Certification Test Report

FCC ID: Z9O-92053026
IC: 10060A-92053026

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

Report Number: BO72131442.200

Manufacturer: Ecolab Inc.
Model(s): 92053026

Test Begin Date: **October 10, 2017**
Test End Date: **November 3, 2017**

Report Issue Date: November 13, 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 16 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 Manufacturer Information

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

1.3 Product Description

The Ecolab, Inc. Model 92053026 is a NXA HHCM touch free dispenser beacon. The device includes three radios operating at 125 kHz, 433.9 MHz and 2405 MHz, respectively. This test report documents the compliance of the 125 kHz radio.

Technical Details
Frequency of Operation: 126 kHz
Number of Channels: 1
Modulation: OOK
Data Rate: 2.7 kbps
Antenna: Magnetic Loop Antenna
Input Voltage: 3 VDC (Size AA Battery)

Test Sample Serial Number(s): 15001FCB

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 125 kHz transmitter inside the Nexa Classic and the Nexa Compact dispensers in the orientation of typical installation. The device was configured to the maximum RF output power setting for the evaluation.

The 125 kHz transmitter does not transmit simultaneously with the 433 MHz and 2405 MHz co-located transmitters. The evaluation for intermodulation products was only performed for the 433 MHz and 2405 MHz radios transmitting simultaneously. All intermodulation products were found to comply with the requirements of FCC Section 15.209 and ISED Canada RSS-Gen. 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.

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

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD AMERICA, INC. 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.

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

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:

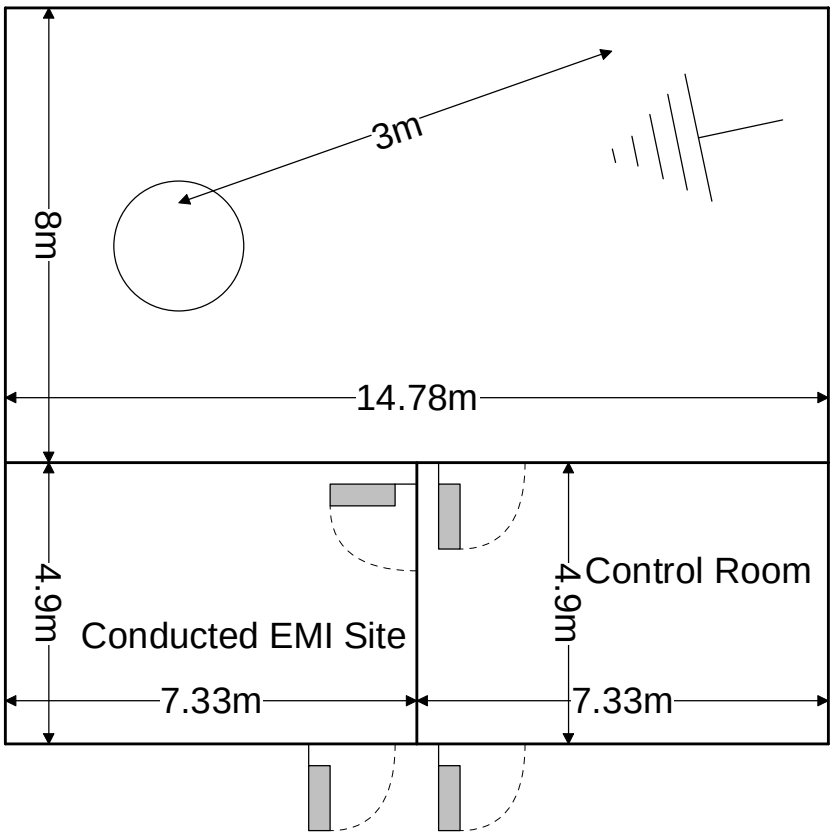

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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:

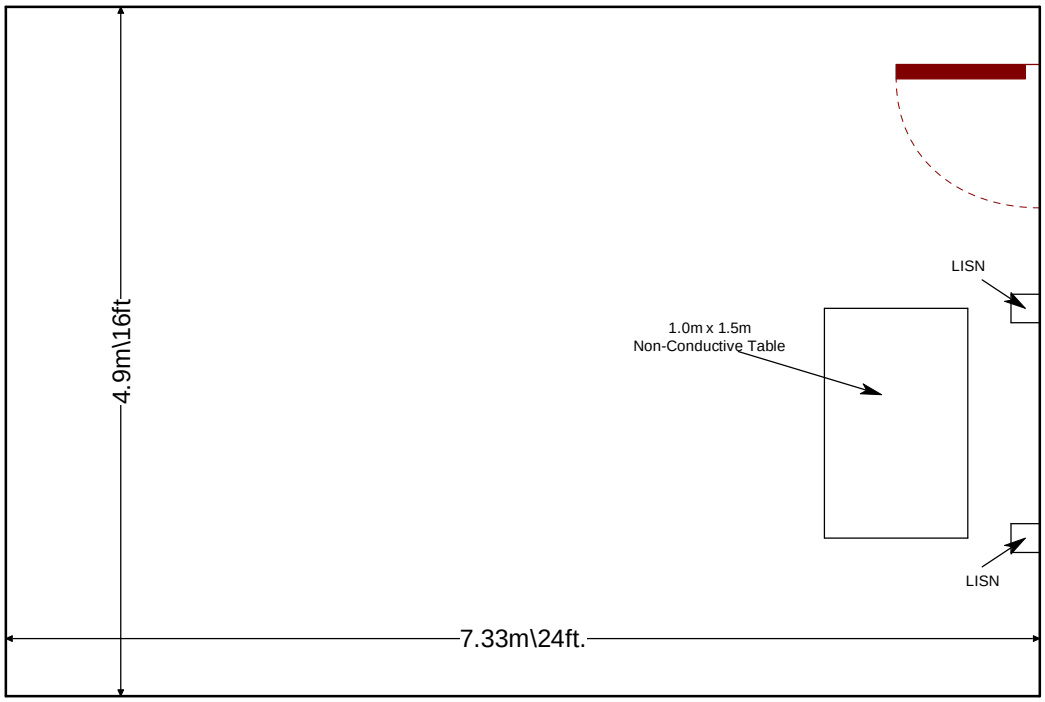

Figure 2.3.2-1: AC Mains Conducted EMI Site

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, 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
79	EMCO	7405	Antennas	93	NCR	NCR
479	Electro-Metrics	ALP-70	Antennas	158	12/3/2015	12/3/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/9/2016	12/9/2018
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	10/27/2017	10/27/2018
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	7/31/2017	7/31/2018
NBLE03366	Agilent	E4440A	Spectrum Analyzer	MY42510427	10/24/2017	10/24/2018

Notes:

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

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Ecolab Inc.	92053026	15001FCB
2	Classic Dispenser	Ecolab Inc.	92021188	N/A
	Compact Dispenser	Ecolab Inc.	92021184	N/A

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	The EUT is a plug-in device into a specific host equipment with no provision for additional connection to accessory equipment.			

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

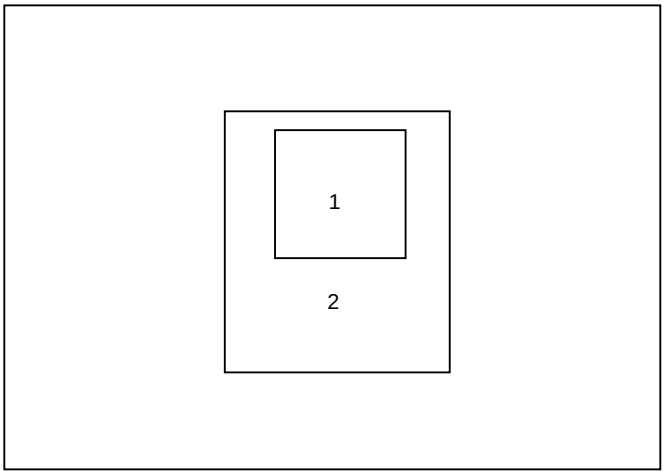

Figure 6-1: EUT Test Setup

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

For the 125-kHz radio, EUT uses an internal loop antenna that is directly soldered to the PCB. The EUT and antenna meet the FCC 15.203 requirements.

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% to 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 [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
0.126	14.104	20.8265

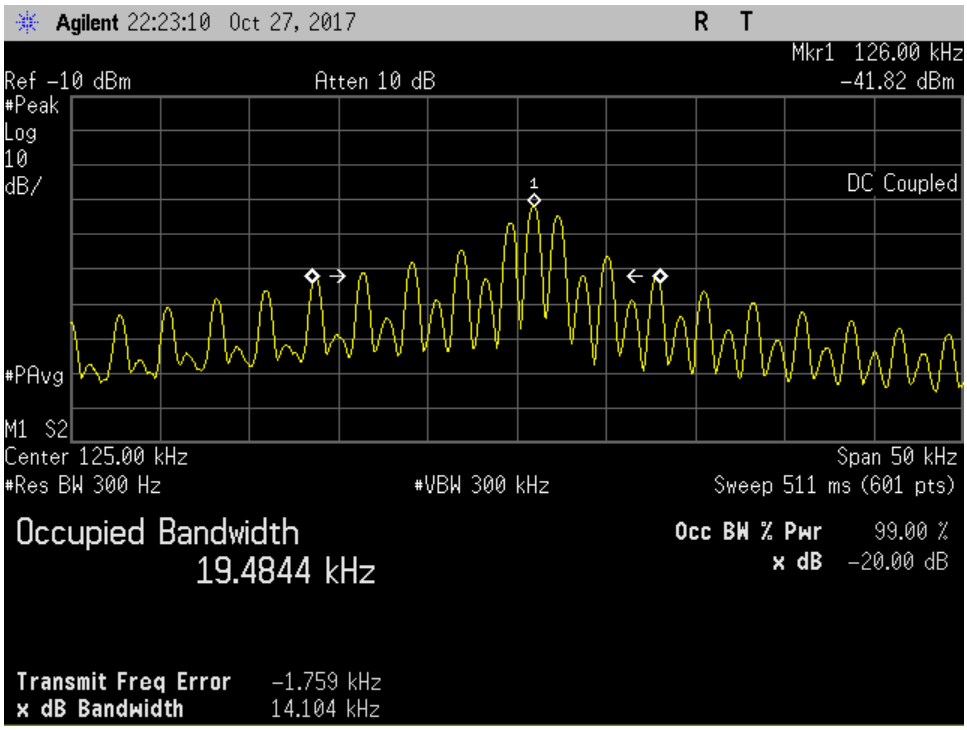

Figure 7.2.2-1: 20 dB BW

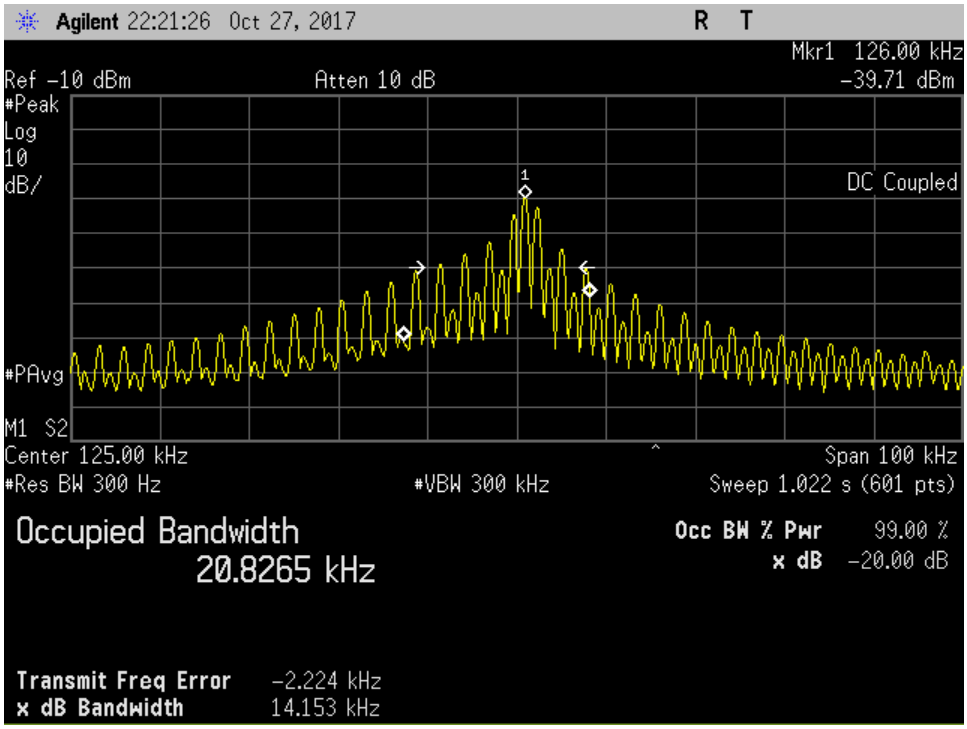

Figure 7.2.2-2: 99% BW

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 1000 MHz which greater than the 10th harmonic of the fundamental frequency. The upper frequency range measured was 1000 MHz.

Measurements below 30 MHz were performed in a semi-anechoic chamber with a 3-meter separation distance between the EUT and measurement antenna. The magnetic loop receiving antenna was positioned 1 meter above the ground. The EUT was rotated 360° to maximize each emission. The spectrum analyzer's resolution and video bandwidths were set to 200 Hz and 1000 Hz respectively for frequencies below 150 kHz, and to 9 kHz and 30 kHz respectively for frequencies between 150 kHz and 30 MHz. 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 1 meter to 4 meters 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

Performed by: Thierry Jean-Charles, Jean Rene

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

Table 7.3.3-1: Radiated Spurious Emissions Tabulated Data – Nexa Classic Dispenser

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
0.126	48.38	46.95	H	28.87	77.25	75.82	125.6	105.6	48.3	29.8
0.126	52.13	50.60	V	28.87	81.00	79.47	125.6	105.6	44.6	26.1
Spurious Emissions										
0.378	27.30	26.32	H	19.37	46.67	45.69	116.1	96.1	69.4	50.4
0.378	28.26	27.54	V	19.37	47.63	46.91	116.1	96.1	68.5	49.2
0.63	---------	35.80	H	16.10	---------	51.90	--------	71.6	---------	19.7
0.63	---------	26.86	V	16.10	---------	42.96	--------	71.6	---------	28.6
0.756	---------	38.38	H	14.99	---------	53.37	--------	70	---------	16.6
0.756	---------	25.40	V	14.99	---------	40.39	--------	70	---------	29.6
0.882	---------	33.60	H	14.25	---------	47.85	--------	68.7	---------	20.8
0.882	---------	17.20	V	14.25	---------	31.45	--------	68.7	---------	37.2
1.008	---------	29.81	H	13.88	---------	43.69	--------	67.5	---------	23.8
1.008	---------	19.27	V	13.88	---------	33.15	--------	67.5	---------	34.4
Emissions from 30 MHz to 1 GHz										
264.875	---------	50.80	H	-13.57	---------	37.23	--------	46	---------	8.8
260.992	---------	40.25	V	-13.74	---------	26.51	--------	46	---------	19.5

Notes:

- The fundamental level Peak and Average measurements used RBW = 30 kHz which is greater than the measured occupied bandwidth.
- The distance correction factor per Section 7.3.2 of this document was applied to the limits below 30 MHz.
- Peak and average measurements were performed at 126 kHz and 378 kHz while the other emissions were measured using a Quasi-Peak detector.

Table 7.3.3-2: Radiated Spurious Emissions Tabulated Data – Nexa Compact Dispenser

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	avg	(H/V)	(dB)	pk	avg	pk	avg	pk	avg
Fundamental Frequency										
0.126	48.83	46.99	H	28.87	77.70	75.86	125.6	105.6	47.9	29.7
0.126	51.74	50.45	V	28.87	80.61	79.32	125.6	105.6	45.0	26.3
Spurious Emissions										
0.378	25.89	24.96	H	19.37	45.26	44.33	116.1	96.1	70.8	51.8
0.378	29.01	28.86	V	19.37	48.38	48.23	116.1	96.1	67.7	47.9
0.63	---------	32.01	H	16.10	---------	48.11	--------	71.6	---------	23.5
0.63	---------	26.30	V	16.10	---------	42.40	--------	71.6	---------	29.2
0.756	---------	34.89	H	14.99	---------	49.88	--------	70	---------	20.1
0.756	---------	26.41	V	14.99	---------	41.40	--------	70	---------	28.6
0.882	---------	27.85	H	14.25	---------	42.10	--------	68.7	---------	26.6
0.882	---------	21.80	V	14.25	---------	36.05	--------	68.7	---------	32.6
1.008	---------	28.18	H	13.88	---------	42.06	--------	67.5	---------	25.4
1.008	---------	21.40	V	13.88	---------	35.28	--------	67.5	---------	32.2
Emissions from 30 MHz to 1 GHz										
274.8	---------	49.29	H	-12.86	---------	36.43	--------	46	---------	9.6
271.1	---------	39.45	V	-13.22	---------	26.23	--------	46	---------	19.8

Notes:

- The fundamental level Peak and Average measurements used RBW = 30 kHz which is greater than the measured occupied bandwidth.
- The distance correction factor per Section 7.3.2 of this document was applied to the limits below 30 MHz.
- Peak and average measurements were performed at 126 kHz and 378 kHz while the other emissions were measured using a Quasi-Peak detector.

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: 27.3 + 19.37 = 46.67 dBµV/m
Margin: 116.1 dBµV/m – 46.67 dBµV/m = 69.4 dB

Example Calculation: Average
Corrected Level: 26.32 + 19.37 – 0= 45.69 dBµV/m
Margin: 96.1 dBµV/m – 45.69 dBµV/m = 50.4 dB

8 MEASUREMENT UNCERTAINTIES

The expanded laboratory measurement uncertainty figures (U_{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_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 1.15 dB
Power Spectral Density	± 1.15 dB
Antenna Port Conducted Emissions	± 1.15 dB
Radiated Emissions ≤ 1GHz	± 5.86 dB
Radiated Emissions > 1GHz	± 4.65 dB
Temperature	± 0.860 °C
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	±3.72 dB

9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the 92053026 manufactured by Ecolab Inc. meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-210.

END REPORT