

Report on the FCC and ISED Testing of the  
Ecolab Inc.  
92053066

In accordance with FCC 47 CFR Part 15.249 &  
ISED Canada's Radio Standards Specifications  
RSS-210

Prepared for: Ecolab Inc.  
370 Wabasha St N  
St. Paul, MN 55102

FCC ID: Z9O-92053066 IC: 10060A-92053066



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| Pete Walsh | Service Line Manager | Authorized Signatory | 2018-August-29 |

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Innovation, Science, and Economic Development Canada  
Accreditation  
Main Site Number 2087A-2 Tampa, FL Test Laboratory  
Satellite Site Number: 4175C Boca Raton, FL Test Laboratory

**EXECUTIVE SUMMARY**

A sample of this product was tested and found to be compliant with FCC Part 15.249, ISED Canada's RSS-210



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TÜV SÜD America  
5610 West Sligh Ave., Suite 100  
Tampa, FL 33634

Phone: 813-284-2715  
[www.tuv-sud-america.com](http://www.tuv-sud-america.com)

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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 Manufacturer Information:

Ecolab, Inc.  
370 Wabasha St N  
St. Paul, MN 55102

### 1.3 Product description

The Ecolab Inc. model 92053066 is a Healthcare Worker (HWC) badge for Ecolab Hand Hygiene Program Compliance Monitoring System. The device includes a 917 MHz transceiver and a 125 kHz receiver.

The test report documents the compliance of the 917 MHz transmitter.

#### Technical Details

Frequency of Operation: 917.015 MHz  
Number of Channels: 1  
Modulation: FSK  
Data Rate: 1.2 kbps  
Antenna / Gain: Ceramic Chip Antenna, -1.0 dBi  
Input Voltage: 3 VDC (CR2032 Battery)

Test Sample Serial Number(s): 0A0090CA

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

### 1.4 Test Methodology and Considerations

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 EUT was evaluated for radiated emissions for the 917 MHz transmitter in three orthogonal orientations. Where applicable, the results are provided for the worst case.

The assessment to the unintentional emissions test requirements is documented in supplier's declaration of conformity test report.

## 2 TEST FACILITIES

### 2.1 Location

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

TÜV SÜD America, Inc.  
3998 FAU Blvd, Suite 310  
Boca Raton, Florida 33431  
Phone: (561) 961-5585  
Fax: (561) 961-5587  
<http://www.tuv-sud-america.com>

Innovation, Science and Economic Development Canada Lab Code: 4175C

### 2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by American Association for Laboratory Accreditation (A2LA) and has been issued certificate number 2955.15 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.

Main Site Information:

TÜV SÜD America, Inc.  
5610 West Sligh Ave., Suite 100  
Tampa, FL 33634  
Phone: 813-284-2715  
[www.tuv-sud-america.com](http://www.tuv-sud-america.com)

FCC Designation Number US1063

Innovation, Science, and Economic Development Canada Lab Codes:

Main Site Number 2087A-2 Tampa, FL Test Laboratory

Satellite Site Number: 4175C Boca Raton, FL Test Laboratory

## 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 can support 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:

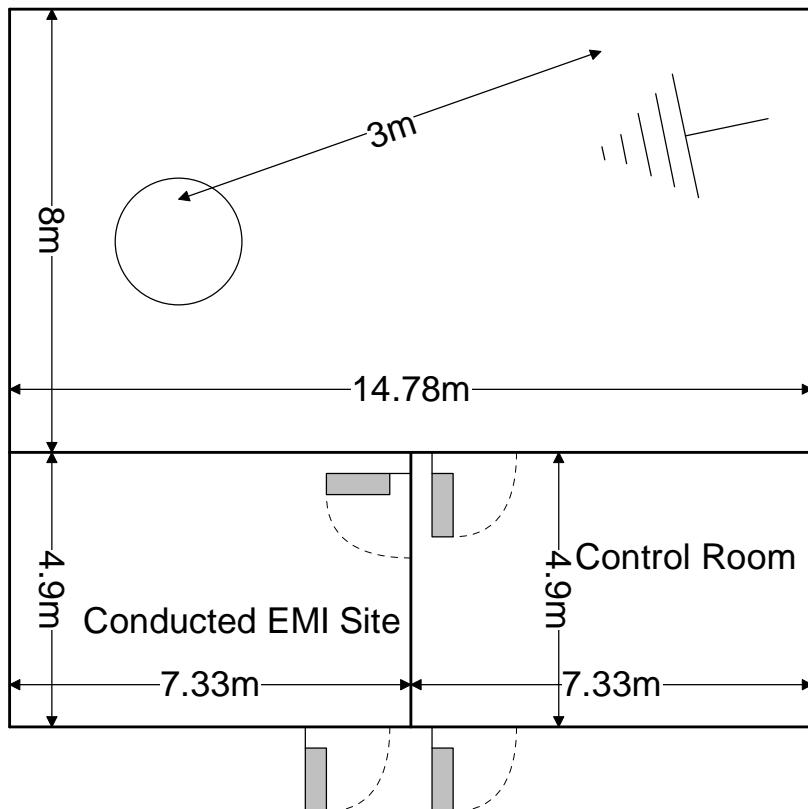


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

### 2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are  $7.3 \times 4.9 \times 3 \text{ m}^3$ . The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50  $\Omega$ /50  $\mu\text{H}$  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:

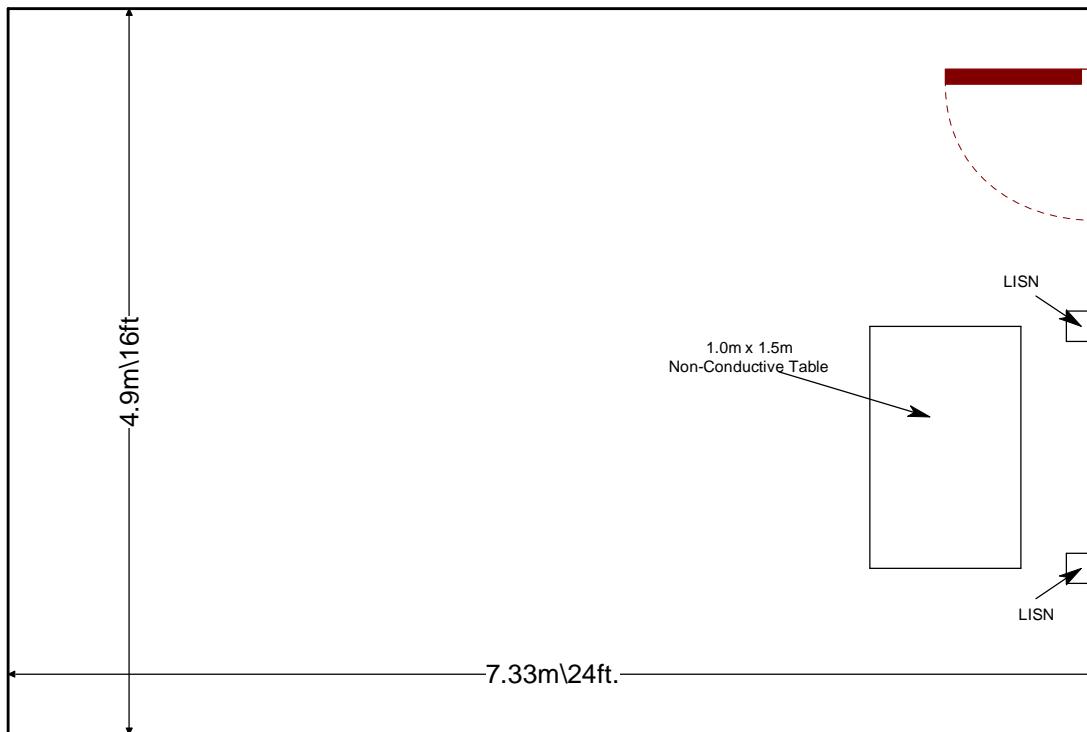


Figure 2.3.2-1: AC Mains Conducted EMI Site

### 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, 2017.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2017
- ❖ 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 |
|-----------|-------------------------|------------------------|--|------------|-----------------------|----------------------|
| BEMC0078  | EMCO                    | 6502                   | Active Loop Antenna                                  | 9104-2608  | 5/9/2018              | 5/9/2020             |
| BEMC00283 | Rohde & Schwarz         | FSP40                  | Spectrum Analyzer                                    | 1000033    | 7/21/2016             | 7/21/2018            |
| BEMC00523 | Agilent                 | E7405                  | 9kHz-26.5GHz EMC analyzer/HYZ                        | MY45103293 | 12/9/2016             | 12/9/2018            |
| BEMC02002 | EMCO                    | 3108                   | 30 MHz to 200 MHz Biconical Antenna                  | 2147       | 11/28/2017            | 11/30/2019           |
| BEMC02004 | EMCO                    | 3146                   | 200 MHz to 1 GHz Log Periodic Antenna                | 1385       | 12/27/2017            | 12/27/2019           |
| BEMC02006 | EMCO                    | 3115                   | Linear Polarized Horn antenna, 1-18 GHz              | 2573       | 4/7/2017              | 4/7/2019             |
| BEMC02011 | Hewlett-Packard         | HP 8447D               | 100 kHz to 1.3 GHz low-noise, high gain amplifier    | 2443A03952 | 10/27/2017            | 10/27/2018           |
| BEMC02086 | Merrimac                | FAN-6-10K              | 10dB Attenuator                                      | 23148-83-1 | 10/27/2017            | 10/27/2018           |
| BEMC02095 | ETS Lindgren            | TILE4! - Version 4.2.A | Tile Automation Software                             | 85242      | NCR                   | NCR                  |
| BEMC02111 | Aeroflex Inmet          | 40AH2W-20              | Attenuator 20dB, 2.9 mm-M/F, DC-40GHz 2 W            | 2111       | 7/20/2017             | 7/20/2018            |
| BEMC02112 | Teledyne Storm Products | 921-0101-036           | Duratest High Frequency Cable Max. frequency 26.5GHz | 12-06-698  | 10/27/2017            | 10/27/2018           |
| BEMC02121 | Teledyne Storm Products | A81-0303               | Radiated Cable Set                                   | 2121       | 7/31/2017             | 7/31/2018            |
| BEMC02138 | Hewlett Packard         | 8449B                  | Pre-Amplifier  | 3008A00320 | 12/1/2017             | 12/1/2018            |

**Notes:**

- NCR=No Calibration Required
- The assets calibration cycle information is provided to cover the entire test period. Where applicable, the assets were only used during the active period of the cycle.

## 5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

| Item # | Type Device | Manufacturer | Model/Part # | Serial # |
|--------|-------------|--------------|--------------|----------|
| 1      | EUT         | Ecolab Inc.  | 92053066     | 0A0090CA |

Table 5-2: Cable Description

| Cable #   | Cable Type | Length | Shield | Termination |
|---|------------|--------|--------|-------------|
| The EUT is a stand-alone device with no provision for connection to additional accessory equipment. |            |        |        |             |

## 6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

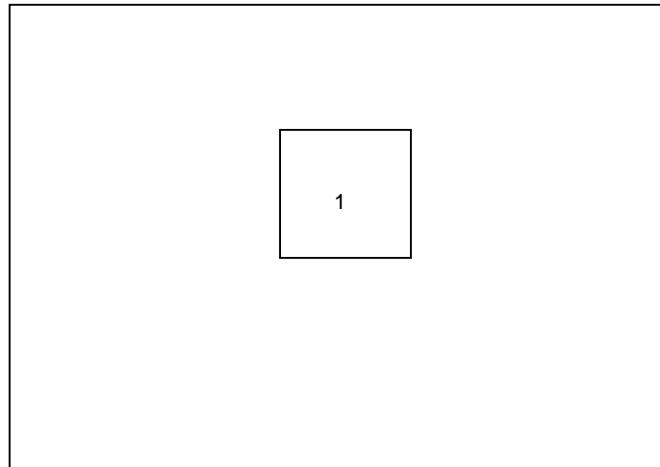


Figure 6-1: EUT Test Setup Diagram

## 7 SUMMARY OF TESTS

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

Test Begin Date: June 15, 2018  
 Test End Date: June 15, 2018

**Table 7-1: Summary of Tests**

| Requirements                   | FCC Rule Part        | ISED Canada                | Test Results |
|--------------------------------|----------------------|----------------------------|--------------|
| Antenna Requirement            | FCC: Section 15.203  |                            | Pass         |
| 20 dB Bandwidth                | FCC: Section 15.215  |                            | Pass         |
| 99% Bandwidth                  |                      | ISED Canada: RSS-GEN 6.6   | Pass         |
| Radiated Spurious Emissions    | FCC: Sections 15.249 | ISED Canada: RSS-210 B. 10 | Pass         |
| Power Line Conducted Emissions | FCC: Section 15.207  | ISED Canada: RSS-Gen 8.8   | N/A          |

### 7.1 Antenna Requirement – FCC: Section 15.203

The device uses a -1.0 dBi ceramic chip antenna that is 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 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 20-dB function of the analyzer was utilized to determine the 20 dB bandwidth of the emission.

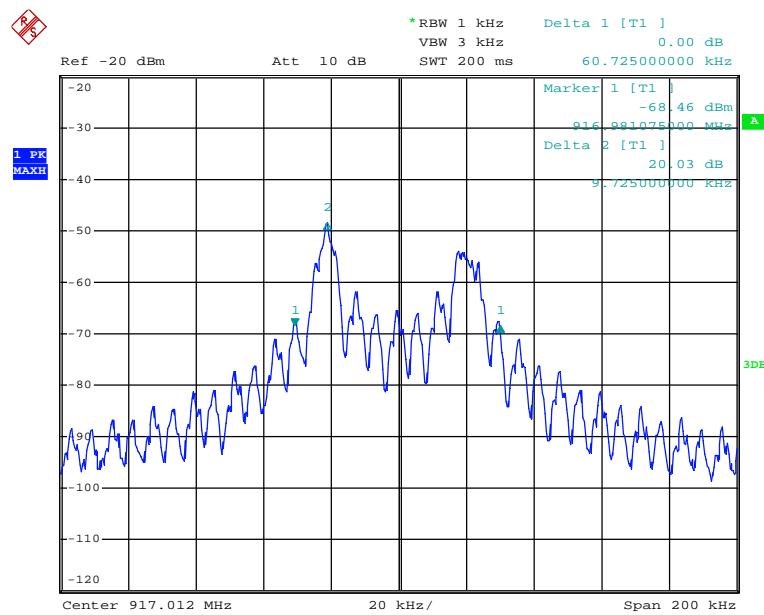
The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was set from 1% and 5% of the estimated 99% bandwidth. The occupied 99% bandwidth was measured by using the occupied bandwidth function of the spectrum analyzer set to 99% with a peak detector.

#### 7.2.2 Measurement Results

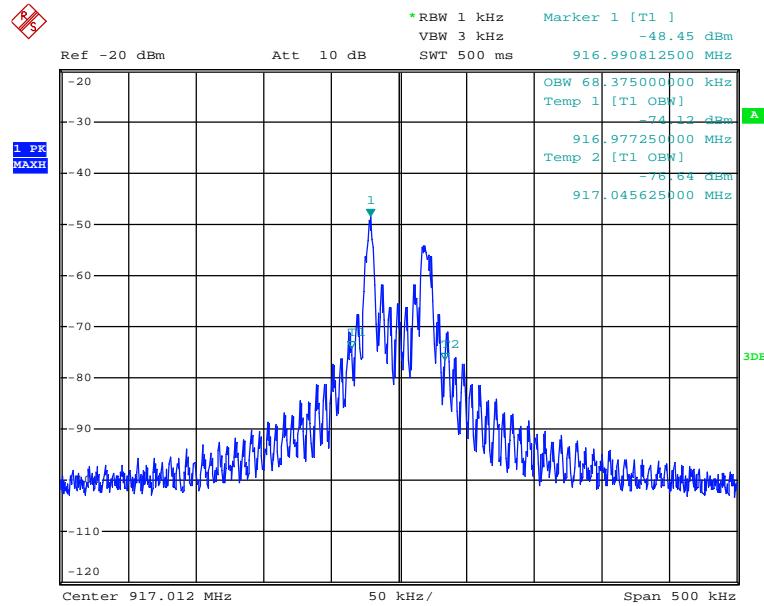
Performed by: Thierry Jean-Charles

**Table 7.2.2-1: 20dB / 99% Bandwidth**

| Frequency<br>[MHz] | 20dB Bandwidth<br>[kHz] | 99% Bandwidth<br>[kHz] |
|--------------------|-------------------------|------------------------|
| 917.012            | 60.725                  | 68.375                 |



Date: 15.JUN.2018 09:47:34

**Figure 7.2.2-1: 20dB Occupied Bandwidth**

Date: 15.JUN.2018 09:40:09

**Figure 7.2.2-2: 99% Occupied Bandwidth**

**7.3 Radiated Spurious Emissions – FCC: Section 15.249(a); ISED Canada: RSS-210 B.10****7.3.1 Measurement Procedure**

Radiated emissions tests were made over the frequency range of 9 kHz to 10 GHz, 10 times the highest fundamental frequency.

For measurements below 30 MHz, the receive antenna height was set to 1 m and the EUT was rotated through 360°. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1 m to 4 m 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. For frequencies above 1000 MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3 MHz respectively.

**7.3.2 Measurement Results**

Performed by: Thierry Jean-Charles, Jean Rene

Radiated spurious emissions found in the band of 9 kHz to 10 GHz are reported in the Table below.

Table 7.3.2-1: Radiated Spurious Emissions Tabulated Data

| Frequency<br>(MHz)    | Level (dBuV) |         | Antenna<br>Polarity<br>(H/V) | Correction<br>Factors<br>(dB) | Corrected Level<br>(dBuV/m) |         | Limit<br>(dBuV/m) |         | Margin<br>(dB) |         |  |  |
|-----------------------|--------------|---------|------------------------------|-------------------------------|-----------------------------|---------|-------------------|---------|----------------|---------|--|--|
|                       | pk           | QPk/Avg |                              |                               | pk                          | QPk/Avg | pk                | QPk/Avg | pk             | QPk/Avg |  |  |
| Standing (X Position) |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| Fundamental Frequency |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 917.015               | 60.17        | 59.80   | H                            | -1.40                         | -----                       | 58.40   | -----             | 94      | -----          | 35.6    |  |  |
| 917.015               | 56.42        | 55.82   | V                            | -1.40                         | -----                       | 54.42   | -----             | 94      | -----          | 39.6    |  |  |
| Spurious Emissions    |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 3668.06               | 38.35        | 25.31   | V                            | 5.93                          | 44.28                       | 31.24   | 74                | 54      | 29.7           | 22.8    |  |  |
| 5502.09               | 39.66        | 32.77   | H                            | 10.52                         | 50.18                       | 43.29   | 74                | 54      | 23.8           | 10.7    |  |  |
| 5502.09               | 38.88        | 30.39   | V                            | 10.52                         | 49.40                       | 40.91   | 74                | 54      | 24.6           | 13.1    |  |  |
| Side (Y Position)     |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| Fundamental Frequency |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 917.015               | 55.30        | 54.47   | H                            | -1.40                         | -----                       | 53.07   | -----             | 94      | -----          | 40.9    |  |  |
| 917.015               | 59.79        | 59.40   | V                            | -1.40                         | -----                       | 58.00   | -----             | 94      | -----          | 36.0    |  |  |
| Spurious Emissions    |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 3668.06               | 38.19        | 25.81   | H                            | 5.93                          | 44.12                       | 31.74   | 74                | 54      | 29.9           | 22.3    |  |  |
| 5502.09               | 38.15        | 27.80   | H                            | 10.52                         | 48.67                       | 38.32   | 74                | 54      | 25.3           | 15.7    |  |  |
| 5502.09               | 39.83        | 32.16   | V                            | 10.52                         | 50.35                       | 42.68   | 74                | 54      | 23.7           | 11.3    |  |  |
| Flat (Z Position)     |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| Fundamental Frequency |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 917.015               | 60.77        | 60.40   | H                            | -1.40                         | -----                       | 59.00   | -----             | 94      | -----          | 35.0    |  |  |
| 917.015               | 55.16        | 54.42   | V                            | -1.40                         | -----                       | 53.02   | -----             | 94      | -----          | 41.0    |  |  |
| Spurious Emissions    |              |         |                              |                               |                             |         |                   |         |                |         |  |  |
| 457.509               | -----        | 35.40   | H                            | -8.98                         | -----                       | 26.42   | -----             | 46      | -----          | 19.6    |  |  |
| 5502.09               | 38.85        | 29.76   | H                            | 10.52                         | 49.37                       | 40.28   | 74                | 54      | 24.6           | 13.7    |  |  |
| 5502.09               | 38.51        | 28.33   | V                            | 10.52                         | 49.03                       | 38.85   | 74                | 54      | 25.0           | 15.2    |  |  |

Note: All the emissions above 5.502 GHz were attenuated below the limits and the noise floor of the measurement equipment.

### 7.3.3 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:  $38.35 + 5.93 = 44.28 \text{ dB}\mu\text{V/m}$

Margin:  $74 \text{ dB}\mu\text{V/m} - 44.28 \text{ dB}\mu\text{V/m} = 29.72 \text{ dB}$

#### Example Calculation: Average

Corrected Level:  $25.31 + 5.93 - 0 = 31.24 \text{ dB}\mu\text{V/m}$

Margin:  $54 \text{ dB}\mu\text{V} - 31.24 \text{ dB}\mu\text{V/m} = 22.76 \text{ dB}$

## 8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures ( $U_{\text{Lab}}$ ) provided below correspond to an expansion factor (coverage factor)  $k = 1.96$  which provide confidence levels of 95%.

**Table 8-1: Measurement Uncertainties**

| Parameter                             | $U_{\text{Lab}}$                     |
|---------------------------------------|--------------------------------------|
| Occupied Channel Bandwidth            | $\pm 0.009 \%$                       |
| RF Conducted Output Power             | $\pm 1.15 \text{ dB}$                |
| Power Spectral Density                | $\pm 1.15 \text{ dB}$                |
| Antenna Port Conducted Emissions      | $\pm 1.15 \text{ dB}$                |
| Radiated Emissions $\leq 1\text{GHz}$ | $\pm 5.86 \text{ dB}$                |
| Radiated Emissions $> 1\text{GHz}$    | $\pm 4.65 \text{ dB}$                |
| Temperature                           | $\pm 0.860 \text{ }^{\circ}\text{C}$ |
| Radio Frequency                       | $\pm 2.832 \times 10^{-8}$           |
| AC Power Line Conducted Emissions     | $\pm 3.72 \text{ dB}$                |

## 9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the 92053066, manufactured by Ecolab Inc. meets the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-210.

**END REPORT**