Excellence in Compliance Testing

Certification Test Report

FCC ID: Z9O-92053007
IC: 10060A-92053007

FCC Rule Part: 15.209
ISED Canada Radio Standards Specification: RSS-210

ACS Report Number: 16-2077.W06.1A

Manufacturer: Ecolab Inc.
Model(s): 92053007

Test Begin Date: **December 1, 2016**
Test End Date: **December 6, 2016**

Report Issue Date: January 12, 2017

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

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.

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This report contains 14 pages

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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 Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

1.2 Product Description

The Ecolab Inc. model 92053007 is installed in NEXA soap/sanitizer dispenser to monitor and report dispenser activations by user. Users are identified by a badge that they wear. The device includes 3 distinct radios operating at 125 kHz, 433.9 MHz and 2405 MHz respectively.

Technical Details
Frequency of Operation: 126 kHz
Number of Channels: 1
Modulation: OOK
Data Rate: 1.2 kbps
Antenna: Ferrite Core Coil Antenna
Input Voltage: 3 VDC (Size AA Battery)

Manufacturer Information:
Ecolab, Inc.
370 Wabasha St N
St. Paul, MN 55102

Test Sample Serial Number(s): ACS#3

Test Sample Condition: The device was provided in good operating condition without any noticeable physical defects.

1.3 Test Methodology and Considerations

The EUT was evaluated for radiated emissions for the 125 kHz transmitter. The evaluation of the 433 MHz and 2405 MHz transceivers as well as the assessment to the unintentional emissions requirements are documented in separate test reports.

The device is battery operated only without any provision for connection to the AC mains. The device is exempted from the power line conducted emissions requirements. The RF output power setting of the device for the evaluation was not configurable and was not provided.

The device was evaluated for radiated emissions in the orientation of typical installation. The 125 kHz transmitter does not transmit simultaneously with the 433 MHz and 2405 MHz co-located transmitters.

2 TEST FACILITIES

2.1 Location

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

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
ISED Canada Lab Code: 4175C

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-1533 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.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

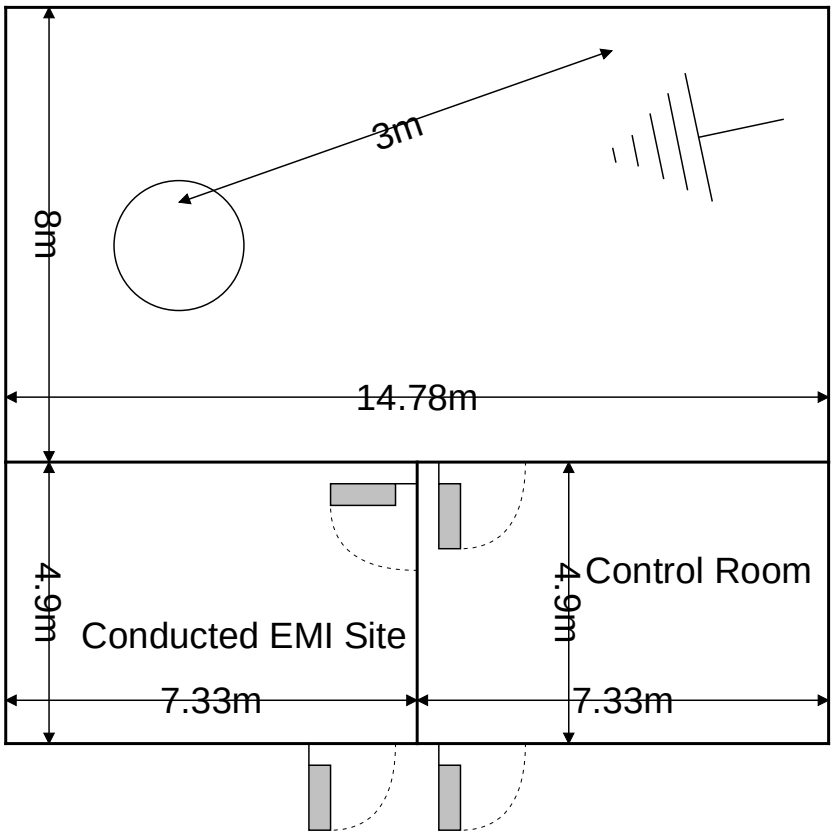

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

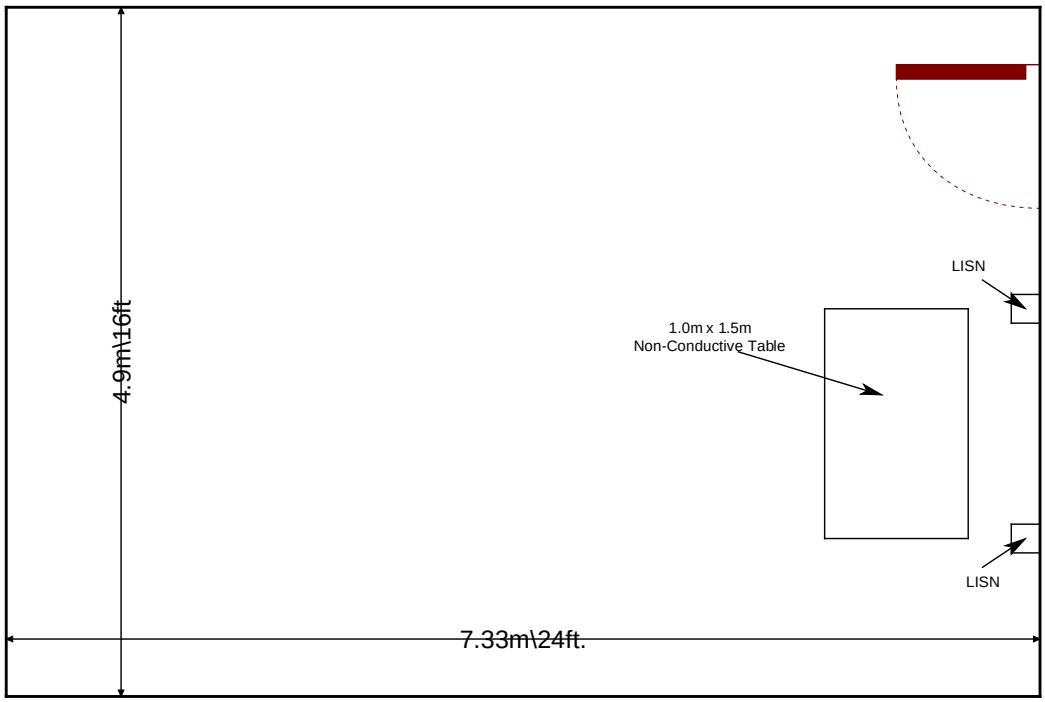

Figure 2.3.2-1: AC Mains Conducted EMI Site

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, 2016.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.
- Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-210 - Licence-Exempt Radio Apparatus: Category I Equipment, Issue 9 August 2016.

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
78	EMCO	6502	Antennas	9104-2608	5/11/2016	5/11/2018
486	Hewlett Packard	8591E	Analyzers	3543A04709	7/12/2016	7/12/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/2/2016	11/2/2017
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/1/2016	8/1/2017

NCR=No Calibration Required

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Ecolab Inc.	92053007	ACS#3

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
	The device is standalone with no provision for connection to accessory equipment			

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

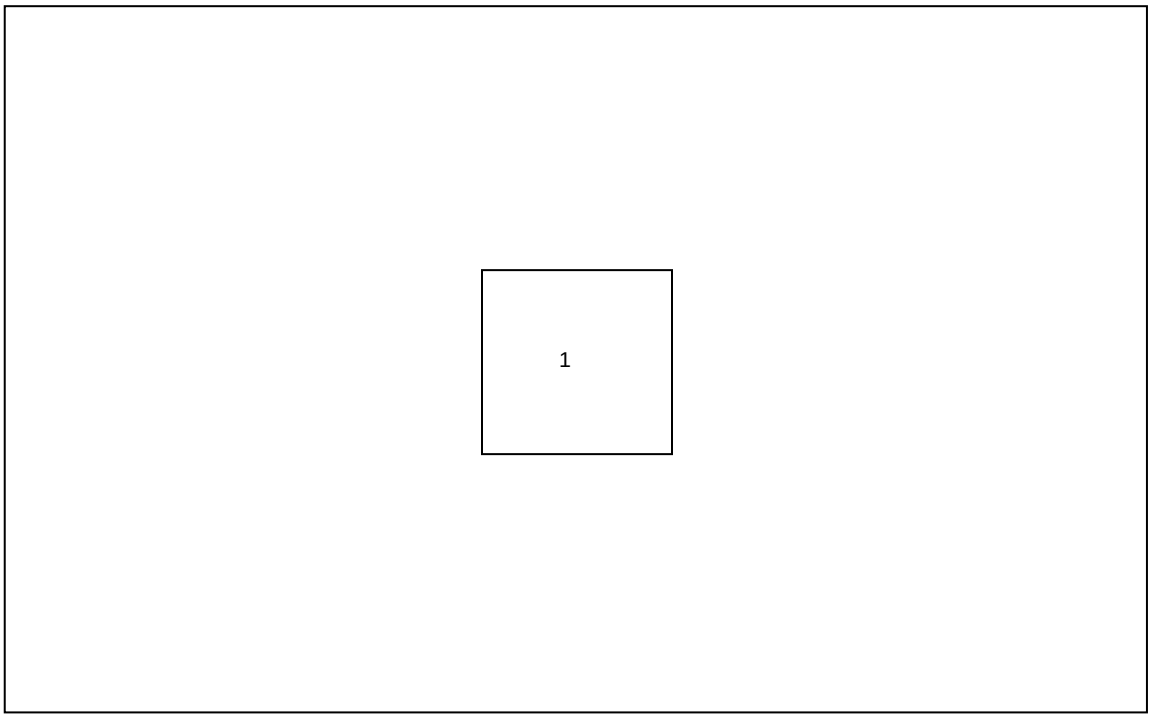

Figure 6-1: EUT Test Setup

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 device uses an internal ferrite core coil antenna that is directly soldered to the PCB. The antenna is not detachable thus meeting the requirements of FCC Section 15.203.

7.2 20dB / 99% Bandwidth: FCC: Section 15.215 / ISED Canada RSS-Gen 6.6

7.2.1 Measurement Procedure

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.

The spectrum analyzer span was set to 2 to 5 times the estimated bandwidth of the emission. The RBW was set from 1% to 5% of the estimated emission bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer detector set to sample. The span was set to fully display the emission, including the emissions skirts. The RBW was set from 1% to 5% of the estimated 99% bandwidth. The occupied 99% bandwidth was measured by using a delta marker at the lower and upper frequencies leading to 0.5% of the total power.

7.2.2 Measurement Results

Results are shown below:

Table 7.2.2-1: 20dB / 99% Bandwidth

Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
0.126	11.264	16.375

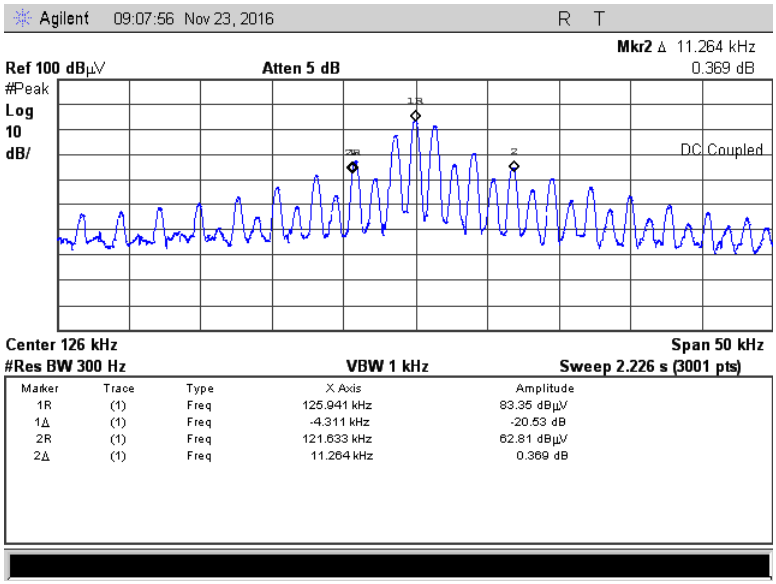

Figure 7.2.2-1: 20dB BW

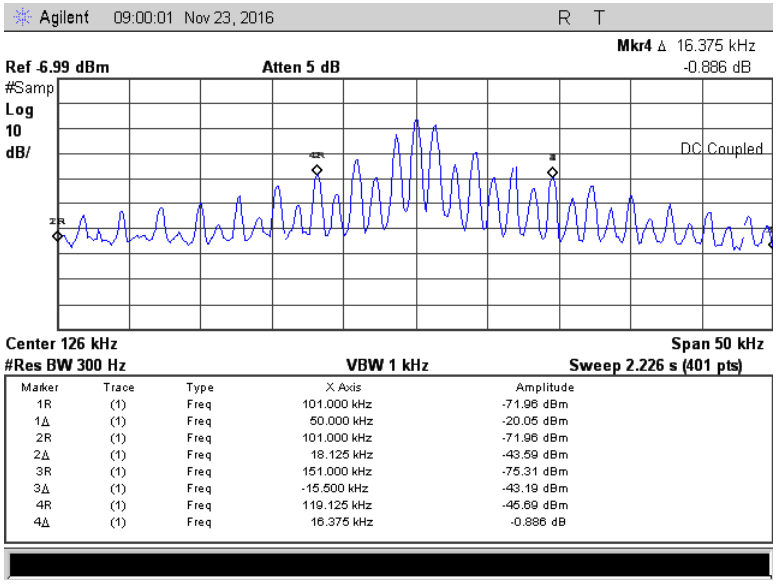

Figure 7.2.2-2: 99% OBW

7.3 Radiated Spurious Emissions – FCC: Section 15.209 / ISED Canada: RSS-210 2.5

7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 1 GHz. Section 15.33(a)(4) specifies, if the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to frequency specified in 15.33(b)(1) for unintentional radiators. The upper frequency range for the digital device is 1000MHz which greater than the 10th harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

Measurements below 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz. The fundamental levels were measured using a resolution bandwidth of 30 kHz which is greater than the measured emission bandwidth. For measurements in the frequency bands 9-90 kHz and 110-490 kHz, an average detector was used. When average measurements are specified, the peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. All other emissions were measured using a Quasi-peak detector. The final measurements were then corrected by antenna correction factors and cable loss for comparison to the limits.

Measurements above 30 MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. 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 1000 MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz.

7.3.2 Distance Correction for Measurements below 30 MHz – FCC Section 15.31

Radiated measurements were performed at a distance closer than 300 meters and 30m as required, according to Part 15.209. Therefore a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown below for limits expressed at a 300m measurement distance and a 30m measurement distance.

Distance correction factor (300m Specified Test Distance) = 40*Log (Test Distance/300)
= 40*Log (3/300)
= - 80 dB

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

7.3.3 Measurement Results

Radiated spurious emissions found in the band of 9 kHz to 1GHz are reported in the Table below.

Table 7.3.3-1: 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
Fundamental Frequency										
0.126	70.28	62.98	H	10.40	80.68	73.38	125.6	105.6	44.9	32.2
0.126	66.66	58.51	V	10.40	77.06	68.91	125.6	105.6	48.5	36.7
Spurious Emissions										
No Spurious Emissions Could Be Detected below 30 MHz										
Unintentional Emissions above 30 MHz										
157.807	---------	30.01	H	-13.63	---------	16.38	--------	43.5	---------	27.1
181.131	---------	29.18	H	-12.84	---------	16.34	--------	43.5	---------	27.2
190.188	---------	33.44	H	-12.66	---------	20.78	--------	43.5	---------	22.7
196.652	---------	29.36	H	-12.43	---------	16.93	--------	43.5	---------	26.6
292.498	---------	34.03	H	-11.69	---------	22.34	--------	46	---------	23.7
428.479	---------	33.66	H	-9.67	---------	23.99	--------	46	---------	22.0
696.535	---------	27.42	H	-3.25	---------	24.17	--------	46	---------	21.8
999.99	---------	25.32	H	0.59	---------	25.91	--------	54	---------	28.1
425.823	---------	29.32	V	-9.72	---------	19.60	--------	46	---------	26.4
694.693	---------	28.51	V	-3.17	---------	25.34	--------	46	---------	20.7
999.99	---------	25.35	V	0.59	---------	25.94	--------	54	---------	28.1

Notes:

- **The fundamental emissions were measured using RBW = 30 kHz which is greater than the measured occupied bandwidth of the device.**
- **No spurious emissions could be observed from 9 kHz – 30 MHz.**
- **The distance correction factor per Section 7.3.2 was applied to the limits below 30 MHz.**

7.3.4 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: 70.28 + 10.4 = 80.68 dBµV/m
Margin: 125.6 dBµV/m – 80.68 dBµV/m = 44.9 dB

Example Calculation: Average
Corrected Level: 62.98 + 10.4 – 0= 73.38 dBµV/m
Margin: 105.6 dBµV/m – 73.38 dBµV/m = 32.2 dB

8 CONCLUSION

In the opinion of ACS, Inc. the 92053007 manufactured by Ecolab Inc. meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-210.

END REPORT