FCC & ISED CANADA CERTIFICATION TEST REPORT

for the

BRAUN THERMOSCAN EAR THERMOMETER

FCC ID: 2ABRGIRT6575

IC ID: 11714A-IRT6575

WLL REPORT# 17018-01 REV 2

Prepared for:

Helen of Troy

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Prepared By:

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Testing Certificate AT-1448

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FCC & ISED Canada Certification

Test Report

for the

Helen of Troy

Braun ThermoScan Ear Thermometer

FCC ID: 2ABRGIRT6575

ISED ID: 11714A-IRT6575

April 7, 2021

WLL Report# 17018-01 Rev 2

Prepared by:

Ryan Mascaro
RF Test Engineer

Reviewed by:

Steven D. Koster
President

Abstract

This report has been prepared on behalf of Helen of Troy to support the attached Application for Equipment Authorization. The test report and application are submitted for a Digital Transmission System (DTS) Transmitter under Part 15.247 of the FCC Rules and Regulations current at the time of testing and Innovation, Science and Economic Development (ISED) Canada RSS 247 Issue 2. This Certification Test Report documents the test configuration and test results for the Helen of Troy, Braun ThermoScan Ear Thermometer. The information provided on this report is only applicable to device herein documented.

Radiated testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 4840 Winchester Boulevard, Frederick MD 21703. 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.

Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory (ISED Canada OATS number 3035A).

The Helen of Troy, Braun ThermoScan Ear Thermometer complies with the limits for a Digital Transmission System (DTS) Hybrid Transmitter device under FCC Part 15.247 and ISED Canada RSS-247 Issue 2 (2/2017).

Revision History	Description of Change	Date
Rev 0	Initial Release	April 7, 2021
Rev 1	ACB Comments, Dated: 9/22/2021	September 23, 2021
Rev 2	EUT Model Name Updated	October 1, 2021

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1 Introduction

1.1 Compliance Statement

The Helen of Troy, Braun ThermoScan Ear Thermometer complies with the limits for a Digital Transmission System (DTS) Hybrid Transmitter device under FCC Part 15.247 and ISED Canada RSS-247 Issue 2 (2/2017).

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with C63.10 "ANSI Procedures for Compliance Testing of Unlicensed Wireless Devices". The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	KAZ USA, Inc. c/o Helen of Troy
Purchase Order Number:	95958
Quotation Number:	72659

1.4 Test and Support Personnel

Washington Laboratories, LTD	Ryan Mascaro
Customer Representative	William Jacobs

1.5 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 Canada OATS number for Washington Laboratories, Ltd. is 3035A. 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 Equipment Under Test

2.1 EUT Identification & Description

Table 1: Device Summary

Contract Manufacturer:	Keytronic
FCC ID:	2ABRGIRT6575
IC ID:	11714A-IRT6575
EUT Model:	Braun ThermoScan Ear Thermometer
FCC Rule Parts:	§ 15.247
ISED Rule Parts:	RSS-247
FCC Emission Designator:	742KG1D
IC Emission Designator:	1M09G1D
IC HVIN:	IRT6575
Protocol:	Bluetooth Low Energy (BLE)
Modulation:	GFSK
Frequency Range:	2400 – 2483.5 MHz
6dB Occupied Bandwidth:	742.1 kHz
Keying:	Automatic
Type of Information:	Human Temperature
Number of Channels:	40
Antenna Type:	PCB Trace Antenna (maximum gain: 5.3 dBi)
Highest BLE Emission:	102.9 dBuV/m @ 3m (7.7 dBm EIRP)
Specific Absorption Rate (SAR):	1.884 @ 5mm (calculated)
Interface Cables:	N/A
Power Source & Voltage:	2x AA batteries, 3.0 VDC

The Helen of Troy, Braun ThermoScan Ear Thermometer is an Infra-Red thermometer used to take human temperatures via the ear canal. The EUT also contains a Bluetooth (BLE) module for connectivity to a mobile application.

2.2 Test Configuration and Algorithm

The Braun ThermoScan Ear Thermometer was provided in one radio test sample. The EUT was tested in a powered on, steady state. The 2.4GHz radio was exercised as necessary to meet the requirements of the testing. For conducted methods of measurement, the BLE radio was observed through the SMA/F antenna port. For radiated emissions below 1GHz, the EUT was set to transmit at the Center Channel. For radiated emissions above 1GHz, the EUT was set to transmit at the each of the Low, Center, and High Channels. Worst case emissions are provided throughout this report.

Table 2: System Configuration List

Name / Description	Model Number	Part Number	Serial Number	Revision
N/A	N/A	N/A	N/A	N/A

Table 3: Support Equipment

Item	Model/Part Number	Serial Number
N/A	N/A	N/A

Table 4: Cable Configuration

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
N/A	N/A	N/A	N/A	N/A

2.3 Measurements

2.3.1 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

2.4 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 uc = standard uncertainty
a, b, c,.. = individual uncertainty elements
Diva, 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)
uc = 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

4 Test Results

The Table Below shows the results of testing for compliance with a Digital Transmission System in accordance with FCC Part 15.247 10/2014 and RSS-247 Issue 2. Full test results are shown in subsequent sub-sections.

Table 6: Test Summary Table

Digital Transmission System (DTS) TX Test Summary			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247(a) (2)	RSS-247 [5.2 (a)]	6dB Bandwidth	Pass
15.247 (b)(3)	RSS-247 [5.4 (d)]	Transmit Output Power	Pass
15.247 (e)	RSS-247 [5.2 (b)]	Power Spectral Density	Pass
15.247 (d)	RSS-247 [5.5]	Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	RSS-Gen [8.9/8.10]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen [8.8]	AC Conducted Emissions	Not Required

4.1 Occupied (DTS) Bandwidth

Occupied bandwidth was performed by monitoring the output of the EUT antenna port with a spectrum analyzer corrected for any cable/attenuator losses. For DTS Hybrid Systems, FCC Part 15.247 and RSS 247 require the minimum 6 dB bandwidth be at least 500 kHz.

4.1.1 Measurement Method:

Tests were performed as specified in ANSI C63.10 section 11.8 "DTS bandwidth" Option 1 (11.8.1).

At full modulation, the occupied bandwidth was measured as shown in Figure 2 through Figure 4.

Table 8 provides a summary of the Occupied Bandwidth Results.

Table 7: Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
100 kHz	300 kHz

Table 8: Occupied Bandwidth Results

Frequency	Bandwidth	Requirement	Pass/Fail
Low Channel, 2402 MHz	713.1 kHz	≥ 500kHz	Pass
Center Channel, 2440 MHz	711.2 kHz	≥ 500kHz	Pass
High Channel, 2480 MHz	742.1 kHz	≥ 500kHz	Pass

Figure 1: Occupied Bandwidth, Low Channel

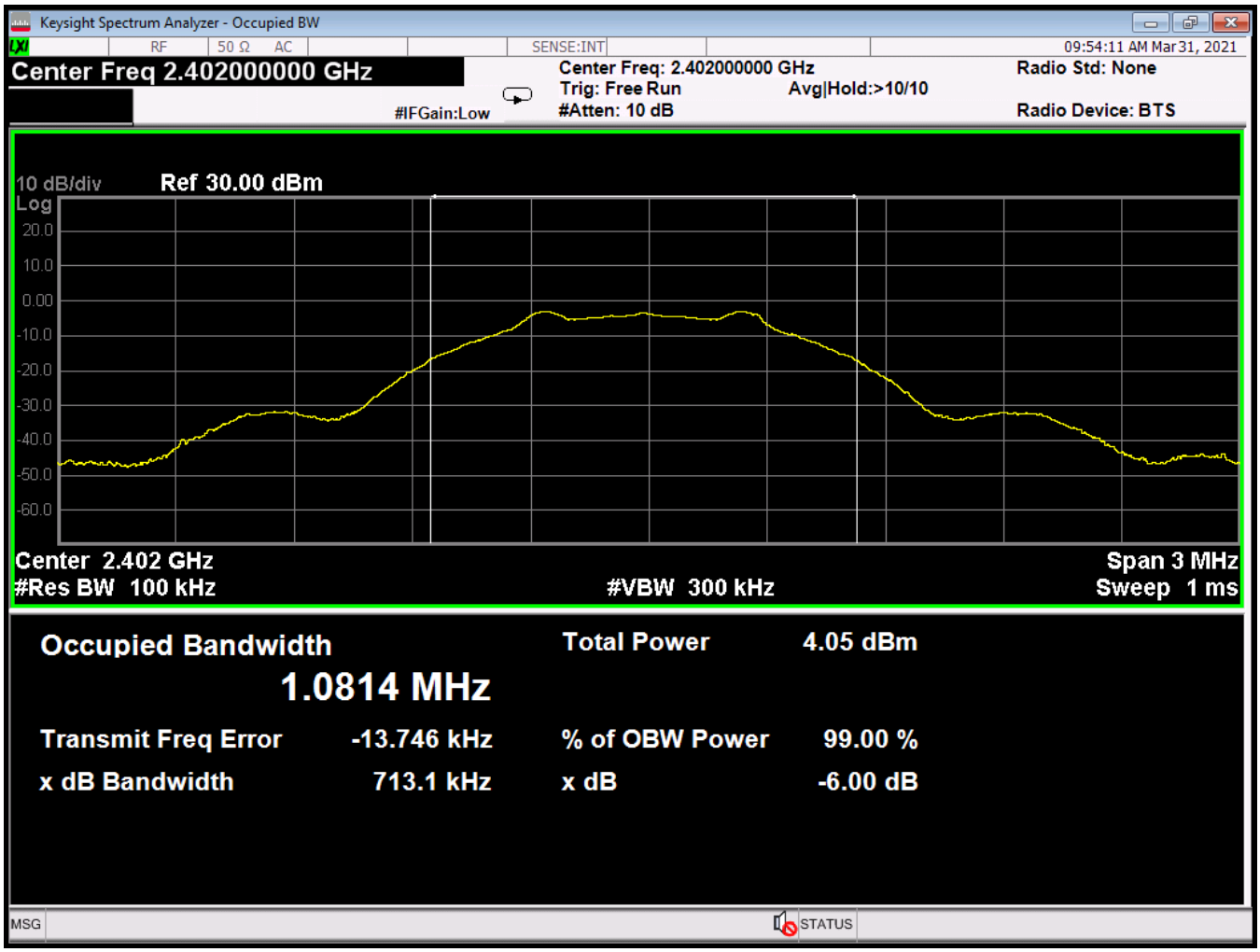


Figure 2: Occupied Bandwidth, Center Channel

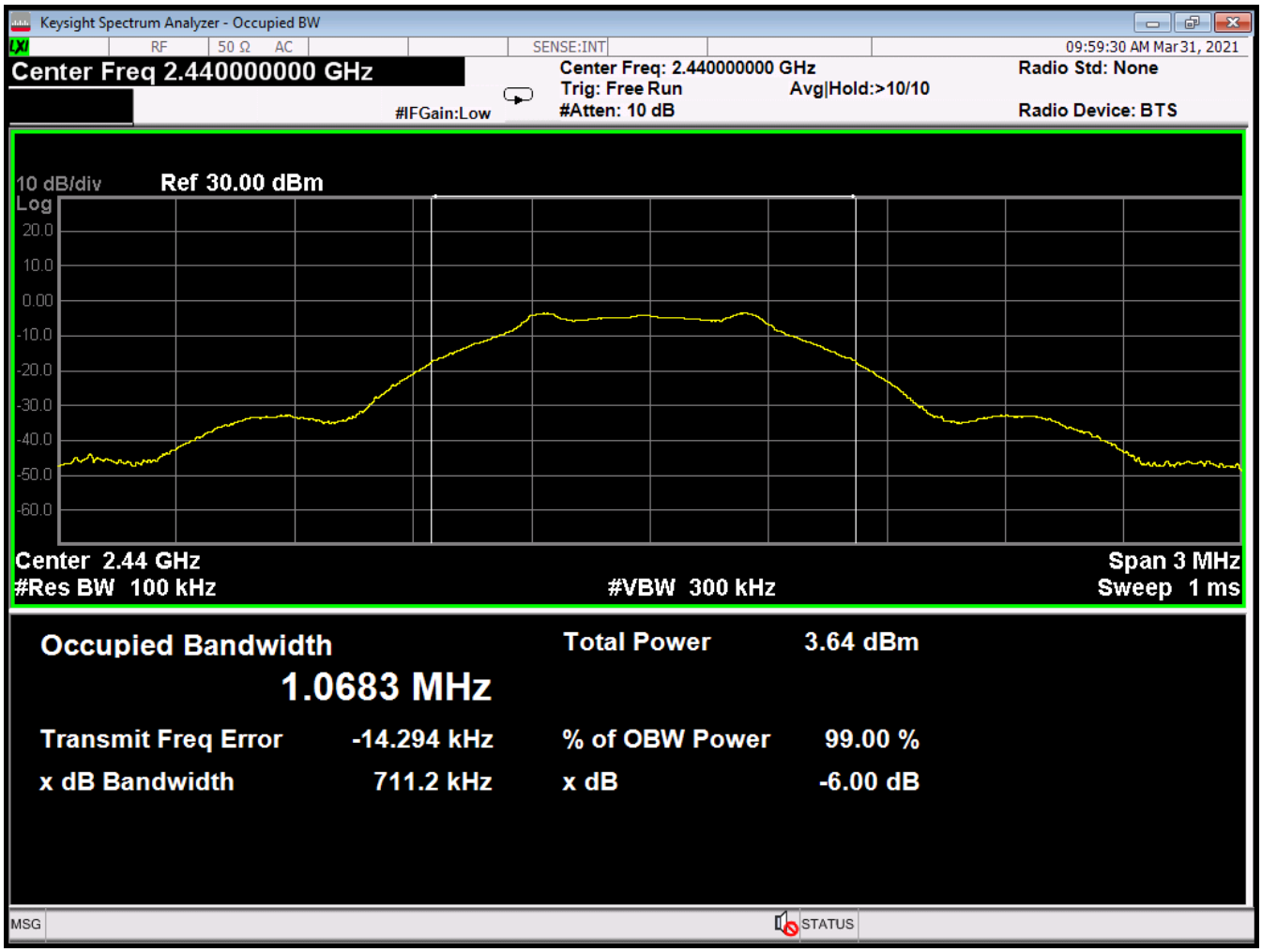
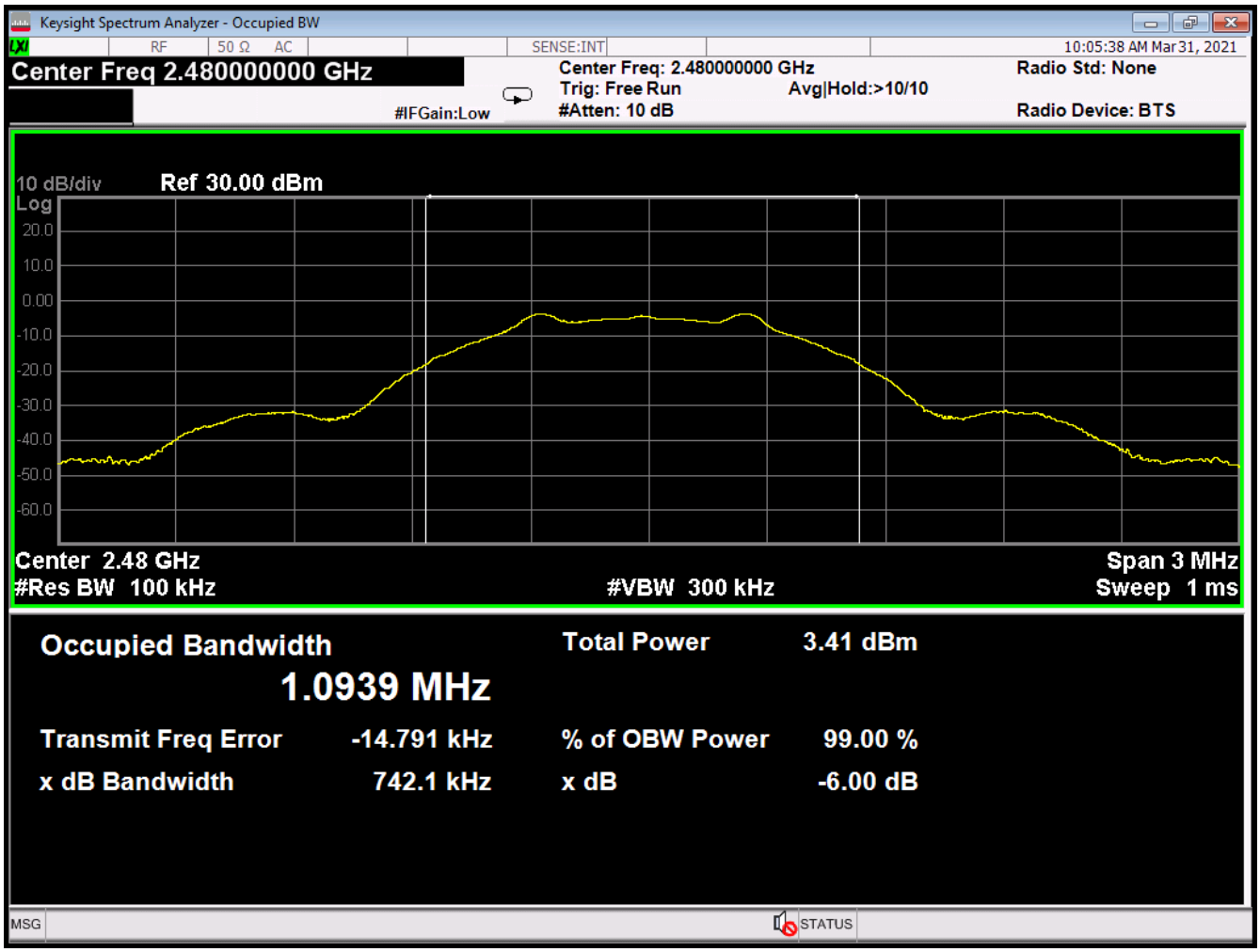


Figure 3: Occupied Bandwidth, High Channel



4.2 RF Power Output

To measure the maximum conducted output power, the unit was set to dwell on the low, middle, and high channels with a continuous 100% transmitter duty cycle. The test was performed with the EUT set to transmit a Continuous Wave (CW) signal, as this produced the worst case emission for this test.

4.2.1 Measurement Method

ANSI C63.10 section "11.9.1 Maximum peak conducted output power" subsection "11.9.1.1 RBW > DTS bandwidth".

a) Set the RBW ⩾ DTS bandwidth.

b) Set VBW ⩾ [3 × RBW].

c) Set span ⩾ [3 × RBW].

d) Sweep time = auto couple.

e) Detector = peak.

f) Trace mode = max hold.

g) Allow trace to fully stabilize.

h) Use peak marker function to determine the peak amplitude level.

Table 9: Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
1 MHz	3 MHz

Table 10: RF Power Output Summary

Frequency	Level (dBm)	Limit (dBm)	Pass/Fail
Low Channel, 2402 MHz	-3.222 dBm	30 dBm	Pass
Center Channel, 2440 MHz	-3.338 dBm	30 dBm	Pass
High Channel, 2480 MHz	-3.274 dBm	30 dBm	Pass

Figure 4: RF Peak Power, Low Channel

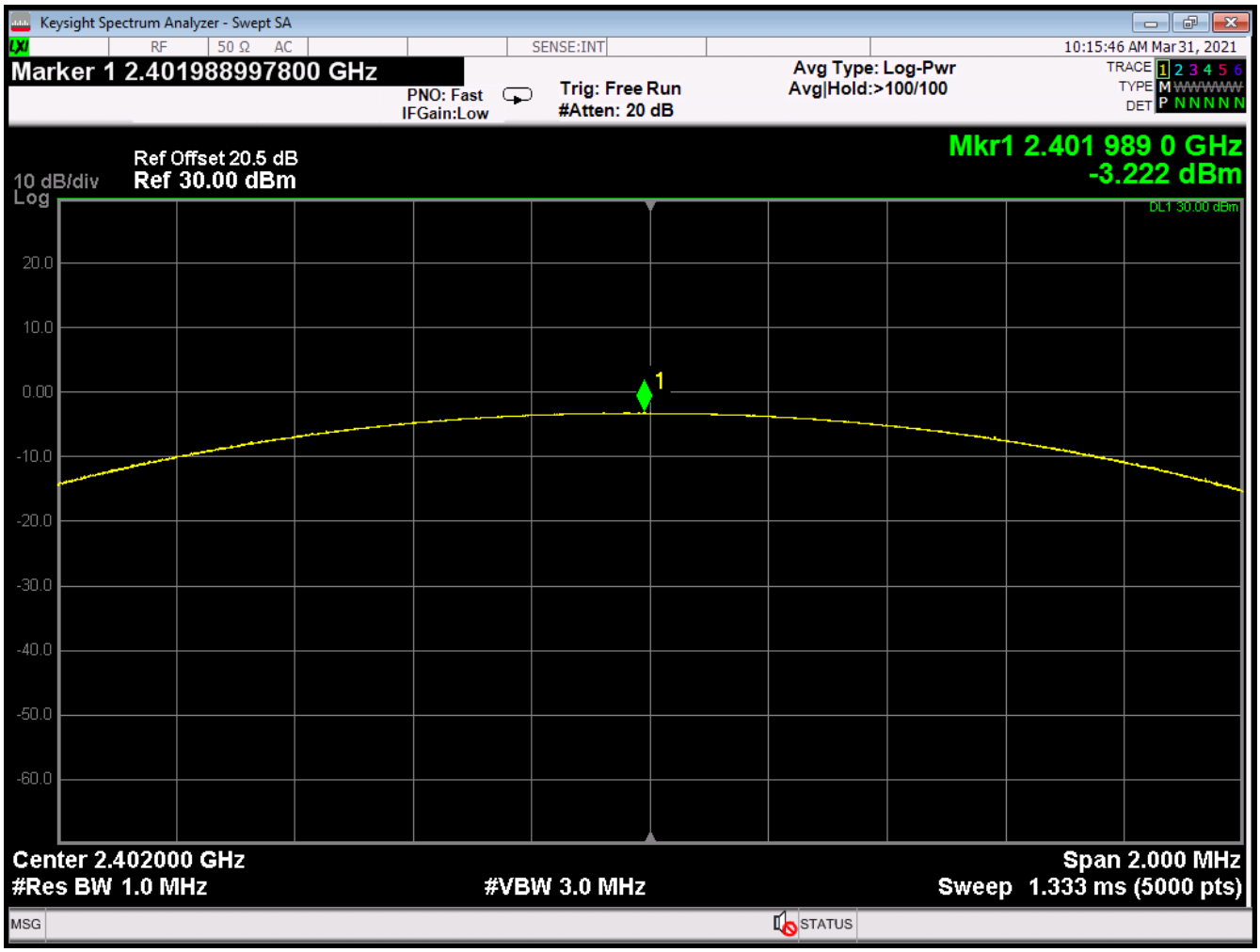


Figure 5: RF Peak Power, Center Channel

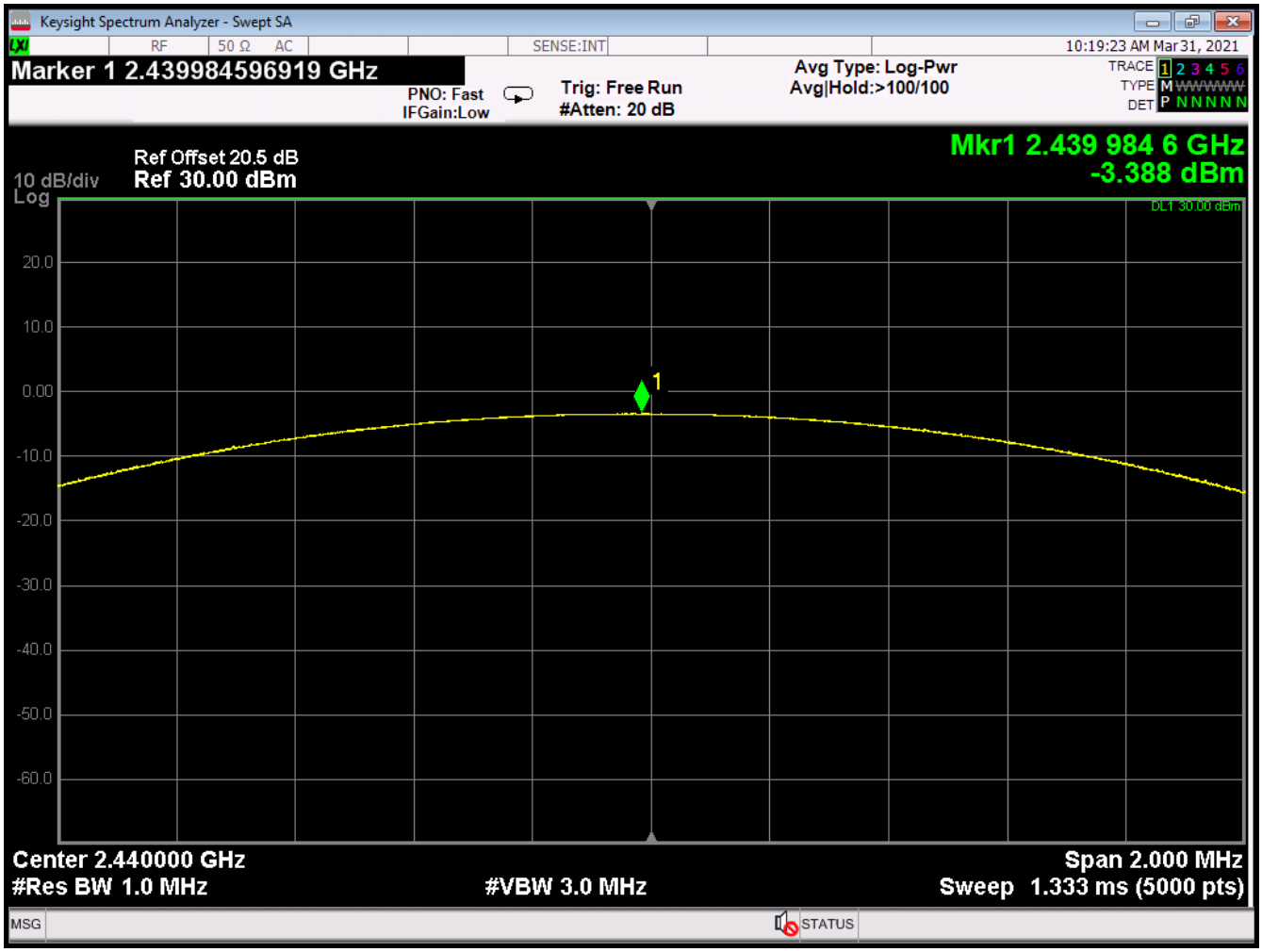
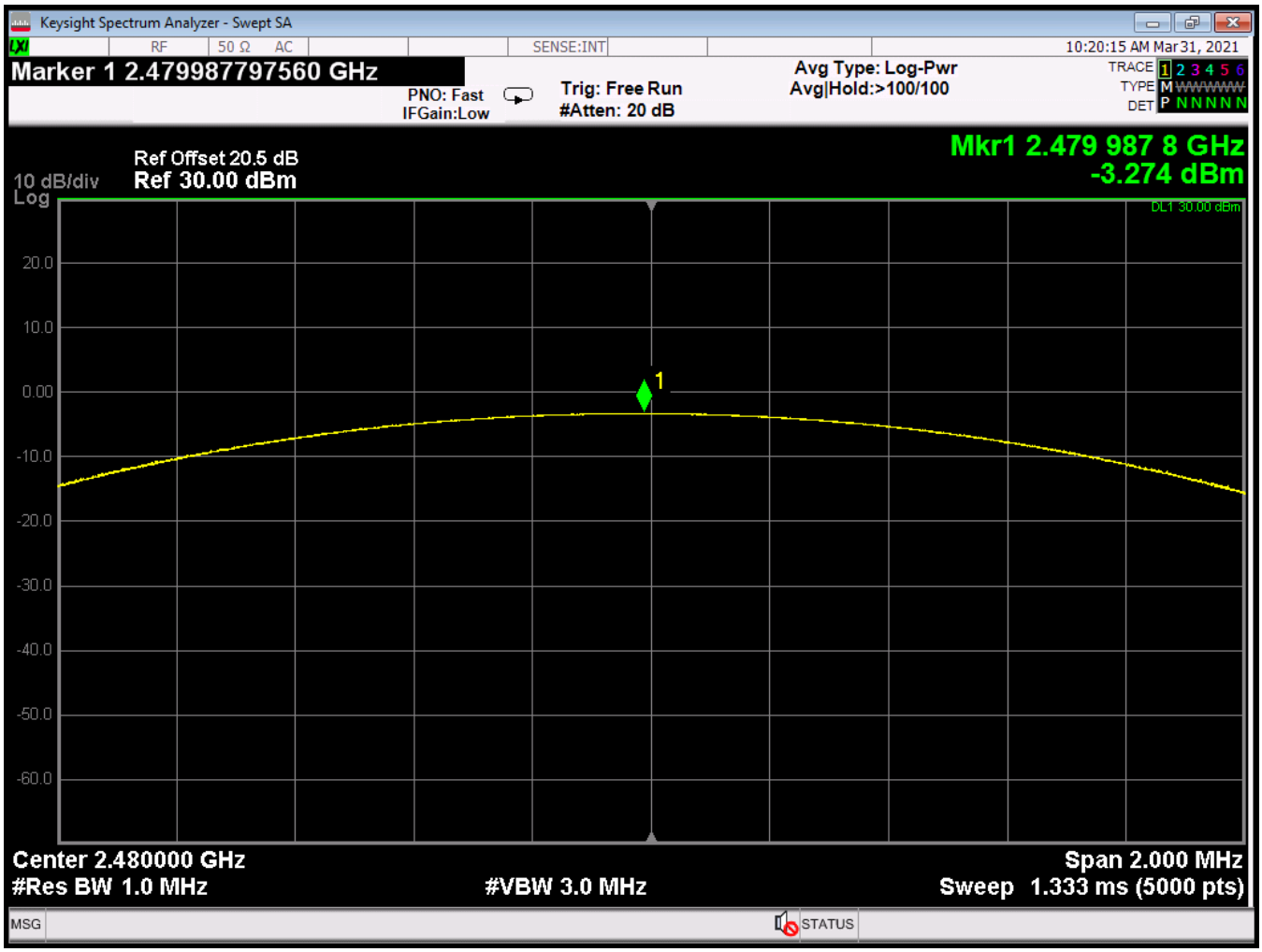


Figure 6: RF Peak Power, High Channel



4.3 Power Spectral Density

Measurements for power spectral density (PSD) were taken at the antenna port in accordance with ANSI C63.10. The spectrum analyzer was set to peak detect mode with a RBW of 3 kHz ,and a VBW setting of 10 kHz. The span was set to 1.5 X the DTS bandwidth, for each channel. The trace sweep time was set to auto.

4.3.1 Measurement Method

ANSI C63.10 SECTION 11.10 "Maximum power spectral density level in the fundamental emission subsection 11.10.2 "Method PKPSD (peak PSD)".

The highest level detected across any 3 kHz band for continuous transmission was then recorded and compared to the limit 8 dBm. The following table and plots give the results for power spectral density testing.

Table 11: Power Spectral Density

Frequency	Peak Level (dBm)	Limit (dBm)	Pass/Fail
Low Channel, 2402 MHz	-12.989	8	Pass
Center Channel, 2440 MHz	-14.536	8	Pass
High Channel, 2480 MHz	-14.106	8	Pass

Figure 7: Power Spectral Density, Low Channel

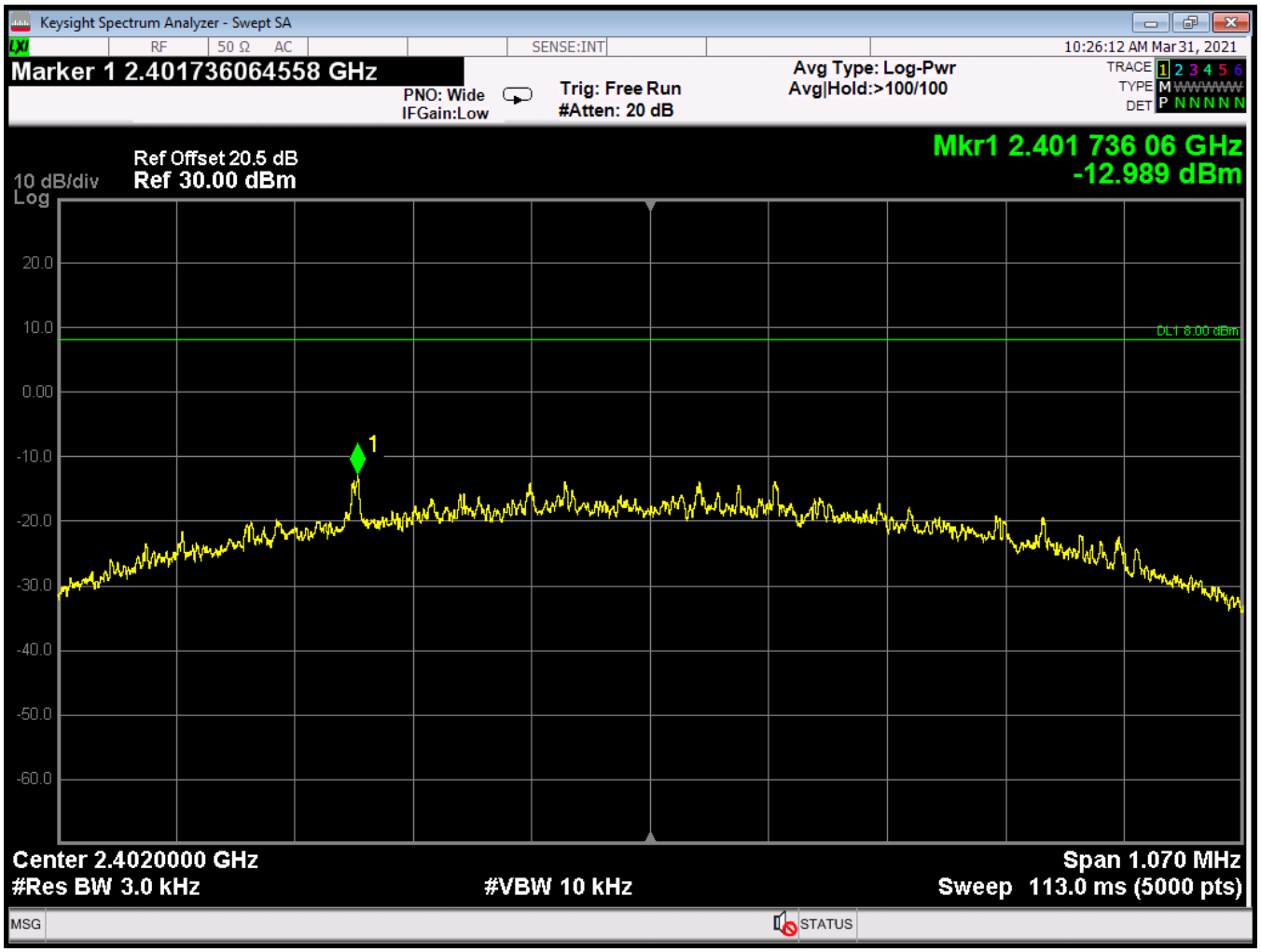


Figure 8: Power Spectral Density, Center Channel

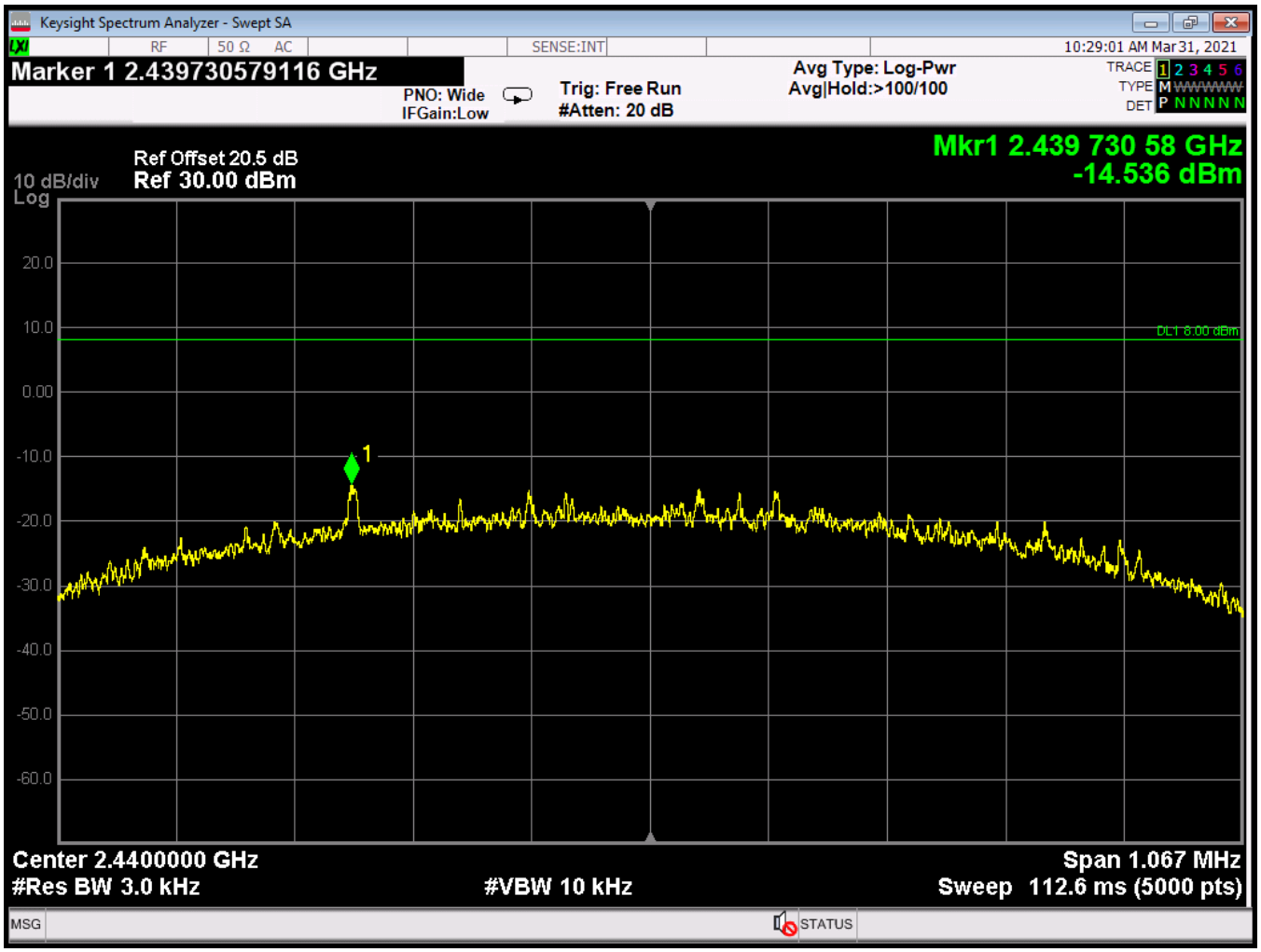
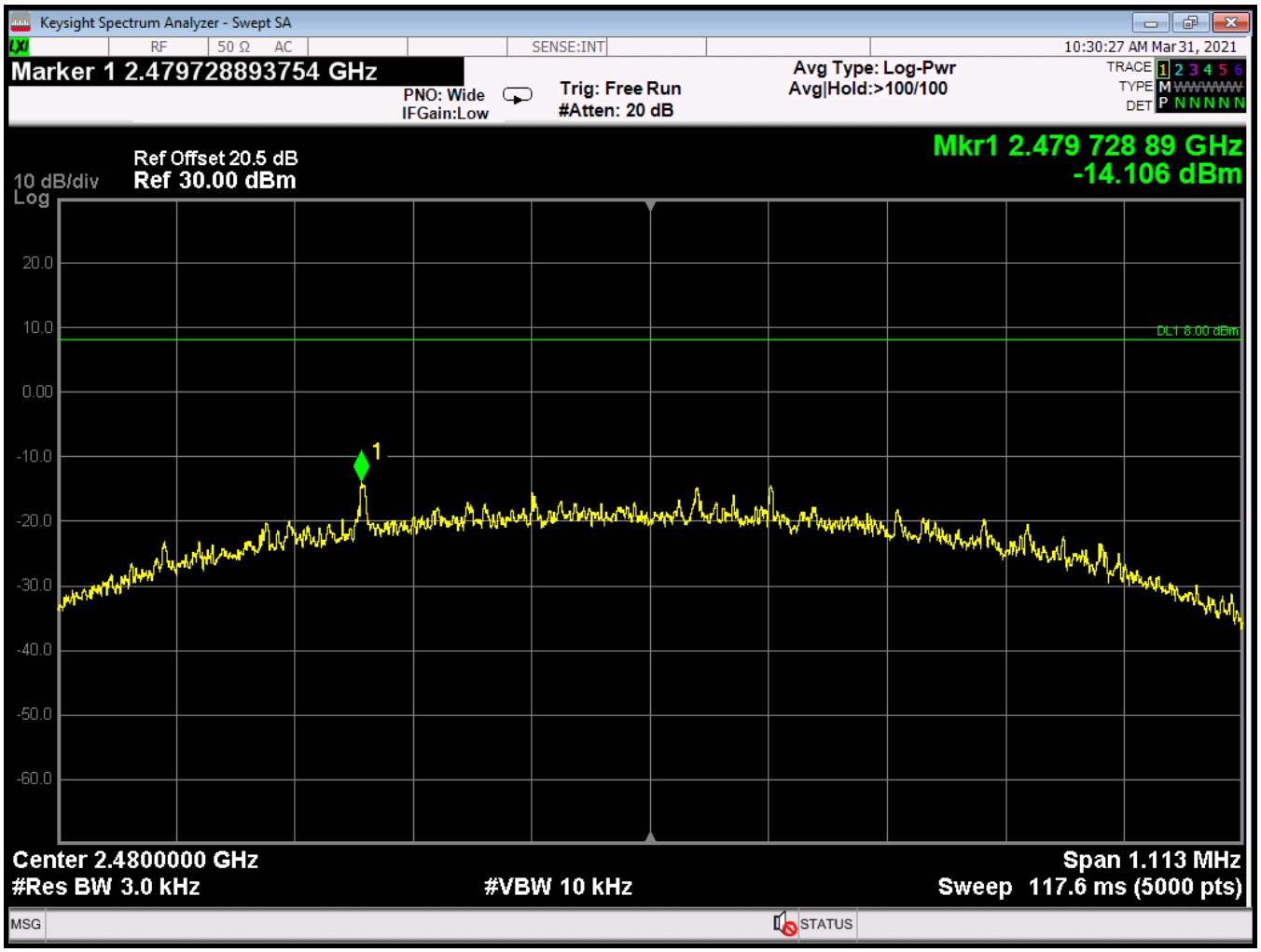


Figure 9: Power Spectral Density, High Channel



4.4 Conducted Band Edge Compliance

In accordance with FCC Public Notice DA-00-705 close-up plots of the low cannel, and of the high channel, with respect to the nearest authorized band-edge, are provided below.

4.4.1 Measurement Method

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Table 12: Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
100 kHz	300 kHz

Table 13: Band Edge Test Results

Frequency	Band Edge (dBc)	Minimum (dBc)	Pass/Fail
Low Channel, 2402 MHz	42.8	20	Pass
High Channel, 2480 MHz	46.5	20	Pass

Figure 10: Low Channel, Lower Band-Edge

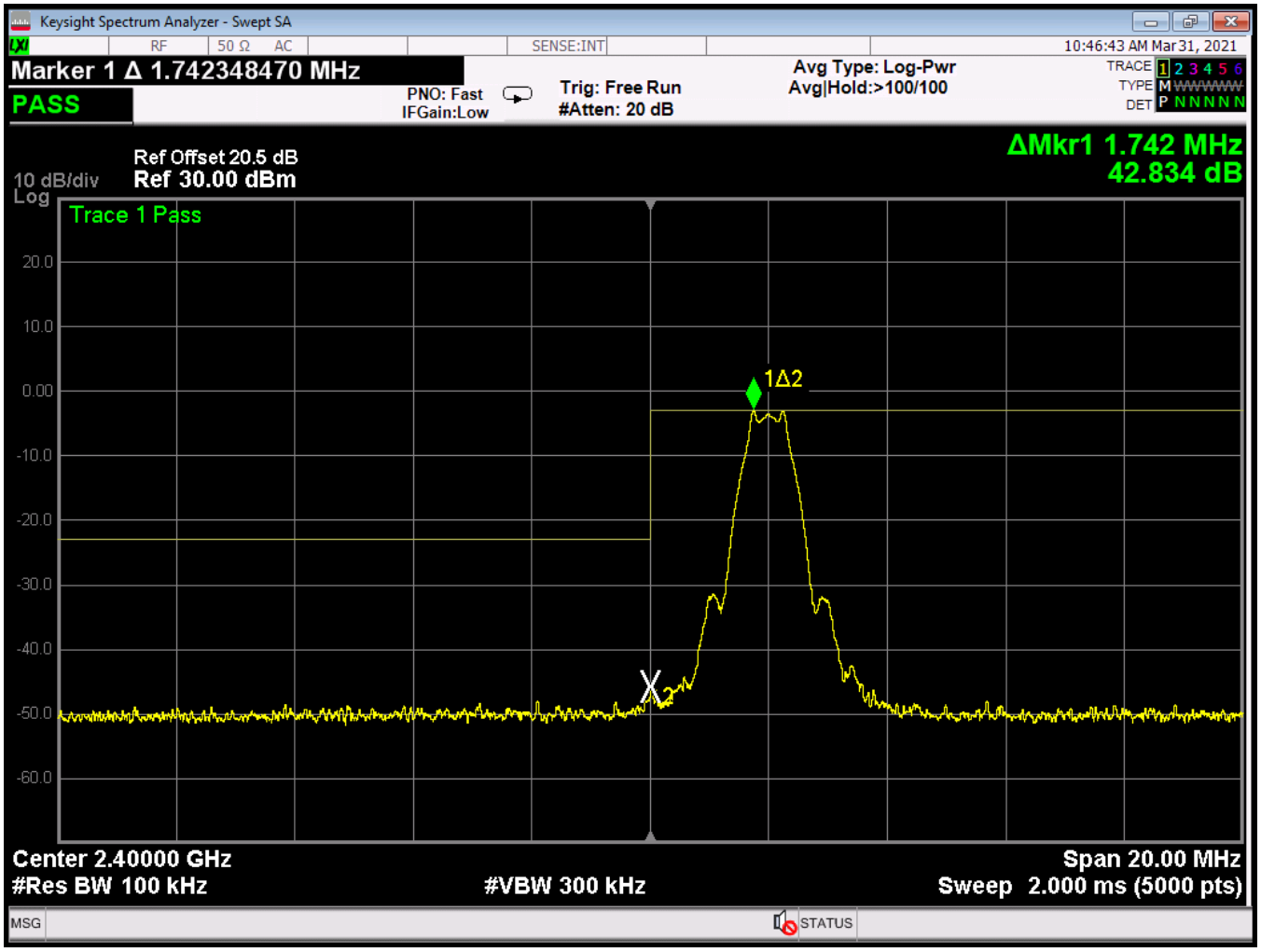
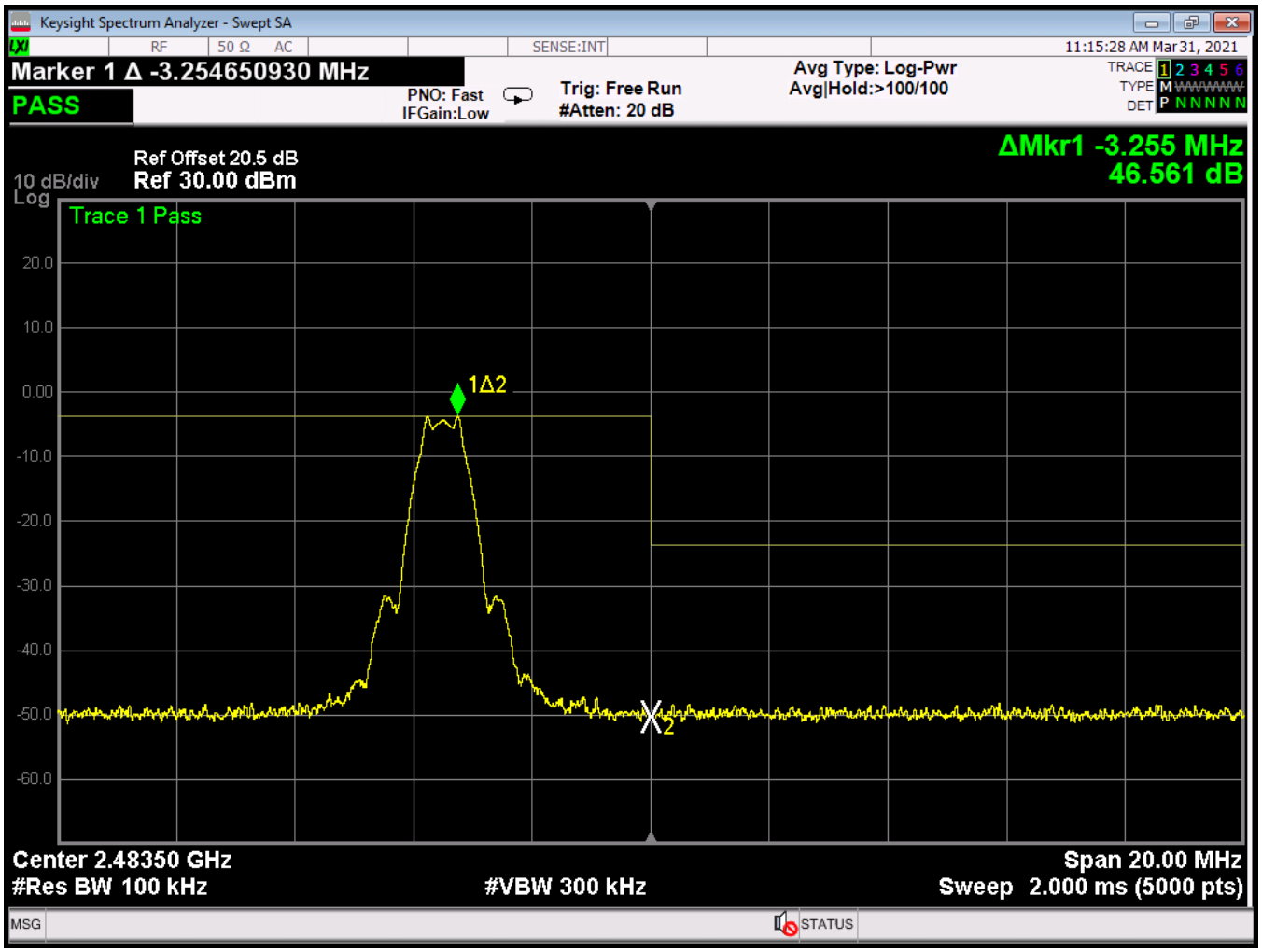


Figure 11: High Channel, Upper Band-Edge



4.5 Conducted Spurious Emissions Compliance

The EUT must comply with the requirements for spurious emissions. Per §15.247(d) all spurious emissions, in any 100 kHz bandwidth, outside the frequency band in which the hybrid spread-spectrum device is operating, shall be attenuated 20 dB below the highest power level of the desired signal.

Per ANSI C63.10 section 11.11 "Emissions in non-restricted frequency bands", this test may be performed at the antenna port, in an RF conducted manner. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 300 kHz. The amplitude of the EUT carrier, for each channel, was measured to determine the emissions limit (20 dB below the carrier frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

The limits for spurious emissions, outside of the frequency band of 2400 to 2483.5, were determined for each of the EUT's channels (low, center, and high).

In addition, RSS-GEN Section 7.4 requires that the spurious emissions from the receiver, at any discrete frequency, (measured at the antenna port by the antenna-conducted method) shall not exceed 2 nW in the frequency range 30 to 1000 MHz and 5 nW above 1 GHz.

4.5.1 Test Summary

The EUT complied with the requirements for Spurious Emissions at the antenna port.

Figure 12 through Figure 29 provide the conducted Transmitter Spurious (unwanted) Emissions test data, for all three channels.

Figure 30 through Figure 35 provide the conducted Receiver Spurious (unwanted) Emissions test data.

Figure 12: Low Channel Conducted Spurious Plot 1

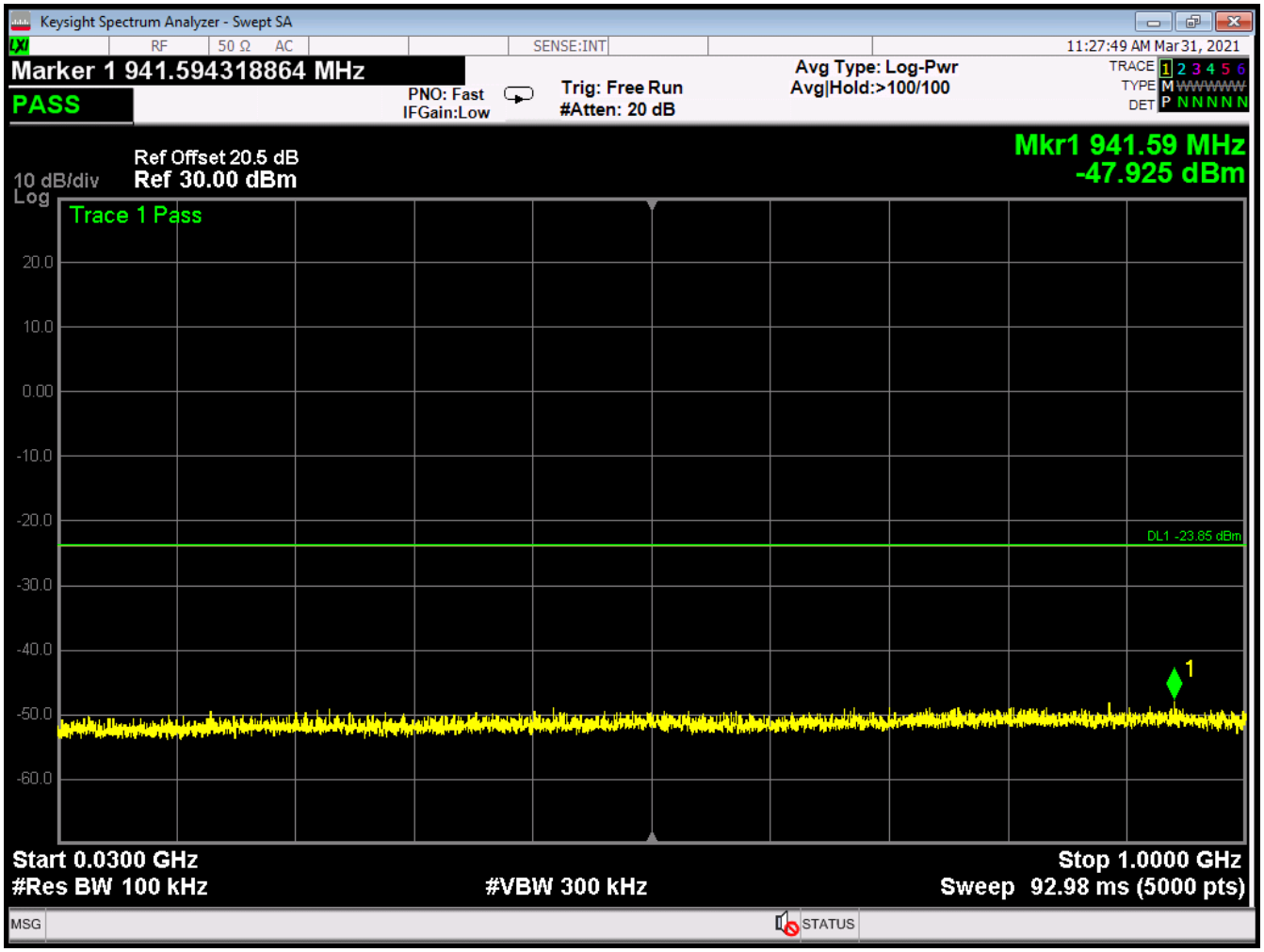


Figure 13: Low Channel Conducted Spurious Plot 2

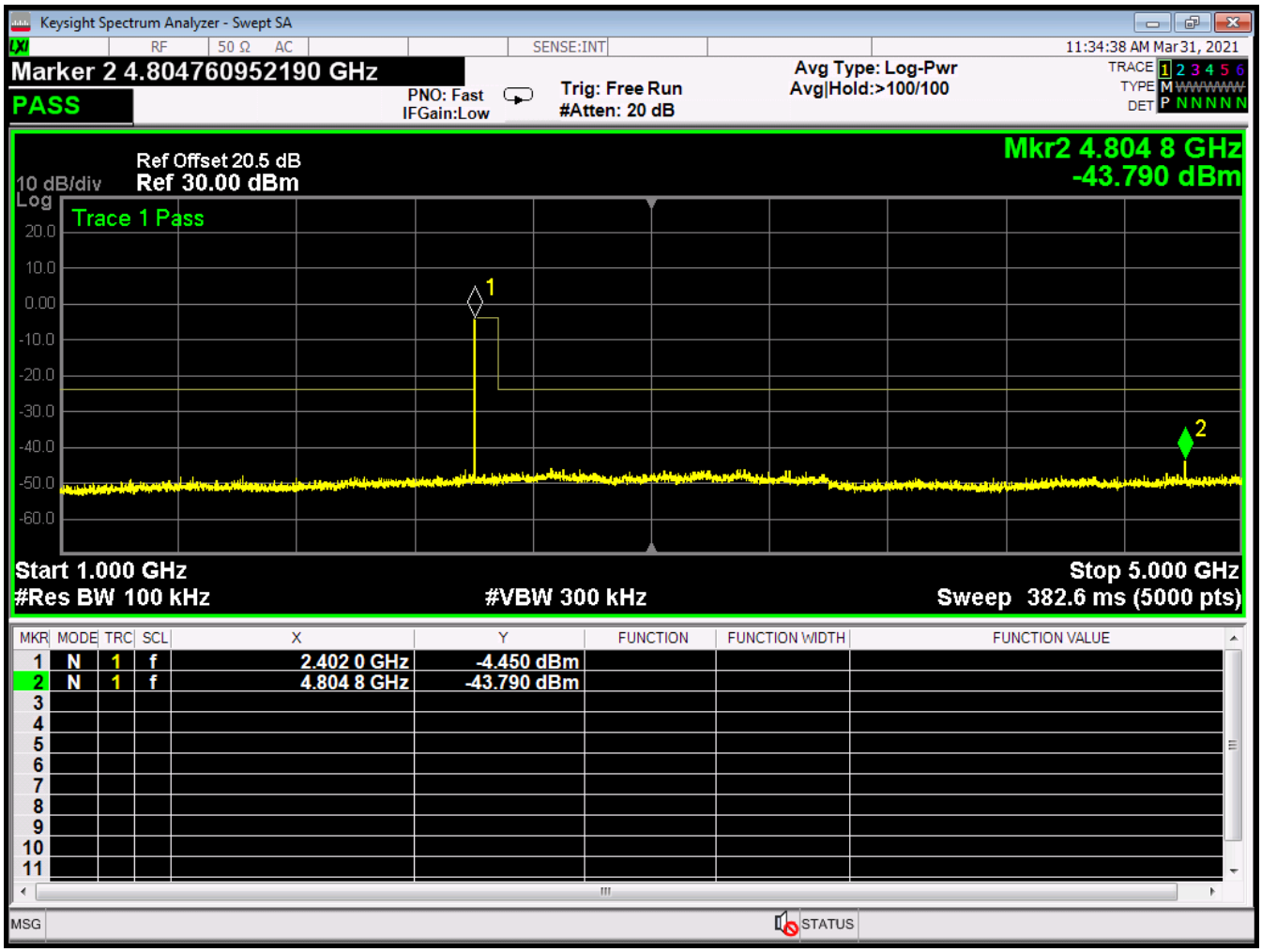


Figure 14: Low Channel Conducted Spurious Plot 3

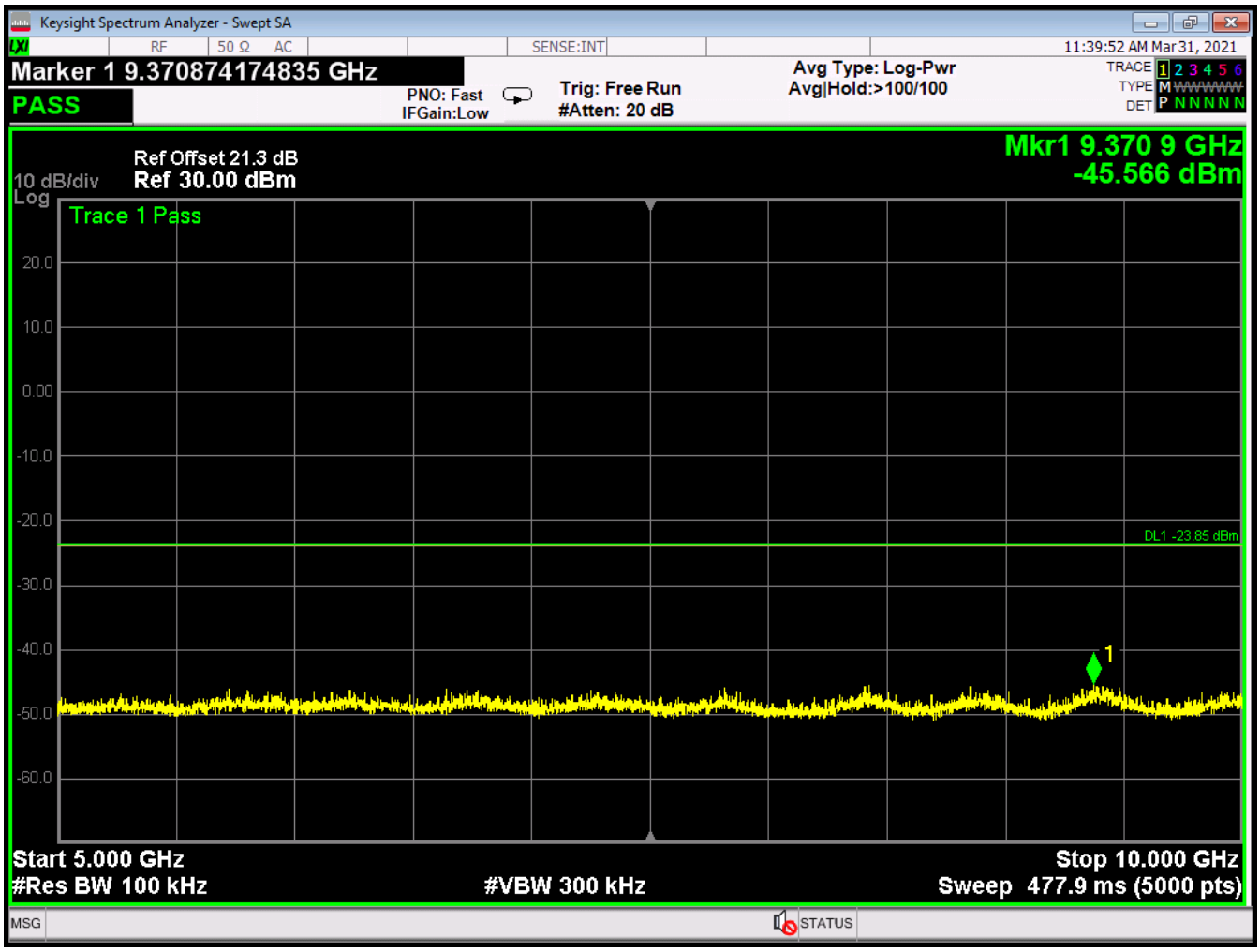


Figure 15: Low Channel Conducted Spurious Plot 4

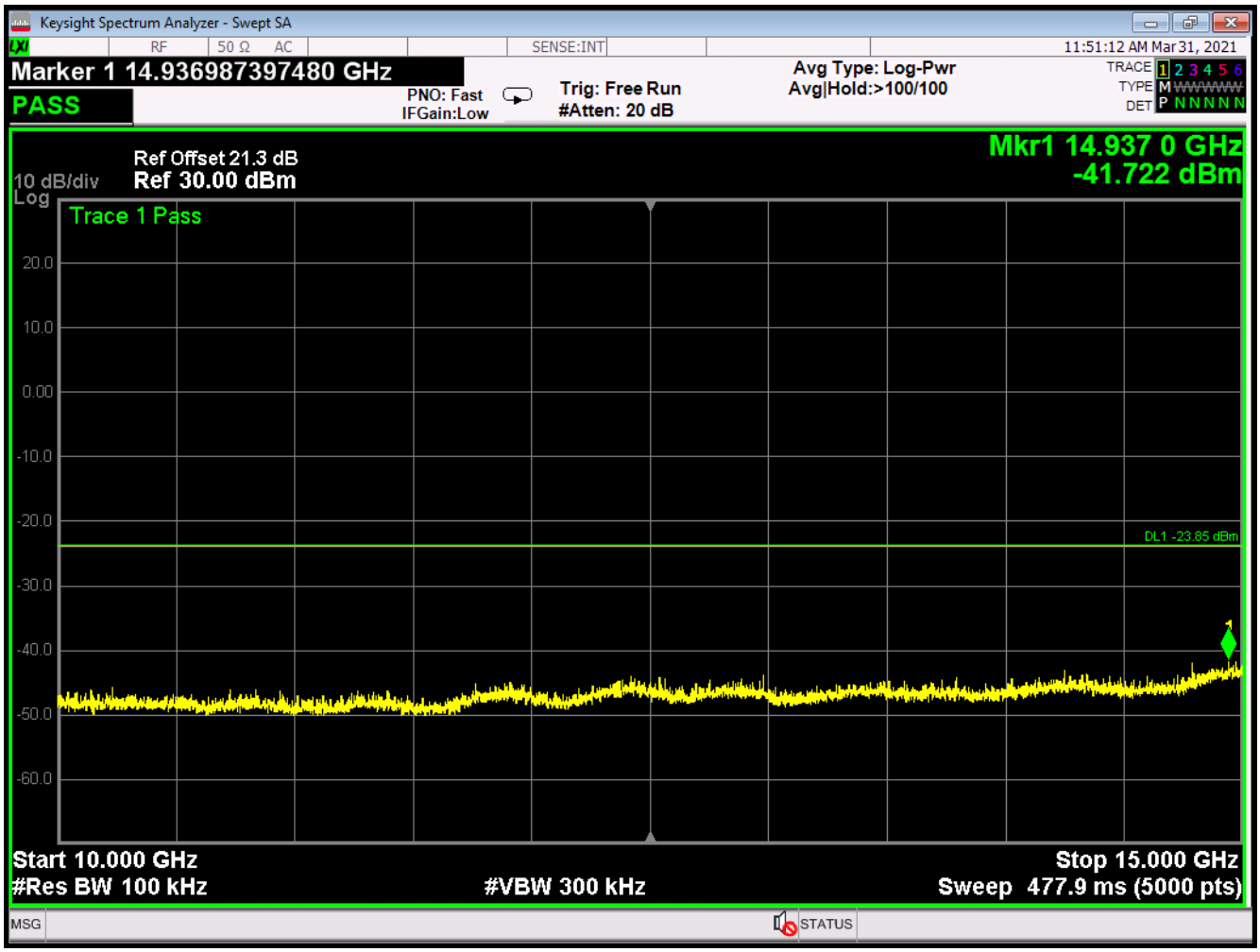


Figure 16: Low Channel Conducted Spurious Plot 5

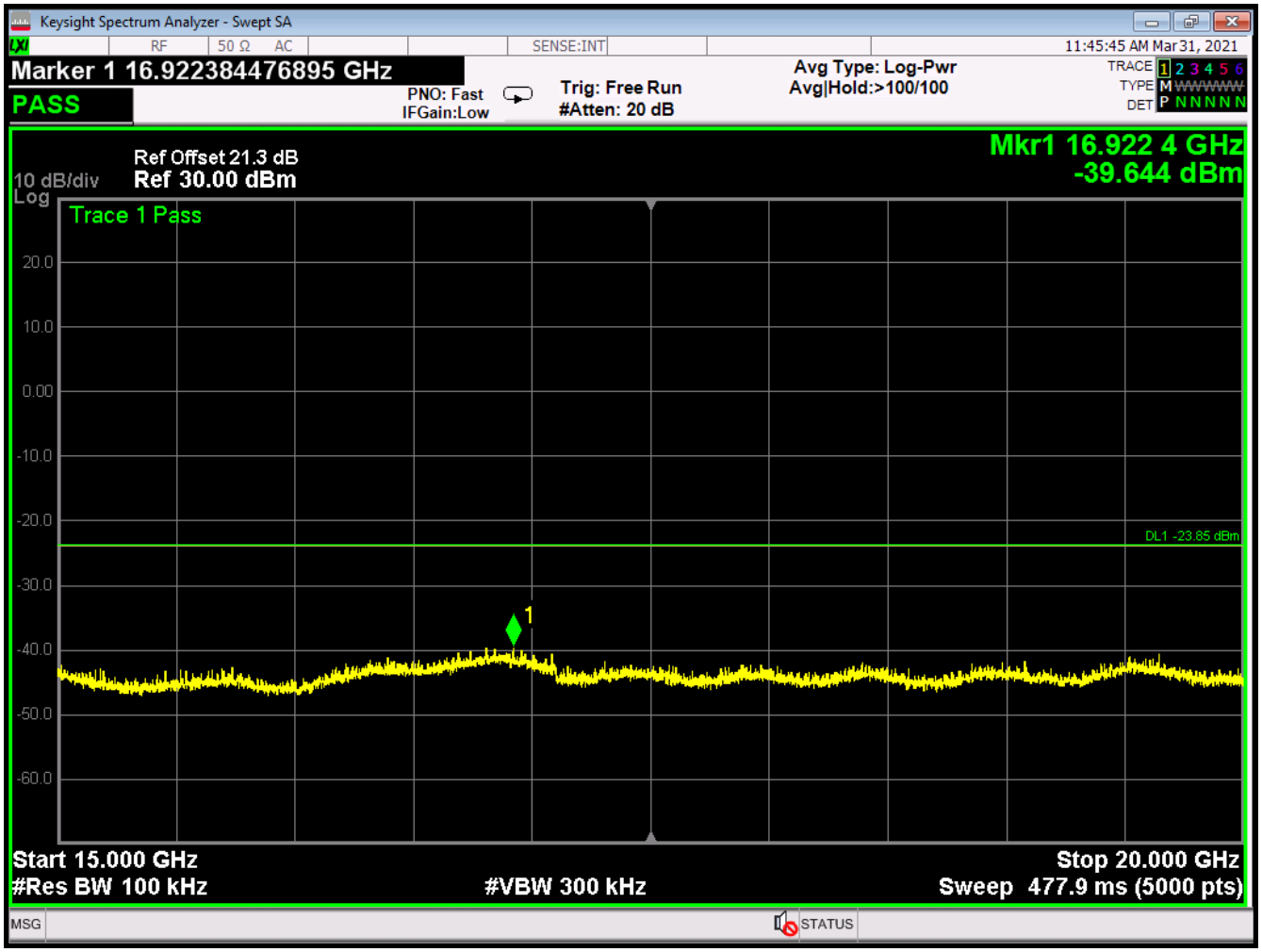


Figure 17: Low Channel Conducted Spurious Plot 6

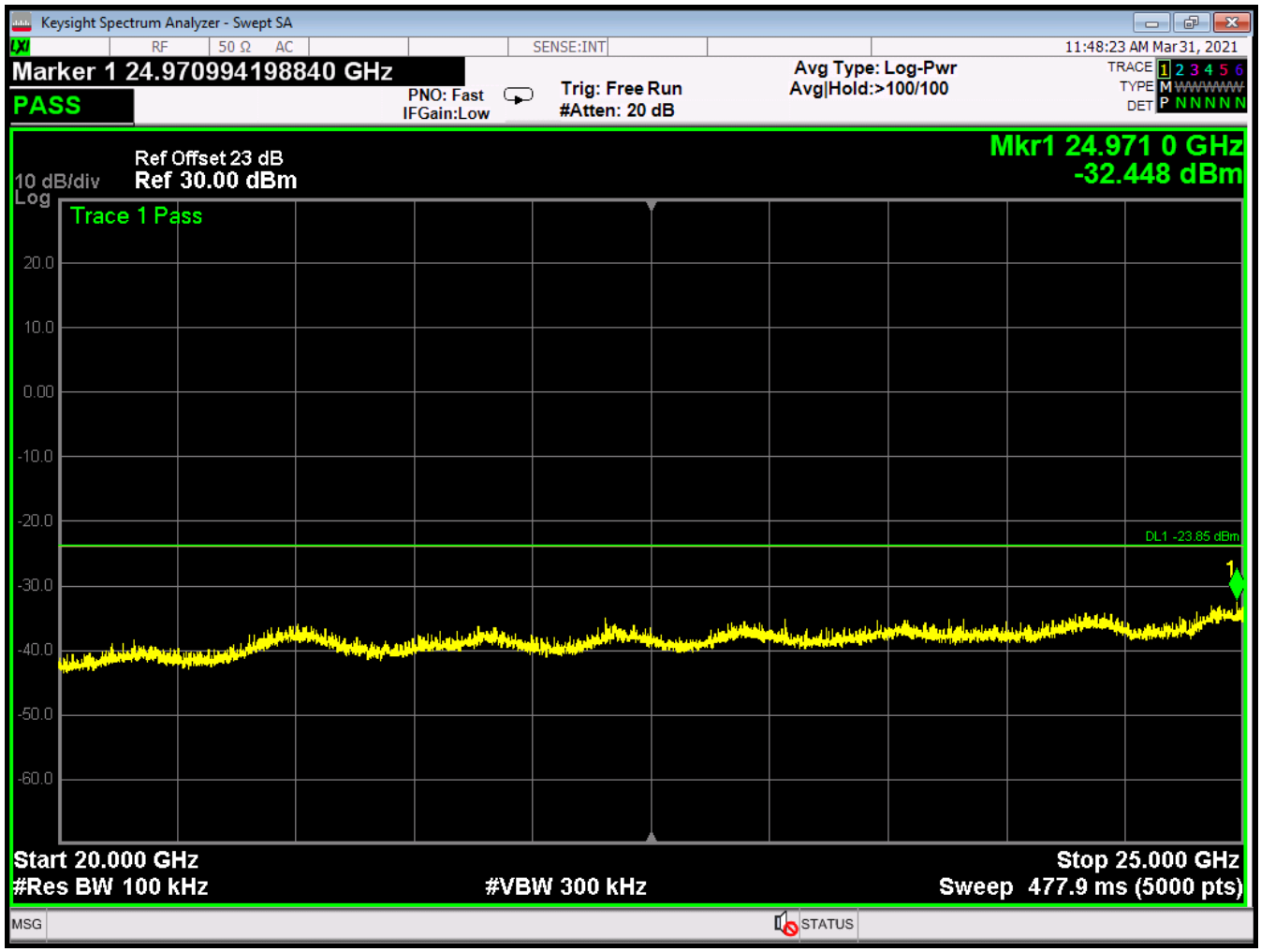


Figure 18: Center Channel Conducted Spurious Plot 1

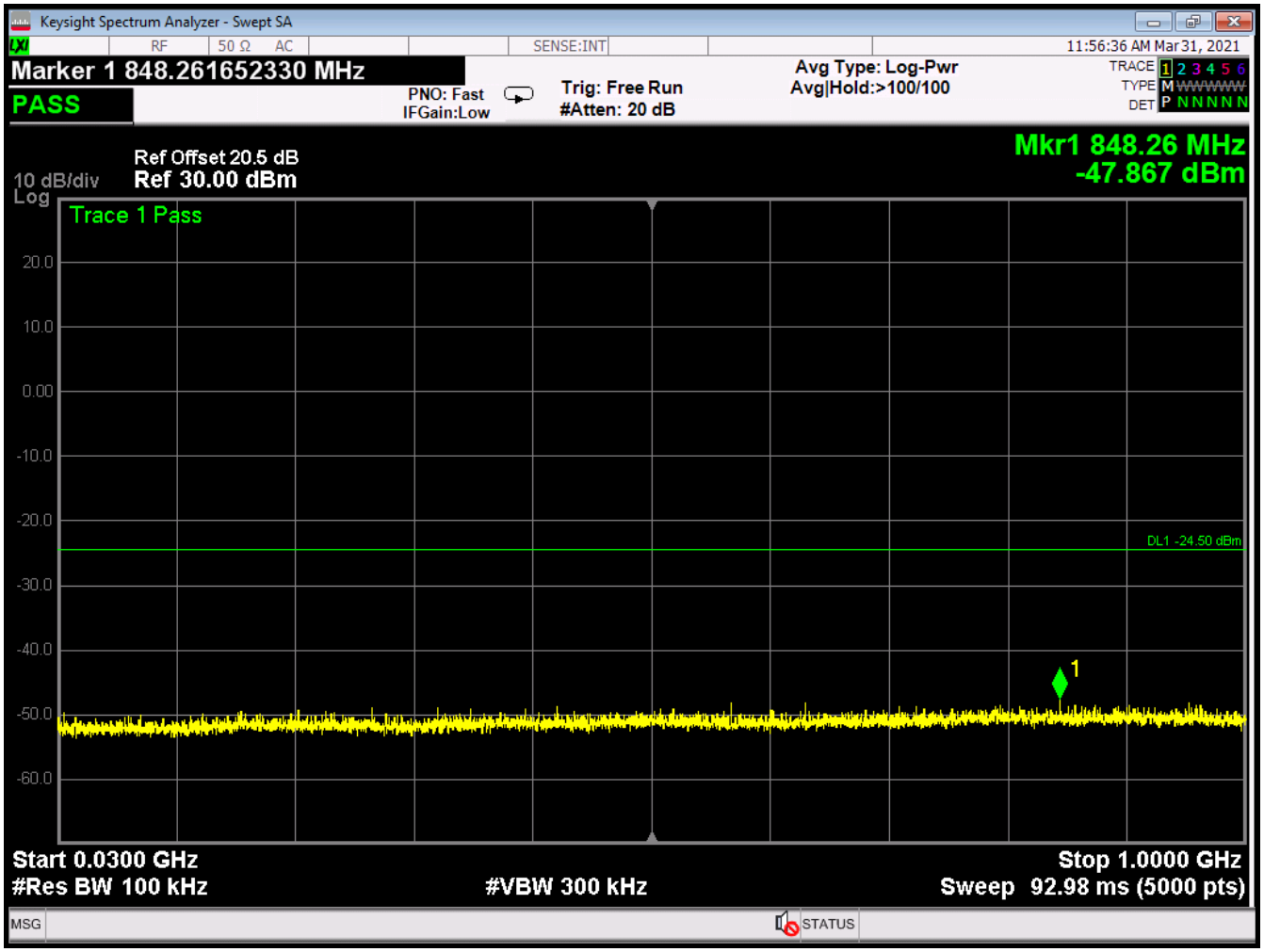


Figure 19: Center Channel Conducted Spurious Plot 2

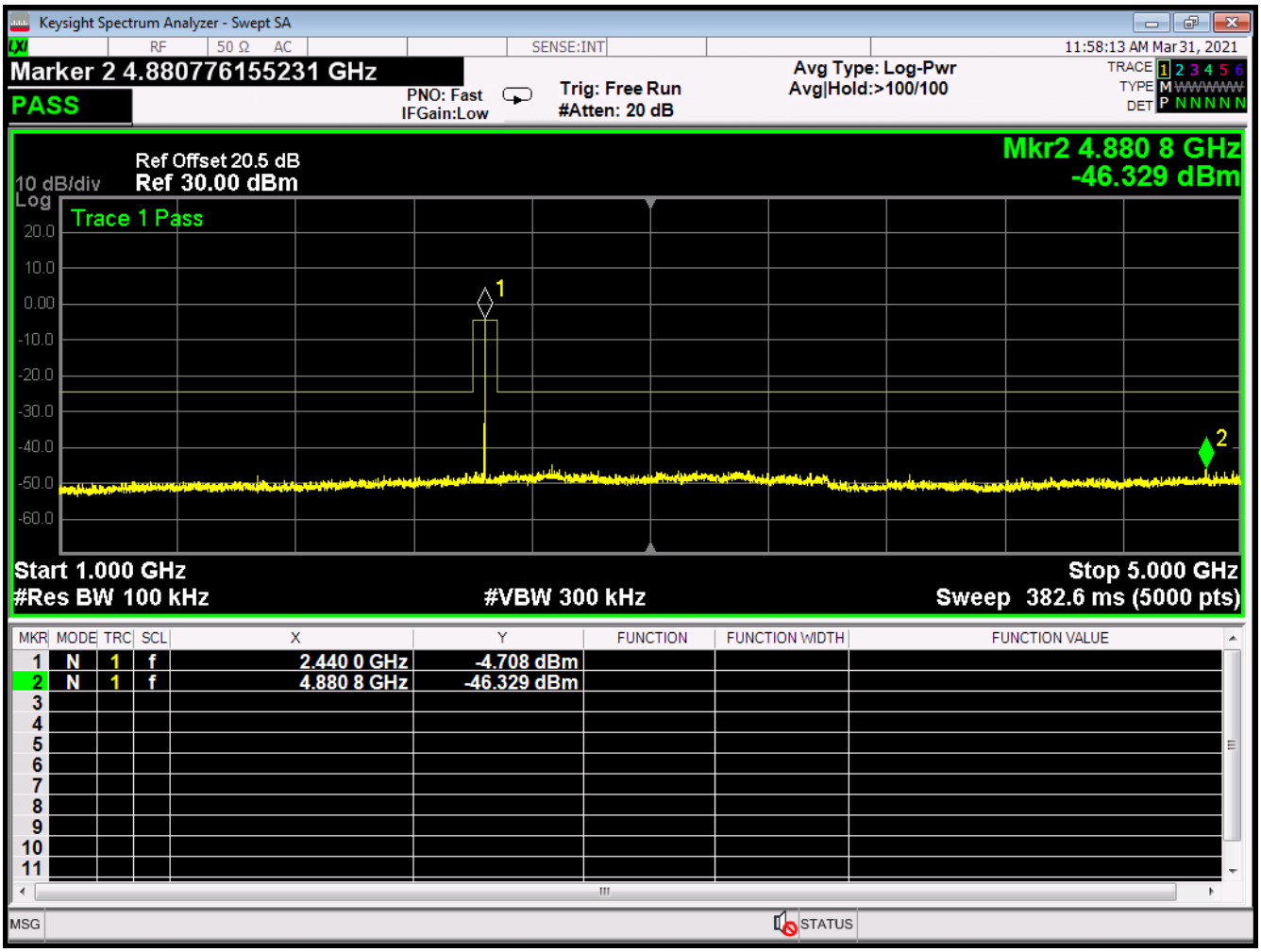


Figure 20: Center Channel Conducted Spurious Plot 3

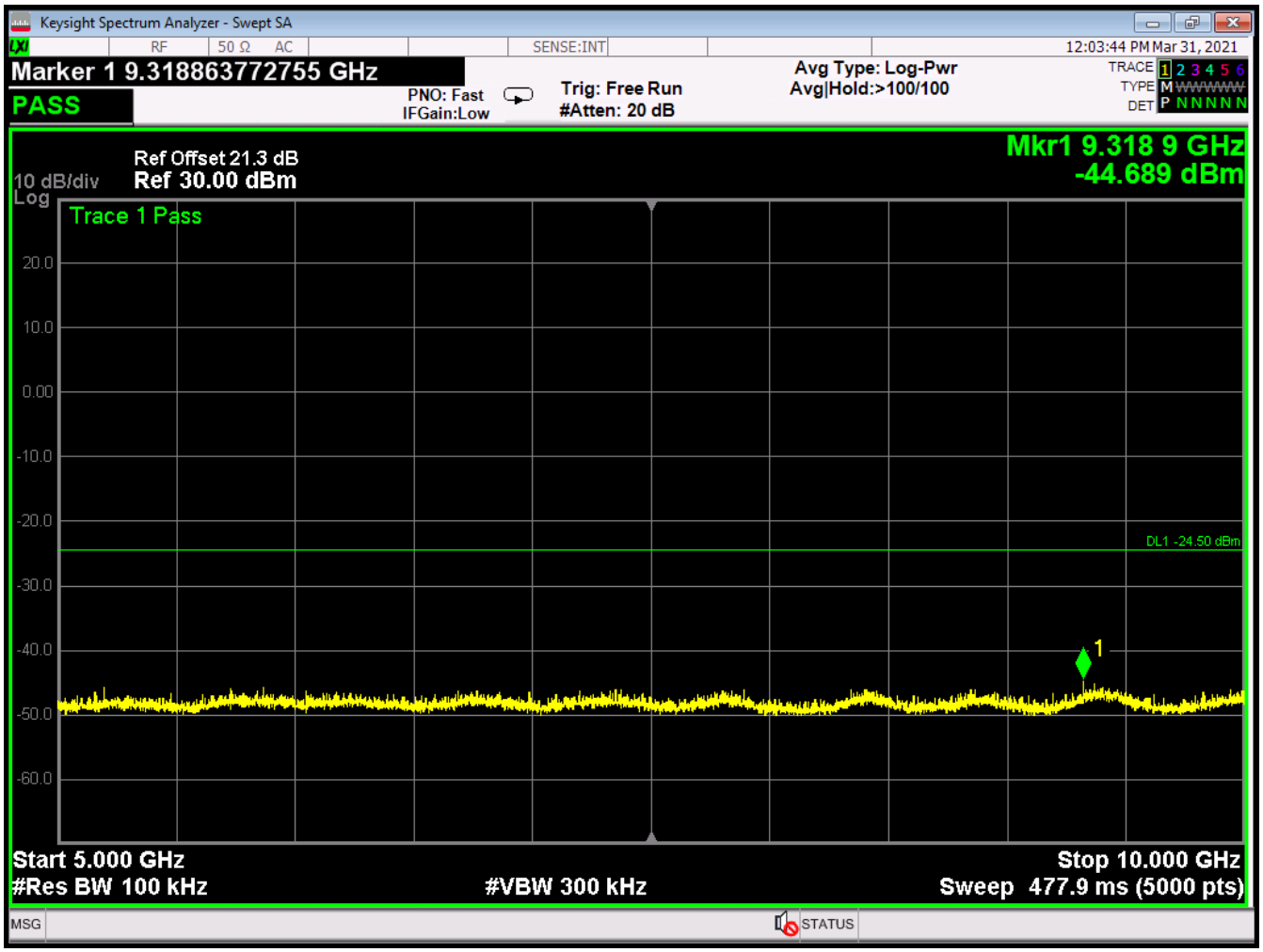


Figure 21: Center Channel Conducted Spurious Plot 4

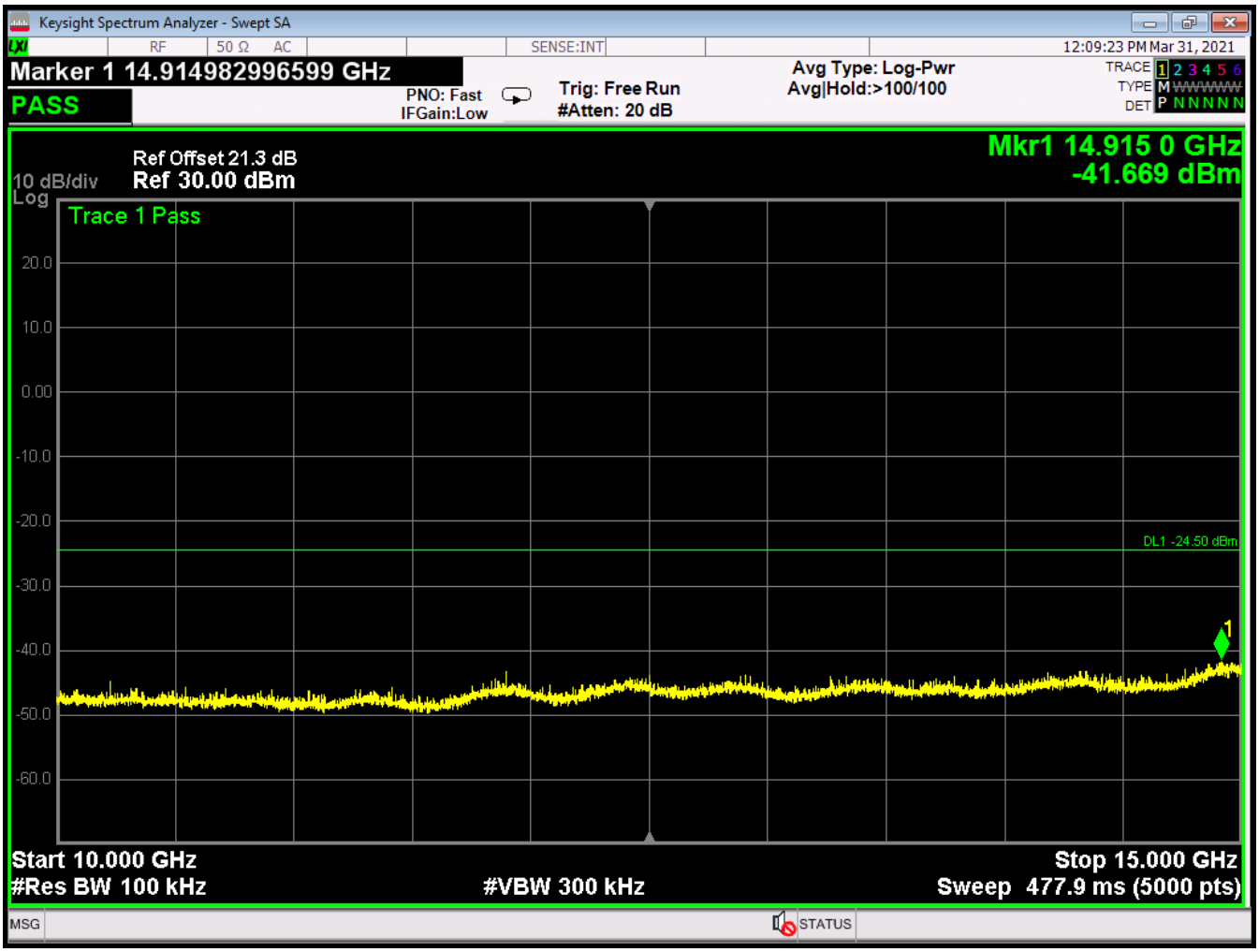


Figure 22: Center Channel Conducted Spurious Plot 5

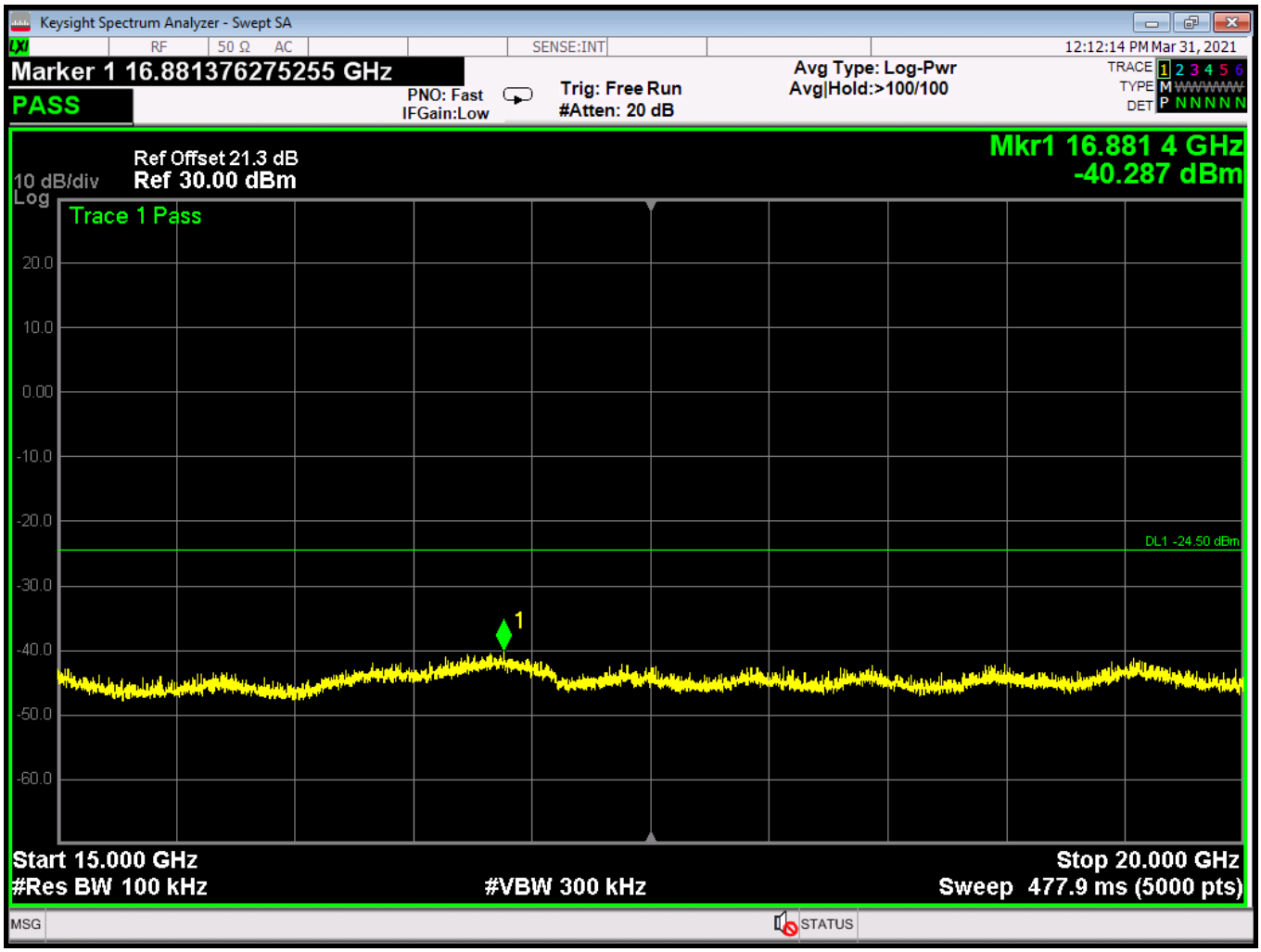


Figure 23: Center Channel Conducted Spurious Plot 6

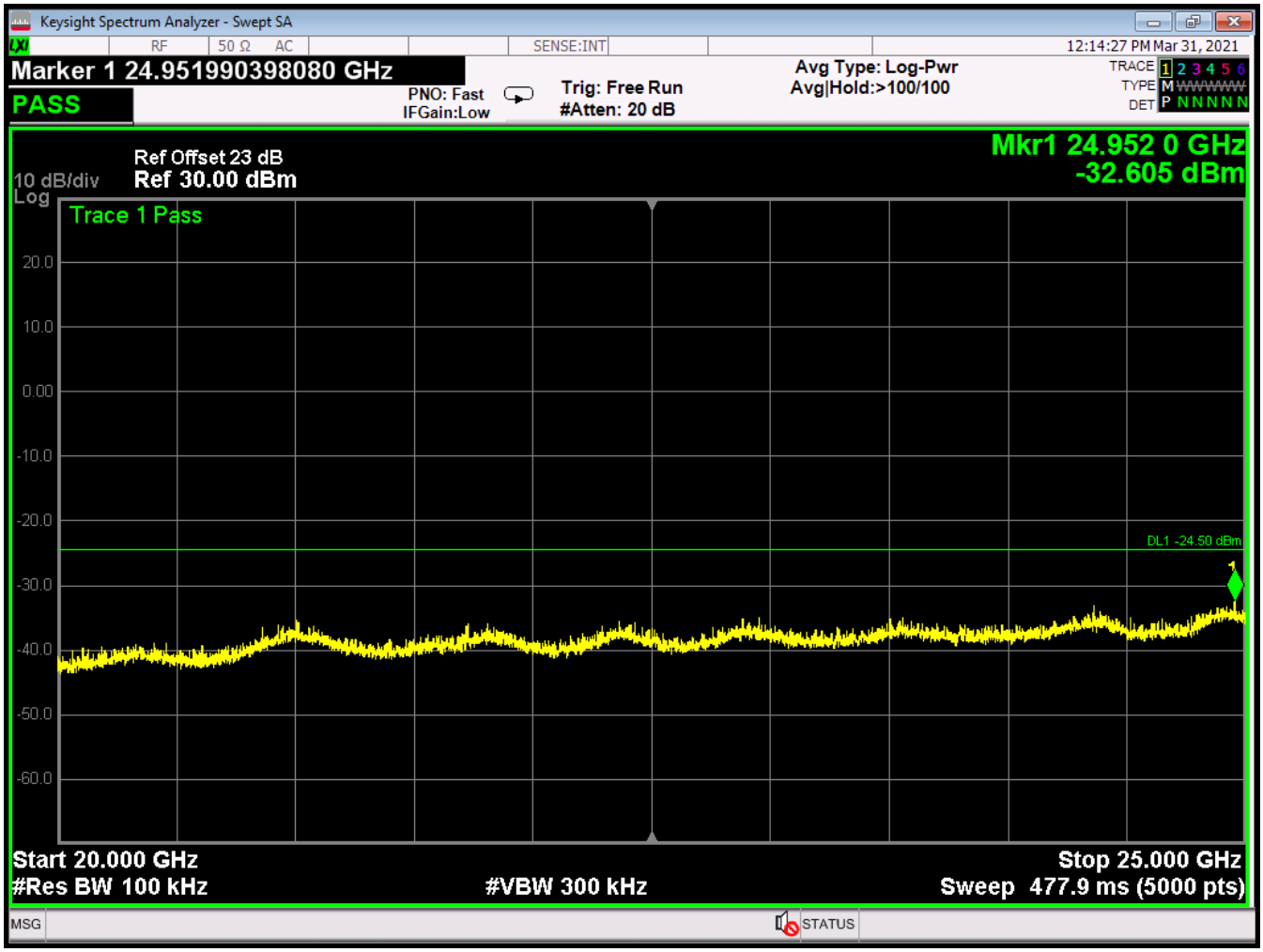


Figure 24: High Channel Conducted Spurious Plot 1

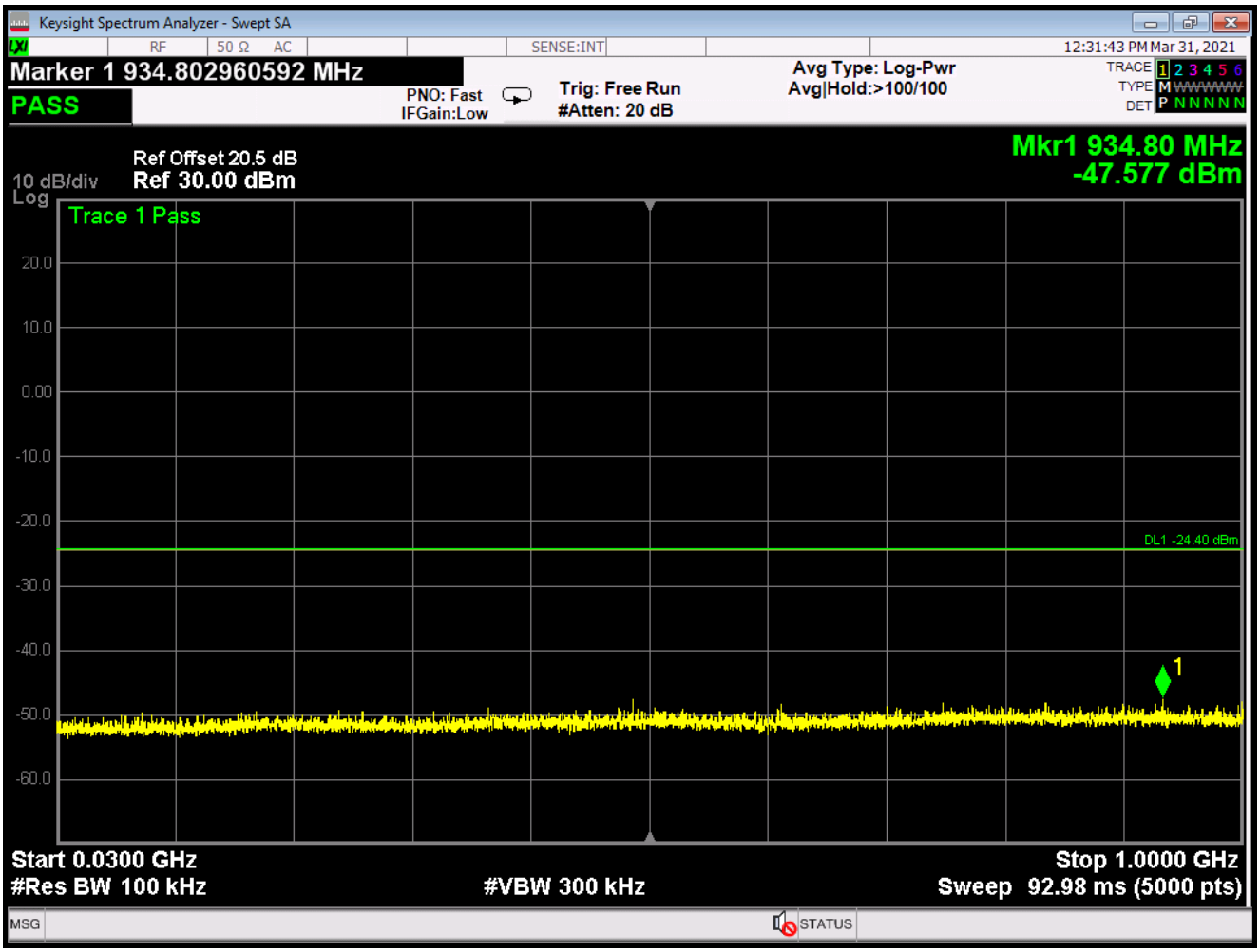


Figure 25: High Channel Conducted Spurious Plot 2

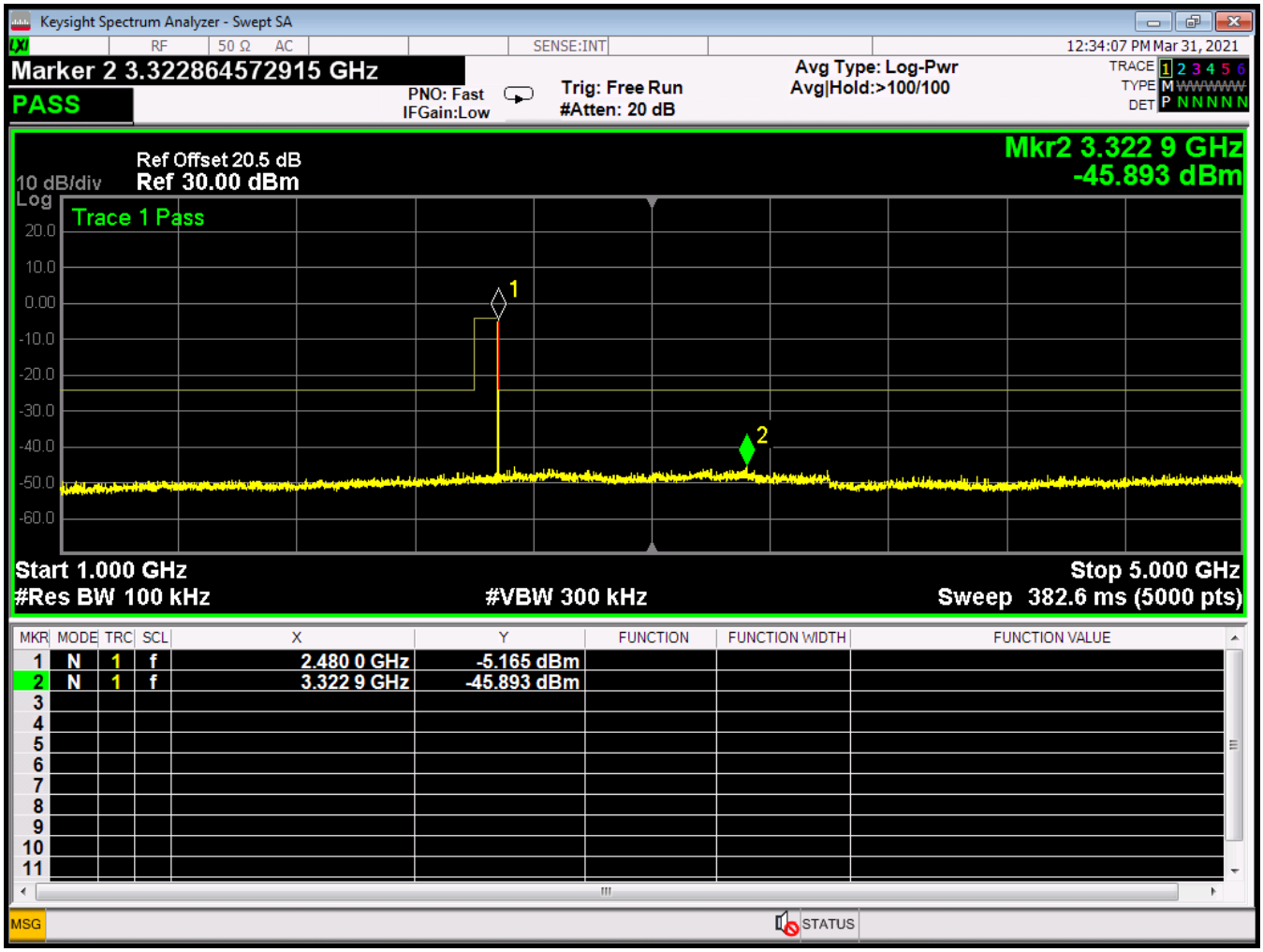


Figure 26: High Channel Conducted Spurious Plot 3

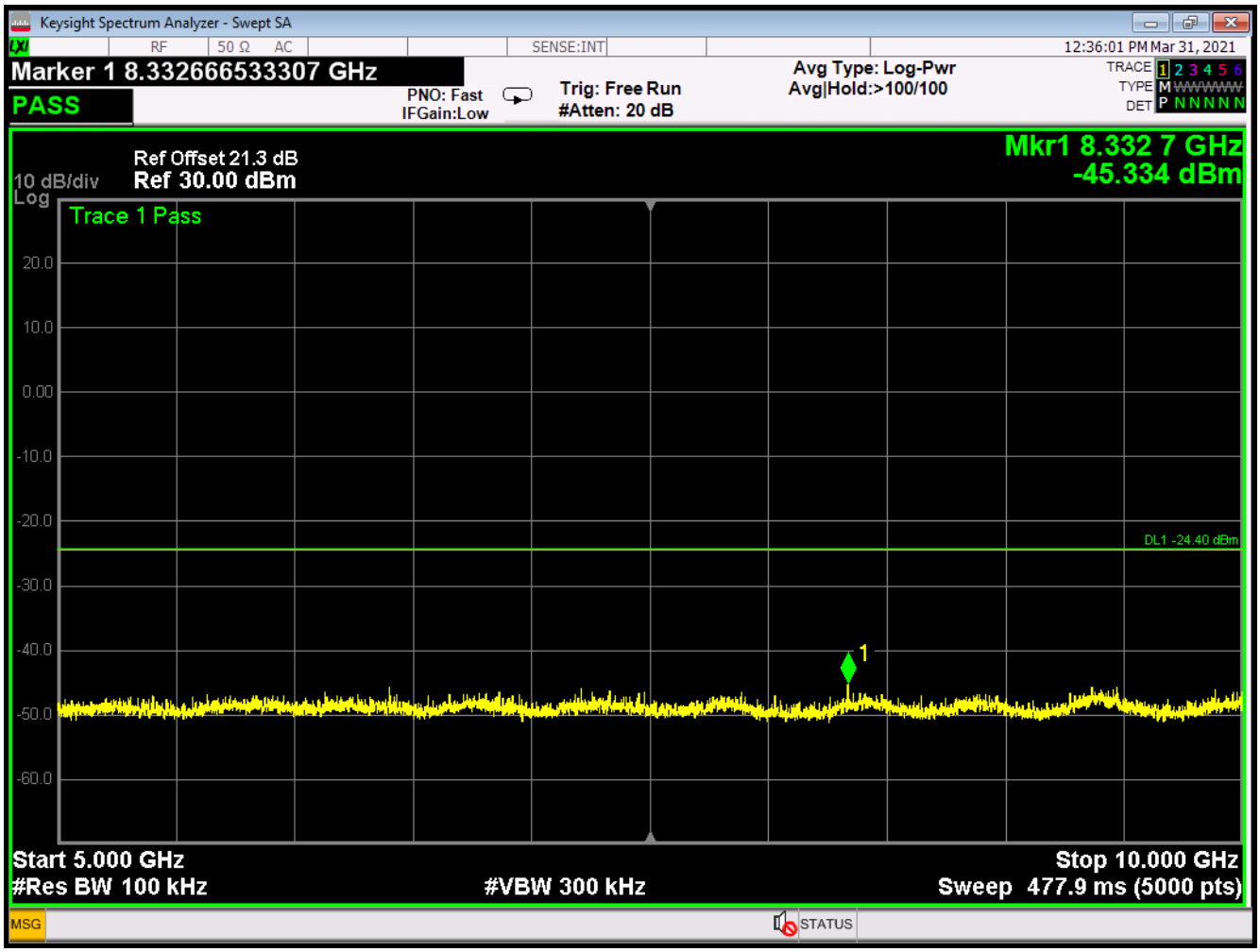


Figure 27: High Channel Conducted Spurious Plot 4

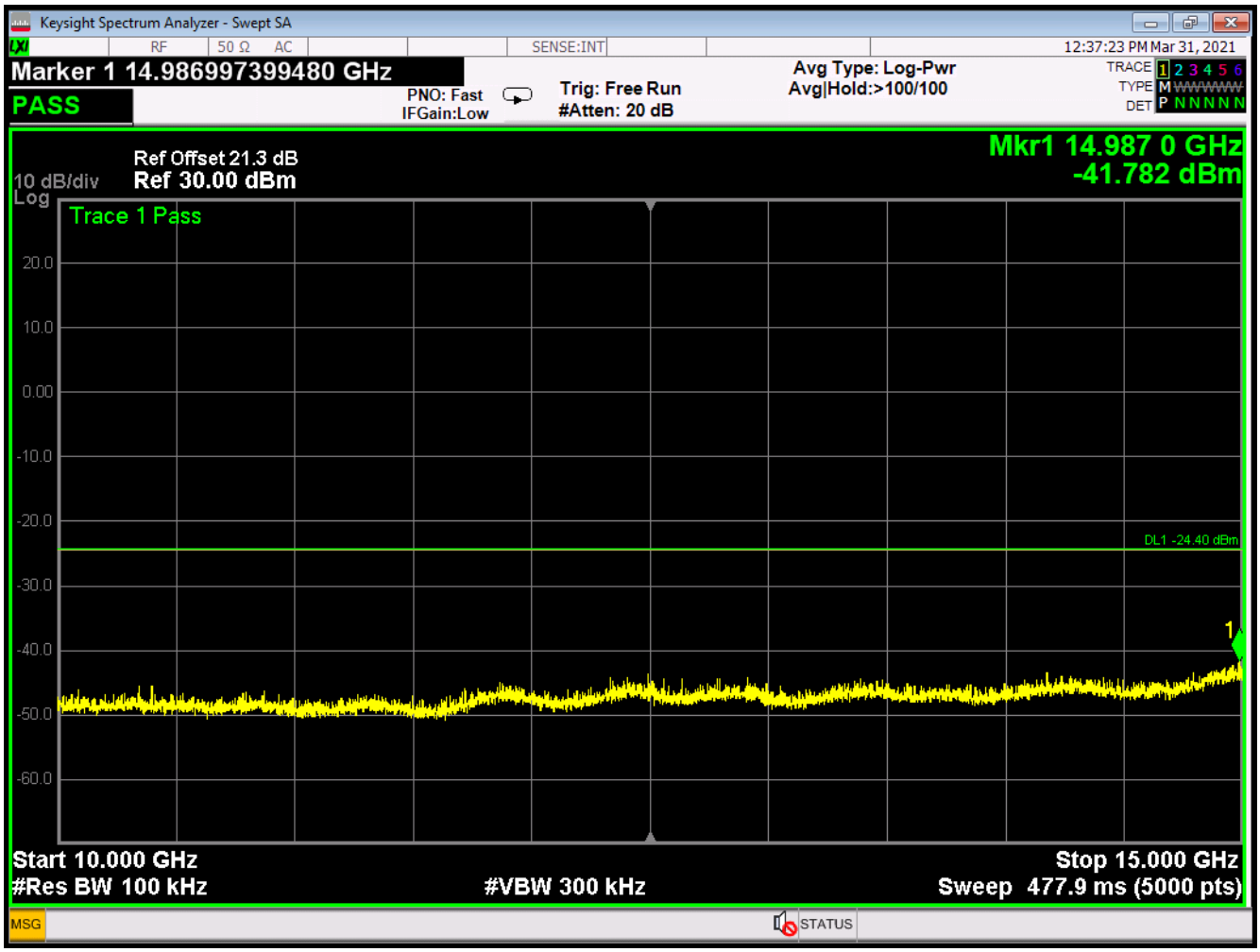


Figure 28: High Channel Conducted Spurious Plot 5

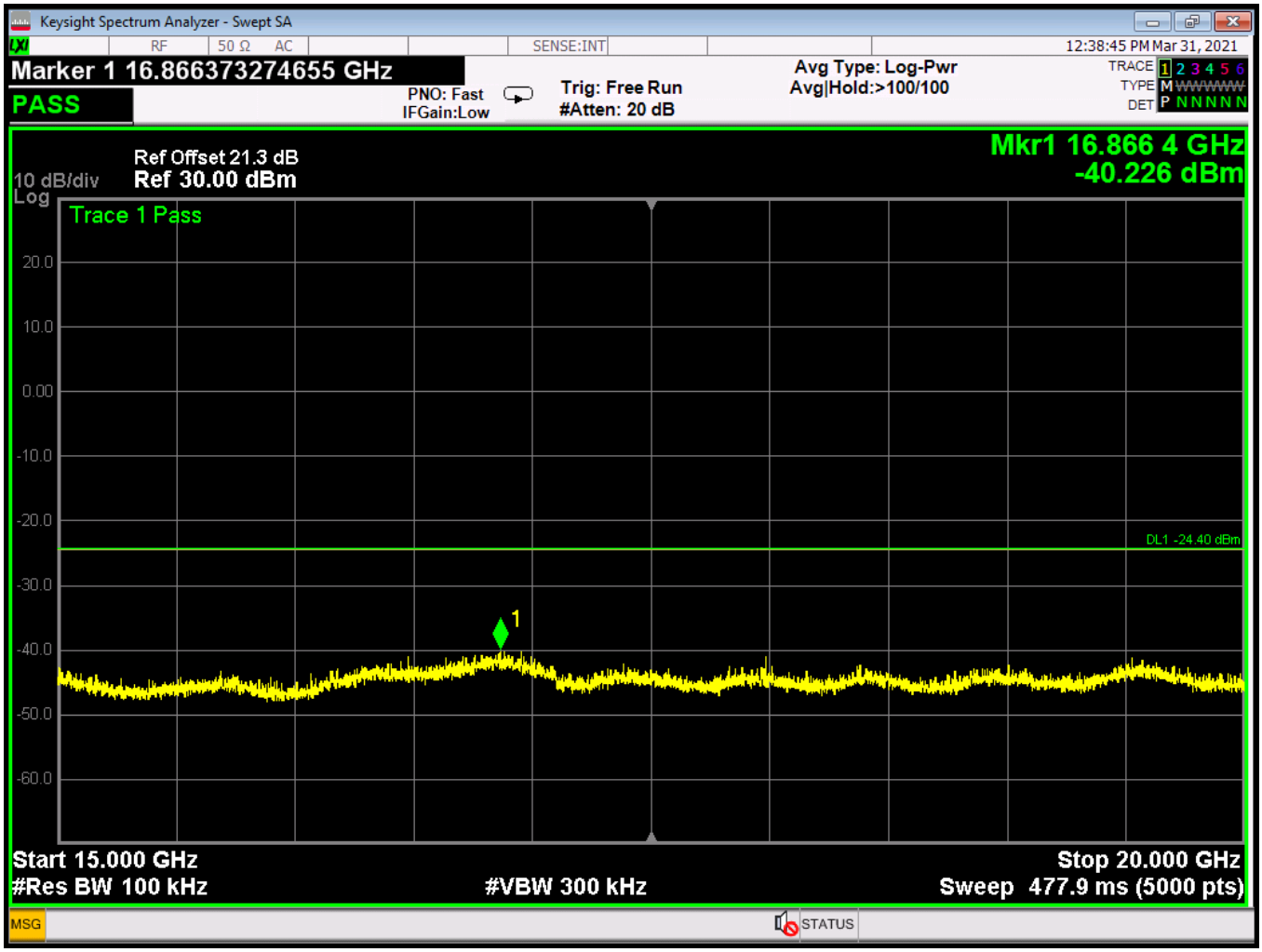


Figure 29: High Channel Conducted Spurious Plot 6

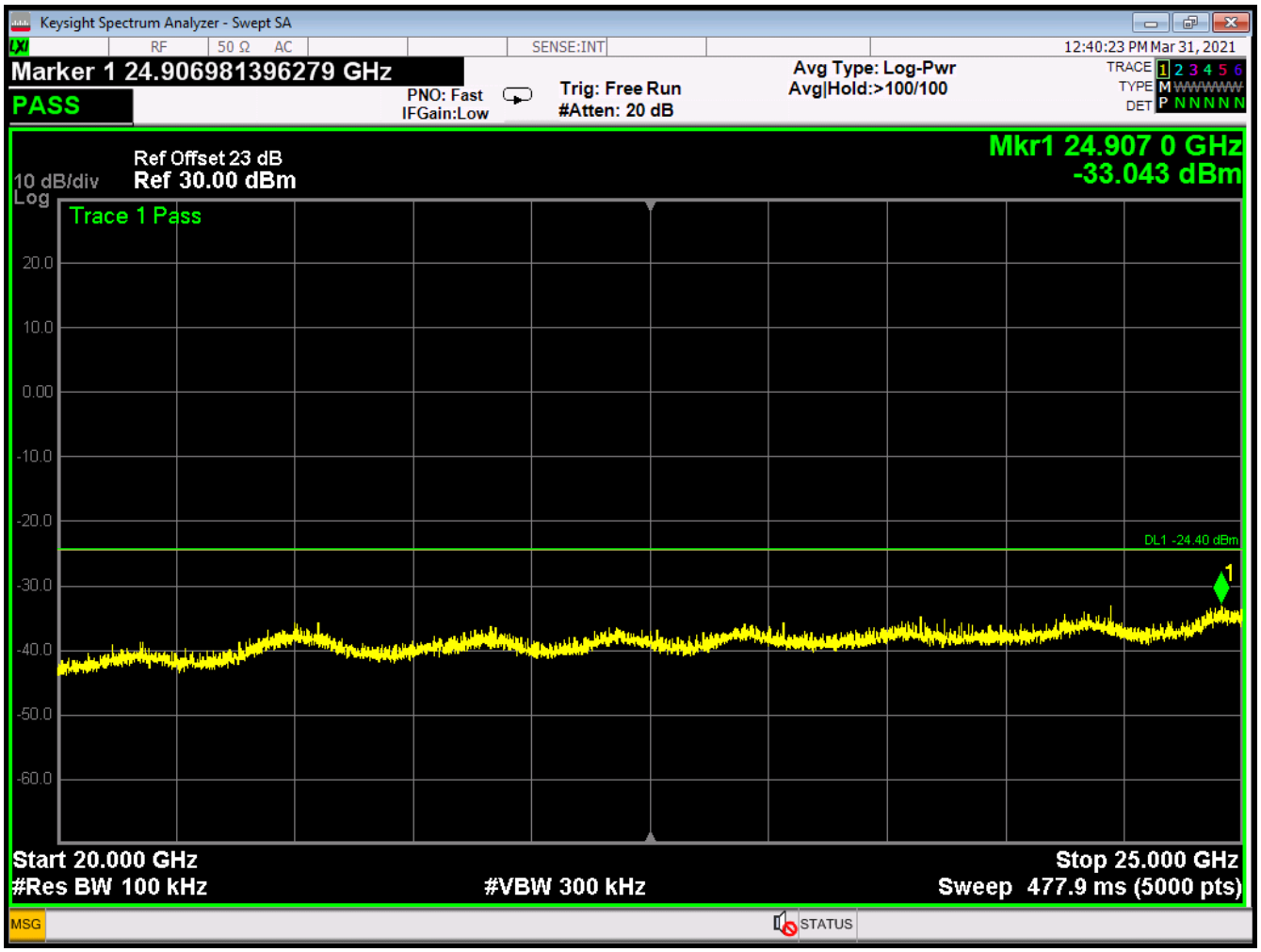


Figure 30: Receive (RX Mode) Conducted Spurious Plot 1

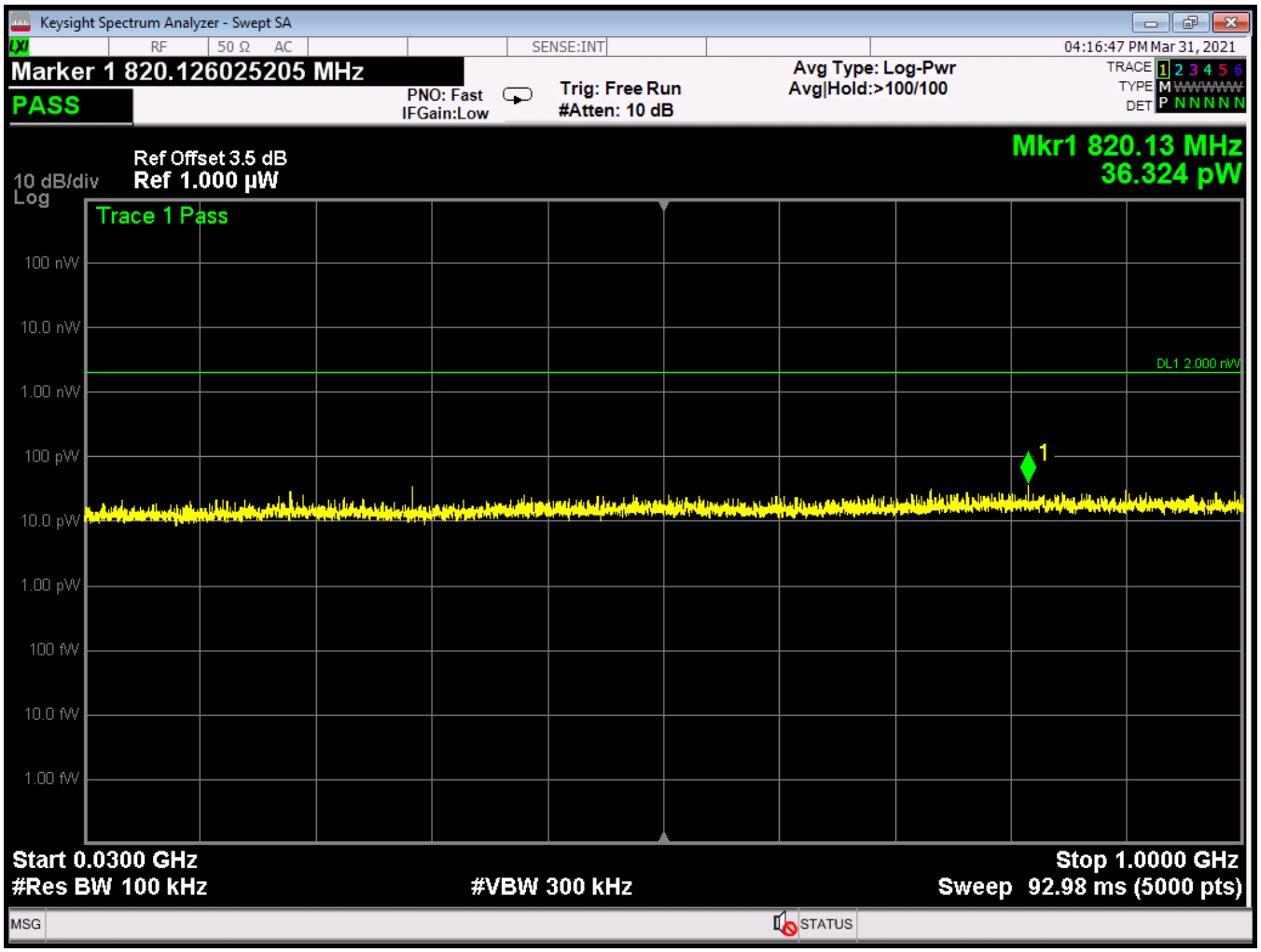


Figure 31: Receive (RX Mode) Conducted Spurious Plot 2

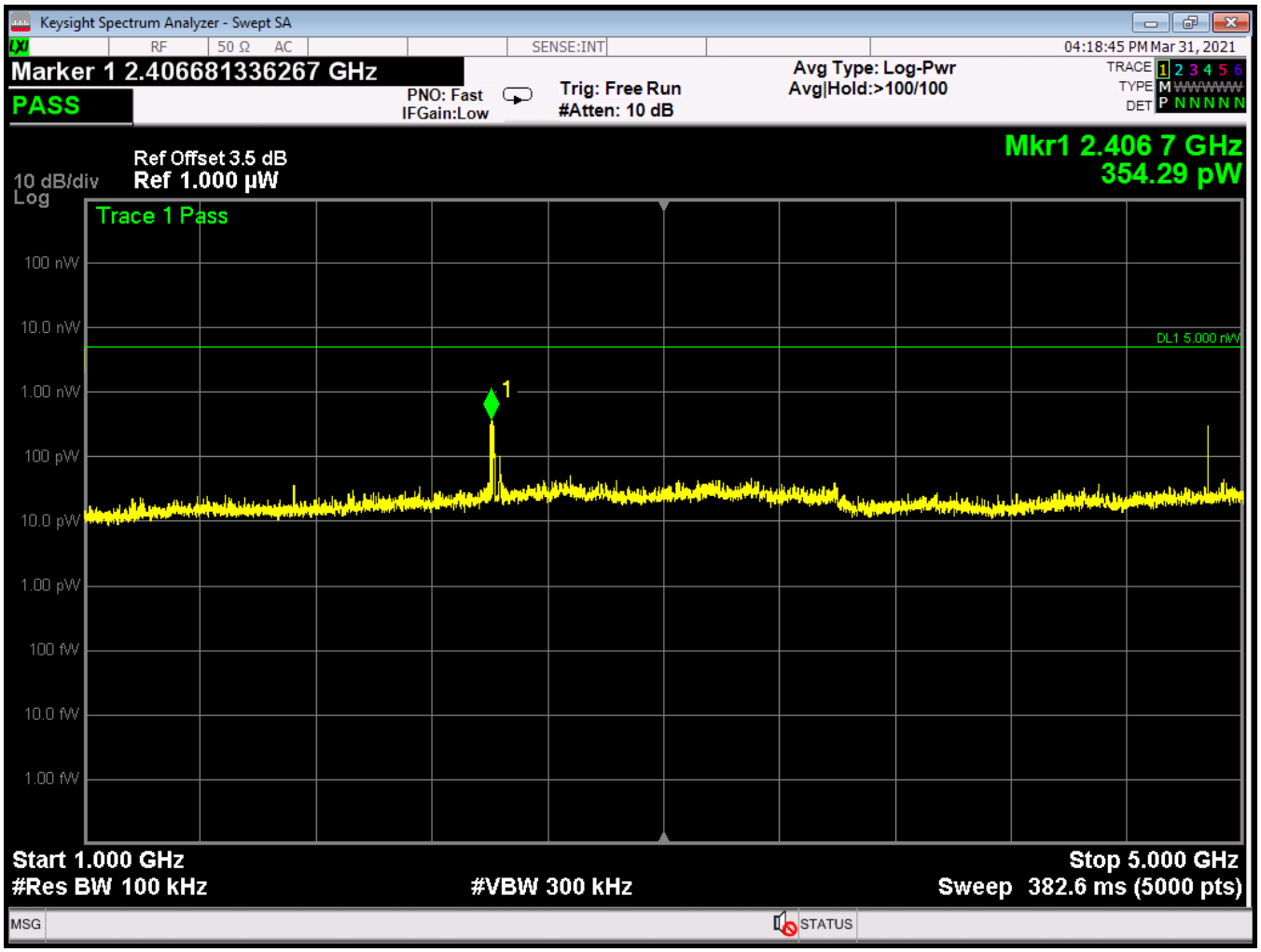


Figure 32: Receive (RX Mode) Conducted Spurious Plot 3

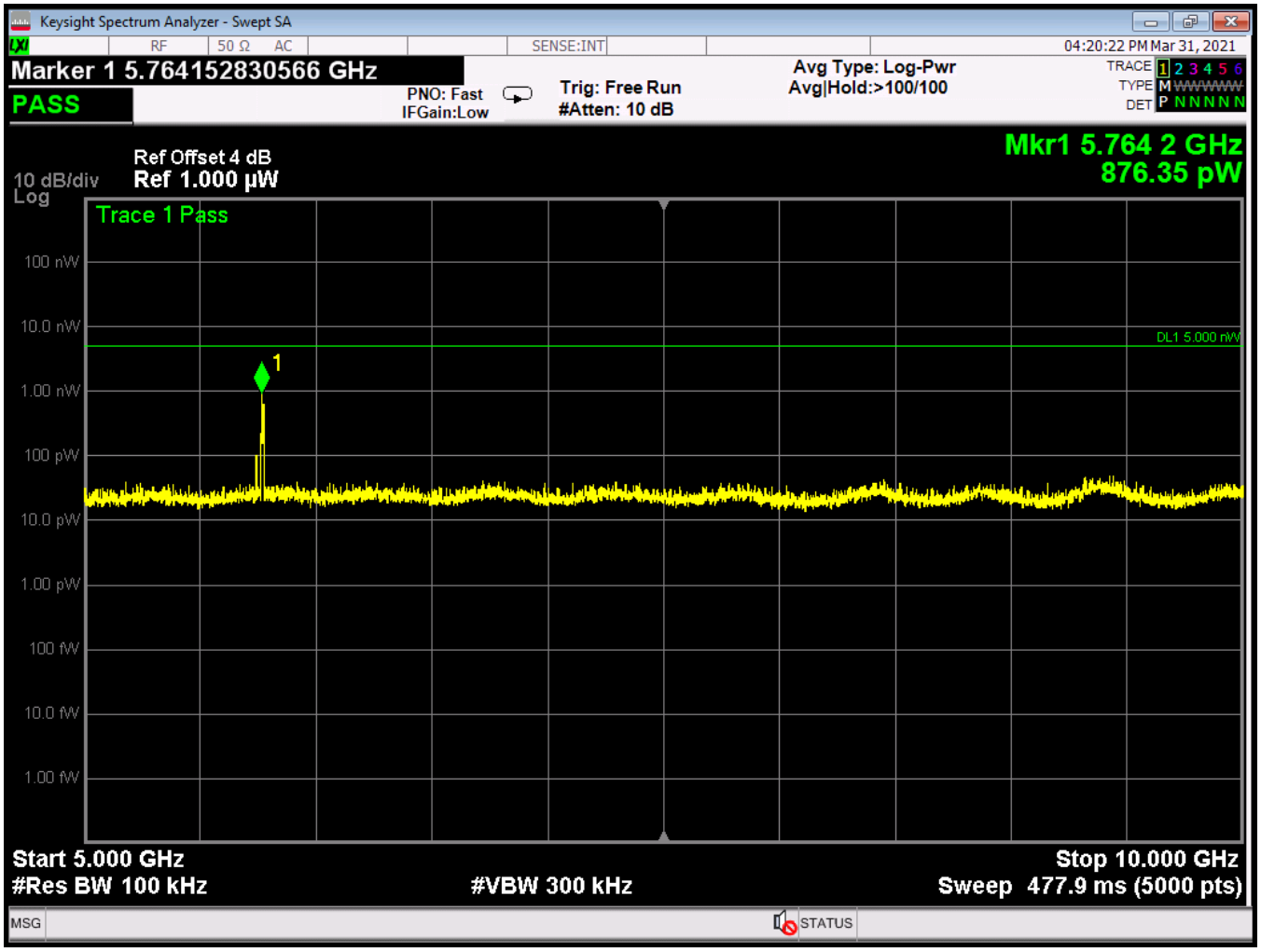


Figure 33: Receive (RX Mode) Conducted Spurious Plot 4

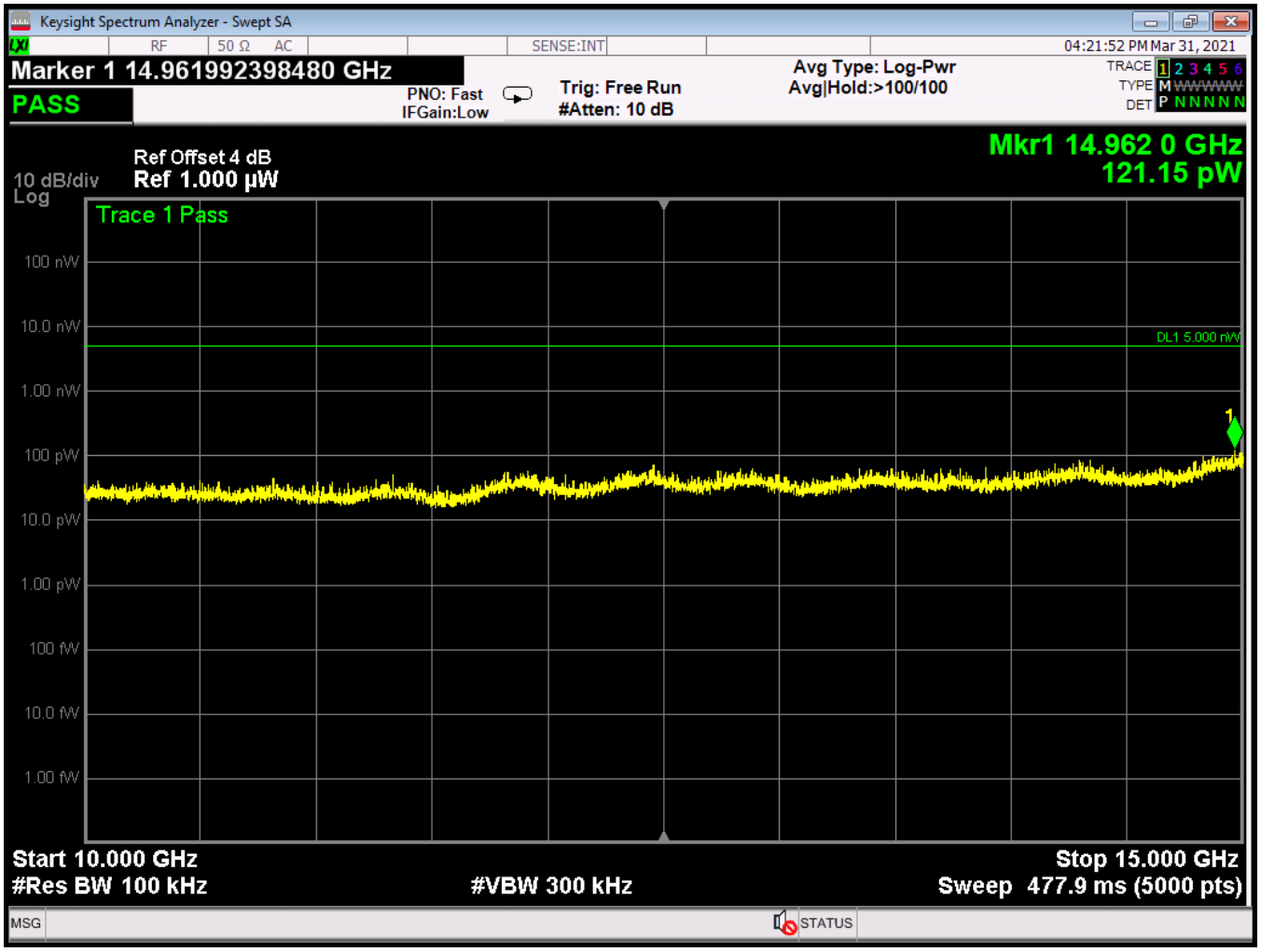


Figure 34: Receive (RX Mode) Conducted Spurious Plot 5

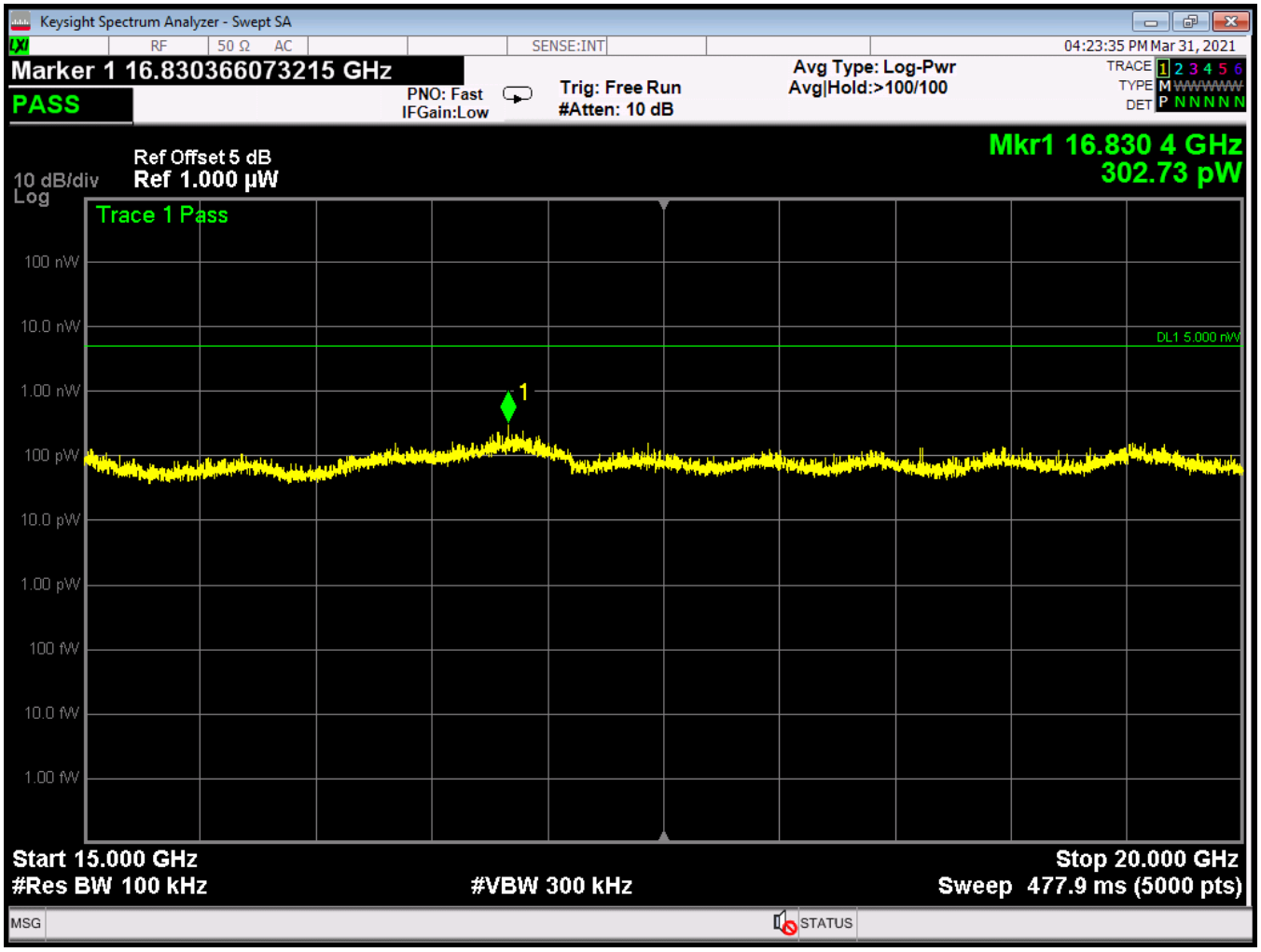
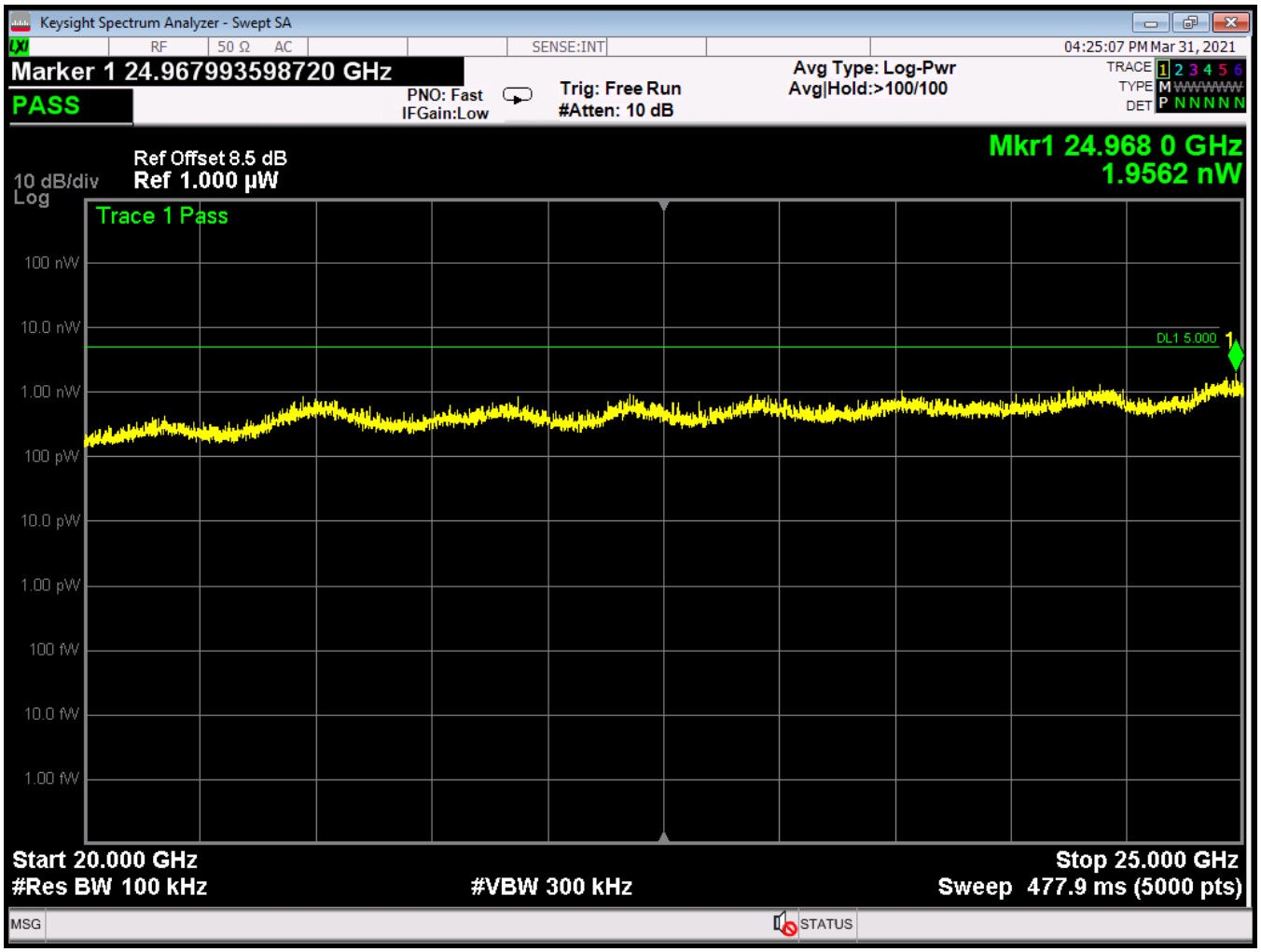


Figure 35: Receive (RX Mode) Conducted Spurious Plot 6



4.6 Radiated Emissions

4.6.1 Requirements

Compliance Standard: FCC Part 15, Class B

FCC Compliance Limits		
Frequency Range	Limit (distance)	
	Class A (10 meter)	Class B (3 meter)
30 – 88 MHz	90 µV/m	100 µV/m
88 – 216 MHz	150 µV/m	150 µV/m
216 – 960 MHz	210 µV/m	200 µV/m
> 960 MHz	300 µV/m	500 µV/m

4.6.2 Test Procedure

The requirements of FCC Part 15 and ICES-003 call for the EUT to be placed on an 80 cm high 1 X 1.5 meters non-conductive motorized turntable for radiated testing on a 3-meter open field test site.

The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Bi-conical and log periodic broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The output of the antenna was connected to the input of the spectrum analyzer and the emissions in the frequency range of 30 MHz to 25 GHz were measured. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak or peak, as appropriate. Above 1GHz average measurement are recorded. The measurement bandwidth of the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth. Frequencies above 1GHz were performed using a measurement bandwidth of 1 MHz with a video bandwidth setting of 10 Hz for the average measurement.

4.6.3 Test Results Summary

The EUT complied with Class B Radiated Emissions requirements.

4.6.4 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are included into the antenna factor (AF) column of the table and in the cable factor (CF) column of the table. The AF (in dB/m) and the CF (in dB) is algebraically added to the raw Spectrum Analyzer Voltage in dBµV to obtain the Radiated Electric Field in dBµV/m. This logarithm amplitude is converted to a linear amplitude, then compared to the FCC limit.

Example:

Spectrum Analyzer Voltage: VdBµV
Antenna Correction Factor: AFdB/m
Cable Correction Factor: CFdB
Pre-Amplifier Gain (if applicable): GdB
Electric Field: EdBµV/m = V dBµV + AFdB/m + CFdB - GdB
To convert to linear units of measure:: EdBµV/m/20 Inv log

4.6.5 Test Data

The radiated emissions test data is provided in the tables below.

AMB indicates that the measurement was taken at the noise floor, and there was no EUT emission.

Spur indicates that there was an emission present.

All frequencies were identified via a Near Field Scan, or are checks of the radio harmonics.

Below 1 GHz is representative of all channels, when observing emissions in the frequency range of 30 MHz to 1000 MHz.

For the radiated testing, all three (3) EUT Orthogonal Axes were tested (X, Y, and Z).
The X-Axis was determined to be the worst case. As such, that data is represented below.

Compliance at the restricted band edge of 2483.5 MHz is demonstrated in Table 16 and Table 17.
The Peak emission at the band edge, meets the AVG limit.

Table 14: Radiated Emission Test Data, 30 – 1000 MHz (Vertical)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector	EUT Orthogonal Plane	Comments
32.77	V	90.0	2.0	24.0	-3.5	10.6	100.0	-19.5	QP	X-Axis	AMB
48.00	V	0.0	2.1	34.7	-13.8	11.0	100.0	-19.1	QP	X-Axis	AMB
67.01	V	0.0	2.0	36.3	-14.5	12.2	100.0	-18.3	QP	X-Axis	AMB
168.01	V	270.0	1.9	35.0	-10.5	16.7	150.0	-19.1	QP	X-Axis	AMB
300.00	V	0.0	1.6	32.6	-8.5	16.0	200.0	-21.9	QP	X-Axis	AMB
712.64	V	0.0	1.5	22.9	-0.2	13.6	200.0	-23.3	QP	X-Axis	AMB
836.37	V	180.0	1.4	28.0	0.9	27.8	200.0	-17.1	QP	X-Axis	AMB
983.10	V	0.0	1.3	22.6	3.0	19.0	500.0	-28.4	QP	X-Axis	AMB
36.51	V	0.0	2.5	31.8	-6.1	19.3	100.0	-14.3	QP	Y-Axis	AMB
50.00	V	90.0	2.0	34.8	-14.6	10.2	100.0	-19.8	QP	Y-Axis	AMB
65.54	V	90.0	1.7	32.5	-14.7	7.8	100.0	-22.2	QP	Y-Axis	AMB
168.01	V	270.0	1.6	26.5	-10.5	6.3	150.0	-27.6	QP	Y-Axis	AMB
467.49	V	270.0	1.6	22.7	-4.3	8.3	200.0	-27.6	QP	Y-Axis	AMB
523.99	V	90.0	1.3	26.5	-2.9	15.1	200.0	-22.4	QP	Y-Axis	AMB
836.37	V	90.0	1.3	26.6	0.9	23.7	200.0	-18.5	QP	Y-Axis	AMB
983.10	V	180.0	1.3	21.6	3.0	16.9	500.0	-29.4	QP	Y-Axis	AMB
72.00	V	0.00	1.90	35.65	-14.23	11.78	100.00	-18.58	QP	Z-Axis	AMB
74.59	V	180.00	1.80	34.10	-14.33	9.74	100.00	-20.23	QP	Z-Axis	AMB
78.28	V	180.00	1.80	31.20	-14.56	6.79	100.00	-23.36	QP	Z-Axis	AMB
100.00	V	270.00	1.60	24.70	-12.65	4.01	150.00	-31.47	QP	Z-Axis	AMB
456.00	V	90.00	1.60	24.60	-4.25	10.41	200.00	-25.67	QP	Z-Axis	AMB
712.64	V	90.00	1.60	21.00	-0.22	10.95	200.00	-25.24	QP	Z-Axis	AMB
836.37	V	0.00	1.50	27.30	0.89	25.66	200.00	-17.83	QP	Z-Axis	AMB
983.10	V	0.00	1.50	22.00	2.98	17.74	500.00	-29.00	QP	Z-Axis	AMB

Table 15: Radiated Emission Test Data, 30 – 1000 MHz (Horizontal)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector	EUT Orthogonal Plane	Comments
32.77	H	0.0	2.4	22.7	-3.5	9.1	100.0	-20.8	QP	X-Axis	AMB
48.00	H	0.0	2.1	32.3	-13.8	8.4	100.0	-21.5	QP	X-Axis	AMB
67.01	H	180.0	1.7	33.8	-14.5	9.2	100.0	-20.7	QP	X-Axis	AMB
168.01	H	270.0	1.7	37.8	-10.5	23.1	150.0	-16.3	QP	X-Axis	AMB
300.00	H	270.0	1.7	32.3	-8.5	15.5	200.0	-22.2	QP	X-Axis	AMB
712.64	H	270.0	1.3	22.3	-0.2	12.7	200.0	-23.9	QP	X-Axis	AMB
836.37	H	180.0	1.3	23.6	0.9	16.8	200.0	-21.5	QP	X-Axis	AMB
983.10	H	90.0	1.2	22.2	3.0	18.2	500.0	-28.8	QP	X-Axis	AMB
36.51	H	270.0	2.3	24.6	-6.1	8.4	100.0	-21.5	QP	Y-Axis	AMB
50.00	H	90.0	2.0	29.6	-14.6	5.6	100.0	-25.0	QP	Y-Axis	AMB
65.54	H	180.0	1.6	33.6	-14.7	8.8	100.0	-21.1	QP	Y-Axis	AMB
168.01	H	0.0	1.6	37.9	-10.5	23.4	150.0	-16.2	QP	Y-Axis	AMB
467.49	H	90.0	1.6	23.0	-4.3	8.6	200.0	-27.3	QP	Y-Axis	AMB
523.99	H	0.0	1.5	22.7	-2.9	9.8	200.0	-26.2	QP	Y-Axis	AMB
836.37	H	0.0	1.4	25.0	0.9	19.7	200.0	-20.1	QP	Y-Axis	AMB
983.10	H	180.0	1.3	21.3	3.0	16.4	500.0	-29.7	QP	Y-Axis	AMB
72.00	H	90.0	2.2	35.1	-14.2	11.1	100.0	-19.1	QP	Z-Axis	AMB
74.59	H	90.0	2.1	33.0	-14.3	8.6	100.0	-21.3	QP	Z-Axis	AMB
78.28	H	270.0	2.1	32.2	-14.6	7.6	100.0	-22.4	QP	Z-Axis	AMB
100.00	H	180.0	1.8	23.9	-12.6	3.7	150.0	-32.3	QP	Z-Axis	AMB
456.00	H	180.0	1.9	24.0	-4.3	9.7	200.0	-26.3	QP	Z-Axis	AMB
712.64	H	180.0	1.9	22.0	-0.2	12.3	200.0	-24.2	QP	Z-Axis	AMB
836.37	H	90.0	1.6	26.8	0.9	24.2	200.0	-18.3	QP	Z-Axis	AMB
983.10	H	0.0	1.5	23.1	3.0	20.1	500.0	-27.9	QP	Z-Axis	AMB

Table 16: Radiated Emission Test Data, 1 – 25 GHz (Vertical)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector	EUT Orthogonal Plane	Comments
1205.24	V	0.0	1.5	63.7	-21.8	124.8	5000.0	-32.1	Peak	X-Axis	Spur
1205.24	V	0.0	1.5	48.7	-21.8	22.2	500.0	-27.1	AVG	X-Axis	Spur
2402.00	V	90.0	1.5	102.9	-17.4	18872.8	BLE		Peak	X-Axis	Radio
2402.00	V	90.0	1.5	97.5	-17.4	10135.3	Low Chan.		AVG	X-Axis	
4804.00	V	90.0	1.5	64.6	-8.1	668.7	5000.0	-17.5	Peak	X-Axis	Spur
4804.00	V	90.0	1.5	49.6	-8.1	118.9	500.0	-12.5	AVG	X-Axis	Spur
7206.00	V	270.0	1.5	63.7	-0.5	1446.2	5000.0	-10.8	Peak	X-Axis	AMB
7206.00	V	270.0	1.5	49.1	-0.5	271.2	500.0	-5.3	AVG	X-Axis	AMB
9608.00	V	0.0	1.5	60.0	3.9	1570.9	5000.0	-10.1	Peak	X-Axis	AMB
9608.00	V	0.0	1.5	43.0	3.9	221.9	500.0	-7.1	AVG	X-Axis	AMB
12010.00	V	0.0	1.5	57.1	5.4	1336.8	5000.0	-11.5	Peak	X-Axis	AMB
12010.00	V	0.0	1.5	42.9	5.4	259.8	500.0	-5.7	AVG	X-Axis	AMB
1205.24	V	0.0	1.5	59.4	-21.8	76.0	5000.0	-36.4	Peak	X-Axis	Spur
1205.24	V	0.0	1.5	44.7	-21.8	14.0	500.0	-31.1	AVG	X-Axis	Spur
2440.00	V	90.0	1.5	100.3	-17.1	14386.8	BLE		Peak	X-Axis	Radio
2440.00	V	90.0	1.5	93.6	-17.1	6652.2	Center Chan.		AVG	X-Axis	
4880.00	V	0.0	1.5	64.2	-7.7	665.0	5000.0	-17.5	Peak	X-Axis	Spur
4880.00	V	0.0	1.5	43.3	-7.7	60.2	500.0	-18.4	AVG	X-Axis	Spur
7320.00	V	90.0	1.5	56.7	-0.9	619.6	5000.0	-18.1	Peak	X-Axis	AMB
7320.00	V	90.0	1.5	43.2	-0.9	130.7	500.0	-11.7	AVG	X-Axis	AMB
9760.00	V	180.0	1.5	57.2	3.4	1060.7	5000.0	-13.5	Peak	X-Axis	AMB
9760.00	V	180.0	1.5	43.0	3.4	208.0	500.0	-7.6	AVG	X-Axis	AMB
12200.00	V	270.0	1.5	55.0	5.3	1036.2	5000.0	-13.7	Peak	X-Axis	AMB
12200.00	V	270.0	1.5	41.0	5.3	206.8	500.0	-7.7	AVG	X-Axis	AMB
1205.24	V	270.0	1.5	60.1	-21.8	82.5	5000.0	-35.7	Peak	X-Axis	Spur
1205.24	V	270.0	1.5	44.5	-21.8	13.7	500.0	-31.3	AVG	X-Axis	Spur
2480.00	V	270.0	1.5	98.0	-16.6	11807.1	BLE		Peak	X-Axis	Radio
2480.00	V	270.0	1.5	92.6	-16.6	6304.4	High Chan.		AVG	X-Axis	
2483.50	V	90.0	1.5	51.4	-16.6	58.8	500.0	-18.6	Peak	X-Axis	Band Edge
4960.00	V	270.0	1.5	79.5	-6.7	4347.7	5000.0	-1.2	Peak	X-Axis	Spur
4960.00	V	270.0	1.5	49.0	-6.7	129.8	500.0	-11.7	AVG	X-Axis	Spur
7440.00	V	0.0	1.5	58.1	-1.7	658.4	5000.0	-17.6	Peak	X-Axis	AMB
7440.00	V	0.0	1.5	44.0	-1.7	129.9	500.0	-11.7	AVG	X-Axis	AMB
9920.00	V	90.0	1.5	57.3	2.8	1016.7	5000.0	-13.8	Peak	X-Axis	AMB
9920.00	V	90.0	1.5	43.2	2.8	200.5	500.0	-7.9	AVG	X-Axis	AMB
12400.00	V	90.0	1.5	53.6	5.7	924.8	5000.0	-14.7	Peak	X-Axis	AMB
12400.00	V	90.0	1.5	38.5	5.7	162.6	500.0	-9.8	AVG	X-Axis	AMB

Table 17: Radiated Emission Test Data, 1 – 25 GHz (Horizontal)

Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Detector	EUT Orthogonal Plane	Comments
1205.24	H	90.0	1.5	58.9	-21.8	71.8	5000.0	-36.9	Peak	X-Axis	Spur
1205.24	H	90.0	1.5	44.6	-21.8	13.8	500.0	-31.2	AVG	X-Axis	Spur
2402.00	H	0.0	1.5	100.8	-17.4	14819.6	BLE Low Chan.		Peak	X-Axis	Radio
2402.00	H	0.0	1.5	99.8	-17.4	13208.0			AVG	X-Axis	
4804.00	H	0.0	1.5	58.2	-8.1	320.1	5000.0	-23.9	Peak	X-Axis	Spur
4804.00	H	0.0	1.5	39.0	-8.1	35.1	500.0	-23.1	AVG	X-Axis	Spur
7206.00	H	0.0	1.5	56.0	-0.5	597.3	5000.0	-18.5	Peak	X-Axis	AMB
7206.00	H	0.0	1.5	42.0	-0.5	119.2	500.0	-12.5	AVG	X-Axis	AMB
9608.00	H	0.0	1.5	57.2	3.9	1138.0	5000.0	-12.9	Peak	X-Axis	AMB
9608.00	H	0.0	1.5	43.0	3.9	221.9	500.0	-7.1	AVG	X-Axis	AMB
12010.00	H	270.0	1.5	58.0	5.4	1477.6	5000.0	-10.6	Peak	X-Axis	AMB
12010.00	H	270.0	1.5	43.0	5.4	262.8	500.0	-5.6	AVG	X-Axis	AMB
1205.24	H	0.0	1.5	58.3	-21.8	67.3	5000.0	-37.4	Peak	X-Axis	Spur
1205.24	H	0.0	1.5	44.0	-21.8	12.9	500.0	-31.8	AVG	X-Axis	Spur
2440.00	H	0.0	1.5	97.6	-17.1	10579.4	BLE Center Chan.		Peak	X-Axis	Radio
2440.00	H	0.0	1.5	91.6	-17.1	5302.3			AVG	X-Axis	
4880.00	H	90.0	1.5	58.7	-7.7	355.1	5000.0	-23.0	Peak	X-Axis	Spur
4880.00	H	90.0	1.5	49.3	-7.7	120.3	500.0	-12.4	AVG	X-Axis	Spur
7320.00	H	90.0	1.5	57.1	-0.9	647.3	5000.0	-17.8	Peak	X-Axis	AMB
7320.00	H	90.0	1.5	42.7	-0.9	123.9	500.0	-12.1	AVG	X-Axis	AMB
9760.00	H	180.0	1.5	56.3	3.4	956.3	5000.0	-14.4	Peak	X-Axis	AMB
9760.00	H	180.0	1.5	42.3	3.4	191.9	500.0	-8.3	AVG	X-Axis	AMB
12200.00	H	180.0	1.5	54.8	5.3	1012.6	5000.0	-13.9	Peak	X-Axis	AMB
12200.00	H	180.0	1.5	40.3	5.3	190.7	500.0	-8.4	AVG	X-Axis	AMB
1205.24	H	90.0	1.5	59.2	-21.8	74.4	5000.0	-36.5	Peak	X-Axis	Spur
1205.24	H	90.0	1.5	45.8	-21.8	15.9	500.0	-30.0	AVG	X-Axis	Spur
2480.00	H	90.0	1.5	93.5	-16.6	7033.0	BLE High Chan.		Peak	X-Axis	Radio
2480.00	H	90.0	1.5	90.8	-16.6	5154.0			AVG	X-Axis	
2483.50	H	90.0	1.5	46.9	-16.2	34.3	500.0	-23.3	Peak	X-Axis	Band Edge
4960.00	H	90.0	1.5	66.0	-6.7	918.9	5000.0	-14.7	Peak	X-Axis	Spur
4960.00	H	90.0	1.5	39.0	-6.7	41.0	500.0	-21.7	AVG	X-Axis	Spur
7440.00	H	270.0	1.5	58.2	-1.7	669.1	5000.0	-17.5	Peak	X-Axis	AMB
7440.00	H	270.0	1.5	44.0	-1.7	129.9	500.0	-11.7	AVG	X-Axis	AMB
9920.00	H	180.0	1.5	54.5	2.8	736.5	5000.0	-16.6	Peak	X-Axis	AMB
9920.00	H	180.0	1.5	41.0	2.8	155.7	500.0	-10.1	AVG	X-Axis	AMB
12400.00	H	180.0	1.5	53.0	5.7	863.1	5000.0	-15.3	Peak	X-Axis	AMB
12400.00	H	180.0	1.5	38.0	5.7	153.5	500.0	-10.3	AVG	X-Axis	AMB

5 Test Equipment

Table 18 shows a list of the test equipment used for measurements along with the calibration information.

Table 18: Test Equipment List

Test Name:	**Radiated Emissions**	Test Date(s): **04/01/2021 & 4/2/2021**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00644	SUNOL SCIENCES CORP.	JB1 925-833-9936	11/9/2022
00425	ARA	DRG-118/A	8/18/2022
00942	AGILENT	MXA-N9020A	10/29/2021
00559	HP, PREAMP	8447D	5/18/2021
00066	HP, PREAMP	BZ-01002650-401545-282525	6/19/2021
00281	ITC, FILTER	21A-3A1	1/18/2022
00885	UTIFLEX COAX, CABLE	UFA2108-0-360-100300	Cal. Before Use

Test Name:	**Conducted RF Emissions**	Test Date: **03/31/2021**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT	MXA-N9020A	10/29/2021
00885	UTIFLEX COAX, CABLE	UFA2108-0-360-100300	Cal. Before Use
N/A	WEINSCHEL	20DB ATTENUATOR	Cal. Before Use