FCC & ISED Certification Test Report
For the
Owlet Baby Care Inc.
Base Station

FCC ID: 2AIEP-OBS1B
ISED: 21386-OBS1B

WLL JOB# 14578-01 Rev 1
August 31, 2016
Revised October 2, 2016

Prepared for:

OWLET BABY CARE INC.
32 W. CENTER STREET.
SUITE 201
PROVO, UT 84601

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

Testing Certificate AT-1448

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Prepared by:

James Ritter
EMC Compliance Engineer

Reviewed by:

John P. Repella
Manager, EMC & Wireless Services

Abstract

This report has been prepared on behalf of Owlet Baby Care 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 Owlet Baby Care Inc. Base Station.

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 Testing Certificate AT-1448 as an independent FCC test laboratory.

The Owlet Baby Care Inc. Base Station 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	August 31, 2016
Rev 1	Corrected low channel power level in table 8.	October 2, 2016

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1 Introduction

1.1 Compliance Statement

The Owlet Baby Care Inc. Base Station complies with the limits for a Digital Transmission System (DTS) Transmitter device under FCC Part 15.247 (10/2014) and ISED RSS-247 issue 1 May 2015.

The Base Station also contains a 2.4GHz 802.11b/g/n device that is certified under a separate report.

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
On Behalf of:	
	Owlet Baby Care Inc. 32 W. Center Street Suite 201 Provo, UT 84601
Quotation Number:	69359A

1.4 Test Dates

Testing was performed on the following date(s):	8/3/2016 to 8/29/2016

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Customer Representative	Stephen Berger

Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**ere**s**
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **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 base station receives sensor readings from the wearable sensor through the BT LE module and communicates them through its WiFi connection to the internet.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Owlet Baby Care Inc.
FCC ID:	2AIEP-OBS1B
ISED:	21386-OBS1B
Model Number:	OBS 1.1
Model Name:	Base Station
FCC Rule Parts:	§15.247
ISED:	RSS-247
Frequency Range:	2402-2480MHz
Maximum Output Power:	16.07mW (12.06dBm) conducted
Modulation:	GFSK
Occupied Bandwidth:	769.9kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	40
Power Output Level	Fixed
Antenna	integral
Antenna Type	-2.13dBi trace antenna
Interface Cables:	None
Power Source & Voltage:	5V (USB) from 120VAC adaptor
Emission Designator	770KFXD
Highest TX Spurious	298.9/m @3m (4980MHz)
Highest RX Spurious	34.4uV/m @3m (39.4MHz)

2.2 Test Configuration

4 devices were submitted for testing, 1 unit 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, & 2480MHz). All units were tested in a stand-alone configuration. All tests were performed in accordance with ANSI C63.10.The conducted unit was programmed at WLL for each frequency.

2.3 Testing Algorithm

The Base Station was programmed for DTS operation .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 ACLASS under 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 License-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

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

Where u_c = standard uncertainty

a, b, c,.. = individual uncertainty elements

$Div_{a,\ b,\ c}$ = the individual uncertainty element divisor based on the probability distribution

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

$k \leq 2$ 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 <u>not</u> 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: **Conducted Antenna Port**		Test Date: **8/26/2016**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	9/30/2016

Test Name: **Radiated Emissions**		Test Date: **8/25/2016**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	9/30/2016
559	HP - 8447D	AMPLIFIER	9/30/2016
644	SUNOL SCIENCES CORPORATION - JB1 925-833-9936	BICONALOG ANTENNA	8/14/2017
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	9/30/2016
4	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	10/8/2016
281	ITC - 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	10/22/2016
282	ITC - 21X-3A1	WAVEGUIDE 6.8-15GHZ	10/22/2016
453	AH SYSTEMS - PAM1840	PRE-AMPLIFIER 18GHZ-40 GHZ	9/30/2016
209	NARDA - V637	HORN STANDARD GAIN	CNR
210	NARDA - V638	HORN STANDARD GAIN	CNR
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	9/30/2016

Test Name: **Conducted Emissions Voltage**		Test Date: **08/26/2016**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
823	AGILENT - N9010A	EXA SPECTRUM ANALYZER	10/5/2016
124	SOLAR - 8012-50-R-24-BNC	LISN	10/15/2016
53	HP - 11947A	LIMITER TRANSIENT	3/1/2017

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	Pas
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	Pass

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	679.8kHz	$\geq$500kHz	Pass
Center Channel: 2440MHz	769.9kHz	$\geq$500kHz	Pass
High Channel: 2480MHz	681.3kHz	$\geq$500kHz	Pass

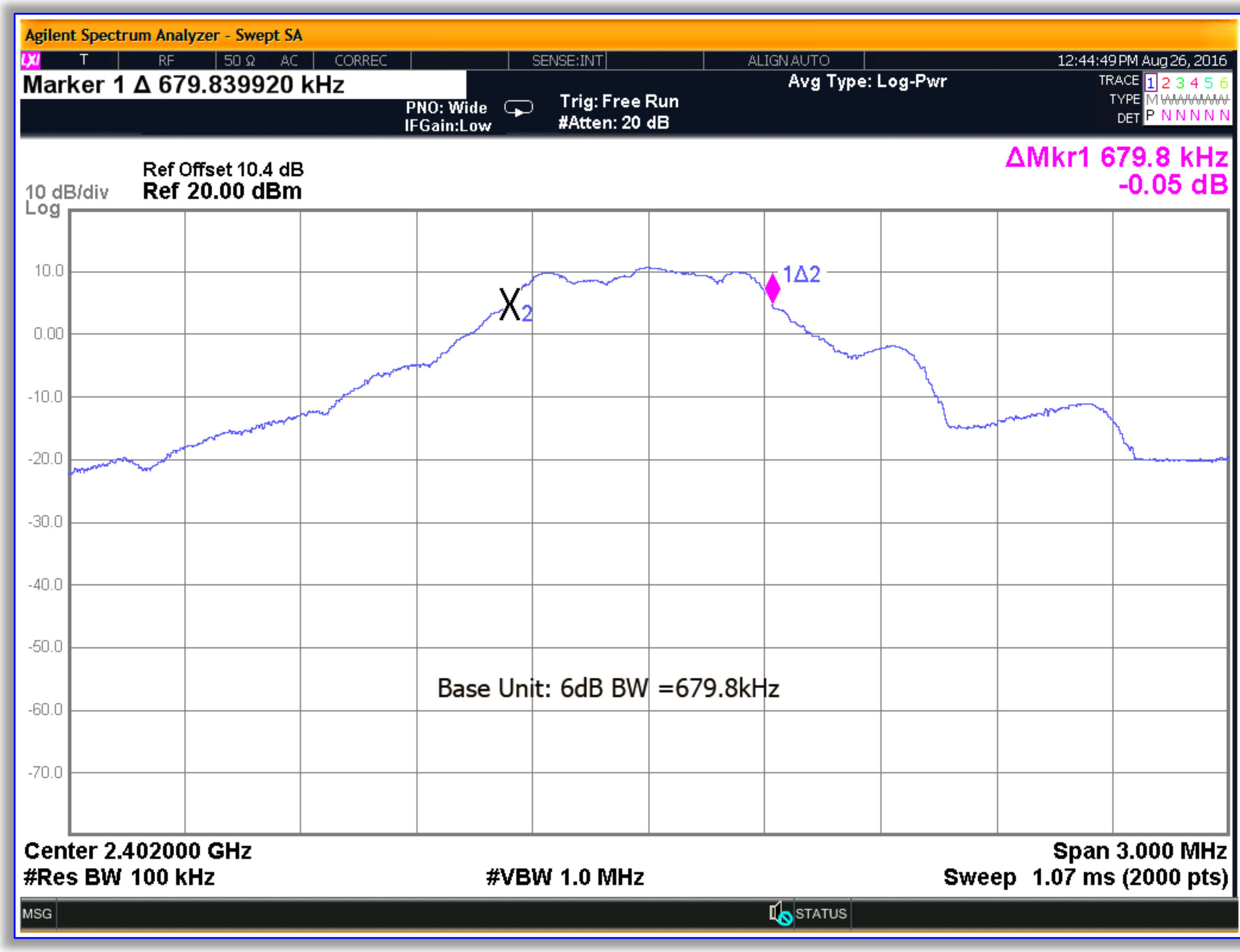

Figure 1: Occupied Bandwidth, Low Channel

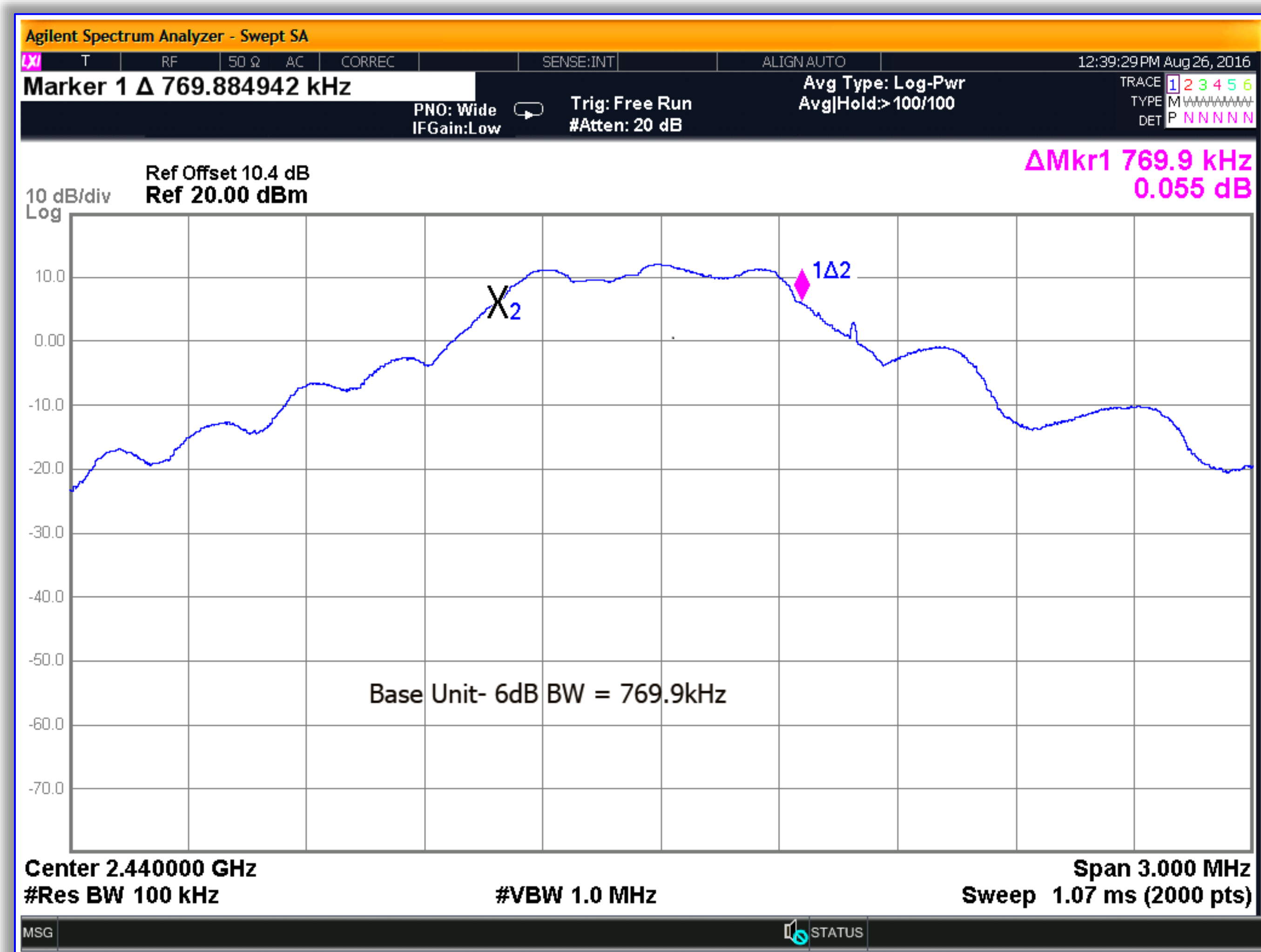

Figure 2: Occupied Bandwidth, Center Channel

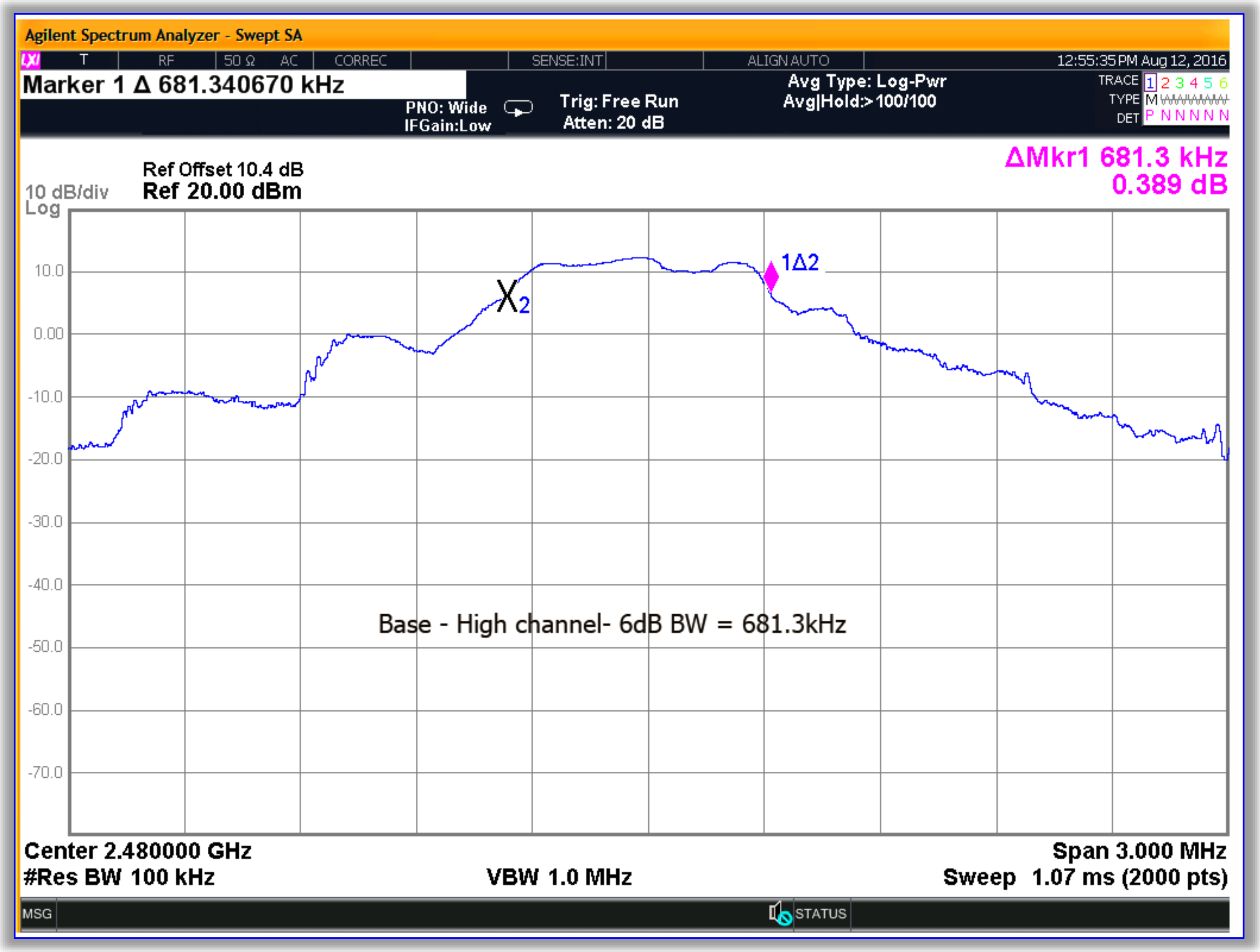

Figure 3: Occupied Bandwidth, High Channel

5.2 RF Power Output:

To measure the output power the unit was set to dwell on the low, high and middle channel. Testing was performed using the method from C63.10 section 11.9.1.1 “RBW ≥ DTS bandwidth” at the antenna port as follows:

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..

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	10.67dBm	30dBm	Pass
Center Channel: 2440MHz	12.05dBm	30dBm	Pass
High Channel: 2480MHz	12.06dBm	30dBm	Pass

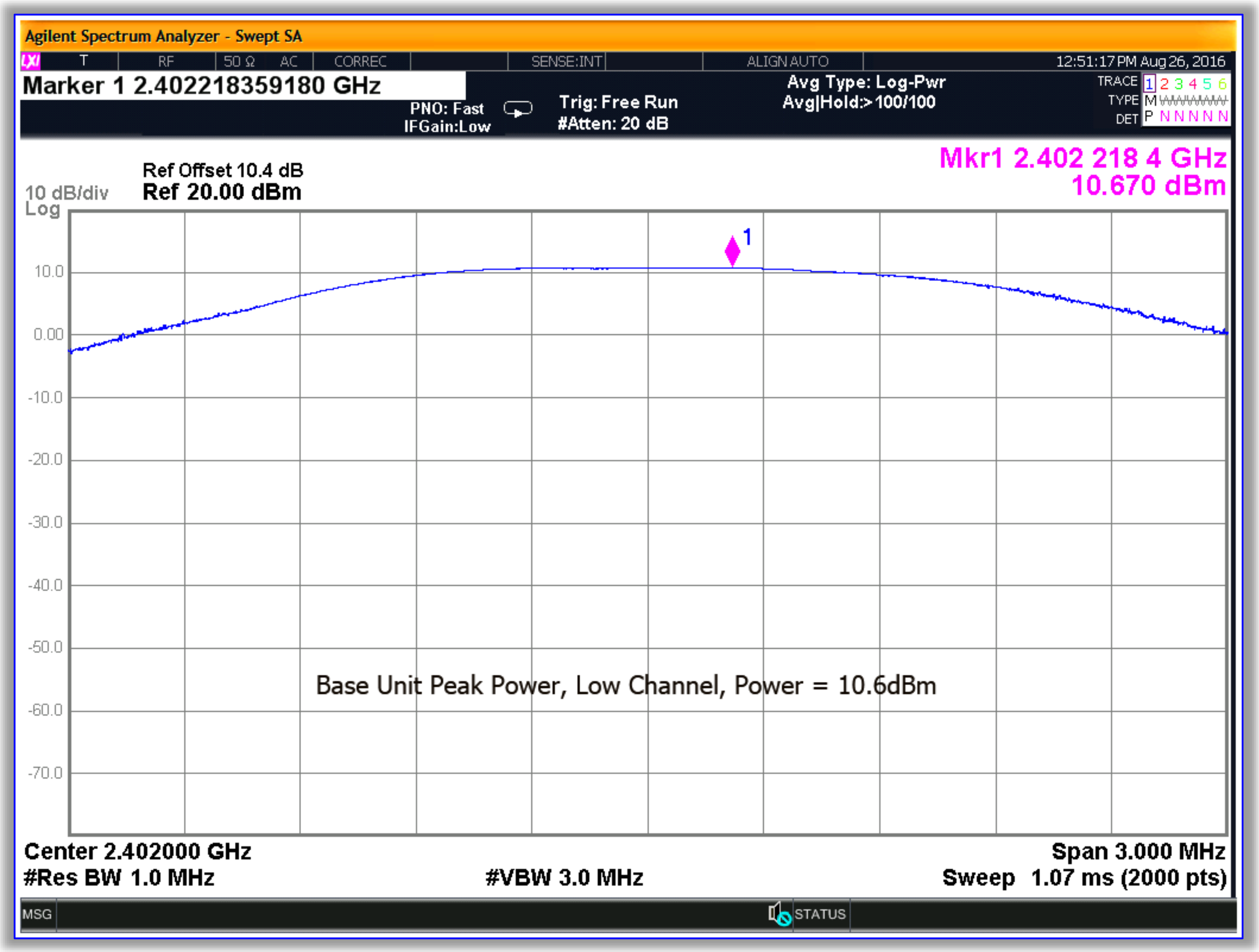

Figure 4: RF Peak Power, Low Channel

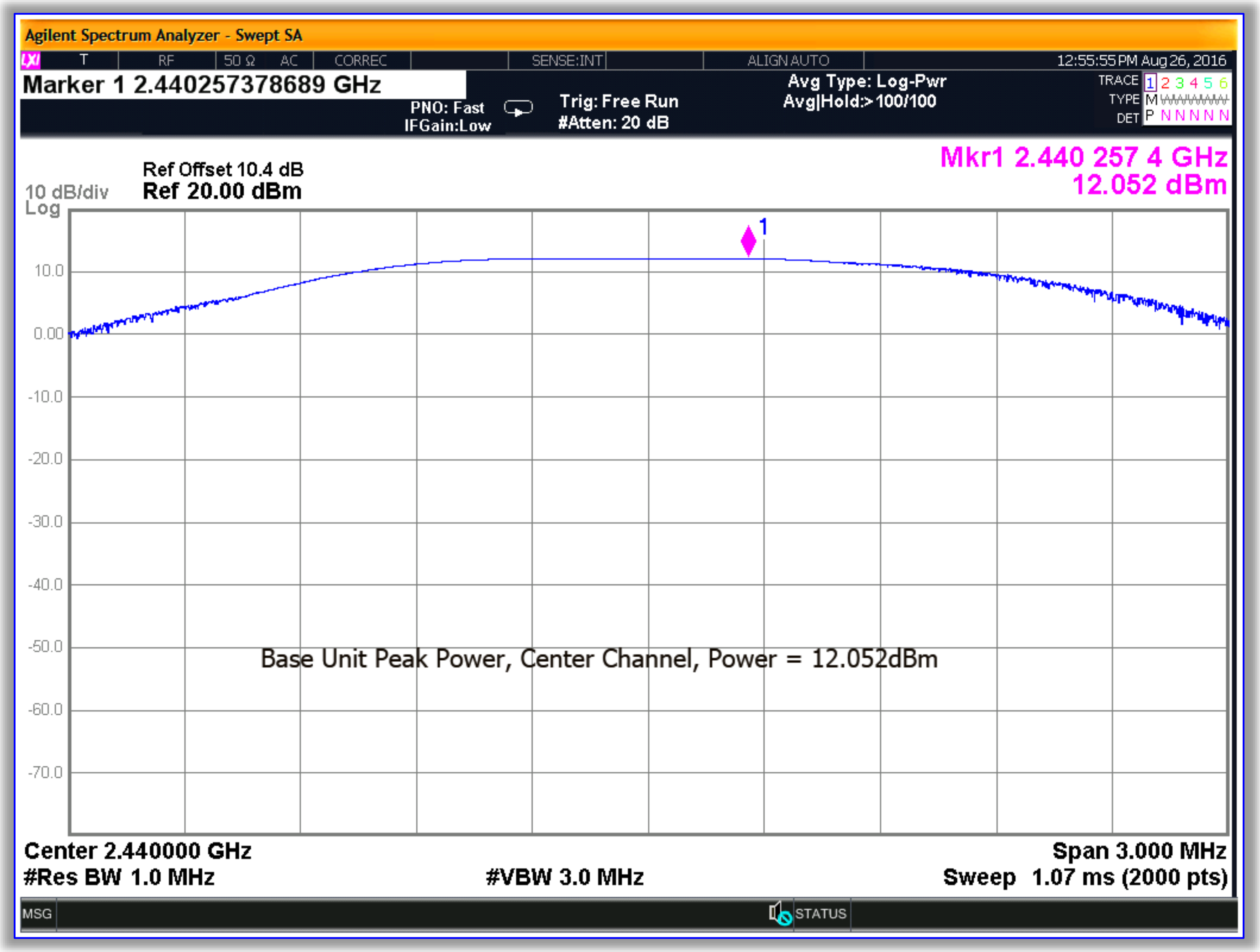

Figure 5: RF Peak Power, Center Channel

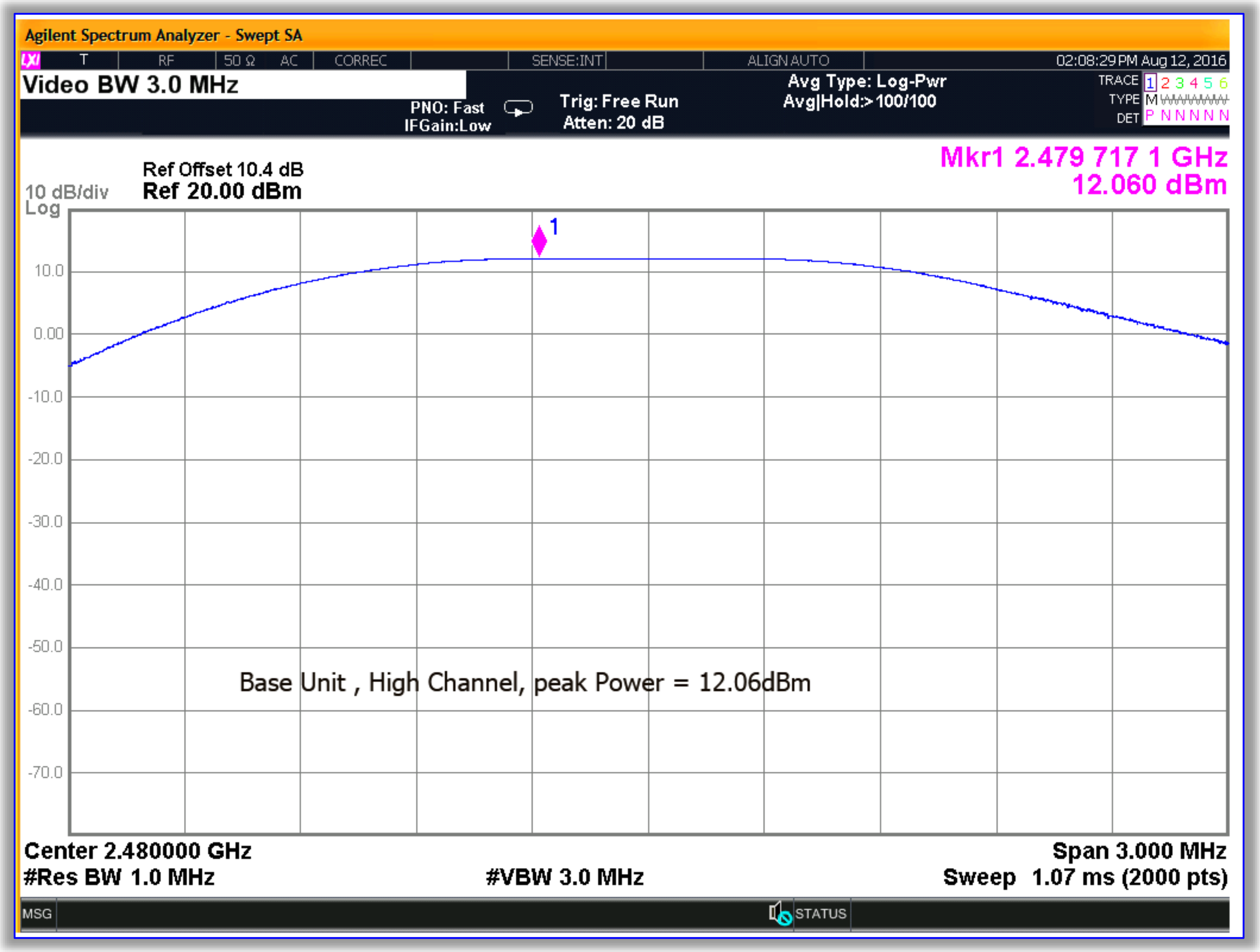

Figure 6: RF Peak Power, High Channel

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 3kHz ,VBW of 3MHz 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	-3.38dBm	8dBm	Pass
Center Channel: 2440MHz	-2.01dBm	8dBm	Pass
High Channel: 2480MHz	0.32dBm	8dBm	Pass

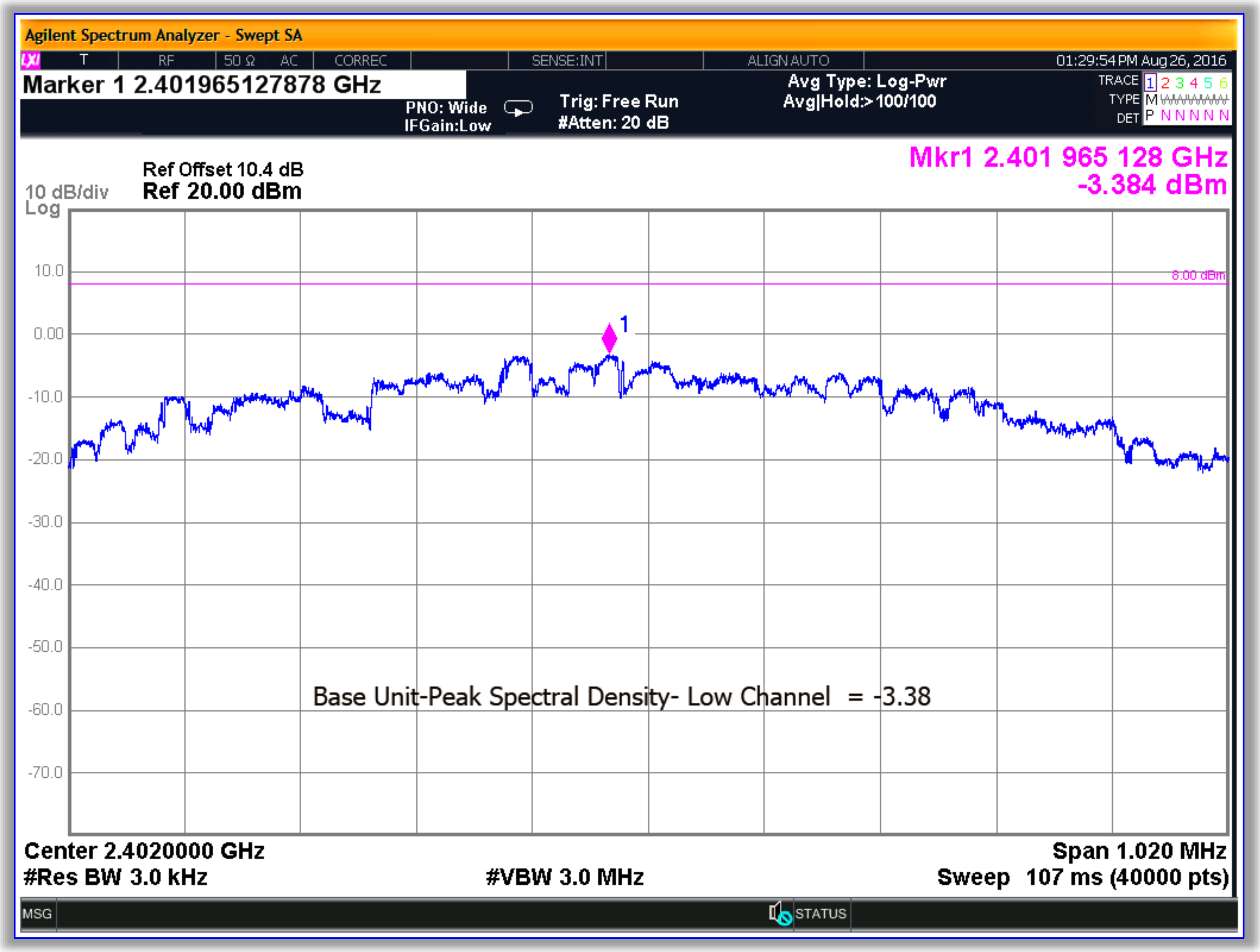

Figure 7: Power Spectral Density, Low Channel

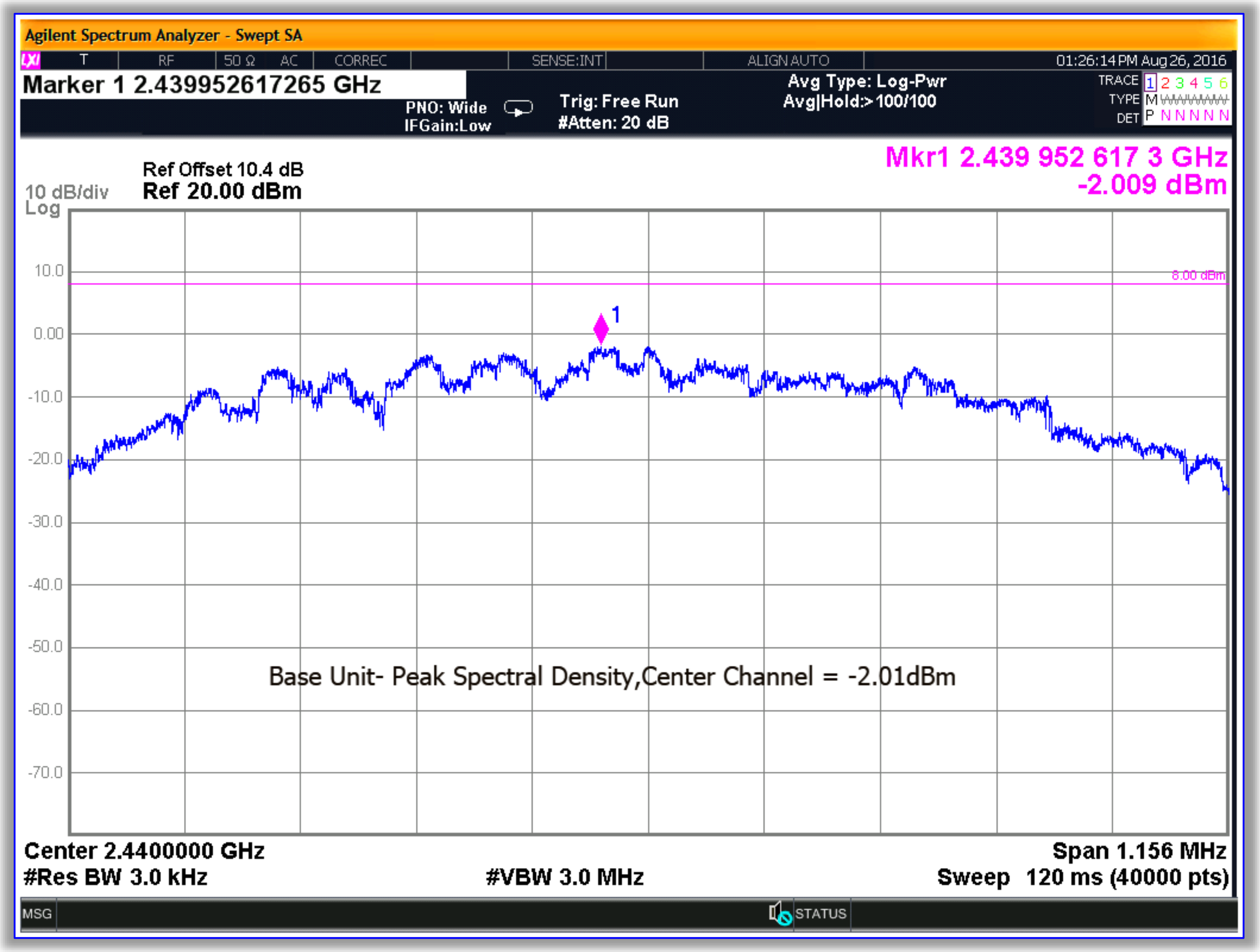

Figure 8: Power Spectral Density, Center Channel

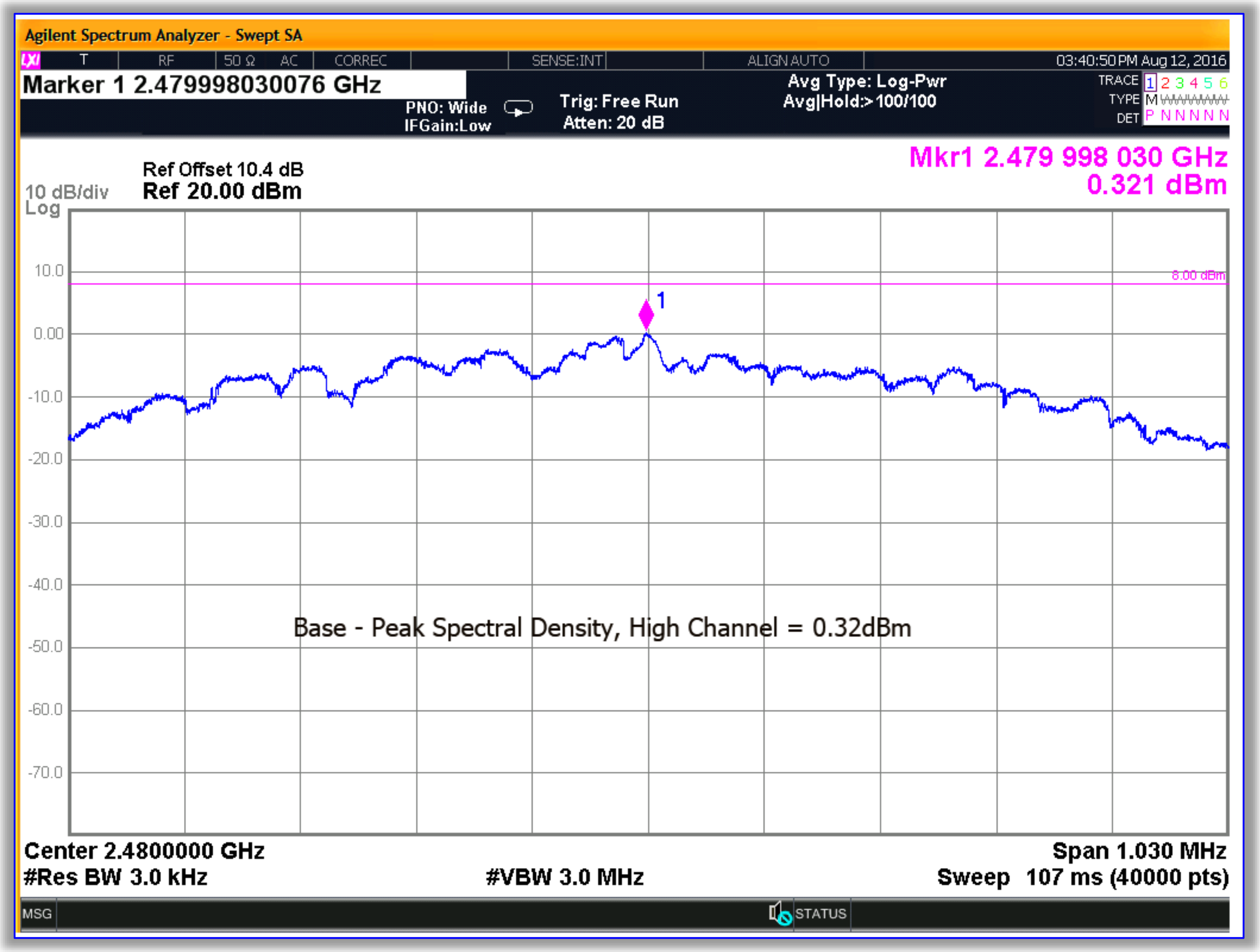

Figure 9: Power Spectral Density, High Channel

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. A peak detector was used for measurements.

As per ANSI C63.10 section 11.11.2 the high 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.

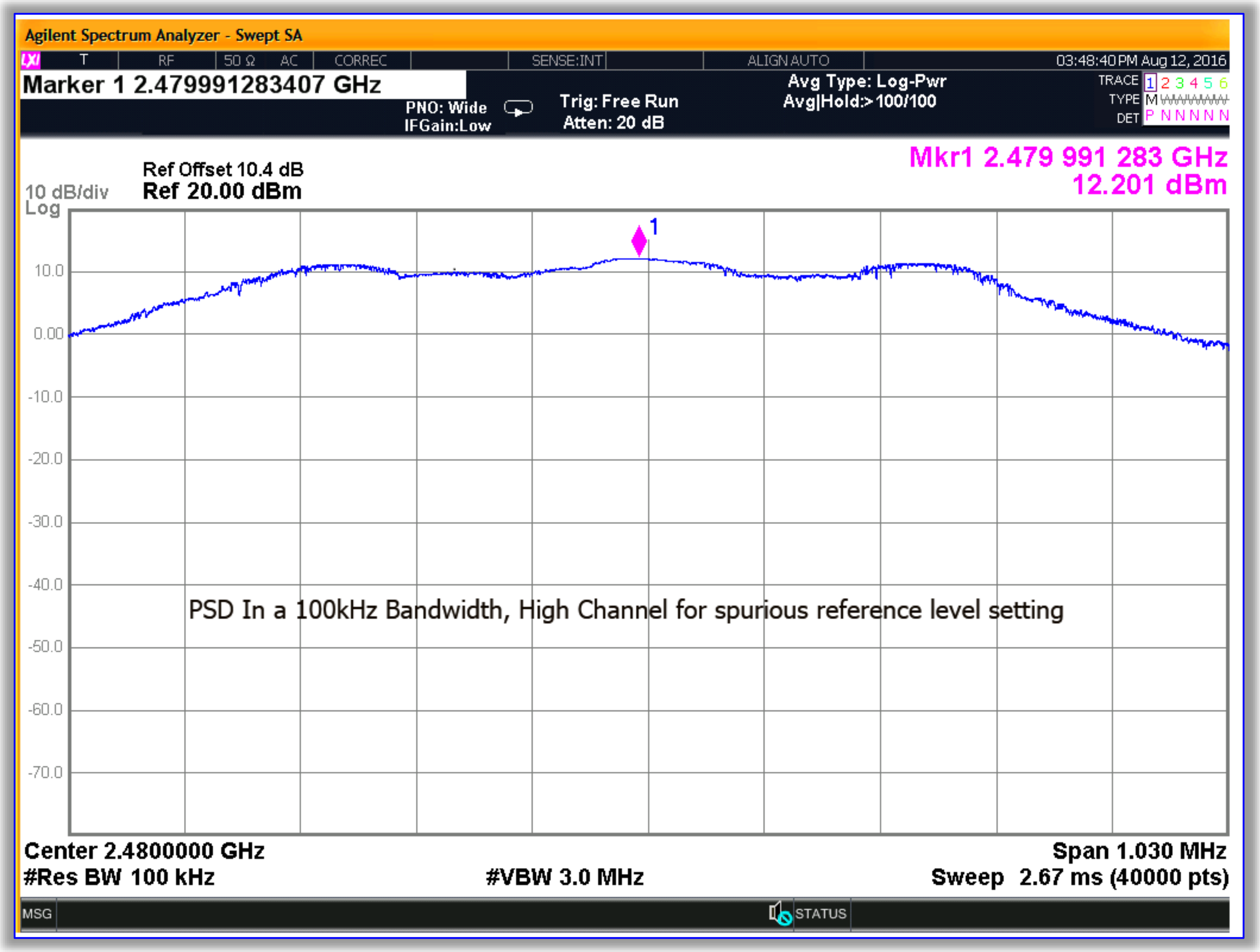

Figure 10: Highest PSD in a 100 kHz Channel (High channel)

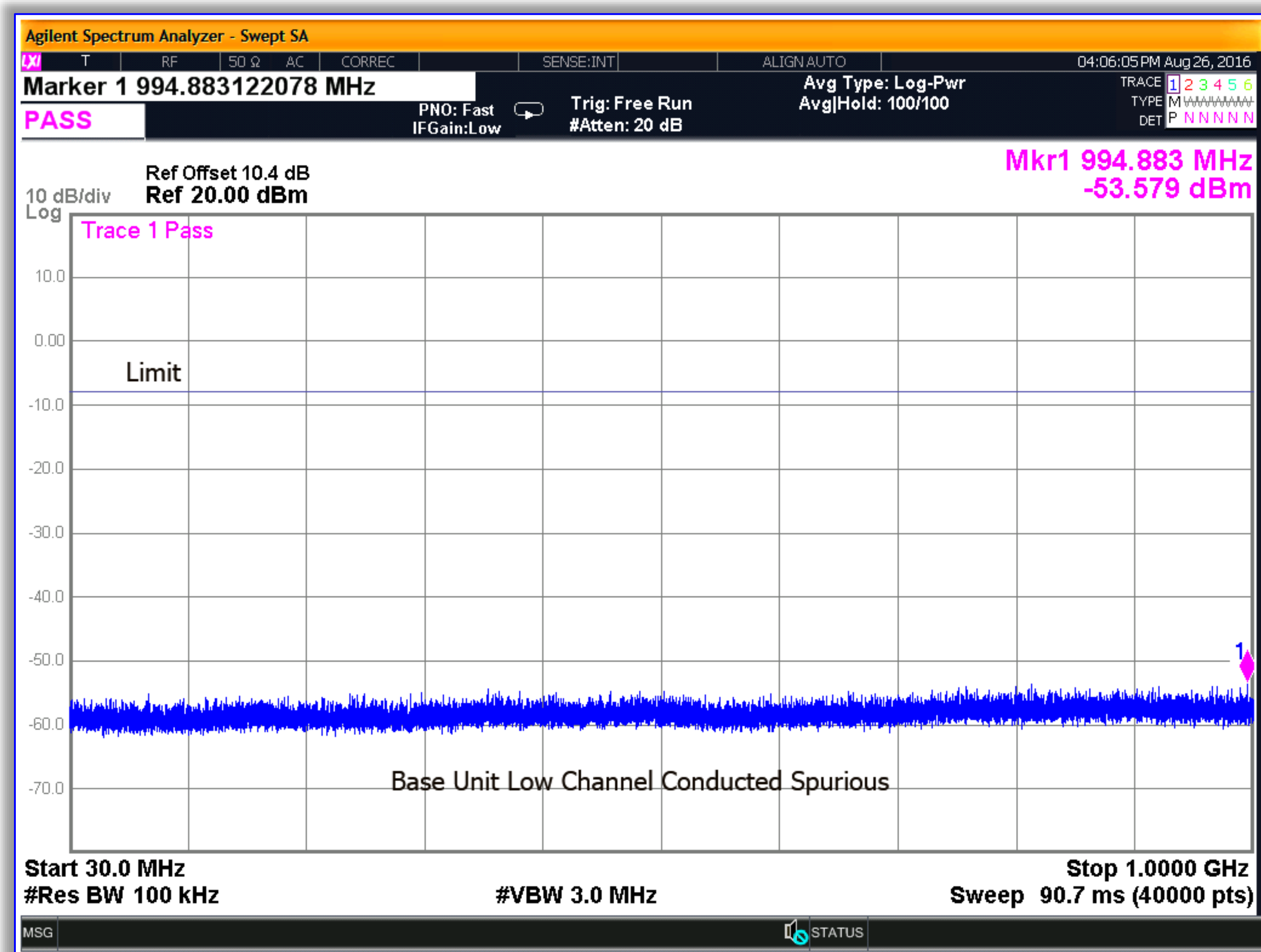

Figure 11: Low Channel Conducted Spurious Plot 1

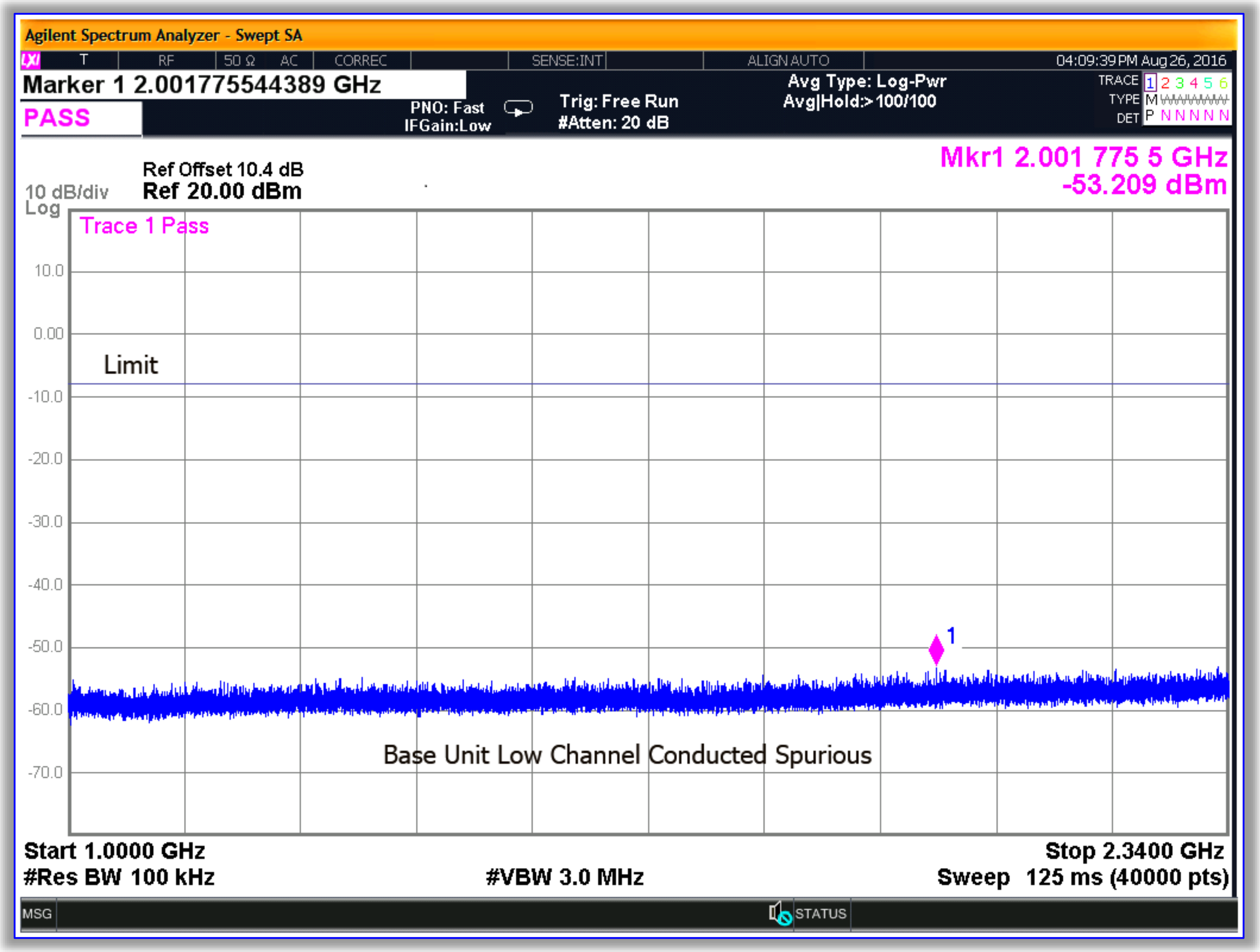

Figure 12: Low Channel Conducted Spurious Plot 2

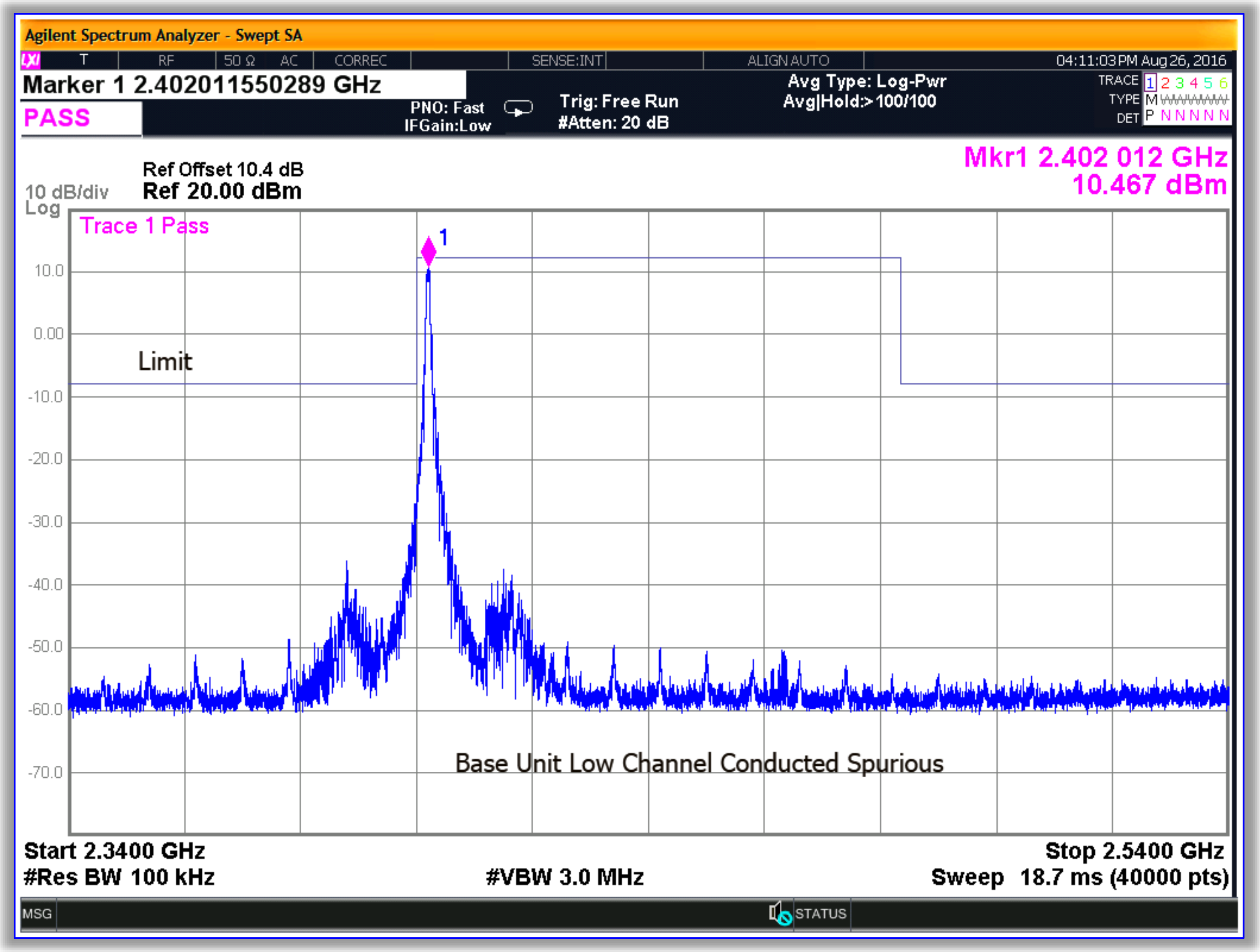

Figure 13: Low Channel Conducted Spurious Plot 3

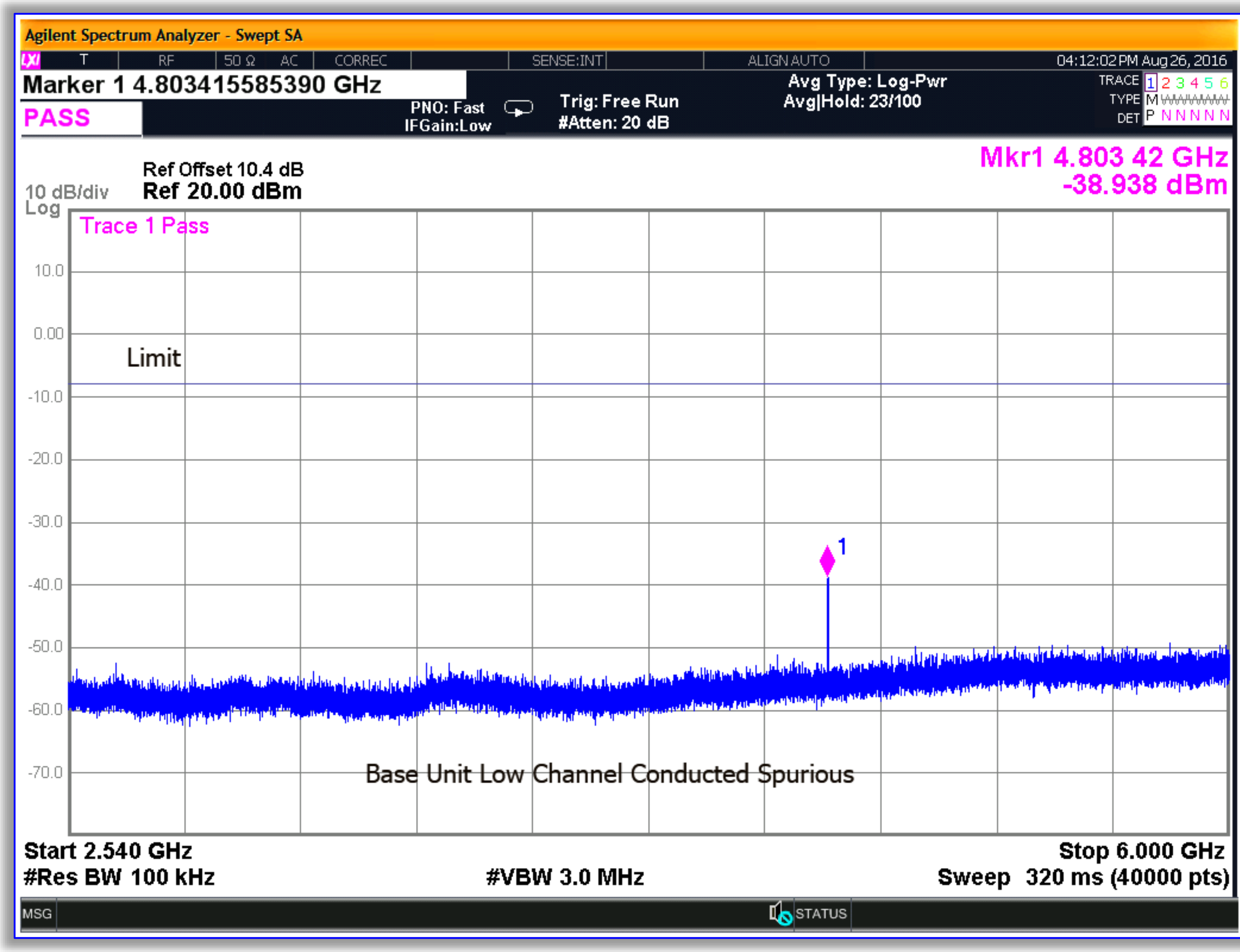

Figure 14: Low Channel Conducted Spurious Plot 4

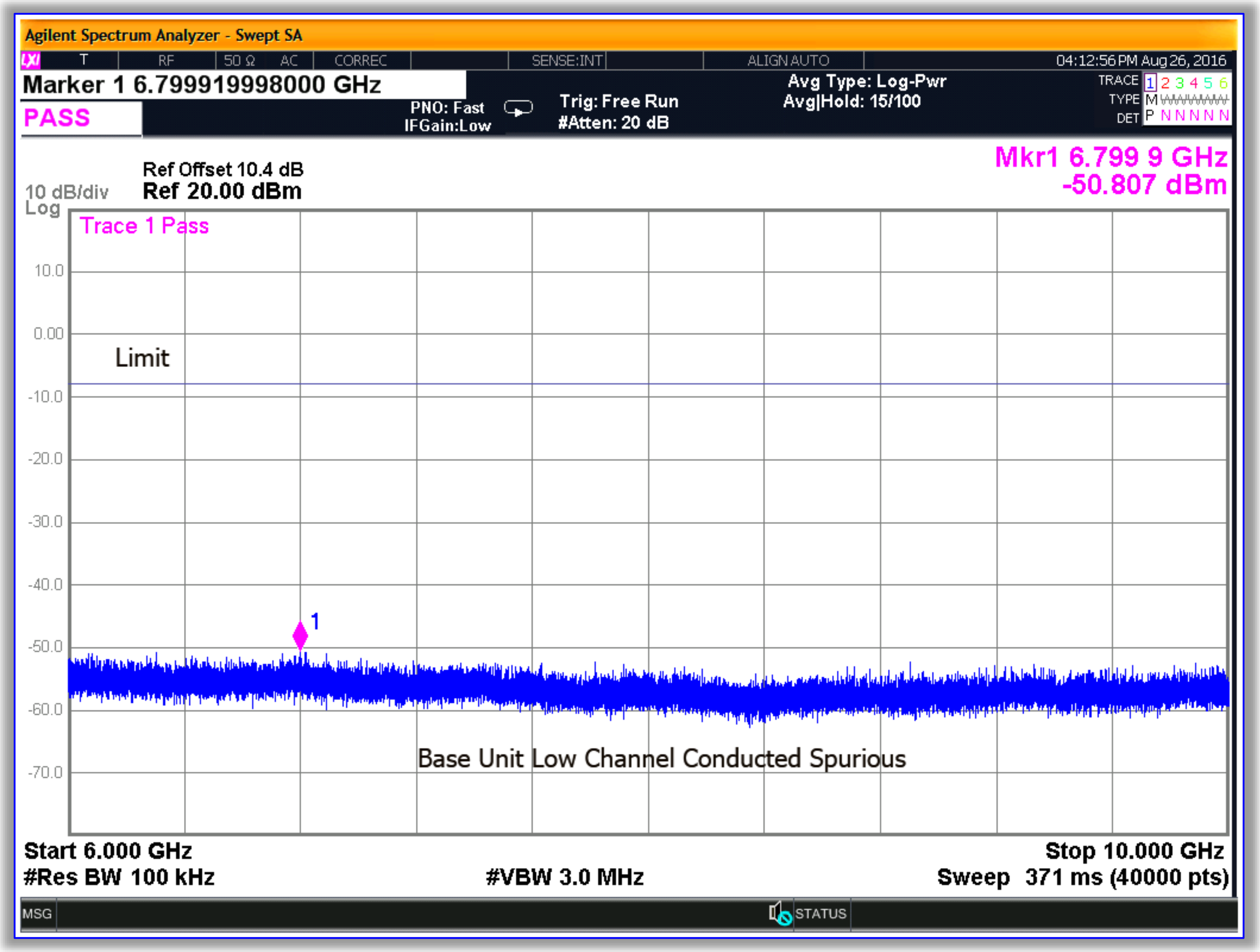

Figure 15: Low Channel Conducted Spurious Plot 5

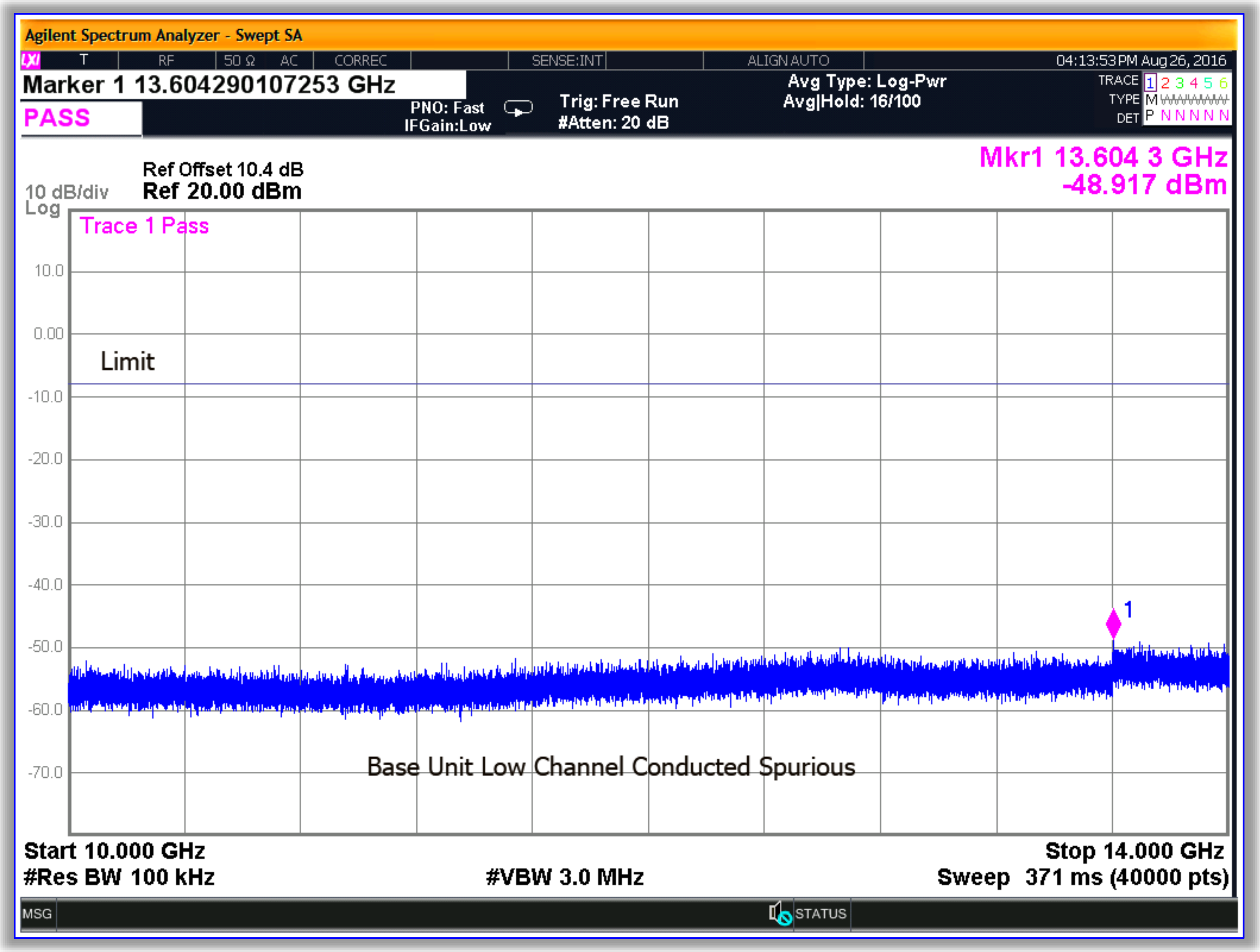

Figure 16: Low Channel Conducted Spurious Plot 6

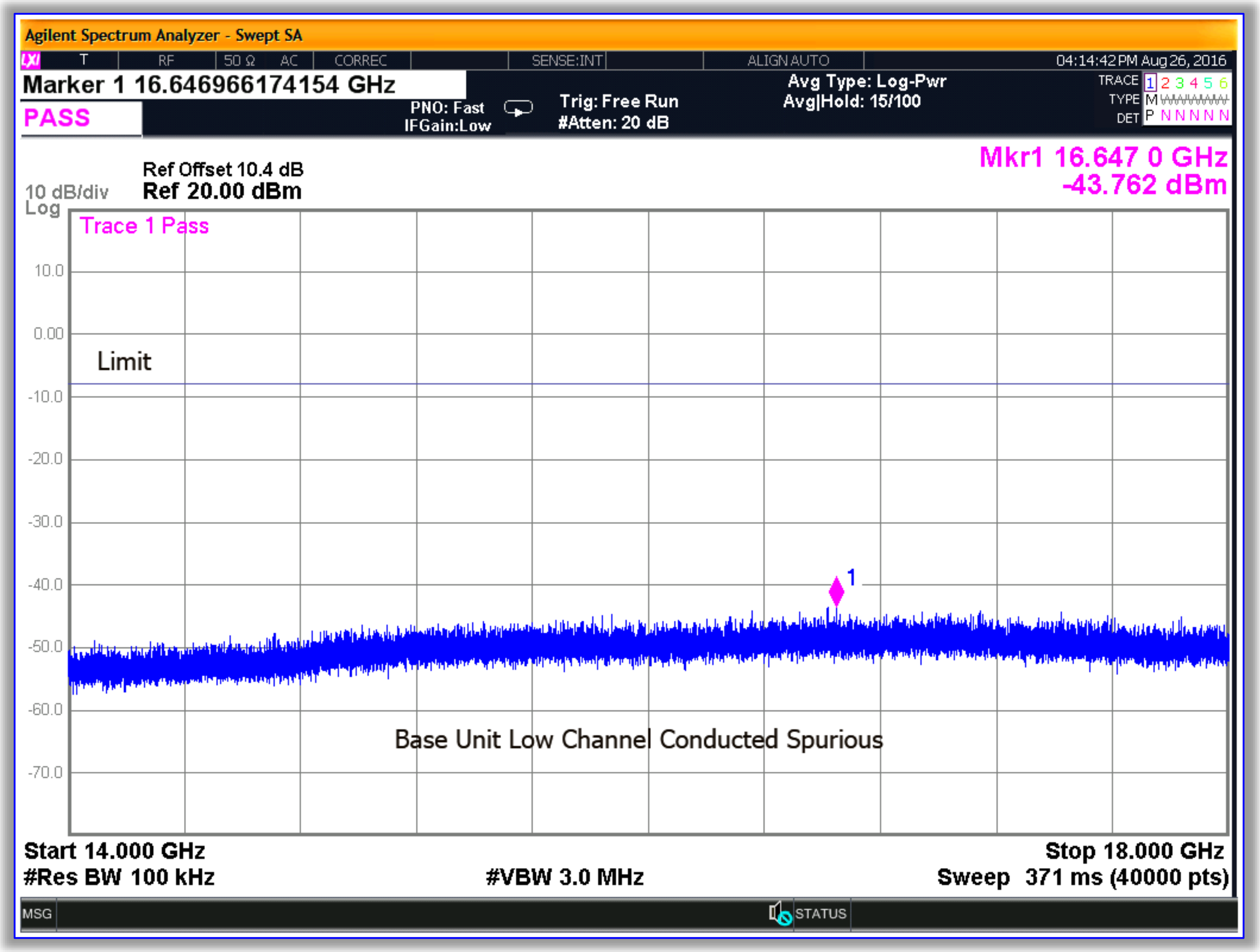

Figure 17: Low Channel Conducted Spurious Plot 7

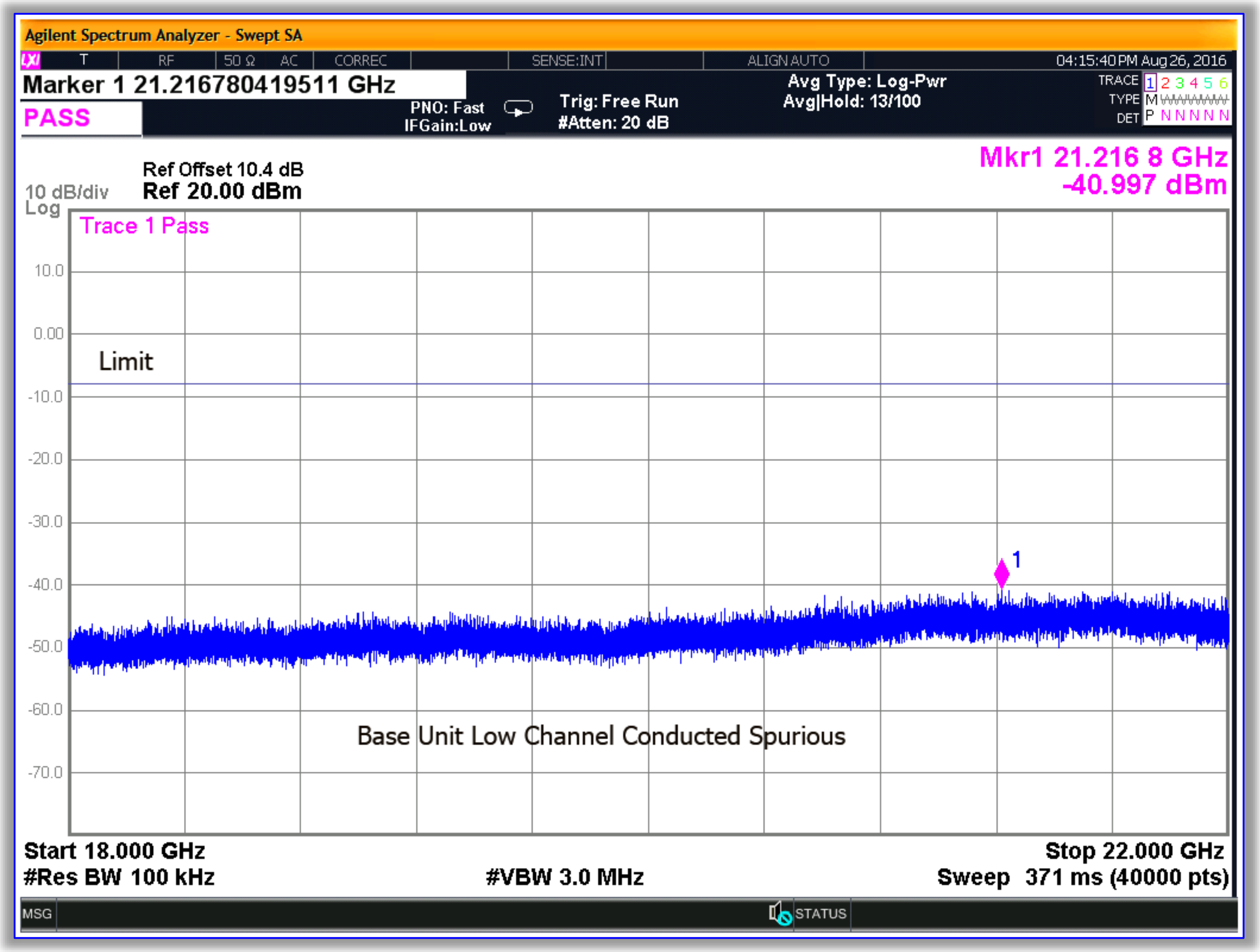

Figure 18: Low Channel Conducted Spurious Plot 8

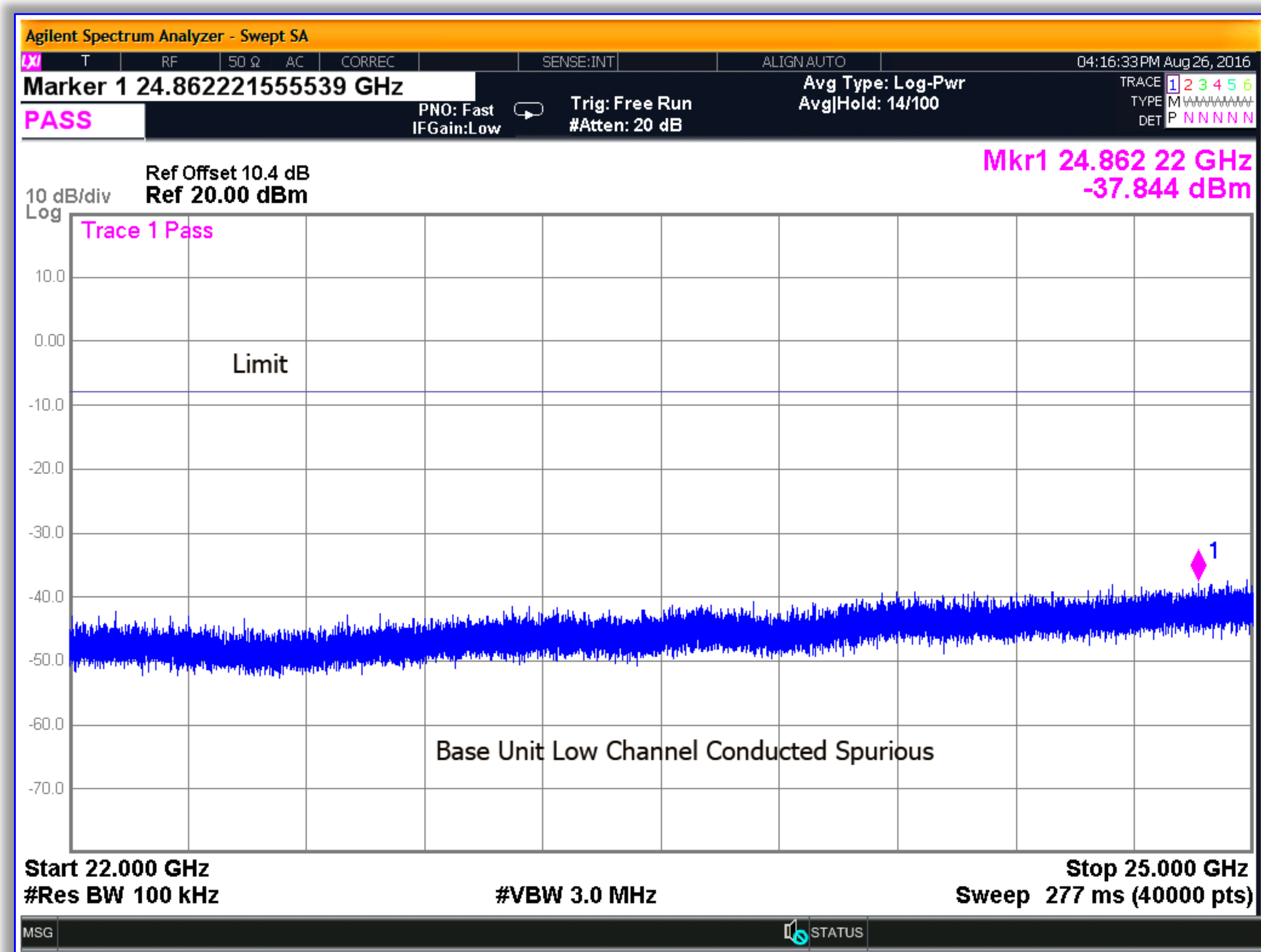

Figure 19: Low Channel Conducted Spurious Plot 9

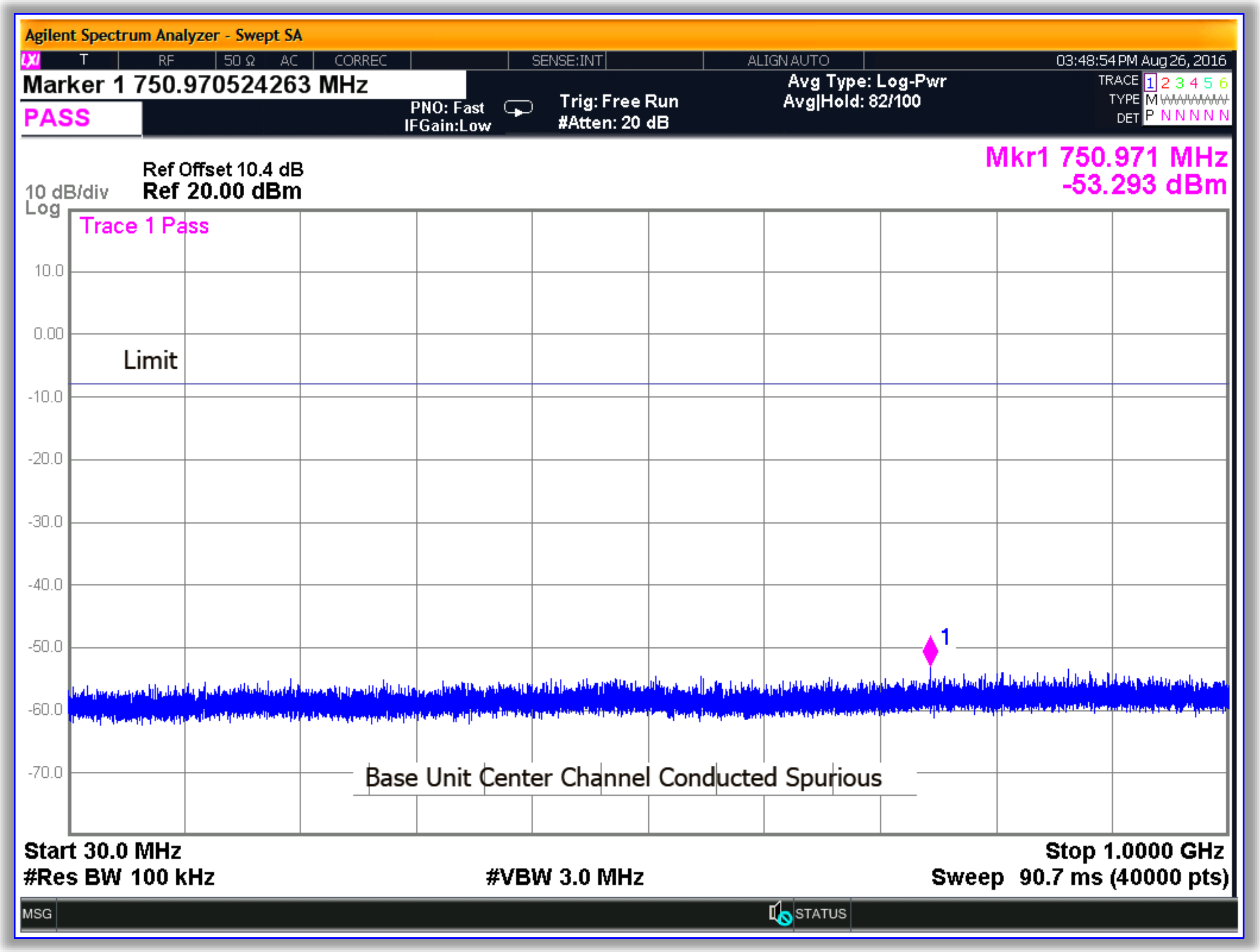

Figure 20: Center Channel Conducted Spurious Plot 1

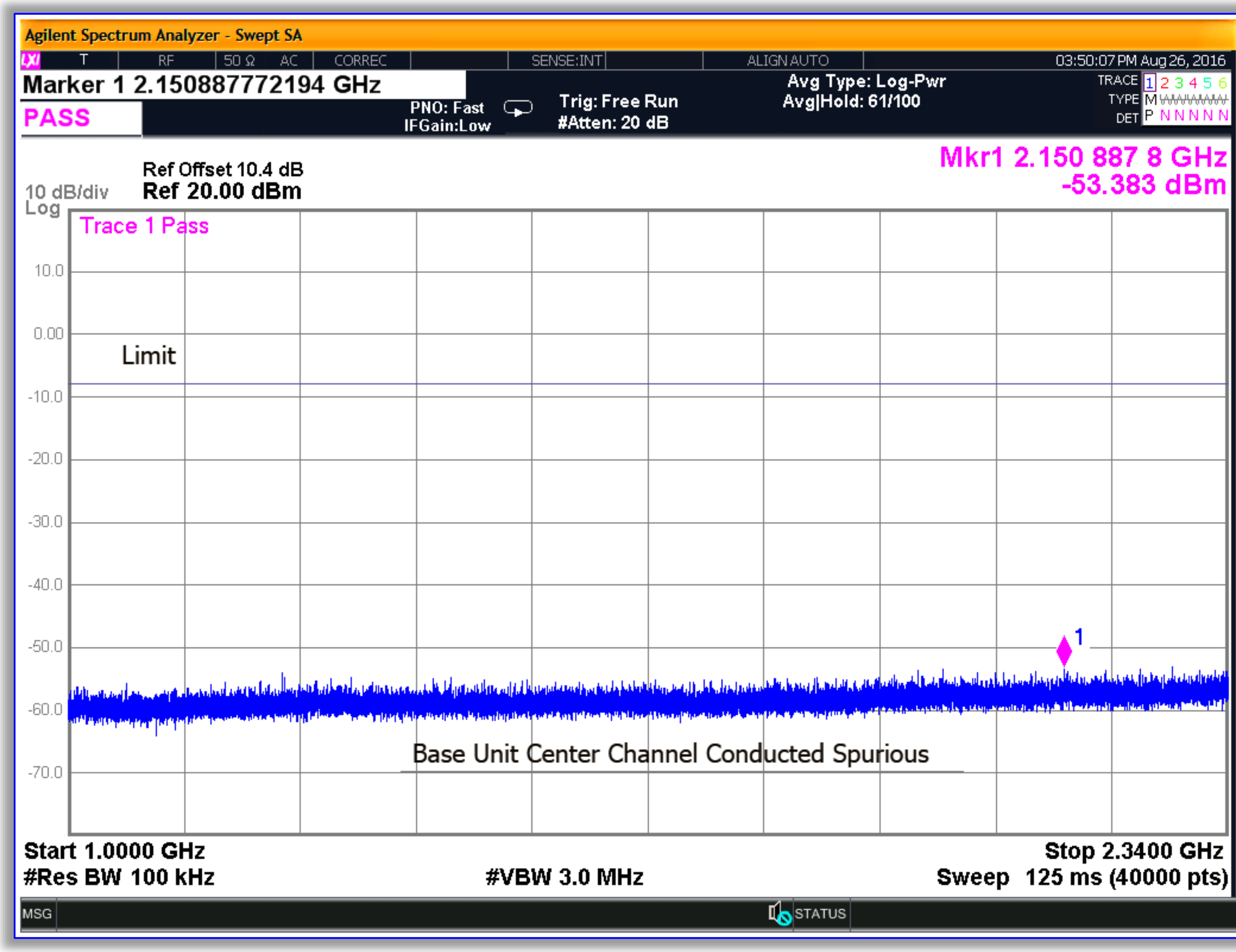

Figure 21: Center Channel Conducted Spurious Plot 2

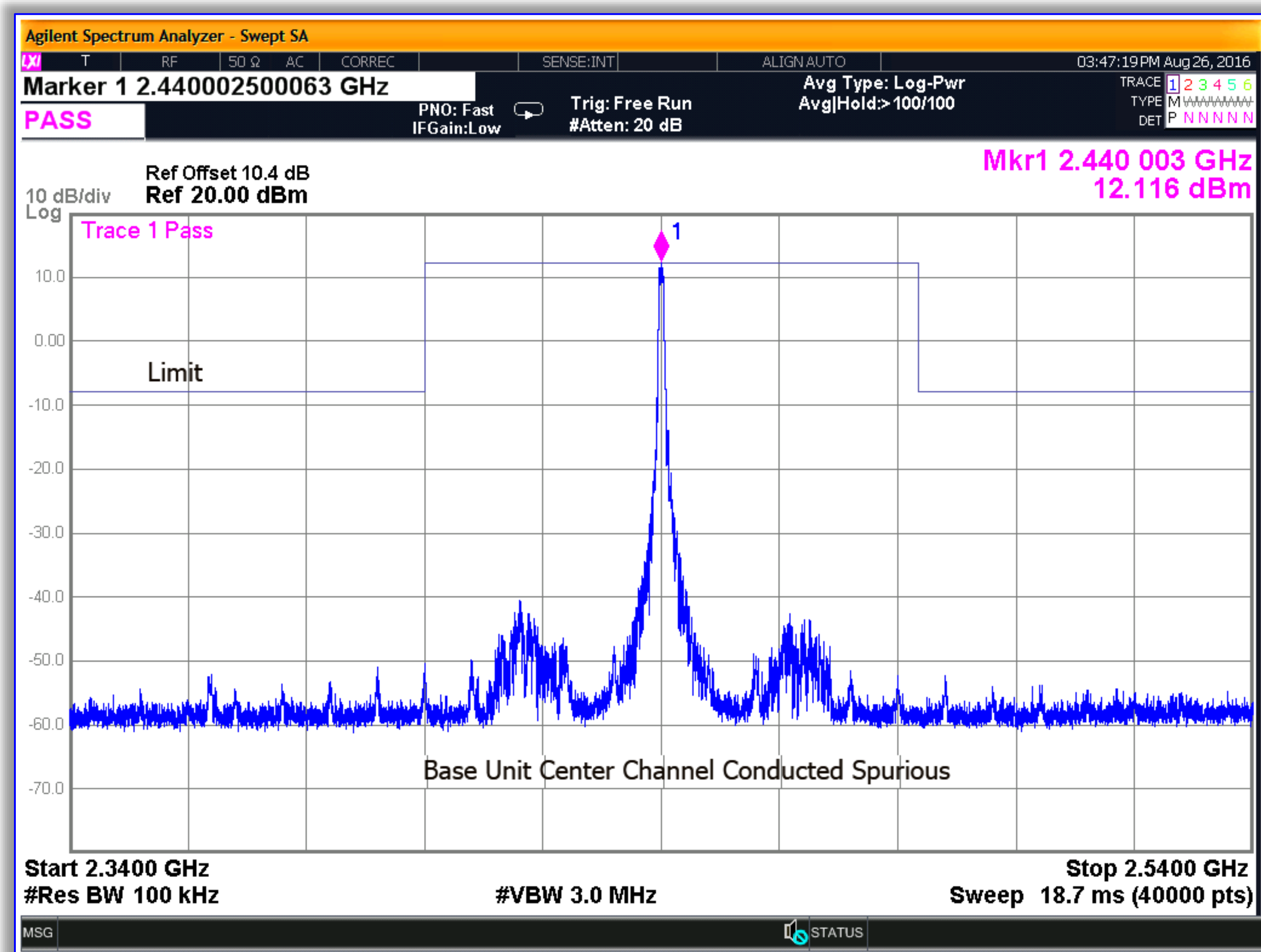

Figure 22: Center Channel Conducted Spurious Plot 3

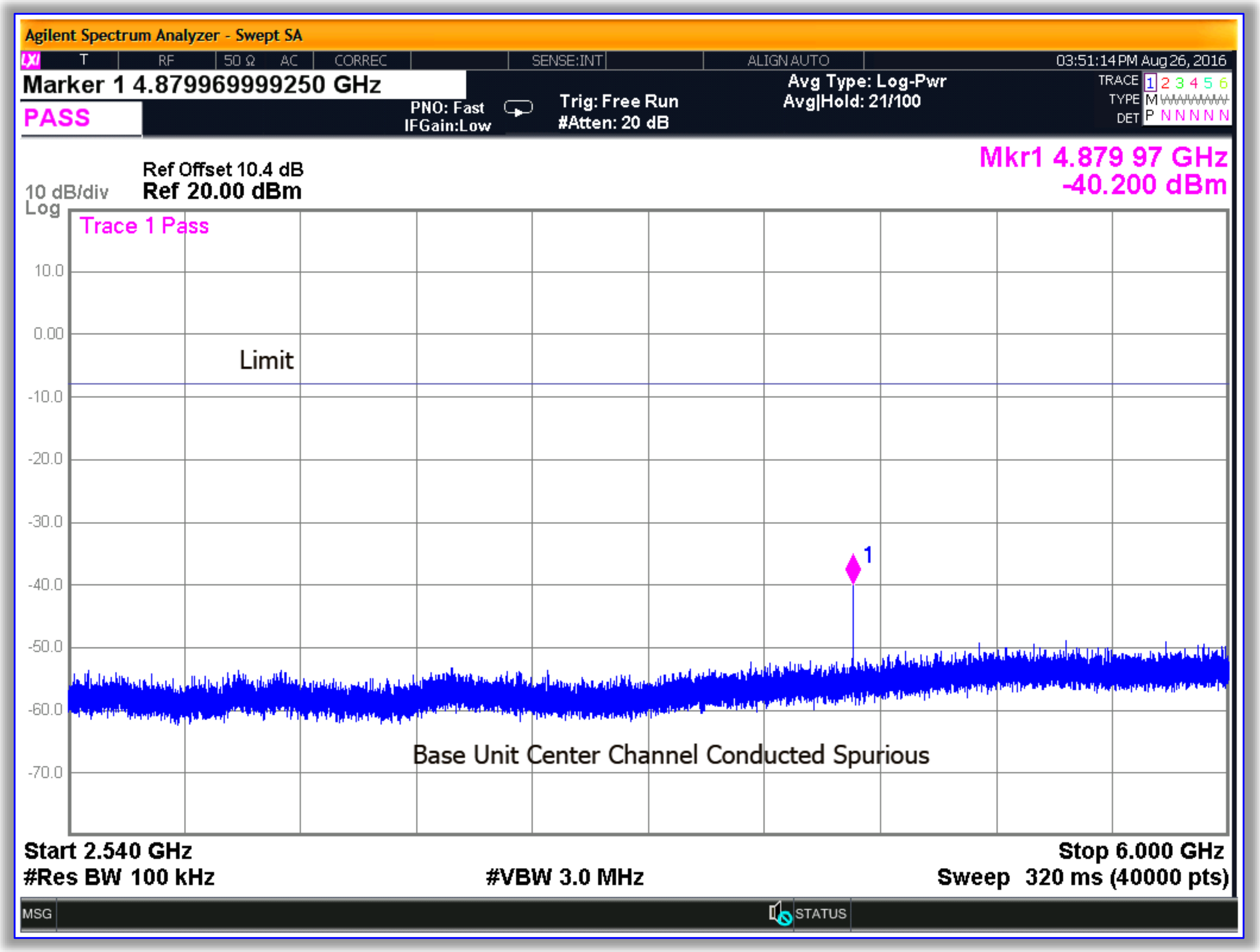

Figure 23: Center Channel Conducted Spurious Plot 4

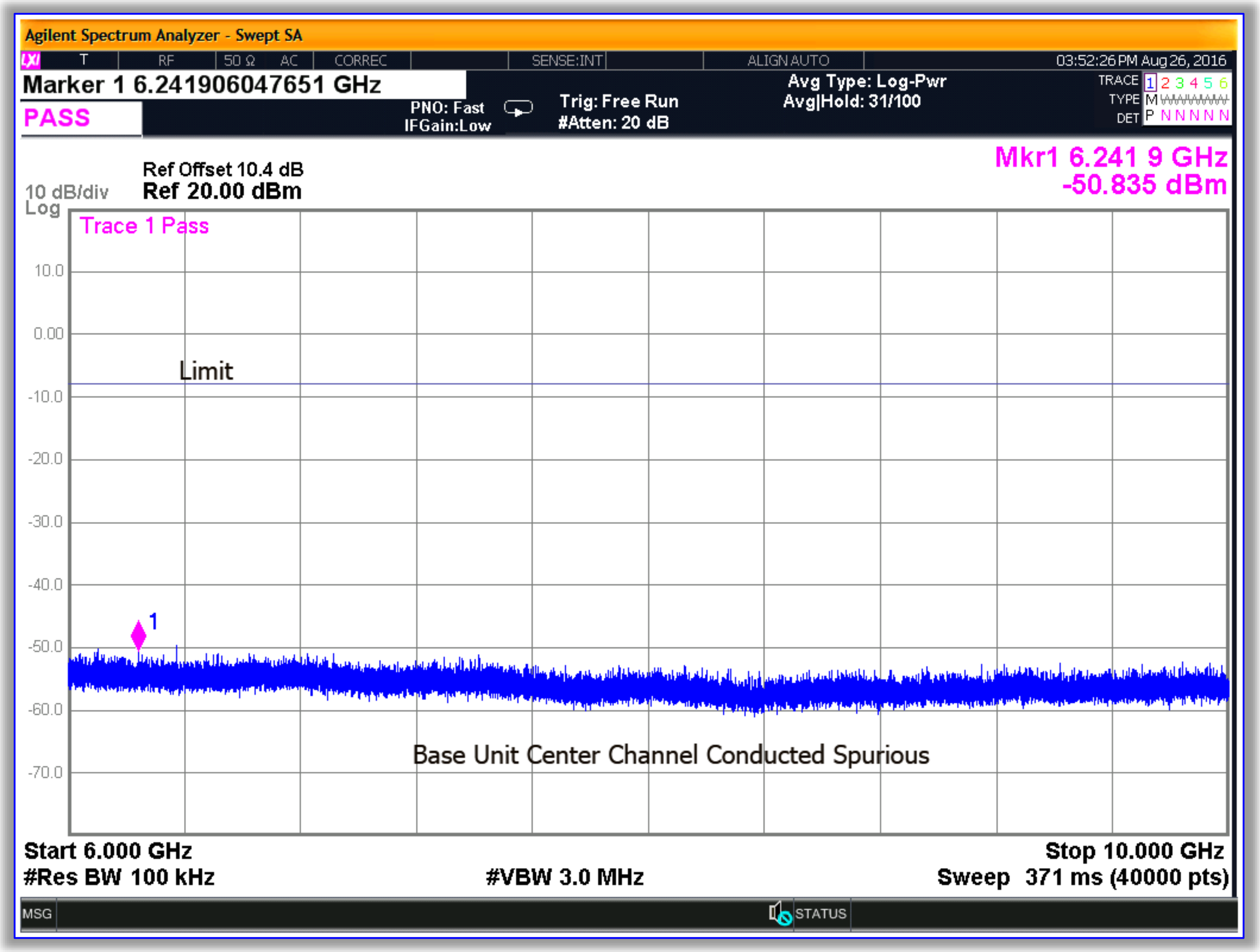

Figure 24: Center Channel Conducted Spurious Plot 5

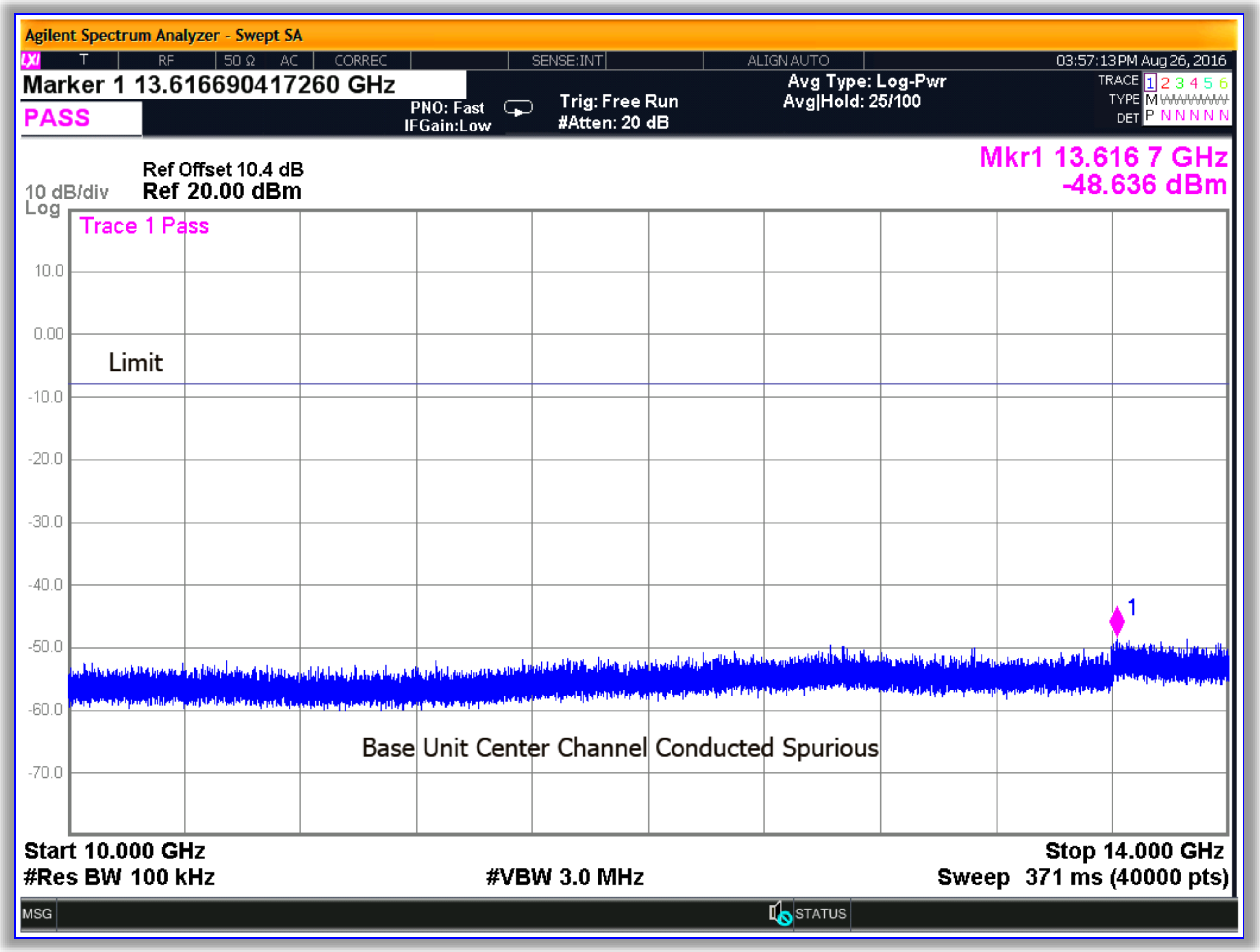

Figure 25: Center Channel Conducted Spurious Plot 6

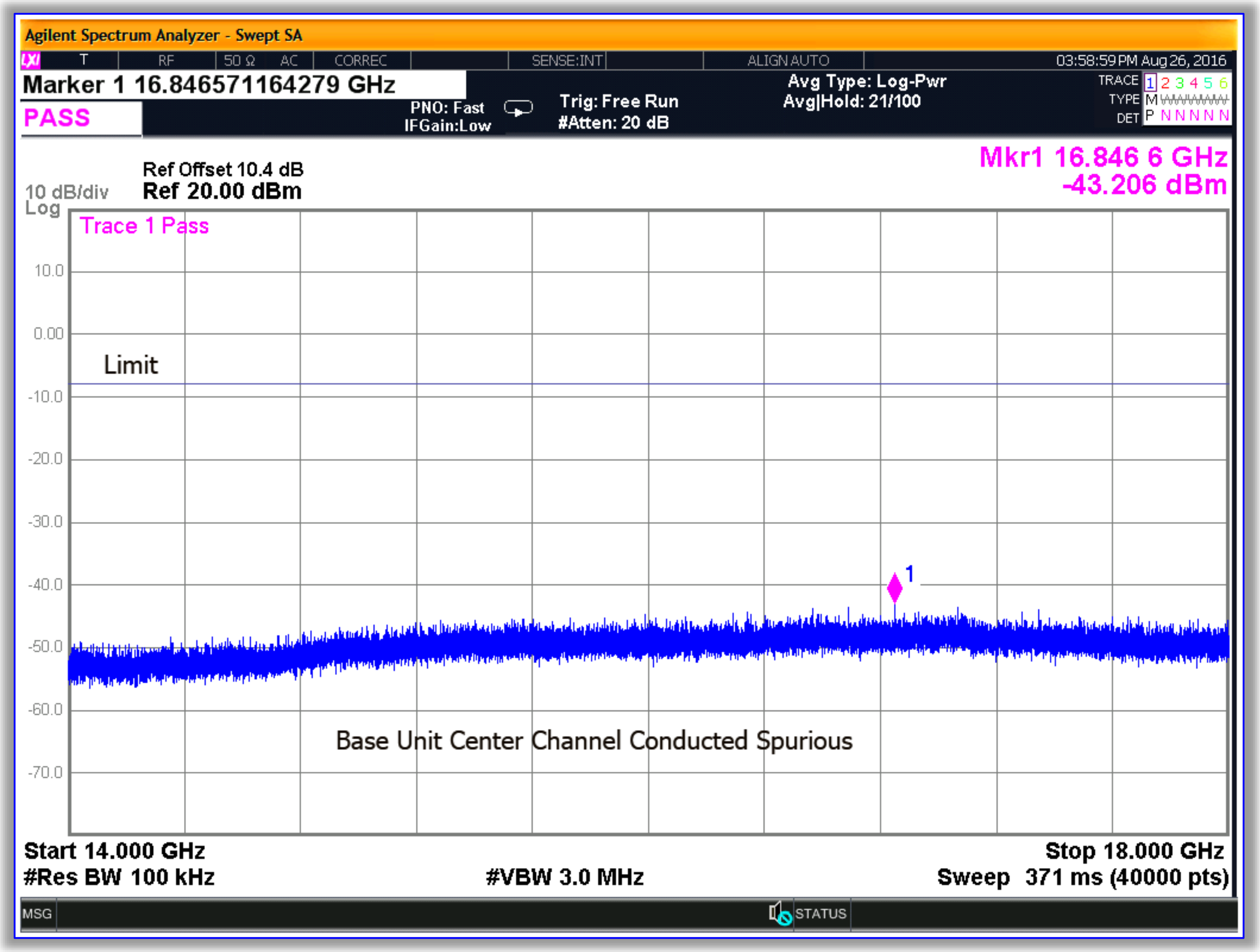

Figure 26: Center Channel Conducted Spurious Plot 7

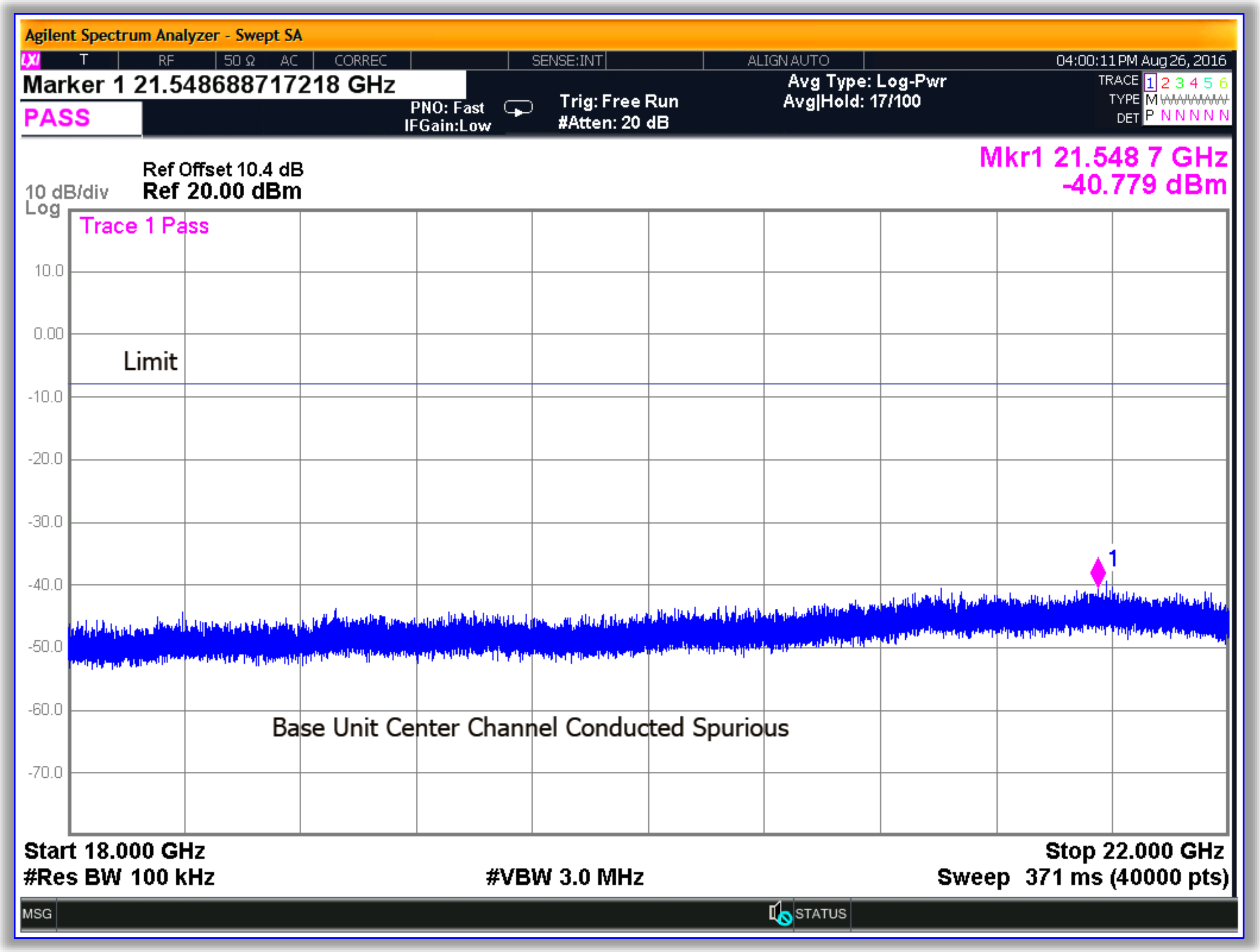

Figure 27: Center Channel Conducted Spurious Plot 8

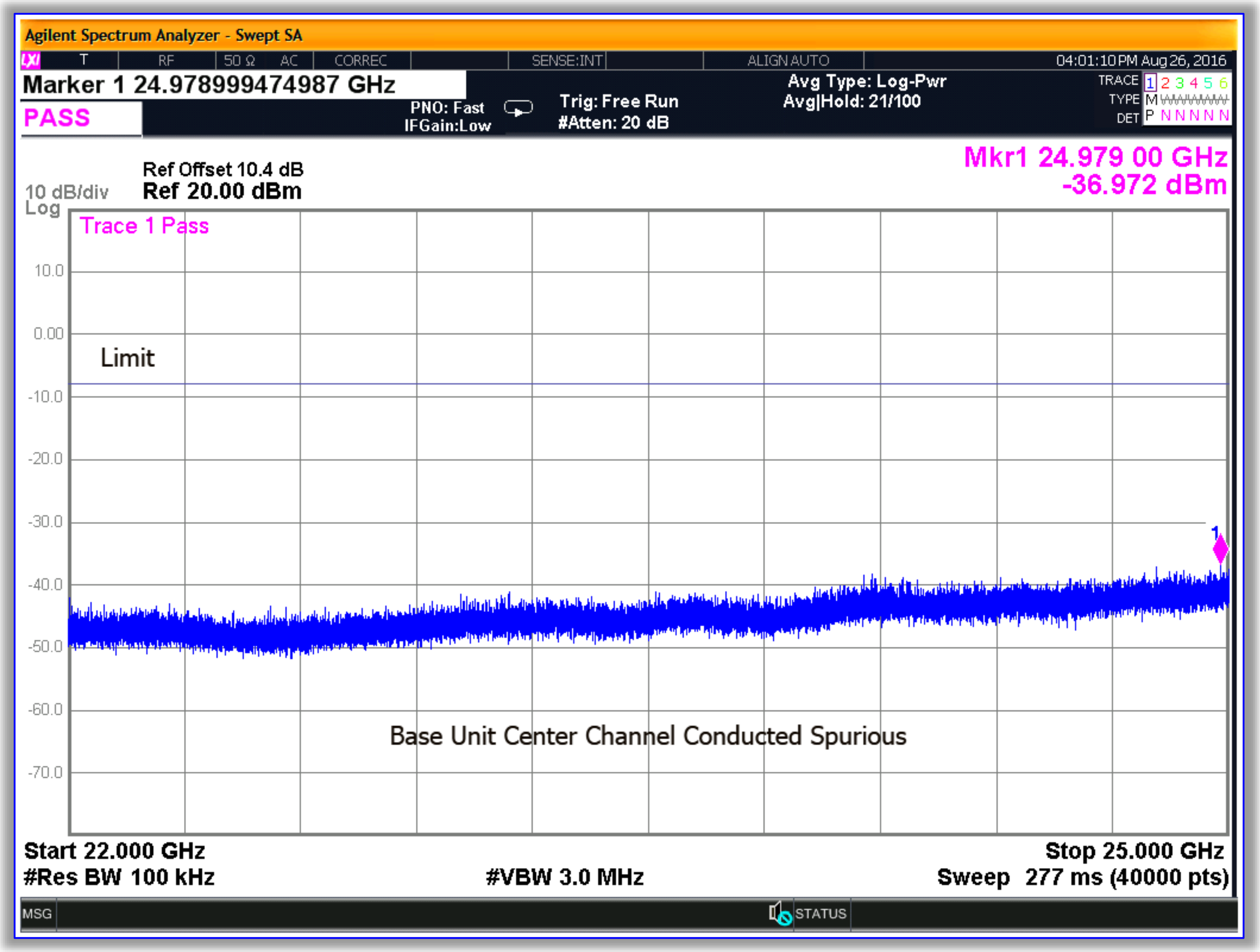

Figure 28: Center Channel Conducted Spurious Plot 9

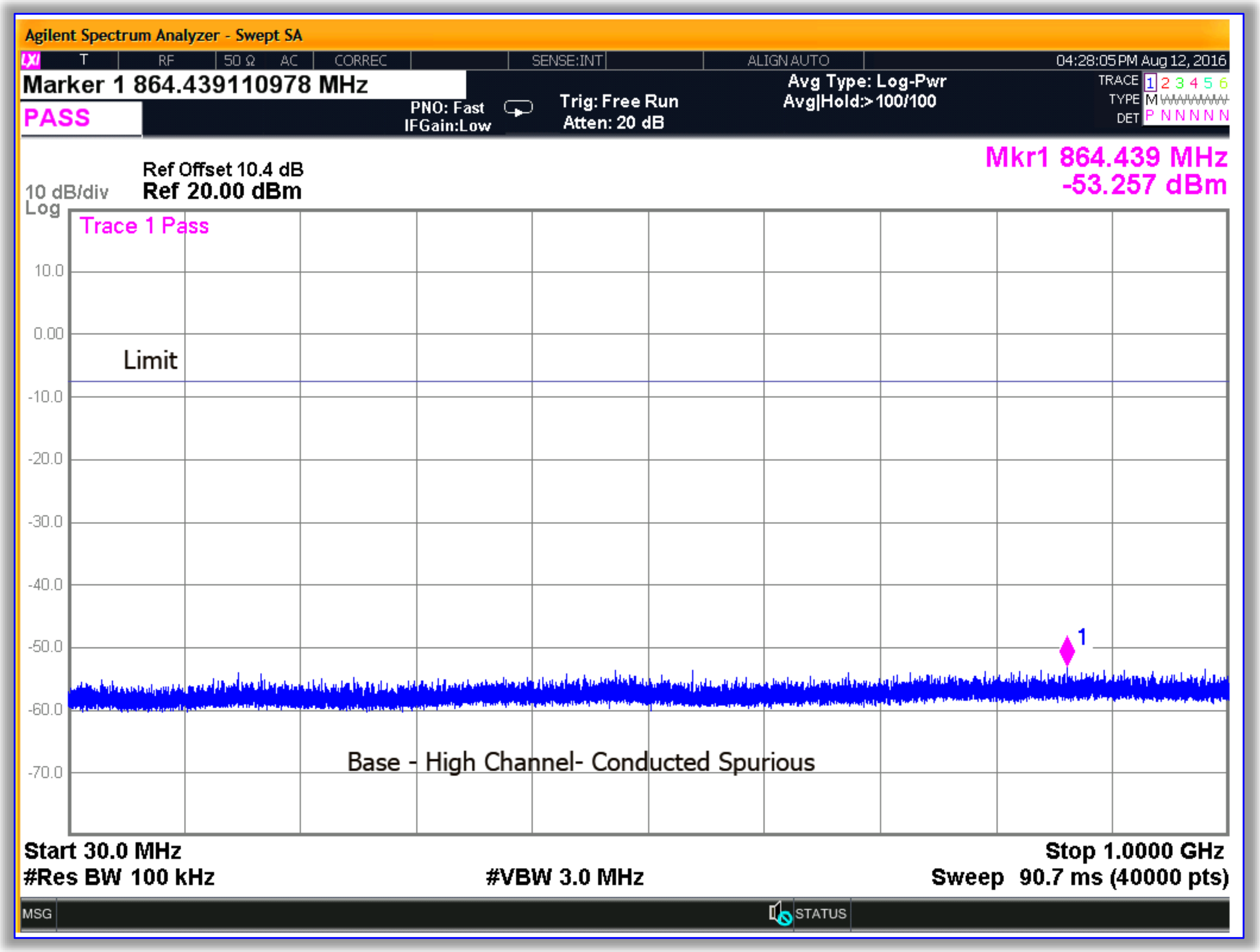

Figure 29: High Channel Conducted Spurious Plot 1

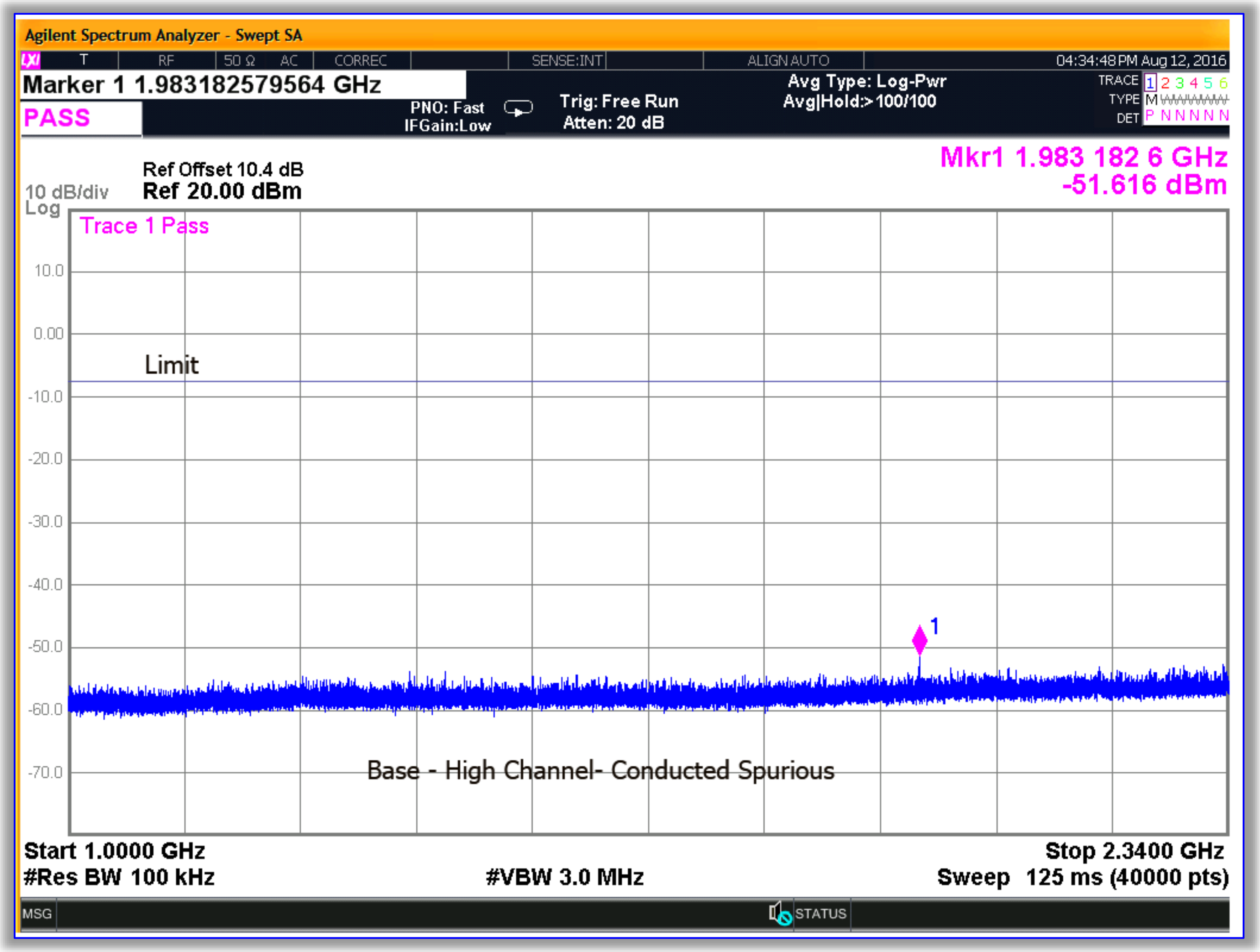

Figure 30: High Channel Conducted Spurious Plot 2

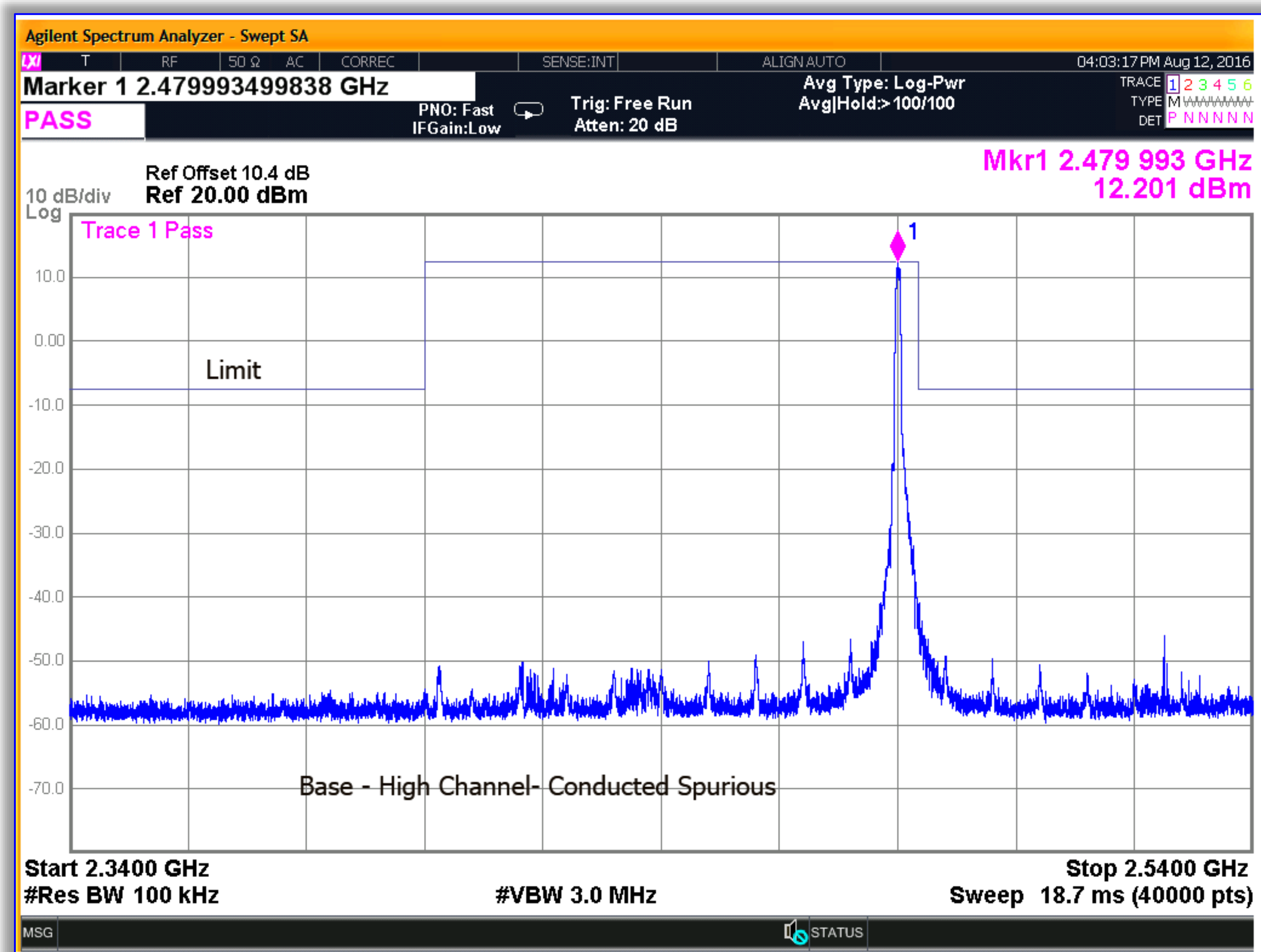

Figure 31: High Channel Conducted Spurious Plot 3

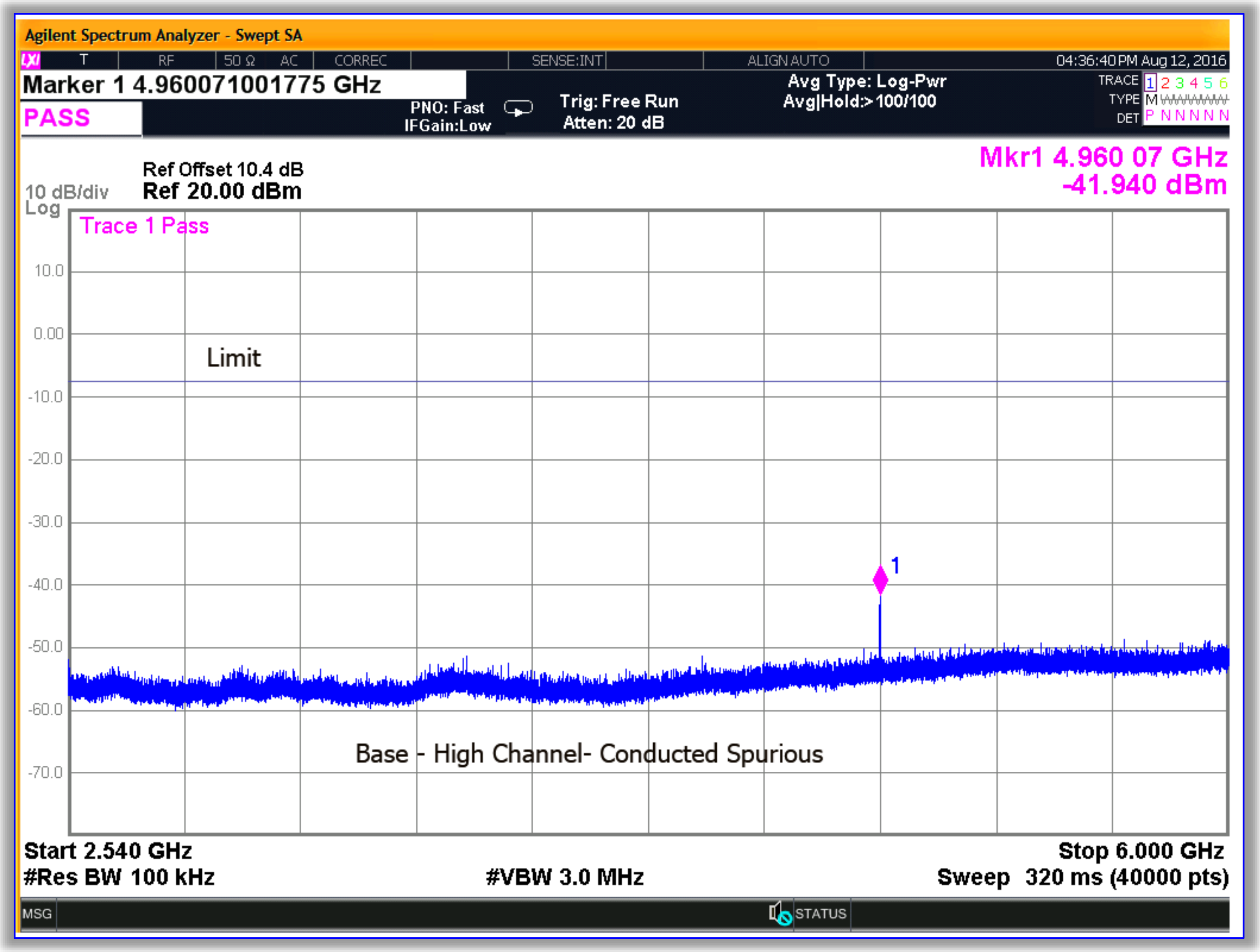

Figure 32: High Channel Conducted Spurious Plot 4

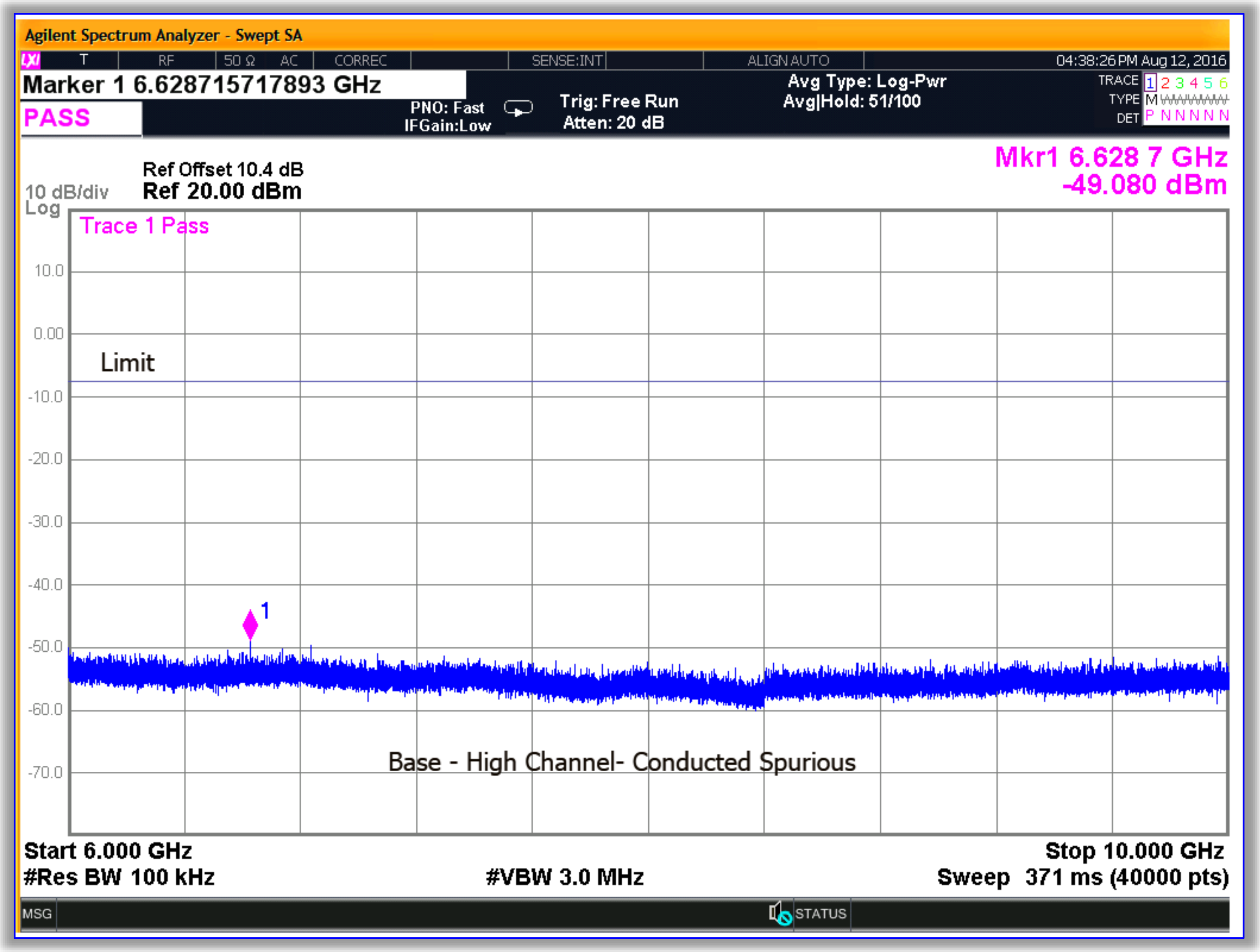

Figure 33: High Channel Conducted Spurious Plot 5

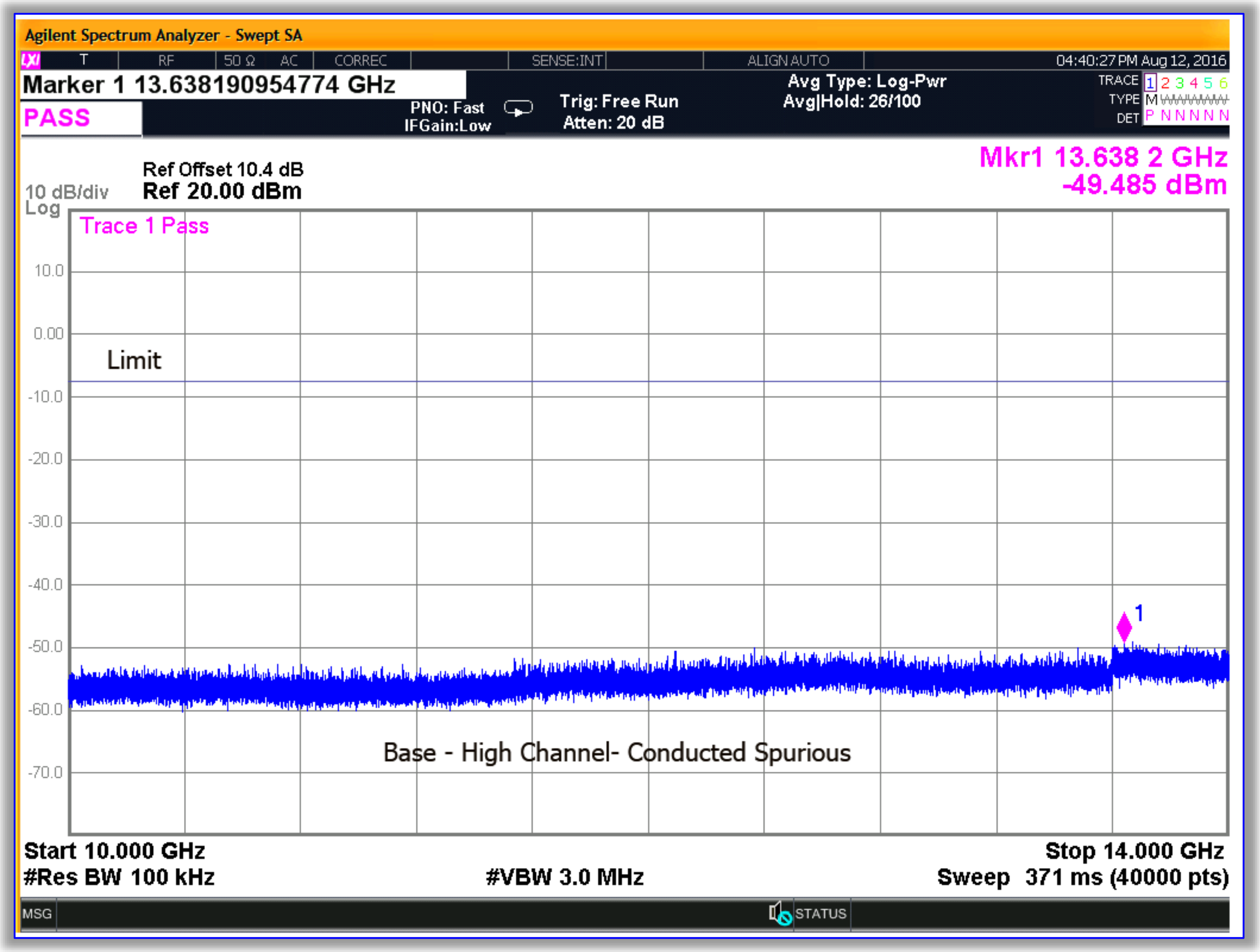

Figure 34: High Channel Conducted Spurious Plot 6

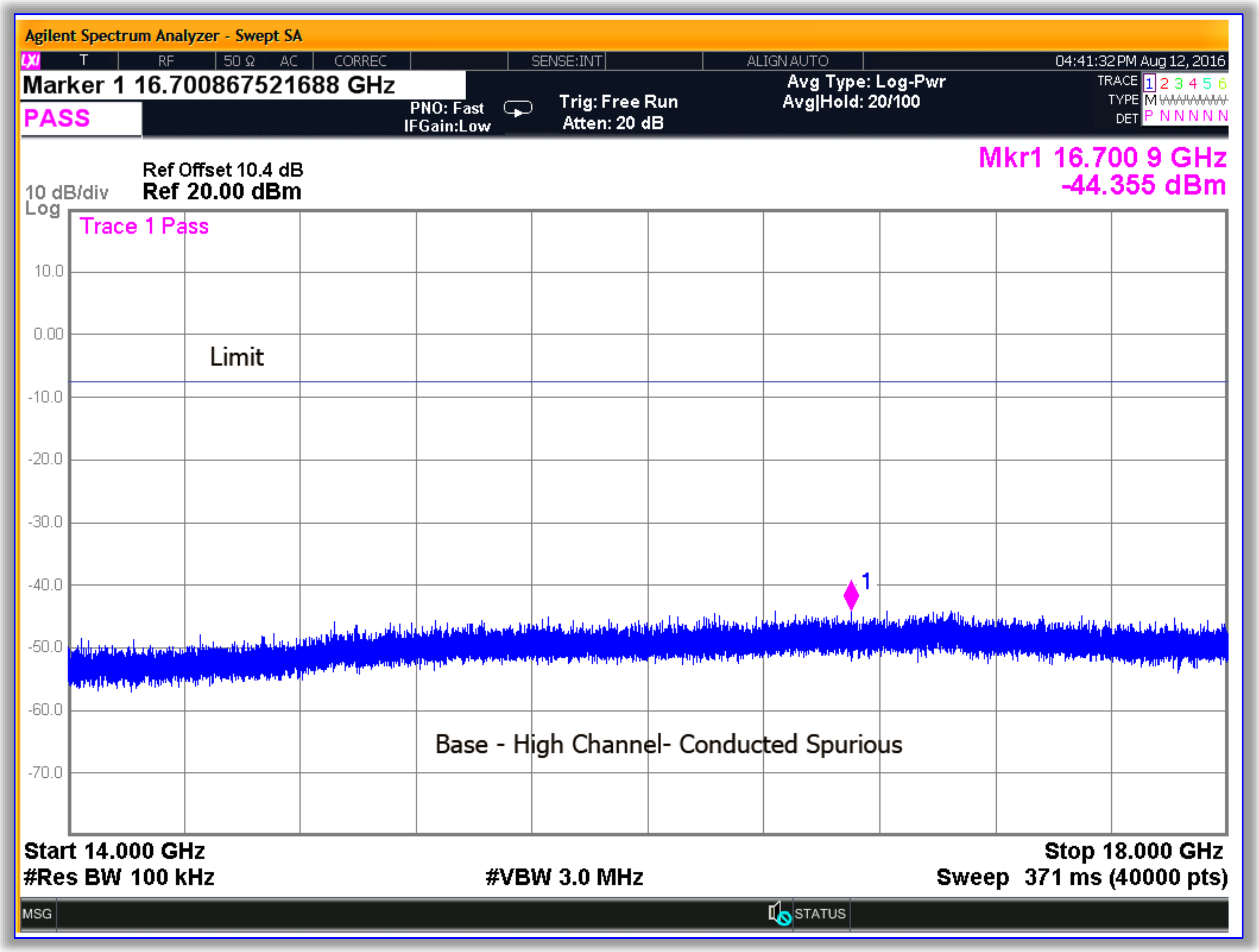

Figure 35: High Channel Conducted Spurious Plot 7

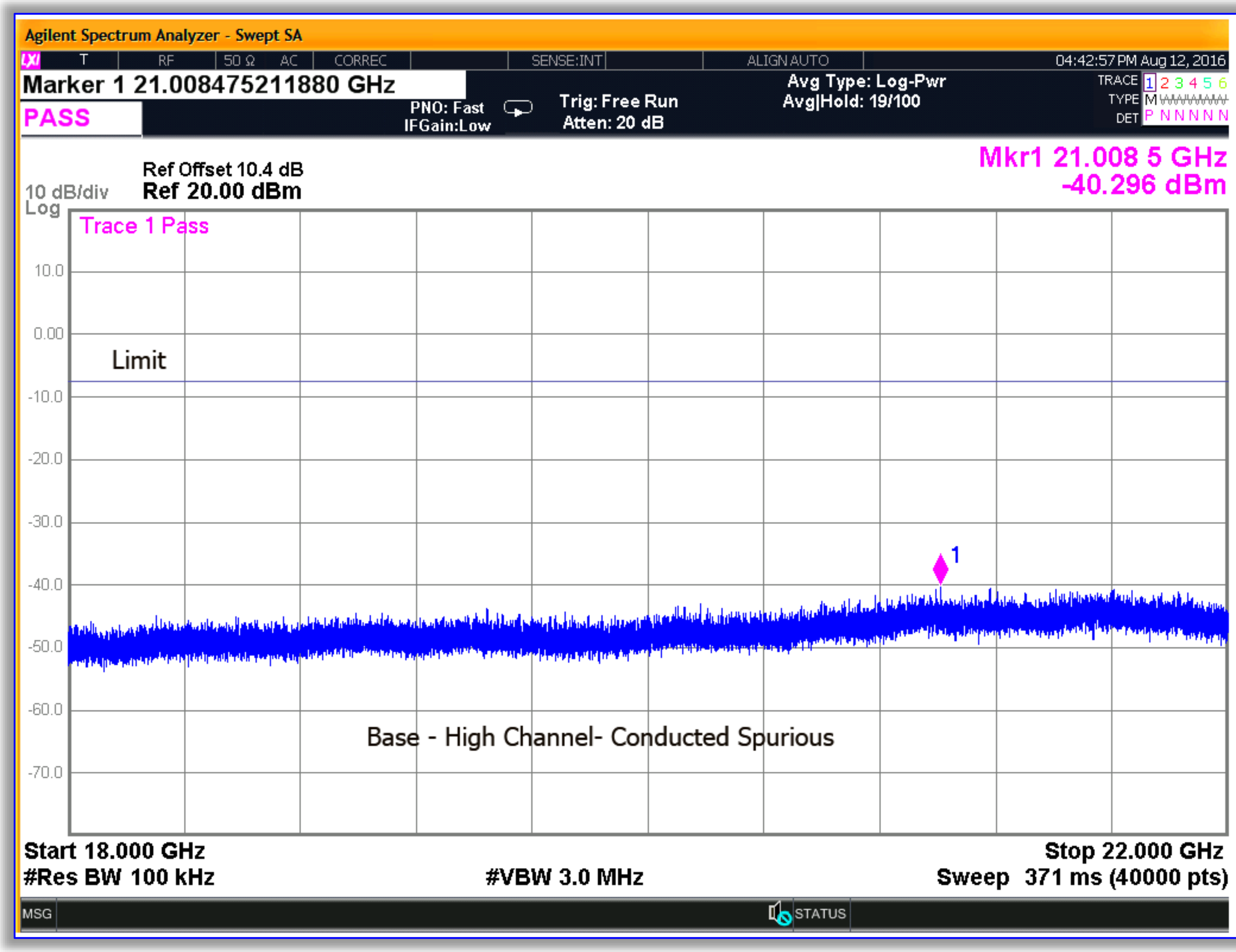

Figure 36: High Channel Conducted Spurious Plot 8

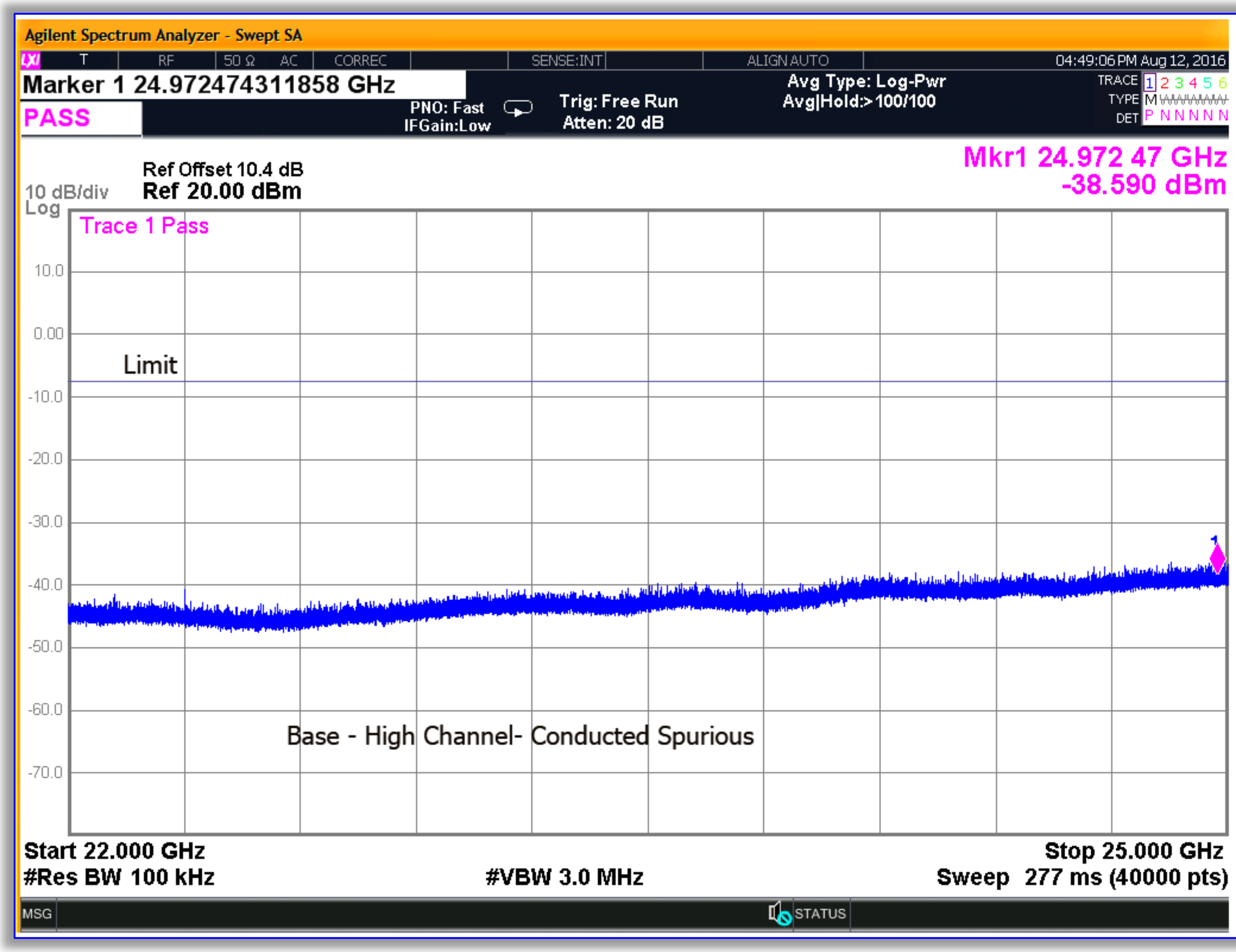

Figure 37: High Channel Conducted Spurious Plot 9

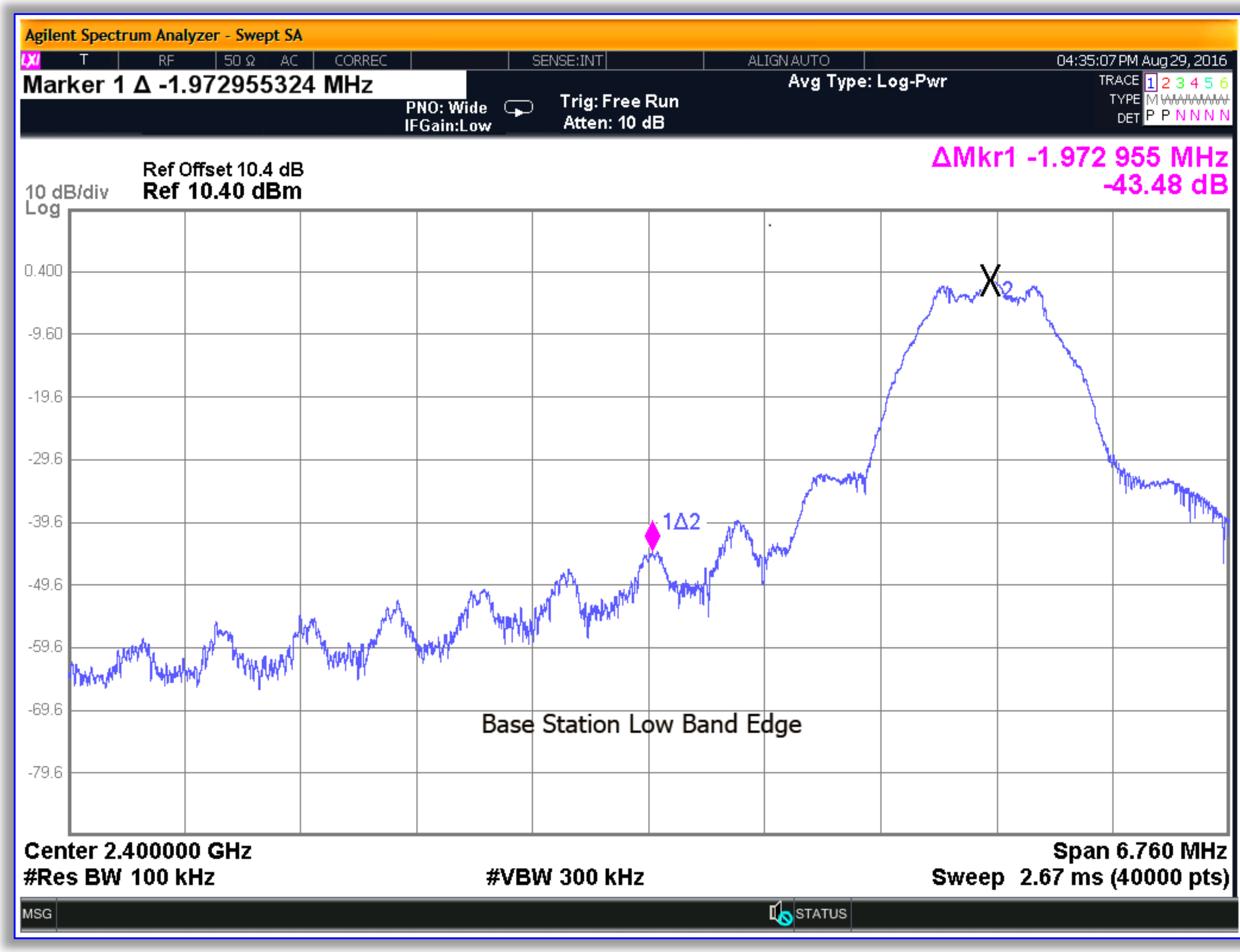

Figure 38: Lower Band Edge Low Channel

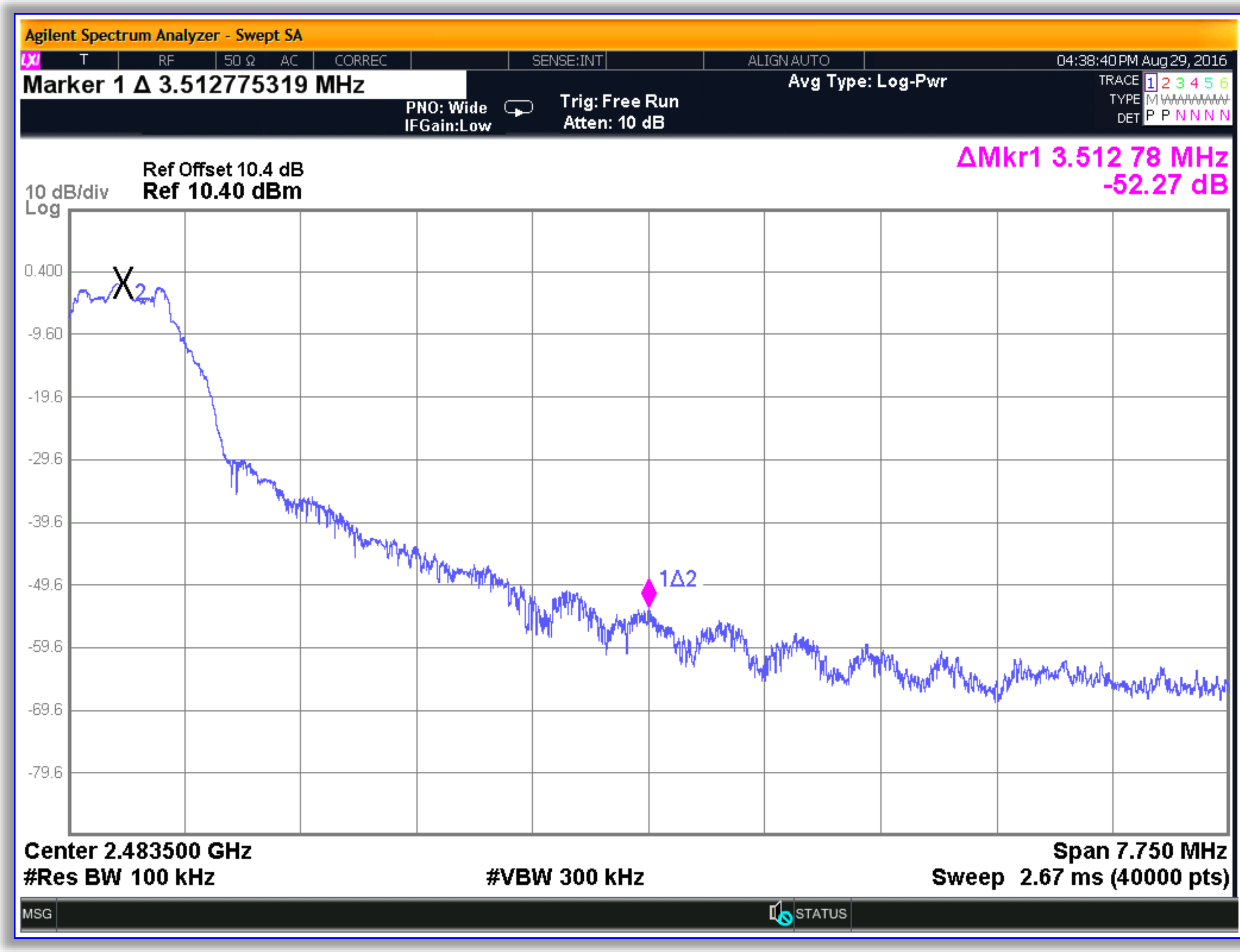

Figure 39: Upper Band Edge High Channel

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 orthogonals 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	100kHz	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.

The EUT was scanned up to 25GHz.

5.5.1.1 Duty Cycle Corrections

A duty cycle correction of 3.2dB 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.

The measured duty cycle = (Time on)/ (Time on and Time off)=291.2us/625.1us=0.47 (47%)

Correction Calculation = 10*Log (1/(duty cycle) =10*Log (1/0.47)= 3.2dBm

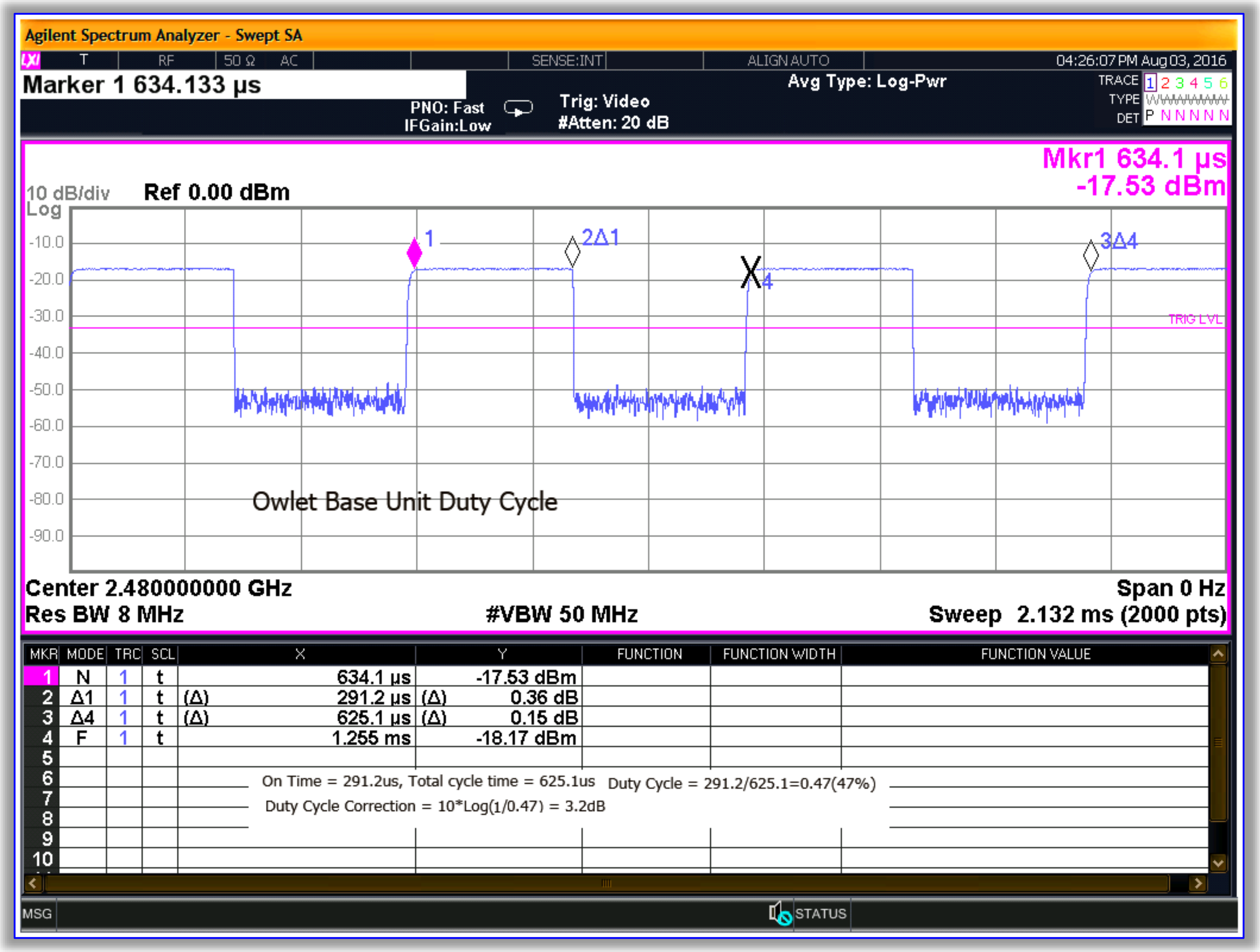

Figure 40: Duty Cycle Calculation

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)	Duty Cycle Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)
37.80	V	0.00	1.00	33.97	-8.2	0.0	19.4	100.0	-14.3
114.30	V	90.00	1.30	36.34	-9.8	0.0	21.1	150.0	-17.0
255.04	V	270.00	1.92	32.02	-11.3	0.0	10.8	200.0	-25.3
38.17	H	45.00	4.00	28.67	-8.5	0.0	10.2	100.0	-19.8
114.43	H	90.00	3.60	32.85	-9.8	0.0	14.1	150.0	-20.5
264.45	H	190.00	2.90	32.87	-10.3	0.0	13.4	200.0	-23.5

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
2402.00	V	190.00	3.60	99.86	-1.5	0.0	82622.8	NA	NA	Fundamental-pk
2390.00	V	190.00	3.60	49.54	-1.5	0.0	252.8	5000.0	-25.9	pk
2390.00	V	190.00	3.60	38.75	-1.5	3.2	105.6	500.0	-13.5	Ave
4804.00	V	270.00	4.00	46.11	3.2	0.0	290.8	5000.0	-24.7	pk
4804.00	V	27.00	4.00	38.00	3.2	3.2	165.2	500.0	-9.6	Ave
12010.00	V	0.00	3.60	37.90	14.1	0.0	398.2	5000.0	-22.0	pk
12010.00	V	0.00	3.60	26.48	14.1	3.2	154.6	500.0	-10.2	Ave
2402.00	H	180.00	3.51	101.39	-1.5	0.0	98616.6	NA	NA	Fundamental-pk
2390.00	H	180.00	3.51	47.89	-1.5	0.0	209.1	5000.0	-27.6	pk
2390.00	H	180.00	3.51	38.83	-1.5	3.2	106.5	500.0	-13.4	Ave
4804.00	H	10.00	3.66	48.59	3.2	0.0	386.9	5000.0	-22.2	pk
4804.00	H	10.00	3.66	39.52	3.2	3.2	196.8	500.0	-8.1	Ave
12010.00	H	90.00	4.00	36.69	14.1	0.0	346.4	5000.0	-23.2	pk
12010.00	H	90.00	4.00	25.80	14.1	3.2	142.9	500.0	-10.9	Ave

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
2440.00	V	60.00	3.40	102.20	-1.5	0.0	108445.8	NA	NA	Fundamental-pk
4880.00	V	45.00	3.80	49.99	4.5	0.0	531.0	5000.0	-19.5	pk
4880.00	V	45.00	3.80	41.80	4.5	3.2	298.9	500.0	-4.5	Ave
7320.00	V	90.00	3.40	45.30	11.3	0.0	674.2	5000.0	-17.4	pk
7320.00	V	90.00	3.40	33.83	11.3	3.2	260.3	500.0	-5.7	Ave
12200.00	V	10.00	3.80	40.50	14.6	0.0	571.6	5000.0	-18.8	pk
12200.00	V	10.00	3.80	29.50	14.6	3.2	232.8	500.0	-6.6	Ave
2440.00	H	60.00	3.40	102.06	-1.5	0.0	106736.5	NA	NA	Fundamental-pk
4880.00	H	90.00	3.15	48.50	4.5	0.0	447.3	5000.0	-21.0	pk
4880.00	H	90.00	3.15	39.70	4.5	3.2	234.7	500.0	-6.6	Ave
7320.00	H	90.00	3.15	45.12	11.3	0.0	660.9	5000.0	-17.6	pk
7320.00	H	90.00	3.15	34.00	11.3	3.2	265.5	500.0	-5.5	Ave
12200.00	H	190.00	3.20	41.20	14.6	0.0	619.5	5000.0	-18.1	pk
12200.00	H	190.00	3.20	30.10	14.6	3.2	249.5	500.0	-6.0	Ave

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 Correction (dB)	Corr. Level (uV/m)	Limit (uV/m)	Margin (dB)	Comments
2480.00	V	90.00	3.80	102.50	-1.5	0.0	112515.0	NA	NA	Fundamental-pk
2483.50	V	90.00	3.80	59.20	-1.5	0.0	769.7	5000.0	-16.3	pk
2483.50	V	90.00	3.80	42.10	-1.5	3.2	155.3	500.0	-10.2	Ave
4960.00	V	90.00	4.00	48.21	3.2	0.0	373.7	5000.0	-22.5	pk
4960.00	V	90.00	4.00	40.39	3.2	3.2	219.7	500.0	-7.1	Ave
7440.00	V	45.00	3.63	42.00	10.8	0.0	437.9	5000.0	-21.2	pk
7440.00	V	45.00	3.63	29.62	10.8	3.2	152.2	500.0	-10.3	Ave
12400.00	V	45.00	3.90	40.44	15.1	0.0	594.8	5000.0	-18.5	pk
12400.00	V	45.00	3.90	28.83	15.1	3.2	226.0	500.0	-6.9	Ave
2480.00	H	0.00	2.80	100.66	-1.5	0.0	91014.5	NA	NA	Fundamental-pk
2483.50	H	0.00	2.80	58.37	-1.5	0.0	699.5	5000.0	-17.1	pk
2483.50	H	0.00	2.80	41.02	-1.5	3.2	137.2	500.0	-11.2	Ave
4960.00	H	0.00	4.00	48.04	3.2	0.0	366.5	5000.0	-22.7	pk
4960.00	H	0.00	4.00	39.26	3.2	3.2	192.9	500.0	-8.3	Ave
7440.00	H	10.00	3.58	43.02	10.8	0.0	492.2	5000.0	-20.1	pk
7440.00	H	10.00	3.58	30.60	10.8	3.2	170.4	500.0	-9.4	Ave
12400.00	H	90.00	4.00	38.30	15.1	0.0	464.9	5000.0	-20.6	pk
12400.00	H	90.00	4.00	26.78	15.1	3.2	178.5	500.0	-8.9	Ave

5.6 Co-Located Transmitters Attestation

The Base Station device (EUT) was scanned in a radiated fashion with both the Wi-Fi 802.11b/g/n transmitter and the onboard 2.4GHz DTS device simultaneously transmitting. During this radiated emissions scan no spurious emissions over the FCC class ‘B’ limits or intermodulation products were noted. The unit was scanned up to 25GHz (10 harmonic)

5.7 Conducted AC Mains Emissions

5.7.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Part 15 (10/2014), Class B

FCC Compliance Limits		
Frequency	**Quasi-peak**	**Average**
0.15-0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 to 5MHz	56dBµV	46dBµV
0.5-30MHz	60dBµV	50dBµV

5.7.2 Test Procedure

The requirements of FCC Part 15 and RSS-Gen call for the EUT to be placed on an 80 cm high 1 X 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 X 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth. For average measurements the post-detector filter was set to 10 Hz.

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

5.7.3 Test Data

The EUT complied with the Class B Conducted Emissions requirements. Table 6 provides the test results for phase and neutral line power line conducted emissions.

5.7.4 Conducted Data Reduction and Reporting

At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed. The Conducted emissions level to be compared to the FCC limit is calculated as shown in the following example.

Example:

Spectrum Analyzer Voltage: VdBµV

LISN Correction Factor: LISN dB

Cable Correction Factor: CF dB

Electric Field: EdBµV = V dBµV + LISN dB + CF dB

Table 15: Conducted Emission Test Data

Tested though AC/USB adaptor PHIHONG Model PSA05A-050QL6

NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.508	33.1	29.0	10.2	0.2	43.5	39.4	56.0	46.0	-12.5	-6.6
1.160	32.5	27.4	10.3	0.2	42.9	37.8	56.0	46.0	-13.1	-8.2
0.850	21.6	15.9	10.3	0.1	31.9	26.3	56.0	46.0	-24.1	-19.7
1.412	19.9	13.7	10.2	0.2	30.3	24.1	56.0	46.0	-25.7	-21.9
5.222	20.8	11.8	10.7	0.1	31.6	22.6	60.0	50.0	-28.4	-27.4
8.200	19.4	10.6	11.0	0.3	30.7	21.9	60.0	50.0	-29.3	-28.1

Phase

Frequency (MHz)	Level QP (dBµV)	Level AVG (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Level QP Corr (dBµV)	Level Corr Avg (dBµV)	Limit QP (dBµV)	Limit AVG (dBµV)	Margin QP (dB)	Margin AVG (dB)
0.520	29.8	25.2	10.2	0.4	40.4	35.8	56.0	46.0	-15.6	-10.2
1.160	31.8	26.8	10.3	0.1	42.2	37.2	56.0	46.0	-13.8	-8.8
0.890	19.8	13.2	10.3	0.1	30.2	23.6	56.0	46.0	-25.8	-22.4
1.381	20.1	13.5	10.2	0.2	30.5	23.9	56.0	46.0	-25.5	-22.1
6.280	19.2	9.9	10.9	0.1	30.1	20.8	60.0	50.0	-29.9	-29.2
7.500	18.9	11.1	11.0	0.1	30.0	22.2	60.0	50.0	-30.0	-27.8