



Certification Test Report

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

Report Number: AT72141218-1Z2

Manufacturer: Johnson Outdoors, Inc.
Model: Helix 7X CHIRP MSI GPS G3N

Test Begin Date: August 16, 2018
Test End Date: August 17, 2018

Report Issue Date: October 24, 2018



For 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.

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This report contains 13 pages

TABLE OF CONTENTS

1	GENERAL	3
1.1	PURPOSE.....	3
1.2	PRODUCT DESCRIPTION	3
1.3	TEST METHODOLOGY AND CONSIDERATIONS	4
2	TEST FACILITIES.....	5
2.1	LOCATION	5
2.2	LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS	5
2.3	RADIATED EMISSIONS TEST SITE DESCRIPTION	6
2.3.1	<i>Semi-Anechoic Chamber Test Site.....</i>	<i>6</i>
3	APPLICABLE STANDARD REFERENCES.....	7
4	LIST OF TEST EQUIPMENT.....	7
5	SUPPORT EQUIPMENT.....	8
6	EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM	8
7	SUMMARY OF TESTS.....	9
7.1	ANTENNA REQUIREMENT – FCC: PART 15.203.....	9
7.2	EMISSION LEVELS	10
7.2.1	<i>Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209, 15.247(d);</i> <i>ISED Canada: RSS-Gen 8.9 / 8.10.....</i>	<i>10</i>
7.2.1.1	<i>Measurement Procedure.....</i>	<i>10</i>
	<i>Each emission found to be in a restricted band as defined by section 15.205, was compared to the</i> <i>radiated emission limits as defined in section 15.209.</i>	<i>10</i>
7.2.2	<i>Test Results.....</i>	<i>11</i>
7.2.3	<i>Sample Calculation:</i>	<i>12</i>
8	ESTIMATION OF MEASUREMENT UNCERTAINTY	13
9	CONCLUSION.....	13

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 certification.

1.2 Product description

The HELIX 7X CHIRP MSI GPS G3N features a large 7" display with LED backlight, CHIRP Down Imaging and CHIRP Digital Sonar. Includes GPS chartplotting with built-in Bluetooth, Ethernet networking capabilities, AutoChart Live with depth, vegetation and bottom hardness mapping, and unit cover. Hummingbird Basemap cartography built-in. The HELIX 7X CHIRP MSI GPS G3N has a built-in Bluetooth 4.1 module model number PAN1326B manufactured by Panasonic (FCC ID: T7V1316).

Model variants include:

HELIX 7 CHIRP GPS G3
HELIX 7X CHIRP GPS G3
HELIX 7 CHIRP MDI GPS G3
HELIX 7X CHIRP MDI GPS G3
HELIX 7 CHIRP MSI GPS G3
HELIX 7X CHIRP MSI GPS G3
HELIX 7 CHIRP GPS G3N
HELIX 7X CHIRP GPS G3N
HELIX 7 CHIRP MDI GPS G3N
HELIX 7X CHIRP MDI GPS G3N
HELIX 7 CHIRP MSI GPS G3N
HELIX 7X CHIRP MSI GPS G3N (Tested Variant)
ICE HELIX 7 CHIRP GPS G2N

This test report demonstrates continued compliance of the FCC ID: T7V1316 integrated into the HELIX 7X CHIRP MSI GPS G3N host device.

Technical Information: Bluetooth Module

Detail	Description
Frequency Range	2402 - 2480 MHz
Number of Channels	BT Classic: 79 BT Low Energy: 40
Modulation Format	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operating Voltage	1.8 VDC
Antenna Type / Gain	Surface Mount Ceramic Chip / 0.9 dBi

Manufacturer Information:

Johnson Outdoors, Inc.
678 Humminbird Lane
Eufaula, AL 36027

Test Sample Serial Number(s): 18073122-3004

Test Sample Condition: The test sample was provided in working order with no visible defects.

1.3 Test Methodology and Considerations

The worst-case modes of operation as defined in the modular test report were evaluated. The data presented in this report represents the worst case where applicable.

For Radiated Emissions, the EUT was programmed to generate a continuously modulated signal. The EUT was evaluated in an orientation typical of normal installation. See test setup photos for more information.

The EUT is a DC-powered device with no provisions for connection to the public utilities, therefore power line conducted emissions was not performed.

Software power setting during test: +10 dB

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.

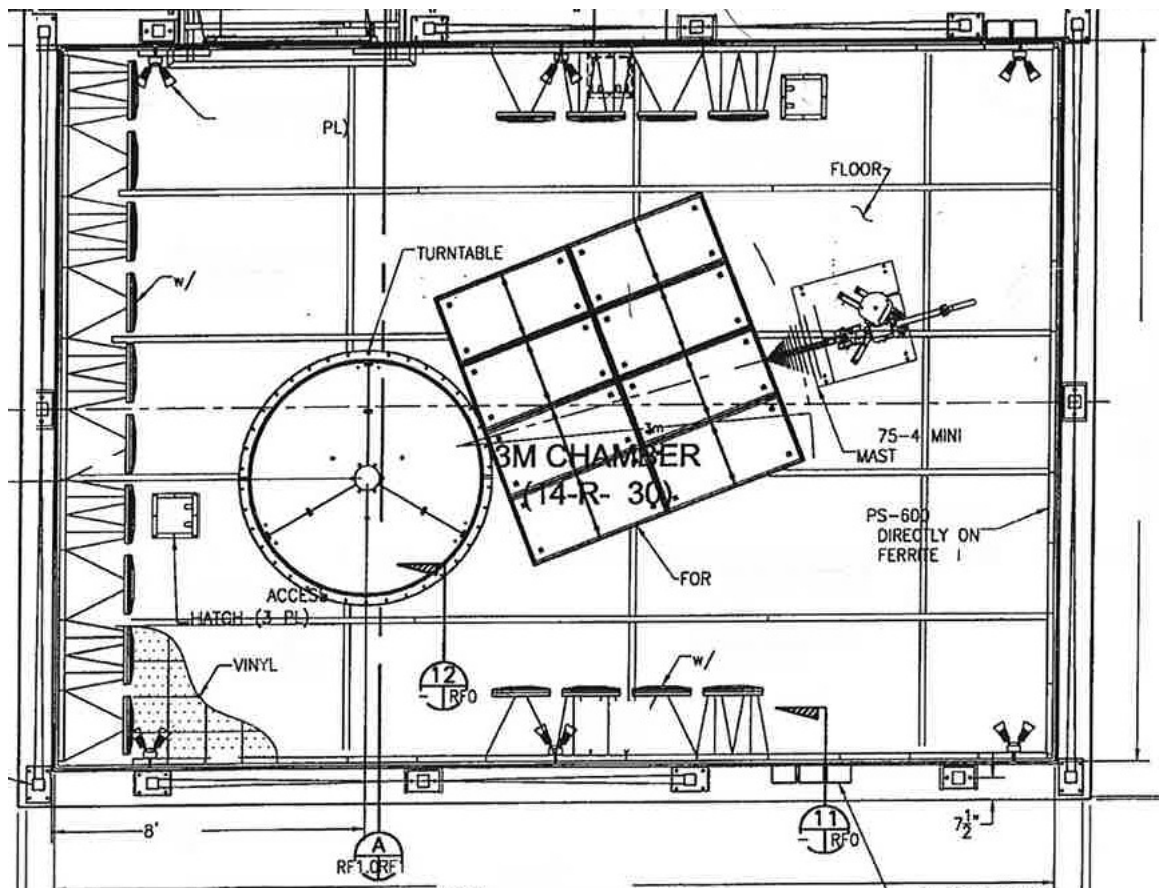


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

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, 2018
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2018
- ❖ 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.
- ❖ Innovation, Science and Economic Development 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	5/9/2017	5/9/2019
213	TEC	PA 102	Amplifier	44927	7/19/2018	7/19/2019
338	Hewlett Packard	8449B	High Frequency Pre-Amp	3008A01111	7/11/2017	7/11/2019
90	Electro-metrics	LPA25	LPA Antenna	1476	1/3/2018	1/3/2020
731	EMCO	3104	Bicon Antenna	2659	11/9/2016	11/9/2018
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	10/31/2017	10/31/2018
836	ETS Lindgren	SAC Cable Set	SAC Cable Set includes 620, 837, 838	N/A	5/1/2018	5/1/2019

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	External GPS Receiver	Johnson Outdoors	AS GPS HS	14121642-0035
2	Marine Battery	AUTOCRAFT	29HM	N/A
3	Transducer	Johnson Outdoors	N/A	N/A
4	Remote Unit	Johnson Outdoors	Helix 7 CHIRP MSI GPS G3N	180424220007

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	GPS Cable	600 cm	No	EUT – External GPS Receiver
B	Transducer Cable	600 cm	No	EUT – Transducer
C	DC Power Cable	190 cm	No	EUT – Marine Battery
D	Ethernet Cable	500 cm	No	EUT – Remote Unit

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

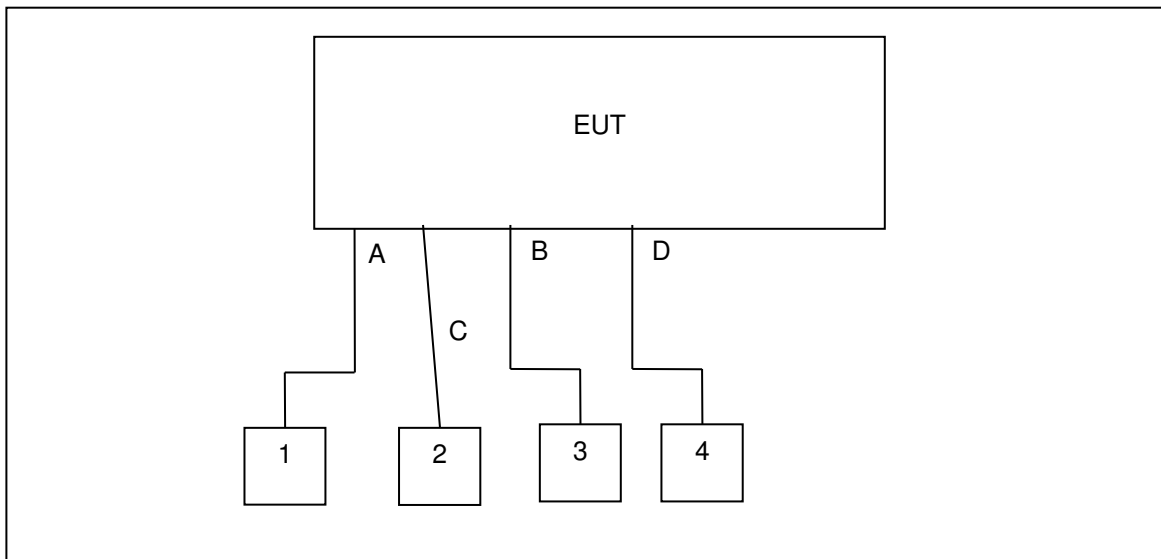


Figure 6-1: EUT System Block Diagram

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: Part 15.203

The antenna is a PCB Printed Loop antenna and is non-detachable without compromising the device, therefore satisfying Part 15.203. The antenna gain is 0.9 dBi.

7.2 Emission Levels

7.2.1 Emissions into Restricted Frequency Bands – FCC: Sections 15.205, 15.209, 15.247(d); ISED Canada: RSS-Gen 8.9 / 8.10

7.2.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 25 GHz, 10 times the highest fundamental frequency.

Measurements below 30 MHz were performed with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360° to maximize each emission. The magnetic loop receiving antenna was positioned with its lowest point 1 meter above the ground. The loop antenna was aligned along the site axis, orthogonal to the site axis, and ground-parallel to the site axis.

The spectrum analyzer's resolution and video bandwidths were set to 200 Hz and 1000 Hz respectively for frequencies below 150 kHz and 9 kHz and 30 kHz respectively for frequencies above 150 kHz and below 30 MHz.

For measurements above 30 MHz, 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, measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz using a quasi-peak detector. For frequencies above 1000 MHz, measurements were made with RBW of 1 MHz and a VBW of 3 MHz using a peak and average detectors.

Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

7.2.2 Test Results

Performed by: Tyler Leeson

Radiated spurious emissions are reported in Table 7.2.2-1 through Table 7.2.2-3. Emissions not reported were below the noise floor of the measurement system.

Table 7.2.2-1: Radiated Emissions – Bluetooth Low Energy

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Spurious Emissions										
4804	51.90	45.10	H	5.07	56.97	50.17	74.0	54.0	17.0	3.8
4804	49.30	39.40	V	5.07	54.37	44.47	74.0	54.0	19.6	9.5
2390	47.50	33.70	H	-0.75	46.75	32.95	74.0	54.0	27.3	21.1
2390	47.80	33.90	V	-0.75	47.05	33.15	74.0	54.0	27.0	20.9

Table 7.2.2-2: Radiated Emissions – Bluetooth GFSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Spurious Emissions										
4804	52.80	47.10	H	5.07	57.87	52.17	74.0	54.0	16.1	1.8
4804	49.90	41.50	V	5.07	54.97	46.57	74.0	54.0	19.0	7.4
2390	47.50	33.70	H	-0.75	46.75	32.95	74.0	54.0	27.3	21.1
2390	47.80	33.90	V	-0.75	47.05	33.15	74.0	54.0	27.0	20.9

Table 7.2.2-3: Radiated Emissions – Bluetooth 8DPSK

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Spurious Emissions										
4804	54.30	44.70	H	5.07	59.37	49.77	74.0	54.0	14.6	4.2
4804	49.80	41.30	V	5.07	54.87	46.37	74.0	54.0	19.1	7.6
2390	47.90	33.70	H	-0.75	47.15	32.95	74.0	54.0	26.9	21.1
2390	47.80	33.90	V	-0.75	47.05	33.15	74.0	54.0	27.0	20.9

7.2.3 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 – Bluetooth 8DPSK – 4804MHz – Horizontal polarity

Corrected Level: $54.30 + 5.07 = 59.37\text{dBuV}$

Margin: $74\text{dBuV} - 59.37\text{dBuV} = 14.6\text{dB}$

Example Calculation: Average – Bluetooth 8DPSK – 4804MHz – Horizontal polarity

Corrected Level: $44.7 + 5.07 = 49.77\text{dBuV}$

Margin: $54\text{dBuV} - 49.77\text{dBuV} = 4.2\text{dB}$

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	$\pm 0.009 \%$
RF Conducted Output Power	$\pm 0.349 \text{ dB}$
Power Spectral Density	$\pm 0.372 \text{ dB}$
Antenna Port Conducted Emissions	$\pm 1.264 \text{ dB}$
Radiated Emissions $\leq 1 \text{ GHz}$	$\pm 5.814 \text{ dB}$
Radiated Emissions $> 1 \text{ GHz}$	$\pm 4.318 \text{ dB}$
Temperature	$\pm 0.860 \text{ }^{\circ}\text{C}$
Radio Frequency	$\pm 2.832 \times 10^{-8}$
AC Power Line Conducted Emissions	$\pm 3.360 \text{ dB}$

9 CONCLUSION

In the opinion of TÜV SÜD America Inc. the Helix 7X CHIRP MSI GPS G3N manufactured by Johnson Outdoors, Inc met the requirements of FCC Part 15 subpart C and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the tests documented herein.

END REPORT