For Scope of Accreditation Under Certificate Number: AT-2021

EMS Technical Report

Prepared For: Johnson Outdoors Marine Electronics, Inc.

Base Model: SOLIX 12 SI (410400-1)
Models Tested: SOLIX 12 (410390-1)

Product Type: TBD
Product Category: Information Technology Equipment

KC ID: TBD

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

EMS Product Standard: Annex 8-1 (KN 301 489-1), Annex 8-8 (KN 301 489-3)

Report: 16-0526.C08.9A
Report Revision: A
Report Issue Date: February 6, 2017

Project Manager:

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Forrest Duncan

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

This report contains 31 pages

REVISION HISTORY Report Number: 16-0526.C08.9A Manufacturer: Johnson Outdoors Marine Electronics, Inc. Model: SOLIX 12 SI (410400-1)					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
February 6, 2017	---	A	Initial Release	All	Forrest Duncan

Project Information Sheet

ACS Project: 16-0526.C08.9A

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: Chris Bennett

Phone: 334-687-6613 ext 1290
Fax:
Email: cbennett@johnsonoutdoors.com

Sample Information

Model: SOLIX 12 SI (410400-1)
Model Variant(s): SOLIX 12 (4104390-1)
Environment of Use: Residential
Sample Receive Date: December 7, 2016
Sample Receive Condition: Good
Test Mode Description: Powered on; GPS and BT active; Monitoring depth
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: 1GHz
Source: Main processor

Product Description

The Humminbird SOLIX 12 SI is a fishfinder/GPS product with Side/Down imaging sonar capability to be used in the marine environment. It is comprised of a keypad, LCD display, Internal GPS, Ethernet, and capable of supporting external GPS, Ethernet, and both external NMEA 0183 and NMEA2K devices.

The SOLIX 12 is identical to the SOLIX 12 SI with the exception of the SW load that limits sonar to traditional 2D only.

Test Information

Test Start Date: December 7, 2016
Test End Date: December 18, 2016
Emissions Pre-scan Site: SAC
Final Emissions Site: SAC
EMI Freq. Band: 150kHz - 6GHz
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)

Table of Contents

SECTION A: GENERAL INFORMATION

1.0 Introduction

1.1 Scope

This report documents conformance with the requirements set forth in Annex 8-1 (KN 301 489-1) and Annex 8-8 (KN 301 489-3) in accordance with the Conformity Assessment Procedure for Electromagnetic Interference (RRA Announce 2015-110) and details the results of testing performed on December 7, 2016 through December 18, 2016 on the model SOLIX 12 SI (410400-1) manufactured by Johnson Outdoors Marine Electronics, Inc..

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
Immunity Standards per Annex 5 (KN24)		
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 address:

Advanced Compliance Solutions, Inc.
5015 B.U. Bowman Drive
Buford GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598
www.acstestlab.com

The laboratory is fully equipped to carry out the tests outlined in section 1.0

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS has been recognized by the Radio Research Agency (RRA) Korea Communications Commission (KCC) under the Asian Pacific Economic Cooperation Mutual Recognition Arrangement (APEC Tel MRA). ACS is designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase 1 procedures of the aforementioned MRA.

As part of the APEC Tel MRA, ACS has been assigned US Identification Number US0156 by the US National Institute of Standards and Technology (NIST).

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

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
Chris Bennett
334-687-6613 ext 1290
cbennett@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

☒ **Modifications <u>were not</u> required to bring the EUT into compliance with the requirements.** ☐ **Modifications <u>were</u> required to bring the EUT into compliance with the requirements.**

3.3 System Block Diagram and Support Equipment

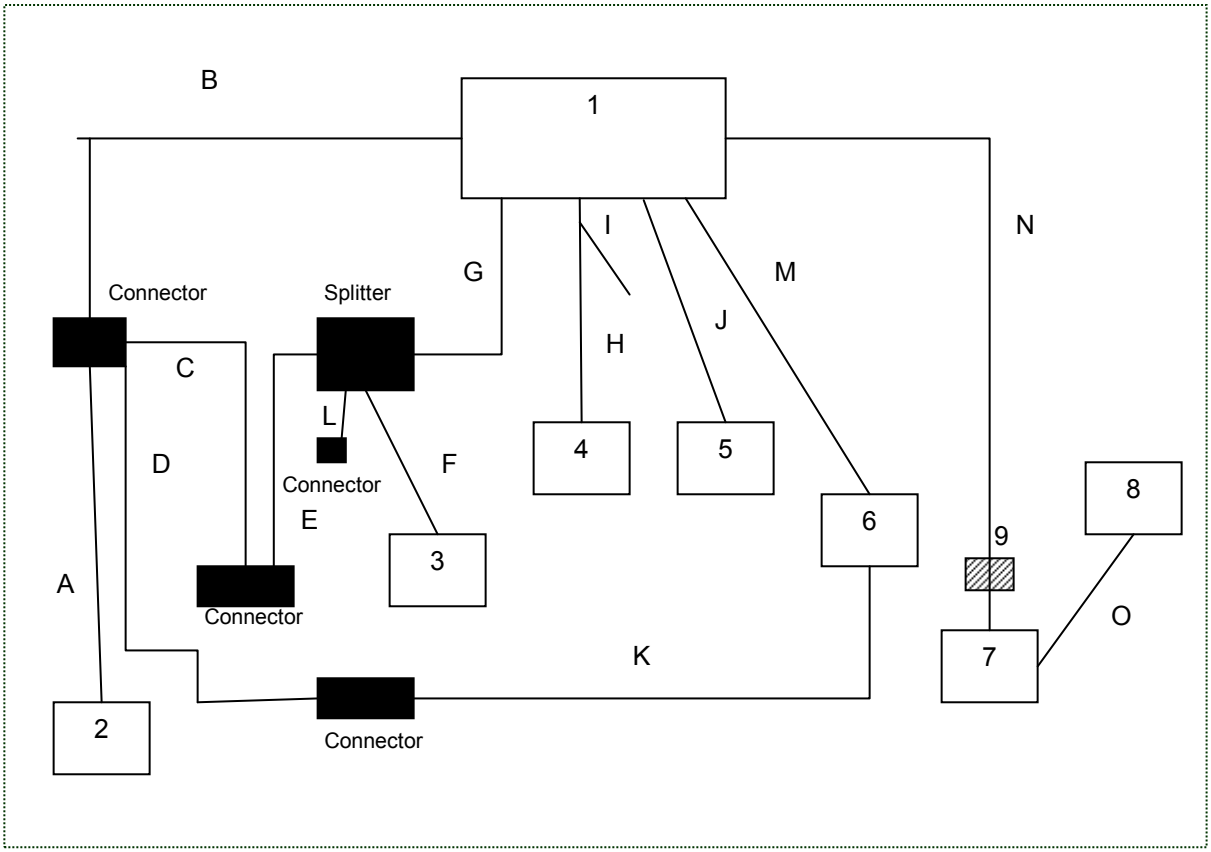


Figure 3.3-1: System Block Diagram

Table 3.3-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Johnson Outdoors	SOLIX 12 SI	X4-7
2	Battery	N/A	N/A	N/A
3	Antenna	Maretron	N/A	Acs#7
4	GPS Antenna	Johnson Outdoors	AS GPS HS	12071842-0039
5	PIS System	Techsonic Industries	G7X AIS	46090073
6	Ancillary Display	Johnson Outdoors	SOLIX 15	X4-1
7	Transducer	Johnson Outdoors	N/A	Acs#6
8	Depth Simulator	Johnson Outdoors	N/A	Acs#5
9	Ferrite bead	Fair-Rite	0475178281	N/A

Table 3.3-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	DC Leads	130cm	No	2 - connector
B	DC Leads	180cm	No	1 - connector
C	DC Leads	160cm	No	Connector - connector
D	DC Leads	160cm	No	Connector - connector
E	DC Leads	700cm	No	Splitter - connector
F	Antenna coax cable	60cm	No	3 - splitter
G	DC Leads	300cm	No	1 - splitter
H	Antenna Coax cable	630cm	No	1 – 4
I	DC leads	60cm	No	1 – GND
K	DC Leads	100cm	No	6 – connector
L	DC Leads	160	No	Connector - splitter
M	Signal cable	900cm	No	1 – 6
N	Transducer cable	620cm	No	1 – 7
O	Coax cable	55ccm	No	7 – 8

3.4 Observations

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

Table 3.4-1: Observations

Observation No.	Description

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#	Calibration Performed Date	Calibration Due Date
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	9/1/2018
371	Fluke	Fluke 115	Meters	93872717	7/14/2016	7/14/2018
582	Kikusui	KES4021 A	ESD Gun	SA003046	4/28/2016	4/28/2017

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 8-1 (KN 301 489-1) and Annex 8-8 (KN 301 489-3) 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:

4.4 Test Setup Photograph

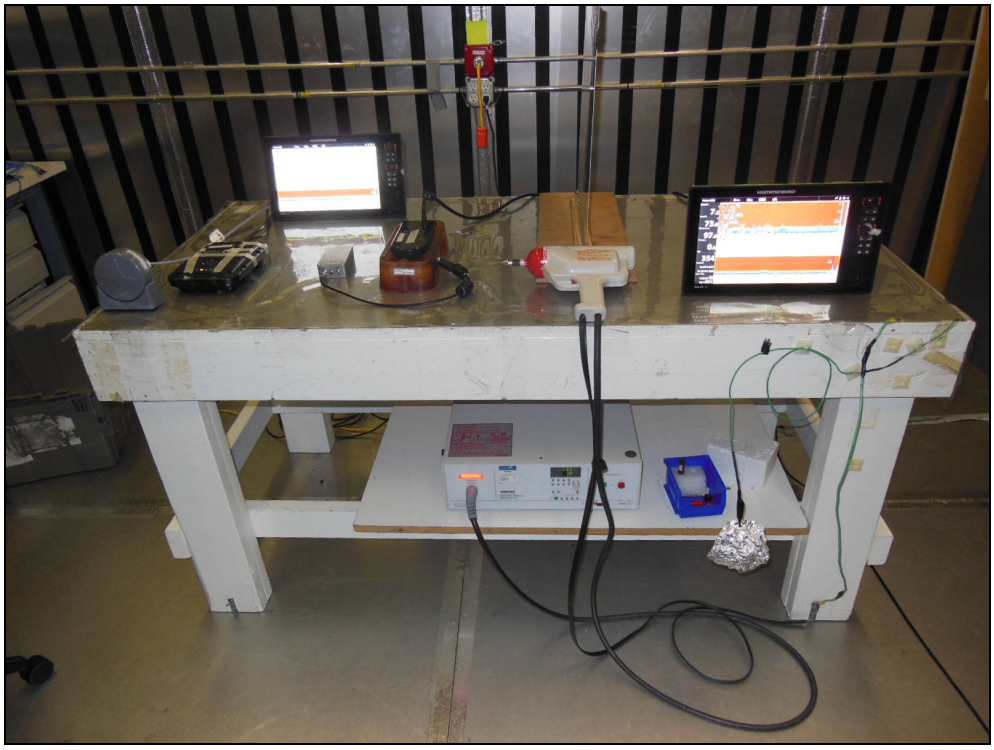
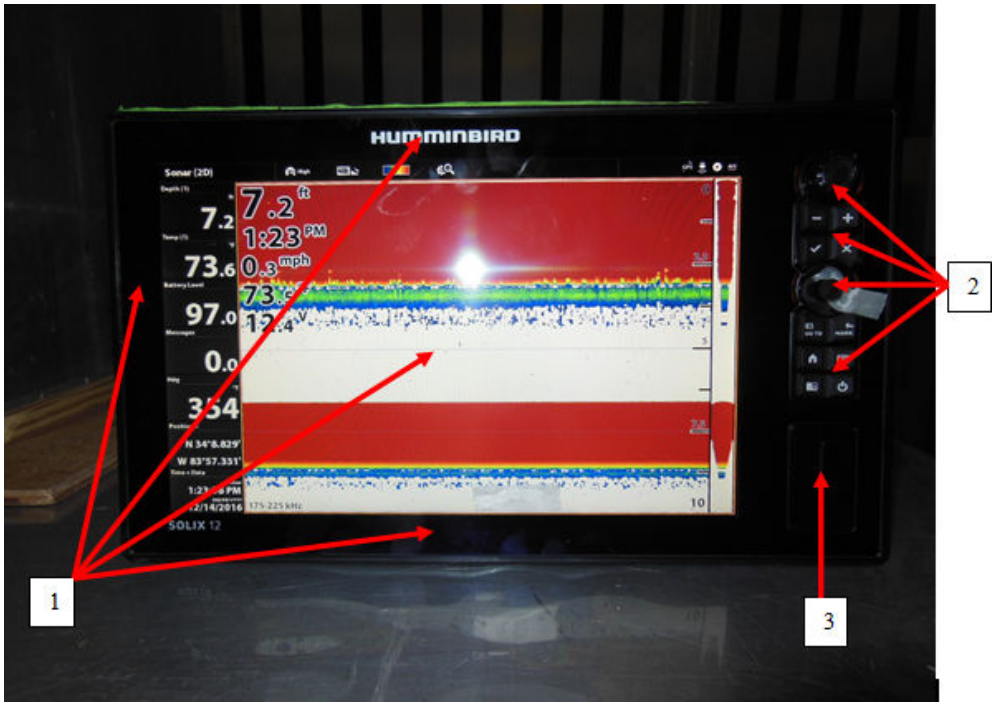
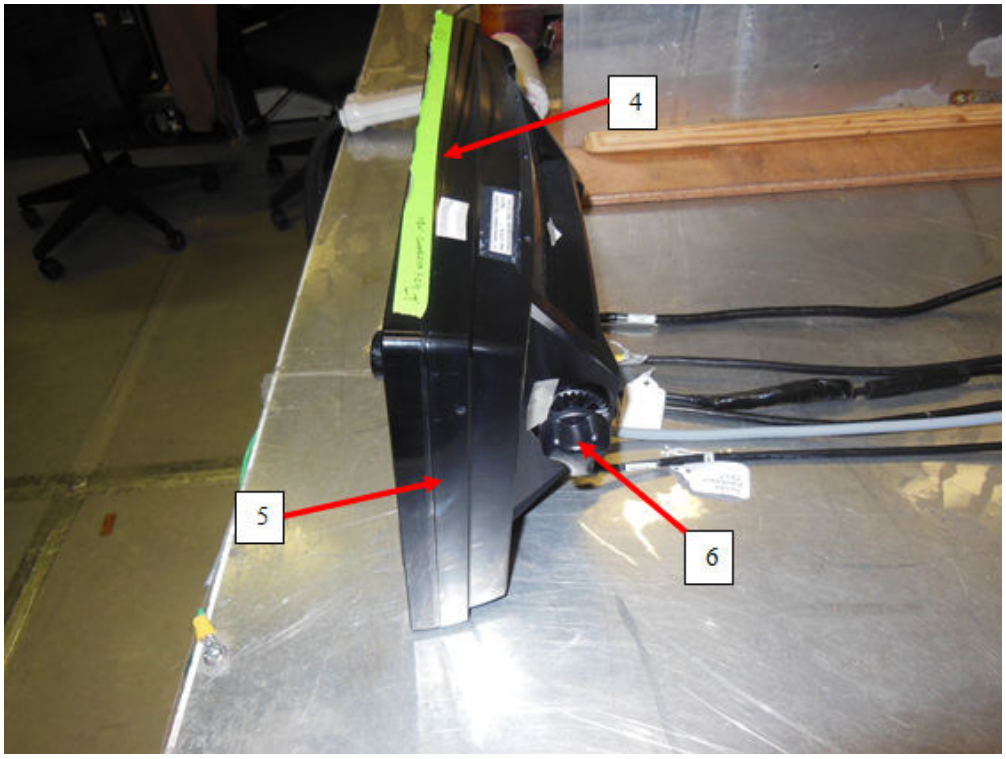


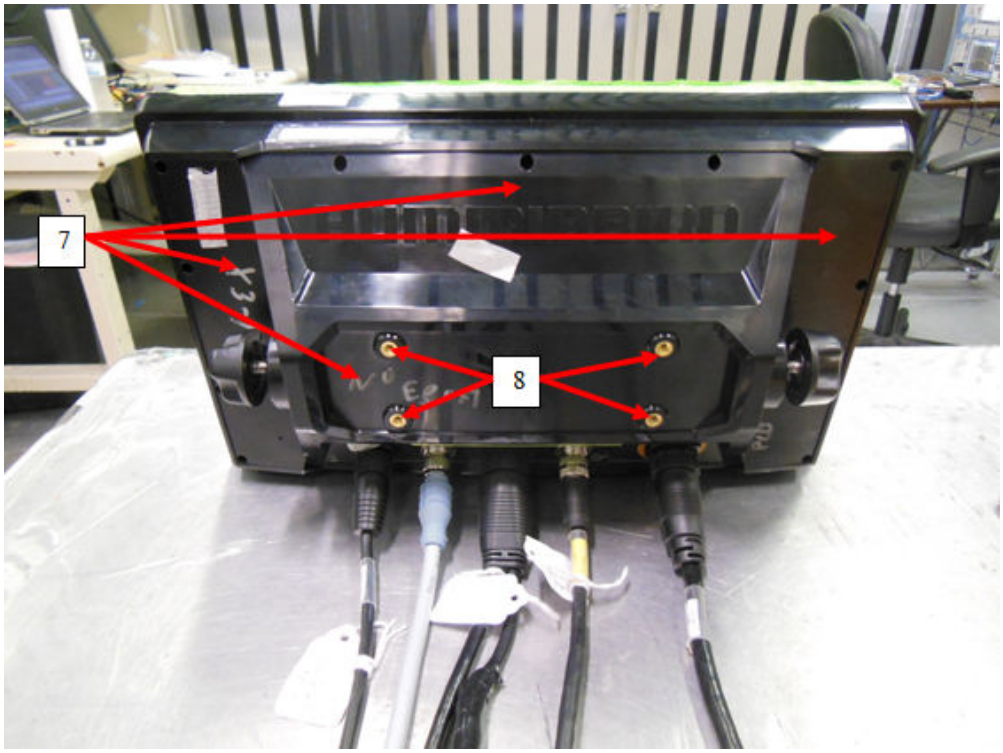
Figure 4.4-1: Test Setup Photograph

4.5 ESD Data Sheet

Test Point Photograph:



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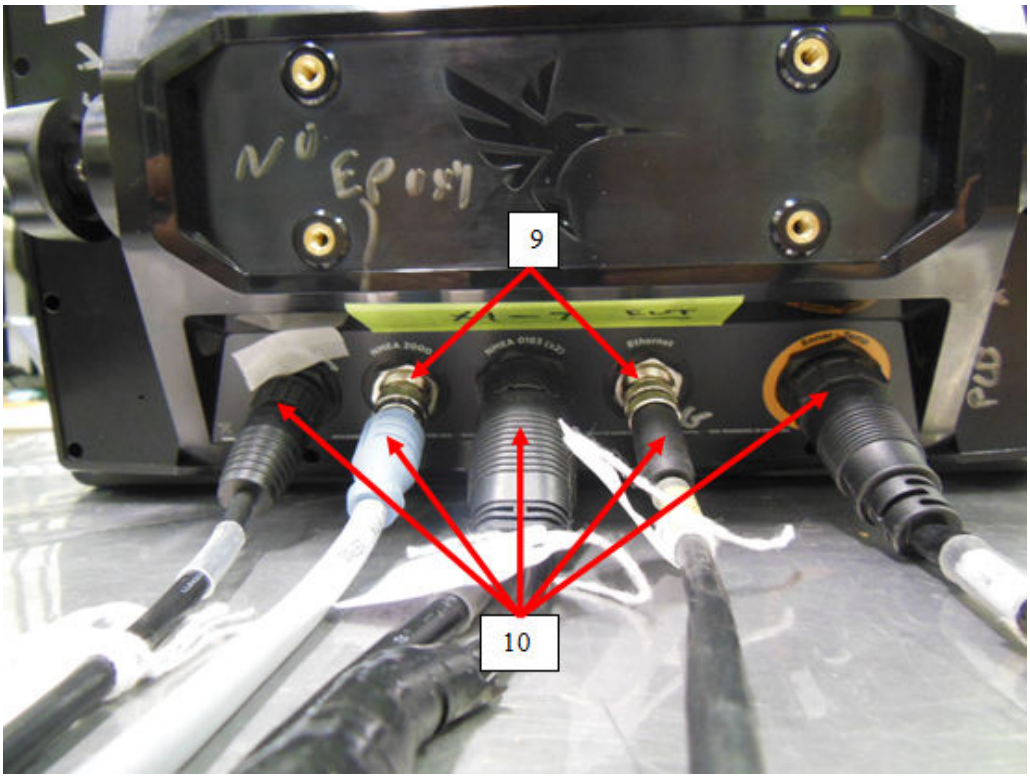
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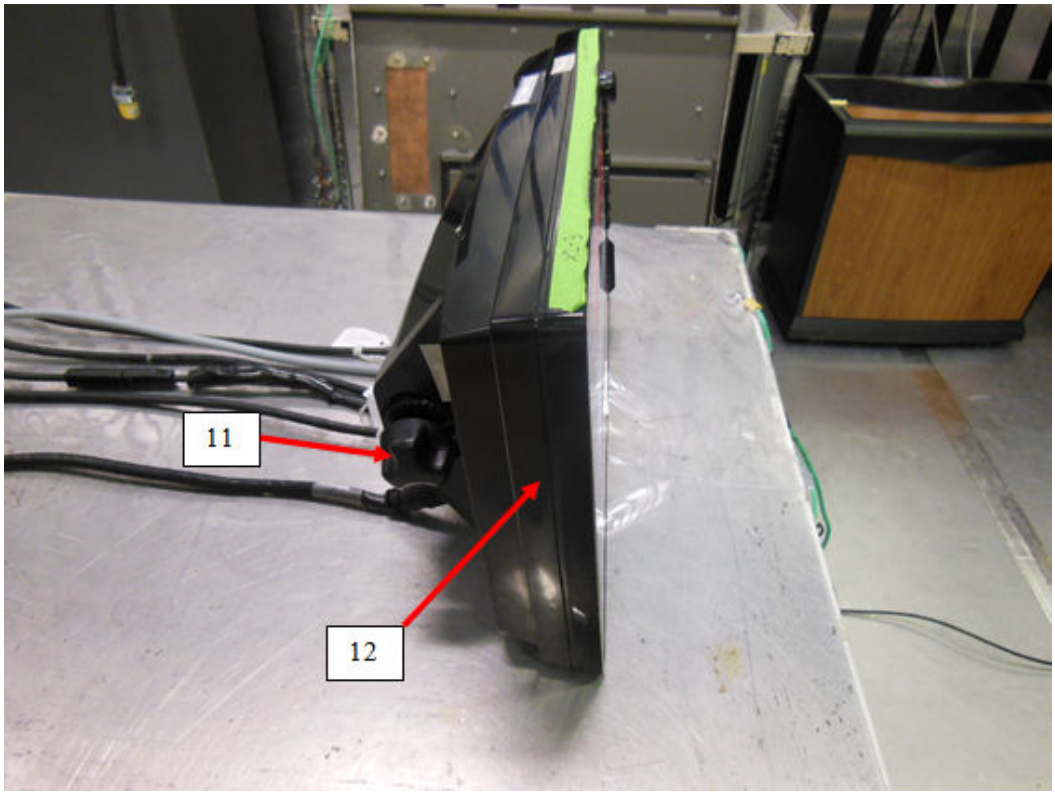

Test Point Selection:

TEST POINT#	DESCRIPTION	TYPE (C/A)	TEST POINT#	DESCRIPTION	TYPE (C/A)
1	Front, Display, Edges	**Air**	7	Back	**Air**
2	Buttons, Control knobs	**Air**	8	Mounting screw	**Contact**
3	Sides, Cover	**Air**	9	MMEA 2000 and Ethernet connectors	**Contact**
4	Top	**Air**	10	Cables and connectors	**Air**
5	Right side	**Air**	11	Mounting screw	**Air**
6	Mounting screw	**Air**	12	Left side	**Air**

4.6 Test Data

Test Parameters:

Test Date:	**December 14, 2016**	**Temperature (ºC)**	**26**
Technician:	**Sean Vick**	**Humidity (%)**	**43**
Equipment Class:	**N/A**	**Barometric Pressure (mBar)**	**1016.8**
		☒ **Pre-test Verification Complete**	
Tested Modes:	**EUT on; Connected to BT; GPS; Monitoring overall functionality**		
AC Input Power:	**N/A**	**VCP Resistor Value Check:**	**962k (Ohms)**
DC Input Power:	**12Vdc**	**HCP Resistor Value Check:**	**944k (Ohms)**

Indirect Contact Discharge:

Check All That Apply to This Data

Plane:	Polarity:	Tested Levels:	
☐ Vertical Coupling Plane	☐ Positive	☒ 2kV	☐ 8kV
☐ Horizontal Coupling Plane	☐ Negative	☒ 4kV	☐ 15kV
☒ Both	☒ Both	☐ 6kV	☐ Enter Other Level Here

Side	Result	Observation (Describe any detectable event)
Front	Pass	
Rear	Pass	
Left	Pass	
Right	Pass	
Bottom	Pass	

Notes:

Air and Direct Contact Discharge:

Check All That Apply to This Data		
Polarity:	**Tested Levels:**	
☐ Positive	☒ 2kV	☒ 8kV
☐ Negative	☒ 4kV	☐ 15kV
☒ Both	☐ 6kV	☐ Enter Other Level Here

Test Point	Discharge Type	Result	Observation (Describe any detectable event)
1	Air	Pass	
2	Air	Pass	
3	Air	Pass	
4	Air	Pass	
5	Air	Pass	
6	Air	Pass	
7	Air	Pass	
8	Contact	Pass	
9	Contact	Pass	
10	Air	Pass	
11	Air	Pass	
12	Air	Pass	

Notes:

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	6/17/2016	6/17/2017
354	ETS Lindgren	3142C	Antennas	00078838	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	8/1/2016	8/1/2018
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	7/25/2016	7/25/2017
1112	Wandel & Goltermann	BN2244/21	Probes	H0006	12/9/2016	12/9/2017

High Frequency

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
329	A.H. Systems	SAS-571	Antennas	721	7/22/2015	7/22/2017
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	8/1/2016	8/1/2018
564	United Microwave Products, Inc.	AO-190-00.36.0	Cables	564	7/29/2016	7/29/2017
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
609	Rohde & Schwarz	SMB100A	Signal Generators	175334	8/16/2016	8/16/2018
1112	Wandel & Goltermann	BN2244/21	Probes	H0006	12/9/2016	12/9/2017
1115	Varian	VZC6961G1	Amplifier	884	NCR	NCR
1116	Varian	VZM6991G5	Amplifier	1147	NCR	NCR
RE89	Amplifier Research	25S1G4A	Amplifier	0324609	NCR	NCR

Semi-Anechoic Chamber

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
354	ETS Lindgren	3142C	Antennas	00078838	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	8/1/2016	8/1/2018
619	Teledyne Storm Microwave	90-195-456	Cables	13-10-601	10/20/2016	10/20/2017
620	Teledyne Storm Microwave	90-195-456	Cables	13-10-602	10/20/2016	10/20/2017
624	Advantest	R3261C	Spectrum Analyzers	31720426	NCR	NCR
1112	Wandel & Goltermann	BN2244/21	Probes	H0006	12/9/2016	12/9/2017

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 8-1 (KN 301 489-1) and Annex 8-8 (KN 301 489-3) 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:**

5.4 Test Setup Photographs

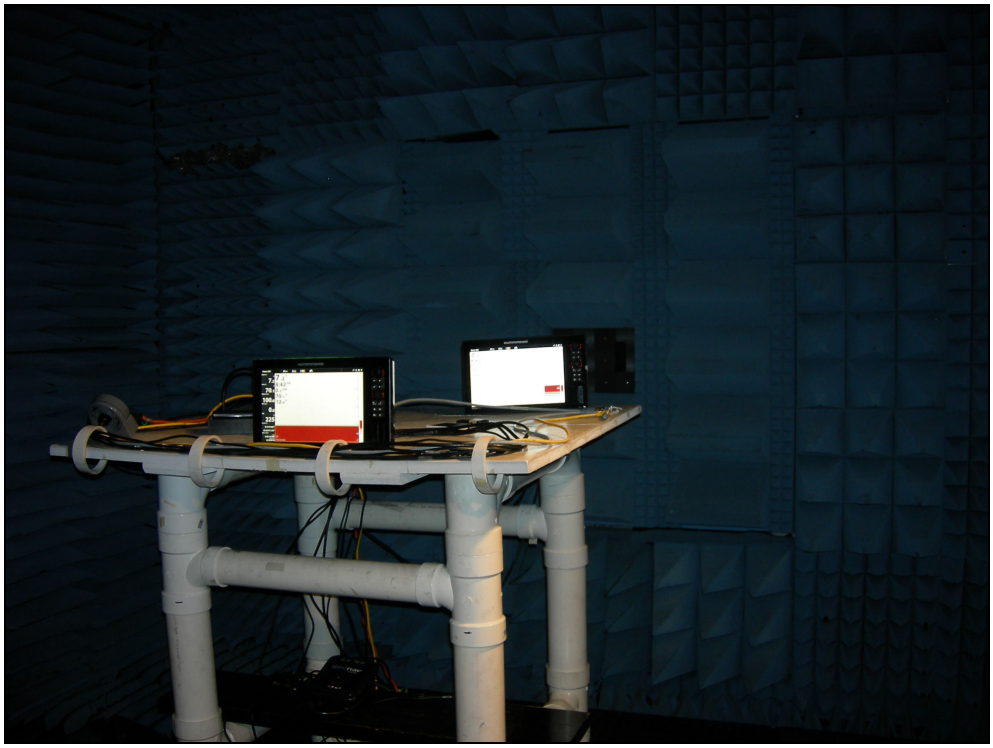

Figure 5.4-1: Test Setup Photograph

5.5 Test Results

Test Parameters:

Test Date:	**December 9, 2016**	**Temperature (ºC)**	**23**
Technician:	**Tommy Payton**	**Humidity (%)**	**30**
Equipment Class:	**N/A**	**Barometric Pressure (mBar)**	**1028**
Tested Modes:	**Monitoring Depth, Speed, Temperature, Bluetooth Connection, Heading, GPS, Network Connection**		
AC Input Power:	**N/A**	☒ **Pre-test Verification Complete**	
DC Input Power:	**12Vdc**		

Test Data:

Check All That Apply to This Data

Polarity	Field Strength:	Freq. Band:	Dwell Time
☐ Horizontal	☒ 3V/m	☒ 80-1000MHz	☒ 1 Second
☐ Vertical	☐ 10V/m	☒ 1400-2700MHz	☐ 3 Seconds
☒ Both	☐ 8V/m	☐ Enter Other Band Here	☐ Enter Other
	☐ Enter Other Level Here		

Azimuth	Result	Observation (Describe any detectable event)
0	Pass	
90	Pass	
180	Pass	
270	Pass	

Notes:

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
62	Haefely Trench	EFT Clamp	Immunity Equipment	N/A	7/15/2016	7/15/2017
474	Keytek	EMC PRO	General Lab Equipment	9803353	12/16/2016	12/16/2017
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	8/1/2016	8/1/2018

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 8-1 (KN 301 489-1) and Annex 8-8 (KN 301 489-3) 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:**

9.4 Test Setup Photographs

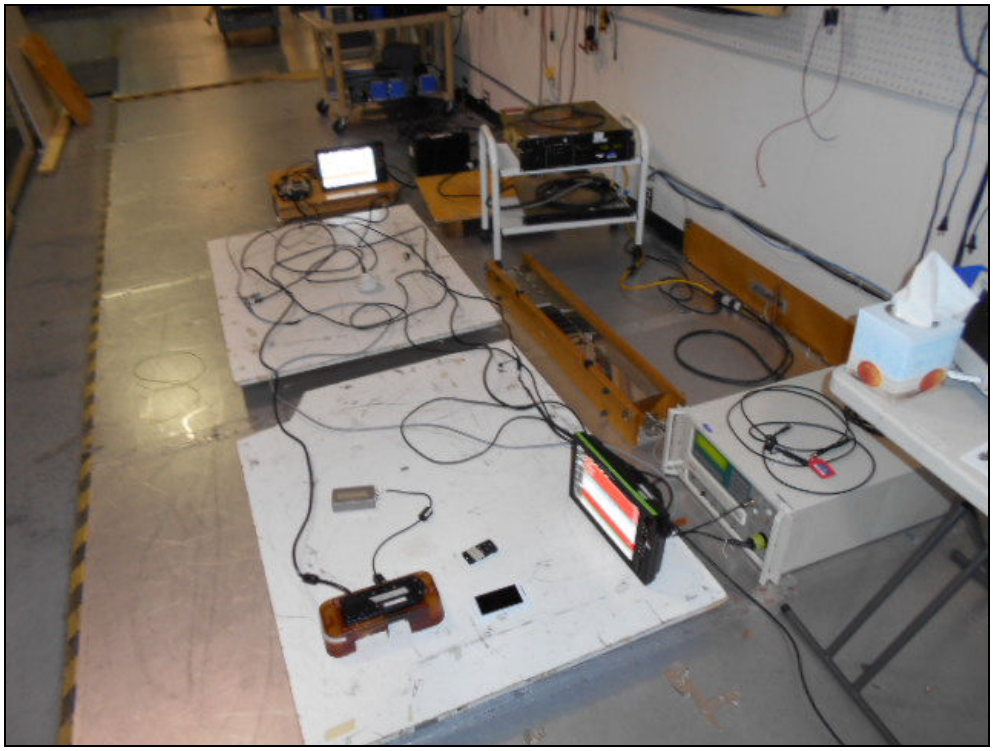

Figure 9.4-1: Test Setup Photograph

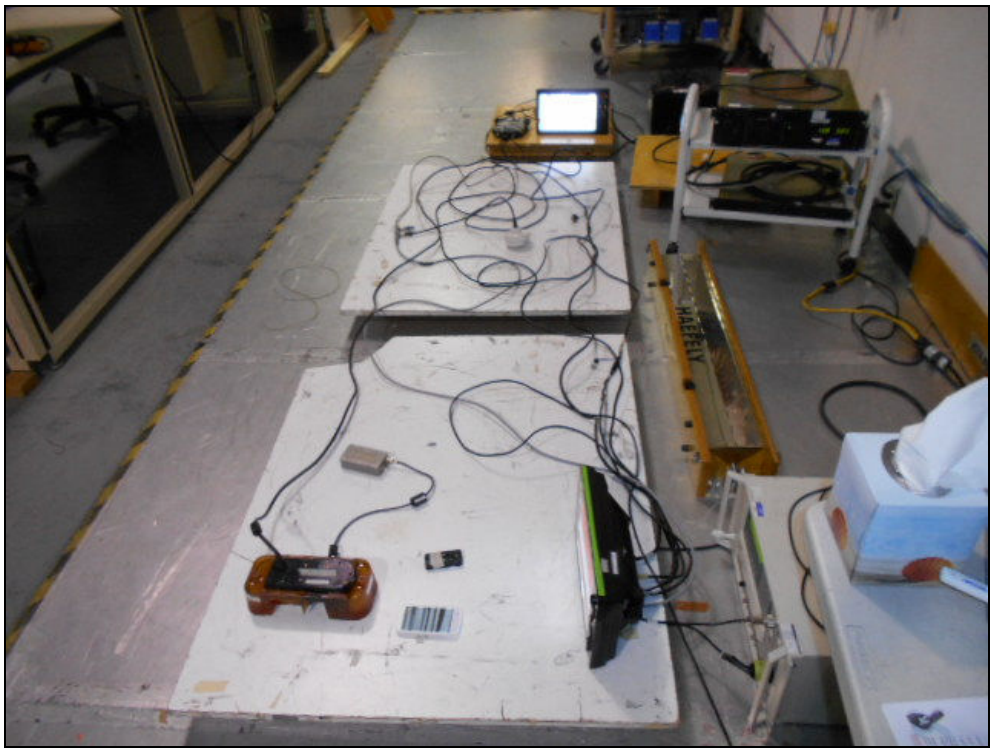

Figure 9.4-2: Test Setup Photograph

9.5 Test Results

Test Parameters:

Test Date:	**12/18/2016**	**Temperature (ºC)**	**25**
Technician:	**Christopher O'Steen**	**Humidity (%)**	**36**
Equipment Class:	**N/A**	**Barometric Pressure (mBar)**	**1018**
Tested Modes:	**Powered ON; connected to AE unit via Ethernet. GPS, Depth, temp, GEOGPS, BT, and remote all connected and monitored during testing.**		
AC Input Power:	**N/A**	☒ **Pre-test Verification Complete**	
DC Input Power:	**12VDC**		

Mains Test Data:

Check All That Apply to This Data

Polarity:	Tested Levels:	Interface Type:
☐ Positive	☒ .5kV	☒ Input
☐ Negative	☒ 1kV	☐ Output
☒ Both	☐ 2kV	☐ Both
	☐	

Coupling Mode	Result	Observation (Describe any detectable event)
L1	Pass	
L2	Pass	
L1-L2	Pass	

Notes:

Signal Line Test Data:

Check All That Apply to This Data

Polarity:	Tested Levels:
☐ Positive	☒ .25kV
☐ Negative	☒ .5kV
☒ Both	☒ 1kV
	☐ 2kV
	☐ Enter Other Level Here

Signal Line	Result	Observation (Describe any detectable event)
Transducer	Pass	
GPS	Pass	
GEO GPS	Pass	
Ethernet	Pass	
Temp cable	Pass	

Notes:

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#	Calibration Performed Date	Calibration Due Date
5	Chase	CSP-8441	Probes	19	5/24/2016	5/24/2017
93	Chase	8101	Clamp	65	5/6/2016	5/6/2017
96	Chase	1000-M3-25	CDN	9806	3/10/2016	3/10/2017
364	Amplifier Research	DC2600A	Coupler	0322466	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
418	Teseq	ISN-S501	LISN	24543	3/16/2016	3/16/2017
425	ACS	EMC Cable Set	Cable Set	425	NCR	NCR
457	Com Power	CDN-M2-25	Coupler	511023	7/13/2016	7/13/2017
471	Bird Technologies Group	150-A-FFN-06	Attenuators	0914	NCR	NCR
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	8/1/2016	8/1/2018
634	Fischer Custom Communications Inc.	FCC-801-M3-16	CDN	9730	4/26/2016	4/26/2017
711	Hewlett Packard	8648B	Signal Generators	3623A01926	7/25/2016	7/25/2017

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 x 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 8-1 (KN 301 489-1) and Annex 8-8 (KN 301 489-3) 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:**

8.4 Test Setup Photographs

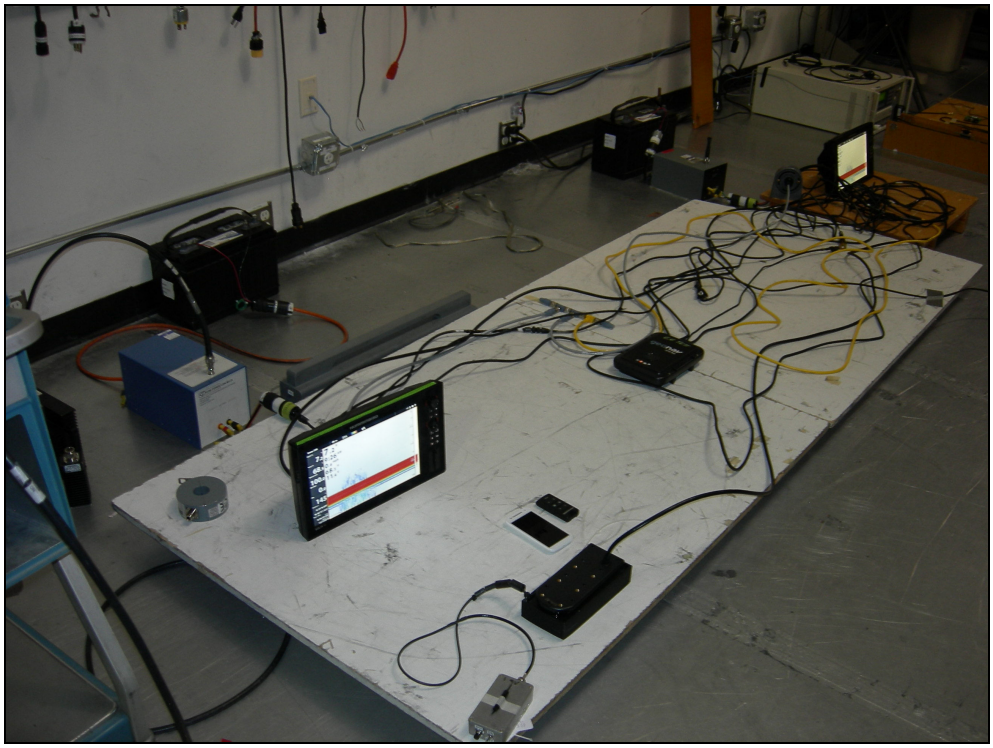

Figure 8.4-1: Test Setup Photograph

8.5 Test Results

Test Parameters:

Test Date:	**December 7, 2016**	**Temperature (ºC)**	**24**
Technician:	**Tommy Payton**	**Humidity (%)**	**41**
Equipment Class:	**N/A**	**Barometric Pressure (mBar)**	**1016**
Tested Modes:	**Monitoring Depth, Speed, Temperature, Bluetooth Connection, Heading, GPS, Network Connection.**		
AC Input Power:	**N/A**	☒ **Pre-Test Verification**	
DC Input Power:	**12Vdc**		

Mains Test Data:

Check All That Apply to This Data

Test Level:
☒ 3Vrms
☐ 10Vrms
☐ 15Vrms
☐ Enter Other Level Here

Freq. Band:
☒ .150-80MHz
☐ Enter Other Band Here

Coupling Mode	Result	Observation (Describe any detectable event)
CDN	Pass	

Notes:

Signal Line Test Data:

Check All That Apply to This Data

Test Level:
☒ 3Vrms
☐ 10Vrms
☐ 15Vrms
☐ Enter Other Level Here

Freq. Band:
☒ .150-80MHz
☐ Enter Other Band Here

Signal Line	Result	Observation (Describe any detectable event)
Transducer Cable	Pass	
GPS Cable	Pass	
AIS Module Cable	Pass	
Ethernet Cable	Pass	
NMEA2K GPS Cable	Pass	

Notes:

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 ACS 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.