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FCC Part 15, Subpart C, Section 15.247

Test Report

On

LoRa eSensor Propane Transmitter

Customer Name: Senet, Inc.

Customer P.O: 608

Date of Report Revision: March 11, 2015

Test Report No: R-5909N-1, Rev. A

Test Start Date: January 19, 2015

Test Finish Date: January 29, 2015

Test Technician: M. Seamans

Revision Approved By: S. Wentworth

Report Revision Prepared By: J. Ramsey

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Technical Information

Report Number:	R-5909N-1, Rev. A
Customer:	Senet, Inc.
Address:	46 River Road
	Hudson, NH 03051
Test Sample:	LoRa eSensor Propane Transmitter
Brand Name:	Senet
Part Number:	5847
Serial Number:	219-04-2166, Rev. C
Manufactured By:	Senet, Inc.
Power Requirements:	3.6 VDC via one disposable lithium coin cell battery
Frequency Band of Operation:	902.3 MHz to 927.5 MHz
Frequencies Tested (Low, Mid and High):	902.3 MHz, 914.9 MHz, 927.5 MHz
Antenna Type:	½ Wave Internal 2dBi
Equipment Use:	Measures Propane Tank Level and Sends Data
FCC ID:	X94-0005847

Test Specification:
FCC Rules and Regulations, Telecommunications, Part 15 Radio Frequency Devices, Subpart C, Intentional Radiators

Test Procedure:
ANSI C63.4:2003, Methods of Measurement of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

558074 D01, FCC Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247, June 5, 2014

DA 00-705, FCC Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems (FHSS) Operating Under 15.247, March 30, 2000

EUT Description:

The LoRa eSensor Propane Transmitter transmits tank data to a receiver. It is used in homes and businesses for propane tank delivery automation. The EUT has two transmission modes for Tank Data Transmissions as described below:

Tank Data Transmission – FHSS:

The tank information is transmitted over the U.S. 915 MHz ISM band using adaptive data rate LoRa modulation; not exceeding transmit power of 20 dBm over a 125 KHz channel selected randomly from 64 possible channels. Transmissions are scheduled, usually once an hour, with each transmission lasting less than 400 milliseconds.

Tank Data Transmission – DTS:

An additional operational mode may be configured, in which the device transmits tank information using 500 MHz channels with a transmit power of 20 dBm in the US 915 MHz ISM band using adaptive data rate LoRa modulation. The Senet Propane Sensor Node will use this mode to enable power-efficient and higher bit rate transmissions in locations with very low concentrations of devices using LoRa modulation

Tests Performed

The test methods performed on the EUT are shown below. Testing was performed in accordance with the applicable FCC requirements for each of the two transmission modes (DTS & FHSS).

FCC Part 15, Subpart C	Test Method
DTS Test Methods Performed	
15.247(a)(2)	6 dB Bandwidth
15.247(b)(3)	Power Output
15.247(d)	Antenna Terminal Out of Band/ Band Edge Conducted Emissions (30 MHz – 25 GHz)
15.247(d)	Out of Band/Band Edge Radiated Emissions (30 MHz to 10 GHz)
15.247(e)	Power Density
FHSS Test Methods Performed	
15.247(a)(1)	20 dB Bandwidth
15.247(a)(1) (iii)	Number of Hopping Channels and Time of Occupancy
15.247(a)(1)	Channel Separation
15.247(b)(3)	Power Output
15.247(d)	Antenna Terminal Out of Band/ Band Edge Conducted Emissions (30 MHz – 25 GHz)
15.247(d)	Out of Band/Band Edge Radiated Emissions (30 MHz to 10 GHz)

General Test Requirements

1. The measurement procedures of ANSI C63.4:2003 and ANSI C63.10: 2013 were utilized as specified in FCC Part 15, Subpart C, Section 15.31(a)(3) and FCC Guidance for Performing Compliance Measurements on Digital Transmission Systems, June 5, 2014.
2. All radiated emissions measurements were performed on an Open Area Test Site (OATS), listed with the FCC, in accordance with FCC Section 15.31(d).
3. All measurements were performed at the specified 3 meter test distance as required by FCC Section 15.31(f).
4. The EUT was rotated throughout 360 degrees for all radiated emissions measurements as specified in FCC Section 15.31(f)(5).
5. All readily accessible EUT controls were adjusted in such a manner as to maximize the level of emissions in accordance with FCC Section 15.31(g).
6. Appropriate accessories were attached to all EUT ports during the performance of radiated emissions measurements as required by FCC Section 15.31(i).
7. The EUT operated over the frequency range of 902.3 MHz to 927.5 MHz. Testing was performed with the device operating at 3 frequencies, 1 at the top, 1 in the middle and 1 at the bottom of the range of operation in accordance with FCC Section 15.31(m).
8. The frequency spectrum was investigated from the lowest frequency generated in the device up to the 10th harmonic of the highest fundamental frequency in accordance with FCC Section 15.33(a)(1).
9. The EUT utilizes an internal ½ wave antenna and does not have an external antenna connector/external antenna and is therefore in compliance with 15.203.

Certification and Signatures

We certify that this report is a true representation of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.

Scott Wentworth
Branch Manager
NVLAP Approved Signatory

Todd Hannemann
Laboratory Supervisor
iNARTE Certified Technician ATL-0255-T

Non-Warranty Provision
The testing services have been performed, findings obtained and reports prepared in accordance with generally accepted laboratory principles and practices. This warranty is in lieu of all others, either expressed or implied.

Non-Endorsement
This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation, endorsement or certification of the product or material tested. This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Revision History

Revisions to this document are listed below; the latest revised document supersedes all previous issues of this document.

Revision	Date	Pages Affected
-	March 9, 2015	Original Release
A	March 11, 2015	Global Changes: • Document changed from R-5909N-1 to R-5909N-1, Rev. A 3: • Revised mode of operation 7: • Added results to FHSS FCC Section 15.247 (b)(3) Power Output 10: • Revised calculations to divide sections by DTS and FHSS mode

Requirements and Test Results

FCC Section 15.247 (a)(2) - DTS Bandwidth

For systems using digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725 – 5850 MHz bands the minimum 6 dB bandwidth shall be at least 500 kHz.

- **Results**: The minimum 6dB bandwidth measured was 732.7 kHz and the device was found to meet the requirement of 15.247 (a)(2).

FCC Section 15.247 (b)(3) - Power Output

For frequency hopping systems operating in the 902-928 MHz; 1 Watt for systems employing at least 50 hopping frequencies.

- **Results**: The maximum measured peak conducted output power was 66.7 mW. The maximum antenna gain of the monopole antenna is 2.0 dBi. The device was found to meet the power output requirements of 15.247 (b)(3) including de facto EIRP.

FCC Section 15.247 (b)(3) - Power Output

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g.: alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

- **Results**: The maximum measured peak conducted output power was 69.2 mW. The maximum antenna gain of the monopole antenna is 2.0 dBi. The device was found to meet the power output requirements of 15.247 (b)(3) including de facto EIRP.

Requirements and Test Results (con't)

FCC Section 15.247(d) – Unwanted Emissions

Antenna Terminal Out of Band/Band Edge Conducted Emissions
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Paragraph (b)(3) of Section 15.247, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

- **Results**: All measured out of band/band edge conducted emissions were below the specified limits and the device was found to meet the requirements of 15.247 (d).

FCC Section 15.247(d) – Unwanted Emissions

Radiated Spurious Emissions/Restricted Bands/Band Edge
Emissions which fall into restricted bands, as defined in 15.205(a) must comply with the radiated emissions limits specified in 15.209(a) and shown below in Table 1. Emissions emanating from the EUT cabinet and cables must also comply with the radiated emissions limits. Radiated emissions measurements were also performed at the band edges to ensure band edge compliance.

Table 1 - Radiated Emission Limits

Frequency of Emission (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 to 88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960	500	3

- **Results**:
  All spurious emissions were measured and found to be in compliance with the limits specified in 15.209(a). Band edge emissions were also found to be in compliance with the limits specified in 15.209(a).

Requirements and Test Results (con't)

FCC Section 15.247(e) – Power Spectral Density
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

- **Results**: The measured power spectral density complied with the specified power density limit and the device was found to meet the requirements of 15.247(e).

Requirement:
FCC Section 15.247 (a)(1)
Channel Separation and 20 dB Bandwidth
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- **Results**:
  The maximum 20 dB bandwidth of the hopping channel was 168.2 kHz. The carrier frequencies were separated by 208.2 kHz which exceeds the 20 dB bandwidth and complies with the requirements specified above.

FCC Section 15.247 (a)(1)
Number of Channels and Occupancy Time
Frequency hopping systems operating in the 902 – 928 MHz band: If the 20dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

- **Results**:
  The frequency hopping system uses 64 Channels. The average time of occupancy did not exceed 0.4 seconds in an 8 second period which meets the above requirements.

Requirements and Test Results (con't)

FCC Section 15.247(i) – RF Exposure

Transmitters operating under 15.247 must be operated in a manner that ensures the public is not exposed to RF energy levels in access of the commission's guidelines. Based on the transmitter power and maximum antenna gain the separation distance for acceptable MPE power density levels to meet both the Occupational/Controlled Exposure and the General Population/Uncontrolled Exposure requirements of 1.1310 was calculated. The calculation below uses the more stringent General Population MPE Limits.

$$S = \frac{PG}{4\pi Dsq}$$

D = Minimum Separation Distance in cm

S = Max allowed Power Density in mW/cmsq

Per 1.1310 For Frequency of 900 MHz = 0.6mW/cmsq

DTS Transmission Mode:

Power = Max Power Input to Antenna = 69.2 mW

Gain = Max Power Gain of Antenna = 2.0 dBi = 1.58 numeric

$$0.6\text{mW/cmsq} = \frac{69.2 \times 1.58}{4\ (3.14) \times Dsq} = \frac{109.336}{12.56 \times Dsq}$$

$$Dsq = \frac{109.336}{12.56 \times 0.6} = 14.51$$

D = sq. root 14.51 = 3.8 cm

The unit has an internal antenna and the minimum separation distance will always be maintained.

FHSS Transmission Mode:

Power = Max Power Input to Antenna = 66.7 mW

Gain = Max Power Gain of Antenna = 2.0 dBi = 1.58 numeric

$$0.6\text{mW/cmsq} = \frac{66.7 \times 1.58}{4\ (3.14) \times Dsq} = \frac{105.386}{12.56 \times Dsq}$$

Requirements and Test Results (con't)

FCC Section 15.247(i) – RF Exposure

$$Dsq = \frac{105.386}{12.56 \times 0.6} = 13.98$$

D = sq. root 13.98 = 3.7cm

The unit has an internal antenna and the minimum separation distance will always be maintained.

EQUIPMENT LISTS

FCC Section 15.247(a)(2) – DTS Bandwidth

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	10/29/2014	10/31/2016
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

FCC Section 15.247(b)(3) – Power Output

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

FCC Section 15.247(d) – Antenna Terminal Out of Band/ Band Edge Conducted Emissions, 30 MHz to 25 GHz

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

FCC Section 15.247(d) – Out of Band/Band Edge Radiated Emissions

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
1232	AGILENT / HP	PRE-AMPLIFIER	1 - 26.5GHz	8449B	6/24/2014	6/30/2015
3258	EMCO	DOUBLE RIDGED GUIDE ANTENNA	1 GHZ - 18GHZ	3115	9/4/2013	3/31/2015
4029	RETLIF	OPEN AREA TEST SITE	3 / 10 Meters	RNH	5/15/2013	5/31/2016
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
5053	EMCO	BICONILOG ANTENNA	26 MHz - 3 GHz	3142C	7/2/2013	1/31/2015
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

FCC Section 15.247(e) – Power Density

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	10/29/2014	10/31/2016

FCC Section 15.247(a)(1) – 20 dB Bandwidth

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
5070	ROHDE & SCHWARZ	EMI TEST RECEIVER	20 Hz - 40 GHz	ESIB40	10/29/2014	10/31/2016
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

EQUIPMENT LISTS (continued)

FCC Section 15.247(a)(1) -- Channel Separation

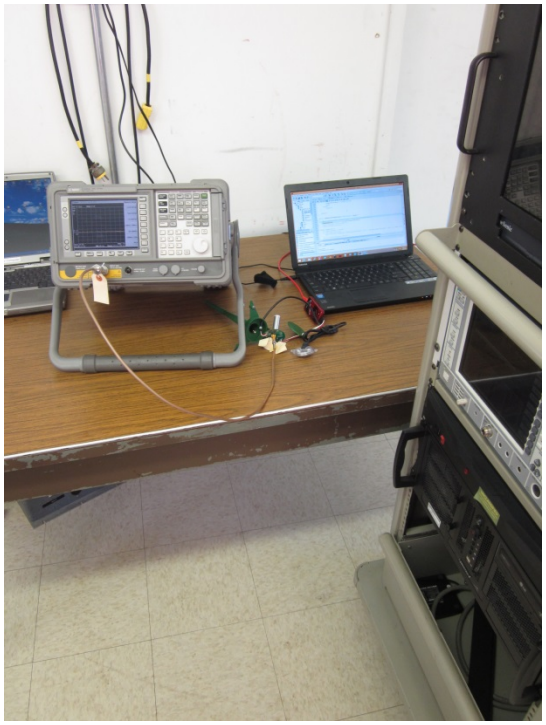
EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

FCC Section 15.247(a)(1)(iii) – Number of Hopping Channels and Time Occupancy

EN	Manufacturer	Description	Range	Model No.	Cal Date	Due Date
5039	FLUKE	20DB ATTENUATOR	DC - 12.4 GHz	Y9305	12/17/2014	12/31/2015
R451	AGILENT / HP	Analyzer, Spectrum	100 Hz - 26.5 GHz	E7405A;A	1/27/2014	1/31/2015

Test Photograph(s)
DTS Bandwidth
6 dB Bandwidth
FCC Section 15.247(a)(2)

Test Photograph(s)
DTS Bandwidth
6 dB Bandwidth

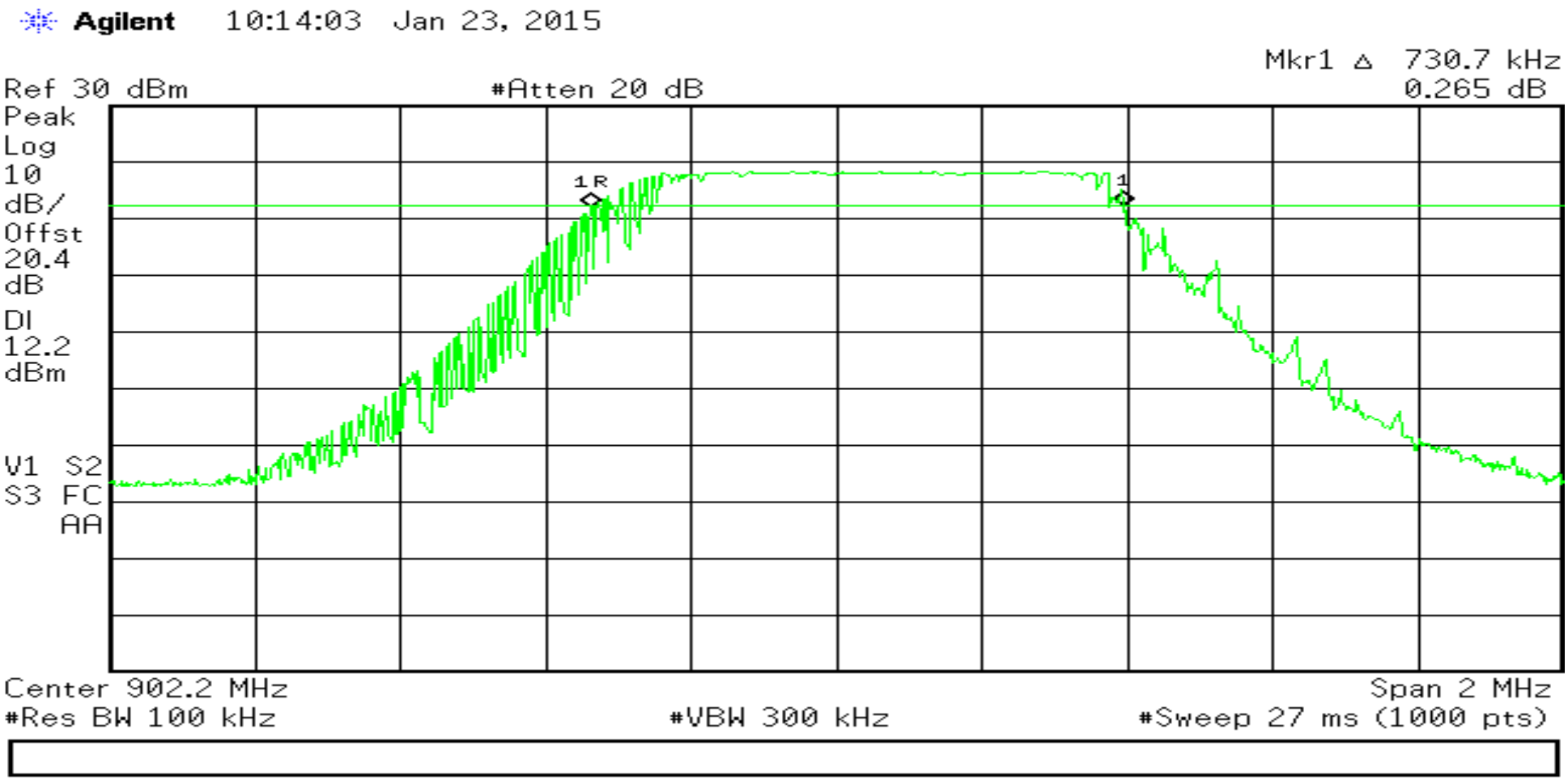


Test Setup

DTS Bandwidth
6 dB Bandwidth
Test Data

RETLIF TESTING LABORATORIES

Test Method:	6dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 902.3 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 730.7 kHz		



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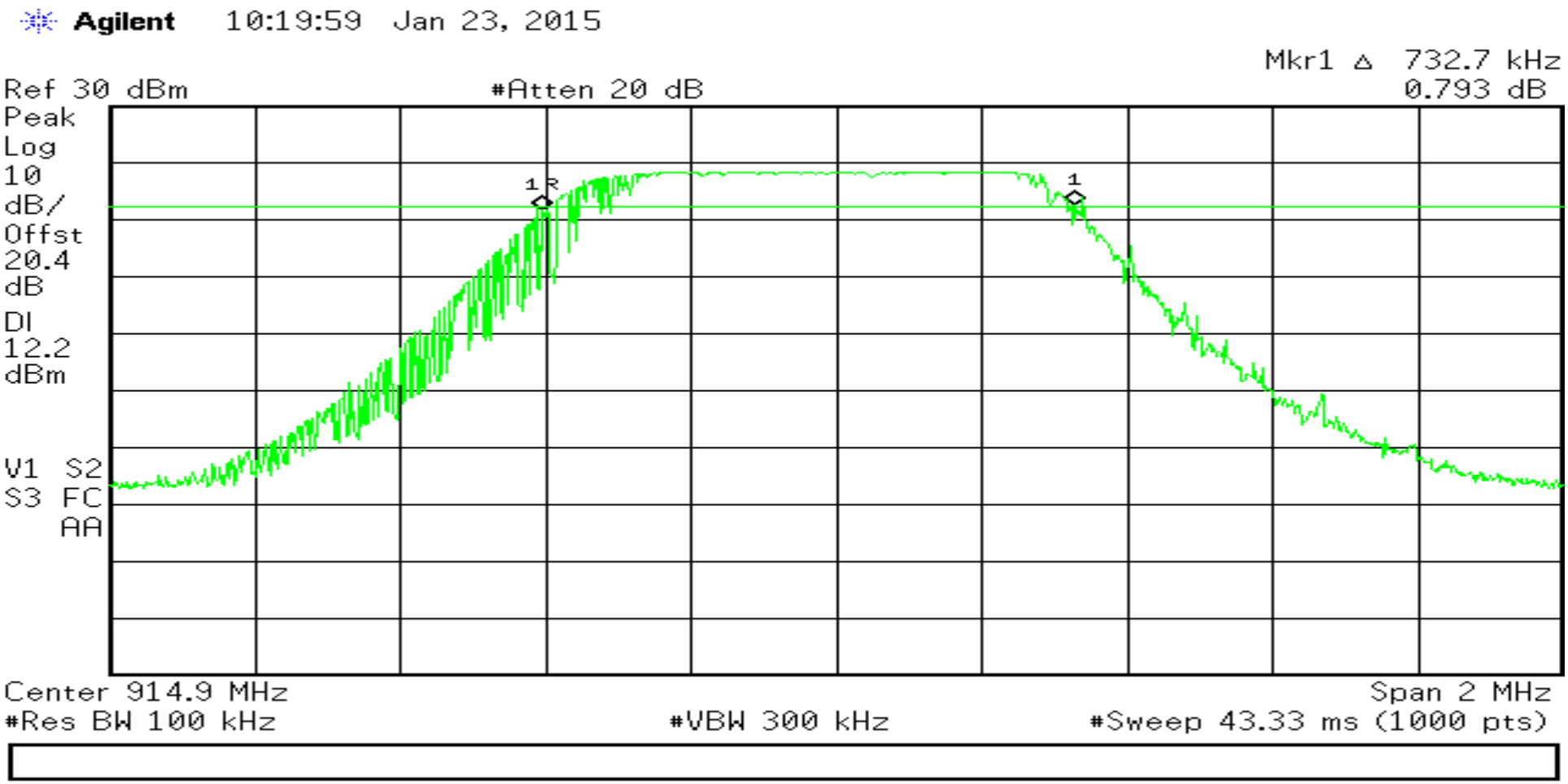
RETLIF TESTING LABORATORIES

Test Method:	6dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 732.7 kHz		



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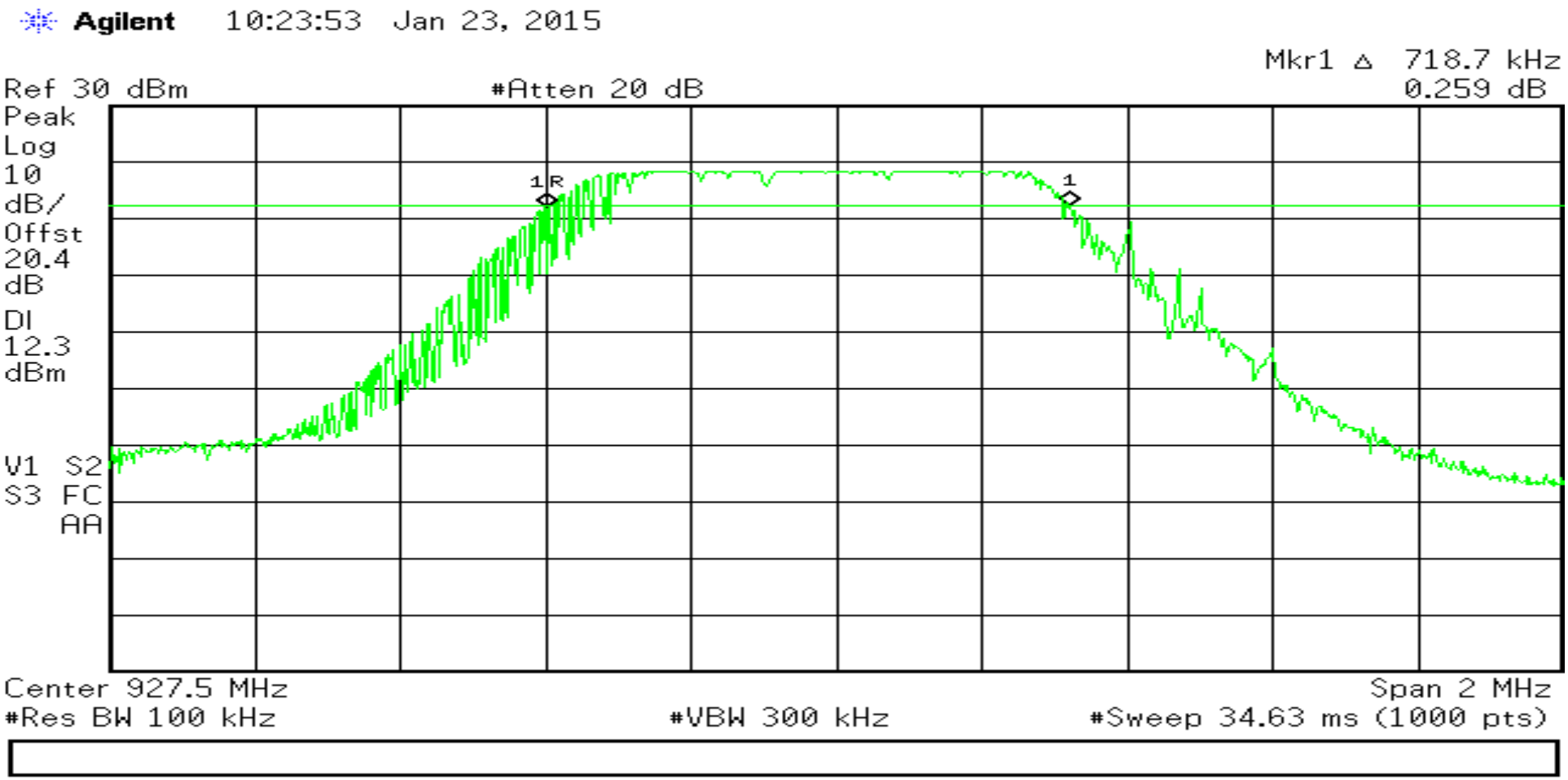
RETLIF TESTING LABORATORIES

Test Method:	6dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 718.7 kHz		



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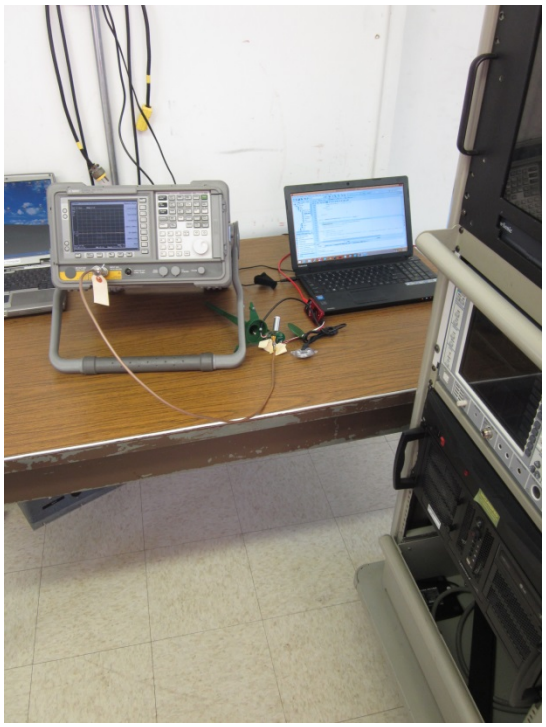
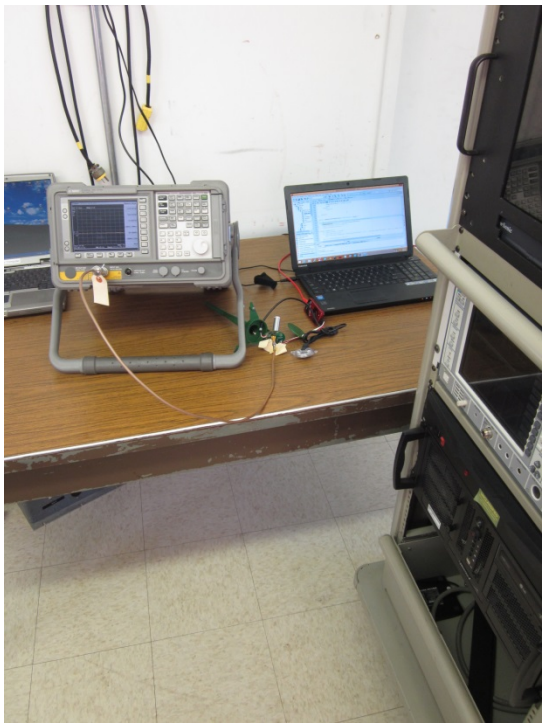
Test Photograph(s)
Power Output
FCC Section 15.247(b)(3)

Test Photograph(s)
Power Output



Test Setup, DTS

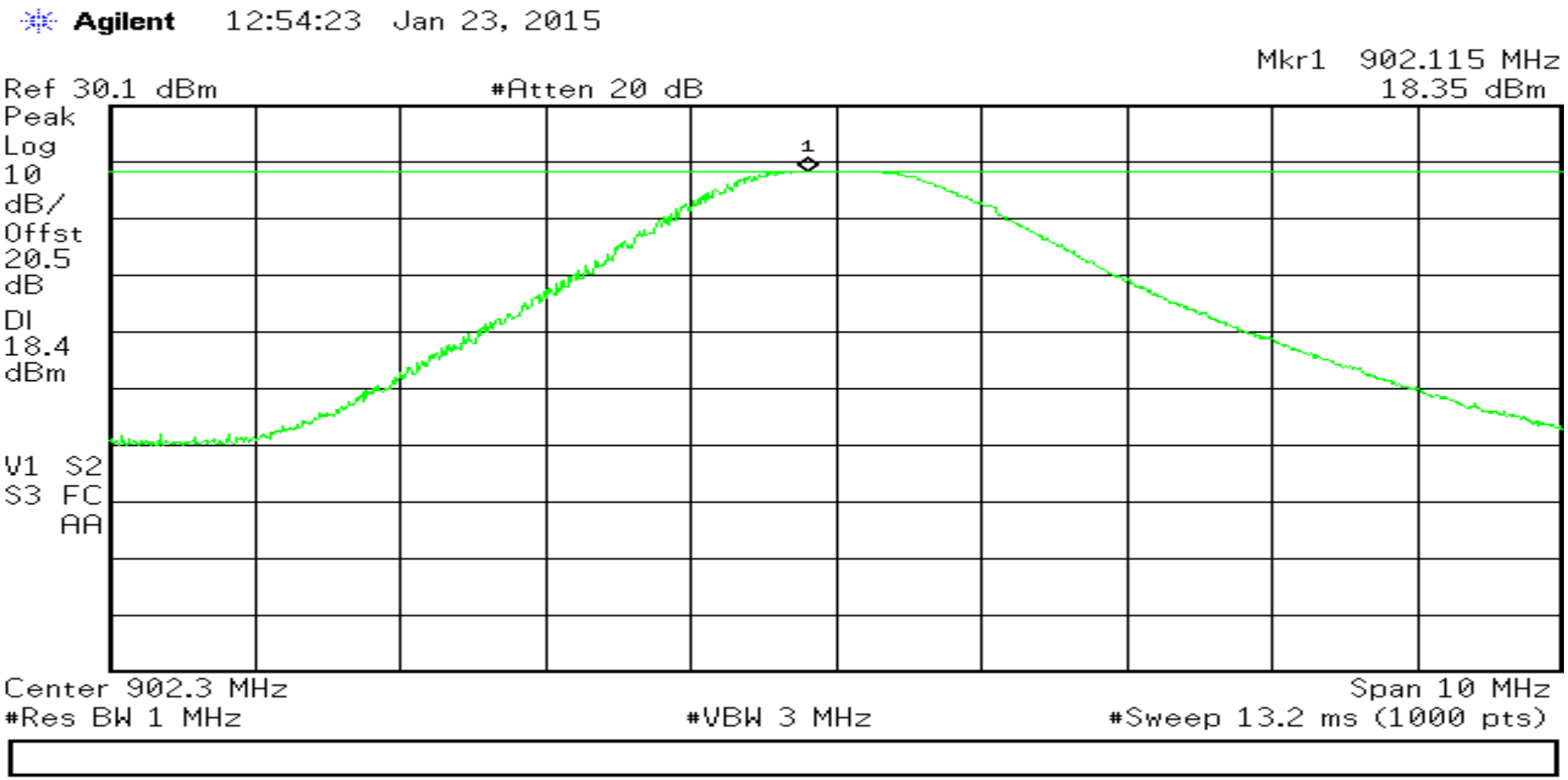


Test Setup, FHSS

Power Output
DTS Test Data

RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	Propane Sensor		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 902.30 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.35 dBm		



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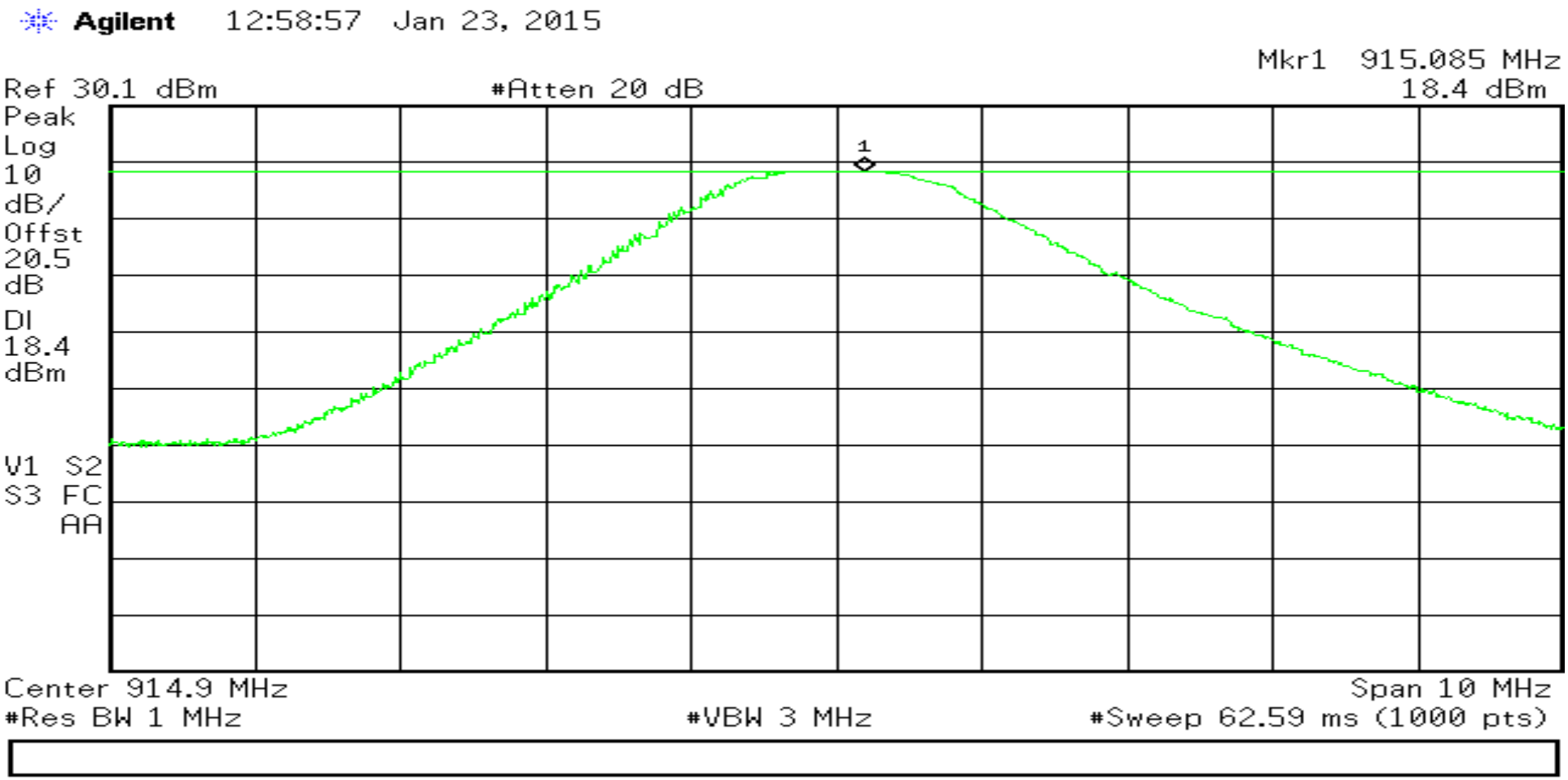
RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	Propane Sensor		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.40dBm		



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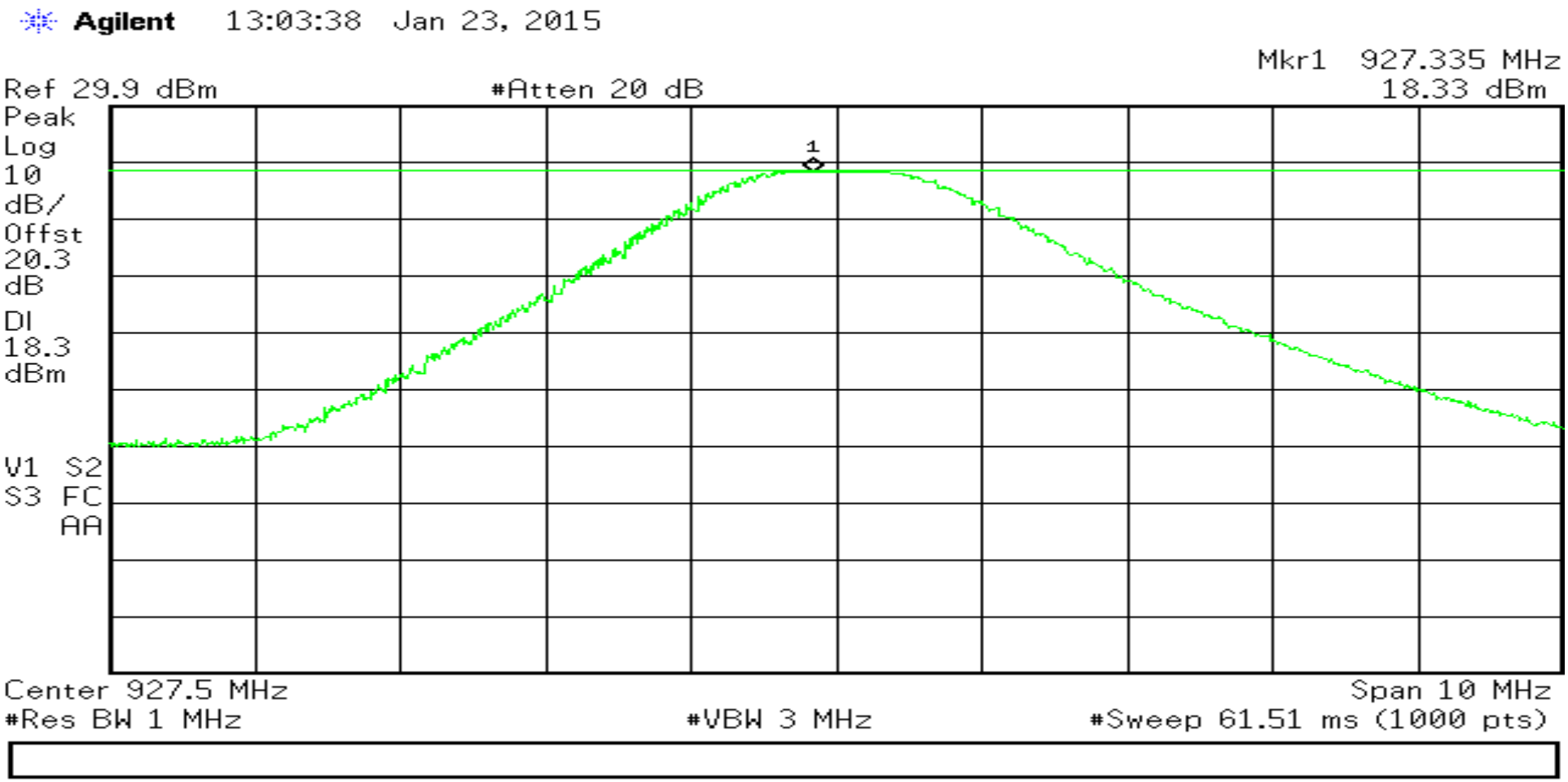
RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	Propane Sensor		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(3)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.33dBm		



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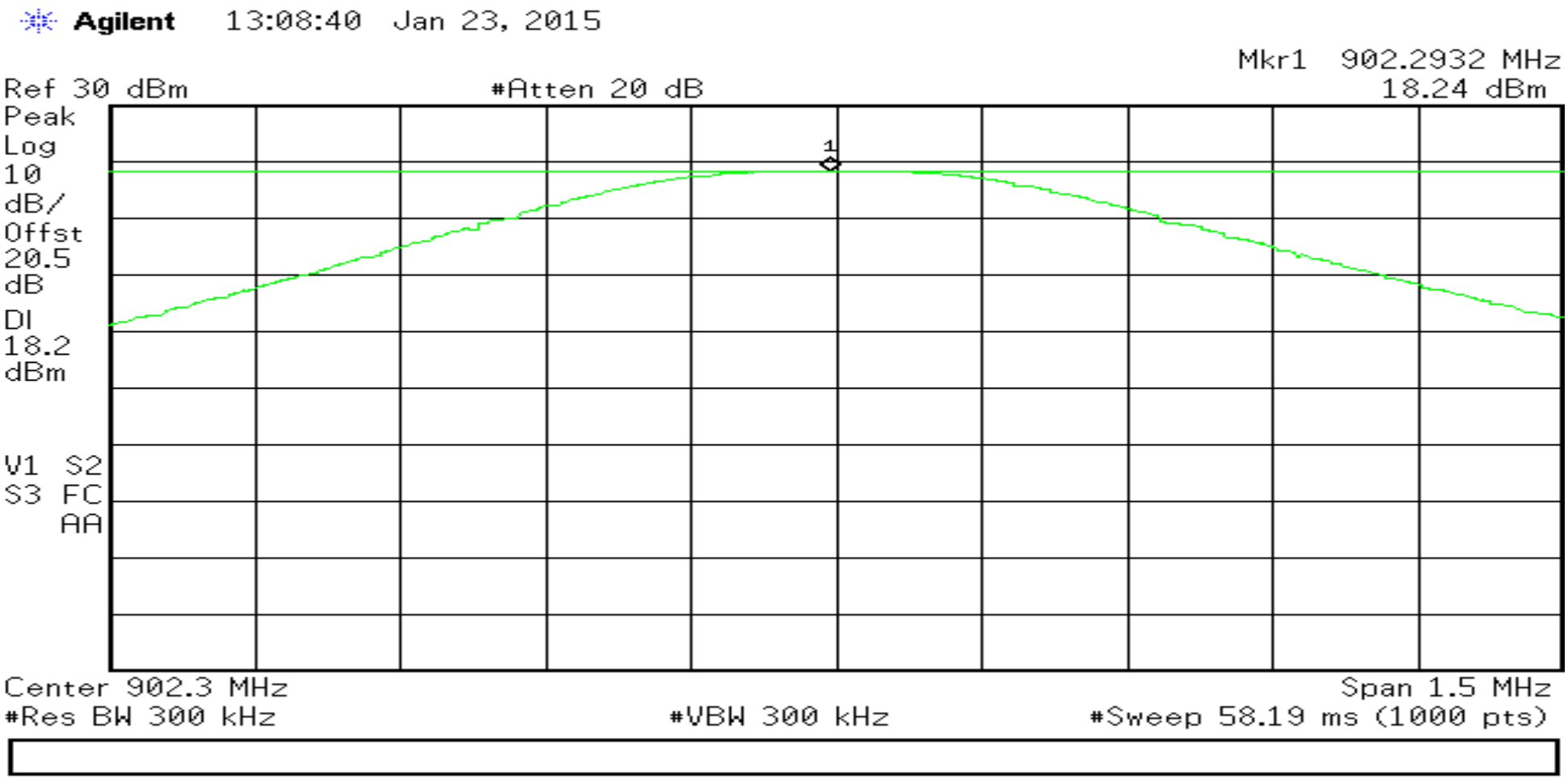
Power Output

FHSS Test Data

RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 902.30 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.24 dBm		



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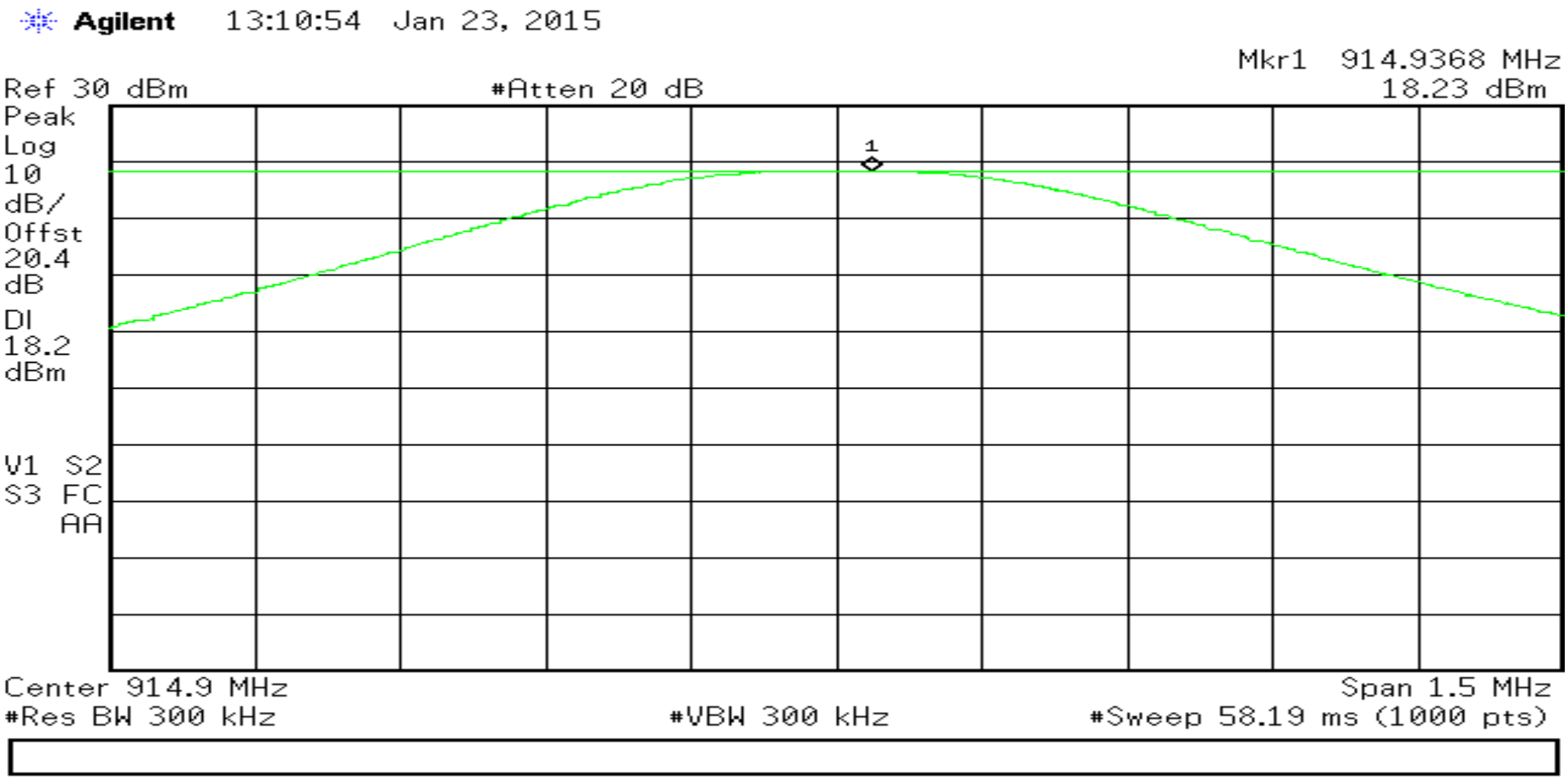
RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.23dBm		



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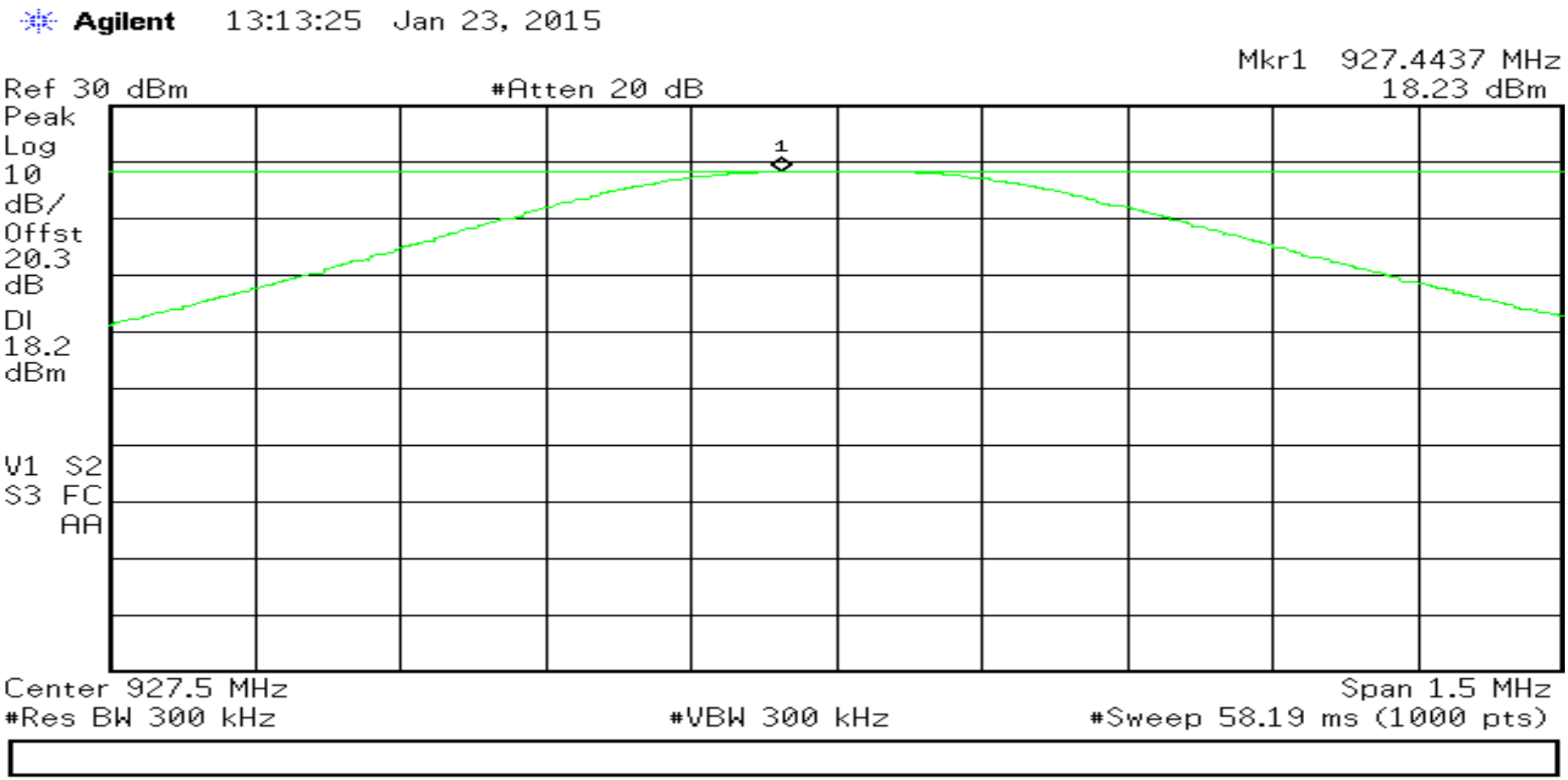
RETLIF TESTING LABORATORIES

Test Method:	Conducted Peak Power Output		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (b)(2)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Peak Power Output: 18.23dBm		



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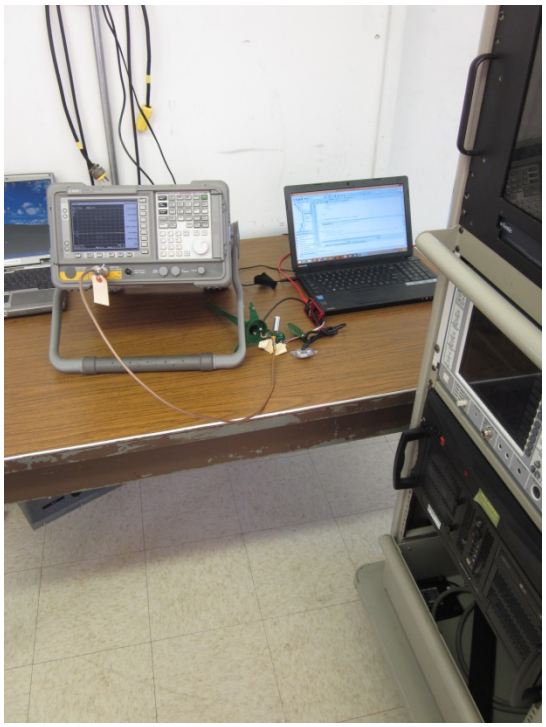
Test Photograph(s)
Antenna Terminal Out of Band/Band Edge Conducted Emissions, 30 MHz to 25 GHz
FCC Section 15.247(d)

Test Photograph(s)
Antenna Terminal Out of Band/Band Edge Conducted Emissions, 30 MHz to 25 GHz

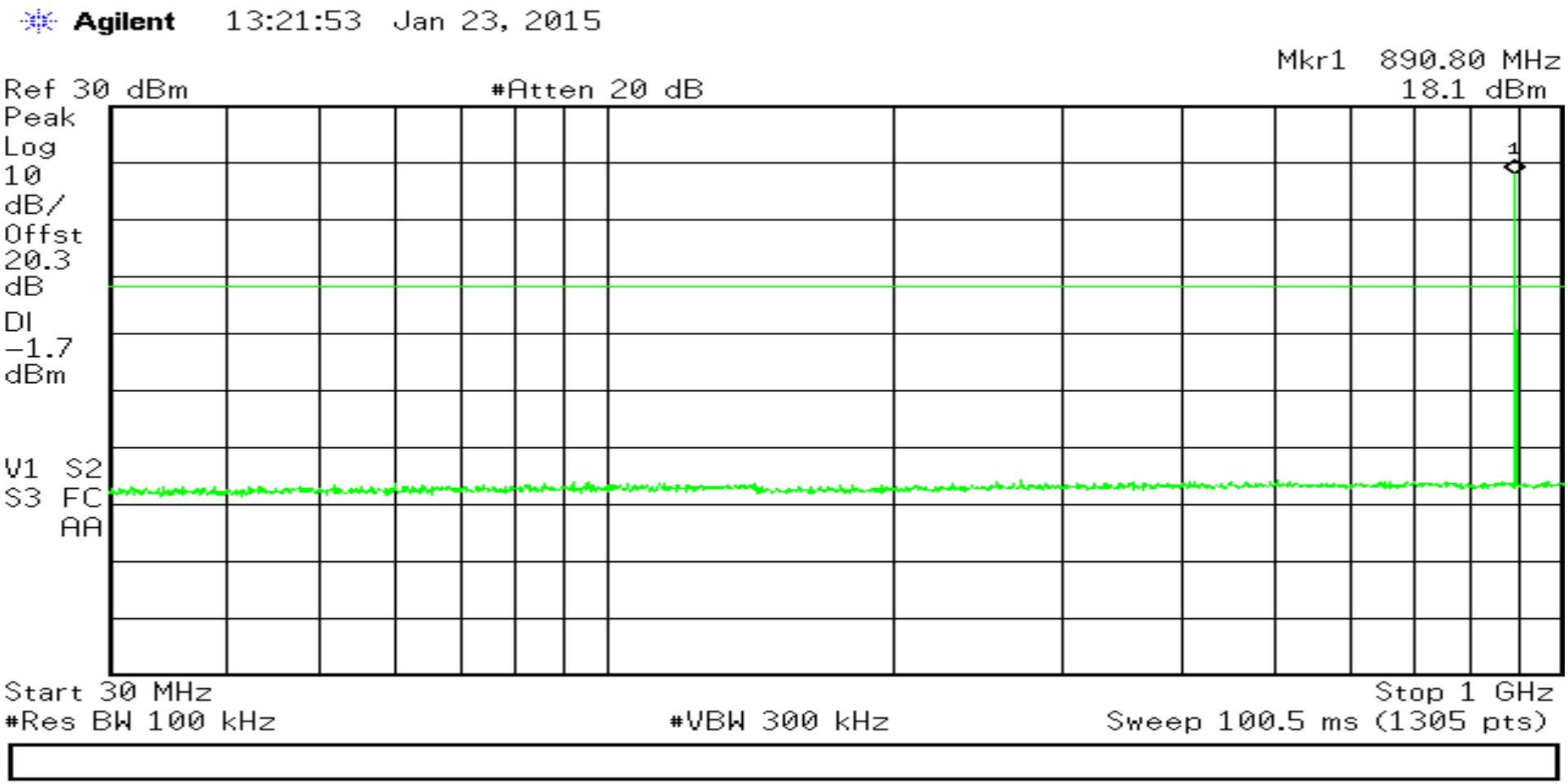


Test Setup

Antenna Terminal Out of Band/Band Edge Conducted Emissions, 30 MHz to 25 GHz
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 902.3 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.70 dBm		



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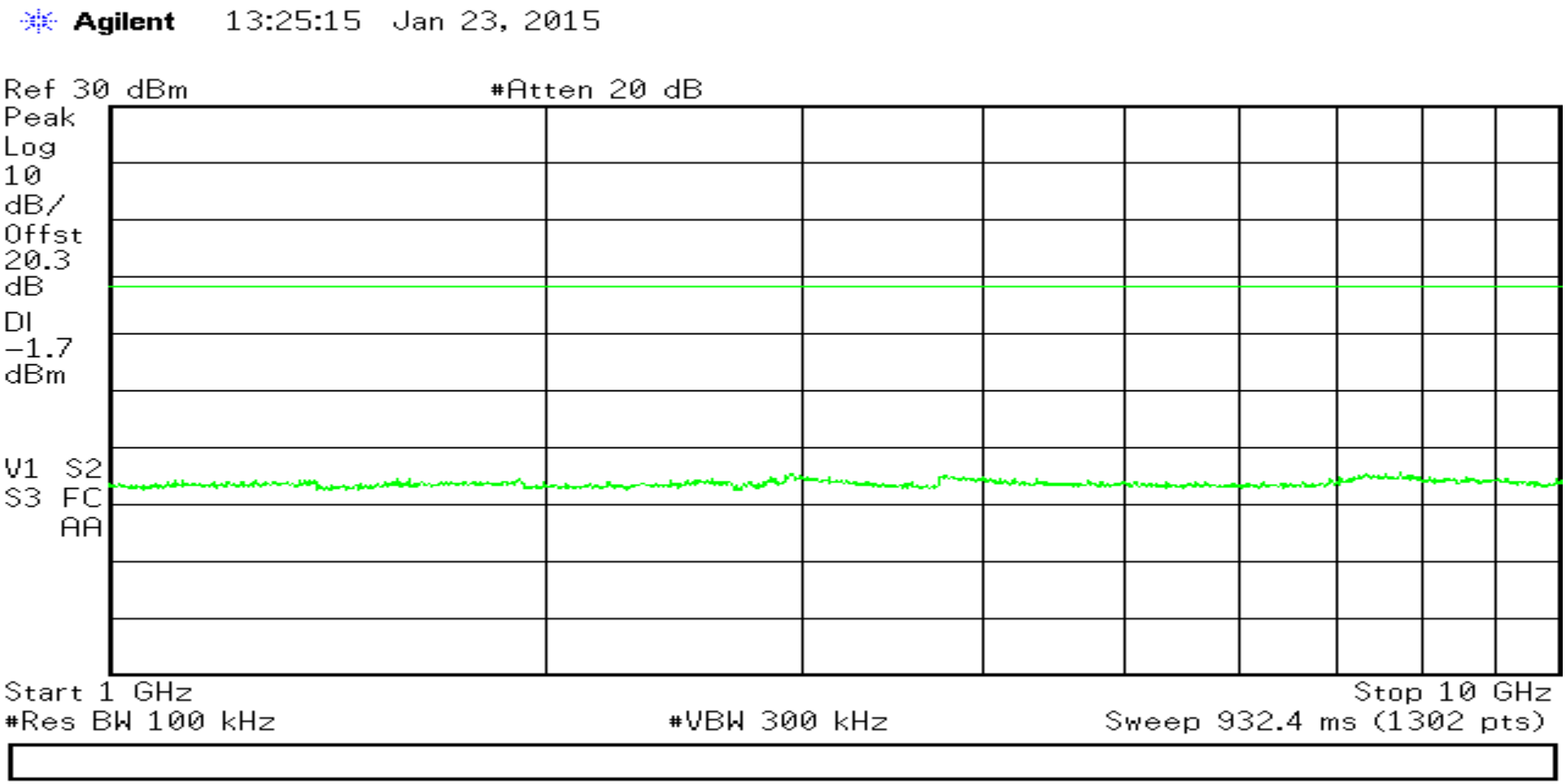
RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 902.3 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.70 dBm		



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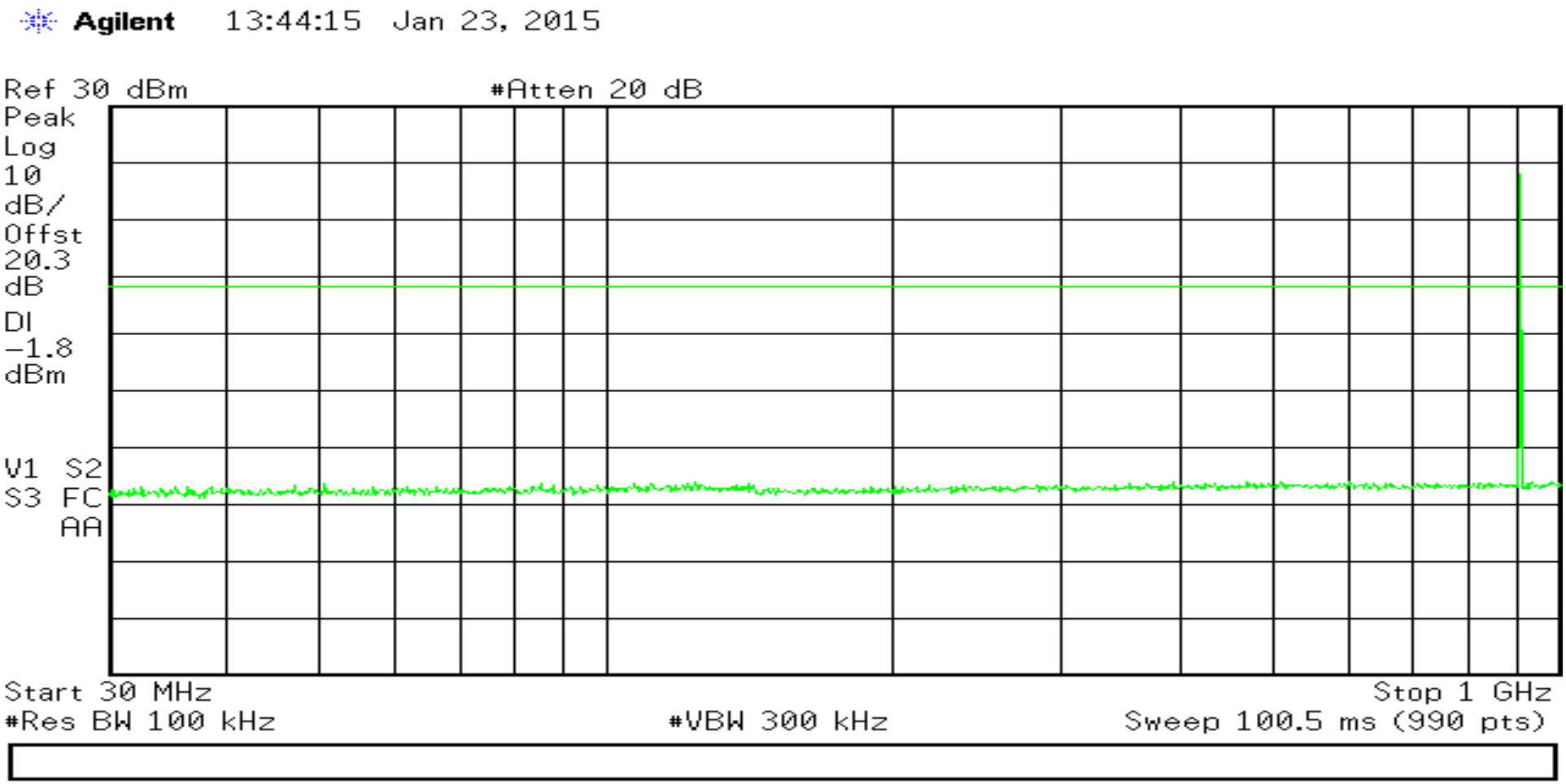
RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.80 dBm		



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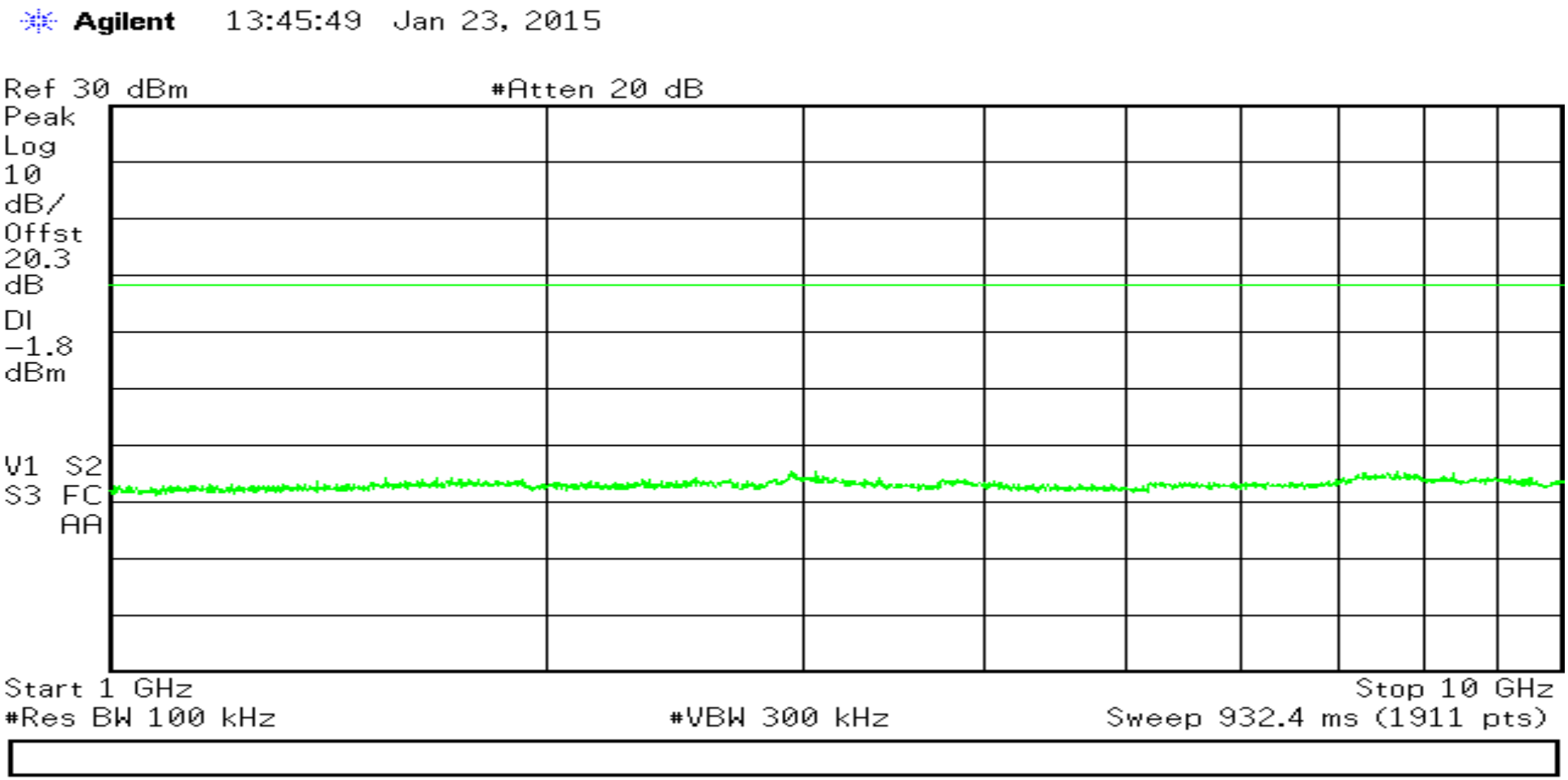
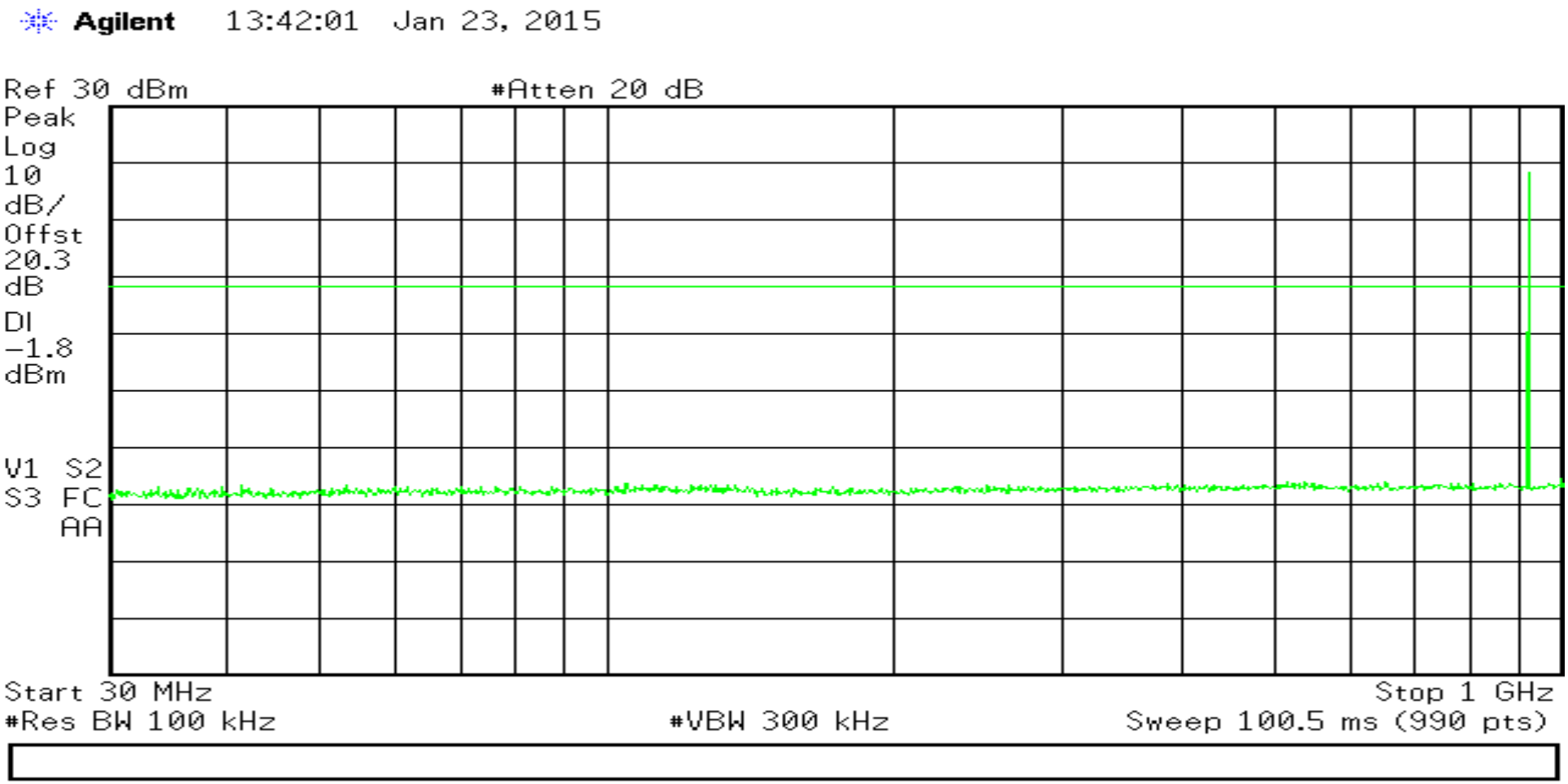
RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.80 dBm		



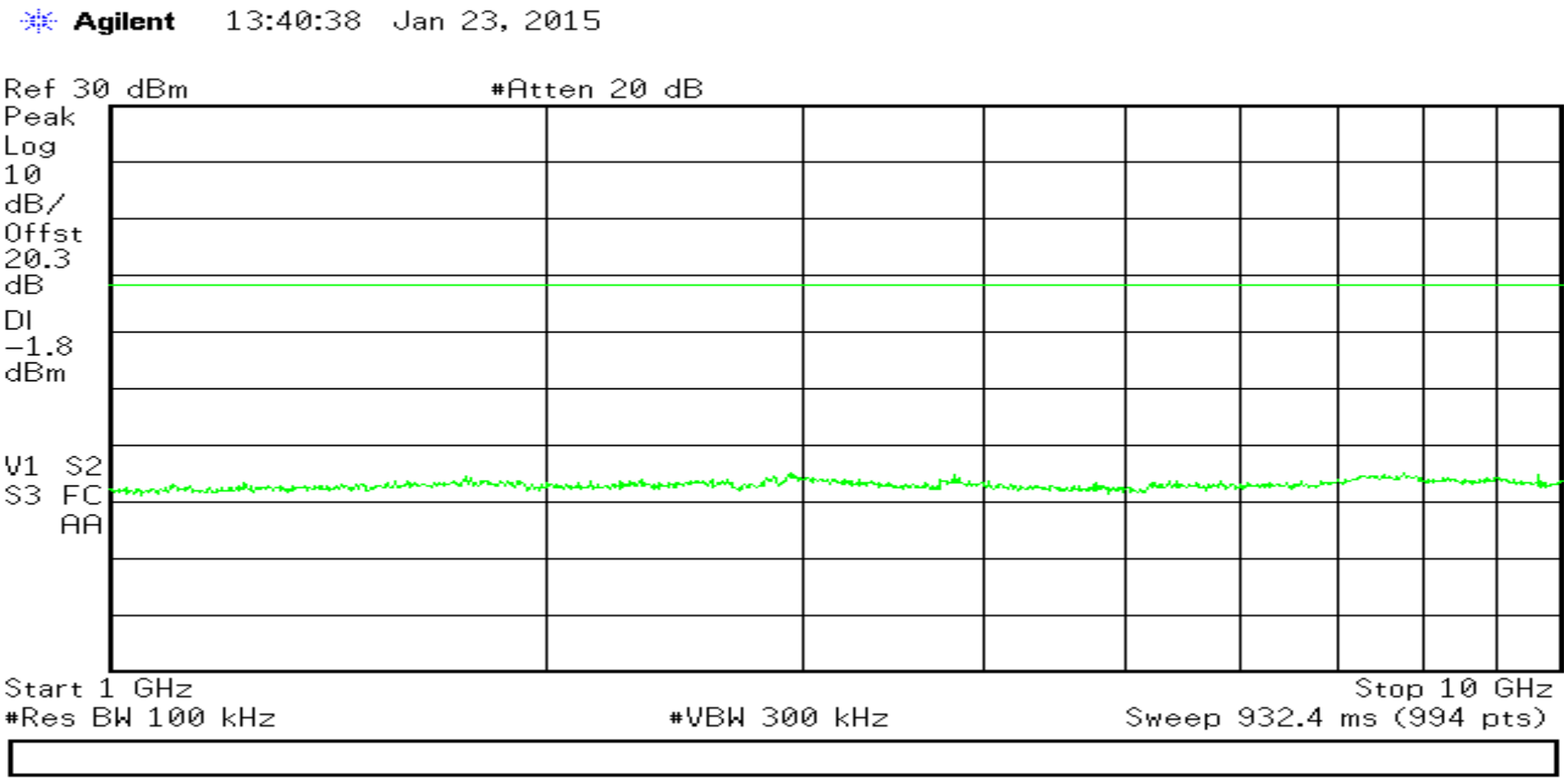
RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 25 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.80 dBm		



RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -3.0 dBm		



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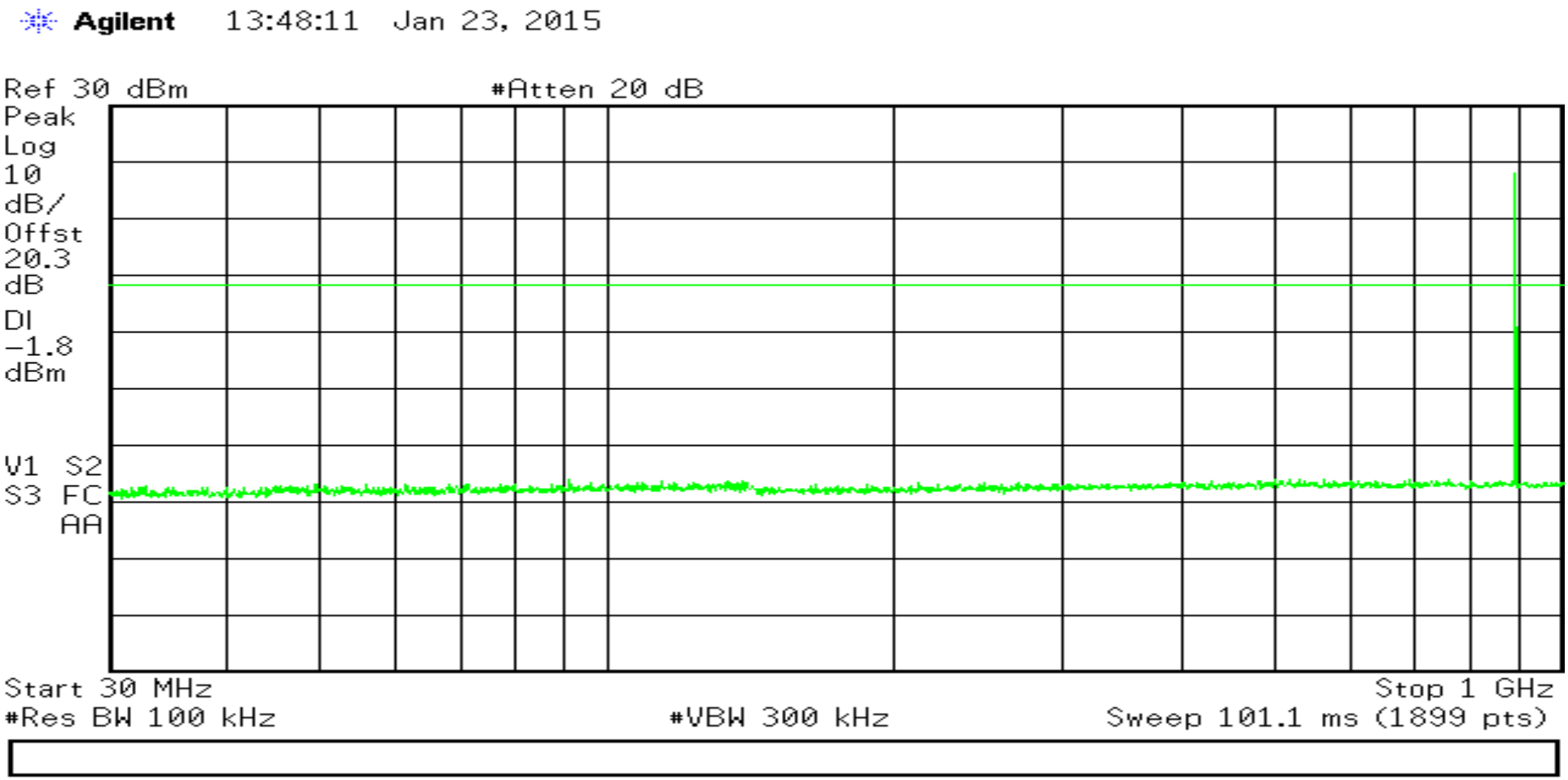
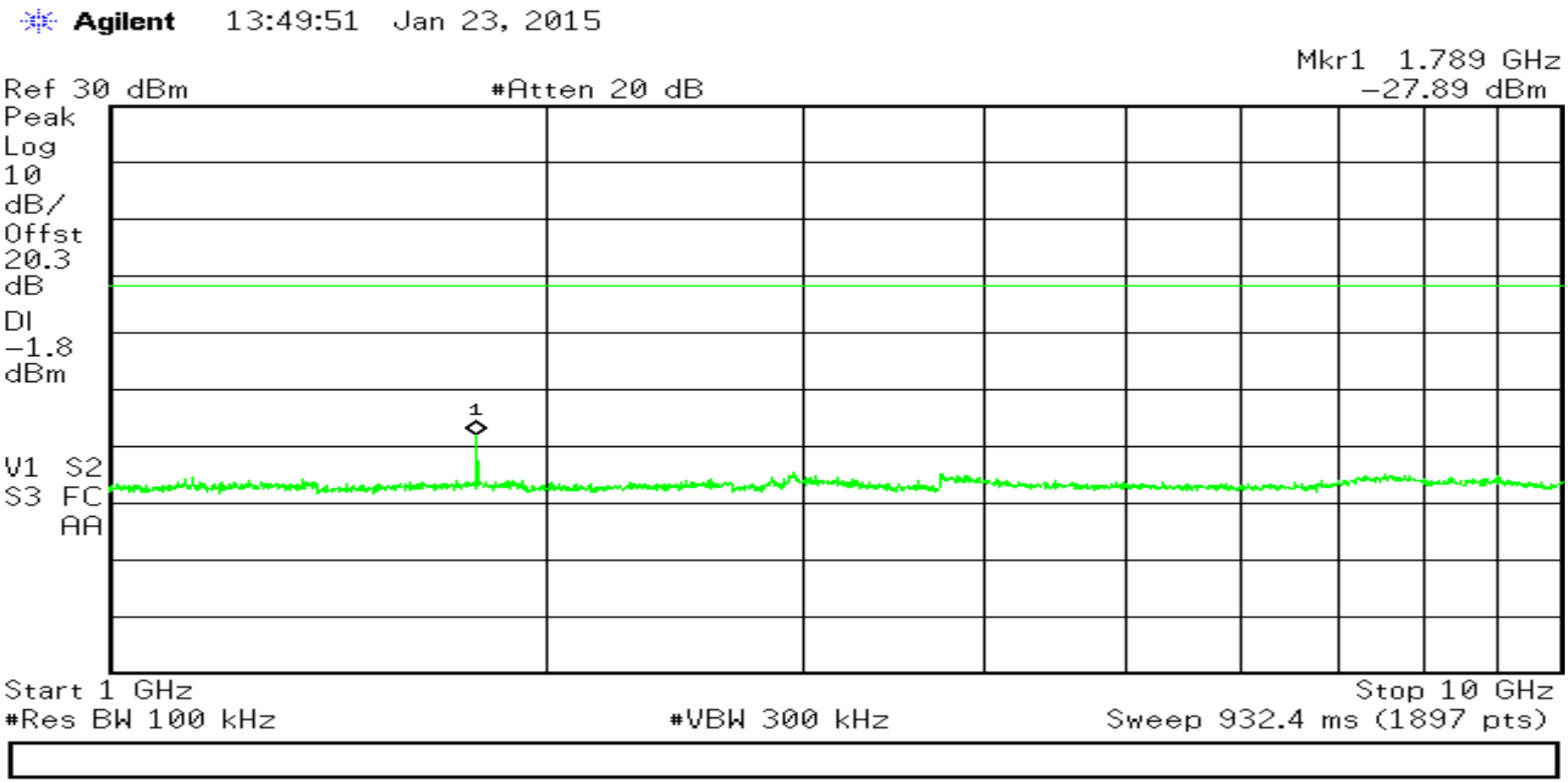
RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.80 dBm		



RETLIF TESTING LABORATORIES

Test Method:	Out of Band Conducted Emissions 30 MHz to 10 GHz		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Limit: -1.80 dBm		



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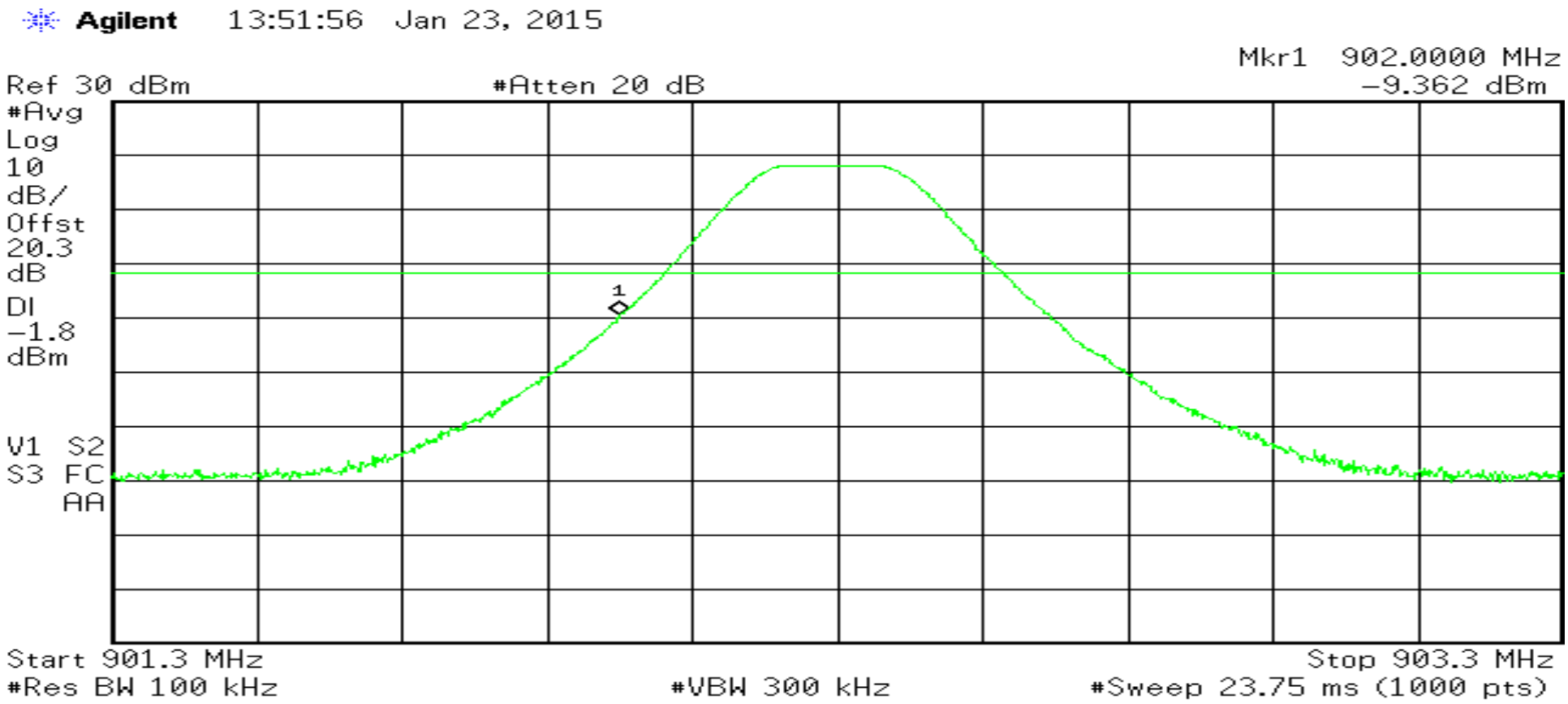
Band Edge Conducted
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Band Edge Conducted		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 902.30 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Lower Band Edge Reading: -9.362 dBm Limit: -1.80 dBm		



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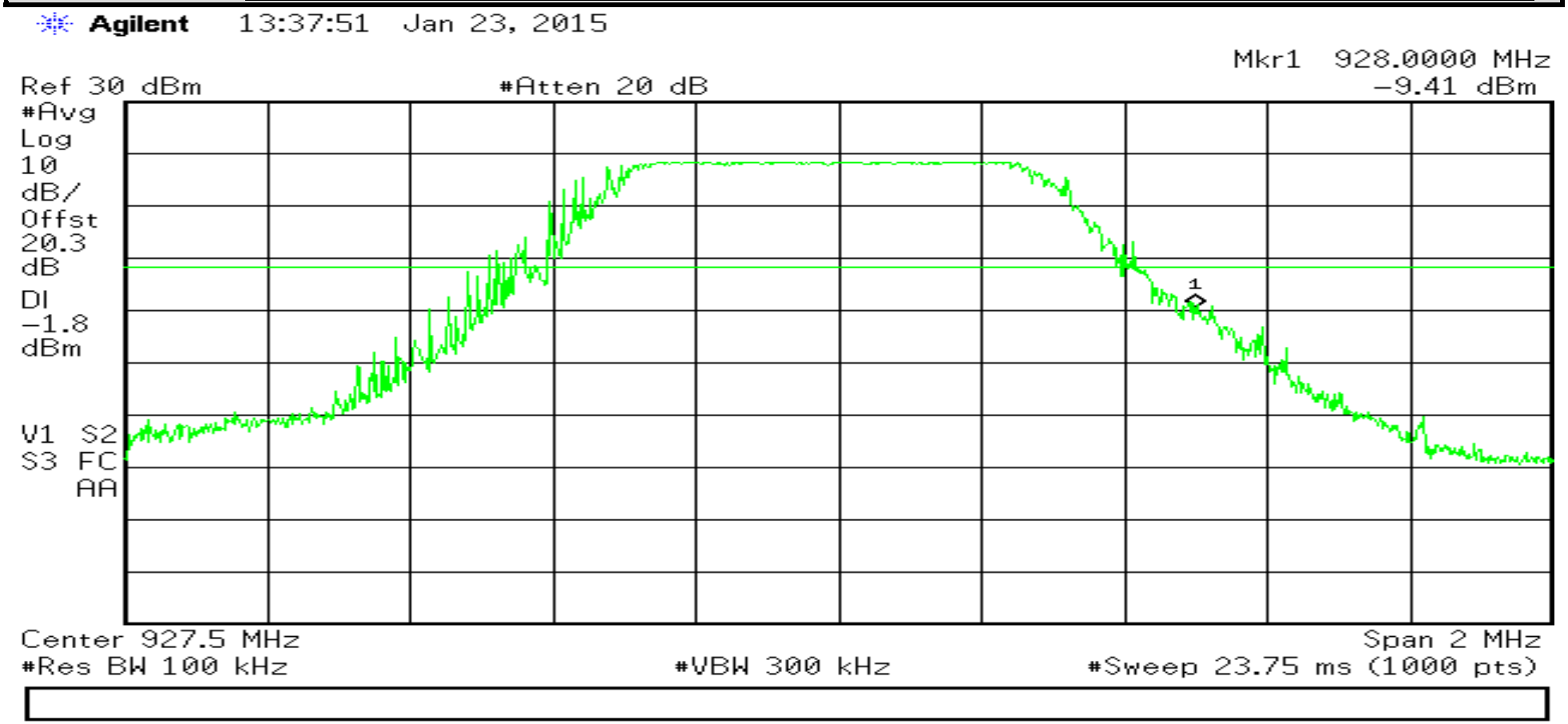
RETLIF TESTING LABORATORIES

Test Method:	Band Edge Conducted		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (d)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Upper Band Edge Reading: -9.41 dBm Limit: -1.80 dBm		



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Test Photograph(s)
Out of Band/Band Edge Radiated Emissions, 30 MHz to 10 GHz
FCC Section 15.247(d)

Test Photograph(s)
Out of Band/Band Edge Radiated Emissions

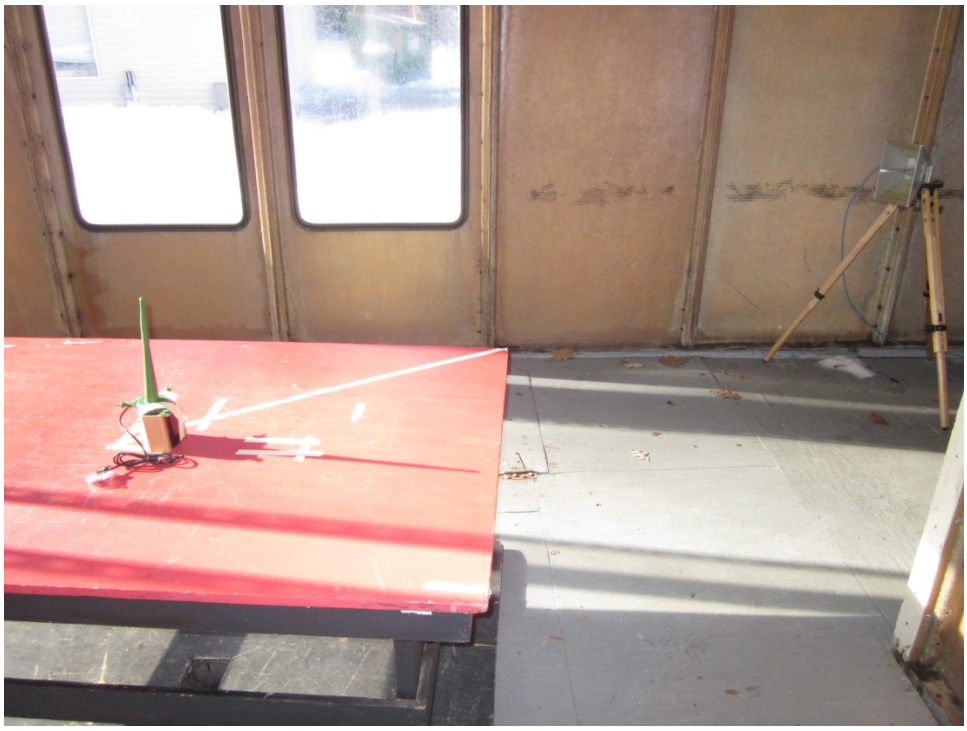
Test Setup

Test Photograph(s)
Out of Band/Band Edge Radiated Emissions

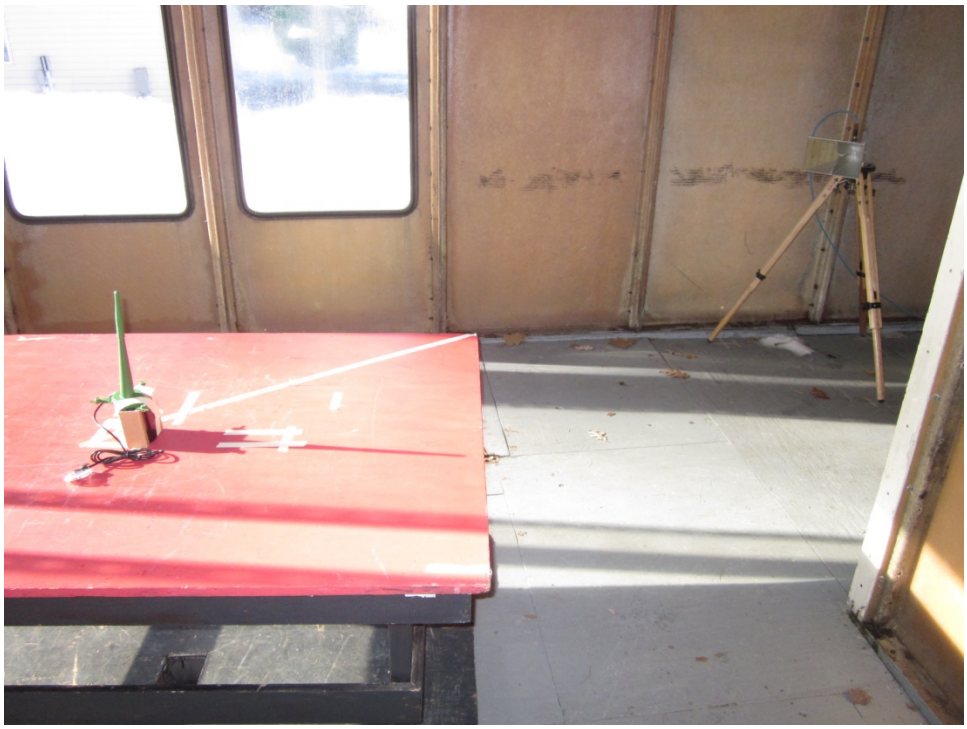
30 MHz – 1 GHz, Horizontal Polarization

30 MHz – 1 GHz, Vertical Polarization

Test Photograph(s)
Out of Band/Band Edge Radiated Emissions



1 GHz – 10 GHz, Horizontal Polarization



1 GHz – 10 GHz, Vertical Polarization

Unwanted Emissions into Restricted Frequency Bands
30 MHz to 10 GHz
DTS Test Data

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
37.50	-	-	-	-			-	100.00
|	38.00*	7.18*	14.42	21.60			12.22	I
38.25	-	-	-	-			-	100.00
73.00	-	-	-	-			-	100.00
|	73.50*	7.77*	8.73	16.50			6.68	I
75.20	-	-	-	-			-	100.00
108.00	-	-	-	-			-	150.00
|	115.00*	3.53*	9.87	13.40			4.67	I
121.94	-	-	-	-			-	150.00
123.00	-	-	-	-			-	150.00
|	132.00*	0.88*	9.72	10.60			3.38	|
138.00	-	-	-	-			-	150.00
149.90	-	-	-	-			-	150.00
|	150.00*	3.73*	11.97	15.70			6.09	I
150.05	-	-	-	-			-	150.00
156.52475	-	-	-	-			-	150.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 1 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	156.52500*	-1.24 *	12.84	11.60			3.80	|
156.52525	-	-	-	-			-	150.00
156.70	-	-	-	-			-	150.00
|	156.80*	-1.47*	12.87	11.40			3.71	|
156.90	-	-	-	-			-	150.00
162.0125	-	-	-	-			-	150.00
|	164.00*	-1.07*	13.57	12.50			4.21	|
167.1700	-	-	-	-			-	150.00
167.72	-	-	-	-			-	150.00
|	170.00*	1.23*	13.97	15.20			5.75	|
173.20	-	-	-	-			-	150.00
240.00	-	-	-	-			-	200.00
|	260.00*	-3.22*	18.92	15.70			6.09	|
285.00	-	-	-	-			-	200.00
322.00	-	-	-	-			-	200.00
|	330.00*	-3.55*	22.05	18.50			8.41	|

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 2 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
335.40	-	-	-	-			-	200.00
399.90	-	-	-	-			-	200.00
|	409.00*	-3.9*	24.70	20.80			10.96	|
410.00	-	-	-	-			-	200.00
608.00	-	-	-	-			-	200.00
|	611.00*	-4.97*	30.97	26.40			20.89	|
614.00	-	-	-	-			-	200.00
960.00	-	-	-	-			-	500.00
|	980.00*	-3.39	36.79	33.40			46.77	|
1240.00	-	-	-	-			-	500.00
1300.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1427.00	-	-	-	-			-	500.00
1435.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1646.50	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 3 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
1660.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1710.00	-	-	-	-			-	500.00
1718.80	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1722.20	-	-	-	-			-	500.00
2200.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2300.00	-	-	-	-			-	500.00
2310.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2390.00	-	-	-	-			-	500.00
2483.50	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2500.00	-	-	-	-			-	500.00
2690.00	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 4 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	2706.90	57.57	-4.65	52.92			442.58	|
|	2744.70	57.92	-4.65	53.27			460.78	|
|	2782.50	56.60	-4.65	51.95			395.82	|
2900.00	-	-	-	-			-	500.00
3260.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3267.00	-	-	-	-			-	500.00
3332.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3339.00	-	-	-	-			-	500.00
3345.80	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3358.00	-	-	-	-			-	500.00
3600.00	-	-	-	-			-	500.00
|	3609.02*	47.10*	-1.64	45.46			187.49	|
|	3659.60*	42.92*	-1.64	41.28			115.87	|
|	3710.00*	42.79*	-1.64	41.15			114.15	|

EUT emissions observed throughout the given frequency spectrum were recorded and evaluated. Emission levels closest to the limit are listed on this data sheet. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 5 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
4400.00	-	-	-	-			-	500.00
4500.00	-	-	-	-			-	500.00
|	4511.50*	41.89*	1.25	43.14			143.54	|
|	4574.50*	41.72*	1.25	42.97			140.76	|
|	4637.50*	42.13*	1.25	43.38			147.57	|
5150.00	-	-	-	-			-	500.00
5350.00	-	-	-	-			-	500.00
|	5413.80*	42.07*	2.48	44.55			168.85	|
|	-	-	-	-			-	
5460.00	-	--	-	-			-	500.00
7250.00	-	-	-	-			-	500.00
|	7319.20*	43.09*	4.29	47.38			233.88	
|	7420.00*	42.86 *	4.29	47.15			227.77	
7750.00	-	-	-	-			-	500.00
8025.00	-	-	-	-			-	500.00
|	8120.70*	43.22*	4.21	47.53			237.95	|
|	8234.10*	43.12*	4.21	47.33			232.54	|

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 6 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting modulated (DTS) signal	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	8347.50*	43.20*	4.21	47.15			227.77	|
8500.00	-	-	-	-			-	500.00
9000.00	-	-	-	-			-	500.00
|	9023.00*	43.19*	5.43	48.62			239.77	|
|	9149.00*	43.46*	5.43	48.89			278.29	|
9200.00	-	-	-	-			-	500.00
9300.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
10000.00	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 7 of 7

Unwanted Emissions into Restricted Frequency Bands
30 MHz to 10 GHz
FHSS Test Data

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
37.50	-	-	-	-			-	100.00
|	38.00*	7.18*	14.42	21.60			12.22	I
38.25	-	-	-	-			-	100.00
73.00	-	-	-	-			-	100.00
|	73.50*	7.77*	8.73	16.50			6.68	I
75.20	-	-	-	-			-	100.00
108.00	-	-	-	-			-	150.00
|	115.00*	3.53*	9.87	13.40			4.67	I
121.94	-	-	-	-			-	150.00
123.00	-	-	-	-			-	150.00
|	132.00*	0.88*	9.72	10.60			3.38	|
138.00	-	-	-	-			-	150.00
149.90	-	-	-	-			-	150.00
|	150.00*	3.73*	11.97	15.70			6.09	I
150.05	-	-	-	-			-	150.00
156.52475	-	-	-	-			-	150.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 1 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	156.52500*	-1.24 *	12.84	11.60			3.80	|
156.52525	-	-	-	-			-	150.00
156.70	-	-	-	-			-	150.00
|	156.80*	-1.47*	12.87	11.40			3.71	|
156.90	-	-	-	-			-	150.00
162.0125	-	-	-	-			-	150.00
|	164.00*	-1.07*	13.57	12.50			4.21	|
167.1700	-	-	-	-			-	150.00
167.72	-	-	-	-			-	150.00
|	170.00*	1.23*	13.97	15.20			5.75	|
173.20	-	-	-	-			-	150.00
240.00	-	-	-	-			-	200.00
|	260.00*	-3.22*	18.92	15.70			6.09	|
285.00	-	-	-	-			-	200.00
322.00	-	-	-	-			-	200.00
|	330.00*	-3.55*	22.05	18.50			8.41	|

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 2 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
335.40	-	-	-	-			-	200.00
399.90	-	-	-	-			-	200.00
|	409.00*	-3.9*	24.70	20.80			10.96	|
410.00	-	-	-	-			-	200.00
608.00	-	-	-	-			-	200.00
|	611.00*	-4.97*	30.97	26.40			20.89	|
614.00	-	-	-	-			-	200.00
960.00	-	-	-	-			-	500.00
|	980.00*	-3.39	36.79	33.40			46.77	|
1240.00	-	-	-	-			-	500.00
1300.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1427.00	-	-	-	-			-	500.00
1435.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1646.50	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 3 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
1660.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1710.00	-	-	-	-			-	500.00
1718.80	-	-	-	-			-	500.00
|	-	-	-	-			-	|
1722.20	-	-	-	-			-	500.00
2200.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2300.00	-	-	-	-			-	500.00
2310.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2390.00	-	-	-	-			-	500.00
2483.50	-	-	-	-			-	500.00
|	-	-	-	-			-	|
2500.00	-	-	-	-			-	500.00
2690.00	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 4 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	2706.90	48.59	-4.65	43.94			157.39	|
|	2725.50	49.19	-4.65	44.54			168.65	|
|	2744.70	49.25	-4.65	44.60			169.82	|
2900.00	-	-	-	-			-	500.00
3260.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3267.00	-	-	-	-			-	500.00
3332.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3339.00	-	-	-	-			-	500.00
3345.80	-	-	-	-			-	500.00
|	-	-	-	-			-	|
3358.00	-	-	-	-			-	500.00
3600.00	-	-	-	-			-	500.00
|	3609.02*	42.28*	-1.64	40.64			107.64	|
|	3634.00*	42.30*	-1.64	40.66			107.89	|
|	3659.90*	42.13*	-1.64	40.49			105.80	|

EUT emissions observed throughout the given frequency spectrum were recorded and evaluated. Emission levels closest to the limit are listed on this data sheet. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 5 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
4400.00	-	-	-	-			-	500.00
4500.00	-	-	-	-			-	500.00
|	4511.50*	41.75*	1.25	43.00			141.25	|
|	4542.50*	41.48*	1.25	42.73			136.93	|
|	4574.50*	41.27*	1.25	42.52			133.06	|
5150.00	-	-	-	-			-	500.00
5350.00	-	-	-	-			-	500.00
|	5413.80*	41.41*	2.48	43.89			156.49	|
|	5451.00*	41.40*	2.48	43.88			156.31	
5460.00	-	--	-	-			-	500.00
7250.00	-	-	-	-			-	500.00
|	7268.00*	42.58*	4.29	46.87			220.54	
|	7319.20*	42.52*	4.29	46.81			219.02	
7750.00	-	-	-	-			-	500.00
8025.00	-	-	-	-			-	500.00
|	8120.70*	43.05*	4.21	47.26			230.67	|
|	8176.50*	42.65*	4.21	46.86			220.29	|

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 6 of 7

RETLIF TESTING LABORATORIES

EMISSIONS TEST DATA SHEET

Test Method	**Restricted Band Emissions 25 MHz to 10 GHz**	
Customer	Senet, Inc.	
Job Number	R-5909N-1	
Test Sample	Propane Sensor	
Part Number	5847	
Serial Number	219-04-2166 Rev. C	
Test Specification	FCC Part 15 Subpart C	Paragraph: 15.247(d)
Operating Mode	Transmitting hopping frequency data	
Technician	M. Seamans	
Date	January 29th, 2015	

Notes: Test Antenna Distance: 3 meters Detector: Quasi-Peak <1GHz, Average >1GHz

TEST PARAMETERS

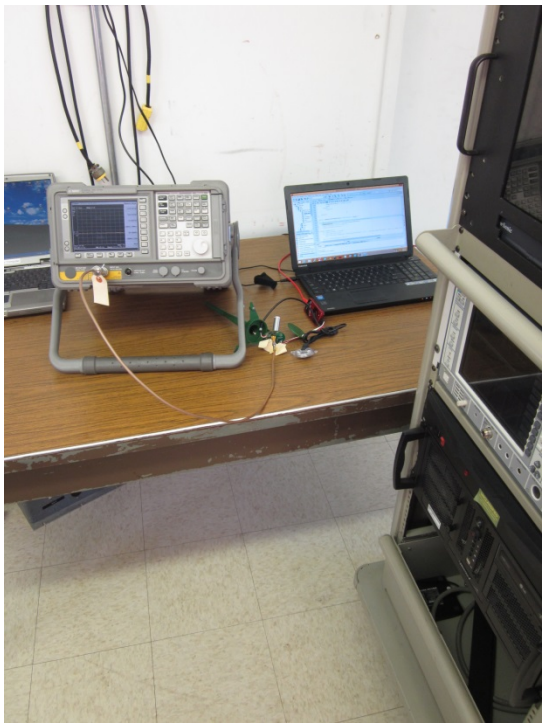
Restricted Band	Measured Frequency	Meter Reading	Correction Factor	Corrected Reading			Converted Reading	Limit at 3M
MHz	MHz	dBuV	dB	dBuV/m			uV/m	uV/m
|	8234.10*	42.83*	4.21	47.04			224.90	|
8500.00	-	-	-	-			-	500.00
9000.00	-	-	-	-			-	500.00
|	9023.00*	43.08*	5.43	48.51			266.37	|
|	9085.00*	42.80*	5.43	48.23			257.92	|
9200.00	-	-	-	-			-	500.00
9300.00	-	-	-	-			-	500.00
|	-	-	-	-			-	|
10000.00	-	-	-	-			-	500.00

No EUT emissions within 10 dB of the specified test limit were observed at the specified test distance throughout the given frequency spectrum. * This emission is not from the EUT. It is a measurement of minimum measurement system sensitivity (Noise Floor).

Data Sheet 7 of 7

Test Photograph(s)
Power Density
FCC Section 15.247(e)

Test Photograph(s)
Power Density

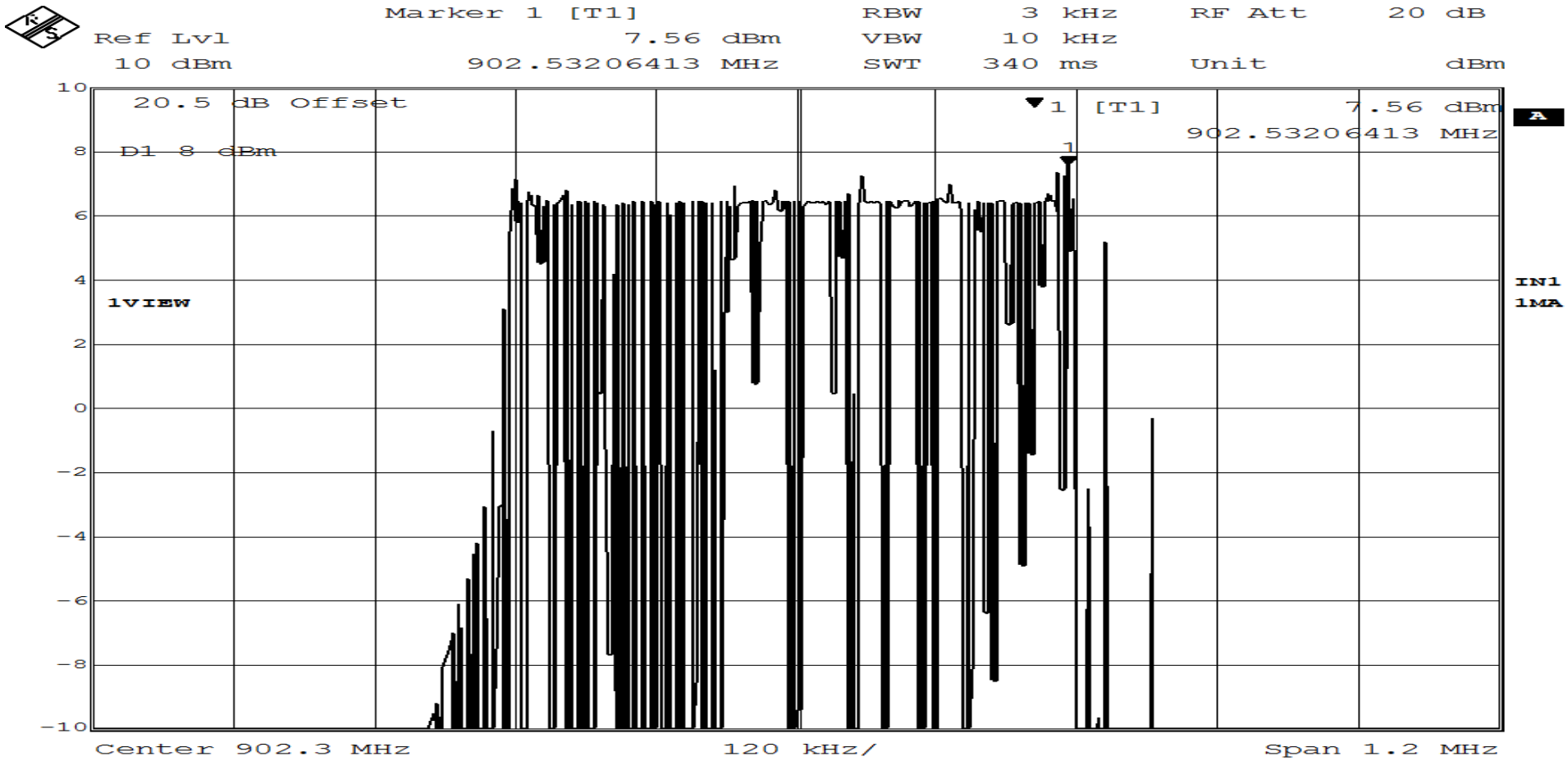


Test Configuration

Power Spectral Density
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Power Spectral Density		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 902.30 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (e)		
Technician	M. Seamans	**Date**	January 26th, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Power Spectral Density: 7.56 dBm Limit: 8.0 dBm		



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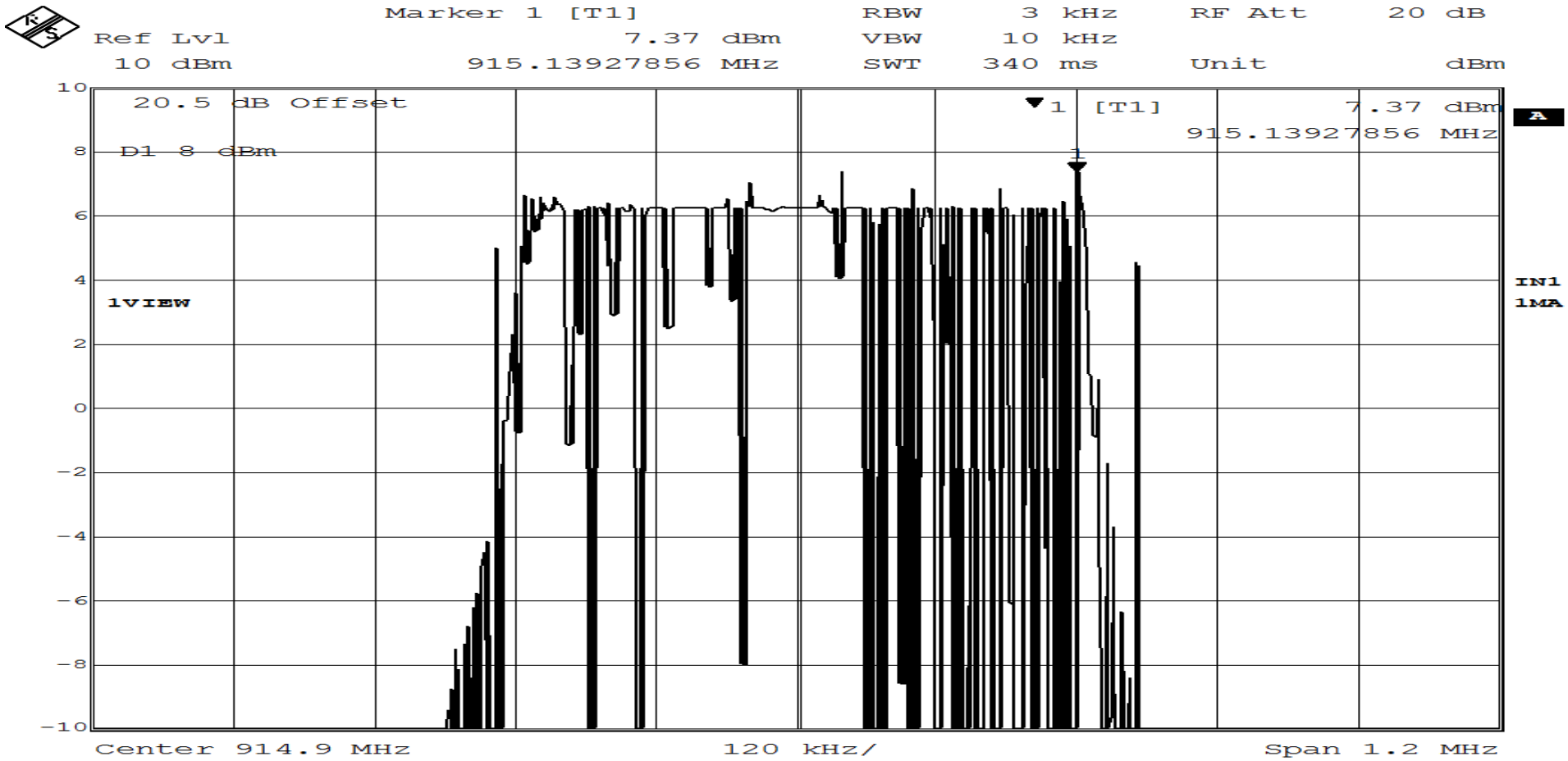
RETLIF TESTING LABORATORIES

Test Method:	Power Spectral Density		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (e)		
Technician	M. Seamans	**Date**	January 26th, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Power Spectral Density: 7.37 dBm Limit: 8.0 dBm		



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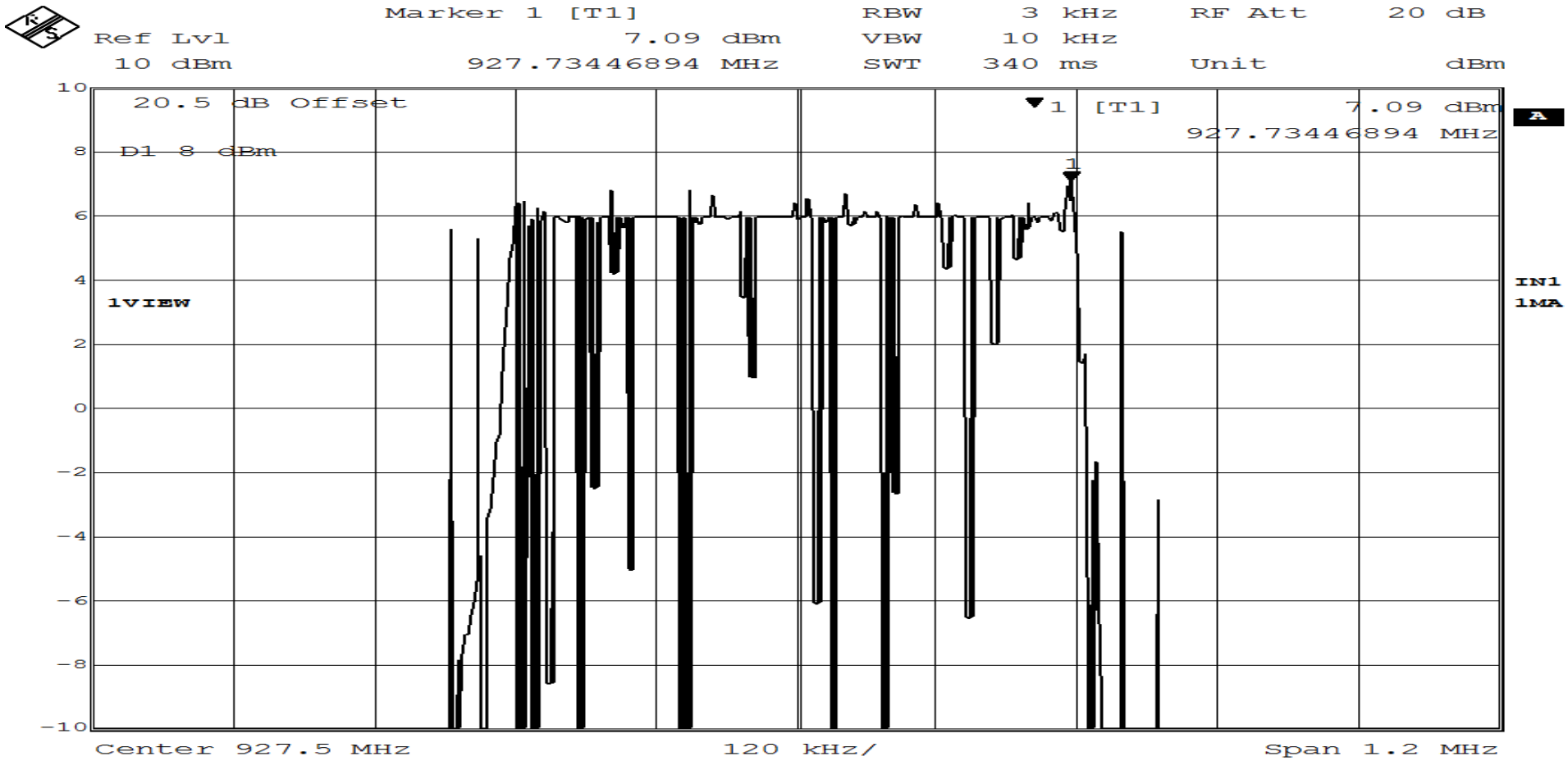
RETLIF TESTING LABORATORIES

Test Method:	Power Spectral Density		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (DTS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (e)		
Technician	M. Seamans	**Date**	January 26th, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Power Spectral Density: 7.09 dBm Limit: 8.0 dBm		



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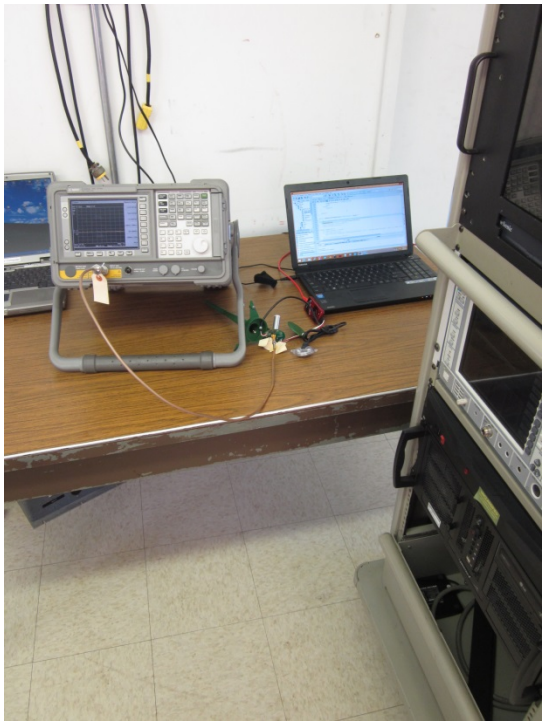
Test Photograph(s)
FHSS Bandwidth
20 dB Bandwidth
FCC Section 15.247(a)(1)

Test Photograph(s)
FHSS Bandwidth
20 dB Bandwidth

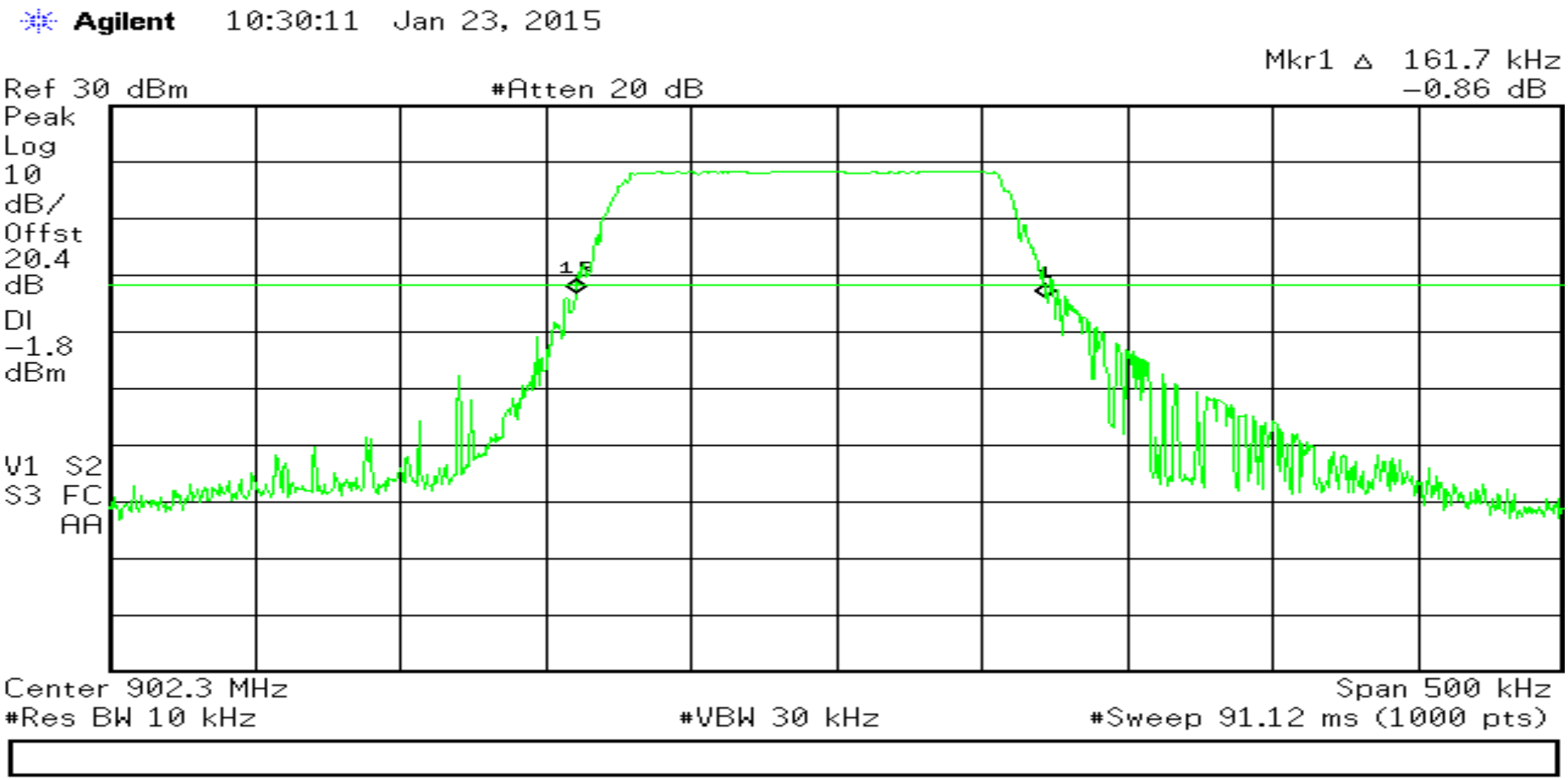


Test Setup

FHSS Bandwidth
20 dB Bandwidth
Test Data

RETLIF TESTING LABORATORIES

Test Method:	20dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 902.30 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 161.7 kHz		



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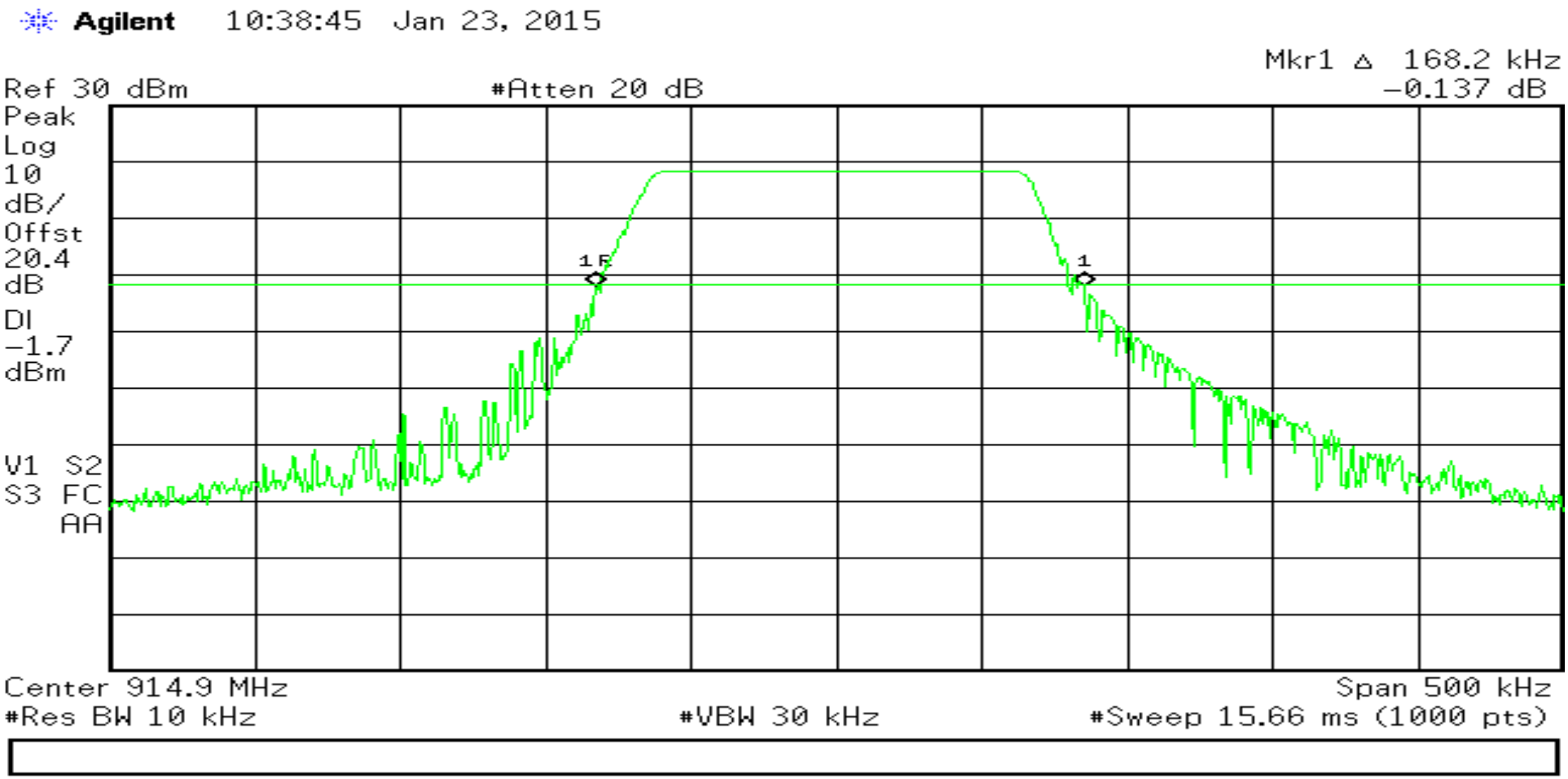
RETLIF TESTING LABORATORIES

Test Method:	20dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 914.9 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 168.2 kHz		



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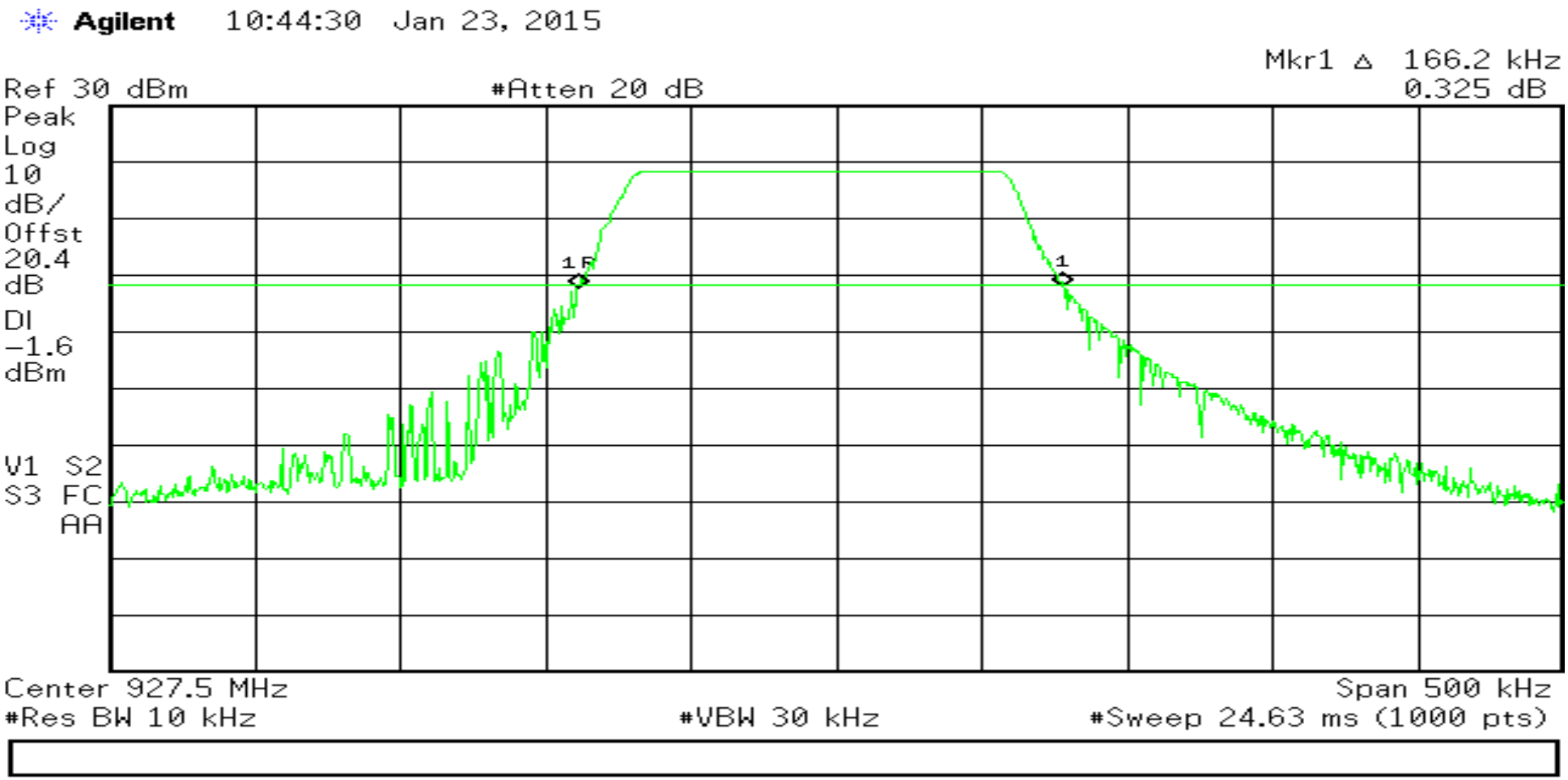
RETLIF TESTING LABORATORIES

Test Method:	20dB Bandwidth		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting modulated (FHSS) signal at 927.5 MHz		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Occupied Bandwidth: 166.2 kHz		



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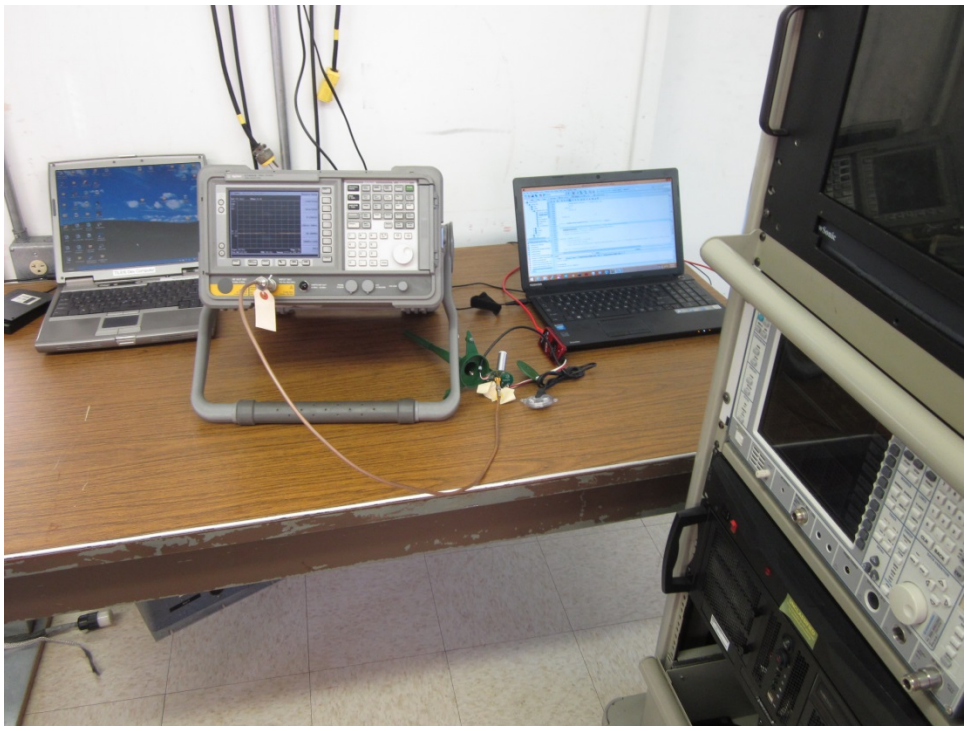
Test Photograph(s)
Number of Hopping Channels and Time of Occupancy
FCC Section 15.247(a)(1)(iii)

Test Photograph(s)
Number of Hopping Channels and Time of Occupancy

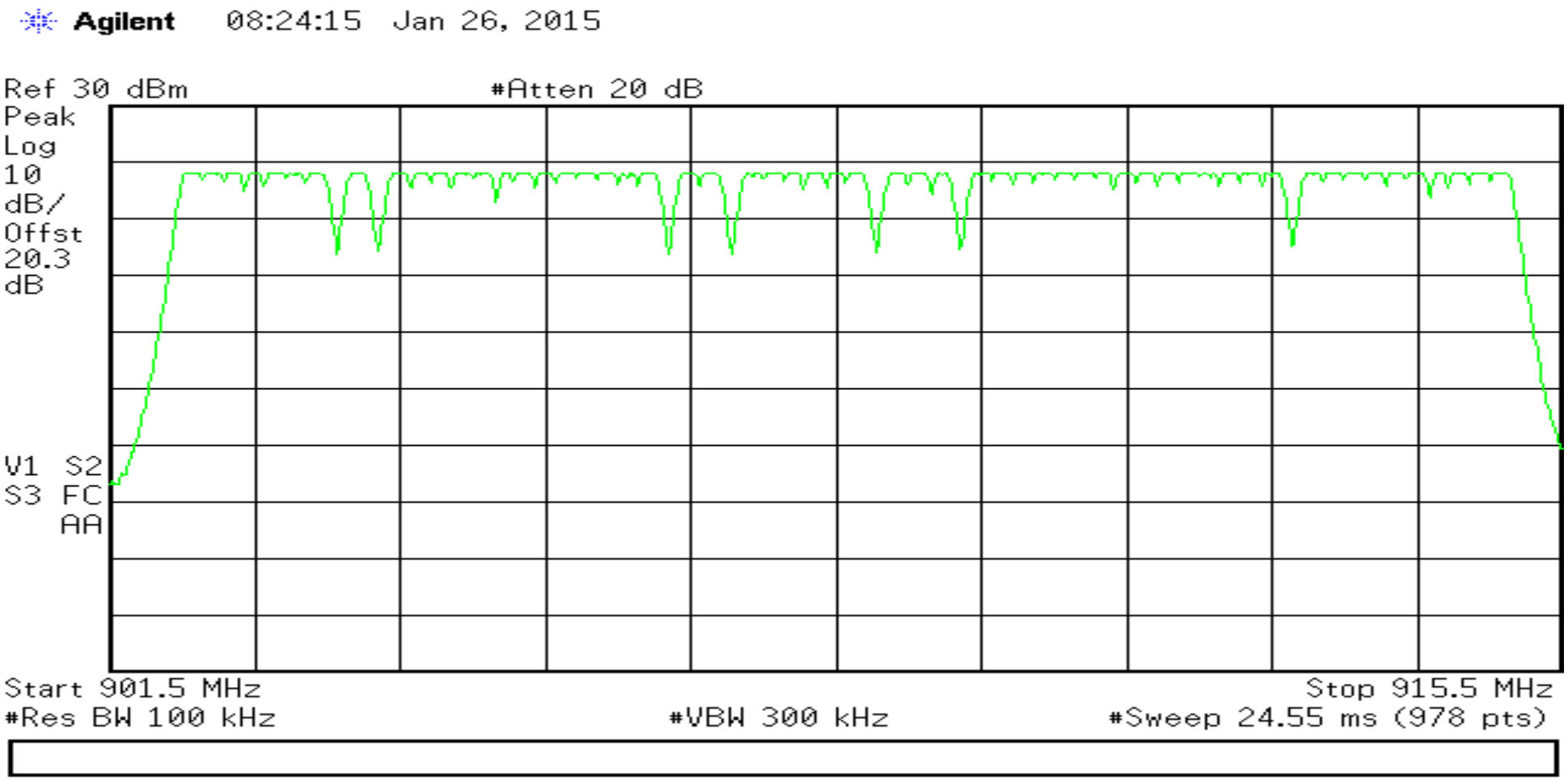


Test Setup

Number of Hopping Channels and Time of Occupancy
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Number of Hopping Frequencies		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Total Number of Hopping Frequencies: 64		



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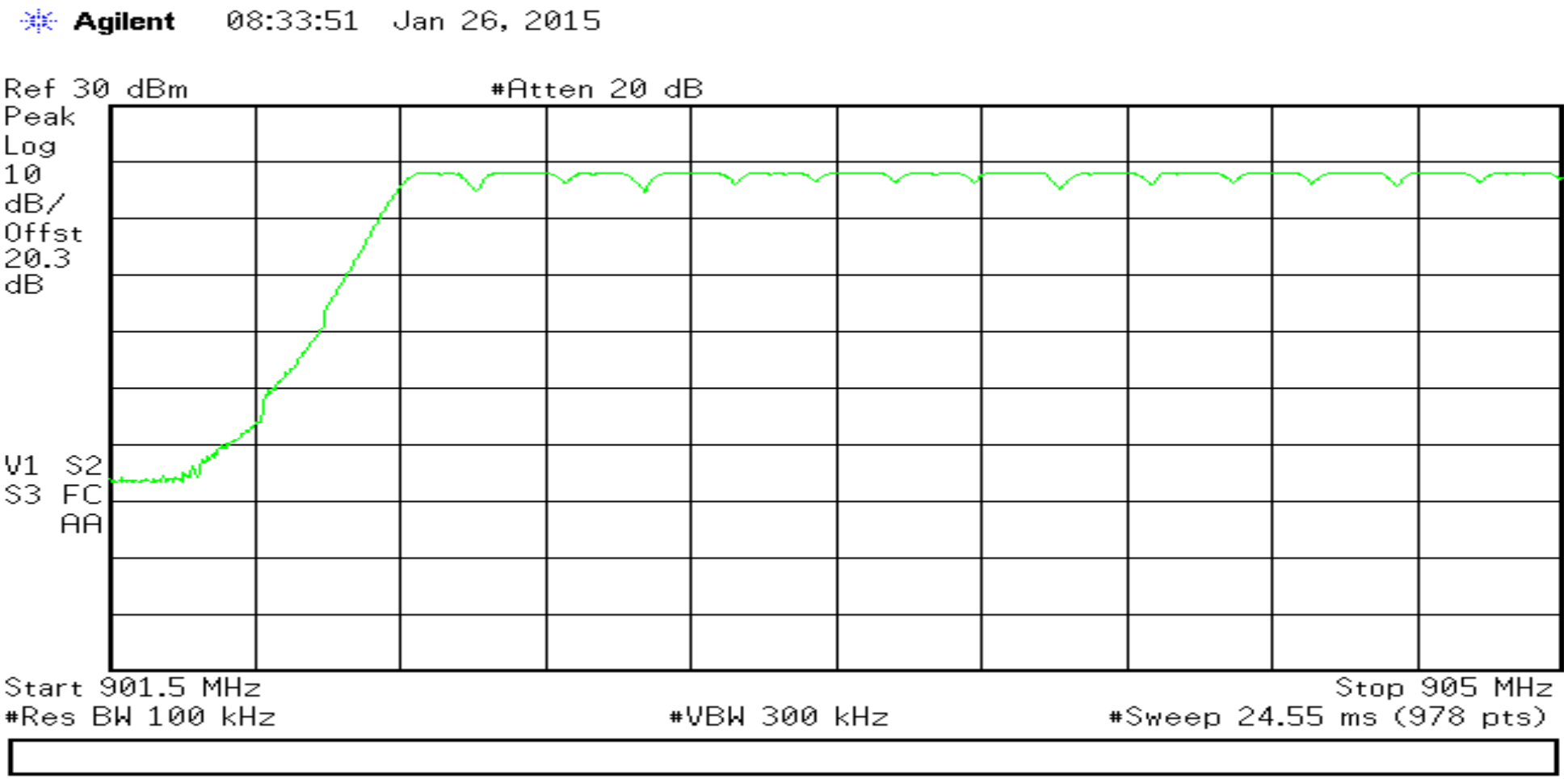
RETLIF TESTING LABORATORIES

Test Method:	Number of Hopping Frequencies		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Number of Hopping Frequencies 902MHz to 905MHz: 14		



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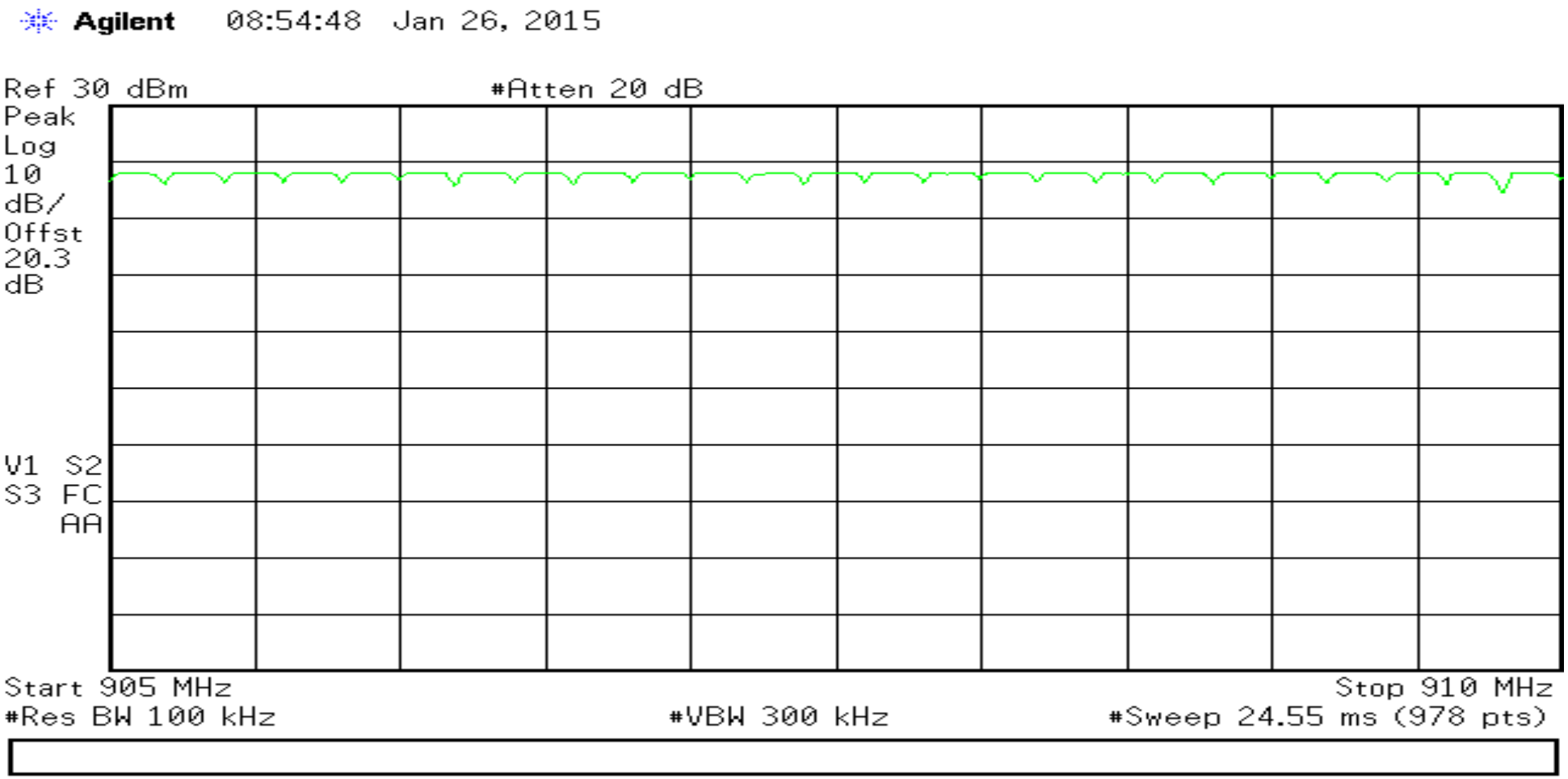
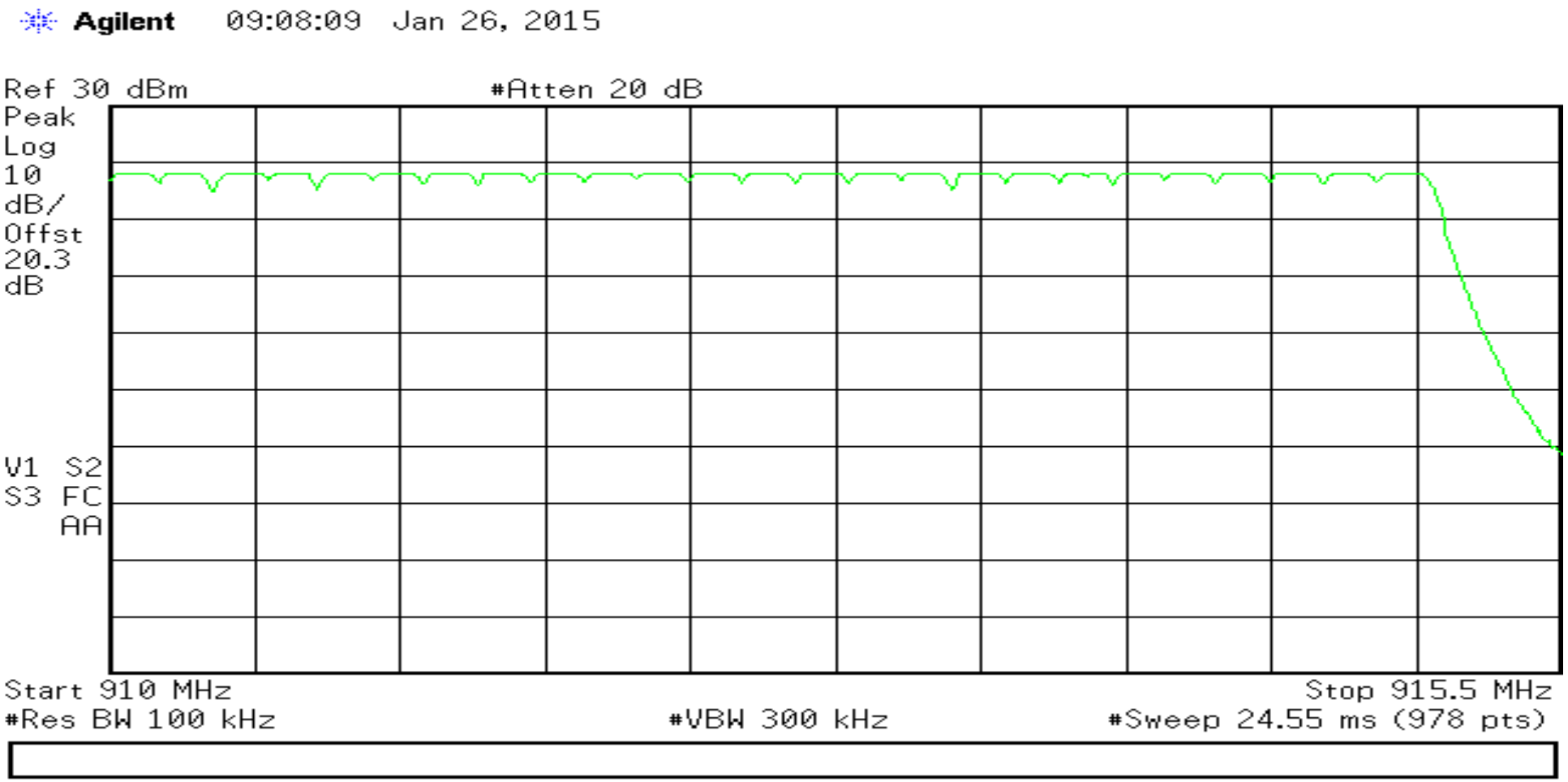
RETLIF TESTING LABORATORIES

Test Method:	Number of Hopping Frequencies		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Number of Hopping Frequencies 905MHz to 910MHz: 25		



RETLIF TESTING LABORATORIES

Test Method:	Number of Hopping Frequencies		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 20.0 %		
Notes	Number of Hopping Frequencies 910MHz to 915MHz: 25		



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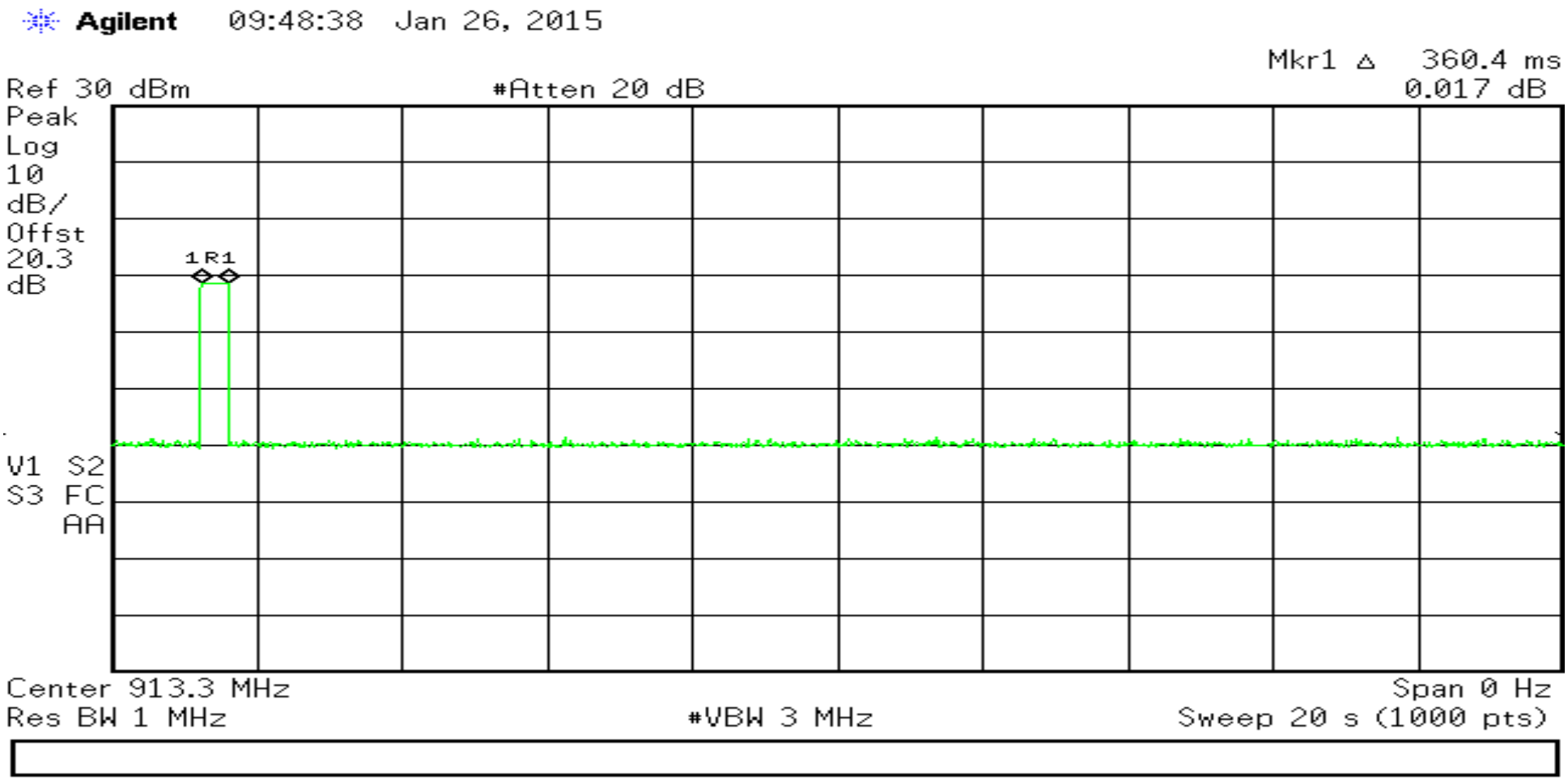
Time of Occupancy
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Time of Occupancy		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)(i)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Test Frequency: 913.3 MHz Pulse Width: 360.4ms		



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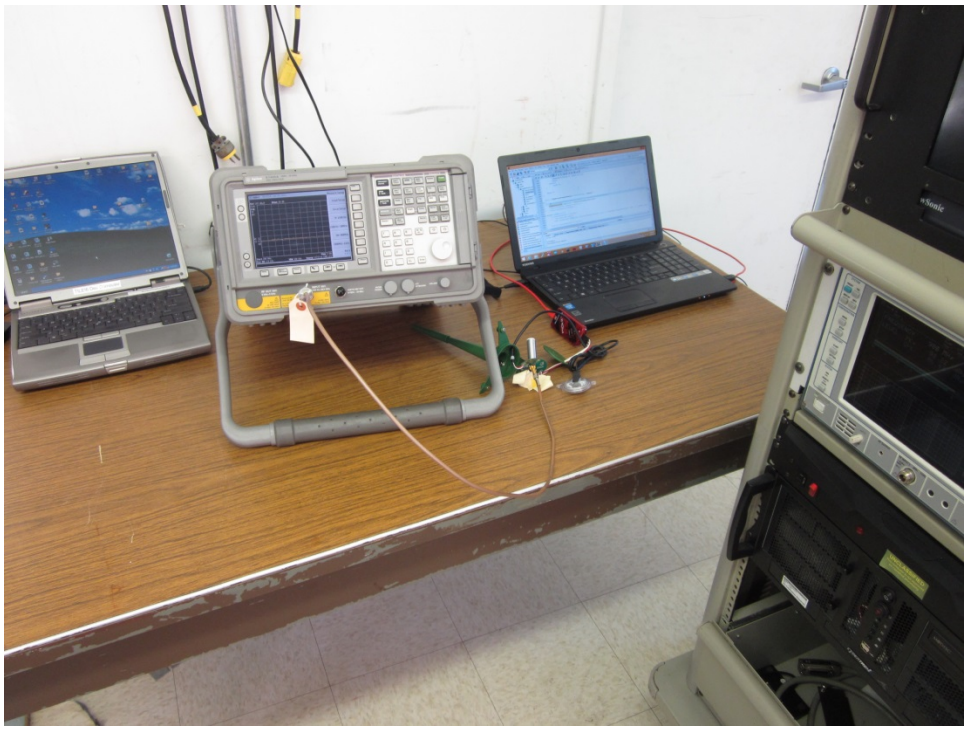
Test Photograph(s)
Channel Separation
FCC Section 15.247(a)(1)

Test Photograph(s)
Channel Separation

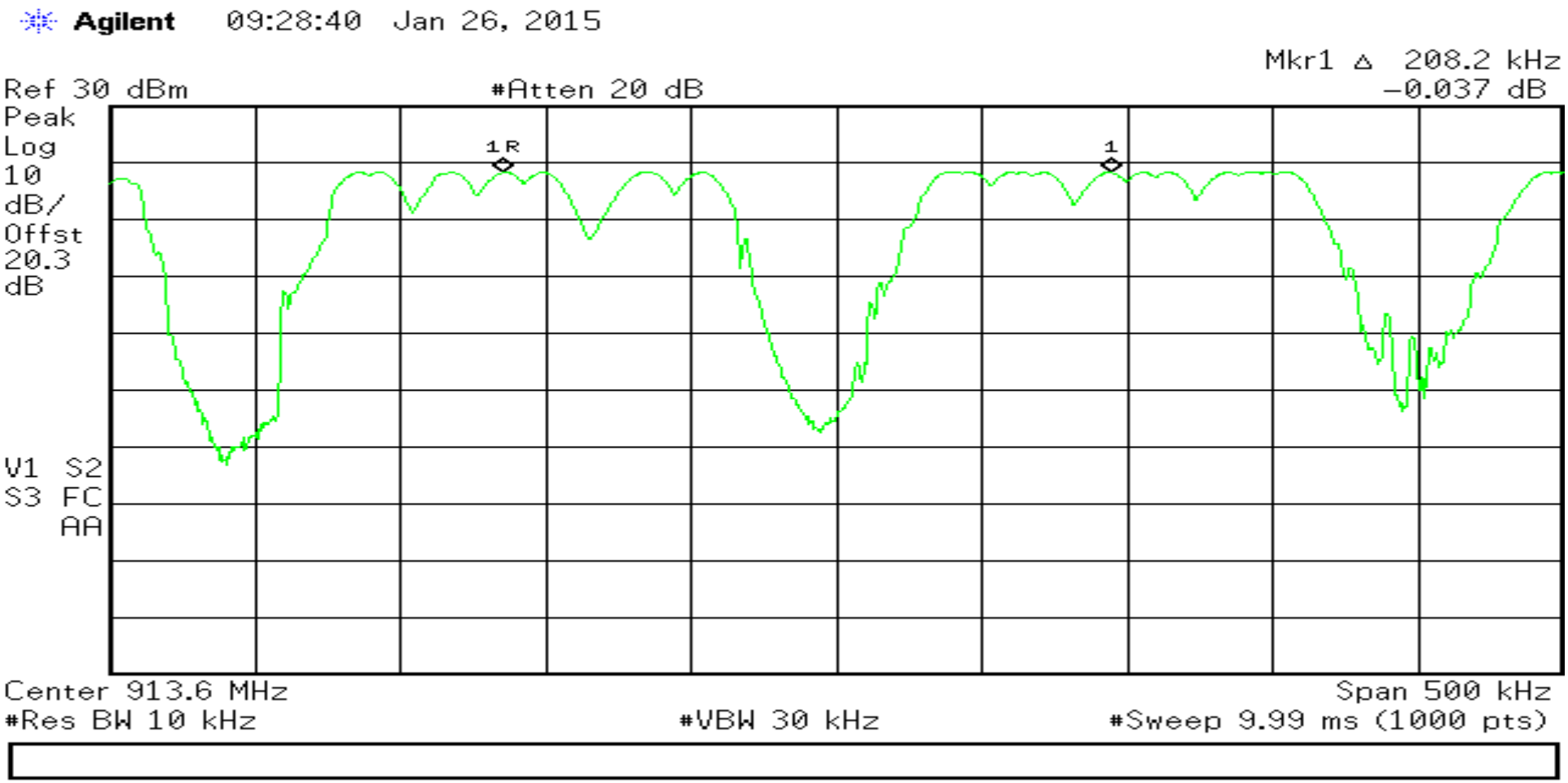


Test Setup

Channel Separation
Test Data

RETLIF TESTING LABORATORIES

Test Method:	Channel Carrier Frequency Separation		
Customer	Senet, Inc.	**Job No.**	R-5909N-1
Test Sample	LoRa eSensor Propane Transmitter		
Part Number	5847	**Serial No.**	219-04-2166 Rev. C
Operating Mode	Transmitting hopping frequency data		
Test Specification	FCC Part 15, Subpart C Paragraph: 15.247 (a)(1)		
Technician	M. Seamans	**Date**	January 23rd, 2015
Climatic Conditions	Temp: 20.0 °C Relative Humidity: 17.0 %		
Notes	Channel Carrier Frequency Separation: 208.2 kHz		



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