FCC PART 15.247 CLASS II PERMISSIVE CHANGE

TEST REPORT

for the

TRUSTEDEDGE MICRO WIFI

WLL REPORT # 17467-01 REV 1

Prepared for:

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Testing Certificate AT-1448

FCC Part 15.247 Class II Permissive Change

Test Report

for the

SECO USA, Inc.

TrustedEdge Micro WiFi

February 28, 2022

WLL Report# 17467-01 Rev 1

Prepared by:

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Reviewed by:

Steven D. Koster
President

Abstract

This report has been prepared on behalf of SECO USA, Inc. to support the attached Application for a Class II Permissive Change. The test report and application are submitted for a Digital Transmission System (DTS) Transmitter under Part 15.247 of the FCC Rules. This Class II Permissive Change Test Report documents the test configuration and test results for the SECO USA, Inc., TrustedEdge Micro WiFi. The information provided on this report is only applicable to device herein documented, as the EUT.

The radiated portion of the testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd., located at 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.

The SECO USA, Inc., TrustedEdge Micro WiFi complies with the requirements for a Digital Transmission System (DTS) Transmitter under FCC Part 15.247.

Revision History	Description of Change	Date
Rev 0	Initial Release	February 28, 2022
Rev 1	Updates per ACB Comments	January 17, 2023

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1 Introduction

1.1 Compliance Statement

The SECO USA, Inc., TrustedEdge Micro WiFi complies with the requirements for a Digital Transmission System (DTS) Transmitter under FCC Part 15.247.

1.2 Reason for Class II Permissive Change

The applicant has integrated a pre-certified radio module onto their host board. As part of the integration to the SECO device, the applicant has changed the final antenna type. The radio manufacturer certified the module with a PCB-uFL Monopole antenna. The applicant has decided to use a dual-band ceramic chip antenna. The only change made to the pre-certified module is the antenna change. This evaluation and test report is provided to ensure that the radio and the host remain in compliance with the rules.

1.3 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. The table below shows the series and results of testing for compliance with a Digital Transmission System Full test results are shown in subsequent report sub-sections.

Table 1: FCC Test Summary Table

FCC Rule Part	Description	Result
15.247(a)(2)	6 dB Bandwidth	Pass
15.247 (b)(3)	Transmit Output Power	Pass
15.247(e)	Power Spectral Density	Not Evaluated
15.247(d)	Band Edge @ 20 dB below	Pass
15.205 15.209	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	AC Mains Conducted Emissions	Not Evaluated

1.4 Contract Information

Customer:	SECO USA, Inc.
Purchase Order Number:	4500021510
Quotation Number:	73056

1.5 Test and Support Personnel

Washington Laboratories, LTD	Ryan Mascaro
Customer Representative	Paul Sayles

1.6 Test Dates

2/15/2022 & 2/16/2022 (also see Section 4 of this report)

1.7 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. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

1.8 Testing Algorithm

The TrustedEdge Micro WiFi was provided to the test laboratory, in a plastic housing. The non-EMI plastic housing was removed to gain access to the PCB and radio transmitter antenna port. The EUT is designed to transmit in three WiFi modes: 802.11b, 802.11g, and 802.11n. Each of these modes was exercised and tested in accordance with Table 1 of this report. Each of the modes were evaluated to determine the worst-case transmitter power level. It was proven that the lowest data-rate of each mode produced the highest peak power measurement. As such, for all testing within this report, the 802.11b/g/n modes were tested at their lowest possible data-rates of 1Mbps, 6Mbps, and 6.5Mbps respectively. Bandedge was also investigated with regard to the various data-rates. Please note that changing the data-rate had a negligible impact on the Bandedge compliance. The final dBc deltas between the available data-rates was only a few tenths of a dB. This is not an area of concern. Overall, the worst-case emission levels, are provided in this report.

2 Test Results

2.1 Occupied (DTS) Bandwidth

Occupied bandwidth was performed by measuring the output of the EUT antenna port with a spectrum analyzer, corrected for any cable/attenuator loss.

For a DTS device, FCC Part 15.247 requires the minimum 6 dB bandwidth be at least 500 kHz.

2.1.1 Measurement Method

This test was performed as specified in ANSI C63.10, Section 11.8.2 "Option 2" for DTS bandwidth.

Occupied Bandwidth – Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
300 kHz	1 MHz

In a fully modulated mode, the OBW was measured as shown in Figures 1 through Figure 9.

Table 2: Occupied Bandwidth Summary

EUT Mode Setting	Channel Name	Frequency (MHz)	6 dB OBW (MHz)	Pass/Fail
802.11b	Low	2412.0	9.14	Pass
	Center	2437.0	9.12	Pass
	High	2462.0	9.13	Pass
802.11g	Low	2412.0	15.92	Pass
	Center	2437.0	15.82	Pass
	High	2462.0	16.01	Pass
802.11n	Low	2412.0	16.33	Pass
	Center	2437.0	16.38	Pass
	High	2462.0	16.53	Pass

Figure 1: Low Channel, Occupied Bandwidth – 802.11b

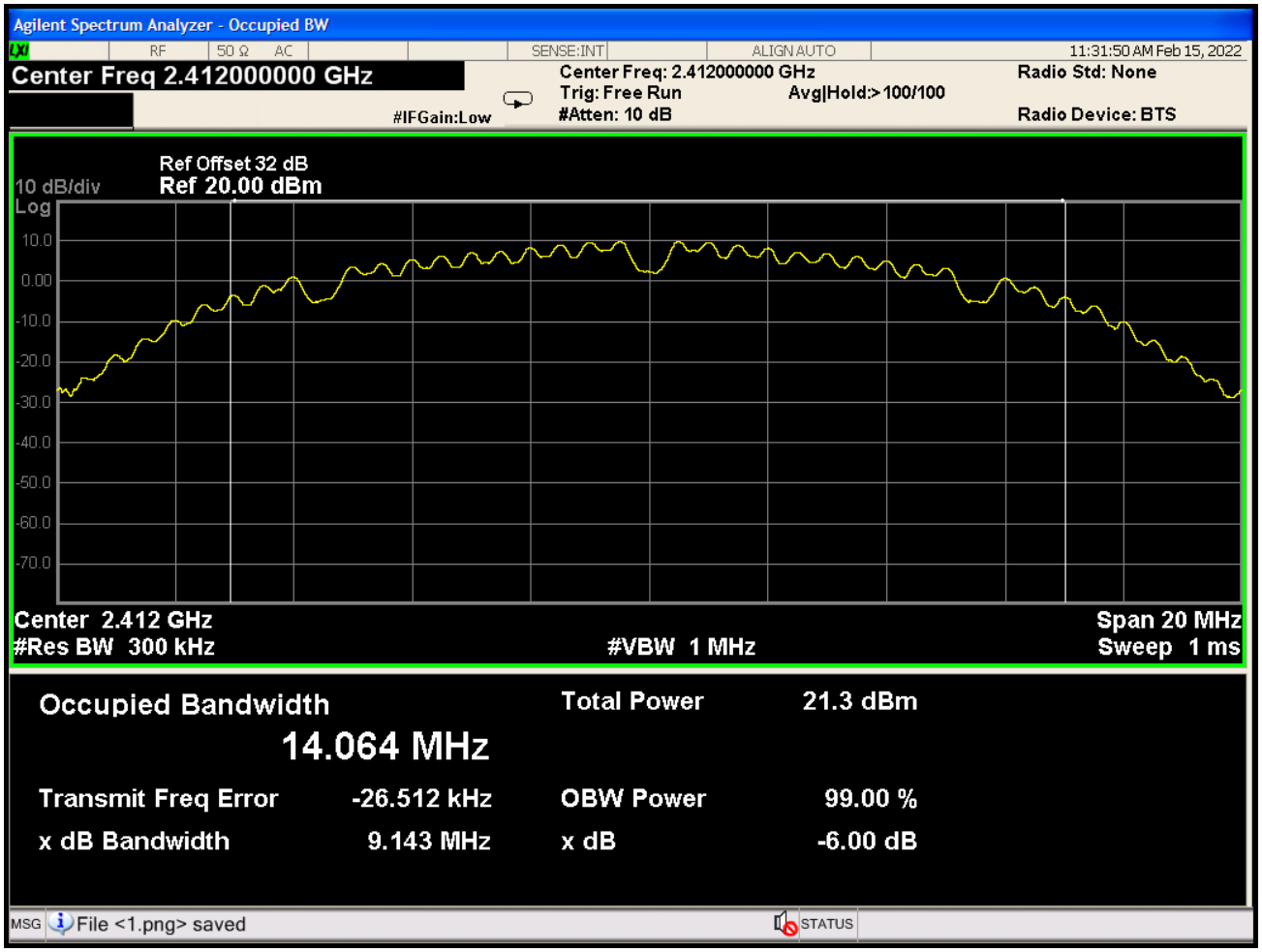


Figure 2: Center Channel, Occupied Bandwidth – 802.11b

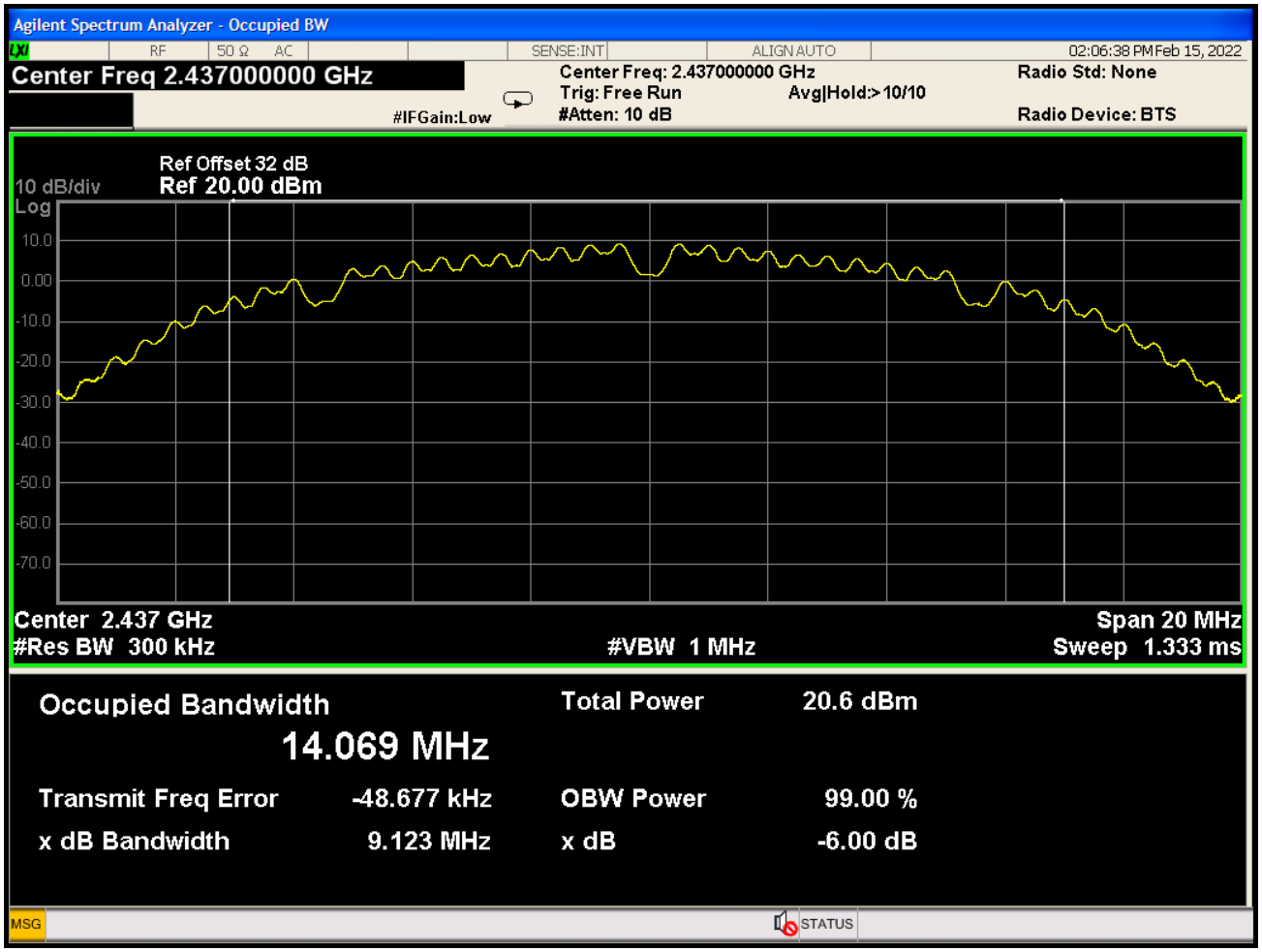


Figure 3: High Channel, Occupied Bandwidth – 802.11b

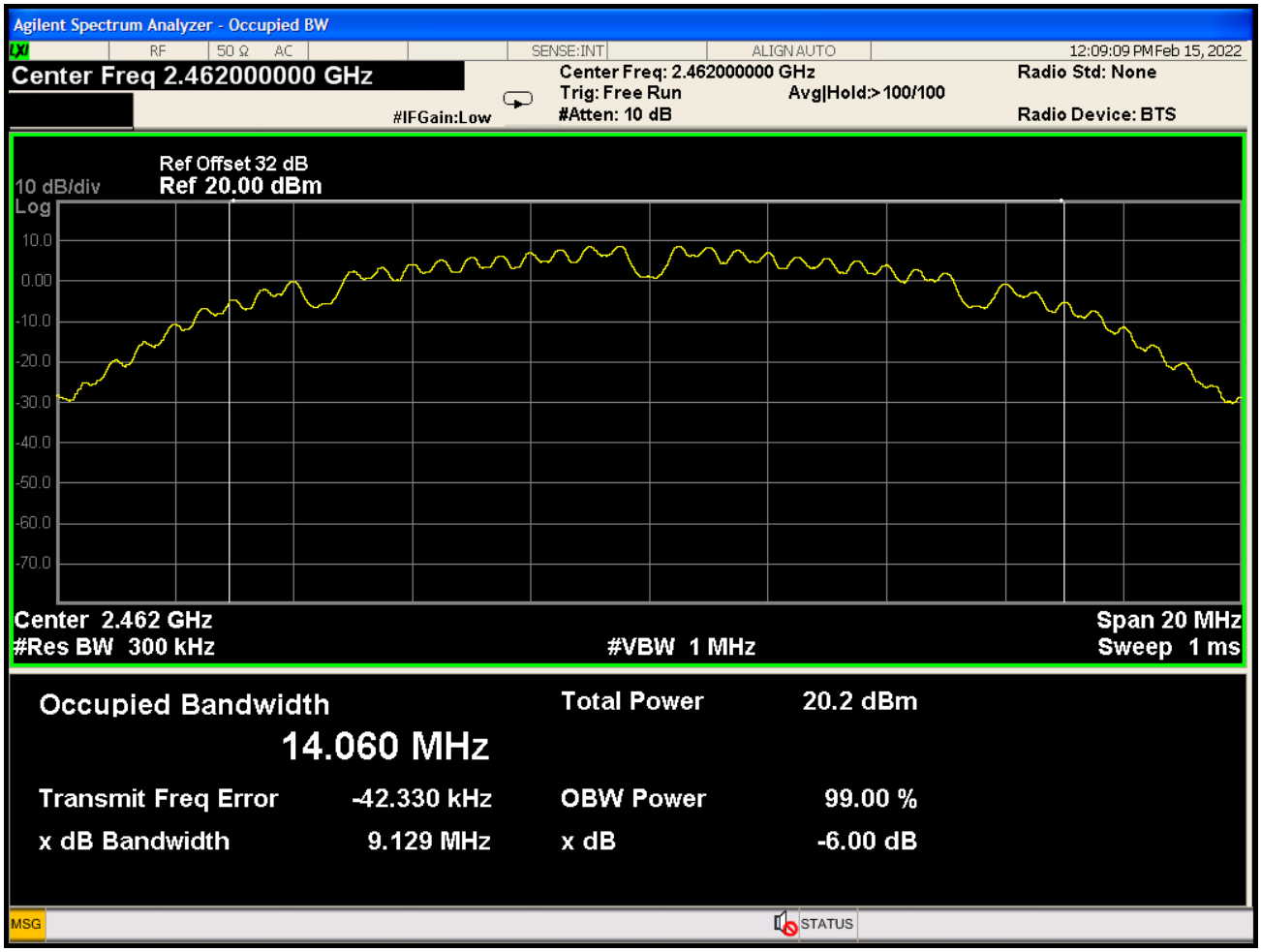


Figure 4: Low Channel, Occupied Bandwidth – 802.11g

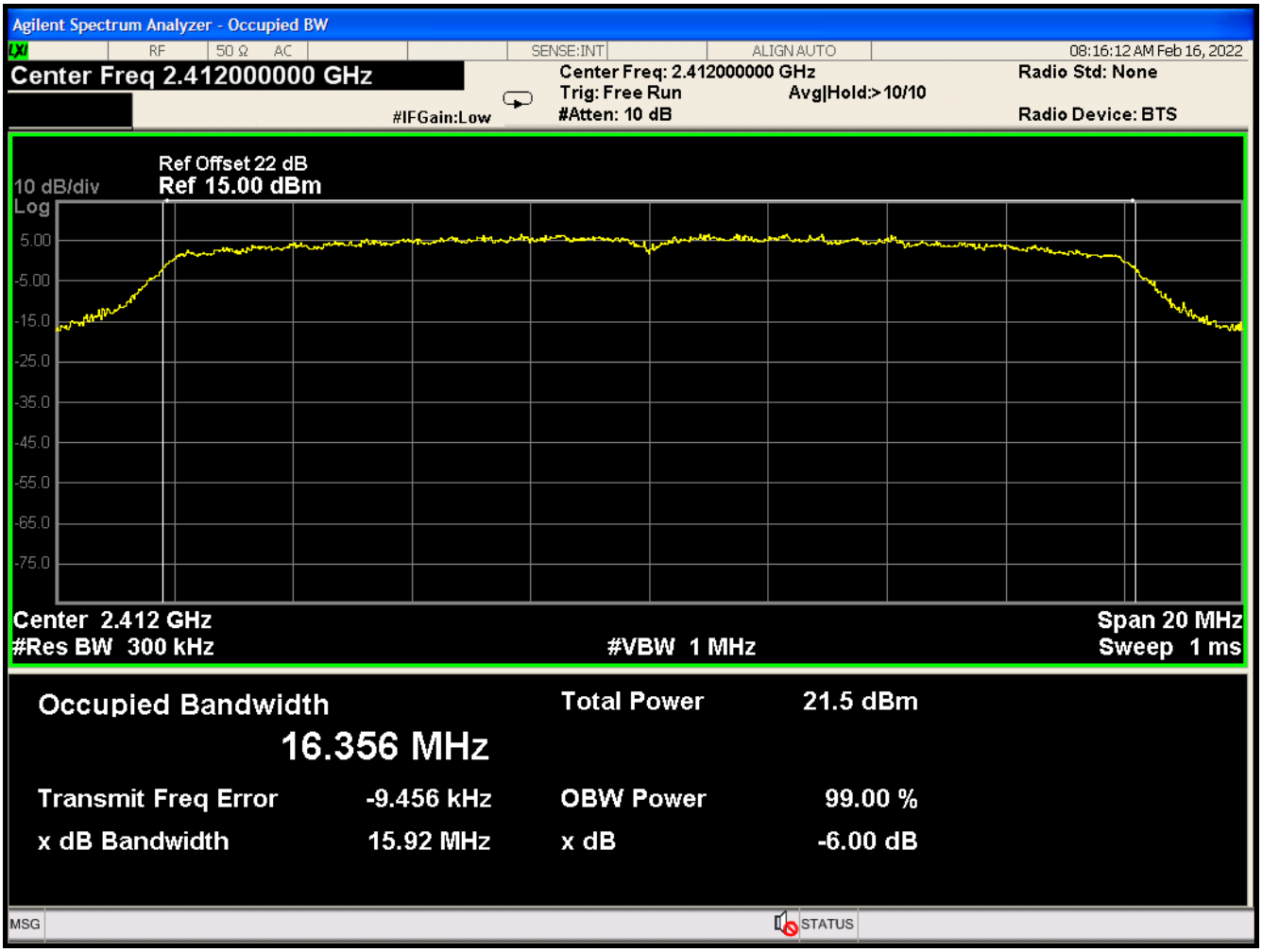


Figure 5: Center Channel, Occupied Bandwidth – 802.11g

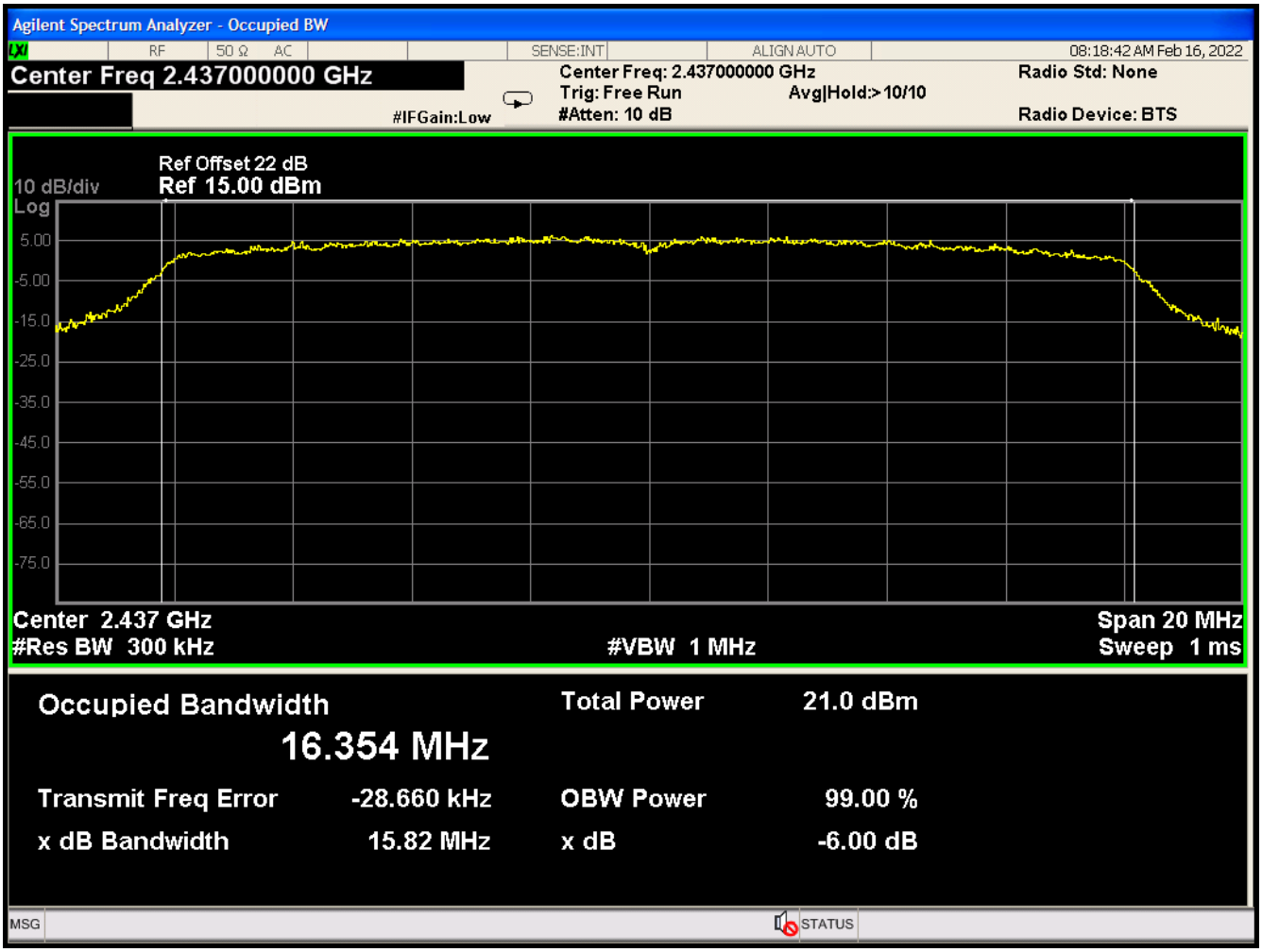


Figure 6: High Channel, Occupied Bandwidth – 802.11g

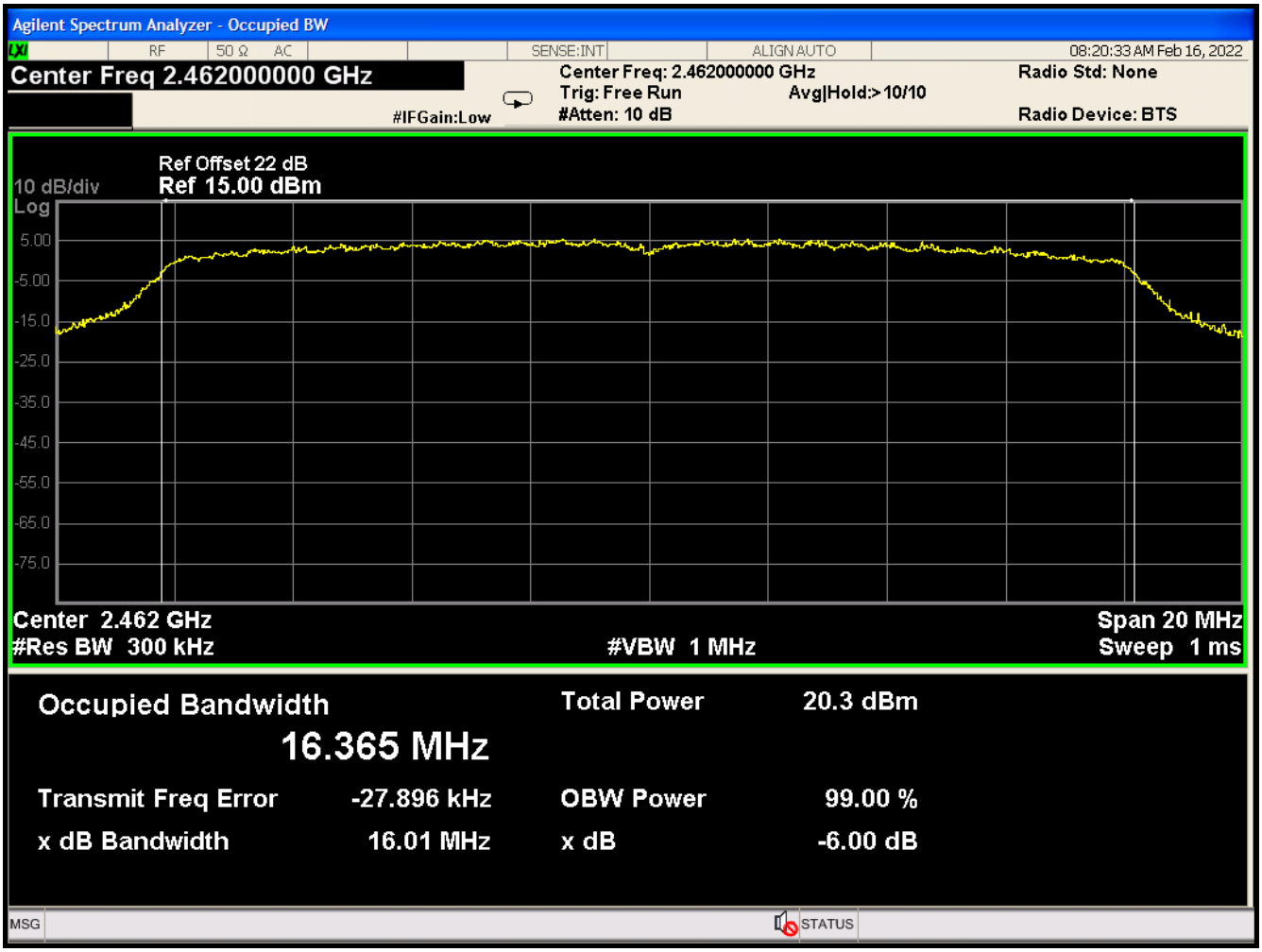


Figure 7: Low Channel, Occupied Bandwidth – 802.11n

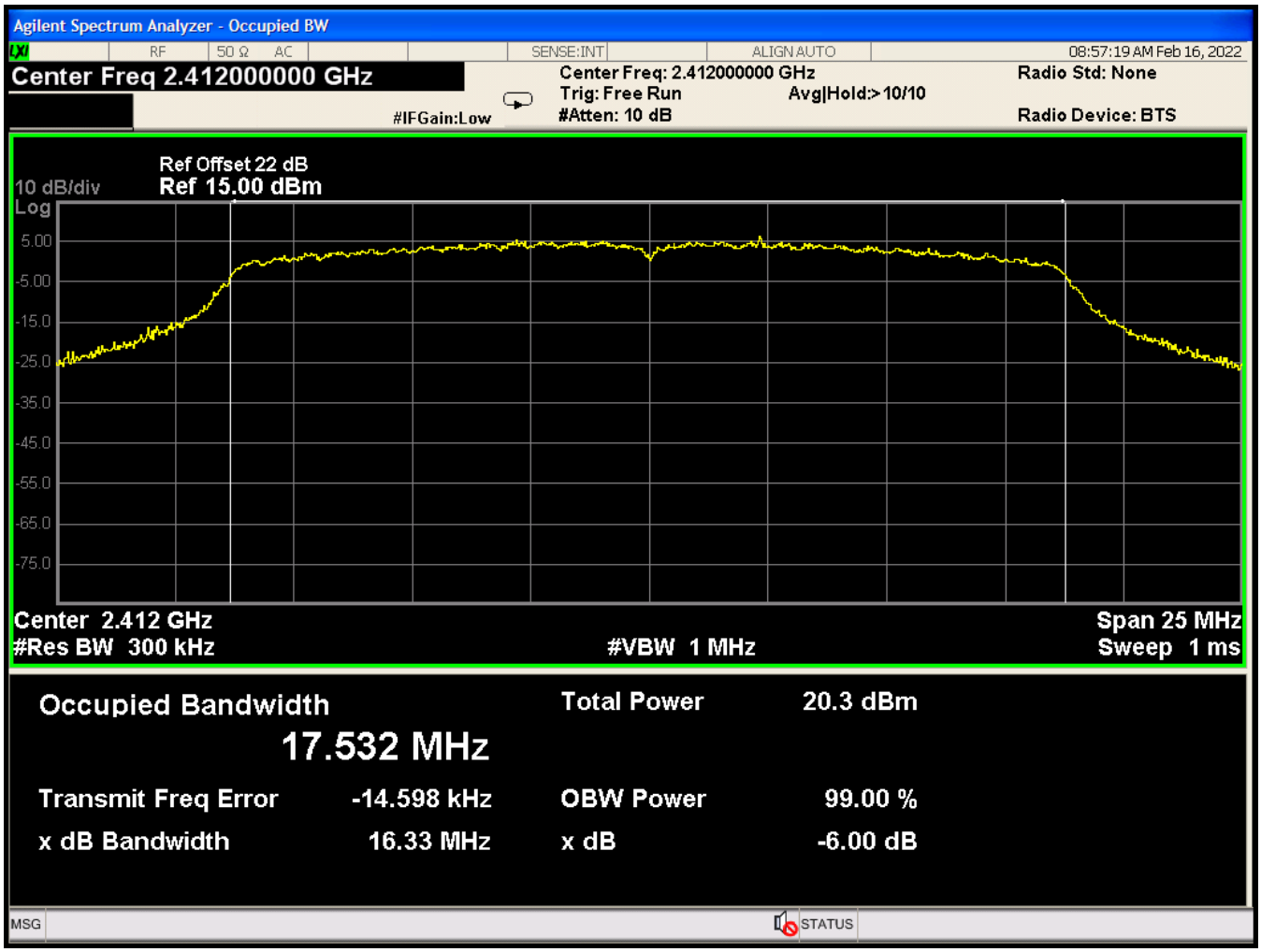


Figure 8: Center Channel, Occupied Bandwidth – 802.11n

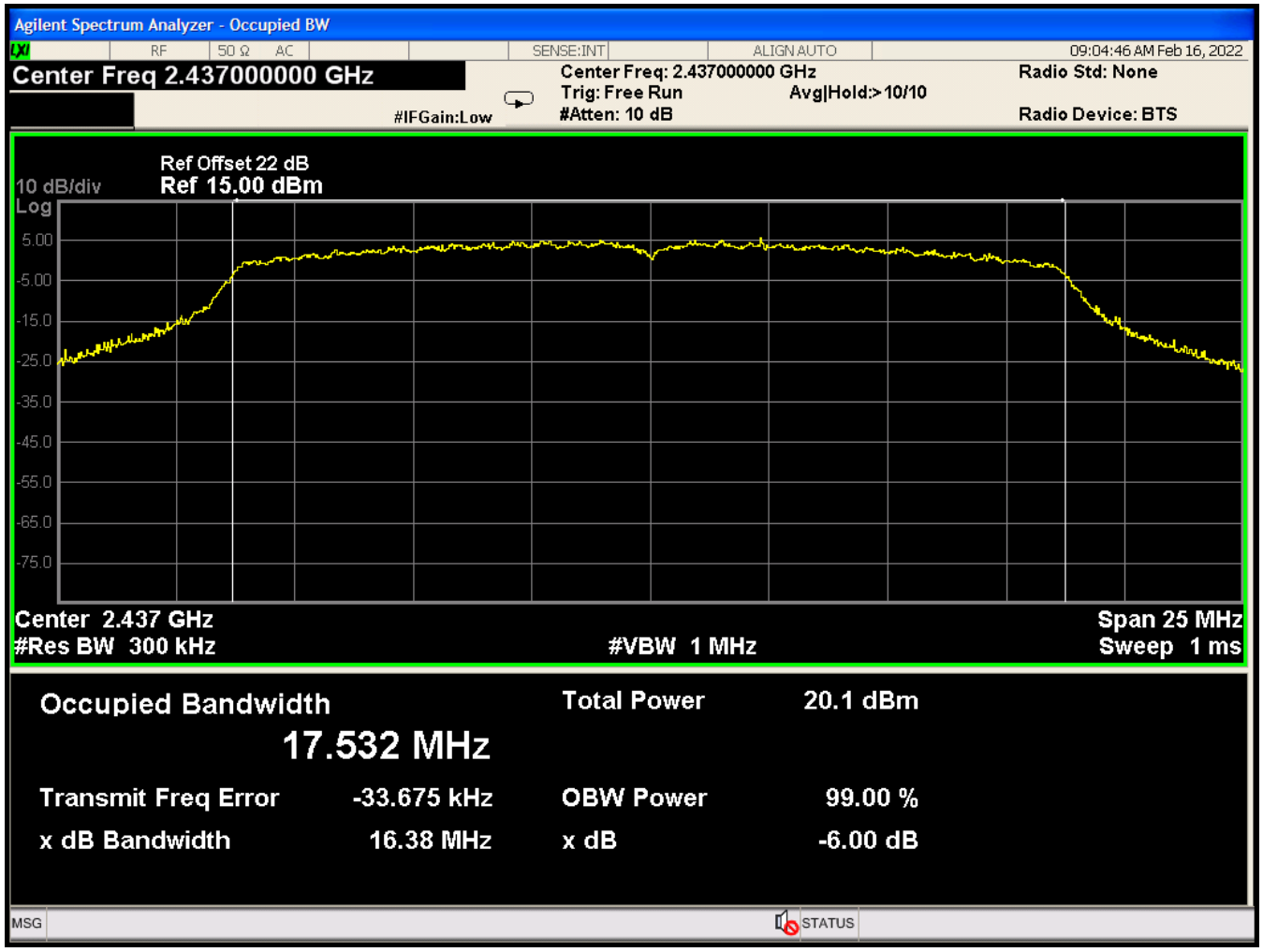
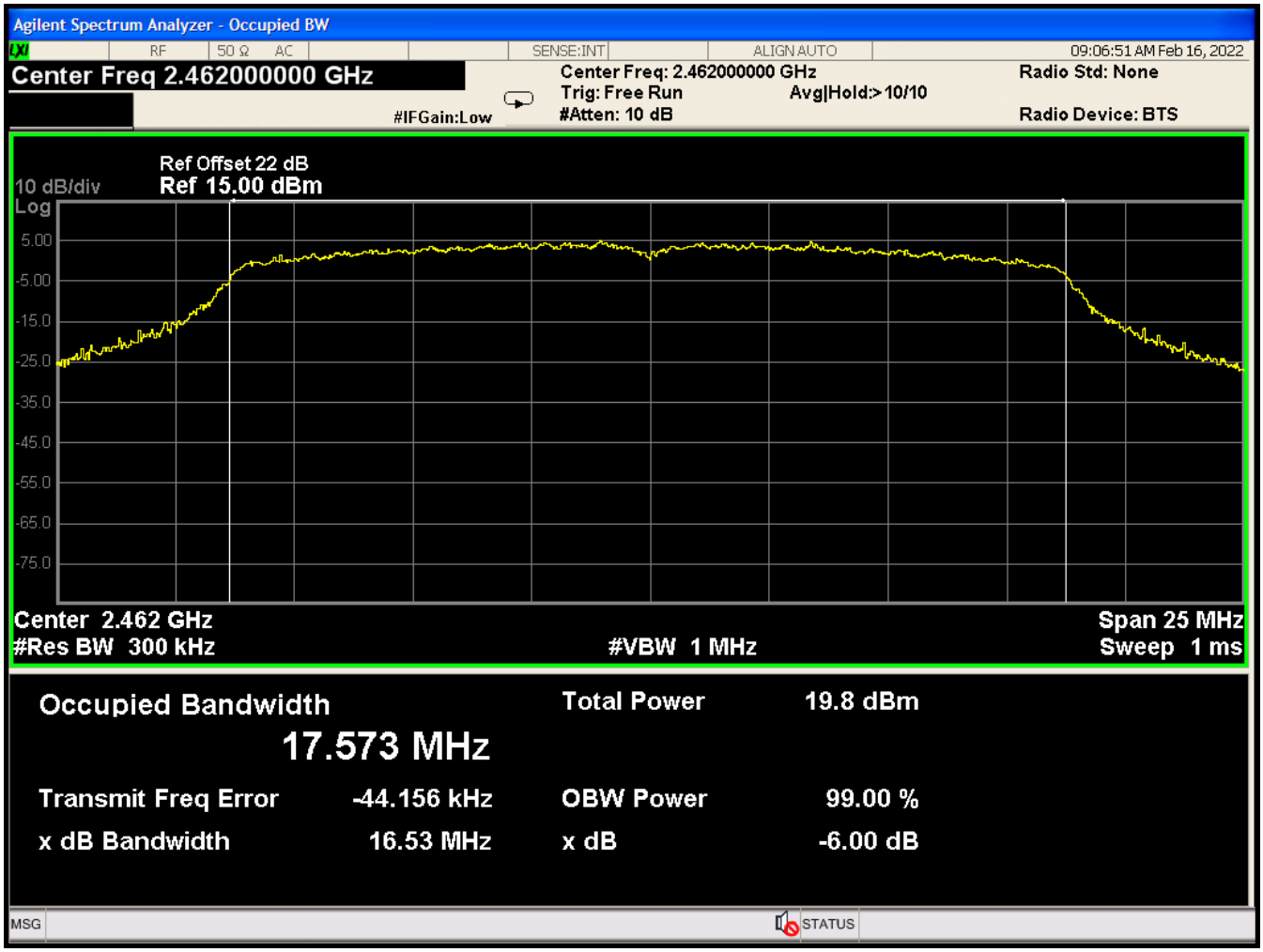


Figure 9: High Channel, Occupied Bandwidth – 802.11n



2.2 RF Power Output

RF Power Output was performed by measuring the output of the EUT antenna port with a spectrum analyzer, corrected for any cable/attenuator loss.

For a DTS device, FCC Part 15.247 requires the maximum conducted output power to be < 30 dBm (1W).

2.2.1 Measurement Method

This test was performed as specified in ANSI C63.10, Section 11.9.1.1, "RBW ≥ DTS bandwidth" for Maximum peak conducted output power.

Peak Conducted Power – Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
25 MHz	50 MHz

In a fully modulated mode, the peak output power was measured as shown in Figures 10 through Figure 18. This data is provided for reference only, and not intended to be used for consideration issuing the FCC Grant of Authorization.

Table 3: RF Power Output Summary

EUT Mode Setting	Channel Name	Frequency (MHz)	Peak Power (dBm)	Pass/Fail
802.11b	Low	2412.0	19.66	Pass
	Center	2437.0	19.33	Pass
	High	2462.0	18.38	Pass
802.11g	Low	2412.0	24.80	Pass
	Center	2437.0	23.64	Pass
	High	2462.0	23.71	Pass
802.11n	Low	2412.0	23.37	Pass
	Center	2437.0	23.32	Pass
	High	2462.0	22.27	Pass

Figure 10: Low Channel, RF Peak Power Output – 802.11b

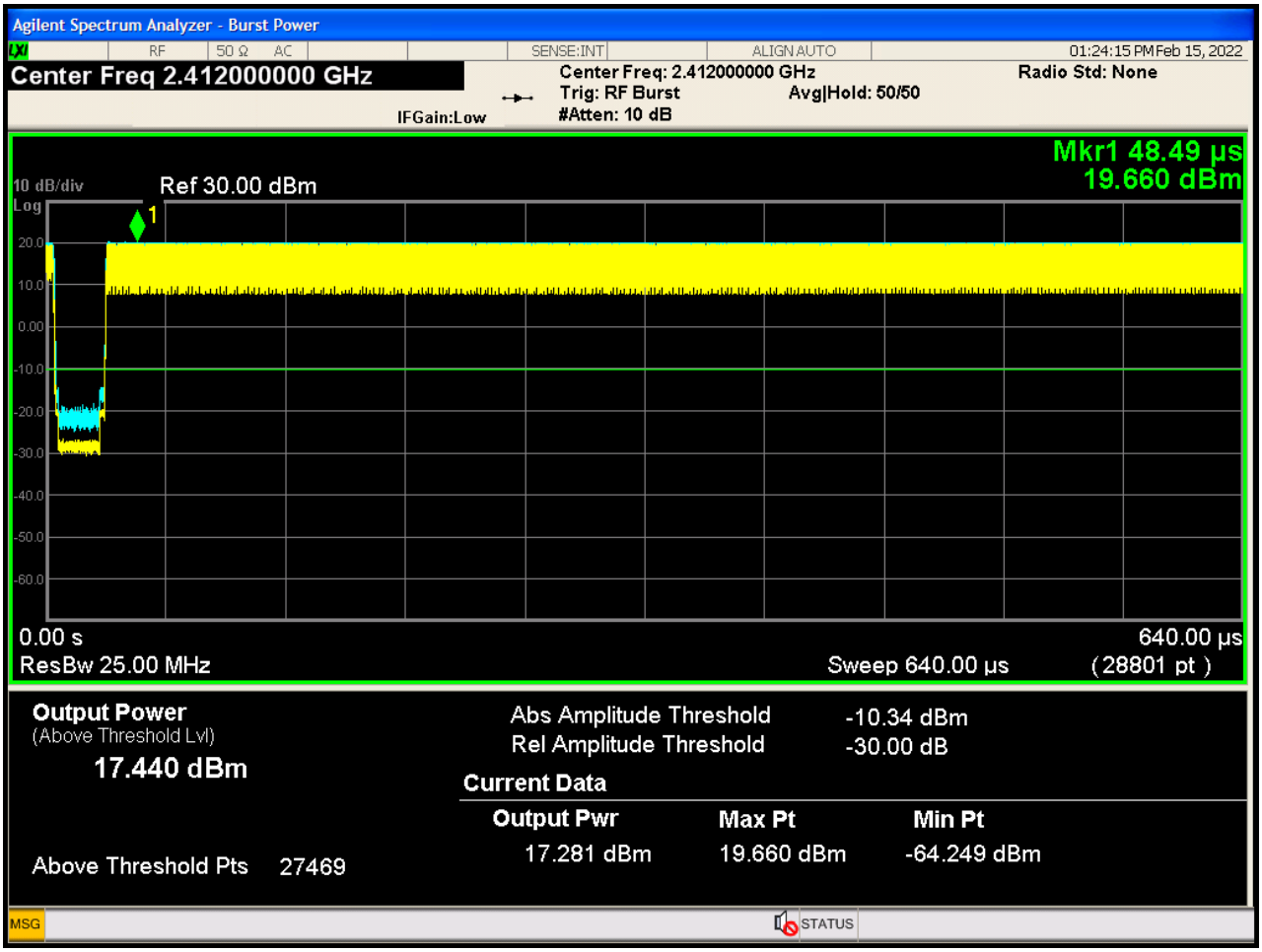


Figure 11: Center Channel, RF Peak Power Output – 802.11b

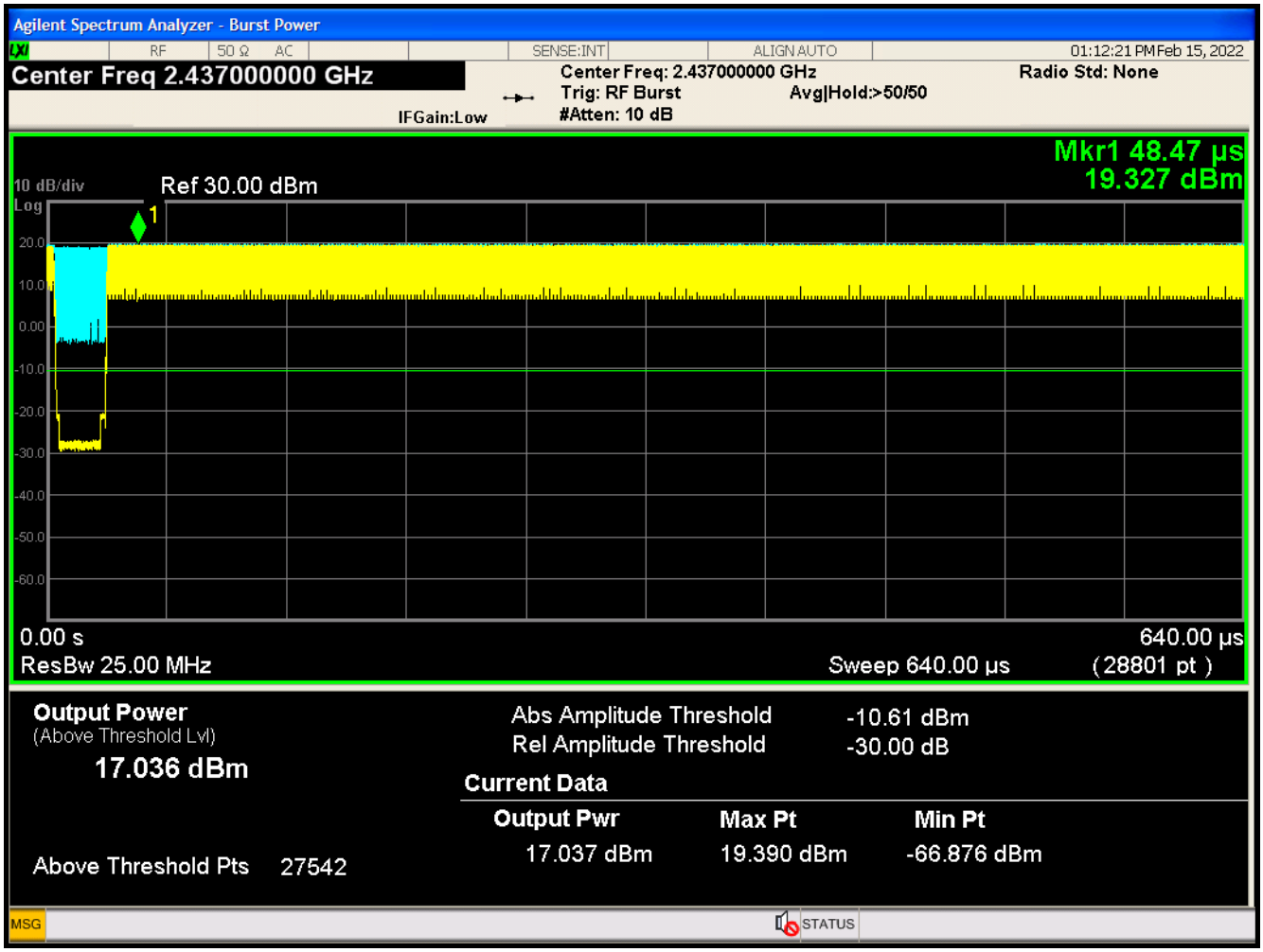


Figure 12: High Channel, RF Peak Power Output – 802.11b

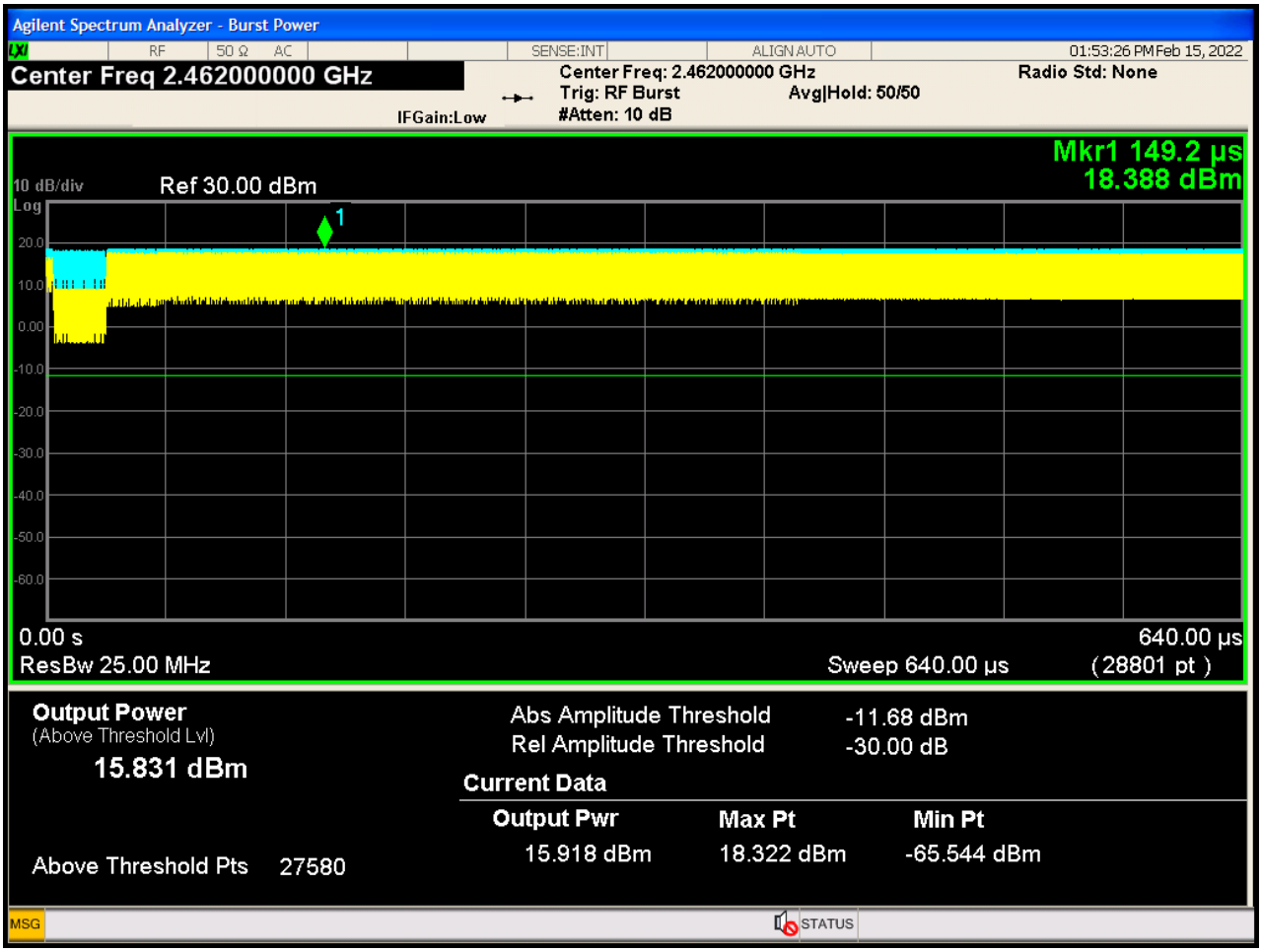


Figure 13: Low Channel, RF Peak Power Output – 802.11g

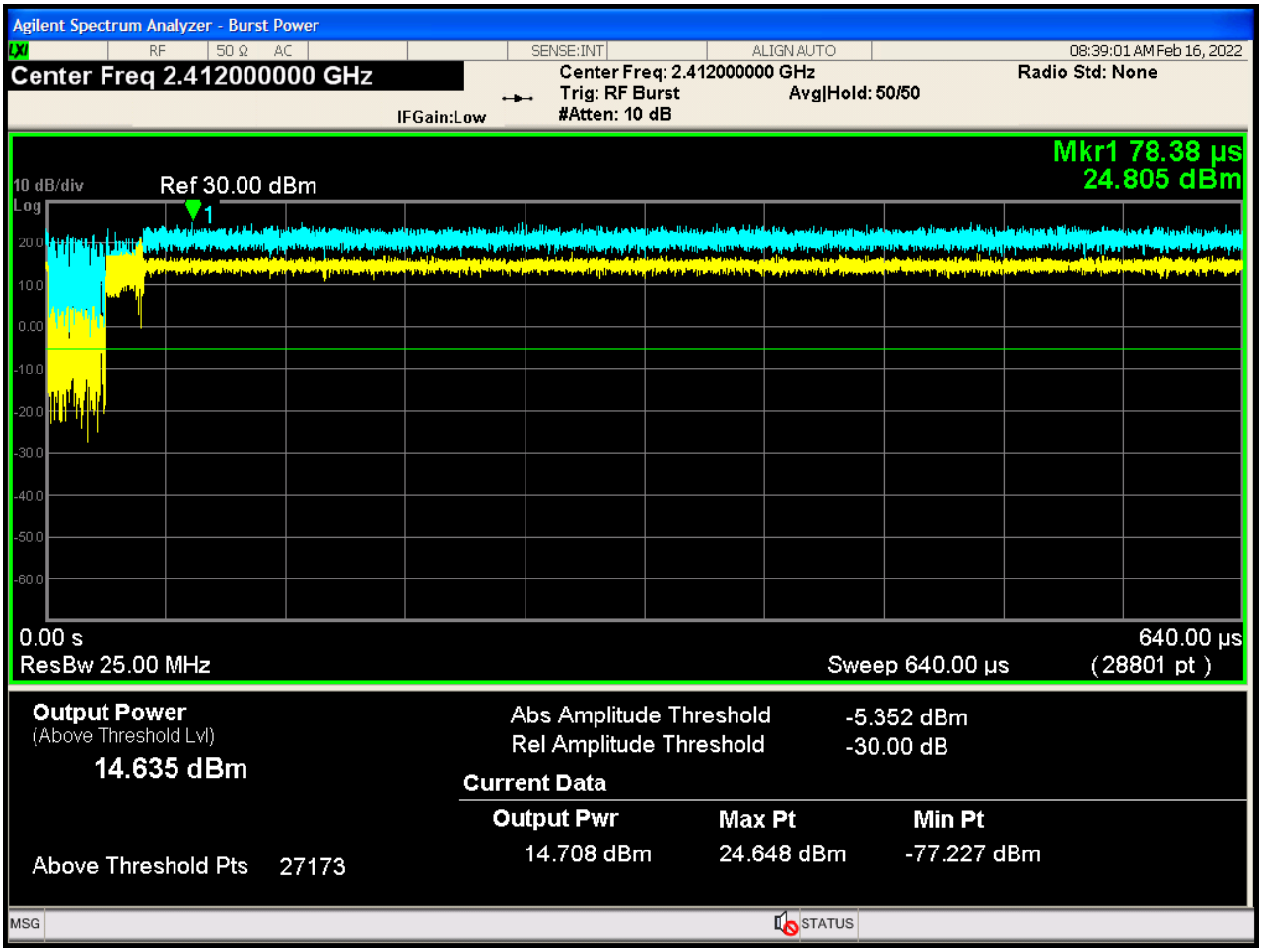


Figure 14: Center Channel, RF Peak Power Output – 802.11g

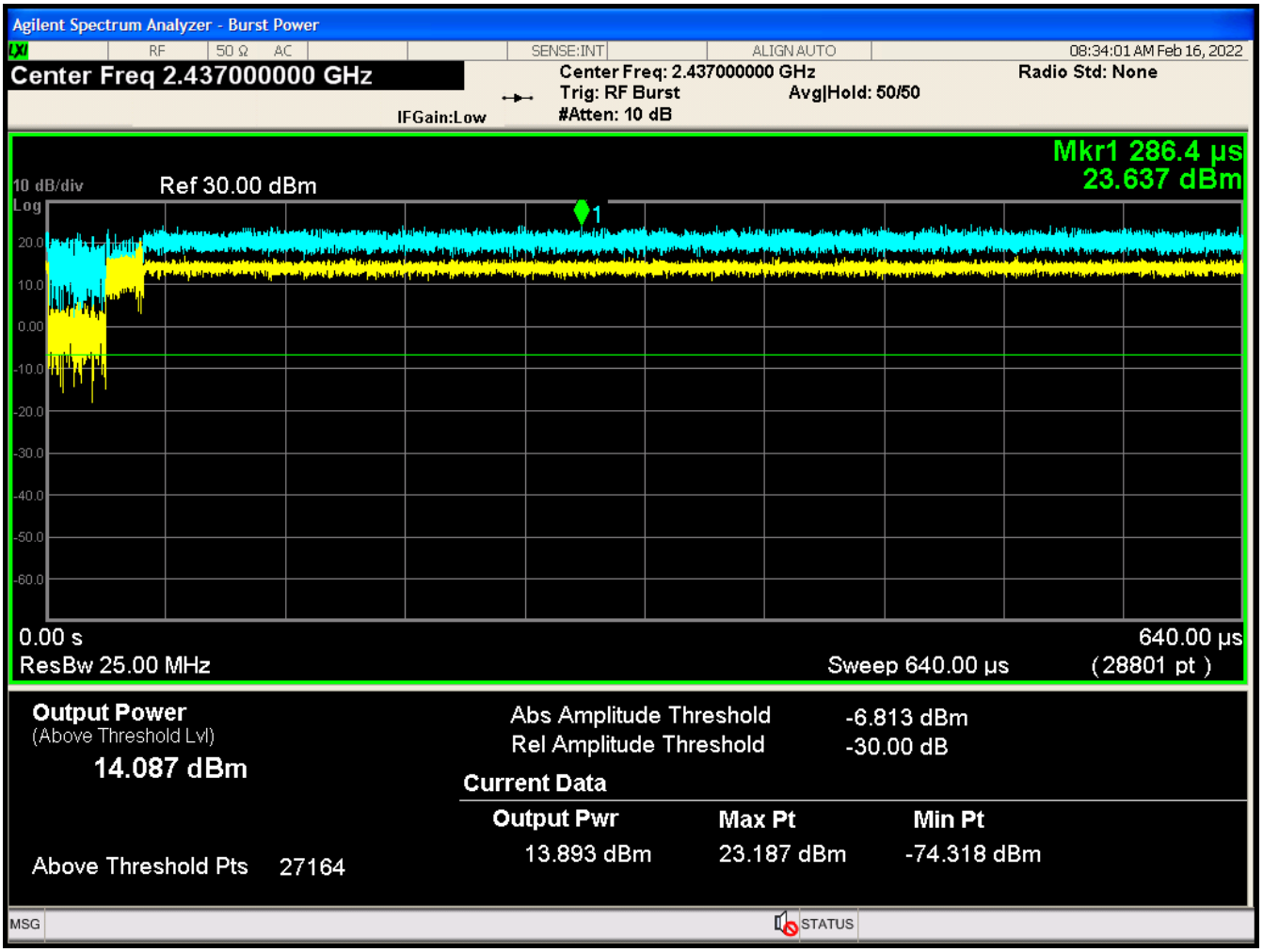


Figure 15: High Channel, RF Peak Power Output – 802.11g

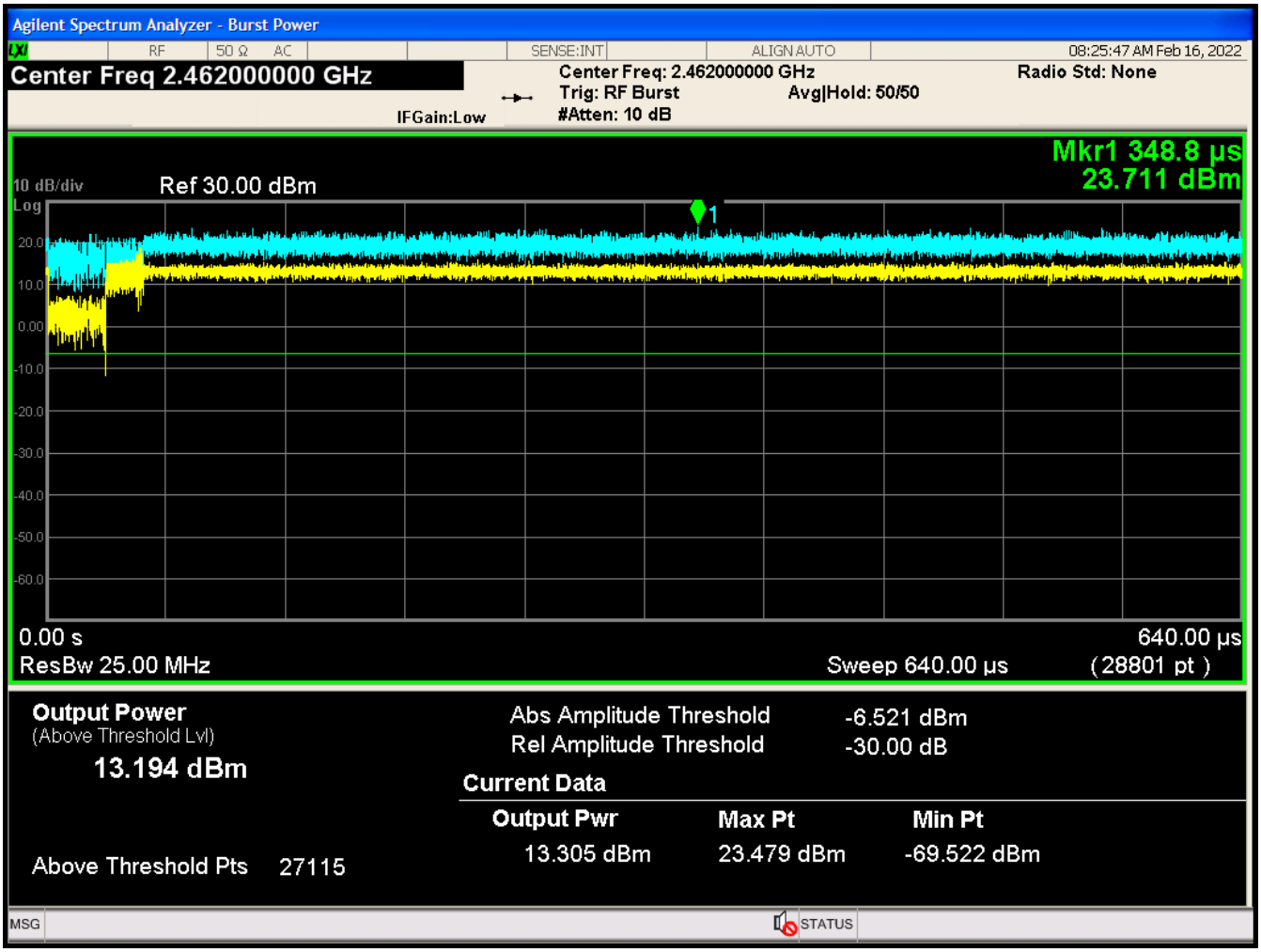


Figure 16: Low Channel, RF Peak Power Output – 802.11n

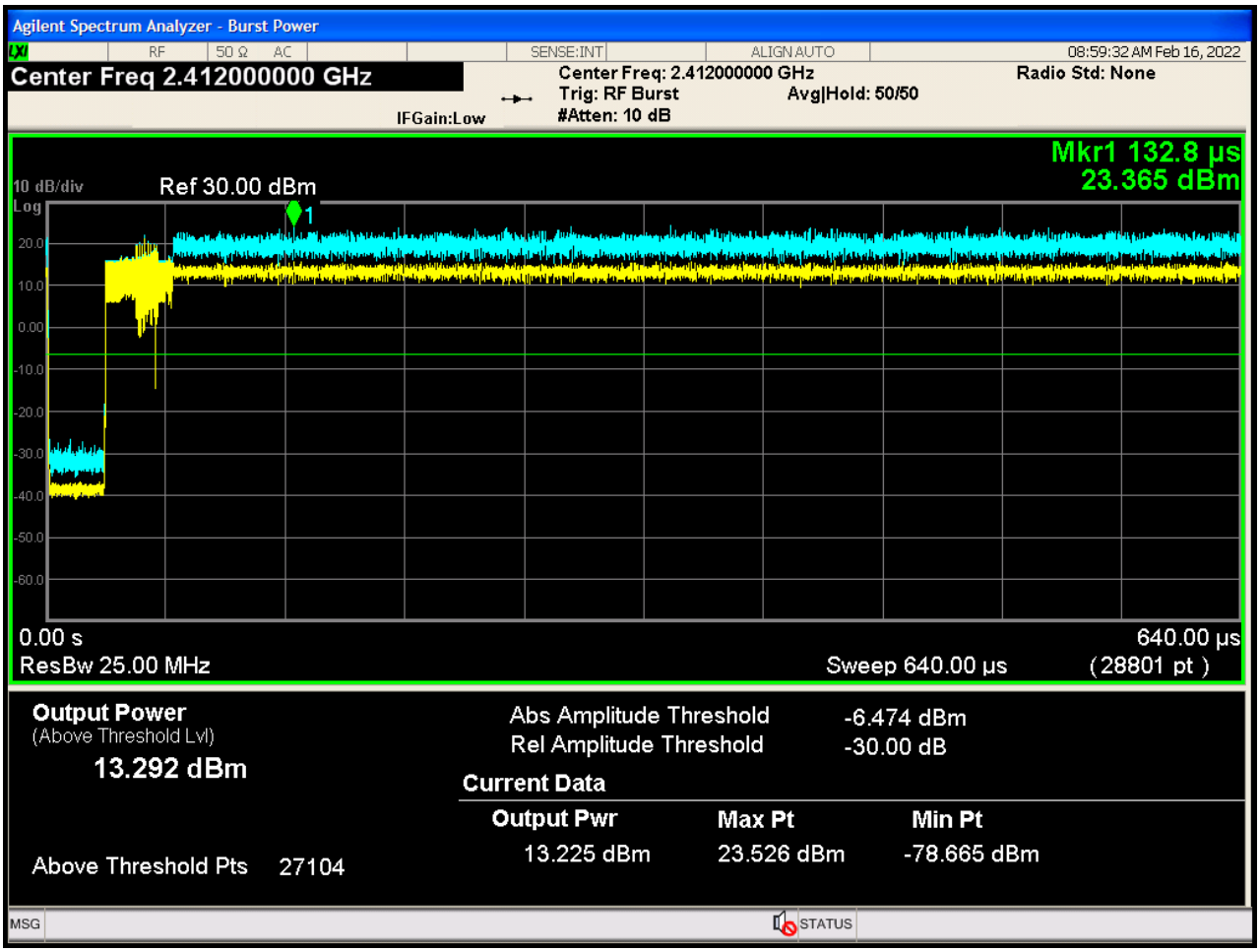


Figure 17: Center Channel, RF Peak Power Output – 802.11n

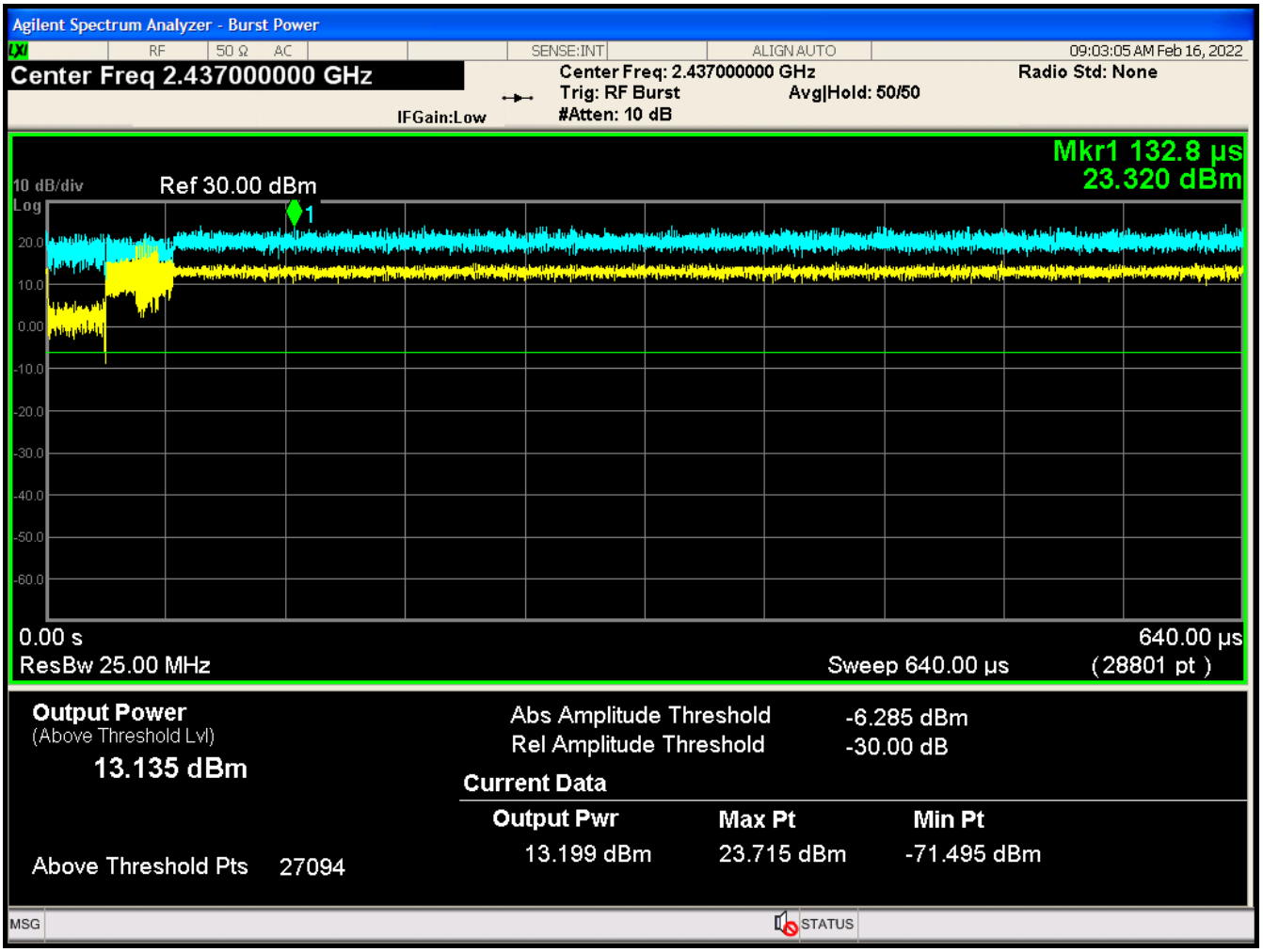
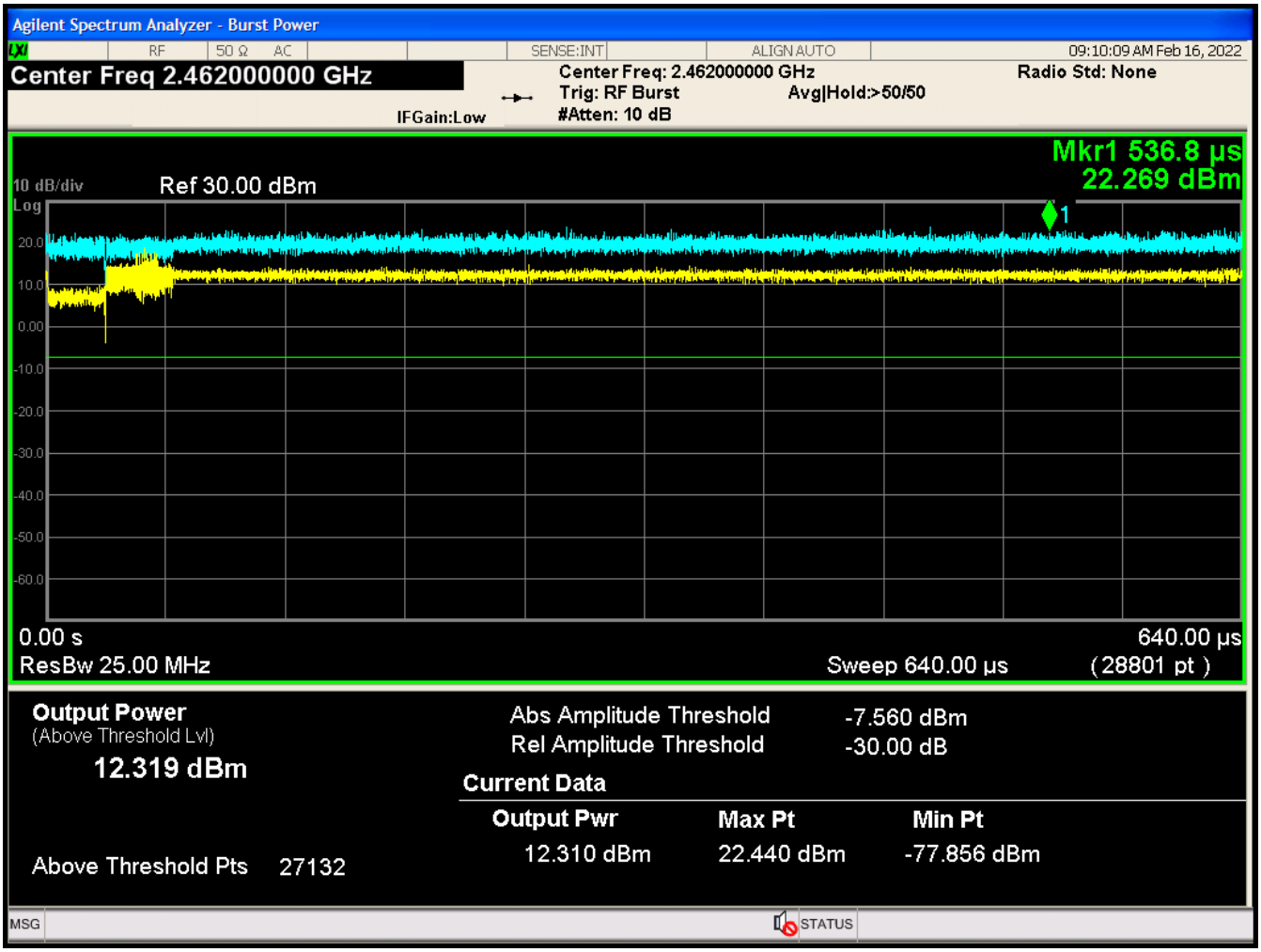


Figure 18: High Channel, RF Peak Power Output – 802.11n



2.3 Conducted Bandedge

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.

2.3.1 Measurement Method

In any 100 kHz bandwidth outside of the authorized 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 dBc as referenced by the fundamental carrier. Compliance may be demonstrated through either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Bandedge – Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
100 kHz	300 kHz

Table 4: Band Edge Summary

EUT Mode Setting	Channel Name	Frequency (MHz)	Bandedge (dBc)	Pass/Fail
802.11b	Low	2412.0	44.46	Pass
	High	2462.0	51.27	Pass
802.11g	Low	2412.0	34.31	Pass
	High	2462.0	49.96	Pass
802.11n	Low	2412.0	33.81	Pass
	High	2462.0	51.99	Pass

Figure 19: Low Channel, Lower Band Edge – 802.11b

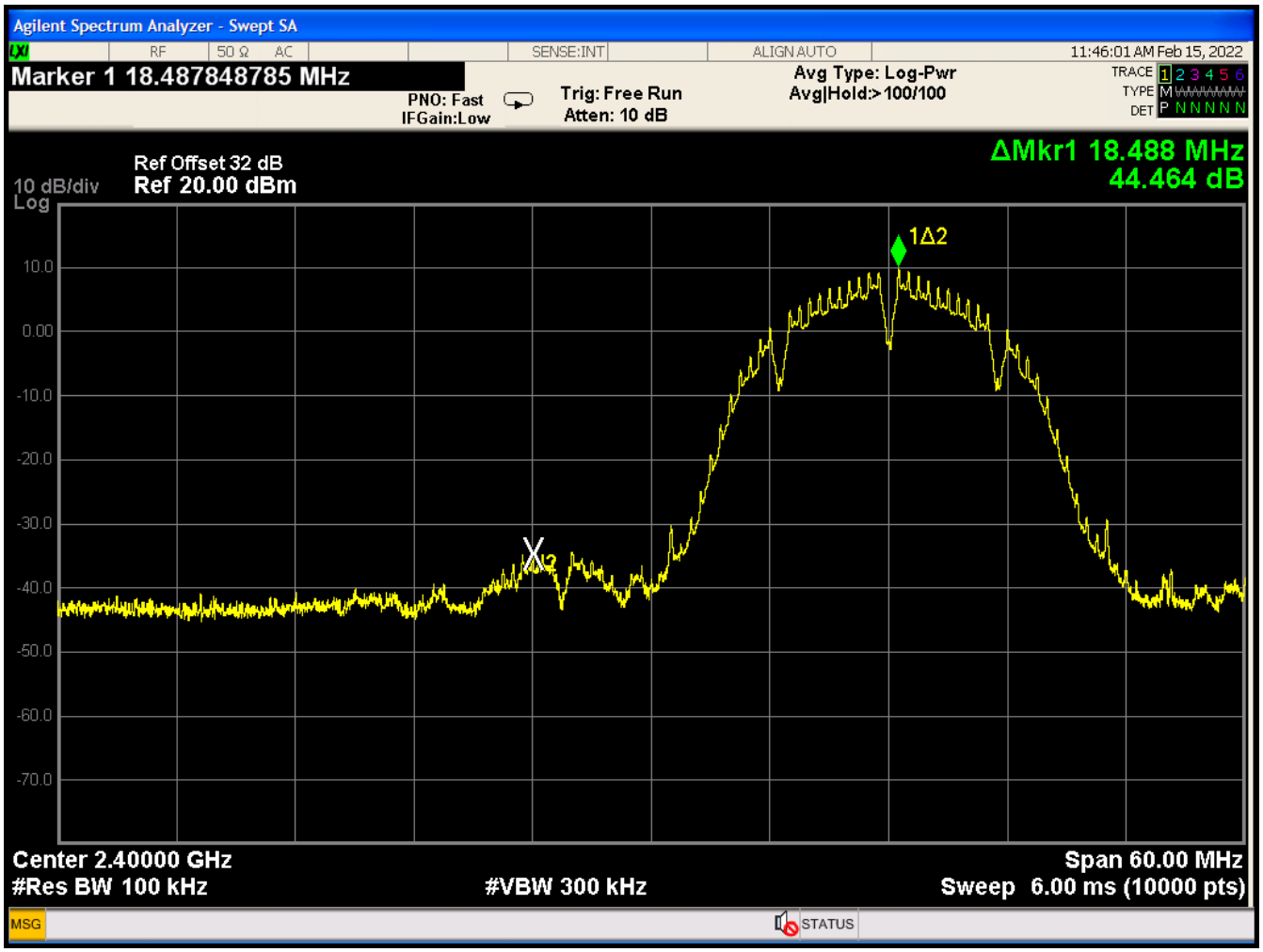


Figure 20: High Channel, Upper Band Edge – 802.11b

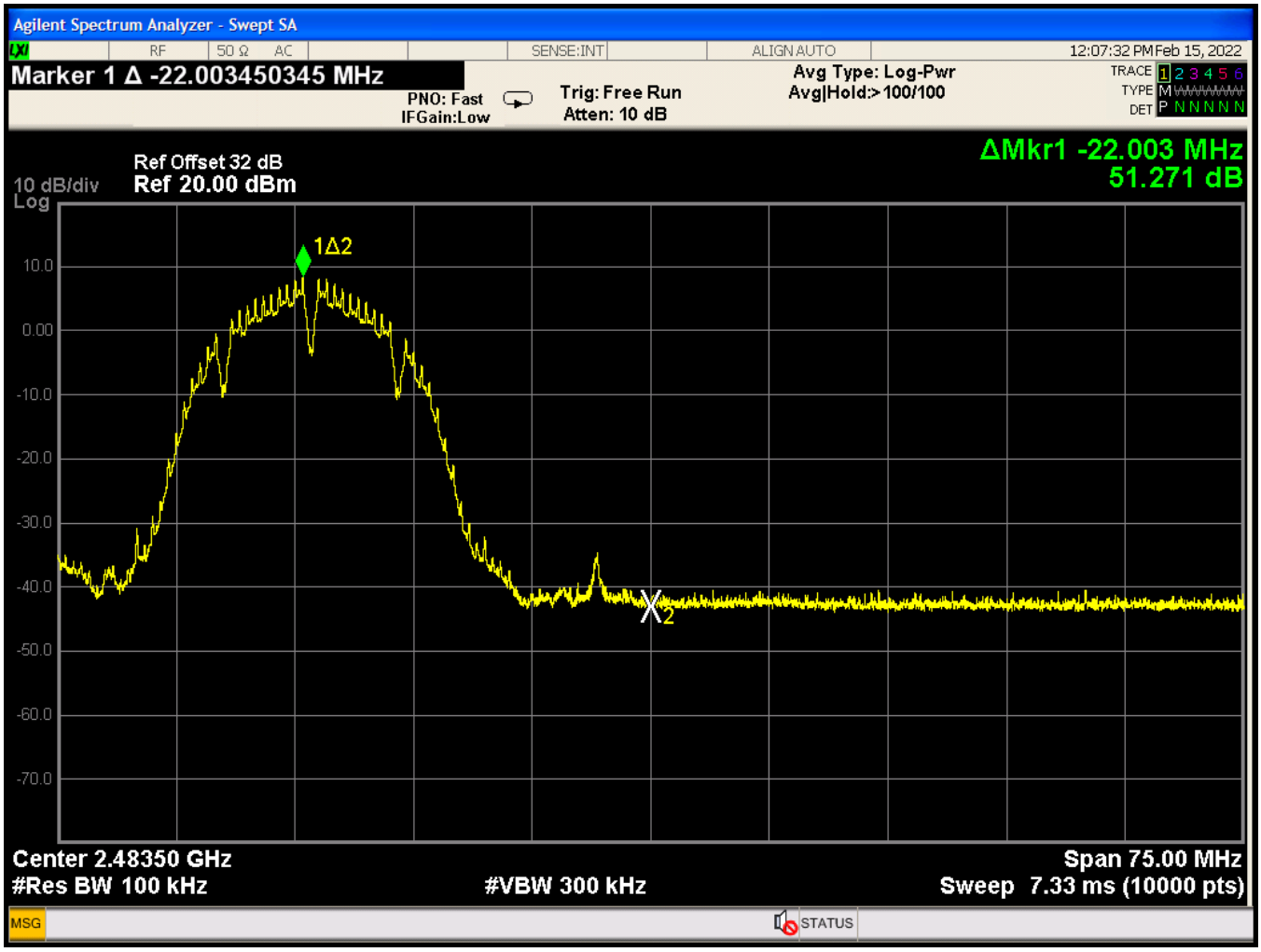


Figure 21: Low Channel, Lower Band Edge – 802.11g

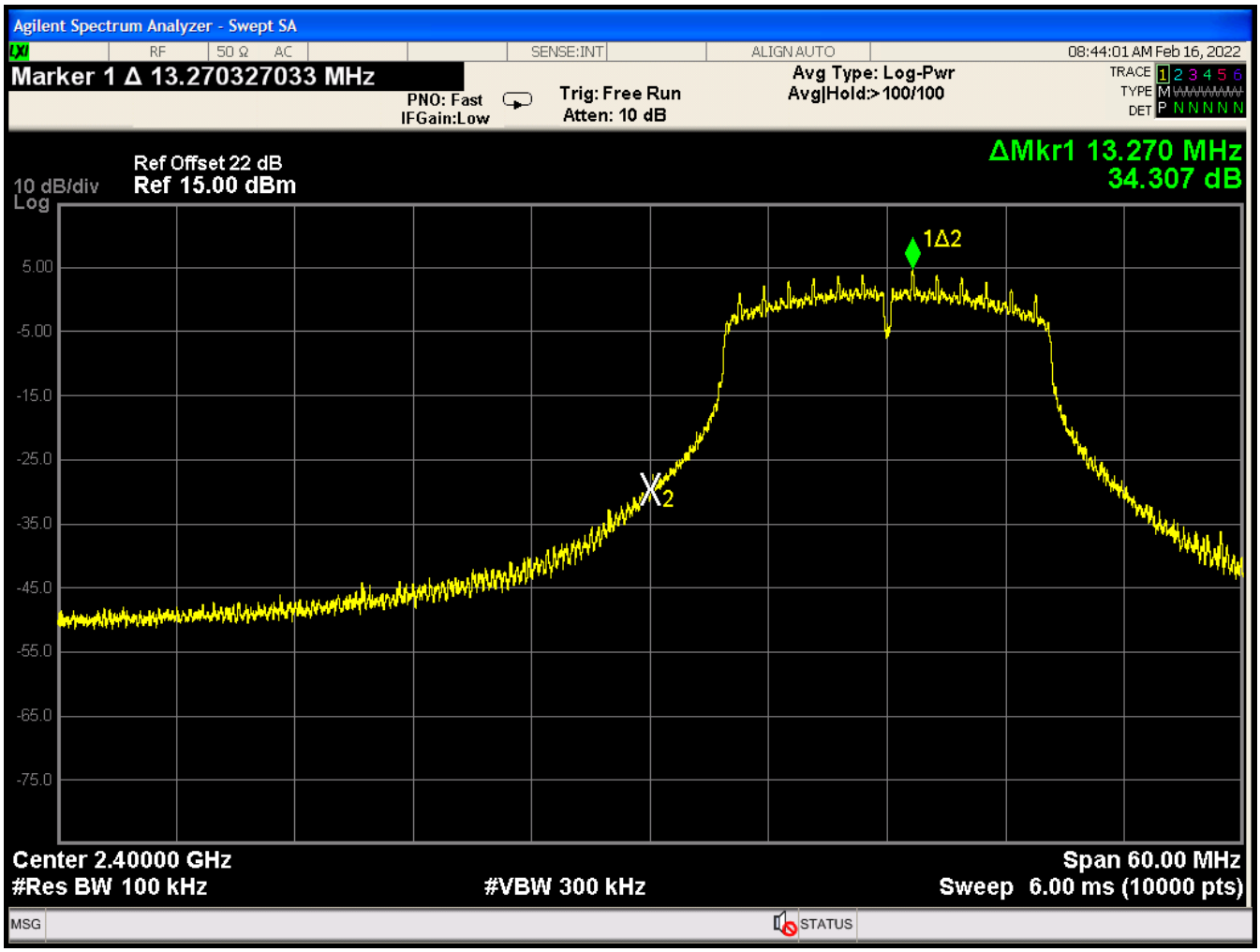


Figure 22: High Channel, Upper Band Edge – 802.11g

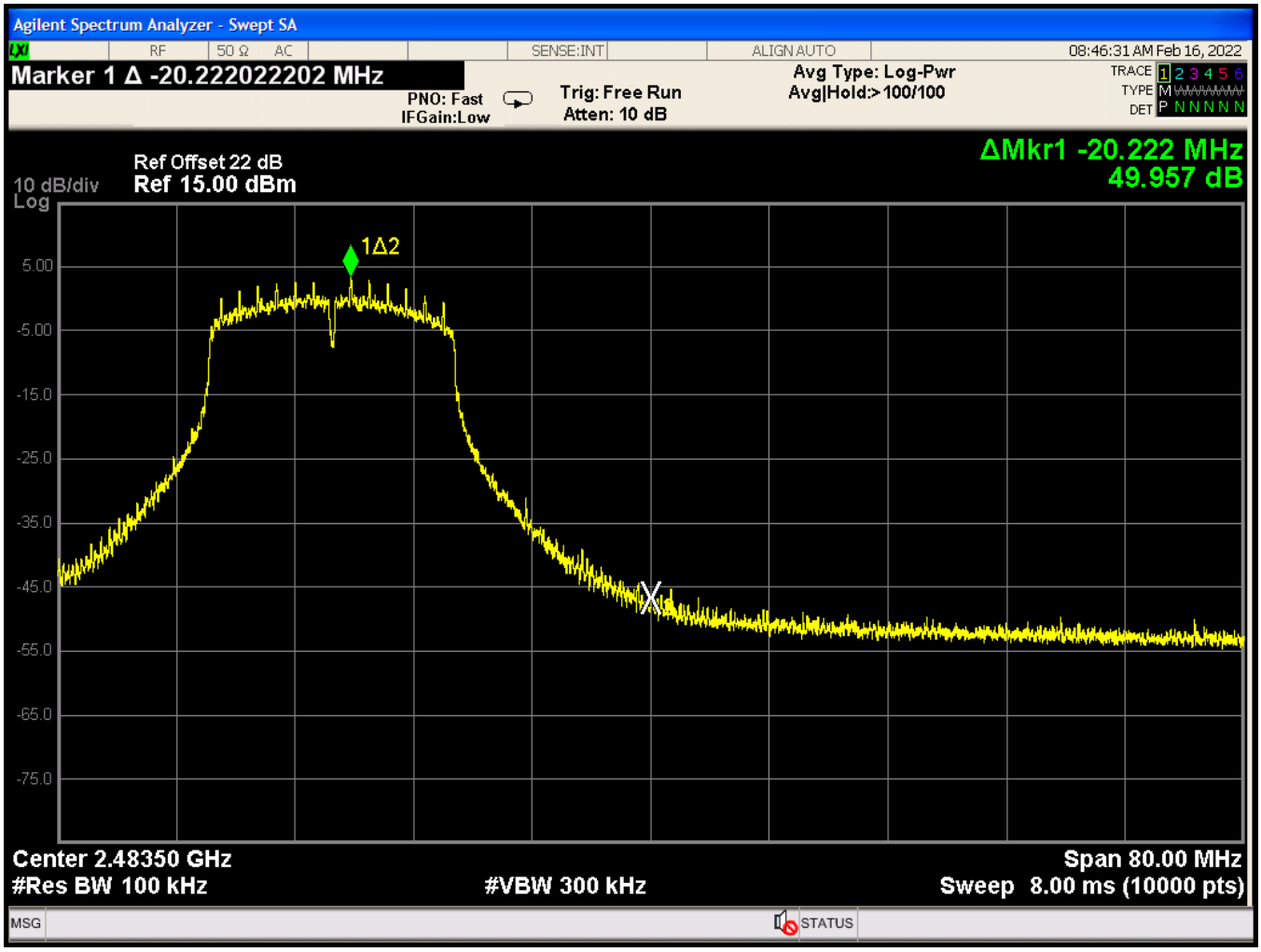


Figure 23: Low Channel, Lower Band Edge – 802.11n

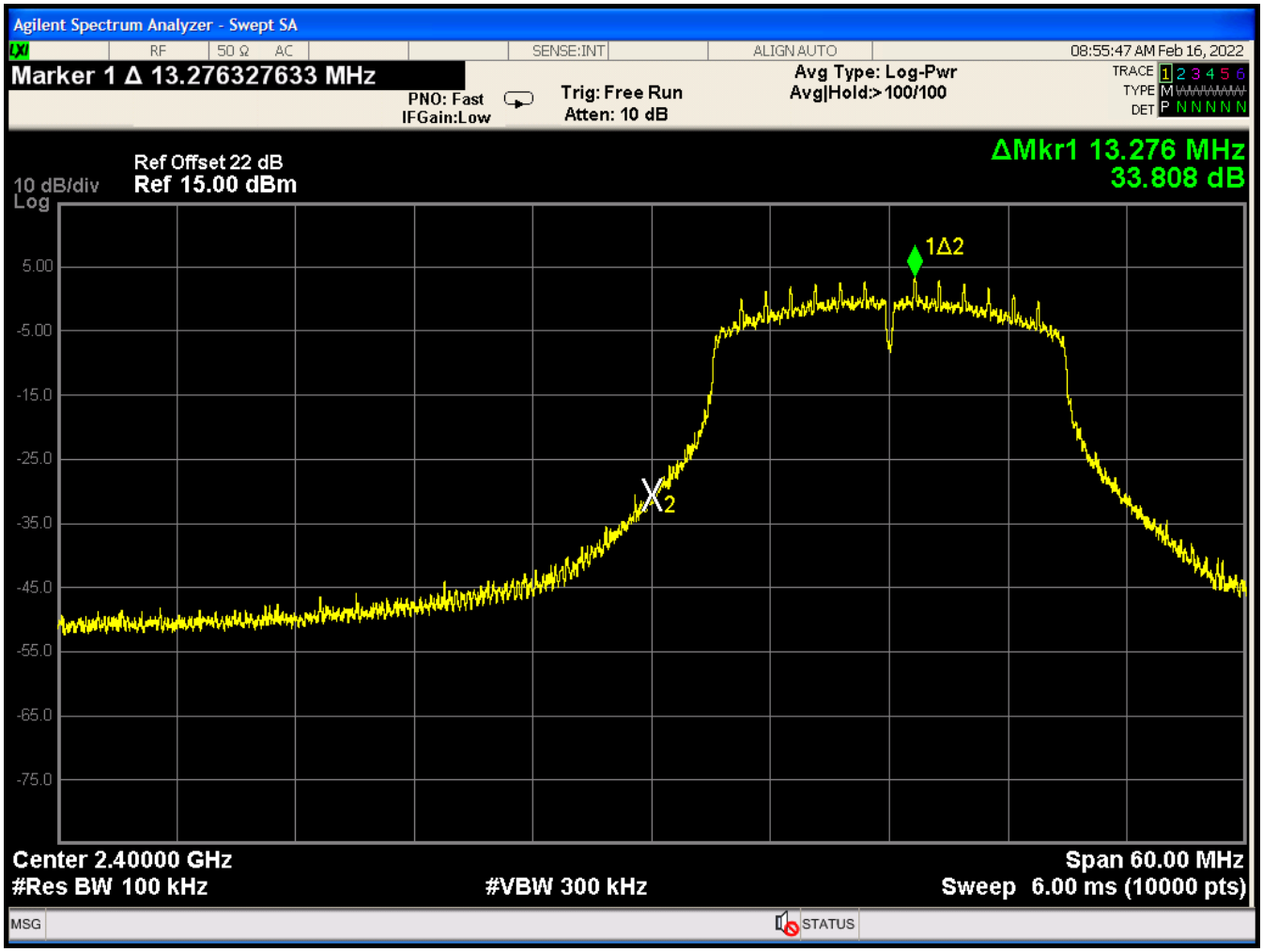
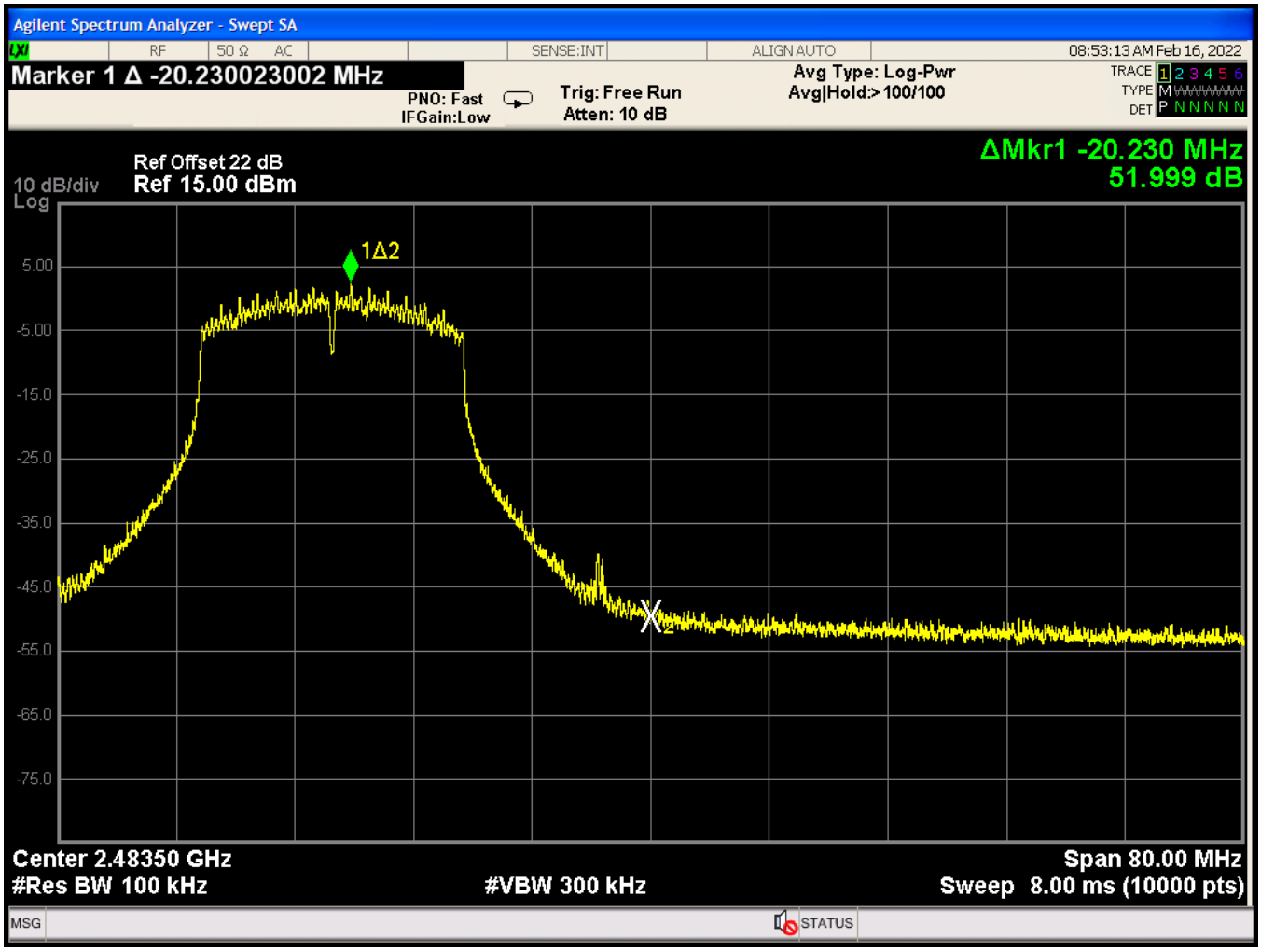


Figure 24: High Channel, Upper Band Edge – 802.11n



2.4 Radiated Emissions

2.4.1 Requirements

Compliance Standard: FCC Part 15, Class B

FCC Compliance Limits		
Frequency Range	Limit Class (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

2.4.2 Test Procedure

The requirements of FCC Part 15 call for the EUT to be placed on a 1 X 1.5 meters non-conductive motorized turntable, at a height of 80cm for measurements below 1 GHz, and a height of 1.5m for measurements above 1 GHz; 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 frequency range of 30 MHz to 25 GHz was measured for all unintentional radiated emissions. The peripherals were placed on the table in accordance with ANSI C63.4. Cables were varied in position to produce maximum emissions. 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 for compliance measurements below 1 GHz. For measurements above 1 GHz, both the peak and average measurement was 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 1 GHz were performed using a measurement bandwidth of 1 MHz with a video bandwidth setting of 10 Hz for the average measurement.

Environmental Conditions during Radiated Emissions Testing

Ambient Temperature:	2.5 °C
Relative Humidity:	48 %

2.4.3 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 = VdBµV + AFdB/m + CFdB - GdB
Convert to linear units of measure:	EdBµV/m/20 Inv log

2.4.4 Test Data

The EUT complies with the Radiated Emissions requirements of FCC Part 15C.

The frequency range of 30 MHz to 25 GHz was investigated, to include the tenth harmonic of the fundamental.

The 2.4 GHz transmitter was evaluated in three orthogonal planes, to determine the worst-case orientation that produced the highest fundamental field strength. The worst-case position was used for all of the testing within this section.

For measurements of frequencies below 1000 MHz, the EUT was set to transmit in the 802.11g mode at the low channel of 2412 MHz (representative of all modes/channels) as this setting produced the highest transmitter power measurement, as denoted in Section 2.2 of this report.

For testing above 1000 MHz, the EUT was scanned at the low and high transmit channels; out to the 10th harmonic. The restricted band-edges were also investigated.

For all radiated emissions testing, the EUT was set to a transmit at the highest possible power settings for each mode.

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

Worst case emission levels are reported below.

Table 5: Radiated Emissions Test Data (30 MHz to 1000 MHz)

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
34.10	V	180.0	2.0	35.8	-5.6	32.4	100.0	-9.8	QP
42.63	V	180.0	2.1	31.7	-11.7	10.0	100.0	-20.0	QP
63.93	V	180.0	1.9	41.2	-16.2	17.8	100.0	-15.0	QP
150.01	V	90.0	1.3	45.7	-11.4	51.9	150.0	-9.2	QP
200.00	V	90.0	1.2	52.1	-11.3	109.1	150.0	-2.8	QP
395.90	V	180.0	1.5	29.0	-7.5	11.9	200.0	-24.5	QP
544.46	V	90.0	1.1	43.2	-4.2	88.6	200.0	-7.1	QP
650.00	V	270.0	1.2	33.0	-2.9	32.1	200.0	-15.9	QP
841.46	V	270.0	1.2	26.0	-0.7	18.4	200.0	-20.7	QP
940.50	V	180.0	1.2	26.0	0.9	22.0	200.0	-19.2	QP
34.10	H	90.0	2.2	36.1	-5.6	33.5	100.0	-9.5	QP
42.63	H	90.0	1.8	32.0	-11.7	10.3	100.0	-19.7	QP
63.93	H	180.0	1.8	41.0	-16.2	17.4	100.0	-15.2	QP
150.01	H	90.0	1.8	45.5	-11.4	50.8	150.0	-9.4	QP
200.00	H	90.0	1.5	51.9	-11.3	106.6	150.0	-3.0	QP
395.90	H	0.0	1.6	29.9	-7.5	13.2	200.0	-23.6	QP
544.46	H	90.0	1.6	44.0	-4.2	97.2	200.0	-6.3	QP
650.00	H	270.0	1.3	32.1	-2.9	28.9	200.0	-16.8	QP
841.46	H	0.0	1.3	25.0	-0.7	16.4	200.0	-21.7	QP
940.50	H	0.0	1.3	25.0	0.9	19.6	200.0	-20.2	QP

* each of the frequencies denoted in Table 5 were identified via a near-field pre-scan investigation.

Table 6: Radiated Spurious Emissions Test Data – 802.11b

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	Comments
2390.00	V	90.0	1.3	46.7	-0.4	207.5	5000.0	-27.6	Peak	Restricted Bandedge (Low Chan.)
2390.00	V	90.0	1.3	34.0	-0.4	48.1	500.0	-20.3	AVG	
2412.00	V	90.0	1.3	93.1	-0.2	44071.3	Radio		Peak	802.11b Low Chan.
2412.00	V	90.0	1.3	88.8	-0.2	26863.1			AVG	
4824.00	V	180.0	1.5	42.9	8.9	391.2	5000.0	-22.1	Peak	AMB
4824.00	V	180.0	1.5	32.0	8.9	111.5	500.0	-13.0	AVG	AMB
7236.00	V	180.0	1.5	43.8	16.0	973.6	5000.0	-14.2	Peak	AMB
7236.00	V	180.0	1.5	31.4	16.0	233.5	500.0	-6.6	AVG	AMB
2462.00	V	270.0	1.5	98.4	0.2	84912.3	Radio		Peak	802.11b High Chan.
2462.00	V	270.0	1.5	95.6	0.2	61513.5			AVG	
2483.50	V	270.0	1.5	47.3	0.4	241.8	5000.0	-26.3	Peak	Restricted Bandedge (High Chan.)
2483.50	V	270.0	1.5	39.0	0.4	93.0	500.0	-14.6	AVG	
4924.00	V	0.0	1.4	50.0	9.1	902.4	5000.0	-14.9	Peak	AMB
4924.00	V	0.0	1.4	39.0	9.1	254.3	500.0	-5.9	AVG	AMB
7386.00	V	0.0	1.4	41.6	15.8	737.3	5000.0	-16.6	Peak	AMB
7386.00	V	0.0	1.4	30.0	15.8	193.9	500.0	-8.2	AVG	AMB
2390.00	H	270.0	1.3	45.6	-0.4	182.8	5000.0	-28.7	Peak	Restricted Bandedge (Low Chan.)
2390.00	H	270.0	1.3	33.9	-0.4	47.5	500.0	-20.4	AVG	
2412.00	H	270.0	1.3	90.0	-0.2	30842.9	Radio		Peak	802.11b Low Chan.
2412.00	H	270.0	1.3	85.0	-0.2	17344.3			AVG	
4824.00	H	0.0	1.5	42.9	8.9	391.2	5000.0	-22.1	Peak	AMB
4824.00	H	0.0	1.5	32.0	8.9	111.5	500.0	-13.0	AVG	AMB
7236.00	H	0.0	1.5	43.8	16.0	973.6	5000.0	-14.2	Peak	AMB
7236.00	H	0.0	1.5	31.4	16.0	233.5	500.0	-6.6	AVG	AMB
2462.00	H	270.0	1.5	93.2	0.2	46662.8	Radio		Peak	802.11b High Chan.
2462.00	H	270.0	1.5	89.2	0.2	29442.2			AVG	
2483.50	H	270.0	1.5	46.0	0.4	208.2	5000.0	-27.6	Peak	Restricted Bandedge (High Chan.)
2483.50	H	270.0	1.5	35.0	0.4	58.7	500.0	-18.6	AVG	
4924.00	H	0.0	1.4	50.0	9.1	902.4	5000.0	-14.9	Peak	AMB
4924.00	H	0.0	1.4	39.0	9.1	254.3	500.0	-5.9	AVG	AMB
7386.00	H	0.0	1.4	41.6	15.8	737.3	5000.0	-16.6	Peak	AMB
7386.00	H	0.0	1.4	30.0	15.8	193.9	500.0	-8.2	AVG	AMB

Table 7: Radiated Spurious Emissions Test Data – 802.11g

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	Comments
2390.00	V	180.0	1.6	48.3	-0.4	249.4	5000.0	-26.0	Peak	Restricted Bandedge (Low Chan.)
2390.00	V	180.0	1.6	36.0	-0.4	60.5	500.0	-18.3	AVG	
2412.00	V	270.0	1.5	92.7	-0.2	42087.7	Radio		Peak	802.11g Low Chan.
2412.00	V	270.0	1.5	86.0	-0.2	19460.6			AVG	
4824.00	V	180.0	1.4	42.9	8.9	391.2	5000.0	-22.1	Peak	AMB
4824.00	V	180.0	1.4	32.0	8.9	111.5	500.0	-13.0	AVG	AMB
7236.00	V	180.0	1.5	43.8	16.0	973.6	5000.0	-14.2	Peak	AMB
7236.00	V	180.0	1.5	31.4	16.0	233.5	500.0	-6.6	AVG	AMB
2462.00	V	90.0	1.6	97.6	0.2	77440.9	Radio		Peak	802.11g High Chan.
2462.00	V	90.0	1.6	88.2	0.2	26300.9			AVG	
2483.50	V	90.0	1.6	53.5	0.4	493.7	5000.0	-20.1	Peak	Restricted Bandedge (High Chan.)
2483.50	V	90.0	1.6	39.4	0.4	97.4	500.0	-14.2	AVG	
4924.00	V	180.0	1.5	50.0	9.1	902.4	5000.0	-14.9	Peak	AMB
4924.00	V	180.0	1.5	39.0	9.1	254.3	500.0	-5.9	AVG	AMB
7386.00	V	90.0	1.4	41.6	15.8	737.3	5000.0	-16.6	Peak	AMB
7386.00	V	90.0	1.4	30.0	15.8	193.9	500.0	-8.2	AVG	AMB
2390.00	H	270.0	1.5	45.8	-0.4	187.0	5000.0	-28.5	Peak	Restricted Bandedge (Low Chan.)
2390.00	H	270.0	1.5	33.0	-0.4	42.8	500.0	-21.3	AVG	
2412.00	H	270.0	1.5	87.0	-0.2	21835.1	Radio		Peak	802.11g Low Chan.
2412.00	H	270.0	1.5	76.0	-0.2	6154.0			AVG	
4824.00	H	180.0	1.4	42.0	8.9	352.7	5000.0	-23.0	Peak	AMB
4824.00	H	180.0	1.4	31.0	8.9	99.4	500.0	-14.0	AVG	AMB
7236.00	H	180.0	1.5	43.0	16.0	887.9	5000.0	-15.0	Peak	AMB
7236.00	H	180.0	1.5	31.0	16.0	223.0	500.0	-7.0	AVG	AMB
2462.00	H	90.0	1.6	91.8	0.2	39716.5	Radio		Peak	802.11g High Chan.
2462.00	H	90.0	1.6	74.0	0.2	5116.5			AVG	
2483.50	H	90.0	1.6	54.5	0.4	553.9	5000.0	-19.1	Peak	Restricted Bandedge (High Chan.)
2483.50	H	90.0	1.6	37.6	0.4	79.1	500.0	-16.0	AVG	
4924.00	H	180.0	1.5	48.6	9.1	768.1	5000.0	-16.3	Peak	AMB
4924.00	H	180.0	1.5	37.0	9.1	202.0	500.0	-7.9	AVG	AMB
7386.00	H	90.0	1.4	41.0	15.8	688.1	5000.0	-17.2	Peak	AMB
7386.00	H	90.0	1.4	29.9	15.8	191.7	500.0	-8.3	AVG	AMB

Table 8: Radiated Spurious Emissions Test Data – 802.11n

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	Comments
2390.00	V	90.0	1.6	48.0	-0.4	241.0	5000.0	-26.3	Peak	Restricted Bandedge (Low Chan.)
2390.00	V	90.0	1.6	33.7	-0.4	46.4	500.0	-20.6	AVG	
2412.00	V	90.0	1.6	90.3	-0.2	31926.8	Radio		Peak	802.11n Low Chan.
2412.00	V	90.0	1.6	80.7	-0.2	10572.0			AVG	
4824.00	V	180.0	1.5	42.9	8.9	391.2	5000.0	-22.1	Peak	AMB
4824.00	V	180.0	1.5	32.0	8.9	111.5	500.0	-13.0	AVG	AMB
7236.00	V	180.0	1.5	43.8	16.0	973.6	5000.0	-14.2	Peak	AMB
7236.00	V	180.0	1.5	31.4	16.0	233.5	500.0	-6.6	AVG	AMB
2462.00	V	270.0	1.4	95.9	0.2	63675.2	Radio		Peak	802.11n High Chan.
2462.00	V	270.0	1.4	85.8	0.2	19905.4			AVG	
2483.50	V	270.0	1.4	57.4	0.4	773.5	5000.0	-16.2	Peak	Restricted Bandedge (High Chan.)
2483.50	V	270.0	1.4	39.0	0.4	93.0	500.0	-14.6	AVG	
4924.00	V	180.0	1.5	48.6	9.1	768.1	5000.0	-16.3	Peak	AMB
4924.00	V	180.0	1.5	37.0	9.1	202.0	500.0	-7.9	AVG	AMB
7386.00	V	90.0	1.4	41.0	15.8	688.1	5000.0	-17.2	Peak	AMB
7386.00	V	90.0	1.4	29.9	15.8	191.7	500.0	-8.3	AVG	AMB
2390.00	H	90.0	1.6	47.0	-0.4	214.8	5000.0	-27.3	Peak	Restricted Bandedge (Low Chan.)
2390.00	H	90.0	1.6	33.0	-0.4	42.8	500.0	-21.3	AVG	
2412.00	H	90.0	1.6	89.9	-0.2	30489.9	Radio		Peak	802.11n Low Chan.
2412.00	H	90.0	1.6	80.0	-0.2	9753.4			AVG	
4824.00	H	0.0	1.5	42.9	8.9	391.2	5000.0	-22.1	Peak	AMB
4824.00	H	0.0	1.5	32.0	8.9	111.5	500.0	-13.0	AVG	AMB
7236.00	H	0.0	1.5	43.8	16.0	973.6	5000.0	-14.2	Peak	AMB
7236.00	H	0.0	1.5	31.4	16.0	233.5	500.0	-6.6	AVG	AMB
2462.00	H	270.0	1.4	94.1	0.2	51757.2	Radio		Peak	802.11n High Chan.
2462.00	H	270.0	1.4	85.0	0.2	18153.9			AVG	
2483.50	H	270.0	1.4	57.0	0.4	738.7	5000.0	-16.6	Peak	Restricted Bandedge (High Chan.)
2483.50	H	270.0	1.4	39.0	0.4	93.0	500.0	-14.6	AVG	
4924.00	H	0.0	1.5	48.0	9.1	716.8	5000.0	-16.9	Peak	AMB
4924.00	H	0.0	1.5	36.0	9.1	180.0	500.0	-8.9	AVG	AMB
7386.00	H	0.0	1.4	40.9	15.8	680.2	5000.0	-17.3	Peak	AMB
7386.00	H	0.0	1.4	30.0	15.8	193.9	500.0	-8.2	AVG	AMB

3 Equipment Under Test

3.1 EUT Identification & Description

The SECO USA, Inc., TrustedEdge Micro WiFi is a network security device. The EUT sits inline within a network connection and communicates with an associated device elsewhere on the network, confirming authentication. During testing, the EUT had two wired connections: one USB 3.0 cable for PCB control, and one DC power cable via USB-C. The EUT is designed to be used in an 802.11 mode only. No other transmitter modes will be employed.

3.2 Test Configuration

The TrustedEdge Micro WiFi was powered by a USB-C 20V DC power supply. The transmitter module was integrated onto the SECO PCB, as depicted in Applicant's Internal Photographs Exhibit.

Figure 25: EUT Testing Block Diagram

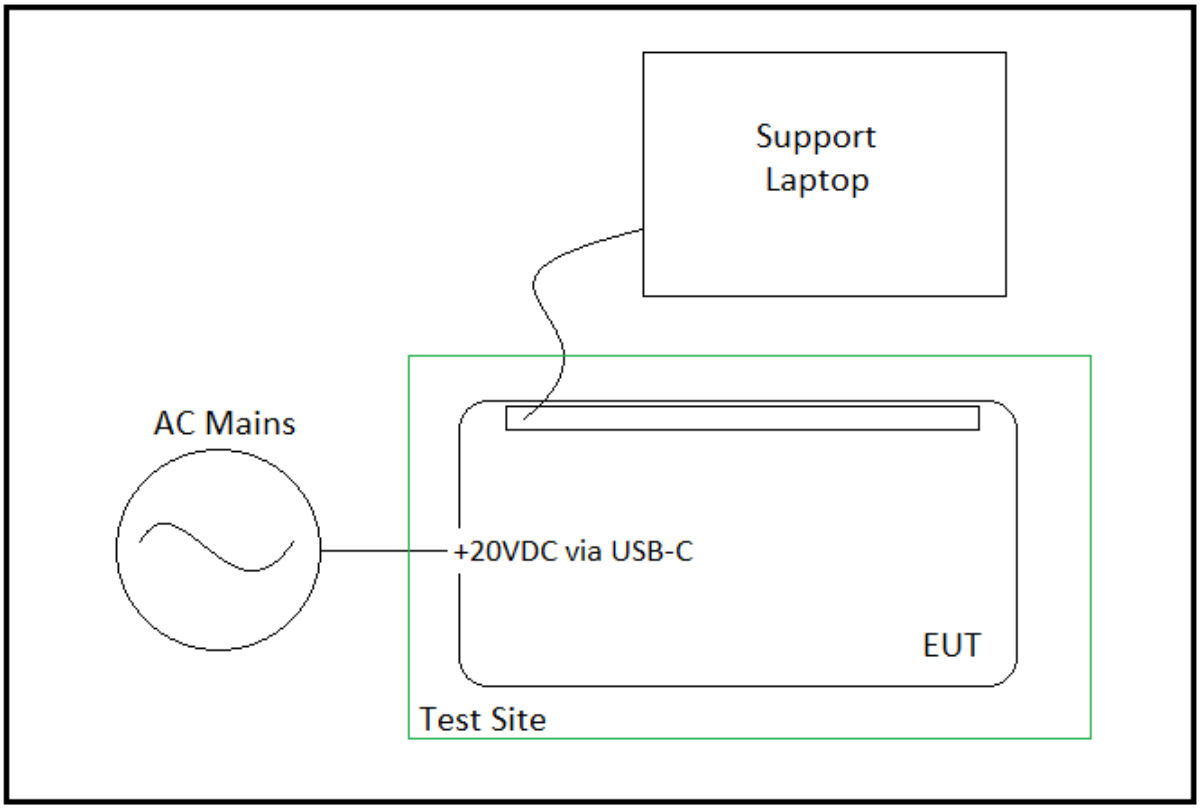


Table 9: Radio Device Summary

Manufacturer & Applicant:	SECO USA, Inc.	
Desired FCC ID for SECO:	2ALZB-LB1DX	
EUT Name:	TrustedEdge Micro WiFi	
Integrated Module:	FCC ID: VPYLB1DX	
FCC Rule Part:	§15.247	
TX Frequency Range:	2412 – 2462 MHz	
Modulation:	802.11b	DBPSK (DSSS)
	802.11g	BPSK (OFDM)
	802.11n	BPSK (OFDM)
6dB Occupied Bandwidth:	802.11b	9.12 MHz
	802.11g	15.82 MHz
	802.11n	16.33 MHz
FCC Emission Designator:	9M12G1DN	
Keying:	Automatic	
Type of Information:	TCP/IP Authentication Data	
Number of Channels:	Not Specified by Applicant	
Antenna Connector:	PCB Mounted/Integrated	
Antenna Type	Unictron (AA077H) Ceramic Chip; 1.7 dBi Gain	
Maximum Potential EIRP:	26.2 dBm (as tested)	
Interface Cables:	See Table 12 of this report	
Software/Firmware:	EUT Firmware: Normal Operation	
	Radio Software: Test Mode per Manufacturer	
Pulsed Transmitter:	No	
Transmitter Timing/Duty Cycle:	~ 98 to 99 %	
Power Source & Voltage:	12-20 VDC via USB-C	
Highest TX Spurious Emission:	MHz (3m, Radiated)	

Table 10: EUT System Configuration List

Name / Description	Model Number	Part Number	Serial Number	Revision
TrustedEdge Micro WiFi	1	N/A	N/A	B0.6

Table 11: Support Equipment

Item	Model/Part Number	Serial Number
AC/DC Power Supply	N/A	N/A
Laptop	Lenovo	N/A

Table 12: Cable Configuration

Port Identification	Connector Type	Cable Length	Shielded (Y/N)	Termination Point
DC Power	USB-C	1m	Y	Power Supply
Test Mode Control	USB 3.0	1m	N	Support Laptop

3.3 Measurements

3.3.1 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

3.4 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 13 below.

Table 13: 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 Equipment

Table 14 shows a list of the test equipment used for measurements, along with the calibration information.

Table 14: Test Equipment List

Test Name: **Benchtop RF Emissions**		Test Dates: 2/15/2022 & 2/16/2022	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT, MXA-N9020A	SPECTRUM ANALYZER	3/18/2022
00806	MINI-CIRCUITS	HF COAXIAL CABLE, SMA	5/10/2022

Test Name: **3m Radiated Emissions**		Test Date: 2/16/2022	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
00942	AGILENT, MXA-N9020A	SPECTRUM ANALYZER	3/18/2022
00644	SUNOL SCIENCES CORP.	BICONALOG ANTENNA	11/9/2022
00425	ARA, DRG-118/A	HF HORN ANTENNA	8/18/2022
00955	JUNKOSHA, MWX322	18M HF COAXIAL CABLE	5/10/2022
00865	STORM 874-0101-036	HF COAXIAL CABLE, SMA	6/17/2022
00276	ELECTRO-METRICS, BPA	RF PRE-AMPLIFIER	6/8/2022
00627	AGILENT, 8449B	RF PRE-AMPLIFIER	9/22/2022
00281	ITC. 21A-3A1	WAVEGUIDE PASS FILTER	3/16/2022