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FCC & Industry Canada Certification Test Report
For the
Eaton's Cooper Power Systems

RFN SelectComm 1272 (3.3V) MODULE
FCC ID: P9X-SCOM1272V3
IC: 6766A-SCOM1272V3

WLL JOB# 15295-01 Rev 1
February 6, 2018

Re-Issued
February 15, 2018

Prepared for:

Eaton's Cooper Power Systems
910 Clopper Road, Suite 201 S
Gaithersburg MD 20878

Prepared By:

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

ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY AT-1448

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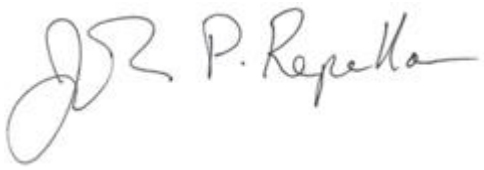

John P. Repella
Manager, EMC & Wireless Services

Reviewed by:

Steven D. Koster
President

Abstract

This report has been prepared on behalf of Eaton's Cooper Power Systems to support the attached Application for Equipment Authorization. The test report and application are submitted for a Frequency Hopping Spread Spectrum Transmitter under Part 15.247 (10/2014) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-247 Issue 2 of Industry Canada. This Certification Test Report documents the test configuration and test results for the Eaton's Cooper Power Systems RFN SelectComm 1272 (3.3V) Module.

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 Industry Canada 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 Eaton's Cooper Power Systems RFN SelectComm 1272 (3.3V) Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and Industry Canada RSS-247.

Revision History	Description of Change	Date
Rev 0	Initial Release	February 6, 2018
Rev 1	Updated to address typographical errors and comments from reviewing engineer	February 15, 2018

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1 Introduction

1.1 Compliance Statement

The Eaton's Cooper Power Systems RFN SelectComm 1272 (3.3V) Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 (10/2014) and Industry Canada RSS-247 Issue 2.

1.2 Test Scope

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

1.3 Contract Information

Customer:	Eaton Cooper Power Systems 910 Clopper Road, Suite 201 S Gaithersburg MD 20878
Purchase Order Number:	4509195776
Quotation Number:	70388

1.4 Test Dates

Testing was performed on the following date(s):	9/19/2017 to 9/23/2017, 12/14/17

1.5 Test and Support Personnel

Washington Laboratories, LTD	John P. Repella, Nikolas Allen
Customer Representative	Steven Seymour

1.6 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 RFN SelectComm 1272 (3.3V) is a radio communications module designed for use in L+G Focus meters. The devices can also be used in Eaton's Cooper Power Systems' Gateways and Relay Nodes. The RFN SelectComm 1272 (3.3V) provides a 902-928 MHz radio interface to an RF mesh network.
This test report covers the 902-928MHz FHSS radio.

Table 1: Device Summary

ITEM	DESCRIPTION
Manufacturer:	Eaton Cooper Power Systems
FCC ID:	P9X-SCOM1272V3
IC:	6766A-SCOM1272V3
Model:	RFN SelectComm 1272 (3.3V)
FCC Rule Parts:	§15.247
Industry Canada:	RSS-247
Frequency Range:	902.75 – 927.25MHz
Maximum Output Power:	29.560dBm (895.4mW)
Modulation:	FSK
Occupied Bandwidth(20dB):	472.8kHz(153.6kbps), 295.7 kHz(76.8kbps), 273.8kHz(38.4kbps), 300.7kHz(19.2kbps), 290.1kHz(9.6kbps)
Occupied Bandwidth (99%):	448.0kHz(153.6kbps), 300.1kHz(76.8kbps),271.0 kHz(38.4kbps), 313.5kHz(19.2kbps), 304.8kHz(9.6kbps)
Keying:	Automatic
Type of Information:	Data
Number of Channels:	50
Power Output Level	Variable from 29.560dBm to -7.78dBm
Antenna Connector	MCX to Type N
Antenna Type	4 antennas: On-Board Antenna 1dBi (Wire Antenna) Laird TRAB9023P, 3dBi Gain Laird B8965CN 5/8 Wave Coil 900MHz Omni Antenna, 5dBi gain OD9-5-ANT, 5dBi
Interface Cables:	None (plug in module)
Power Source & Voltage:	3.3 Vdc (Unregulated)
FCC Emission Designator	473KFXD
ISED Emissions Designator	448KFXD(153.6kbps), 300KFXD(76.8kbps), 271KFXD(38.4kbps), 314KFXD(19.2kbps), 305KFXD(9.6kbps)
Highest TX Spurious Emission	17.1uV/m@3m-150.44MHz
Highest RX Spurious Emission	61.1uV/m @ 3m, 167.61MHz

2.2 Test Configuration

The Eaton's Cooper Power Systems RFN SelectComm 1272 (3.3V), Equipment Under Test (EUT), was operated from a 115Vac power supply. Programming commands were sent from a support laptop via a custom RS232 adaptor board to a header on the EUT module. The measurements were performed on the EUT in a manner which represents the typical installation configuration. A piece of closed cell foam was used to support the EUT and antenna combination.

2.3 Testing Algorithm

The RFN SelectComm 1272 (3.3V) was programmed for operation from a support laptop via a custom RS232 adaptor board to a header on the EUT module. The Hyper-terminal console program was used on the support laptop to enter commands setting the EUT to the desired channel, data rate power or hopping mode.

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 Industry Canada 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 "Procedures for Compliance Testing of Unlicensed Wireless Devices"

ANSI C63.2 "Specifications for Electromagnetic Noise and Field Strength Instrumentation"

ANSI C63.4 "Methods of Measurement of Radio Noise from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz".

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

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

Where u_c = standard uncertainty

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

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

Divisor = 1.732 for rectangular distribution

Divisor = 2 for normal distribution

Divisor = 1.414 for trapezoid distribution

Equation 2: Expanded Uncertainty

$$U = ku_c$$

Where U = expanded uncertainty

k = coverage factor

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

u_c = standard uncertainty

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

Table 2: Expanded Uncertainty List

Parameter	Uncertainty	Actual (+/-)	Unit
Radio Frequency	±1 x 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
Radiated RF power	±6 dB	N/A	dB
Average sensitivity (radiated)	±3 dB	N/A	dB

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

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 Emissions Voltage**	**Test Date:**	**12/14/2017**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT - E4446A	3Hz- 44GHz ANALYZER SPECTRUM	12/19/2018
125	SOLAR/8028-50-TS-24-BNC	LISN, 150kHz-30MHz	02/16/2018
126	SOLAR/8028-50-TS-24-BNC	LISN, 150kHz-30MHz	02/16/2018

Test Name:	**Radiated Emissions**	Test Date:	**9/21/2017**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT - E4446A	3HZ - 44GHZ ANALYZER SPECTRUM	10/10/2017
276	ELECTRO-METRICS - BPA-1000	RF PRE-AMPLIFIER	1/18/2018
627	AGILENT - 8449B	AMPLIFIER 1-26GHZ	11/7/2017
280	ITC - 21C-3A1	WAVEGUIDE 3.45-11.0GHZ	11/1/2017
742	PENN ENGINEERING - WR284	2.2-4.15GHZ BANDPASS FILTER	11/11/2017
382	SUNOL SCIENCES CORPORATION - JB1	ANTENNA BICONLOG	10/31/2017
610	WLL - RG-223	BNC COAXIAL CABLE(1.0M)	1/23/2018
425	ARA - DRG-118/A	ANTENNA DRG 1-18GHZ	11/23/2017
281	ITC- 21A-3A1	WAVEGUIDE 4.51-10.0GHZ	11/1/2017

Test Name:	**Bench Conducted Emissions**	Test Date:	**12/14/2017**
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
528	AGILENT/ E4446A	3Hz - 44GHz SPECTRUM ANALYZER	12/19/2018
823	AGILENT/EXA 9010A	10Hz-26.5GHz SPECTRUM ANALYZER	4/30/2018
879	ETS-LINDGREN/EM Power 7002-006	USB RF POWER METER	6/23/2018

4 Test Summary

The Table Below shows the results of testing for compliance with a Frequency Hopping System in accordance with FCC Part 15.247 10/2014 and RSS-247 Issue 2. Full test results are shown in Section 5.

Table 4: Test Summary Table

TX Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247 (a)(1)(i)	RSS-247 Section 5.1 (1)	20dB Bandwidth	Pass
15.247 (b)(2)	RSS-247 Section 5.4 (1)	Transmit Output Power	Pass
15.247 (a)(1)	RSS-247 Section 5.1 (2)	Channel Separation	Pass
15.247 (a)(1)(i)	RSS-247 Section 5.1 (3)	Number of Channels =50 minimum	Pass
15.247 (a)(1)(i)	RSS-247 Section 5.1 (3)	Time of Occupancy	Pass
15.247 (d)	RSS-247 Section 5.5	Occupied BW / Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	RSS-247 Section 5.5	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
15.207	RSS-Gen	AC Conducted Emissions	Pass
RX/Digital Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.207	RSS-Gen	AC Conducted Emissions	Pass
15.209	RSS-Gen	General Field Strength Limits	Pass

5 Test Results

5.1 Duty Cycle Correction and Time of Occupancy

In accordance with the FCC Public Notice the average spurious radiated emissions measurements may be further adjusted using a duty cycle correction factor if the dwell time per channel of the hopping signal is less than 100 ms. In addition, the transmitter shall have a time of occupancy for systems having a 20dB bandwidth greater than 250 kHz of no more than 0.4seconds in any 10 second period.

The duty cycle correction factor is calculated by:

20*log (dwell time/100 ms)

The following table and figures show the data for the occupancy time for the transmitter. Based on this plot, the occupancy time per hop is 20.1332ms. The maximum total occupancy time per 100ms is 40.2306ms. This corresponds to a duty cycle correction of -7.908dB for radiated spurious emissions.

These tests were conducted with the RF output connected through appropriate attenuators to the input of a spectrum analyzer set to zero span mode. The unit was set to hopping mode with the spectrum analyzer set to 902.75MHz. The results are shown in the plots below.

Table 5: Duty Cycle Data Rate Summary

Data Rate (kbps)	Medium Utilization (%)	Duty Cycle (%)	Min. Gap Time (ms)	Max. Sequence Time (ms)	Max. Sequence Time (100ms)
9.6	0.683	46.094	22.686	19.400	38.800
19.2	0.642	47.796	21.952	20.1332	40.2306
38.4	0.692	46.767	16.288	19.682	39.396
76.8	0.579	46.077	18.547	19.391	38.785
153.6	0.582	41.768	11.005	9.209	36.831

Table 6: Duty Cycle/Time of Occupancy Results

Test	Result	Limit	Pass/Fail
Dwell time per Hop	20.1332ms	NA	NA
Dwell time per 100ms	40.2306ms 7.908dB Correction	NA	NA
Time of Occupancy	0.2415s/10 sec	0.4s/10 sec	Pass

Calculations assume a maximum occupancy for each hop to produce 0.242s of total occupancy.

Data Rate: 19.2kbps (Worst Case)

Medium Utilization (%)	Duty Cycle (%)	Max. Sequence Time (ms)
0.642	47.796	20.1332

Burst #	Start Time (ms)	Stop Time (ms)	On Time (ms)	Off Time (ms)
1	8.3102	28.4076	20.0974	21.9880
2	50.3956	70.5288	20.1332	21.9522
Total			40.2306	

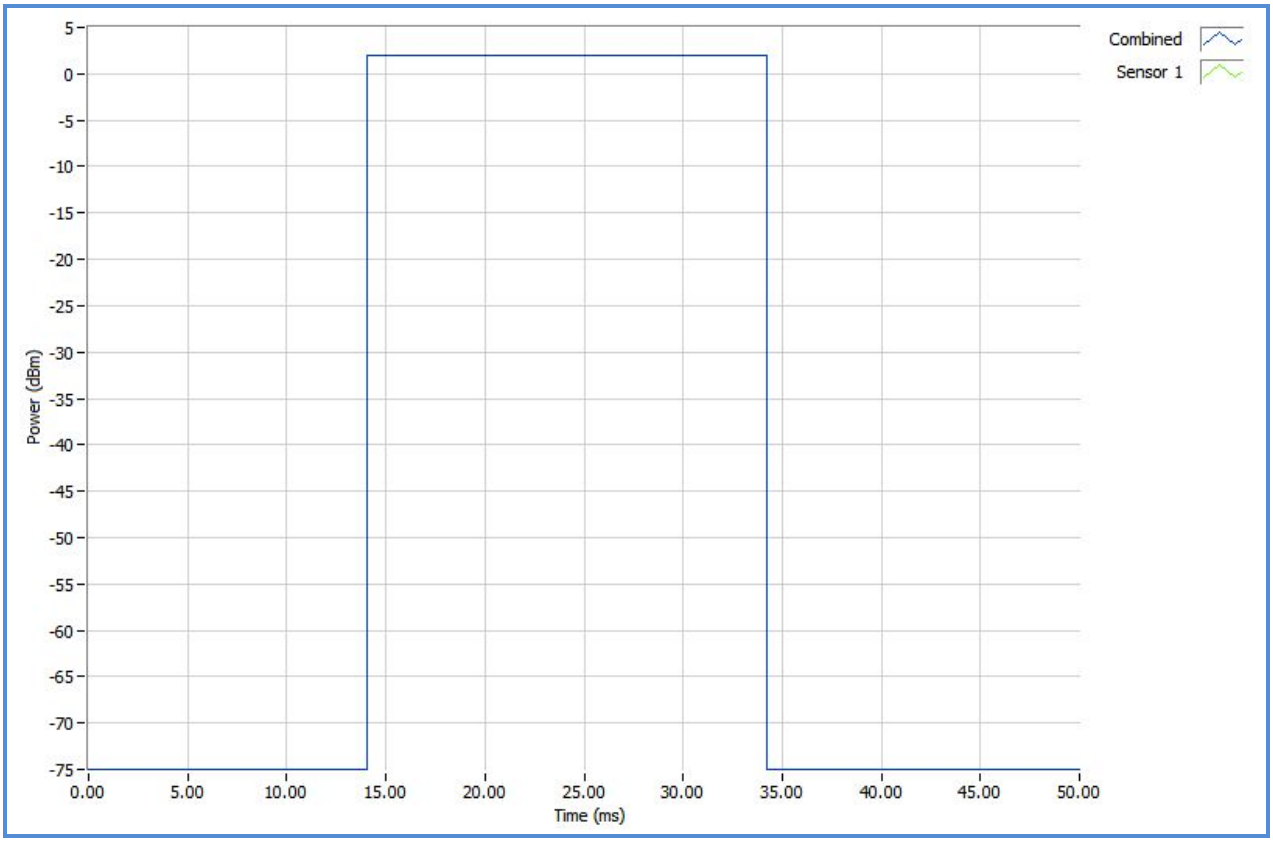

Figure 1: Occupancy Single Hop

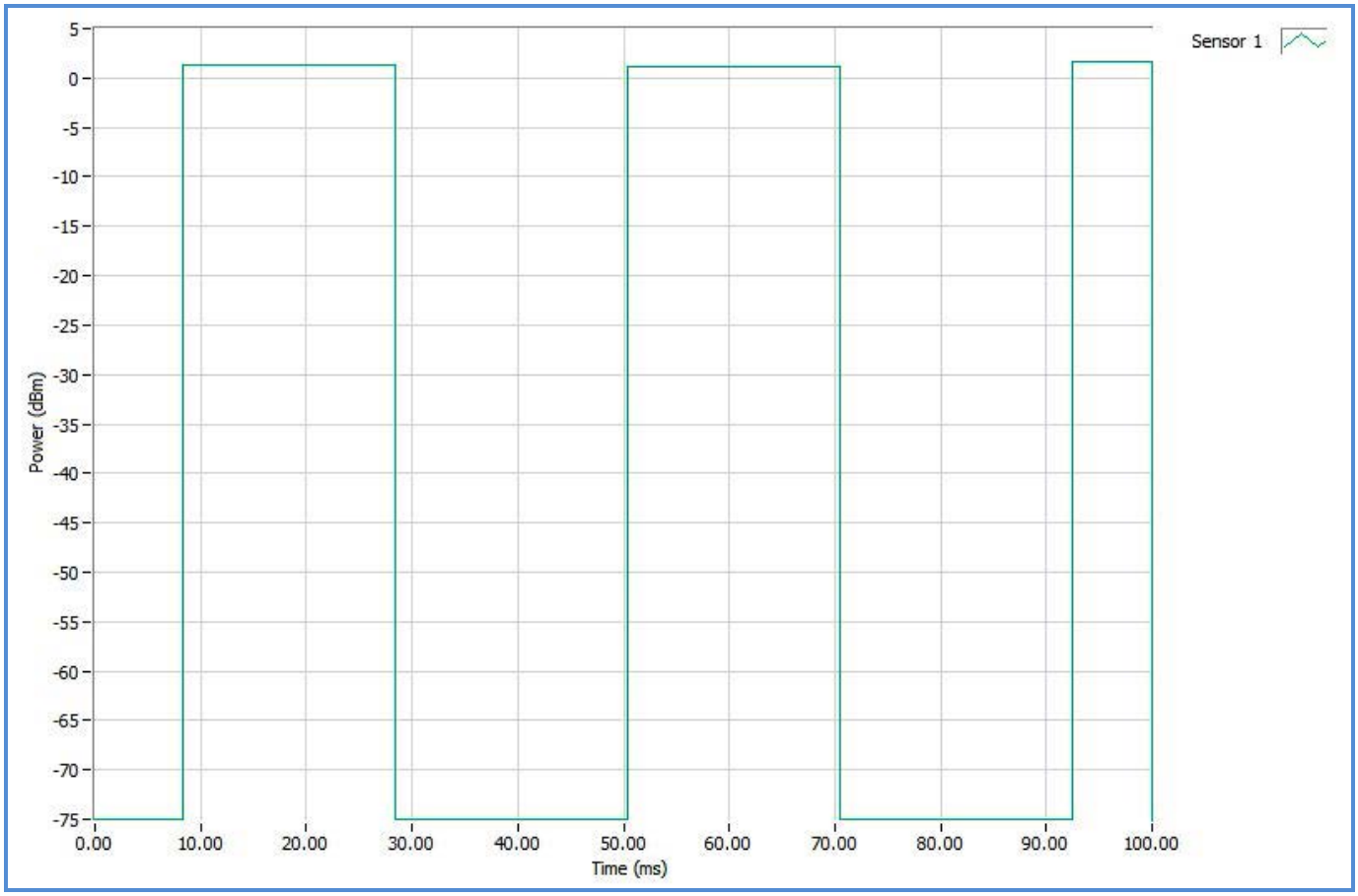

Figure 2: Occupancy per 100ms

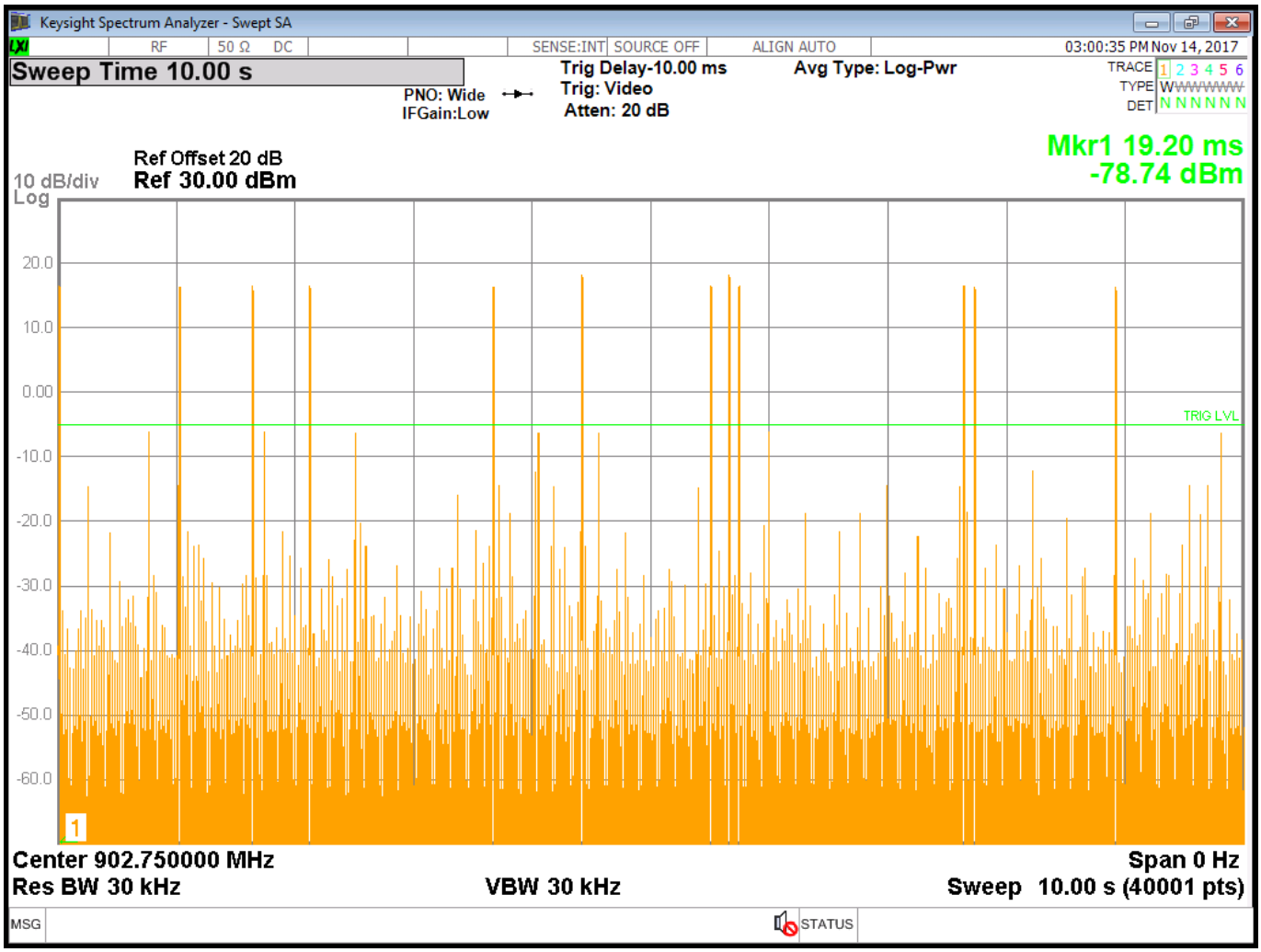

Figure 3: Time of Occupancy

5.2 RF Power Output: (FCC Part §2.1046)

To measure the output power the hopping sequence was stopped while the frequency dwelled on a low, high and Center channel. The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system. The EUT has an adjustable output range. The highest and lowest power available is shown below.

Table 7: RF Power Output

Frequency	Power Setting	Level (dBm)	Limit (dBm)	Pass/Fail
Low Channel: 902.75MHz	High	29.560	30	Pass
Center Channel: 914.75MHz	High	29.540	30	Pass
High Channel: 927.25MHz	High	29.380	30	Pass
Low Channel: 902.75MHz	Low	-7.780	30	Pass
Center Channel: 914.75MHz	Low	-8.210	30	Pass
High Channel: 927.25MHz	Low	-8.680	30	Pass

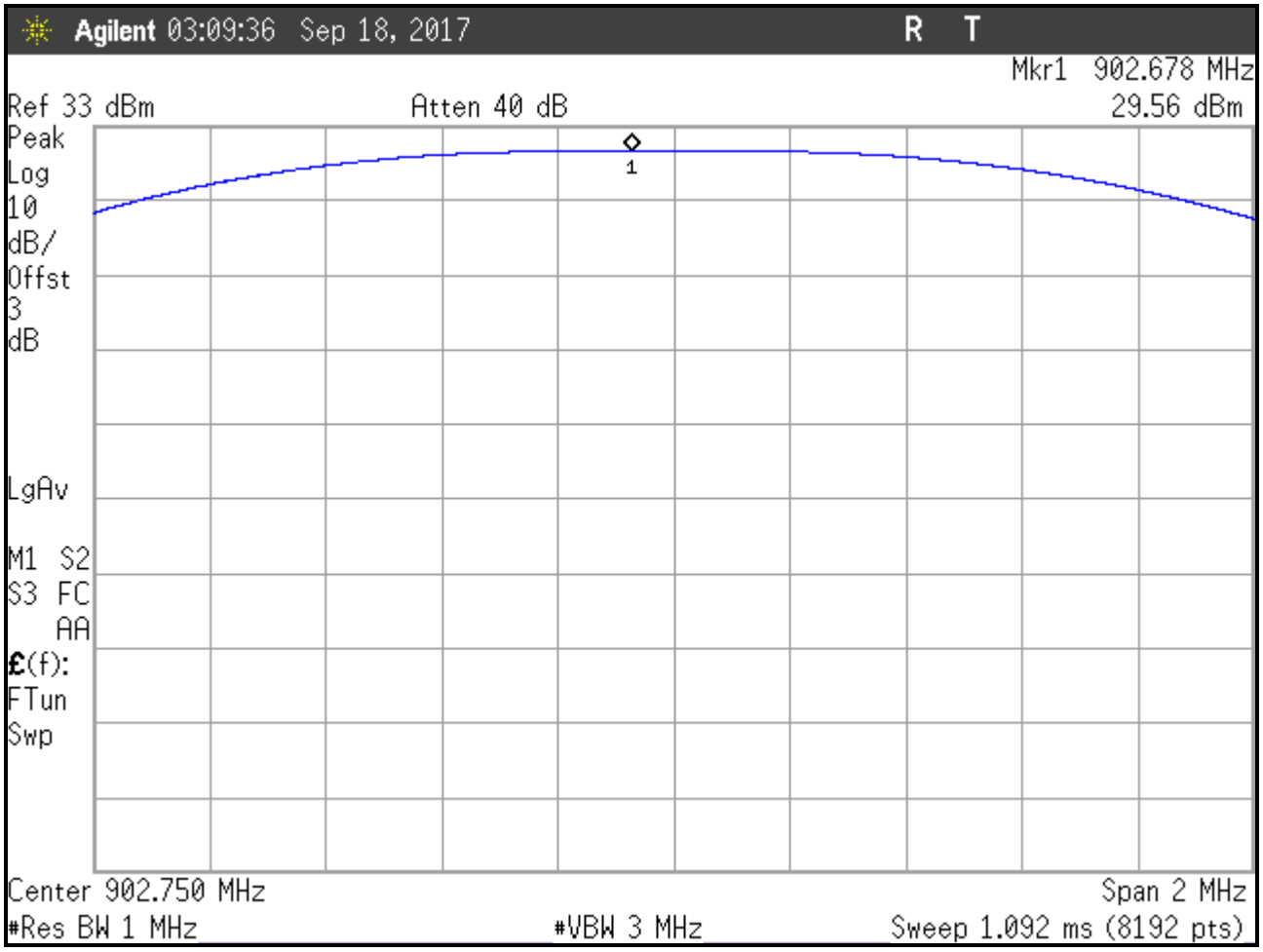

Figure 4: RF Peak Power, High Power, Low Channel

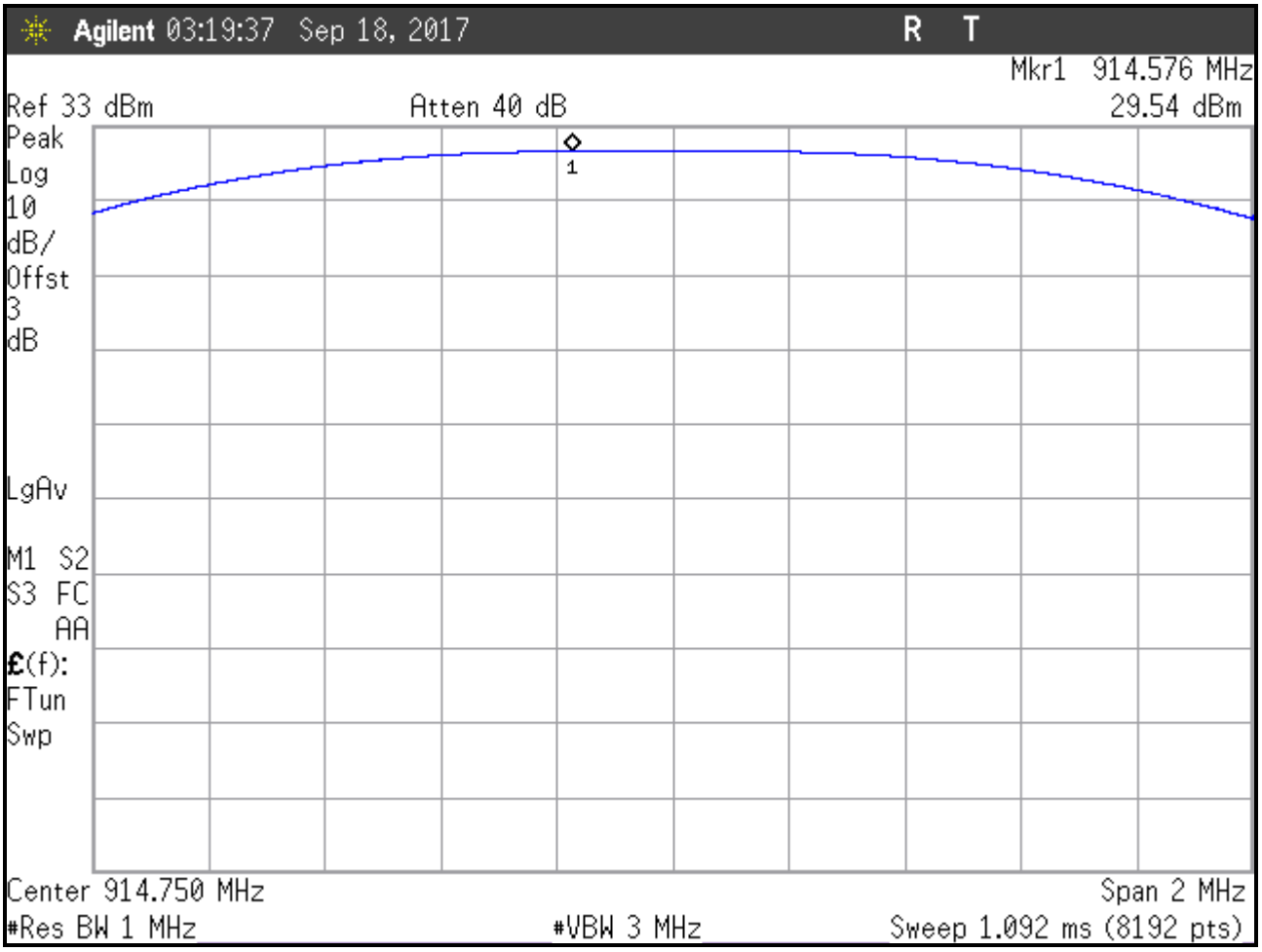

Figure 5: RF Peak Power, High Power, Center Channel

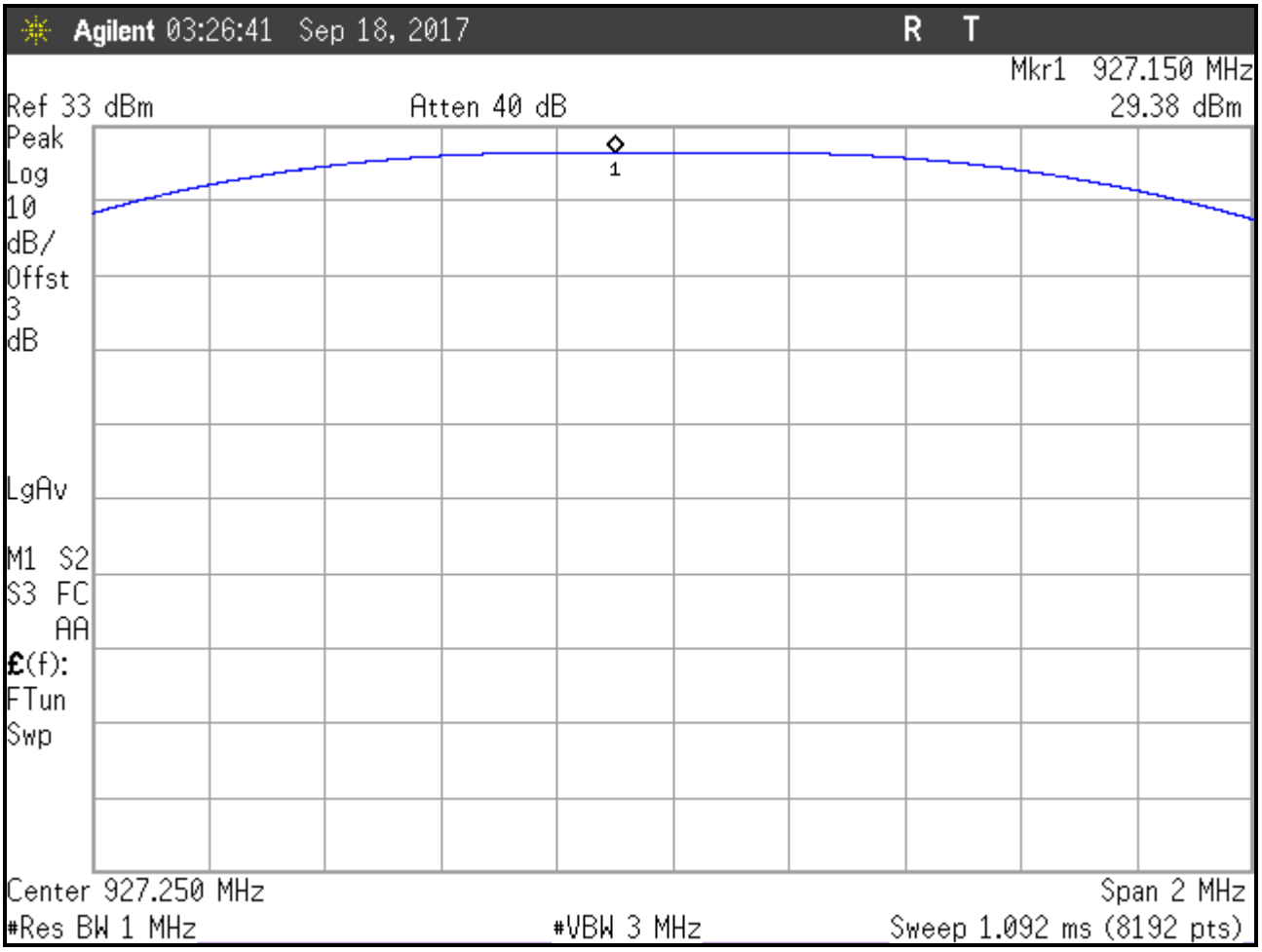

Figure 6: RF Peak Power, High Power, High Channel

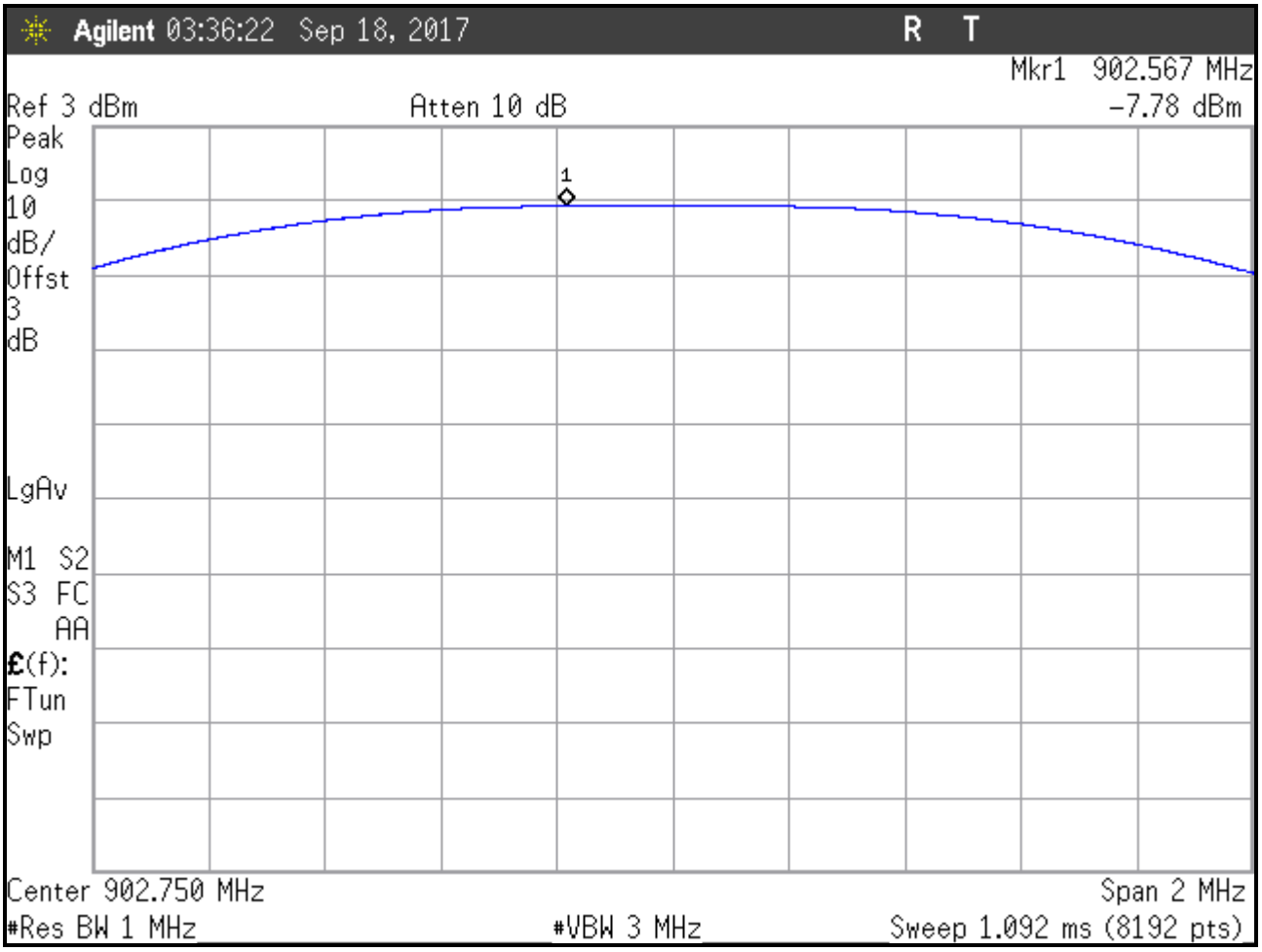

Figure 7: RF Peak Power, Low Power, Low Channel

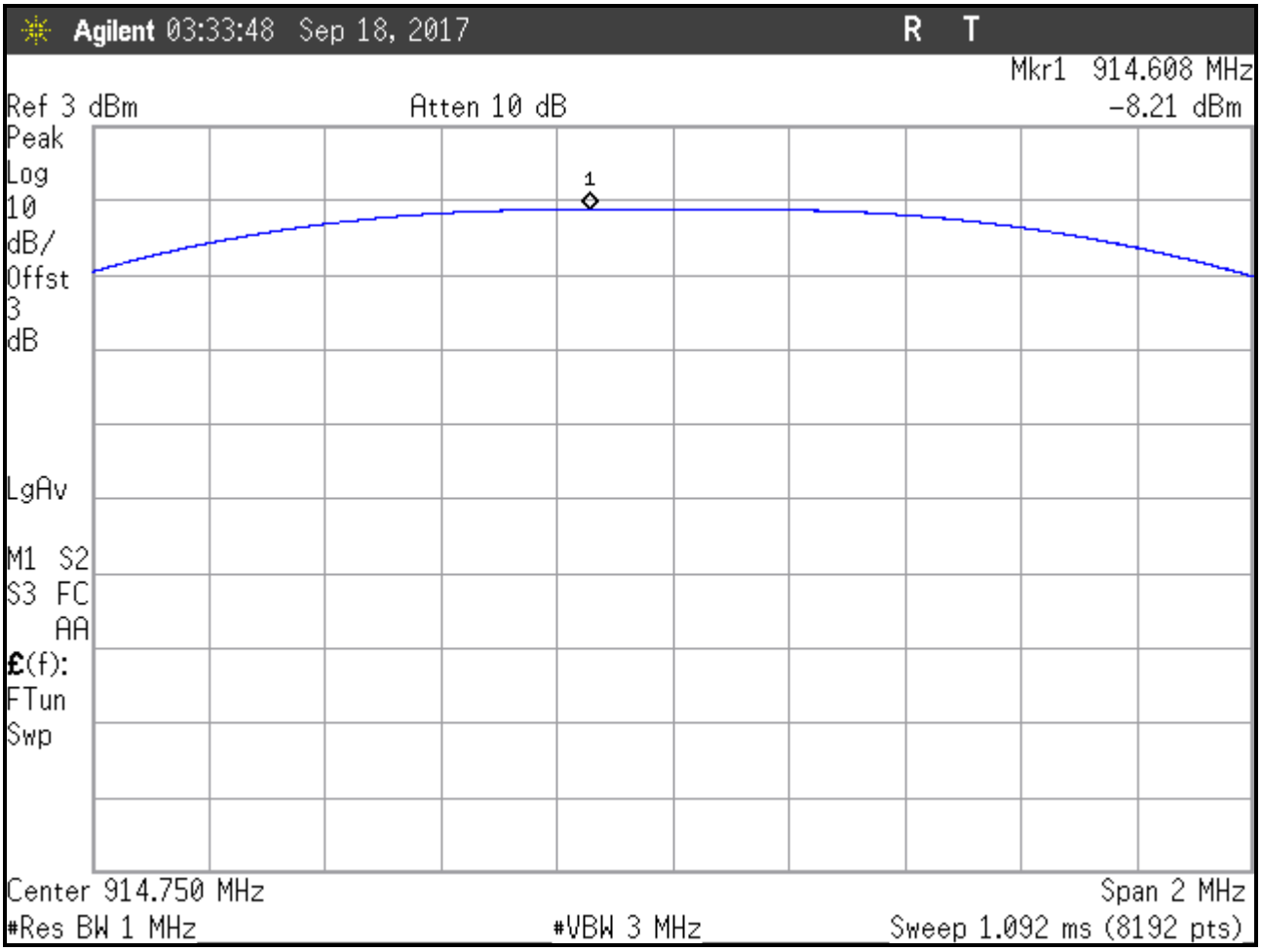

Figure 8: RF Peak Power, Low Power, Center Channel

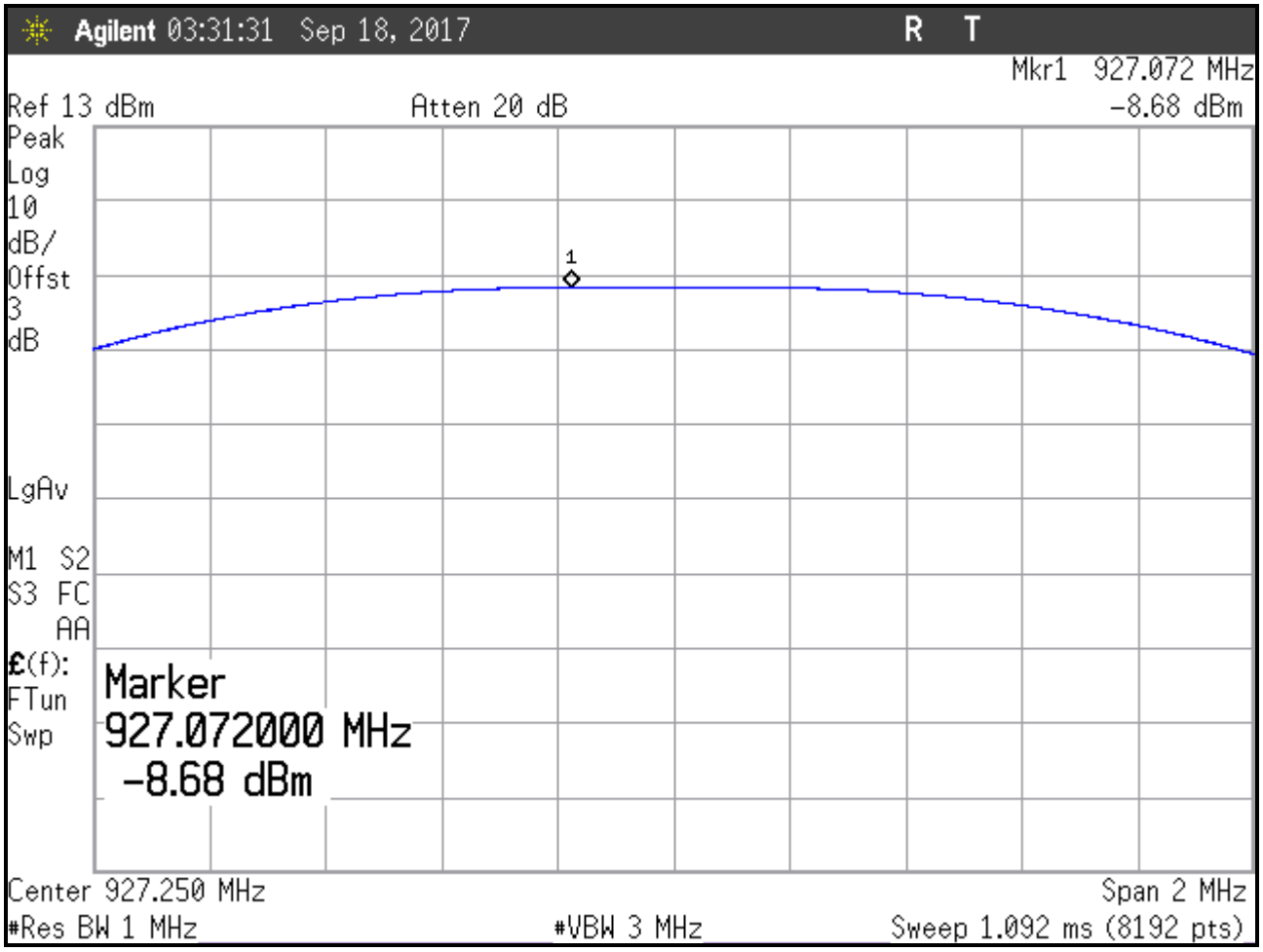

Figure 9: RF Peak Power, Low Power, High Channel

5.3 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer. For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the maximum 20 dB bandwidth not exceed 500 kHz.

The automatic bandwidth measurement capability was employed using the X dB bandwidth mode with X set to 6 dB, (i.e., RBW = 10 kHz, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. Care was taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6dB. At full modulation, the occupied bandwidth was measured and is summarized in Table 8 for the available data rates. Figures 10-12 provide a sample of the occupied bandwidth measurements for the highest data rate

Table 8: Occupied Bandwidth Results

Data Rate: 153.6kbps	20dB Bandwidth (kHz)	99% Power Bandwidth(kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	472.8	448.00	500	Pass
Center Channel: 914.75MHz	471.4	444.79	500	Pass
High Channel: 927.25MHz	470.0	443.6	500	Pass

Data Rate: 76.8kbps	20dB Bandwidth (kHz)	99% Power Bandwidth(kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	295.7	300.05	500	Pass
Center Channel: 914.75MHz	274.8	279.93	500	Pass
High Channel: 927.25MHz	291.7	290.04	500	Pass

Data Rate: 38.4kbps	20dB Bandwidth (kHz)	99% Power Bandwidth(kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	273.8	271.01	500	Pass
Center Channel: 914.75MHz	257.9	269.26	500	Pass
High Channel: 927.25MHz	255.9	267.2	500	Pass

Data Rate: 19.2kbps	20dB Bandwidth (kHz)	99% Power Bandwidth(kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	300.7	313.5	500	Pass
Center Channel: 914.75MHz	299.4	310.84	500	Pass
High Channel: 927.25MHz	291.0	307.36	500	Pass

Data Rate: 9.6kbps	20dB Bandwidth (kHz)	99% Power Bandwidth(kHz)	Limit (kHz)	Pass/Fail
Low Channel: 902.75MHz	290.1	300.29	500	Pass
Center Channel: 914.75MHz	288.3	298.99	500	Pass
High Channel: 927.25MHz	288.9	304.84	500	Pass

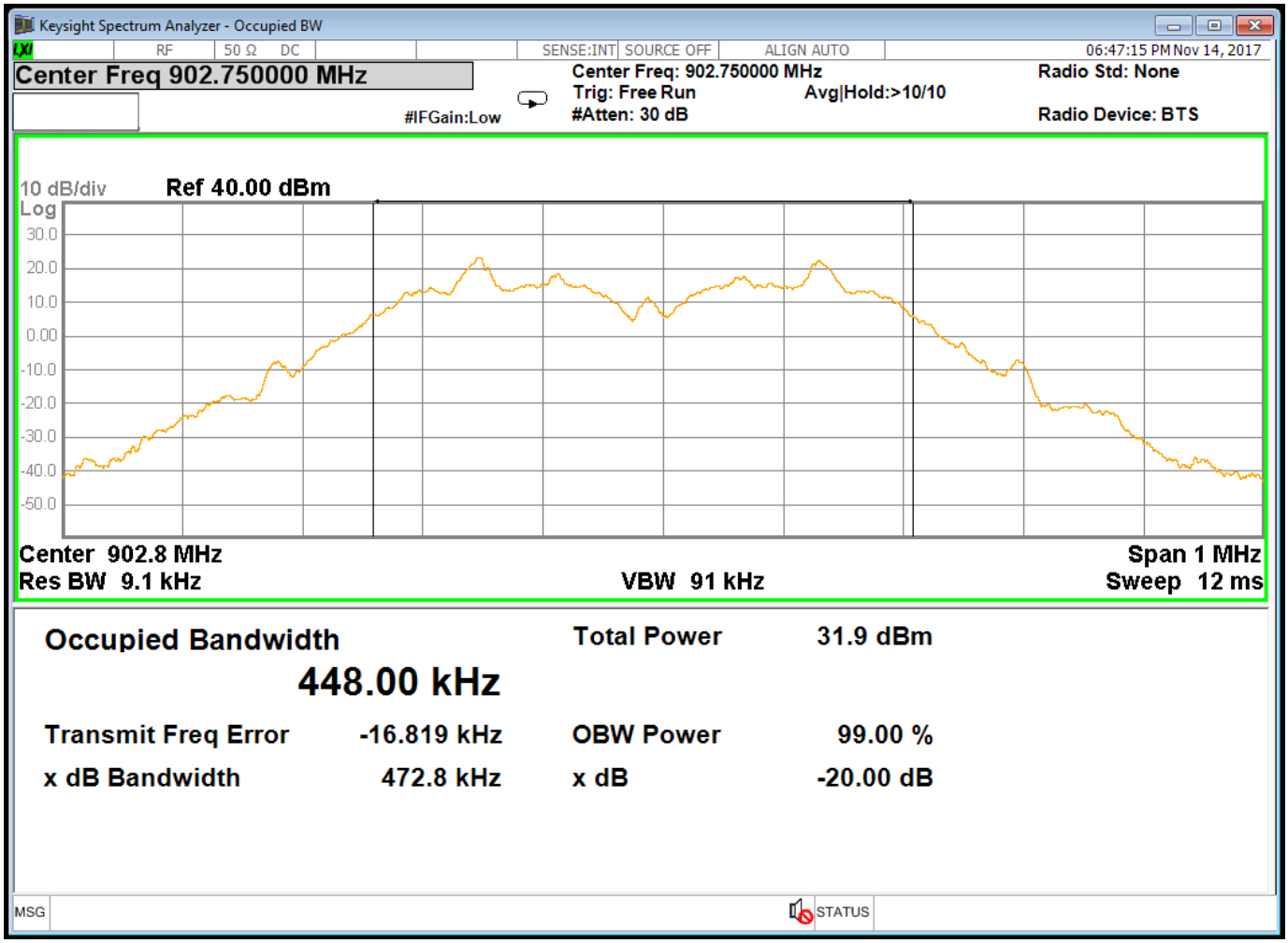

Figure 10: Occupied Bandwidth, Low Channel

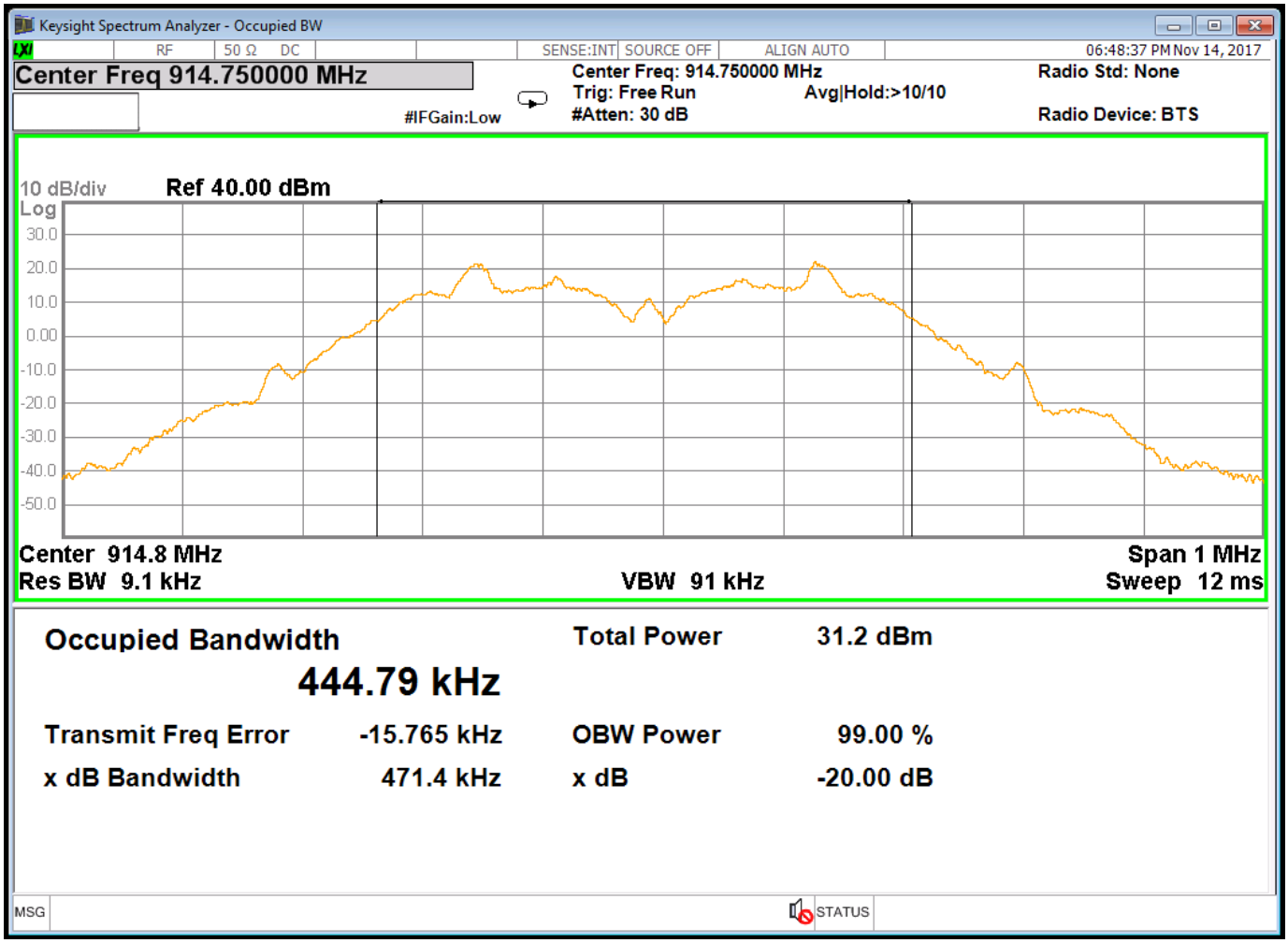

Figure 11: Occupied Bandwidth, Center Channel

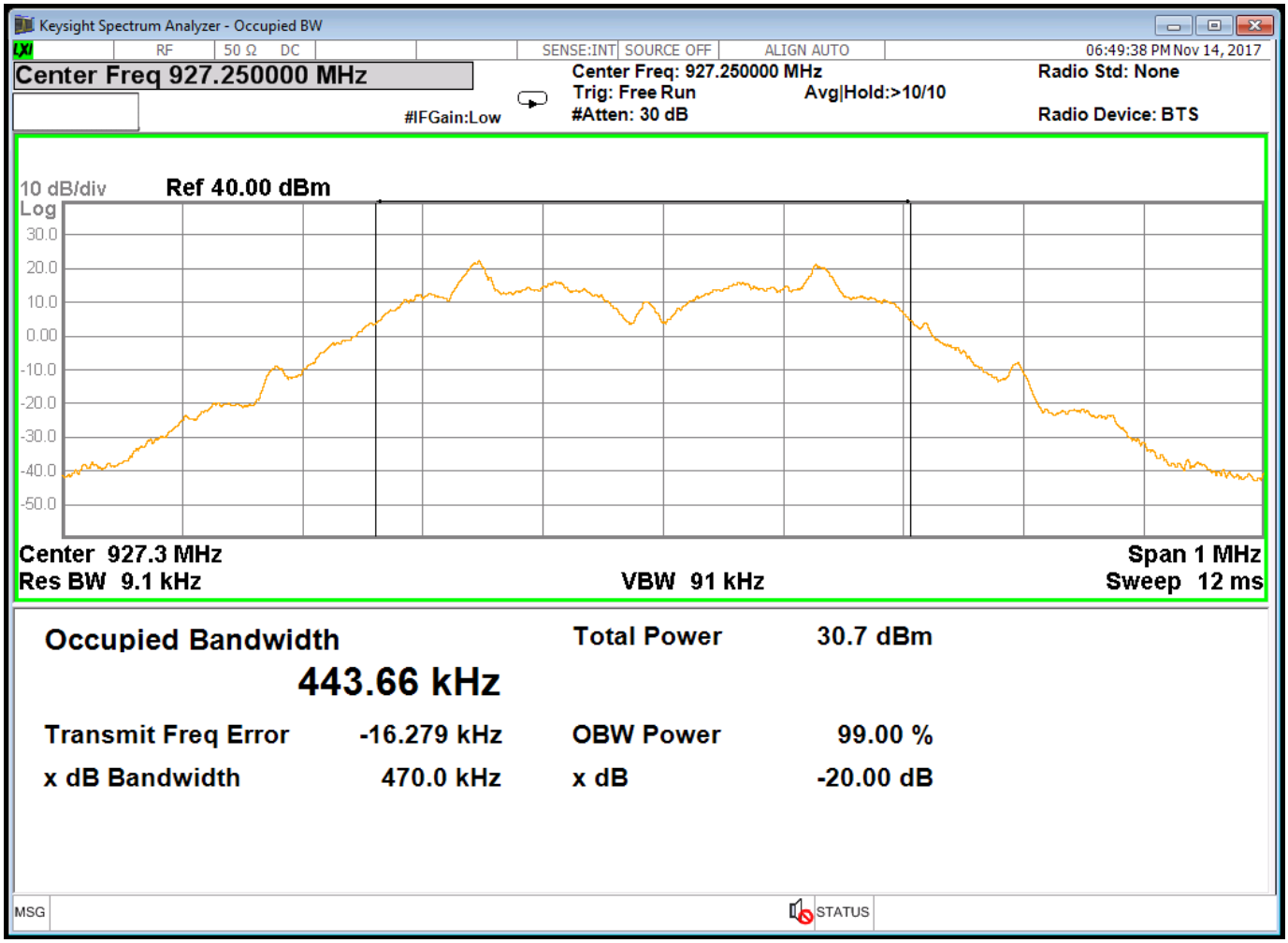

Figure 12: Occupied Bandwidth, High Channel

5.4 Channel Spacing and Number of Hop Channels (FCC Part §15.247(a)(1))

Per the FCC requirements, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth, whichever is greater. The maximum 20dB bandwidth measured is 472.8 kHz so the channel spacing must be more than 472.8 kHz. In addition, for a 902-928MHz transmitter with an occupied bandwidth greater than 250 kHz the minimum number of hopping channels shall be 25.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 20 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 30 kHz and the video bandwidth was set to 100 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 100 kHz. Also, the number of hopping channels was measured from 902-928MHz using a RBW/VBW setting of 30/100 kHz.

The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 492.4 kHz and the number of channels used is 100.

Note: In the following plots each channel is composed of 2 distinct peaks.

Table 9: Channel Spacing and Number of Channels Results

Frequency	Result	Limit	Pass/Fail
Channel Spacing	492.4kHz	472.8kHz Minimum	Pass
Number of channels	50 channels	25 Channels Minimum	Pass

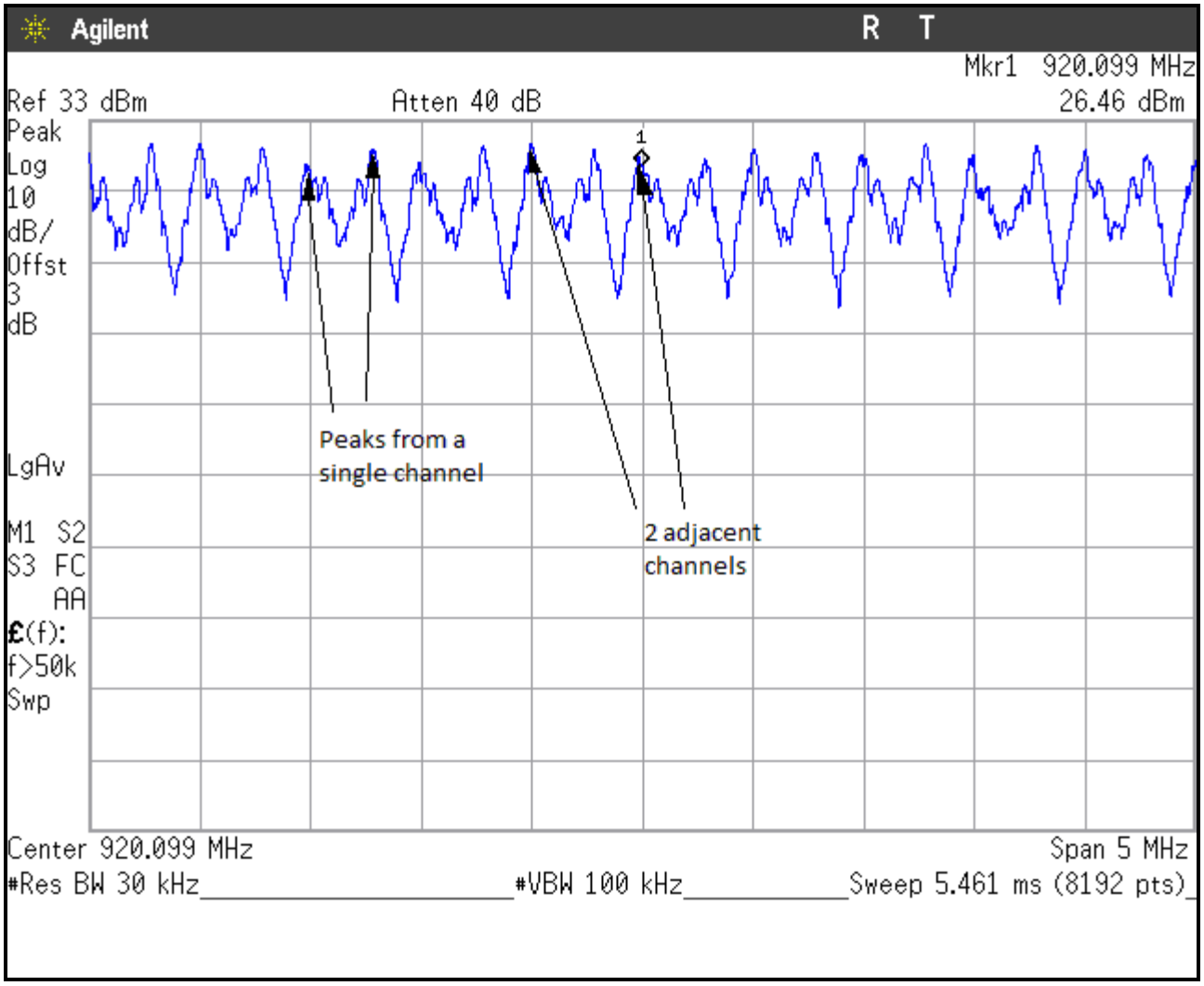

Figure 13: Channel Spacing

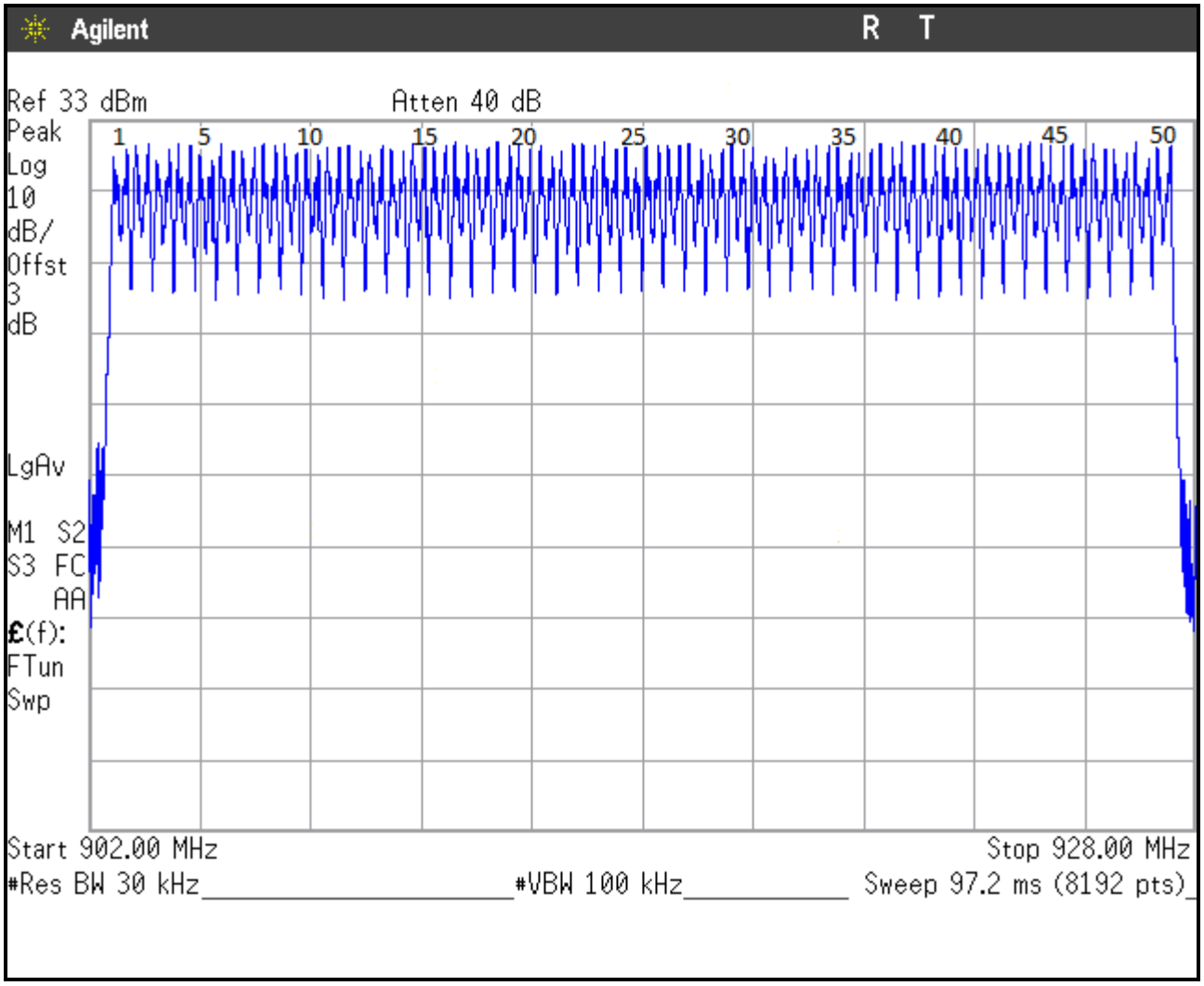

Figure 14: Number of Hopping Channels

5.5 Conducted Spurious Emissions at Antenna Terminals (FCC Part §2.1051)

The EUT must comply with requirements for spurious emissions at antenna terminals. Per §15.247(c) 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.

The EUT antenna was bypassed and the cable was connected directly into a spectrum analyzer through a 3 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. 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.

The following are plots of the conducted spurious emissions data.

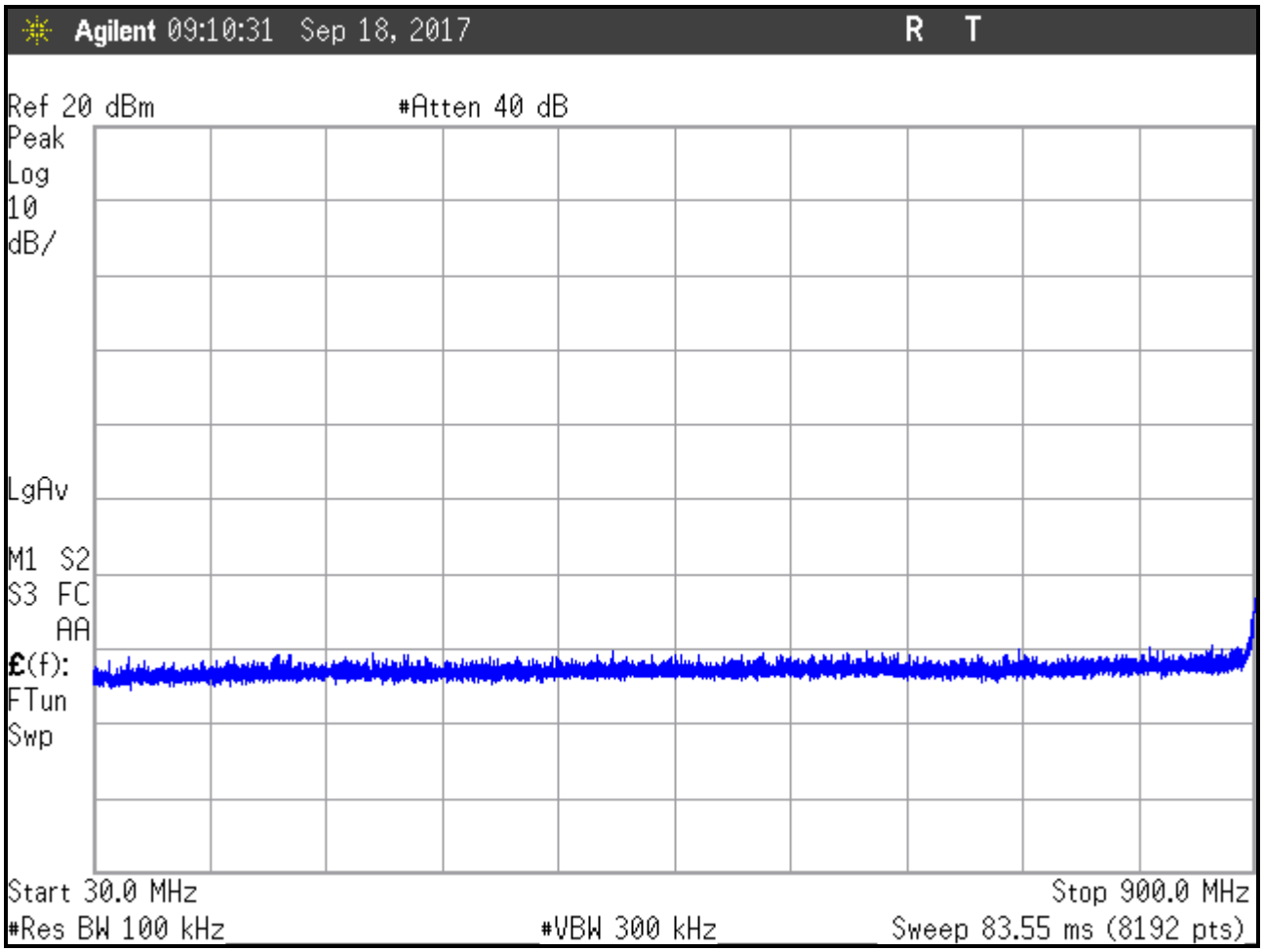

Figure 15: Conducted Spurious Emissions, High Power, Low Channel 30 - 900MHz

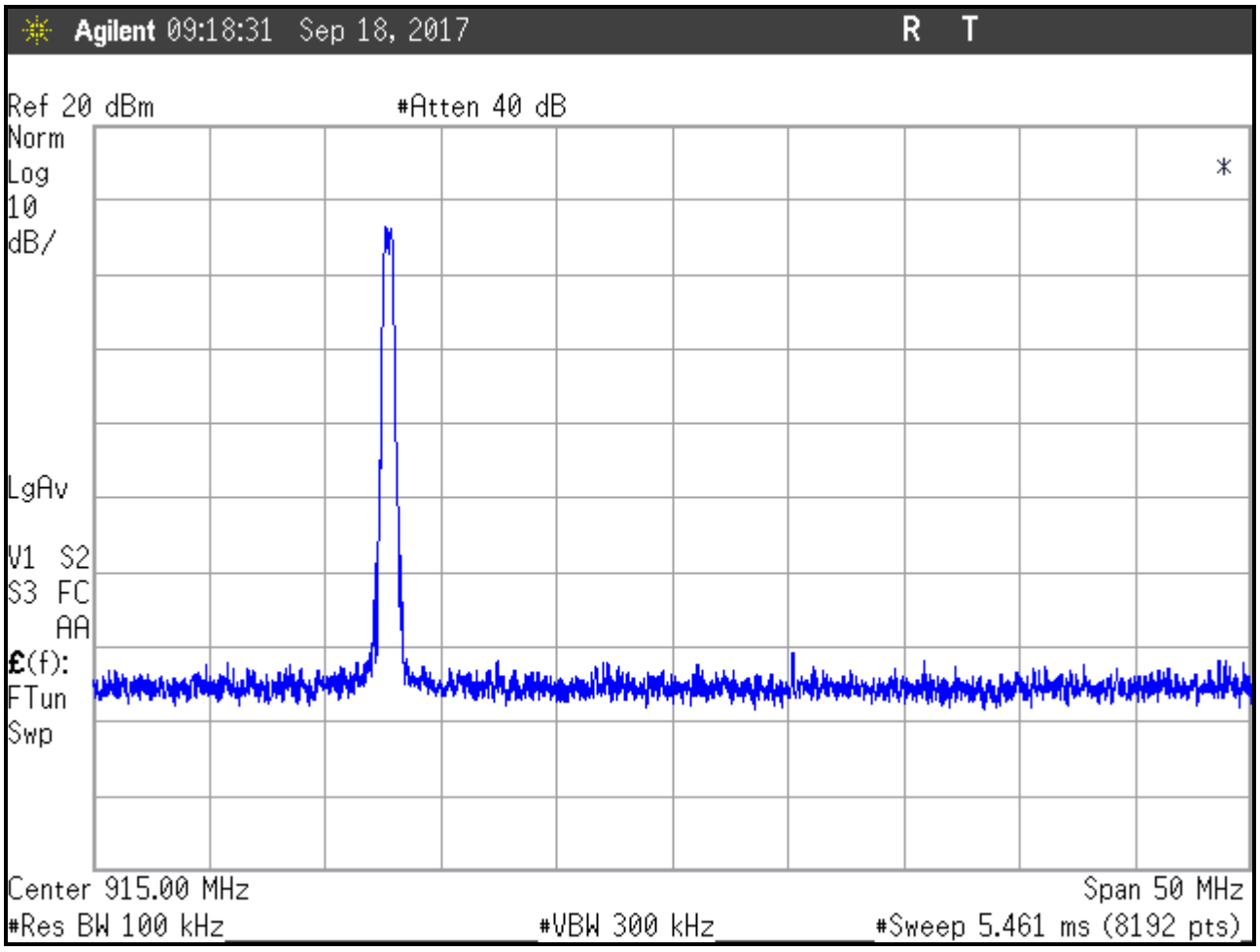

Figure 16: Conducted Spurious Emissions, High Power, Low Channel 900 – 930MHz

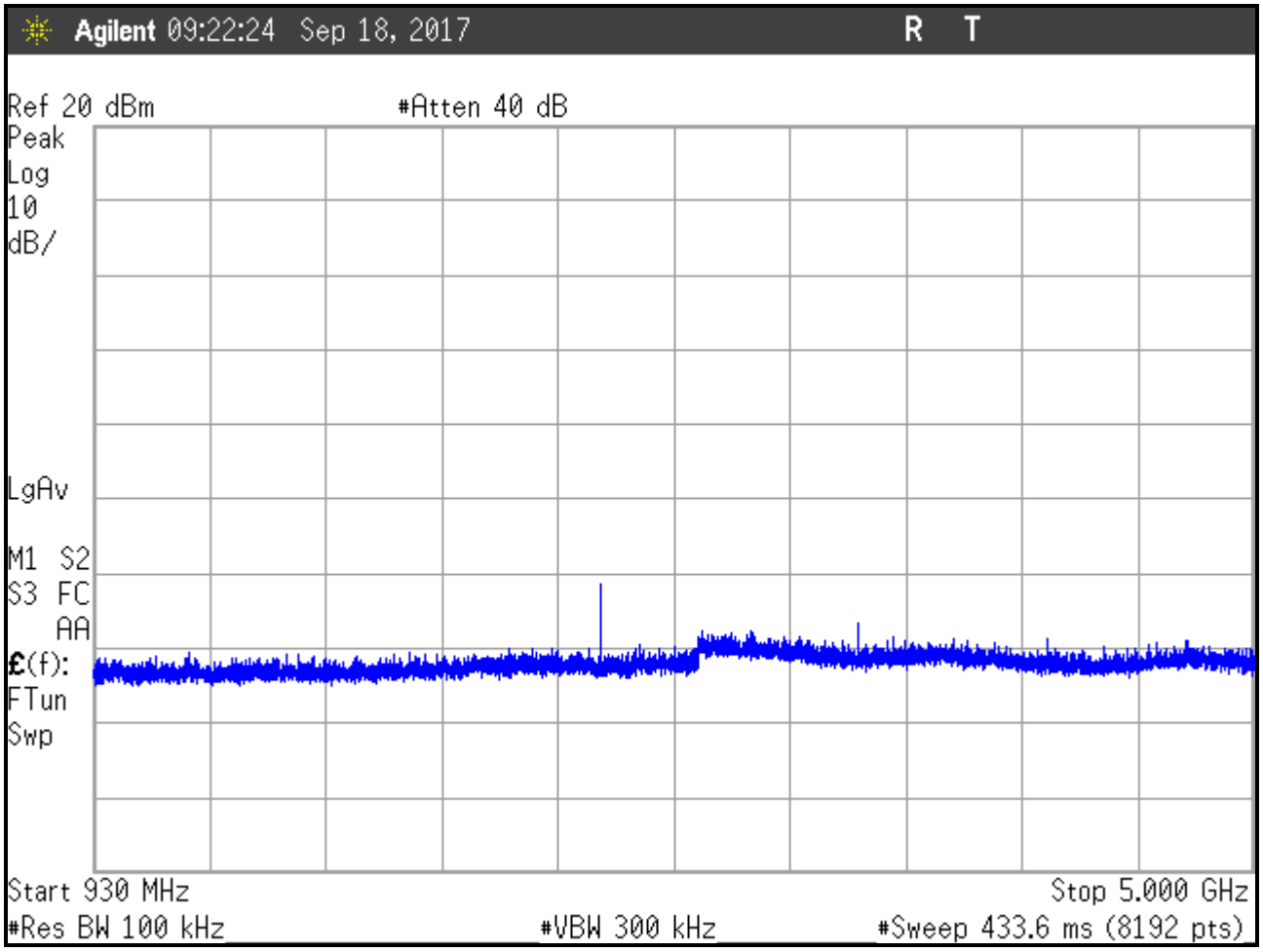

Figure 17: Conducted Spurious Emissions, High Power, Low Channel 930-5000MHz

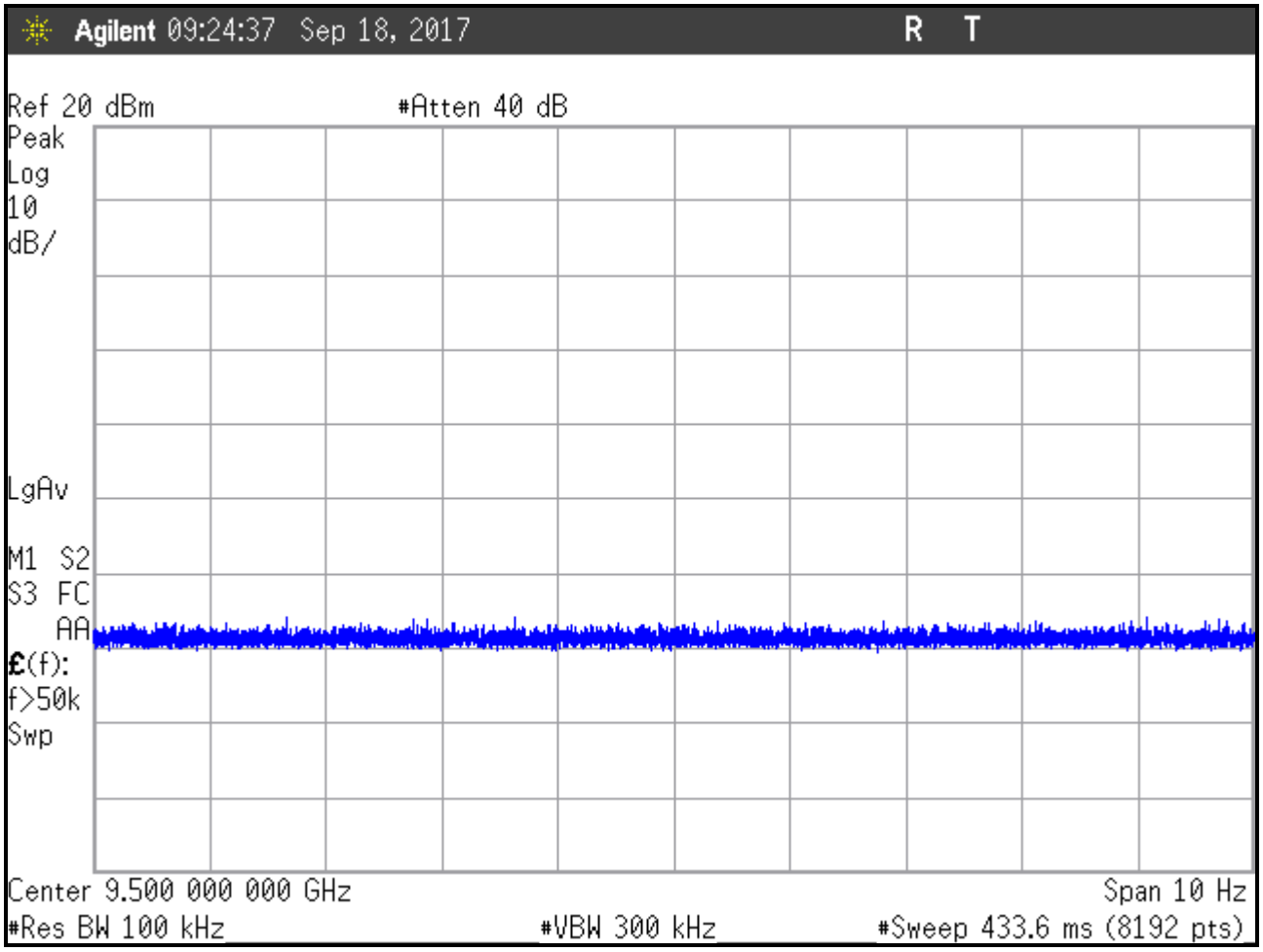

Figure 18: Conducted Spurious Emissions, High Power, Low Channel 5-9.5GHz

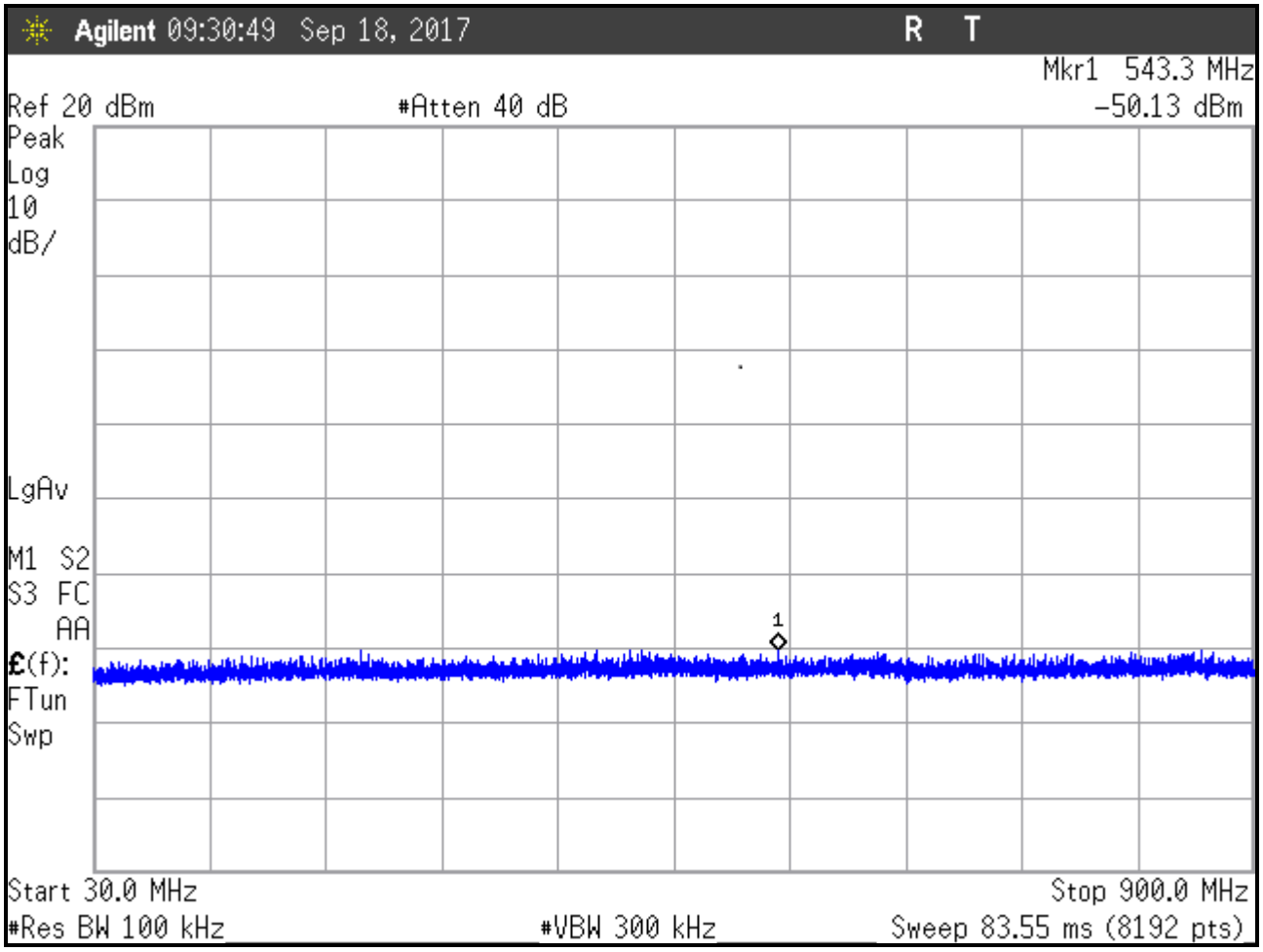

Figure 19: Conducted Spurious Emissions, High Power, Center Channel 30 - 900MHz

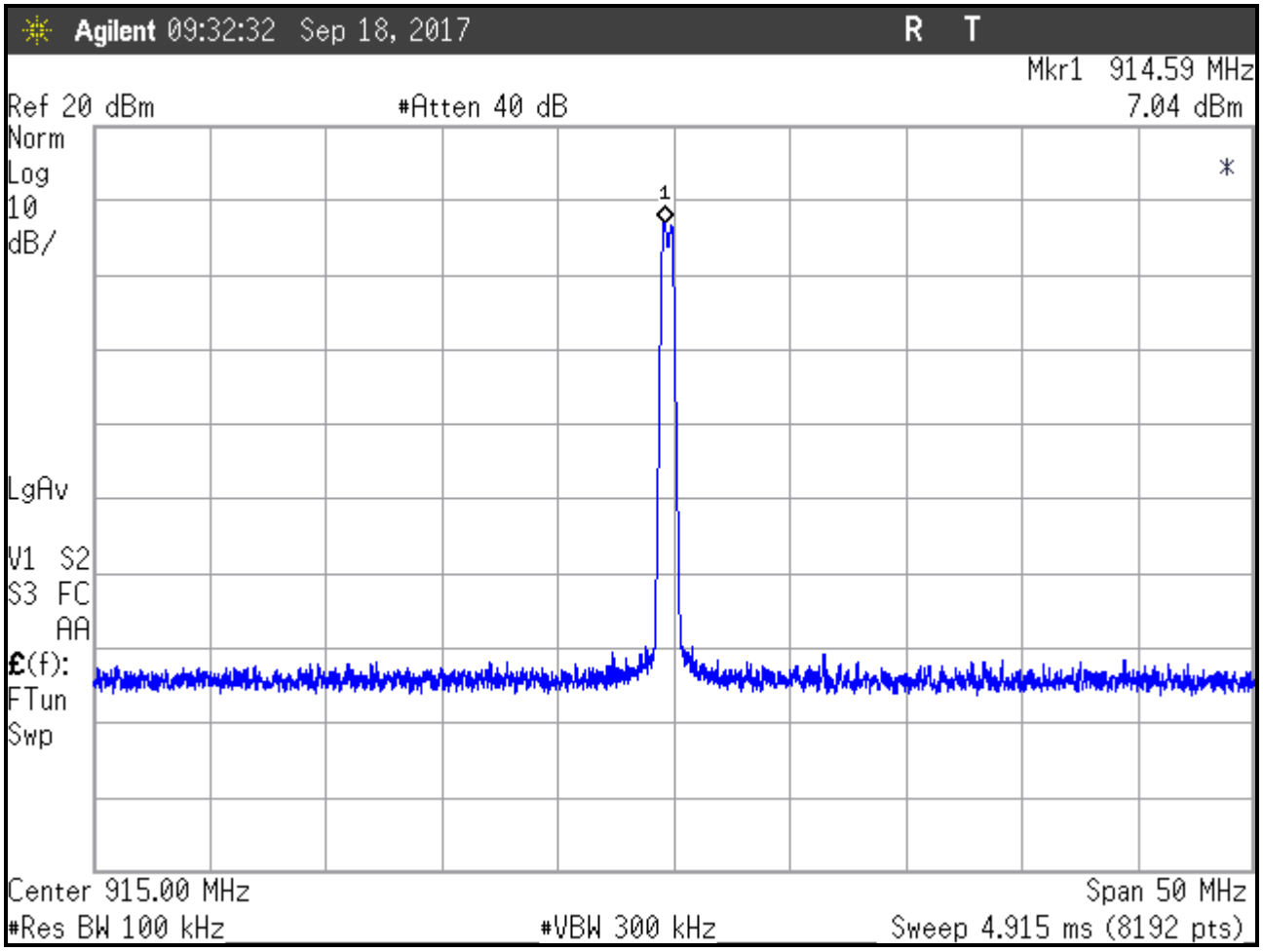

Figure 20: Conducted Spurious Emissions, High Power, Center Channel 900 – 930MHz

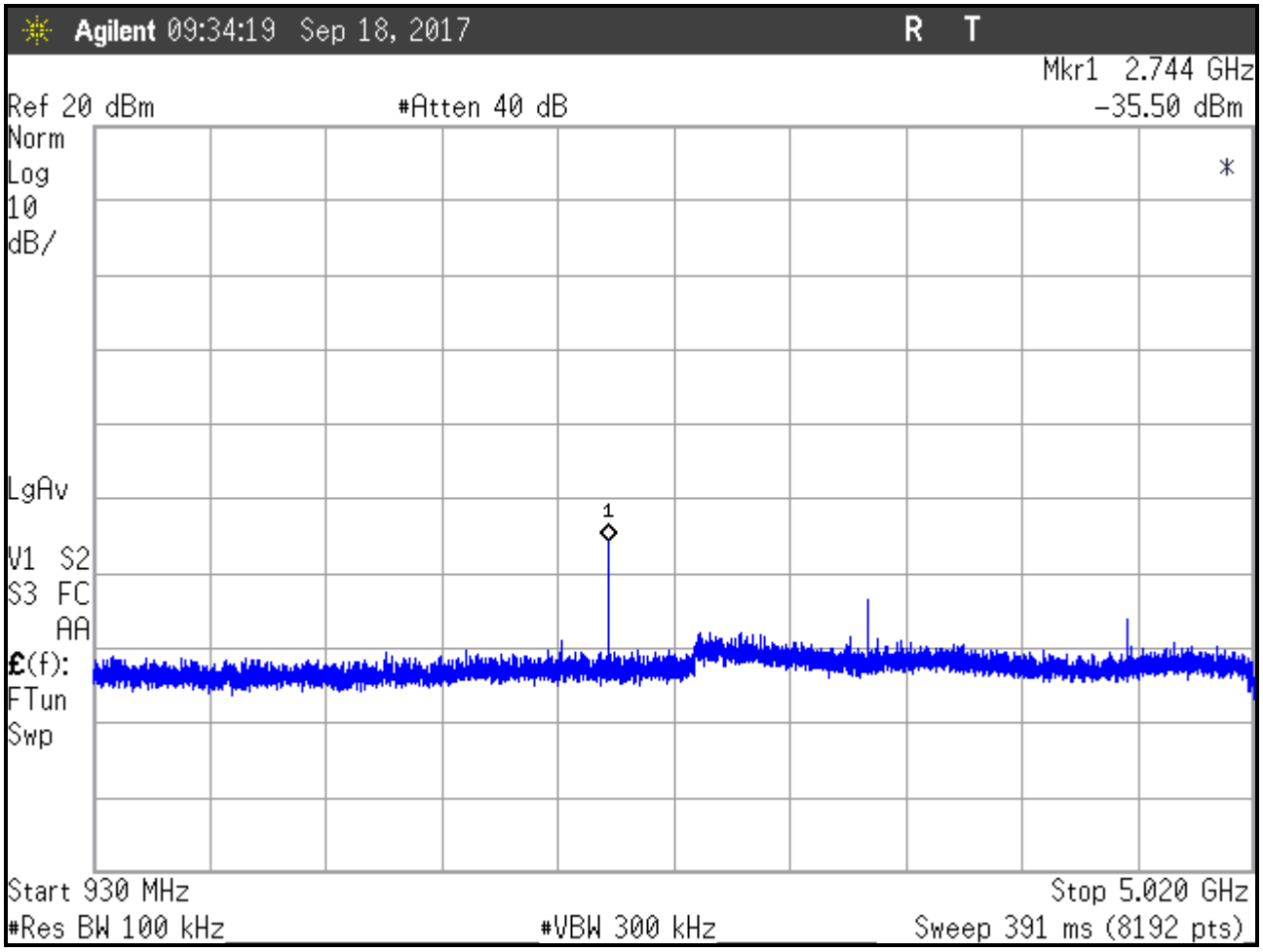

Figure 21: Conducted Spurious Emissions, High Power, Center Channel 930-5000MHz

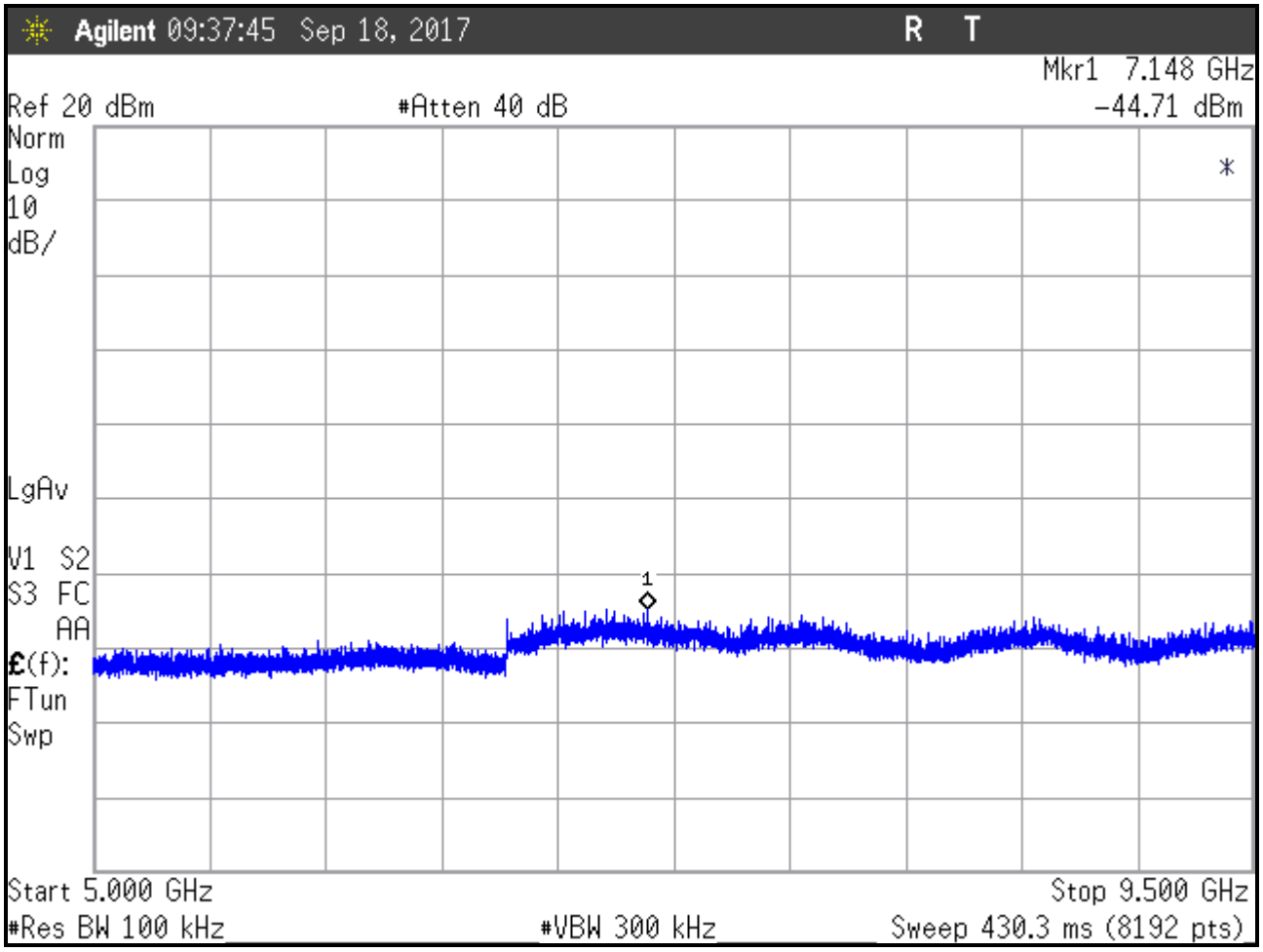

Figure 22: Conducted Spurious Emissions, High Power, Center Channel 5-9.5GHz

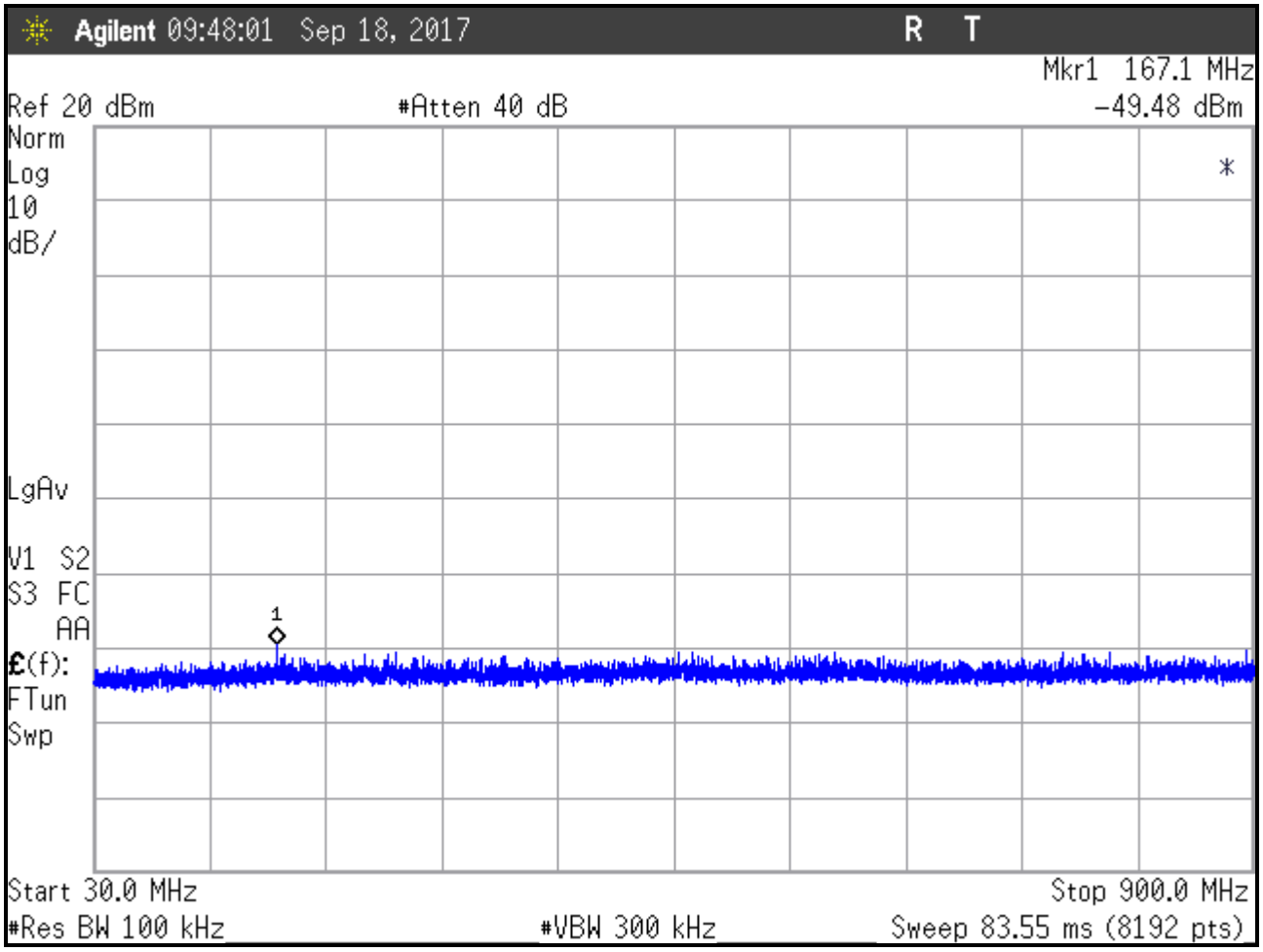

Figure 23: Conducted Spurious Emissions, High Power, High Channel 30 - 900MHz

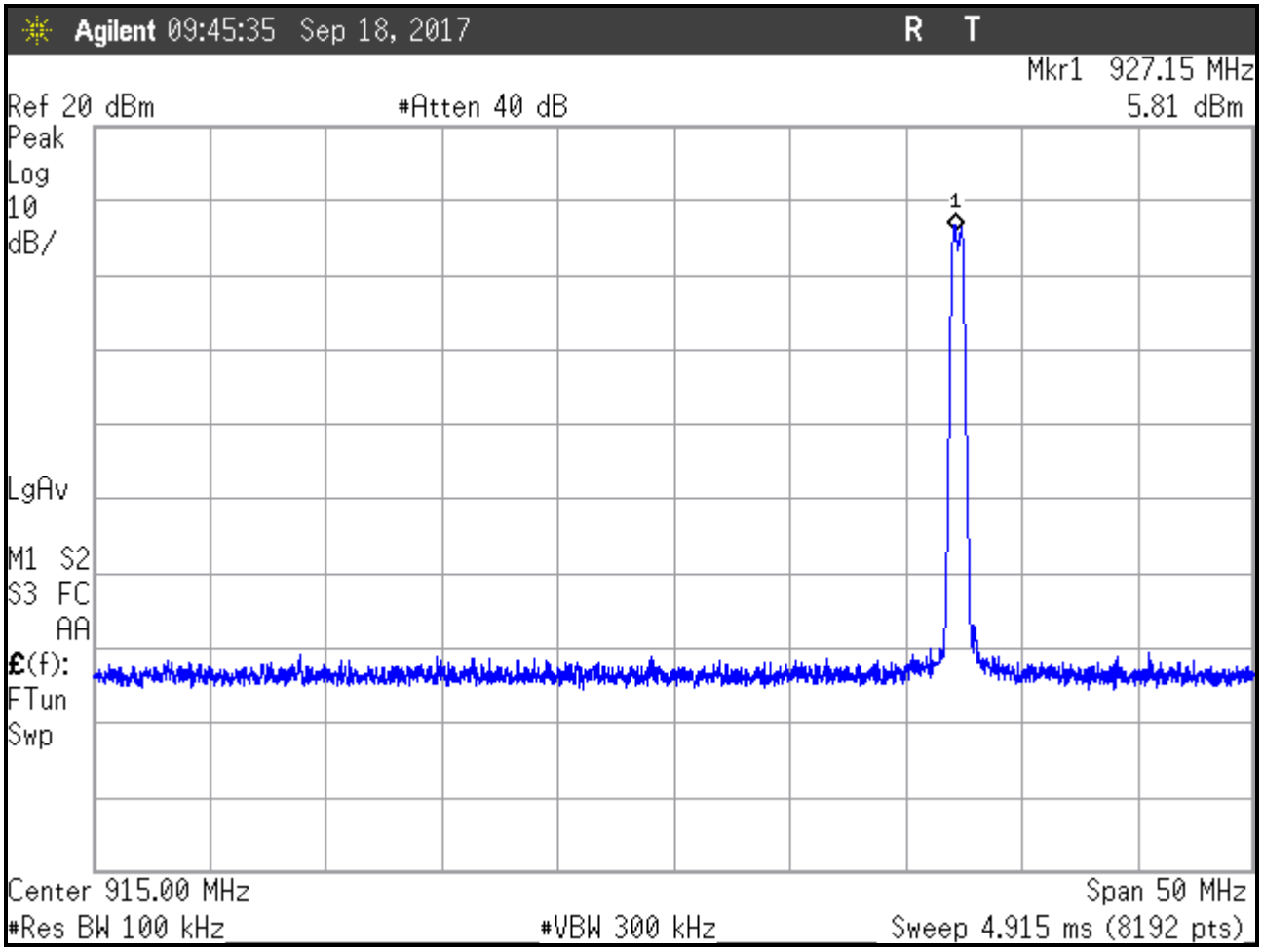

Figure 24: Conducted Spurious Emissions, High Power, High Channel 900 – 930MHz

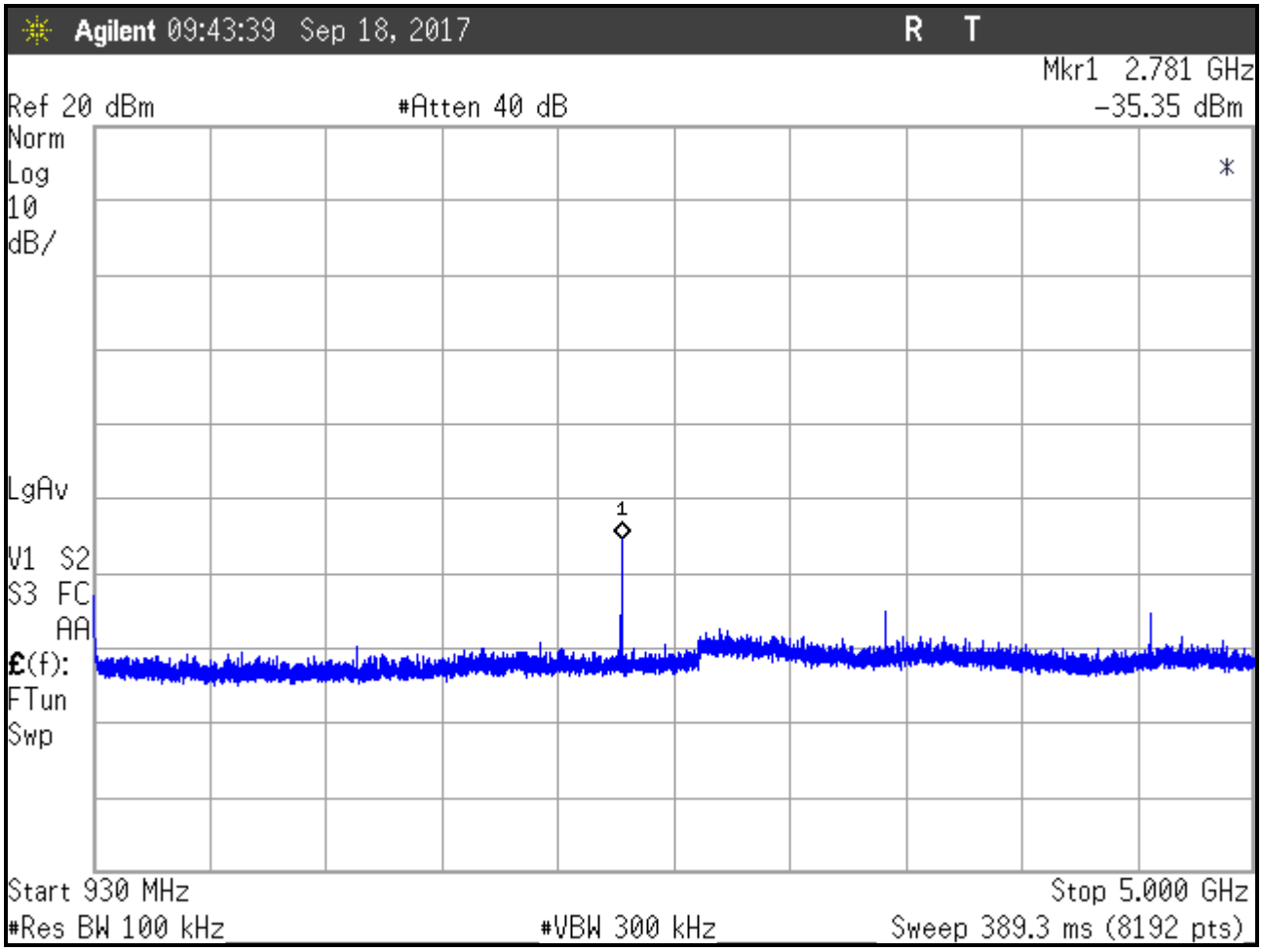

Figure 25: Conducted Spurious Emissions, High Power, High Channel 930-5000MHz

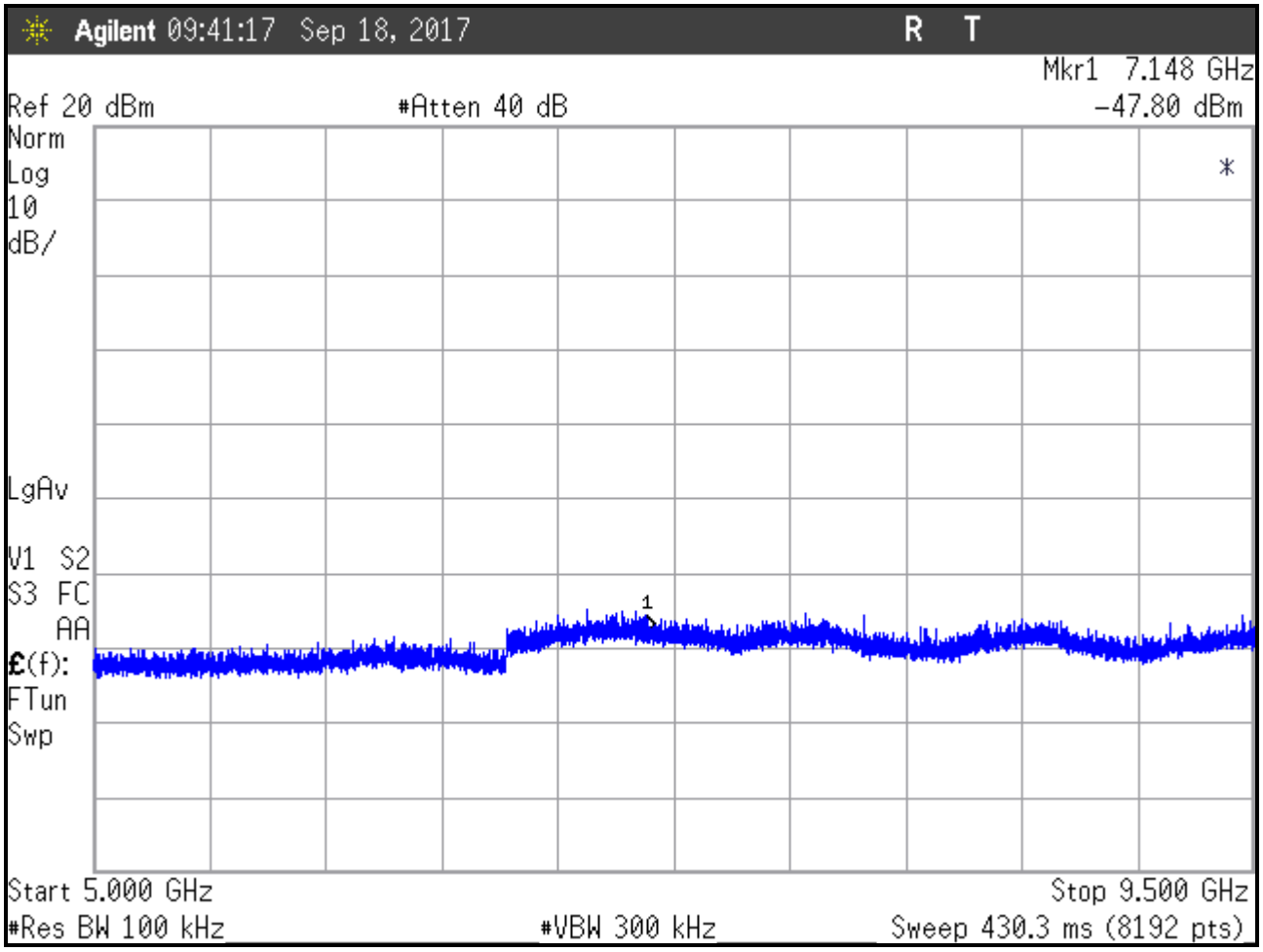

Figure 26: Conducted Spurious Emissions, High Power, High Channel 5-9.5GHz

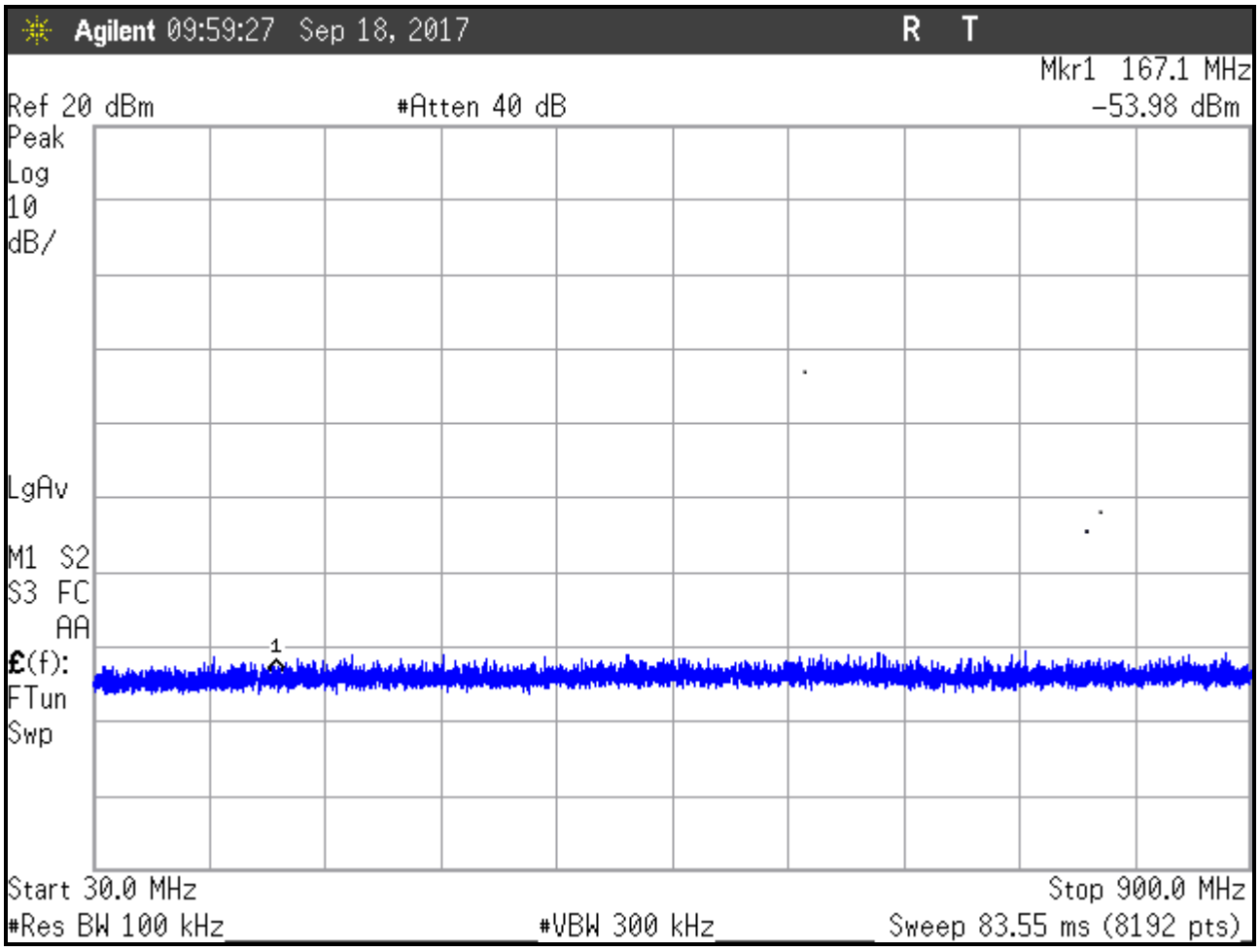

Figure 27: Conducted Spurious Emissions, Low Power, Low Channel 30 - 900MHz

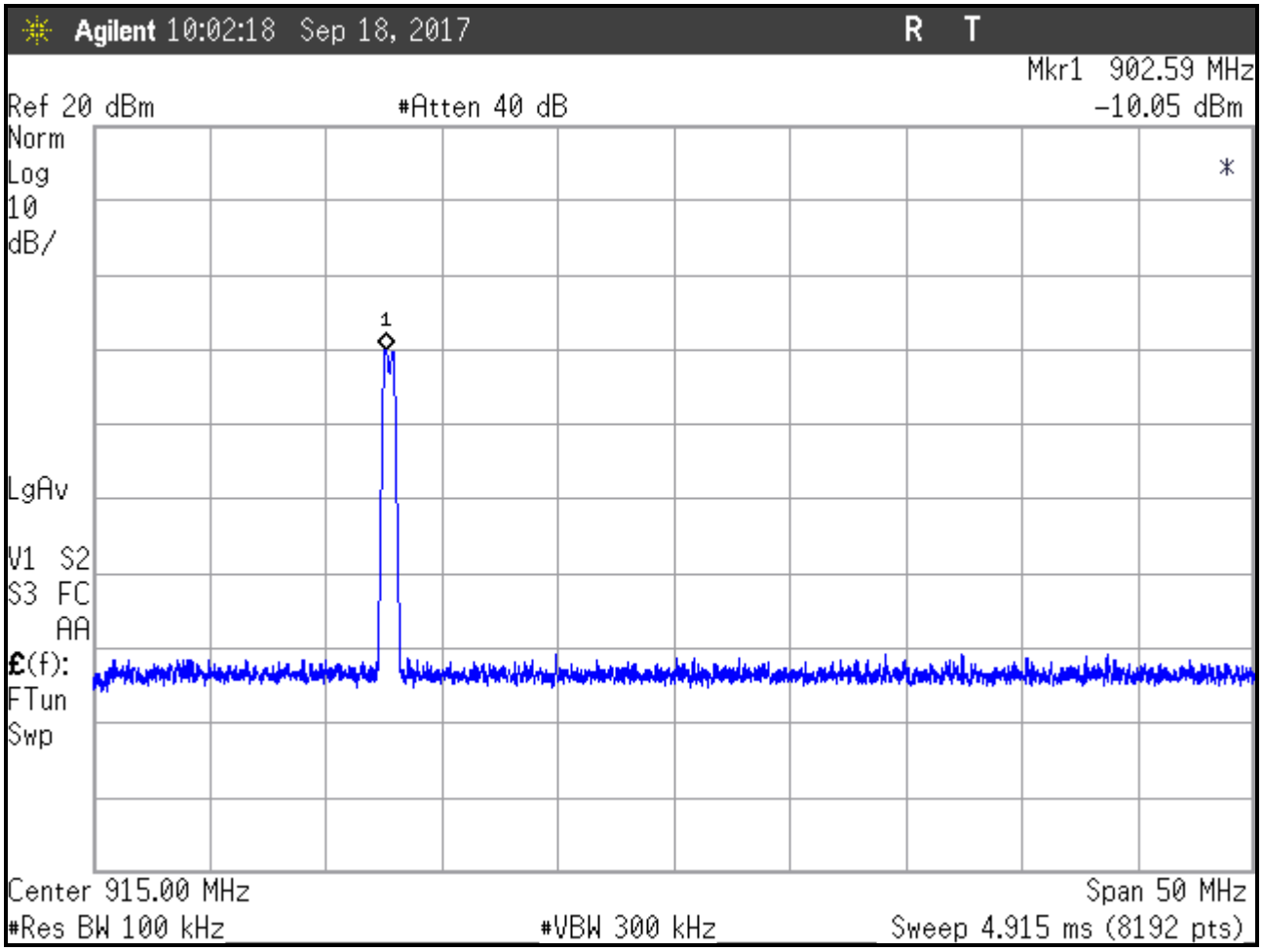

Figure 28: Conducted Spurious Emissions, Low Power, Low Channel 900 – 930MHz

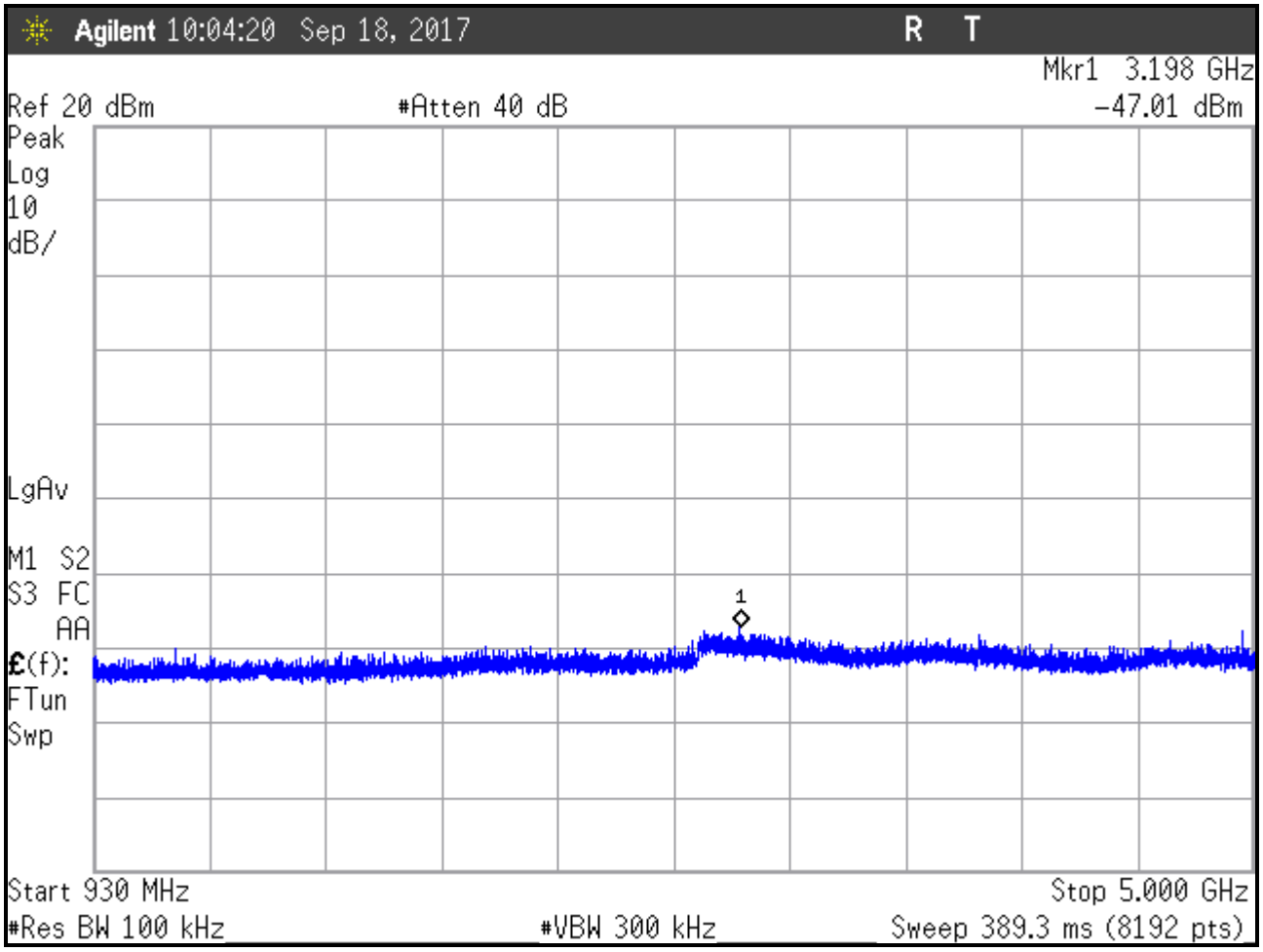

Figure 29: Conducted Spurious Emissions, Low Power, Low Channel 930-5000MHz

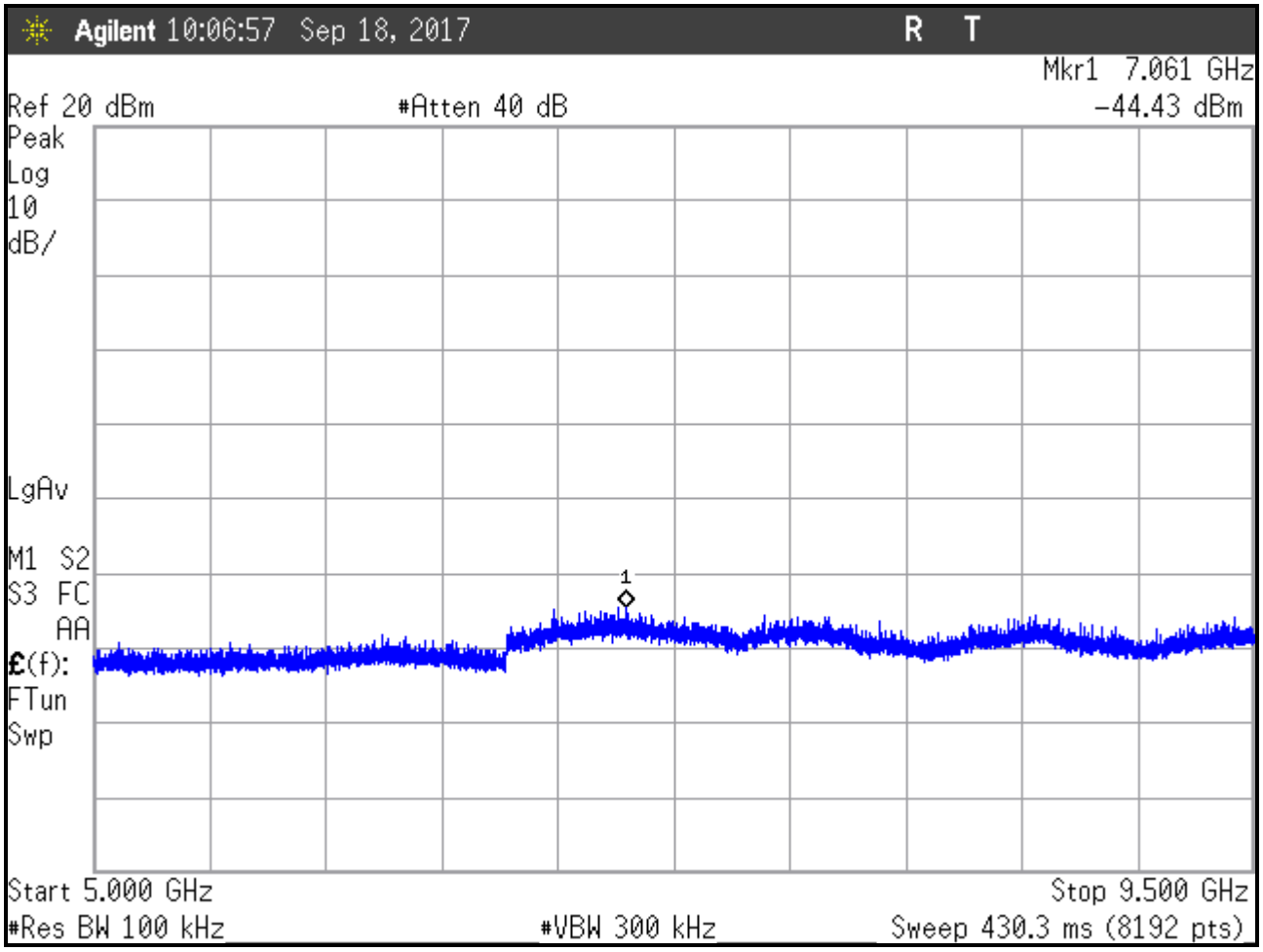

Figure 30: Conducted Spurious Emissions, Low Power, Low Channel 5-9.5GHz

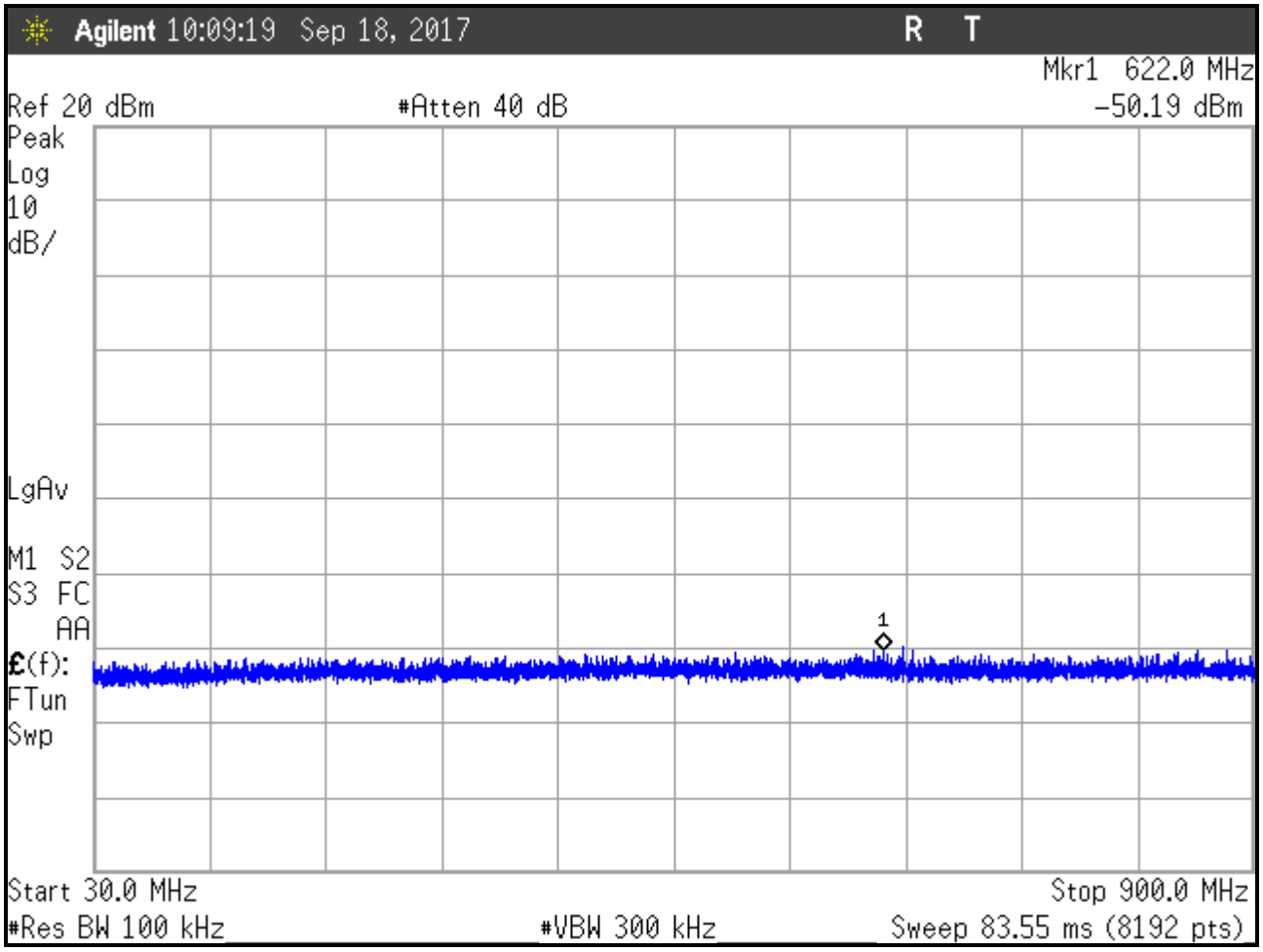

Figure 31: Conducted Spurious Emissions, Low Power, Center Channel 30 - 900MHz

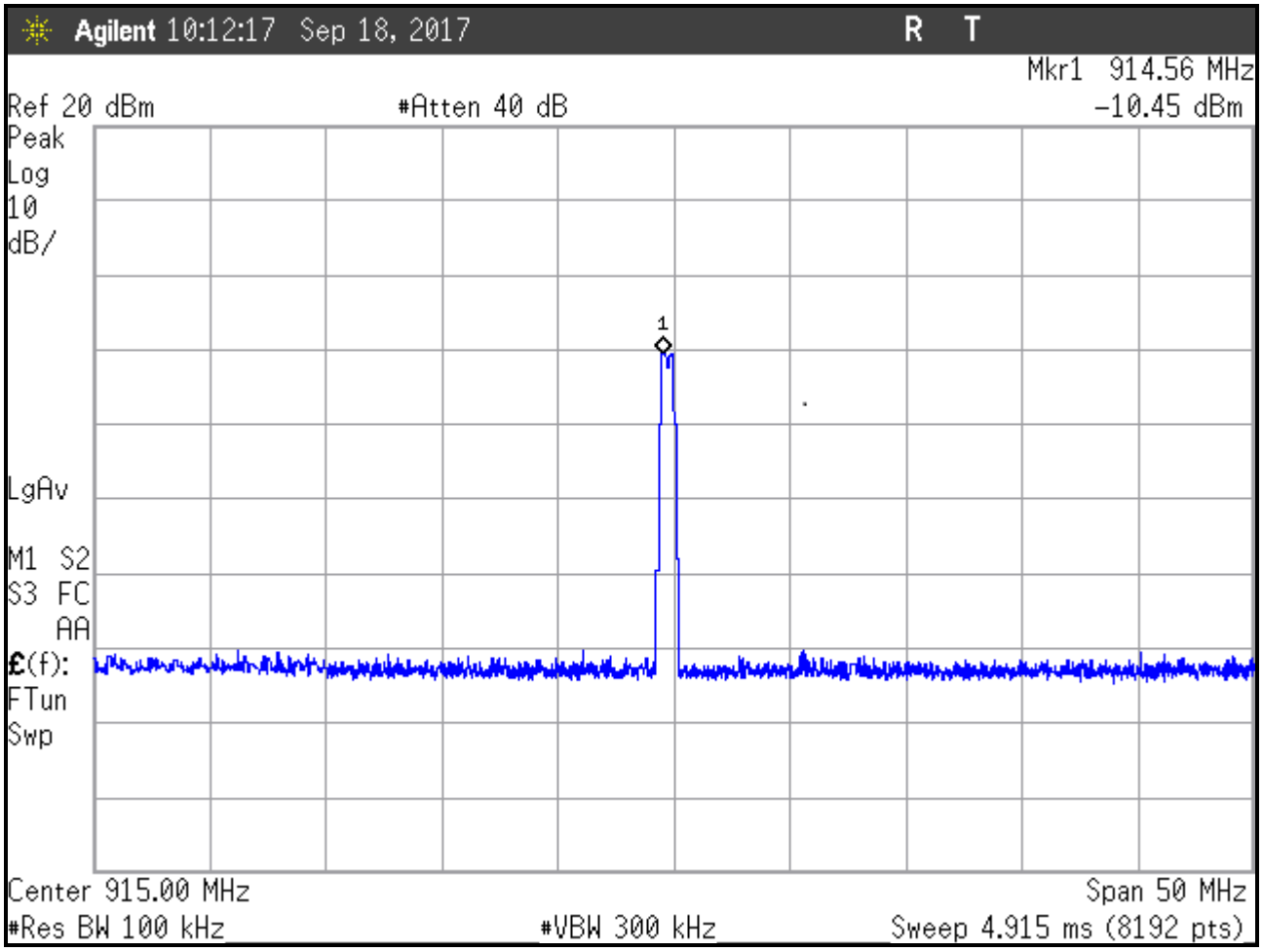

Figure 32: Conducted Spurious Emissions, Low Power, Center Channel 900 – 930MHz

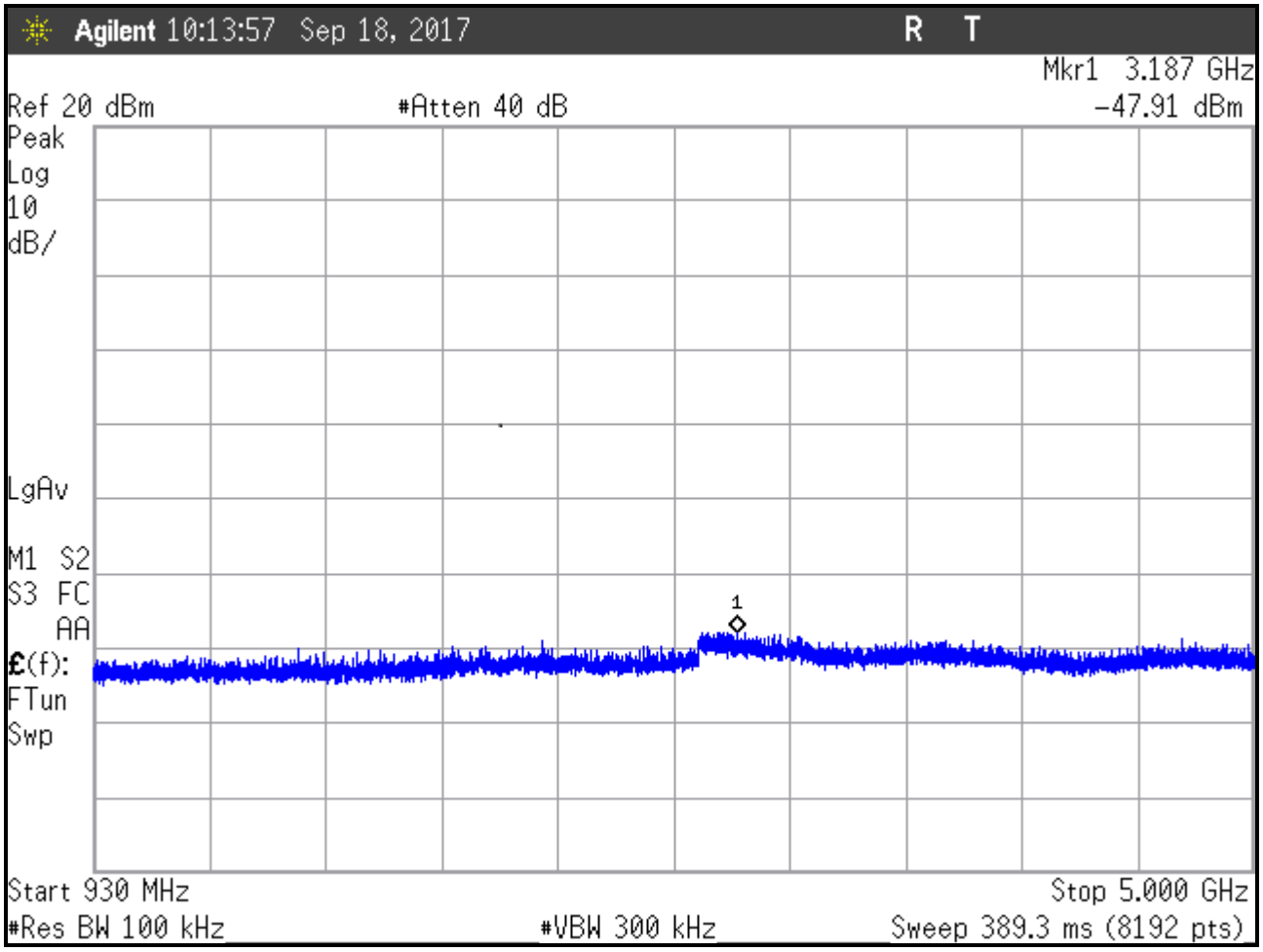

Figure 33: Conducted Spurious Emissions, Low Power, Center Channel 930-5000MHz

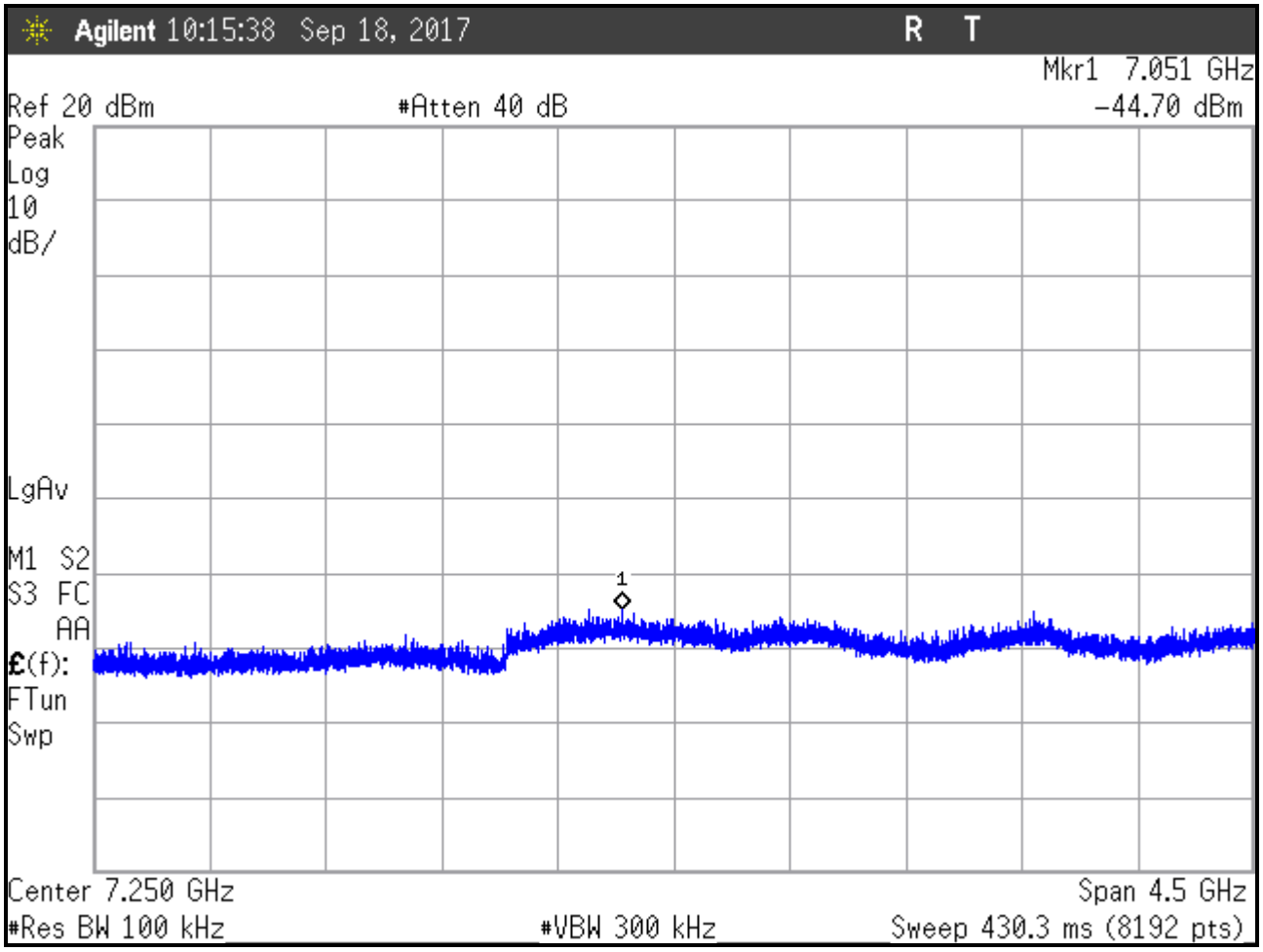

Figure 34: Conducted Spurious Emissions, Low Power, Center Channel 5-9.5GHz

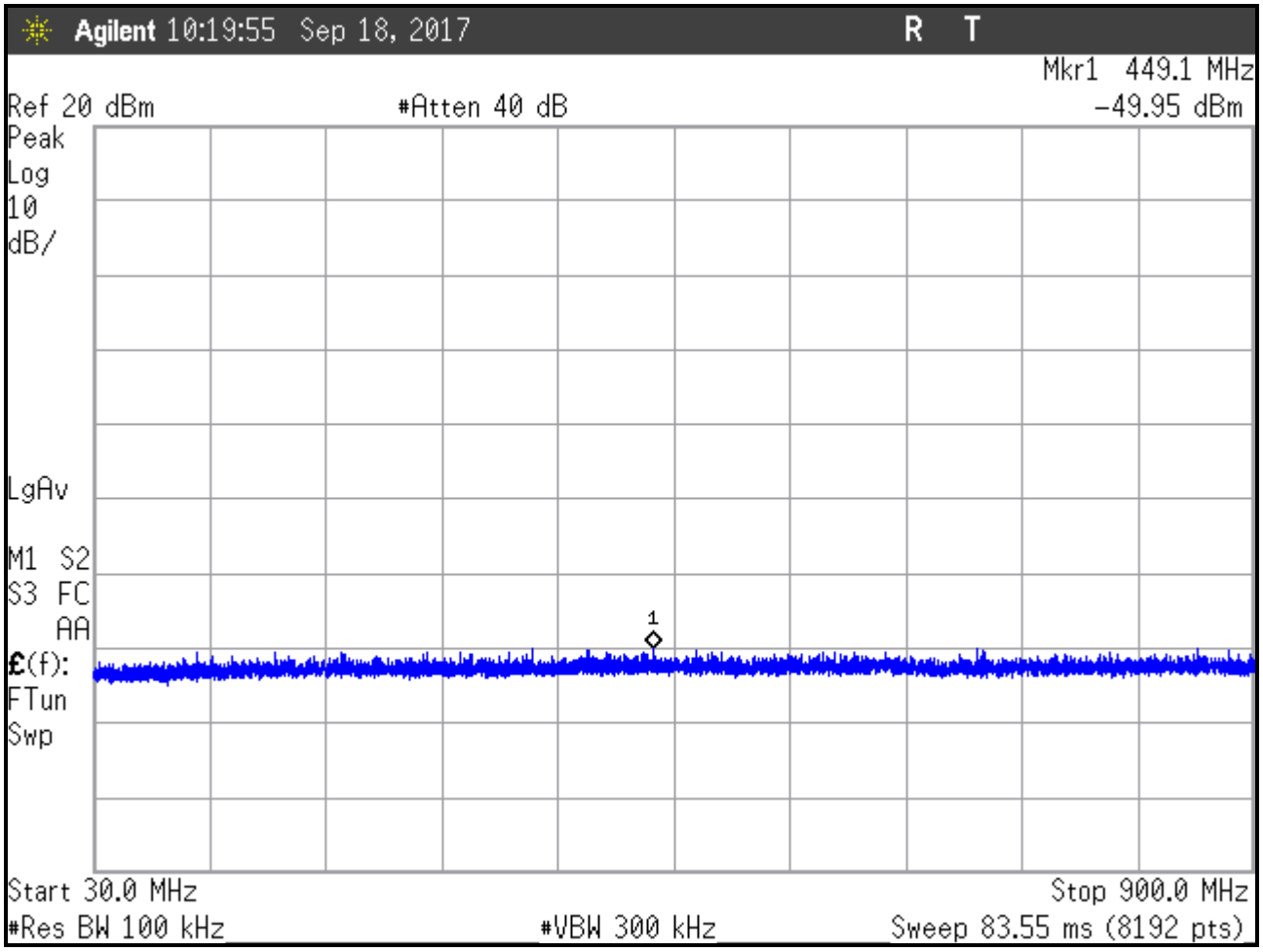

Figure 35: Conducted Spurious Emissions, Low Power, High Channel 30 - 900MHz

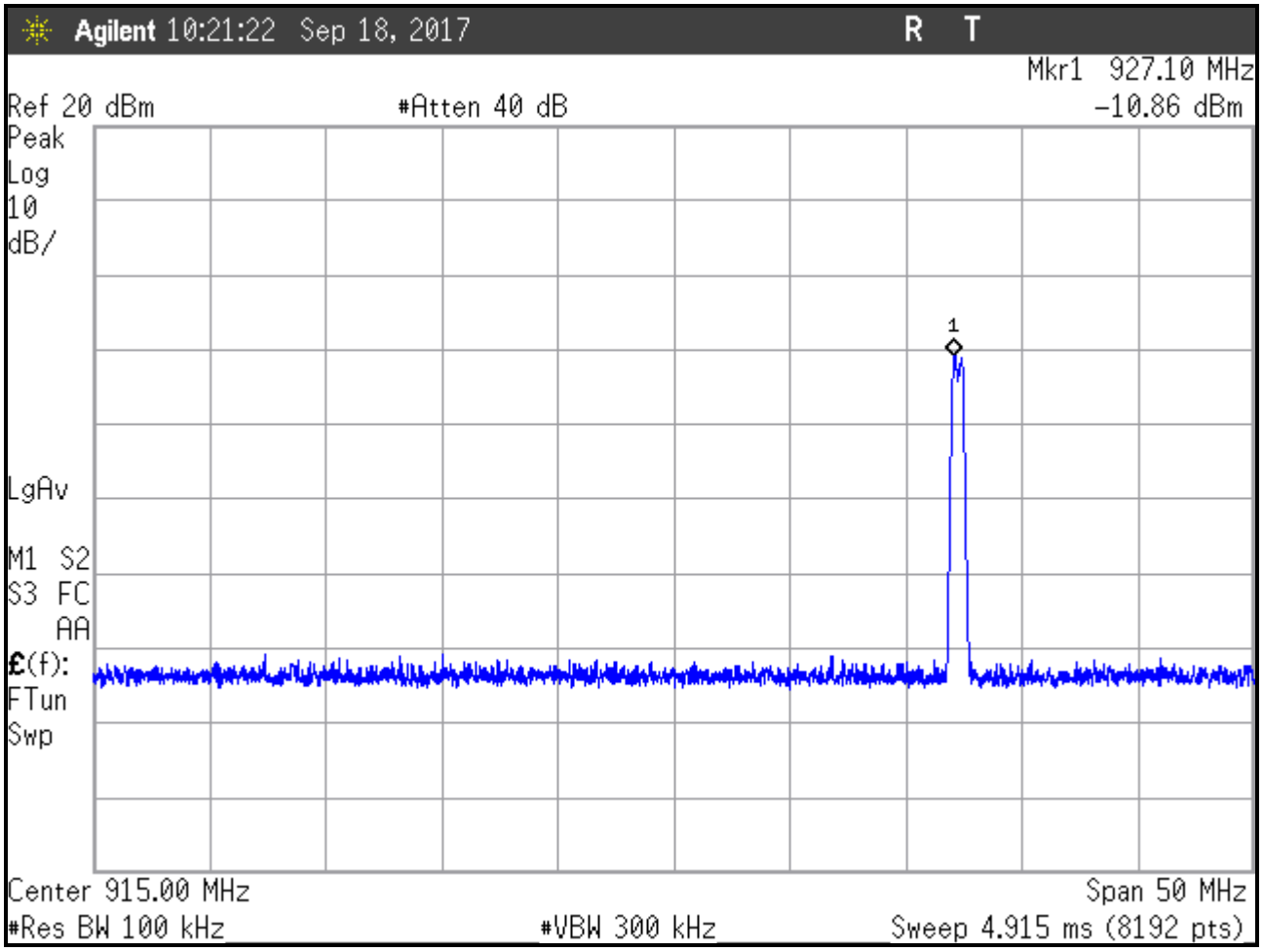

Figure 36: Conducted Spurious Emissions, Low Power, High Channel 900 – 930MHz

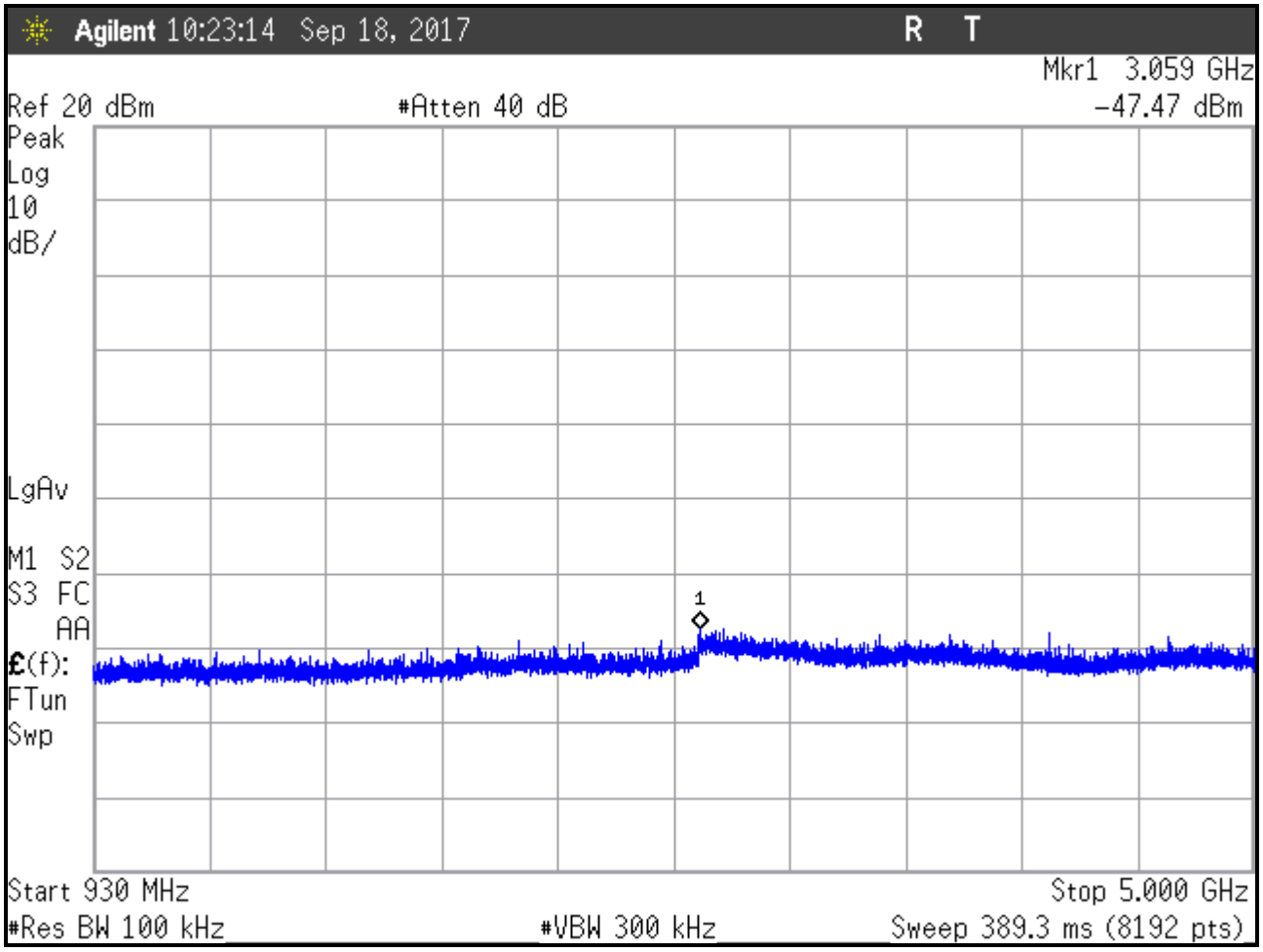

Figure 37: Conducted Spurious Emissions, Low Power, High Channel 930-5000MHz

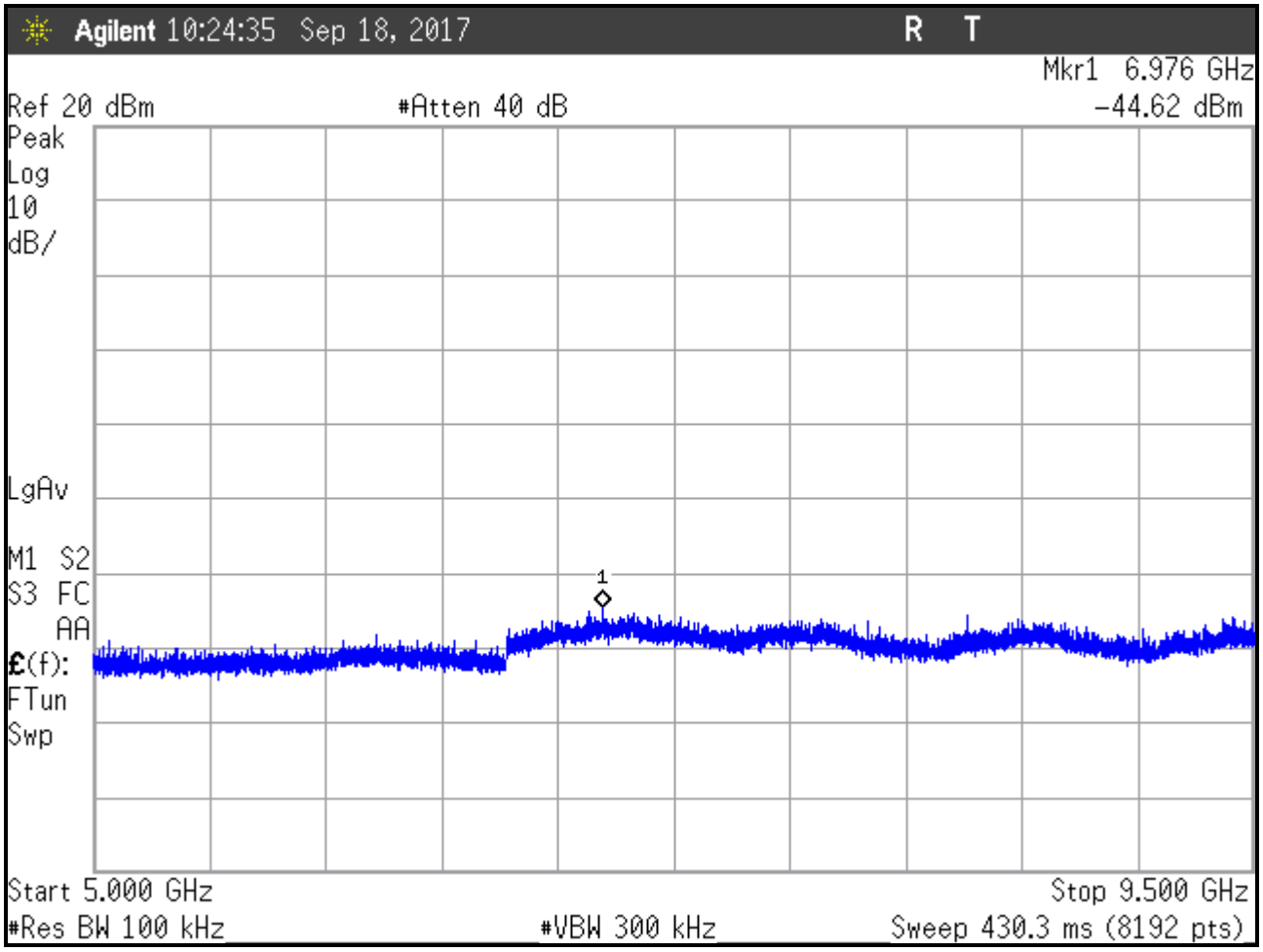

Figure 38: Conducted Spurious Emissions, Low Power, High Channel 5-9.5GHz

5.5.1 Band Edge Compliance

In accordance with FCC Public Notice DA-00-705 close-up plots of the upper and lower channels in both hopping and non-hopping modes with respect to the nearest authorized band-edges are provided below. The tests were performed in the same manner as the above conducted spurious emissions tests.

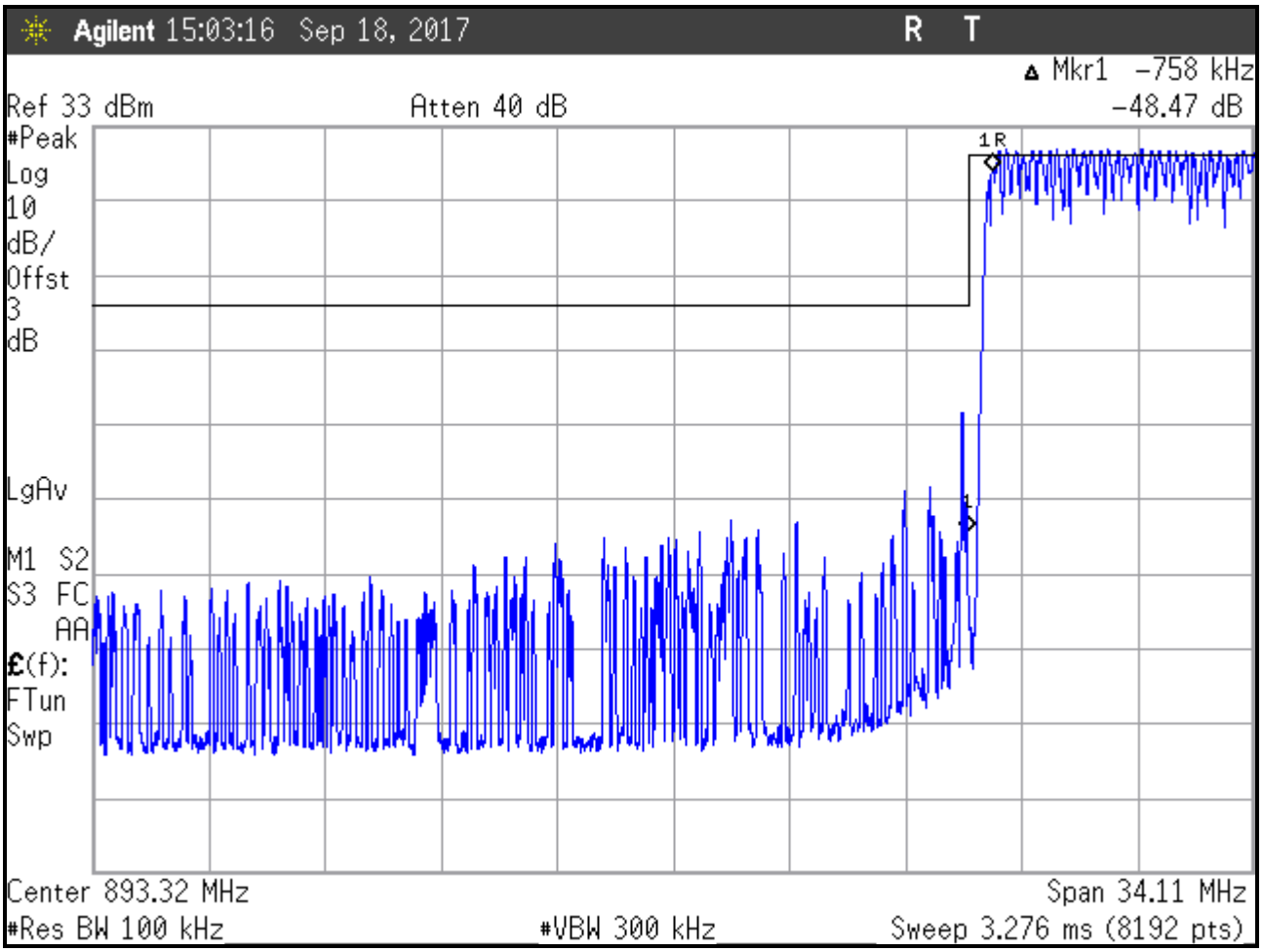

Figure 39: Band-edge, Hopping Mode, Lower Edge, High Power Setting

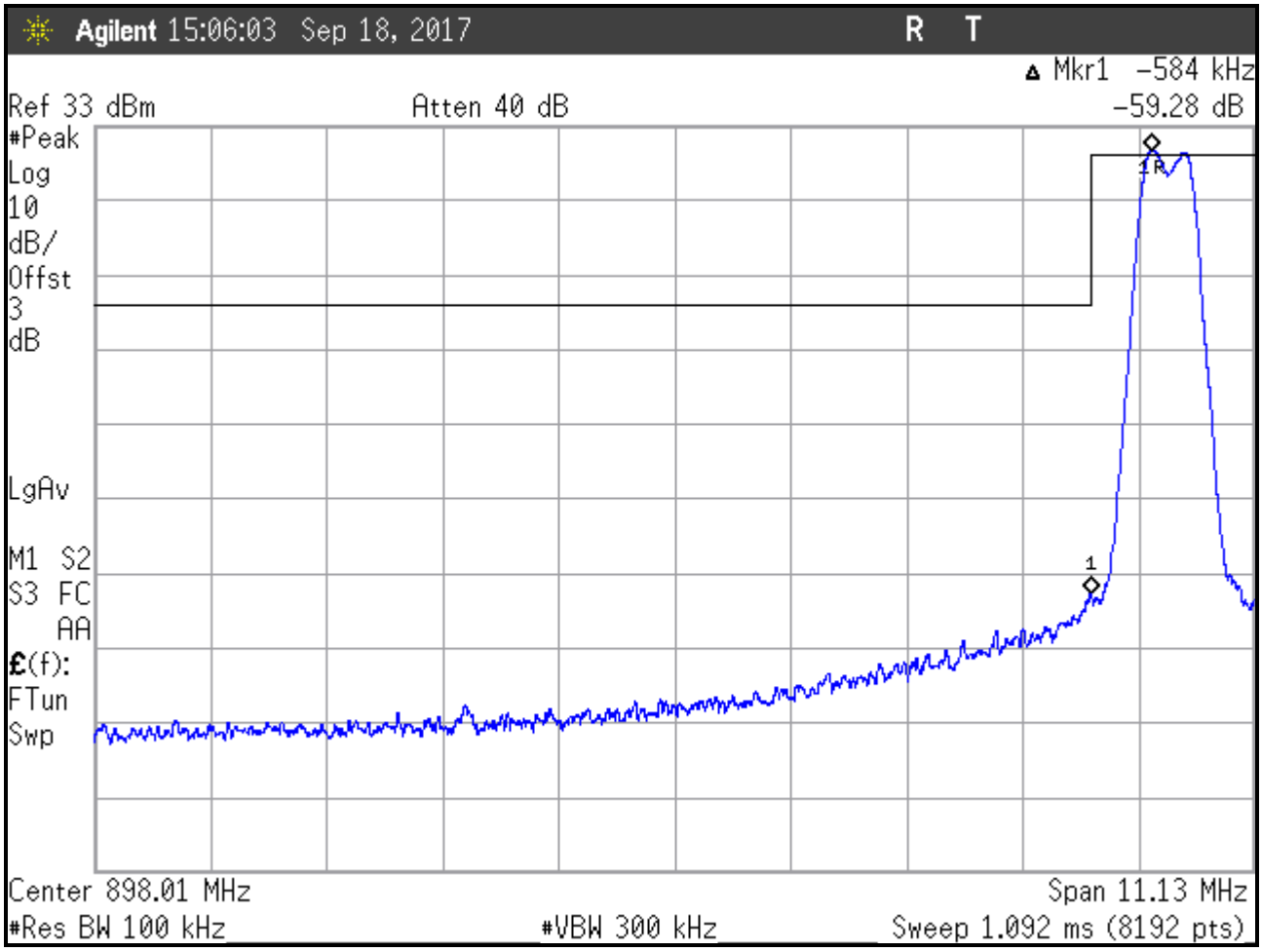

Figure 40: Low Channel, Lower Band-edge, High Power Setting

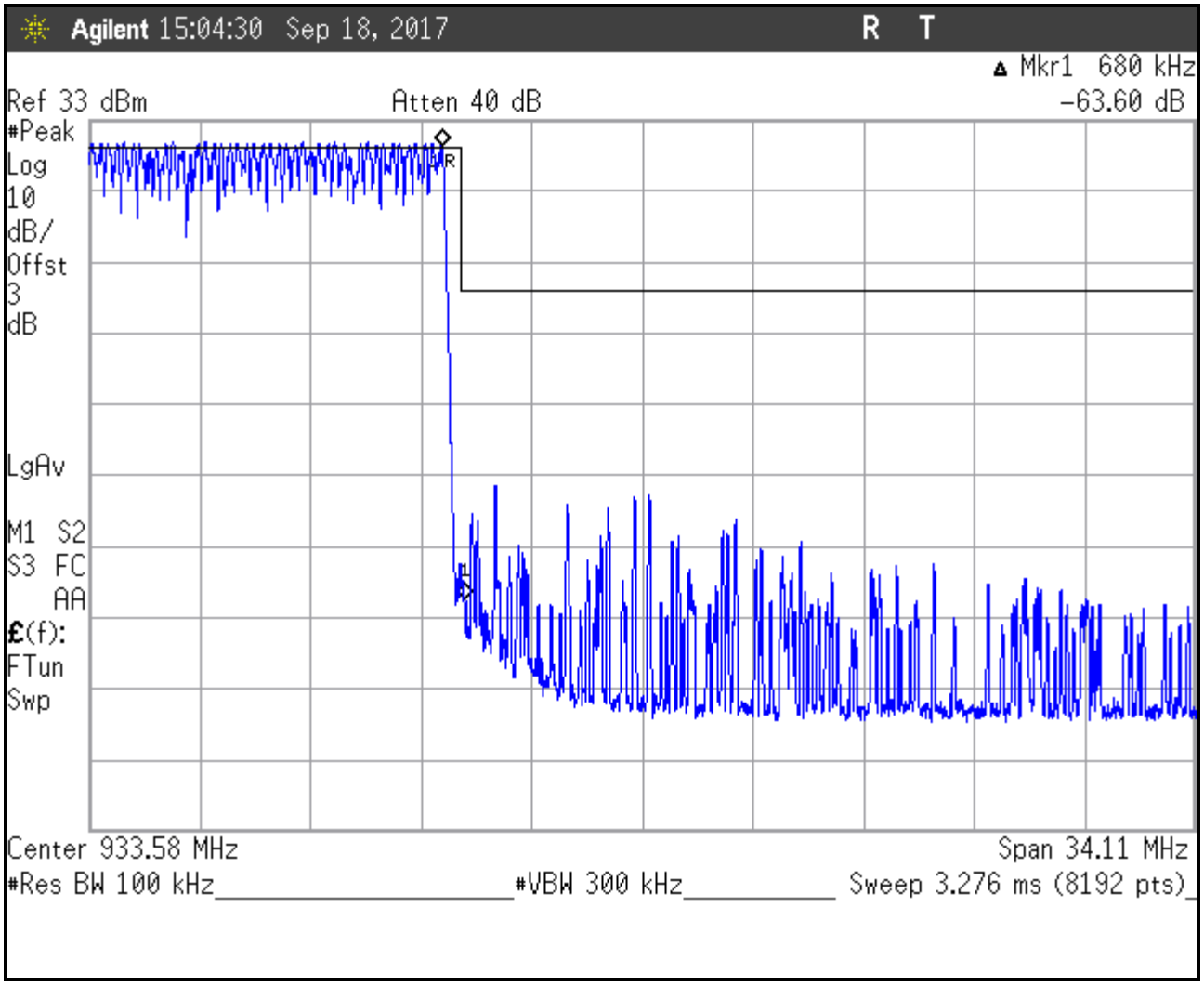

Figure 41: Band-edge, Hopping Mode, Upper Edge, High Power Setting

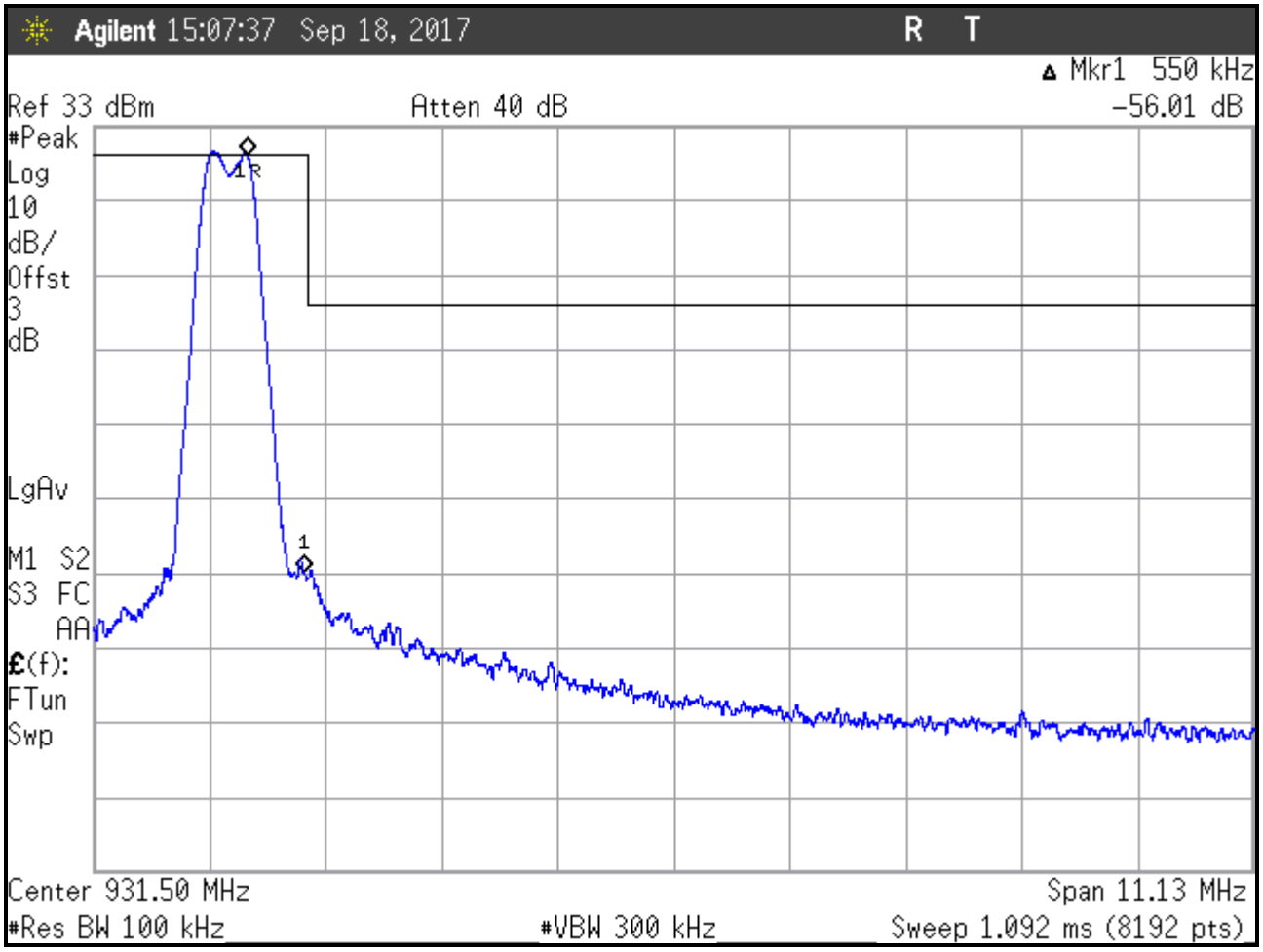

Figure 42: High Channel, Upper Band-edge, High Power Setting

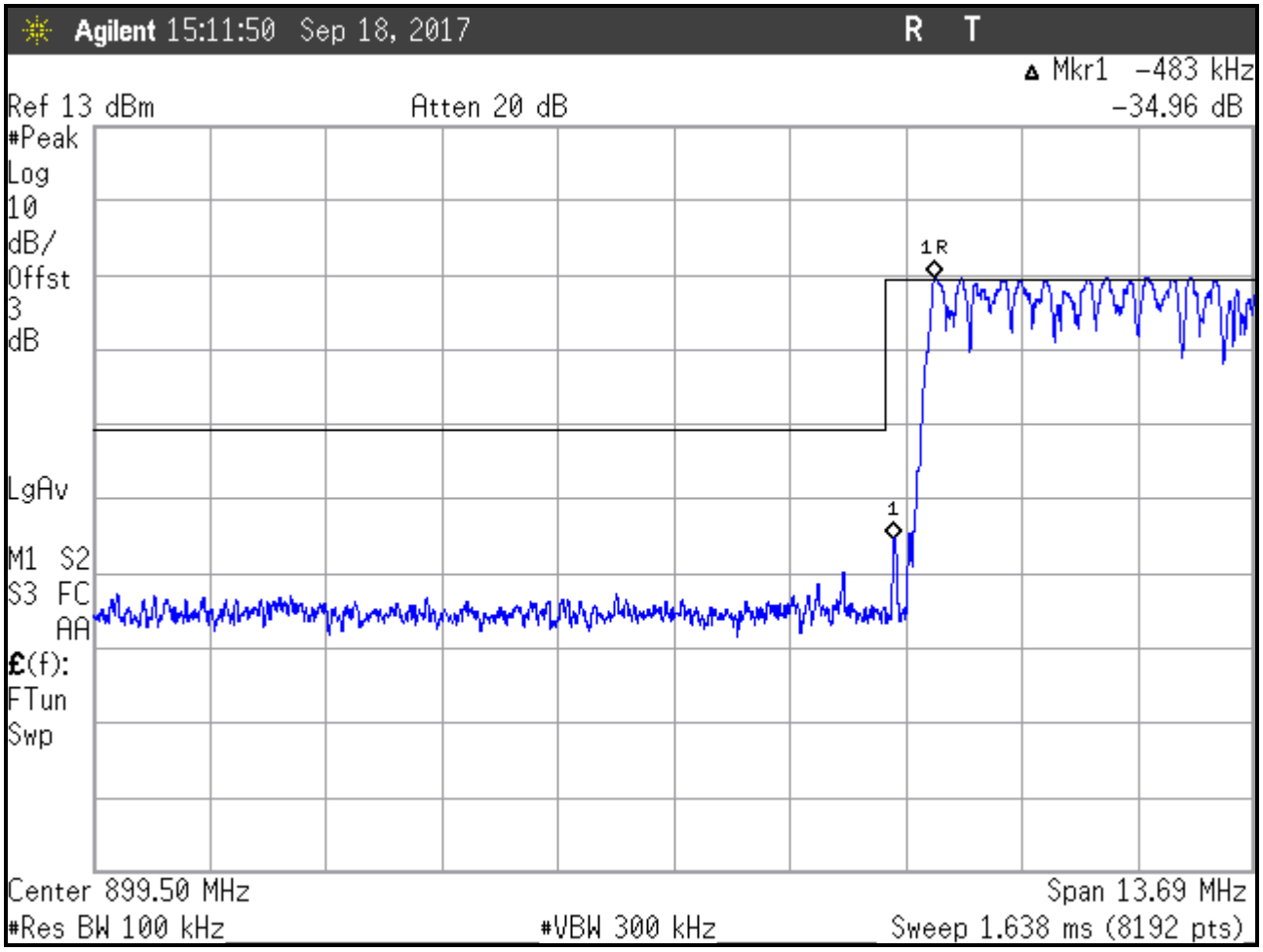

Figure 43: Band-edge, Hopping Mode, Lower Band Edge, Low Power Setting

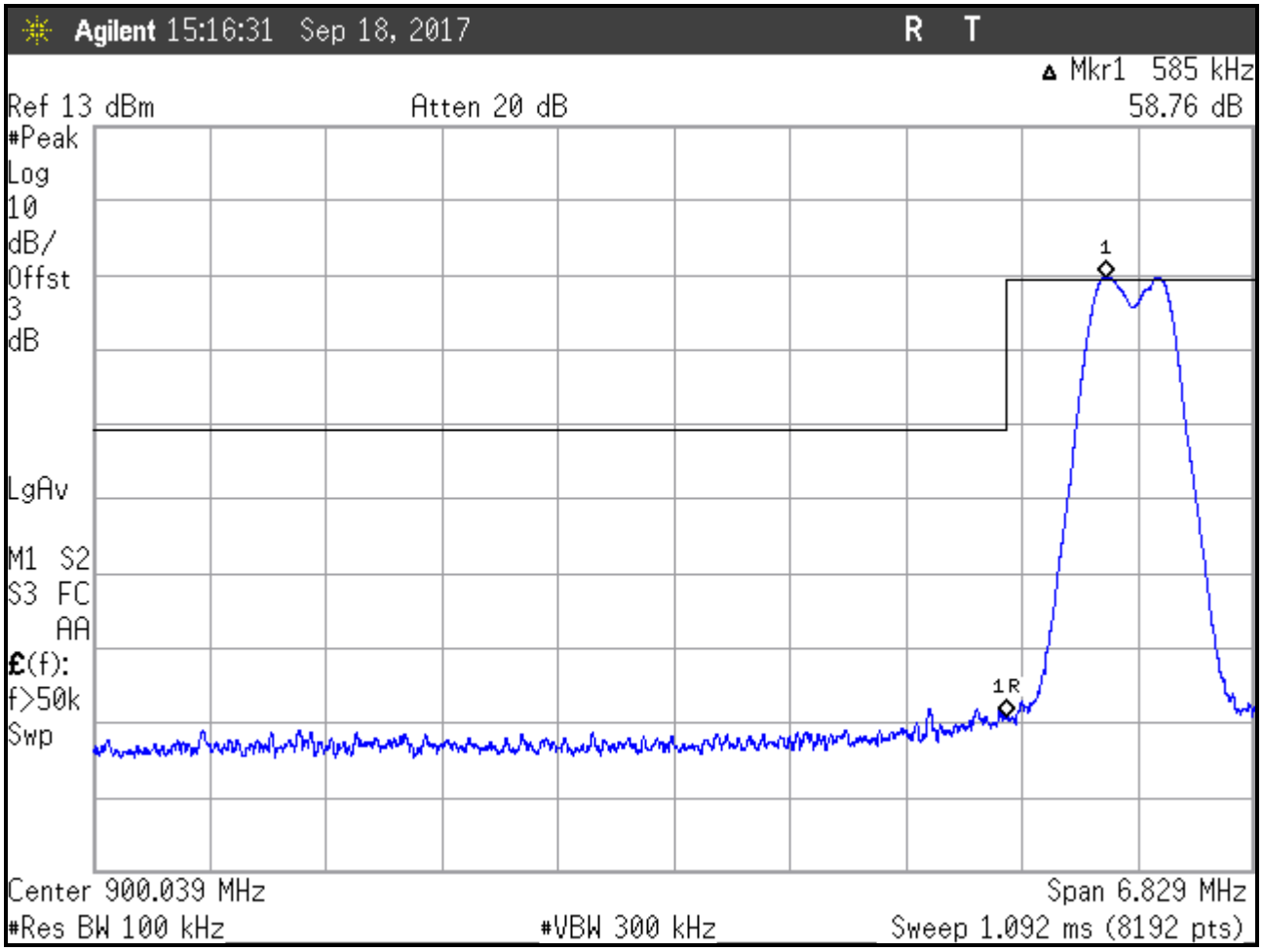

Figure 44: Low Channel, Lower Band Edge, Low Power Setting

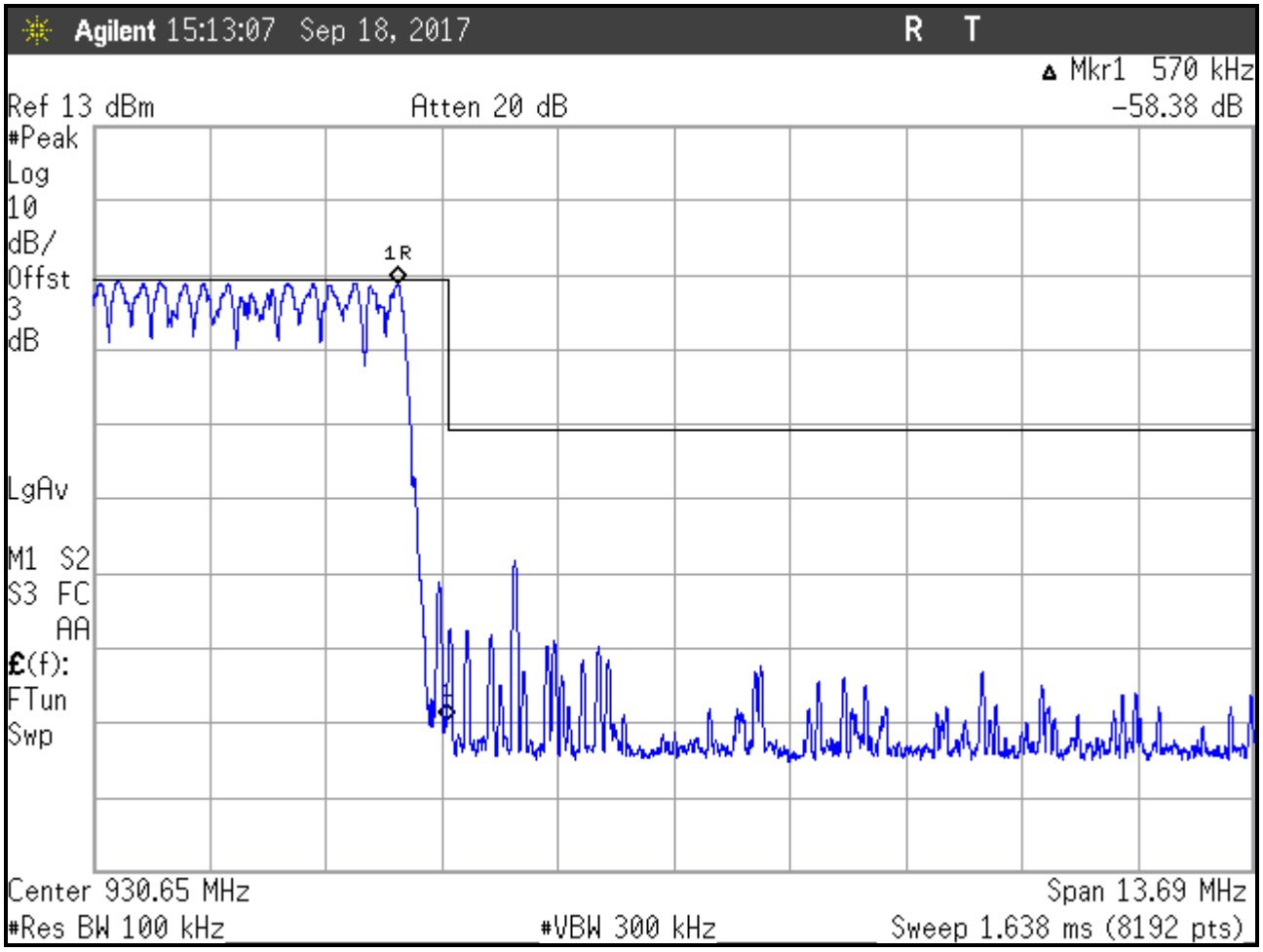

Figure 45: Band-edge, Hopping Mode, Upper Band-edge, Low Power Setting

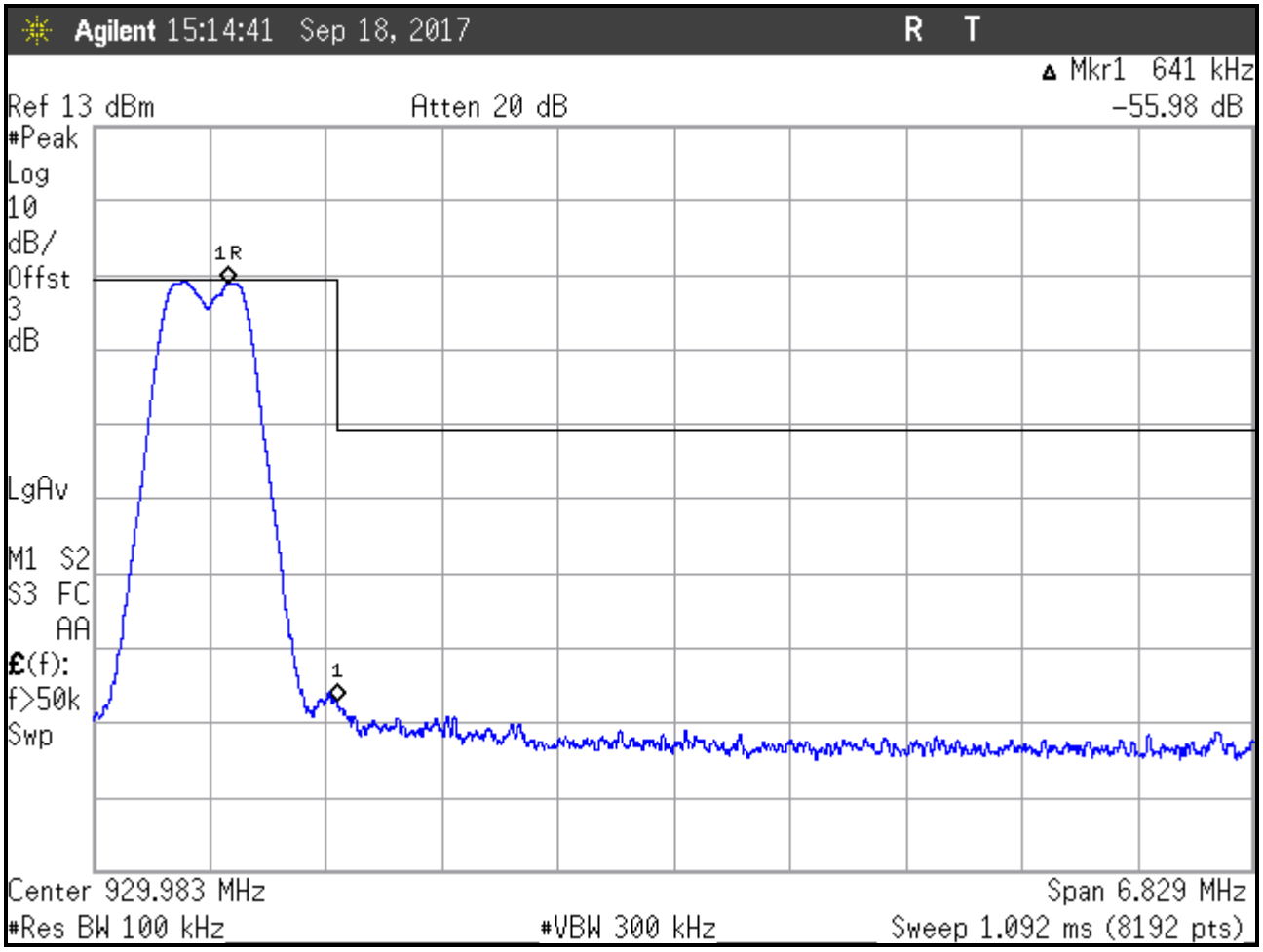

Figure 46: High Channel, Upper Band-edge, Low Power Setting

5.6 Radiated Spurious Emissions: (FCC Part §2.1053)

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.

5.6.1 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. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Worst case emissions are represented.

The emissions were measured using the following resolution bandwidths:

Table 10: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<10 Hz (Avg.), 1MHz (Peak)

Table 11: Radiated Emission Test Data < 1GHz
(Covers all antenna configurations)

S

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)
52.90	V	180.00	1.00	48.98	-17.0	19.8	100.0	-8.04
73.48	V	90.00	1.00	43.78	-15.6	25.7	100.0	-11.80
74.15	V	0.00	1.00	45.12	-15.6	30.0	100.0	-10.47
118.94	V	0.00	1.00	51.21	-9.2	23.9	150.0	-1.55
130.00	V	270.00	1.00	45.97	-9.2	16.0	150.0	-6.77
150.44	V	270.00	1.00	53.85	-10.5	17.1	150.0	-0.17
264.90	V	90.00	1.50	43.39	-8.8	17.9	200.0	-11.42
281.90	V	90.00	1.50	34.71	-7.9	21.9	200.0	-19.22
298.32	V	0.00	1.50	43.81	-7.9	22.5	200.0	-10.11
325.15	V	0.00	1.50	35.67	-6.9	19.2	200.0	-17.30
349.00	V	180.00	2.00	43.85	-6.4	40.1	200.0	-8.59
531.83	V	180.00	2.00	46.14	-1.0	122.1	200.0	-0.88
612.18	V	90.00	2.00	33.59	-0.3	44.6	200.0	-12.75
985.00	V	90.00	1.00	41.94	5.7	87.2	500.0	-6.38
52.90	H	90.00	1.50	42.09	-17.0	7.1	100.0	-14.93
73.48	H	270.00	1.50	38.96	-15.6	11.2	100.0	-16.62
74.15	H	270.00	1.50	40.24	-15.6	11.6	100.0	-15.35
118.94	H	180.00	1.00	38.85	-9.2	30.2	150.0	-13.91
130.00	H	180.00	1.00	37.04	-9.2	20.2	150.0	-15.70
150.44	H	90.00	1.50	46.20	-10.5	20.3	150.0	-7.82
264.90	H	90.00	1.00	34.92	-8.8	20.3	200.0	-19.89
281.90	H	180.00	1.00	36.25	-7.9	23.3	200.0	-17.68
298.32	H	180.00	1.00	50.40	-7.9	21.1	200.0	-3.52
325.15	H	270.00	1.00	37.18	-6.9	23.9	200.0	-15.79
349.00	H	90.00	1.00	42.90	-6.4	29.7	200.0	-9.54
531.83	H	90.00	1.00	45.94	-1.0	144.8	200.0	-1.08
612.18	H	270.00	1.00	34.72	-0.3	45.3	200.0	-11.62
985.00	H	0.00	1.00	46.71	5.7	81.5	500.0	-1.61

Table 12: Radiated Emission Test Data >1GHz, Low Channel

(On Board Antenna)

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)	Comments
2708.25	V	0.00	1.00	54.12	1.2	581.7	5000.0	-18.7	
4513.75	V	190.00	1.00	49.47	5.3	547.8	5000.0	-19.2	
5416.50	V	290.00	1.00	48.61	8.8	742.6	5000.0	-16.6	
2708.25	V	0.00	1.00	45.01	1.2	203.8	500.0	-7.8	
4513.75	V	190.00	1.00	37.40	5.3	136.5	500.0	-11.3	
5416.50	V	290.00	1.00	36.44	8.8	182.9	500.0	-8.7	
2708.25	H	90.00	2.20	54.05	1.2	577.0	5000.0	-18.8	
4513.75	H	180.00	2.20	48.14	5.3	470.1	5000.0	-20.5	
5416.50	H	270.00	2.20	46.03	8.8	551.8	5000.0	-19.1	
2708.25	H	90.00	2.20	43.74	1.2	176.1	500.0	-9.1	
4513.75	H	180.00	2.20	38.10	5.3	148.0	500.0	-10.6	
5416.50	H	270.00	2.20	35.40	8.8	162.3	500.0	-9.8	

Table 13: Radiated Emission Test Data >1GHz, Low Channel

(Laird TRAB9023P)

Frequency (MHz)	Polarity (H/V)	Azimuth (Degree)	Ant. Height (m)	SA Level (dBuV)	Corr Factors (dB)	Corr. Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Peak or Average
1805.20	V	0.0	2.0	46.4	-4.7	121.0	5000.0	-32.3	Peak
2707.84	V	190.0	1.0	42.6	1.2	154.8	5000.0	-30.2	Peak
4513.75	V	90.0	2.2	28.2	5.3	47.1	5000.0	-40.5	Peak
5416.50	V	180.0	3.0	30.3	8.8	90.5	5000.0	-34.8	Peak
8124.75	V	180.0	3.0	30.3	14.9	183.1	5000.0	-28.7	Peak
9027.50	V	160.0	1.0	27.5	17.0	168.2	5000.0	-29.5	Peak
1805.20	V	0.0	2.0	33.3	-4.7	26.8	500.0	-25.4	Ave
2707.84	V	190.0	1.0	27.2	1.2	26.1	500.0	-25.6	Ave
4513.75	V	90.0	2.2	18.9	5.3	16.3	500.0	-29.7	Ave
5416.50	V	180.0	3.0	18.3	8.8	22.7	500.0	-26.9	Ave
8124.75	V	180.0	3.0	18.5	14.9	46.9	500.0	-20.6	Ave
9027.50	V	160.0	1.0	19.7	17.0	68.6	500.0	-17.3	Ave
1805.20	H	0.0	2.0	51.7	-4.7	223.2	5000.0	-27.0	Peak
2707.84	H	190.0	1.0	43.1	1.2	163.8	5000.0	-29.7	Peak
4513.75	H	90.0	2.2	28.9	5.3	51.2	5000.0	-39.8	Peak
5416.50	H	180.0	3.0	29.8	8.8	85.4	5000.0	-35.4	Peak
8124.75	H	180.0	3.0	31.2	14.9	202.4	5000.0	-27.9	Peak
9027.50	H	160.0	1.0	31.0	17.0	250.2	5000.0	-26.0	Peak
1805.20	H	0.0	2.0	41.6	-4.7	69.6	500.0	-17.1	Ave
2707.84	H	190.0	1.0	34.4	1.2	60.3	500.0	-18.4	Ave
4513.75	H	90.0	2.2	18.9	5.3	16.2	500.0	-29.8	Ave
5416.50	H	180.0	3.0	18.3	8.8	22.8	500.0	-26.8	Ave
8124.75	H	180.0	3.0	20.4	14.9	58.3	500.0	-18.7	Ave
9027.50	H	160.0	1.0	20.5	17.0	75.5	500.0	-16.4	Ave

Table 14: Radiated Emission Test Data >1GHz, Low Channel

(Laird B8965)

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)	Comments
2708.58	V	150.0	1.0	16.1	7.5	15.1	500.0	-30.4	Ave
3611.06	V	270.00	1.50	20.66	11.0	38.2	500.0	-22.3	Ave
4513.70	V	90.00	2.00	17.72	14.3	39.7	500.0	-22.0	Ave
5488.64	V	270.00	2.50	16.97	18.9	61.9	500.0	-18.1	Ave
6319.25	V	180.00	2.50	19.48	21.9	117.1	500.0	-12.6	Ave
2708.58	V	150.00	1.00	37.91	7.5	185.7	5000.0	-28.6	Peak
3611.06	V	270.00	1.50	31.86	11.0	138.8	5000.0	-31.1	Peak
4513.70	V	90.00	2.00	28.93	14.3	144.3	5000.0	-30.8	Peak
5488.64	V	270.00	2.50	28.83	18.9	242.6	5000.0	-26.3	Peak
6319.25	V	180.00	2.50	29.15	21.9	356.4	5000.0	-22.9	Peak
2708.58	H	0.0	1.0	30.71	7.5	81.1	500.0	-15.8	Ave
3611.06	H	270.00	2.00	23.19	11.0	51.1	500.0	-19.8	Ave
4513.70	H	90.00	2.00	19.78	14.3	50.3	500.0	-19.9	Ave
5488.64	H	270.00	2.50	19.22	18.9	80.2	500.0	-15.9	Ave
6319.25	H	90.00	2.50	19.50	21.9	117.3	500.0	-12.6	Ave
2708.58	H	0.00	1.00	37.86	7.5	184.6	5000.0	-28.7	Peak
3611.06	H	270.00	2.00	31.90	11.0	139.4	5000.0	-31.1	Peak
4513.70	H	90.00	2.00	30.47	14.3	172.2	5000.0	-29.3	Peak
5488.64	H	270.00	2.50	30.06	18.9	279.5	5000.0	-25.1	Peak
6319.25	H	90.00	2.50	31.14	21.9	448.2	5000.0	-21.0	Peak

Table 15: Radiated Emission Test Data >1GHz, Low Channel

(ANT-DS-OD9)

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)	Comments
2708.58	V	0.0	1.0	34.2	7.5	121.0	500.0	-12.3	Ave
3611.06	V	180.00	1.50	29.28	11.0	103.1	500.0	-13.7	Ave
4513.70	V	90.00	2.00	20.68	14.3	55.8	500.0	-19.0	Ave
5488.64	V	270.00	2.50	18.80	18.9	76.4	500.0	-16.3	Ave
6319.25	V	180.00	2.50	19.00	21.9	110.8	500.0	-13.1	Ave
2708.58	V	0.00	1.00	41.54	7.5	282.0	5000.0	-25.0	Peak
3611.06	V	180.00	1.50	35.29	11.0	206.0	5000.0	-27.7	Peak
4513.70	V	90.00	2.00	31.82	14.3	201.2	5000.0	-27.9	Peak
5488.64	V	270.00	2.50	30.99	18.9	311.1	5000.0	-24.1	Peak
6319.25	V	180.00	2.50	29.15	21.9	356.4	5000.0	-22.9	Peak
2708.58	H	0.0	1.0	26.82	7.5	51.8	500.0	-19.7	Ave
3611.06	H	270.00	2.00	24.94	11.0	62.6	500.0	-18.1	Ave
4513.70	H	90.00	2.00	19.80	14.3	50.4	500.0	-19.9	Ave
5488.64	H	270.00	2.50	19.37	18.9	81.6	500.0	-15.7	Ave
6319.25	H	90.00	2.50	19.45	21.9	116.7	500.0	-12.6	Ave
2708.58	H	0.00	1.00	37.22	7.5	171.5	5000.0	-29.3	Peak
3611.06	H	270.00	2.00	33.13	11.0	160.6	5000.0	-29.9	Peak
4513.70	H	90.00	2.00	30.89	14.3	180.8	5000.0	-28.8	Peak
5488.64	H	270.00	2.50	32.62	18.9	375.3	5000.0	-22.5	Peak
6319.25	H	90.00	2.50	33.04	21.9	557.8	5000.0	-19.1	Peak

Table 16: Radiated Emission Test Data >1GHz, Center Channel

(On-Board Antenna)

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)	Comments
2744.25	V	180.00	1.00	56.98	1.2	811.7	5000.0	-15.8	
3659.00	V	190.00	1.00	56.15	3.3	935.5	5000.0	-14.6	
4573.75	V	180.00	1.00	51.91	5.5	745.5	5000.0	-16.5	
2744.25	V	180.00	1.00	48.98	1.2	323.1	500.0	-3.8	
3659.00	V	190.00	1.00	45.93	3.3	288.4	500.0	-4.8	
4573.75	V	180.00	1.00	40.00	5.5	189.2	500.0	-8.4	
2744.25	H	270.00	2.20	56.95	1.2	808.9	5000.0	-15.8	
3659.00	H	165.00	2.20	55.11	3.3	829.9	5000.0	-15.6	
4573.75	H	270.00	2.20	50.54	5.5	636.7	5000.0	-17.9	
2744.25	H	270.00	2.20	47.83	1.2	283.1	500.0	-4.9	
3659.00	H	165.00	2.20	43.71	3.3	223.4	500.0	-7.0	
4573.75	H	270.00	2.20	38.07	5.5	151.5	500.0	-10.4	

Table 17: Radiated Emission Test Data >1GHz, Center Channel

(Laird TRAB9023P)

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)	Comments
2744.25	V	100.0	1.0	15.20	7.6	13.8	500.0	-31.2	Ave
3659.00	V	0.00	2.00	18.81	11.1	31.3	500.0	-24.1	Ave
4573.35	V	180.00	2.00	16.76	14.6	36.8	500.0	-22.7	Ave
7318.00	V	0.00	2.25	19.71	26.2	197.9	500.0	-8.1	Ave
8232.75	V	270.00	2.30	18.53	28.0	212.7	500.0	-7.4	Ave
2744.25	V	100.00	1.00	25.30	7.6	44.0	5000.0	-41.1	Peak
3659.00	V	0.00	2.00	31.78	11.1	139.3	5000.0	-31.1	Peak
4573.35	V	180.00	2.00	24.67	14.6	91.4	5000.0	-34.8	Peak
7318.00	V	0.00	2.25	28.86	26.2	567.5	5000.0	-18.9	Peak
8232.75	V	270.00	2.30	31.64	28.0	962.3	5000.0	-14.3	Peak
2744.25	H	100.0	1.0	18.94	7.6	21.2	500.0	-27.5	Ave
3659.00	H	0.00	2.00	17.11	11.1	25.7	500.0	-25.8	Ave
4573.35	H	180.00	2.00	16.84	14.6	37.1	500.0	-22.6	Ave
7318.00	H	0.00	2.25	19.81	26.2	200.2	500.0	-8.0	Ave
8232.75	H	270.00	2.30	18.52	28.0	212.5	500.0	-7.4	Ave
2744.25	H	100.00	1.00	25.30	7.6	44.0	5000.0	-41.1	Peak
3659.00	H	0.00	2.00	31.78	11.1	139.3	5000.0	-31.1	Peak
4573.35	H	180.00	2.00	29.82	14.6	165.4	5000.0	-29.6	Peak
7318.00	H	0.00	2.25	33.80	26.2	1002.2	5000.0	-14.0	Peak
8232.75	H	270.00	2.30	31.39	28.0	935.0	5000.0	-14.6	Peak

Table 18: Radiated Emission Test Data >1GHz, Center Channel

(Laird B8965)

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)	Comments
2744.37	V	0.0	1.0	24.40	7.6	39.7	500.0	-22.0	Ave
3659.00	V	270.00	2.00	18.88	11.1	31.5	500.0	-24.0	Ave
4573.75	V	90.00	2.00	16.90	14.6	37.4	500.0	-22.5	Ave
5488.64	V	270.00	2.50	17.58	18.9	66.4	500.0	-17.5	Ave
6403.25	V	90.00	2.50	17.70	22.2	98.3	500.0	-14.1	Ave
2744.37	V	0.00	1.00	34.13	7.6	121.6	5000.0	-32.3	Peak
3659.00	V	270.00	2.00	32.51	11.1	151.5	5000.0	-30.4	Peak
4573.75	V	90.00	2.00	27.51	14.6	126.8	5000.0	-31.9	Peak
5488.64	V	270.00	2.50	27.62	18.9	211.0	5000.0	-27.5	Peak
6403.25	V	90.00	2.50	28.79	22.2	352.4	5000.0	-23.0	Peak
2744.37	H	0.0	1.0	27.34	7.6	55.6	500.0	-19.1	Ave
3659.00	H	270.00	2.00	18.51	11.1	30.2	500.0	-24.4	Ave
4573.75	H	90.00	2.00	17.59	14.6	40.5	500.0	-21.8	Ave
5488.64	H	270.00	2.50	17.69	18.9	67.3	500.0	-17.4	Ave
6403.25	H	90.00	2.50	17.72	22.2	98.5	500.0	-14.1	Ave
2744.37	H	0.00	1.00	33.89	7.6	118.3	5000.0	-32.5	Peak
3659.00	H	270.00	2.00	29.19	11.1	103.4	5000.0	-33.7	Peak
4573.75	H	90.00	2.00	28.20	14.6	137.3	5000.0	-31.2	Peak
5488.64	H	270.00	2.50	28.68	18.9	238.4	5000.0	-26.4	Peak
6403.25	H	90.00	2.50	28.36	22.2	335.4	5000.0	-23.5	Peak

Table 19: Radiated Emission Test Data >1GHz, Center Channel

(ANT-DS-OD9)

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)	Comments
2743.94	V	0.0	1.5	37.50	7.6	179.4	500.0	-8.9	Ave
3611.06	V	180.00	1.50	20.18	11.0	36.2	500.0	-22.8	Ave
4573.50	V	90.00	2.00	19.27	14.6	49.1	500.0	-20.2	Ave
5488.50	V	270.00	2.50	19.16	18.9	79.7	500.0	-16.0	Ave
6403.25	V	180.00	2.50	19.79	22.2	125.1	500.0	-12.0	Ave
2708.58	V	0.00	1.5	42.60	7.5	318.6	5000.0	-23.9	Peak
3611.06	V	180.00	1.50	31.17	11.0	128.2	5000.0	-31.8	Peak
4573.50	V	90.00	2.00	30.07	14.6	170.2	5000.0	-29.4	Peak
5488.50	V	270.00	2.50	30.03	18.9	278.5	5000.0	-25.1	Peak
6403.25	V	180.00	2.50	30.27	22.2	417.9	5000.0	-21.6	Peak
2743.94	H	0.0	1.0	32.78	7.6	104.1	500.0	-13.6	Ave
3611.06	H	270.00	2.00	20.14	11.0	36.0	500.0	-22.9	Ave
4573.50	H	90.00	2.00	18.74	14.6	46.2	500.0	-20.7	Ave
5488.50	H	270.00	2.50	18.90	18.9	77.3	500.0	-16.2	Ave
6403.25	H	90.00	2.50	19.92	22.2	126.9	500.0	-11.9	Ave
2708.58	H	0.00	1.00	41.09	7.5	267.8	5000.0	-25.4	Peak
3611.06	H	270.00	2.00	30.51	11.0	118.8	5000.0	-32.5	Peak
4573.50	H	90.00	2.00	29.05	14.6	151.4	5000.0	-30.4	Peak
5488.50	H	270.00	2.50	29.02	18.9	247.9	5000.0	-26.1	Peak
6403.25	H	90.00	2.50	30.42	22.2	425.2	5000.0	-21.4	Peak

Table 20: Radiated Emission Test Data >1GHz, High Channel

(On-Board Antenna)

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)	Comments
2781.75	V	270.00	1.00	53.92	1.2	572.9	5000.0	-18.8	
3709.00	V	240.00	1.00	50.60	3.3	496.4	5000.0	-20.1	
4636.25	V	90.00	1.00	46.28	6.0	409.0	5000.0	-21.7	
2781.75	V	270.00	1.00	45.80	1.2	225.0	500.0	-6.9	
3709.00	V	240.00	1.00	41.48	3.3	173.7	500.0	-9.2	
4636.25	V	90.00	1.00	34.32	6.0	103.2	500.0	-13.7	
2781.75	H	290.00	2.20	56.00	1.2	728.0	5000.0	-16.7	
3709.00	H	90.00	2.20	48.80	3.3	403.4	5000.0	-21.9	
4636.25	H	180.00	2.20	45.95	6.0	393.8	5000.0	-22.1	
2781.75	H	290.00	2.20	48.86	1.2	320.0	500.0	-3.9	
3709.00	H	90.00	2.20	39.33	3.3	135.6	500.0	-11.3	
4636.25	H	180.00	2.20	32.36	6.0	82.4	500.0	-15.7	

Table 21: Radiated Emission Test Data >1GHz, High Channel

(Laird TRAB9023P)

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)	Comments
2744.25	V	100.0	1.0	27.0	7.6	53.5	500.0	-19.4	Ave
3659.00	V	0.00	2.00	17.06	11.1	25.6	500.0	-25.8	Ave
4573.35	V	180.00	2.00	15.86	14.6	33.2	500.0	-23.6	Ave
7318.00	V	0.00	2.25	10.08	26.2	65.3	500.0	-17.7	Ave
8232.75	V	270.00	2.30	2.92	28.0	35.3	500.0	-23.0	Ave
2744.25	V	100.00	1.00	35.60	7.6	144.0	5000.0	-30.8	Peak
3659.00	V	0.00	2.00	27.45	11.1	84.6	5000.0	-35.4	Peak
4573.35	V	180.00	2.00	23.76	14.6	82.3	5000.0	-35.7	Peak
7318.00	V	0.00	2.25	18.68	26.2	175.8	5000.0	-29.1	Peak
8232.75	V	270.00	2.30	12.86	28.0	110.7	5000.0	-33.1	Peak
2744.25	H	100.0	1.0	28.20	7.6	61.4	500.0	-18.2	Ave
3659.00	H	0.00	2.00	18.81	11.1	31.3	500.0	-24.1	Ave
4573.35	H	180.00	2.00	17.13	14.6	38.4	500.0	-22.3	Ave
7318.00	H	0.00	2.25	14.60	26.2	109.9	500.0	-13.2	Ave
8232.75	H	270.00	2.30	12.30	28.0	103.8	500.0	-13.7	Ave
2744.25	H	100.00	1.00	33.93	7.6	118.8	5000.0	-32.5	Peak
3659.00	H	0.00	2.00	32.23	11.1	146.7	5000.0	-30.7	Peak
4573.35	H	180.00	2.00	27.37	14.6	124.7	5000.0	-32.1	Peak
7318.00	H	0.00	2.25	24.52	26.2	344.3	5000.0	-23.2	Peak
8232.75	H	270.00	2.30	22.40	28.0	332.1	5000.0	-23.6	Peak

Table 22: Radiated Emission Test Data >1GHz, High Channel

(Laird B8965)

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)	Comments
2708.25	V	180.0	1.0	19.2	7.5	21.4	500.0	-27.4	Ave
3611.00	V	270.00	2.00	18.24	11.0	28.9	500.0	-24.8	Ave
4513.75	V	180.00	2.00	17.26	14.3	37.6	500.0	-22.5	Ave
6319.25	V	0.00	2.25	17.94	21.9	98.0	500.0	-14.2	Ave
7222.00	V	270.00	2.30	20.40	26.1	212.2	500.0	-7.4	Ave
2708.25	V	180.00	1.00	32.96	7.5	105.0	5000.0	-33.6	Peak
3611.00	V	270.00	2.00	30.43	11.0	117.7	5000.0	-32.6	Peak
4513.75	V	180.00	2.00	30.35	14.3	169.9	5000.0	-29.4	Peak
6319.25	V	0.00	2.25	30.25	21.9	404.5	5000.0	-21.8	Peak
7222.00	V	270.00	2.30	30.77	26.1	700.1	5000.0	-17.1	Peak
2708.25	H	100.0	1.0	18.80	7.5	20.6	500.0	-27.7	Ave
3611.00	H	0.00	2.00	18.35	11.0	29.3	500.0	-24.6	Ave
4513.75	H	180.00	2.00	17.50	14.3	38.7	500.0	-22.2	Ave
6319.25	H	0.00	2.25	17.79	21.9	96.4	500.0	-14.3	Ave
7222.00	H	270.00	2.30	18.52	26.1	170.9	500.0	-9.3	Ave
2708.25	H	100.00	1.00	32.37	7.5	98.1	5000.0	-34.1	Peak
3611.00	H	0.00	2.00	30.02	11.0	112.3	5000.0	-33.0	Peak
4513.75	H	180.00	2.00	30.29	14.3	168.7	5000.0	-29.4	Peak
6319.25	H	0.00	2.25	30.33	21.9	408.3	5000.0	-21.8	Peak
7222.00	H	270.00	2.30	29.72	26.1	620.4	5000.0	-18.1	Peak

Table 23: Radiated Emission Test Data >1GHz, High Channel

(ANT-DS-OD9)

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)	Comments
2781.30	V	0.0	1.5	31.8	7.7	93.9	500.0	-14.5	Ave
3709.30	V	180.00	1.50	21.72	11.2	44.4	500.0	-21.0	Ave
4636.05	V	90.00	2.00	18.09	15.0	45.3	500.0	-20.9	Ave
5563.50	V	270.00	2.50	18.27	19.0	72.7	500.0	-16.8	Ave
6403.25	V	180.00	2.50	18.94	22.2	113.4	500.0	-12.9	Ave
2781.30	V	0.00	1.5	42.2	7.7	311.0	5000.0	-24.1	Peak
3709.30	V	180.00	1.50	29.87	11.2	113.4	5000.0	-32.9	Peak
4636.05	V	90.00	2.00	29.33	15.0	165.2	5000.0	-29.6	Peak
5563.50	V	270.00	2.50	30.80	19.0	307.6	5000.0	-24.2	Peak
6403.25	V	180.00	2.50	28.27	22.2	332.0	5000.0	-23.6	Peak
2781.30	H	0.0	1.0	29.91	7.7	75.7	500.0	-16.4	Ave
3709.30	H	180.00	2.00	20.20	11.2	37.2	500.0	-22.6	Ave
4636.05	H	90.00	2.00	19.33	15.0	52.2	500.0	-19.6	Ave
5563.50	H	270.00	2.50	18.33	19.0	73.2	500.0	-16.7	Ave
6403.25	H	90.00	2.50	18.90	22.2	112.9	500.0	-12.9	Ave
2781.30	H	0.00	1.00	41.01	7.7	271.8	5000.0	-25.3	Peak
3709.30	H	180.00	2.00	32.02	11.2	145.2	5000.0	-30.7	Peak
4636.05	H	90.00	2.00	26.98	15.0	126.0	5000.0	-32.0	Peak
5563.50	H	270.00	2.50	26.92	19.0	196.7	5000.0	-28.1	Peak
6403.25	H	90.00	2.50	28.98	22.2	360.0	5000.0	-22.9	Peak

5.7 Receiver Radiated Spurious Emissions: (RSS-210 sect 2.6)

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 §15.109 for peak measurements.

5.7.1 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. The peripherals were placed on the table in accordance with ANSI C63.4-2014. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured. Worst case emissions are represented.

The emissions were measured using the following resolution bandwidths:

Table 24: Spectrum Analyzer Settings

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	10 Hz (Avg.), 1MHz (Peak)

Table 25: Radiated Emission Test Data, Receiver

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)	Comments
38.23	V	180.00	1.00	42.85	-11.3	38.0	100.0	-8.4	
42.19	V	180.00	1.00	42.07	-14.2	24.8	100.0	-12.1	
46.99	V	180.00	1.00	43.65	-17.3	20.8	100.0	-13.6	
49.94	V	180.00	1.00	43.02	-18.6	16.7	100.0	-15.5	
52.02	V	180.00	1.00	46.24	-19.1	22.9	100.0	-12.8	
61.02	V	225.00	1.00	43.93	-18.8	18.0	100.0	-14.9	
142.62	V	225.00	1.00	41.35	-12.7	27.0	150.0	-14.9	
143.22	V	225.00	1.00	39.63	-12.8	22.0	150.0	-16.7	
167.61	V	225.00	1.00	42.93	-13.5	29.8	150.0	-14.1	
177.50	V	135.00	1.00	40.50	-13.8	21.5	150.0	-16.9	
192.01	V	135.00	1.00	35.40	-13.7	12.1	150.0	-21.8	
204.40	V	135.00	1.00	42.40	-13.3	28.4	150.0	-14.4	
215.90	V	180.00	1.00	38.10	-14.3	15.5	150.0	-19.7	
240.41	V	180.00	1.30	39.90	-13.1	21.8	200.0	-19.3	
448.20	V	180.00	1.80	38.60	-6.5	40.5	200.0	-13.9	
38.23	H	180.00	4.00	36.73	-11.3	18.8	100.0	-14.5	
42.19	H	180.00	4.00	39.84	-14.2	19.2	100.0	-14.3	
46.99	H	180.00	4.00	47.40	-17.3	32.0	100.0	-9.9	
49.94	H	180.00	4.00	41.99	-18.6	14.9	100.0	-16.6	
52.02	H	180.00	4.00	41.37	-19.1	13.1	100.0	-17.7	
61.02	H	225.00	4.00	35.03	-18.8	6.4	100.0	-23.8	
142.62	H	135.00	4.00	39.26	-12.7	21.2	150.0	-17.0	
143.22	H	135.00	4.00	38.77	-12.8	19.9	150.0	-17.5	
167.61	H	135.00	4.00	49.18	-13.5	61.1	150.0	-7.8	
177.50	H	180.00	4.00	37.90	-13.8	16.0	150.0	-19.5	
192.01	H	180.00	4.00	40.50	-13.7	21.8	150.0	-16.7	
204.40	H	180.00	3.80	41.20	-13.3	24.8	150.0	-15.6	
215.90	H	180.00	3.80	39.50	-14.3	18.3	150.0	-18.3	
240.41	H	180.00	3.80	36.10	-13.1	14.1	200.0	-23.1	
448.20	H	180.00	3.20	37.30	-6.5	34.9	200.0	-15.2	

No frequencies noted above 1GHz

5.8 AC Conducted Emissions

5.8.1 Requirements

Compliance Standard: FCC Part 15, Class B

FCC Compliance Limits

Frequency Range	Class B Digital Device	
	Quasi-peak	Average
0.15-0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 to 5MHz	56dBµV	46dBµV
0.5-30MHz	60dBµV	50dBµV

5.8.2 Test Procedure

The requirements of FCC Part 15 and ICES-003 call for the EUT to be placed on an 80cm-high 1 X 1.5-meter 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.

These emissions must meet the limits specified in §15.207 for quasi-peak and average measurements. At frequencies where quasi-peak or peak measurements comply with the average limit, no average measurements need be performed.

5.8.3 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

5.8.4 Test Data

The table below shows AC conducted data for the 3.3V module.

Table 26: Conducted Emissions

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)
0.159	36.7	24.4	10.2	0.2	47.2	34.8	65.5	55.5	-18.4	-20.7
0.195	29.2	16.2	10.2	0.2	39.6	26.6	63.8	53.8	-24.2	-27.2
0.320	28.3	12.1	10.2	0.3	38.7	22.5	59.7	49.7	-21.0	-27.2
0.887	32.5	31.1	10.3	0.2	43.0	41.6	56.0	46.0	-13.0	-4.4
1.774	28.4	25.8	10.2	0.3	38.9	36.3	56.0	46.0	-17.1	-9.7
16.227	20.5	13.0	11.4	0.7	32.7	25.1	60.0	50.0	-27.3	-24.9

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)
0.191	30.9	20.7	10.2	0.0	41.2	30.9	64.0	54.0	-22.9	-23.1
0.887	32.0	30.8	10.3	0.2	42.4	41.3	56.0	46.0	-13.6	-4.7
1.230	21.1	18.3	10.3	0.3	31.7	28.8	56.0	46.0	-24.3	-17.2
1.774	29.5	27.1	10.2	0.3	39.9	37.6	56.0	46.0	-16.1	-8.4
16.452	19.8	12.8	11.4	0.5	31.7	24.7	60.0	50.0	-28.3	-25.3