Excellence in Compliance Solutions

Class II Permissive Change Wireless Test Report

FCC ID: QZC-ELIR1
IC: 4557A-ELIR1

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

ACS Report Number: 16-3066.W06.1A

Manufacturer: Elster Solutions, LLC
Model: ELIR1

Test Begin Date: October 4, 2016
Test End Date: October 10, 2016

Report Issue Date: October 26, 2016

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code AT-1921

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

Prepared by:

Randle Sherian
Lab Manager - RTP
Advanced Compliance Solutions, Inc.

Reviewed by:

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

This report contains 12 pages

TABLE OF CONTENTS

1 GENERAL

1.1 Purpose

The purpose of this Class II Permissive Change report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and ISED Canada's Radio Standards Specification RSS-247 Certification due to a capacitor value change in the antenna path which increased the gain of the antenna.

1.2 Product description

The Elster Model ELIR1 wireless light control module contains a frequency hopping spread spectrum (FHSS) radio operating in the 902-928 MHz ISM frequency band. The ELI NIC (Elster Lighting Intelligence Network Interface Card) PCB is installed on top of the Logic PCB. These two PCBs are combined on top of an additional PCB that controls power functions. These boards together form the model ELIR1 module which can be mounted on a light fixture to form a complete setup. Installations of the module can compromise part of an Advanced Metering Infrastructure (AMI) system that utilized a proprietary network architecture and protocol devised by Elster Electricity LLC, referred to here as the Energy Axis (EA) network.

Technical Information:

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
FHSS	902.4 – 927.6	25	400kHz	18*, 142.22

*Note: 18kbps is Manchester encoded, which appears as 35.56kbps.

Modulation Format: FSK
Antenna Type / Gain: Integral omni-directional Inverted-F/ 3.3dBi
Operating Voltage: 90VAC – 480VAC
Test Firmware Version Identification Number: 253.16
Test Power Output Setting: 17(Hexadecimal)

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

EUT Serial Number: 15

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

1.3 Test Methodology and Considerations

Based on the antenna gain increase due to the capacitor change, output power and radiated spurious measurements were evaluated for the Energy Axis (EA) radio. The lowest and highest data rate was evaluation for both output power and radiated spurious emissions. The worst case was the highest data rate (142.22kbps). The radiated spurious emissions documented in this report represent the worst case.

2 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 381-4235

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1921 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC and Innovation, Science and Economic Development (ISED) Canada.

FCC Registered Test Site Number: 637011
ISED Canada Test Site Registration Number: 20446

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm 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 short #6 copper wire. 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 turntable. 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.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase 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:

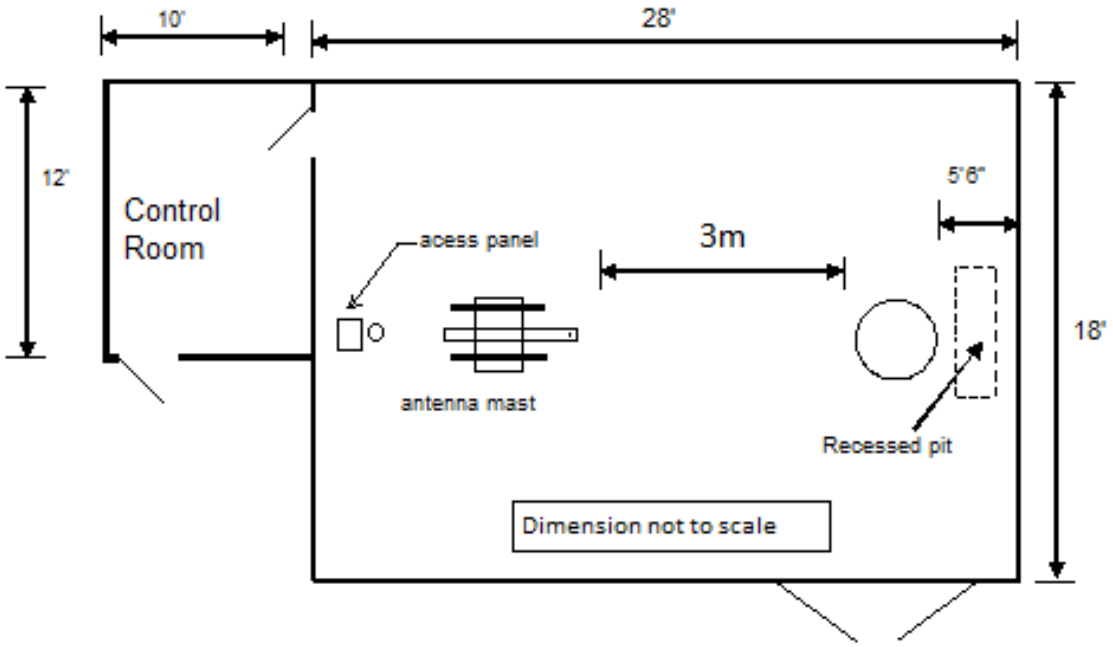

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8’ x 10’ sheet galvanized steel horizontal ground reference plane (GRP) bonded every 6” to an 8’ X 8’ aluminum vertical ground plane.

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

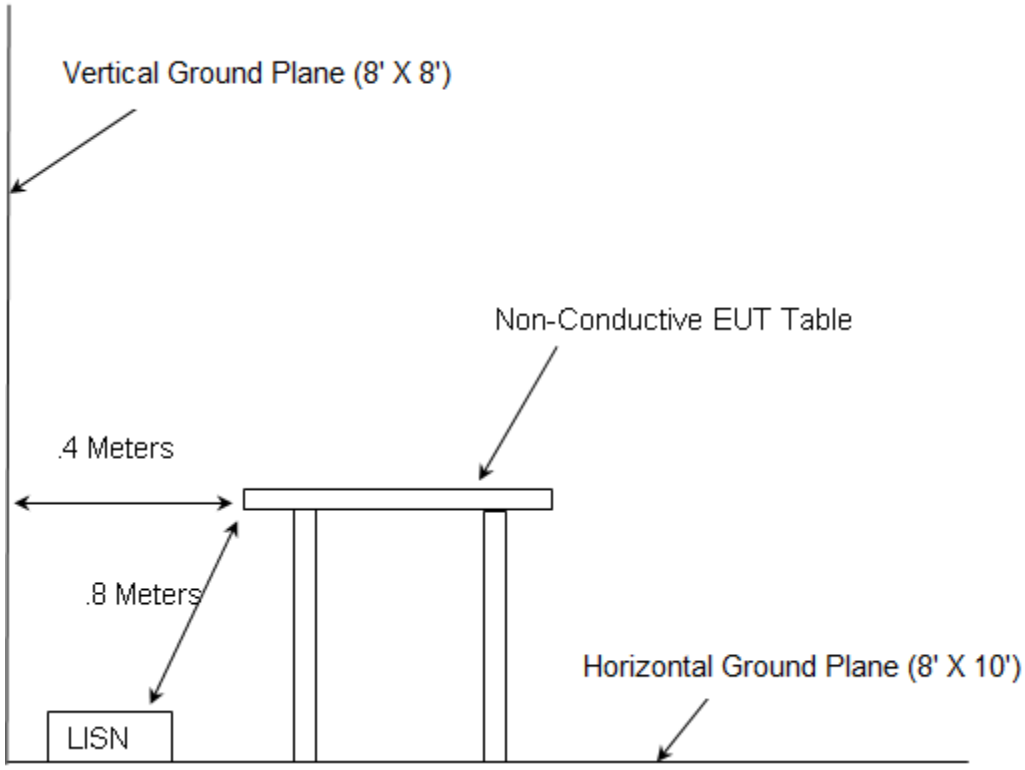

Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014 - American National Standard for Methods of Measurement of Radio-Noise Emissions from low-voltage electrical and electronic equipment in the range of 9kHz to 40 GHz.
- 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, 2016
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- ISED Canada Radio Standards Specification: RSS-247, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, Nov 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

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
277	EMCO	93146	Antennas	9904-5199	9/12/2016	9/12/2018
626	EMCO	3110B	Antennas	9411-1945	2/29/2016	2/28/2017
3002	Rohde & Schwarz	ESU40	Receiver	100346	1/8/2016	1/8/2017
3006	Rohde & Schwarz	TS-PR18	Amplifiers	122006	6/29/2015	12/29/2016
3012	Rohde & Schwarz	EMC32-EB	Software	100731	8/2/2016	2/2/2017
3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antennas	2013120203	1/26/2016	1/26/2018
3029	Micro-Tronics	HPM50108	Filter	134	12/21/2015	12/21/2016
3036	Hasco, Inc.	HLL142-S1-S1-24	Cables	2450	1/7/2016	1/7/2017
3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	12/22/2015	12/22/2016
3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	12/22/2015	12/22/2016
3041	Aeroflex Inmet	18N10W-30	Cable Set	1447	1/8/2016	1/8/2017
3042	Aeroflex Inmet	18N10W-10	Cable Set	1444	1/8/2016	1/8/2017
3046	Aeroflex Inmet	26AH-10	Attenuator	1443	1/6/2016	1/6/2017
3055	Rohde & Schwarz	3005	Cables	3055	12/30/2015	12/30/2016

DMAS MT-25 RF absorber material was used on the floor for all final measurements above 1 GHz.
NCR = No Calibration Required
Firmware Version: ESU40 is 4.73 SP4
Software Version: EMC32-B is 9.15

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	Elster	ELIR1	15
2	Laptop	HP	8440P	13200
3	Programming Board	Elster	Debug Board	None
4	Power Supply	GlobTek, Inc	WR9Q43750LC PNKIT	None
A	Power	220cm	No	1 to Power
B	USB	50cm	Yes	2 to 3
C	Power	50cm	No	3 to 4

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

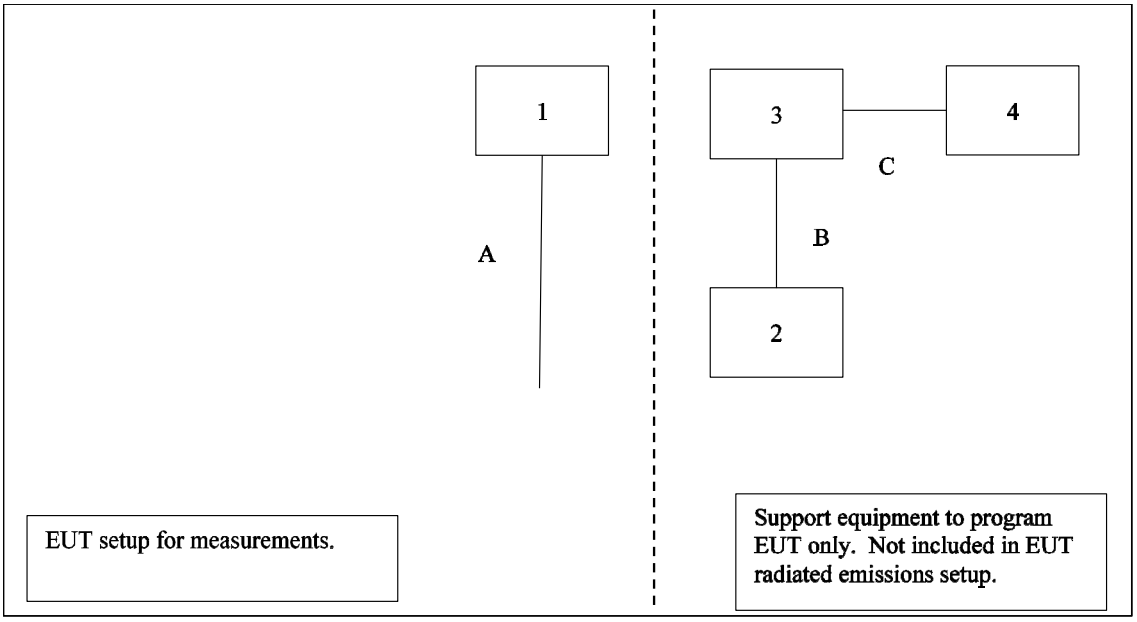

Figure 6-1: Test Setup Block Diagram

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 antenna is an integral antenna. Therefore, the connector meets the requirements of 15.203.

7.2 Peak Output Power - FCC 15.247(b)(2) ISED Canada: RSS-247

7.2.1 Measurement Procedure (Conducted Method)

The RF output port of the EUT was directly connected to the input of a power meter. The device employs 25 channels therefore the power is limited to 0.25 Watt.

7.2.2 Measurement Results

Table 7.2.2-1: RF Output Power – 18 kbps Data Rate

Frequency [MHz]	Level [dBm]
902.4	22.42
914.8	22.03
927.6	21.18

Table 7.2.2-2: RF Output Power – 142.22 kbps Data Rate

Frequency [MHz]	Level [dBm]
902.4	22.51
914.8	22.05
927.6	21.24

7.3 Radiated Spurious Emissions - FCC 15.205, 15.209; ISED Canada RSS-247, RSS-Gen 8.9/8.10

7.3.1.1 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 average emissions were further corrected by applying the duty cycle correction of the EUT for comparison to the average limit.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

Both data rates were evaluated and the worst case was 142.22kbps and was reported below.

7.3.1.2 Duty Cycle Correction

The Duty Cycle Correction was not required.

7.3.1.3 Measurement Results

Table 7.3.1.3-1: Radiated Spurious Emissions Tabulated Data

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	44.10	36.40	H	0.08	44.18	36.48	74.0	54.0	29.8	17.5
2707.2	43.70	36.70	V	0.08	43.78	36.78	74.0	54.0	30.2	17.2
Middle Channel										
2744.4	42.20	34.60	H	0.26	42.46	34.86	74.0	54.0	31.5	19.1
2744.4	43.60	37.10	V	0.26	43.86	37.36	74.0	54.0	30.1	16.6
High Channel										
2782.8	41.60	32.70	H	0.44	42.04	33.14	74.0	54.0	32.0	20.9
2782.8	42.30	34.60	V	0.44	42.74	35.04	74.0	54.0	31.3	19.0

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: 44.10 + 0.08 = 44.18dBuV/m
Margin: 74dBuV/m – 44.18dBuV/m = 29.82dB

Example Calculation: Average

Corrected Level: 36.70 + 0.08 - 0 = 36.78dBuV
Margin: 54dBuV – 36.78dBuV = 17.22dB

8 CONCLUSION

In the opinion of ACS, Inc. the ELIR1, manufactured by Elster Solutions, LLC meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247.

END REPORT