BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:
FCC Part 15 Subpart C, IC RSS-Gen, IC RSS-247
DSS Intentional Radiator

Woodstream Corporation Model V420 Lora Radio Mouse Snap Trap

FCC ID: SNA-V420
ISED ID: 9458A-V420

REPORT BEC-2127-03 REV2

TEST DATES: 03/08/2021 – 06/23/2021

CUSTOMER:
Woodstream Corporation
69 North Locust Street
Lititz, PA 17543

PREPARED BY: _____
Paul Banker**,** Test Engineer

REVIEWED and APPROVED BY: _____
Steve Fanella**,** Quality Manager

ACCREDITED
Testing Cert #2957.01

TABLE OF CONTENTS

Notice to Customer
This report and any recommendations it contains represent the result of BEC's testing and assessment on behalf of your company. Testing has been conducted according to accepted engineering standards and practices. This report reflects testing and assessment of product samples provided by your company and may not reflect the characteristics of other samples, especially those produced at different times. This report and its findings and recommendations, if implemented, should not be construed as an assurance or implied warranty for the continuing electromagnetic compatibility (EMC) of the product. **BEC shall not be liable for incidental or consequential damages, even if advised of the possibility thereof.**

BEC will not disseminate this report to other parties without your express permission. You may reproduce this report in its entirety including this notice and the entireties of any supplemental test reports on the same product (e.g. reports on additional testing following modification). However 'you may not reproduce portions of the report (except for the entirety of the summary section) or quote from it for any purpose without specific prior written permission from BEC'.

Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	04/16/2021
1	Added EUT Test Software Version to Section 1.1. Added Section 2.9 Antenna Gain Information. Edited Section 2.11 to add the Serial Port Connection added to the Samples 2127-01 and 2127-03. Added description of X, Y and Z Orientation Planes Examined for Emissions Testing in Section 4.5.2. Edited 4.12 Band Edge Results to reflect the data measured with EUT in Hopping Mode	04/26/2021	04/26/2021
2	Added Hybrid mode information in the EUT Description section. Added Power Spectral Density Test for operation in Hybrid Mode. Added Average Conducted Measurement for Maximum Output Power. Lowered limit from 20 dBc to 30 dBc for conducted emissions in non-restricted bands and band edge tests	06/28/2021	06/28/2021

1.0 Administrative Information

1.1 Project Details

Project Number	BEC-2127	
Manufacturer	Woodstream Corporation	
Model Number	V420	
EUT Description	VLINK Mouse Snap Trap with LoRa Radio Communication	
Serial Number	None	
Sample Types	Modified with SMA connector on transmitter output port (Antenna Conducted Sample)	Unmodified Sample (Radiated Sample)
Sample Numbers	2127-01	2127-03
FCC ID	SNA-V420	
ISED ID	9458A-V420	
Radio Chip Manufacturer	Semtech Corporation	
Radio Chip Model Number	SX1272	
Frequency of Operation	902 – 915 MHz	
Frequencies Tested	Low (902.3 MHz), Middle (908.7 MHz), High (914.9 MHz)	
Antenna Gain	-6.61 dBi	
FCC Classification	DSS Spread Spectrum Transmitter	
EUT Firmware Version	1.3.1, built Tue 03/09/2021 7:59:52.26 (US 915)	
Date Samples Received	03/08/2021	
Condition Samples Received	Suitable for test	
Sample Type	Production unit	
Applicable FCC Rules	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Part 15 Spread Spectrum Transmitter	
Applicable ISED Rules	RSS-Gen: General Requirements for Compliance of Radio Apparatus & RSS-247: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices	

1.2 Preface

This report documents product testing conducted to verify compliance of the specified EUT with applicable standards and requirements as identified herein. EUT, test instrument configurations, test procedures, and recorded data are generally described in this report. The reader is referred to the applicable test standards for detailed procedures. The following table summarizes the test results obtained during this evaluation.

1.3 Laboratory and Customer Information

Test Laboratory Location	BEC Incorporated 970 East High Street Pottstown, PA 19464
Test Personnel	Paul Banker / Steve Fanella / JR Fanella
BEC Laboratory Number FCC Registration	US1118
BEC Laboratory Number ISED Registration	7342A-1
Test Performed For	Woodstream Corporation 69 North Locust Street Lititz, PA 17543
Customer Technical Contact	Dwayne Arrighy
Customer Reference Number	PO # 183621

1.4 Measurement Uncertainty

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Radiated Disturbance	3 Meter	30 MHz – 1 GHz	Class B	4.12
Conducted Disturbance AC Mains	N/A	150 kHz – 30 MHz	Class A or B	2.69

No adjustments to measured data presented in this report are required because all values of uncertainty are less that the CISPR 16-4-2:2018 recommendations. These uncertainties have a coverage factor of $k = 2$, which yields approximately a 95% level of confidence for the near-normal distribution typical of most measurement results.

FCC Registered Test Site Number: US1118
ISED Registered Test Site Number: 7342A-1

1.5 Test Result Summary Table

The Woodstream Model V420 LoRa Radio Mouse Snap Trap was tested and found to be compliant to the sections of the FCC Part 15 Subpart C and ISED standards listed below:

Report Section	FCC Part 15, Subpart C	IC RSS-Gen	IC RSS-247	Test Description	Result
N/A	15.207(b)	7.2		Conducted Emissions, AC 150 kHz to 30 MHz	**N/A**
4.1	15.203(b)	Annex A 10(g)		Antenna Requirement	**PASS**
4.2	15.204	8.3		External RF power amps/antenna modifications	**PASS**
4.3	ANSI C63.10, Section 11.6			Duty Cycle	**Measured**
4.4	15.247(d)	5.5	3.3	DSS Emissions in Non-Restricted Frequency Bands 30 MHz to 10 GHz	**PASS**
4.5	15.205, 15.209 15.35(b)	8.1, 8.9, 8.10		DSS Emissions in Restricted & Non-restricted Frequency Bands 30 MHz to 10GHz	**PASS**
4.6	15.247(a)(1)		5.1 c)	20 dB Occupied Bandwidth	**PASS**
4.7	2.1049(h)	6.7		DSS 99% Occupied Bandwidth	**PASS**
4.8	15.247(b)(3)		5.4 d)	Maximum Output Power, Peak and Average, EIRP	**PASS**
4.9	15.247(a)(1)		5.1 c)	Carrier Frequency Separation	**PASS**
4.10	15.247(a)(1)(iii)		5.1 c)	Number of Hopping Frequencies	**PASS**
4.11	15.247(a)(1)(i)		5.1 c)	Time of Occupancy	**PASS**
4.12	15.247(d)		5.5	Band Edge Measurement	**PASS**
4.13	15.247(e)		5.2 b)	Average Power Spectral Density	**PASS**

1.6 Condition of Received Sample

An evaluation of the EUT was conducted in order to verify test subject identity and condition and to ensure suitability for testing. No evidence of physical damage was noted. The test item condition was deemed acceptable for the performance of the requested test services.

1.7 Climatic Environment

Unless noted elsewhere in this report, the following were the ambient conditions in the laboratory during testing:

Temperature: 22° ± 5°
Humidity: 50% ± 20%
Barometric Pressure: 1000mb ± 20%

1.8 Test Equipment

All test equipment is checked to manufacturer's specifications and, when applicable, have current N.I.S.T. traceable, ISO 9002 conforming certificates of calibration. Test equipment used for the tests described herein is listed in Appendix A.

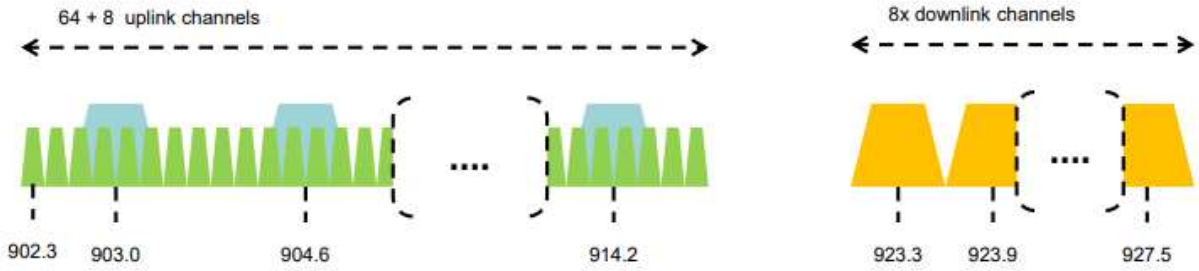
2.0 Equipment Under Test

Unless otherwise noted in the individual test results sections, testing was performed on the EUT as follows.

2.1 EUT Description

The Woodstream Model V420 VLINK is a Mouse Snap Trap which incorporates a LoRa Radio to communicate trap status to a smart phone or network application.
The device is powered by two CR2032 coin cell batteries in parallel (3 V dc).

The V420 operates in FHSS mode while in the joining phase and then switches to Hybrid mode for data phase. FHSS mode uses 64 channels and Hybrid mode uses a subset of 8 channels.



2.2 Product Category

FCC Part 15, Subpart C (Section 15.247), IC RSS-Gen, IC RSS-247

2.3 Product Classification

Intentional Radiator Testing Requirements, DSS Operation within the band of 902 - 928 MHz.

2.4 Test Configuration

The Woodstream Model V420 LoRa Radio Mouse Snap Trap Sample # 2127-01 was tested without a trap enclosure for all antenna terminal measurements. The Woodstream Model V420 LoRa Radio Mouse Snap Trap Sample # 2127-03 was tested for all radiated emissions tests.

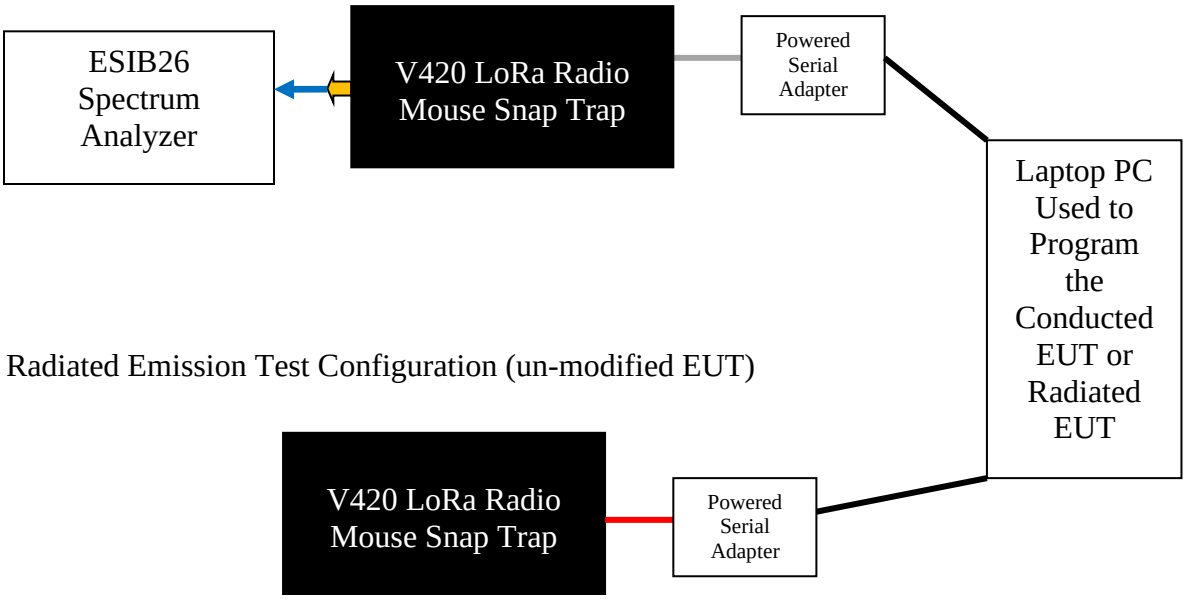
2.5 Test Configuration Rationale

The modified radio of the Woodstream Model V420 LoRa Radio Mouse Snap Trap allows direct access to the output of the radio, without a transmission antenna. The unmodified unit is factory produced with modified software for EMI test purposes.

2.6 Test Configuration Diagrams

Block diagrams of the EUT configuration showing interconnection cables are illustrated below. The drawing shows the physical hardware layout used for the tests along with I/O cables and AC power distribution.

Antenna Conducted Test Configuration (modified with SMA connector in place of antenna)



Radiated Emission Test Configuration (un-modified EUT)

2.7 EUT Information, Interconnection Cabling and Support Equipment

EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Lora Radio Mouse Snap Trap (modified with SMA, test software)	Woodstream Corporation	V420	None	2127-01
Lora Radio Mouse Snap Trap (unmodified, test software)				2127-03

Interconnection Cable List (Conducted Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Suhner	S04272B	High Frequency RF Cable 1 to 40 GHz	Double Braid	1 Meter	Measurement Cable from the Antenna SMA Connector to the Rohde and Schwarz ESIB26 Receiver. Asset # BEC-962

Support Equipment

Description	Manufacturer	Model	Serial Number
Powered Serial Adapter	Woodstream	2457159A_Y40	none
Lap Top Computer	Dell	Inspiron 15-3567	E4B4B16C-F475-4A3F-9795-A06C5CB4AB43

2.8 Test Signals and Test Modulation

By design this product does not have an external Modulation input connector, therefore, normal operating modulation was used for all testing reported herein. The only test where modulation was not active was during testing of the Maximum Peak Power Output FCC Section 15.247(b) (3) (Section 4.8 of this report) to ensure that the un-modulated carrier was not higher than the modulated carrier.

The product is a Frequency Hopping Spread Spectrum System (FHSS) transmitter. The Woodstream Model V420 LoRa Radio Mouse Snap Trap hops on 64 Channels. The Channels and frequencies that can be transmitted by the EUT are as follows:

Low	0	902.3	16	905.5	Middle	32	908.7	48	911.9		
	1	902.5	17	905.7		33	908.9	49	912.1		
	2	902.7	18	905.9		34	909.1	50	912.3		
	3	902.9	19	906.1		35	909.3	51	912.5		
	4	903.1	20	906.3		36	909.5	52	912.7		
	5	903.3	21	906.5		37	909.7	53	912.9		
	6	903.5	22	906.7		38	909.9	54	913.1		
	7	903.7	23	906.9		39	910.1	55	913.3		
	8	903.9	24	907.1		40	910.3	56	913.5		
	9	904.1	25	907.3		41	910.5	57	913.7		
	10	904.3	26	907.5		42	910.7	58	913.9		
	11	904.5	27	907.7		43	910.9	59	914.1		
	12	904.7	28	907.9		44	911.1	60	914.3		
	13	904.9	29	908.1		45	911.3	61	914.5		
	14	905.1	30	908.3		46	911.5	62	914.7		
	15	905.3	31	908.5		47	911.7	63	914.9	High	

The EUT was configured to transmit on all channels for some tests and also dwell on a low, middle and high channel as depicted in the above table. The EUT operates with a 125 KHz bandwidth and a Spread Factor of 7 - 10. Examination of the Spread Factor effect on emission amplitude and bandwidth determined that a Spread Factor of 10 produced the highest emission. The maximum output power setting of 20 was used for all tests. The Duty Cycle of the LoRa Modulation signal is greater than 100%.

2.9 Antenna Gain

The antenna gain was derived using the formulae outlined in Appendix G of ANSI C63.10. The maximum peak output of the transmitter was measured at the SMA connector. The maximum radiated emission from the EUT with the internal antenna attached was measured at a distance of 3 meters from the EUT. The resultant antenna gain was the difference between EIRP at the transmitter terminals and the EIRP calculated from the field strength measured at 3m.

2.10 Grounding

There was no ground connection used; the EUT is battery powered and self-contained.

2.11 EUT Modifications

The Woodstream Model V420 LoRa Radio Mouse Snap Trap Samples 2127-01 and 2127-03 were modified to add a Serial Port for programming the EUTs radio. Also, an SMA connector was added directly to the antenna output on the main board of the Woodstream Model V420 LoRa Radio Mouse Snap Trap Sample 2127-01.

2.12 EUT Pictures Woodstream Model V420 LoRa Radio Mouse Snap Trap

See Appendix B Woodstream V420 LoRa Radio Mouse Snap Trap External Photos

3.0 Applicable Requirements, Methods, and Procedures

3.1 Applicable Requirements

The results of the measurement of the radio disturbance characteristics of the EUT described herein may be applied and where appropriate, provide a presumption of compliance to one or more of the following requirements or to other requirements at the discretion of the customer, regulatory agencies, or other entities.

3.1.1 FCC Requirements

Code of Federal Regulations: Title 47 – Telecommunication

Chapter I - Federal Communications Commission

Sub-chapter A – General

Part 15 – Radio Frequency Devices

Subpart C - Intentional Radiators

3.1.2 Innovation, Science and Economic Development Canada (ISED)

RSS-Gen Issue 5 March 2019 Amendment 1: General Requirements for Compliance of Radio Apparatus

RSS-247 Issue 2 February 2017: Digital Transmission Systems (DSSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

3.1.3 Basic Test Methods and Test Procedures

KDB Document 558074 D01 15.247 Meas Guidance v05r02, Guidance for Performing Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of the FCC Rules.

ANSI C63.10-2020, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.2 Deviations or Exclusions from the Requirements

No deviations or exclusions were made.

4.0 Test Results

4.1 Antenna Requirement (47 CFR 15.203)(RSS-GEN ANNEX A (10)(g))

The antenna used by the Woodstream Model V420 LoRa Radio Mouse Snap Trap is the external, metal bail. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

4.2 External RF power amps/antenna modifications (47 CFR 15.204)(RSS-GEN 8.3)

There are no RF power amplifier kits available to be used with the Woodstream Model V420 LoRa Radio Mouse Snap Trap. There are no detachable parts of the antenna. The antenna is not replaceable, nor changeable, and therefore complies with the requirements of this section.

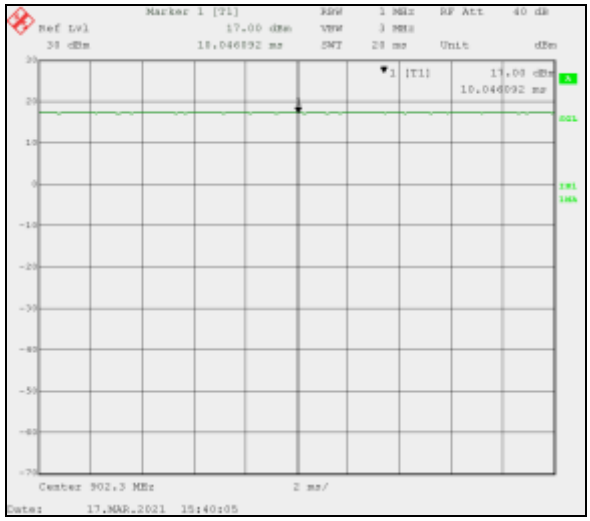
4.3 Duty Cycle of the DSS Fundamental Transmission

The duty cycle of the DSS transmission should be 100%. This ensures that the various emissions measured for this certification test will be made with the transmitter fully active. Duty cycles less than 98% can be used and a duty cycle correction factor can be calculated to reduce the peak level of the emission for radiated emission tests. The procedure of ANSI C63.10, Section 11.6 was used to evaluate the duty cycle of this device.

4.3.1 Duty Cycle Measurement Results (03/17/2021)

The fundamental transmission signal, tuned to 902.3 MHz, was displayed on the spectrum analyzer with zero frequency span and 1 MHz RBW and 3 MHz VBW to determine the duty cycle. The depiction below shows a continuous transmission. There is no off time while the transmitter is active with LoRa modulation. Therefore, the duty cycle is 100%.

Duty Cycle of DSS Transmission



4.4 DSS Emissions in Non-restricted Frequency Bands (FCC Section 15.247(d), RSS-247 Sec.5)

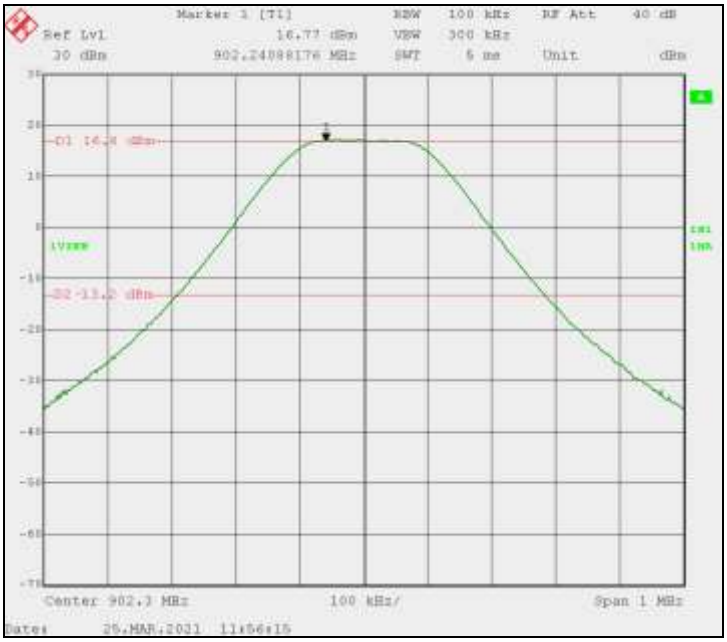
4.4.1 DSS Emissions in Non-restricted Frequency Bands Test Procedure

A measurement of the emissions in non-restricted frequency bands was made for to low (Channel 0), middle (Channel 32) and high (Channel 63) channel frequencies. The signal output was maximized with LoRa modulation with 125 kHz bandwidth and Spread Factor of 10. The procedure for the test is ANSI C63.10, Section 11.11. The frequency spectrum from 9 kHz to 10 GHz was divided into five bands: 9 kHz – 100 MHz, 100-500 MHz, 500 M – 1 GHz, 1 – 5 GHz and 5 – 10 GHz. An in-line high-pass filter was used to measure frequencies above 1 GHz. The limit is 30 dBc based upon the measurement of Maximum Average Output Power. Each of the three fundamental test frequencies was measured for the reference value to determine the -30 dBc value.

Spectrum Analyzer Settings

RBW	100	kHz
VBW	300	kHz
Span	Varies	MHz
Sweep(Auto)	Varies	ms

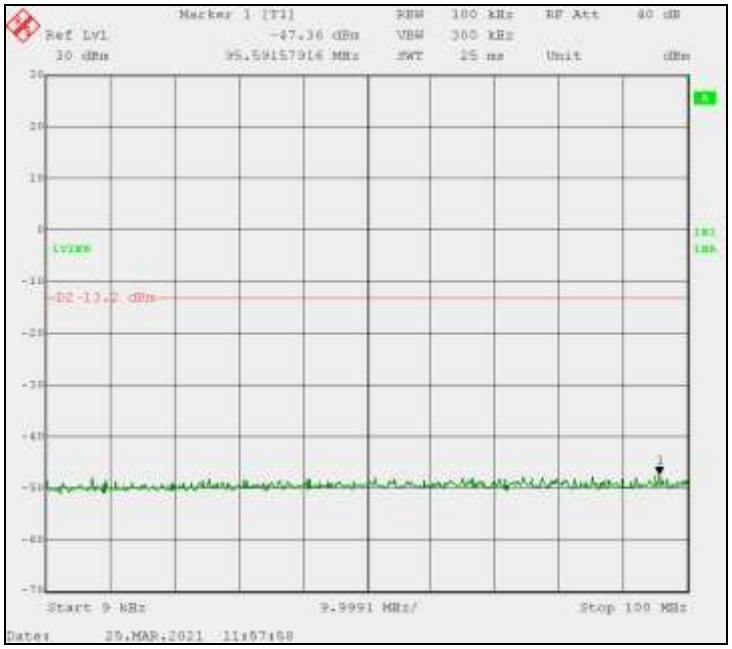
4.4.2 DSS Emissions in Non-restricted Frequency Bands Reference Measurement Channel 0 (03/25/2021)



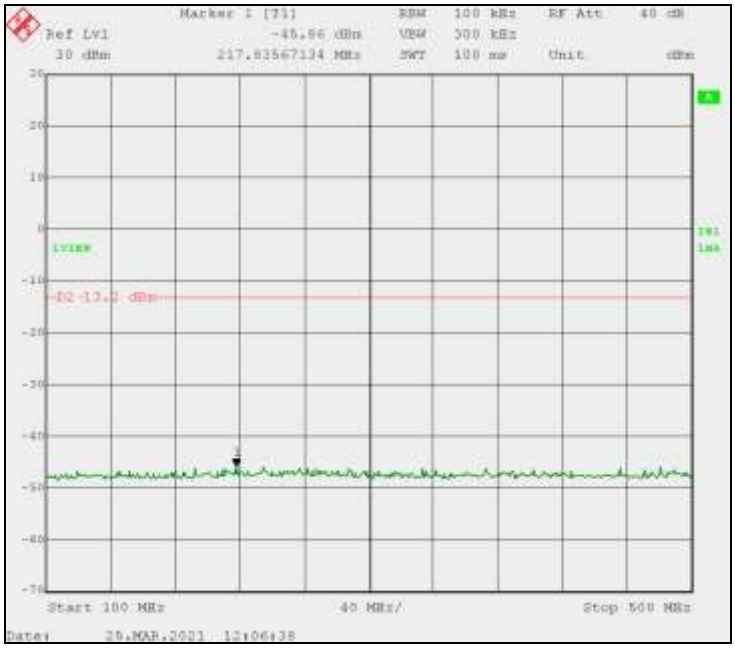
The peak level of 16.8 dBm is the maximum peak output of the Woodstream Model V420 LoRa Radio Mouse Snap Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -13.2 dBm and is displayed on the plots below.

4.4.3 DSS Emissions in Non-restricted Frequency Bands Channel 0 Test Results (03/25/2021)

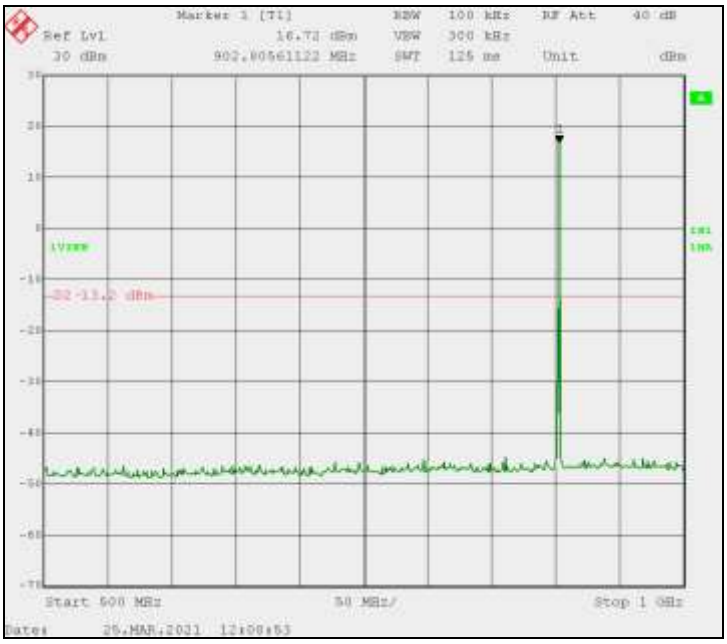
9 kHz – 100 MHz



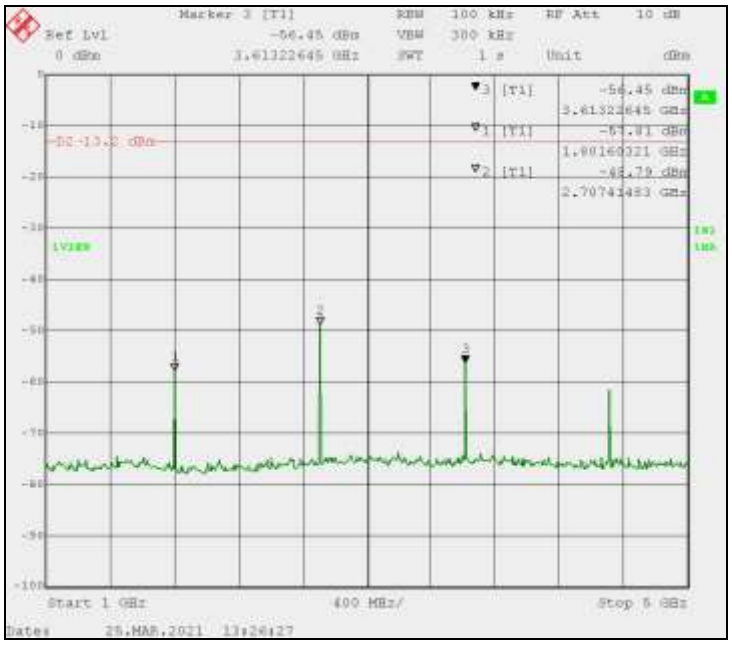
100 MHz – 500 MHz



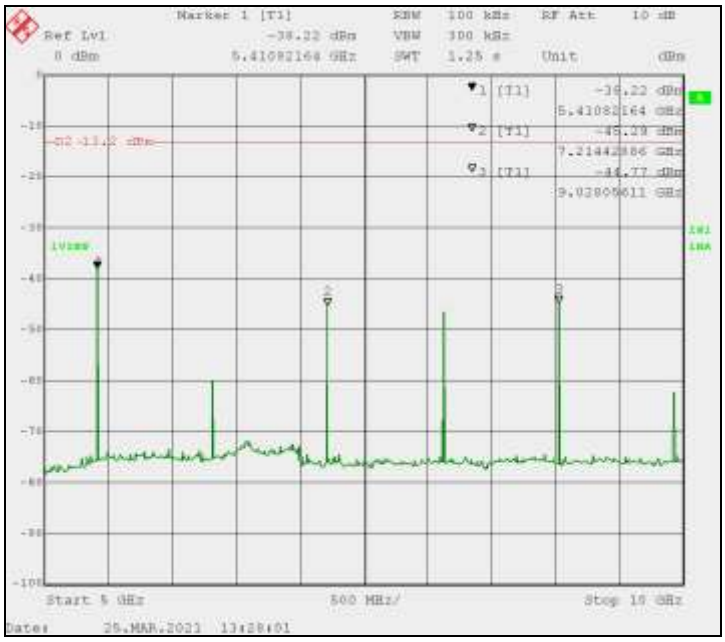
500 MHz – 1000 MHz



1 GHz – 5 GHz



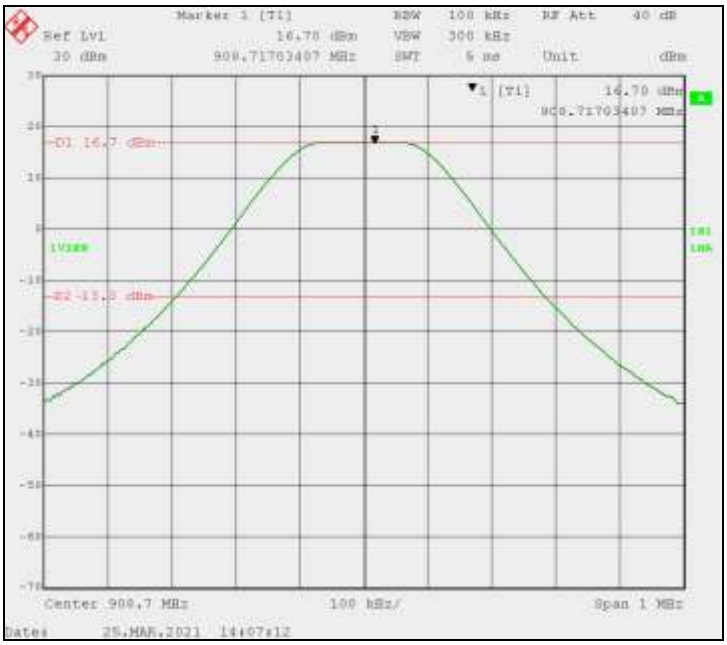
5 GHz – 10 GHz



Highest Emissions: Channel 0

Channel	Frequency	Level	Limit	Margin	Result
#	GHz	dBc	dBc	dB	
0	5.4108	-55.02	-30.00	-25.02	Pass
0	7.2144	-62.09	-30.00	-32.09	Pass
0	9.0281	-61.57	-30.00	-31.57	Pass

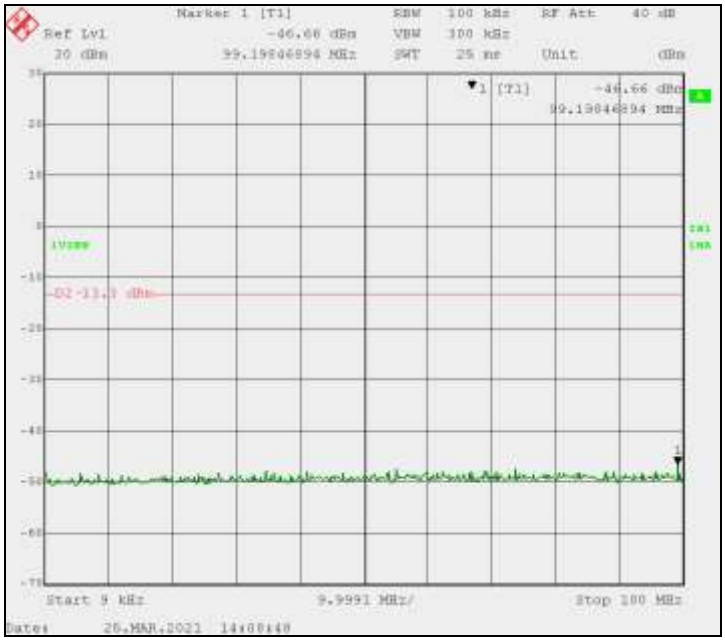
4.4.4 DSS Emissions in Non-restricted Frequency Bands Reference Measurement Channel 32 (03/25/2021)



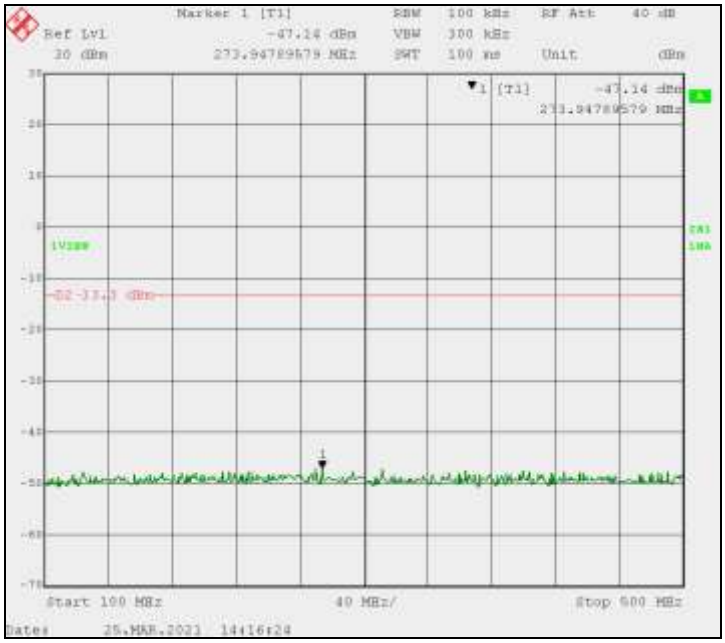
The peak level of 16.7 dBm is the maximum peak output of the Woodstream Model V420 LoRa Radio Mouse Snap Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -13.3 dBm and is displayed on the plots below.

4.4.5 DSS Emissions in Non-restricted Frequency Bands Channel 32 Test Results (03/25/2021)

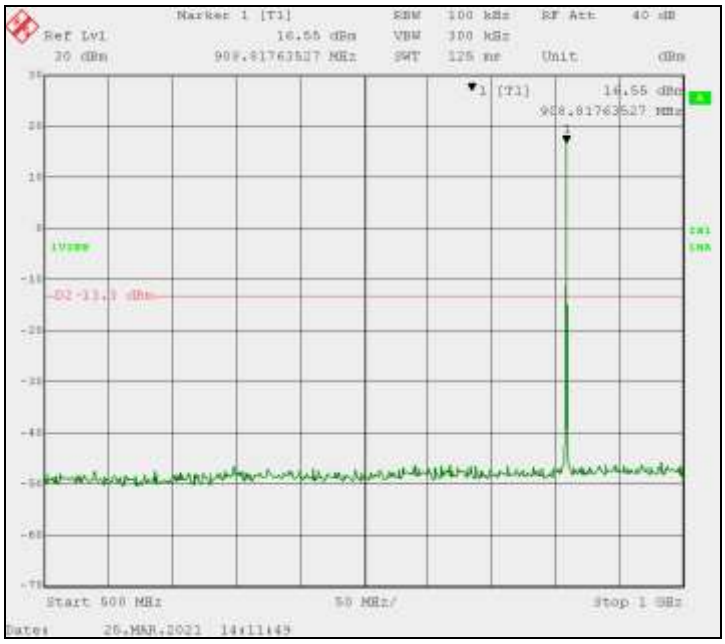
9 kHz – 100 MHz



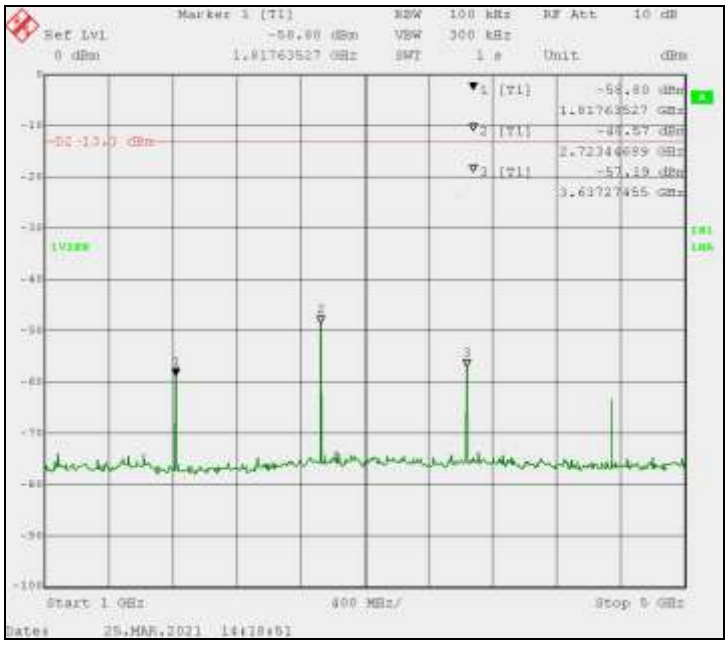
100 MHz – 500 MHz



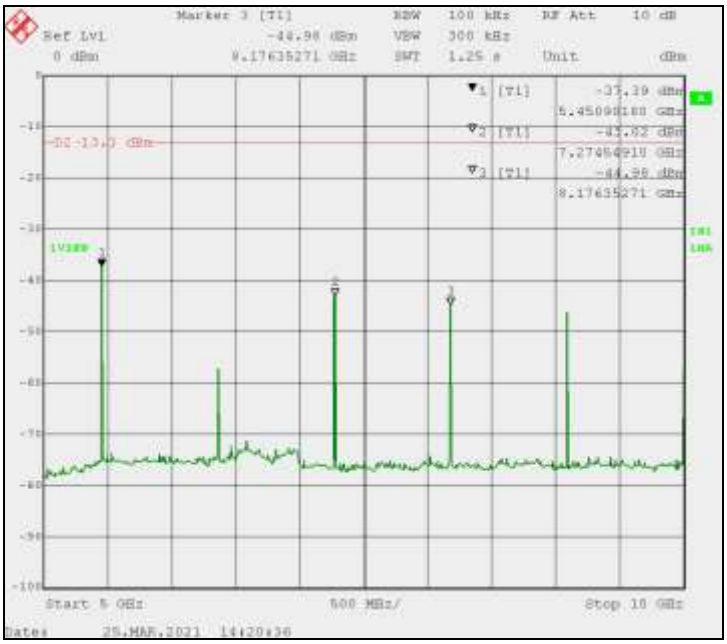
500 MHz – 1000 MHz



1 GHz – 5 GHz



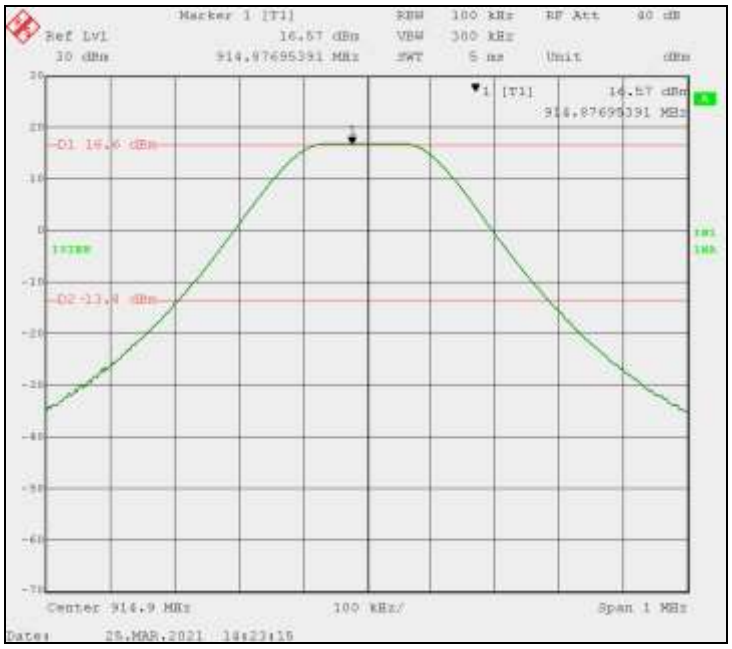
5 GHz – 10 GHz



Highest Emissions: Channel 32

Channel	Frequency	Level	Limit	Margin	Result
#	GHz	dBc	dBc	dB	
32	5.4509	-54.09	-30.00	-24.09	Pass
32	7.2756	-59.72	-30.00	-29.72	Pass
32	8.1764	-61.68	-30.00	-31.68	Pass

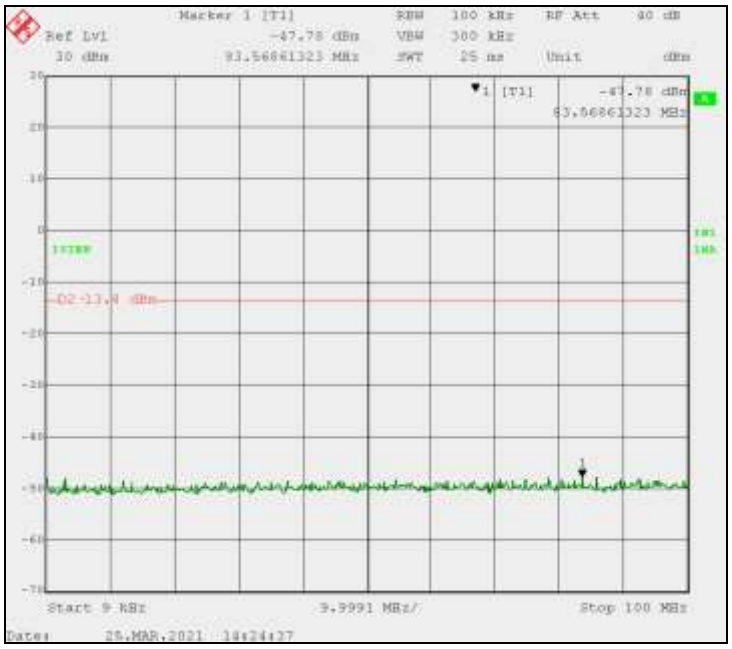
4.4.6 DSS Emissions in Non-restricted Frequency Bands Reference Measurement Channel 63 (03/25/2021)



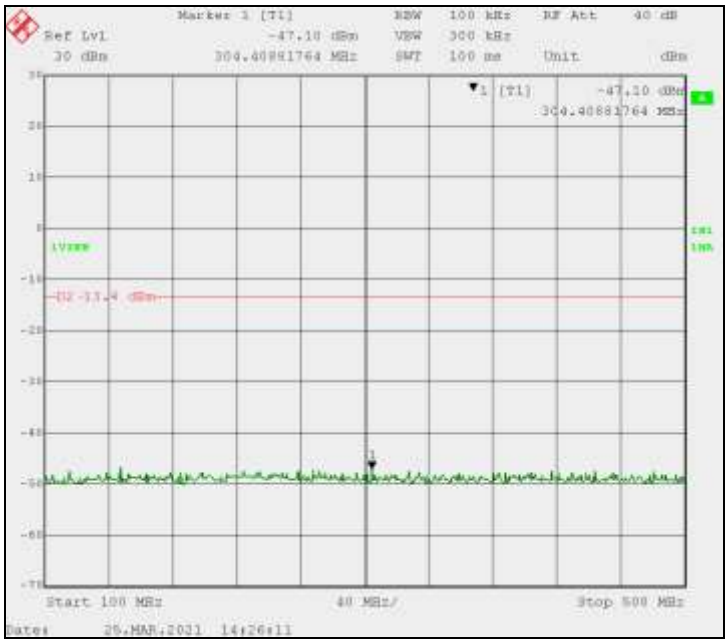
The peak level of 16.6 dBm is the maximum peak output of the Woodstream Model V420 LoRa Radio Mouse Snap Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -13.4 dBm and is displayed on the plots below.

4.4.7 DSS Emissions in Non-restricted Frequency Bands Channel 63 Test Results (03/25/2021)

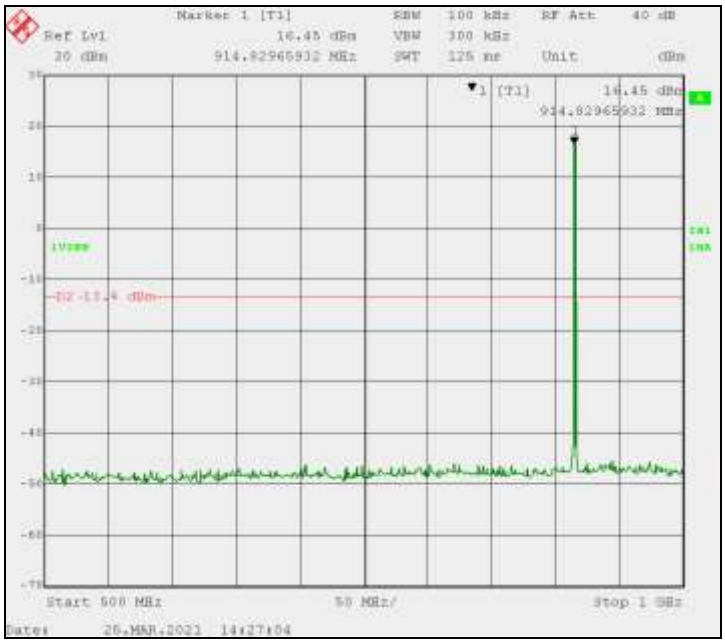
9 kHz – 100 MHz



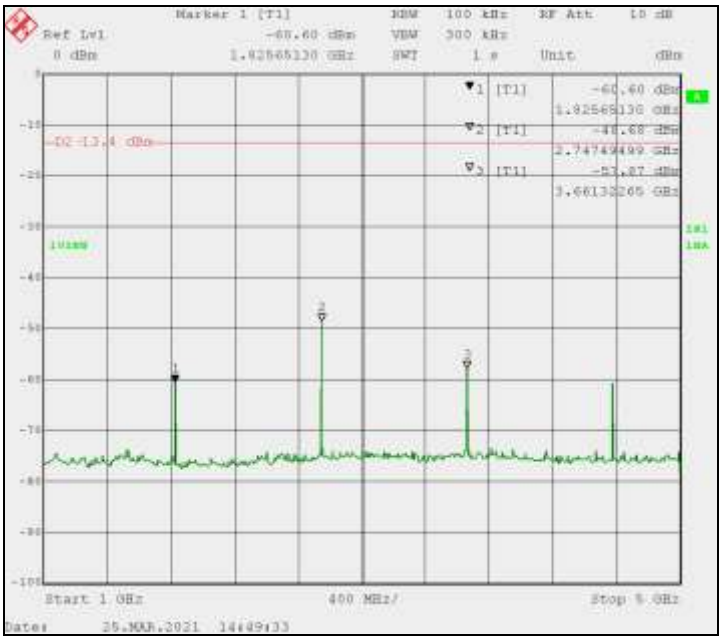
100 MHz – 500 MHz



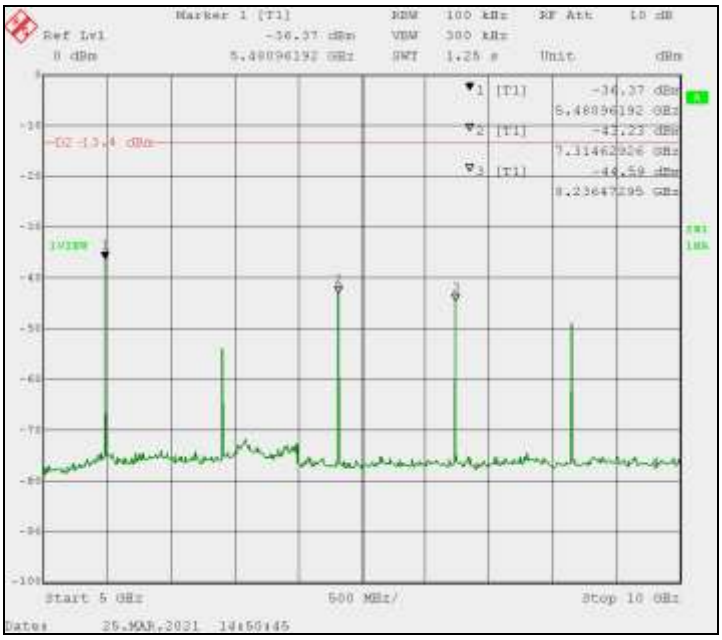
500 MHz – 1000 MHz



1 GHz – 5 GHz



5 GHz – 10 GHz



Highest Emissions: Channel 63

Channel	Frequency	Level	Limit	Margin	Result
#	GHz	dBc	dBc	dB	
63	5.48	-52.97	-30.00	-22.97	Pass
63	7.31	-59.83	-30.00	-29.83	Pass
63	8.24	-61.19	-30.00	-31.19	Pass

Test Results: The Antenna Conducted Spurious Emissions of the Woodstream Model V420 LoRa Radio Mouse Snap Trap, at Low, Middle and High Frequencies, are below the 30 dBc limit and therefore compliant with the limits specified in FCC Section 15.247(d).

4.5 DSS Radiated Emissions in Non-restricted and Restricted Frequency Bands, 30 MHz - 10 GHz (47 CFR 15.205 & 15.209)(RSS-GEN 8.9 & 8.10)

The emissions from the Woodstream Model V420 LoRa Radio Mouse Snap Trap, which fall in the restricted bands of operation and unrestricted bands of operation, detailed in this section, comply with the limits of 15.209. The Woodstream Model V420 LoRa Radio Mouse Snap Trap was tested at three frequencies: low (902.3 MHz), middle (908.7 MHz) and high (914.9 MHz). The transmitter was operated at maximum output power (20), 125 kHz bandwidth and Spread Factor of 10.

Measurement of the signals was performed with the EUT on a turntable and a variable height antenna mast at 3 meters distance. The signals residing in restricted bands of operation are indicated in the tables below.

4.5.1 Non-restricted and Restricted Bands Test Facility

OATS

The Open Area Test Site (OATS) is an all-weather facility with a wooden enclosure that contains a ground level 4-foot diameter turntable capable of rotating equipment 360 degrees. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This non-metallic enclosure and the 3 and 10 meter test range existing outside the enclosure rest upon a protective insulating material, which in turn covers a flat, metal, continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel indoors. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment. The test site complies with the requirements of ANSI C63.4 and ANSI C63.10.

SR#1

The Semi-Anechoic Shielded Room (SR#1) is a ferrite and absorber lined chamber which houses a 5-foot diameter turntable capable of rotating equipment 360 degrees and antenna mast for Horizontal and Vertical polarity measurements. The enclosure is free of reflective metallic objects and extraneous electromagnetic signals. This 3 meter shielded enclosure has a raised computer floor with metal tile bottoms providing a continuous ground plane.

Instrumentation for remote control of the antenna mast, turntable, and other equipment are controlled by personnel outside the chamber. The EUT and support peripherals required for EUT operation were placed on a table 80 cm high for tabletop equipment or directly on the turntable surface for floor standing equipment.

The chamber complies with the requirements of ANSI C63.4 and ANSI C63.10.

4.5.2 Non-restricted and Restricted Bands Radiated Emissions Test Procedure

Radiated Emissions 30 MHz – 40 GHz
The EMI receiver was set to quasi-peak mode for frequencies from 30MHz to 1GHz and the appropriate CISPR bandwidths were employed. The receiver was set to average mode for frequencies above 1GHz with the appropriate CISPR bandwidths were employed.

Three orthogonal positions of the EUT were evaluated for maximum emissions. The position of the EUT, with the base of the trap placed on the horizontal surface of the 80-cm table, was determined to be the axis that produced the highest emissions.

Significant emissions found during the preliminary scans were maximized by rotating the turntable and varying the antenna height. Both horizontal and vertical antenna polarities were also investigated for suspect emissions. The signals are maximized and measured using the in house generated RADE or off the shelf TILE software. The support equipment and test item(s) were powered off in turn to determine the source of the emissions where appropriate.

Field strengths were calculated as follows:

Field Strength (dBµV/m) = Meter Reading (dBµV) + Antenna Factor (dB/m) + Cable Loss (dB) – Amplifier Gain (dB)

Measurements were made with the Woodstream Model V420 LoRa Radio Mouse Snap Trap transmitting at low (Channel 0), middle (Channel 32) and high (Channel 63). LoRa modulation with 125 kHz bandwidth was applied with the spread factor = 10. The following tables are the highest emissions recorded and summarized. Restricted band signals are marked with an asterisk. Other spurious emissions are shown to demonstrate compliance of the EUT enclosure to 15.209 limits.

4.5.3 DSS Emissions in Non-restricted and Restricted Bands of Operation, 30 MHz – 1000 MHz Test Results (03/30/2021)

Low Channel 0 (902.3 MHz)

Freq	PkLevel	Quasi-Peak	Pol	Azimuth	Hght	C/F	Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	
111.031*	13.76	11.69	V	223	146	-7.64	43.52	-31.83	Pass
120.033*	12.48	12.39	H	130	224	-6.67	43.52	-31.13	Pass
201.268	13.79	11.52	H	058	183	-7.19	43.52	-32.00	Pass
267.75*	14.37	12.94	V	314	146	-5.73	46.02	-33.08	Pass
271.635*	15.50	13.12	H	297	152	-5.55	46.02	-32.90	Pass
485.055	19.22	18.07	V	308	146	-1.99	46.02	-27.95	Pass
650.204	21.18	20.43	V	343	104	0.39	46.02	-25.59	Pass
688.060	21.44	20.69	H	138	172	0.80	46.02	-25.33	Pass
847.280	25.43	23.20	V	316	208	3.29	46.02	-22.82	Pass
868.691	25.07	23.20	H	049	203	3.48	46.02	-22.82	Pass
956.778	25.55	24.31	V	189	111	4.54	46.02	-21.71	Pass
958.380	26.42	24.36	H	150	110	4.67	46.02	-21.66	Pass

*Restricted Band Signal

Middle Channel 32 (908.7 MHz)

Freq	PkLevel	Quasi-Peak	Pol	Azimuth	Hght	C/F	Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	
120.686*	13.90	12.62	H	103	115	-6.66	43.52	-30.90	Pass
121.746*	15.36	12.29	V	141	135	-6.66	43.52	-31.23	Pass
199.086	14.92	11.79	H	033	140	-7.15	43.52	-31.73	Pass
270.73*	14.22	13.74	H	152	103	-5.62	46.02	-32.28	Pass
354.527	16.83	14.46	V	302	235	-4.39	46.02	-31.56	Pass
487.310	21.61	18.09	V	054	162	-1.96	46.02	-27.93	Pass
688.805	23.26	20.82	H	324	193	0.80	46.02	-25.20	Pass
713.832	23.83	21.36	V	323	111	1.21	46.02	-24.66	Pass
845.385	22.47	22.87	V	094	193	3.29	46.02	-23.15	Pass
867.323	26.90	23.37	H	179	178	3.46	46.02	-22.65	Pass
957.392	27.11	24.41	H	140	216	4.59	46.02	-21.61	Pass
957.791	25.12	24.23	V	229	220	4.64	46.02	-21.79	Pass

*Restricted Band Signal

High Channel 63 (914.9 MHz)

Freq	PkLevel	Quasi-Peak	Pol	Azimuth	Hght	C/F	Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	
132.163*	12.03	12.10	V	133	249	-6.87	43.52	-31.42	Pass
147.150	13.21	11.74	H	234	235	-7.24	43.52	-31.78	Pass
204.812	12.45	10.57	H	125	188	-8.36	43.52	-32.95	Pass
389.973	18.17	15.51	V	070	126	-3.89	46.02	-30.51	Pass
483.463	21.10	18.38	H	333	215	-2.08	46.02	-27.64	Pass
556.068	22.01	18.17	V	326	209	-1.37	46.02	-27.85	Pass
614.781	24.35	19.15	V	243	146	-0.65	46.02	-26.87	Pass
646.689	23.30	20.56	H	360	247	0.39	46.02	-25.46	Pass
821.699	24.14	22.66	V	333	240	3.01	46.02	-23.36	Pass
859.921	27.20	23.50	H	205	225	3.46	46.02	-22.52	Pass
974.023*	26.35	24.39	V	209	136	4.85	53.98	-29.59	Pass
985.211*	24.87	24.33	H	050	224	4.91	53.98	-29.65	Pass

*Restricted Band Signal

Receive Mode

Freq	PkLevel	Quasi-Peak	Pol	Azimuth	Hght	C/F	Limit	Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	
119.57*	13.41	12.27	V	202	239	-6.72	43.52	-31.25	Pass
131.898*	14.44	12.09	H	007	104	-6.86	43.52	-31.43	Pass
285.826	14.70	13.32	V	345	181	-5.35	46.02	-32.70	Pass
327.289*	16.23	13.86	H	286	111	-4.81	46.02	-32.16	Pass
537.509	21.08	18.64	H	216	171	-1.49	46.02	-27.38	Pass
583.028	21.07	19.68	V	026	116	-0.71	46.02	-26.34	Pass
600.180	21.68	19.28	H	053	131	-0.64	46.02	-26.74	Pass
736.094	26.24	24.80	V	214	255	1.61	46.02	-21.22	Pass
790.490	25.06	22.38	H	279	104	2.52	46.02	-23.64	Pass
809.576	23.20	22.82	V	258	193	2.97	46.02	-23.20	Pass
966.271*	26.07	24.20	V	025	188	4.72	53.98	-29.78	Pass
969.143*	27.02	24.47	H	354	199	4.80	53.98	-29.51	Pass

*Restricted Band Signal

Test Results: The Woodstream Model V420 LoRa Radio Mouse Snap Trap, operating in DSS mode and receive mode, comply with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 for restricted bands of operation with a margin of 21.22 dB.

4.5.4 DSS Emissions in Non-restricted and Restricted Bands of Operation, 1 – 10 GHz Test Results (03/25/2021 - 04/07/2021)

Low Channel 0 (902.3 MHz)

Freq	PkLevel	AVG Level	Pol	Azimuth	Hght	C/F	15.35(b) Peak Limit	Peak Margin	15.209 AVG Limit	AVG Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.8044	51.82	50.22	H	094	104	-8.18	73.98	-22.16	53.98	-3.76	Pass
1.8045	51.72	50.52	V	360	100	-8.18	73.98	-22.26	53.98	-3.46	Pass
2.4146	33.60	22.94	H	016	104	-5.51	73.98	-40.38	53.98	-31.04	Pass
2.4164	32.39	23.02	V	001	157	-5.50	73.98	-41.59	53.98	-30.96	Pass
2.7068*	46.45	44.75	V	344	120	-4.54	73.98	-27.53	53.98	-9.23	Pass
2.7072*	38.65	37.00	H	183	101	-4.53	73.98	-35.33	53.98	-16.98	Pass
6.8447	44.16	34.78	H	340	247	3.66	73.98	-29.82	53.98	-19.21	Pass
8.3468*	48.83	37.42	V	055	146	5.77	73.98	-25.15	53.98	-16.56	Pass
9.0686*	48.11	37.90	H	360	232	6.83	73.98	-25.87	53.98	-16.08	Pass

*Restricted Band Signal

Middle Channel 32 (908.7 MHz)

Freq	PkLevel	AVG Level	Pol	Azimuth	Hght	C/F	15.35(b) Peak Limit	Peak Margin	15.209 AVG Limit	AVG Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.8174	45.94	44.27	H	061	102	-8.04	73.98	-28.04	53.98	-9.71	Pass
1.8175	53.07	51.67	V	045	101	-8.03	73.98	-20.91	53.98	-2.31	Pass
2.4091	33.16	22.85	V	235	186	-5.51	73.98	-40.82	53.98	-31.13	Pass
2.4423	34.04	23.94	H	029	101	-5.48	73.98	-39.94	53.98	-30.04	Pass
2.7262*	44.95	42.80	V	232	101	-4.50	73.98	-29.03	53.98	-11.18	Pass
6.8191	44.35	34.37	H	077	105	3.64	73.98	-29.63	53.98	-19.61	Pass
8.1487*	47.94	37.19	H	000	153	5.47	73.98	-26.04	53.98	-16.79	Pass
9.0736*	48.35	38.29	V	267	155	6.84	73.98	-25.63	53.98	-15.69	Pass
9.0872*	49.02	40.02	H	001	141	6.87	73.98	-24.96	53.98	-13.96	Pass

*Restricted Band Signal

High Channel 63 (914.9 MHz)

Freq	PkLevel	AVG Level	Pol	Azimuth	Hght	C/F	15.35(b) Peak Limit	Peak Margin	15.209 AVG Limit	AVG Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.8298	50.30	48.30	H	112	168	-7.90	73.98	-23.68	53.98	-5.68	Pass
1.8299	53.00	51.70	V	147	101	-7.90	73.98	-20.98	53.98	-2.28	Pass
2.4136	33.40	23.38	H	304	102	-5.51	73.98	-40.58	53.98	-30.60	Pass
2.4140	32.63	23.39	V	001	111	-5.51	73.98	-41.35	53.98	-30.59	Pass
2.7352*	34.01	24.62	H	242	102	-4.49	73.98	-39.97	53.98	-29.36	Pass
2.7446*	45.58	43.35	V	328	120	-4.47	73.98	-28.40	53.98	-10.63	Pass
8.0998*	46.44	37.22	V	354	105	5.43	73.98	-27.54	53.98	-16.76	Pass
8.2449*	47.95	36.86	H	308	156	5.58	73.98	-26.03	53.98	-17.12	Pass
9.1486*	48.09	41.24	V	342	237	6.96	73.98	-25.89	53.98	-12.74	Pass
9.2697	46.96	38.46	H	317	198	7.21	73.98	-27.02	53.98	-15.52	Pass

*Restricted Band Signal

Receive Mode

Freq	PkLevel	AVG Level	Pol	Azimuth	Hght	C/F	15.35(b) Peak Limit	Peak Margin	15.209 AVG Limit	AVG Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.8211	30.85	22.24	V	37	141	-8.00	73.98	-43.13	53.98	-31.74	Pass
1.8623	31.31	23.26	H	193	200	-7.63	73.98	-42.67	53.98	-30.72	Pass
2.6370	34.16	23.69	H	268	106	-4.68	73.98	-39.82	53.98	-30.29	Pass
2.7369*	35.12	24.30	V	261	135	-4.49	73.98	-38.86	53.98	-29.68	Pass
3.5042	35.03	26.22	H	102	104	-1.57	73.98	-38.95	53.98	-27.76	Pass
3.6569*	36.67	27.19	V	273	103	-0.82	73.98	-37.31	53.98	-26.79	Pass
5.4974	39.48	30.00	V	45	219	3.35	73.98	-34.50	53.98	-23.98	Pass
7.6098*	44.44	35.29	H	332	233	4.61	73.98	-29.54	53.98	-18.69	Pass
7.8412	45.97	36.04	H	235	169	4.88	73.98	-28.01	53.98	-17.94	Pass
8.1460*	45.52	37.35	V	205	143	5.46	73.98	-28.46	53.98	-16.63	Pass
9.1463*	48.87	37.94	V	64	168	6.96	73.98	-25.11	53.98	-16.04	Pass
9.5057	46.74	38.58	H	235	188	7.69	73.98	-27.24	53.98	-15.40	Pass

*Restricted Band Signal

Test Results: The Woodstream Model V420 LoRa Radio Mouse Snap Trap, operating in DSS and receive modes, comply with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 with a margin of 2.28 dB.

4.6 DSS 20 dB Occupied Bandwidth (FCC Section 15.247(a)(2) RSS-247 5.2(a))

4.6.1 20 dB Occupied Bandwidth – Test Procedure

The maximum DSS (20 dB) bandwidth, specified in FCC Section 15.247(a)(1)(i) was measured using a Spectrum Analyzer with 3 kHz resolution bandwidth and 10 kHz video bandwidth. Transmission frequencies at low (Channel 0), middle (Channel 32) and high (Channel 63) were measured with LoRa modulation with a bandwidth of 125 kHz and spread factors of 7 and 10. The test procedure of ANSI C63.10, Section 11.8, Option 1, was used.

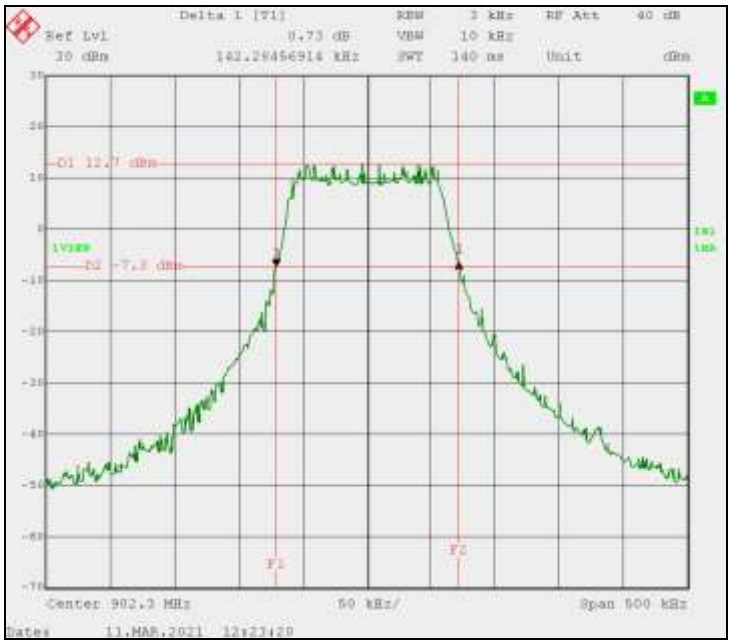
Spectrum Analyzer Settings:

Span	500 kHz
RBW	3 kHz
VBW	10 kHz
Sweep Time	140 ms (Auto)

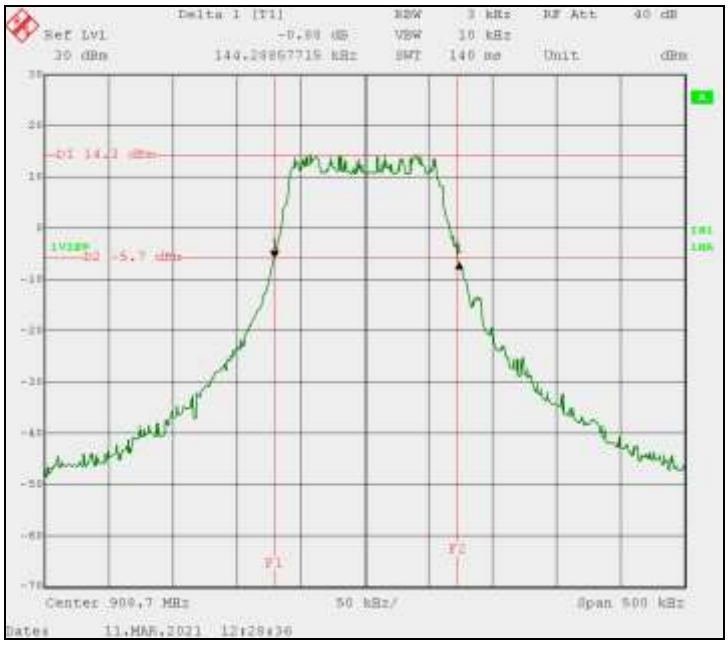
4.6.2 DSS (20 dB) Occupied Bandwidth Test Results (03/11/2021)

Channel	Spread Factor	Frequency	Measured 20 dB Bandwidth	RSS-247 5.1.3, FCC 15.247 (1)(a)(i) 20 dB BW Limit	Margin	Result
#		MHz	kHz	kHz	kHz	
0	7	902.3	142.28	500	-357.72	Pass
32		908.7	144.29		-355.71	Pass
63		914.9	143.29		-356.71	Pass
0	10	902.3	141.28		-358.72	Pass
32		908.7	141.28		-358.72	Pass
63		914.9	141.28		-358.72	Pass

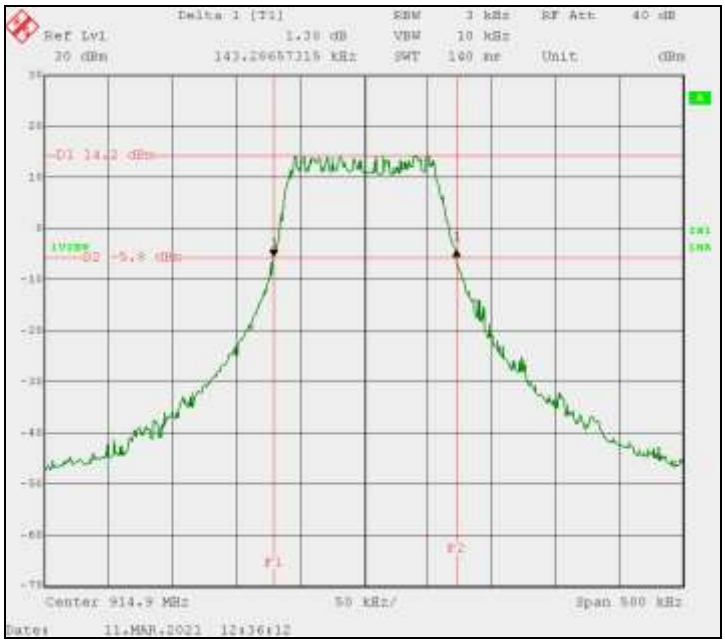
Channel 0: 902.30 MHz SF=7



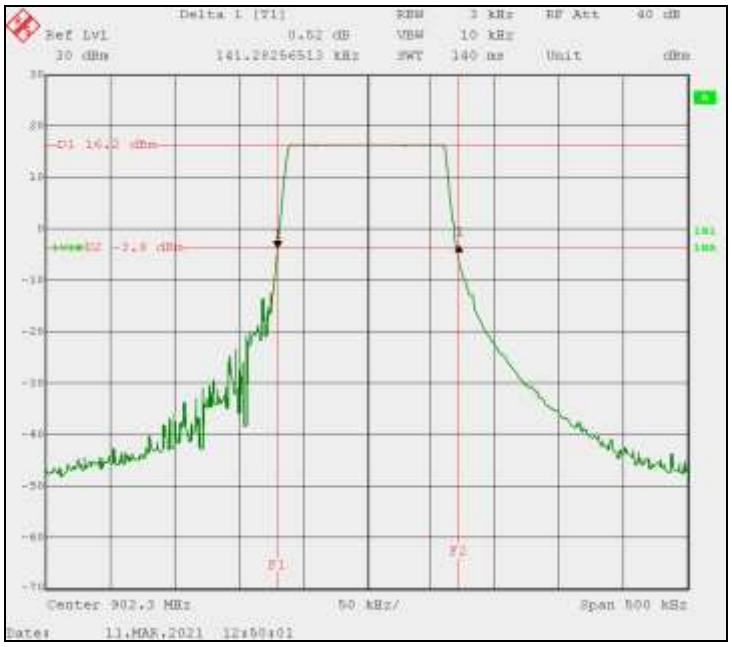
Channel 32: 908.70 MHz SF=7



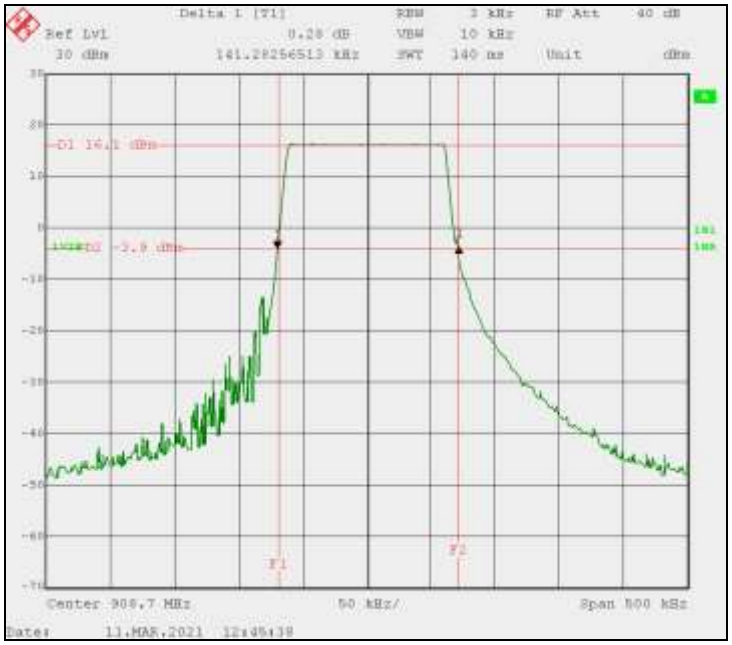
Channel 63: 914.90 MHz SF=7



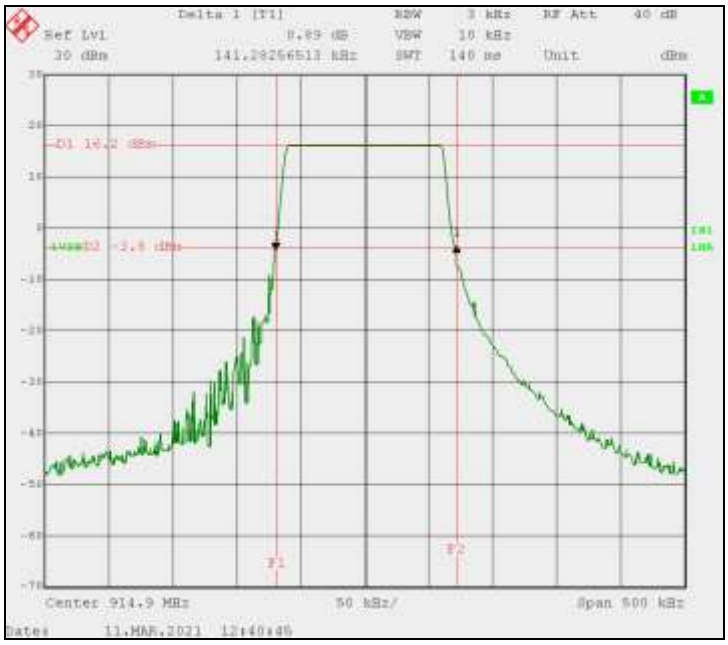
Channel 0: 902.30 MHz SF=10



Channel 32: 908.70 MHz SF=10



Channel 63: 914.90 MHz SF=10



Test Results: The DSS, 20 dB, Occupied Bandwidth measurements for the Woodstream Model V420 LoRa Radio Mouse Snap Trap were measured and are compliant to FCC and ISED requirements.

4.7 DSS 99% Occupied Bandwidth RSS-Gen 6.7

4.7.1 DSS 99% Occupied Bandwidth – Test Procedure

The 99% Occupied Bandwidth measurement per RSS-Gen Section 6.7 was measured using a Spectrum Analyzer with 3 kHz resolution bandwidth and 10 kHz video bandwidth. Transmission frequencies at low (Channel 0), middle (Channel 32) and high (Channel 63) were measured with LoRa modulation, 125 kHz bandwidth and spread factors of 7 and 10. The test procedure of ANSI C63.10, Section 6.9.3 was used.

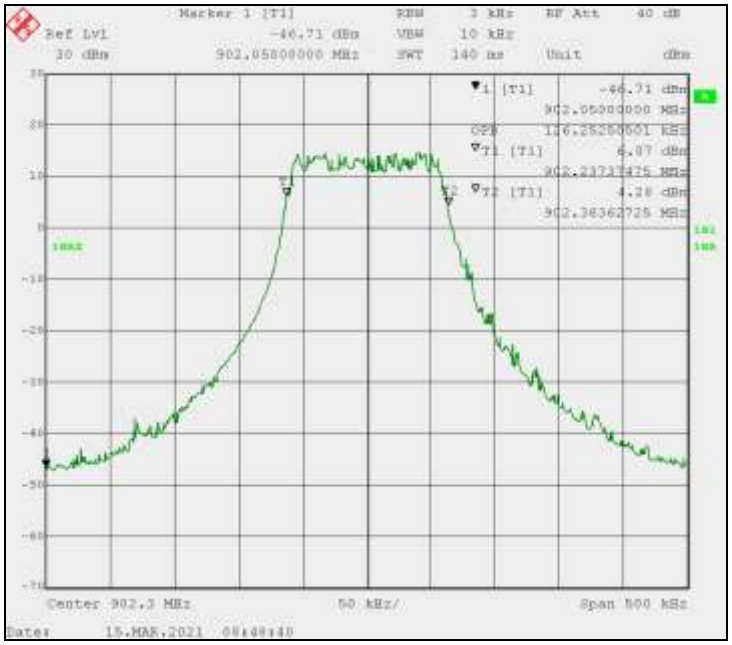
Spectrum Analyzer Settings:

Span	500 kHz
RBW	3 kHz
VBW	10 kHz
Sweep Time	140 ms (Auto)

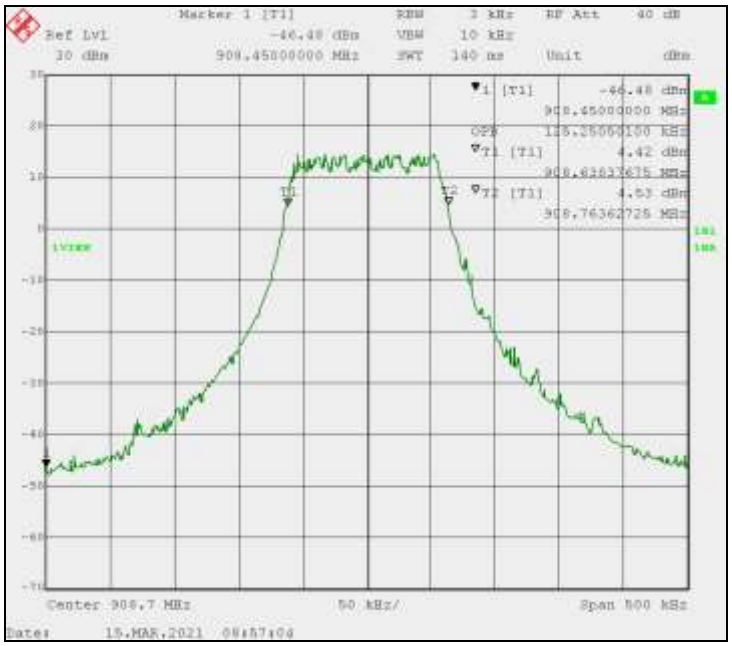
4.7.2 DSS 99% Occupied Bandwidth Test Results (03/15/2021)

Channel	Spread Factor	Modulation	Frequency (MHz)	99% OBW (kHz)
0	7	LoRa	902.3	126.25
32	7		908.7	125.25
63	7		914.9	126.25
0	10	LoRa	902.3	127.25
32	10		908.7	127.25
63	10		914.9	127.25

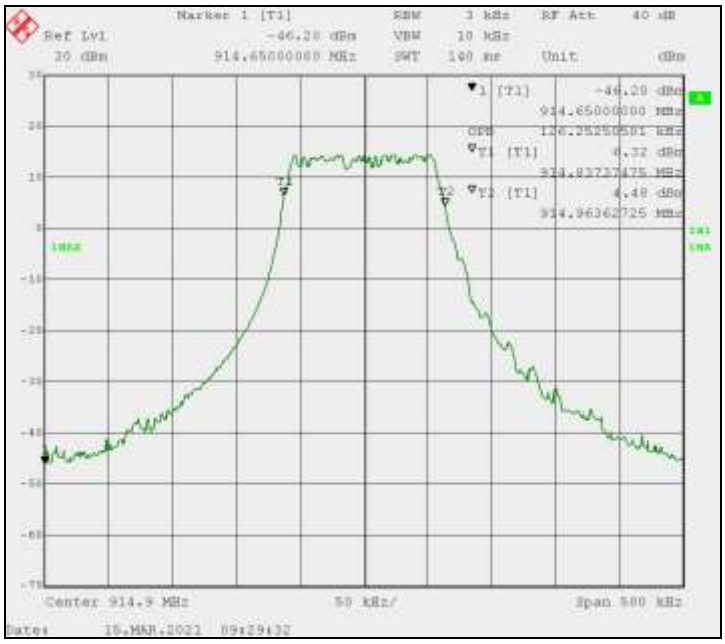
Channel 0: 902.30 MHz SF=7



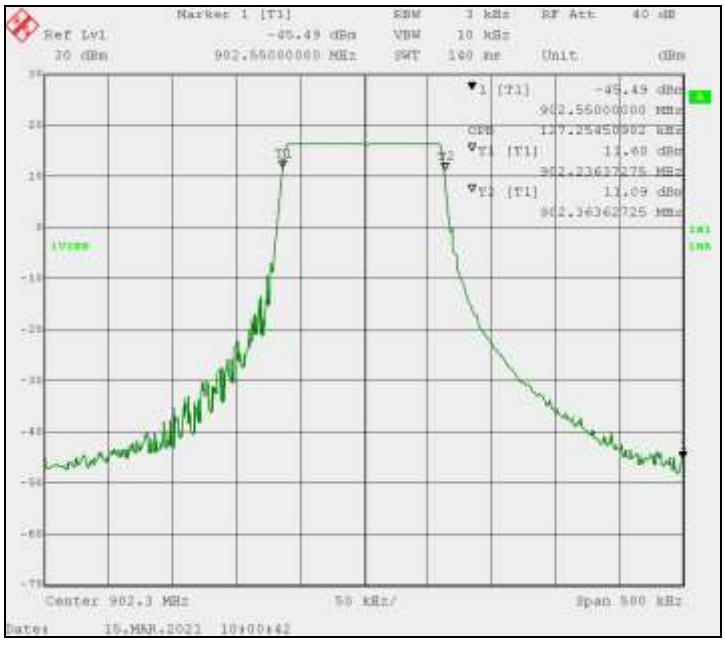
Channel 32: 908.70 MHz SF=7



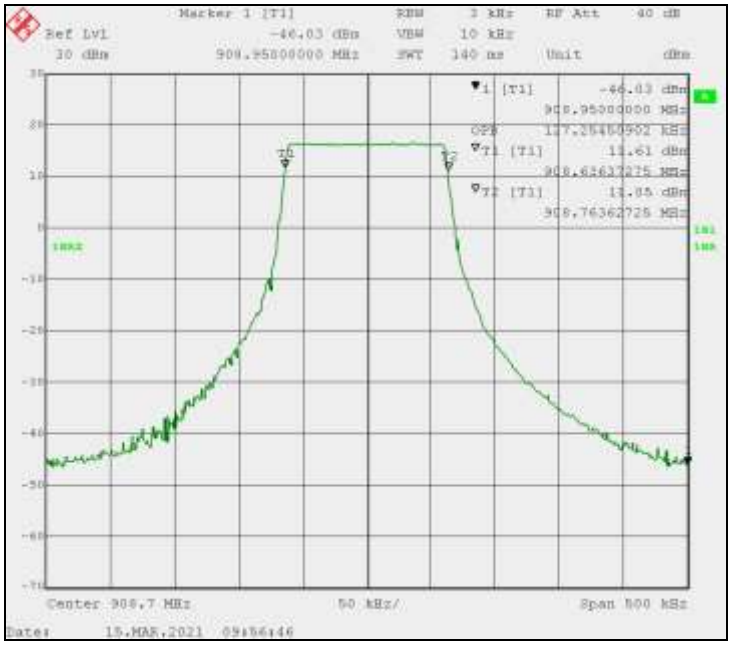
Channel 63: 914.90 MHz SF=7



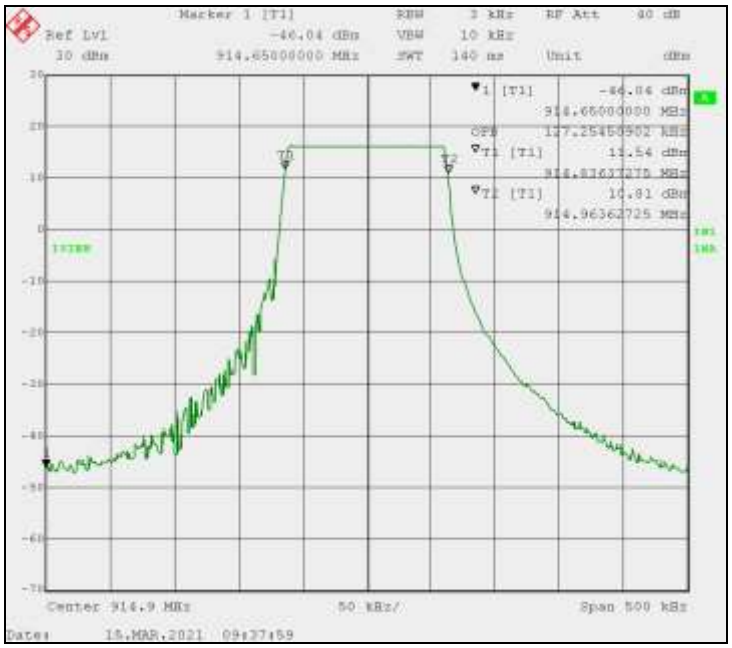
Channel 0: 902.30 MHz SF=10



Channel 32: 908.70 MHz SF=10



Channel 63: 914.90 MHz SF=10



Test Results: The DSS 99% Occupied Bandwidth measurements for the Woodstream Model V420 LoRa Radio Mouse Snap Trap were measured for RSS-Gen Section 6.7 requirement.

4.8 Maximum Conducted Output Power and EIRP (FCC Part 15.247(b)(3), RSS-247 Section 5.4(d))

4.8.1 Maximum Peak Conducted Output Power, DSS Mode, Test Procedure

A conducted power measurement of the output frequency was measured according to ANSI C63.10, Section 11.9.1.1. Spectrum Analyzer Resolution Bandwidth and Frequency Span were based upon the Operating Bandwidth (OBW) measured in the previous section. Transmission frequencies at low (Channel 0), middle (Channel 32) and high (Channel 63) were measured without modulation and with LoRa modulation, bandwidth of 125 kHz and spread factors of 7 and 10. Measurements were made with a peak detector.

Spectrum Analyzer Settings using Peak Detection:

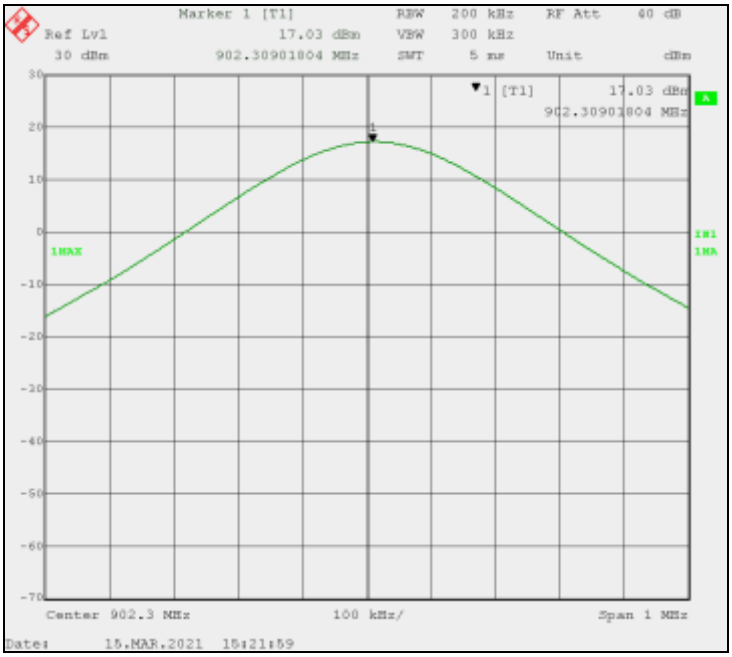
Span	1 MHz
RBW	200 kHz
VBW	300 kHz
Sweep Time	5 ms

4.8.1.1 Maximum Peak Conducted Output Power Test Results (03/17/2021)

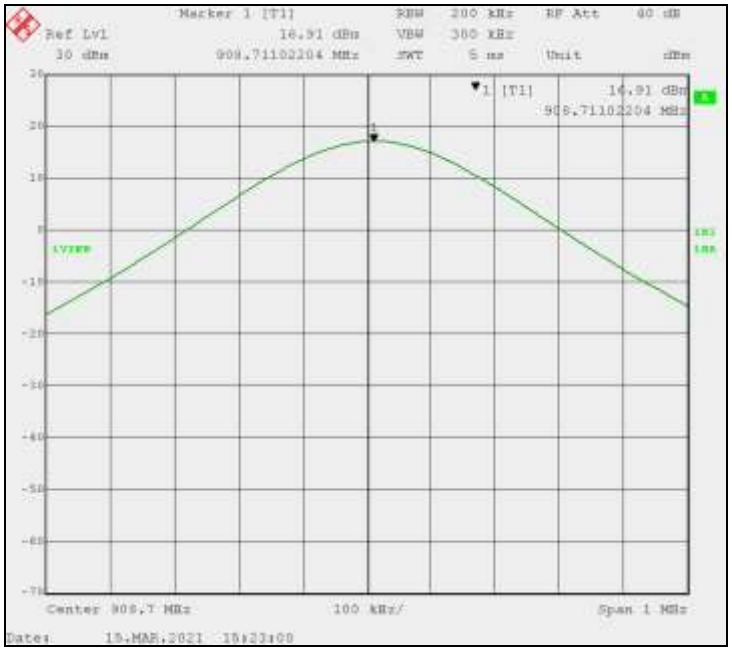
Channel	Modulation	Frequency (MHz)	Measured Level (dBm)	Cable # 962 Loss (dB)	Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
0	Unmodulated	902.3	17.03	0.26	17.29	0.054	30.00	1.000	-12.71	-0.946	Pass
32		908.7	16.91	0.26	17.17	0.052	30.00	1.000	-12.83	-0.948	Pass
63		914.9	16.78	0.26	17.04	0.051	30.00	1.000	-12.96	-0.949	Pass
0	LoRa 125 kHz BW SF=7	902.3	17.02	0.26	17.28	0.053	30.00	1.000	-12.72	-0.947	Pass
32		908.7	16.87	0.26	17.13	0.052	30.00	1.000	-12.87	-0.948	Pass
63		914.9	16.81	0.26	17.07	0.051	30.00	1.000	-12.93	-0.949	Pass
0	LoRa 125 kHz BW SF=10	902.3	17.04	0.26	17.30	0.054	30.00	1.000	-12.70	-0.946	Pass
32		908.7	16.91	0.26	17.17	0.052	30.00	1.000	-12.83	-0.948	Pass
63		914.9	16.74	0.26	17.00	0.050	30.00	1.000	-13.00	-0.950	Pass

The following pages display the spectrum analyzer screens of the peak output power measurements.

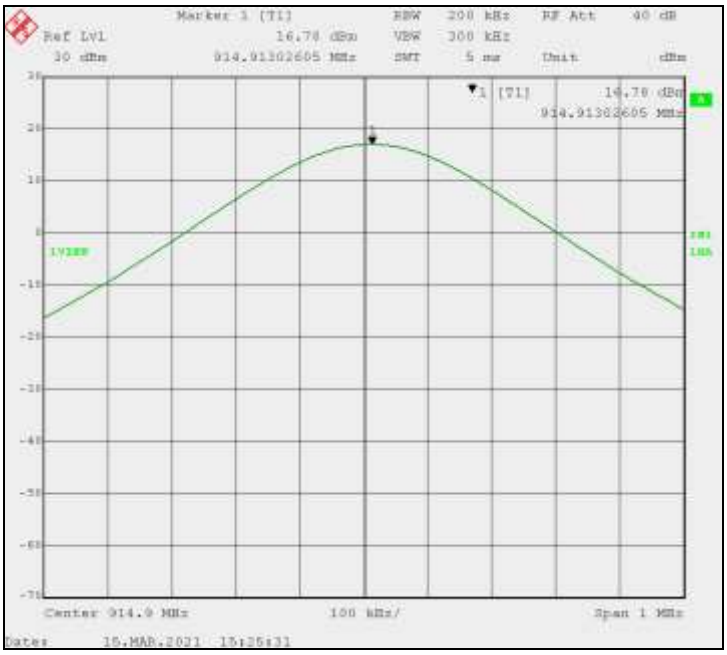
Channel 0: 902.30 MHz No Modulation



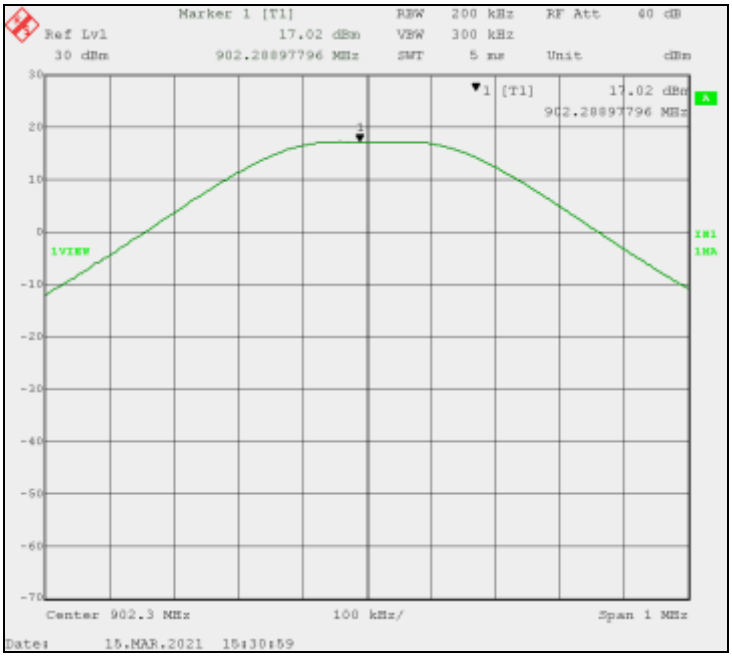
Channel 32: 908.70 MHz No Modulation



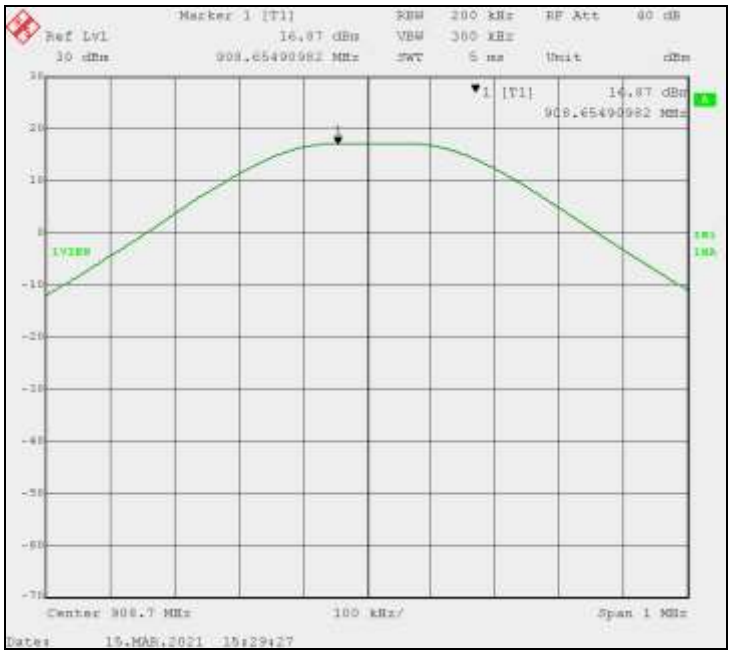
Channel 63: 914.9 MHz No Modulation



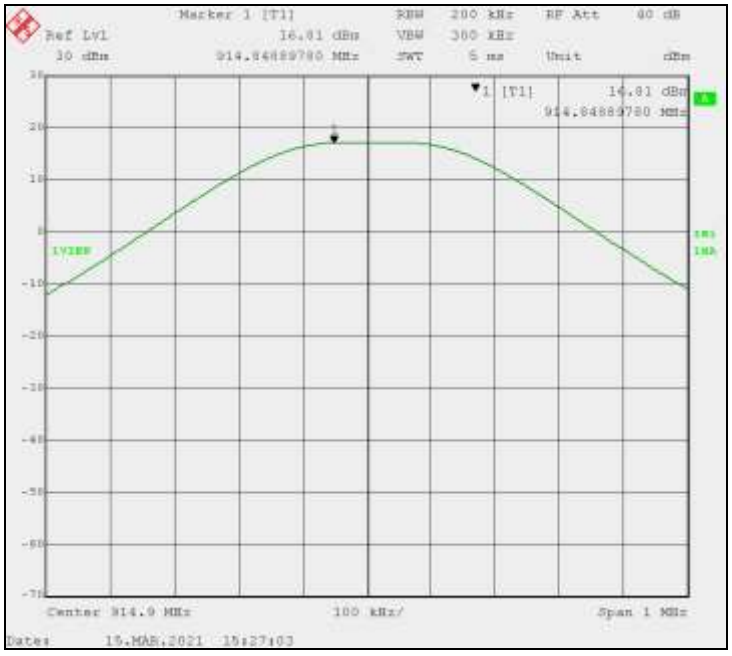
Channel 0: 902.30 MHz LoRa Modulation, SF = 7



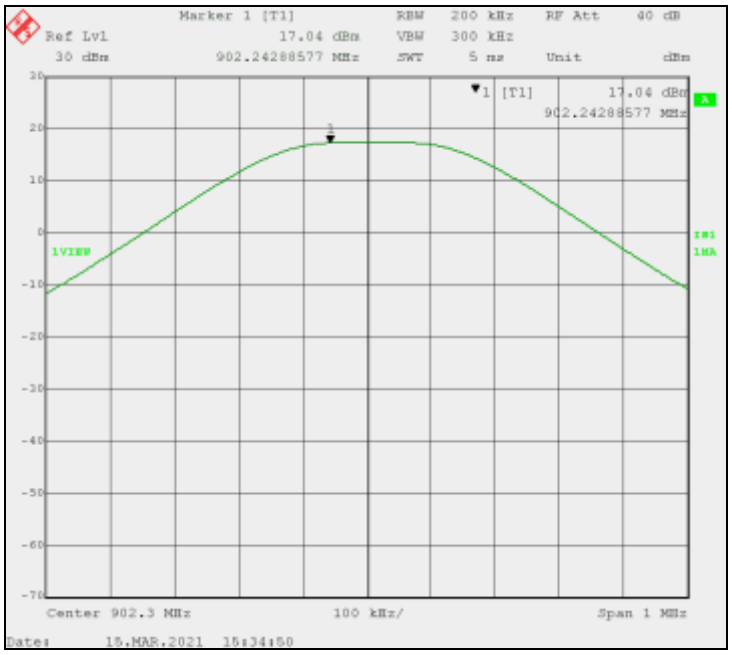
Channel 32: 908.70 MHz LoRa Modulation, SF = 7



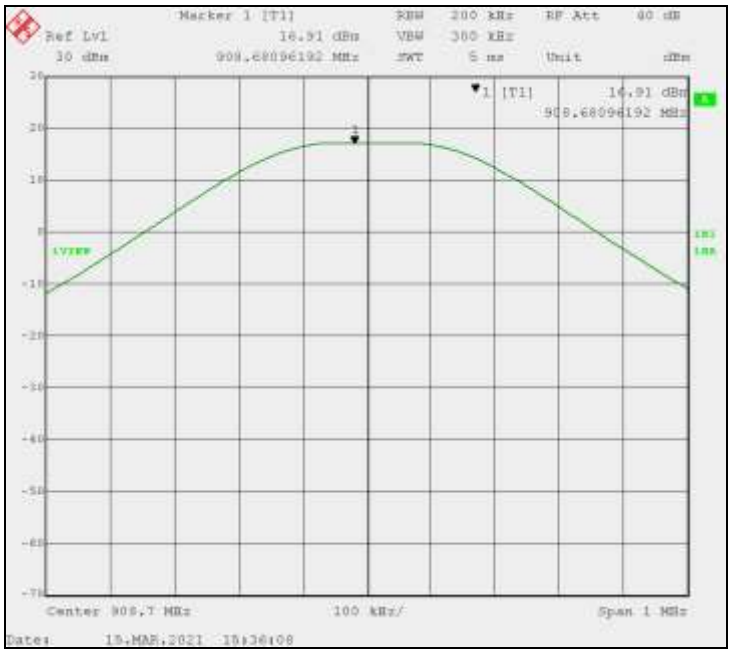
Channel 63: 914.9 MHz LoRa Modulation, SF = 7



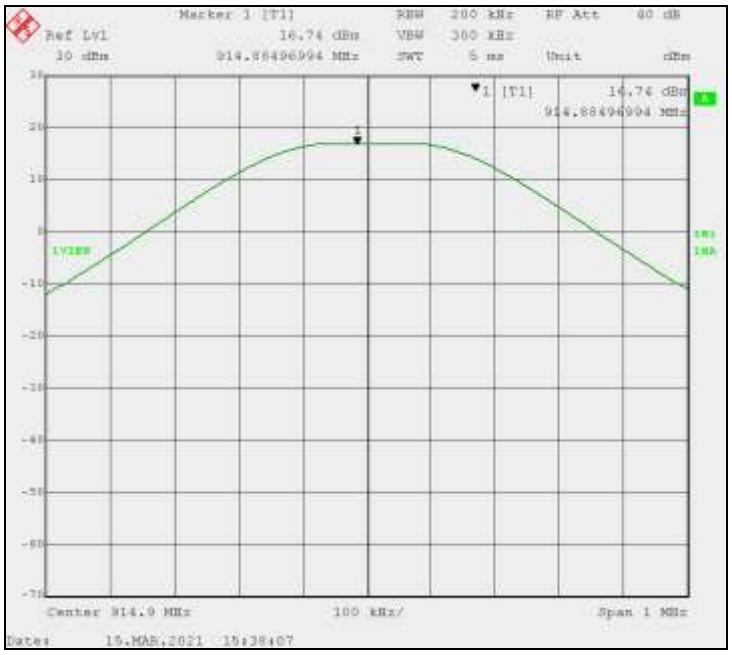
Channel 0: 902.30 MHz LoRa Modulation, SF = 10



Channel 32: 908.70 MHz LoRa Modulation, SF = 10



Channel 63: 914.9 MHz LoRa Modulation, SF = 10



Test Results: The Maximum Peak Conducted Output Power peak measurements for the Woodstream Model V420 LoRa Radio Mouse Snap Trap, with and without modulation, are compliant with the limits specified in FCC Section 15.247(b)(3).

4.8.2 Maximum Average Conducted Output Power, Hybrid Mode, Test Procedure

Average Conducted power measurement of the output frequency was measured according to ANSI C63.10, Section 11.9.2.2. Spectrum Analyzer Resolution Bandwidth and Frequency Span were based upon the Operating Bandwidth (OBW) measured in the previous section. Based upon the results of the Maximum Peak Conducted Output Power Test, modulation with a spread factor of 10 produced the highest peak level. The transmission frequencies at low (Channel 0), middle (Channel 32) and high (Channel 63) were measured with LoRa modulation, bandwidth of 125 kHz and spread factor of 10. Measurements were made using an RMS detector.

Spectrum Analyzer Settings using RMS Detection:

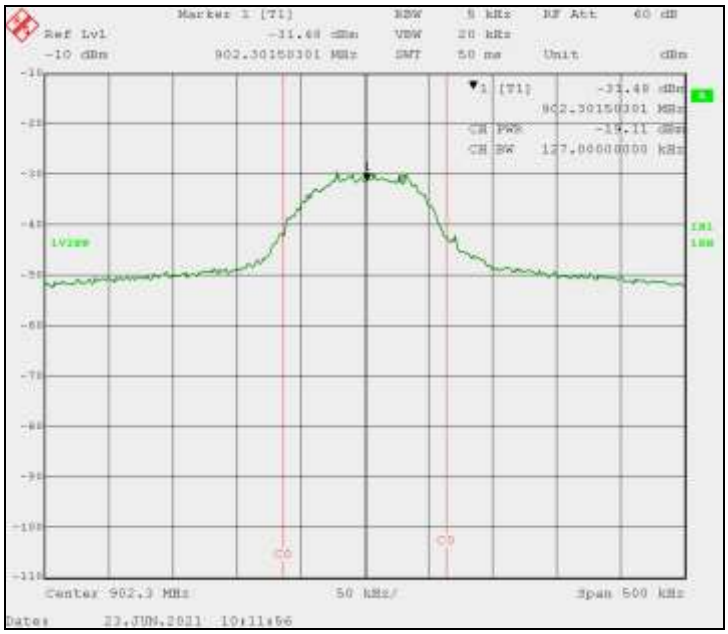
Span	500 kHz
RBW	5 kHz
VBW	20 kHz
Sweep Time	50 ms

4.8.2.1 Maximum Average Conducted Output Power Test Results (06/23/2021)

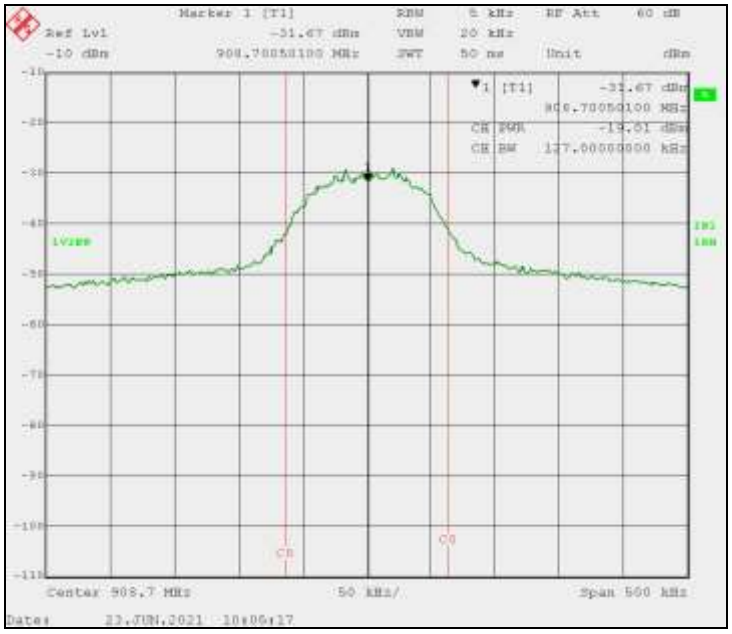
Channel	Modulation	Frequency (MHz)	Average Measured Level (dBm)	Cable # 962 Loss (dB)	Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
0	LoRa 125 kHz BW SF=10	902.3	-19.11	0.26	-18.85	0.000013	30.00	1.000	-48.85	-0.999987	Pass
32		908.7	-19.01	0.26	-18.75	0.000013	30.00	1.000	-48.75	-0.999987	Pass
63		914.9	-19.26	0.26	-19.00	0.000013	30.00	1.000	-49.00	-0.999987	Pass

The following pages display the spectrum analyzer screens of the average output power measurements.

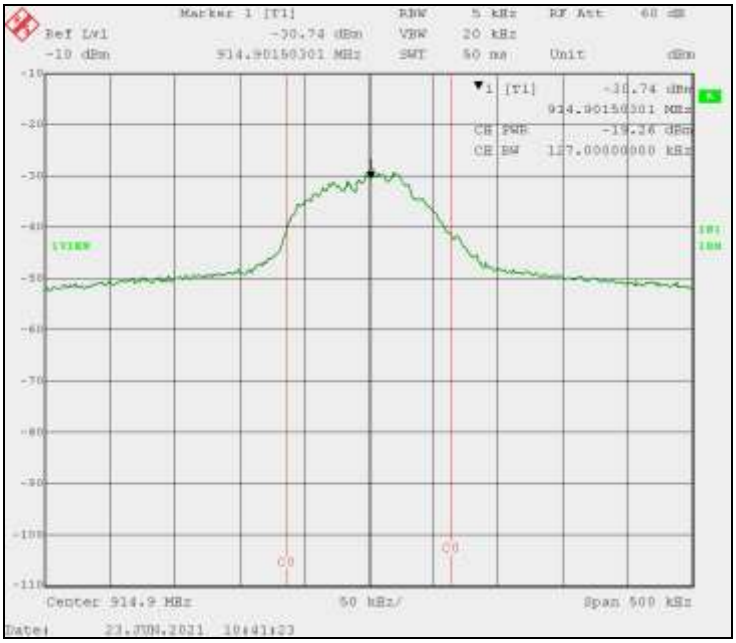
Channel 0: 902.30 MHz LoRa Modulation, SF = 10



Channel 32: 908.70 MHz LoRa Modulation, SF = 10



Channel 63: 914.9 MHz LoRa Modulation, SF = 10



Test Results: The Maximum Average Conducted Output Power peak measurements for the Woodstream Model V420 LoRa Radio Mouse Snap Trap, with modulation and spread factor of 10, are compliant with the limits specified in FCC Section 15.247(b)(3).

4.8.3 EIRP Calculation RSS-247 (03/17/2021)

The gain of the antenna, used in the Woodstream Model V420 LoRa Radio Mouse Snap Trap is –6.61 dBi. Applying the antenna gain to the maximum peak transmitter output produces the following values of EIRP.

Channel	Modulation and Settings	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP		EIRP Limit	Margin	Results
			dBm	Watts	Isotropic	Numeric	dBm	Watts	Watts	Watts	
0	Unmodulated	902.3	17.29	0.054	-6.61	0.218	10.68	0.012	4.00	-3.988	Pass
32		908.7	17.17	0.052	-6.61	0.218	10.56	0.011	4.00	-3.989	Pass
63		914.9	17.04	0.051	-6.61	0.218	10.43	0.011	4.00	-3.989	Pass
0	LoRa 125 kHz BW SF=7	902.3	17.28	0.053	-6.61	0.218	10.67	0.012	4.00	-3.988	Pass
32		908.7	17.13	0.052	-6.61	0.218	10.52	0.011	4.00	-3.989	Pass
63		914.9	17.07	0.051	-6.61	0.218	10.46	0.011	4.00	-3.989	Pass
0	LoRa 125 kHz BW SF=10	902.3	17.30	0.054	-6.61	0.218	10.69	0.012	4.00	-3.988	Pass
32		908.7	17.17	0.052	-6.61	0.218	10.56	0.011	4.00	-3.989	Pass
63		914.9	17.00	0.050	-6.61	0.218	10.39	0.011	4.00	-3.989	Pass

The results in the above table demonstrate compliance to the ISED requirements for EIRP limits of RSS-247.

4.9 Carrier Frequency Separation 47 CFR 15.247(a)(1) RSS-247 (5.1)(b) (03/22/2021)

4.9.1 Carrier Frequency Separation Test Procedure

47 CFR Part 15.247(a)(1) and RSS-247 (5.1)(b) specify Hopping Channels must be separated by a minimum of 25 kHz or the 20 dB bandwidth whichever is greater. The 20 dB Bandwidth of this device is 144.3 kHz and this value is the required minimum separation between FHSS channels. The test procedure of ANSI C63.10, Section 7.8.2 was used.

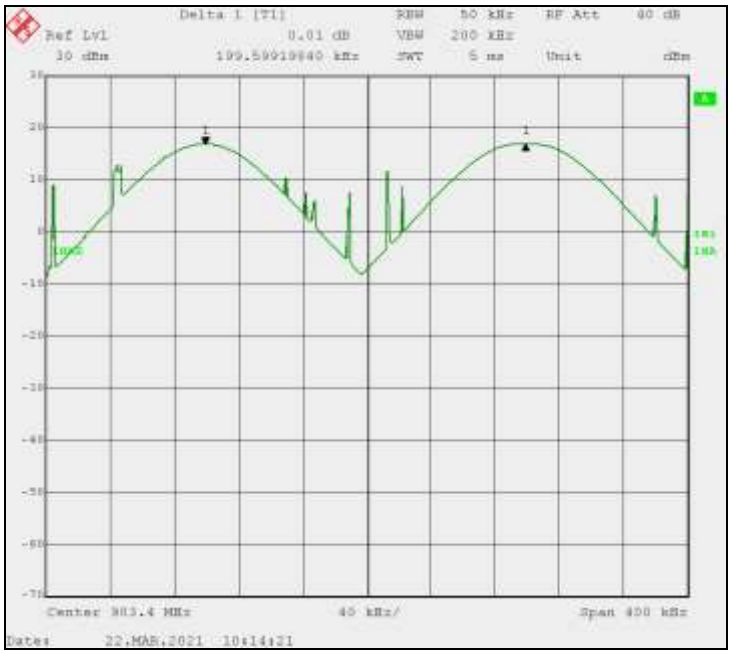
Spectrum Analyzer Settings:

Span	400 kHz
RBW	50 kHz
VBW	200 kHz
Sweep Time	140 ms (Auto)

4.9.2 Carrier Frequency Separation Test Results (03/22/2021)

Hopping Channel	Channel Frequency	Channel Separation (Marker 1 - Delta 1)	Minumum Separation Limit (20 dB Bandwidth)	Margin	Result
#	MHz	kHz	kHz	kHz	
5	903.3	199.60	144.3	-55.31	Pass
6	903.5				

Channels 5 and 6 Carrier Frequency Separation



Test Results: The FHSS Carrier Frequency Separation of the Woodstream Model V420 LoRa Radio Mouse Snap Trap is compliant with the limits specified in FCC Section 15.247(a)(1) and RSS-247(5.1)(b).

4.10 Number of Hopping Frequencies 47 CFR 15.247(a)(1)(i), RSS-247 (5.1)(c) (03/24/2021)

4.10.1 Number of Hopping Frequencies Test Procedure

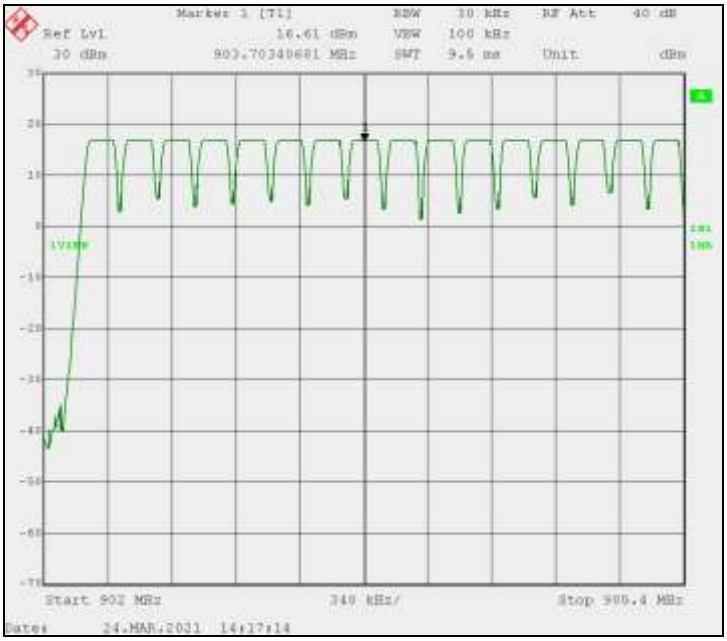
47 CFR Part 15.247(a)(1)(i) and RSS-247 (5.1)(c) specify a minimum of 50 channels for FHSS transmitters with 20-dB bandwidths less than 250 kHz. The test procedure of ANSI C63.10, Section 7.8.3 was used to demonstrate the number of hopping frequencies.

Spectrum Analyzer Settings:

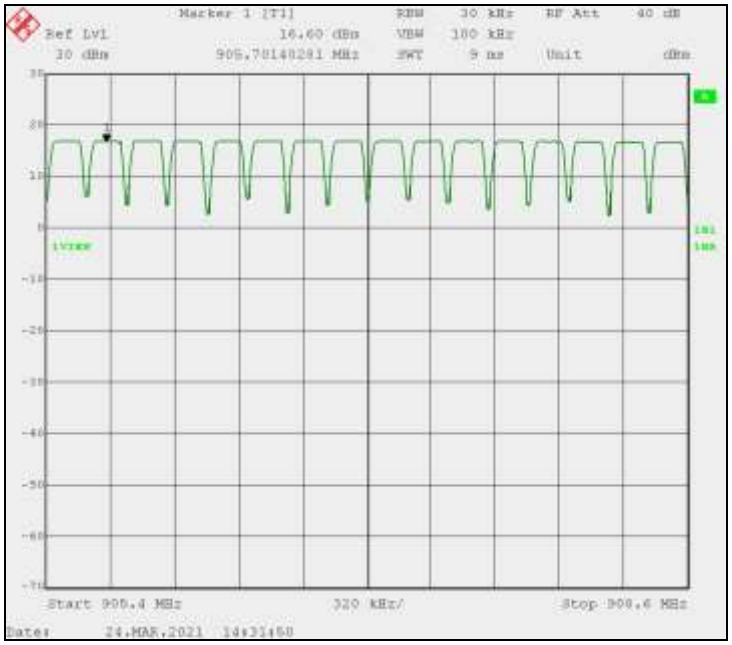
Span	320, 340 kHz
RBW	30 kHz
VBW	100 kHz
Sweep Time	9-9.5 ms (Auto)

4.10.2 Number of Hopping Frequencies Test Results (04/01/2021)

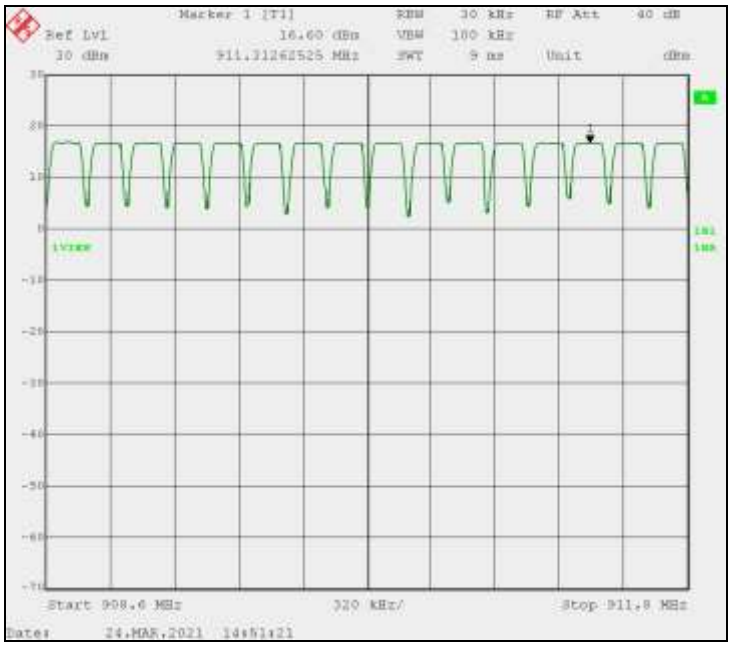
Channels 0 - 15



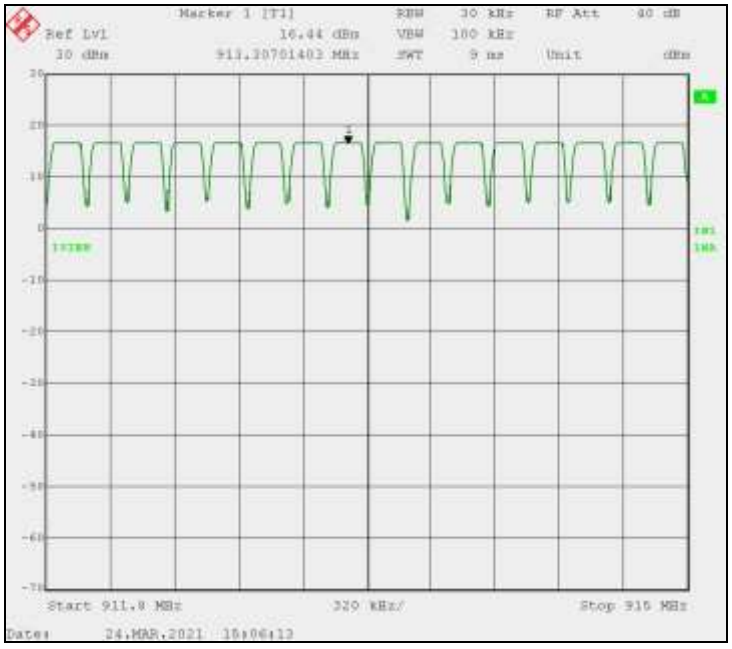
Channels 16 - 31



Channels 32-47



Channels 48-63



Test Results: The number of channels of the Woodstream Model V420 LoRa Radio Mouse Snap Trap total 64 and are compliant to the minimum of 50 required by 47 CFR Part 15.247 (a)(1)(i) and RSS-247 (5.1)(c).

4.11 Time of Occupancy (Dwell Time) 47 CFR 15.247(a)(1)(i) RSS-247 (5.1)(c) (03/25/2021)

4.11.1 Time of Occupancy (Dwell Time) Test Procedure

47 CFR Part 15.247 (a)(1)(iii) and RSS-245 (5.1(c) require the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period. Below are spectrum analyzer screens at low, middle and high frequencies that demonstrate the dwell time and period at all possible modulation parameters. The procedure of ANSI C63.10, Section 7.8.4 was used.

Spectrum Analyzer Settings:

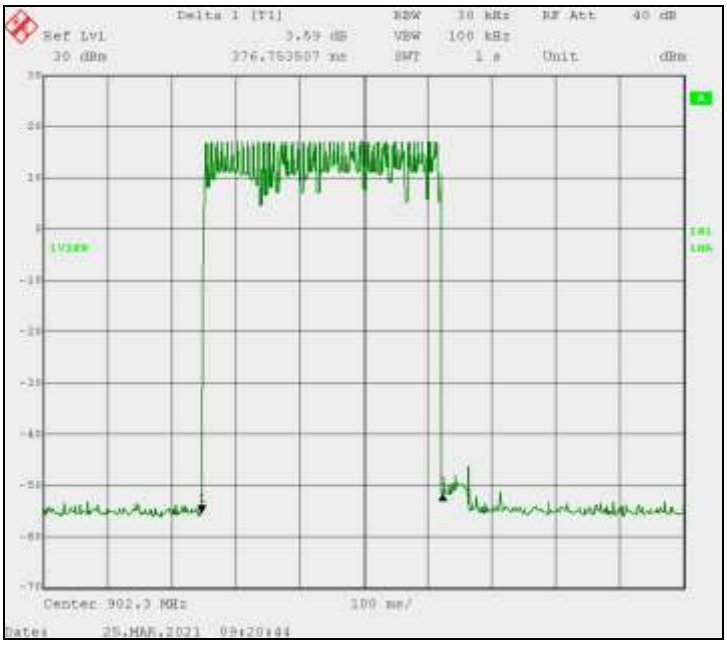
Span	0 Hz
RBW	30 kHz
VBW	100 kHz
Sweep Time	Various

4.11.2 Time of Occupancy (Dwell Time) Test Results

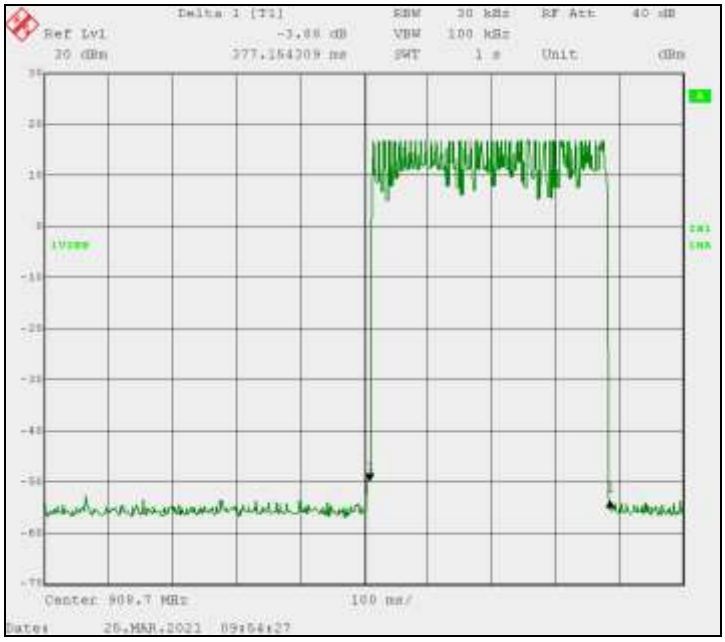
Channel #	Freq (MHz)	Modulation	Data Rate	Spread Factor	Bit Rate	Dwell Time (msec)	Limit (msec)	Margin (msec)	Result
0	902.3	LoRa	0	10	980	376.75	400	-23.25	Pass
32	908.7					377.15	400	-22.85	Pass
64	914.9					375.55	400	-24.45	Pass
0	902.3		1	9	1760	208.42	400	-191.58	Pass
32	908.7					208.42	400	-191.58	Pass
64	914.9					207.41	400	-192.59	Pass
0	902.3		2	8	3125	116.23	400	-283.77	Pass
32	908.7					115.23	400	-284.77	Pass
64	914.9					115.23	400	-284.77	Pass
0	902.3		3	7	5470	62.52	400	-337.48	Pass
32	908.7					62.93	400	-337.07	Pass
64	914.9					62.52	400	-337.48	Pass

The following pages contain facsimiles of spectrum analyzer display screens demonstrating the time of occupancy.

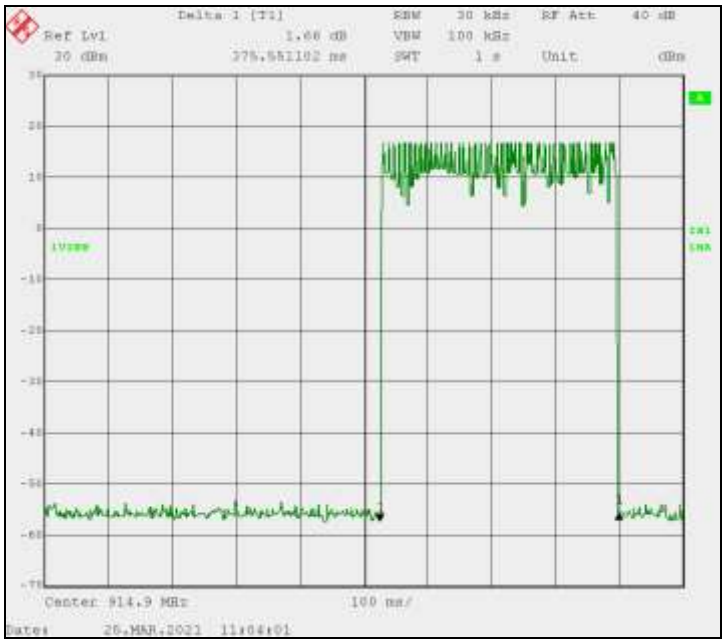
Channel 0, Data Rate = 0 (SF=10)



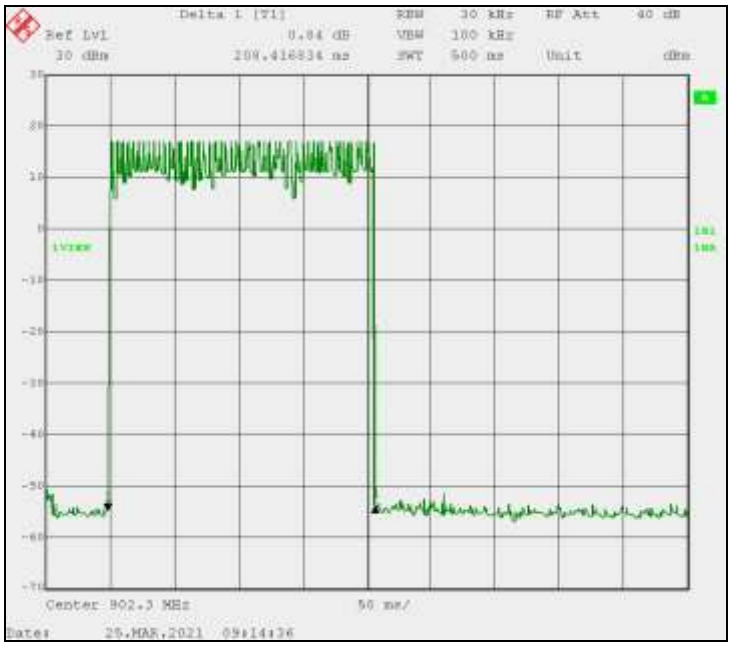
Channel 32, Data Rate = 0 (SF=10)



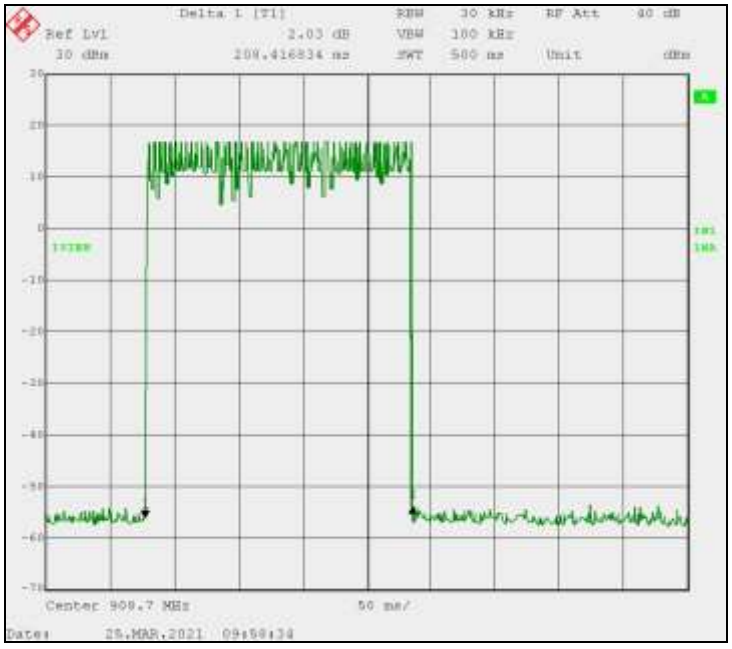
Channel 63, Data Rate = 0 (SF=10)



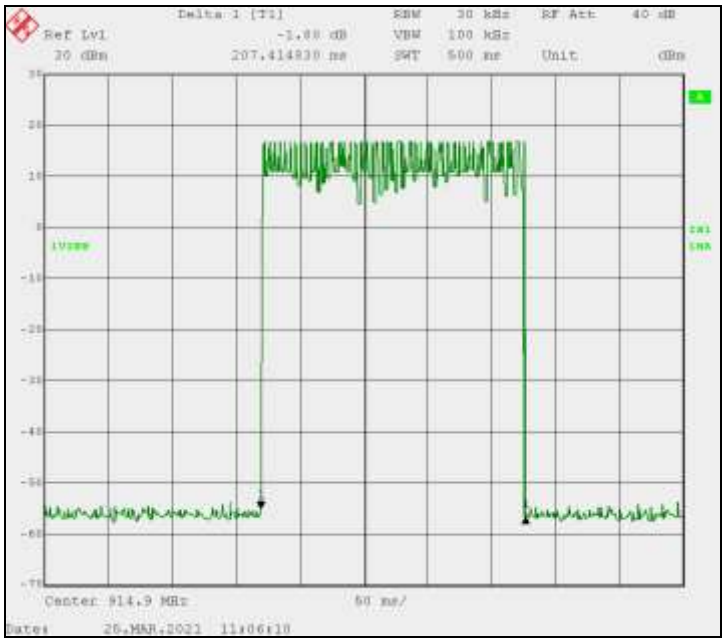
Channel 0, Data Rate = 1 (SF=9)



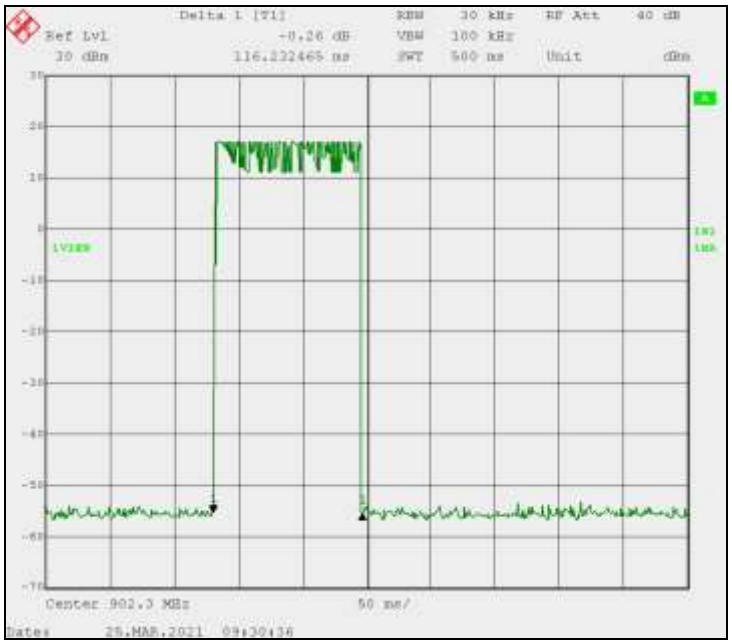
Channel 32, Data Rate = 1 (SF=9)



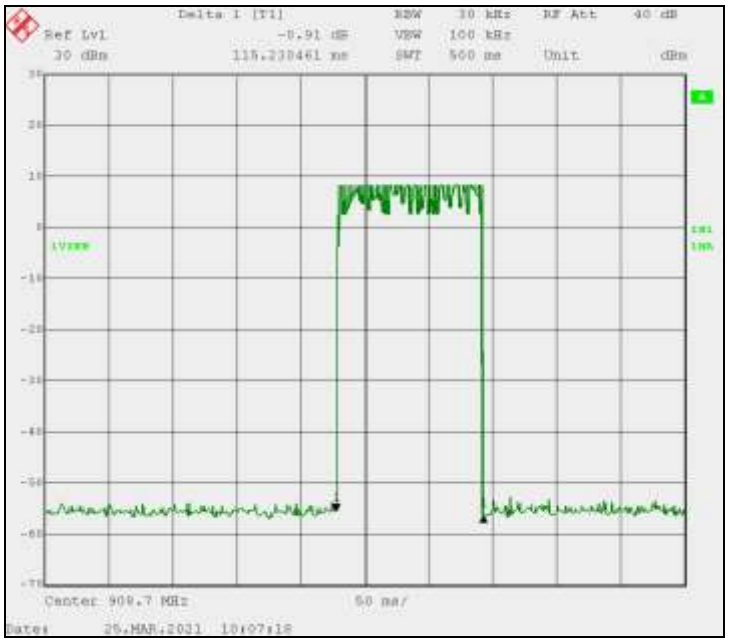
Channel 63, Data Rate = 1 (SF=9)



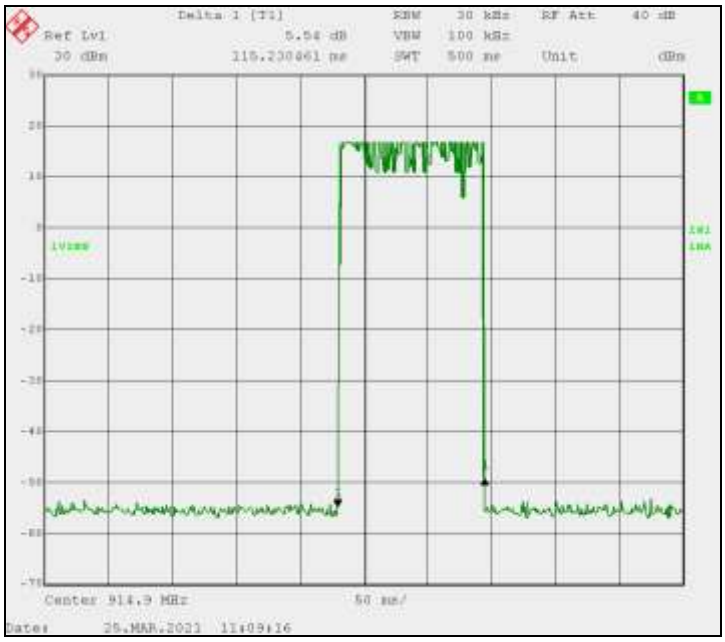
Channel 0, Data Rate = 2 (SF=8)



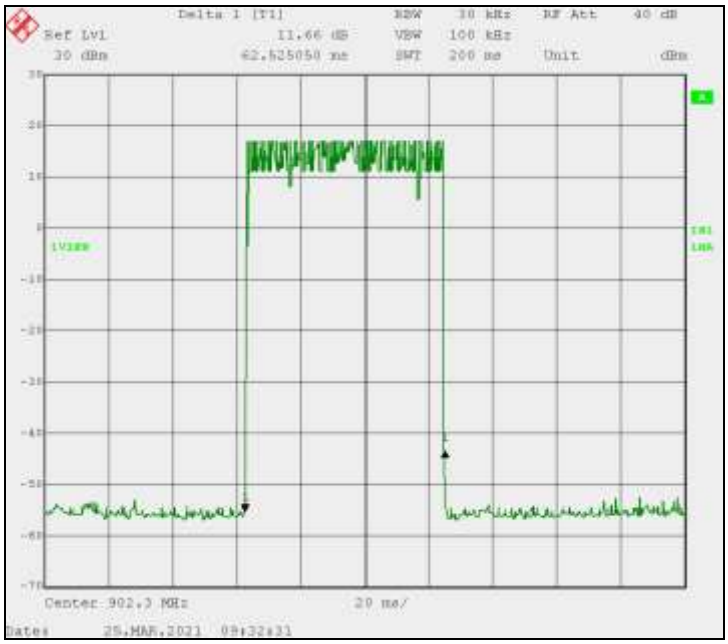
Channel 32, Data Rate = 2 (SF=8)



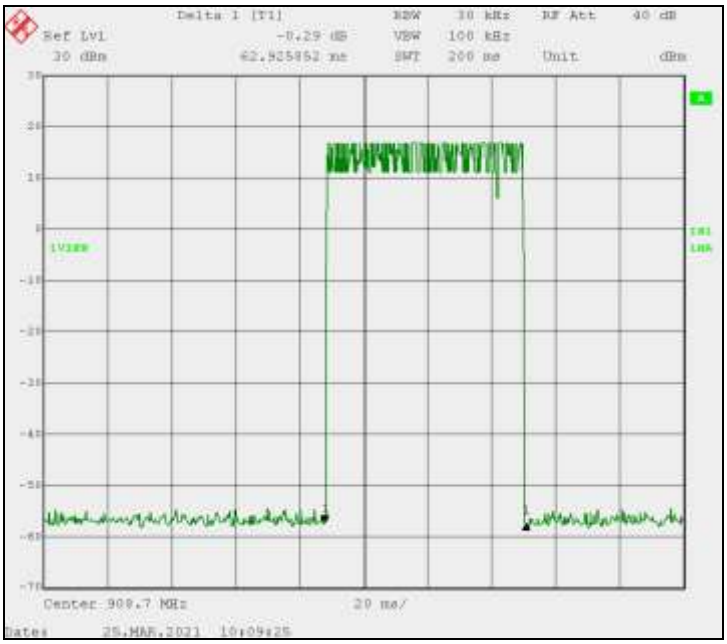
Channel 63, Data Rate = 2 (SF=8)



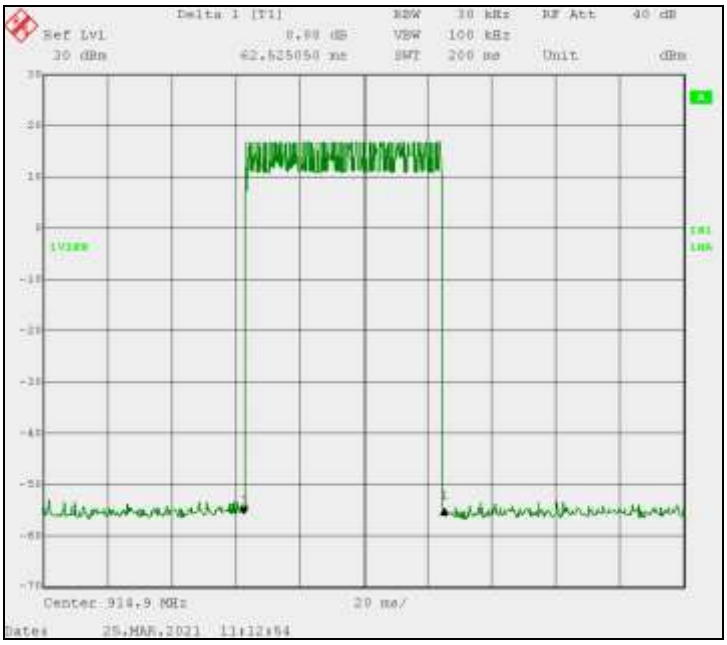
Channel 0, Data Rate = 3 (SF=7)



Channel 32, Data Rate = 3 (SF=7)

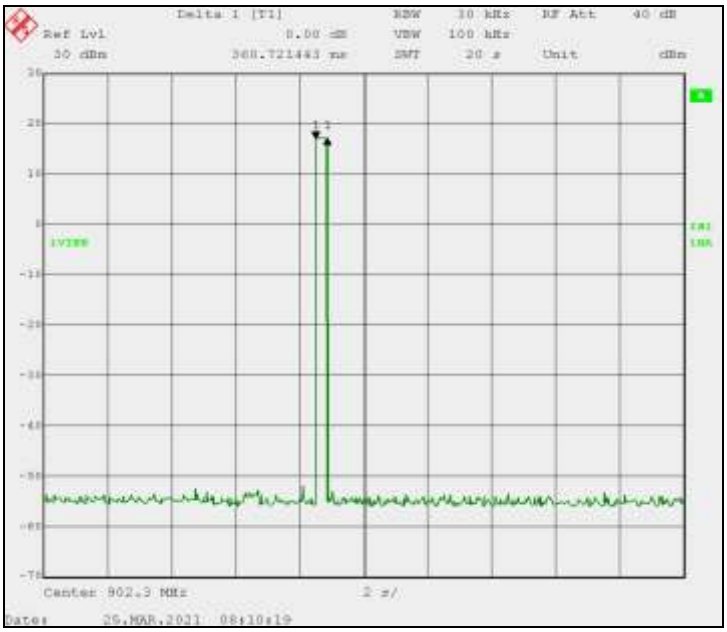


Channel 63, Data Rate = 3 (SF=7)

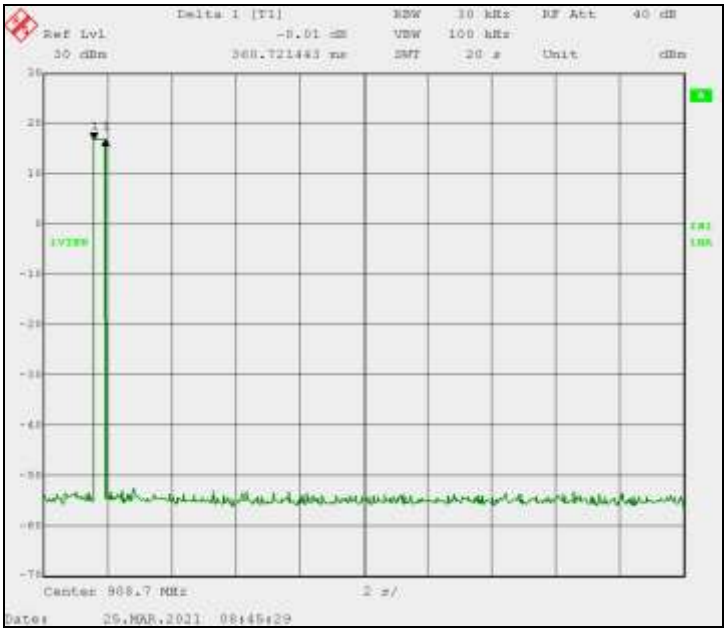


The following pages contain facsimiles of spectrum analyzer display screens demonstrating the requirement of the dwell time within a 20 second period.

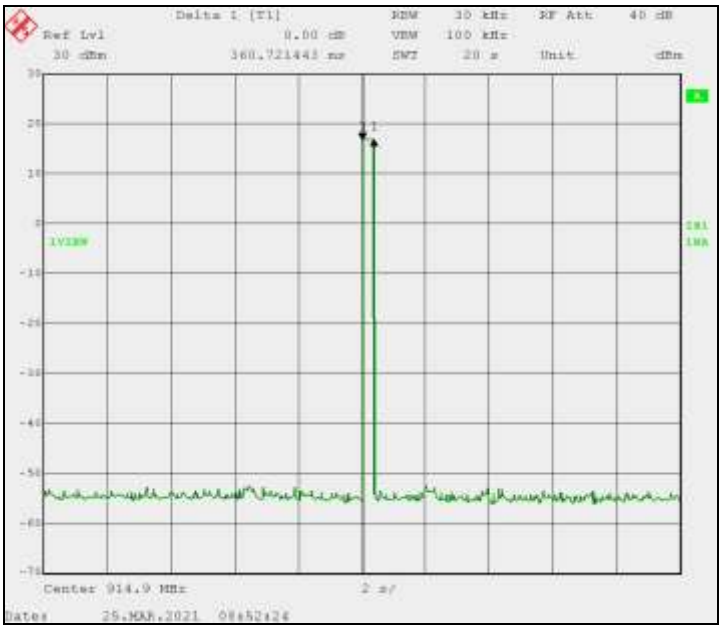
Channel 0, Data Rate = 0 (SF=10)



Channel 32, Data Rate = 0 (SF=10)



Channel 63, Data Rate = 0 (SF=10)



Test Results: The dwell time and period for each of the low, middle and high channels are compliant with the requirements of 47 CFR Part 15.247 and RSS-247.

4.12 Band Edge Measurement 47 CFR 15.247(d) and RSS-247 (5.5) (04/01/2021)

4.12.1 Band Edge Measurement Test Procedure

Band edge measurements were made while operating in non-hopping mode and hopping mode. Low Channel, 902.3 MHz (Channel 0) and High Channel, 914.9 MHz (Channel 63) were used as reference signals for the Low Band Edge and High Band Edge. The Authorized Band Edge measurements were made using the Relative Method of Section 6.10.4 of ANSI C63.10. The Spectrum Analyzer Screens below show emissions between the modulated carrier, at low and high frequencies and the lower and upper band edges. The limit is 30 dBc, based upon the Maximum Average Output Power Test Measurement procedure.

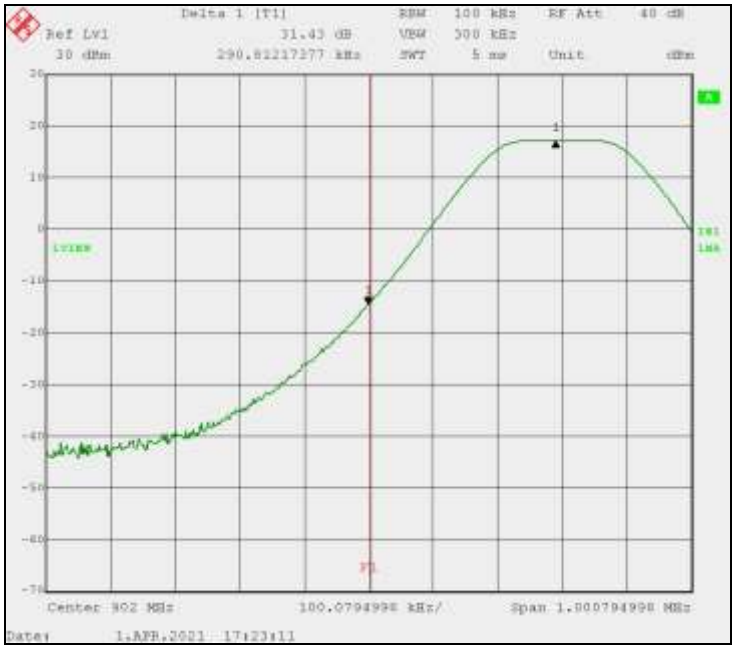
Spectrum Analyzer Settings:

Span	Various
RBW	100 kHz
VBW	300 kHz
Sweep	5 ms

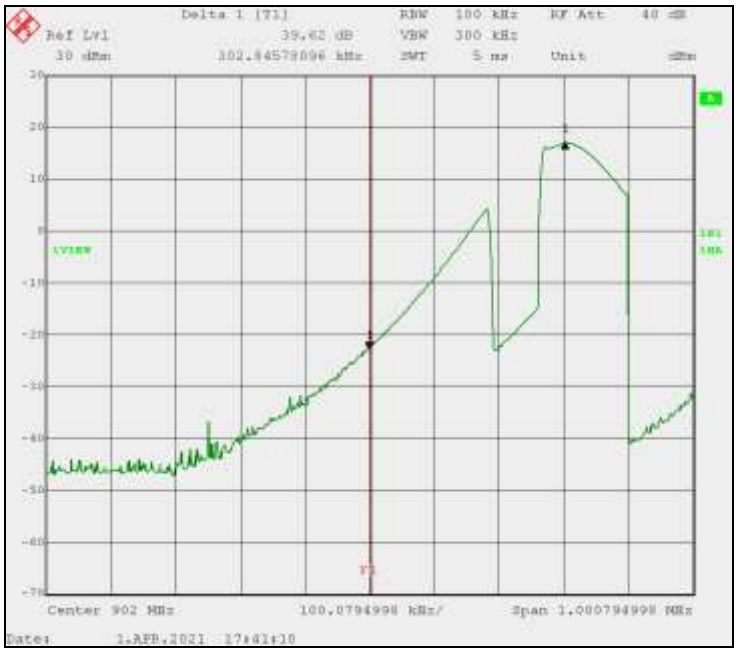
4.12.2 Band Edge Measurement Test Results (04/01/2021)

Mode	Frequency (MHz)	Peak Transmit	Band Edge Measurement				Result
			Peak Level	Limit	Delta	Margin	
non-hopping	902.3	17.68	-13.75	30.00	31.43	-1.43	Pass
hopping	902.3	16.28	-23.34	30.00	39.62	-9.62	Pass
non-hopping	914.9	16.62	-47.22	30.00	63.84	-33.84	Pass
hopping	914.9	17.34	-44.46	30.00	61.80	-31.80	Pass

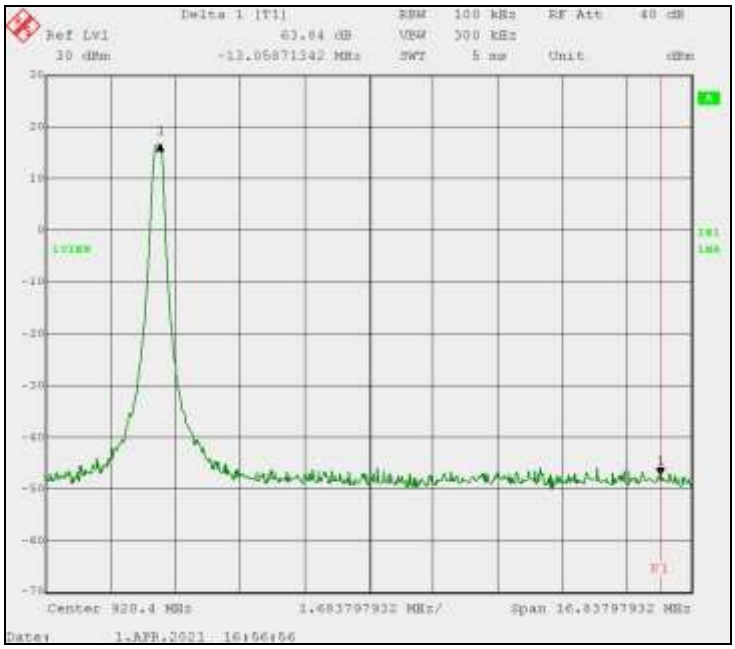
Low Band Edge – Non-Hopping (Channel 0, 902.3 MHz, BW=125 kHz, SF=10)



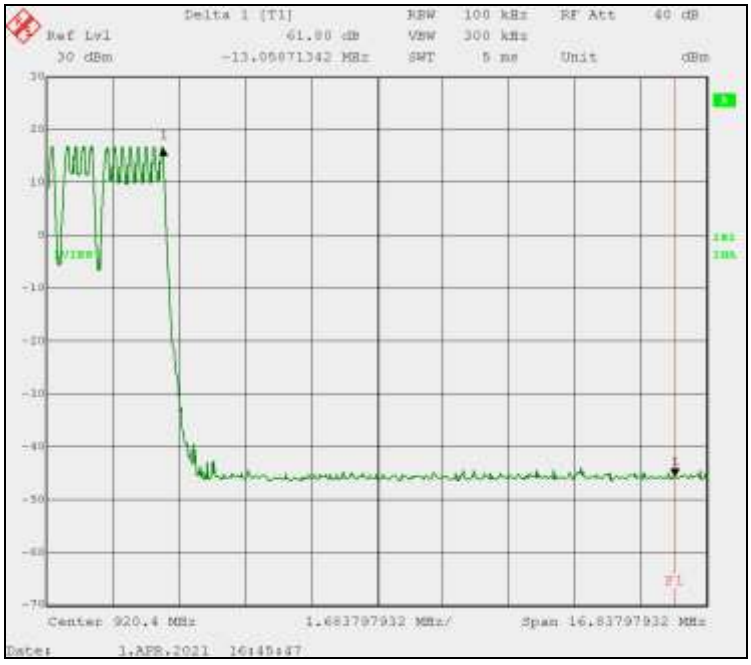
Low Band Edge – Hopping (Data Rate=980 bits/sec)



High Band Edge – Non-Hopping (Channel 63, 914.9 MHz, BW=125 kHz, SF=10)



High Band Edge – Hopping (Data Rate=980 bits/sec)



Test Results: The band edge emissions of each of the low and high channels, in non-hopping and hopping modes, are compliant with the requirements of 47 CFR Part 15.247 and RSS-247.

4.13 Average Power Spectral Density, Hybrid Mode (FCC Section 15.247(e), RSS-247 Section 5.2(b))

4.13.1 Average Power Spectral Density Test Procedure

A conducted power measurement of the output frequency was measured using an RMS detector for the Woodstream V420 for each of the low (Channel 0), middle (Channel 32) and high (Channel 64) channel frequencies. The signal output was maximized with LoRa modulation with 125 kHz bandwidth using a Spread Factor of 10. The test procedure of ANSI C63.10, Section 11.10.3 Method (AVGPSD-1) was used.

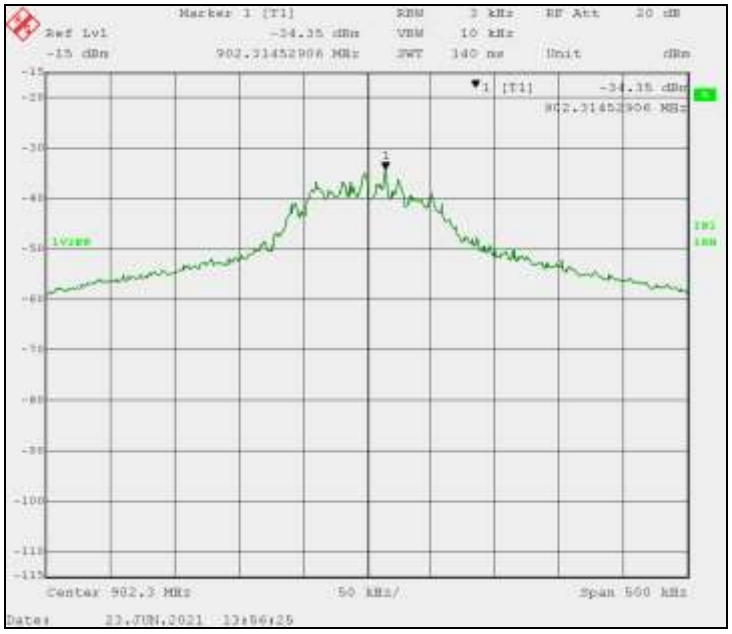
Spectrum Analyzer Settings using RMS Detection:

RBW	3	kHz
VBW	10	kHz
Span	500	kHz
Sweep(Auto)	140	ms

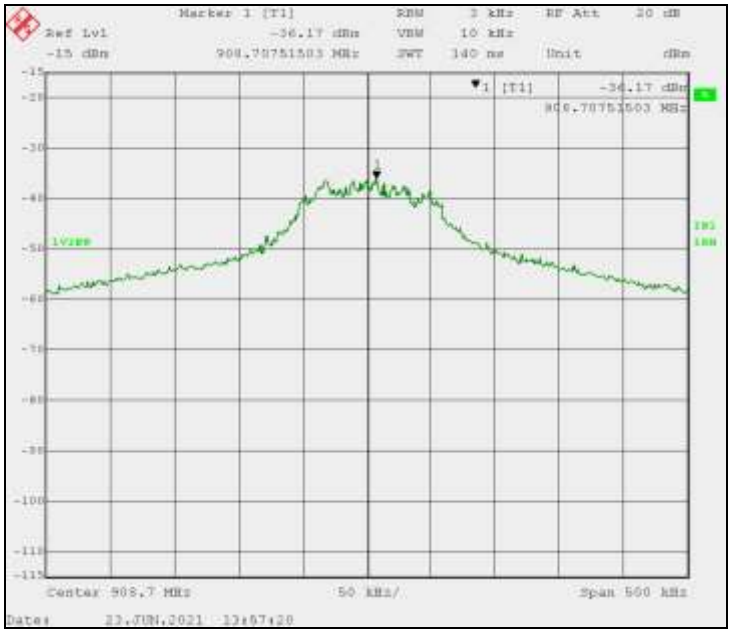
4.13.1.1 Peak Power Spectral Density Test Results (06/23/2021)

Channel	Frequency (MHz)	LoRa Modulation Spread Factor	Measured Avg Level	Cable # 962 Loss	Total	Limit	Margin	Test Result
			dBm	dB	dBm	dBm	dBm	
0	902.3	10	-34.35	0.26	-34.09	8.00	-42.09	Pass
32	908.7		-34.17	0.26	-33.91	8.00	-41.91	Pass
63	914.9		-34.95	0.26	-34.69	8.00	-42.69	Pass

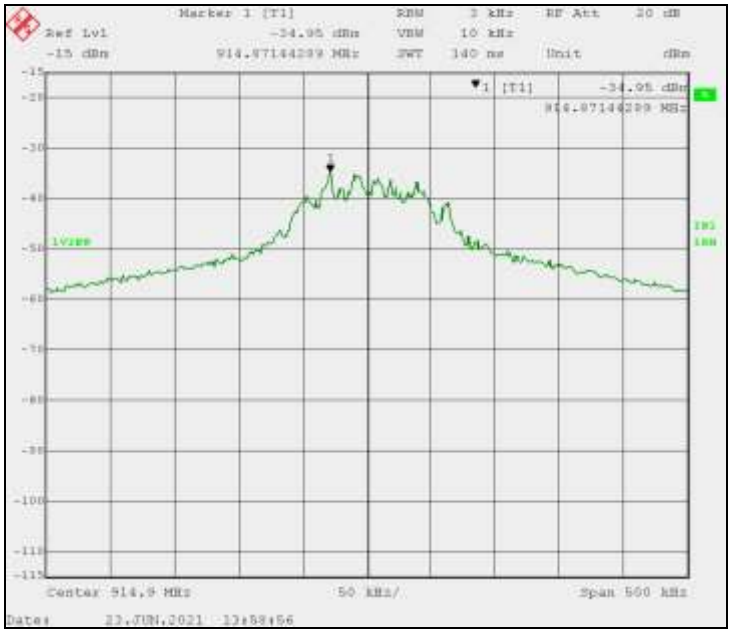
Channel 0, 902.3 MHz, LoRa Modulation



Channel 32, 908.7 MHz, LoRa Modulation



Channel 63, 914.9 MHz, LoRa Modulation



Test Results: The Average Power Spectral Density measurements of the Woodstream Model V420 LoRa Radio Mouse Snap Trap are compliant with the limits specified in FCC Section 15.247(e) and RSS-247.

5.0 Test Setup Photos

See Appendix C Woodstream V420 LoRa Mouse Snap Trap Test Setup Photos

Appendix A – Test Equipment

Equipment	Manufacturer	Model #	Serial #	BEC #	Calibration Date	Calibration Cycle	Calibration Due Date
EMI Receiver (20 Hz – 26.5 GHz)	Rohde & Schwarz	ESIB 26	836119/006	1010	07/02/19	3 Years	07/02/22
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/26/18	3 Years	06/26/21
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	02/27/18	3 Years 3 Months	05/27/21
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/16/18	3 Years	05/16/21
Amplifier (.09 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	01/13/21	2 Years	01/13/23
EMC Analyzer (9 kHz - 1.8 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/23/20	3 Years	03/23/23
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	10/13/20	2 Years	10/13/22
Double Ridged Horn Antenna (1 - 18 GHz)	EMCO	3115	9705-5225	1028	11/19/18	2 Years	11/19/21
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	08/17/19	3 Years	08/17/22
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	08/03/20	1 Year	08/03/21
Temp/Humidity Meter	Control Company	4096	151872672	780	10/13/20	2 Years	10/13/22
Notch Filter	Anatech	AE915N S2095	10	923	08/16/18	3 Years	08/16/21

High-Pass Filter	Trilithic Inc.	6HC1500 /18000-3-KK	20044046	741	02/27/20	3 Years	02/27/23
Software (Tile Instrument Control System)	Quantum Change/EMC Systems	Version 3	N/A	N/A	No Cal. Required	No Cal. Required	No Cal. Required
Radiated Emissions Test Software	BEC	RADE	2.2	N/A	No Cal. Required	No Cal. Required	No Cal. Required