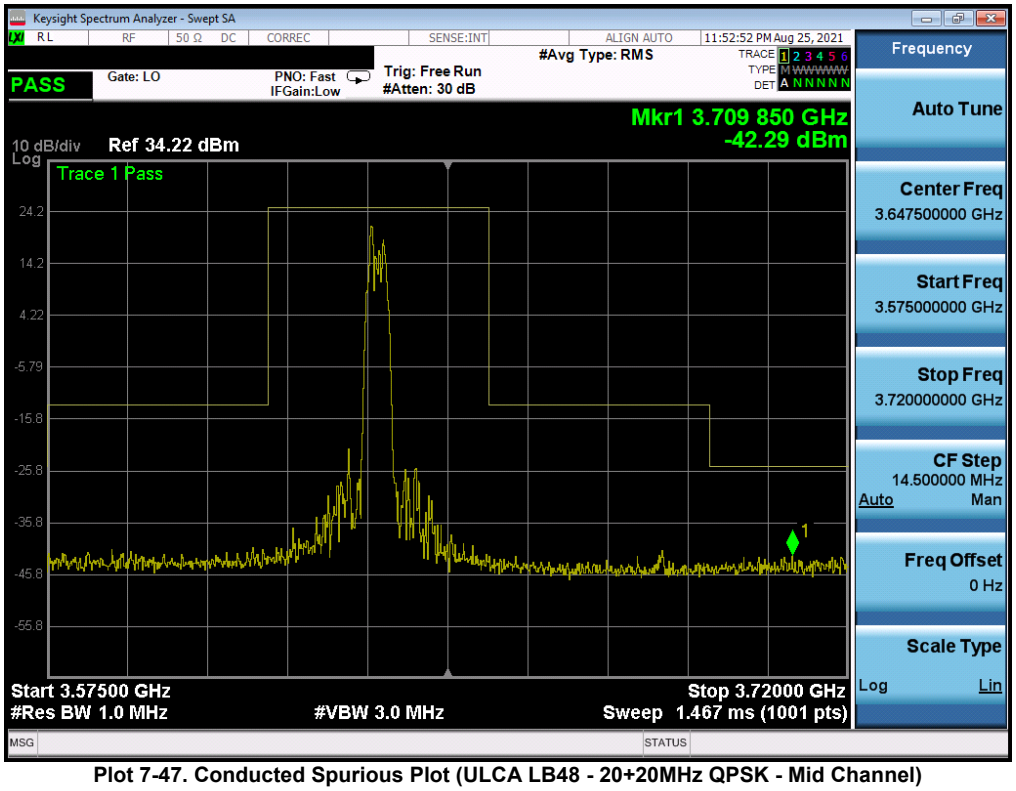
Plot 7-44. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



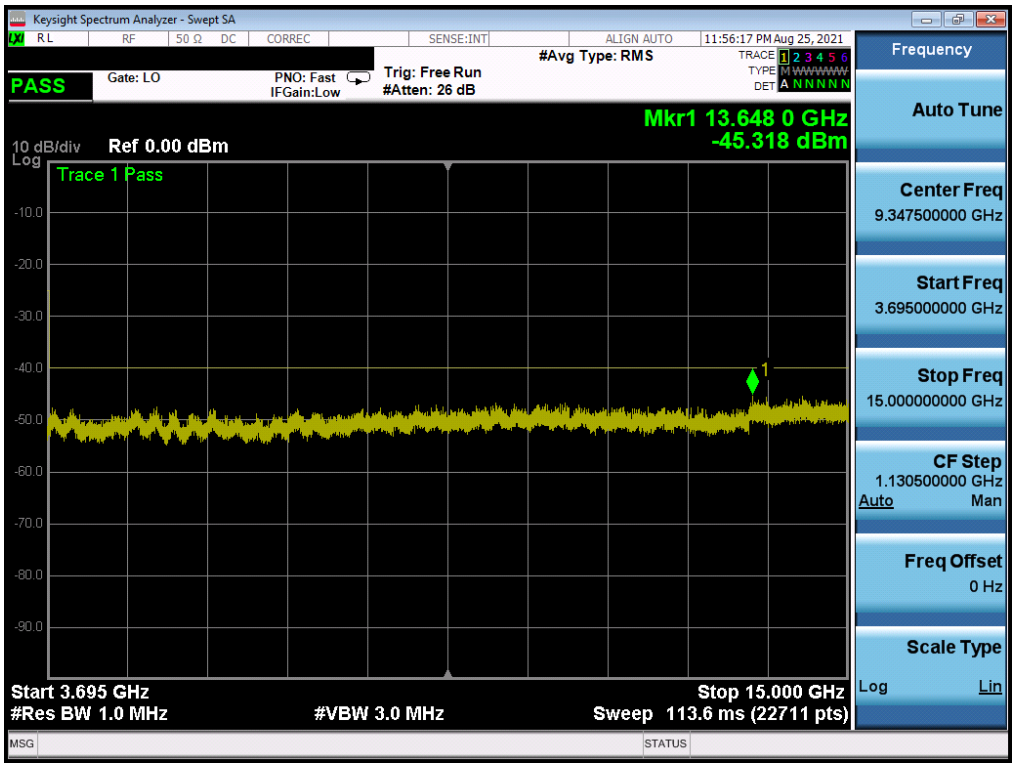
Plot 7-45. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



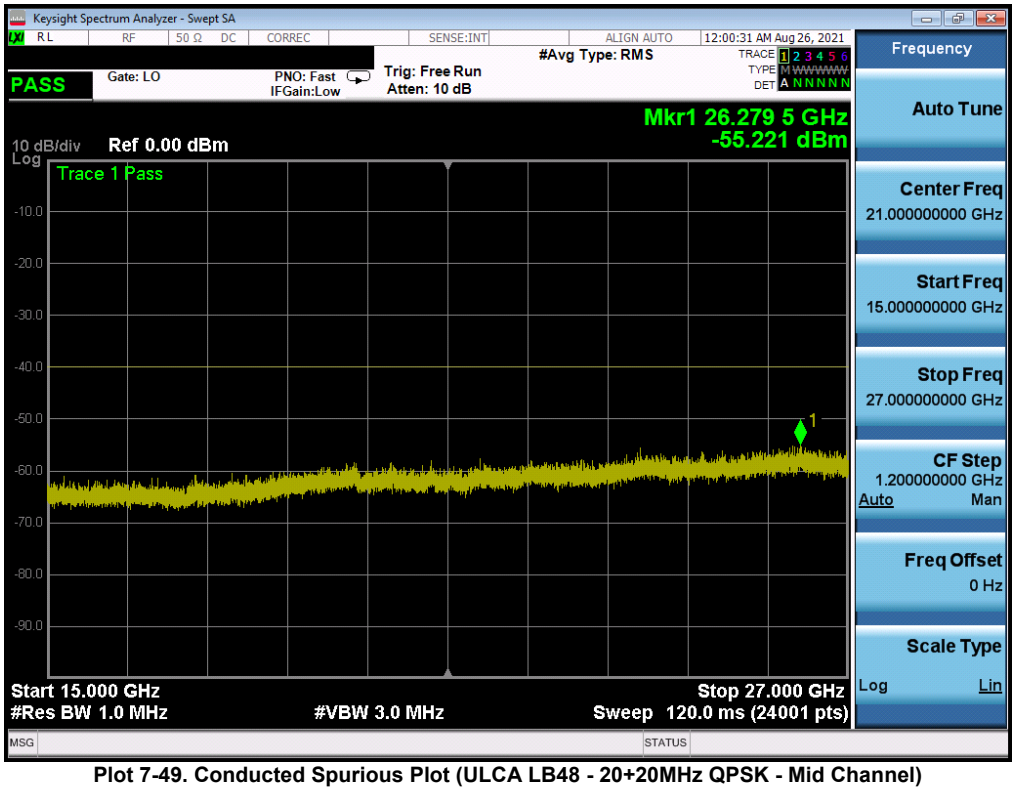
Plot 7-46. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



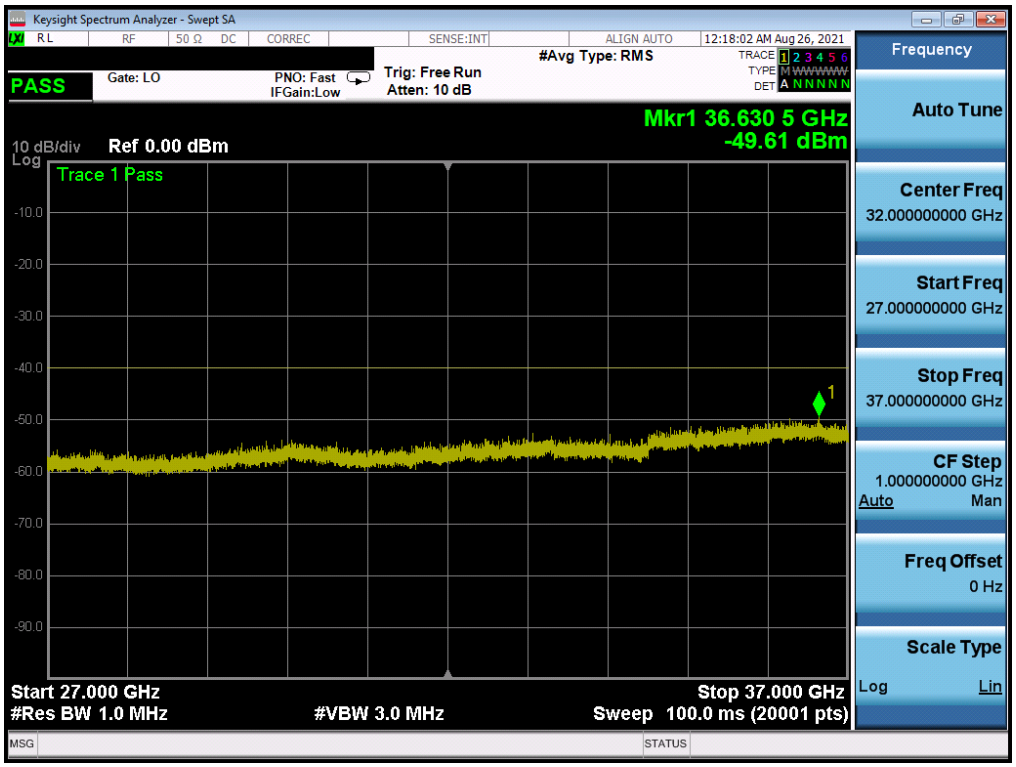
Plot 7-47. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



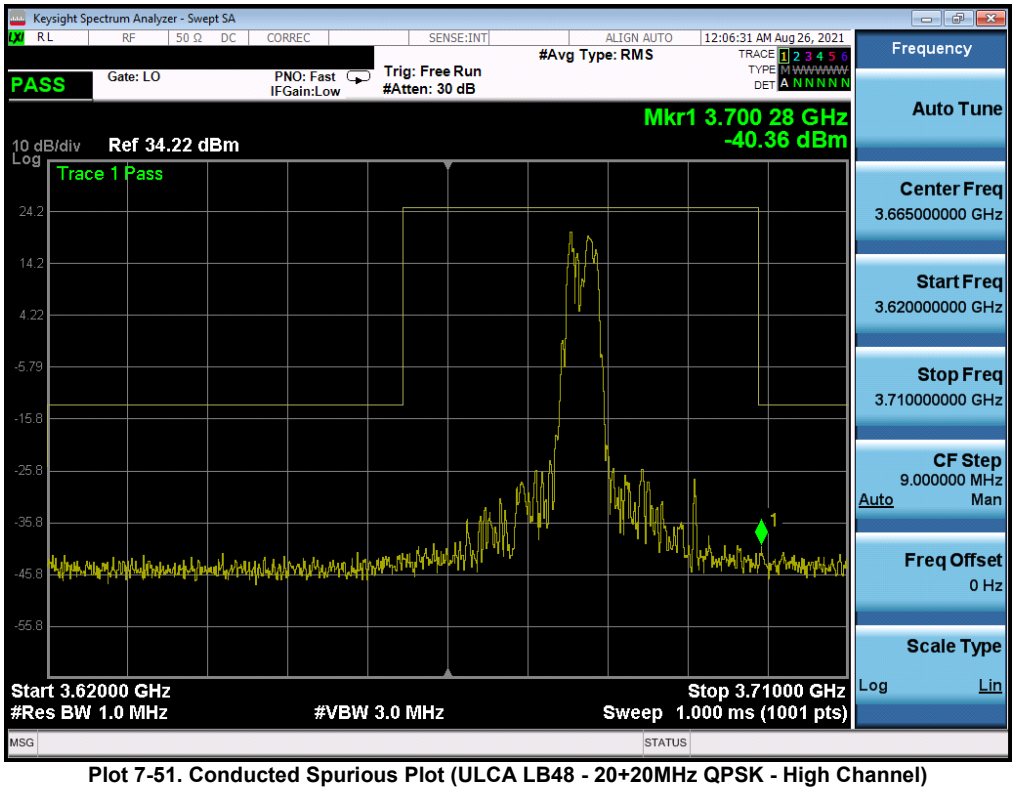
Plot 7-48. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



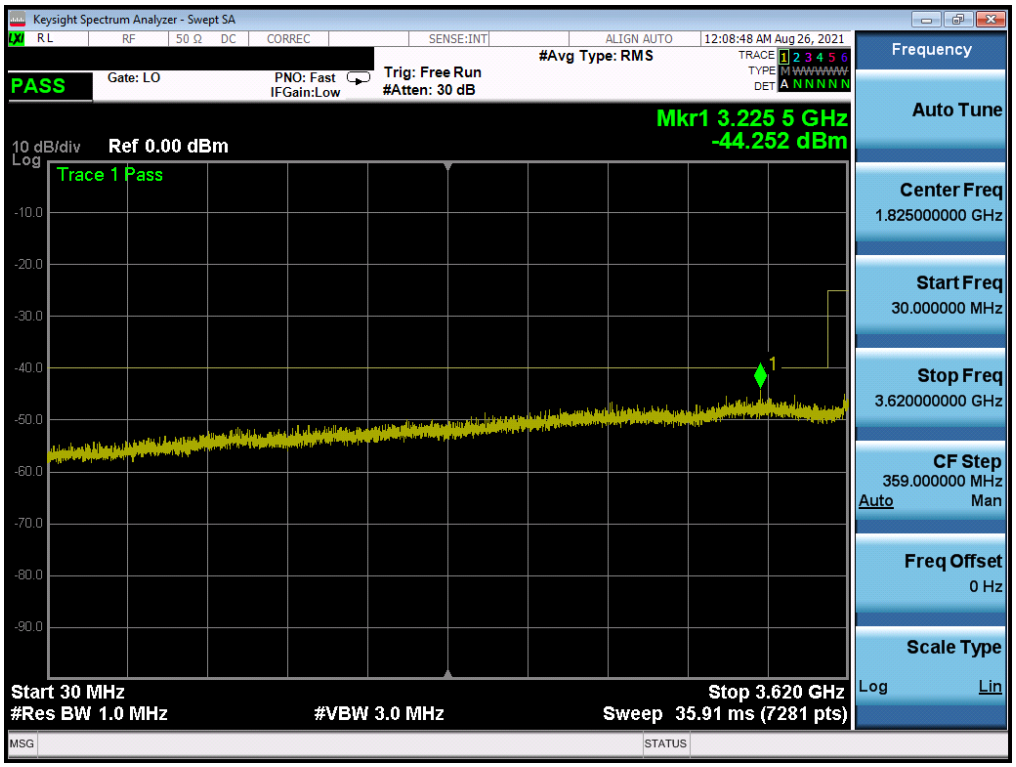
Plot 7-49. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



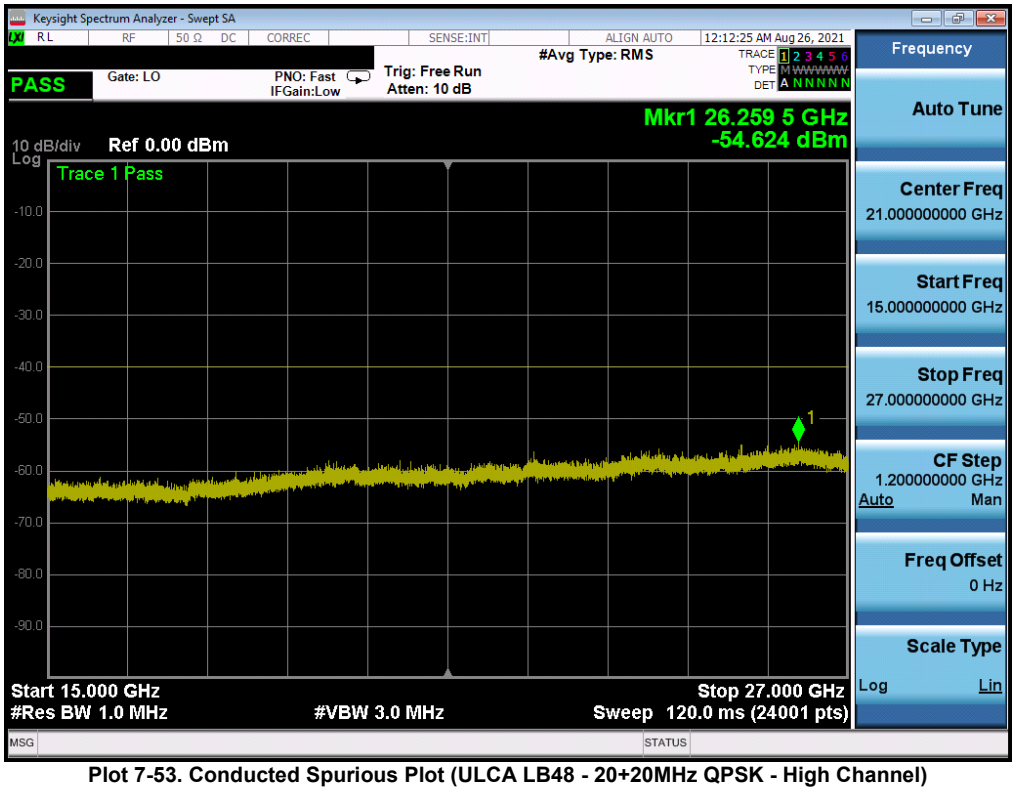
Plot 7-50. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



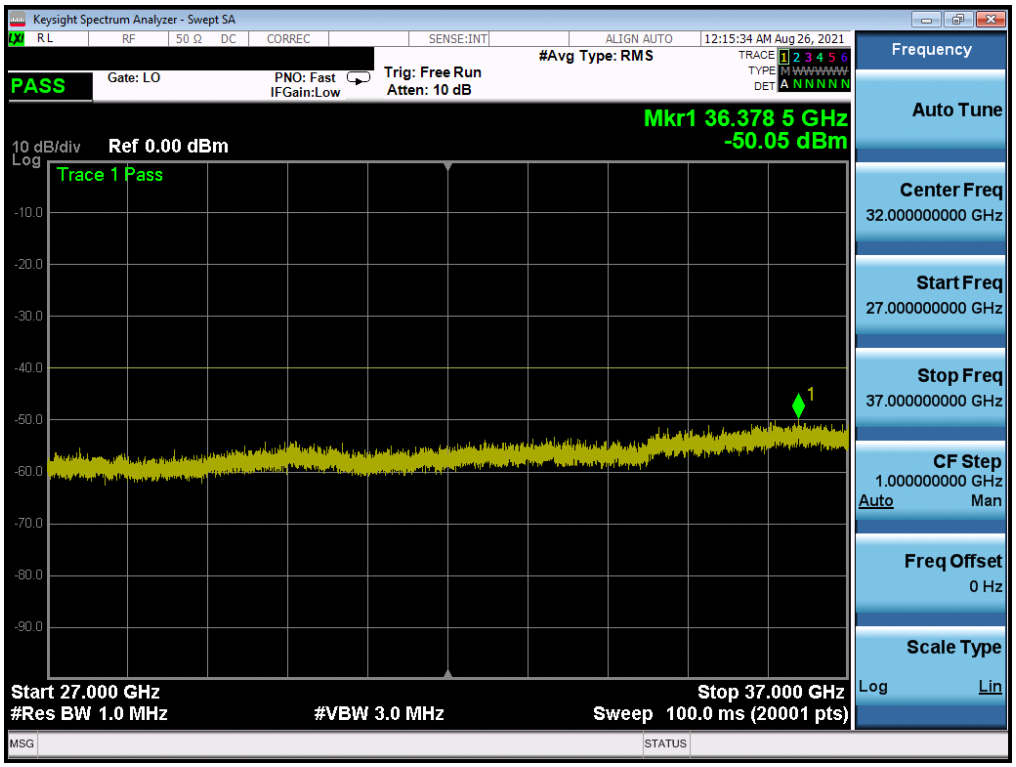
Plot 7-51. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)



Plot 7-52. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)

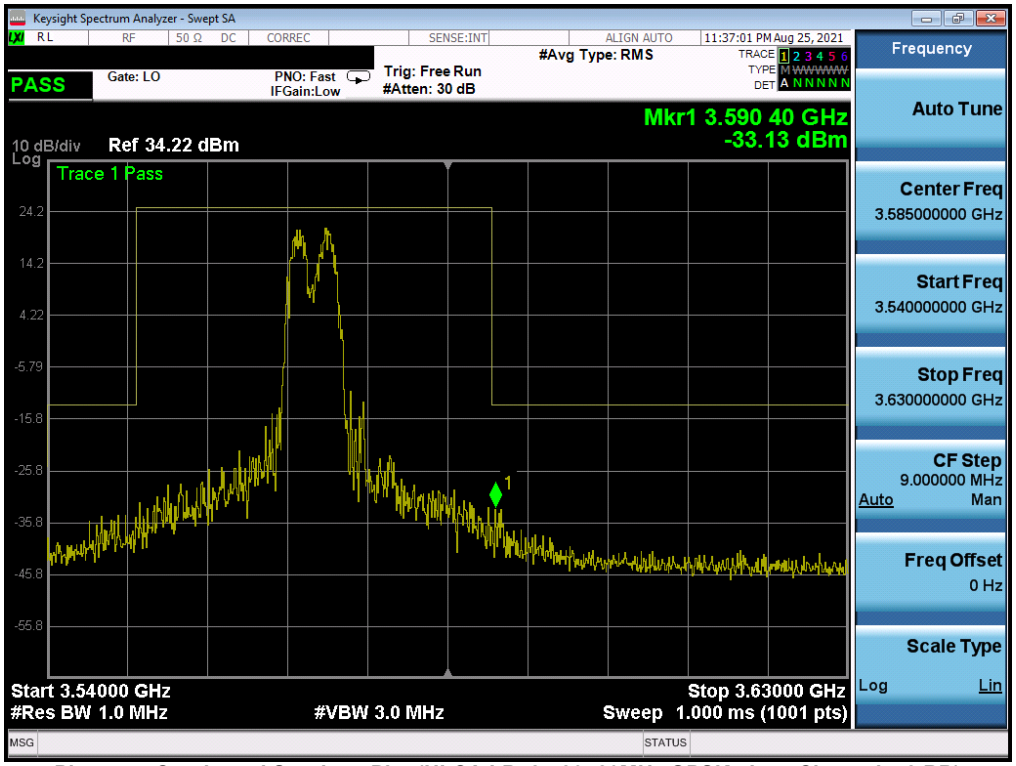


Plot 7-53. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)

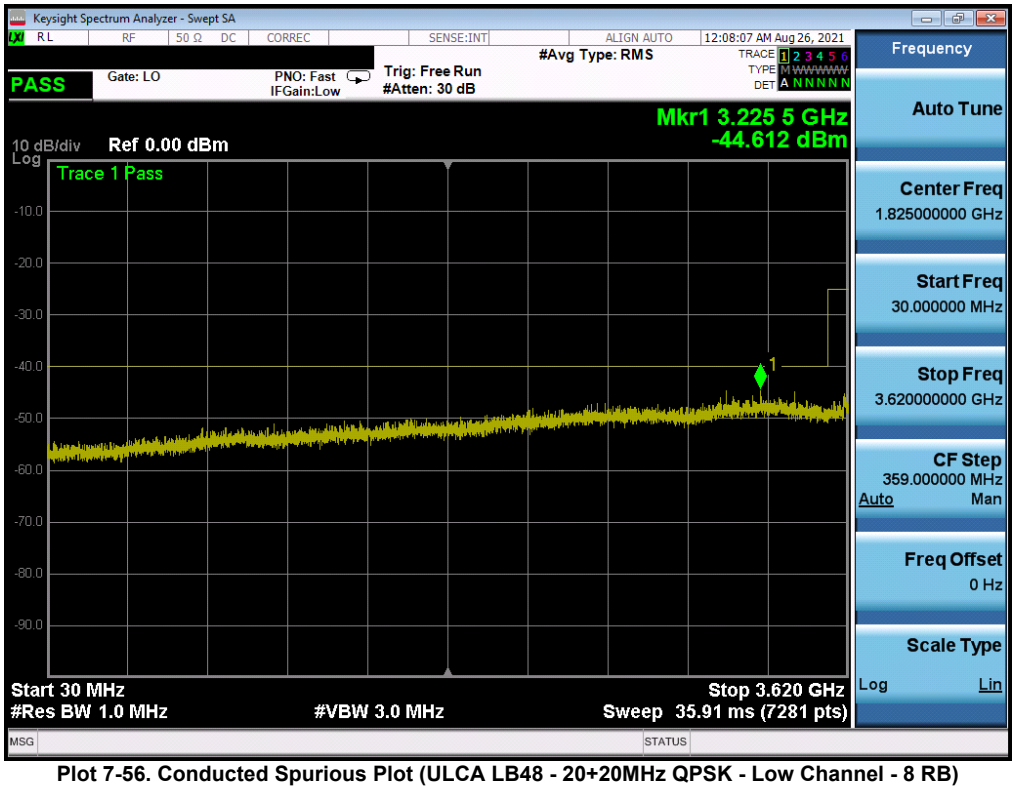


Plot 7-54. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)

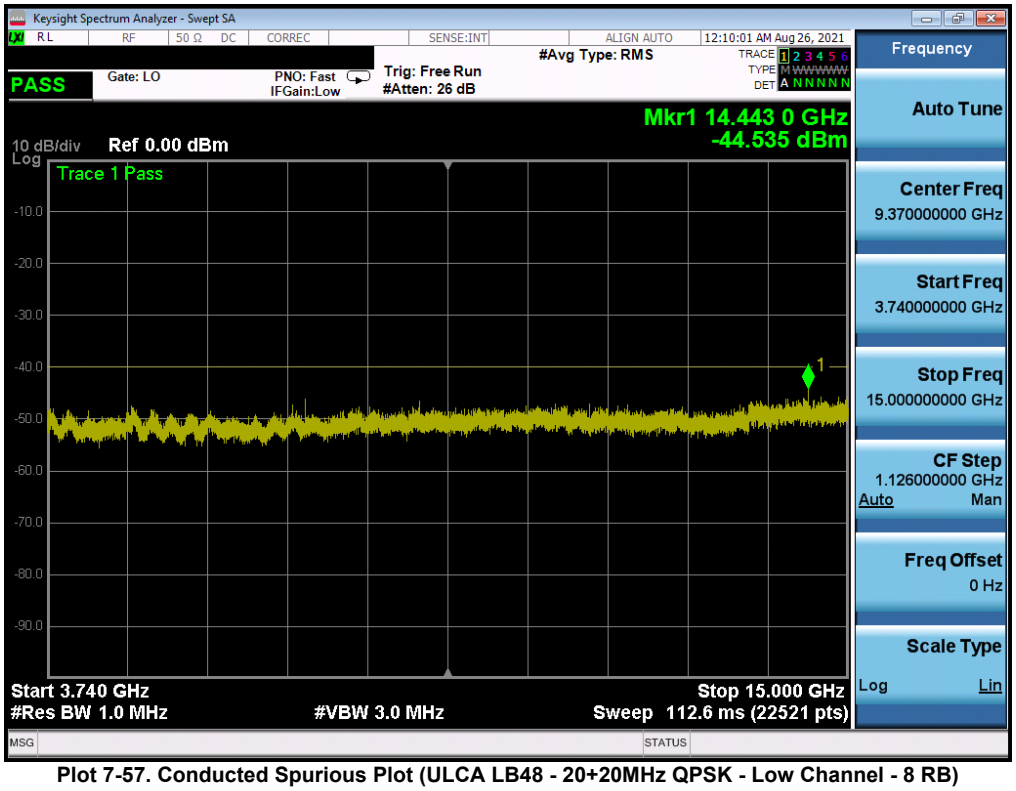
ULCA LB48 – 8 RB Case



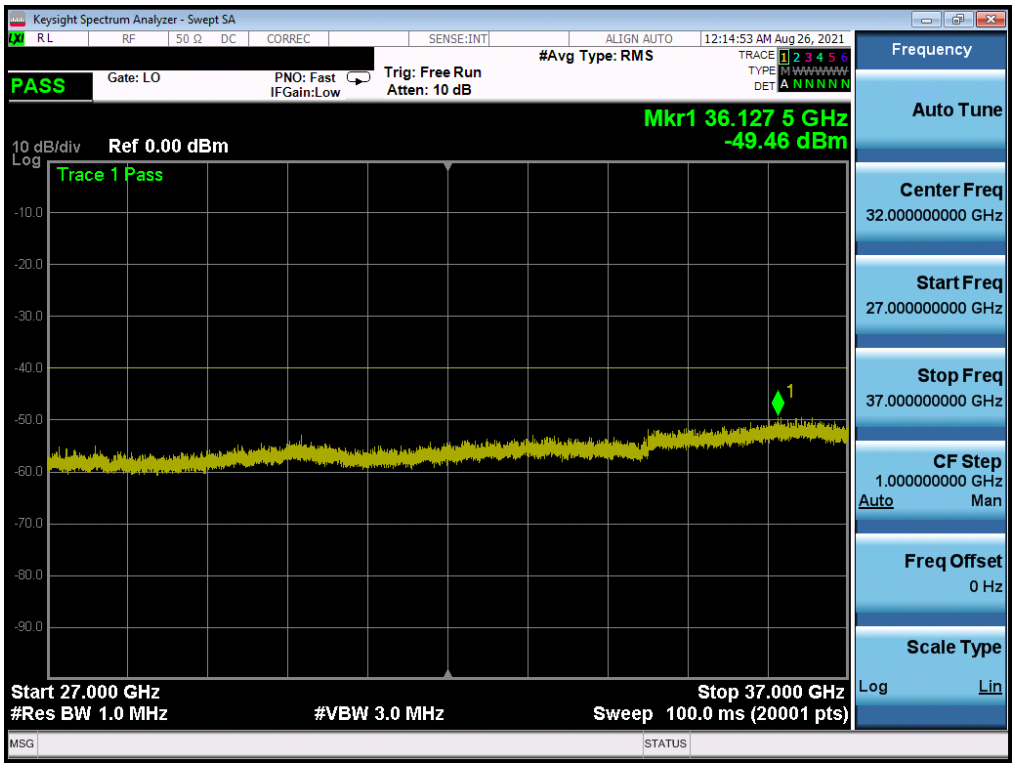
Plot 7-55. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel – 8 RB)



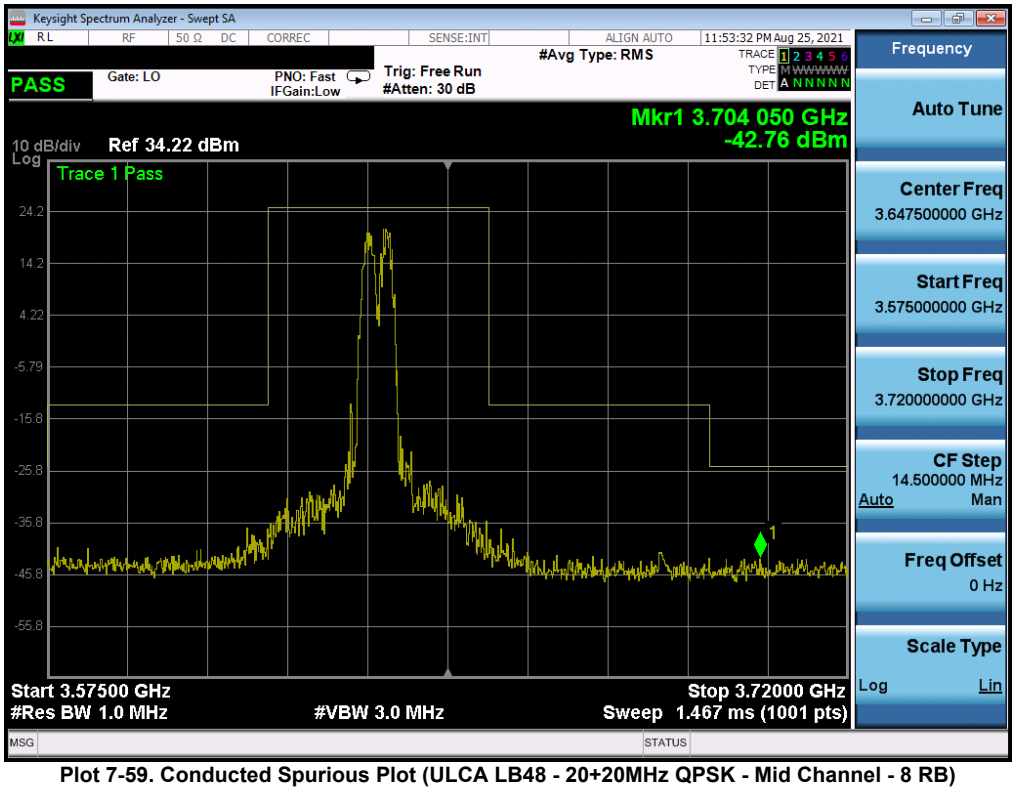
Plot 7-56. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel - 8 RB)



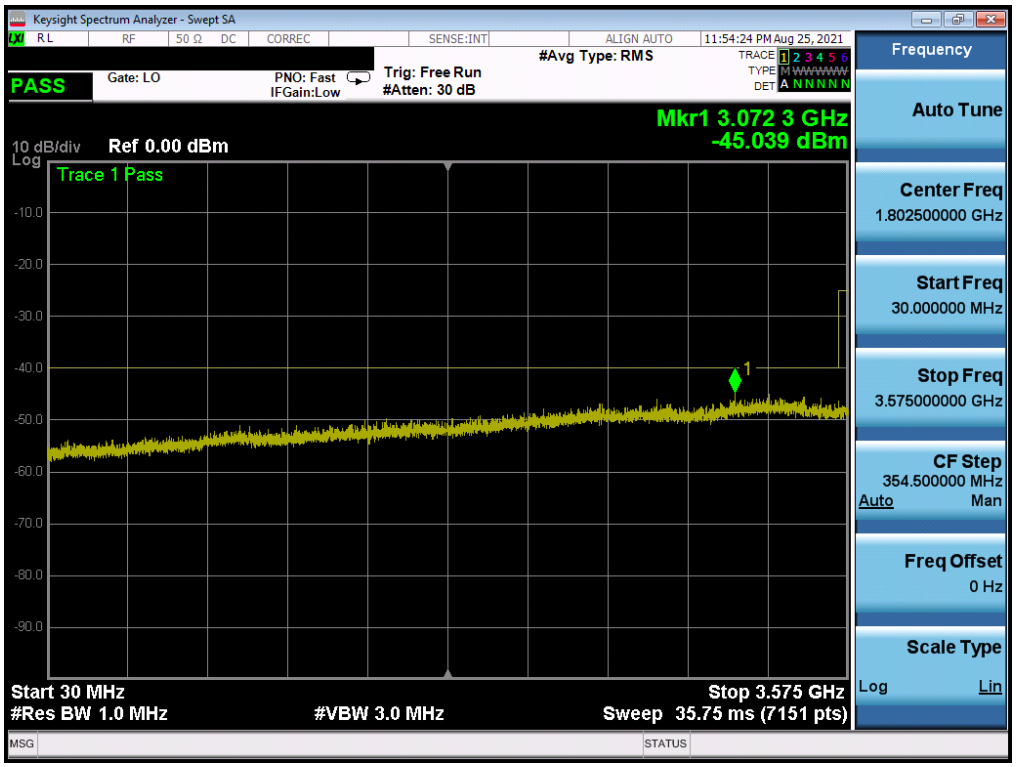
Plot 7-57. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel - 8 RB)



Plot 7-58. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel - 8 RB)

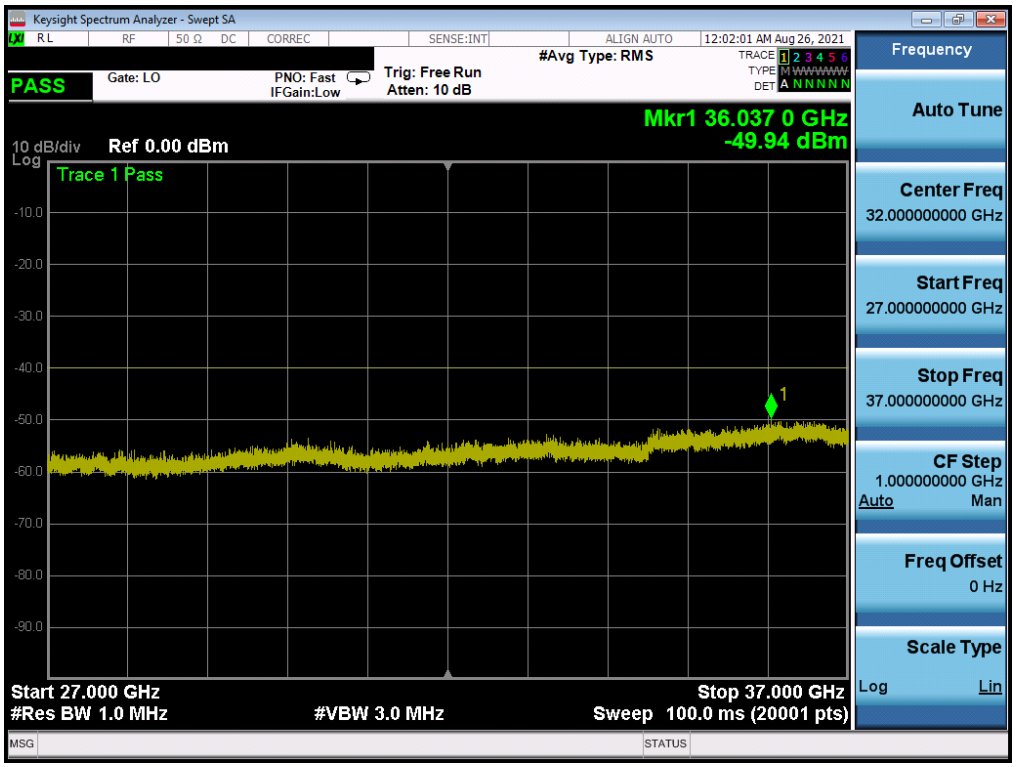


Plot 7-59. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel - 8 RB)

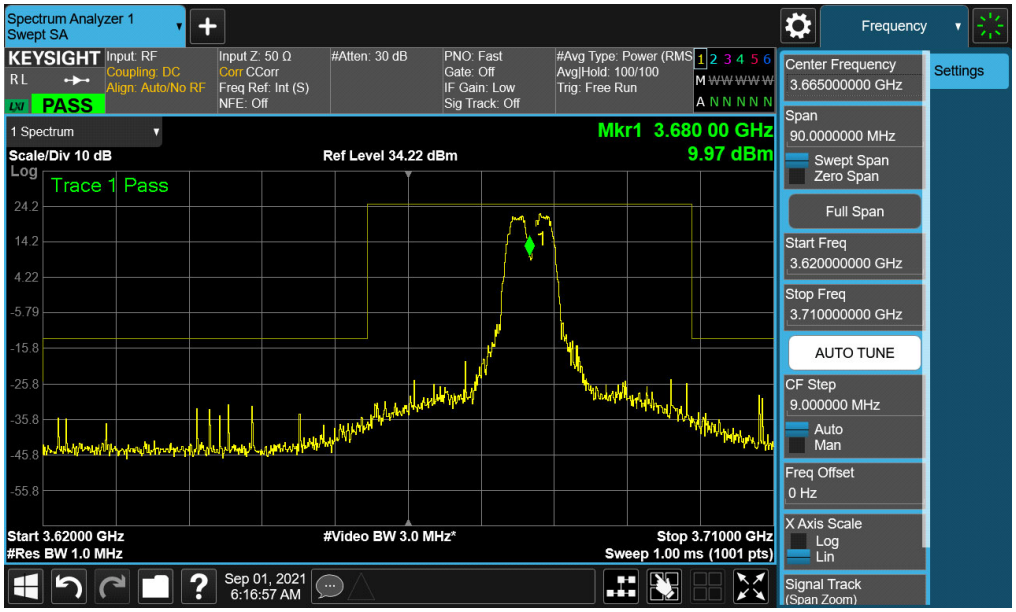


Plot 7-60. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel - 8 RB)

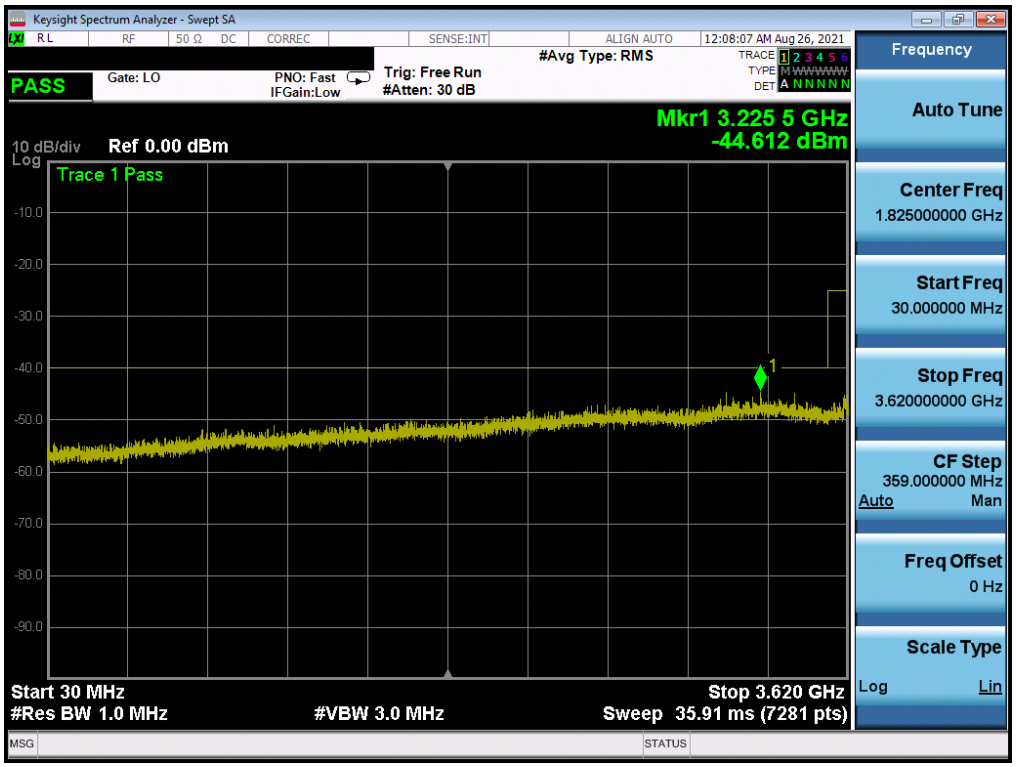
Plot 7-61. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel - 8 RB)



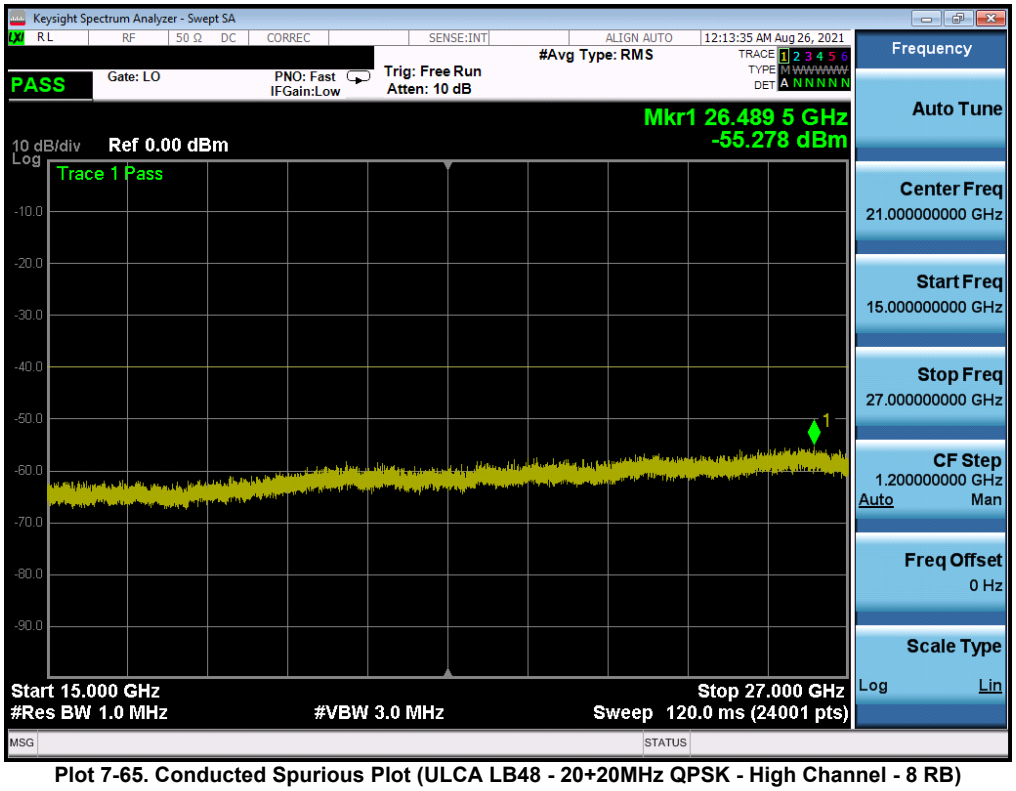
Plot 7-62. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel - 8 RB)



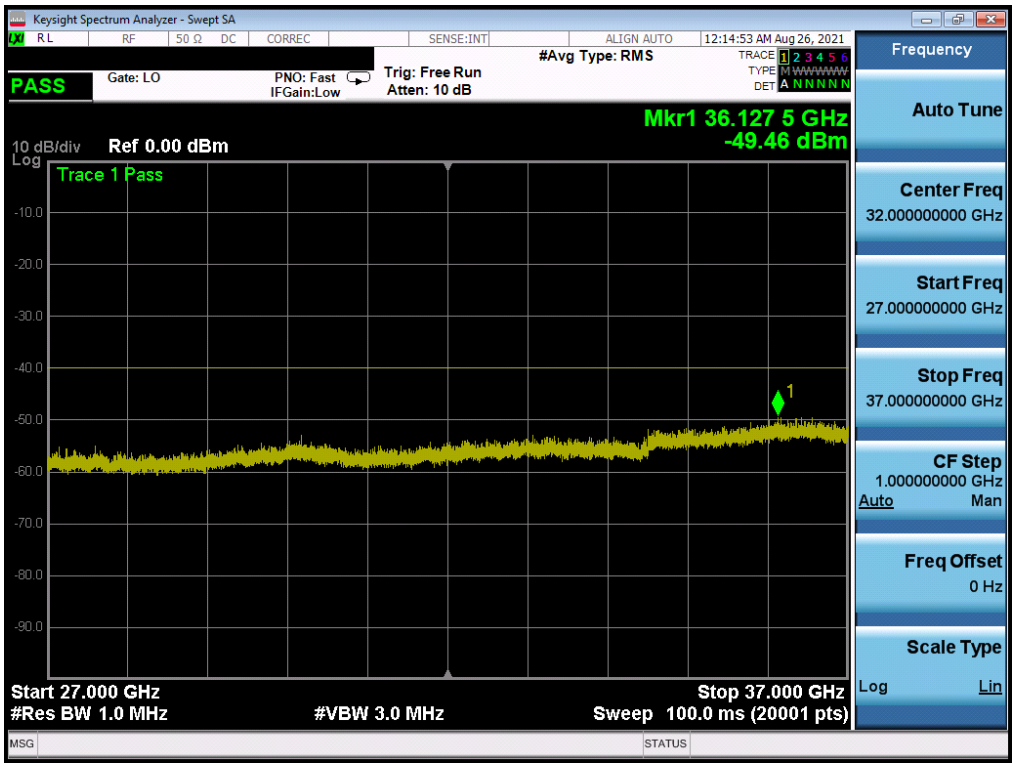
Plot 7-63. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel - 8 RB)



Plot 7-64. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel - 8 RB)



Plot 7-65. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel - 8 RB)



Plot 7-66. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel - 8 RB)

7.5 Band Edge Emissions at Antenna Terminal

§2.1051 §96.41(e)(ii)

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 to B MHz (where B is the bandwidth in MHz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B MHz below the lower CBSD-assigned channel edge. At all frequencies greater than B MHz above the upper CBSD assigned channel edge and less than B MHz below the lower CBSD-assigned channel edge, the conducted power of any end user device emission shall not exceed −25 dBm/MHz. The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/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.

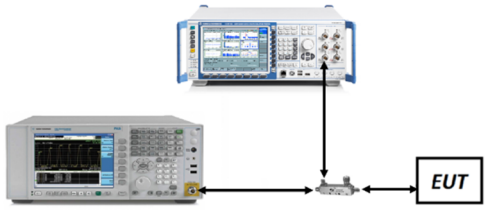
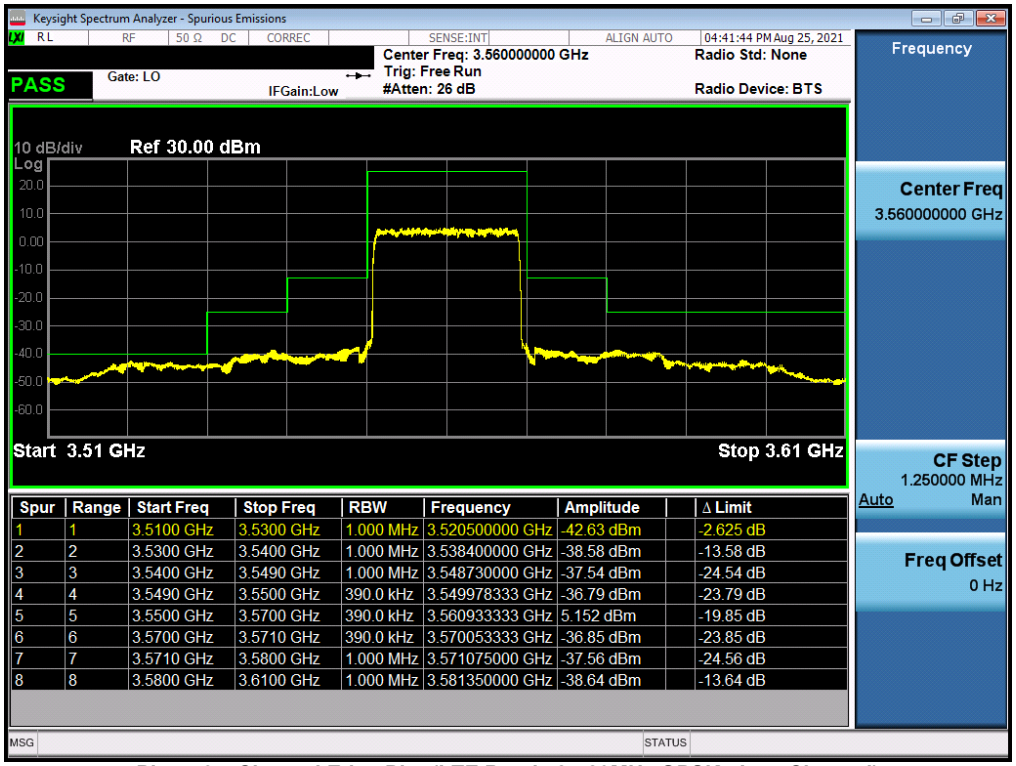


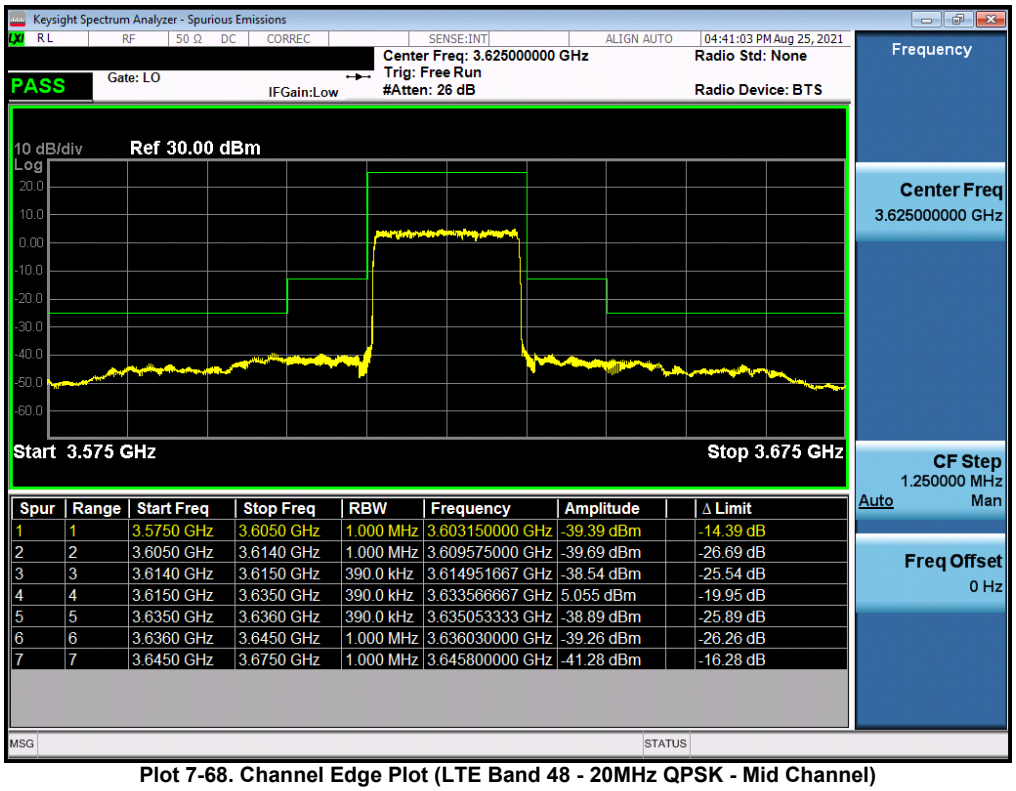
Figure 7-4. Test Instrument & Measurement Setup

LTE Band 48



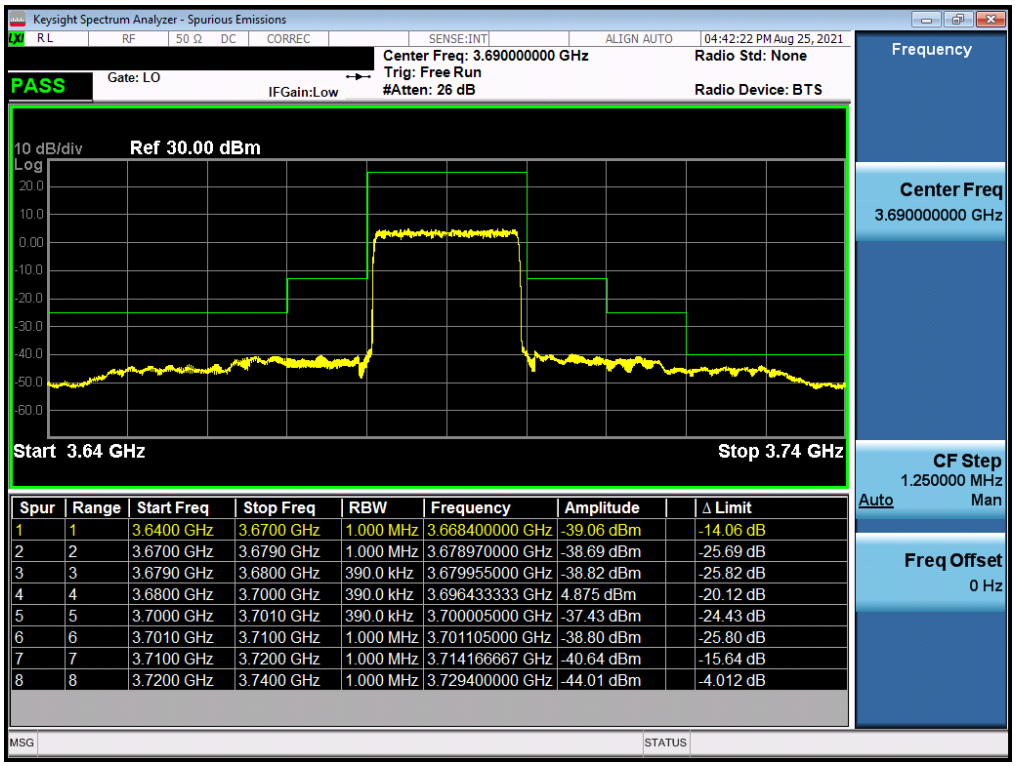
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.520500000 GHz	-42.63 dBm	-2.625 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.538400000 GHz	-38.58 dBm	-13.58 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548730000 GHz	-37.54 dBm	-24.54 dB
4	4	3.5490 GHz	3.5500 GHz	390.0 kHz	3.549978333 GHz	-36.79 dBm	-23.79 dB
5	5	3.5500 GHz	3.5700 GHz	390.0 kHz	3.560933333 GHz	5.152 dBm	-19.85 dB
6	6	3.5700 GHz	3.5710 GHz	390.0 kHz	3.570053333 GHz	-36.85 dBm	-23.85 dB
7	7	3.5710 GHz	3.5800 GHz	1.000 MHz	3.571075000 GHz	-37.56 dBm	-24.56 dB
8	8	3.5800 GHz	3.6100 GHz	1.000 MHz	3.581350000 GHz	-38.64 dBm	-13.64 dB

Plot 7-67. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Low Channel)



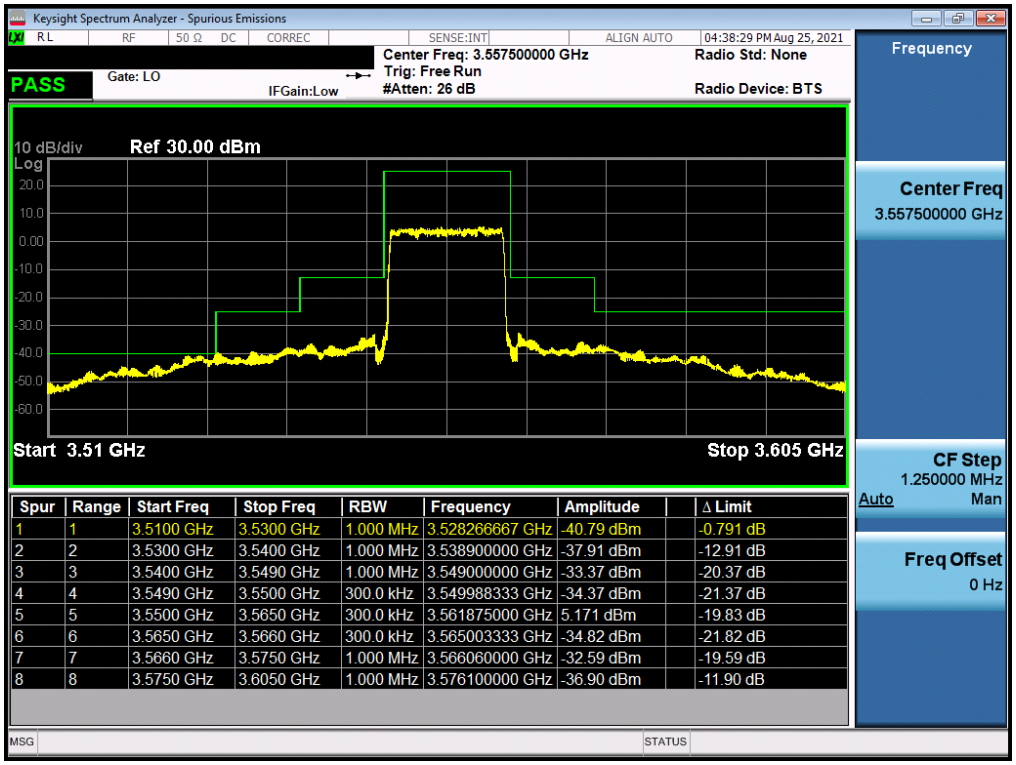
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5750 GHz	3.6050 GHz	1.000 MHz	3.603150000 GHz	-39.39 dBm	-14.39 dB
2	2	3.6050 GHz	3.6140 GHz	1.000 MHz	3.609575000 GHz	-39.69 dBm	-26.69 dB
3	3	3.6140 GHz	3.6150 GHz	390.0 kHz	3.614951667 GHz	-38.54 dBm	-25.54 dB
4	4	3.6150 GHz	3.6350 GHz	390.0 kHz	3.633566667 GHz	5.055 dBm	-19.95 dB
5	5	3.6350 GHz	3.6360 GHz	390.0 kHz	3.635053333 GHz	-38.89 dBm	-25.89 dB
6	6	3.6360 GHz	3.6450 GHz	1.000 MHz	3.636030000 GHz	-39.26 dBm	-26.26 dB
7	7	3.6450 GHz	3.6750 GHz	1.000 MHz	3.645800000 GHz	-41.28 dBm	-16.28 dB

Plot 7-68. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)



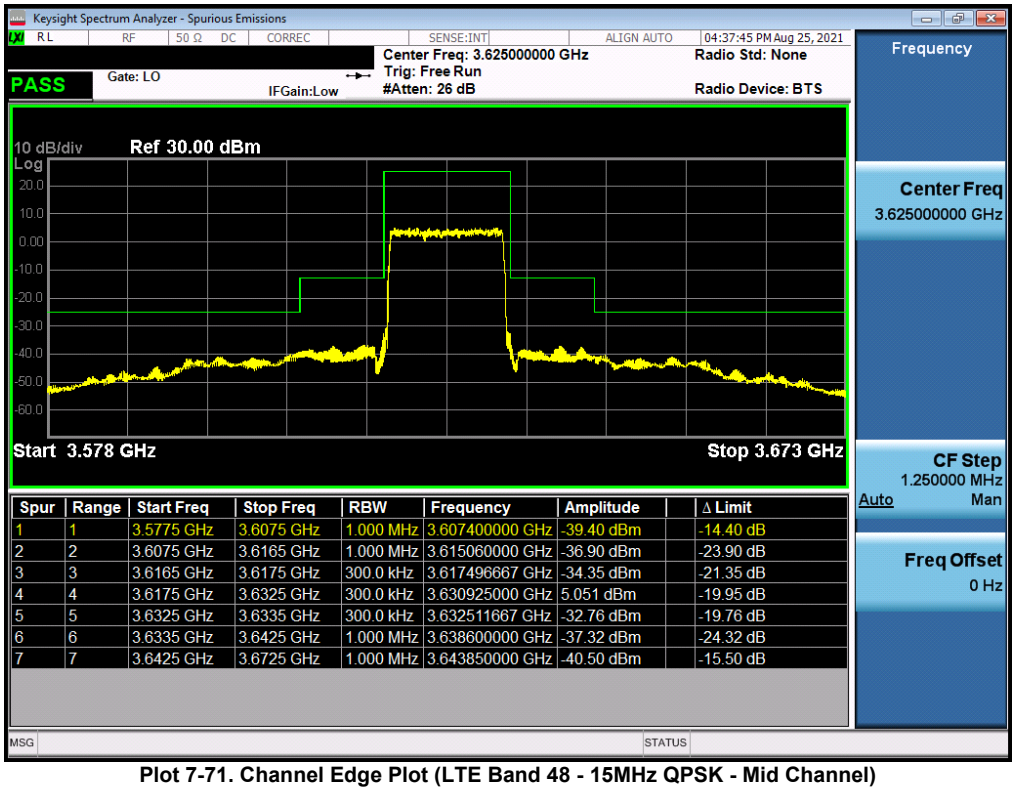
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6400 GHz	3.6700 GHz	1.000 MHz	3.668400000 GHz	-39.06 dBm	-14.06 dB
2	2	3.6700 GHz	3.6790 GHz	1.000 MHz	3.678970000 GHz	-38.69 dBm	-25.69 dB
3	3	3.6790 GHz	3.6800 GHz	390.0 kHz	3.679955000 GHz	-38.82 dBm	-25.82 dB
4	4	3.6800 GHz	3.7000 GHz	390.0 kHz	3.696433333 GHz	4.875 dBm	-20.12 dB
5	5	3.7000 GHz	3.7010 GHz	390.0 kHz	3.700005000 GHz	-37.43 dBm	-24.43 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701105000 GHz	-38.80 dBm	-25.80 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.714166667 GHz	-40.64 dBm	-15.64 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.729400000 GHz	-44.01 dBm	-4.012 dB

Plot 7-69. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - High Channel)



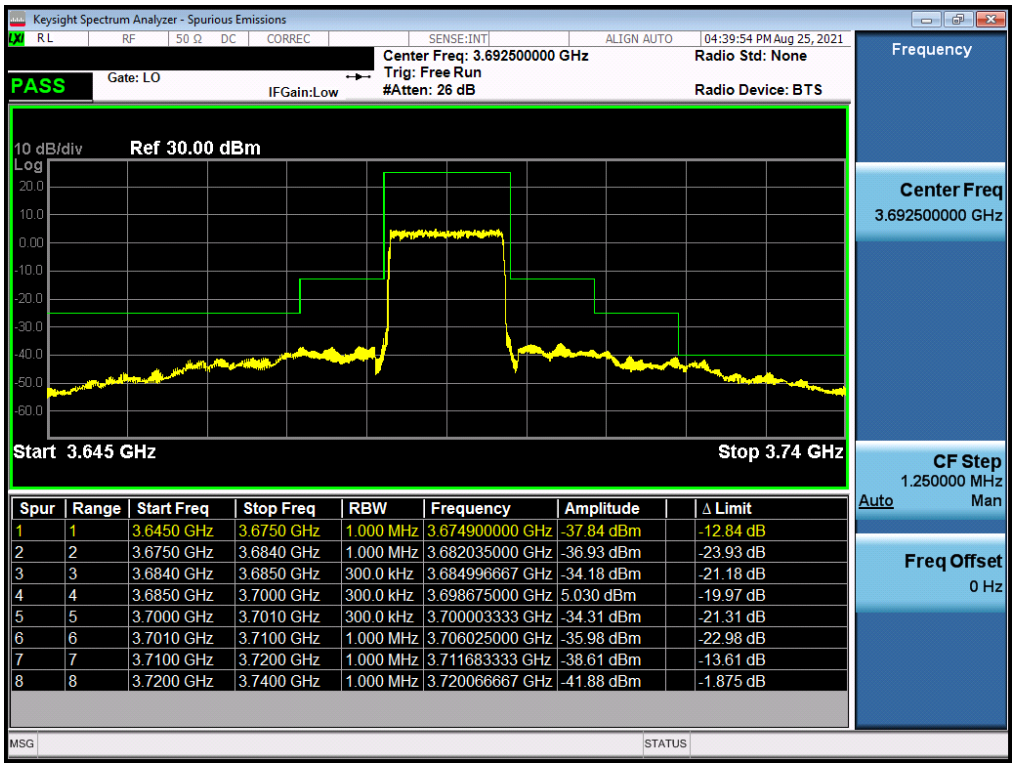
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.528266667 GHz	-40.79 dBm	-0.791 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.538900000 GHz	-37.91 dBm	-12.91 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.549000000 GHz	-33.37 dBm	-20.37 dB
4	4	3.5490 GHz	3.5500 GHz	300.0 kHz	3.549988333 GHz	-34.37 dBm	-21.37 dB
5	5	3.5500 GHz	3.5650 GHz	300.0 kHz	3.561875000 GHz	5.171 dBm	-19.83 dB
6	6	3.5650 GHz	3.5660 GHz	300.0 kHz	3.565003333 GHz	-34.82 dBm	-21.82 dB
7	7	3.5660 GHz	3.5750 GHz	1.000 MHz	3.566060000 GHz	-32.59 dBm	-19.59 dB
8	8	3.5750 GHz	3.6050 GHz	1.000 MHz	3.576100000 GHz	-36.90 dBm	-11.90 dB

Plot 7-70. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Low Channel)



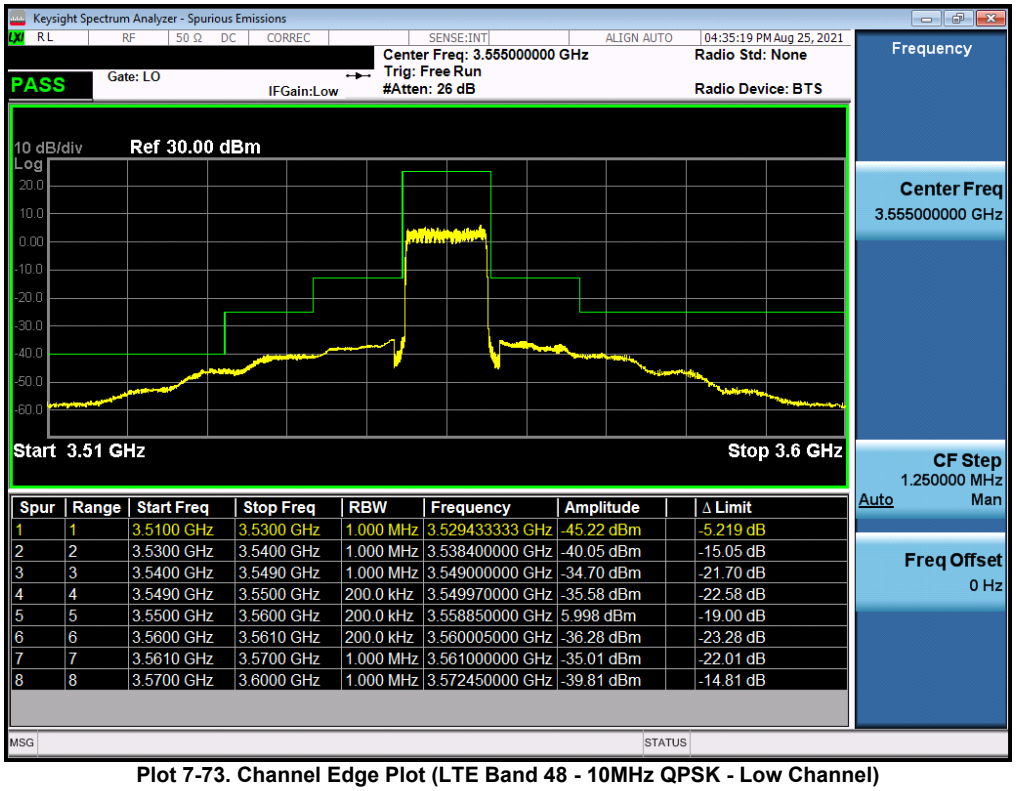
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5775 GHz	3.6075 GHz	1.000 MHz	3.607400000 GHz	-39.40 dBm	-14.40 dB
2	2	3.6075 GHz	3.6165 GHz	1.000 MHz	3.615060000 GHz	-36.90 dBm	-23.90 dB
3	3	3.6165 GHz	3.6175 GHz	300.0 kHz	3.617496667 GHz	-34.35 dBm	-21.35 dB
4	4	3.6175 GHz	3.6325 GHz	300.0 kHz	3.630925000 GHz	5.051 dBm	-19.95 dB
5	5	3.6325 GHz	3.6335 GHz	300.0 kHz	3.632511667 GHz	-32.76 dBm	-19.76 dB
6	6	3.6335 GHz	3.6425 GHz	1.000 MHz	3.638600000 GHz	-37.32 dBm	-24.32 dB
7	7	3.6425 GHz	3.6725 GHz	1.000 MHz	3.643850000 GHz	-40.50 dBm	-15.50 dB

Plot 7-71. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Mid Channel)



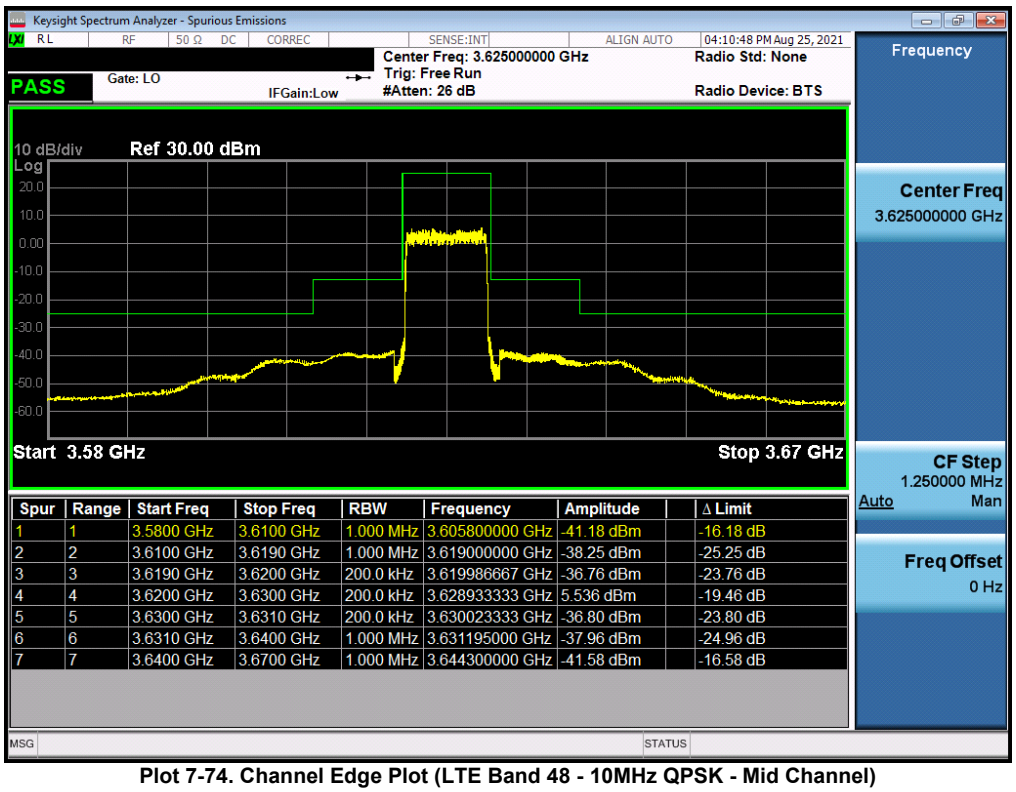
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6450 GHz	3.6750 GHz	1.000 MHz	3.674900000 GHz	-37.84 dBm	-12.84 dB
2	2	3.6750 GHz	3.6840 GHz	1.000 MHz	3.682035000 GHz	-36.93 dBm	-23.93 dB
3	3	3.6840 GHz	3.6850 GHz	300.0 kHz	3.684996667 GHz	-34.18 dBm	-21.18 dB
4	4	3.6850 GHz	3.7000 GHz	300.0 kHz	3.698675000 GHz	5.030 dBm	-19.97 dB
5	5	3.7000 GHz	3.7010 GHz	300.0 kHz	3.700003333 GHz	-34.31 dBm	-21.31 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.706025000 GHz	-35.98 dBm	-22.98 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.711683333 GHz	-38.61 dBm	-13.61 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720066667 GHz	-41.88 dBm	-1.875 dB

Plot 7-72. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - High Channel)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529433333 GHz	-45.22 dBm	-5.219 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.538400000 GHz	-40.05 dBm	-15.05 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.549000000 GHz	-34.70 dBm	-21.70 dB
4	4	3.5490 GHz	3.5500 GHz	200.0 kHz	3.549970000 GHz	-35.58 dBm	-22.58 dB
5	5	3.5500 GHz	3.5600 GHz	200.0 kHz	3.558850000 GHz	5.998 dBm	-19.00 dB
6	6	3.5600 GHz	3.5610 GHz	200.0 kHz	3.560005000 GHz	-36.28 dBm	-23.28 dB
7	7	3.5610 GHz	3.5700 GHz	1.000 MHz	3.561000000 GHz	-35.01 dBm	-22.01 dB
8	8	3.5700 GHz	3.6000 GHz	1.000 MHz	3.572450000 GHz	-39.81 dBm	-14.81 dB

Plot 7-73. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Low Channel)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5800 GHz	3.6100 GHz	1.000 MHz	3.605800000 GHz	-41.18 dBm	-16.18 dB
2	2	3.6100 GHz	3.6190 GHz	1.000 MHz	3.619000000 GHz	-38.25 dBm	-25.25 dB
3	3	3.6190 GHz	3.6200 GHz	200.0 kHz	3.619986667 GHz	-36.76 dBm	-23.76 dB
4	4	3.6200 GHz	3.6300 GHz	200.0 kHz	3.628933333 GHz	5.536 dBm	-19.46 dB
5	5	3.6300 GHz	3.6310 GHz	200.0 kHz	3.630023333 GHz	-36.80 dBm	-23.80 dB
6	6	3.6310 GHz	3.6400 GHz	1.000 MHz	3.631195000 GHz	-37.96 dBm	-24.96 dB
7	7	3.6400 GHz	3.6700 GHz	1.000 MHz	3.644300000 GHz	-41.58 dBm	-16.58 dB

Plot 7-74. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Mid Channel)