



**BEC INCORPORATED**

**CERTIFICATION APPLICATION TEST REPORT**

**TEST STANDARDS:**

**FCC Part 15 Subpart C, IC RSS-Gen, IC RSS-247  
DTS Intentional Radiator**

**Woodstream Corporation Model V400M LoRa Radio Control Unit  
With Models V450 and V460 Connected Control Rodent Traps**

**FCC ID: SNA-V400M  
ISED ID: 9458A-V400M**

**REPORT BEC-1908-02**

**TEST DATES: 10/18/2018 – 11/08/2018**

**CUSTOMER:**

**Woodstream Corporation  
69 North Locust Street  
Lititz, PA 17543**

**PREPARED BY:**

**Paul Banker, Test Engineer**

**REVIEWED and APPROVED BY:**

**Steve Fanella, Quality Manager**

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### Notice to Customer

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### Revision History

Revision #	Description of Changes	Date of Changes	Date Released
0	Test Report Initial Release	N/A	11/26/2018
1	Added -30 dB limit line to Antenna Spurious screens	12/5/2018	12/05/2018



## 1.0 Administrative Information

### 1.1 Project Details

<b>Project Number</b>	BEC-1908	
<b>Manufacturer</b>	Woodstream Corporation	
<b>Chassis Model Numbers</b>	Connected Control Rodent Traps V450 (Small) and V460 (Large)	
<b>Chassis Model Serial Numbers</b>	None	
<b>LoRa Radio Control Unit Model Number</b>	V400M	
<b>LoRa Radio Control Unit Type</b>	Unmodified Sample	Modified with SMA connector on transmitter output port
<b>LoRa Radio Control Unit Serial #s</b>	None	
<b>LoRa Radio Control Unit Sample Numbers</b>	1908-05	1908-06
<b>FCC ID</b>	SNA-V400M	
<b>ISED ID</b>	9458A-V400M	
<b>Radio Chip Manufacturer</b>	Semtech Corporation	
<b>Radio Chip Model Number</b>	SX1272	
<b>Frequency of Operation</b>	902 – 915 MHz	
<b>Antenna Gain</b>	+ 3 dBi	
<b>FCC Classification</b>	Digital Transmission System (DTS)	
<b>Date Samples Received</b>	10/18/2018	
<b>Condition Samples Received</b>	Suitable for test	
<b>Sample Type</b>	Production unit	
<b>EUT Description</b>	Connected Control Rodent Traps with LoRa Radio Communication	
<b>Applicable FCC Rules</b>	FCC Rules Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System	
<b>Applicable ISED Rules</b>	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

<b>Test Laboratory Location</b>	BEC Incorporated 970 East High Street Pottstown, PA 19464
<b>Test Personnel</b>	Paul Banker / Steve Fanella / JR Fanella
<b>BEC Laboratory Number FCC Registration</b>	US1118
<b>BEC Laboratory Number ISED Registration</b>	7342A-1
<b>Test Performed For</b>	Woodstream Corporation 69 North Locust Street Lititz, PA 17543
<b>Customer Technical Contact</b>	Dwayne Arrighy
<b>Customer Reference Number</b>	PO # 175123

## 1.4 Measurement Uncertainty

<b>Measurement</b>	<b>Measurement Distance</b>	<b>Frequency Range</b>	<b>Measurement Limit</b>	<b>Expanded Uncertainty</b>
Radiated Disturbance	3 Meter	30 MHz – 1 GHz	Class B	4.57
Conducted Disturbance AC Mains	N/A	150 kHz – 30 MHz	Class A or B	3.43

No adjustments to measured data presented in this report are required because all values of uncertainty are less than the CISPR 16-4-2:2011 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 V400M LoRa Radio Control Unit was tested and found to be compliant to the sections of the FCC Part 15 Subpart C standard listed below:

Report Section	FCC Part 15, Subpart C	RSS-Gen	RSS-247	Test Description	Result
N/A	15.207	7.2		Conducted Limits (AC Power)	N/A
<a href="#">4.1</a>	15.203(b)	Annex A 10(g)		Antenna Requirement	PASS
<a href="#">4.2</a>	15.204	8.3		External RF power amplifiers and antenna modifications	PASS
<a href="#">4.3</a>	15.205(a)	8.9	3.3	Restricted Bands of Operation 30 MHz to 10 GHz	PASS
<a href="#">4.4</a>	15.209	8.10		Radiated Emissions, 30 MHz to 10GHz	PASS
<a href="#">4.5</a>	15.247(a)(2)		5.2 (a)	6 dB Occupied Bandwidth	PASS
<a href="#">4.6</a>	15.247(b)(3)		5.4 (d)	Maximum Average, Peak Power Output and EIRP	PASS
<a href="#">4.7</a>	15.247(d)		5.5	Antenna Port, Conducted Spurious Emissions	PASS
<a href="#">4.8</a>	15.247(e)		5.2 (b)	Antenna Port, Power Spectral Density	PASS
<a href="#">4.9</a>	15.247(d)		5.5	Band Edge Measurement	PASS

**Interpretation of Test Results:** The EUT was tested using LoRa modulation. The resultant data is presented by showing the worst-case levels for each modulation type and/or frequency. All recorded results are maintained at BEC Incorporated and are available upon request.



## **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:  $22^{\circ} \pm 5^{\circ}$

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

Barometric Pressure:  $1000\text{mb} \pm 20\%$

## **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 Connected Rodent Control Trap utilizes a Woodstream Model V400M LoRa Radio Control Unit to communicate trap status to a smart phone or network application. The LoRa Radio Control Unit Model V400M can be used with either Model Number V450 Mouse Trap, or Model V460 Rat Trap Enclosure. Power for the V400M is provided by four, AA batteries.

### **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, DTS Operation within the band of 902 - 928 MHz.

### **2.4 Test Configuration**

The Woodstream Model V400M LoRa Radio Control Unit Sample # 1908-05 was tested in both the small (Model V450) and large (Model V460) trap enclosures for all radiated emissions tests. The Woodstream Model V400M LoRa Radio Control Unit Sample # 1908-06 was tested without a trap enclosure for all antenna terminal measurements.

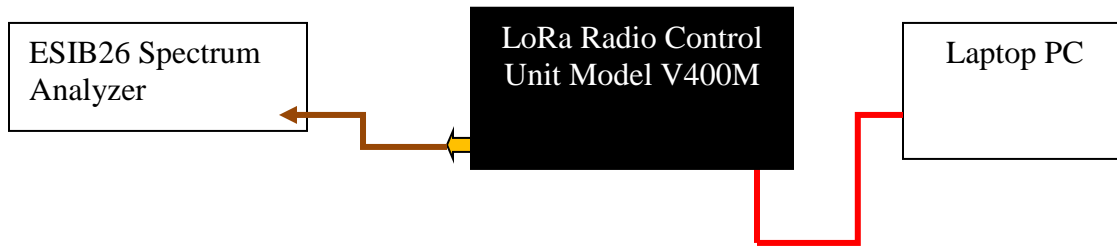
### **2.5 Test Configuration Rationale**

The tested configurations are the two sizes of trap enclosures available by the manufacturer. The modified radio of the Woodstream Model V400M LoRa Radio Control Unit allows direct access to the output of the radio, without a transmission antenna.



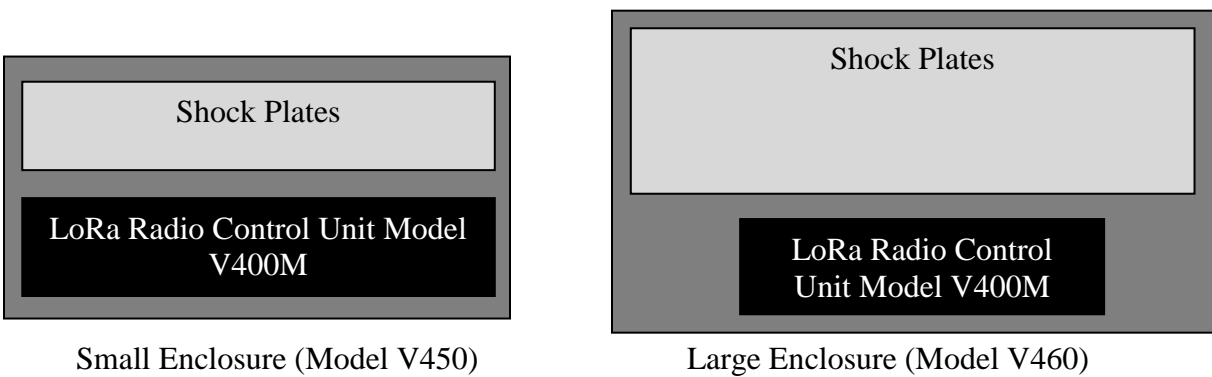
## 2.6 Test Configuration Diagram (Transmitter Conducted Measurements)

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



## 2.7 Test Configuration Diagrams (Radiated Measurements)

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





## 2.8 EUT Information, Interconnection Cabling and Support Equipment

### EUT Hardware

Description	Manufacturer	Model	Serial Number	Sample Number
Lora Radio Control Unit (unmodified)	Woodstream Corporation	V400M	None	1908-05
Lora Radio Control Unit (modified with SMA)				1908-06

### Interconnection Cable List (Conducted Test Setup)

Manufacturer	Model	Type	Shielding	Length	Description
Workhorse	WHU18-3636-036	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-814

### Support Equipment

Description	Manufacturer	Model	Serial Number
USB to Serial Port Adapter	Sparkfun	FTDI Basic	none
Lap Top Computer	Dell	PP04X	CN-OHN338-48643-84F-0307



## 2.9 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 4.6 of this report) to ensure that the un-modulated carrier was not higher than the modulated carrier.

The control unit in this product is a digital frequency transmitter. The EUT transmits to a discrete frequency on a specific channel. The Woodstream Model V400M LoRa Radio Control Unit has 8 Channels available. The 8 Channels and frequencies that can be transmitted by the EUT are as follows:

Channel	Frequency (MHz)		Channel	Frequency (MHz)
0	903.0		4	909.4
1	904.6		5	911.0
2	906.2		6	912.6
3	907.8		7	914.2

For the required testing, the EUT was configured to transmit at low Channel 0 (903 MHz), middle Channel 4 (909.4 MHz) and high Channel 7 (914.2 MHz). The variable spread factors, values 7 through 12, were examined. Evidence in the DTS Bandwidth Test (Section 4.5) and the Maximum Average Power Output Test (Section 4.6), demonstrates that a spread factor of 12 produces the greatest bandwidth and amplitude.

## 2.10 Grounding

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

## 2.11 EUT Modifications

With the exception for the attachment of an SMA connector directly to the antenna output on the main board of the Woodstream Model V400M LoRa Radio Control Unit (Sample # 1908-06), no modifications were made to the EUT.



## 2.12 EUT Pictures Woodstream Model V400M LoRa Radio Control Unit and Enclosures

WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 FRONT SIDE



WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 REAR SIDE

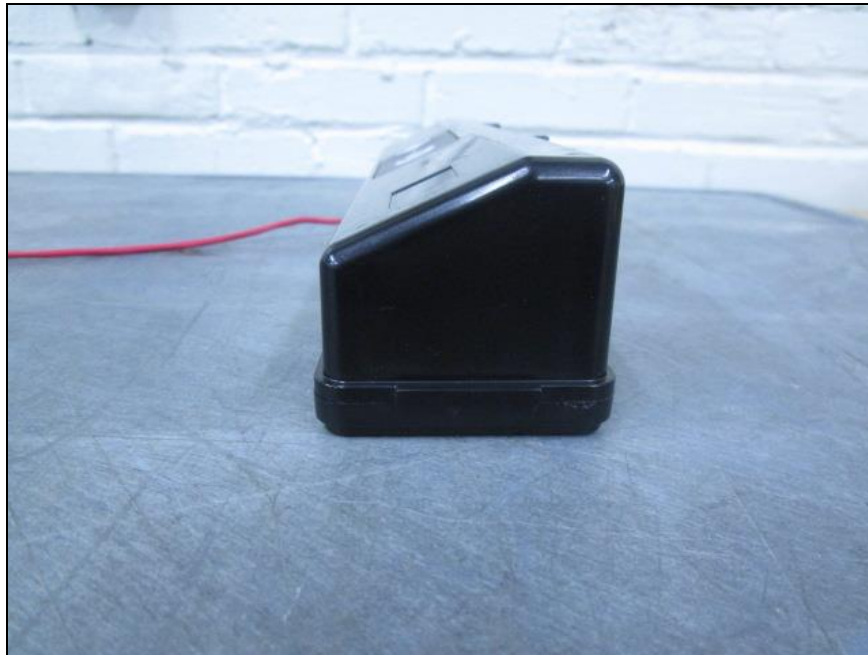




WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 LEFT SIDE



WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 RIGHT SIDE

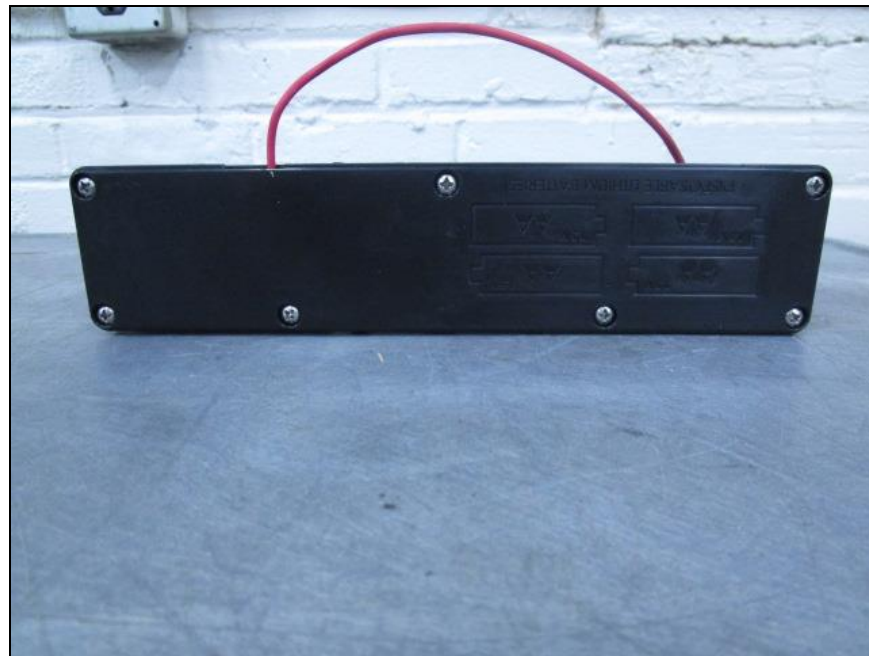




WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 TOP SIDE



WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-05 BOTTOM SIDE





WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-06 TOP VIEW



WOODSTREAM LORA RADIO CONTROL UNIT SAMPLE 1908-06 LEFT SIDE VIEW







WOODSTREAM MOUSE TRAP ENCLOSURE MODEL V450 (LID CLOSED)



WOODSTREAM MOUSE TRAP ENCLOSURE MODEL V450 (LID OPENED)





WOODSTREAM MOUSE TRAP ENCLOSURE MODEL V450 (COMPONENTS)

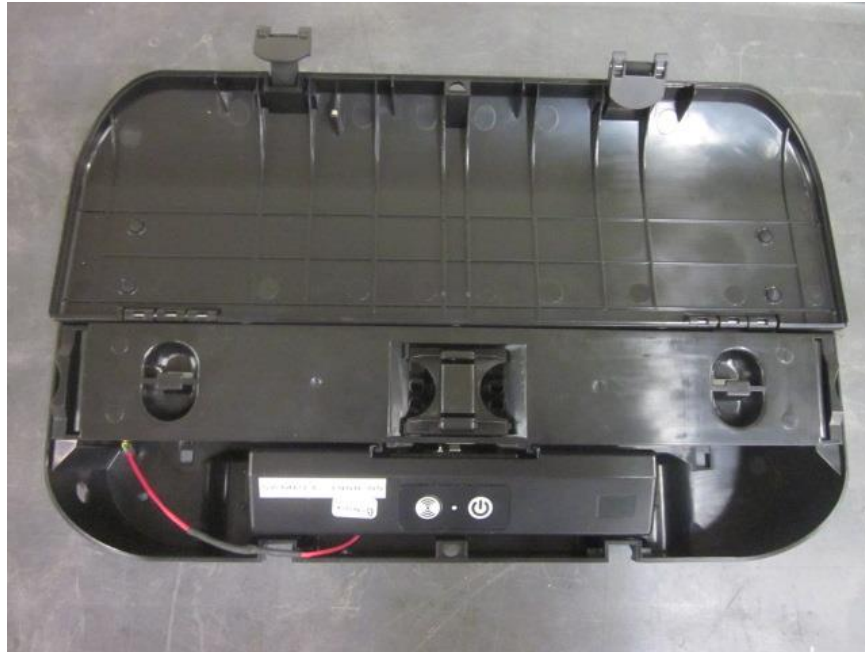


WOODSTREAM RAT TRAP ENCLOSURE MODEL V460 (LID CLOSED)





WOODSTREAM RAT TRAP ENCLOSURE MODEL V460 (LID OPENED)



WOODSTREAM RAT TRAP ENCLOSURE MODEL V460 (COMPONENTS)





## **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 Industry Canada Requirements**

RSS-Gen Issue 5: General Requirements for Compliance of Radio Apparatus

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

#### **3.1.3 Basic Test Methods and Test Procedures**

558074 D01 DTS Meas Guidance v04, Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under Section 15.247.

ANSI C63.4: 2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

### **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 V400M LoRa Radio Control Unit is a short trace on the main PCB of the EUT. 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 V400M LoRa Radio Control Unit. 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 Restricted Bands of Operation 30 MHz - 10 GHz (47 CFR 15.205)(RSS-GEN 8.9)

The emissions from the Woodstream Model V400M LoRa Radio Control Unit, which fall in the restricted bands of operation, detailed in this section, comply with the limits of 15.209. The Woodstream Model V400M LoRa Radio Control Unit was tested with each of the two enclosures; Model V450 and Model V460. The Woodstream Model V400M LoRa Radio Control Unit was tested at three frequencies: low (903 MHz), middle (909.4 MHz) and high (914.2 MHz). The modulation was LoRa.

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 listed in the tables below.

#### 4.3.1 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 attenuation measurements specified in ANSI C63.4 and CISPR 22.



### **SR#1**

The Semi-Anechoic Shielded Room (SR#1) is an 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 test site complies with the attenuation measurements specified in ANSI C63.4 and CISPR 22.

### **4.3.2 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. 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 V400M LoRa Radio Control Unit transmitting at low (Channel 0), middle (Channel 4) and high (Channel 7). LoRa modulation was applied with the spread factor = 12. The following tables are the highest emissions recorded and summarized. Each signal has the associated channel number and frequency when measured. The signals in the tables fall into the restricted bands described in 15.205.



### 4.3.3 Restricted Bands of Operation 30 MHz – 1000 MHz Test Results (10/19/2018, 10/31/2018 and 11/01/2018)

#### WOODSTREAM MODEL V400M IN THE SMALL ENCLOSURE (MODEL V450)

Frequency	Peak	QP	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	RSS-Gen, FCC Class B Limit	Margin	Results	Source
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB		Channel # / MHz
125.552	12.92	12.87	V	146	217	-6.58	43.52	-30.65	PASS	4 / 909.4
135.243	19.12	16.72	H	258	110	-7.00	43.52	-26.80	PASS	0 / 903
172.180	16.31	14.19	V	220	099	-8.09	43.52	-29.33	PASS	7 / 914.2
173.003	15.35	15.37	H	226	184	-8.16	43.52	-28.15	PASS	4 / 909.4
400.482	27.44	27.20	H	191	103	-7.51	46.02	-18.82	PASS	7 / 914.2
403.090	27.37	24.63	H	182	115	-7.50	46.02	-21.39	PASS	7 / 914.2
405.899	29.75	23.33	H	202	252	-7.50	46.02	-22.69	PASS	7 / 914.2
409.436	24.32	23.38	H	153	249	-7.49	46.02	-22.64	PASS	4 / 909.4
960.107	15.56	14.31	V	260	160	-3.21	53.98	-39.67	PASS	0 / 903
989.567	18.41	16.72	V	148	143	-2.81	53.98	-37.26	PASS	4 / 909.4

#### WOODSTREAM MODEL V400M IN THE LARGE ENCLOSURE (MODEL V460)

Frequency	Peak	QP	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	RSS-Gen, FCC Class B Limit	Margin	Results	Source
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB		Channel # / MHz
113.973	14.84	12.43	V	029	247	-7.25	43.52	-31.09	PASS	0 / 903
114.778	15.64	13.21	V	351	212	-7.16	43.52	-30.31	PASS	7 / 914.2
118.446	13.30	12.91	V	161	138	-6.83	43.52	-30.61	PASS	4 / 909.4
132.499	15.07	12.88	V	047	143	-6.81	43.52	-30.64	PASS	7 / 914.2
169.224	24.00	23.75	H	197	160	-7.82	43.52	-19.77	PASS	0 / 903
170.846	25.20	22.21	H	022	149	-7.97	43.52	-21.31	PASS	4 / 909.4
323.282	28.73	28.52	H	023	104	-7.83	46.02	-17.50	PASS	0 / 903
324.508	30.14	27.22	H	014	103	-7.84	46.02	-18.80	PASS	4 / 909.4
325.913	28.20	28.42	H	029	100	-7.84	46.02	-17.60	PASS	0 / 903
327.344	29.91	26.99	H	061	114	-7.85	46.02	-19.03	PASS	4 / 909.4
328.581	28.29	26.36	H	049	111	-7.85	46.02	-19.66	PASS	0 / 903
330.383	31.33	29.39	H	026	121	-7.85	46.02	-16.63	PASS	4 / 909.4
330.962	31.09	27.86	H	009	115	-7.84	46.02	-18.16	PASS	0 / 903
333.038	34.51	32.51	H	028	121	-7.80	46.02	-13.51	PASS	7 / 914.2
333.140	30.63	28.94	H	028	120	-7.80	46.02	-17.08	PASS	4 / 909.4
333.564	29.87	27.43	H	025	103	-7.79	46.02	-18.59	PASS	0 / 903
400.000	30.21	27.02	H	197	235	-7.51	46.02	-19.00	PASS	7 / 914.2
405.657	29.50	27.47	H	208	231	-7.50	46.02	-18.55	PASS	7 / 914.2
408.785	28.32	24.07	H	203	254	-7.49	46.02	-21.95	PASS	7 / 914.2
608.065	34.21	32.74	H	036	120	-5.78	46.02	-13.28	PASS	7 / 914.2
960.410	16.66	16.13	H	304	235	-3.20	53.98	-37.85	PASS	0 / 903
961.150	16.39	16.04	V	303	127	-3.19	53.98	-37.94	PASS	0 / 903

**Test Results:** The Woodstream Model V400M LoRa Radio Control Unit, housed in either enclosure, complies with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 for restricted bands of operation with a margin of 13.28 dB.



### 4.3.4 Restricted Bands of Operation 1 – 10 GHz Test Results (10/18/2018 and 10/19/2018)

WOODSTREAM MODEL V400M IN THE SMALL ENCLOSURE (MODEL V450)

Frequency	Peak	Average	Polarity	TT angle	Ant Height	Correction	RSS-Gen, FCC Class	Margin	Results	Source
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	B Limit dBuV/m	dB		Channel# / MHz
1.0051	30.00	21.11	V	123	141	-13.32	53.98	-32.87	PASS	0 / 903
1.0071	31.05	20.99	H	228	141	-13.30	53.98	-32.99	PASS	7 / 914.2
1.0134	32.02	20.32	V	359	169	-13.26	53.98	-33.66	PASS	7 / 914.2
1.0148	30.99	20.46	V	191	141	-13.25	53.98	-33.52	PASS	4 / 909.4
1.0753	29.66	19.71	H	251	144	-12.84	53.98	-34.28	PASS	0 / 903
2.7089	45.99	38.51	H	238	201	-3.36	53.98	-15.47	PASS	0 / 903
2.7093	51.60	42.97	V	117	133	-3.36	53.98	-11.01	PASS	0 / 903
2.7278	50.10	42.89	V	102	109	-3.26	53.98	-11.09	PASS	4 / 909.4
2.7286	45.32	39.00	H	256	100	-3.25	53.98	-14.98	PASS	4 / 909.4
2.7428	37.79	34.25	H	169	191	-3.17	53.98	-19.74	PASS	7 / 914.2
2.7433	52.23	46.13	V	122	100	-3.17	53.98	-7.85	PASS	7 / 914.2
3.6116	44.37	38.20	H	164	214	0.51	53.98	-15.78	PASS	0 / 903
3.6122	44.61	41.84	V	015	180	0.51	53.98	-12.14	PASS	0 / 903
3.6371	38.89	40.51	V	065	107	0.59	53.98	-13.47	PASS	4 / 909.4
3.6381	41.32	38.10	H	227	170	0.59	53.98	-15.88	PASS	4 / 909.4
3.6560	40.83	37.51	V	001	112	0.65	53.98	-16.47	PASS	7 / 914.2
3.6573	43.90	35.37	H	199	190	0.65	53.98	-18.61	PASS	7 / 914.2
4.5152	54.67	45.27	V	175	124	1.87	53.98	-8.71	PASS	0 / 903
4.5161	44.97	36.31	H	311	124	1.87	53.98	-17.67	PASS	0 / 903
4.5472	43.83	37.38	H	143	166	2.00	53.98	-16.60	PASS	4 / 909.4
4.5480	47.66	35.74	V	204	101	2.00	53.98	-18.24	PASS	4 / 909.4
4.5715	46.78	38.32	H	138	117	2.09	53.98	-15.66	PASS	7 / 914.2
4.5716	50.08	40.59	V	204	113	2.09	53.98	-13.39	PASS	7 / 914.2
7.2741	58.53	48.15	V	057	151	6.16	53.98	-5.83	PASS	4 / 909.4
7.2746	51.67	41.48	H	125	116	6.16	53.98	-12.50	PASS	4 / 909.4
7.3133	58.90	45.90	V	046	148	6.30	53.98	-8.08	PASS	7 / 914.2
7.3142	52.62	41.66	H	124	140	6.31	53.98	-12.32	PASS	7 / 914.2
8.1261	50.88	43.41	H	039	121	7.48	53.98	-10.57	PASS	0 / 903
8.1273	60.28	46.78	V	159	120	7.48	53.98	-7.20	PASS	0 / 903
8.1825	51.75	43.08	V	048	144	7.55	53.98	-10.90	PASS	4 / 909.4
8.1828	48.81	43.68	H	037	148	7.55	53.98	-10.30	PASS	4 / 909.4
8.2265	48.87	42.10	H	046	159	7.60	53.98	-11.88	PASS	7 / 914.2
8.2270	49.76	43.78	V	159	152	7.60	53.98	-10.20	PASS	7 / 914.2
9.0322	59.95	46.55	V	045	131	8.85	53.98	-7.43	PASS	0 / 903
9.0952	62.34	48.44	V	174	138	8.84	53.98	-5.54	PASS	4 / 909.4
9.1403	57.13	43.43	H	262	100	8.83	53.98	-10.55	PASS	7 / 914.2
9.1404	62.73	48.73	V	205	127	8.83	53.98	-5.25	PASS	7 / 914.2





WOODSTREAM MODEL V400M IN THE LARGE ENCLOSURE (MODEL V460)

Frequency	Peak	Average	Polarity	TT angle	Ant Height	Correction	RSS-Gen, FCC Class	Margin	Results	Source
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	B Limit	dB		Channel# / MHz
1.0014	29.82	21.09	V	285	164	-13.34	53.98	-32.89	PASS	0 / 903
1.0022	31.01	20.91	H	359	212	-13.34	53.98	-33.07	PASS	4 / 909.4
1.0031	30.98	20.66	V	032	188	-13.33	53.98	-33.32	PASS	4 / 909.4
1.0051	31.01	21.11	H	143	107	-13.32	53.98	-32.87	PASS	7 / 914.2
1.0066	29.42	20.95	V	231	184	-13.31	53.98	-33.03	PASS	7 / 914.2
2.7092	44.52	41.81	V	229	121	-3.36	53.98	-12.17	PASS	0 / 903
2.7095	49.73	41.63	H	104	116	-3.36	53.98	-12.35	PASS	0 / 903
2.7279	46.74	42.43	H	236	161	-3.26	53.98	-11.55	PASS	4 / 909.4
2.7280	41.93	42.66	V	123	121	-3.26	53.98	-11.32	PASS	4 / 909.4
2.7420	47.24	41.65	H	243	205	-3.18	53.98	-12.33	PASS	7 / 914.2
2.7433	50.73	44.83	V	120	100	-3.17	53.98	-9.15	PASS	7 / 914.2
3.6123	52.31	43.51	V	007	148	0.51	53.98	-10.47	PASS	0 / 903
3.6381	40.21	38.22	H	229	110	0.59	53.98	-15.76	PASS	4 / 909.4
3.6385	39.82	38.74	V	010	135	0.59	53.98	-15.24	PASS	4 / 909.4
3.6566	52.75	44.65	V	015	130	0.65	53.98	-9.33	PASS	7 / 914.2
3.6571	41.13	37.93	H	266	135	0.65	53.98	-16.05	PASS	7 / 914.2
4.5139	41.04	39.45	H	072	099	1.86	53.98	-14.53	PASS	0 / 903
4.5144	48.12	42.29	V	001	103	1.87	53.98	-11.69	PASS	0 / 903
4.5469	54.09	44.99	V	340	124	1.99	53.98	-8.99	PASS	4 / 909.4
4.5473	46.04	40.03	H	110	125	2.00	53.98	-13.95	PASS	4 / 909.4
4.5699	40.96	40.96	V	000	129	2.09	53.98	-13.02	PASS	7 / 914.2
4.5719	46.08	38.96	H	079	103	2.09	53.98	-15.02	PASS	7 / 914.2
7.2765	49.82	43.14	V	036	123	6.17	53.98	-10.84	PASS	4 / 909.4
7.2762	57.47	44.97	H	035	138	6.17	53.98	-9.01	PASS	4 / 909.4
7.3118	47.49	42.23	H	023	136	6.3	53.98	-11.75	PASS	7 / 914.2
7.3122	54.61	41.65	V	037	119	6.3	53.98	-12.33	PASS	7 / 914.2
8.1253	56.88	43.98	V	042	100	7.48	53.98	-10.00	PASS	0 / 903
8.1282	49.43	42.60	H	306	108	7.48	53.98	-11.38	PASS	0 / 903
8.1864	48.76	41.65	H	000	122	7.55	53.98	-12.33	PASS	4 / 909.4
8.1864	48.95	42.94	V	293	100	7.55	53.98	-11.04	PASS	4 / 909.4
8.2283	49.75	42.37	V	066	114	7.6	53.98	-11.61	PASS	7 / 914.2
8.2301	49.26	41.79	H	034	132	7.61	53.98	-12.20	PASS	7 / 914.2
9.0300	62.85	49.15	V	189	147	8.85	53.98	-4.83	PASS	0 / 903
9.0300	56.85	43.55	H	044	128	8.85	53.98	-10.43	PASS	0 / 903
9.0927	49.29	42.55	H	283	136	8.84	53.98	-11.43	PASS	4 / 909.4
9.0960	49.4	42.52	V	338	102	8.84	53.98	-11.46	PASS	4 / 909.4
9.0959	59.64	45.94	H	256	132	8.84	53.98	-8.04	PASS	4 / 909.4
9.1408	56.24	46.77	V	184	151	8.83	53.98	-7.21	PASS	7 / 914.2
9.1421	59.73	46.13	H	252	127	8.83	53.98	-7.85	PASS	7 / 914.2

**Test Results:** The Woodstream Model V400M LoRa Radio Control Unit, housed in either enclosure, complies with the requirements of 47 CFR Part 15.205 and RSS-Gen Section 8.10 with a margin of 4.83 dB.



#### 4.4. Spurious Radiated Emissions 30 MHz to 10 GHz (47 CFR 15.209)(RSS-GEN 8.10)

The following tables shows the highest amplitude average detected field strengths as recorded from the EUT. These measurements were performed over the frequency range of 30 MHz to 1000 MHz at a distance of 3 meters to satisfy FCC Section 15.209 requirements. Spurious emissions from the EUT were measured at low, middle and high transmit frequencies. LoRa modulation, with a spread factor of 12 was applied. The measurements below were made using the same facility and procedure as the Restricted Band measurements.

#### 4.4.1 Spurious Radiated Emissions 30 MHz to 1 GHz Test Results (10/19/2018, 10/31/2018 and 11/01/2018)

WOODSTREAM MODEL V400M IN THE SMALL ENCLOSURE (MODEL V450)

Frequency	Peak	QP	Antenna Polarity	Turntable Angle	Antenna Height	Correction Factors	RSS-Gen, FCC Class B Limit	Margin	Results	Source
MHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	dBuV/m	dB		Channel # / MHz
30.035	21.66	19.06	V	344	237	-0.52	40.00	-20.94	PASS	4 / 909.4 MHz
30.372	20.34	17.33	V	263	168	-0.69	40.00	-22.67	PASS	0 / 903 MHz
30.866	20.45	18.50	V	272	184	-0.95	40.00	-21.50	PASS	7 / 914.2 MHz
31.226	17.42	17.30	H	071	179	-1.22	40.00	-22.70	PASS	0 / 903 MHz
31.507	19.95	18.19	H	224	190	-1.47	40.00	-21.81	PASS	4 / 909.4 MHz
66.959	17.23	17.01	V	026	110	-12.76	40.00	-22.99	PASS	0 / 903 MHz
175.974	23.79	20.57	H	190	178	-8.33	43.52	-22.95	PASS	0 / 903 MHz
363.835	33.49	31.19	H	022	230	-7.64	46.02	-14.83	PASS	7 / 914.2 MHz
366.100	32.48	30.62	H	020	230	-7.63	46.02	-15.40	PASS	7 / 914.2 MHz
368.863	30.80	27.90	H	015	100	-7.64	46.02	-18.12	PASS	7 / 914.2 MHz
371.398	27.59	25.89	H	167	103	-7.63	46.02	-20.13	PASS	4 / 909.4 MHz
374.014	34.76	30.03	H	195	104	-7.60	46.02	-15.99	PASS	7 / 914.2 MHz
376.469	32.17	28.39	H	196	103	-7.61	46.02	-17.63	PASS	7 / 914.2 MHz
377.723	29.35	26.02	H	201	238	-7.62	46.02	-20.00	PASS	0 / 903 MHz
379.334	31.12	26.54	H	193	230	-7.64	46.02	-19.48	PASS	7 / 914.2 MHz
384.733	30.34	25.65	H	194	103	-7.56	46.02	-20.37	PASS	7 / 914.2 MHz
390.201	29.50	25.83	H	214	241	-7.57	46.02	-20.19	PASS	7 / 914.2 MHz
392.908	27.94	23.67	H	179	110	-7.58	46.02	-22.35	PASS	7 / 914.2 MHz
395.060	30.54	24.31	H	157	103	-7.59	46.02	-21.71	PASS	7 / 914.2 MHz
398.302	29.49	25.38	H	183	099	-7.54	46.02	-20.64	PASS	4 / 909.4 MHz
411.125	25.97	23.77	H	186	100	-7.50	46.02	-22.25	PASS	7 / 914.2 MHz
428.330	25.18	22.71	H	149	242	-7.63	46.02	-23.31	PASS	4 / 909.4 MHz
521.247	25.16	23.16	H	184	179	-6.49	46.02	-22.86	PASS	0 / 903 MHz
562.657	23.59	24.37	V	104	172	-6.06	46.02	-21.65	PASS	7 / 914.2 MHz
571.476	29.17	25.67	H	196	149	-6.03	46.02	-20.35	PASS	0 / 903 MHz
588.821	24.98	23.98	H	158	145	-5.88	46.02	-22.04	PASS	4 / 909.4 MHz
589.740	25.09	23.18	V	046	103	-5.86	46.02	-22.84	PASS	7 / 914.2 MHz
606.103	25.19	23.33	H	278	132	-5.78	46.02	-22.69	PASS	0 / 903 MHz
909.274	9.59	28.94	V	296	126	-3.78	46.02	-17.08	PASS	4 / 909.4 MHz
909.384	13.03	25.91	H	134	252	-3.77	46.02	-20.11	PASS	4 / 909.4 MHz



WOODSTREAM MODEL V400M IN THE LARGE ENCLOSURE (MODEL V460)

Frequency MHz	Peak dBuV/m	QP dBuV/m	Antenna Polarity H/V	Turntable Angle degrees	Antenna Height cm	Correction Factors dB	RSS-Gen, FCC Class B Limit dBuV/m	Margin dB	Results	Source
										Channel # / MHz
30.151	23.47	19.39	V	185	191	-0.58	40.00	-20.61	PASS	7 / 914.2 MHz
31.167	20.48	18.75	V	252	174	-1.17	40.00	-21.25	PASS	4 / 909.4 MHz
159.980	22.59	22.65	H	023	149	-7.21	43.52	-20.87	PASS	4 / 909.4 MHz
173.869	24.63	23.38	H	011	217	-8.24	43.52	-20.14	PASS	4 / 909.4 MHz
175.956	28.72	26.14	H	174	171	-8.33	43.52	-17.38	PASS	0 / 903 MHz
176.968	26.51	23.55	H	163	195	-8.42	43.52	-19.97	PASS	4 / 909.4 MHz
321.538	28.58	27.48	H	034	104	-7.83	46.02	-18.54	PASS	4 / 909.4 MHz
347.532	26.74	25.70	H	050	132	-7.69	46.02	-20.32	PASS	7 / 914.2 MHz
381.657	30.78	26.50	H	355	099	-7.62	46.02	-19.52	PASS	7 / 914.2 MHz
387.343	31.02	29.19	H	360	100	-7.56	46.02	-16.83	PASS	7 / 914.2 MHz
389.747	31.62	27.60	H	357	242	-7.57	46.02	-18.42	PASS	7 / 914.2 MHz
392.745	28.82	25.43	H	349	100	-7.58	46.02	-20.59	PASS	7 / 914.2 MHz
393.818	26.53	26.21	H	000	103	-7.59	46.02	-19.81	PASS	0 / 903 MHz
394.721	27.36	24.94	H	014	100	-7.59	46.02	-21.08	PASS	4 / 909.4 MHz
397.274	25.17	25.65	H	188	109	-7.55	46.02	-20.37	PASS	0 / 903 MHz
397.929	31.51	29.84	H	209	100	-7.54	46.02	-16.18	PASS	7 / 914.2 MHz
410.490	29.75	25.95	H	360	252	-7.49	46.02	-20.07	PASS	7 / 914.2 MHz
443.051	27.94	25.10	H	024	184	-7.82	46.02	-20.92	PASS	0 / 903 MHz
444.872	30.55	27.73	H	032	200	-7.82	46.02	-18.29	PASS	0 / 903 MHz
455.621	24.07	23.17	V	064	231	-7.84	46.02	-22.85	PASS	4 / 909.4 MHz
458.584	24.90	24.13	V	085	219	-7.84	46.02	-21.89	PASS	4 / 909.4 MHz
585.700	24.48	23.60	V	260	100	-5.94	46.02	-22.42	PASS	0 / 903 MHz
588.894	35.09	32.21	H	342	155	-5.87	46.02	-13.81	PASS	7 / 914.2 MHz
588.938	26.82	25.20	V	296	110	-5.87	46.02	-20.82	PASS	7 / 914.2 MHz
589.018	26.84	24.19	V	301	103	-5.87	46.02	-21.83	PASS	4 / 909.4 MHz
592.762	33.80	30.50	H	336	157	-5.83	46.02	-15.52	PASS	4 / 909.4 MHz
595.682	35.81	31.40	H	360	144	-5.82	46.02	-14.62	PASS	7 / 914.2 MHz
600.532	32.39	32.09	H	359	160	-5.79	46.02	-13.93	PASS	7 / 914.2 MHz
606.889	33.49	31.80	H	005	132	-5.78	46.02	-14.22	PASS	0 / 903 MHz
909.250	9.00	28.06	V	273	190	-3.78	46.02	-17.96	PASS	4 / 909.4 MHz
909.639	10.30	29.17	H	060	110	-3.77	46.02	-16.85	PASS	4 / 909.4 MHz
914.017	8.10	27.22	V	266	120	-3.66	46.02	-18.80	PASS	7 / 914.2 MHz

**Test Results:** Spurious radiated emissions, recorded at a distance of 3 meters from the Woodstream Model V400M LoRa Radio Control Unit, in either enclosure, are below the 3 meter limit specified by FCC Section 15.209 and RSS-Gen Section 8.10 requirements by a margin of at least 13.81 dB.



#### 4.4.2 Spurious Radiated Emissions 1 to 10 GHz Test Results (10/18/2018 and 10/19/2018)

##### WOODSTREAM MODEL V400M IN THE SMALL ENCLOSURE (MODEL V450)

Frequency	Peak	Average	Polarity	TT angle	Ant Height	Correction	RSS-Gen, FCC Class	Margin	Results	Source
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	B Limit dBuV/m	dB		Channel # / MHz
1.2683	30.54	20.98	H	178	144	-11.54	53.98	-33.00	PASS	7 / 914.2
1.8057	36.49	28.35	V	103	100	-7.97	53.98	-25.63	PASS	0 / 903
1.8185	38.00	33.98	V	118	103	-7.88	53.98	-20.00	PASS	4 / 909.4
1.8284	38.72	36.24	V	239	111	-7.82	53.98	-17.74	PASS	7 / 914.2
1.8327	34.86	23.38	H	157	111	-7.79	53.98	-30.60	PASS	4 / 909.4
1.8671	32.51	23.78	H	332	210	-7.56	53.98	-30.20	PASS	7 / 914.2
1.9218	33.28	22.81	H	328	174	-7.20	53.98	-31.18	PASS	7 / 914.2
2.3967	34.25	24.63	H	027	121	-4.97	53.98	-29.35	PASS	7 / 914.2
2.4031	34.47	24.89	V	123	195	-4.94	53.98	-29.09	PASS	7 / 914.2
7.2221	48.58	42.08	V	056	162	5.97	53.98	-11.90	PASS	0 / 903
7.2235	47.64	41.45	H	049	135	5.98	53.98	-12.53	PASS	0 / 903

##### WOODSTREAM MODEL V400M IN THE LARGE ENCLOSURE (MODEL V460)

Frequency	Peak	Average	Polarity	TT angle	Ant Height	Correction	RSS-Gen, FCC Class	Margin	Results	Source
GHz	dBuV/m	dBuV/m	H/V	degrees	cm	dB	B Limit dBuV/m	dB		Channel # / MHz
1.8026	33.38	23.43	H	101	119	-7.99	53.98	-30.55	PASS	0 / 903
1.8060	39.34	31.49	V	242	109	-7.97	53.98	-22.49	PASS	0 / 903
1.8188	37.47	29.45	V	248	202	-7.88	53.98	-24.53	PASS	4 / 909.4
1.8284	40.52	33.12	V	227	114	-7.82	53.98	-20.86	PASS	7 / 914.2
2.4023	34.98	25.14	H	294	170	-4.94	53.98	-28.84	PASS	7 / 914.2
2.4092	34.72	24.70	H	037	136	-4.91	53.98	-29.28	PASS	0 / 903
2.4131	33.77	23.94	H	068	188	-4.90	53.98	-30.04	PASS	4 / 909.4
7.2245	52.17	40.23	H	001	166	5.98	53.98	-13.76	PASS	0 / 903
7.2260	48.72	40.32	V	050	154	5.99	53.98	-13.66	PASS	0 / 903

Test Results: Spurious radiated emissions, recorded at a distance of 3 meters from the Woodstream Model V400M LoRa Radio Control Unit, in either enclosure, are below the 3 meter limit specified by FCC Section 15.209 and RSS-Gen Section 8.10 requirements by a margin of at least 11.90 dB.



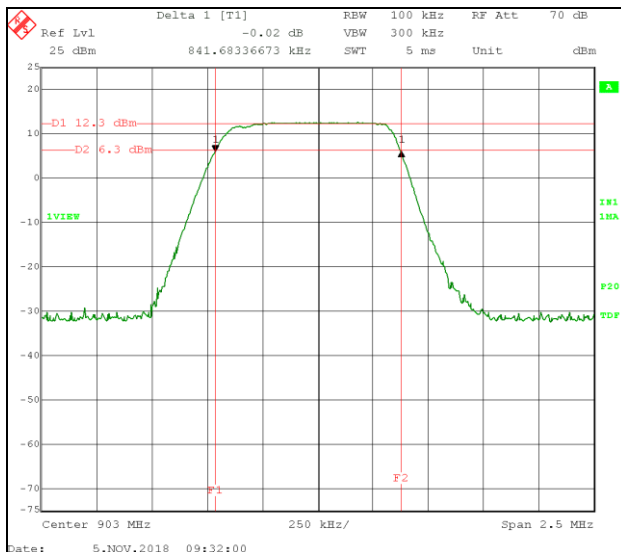
## 4.5 DTS 6 dB Occupied Bandwidth (FCC Section 15.247(a)(2) RSS-247 5.2(a))

### 4.5.1 6 dB Occupied Bandwidth – Test Procedure

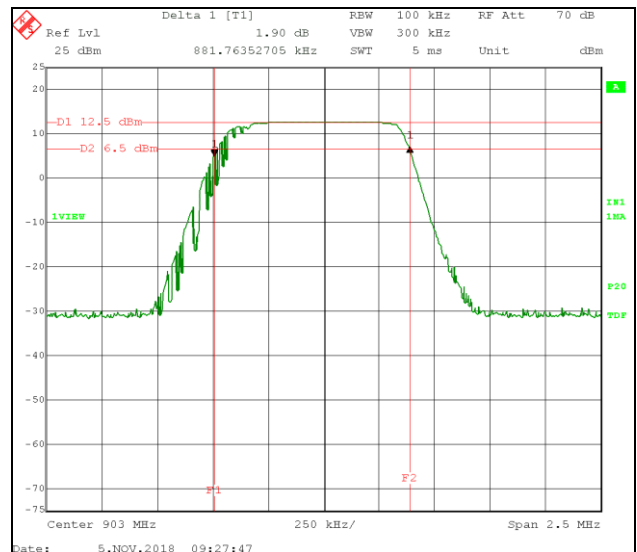
The minimum DTS (6 dB) bandwidth, specified in FCC Section 15.247(a) (2) was measured using a Spectrum Analyzer with 100 kHz resolution bandwidth and 300 kHz video bandwidth.

### 4.5.2 DTS (6 dB) Occupied Bandwidth Test Results (11/05/2018)

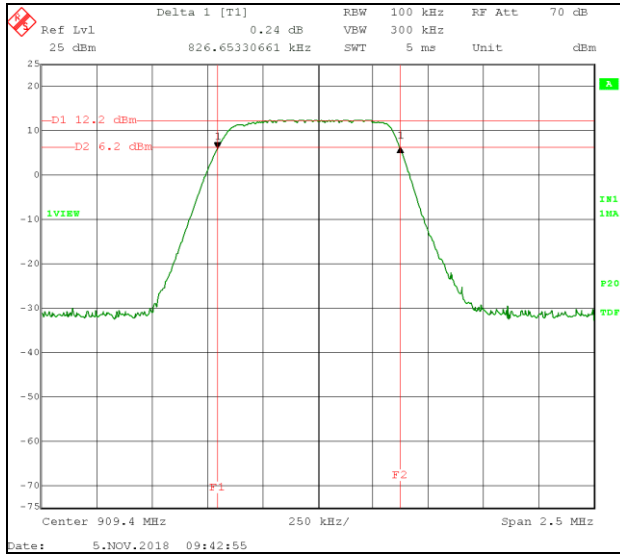
Channel	Spread Factor	Frequency	Measured 6 dB Bandwidth
		MHz	kHz
0	7	903.00	841.68
4		909.40	826.65
7		914.20	826.65
0	12	903.00	881.76
4		909.40	851.70
7		914.20	856.71



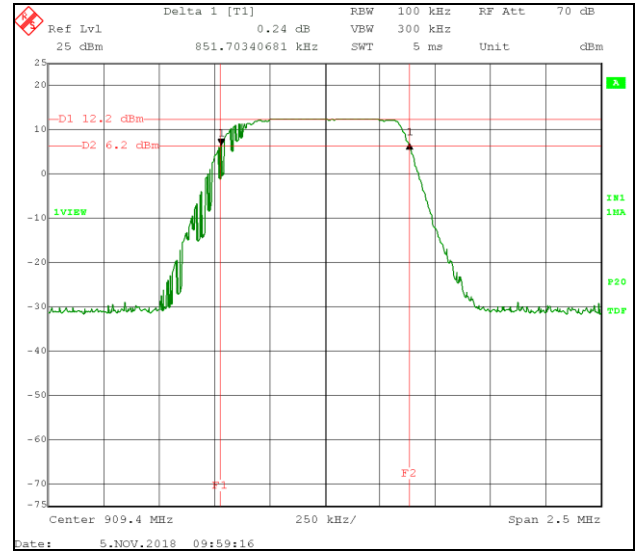
Channel 0, Spread = 7



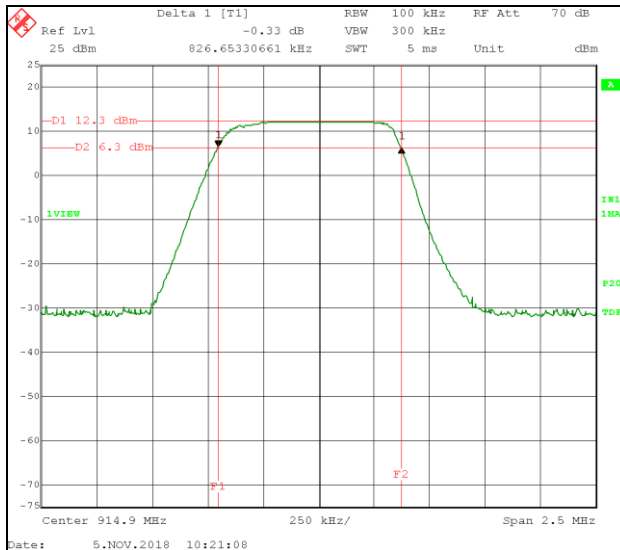
Channel 0, Spread = 12



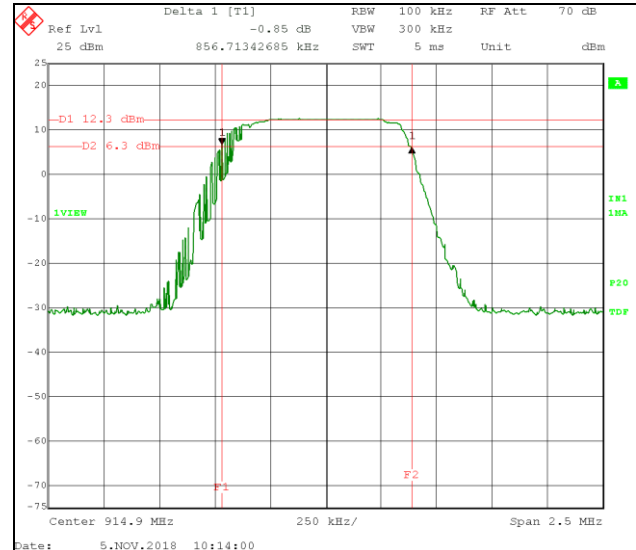
Channel 4, Spread = 7



Channel 4, Spread = 12



Channel 7, Spread = 7



Channel 7, Spread = 12

**Test Results:** The DTS, 6 dB, Occupied Bandwidth measurements for the Woodstream Model V400M LoRa Radio Control Unit were measured and used to select bandwidths and frequency spans for other radio measurements. Also, the Spread Factor of 12 produces the widest bandwidth.



## 4.6 Maximum Average and Peak Power Output and EIRP (FCC Part 15.247(b)(3), RSS-247 Section 5.4(d))

### 4.6.1 Maximum Average Power Output Test Procedure

A conducted power measurement of the output frequency was measured according to the AVGSA-1 Method of 558074 D01 DTS Meas Guidance v04. 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 4) and high (Channel 8) were measured with LoRa modulation and minimum and maximum spread factors.

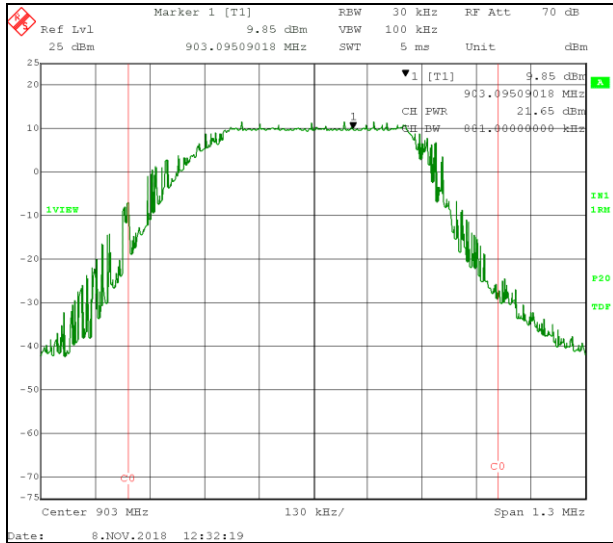
### 4.6.2 Maximum Average Power Output Test Results (11/08/2018)

Channel	LoRa Modulation Spread Factor	Frequency (MHz)	Measured Level (dBm)(Avg)	Cable # 814 Loss	Total		Limit		Margin	
					dBm	Watts	dBm	Watts	dBm	Watts
0	7	903.0	21.65	0.33	21.98	0.158	30.00	1.000	-8.02	-0.842
4		909.4	21.65	0.34	21.99	0.158	30.00	1.000	-8.01	-0.842
7		914.2	21.46	0.35	21.81	0.152	30.00	1.000	-8.19	-0.848
0	12	903.0	24.73	0.33	25.06	0.321	30.00	1.000	-4.94	-0.679
4		909.4	24.34	0.34	24.68	0.294	30.00	1.000	-5.32	-0.706
7		914.2	24.27	0.35	24.62	0.290	30.00	1.000	-5.38	-0.710

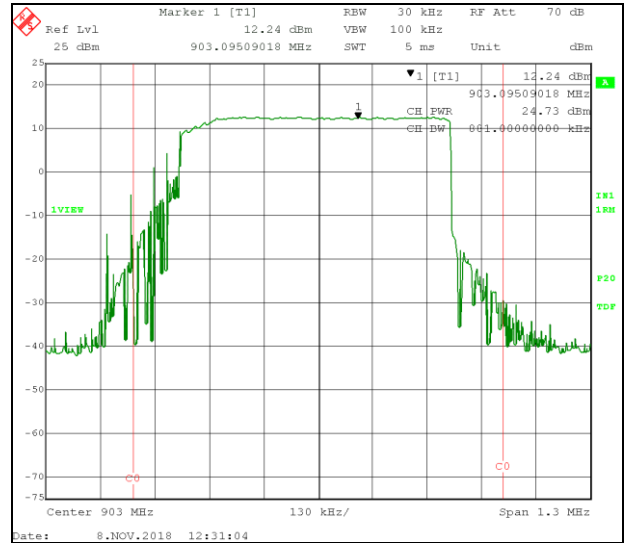
The gain of the antenna, used in the Woodstream Model V400M LoRa Radio Control Unit is 3.0 dB. Applying the antenna gain to the maximum peak transmitter output produces the following values of EIRP.

Channel	Modulation	Frequency (MHz)	Transmitter Output Total		Antenna Gain		EIRP			
			dBm	Watts	Isotropic	Numeric	Total		Limit	Margin
							dBm	Watts	Watts	Watts
0	None	903.0	12.71	0.019	3.00	1.995	15.71	0.038	4.00	-3.962
4		909.4	12.24	0.017	3.00	1.995	15.24	0.034	4.00	-3.966
7		914.2	11.85	0.015	3.00	1.995	14.85	0.030	4.00	-3.970
0	LoRa SF = 7	903.0	12.98	0.020	3.00	1.995	15.98	0.040	4.00	-3.960
4		909.4	12.47	0.018	3.00	1.995	15.47	0.036	4.00	-3.964
7		914.2	12.35	0.017	3.00	1.995	15.35	0.034	4.00	-3.966
0	LoRa SF = 12	903.0	13.48	0.022	3.00	1.995	16.48	0.044	4.00	-3.956
4		909.4	12.25	0.017	3.00	1.995	15.25	0.034	4.00	-3.966
7		914.2	12.01	0.016	3.00	1.995	15.01	0.032	4.00	-3.968

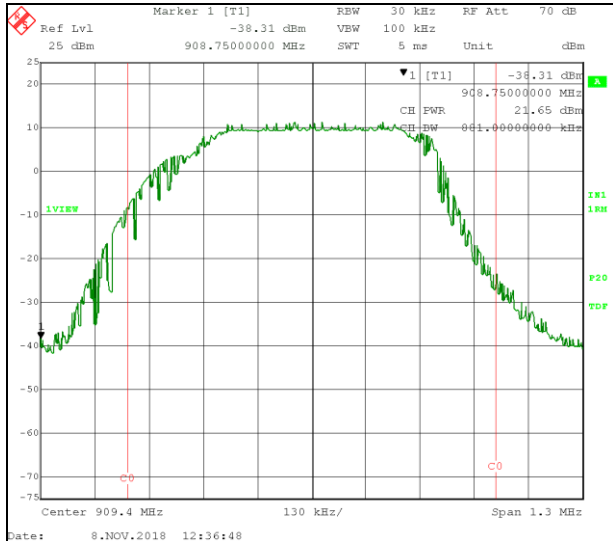
The results in the above table show compliance to the ISED requirements. Below are the spectrum analyzer screens of the average output power measurements.



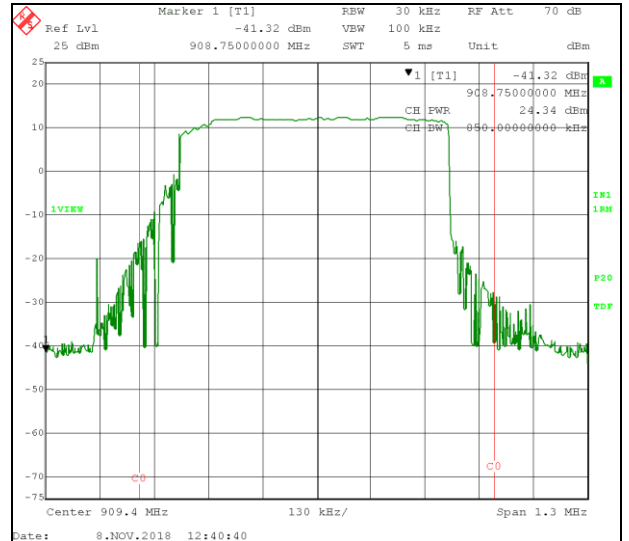
Channel 0, Spread Factor = 7



Channel 0, Spread Factor = 12

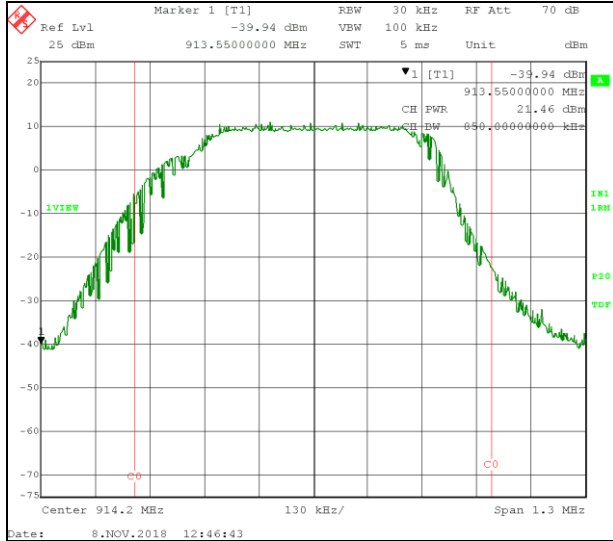


Channel 4, Spread Factor = 7



Channel 4, Spread Factor = 12





Channel 7, Spread Factor = 7



Channel 7, Spread Factor = 12

Test Results: The Average Power Output measurements for the Woodstream Model V400M LoRa Radio Control Unit are compliant with the limits specified in FCC Section 15.247(b)(3). The Spread Factor of 12 produces the greatest output level.

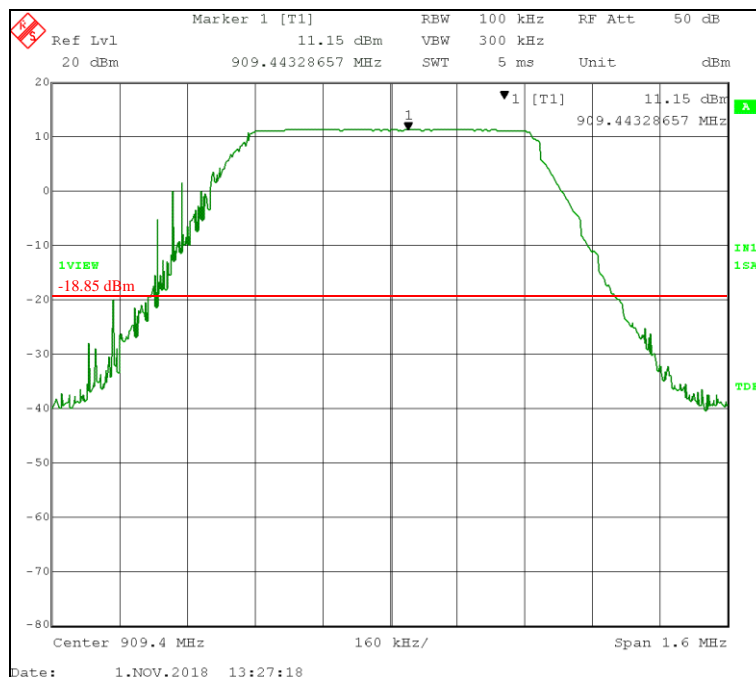


## 4.7 Antenna Conducted Spurious Emissions (FCC Section 15.247(d), RSS-247 Sec.5)

### 4.7.1 Antenna Conducted Spurious Emissions Test Procedure

A conducted power measurement of the output frequency was measured for to low (Channel 0), middle (Channel 4) and high (Channel 7). The signal output was maximized with modulation. Three Frequency Sections were examined in the range of 30 to 1000 MHz and 1 to 10 GHz. 558074 D01 DTS Meas Guidance v04 advises to use the Power Spectral Density results to determine which carrier frequency to use to determine the Reference Level for the Spurious conducted emissions test. The middle frequency of 909.4 MHz showed the highest PSD level by .15 dB. Therefore, 909.4 is the reference level shown below.

### 4.7.2 Antenna Conducted Spurious Emissions 30 dB Reference. (11/01/2018)

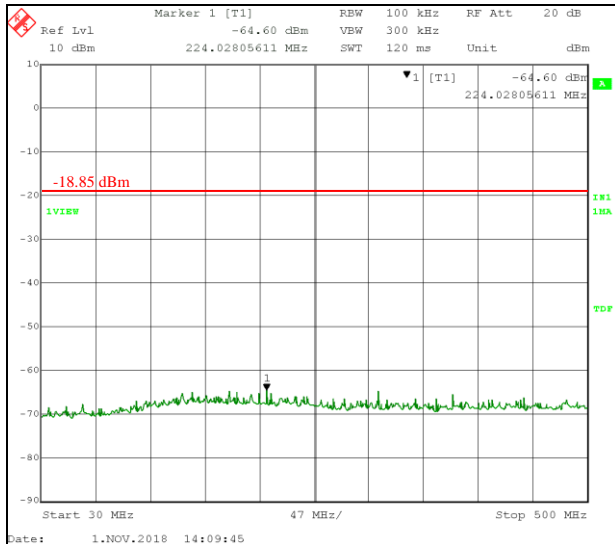


The peak level of 11.15 dBm is the maximum peak output of the Woodstream Model V400M LoRa Radio Control Unit. The conducted spurious emissions from the antenna port must be 30 dB down from this peak. The resultant limit is therefore -18.85 dBm. This limit is displayed on the plots below.

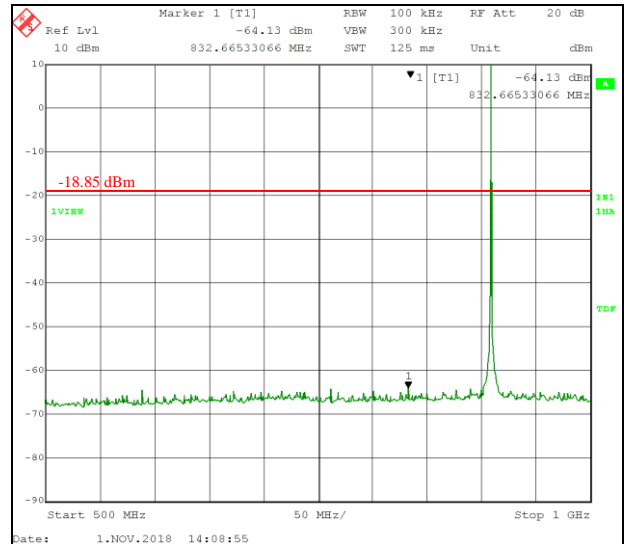


### 4.7.3 Antenna Conducted Spurious Emissions Test Results (11/01/2018)

#### Frequency Range: 30 MHz to 1000 MHz

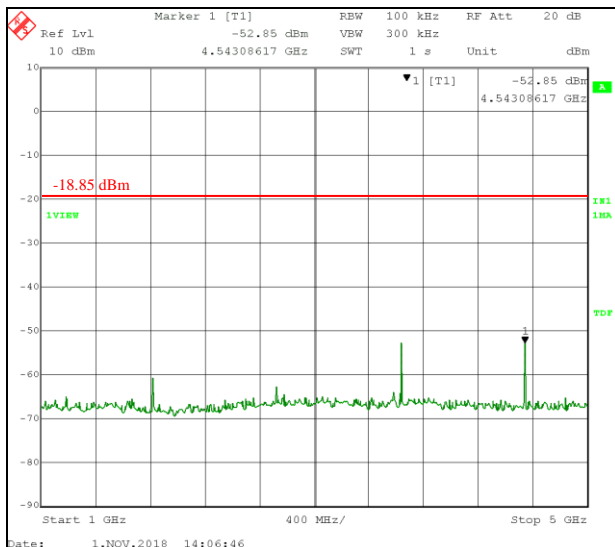


Channel 4, 909.4 MHz, 30 – 500 MHz

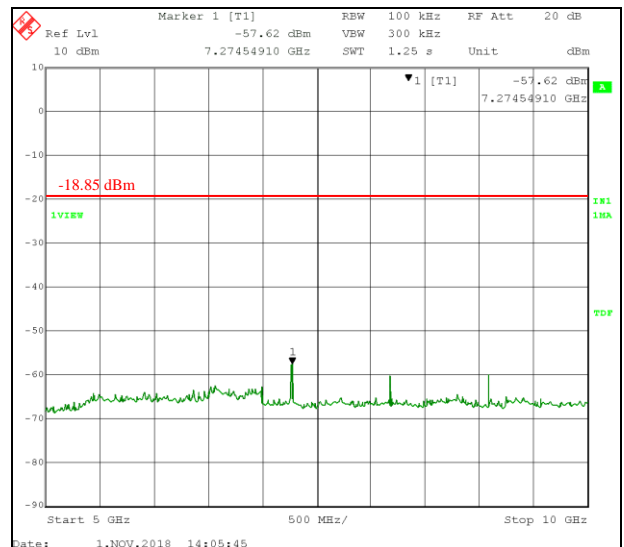


Channel 4, 909.4 MHz, 500 – 1000 MHz

#### Frequency Range: 1 to 10 GHz



Channel 4, 909.4 MHz, 1 – 5 GHz



Channel 4, 909.4 MHz, 5 – 10 GHz

**Test Results:** The Antenna Conducted Spurious Emissions of the Woodstream Model V400M LoRa Radio Control Unit are below the carrier -30 dB limit and therefore compliant with the limits specified in FCC Section 15.247(d).



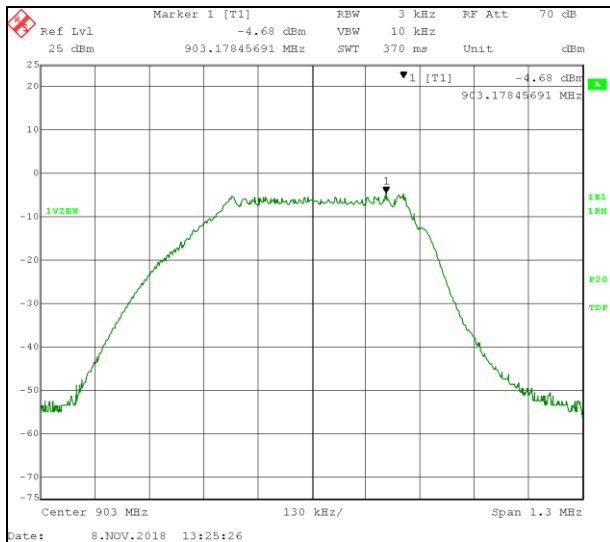
## 4.8 Power Spectral Density (FCC Section 15.247(e), RSS-247 Section 5.2(b))

### 4.8.1 Power Spectral Density Test Procedure

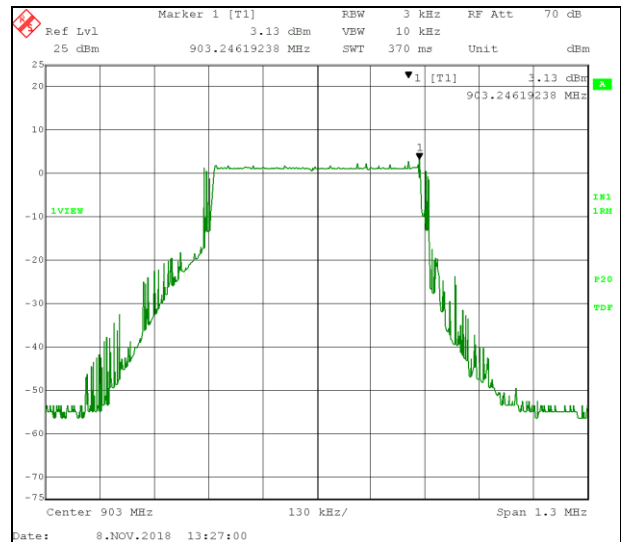
A conducted, average, power measurement of the output frequency was measured for the Woodstream V400M for each of the low (Channel 0), middle (Channel 4) and high (Channel 7). The signal output was maximized with LoRa modulation. Since the Method AVGSA-1 was used to measure output power, method AVGPS-1 with 3 KHz bandwidth, was used to measure Power Spectral Density.

### 4.8.2 Power Spectral Density Test Results (11/08/2018)

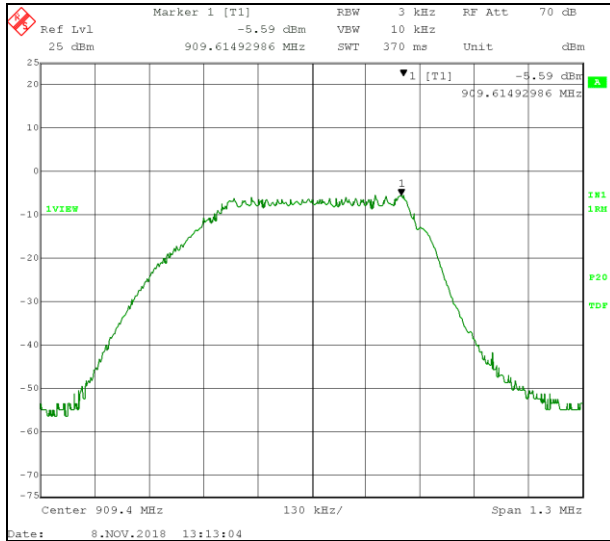
Channel	LoRa Modulation Spread Factor	Frequency (MHz)	Measured Level (dBm)	Cable # 814 Loss (dB)	Total	Limit	Margin
					dBm	dBm	dBm
0	7	903.0	-4.68	0.33	-4.35	8.00	-12.35
4		909.4	-5.59	0.34	-5.25	8.00	-13.25
7		914.2	-5.44	0.35	-5.09	8.00	-13.09
0	12	903.0	3.13	0.33	3.46	8.00	-4.54
4		909.4	2.98	0.34	3.32	8.00	-4.68
7		914.2	1.74	0.35	2.09	8.00	-5.91



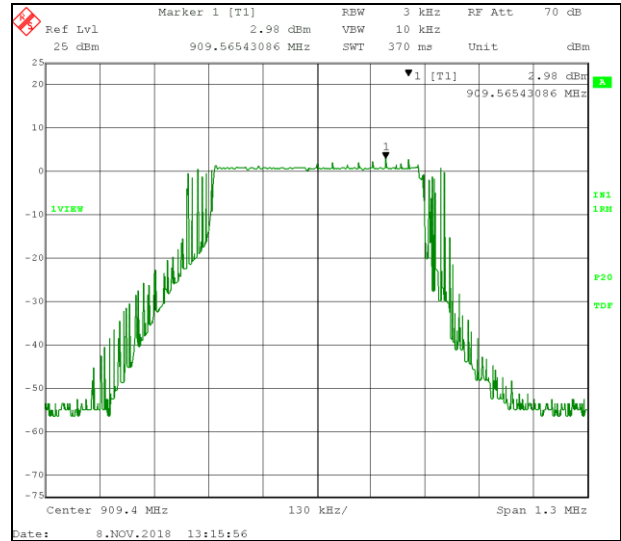
Channel 0, Spread Factor = 7



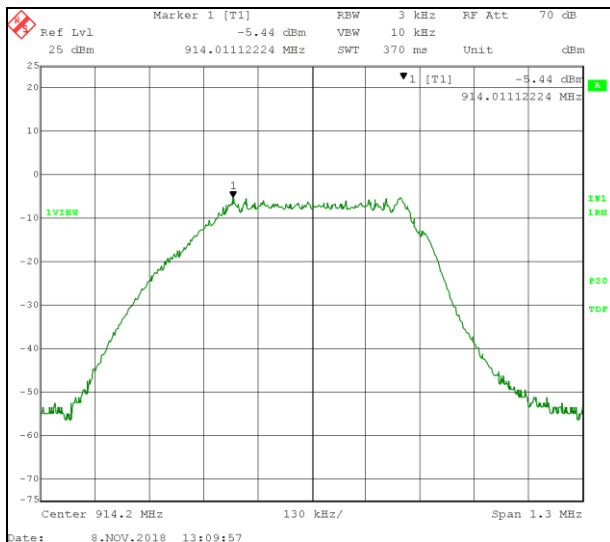
Channel 0, Spread Factor = 12



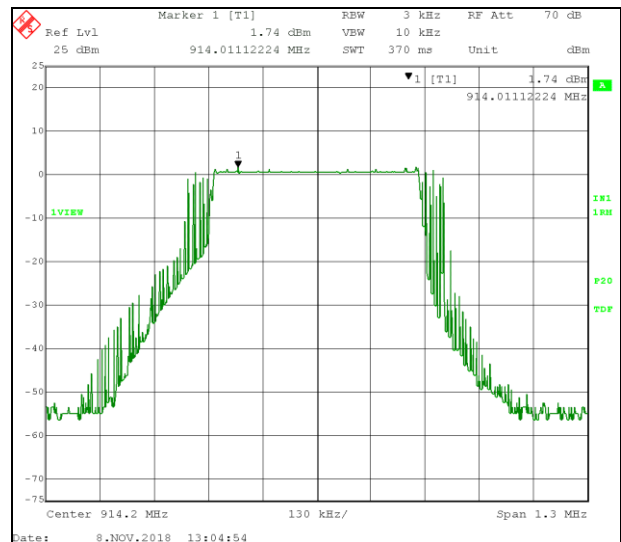
Channel 4, Spread Factor = 7



Channel 4, Spread Factor = 12



Channel 7, Spread Factor = 12



Channel 7, Spread Factor = 7

**Test Results:** The Power Spectral Density measurements of the Woodstream Model V400M LoRa Radio Control Unit are compliant with the limits specified in FCC Section 15.247(e).



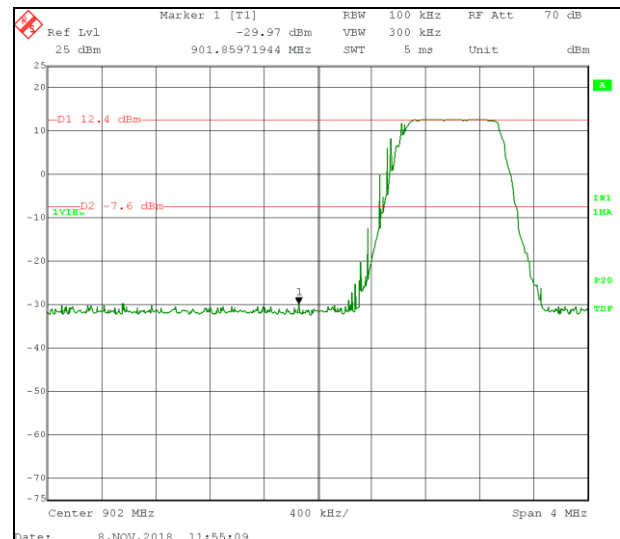
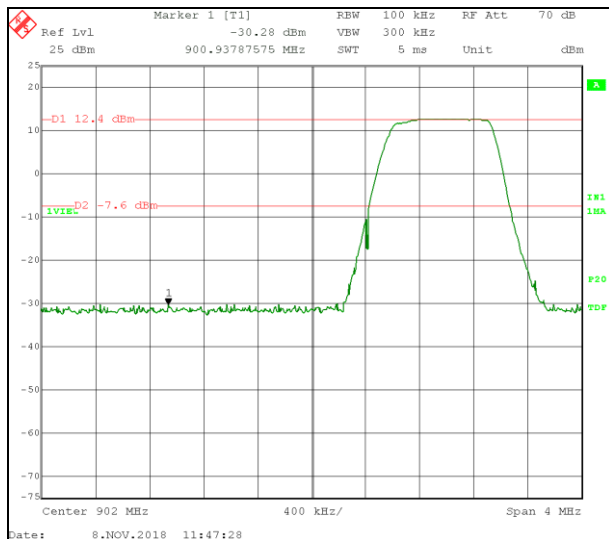
## 4.9 Band Edge Measurement (FCC Part 15.247(d), RSS-247 5.5)

### 4.9.1 Band Edge Measurement Test Procedure

Band edge measurements were recorded on the EUT while operating with a modulated carrier at 903 MHz (Channel 0). This frequency is the emission that falls within 2 MHz of the lower band edge of the operating bandwidth of the device. The measurement procedure used was the conducted output power method, where the antenna output port of the EUT was connected to the receiver input port for direct measurement.

### 4.9.2 Band Edge Measurement Test Results (11/08/2018)

Channel	LoRa Modulation Spread Factor	Frequency (MHz)	Fundamental Peak	Band-edge Peak Level	Delta	Limit	Margin
			dBm	dBm	dB	dB	dB
0	7	903.0	12.4	-30.28	42.68	20	22.68
7		914.2	Band-edge measurement not required; highest channel is 914.2 MHz, not within 2 MHz of upper band frequency of 928 MHz				
0	12	903.0	12.4	-29.97	42.37	20	22.37
7		914.2	Band-edge measurement not required; highest channel is 914.2 MHz, not within 2 MHz of upper band frequency of 928 MHz				



**Test Results:** The Band Edge measurements of the Woodstream Model V400M LoRa Radio Control Unit LoRa Radio Control Unit are compliant with the limits specified in FCC Section 15.247(d).



## 5.0 Test Setup Pictures

### 5.1 Antenna Conducted Measurements Test Setup Picture Model V400M



### 5.2 Radiated Emissions Test Setup Pictures

#### Small Enclosure (Model V450 With Model V400M) 30 – 1000 MHz Test Setup

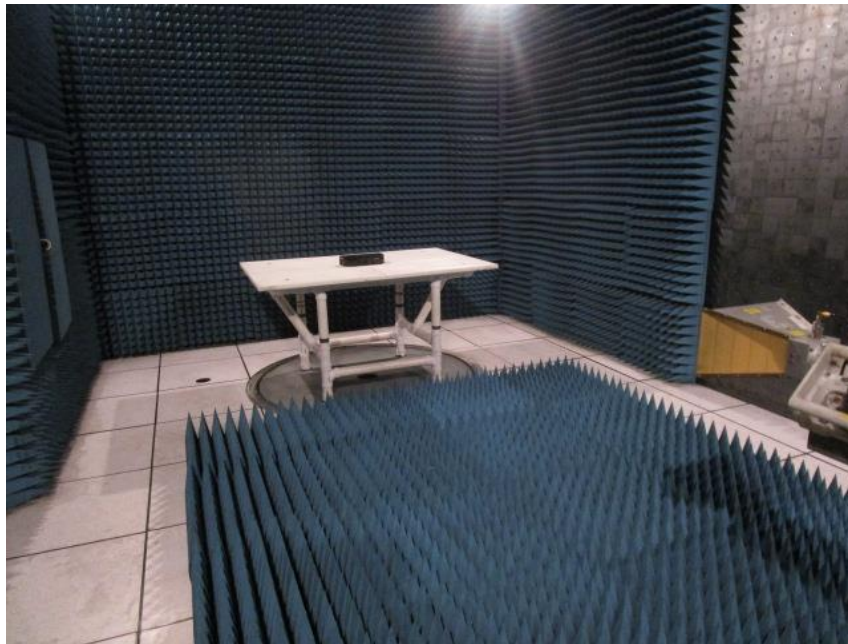




**Large Enclosure (Model V460 With Model V400M) 30 – 1000 MHz Test Setup**



**Small Enclosure (Model V450 With Model V400M) 1 – 10 GHz Test Setup**







## Large Enclosure (Model V460 With Model V400M) 1 – 10 GHz Test Setup





## 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	07/01/16	3 Years	07/01/19
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A022108	712	06/26/18	2 Years	06/26/20
9kHz-3GHz EMC Analyzer	Agilent	E7402A	US39440162	883	02/27/18	3 Years	02/27/21
Antenna (30 MHz - 6 GHz)	Sunol Sciences	JB6	A020714	882	05/16/18	2 Years	05/16/20
Amplifier (.09 – 1300 MHz)	Hewlett Packard	8447F	3313A06658	807	01/18/17	2 Years	01/18/19
EMC Analyzer (9 kHz - 1.8 GHz)	Hewlett Packard	8593EM	3710A00214	1026	03/02/17	2 Years	03/02/19
Amplifier System (0.5 – 50 GHz)	Hewlett Packard	83015A 83017A	3123A00360 & 3332A00219	1027	10/14/18	2 Years	10/14/20
Double Ridged Horn Antenna (1 - 18 GHz)	Eaton	3115	2113	836	12/16/15	3 Years	12/16/18
Shielded Room #1	ETS Lindgren	12-2/2-0	4078	859	05/17/18	2 Years	05/17/20
OATS Site (30 MHz – 1 GHz)	BEC	N/A	N/A	705	05/16/18	1 Year	05/16/19
Intentional Radiator Testing High Frequency RF Test Cable	Workhorse	WHU18- 3636-036	N/A	814	12/29/16	2 Years	12/29/18



Temp/Humidity Meter	Control Company	4096	151872672	780	07/14/17	2 Years	07/14/19
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