



EMS Technical Report

Prepared For: Johnson Outdoors Marine Electronics, Inc.

Model Tested: HELIX 7 CHIRP GPS G2N

Model Variants: See Product Description

Product Type: Sonar Fish Finder

Product Category: Information Technology Equipment

KC ID: MSIP-REM-Jom-H7G2N

**In Accordance with the:
Conformity Assessment Procedure for Electromagnetic Interference
(RRA Announce 2015-110, Dec 3, 2015)**

EMS Product Standard: Annex 14 (KN 60945)

Report: 16-0342.C08.9E

Report Revision: E

Report Issue Date: January 9, 2019



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 32 pages

REVISION HISTORY

Report Number: 16-0342.C08.9E

Manufacturer: Johnson Outdoors Marine Electronics, Inc.

Model: HELIX 7 CHIRP GPS G2N

DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
October 18, 2016	---	A	Initial Release	All	Forrest Duncan
October 28, 2016	A	B	Corrected model covered and variants per manufacturer and corrected street address	1, 3, 5, 8	Jeremy Pickens
November 4, 2016	B	C	Revised model name in product description	3	Ray Verar
March 3, 2017	C	D	Added KC ID, Removed non-x series models.	1 (and header)	Sam Wismer
January 9, 2019	D	E	- Added new test site descriptions - Added new model variants -- Added manufacturer declaration (Appendix B) for G3N series models	All	Jeremy Pickens

Project Information Sheet

ACS Project: 16-0342.C08.9E

Applicant Details

Manufacturer: Johnson Outdoors Marine Electronics, Inc.

Street Address: 678 Humminbird Lane

City, State/Province and Postal Code: Eufaula, AL 36027

Country: USA

Contact: Seth Bergman

Phone: 334-687-6613

Fax:

Email: sbergman@johnsonoutdoors.com

Sample Information

Model: HELIX 7 CHIRP GPS G2N

Model Variant(s): See Product Description

Environment of Use: Residential

Sample Receive Date: July 25, 2016

Sample Receive Condition: Good

Test Mode Description: GPS Active; Sonar mode measuring depth (7.2 ft), Speed/Temp Sensor Active

Unacceptable Degradation (Provided by Mfg.): The Depth reading should stay with +/- 2ft. The manufacturer declares an exclusion band for the SONAR and GPS frequencies of +/- 5%. The sonar frequency is designed to work at 200kHz during normal operation.

Highest Data Rate: 800MHz

Source: Main processor

Product Description

The Humminbird HELIX 7 CHIRP SI G2N is a Sonar/Fishfinder product to be used in the marine environment. Product has a 7" display, 10 keypad buttons and displays Sonar return information on the screen. It differs from the H7 G2 by including Ethernet and Bluetooth (Classic and BLE). The client declares all models are identical and differ only in software. The HELIX 7 CHIRP SI G2N having the most functionality, was submitted for testing to represent the above model variants.

The Humminbird Helix 7X CHIRP MSI GPS G3N (411080-1M) is a fishfinder/GPS product with side imaging sonar capability. It is comprised of a keypad, 7" LCD display, two SD card slots, internal GPS, Bluetooth capability, Ethernet capability, transducer and power cable. All G3N CHIRP model variations are built exactly the same. The non G3N variations do not have Bluetooth. They all differ by installed options, SELV circuits and languages.

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

HELIX 7 CHIRP GPS G2N (Tested variant)

HELIX 7 CHIRP DI GPS G2N

HELIX 7 CHIRP SI GPS G2N

HELIX 7X CHIRP GPS G2N

HELIX 7X CHIRP DI GPS G2N

HELIX 7X CHIRP SI GPS G2N

Test Information

Test Start Date: July 27, 2016

Test End Date: December 3, 2018

Emissions Pre-scan Site: SAC

Final Emissions Site: SAC

EMI Freq. Band: 10kHz - 10GHz

RFI Site: FAC

Radiated Emissions Equipment

Class: Class B

Test Methods Applied

(Check all that apply)

☒ Annex 1-1 (KN 61000-4-2)

☒ Annex 1-2 (KN 61000-4-3)

☒ Annex 1-3 (KN 61000-4-4)

☐ Annex 1-4 (KN 61000-4-5)

☒ Annex 1-5 (KN 61000-4-6)

☐ Annex 1-6 (KN 61000-4-8)

☐ Annex 1-7 (KN 61000-4-11)

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SECTION A: GENERAL INFORMATION

1.0 Introduction

1.1 Scope

This report documents conformance with the requirements set forth in Annex 14 (KN 60945) in accordance with the Conformity Assessment Procedure for Electromagnetic Interference (RRA Announce 2015-110) and details the results of testing performed on July 27, 2016 through December 3, 2018 on the model HELIX 7X CHIRP SI GPS G2N manufactured by Johnson Outdoors Marine Electronics, Inc..

Johnson Outdoors Marine Electronics, Inc. declares that, based on electrical similarity, the model Helix 7X CHIRP MSI GPS G3N continues to comply with the applicable immunity requirements. Refer to Appendix B for details.

1.2 Purpose

Testing was performed to evaluate the EUT with regard to EMC regulatory requirements in accordance with the Conformity Assessment Procedures for Electromagnetic Interference (RRA Announce 2015-110) arrangements.

1.3 Results Summary

Product Standard or Test Method Applied	Description	Result
<u>Immunity Standards per Annex 5 (KN24)</u>		
Annex 1-1 (KN 61000-4-2)	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	Pass
Annex 1-2 (KN 61000-4-3)	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	Pass
Annex 1-3 (KN 61000-4-4)	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	Pass
Annex 1-4 (KN 61000-4-5)	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	N/A
Annex 1-5 (KN 61000-4-6)	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	Pass
Annex 1-6 (KN 61000-4-8)	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	N/A
Annex 1-7 (KN 61000-4-11)	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	N/A

N/A = Test Not Applicable to this EUT

N/P = Not Performed. See Test Justification for Details

1.4 Performance Criteria

1.4.1 Immunity Performance Criteria

Each immunity test requires 1 of 3 performance criteria to be met. Below are descriptions of each.

Performance Criterion A: The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion C: Temporary loss of function is allowed, provided the function is self recoverable or can be restored by the operation of the controls

Manufacturers Performance Criterion: See Sample Information on page 3 of this report.

2.0 Test Facilities & Environment

2.1 Test Facilities

All testing was performed at the following addresses:

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

TÜV SÜD America Inc.
5015 B.U. Bowman Drive
Buford GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598
www.TUVamerica.com

The laboratory is fully equipped to carry out the tests outlined in the project information section on page 3.

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. (Buford Facility) is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program and has been issued certificate number AT-2021 in recognition of this accreditation.

TÜV SÜD America, Inc. (Alpharetta Facility) 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, Open Area Test Sites (OATS) 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.

Buford Facility

FCC Registration Number:	391271
ISED Canada Lab Code:	23597
VCCI Member Number:	1831
• VCCI Registration Number	A-0259

Alpharetta Facility

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

TUV has been designated through NIST (US Identification Number: US0156) as a Phase I CAB under the APECTel MRA to perform testing for:

- Chinese Taipei's (Taiwan) Bureau of Standards, Metrology and Inspection: BSMI Number SL2-IN-E-1127R
- Hong Kong's Office of the Telecommunications Authority (OFTA)
- Singapore's Infocomm Development Authority of Singapore (IDA)
- Australia's Australian Communication and Media Authority (ACMA)

TUV test sites are also designated by Japan's Voluntary Control Council for Interference (VCCI) to perform testing in accordance with VCCI technical regulations. The VCCI has issued the following designation code in recognition of these test sites: A-0152.

2.3 Test Environment

Unless otherwise specified by the generic or product standard, the EUT was evaluated within the climate conditions of the EUT as specified by the manufacturer.

Where the manufacturer does not specify climate parameters for the EUT, all test are performed within the climate parameters given below:

- Ambient temperature 15° to 35° C
- Relative Humidity 30% to 60%
- Atmospheric Pressure 860mbar to 1060mbar

2.4 Test Equipment Calibration Statement

Test equipment used for each test is specified in the relevant sections of this test report. Unless expressly given, all test equipment is calibrated on an annual basis, where applicable. All test equipment is operated within the climate specifications as defined by the manufacturer.

3.0 Equipment Under Test (EUT)

3.1 Manufacturer

Johnson Outdoors Marine Electronics, Inc.
678 Humminbird Lane
Eufaula, AL 36027
Seth Bergman
334-687-6613
sbergman@johnsonoutdoors.com

3.2 Modifications

Table 3.2-1 below describes any modification required to bring the EUT into compliance with the test standard. Photographs of the modifications, if any, are contained in appendix a.

Table 3.2-1: EUT Modifications

- | |
|--|
| <input checked="" type="checkbox"/> Modifications <u>were not</u> required to bring the EUT into compliance with the requirements. |
| <input type="checkbox"/> Modifications <u>were</u> required to bring the EUT into compliance with the requirements. |

3.3 System Block Diagram and Support Equipment

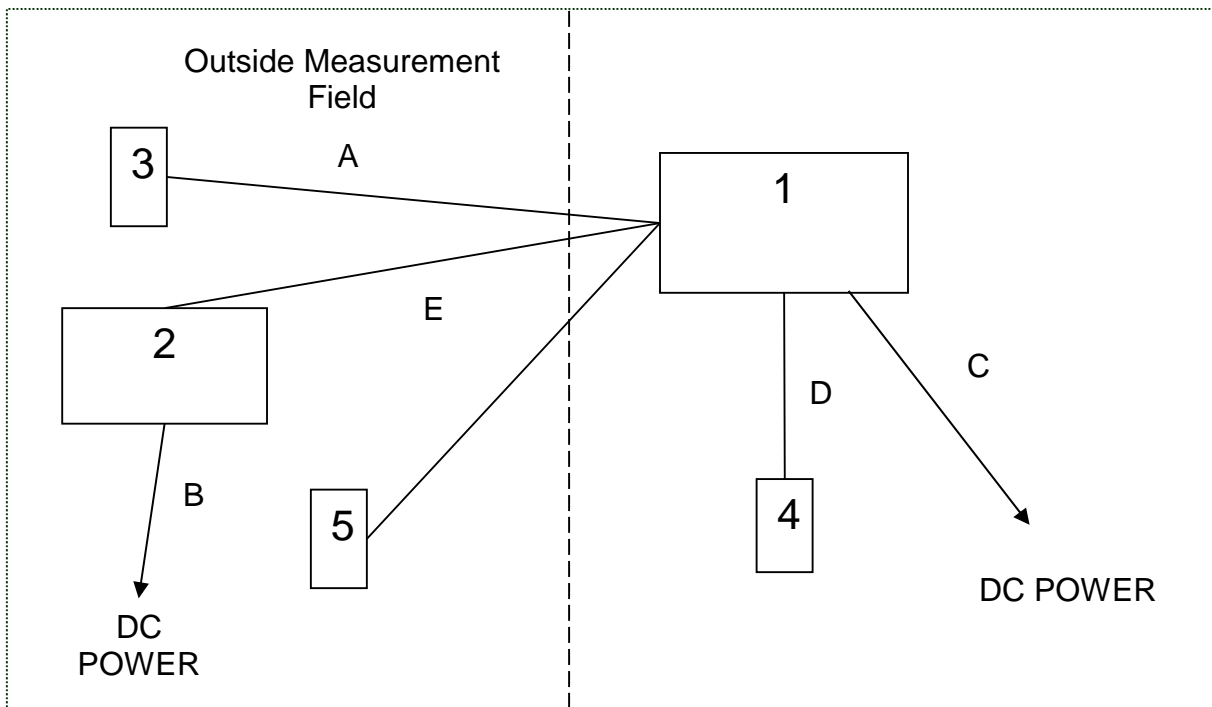


Figure 3.3-1: System Block Diagram

Table 3.3-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Johnson Outdoors	HELIX 7 CHIRP G3	n/a
2	Auxiliary Equipment	Johnson Outdoors	HELIX 7	n/a
3	GPS antenna	Humminbird	AS*GPS HS	12071842-0039
4	Transducer	Johnson Outdoors	n/a	n/a
5	Speed sensor	Johnson Outdoors	n/a	n/a

Table 3.3-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	GPS	20'	No	1 - 4
B	DC leads	4'	No	3 – DC power
C	DC leads	5'	No	1 – DC power
D	Transducer cable	20'	No	1 - 5
E	Ethernet	30'	No	1 - 2

3.4 Observations

Any general observations regarding any part of the evaluation are given in table 3.4-1.

Table 3.4-1: Observations

<u>Observation No.</u>	<u>Description</u>

SECTION B: TEST INFORMATION AND RESULTS

4.0 Annex 1-1 (KN 61000-4-2) Electrostatic Discharge Immunity

4.1 Test Site Description

The EUT was configured and connected to satisfy its functional requirements.

For a table top configuration, the EUT was placed on an insulating support of 0.5mm in the center of the Horizontal Coupling Plane (HCP). The HCP laid flat on a non-conductive table measuring 1.6 meters x 0.8 meters x 0.8 meters. The non-conductive table was placed on a 16 feet x 8 feet Ground Reference Plane (GRP). The Vertical Coupling Plane was placed 10cm from the EUT and insulated from the HCP.

For a floor standing configuration the EUT was placed on a 10cm insulated support. The non-conductive spacer was placed on a 16 feet x 8 feet Ground Reference Plane (GRP). The Vertical Coupling Plane was placed 10cm from the EUT.

Both the HCP and the VCP were connected to the GRP via cables with 470kΩ resistors located at each end. The ground lead of the ESD generator was also connected to the GRP.

4.2 Test Equipment

Table 4.2-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
582	Kikusui	KES4021A	ESD Gun	SA003046	4/28/2016	4/28/2017
144	Omega	RH411	Climate Monitoring Equipment	H0103373	7/24/2014	7/24/2016

NCR = No Calibration Required

4.3 Test Methodology

Annex 1-1 (KN 61000-4-2) - Electromagnetic compatibility (EMC) - Part 4. Testing and measurement techniques - Section 4.2 Electrostatic discharge immunity test - Basic EMC Publication, was the guiding document for this test. The purpose of this test is to verify the immunity of single devices or systems against electrostatic discharges (ESD) generated by an operator or object touching the equipment, or by objects or persons coming into contact in the vicinity of the equipment.

Only areas of the EUT that are accessible to the user are considered for the evaluation.

Direct Contact Discharge

Devices with accessible conductive surfaces are subject to direct contact discharges. Each test point identified was subjected to 10 discharges of both positive and negatives impulses.

Indirect Contact Discharge

The EUT was subjected to indirect contact discharges to a horizontal coupling plane (HCP). At least 10 single discharges in both polarities were applied to the EUT via the HCP on all sides and at a separation distance of 10cm. In addition the EUT was subjected indirect discharges to a vertical coupling plane (VCP). At least 10 single discharges in both polarities were applied to the EUT via the VCP on all sides and at a separation distance of 10cm.

Air Discharge

Insulated surfaces of the EUT that are accessible were subjected to air discharges. Each test point is subjected to 10 discharges of each polarity.

4.3.1 Test Criteria

Annex 14 (KN 60945) requires performance criterion B to be met as described in section 1.4.1.

4.3.2 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

See Appendix B – Additional Test Justification

4.4 Test Setup Photograph

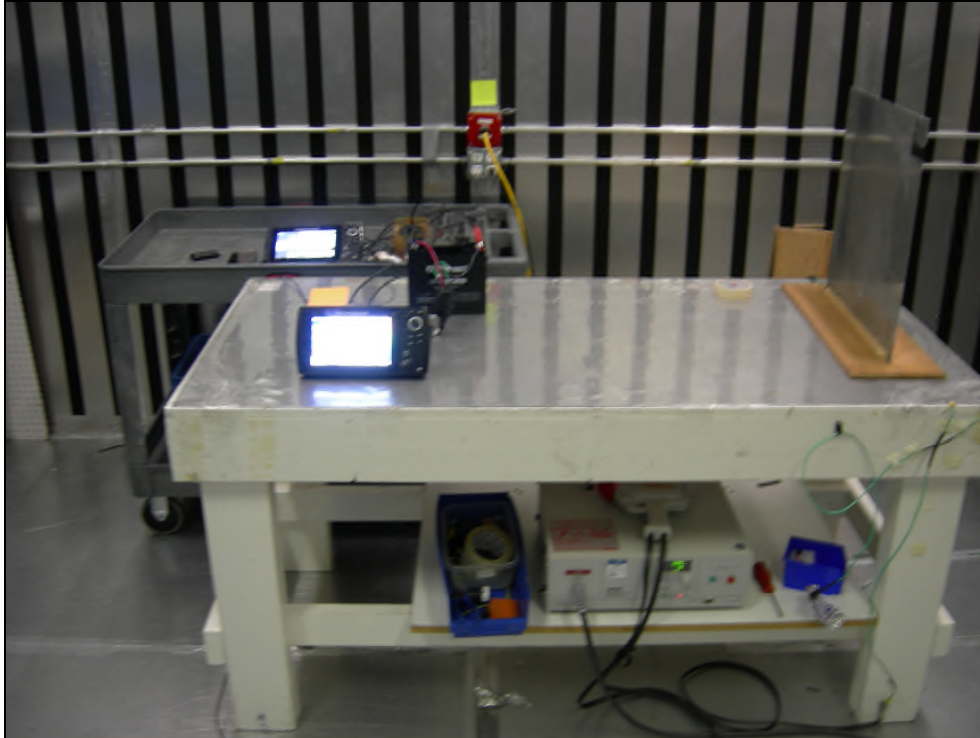
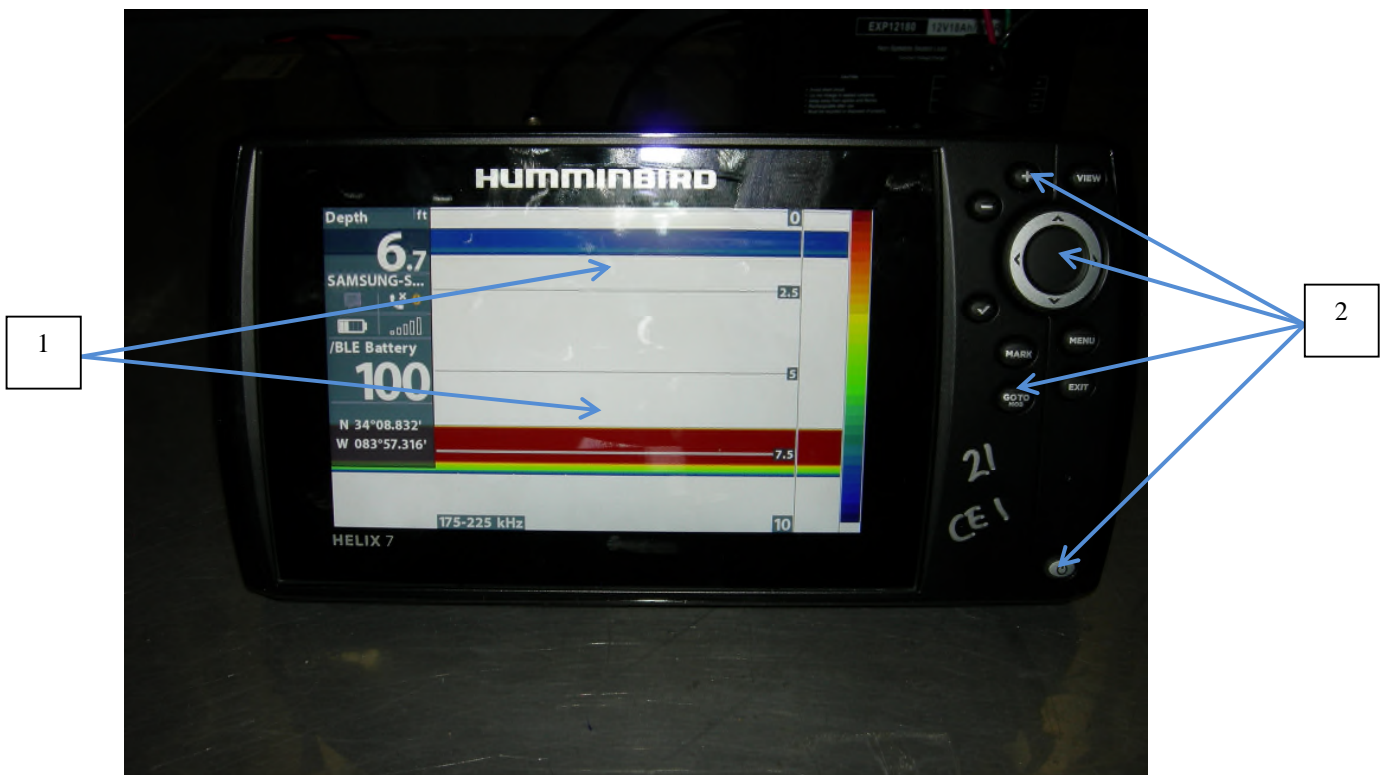
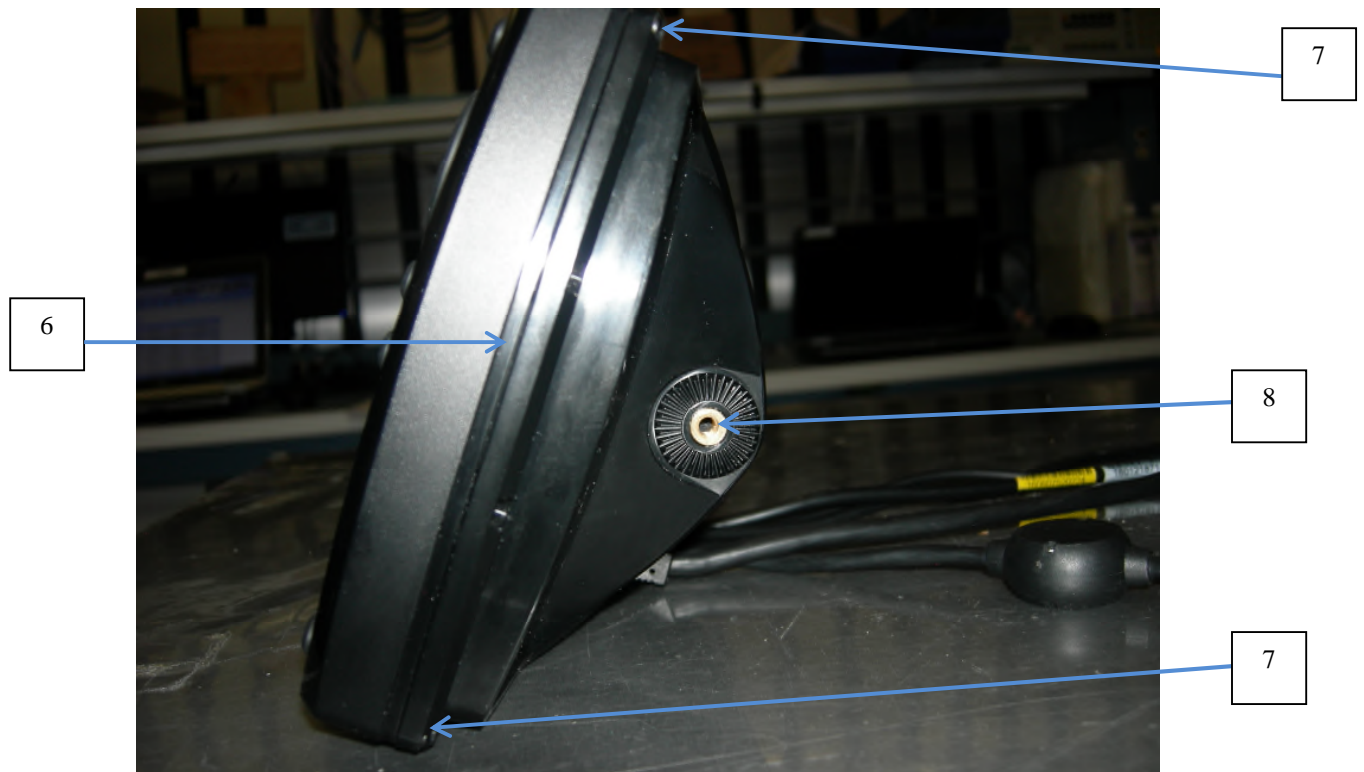


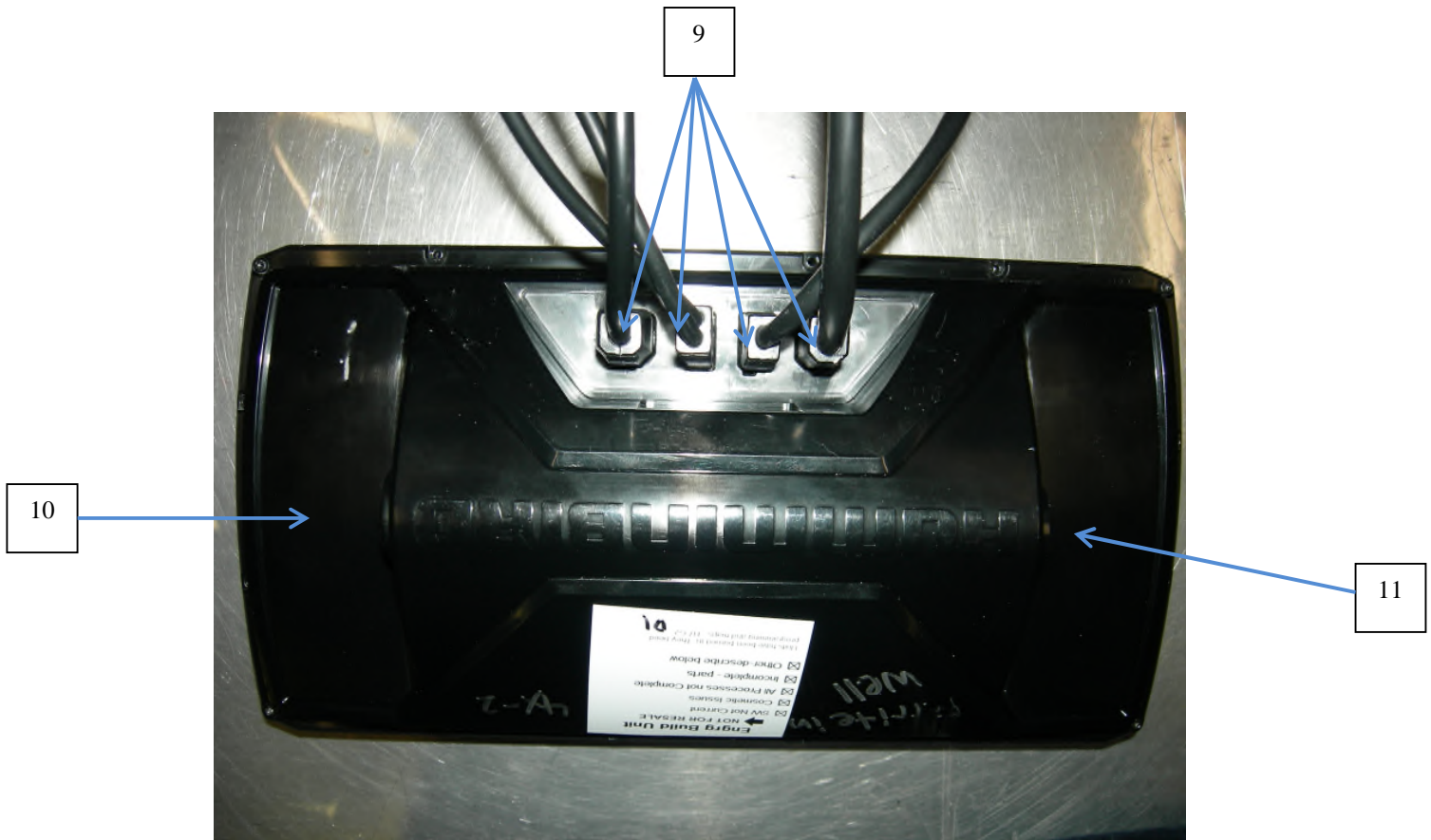
Figure 4.4-1: Test Setup Photograph

4.5 ESD Data Sheet

Test Point Photograph:







Test Point Selection:

TEST POINT#	DESCRIPTION	TYPE (C/A)	TEST POINT#	DESCRIPTION	TYPE (C/A)
1	EUT display screen	Air	11	EUT chassis rear right side	Air
2	EUT user interface buttons	Air			
3	Left mounting bracket connection	Contact			
4	EUT chassis rear screws: left	Contact			
5	EUT chassis left side seam	Air			
6	EUT chassis right side seam	Air			
7	EUT chassis rear screws :right	Contact			
8	Right mounting bracket connection	Contact			
9	EUT cable connections	Air			
10	EUT chassis rear left side	Air			

4.6 Test Data

Test Parameters:

Test Date:	July 27, 2016	Temperature (°C)	22
Technician:	Chris O'Steen	Humidity (%)	40
Equipment Class:	N/A	Barometric Pressure (mBar)	1017
		<input checked="" type="checkbox"/> Pre-test Verification Complete	
Tested Modes:			
AC Input Power:	N/A	VCP Resistor Value Check:	951k (Ohms)
DC Input Power:	12Vdc	HCP Resistor Value Check:	945k (Ohms)

Indirect Contact Discharge:

Check All That Apply to This Data		
Plane:	Polarity:	Tested Levels:
<input type="checkbox"/> Vertical Coupling Plane	<input type="checkbox"/> Positive	<input checked="" type="checkbox"/> 2kV <input type="checkbox"/> 8kV
<input type="checkbox"/> Horizontal Coupling Plane	<input type="checkbox"/> Negative	<input checked="" type="checkbox"/> 4kV <input type="checkbox"/> 15kV
<input checked="" type="checkbox"/> Both	<input checked="" type="checkbox"/> Both	<input type="checkbox"/> 6kV <input type="checkbox"/> Enter Other Level Here
Side	Result	Observation (Describe any detectable event)
Front	Pass	
Back	Pass	
Left	Pass	
Right	Pass	
Bottom	Pass	

Notes:

Air and Direct Contact Discharge:

Check All That Apply to This Data			
Polarity:	Tested Levels:		
<input type="checkbox"/> Positive	<input checked="" type="checkbox"/> 2kV	<input checked="" type="checkbox"/> 8kV	
<input type="checkbox"/> Negative	<input checked="" type="checkbox"/> 4kV	<input type="checkbox"/> 15kV	
<input checked="" type="checkbox"/> Both	<input checked="" type="checkbox"/> 6kV	<input type="checkbox"/> Enter Other Level Here	
Test Point	Discharge Type	Result	Observation (Describe any detectable event)
1	Air	Pass	
2	Air	Pass	
3	Contact	Pass	
4	Contact	Pass	
5	Air	Pass	
6	Air	Pass	
7	Contact	Pass	
8	Contact	Pass	
9	Air	Pass	
10	Air	Pass	
11	Air	Pass	

5.0 Annex 1-2 (KN 61000-4-3) Radio-Frequency Electromagnetic Fields

5.1 Test Site Description

The radiated fields test was performed in a fully-anechoic chamber.

5.2 Test Equipment

Table 5.2-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Calibration Performed Date	Calibration Due Date
197	Amplifier Research	DC6080	Coupler	307006	06-17-2016	06-17-2017
1115	Varian	VZC6961G1	Amplifier	884	NCR	NCR
329	A.H.Systems	SAS-571	Antennas	721	07-22-2015	07-22-2017
354	ETS Lindgren	3142C	Antennas	78838	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
494	Omega	IBTHX-W	Climate Monitoring Equipment	9460211	12/8/2014	12/8/2016
564	United Microwave Products, Inc.	AO-190-00.36.0	Cables	564	07-29-2016	07-29-2017
565	United Microwave Products, Inc.	OO-190-15.00.0	Cables	565	NCR	NCR
566	United Microwave Products, Inc.	OO-190-00-120.0	Cables	566	NCR	NCR
642	Fairview Microwave	FMC0101951-200CM	Cables	N/A	NCR	NCR
711	Hewlett Packard	8648B	Signal Generators	3623A01926	07-25-2016	07-25-2017
1112	Wandel & Goltermann	BN2244/21	Probes	H0006	12/3/2015	12/3/2016
1201	Wandel & Goltermann	2244/99.22	Probes	W-0004	12/3/2015	12/3/2016
711	Hewlett Packard	8648B	Signal Generators	3623A01926	07-25-2016	07-25-2017
RE89	Amplifier Research	25S1G4A	Amplifiers	324609	NCR	NCR

NCR = No Calibration Required

5.3 Test Methodology

Annex 1-2 (KN 61000-4-3)- Electromagnetic compatibility (EMC) - Part 4. Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test, was the guiding document for this test. The purpose of this test is to verify the immunity of single devices or systems when subjected to radio-frequency electromagnetic field.

The EUT was configured and connected to satisfy its functional requirements. One representative sample was placed on the table and rotated 90° to expose all side of the EUT to the radiofrequency electromagnetic field. The table is non-conductive measuring 1.5 meters x 1.0 meters x 0.8 meters. The non-conductive table was placed 3 meters from the radiating antenna.

The frequency ranges to be considered are swept with the signal 80% amplitude modulated with a 1kHz AM sine wave, pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range is swept incrementally, the step size shall not exceed 1% of fundamental with linear interpolation between calibrated points.

The test shall normally be performed with the generating antenna facing each of the four sides of the EUT, however if the equipment can be used in different orientations, the test shall be performed on all sides, 6 total.

The polarization of the field generated by each antenna necessitates testing each side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.

5.3.1 Test Criteria

Annex 14 (KN 60945) requires criterion A to be met as described in section 1.4.1.

5.3.2 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

See Appendix B – Additional Test Justification

5.4 Test Setup Photographs

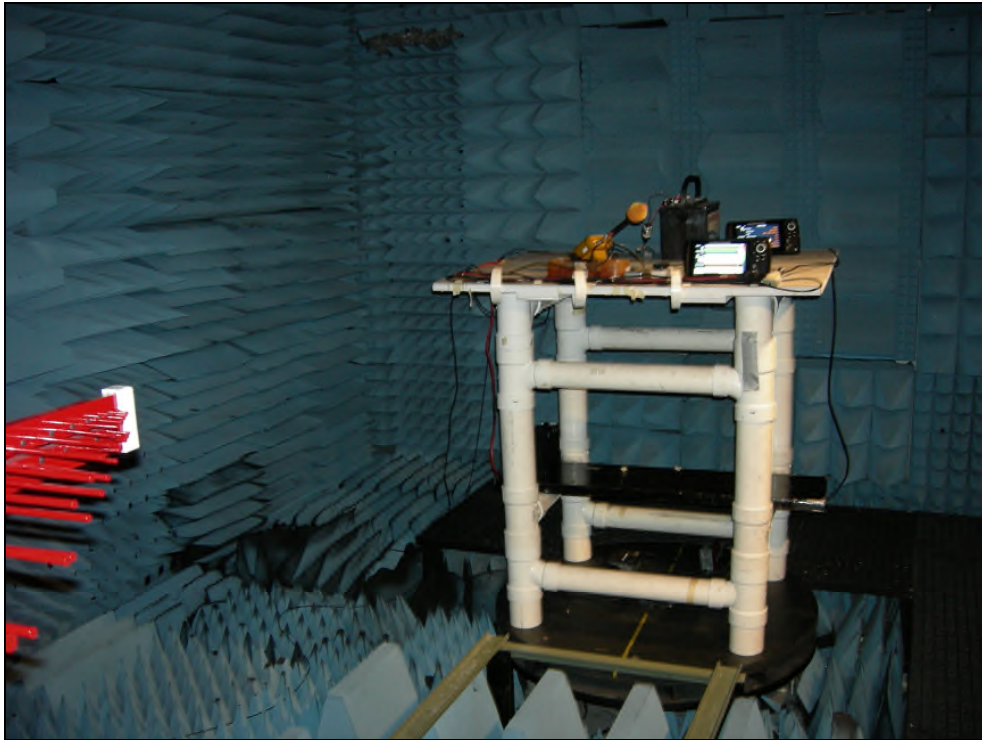


Figure 5.4-1: Test Setup Photograph

5.5 Test Results

Test Parameters:

Test Date:	July 31, 2016	Temperature (°C)	24
Technician:	Chris O'Steen	Humidity (%)	45
Equipment Class:	N/A	Barometric Pressure (mBar)	1017
Tested Modes:	GPS, BLE, BT, and depth simulator active and monitored.		
AC Input Power:	N/A	<input checked="" type="checkbox"/> Pre-test Verification Complete	
DC Input Power:	12Vdc		

Test Data:

Check All That Apply to This Data			
Polarity <input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical <input checked="" type="checkbox"/> Both	Field Strength: <input type="checkbox"/> 3V/m <input checked="" type="checkbox"/> 10V/m <input type="checkbox"/> 8V/m <input type="checkbox"/> Enter Other Level Here	Freq. Band: <input type="checkbox"/> 80-1000MHz <input type="checkbox"/> 80-2700MHz <input checked="" type="checkbox"/> 80MHz - 2GHz	Dwell Time <input type="checkbox"/> 1 Second <input checked="" type="checkbox"/> 2.86 Seconds (80MHz – 1GHz) <input checked="" type="checkbox"/> 8.6 Seconds (1GHz – 2GHz)
Azimuth	Result	Observation (Describe any detectable event)	
0	Pass		
90	Pass		
180	Pass		
270	Pass		

Notes:

Testing was completed using a 400Hz modulation.

Spot frequencies less than 30MHz were seen during Conducted RF Immunity, those above 30MHz were seen during Radiated Fields Immunity as follows; 50MHz for Ethernet clock, 800MHz for Main internal processor, 1575.42MHz for the GPS receiver, and 2.4GHz for the Bluetooth radio.

6.0 Annex 1-3 (KN 61000-4-4) Electrical Fast Transient/Bursts

6.1 Test Site Description

The EUT was configured and connected to satisfy its functional requirements. The EUT was placed in the center of a non-conductive support measuring 125cm x 96cm x 10 cm. The non-conductive support is placed on a 8 feet x 8 feet Ground Reference Plane (GRP). A minimum distance of 50 cm between the EUT and all other conductive structures was maintained. A minimum distance of 50 cm between the coupling clamp and all other conductive structures, except the GRP, was maintained. A 10 cm insulated support was placed between the capacitive coupling clamp and the GRP. The GRP was bonded to the EFT/B generator.

The input power port of the EUT was tested using the coupling/decoupling network. The +/-1kV bursts were applied to all lines individually as well as simultaneously.

The bursts were applied to the signal/control line ports, if present, using the capacitive coupling clamp.

6.2 Test Equipment

Table 6.2-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Calibration Performed Date	Calibration Due Date
474	Keytek	EMC PRO	General Lab Equipment	9808246	10/7/2015	10/7/2016
62	Haefely Trench	EFT Clamp	Immunity Equipment	None	07-15-2016	07-15-2017

NCR = No Calibration Required

6.3 Test Methodology

Annex 1-3 (KN 61000-4-4) - Electromagnetic compatibility (EMC) - Part 4. Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test - Basic EMC Publication., was the guiding document for this test. The purpose of this test is to verify the immunity of single devices or systems when subjected to types of transient disturbances such as those originating from switching transients such as interruption of inductive loads or relay contact bounce.

6.3.1 Test Criteria

Annex 14 (KN 60945) requires criterion B to be met as described in section 1.4.1.

6.3.2 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

See Appendix B – Additional Test Justification

6.4 Test Setup Photographs

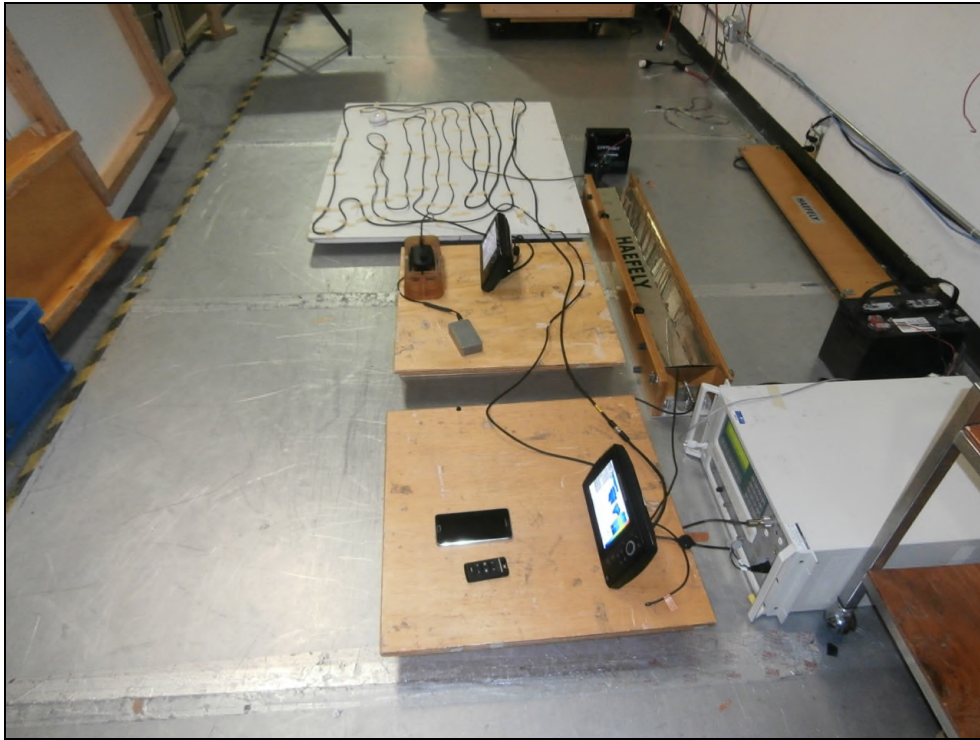


Figure 6.4-1: Test Setup Photograph

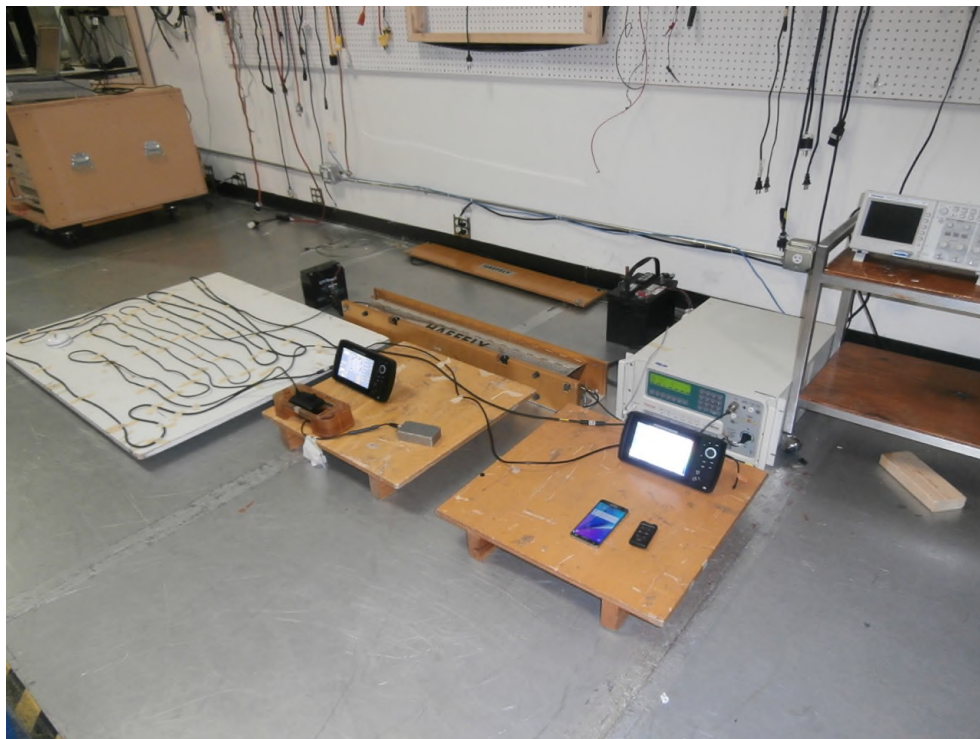


Figure 6.4-2: Test Setup Photograph

6.5 Test Results

Test Parameters:

Test Date:	July 26, 2016	Temperature (°C)	25.0
Technician:	Jaime Smith	Humidity (%)	46.2
Equipment Class:	N/A	Barometric Pressure (mBar)	1015.4
Tested Modes:	GPS, Depth, BTE, BLE, and temp running.		
AC Input Power:	N/A	<input checked="" type="checkbox"/> Pre-test Verification Complete	
DC Input Power:	12VDC		

Signal Line Test Data:

Check All That Apply to This Data		
<div> <div> Polarity: <input type="checkbox"/> Positive <input type="checkbox"/> Negative <input checked="" type="checkbox"/> Both </div> <div> Tested Levels: <input checked="" type="checkbox"/> .25kV <input checked="" type="checkbox"/> .5kV <input checked="" type="checkbox"/> 1kV <input type="checkbox"/> 2kV <input type="checkbox"/> Enter Other Level Here </div> </div>		
Signal Line	Result	Observation (Describe any detectable event)
Describe	Pass	
Describe	Pass	
Describe	Pass	

Notes:

EFT testing per 60945 with burst duration at 3 minutes 5KHz repetition.

7.0 Annex 1-4 (KN 61000-4-5) Surge Immunity

7.1 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

This test is not applicable, because the EUT is not powered through an AC Mains power supply.

8.0 Annex 1-5 (KN 61000-4-6) Radio-Frequency Common-Mode Immunity

8.1 Test Site Description

The EUT was configured and connected to satisfy its functional requirements. The EUT was placed on an insulating support of 0.1m height above a ground reference plane. All relevant cables were provided with the appropriate coupling and decoupling devices at a distance between 0.1m and 0.3m from the projected geometry of the EUT on the Ground Reference Plane (GRP).

8.2 Test Equipment

Table 8.2-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
448	IFR	2023A	Signal Generators	202302/190	2/11/2016	2/11/2017
14	IFI	PS5000	Power Supplies	0492-4147	NCR	NCR
15	IFI	AMP5580	Amplifiers	0492-4147	NCR	NCR
471	Bird Technologies Group	150-A-FFN-06	Attenuators	914	NCR	NCR
457	Com Power	CDN-M2-25	Coupler	511023	7/13/2016	7/13/2017
364	Amplifier Research	DC2600A	Coupler	322466	NCR	NCR
96	Chase	1000-M3-25	CDN's	9806	3/10/2016	3/10/2017
93	Chase	8101	Clamp	65	5/6/2016	5/6/2017

NCR = No Calibration Required

8.3 Test Methodology

Annex 1-5 (KN 61000-4-6) - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio- frequency fields, was the guiding document for this test. The purpose of this test is to verify the immunity of single devices or systems when subjected to radio-frequency electromagnetic field.

The EUT was caused to operate as intended and monitored for changes in performance. The frequency range is swept from 150 kHz to 80MHz, using the signal levels established during the setting process, and with the disturbance signal 80% amplitude modulated with a 1kHz AM sine wave, pausing to adjust the RF signal level or to switch coupling devices as necessary. The rate of sweep shall not exceed 1.5×10^{-3} decades. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

8.3.1 Test Criteria

Annex 14 (KN 60945) requires criterion A to be met as described in section 1.4.1.

8.3.2 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

See Appendix B – Additional Test Justification

8.4 Test Setup Photographs

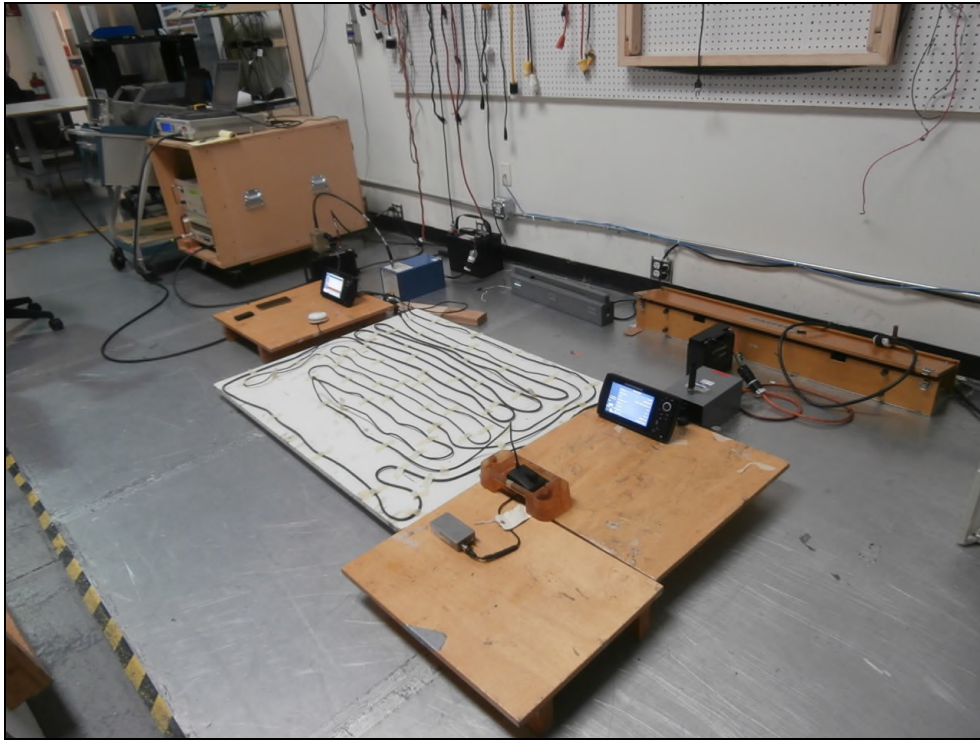


Figure 8.4-1: Test Setup Photograph

8.5 Test Results

Test Parameters:

Test Date:	July 26, 2016	Temperature (°C)	25.0
Technician:	Jaime Smith	Humidity (%)	46.2
Equipment Class:	N/A	Barometric Pressure (mBar)	1015.4
Tested Modes:	EUT on; Monitoring depth; BT connected to phone and remote		
AC Input Power:	N/A	<input checked="" type="checkbox"/> Pre-Test Verification	
DC Input Power:	12VDC		

Signal Line Test Data:

Check All That Apply to This Data		
Test Level:	Freq. Band:	
<input checked="" type="checkbox"/> 3Vrms	<input checked="" type="checkbox"/> .150-80MHz	
<input type="checkbox"/> 10Vrms	<input type="checkbox"/> Enter Other Level Here	
<input type="checkbox"/> 15Vrms		
<input type="checkbox"/> Enter Other Level Here		
Signal Line	Result	Observation (Describe any detectable event)
	Pass	
	Pass	
	Pass	

Notes:

CI testing was performed with a 400Hz modulation. The spot frequencies were with 400Hz modulation at 10Vrms.

Spot frequency test at 10Vrms at 2.0, 3.0, 4.0, 6.2, 8.2, 12.6, 16.5, 18.8, 22 and 25 (MHz) discrete frequencies.

Backlight boost controller: 973 KHz

5V Buck regulator: 1.15 MHz

LCD Bias controller: 1.25 MHz

Boost switcher: 1.95 MHz

Power manager: 2.26 MHz

AM3354 TCXO: 24 MHz

DSP TCXO: 25 MHz

GPS TCXO: 26 MHz

Display clock: 29 MHz

Ethernet Clock: 50 MHz

9.0 Annex 1-6 (KN 61000-4-8) Power Frequency Magnetic Fields Immunity

9.1 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

This test is not applicable, because the EUT does not employ magnetically sensitive components.

10.0 Annex 1-7 (KN 61000-4-11) Voltage Dips and Interruptions

10.1 Test Justification

- ☐ No justification - The EUT was tested per the appropriate test methods and test plan.
☒ The test method, standard, and/or test plan was deviated from for the following reason:

This test is not applicable, because the EUT is not powered through an AC Mains power supply.

SECTION D: MEASUREMENT UNCERTAINTY

General

Measurement Uncertainty is based on the following publications:

- CISPR 16-4-2: Uncertainties, statistics and limit modeling – Uncertainty in EMC measurements
- The Guide to the Expression of Uncertainty in Measurement(GUM): 1995
- ANSI / NCSL Z540.2-1997 (R2002) U.S. Guide to Expression of Uncertainty in Measurement

Calculations for measurement uncertainty are available upon request.

Emissions:

Test Method	U_{Lab}	U_{CISPR}	Uncertainty Units
Radiated Emissions 30MHz-1000MHz	3.68	5.2	dB
Radiated Emissions 30MHz to 200MHz	3.79	5.2	dB
Radiated Emissions 200 to 1000MHz	3.62	5.2	dB
Radiated Emissions 1-18GHz	3.65	---	dB
Conducted Emissions .150k-30MHz	1.52	3.6	dB
Radiated Disturbances 5MHz to 30MHz	2.81	4.5	dB
Radiated Disturbances 30MHz to 950MHz	2.21	4.5	dB
Harmonic Current Emissions	1.7	---	%
Voltage Fluctuations & Flicker	1.7	---	%
Insertion Loss/Internal Calibrations	.65	---	dB
Radiated Immunity 80-1000MHz	1.21	---	dB
Conducted Immunity .150-80MHz	1.64	---	dB
Frequency Interpolations	.81 (ave)	---	dB

NOTE U_{CISPR} resembles a value of measurement uncertainty for a specific test, which was determined by considering uncertainties associated with the quantities listed in CISPR 16-4-2:2003 Section 4.2. Where no value is given for U_{CISPR} the procedure below does not apply.

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If U_{Lab} is less than or equal to U_{CISPR} in Table 5.0-1, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If U_{Lab} is greater than U_{CISPR} , then:

- compliance is deemed to occur if no measured disturbance, increased by $(U_{Lab} - U_{CISPR})$, exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance, increased by $(U_{Lab} - U_{CISPR})$, exceeds the disturbance limit.

The TUV calculated MU is much less than the internationally accepted MU, therefore an adjustment to the measured result as mentioned above is not necessary.

Immunity

The EUT was subjected to the appropriate test levels required by the standard with a confidence level of 95 %($k=2$).

SECTION E: CONCLUSION

The EUT is determined to meet the requirements as defined in the applicable regulations.

Appendix A – ANAB 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

TÜV SÜD America, Inc.
5015 B. U. Bowman Drive
Buford, GA 30518

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-2021

Certificate Number


ANAB Approval

Certificate Valid: 03/14/2018 - 12/17/2018
Version No. 013 Issued: 03/14/2018



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).

Appendix B – Additional Test Justification

The manufacturer has declared the following statement:

“The radiated and conducted emissions scans of the Helix G3 models are slightly different from the scans of the Helix G2 models done previously. However, even with these differences the G3 models pass both the radiated and conducted emission limits as specified in the test results. The base circuit design (processor, memory, interfaces and power supplies), is the same between the G2 and G3 versions. Using the same base design means the power port along with signal and control ports on the G3 units are the same as those on the G2 units. The major change for the G3 series is a different external sonar transducer and minor circuitry variations to support that transducer.

Based on the fact that we passed the radiated and conducted emissions scans and that the power port, and signal and control ports are the same between the two series, we deem that the Helix series of products provide a significant amount of immunity to warrant our declining to have the immunity portion of the testing done on the Helix G3 models.”