



BEC INCORPORATED

CERTIFICATION APPLICATION TEST REPORT

TEST STANDARDS:

**FCC Part 15 Subpart C, ISED RSS-Gen, ISED RSS-247
DSS Intentional Radiator**

Woodstream Corporation Model V440 Lora Radio Bait Box Rodent Trap

**FCC ID: SNA-V440
ISED ID: 9458A-V440**

REPORT BEC-2224-02

TEST DATES: 09/27/2022 – 10/17/2022

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

PREPARED BY: 
JR Fanella, Test Engineer

REVIEWED and APPROVED BY: 
Steve Fanella, Quality Manager

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Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	11/10/2022



1.0 Administrative Information

1.1 Project Details

Project Number	BEC-2224	
Manufacturer	Woodstream Corporation	
Model Number	V440	
EUT Description	VLINK Bait Box Rodent Trap with LoRa Radio	
Serial Numbers	None	
Sample Types	Radiated Emissions Test Samples	Antenna Conducted Test Sample with SMA Adapter
Sample Numbers	2224-01 and 2224-03	2224-02
FCC ID	SNA-V440	
ISED ID	9458A-V440	
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	+ 5.06 dBi	
Antenna Type	Inverted F PCB Trace	
Modulation	LoRa	
FCC Classification	DSS Spread Spectrum Transmitter	
EUT Firmware Version	FW Version 1.2.10 MCU: AVR32DA32	
Date Samples Received	09/23/2022	
Sample Types and Condition Received	Production Units Suitable for Test	
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
BEC Test Personnel	JR Fanella / Tom Koester / Steve 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 Contacts	Dwayne Arrighy/Matt Kauffman
Customer Reference Number	PO # 197937



1.4 Measurement Uncertainty

Measurement	Measurement Distance	Frequency Range	Measurement Limit	Expanded Uncertainty
Radiated Disturbance	3 Meter	30 MHz – 1 GHz	Class B	4.27
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 than 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

Test Measurement	ETSI EN 300 220-1 Limit	BEC Value
Radio Frequency	± 0.5 ppm	± 0.027 ppm
RF Power, Conducted	± 1.5 dB	± 1.45 dB
Conducted Spurious Emission of Transmitter, Valid up to 6 GHz	± 3 dB	± 0.9 dB
Radiated Emission of Transmitter, Valid up to 6 GHz	± 6 dB	± 4.87 dB
Radiated Emission of Receiver, Valid up to 6 GHz	± 6 dB	± 4.87 dB
Occupied Bandwidth	± 5 %	± 2 %
Temperature	± 2.5 °C	± 0.5 °C
Humidity	± 10 %	± 2.5 %

These uncertainties have a coverage factor of $k = 1.96$ or $k = 2$, (which provide confidence levels of respectively 95 % and 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028 [i.3], in particular in annex D of ETSI TR 100 028-2 [i.3].



1.5 Test Result Summary Table

The Woodstream Model V440 LoRa Radio Bait Box Rodent 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	ISED RSS-Gen	ISED RSS-247	Test Description	Result
N/A	15.207(b)	7.2		Conducted Emissions AC Mains 150 kHz to 30 MHz	N/A
4.1	15.203	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	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	3.3	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 Conducted Output Power, Peak and Average, EIRP	PASS
4.9	15.247(a)(1)		5.1 b)	Carrier Frequency Separation	PASS
4.10	15.247(a)(1)(i)		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) and (f)		5.2 b) and 5.3	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

The following were the general environmental conditions inside the laboratory during testing:

Temperature: $22^{\circ}\text{C} \pm 5^{\circ}\text{C}$

Humidity: $50\% \pm 20\%$

Barometric Pressure: $1010 - 1050 \text{ mb} \pm 20\%$

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.



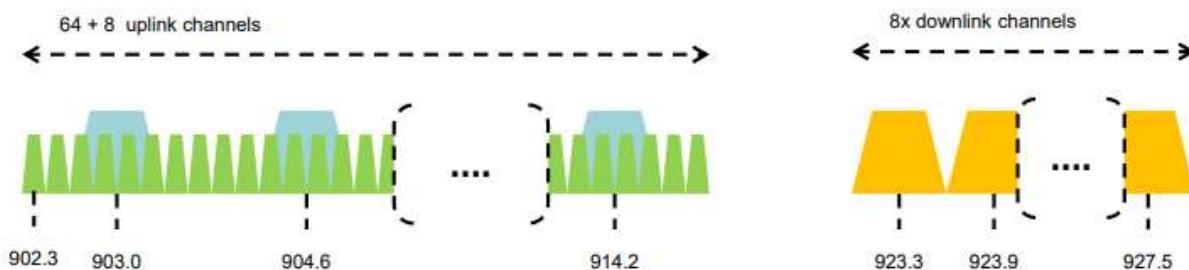
2.0 Equipment Under Test

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

2.1 EUT Description

The Woodstream Model V440 VLINK is a Rodent Trap which incorporates a LoRa Radio to communicate trap status to a smart phone or network application. The device is powered by four (4) 1.5 VDC AA alkaline batteries.

The Model V440 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), ISED RSS-Gen, ISED 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 V440 LoRa Radio Bait Box Rodent Trap Sample # 2224-02 was tested without the enclosure for all antenna conducted measurements. The Woodstream Model V440 LoRa Radio Bait Box Rodent Trap Sample # 2224-01 and Sample # 2224-03 were tested within the trap enclosure during all radiated emissions tests.

2.5 Test Configuration Rationale

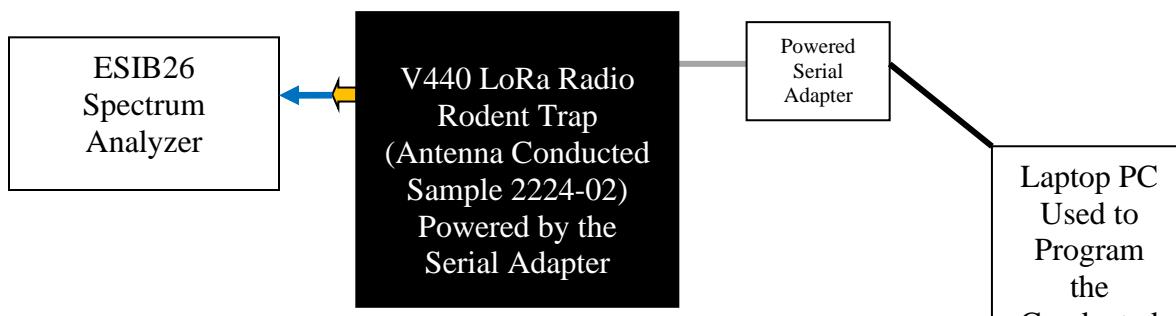
The modified radio of the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap allows direct access to the output of the radio, without a transmission antenna. The unmodified unit is factory produced with modified software for EMI test purposes.



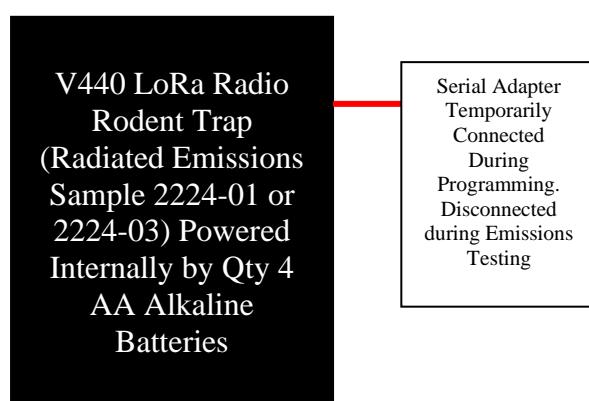
2.6 Test Configuration Diagrams

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 VLINK Rodent Trap (Unmodified Emissions Samples)	Woodstream Corporation	V440	None	2224-01 and 2224-03
Lora Radio VLINK Rodent Trap (Modified with SMA Antenna Conducted Sample)				2224-02

Interconnection Cable List (Conducted Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Flexco Microwave	FC19560 600236A 2B	Antenna Conducted RF Measurement Cable	Double Braid	0.6 Meter	Measurement Cable from the Antenna SMA Connector of the EUT to the input of the Rohde and Schwarz ESIB26 Receiver. BEC Asset # BEC-811

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 EUT was set by customer provided test software to transmit a signal with LoRa modulation at maximum output and using the typical bandwidth and spread factor.

The product is a Frequency Hopping Spread Spectrum System (FHSS) transmitter. The Woodstream Model V440 LoRa Radio Bait Box Rodent 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 8. The maximum output power setting of 20 was used for all tests. The Duty Cycle of the LoRa Modulation signal is greater than 98%.



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 3 Meters. Antenna gain value was calculated to be + 5.06 dBi.

2.10 Grounding

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

2.11 EUT Modifications

The Woodstream Model V440 LoRa Radio Bait Box Rodent Trap Radiated Emissions Test Samples 2224-01 and 2224-03 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 V440 LoRa Radio Bait Box Rodent Trap Antenna Conducted Test Sample 2224-02.

2.12 EUT Pictures Woodstream Model V440 LoRa Radio Bait Box Rodent Trap

See Appendix B Woodstream V440 LoRa Radio Bait Box Rodent 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

15.247 Operation within the bands 902-928 MHz,

2400-2483.5 MHz, and 5725-5850 MHz.

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 V440 LoRa Radio Bait Box Rodent Trap is an Inverted-F PCB Trace Antenna. 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 V440 LoRa Radio Bait Box Rodent 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.

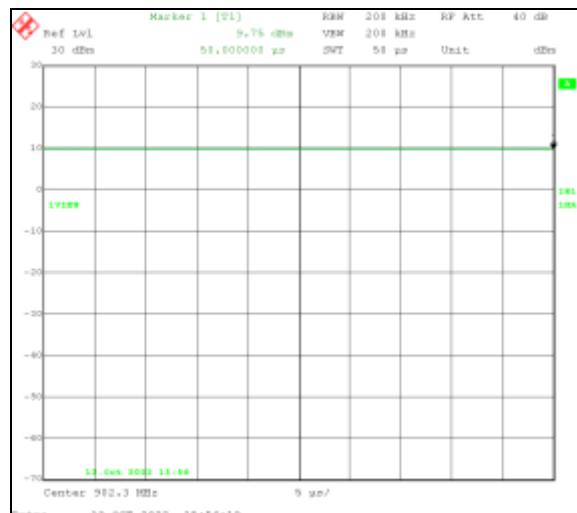
4.3 Duty Cycle of the DSS Fundamental Transmission

The duty cycle of the DSS transmission should be greater than or equal to 98%. 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 (10/13/2022)

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. 5.5)

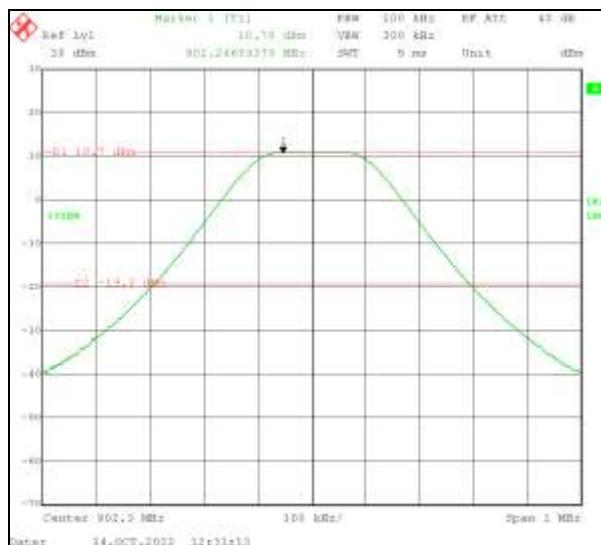
4.4.1 DSS Emissions in Non-restricted Frequency Bands Test Procedure

A measurement of the emissions in non-restricted frequency bands was made at the low Frequency 902.3 MHz (Channel 0), middle Frequency 908.7 MHz (Channel 32) and high Frequency 914.9 MHz (Channel 63). The signal output was maximized with LoRa modulation with 125 kHz bandwidth and Spread Factor of 8. 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 (10/14/2022)

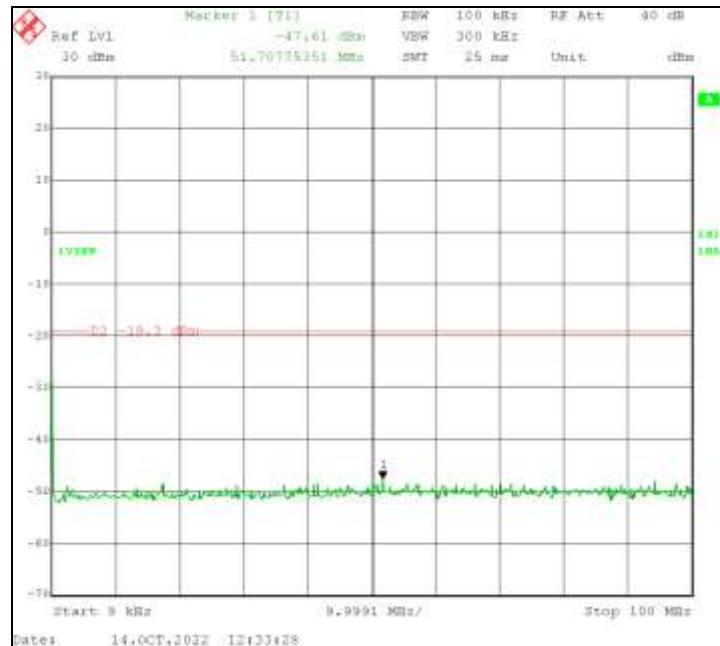


The peak level of 10.7 dBm is the maximum peak output of the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -19.3 dBm and is displayed on the plots below.

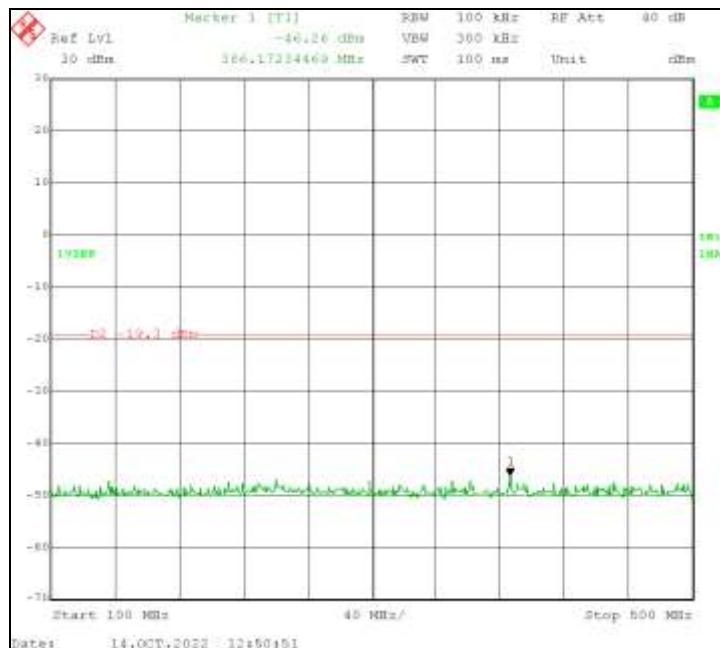


4.4.3 DSS Emissions in Non-restricted Frequency Bands Channel 0 Test Results (10/14/2022)

9 kHz – 100 MHz

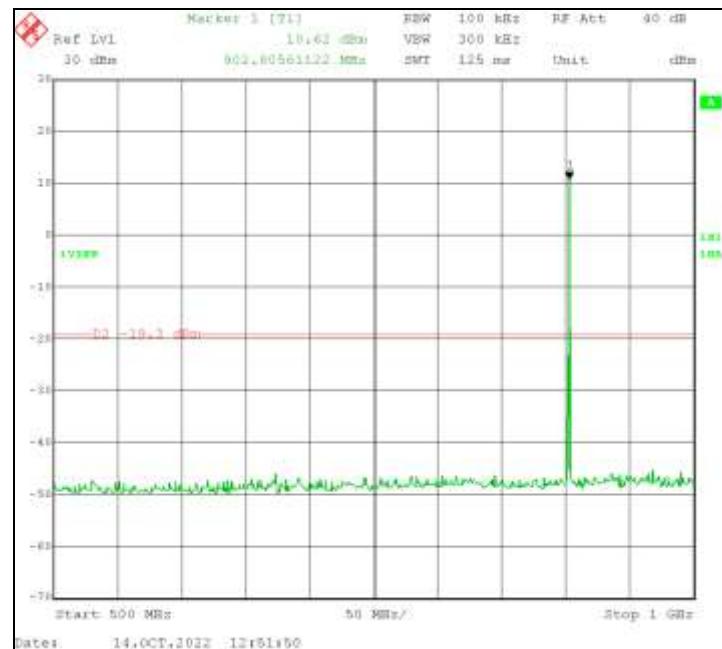


100 MHz – 500 MHz

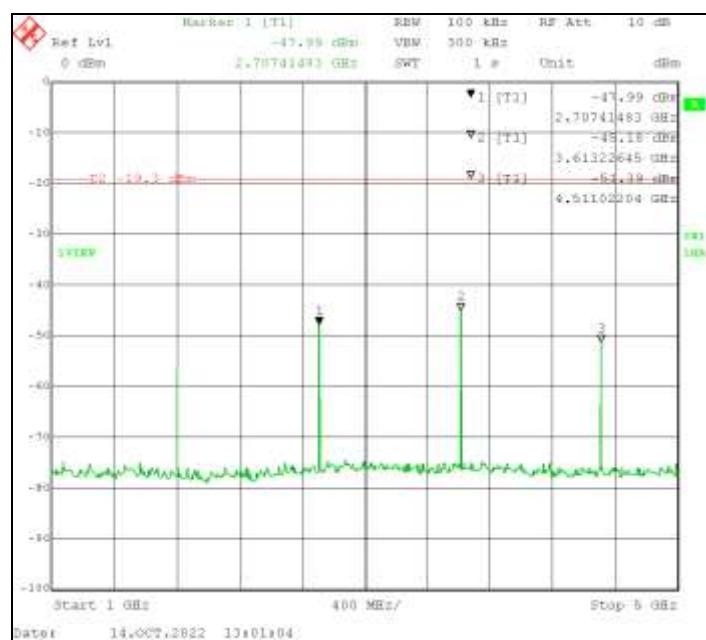




500 MHz – 1000 MHz

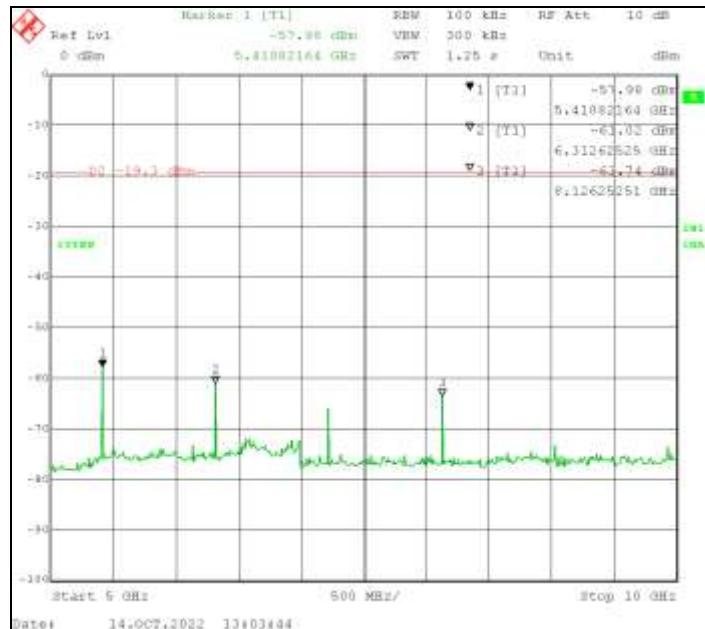


1 GHz – 5 GHz





5 GHz – 10 GHz

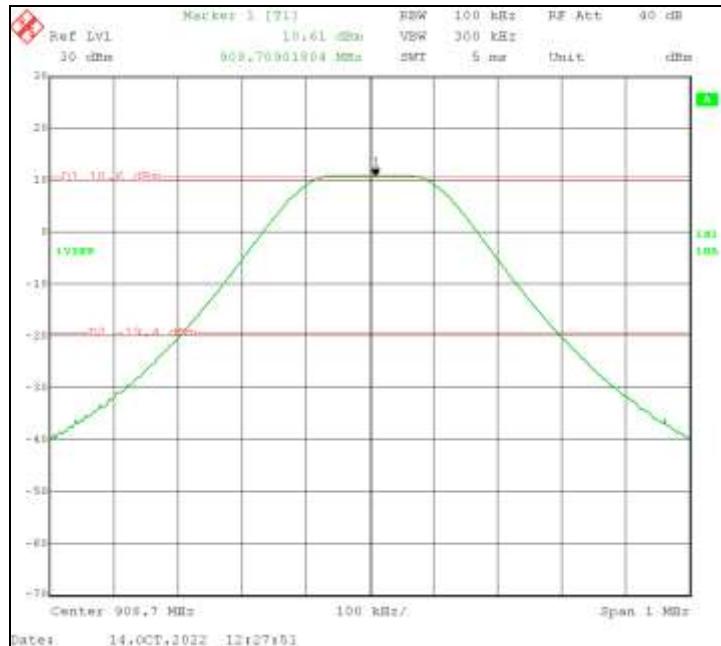


Test Results of Highest Emissions: Channel 0 (Frequency 902.3 MHz)

Channel Frequency	Frequency	Measured Peak Level	30 dBc Limit	Margin	Result
MHz	GHz	dBm	dBm	dB	
902.3	2.707	-47.99	-19.30	-28.69	Pass
902.3	3.613	-45.18	-19.30	-25.88	Pass
902.3	4.511	-51.39	-19.30	-32.09	Pass
902.3	5.411	-57.98	-19.30	-38.68	Pass
902.3	6.313	-61.02	-19.30	-41.72	Pass
902.3	8.126	-63.74	-19.30	-44.44	Pass



4.4.4 DSS Emissions in Non-restricted Frequency Bands Reference Measurement Channel 32 (10/14/2022)

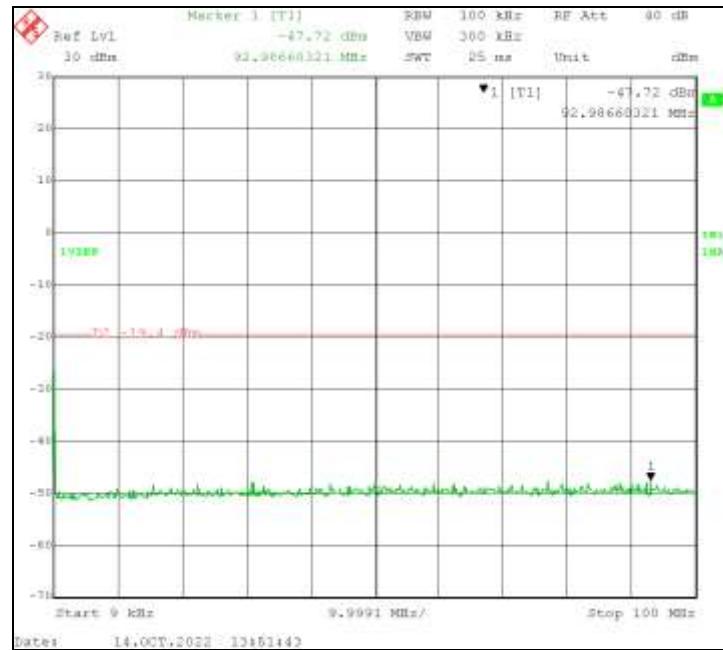


The peak level of 10.6 dBm is the maximum peak output of the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -19.4 dBm and is displayed on the plots below.

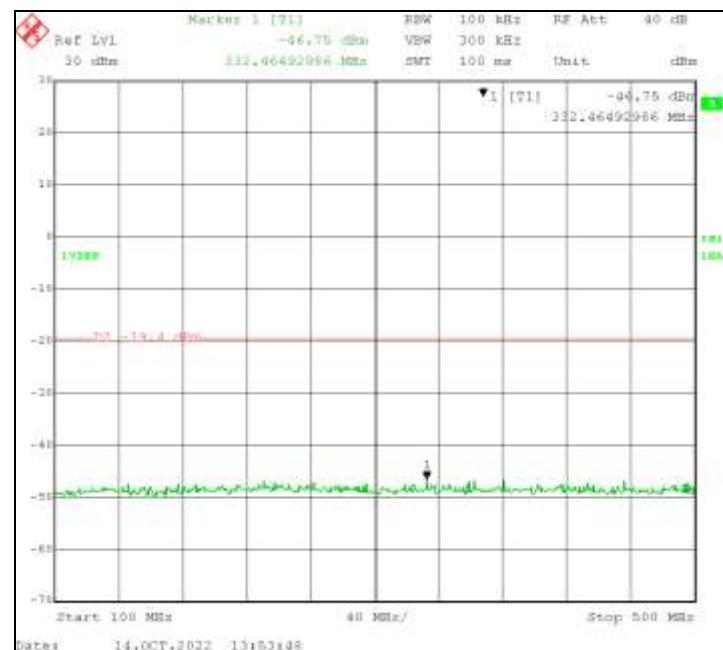


4.4.5 DSS Emissions in Non-restricted Frequency Bands Channel 32 Test Results (10/14/2022)

9 kHz – 100 MHz

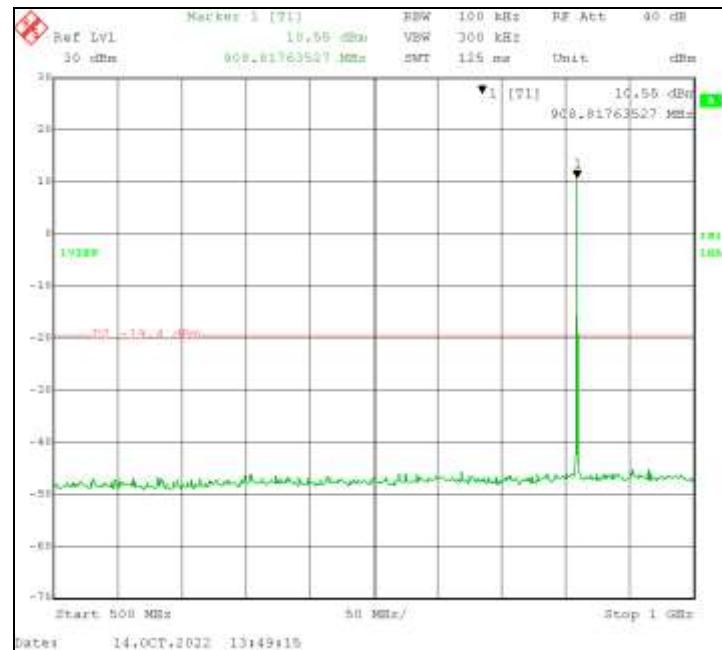


100 MHz – 500 MHz

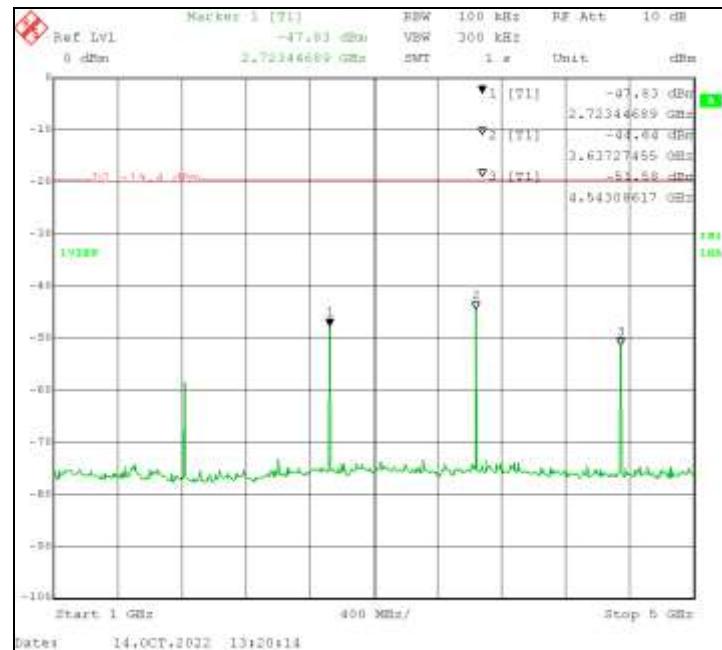




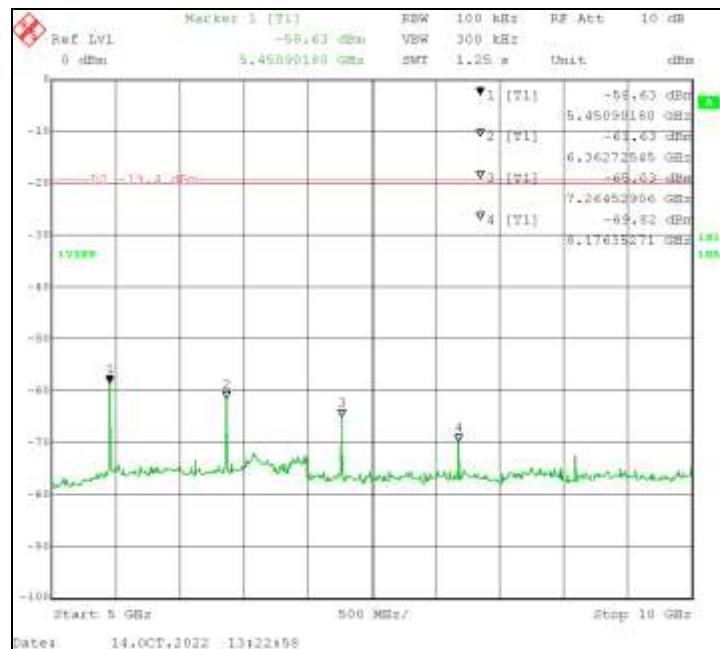
500 MHz – 1000 MHz



1 GHz – 5 GHz



5 GHz – 10 GHz

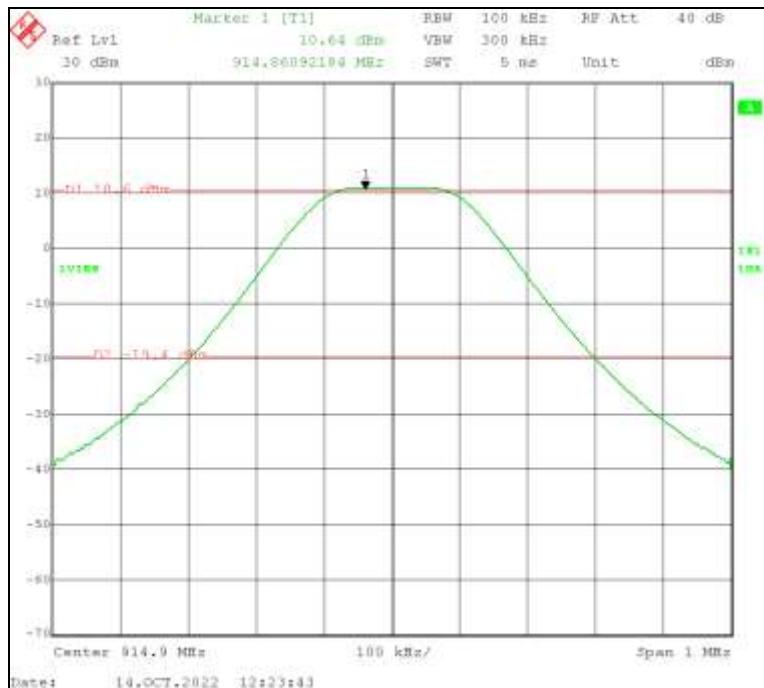


Test Results Table Highest Emissions: Channel 32 (908.7 MHz)

Channel Frequency	Frequency	Measured Peak Level	30 dBc Limit	Margin	Result
MHz	GHz	dBm	dBm	dB	
908.7	2.723	-47.83	-19.40	-28.43	Pass
908.7	3.637	-44.64	-19.40	-25.24	Pass
908.7	4.543	-51.58	-19.40	-32.18	Pass
908.7	5.451	-58.63	-19.40	-39.23	Pass
908.7	6.363	-61.63	-19.40	-42.23	Pass
908.7	7.265	-65.03	-19.40	-45.63	Pass
908.7	8.176	-69.82	-19.40	-50.42	Pass



4.4.6 DSS Emissions in Non-restricted Frequency Bands Reference Measurement Channel 63 (10/14/2022)

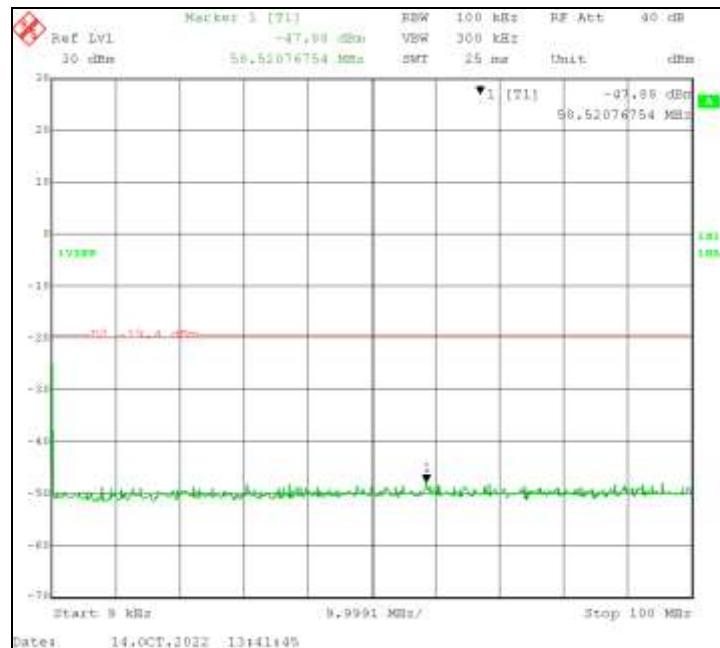


The peak level of 10.6 dBm is the maximum peak output of the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -19.4 dBm and is displayed on the plots below.

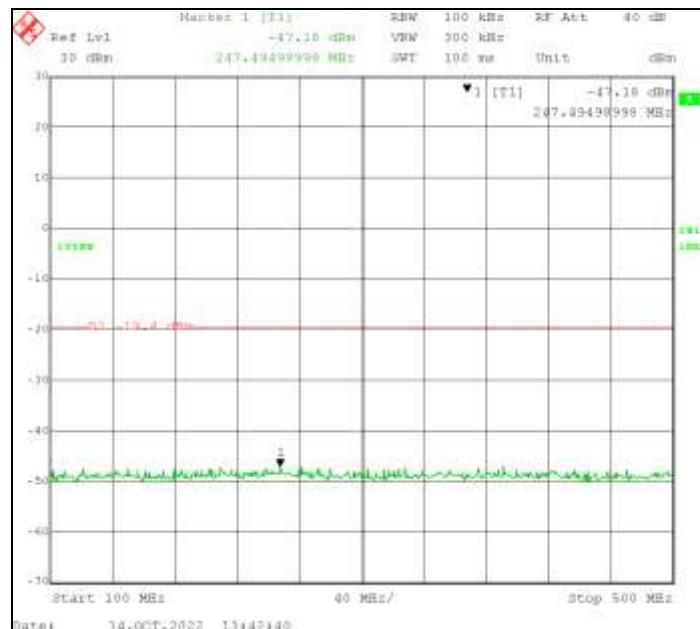


4.4.7 DSS Emissions in Non-restricted Frequency Bands Channel 63 Test Results (10/14/2022)

9 kHz – 100 MHz

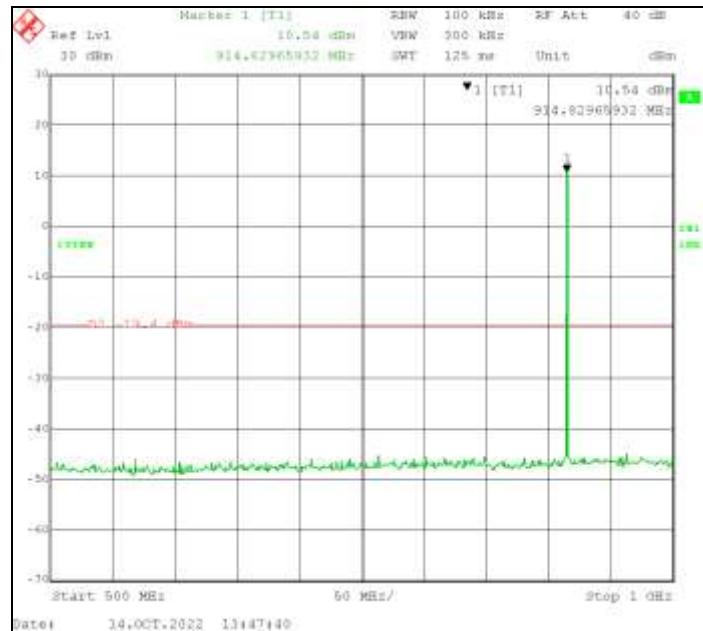


100 MHz – 500 MHz

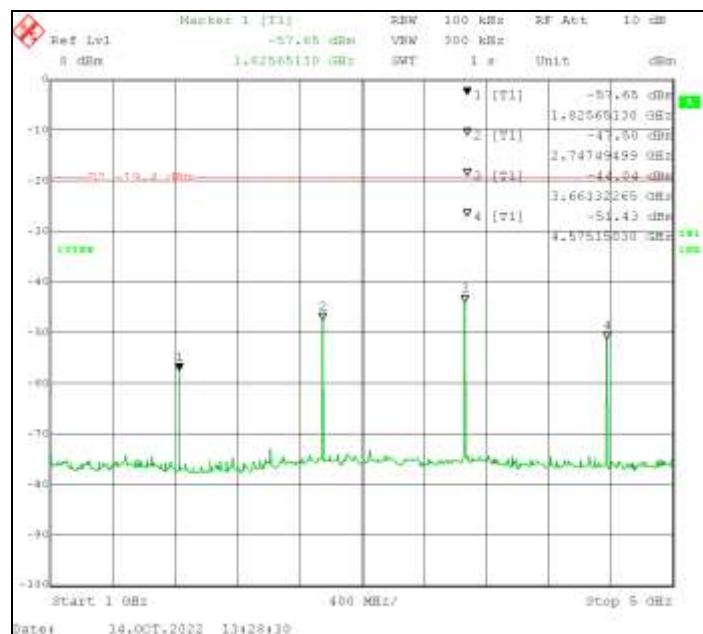




500 MHz – 1000 MHz

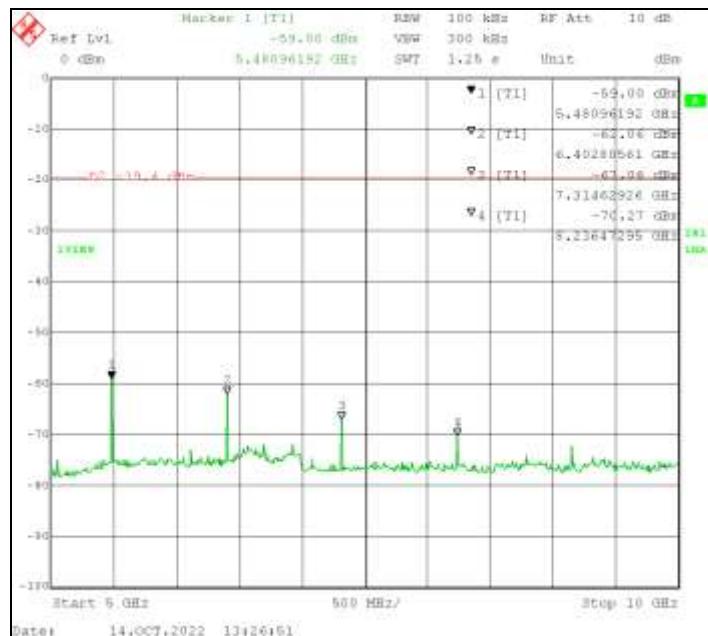


1 GHz – 5 GHz





5 GHz – 10 GHz



Test Results Table Highest Emissions: Channel 63 (914.9 MHz)

Channel Frequency	Frequency	Measured Peak Level	30 dBc Limit	Margin	Result
MHz	GHz	dBm	dBm	dB	
914.9	1.826	-57.65	-19.40	-38.25	Pass
914.9	2.747	-47.50	-19.40	-28.10	Pass
914.9	3.661	-44.04	-19.40	-24.64	Pass
914.9	4.575	-51.43	-19.40	-32.03	Pass
914.9	5.481	-59.00	-19.40	-39.60	Pass
914.9	6.403	-62.06	-19.40	-42.66	Pass
914.9	7.315	-67.06	-19.40	-47.66	Pass
914.9	8.236	-70.27	-19.40	-50.87	Pass

Test Results: The Antenna Conducted Spurious Emissions of the Woodstream Model V440 LoRa Radio Bait Box Rodent 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 V440 LoRa Radio Bait Box Rodent 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 V440 LoRa Radio Bait Box Rodent Trap was tested at three frequencies: low (Channel 0, 902.3 MHz), middle (Channel 32, 908.7 MHz) and high (Channel 63, 914.9 MHz). The transmitter was operated at maximum output power (20), 125 kHz bandwidth and Spread Factor of 8.

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:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{Meter Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)}$$

Measurements were made with the Woodstream Model V440 LoRa Radio Bait Box Rodent 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 = 8. 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 to 15.209 limits.



4.5.3 DSS Emissions in Non-restricted and Restricted Bands of Operation, 30 MHz – 1000 MHz Test Results (10/03/2022)

Low Channel 0 (902.3 MHz)

Frequency	Peak Corrected	Quasi-Peak Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	Peak Limit	Peak Margin	QP Limit	QP Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*133.865	18.10	14.62	H	067	187	-6.77	63.52	-45.42	43.52	-28.90	Pass
*113.248	15.47	15.02	V	167	110	-7.12	63.52	-48.05	43.52	-28.50	Pass
*125.867	18.64	16.99	V	319	171	-6.46	63.52	-44.88	43.52	-26.53	Pass
200.002	19.78	16.22	H	265	240	-6.89	63.52	-43.74	43.52	-27.30	Pass
*240.002	20.49	18.68	V	009	240	-7.40	66.02	-45.53	46.02	-27.34	Pass
377.573	25.30	22.85	V	033	130	-4.08	66.02	-40.72	46.02	-23.17	Pass
377.670	23.22	23.18	H	095	135	-4.07	66.02	-42.80	46.02	-22.84	Pass
487.000	21.22	20.46	H	241	208	-1.90	66.02	-44.80	46.02	-25.56	Pass
578.875	25.85	24.47	V	075	151	-0.72	66.02	-40.17	46.02	-21.55	Pass
579.008	23.86	24.02	H	338	234	-0.74	66.02	-42.16	46.02	-22.00	Pass
623.061	24.43	21.20	V	147	182	-0.32	66.02	-41.59	46.02	-24.82	Pass
636.152	21.75	21.58	V	356	151	0.25	66.02	-44.27	46.02	-24.44	Pass
639.468	25.71	22.21	H	010	143	0.37	66.02	-40.31	46.02	-23.81	Pass
735.548	27.32	31.80	H	258	234	1.61	66.02	-38.70	46.02	-14.22	Pass
735.672	30.74	32.03	V	055	099	1.61	66.02	-35.28	46.02	-13.99	Pass
739.590	26.93	26.62	H	237	128	1.62	66.02	-39.09	46.02	-19.40	Pass
763.064	23.85	22.96	V	084	256	1.91	66.02	-42.17	46.02	-23.06	Pass
923.205	26.26	24.16	V	033	130	4.38	66.02	-39.76	46.02	-21.86	Pass

*Restricted Band Signal

Middle Channel 32 (908.7 MHz)

Frequency	Peak Corrected	Quasi-Peak Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	Peak Limit	Peak Margin	QP Limit	QP Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*134.291	18.21	16.15	H	019	100	-6.78	63.52	-45.31	43.52	-27.37	Pass
*113.25	18.45	14.91	V	053	124	-7.12	63.52	-45.07	43.52	-28.61	Pass
199.972	18.62	17.32	H	294	245	-6.89	63.52	-44.90	43.52	-26.20	Pass
201.432	20.50	18.23	V	112	129	-7.11	63.52	-43.02	43.52	-25.29	Pass
*240.01	21.35	17.79	V	086	207	-7.40	66.02	-44.67	46.02	-28.23	Pass
377.603	24.18	21.90	H	174	212	-4.08	66.02	-41.84	46.02	-24.12	Pass
377.693	23.72	20.99	V	078	193	-4.07	66.02	-42.30	46.02	-25.03	Pass
485.792	20.70	20.47	H	168	204	-1.90	66.02	-45.32	46.02	-25.55	Pass
579.185	24.54	24.01	H	340	182	-0.72	66.02	-41.48	46.02	-22.01	Pass
635.217	22.66	24.05	V	215	192	0.24	66.02	-43.36	46.02	-21.97	Pass
636.491	23.96	25.02	H	026	165	0.25	66.02	-42.06	46.02	-21.00	Pass
699.935	24.20	23.75	H	055	249	1.13	66.02	-41.82	46.02	-22.27	Pass
701.418	22.70	22.10	V	233	128	1.18	66.02	-43.32	46.02	-23.92	Pass
735.454	28.26	31.21	V	192	176	1.61	66.02	-37.76	46.02	-14.81	Pass
735.890	27.74	30.83	H	059	104	1.61	66.02	-38.28	46.02	-15.19	Pass
741.029	35.17	31.35	V	002	107	1.73	66.02	-30.85	46.02	-14.67	Pass
746.868	29.86	27.07	H	070	175	1.75	66.02	-36.16	46.02	-18.95	Pass
767.404	27.57	23.28	V	160	155	2.03	66.02	-38.45	46.02	-22.74	Pass
875.543	27.47	26.87	V	259	108	3.63	66.02	-38.55	46.02	-19.15	Pass

*Restricted Band Signal



High Channel 63 (914.9 MHz)

Frequency	Peak Corrected	Quasi-Peak Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	Peak Limit	Peak Margin	QP Limit	QP Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*133.825	15.95	17.15	H	227	115	-6.77	63.52	-47.57	43.52	-26.37	Pass
*134.211	14.88	15.62	V	050	141	-6.78	63.52	-48.64	43.52	-27.90	Pass
199.985	20.56	17.86	H	223	254	-6.89	63.52	-42.96	43.52	-25.66	Pass
207.006	14.01	13.24	V	339	144	-8.72	63.52	-49.51	43.52	-30.28	Pass
*274.874	14.57	14.05	H	337	172	-5.43	66.02	-51.45	46.02	-31.97	Pass
336.760	15.99	14.90	V	219	233	-4.71	66.02	-50.03	46.02	-31.12	Pass
377.588	22.71	23.30	V	204	224	-4.08	66.02	-43.31	46.02	-22.72	Pass
377.601	23.50	21.06	H	284	119	-4.08	66.02	-42.52	46.02	-24.96	Pass
578.973	24.02	23.60	H	117	208	-0.73	66.02	-42.00	46.02	-22.42	Pass
579.065	24.83	24.09	V	034	119	-0.73	66.02	-41.19	46.02	-21.93	Pass
624.171	21.65	21.96	V	166	160	-0.21	66.02	-44.37	46.02	-24.06	Pass
636.475	23.95	21.71	V	038	101	0.25	66.02	-42.07	46.02	-24.31	Pass
637.007	22.12	22.56	H	064	193	0.25	66.02	-43.90	46.02	-23.46	Pass
735.639	32.52	33.12	V	326	228	1.61	66.02	-33.50	46.02	-12.90	Pass
737.170	32.24	33.40	H	000	255	1.61	66.02	-33.78	46.02	-12.62	Pass
742.669	29.41	30.22	V	031	155	1.74	66.02	-36.61	46.02	-15.80	Pass
750.275	24.81	26.03	H	168	173	1.74	66.02	-41.21	46.02	-19.99	Pass
762.657	25.79	23.03	H	296	147	1.91	66.02	-40.23	46.02	-22.99	Pass
869.920	28.83	25.56	V	100	110	3.50	66.02	-37.19	46.02	-20.46	Pass

*Restricted Band Signal

Receive Mode

Frequency	Peak Corrected	Quasi-Peak Corrected	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	Peak Limit	Peak Margin	QP Limit	QP Margin	Result
MHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*134.373	18.76	15.75	H	095	101	-6.78	63.52	-44.76	43.52	-27.77	Pass
*133.785	14.33	16.32	V	261	103	-6.76	63.52	-49.19	43.52	-27.20	Pass
199.997	21.16	17.91	H	064	104	-6.89	63.52	-42.36	43.52	-25.61	Pass
201.367	18.37	18.84	V	101	118	-7.09	63.52	-45.15	43.52	-24.68	Pass
*240.005	20.38	19.45	V	150	245	-7.40	66.02	-45.64	46.02	-26.57	Pass
*240.007	19.83	18.46	H	059	235	-7.40	66.02	-46.19	46.02	-27.56	Pass
377.531	22.90	23.20	H	087	100	-4.09	66.02	-43.12	46.02	-22.82	Pass
377.708	22.75	23.39	V	193	254	-4.07	66.02	-43.27	46.02	-22.63	Pass
578.903	22.40	21.89	V	279	103	-0.73	66.02	-43.62	46.02	-24.13	Pass
579.170	24.72	24.64	H	280	146	-0.72	66.02	-41.30	46.02	-21.38	Pass
634.845	23.54	23.98	H	340	192	0.22	66.02	-42.48	46.02	-22.04	Pass
637.581	22.79	22.34	V	348	135	0.26	66.02	-43.23	46.02	-23.68	Pass
734.942	34.83	32.34	V	096	136	1.60	66.02	-31.19	46.02	-13.68	Pass
735.123	34.82	32.03	H	322	202	1.61	66.02	-31.20	46.02	-13.99	Pass
743.019	32.22	31.73	H	273	145	1.74	66.02	-33.80	46.02	-14.29	Pass
743.467	34.61	32.93	V	357	113	1.74	66.02	-31.41	46.02	-13.09	Pass
747.017	25.95	27.57	V	000	239	1.75	66.02	-40.07	46.02	-18.45	Pass
747.140	25.09	24.46	H	282	255	1.75	66.02	-40.93	46.02	-21.56	Pass

*Restricted Band Signal

Test Results: The Woodstream Model V440 LoRa Radio Bait Box Rodent 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 12.62 dB.



4.5.4 DSS Emissions in Non-restricted and Restricted Bands of Operation, 1 – 10 GHz Test Results (10/7/2022 - 10/10/2022)

Low Channel 0 (902.3 MHz)

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC Part 15.35(b) Peak Limit	Peak Margin	FCC Part 15.209 Average Limit	Average Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.92174	31.93	22.91	H	284	117	-7.36	73.98	-42.05	53.98	-31.07	Pass
*2.70693	37.59	32.85	V	190	101	-4.54	73.98	-36.39	53.98	-21.13	Pass
*3.60103	36.12	26.15	H	319	132	-1.27	73.98	-37.86	53.98	-27.83	Pass
*3.60924	43.11	35.09	V	059	170	-1.22	73.98	-30.87	53.98	-18.89	Pass
*4.51141	45.54	41.36	V	014	181	0.66	73.98	-28.44	53.98	-12.62	Pass
*4.51143	46.29	44.47	H	315	199	0.66	73.98	-27.69	53.98	-9.51	Pass
*5.41352	50.68	47.07	H	069	181	3.30	73.98	-23.30	53.98	-6.91	Pass
*5.41373	43.42	38.37	V	080	198	3.30	73.98	-30.56	53.98	-15.61	Pass
6.31585	49.12	44.39	V	009	189	3.10	73.98	-24.86	53.98	-9.59	Pass
6.31605	50.87	45.75	H	049	181	3.10	73.98	-23.11	53.98	-8.23	Pass
7.21799	49.15	44.01	V	005	211	4.17	73.98	-24.83	53.98	-9.97	Pass
7.21870	57.17	50.67	H	325	164	4.17	73.98	-16.81	53.98	-3.31	Pass
*8.12074	58.16	52.86	H	312	152	5.46	73.98	-15.82	53.98	-1.12	Pass
*8.12089	51.37	42.17	V	061	132	5.46	73.98	-22.61	53.98	-11.81	Pass
*9.02289	52.57	46.21	H	309	159	6.84	73.98	-21.41	53.98	-7.77	Pass

*Restricted Band Signal

Middle Channel 32 (908.7 MHz)

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC Part 15.35(b) Peak Limit	Peak Margin	FCC Part 15.209 Average Limit	Average Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
1.81750	36.09	24.21	H	023	102	-7.86	73.98	-37.89	53.98	-29.77	Pass
1.83366	30.31	21.83	V	024	126	-7.79	73.98	-43.67	53.98	-32.15	Pass
*2.73406	34.79	24.23	H	051	110	-4.50	73.98	-39.19	53.98	-29.75	Pass
*2.74048	34.30	24.02	V	318	102	-4.48	73.98	-39.68	53.98	-29.96	Pass
*3.6348	42.90	38.41	V	049	161	-1.07	73.98	-31.08	53.98	-15.57	Pass
*3.64614	35.91	26.27	H	333	106	-1.00	73.98	-38.07	53.98	-27.71	Pass
*4.54331	45.85	41.53	V	042	163	0.69	73.98	-28.13	53.98	-12.45	Pass
*4.54358	48.92	45.63	H	331	214	0.70	73.98	-25.06	53.98	-8.35	Pass
*5.45228	41.13	31.87	V	326	210	3.28	73.98	-32.85	53.98	-22.11	Pass
*5.45255	46.22	36.52	H	004	206	3.28	73.98	-27.76	53.98	-17.46	Pass
6.36093	46.01	40.32	H	043	187	2.99	73.98	-27.97	53.98	-13.66	Pass
6.36123	42.78	37.50	V	346	209	2.99	73.98	-31.20	53.98	-16.48	Pass
*7.26959	46.02	38.12	V	029	209	4.43	73.98	-27.96	53.98	-15.86	Pass
*7.26982	54.83	48.43	H	316	194	4.43	73.98	-19.15	53.98	-5.55	Pass
*8.17895	50.77	45.96	H	346	135	5.52	73.98	-23.21	53.98	-8.02	Pass
*9.08707	49.15	39.68	H	337	104	6.89	73.98	-24.83	53.98	-14.30	Pass

*Restricted Band Signal



High Channel 63 (914.9 MHz)

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC Part 15.35(b) Peak Limit	Peak Margin	FCC Part 15.209 Average Limit	Average Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*2.74587	33.46	23.87	H	124	109	-4.47	73.98	-40.52	53.98	-30.11	Pass
1.82959	34.78	30.51	V	020	113	-7.81	73.98	-39.20	53.98	-23.47	Pass
*2.74462	39.01	34.05	V	115	103	-4.47	73.98	-34.97	53.98	-19.93	Pass
*3.65935	41.20	39.23	V	017	200	-0.89	73.98	-32.78	53.98	-14.75	Pass
*4.56598	35.89	26.52	H	090	173	0.77	73.98	-38.09	53.98	-27.46	Pass
*4.57448	43.70	40.21	V	041	185	0.81	73.98	-30.28	53.98	-13.77	Pass
*5.4895	48.27	43.87	H	023	160	3.28	73.98	-25.71	53.98	-10.11	Pass
*5.48966	42.89	36.81	V	354	208	3.28	73.98	-31.09	53.98	-17.17	Pass
6.40419	44.61	39.79	V	353	198	2.89	73.98	-29.37	53.98	-14.19	Pass
6.40428	47.01	42.70	H	038	205	2.89	73.98	-26.97	53.98	-11.28	Pass
*7.31902	55.55	50.25	H	324	183	4.65	73.98	-18.43	53.98	-3.73	Pass
*7.31913	48.92	41.41	V	339	213	4.65	73.98	-25.06	53.98	-12.57	Pass
*8.23413	52.46	48.49	H	329	155	5.62	73.98	-21.52	53.98	-5.49	Pass
*8.28544	46.06	36.39	V	153	154	5.71	73.98	-27.92	53.98	-17.59	Pass

*Restricted Band Signal

Receive Mode

Frequency	Peak Level	Average Level	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factor	FCC Part 15.35(b) Peak Limit	Peak Margin	FCC Part 15.209 Average Limit	Average Margin	Result
GHz	dBuV/m	dBuV/m	H or V	degrees	cm	dB	dBuV/m	dB	dBuV/m	dB	
*1.2301	30.75	20.38	H	286	117	-12.17	73.98	-43.23	53.98	-33.60	Pass
*1.22816	29.44	20.27	V	255	101	-12.17	73.98	-44.54	53.98	-33.71	Pass
1.91888	31.22	22.10	H	258	101	-7.37	73.98	-42.76	53.98	-31.88	Pass
*3.65267	34.86	26.20	V	115	154	-0.95	73.98	-39.12	53.98	-27.78	Pass
7.95123	44.36	35.39	V	283	201	5.17	73.98	-29.62	53.98	-18.59	Pass
*8.26196	45.74	36.05	H	263	166	5.66	73.98	-28.24	53.98	-17.93	Pass

*Restricted Band Signal

Test Results: The Woodstream Model V440 LoRa Radio Bait Box Rodent 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 1.12 dB.



4.6 DSS 20 dB Occupied Bandwidth (FCC Section 15.247(a)(1) RSS-247 5.1(c))

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, Frequency 902.3 MHz), middle (Channel 32, Frequency 908.7 MHz) and high (Channel 63, Frequency 914.9 MHz) were measured with LoRa modulation with a bandwidth of 125 kHz and spread factor of 8. ANSI C63.10 Section 6.9.2 Occupied bandwidth-relative measurement procedure was used.

Spectrum Analyzer Settings:

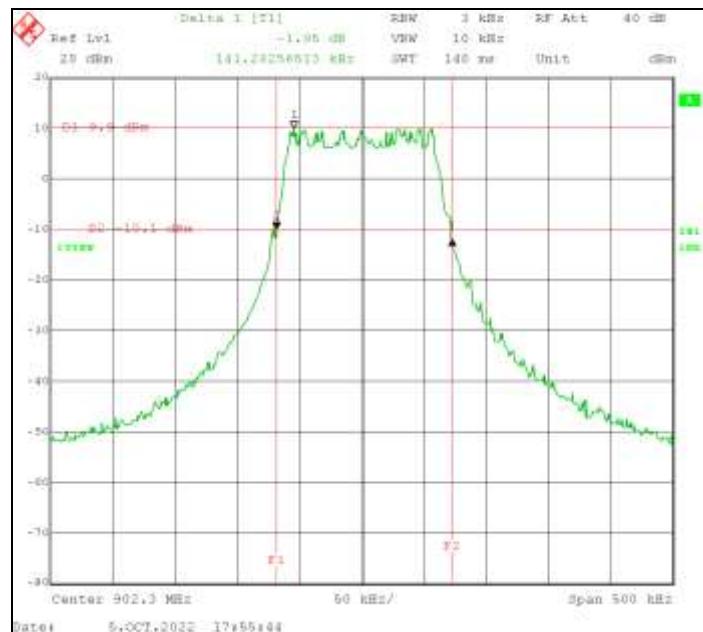
Span	500 kHz
RBW	3 kHz
VBW	10 kHz
Sweep Time	140 ms (Auto)

4.6.2 DSS (20 dB) Occupied Bandwidth Test Results (10/05/2022)

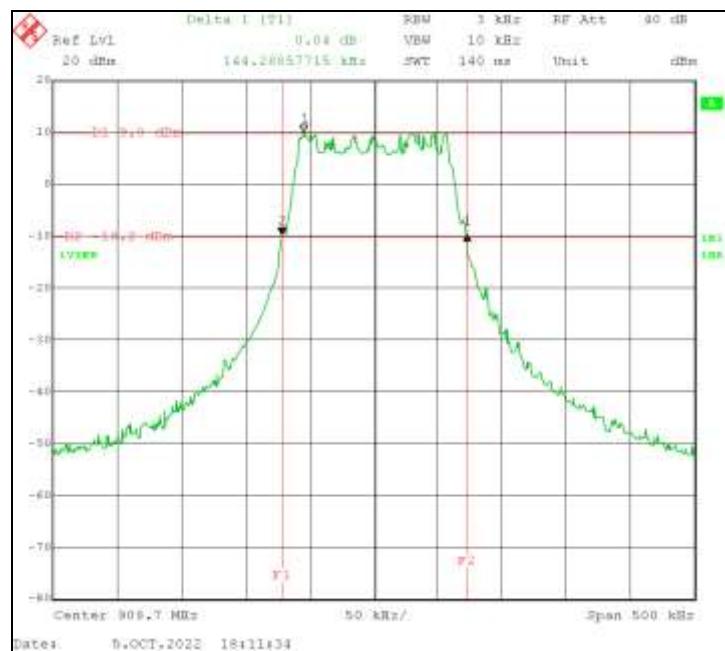
Channel	Spread Factor	Frequency	Measured 20 dB Bandwidth	RSS-247 5.1.3, FCC 15.247 (1)(a)(i) 20 dB BW Limit	Margin	Result
#		MHz	kHz	kHz	kHz	
0	8	902.3	141.28	500	-358.72	Pass
32		908.7	144.29		-355.71	Pass
63		914.9	143.29		-356.71	Pass



Channel 0: 902.30 MHz

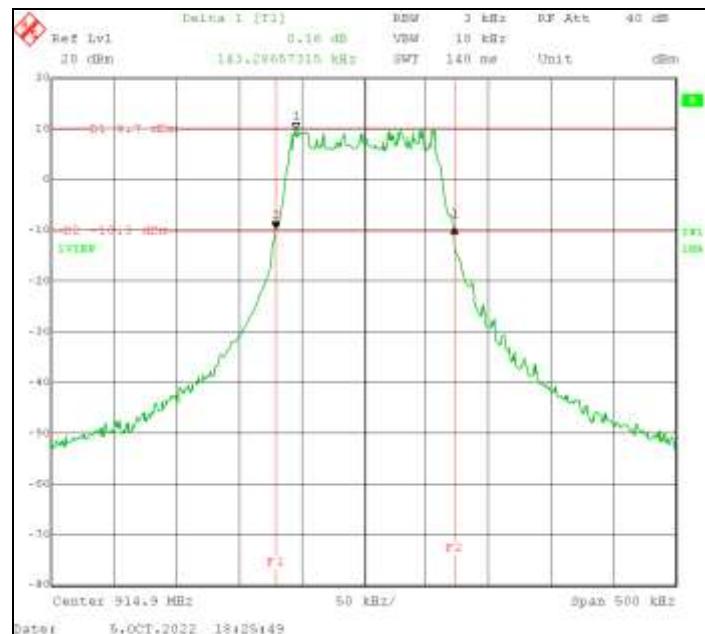


Channel 32: 908.70 MHz





Channel 63: 914.90 MHz



Test Results: The DSS, 20 dB, Occupied Bandwidth measurements for the Woodstream Model V440 LoRa Radio Bait Box Rodent 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 factor of 8. The test procedure of ANSI C63.10, Section 6.9.3 was used.

Spectrum Analyzer Settings:

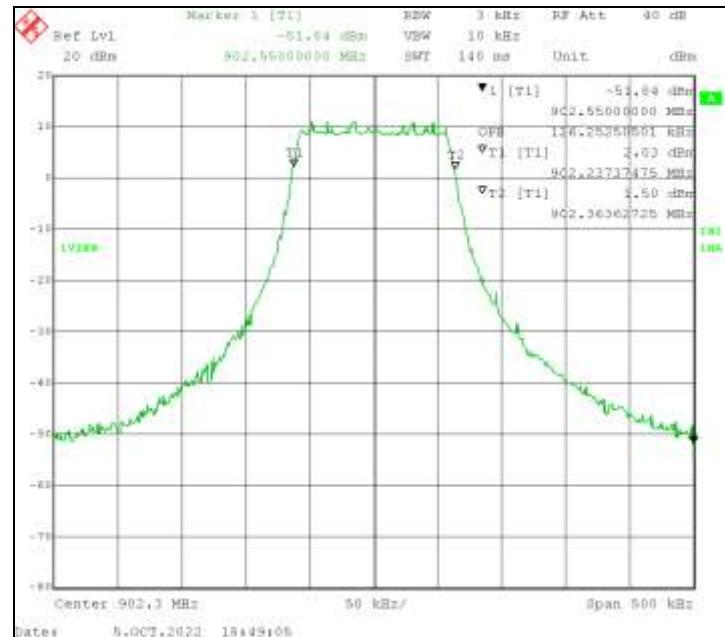
Span	500 kHz
RBW	3 kHz
VBW	10 kHz
Sweep Time	140 ms (Auto)

4.7.2 DSS 99% Occupied Bandwidth Test Results (10/05/2022)

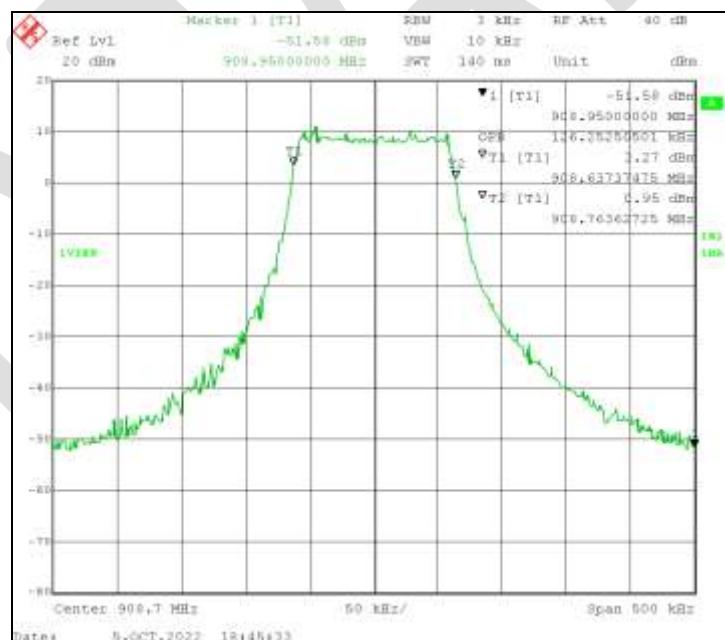
Channel	Modulation	Frequency (MHz)	99% OBW (kHz)
0	LoRa	902.3	126.25
32		908.7	126.25
63		914.9	125.25



Channel 0: 902.30 MHz

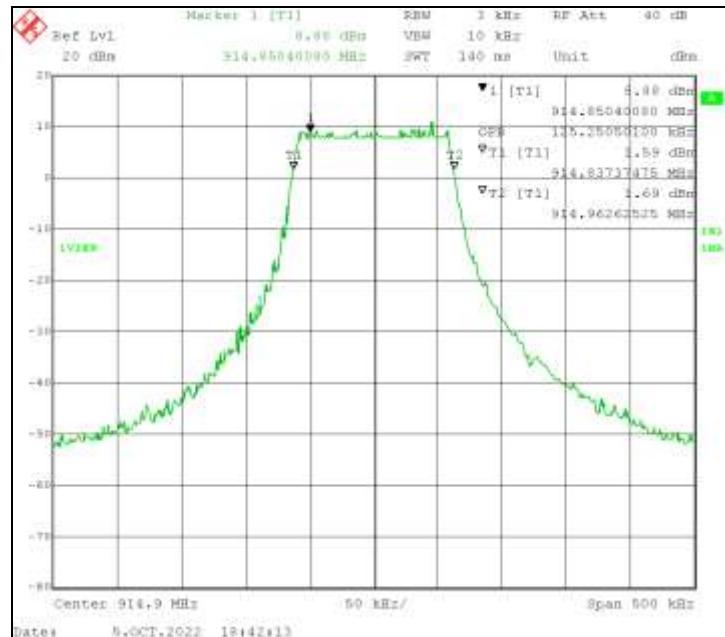


Channel 32: 908.70 MHz





Channel 63: 914.90 MHz



Test Results: The DSS 99% Occupied Bandwidth measurements for the Woodstream Model V440 LoRa Radio Bait Box Rodent 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, Frequency 902.3 MHz), middle (Channel 32, Frequency 908.7 MHz) and high (Channel 63, Frequency 914.9 MHz) were measured without modulation and with LoRa modulation, bandwidth of 125 kHz and spread factor of 8. Measurements were made with a peak detector.

Spectrum Analyzer Settings using Peak Detection:

Span	1 MHz
RBW	200 kHz
VBW	500 kHz
Sweep Time	5 ms

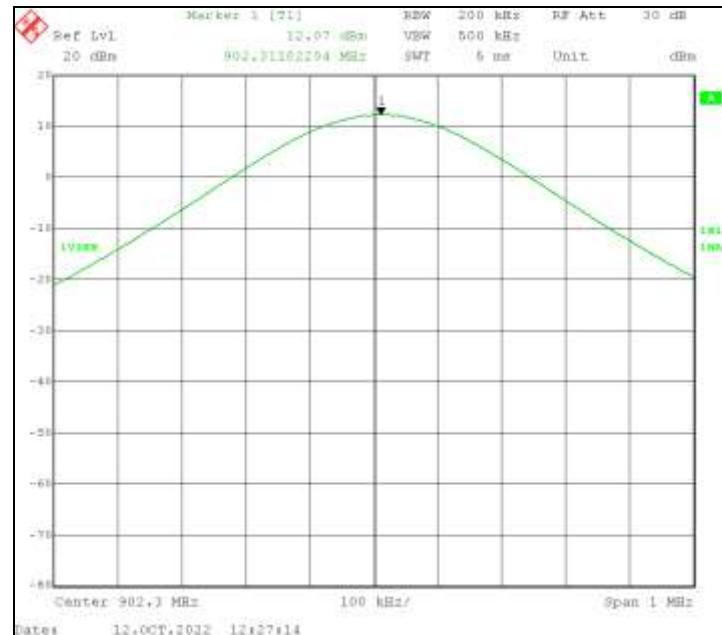
4.8.1.1 Maximum Peak Conducted Output Power Test Results (10/11/2022 and 10/12/2022)

Channel	EUT Settings	Frequency (MHz)	Measured Level (dBm)	Cable # 811 Loss (dB)	Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
0	Unmodulated Tx Signal-20 Output Power	902.3	12.07	0.20	12.27	0.017	30.00	1.000	-17.73	-0.983	Pass
32		908.7	11.90	0.23	12.13	0.016	30.00	1.000	-17.87	-0.984	Pass
63		914.9	11.92	0.20	12.12	0.016	30.00	1.000	-17.88	-0.984	Pass
0	Power=20, BW=125 kHz, SF=8, LoRa Modulation	902.3	11.12	0.20	11.32	0.014	30.00	1.000	-18.68	-0.986	Pass
32		908.7	11.02	0.23	11.25	0.013	30.00	1.000	-18.75	-0.987	Pass
63		914.9	11.13	0.20	11.33	0.014	30.00	1.000	-18.67	-0.986	Pass

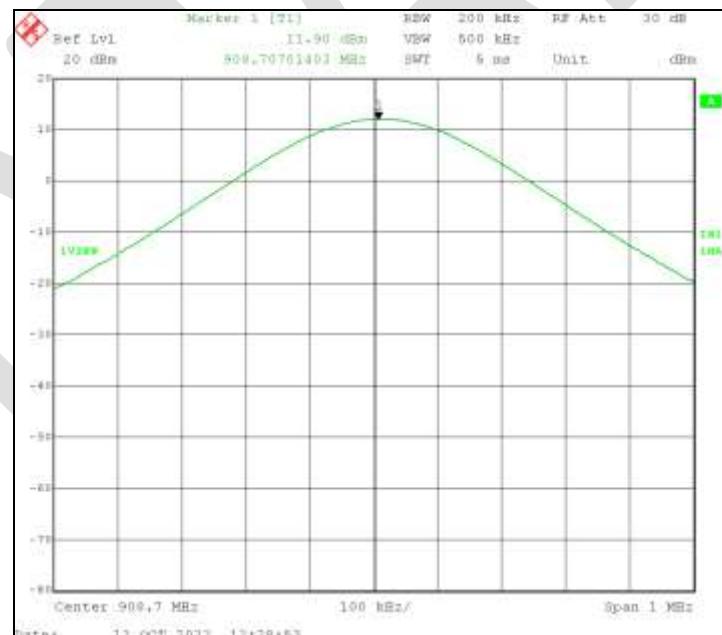
The following pages display the spectrum analyzer screens of the peak output power measurements.



Channel 0: 902.30 MHz No Modulation

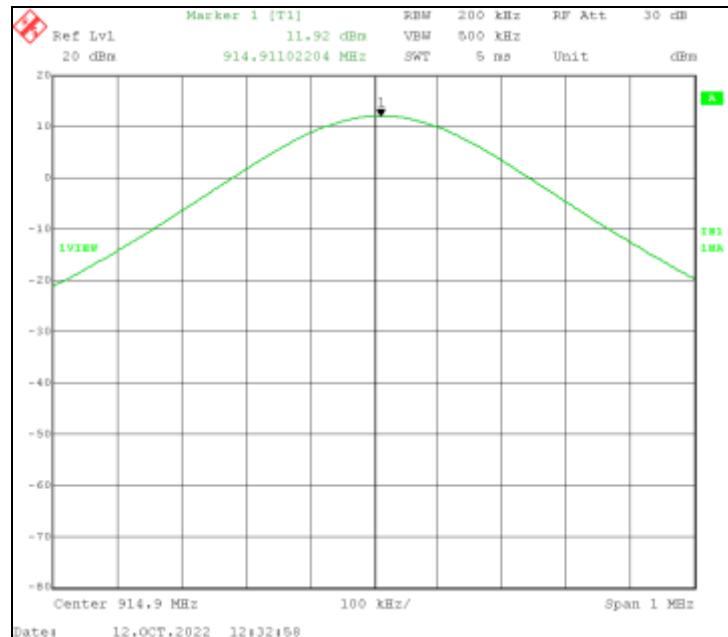


Channel 32: 908.70 MHz No Modulation





Channel 63: 914.9 MHz No Modulation

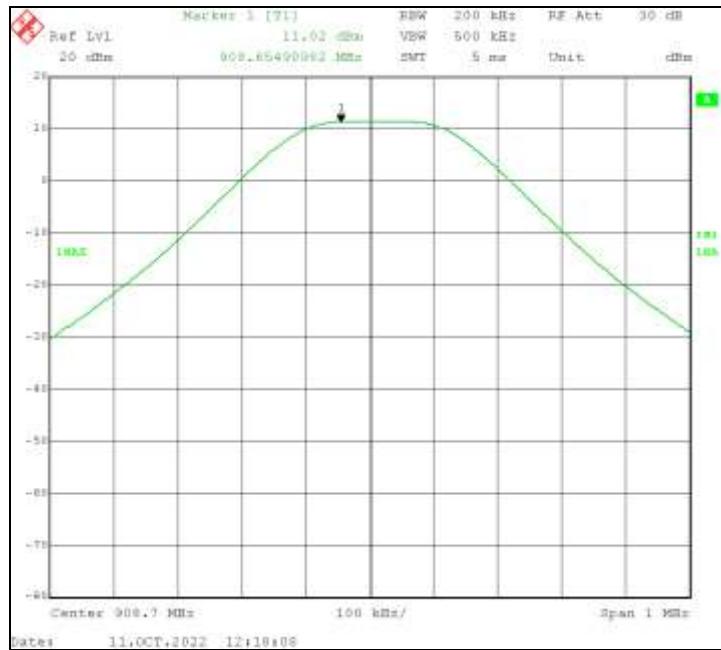


Channel 0: 902.30 MHz LoRa Modulation

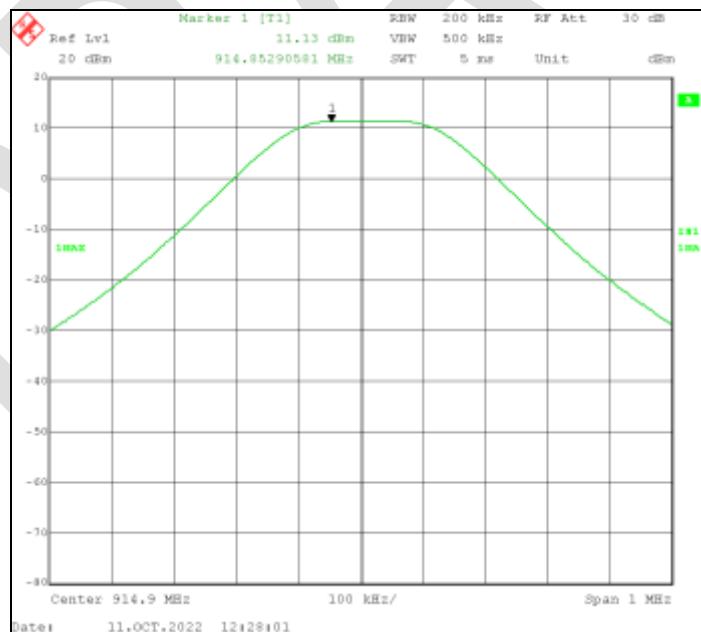




Channel 32: 908.70 MHz LoRa Modulation



Channel 63: 914.9 MHz LoRa Modulation



Test Results: The Maximum Peak Conducted Output Power peak measurements for the Woodstream Model V440 LoRa Radio Bait Box Rodent 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. The transmission frequencies at low (Channel 0, Frequency 902.3 MHz), middle (Channel 32, Frequency 908.7 MHz) and high (Channel 63, Frequency 914.9 MHz) were measured with LoRa modulation, bandwidth of 125 kHz and spread factor of 8. 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

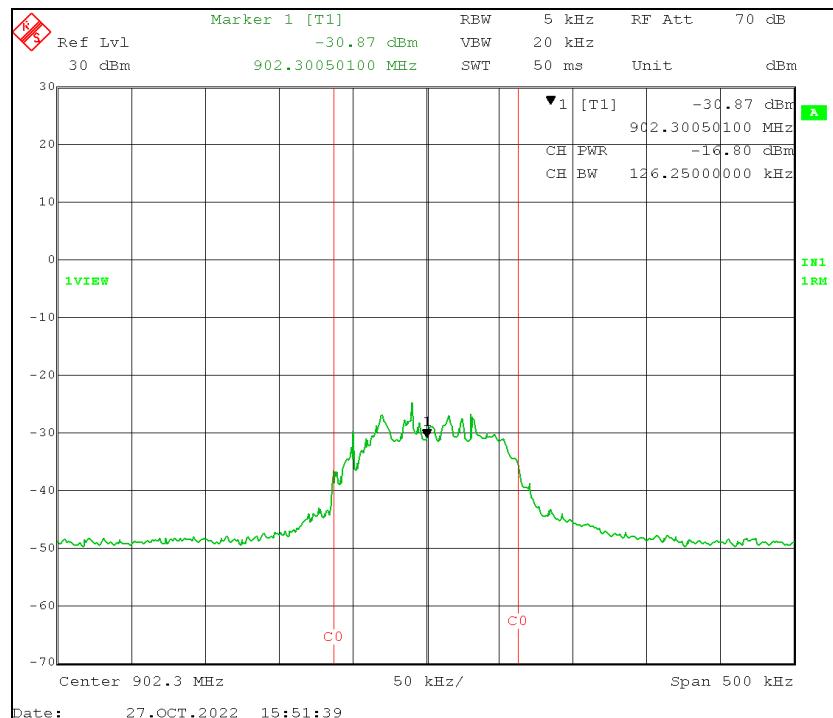
4.8.2.1 Maximum Average Conducted Output Power Test Results (10/27/2022)

Channel	EUT Settings	Frequency (MHz)	Measured Level (dBm)	Cable # 811 Loss (dB)	Corrected Total		Limit		Margin		Result
					dBm	Watts	dBm	Watts	dBm	Watts	
0	Power=20, BW=125	902.3	-16.80	0.20	-16.60	0.000022	30.00	1.000	-46.60	-0.999978	Pass
32	kHz, SF=8, LoRa	908.7	-16.12	0.23	-15.89	0.000026	30.00	1.000	-45.89	-0.999974	Pass
63	Modulation	914.9	-16.23	0.20	-16.03	0.000025	30.00	1.000	-46.03	-0.999975	Pass

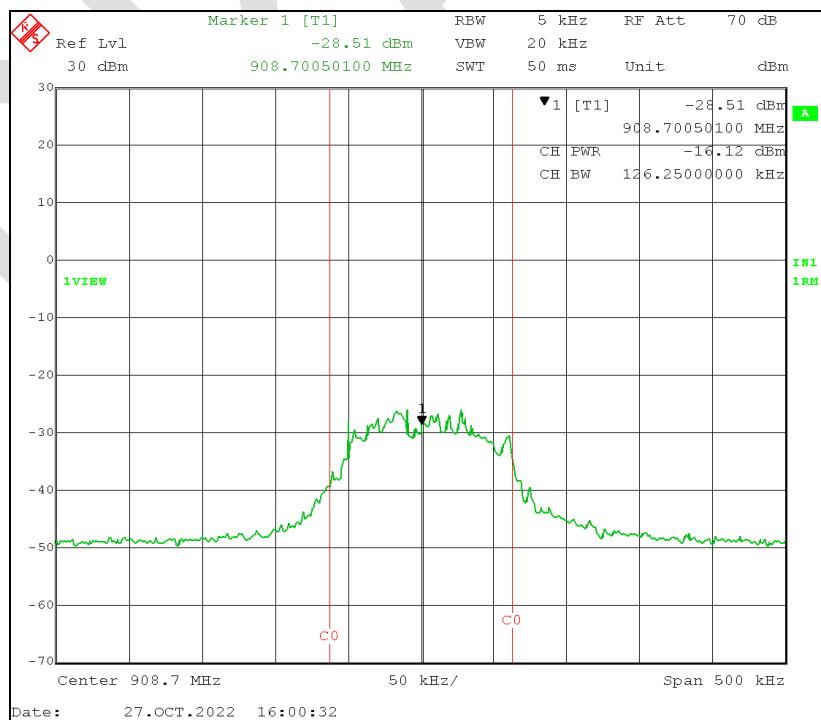
The following pages display the spectrum analyzer screens of the average output power measurements.



Channel 0: 902.30 MHz LoRa Modulation

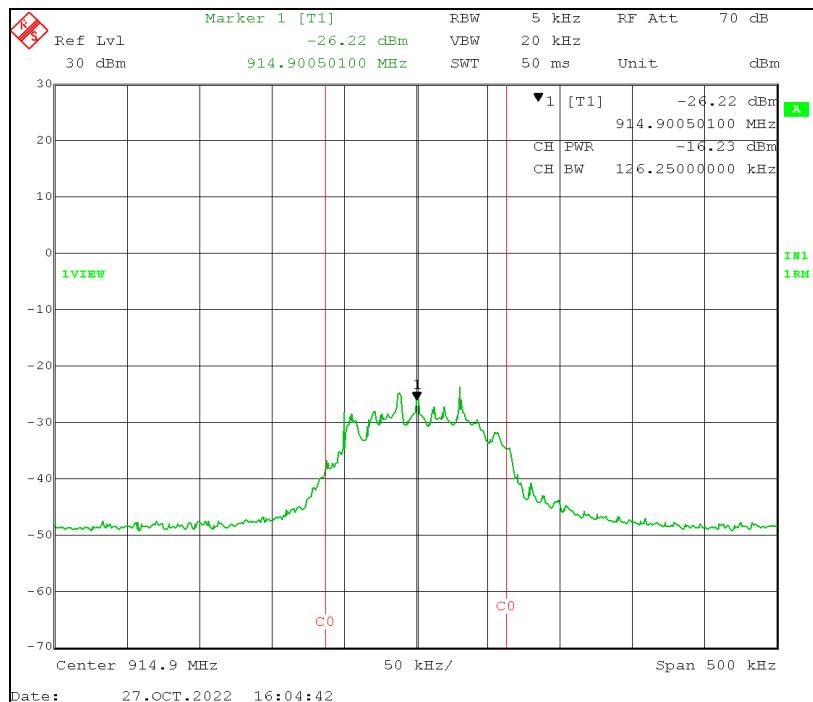


Channel 32: 908.70 MHz LoRa Modulation





Channel 63: 914.9 MHz LoRa Modulation



Test Results: The Maximum Average Conducted Output Power peak measurements for the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap, with no modulation and modulation, 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 V440 LoRa Radio Bait Box Rodent Trap is 5.06 dBi. Applying the antenna gain to the maximum peak transmitter output produces the following values of EIRP.

Channel	EUT Settings	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP		EIRP Limit Watts	Margin Watts	Results	
			dBm	Watts	Isotropic	Numeric	dBm	Watts				
0	Unmodulated Tx	902.3	12.27	0.017	5.06	3.206	17.33	0.054	4.00	-3.946	Pass	
		908.7	12.13	0.016	5.06	3.206	17.19	0.052	4.00	-3.948	Pass	
		914.9	12.12	0.016	5.06	3.206	17.18	0.052	4.00	-3.948	Pass	
Channel	EUT Settings	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP		EIRP Limit Watts	Margin Watts	Results	
			dBm	Watts	Isotropic	Numeric	dBm	Watts				
			902.3	11.32	0.014	5.06	3.206	16.38	0.043	4.00	-3.957	Pass
			908.7	11.25	0.013	5.06	3.206	16.31	0.043	4.00	-3.957	Pass
			914.9	11.33	0.014	5.06	3.206	16.39	0.044	4.00	-3.956	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)

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 144.29 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:

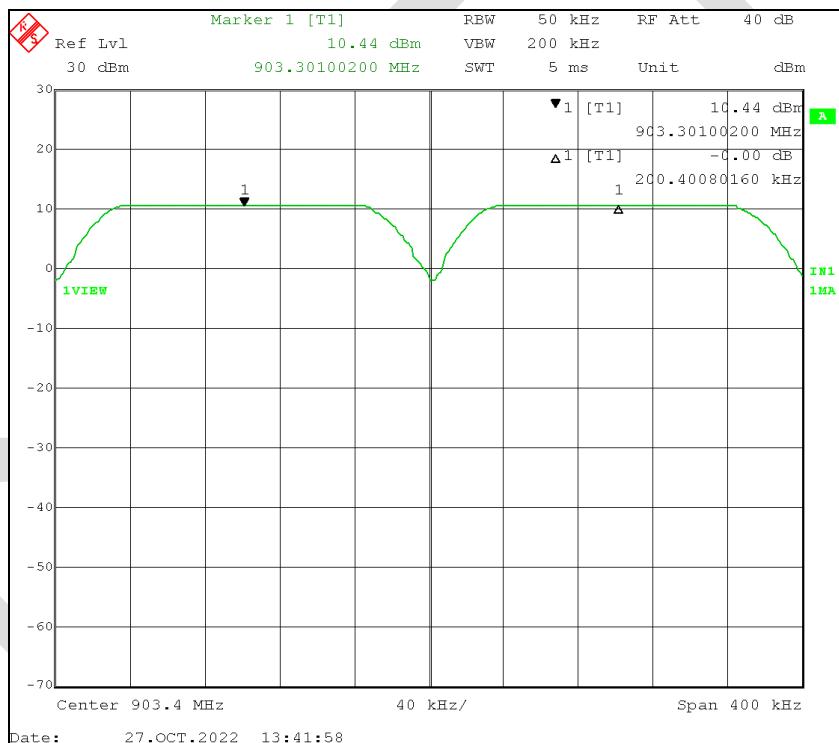
Span	400 kHz
RBW	50 kHz
VBW	200 kHz
Sweep Time	5 ms (Auto)



4.9.2 Carrier Frequency Separation Test Results (10/27/2022)

Hopping Channel	Channel Frequency	Channel Separation (Marker 1 - Delta 1)	Minimum Separation Limit (20 dB Bandwidth)	Margin
#	MHz	kHz	kHz	kHz
5	903.3	200.40	144.29	-56.11
6	903.5			

Channels 5 and 6 Carrier Frequency Separation



Test Results: The FHSS Carrier Frequency Separation of the Woodstream Model V440 LoRa Radio Bait Box Rodent 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)

4.10.1 Number of Hopping Frequencies Test Procedure

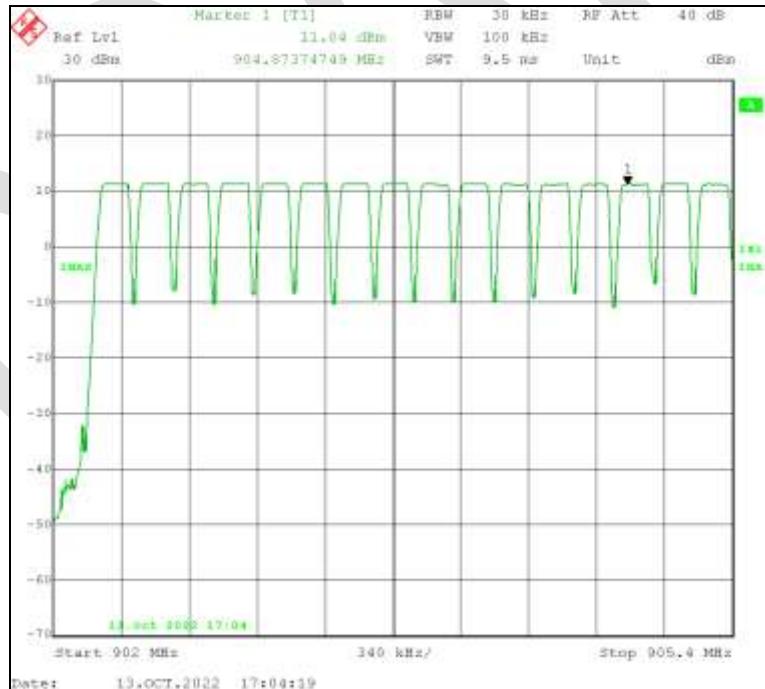
47 CFR Part 15.247(a)(1)(i) and RSS-247 (5.1)(c) specify a minimum of 50 channels for FHSS transmitters with 20-dB bandwidths less than 250 kHz. The test procedure of ANSI C63.10, Section 7.8.3 was used to demonstrate the number of hopping frequencies.

Spectrum Analyzer Settings:

RBW	30	kHz
VBW	100	kHz
Span	330 kHz & 320 kHz	MHz
Sweep Time	Auto (9.5 & 9.0)	ms

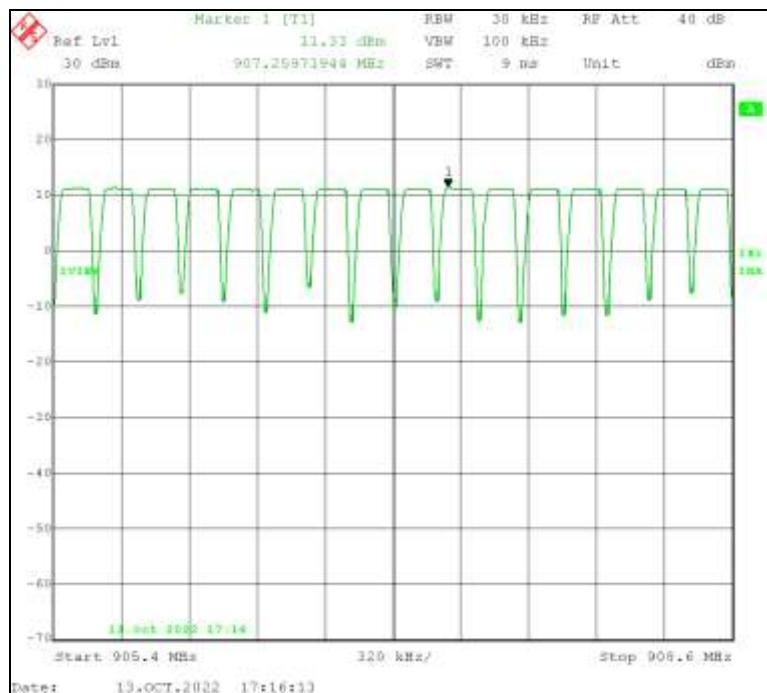
4.10.2 Number of Hopping Frequencies Test Results (10/13/2022)

Channels 0 - 15

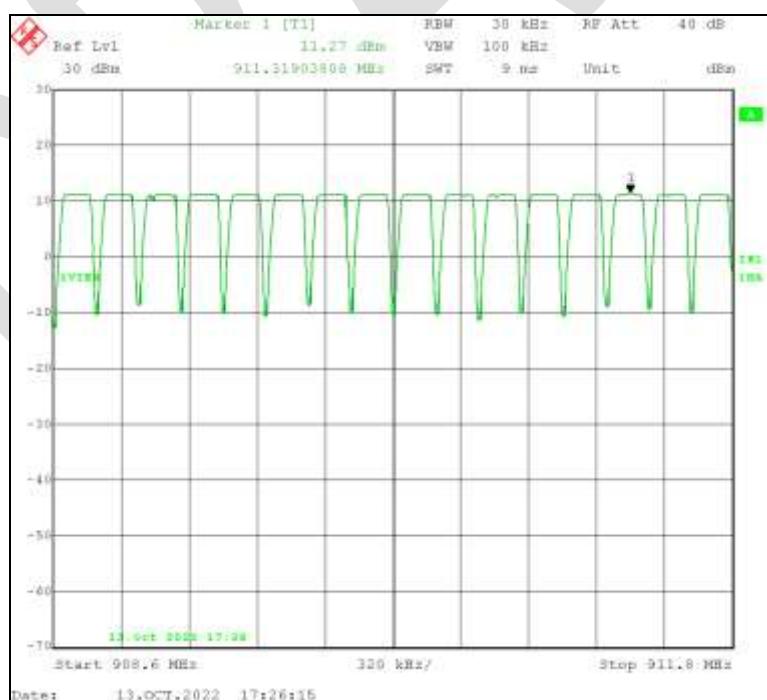




Channels 16 - 31

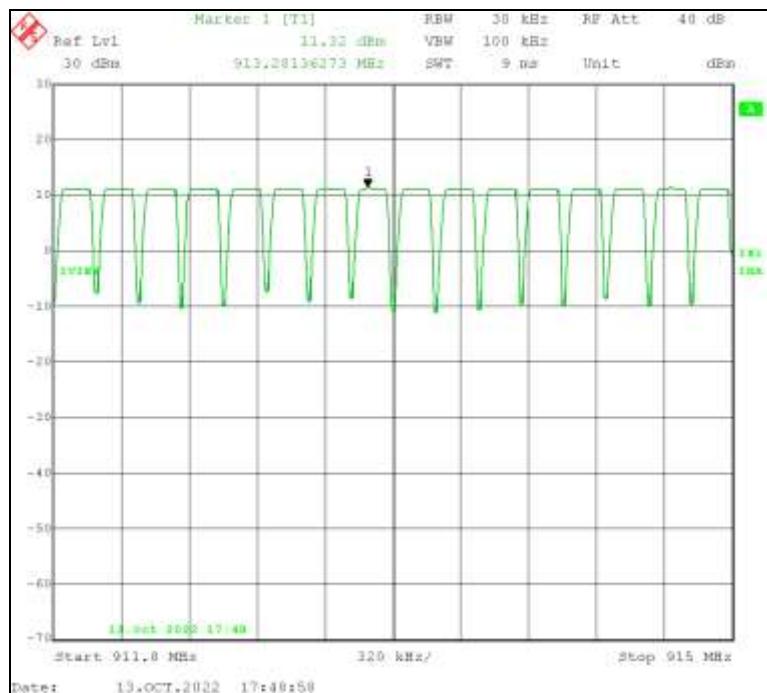


Channels 32-47





Channels 48-63



Test Results: The number of channels of the Woodstream Model V440 LoRa Radio Bait Box Rodent 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)

4.11.1 Time of Occupancy (Dwell Time) Test Procedure

47 CFR Part 15.247 (a)(1)(i) 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	200 kHz
VBW	2 MHz
Sweep Time	500ms

For 20 Second Time of Occupancy Test

Span	0 Hz
RBW	200 kHz
VBW	2 MHz
Sweep Time	20 Sec

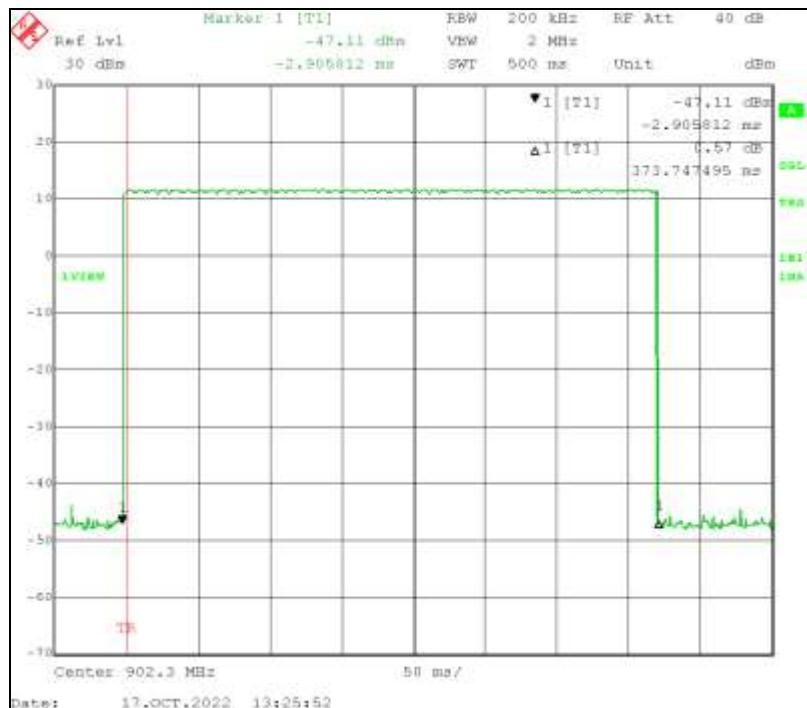
4.11.2 Time of Occupancy (Dwell Time) Test Results (10/17/2022)

Channel #	Freq (MHz)	Modulation	Data Rate	Spread Factor	Bit Rate	Dwell Time (msec)	Limit (msec)	Margin (msec)	Result
0	902.3	LoRa	0	8	3125	373.75	400	-26.25	Pass
32	908.7					373.75	400	-26.25	Pass
63	914.9					373.75	400	-26.25	Pass

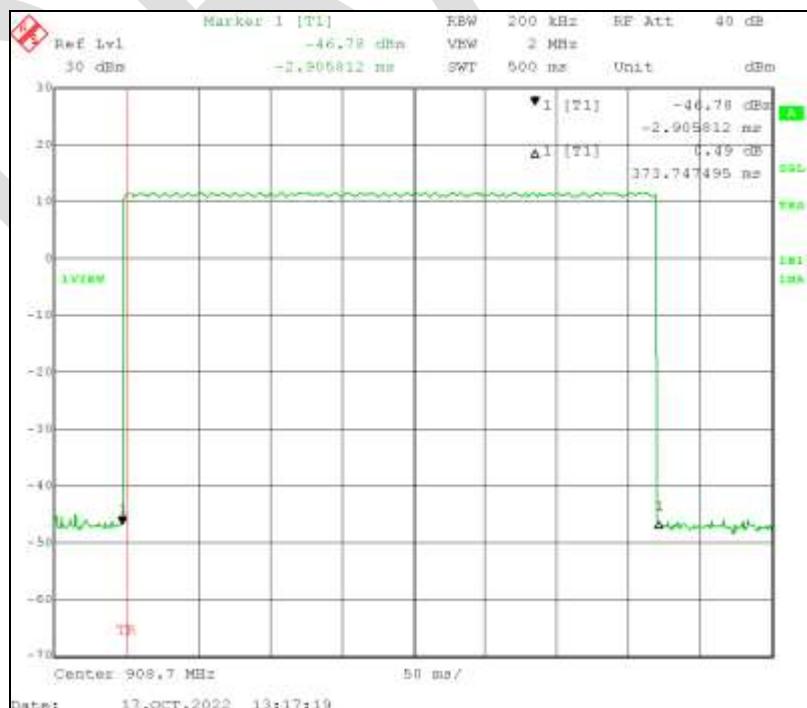


The following pages contain facsimiles of spectrum analyzer display screens demonstrating the time of occupancy.

Channel 0

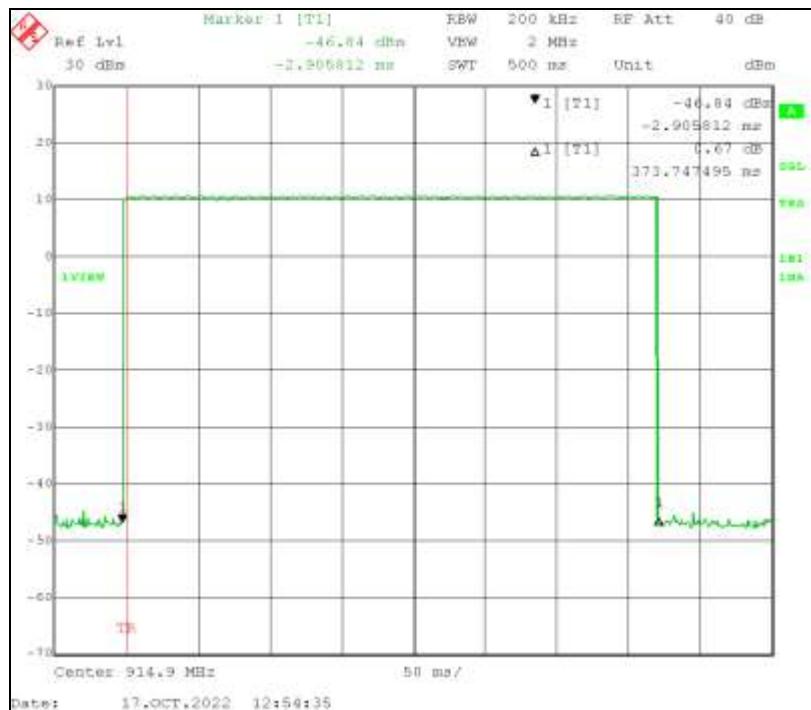


Channel 32





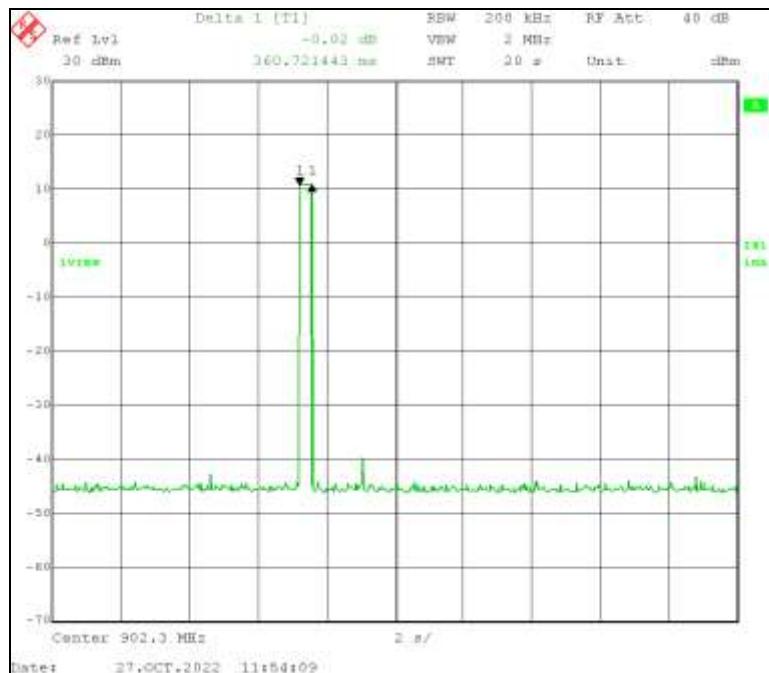
Channel 63



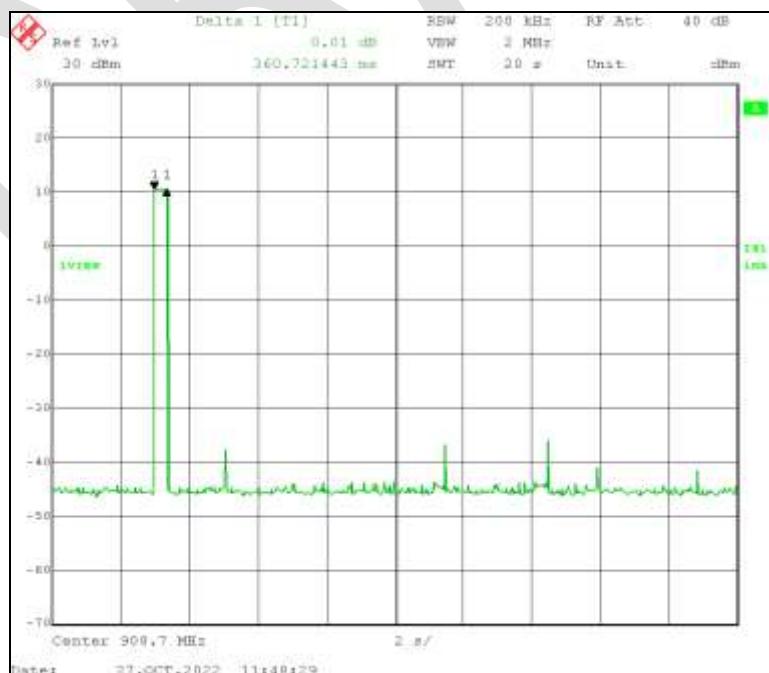


The following pages contain facsimiles of spectrum analyzer display screens demonstrating the requirement of the dwell time within a 20 second period.

Channel 0

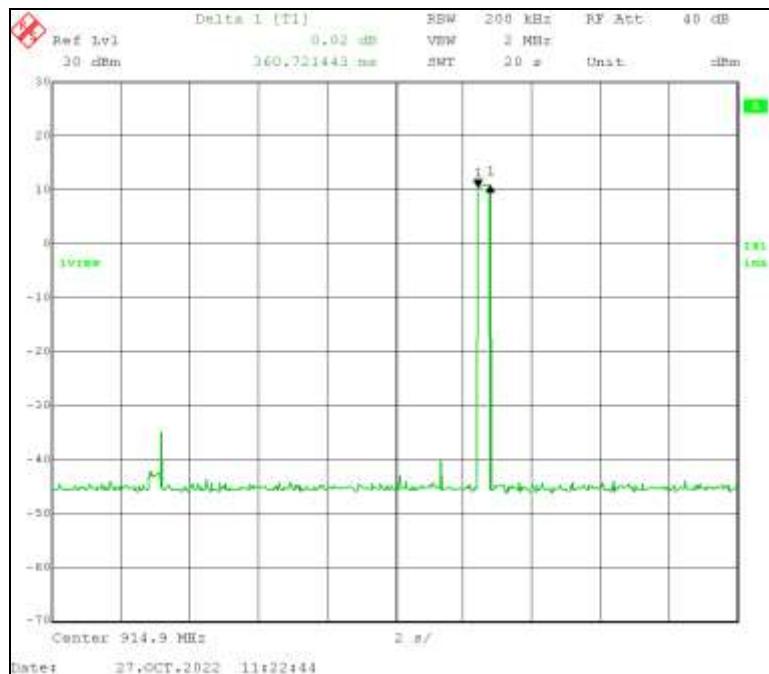


Channel 32





Channel 63



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)

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:

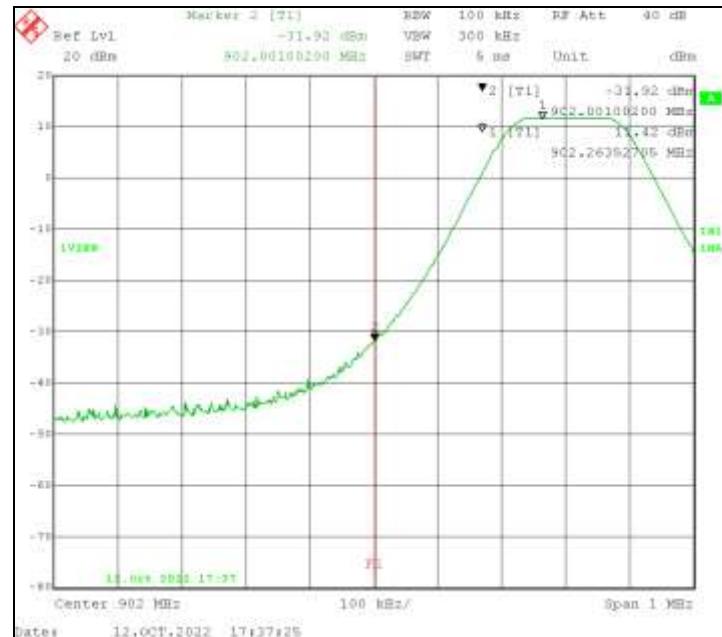
Span	Various
RBW	100 kHz
VBW	300 kHz
Sweep	5 ms

4.12.2 Band Edge Measurement Test Results (10/12/2022)

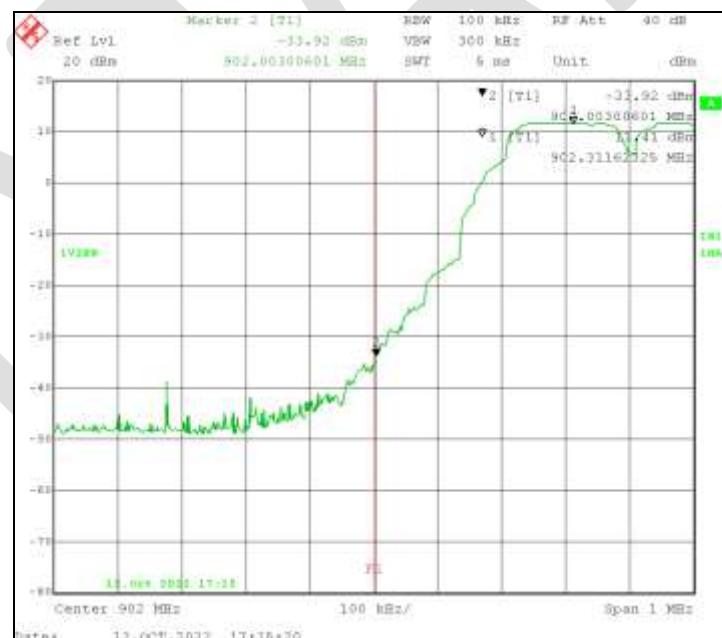
Mode	Frequency (MHz)	Peak Transmit	Band Edge Measurement				Result
			Peak Level @ 100 kHz Below the Lower Band or Peak Level @ 100 kHz Above the Higher Band	Limit (dB)	Delta	Margin	
non-hopping	902.3	11.42	-31.92	30.00	43.34	-13.34	Pass
hopping	902.3	11.41	-33.92	30.00	45.33	-15.33	Pass
non-hopping	914.9	11.15	-48.25	30.00	59.40	-29.40	Pass
hopping	914.9	11.02	-47.37	30.00	58.39	-28.39	Pass



Low Band Edge – Non-Hopping (Channel 0, 902.3 MHz, BW=125 kHz, SF=8)

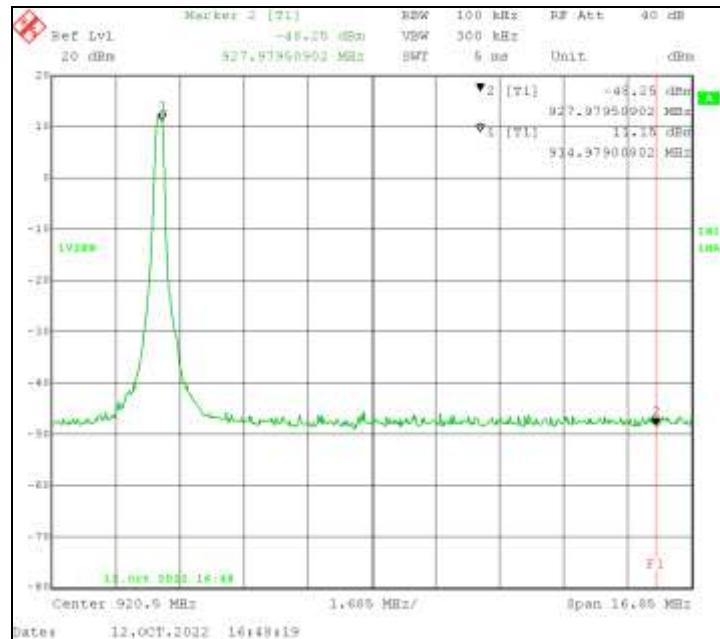


Low Band Edge – Hopping (Data Rate=980 bits/sec)

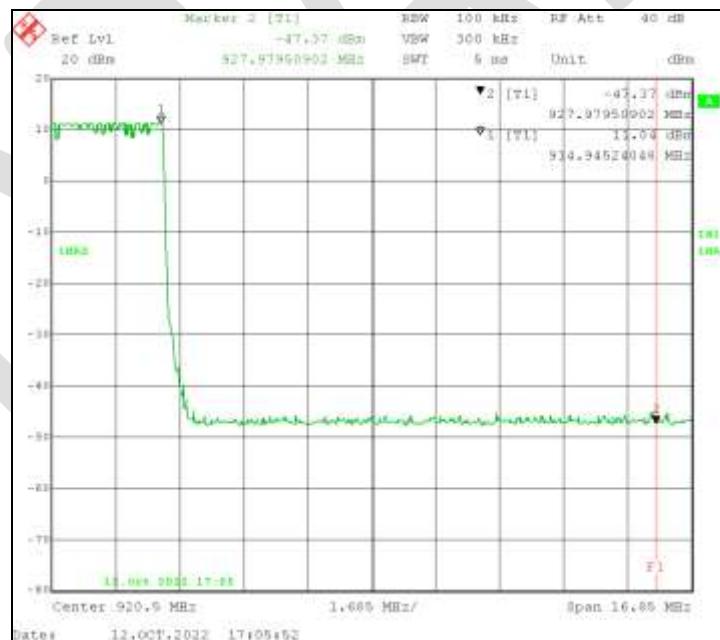




High Band Edge – Non-Hopping (Channel 63, 914.9 MHz, BW=125 kHz, SF=8)



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) and (f), RSS-247 Section 5.2(b) and 5.3)

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 V440 for each of the low (Channel 0), middle (Channel 32) and high (Channel 63) channel frequencies. The signal output was maximized with LoRa modulation with 125 kHz bandwidth using a Spread Factor of 8. The test procedure of ANSI C63.10, Section 11.10.3 Method (AVG PSD-1) was used.

Spectrum Analyzer Settings using RMS Detection:

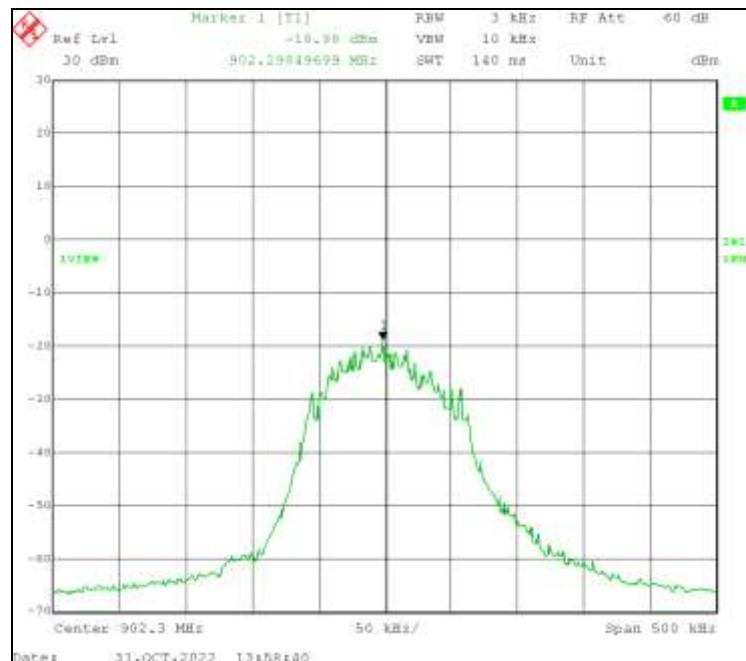
RBW (3 kHz \leq RBW \leq 100 kHz)	3	kHz
VBW (3 X RBW)	10	kHz
Span (1.5 X the DSS Bandwidth of 125 kHz)	500	kHz
Sweep Time (Auto)	140	ms
Detector	RMS	

4.13.1.1 Average Power Spectral Density Test Results (10/31/2022)

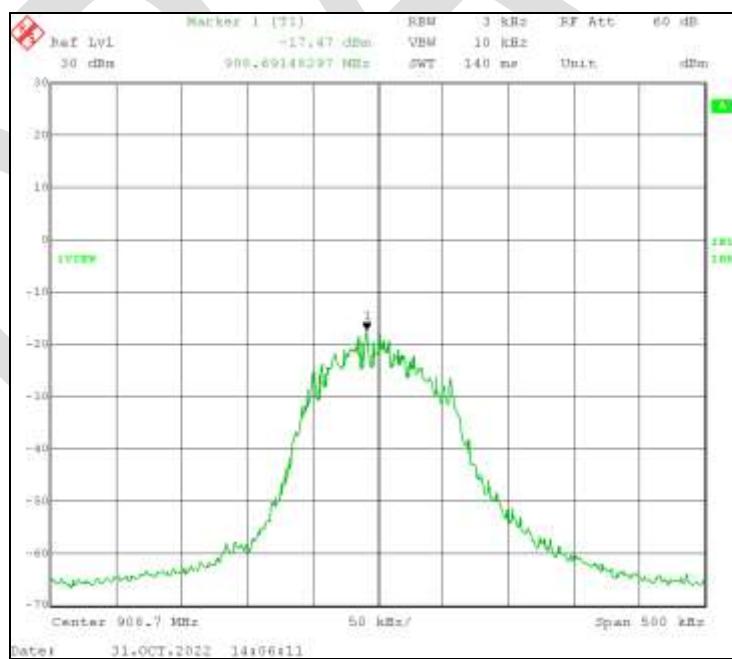
Channel	Frequency (MHz)	Measured Average Level	Cable # 811 Loss	Total	Limit	Margin
		dBm	dB	dBm	dBm	dBm
0	902.3	-18.98	0.20	-18.78	8.00	-26.78
32	908.7	-17.47	0.23	-17.24	8.00	-25.24
63	914.9	-17.02	0.20	-16.82	8.00	-24.82



Channel 0, 902.3 MHz, LoRa Modulation

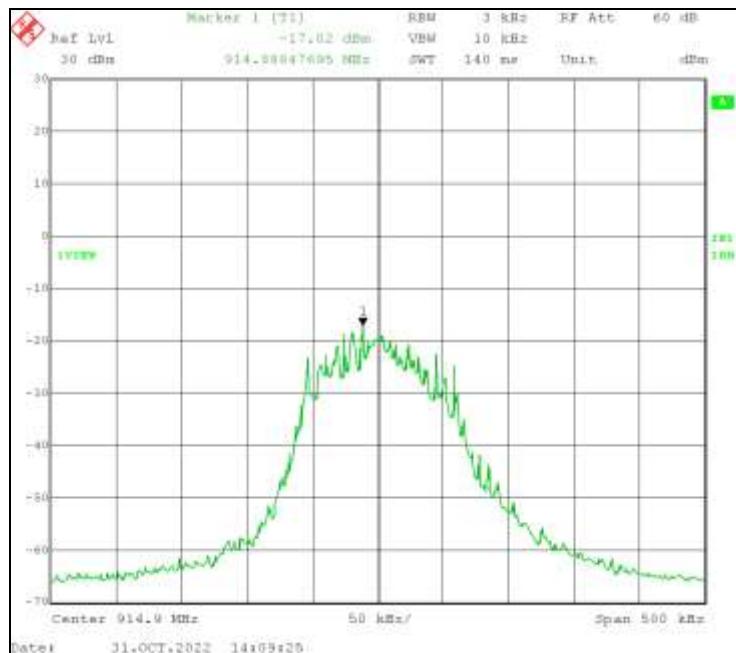


Channel 32, 908.7 MHz, LoRa Modulation





Channel 63, 914.9 MHz, LoRa Modulation



Test Results: The Average Power Spectral Density measurements of the Woodstream Model V440 LoRa Radio Bait Box Rodent Trap are compliant with the limits specified in FCC Section 15.247 and RSS-247.



5.0 Test Setup Photos

See Appendix C Woodstream V440 LoRa Mouse Snap Trap Test Setup Photos.

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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	3.5 Years	01/02/23
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/21/21	3 Years	06/21/24
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	06/21/21	3 Years	06/21/24
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/24/21	3 Years	05/24/24
Amplifier (.09 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	01/13/21	3 Years	01/13/24
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	06/16/21	3 Years	06/16/24
Double Ridged Horn Antenna (1 - 18 GHz)	EMCO	3115	9705-5225	1028	11/24/21	3 Years	11/21/24
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	10/07/22	1 Year	10/07/23
Temp/Humidity Meter	Control Company	4096	151872672	780	07/21/22	3 Years	07/21/25
Notch Filter	Anatech	AE915N S2095	10	923	02/15/22	1 Year	02/15/23
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

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