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Part 96 MEASUREMENT REPORT

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

Date of Testing:
4/8/2022 - 6/23/2022
Test Report Issue Date:
6/23/2022
Test Site/Location:
Element Lab., Columbia, MD, USA
Test Report Serial No.:
1M2204080051-08.A3L

FCC ID:	**A3LSMF721U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-F721U
Additional Models:	SM-F721U1
EUT Type:	Portable Handset
FCC Classification:	Citizens Band End User Devices (CBE)
FCC Rule Part(s):	96
Test Procedure(s):	ANSI C63.26-2015, KDB 940660 D01 v03, WINNF-TS-0122 v1.0.2, KDB 648474 D03 v01r04

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

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

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.01

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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
LTE Band 48	40 MHz	QPSK	3570.0 - 3680.0	0.061	17.87	37M7G7D
		16QAM	3570.0 - 3680.0	0.051	17.08	37M7W7D
	35 MHz	QPSK	3567.5 - 3682.5	0.070	18.43	32M8G7D
		16QAM	3567.5 - 3682.5	0.053	17.25	32M6W7D
	30 MHz	QPSK	3565.0 - 3685.0	0.068	18.32	27M9G7D
		16QAM	3565.0 - 3685.0	0.054	17.30	28M0W7D
	25 MHz	QPSK	3562.5 - 3687.5	0.067	18.29	23M1G7D
		16QAM	3562.5 - 3687.5	0.052	17.16	23M0W7D
	20 MHz	QPSK	3560.0 - 3690.0	0.060	17.82	18M0G7D
		16QAM	3560.0 - 3690.0	0.050	16.99	18M0W7D
	15 MHz	QPSK	3557.5 - 3692.5	0.061	17.88	13M5G7D
		16QAM	3557.5 - 3692.5	0.050	16.98	13M5W7D
	10 MHz	QPSK	3555.0 - 3695.0	0.061	17.88	9M04G7D
		16QAM	3555.0 - 3695.0	0.051	17.09	9M00W7D
	5 MHz	QPSK	3552.5 - 3697.5	0.061	17.85	4M54G7D
		16QAM	3552.5 - 3697.5	0.052	17.17	4M53W7D
NR Band n48 Ant F	40 MHz	π/2 BPSK	3570.0 - 3680.0	0.085	19.29	36M0G7D
		QPSK	3570.0 - 3680.0	0.074	18.70	38M1G7D
		16QAM	3570.0 - 3680.0	0.064	18.05	38M1W7D
	30 MHz	π/2 BPSK	3565.0 - 3685.0	0.085	19.28	27M0G7D
		QPSK	3565.0 - 3685.0	0.074	18.69	27M9G7D
		16QAM	3565.0 - 3685.0	0.063	17.99	28M1W7D
	20 MHz	π/2 BPSK	3560.0 - 3690.0	0.083	19.19	18M0G7D
		QPSK	3560.0 - 3690.0	0.072	18.60	18M4G7D
		16QAM	3560.0 - 3690.0	0.061	17.89	18M4W7D
	10 MHz	π/2 BPSK	3555.0 - 3695.0	0.080	19.02	8M66G7D
		QPSK	3555.0 - 3695.0	0.069	18.40	8M70G7D
		16QAM	3555.0 - 3695.0	0.059	17.74	8M69W7D

EUT Overview

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP	
				Max. Power [W]	Max. Power [dBm]
NR Band n48 Ant I	40 MHz	π/2 BPSK	3570.0 - 3680.0	0.041	16.12
		QPSK	3570.0 - 3680.0	0.041	16.08
		16QAM	3570.0 - 3680.0	0.035	15.42
NR Band n48 Ant E	40 MHz	π/2 BPSK	3570.0 - 3680.0	0.017	12.38
		QPSK	3570.0 - 3680.0	0.017	12.41
		16QAM	3570.0 - 3680.0	0.017	12.29
NR Band n48 Ant C	40 MHz	π/2 BPSK	3570.0 - 3680.0	0.015	11.79
		QPSK	3570.0 - 3680.0	0.015	11.84
		16QAM	3570.0 - 3680.0	0.013	10.97

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 Element Test Location

These measurement tests were conducted at the Element laboratory 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 Element lab located in Columbia, MD 21046, U.S.A.

- Element Washington DC LLC is a OnGo Alliance Approved Test Lab (ATL)
- Element Washington DC LLC is a WInnForum Approved Test Lab
- Element Washington DC LLC 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.
- Element Washington DC LLC 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).
- Element Washington DC LLC facility is a registered (2451B) test laboratory with the site description on file with ISED.
- Element Washington DC LLC is a Recognized U.S. Certification Assessment Body (CAB # US0110) for ISED Canada as designated by NIST under the U.S. and Canada Mutual Recognition Agreement.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMF721U**. 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 as a Citizens Band End User Devices (CBE).

Test Device Serial No.: 0834M, 0860M, 0270M, 0860M, 0294M, 1165M, 0881M, 0572M, 0209M, 0670M, 0660M, 0666M, 0270M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1 and FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation. The tuner for this device was set to simulate a "free space" condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

This device supports two configurations: one is with screen open and one is with screen closed. Open, half open and closed configurations are tested, and the worst case radiated emissions data is shown in this report.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version F721USQU0AVED installed on the EUT.

2.5 EMI Suppression Device(s)/Modifications

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

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) were used in the measurement of the EUT**.**

Deviation from Measurement Procedure……..None

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.

For radiated power measurements, substitution method is used per the guidance of ANSI C63.26-2015. For emissions below 1GHz, a half-wave dipole is 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 $_{[dB]}$.

For radiated spurious emissions measurements, the field strength conversion method is used per the formulas in Section 5.2.7 of ANSI C63.26-2015. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;$$ where D is the measurement distance in meters.

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 v01r01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015.

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
-	AP2-001	EMC Cable and Switch System	1/4/2022	Annual	1/4/2023	AP2-001
-	AP2-002	EMC Cable and Switch System	3/11/2022	Annual	3/11/2023	AP2-002
-	ETS-001	EMC Cable and Switch System	12/9/2021	Annual	12/9/2022	ETS-001
-	ETS-002	EMC Cable and Switch System	3/10/2022	Annual	3/10/2023	ETS-002
-	AP1-002	EMC Cable and Switch System	3/9/2022	Annual	3/9/2023	AP1-002
-	MVG-001	EMC Cable and Switch System	3/10/2022	Annual	3/10/2023	MVG-001
-	MVG-002	EMC Cable and Switch System	3/10/2022	Annual	3/10/2023	MVG-002
-	LTx1	Licensed Transmitter Cable Set	12/19/2021	Annual	12/19/2022	LTx1
-	LTx3	LIcensed Transmitter Cable Set	8/18/2021	Annual	8/18/2022	LTx3
-	LTx5	LIcensed Transmitter Cable Set	12/19/2021	Annual	12/19/2022	LTx5
-	LTx6-40	Licensed Transmitter Cable Set	12/19/2021	Annual	12/19/2022	LTx6-40
-	WL40-1	WLAN Cable Set (40GHz)	12/19/2021	Annual	12/19/2022	WL40-1
Anritsu	MT8000A	Radio Communication Test Station	8/2/2021	Annual	8/2/2022	6272337437
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201525694
Espec	ESX-2CA	Environmental Chamber	8/27/2020	Annual	8/27/2022	17620
Sunol Sciences	DRH-118	1-18GHz Horn (Small)	2/14/2022	Biennial	2/14/2024	A050307
ETS-Lindgren	3116C	DRG Horn Antenna	5/11/2021	Biennial	5/11/2023	218893
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/20/2021	Biennial	4/20/2023	00125518
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	7/21/2021	Annual	7/21/2022	MY49430494
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	2/14/2022	Annual	2/14/2023	MY52350166
Keysight Technologies	N9030B	PXA Signal Analyzer, Multi-touch	1/7/2022	Annual	1/7/2023	MY57141001
Keysight Technologies	N9038A	MXE EMI Receiver	1/21/2022	Annual	1/21/2023	MY51210133
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	5/25/2021	Annual	5/25/2022	100348
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	3/28/2022	Annual	3/28/2023	101716
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Test Antenna	8/13/2020	Biennial	8/13/2022	101073
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107
Sunol	JB6	LB6 Antenna	11/13/2020	Biennial	11/13/2022	A082816

Table 5-1. Test Equipment

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: Samsung Electronics Co., Ltd.

FCC ID: A3LSMF721U

FCC Classification: Citizens Band End User Devices (CBE)

Mode(s): LTE/NR

Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Conducted Power	2.1046(a), 2.1046(c)	N/A	PASS	Section 7.2
	Occupied Bandwidth	2.1049(h)	N/A	PASS	Section 7.3
	Conducted Band Edge / Spurious Emissions (CBSD)	2.1051, 96.41(e)(i)	-13 dBm/MHz at frequencies within 0-10 MHz of above the upper SAS-assigned channel edge and within 0-10MHz below the lower SAS-assigned channel edge -25 dBm/MHz at frequencies greater than 10 MHz above and below channel edge -emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz	PASS	Sections 7.4, 7.5
	Additional Maximum Power Reduction (A-MPR)	2.1046	N/A	PASS	Section 7.6
	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 7.7
RADIATED	Equivalent Isotropic Radiated Power (EIRP) (Catogory A CBSD)	96.41(b)	30 dBm/10MHz	PASS	Section 7.8
	Equivalent Isotropic Radiated Power (EIRP) (Catogory B CBSD)	96.41(b)	47 dBm/10MHz	PASS	Section 7.8

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 EMC Software Tool v1.0.

7.2 Conducted Output Power 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.

A-MPR is implemented in this device per the A-MPR specification in 3GPP TS 36.101. The conducted powers are shown herein to cover the different A-MPR levels specified in the standard. Measurement equipment was set up with triggering/gating on the spectrum analyzer such that powers were measured only during the on-time of the signal.

Test Procedure Used

ANSI C63.26-2015 – Section 5.2

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.

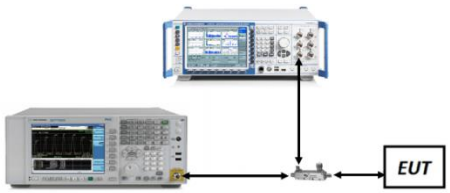


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. A-MPR was only applied for test purposes to the 2CC case since the 1CC case was compliant for all testing at max power.

2. A-MPR was verified to comply with the "CA_NS_10" specification in the 3GPP TS 36.101 standard by setting the MCC to a U.S. code and the MNC to a U.S. carrier supporting LTE B48 operation.

3. 256QAM operations does not employ A-MPR.

4. Conducted power measurements were evaluated using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.

5. All other conducted power measurements are contained in the RF exposure report for this filing.

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	55340	3560.0	1 / 50	23.79
		55990	3625.0	1 / 0	23.88
		56640	3690.0	1 / 99	23.96
	16-QAM	56640	3690.0	1 / 50	22.78
15 MHz	QPSK	55315	3557.5	1 / 37	23.90
		55990	3625.0	1 / 37	23.57
		56665	3692.5	1 / 37	23.79
	16-QAM	55990	3625.0	1 / 37	22.29
10 MHz	QPSK	55290	3555.0	1 / 49	23.91
		55990	3625.0	1 / 49	23.60
		56690	3695.0	1 / 49	23.57
	16-QAM	55990	3625.0	1 / 49	22.41
5 MHz	QPSK	55265	3552.5	1 / 12	23.76
		55990	3625.0	1 / 24	23.83
		56715	3697.5	1 / 12	23.99
	16-QAM	56715	3697.5	1 / 12	22.97

Table 7-2. Conducted Power Output Data (LTE Band 48)

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	23.41
		20	3625.0	1 / 99	20	3644.8	1 / 0	23.27
		20	3690.0	1 / 0	20	3670.2	1 / 99	23.23
	16-QAM	20	3560.0	1 / 99	20	3579.8	1 / 0	22.57
		20	3625.0	1 / 99	20	3644.8	1 / 0	22.47
		20	3690.0	1 / 0	20	3670.2	1 / 99	22.64
	64-QAM	20	3560.0	1 / 99	20	3579.8	1 / 0	21.64
		20	3625.0	1 / 99	20	3644.8	1 / 0	21.38
		20	3690.0	1 / 0	20	3670.2	1 / 99	21.61
	256-QAM	20	3560.0	1 / 99	20	3579.8	1 / 0	18.19
		20	3625.0	1 / 99	20	3644.8	1 / 0	18.09
		20	3690.0	1 / 0	20	3670.2	1 / 99	18.63
35 MHz	QPSK	20	3560.0	1 / 99	15	3577.1	1 / 0	23.70
		20	3625.0	1 / 99	15	3642.1	1 / 0	23.46
		20	3690.0	1 / 0	15	3672.9	1 / 74	23.82
	16-QAM	20	3560.0	1 / 99	15	3577.1	1 / 0	22.26
		20	3625.0	1 / 99	15	3642.1	1 / 0	22.48
		20	3690.0	1 / 0	15	3672.9	1 / 74	22.92
	64-QAM	20	3560.0	1 / 99	15	3577.1	1 / 0	21.62
		20	3625.0	1 / 99	15	3642.1	1 / 0	20.96
		20	3690.0	1 / 0	15	3672.9	1 / 74	21.42
	256-QAM	20	3560.0	1 / 99	15	3577.1	1 / 0	18.39
		20	3625.0	1 / 99	15	3642.1	1 / 0	18.48
		20	3690.0	1 / 0	15	3672.9	1 / 74	18.14
30 MHz	QPSK	20	3560.0	1 / 99	10	3574.4	1 / 0	23.87
		20	3625.0	1 / 99	10	3639.4	1 / 0	23.43
		20	3690.0	1 / 0	10	3675.6	1 / 49	23.70
	16-QAM	20	3560.0	1 / 99	10	3574.4	1 / 0	22.78
		20	3625.0	1 / 99	10	3639.4	1 / 0	22.48
		20	3690.0	1 / 0	10	3675.6	1 / 49	22.55
	64-QAM	20	3560.0	1 / 99	10	3574.4	1 / 0	21.66
		20	3625.0	1 / 99	10	3639.4	1 / 0	21.20
		20	3690.0	1 / 0	10	3675.6	1 / 49	21.92
	256-QAM	20	3560.0	1 / 99	10	3574.4	1 / 0	18.33
		20	3625.0	1 / 99	10	3639.4	1 / 0	17.76
		20	3690.0	1 / 0	10	3675.6	1 / 49	19.05
25 MHz	QPSK	20	3560.0	1 / 99	5	3571.7	1 / 0	23.82
		20	3625.0	1 / 99	5	3636.7	1 / 0	23.40
		20	3690.0	1 / 0	5	3678.3	1 / 24	23.67
	16-QAM	20	3560.0	1 / 99	5	3571.7	1 / 0	22.64
		20	3625.0	1 / 99	5	3636.7	1 / 0	22.18
		20	3690.0	1 / 0	5	3678.3	1 / 24	22.44
	64-QAM	20	3560.0	1 / 99	5	3571.7	1 / 0	21.76
		20	3625.0	1 / 99	5	3636.7	1 / 0	21.37
		20	3690.0	1 / 0	5	3678.3	1 / 24	21.68
	256-QAM	20	3560.0	1 / 99	5	3571.7	1 / 0	18.78
		20	3625.0	1 / 99	5	3636.7	1 / 0	18.40
		20	3690.0	1 / 0	5	3678.3	1 / 24	18.43

Table 7-3. Conducted Power Output Data (ULCA LB48)

Test Case	NS	MCC	MNC	Channel BW [MHz]	PCC			SCC			A-MPR [dB]	Modulation	MPR [dB]	Maximum Target Output Power [dBm]	A-MPR Measured Power [dBm]
					Channel Frequency [MHz]	RB Size	RB Offset	Channel Frequency [MHz]	RB Size	RB Offset					
1	NS_01	310	910	20 + 20	3690	100	0	3670.2	100	0	≤ 11	QPSK	0	23.00	12.48
												16-QAM	1	22.00	12.46
												64-QAM	2	21.00	12.59
												256-QAM	4	19.00	12.52
2				20 + 20	3690	1	0	3670.2	1	99	≤ 11	QPSK	0	23.00	18.68
												16-QAM	1	22.00	19.05
												64-QAM	2	21.00	19.29
												256-QAM	4	19.00	18.66

Table 7-4. A-MPR Conducted Power Output Data (ULCA LB48)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 26	24.02
		641666	3625.0	1 / 26	23.94
		645332	3680.0	1 / 26	23.66
	QPSK	638000	3570.0	1 / 26	24.01
		641666	3625.0	1 / 26	23.92
		645332	3680.0	1 / 26	23.65
	16-QAM	641666	3625.0	1 / 26	22.84
30 MHz	π/2 BPSK	637668	3565.0	1 / 19	23.92
		641666	3625.0	1 / 39	23.93
		645666	3685.0	1 / 19	23.70
	QPSK	637668	3565.0	1 / 19	23.88
		641666	3625.0	1 / 39	23.91
		645666	3685.0	1 / 19	23.63
	16-QAM	641666	3625.0	1 / 39	22.78
20 MHz	π/2 BPSK	637334	3560.0	1 / 37	23.93
		641666	3625.0	1 / 13	23.84
		646000	3690.0	1 / 13	23.51
	QPSK	637334	3560.0	1 / 37	23.93
		641666	3625.0	1 / 13	23.82
		646000	3690.0	1 / 13	23.45
	16-QAM	641666	3625.0	1 / 13	22.68
10 MHz	π/2 BPSK	637000	3555.0	1 / 6	23.71
		641666	3625.0	1 / 17	23.67
		646332	3695.0	1 / 17	23.38
	QPSK	637000	3555.0	1 / 6	23.71
		641666	3625.0	1 / 17	23.61
		646332	3695.0	1 / 17	23.36
	16-QAM	641666	3625.0	1 / 17	22.53

Table 7-5. Conducted Power Output Data (NR Band n48 Ant F)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 53	20.89
		641666	3625.0	1 / 26	20.89
		645332	3680.0	1 / 26	20.64
	QPSK	638000	3570.0	1 / 53	20.85
		641666	3625.0	1 / 26	20.98
		645332	3680.0	1 / 26	20.94
	16-QAM	638000	3570.0	1 / 53	20.07

Table 7-6. Conducted Power Output Data (NR Band n48 Ant I)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 26	20.45
		641666	3625.0	1 / 26	20.88
		645332	3680.0	1 / 26	20.68
	QPSK	638000	3570.0	1 / 26	20.43
		641666	3625.0	1 / 26	20.96
		645332	3680.0	1 / 26	20.70
	16-QAM	638000	3570.0	1 / 26	18.76

Table 7-7. Conducted Power Output Data (NR Band n48 Ant E)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 26	18.78
		641666	3625.0	1 / 26	18.17
		645332	3680.0	1 / 26	17.33
	QPSK	638000	3570.0	1 / 53	18.81
		641666	3625.0	1 / 53	18.16
		645332	3680.0	1 / 26	17.61
	16-QAM	638000	3570.0	1 / 26	17.14

Table 7-8. Conducted Power Output Data (NR Band n48 Ant C)

NR (SCS 30kHz)						LTE						NR Conducted Power [dBm]	LTE Conducted Power [dBm]	EN-DC Total Tx. Power [dBm]
NR Band	NR Bandwidth [MHz]	NR Channel	NR Frequency [MHz]	Mod.	NR RB#/Offset	LTE Band	LTE Bandwidth [MHz]	LTE Channel	LTE Frequency [MHz]	Mod.	LTE RB#/Offset			
n48	40	Mid	3625	QPSK	100/0	B66	20	Mid	1745	QPSK	100/0	18.42	20.04	22.32
				QPSK	100/0					QPSK	1/50	18.11	21.38	23.06
				QPSK	1/53					QPSK	100/0	21.63	19.96	23.89
				QPSK	1/53					QPSK	1/50	21.47	21.26	24.38
				16Q	1/53					16Q	1/50	19.80	20.78	23.33

Table 7-9. Conducted Power Output Data (EN-DC n48-B66)

7.3 Occupied Bandwidth

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

ANSI C63.26-2015 – Section 5.4.4

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.

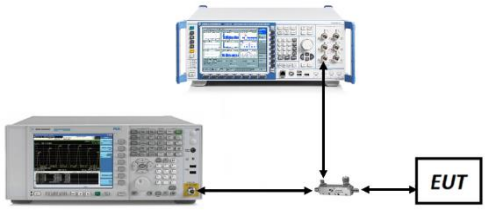
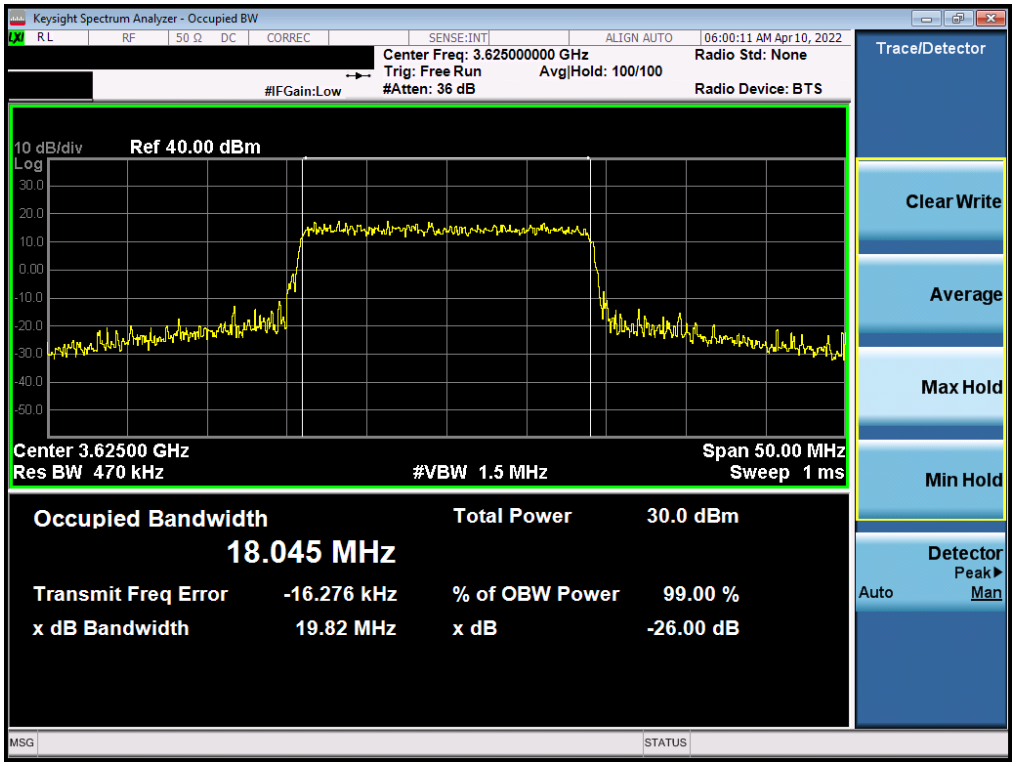


Figure 7-2. Test Instrument & Measurement Setup

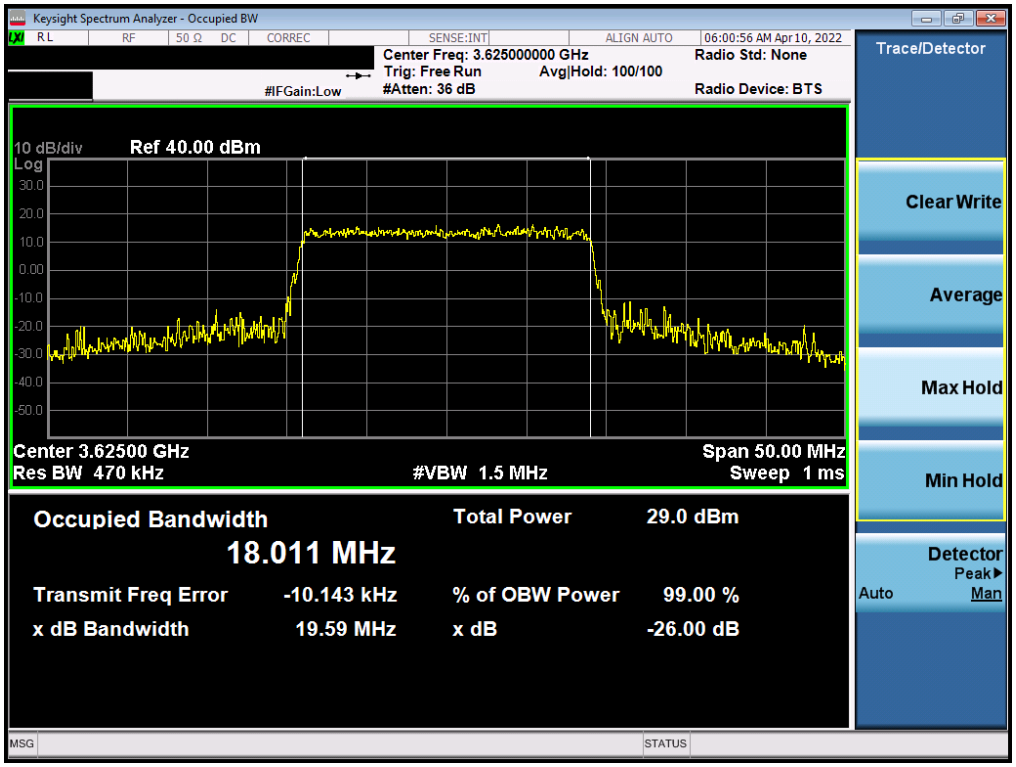
Test Notes

None

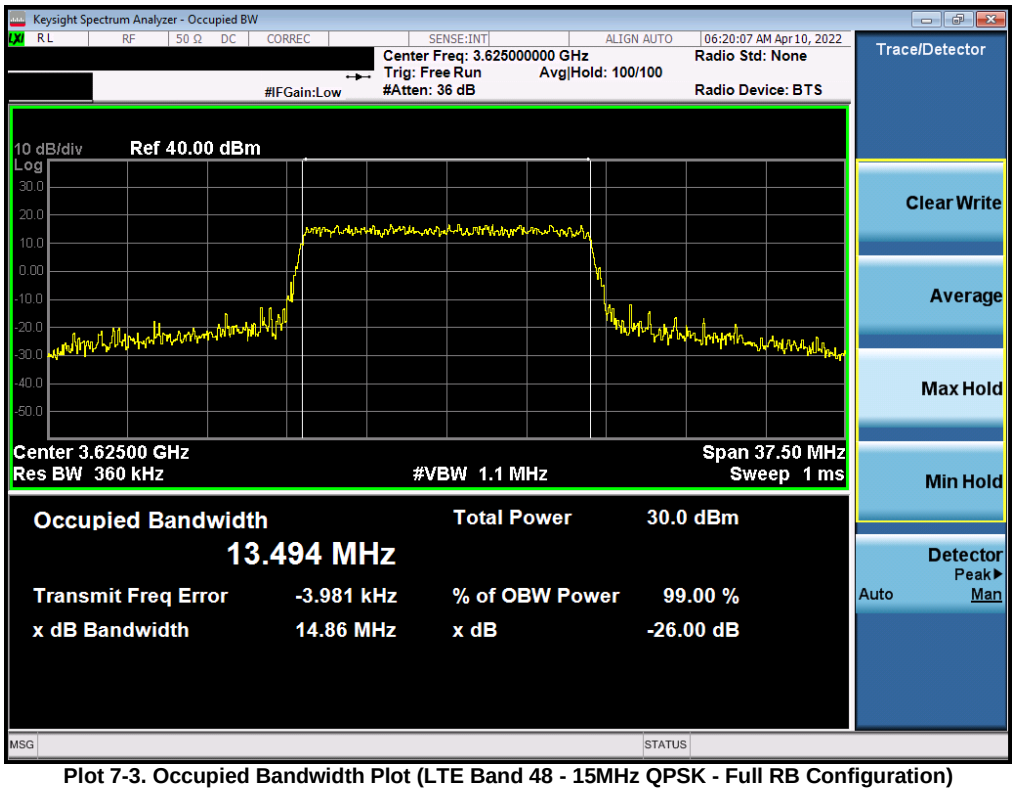
LTE Band 48



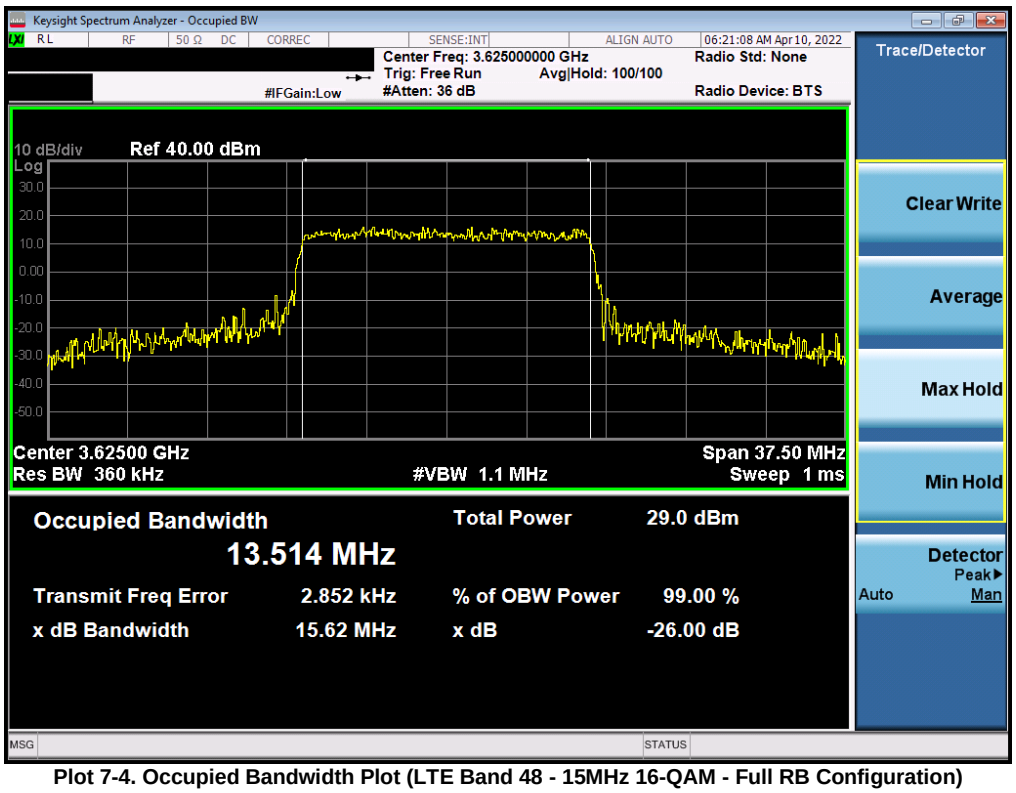
Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)



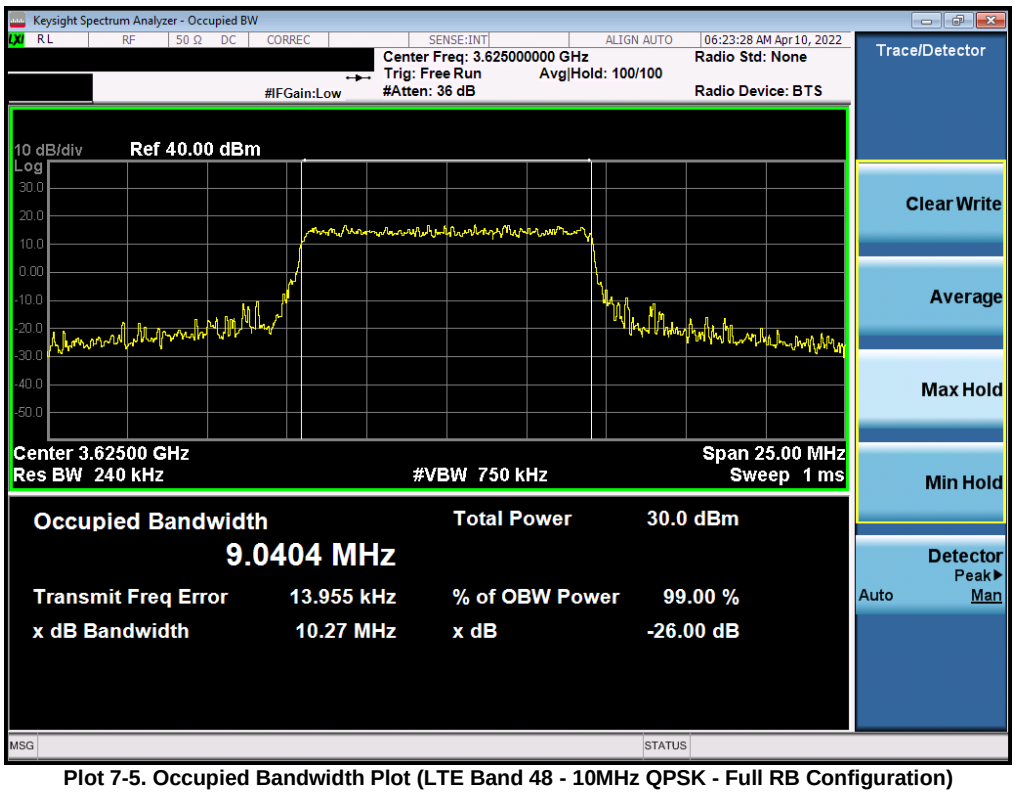
Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)



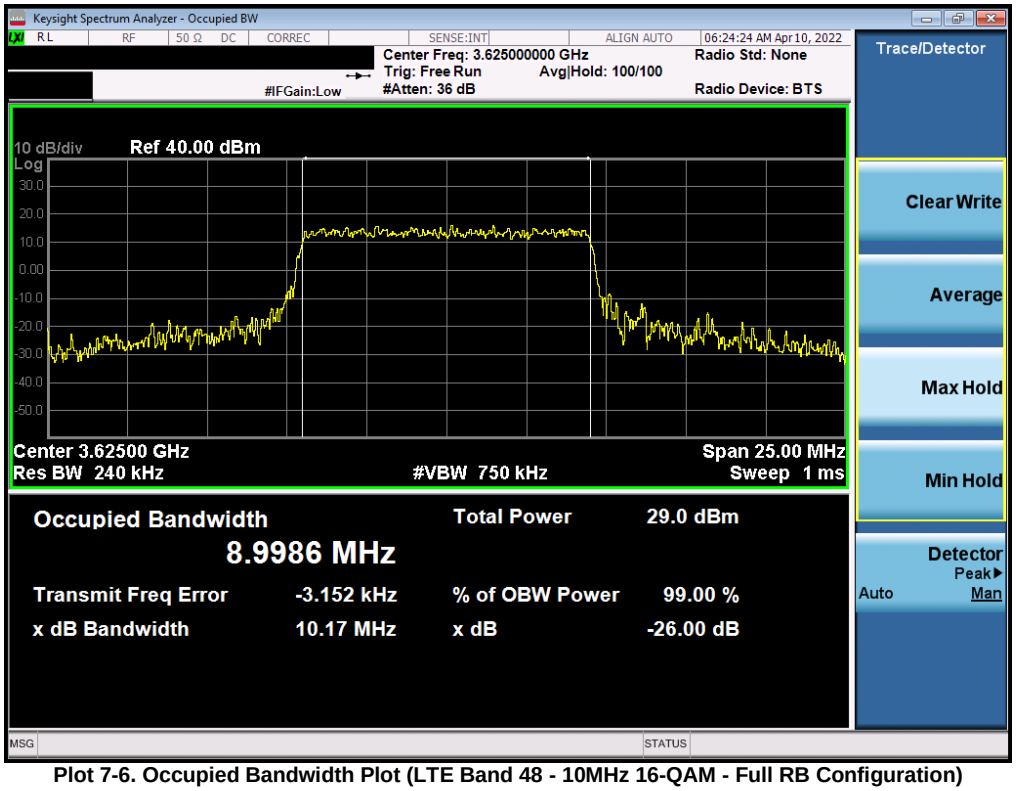
Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)



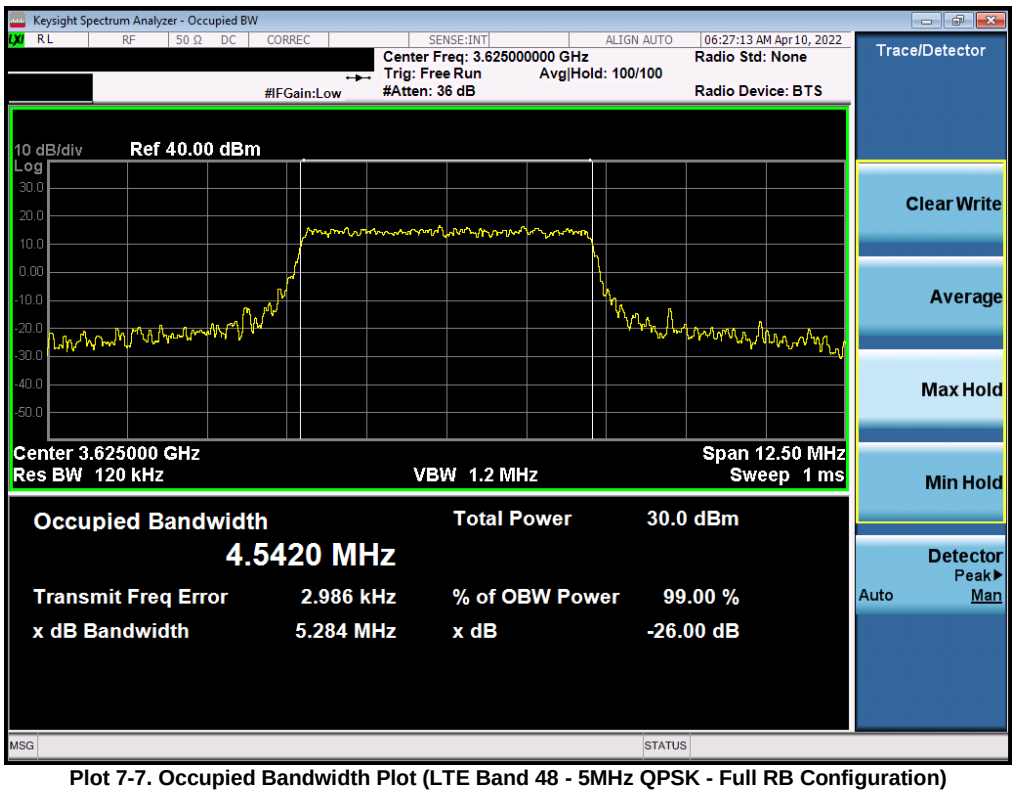
Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)



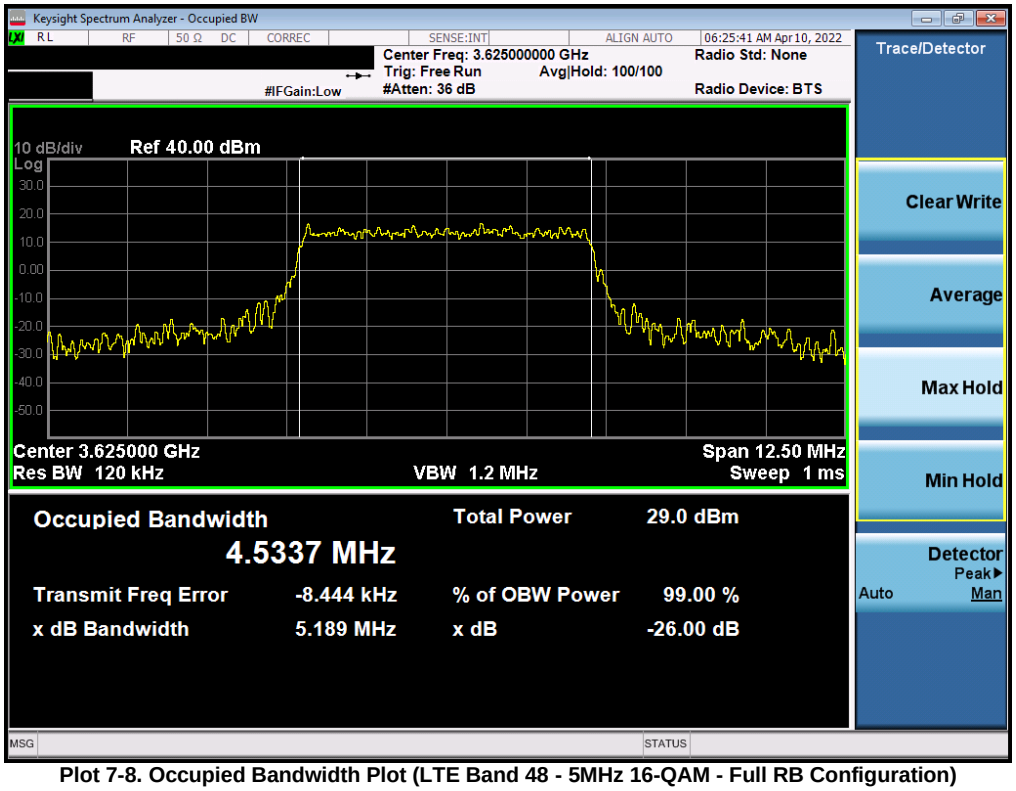
Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)



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

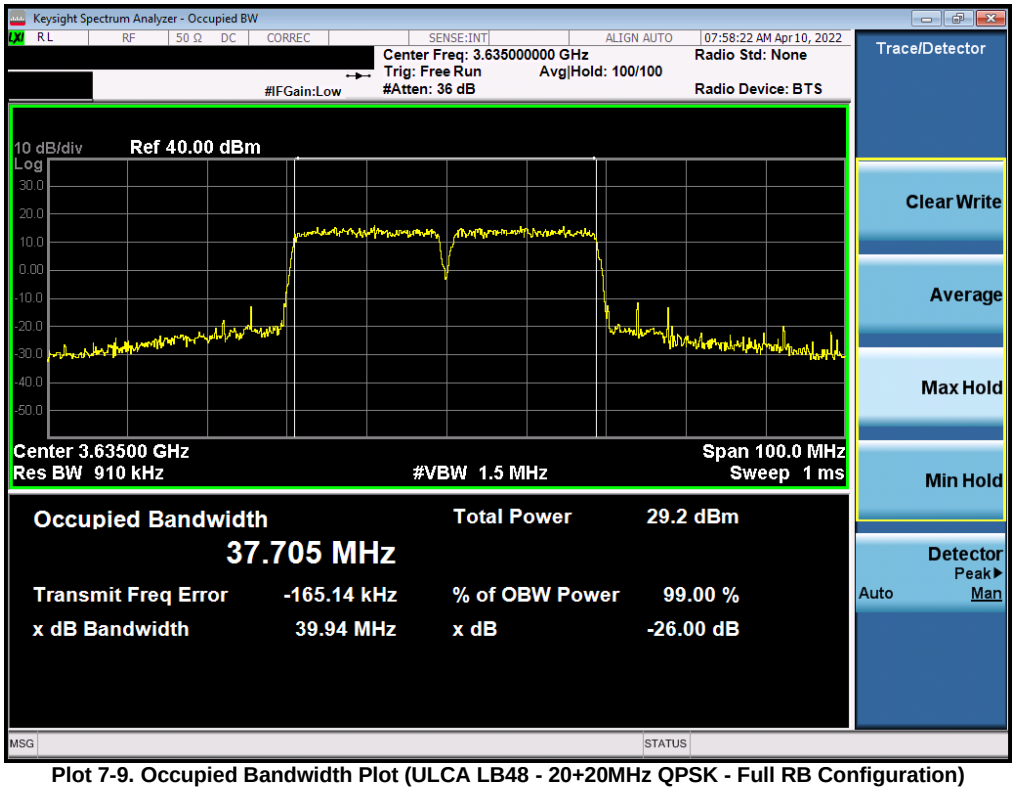


Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

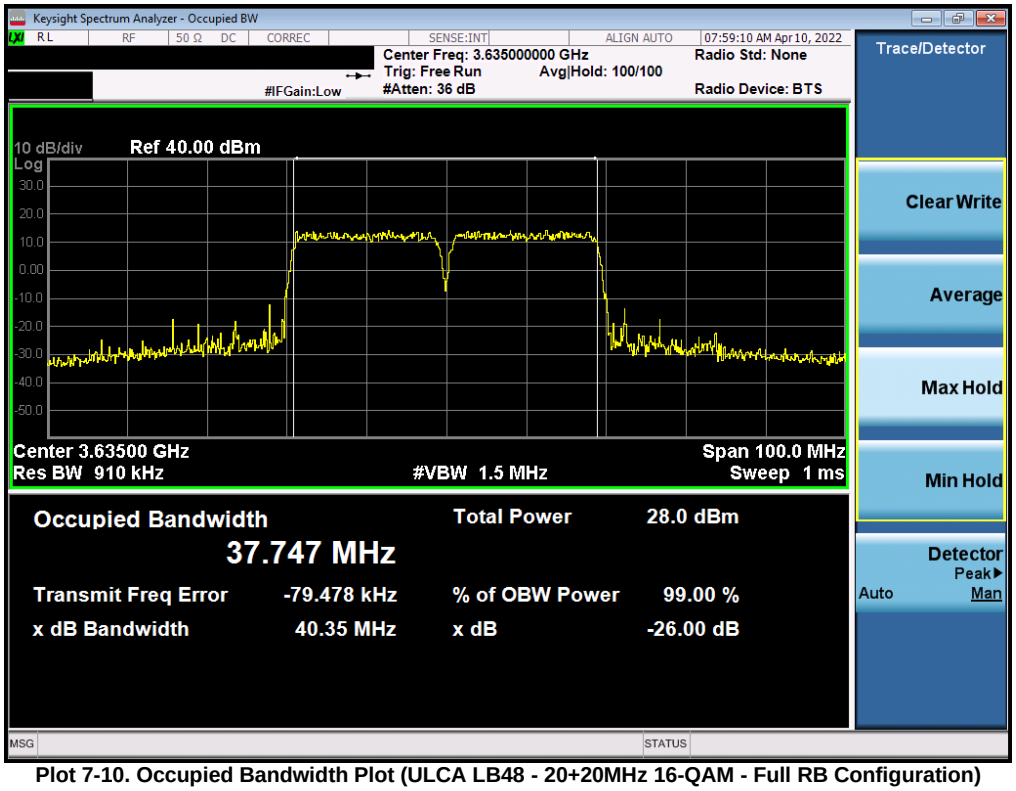


Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

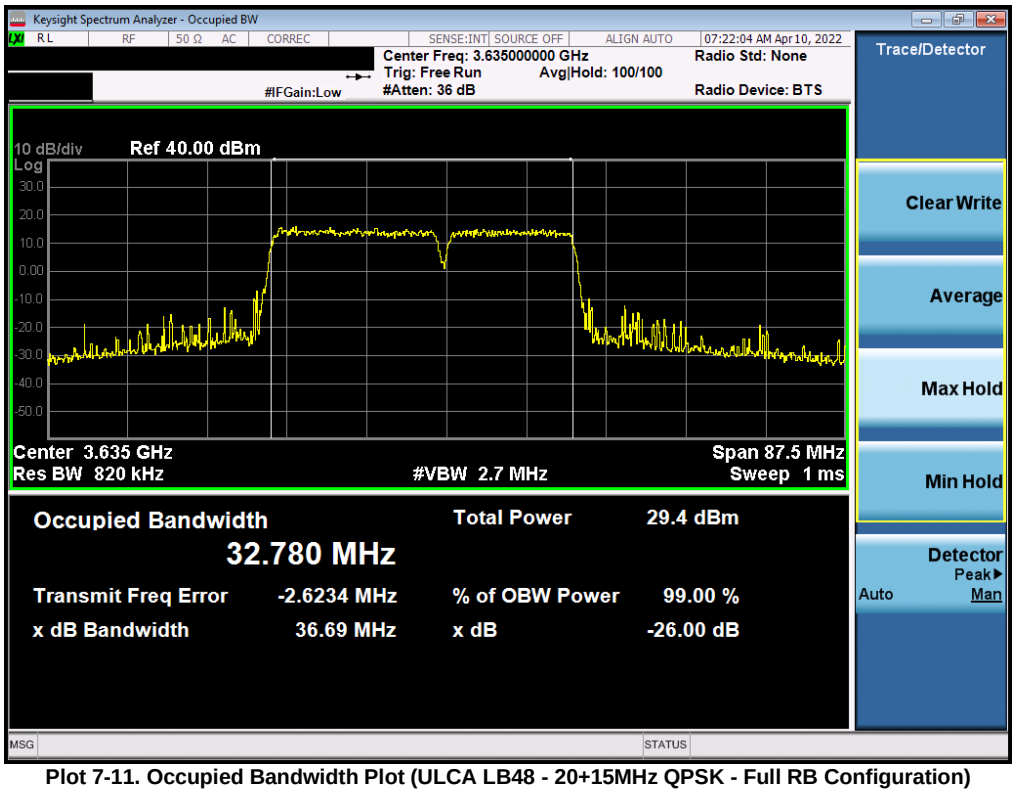
ULCA LTE Band 48



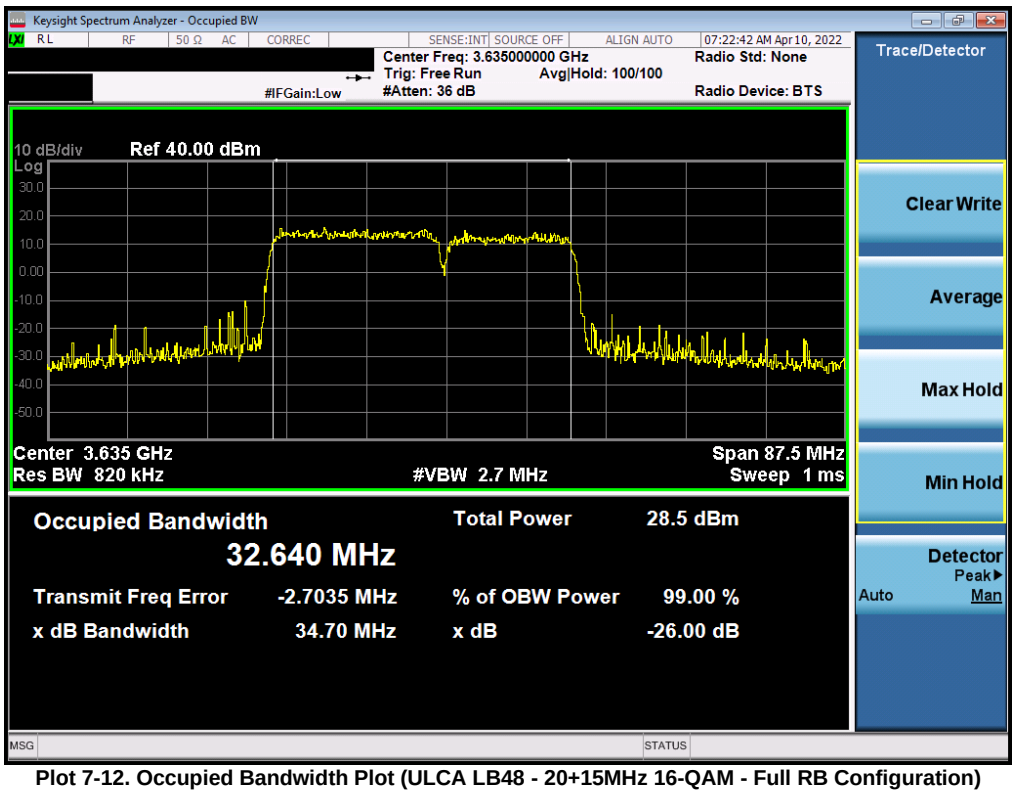
Plot 7-9. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz QPSK - Full RB Configuration)



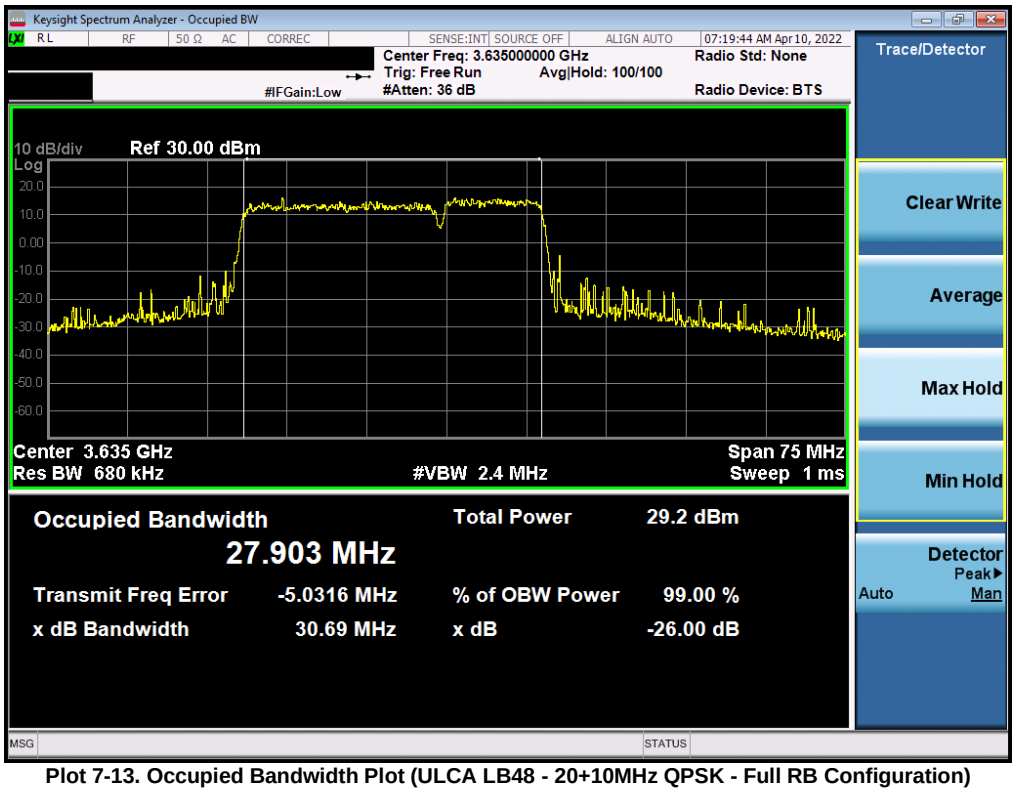
Plot 7-10. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz 16-QAM - Full RB Configuration)



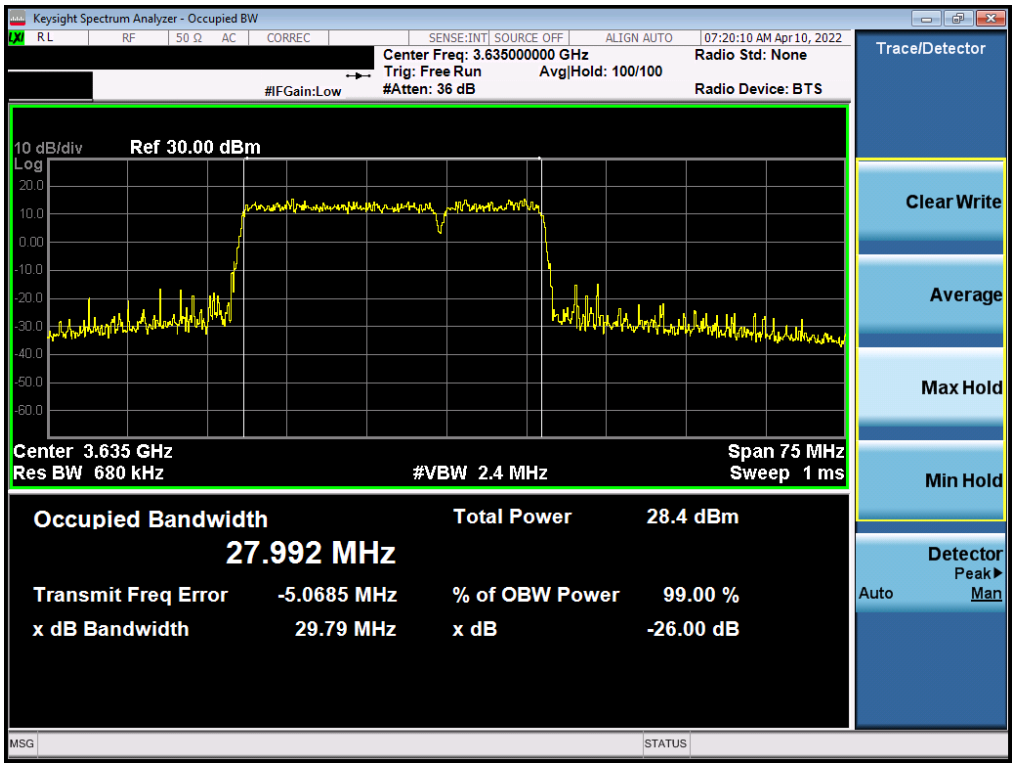
Plot 7-11. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz QPSK - Full RB Configuration)



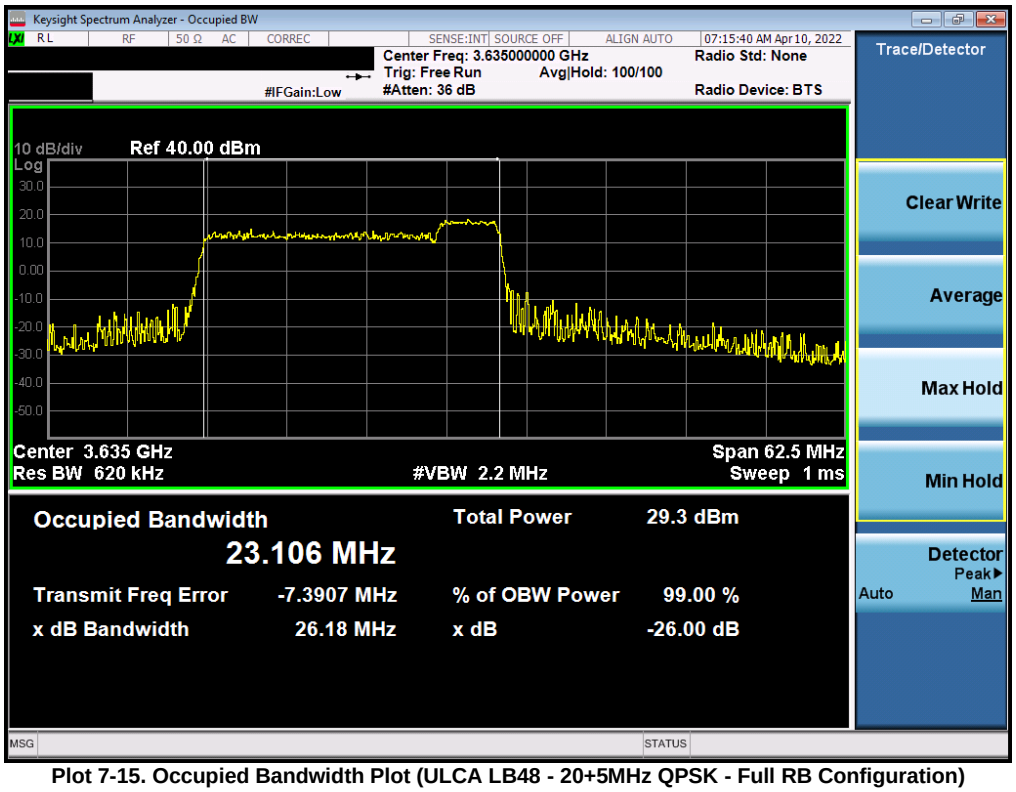
Plot 7-12. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz 16-QAM - Full RB Configuration)



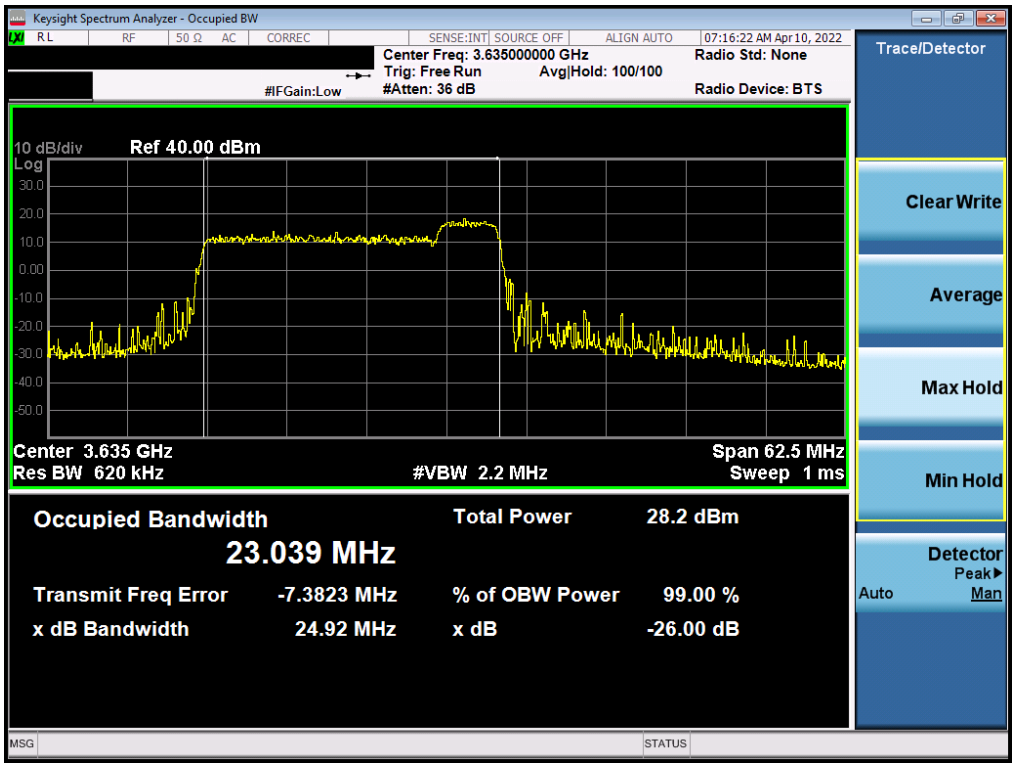
Plot 7-13. Occupied Bandwidth Plot (ULCA LB48 - 20+10MHz QPSK - Full RB Configuration)



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

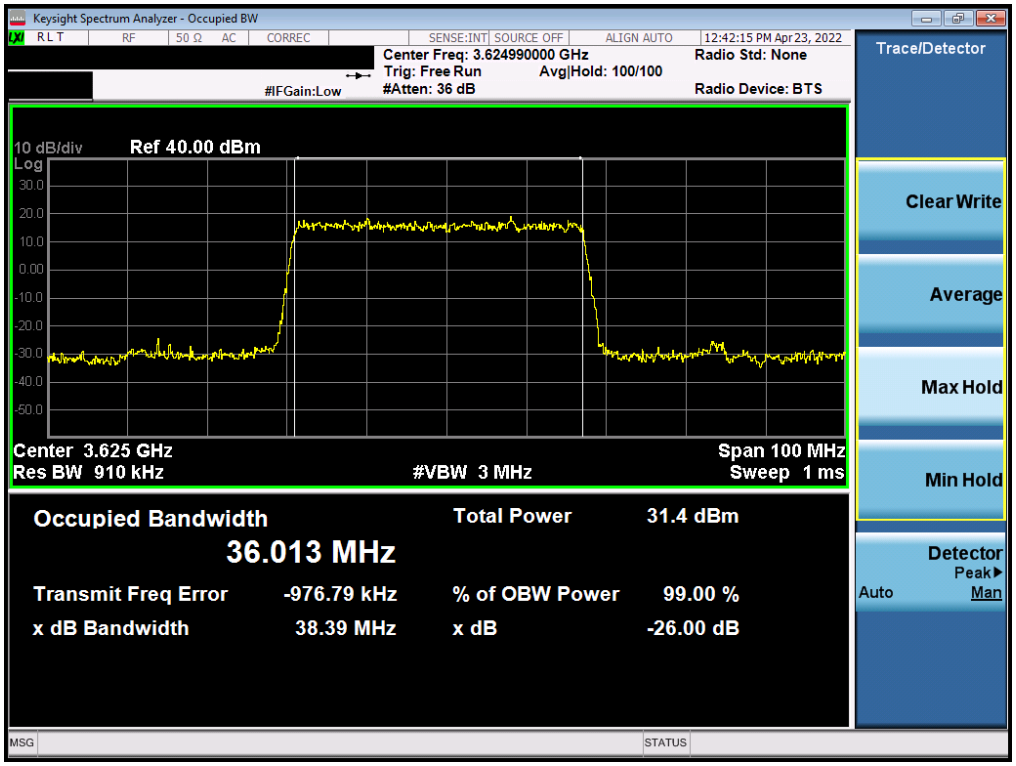


Plot 7-15. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz QPSK - Full RB Configuration)

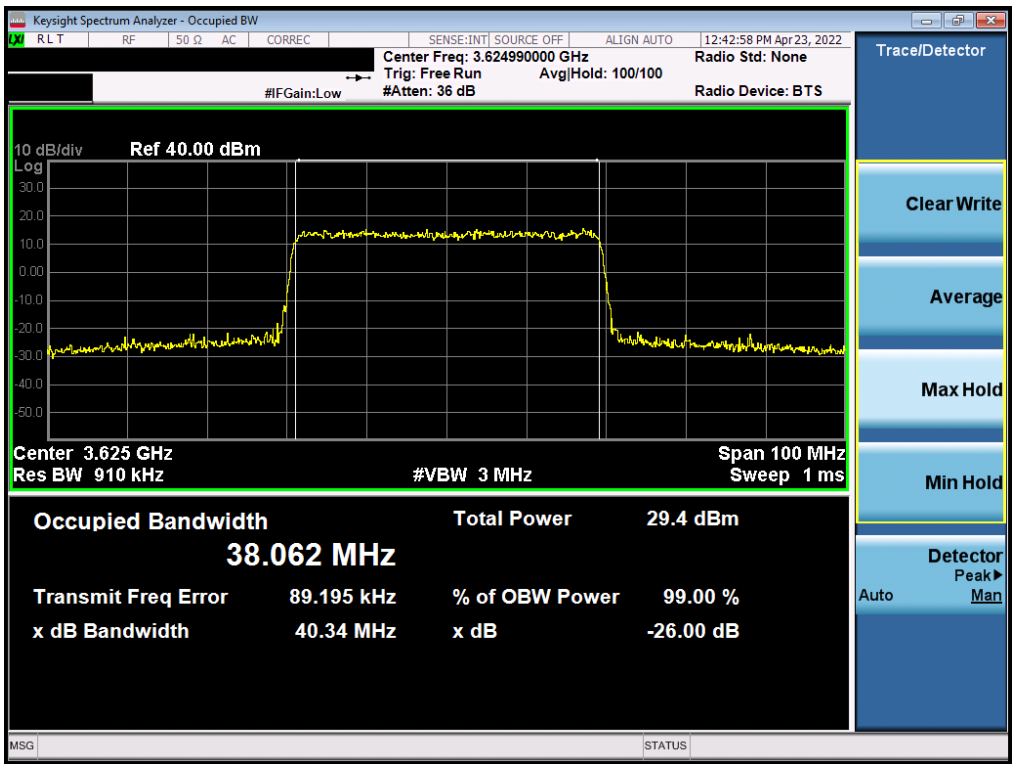


Plot 7-16. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz 16-QAM - Full RB Configuration)

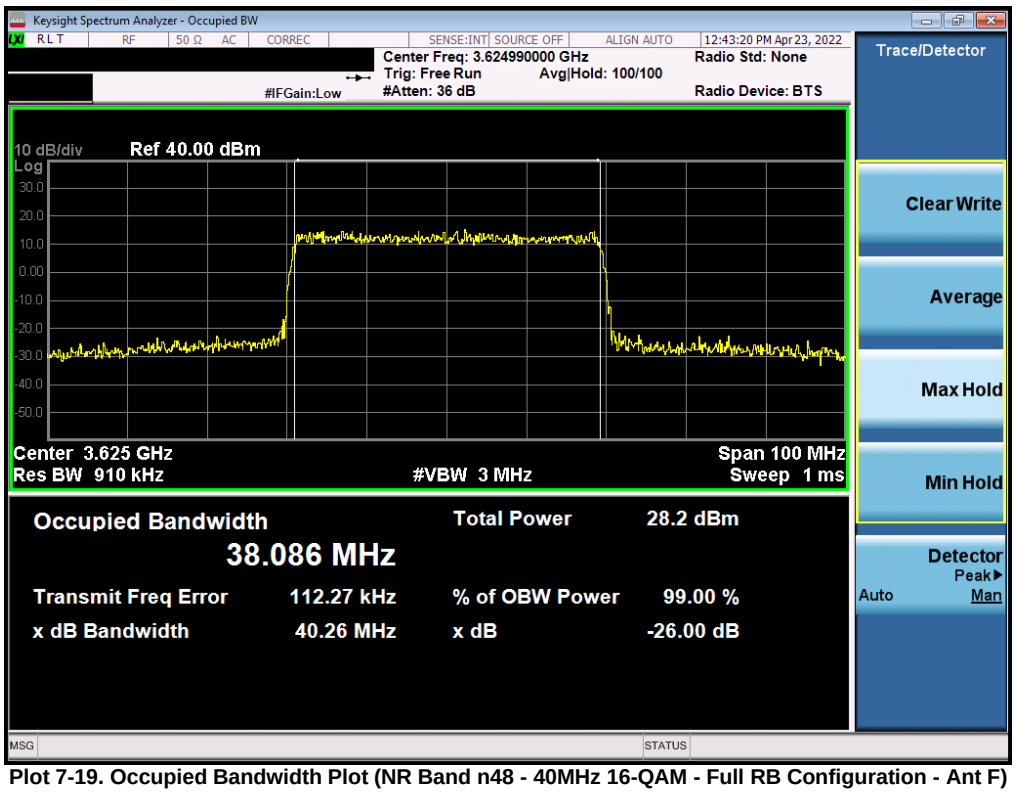
NR Band n48 – Ant F



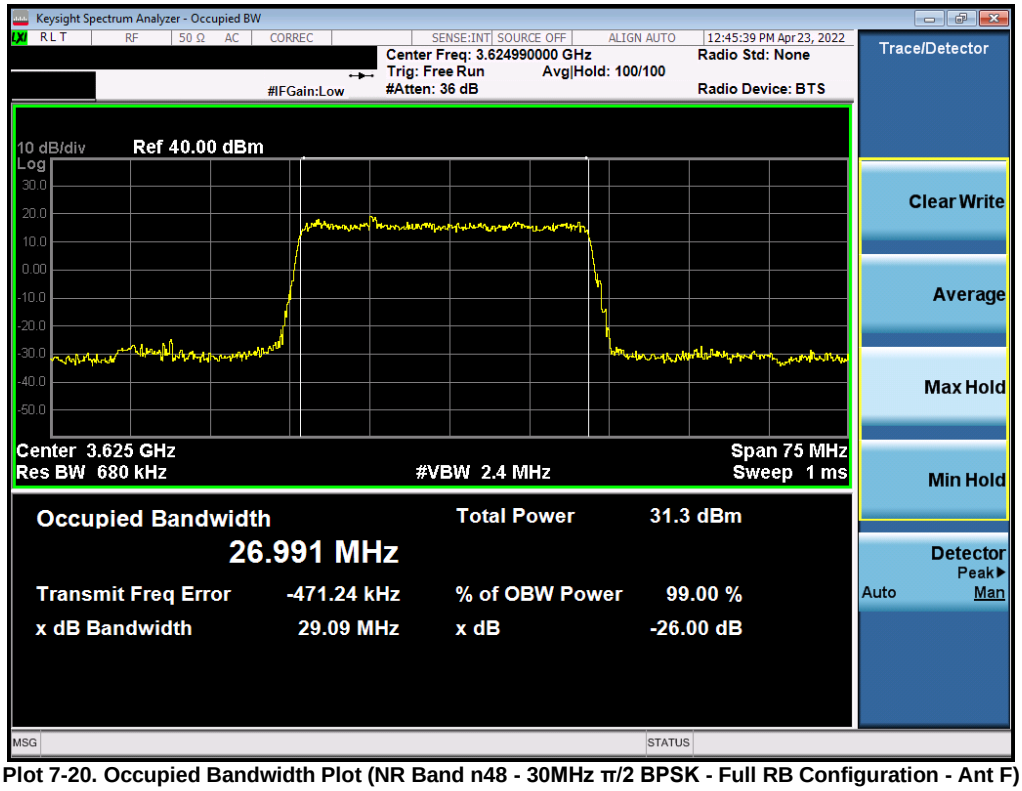
Plot 7-17. Occupied Bandwidth Plot (NR Band n48 - 40MHz π/2 BPSK - Full RB Configuration - Ant F)



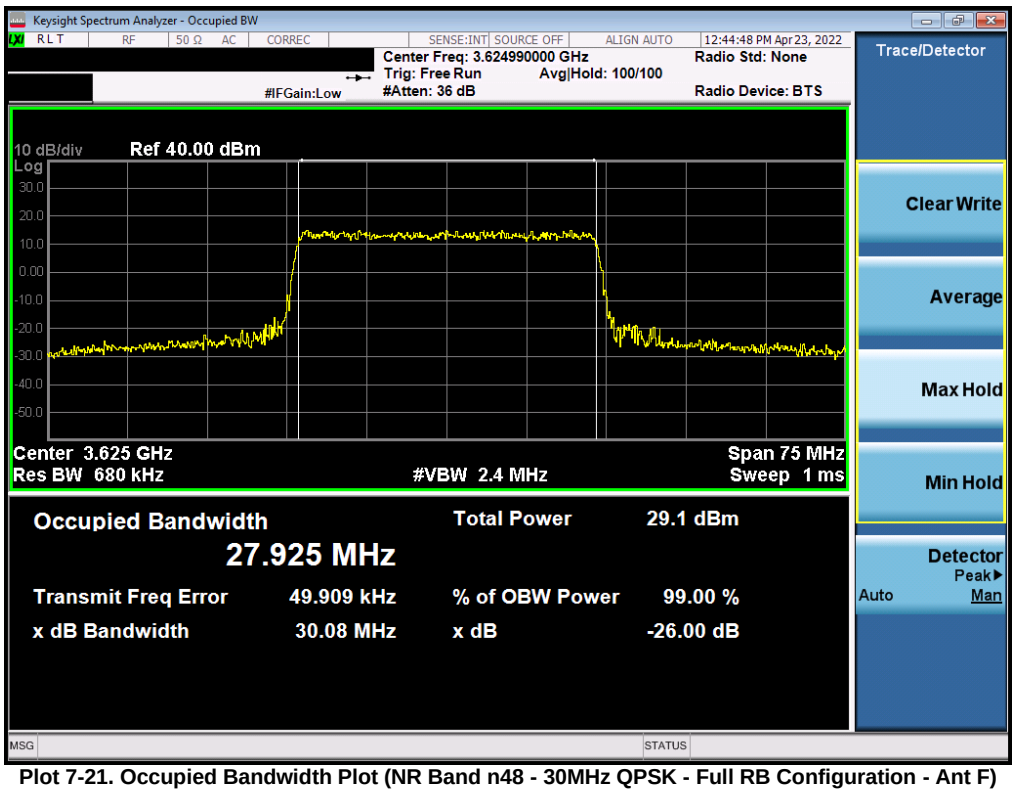
Plot 7-18. Occupied Bandwidth Plot (NR Band n48 - 40MHz QPSK - Full RB Configuration - Ant F)



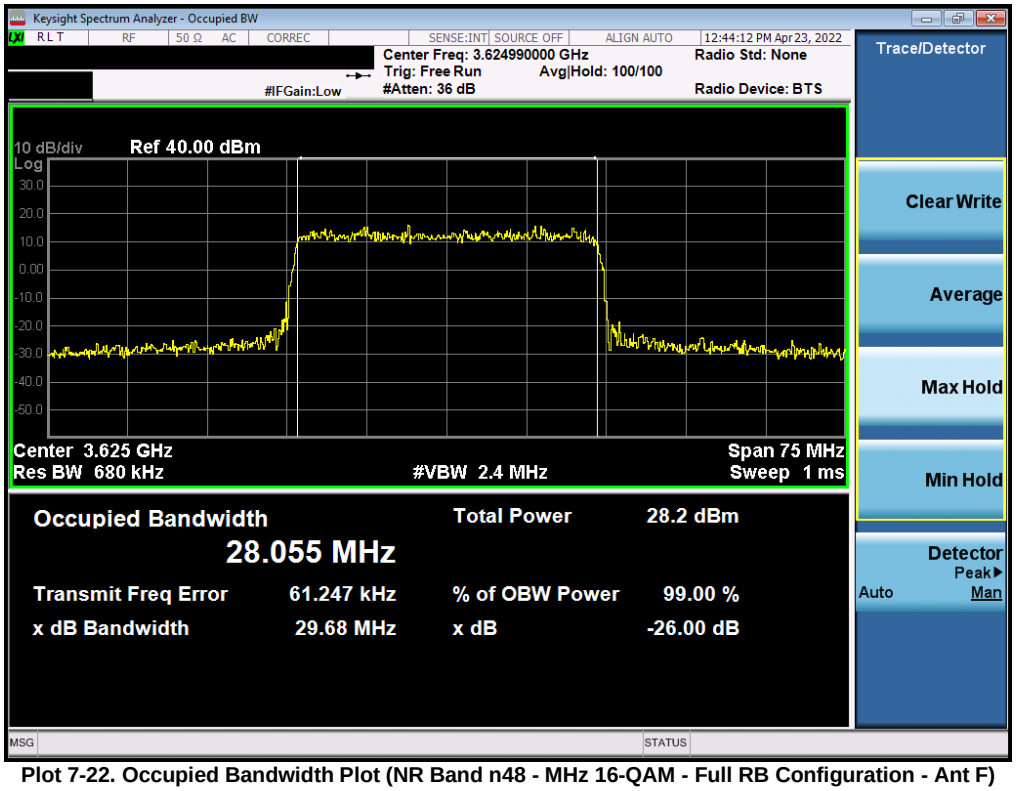
Plot 7-19. Occupied Bandwidth Plot (NR Band n48 - 40MHz 16-QAM - Full RB Configuration - Ant F)



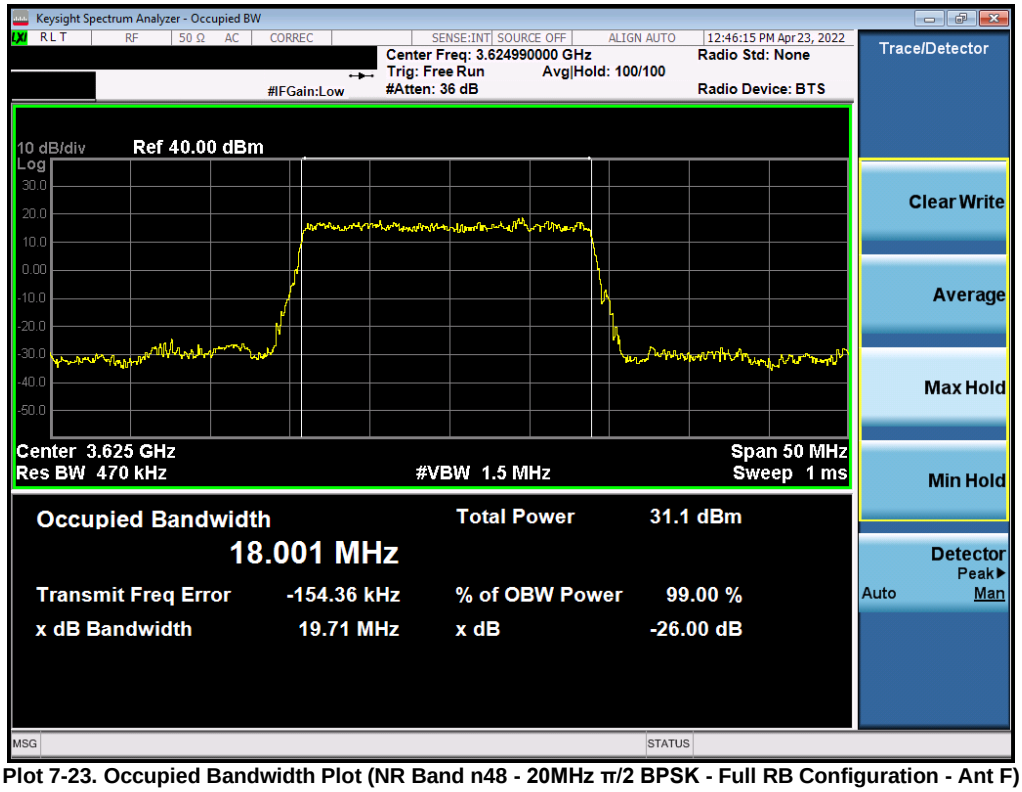
Plot 7-20. Occupied Bandwidth Plot (NR Band n48 - 30MHz π/2 BPSK - Full RB Configuration - Ant F)



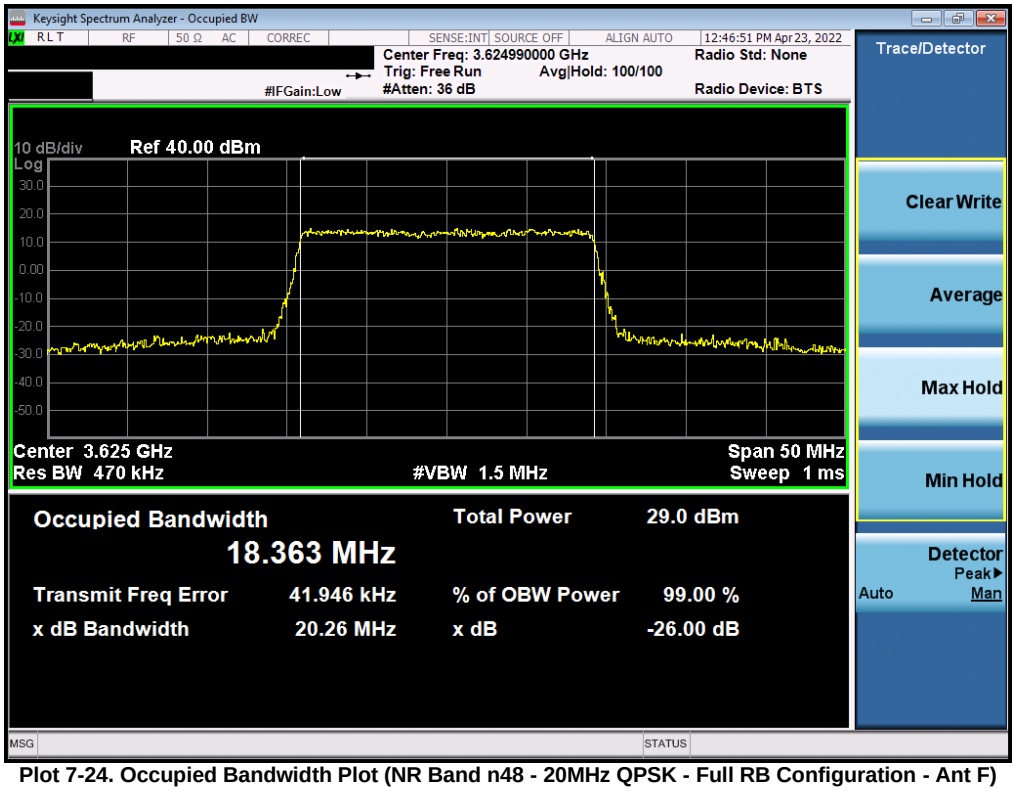
Plot 7-21. Occupied Bandwidth Plot (NR Band n48 - 30MHz QPSK - Full RB Configuration - Ant F)



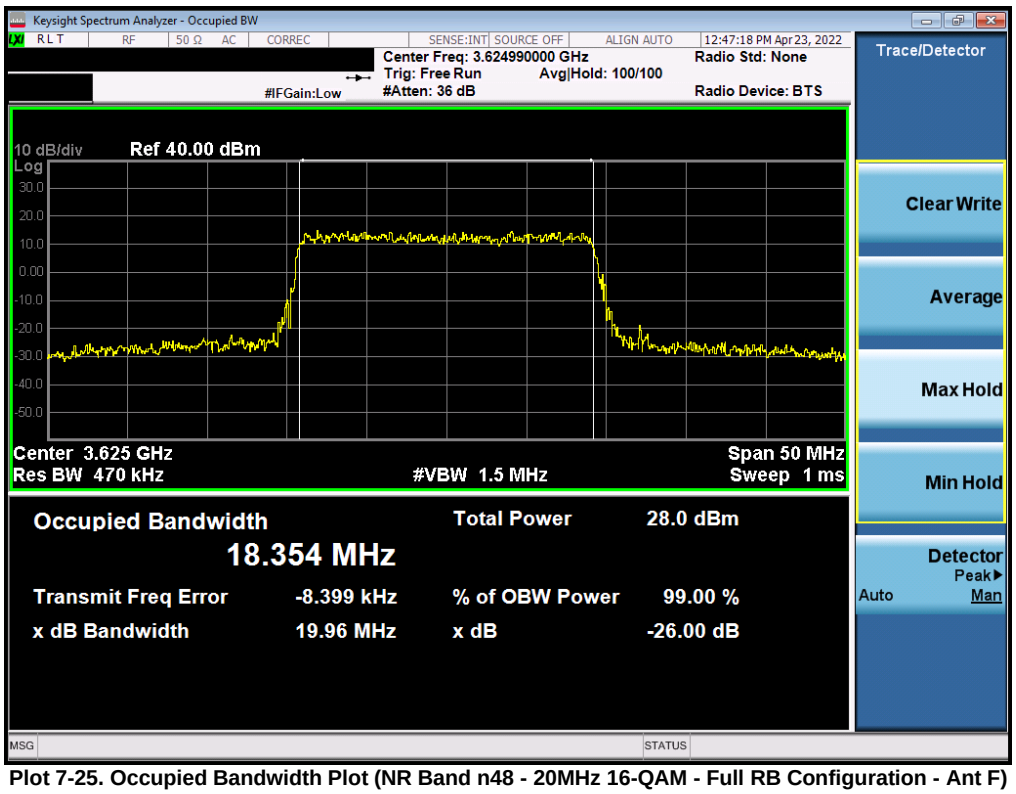
Plot 7-22. Occupied Bandwidth Plot (NR Band n48 - MHz 16-QAM - Full RB Configuration - Ant F)



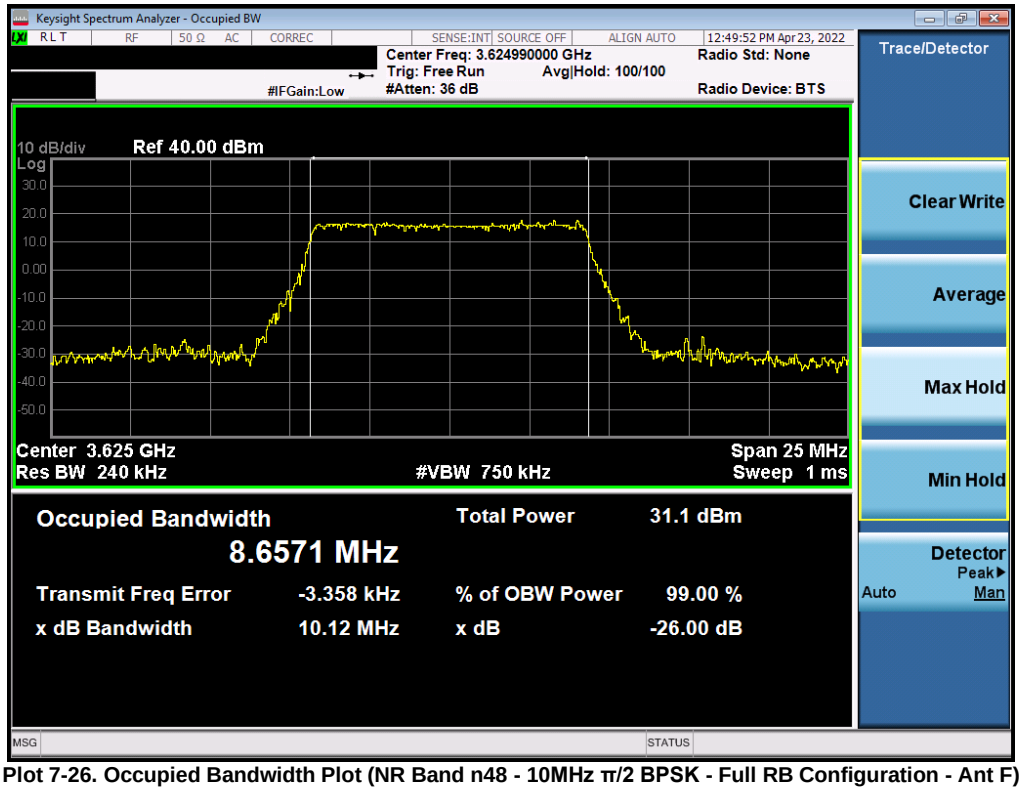
Plot 7-23. Occupied Bandwidth Plot (NR Band n48 - 20MHz π/2 BPSK - Full RB Configuration - Ant F)



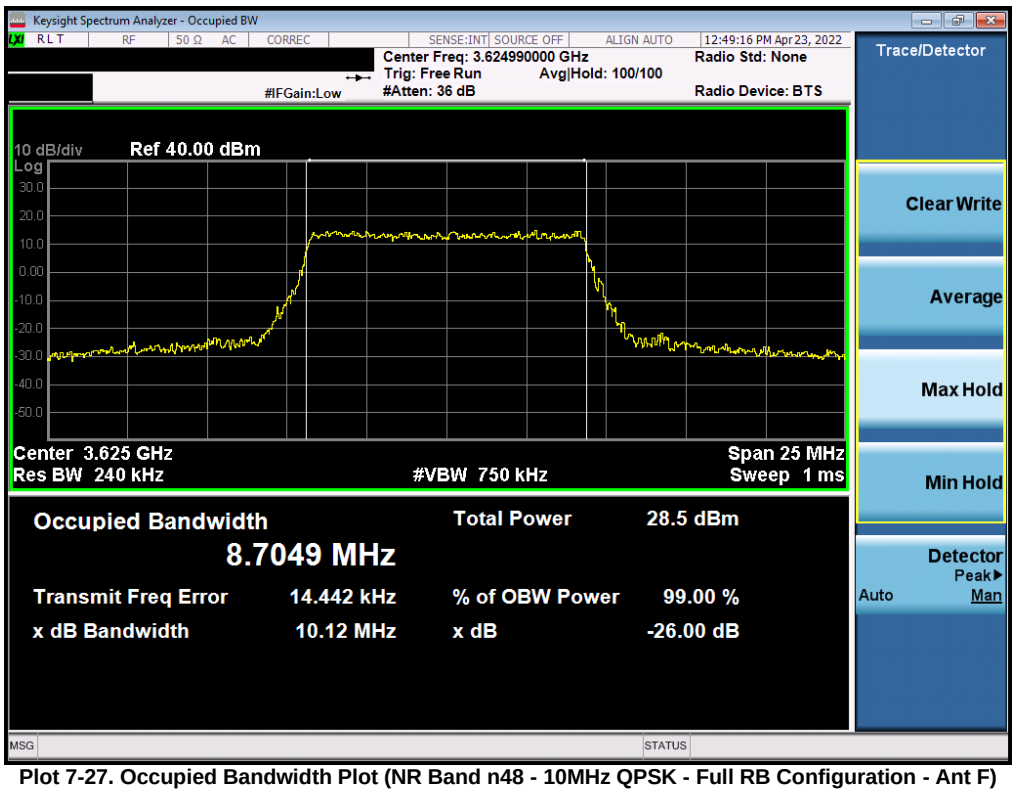
Plot 7-24. Occupied Bandwidth Plot (NR Band n48 - 20MHz QPSK - Full RB Configuration - Ant F)



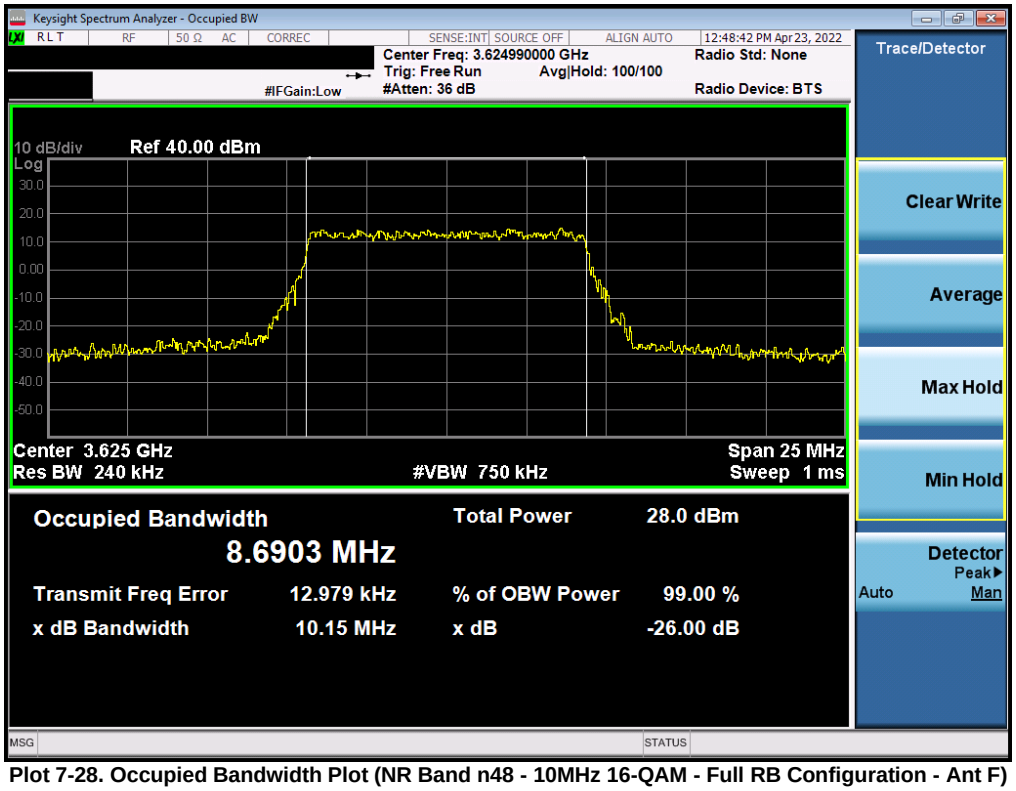
Plot 7-25. Occupied Bandwidth Plot (NR Band n48 - 20MHz 16-QAM - Full RB Configuration - Ant F)



Plot 7-26. Occupied Bandwidth Plot (NR Band n48 - 10MHz π/2 BPSK - Full RB Configuration - Ant F)



Plot 7-27. Occupied Bandwidth Plot (NR Band n48 - 10MHz QPSK - Full RB Configuration - Ant F)



Plot 7-28. Occupied Bandwidth Plot (NR Band n48 - 10MHz 16-QAM - Full RB Configuration - Ant F)

7.4 Spurious and Harmonic Emissions at Antenna Terminal

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

ANSI C63.26-2015 – Section 5.7.4

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.

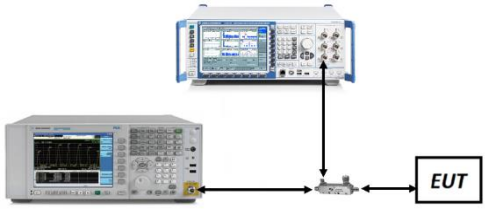


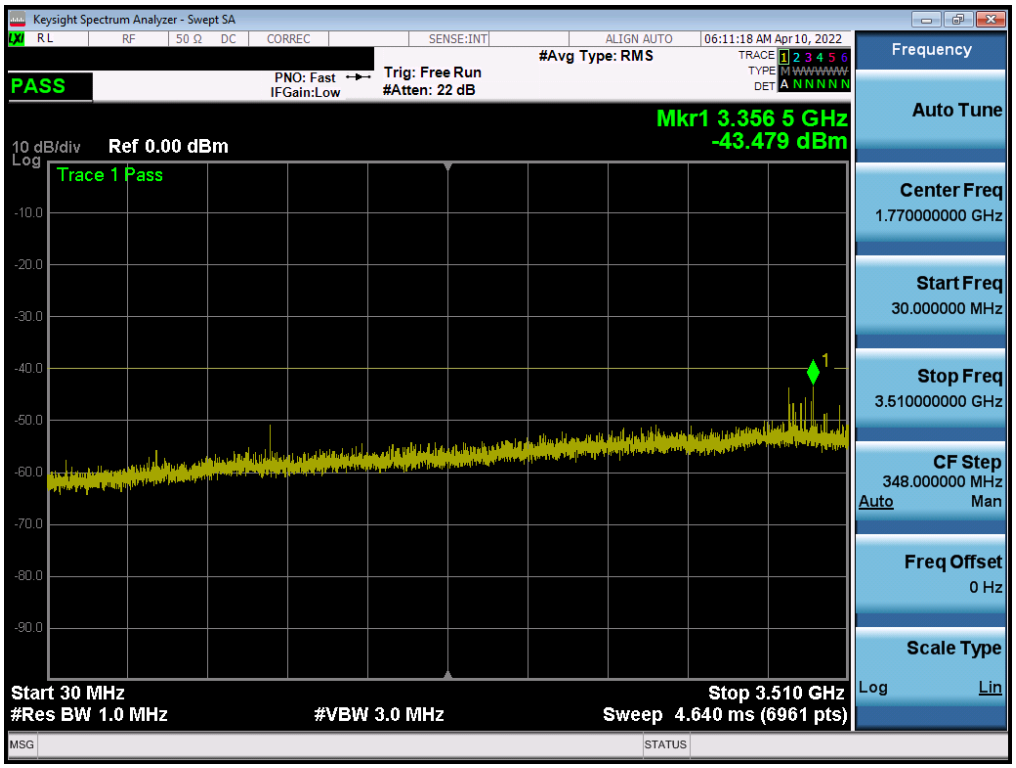
Figure 7-3. Test Instrument & Measurement Setup

Test Notes

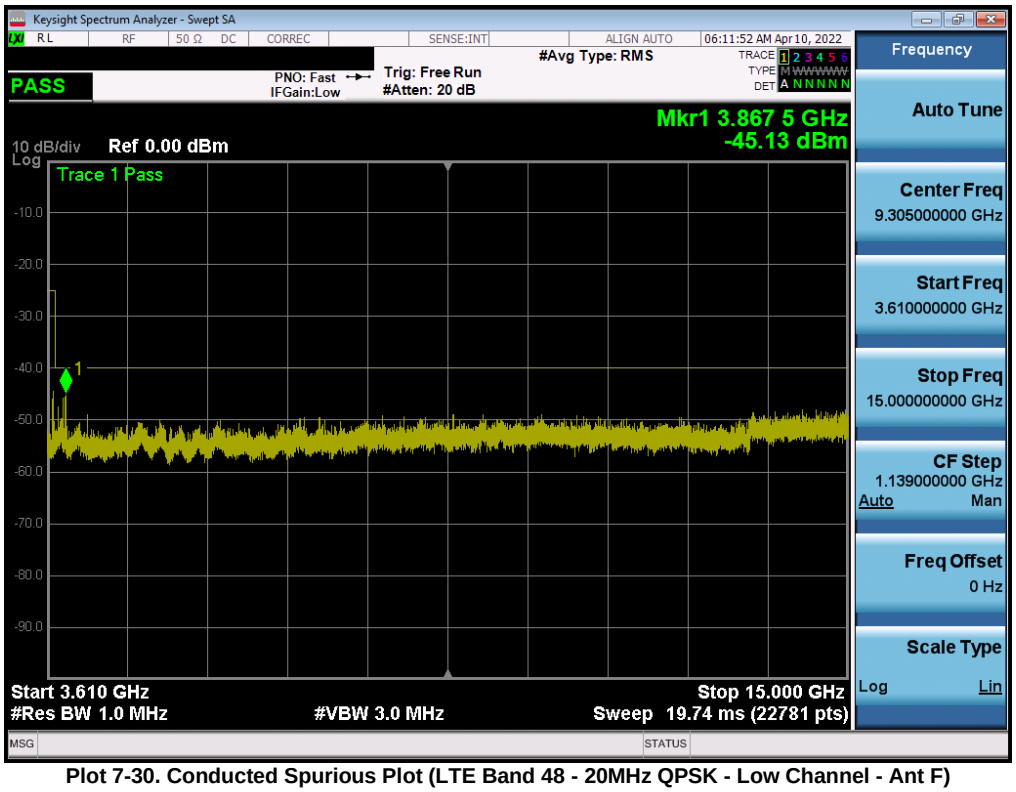
1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) 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.

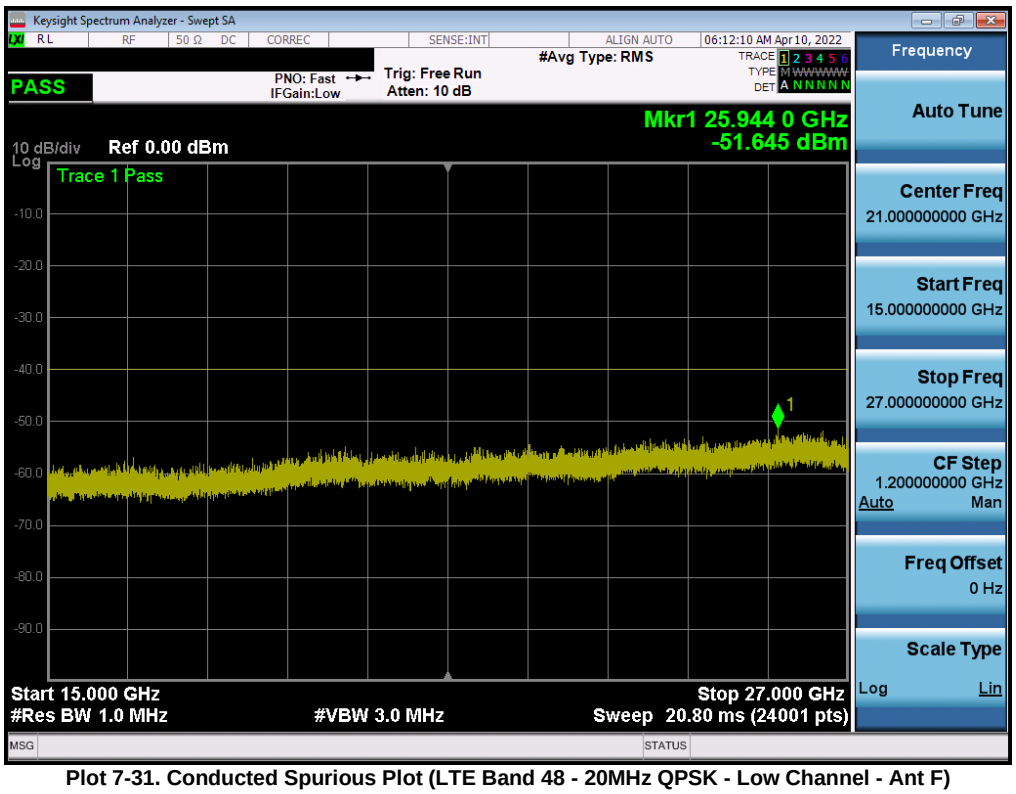
LTE Band 48



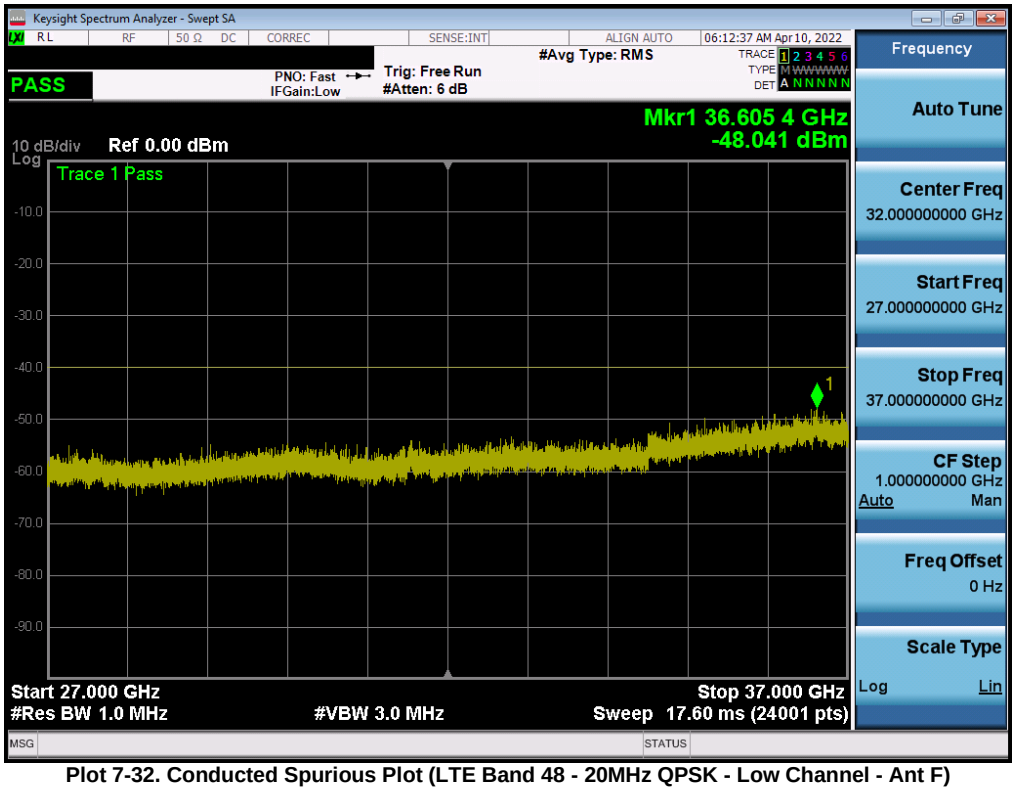
Plot 7-29. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - Ant F)



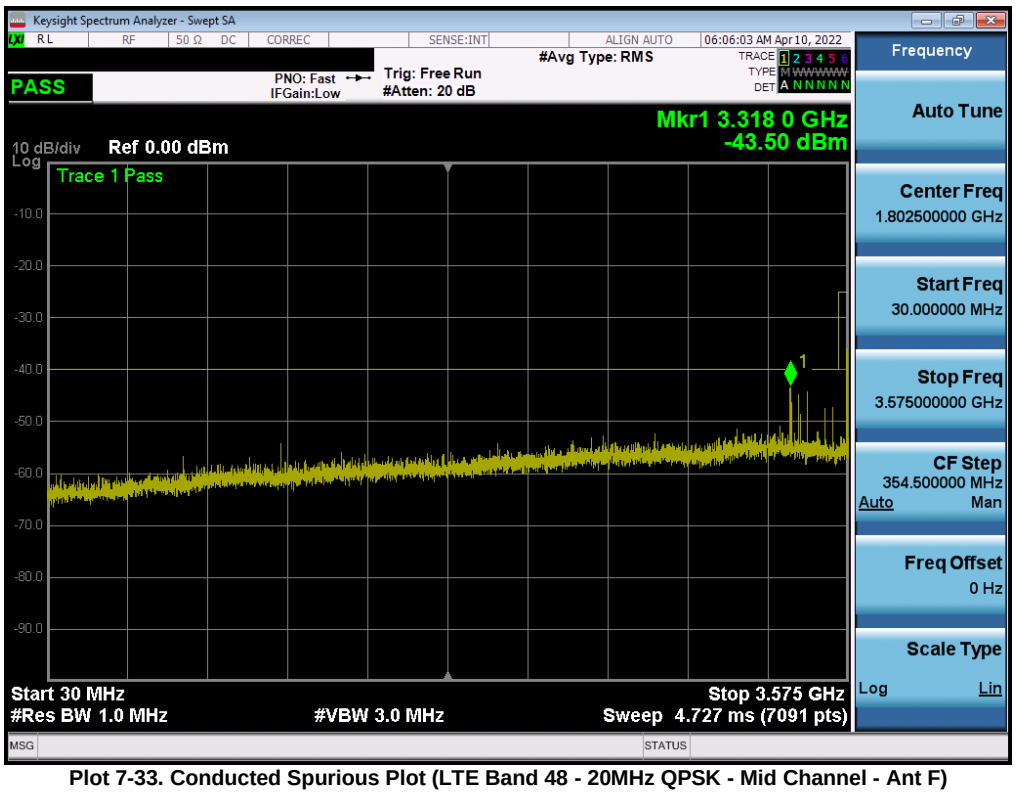
Plot 7-30. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - Ant F)



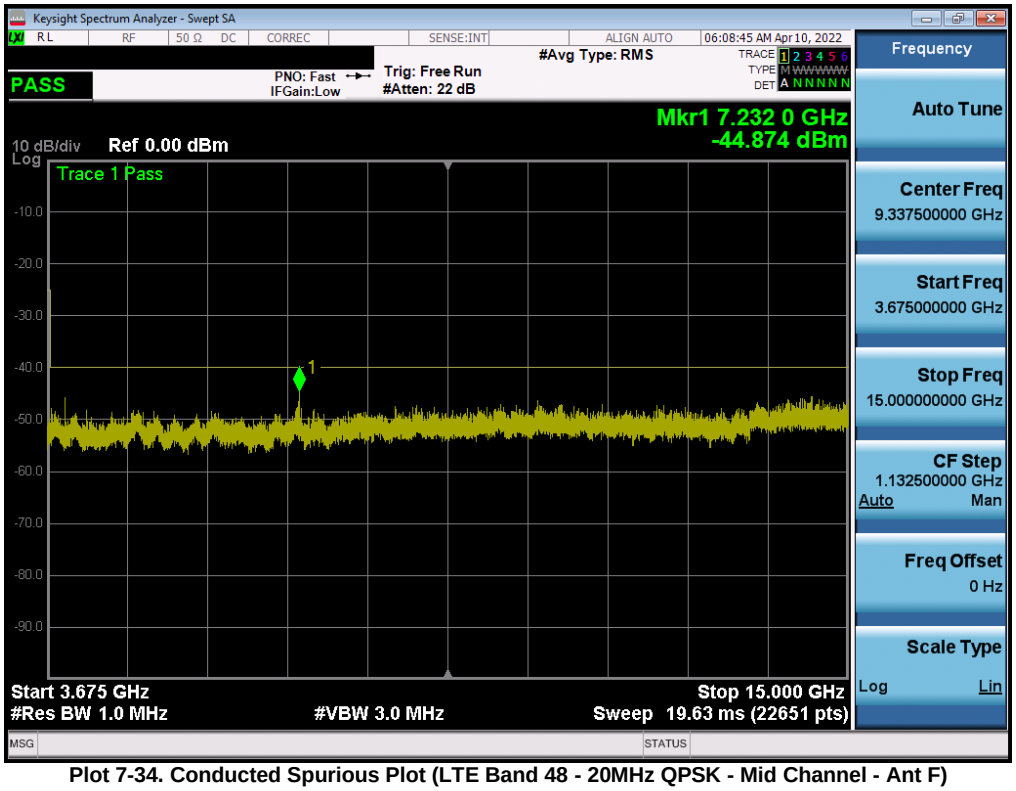
Plot 7-31. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - Ant F)



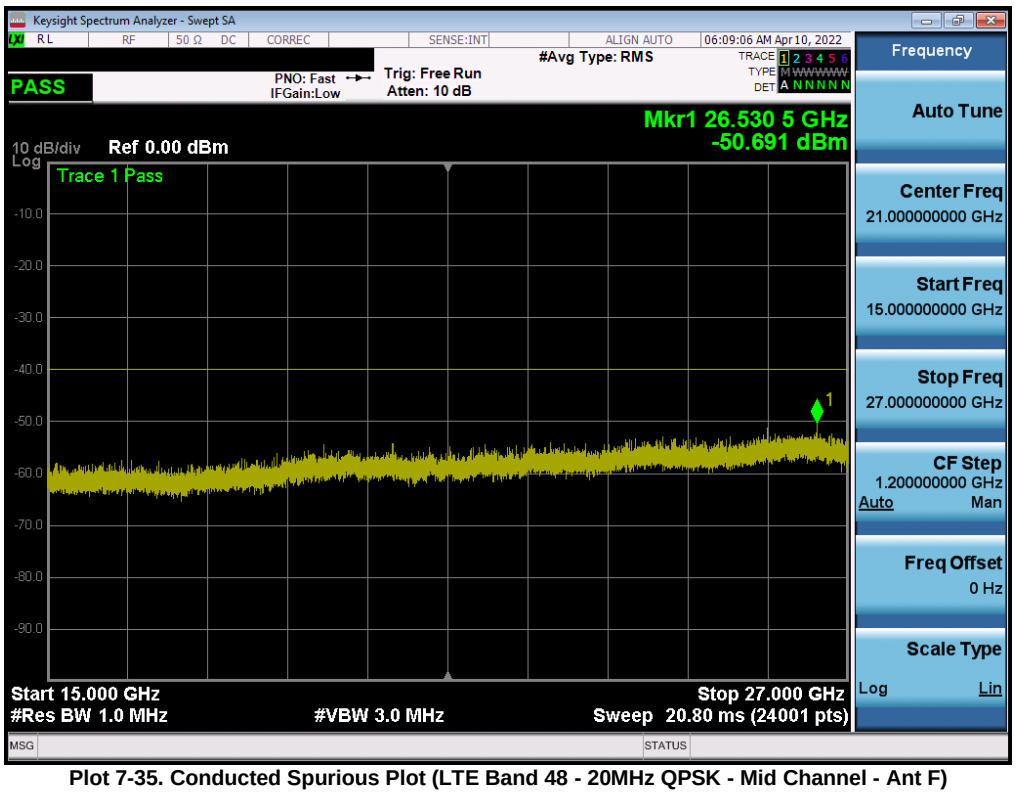
Plot 7-32. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel - Ant F)



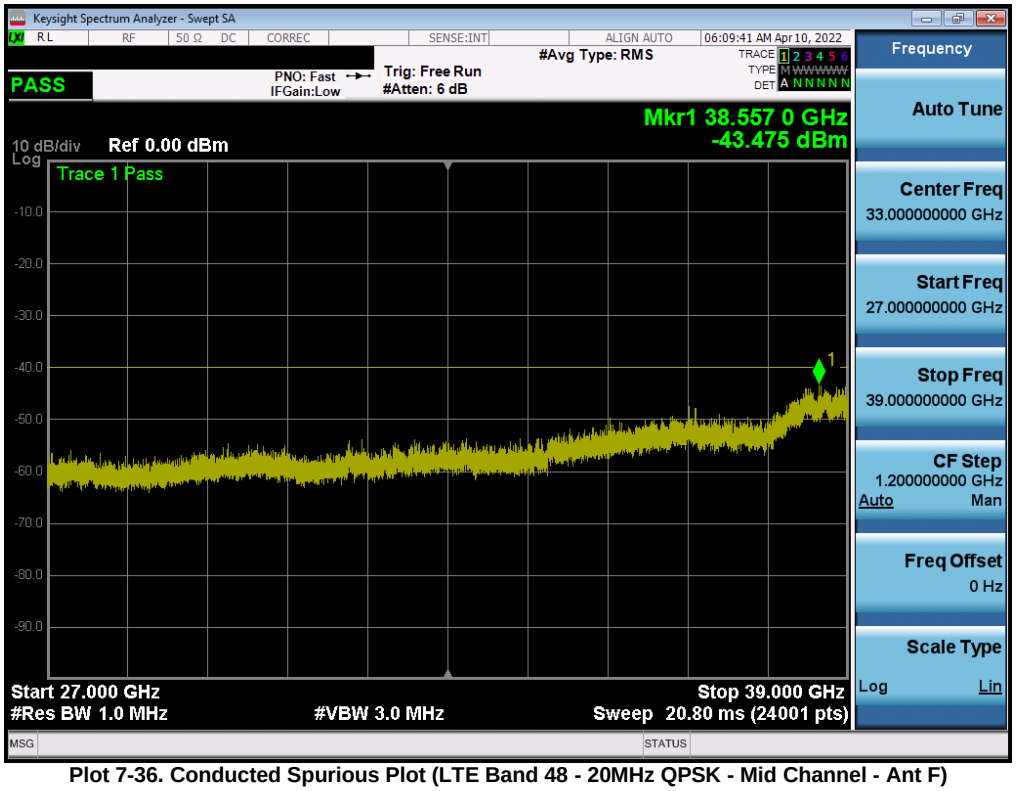
Plot 7-33. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - Ant F)



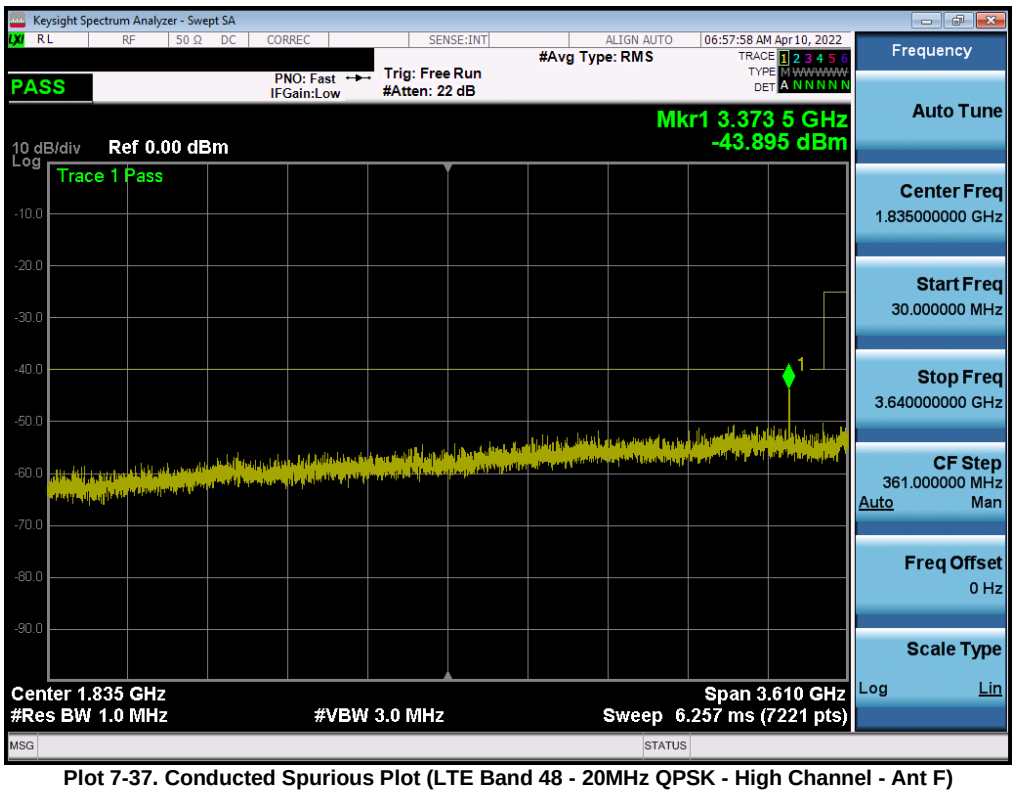
Plot 7-34. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - Ant F)



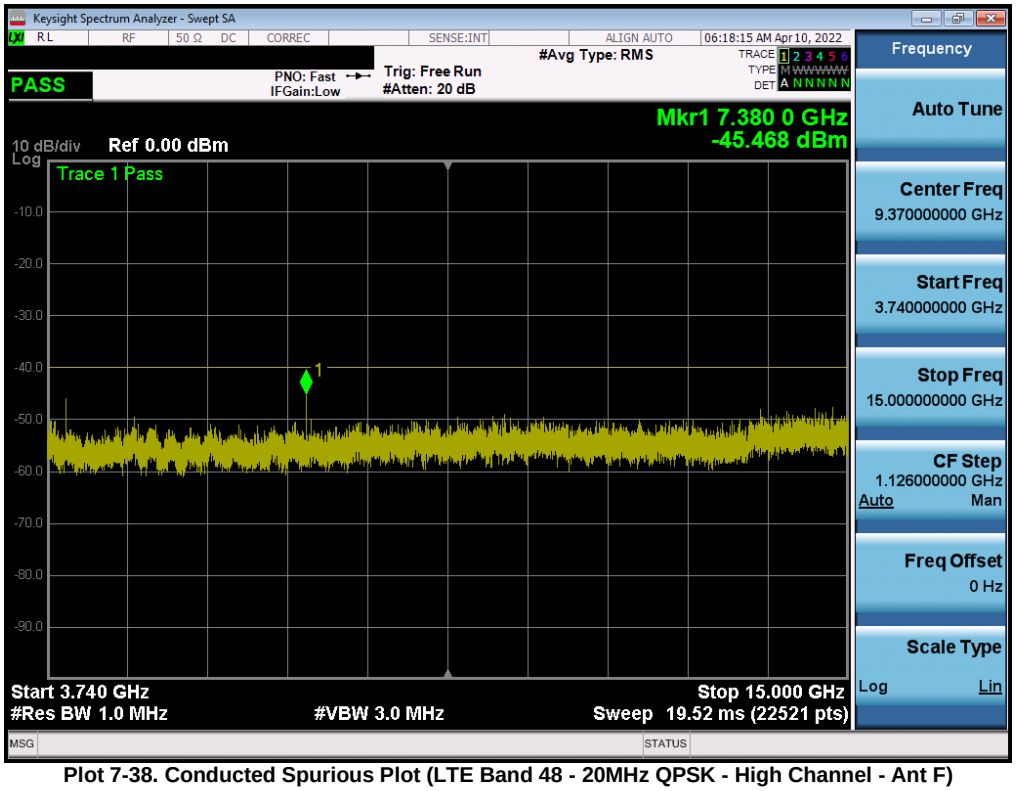
Plot 7-35. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - Ant F)



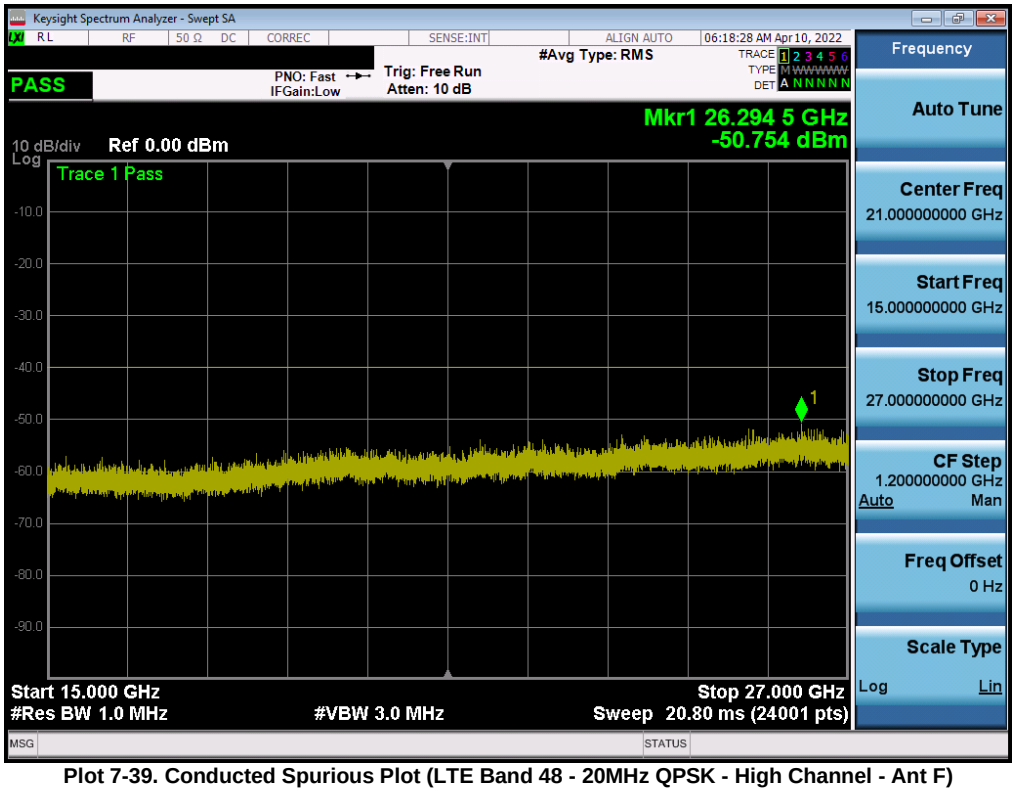
Plot 7-36. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel - Ant F)



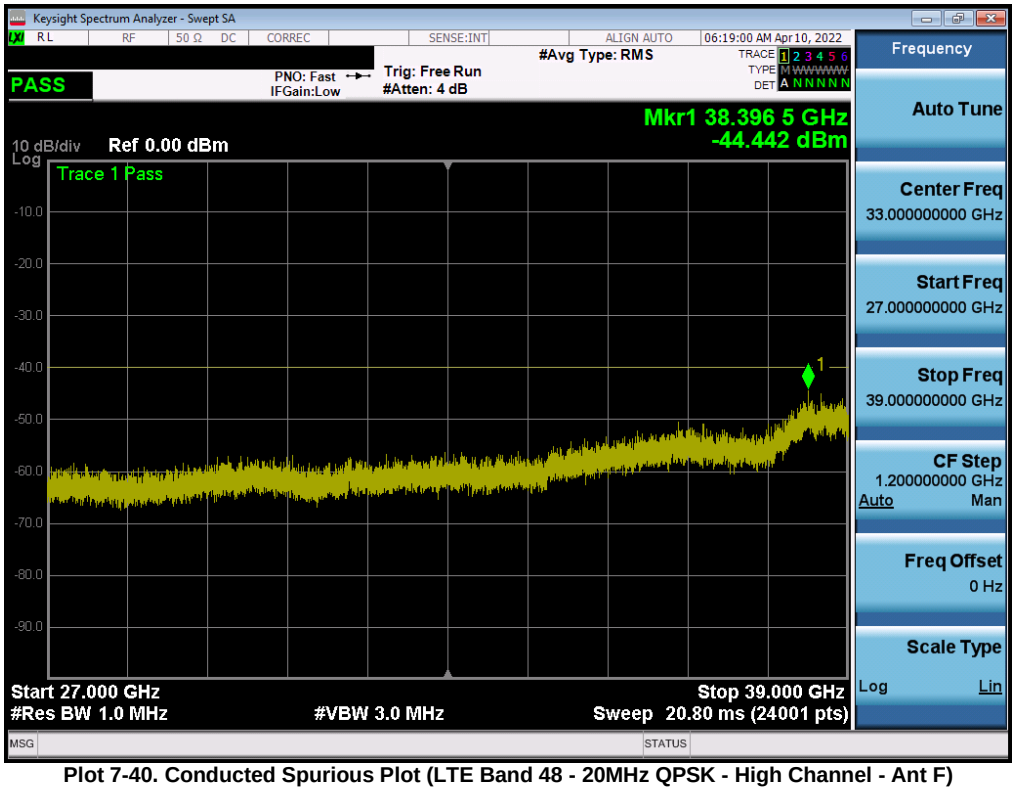
Plot 7-37. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - Ant F)



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

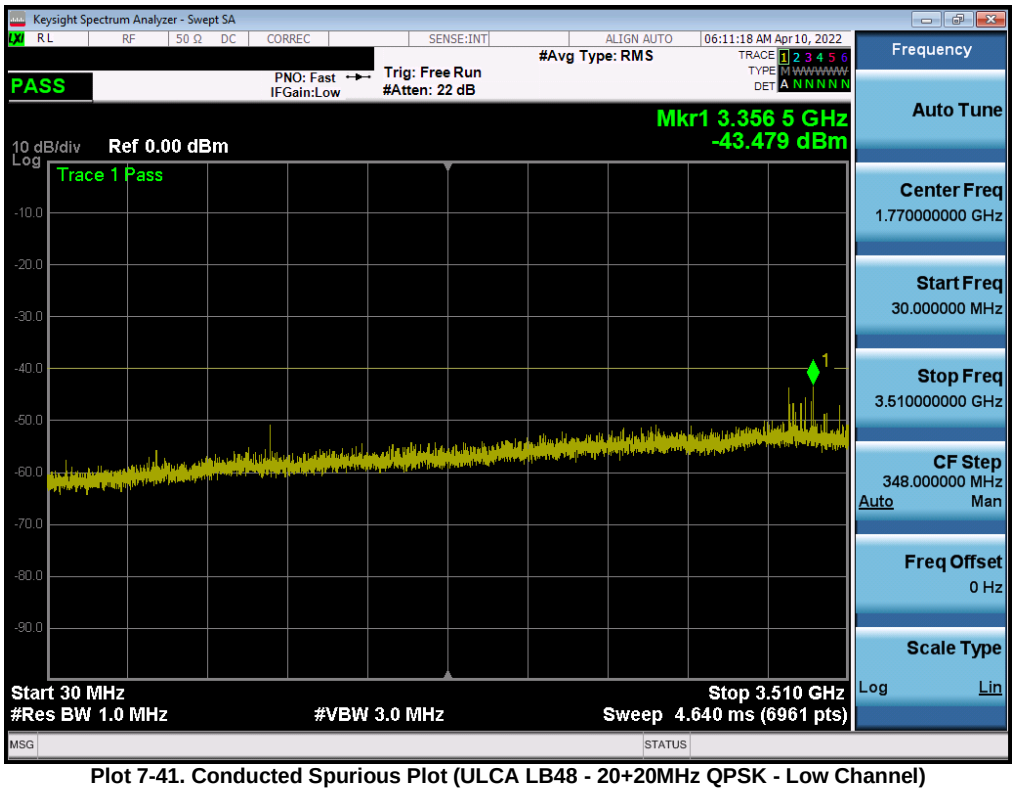


Plot 7-39. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - Ant F)

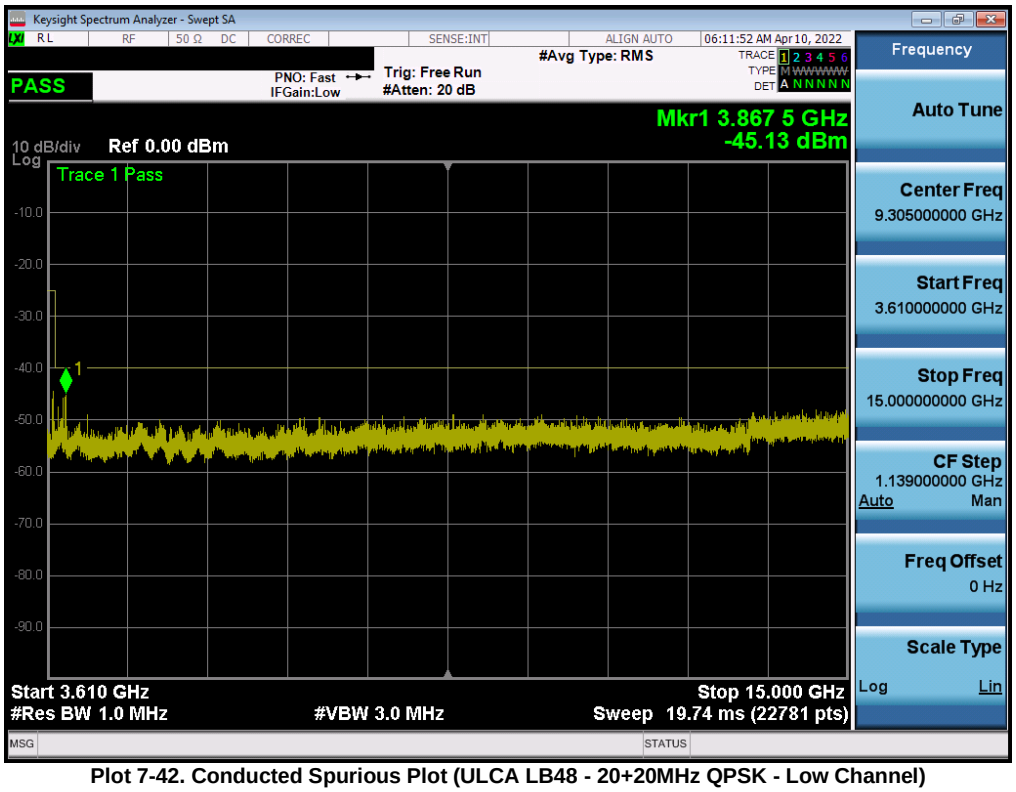


Plot 7-40. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel - Ant F)

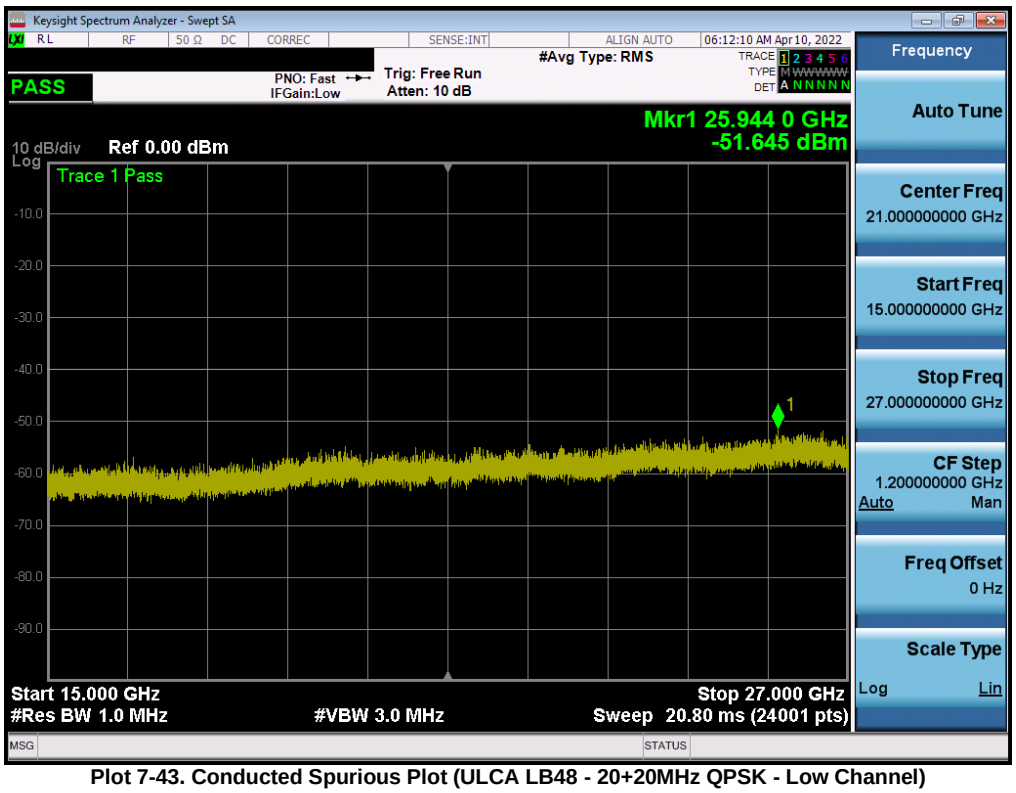
ULCA LB48



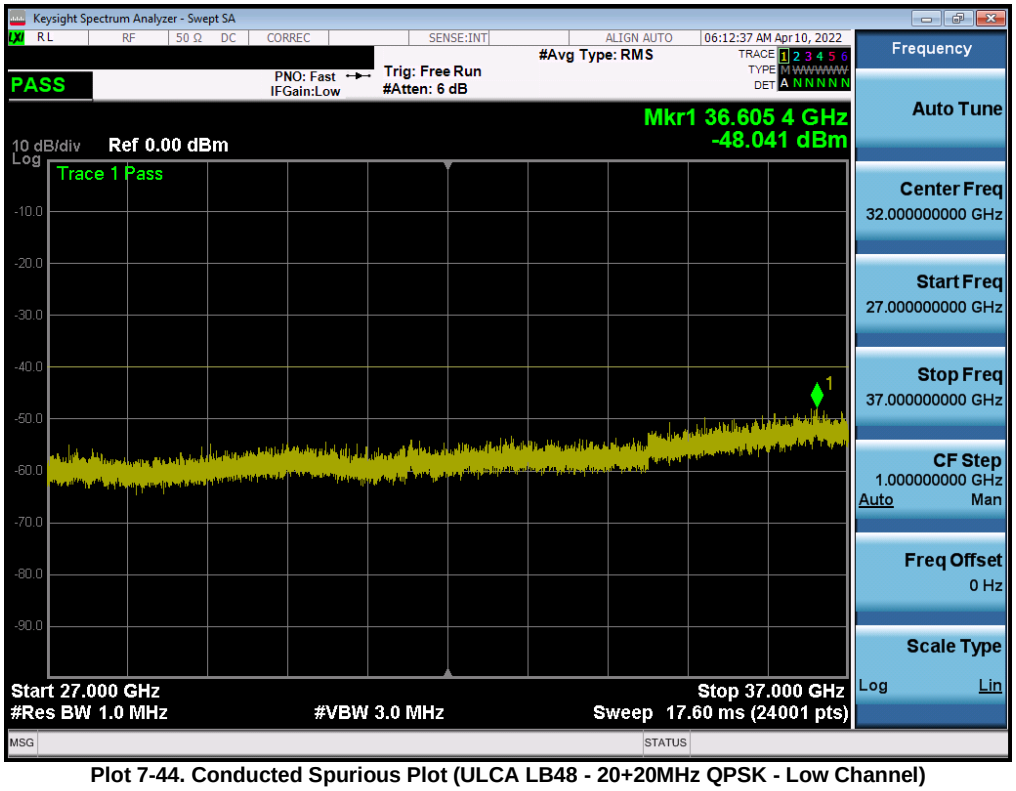
Plot 7-41. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



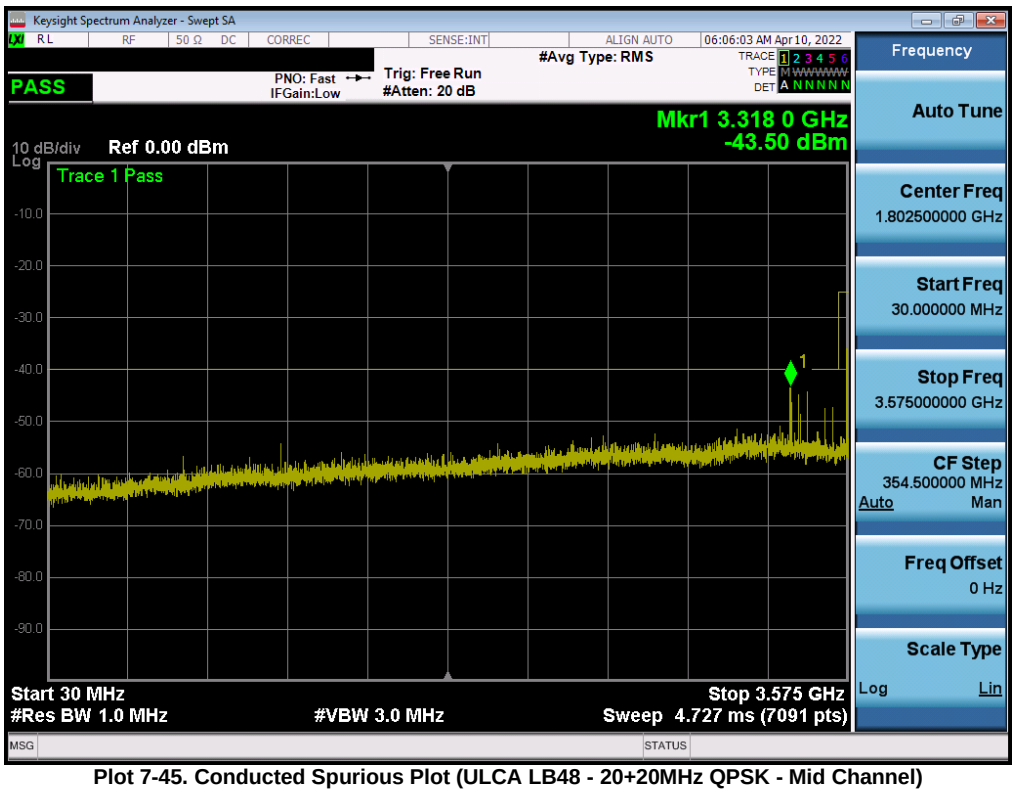
Plot 7-42. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



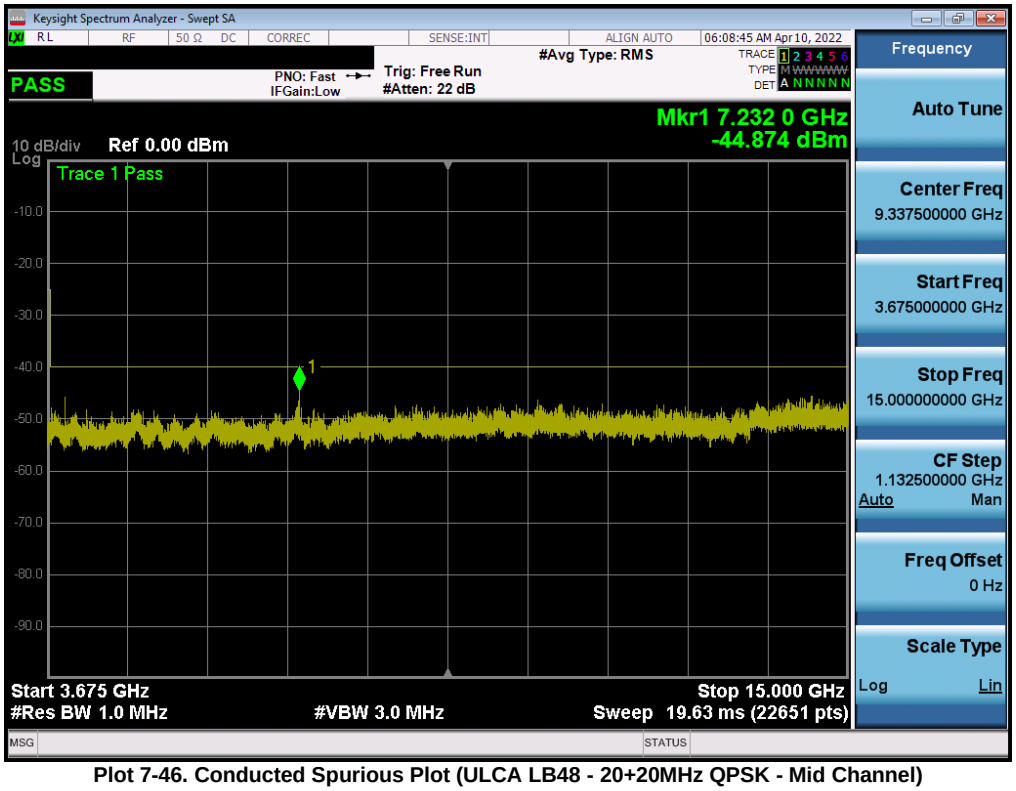
Plot 7-43. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



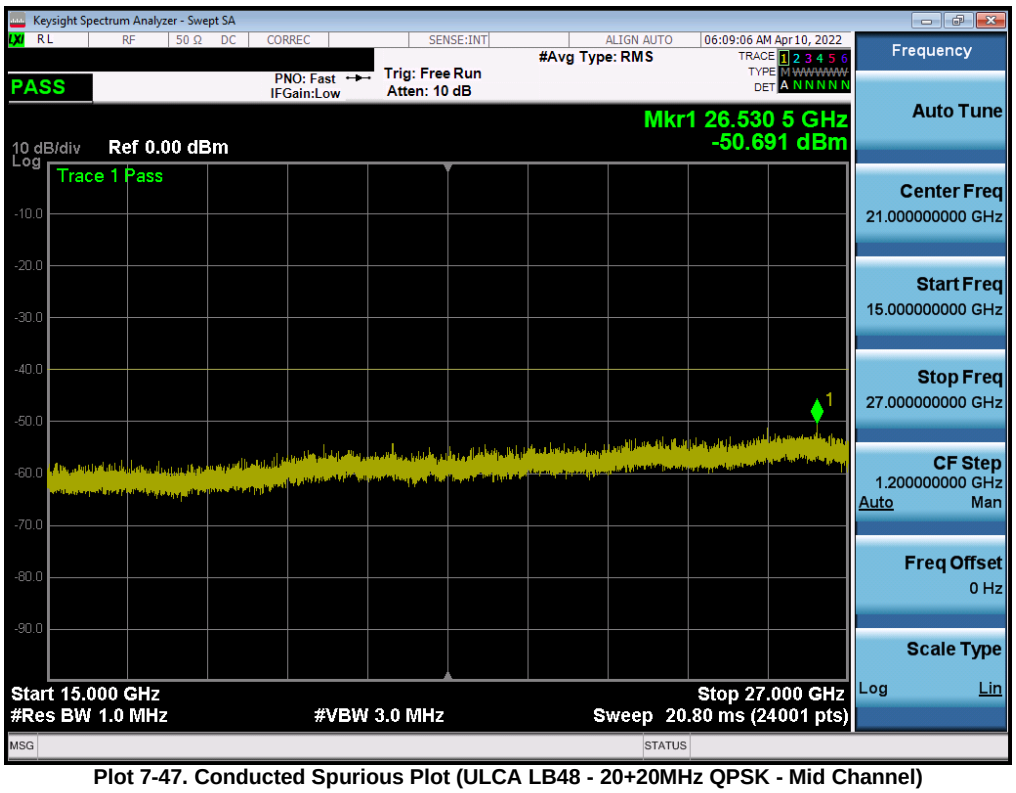
Plot 7-44. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Low Channel)



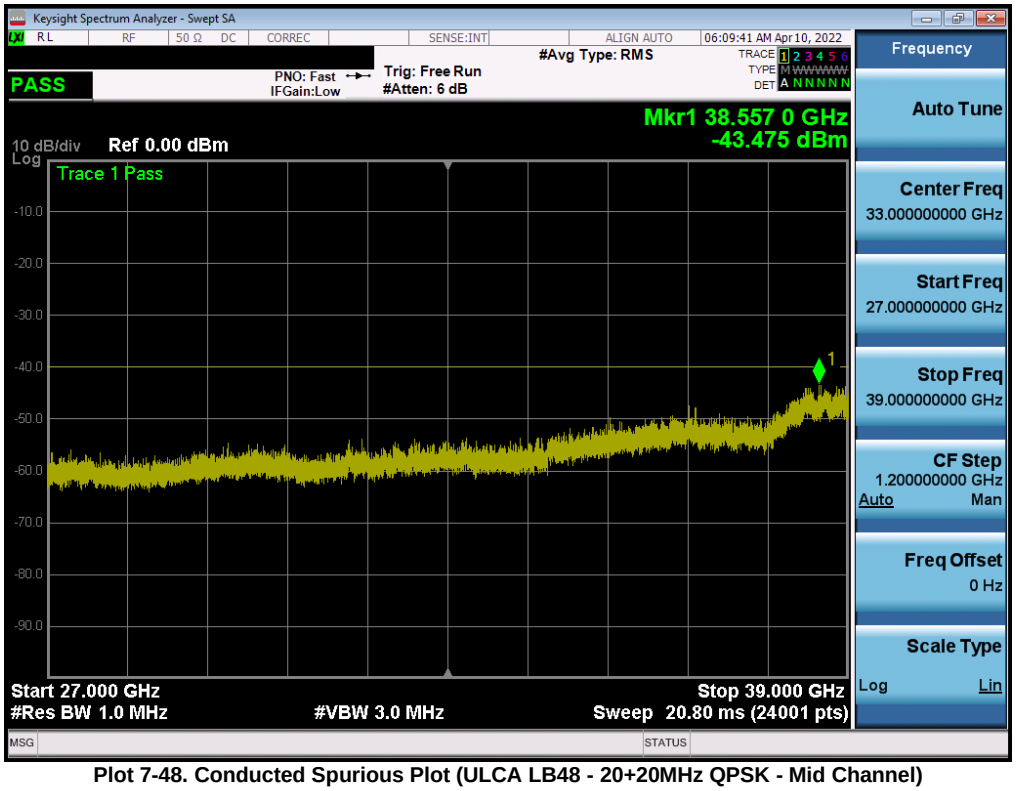
Plot 7-45. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



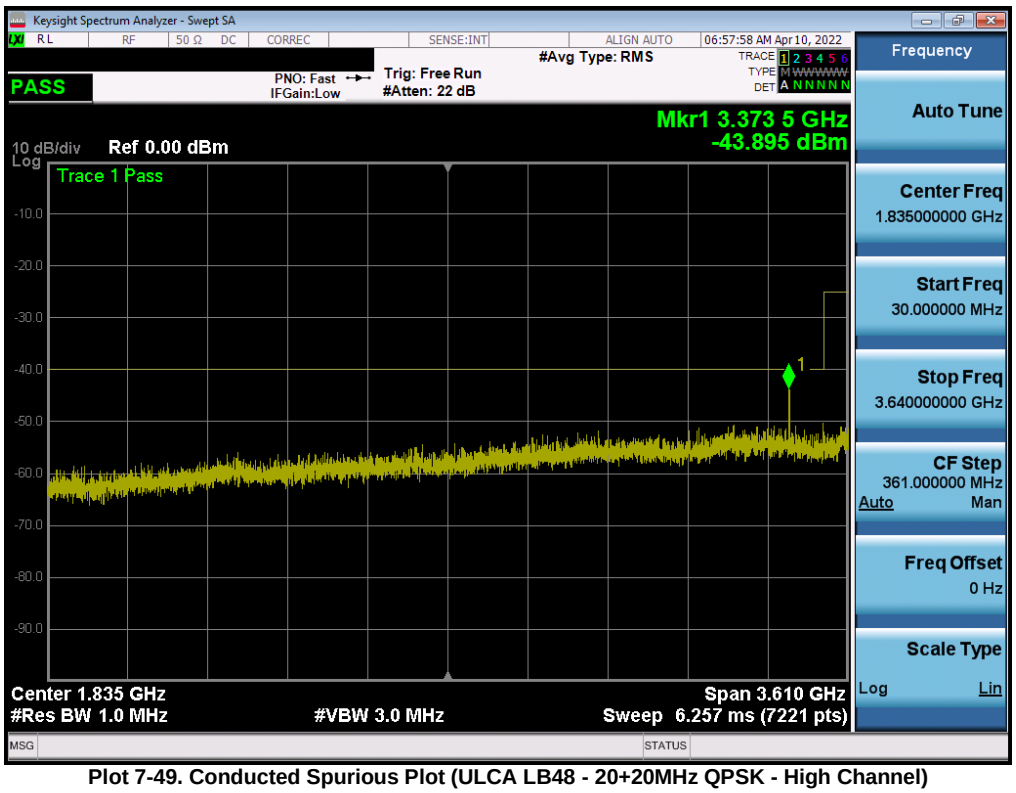
Plot 7-46. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



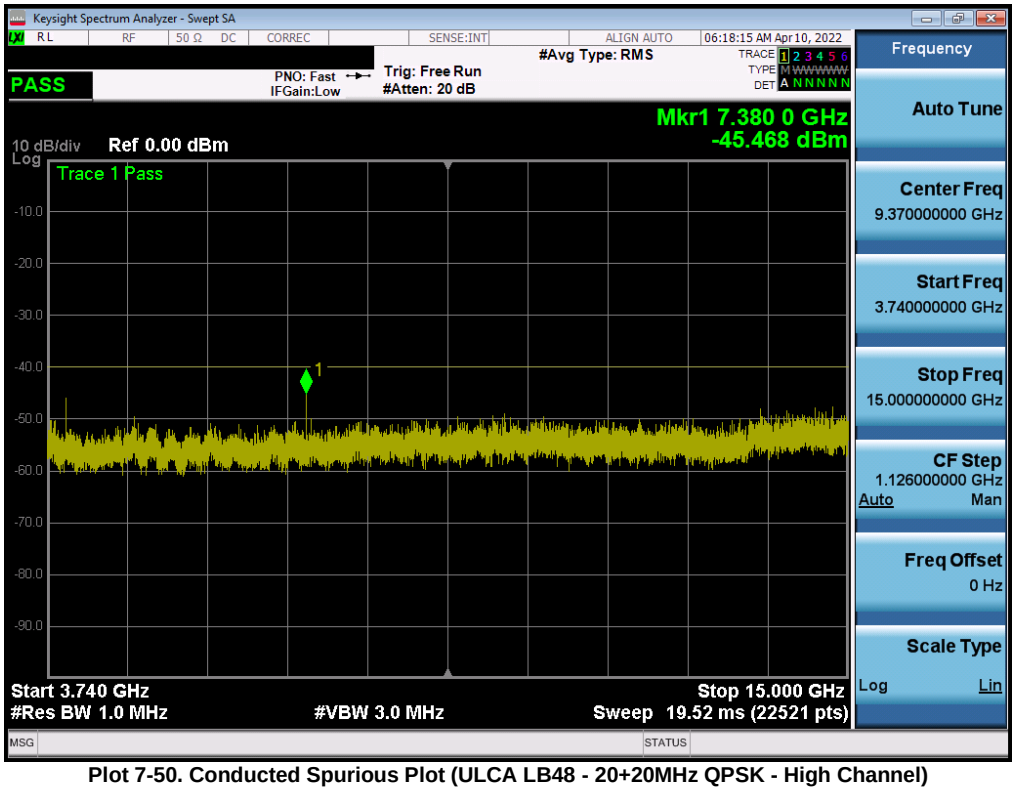
Plot 7-47. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



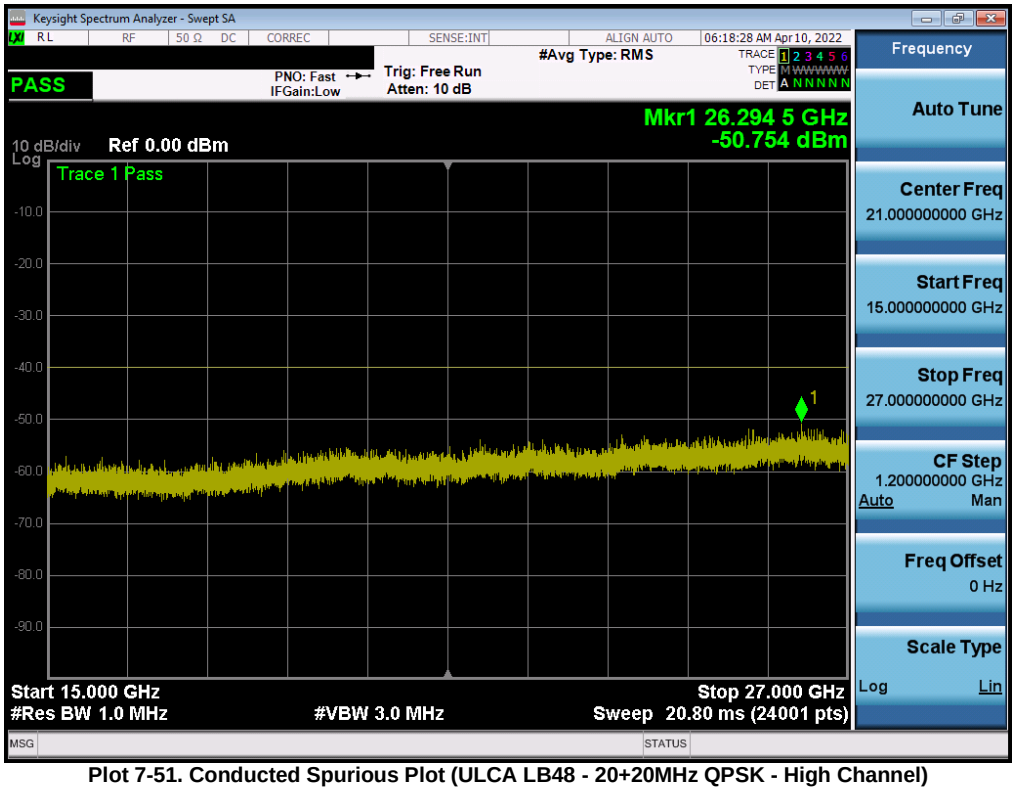
Plot 7-48. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - Mid Channel)



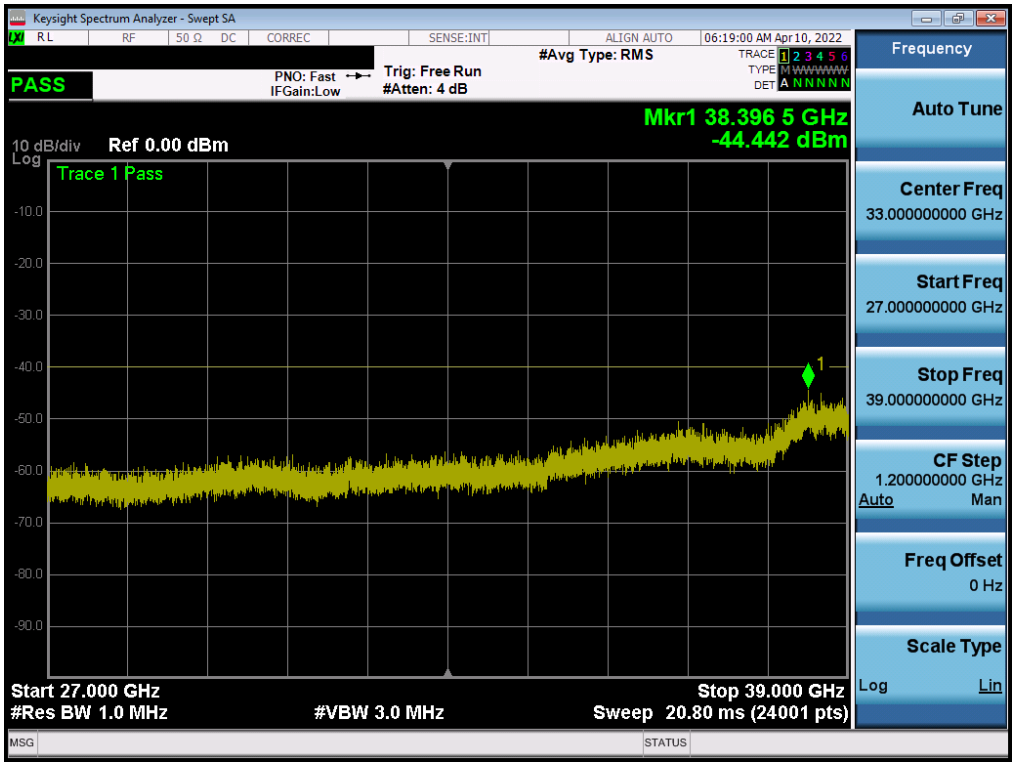
Plot 7-49. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)



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

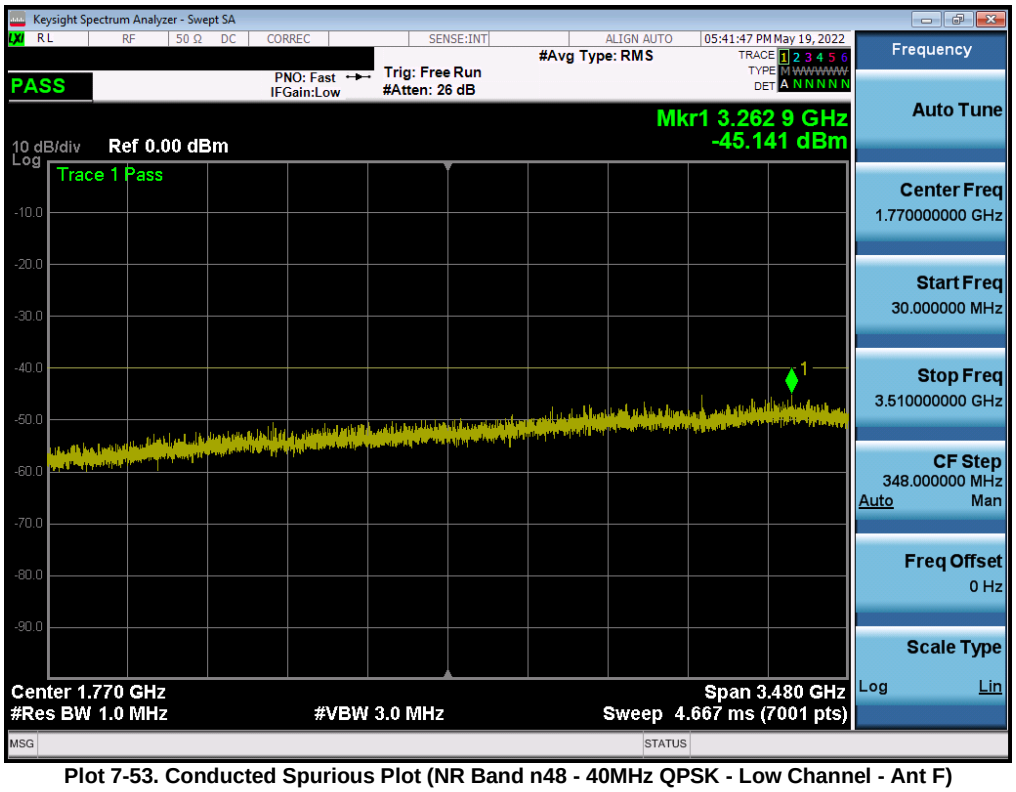


Plot 7-51. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)

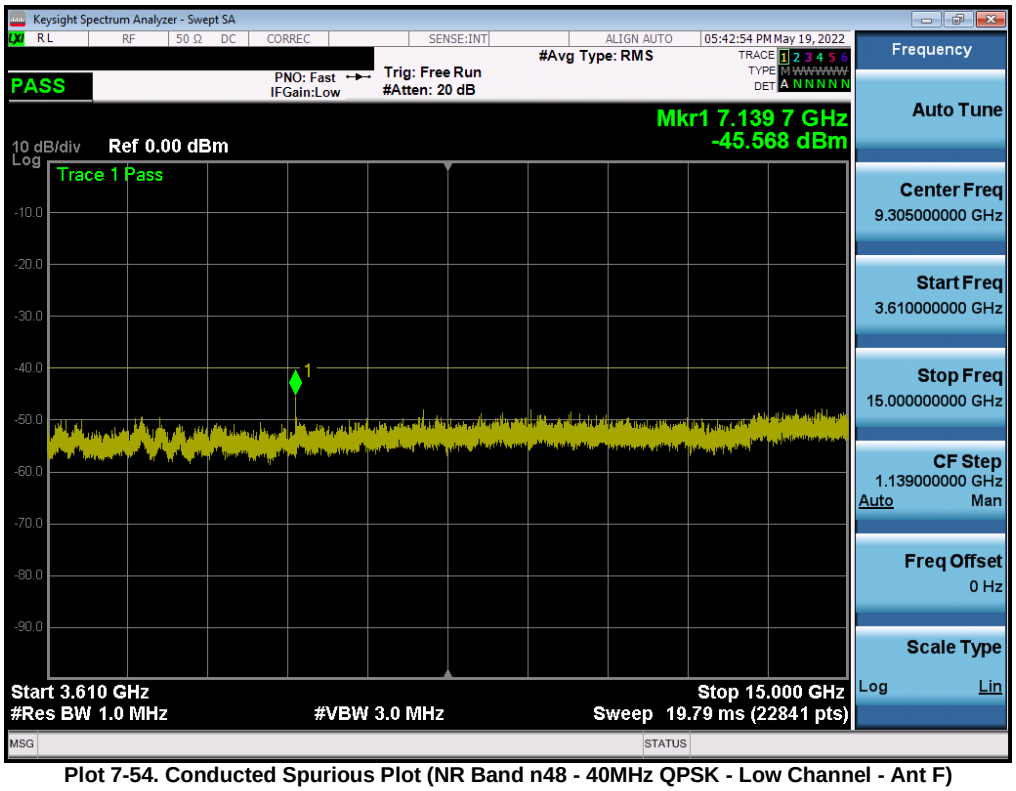


Plot 7-52. Conducted Spurious Plot (ULCA LB48 - 20+20MHz QPSK - High Channel)

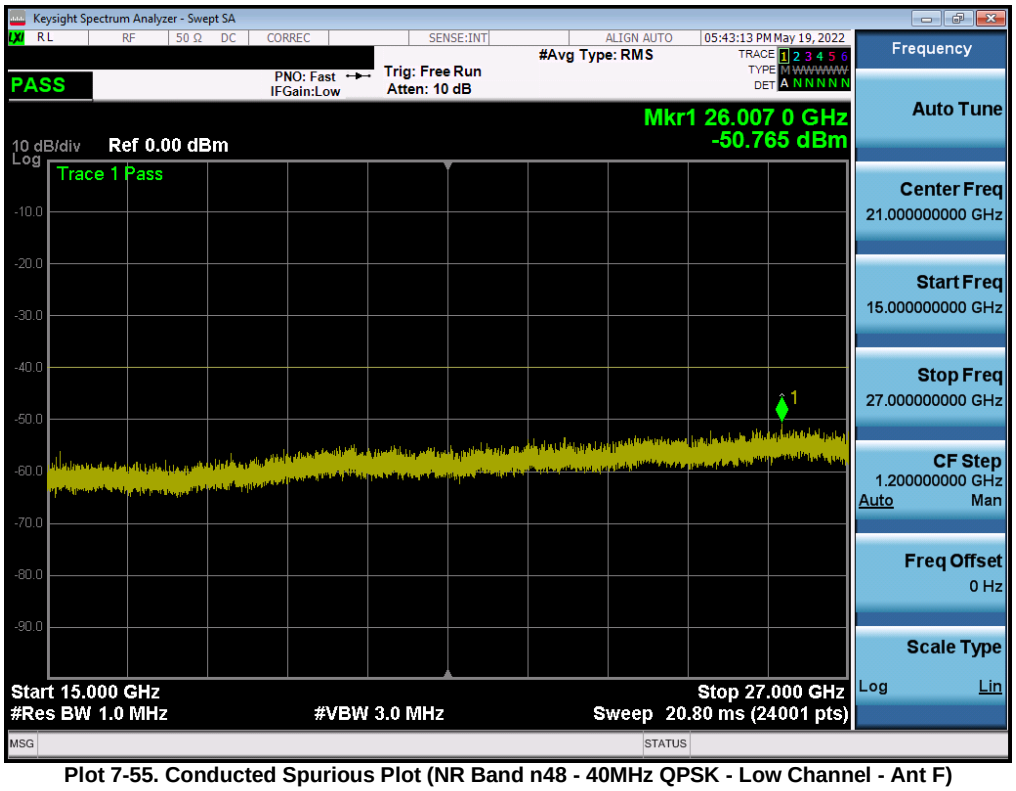
NR Band n48 Ant F



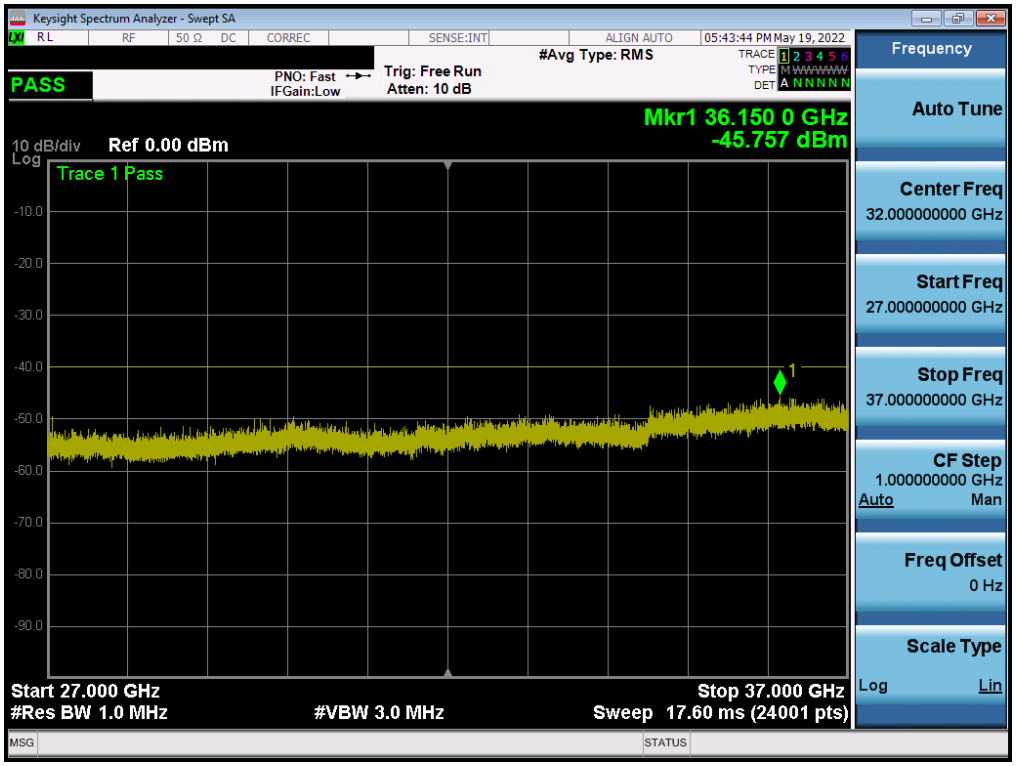
Plot 7-53. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant F)



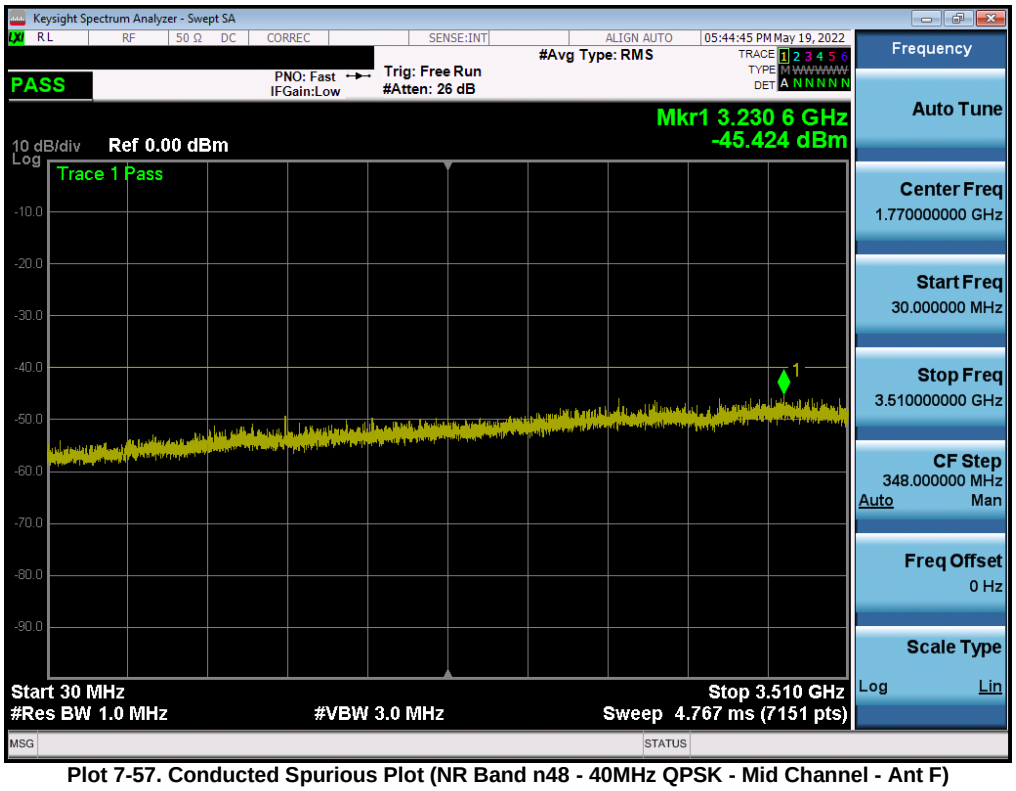
Plot 7-54. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant F)



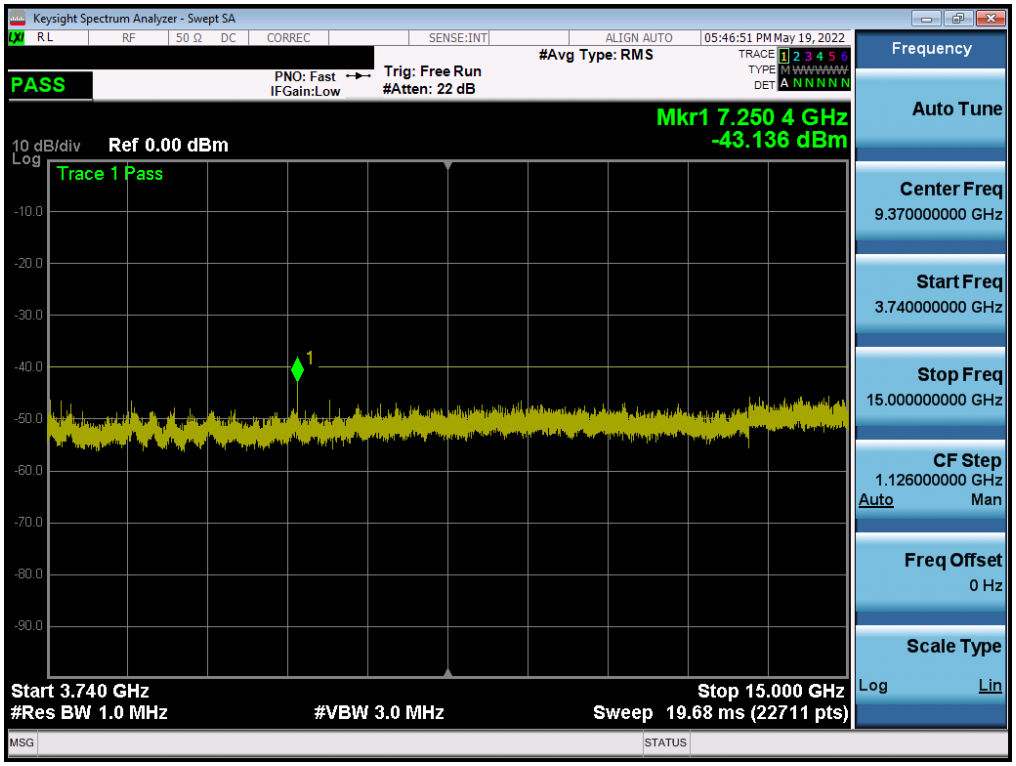
Plot 7-55. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant F)



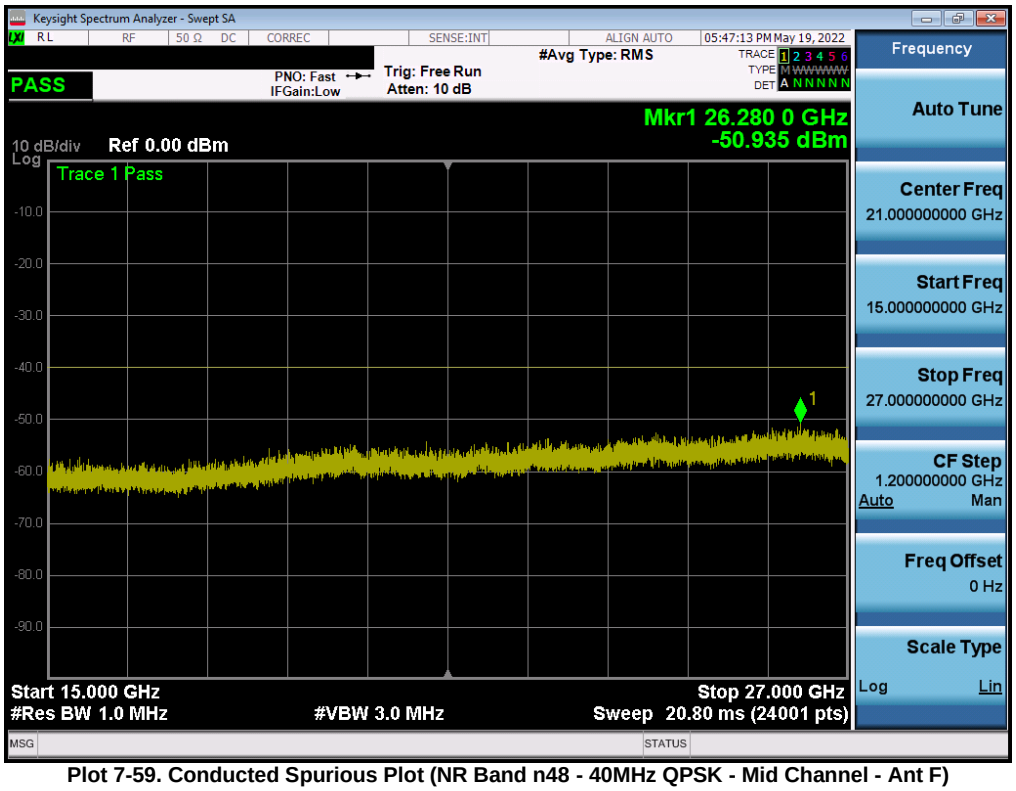
Plot 7-56. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant F)



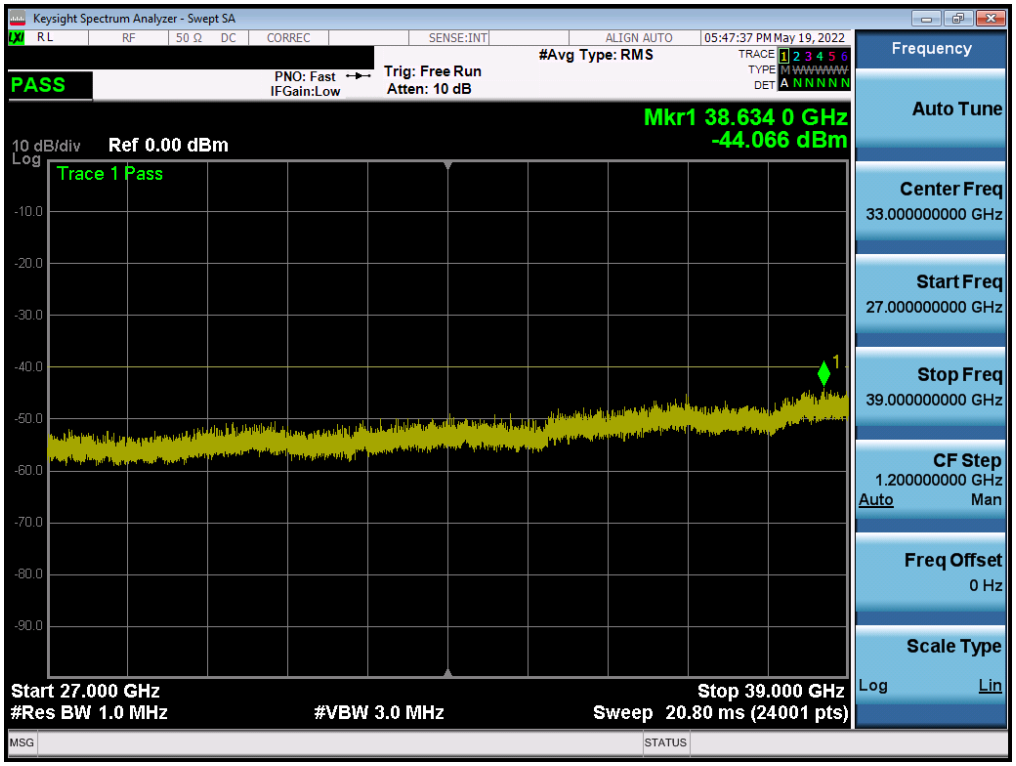
Plot 7-57. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant F)



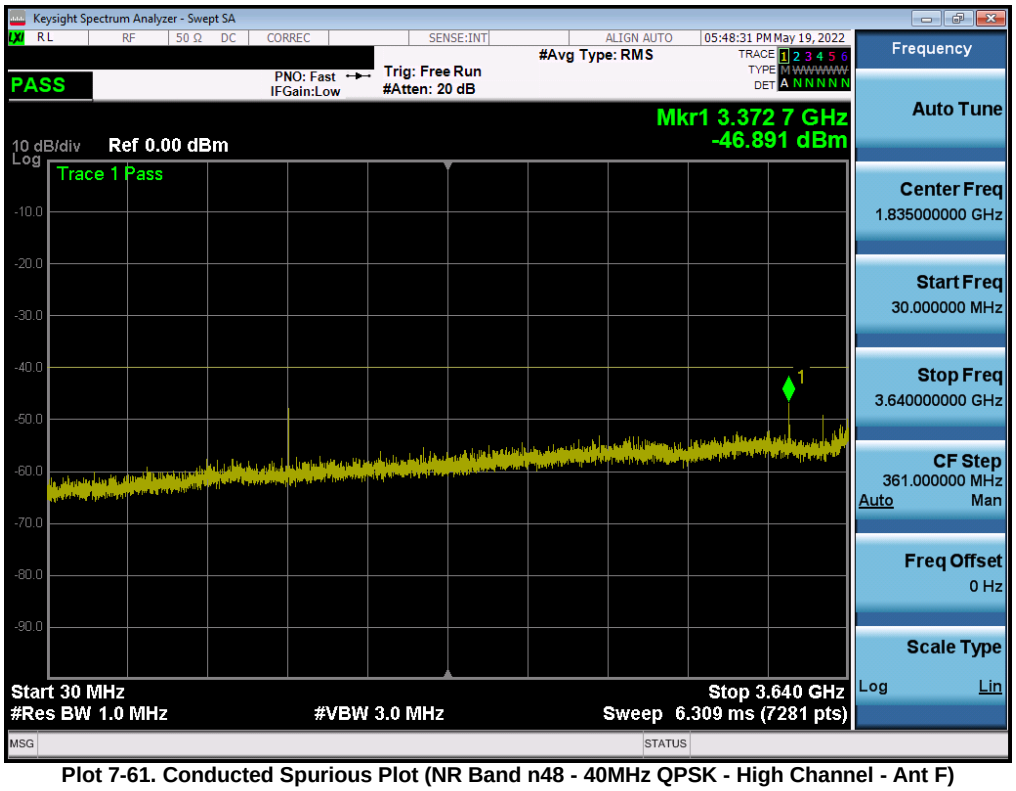
Plot 7-58. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant F)



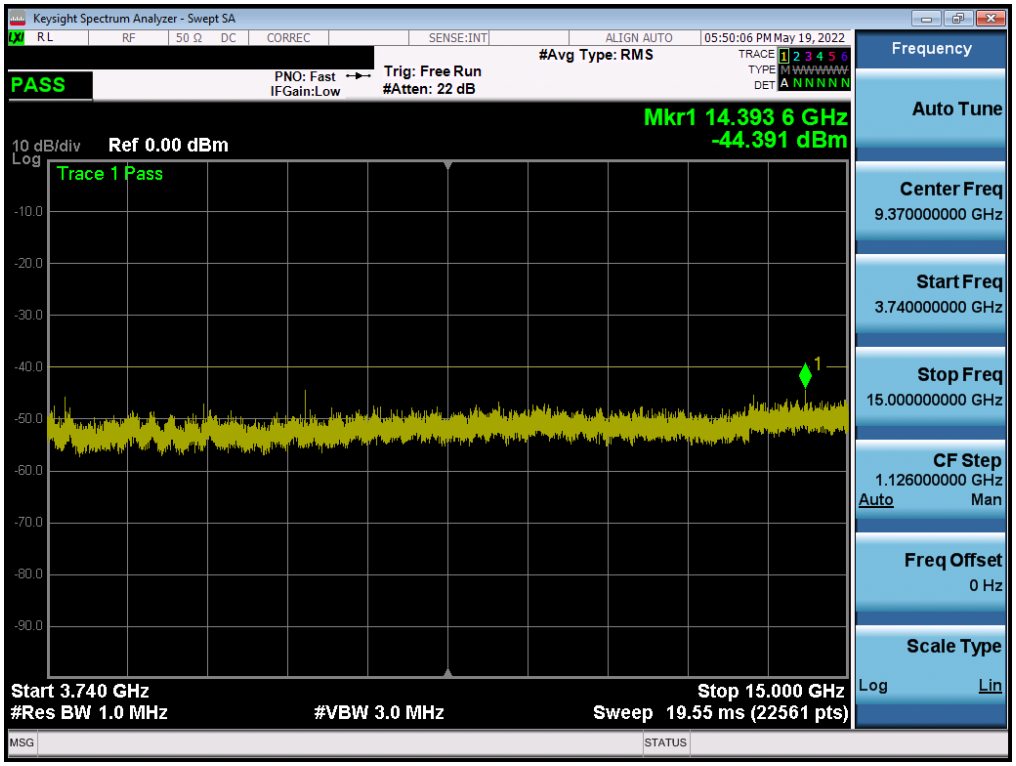
Plot 7-59. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant F)



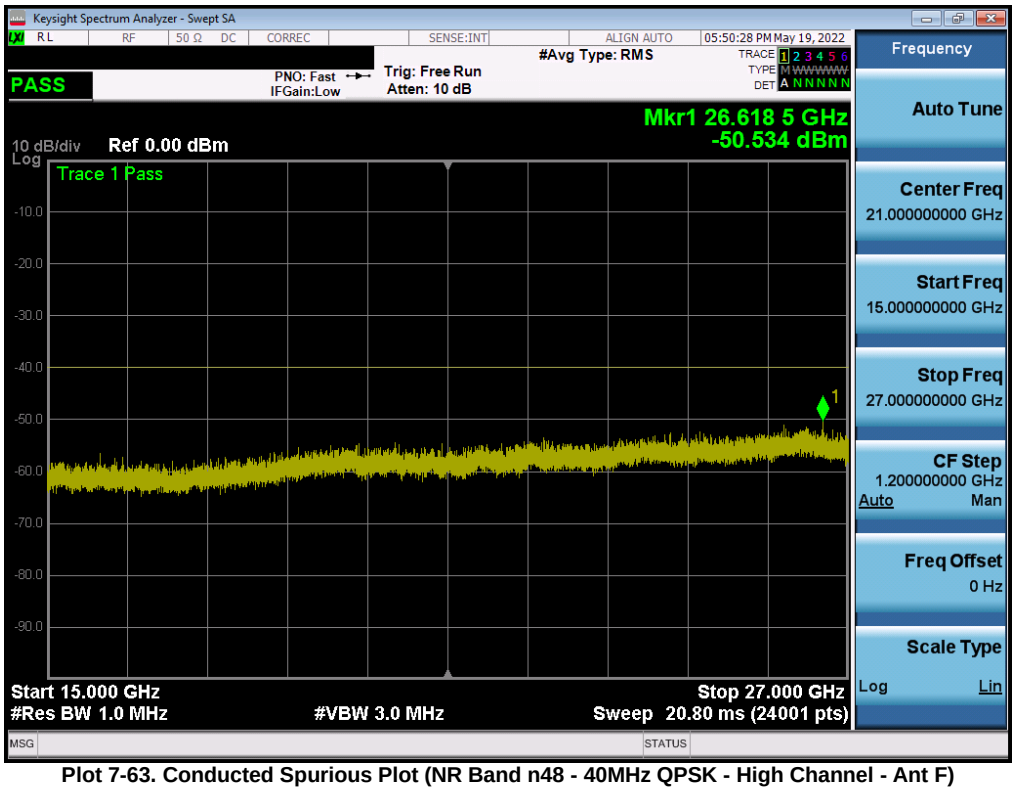
Plot 7-60. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant F)



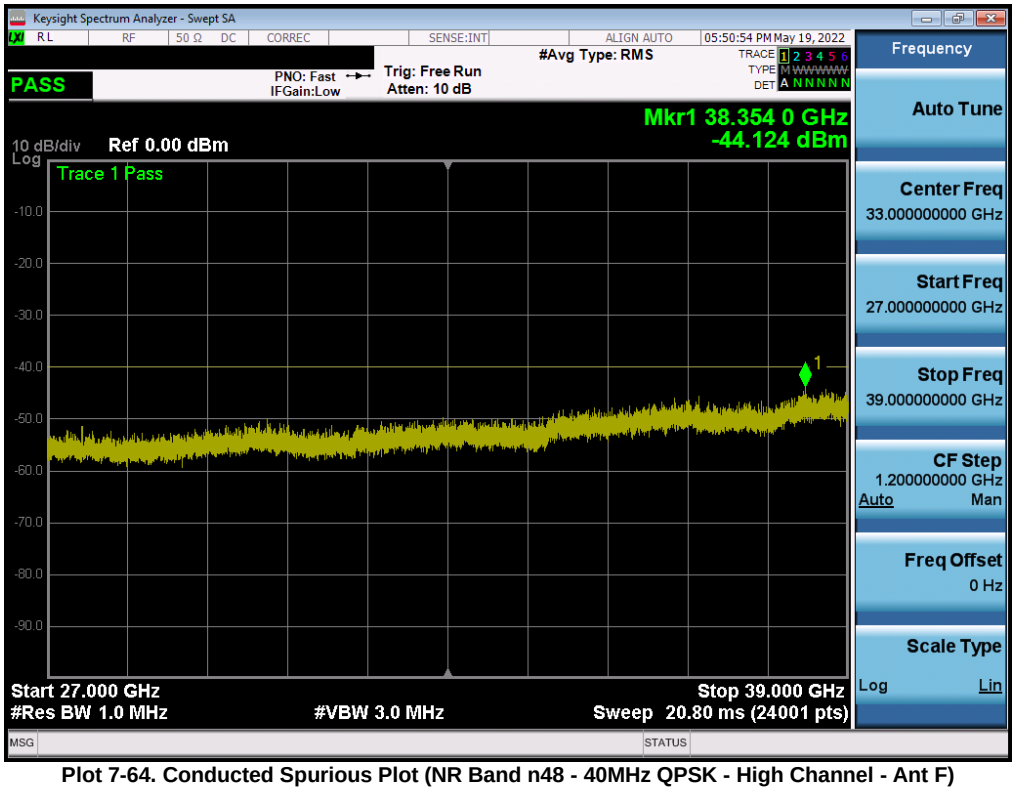
Plot 7-61. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant F)



Plot 7-62. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant F)

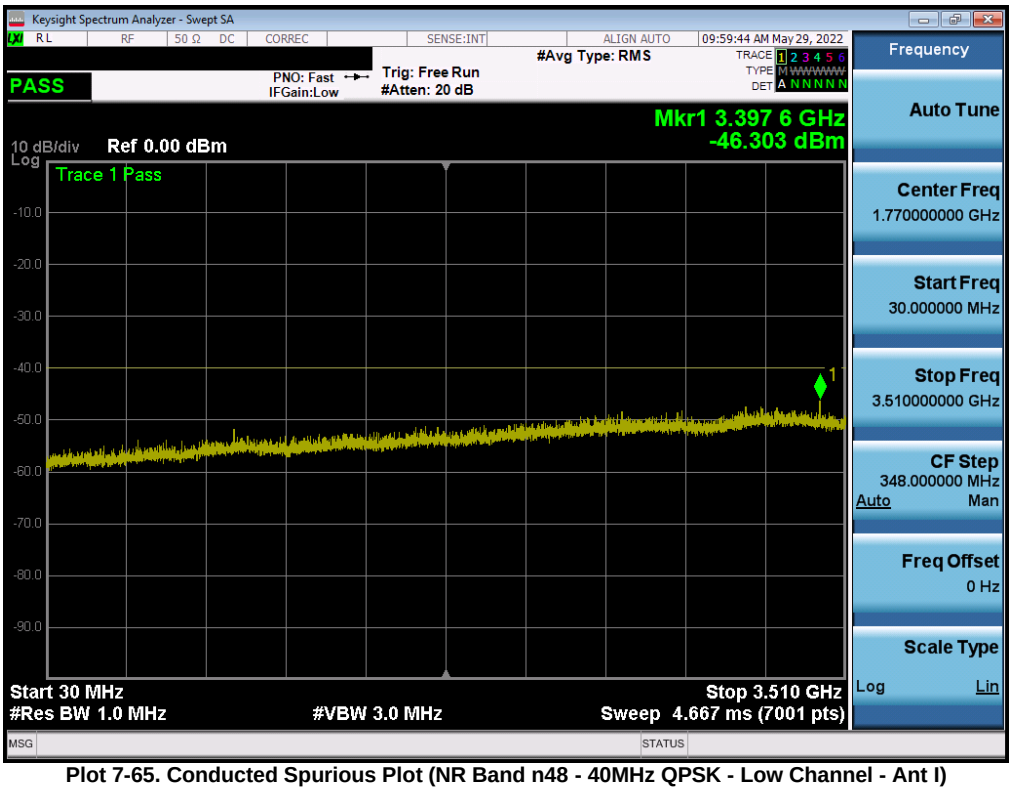


Plot 7-63. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant F)

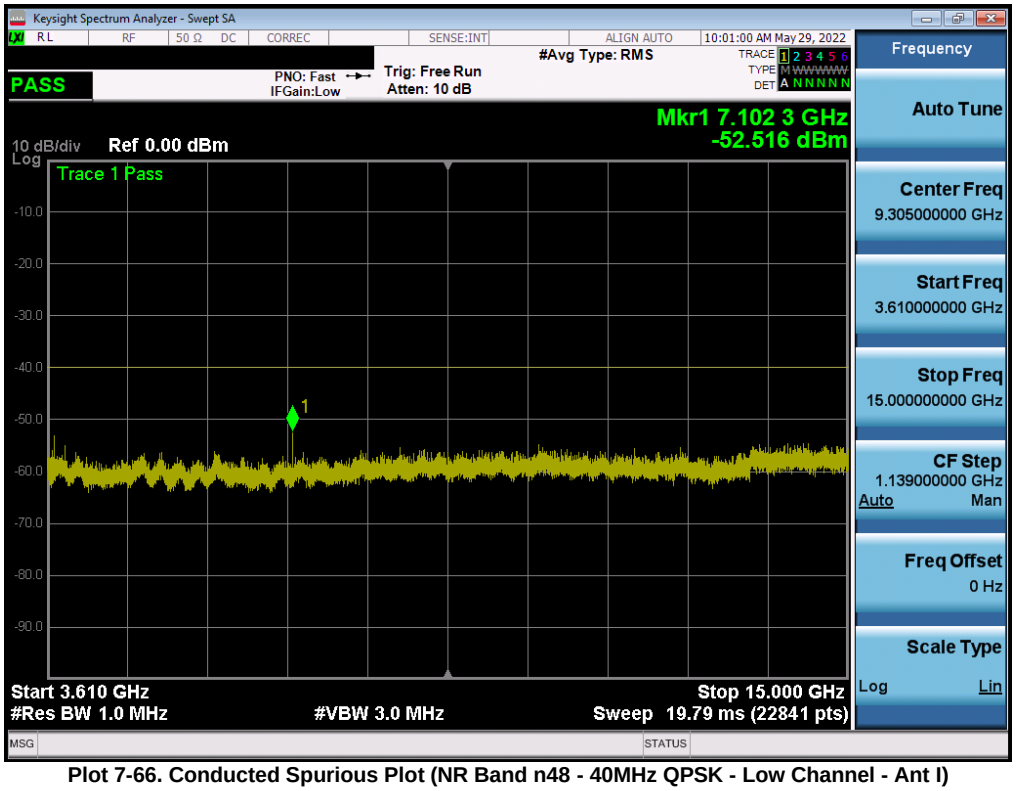


Plot 7-64. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant F)

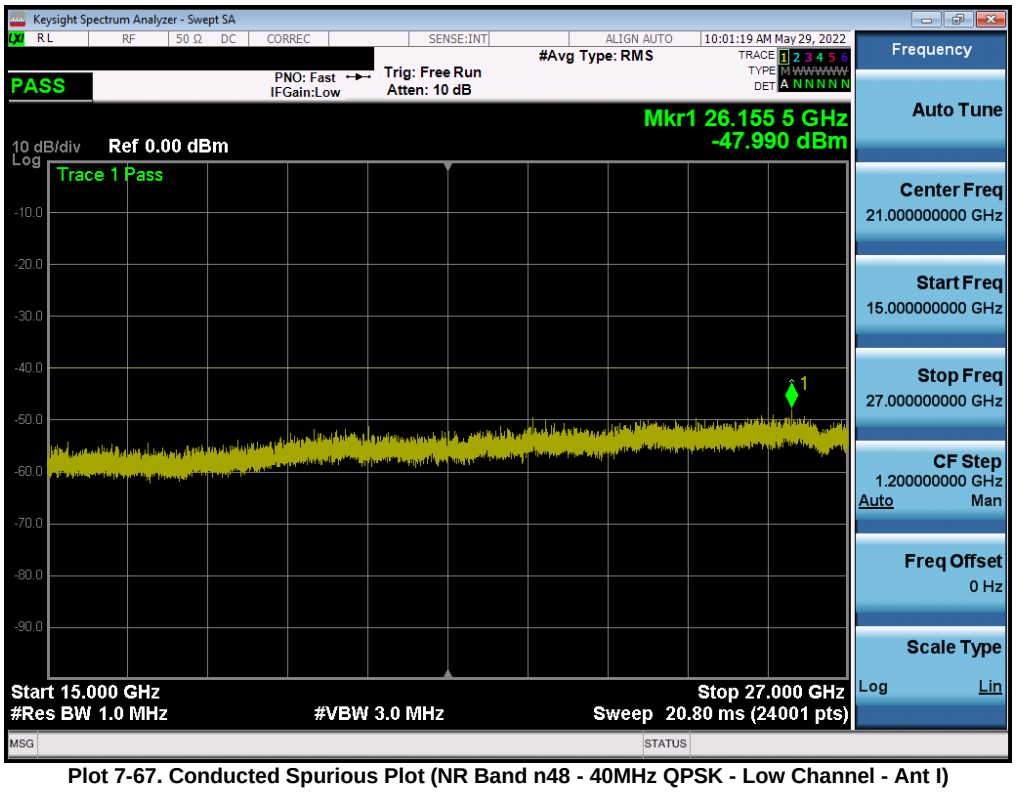
NR Band n48 Ant I



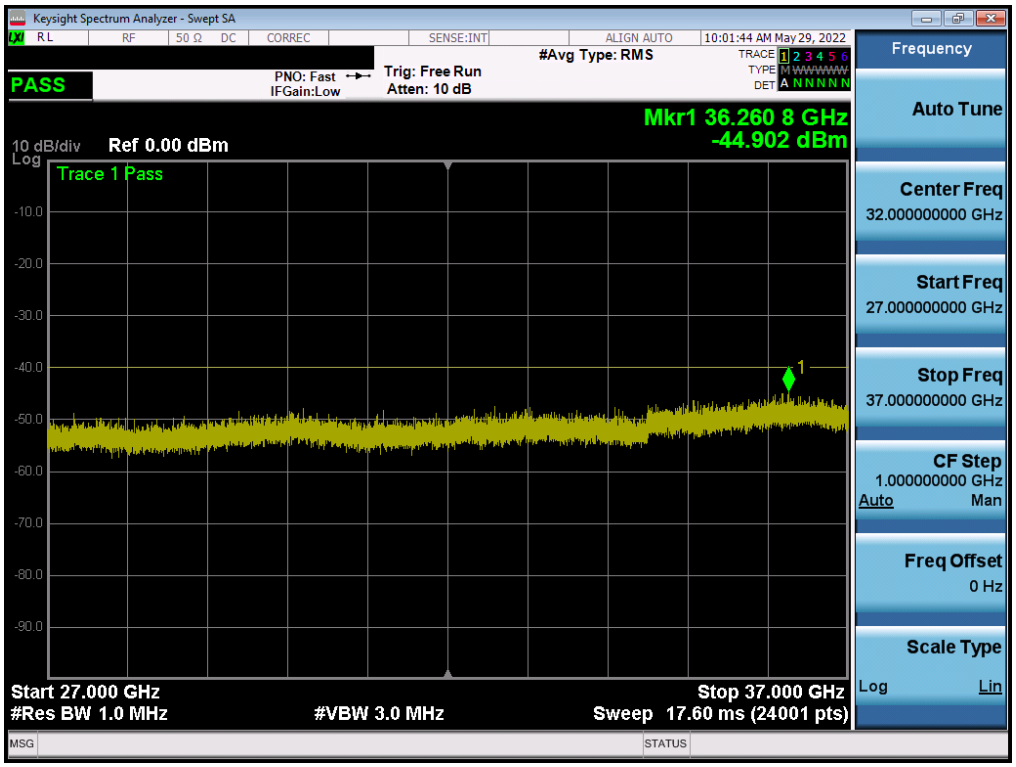
Plot 7-65. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant I)



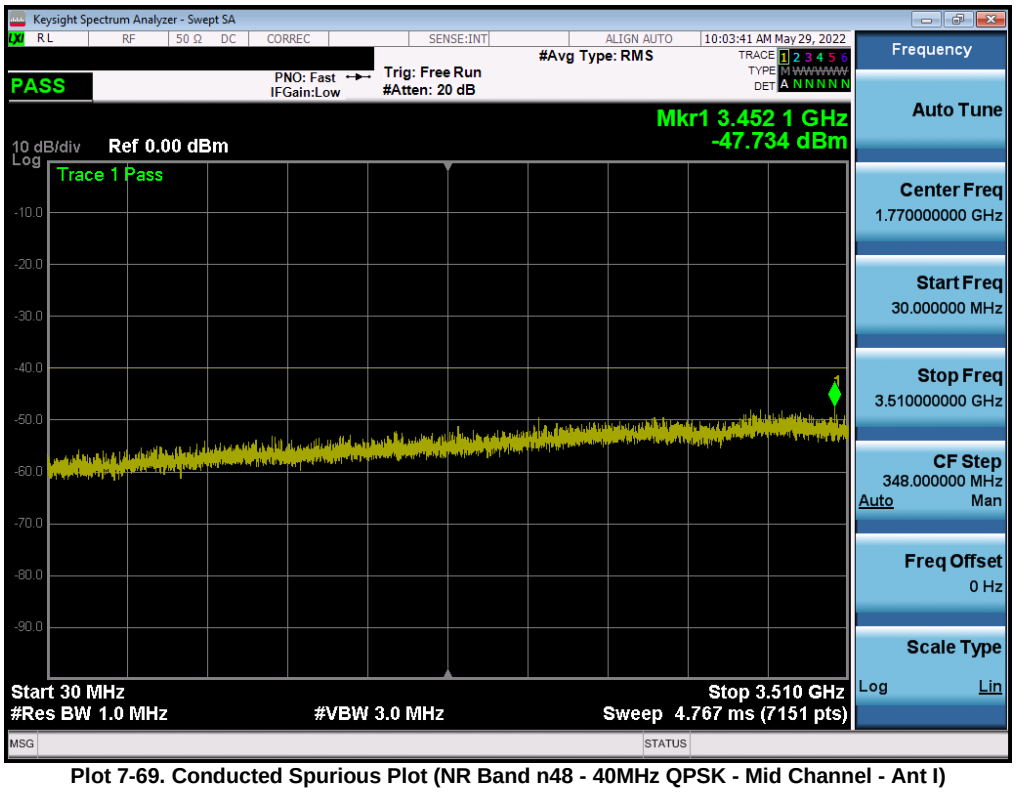
Plot 7-66. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant I)



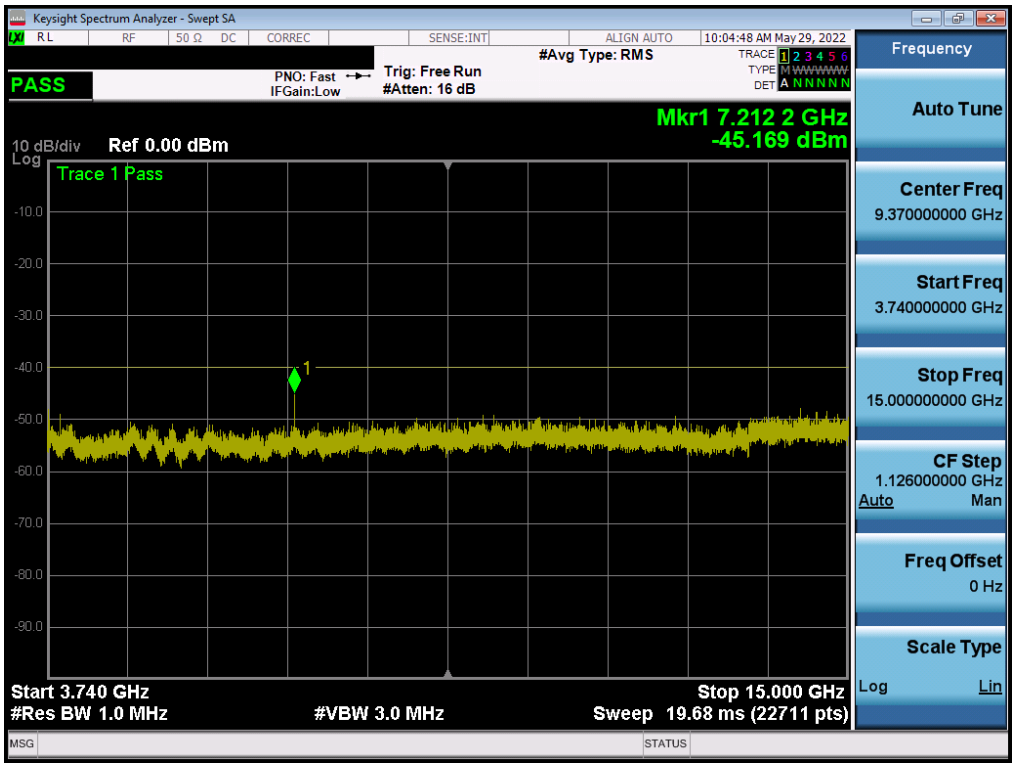
Plot 7-67. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant I)



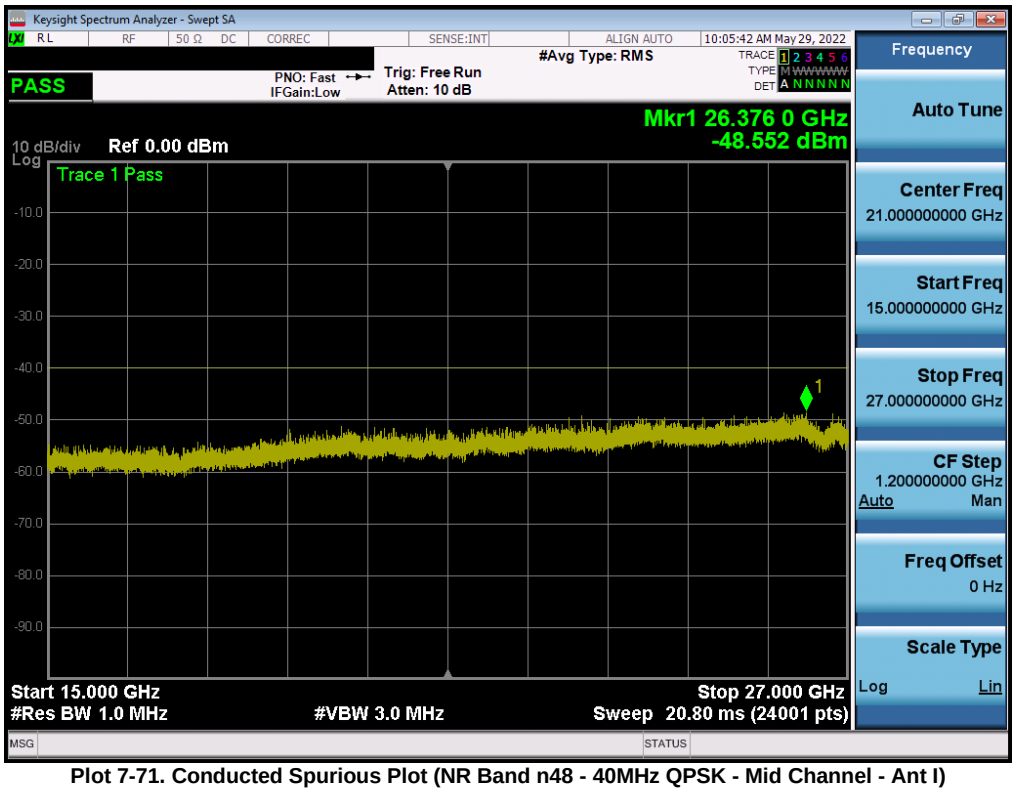
Plot 7-68. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant I)



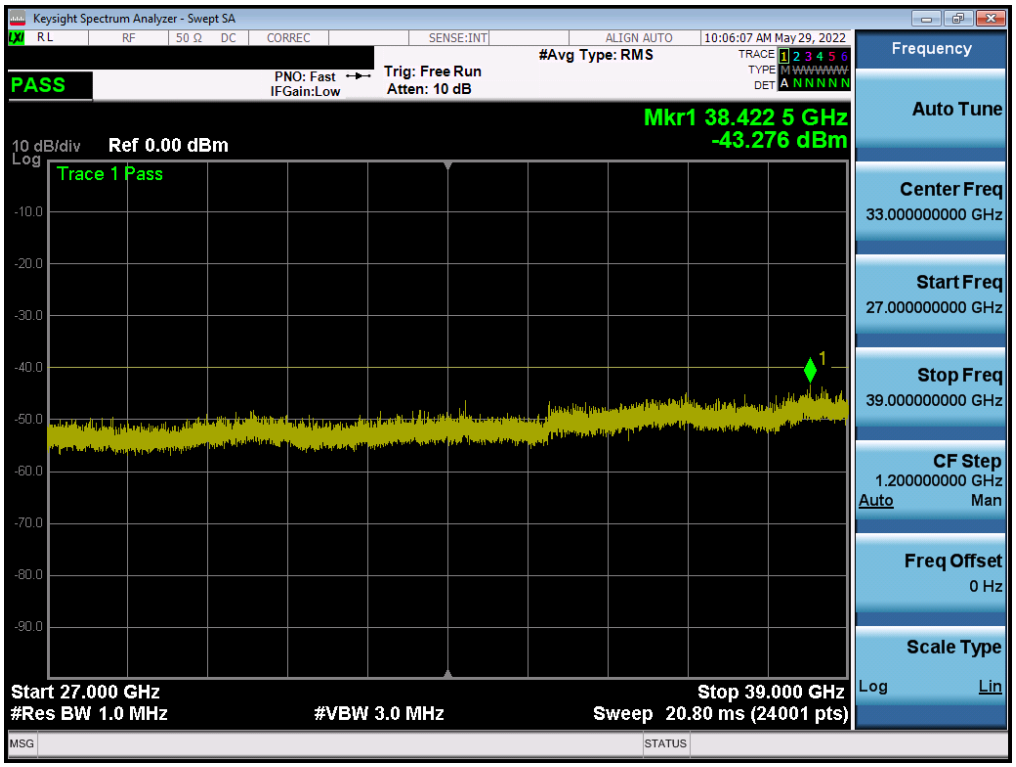
Plot 7-69. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant I)



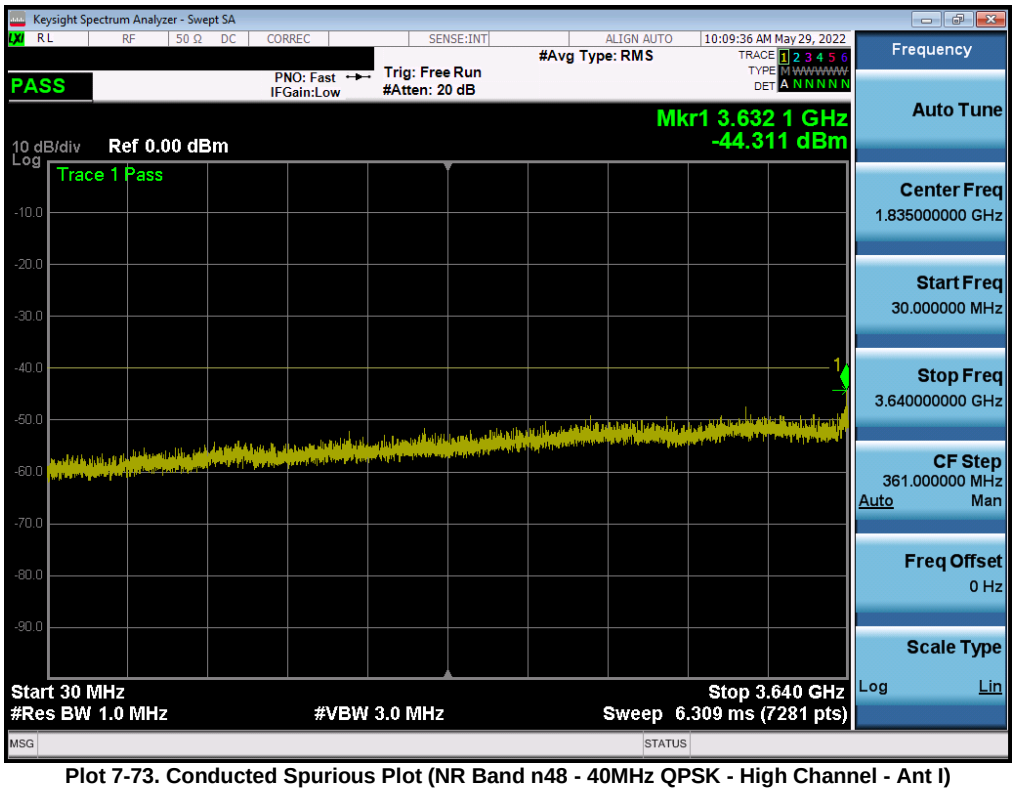
Plot 7-70. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant I)



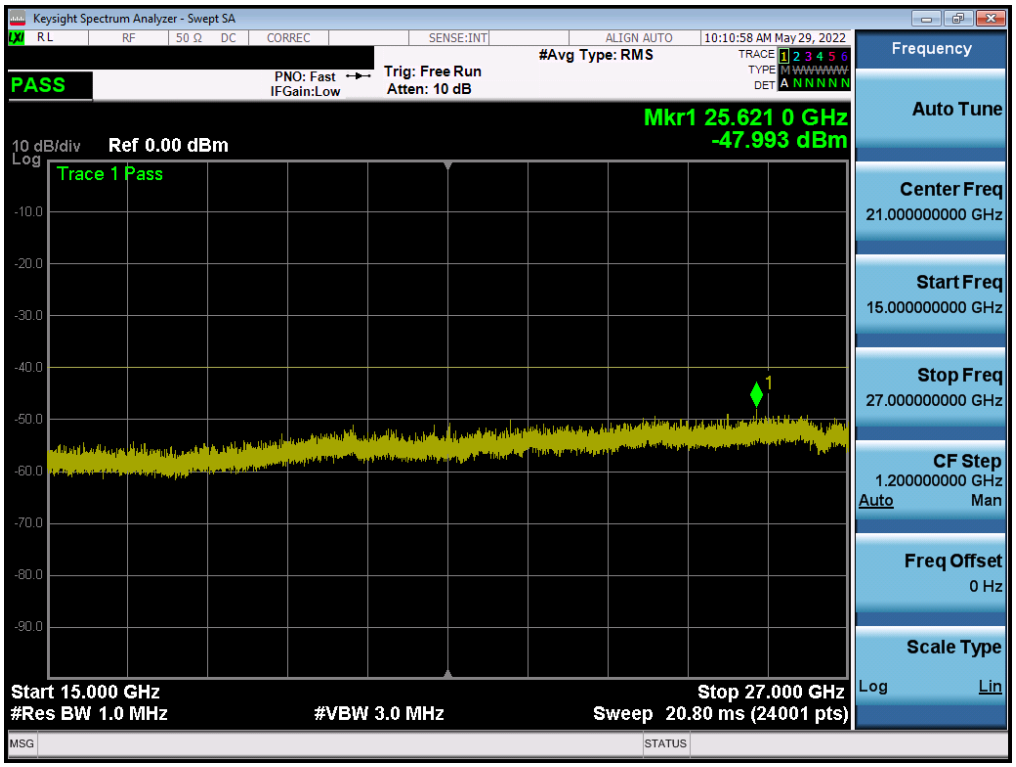
Plot 7-71. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant I)



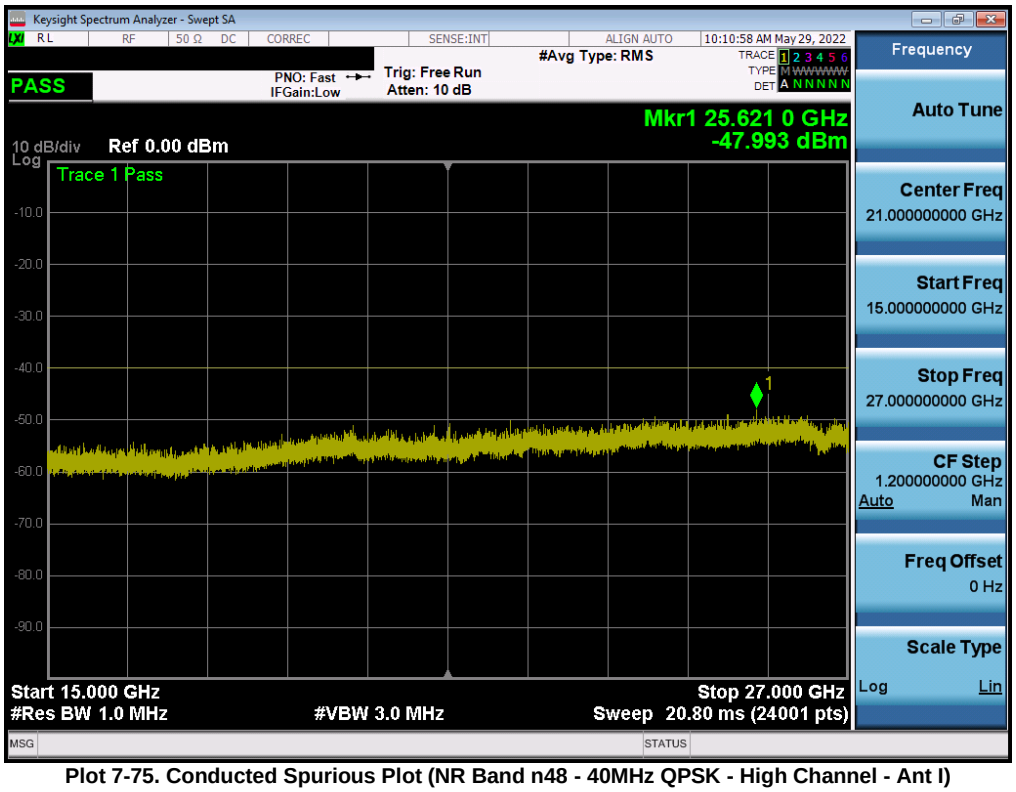
Plot 7-72. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant I)



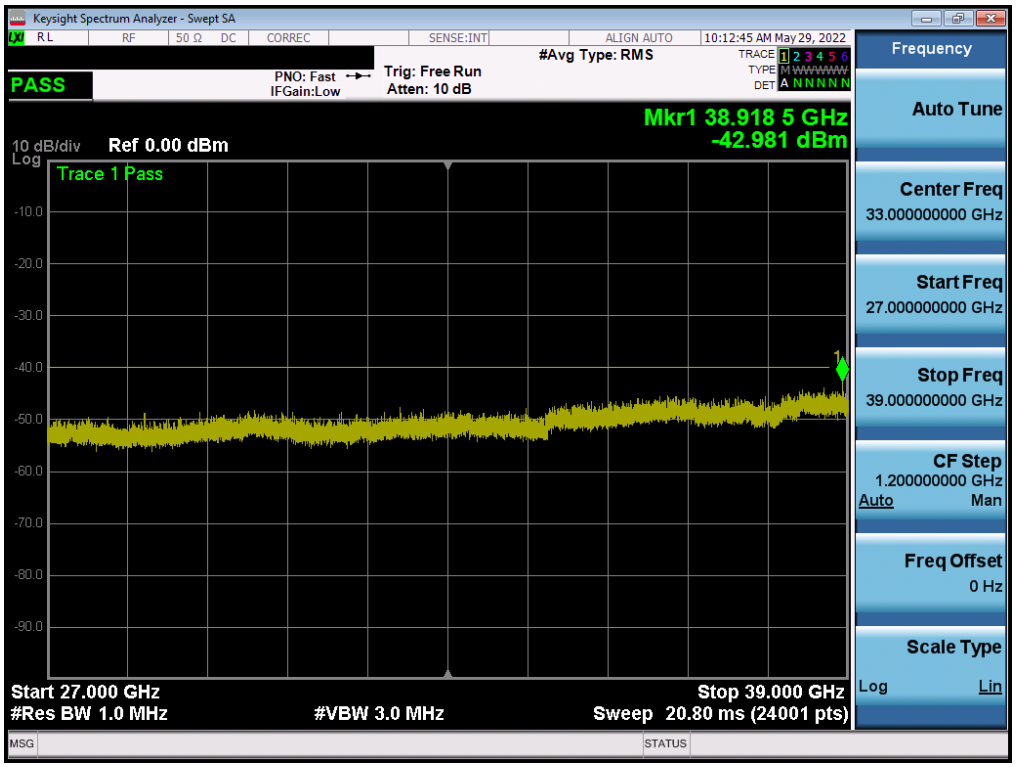
Plot 7-73. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant I)



Plot 7-74. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant I)

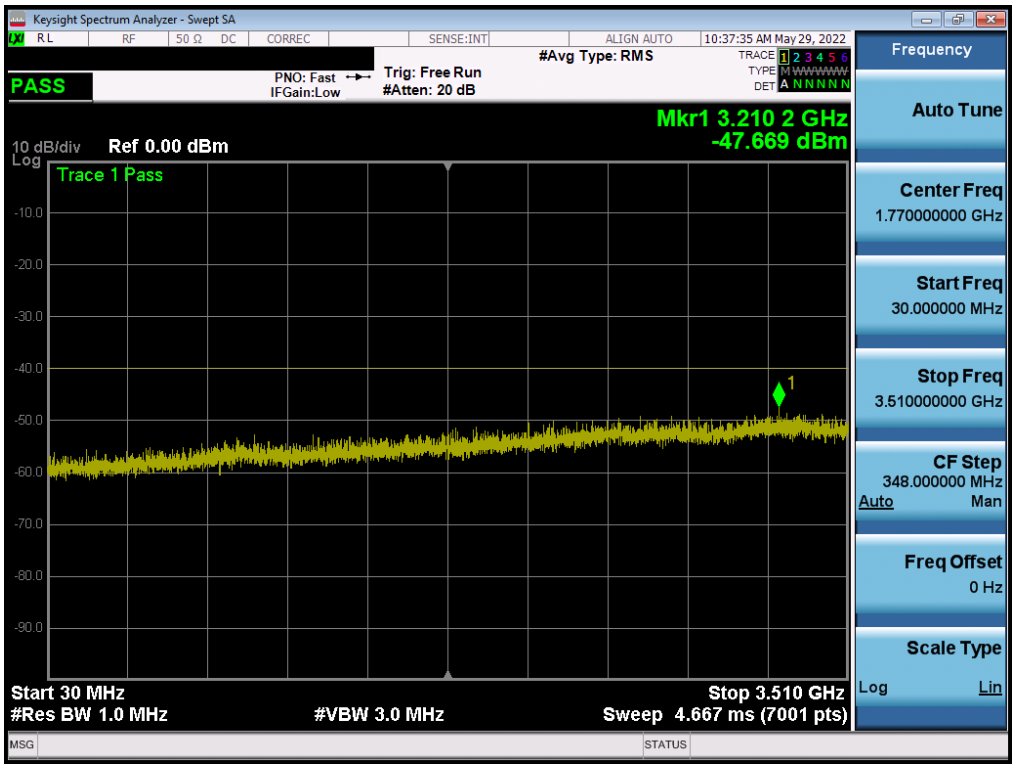


Plot 7-75. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant I)

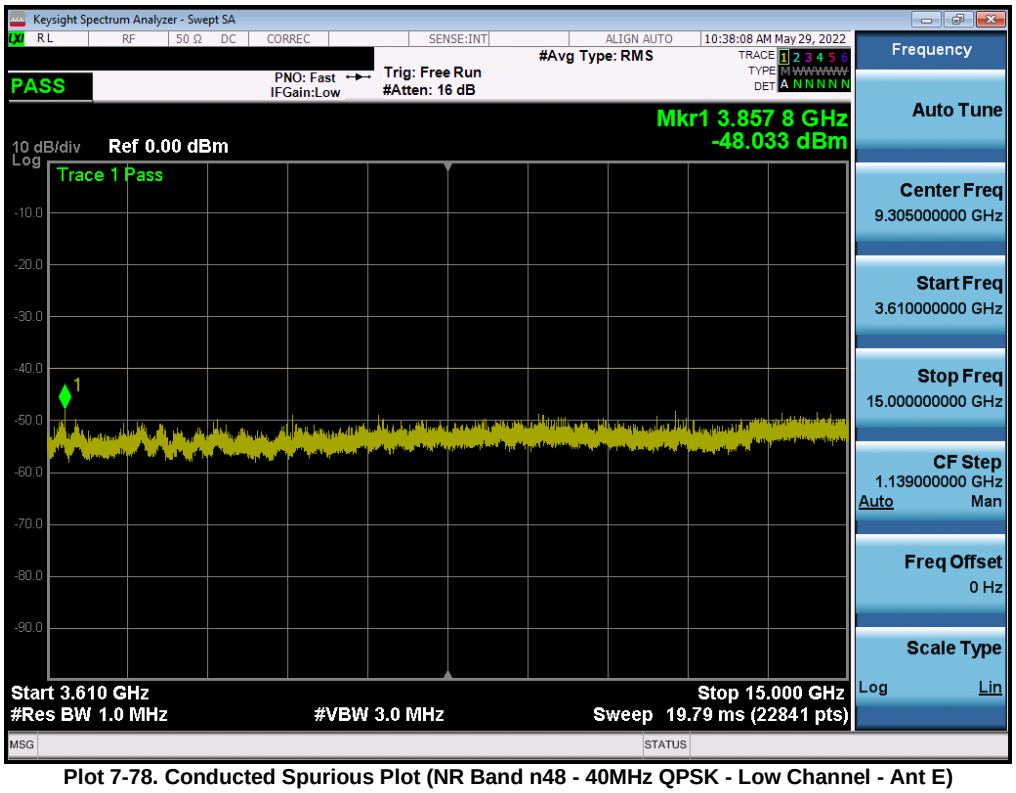


Plot 7-76. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant I)

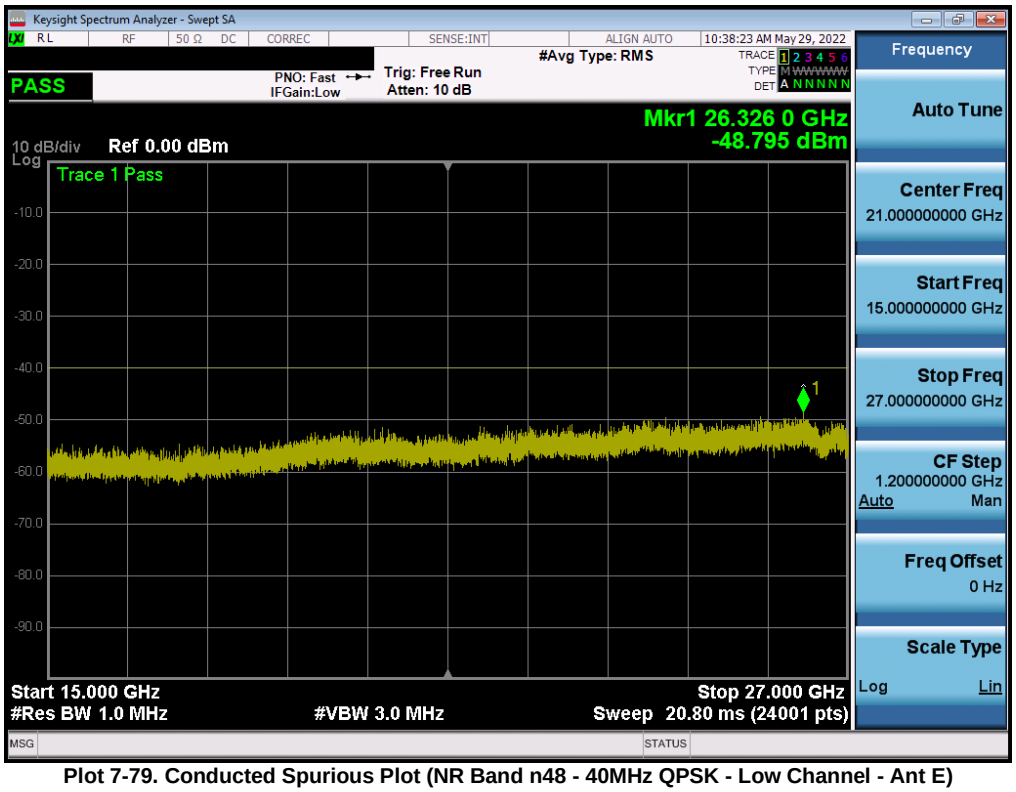
NR Band n48 Ant E



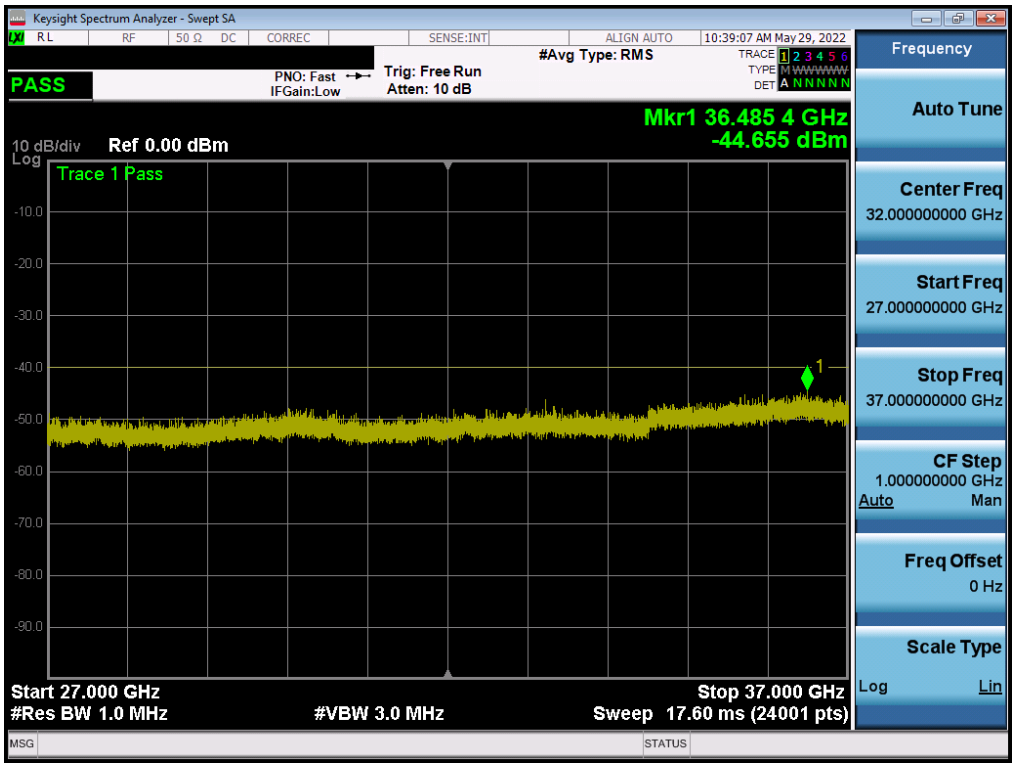
Plot 7-77. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant E)



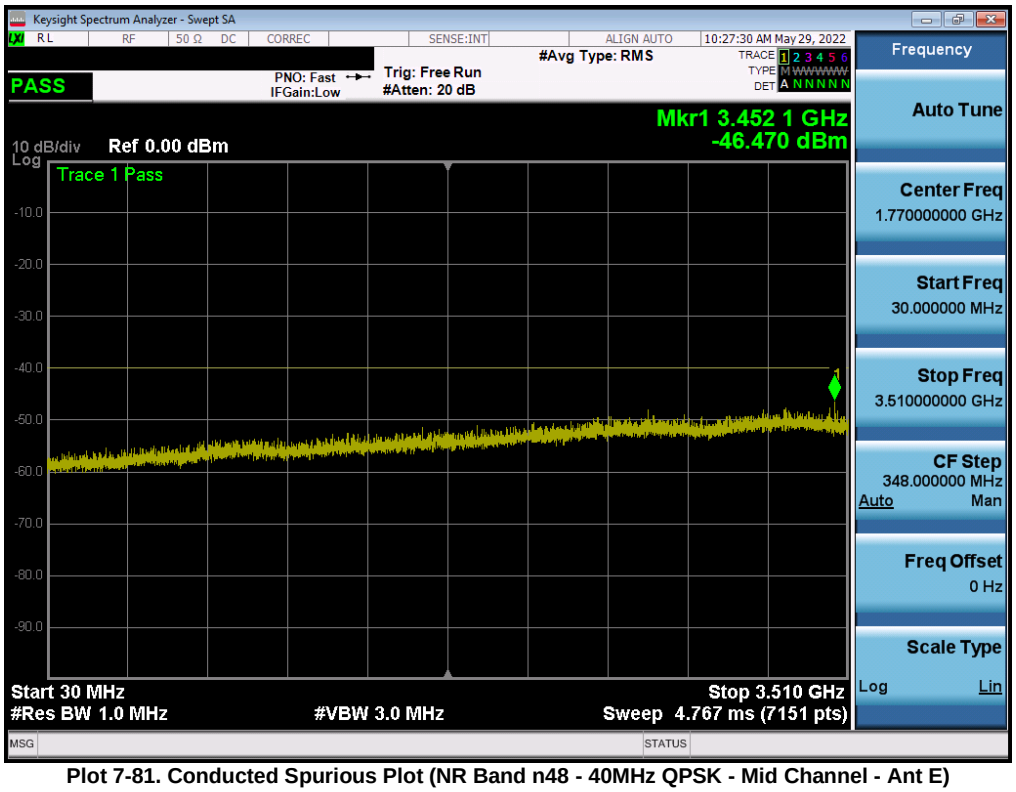
Plot 7-78. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant E)



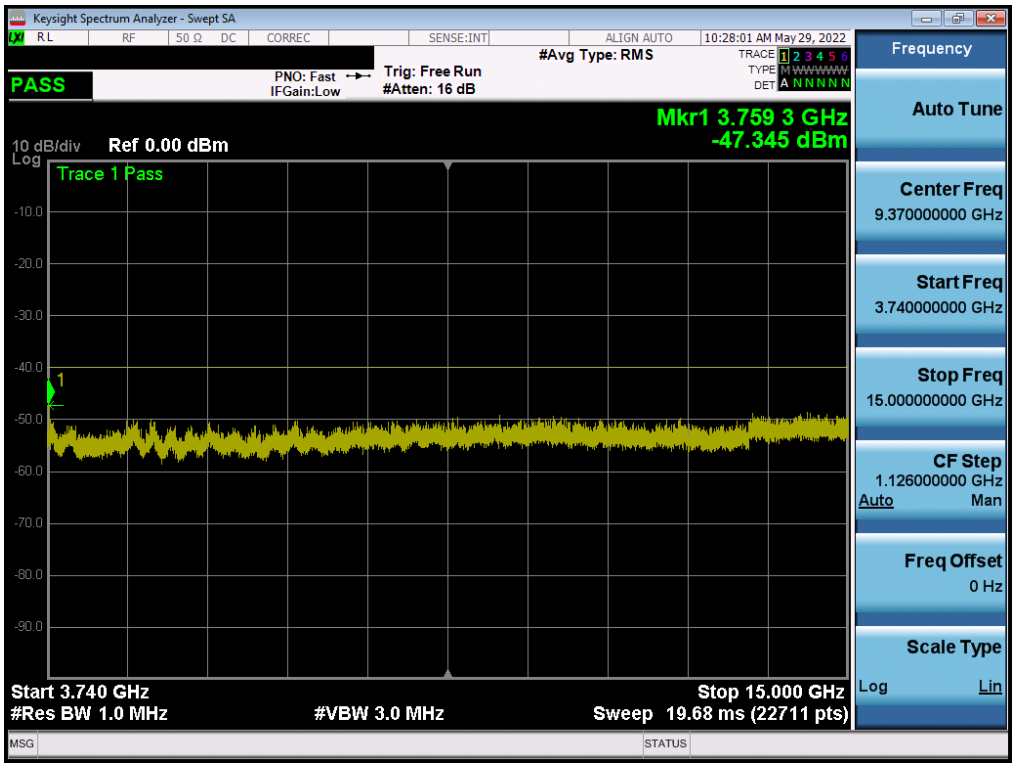
Plot 7-79. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant E)



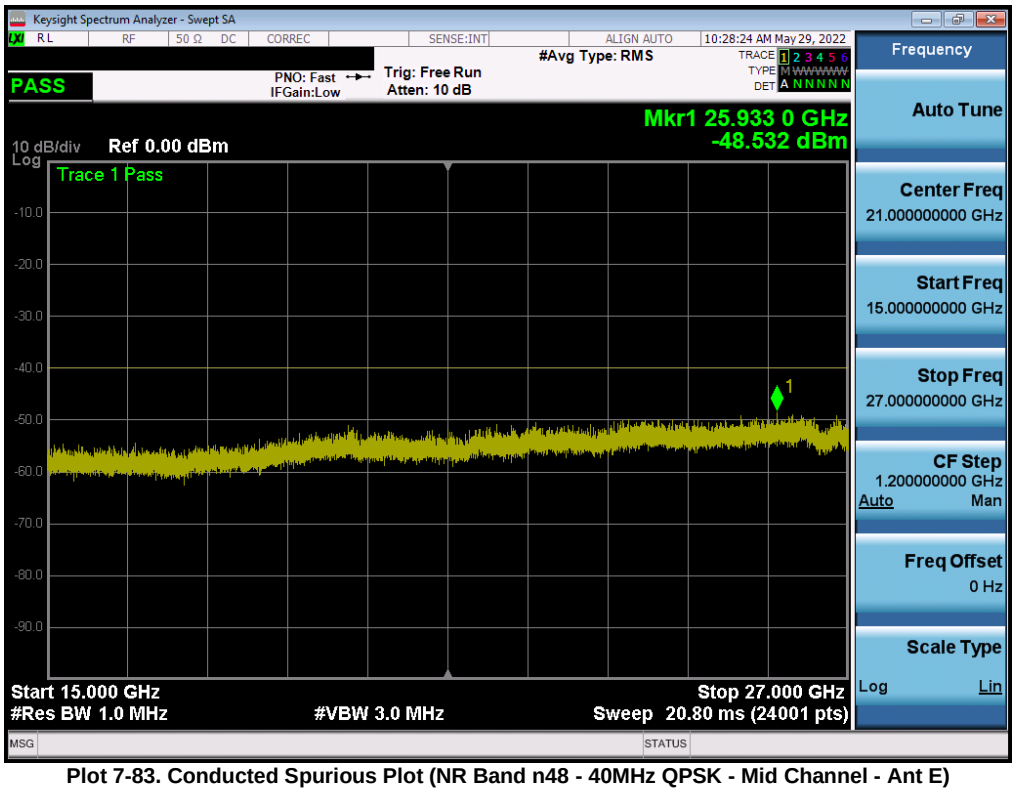
Plot 7-80. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant E)



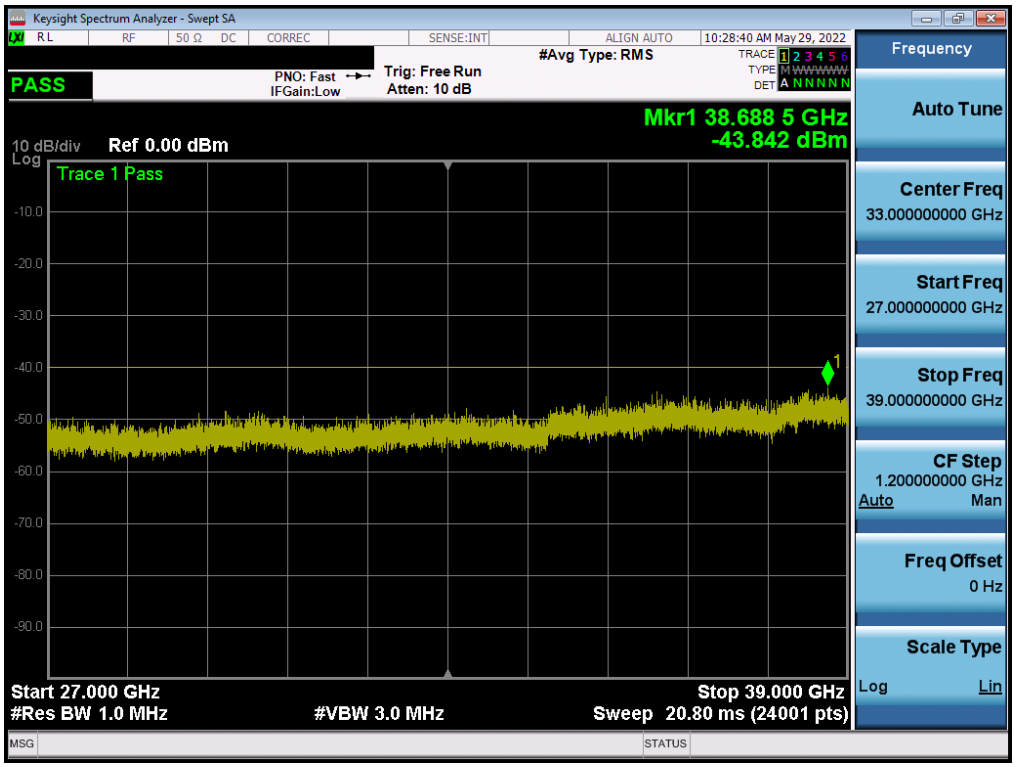
Plot 7-81. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant E)



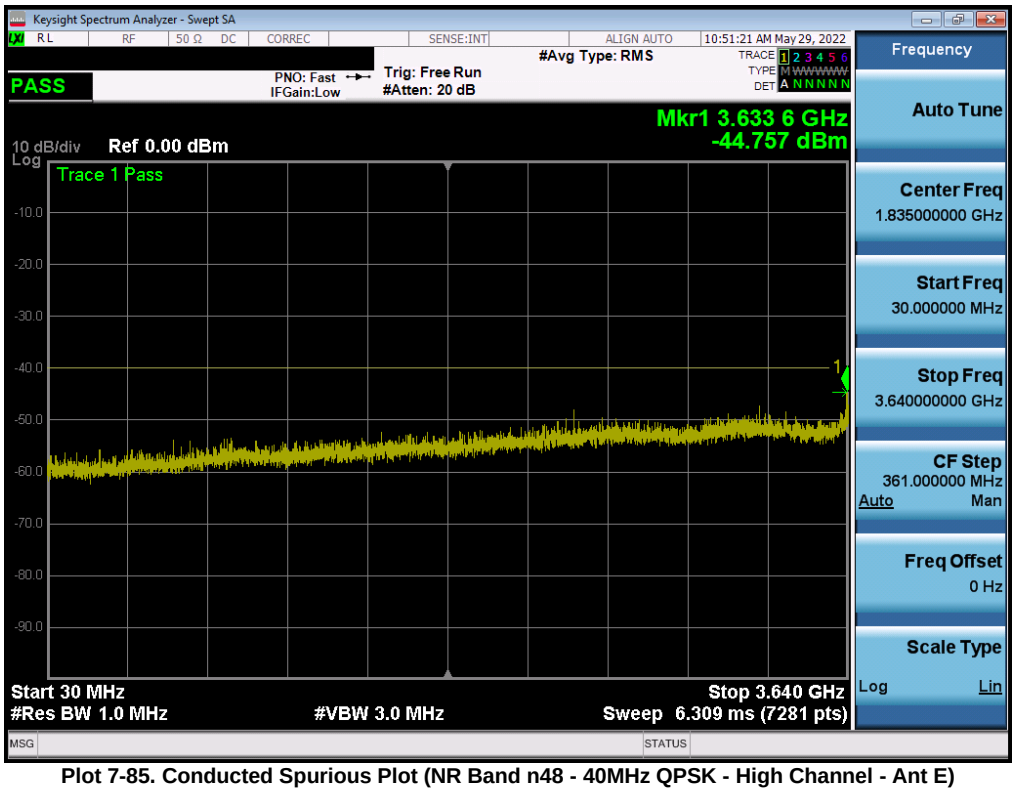
Plot 7-82. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant E)



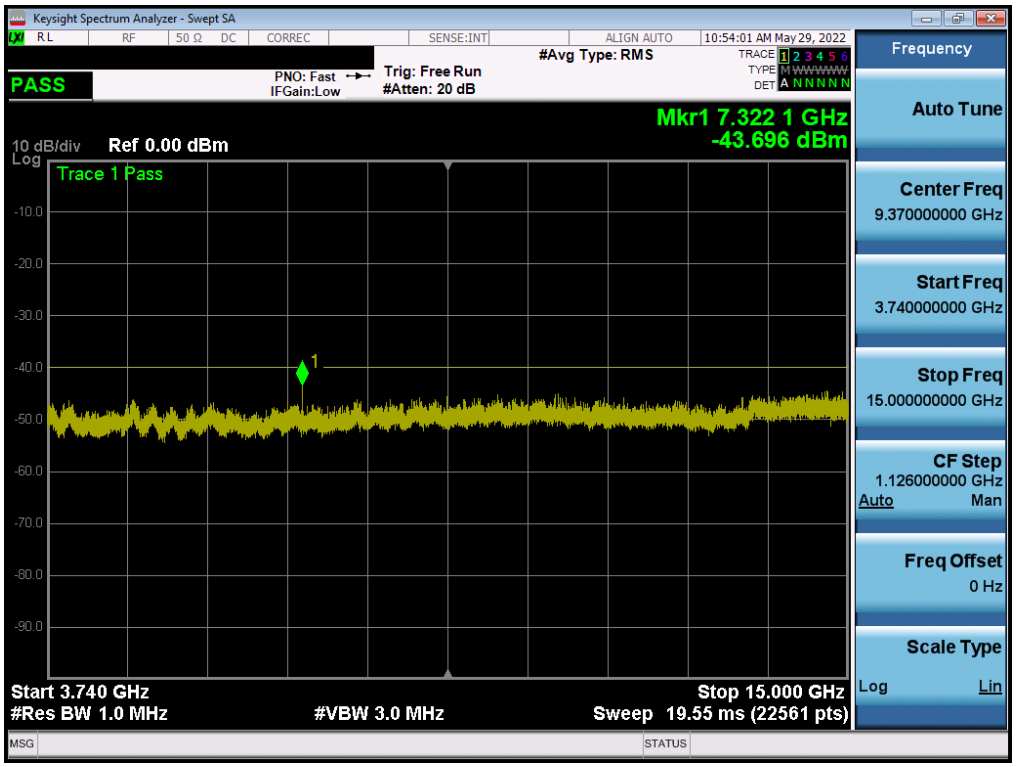
Plot 7-83. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant E)



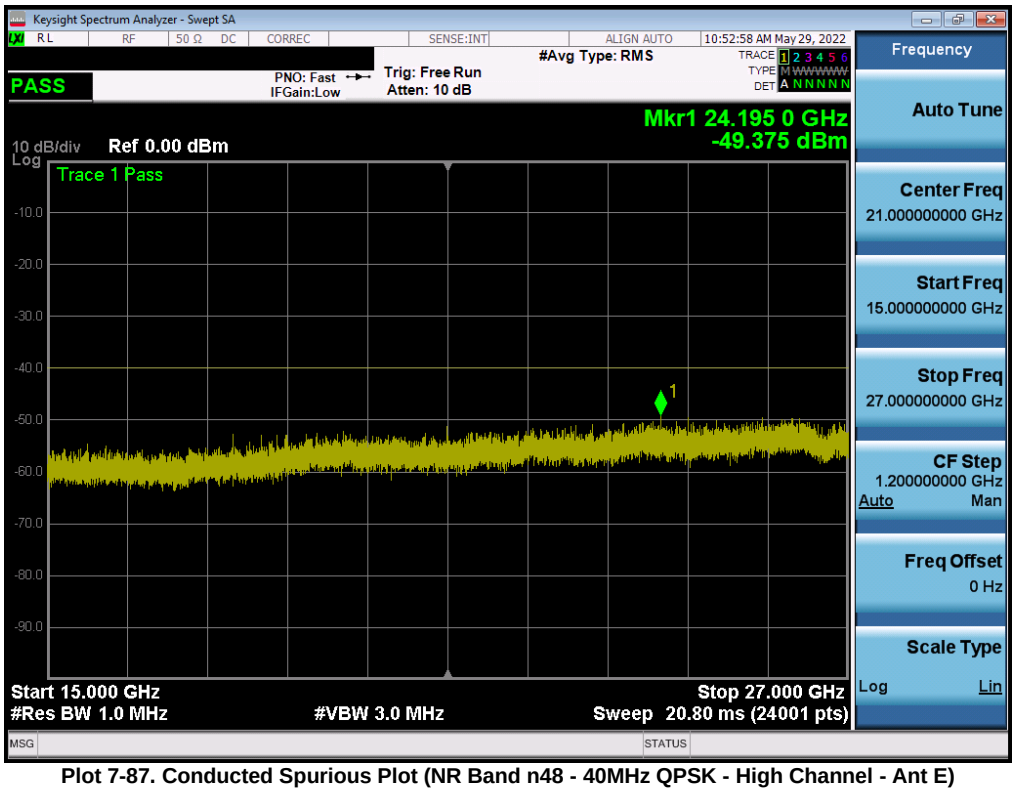
Plot 7-84. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant E)



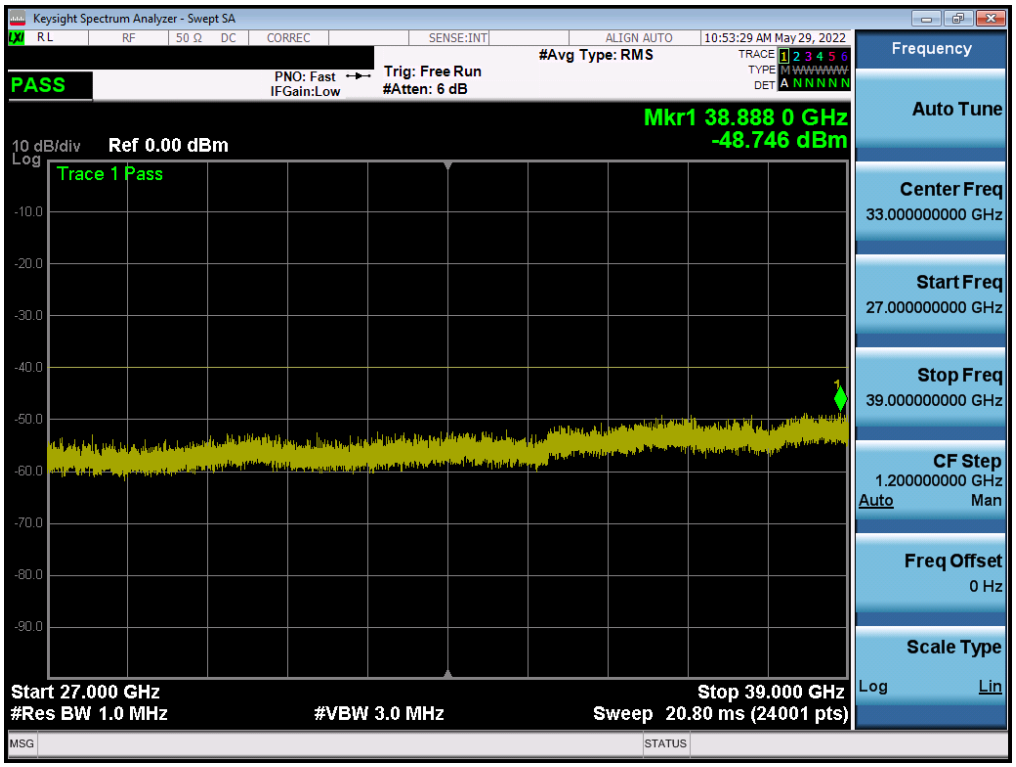
Plot 7-85. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant E)



Plot 7-86. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant E)

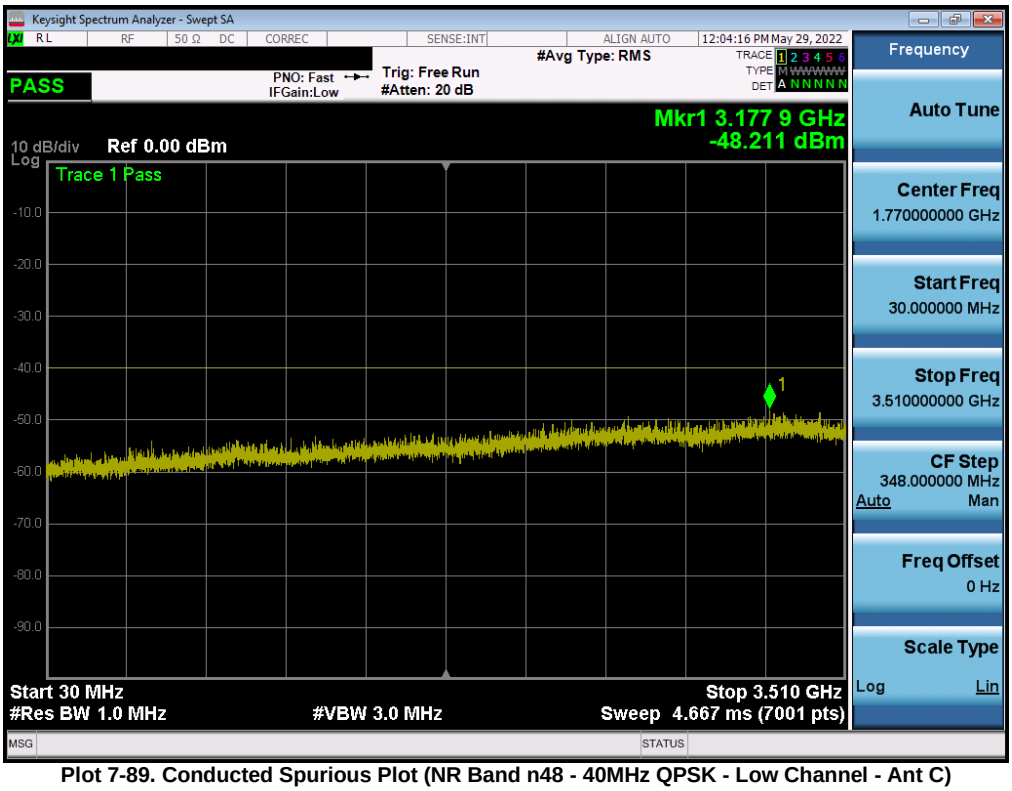


Plot 7-87. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant E)

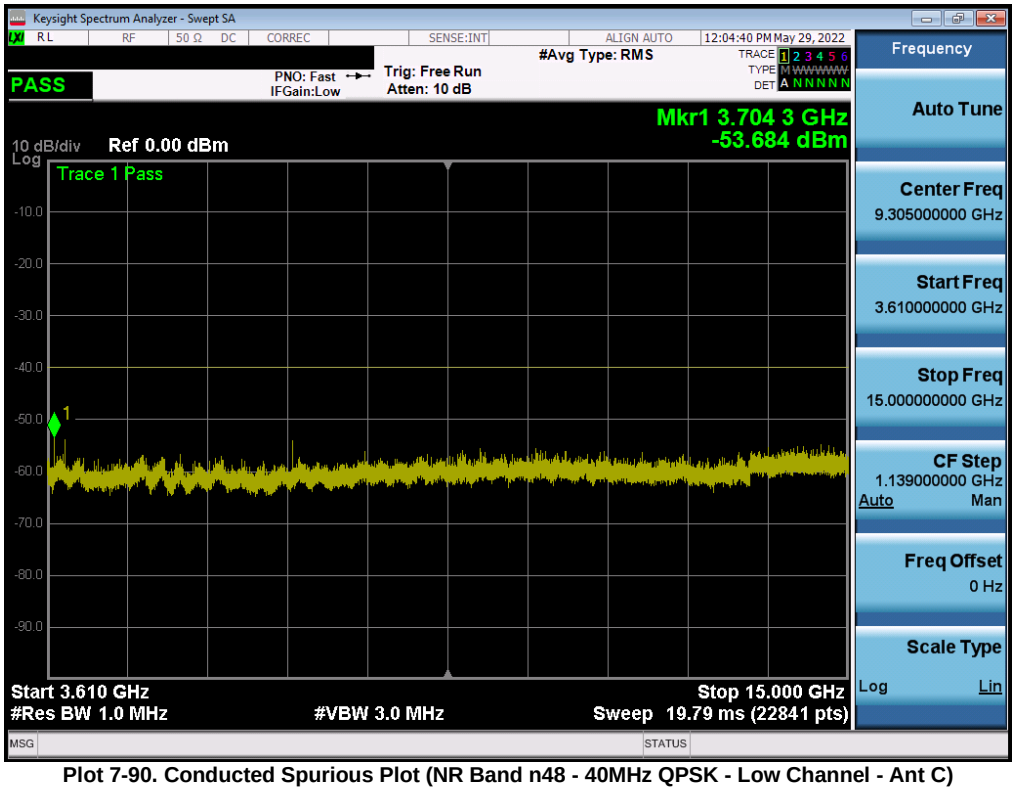


Plot 7-88. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant E)

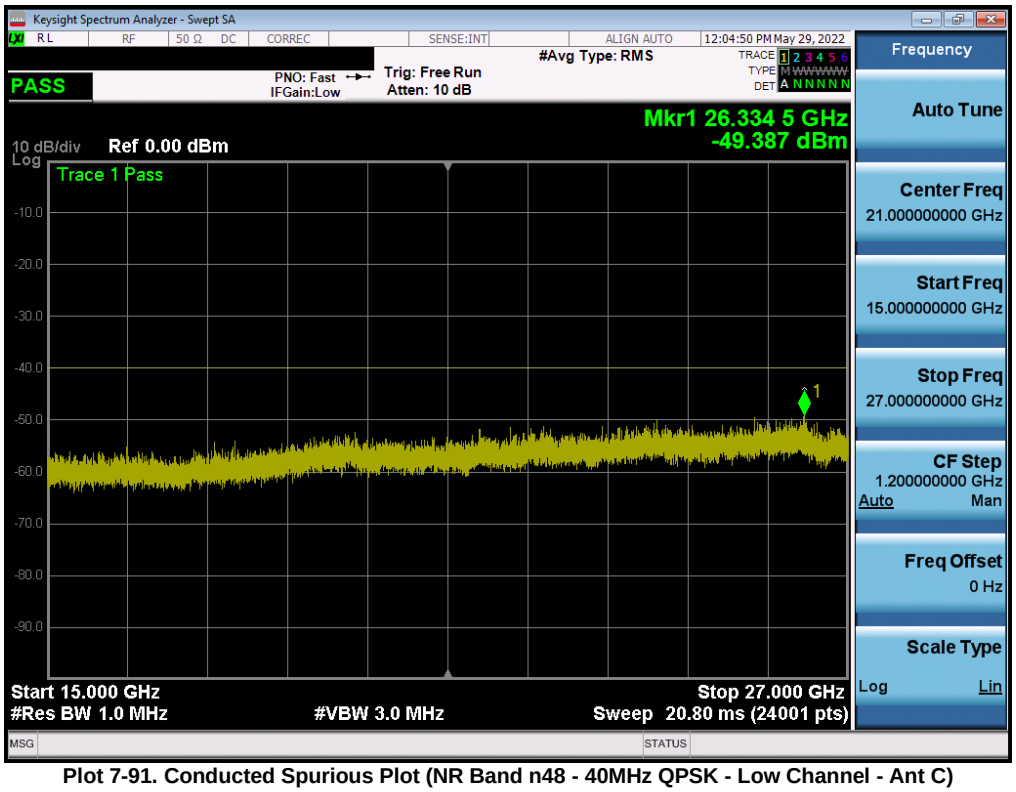
NR Band n48 Ant C



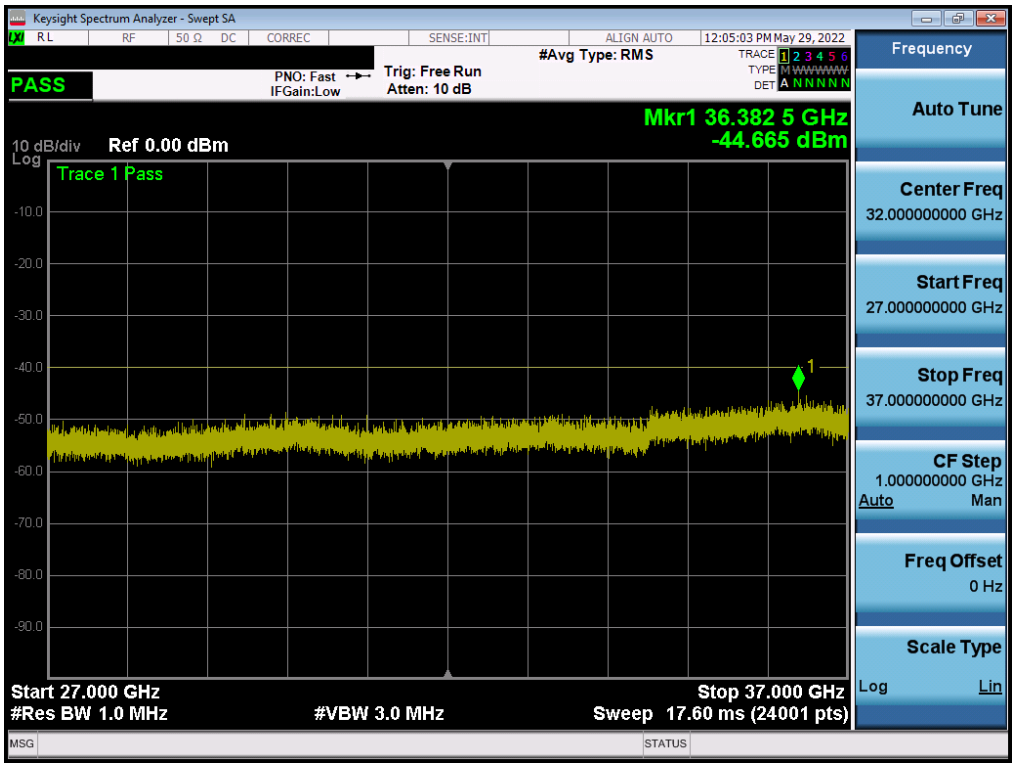
Plot 7-89. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant C)



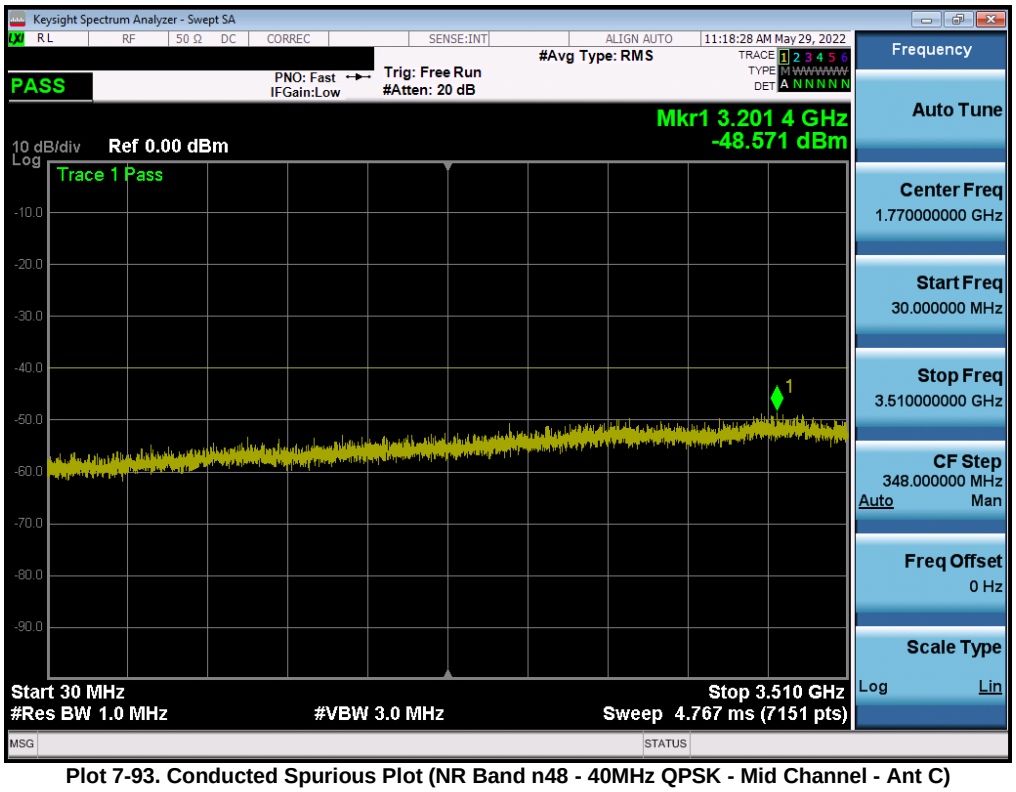
Plot 7-90. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant C)



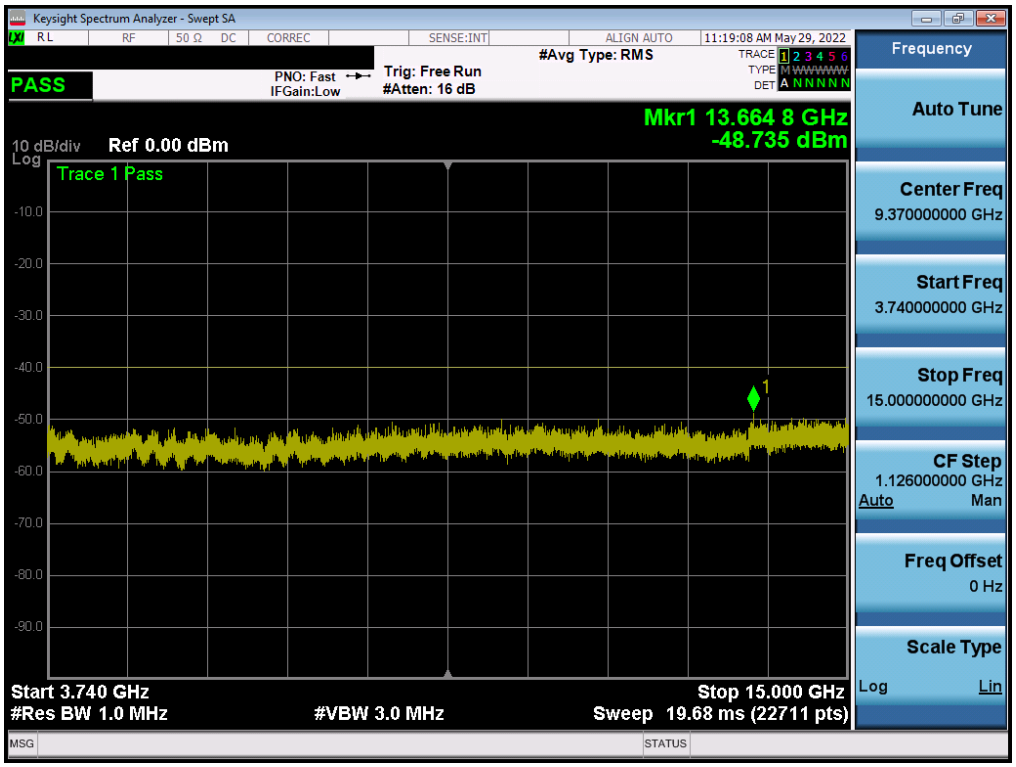
Plot 7-91. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant C)



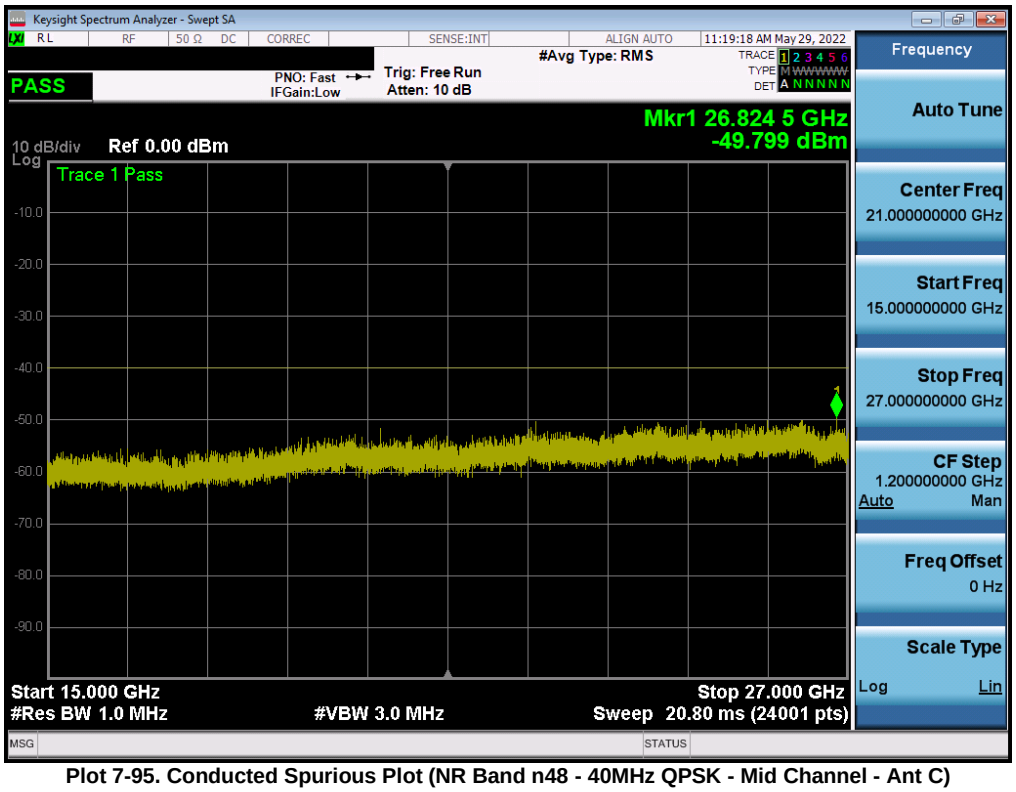
Plot 7-92. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel - Ant C)



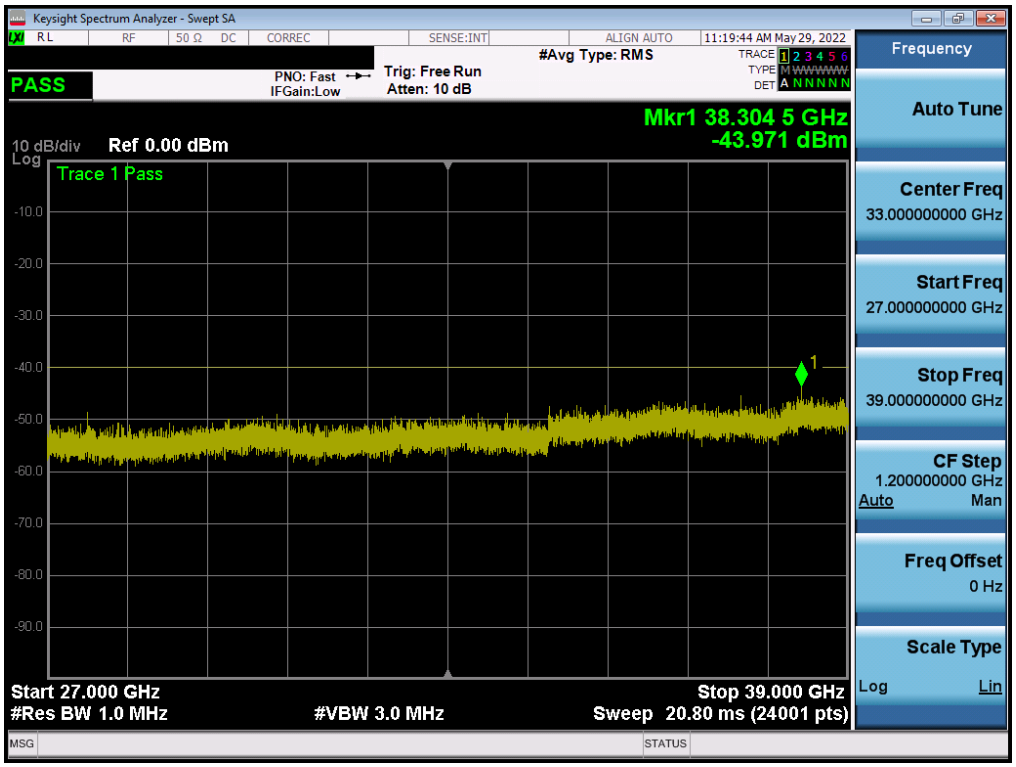
Plot 7-93. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant C)



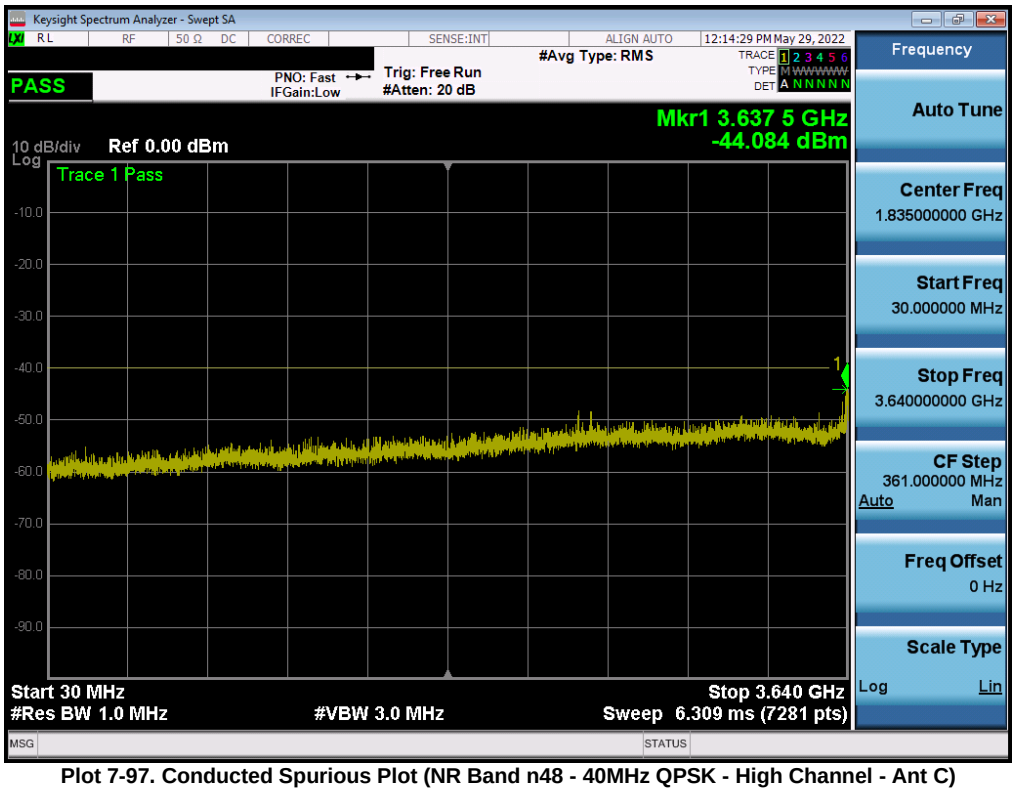
Plot 7-94. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant C)



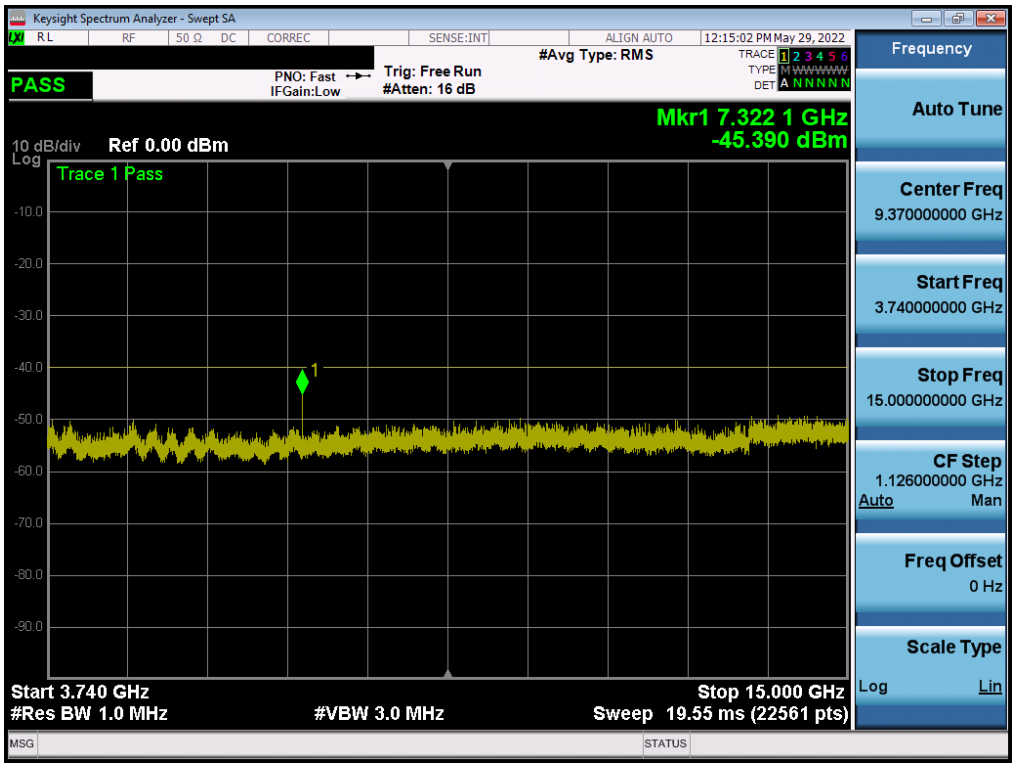
Plot 7-95. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant C)



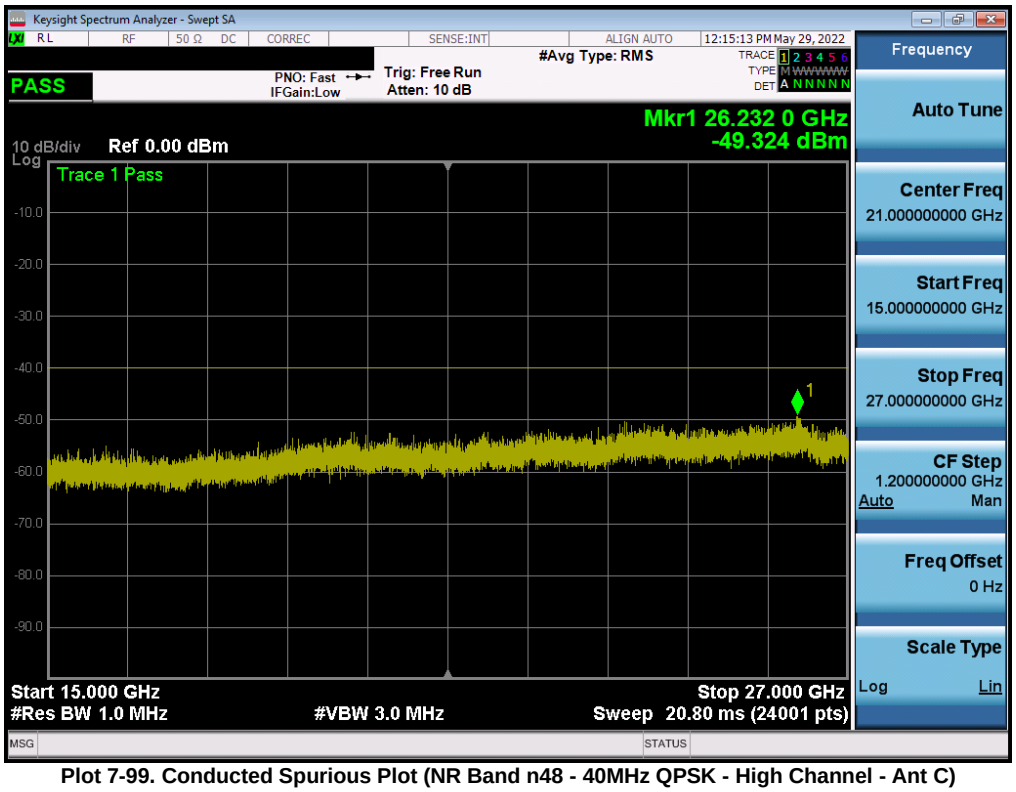
Plot 7-96. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel - Ant C)



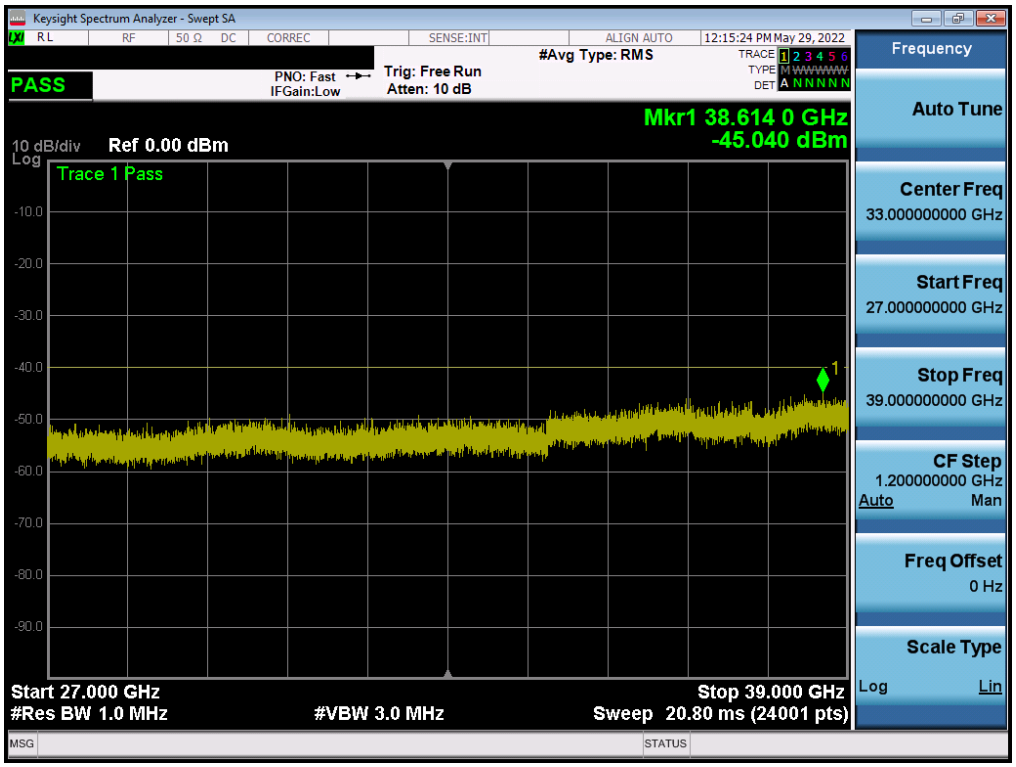
Plot 7-97. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant C)



Plot 7-98. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant C)



Plot 7-99. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant C)



Plot 7-100. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel - Ant C)

7.5 Band Edge Emissions at Antenna Terminal

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.

For an End User Device, 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

ANSI C63.26-2015 – Section 5.7.3

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.

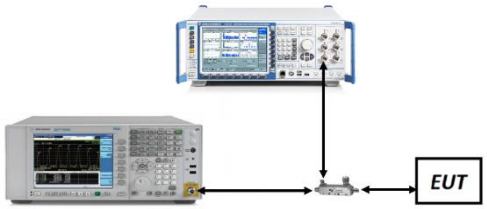


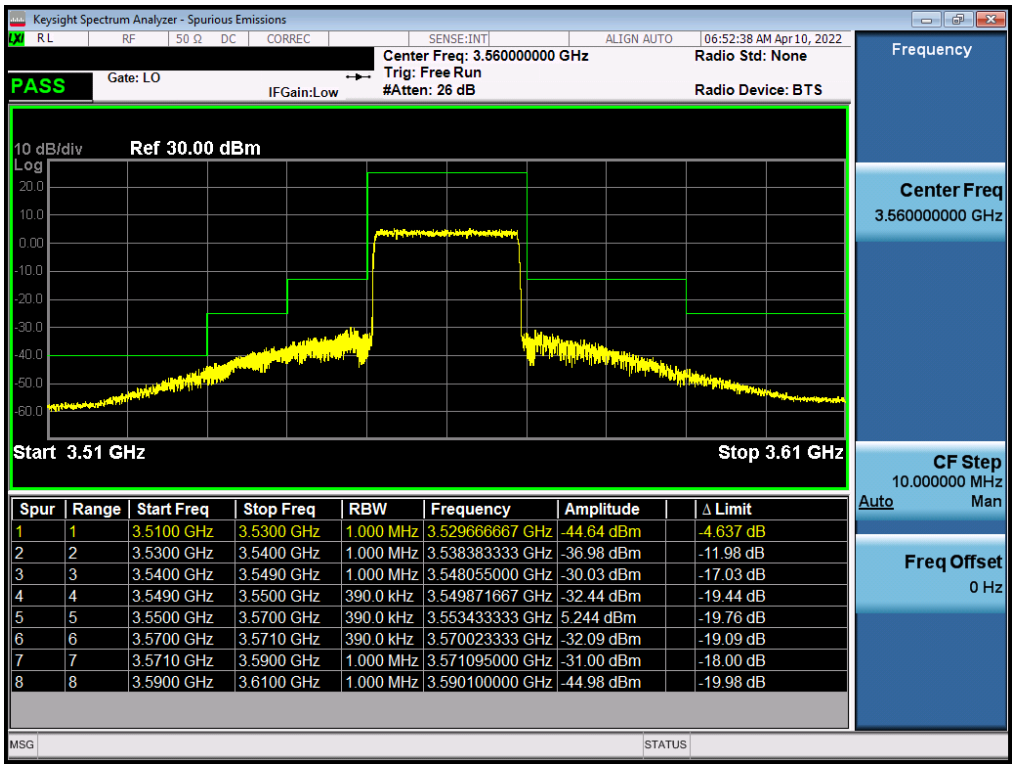
Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. Per 96.41(e)(3)(i), compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (i.e., 1 MHz or 1 percent of emission bandwidth, as specified). The fundamental 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 emissions are attenuated at least 26 dB below the transmitter power.

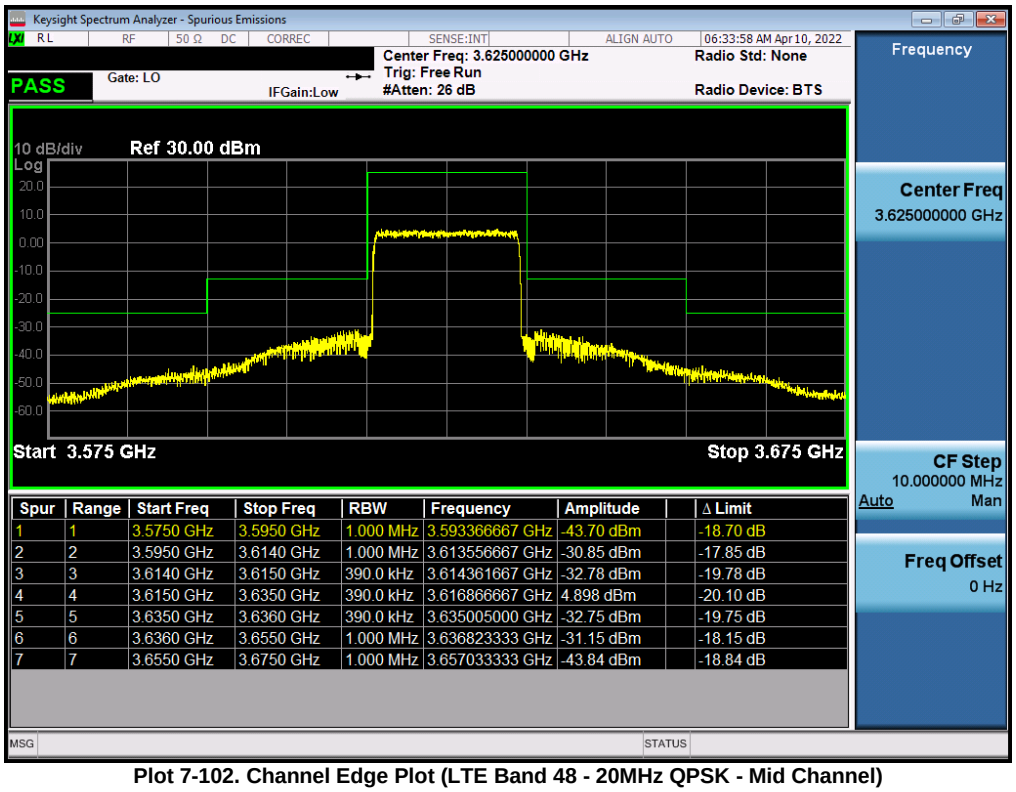
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

LTE Band 48



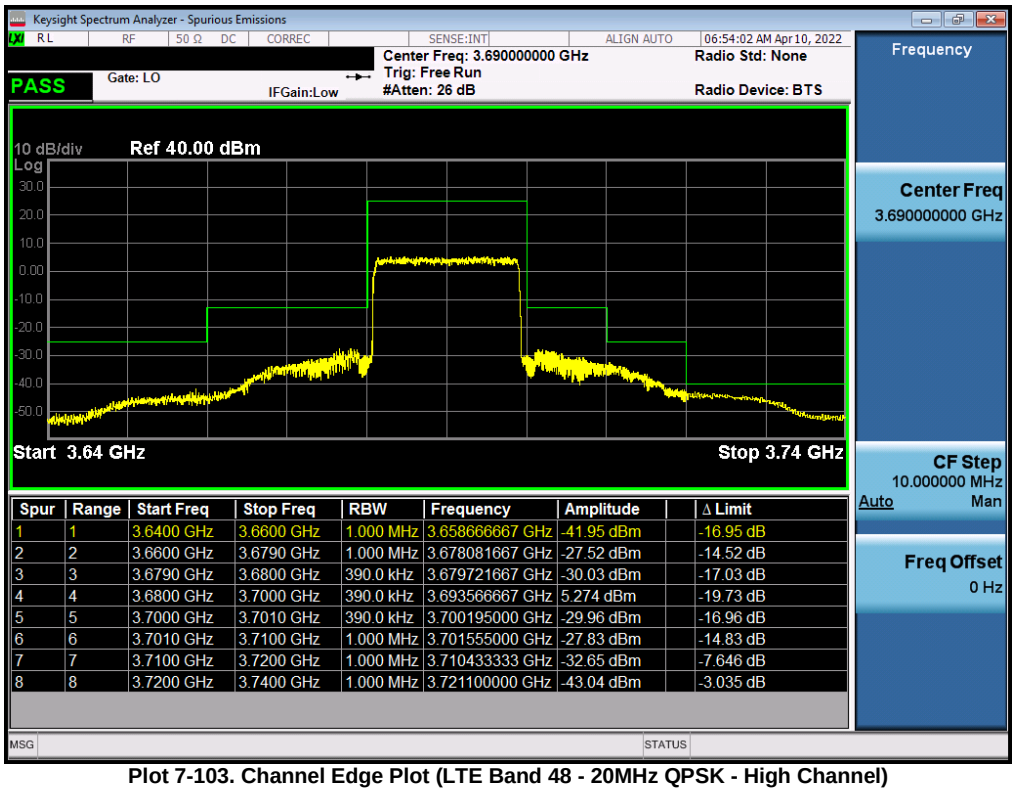
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529666667 GHz	-44.64 dBm	-4.637 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.538383333 GHz	-36.98 dBm	-11.98 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548055000 GHz	-30.03 dBm	-17.03 dB
4	4	3.5490 GHz	3.5500 GHz	390.0 kHz	3.549871667 GHz	-32.44 dBm	-19.44 dB
5	5	3.5500 GHz	3.5700 GHz	390.0 kHz	3.553433333 GHz	5.244 dBm	-19.76 dB
6	6	3.5700 GHz	3.5710 GHz	390.0 kHz	3.570023333 GHz	-32.09 dBm	-19.09 dB
7	7	3.5710 GHz	3.5900 GHz	1.000 MHz	3.571095000 GHz	-31.00 dBm	-18.00 dB
8	8	3.5900 GHz	3.6100 GHz	1.000 MHz	3.590100000 GHz	-44.98 dBm	-19.98 dB

Plot 7-101. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Low Channel)



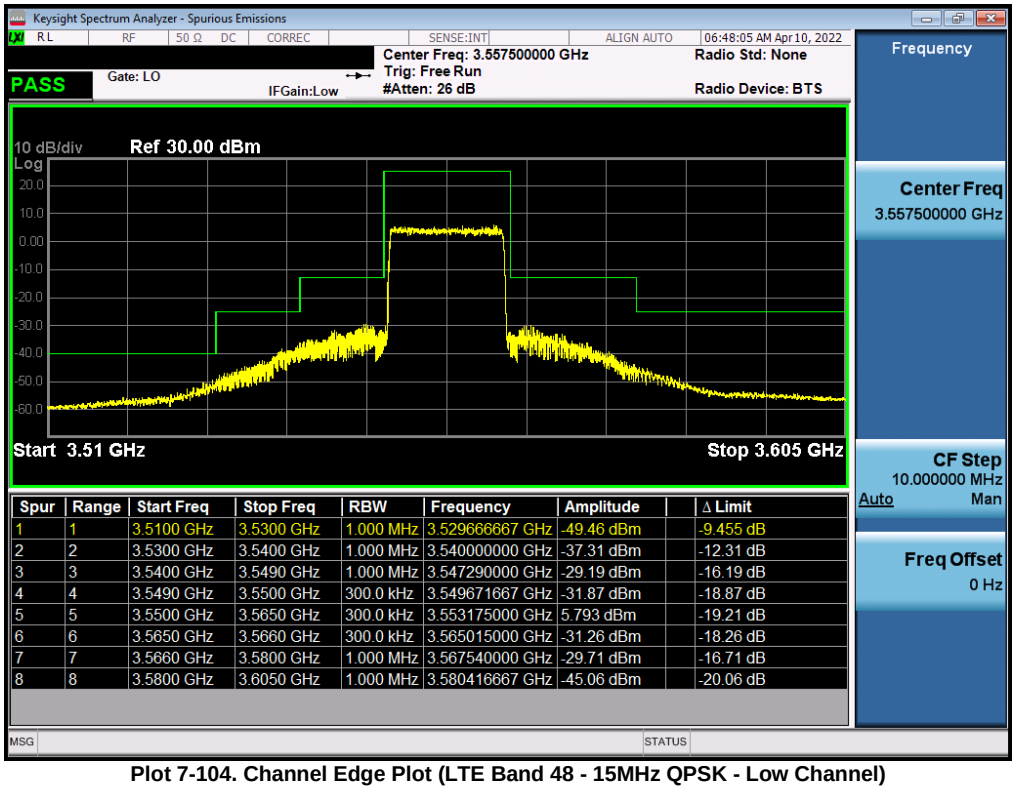
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5750 GHz	3.5950 GHz	1.000 MHz	3.593366667 GHz	-43.70 dBm	-18.70 dB
2	2	3.5950 GHz	3.6140 GHz	1.000 MHz	3.613556667 GHz	-30.85 dBm	-17.85 dB
3	3	3.6140 GHz	3.6150 GHz	390.0 kHz	3.614361667 GHz	-32.78 dBm	-19.78 dB
4	4	3.6150 GHz	3.6350 GHz	390.0 kHz	3.616866667 GHz	4.898 dBm	-20.10 dB
5	5	3.6350 GHz	3.6360 GHz	390.0 kHz	3.635005000 GHz	-32.75 dBm	-19.75 dB
6	6	3.6360 GHz	3.6550 GHz	1.000 MHz	3.636823333 GHz	-31.15 dBm	-18.15 dB
7	7	3.6550 GHz	3.6750 GHz	1.000 MHz	3.657033333 GHz	-43.84 dBm	-18.84 dB

Plot 7-102. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)



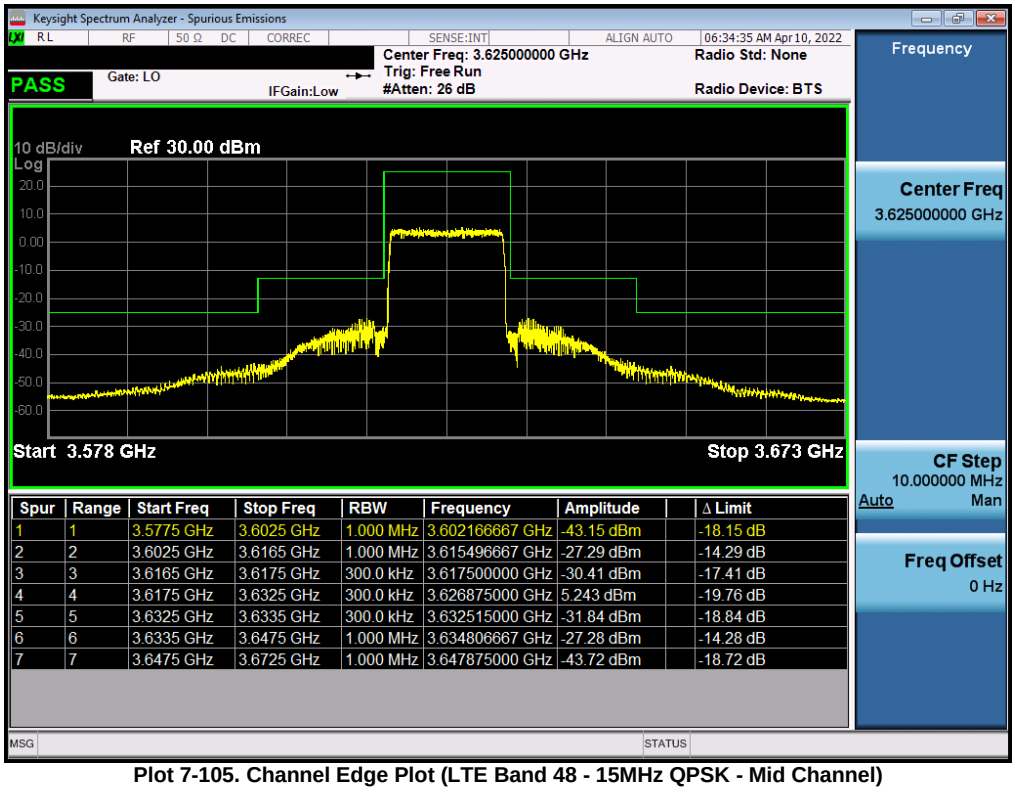
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6400 GHz	3.6600 GHz	1.000 MHz	3.658666667 GHz	-41.95 dBm	-16.95 dB
2	2	3.6600 GHz	3.6790 GHz	1.000 MHz	3.678081667 GHz	-27.52 dBm	-14.52 dB
3	3	3.6790 GHz	3.6800 GHz	390.0 kHz	3.679721667 GHz	-30.03 dBm	-17.03 dB
4	4	3.6800 GHz	3.7000 GHz	390.0 kHz	3.693566667 GHz	5.274 dBm	-19.73 dB
5	5	3.7000 GHz	3.7010 GHz	390.0 kHz	3.700195000 GHz	-29.96 dBm	-16.96 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701555000 GHz	-27.83 dBm	-14.83 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710433333 GHz	-32.65 dBm	-7.646 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.721100000 GHz	-43.04 dBm	-3.035 dB

Plot 7-103. Channel Edge Plot (LTE Band 48 - 20MHz QPSK - High Channel)



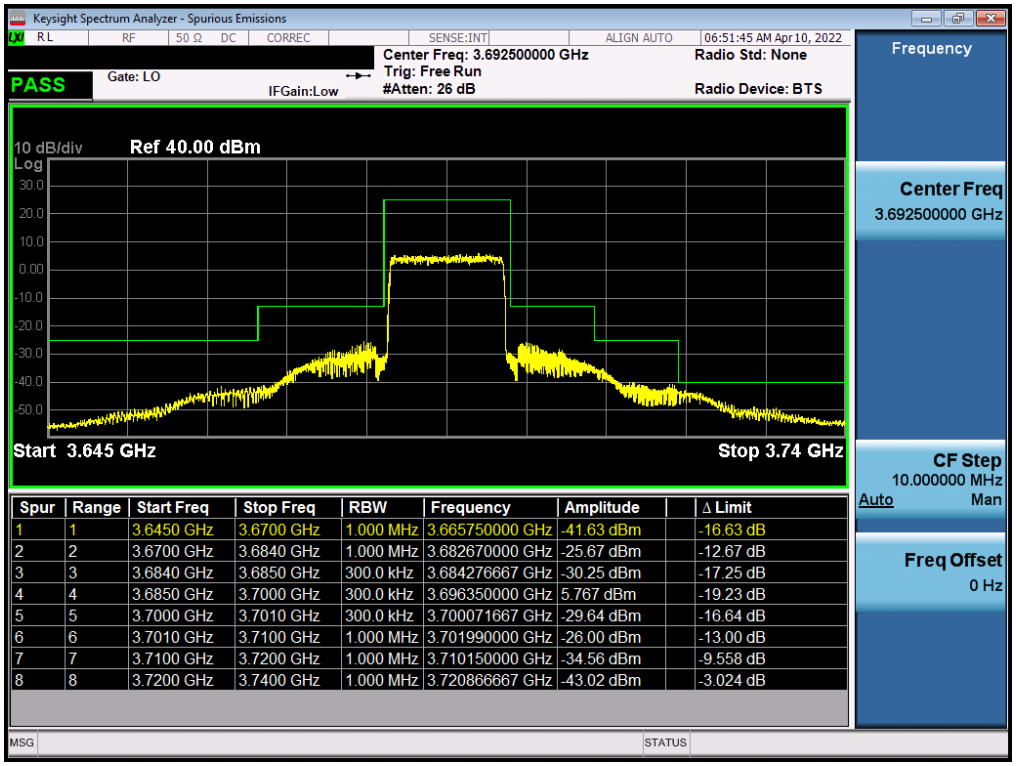
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529666667 GHz	-49.46 dBm	-9.455 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.540000000 GHz	-37.31 dBm	-12.31 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.547290000 GHz	-29.19 dBm	-16.19 dB
4	4	3.5490 GHz	3.5500 GHz	300.0 kHz	3.549671667 GHz	-31.87 dBm	-18.87 dB
5	5	3.5500 GHz	3.5650 GHz	300.0 kHz	3.553175000 GHz	5.793 dBm	-19.21 dB
6	6	3.5650 GHz	3.5660 GHz	300.0 kHz	3.565015000 GHz	-31.26 dBm	-18.26 dB
7	7	3.5660 GHz	3.5800 GHz	1.000 MHz	3.567540000 GHz	-29.71 dBm	-16.71 dB
8	8	3.5800 GHz	3.6050 GHz	1.000 MHz	3.580416667 GHz	-45.06 dBm	-20.06 dB

Plot 7-104. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Low Channel)



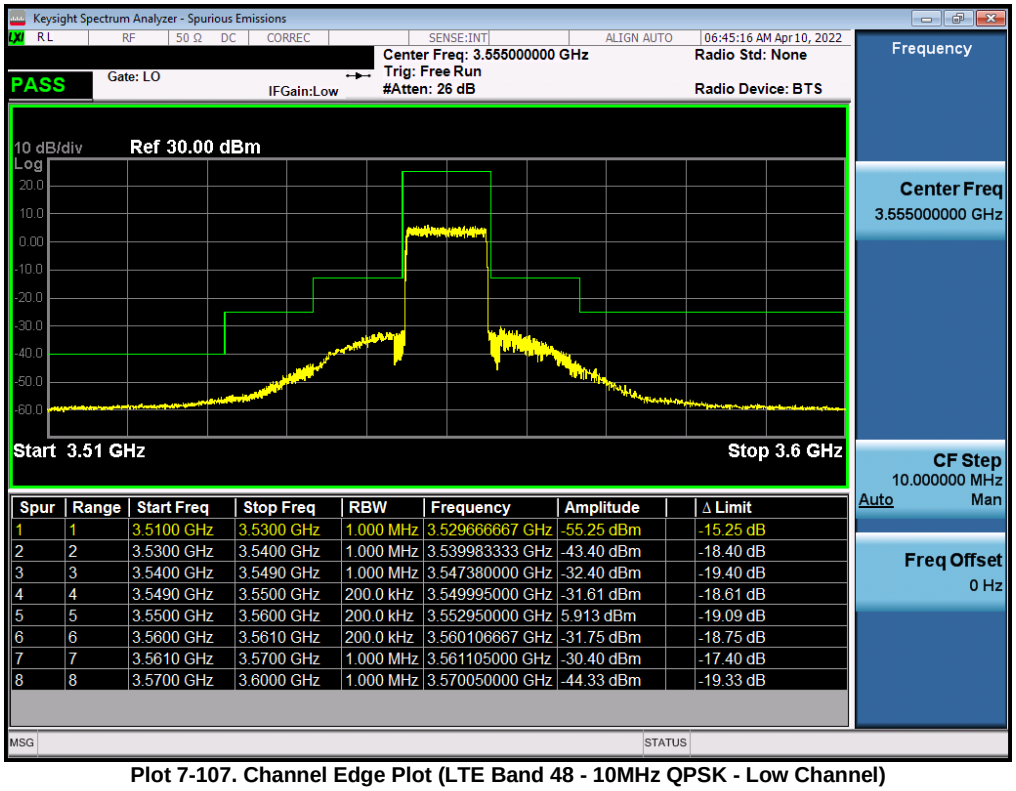
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5775 GHz	3.6025 GHz	1.000 MHz	3.602166667 GHz	-43.15 dBm	-18.15 dB
2	2	3.6025 GHz	3.6165 GHz	1.000 MHz	3.615496667 GHz	-27.29 dBm	-14.29 dB
3	3	3.6165 GHz	3.6175 GHz	300.0 kHz	3.617500000 GHz	-30.41 dBm	-17.41 dB
4	4	3.6175 GHz	3.6325 GHz	300.0 kHz	3.626875000 GHz	5.243 dBm	-19.76 dB
5	5	3.6325 GHz	3.6335 GHz	300.0 kHz	3.632515000 GHz	-31.84 dBm	-18.84 dB
6	6	3.6335 GHz	3.6475 GHz	1.000 MHz	3.634806667 GHz	-27.28 dBm	-14.28 dB
7	7	3.6475 GHz	3.6725 GHz	1.000 MHz	3.647875000 GHz	-43.72 dBm	-18.72 dB

Plot 7-105. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - Mid Channel)



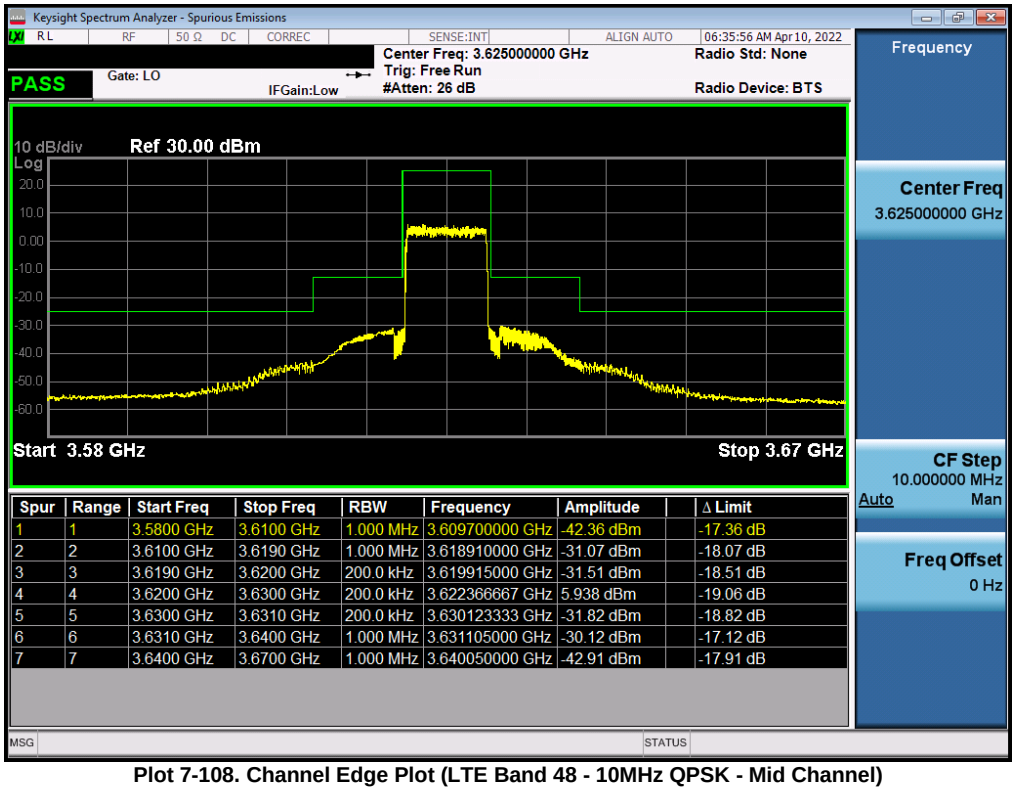
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6450 GHz	3.6700 GHz	1.000 MHz	3.665750000 GHz	-41.63 dBm	-16.63 dB
2	2	3.6700 GHz	3.6840 GHz	1.000 MHz	3.682670000 GHz	-25.67 dBm	-12.67 dB
3	3	3.6840 GHz	3.6850 GHz	300.0 kHz	3.684276667 GHz	-30.25 dBm	-17.25 dB
4	4	3.6850 GHz	3.7000 GHz	300.0 kHz	3.696350000 GHz	5.767 dBm	-19.23 dB
5	5	3.7000 GHz	3.7010 GHz	300.0 kHz	3.700071667 GHz	-29.64 dBm	-16.64 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701990000 GHz	-26.00 dBm	-13.00 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710150000 GHz	-34.56 dBm	-9.558 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720866667 GHz	-43.02 dBm	-3.024 dB

Plot 7-106. Channel Edge Plot (LTE Band 48 - 15MHz QPSK - High Channel)



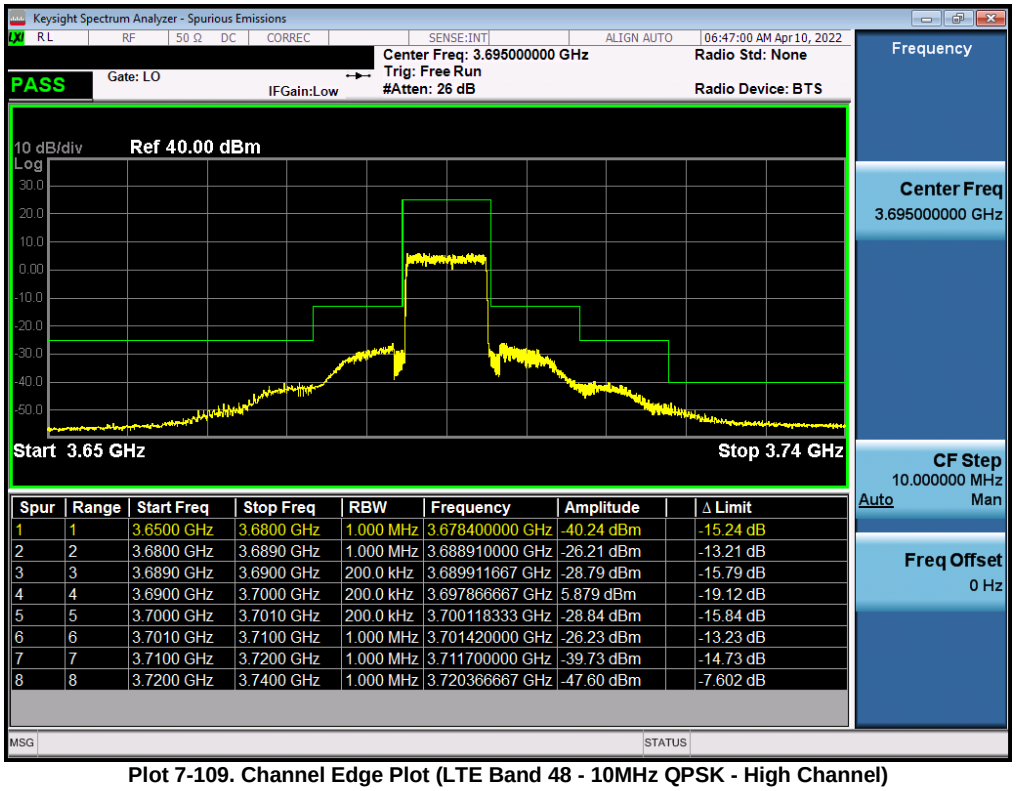
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.529666667 GHz	-55.25 dBm	-15.25 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539983333 GHz	-43.40 dBm	-18.40 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.547380000 GHz	-32.40 dBm	-19.40 dB
4	4	3.5490 GHz	3.5500 GHz	200.0 kHz	3.549995000 GHz	-31.61 dBm	-18.61 dB
5	5	3.5500 GHz	3.5600 GHz	200.0 kHz	3.552950000 GHz	5.913 dBm	-19.09 dB
6	6	3.5600 GHz	3.5610 GHz	200.0 kHz	3.560106667 GHz	-31.75 dBm	-18.75 dB
7	7	3.5610 GHz	3.5700 GHz	1.000 MHz	3.561105000 GHz	-30.40 dBm	-17.40 dB
8	8	3.5700 GHz	3.6000 GHz	1.000 MHz	3.570050000 GHz	-44.33 dBm	-19.33 dB

Plot 7-107. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Low Channel)



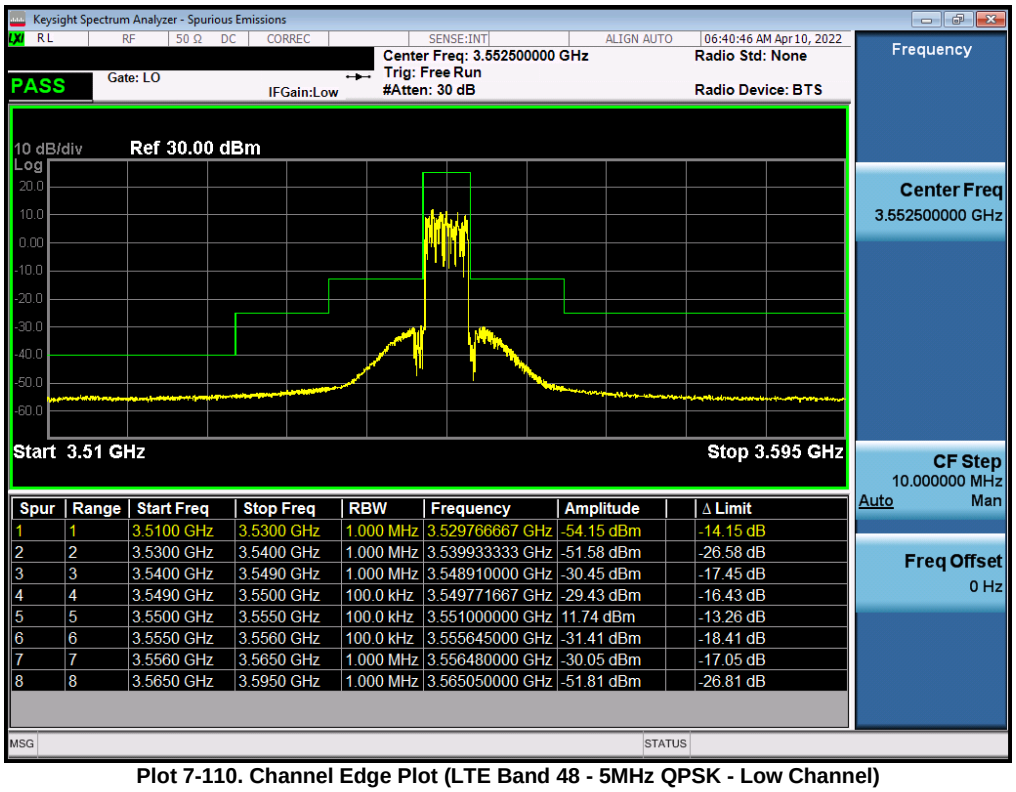
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5800 GHz	3.6100 GHz	1.000 MHz	3.609700000 GHz	-42.36 dBm	-17.36 dB
2	2	3.6100 GHz	3.6190 GHz	1.000 MHz	3.618910000 GHz	-31.07 dBm	-18.07 dB
3	3	3.6190 GHz	3.6200 GHz	200.0 kHz	3.619915000 GHz	-31.51 dBm	-18.51 dB
4	4	3.6200 GHz	3.6300 GHz	200.0 kHz	3.622366667 GHz	5.938 dBm	-19.06 dB
5	5	3.6300 GHz	3.6310 GHz	200.0 kHz	3.630123333 GHz	-31.82 dBm	-18.82 dB
6	6	3.6310 GHz	3.6400 GHz	1.000 MHz	3.631105000 GHz	-30.12 dBm	-17.12 dB
7	7	3.6400 GHz	3.6700 GHz	1.000 MHz	3.640050000 GHz	-42.91 dBm	-17.91 dB

Plot 7-108. Channel Edge Plot (LTE Band 48 - 10MHz QPSK - Mid Channel)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6500 GHz	3.6800 GHz	1.000 MHz	3.678400000 GHz	-40.24 dBm	-15.24 dB
2	2	3.6800 GHz	3.6890 GHz	1.000 MHz	3.688910000 GHz	-26.21 dBm	-13.21 dB
3	3	3.6890 GHz	3.6900 GHz	200.0 kHz	3.689911667 GHz	-28.79 dBm	-15.79 dB
4	4	3.6900 GHz	3.7000 GHz	200.0 kHz	3.697866667 GHz	5.879 dBm	-19.12 dB
5	5	3.7000 GHz	3.7010 GHz	200.0 kHz	3.700118333 GHz	-28.84 dBm	-15.84 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701420000 GHz	-26.23 dBm	-13.23 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.711700000 GHz	-39.73 dBm	-14.73 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720366667 GHz	-47.60 dBm	-7.602 dB

Plot 7-109. Channel Edge Plot (LTE Band 48 - 10MHz 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	3.529766667 GHz	-54.15 dBm	-14.15 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539933333 GHz	-51.58 dBm	-26.58 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548910000 GHz	-30.45 dBm	-17.45 dB
4	4	3.5490 GHz	3.5500 GHz	100.0 kHz	3.549771667 GHz	-29.43 dBm	-16.43 dB
5	5	3.5500 GHz	3.5550 GHz	100.0 kHz	3.551000000 GHz	11.74 dBm	-13.26 dB
6	6	3.5550 GHz	3.5560 GHz	100.0 kHz	3.555645000 GHz	-31.41 dBm	-18.41 dB
7	7	3.5560 GHz	3.5650 GHz	1.000 MHz	3.556480000 GHz	-30.05 dBm	-17.05 dB
8	8	3.5650 GHz	3.5950 GHz	1.000 MHz	3.565050000 GHz	-51.81 dBm	-26.81 dB

Plot 7-110. Channel Edge Plot (LTE Band 48 - 5MHz QPSK - Low Channel)