



EMC TEST REPORT

Report Number: 101624281ATL-004b

Project Number: G101624281

Report Issue Date: June 30, 2014

Product Designation: GoWow Load Controller

Standards: CFR47 FCC Part 15 Subpart B:2014 Section 15.107, 15.109
Industry Canada RSS-GEN Issue 3 December 2010

Tested by:
Intertek Testing Services NA, Inc.
1950 Evergreen Blvd, Suite 100
Duluth, GA 30096 USA

Client:
Levven Electronics Ltd.
9741 54 Avenue
Edmonton AB T6E 5J4
Canada

Report prepared by

Mary Sampson/Senior Project Engineer

Report reviewed by

Bryan Taylor/CE Team Leader

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	
4	Description of Equipment Under Test	
5	System Setup and Method	
6	Receiver Spurious Radiated Emissions (CFR47 FCC Part 15 Subpart B:2014 Section 15.109 Industry Canada RSS-GEN Issue 3 December 2010, Section 6.1)	Pass
7	AC Mains Conducted Emissions	Pass
8	Revision History	

3 Client Information

This EUT was tested at the request of:

Client: Levven Electronics Ltd.
9741 54 Avenue
Edmonton AB T6E 5J4
CAN
Contact: Jim Qualie
Telephone: (780) 391-3004
Fax: Not provided
Email: jqualie@levven.com

4 Description of Equipment Under Test

Manufacturer: Levven Automation Inc
9741-54th Ave NW
Edmonton, AB T6E 5J4
Canada

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Controller	Levven Automation Inc	Load Controller	Intertek Assigned ID: ATL1405221559-004

Receive Date:	05/22/2014
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

The Controller is an action component that receives commands from remote switches and takes action accordingly. It is installed in the junction box to a lighting fixture connected with phase, neutral and control wires. It does not transmit any signals. The switch to controller can be point to point (one switch controlling one controller) or multi point to multi point (multi switches signaling one or more controllers).

Equipment Under Test Power Configuration			
Rated Voltage	Maximum Load	Rated Frequency	Number of Phases
120 Vac	600 W	60 Hz	1

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Continuous Receive mode

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	When powered on, the EUT enters an infinite loop to continuously monitor button actions and wireless signal receiving. If there is an event happened, such as a button pressed or a new wireless package received, it goes to related handling processes to take action or to give response.

5 System Setup and Method

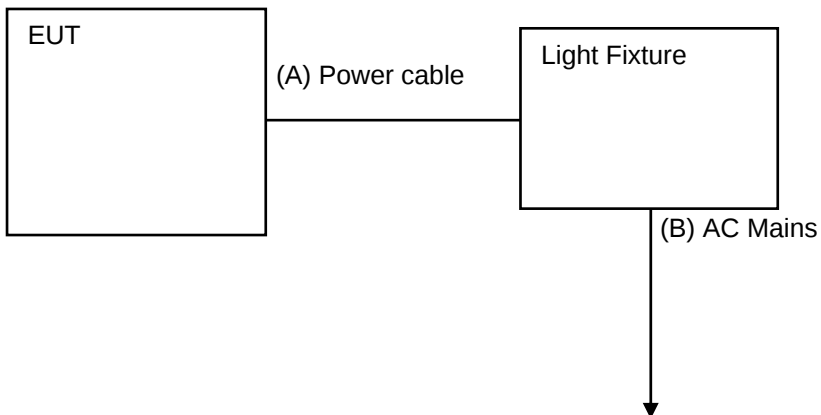
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
A	Power Cable	.1	No	No	Light Fixture
B	Power Cable	1.9	No	No	AC Mains

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Light Fixture	None known	None known	None known

5.1 Method:

Configuration as required by ANSI C63.4-2009, CFR47 FCC Part 15 Subpart B:2014 Section 15.107, 15.109, and Industry Canada RSS-GEN Issue 3 December 2010.

5.2 EUT Block Diagram:



6 Receiver Spurious Radiated Emissions

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15 Subpart B:2014 Section 15.109 and Industry Canada RSS-GEN Issue 3 December 2010, Section 6.1.

TEST SITE: 10m Semi-Anechoic Chamber

10 Meter Semi-Anechoic Chamber The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

Measurement Uncertainty

For radiated emissions, U_{lab} (3.9 dB at 3m and 3.6 dB at 10m below 1 GHz, and 4.2 dB at 3m above 1 GHz) $< U_{CISPR}$ (5.2 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200162;	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014
MP-HF-1	Cable, 3-meters, 1-18GHz	Megaphase	EM18-N1N1-119	12090601001	07/17/2013	07/17/2014
ST-5;	7m Cable, 0.01-18GHz	Storm Products Co.	A81-0303-275.6	121-07-002	08/05/2013	08/05/2014
BOX-HORN1;	Antenna, Horn, <18 GHz	EMCO	3115	9512-4632	09/10/2013	09/10/2014
211386;	Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	2622	12/12/2013	12/12/2014
T006217;	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
213191;	Preamplifier, 1-26 GHz	Hewlett Packard	8449B	3008A00989	01/14/2014	01/14/2015
211122;	Multimeter	Fluke	87	62920248	11/06/2013	11/06/2014
MP3;	Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/08/2014	05/08/2015
E208;	RF Coax Cable	Megaphase	TM18-N1N1-120	14065201-002	05/08/2014	05/08/2015
E209;	RF Coax Cable	Megaphase	TM18-N1N1-120	14065201-003	05/08/2014	05/08/2015
200082;	Preamplifier, 20MHz to 2GHz, 30 dB	A.H. Systems	PAM-0202	203	10/22/2013	10/22/2014

Software Utilized:

Name	Manufacturer	Version
Tile	Quantum Change	3.4.K.22

6.3 Results:

The sample tested was found to Comply.

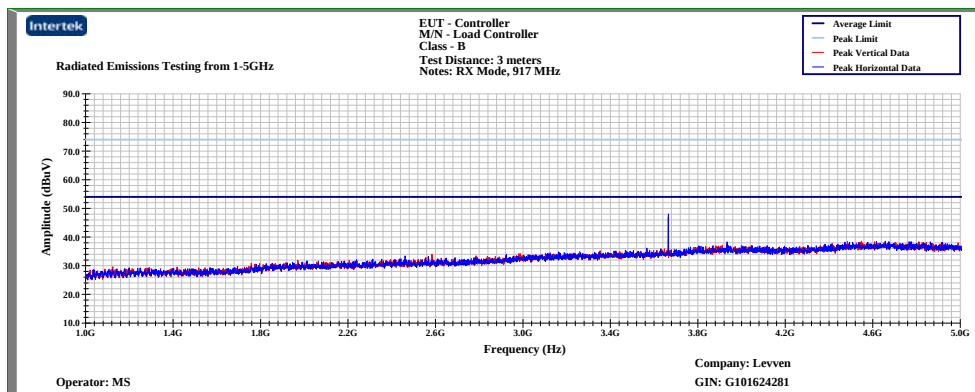
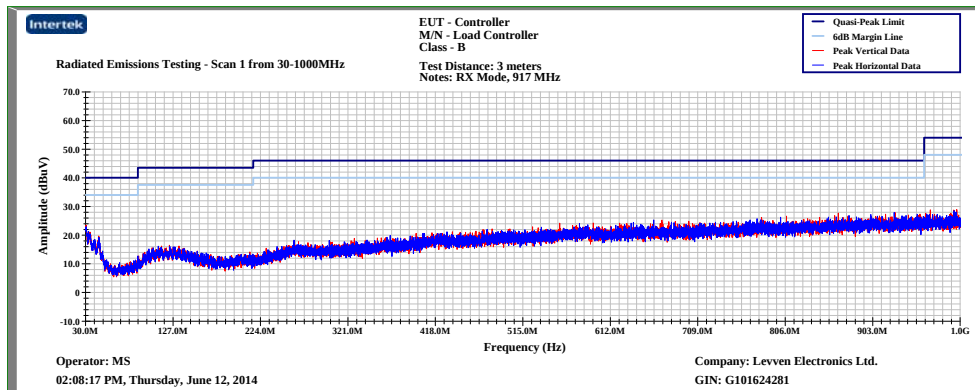
FCC 15.109 and RSS-GEN Section 6.1

Frequency of Emission (MHz)	Field Strength (microvolts/m)
30-88	100
88-216	150
216-960	200
Above 960	500

6.4 Setup Photographs:

The picture can be found in a different document, Test Setup Photos.

6.5 Plots/Data:



Client: Levven Electronics Ltd.
Model Number: Load Controller
Project Number: G101624281
Tested By: MS
Date: 6/2/14

Receiver: R&S ESU 40
Antenna: EMCO 3115
Cables: ST-5+MP-HF-1
Preamplifier: HP8449B- 213191

Frequency Range (MHz): 30-5000
Input power: 120Vac/60Hz

Test Distance (m): 3
Limit: FCC15 Class B-3m

Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Net dB(uV/m)	3m Limit dB(uV/m)	Margin dB	Detectors / Bandwidths Det/RBW/VBW
H	2460.382	49.6	28.3	2.5	35.6	44.8	74.0	-29.2	PK/1M/3M
H	2461.427	47.7	28.3	2.5	35.6	42.9	54.0	-11.1	AVG/1M/3M
V	2584.784	49.1	28.6	2.5	35.6	44.7	74.0	-29.3	PK/1M/3M
V	2580.379	36.3	28.6	2.5	35.6	31.9	54.0	-22.1	AVG/1M/3M
H	3566.231	48.0	31.1	3.1	35.4	46.8	74.0	-27.2	PK/1M/3M
H	3568.189	35.8	31.1	3.1	35.4	34.7	54.0	-19.3	AVG/1M/3M
H	3636.004	47.7	31.4	3.1	35.2	47.0	74.0	-27.0	PK/1M/3M
H	3936.146	35.1	32.5	3.4	34.8	36.2	54.0	-17.8	AVG/1M/3M
V	4546.099	48.5	32.6	3.8	35.1	49.8	74.0	-24.2	PK/1M/3M
V	4546.665	36.2	32.6	3.8	35.1	37.5	54.0	-16.5	AVG/1M/3M
H	4657.320	48.6	32.8	3.9	35.1	50.1	74.0	-23.9	PK/1M/3M
H	4654.340	36.3	32.7	3.9	35.1	37.9	54.0	-16.1	AVG/1M/3M
Calculations		G=C+D+E-F		I=G-H					

Test Personnel: Mary Sampson *MTS*
 Supervising/Reviewing Engineer: _____
 (Where Applicable) N/A
 Product Standard: FCC 15.109, RSS-GEN
 Input Voltage: 120 Vac, 60Hz
 Pretest Verification w/ Ambient Signals or BB Source: BB Source

Test Date: 6/12/2014
 Limit Applied: See Section 6.3
 Ambient Temperature: 23°C
 Relative Humidity: 48%
 Atmospheric Pressure: 978 mbars

Deviations, Additions, or Exclusions: None

7 AC Mains Conducted Emissions

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15 Subpart B:2014 Section 15.107 and Industry Canada RSS-GEN Issue 3 December 2010, Section 7.2.4.

TEST SITE: 10m Semi-Anechoic Chamber

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

10 Meter Semi-Anechoic Chamber The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096. It is a 10 meter semi-anechoic chamber manufactured by Panashield. Embedded in the floor is a 3 meter diameter turntable.

Measurement Uncertainty

For conducted emissions, U_{lab} (2.8 dB in worst case) $< U_{CISPR}$ (3.6 dB), which is the reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
T006217;	THDX	Oregon Scientific	BA888	NSN	12/11/2013	12/11/2014
E210;	RF Coax Cable	Megaphase	TM18-N1N1-120	14065201-003	05/08/2014	05/08/2015
MP1;	Cable MP1, 18 GHz, N, 394 inches	Megaphase	G919-NKNK-310	MP1	11/07/2013	11/07/2014
MP3;	Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/08/2014	05/08/2015
213150;	Line Input Stabilization Network (LISN)	Com-Power	LI-215A	191968	04/08/2014	04/08/2015
200162;	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	11/21/2013	11/21/2014
213047;	Multimeter	Fluke	87	65290209	01/09/2014	01/09/2015

Software Utilized:

Name	Manufacturer	Version
Tile	Quantum Change	3.4.K.22

7.3 Results:

The sample tested was found to Comply.

FCC 15.107 and RSS-GEN Section 7.2.4

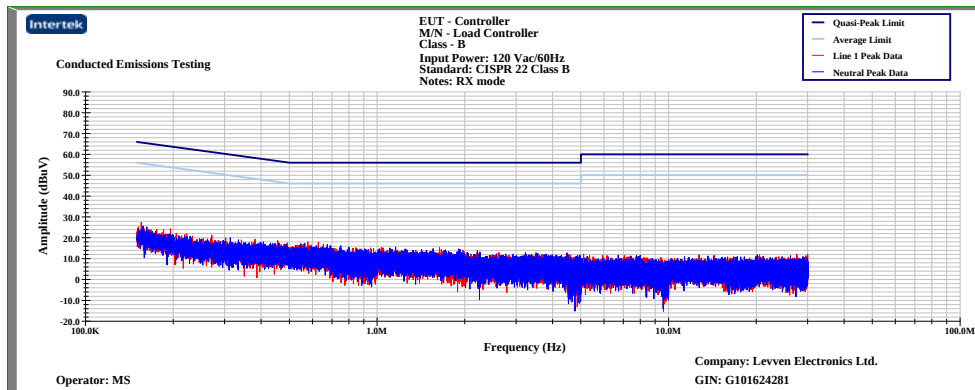
Frequency (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

7.4 Setup Photographs:

The picture can be found in a different document, Test Setup Photos.

7.5 Plots/Data:



Client: Levven Electronics Ltd.
Model Number: Load Controller
Project Number: G101624281
Tested By: MS
Date: 6/17/14
Frequency Range (MHz): .15 to 30
Input power: 120Vac/60Hz

Receiver: R&S ESU 40
Cables: MP1+MP3+E-210
LISN 1: 213150 Line 1
LISN 2: 213150 Line 2

Limit: CISPR Class B

Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I
LISN Number 1,2	Detector (P,QP, A)	Frequency MHz	Reading dBuV	Cable Loss dB	LISN Ins. Loss dB	Net dBuV	Limit dBuV	Margin dB
1	QP	0.152	18.1	0.0	0.1	18.2	66.0	-47.8
1	A	0.152	11.2	0.0	0.1	11.3	56.0	-44.7
1	QP	0.155	17.7	0.0	0.1	17.8	65.7	-47.9
1	A	0.155	10.8	0.0	0.1	10.9	55.7	-44.8
1	QP	0.159	17.4	0.0	0.1	17.5	65.7	-48.2
1	A	0.159	10.5	0.0	0.1	10.6	55.7	-45.1
1	QP	0.175	15.7	0.0	0.1	15.8	64.7	-48.9
1	A	0.175	9.0	0.0	0.1	9.1	54.7	-45.6
1	QP	0.185	14.9	0.0	0.1	15.0	64.3	-49.3
1	A	0.185	8.1	0.0	0.1	8.2	54.3	-46.1
1	QP	0.195	14.8	0.0	0.1	14.9	63.8	-48.9
1	A	0.195	8.3	0.0	0.1	8.4	53.8	-45.4
2	QP	0.152	18.2	0.0	0.1	18.3	66.0	-47.7
2	A	0.152	11.3	0.0	0.1	11.4	56.0	-44.6
2	QP	0.152	18.2	0.0	0.1	18.3	66.0	-47.7
2	A	0.152	11.3	0.0	0.1	11.4	56.0	-44.6
2	QP	0.155	17.7	0.0	0.1	17.8	65.7	-47.9
2	A	0.155	10.9	0.0	0.1	11.0	55.7	-44.7
2	QP	0.158	17.5	0.0	0.1	17.6	65.7	-48.1
2	A	0.158	10.6	0.0	0.1	10.7	55.7	-45.0
2	QP	0.162	17.0	0.0	0.1	17.1	65.5	-48.4
2	A	0.162	10.1	0.0	0.1	10.2	55.5	-45.3
2	QP	0.165	16.7	0.0	0.1	16.8	65.2	-48.4
2	A	0.165	9.9	0.0	0.1	10.0	55.2	-45.2
Calculations		G=D+E+F		I=G-H				

Note: Peak measurements are compared to the average limit.

Test Personnel: Mary Sampson *MTS*
 Supervising/Reviewing Engineer:
 (Where Applicable) N/A
 Product Standard: FCC 15.107, RSS-GEN
 Input Voltage: 120Vac, 60 Hz Battery, 3V

Test Date: 6/17/2014

Limit Applied: See Section 7.3

Ambient Temperature: 23°C

Relative Humidity: 47 %

Atmospheric Pressure: 987 mbars

Deviations, Additions, or Exclusions: None

8 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	6/30/14	101624281ATL-004b	MS	BT	Original Issue