

PART 96 MEASUREMENT REPORT

Applicant Name:

Apple Inc.
One Apple Park Way
Cupertino, CA 95014
United States

Date of Testing:

10/01/2023-03/29/2024

Test Report Issue Date:

04/2/2024

Test Site/Location:

Element Materials Technology

Test Report Serial No.:

1C2311270068-13.BCG

FCC ID:	BCGA2837
Applicant Name:	Apple Inc.

Application Type:

Certification

Model:

A2837, A3006

EUT Type:

Tablet Device

FCC Classification:

Citizens Band End User Devices (CBE)

FCC Rule Part:


96

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016,
KDB 971168 D01 v03r01, 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.

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

Prepared by: WKR0000006184

Reviewed by: WKR0000005805





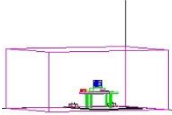
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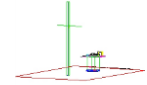
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Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	OBW [MHz]	PAR at 0.1% [dB]	EIRP		Emission Designator	
						Max. Power [W]	Max. Power [dBm]		
LTE Band 48	5 MHz	QPSK	3552.5 - 3697.5	4.5474	4.91	0.178	22.50	4M55G7W	
		16QAM	3552.5 - 3697.5	4.5196	6.26	0.140	21.45	4M52D7W	
		64QAM	3552.5 - 3697.5	4.5269	6.93	0.112	20.48	4M53D7W	
		256QAM	3552.5 - 3697.5	4.5548	6.98	0.058	17.60	4M55D7W	
	10 MHz	QPSK	3555.0 - 3695.0	9.0066	4.96	4.96	0.178	22.50	9M01G7W
		16QAM	3555.0 - 3695.0	9.0111	6.54	0.143	21.54	9M01D7W	
		64QAM	3555.0 - 3695.0	9.0511	6.75	0.112	20.51	9M05D7W	
		256QAM	3555.0 - 3695.0	9.0016	6.94	0.058	17.63	9M00D7W	
	15 MHz	QPSK	3557.5 - 3692.5	13.5230	4.92	4.92	0.178	22.50	13M5G7W
		16QAM	3557.5 - 3692.5	13.5140	6.47	0.143	21.55	13M5D7W	
		64QAM	3557.5 - 3692.5	13.4550	6.82	0.112	20.49	13M5D7W	
		256QAM	3557.5 - 3692.5	13.5410	6.87	0.057	17.59	13M5D7W	
	20 MHz	QPSK	3560.0 - 3690.0	18.0410	5.00	5.00	0.178	22.50	18M0G7W
		16QAM	3560.0 - 3690.0	18.0090	6.10	0.142	21.51	18M0D7W	
		64QAM	3560.0 - 3690.0	18.0190	6.97	0.112	20.48	18M0D7W	
		256QAM	3560.0 - 3690.0	18.0110	7.07	0.058	17.60	18M0D7W	
LTE ULCA Band 48	20 + 5 MHz	QPSK	3562.5 - 3687.5	23.2970	-	0.177	22.48	23M3G7W	
		16QAM	3562.5 - 3687.5	23.3030	-	0.141	21.50	23M3D7W	
		64QAM	3562.5 - 3687.5	23.2870	-	0.112	20.50	23M3D7W	
		256QAM	3562.5 - 3687.5	23.1870	-	0.056	17.48	23M2D7W	
	20 + 10 MHz	QPSK	3565.0 - 3685.0	28.1280	-	-	0.175	22.42	28M1G7W
		16QAM	3565.0 - 3685.0	28.1010	-	-	0.142	21.51	28M1D7W
		64QAM	3565.0 - 3685.0	27.9880	-	-	0.110	20.43	28M0D7W
		256QAM	3565.0 - 3685.0	28.0020	-	-	0.057	17.56	28M0D7W
	20 + 15 MHz	QPSK	3567.5 - 3682.5	32.8820	-	-	0.178	22.50	32M9G7W
		16QAM	3567.5 - 3682.5	32.8310	-	-	0.139	21.42	32M8D7W
		64QAM	3567.5 - 3682.5	32.8670	-	-	0.113	20.53	32M9D7W
		256QAM	3567.5 - 3682.5	32.8510	-	-	0.057	17.58	32M9D7W
	20 + 20 MHz	QPSK	3570.0 - 3680.0	37.6960	-	-	0.178	22.50	37M7G7W
		16QAM	3570.0 - 3680.0	37.7550	-	-	0.142	21.51	37M8D7W
		64QAM	3570.0 - 3680.0	37.7360	-	-	0.108	20.32	37M7D7W
		256QAM	3570.0 - 3680.0	37.7400	-	-	0.056	17.46	37M7D7W
	NR Band n48	10 MHz	11/2 BPSK	3555.0 - 3695.0	8.6355	4.13	0.178	22.50	8M64G7W
			QPSK	3555.0 - 3695.0	8.9711	5.47	0.178	22.50	8M97G7W
			16QAM	3555.0 - 3695.0	8.9415	6.10	0.142	21.52	8M94D7W
			64QAM	3555.0 - 3695.0	8.9567	6.46	0.114	20.56	8M96D7W
256QAM			3555.0 - 3695.0	8.9379	6.50	0.058	17.64	8M94D7W	
15 MHz		11/2 BPSK	3557.5 - 3692.5	12.8970	3.90	0.178	22.50	12M9G7W	
		QPSK	3557.5 - 3692.5	12.9080	5.22	0.178	22.50	12M9G7W	
		16QAM	3557.5 - 3692.5	12.9120	6.14	0.141	21.50	12M9D7W	
		64QAM	3557.5 - 3692.5	12.8960	6.46	0.112	20.50	12M9D7W	
		256QAM	3557.5 - 3692.5	12.8810	6.54	0.058	17.64	12M9D7W	
20 MHz		11/2 BPSK	3560.0 - 3690.0	17.8900	3.85	0.178	22.50	17M9G7W	
		QPSK	3560.0 - 3690.0	18.2190	5.15	0.178	22.50	18M2G7W	
		16QAM	3560.0 - 3690.0	18.2460	6.08	0.142	21.52	18M2D7W	
		64QAM	3560.0 - 3690.0	18.2570	6.42	0.112	20.50	18M3D7W	
		256QAM	3560.0 - 3690.0	18.2170	6.50	0.058	17.60	18M2D7W	
30 MHz		11/2 BPSK	3565.0 - 3685.0	26.8110	4.17	0.178	22.50	26M8G7W	
		QPSK	3565.0 - 3685.0	27.9200	5.12	0.178	22.50	27M9G7W	
		16QAM	3565.0 - 3685.0	27.8840	6.01	0.141	21.48	27M9D7W	
		64QAM	3565.0 - 3685.0	27.8210	6.39	0.112	20.50	27M8D7W	
		256QAM	3565.0 - 3685.0	27.8750	6.46	0.058	17.60	27M9D7W	
40 MHz		11/2 BPSK	3570.0 - 3680.0	35.7660	4.04	0.178	22.50	35M8G7W	
		QPSK	3570.0 - 3680.0	37.9660	5.09	0.178	22.50	38M0G7W	
		16QAM	3570.0 - 3680.0	37.9080	6.03	0.142	21.53	37M9D7W	
		64QAM	3570.0 - 3680.0	37.9670	6.32	0.113	20.53	38M0D7W	
		256QAM	3570.0 - 3680.0	37.8930	6.33	0.058	17.62	37M9D7W	

EUT Overview

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1.0 INTRODUCTION

1.1 Scope

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


1.2 Element Materials Technology Test Location

These measurement tests were conducted at the Element Materials Technology facility located at 18855 Adams Court, Morgan Hill, CA 95037. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014 and KDB 414788 D01 v01r01.

1.3 Test Facility / Accreditations

Measurements were performed at Element Materials Technology located in Morgan Hill, CA 95037, U.S.A.

- Element Materials Technology Washington DC LLC is a CBRS Alliance (OnGo) Approved Test Lab
- Element Materials Technology Washington DC LLC is a WInnForum Approved Test Lab
- Element Materials Technology is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- 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 Materials Technology facility is a registered (22831) 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 Agreements (MRAs).

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Apple Table Device FCC ID:BCGA2837**. The test data contained in this report pertains only to the emissions due to the EUT's LTE Band 48 and NR FR1 n48 operation in the CBRS band. Per FCC Part 96, this device is evaluated under Citizens Band End User Devices (CBE).

Test Device Serial No.: LCJRK9GLW0, KXYH5M6MPG, H5XXDMX5K9, GJ6WJ67WFX, DLXH16000010000661

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, 802.11a/ax WIFI 6E, Bluetooth (1x, EDR, LE1M, LE2M, HDR4, HDR8), NB UNII (1x, HDR4, HDR8), WPT, 802.15.4

This device supports BT Beamforming

Measurements for LTE-Band48 and ULCA CA_48C were performed with NS27 for LTE and NS10 for ULCA for all antennas.

This device supports simultaneous transmission operations, which allows for multiple transmitters to transmit simultaneously on the same antenna. The table below shows all configurations possible.


Antenna	Simultaneous Tx Config	Wifi 2GHz	Bluetooth	Thread	Wifi 5GHz	Wifi 6GHz	NB UNII	LTE/FR1 NR	
		802.11 b/g/n/ax	BDR, EDR, HDR4/8, LE1/2M	802.15.4	802.11 a/n/ac/ax	802.11 a/ax	BDR, HDR4/8	MB/HB	UHB
2a	Config 1	X	✓	X	✓	X	X	X	X
2a	Config 2	X	✓	X	X	✓	X	X	X
2a	Config 3	✓	X	X	X	X	✓	X	X
2a	Config 4	X	X	✓	✓	X	X	X	X
2a	Config 5	X	X	✓	X	✓	X	X	X
4a	Config 6	X	✓	X	✓	X	X	X	X
4a	Config 7	X	✓	X	X	✓	X	X	X
4a	Config 8	✓	X	X	X	X	✓	X	X
4a	Config 9	X	X	✓	✓	X	X	X	X
4a	Config 10	X	X	✓	X	✓	X	X	X

Table 2-1. Simultaneous Transmission Configurations

✓ = Support; ✗ = Not Support

Note:

1. All the above simultaneous transmission configurations have been tested and the worst case configuration was found to be Config 1 and reported in RF Bluetooth and RF UNII reports.
2. Specific 2.4GHz Wi-Fi antenna that can only transmit simultaneously with 2.4GHz Bluetooth antenna is listed in the SAR test report. For BT (2.4GHz) in connected mode and Wi-Fi (2.4GHz) - Wi-Fi max power will not exceed minimum of (13.5dBm, SAR max cap, Reg max cap) power. For BT (2.4GHz) in disconnected mode and Wi-Fi (2.4GHz) - BT will be using iPA only and Wi-Fi max power will not exceed minimum of (SAR max cap, Reg max cap) power. Bluetooth can simultaneously transmit with IEEE 802.11a/n/ac/ax 5/6 GHz on separate antenna.

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2.3 Antenna Description

The following antenna gains provided by the manufacturer were used for testing.


Band	Antenna Gain [dBi]			
	Antenna 3	Antenna 1	Antenna 4b	Antenna 2b
LTE Band 48 NR Band n48	1.8	1.1	-0.4	-1.6

Table 2-2. Highest Antenna Gain

2.4 Test Support Equipment

1	Apple MacBook Pro w/AC/DC Adapter	Model: A2141 Model: A2166	S/N: C02H604EQ05D S/N: C4H042705ZNP0WA6
2	Apple USB-C Cable	Model: Spartan	S/N: GXK1336018XKTR024
3	USB-C Cable w/ AC Adapter	Model: A246C Model: A2305	S/N: DWH80115BK826GV19 S/N: C4H95160004PF4F4V
4	Apple Pencil	Model: A2538	S/N: KJ26TCFXJW
5	DC Power Supply	Model: KPS3010D	S/N: N/A
6	LTE B48 Access Point	Model: AV1500	S/N: E2C86B00EBE0
7	NR FR1 n48 Access Point	Model: AV1901	S/N: F0887410B2FA

Table 2-3. Test Support Equipment

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2.5 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015, TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

For emissions from 1GHz – 18GHz, low, mid, and high channels were tested with highest power and worst case configuration. The emissions below 1GHz and above 18GHz were tested with the highest transmitting power and the worst case channel.


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

2.6 Software and Firmware

The test was conducted with firmware version 21E8197 installed on the EUT.

2.7 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled “American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services” (ANSI C63.26-2015, TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure.....None

3.2 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 spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. 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

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

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

Per KDB 414788 D01 v01r01, radiated emission test sites other than open-field test sites (e.g., shielded anechoic chambers), may be employed for emission measurements below 30MHz if characterized so that the measurements correspond to those obtained at an open-field test site. To determine test site equivalency, a reference sample transmitting at 149kHz was measured on an open field test site (asphalt with no ground plane) and then measured in the 3m semi-anechoic chamber. A calibrated 60cm loop antenna was used while the reference device was rotated through the X, Y and Z axis in order to capture the worst case level. A maximum deviation of 2.77dB at 149kHz was measured when comparing the 3 meter semi-anechoic chamber to the open field site.

Radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI C63.26-2015 and TIA-603-E-2016.


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4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.23-2012. 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 (\pm dB)
Conducted Bench Top Measurements	2.07
Radiated Disturbance (<30MHz)	4.12
Radiated Disturbance (30MHz-1GHz)	4.85
Radiated Disturbance (1-18GHz)	5.08
Radiated Disturbance (>18GHz)	4.59

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5.0 TEST EQUIPMENT CALIBRATION DATA


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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	6/21/2023	Annual	6/21/2024	MY49430244
ESPEC	SU-241	Tabletop Temperature Chamber	11/17/2023	Annual	11/17/2024	92009574
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	3/30/2023	Annual	3/30/2024	00218555
Keysight Technology	N9040B	UXA Signal Analyzer	11/5/2023	Annual	11/5/2024	MY57213068
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	8/31/2023	Annual	8/31/2024	100052
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	5/11/2023	Annual	5/11/2024	101619
Rohde & Schwarz	ESW44	EMI Test Receiver	6/6/2023	Annual	6/6/2024	101668
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	6/22/2023	Annual	6/22/2024	102356
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	11/30/2023	Annual	11/30/2024	161616
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	12/27/2023	Annual	12/27/2024	164715
Rohde & Schwarz	TS-PR1840	Pre-Amplifier (18GHz - 40GHz)	6/2/2023	Annual	6/2/2024	100050
Rohde & Schwarz	HFH2-Z2	Loop Antenna	5/1/2023	Annual	5/1/2024	100519
Rohde & Schwarz	FSW43	Signal Analyzer (2Hz-43.5GHz)	7/13/2023	Annual	7/13/2024	101261
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/17/2023	Annual	4/17/2024	00304

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.

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6.0 SAMPLE CALCULATIONS

Emission Designator

$\pi/2$ BPSK / QPSK Modulation

Emission Designator = 8M62G7W

LTE BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination of Any

QAM Modulation

Emission Designator = 8M45D7W

LTE BW = 8.45 MHz

D = Amplitude/Angle Modulated


7 = Quantized/Digital Info

W = Combination of Any

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive 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 analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of -30.9 dBm yielding -24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm $- (-24.80) = 50.3$ dBc.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Apple Inc.
 FCC ID: BCGA2837
 FCC Classification: Citizens Band End User Devices (CBE)
 Mode(s): NR/LTE/ULCA


Test Condition	Test Description	FCC Part Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Occupied Bandwidth	2.1049	N/A	N/A	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 96.41(e)(ii)	-13 dBm/MHz at frequencies within 0-B MHz of channel edge (where B is the bandwidth of the assigned channel) -25 dBm/MHz at frequencies greater than B MHz above and below channel edge -40 dBm/MHz at frequencies below 3530 MHz and above 3720 MHz	PASS	Sections 7.3, 7.4
	Transmitter Conducted Output Power	2.1046	N/A	N/A	See RF Exposure Report
	Peak-Average Ratio	96.41(g)	< 13 dB	PASS	Section 7.5
	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
	Equivalent Isotropic Radiated Power (EIRP)	96.41(b)	23 dBm/10MHz	PASS	Section 7.6
RADIATED	Radiated Spurious Emissions	2.1053, 96.41(e)	-40 dBm/MHz	PASS	Section 7.7

Table 7-1. Summary of Test Results

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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. All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized was Element Materials Technology EMC Software Tool 1.1.
5. For radiated spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software's utilized are Element "Chamber Automation," Version 1.3.1.

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7.2 Occupied Bandwidth

§2.1049

Test Overview

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

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

Test Setup

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

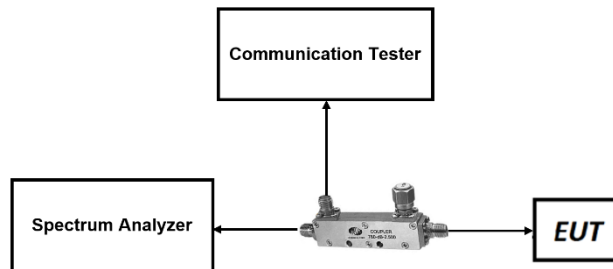



Figure 7-1. Test Instrument & Measurement Setup

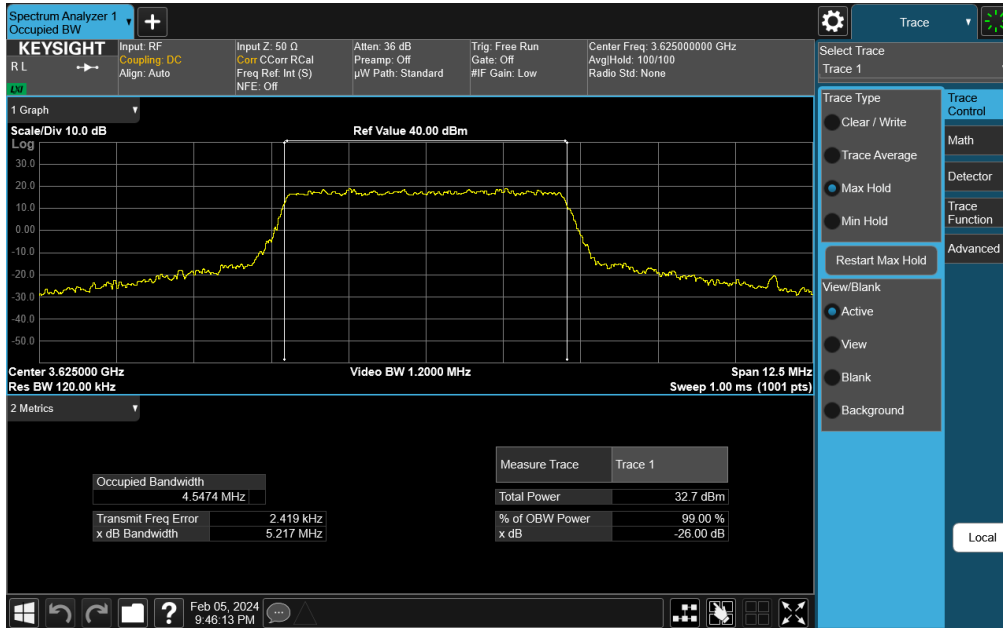
Test Notes

None.

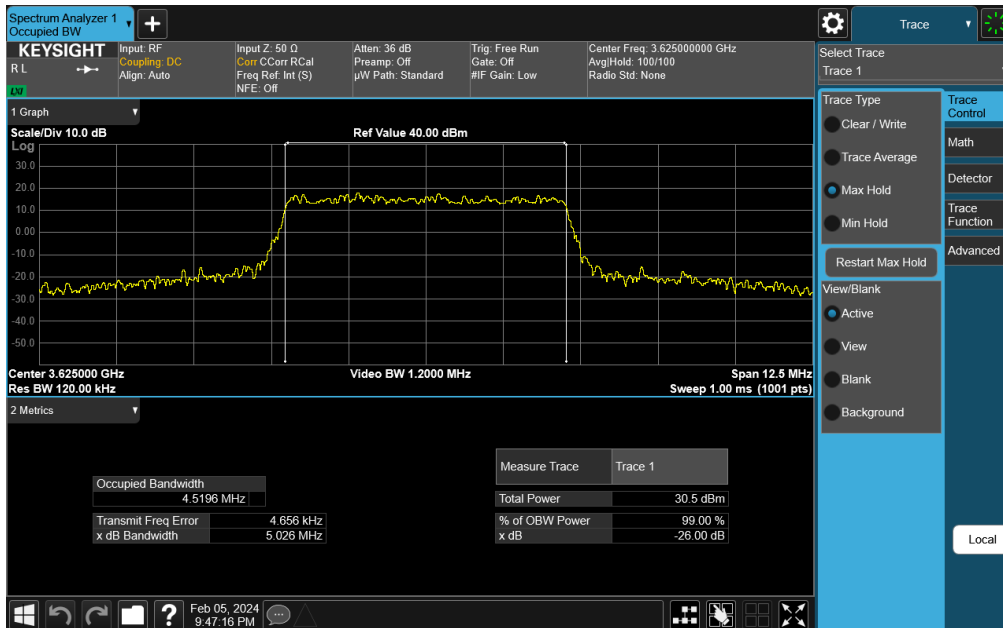
FCC ID: BCGA2837	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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LTE Band 48

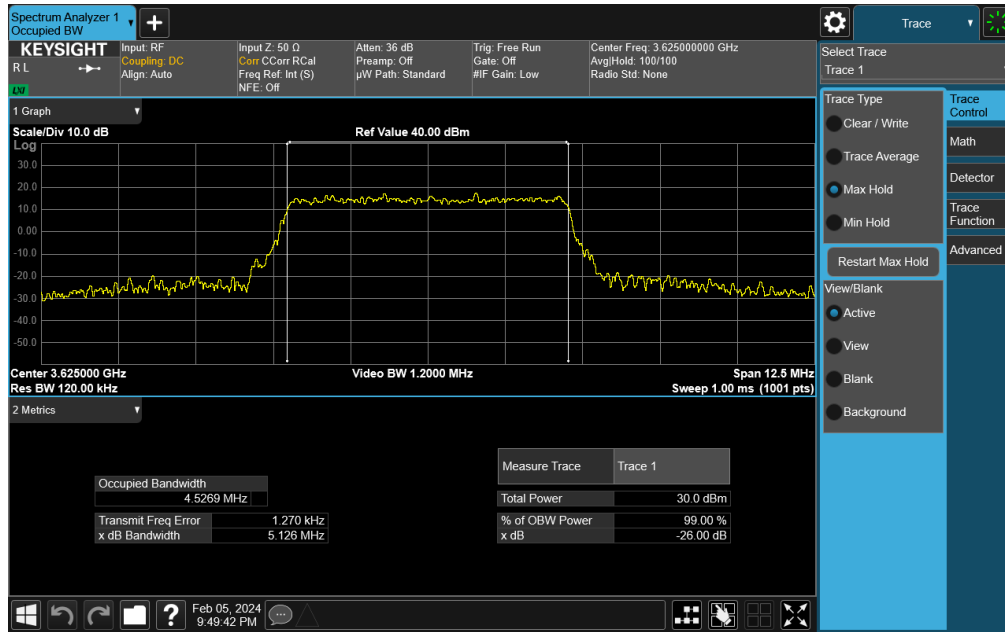


Plot 7-1. Occupied Bandwidth Plot (LTE Band 48 - 5MHz QPSK - Full RB Configuration)

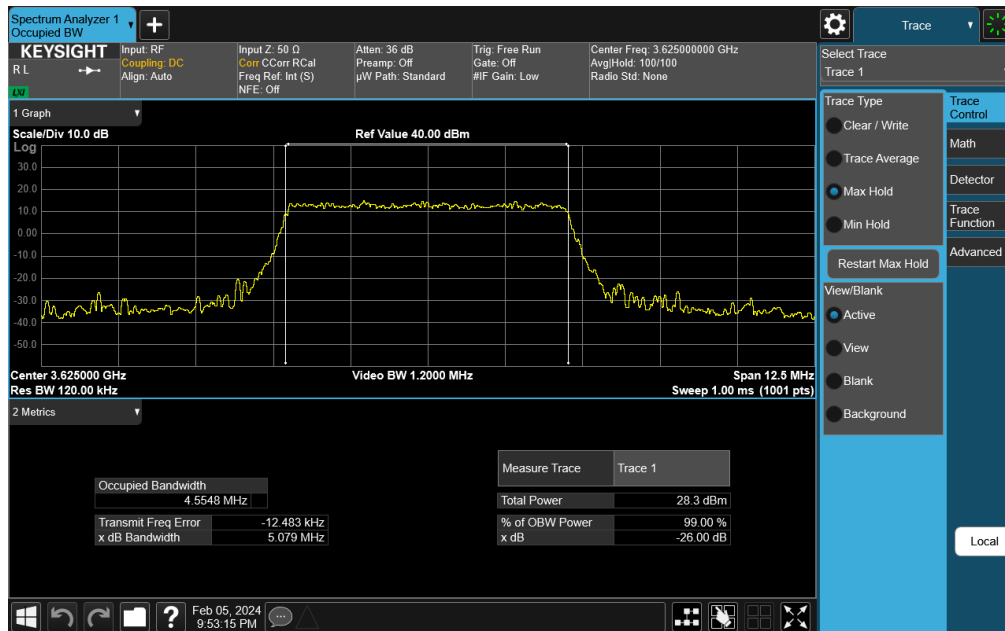


Plot 7-2. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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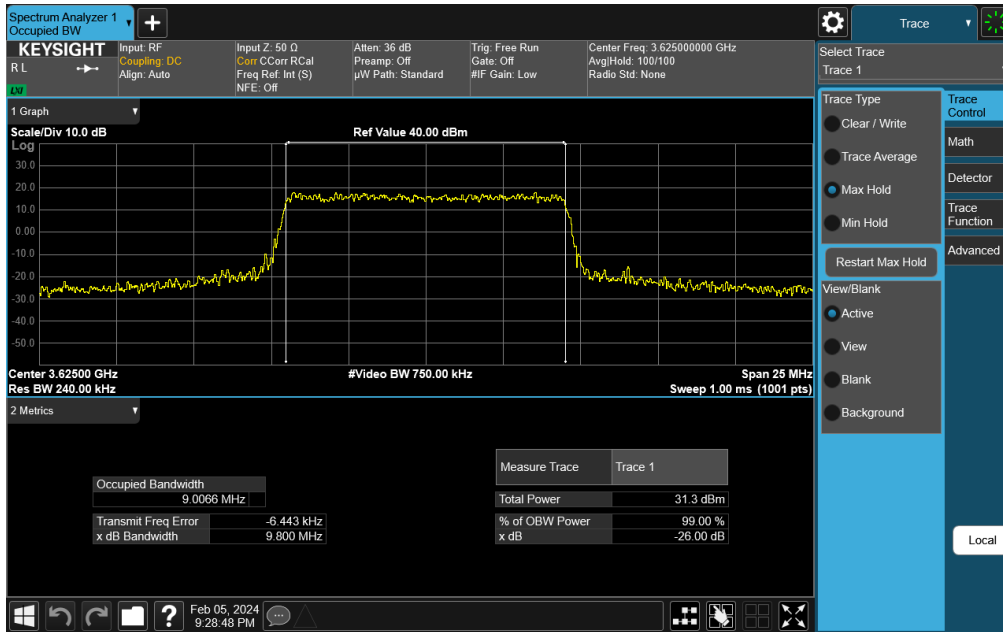


Plot 7-3. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 64-QAM - Full RB Configuration)

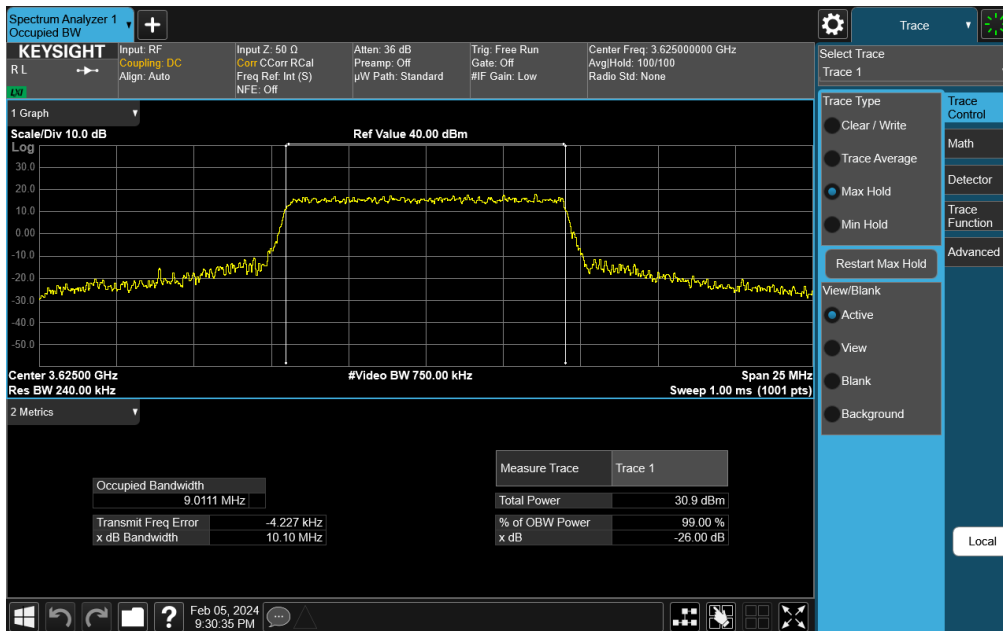


Plot 7-4. Occupied Bandwidth Plot (LTE Band 48 - 5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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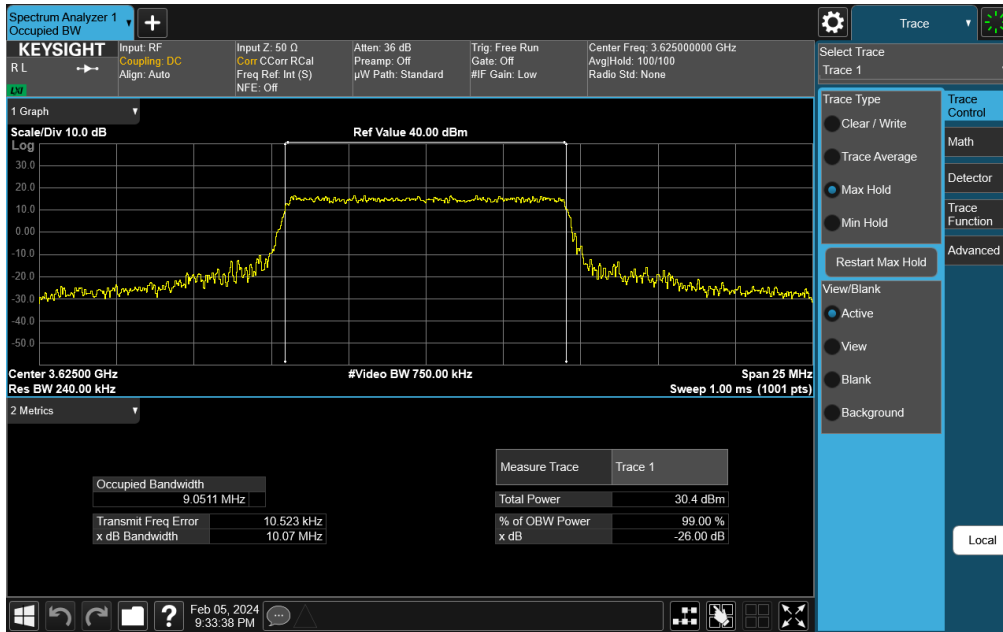


Plot 7-5. Occupied Bandwidth Plot (LTE Band 48 - 10MHz QPSK - Full RB Configuration)

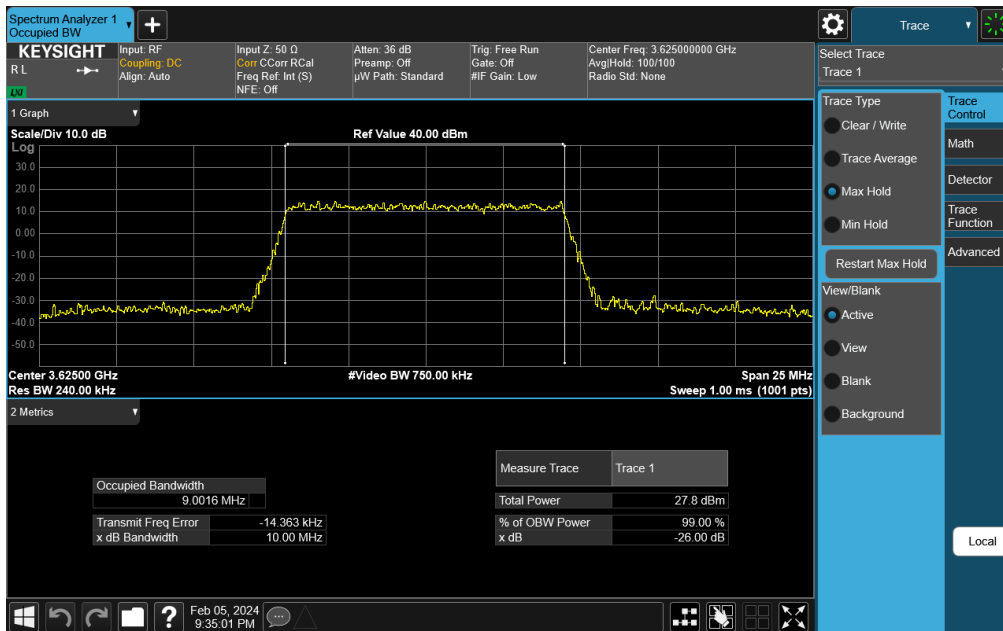


Plot 7-6. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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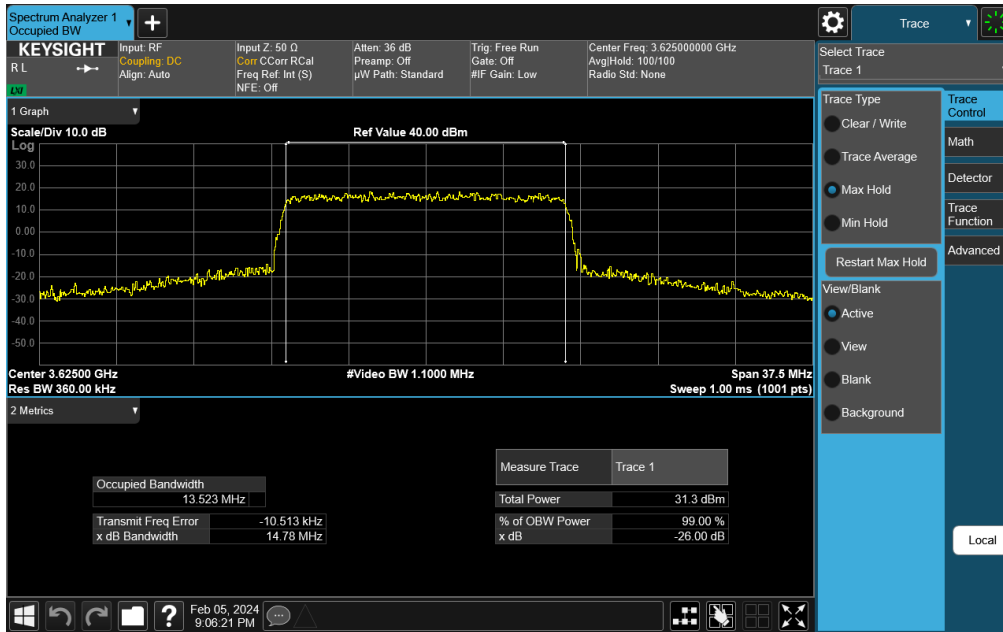


Plot 7-7. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 64-QAM - Full RB Configuration)

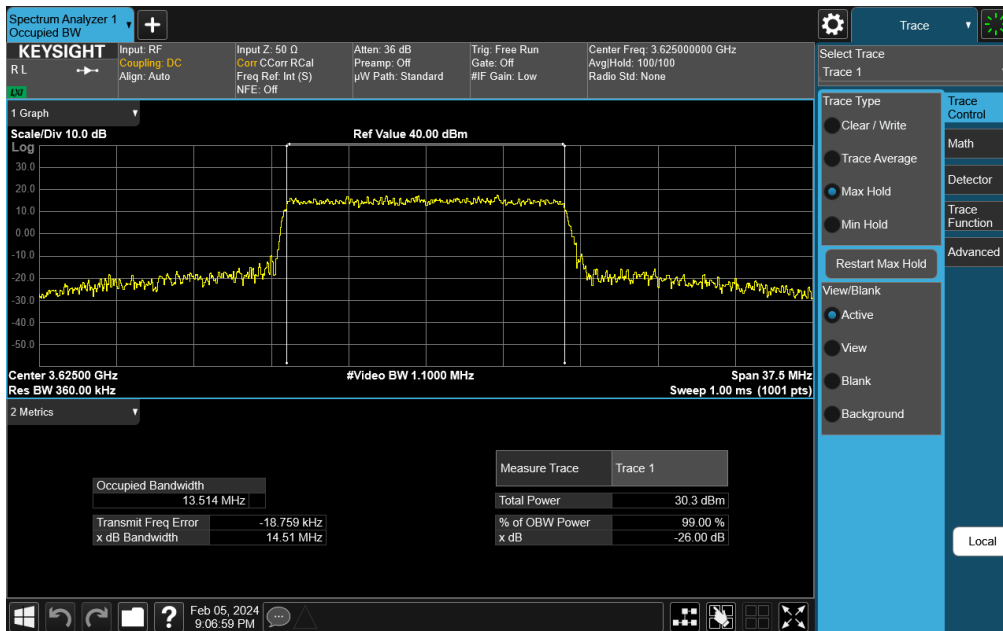


Plot 7-8. Occupied Bandwidth Plot (LTE Band 48 - 10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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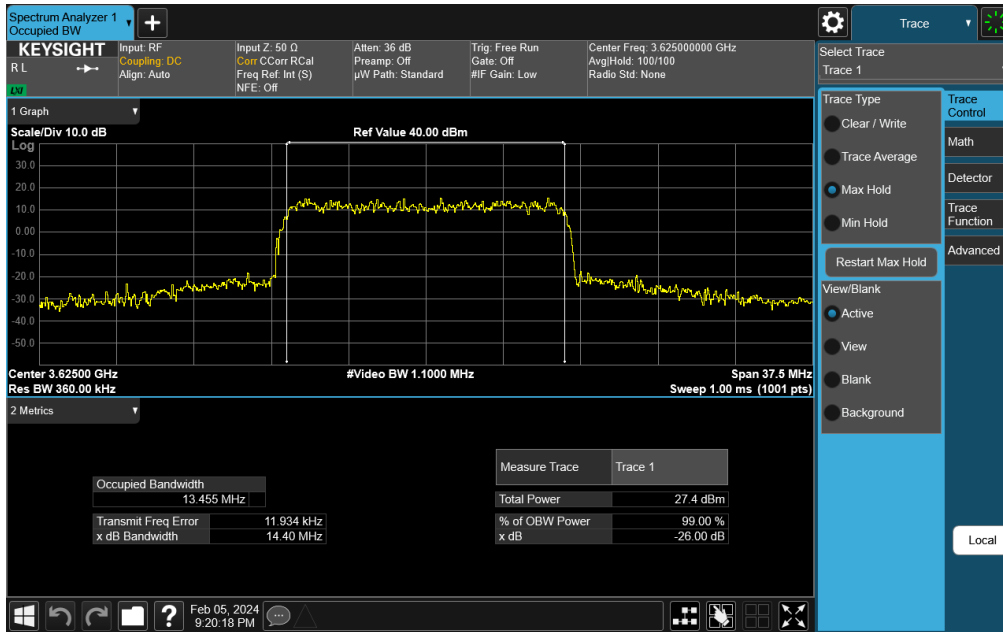


Plot 7-9. Occupied Bandwidth Plot (LTE Band 48 - 15MHz QPSK - Full RB Configuration)

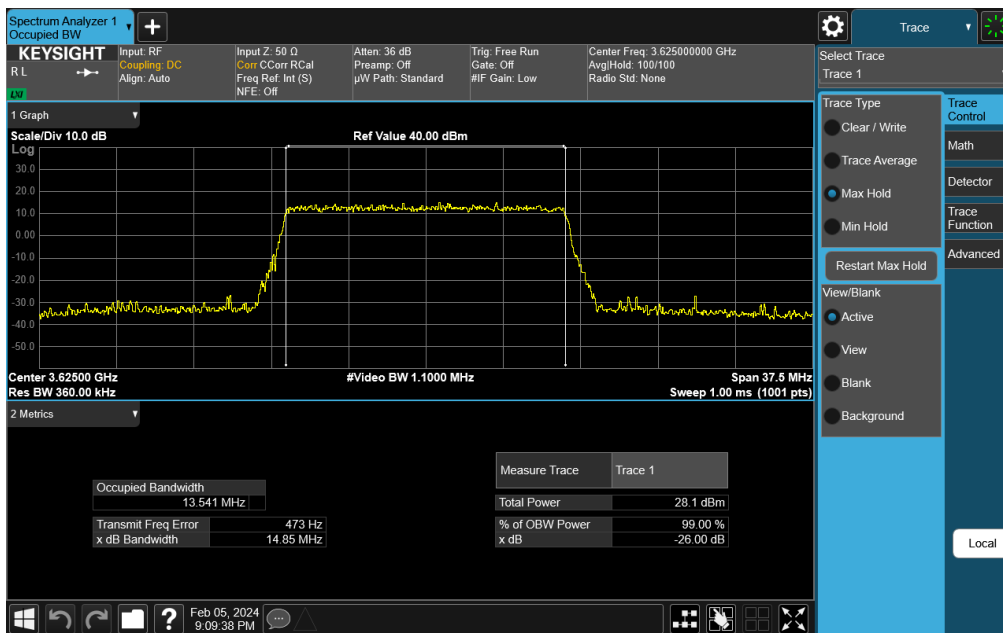


Plot 7-10. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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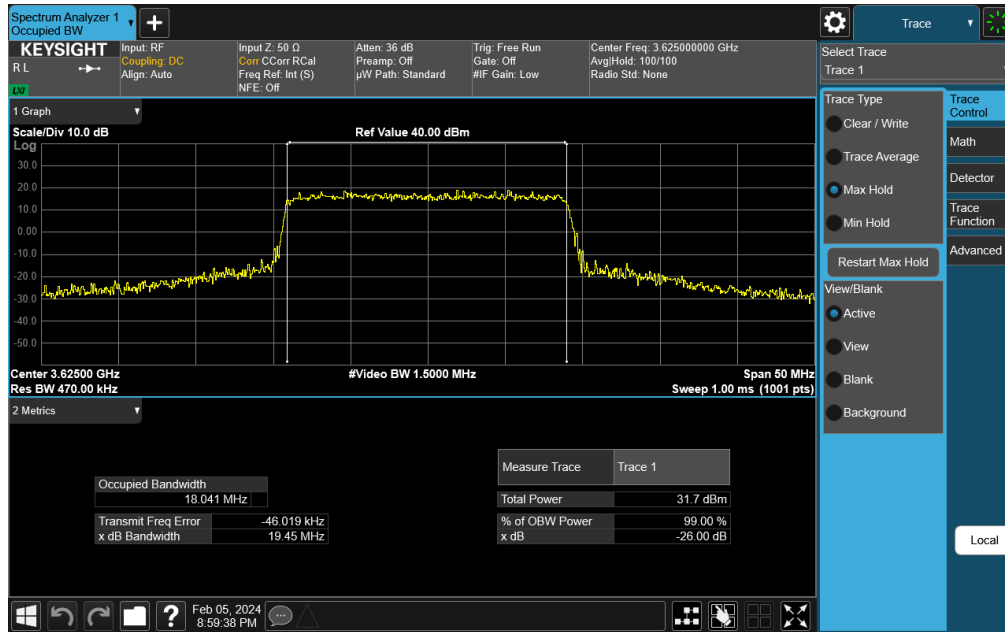


Plot 7-11. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 64-QAM - Full RB Configuration)

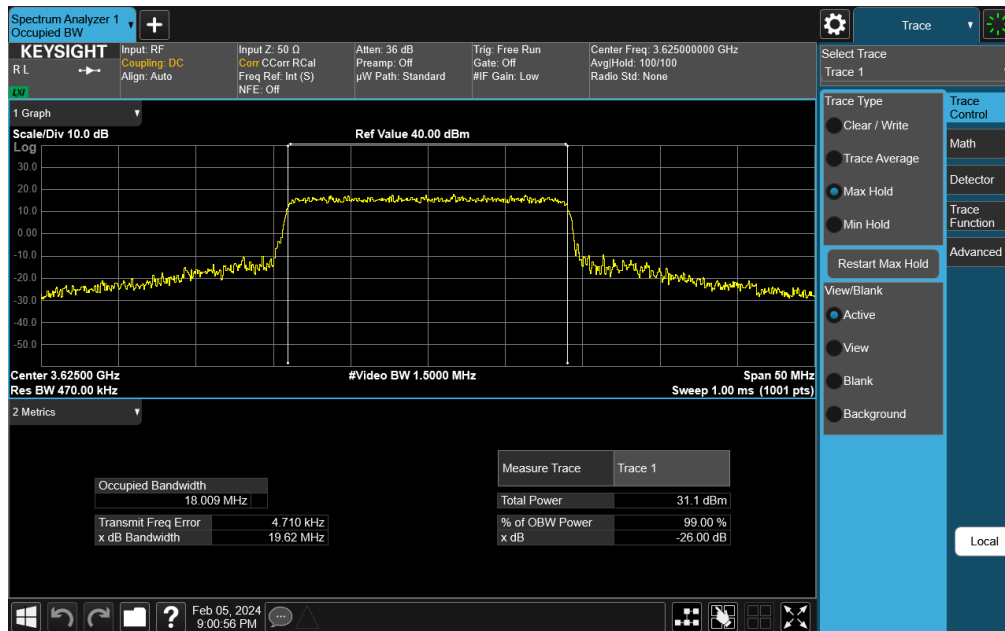


Plot 7-12. Occupied Bandwidth Plot (LTE Band 48 - 15MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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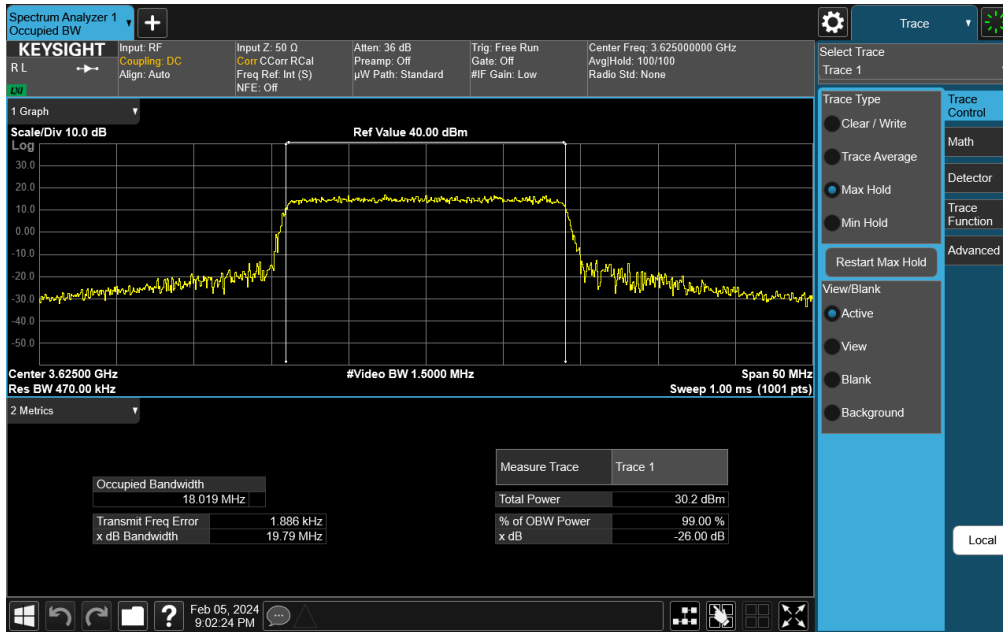


Plot 7-13. Occupied Bandwidth Plot (LTE Band 48 - 20MHz QPSK - Full RB Configuration)

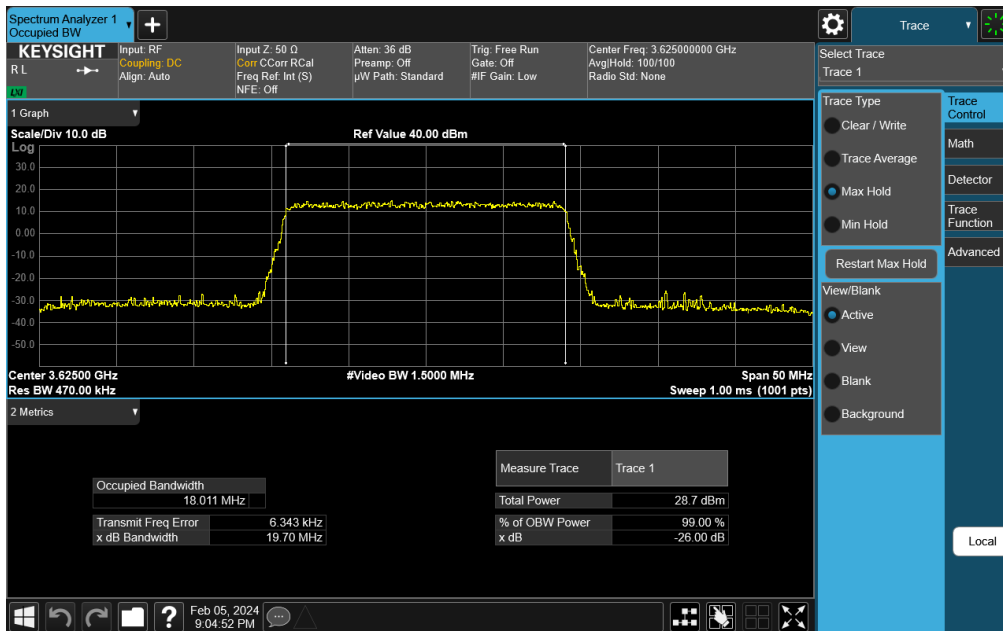


Plot 7-14. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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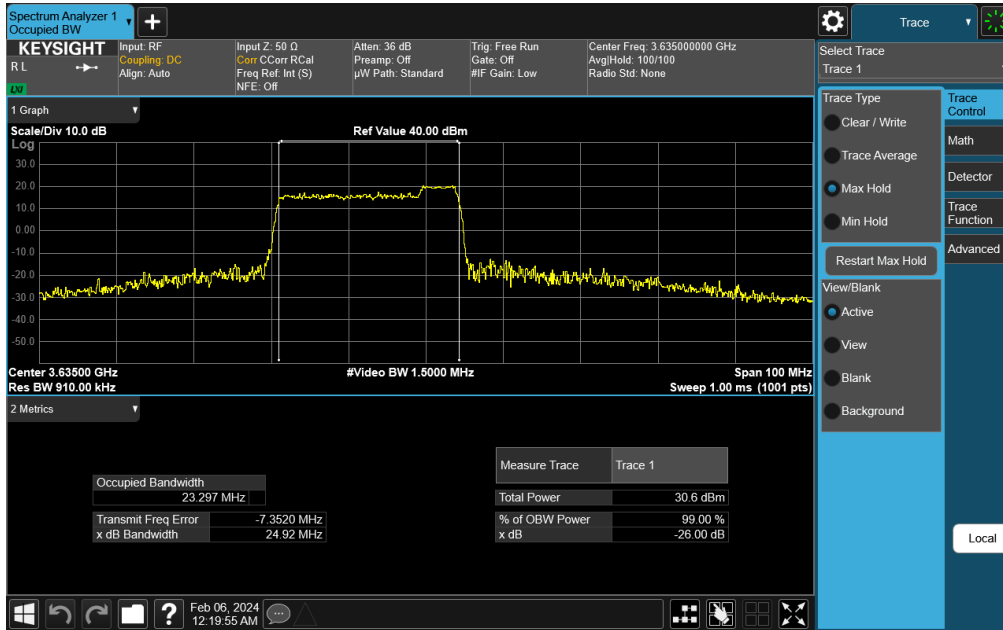
Plot 7-15. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 64-QAM - Full RB Configuration)



Plot 7-16. Occupied Bandwidth Plot (LTE Band 48 - 20MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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ULCA LTE Band 48

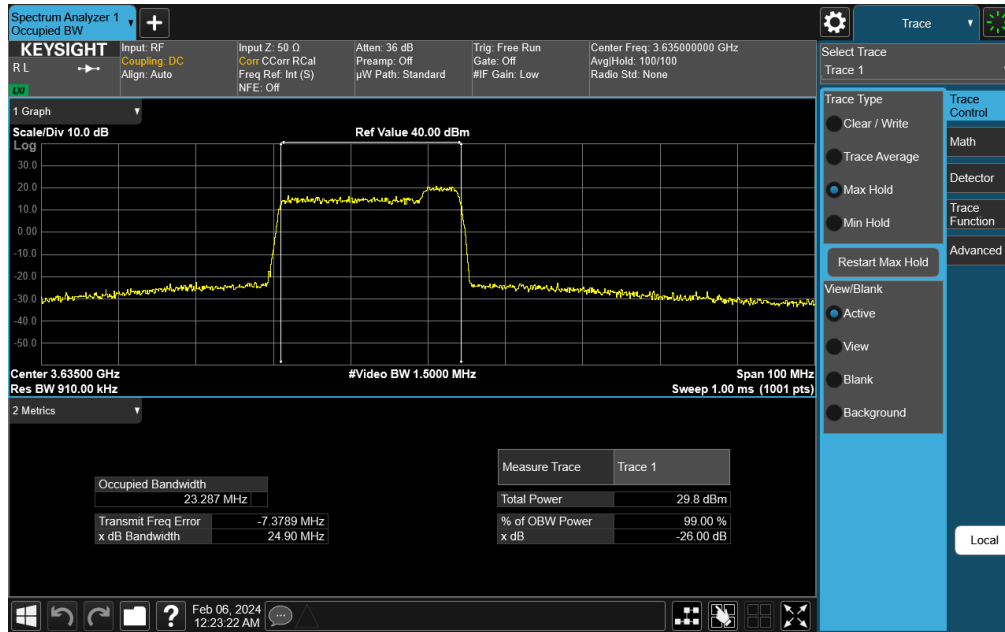


Plot 7-17. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+5MHz QPSK - Full RB Configuration)

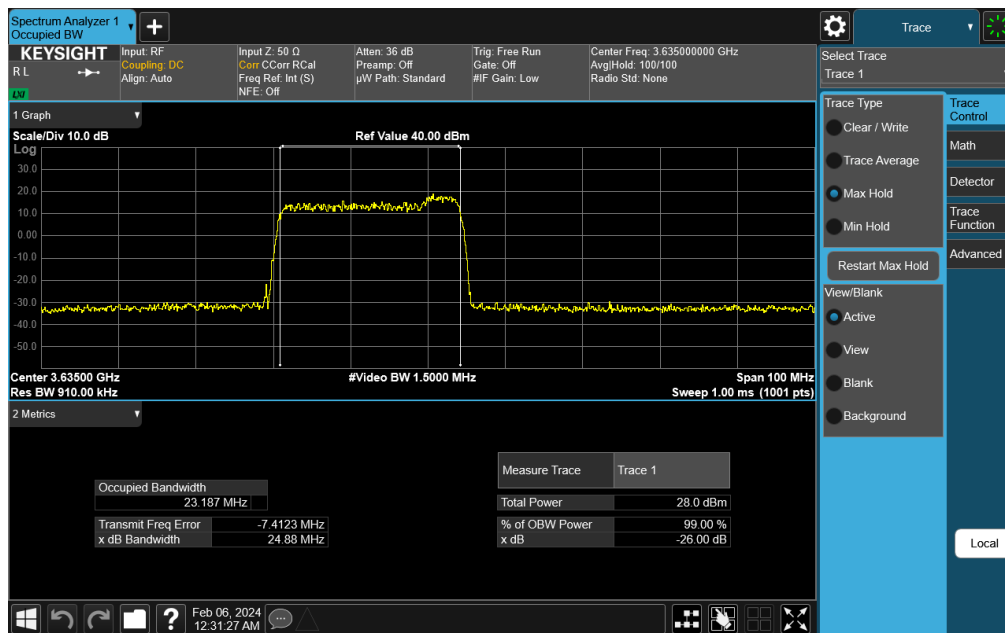


Plot 7-18. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+5MHz 16-QAM - Full RB Configuration)


FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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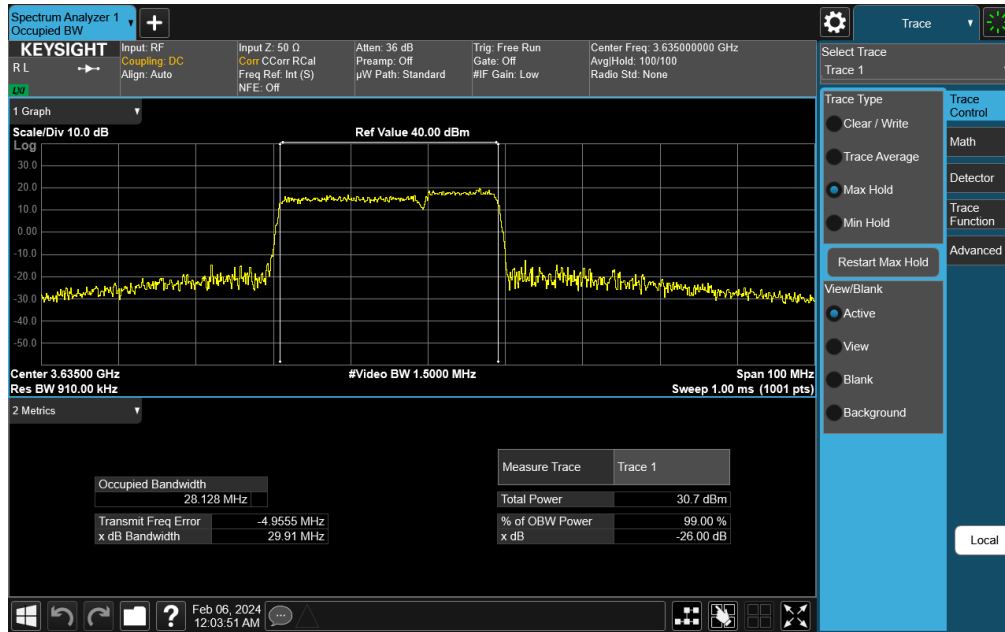


Plot 7-19. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+5MHz 64-QAM - Full RB Configuration)

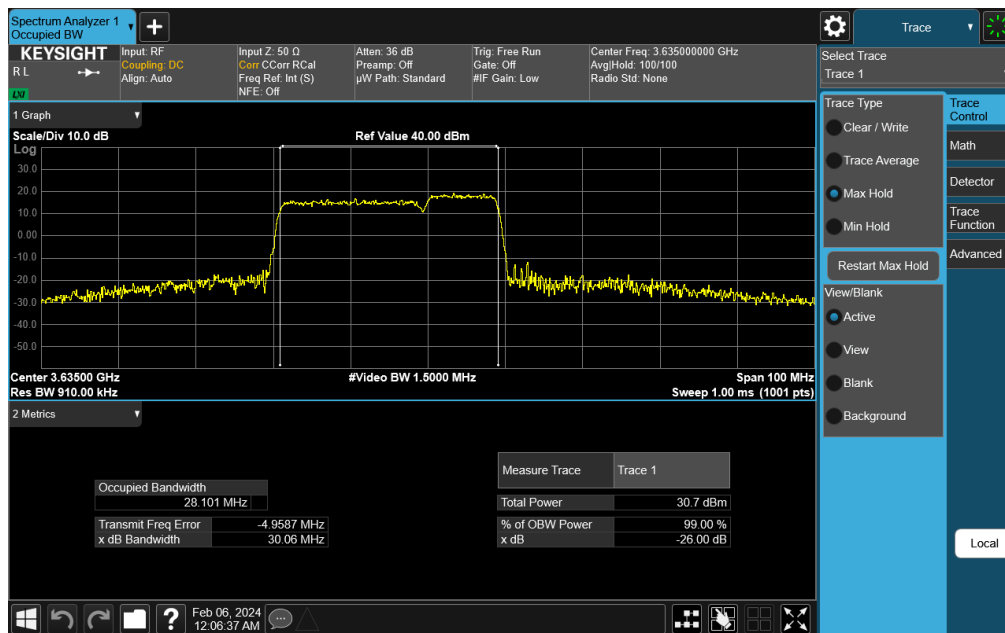


Plot 7-20. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+5MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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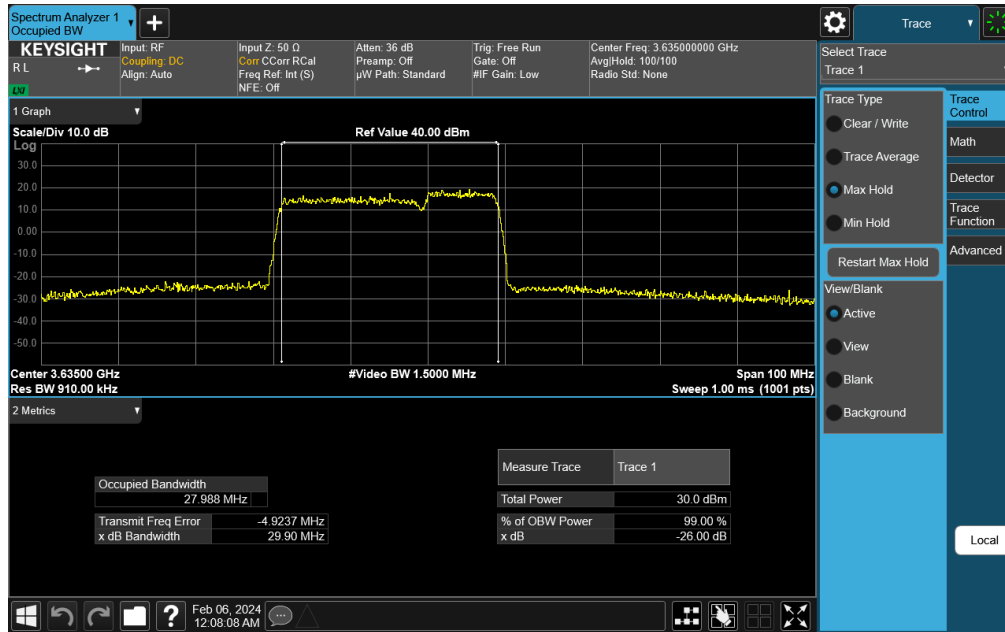


Plot 7-21. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+10MHz QPSK - Full RB Configuration)

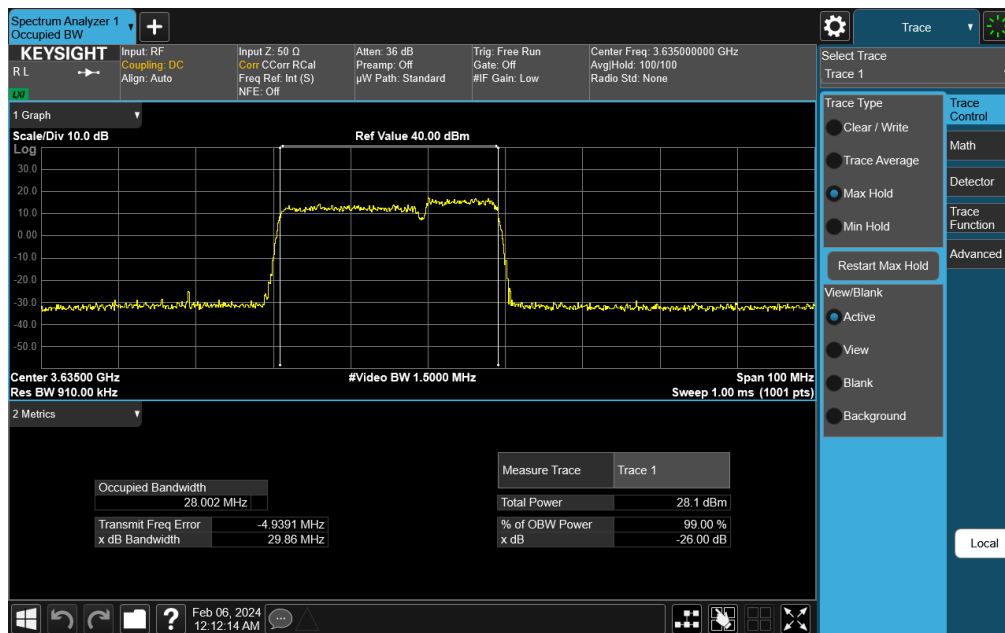


Plot 7-22. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+10MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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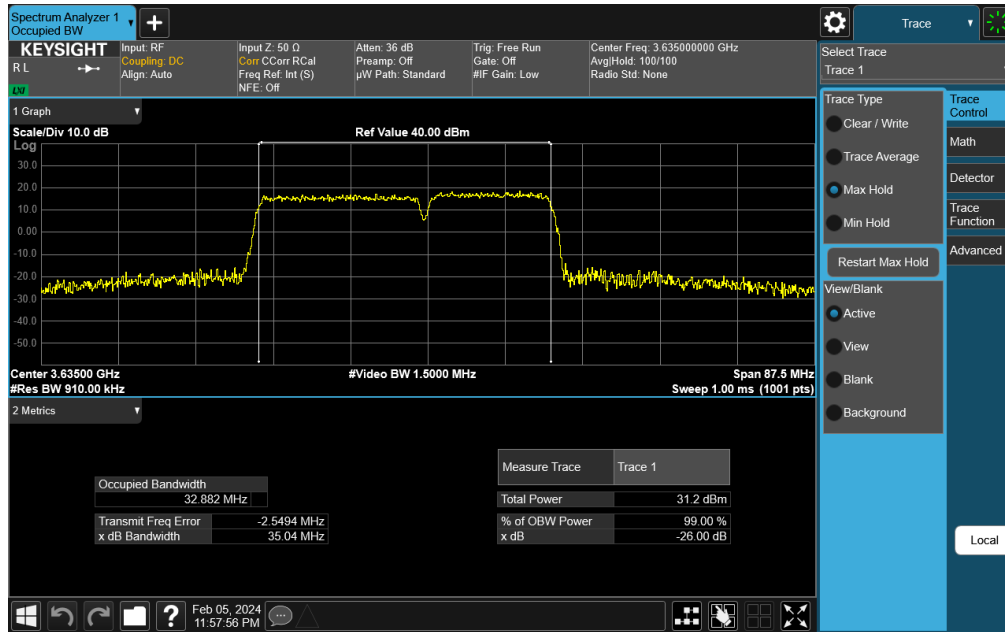


Plot 7-23. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+10MHz 64-QAM - Full RB Configuration)

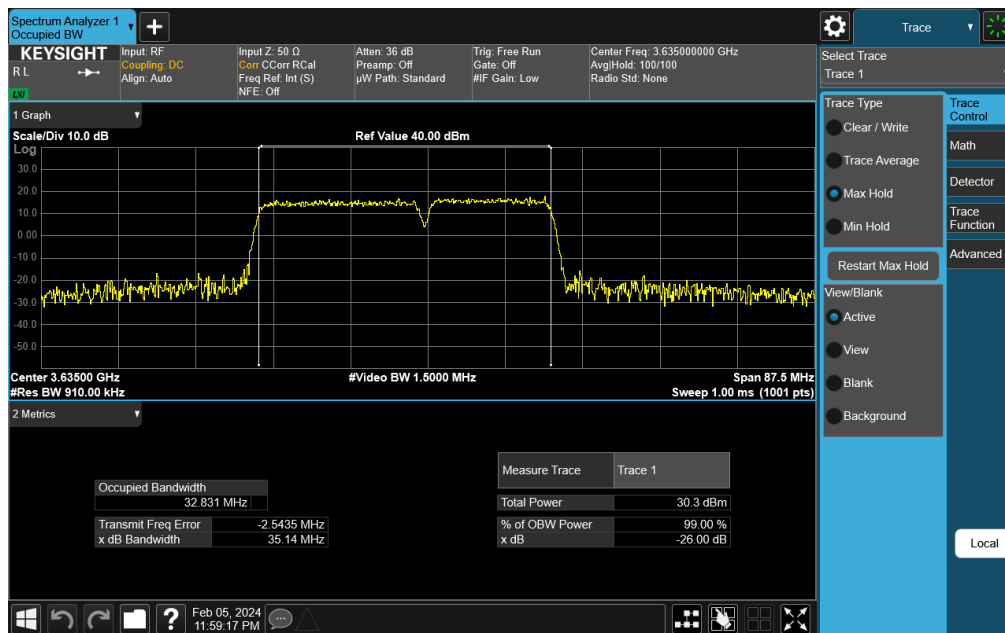


Plot 7-24. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+10MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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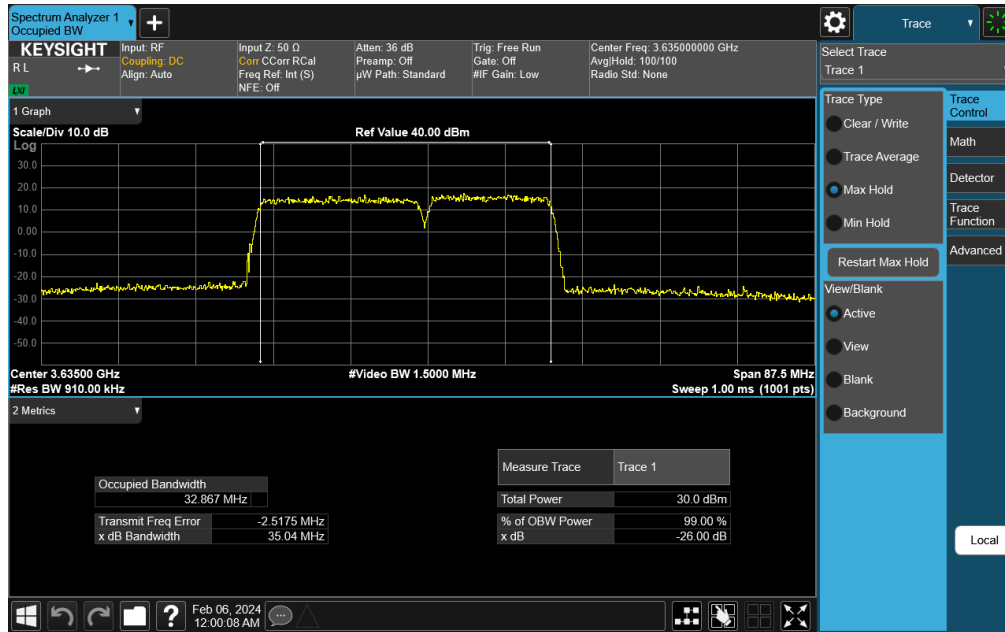


Plot 7-25. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+15MHz QPSK - Full RB Configuration)

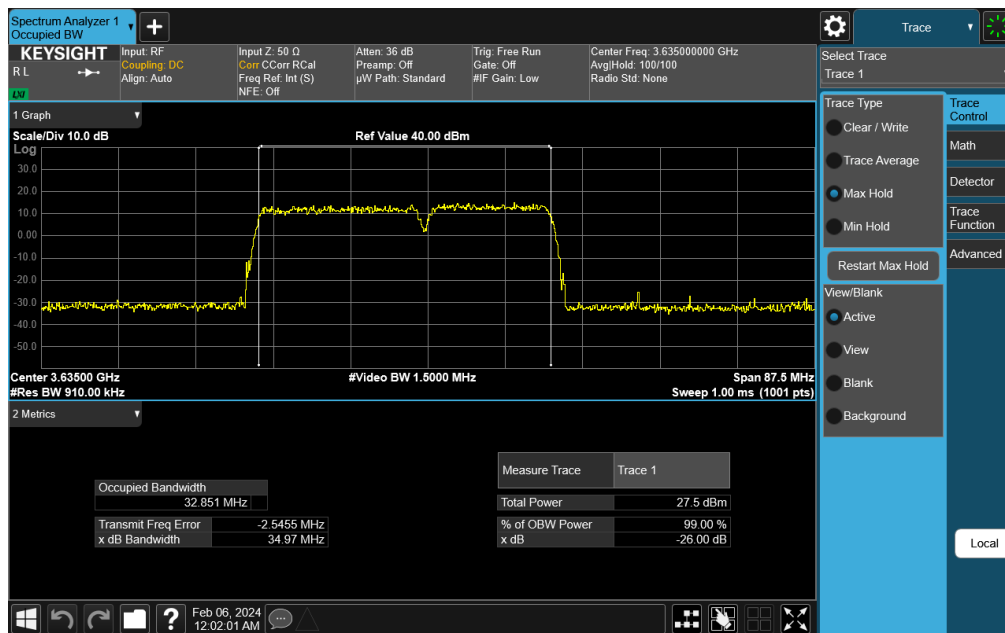


Plot 7-26. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+15MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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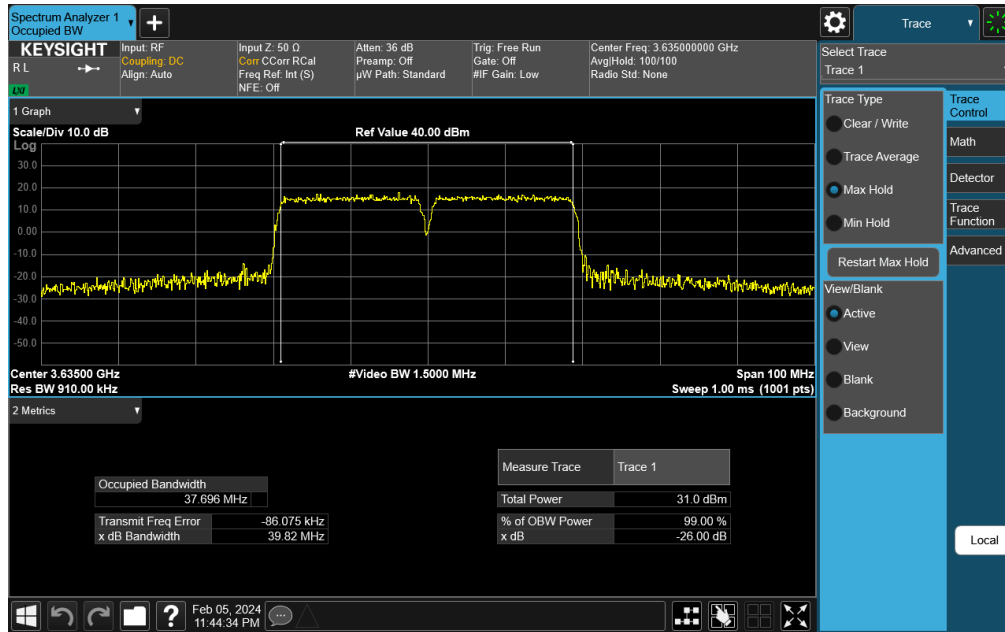


Plot 7-27. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+15MHz 64-QAM - Full RB Configuration)

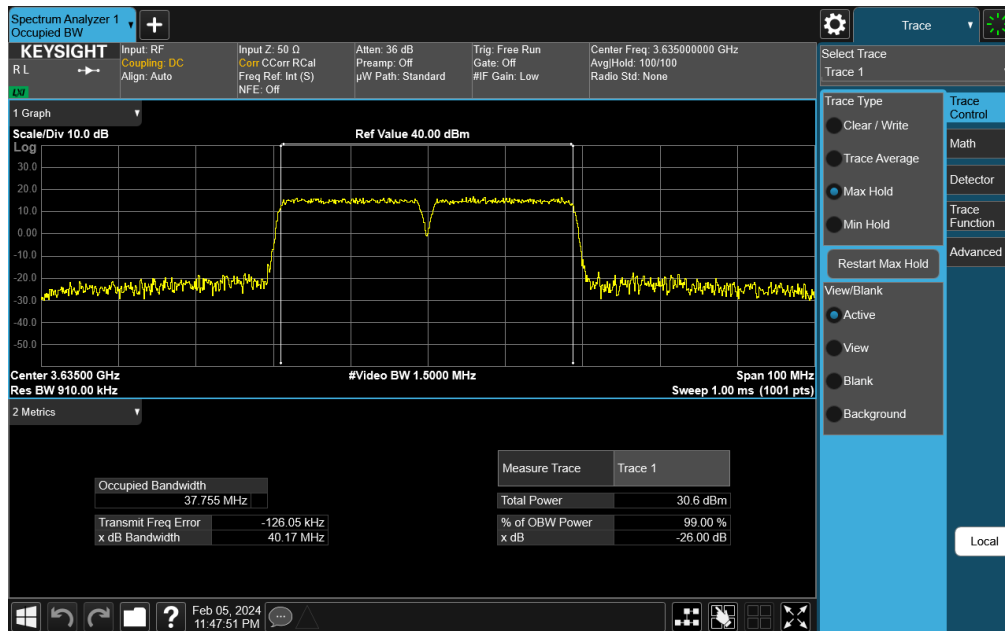


Plot 7-28. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+15MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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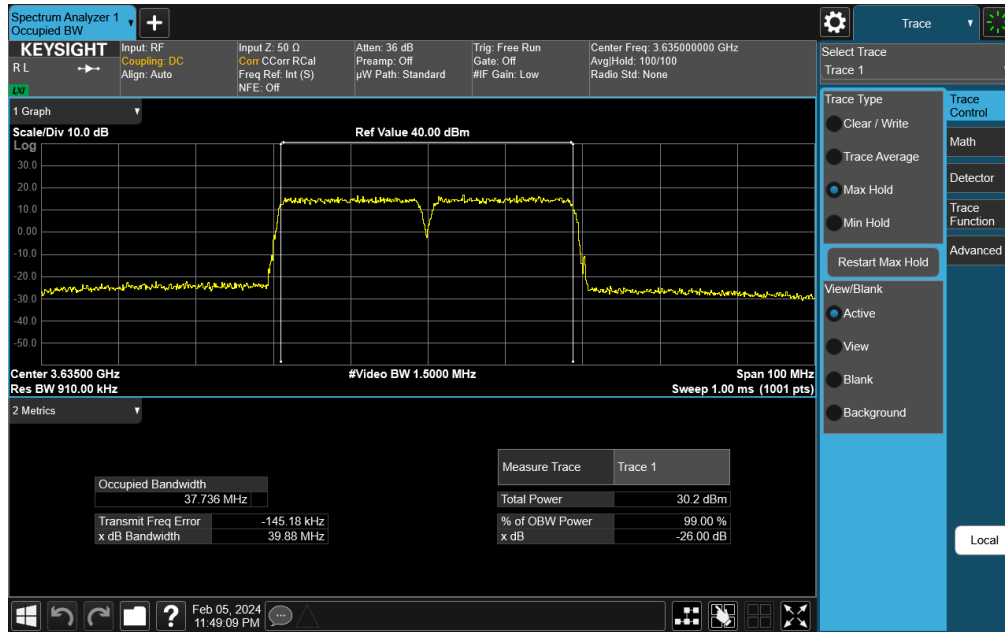


Plot 7-29. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Full RB Configuration)

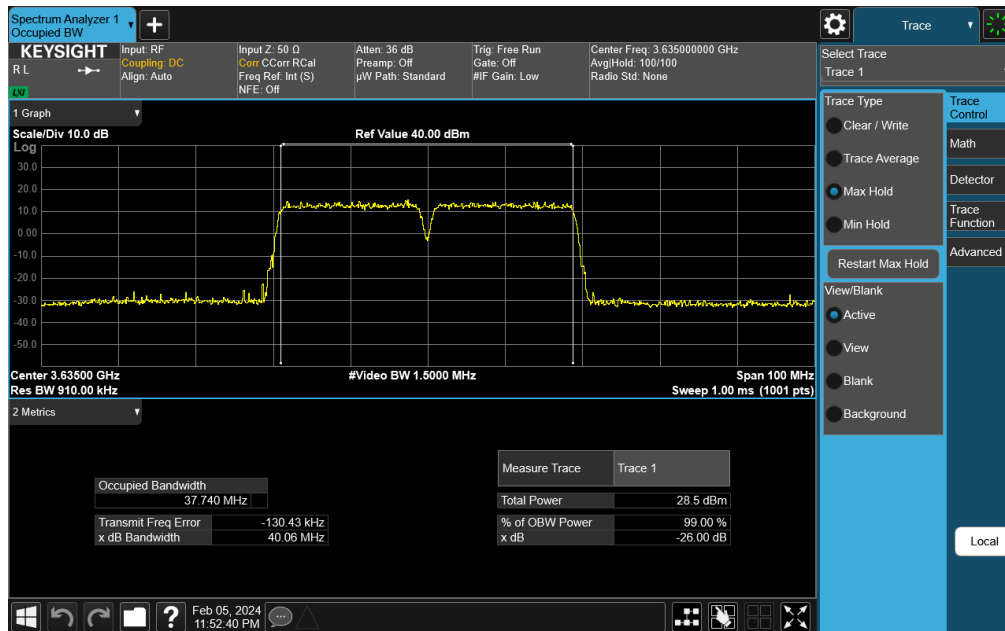


Plot 7-30. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+20MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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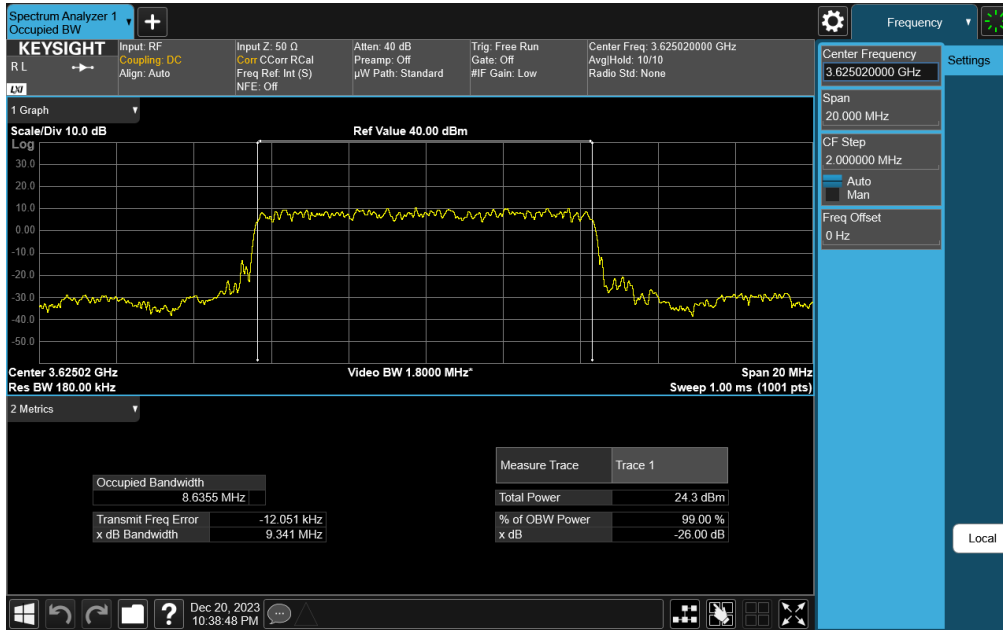
Plot 7-31. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+20MHz 64-QAM - Full RB Configuration)



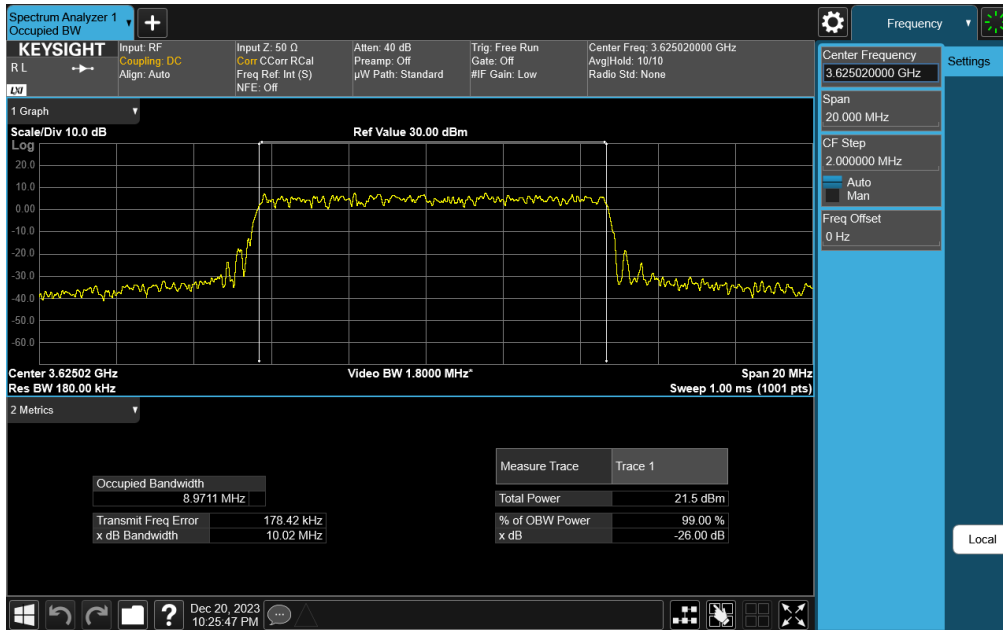
Plot 7-32. Occupied Bandwidth Plot (ULCA LTE Band 48 - 20+20MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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NR Band n48

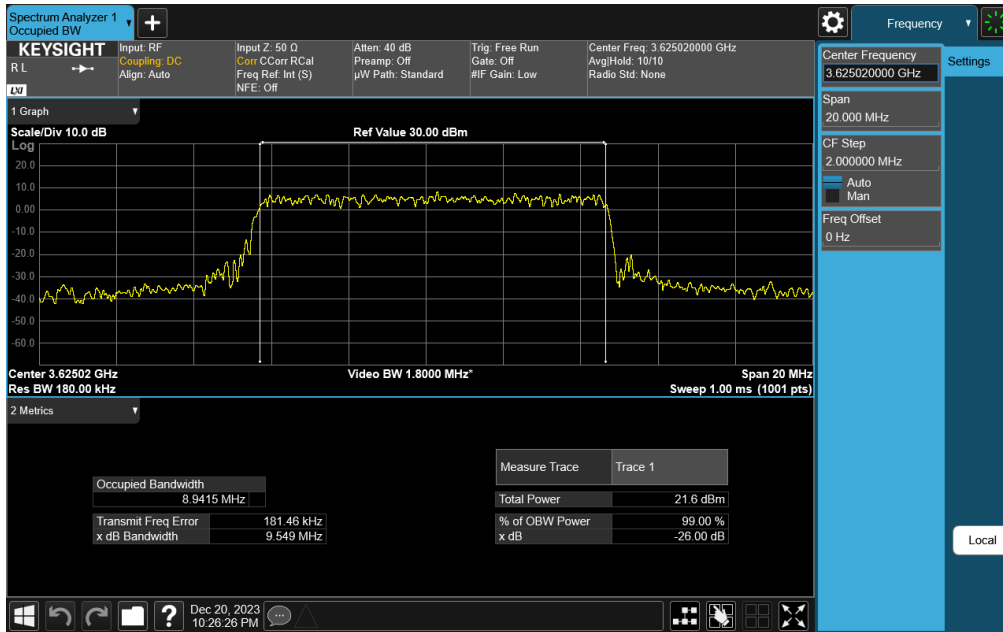


Plot 7-33. Occupied Bandwidth Plot (NR Band n48 - 10MHz $\pi/2$ BPSK - Full RB Configuration)

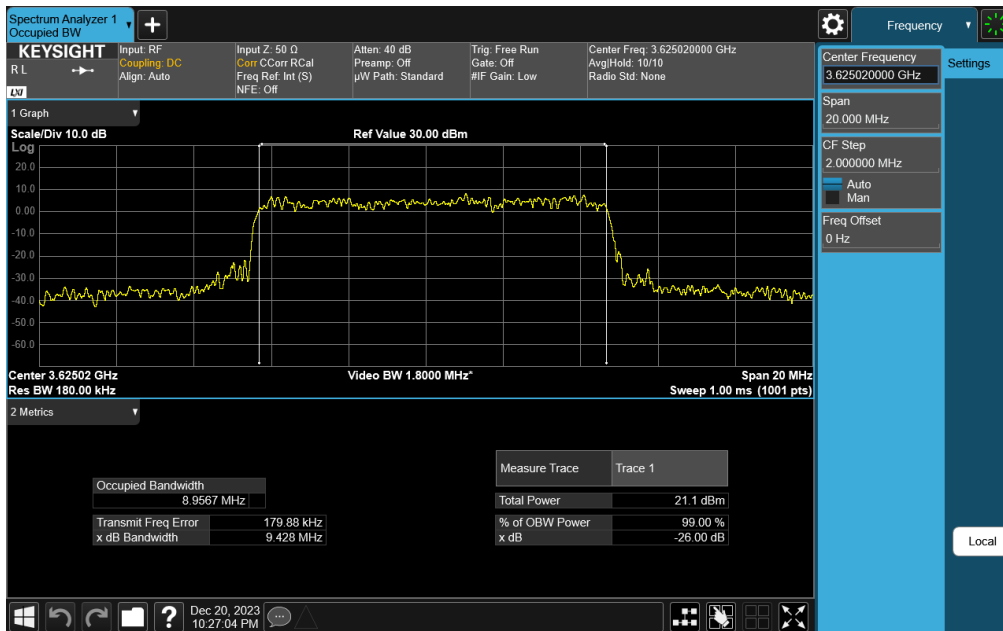


Plot 7-34. Occupied Bandwidth Plot (NR Band n48 - 10MHz QPSK - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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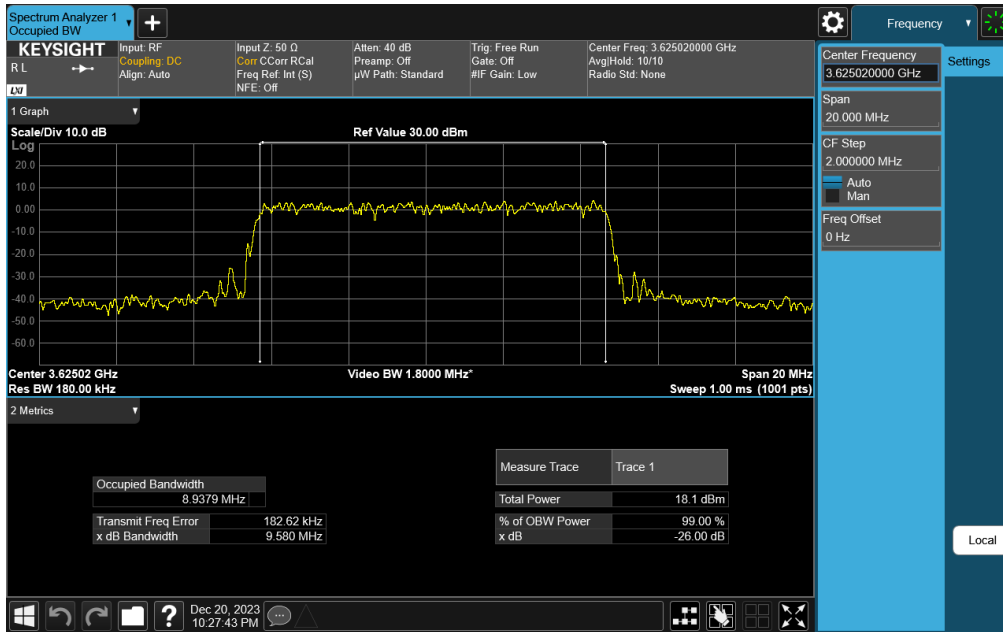


Plot 7-35. Occupied Bandwidth Plot (NR Band n48 - 10MHz 16-QAM - Full RB Configuration)

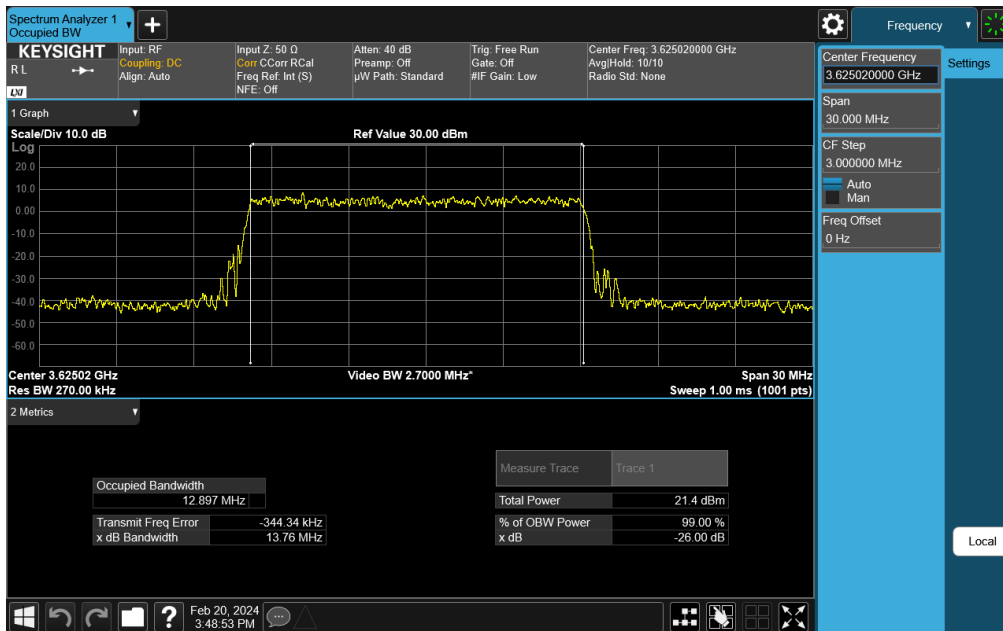


Plot 7-36. Occupied Bandwidth Plot (NR Band n48 - 10MHz 64-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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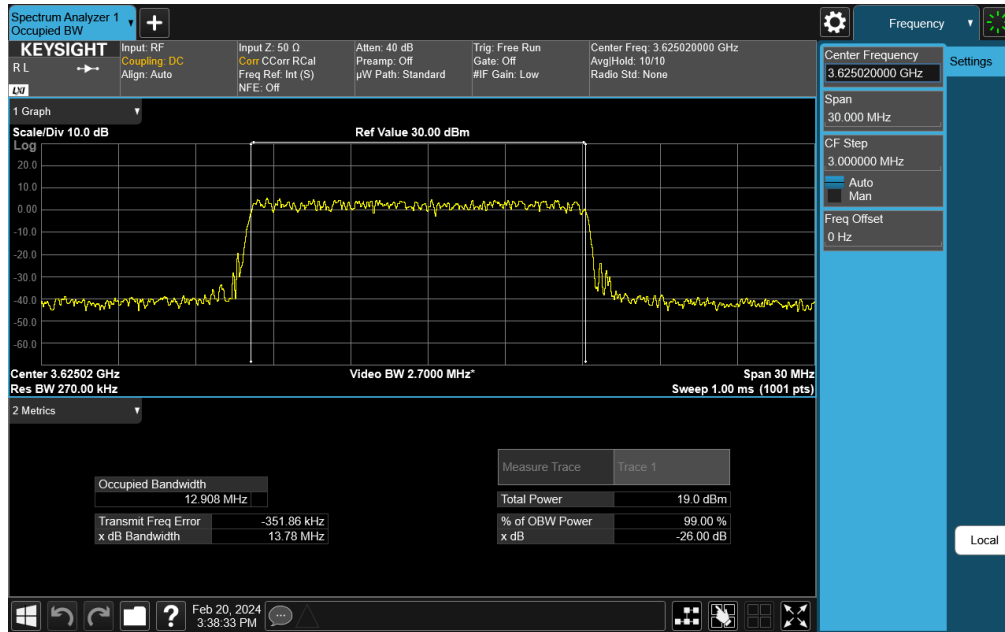


Plot 7-37. Occupied Bandwidth Plot (NR Band n48 - 10MHz 256-QAM - Full RB Configuration)

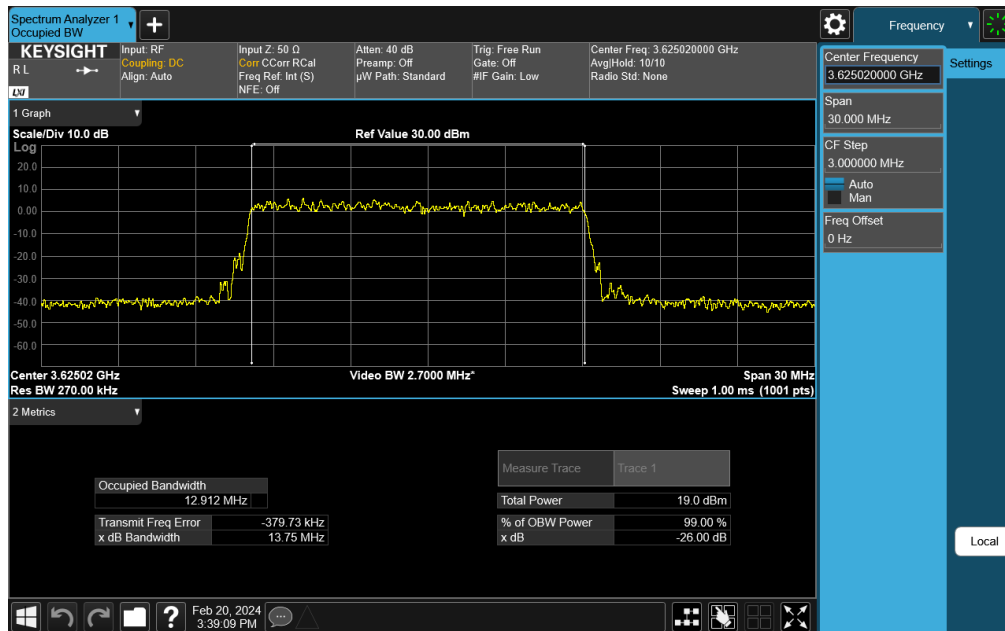


Plot 7-38. Occupied Bandwidth Plot (NR Band n48 - 15MHz $\pi/2$ BPSK - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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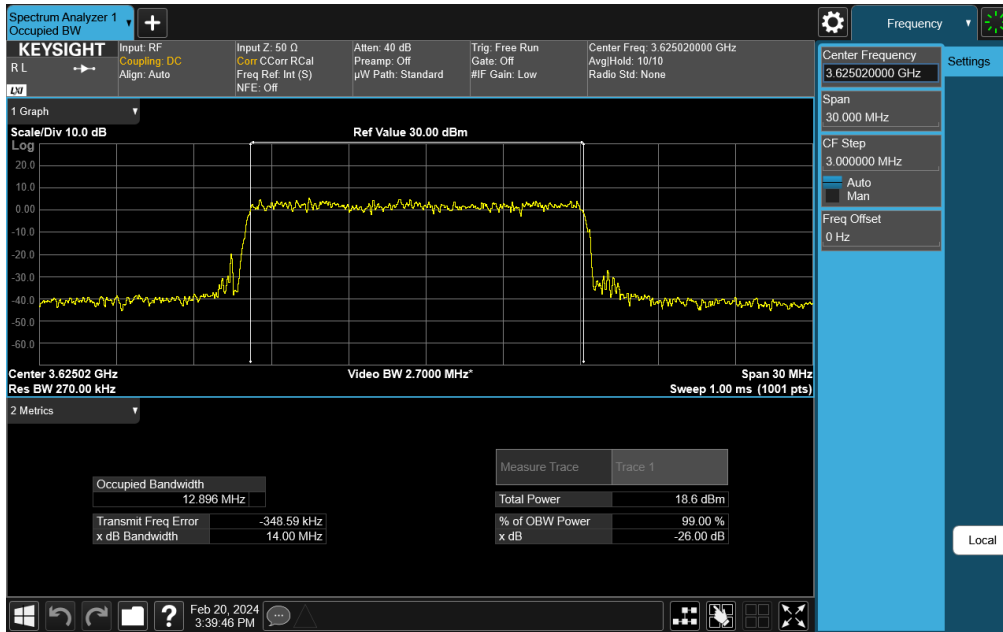


Plot 7-39. Occupied Bandwidth Plot (NR Band n48 - 15MHz QPSK - Full RB Configuration)

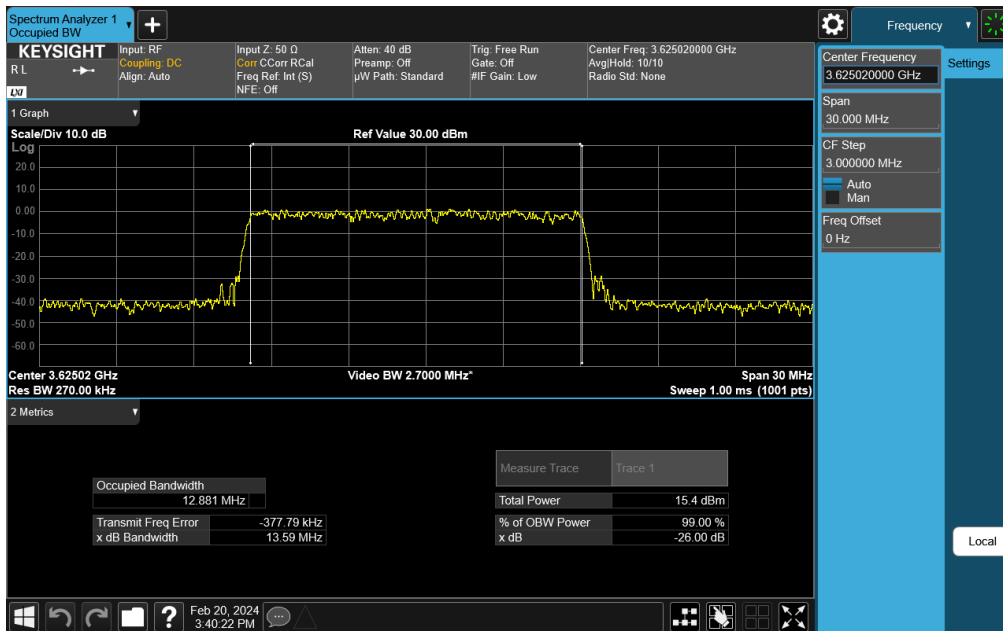


Plot 7-40. Occupied Bandwidth Plot (NR Band n48 - 15MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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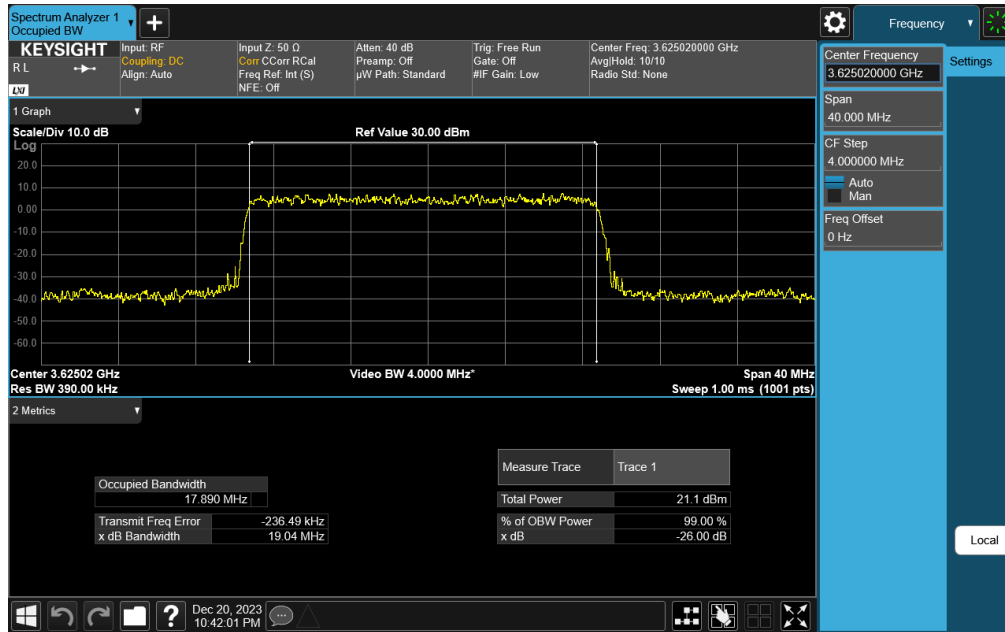


Plot 7-41. Occupied Bandwidth Plot (NR Band n48 - 15MHz 64-QAM - Full RB Configuration)

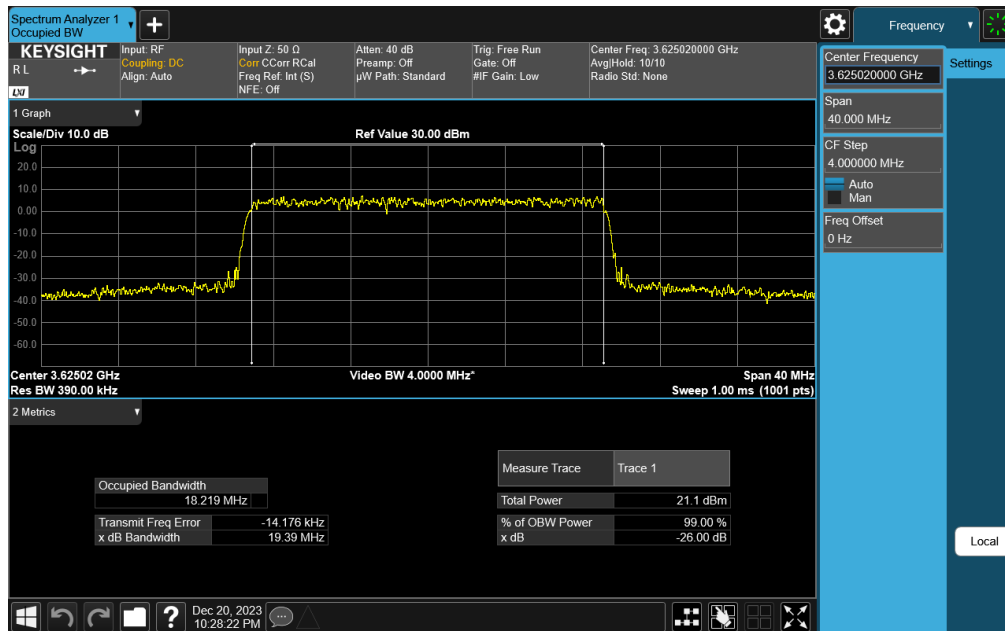


Plot 7-42. Occupied Bandwidth Plot (NR Band n48 - 15MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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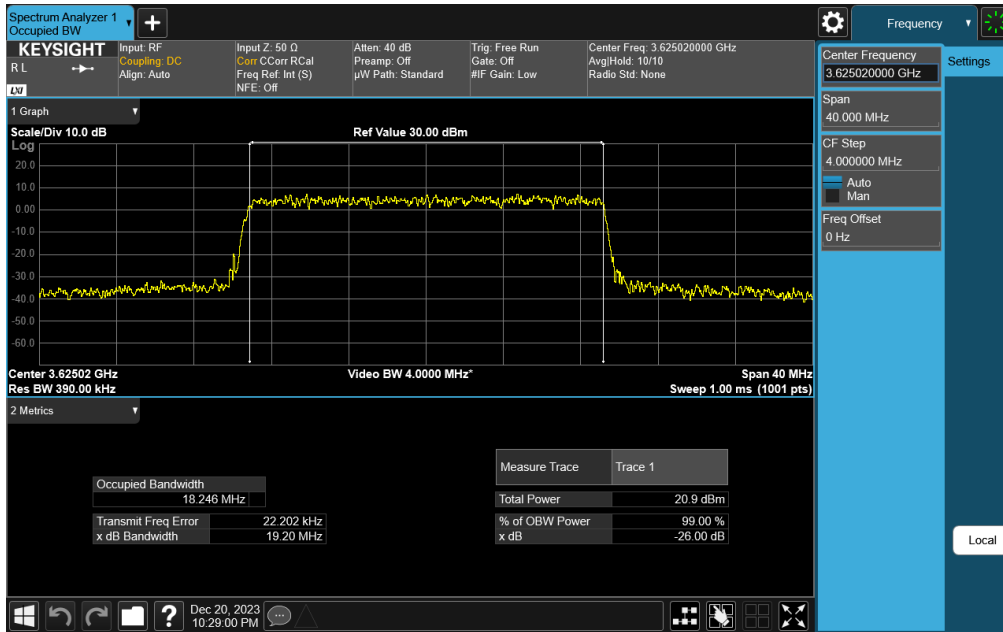


Plot 7-43. Occupied Bandwidth Plot (NR Band n48 - 20MHz $\pi/2$ BPSK - Full RB Configuration)

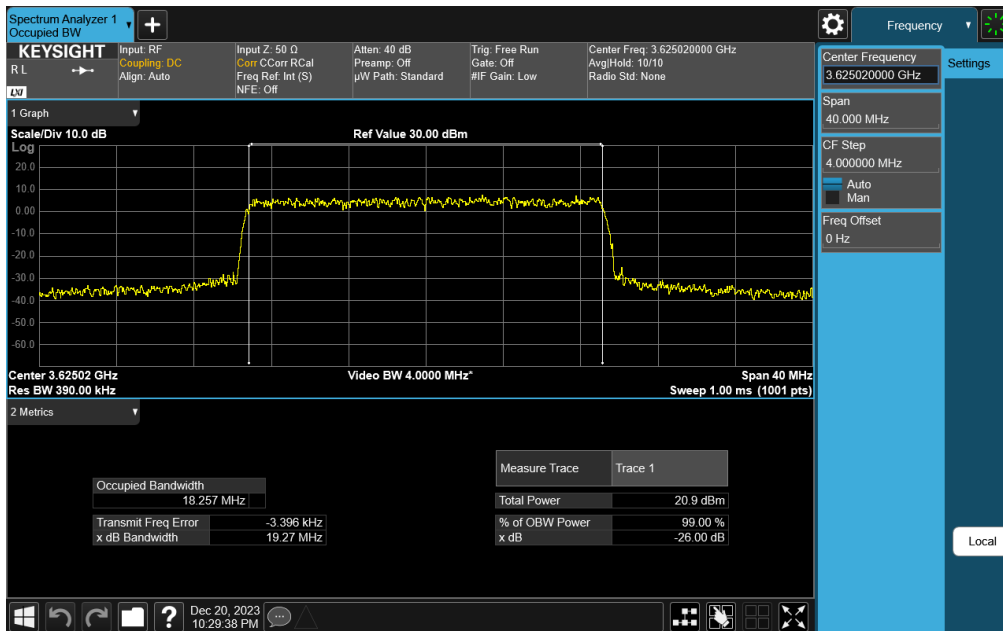


Plot 7-44. Occupied Bandwidth Plot (NR Band n48 - 20MHz QPSK - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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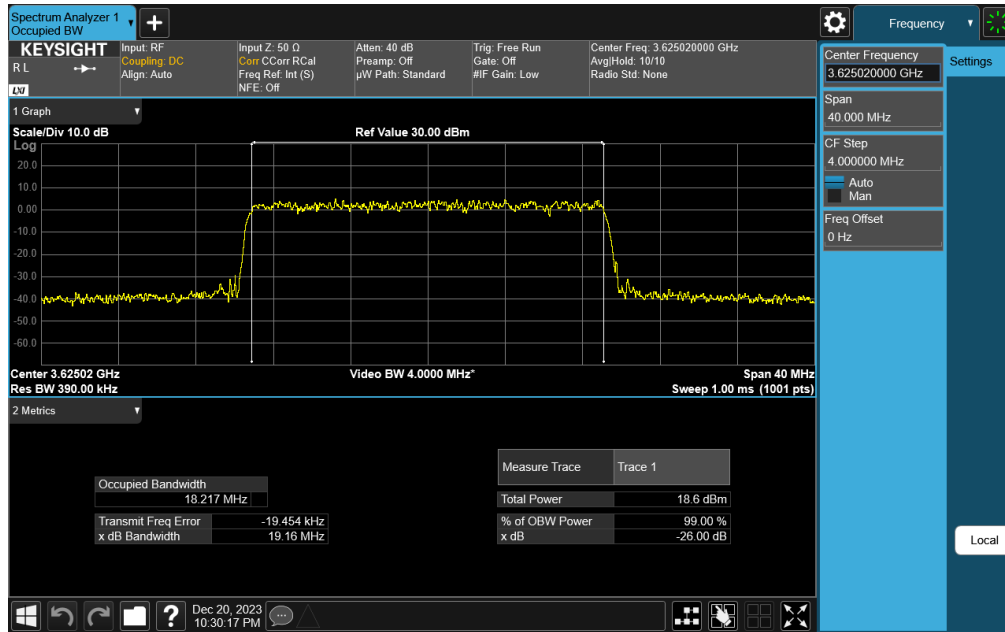


Plot 7-45. Occupied Bandwidth Plot (NR Band n48 - 20MHz 16-QAM - Full RB Configuration)

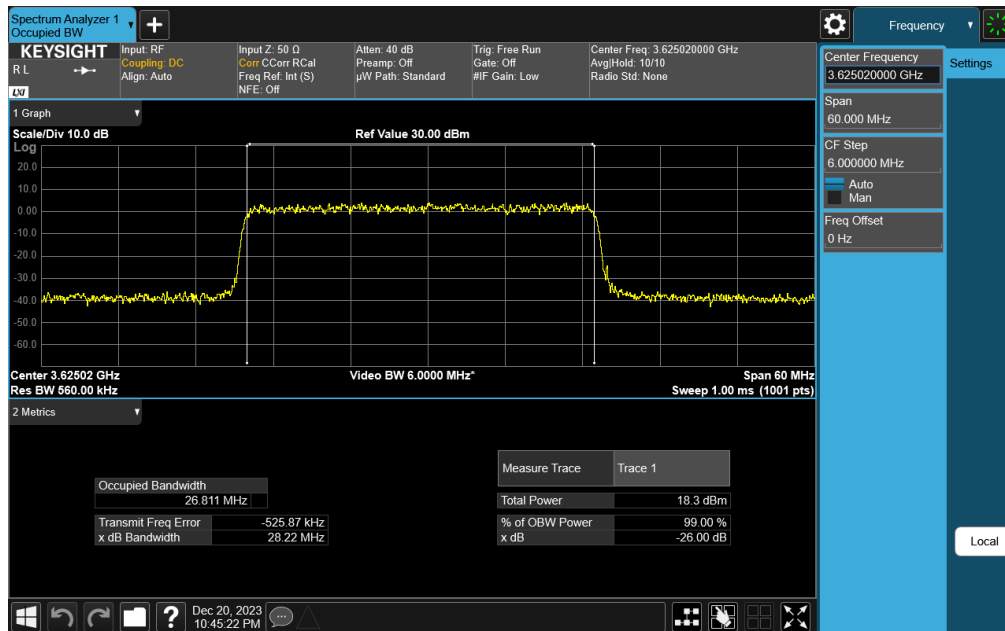


Plot 7-46. Occupied Bandwidth Plot (NR Band n48 - 20MHz 64-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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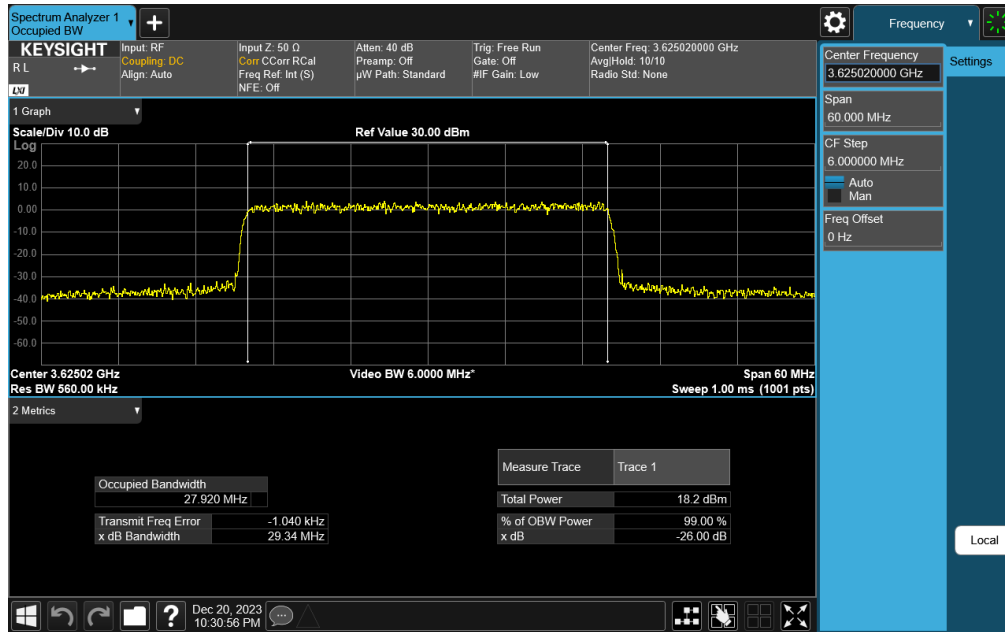


Plot 7-47. Occupied Bandwidth Plot (NR Band n48 - 20MHz 256-QAM - Full RB Configuration)

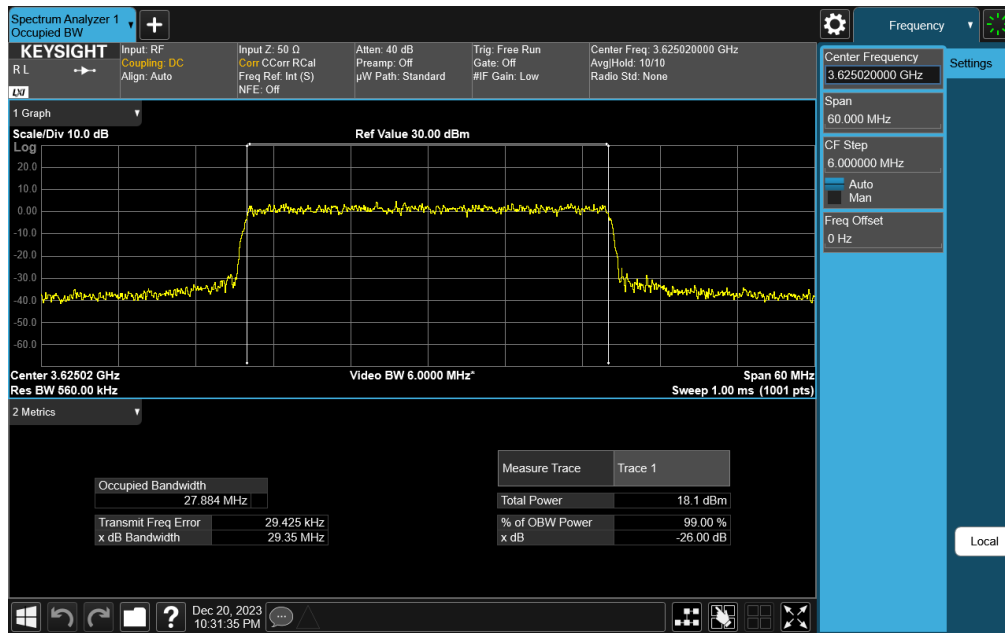


Plot 7-48. Occupied Bandwidth Plot (NR Band n48 - 30MHz $\pi/2$ BPSK - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-49. Occupied Bandwidth Plot (NR Band n48 - 30MHz QPSK - Full RB Configuration)

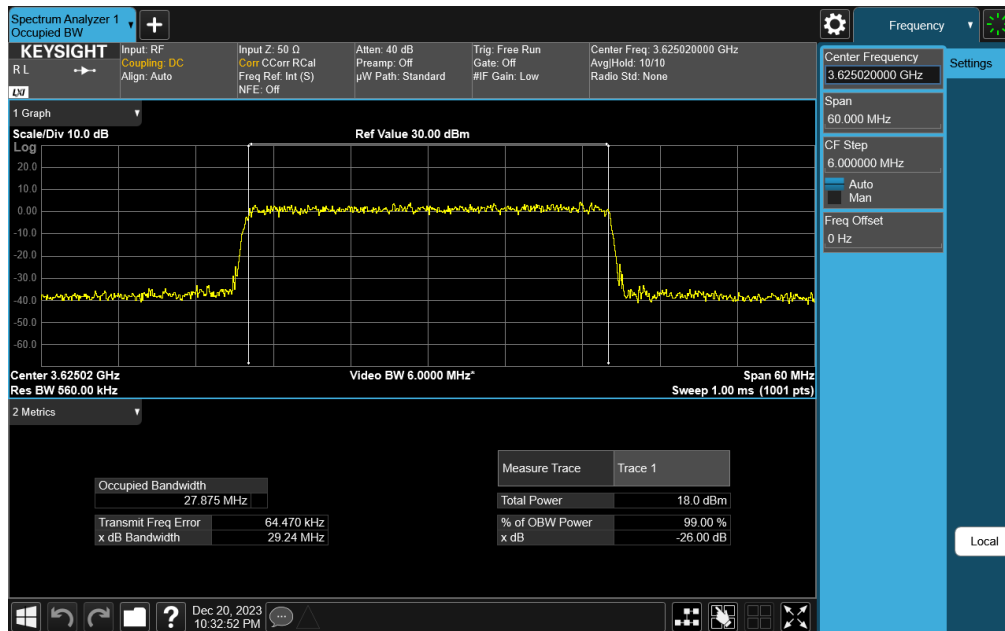


Plot 7-50. Occupied Bandwidth Plot (NR Band n48 - 30MHz 16-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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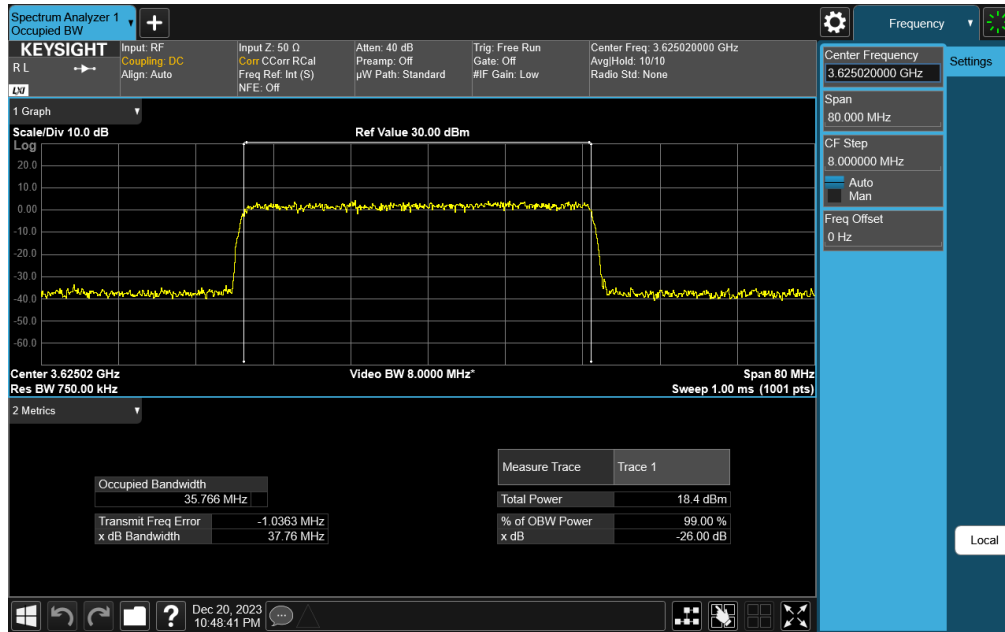


Plot 7-51. Occupied Bandwidth Plot (NR Band n48 - 30MHz 64-QAM - Full RB Configuration)

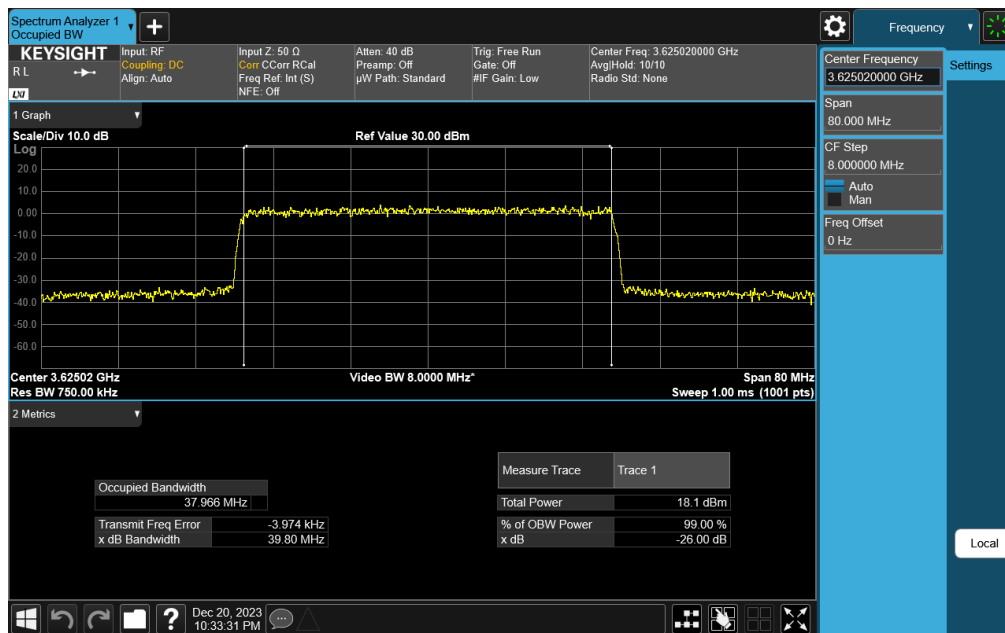


Plot 7-52. Occupied Bandwidth Plot (NR Band n48 - 30MHz 256-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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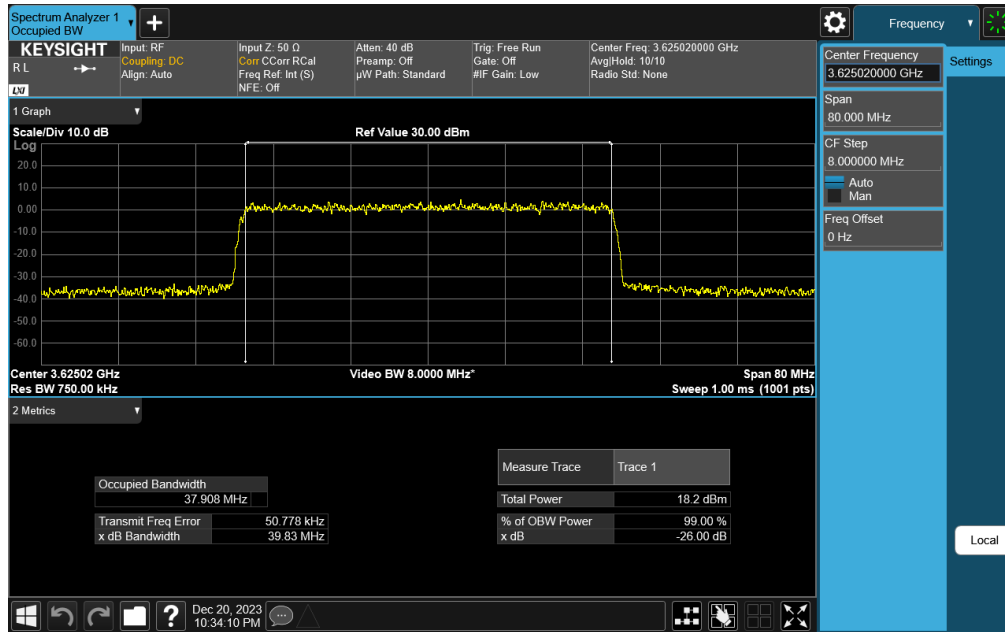


Plot 7-53. Occupied Bandwidth Plot (NR Band n48 - 40MHz $\pi/2$ BPSK - Full RB Configuration)

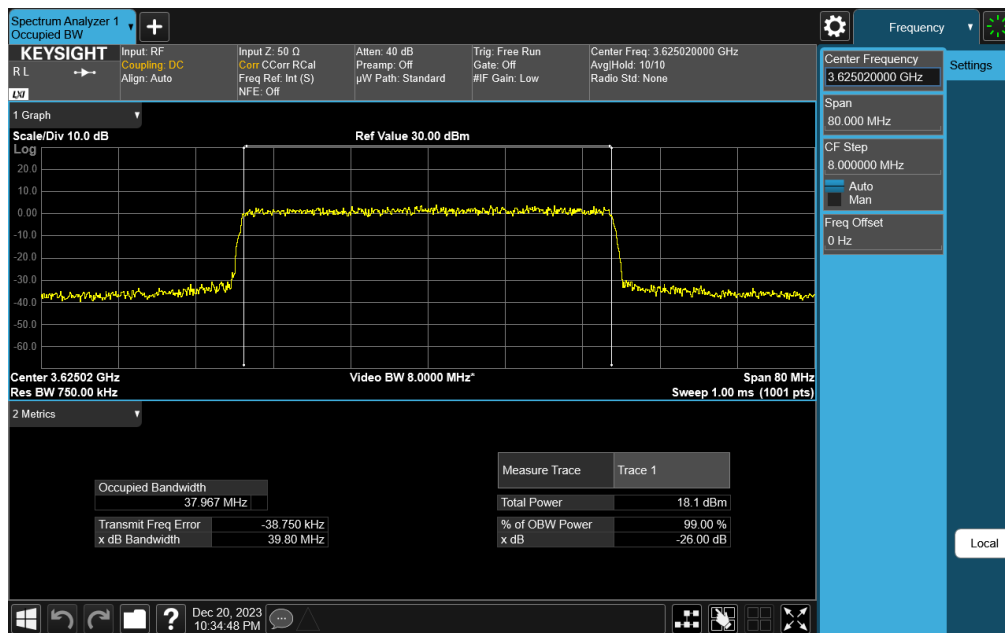


Plot 7-54. Occupied Bandwidth Plot (NR Band n48 - 40MHz QPSK - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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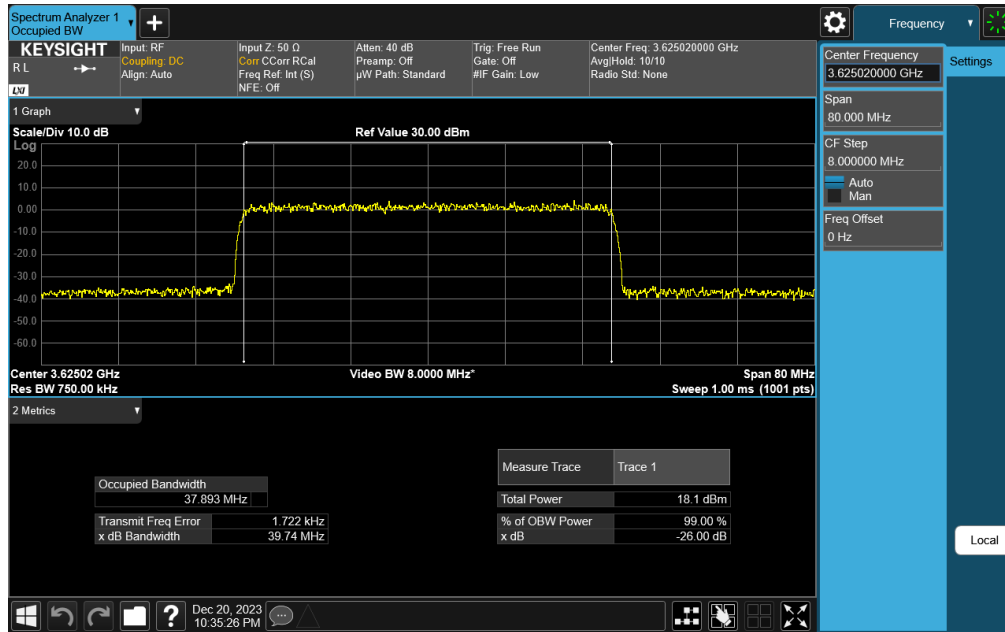


Plot 7-55. Occupied Bandwidth Plot (NR Band n48 - 40MHz 16-QAM - Full RB Configuration)




Plot 7-56. Occupied Bandwidth Plot (NR Band n48 - 40MHz 64-QAM - Full RB Configuration)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-57. Occupied Bandwidth Plot (NR Band n48 - 40MHz 256-QAM - Full RB Configuration)

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7.3 Spurious and Harmonic Emissions at Antenna Terminal §2.1051 §96.41(e)

Test Overview

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

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

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

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

Test Setup

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

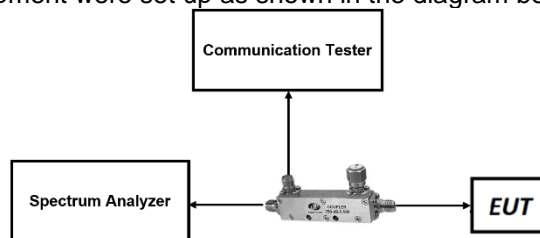




Figure 7-2. Test Instrument & Measurement Setup

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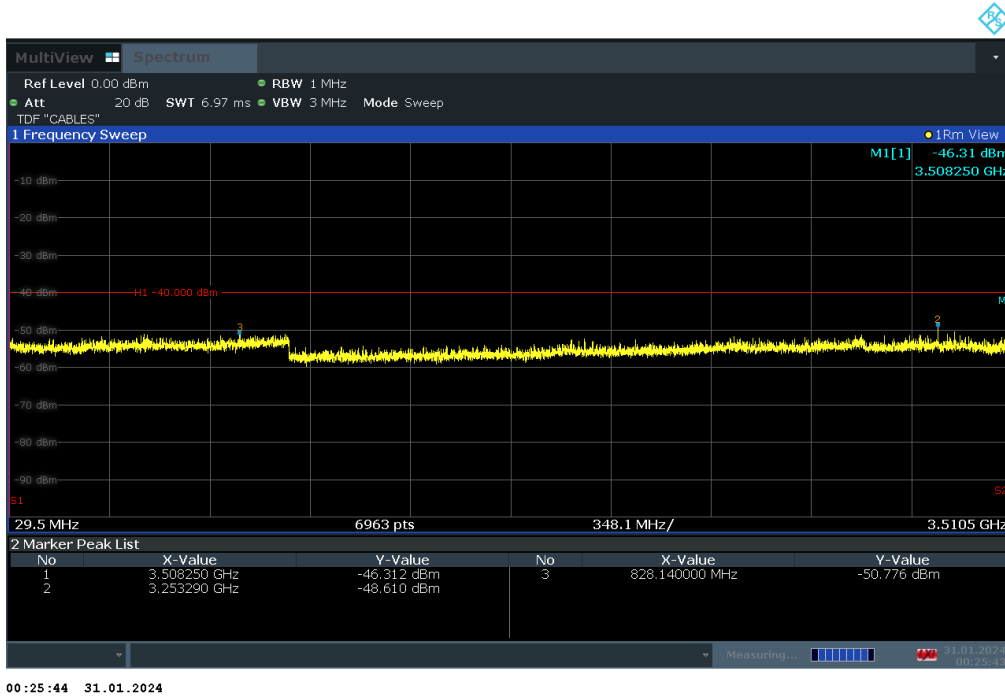
Test Notes

1. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.
2. Uplink carrier aggregation conducted spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. The worst case (highest) powers were found while operating with QPSK modulation with both carriers set to transmit using 1RB.
3. Uplink carrier aggregation inter-band emission was investigated and found to not be the worst case.
4. 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.

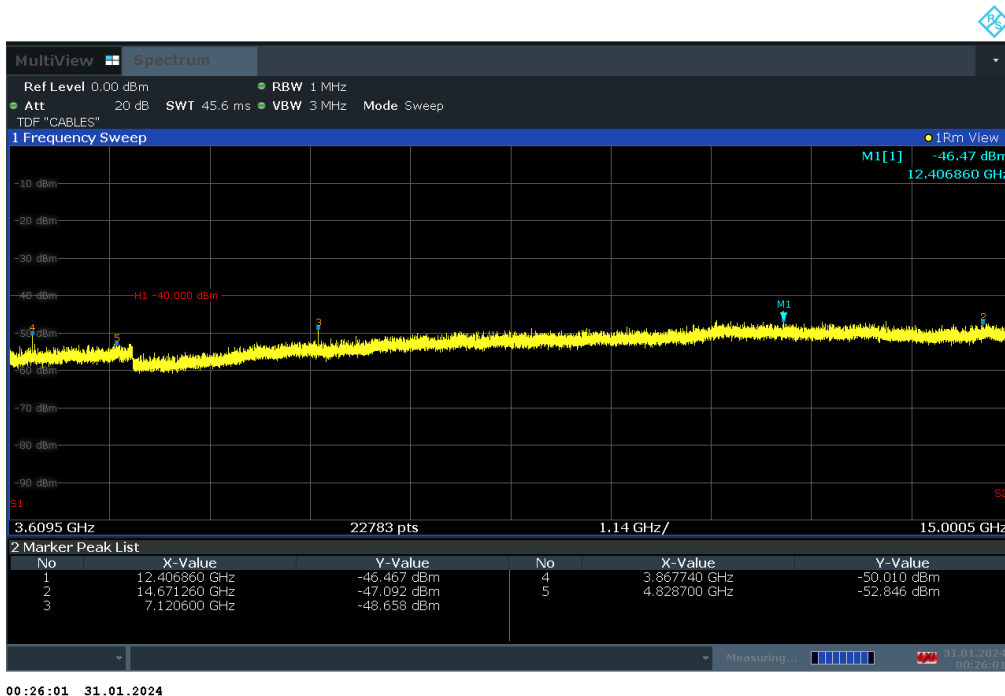
FCC ID: BCGA2837	 PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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LTE Band 48

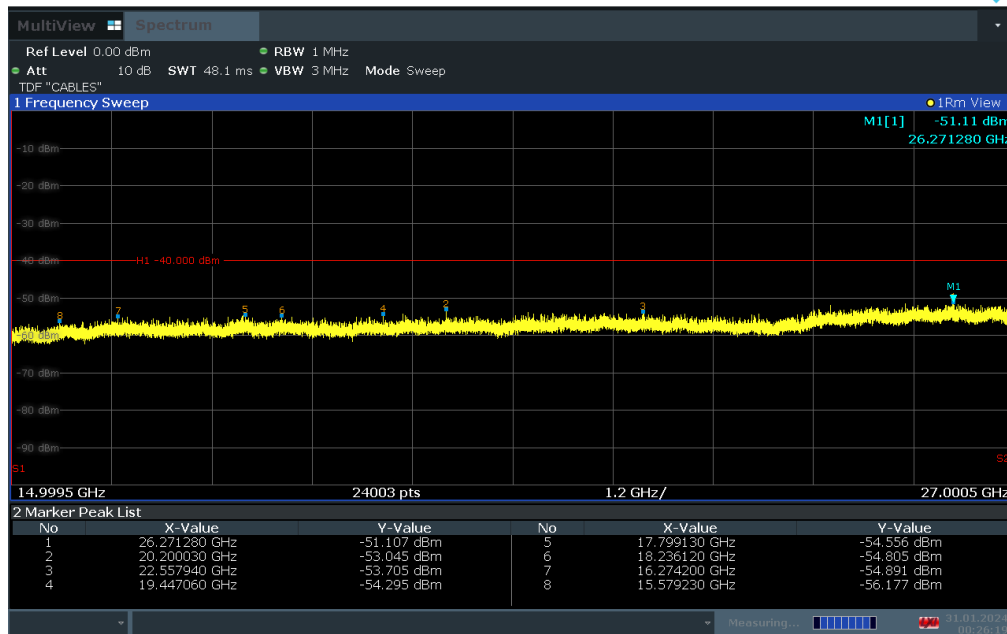


Plot 7-58. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)



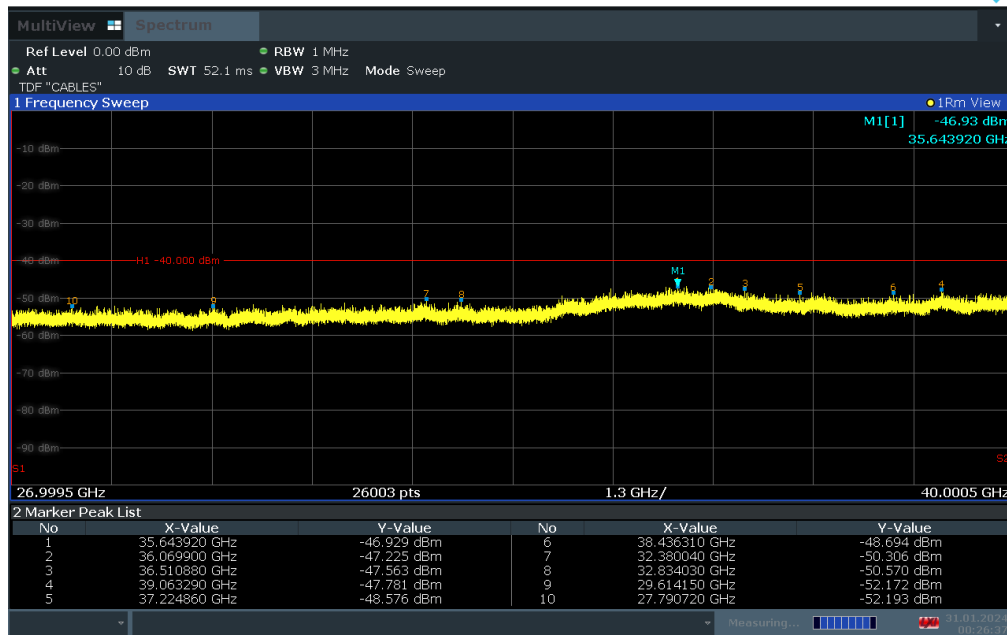
Plot 7-59. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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00:26:19 31.01.2024

Plot 7-60. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

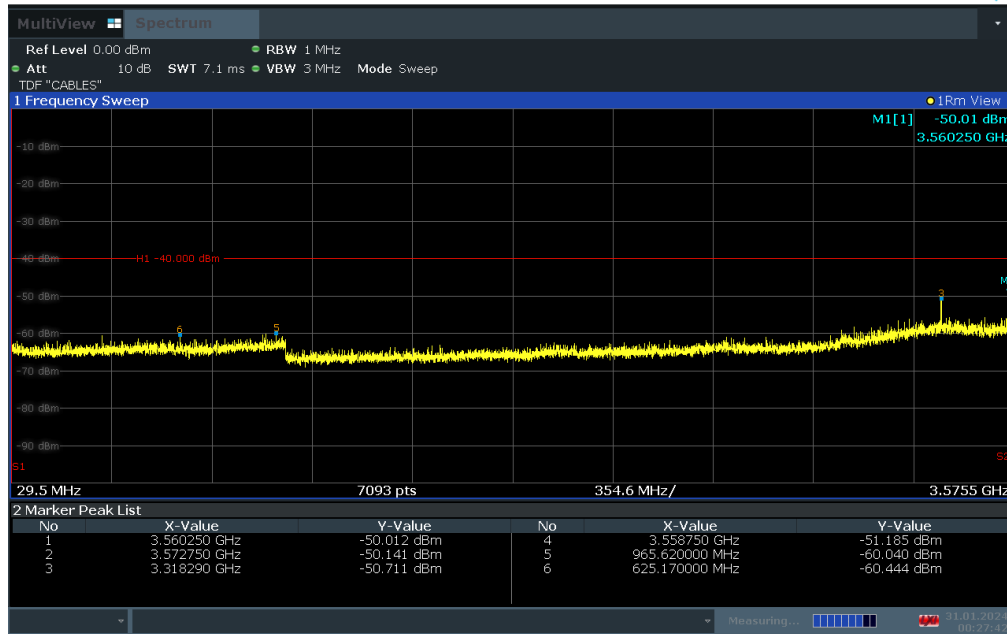


00:26:37 31.01.2024

Plot 7-61. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Low Channel)

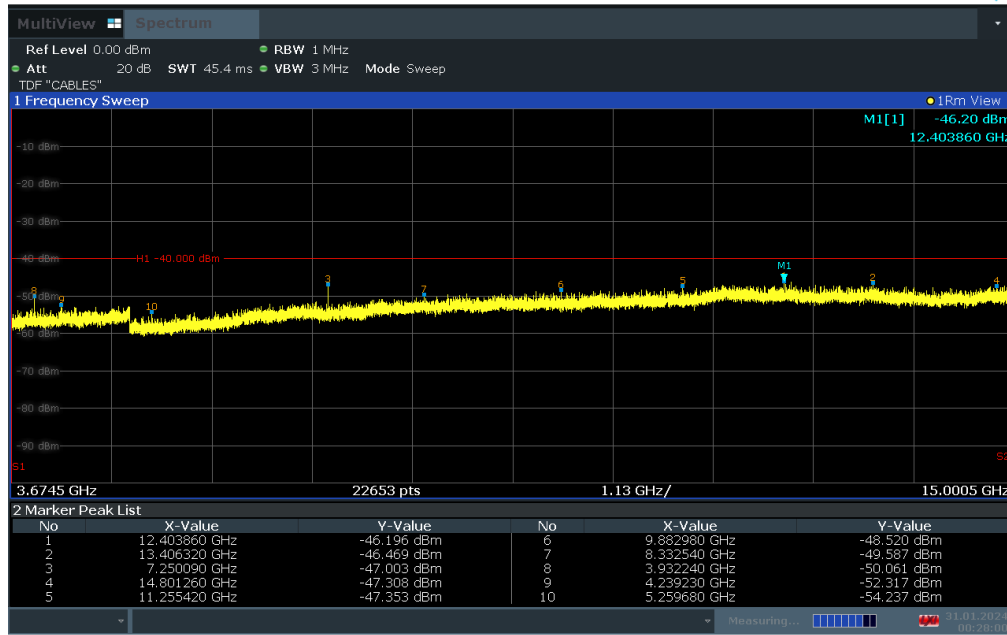
FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
Test Report S/N: 1C2311270068-13.BCG	Test Dates: 10/01/2023-03/29/2024	EUT Type: Tablet Device
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00:27:43 31.01.2024

Plot 7-62. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

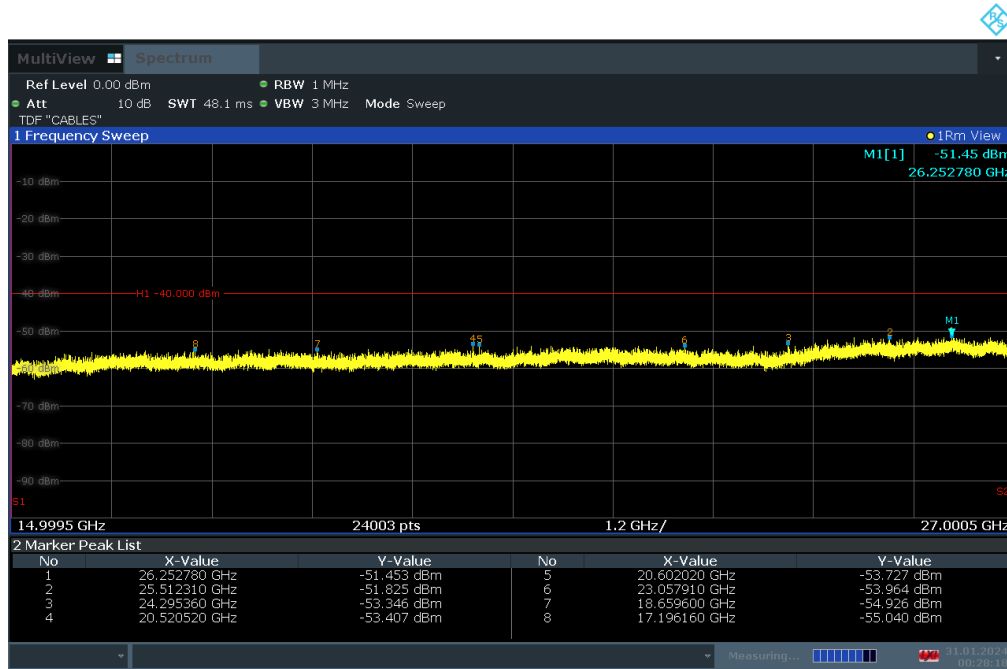


00:28:00 31.01.2024

Plot 7-63. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

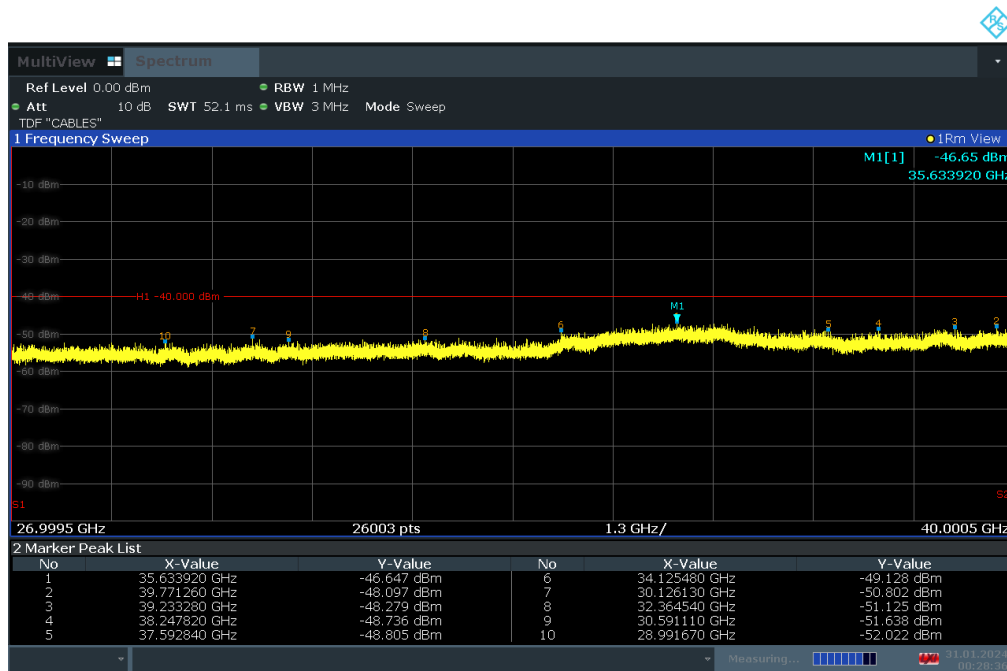
FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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00:28:18 31.01.2024

Plot 7-64. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

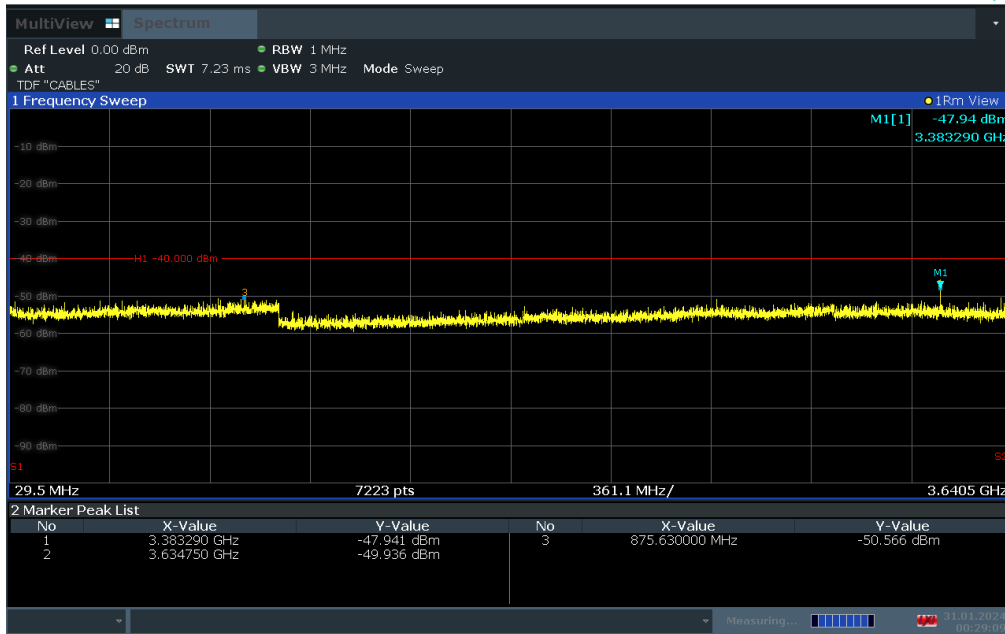


00:28:36 31.01.2024

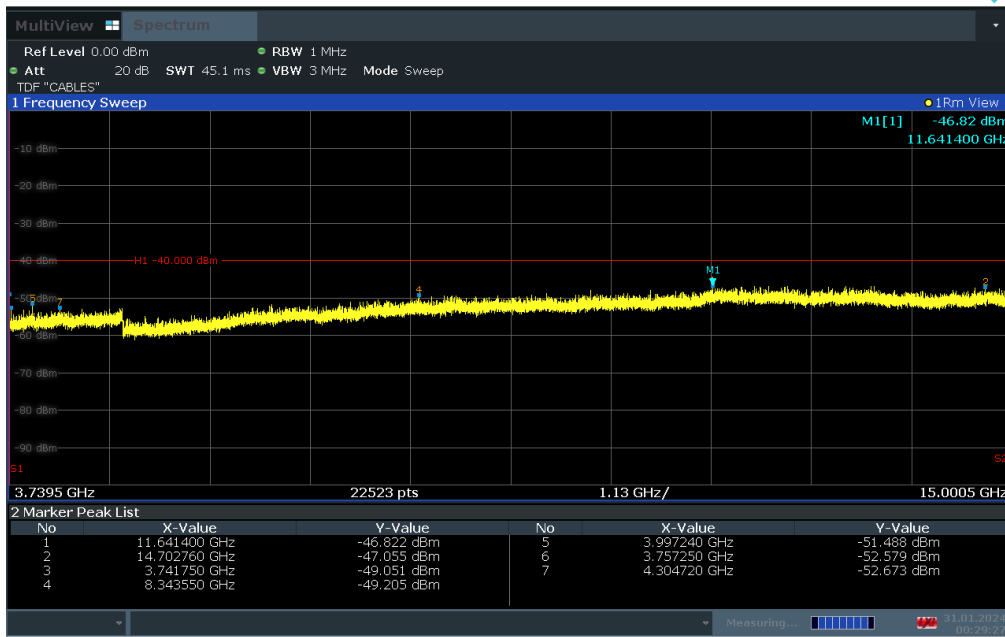
Plot 7-65. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - Mid Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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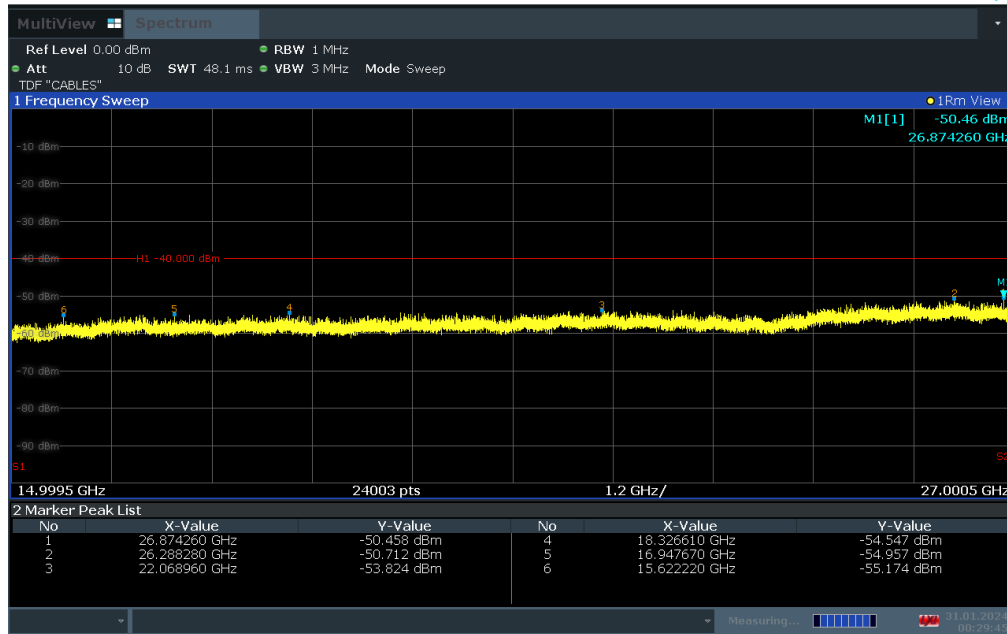


Plot 7-66. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)



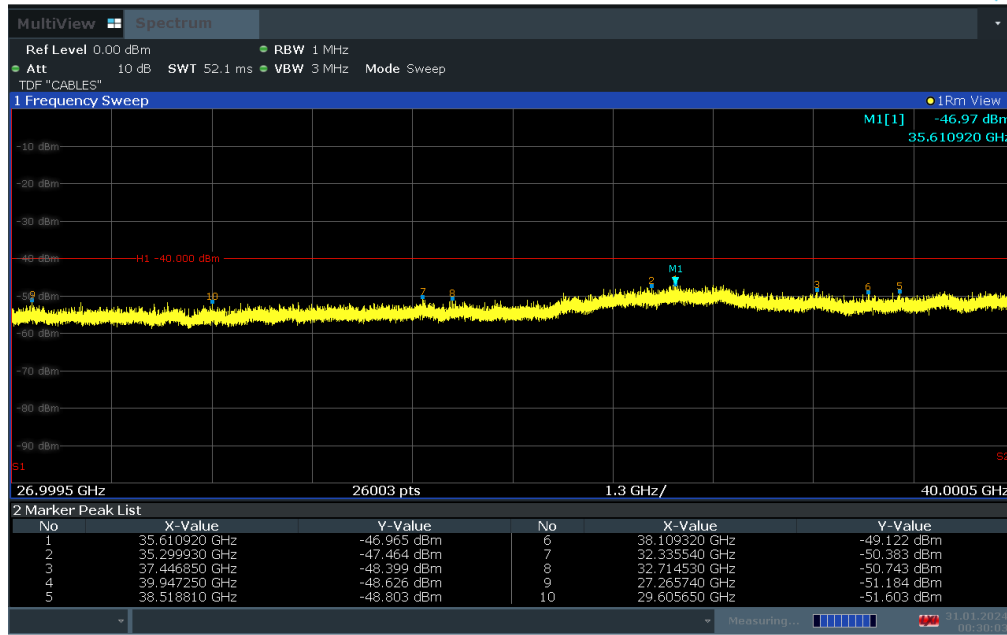
Plot 7-67. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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00:29:45 31.01.2024

Plot 7-68. Conducted Spurious Plot (LTE Band 48 - 20MHz QPSK - High Channel)



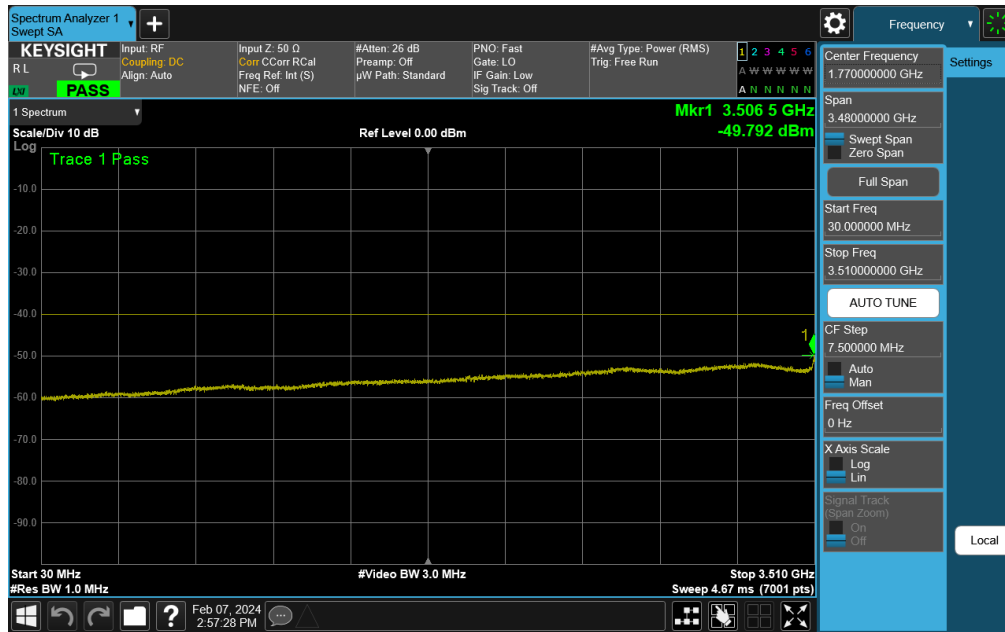
00:30:03 31.01.2024

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

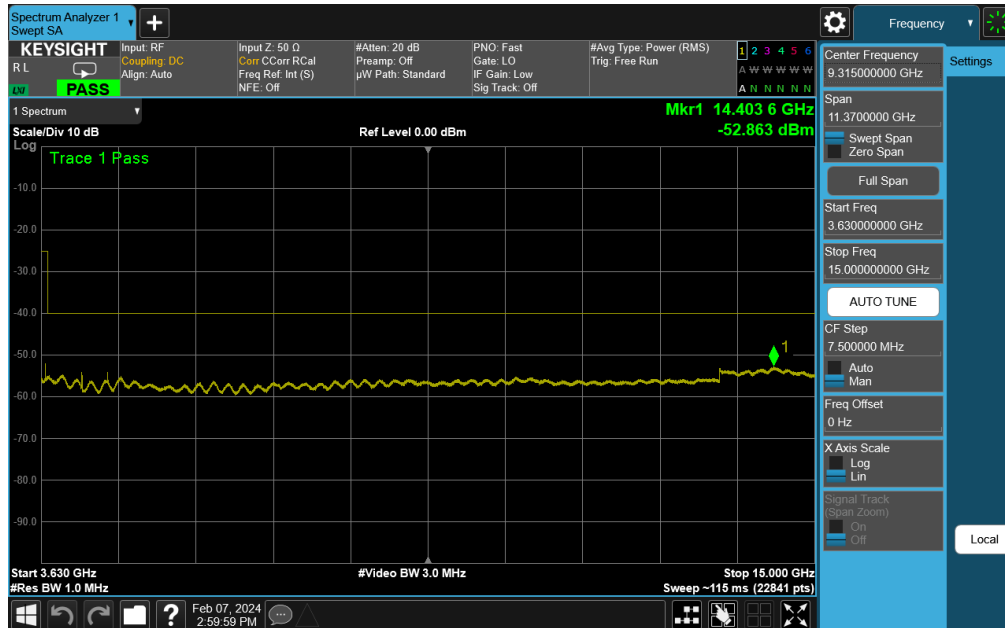
FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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ULCA LTE Band 48

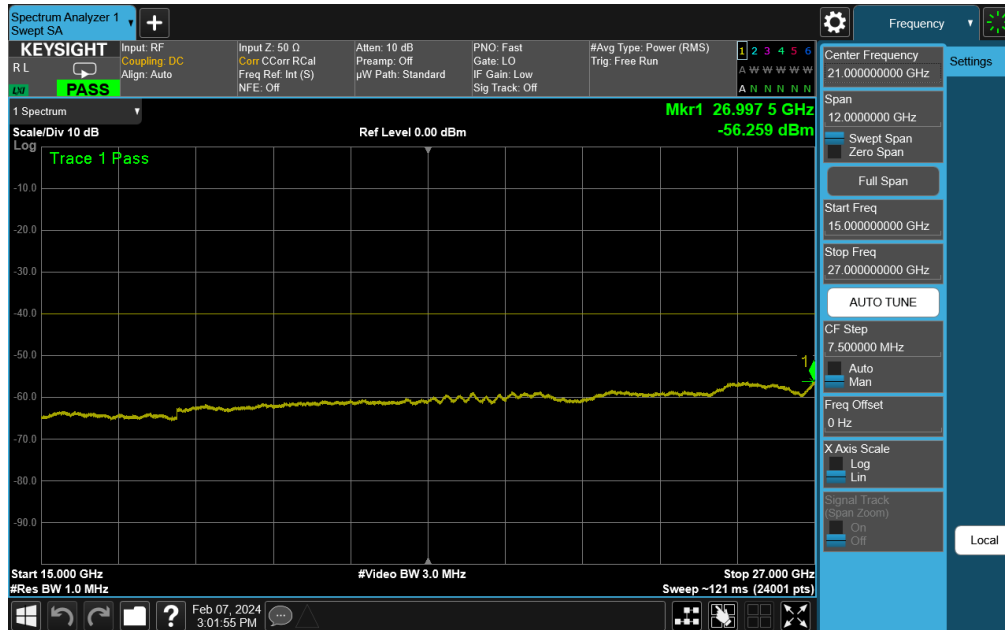


Plot 7-70. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Low Channel)

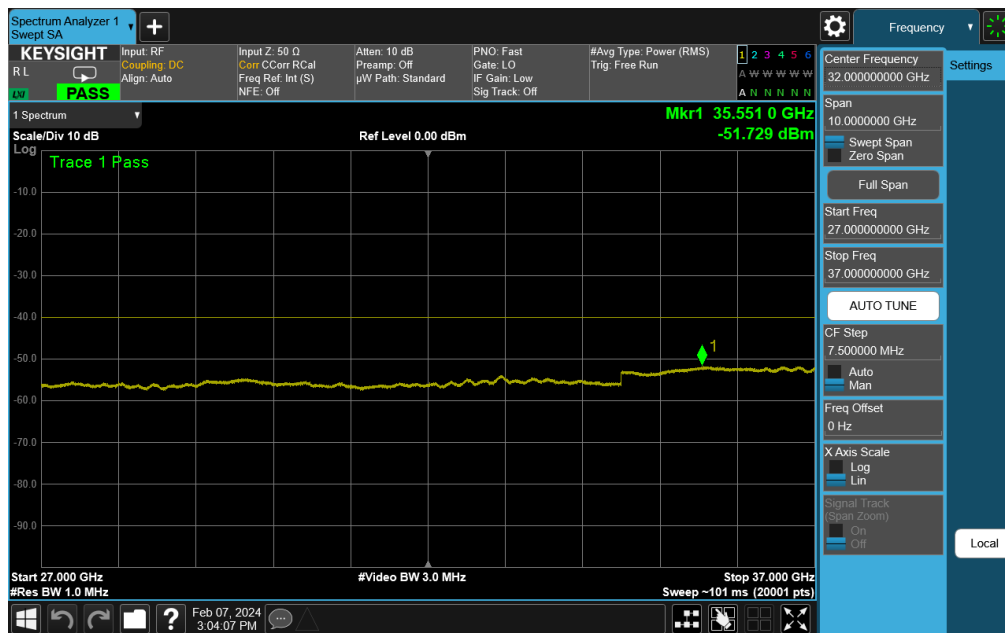


Plot 7-71. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Low Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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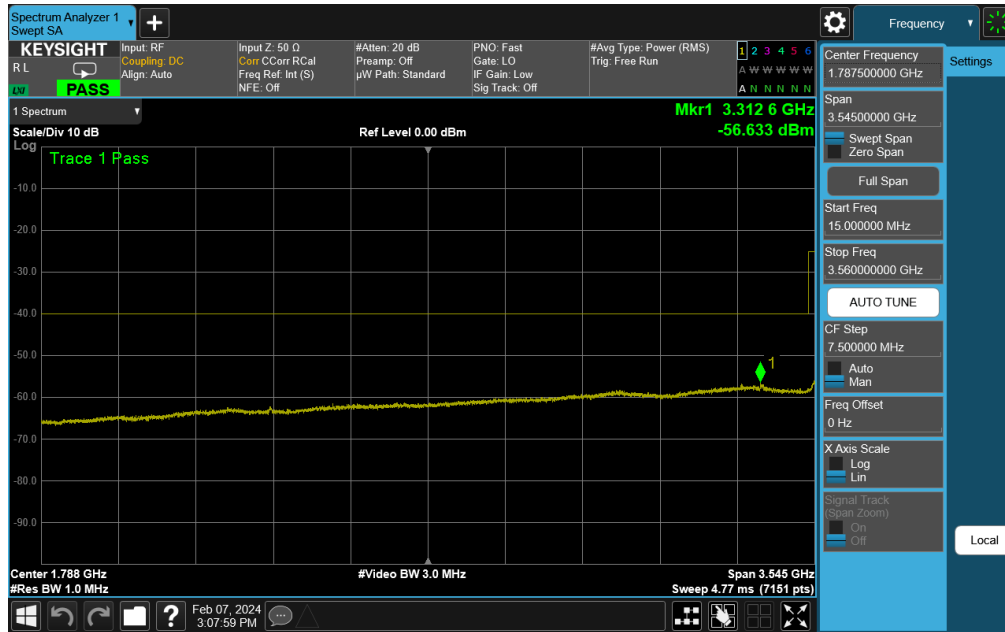


Plot 7-72. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Low Channel)

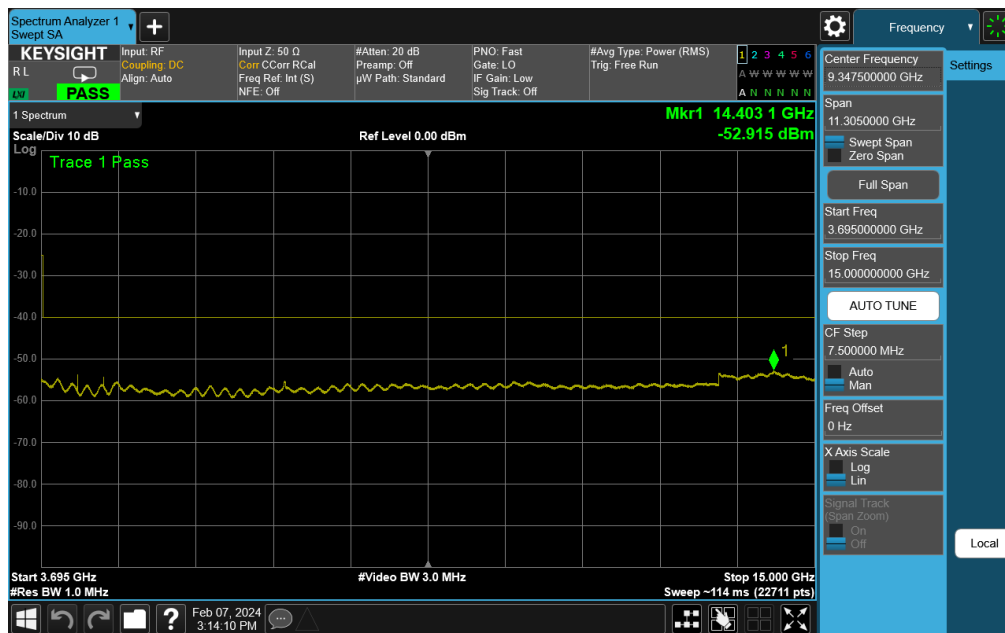


Plot 7-73. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Low Channel)


FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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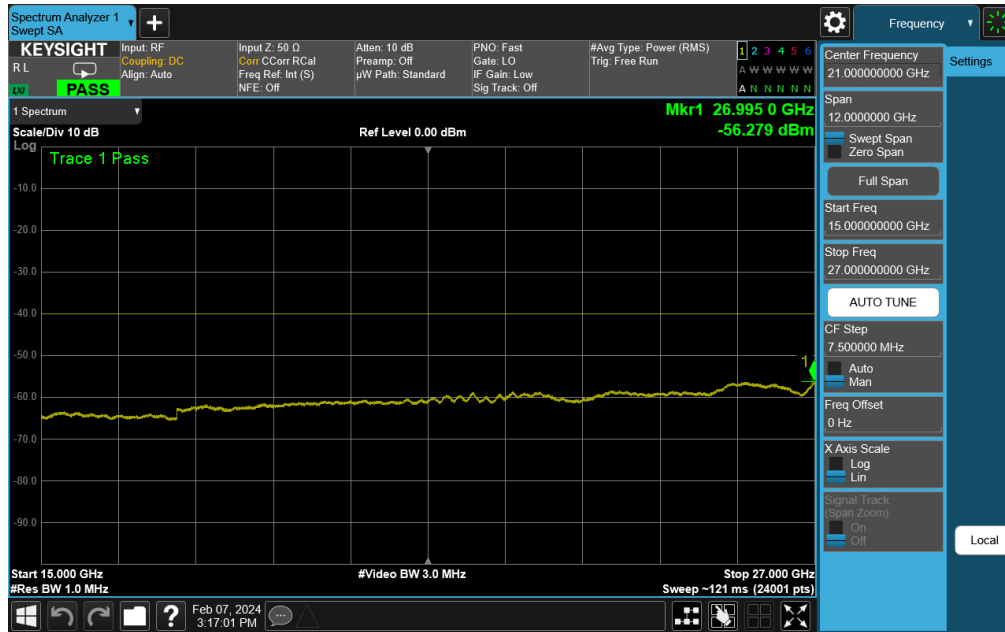


Plot 7-74. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Mid Channel)

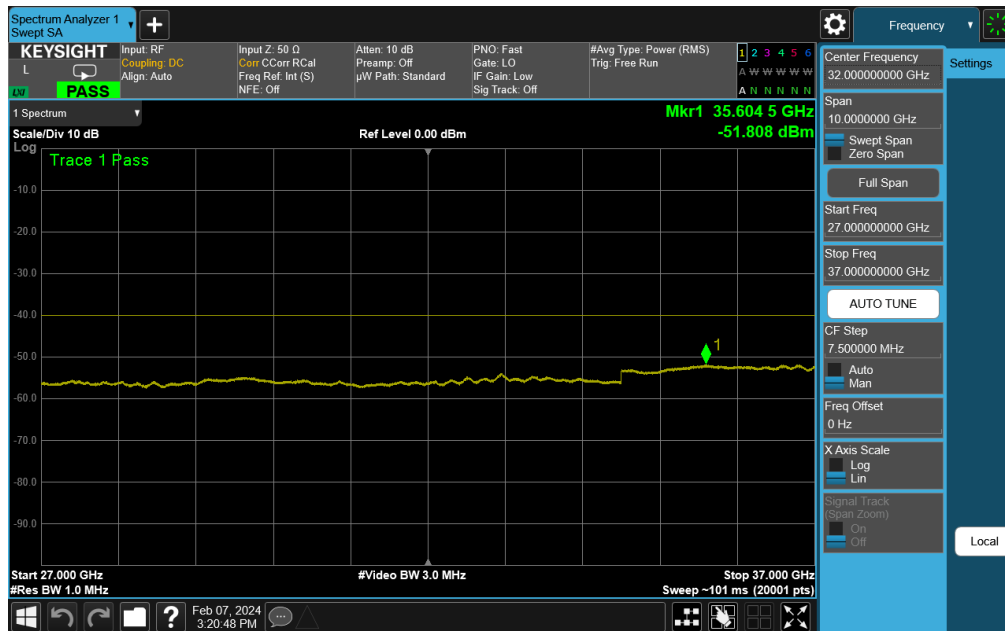


Plot 7-75. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Mid Channel)

FCC ID: BCGA2837	 PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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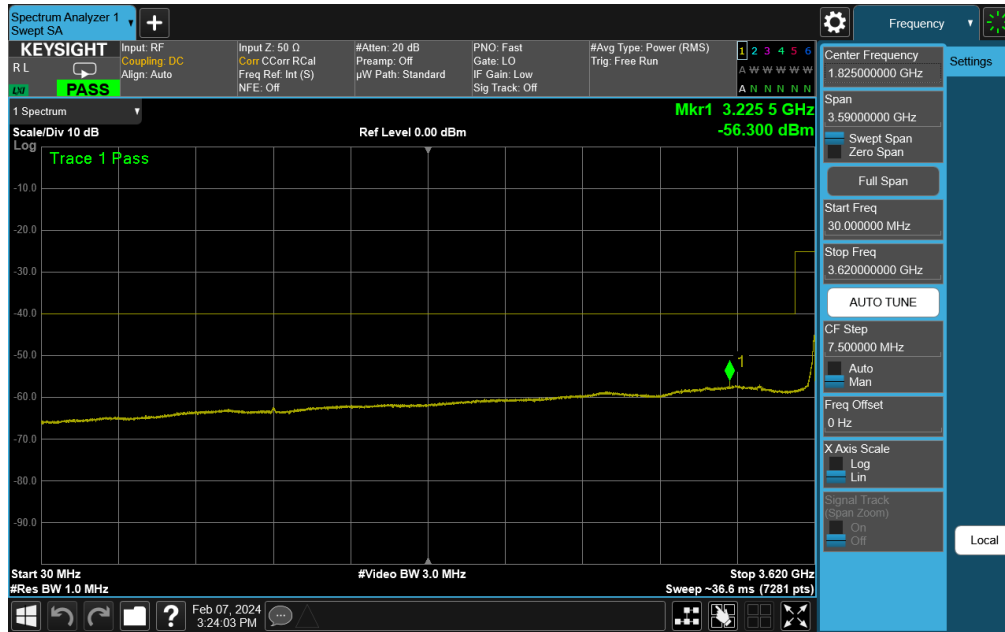


Plot 7-76. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Mid Channel)

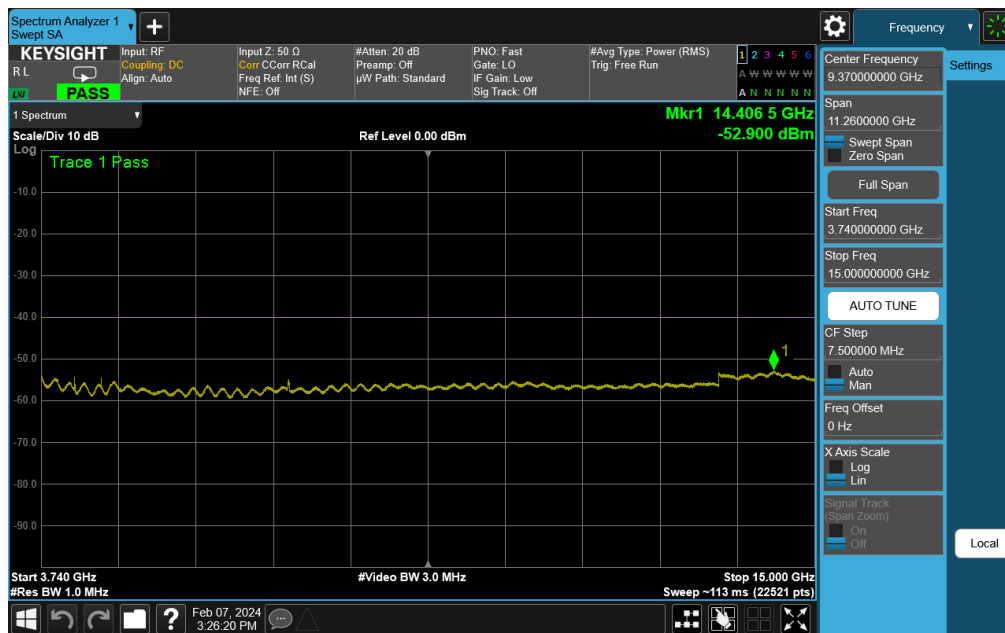


Plot 7-77. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - Mid Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT		Approved by: Technical Manager
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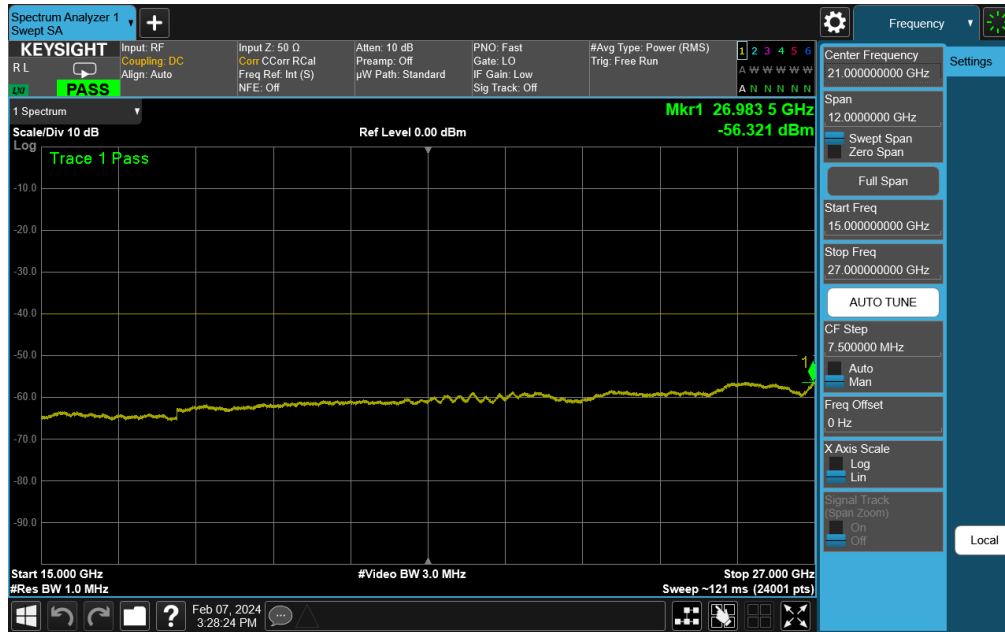


Plot 7-78. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - High Channel)

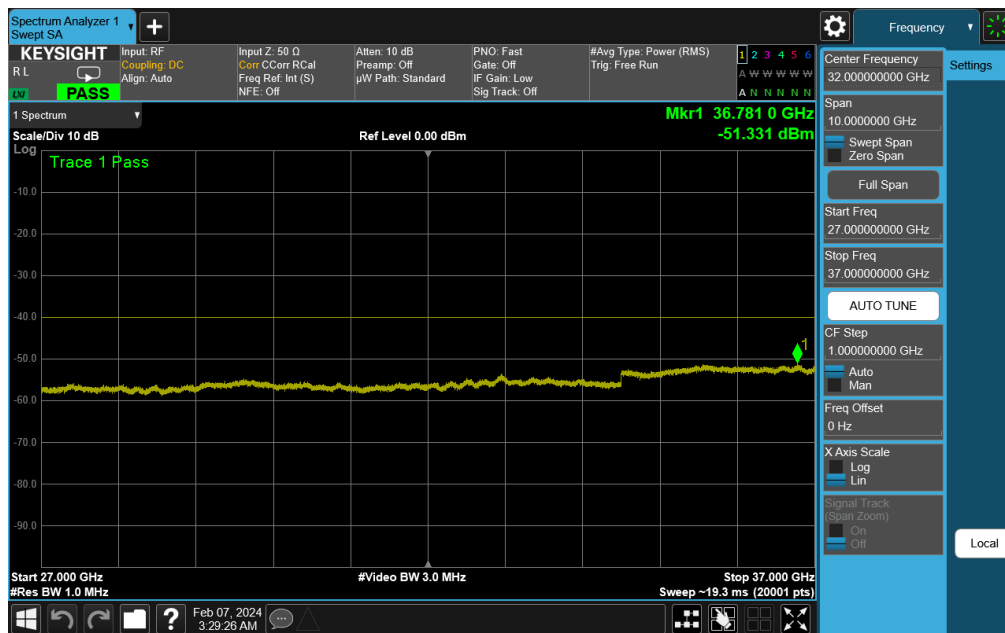


Plot 7-79. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - High Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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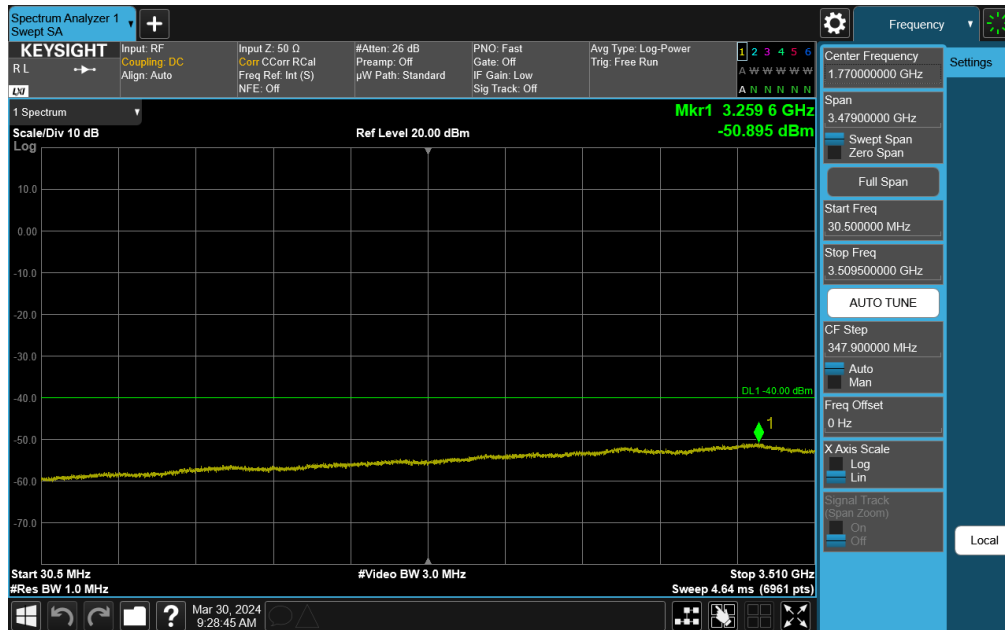
Plot 7-80. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - High Channel)



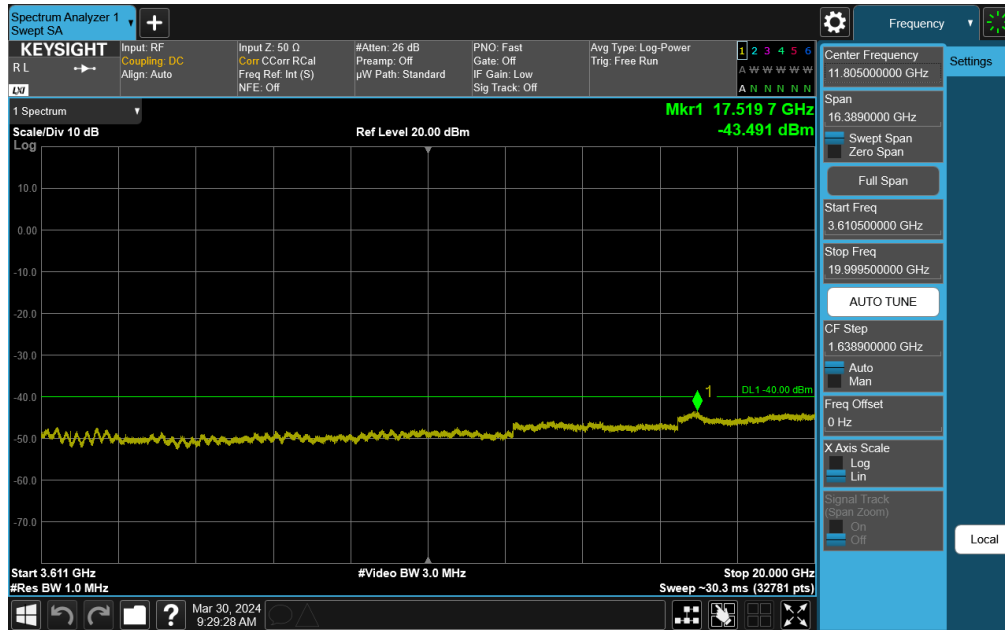
Plot 7-81. Conducted Spurious Plot (ULCA LTE Band 48 - 20+20MHz QPSK - High Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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NR Band n48



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

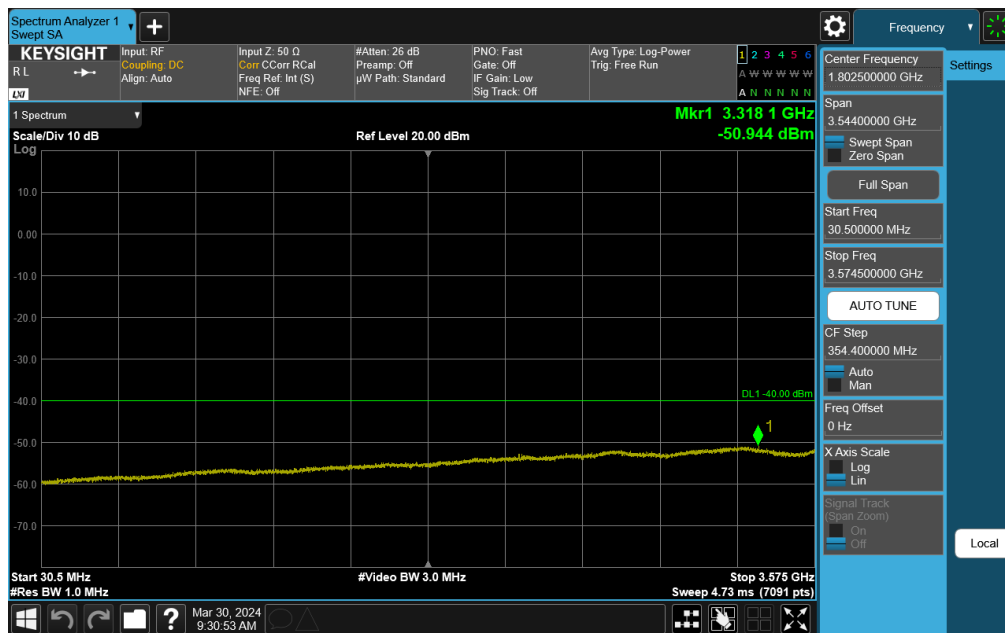


Plot 7-83. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel)


FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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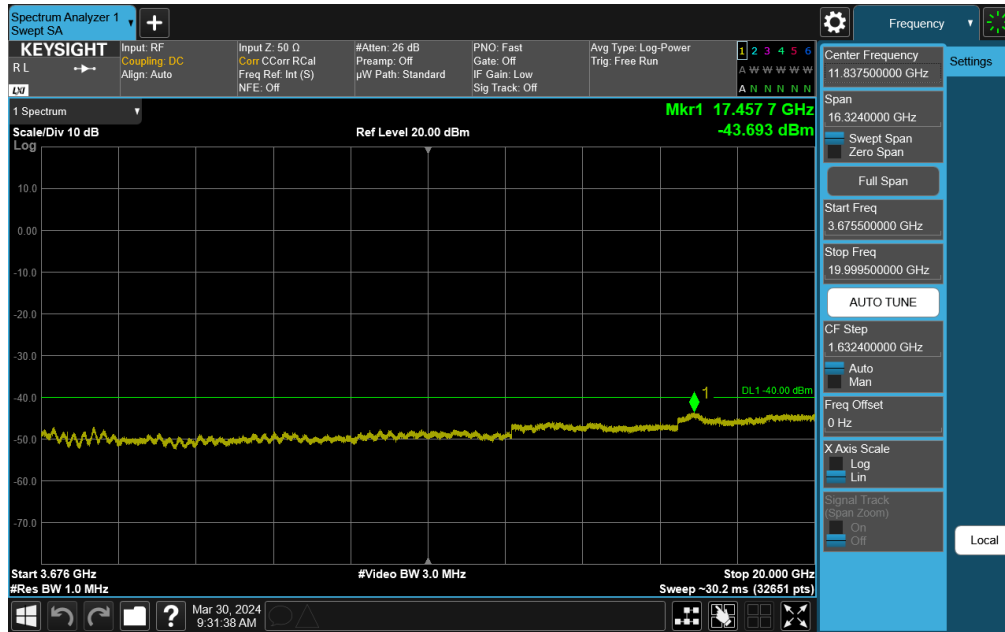


Plot 7-84. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Low Channel)

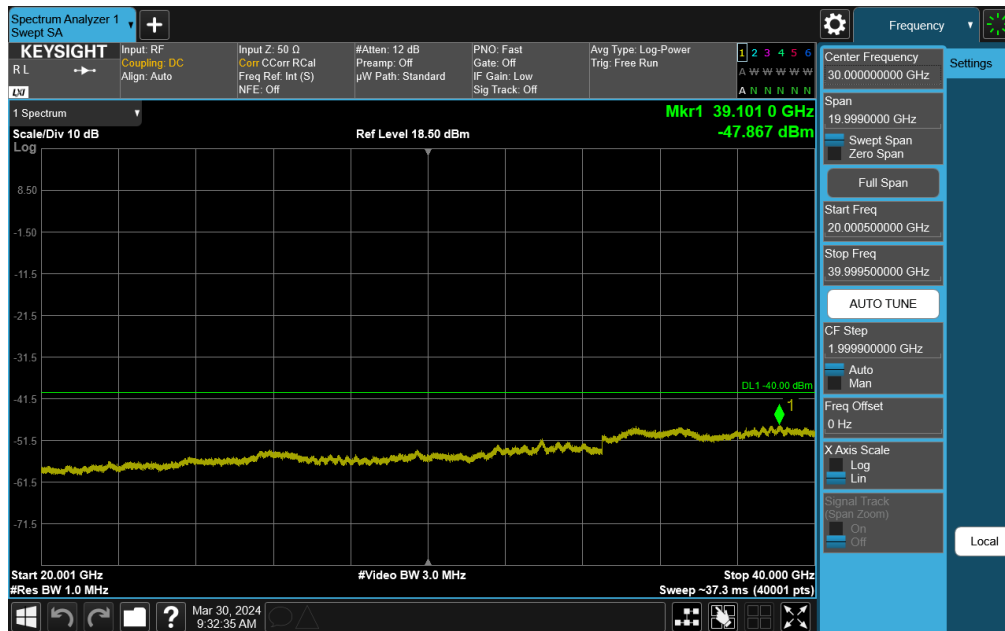


Plot 7-85. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel)

FCC ID: BCGA2837	 PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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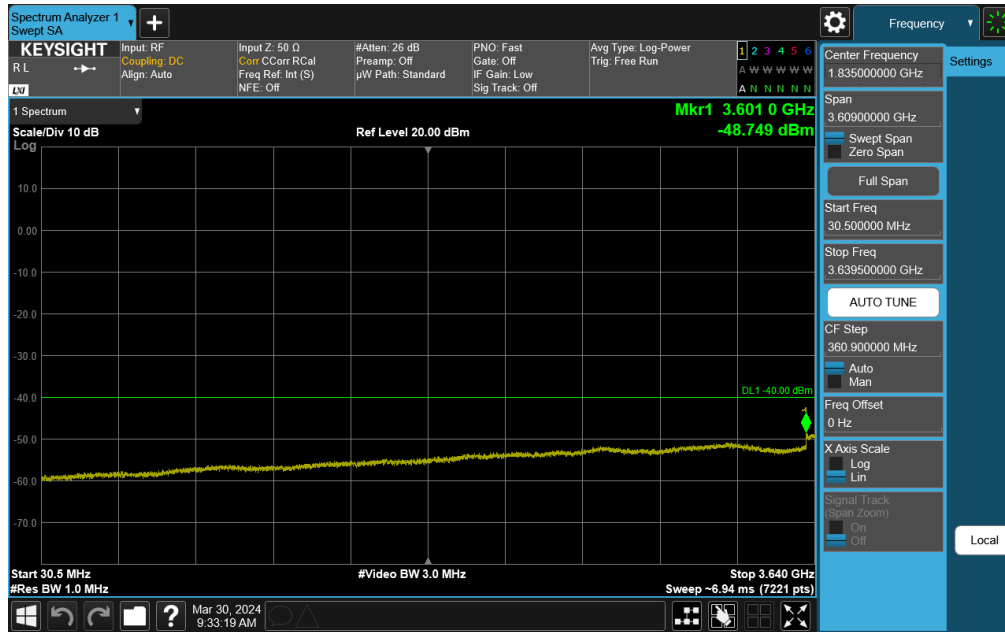


Plot 7-86. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel)

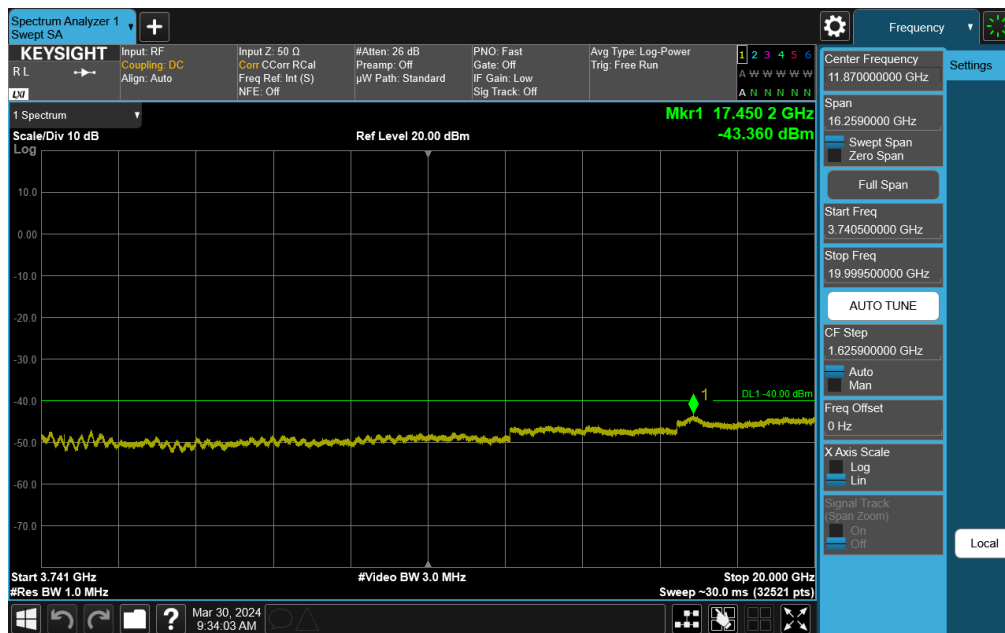


Plot 7-87. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - Mid Channel)

FCC ID: BCGA2837	PART 96 MEASUREMENT REPORT	Approved by: Technical Manager
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Plot 7-88. Conducted Spurious Plot (NR Band n48 - 40MHz QPSK - High Channel)



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

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