Excellence in Compliance Testing

Certification Test Report

FCC ID: QZC-REXU
IC: 4557A-REXU

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-247

ACS Report Number: 15-0255.W04.1A

Manufacturer: Elster Electricity, LLC.
Model: REXU

Test Begin Date: July 27, 2015
Test End Date: July 27, 2015

Report Issue Date: September 3, 2015

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

Reviewed by:

Kirby Munroe
Director, Wireless Certifications
ACS, Inc.

This report contains 14 pages

TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-247 Certification for a class II permissive change.

The purpose of this permissive change is to add an external whip antenna to the originally certified 900 MHz radio.

The antenna included in this filing is not directly connected to the REXU module, but instead is connected to the host utility meter via a passive coupler. The passive coupler is equipped with a coax cable that is terminated in a type N connector. The type N connector is mounted to a circular ground plane and connected to the antenna described in this filing.

1.2 Product description

The REXU module is a Printed Circuit Board Assembly (PCBA) that forms a complete electricity meter when installed in a housing and meter base.

The REXU contains (1) 900 MHz LAN frequency hopping spread spectrum radio and (1) 2.4 GHz direct sequence spread spectrum Zigbee radio. This report addresses the new antenna/host with respect to the 900 MHz LAN radio only.

Technical Information:
The model REXU provides 4 distinct frequency hopping modes of operation as outlined below.

Mode	Frequency Range (MHz)	Modulation	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
1	902.4 - 927.6	FSK	64	400	50, 200
2	902.4 - 927.6	FSK	25	400	35.5, 142
3	902.3 - 927.8	FSK	86	300	9.6, 19.2, 38.4, 115.2
4	904.0 - 927.9	FSK	240	100	9.6, 19.2, 38.4

Modulation Format: FSK
Antenna Type / Gain: Embedded Slot Antenna / 4.07dBi gain (Module)
Antenna Type / Gain: Patch Antenna (External Adhesive Patch Coupler) – New to C2PC
Antenna Type / Gain: Omni Whip Antenna / 5dBi gain (External) – New to C2PC
Operating Voltage: 18Vdc

Manufacturer Information:
Elster Solutions, LLC
208 S. Rogers Lane
Raleigh, NC 27610

EUT Serial Numbers: 5D25984G1413 0 1152501804

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated. The data presented in this report represents the worst case where applicable.

The EUT was evaluated in a FM2S Electric Utility Meter (model: ZHCW2A000L0S) in an orientation representative of final installation.

Mode 1 software power setting during test: 89
Mode 2 software power setting during test: 44 (Low Channel), 38 (Middle Channel), 34 (High Channel)
Mode 3 - 4 software power setting during test: 89 (Low Channel), 81 (Middle Channel), 75 (High Channel)

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200612-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 511277
Industry Canada Lab Code: IC 4175A
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 – 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 – 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

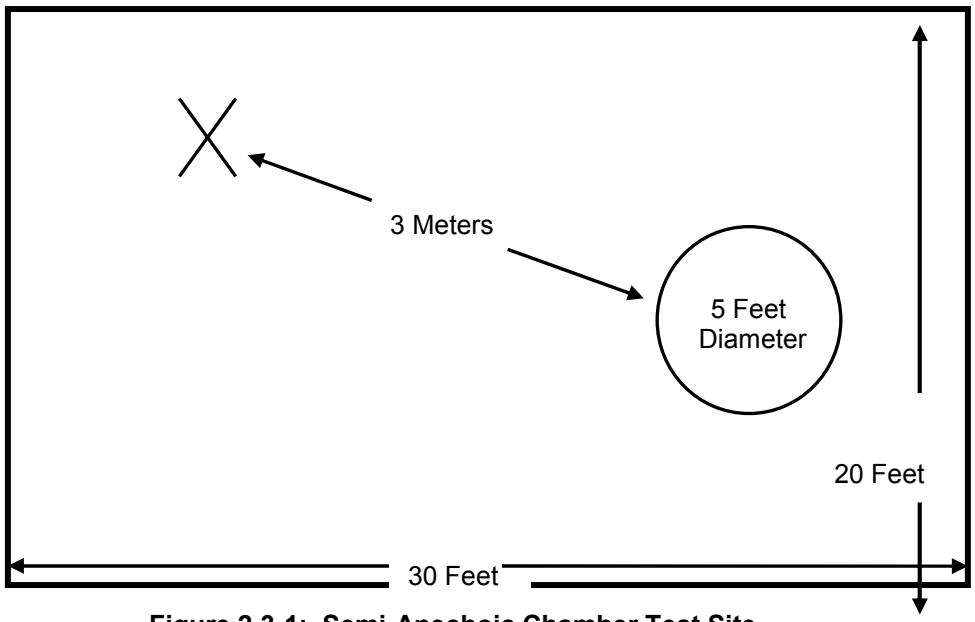


Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 – 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 – 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

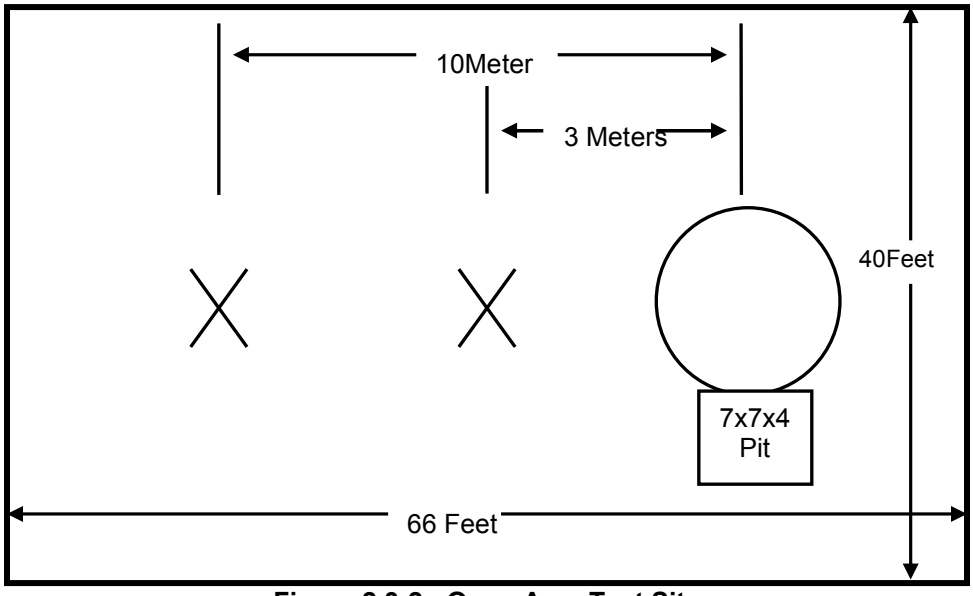


Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 2.4-1:

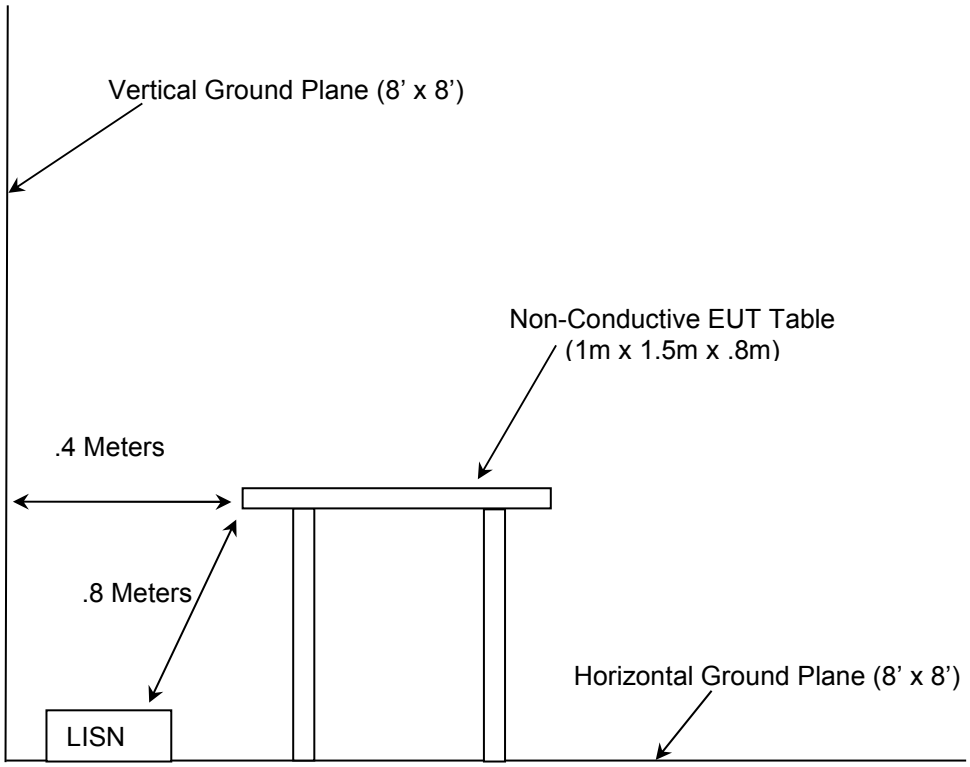


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2015
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- Industry Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

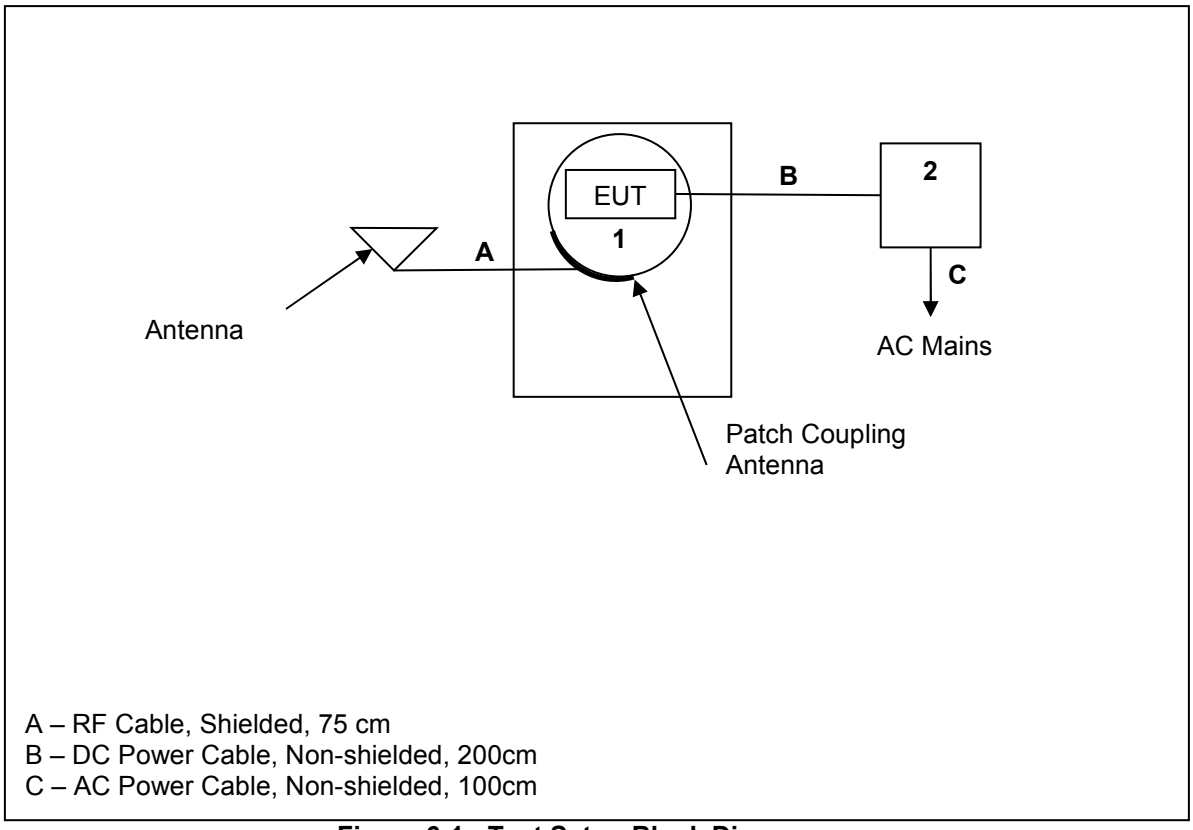
AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
1	Rohde & Schwarz	ESMI - Display	Spectrum Analyzers	833771/007	7/14/2015	7/14/2016
2	Rohde & Schwarz	ESMI-Receiver	Spectrum Analyzers	839587/003	7/14/2015	7/14/2016
30	Spectrum Technologies	DRH-0118	Antennas	970102	4/30/2015	4/30/2017
40	EMCO	3104	Antennas	3211	2/10/2015	2/10/2017
73	Agilent	8447D	Amplifiers	2727A05624	7/15/2015	7/15/2016
167	ACS	Chamber EMI Cable Set	Cable Set	167	10/28/2014	10/28/2015
292	Florida RF Cables	480.0-SMR	Cables	None	3/3/2015	3/3/2016
337	Microwave Circuits	H1G513G1	Filters	282706	5/20/2015	5/20/2016
338	Hewlett Packard	8449B	Amplifiers	3008AD01111	7/30/2013	8/30/2015
412	Electro Metrics	LPA-25	Antennas	1241	7/24/2014	7/24/2016
422	Florida RF	SMR	Cables	805	11/5/2014	11/5/2015
616	Florida RF Cables	SMRE	Cables	N/A	9/10/2014	9/10/2015

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	FM2S Electric Utility Meter	Elster Electricity, LLC.	ZHCW2A000L0S	15 770 617
2	DC Power Supply	Hewlett Packard	E3630A	KR64308603

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



A – RF Cable, Shielded, 75 cm
B – DC Power Cable, Non-shielded, 200cm
C – AC Power Cable, Non-shielded, 100cm

Figure 6-1: Test Setup Block Diagram

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The external antenna is coupled to the EUT antenna via a passive coupling patch antenna attached to the host device. This antenna is not directly connected to the EUT. The external antenna is an omni-directional whip antenna with a maximum gain of +5dBi. Professional installation is utilized.

7.1.1 Radiated Spurious Emissions - FCC 15.205, 15.209; IC RSS-210 2.2, RSS-Gen 8.9/8.10

7.1.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous modulated carrier on the hopping channel.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

Radiated spurious emissions were evaluated for all combinations of operating modes and data rates with worst case data provided.

7.1.1.2 Measurement Results

Table 7.1.1.2-1: Radiated Spurious Emissions Tabulated Data – Mode 1

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2707.2	48.27	38.97	H	-4.56	43.71	34.41	74.0	54.0	30.3	19.6
2707.2	49.17	40.84	V	-4.56	44.61	36.28	74.0	54.0	29.4	17.7
3609.6	51.94	45.82	H	-1.30	50.64	44.52	74.0	54.0	23.4	9.5
3609.6	50.72	43.72	V	-1.30	49.42	42.42	74.0	54.0	24.6	11.6
Middle Channel										
2748	48.22	39.09	V	-4.41	43.81	34.68	74.0	54.0	30.2	19.3
3664	49.44	39.73	H	-1.11	48.33	38.62	74.0	54.0	25.7	15.4
3664	49.18	39.17	V	-1.11	48.07	38.06	74.0	54.0	25.9	15.9
High Channel										
2782.8	47.12	36.25	H	-4.29	42.83	31.96	74.0	54.0	31.2	22.0
2782.8	46.18	35.89	V	-4.29	41.89	31.60	74.0	54.0	32.1	22.4
3710.4	47.22	36.45	H	-0.94	46.28	35.51	74.0	54.0	27.7	18.5
3710.4	48.59	39.17	V	-0.94	47.65	38.23	74.0	54.0	26.3	15.8

Table 7.1.1.2-2: Radiated Spurious Emissions Tabulated Data – Mode 2

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2707.2	46.23	35.16	H	-4.56	41.67	30.60	74.0	54.0	32.3	23.4
2707.2	46.41	35.36	V	-4.56	41.85	30.80	74.0	54.0	32.1	23.2
3609.6	48.21	36.25	H	-1.30	46.91	34.95	74.0	54.0	27.1	19.1
Middle Channel										
2748	57.88	51.44	H	-4.41	53.47	47.03	74.0	54.0	20.5	7.0
2748	57.22	50.72	V	-4.41	52.81	46.31	74.0	54.0	21.2	7.7
3664	46.13	34.93	H	-1.11	45.02	33.82	74.0	54.0	29.0	20.2
3664	46.15	34.75	V	-1.11	45.04	33.64	74.0	54.0	29.0	20.4
4580	51.64	42.04	H	0.85	52.49	42.89	74.0	54.0	21.5	11.1
4580	48.34	38.54	V	0.85	49.19	39.39	74.0	54.0	24.8	14.6
High Channel										
3710.4	47.78	35.84	H	-0.94	46.84	34.90	74.0	54.0	27.2	19.1
3710.4	47.12	35.54	V	-0.94	46.18	34.60	74.0	54.0	27.8	19.4

Table 7.1.1.2-3: Radiated Spurious Emissions Tabulated Data – Mode 3 - 4

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2707.2	47.04	37.32	H	-4.56	42.48	32.76	74.0	54.0	31.5	21.2
2707.2	49.23	43.06	V	-4.56	44.67	38.50	74.0	54.0	29.3	15.5
Middle Channel										
2748	47.50	39.25	H	-4.41	43.09	34.84	74.0	54.0	30.9	19.2
2748	48.11	40.74	V	-4.41	43.70	36.33	74.0	54.0	30.3	17.7
High Channel										
No emissions detected above the noise floor of the measurement system.										

Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 48.27 - 4.56 = 43.71dBuV/m
Margin: 74dBuV/m – 43.71dBuV/m = 30.3dB

Example Calculation: Average

Corrected Level: 38.97 - 4.56 - 0 = 34.41dBuV
Margin: 54dBuV – 34.41dBuV = 19.6dB

8 CONCLUSION

In the opinion of ACS, Inc. the REXU, manufactured by Elster Solutions, LLC meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-247.

END REPORT