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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:
11/20 - 12/22/2023
Test Report Issue Date:
1/4/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2311010111-07-R1.A3L

FCC ID:	**A3LSMA356U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-A356U
Additional Models:	SM-A356U1, SM-S356V
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

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

This revised Test Report (S/N: 1M2311010111-07-R1.A3L) supersedes and replaces the previously issued test report (S/N: 1M2311010111-07.A3L) 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.

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	0.120	20.80	37M7G7D
		16QAM	3570.0 - 3680.0	0.128	21.08	37M9W7D
	35 MHz	QPSK	3567.5 - 3682.5	0.128	21.06	32M8G7D
		16QAM	3567.5 - 3682.5	0.131	21.17	32M8W7D
	30 MHz	QPSK	3565.0 - 3685.0	0.123	20.91	28M0G7D
		16QAM	3565.0 - 3685.0	0.127	21.03	28M0W7D
	25 MHz	QPSK	3562.5 - 3687.5	0.123	20.88	23M1G7D
		16QAM	3562.5 - 3687.5	0.130	21.13	23M1W7D
	20 MHz	QPSK	3560.0 - 3690.0	0.120	20.79	18M0G7D
		16QAM	3560.0 - 3690.0	0.099	19.95	17M9W7D
	15 MHz	QPSK	3557.5 - 3692.5	0.122	20.88	13M5G7D
		16QAM	3557.5 - 3692.5	0.099	19.97	13M5W7D
	10 MHz	QPSK	3555.0 - 3695.0	0.121	20.82	9M01G7D
		16QAM	3555.0 - 3695.0	0.102	20.07	8M99W7D
	5 MHz	QPSK	3552.5 - 3697.5	0.124	20.92	4M50G7D
		16QAM	3552.5 - 3697.5	0.107	20.30	4M50W7D

EUT Overview (ANT G)

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

Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	
NR Band n48	40 MHz	π/2 BPSK	3570.0 - 3680.0	0.107	20.31	36M0G7D
		QPSK	3570.0 - 3680.0	0.108	20.34	38M1G7D
		16QAM	3570.0 - 3680.0	0.069	18.41	38M2W7D
	30 MHz	π/2 BPSK	3565.0 - 3685.0	0.107	20.30	27M1G7D
		QPSK	3565.0 - 3685.0	0.108	20.33	28M0G7D
		16QAM	3565.0 - 3685.0	0.069	18.37	28M1W7D
	20 MHz	π/2 BPSK	3560.0 - 3690.0	0.103	20.13	18M1G7D
		QPSK	3560.0 - 3690.0	0.107	20.29	18M4G7D
		16QAM	3560.0 - 3690.0	0.068	18.35	18M4W7D
	15 MHz	π/2 BPSK	3557.5 - 3692.5	0.106	20.25	13M0G7D
		QPSK	3557.5 - 3692.5	0.107	20.29	13M7G7D
		16QAM	3557.5 - 3692.5	0.069	18.37	13M8W7D
	10 MHz	π/2 BPSK	3555.0 - 3695.0	0.106	20.27	8M73G7D
		QPSK	3555.0 - 3695.0	0.108	20.34	8M68G7D
		16QAM	3555.0 - 3695.0	0.068	18.30	8M69W7D

EUT Overview (ANT G)

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: A3LSMA356U**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 and 5G NR Band n48 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.: 2214M, 2317M, 3383M, 3425M, 3440M, 3596M, 3597M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1), 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 C63.26-2015. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

2.4 Software and Firmware

Testing was performed on device(s) using software/firmware version A356USQU0AWJ2 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	1/11/2023	Annual	1/11/2024	AP2-001
-	AP2-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	AP2-002
-	ETS-001	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-001
-	ETS-002	EMC Cable and Switch System	1/11/2023	Annual	1/11/2024	ETS-002
-	LTX4	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTX4
-	LTX5	Licensed Transmitter Cable Set	1/12/2023	Annual	1/12/2024	LTX5
Anritsu	MT8821C	Radio Communication Analyzer	N/A			620152694
Com-Power	AL-130R	9kHz - 30MHz Loop Antenna	1/18/2022	Biennial	1/19/2024	121085
EMCO	3115	Horn Antenna (1-18GHz)	8/8/2022	Biennial	8/8/2024	9704-5182
EMCO	3116	Horn Antenna (18-40GHz)	7/5/2023	Biennial	7/5/2025	9203-2178
Keysight Technologies	N9030A	PXA Signal Analyzer (3Hz-26.5GHz)	8/7/2023	Annual	8/7/2024	MY54490576
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	3/15/2023	Annual	3/15/2024	MY52350166
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	TC-TA18	Cross Polarized Vivaldi Test Antenna	9/28/2022	Biennial	9/28/2024	101058
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	9/25/2023	Annual	9/25/2024	100342
Rohde & Schwarz	ESW44	EMI Test Receiver (2Hz-44GHz)	3/1/2023	Annual	3/1/2024	101716
Rohde & Schwarz	VULB9162	Bi-Log Antenna	2/21/2023	Biennial	2/21/2025	00301
Sunol	DRH-118	Horn Antenna (1-18GHz)	2/14/2022	Biennial	2/14/2024	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	8/30/2022	Biennial	8/30/2024	A051107

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) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMA356U

FCC Classification: Citizens Band End User Devices (CBE)

Mode(s): LTE/NR/ULCA

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 (EUD)	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
	Additional Maximum Power Reduction (A-MPR)	2.1046	N/A	PASS	Section 7.2
	Frequency Stability	2.1055	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
	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 7.9
	Uplink Carrier Aggregation	96.41(e)	-40dBm/MHz at Band Edge and for all out-of-band emissions	PASS	Section 7.4
RADIATED	Equivalent Isotropic Radiated Power (EIRP) (EUD)	96.41(b)	23 dBm/10MHz	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 96.41(e)	-40 dBm/MHz	PASS	Section 7.7

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 v1.2.2.

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.

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.

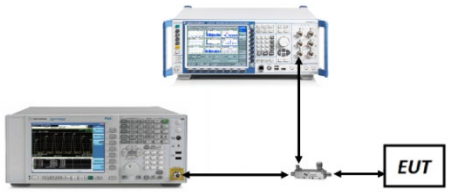


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. 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.

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

3. Conducted power was found to reduce for the higher order QAM modulations when compared to 16QAM. Due to this trend, only the worst-case QAM (16QAM) powers are included in this section.

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

5. 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.

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	22.41
		20	3625.0	1 / 99	20	3644.8	1 / 0	22.34
		20	3690.0	1 / 0	20	3670.2	1 / 99	22.43
	16-QAM	20	3560.0	1 / 99	20	3579.8	1 / 0	21.69
35 MHz	QPSK	20	3560.0	1 / 99	15	3577.1	1 / 0	22.48
		20	3625.0	1 / 99	15	3642.1	1 / 0	22.32
		20	3690.0	1 / 0	15	3672.9	1 / 74	22.41
	16-QAM	20	3625.0	1 / 99	15	3642.1	1 / 0	21.46
30 MHz	QPSK	20	3560.0	1 / 99	10	3574.4	1 / 0	22.43
		20	3625.0	1 / 99	10	3639.4	1 / 0	22.37
		20	3690.0	1 / 0	10	3675.6	1 / 49	22.32
	16-QAM	20	3560.0	1 / 99	10	3574.4	1 / 0	21.68
25 MHz	QPSK	20	3560.0	1 / 99	5	3571.7	1 / 0	22.42
		20	3625.0	1 / 99	5	3636.7	1 / 0	22.28
		20	3690.0	1 / 0	5	3678.3	1 / 24	22.45
	16-QAM	20	3690.0	1 / 0	5	3678.3	1 / 24	21.56

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

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	3560	100	0	3579.8	100	0	≤ 11	QPSK	0	21.50	11.63
												16-QAM	1	20.50	11.66
2				20 + 20	3560	1	99	3579.8	1	0	≤ 11	QPSK	0	21.50	17.61
												16-QAM	1	20.50	17.57
3				20 + 20	3605.1	100	0	3624.9	100	0	≤ 4.5	QPSK	0	21.50	17.65
												16-QAM	1	20.50	17.58
4				20 + 20	3605.1	1	99	3624.9	1	0	≤ 4.5	QPSK	0	21.50	17.34
												16-QAM	1	20.50	17.42
5				20 + 20	3670.1	100	0	3689.9	100	0	≤ 11	QPSK	0	21.50	11.41
												16-QAM	1	20.50	11.39
6				20 + 20	3670.1	1	99	3689.9	1	0	≤ 11	QPSK	0	21.50	17.41
												16-QAM	1	20.50	17.36

Table 7-3. Conducted Power Output Data (LTE ULCA Band 48 -A-MPR)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
20 MHz	QPSK	55340	3560.0	1 / 49	22.34
		55990	3625.0	1 / 49	20.83
		56640	3690.0	1 / 49	21.41
	16-QAM	55340	3560.0	1 / 49	21.48
15 MHz	QPSK	55315	3557.5	1 / 19	22.37
		55990	3625.0	1 / 19	20.92
		56665	3692.5	1 / 19	21.56
	16-QAM	55315	3557.5	1 / 19	21.49
10 MHz	QPSK	55290	3555.0	1 / 22	22.19
		55990	3625.0	1 / 22	20.86
		56690	3695.0	1 / 22	21.34
	16-QAM	55290	3555.0	1 / 1	21.45
5 MHz	QPSK	55265	3552.5	1 / 5	22.36
		55990	3625.0	1 / 5	20.96
		56715	3697.5	1 / 5	21.56
	16-QAM	56715	3697.5	1 / 1	21.34

Table 7-4. Conducted Power Output Data (LTE Band 48)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 53	21.53
		641666	3625.0	1 / 53	21.62
		645332	3680.0	1 / 53	21.43
	QPSK	638000	3570.0	1 / 53	21.50
		641666	3625.0	1 / 53	21.58
		645332	3680.0	1 / 53	21.49
	16-QAM	638000	3570.0	1 / 53	19.69
30 MHz	π/2 BPSK	637666	3565.0	1 / 39	21.44
		641666	3625.0	1 / 39	21.61
		645666	3685.0	1 / 39	21.46
	QPSK	637666	3565.0	1 / 39	21.44
		641666	3625.0	1 / 39	21.57
		645666	3685.0	1 / 39	21.57
	16-QAM	641666	3625.0	1 / 39	19.54
20 MHz	π/2 BPSK	637334	3560.0	1 / 25	21.42
		641666	3625.0	1 / 25	21.44
		646000	3690.0	1 / 25	21.48
	QPSK	637334	3560.0	1 / 25	21.48
		641666	3625.0	1 / 25	21.53
		646000	3690.0	1 / 25	21.46
	16-QAM	641666	3625.0	1 / 25	19.52
15 MHz	π/2 BPSK	637166	3557.5	1 / 19	21.32
		641666	3625.0	1 / 19	21.56
		646166	3692.5	1 / 19	21.46
	QPSK	637166	3557.5	1 / 19	21.42
		641666	3625.0	1 / 19	21.53
		646166	3692.5	1 / 19	21.49
	16-QAM	646166	3692.5	1 / 19	19.55
10 MHz	π/2 BPSK	637000	3555.0	1 / 12	21.33
		641666	3625.0	1 / 12	21.58
		646332	3695.0	1 / 12	21.55
	QPSK	637000	3555.0	1 / 12	21.36
		641666	3625.0	1 / 12	21.58
		646332	3695.0	1 / 12	21.55
	16-QAM	646332	3695.0	1 / 12	19.58

Table 7-5. Conducted Power Output Data (NR Band n48 ANT G)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 104	17.51
		641666	3625.0	1 / 1	17.97
		645332	3680.0	1 / 1	18.46
	QPSK	638000	3570.0	1 / 104	17.31
		641666	3625.0	1 / 1	17.94
		645332	3680.0	1 / 1	18.30
	16-QAM	638000	3570.0	1 / 104	16.24
		641666	3625.0	1 / 1	16.75
		645332	3680.0	1 / 1	16.79

Table 7-6. Conducted Power Output Data (NR Band n48 ANT B)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 53	18.68
		641666	3625.0	1 / 53	18.85
		645332	3680.0	1 / 53	18.99
	QPSK	638000	3570.0	1 / 53	19.07
		641666	3625.0	1 / 53	19.27
		645332	3680.0	1 / 53	19.49
	16-QAM	638000	3570.0	1 / 53	17.51
		641666	3625.0	1 / 53	17.69
		645332	3680.0	1 / 104	18.13

Table 7-7. Conducted Power Output Data (NR Band n48 ANT K)

Bandwidth	Modulation	Channel	Frequency [MHz]	RB Size/Offset	Conducted Power [dBm]
40 MHz	π/2 BPSK	638000	3570.0	1 / 1	16.47
		641666	3625.0	1 / 53	16.42
		645332	3680.0	1 / 53	17.73
	QPSK	638000	3570.0	1 / 1	16.62
		641666	3625.0	1 / 53	16.79
		645332	3680.0	1 / 53	17.83
	16-QAM	638000	3570.0	1 / 1	15.28
		641666	3625.0	1 / 53	15.05
		645332	3680.0	1 / 53	15.38

Table 7-8. Conducted Power Output Data (NR Band n48 ANT L)

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.

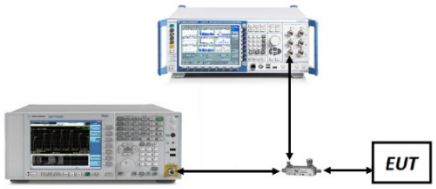


Figure 7-2. Test Instrument & Measurement Setup

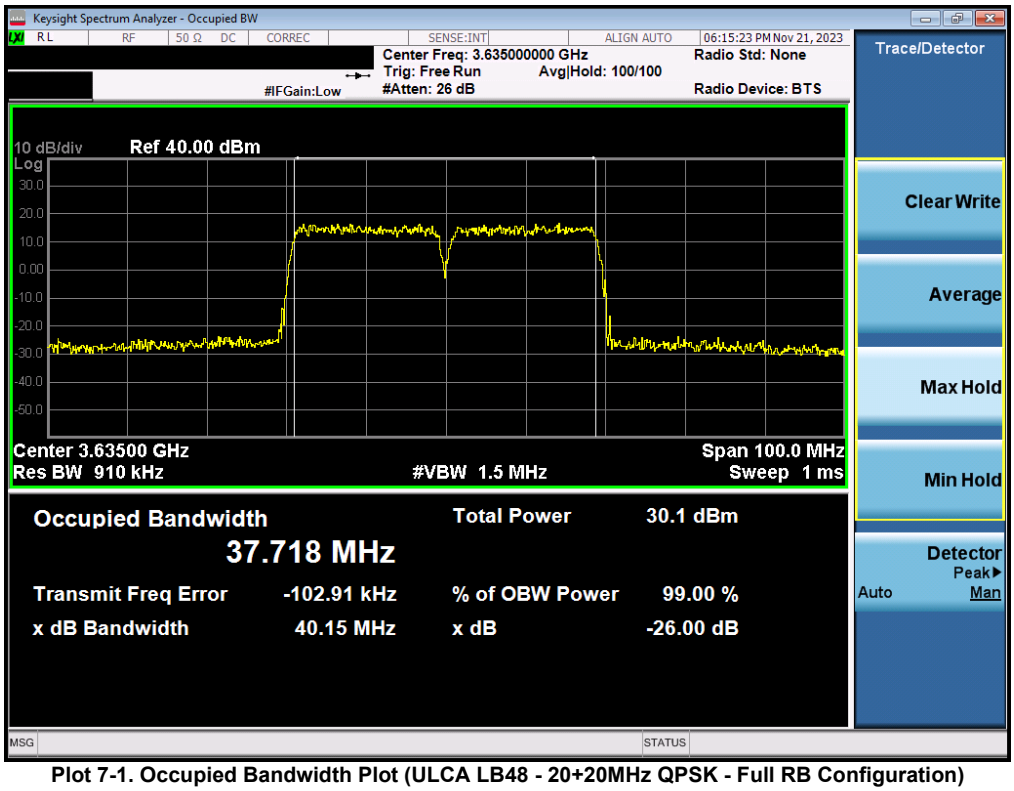
Test Notes

1. Occupied Bandwidth was only measured on the antenna (Ant F) with the highest power for each band.
2. Only the worst case data for each Modulation/Channel Bandwidth combination is displayed in the following plots.

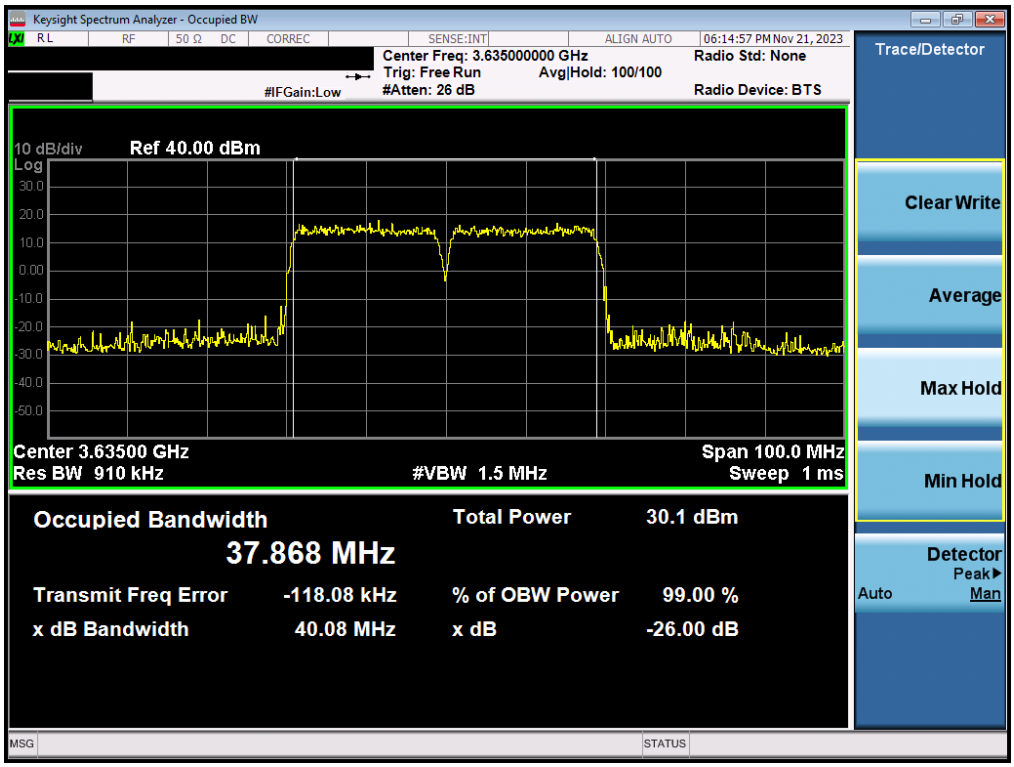
LTE Band 48

Mode	Bandwidth	Modulation	OBW [MHz]
LTE-B48	20MHz	QPSK	17.96
		16QAM	17.94
	15MHz	QPSK	13.55
		16QAM	13.50
	10MHz	QPSK	9.01
		16QAM	8.99
	5MHz	QPSK	4.50
		16QAM	4.50
LTE-B48 ULCA	20+20MHz	QPSK	37.72
		16QAM	37.87
	20+15MHz	QPSK	32.79
		16QAM	32.81
	20+10MHz	QPSK	27.97
		16QAM	27.97
	20+5MHz	QPSK	23.05
		16QAM	23.15

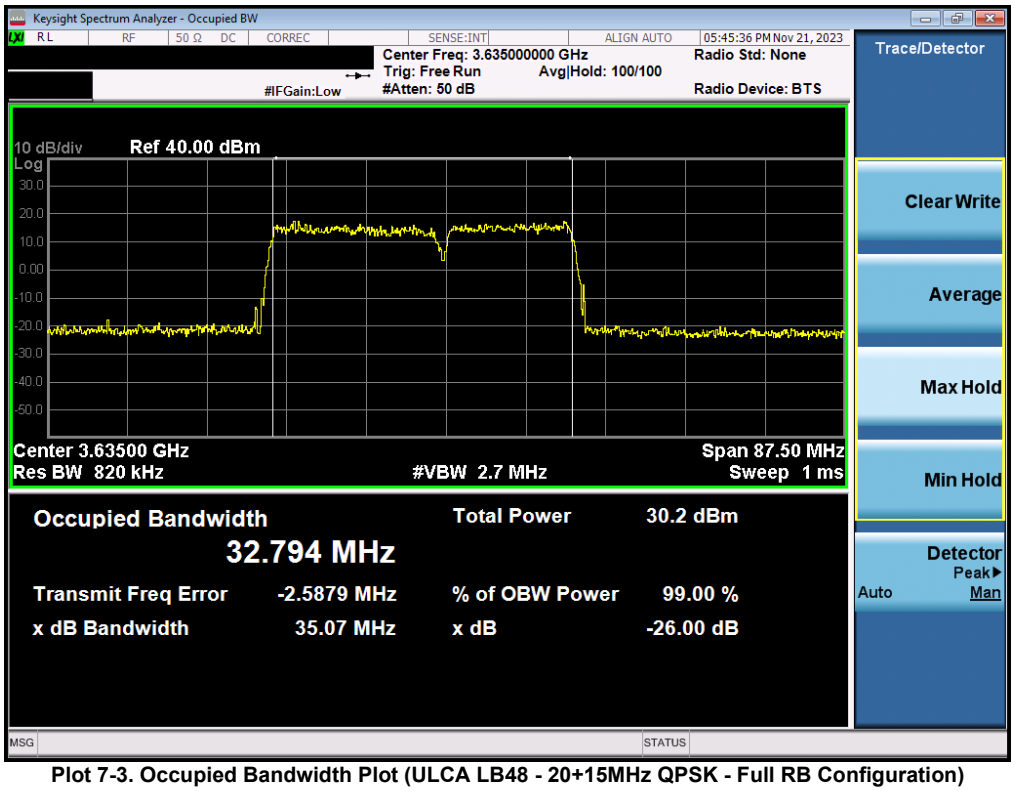
Table 7-9. Occupied Bandwidth Test Result (LTE Band 48)



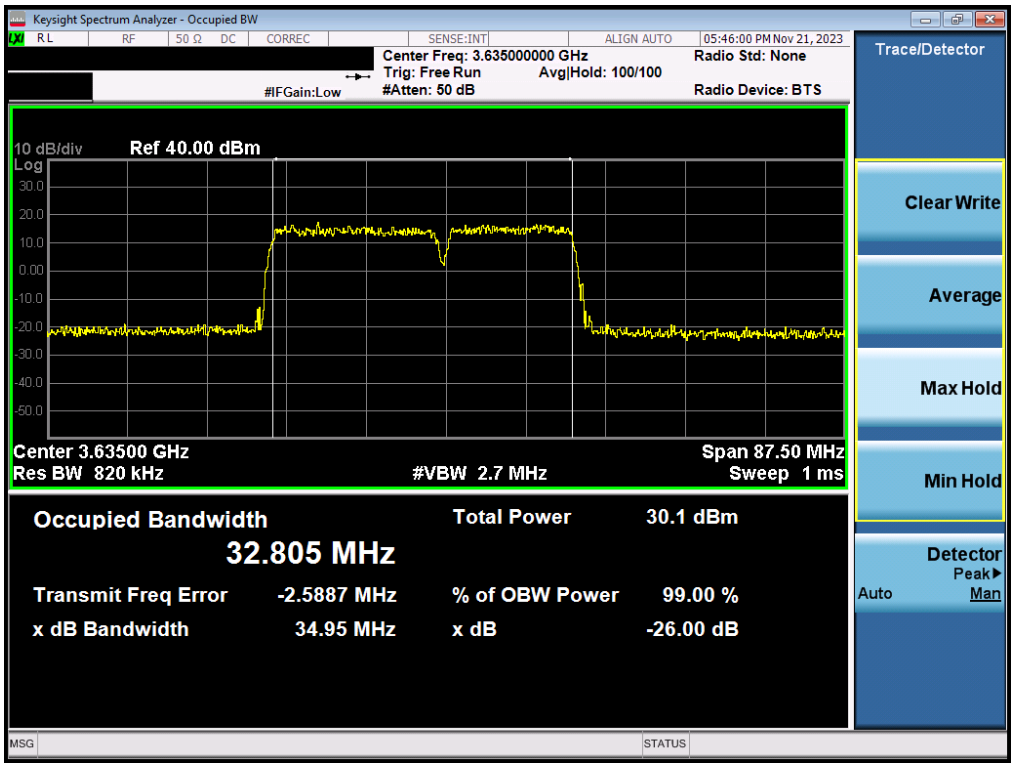
Plot 7-1. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz QPSK - Full RB Configuration)



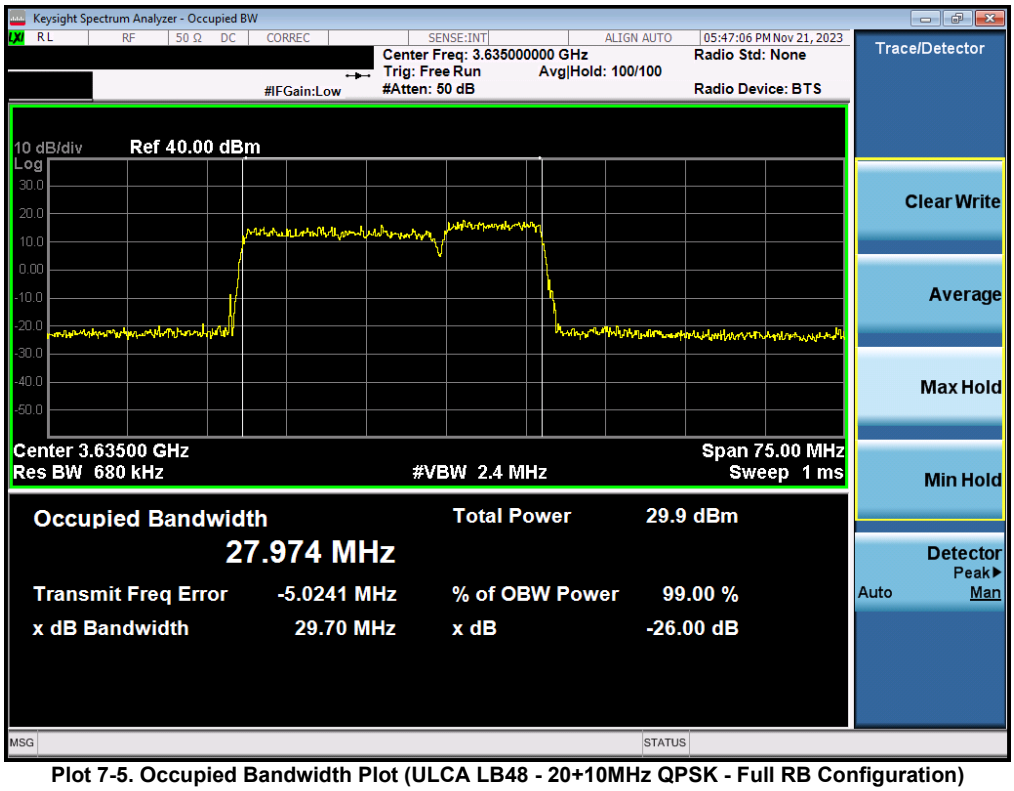
Plot 7-2. Occupied Bandwidth Plot (ULCA LB48 - 20+20MHz 16-QAM - Full RB Configuration)



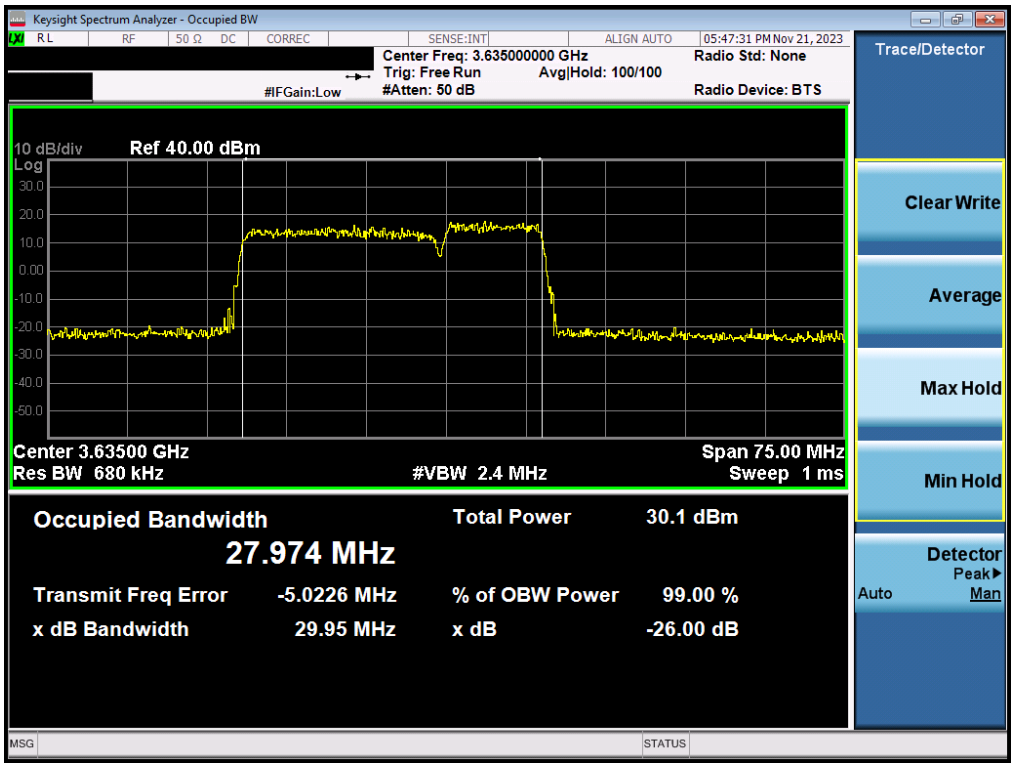
Plot 7-3. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz QPSK - Full RB Configuration)



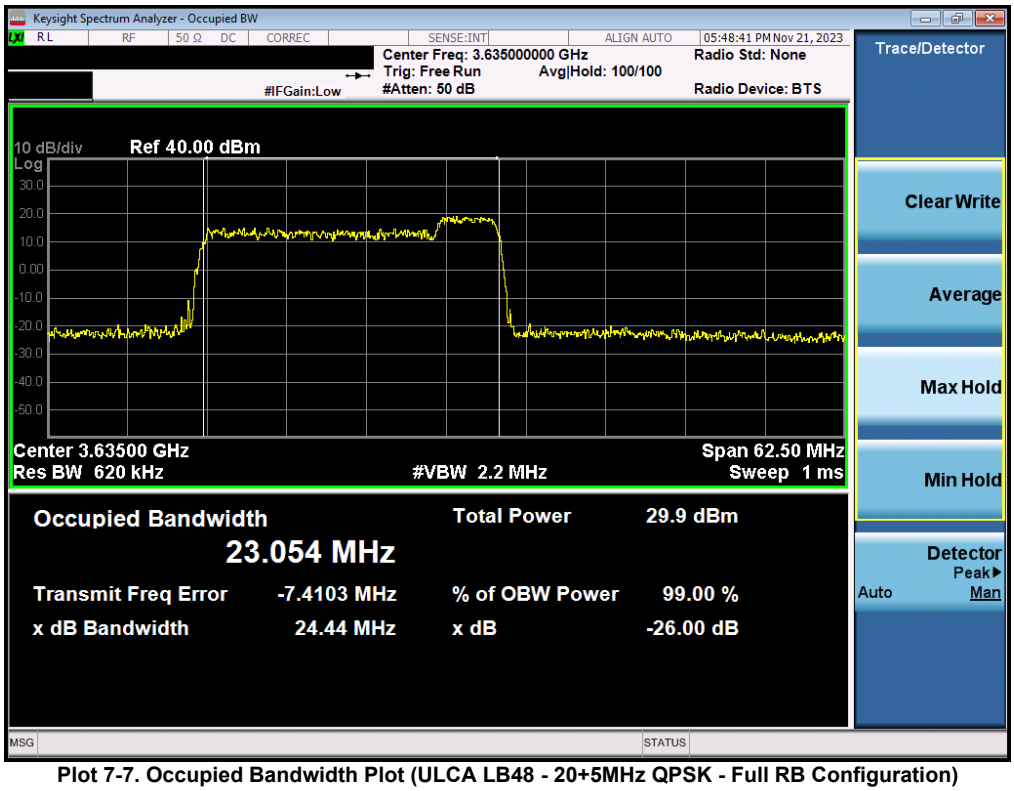
Plot 7-4. Occupied Bandwidth Plot (ULCA LB48 - 20+15MHz 16-QAM - Full RB Configuration)



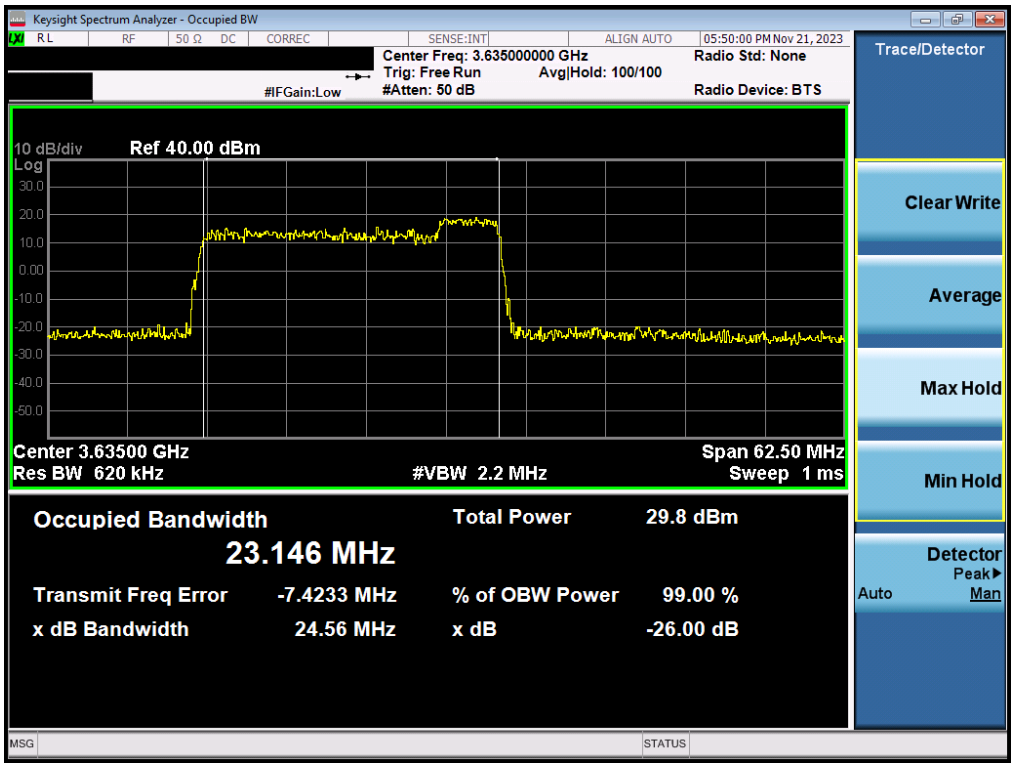
Plot 7-5. Occupied Bandwidth Plot (ULCA LB48 - 20+10MHz QPSK - Full RB Configuration)



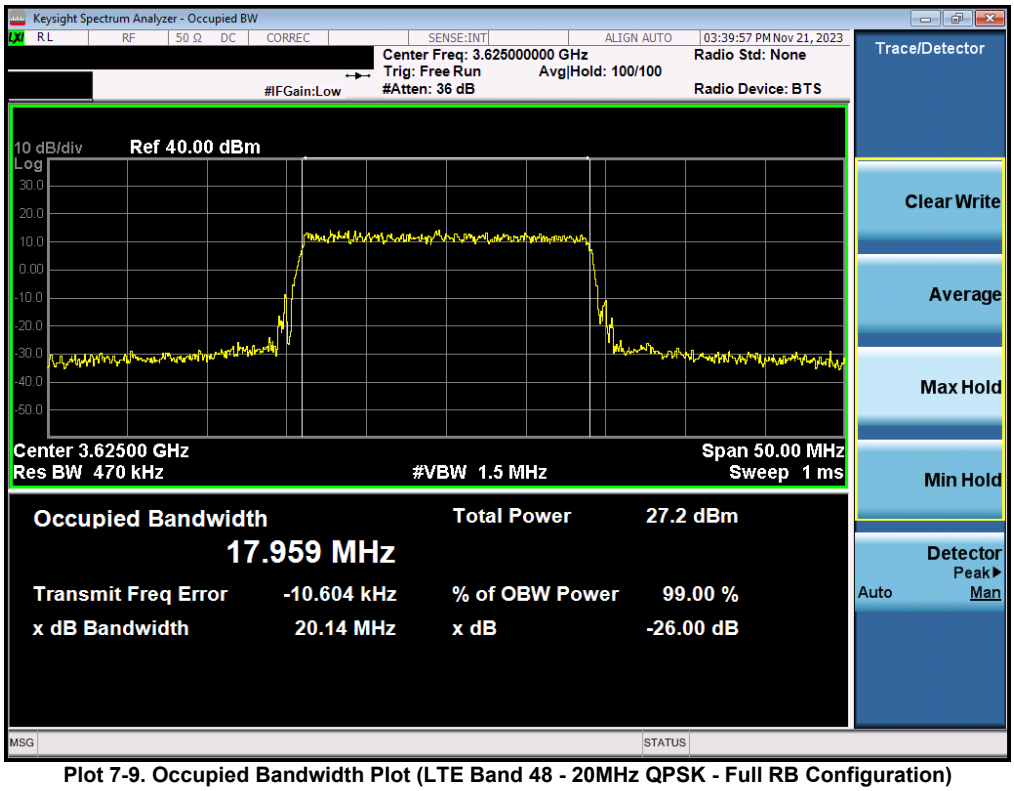
Plot 7-6. Occupied Bandwidth Plot (ULCA LB48 - 20+10MHz 16-QAM - Full RB Configuration)



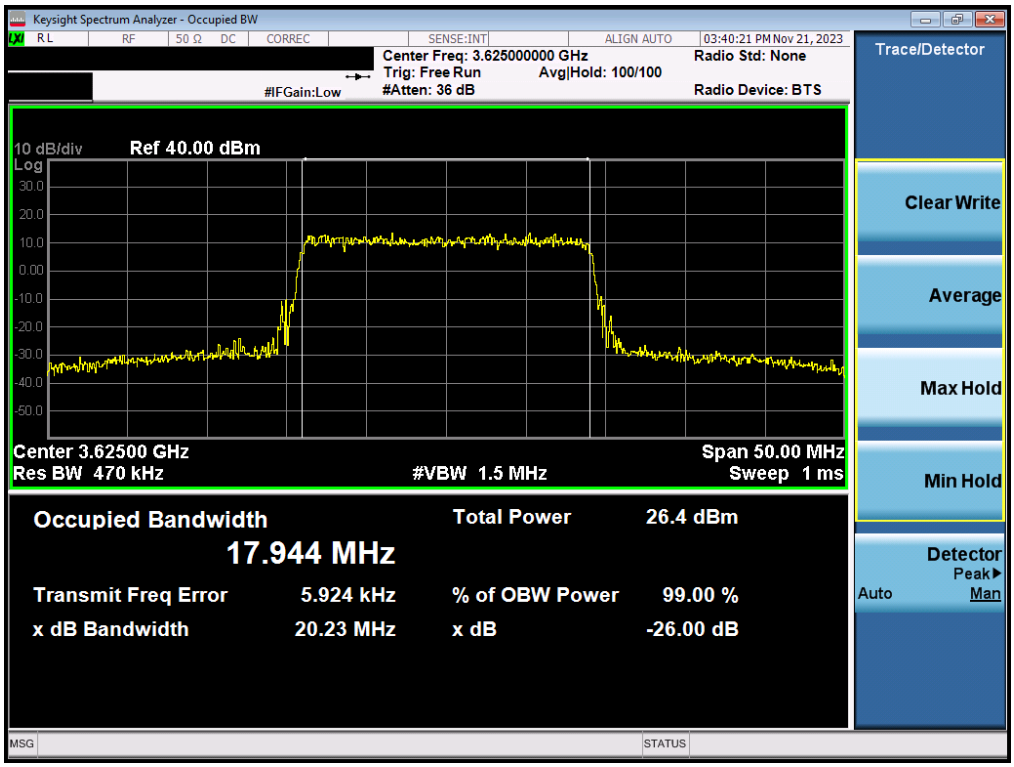
Plot 7-7. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz QPSK - Full RB Configuration)



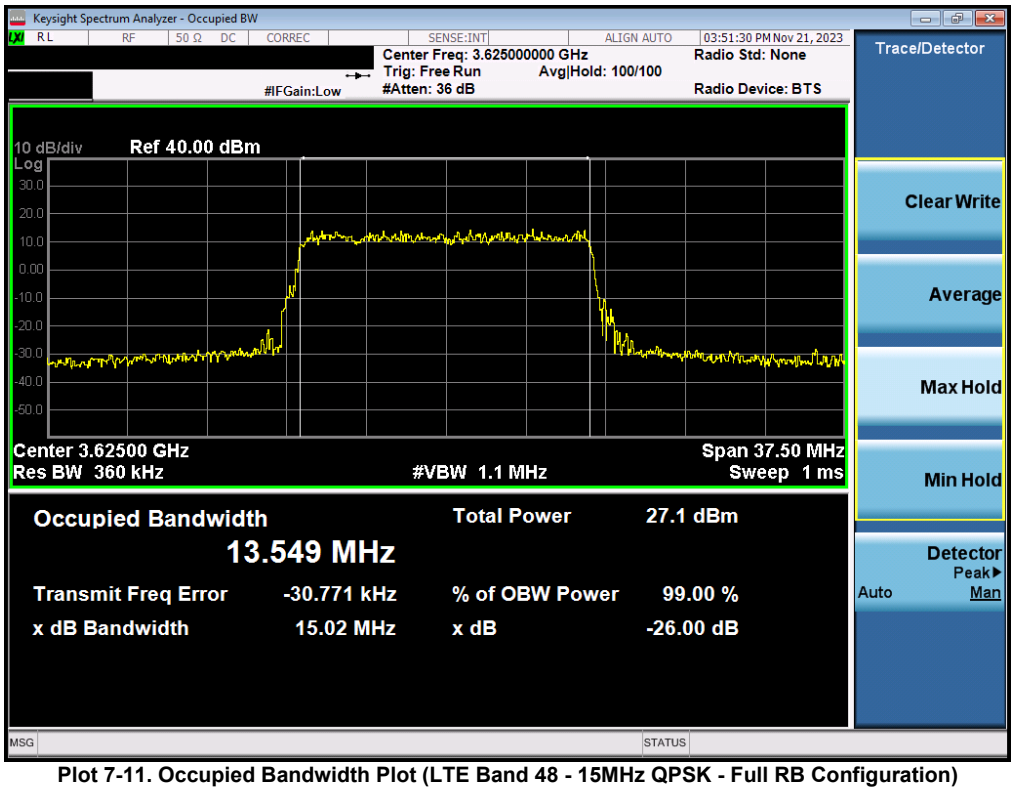
Plot 7-8. Occupied Bandwidth Plot (ULCA LB48 - 20+5MHz 16-QAM - Full RB Configuration)



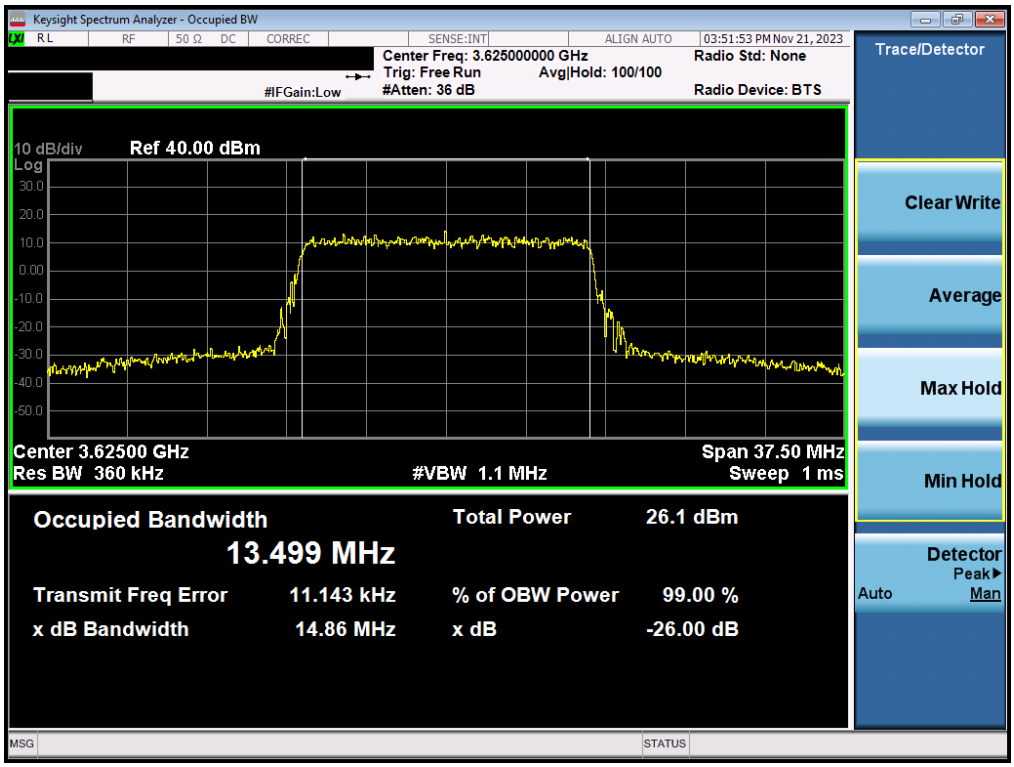
Plot 7-9. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)



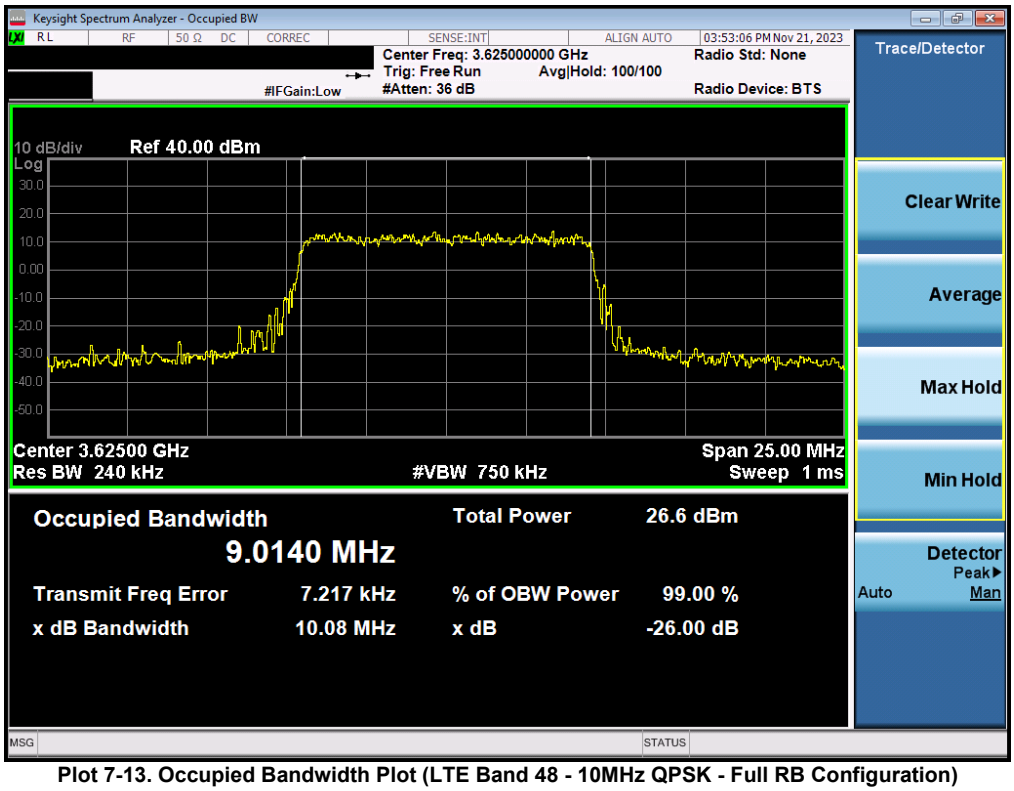
Plot 7-10. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)



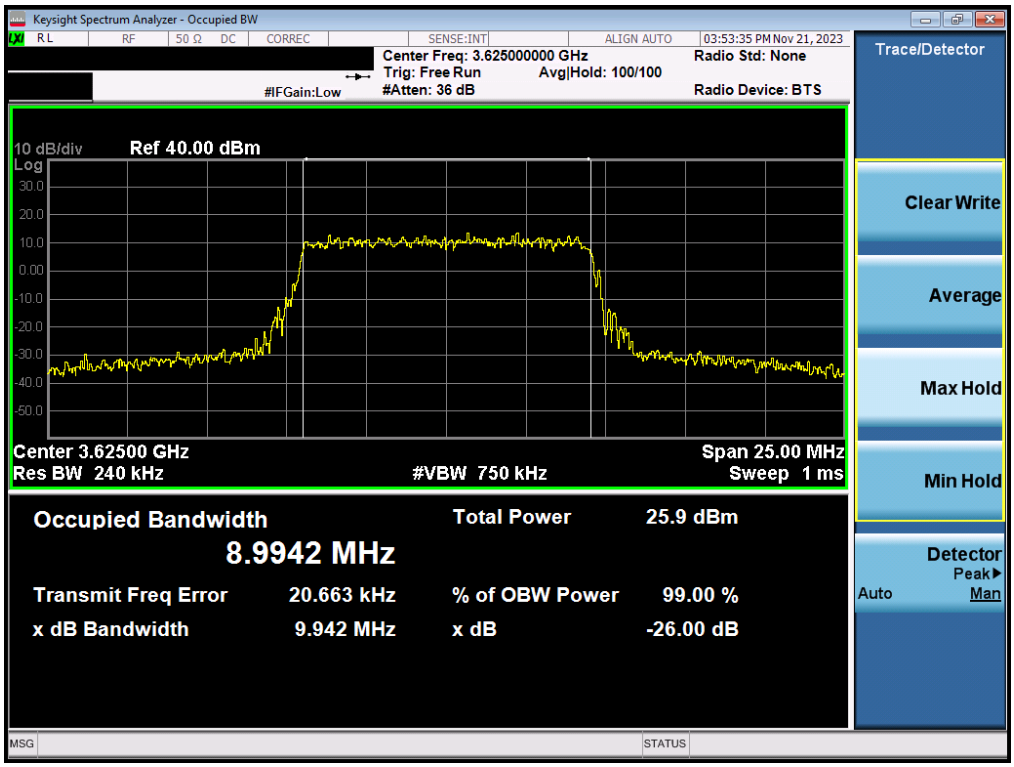
Plot 7-11. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)



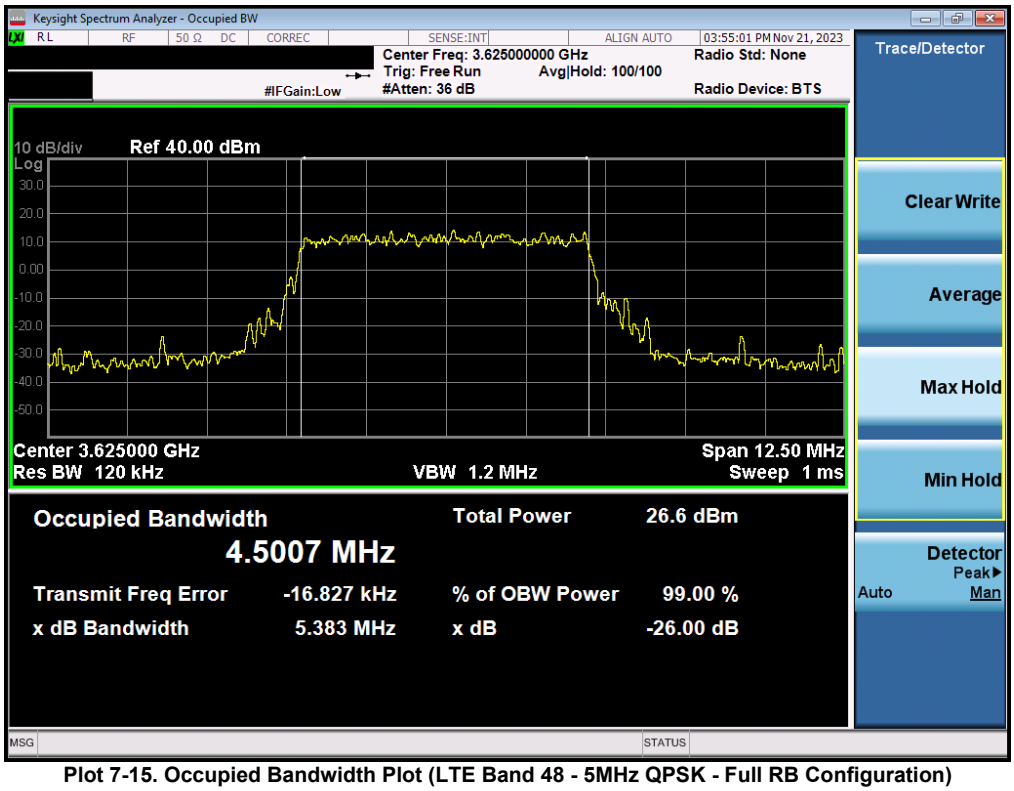
Plot 7-12. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)



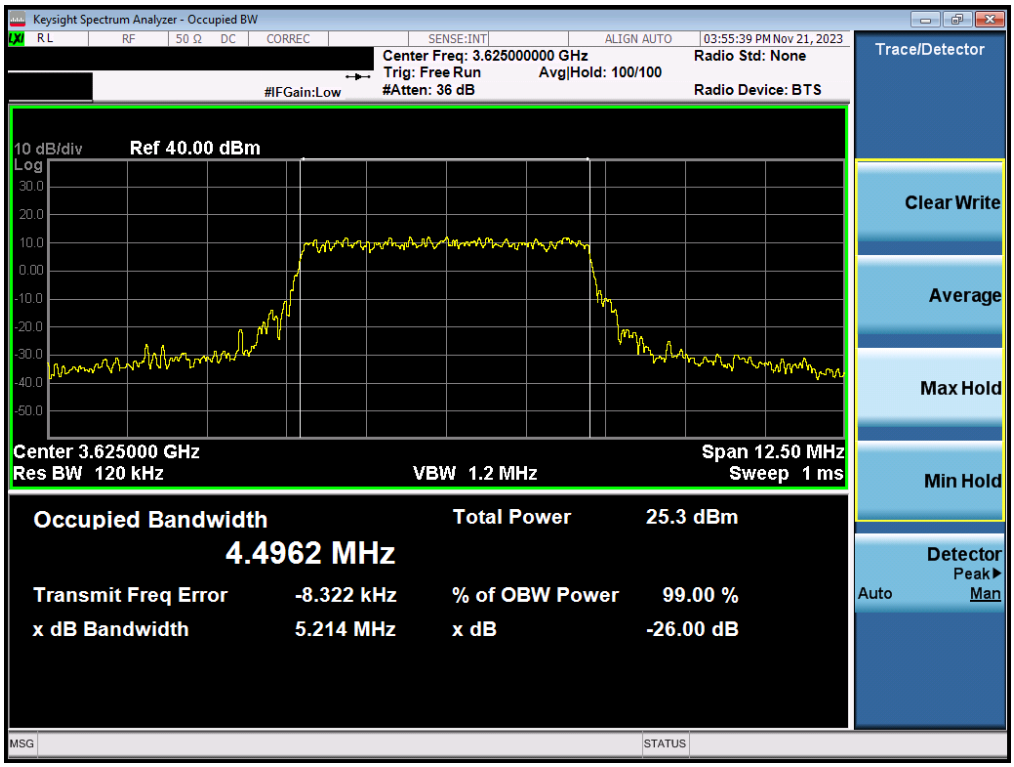
Plot 7-13. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)



Plot 7-14. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 16-QAM - Full RB Configuration)



Plot 7-15. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

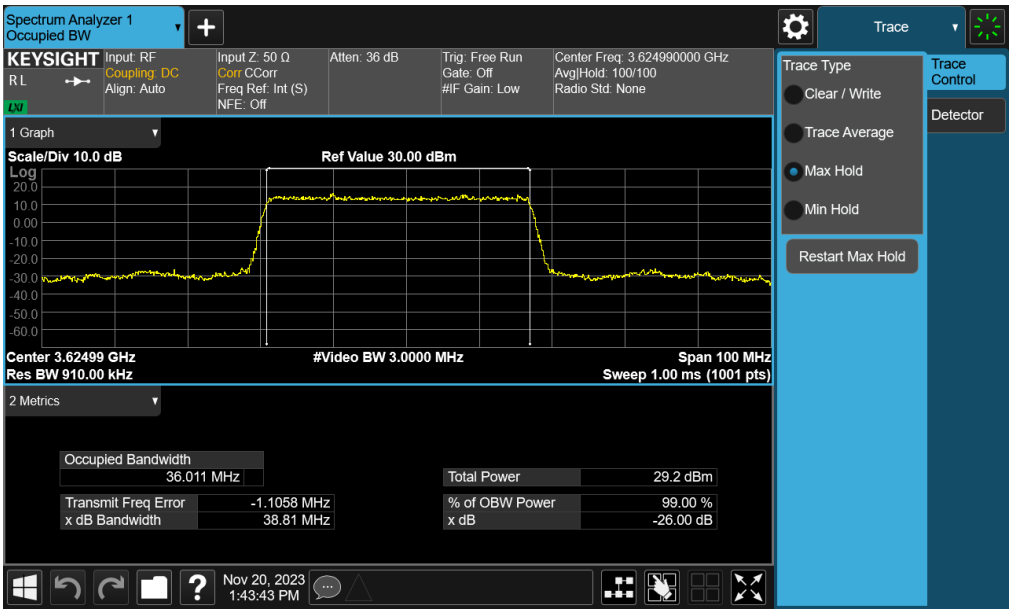


Plot 7-16. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

NR Band n48 ANT G

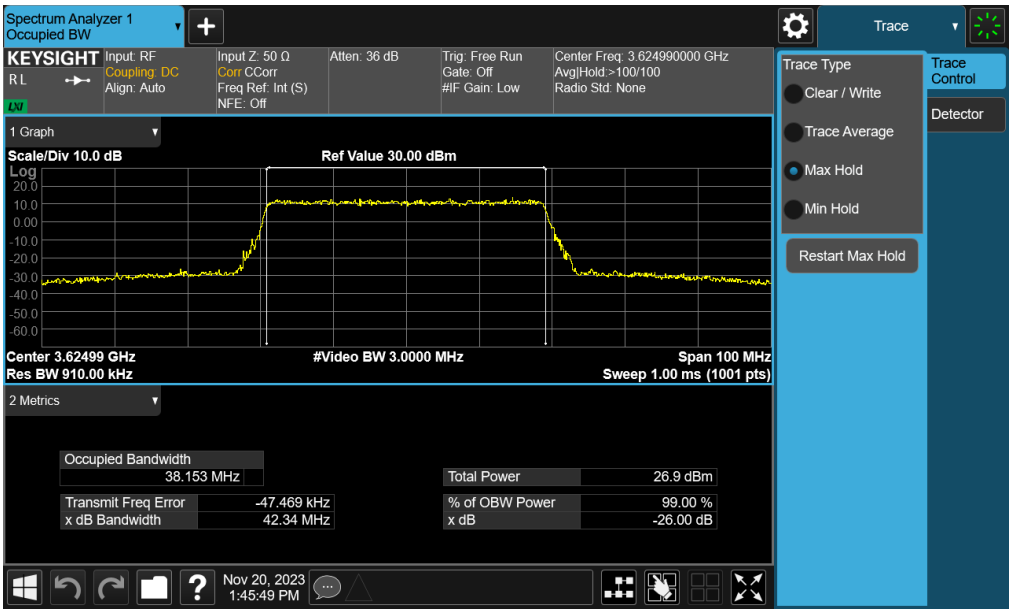
Mode	Bandwidth	Modulation	OBW [MHz]
NR-n48	40MHz	BPSK	36.01
		QPSK	38.14
		16QAM	38.15
	30MHz	BPSK	27.06
		QPSK	28.02
		16QAM	28.06
	20MHz	BPSK	18.08
		QPSK	18.37
		16QAM	18.37
	15MHz	BPSK	13.03
		QPSK	13.69
		16QAM	13.75
	10MHz	BPSK	8.73
		QPSK	8.68
		16QAM	8.69

Table 7-10. Occupied Bandwidth Test Result (NR Band n48)

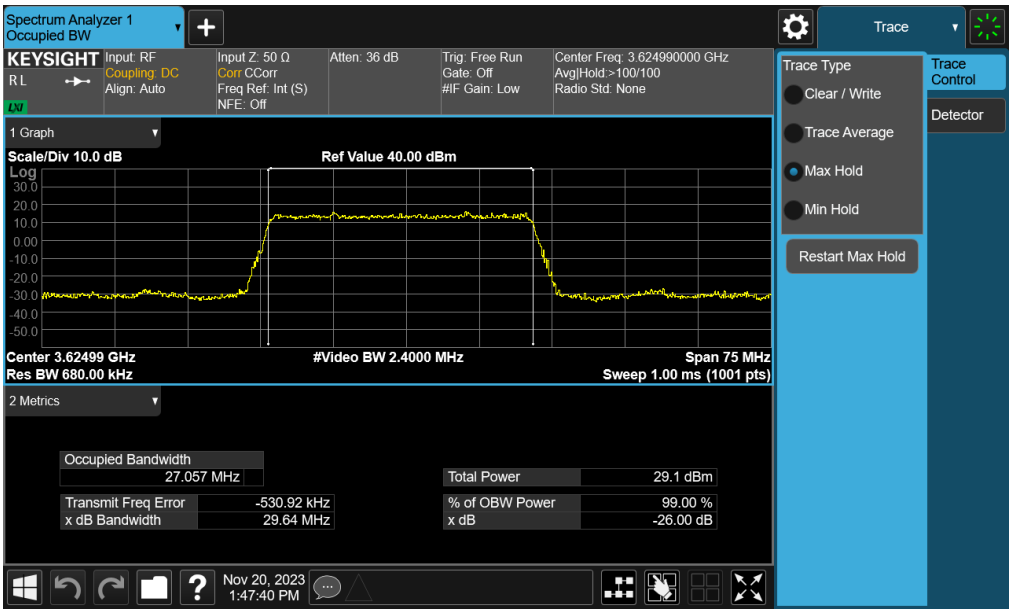


Plot 7-17. Occupied Bandwidth Plot (NR Band n48 - 40MHz π/2 BPSK - Full RB Configuration)

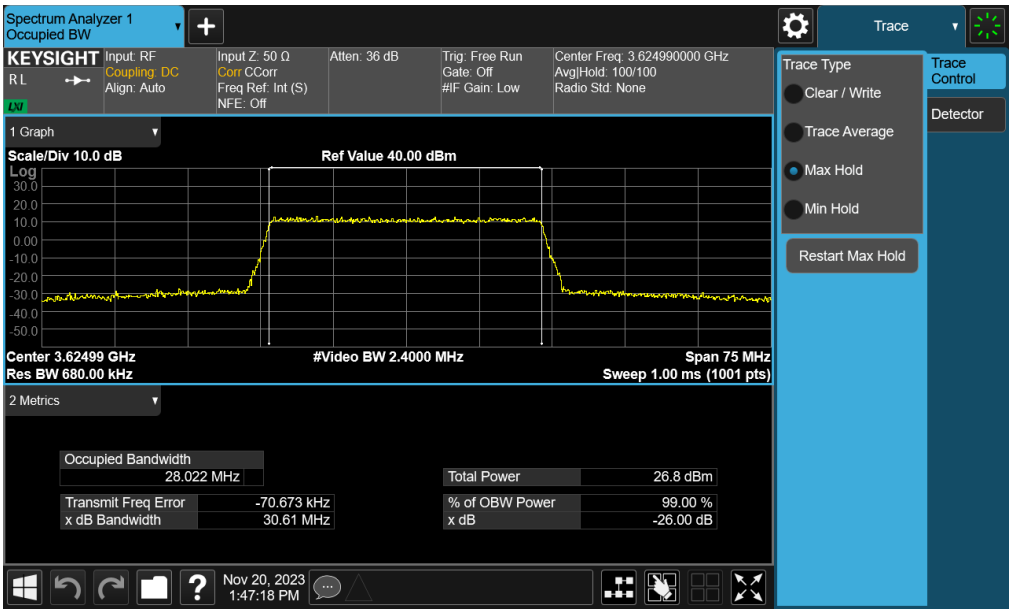
Plot 7-18. Occupied Bandwidth Plot (NR Band n48 - 40MHz QPSK - Full RB Configuration)



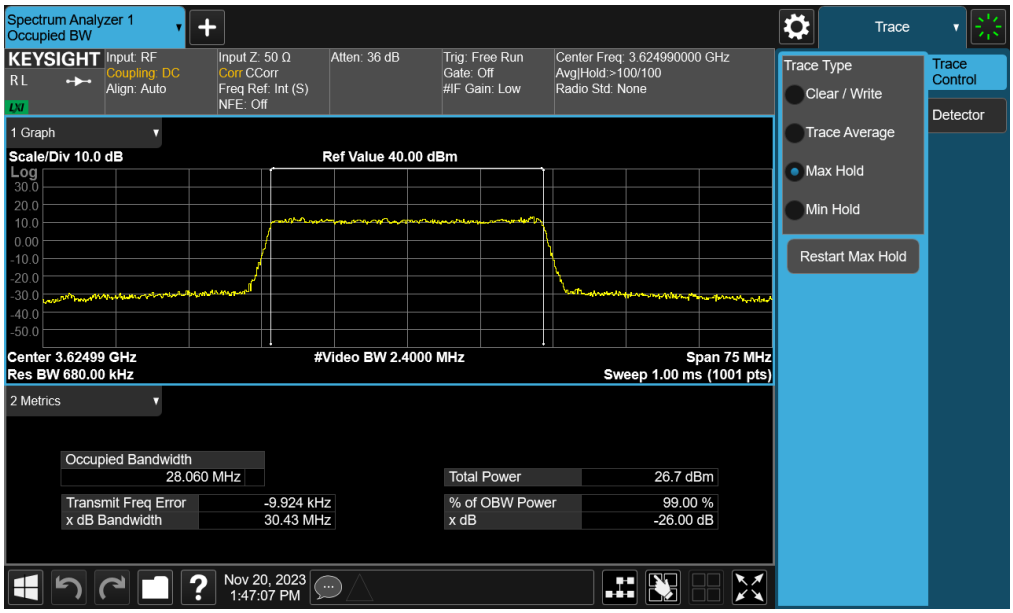
Plot 7-19. Occupied Bandwidth Plot (NR Band n48 - 40MHz 16-QAM - Full RB Configuration)



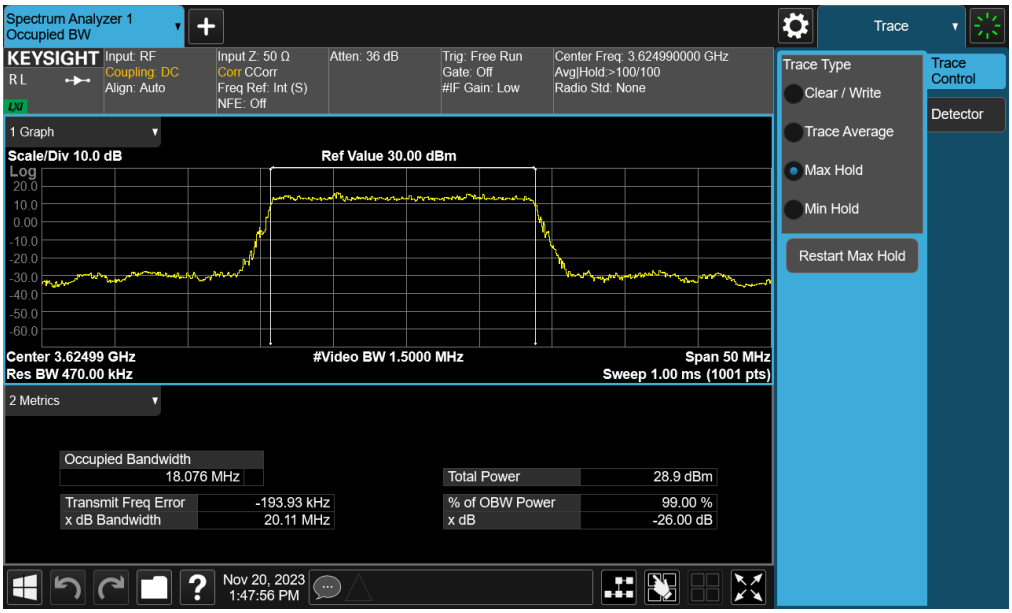
Plot 7-20. Occupied Bandwidth Plot (NR Band n48 - 30MHz π/2 BPSK - Full RB Configuration)



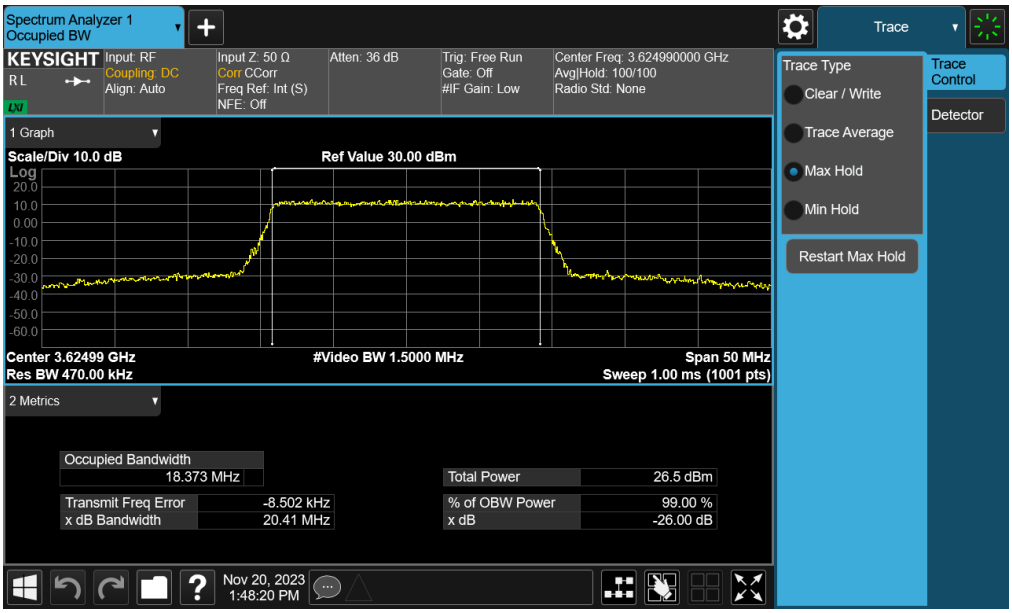
Plot 7-21. Occupied Bandwidth Plot (NR Band n48 - 30MHz QPSK - Full RB Configuration)



Plot 7-22. Occupied Bandwidth Plot (NR Band n48 - 30MHz 16-QAM - Full RB Configuration)

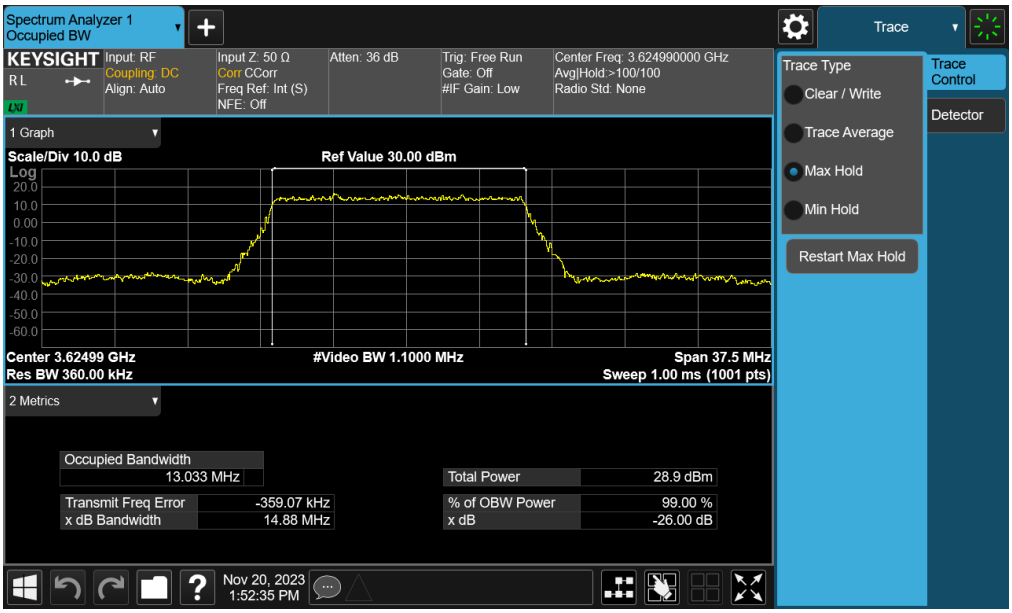


Plot 7-23. Occupied Bandwidth Plot (NR Band n48 - 20MHz π/2 BPSK - Full RB Configuration)

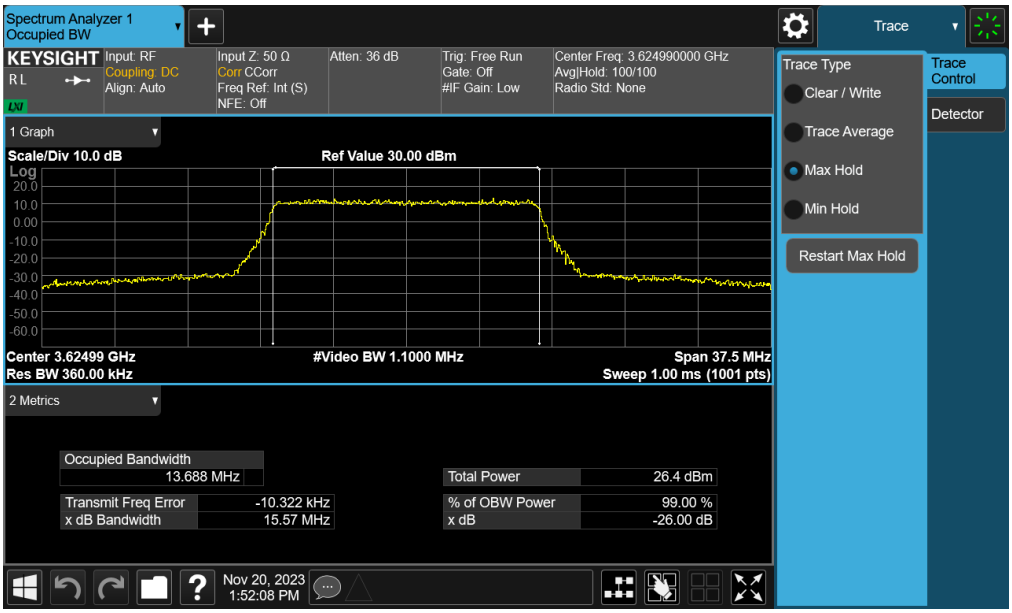


Plot 7-24. Occupied Bandwidth Plot (NR Band n48 - 20MHz QPSK - Full RB Configuration)

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



Plot 7-26. Occupied Bandwidth Plot (NR Band n48 - 15MHz π/2 BPSK - Full RB Configuration)



Plot 7-27. Occupied Bandwidth Plot (NR Band n48 - 15MHz QPSK - Full RB Configuration)

Plot 7-28. Occupied Bandwidth Plot (NR Band n48 - 15MHz 16-QAM - Full RB Configuration)

Plot 7-29. Occupied Bandwidth Plot (NR Band n48 - 10MHz π/2 BPSK - Full RB Configuration)

Plot 7-30. Occupied Bandwidth Plot (NR Band n48 - 10MHz QPSK - Full RB Configuration)

Plot 7-31. Occupied Bandwidth Plot (NR Band n48 - 10MHz 16-QAM - Full RB Configuration)

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.

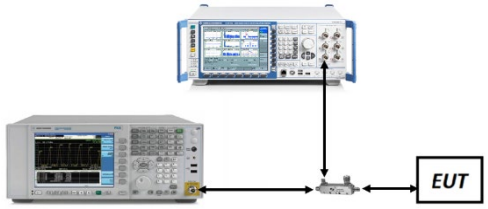


Figure 7-3. Test Instrument & Measurement Setup

Test Notes

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

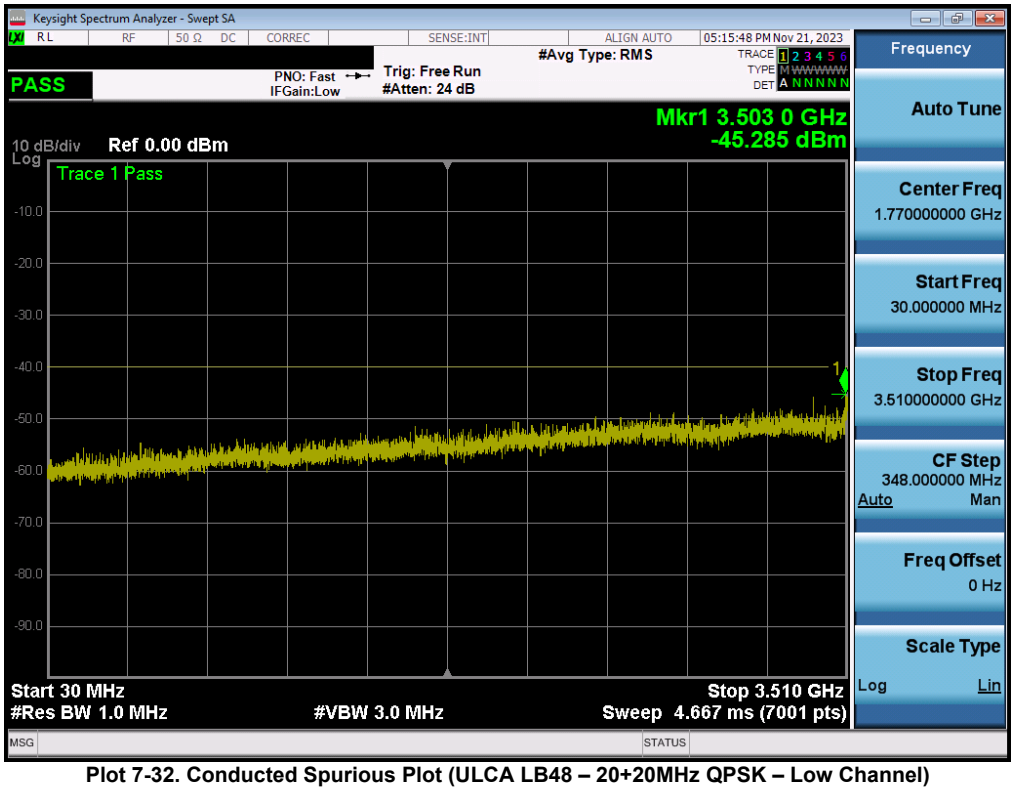
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

3. All test cases were measured and included in the test result tables. Plots representative of the worst case are included in this section.

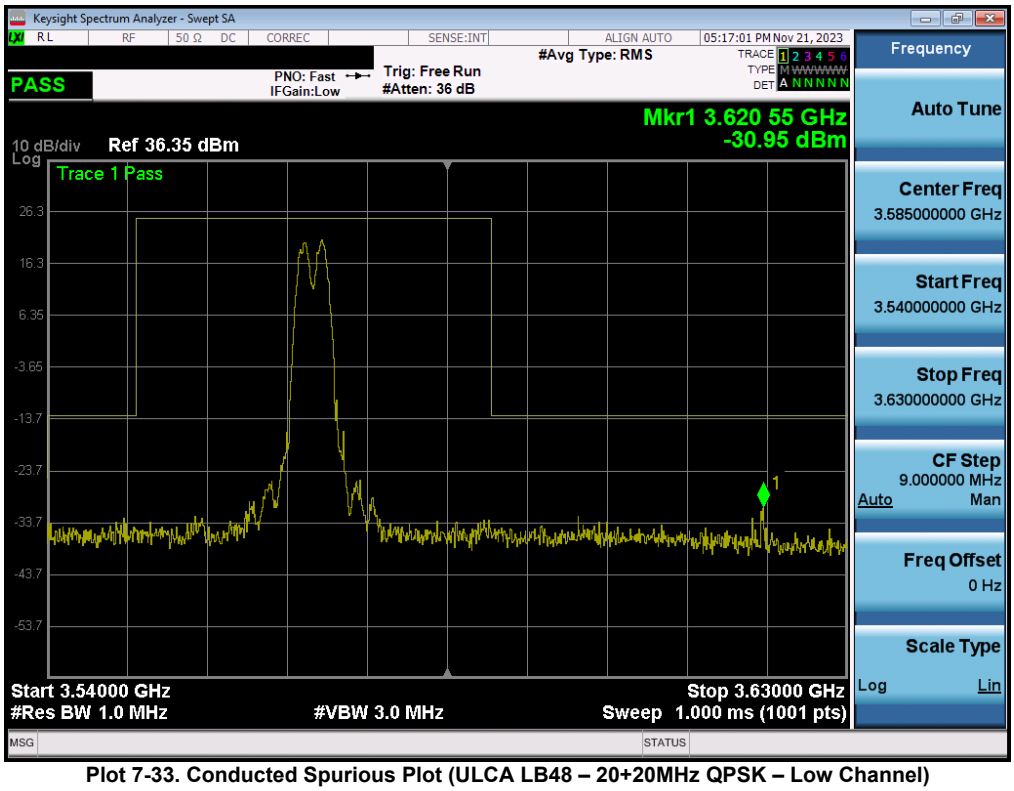
LTE Band 48 ULCA

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B48	20+20MHz	Low	30.0 - 3510.0	-45.29	-40	-5.29
		Low	3540.0 - 3630.0	-30.95	-	-
		Low	3610.0 - 15000.0	-51.81	-40	-11.81
		Low	15000.0 - 27000.0	-51.49	-40	-11.48
		Low	27000.0 - 40000.0	-48.17	-40	-8.17
		Mid	30.0 - 3575.0	-47.90	-40	-7.90
		Mid	3575.0 - 3720.0	-35.07	-	-
		Mid	3675.0 - 15000.0	-48.70	-40	-8.70
		Mid	15000.0 - 27000.0	-51.08	-40	-11.08
		Mid	27000.0 - 40000.0	-47.35	-40	-7.35
		High	30.0 - 3640.0	-45.74	-40	-5.74
		High	3620.0 - 3710.0	-32.96	-	-
		High	3740.0 - 15000.0	-45.31	-40	-5.31
		High	15000.0 - 27000.0	-51.12	-40	-11.12
		High	27000.0 - 40000.0	-48.45	-40	-8.45

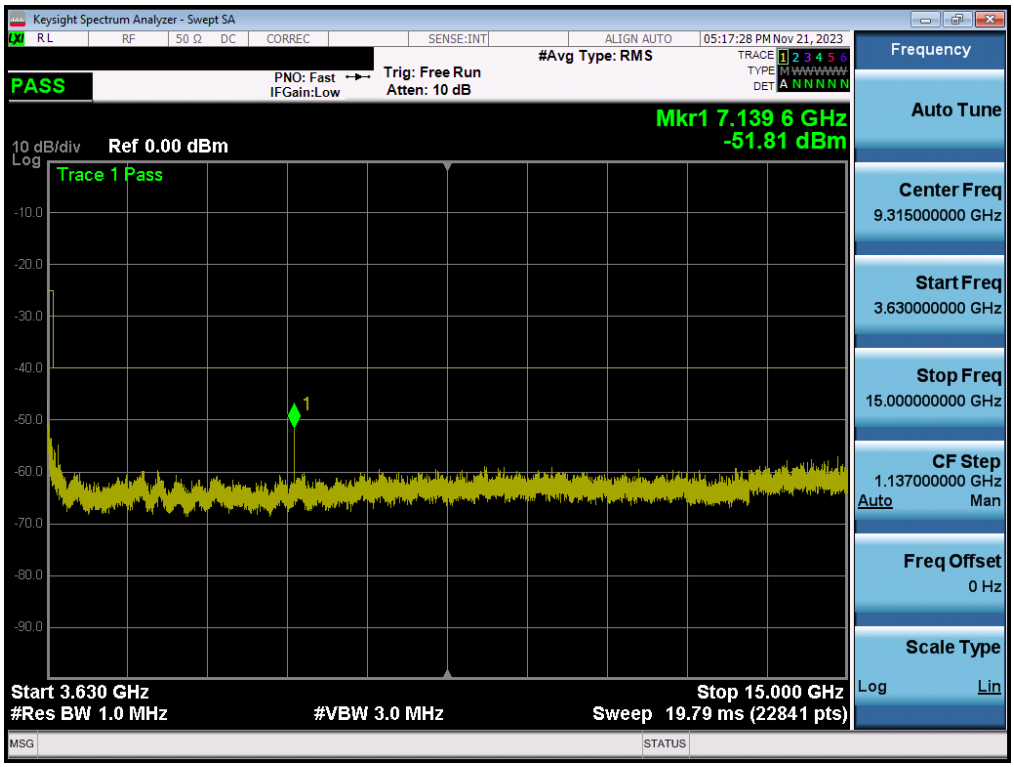
Table 7-11. Spurious and Harmonic Emissions Test Result (LTE ULCA Band 48)



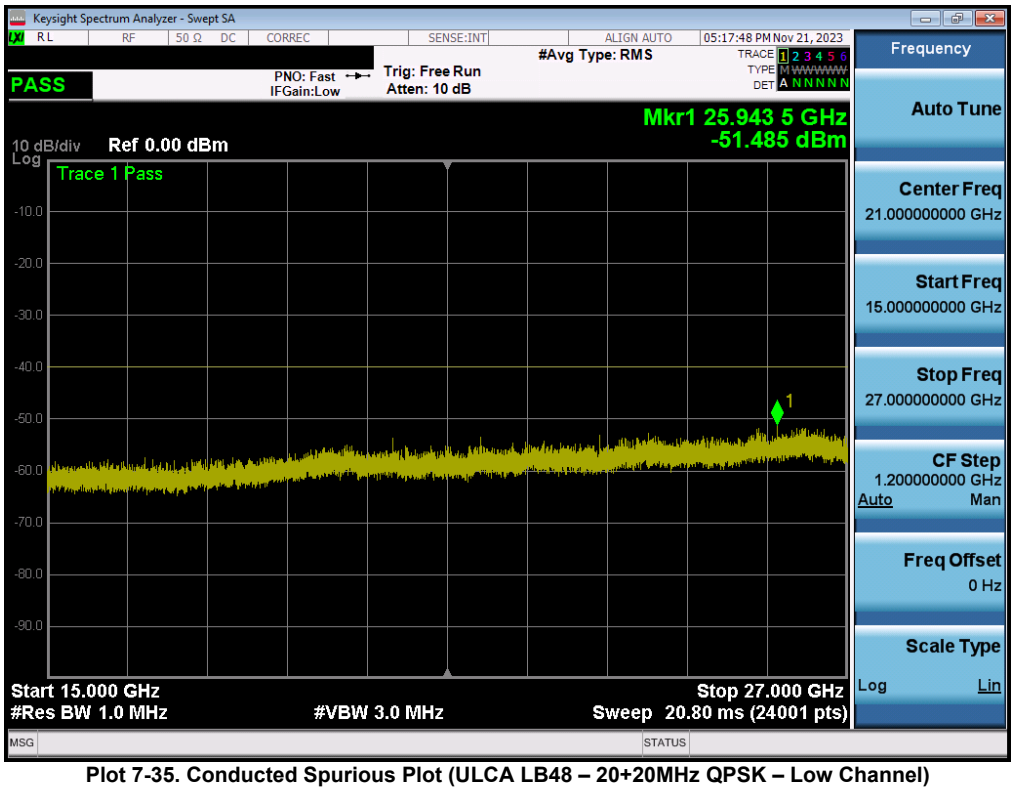
Plot 7-32. Conducted Spurious Plot (ULCA LB48 – 20+20MHz QPSK – Low Channel)



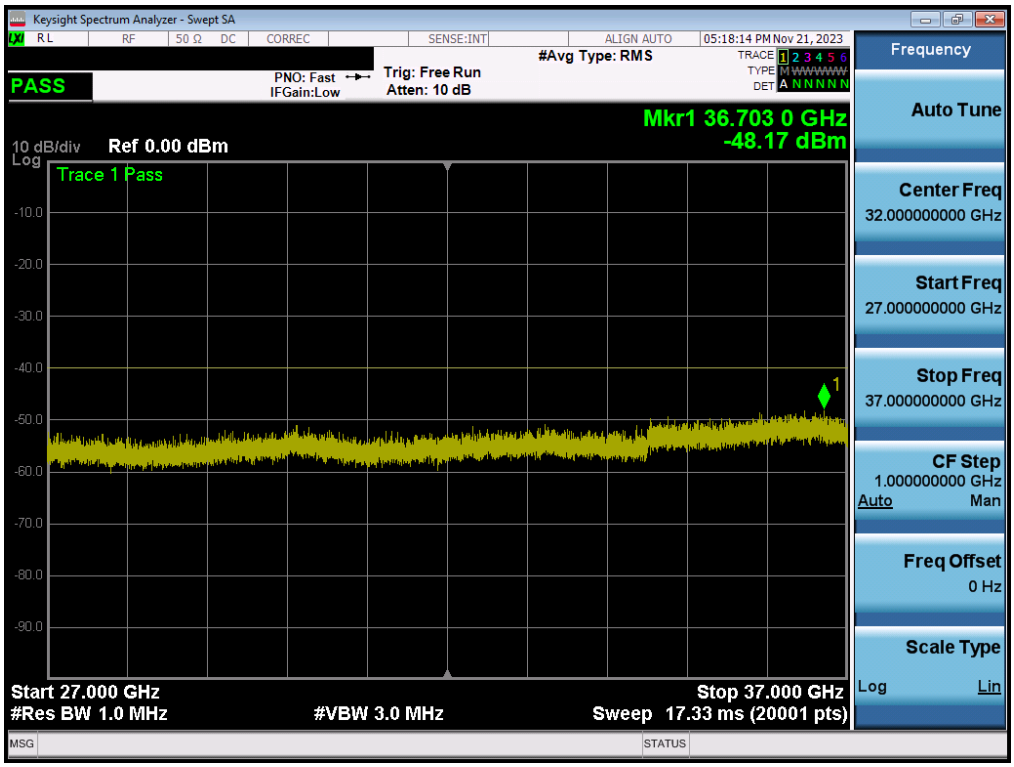
Plot 7-33. Conducted Spurious Plot (ULCA LB48 – 20+20MHz QPSK – Low Channel)



Plot 7-34. Conducted Spurious Plot (ULCA LB48 – 20+20MHz QPSK – Low Channel)



Plot 7-35. Conducted Spurious Plot (ULCA LB48 – 20+20MHz QPSK – Low Channel)

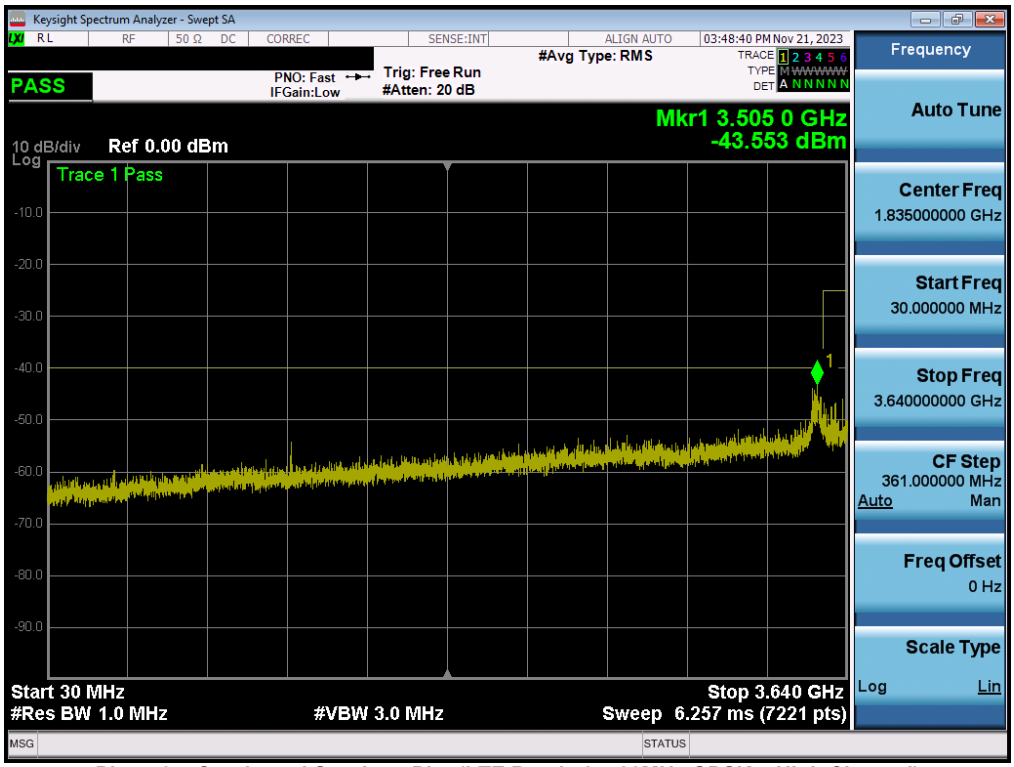


Plot 7-36. Conducted Spurious Plot (ULCA LB48 – 20+20MHz QPSK – Low Channel)

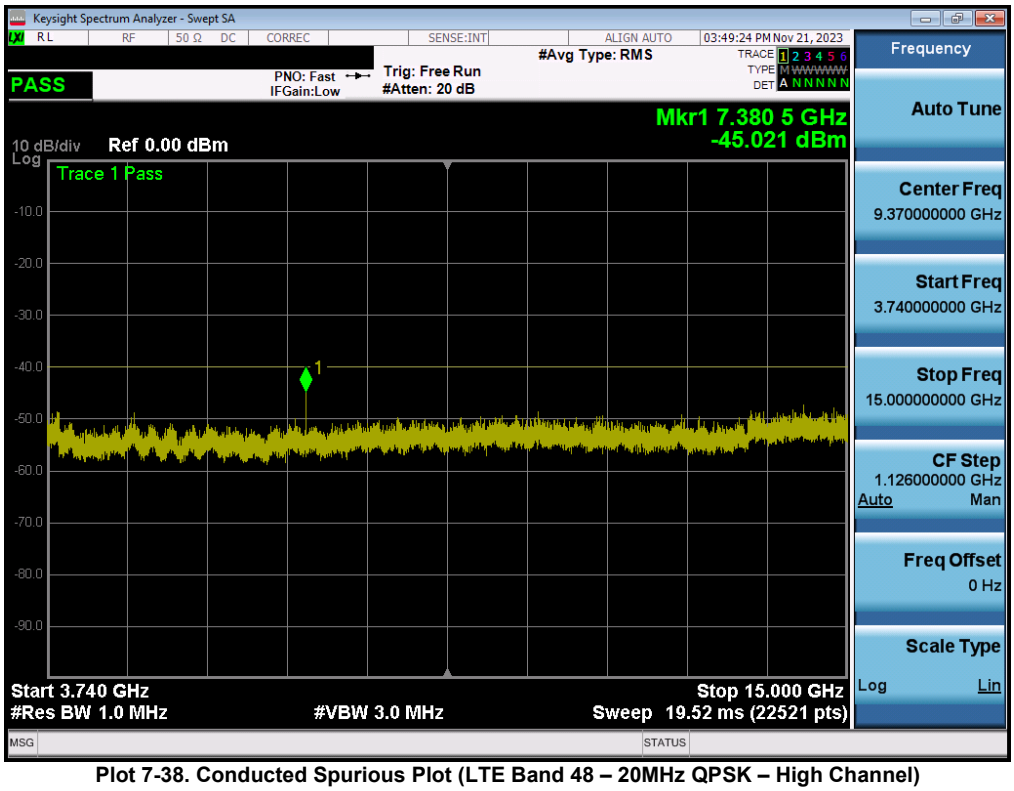
LTE Band 48

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B48	20MHz	Low	30.0 - 3510.0	-44.78	-40	-4.78
		Low	3610.0 - 15000.0	-47.59	-40	-7.59
		Low	15000.0 - 27000.0	-51.34	-40	-11.34
		Low	27000.0 - 40000.0	-47.73	-40	-7.73
		Mid	30.0 - 3575.0	-46.22	-40	-6.22
		Mid	3675.0 - 15000.0	-46.27	-40	-6.27
		Mid	15000.0 - 27000.0	-51.54	-40	-11.54
		Mid	27000.0 - 40000.0	-47.36	-40	-7.36
		High	30.0 - 3640.0	-43.55	-40	-3.55
		High	3740.0 - 15000.0	-45.02	-40	-5.02
		High	15000.0 - 27000.0	-50.96	-40	-10.96
		High	27000.0 - 40000.0	-46.88	-40	-6.88

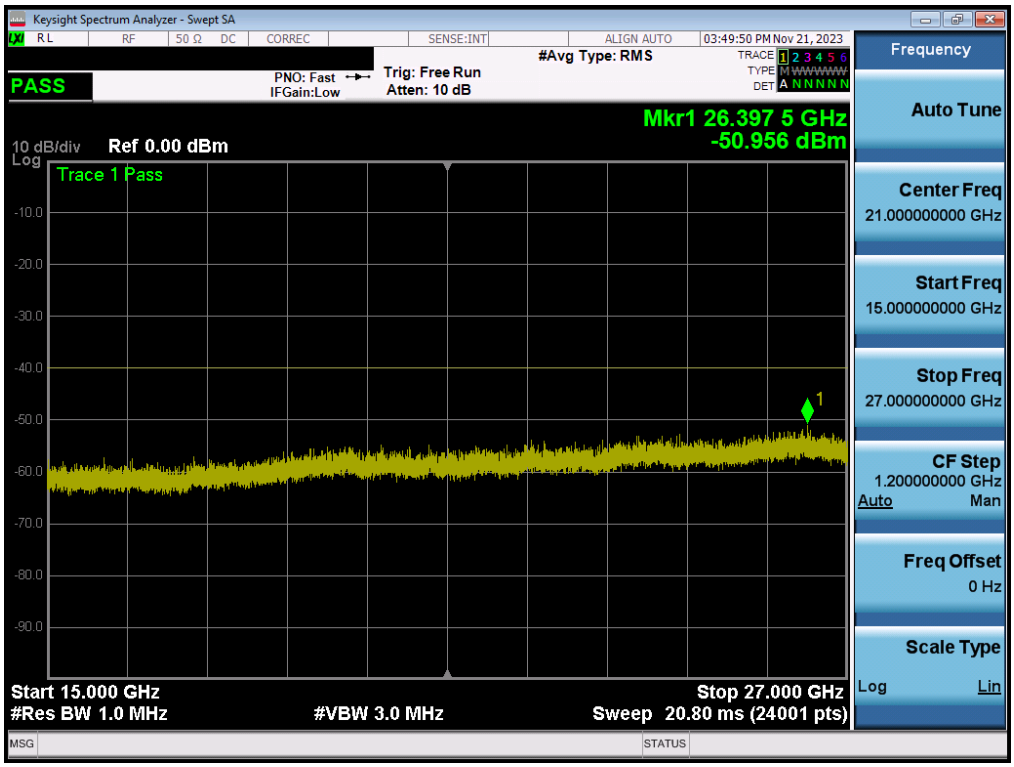
Table 7-12. Spurious and Harmonic Emissions Test Result (LTE Band 48)



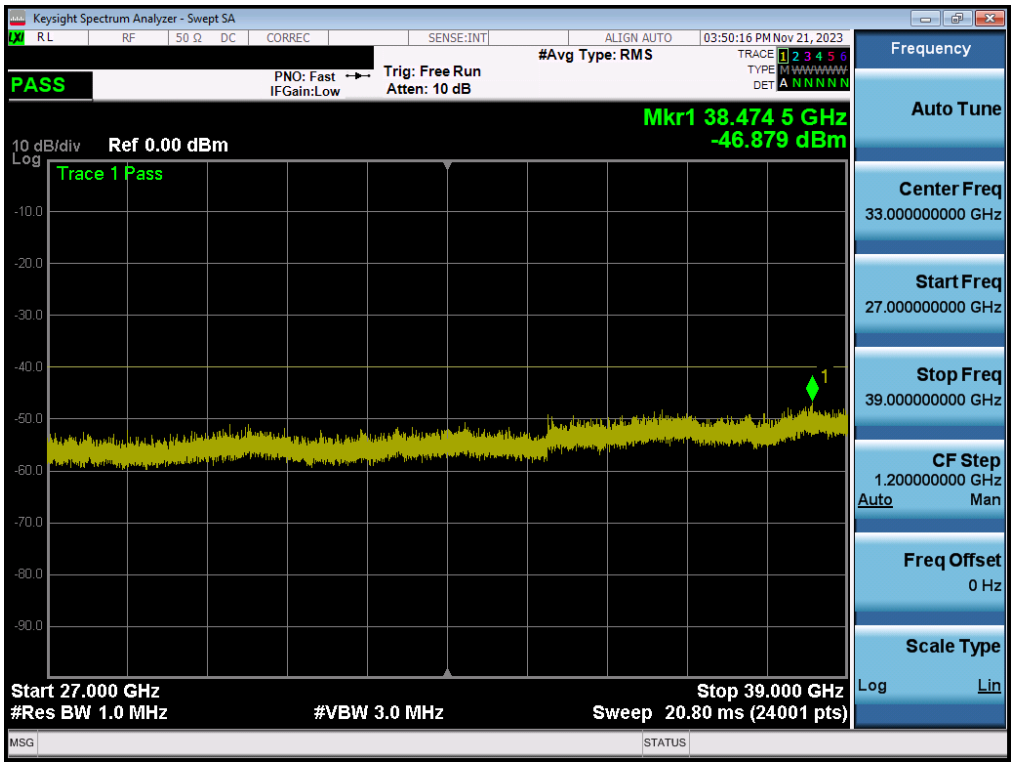
Plot 7-37. Conducted Spurious Plot (LTE Band 48 – 20MHz QPSK – High Channel)



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



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

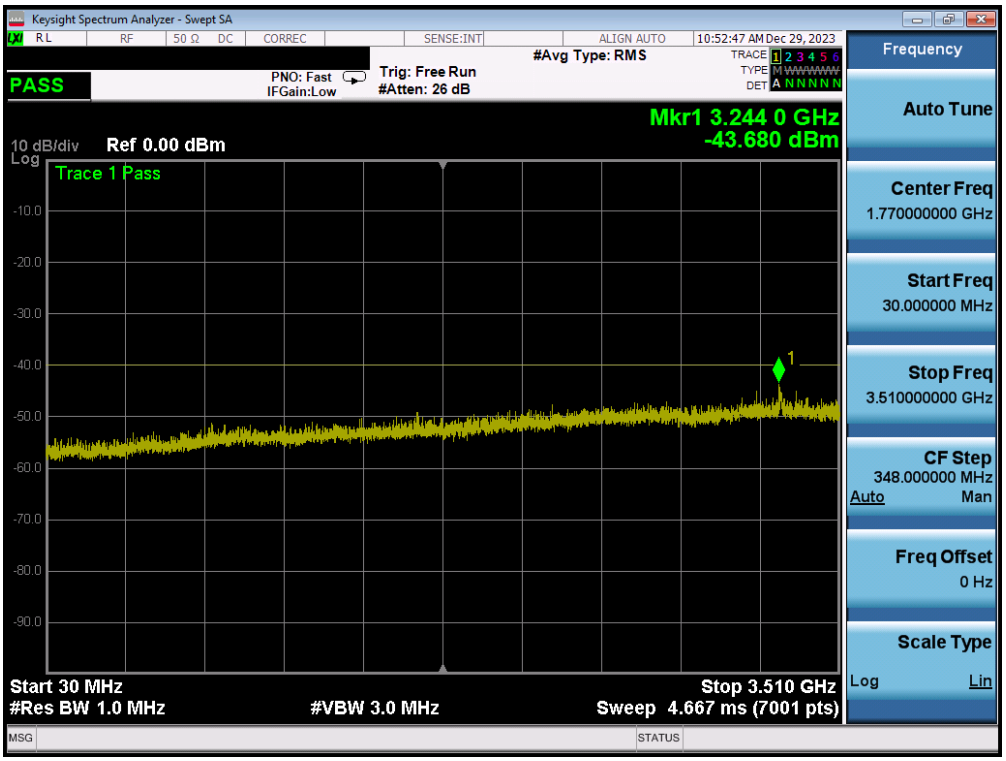


Plot 7-40. Conducted Spurious Plot (LTE Band 48 – 20MHz QPSK – High Channel)

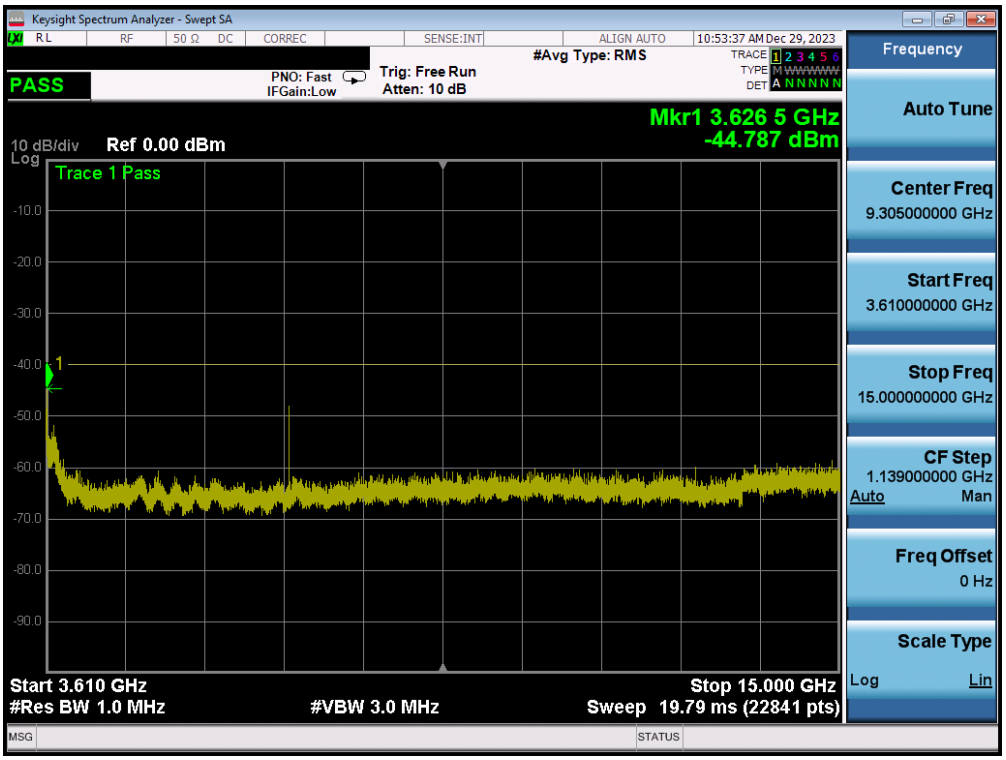
NR Band n48 ANT G

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n48	40MHz	Low	30.0 - 3510.0	-43.68	-40	-3.68
		Low	3610.0 - 15000.0	-44.79	-40	-4.79
		Low	15000.0 - 27000.0	-53.03	-40	-13.03
		Low	27000.0 - 40000.0	-48.43	-40	-8.43
		Mid	30.0 - 3575.0	-44.52	-40	-4.52
		Mid	3675.0 - 15000.0	-46.94	-40	-6.94
		Mid	15000.0 - 27000.0	-51.73	-40	-11.73
		Mid	27000.0 - 40000.0	-53.30	-40	-13.30
		High	30.0 - 3640.0	-44.45	-40	-4.45
		High	3740.0 - 15000.0	-42.60	-40	-2.60
		High	15000.0 - 27000.0	-52.53	-40	-12.53
		High	27000.0 - 40000.0	-48.54	-40	-8.54

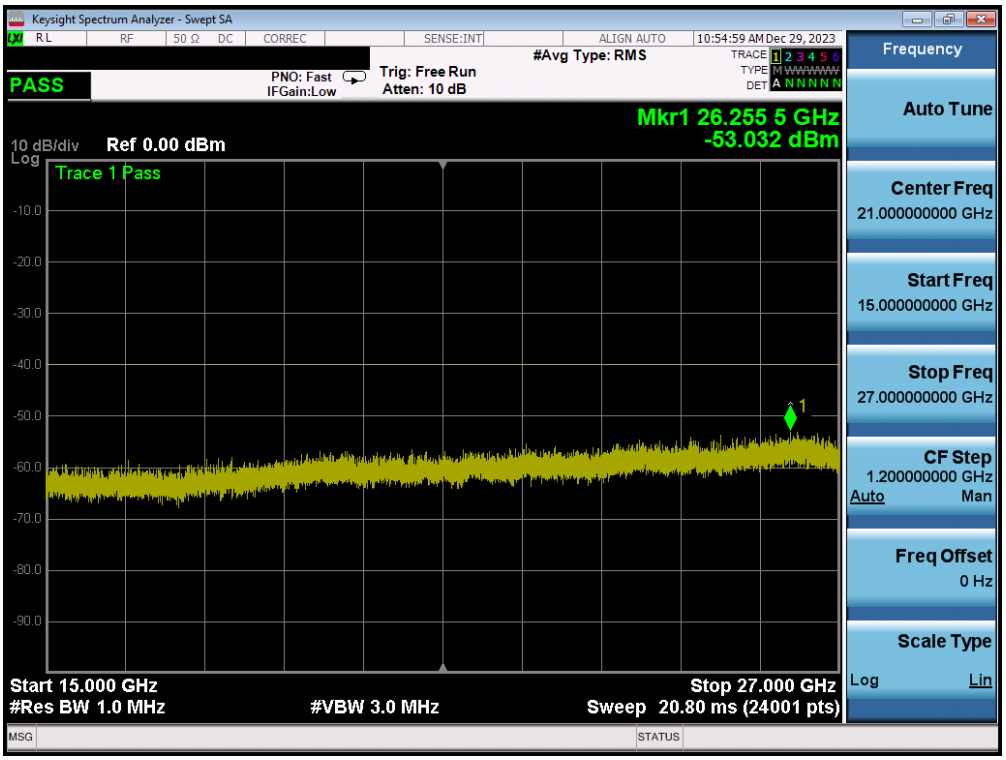
Table 7-13. Spurious and Harmonic Emissions Test Result (NR Band n48)



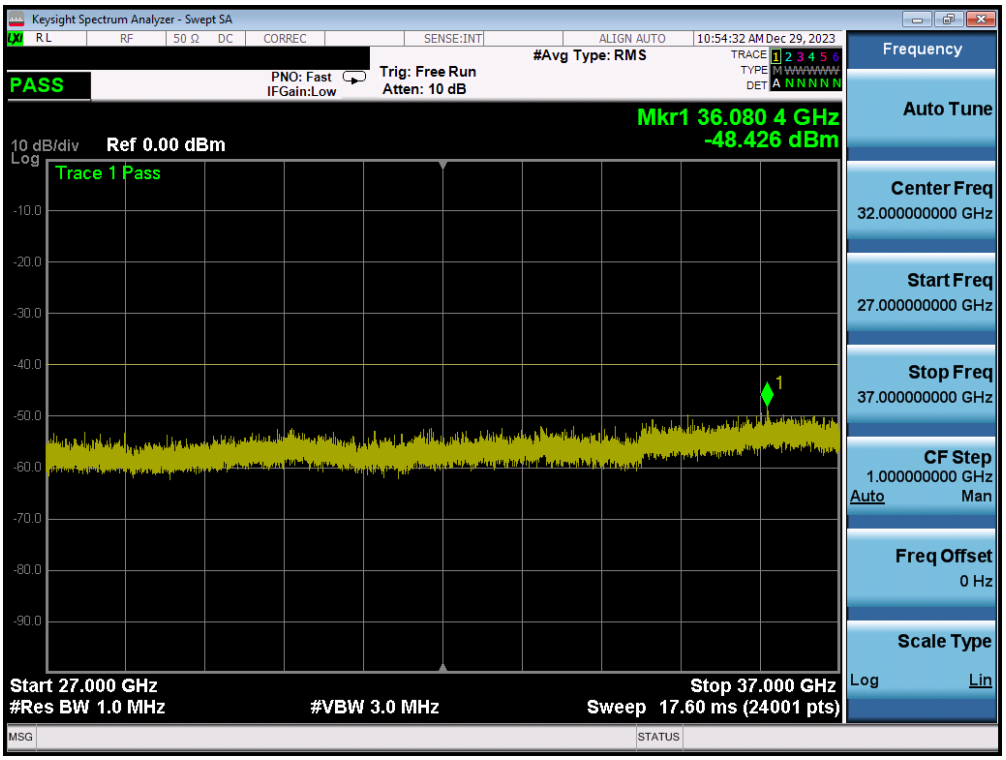
Plot 7-41. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-42. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-43. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

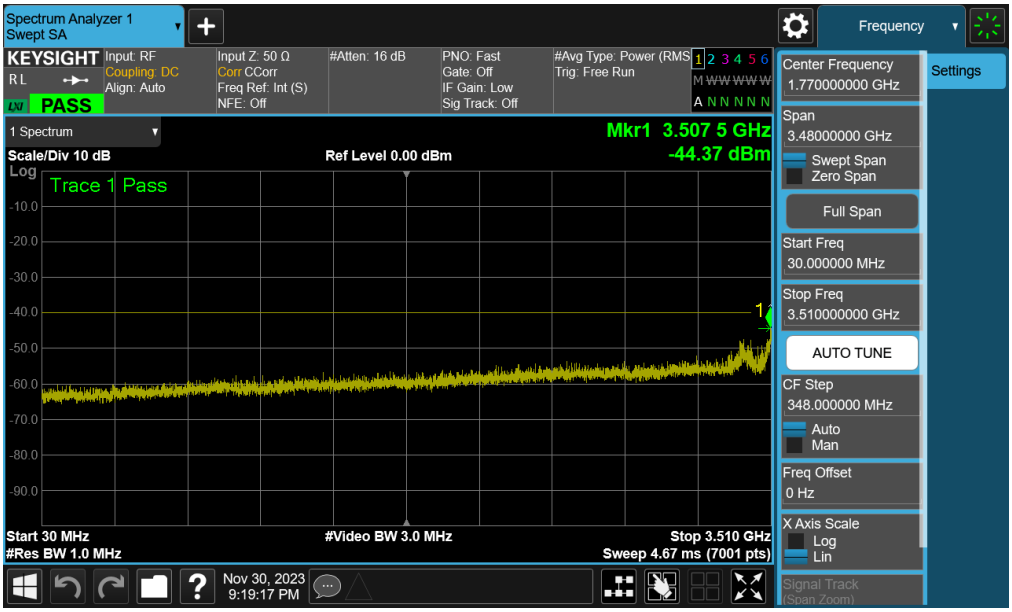


Plot 7-44. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

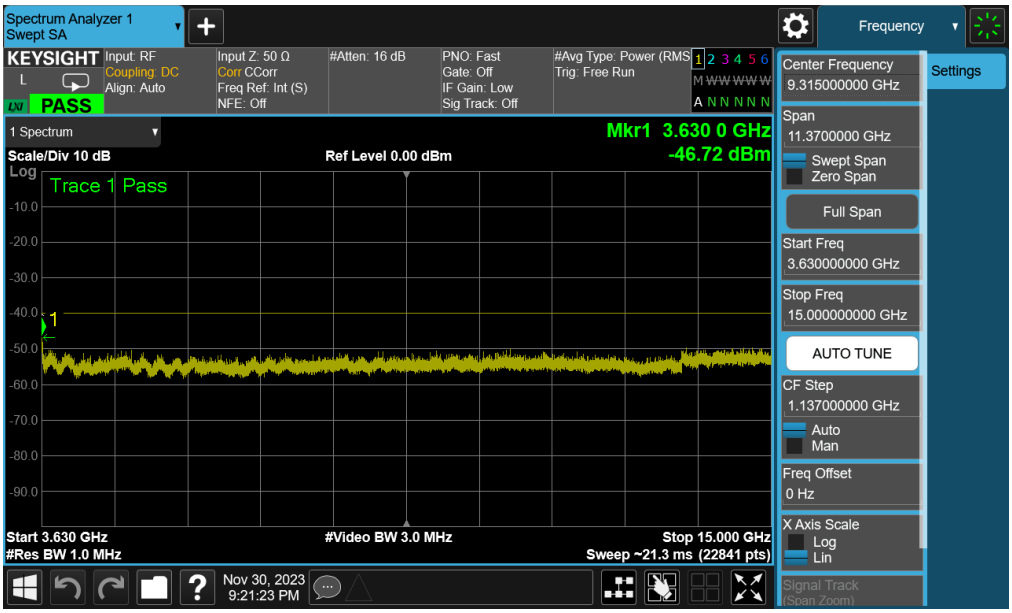
NR Band n48 ANT B

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n48	40MHz	Low	30.0 - 3510.0	-44.37	-40	-4.37
		Low	3610.0 - 15000.0	-46.72	-40	-6.72
		Low	15000.0 - 27000.0	-49.43	-40	-9.43
		Low	27000.0 - 40000.0	-54.29	-40	-14.29
		Mid	30.0 - 3575.0	-46.10	-40	-6.10
		Mid	3675.0 - 15000.0	-47.63	-40	-7.63
		Mid	15000.0 - 27000.0	-49.65	-40	-9.65
		Mid	27000.0 - 40000.0	-51.37	-40	-11.37
		High	30.0 - 3640.0	-46.05	-40	-6.05
		High	3740.0 - 15000.0	-47.03	-40	-7.03
		High	15000.0 - 27000.0	-49.88	-40	-9.88
		High	27000.0 - 40000.0	-52.12	-40	-12.12

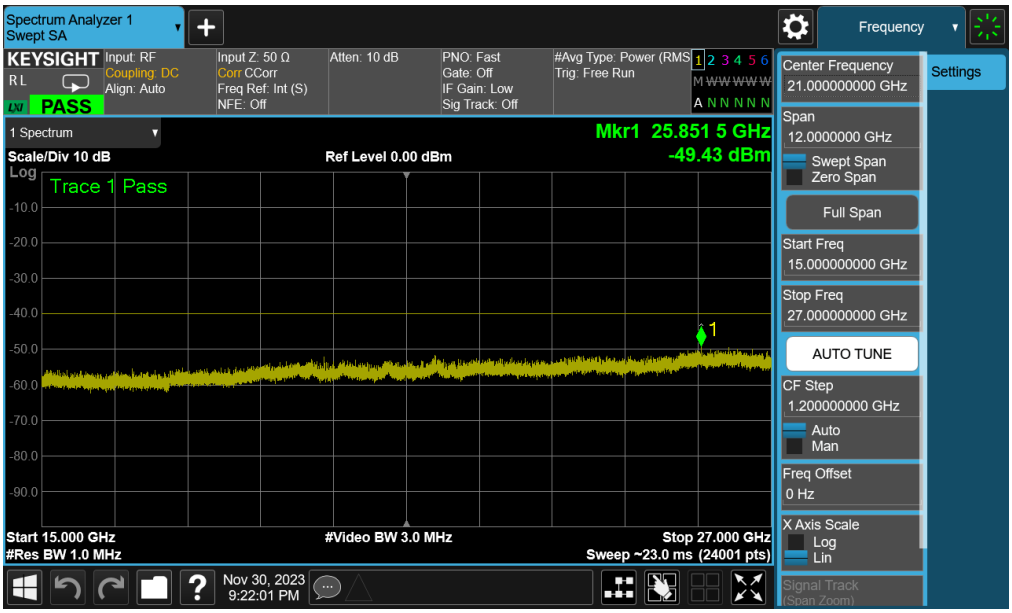
Table 7-14. Spurious and Harmonic Emissions Test Result (NR Band n48)



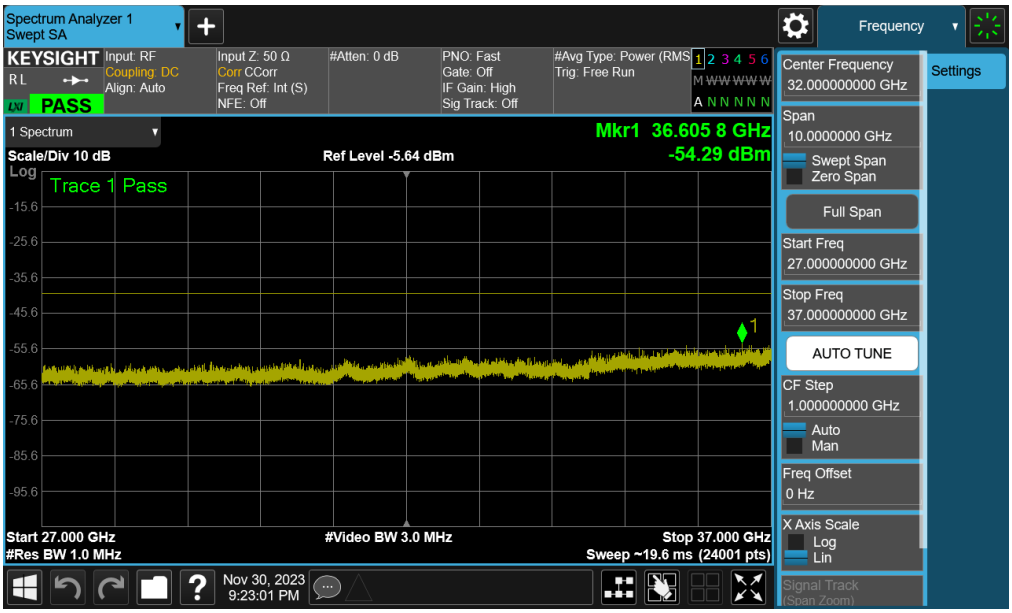
Plot 7-45. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-46. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-47. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

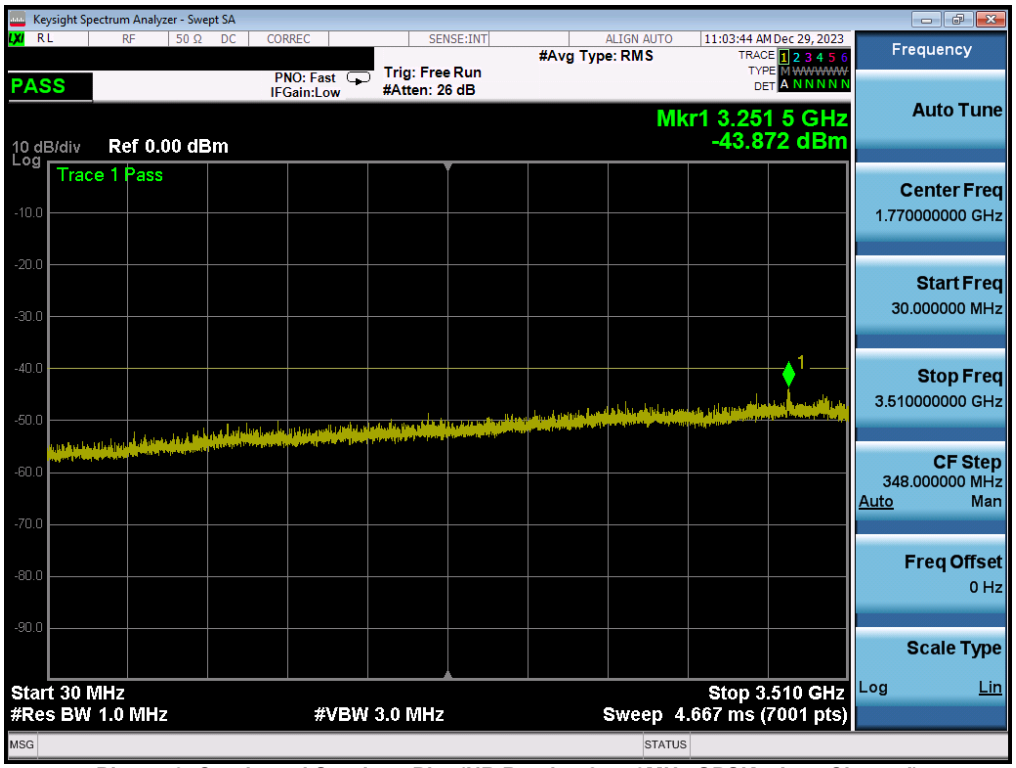


Plot 7-48. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

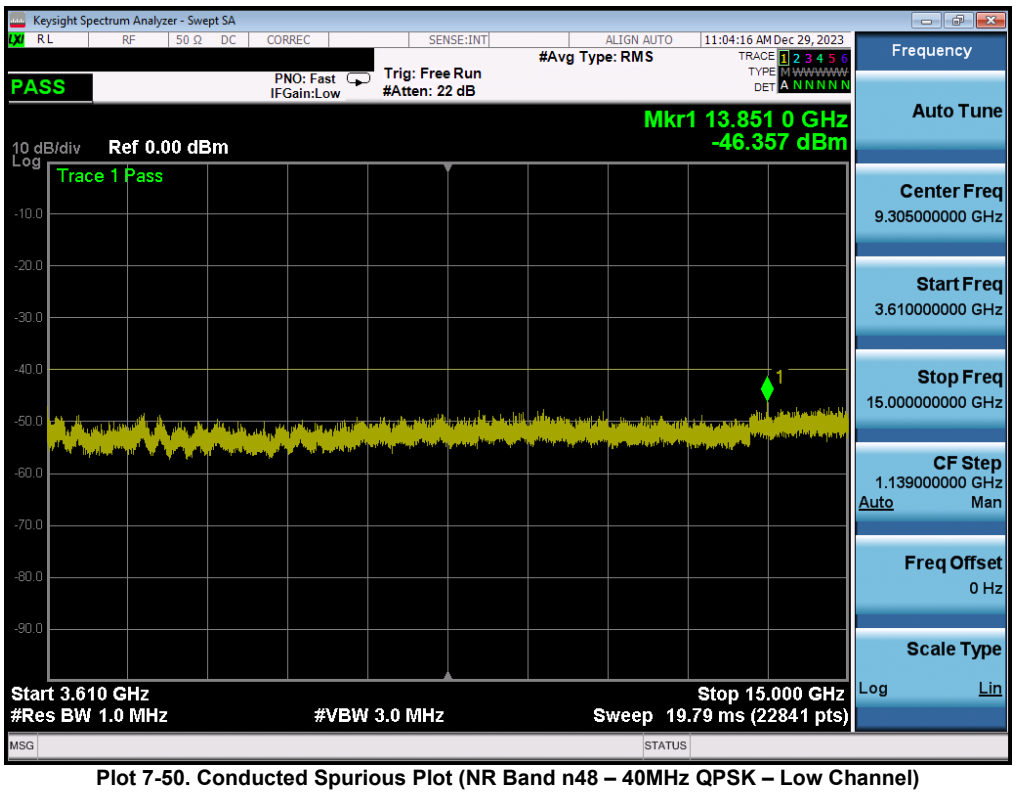
NR Band n48 ANT K

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n48	40MHz	Low	30.0 - 3510.0	-43.87	-40	-3.87
		Low	3610.0 - 15000.0	-46.36	-40	-6.36
		Low	15000.0 - 27000.0	-53.12	-40	-13.12
		Low	27000.0 - 40000.0	-48.91	-40	-8.91
		Mid	30.0 - 3575.0	-43.38	-40	-3.38
		Mid	3675.0 - 15000.0	-46.99	-40	-6.99
		Mid	15000.0 - 27000.0	-52.69	-40	-12.69
		Mid	27000.0 - 40000.0	-48.22	-40	-8.22
		High	30.0 - 3640.0	-44.11	-40	-4.11
		High	3740.0 - 15000.0	-43.59	-40	-3.59
		High	15000.0 - 27000.0	-52.65	-40	-12.65
		High	27000.0 - 40000.0	-48.36	-40	-8.36

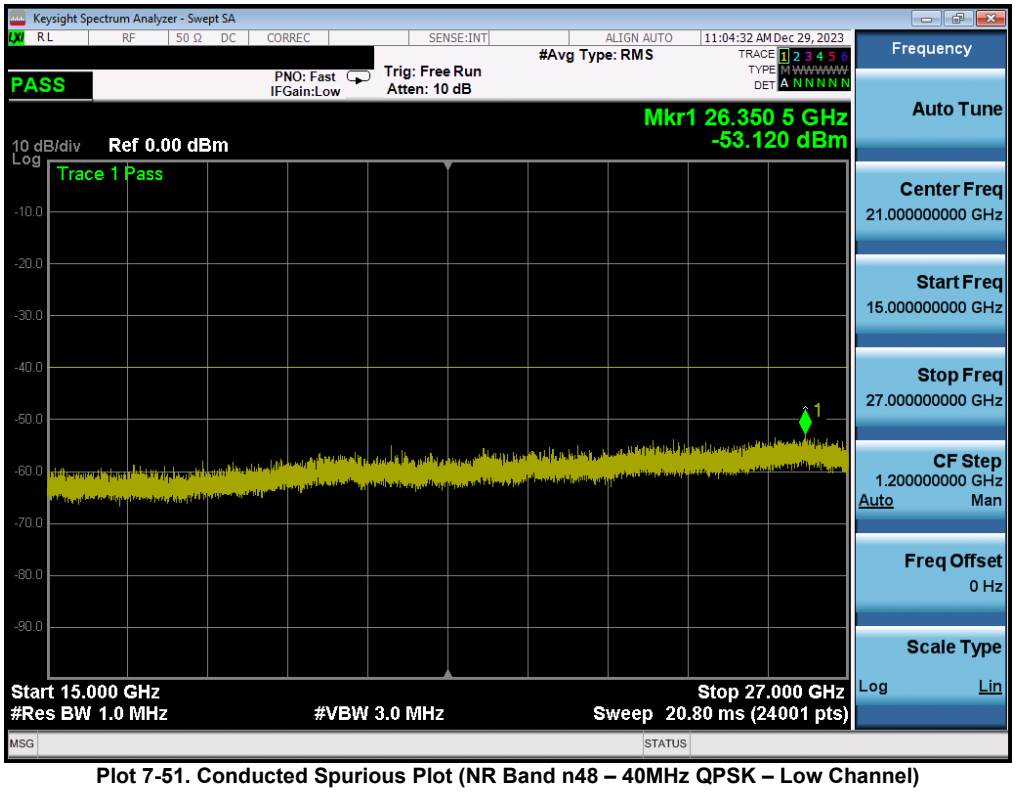
Table 7-15. Spurious and Harmonic Emissions Test Result (NR Band n48)



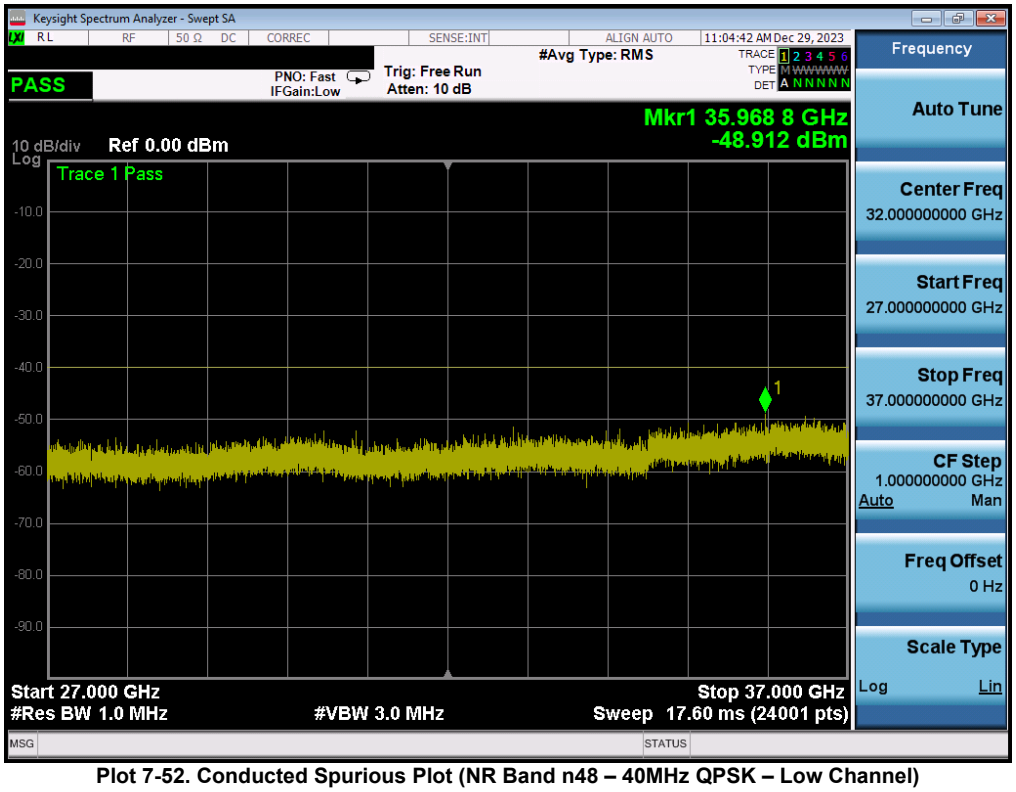
Plot 7-49. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-50. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)



Plot 7-51. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

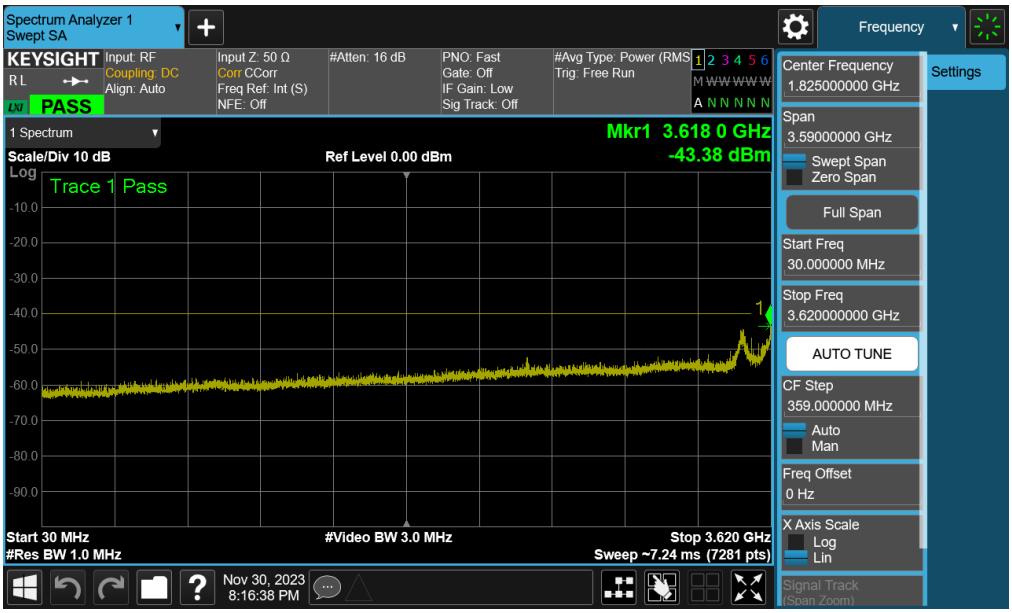


Plot 7-52. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – Low Channel)

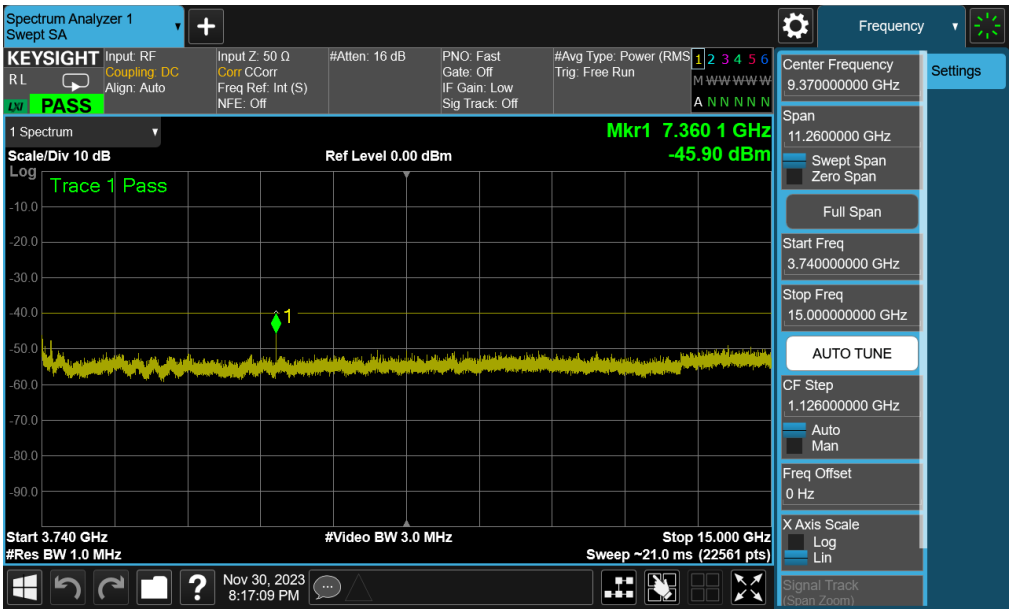
NR Band n48 ANT L

Mode	Bandwidth	Channel	Range [MHz]	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n48	40MHz	Low	30.0 - 3620.0	-43.96	-40.00	-3.96
		Low	3610.0 - 15000.0	-45.14	-40.00	-5.14
		Low	15000.0 - 27000.0	-48.92	-40.00	-8.92
		Low	27000.0 - 40000.0	-54.21	-40.00	-14.21
		Mid	30.0 - 3575.0	-48.95	-40.00	-8.95
		Mid	3675.0 - 15000.0	-45.58	-40.00	-5.58
		Mid	15000.0 - 27000.0	-49.75	-40.00	-9.75
		Mid	27000.0 - 40000.0	-52.54	-40.00	-12.54
		High	30.0 - 3640.0	-43.38	-40.00	-3.38
		High	3740.0 - 15000.0	-45.90	-40.00	-5.90
		High	15000.0 - 27000.0	-49.81	-40.00	-9.81
		High	27000.0 - 40000.0	-51.80	-40.00	-11.80

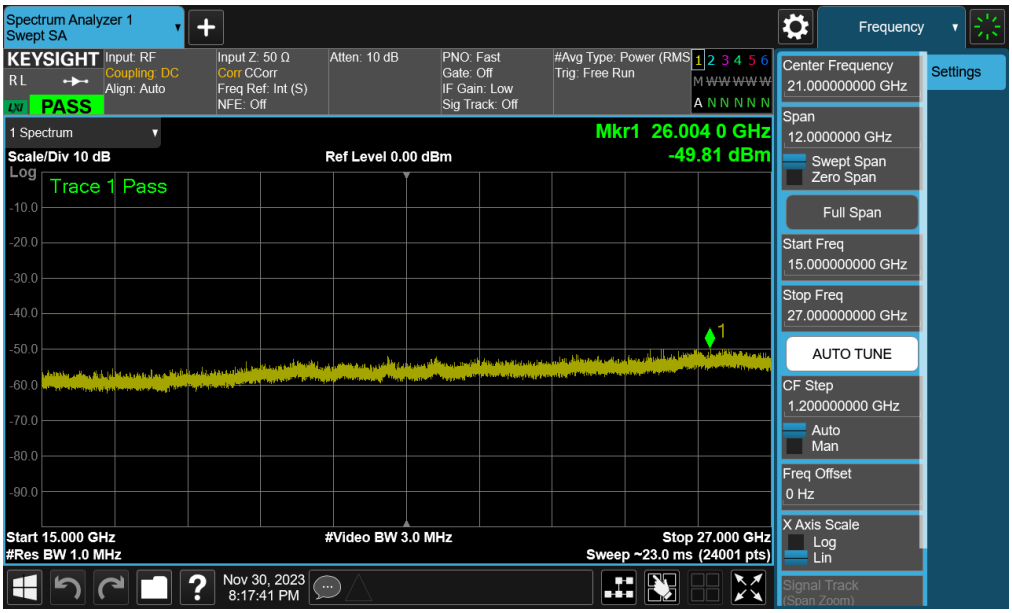
Table 7-16. Spurious and Harmonic Emissions Test Result (NR Band n48)



Plot 7-53. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – High Channel)



Plot 7-54. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – High Channel)



Plot 7-55. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – High Channel)

Plot 7-56. Conducted Spurious Plot (NR Band n48 – 40MHz QPSK – High Channel)

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.

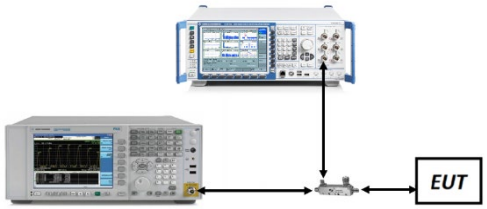


Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. Per 96.41l(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.

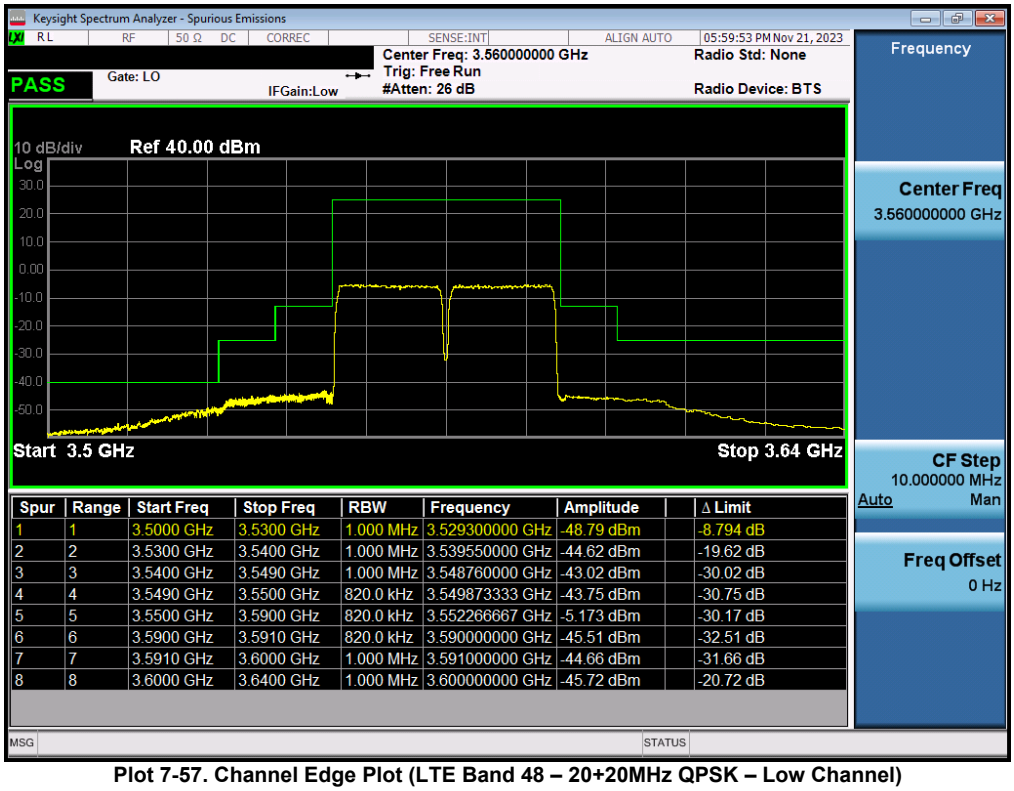
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst-case configuration. All modes of operation were investigated and the worst-case configuration results are reported in this section.

3. All test cases were measured and included in the test result tables. Plots representative of the worst case are included in this section.

ULCA LB48

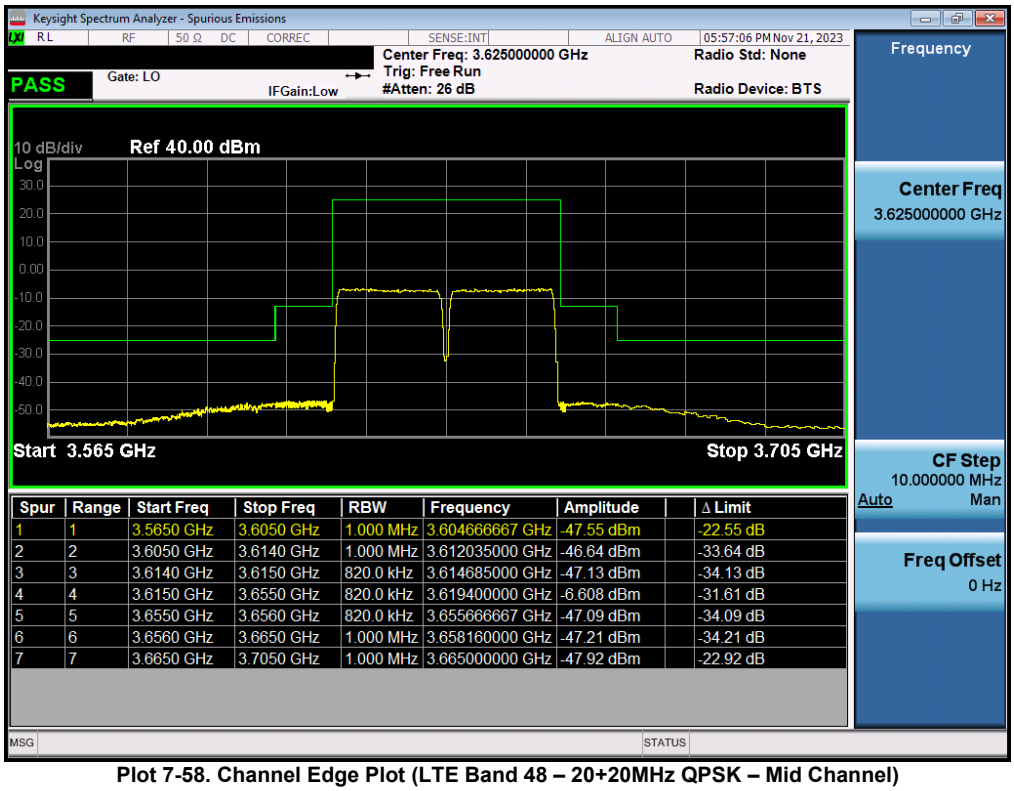
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B48 ULCA	20+20MHz	Low	Band Edge	-48.79	-40	-8.79
		Mid	Band Edge	-47.55	-25	-22.55
		High	Band Edge	-51.45	-40	-11.45

Table 7-17. Band Edge Emissions Test Result (LTE ULCA Band 48)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5000 GHz	3.5300 GHz	1.000 MHz	3.529300000 GHz	-48.79 dBm	-8.794 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539550000 GHz	-44.62 dBm	-19.62 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548760000 GHz	-43.02 dBm	-30.02 dB
4	4	3.5490 GHz	3.5500 GHz	820.0 kHz	3.549873333 GHz	-43.75 dBm	-30.75 dB
5	5	3.5500 GHz	3.5900 GHz	820.0 kHz	3.552266667 GHz	-5.173 dBm	-30.17 dB
6	6	3.5900 GHz	3.5910 GHz	820.0 kHz	3.590000000 GHz	-45.51 dBm	-32.51 dB
7	7	3.5910 GHz	3.6000 GHz	1.000 MHz	3.591000000 GHz	-44.66 dBm	-31.66 dB
8	8	3.6000 GHz	3.6400 GHz	1.000 MHz	3.600000000 GHz	-45.72 dBm	-20.72 dB

Plot 7-57. Channel Edge Plot (LTE Band 48 – 20+20MHz QPSK – Low Channel)



Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5650 GHz	3.6050 GHz	1.000 MHz	3.604666667 GHz	-47.55 dBm	-22.55 dB
2	2	3.6050 GHz	3.6140 GHz	1.000 MHz	3.612035000 GHz	-46.64 dBm	-33.64 dB
3	3	3.6140 GHz	3.6150 GHz	820.0 kHz	3.614685000 GHz	-47.13 dBm	-34.13 dB
4	4	3.6150 GHz	3.6550 GHz	820.0 kHz	3.619400000 GHz	-6.608 dBm	-31.61 dB
5	5	3.6550 GHz	3.6560 GHz	820.0 kHz	3.655666667 GHz	-47.09 dBm	-34.09 dB
6	6	3.6560 GHz	3.6650 GHz	1.000 MHz	3.658160000 GHz	-47.21 dBm	-34.21 dB
7	7	3.6650 GHz	3.7050 GHz	1.000 MHz	3.665000000 GHz	-47.92 dBm	-22.92 dB

Plot 7-58. Channel Edge Plot (LTE Band 48 – 20+20MHz QPSK – Mid Channel)

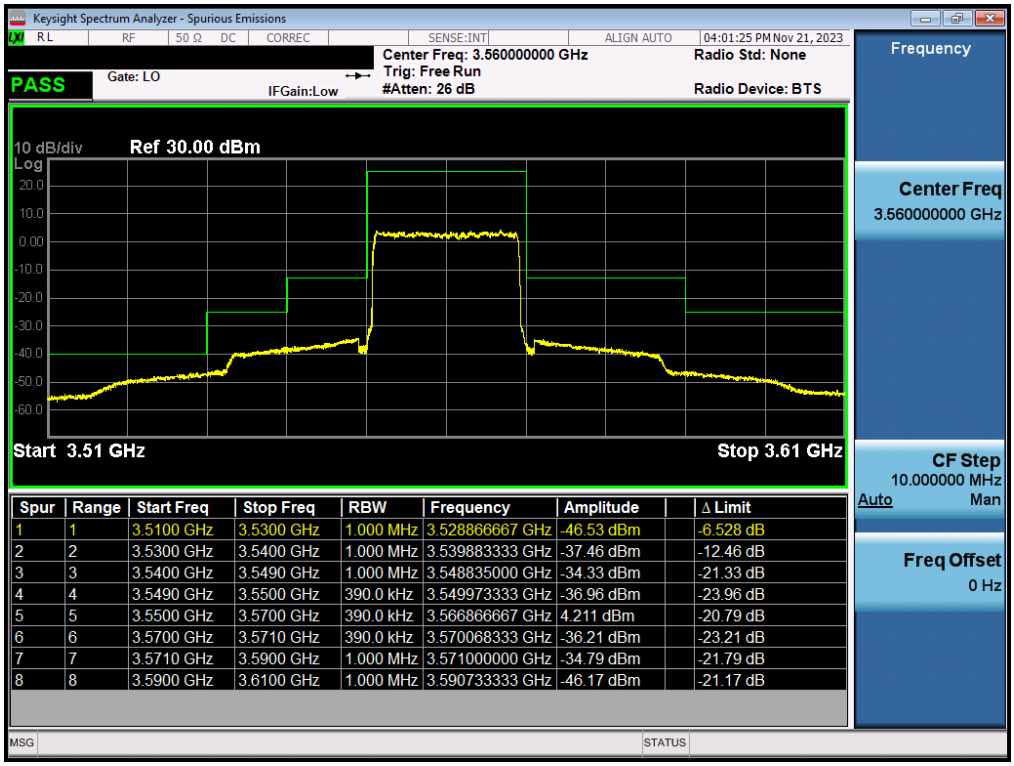
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6100 GHz	3.6500 GHz	1.000 MHz	3.649666667 GHz	-46.61 dBm	-21.61 dB
2	2	3.6500 GHz	3.6590 GHz	1.000 MHz	3.658595000 GHz	-45.63 dBm	-32.63 dB
3	3	3.6590 GHz	3.6600 GHz	820.0 kHz	3.659928333 GHz	-46.46 dBm	-33.46 dB
4	4	3.6600 GHz	3.7000 GHz	820.0 kHz	3.663200000 GHz	-6.597 dBm	-31.60 dB
5	5	3.7000 GHz	3.7010 GHz	820.0 kHz	3.700141667 GHz	-45.84 dBm	-32.84 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701450000 GHz	-47.06 dBm	-34.06 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710400000 GHz	-47.91 dBm	-22.91 dB
8	8	3.7200 GHz	3.7500 GHz	1.000 MHz	3.722400000 GHz	-51.45 dBm	-11.45 dB

Plot 7-59. Channel Edge Plot (LTE Band 48 – 20+20MHz QPSK – High Channel)

LTE Band 48

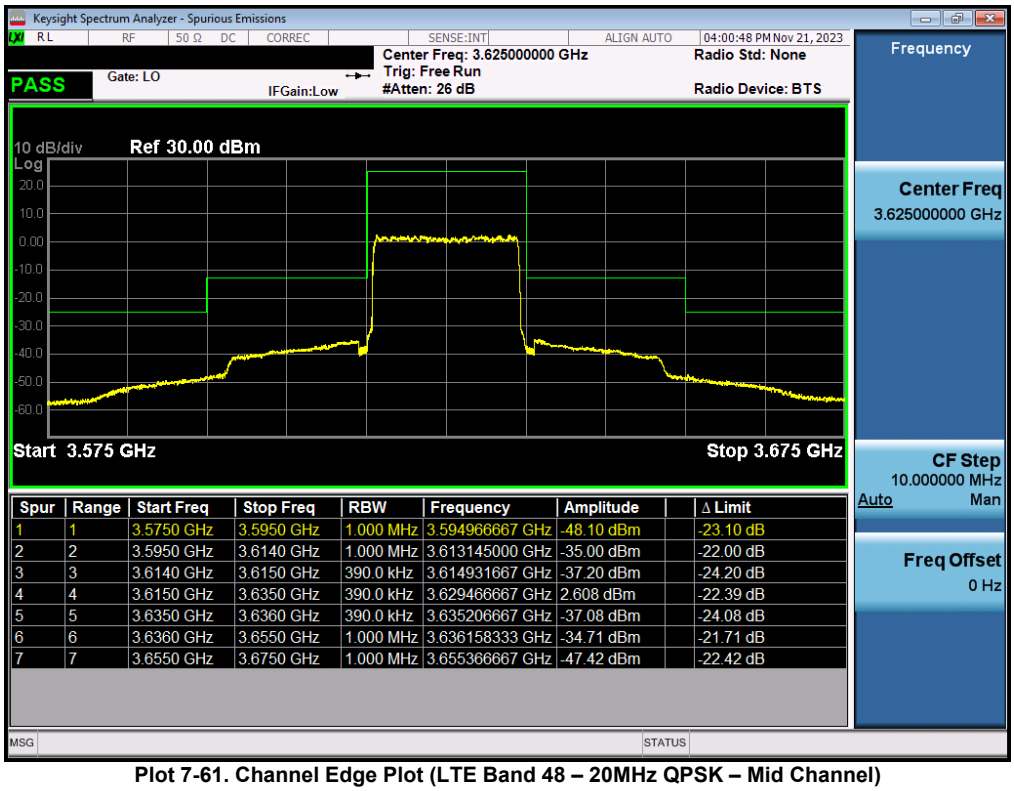
Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
LTE-B48	20MHz	Low	Band Edge	-46.53	-40	-6.53
		Mid	Band Edge	-34.71	-13	-21.71
		High	Band Edge	-47.72	-40	-7.72
	15MHz	Low	Band Edge	-46.58	-40	-6.58
		Mid	Band Edge	-33.25	-13	-20.25
		High	Band Edge	-47.84	-40	-7.84
	10MHz	Low	Band Edge	-51.26	-40	-11.26
		Mid	Band Edge	-43.59	-25	-18.59
		High	Band Edge	-52.95	-40	-12.95
	5MHz	Low	Band Edge	-50.06	-40	-10.06
		Mid	Band Edge	-27.89	-13	-14.89
		High	Band Edge	-52.03	-40	-12.03

Table 7-18. Band Edge Emissions Test Result (LTE Band 48)



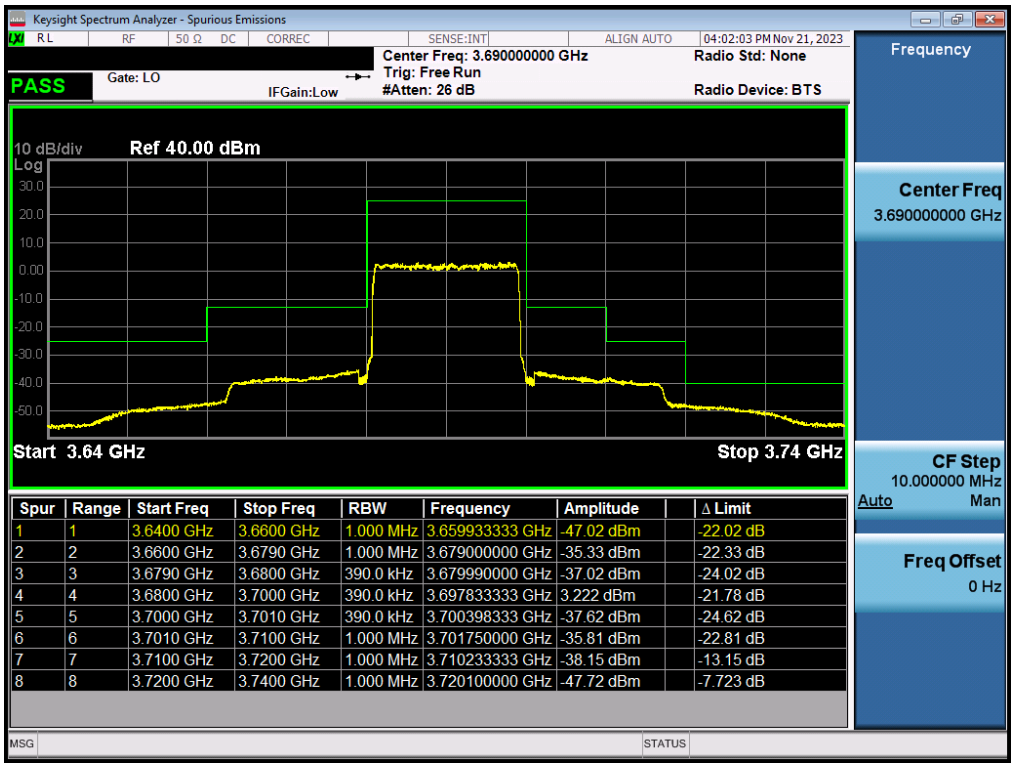
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.5100 GHz	3.5300 GHz	1.000 MHz	3.528866667 GHz	-46.53 dBm	-6.528 dB
2	2	3.5300 GHz	3.5400 GHz	1.000 MHz	3.539883333 GHz	-37.46 dBm	-12.46 dB
3	3	3.5400 GHz	3.5490 GHz	1.000 MHz	3.548835000 GHz	-34.33 dBm	-21.33 dB
4	4	3.5490 GHz	3.5500 GHz	390.0 kHz	3.549973333 GHz	-36.96 dBm	-23.96 dB
5	5	3.5500 GHz	3.5700 GHz	390.0 kHz	3.566866667 GHz	4.211 dBm	-20.79 dB
6	6	3.5700 GHz	3.5710 GHz	390.0 kHz	3.570068333 GHz	-36.21 dBm	-23.21 dB
7	7	3.5710 GHz	3.5900 GHz	1.000 MHz	3.571000000 GHz	-34.79 dBm	-21.79 dB
8	8	3.5900 GHz	3.6100 GHz	1.000 MHz	3.590733333 GHz	-46.17 dBm	-21.17 dB

Plot 7-60. 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	3.594966667 GHz	-48.10 dBm	-23.10 dB
2	2	3.5950 GHz	3.6140 GHz	1.000 MHz	3.613145000 GHz	-35.00 dBm	-22.00 dB
3	3	3.6140 GHz	3.6150 GHz	390.0 kHz	3.614931667 GHz	-37.20 dBm	-24.20 dB
4	4	3.6150 GHz	3.6350 GHz	390.0 kHz	3.629466667 GHz	2.608 dBm	-22.39 dB
5	5	3.6350 GHz	3.6360 GHz	390.0 kHz	3.635206667 GHz	-37.08 dBm	-24.08 dB
6	6	3.6360 GHz	3.6550 GHz	1.000 MHz	3.636158333 GHz	-34.71 dBm	-21.71 dB
7	7	3.6550 GHz	3.6750 GHz	1.000 MHz	3.655366667 GHz	-47.42 dBm	-22.42 dB

Plot 7-61. Channel Edge Plot (LTE Band 48 – 20MHz QPSK – Mid Channel)



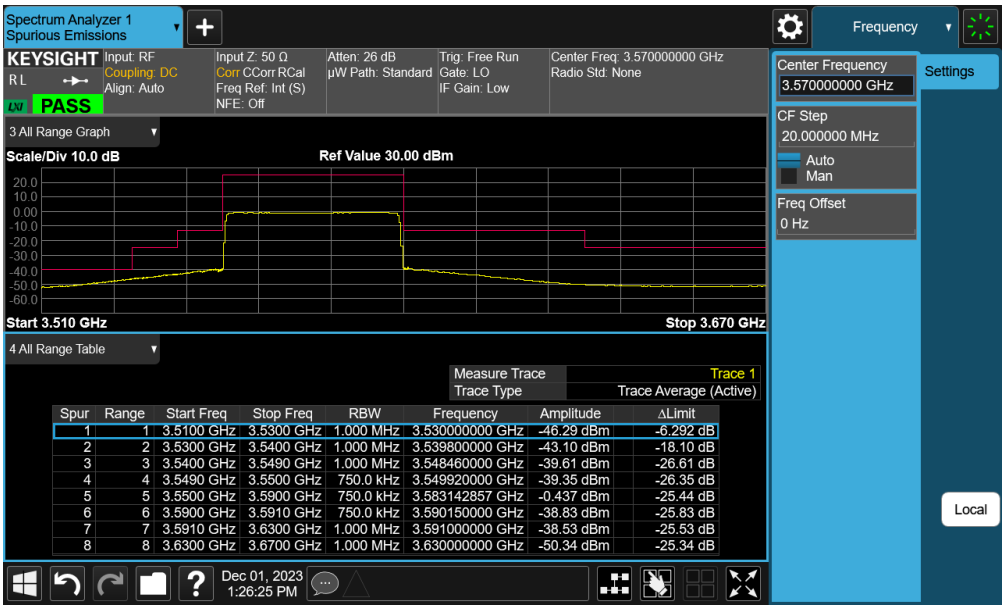
Spur	Range	Start Freq	Stop Freq	RBW	Frequency	Amplitude	Δ Limit
1	1	3.6400 GHz	3.6600 GHz	1.000 MHz	3.659933333 GHz	-47.02 dBm	-22.02 dB
2	2	3.6600 GHz	3.6790 GHz	1.000 MHz	3.679000000 GHz	-35.33 dBm	-22.33 dB
3	3	3.6790 GHz	3.6800 GHz	390.0 kHz	3.679990000 GHz	-37.02 dBm	-24.02 dB
4	4	3.6800 GHz	3.7000 GHz	390.0 kHz	3.697833333 GHz	3.222 dBm	-21.78 dB
5	5	3.7000 GHz	3.7010 GHz	390.0 kHz	3.700398333 GHz	-37.62 dBm	-24.62 dB
6	6	3.7010 GHz	3.7100 GHz	1.000 MHz	3.701750000 GHz	-35.81 dBm	-22.81 dB
7	7	3.7100 GHz	3.7200 GHz	1.000 MHz	3.710233333 GHz	-38.15 dBm	-13.15 dB
8	8	3.7200 GHz	3.7400 GHz	1.000 MHz	3.720100000 GHz	-47.72 dBm	-7.723 dB

Plot 7-62. Channel Edge Plot (LTE Band 48 – 20MHz QPSK – High Channel)

NR Band n48 ANT G

Mode	Bandwidth	Channel	Test Case	Level [dBm]	Limit [dBm]	Margin [dB]
NR-n48	40MHz	Low	Band Edge	-46.29	-40	-6.29
		Mid	Band Edge	-49.09	-25	-24.09
		High	Band Edge	-47.79	-40	-7.79
	30MHz	Low	Band Edge	-44.60	-40	-4.60
		Mid	Band Edge	-44.22	-25	-19.22
		High	Band Edge	-46.77	-40	-6.77
	20MHz	Low	Band Edge	-46.32	-40	-6.32
		Mid	Band Edge	-46.80	-25	-21.80
		High	Band Edge	-47.12	-40	-7.12
	15MHz	Low	Band Edge	-47.03	-40	-7.03
		Mid	Band Edge	-44.57	-25	-19.57
		High	Band Edge	-47.94	-40	-7.94
	10MHz	Low	Band Edge	-49.60	-40	-9.60
		Mid	Band Edge	-41.42	-25	-16.42
		High	Band Edge	-50.93	-40	-10.93

Table 7-19. Band Edge Emissions Test Result (NR Band n48)



Plot 7-63. Channel Edge Plot (NR Band n48 - 40MHz QPSK - Low Channel)