



REPORT

For

Clad Innovations Ltd.

554 East 15th Ave.
Second Floor
Vancouver, BC
V5T 2R5, Canada

Date: 29 March 2018
Report No.: 16686-1E
Revision No.: 2
Project No.: 16686
Equipment: TZOA Home Air Quality Monitor
Model No.: HAVEN
FCC ID: 2ANU9HAVEN
IC ID.: 23327-HAVEN



ONE STOP GLOBAL CERTIFICATION SOLUTIONS



Unit 205 – 8291 92 ST., Delta, BC
V4G 0A4, Canada
Phone: 604-247-0444
Fax: 604-247-0442
www.labtestcert.com

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TEST REPORT_FCC Part 15.247 and IC RSS-247	
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	
Report Reference No.....:	16686-1E
Report Revision History.....:	✓ Rev. 0: 22Dec 2017 ✓ Rev. 1: 09 Feb 2018; Final Release ✓ Rev. 2: 29 Mar 2018; minor corrections
Compiled by (+ signature)	David Johanson 
Approved by (+ signature)	Jeremy Lee 
Date of issue	29 March 2018
Total number of pages	19
FCC Site Registration No.:	CA5970
IC Site Registration No.:	5970A-2
Testing Laboratory	LabTest Certification Inc.
Address	Unit 205 – 8291 92 Street. Delta, B.C. V4G 0A4, Canada
Applicant's name.....:	Clad Innovations Ltd.
Address	554 East 15 th Ave, Second Floor, Vancouver, BC V5T 2R5
Manufacture's Name	Same as Applicant
Address	Same as Applicant
Test specification:	
Standards	➤ FCC Part 15.247; 2017 ➤ IC RSS-247 Issue2 February 2017
Test procedure	➤ ANSI C63.10:2013 ➤ ANSI C63.4:2014 ➤ RSS-Gen, Issue 4, November 2014
Non-standard test method.....:	N/A
Test Report Form(s) Originator	Jeremy Lee
Master TRF	1036_Rev2 – RF Report Template
Test item description :	
Trade Mark	TZOA HAVEN

Model/Type reference	HAVEN
Serial Number	Eng001
FCC ID	2ANU9HAVEN
IC ID	23327-HAVEN
Possible test case verdicts:	
- test case does not apply to the test object :	N/A
- test object does meet the requirement :	P (Pass)
- test object does not meet the requirement :	F (Fail)
Testing:	
Date of receipt of test item	19 November 2017
Date (s) of performance of tests.....	20-21 November 2017

Revision History

Revision	Date	Reason For Change	Author(s)
0	22December 2017	Initial Data	David Johanson
1.0	09 February 2018	Final Release	David Johanson
2.0	29 March 2018	Final Release; minor modifications in Address, model number and remove references to Class II change	David Johanson

Device Under Test Description

Application for	KDB 996369 D02 module file for a new FCC ID of FCC ID: VRA-SG9011203 Wireless Module due to change in Antenna Type and Gain.
Operating Transmit Frequency	2.412 to 2.462 GHz
Operating Receive Frequency	2.412 to 2.462 GHz
Number of Channels	Depends on 802.11 communication Protocol
Rated RF Output.....	0.36 Watts
Modulation Type	802.11b/g Protocols
Antenna Type/Gain	TRF1001 Dipole 2.4-2.5GHz 2dBi
.....	TRF1002 Dipole 2.4-2.5GHz 5dBi
Equipment mobility	Fixed
Operating condition	0 to +50°C
Nominal Voltages for:	
Supply Voltage:	12 to 24 VAC or DC

Program details

Testing Facility by procedure:		
<input checked="" type="checkbox"/>	All Testing:	LabTest Certification Inc.
Testing location/ address.....:		Unit 3128-20800 Westminster HWY, Richmond, B.C. V6V 2W3 Canada

Summary of testing:	
Tests performed (name of test and test clause): Radiated Field strength and Emissions AC Power Line Conducted Emissions	Testing location: In SAC, Richmond In SAC, Richmond
<p>The tests indicated in Test Summary were performed on the product constructed as described below. The 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.</p> <p>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. LabTest does not make any claims of compliance for samples or variants which were not tested.</p>	

Description of Equipment Under Test and Variant Models

Description: TZOA Air Quality Sensor
Details: This product is based on using an existing Wireless Module for Sagrad FCC ID: VRA-SG9011203 The only differences are: <ul style="list-style-type: none">➤ RF Port 2 has been disabled➤ Only Protocol 802.11g is used➤ The antenna is changed to use either of the following:<ul style="list-style-type: none">a) Aristotle RFA-02-L2H1 Description: 2 dBi 2.4 GHz External Dipole Antenna.b) Aristotle RFA-02-5-F7H1 Description: 5 dBi 2.4 GHz External Dipole Antenna. <p>This test report is only performing the additional tests as required for changing the antenna. It is to be read in combination with the Sagrad Test Report: "Sagraad Test Report.pdf" as contained in the Original Sagrad submission for FCC ID: VRA-SG9011203</p>

- Top view



Variant Models:

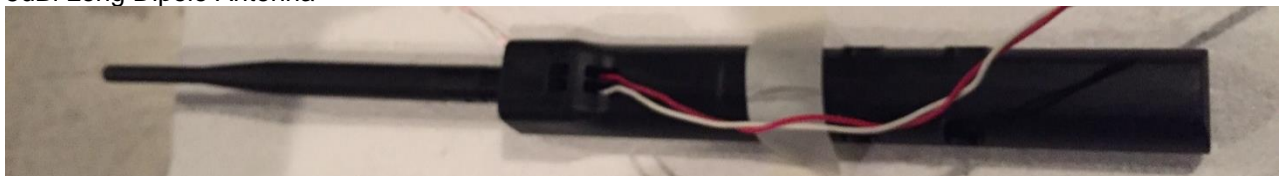
The following variant models were part of this evaluation, and have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Labtest does not make any claims of compliance for samples or variants which were not tested.

The 2 different product variations are based on the antenna capabilities.

2dBi short Dipole antenna



5dBi Long Dipole Antenna



Since both antenna's are of the same geometry, monopole, and frequency range, all emissions tests were performed using the highest gain 5dBi antenna.

EUT Internal Operating Frequencies

Frequency	Description	Frequency	Description
16.00 MHz	Crystal	1.5625 MHz	SPI Memsic
32.768 kHz	RTC	400 kHz	I2C
25 MHz	SPI Flash	2.1 MHz	Switching supply
25 MHz	Spi MCU-MCU	115.2kHz	Baud rate to WiFi

Additional Client Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Power Supply	Hammond	A5-AC2420VA-2S	
AE	Laptop	ACER	ASPIRE/V5	Windows
Abbreviations: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)				

Software and Firmware

Use*	Description	Version
AE	Module programming Software	ETF_FW_A08.28.0165-SPI
EUT	SPWF01 Wifi module firmware - SPWF01S = SPWF01 module with external antenna - 170111 = date code - 665d284 = CRC	SPWF01S-170111-665d284
Abbreviations: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)		

Input/Output Ports

Port #	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
1	USB Programming Port	I/O	10m	Yes	Temporary for testing only
2	Power 24Vac	AC	1m	No	Could be any power supply 12 to 24V AC or DC
<p>*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports</p>					

Power Interface

Mode #	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	120	0.3	20VA	AC	1	Used for 24vAC power adapter

EUT Operation Modes

Mode #	Description
1	Transmission Mode

EUT Configuration Modes

Mode #	Description
1	5dBi Dipole Antenna and EUT Flat on table top
2	5dBi Dipole Antenna 45deg up and EUT flat on table top
3	5dBi Dipole Antenna 90deg up and EUT flat on table top

Test Equipment Verified for function

Model #	Description	Checked Function	Results
N9038A	Spectrum Analyzer	Frequency and Amplitude	Connected 50MHz and -20 dBm Ref_siganl and checked OK.
JB1	Antenna, 30 to 2000MHz	Checked structure	Normal – no damage.
SAS-571	Antenna, 1 to 18GHz	Checked structure	Normal – no damage.
AL-130	Antenna, 9kHz to 30MHz	Checked structure	Normal – no damage.

BW-S20W20	20dB Attenuator	Frequency and Loss	Created loss table
VAT-20	20dB Attenuator	Frequency and Loss	Created loss table
RFC1	SAC RF cable 10m	Frequency and Loss	Created loss table
RFC2	RF cable 0.5m	Frequency and Loss	Created loss table

Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests:

Parameter	Uncertainty
Radio Frequency	± 1 ppm
Total RF Power: Conducted	± 1 dB
RF Power Density: Conducted	± 2.75 dB
Spurious Emissions: Conducted	± 3.0 dB
Temperature	± 1.0 °C
Humidity	± 5.0 %
DC and Low Frequency Voltages	± 3.0 %
Radiated Emission, 30 to 18,000MHz	± 4.93 dB
Conducted Measurements, 0.15 to 30MHz	± 3.52 dB

Uncertainty figures are valid to a confidence level of 95%.

Result Summary

The Compliance Status is a judgment based on the direct measurements and calculated highest emissions to appropriate standard limits. Measurement uncertainty values, provided on calibration certificates, were not be used in the judgment of the final status of compliance.

FCC Part 15.247 and IC RSS-247 Class II testing as per Part 2.1043 and KDB 178919			
Test Type	Regulation	Measurement Method	Result
Out-of-Band Radiated Spurious Emission	FCC 15.247(d) & RSS-247 Section 5.5	ANSI C63.4:2014 & ANSI C63.10:2013, Clause 6	PASS
Radiated Emission Band Edge	FCC 15.247(d), 15.209, 15.205 & RSS-247	ANSI C63.4:2014 & ANSI C63.10:2013, Clause 6	PASS
Antenna Requirement	FCC 15.203 & RSS-Gen	-	PASS

Field Strength of Spurious Radiation

Governing Doc	FCC Part 15.247(d) IC RSS-247 § 5.5	Room Temperature (°C)	23.5		
Basic Standard	ANSI c63.10	Relative Humidity (%)	45		
Test Location	Richmond	Barometric Pressure (kPa)	101.6		
Test Engineer	David Johanson	Date	21 November 2017		
EUT Voltage	<input checked="" type="checkbox"/> 24VDC <input type="checkbox"/> 120VAC @ 60Hz				
Test Equipment Used	Manufacturer	Model	Identifier	Calibration	Calibration due
EMC Analyzer	Keysight	N9038A	702	27-Apr-2017	27-Apr-2018
Biconilog Antenna	Sunol	JB1	371	29-Mar-2016	29-Mar-2018
Loop Antenna	Com-Power	AL-130	241	08-Nov-2017	08-Nov-2019
Biconical Antenna	AH Systems	SAS-542	227B	29-Mar-2016	29-Mar-2018
Horn Antenna	A.H. Systems	SAS-571	227C	22-Sep-2016	22-Sep-2018
RF Preamplifier	Agilent	8449B	273	NCR	NCR
RF Generator	Anritsu	MG3710A	707	06-Jul-2016	06-Jul-2018
EMC Shielded Enclosure	USC	USC-26	374	NCR	NCR
RFC1	MRO	FLL400SFP	SAC	21Nov17	21Nov18
ATTEN20dB20W	Mini-Circuits	BW-S20W20	SAC	21Nov17	21Nov18
ATTEN20dB1W	Mini-Circuits	VAT-20	SAC	21Nov17	21Nov18
FILT_VLF-1800	Mini-circuits	VLF-1800	SAC	21Nov17	21 Nov18
FILT_VHF 3100	Mini-Circuits	VHF-3100	SAC	21Nov17	21No
Note) NCR = No Calibration Required					
Frequency Range:	<input checked="" type="checkbox"/> 1.0-18GHz <input checked="" type="checkbox"/> 30-1000MHz <input checked="" type="checkbox"/> 9kHz-30MHz				
Detector:	<input checked="" type="checkbox"/> Peak(for Prescan and Formal) <input checked="" type="checkbox"/> Average (for Formal) <input checked="" type="checkbox"/> Quasi-Peak(for Formal 30-1000MHz)				
RBW/VBW:	<input checked="" type="checkbox"/> 1/3MHz <input checked="" type="checkbox"/> 120/300kHz <input checked="" type="checkbox"/> 9/30kHz				
Type of Facility:	<input checked="" type="checkbox"/> SAC <input type="checkbox"/> OATS <input type="checkbox"/> <i>in-situ</i>				
Distance:	<input checked="" type="checkbox"/> 3meter <input type="checkbox"/> 10meter <input type="checkbox"/> 1meter				
Arrangement of EUT:	<input checked="" type="checkbox"/> Table-top only <input type="checkbox"/> Floor-standing only <input type="checkbox"/> Rack Mounted				
Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/>					

Test Method

The EUT and test equipment were set up and measurements taken using the procedures is based on ANSI c63.10

Adjust the spectrum analyzer for the following setting:

- a) RBW : 100 kHz (< 1 GHz), 1 MHz (> 1 GHz).
- b) VBW : 300 kHz (< 1 GHz), 3 MHz (> 1 GHz).
- c) Detector mode : Positive Peak

The transmitter was placed on a Styrofoam table, and it was set for continuous transmission

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

Requirements – Radiated Spurious Emissions:

Emissions found in Restricted bands, the levels must comply with the general limits found in FCC Part 15.209.

Frequency	Limits
FCC Part 15.209, IC RSS-GEN 8.9	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Test Setup

Description of test set-up:

The EUT was placed on a 0.8m non-conducting table above a ground reference plane (GRP) for the frequency range 9kHz to 1GHz.

The EUT was placed on a 1.5m non-conducting table above a ground reference plane (GRP) for the frequency range 1 to 25GHz.

The EUT was set to **Operation Mode #1 with configuration Modes #1 for the prescan. The EUT antenna was then changed to Modes 2 and 3 for final measurments as required.**

1 to 25GHz with Horn Antenna:



Results

All Radiated spurious emissions from the transmitter were greater than 20dB below the limit line and were not measured.

All other emissions detected are from the Power Supply or digital circuitry

Low Channel Bandedge



Client: Clad Innovations
Report No.:16686-1E
Revision No.:2



Antenna Requirement

Governing Doc	15.203	Room Temperature (°C)	N/A
Basic Standard	15.203	Relative Humidity (%)	N/A
Test Location	Richmond	Barometric Pressure (kPa)	N/A
Test Engineer	David Johanson	Date	22Dec2017
EUT Voltage	<input checked="" type="checkbox"/> 24DC <input type="checkbox"/> 120VAC @ 60Hz		
Compliant <input checked="" type="checkbox"/> Non-Compliant <input type="checkbox"/> Not Applicable <input type="checkbox"/>			

Results

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The EUT has 2 approved antenna, which accordance to the above sections, is considered sufficient to comply with the provisions of these sections. Both antenna's are permanently mounted inside the EUT and can not be easily replaced without using special tools and appropriate mounting hardware.

TZOA Part Number: TRF1001

Manufacturer: Aristotle P/N: RFA-02-L2H1 Description: 2 dBi 2.4 GHz External Antenna

TZOA Part Number: TRF1002

Manufacturer: Aristotle P/N: RFA-02-5-F7H1 Description: 5 dBi 2.4 GHz External Antenna –



APPENDIX A: ISO 17025:2005 Accreditation Certificate



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Labtest Certification, Inc.
3128, 20800 Westminster HWY
Richmond B.C. V6V 2W3

has been assessed by ANAB
and meets the requirements of international standard

ISO/IEC 17025:2005

while demonstrating technical competence in the field of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of tests to which this accreditation applies.

AT-2033

Certificate Number



ANAB Approval

Certificate Valid: 08/07/2017-03/04/2018
Version No. 004 Issued: 08/07/2017



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Labtest Certification, Inc.
3128, 20800 Westminster HWY
Richmond, B.C. V6V 2W3
Kavinder Dhillon Ruben Ugarte Phone: 604-247-0444
kdhillon@labtestcert.com rubenUgarte@labtestcert.com
www.labtestcert.com

TESTING

Valid to: March 4, 2018

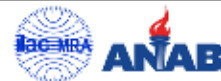
Certificate Number: A-T-2033

Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Unintentional Radiators (FCC Part 15, Subpart B)	• ANSI C63.4-2014		
Industrial, Scientific, and Medical Equipment (FCC Part 18)	• FCC MP-5, (February 1986)		
• Consumer ISM equipment			
Intentional Radiators (FCC Part 15 Subpart C)	• ANSI C63.10-2013		
UPCS (FCC Part 15, Subpart D)	• ANSI C63.17-2013		
• Unlicensed Personal Communication Systems devices			
U-NII without DFS Intentional Radiators (FCC Part 15, Subpart E)	• ANSI C63.10-2013	KDB Publication 789033	
• Unlicensed National Information Infrastructure Devices (U-NII without DFS)			
U-NII with DFS Intentional Radiators (FCC Part 15 Subpart E)	• FCC KDB Publication 905462 D02 UNII DFS Compliance Procedures New Rules v01 (April 8, 2016)		
• Unlicensed National Information Infrastructure U-NII Devices with Dynamic Frequency Selection (DFS)			
UWB Intentional Radiators (FCC Part 15, Subpart F)	• ANSI C63.10-2013		
• Ultra-wideband Operation			
BPL Intentional Radiators (FCC Part 15, Subpart G)	• ANSI C63.10-2013		
• Access Broadband Over Power Line (Access BPL)			
White Space Device Intentional Radiators (FCC Part 15, Subpart H)	• ANSI C63.10-2013		
• White Space Devices			

Version 003 Issued: 08/07/2017

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Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Commercial Mobile Services (FCC Licensed Radio Service Equipment) •Part 22 (cellular) •Part 24 •Part 25 (non-microwave) •Part 27	• ANSI/TIA-603-D • TIA-102.CAAA-D	KDB Publication 971168	
General Mobile Radio Services (FCC Licensed Radio Service Equipment) •Part 22 (non-cellular) •Part 90 (non-microwave) •Part 95 •Part 97 •Part 101 (non-microwave)	• ANSI/TIA-603-D • TIA-102.CAAA-D		Microwave Frequencies, as used in this part, refers to frequencies of 890 MHz and above.
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) •Part 96	• ANSI/TIA-603-D • TIA-102.CAAA-D	KDB Publication 971168	
Maritime and Aviation Radio Services (FCC Licensed Radio Service Equipment) •Part 80 •Part 87	• ANSI/TIA-603-D		
Microwave and Millimeter Bands Radio Services (FCC Licensed Radio Service Equipment) •Part 25 •Part 74 •Part 90 (90Y, 90Z, D SRC) •Part 101	• ANSI/TIA-603-D • TIA-102.CAAA-D		
Broadcast Radio Services (FCC Licensed Radio Service Equipment) •Part 73 •Part 74 (non-microwave)	• ANSI/TIA-603-D • TIA-102.CAAA-D		
RF Exposure •Devices subject to SAR requirements	• IEEE Std 1528™-2013	KDB Publication 865664 KDB Publication 447498	
Hearing Aid Compatibility (Part 20) •HAC for Commercial mobile services	• ANSI C63.19-2007; or • ANSI C63.19-2011		



Testing performed in support of FCC DoC and Certification approval procedures

Type of Device Examples	Scope of Accreditation	Supporting FCC Guidance	Comments
Signal Boosters (Part 20) •Wideband Consumer signal boosters •Provider-specific signal boosters •Industrial signal boosters	<ul style="list-style-type: none"> FCC KDB Publication 935210 D03 Signal Booster Measurements v04 (February 12, 2016) FCC KDB Publication 935210 D04 Provider Specific Booster Measurements v02 (February 12, 2016) FCC KDB Publication 935210 D05 Indus Booster Basic Meas v01r01 (February 12, 2016) 		

Electromagnetic Compatibility (EMC)

Test Method	Test Specification(s)	Range	Comments
Unintentional Radiators	ANSI C63.4-2003 ANSI C63.4-2009 ANSI C63.4:2014;		
Radiated and Conducted Emissions	FCC O STMP-05 (1986); ICES-001(2006); ICES-002(2013); ICES-003(2016); ICES-005(2009); CISPR 16-1-1(2015); CISPR 16-1-2(2014); CISPR 16-1-3(2006); CISPR 16-2-1(2014); CISPR 16-2-2(2010); CISPR 16-2-3(2014); CISPR 16-2-5(2008); CISPR 16-4-2(2014); EN 55016-1-1(2010); EN 55016-1-2(2014); EN 55016-1-3(2006); EN 55016-1-4(2010); EN 55016-2-1(2014); EN 55016-2-2(2011); EN 55016-2-3(2014); EN 55016-4-2(2014); CISPR 11(2012); EN 55011(2013); AS/NZS CISPR 11(2013); KN 11 (RRA Announce 2015-110, Dec, 03, 2015); VCCI V-3 (up to 6 GHz); VCCI V-5; CNS 13438	9 kHz to 40 GHz	



END OF REPORT