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EMC Technical Report

Prepared For: JOHNSON OUTDOORS

Model Covered: SOLIX 12 MSI G2

Model Variants: SOLIX 12 MDI G2 CHO, SOLIX 10 MSI G2, SOLIX 10 MDI G2 CHO

In Accordance with the:

Electromagnetic Compatibility Directive – 2014/30/EU

Immunity Product Standard: EN 60945:2002

Emissions Product Standard(s): EN 60945:2002

Report Number: 72143829.4E0

Report Revision: A

Report Issue Date: 12/17/2018

This report contains Page 47 pages



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REVISION HISTORY

Report Number: 72143829.4E0
Manufacturer: JOHNSON OUTDOORS
Model: SOLIX 12 MSI G2

Project Information Sheet

Applicant Details

Manufacturer: JOHNSON OUTDOORS
Street Address: 1220 Old Alpharetta Road
Suite 340
City, State/Province and Postal Code:
Alpharetta, GA 30005
Country: USA
Contact: Kim Lincoln

Phone: +177088862921076
Fax:
Email: Kim.Lincoln@johnsonoutdoors.com

Sample Information

Model: SOLIX 12 MSI G2
Model Variant(s): SOLIX 12 MDI G2 CHO, SOLIX 10 MSI G2, SOLIX 10 MDI G2 CHO
Environment of Use: Residential
Sample Receive Date: October 2, 2018
Sample Receive Condition: Good
Test Mode Description: Powered ON; Monitoring depth, speed, temp, GPS
Unacceptable Degradation (Provided by Mfg.): Not Provided. See Section 1.4.4
Highest Data Rate: 1GHz **Source:** Main Processor

Product Description

SOLIX 12 MSI G2 – main unit – supports 2D, MDI and MSI Sonar with GNSS receiver, Wi-Fi/BT/BLE, and Ethernet port
SOLIX 12 MDI G2 CHO – same as main unit but MSI Sonar disabled via software
SOLIX 10 MSI G2 – same as main but with smaller screen
SOLIX 10 MDI G2 CHO – same as main but with MSI Sonar disabled via software and smaller screen

Test Information

Test Start Date: October 30, 2018
Test End Date: November 30, 2018
Emissions Pre-scan Site: SAC
Final Emissions Site: OATS
EMI Freq. Band: 10KHz-2GHz
RFI Site: SAC
Radiated Emissions Equipment Class: Class B
Harmonic Current EMI Class: N/A

Test Methods Applied

(Check all that apply)

- CISPR 16-2-1 Ed. 1.1 2005
- CISPR 16-2-3 1st Ed. 2003
- IEC 61000-4-2 Ed. 2.0
- IEC 61000-4-3 Ed. 3.2
- IEC 61000-4-4 Ed. 2.0
- IEC 61000-4-5 2nd Ed.
- IEC 61000-4-6 3rd Ed.
- IEC 61000-4-8 2nd Ed.
- IEC 61000-4-11 2nd Ed.

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SECTION A: GENERAL INFORMATION

1.0 Introduction

1.1 Scope

This report documents conformance with the requirements set forth in EN 60945:2002 and details the results of testing performed on October 30, 2018 through November 30, 2018 on the model SOLIX 12 MSI G2 manufactured by JOHNSON OUTDOORS .

1.2 Purpose

Testing was performed to evaluate the EUT with regard to EMC regulatory requirements in accordance with the European Union's CE Marking arrangements.



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1.3 Results Summary

Product Standard or Test Method Applied	Description	Result
<u>Product Standards</u>		
IEC 60945:2002	Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results	Pass
EN 61000-3-2:2014	Electromagnetic compatibility (EMC) -- Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)	N/A
EN 61000-3-3:2013	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection	N/A
<u>Basic Immunity Standards per EN 60945:2002</u>		
IEC 61000-4-2 Ed. 2.0	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	Pass
IEC 61000-4-3 Ed. 3.2	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	Pass
IEC 61000-4-4 Ed. 2.0	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	N/P
IEC 61000-4-5 2 nd Ed.	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	N/A
IEC 61000-4-6 3 rd Ed.	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	Pass
IEC 61000-4-8 2 nd Ed.	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	N/A
IEC 61000-4-11 2 nd Ed.	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 Emissions Performance Criteria

For model SOLIX 12 MSI G2 the limits which apply are EN 60945:2002 Class B. These limits are found in Table 1.4.1-1 below:

Table 1.4.1-1 Emissions Limits

	Portable	Protected	Exposed	Submerged
Conducted emissions (9.2)		10 kHz – 150 kHz 150 kHz – 350 kHz 350 kHz – 30 MHz	63 mV – 0,3 mV (96 dB μ V – 50 dB μ V) 1 mV – 0,3 mV (60 dB μ V – 50 dB μ V) 0,3 mV (50 dB μ V)	
Radiated emissions (9.3)	150 kHz – 300 kHz 300 kHz – 30 MHz 30 MHz – 2 GHz 156 MHz – 165 MHz	10 mV/m – 316 μ V/m (80 dB μ V/m – 52 dB μ V/m) 316 μ V/m – 50 μ V/m (52 dB μ V/m – 34 dB μ V/m) 500 μ V/m (54 dB μ V/m) except for 16 μ V/m (24 dB μ V/m) quasi-peak or 32 μ V/m (30 dB μ V/m) peak		

1.4.4 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 by 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

2.0 Test Facilities & Environment

2.1 Test Facilities

All testing was performed at the following address:

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 section 1.0

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 scope of accreditation.

TÜV SÜD America Inc. 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.



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3.0 Equipment Under Test (EUT)

3.1 Manufacturer

JOHNSON OUTDOORS
1220 Old Alpharetta Road Suite 340
Alpharetta, GA 30005

Kim Lincoln
+177088862921076
Kim.Lincoln@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.					
<u>Modification Type</u>	<u>Component/Material Description (Model)</u>	<u>Location</u>	<u>Test Required For</u>	<u>Specific Need</u>	<u>Photograph Designation</u>

3.3 System Block Diagram and Support Equipment

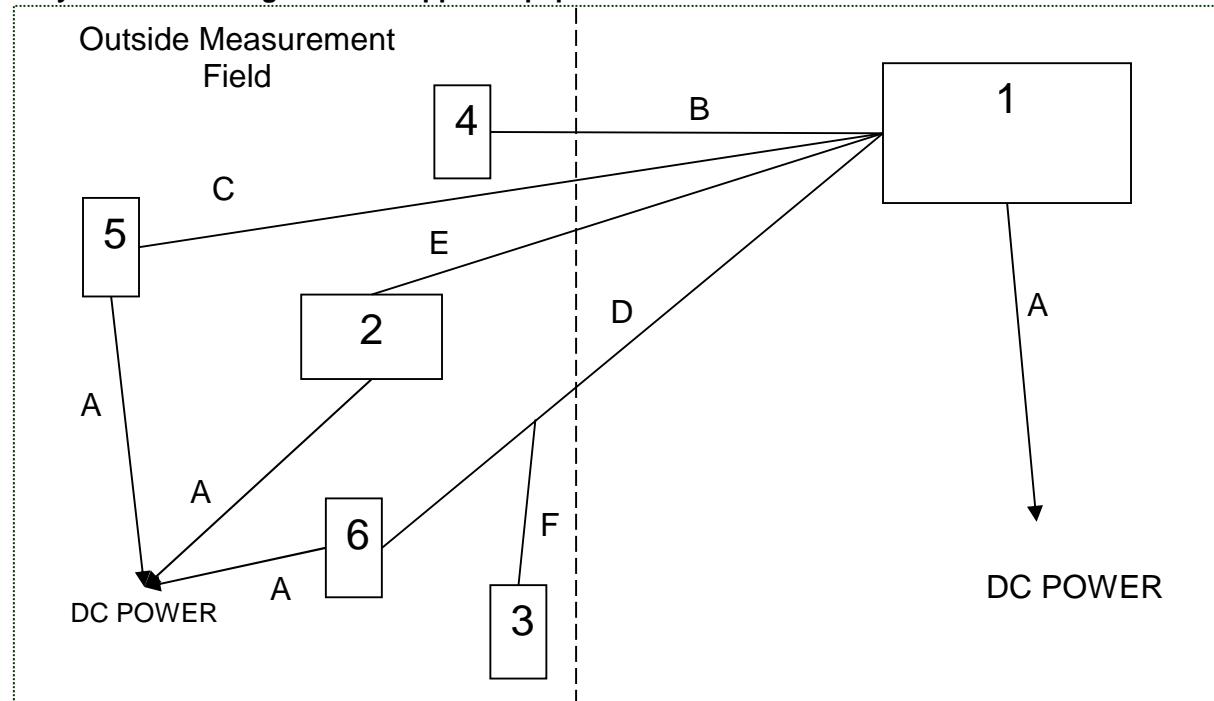


Figure 3.3-1: System Block Diagram

Table 3.3-1: EUT and Support Equipment Description

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Johnson Outdoors	SOLIX 12	N/A
2	Auxiliary Equipment	Johnson Outdoors	SOLIX 12	2006
3	Precision GPS Module	Humminbird	GPS	12071842-0039
4	Transducer	Johnson Outdoors	Humminbird	Humminbird
5	GPS Antenna	Maretron	n/a	n/a
6	AIS	GeoNav	GTX AIS	508585

Table 3.3-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	DC Leads	1.8m	No	1 – DC 2 – DC 5 – DC 6 - DC
B	Transducer cable	6.1m	No	1 – 4
C	GPS antenna cable	5m	No	1 – 5
D	AIS cable	8m	No	1 – 6
E	Ethernet	8m	No	1 – 2
F	GPS	6.1m	No	D - 3



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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>

3.5 EUT Photographs

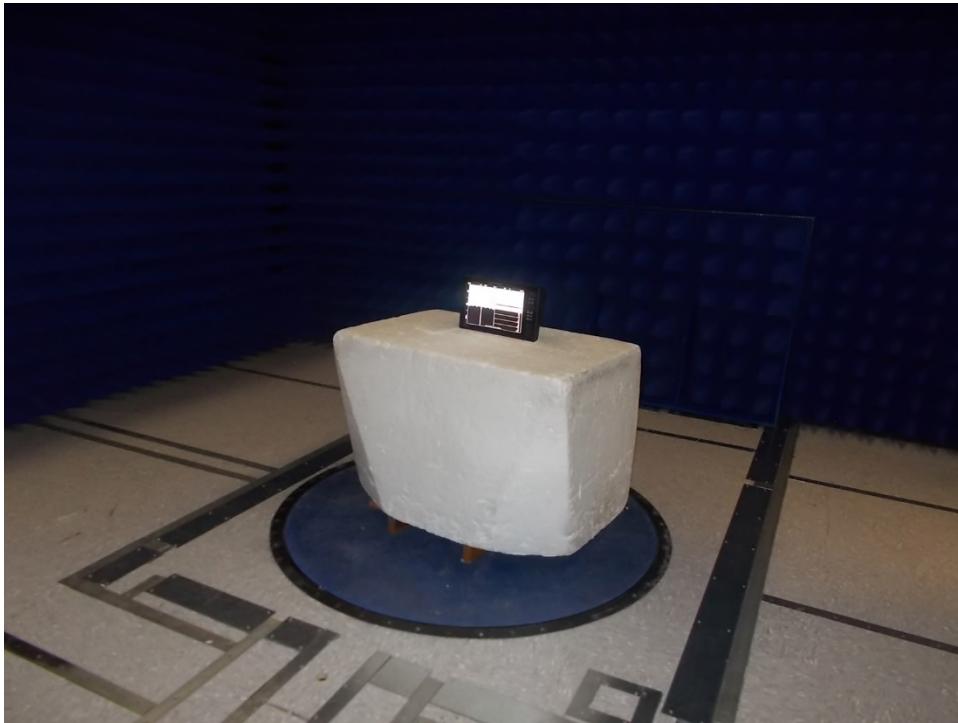


Figure 3.5-1: EUT Photo – Front

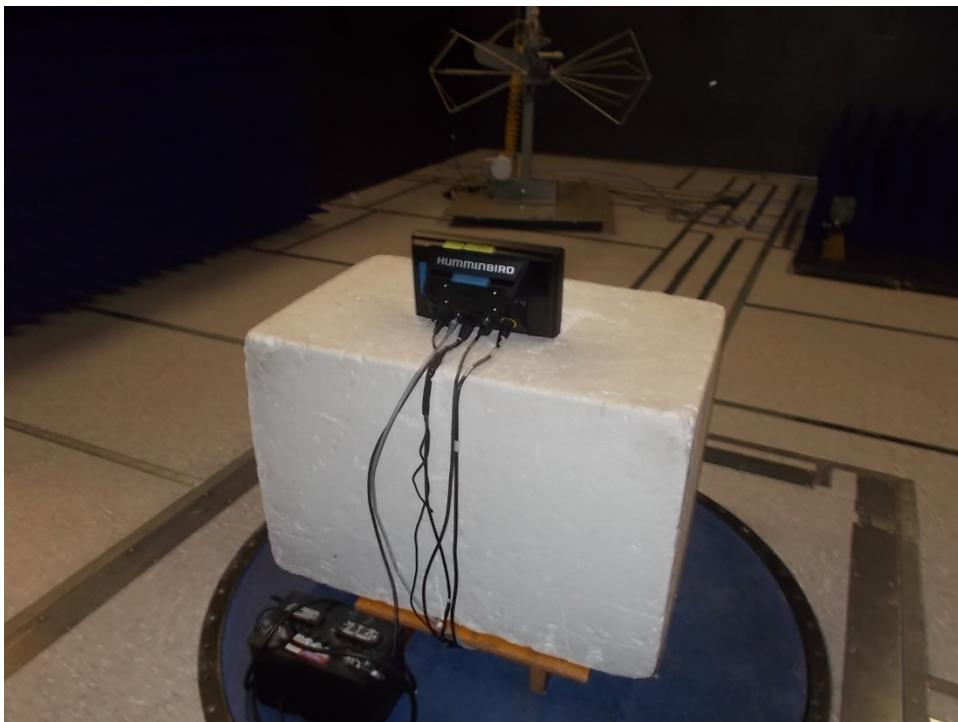


Figure 3.5-2: EUT Photo – Back

SECTION B: EMISSIONS – TEST INFORMATION AND RESULTS

4.0 Radiated and Conducted Emissions

4.1 Radiated Emissions

4.1.1 Radiated Emissions Test Site

4.1.1.1 Open Area Test Site

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style reinforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 4.1.1.1-1 below:

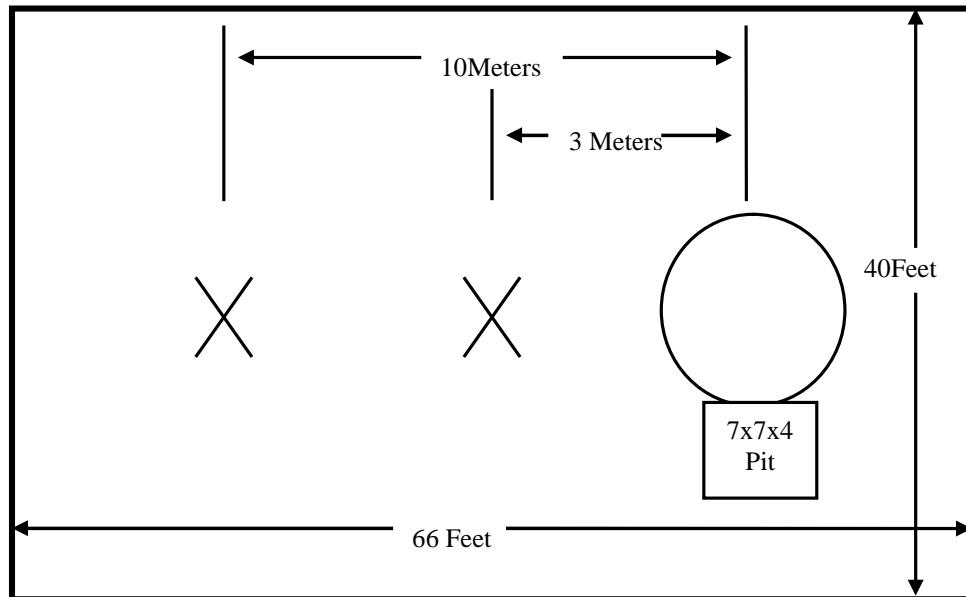


Figure 4.1.1.1-1: Open Area Test Site

4.1.1.2 Semi-Anechoic Chamber

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.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 4.1.1.2-1 below:

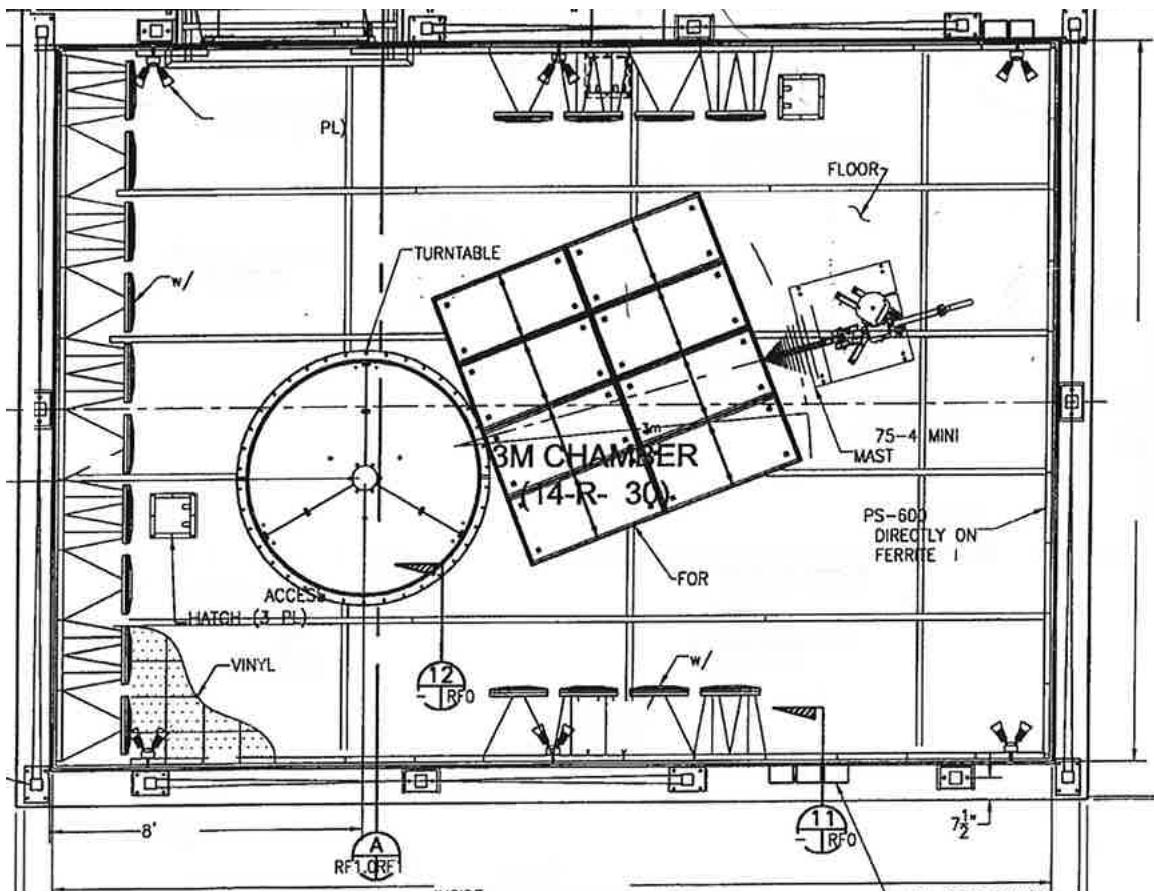


Figure 4.1.1.2-1: Semi-Anechoic Chamber Test Site

4.1.1.3 Fully Anechoic Chamber

The 3m fully anechoic chamber is used for pre-screening the EUT for emissions only. Final screening is performed on the OATS or in case of Class B EUT's, in the 3m semi-anechoic chamber. The Fully Anechoic Chamber has been characterized for field uniformity in accordance with IEC 61000-4-3 and can be used for final radiated fields immunity testing.

The Fully-Anechoic Chamber Test Site consists of a 24'L x 16'W x 12'H shielded enclosure. The chamber is fully lined with RF absorbing foam. The foam ranges in type from 8-24" conventional pyramidal cones, 8-12" conventional wedges and 6" and 16" Hybrid Foam over ferrite tile. The Hybrid material is placed in the 6 specular regions of the chamber for better low-frequency performance. The specular regions are 1) directly behind the receiving antenna, 2) on the floor between the receiving antenna and the EUT table, 3) the wall directly behind the EUT, 4&5) the side walls between the receiving antenna and the EUT table and 6) the ceiling between the receiving antenna and the EUT. The specular regions are 6' x 4' in size.

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 3/4" stainless steel braided cable. The turntable is a remotely controlled EMCO Model 1060 and is 150cm in diameter and is located 1m from the absorber on the back wall of the chamber.

A diagram of the Fully Anechoic Chamber Test Site is shown in Figure 4.1.1.3-1 below:

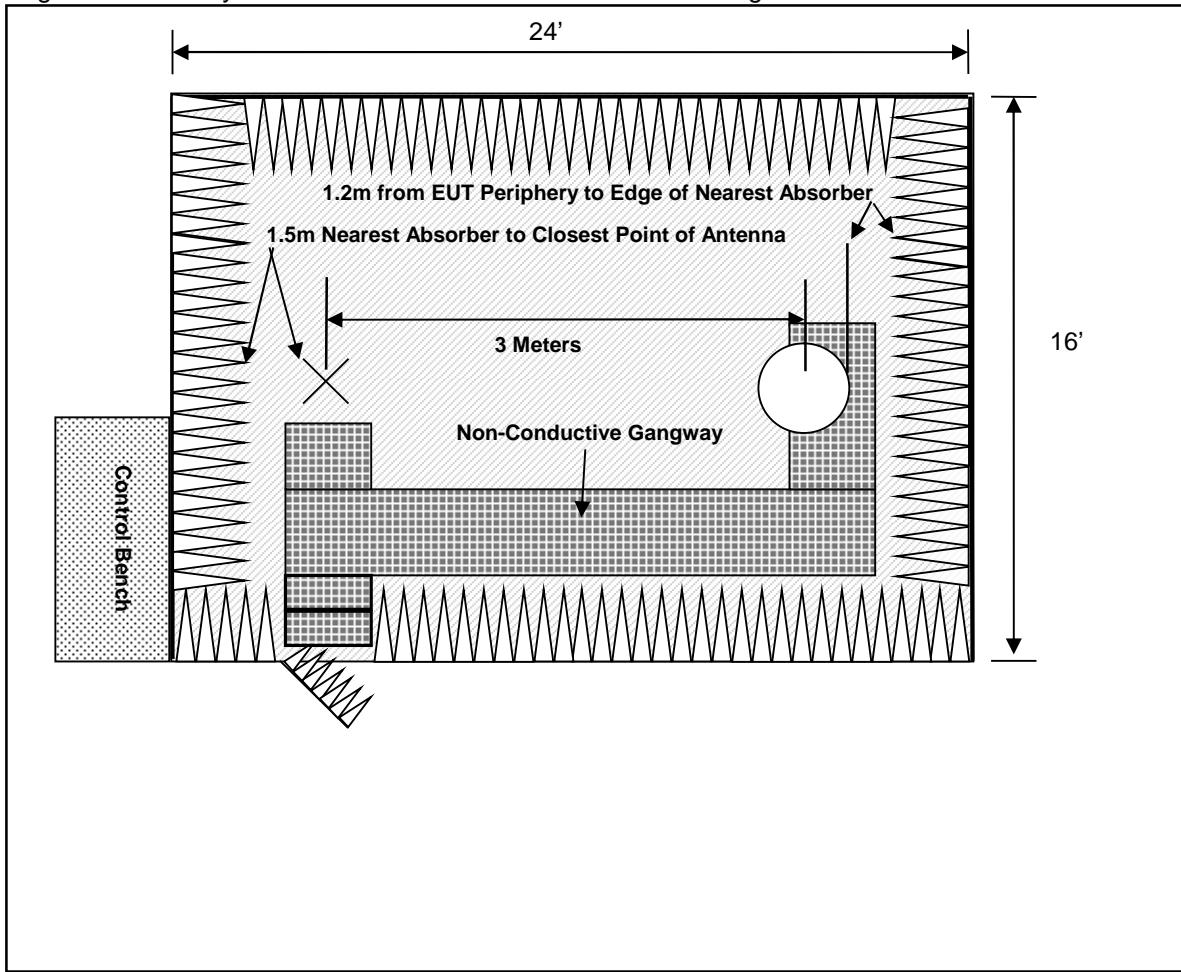


Figure 4.1.1.3-1: Fully Anechoic Chamber Test Site



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4.1.2 Test Equipment

Table 4.1.2-1 identifies all equipment used for radiated emissions respectively.

**Table 4.1.2-1 Test Equipment – Radiated Emissions
Semi-Anechoic Chamber**

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
731	EMCO	3104	Antennas	2659	11/09/2016	11/09/2018
213	TEC	PA 102	Amplifiers	44927	7/19/2018	7/19/2019
836	ETS Lindgren	Chamber B EMI Cable Set	Cable Set	836	5/1/2018	5/1/2019
412	Electro Metrics	LPA-25	Antennas	1241	8/22/2018	8/22/2020
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019
90	Electro-metrics	LPA25	Antennas	1476	1/3/2018	1/3/2020
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019

Semi-Anechoic Chamber High Frequency

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
30	Spectrum Technologies	DRH-0118	Antennas	970102	5/9/2017	5/9/2019
338	Hewlett Packard	8449B	Amplifiers	3008A01111	7/11/2017	7/11/2019
836	ETS Lindgren	Chamber B EMI Cable Set	Cable Set	836	5/1/2018	5/1/2019
819	Rohde & Schwarz	ESR26	EMI Test Receiver	101345	11/06/2018	11/06/2019
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019

NCR = No Calibration Required

4.1.3 Test Methodology

4.1.3.1 Pre-Scans

Radiated pre-scans are performed on all EUT's in either the 3m Semi-Anechoic or the 3m Fully-Anechoic Chamber. Final emission testing for Class A equipment is performed on the 3/10m Open Area Test Site (OATS) as described in section 4.1.1.1. Final emission testing on Class B equipment can be performed either in the 3m Semi-Anechoic chamber described in section 4.1.1.2 or on the OATS.

Pre-scans are a method by which the 10 highest emissions can be identified for final evaluation. This is achieved by taking automated emission snapshots of the EUT at various azimuths and antenna heights. The software is programmed to perform a peak sweep of the band using the maxhold function. This sweep is performed every 90° in both horizontal and vertical polarities and at antenna heights of 100cm and 300cm. Although not a fully maximized scan, the pre-scan gives a good indication of pass or fail.

4.1.3.2 Final Scans

Radiated emissions measurements were made over the frequency range of 150KHz – 2GHz. Quasi-Peak measurements are taken with the Spectrum Analyzer's resolution bandwidth was set to 120KHz and video bandwidth set to 300 kHz for measurements below 1000MHz. Average measurements are taken above 1000MHz with the RBW set to 1MHz and VBW set to 10Hz. The calculation for the radiated emissions field strength is as follows:

$$\begin{aligned}\text{Corrected Reading} &= \text{Analyzer Reading} + \text{Cable Loss} + \text{Antenna Factor} - \text{Amplifier Gain} \\ \text{Margin(dB)} &= \text{Applicable Limit} - \text{Corrected Reading}\end{aligned}$$

4.1.3.3 Test Criteria

The EUT must meet the Class B Limits as given in section 1.2.

4.1.3.4 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:**

4.1.4 Test Setup Photographs

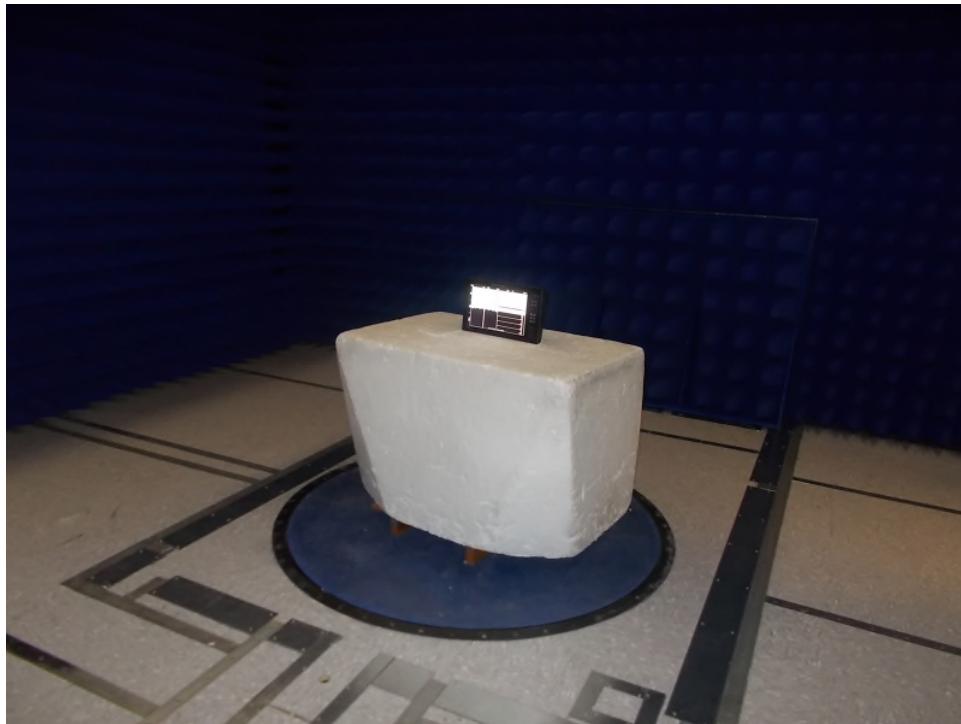


Figure 4.1.4-1: Radiated Emissions - Front View



Figure 4.1.4-2: Radiated Emissions - Rear View



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4.1.5 Test Data

Final tabulated radiated emissions data are reported in the Test Data Table below:

Test Parameters:

Test Date:	11/6/2018	Temperature (°C)	23
Technician:	A Sumner	Humidity (%)	51
Equipment Class:	Class B	Barometric Pressure (mBar)	1019
Tested Modes:	EUT on; auxillary unit, GPS Antenna, Maretron Antenna, depth simulator		
AC Input Power:	n/a		
DC Input Power:	12 VDC		

Test Data Table:

Frequency (MHz)	Measured Level (dBuV)		Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (o)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	Pk	Qpk/Av					Pk	Qpk/Av	Pk	Qpk/Av	Pk	Qpk/Av
	40.2	-----	41.93	H	100	355	-12.98	-----	28.95	-----	54.0	-----
52.8	-----	45.91	V	100	0	-14.12	-----	31.79	-----	54.0	-----	22.2
53.29	-----	45.62	V	100	0	-14.21	-----	31.41	-----	54.0	-----	22.6
250	-----	52.20	V	100	222	-12.76	-----	39.44	-----	54.0	-----	14.6
288	-----	30.32	H	100	4	-11.12	-----	19.20	-----	54.0	-----	34.8
401.2	-----	50.57	V	157	166	-8.83	-----	41.74	-----	54.0	-----	12.3
426.95	-----	39.59	H	117	4	-8.41	-----	31.18	-----	54.0	-----	22.8
125	-----	52.42	V	100	4	-13.01	-----	39.41	-----	54.0	-----	14.6
164.34	33.19	-----	V	100	0	-9.63	-----	23.56	-----	30.0	-----	6.4
163.07	32.47	-----	V	100	0	-9.82	-----	22.65	-----	30.0	-----	7.4
164.34	-----	19.72	V	100	0	-9.63	-----	10.09	-----	24.0	-----	13.9
163.07	-----	20.19	H	100	0	-9.82	-----	10.37	-----	24.0	-----	13.6
1203.25	-----	35.00	V	100	4	-6.04	-----	28.96	-----	54.0	-----	25.0
1351.75	-----	36.04	V	100	311	-5.05	-----	30.99	-----	54.0	-----	23.0

Qpk = Quasi-Peak Measurement or Limit (< 1GHz)

AV = Average Measurement or Limit (>1GHz)

Notes:

4.2 Conducted Emissions

4.2.1 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 C63.4:2003 and 2009.

A diagram of the room is shown below in figure 4.2.1-1:

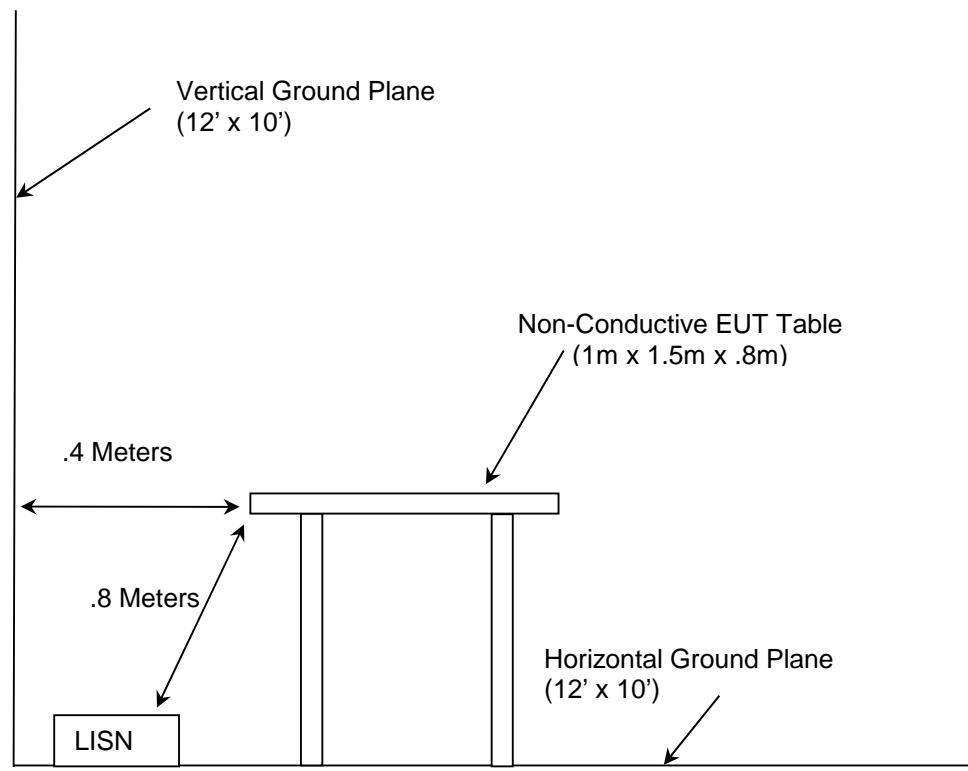


Figure 4.2.1-1: AC Mains Conducted EMI Site

4.2.2 Test Equipment

Table 4.2.2-1 Test Equipment – Conducted Emissions

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
324	ACS	Belden	Cables	8214	4/5/2018	4/5/2019
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
3010	Rohde & Schwarz	ENV216	LISN	3010	7/11/2018	7/11/2019
813	PMM	9010	Receiver	697WW30606	2/12/2018	2/12/2019

Conducted Emissions Telecom

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
168	Hewlett Packard	11947A	Attenuators	44829	1/22/2018	1/22/2019
324	ACS	Belden	Cables	8214	4/5/2018	4/5/2019
419	Teseq	ISN T800	LISN	25203	8/9/2017	2/09/20
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
561	Teseq	ISN ST08	Coupler	31286	7/11/2018	7/11/2019
813	PMM	9010	Receiver	697WW30606	2/12/2018	2/12/2019

NCR = No Calibration Required

4.2.3 Test Methodology

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 = Corrected Reading – Applicable Limit

4.2.3.1 Test Criteria

The EUT must meet the Class B Limits as given in section 1.4.1.

4.2.3.2 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:

4.2.4 Test Setup Photographs

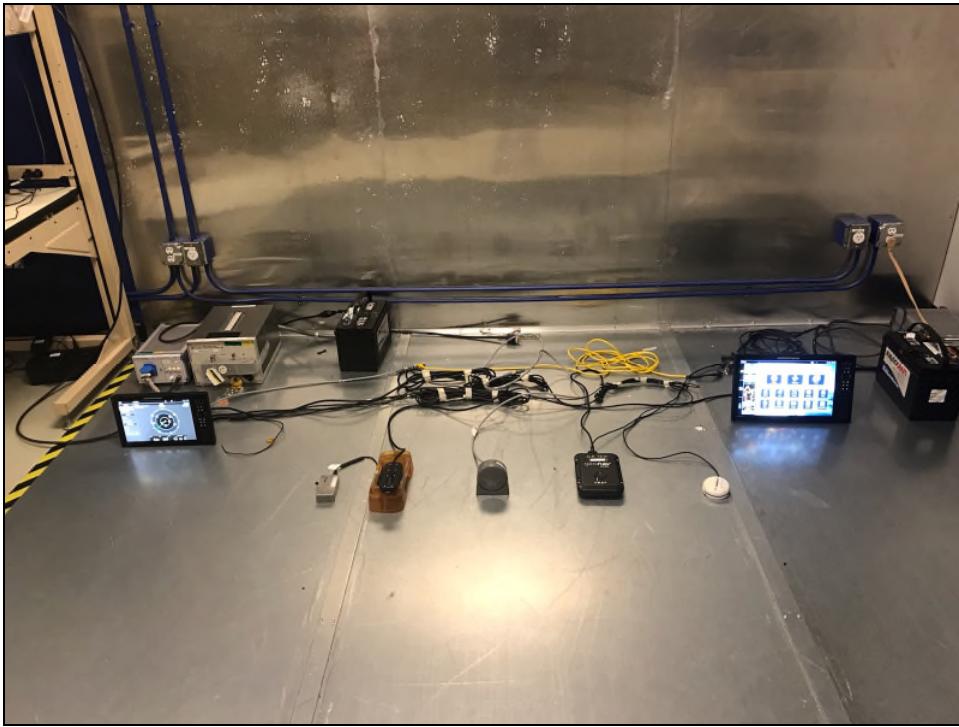


Figure 4.2.4-1: Conducted Emissions Test Setup – Front View

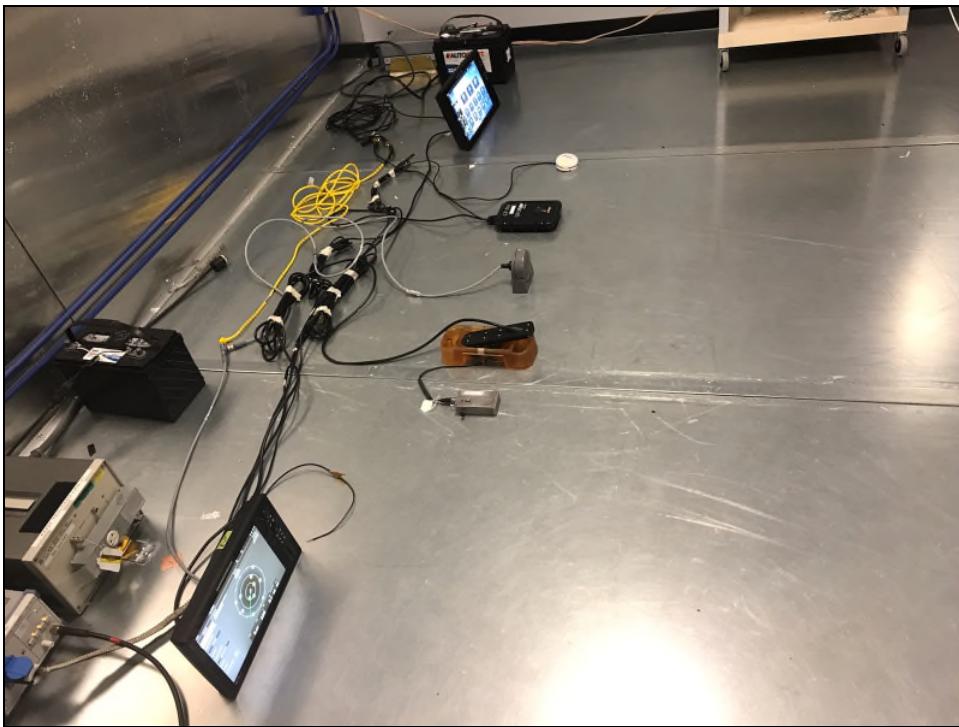


Figure 4.2.4-2: Conducted Emissions Test Setup – Side View



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4.2.5 Test Data

Tabulated data is given in the Test Data Tables below.

Test Parameters:

Test Date:	11/29/18	Temperature (°C)	22
Technician:	Eugene Sello	Humidity (%)	38
Equipment Class:	Enter	Barometric Pressure (mBar)	993
Tested Modes:	Powered ON, connected to accessory equipment		
AC Input Power:	N/A		
DC Input Power:	12VDC		

Tested Leads:

- AC Mains – Number of Lines:
- DC Mains – Number of Lines: 2
- Telecom Port – Quantity:

Power Line, L1							
Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.13	23.1		92		-68.90		9.85
0.402	33.12		50		-16.88		9.59
0.562	37.61		50		-12.39		9.59
0.93	34.31		50		-15.69		9.6
1.05	36.55		50		-13.45		9.6
1.298	36.29		50		-13.71		9.6
1.886	34.86		50		-15.14		9.61
3.498	30.83		50		-19.17		9.62
4.49	30.76		50		-19.24		9.63
5.594	30.78		50		-19.22		9.65
5.718	31.61		50		-18.39		9.65

Notes:



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<u>Power Line, N</u>							
Frequency (MHz)	Corrected Reading		Limit		Margin		
	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dBuV)	Average (dBuV)	Quasi-Peak (dB)	Average (dB)	Correction (dB)
0.12	23.1		92		-68.90		9.85
0.174	39.66		57.86		-18.2		9.58
1.434	39.36		50		-10.64		9.6
1.514	41.48		50		-8.52		9.61
4.422	30.76		50		-19.24		9.63
4.498	30.76		50		-19.24		9.63
4.586	33.39		50		-16.61		9.64
4.746	37.66		50		-12.34		9.64
5.618	37.21		50		-12.79		9.65
5.726	32.86		50		-17.14		9.65
5.862	33.74		50		-16.26		9.65

Notes:



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5.0 Harmonic Current Emissions

5.1 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:

EUT is not powered by AC mains. HCE test is not applicable.



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6.0 Voltage Fluctuations & Flicker

6.1 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:

EUT is not powered by AC mains. VFF test is not applicable.

SECTION C: IMMUNITY – TEST INFORMATION AND RESULTS

7.0 Electrostatic Discharge Immunity

7.1 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.

7.2 Test Equipment

Table 7.2-1: Test Equipment List

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
144	Omega	RH411	Climate Monitoring Equipment	H0103373	10/24/2018	10/24/2020
375	Fluke	Fluke 115	Meters	93771446	7/10/2018	7/10/2020
582	Kikusui	KES4021A	ESD Gun	SA003046	5/17/2018	5/17/2019

NCR = No Calibration Required

7.3 Test Methodology

IEC 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.

7.3.1 Test Criteria

EN 60945:2002 requires performance criterion B to be met as described in section 1.4.4

7.3.2 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:**

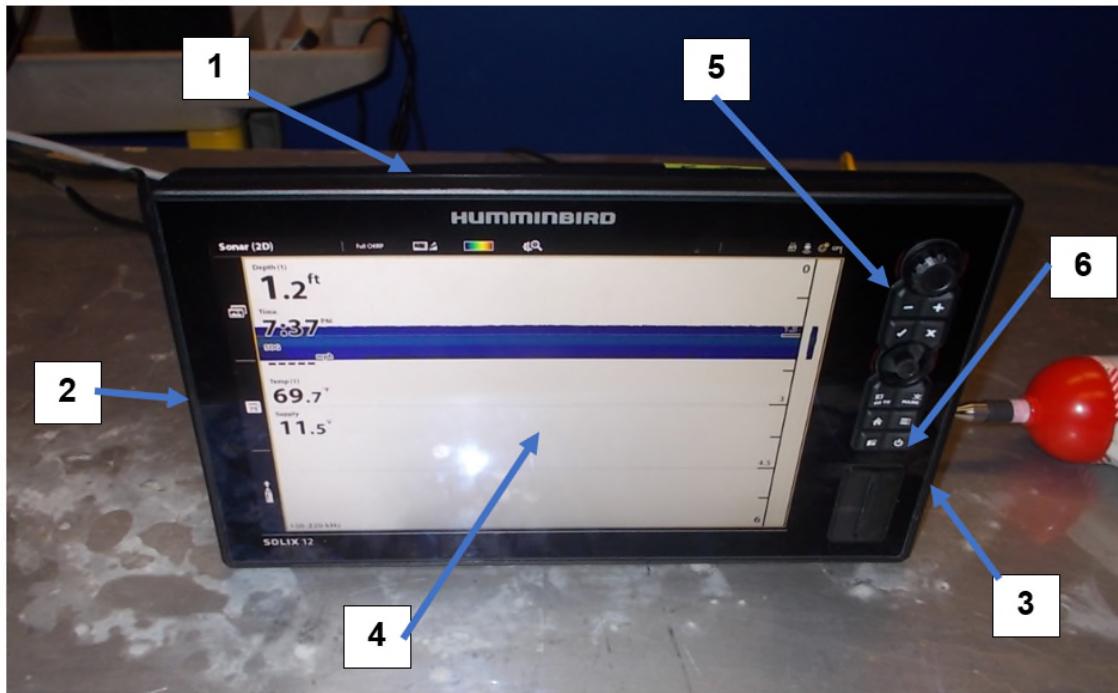
7.4 Test Setup Photograph



Figure 7.4-1: Test Setup Photograph

7.5 ESD Data Sheet

Test Point Photograph:





Test Point Selection:

TEST POINT#	DESCRIPTION	TYPE (C/A)	TEST POINT#	DESCRIPTION	TYPE (C/A)
1	Top	Air	5	Control Panel	Air
2	Right side	Air	6	Power Button	Air
3	Left side	Air	7	Rear Plastic Connectors	Air
4	Front Screen	Air	8	Rear Metal Connectors	Contact



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7.6 Test Data

Test Parameters:

Test Date:	11/13/2018	Temperature (°C)	24
Technician:	A Sumner	Humidity (%)	46
Equipment Class:	N/A	Barometric Pressure (mBar)	1016
<input checked="" type="checkbox"/> Pre-test Verification Complete			
Tested Modes:	Powered On; Connected to AUX, GPS, Maretron GPS, Transducer		
AC Input Power:	N/A	VCP Resistor Value Check:	942k (Ohms)
DC Input Power:	12VDC Battery	HCP Resistor Value Check:	960k (Ohms)

Indirect Contact Discharge:

<u>Check All That Apply to This Data</u>					
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 checked="" type="checkbox"/> 6kV	<input type="checkbox"/> Enter Other Level Here		
Side	Result	Observation (Describe any detectable event)			
Front	Pass				
Rear	Pass				
Left	Pass				
Right	Pass				
Bottom	Pass				

Air and Direct Contact Discharge:

<u>Check All That Apply to This Data</u>						
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	Air	Pass				
4	Air	Pass				
5	Air	Pass				
6	Air	Pass				
7	Air	Pass				
8	Contact	Pass				

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8.0 Radio-Frequency Electromagnetic Fields

8.1 Test Site Description

The radiated fields test was performed in the semi or fully-anechoic chamber described in section 4.1.1.2 or 4.1.1.3 respectively.

8.2 Test Equipment

Table 8.2-1: Test Equipment List

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
197	Amplifier Research	DC6080	Coupler	307006	NCR	NCR
354	ETS Lindgren	3142C	Antennas	00078838	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
684	Rohde & Schwarz	SML03	Signal Generators	103503	7/11/2018	7/11/2019
711	Hewlett Packard	8648B	Signal Generators	3623A01926	7/11/2018	7/11/2019
214	Holaday	HI-4433-GRE	Probes	00034096	4/12/2018	4/12/2019
836	ETS Lindgren	Chamber B EMI Cable Set	Cable Set	836	5/1/2018	5/1/2019
824	IFI	CMX5001	Amplifier	932-1095	NCR	NCR

High Frequency RFI

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
329	A.H. Systems	SAS-571	Antennas	721	8/3/2017	8/3/2019
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
836	ETS Lindgren	Chamber B EMI Cable Set	Cable Set	836	5/1/2018	5/1/2019
684	Rohde & Schwarz	SML03	Signal Generators	103503	7/11/2018	7/11/2019
214	Holaday	HI-4433-GRE	Probes	00034096	4/12/2018	4/12/2019
1115	Varian	VZC6961G1	Amplifier	884	NCR	NCR
1116	Varian	VZM6991G5	Amplifier	1147	NCR	NCR
814	Ophir	5293FE	Amplifier	1046	NCR	NCR

Semi-Anechoic Chamber - RFI

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
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
619	Teledyne Storm Microwave	90-195-456	Cables	13-10-601	NCR	NCR
620	Teledyne Storm Microwave	90-195-456	Cables	13-10-602	NCR	NCR
624	Advantest	R3261C	Spectrum Analyzers	31720426	NCR	NCR
214	Holaday	HI-4433-GRE	Probes	00034096	4/12/2018	4/12/2019

NCR = No Calibration Required



8.3 Test Methodology

IEC 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.

8.3.1 Test Criteria

EN 60945:2002 requires criterion A to be met as described in section 1.4.4.

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



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8.5 Test Results

Test Parameters:

Test Date:	November 13, 2018	Temperature (°C)	22
Technician:	Tyler Leeson	Humidity (%)	33
Equipment Class:	N/A	Barometric Pressure (mBar)	987.4
Tested Modes:	EUT on; Auxillary equipment on table; GPS connected		
AC Input Power:	n/a	<input checked="" type="checkbox"/> Pre-test Verification Complete	
DC Input Power:	12VDC		

Test Data: EN60945

<u>Check All That Apply to This Data</u>			
Polarity	Field Strength:	Freq. Band:	Dwell Time
<input type="checkbox"/> Horizontal	<input type="checkbox"/> 3V/m	<input type="checkbox"/> 80-1000MHz	<input type="checkbox"/> 1 Second
<input type="checkbox"/> Vertical	<input checked="" type="checkbox"/> 10V/m	<input checked="" type="checkbox"/> 80-2000MHz@400Hz AM	<input checked="" type="checkbox"/> 3 Seconds
<input checked="" type="checkbox"/> Both	<input type="checkbox"/> 8V/m	<input type="checkbox"/> Enter other band here	<input type="checkbox"/> Enter Other
	<input type="checkbox"/> Enter Other Level Here		
Azimuth	Result	Observation (Describe any detectable event)	
0	Pass		
90	Pass		
180	Pass		
270	Pass		

Notes:



9.0 Electrical Fast Transient/Bursts

9.1 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.

9.2 Test Equipment

Table 9.2-1: Test Equipment List

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
62	Haefely Trench	EFT Clamp	Immunity Equipment	N/A	3/13/2018	3/13/2019
494	Omega	iBTHX-W	Climate Monitoring Equipment	9460211	10/24/2018	10/24/2020
474	Keytek	EMC PRO	General Lab Equipment	9808246	3/13/2018	3/13/2019

NCR = No Calibration Required

9.3 Test Methodology

IEC 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.

9.3.1 Test Criteria

EN 60945:2002 requires criterion B to be met as described in section 1.4.4.

9.3.2 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





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9.5 Test Results

Test Parameters:

Test Date:	October 9, 2018	Temperature (°C)	21
Technician:	Eugene Sello	Humidity (%)	58
Equipment Class:	N/A	Barometric Pressure (mBar)	1018
Tested Modes:	EUT on; GPS simulator connected, phone connected via bluetooth; Wireless remote connected; Sonar Transducer on		
AC Input Power:	N/A	<input checked="" type="checkbox"/> Pre-test Verification Complete	
DC Input Power:	12VDC		

Mains Test Data:

<u>Check All That Apply to This Data</u>			
Polarity:	Tested Levels:	Interface Type:	
<input type="checkbox"/> Positive	<input checked="" type="checkbox"/> .5kV	<input checked="" type="checkbox"/> Input	
<input type="checkbox"/> Negative	<input checked="" type="checkbox"/> 1kV	<input type="checkbox"/> Output	
<input checked="" type="checkbox"/> Both	<input type="checkbox"/> 2kV	<input type="checkbox"/> Both	
Coupling Mode	Result	Observation (Describe any detectable event)	
L1	Pass		
L2	Pass		
L1-L2	Pass		

Notes:

Signal Line Test Data:

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

Notes:



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10.0 Surge Immunity

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:

EUT was powered by 12Vdc and does not connect to AC public mains. Surge testing was not required.

11.0 Radio-Frequency Common-Mode Immunity

11.1 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).

11.2 Test Equipment

Table 11.2-1: Test Equipment List
Test Equipment List – Conducted Immunity

AssetID	Manufacturer	Model#	Equipment Type	Serial#	Calibration Performed Date	Calibration Due Date
5	Chase	CSP-8441	Probes	19	6/19/2018	6/19/2020
93	Chase	8101	Clamp	65	5/24/2018	5/24/2019
96	Chase	1000-M3-25	CDN	9806	5/1/2018	5/1/2019
364	Amplifier Research	DC2600A	Coupler	0322466	NCR	NCR
370	IFI	CMX5002	Amplifier	L364-0407	NCR	NCR
418	Tesed	ISN-S501	LISN	24543	5/1/2018	5/1/2019
425	ACS	EMC Cable Set	Cable Set	425	NCR	NCR
457	Com Power	CDN-M2-25	Coupler	511023	7/11/2018	7/11/2019
471	Bird Technologies Group	150-A-FFN-06	Attenuators	0914	NCR	NCR
144	Omega	RH411	Climate Monitoring Equipment	H0103373	9/1/2016	3/11/2019
634	Fischer Custom Communications Inc.	FCC-801-M3-16	CDN	9730	5/22/2018	5/22/2019
711	Hewlett Packard	8648B	Signal Generators	3623A01926	7/11/2018	7/11/2019
684	Rohde & Schwarz	SML03	Signal Generators	103503	7/11/2018	7/11/2019

NCR = No Calibration Required

11.3 Test Methodology

IEC 61000-4-6 3rd Ed. - 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.

11.3.1 Test Criteria

EN 60945:2002 requires criterion A to be met as described in section 1.4.4.

11.3.2 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:**

11.4 Test Setup Photographs

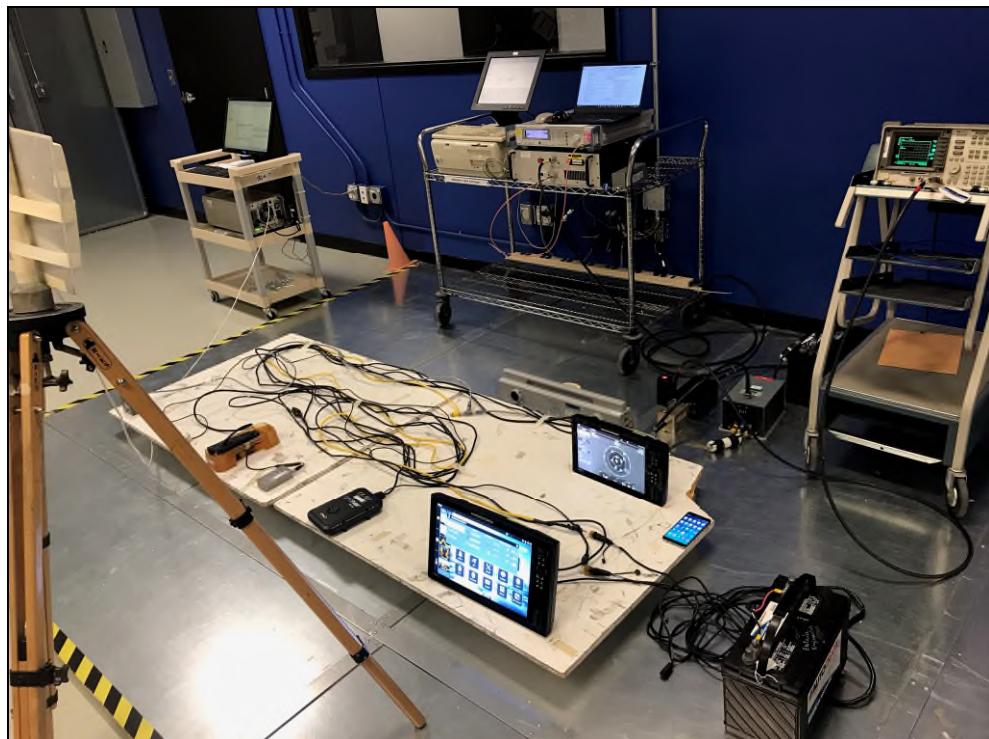


Figure 11.4-1: Test Setup Photograph



Model: SOLIX 12 MSI G2

Report No: 72143829.4E0

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11.5 Test Results

Test Parameters:

Test Date:	11/29/18	Temperature (°C)	23
Technician:	Eugene Sello	Humidity (%)	35
Equipment Class:	N/A	Barometric Pressure (mBar)	979
Tested Modes:	Powered on; GPS/Glonass Active; Bluetooth connected;		
AC Input Power:	N/A	<input checked="" type="checkbox"/> Pre-Test Verification	
DC Input Power:	12VDC		

Mains Test Data:

<u>Check All That Apply to This Data</u>			
Test Level:		Freq. Band:	
<input checked="" type="checkbox"/> 3Vrms		<input checked="" type="checkbox"/> .150-80MHz@400Hz AM	
<input type="checkbox"/> 10Vrms		<input type="checkbox"/> Enter Other Band Here	
<input type="checkbox"/> 15Vrms			
<input type="checkbox"/> Enter Other Level Here			
Coupling Mode	Result	Observation (Describe any detectable event)	
CDN	Pass		

Notes:

The following spot frequencies were tested at 10Vrms: 2MHz, 3MHz, 6.2MHz, 8.2MHz, 12.6MHz, 16.5MHz, 18.8MHz, 22MHz, and 25MHz

Signal Line Test Data:

<u>Check All That Apply to This Data</u>			
Test Level:		Freq. Band:	
<input checked="" type="checkbox"/> 3Vrms		<input checked="" type="checkbox"/> .150-80MHz@400Hz AM	
<input type="checkbox"/> 10Vrms		<input type="checkbox"/> Enter Other Band Here	
<input type="checkbox"/> 15Vrms			
<input type="checkbox"/> Enter Other Level Here			
Signal Line	Result	Observation (Describe any detectable event)	
GPS input	Pass		
Ethernet	Pass		
Maretron GPS	Pass		
SONAR Transducer	Pass		

Notes:

The following spot frequencies were tested at 10Vrms: 2MHz, 3MHz, 6.2MHz, 8.2MHz, 12.6MHz, 16.5MHz, 18.8MHz, 22MHz, and 25MHz



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12.0 Power Frequency Magnetic Fields Immunity

12.1 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:

EUT does not employ any magnetically sensitive components. PFMF test is not applicable



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13.0 Voltage Dips and Interruptions

13.1 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:

EUT is powered by 12Vdc battery. VDI testing is not applicable.

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 $(U_{\text{Lab}} - U_{\text{cispr}})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance, increased by $(U_{\text{Lab}} - U_{\text{cispr}})$, exceeds the disturbance limit.

The 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.



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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).