Certification Test Report

FCC ID: O76ONVATION
IC: 10391B-ONVATION

FCC Rule Part: 15.247
ISED Canada Radio Standards Specification: RSS-247

Report Number: AT72146324-1C0

Manufacturer: GOJO Industries, Inc.
Model: Onvation Module
HVIN: PC10257

Test Begin Date: February 18, 2019
Test End Date: March 5, 2019

Report Issue Date: March 13, 2019

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: 2955.09

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the Federal Government.

Prepared By:

Jeremy Pickens
Senior Wireless Engineer
TÜV SÜD America Inc.

Reviewed by:

Ryan McGann
Team Leader
TÜV SÜD America Inc.

This report contains 20 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-247 for limited single modular approval.

1.2 Applicant Information

GOJO Industries, Inc.
One Gojo Plaza Suite 500 (PO Box 991)
Akron, OH 44311 USA

1.3 Product Description

The Onvation module utilizes the Nordic BLE IC (nRF52832) and is used in various automatic soap dispensers.

Technical Details

Mode of Operation:	Bluetooth Low Energy (BLE)
Frequency Range:	2402 MHz - 2480 MHz
Number of Channels:	40
Channel Separation:	2 MHz
Modulations:	GFSK
Antenna Type/Gain:	PCB Trace Antenna / 0.5dBi Peak
Input Power:	5 Vdc (to module)

Model Number: Onvation Module, HVIN: PC10257

Test Sample Serial Number(s): Not Labeled

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

All modes of operation, including all data rates, were evaluated and the data presented in this report represents the worst case where applicable.

For radiated emissions, the EUT was installed in three different host devices. Due to only one mounting position, these were only evaluated in a single orientation.

For RF Conducted measurements, the module's antenna was replaced with an SMA connector for direct connection to the test equipment. The EUT was programmed to generate a continuously modulated signal on each channel evaluated.

For power line conducted emissions, the EUT was evaluated in a host powered via 120Vac, 60Hz.

Power setting during test: 0dBm

2 TEST FACILITIES

2.1 Location

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

TÜV SÜD America, Inc.
5945 Cabot Pkwy, Suite 100
Alpharetta, GA 30005
Phone: (678) 341-5900

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation/A2LA accreditation program and has been issued certificate number 2955.09 in recognition of this accreditation.

Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scopes of accreditation.

The Semi-Anechoic Chamber Test Sites and Conducted Emissions Sites have been fully described, submitted to, and accepted by the FCC, ISED Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number:	967699
ISED Canada Lab Code:	23932
VCCI Member Number:	1831
• VCCI Registration Number	A-0295

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20'W x 30'L x 20'H shielded enclosure. The chamber is lined with ETS-Lindgren Ferrite Absorber, model number FT-1500. The ferrite tile 600 mm x 600 mm (2.62 in x 23.62 in) panels and are mounted directly on the inner walls of the chamber shield.

The specular regions of the chamber are lined with additional ETS-Lindgren PS-600 hybrid absorber to extend its frequency range up to 18GHz and beyond.

The turntable is a 2m ETS-Lindgren Model 2170 and installed off the center axis is located 5'6" from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the shield using #8 solid copper wire.

The antenna mast is an EMCO 1060 and is remotely controlled from the control room for both antenna height and polarization.

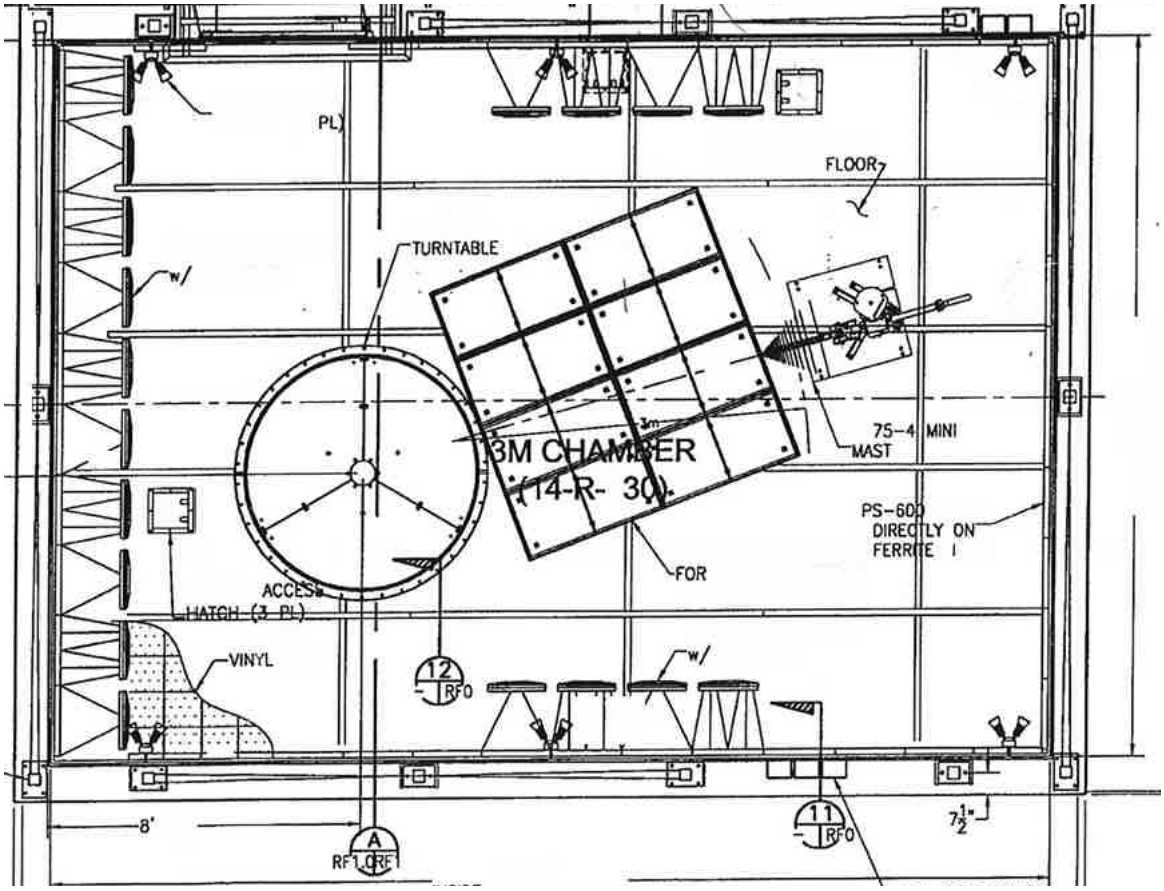

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

2.4.1 Conducted Emissions Test Site

The AC mains conducted EMI site is located in the main EMC lab. It consists of a 12' x 10' horizontal coupling plane (HCP) as well as a 12'x8' vertical coupling plane(VCP). The HGP is constructed of 4' x 10' sheets of particle board sandwiched by galvanized steel sheets. These panels are bonded using 11AWG 1/8" x 2" by 10' galvanized sheet steel secured to the panels via by screws. The VCP is constructed of three 4'x8' sheets of 11AWG solid aluminum.

The HCP and VCP are electrically bonded together using 1"x1" angled aluminum secured with screws.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.10.

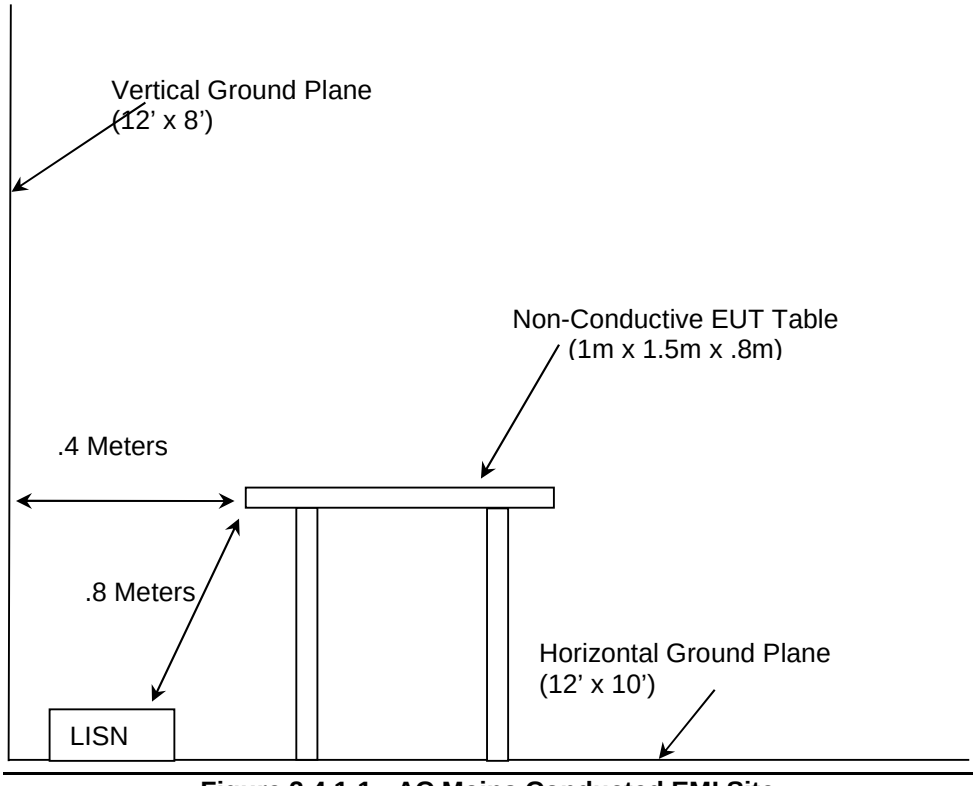

Figure 2.4.1-1: AC Mains Conducted EMI Site

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, 2019
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2019
- FCC KDB 558074 D01 DTS Meas Guidance v05r01 - Guidance for Compliance Measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules, February 11, 2019
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017.
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, April 2018.

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

Asset ID	Manufacturer	Model	Equipment Type	Serial Number	Last Calibration Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	1-18GHz Horn Antenna	970102	05/09/2017	05/09/2019
213	TEC	PA 102	Amplifier	44927	07/19/2018	07/19/2019
321	Hewlett Packard	HPC 8447D	Low Freq. Pre-Amp	1937A02809	09/12/2018	09/12/2019
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	07/11/2017	07/11/2019
622	Rohde & Schwarz	FSV40 (v3.40)	FSV Signal Analyzer 10Hz to 40GHz	101338	07/30/2018	07/30/2020
638	Rohde & Schwarz	OSP 120	Open Switch and Control Unit	101229	04/28/2017	04/28/2019
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019
827	(-)	TS8997 Rack Cable Set	TS8997 Rack Cable Set	N/A	08/13/2018	08/13/2019
831	Rohde & Schwarz	FSP38	Spectrum Analyzer 9kHz-40GHz	0	04/26/2018	04/26/2019
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	05/01/2018	05/01/2019
851	TUV ATLANTA	FMC0101951-100CM	ASAC Cable Set Consisting of 566, 619, and 643	N/A	09/26/2018	09/26/2019
852	Teseq	CBL 6112D	Bilog Antenna; Attenuator	51617	10/15/2018	10/15/2019
853	Teseq	CBL 6112D; 6804.17.A	Bilog Antenna; Attenuator	51616; 20181110A	10/15/2018	10/15/2019

NCR = No Calibration Required
NOTE: All test equipment was used only during active calibration cycles as reported above.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Onvation Module	GOJO Industries, Inc.	PC10257	NA
2	Soap Dispenser	GOJO Industries, Inc.	GoJo – LTX	Not labeled
			Purell – ES8	
			CXR	
3	AC/DC Adapter	Shenzhen Geao Technology Co LTD	GEO651DA-0660	NA

Table 5-2: Cable Description

Item	Cable Type	Length	Shield	Termination
A	DC Power	1.0 m	No	2 - 3
B	AC Power Cable	1.2 m	No	3 - AC

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

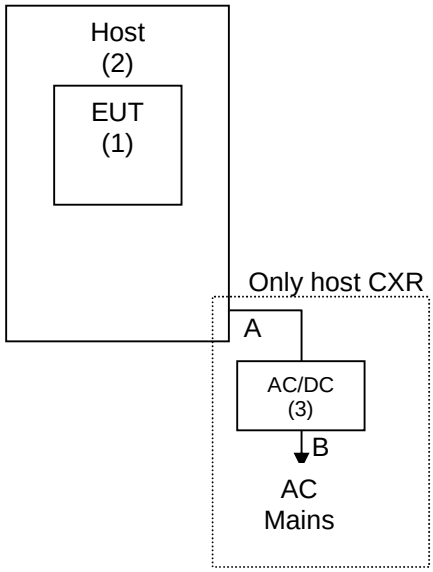

Figure 6-1: Test Setup Block Diagram

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 15.203

The EUT utilizes a PCB trace antenna. The antenna is integral to the device and cannot be removed or replaced by the end user. The maximum gain of the antenna is 0.5 dBi.

7.2 Power Line Conducted Emissions – FCC 15.207, ISED Canada: RSS-Gen 8.8

7.2.1 Measurement Procedure

ANSI C63.10 section 6 was the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Measurement Results

Performed by: Eugene Sello

Table 7.2.2-1: Conducted EMI Results Line 1

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.15	34.6	10.65	66	56	31.4	45.35	9.59
0.158	38.71	19.49	65.57	55.57	26.86	36.08	9.58
0.202	37.47	13.12	63.53	53.53	26.06	40.41	9.58
0.258	31.75	13.15	61.5	51.5	29.75	38.35	9.58
0.514	29.93	17.24	56	46	26.07	28.76	9.59
2.794	29.69	10.68	56	46	26.31	35.32	9.62
2.87	24.02	10.7	56	46	31.98	35.3	9.62
2.914	23.71	10.71	56	46	32.29	35.29	9.62
2.99	23.83	10.74	56	46	32.17	35.26	9.62
29.998	26.73	13.38	60	50	33.27	36.62	9.81

Table 7.2.2-2: Conducted EMI Results Line 2

Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak (dBµV)	Average (dBµV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.15	35.82	17.52	66	56	30.18	38.48	9.59
0.17	32.66	19.05	64.96	54.96	32.3	35.91	9.58
0.202	33.65	14.08	63.53	53.53	29.88	39.45	9.58
0.214	32.68	13.34	63.05	53.05	30.37	39.71	9.58
2.734	23.78	10.66	56	46	32.22	35.34	9.62
2.782	23.87	10.67	56	46	32.13	35.33	9.62
2.802	23.75	10.68	56	46	32.25	35.32	9.62
2.938	23.76	10.72	56	46	32.24	35.28	9.62
2.974	23.88	10.73	56	46	32.12	35.27	9.62
29.998	26.83	13.47	60	50	33.17	36.53	9.9

7.3 6dB / 99% Bandwidth – FCC 15.247(a)(2), ISED Canada: RSS-247 5.2(a)

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 Section 8.2 which references Subclause 11.8 of ANSI C63.10. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set from 1% to 5% of the occupied bandwidth and the video bandwidth set to at least 3 times the resolution bandwidth. A peak detector was used.

7.3.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.3.2-1: 6dB / 99% Bandwidth

Modulation	Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
GFSK	2402	0.891	1.938
	2440	0.891	1.878
	2480	0.812	1.885

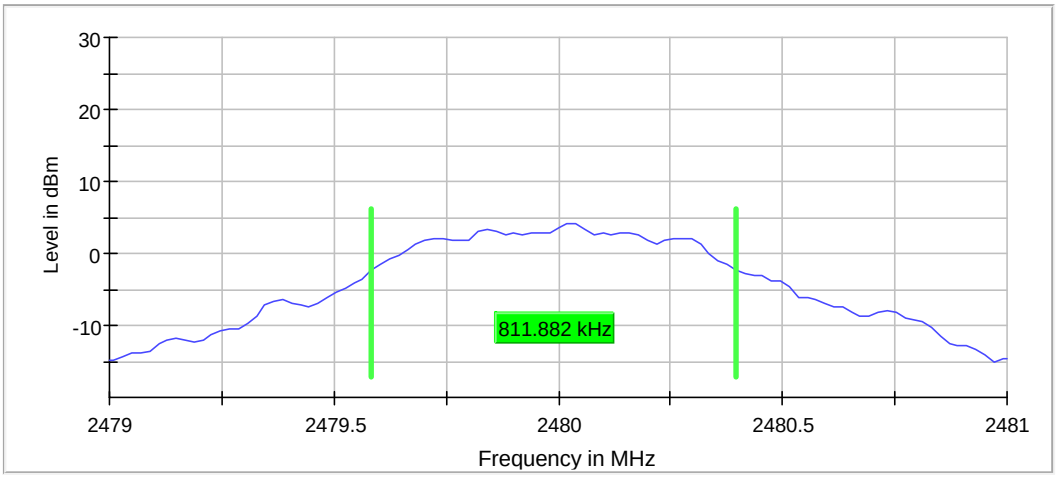

Figure 7.3.2-1: Sample Plot - 6dB BW

Table 7.3.2-2: Sample Measurement Settings (6dB BW)

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 40
Sweeptime	18.938 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	9 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.21 dB	0.50 dB

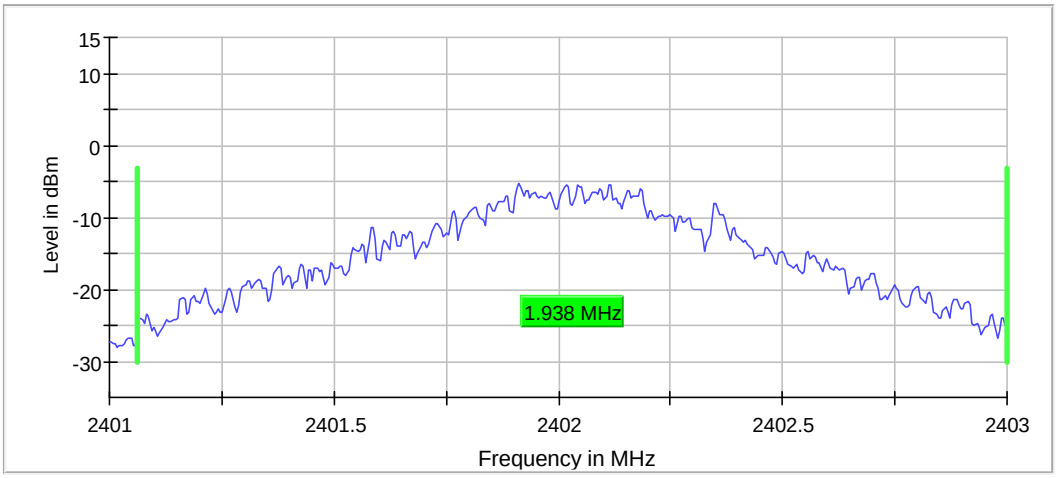

Figure 7.3.2-2: Sample Plot - 99% OBW

Table 7.3.2-3: Sample Measurement Settings (OBW)

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	>= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
Sweeptime	189.648 µs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	7 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.13 dB	0.50 dB

7.4 Fundamental Emission Output Power – FCC 15.247(b)(3), ISED Canada: RSS-247 5.4(d)

7.4.1 Measurement Procedure

The maximum conducted output power was measured in accordance with FCC KDB 558074 D01 utilizing the RBW ≥ DTS Bandwidth method. The RF output of the equipment under test was directly connected to the input of the analyzer applying suitable attenuation. Worst-case power across all data rates is reported.

7.4.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.4.2-1: Conducted Output Power

Modulation	Frequency [MHz]	Peak Power [dBm]
GFSK	2402	1.1
	2440	1.4
	2480	1.4

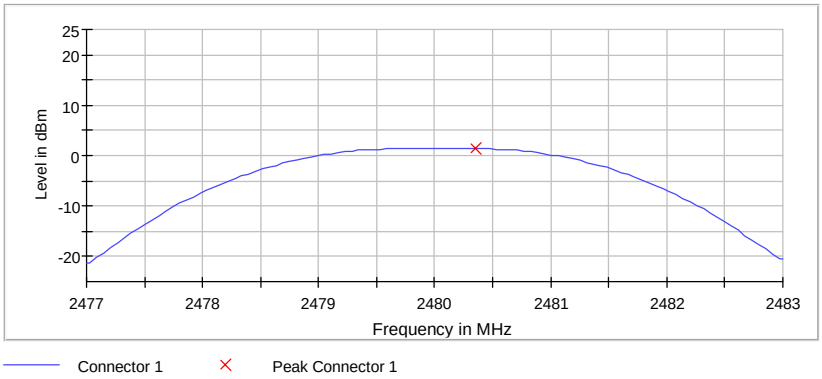

Figure 7.4.2-1: Sample Plot

Table 7.4.2-2: Sample Measurement Settings

Setting	Instrument Value	Target Value
Start Frequency	2.47700 GHz	2.47700 GHz
Stop Frequency	2.48300 GHz	2.48300 GHz
Span	6.000 MHz	6.000 MHz
RBW	2.000 MHz	>= 1.000 MHz
VBW	10.000 MHz	>= 6.000 MHz
SweepPoints	101	~ 101
Sweeptime	953.450 ns	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.02 dB	0.50 dB

7.5 Emission Levels

7.5.1 Emissions into Non-restricted Frequency Bands – FCC 15.247(d); ISED Canada: RSS-247 5.5

7.5.1.1 Measurement Procedure

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 Section 8.5. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit at the band edges. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. The worst-case for each modulation was investigated at the lower and upper band edges.

7.5.1.2 Measurement Results

Performed by: Tyler Leeson

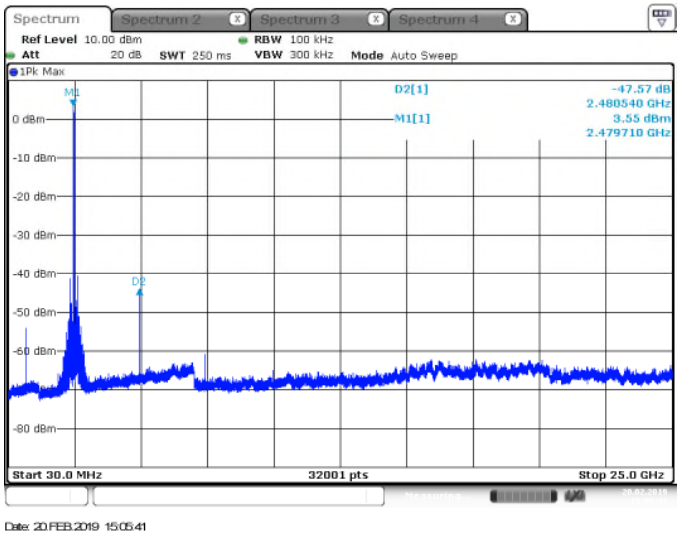

Figure 7.5.1.2-1: LCH – 30MHz–25GHz

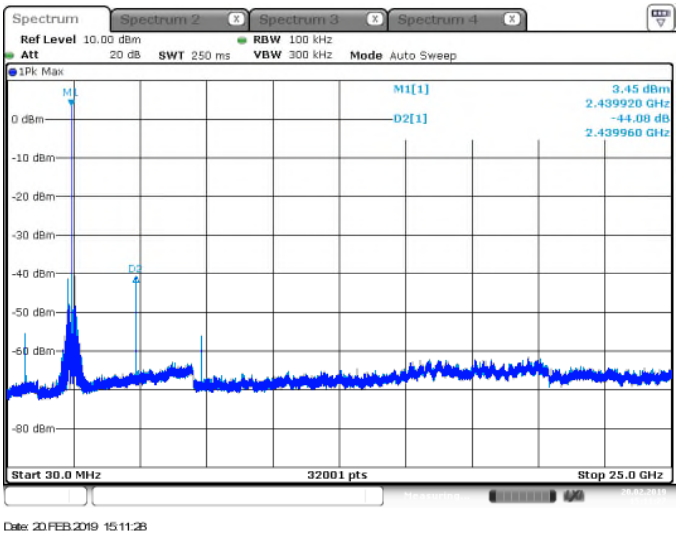

Figure 7.5.1.2-2: MCH – 30MHz–25GHz

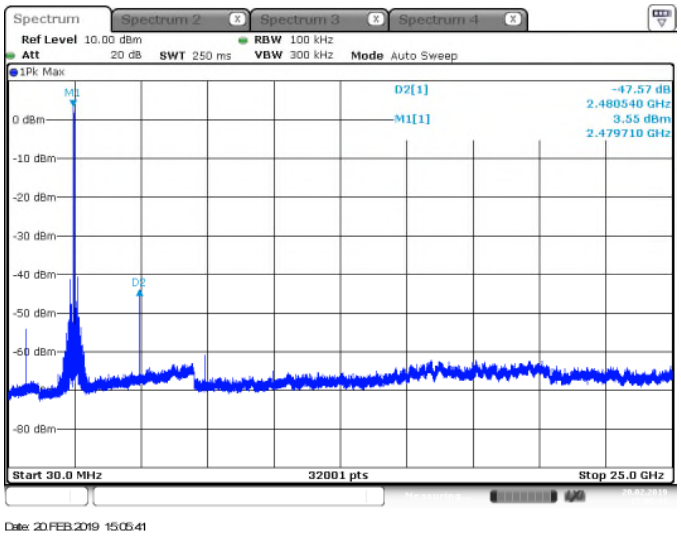

Figure 7.5.1.2-3: HCH – 30MHz–25GHz

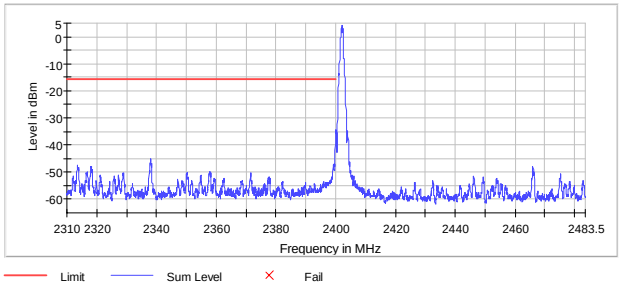

Figure 7.5.1.2-4: Lower Band-edge

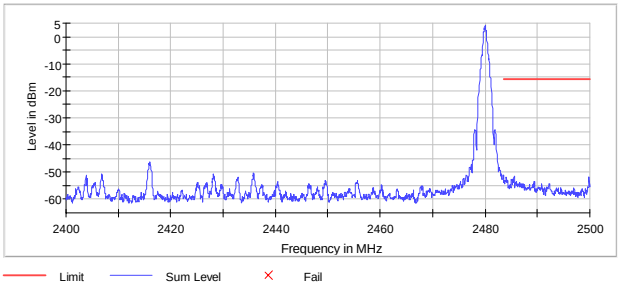

Figure 7.5.1.2-5: Upper Band-edge

Table 7.5.1.2-1: Lower Band-edge

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-34.7	18.9	-15.7	PASS
2399.925000	-35.5	19.8	-15.7	PASS
2399.875000	-37.0	21.3	-15.7	PASS
2399.825000	-39.4	23.6	-15.7	PASS
2399.775000	-42.1	26.3	-15.7	PASS
2338.025000	-45.0	29.3	-15.7	PASS
2399.725000	-45.0	29.3	-15.7	PASS
2338.075000	-45.9	30.1	-15.7	PASS
2337.975000	-46.0	30.2	-15.7	PASS
2338.125000	-46.0	30.3	-15.7	PASS
2337.925000	-46.4	30.6	-15.7	PASS
2338.325000	-46.7	30.9	-15.7	PASS
2337.875000	-46.8	31.1	-15.7	PASS
2338.375000	-46.9	31.1	-15.7	PASS
2399.175000	-47.0	31.3	-15.7	PASS

Table 7.5.1.2-2: Upper Band-edge

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2485.525000	-51.7	35.9	-15.8	PASS
2499.825000	-51.9	36.2	-15.8	PASS
2484.075000	-52.0	36.2	-15.8	PASS
2485.575000	-52.0	36.3	-15.8	PASS
2485.475000	-52.3	36.5	-15.8	PASS
2484.025000	-52.6	36.9	-15.8	PASS
2485.075000	-52.8	37.0	-15.8	PASS
2499.875000	-52.8	37.0	-15.8	PASS
2485.275000	-52.8	37.1	-15.8	PASS
2484.275000	-52.9	37.1	-15.8	PASS
2483.925000	-52.9	37.2	-15.8	PASS
2485.125000	-52.9	37.2	-15.8	PASS
2484.325000	-52.9	37.2	-15.8	PASS
2483.675000	-53.0	37.2	-15.8	PASS
2499.775000	-53.0	37.2	-15.8	PASS

7.5.2 Emissions into Restricted Frequency Bands – FCC: 15.205, 15.209; ISED Canada: RSS-Gen 8.9 / 8.10

7.5.2.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

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. For frequencies above 1000 MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.5.2.2 Measurement Results

Performed by: Eugene Sello / Jeremy Pickens

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data (Host CXR)

Frequency (MHz)	Level (dBµV)		Antenna Polarity	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2402 MHz										
4804	53.70	49.30	H	4.51	58.21	18.62	74.0	54.0	15.8	35.4
4804	51.90	47.10	V	4.51	56.41	16.42	74.0	54.0	17.6	37.6
2440 MHz										
4880	47.20	44.80	H	4.82	52.02	14.43	74.0	54.0	22.0	39.6
4880	47.10	44.70	V	4.82	51.92	14.33	74.0	54.0	22.1	39.7
2480 MHz										
4960	44.80	41.60	H	5.14	49.94	11.56	74.0	54.0	24.1	42.4
4960	44.40	40.80	V	5.14	49.54	10.76	74.0	54.0	24.5	43.2

Table 7.5.2.2-2: Radiated Spurious Emissions Tabulated Data (Host ES8)

Frequency (MHz)	Level (dBµV)		Antenna Polarity	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2402 MHz										
2390	47.69	35.49	H	-4.87	42.82	-4.57	74.0	54.0	31.2	58.6
2390	47.99	35.96	V	-4.87	43.12	-4.10	74.0	54.0	30.9	58.1
4804	54.23	51.36	H	2.45	56.68	18.63	74.0	54.0	17.3	35.4
4804	51.43	46.99	V	2.45	53.88	14.26	74.0	54.0	20.1	39.7
2440 MHz										
4880	53.29	49.10	H	2.82	56.11	16.73	74.0	54.0	17.9	37.3
4880	51.81	47.66	V	2.82	54.63	15.29	74.0	54.0	19.4	38.7
2480 MHz										
2483.5	53.01	49.14	H	-4.48	48.53	9.47	74.0	54.0	25.5	44.5
2483.5	61.95	59.6	V	-4.48	57.47	19.93	74.0	54.0	16.5	34.1
4960	51.53	47.67	H	3.20	54.73	15.68	74.0	54.0	19.3	38.3
4960	51.23	46.47	V	3.20	54.43	14.48	74.0	54.0	19.6	39.5

Table 7.5.2.2-3: Radiated Spurious Emissions Tabulated Data (Host LTX)

Frequency (MHz)	Level (dBµV)		Antenna Polarity	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2402 MHz										
2390	46.99	35.18	H	-4.87	42.12	-4.88	74.0	54.0	31.9	58.9
2390	48.33	35.97	V	-4.87	43.46	-4.09	74.0	54.0	30.5	58.1
4804	55.61	52.72	H	2.45	58.06	19.99	74.0	54.0	15.9	34.0
4804	51.85	46.85	V	2.45	54.30	14.12	74.0	54.0	19.7	39.9
2440 MHz										
4880	54.72	51.55	H	2.82	57.54	19.18	74.0	54.0	16.5	34.8
4880	51.40	46.38	V	2.82	54.22	14.01	74.0	54.0	19.8	40.0
2480 MHz										
2483.5	55.79	52.81	H	-4.48	51.31	13.14	74.0	54.0	22.7	40.9
2483.5	61.11	58.83	V	-4.48	56.63	19.16	74.0	54.0	17.4	34.8
4960	52.28	47.69	H	3.20	55.48	15.70	74.0	54.0	18.5	38.3
4960	51.22	45.2	V	3.20	54.42	13.21	74.0	54.0	19.6	40.8

7.5.2.3 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 (LTX Low Channel)

Corrected Level: 55.61 + 2.45 = 58.06dBuV/m
Margin: 74dBuV/m – 58.06dBuV/m = 15.9dB

Example Calculation: Average (LTX Low Channel)

Corrected Level: 52.72 + 2.45 - 35.18 = 19.99dBuV
Margin: 54dBuV – 19.99dBuV = 34.0dB

7.6 Maximum Power Spectral Density in the Fundamental Emission – FCC 15.247(e) ISED Canada: RSS-247 5.2(b)

7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB 558074 D01 utilizing Section 8.4. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 10 kHz. The Video Bandwidth (VBW) was set to 30 kHz. Span was set to 1.5 times the channel bandwidth. The trace was set to max hold with the peak detector active.

7.6.2 Measurement Results

Performed by: Jeremy Pickens

Table 7.6.2-1: Power Spectral Density

Modulation	Frequency [MHz]	PSD [dBm]
GFSK	2402	-7.008
	2440	-5.972
	2480	-7.825

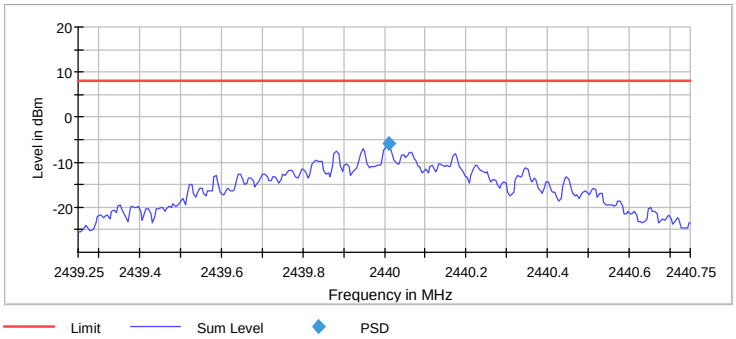

Figure 7.6.2-1: Sample PSD Plot

Table 7.6.2-2: Sample Measurement Settings (PSD)

Setting	Instrument Value	Target Value
Start Frequency	2.43925 GHz	2.43925 GHz
Stop Frequency	2.44075 GHz	2.44075 GHz
Span	1.500 MHz	1.500 MHz
RBW	10.000 kHz	<= 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	300	~ 300
Sweeptime	1.500 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	2 / 2	2
Max Stable Difference	0.20 dB	0.50 dB

8 ESTIMATION OF MEASUREMENT UNCERTAINTY

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: Estimation of Measurement Uncertainty

Parameter	U_{lab}
Occupied Channel Bandwidth	± 0.009 %
RF Conducted Output Power	± 0.349 dB
Power Spectral Density	± 0.372 dB
Antenna Port Conducted Emissions	± 1.264 dB
Radiated Emissions ≤ 1 GHz	± 5.814 dB
Radiated Emissions > 1 GHz	± 4.318 dB
Temperature	± 0.860 °C
Radio Frequency	± 2.832 x 10^{-8}
AC Power Line Conducted Emissions	± 3.360 dB

9 CONCLUSION

In the opinion of TUV SUD the Onvation Module, manufactured by GOJO Industries, Inc. meets the requirements of FCC Part 15 subpart C and ISED Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT