



FCC & ISED Certification Test Report
For the
SwipeSense Inc.
Badge

FCC ID: 2AB5RBAD120
ISED: TBD

WLL JOB# 14599-01 Rev 2
Revised June 30, 2016

Prepared for:

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SUITE 202.
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Prepared By:

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Gaithersburg, Maryland 20879



Testing Certificate AT-1448

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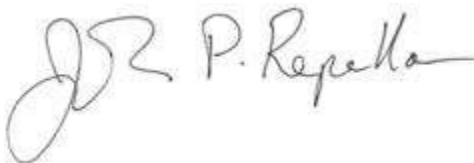
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Prepared by:



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John P. Repella
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Abstract

This report has been prepared on behalf of SwipeSense Inc. 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 (10/2014) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-247 issue 1 of ISED. This Certification Test Report documents the test configuration and test results for the SwipeSense Inc. Badge.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. 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 OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Certificate AT-1448 as an independent FCC test laboratory.

The SwipeSense Inc. Badge complies with the limits for a Digital Transmission System (DTS) Transmitter device under FCC Part 15.247 and ISED RSS-247.

Revision History	Description of Change	Date
Rev 0	Initial Release	June 6, 2016
Rev 1	Typographical errors corrected	June 22, 2016
Rev 2	Added Duty Cycle correction statement and added duty cycle correction to radiated emissions results.	June 30, 2016

Table of Contents

Abstract	iii
1 Introduction	1
1.1 Compliance Statement	1
1.2 Test Scope	1
1.3 Contract Information	1
1.4 Test Dates	1
1.5 Test and Support Personnel	1
1.6 Abbreviations	2
2 Equipment Under Test	3
2.1 EUT Identification & Description	3
2.2 Test Configuration	3
2.3 Testing Algorithm	3
2.4 Test Location	4
2.5 Measurements	4
2.5.1 References	4
2.6 Measurement Uncertainty	4
3 Test Equipment	6
4 Test Summary	7
5 Test Results	8
5.1 Occupied (DTS) Bandwidth:	8
5.1.1 Measurement Method:	8
5.2 RF Power Output:	12
5.2.1 Measurement Method:	12
5.3 Power Spectral Density	16
5.3.1 Measurement Method:	16
5.4 Conducted Spurious Emissions compliance	20
5.4.1 Test Summary	20
5.5 Radiated Spurious Emissions:	69
5.5.1 Test Procedure	69
5.5.2 Test Summary	70

List of Tables

Table 1: Device Summary	3
Table 2: Expanded Uncertainty List	5
Table 3: Test Equipment List.....	6
Table 4: Test Summary Table.....	7
Table 5: Occupied Bandwidth Spectrum Analyzer Settings.....	8
Table 6: Occupied Bandwidth Results.....	8
Table 7: Spectrum Analyzer Settings	12
Table 8: RF Power Output Summary.....	12
Table 9: Power Spectral Density.....	16
Table 10: Spectrum Analyzer Settings	69
Table 11: Radiated Emission Test Data (all Channels)	71
Table 12: Radiated Emission Test Data, Low Channel	72
Table 13: Radiated Emission Test Data, Center Channel.....	74
Table 14: Radiated Emission Test Data, High Channel	75

List of Figures

Figure 1: Occupied Bandwidth, Low Channel	9
Figure 2: Occupied Bandwidth, Center Channel	10
Figure 3: Occupied Bandwidth, High Channel.....	11
Figure 4: RF Peak Power, Low Channel	13
Figure 5: RF Peak Power, Center Channel	14
Figure 6: RF Peak Power, High Channel.....	15
Figure 7: Power Spectral Density, Low Channel.....	17
Figure 8: Power Spectral Density, Center Channel	18
Figure 9: Power Spectral Density, High Channel	19
Figure 10: Highest PSD Level (center channel)	21
Figure 11: Low Channel Conducted Spurious Plot 1	22
Figure 12: Low Channel Conducted Spurious Plot 2	23
Figure 13: Low Channel Conducted Spurious Plot 3	24
Figure 14: Low Channel Conducted Spurious Plot 4	25
Figure 15: Low Channel Conducted Spurious Plot 5	26
Figure 16: Low Channel Conducted Spurious Plot 6	27
Figure 17: Low Channel Conducted Spurious Plot 7	28
Figure 18: Low Channel Conducted Spurious Plot 8	29
Figure 19: Low Channel Conducted Spurious Plot 9	30
Figure 20: Low Channel Conducted Spurious Plot 10	31
Figure 21: Low Channel Conducted Spurious Plot 11	32
Figure 22: Low Channel Conducted Spurious Plot 12	33
Figure 23: Low Channel Conducted Spurious Plot 13	34
Figure 24: Low Channel Conducted Spurious Plot 14	35
Figure 25: Low Channel Conducted Spurious Plot 15	36
Figure 26: Center Channel Conducted Spurious Plot 1	37
Figure 27: Center Channel Conducted Spurious Plot 2	38

Figure 28: Center Channel Conducted Spurious Plot 3	39
Figure 29: Center Channel Conducted Spurious Plot 4	40
Figure 30: Center Channel Conducted Spurious Plot 5	41
Figure 31: Center Channel Conducted Spurious Plot 6	42
Figure 32: Center Channel Conducted Spurious Plot 7	43
Figure 33: Center Channel Conducted Spurious Plot 8	44
Figure 34: Center Channel Conducted Spurious Plot 9	45
Figure 35: Center Channel Conducted Spurious Plot 10	46
Figure 36: Center Channel Conducted Spurious Plot 11	47
Figure 37: Center Channel Conducted Spurious Plot 12	48
Figure 38: Center Channel Conducted Spurious Plot 13	49
Figure 39: Center Channel Conducted Spurious Plot 14	50
Figure 40: Center Channel Conducted Spurious Plot 15	51
Figure 41: High Channel Conducted Spurious Plot 1	52
Figure 42: High Channel Conducted Spurious Plot 2	53
Figure 43: High Channel Conducted Spurious Plot 3	54
Figure 44: High Channel Conducted Spurious Plot 4	55
Figure 45: High Channel Conducted Spurious Plot 5	56
Figure 46: High Channel Conducted Spurious Plot 6	57
Figure 47: High Channel Conducted Spurious Plot 7	58
Figure 48: High Channel Conducted Spurious Plot 8	59
Figure 49: High Channel Conducted Spurious Plot 9	60
Figure 50: High Channel Conducted Spurious Plot 10	61
Figure 51: High Channel Conducted Spurious Plot 11	62
Figure 52: High Channel Conducted Spurious Plot 12	63
Figure 53: High Channel Conducted Spurious Plot 13	64
Figure 54: High Channel Conducted Spurious Plot 14	65
Figure 55: High Channel Conducted Spurious Plot 15	66
Figure 56: Lower Band Edge Low Channel	67
Figure 57: Upper Band Edge High Channel	68
Figure 58: Duty Cycle Calculation	70

1 Introduction

1.1 Compliance Statement

The SwipeSense Inc. Badge complies with the limits for a Digital Transmission System (DTS) Transmitter device under FCC Part 15.247 (10/2014) and ISSED RSS-247 issue 1 May 2015.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed in accordance with "C63.10 American National Standard of 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:	TEMS Consulting Inc. 140 River Road Georgetown, TX, 78628
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On Behalf of:

SwipeSense Inc.
4619 N. Ravenswood Ave.
Suite 202
Chicago, IL 60640

Quotation Number:	69498
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1.4 Test Dates

Testing was performed on the following date(s):	5/26/2016 to 6/5/2016
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1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Customer Representative	Stephen Berger

1.6 Abbreviations

A	A mpere
ac	a lternating c urrent
AM	A mplitude M odulation
Amps	A mperes
b/s	b its per second
BW	B and W idth
CE	C onducted E mission
cm	C entimeter
CW	C ontinuous W ave
dB	d ecibel
dc	d irect current
EMI	E lectromagnetic I nterference
EUT	E quipment U nder T est
FM	F requency M odulation
G	g iga – prefix for 10^9 multiplier
Hz	H ertz
IF	I ntermediate F requency
k	k ilo – prefix for 10^3 multiplier
LISN	L ine I mpedance S tabilization N etwork
M	M ega – prefix for 10^6 multiplier
m	M eter
μ	m icro – prefix for 10^{-6} multiplier
NB	N arrow b and
QP	Q uasi- P eak
RE	R adiated E missions
RF	R adio F requency
rms	r oot- m ean- s quare
SN	S erial N umber
S/A	S pectrum A nalyzer
V	V olt

2 Equipment Under Test

2.1 EUT Identification & Description

The badge is worn by personnel and transmits a beacon periodically so that their location can be identified.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	SwipeSense Inc.
FCC ID:	2AB5RBAD120
ISED:	TBD
Model Number:	BAD120
Model Name:	Badge
FCC Rule Parts:	§15.247
ISED:	RSS-247
Frequency Range:	2402-2482MHz
Maximum Output Power:	1.32mW (1.21dBm) conducted
Modulation:	GFSK
Occupied Bandwidth:	692kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	Unit is preset to a single channel
Power Output Level	Fixed
Antenna	integral
Antenna Type	5.18dBi Inverted 'F', laid out on PWB
Interface Cables:	None
Power Source & Voltage:	3.1 VDC Cell Battery
Emission Designator	692KFXD
Highest TX spurious Emission	7320MHz, 174.5uV/m @ 3m

2.2 Test Configuration

Six devices were submitted for testing, 3 units with the antenna replaced by a temporary antenna port and three with antennas for radiated testing. Each EUT was programmed to transmit at one of 3 frequencies (2402, 2440, & 2482MHz). All units were tested in a stand-alone configuration. All tests were performed in accordance with ANSI C63.10.

2.3 Testing Algorithm

The Badge was programmed for DTS operation by the manufacturer. The EUT was set to transmit PRBS packets continuously at the desired transmit frequency. Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, 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 OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

- ANSI C63.10:2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation
- RSS-Gen Issue 4 — General Requirements for Compliance of Radio Apparatus
- RSS-247 issue 1 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices

2.6 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

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

Where u_c = standard uncertainty

$a, b, c, \dots$ = individual uncertainty elements

$\text{Div}_{a, b, c}$ = 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

$$U = k u_c$$

Where U = expanded uncertainty

k = coverage factor

$k \leq 2$ 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 2 below.

Table 2: Expanded Uncertainty List

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

Parameter	Uncertainty	Actual (+/-)	Unit
Radio Frequency	$\pm 1 \times 10^{-7}$	8.64E-08	parts
RF Power conducted (up to 160 W)	± 0.75 dB	0.3	dB
Conducted RF Power variations using a test fixture	± 0.75 dB	0.3	dB
Transmitter transient frequency (frequency difference)	± 250 Hz	160.7	Hz
Transmitter transient time	± 20 %	9.2	%

3 Test Equipment

Table 3 shows a list of the test equipment used for measurements along with the calibration information.

Table 3: Test Equipment List

Test Name: Radiated Emissions		Test Date: 6/3/2016	
Asset #	Manufacturer/Model	Description	Cal. Due
528	AGILENT - E4446A	3HZ - 44GHZ ANALYZER SPECTRUM	7/15/2016
559	HP - 8447D	AMPLIFIER	8/29/2016
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	7/30/2016
281	ITC - 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	8/1/2016
283	ITC - 21KU-3A1	WAVEGUIDE 9.8-20.5GHZ	8/1/2016
453	AH SYSTEMS - PAM1840	PRE-AMPLIFIER 18GHZ-40 GHZ	7/30/2016
209	NARDA - V637	HORN STANDARD GAIN	CNR
210	NARDA - V638	HORN STANDARD GAIN	CNR
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	8/31/2017
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	10/8/2016

Test Name: Bench Tests		Test Date: 5/31/2016	
Asset #	Manufacturer/Model	Description	Cal. Due
528	AGILENT - E4446A	3HZ - 44GHZ ANALYZER SPECTRUM	7/15/2016
823	AGILENT - N9010A	EXA Spectrum Analyze	8/5/2016

4 Test Summary

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 RSS47 issue 1, 5/2015. Full results are shown in section 5.

Table 4: Test Summary Table

TX Test Summary (Digital Transmission System (DTS))			
FCC Rule Part	IC Rule Part	Description	Result
15.247(a) (2)	RSS-247 [5.2 (1)]	6dB Bandwidth	Pass
15.247 (b)(3)	RSS-247 [5.4 (4)]	Transmit Output Power	Pass
15.247 (e)	RSS-247 [5.2 (2)]	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 7.2.2	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	NA
RX/Digital Test Summary (Digital Transmission System (DTS))			
FCC Rule Part	IC Rule Part	Description	Result
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	NA
15.209	RSS-210 sect 2.5 RSS-Gen [4.1]	General Field Strength Limits	NA

5 Test Results

5.1 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 Direct Sequence Spread Spectrum Systems, FCC Part 15.247 requires the minimum 6 dB bandwidth be at least 500 kHz.

5.1.1 Measurement Method:

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

Table 5: Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
100kHz	1MHz

At full modulation, the occupied bandwidth was measured as shown in Figures 1-3.

Table 6 provides a summary of the Occupied Bandwidth Results.

Table 6: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel: 2402MHz	692kHz	$\geq 500\text{kHz}$	Pass
Center Channel: 2440MHz	692kHz	$\geq 500\text{kHz}$	Pass
High Channel: 2480MHz	682kHz	$\geq 500\text{kHz}$	Pass

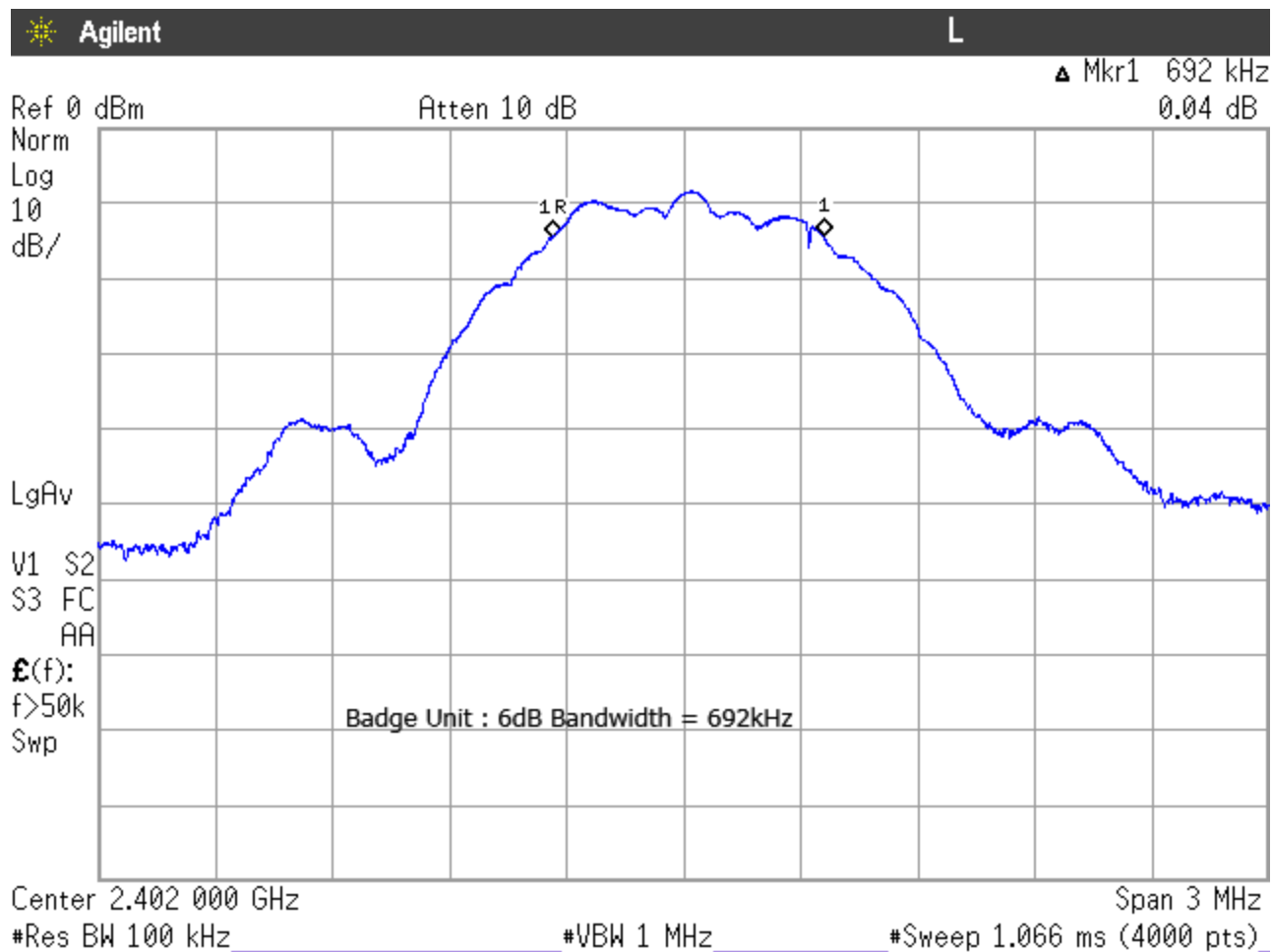


Figure 1: Occupied Bandwidth, Low Channel

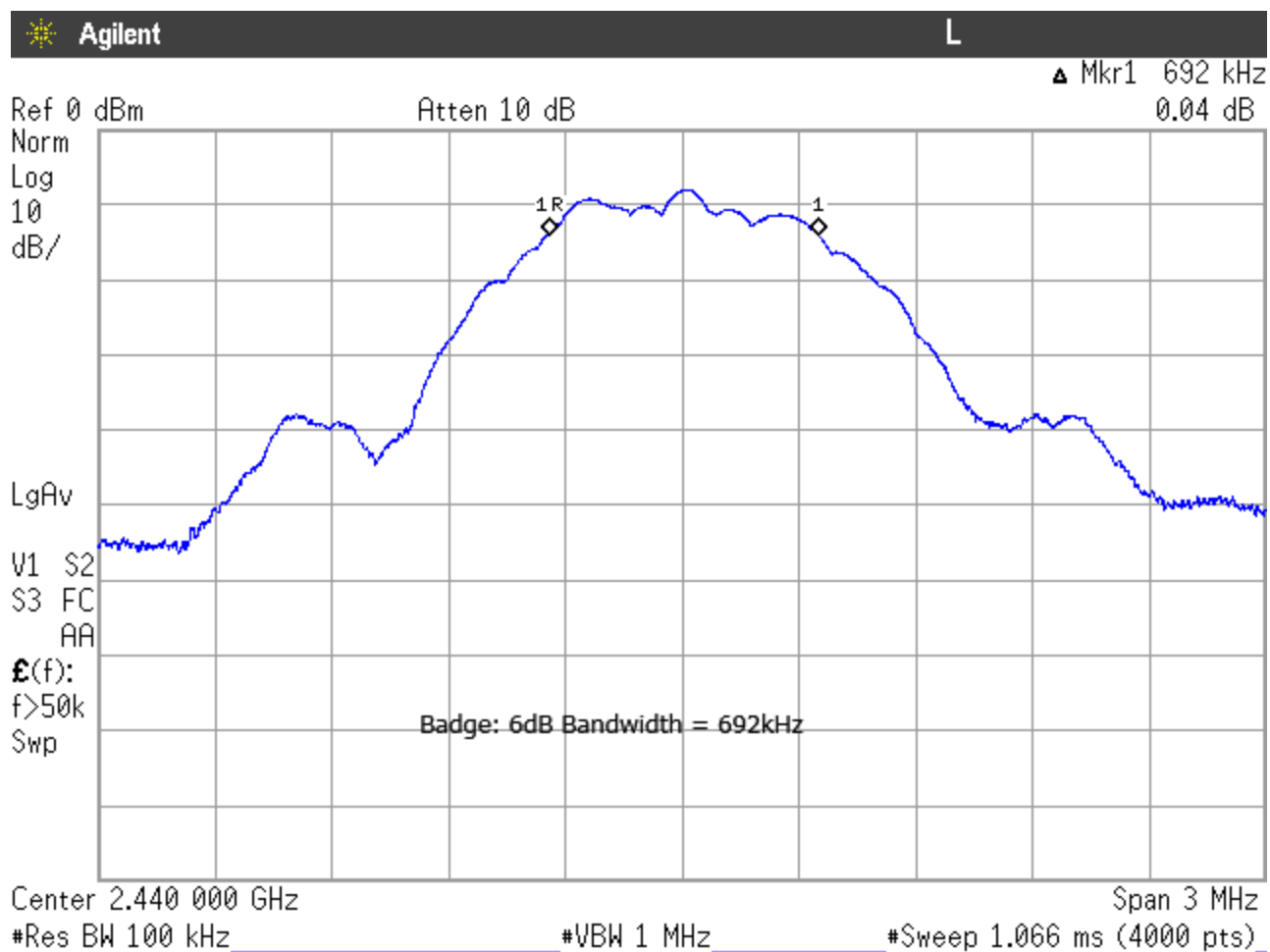


Figure 2: Occupied Bandwidth, Center Channel

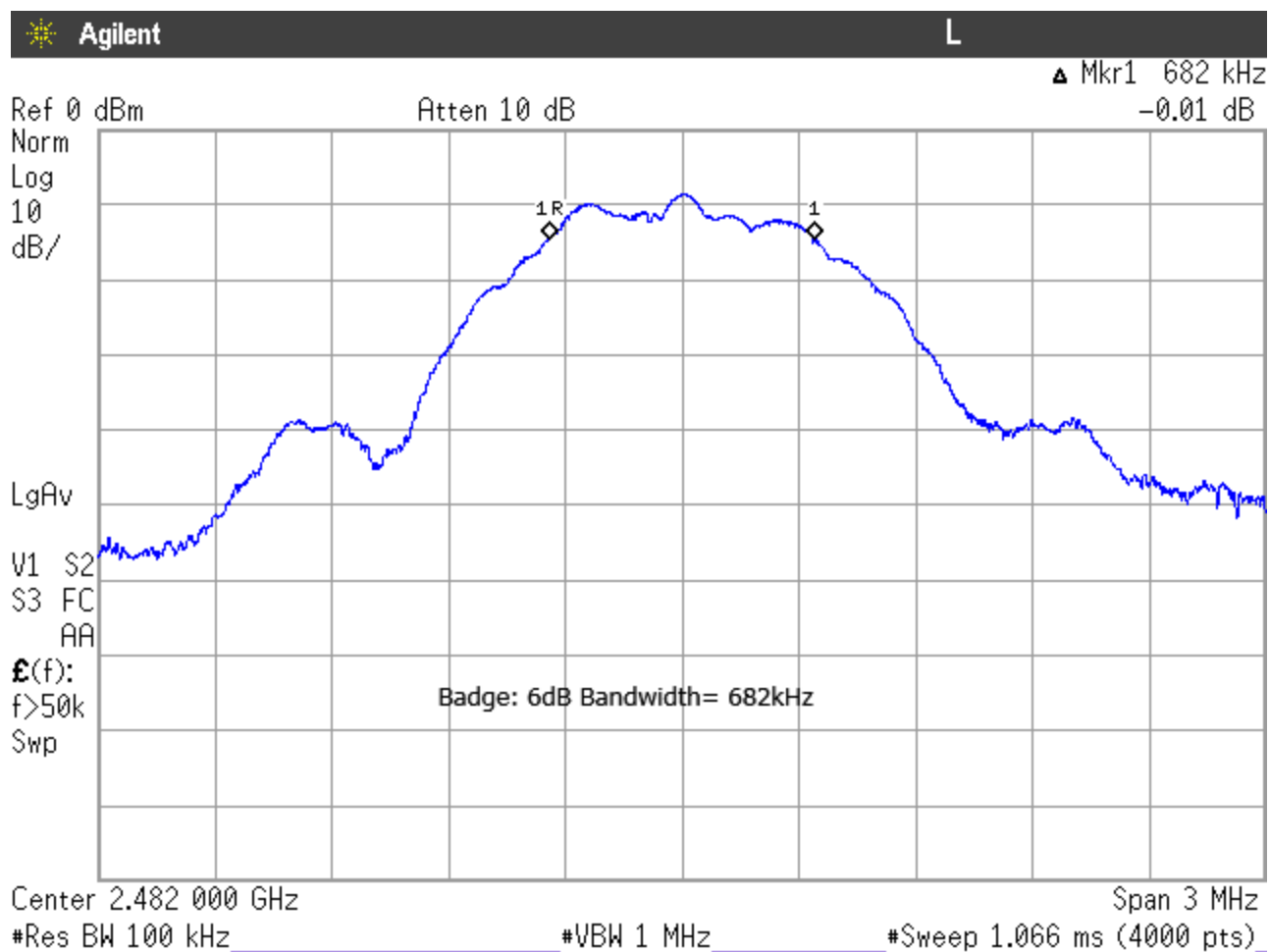


Figure 3: Occupied Bandwidth, High Channel

5.2 RF Power Output:

To measure the output power the unit was set to dwell on the low, high and middle channel with a continuous 100% duty cycle. Testing was performed using the method from C63.10 section 11.9.1.1 “RBW $\geq$ DTS bandwidth” at the antenna port as follows:

- a) Set the RBW $\geq$ DTS bandwidth.
- b) Set VBW $\geq [3 \times \text{RBW}]$.
- c) Set span $\geq [3 \times \text{RBW}]$.
- 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..

5.2.1 Measurement Method:

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

Table 7: Spectrum Analyzer Settings

Resolution Bandwidth	Video Bandwidth
1MHz	3MHz

Table 8: RF Power Output Summary

Frequency	Level	Limit	Pass/Fail
Low Channel: 2402MHz	0.96dBm	30 dBm	Pass
Center Channel: 2440MHz	1.21dBm	30 dBm	Pass
High Channel: 2480MHz	0.55dBm	30 dBm	Pass

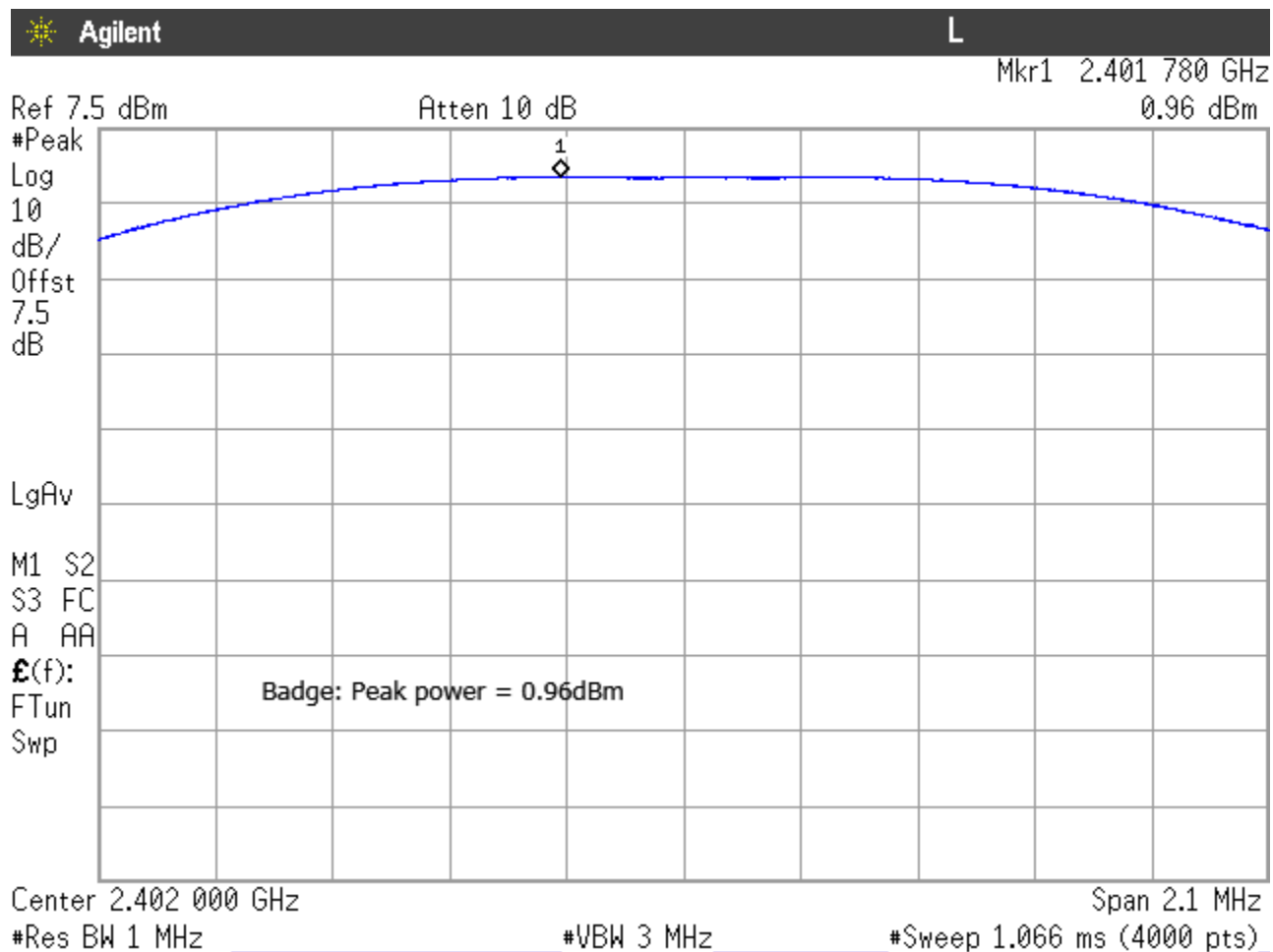


Figure 4: RF Peak Power, Low Channel

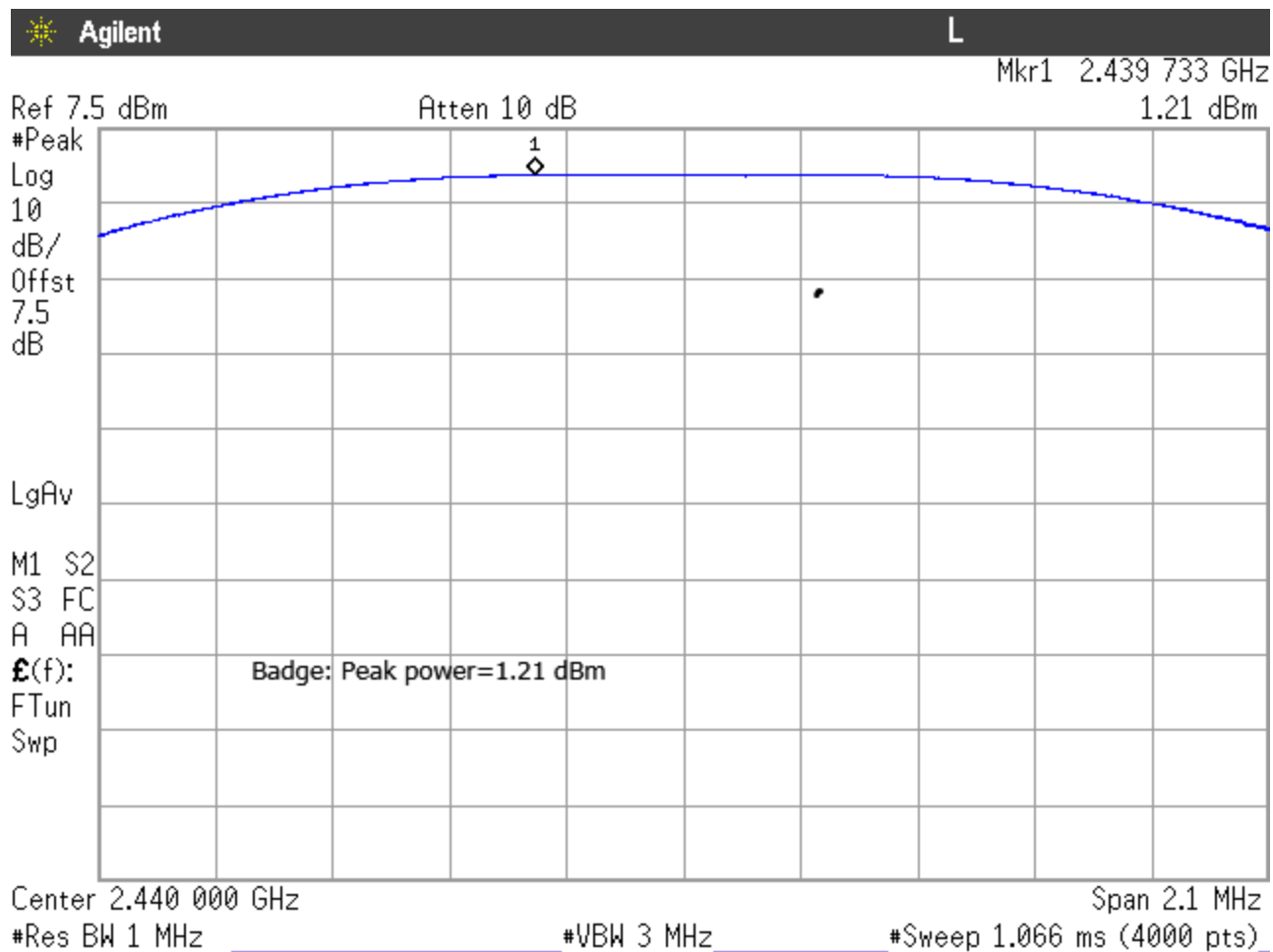


Figure 5: RF Peak Power, Center Channel

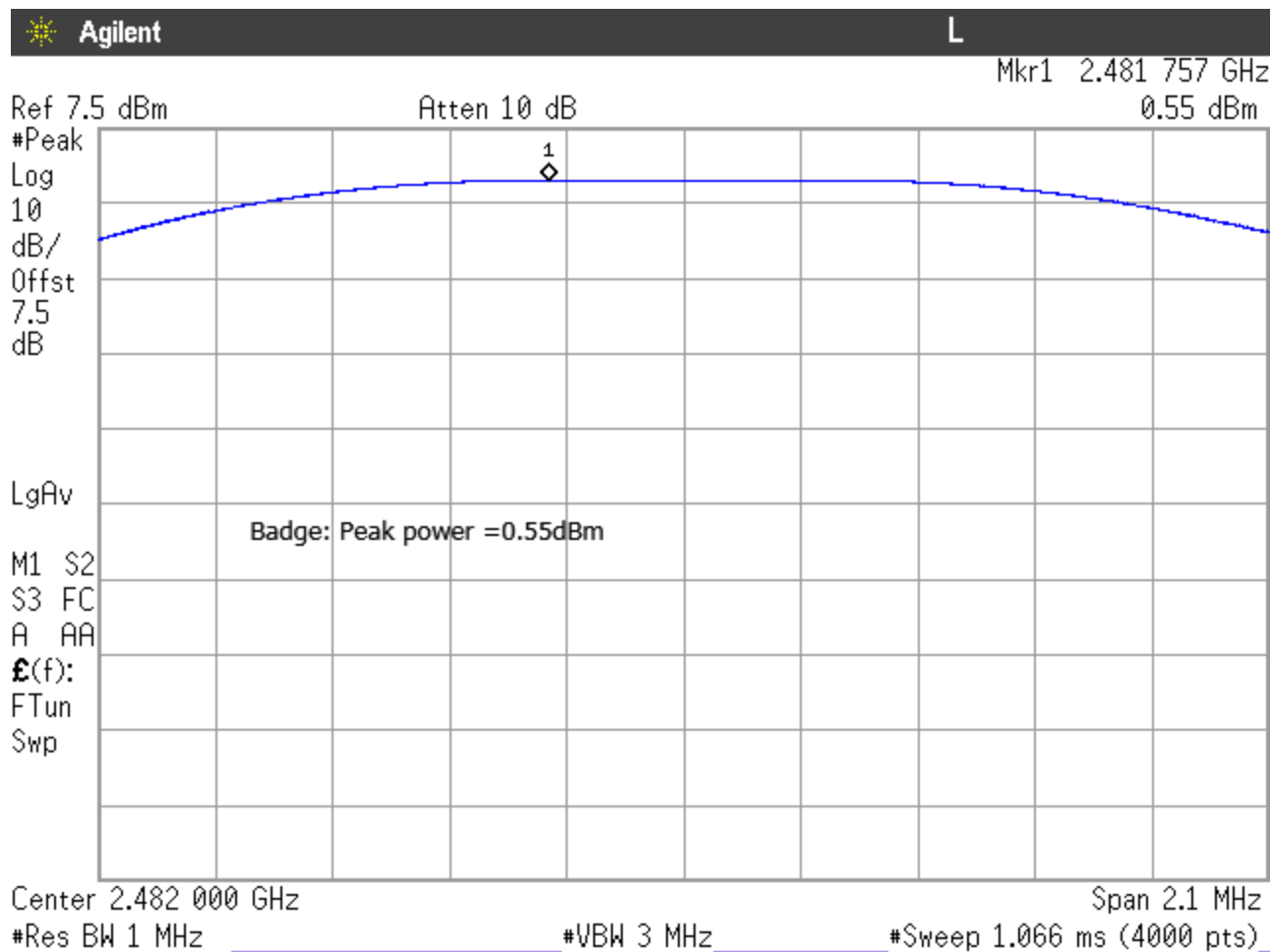


Figure 6: RF Peak Power, High Channel

5.3 Power Spectral Density

Measurements for power spectral density 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 100kHz ,VBW of 300kHz across a span 1.5X the DTS bandwidth using an auto sweep time..

5.3.1 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 8dBm. The following table and plots give the results for power spectral density testing.

Table 9: Power Spectral Density

Frequency	Peak Level	Limit	Pass/Fail
Low Channel: 2402MHz	0.49dBm	8 dBm	Pass
Center Channel: 2440MHz	1.12dBm	8 dBm	Pass
High Channel: 2480MHz	0.17dBm	8 dBm	Pass

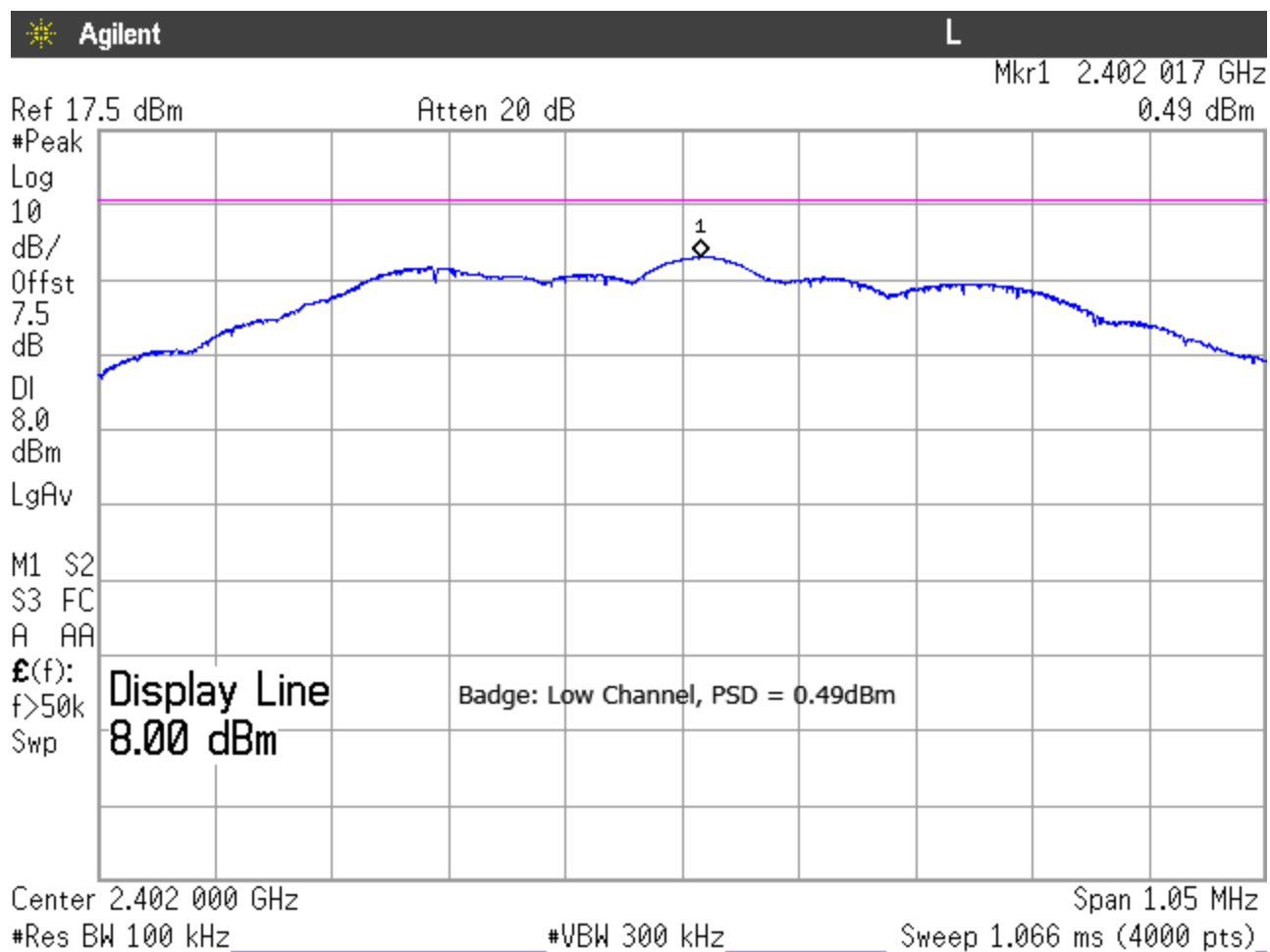


Figure 7: Power Spectral Density, Low Channel

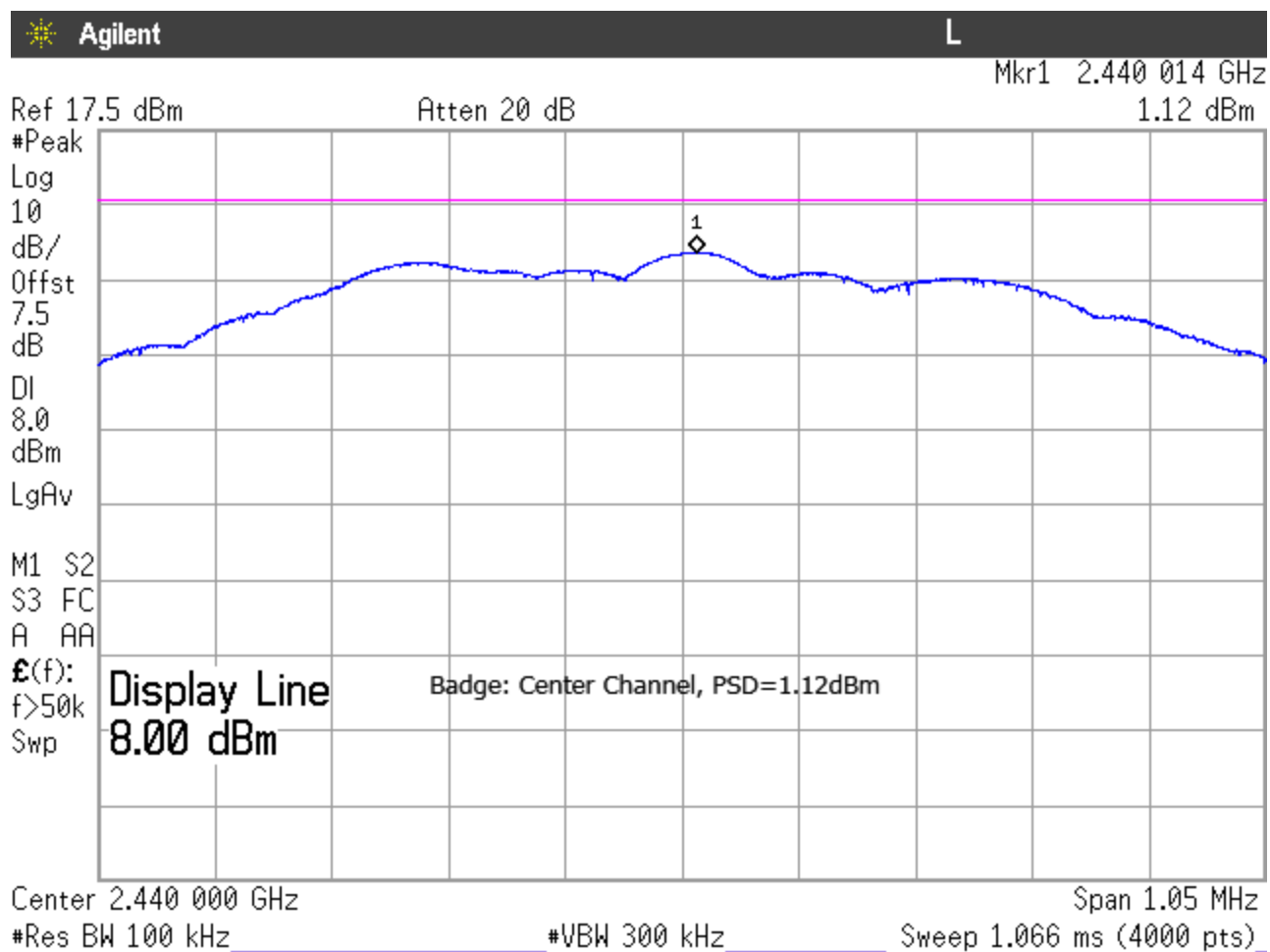


Figure 8: Power Spectral Density, Center Channel

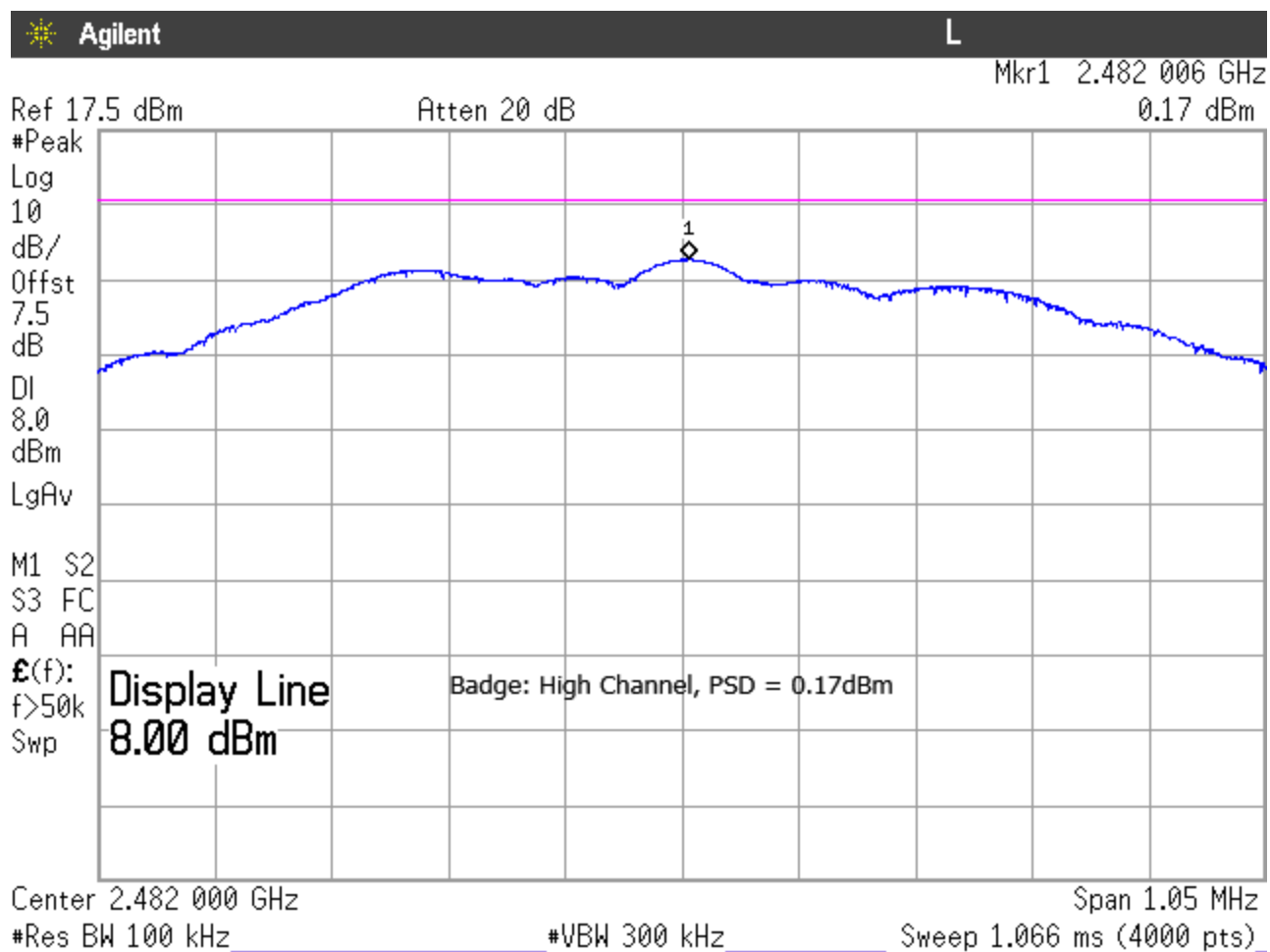


Figure 9: Power Spectral Density, High Channel

5.4 Conducted Spurious Emissions compliance

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

Per ANSI C63.10 section 11.11 “Emissions in non-restricted frequency bands” this test may be performed in an antenna port 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 frequency 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.

As per ANSI C63.10 section 11.11.2 the Center channel has the highest PSD and the limit for all channels was based on this level.

The following table shows the spurious emissions data.

5.4.1 Test Summary

The EUT complied with the requirements for spurious emissions at the antenna port.

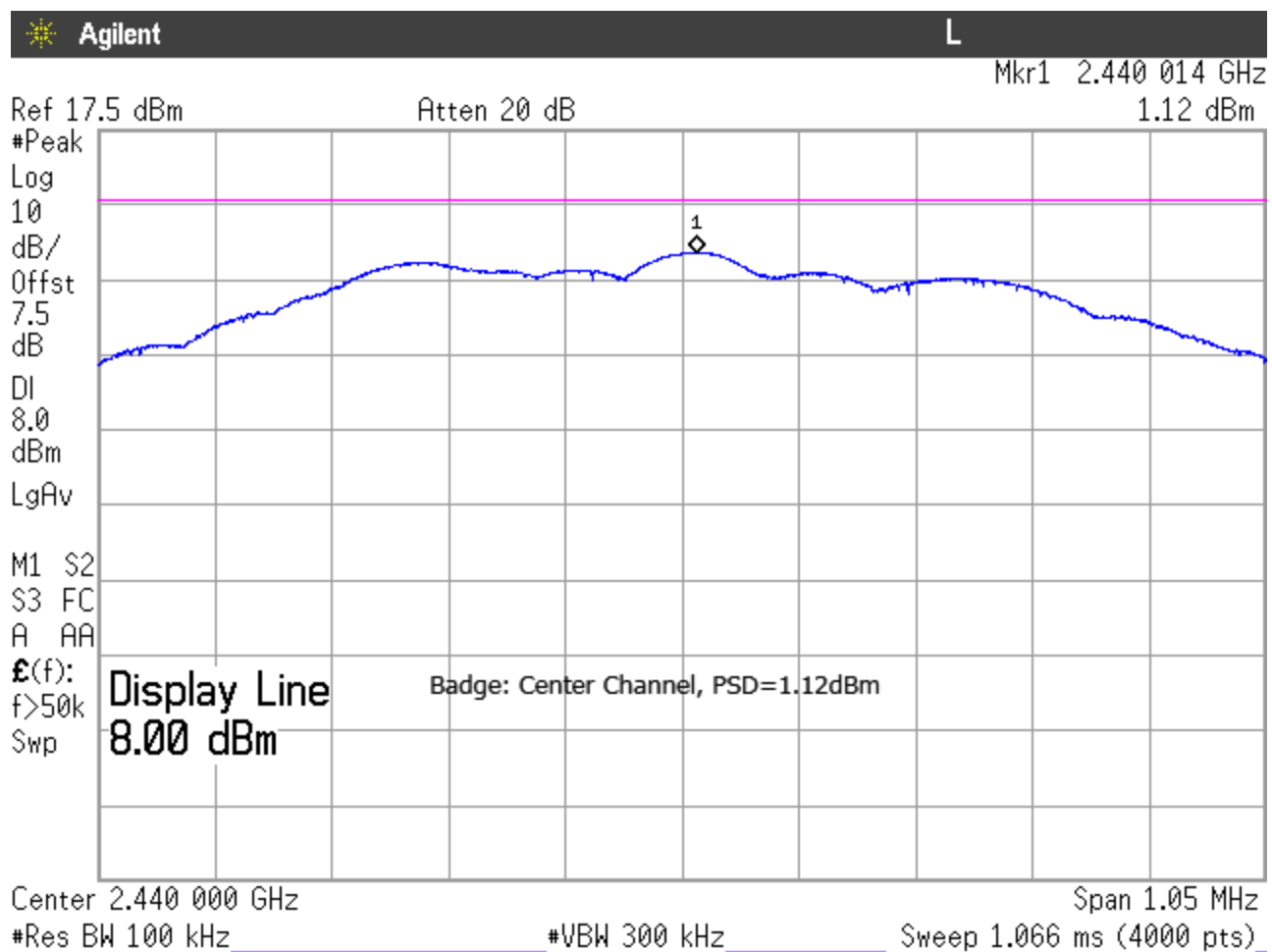


Figure 10: Highest PSD Level (center channel)

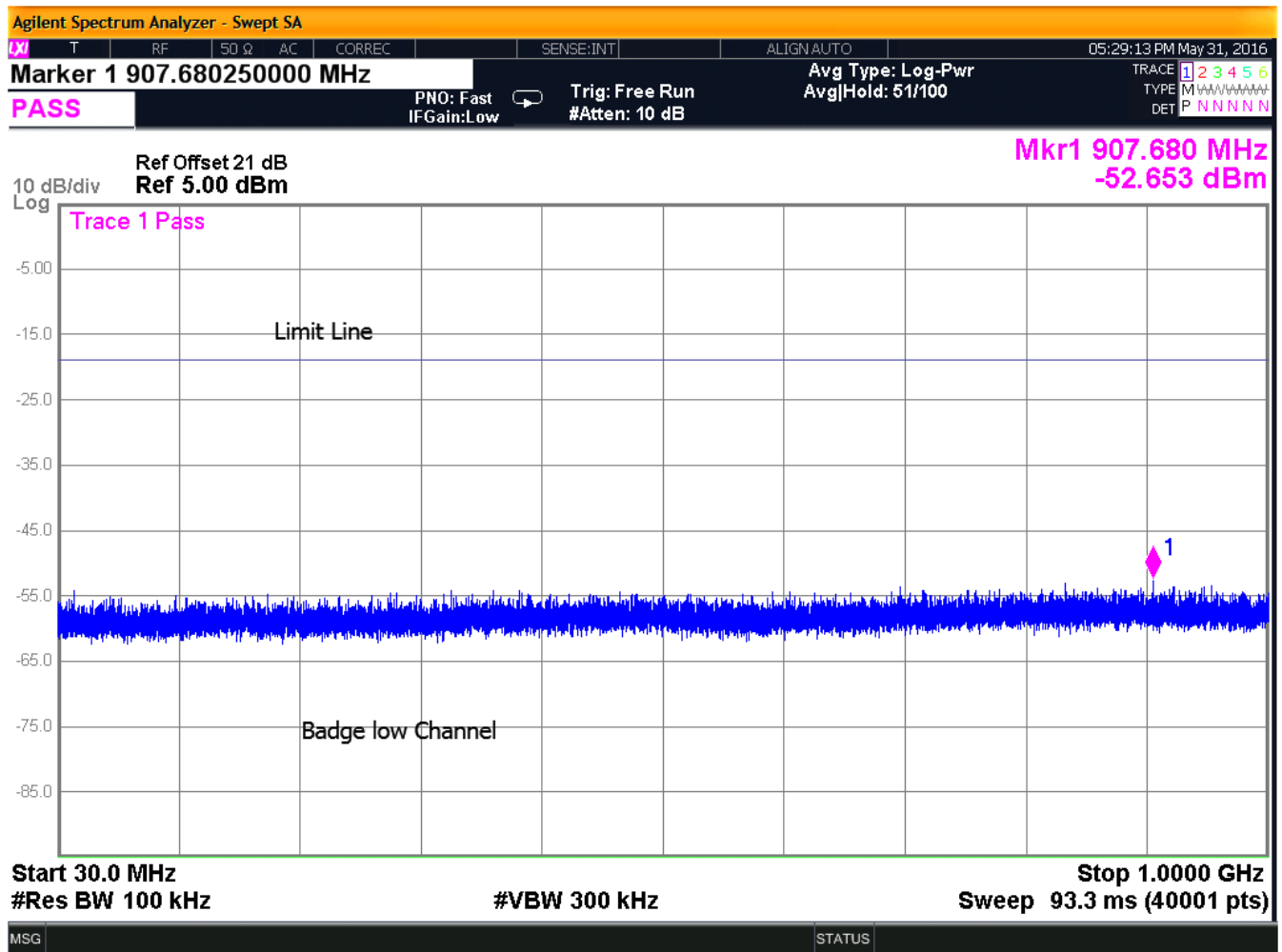


Figure 11: Low Channel Conducted Spurious Plot 1

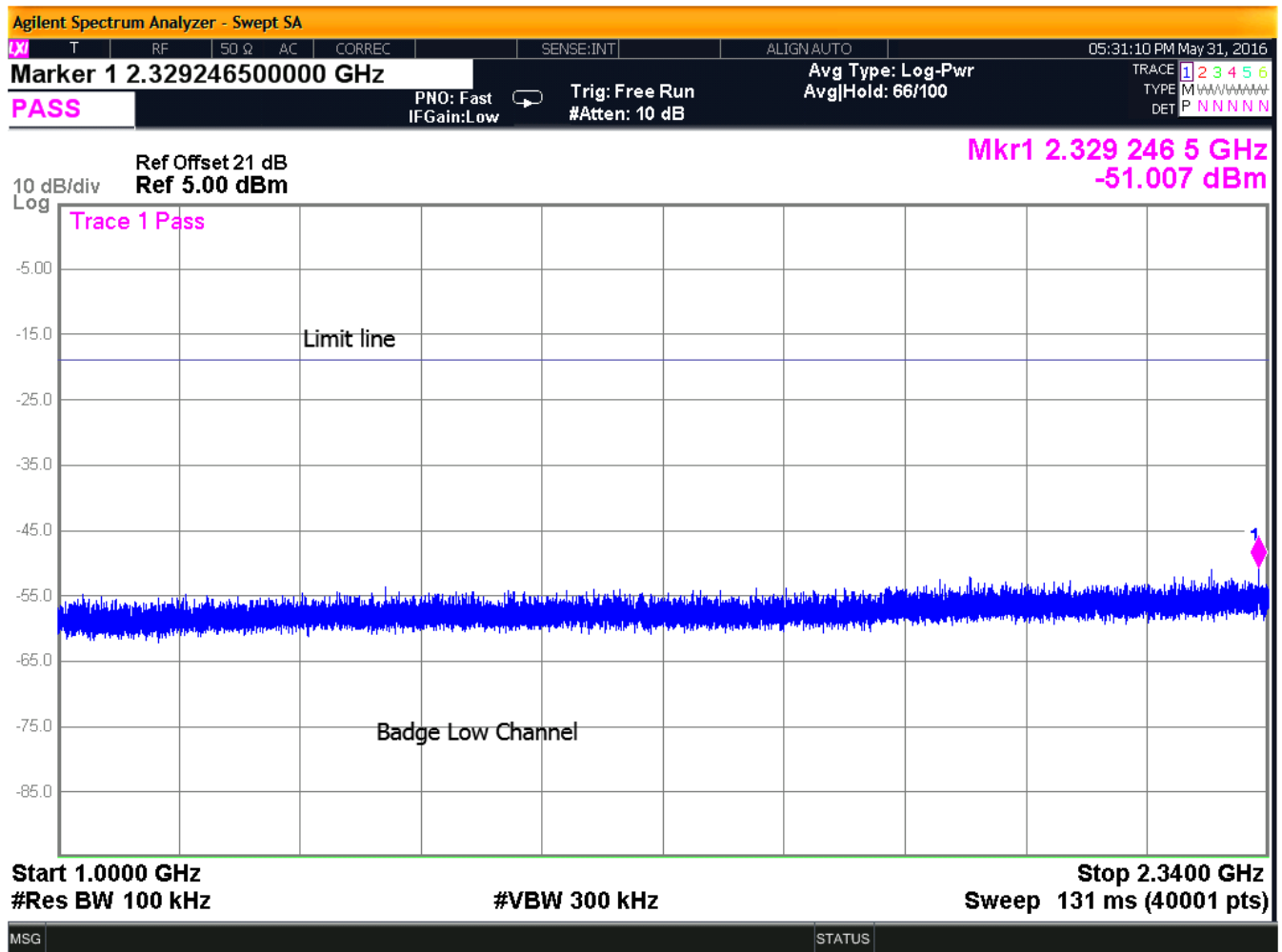


Figure 12: Low Channel Conducted Spurious Plot 2

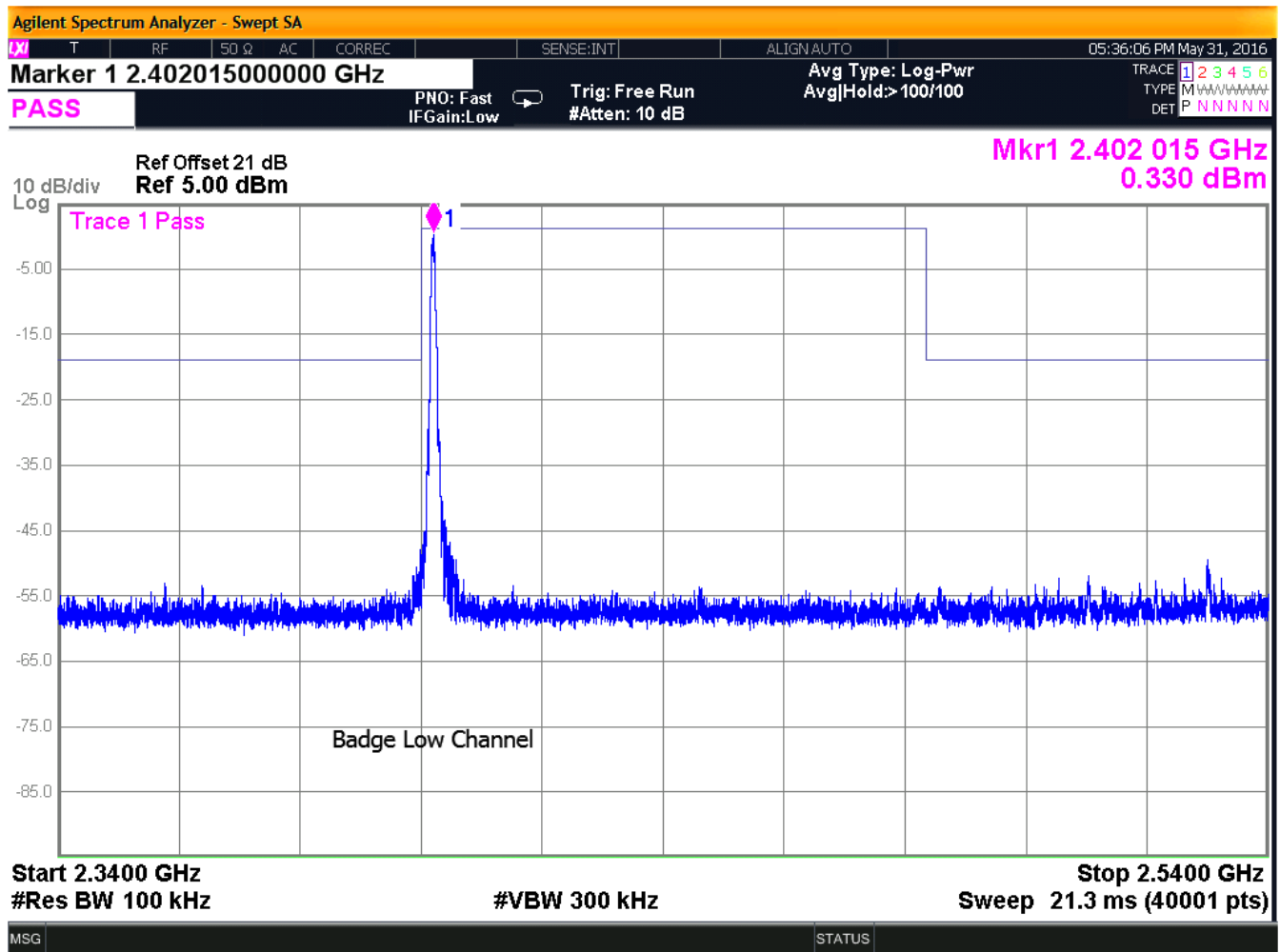


Figure 13: Low Channel Conducted Spurious Plot 3

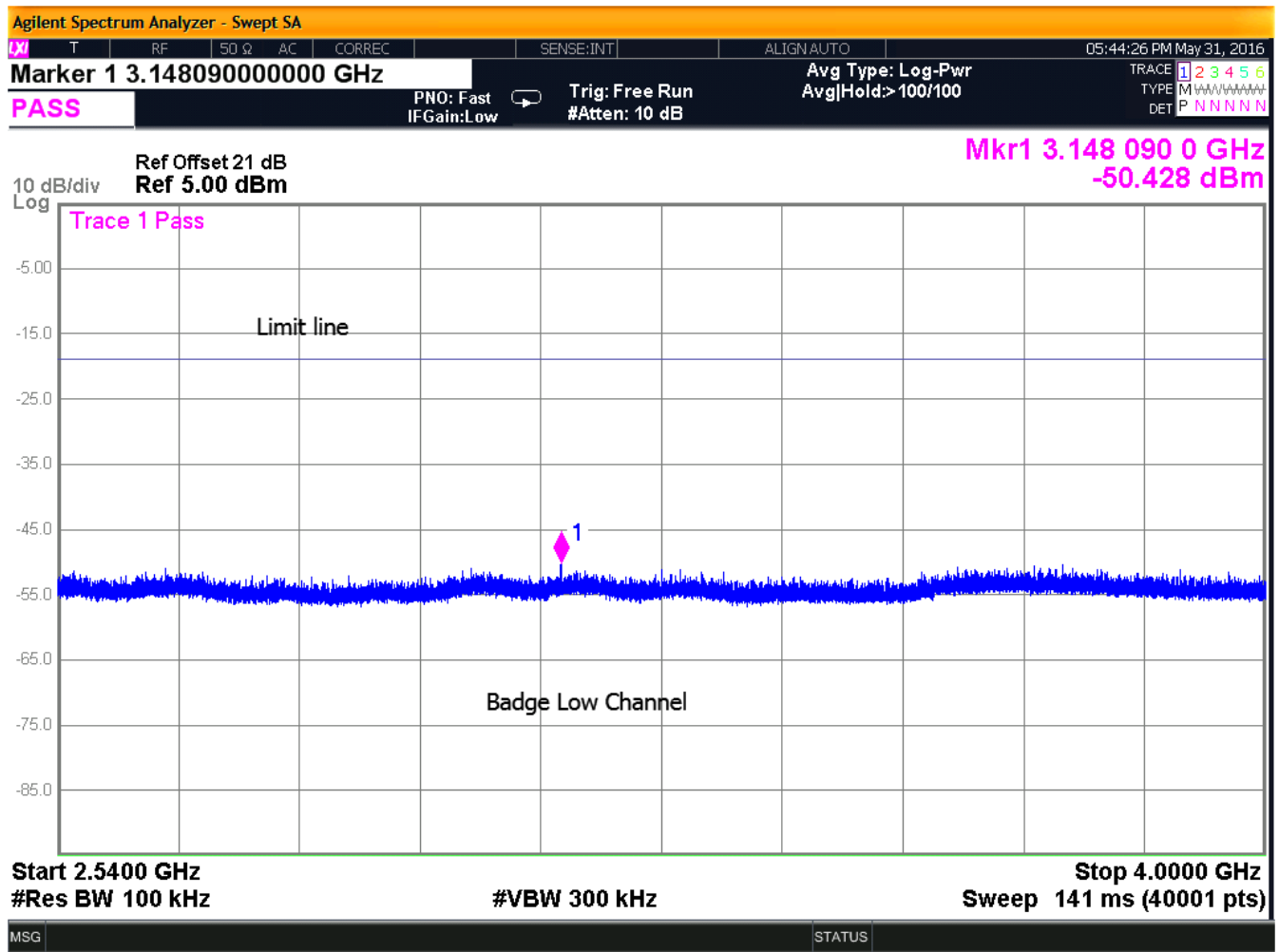


Figure 14: Low Channel Conducted Spurious Plot 4

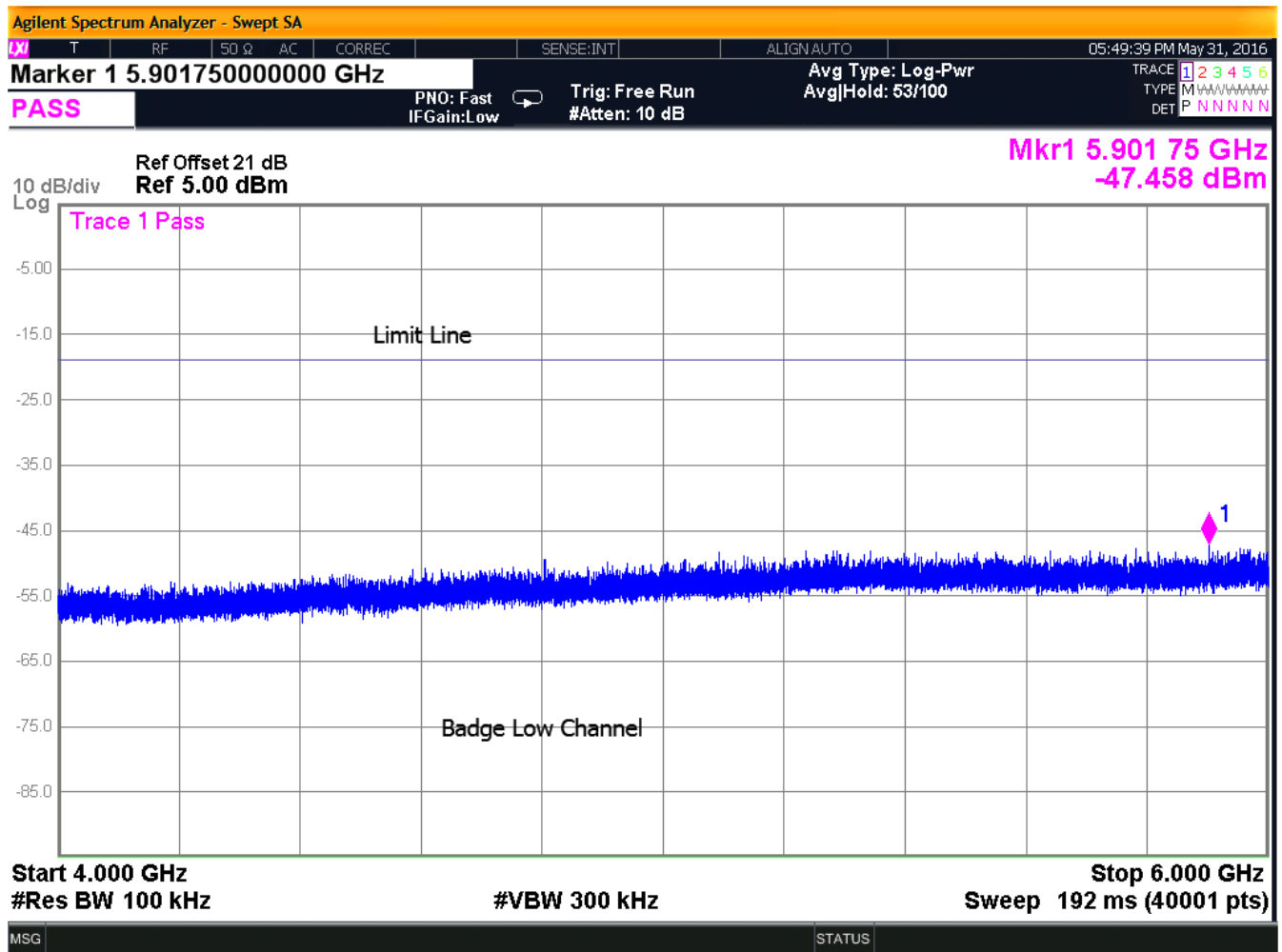


Figure 15: Low Channel Conducted Spurious Plot 5

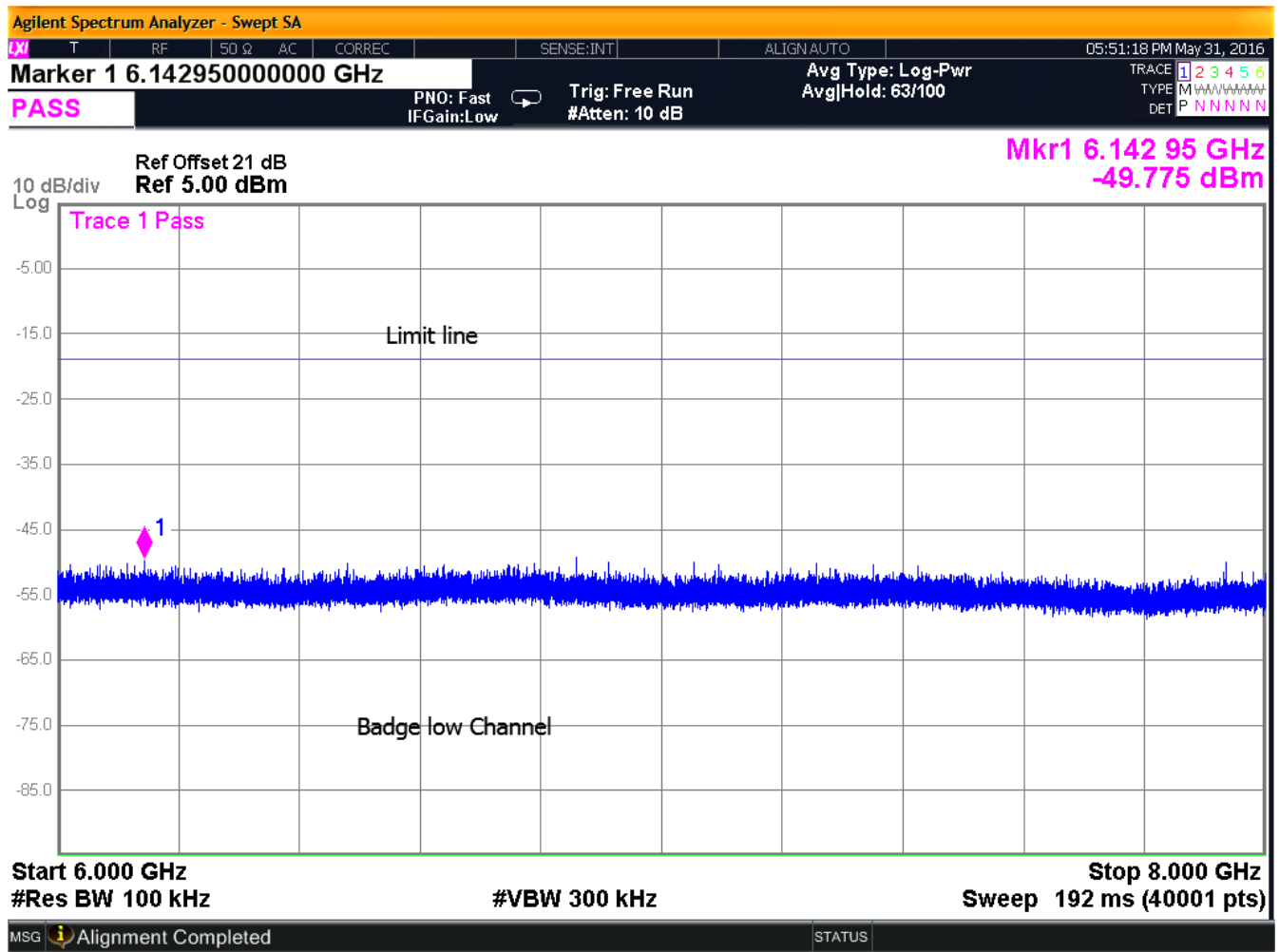


Figure 16: Low Channel Conducted Spurious Plot 6

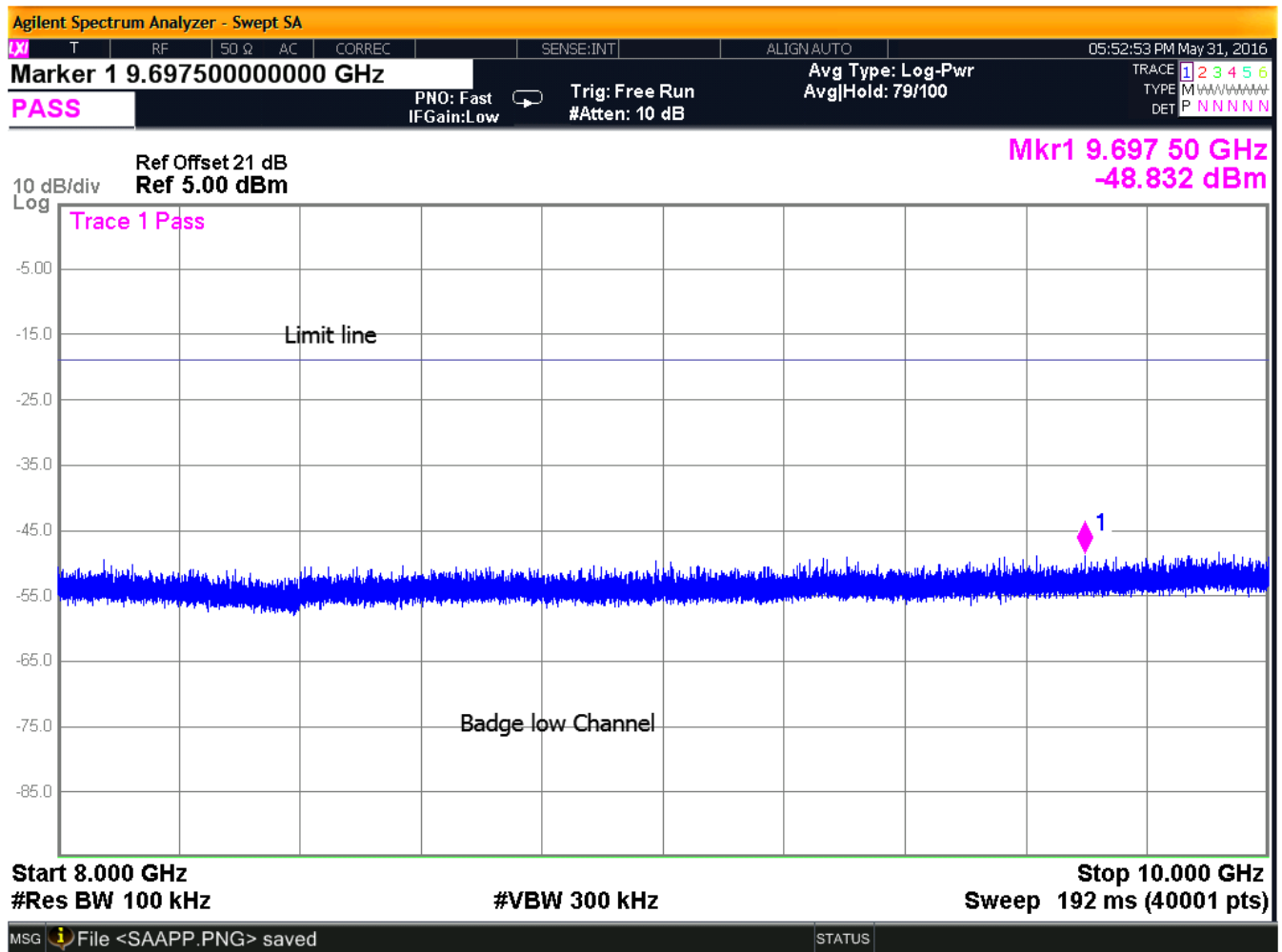


Figure 17: Low Channel Conducted Spurious Plot 7

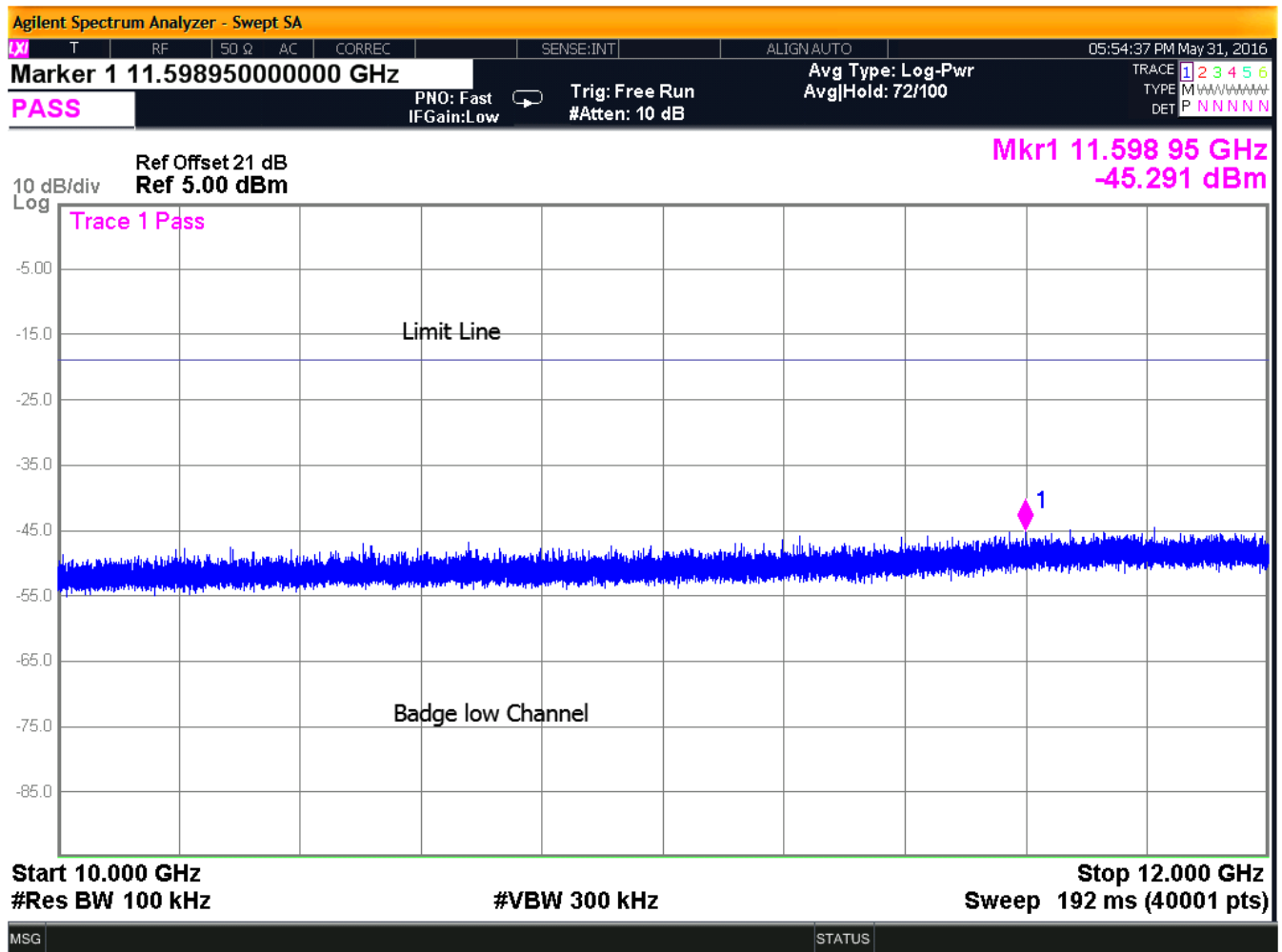


Figure 18: Low Channel Conducted Spurious Plot 8

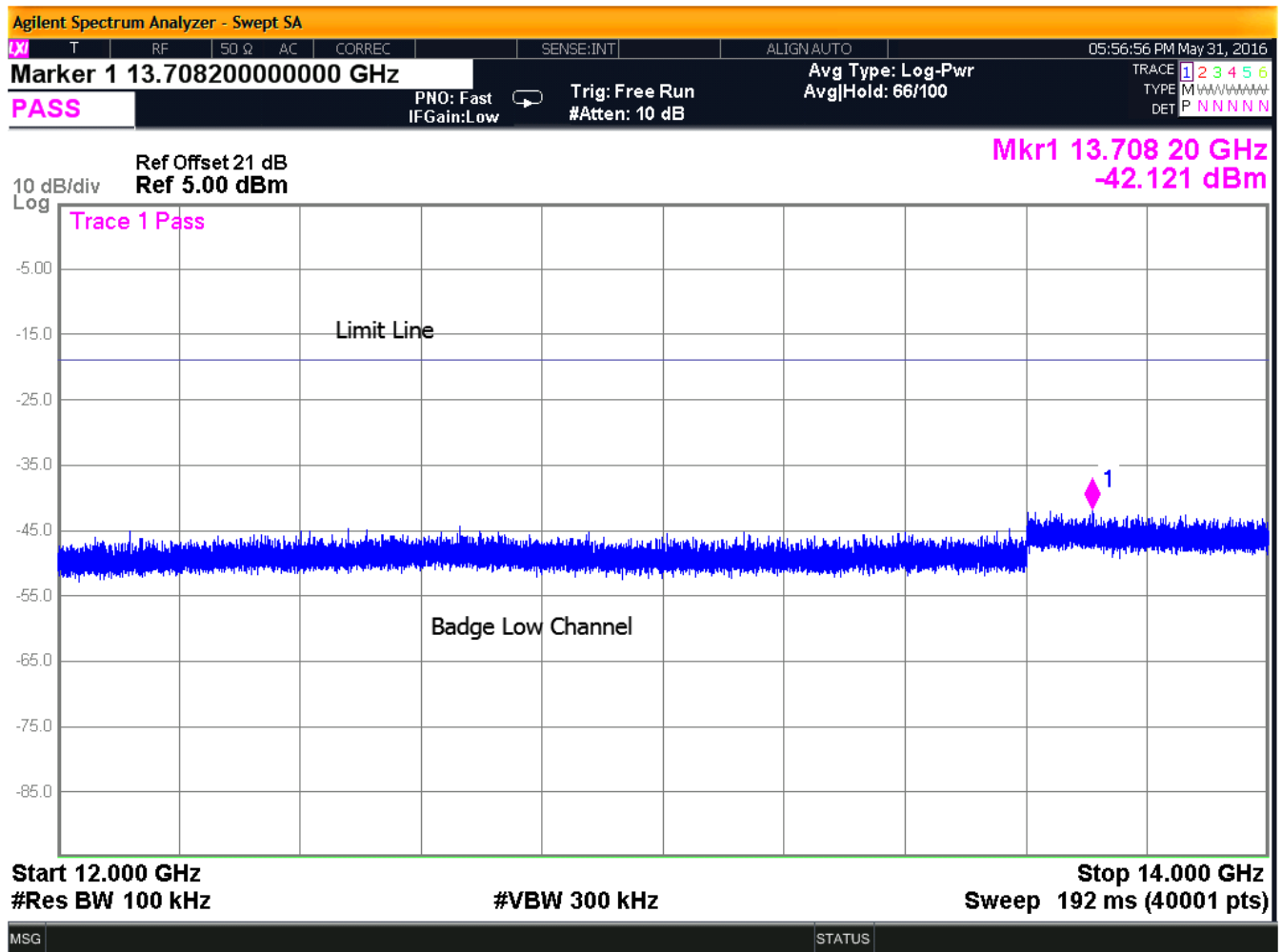


Figure 19: Low Channel Conducted Spurious Plot 9

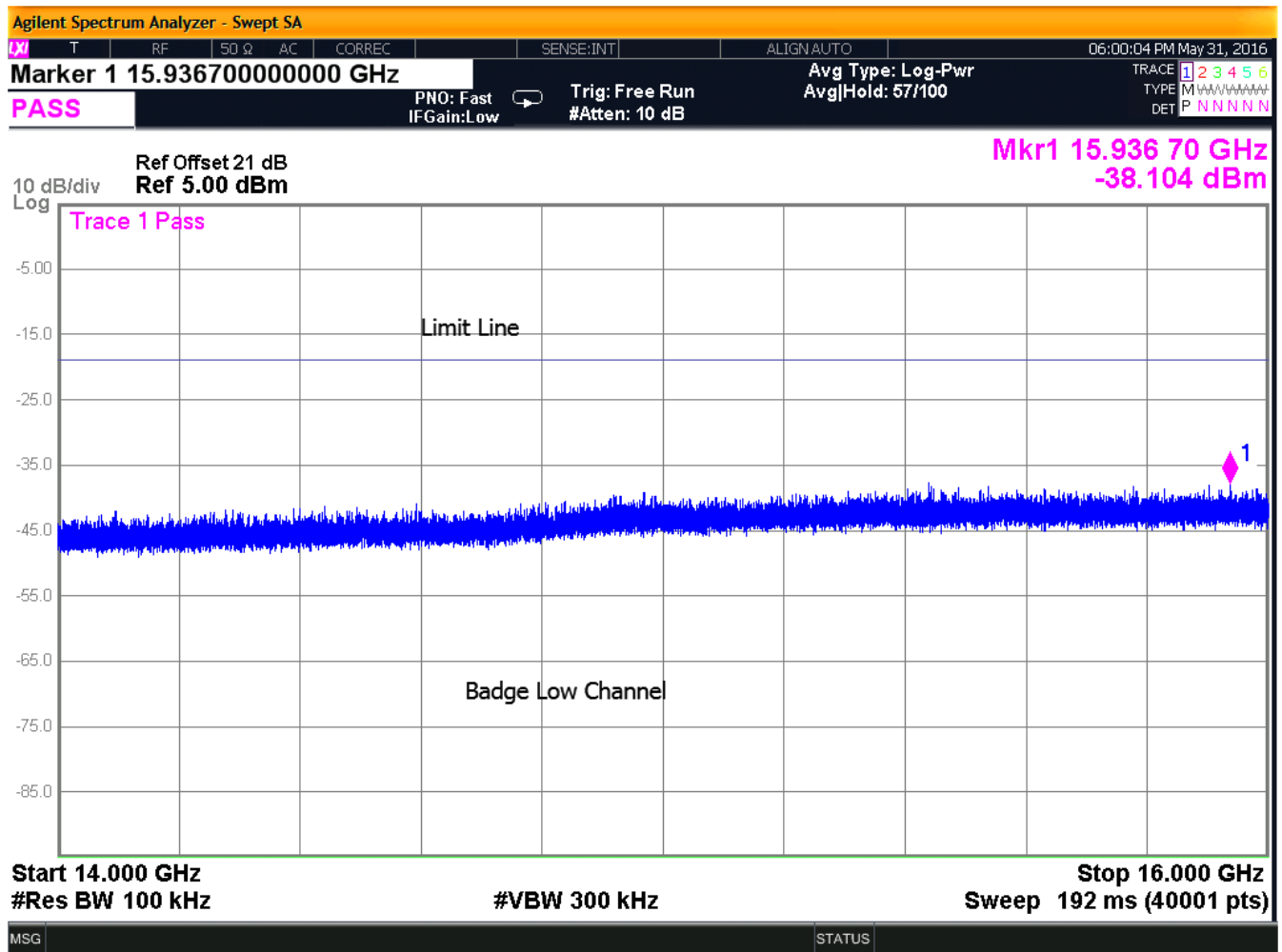


Figure 20: Low Channel Conducted Spurious Plot 10

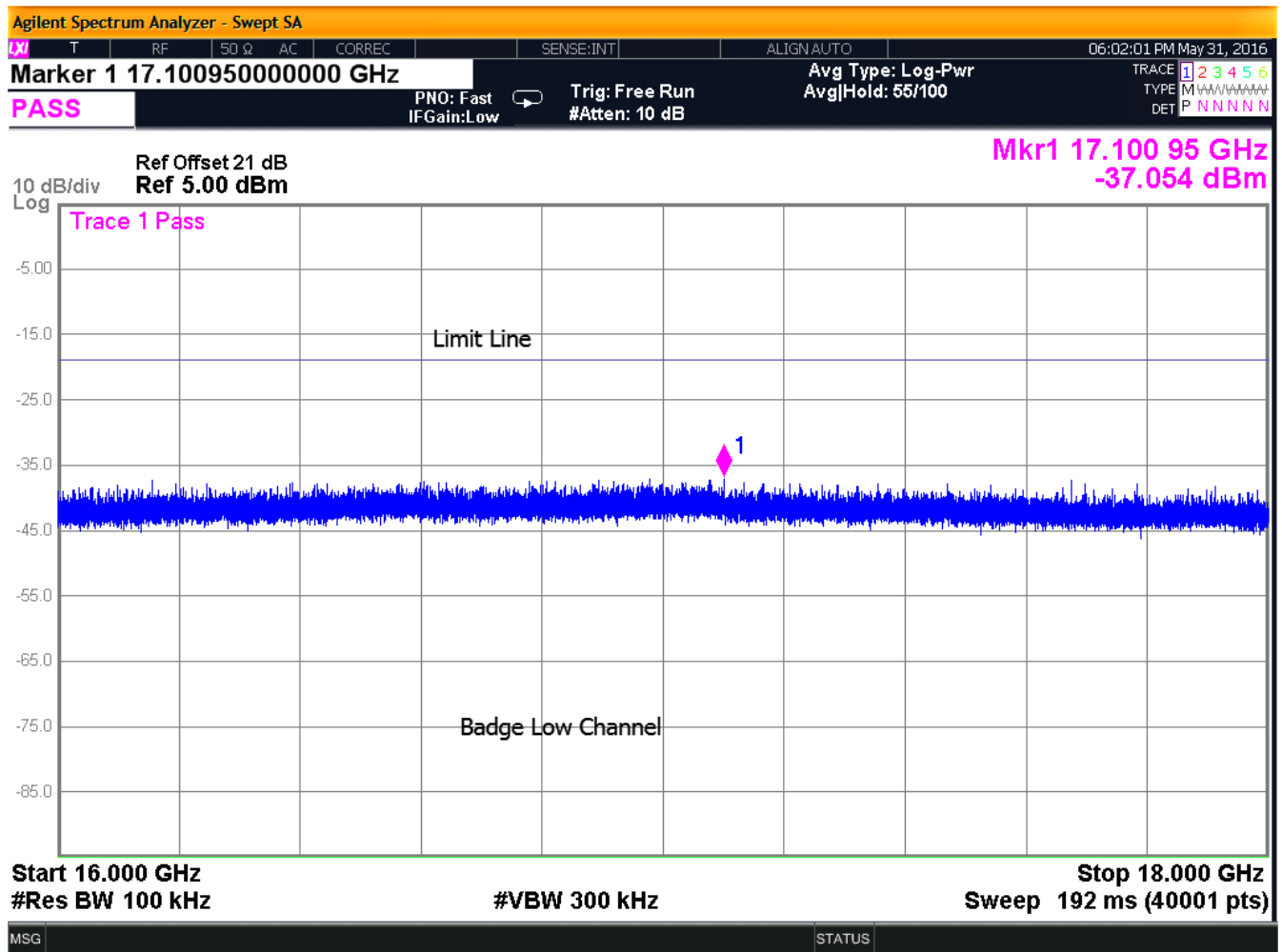


Figure 21: Low Channel Conducted Spurious Plot 11

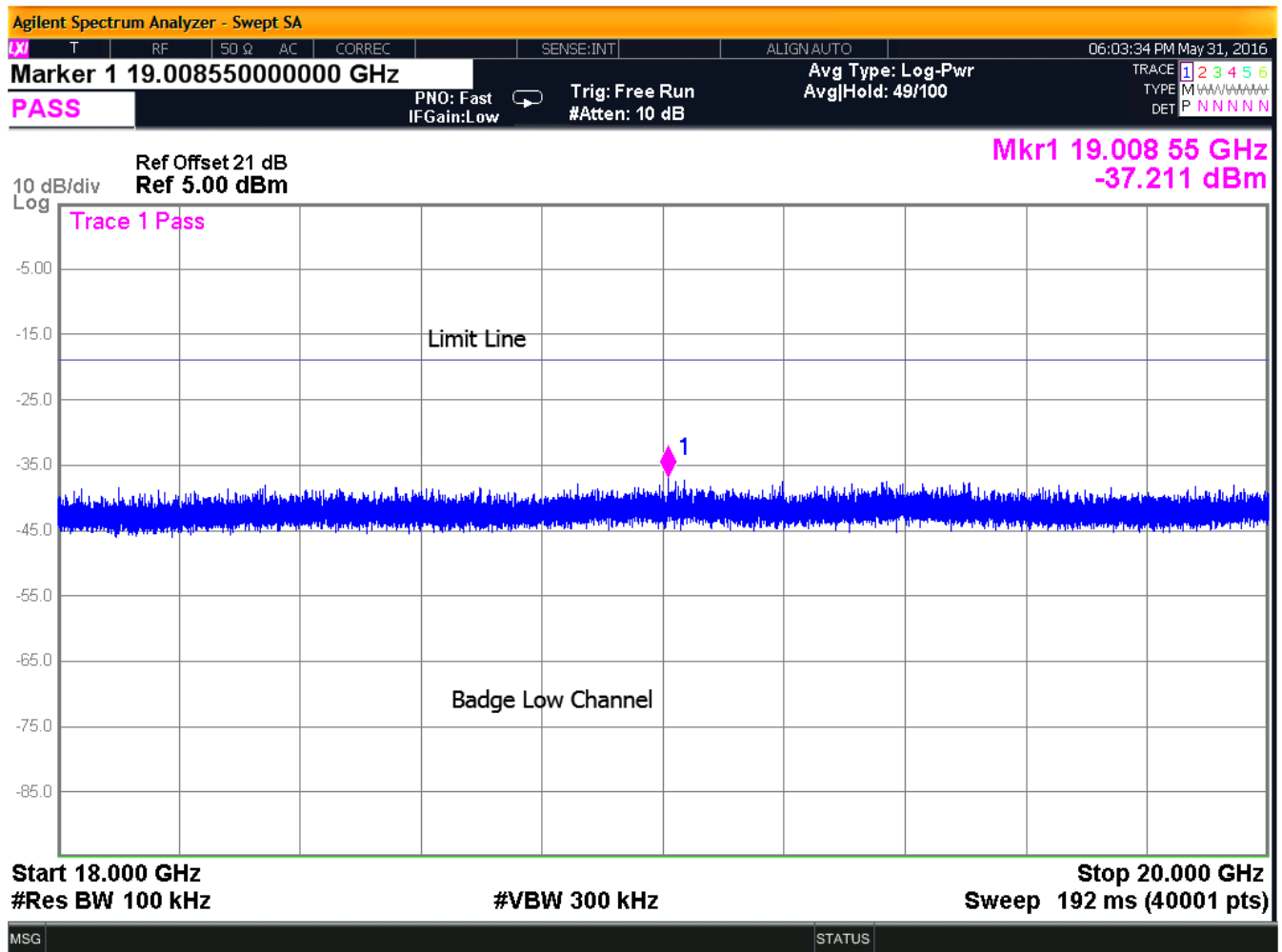


Figure 22: Low Channel Conducted Spurious Plot 12

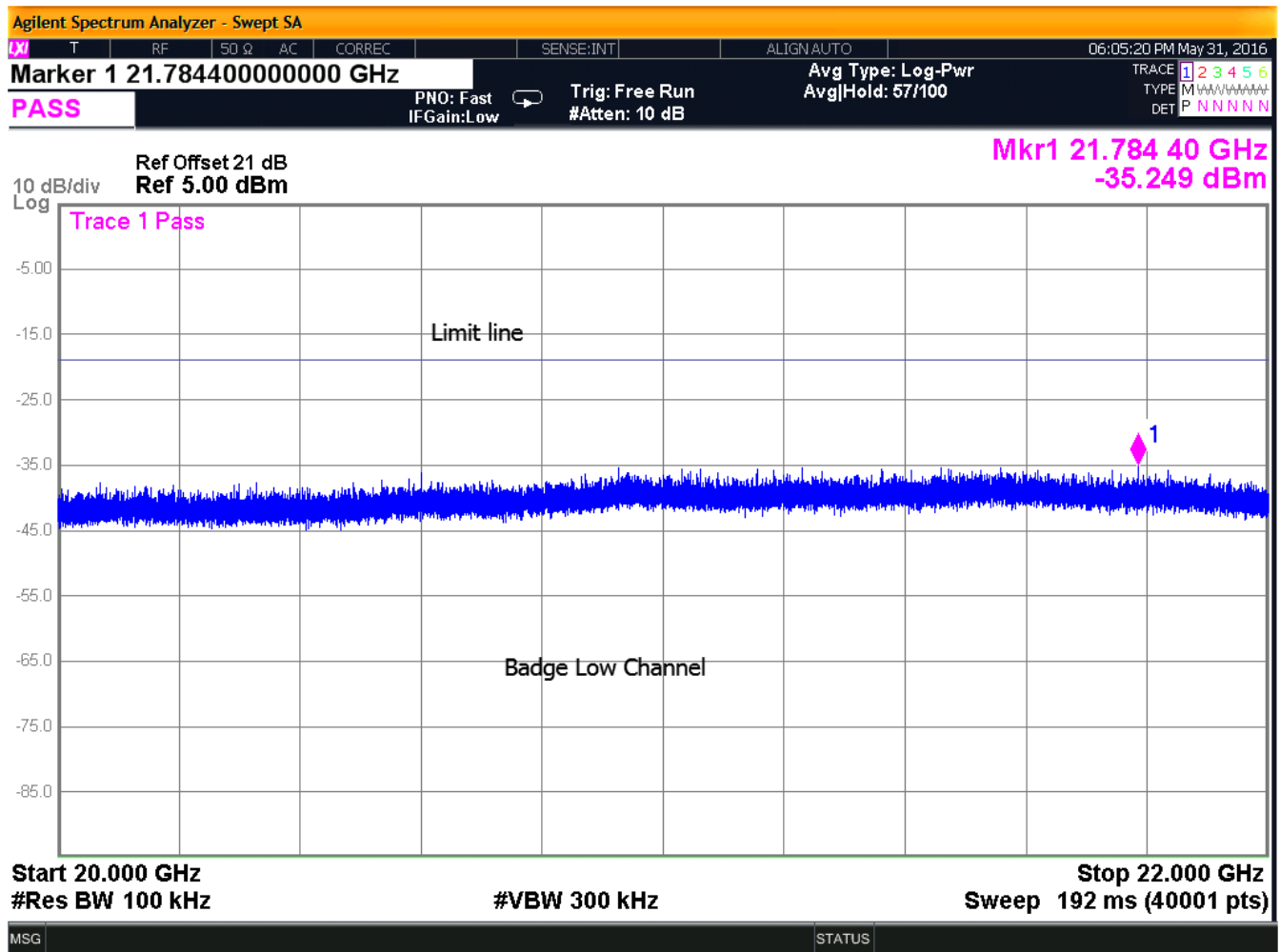


Figure 23: Low Channel Conducted Spurious Plot 13

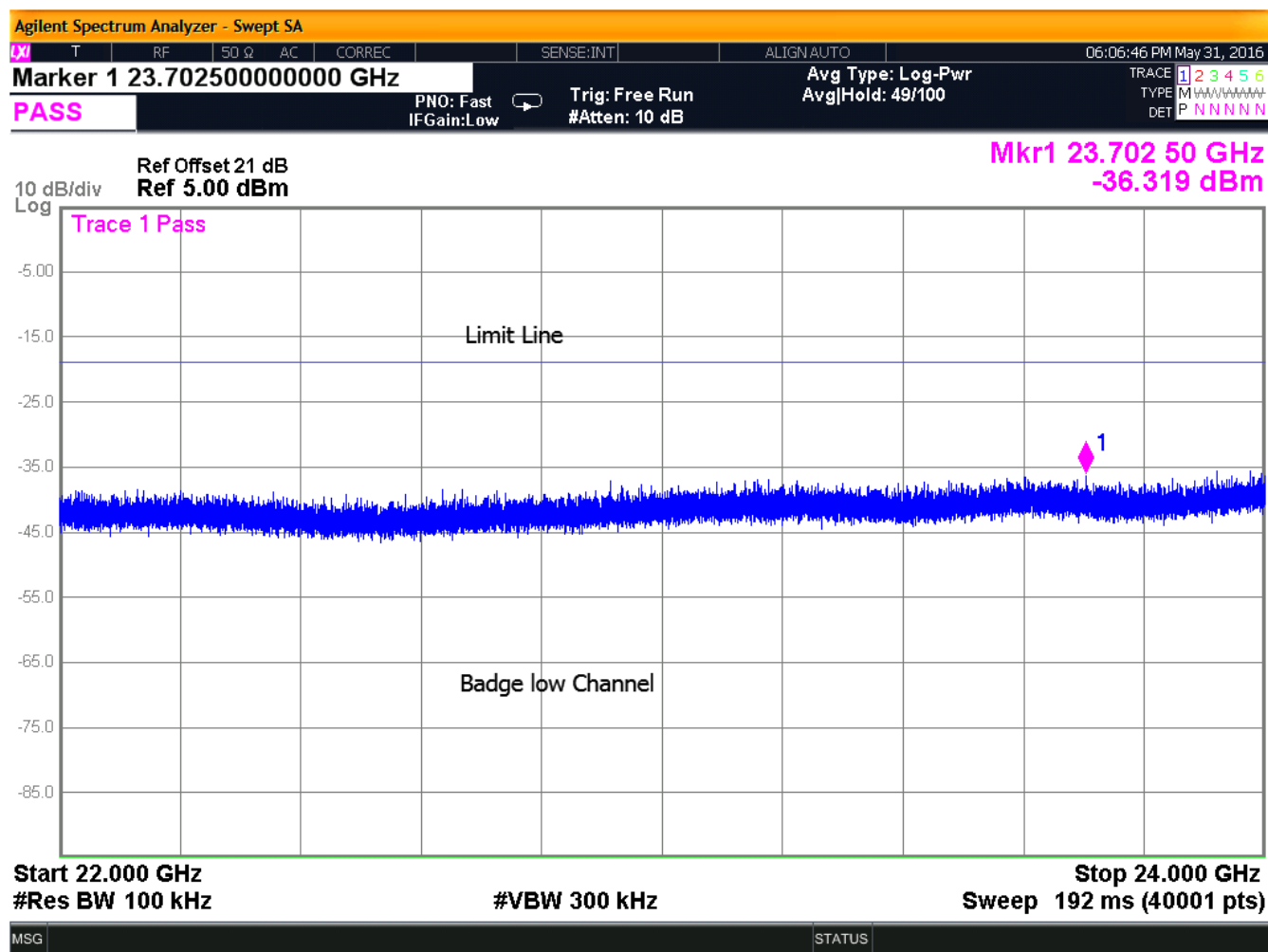


Figure 24: Low Channel Conducted Spurious Plot 14

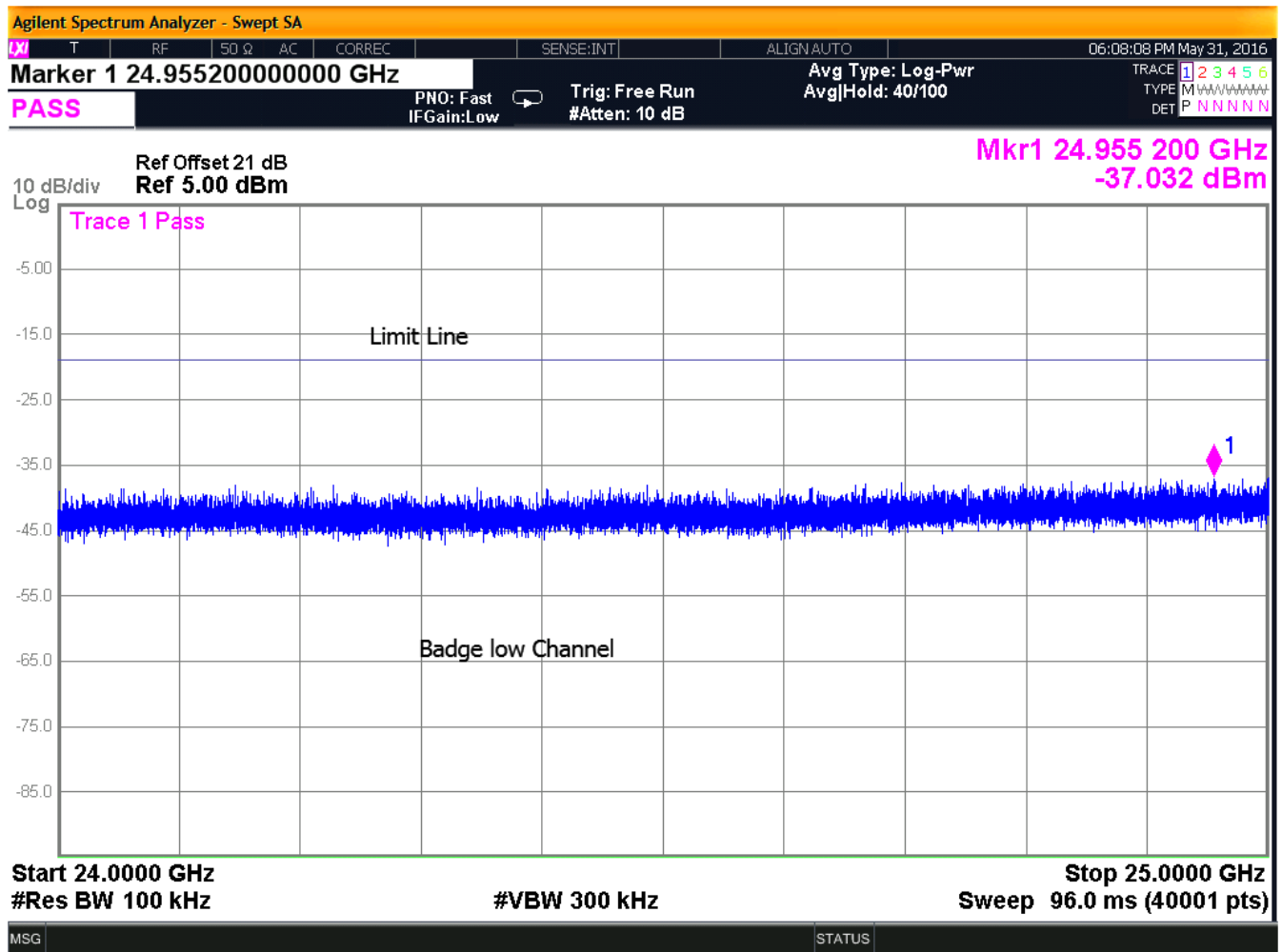


Figure 25: Low Channel Conducted Spurious Plot 15

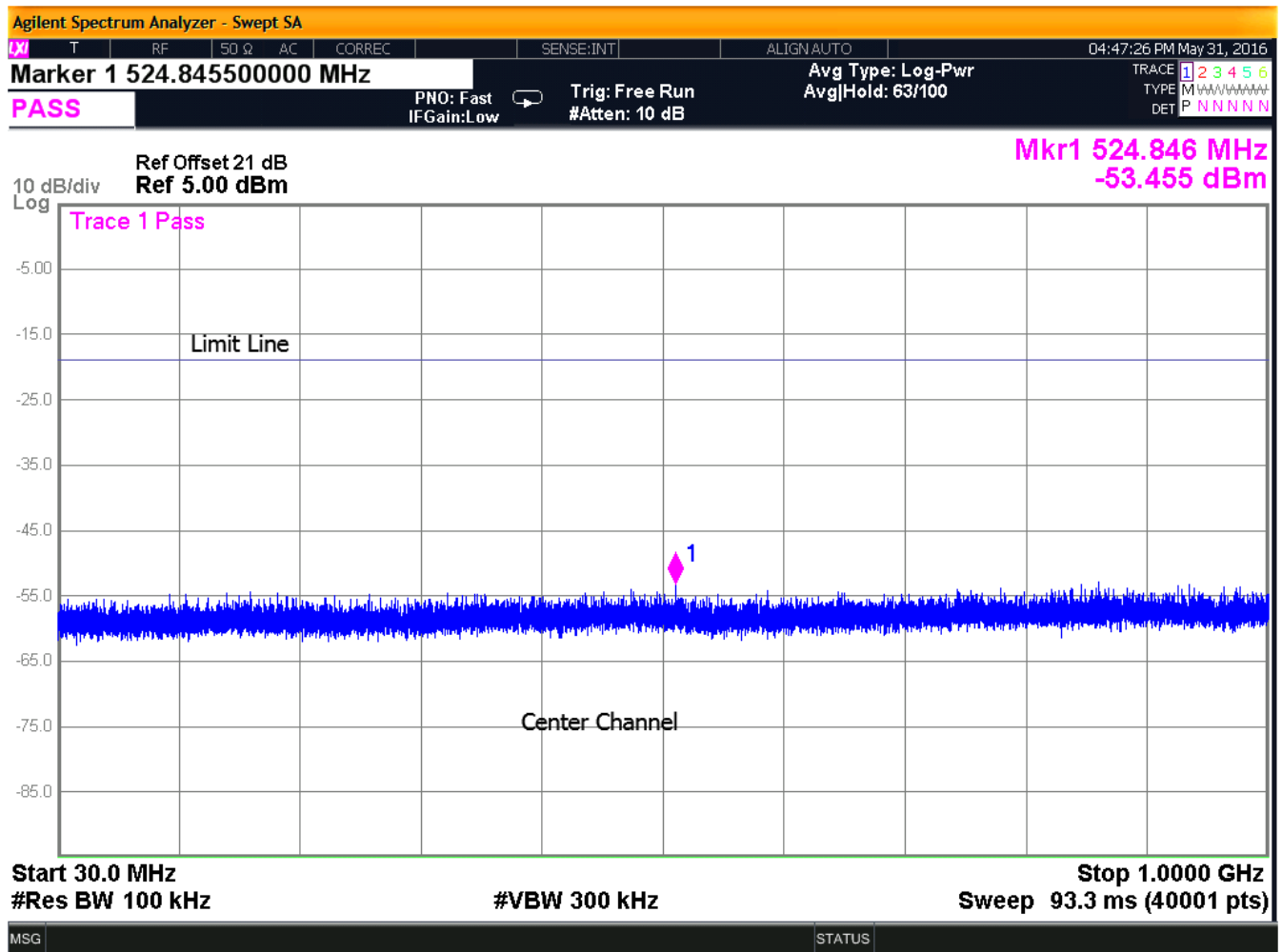


Figure 26: Center Channel Conducted Spurious Plot 1

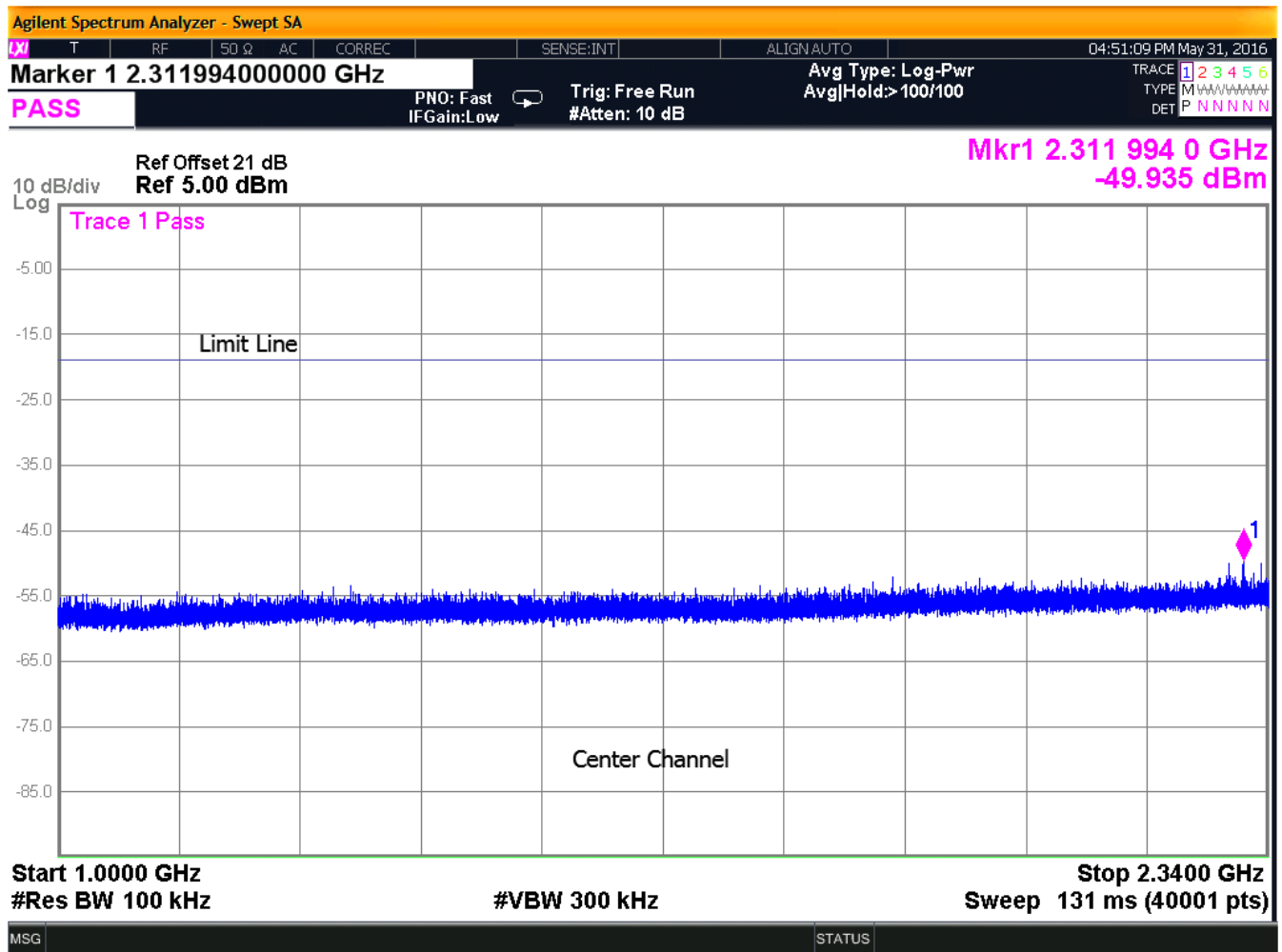


Figure 27: Center Channel Conducted Spurious Plot 2

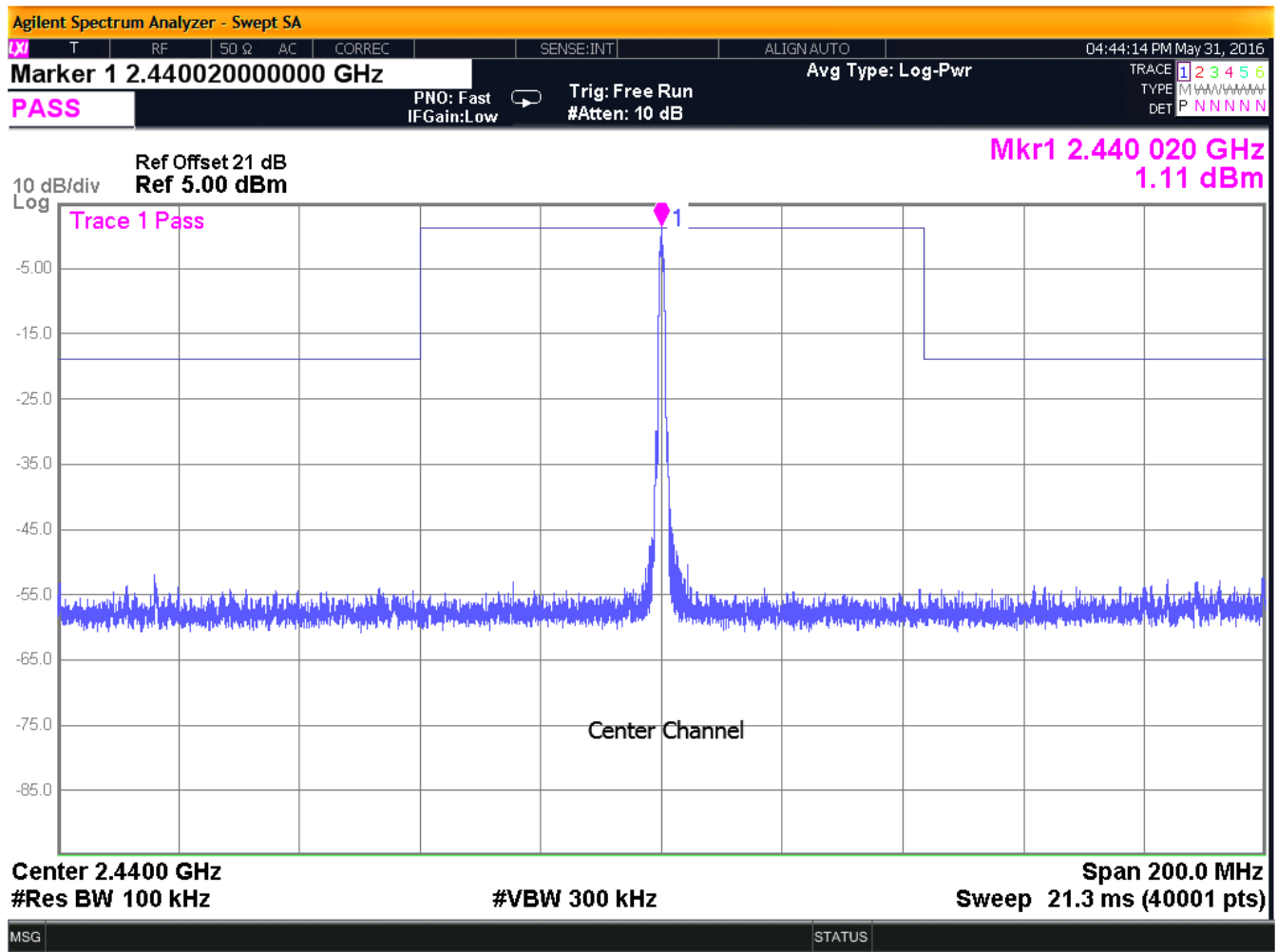


Figure 28: Center Channel Conducted Spurious Plot 3

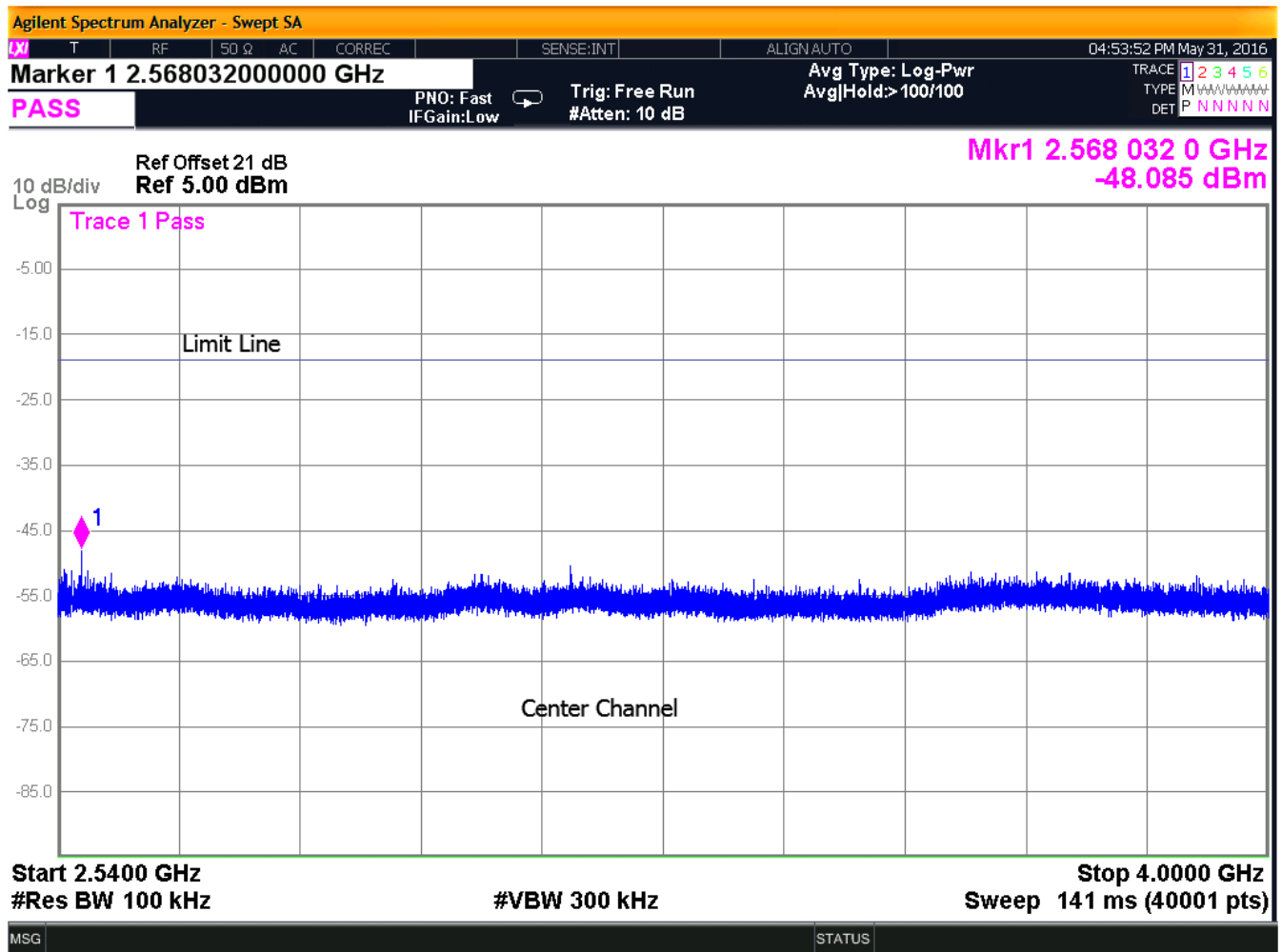


Figure 29: Center Channel Conducted Spurious Plot 4

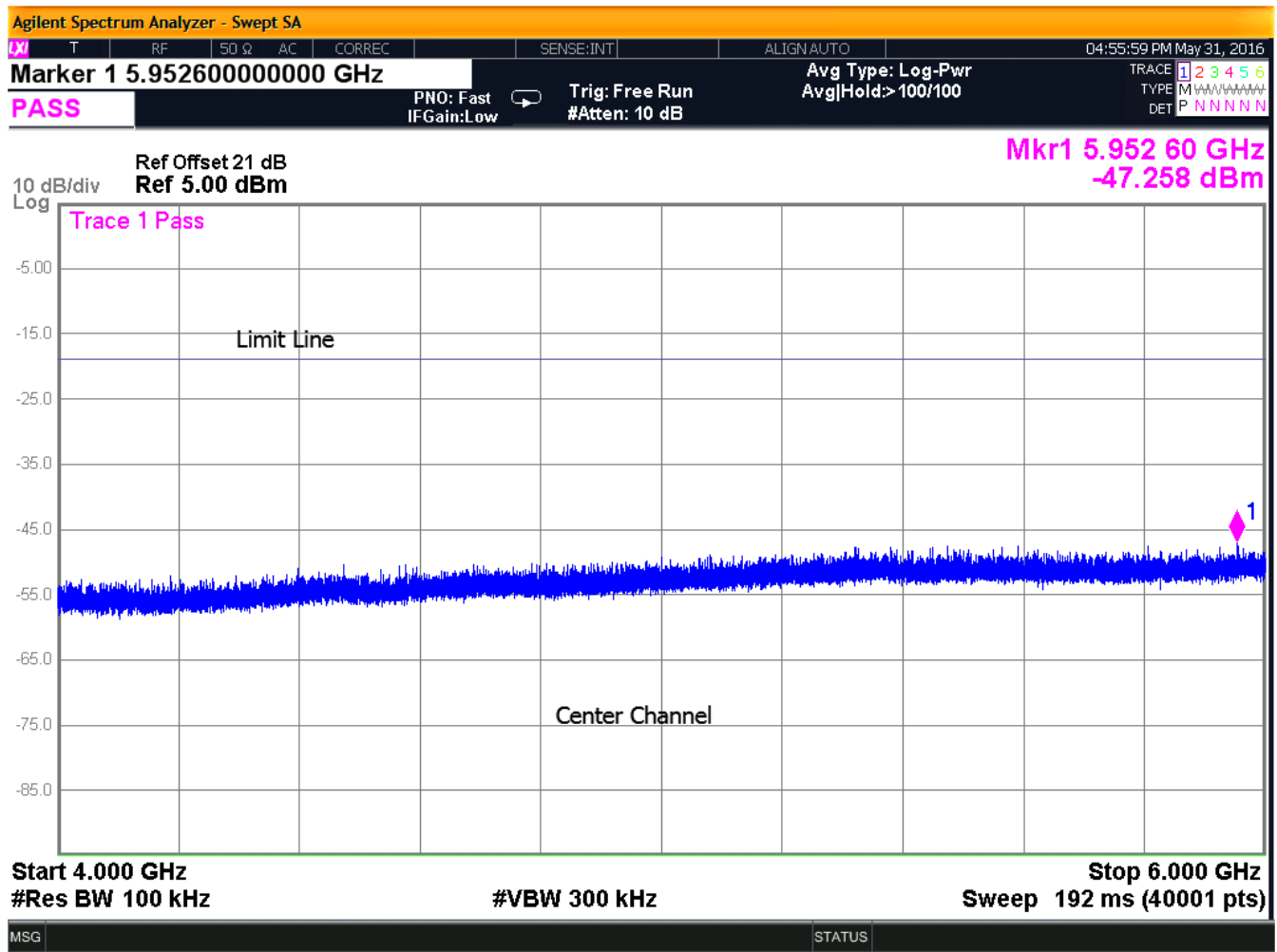


Figure 30: Center Channel Conducted Spurious Plot 5

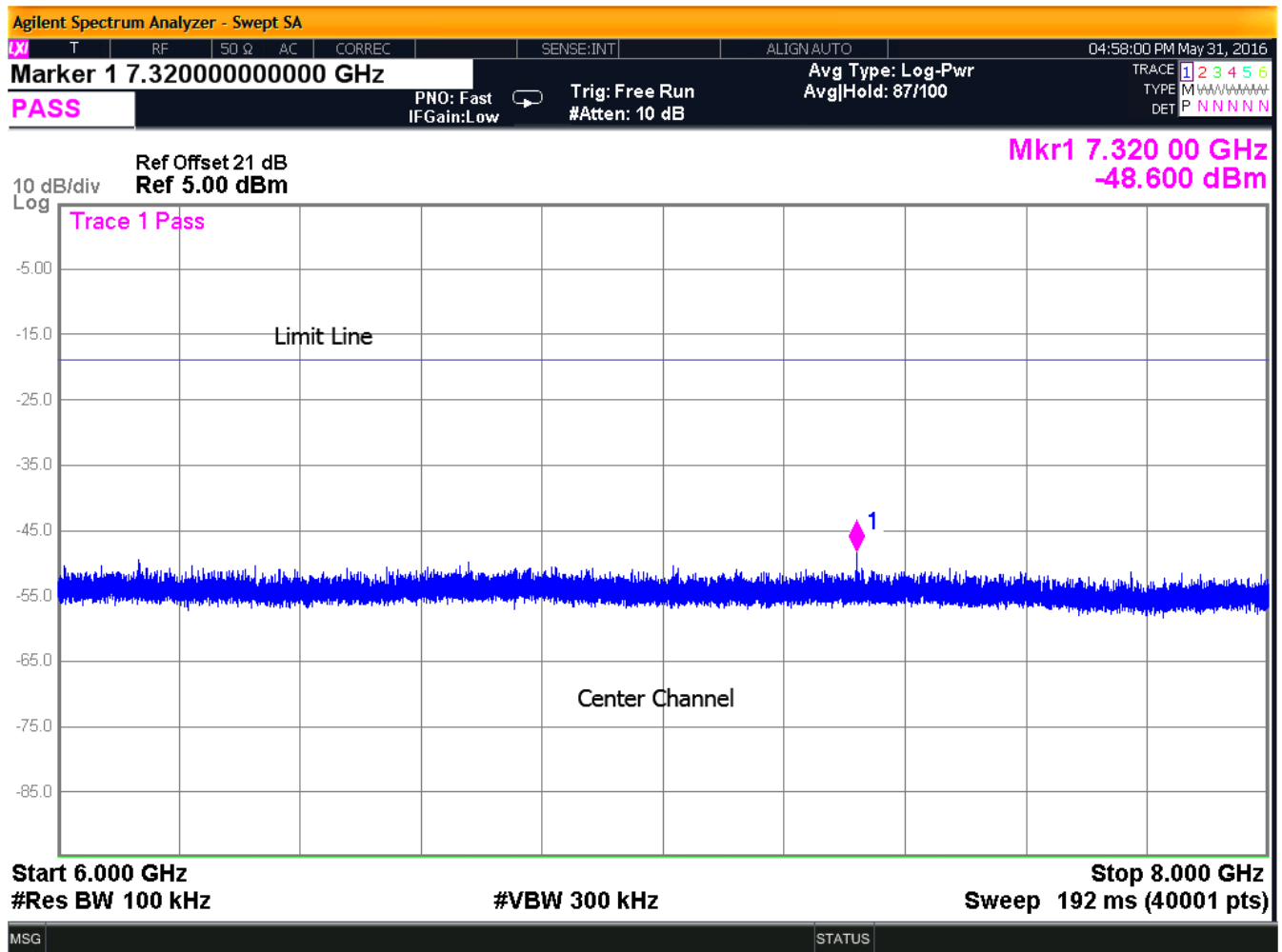


Figure 31: Center Channel Conducted Spurious Plot 6

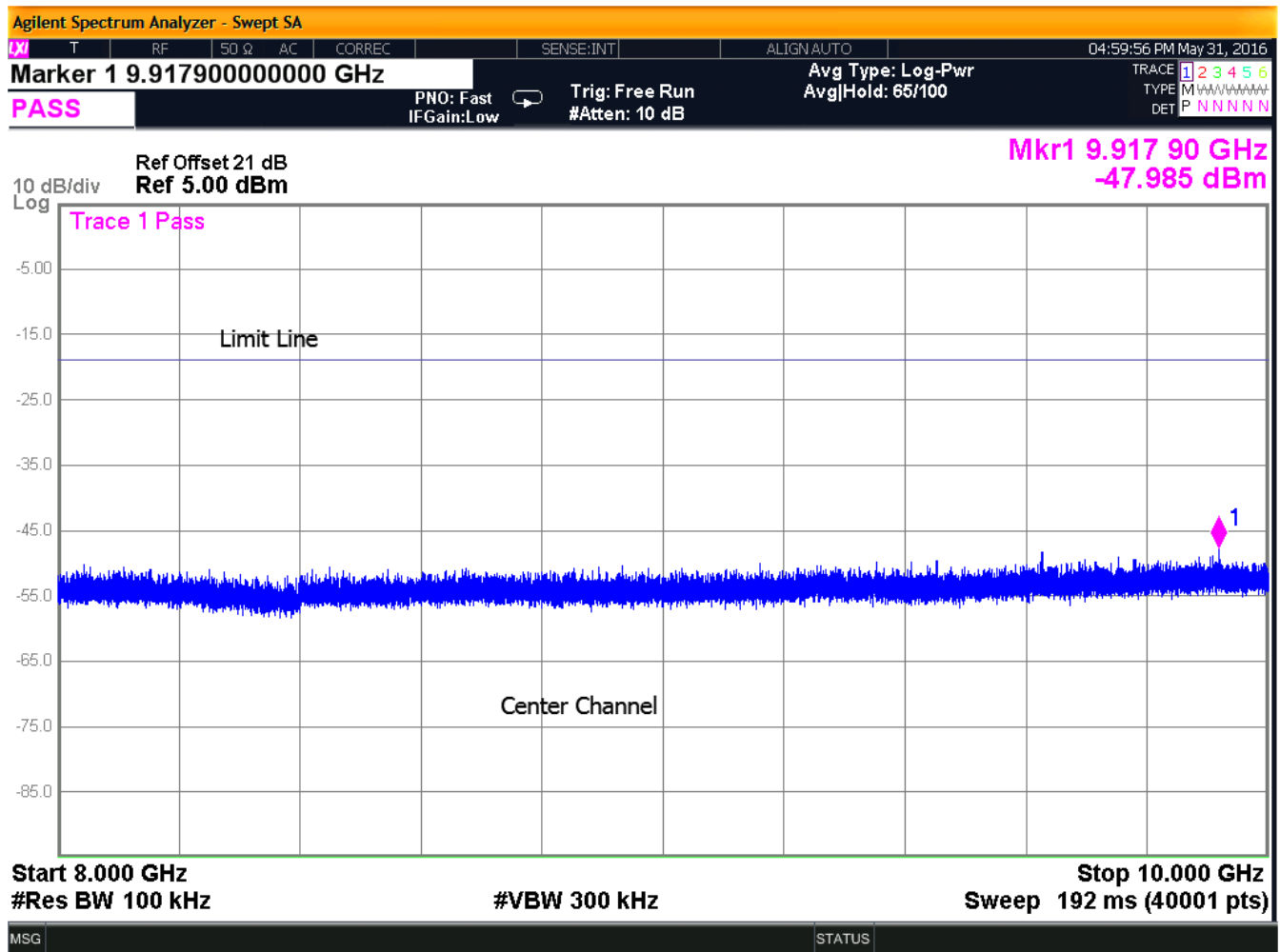


Figure 32: Center Channel Conducted Spurious Plot 7

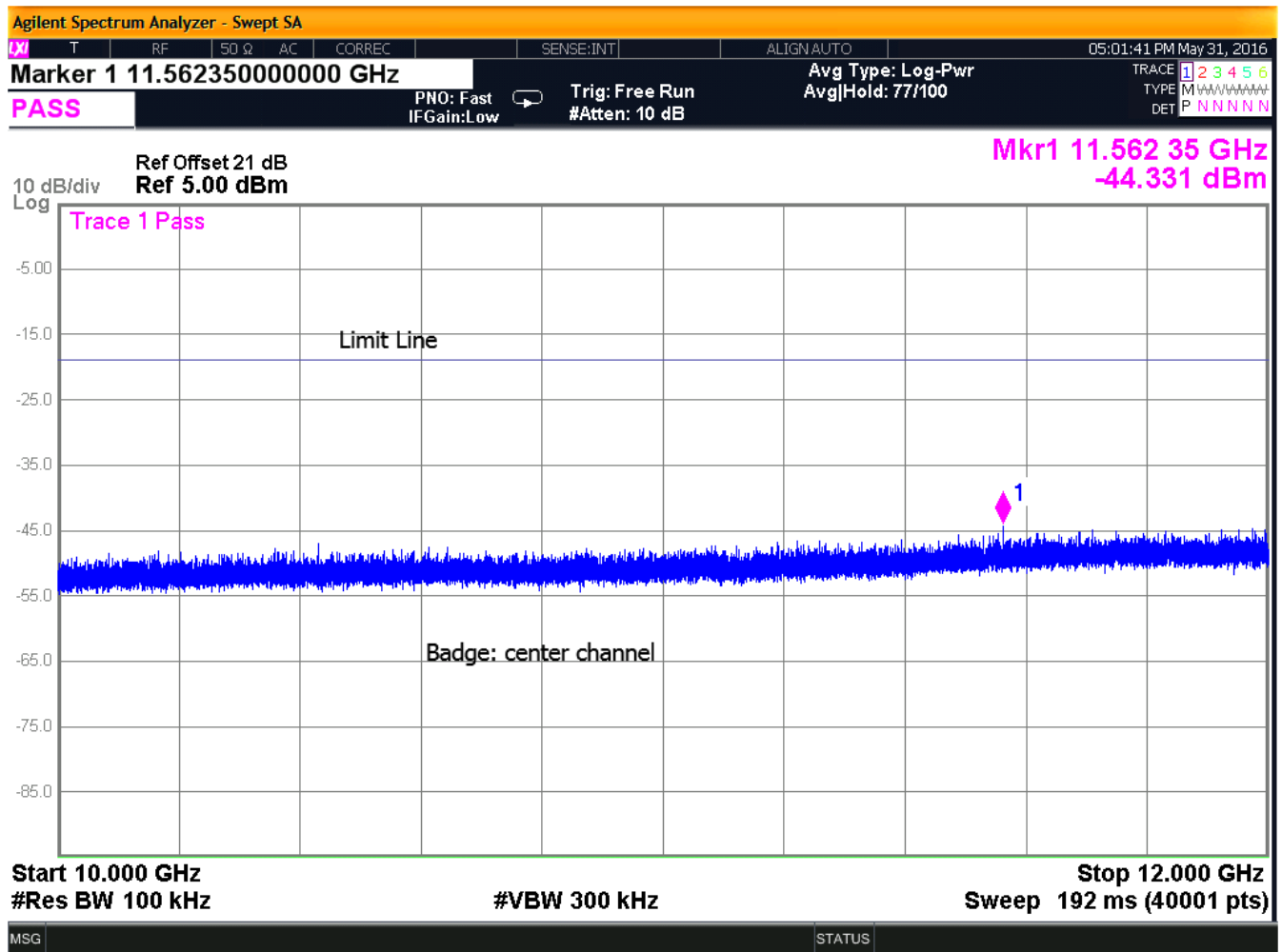


Figure 33: Center Channel Conducted Spurious Plot 8

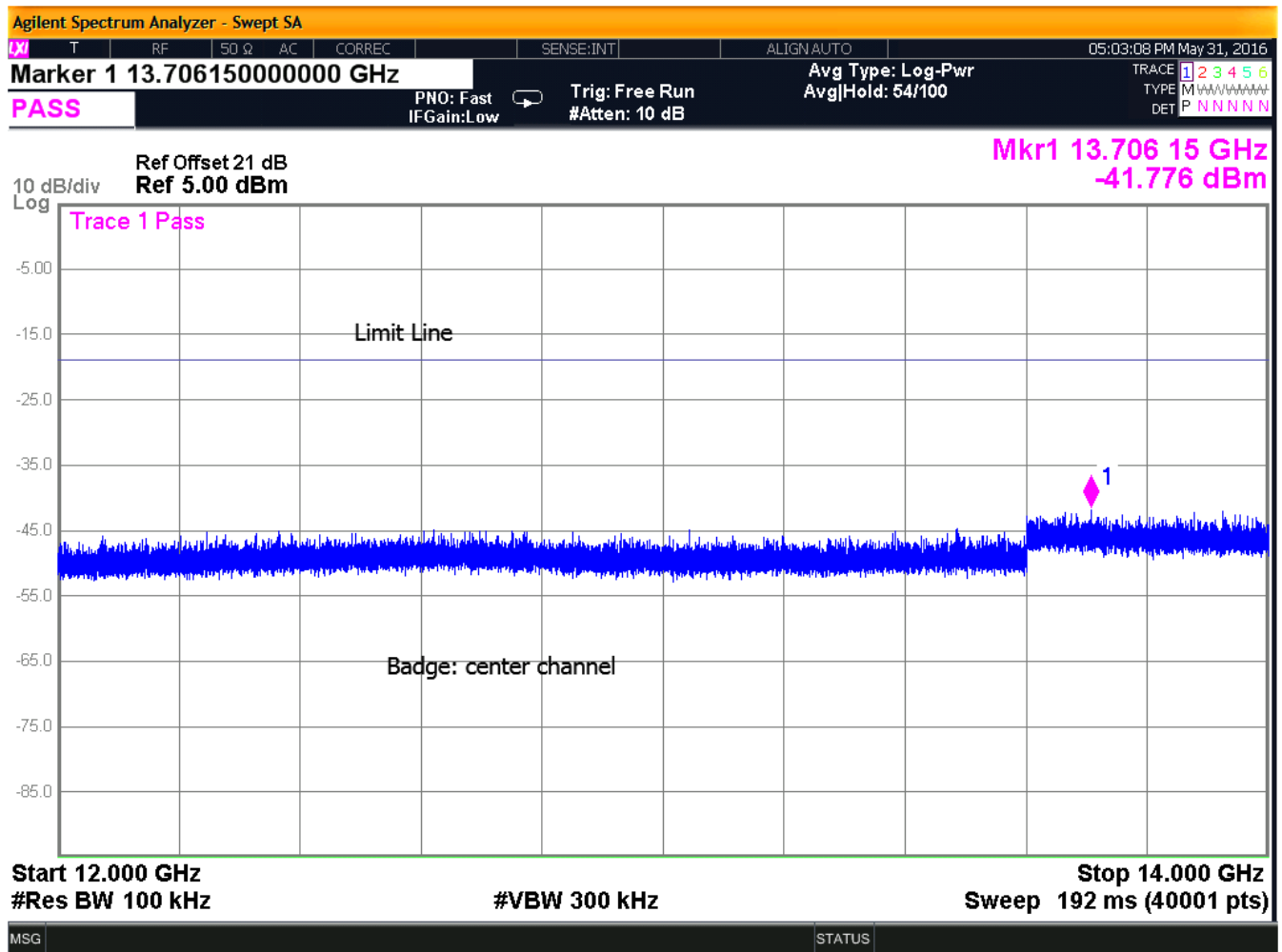


Figure 34: Center Channel Conducted Spurious Plot 9

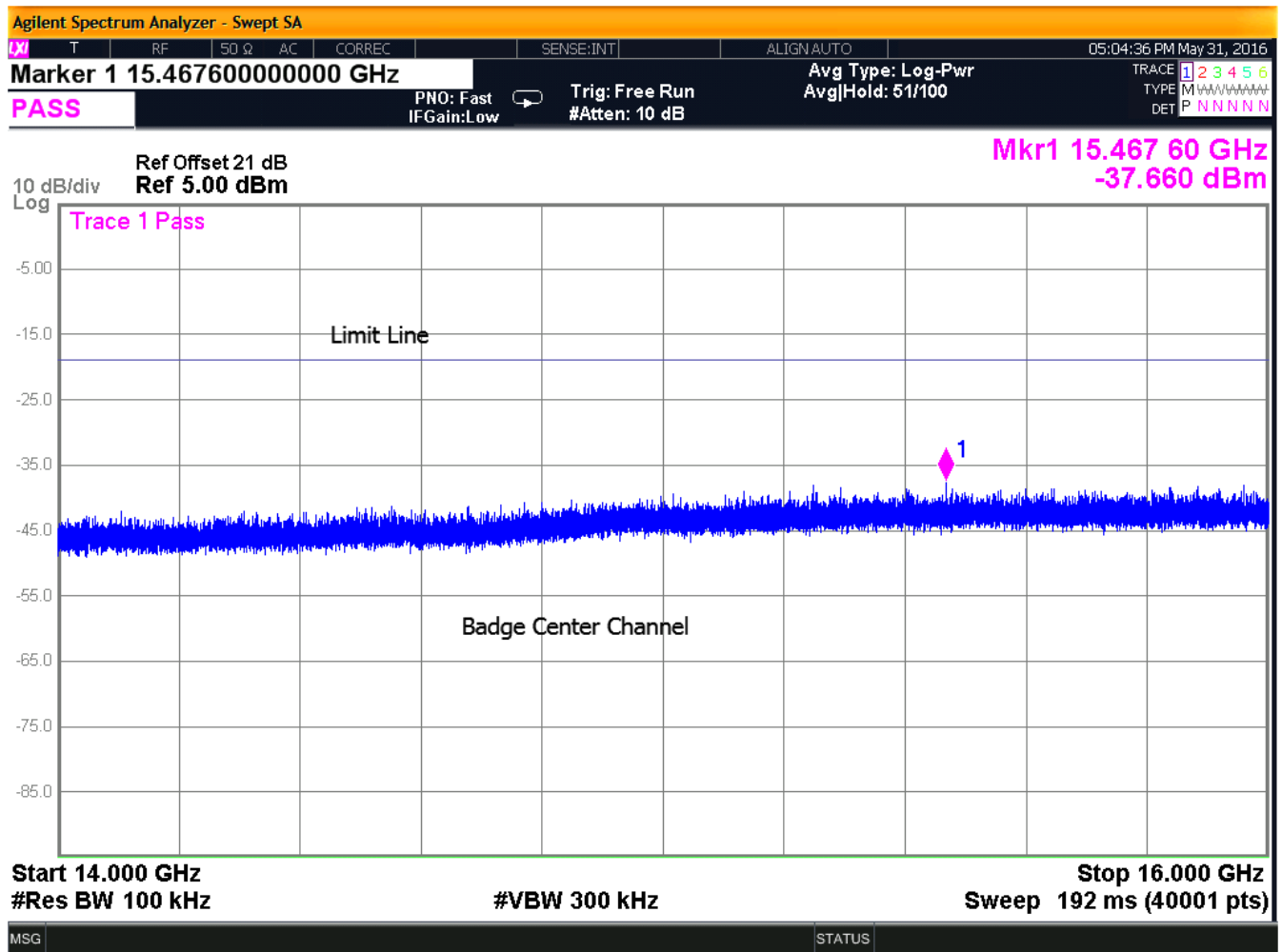


Figure 35: Center Channel Conducted Spurious Plot 10

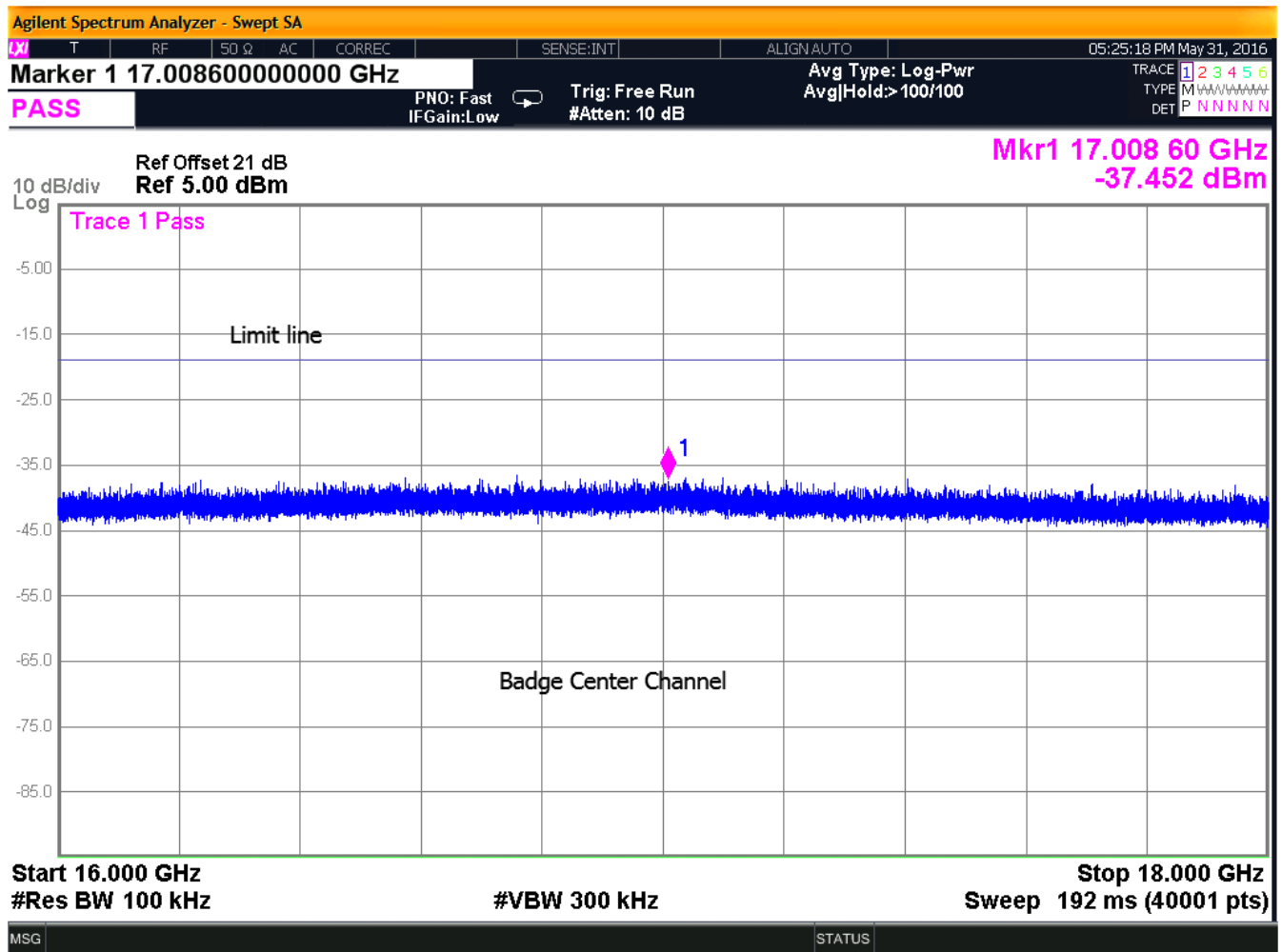


Figure 36: Center Channel Conducted Spurious Plot 11

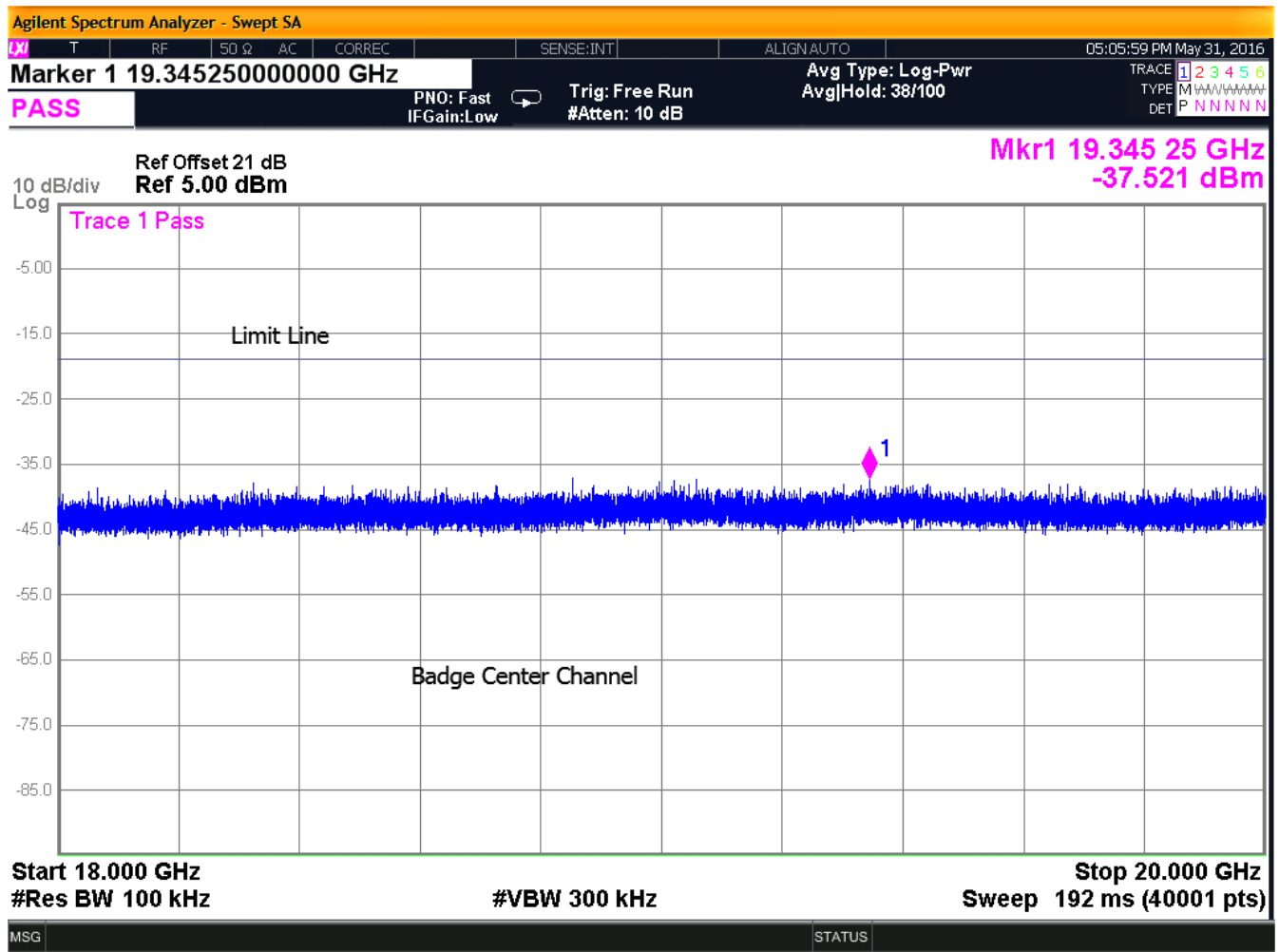


Figure 37: Center Channel Conducted Spurious Plot 12

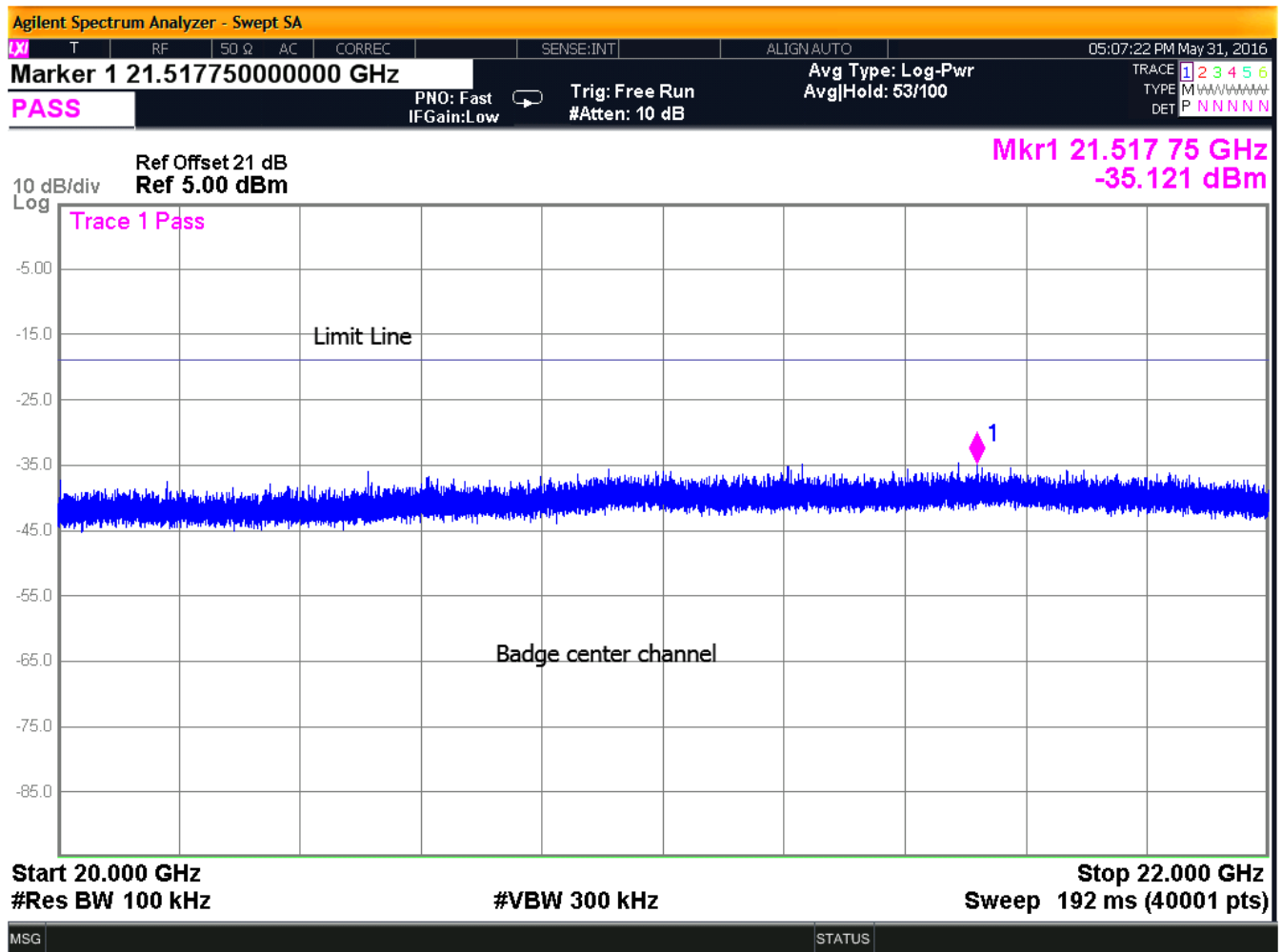


Figure 38: Center Channel Conducted Spurious Plot 13

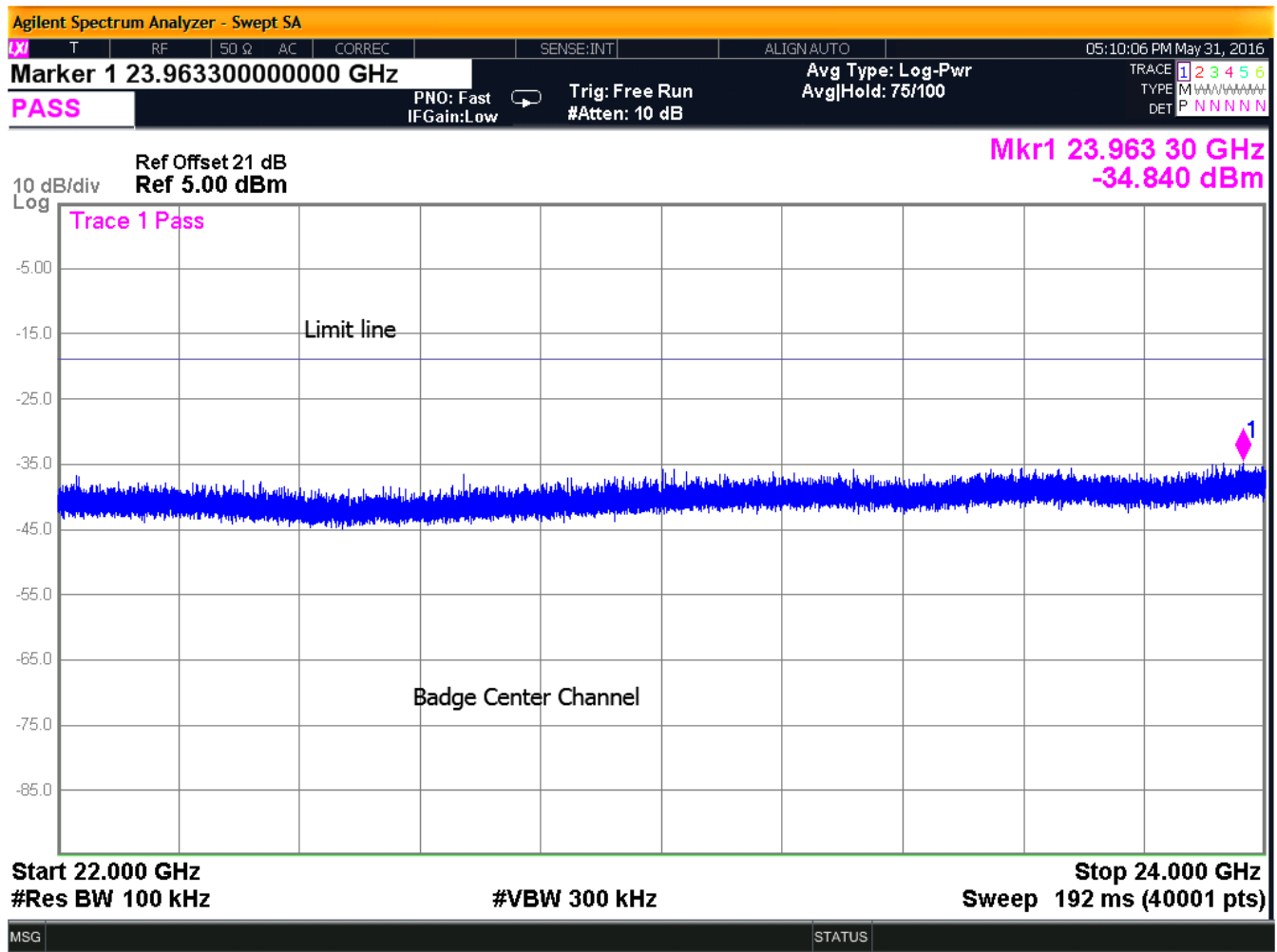


Figure 39: Center Channel Conducted Spurious Plot 14

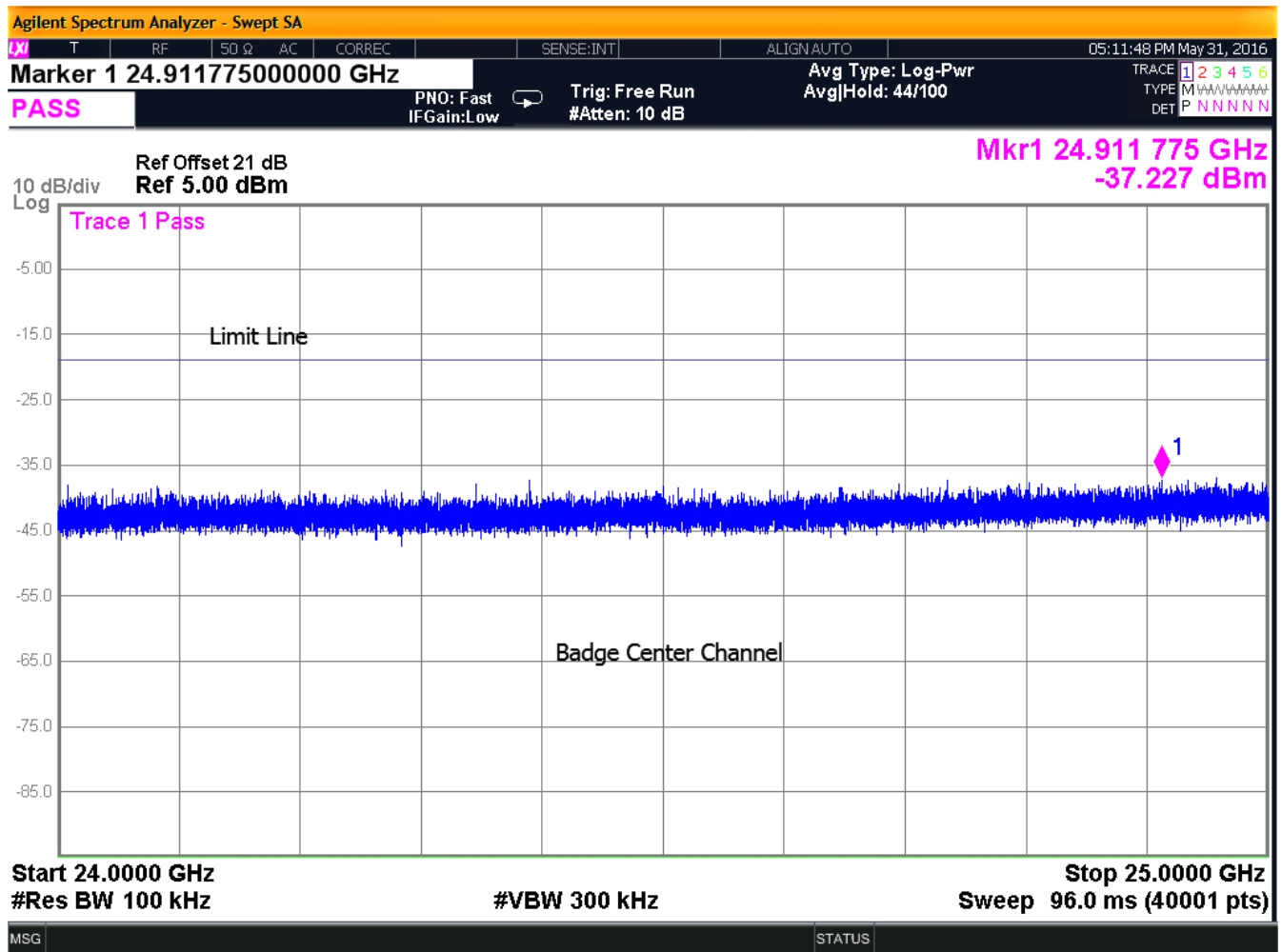


Figure 40: Center Channel Conducted Spurious Plot 15

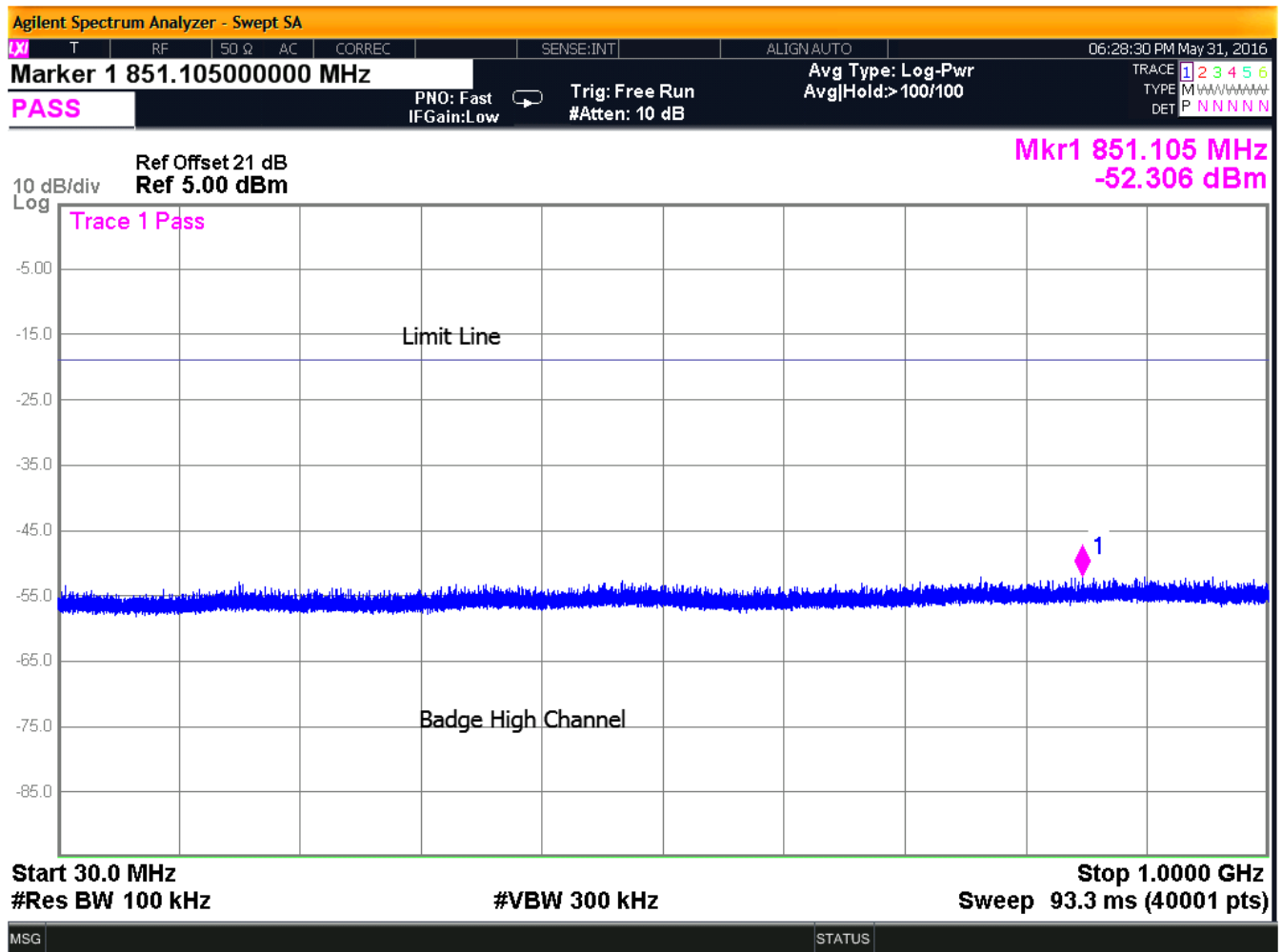


Figure 41: High Channel Conducted Spurious Plot 1

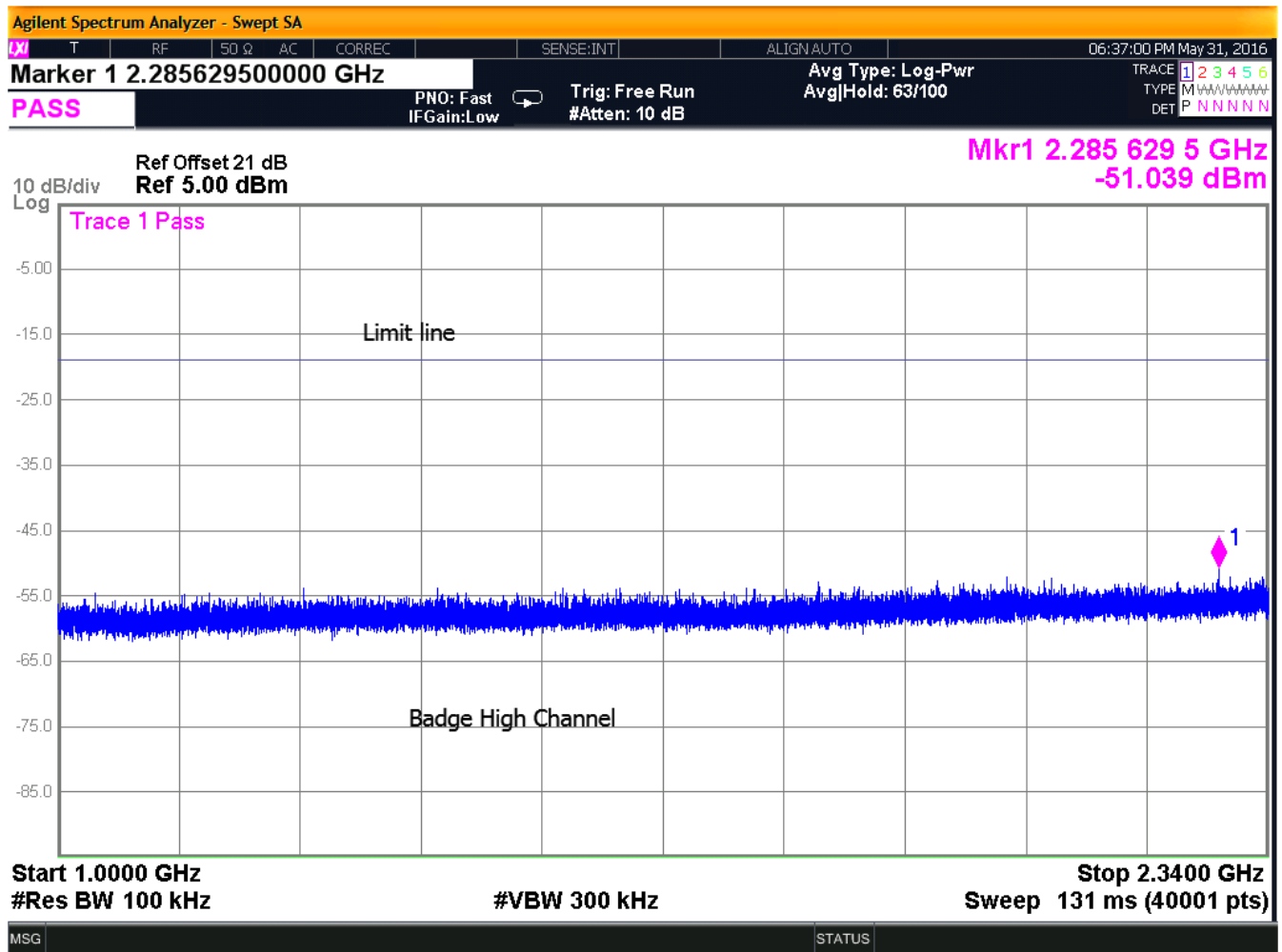


Figure 42: High Channel Conducted Spurious Plot 2

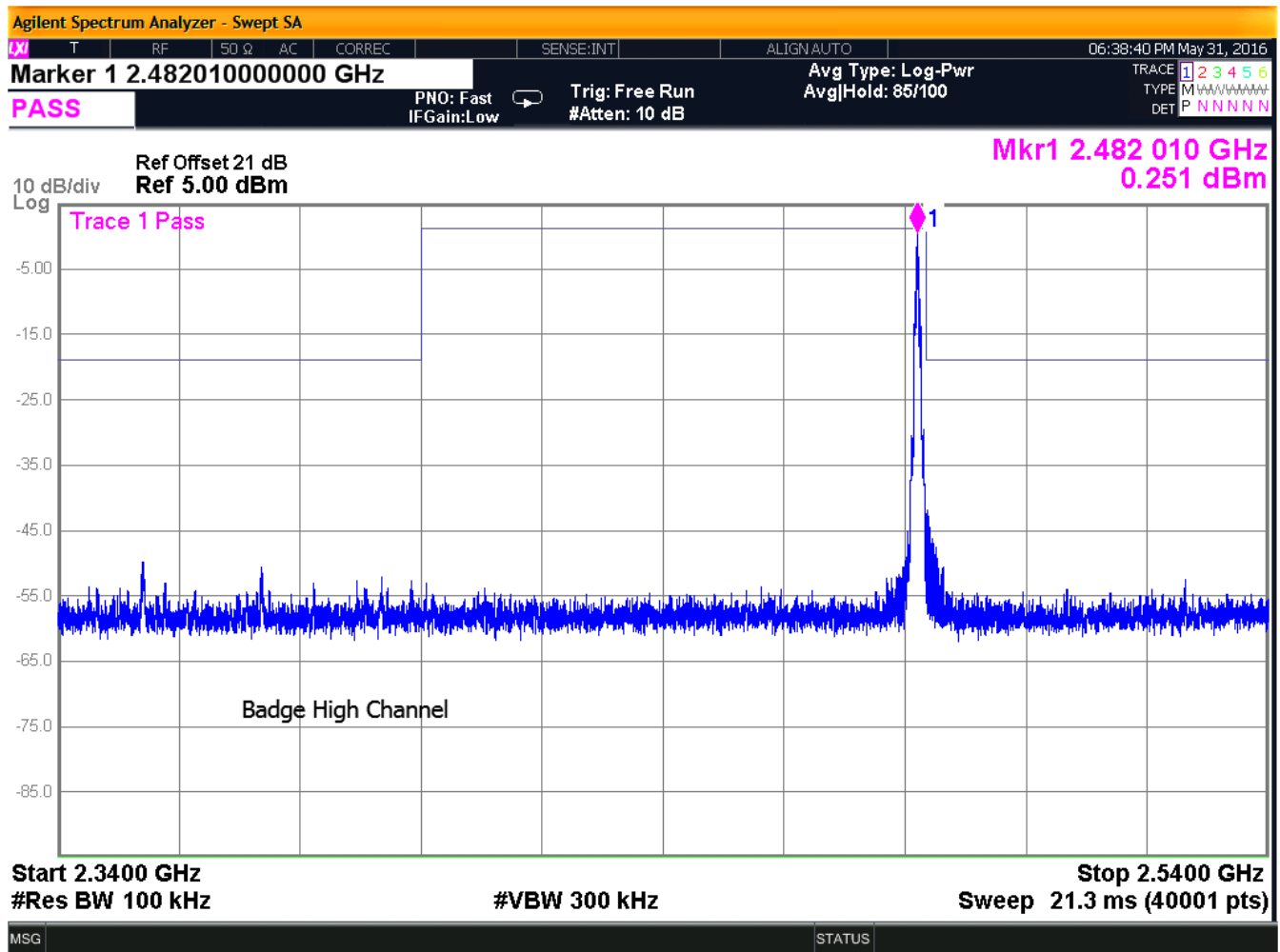


Figure 43: High Channel Conducted Spurious Plot 3

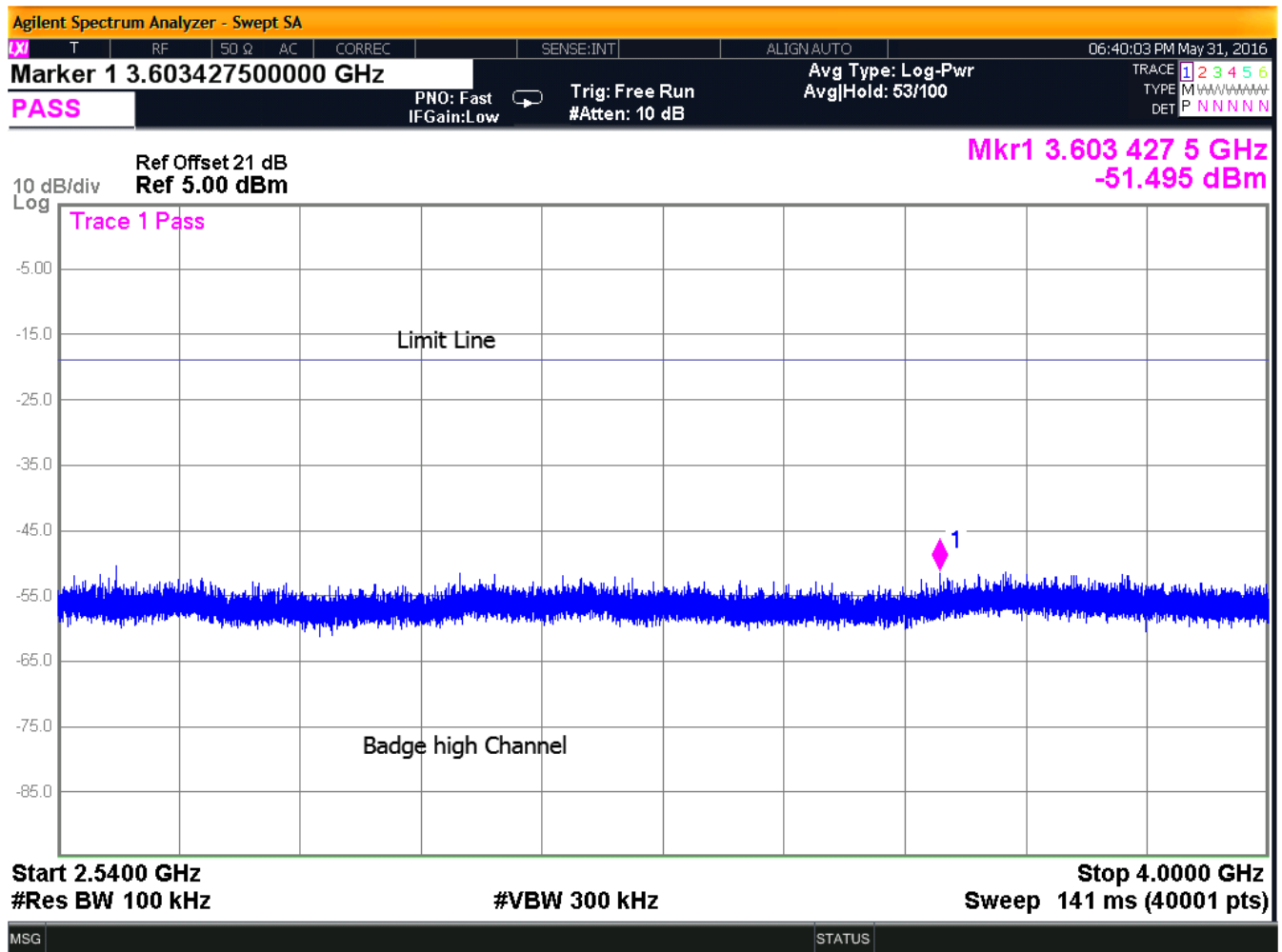


Figure 44: High Channel Conducted Spurious Plot 4

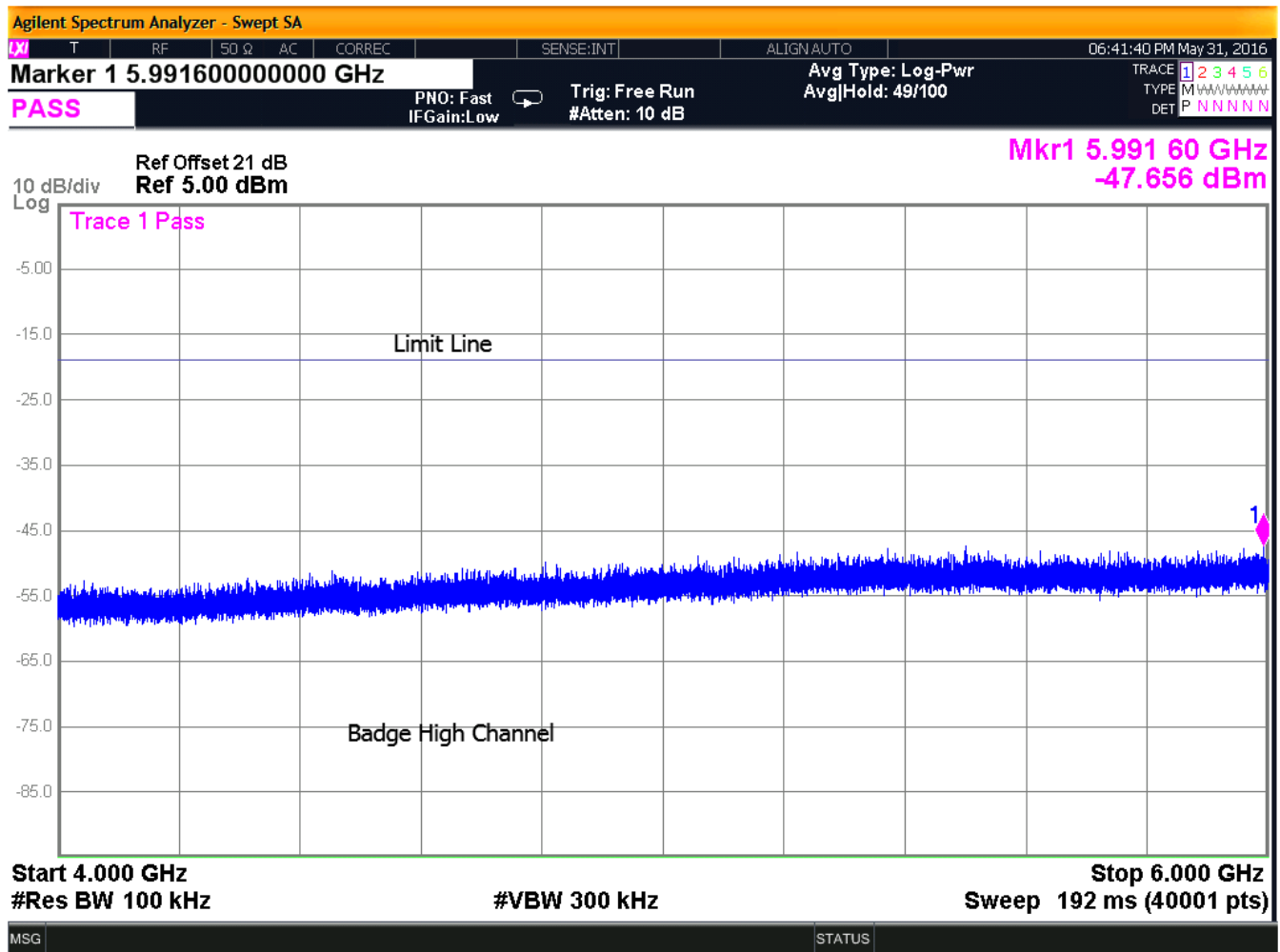


Figure 45: High Channel Conducted Spurious Plot 5

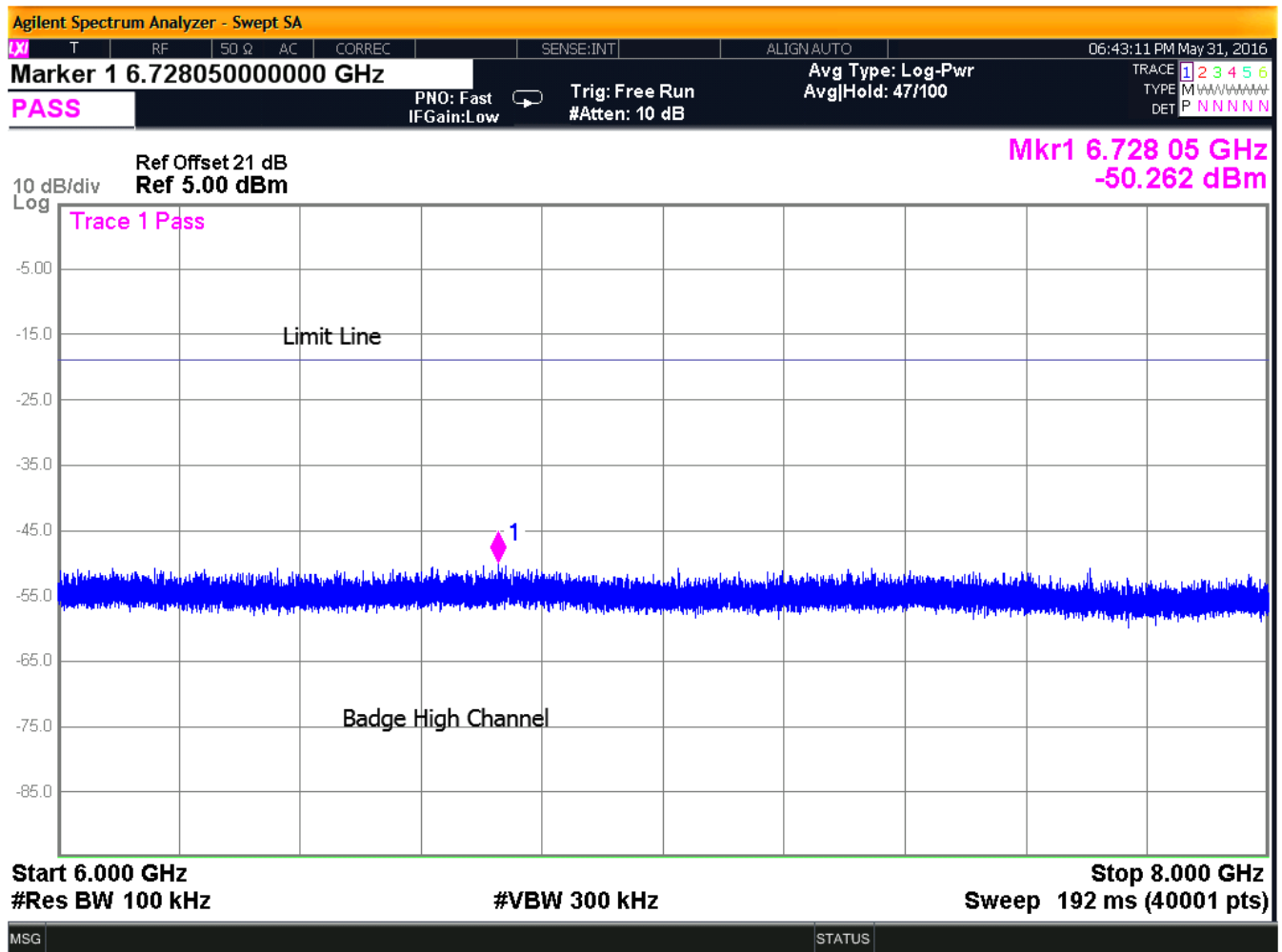


Figure 46: High Channel Conducted Spurious Plot 6

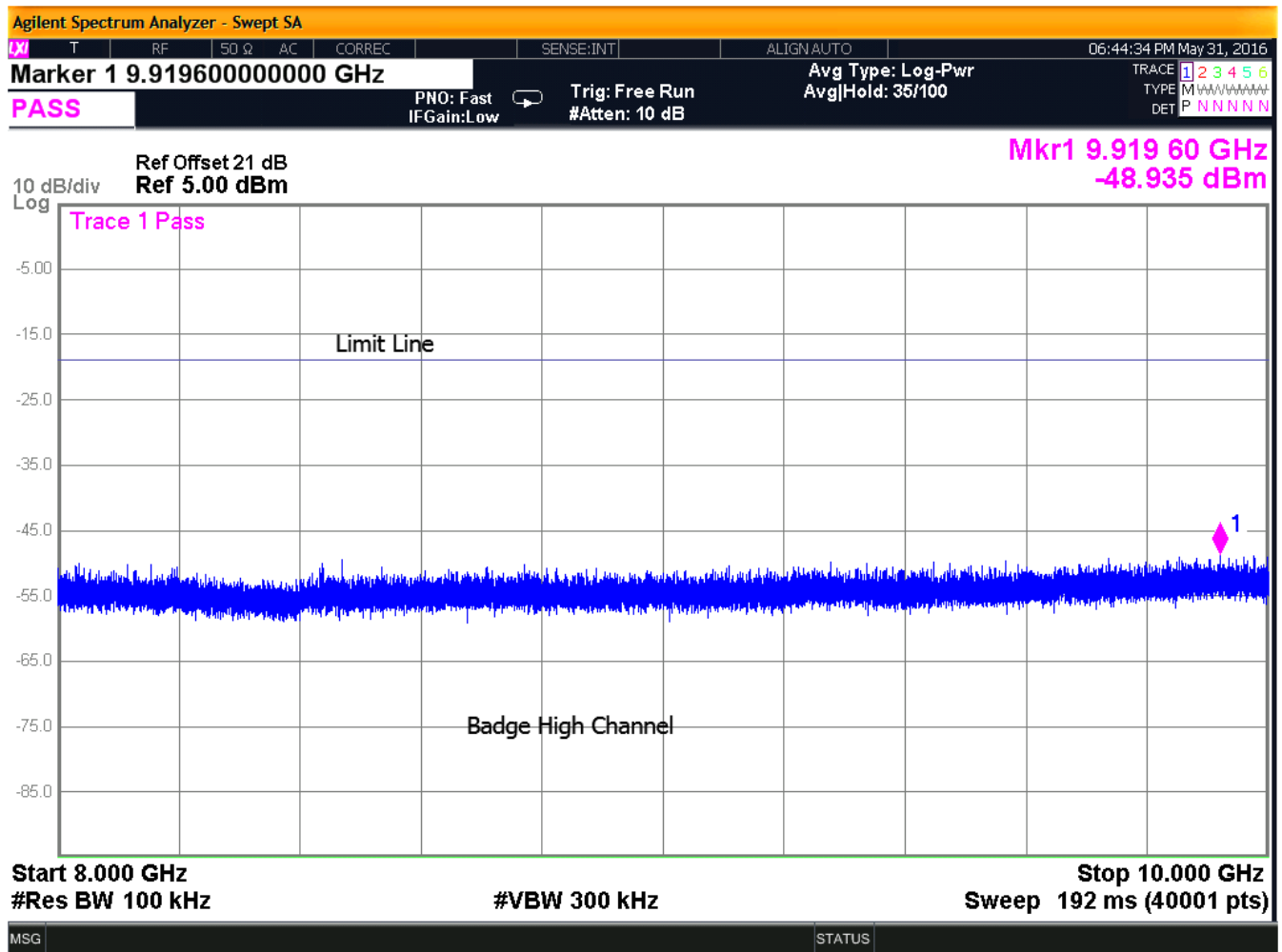


Figure 47: High Channel Conducted Spurious Plot 7

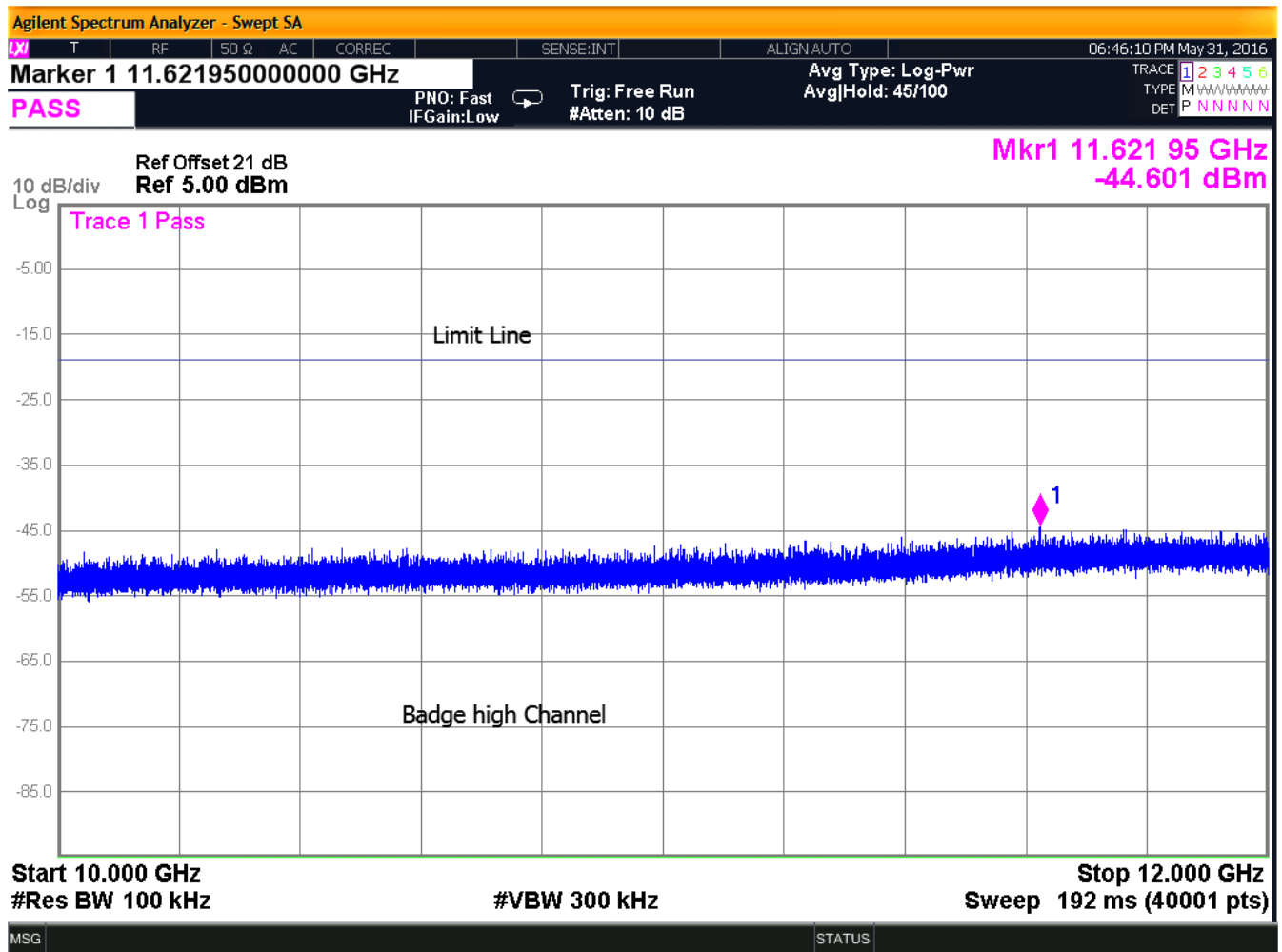


Figure 48: High Channel Conducted Spurious Plot 8

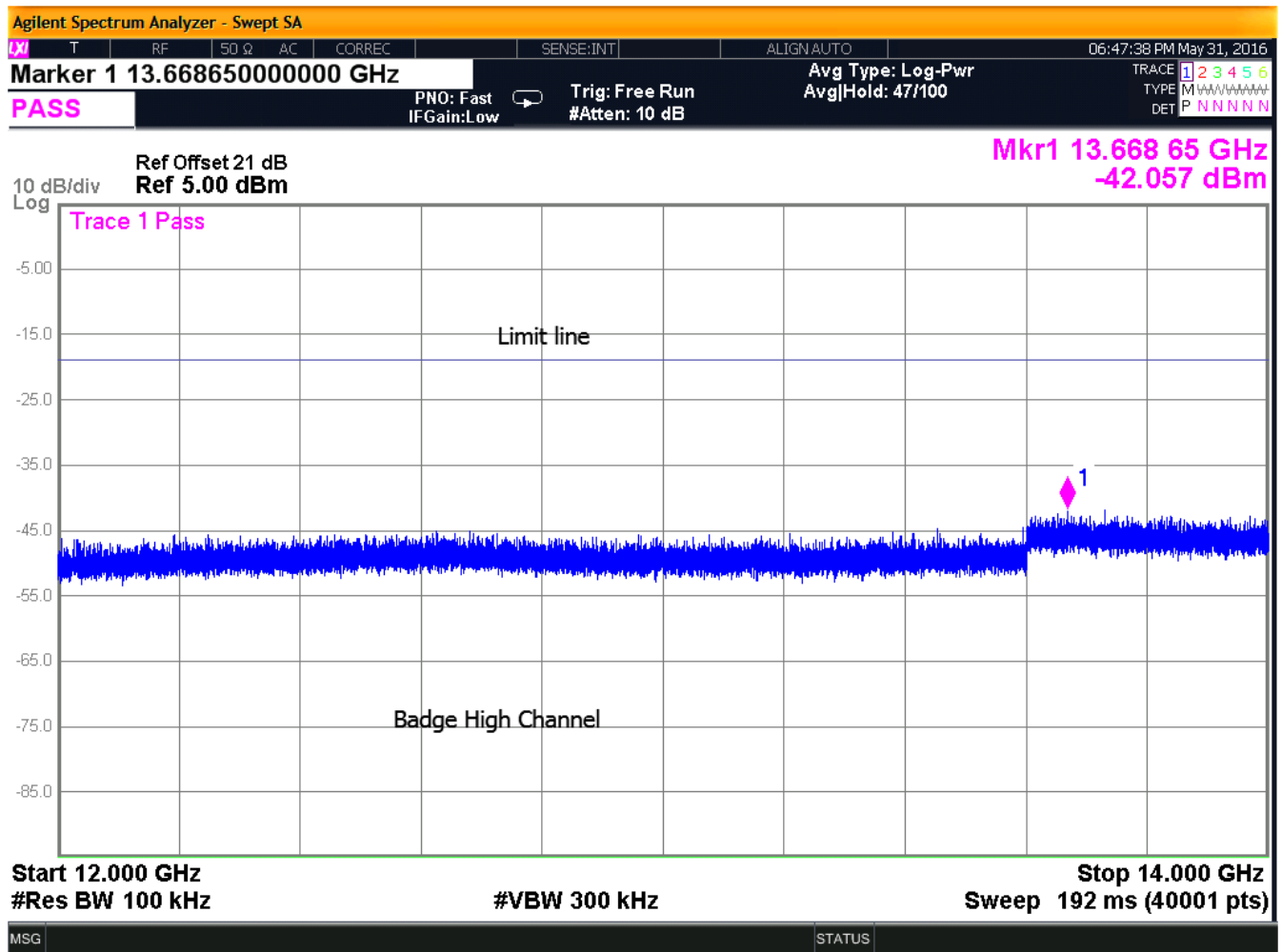


Figure 49: High Channel Conducted Spurious Plot 9

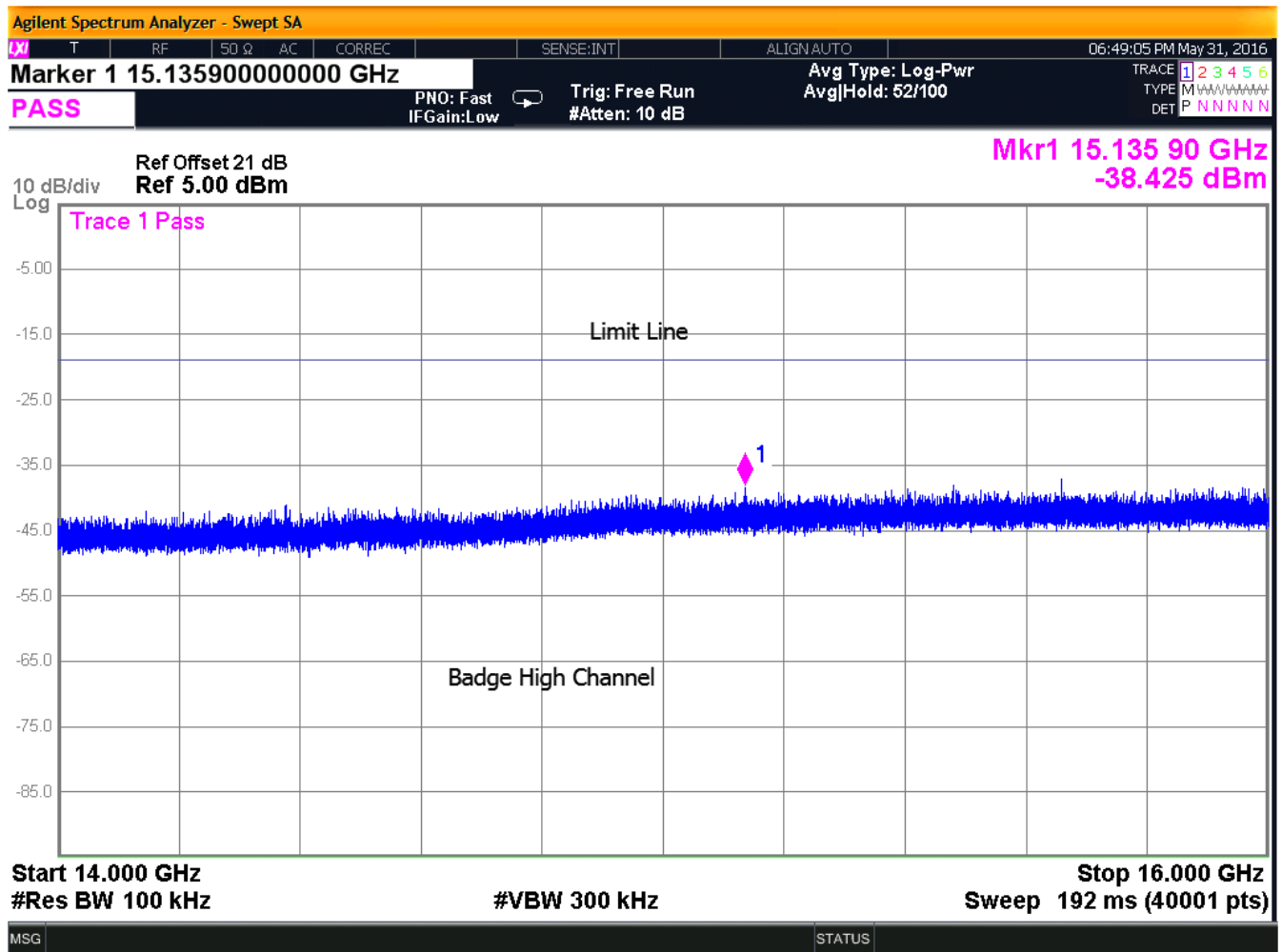


Figure 50: High Channel Conducted Spurious Plot 10

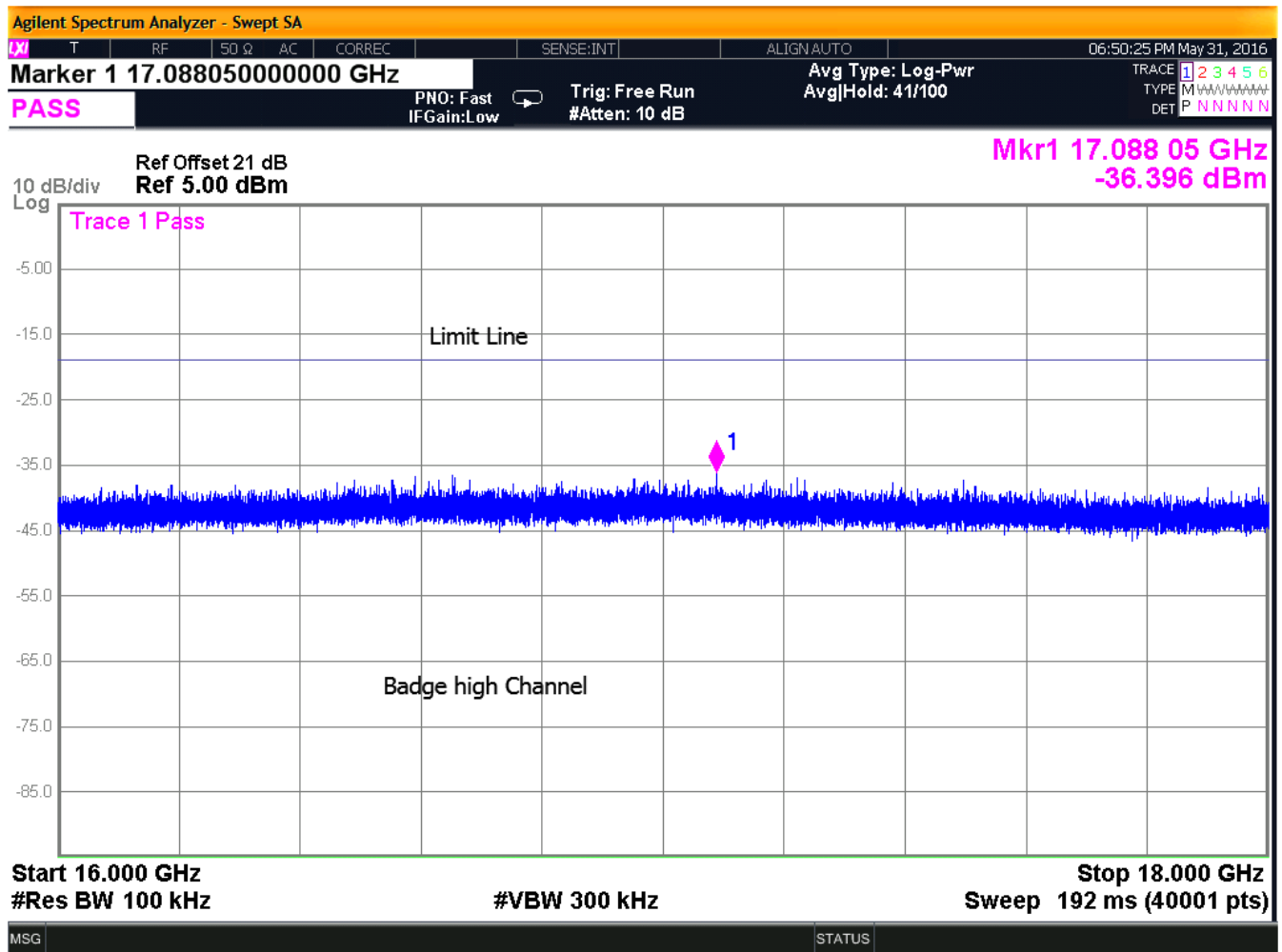


Figure 51: High Channel Conducted Spurious Plot 11

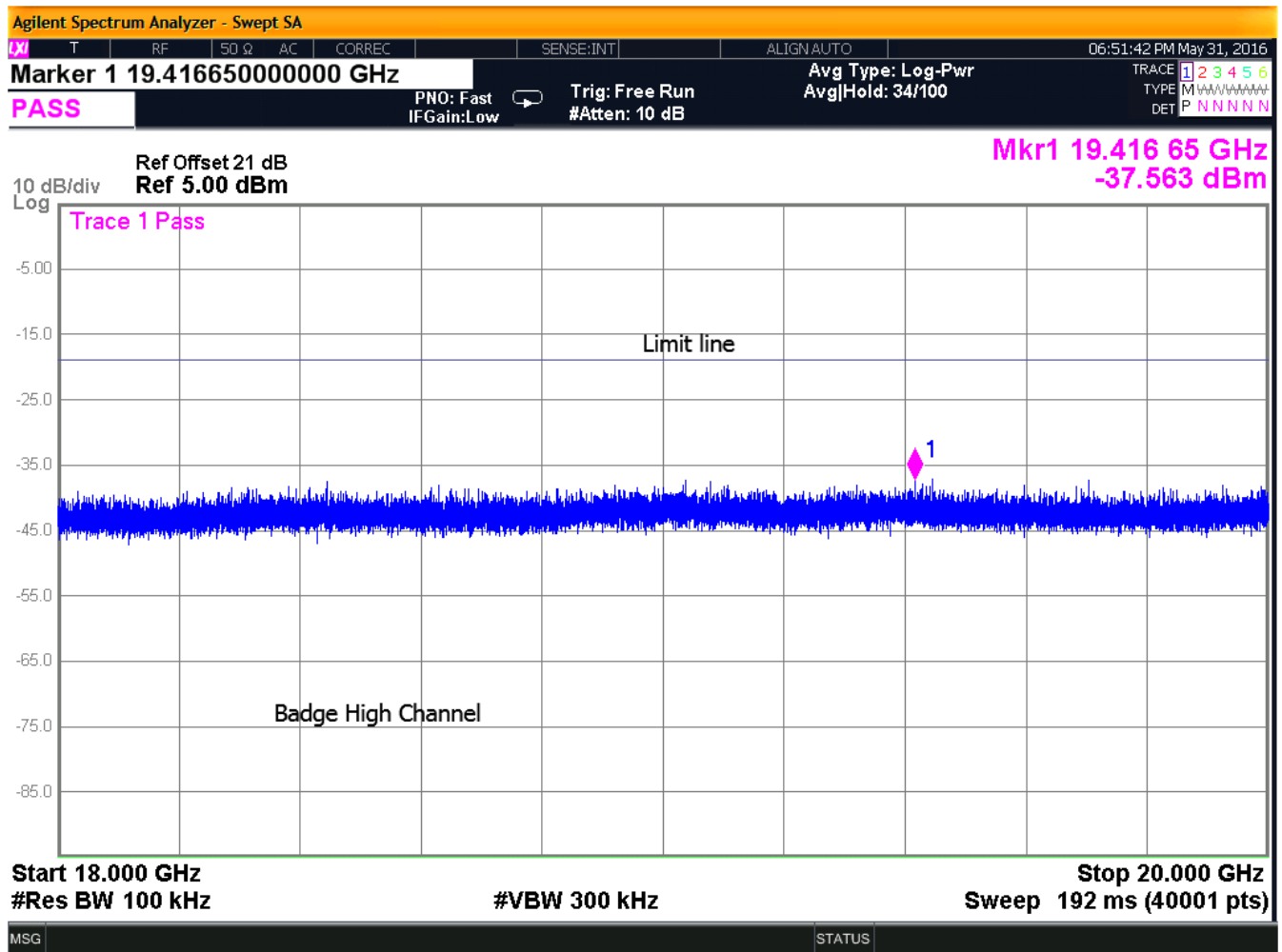


Figure 52: High Channel Conducted Spurious Plot 12

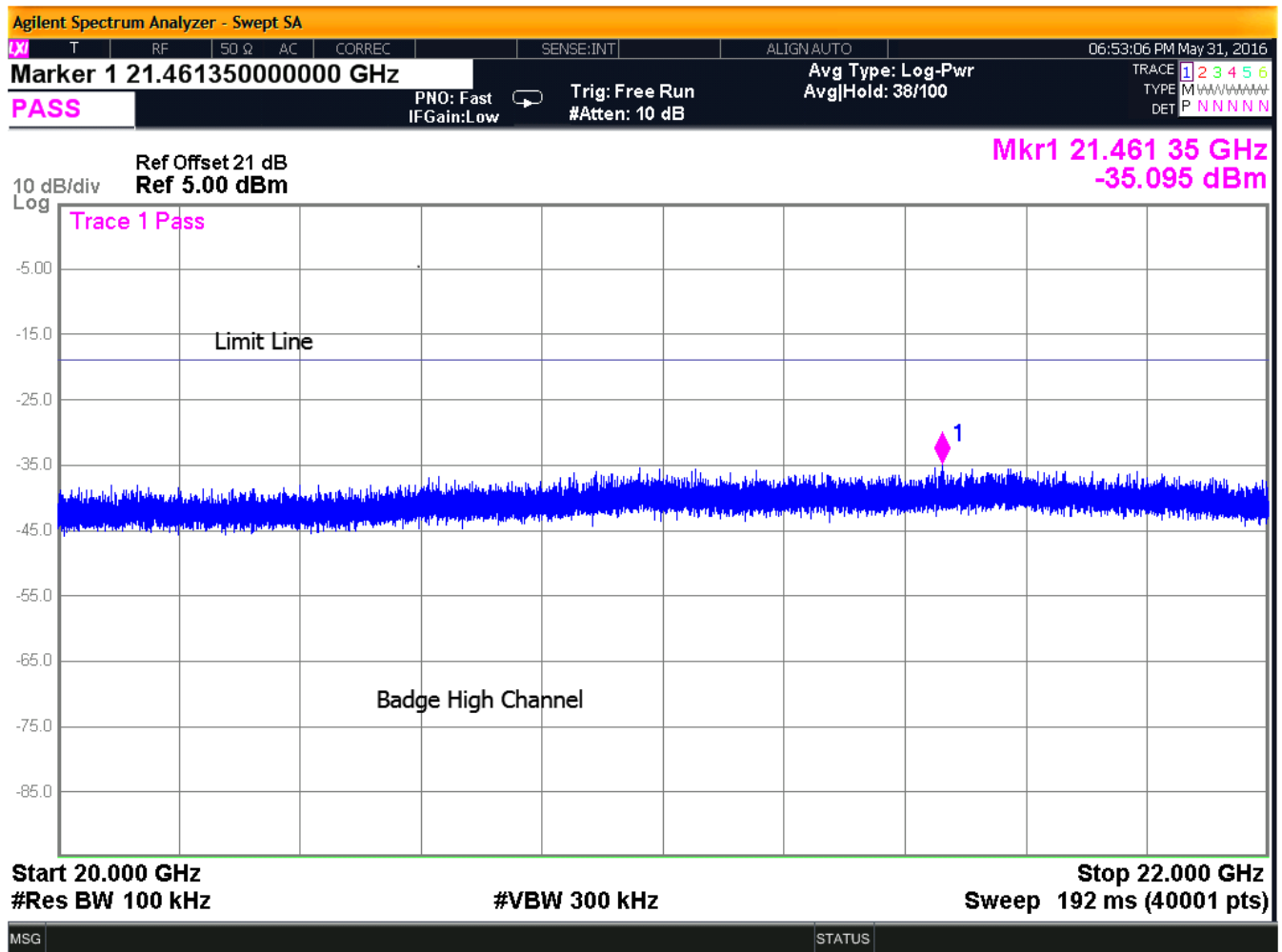


Figure 53: High Channel Conducted Spurious Plot 13

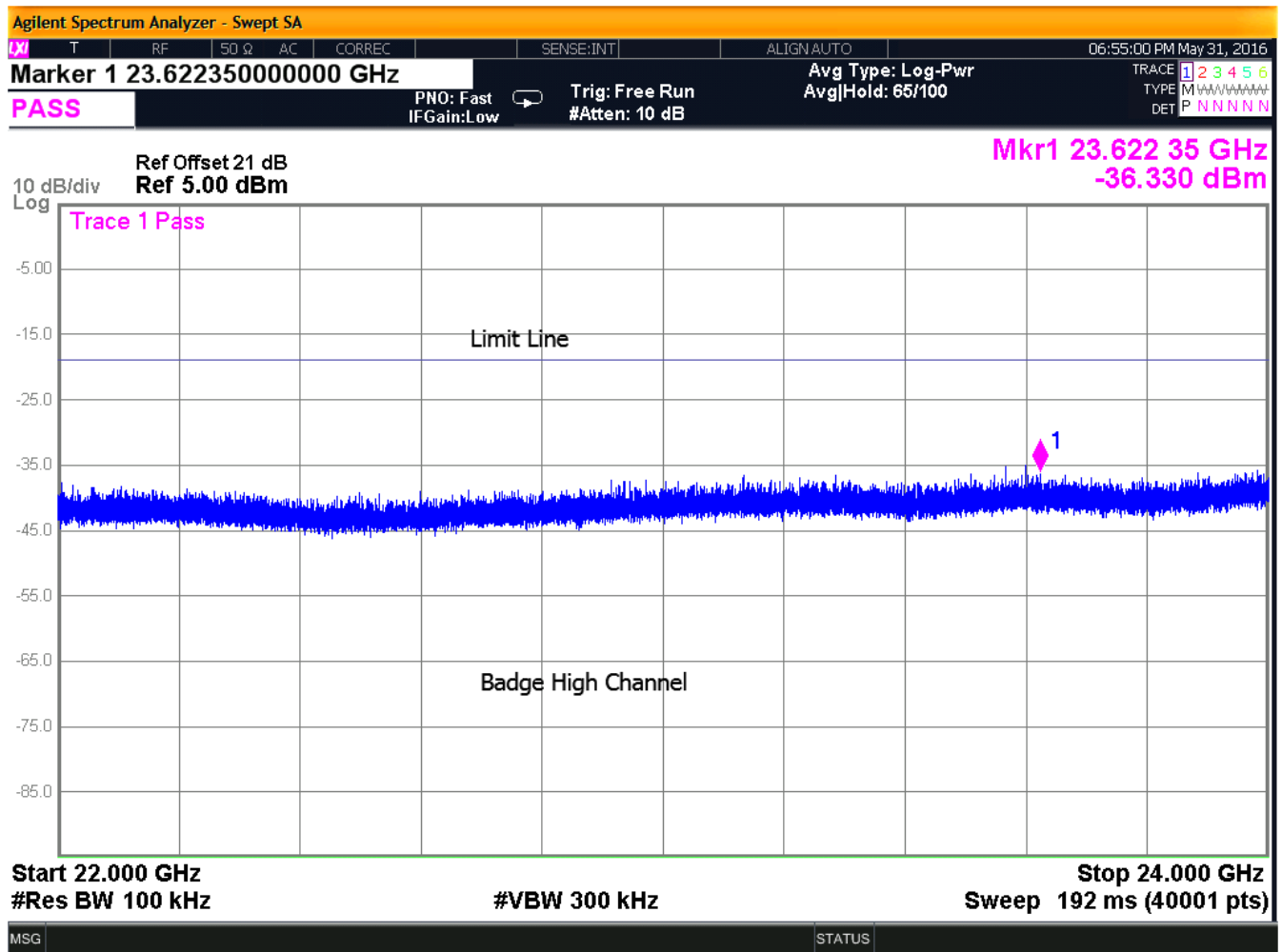


Figure 54: High Channel Conducted Spurious Plot 14

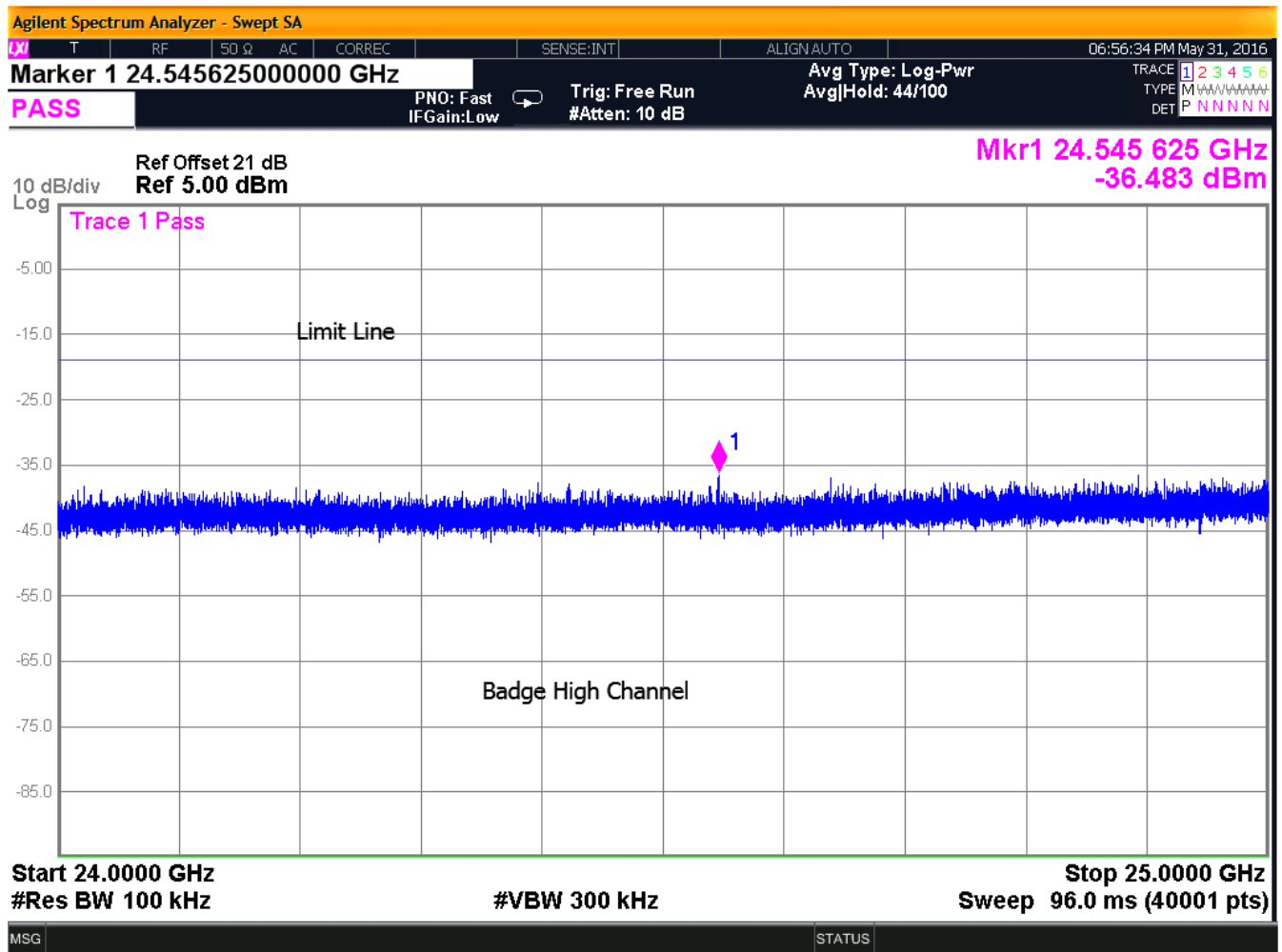


Figure 55: High Channel Conducted Spurious Plot 15

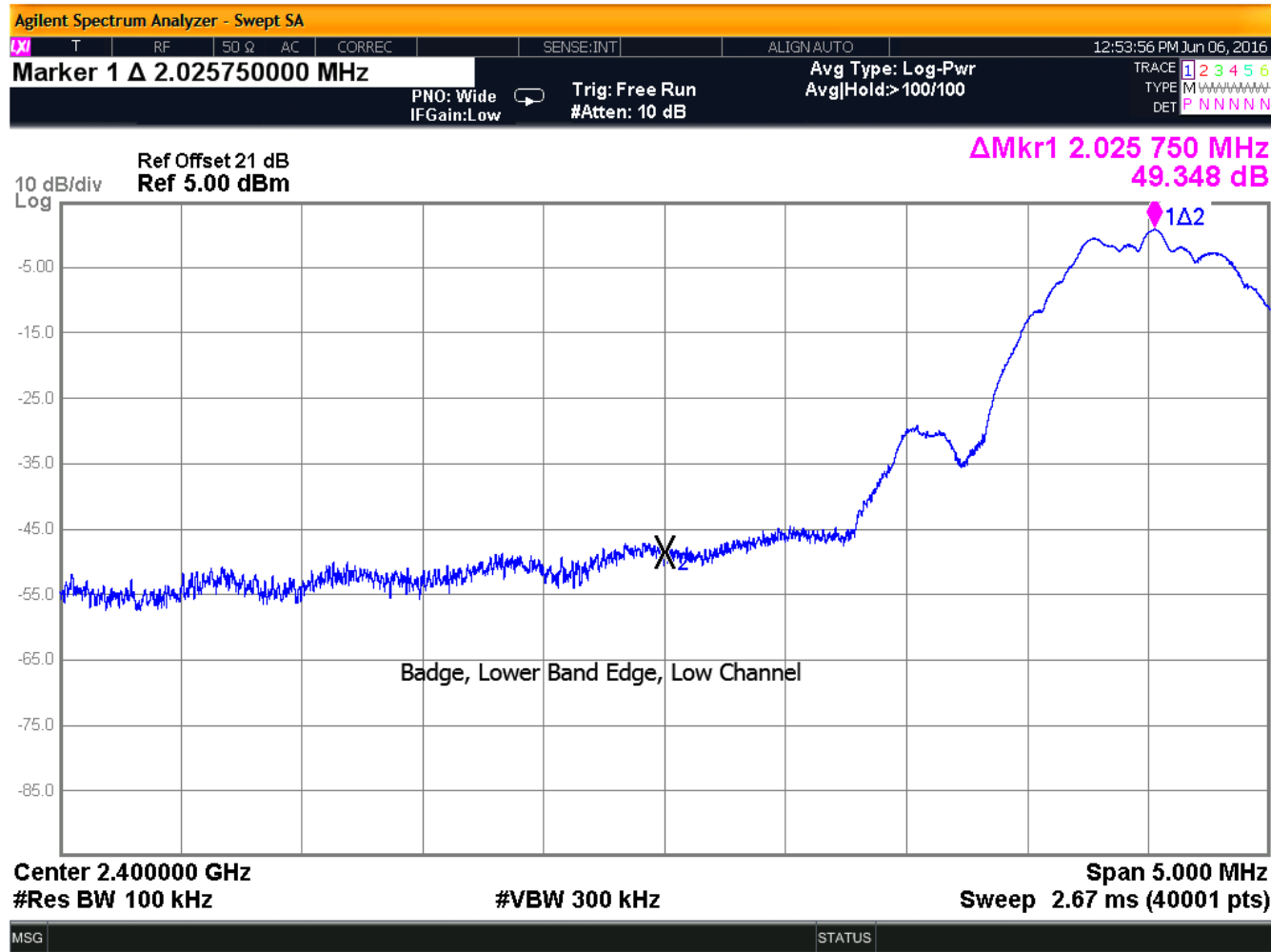


Figure 56: Lower Band Edge Low Channel

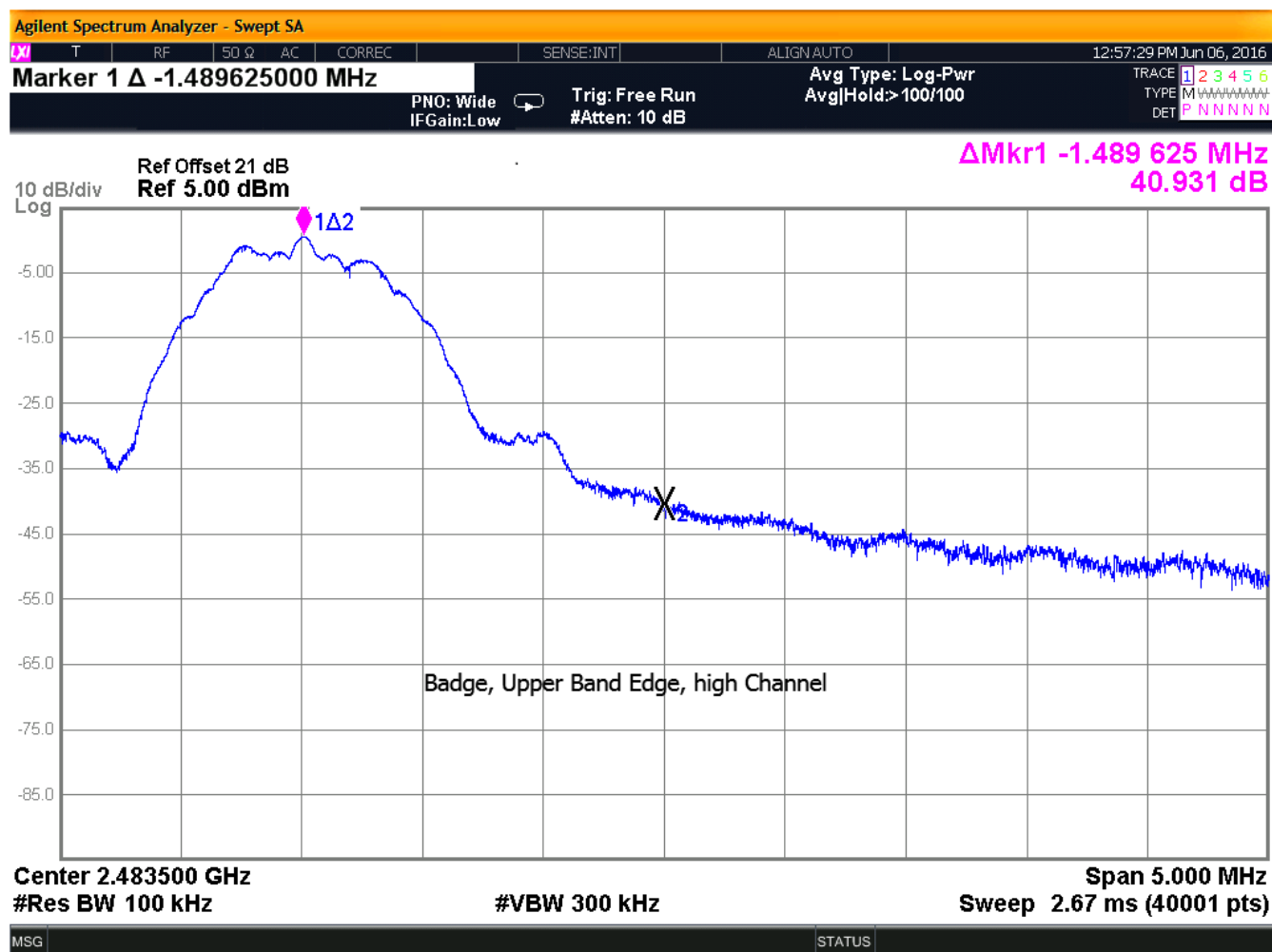


Figure 57: Upper Band Edge High Channel

5.5 Radiated Spurious Emissions:

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

5.5.1 Test Procedure

The EUT was placed on 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. Receiving 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. Both the horizontal and vertical field components were measured.

The EUT was tested in 3 orthogonal with the worst case readings reported.

Above 1GHz the EUT was placed on a 1.5meter table with RF absorber material between the EUT and Receive antenna.

The emissions were measured using the following resolution bandwidths:

Table 10: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	1MHz
>1000 MHz	1 MHz	3MHz

Average measurements above 1GHz were made with the Spectrum analyzer set to RMS Average. Correction factors were then applied and the resulting value was compared to the limit.

5.5.1.1 Duty Cycle Corrections

A duty cycle correction of 7dB was added to the RMS average readings to compensate for the on time of the EUT in accordance with C63.10 section 11.13.3.4.

Correction Calculation = $10 \cdot \log(1/(\text{duty cycle})) = 10 \cdot \log(1/0.2) = 6.98$

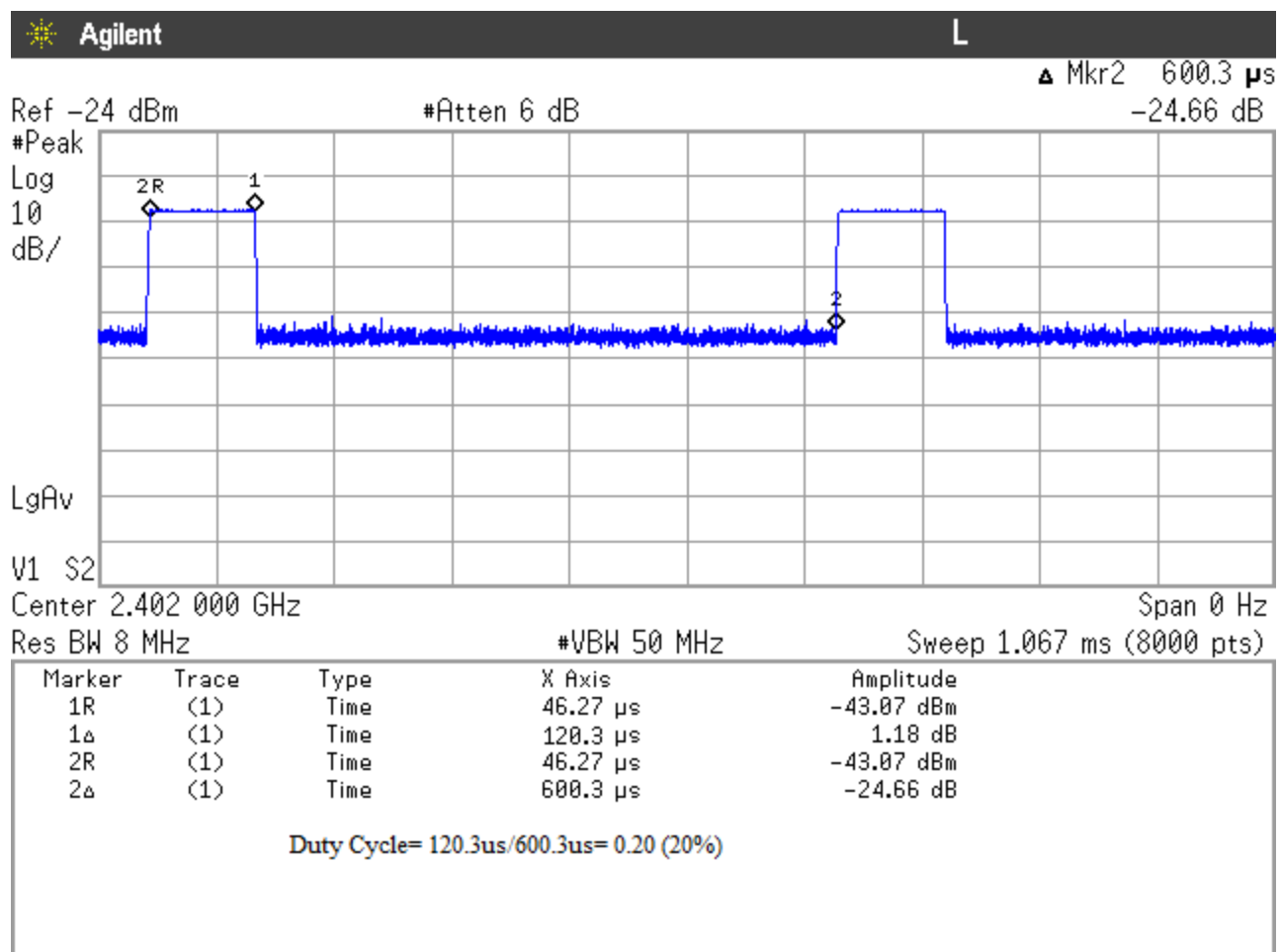


Figure 58: Duty Cycle Calculation

5.5.2 Test Summary

The EUT complied with the requirements for radiated spurious emissions.

Table 11: Radiated Emission Test Data (all Channels)
(Restricted Bands)

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)
75.00	V	190.00	1.20	32.00	-18.0	5.0	100.0	-26.0
128.00	V	90.00	1.00	28.33	-11.6	6.8	150.0	-26.8
75.00	H	270.00	4.00	29.50	-18.0	3.8	100.0	-28.5
128.00	H	90.00	3.50	29.20	-11.6	7.6	150.0	-26.0

Table 12: Radiated Emission Test Data, Low Channel

Low Channel @ 2402MHz

	Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Unit upright	2402.00	V	45.00	2.54	86.50	-1.8	0.0	17133.2	NA	NA	FUND Pk
	2390.00	V	45.00	2.60	43.85	-1.8	0.0	126.7	5000.0	-31.9	Restricted edge pk
	2390.00	V	45.00	2.60	34.71	-1.8	7.0	99.0	500.0	-14.1	Restricted edge av
	4804.00	V	10.00	2.40	42.68	5.1	0.0	244.7	5000.0	-26.2	pk
Flat	4804.00	V	10.00	2.40	33.98	5.1	7.0	201.2	500.0	-7.9	av
	2390.00	V	45.00	2.58	45.50	-1.8	0.0	153.2	5000.0	-30.3	Restricted edge pk
	2390.00	V	45.00	2.58	33.60	-1.8	7.0	87.1	500.0	-15.2	Restricted edge av
	4804.00	V	0.00	2.62	40.48	5.1	0.0	190.0	5000.0	-28.4	pk
On side	4804.00	V	0.00	2.62	32.10	5.1	7.0	162.1	500.0	-9.8	av
	2390.00	V	0.00	2.56	44.54	-1.8	0.0	137.2	5000.0	-31.2	Restricted edge pk
	2390.00	V	0.00	2.56	36.07	-1.8	7.0	115.8	500.0	-12.7	Restricted edge av
		V									
	4804.00	V	0.00	2.40	42.60	5.1	0.0	242.5	5000.0	-26.3	pk
Unit upright	4804.00	V	0.00	2.40	33.90	5.1	7.0	199.4	500.0	-8.0	av
	2402.00	H	180.00	2.60	87.28	-1.8	0.0	18743.0	NA	NA	FUND Pk
	2390.00	H	180.00	2.60	43.91	-1.8	0.0	127.6	5000.0	-31.9	Restricted edge pk
	2390.00	H	180.00	2.60	40.06	-1.8	7.0	183.3	500.0	-8.7	Restricted edge av
Flat											
	4804.00	H	180.00	2.37	39.80	5.1	0.0	175.7	5000.0	-29.1	pk
	4804.00	H	180.00	2.37	32.80	5.1	7.0	175.7	500.0	-9.1	av
	2390.00	H	10.00	2.40	42.98	-1.8	0.0	114.6	5000.0	-32.8	Restricted edge pk
	2390.00	H	10.00	2.40	39.05	-1.8	7.0	163.2	500.0	-9.7	Restricted edge av
	4804.00	H	0.00	2.29	42.10	5.1	0.0	228.9	5000.0	-26.8	pk

On side	4804.00	H	0.00	2.29	34.80	5.1	7.0	221.1	500.0	-7.1	av
	2390.00	H	10.00	2.44	42.98	-1.8	0.0	114.6	5000.0	-32.8	Restricted edge pk
	2390.00	H	10.00	2.44	33.13	-1.8	7.0	82.5	500.0	-15.6	Restricted edge av
	4804.00	H	10.00	2.50	42.10	5.1	0.0	228.9	5000.0	-26.8	pk
	4804.00	H	10.00	2.50	32.90	5.1	7.0	177.7	500.0	-9.0	av

Table 13: Radiated Emission Test Data, Center Channel

Center Channel @ 2440 MHz

	Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Unit upight	2440.00	V	10.00	2.52	94.50	-1.8	0.0	43245.4	NA	NA	FUND Pk
	4880.00	V	0.00	2.70	41.10	5.1	0.0	204.0	5000.0	-27.8	pk
	4880.00	V	0.00	2.70	31.90	5.1	7.0	158.3	500.0	-10.0	av
	7320.00	V	45.00	2.61	38.27	12.9	0.0	360.0	5000.0	-22.9	pk
Flat	7320.00	V	45.00	2.61	30.91	12.9	7.0	345.4	500.0	-3.2	av
	4880.00	V	90.00	2.10	41.21	5.1	0.0	206.6	5000.0	-27.7	pk
	4880.00	V	90.00	2.10	33.20	5.1	7.0	183.9	500.0	-8.7	av
	7320.00	V	180.00	2.20	39.38	12.9	0.0	409.1	5000.0	-21.7	pk
On side	7320.00	V	180.00	2.20	30.76	12.9	7.0	339.5	500.0	-3.4	av
	4880.00	V	45.00	1.80	42.20	5.1	0.0	231.5	5000.0	-26.7	pk
	4880.00	V	45.00	1.80	34.20	5.1	7.0	206.3	500.0	-7.7	av
	7320.00	H	90.00	2.50	36.70	12.9	0.0	300.5	5000.0	-24.4	pk
Unit upight	7320.00	H	90.00	2.50	30.57	12.9	7.0	332.1	500.0	-3.6	av
	2400.00	H	10.00	2.65	86.50	-1.8	0.0	17128.8	NA	NA	FUND Pk
	4880.00	H	0.00	2.77	43.63	5.1	0.0	273.0	5000.0	-25.3	pk
	4880.00	H	0.00	2.77	33.67	5.1	7.0	194.1	500.0	-8.2	av
Flat											
	7320.00	H	90.00	2.85	39.12	12.9	0.0	397.0	5000.0	-22.0	pk
	7320.00	H	90.00	2.85	30.79	12.9	7.0	340.7	500.0	-3.3	av
	4880.00	H	0.00	2.24	42.70	5.1	0.0	245.2	5000.0	-26.2	pk
	4880.00	H	0.00	2.24	33.74	5.1	7.0	195.7	500.0	-8.1	av
On side											
	7320.00	H	10.00	2.50	41.23	12.9	0.0	506.2	5000.0	-19.9	pk
	7320.00	H	10.00	2.50	31.98	12.9	7.0	390.7	500.0	-2.1	av
	4880.00	H	180.00	2.86	41.57	5.1	0.0	215.3	5000.0	-27.3	pk
	4880.00	H	180.00	2.86	33.39	5.1	7.0	188.0	500.0	-8.5	av
	7320.00	H	2.74	180.00	39.84	12.9	0.0	431.4	5000.0	-21.3	pk
	7320.00	H	2.74	180.00	30.34	12.9	7.0	323.5	500.0	-3.8	av

Table 14: Radiated Emission Test Data, High Channel

High Channel @ 2480MHz

	Frequency (MHz)	Polarity H/V	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Duty Cycle Corr. (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
Unit uplight	2482.00	V	90.00	2.75	87.10	-1.7	0.0	18544.9	NA	NA	FUND Pk
Flat	2483.50	V	0.00	2.70	42.16	-1.7	0.0	105.0	5000.0	-33.6	Marker Delta Method-Pk
	2483.50	V	0.00	2.70	41.80	-1.7	7.0	225.6	500.0	-6.9	Marker Delta Method-Ave
	4964.00	V	45.00	2.50	44.33	5.2	0.0	301.3	5000.0	-24.4	Pk
	4964.00	V	45.00	2.50	34.40	5.2	7.0	215.0	500.0	-7.3	Av
	7446.00	V	90.00	2.60	41.03	12.6	0.0	479.3	5000.0	-20.4	Pk
	7446.00	V	90.00	2.60	33.31	12.6	7.0	441.2	500.0	-1.1	Av
	2483.50	V	0.00	2.65	46.20	-1.7	0.0	167.2	5000.0	-29.5	Marker Delta Method-Pk
On side	2483.50	V	0.00	2.65	43.50	-1.7	7.0	274.4	500.0	-5.2	Marker Delta Method-Ave
	4964.00	V	0.00	2.70	43.10	5.2	0.0	261.5	5000.0	-25.6	Pk
	4964.00	V	0.00	2.70	33.20	5.2	7.0	187.3	500.0	-8.5	Av
	7446.00	V	45.00	2.70	40.80	12.6	0.0	466.8	5000.0	-20.6	Pk
	7446.00	V	45.00	2.70	33.00	12.6	7.0	425.7	500.0	-1.4	Av
	2483.50	V	0.00	2.70	42.16	-1.7	0.0	105.0	5000.0	-33.6	Marker Delta Method-Pk
	2483.50	V	0.00	2.70	41.80	-1.7	0.0	100.8	500.0	-13.9	Marker Delta Method-Ave
Unit uplight											
	4964.00	V	45.00	2.50	44.33	5.2	7.0	674.5	5000.0	-17.4	
	4964.00	V	45.00	2.50	34.40	5.2	0.0	96.0	500.0	-14.3	
	7446.00	V	90.00	2.60	41.03	12.6	7.0	1073.0	5000.0	-13.4	
	7446.00	V	90.00	2.60	33.31	12.6	0.0	197.1	500.0	-8.1	
	2482.00	H	180.00	3.10	88.50	-1.7	7.0	48778.0	NA	NA	FUND Pk
	2483.50	H	180.00	3.16	47.11	-1.7	0.0	185.7	5000.0	-28.6	Marker Delta Method-Pk
Unit uplight	2483.50	H	180.00	3.16	45.24	-1.7	7.0	335.2	500.0	-3.5	Marker Delta Method-Ave

Flat	4964.00	H	10.00	3.09	38.50	5.2	0.0	154.0	5000.0	-30.2	Pk
	4964.00	H	10.00	3.09	34.22	5.2	7.0	210.6	500.0	-7.5	Av
	7446.00	H	90.00	2.90	32.60	12.6	0.0	181.6	5000.0	-28.8	Pk
	7446.00	H	90.00	2.90	28.39	12.6	7.0	250.4	500.0	-6.0	Av
	2483.50	H	45.00	3.30	45.80	-1.7	0.0	159.7	5000.0	-29.9	Marker Delta Method-Pk
	2483.50	H	45.00	3.30	42.80	-1.7	7.0	253.1	500.0	-5.9	Marker Delta Method-Ave
	4964.00	H	0.00	2.90	37.50	5.2	0.0	137.2	5000.0	-31.2	Pk
On side	4964.00	H	0.00	2.90	33.20	5.2	7.0	187.3	500.0	-8.5	Av
	7446.00	H	180.0 0	2.95	33.10	12.6	0.0	192.3	5000.0	-28.3	Pk
	7446.00	H	180.0 0	2.95	29.50	12.6	7.0	284.5	500.0	-4.9	Av
	2483.50	H	180.0 0	3.00	44.20	-1.7	0.0	132.8	5000.0	-31.5	Marker Delta Method-Pk
	2483.50	H	180.0 0	3.00	40.90	-1.7	7.0	203.4	500.0	-7.8	Marker Delta Method-Ave
	4964.00	H	10.00	3.10	35.20	5.2	0.0	105.3	5000.0	-33.5	Pk
	4964.00	H	10.00	3.10	32.80	5.2	7.0	178.8	500.0	-8.9	Av
	7446.00	H	180.0 0	3.10	33.80	12.6	0.0	208.5	5000.0	-27.6	Pk
	7446.00	H	180.0 0	3.10	30.10	12.6	7.0	304.9	500.0	-4.3	Av