FCC PART 25 LICENSED DEVICE

CERTIFICATION TEST REPORT

for the

JACOBS

FCC ID: 2A99V-CST88

IC ID: 30125-CST88

WLL REPORT# 17580 REV 4

Prepared for:

Jacobs

7765 Old Telegraph Road

Severn, Maryland 21144

Prepared By:

Washington Laboratories, Ltd.

4840 Winchester Boulevard

Frederick, Maryland 21703

Testing Certificate AT-1448

FCC Part 25 Licensed Device
Certification Test Report

for the

Jacobs

Modem

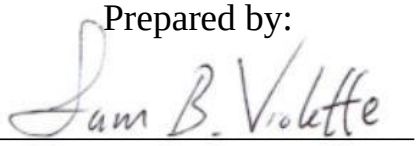
FCC ID: 2A99V-CST88

ISED ID: 30125-CST88

March 16, 2023

WLL Report# 17580 Rev 4

Prepared by:



Samuel Violette
Vice President

Reviewed by:

Steve Koster
President

Abstract

The information provided on this report is only applicable to device herein documented.

Revision History	Description of Change	Date
Rev 0	Initial Release	March 16, 2023
Rev 1	ACB Comments	May 25, 2023
Rev 2	ACB Comments	July 12, 2023
Rev 3	ACB Comments	July 12, 2023
Rev 4	ACB Comments	July 19, 2023

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1 Introduction

1.1 Compliance Statement

The device under test was found to be in accordance with FCC 47 CFR Part 25, FCC 47 CFR Part 2, Industry Canada RSS-170 and ISED RSS-GEN is shown below.

				Test Description	Result
Part 25	Part 2	RSS-170	RSS-GEN		
-	2.1049	-	6.7	Occupied Bandwidth	Pass
25.202(d)	2.1055	5.3	6.11	Frequency Tolerance	Pass
25.202(f)	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass
25.204	2.1046	5.5	6.12	Equivalent Isotropic Radiated Power	Pass

1.2 Contract Information

Customer:	Jacobs
Purchase Order Number:	RS001-0000006804
Quotation Number:	71994

1.3 Test and Support Personnel

Washington Laboratories, LTD	Samuel Violette
Customer Representative	John Daniel

2 Equipment Under Test

2.1 EUT Identification & Description

Table 1: Device Summary

Item	Description
Manufacturer:	Jacobs
FCC ID:	2A99V-CST88
ISED ID:	30125-CST88
Model:	Modem
FCC Rule Parts:	§ 25
ISED Rule Parts:	RSS-170
Frequency Range:	1616-1626.5MHz
Maximum Conducted Output Power:	10W (40dBm)
Modulation:	QPSK
Occupied Bandwidth (99%):	33kHz, 65kHz, & 260kHz
ITU Emission Designator:	33k7Q7, 65K4Q7,260k3Q7W
Keying:	Automatic, Manual
Number of Channels:	240 Max
Highest TX Spurious Emission:	9754MHz, 76.4dBuV/m@3m
Antenna Connector	MMCX
Antenna Gain	3dBi
Interface Cables:	50 Pin Connector
Maximum Data Rate:	88k (uplink & downlink)
Power Source & Voltage:	Nominal: 12Vdc ±2Vdc, 3A
Firmware Version:	0.0.0.XC-221028M-22215-C2-P4191-435886-6527891-OWL-DEVSNAP

The Jacobs CST88 is a compact satellite transceiver designed for use on the Iridium satellite network. The transceiver is capable of continuous 88 kbps bi-directional data through a small aperture passive antenna. The small size, weight and power requirements make the unit ideal for communications on the move. The unit can further be used in both manned and unmanned applications and for ground mobile, aeronautical and maritime environments. The CST88 is a building block that can be incorporated into a satellite communications product for medium bandwidth applications. The minimum supporting electronics required to for CST88 integration is a power supply to supply and regulate power going to the CST88 to 12 VDC from an external source or from a battery source. An interface/applications processor is also required to communicate command and control functions with the CST88 transceiver and to route user data to and from the transceiver. An interface/applications processor, along with the CST88 and power supply are the essence of a satellite modem that can provide IT connectivity anywhere around the globe.

2.2 Test Configuration

Table 2: System Configuration List

Name / Description	Model Number	Part Number	Serial Number	Revision
RF Module	CST88	Not Provided	Not Provided	Not Provided

Table 3: Support Equipment

Item	Model/Part Number	Serial Number
Laptop	Dell	N/a
DVT Support Test Bed	Iridium	N/a

Support Equipment Note: The DVT support Test Bed generated emissions that were non-compliant. The PCB board (DVT Test Bed) was isolated from the EUT (CST88) in an aluminum enclosure.

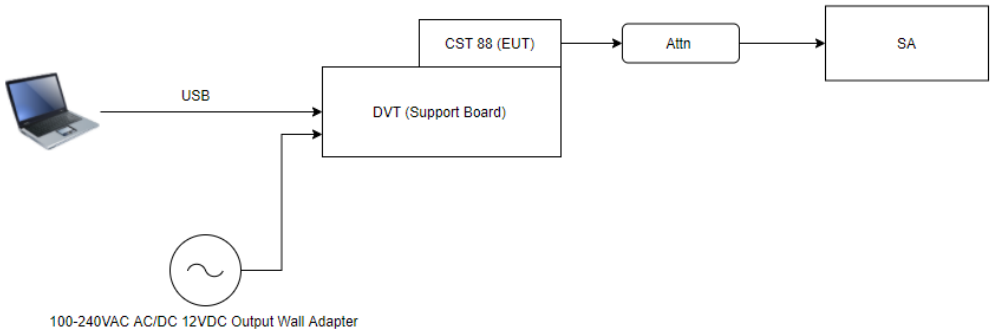

Figure 1: EUT Test Configuration, Bench Setup

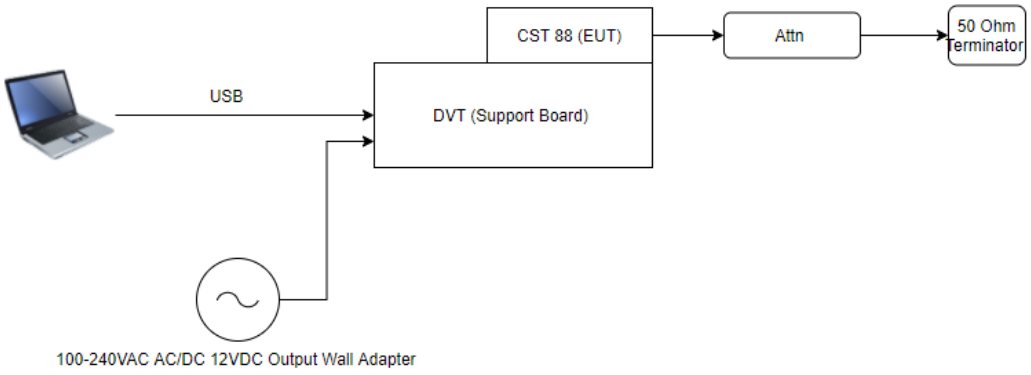

Figure 2: EUT Test Configuration. Case Radiated Setup

2.3 Interface Cables

Table 4: Cable Configuration

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
Not Identified on EUT	MMCX	N/A	Y	To Antenna
Not Identified on EUT	50 Pin	N/a	N	To External Various I/O's (UART Commands)

2.4 Testing Algorithm

The Modem was tested via a support laptop to control the different operating modes.

EUT Firmware:

CST88 firmware: 0.0.0.XC-221028M-22215-C2-P4191-435886-6527891-OWL-DEVSNAP

EUT Test Software on support laptop:

1. Virtual Machine: VMware Workstation 16 Player
2. Terra Term Pro Version 2.3 + IPv6 0.81

2.5 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Frederick, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The ISED number is 3035A for Washington Laboratories, Ltd. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

2.6 Measurements

2.6.1 References

ANSI C63.2 (Jan-2016) Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 (Jan 2014) American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

ANSI C63.10 (Jun 2013) American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI C63.26 (Dec 2015) American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

2.7 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The basis for uncertainty calculation uses ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation of the standard uncertainty. Elements contributing to the standard uncertainty are combined using the method described in Equation 1 to arrive at the total standard uncertainty. The standard uncertainty is multiplied by the coverage factor to determine the expanded uncertainty which is generally accepted for use in commercial, industrial, and regulatory applications and when health and safety are concerned (see Equation 2). A coverage factor was selected to yield a 95% confidence in the uncertainty estimation.

Equation 1: Standard Uncertainty

$$u_c = \pm\sqrt{\frac{a^2}{div_a{}^2} + \frac{b^2}{div_b{}^2} + \frac{c^2}{div_c{}^2} + ...}$$

Where u_c	= standard uncertainty
a, b, c,..	= individual uncertainty elements
$Div_{a, b, c}$	= the individual uncertainty element divisor based on the probability distribution
Divisor	= 1.732 for rectangular distribution
Divisor	= 2 for normal distribution
Divisor	= 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where

U = expanded uncertainty

k = coverage factor

k ≤ 2 for 95% coverage (ANSI/NCSL Z540-2 Annex G)

u_c = standard uncertainty

The measurement uncertainty complies with the maximum allowed uncertainty from CISPR 16-4-2. Measurement uncertainty is not used to adjust the measurements to determine compliance. The expanded uncertainty values for the various scopes in the WLL accreditation are provided in Table 5 below.

Table 5: Expanded Uncertainty List

Scope	Standard(s)	Expanded Uncertainty
Conducted Emissions	CISPR11, CISPR22, CISPR32, CISPR14, FCC Part 15	±2.63 dB
Radiated Emissions	CISPR11, CISPR22, CISPR32, CISPR14, FCC Part 15	±4.55 dB

3 Test Equipment

Table 6 shows a list of the test equipment used for measurements along with the calibration information.

Table 6: Test Equipment List

Test Name:	**Benchtop Conducted Emissions**		Test Date:2/7/2023
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT, N9020A	MXA SPECTRUM ANALYZER	12/19/2023

Test Name:	**Radiated Emissions**		Test Date: 2/8/2023 & 2/23/2023
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT, N9020A	MXA SPECTRUM ANALYZER	12/19/2023
00644	SUNOL SCIENCES CORP.	BICONALOG ANTENNA	11/14/2024
00626	ARA, DRG-118/A	HORN ANTENNA	8/20/2023
00977	JUNKOSHA, MWX322	ARMORED COAX. CABLE	12/28/2023
00806	MINI-CIRCUITS	SMA COAXIAL CABLE	5/5/2023
00834	ULTIFLEX, UFA 2108	SMA COAXIAL CABLE	12/28/2023
00276	ELECTRO-METRICS	RF PRE-AMPLIFIER	5/5/2023
00066	B&Z (HP), BZ-01002650	PRE-AMPLIFIER	5/5/2023
00742	PENN ENG., WR284	WAVEGUIDE PASS FILTER	Cal. Before Use
00281	ITC. 21A-3A1	WAVEGUIDE PASS FILTER	Cal. Before Use
00721	WEINSCHEL, DS109	TUNABLE ATTENUATOR	Cal. Before Use

Test Name:	**AC Mains Conducted Emissions**		Test Date:2/24/2023
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT, N9020A	MXA SPECTRUM ANALYZER	12/19/2023
00895	HP, 11947A	TRANSIENT LIMITER	2/14/2024
00125	SOLAR, LISN	8028-50-TS-24-BNC	9/14/2023
00126	SOLAR, LISN	8028-50-TS-24-BNC	9/14/2023
00330	WLL, BNC CABLE	CE SITE 1 CABLE	5/6/2023

Test Name:	**Temperature Stability**		Test Date:2/8/2023
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00776	Tenney	Temperature Chamber	7/25/2023
00948	HP8564EC	Spectrum Analyzer	1/17/2025

4 Test Results

4.1 Occupied Bandwidth

4.1.1 Specification References

FCC 47 CFR Part 2, Clause 2.1049

ISED RSS-GEN, Clause 6.7

4.1.2 Test Method

OBW was performed to ANSI C63.26, Clause 5.4.4

4.1.3 Test Results

Table 7: OBW Test Results Summary

Modulation Type	Channel (Low/High)	6dB OBW (kHz)	99% OBW (kHz)
C1	Low	31.9	33.0
C1	High	31.9	32.7
C2	Low	62.2	65.0
C2	High	62.2	65.0
C8	Low	249.0	259.3
C8	High	244.3	259.5

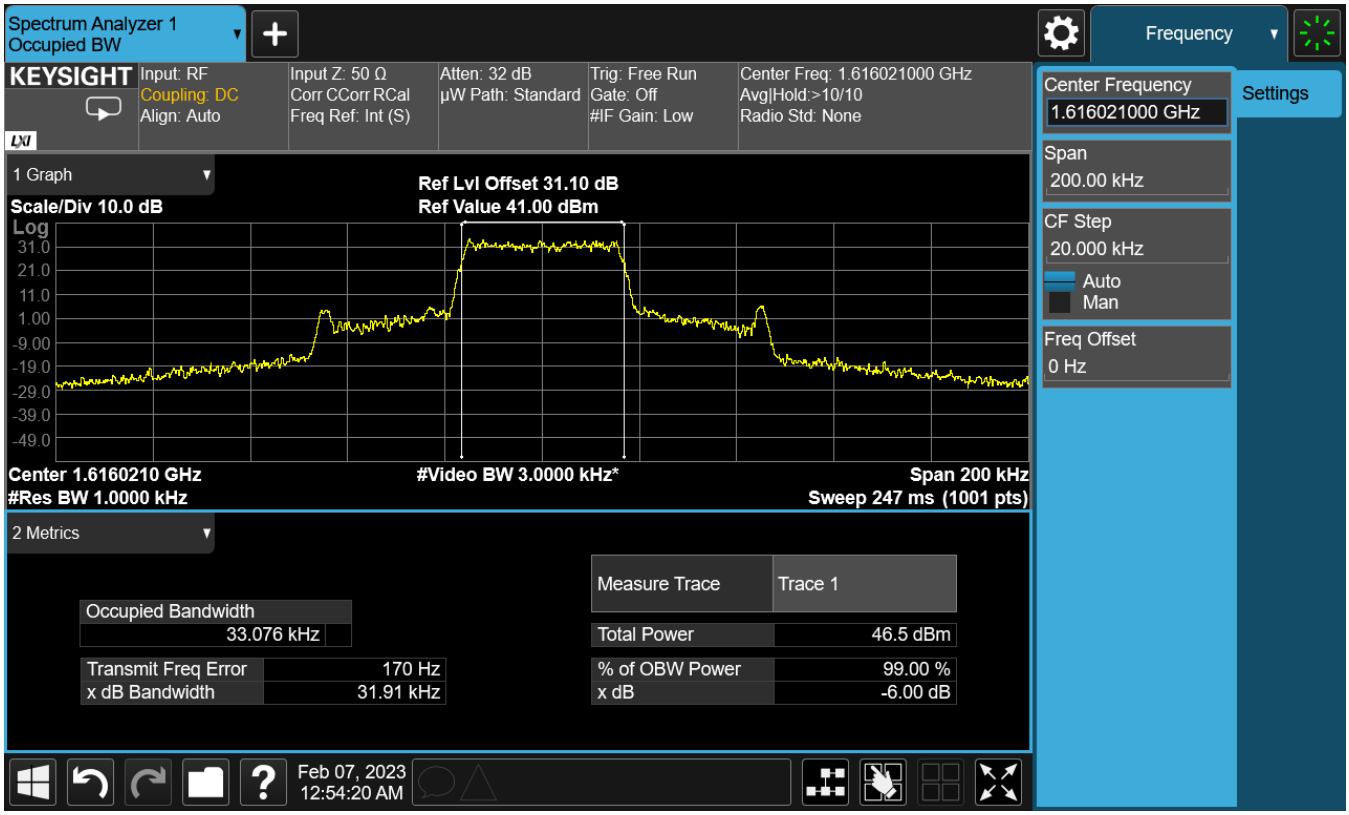

Figure 3: OBW C1 Test Plot, Low Channel

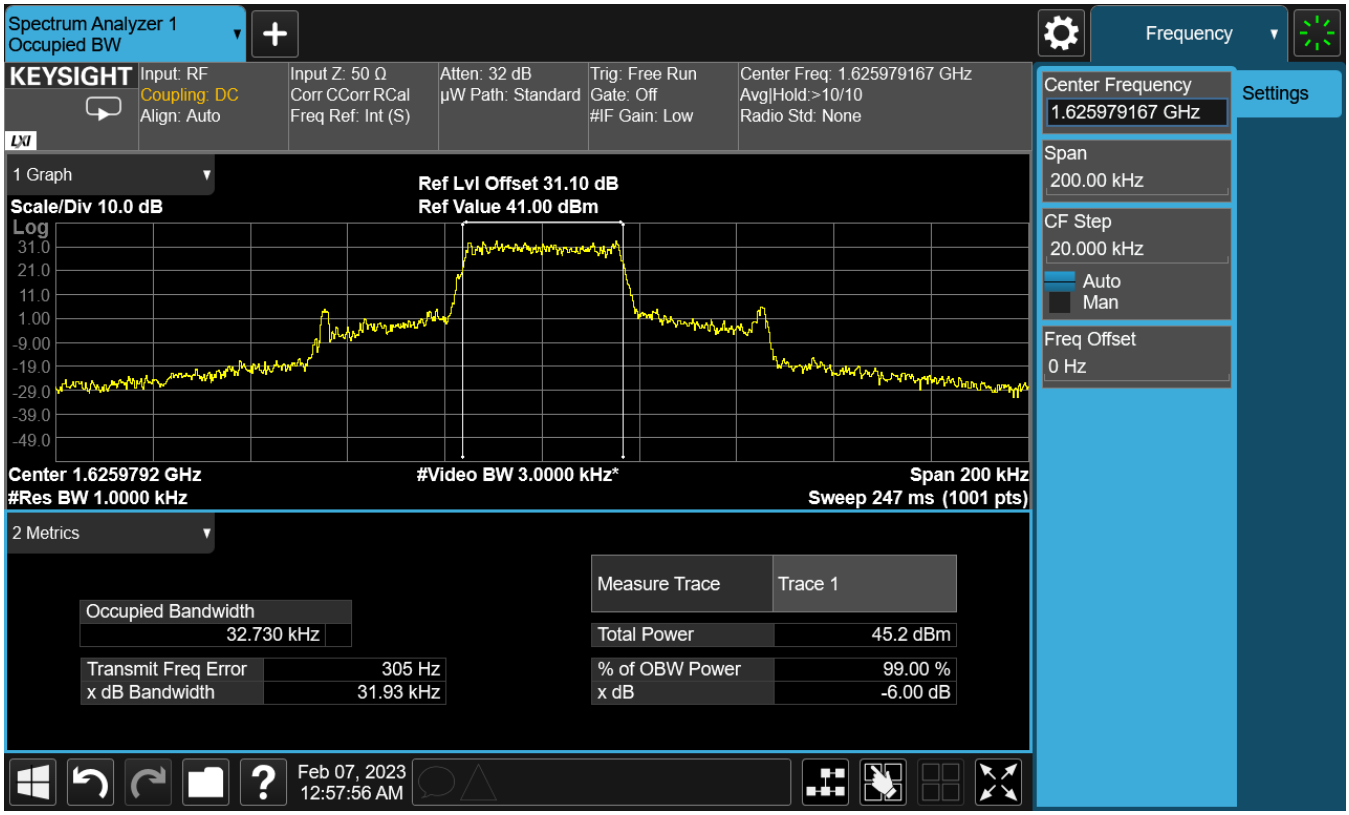

Figure 4: OBW C1 Test Plot, High Channel

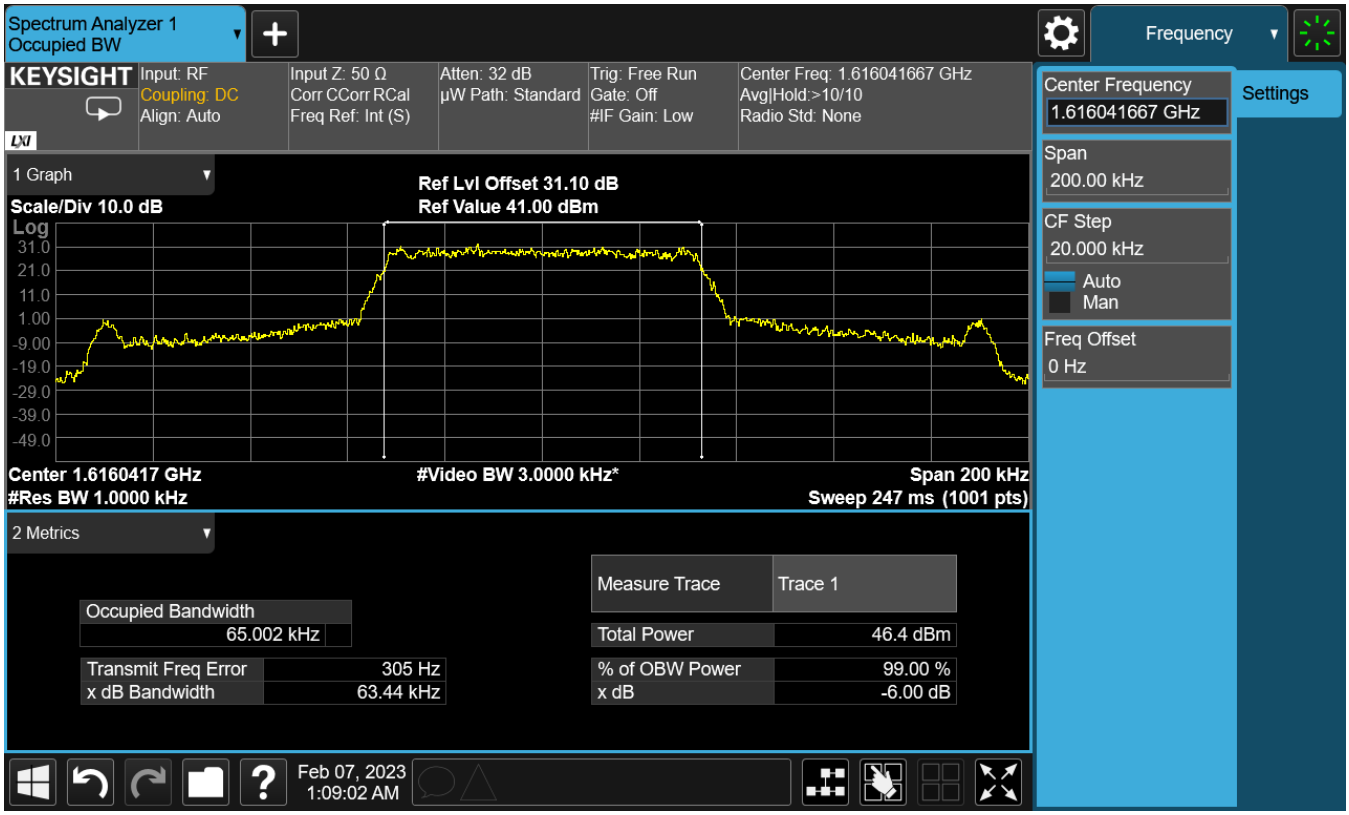

Figure 5: OBW C2 Test Plot, Low Channel

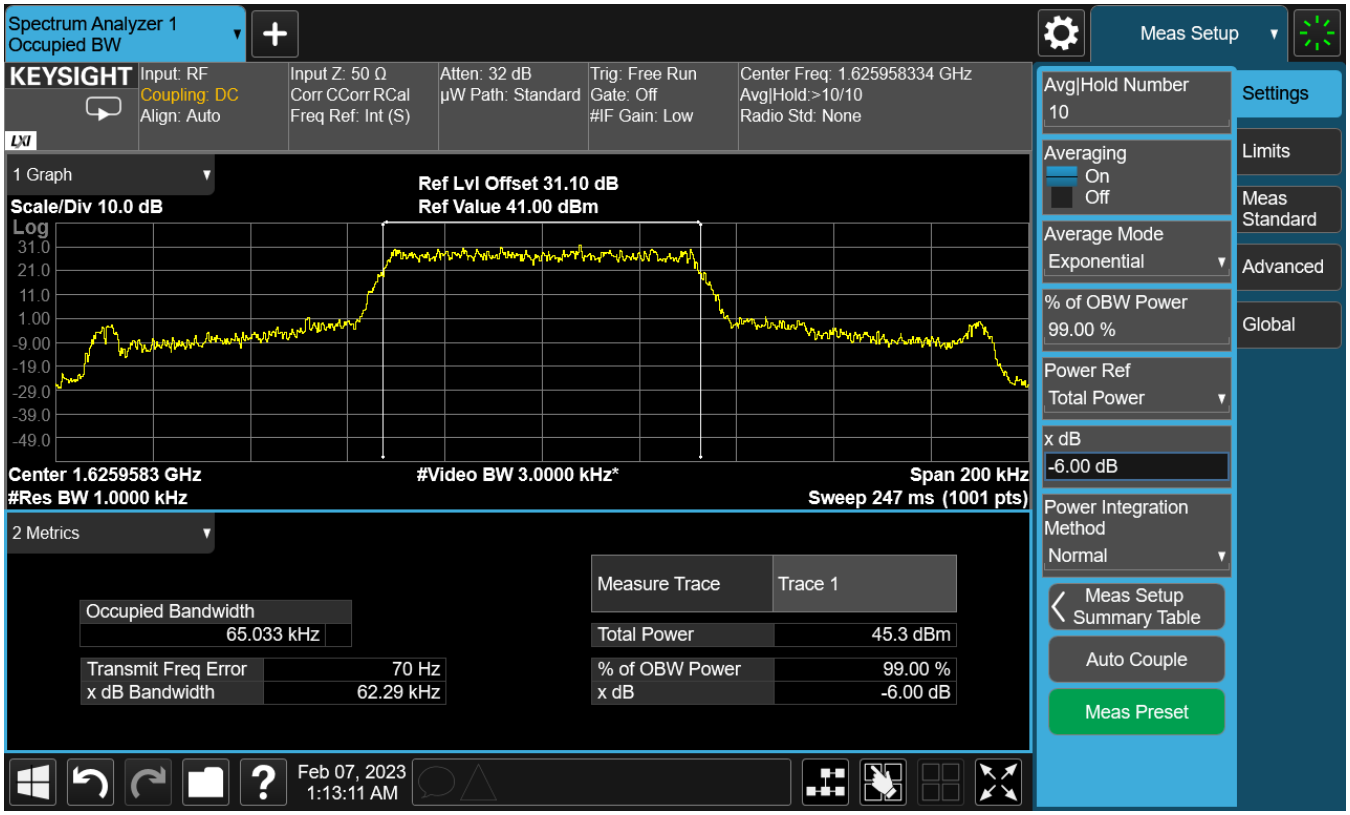

Figure 6: OBW, C2 Test Plot, High Channel

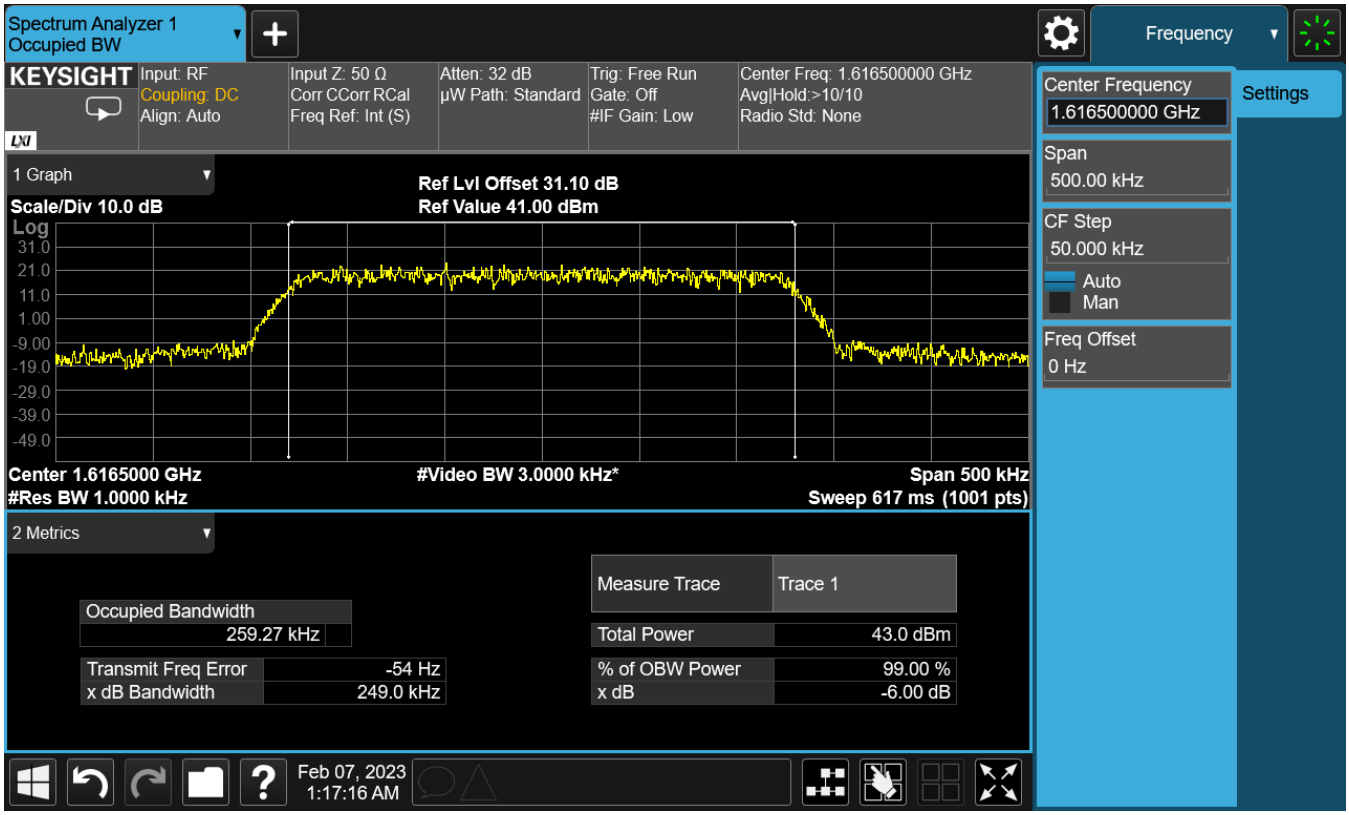

Figure 7: OBW, C8 Test Plot, Low Channel

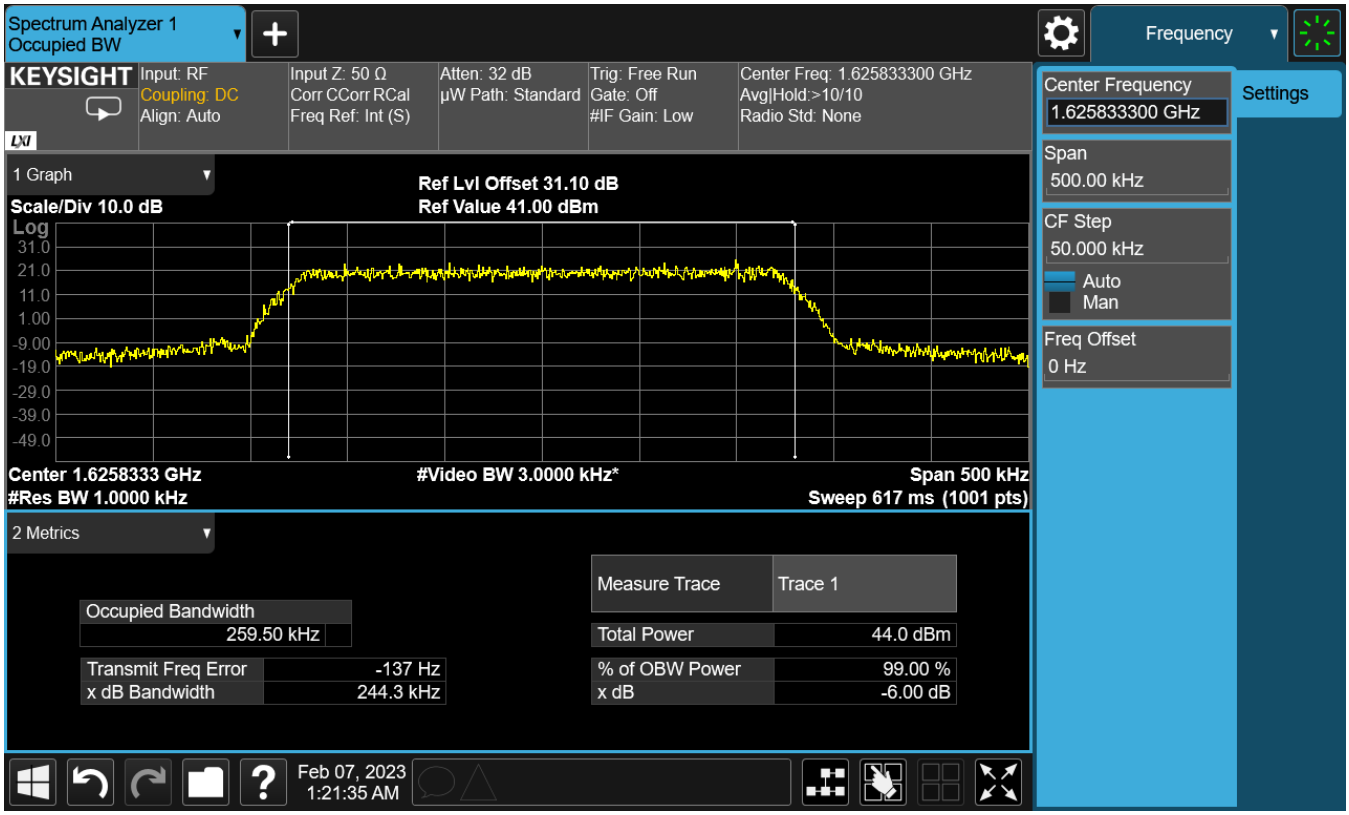

Figure 8: OBW, C8 Test Plot, High Channel

4.2 EIRP (Equivalent Isotropic Radiated Power)

4.2.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.204

FCC 47 CFR Part 2, Clause 2.1046

Industry Canada RSS-170, Clause 5.5

ISEDC RSS-GEN, Clause 6.12

4.2.2 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.2.3.5

4.2.3 Environmental Conditions

Environmental Conditions during Conducted Spurious Emissions

Ambient Temperature:	24°C
Relative Humidity:	55%

4.2.4 EIRP Test Results

EIRP for Modulation C1

Channel	Freq. (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBW)
Low	1616.021	41.82	3	44.82	40
High	1625.988	41.46	3	44.46	40

EIRP for Modulation C2

Channel	Freq. (MHz)	Measured Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBW)
Low	1616.021	41.48	3	44.48	40
High	1625.988	41.46	3	44.46	40

EIRP for Modulation C8

Channel	Freq. (MHz)	Measured Conducted Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBW)
Low	1616.085	41.46	3	44.46	40
High	1625.988	41.28	3	44.28	40

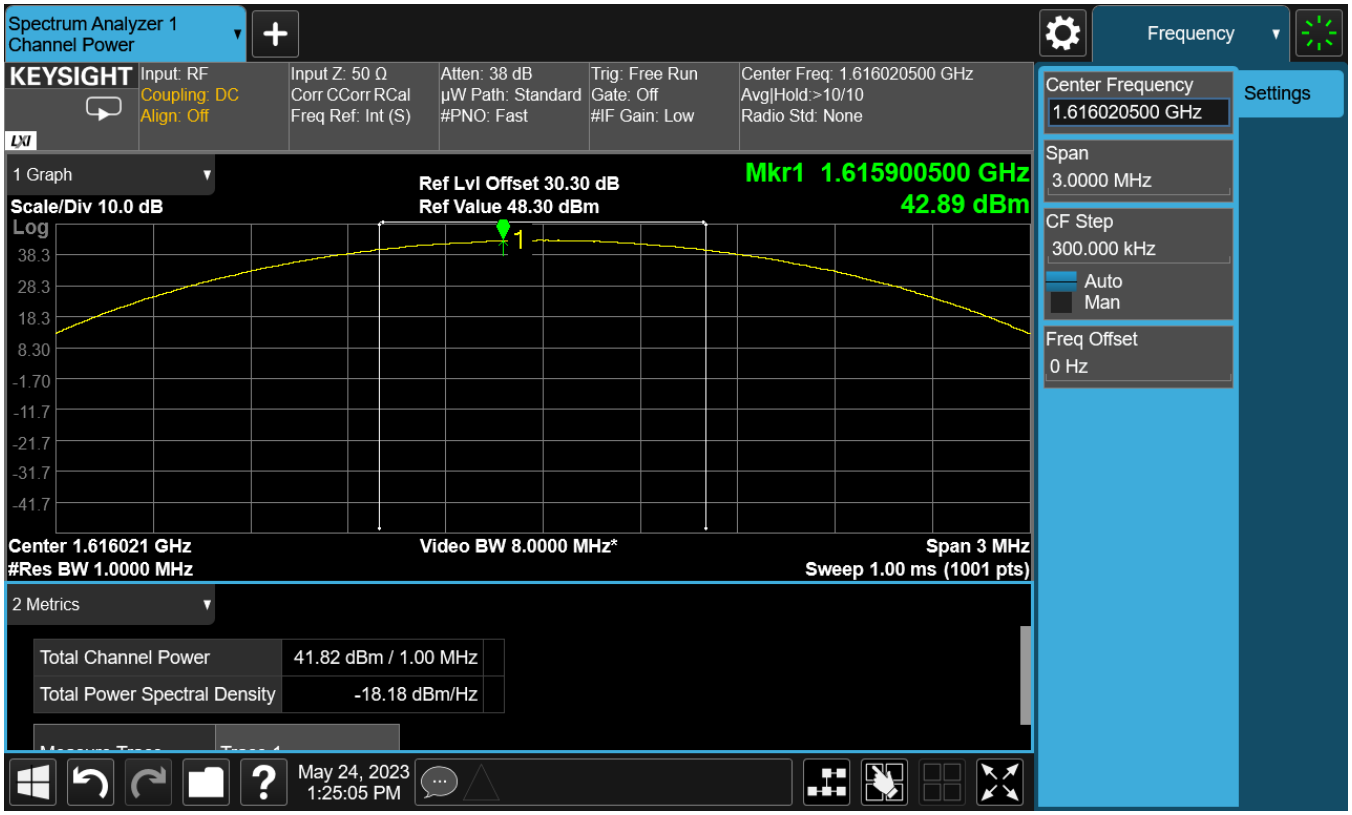

Figure 9: Conducted Power, C1 Modulation, Low Channel

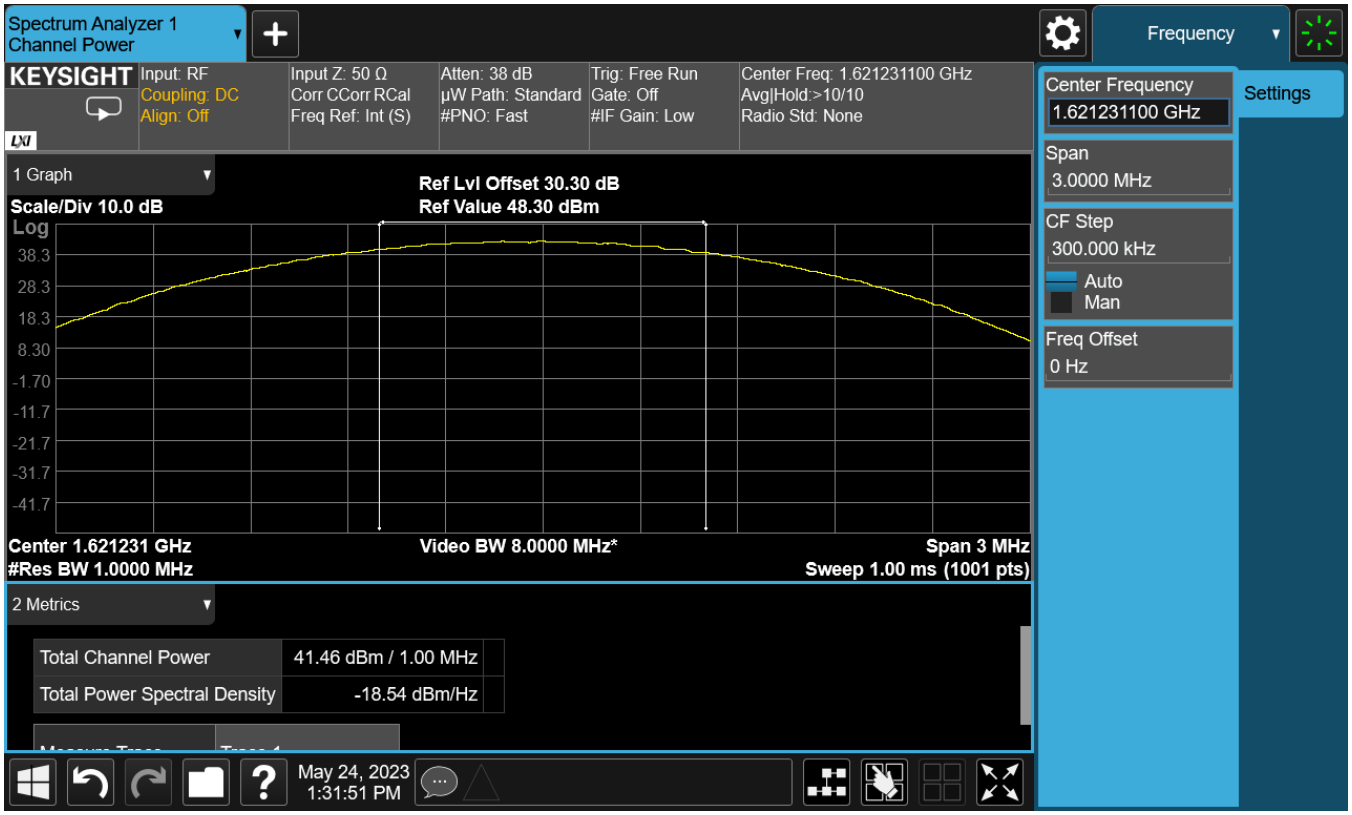

Figure 10: Conducted Power, C1 Modulation, High Channel

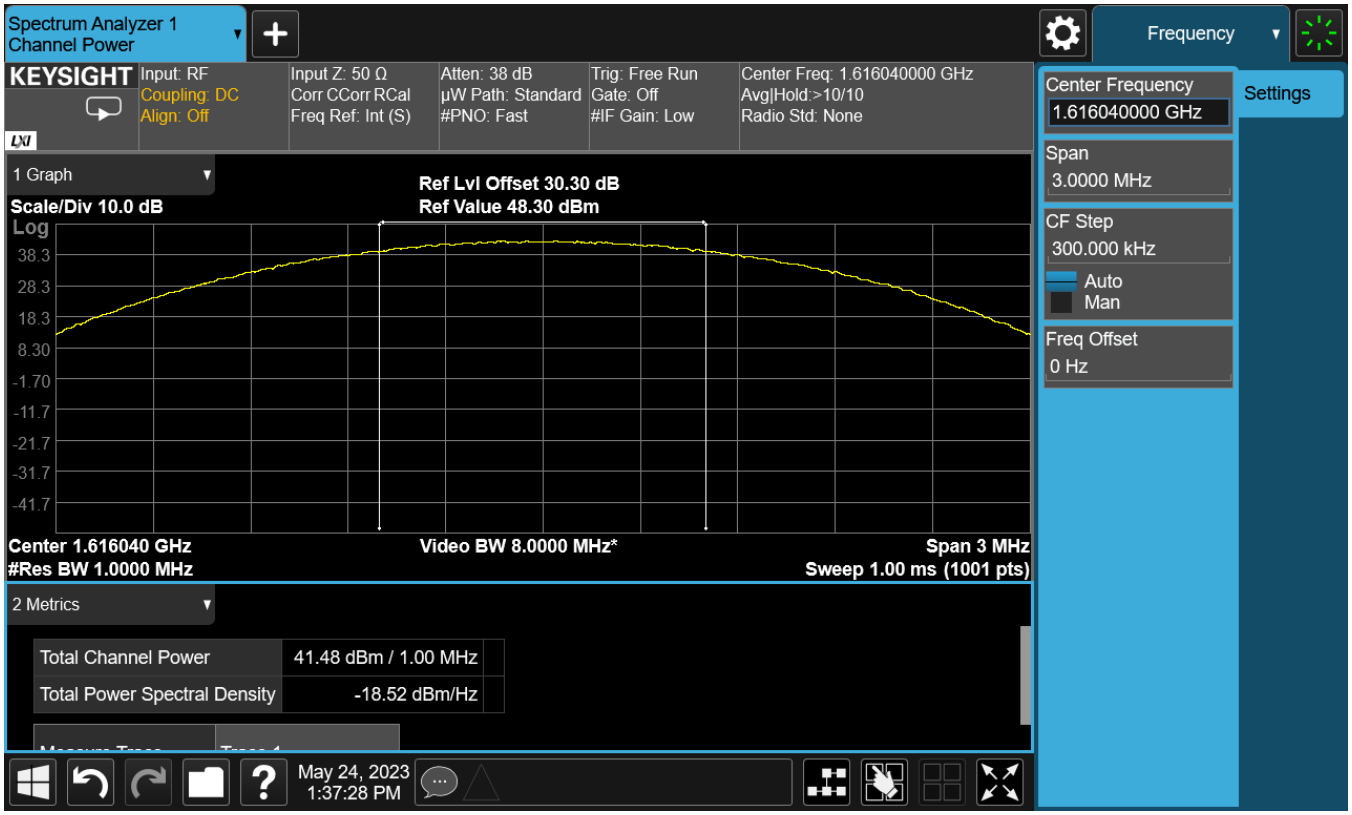

Figure 11: Conducted Power, C2 Modulation, Low Channel

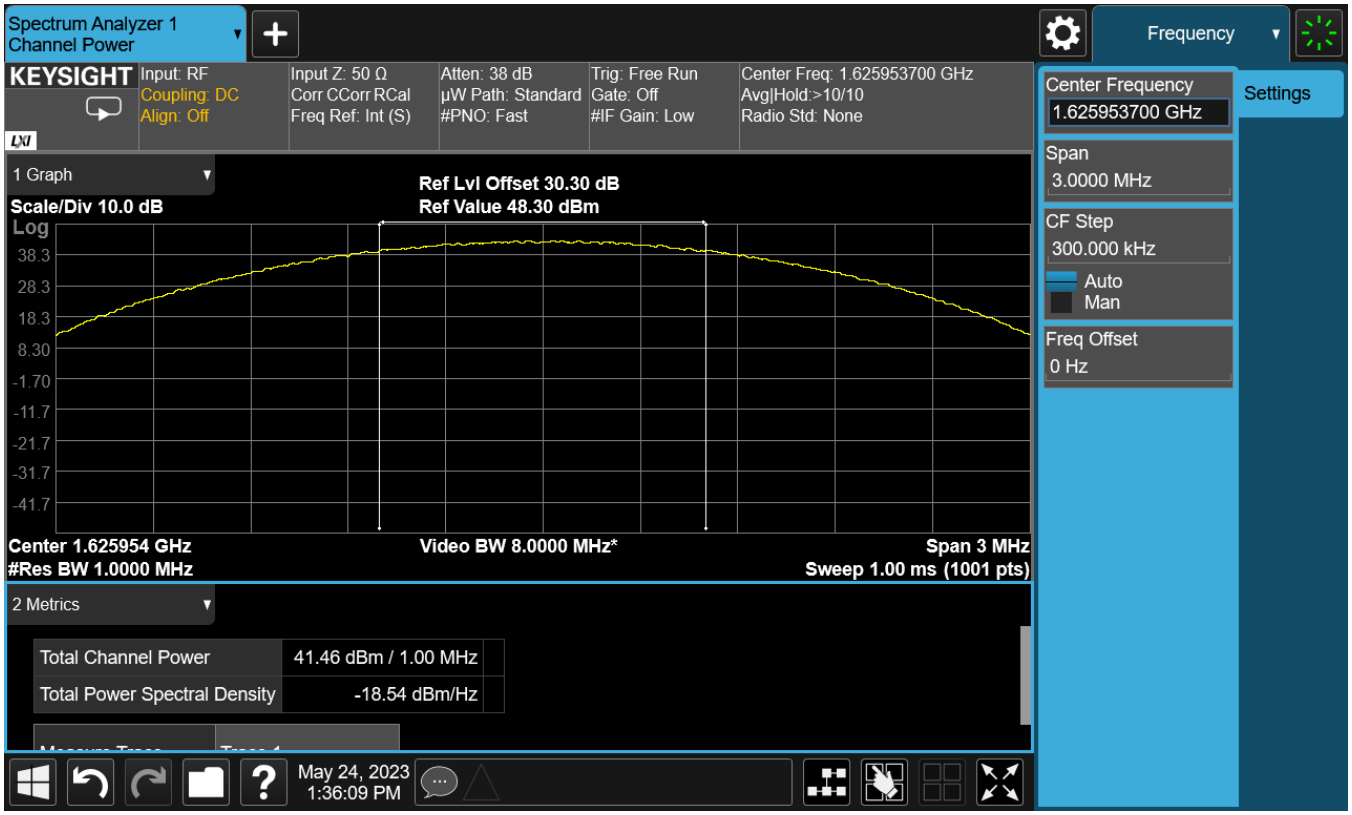

Figure 12: Conducted Power, C2 Modulation, High Channel

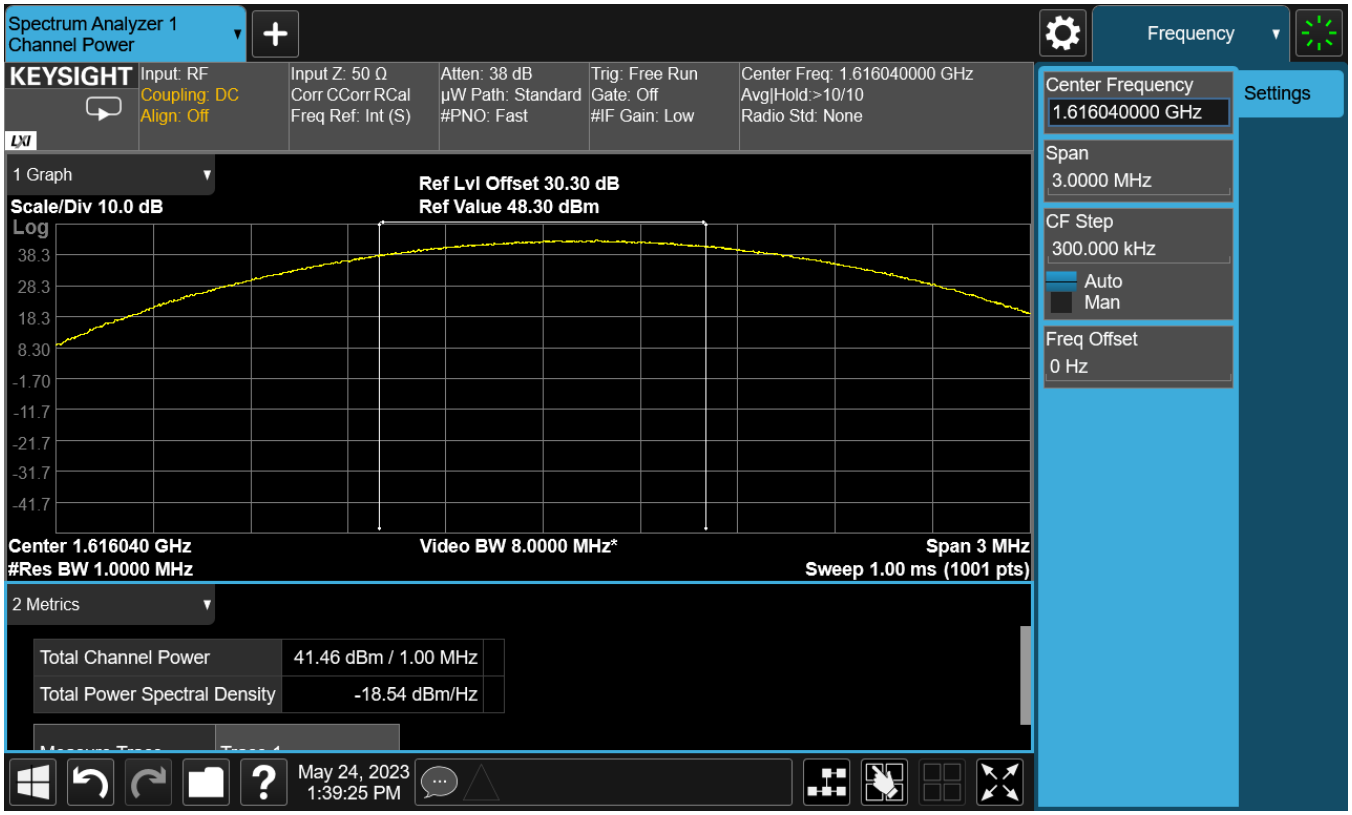

Figure 13: Conducted Power, C8 Modulation, Low Channel

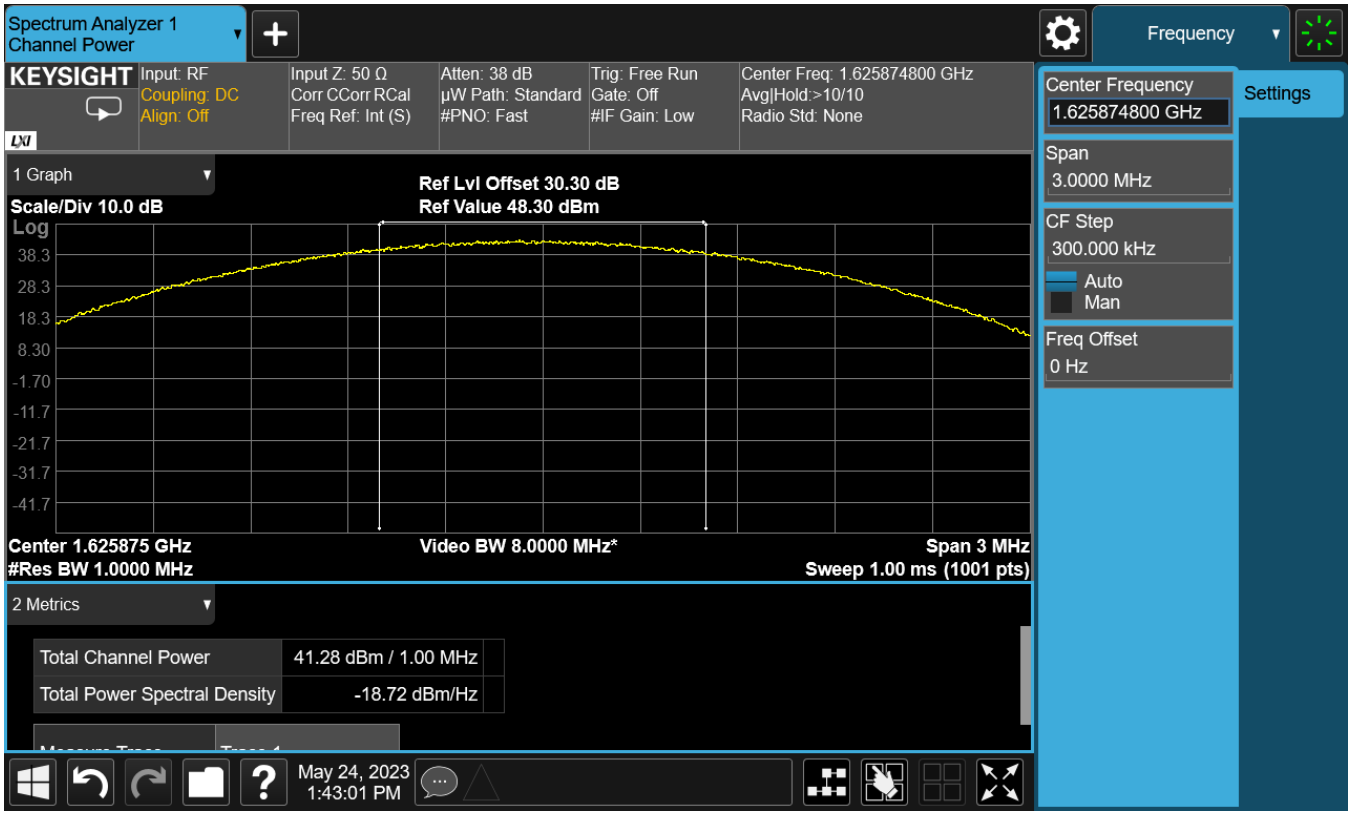

Figure 14: Conducted Power, C8 Modulation, High Channel

4.3 Spurious Emissions at Antenna Terminals (Conducted)

4.3.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.202(f)
FCC 47 CFR Part 2, Clause 2.1051
Industry Canada RSS-170, Clause 5.8
ISEDC RSS-GEN, Clause 6.13

4.3.2 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7

4.3.3 Environmental Conditions

Environmental Conditions during Conducted Spurious Emissions

Ambient Temperature:	24°C
Relative Humidity:	55%

4.3.4 Spurious Emissions Test Results

See Figure 1 through Figure 56.

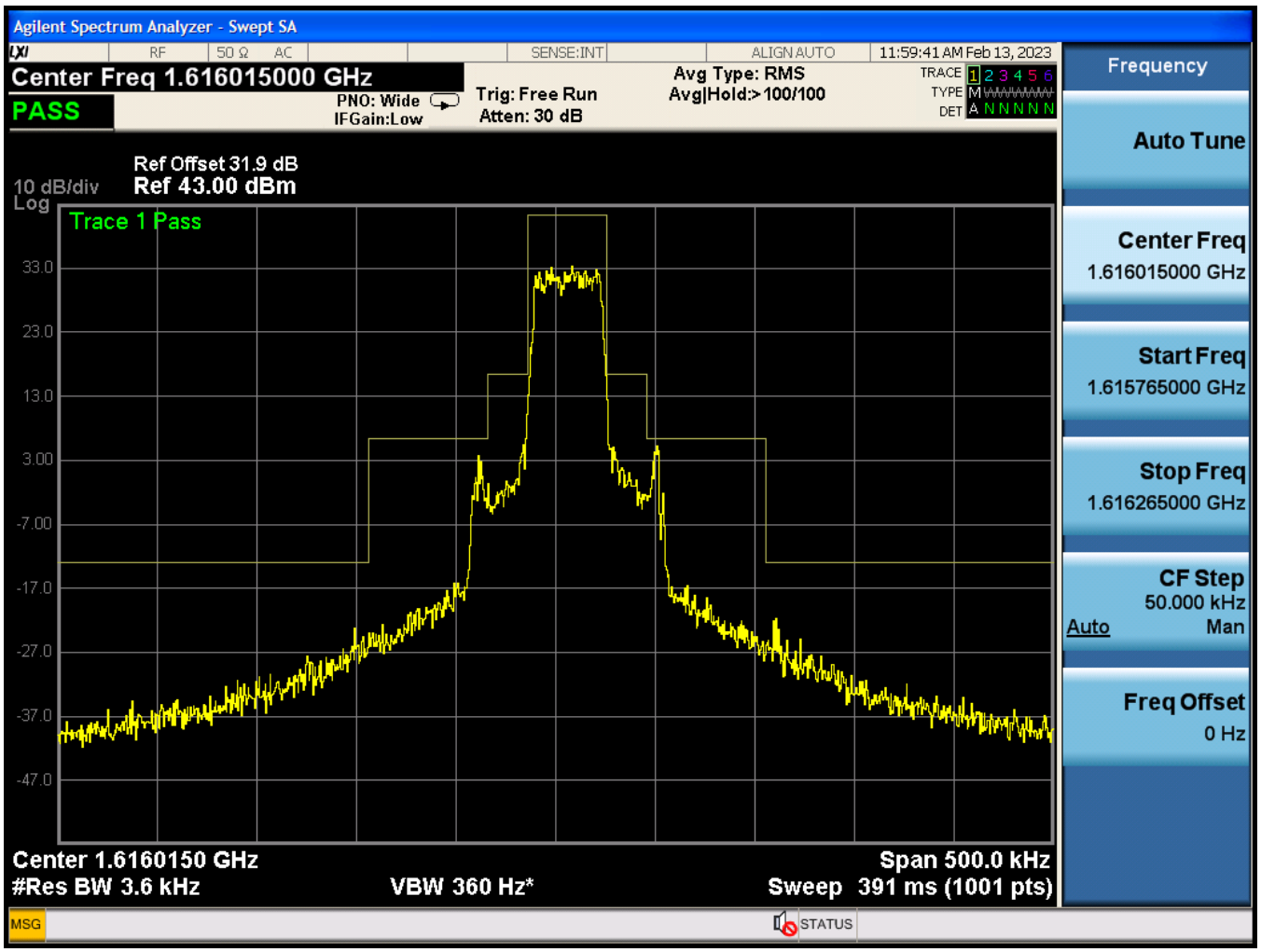

Figure 15: Mask, C1, Test Plot, Low Channel

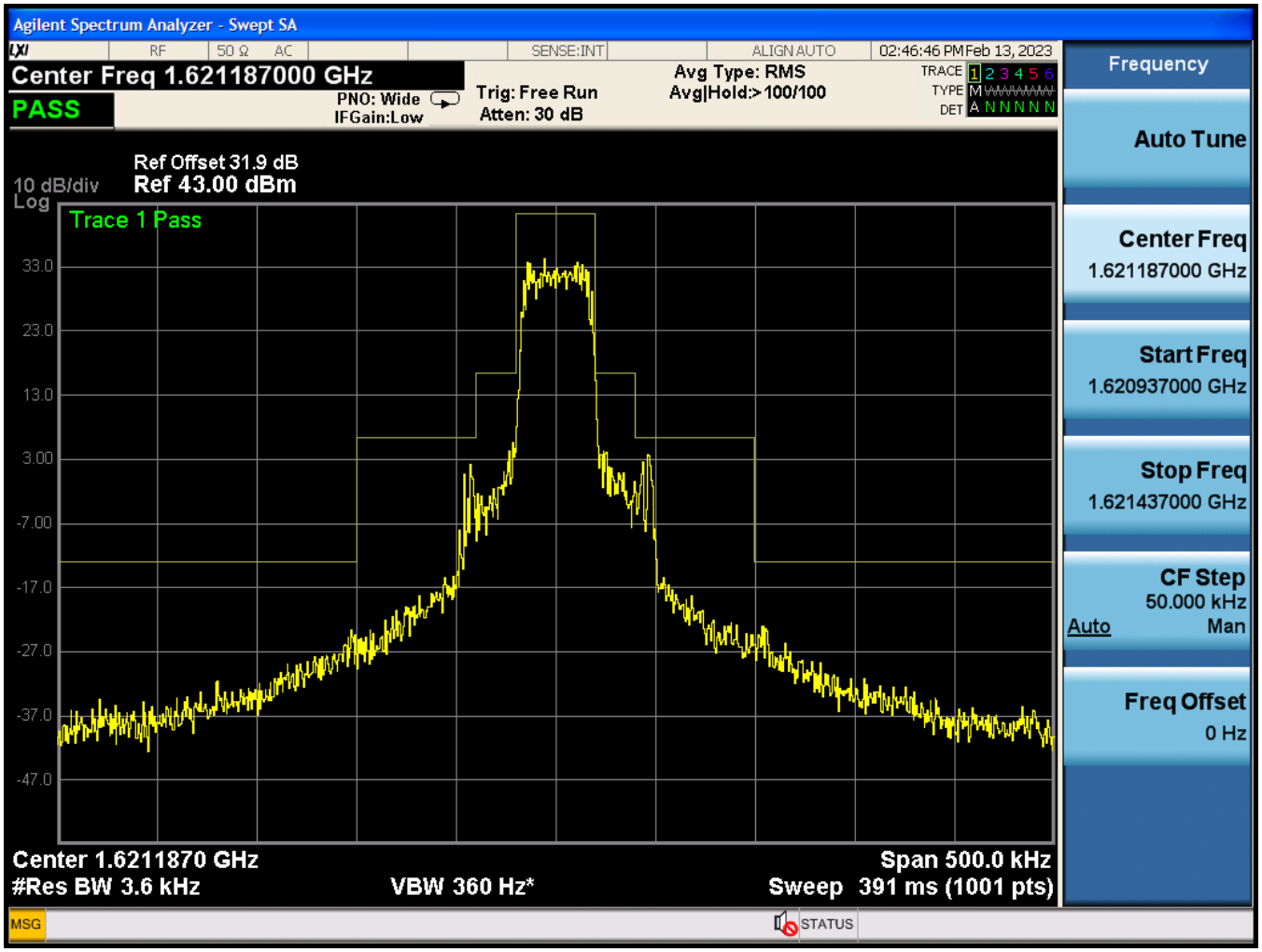

Figure 16: Mask, C1, Test Plot, High Channel

Figure 17: Mask, C2, Test Plot, Low Channel

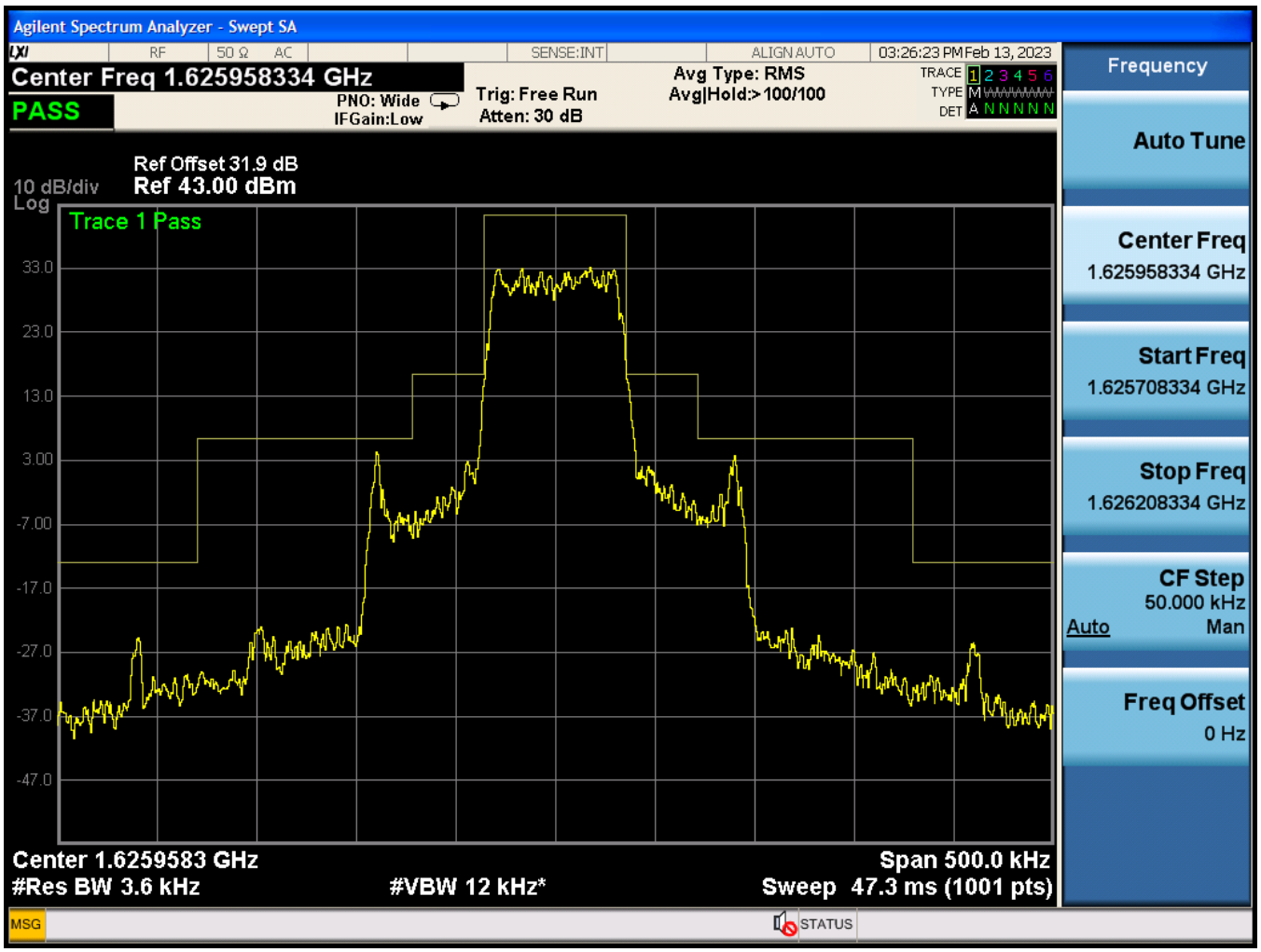

Figure 18: Mask, C2, Test Plot, High Channel

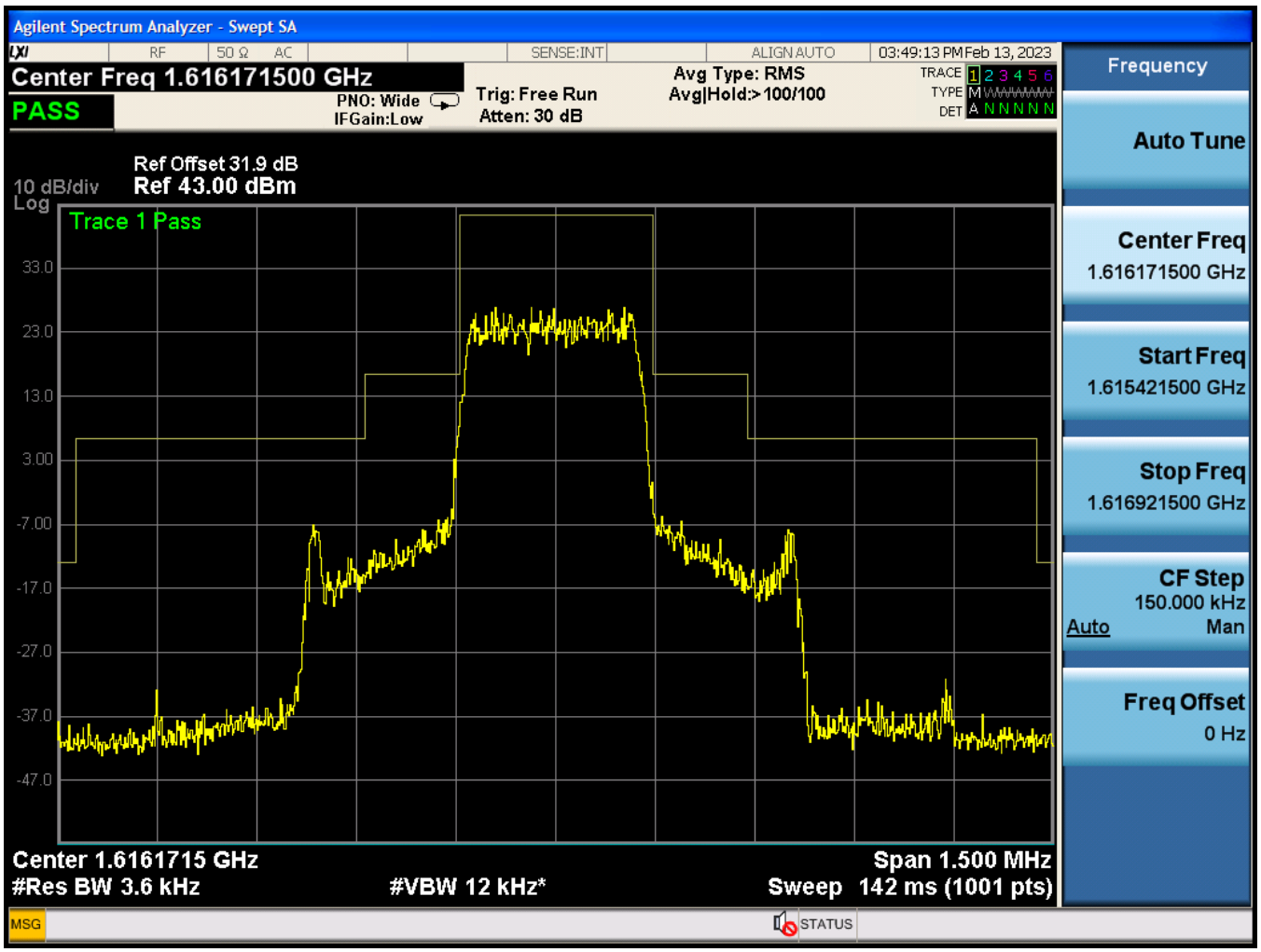

Figure 19: Mask, C8, Test Plot, Low Channel

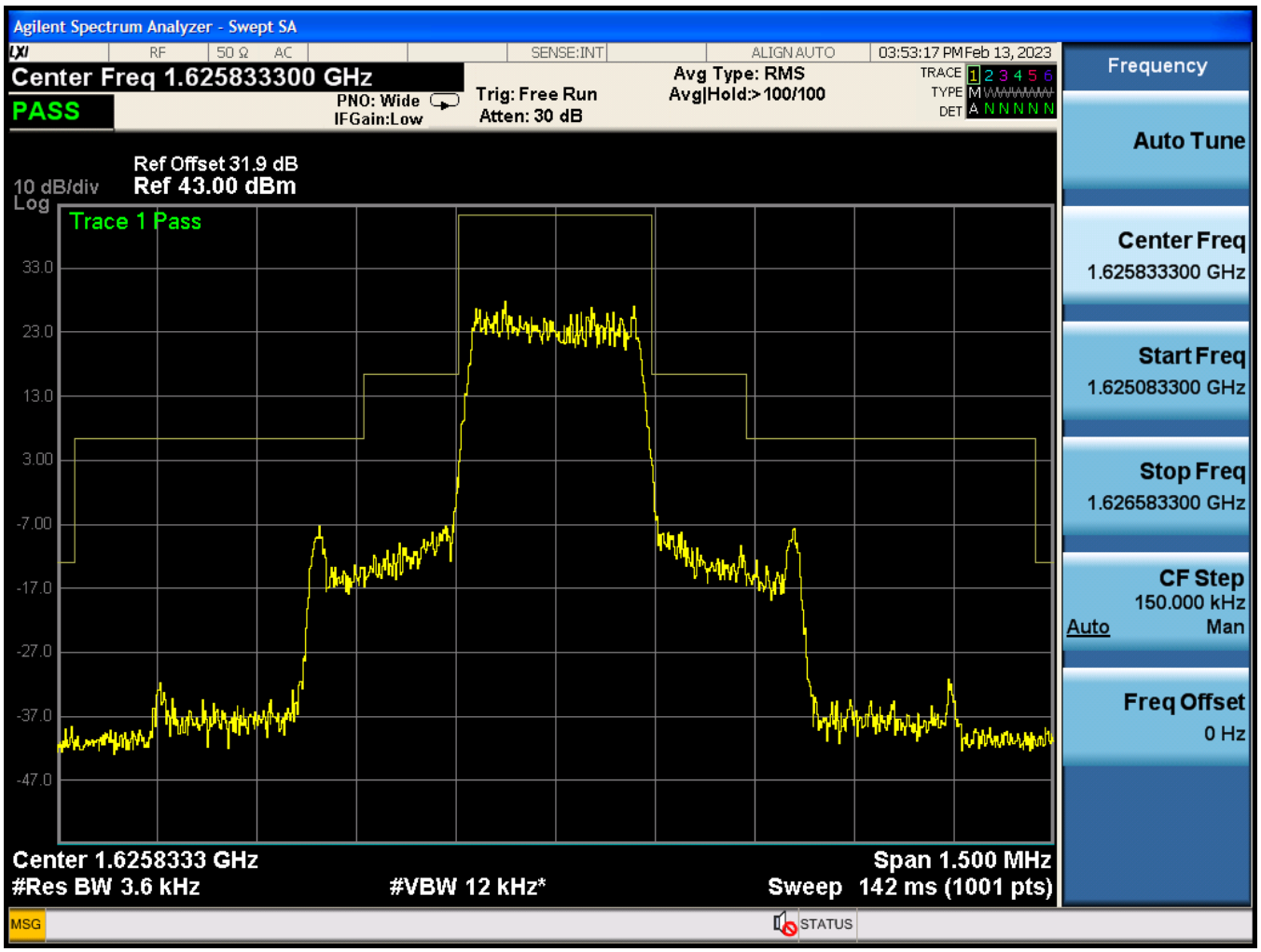

Figure 20: Mask, C8, Test Plot, High Channel

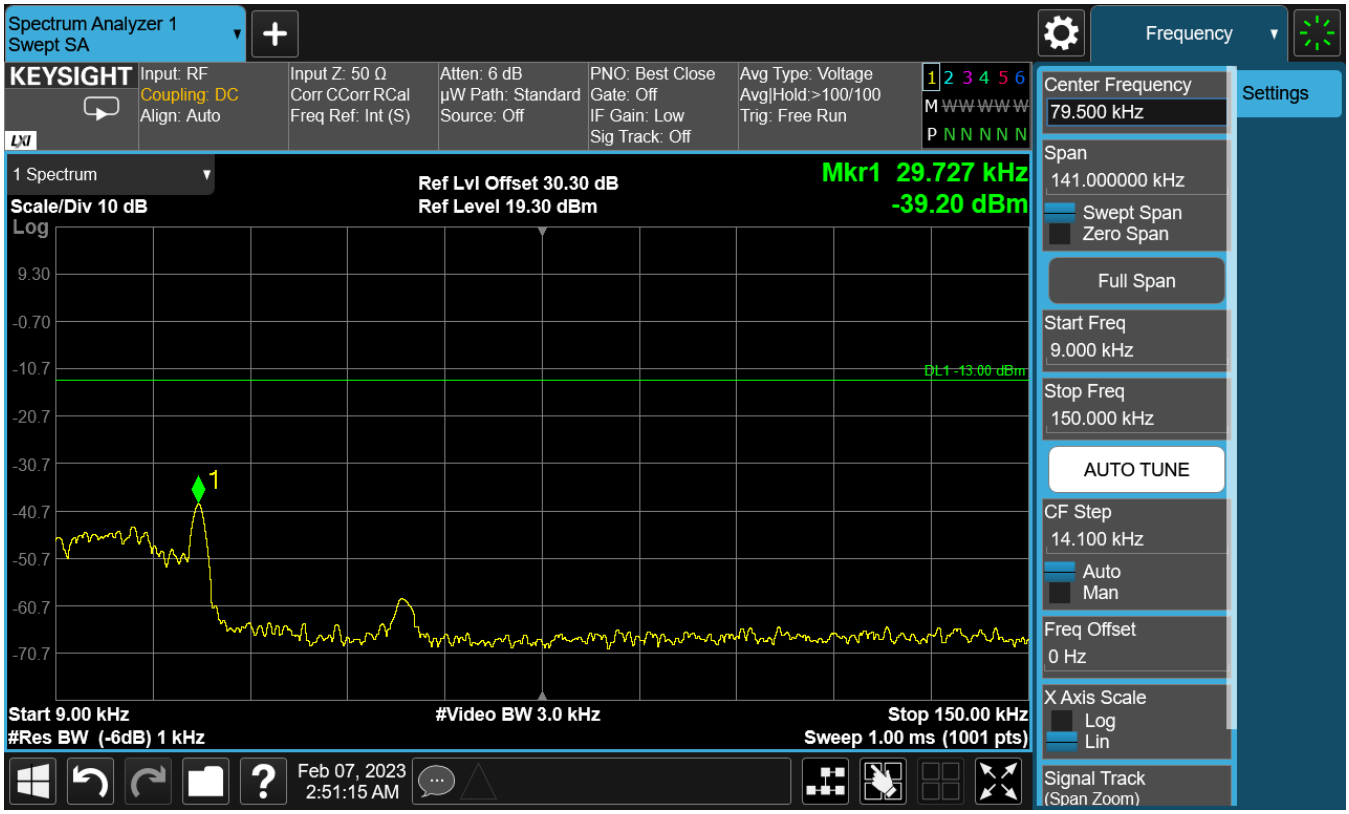

Figure 21: 9kHz to 150kHz, Spurious Emissions, C1, Low Channel

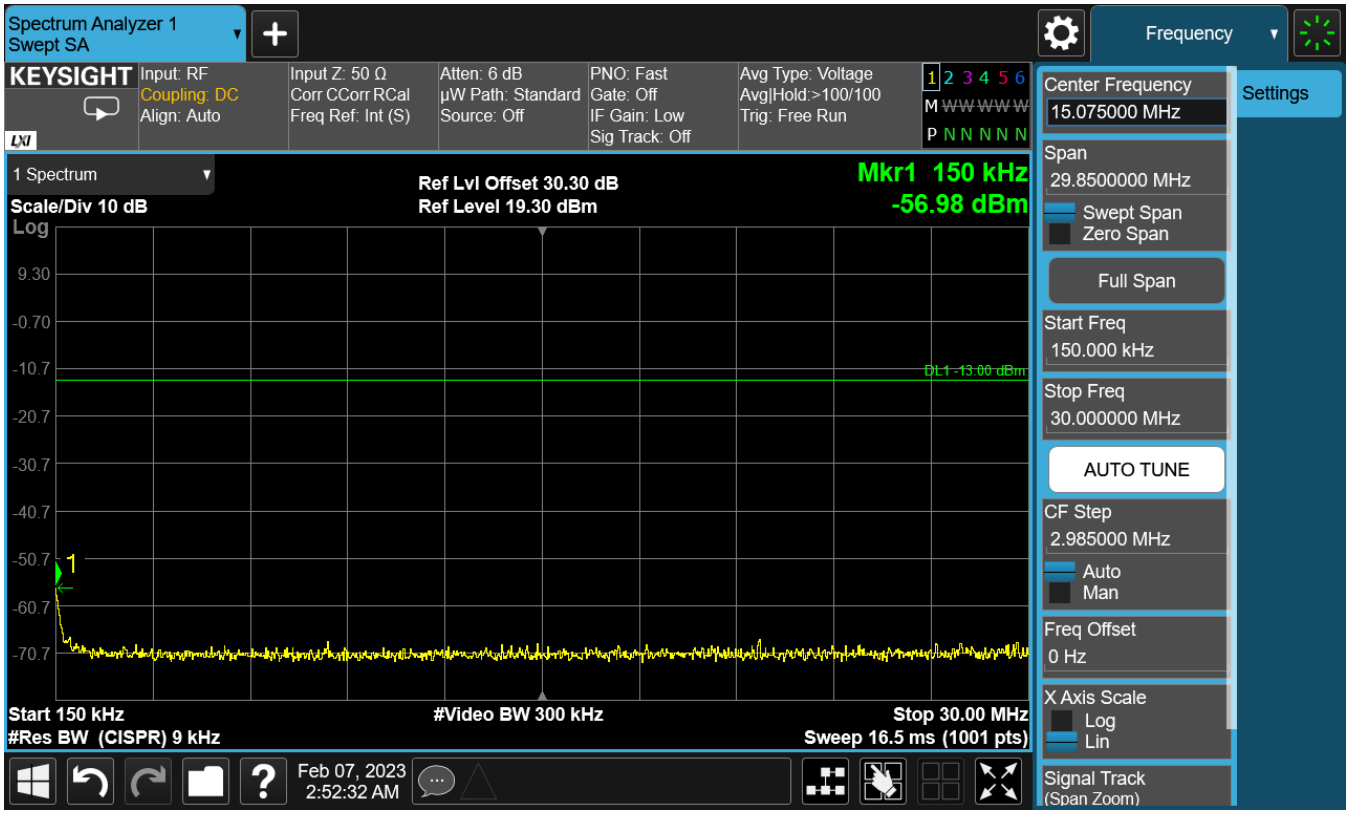

Figure 22: 150kHz to 30MHz, Spurious Emissions, C1, Low Channel

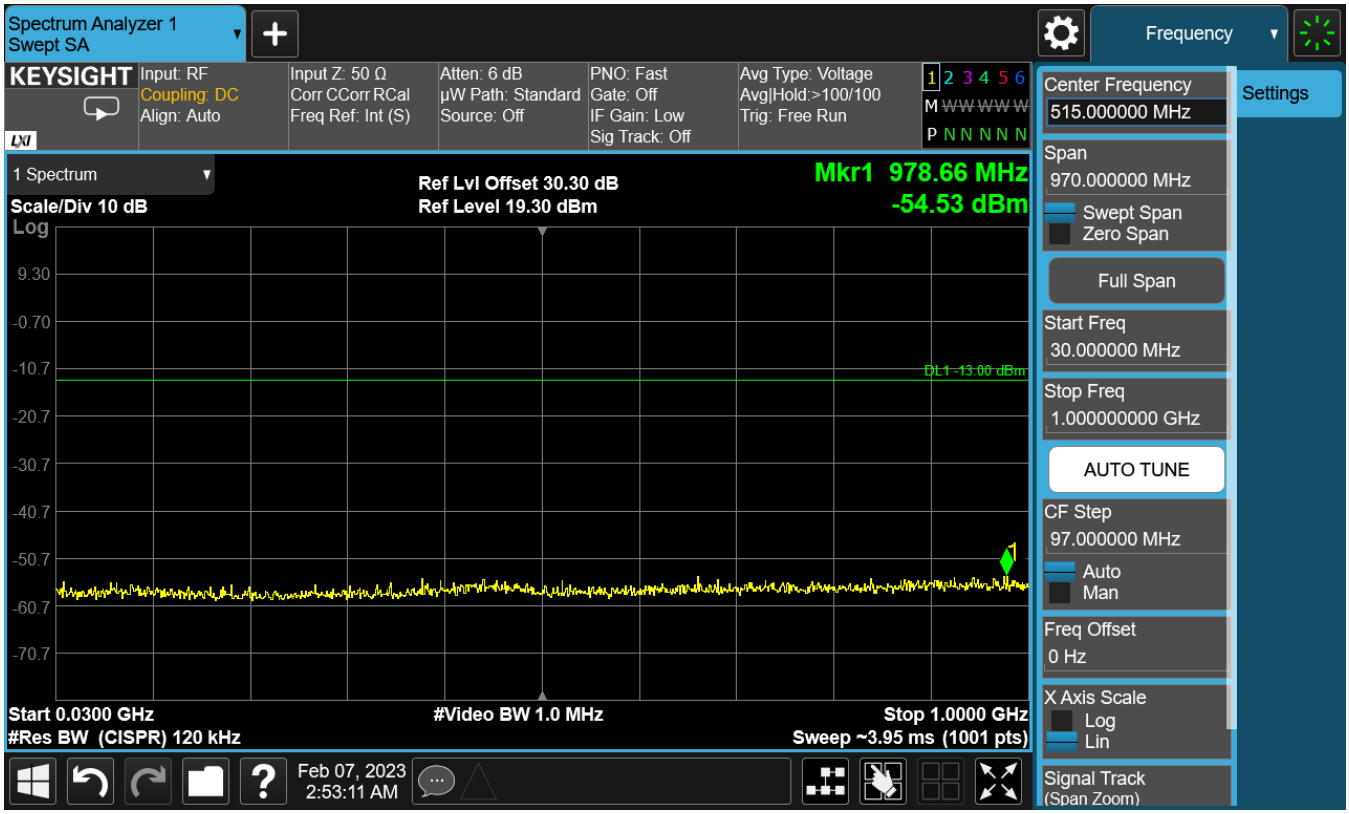

Figure 23: 30MHz to 1GHz, Spurious Emissions, C1, Low Channel

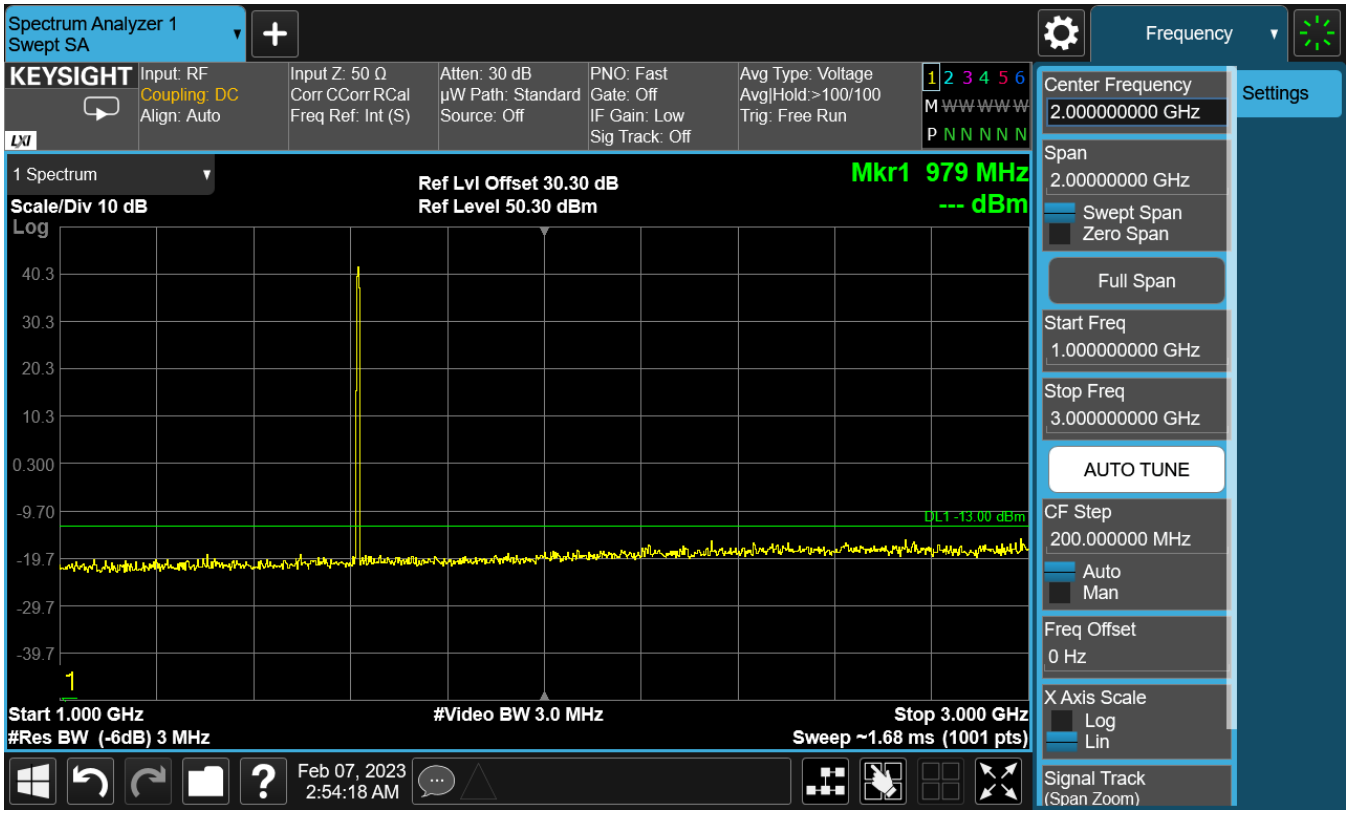

Figure 24: 1GHz to 3GHz, Spurious Emissions, C1, Low Channel

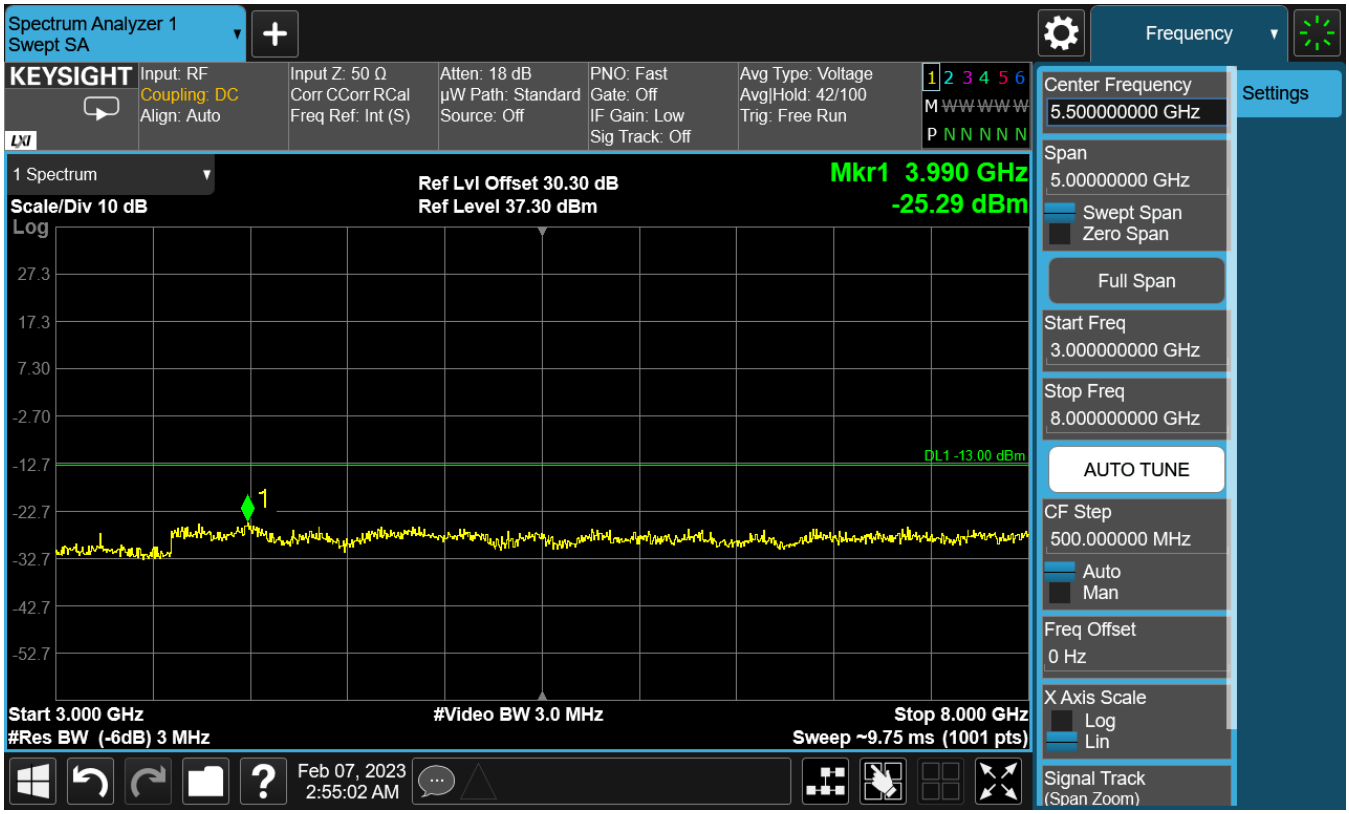

Figure 25: 3GHz to 8GHz, Spurious Emissions, C1, Low Channel

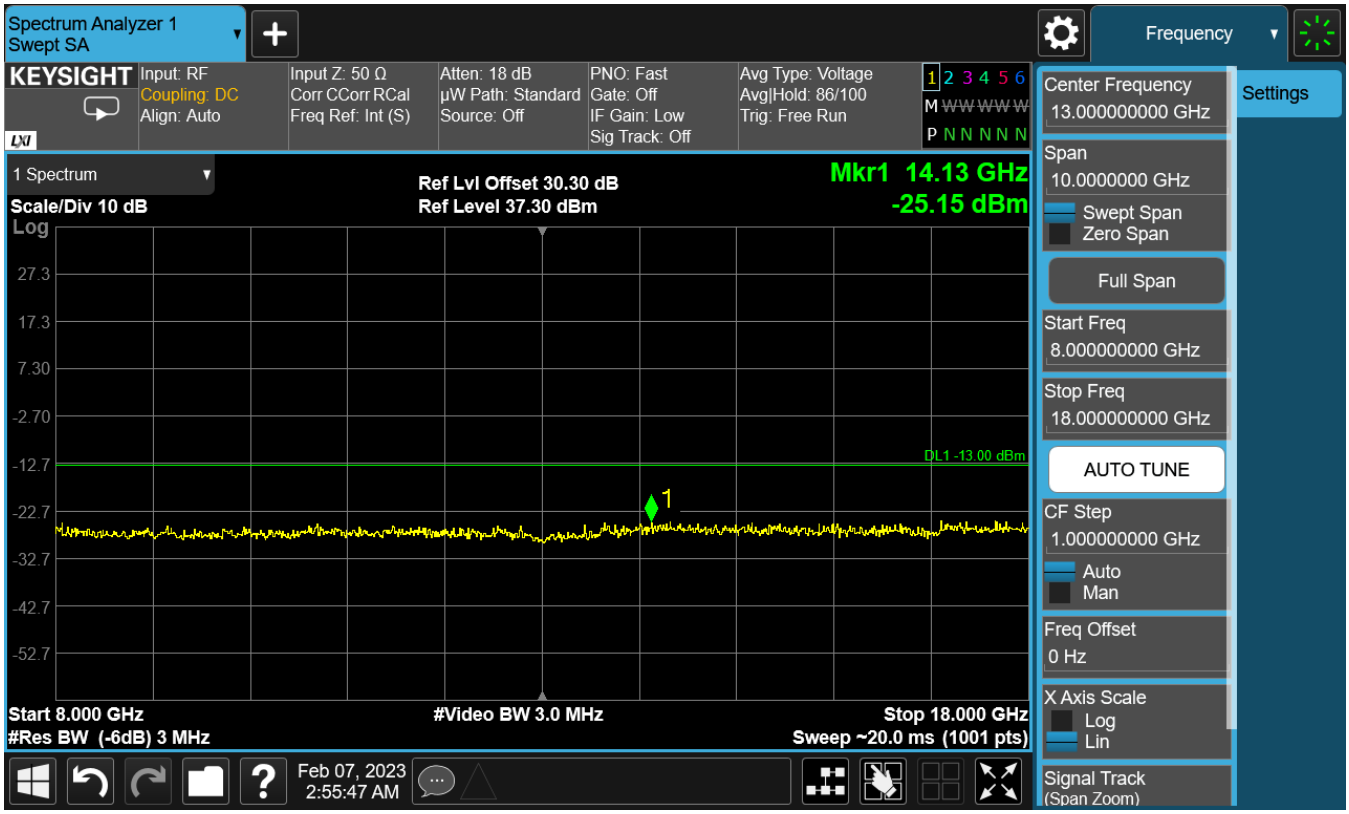

Figure 26: 8GHz to 18GHz, Spurious Emissions, C1, Low Channel

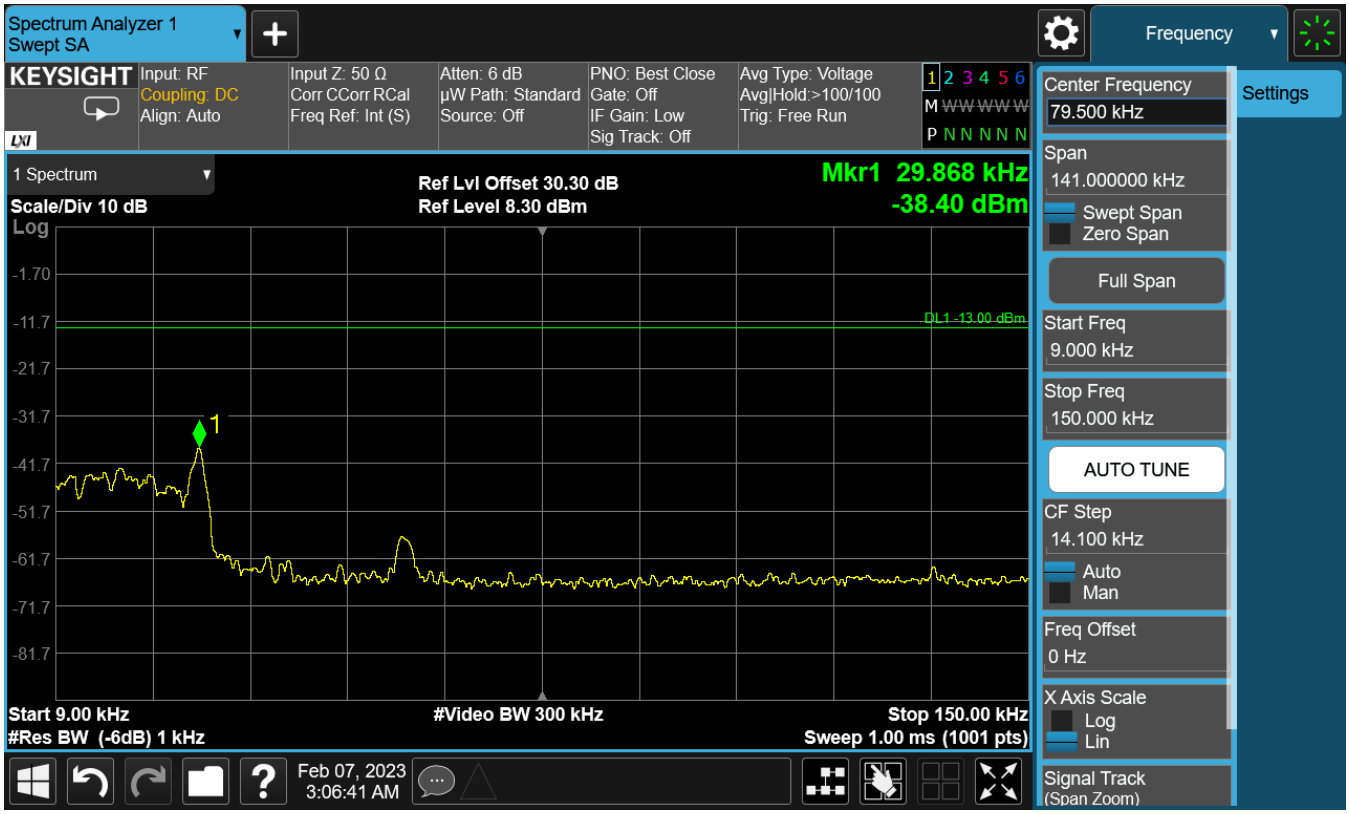

Figure 27: 9kHz to 150kHz, Spurious Emissions, C2, High Channel

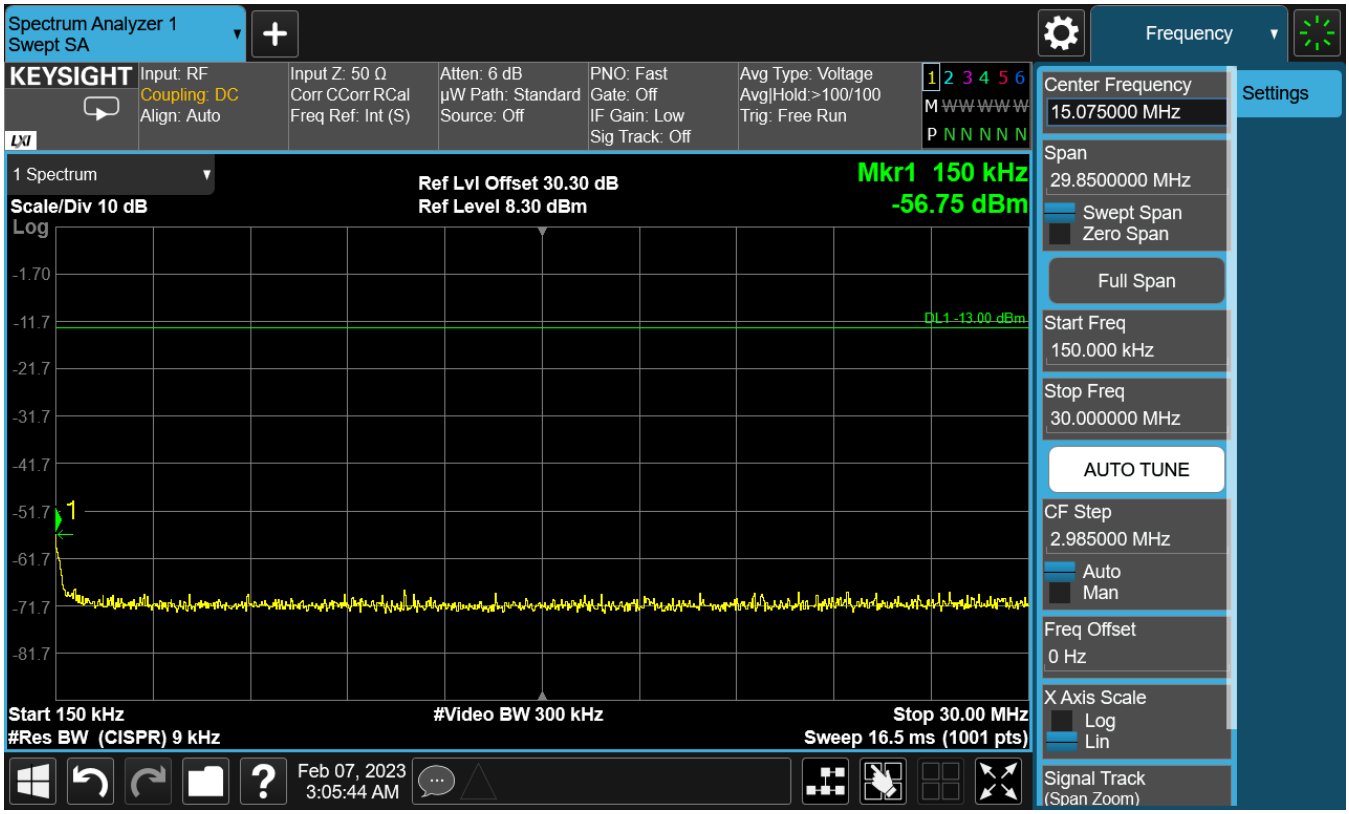

Figure 28: 150kHz to 30MHz, Spurious Emissions, C1, High Channel

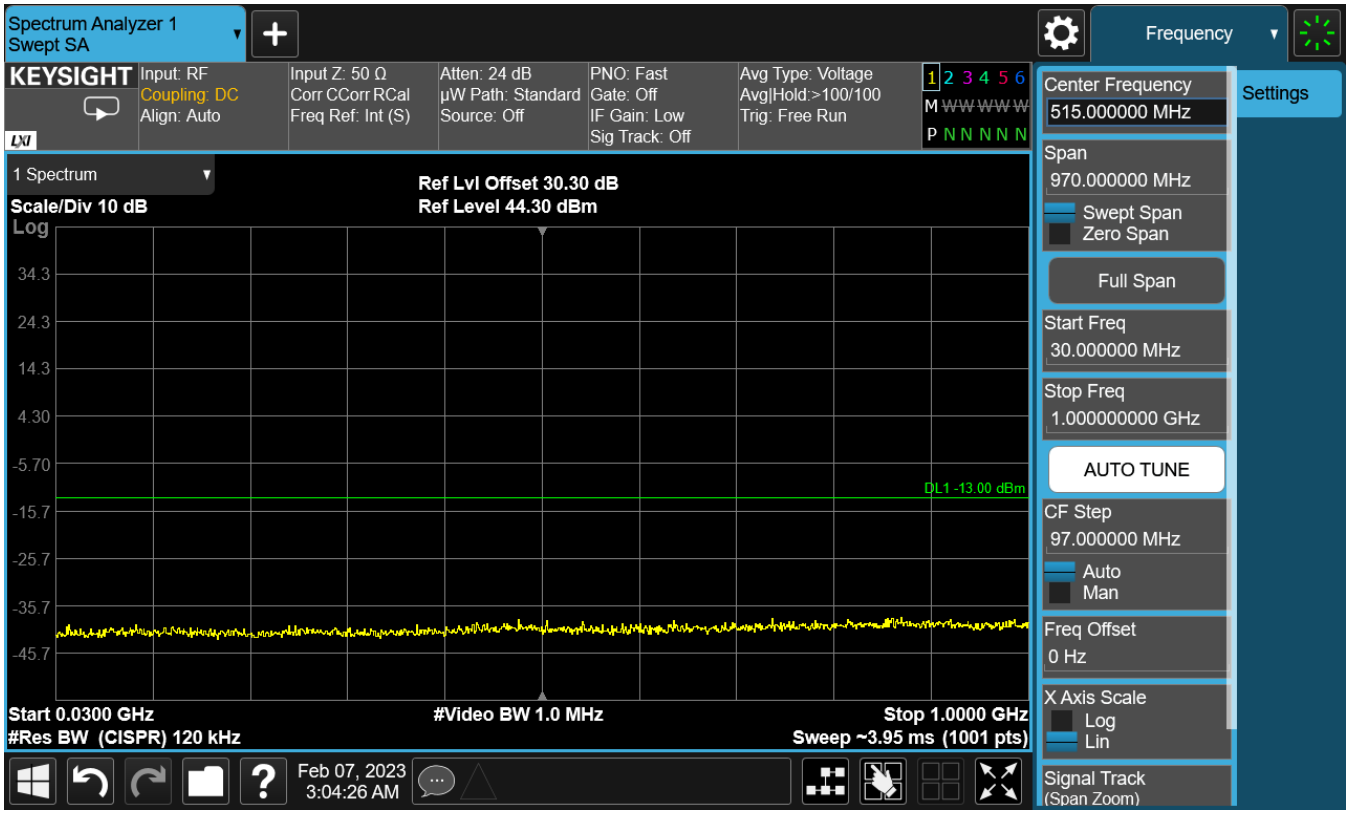

Figure 29: 30MHz to 1GHz, Spurious Emissions, C1, High Channel

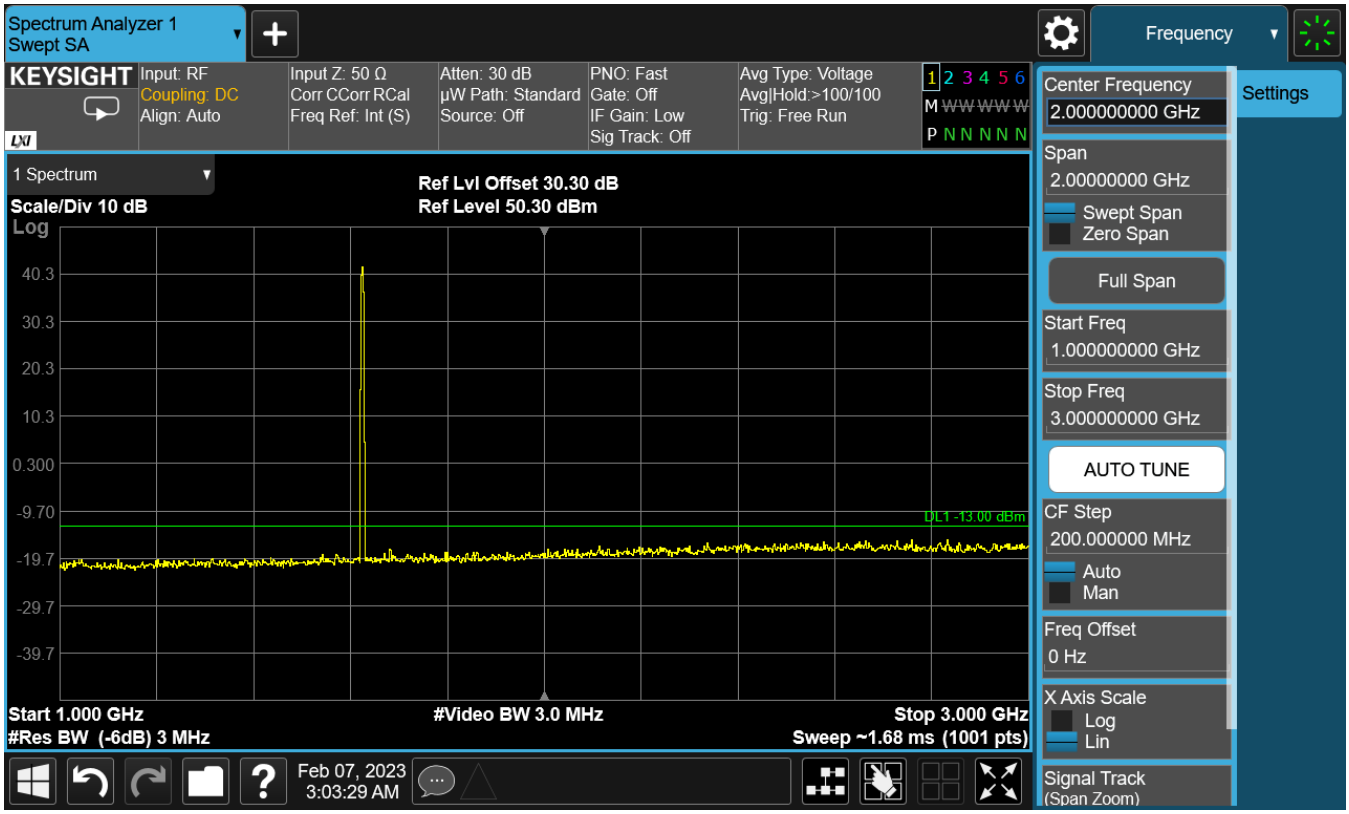

Figure 30: 1GHz to 3GHz, Spurious Emissions, C1, High Channel

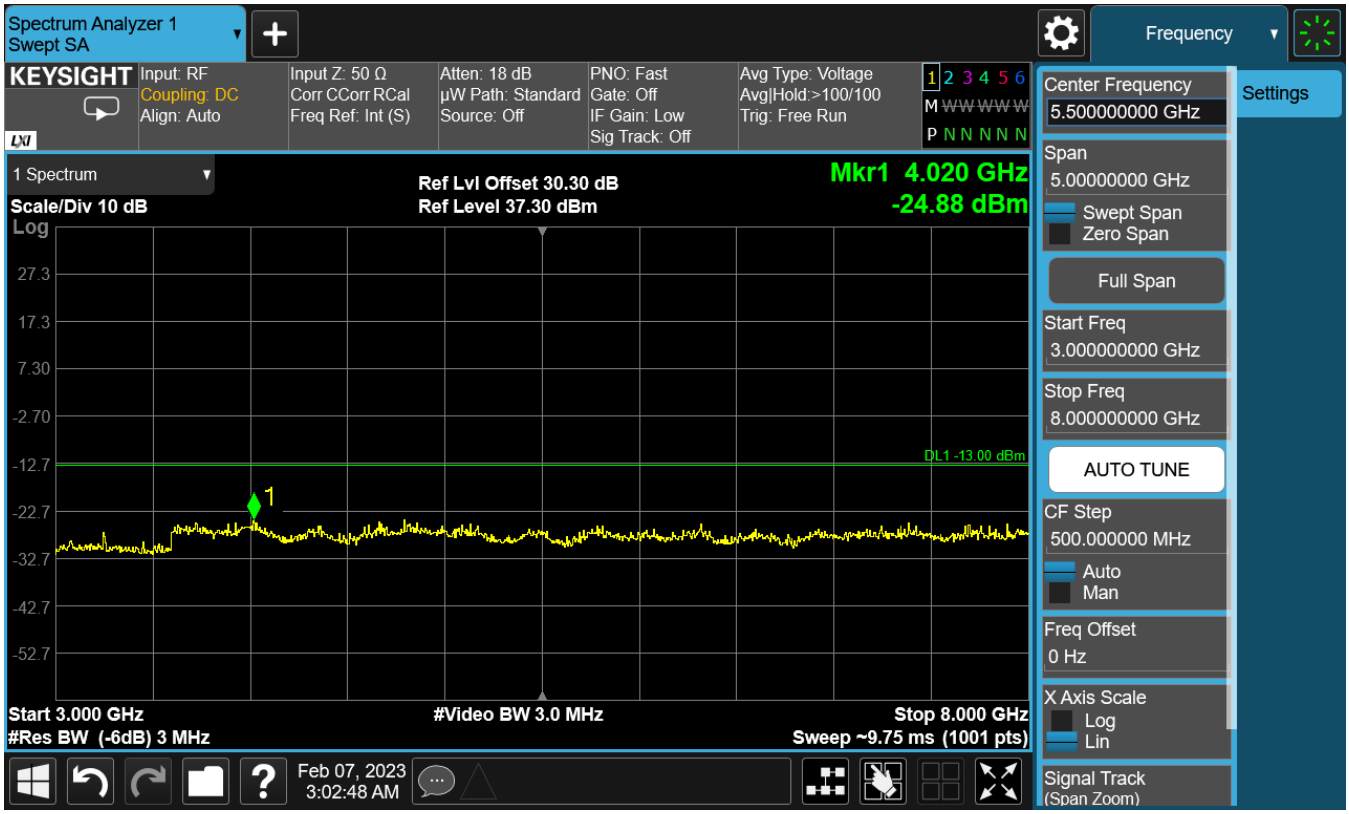

Figure 31: 3GHz to 8GHz, Spurious Emissions, C1, High Channel

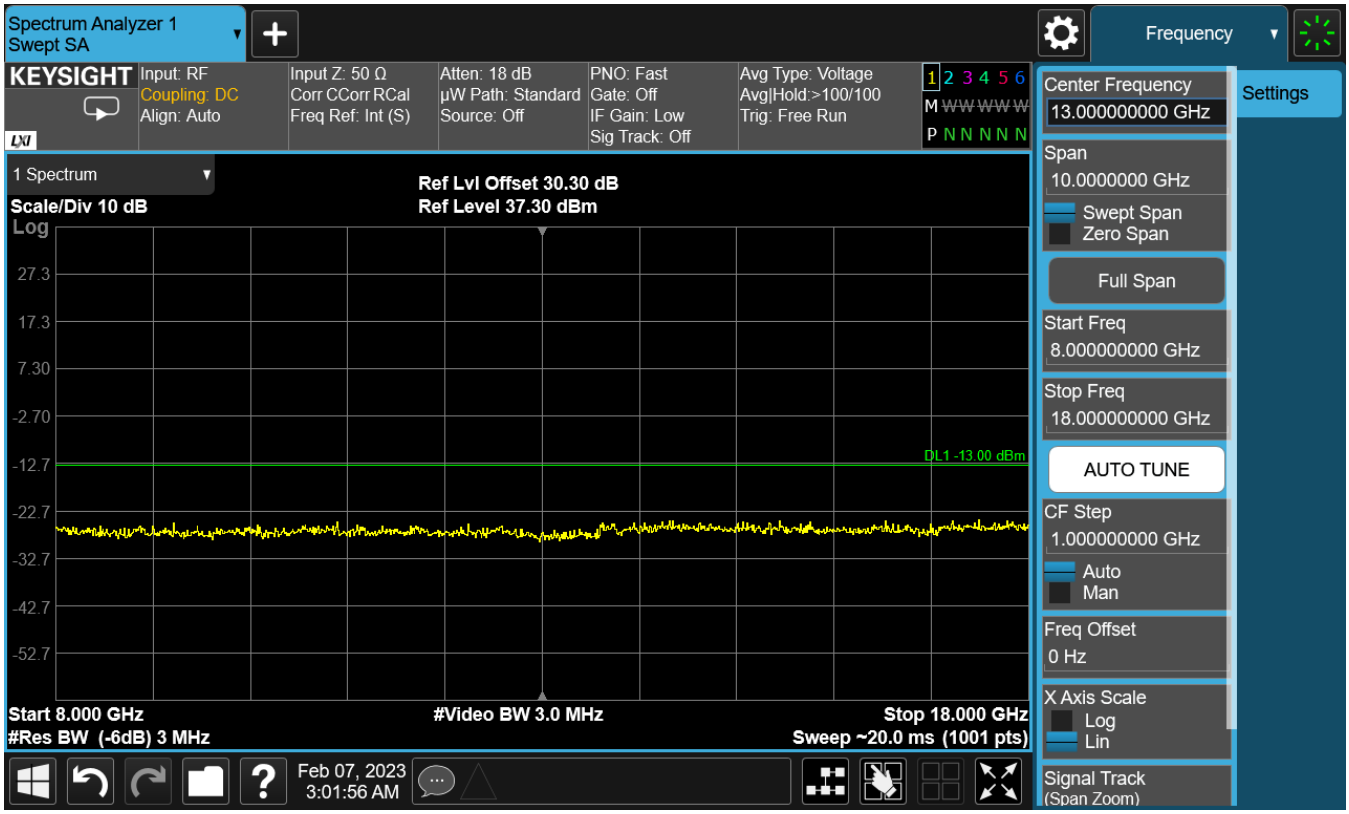

Figure 32: 8GHz to 18GHz, Spurious Emissions, C1, High Channel

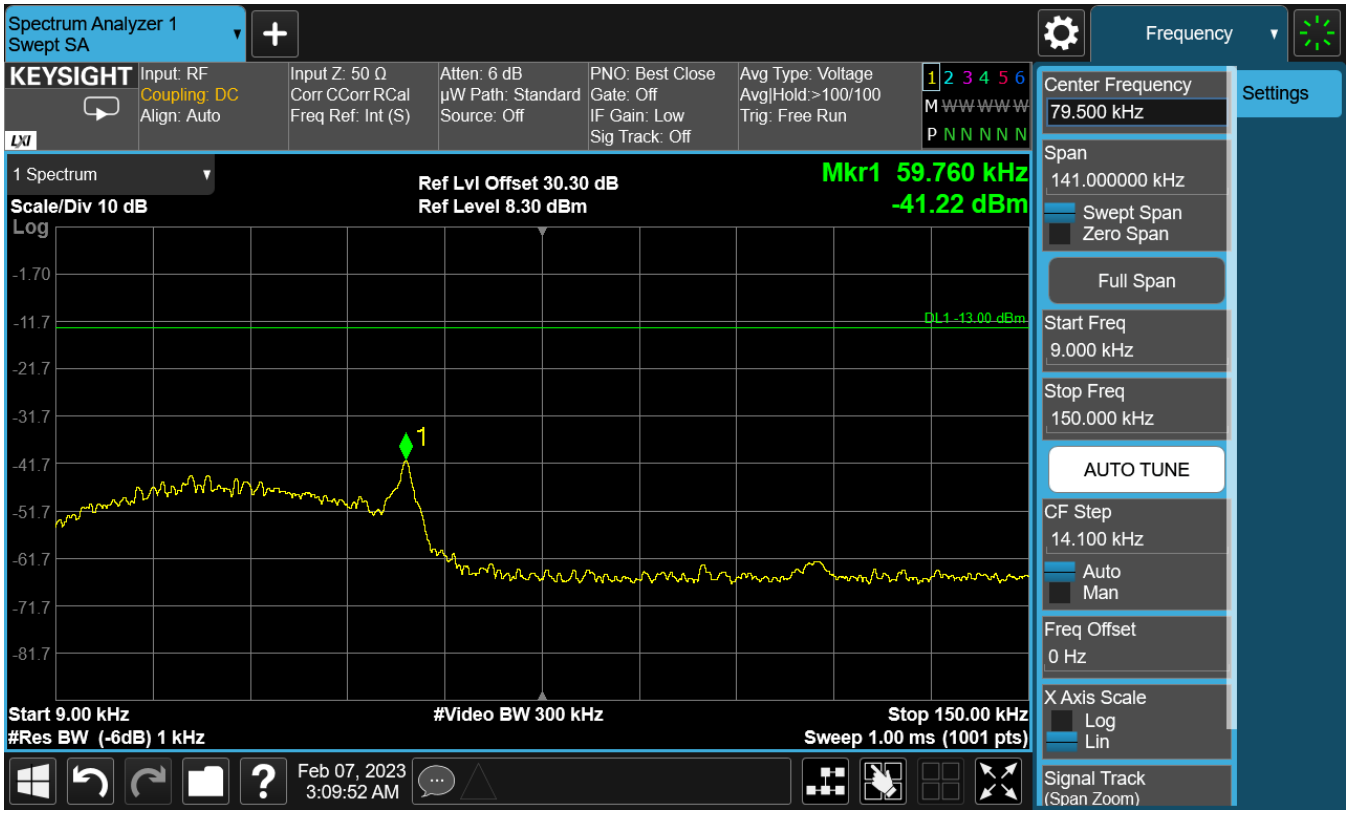

Figure 33: 9kHz to 150kHz, Spurious Emissions, C2, Low Channel

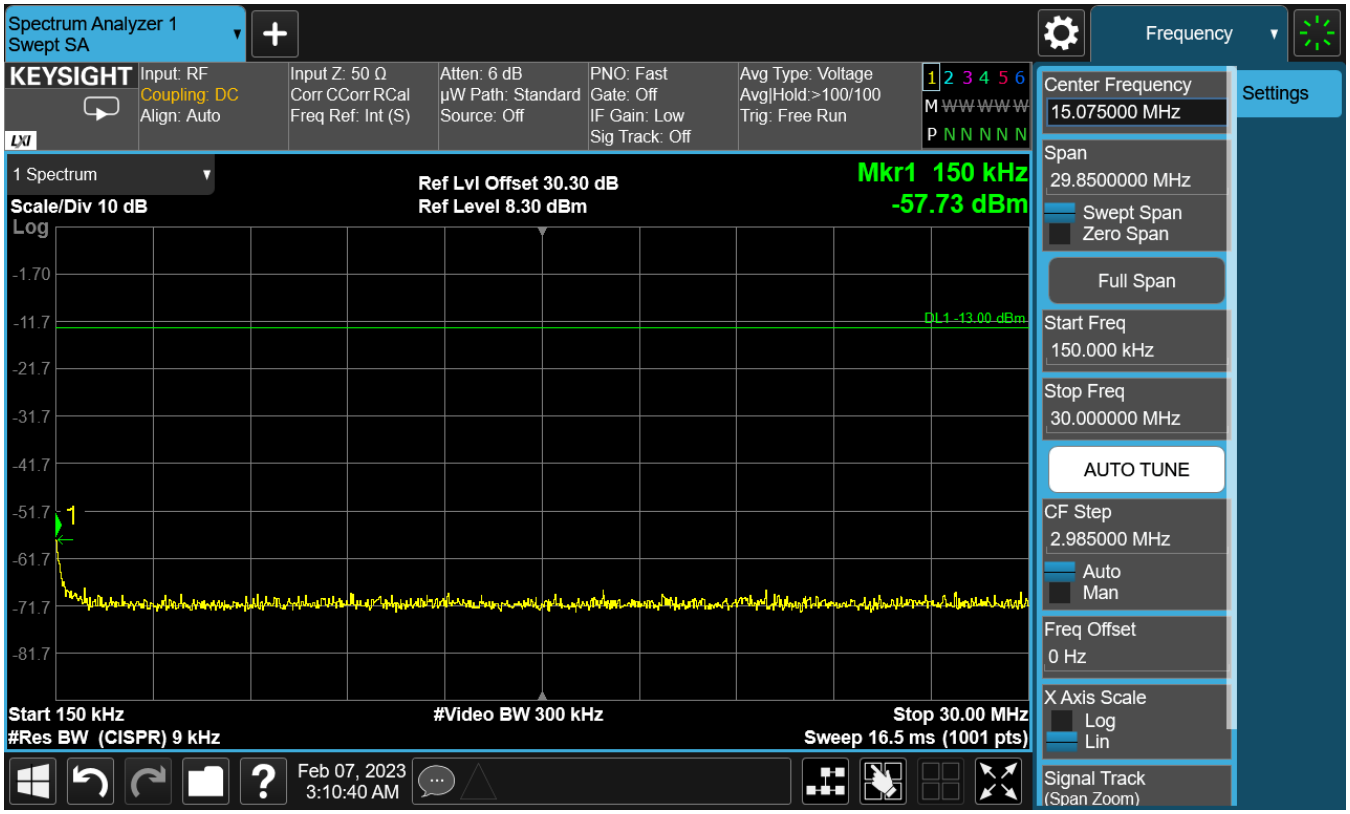

Figure 34: 150kHz to 30MHz, Spurious Emissions, C2, Low Channel

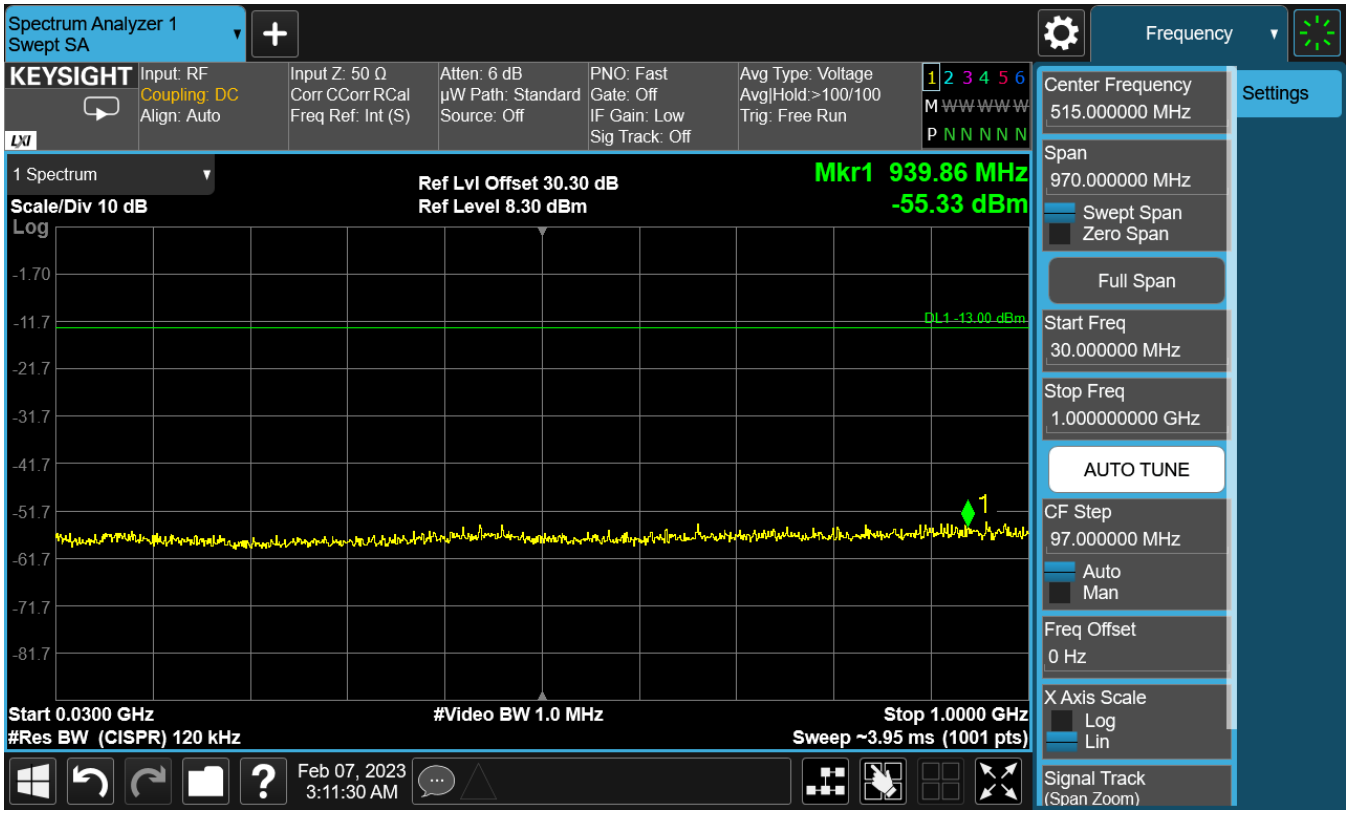

Figure 35: 30MHz to 1GHz, Spurious Emissions, C2, Low Channel

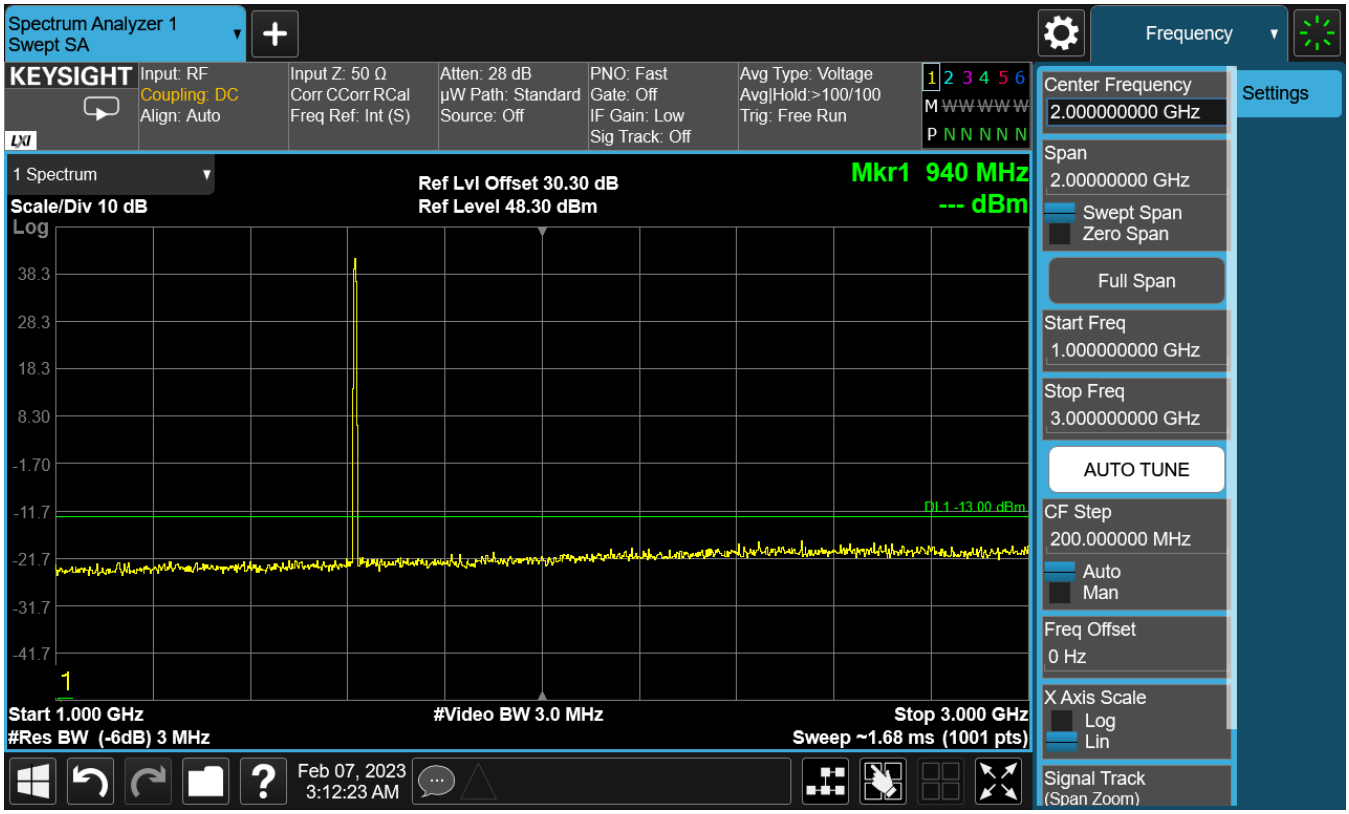

Figure 36: 1GHz to 3GHz, Spurious Emissions, C2, Low Channel

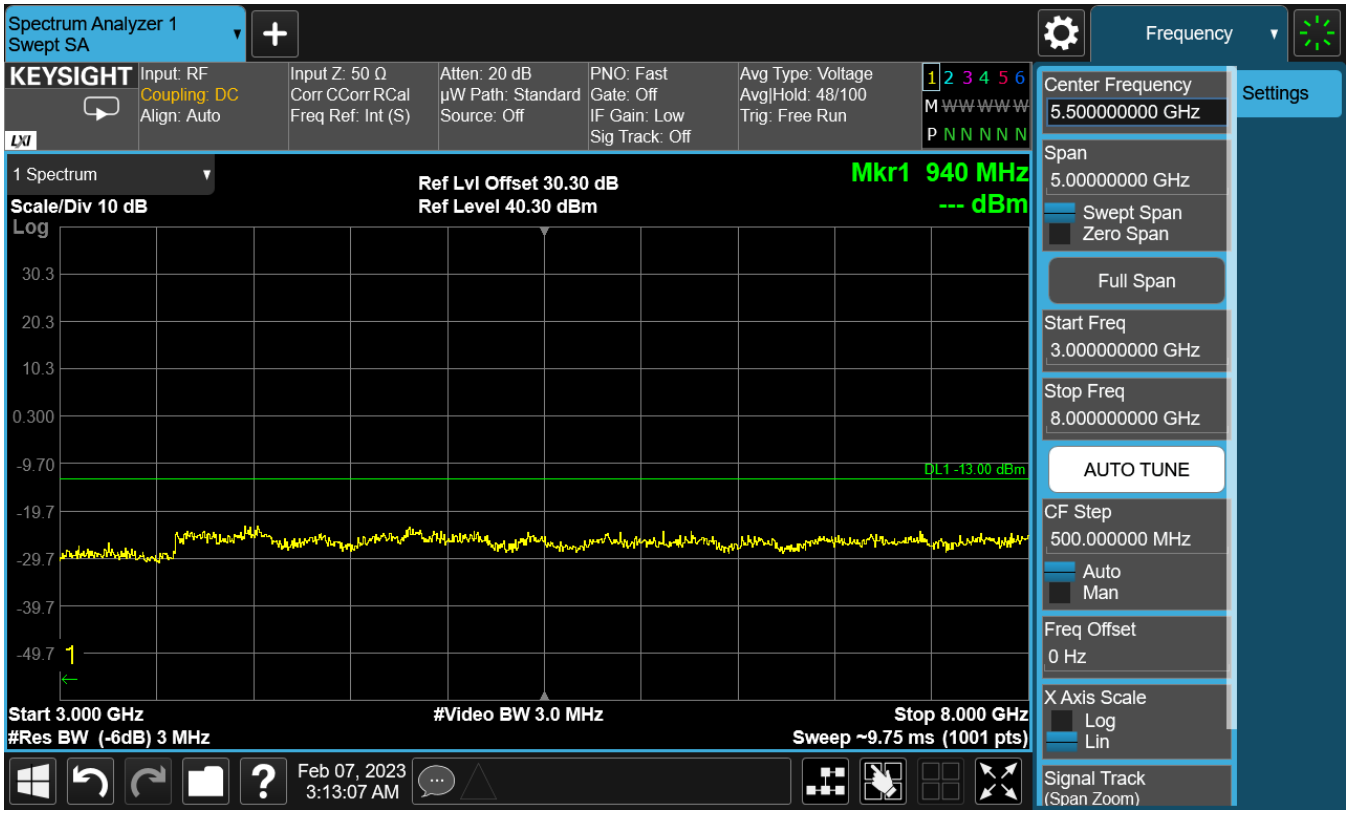

Figure 37: 3GHz to 8GHz, Spurious Emissions, C2, Low Channel

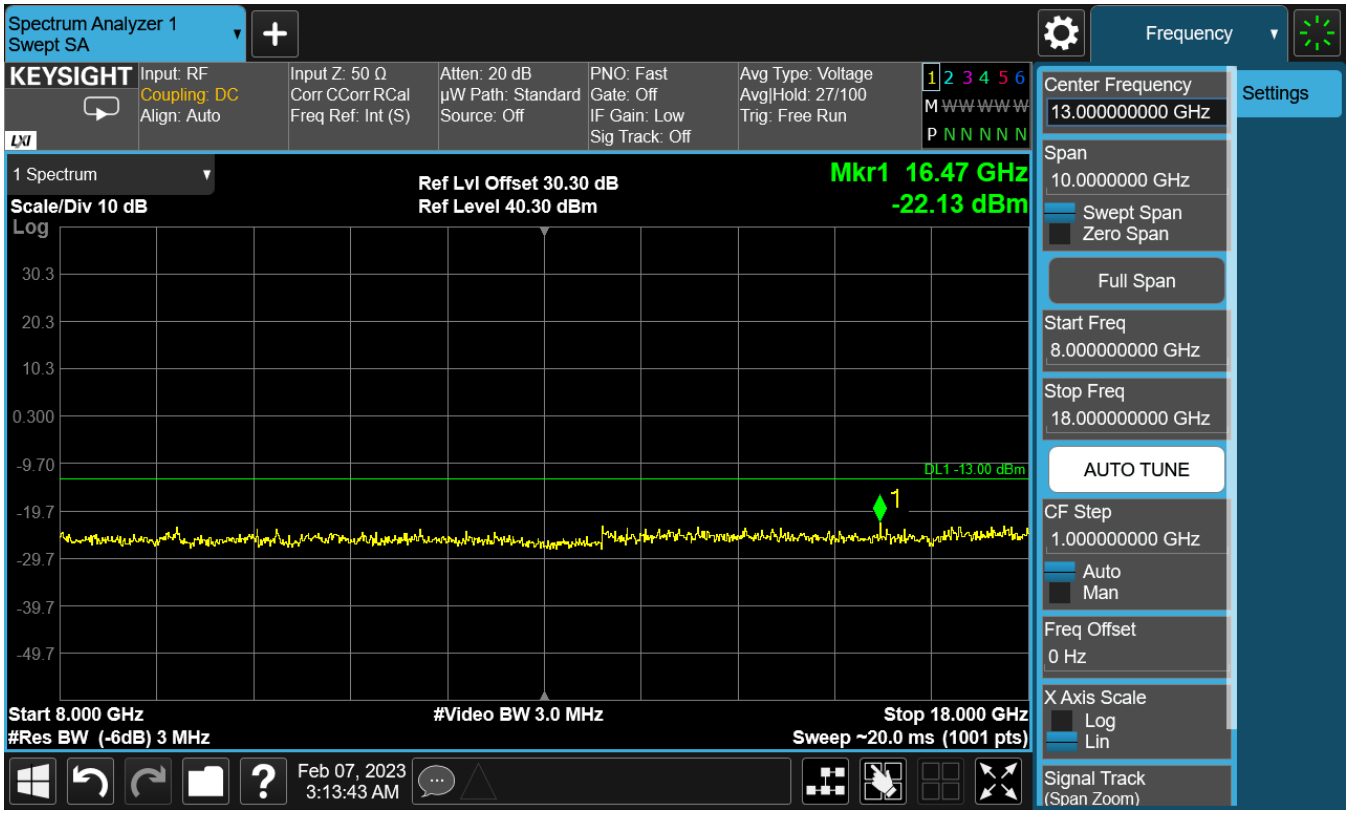

Figure 38: 8GHz to 18GHz, Spurious Emissions, C2, Low Channel

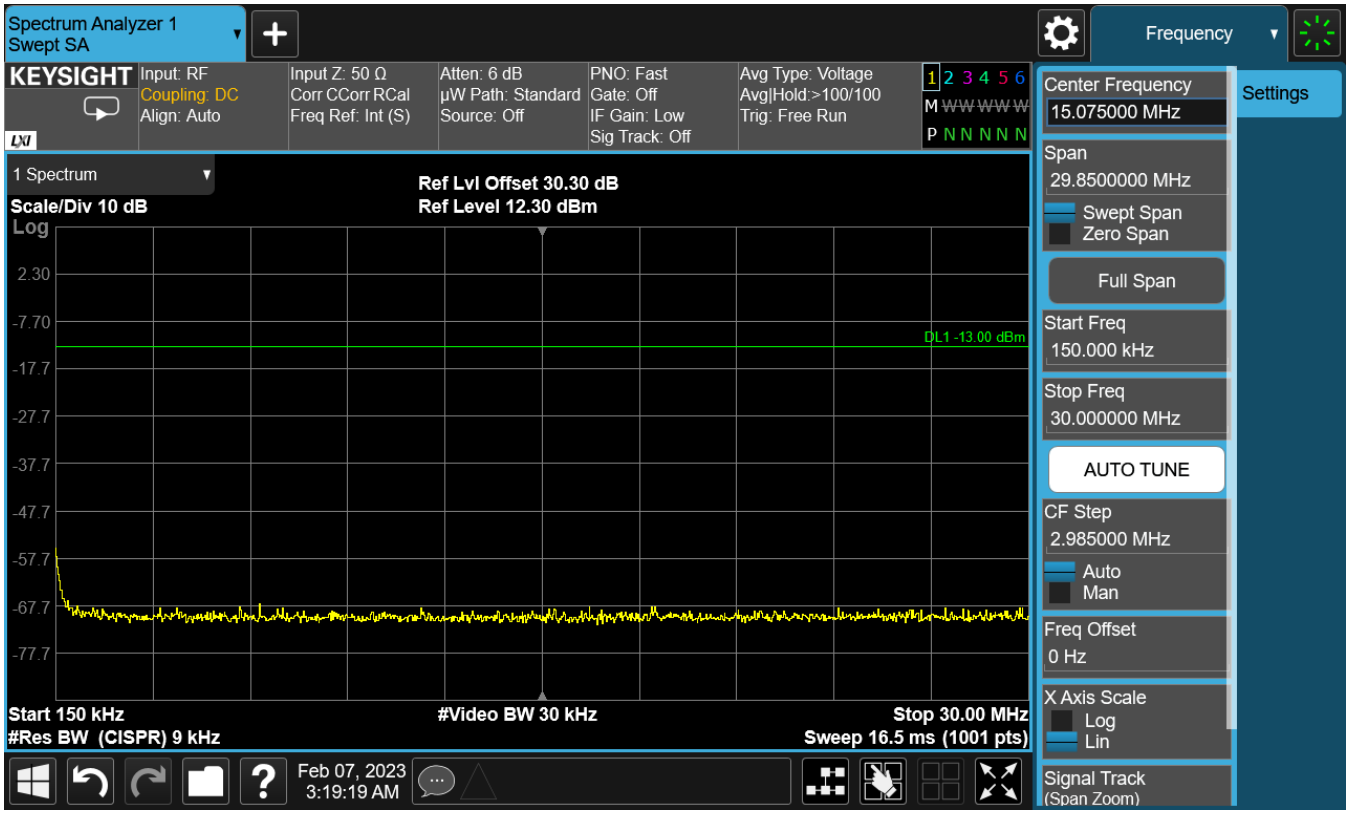

Figure 39: 9kHz to 150kHz, Spurious Emissions, C2, High Channel

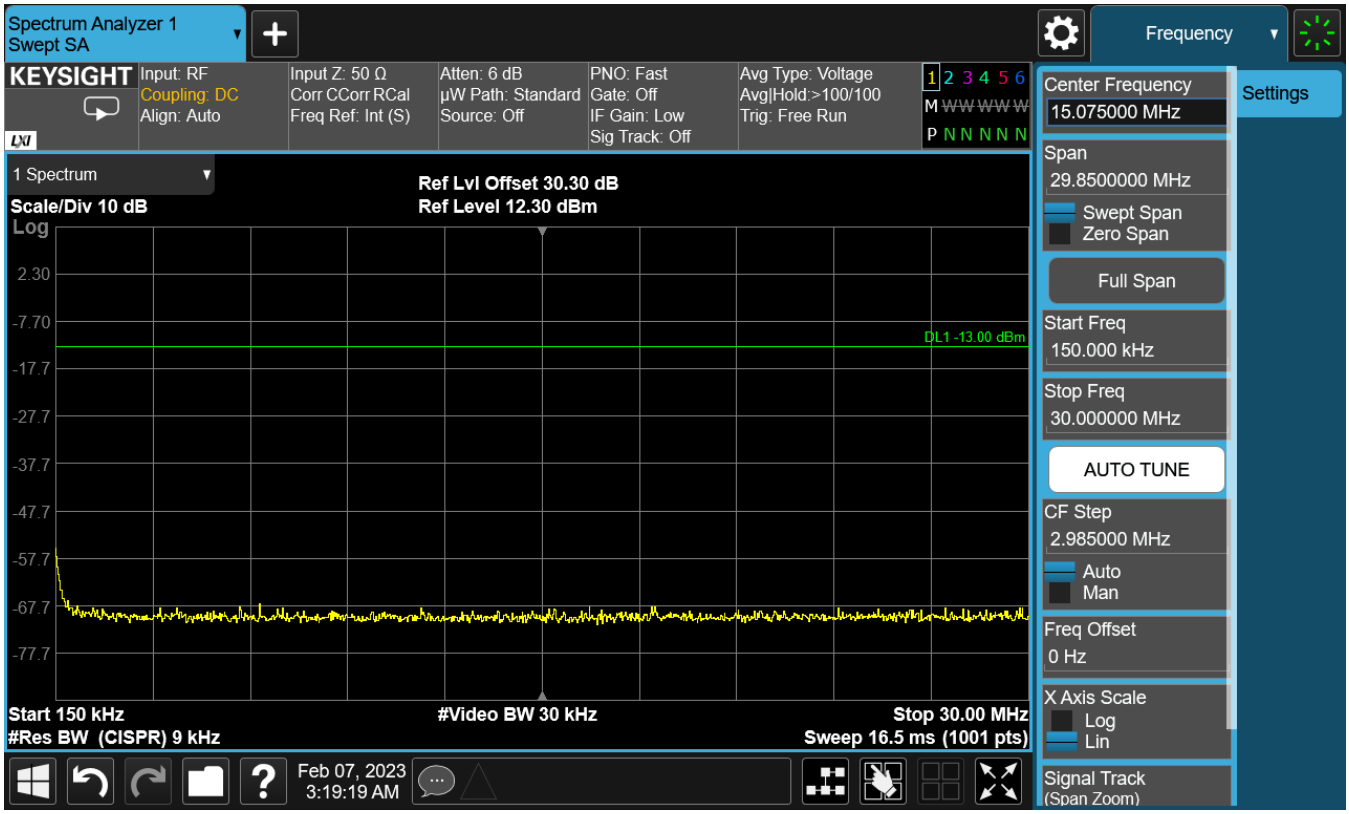

Figure 40: 150kHz to 30MHz, Spurious Emissions, C2, High Channel

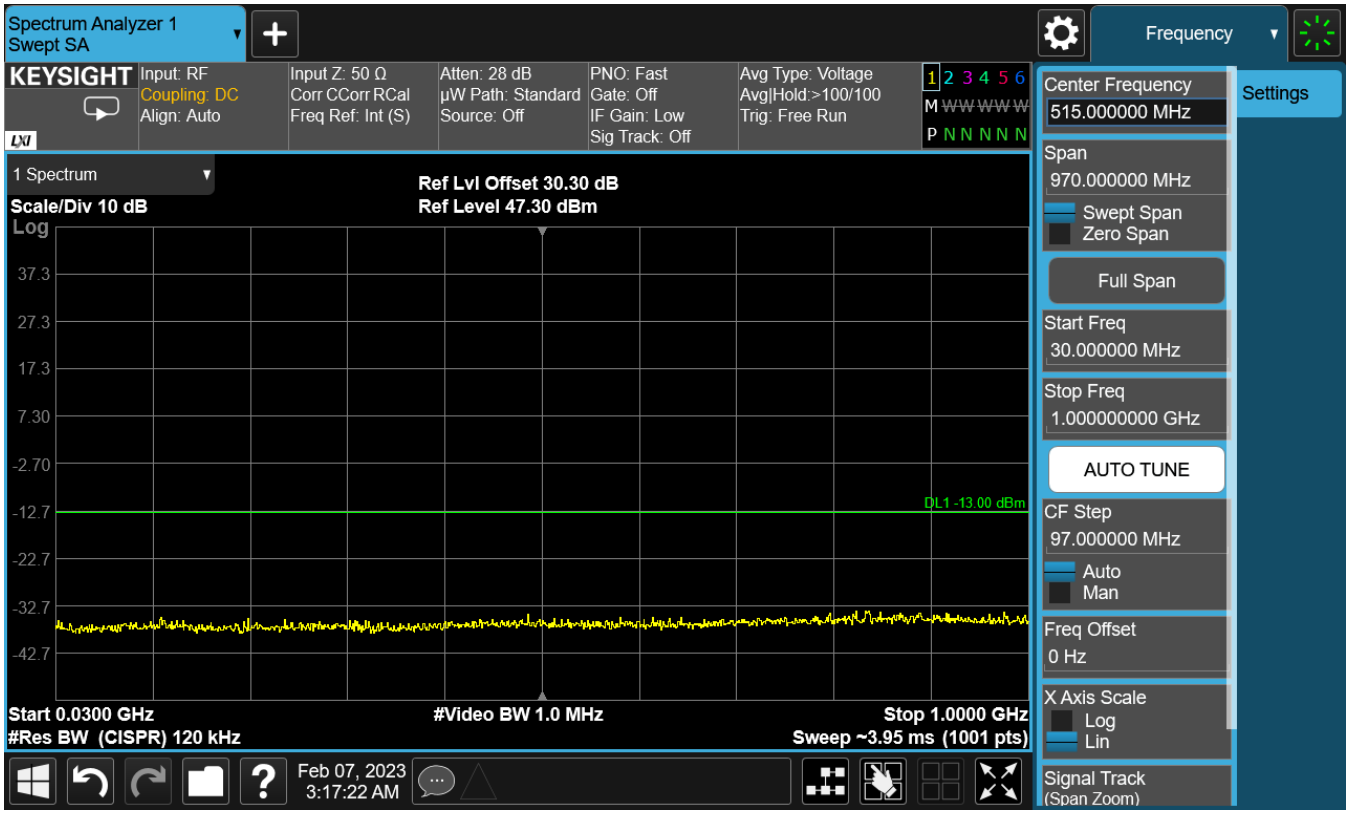

Figure 41: 30MHz to 1GHz, Spurious Emissions, C2, High Channel

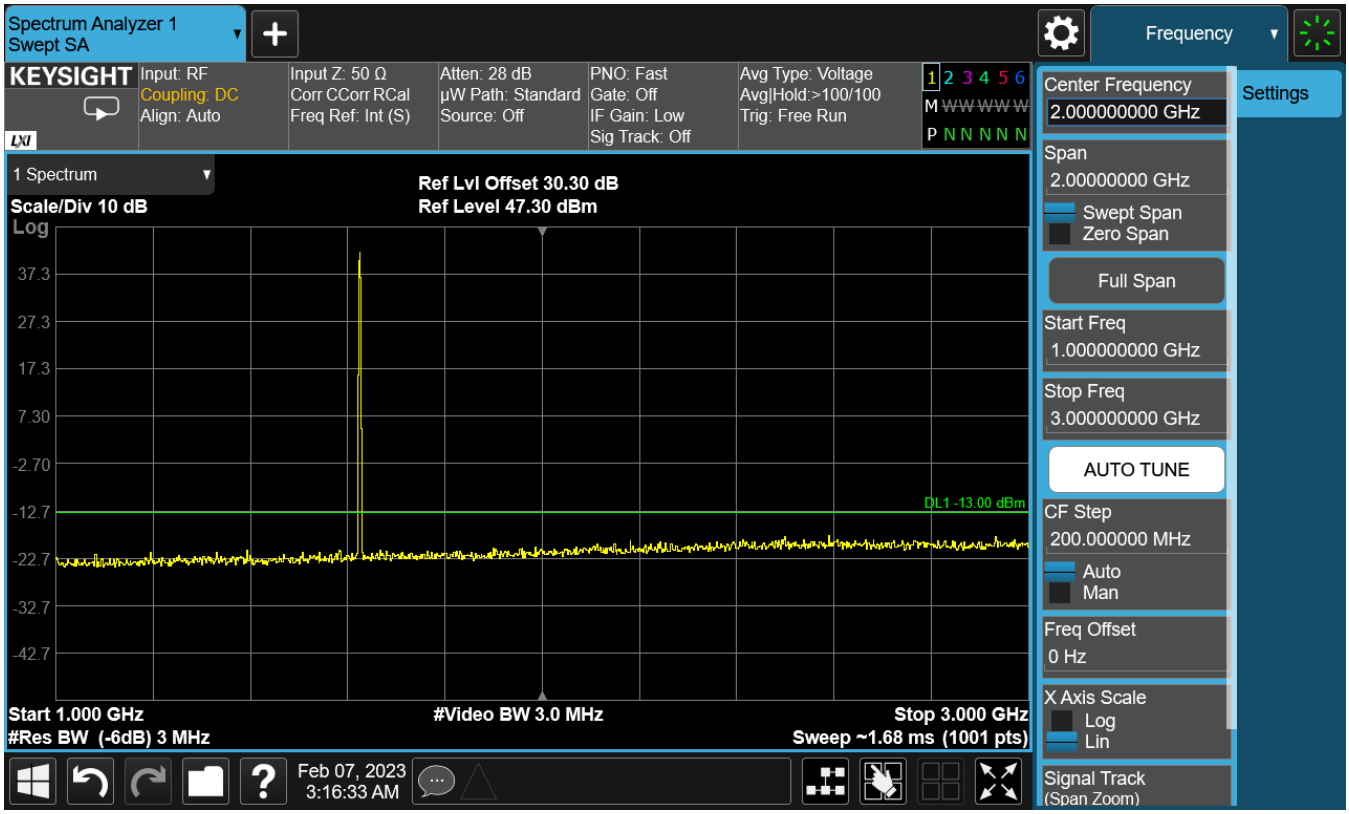

Figure 42: 1GHz to 3GHz, Spurious Emissions, C2, High Channel

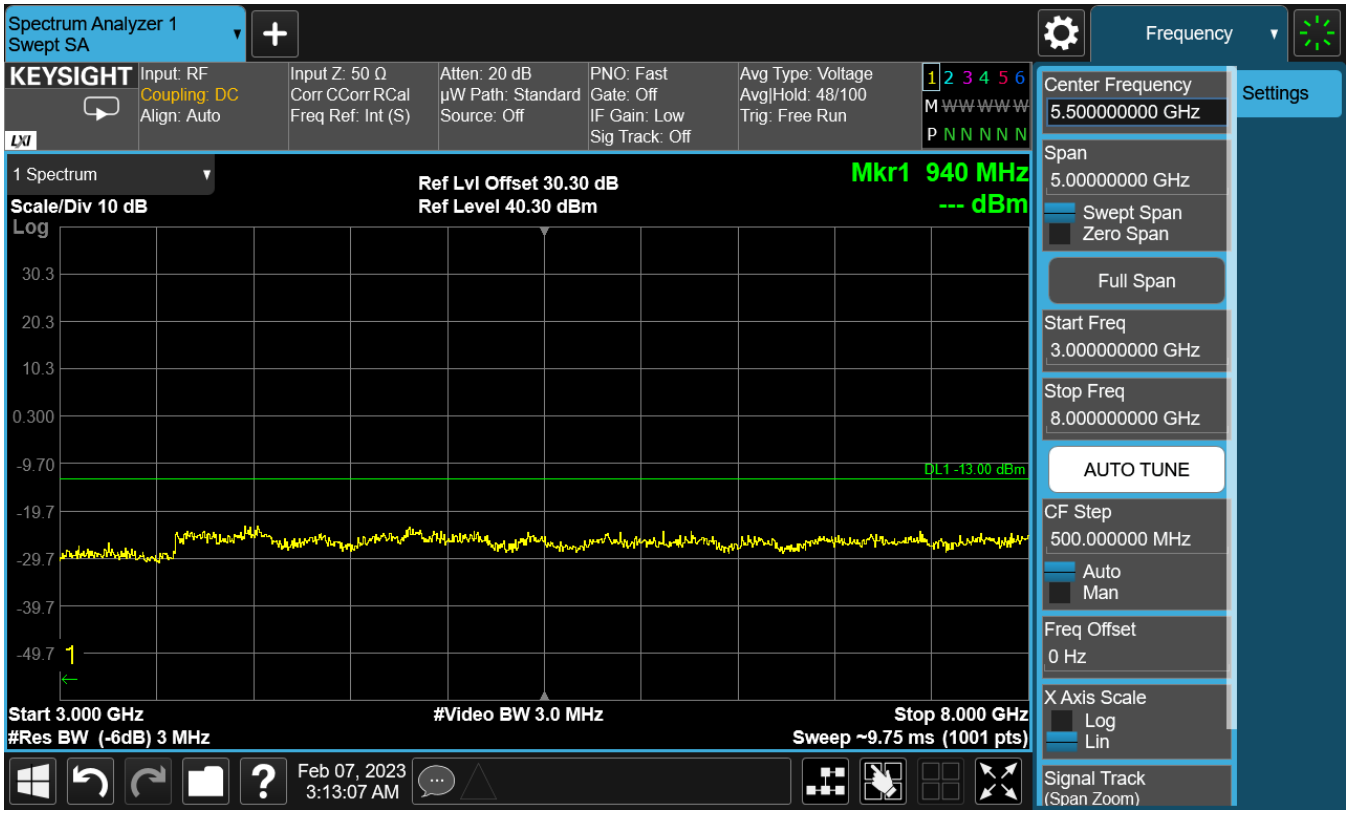

Figure 43: 3GHz to 8GHz, Spurious Emissions, C2, High Channel

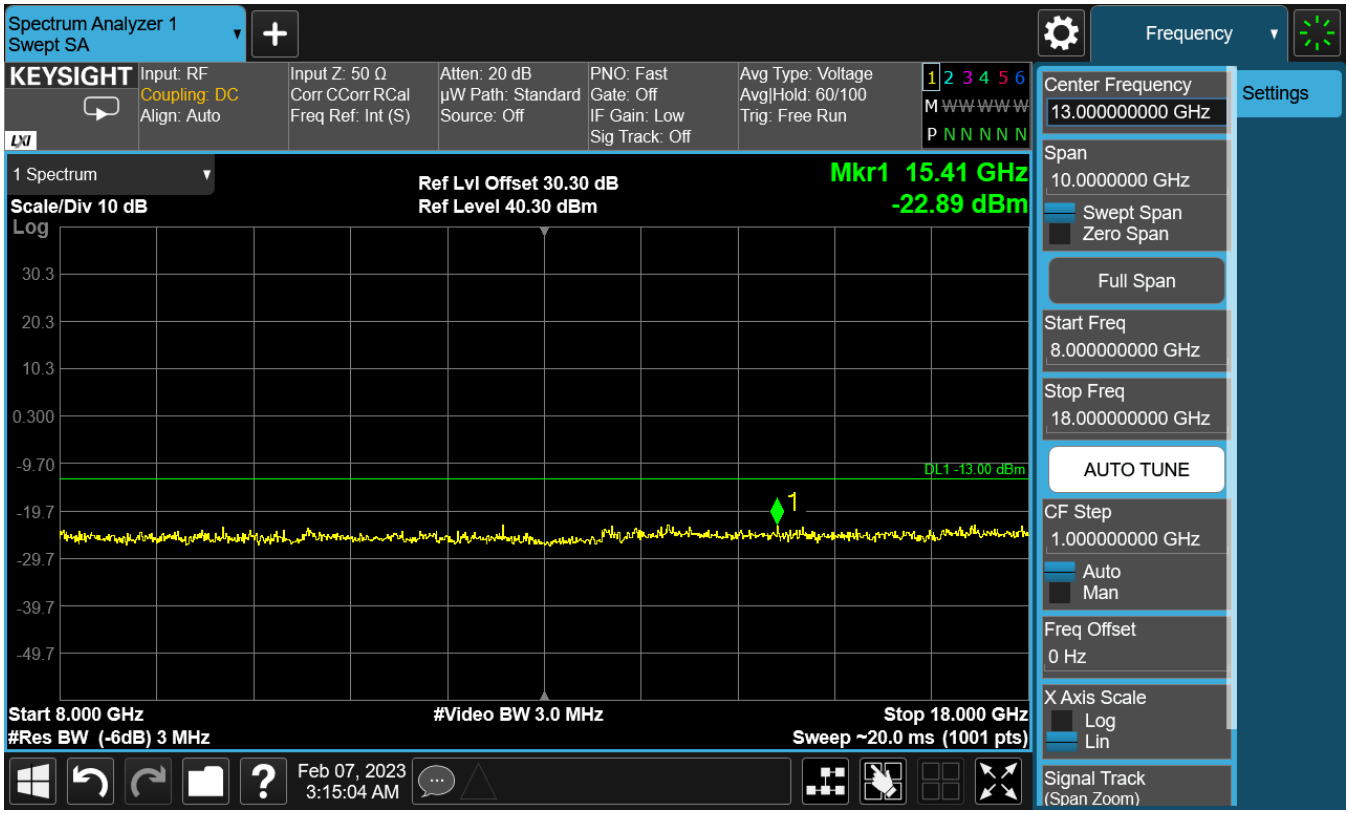

Figure 44: 8GHz to 18GHz, Spurious Emissions, C2, High Channel

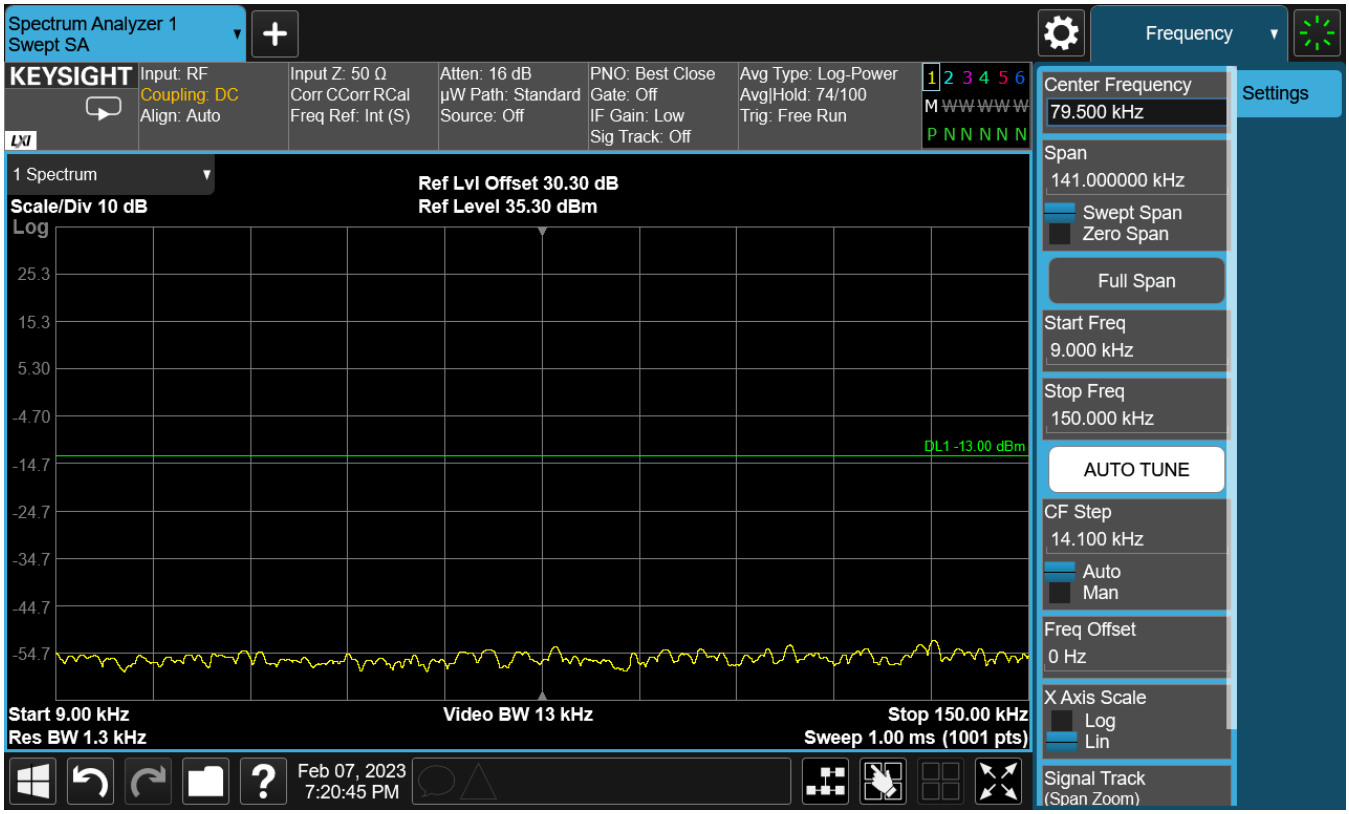

Figure 45: 9kHz to 150kHz, Spurious Emissions, C8, Low Channel

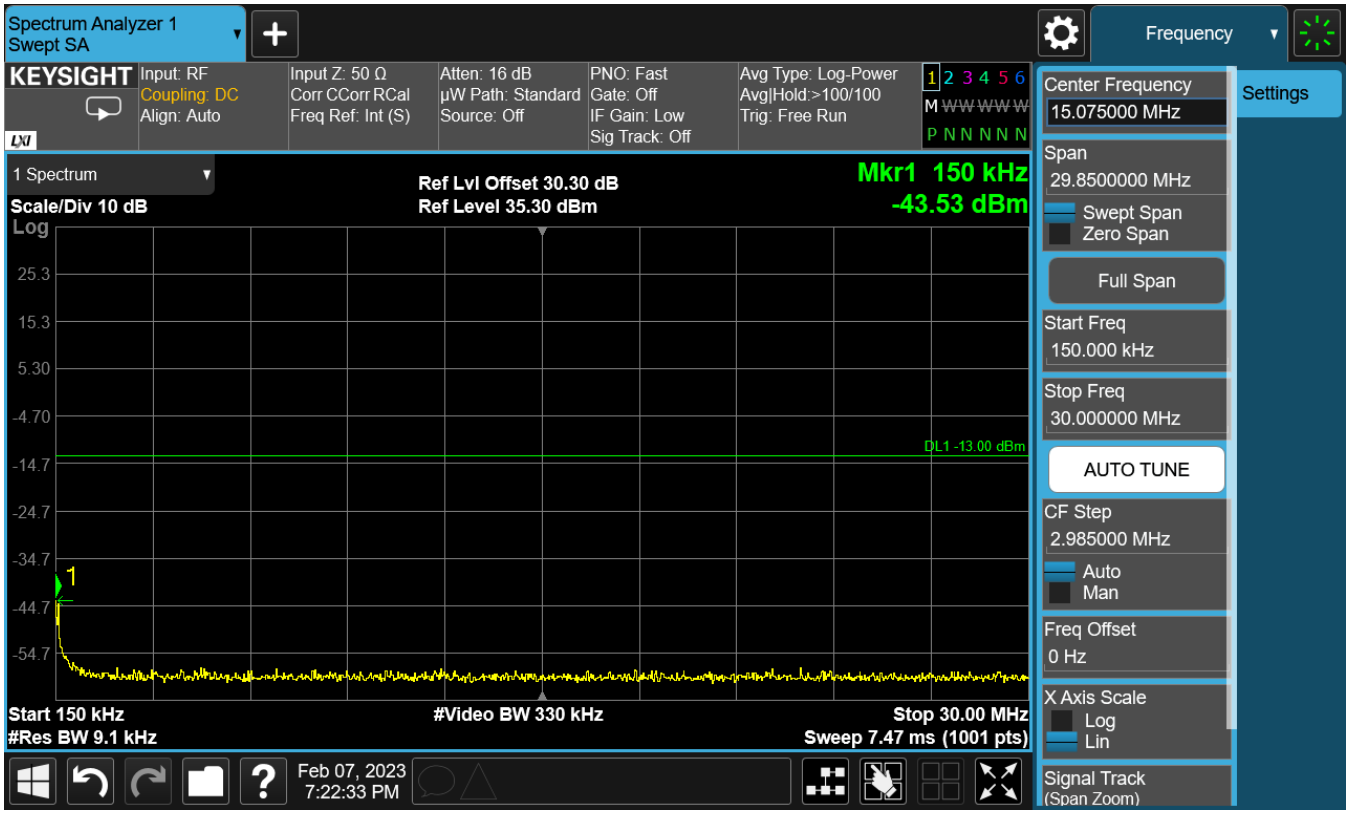

Figure 46: 150kHz to 30MHz, Spurious Emissions, C8, Low Channel

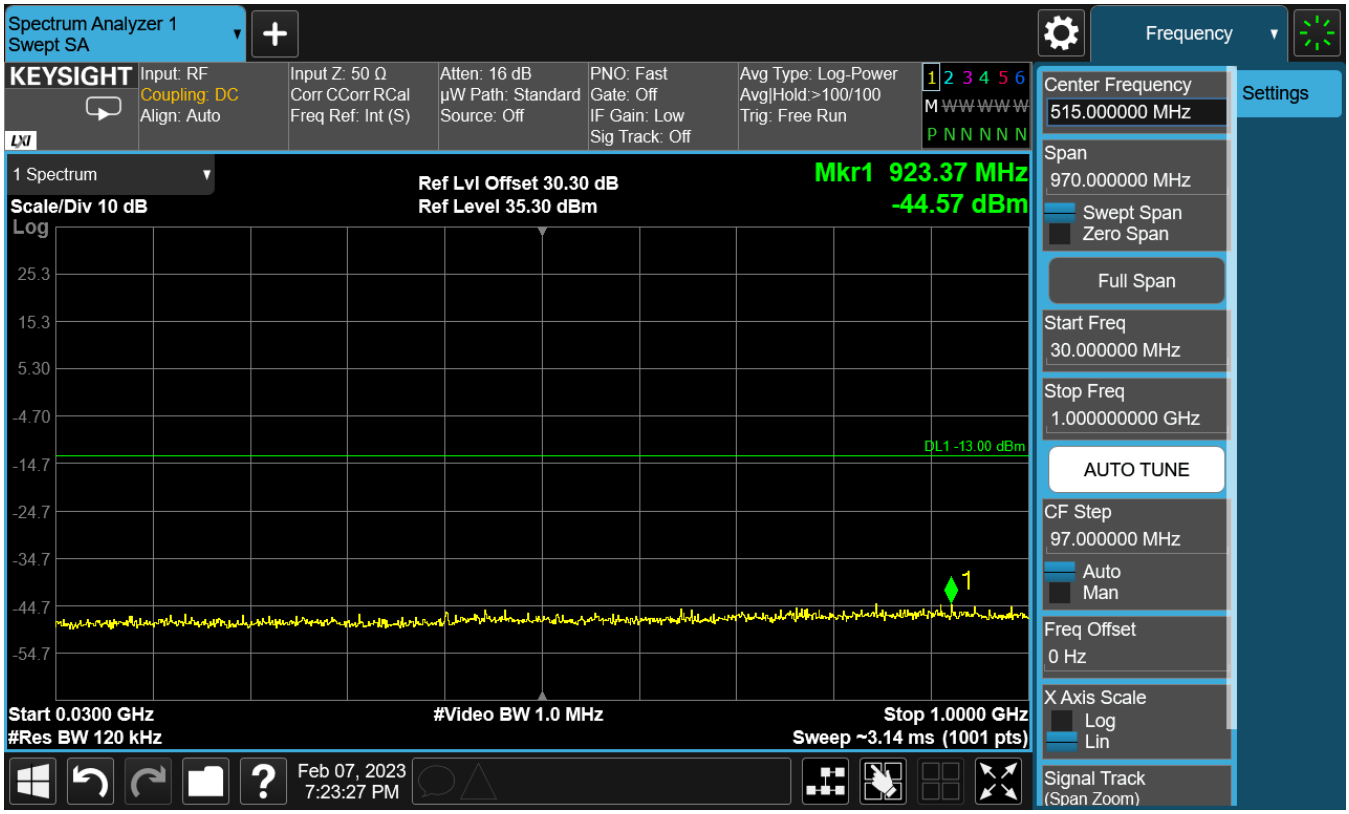

Figure 47: 30MHz to 1GHz, Spurious Emissions, C8, Low Channel

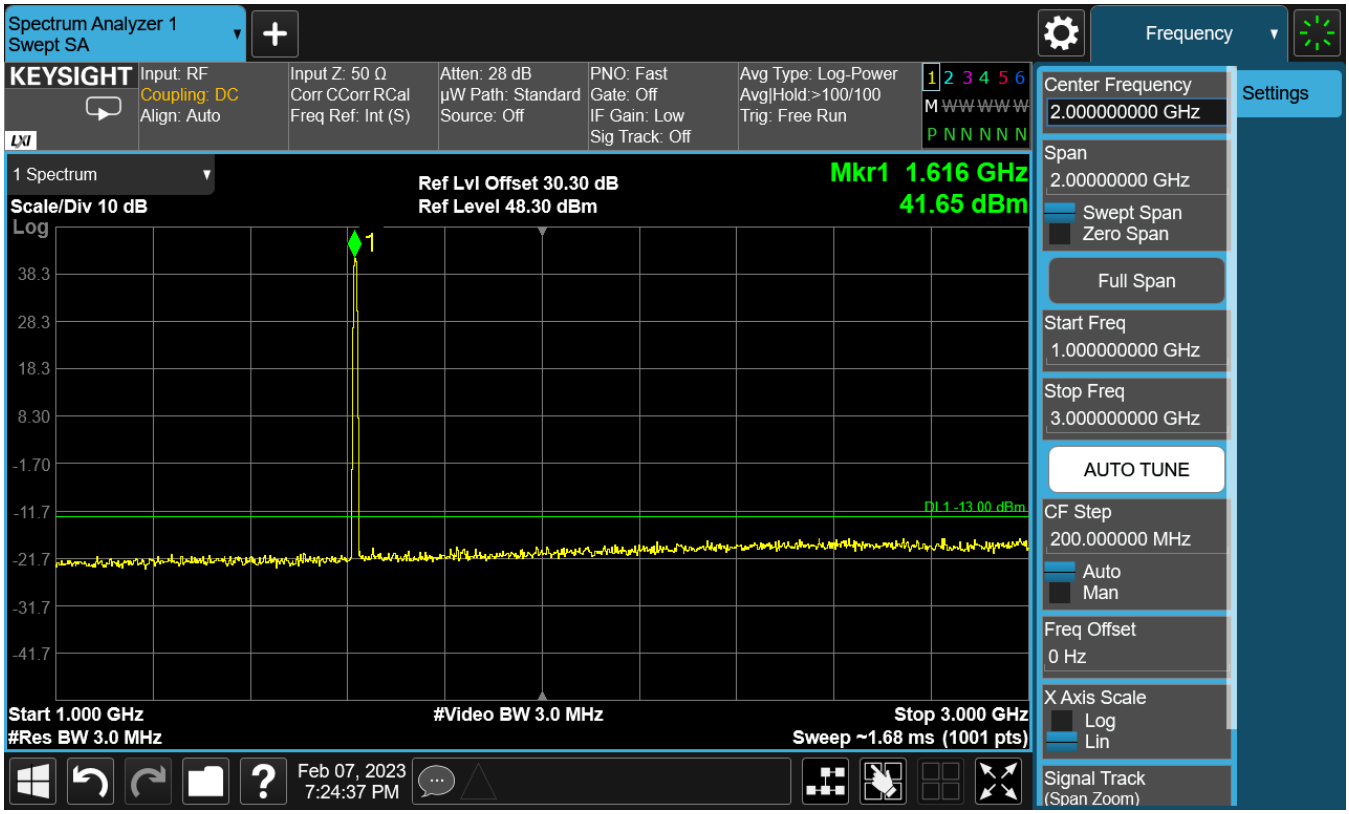

Figure 48: 1GHz to 3GHz, Spurious Emissions, C8, Low Channel

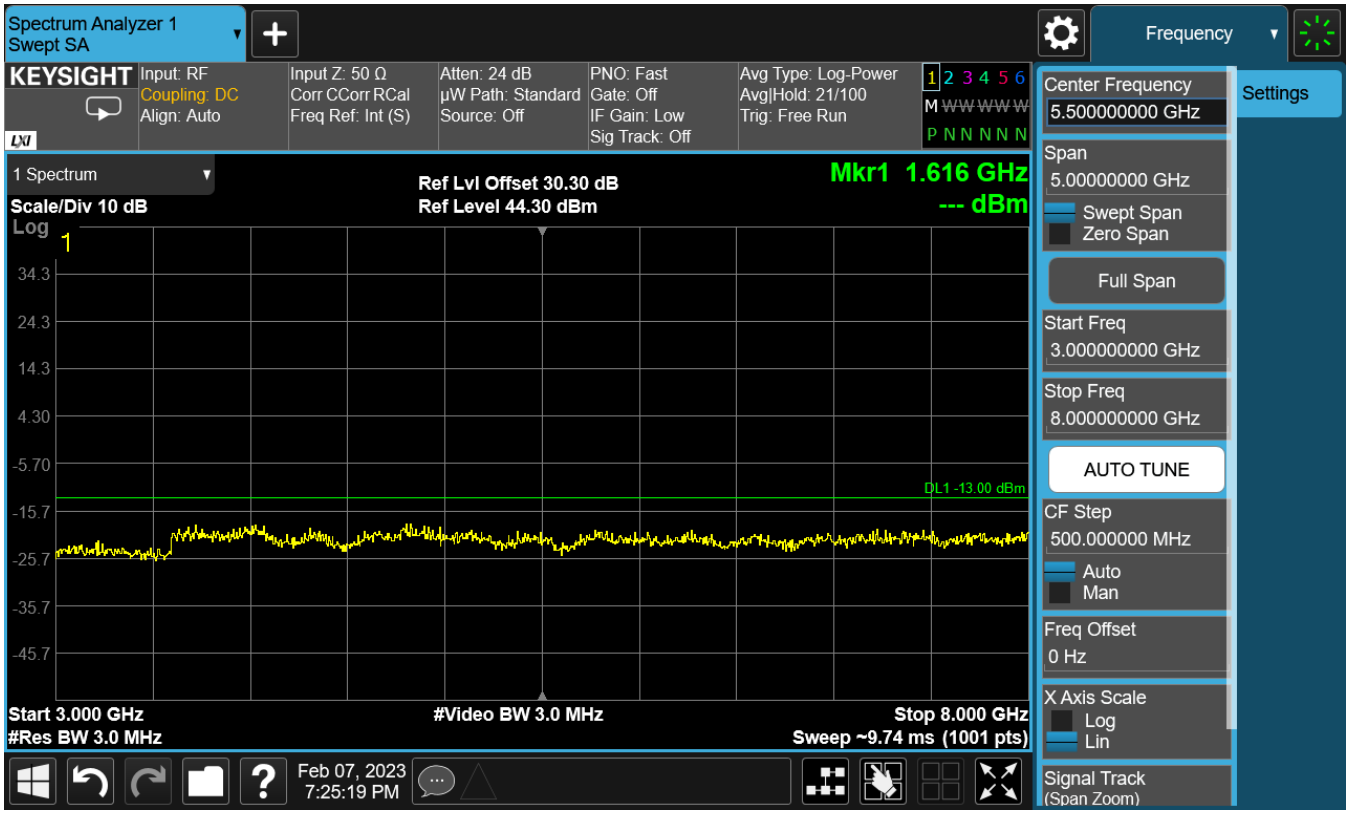

Figure 49: 3GHz to 8GHz, Spurious Emissions, C8, Low Channel

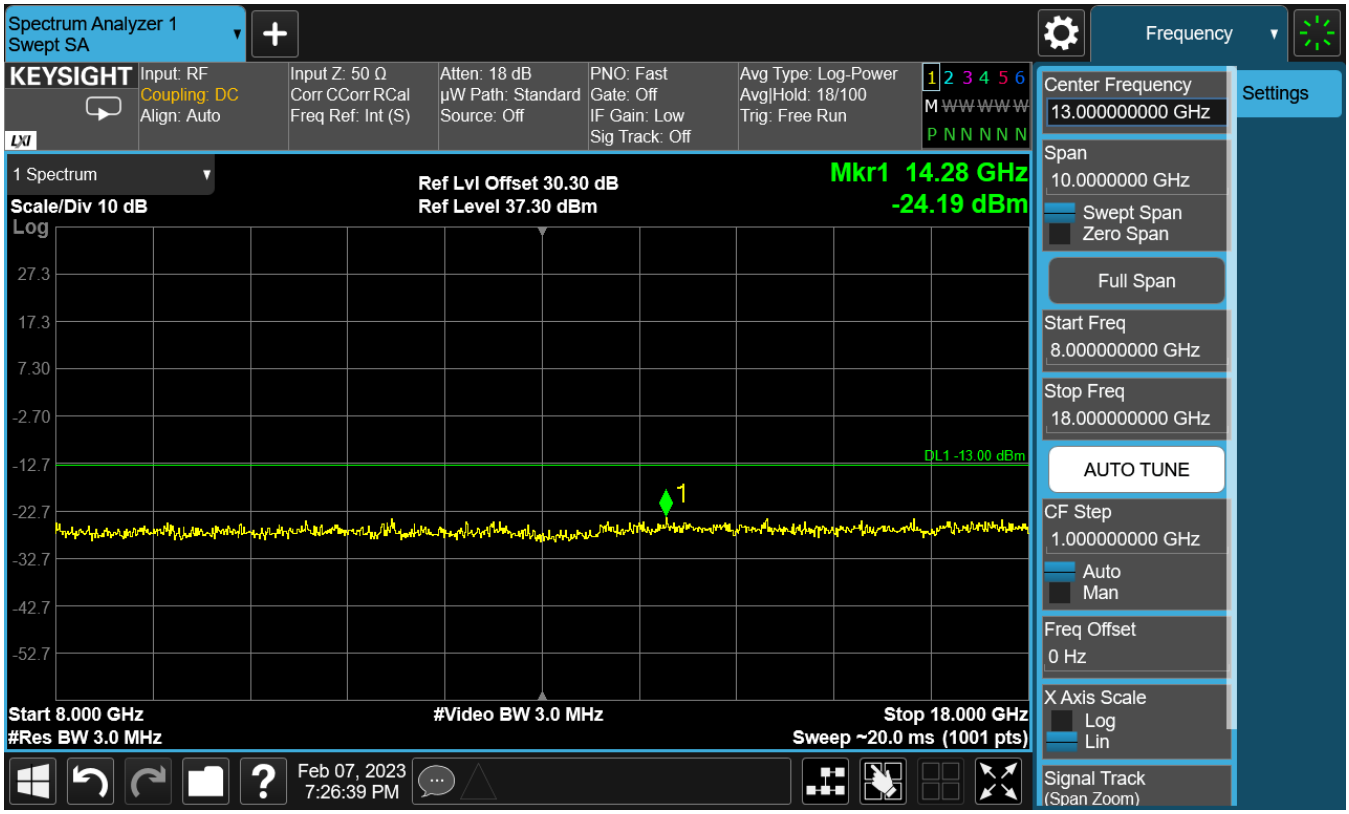

Figure 50: 8GHz to 18GHz, Spurious Emissions, C8, Low Channel

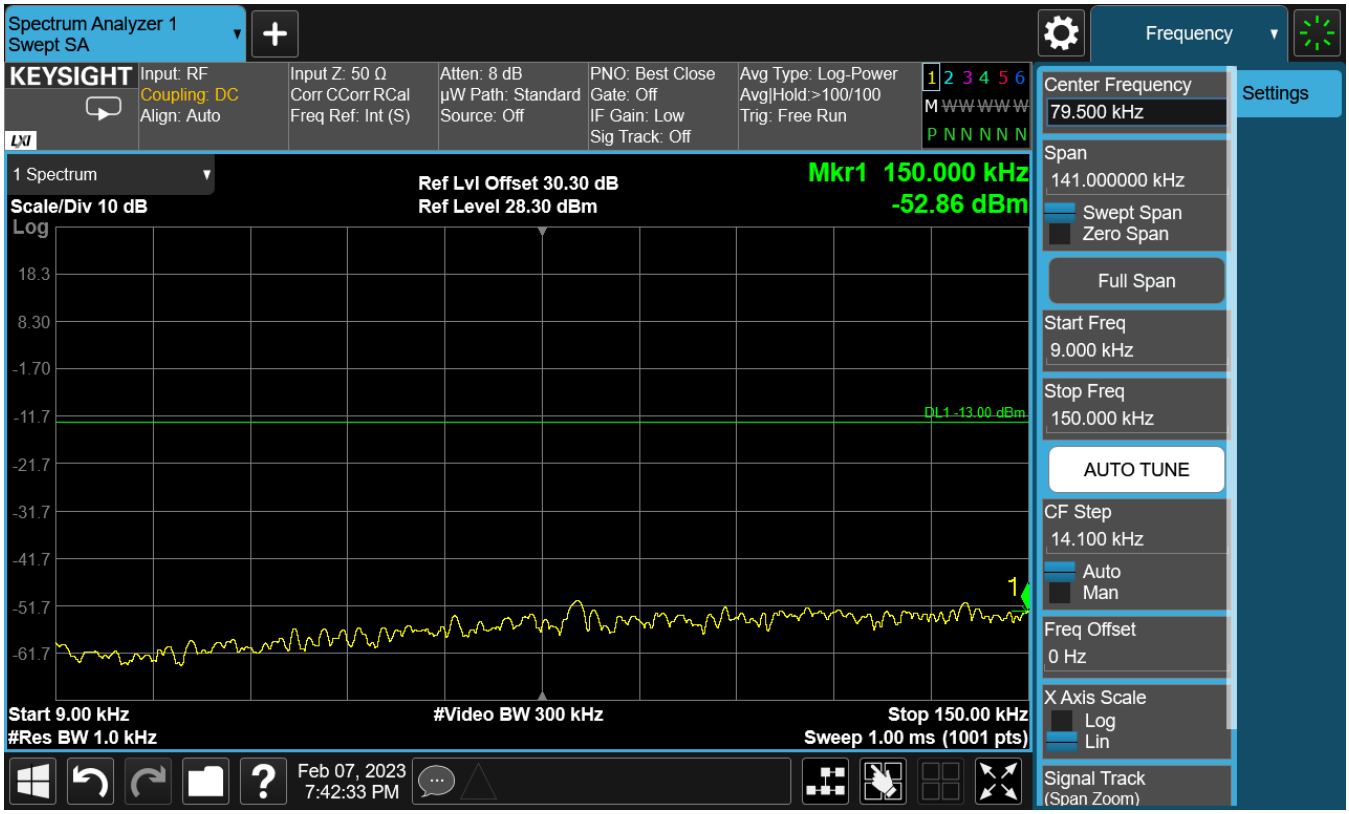

Figure 51: 9kHz to 150kHz, Spurious Emissions, C8, High Channel

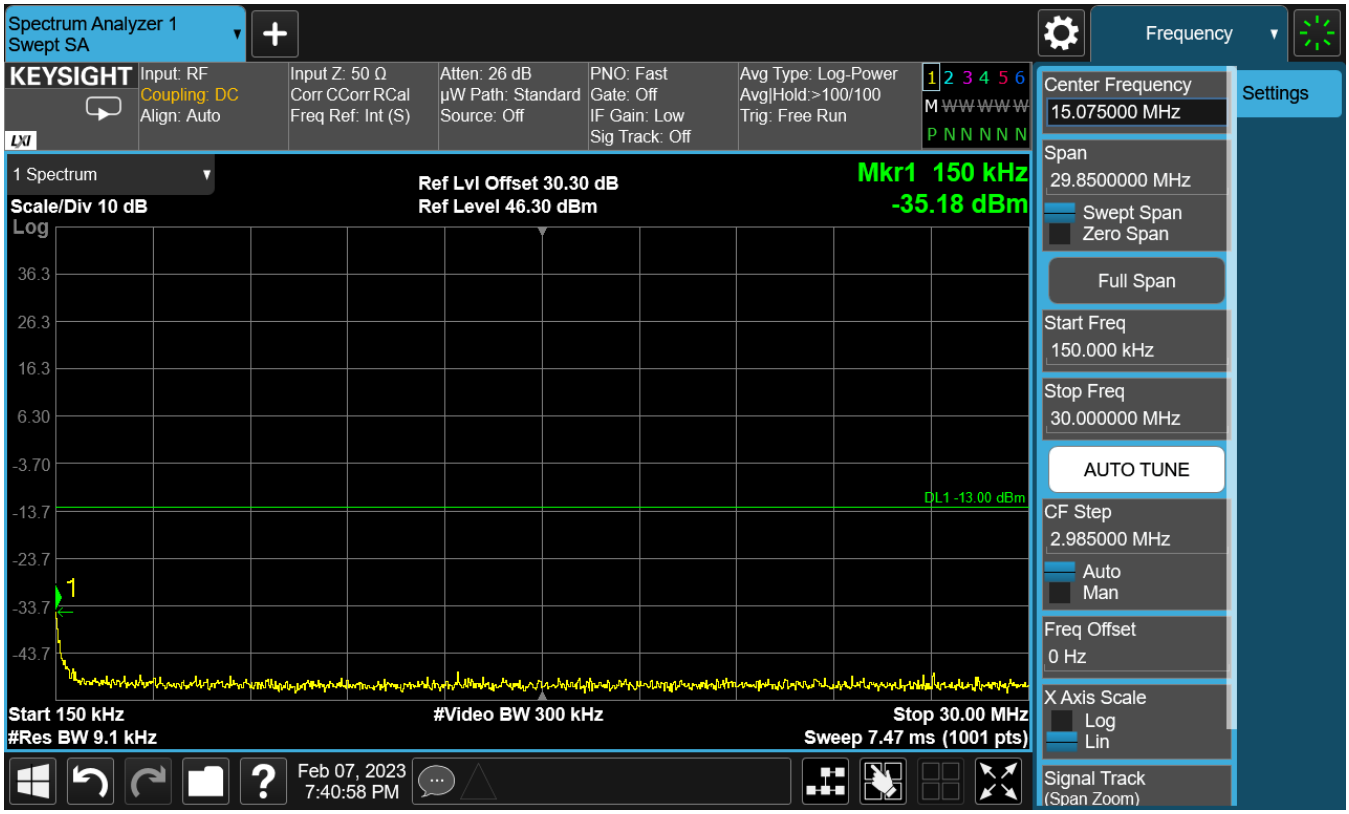

Figure 52: 150kHz to 30MHz, Spurious Emissions, C8, High Channel

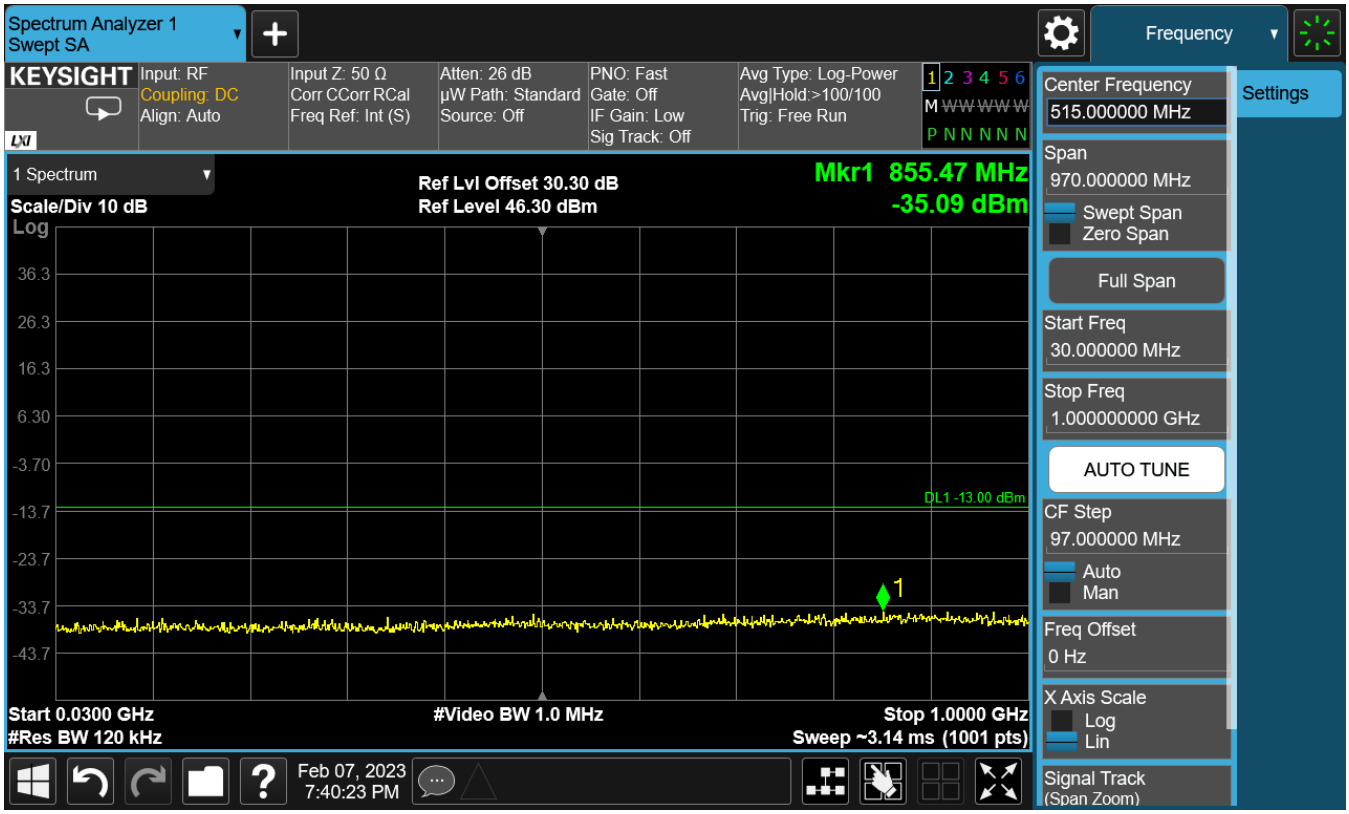

Figure 53: 30MHz to 1GHz, Spurious Emissions, C8, High Channel

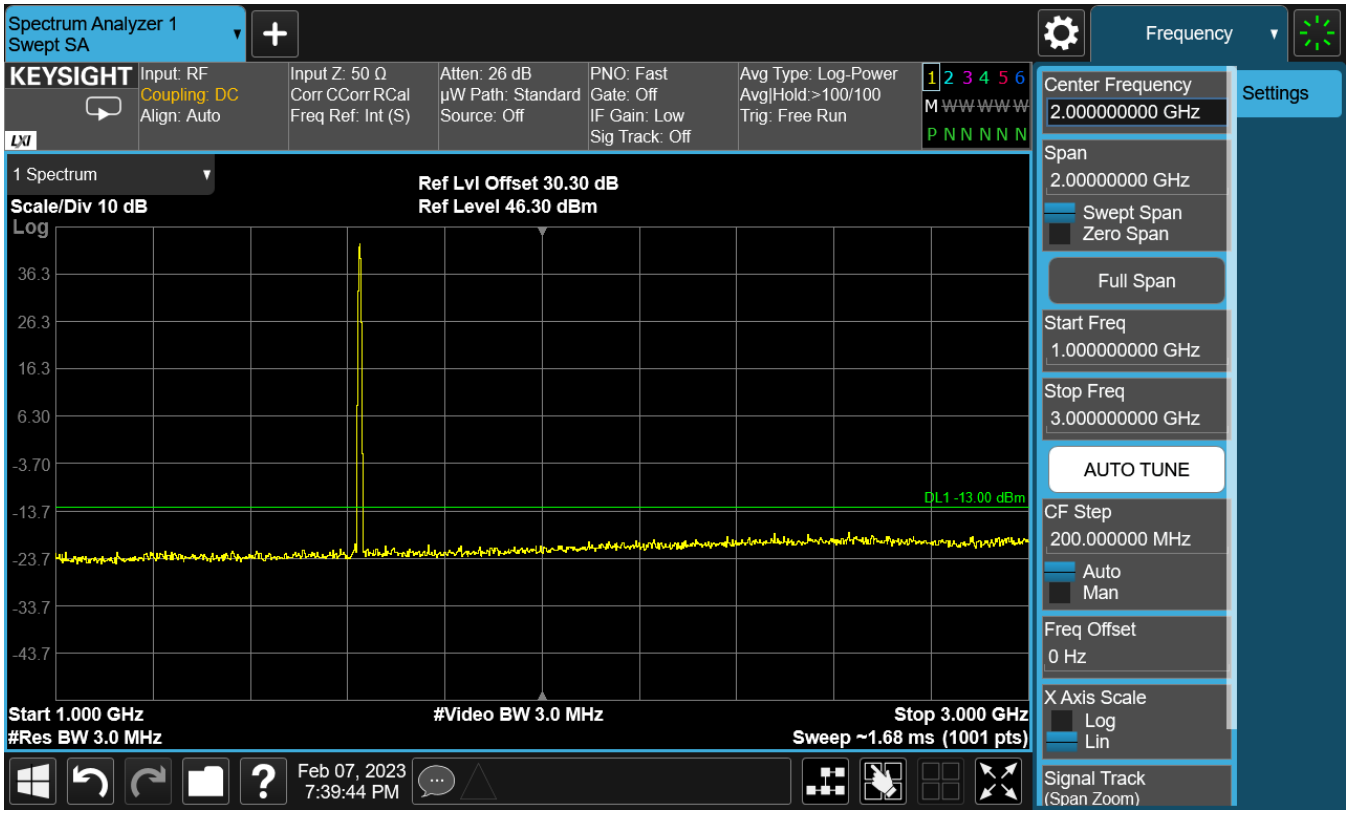

Figure 54: 1GHz to 3GHz, Spurious Emissions, C8, High Channel

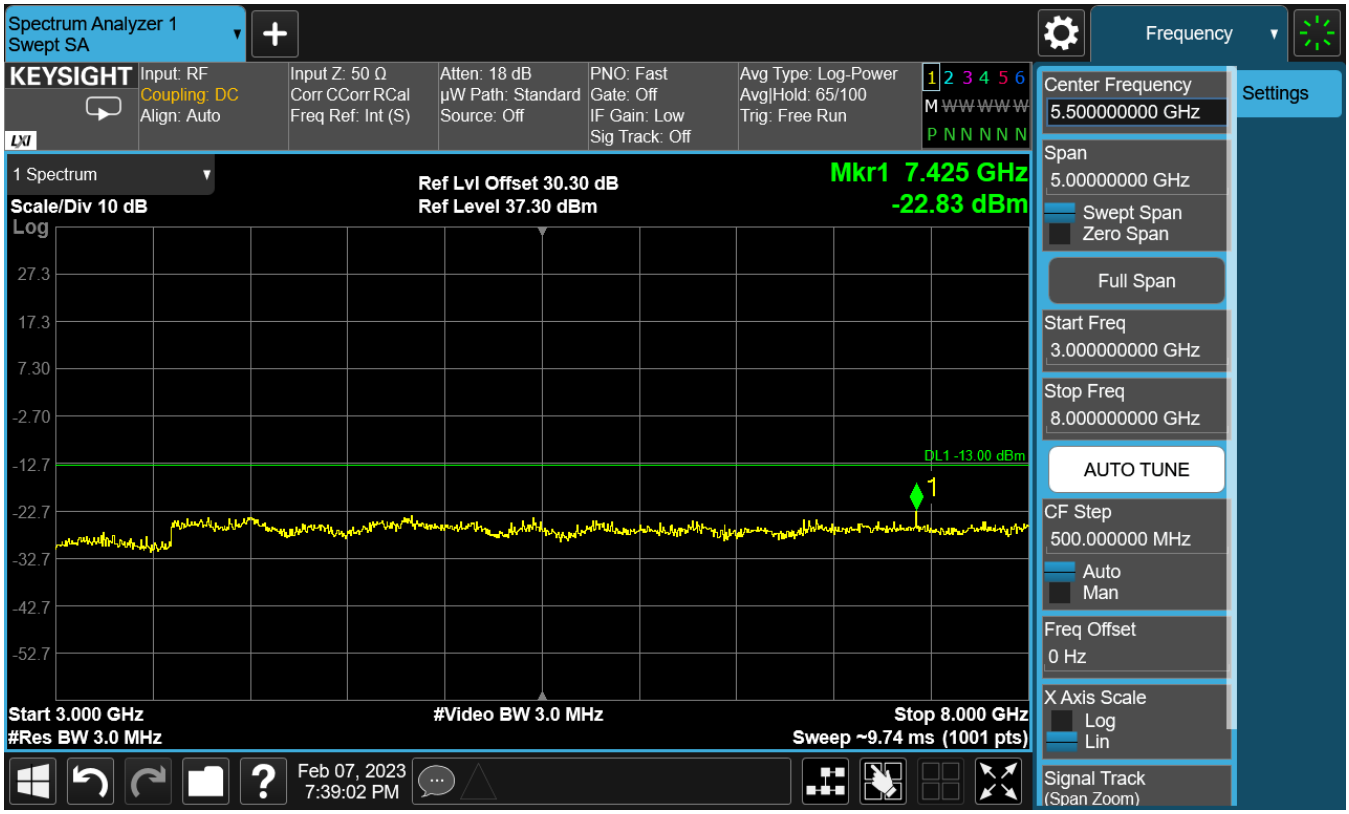

Figure 55: 3GHz to 8GHz, Spurious Emissions, C8, High Channel

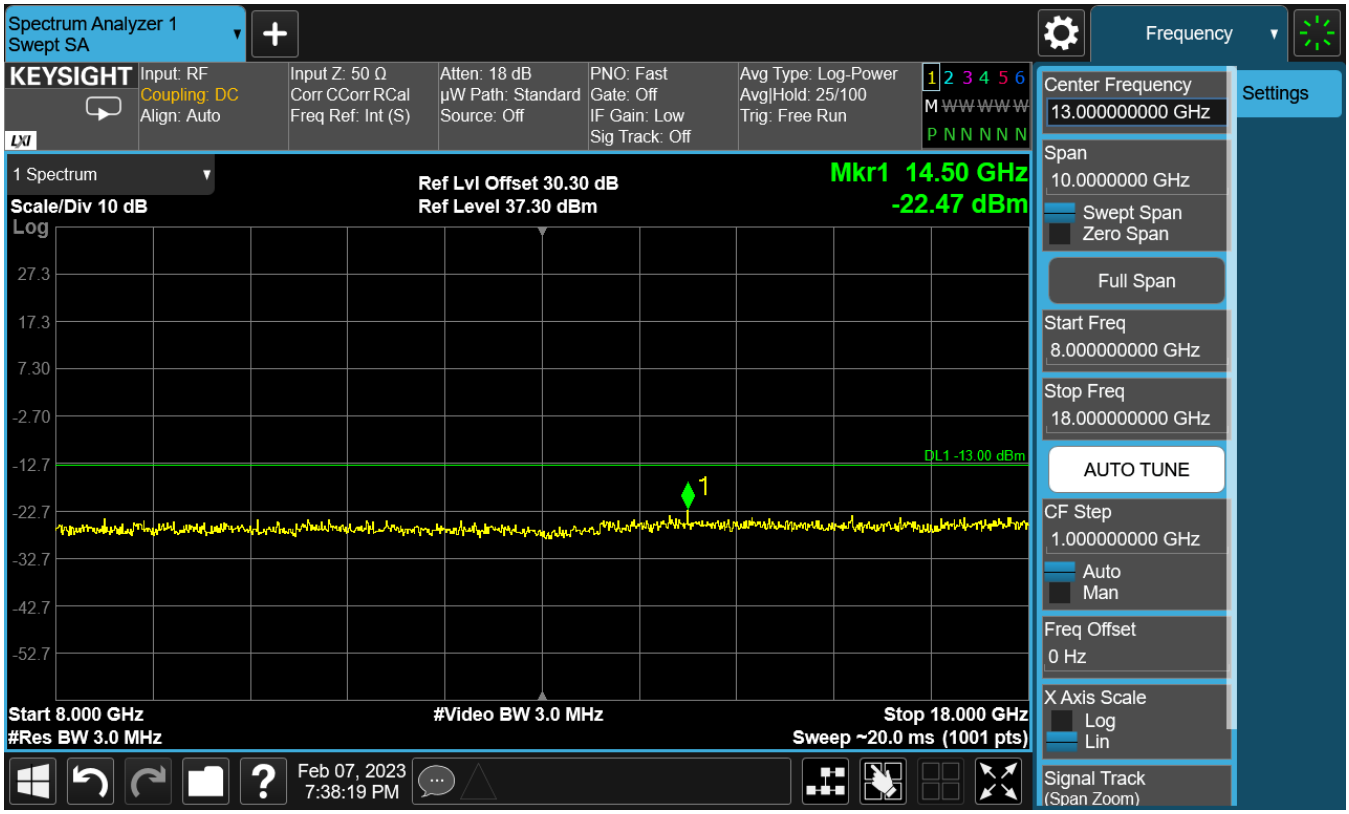

Figure 56: 8GHz to 18GHz, Spurious Emissions, C8, High Channel

4.4 Radiated Spurious Emissions

4.4.1 Specification References

FCC 47 CFR Part 25, Clause 25.202(f)

FCC 47 CFR Part 2, Clause 2.1051

Industry Canada RSS-170, Clause 5.8

ISEDC RSS-GEN, Clause 6.13

4.4.2 Test Method

Testing was performed in accordance with ANSI C63.26, clause 5.5.

4.4.3 Test Results

4.4.4 Environmental Conditions

Environmental Conditions during Conducted Spurious Emissions

Ambient Temperature:	19 °C
Relative Humidity:	52%

Table 8: Case Radiated Spurious Emissions Test Data

Freq. (MHz)	Polarity / Axis	Corrected E-Field (dBuV/m)	EIRP (Calculated)	Limit	Margin	Mode
9754	V / X	76.4	-18.86	-13	-5.86	C8, High Channel
9698	V/X	75.5	-19.76	-13	-6.76	C8, High Channel
9754	V/X	71.0	-24.26	-13	-11.26	C8, High Channel
9754	H/Y	73.9	-21.36	-13	-8.36	C8, Low Channel
9754	H/Y	76.2	-19.06	-13	-6.06	C8, High Channel
9730	V/X	71.1	-24.16	-13	-11.16	C1, High Channel

Note: Six highest emissions reported, all three EUT Axis (X, Y, &Z), Low & High Channels, and Modulations evaluated.

4.5 Limits on Aeronautical Navigational Bands

4.5.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.216
Industry Canada RSS-170, Clause 5.7.1

4.5.2 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7

4.5.3 Environmental Conditions

Environmental Conditions during Conducted Spurious Emissions

Ambient Temperature:	20 °C
Relative Humidity:	52%

4.5.4 Protection of Aeronautical Bands Test Results

The EUT was tested in a TX enabled, modulated mode.

The Low, Center, and High channels were investigated.

The plots provided below, include the EUT antenna gain of 3.0 dBi.

See Figure 57 through Figure 71 for the final test results.

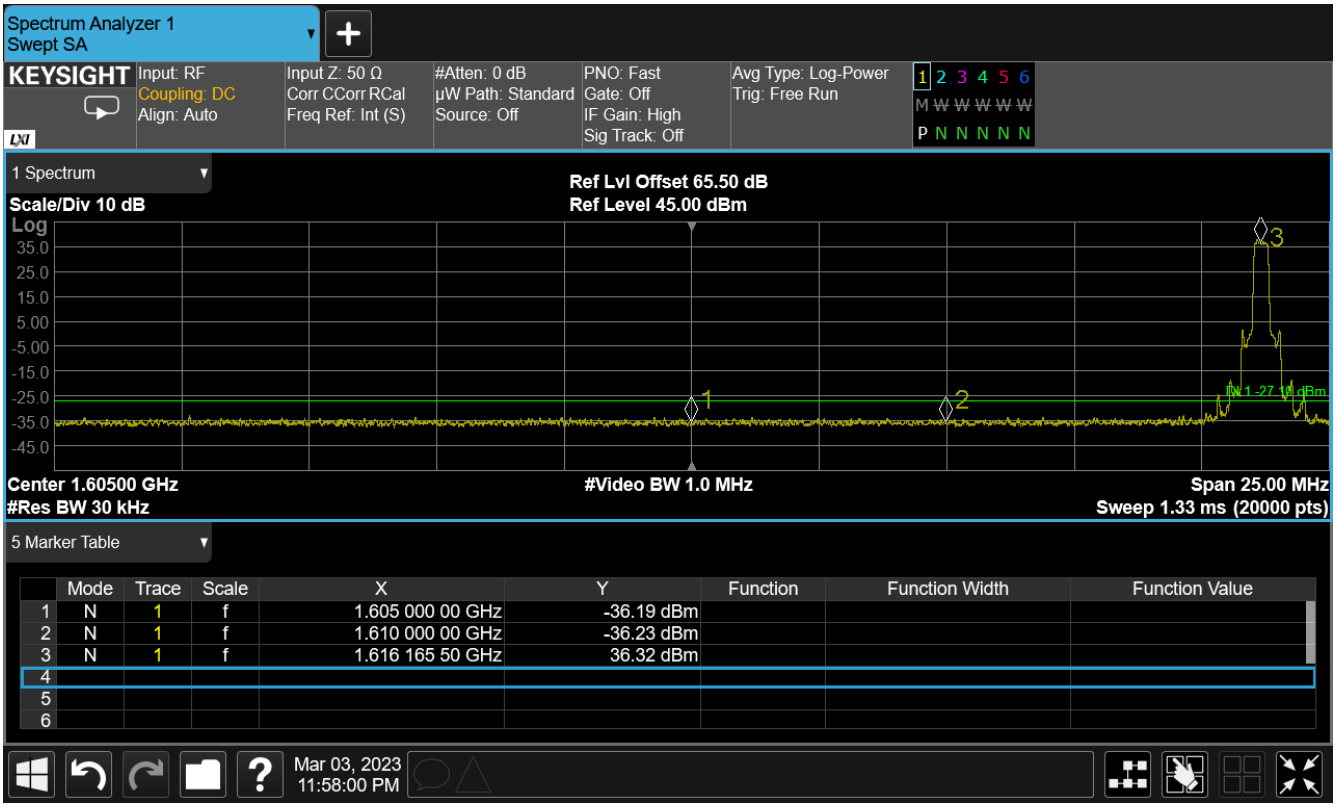

Figure 57: Radionavigation Bandedge, Low Channel

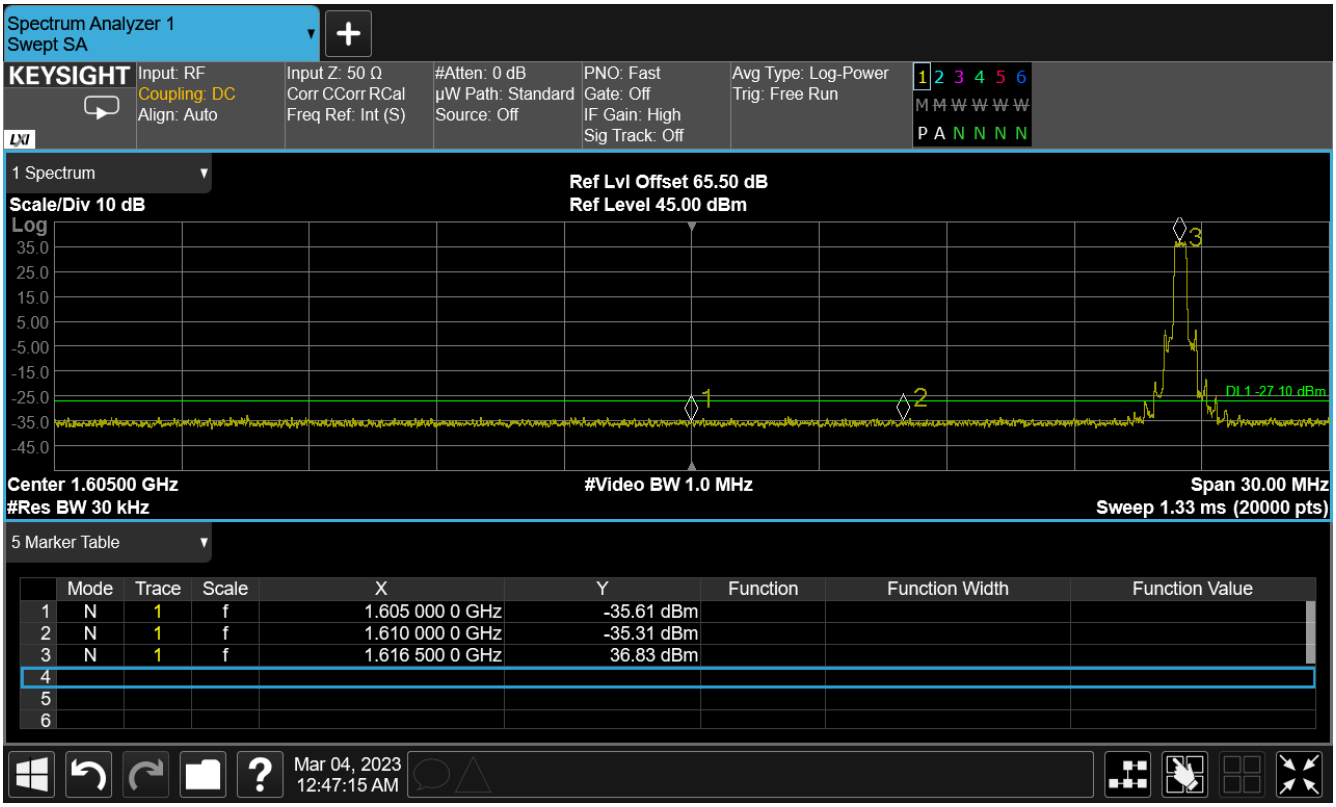

Figure 58: Radionavigation Bandedge, Center Channel

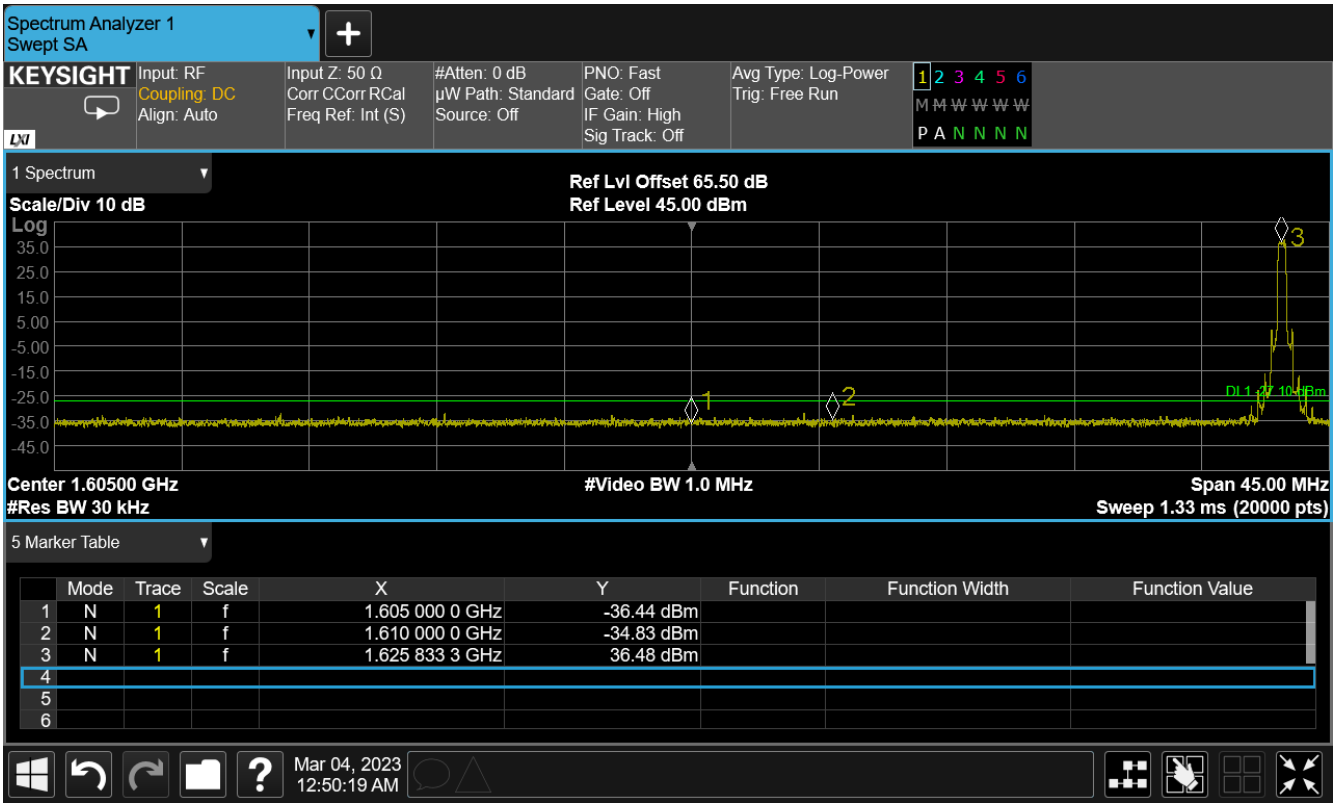

Figure 59: Radionavigation Bandedge, High Channel

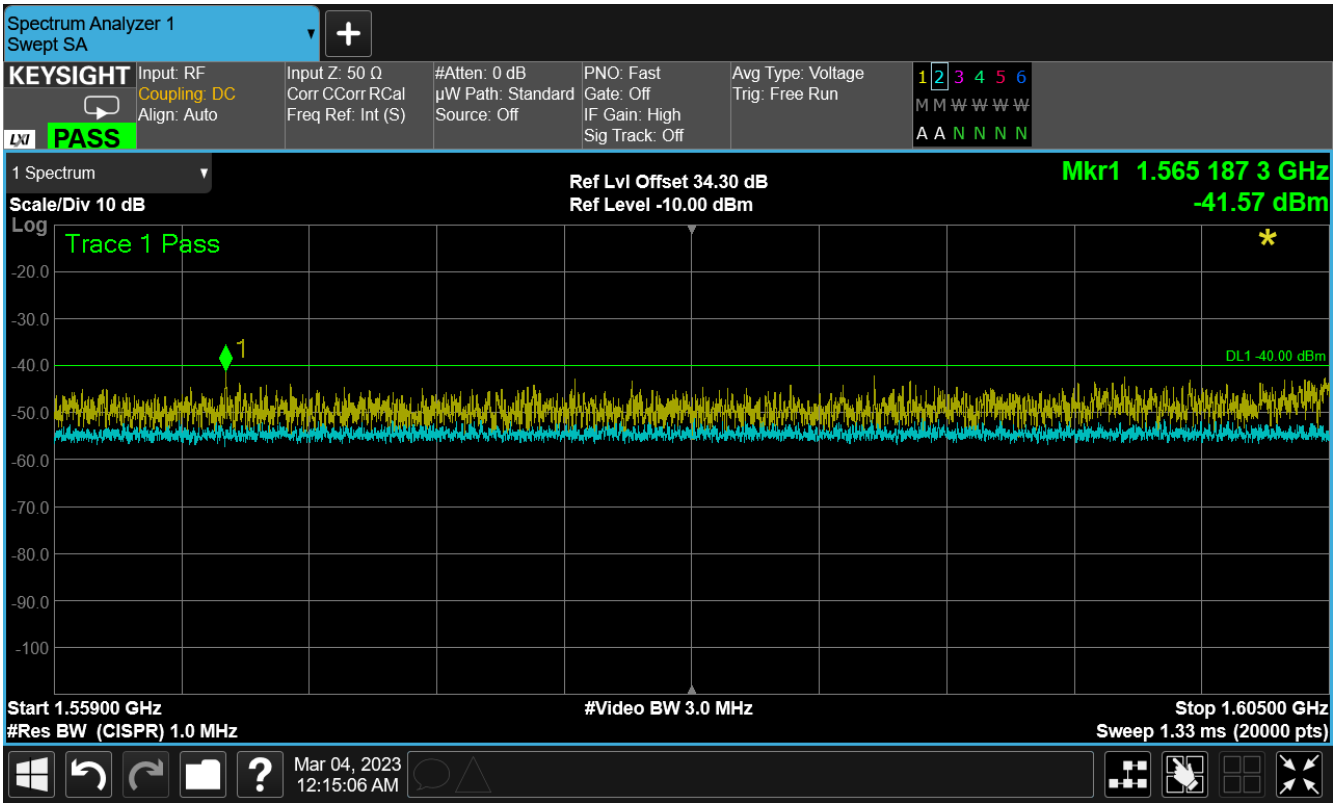

Figure 60: Unwanted Broadband Emissions, Low Channel, Plot 1

* Trace 2 is provided to demonstrate the ambient conditions of the measurement equipment

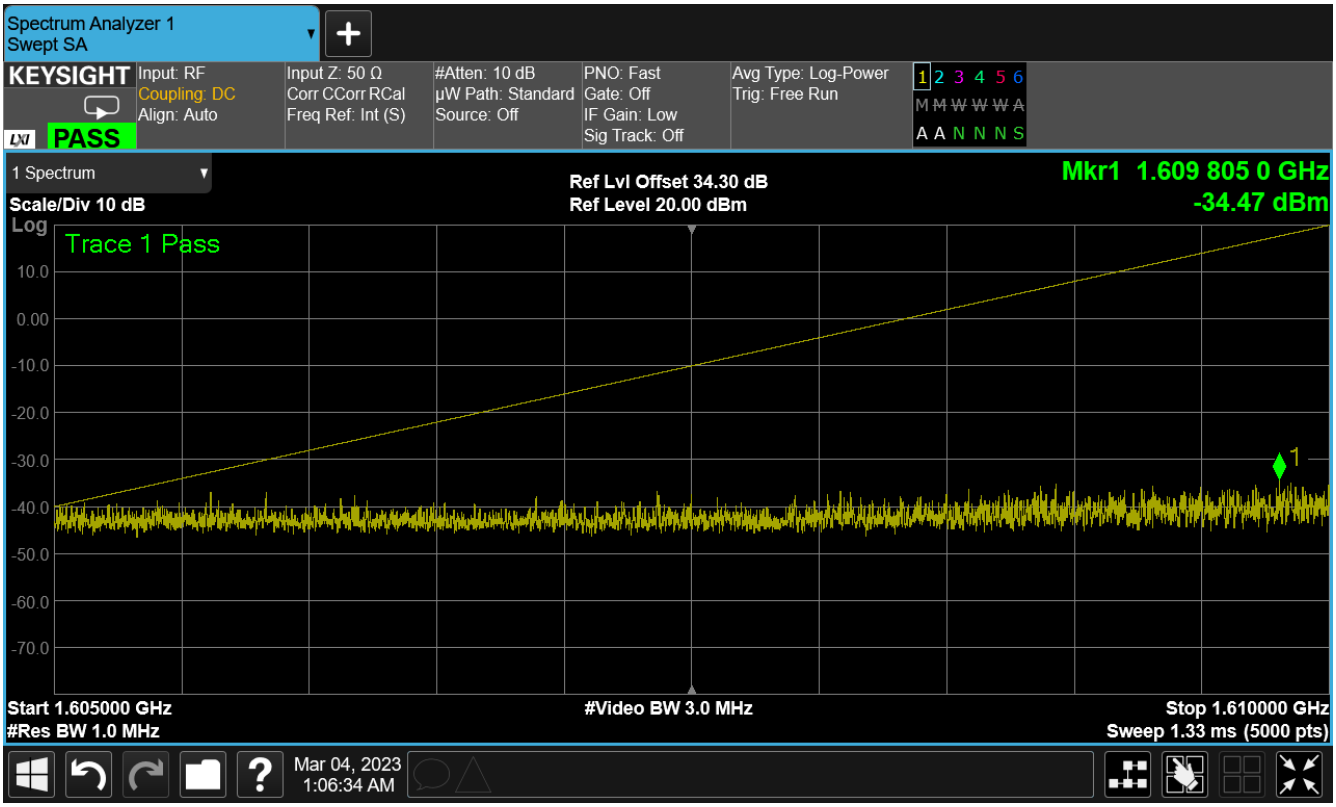

Figure 61: Unwanted Broadband Emissions, Low Channel, Plot 2

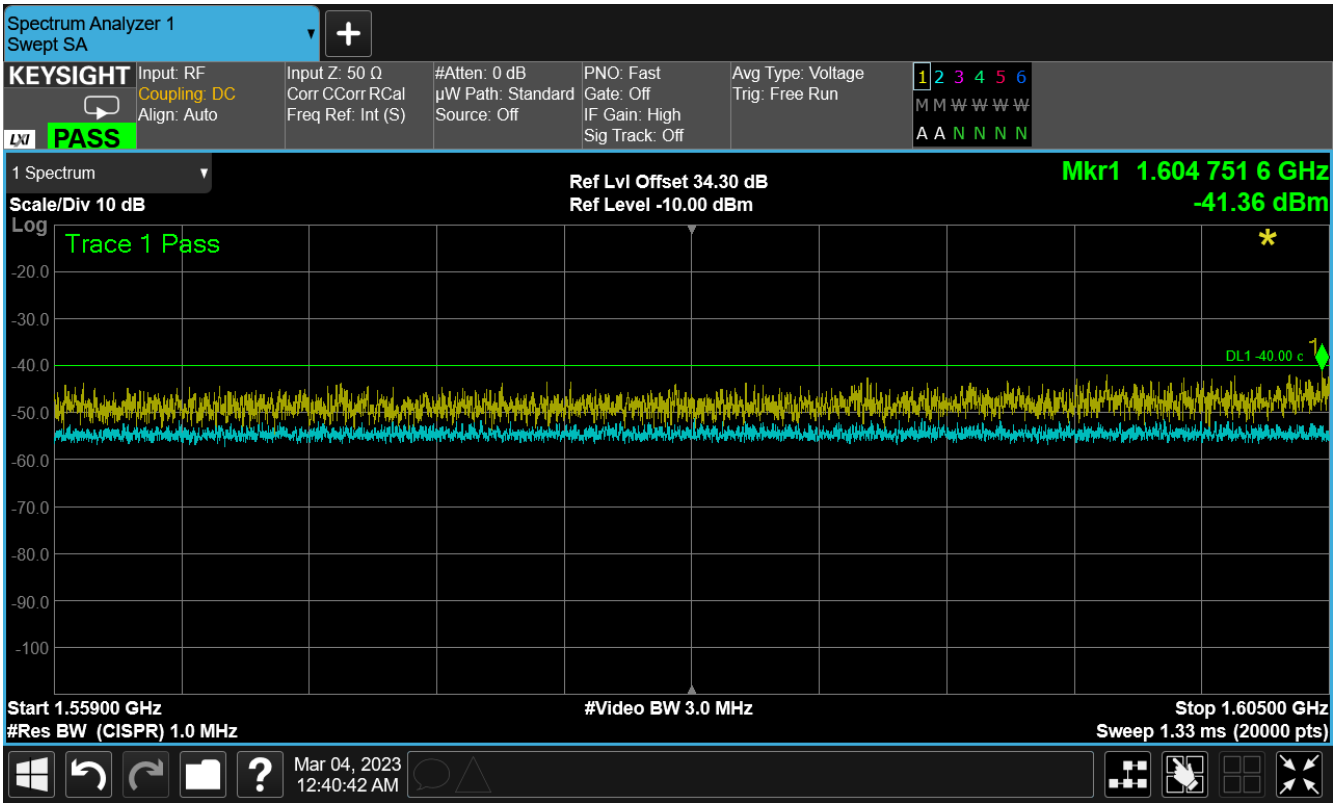

Figure 62: Unwanted Broadband Emissions, Center Channel, Plot 1

* Trace 2 is provided to demonstrate the ambient conditions of the measurement equipment

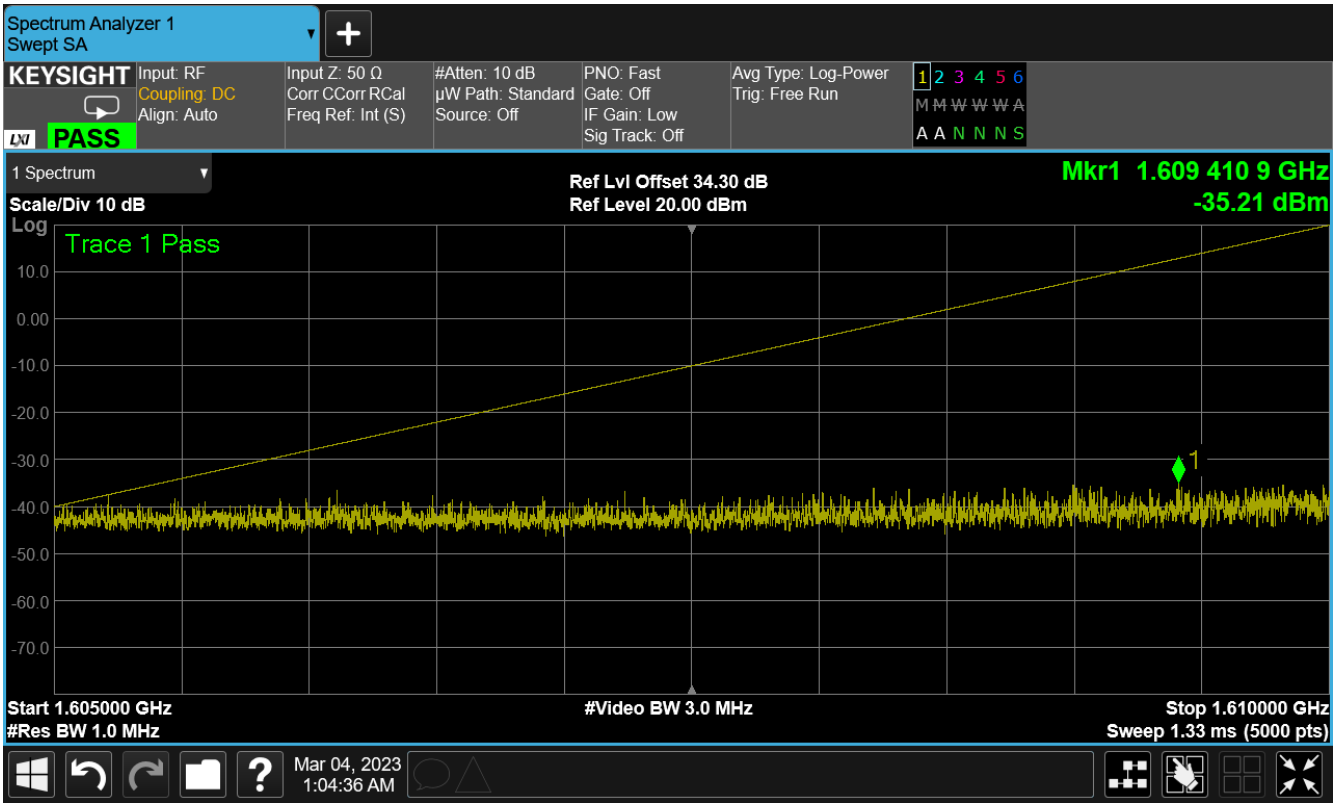

Figure 63: Unwanted Broadband Emissions, Center Channel, Plot 2

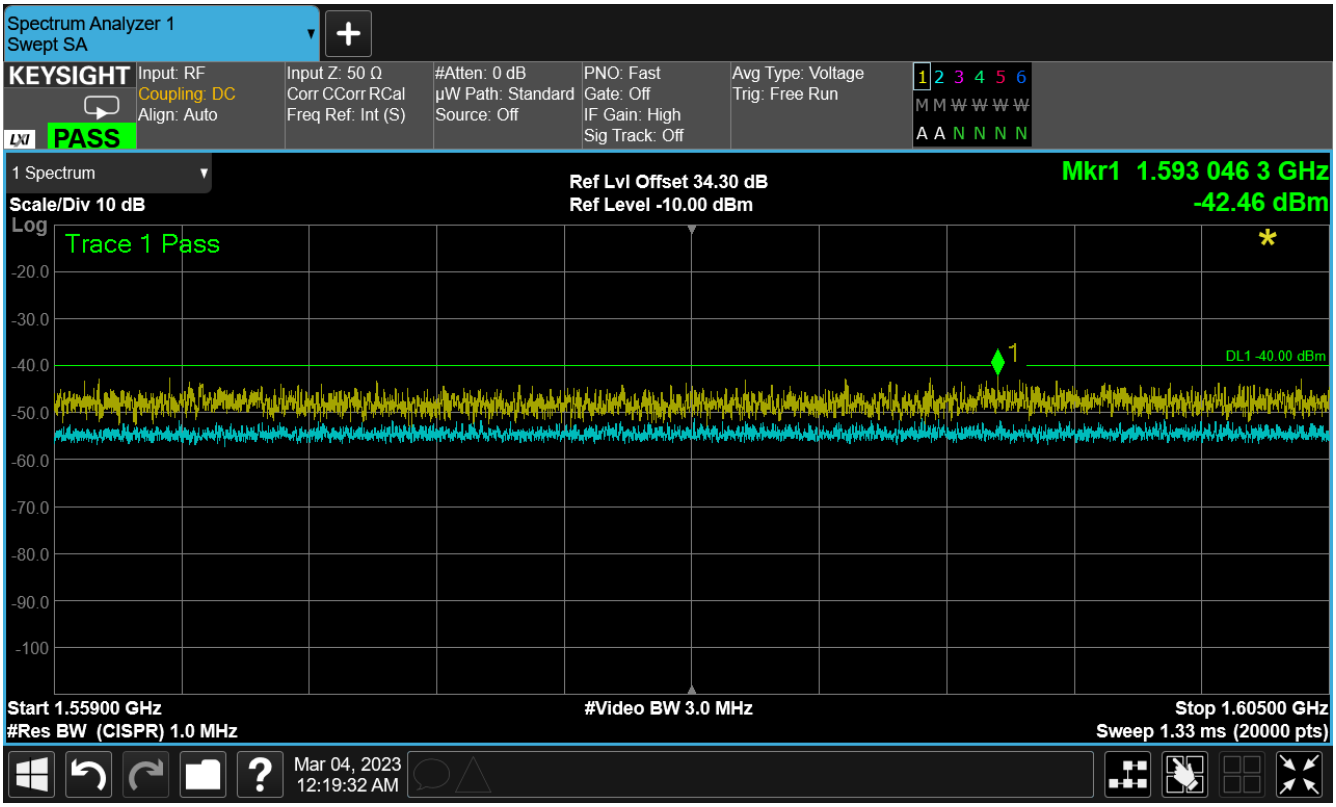

Figure 64: Unwanted Broadband Emissions, High Channel, Plot 1

* Trace 2 is provided to demonstrate the ambient conditions of the measurement equipment

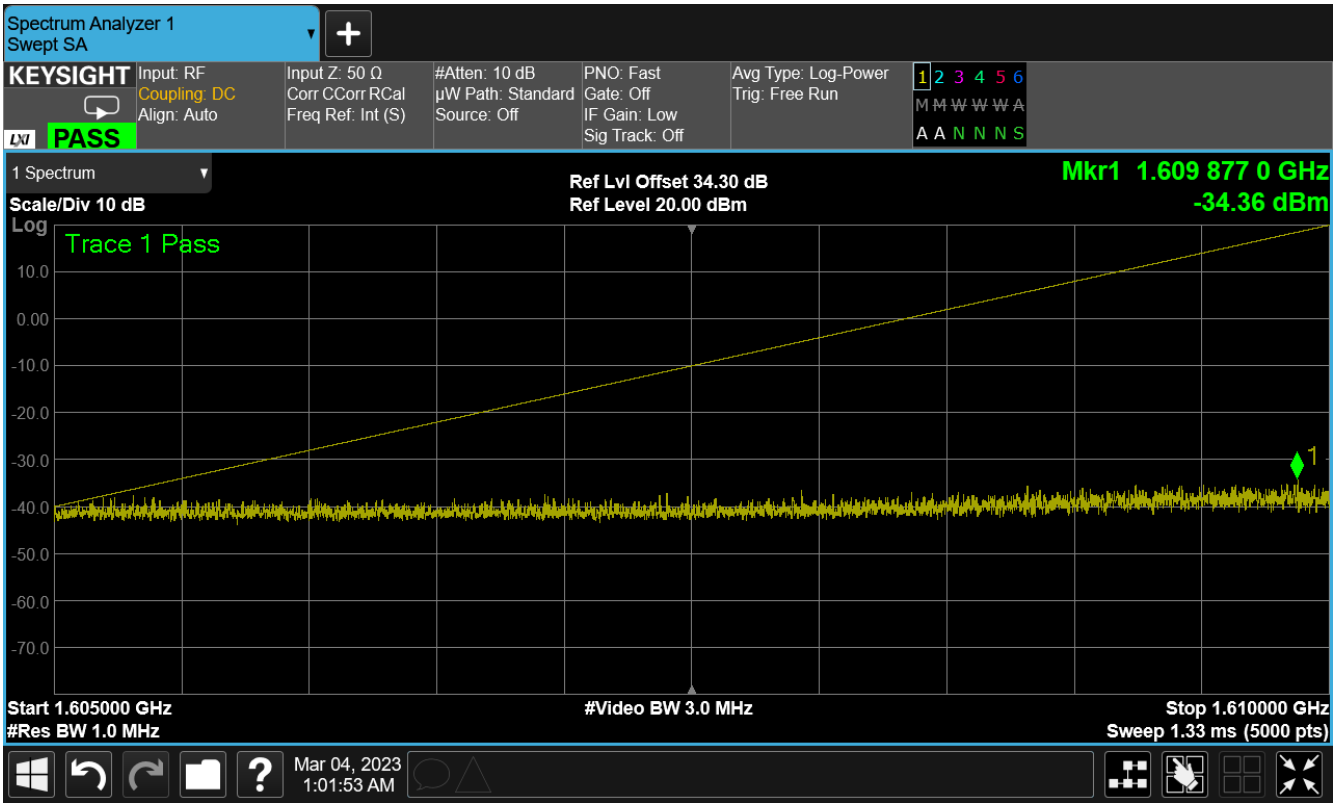

Figure 65: Unwanted Broadband Emissions, High Channel, Plot 2

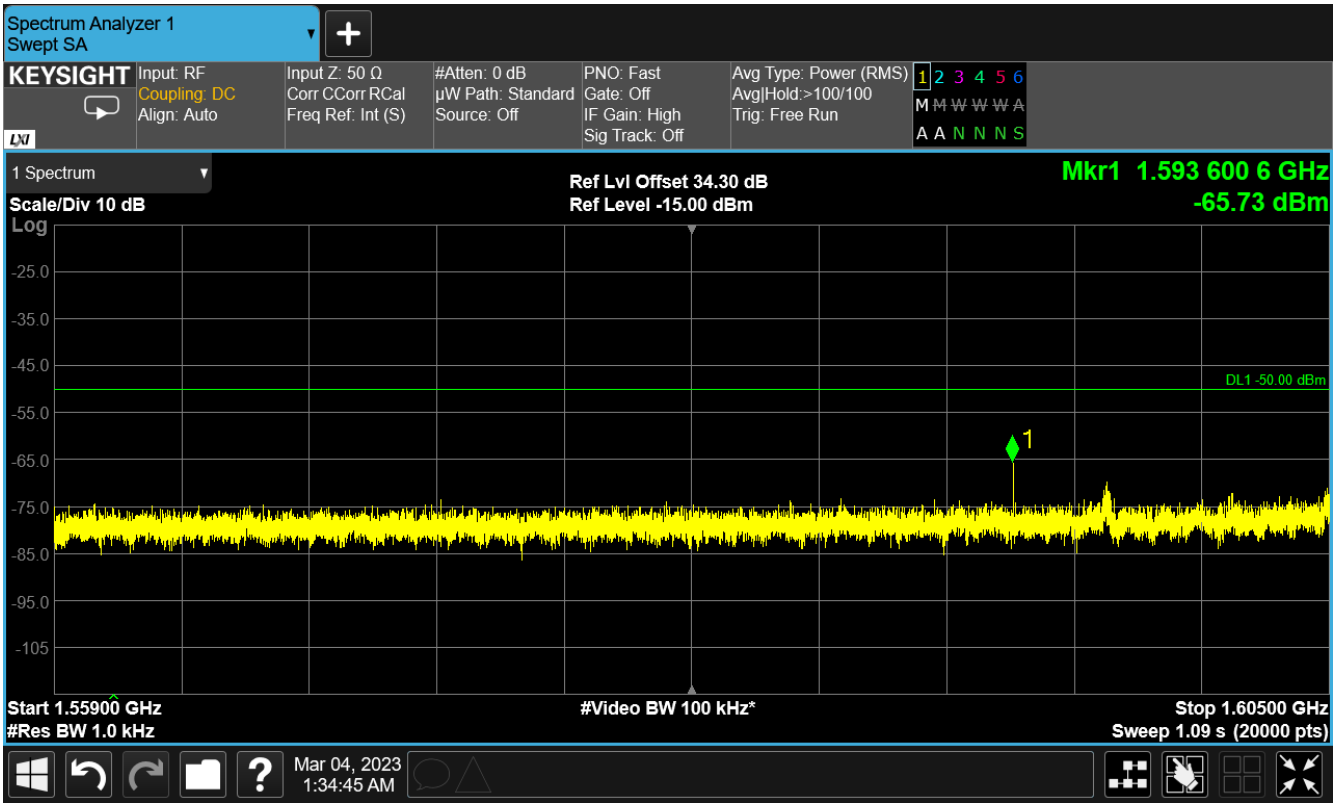

Figure 66: Unwanted Narrowband Emissions, Low Channel, Plot 1

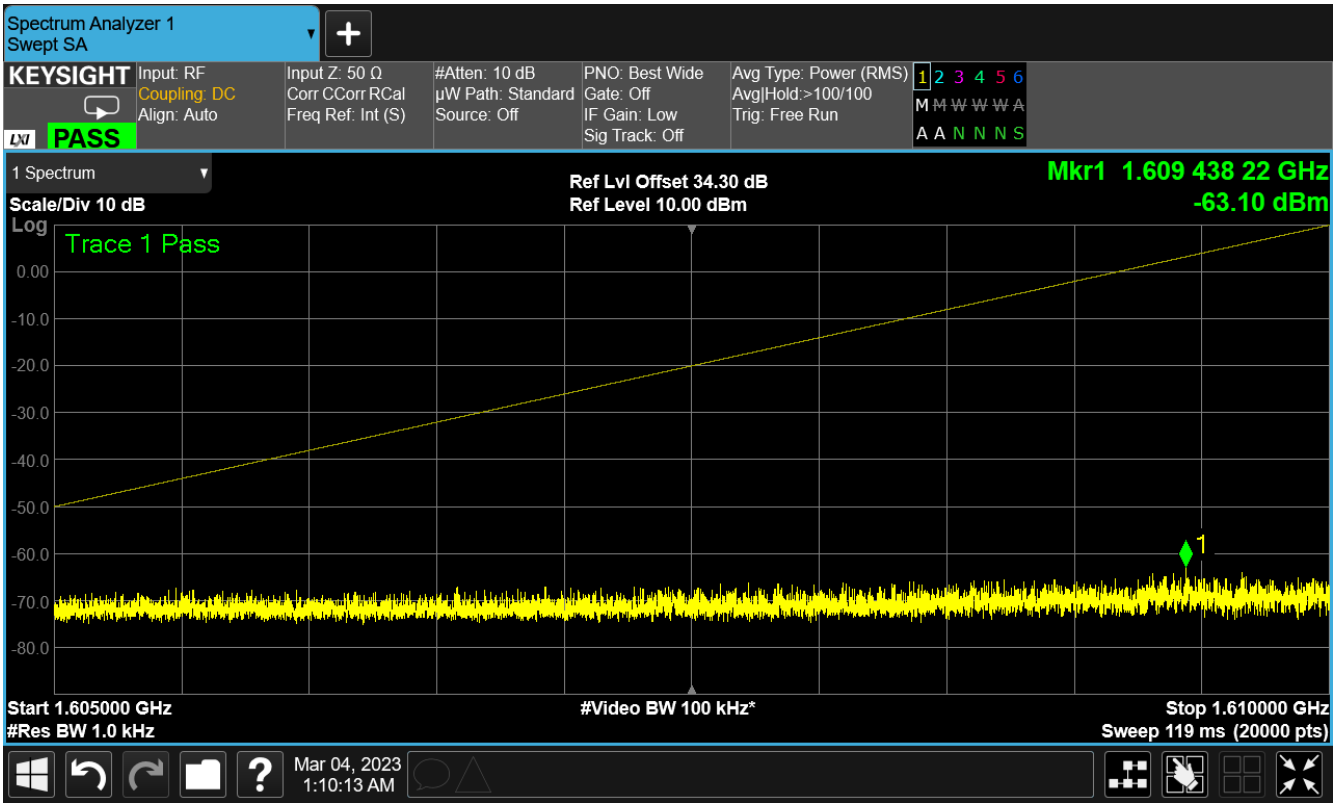

Figure 67: Unwanted Narrowband Emissions, Low Channel, Plot 2

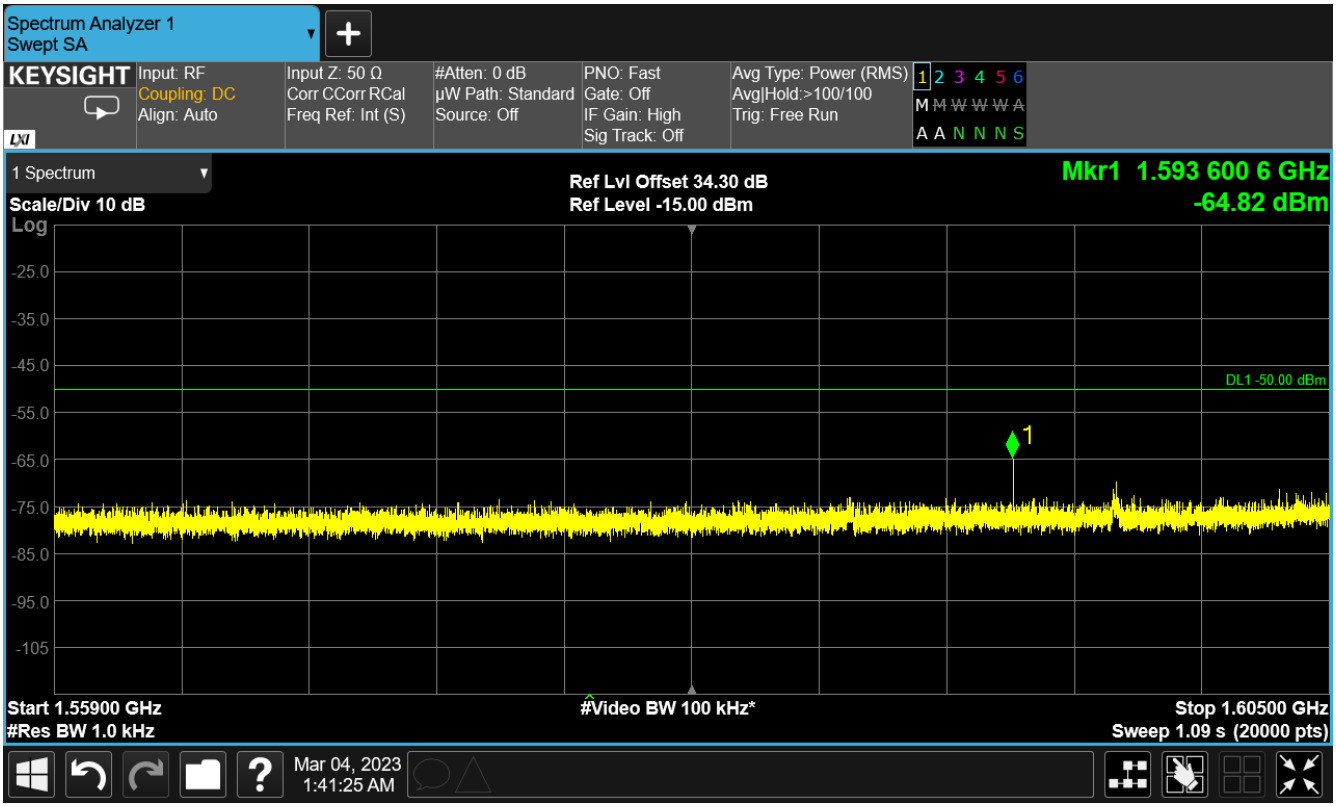

Figure 68: Unwanted Narrowband Emissions, Center Channel, Plot 1

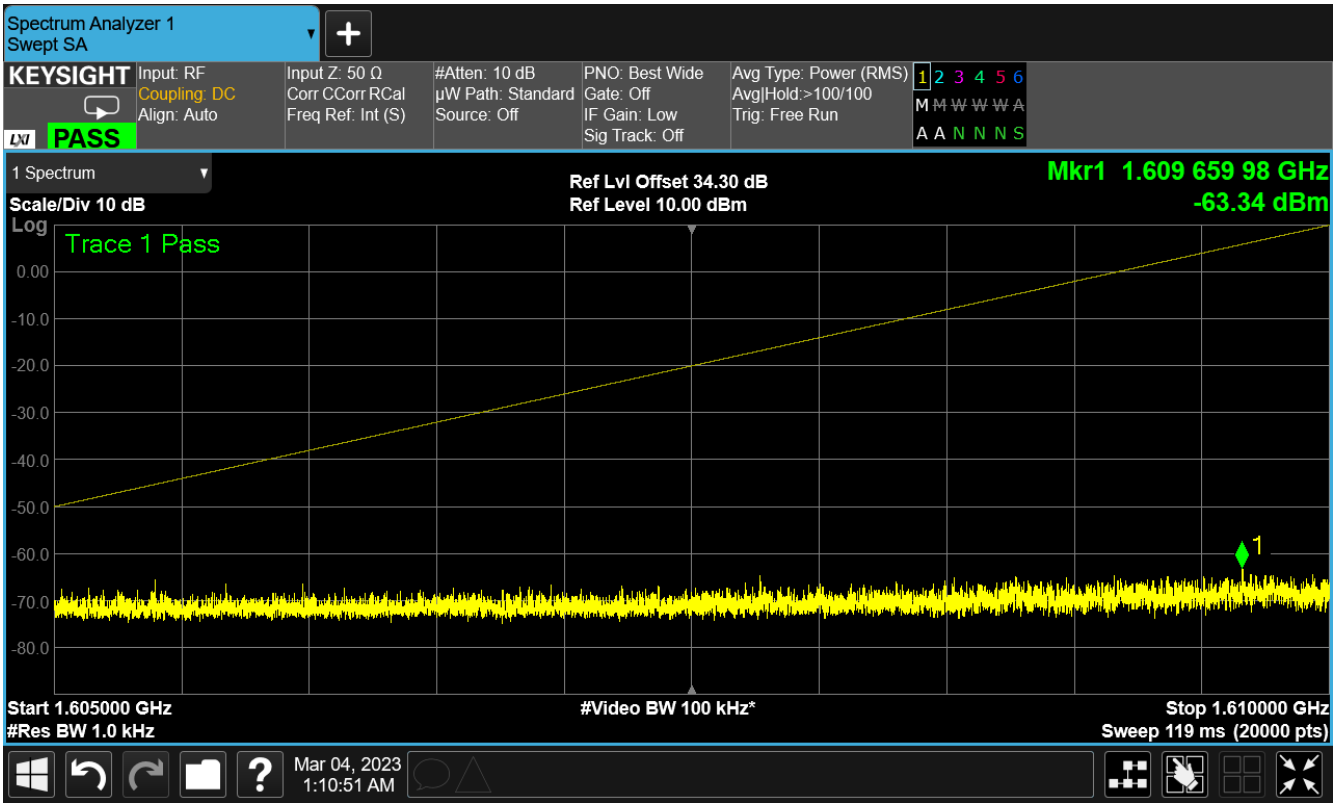

Figure 69: Unwanted Narrowband Emissions, Center Channel, Plot 2

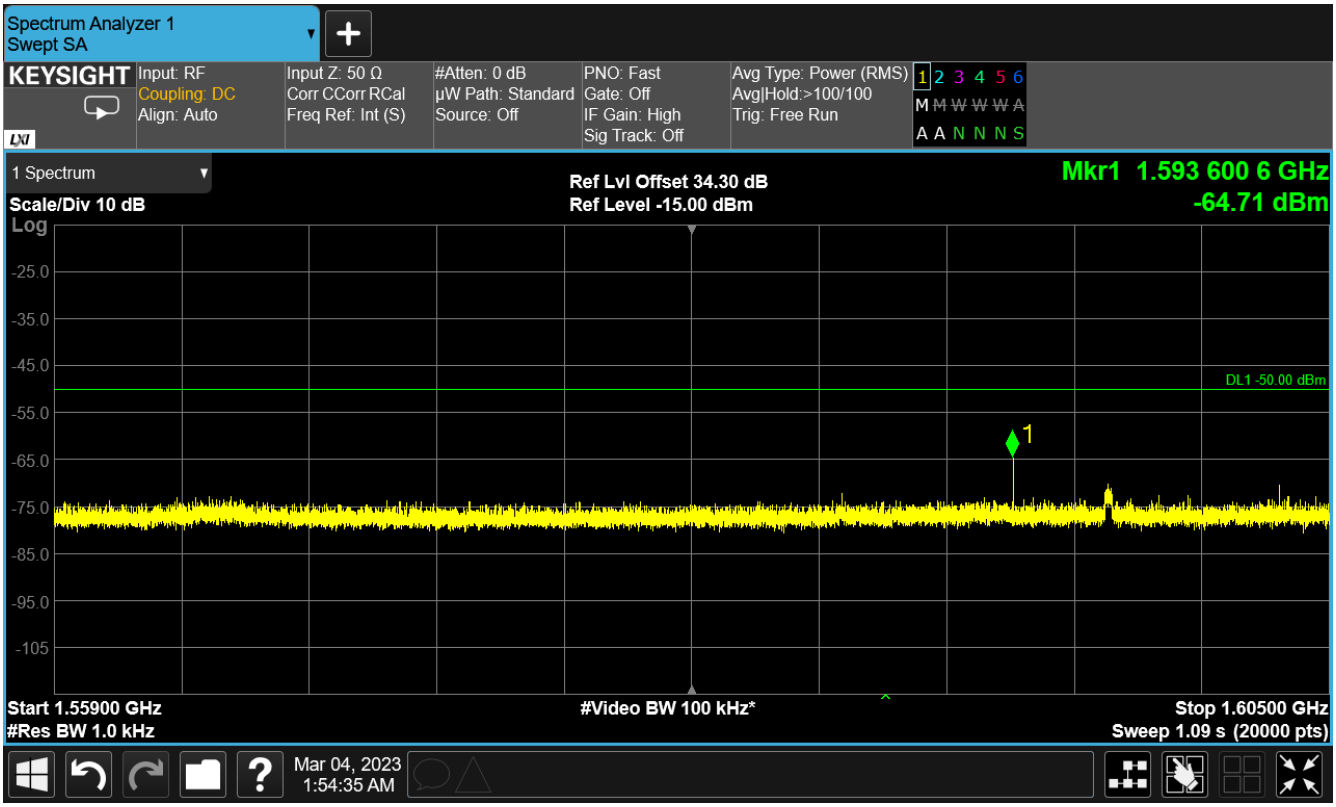

Figure 70: Unwanted Narrowband Emissions, High Channel, Plot 1

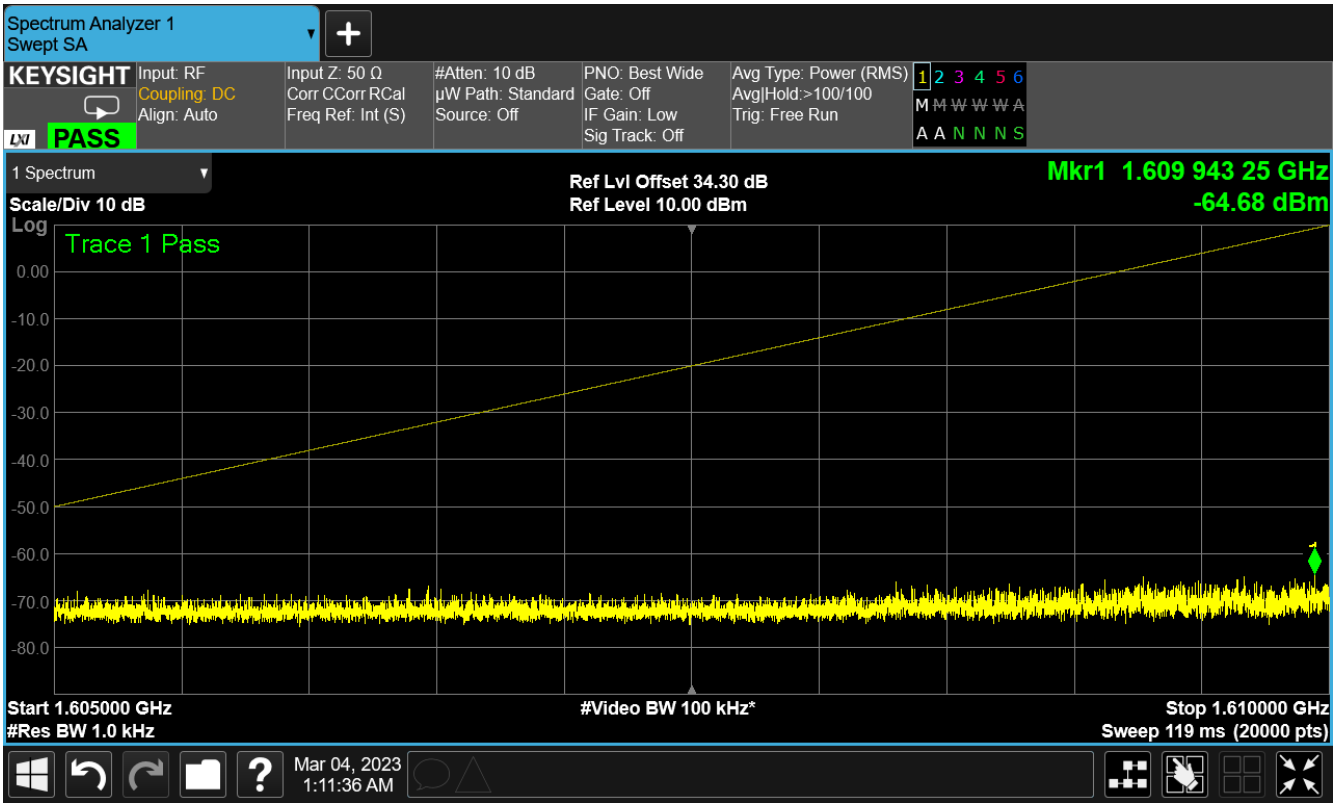

Figure 71: Unwanted Narrowband Emissions, High Channel, Plot 2

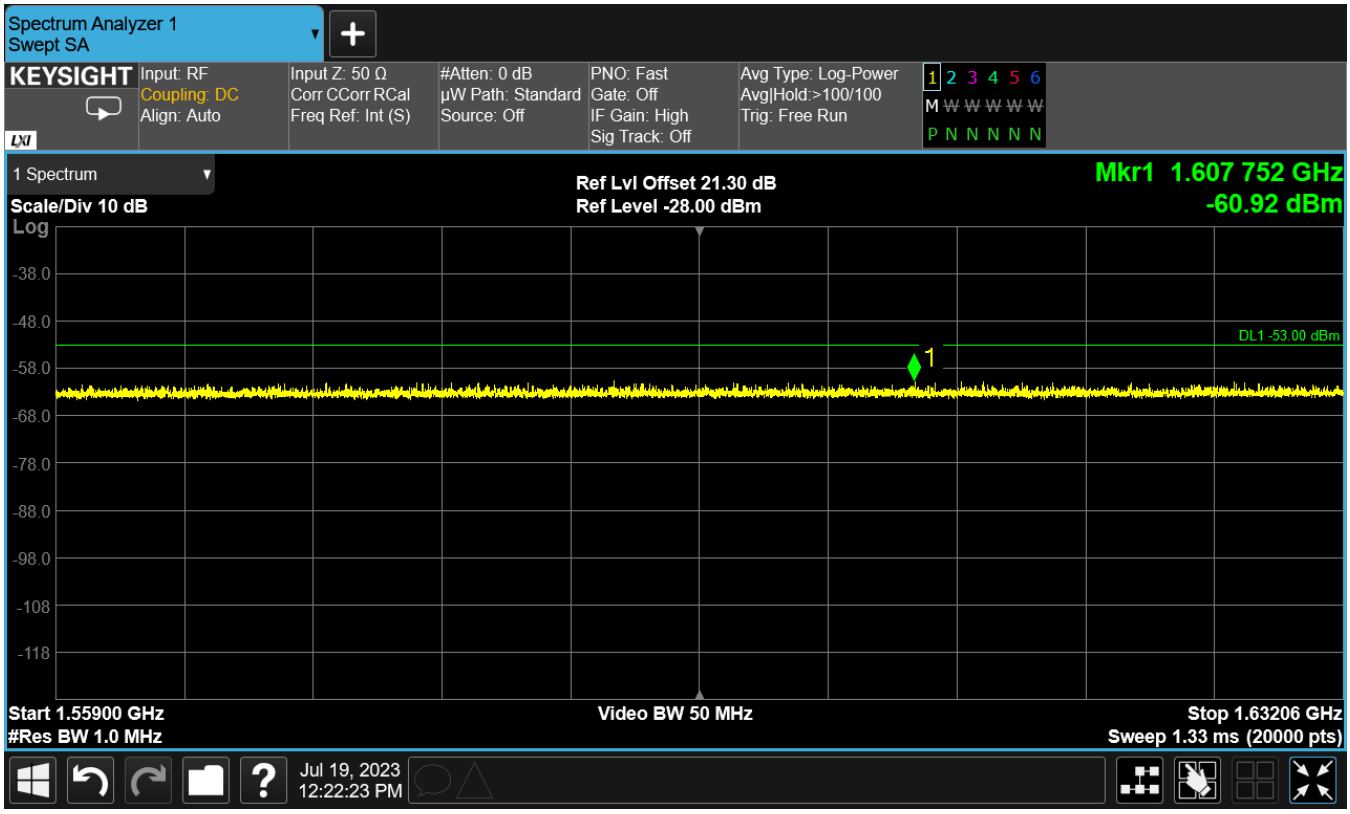

Figure 72: Unwanted Narrowband Emissions, Carrier Off

4.6 Temperature Frequency Stability

4.6.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.202(d)

FCC 47 CFR Part 2, Clause 2.1055

Industry Canada RSS-170, Clause 5.3

4.6.2 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.6.

Table 9: Frequency Temperature Stability Test Data

Temperature	1621.389010 MHz					
	10 V DC		12 V DC		14.5 V DC	
	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30.0°C	0.00002467	0.246702	0.00004317	0.431729	0.00006168	0.616755
-20.0°C	0.00002467	0.246702	0.00001850	0.185027	0.00006168	0.616755
-10.0°C	0.00004317	0.431729	0.00004317	0.431729	0.00001850	0.185027
0°C	0.00004317	0.431729	0.00004317	0.431729	0.00002467	0.246702
+10.0°C	0.00001850	0.185027	0.00001850	0.185027	0.00000617	0.061676
+20.0°C (AMB)	0	0	0	0	0	0
+30.0°C	0.00004317	0.431729	0.00004317	0.431729	0.00001850	0.185027
+40.0°C	0.00006168	0.616755	0.00006168	0.616755	0.00002467	0.246702
+50.0°C	0.00004317	0.431729	0.00004317	0.431729	0.00001850	0.185027

4.6.2.1.1.1 FCC 47 CFR Part 2, Limit Clause 25.202(d)

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

4.6.2.1.1.2 Industry Canada RSS-170, Limit Clause 5.2

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than ±10 ppm.