1601 North A.W. Grimes, Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

April 9, 2014

Dale Williams
Tideland Signal Corporation
4310 Directors Row
Houston, Texas 77092

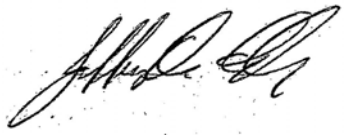
Dear Dale:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Tideland Signal Corporation. Enclosed is the Electromagnetic Compatibility Test Report for the E-Navcon.

This report can be used to demonstrate EMC compliance for the European Union, the United States, and Canada. For this product, the standards used to demonstrate compliance to the EMC directive were EN 60945: 2002, CISPR 16-2: 1996, and ETSI EN 301 489 v1.9.2 (2011-09).

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 13862-10

Tideland Signal Corporation
E-Navcon

Electromagnetic Compatibility Test Report

Prepared for:

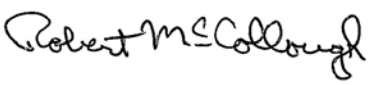
Tideland Signal Corporation
4310 Directors Row
Houston, Texas 77092

By

Professional Testing (EMI), Inc.
1601 North A.W. Grimes, Suite B
Round Rock, Texas 78665

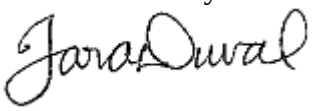
April 9, 2014

Reviewed by



Robert McCollough
Director of Testing Services

Written by



Tara Duval
Technical Writer

Revision History

Revision Number	Description	Date
00	Initial Release	April 8, 2014
Final	Final Release	April 9, 2014

Table of Contents

Certificate of Compliance

Applicant:	Tideland Signal Corporation 4310 Directors Row Houston, Texas 77092	Model: Serial #: Project #:	E-Navcon 7065 13862-10

The **E-Navcon** by **Tideland Signal Corporation** was tested utilizing the following documents and found to be in compliance with the required criteria on the indicated test date.

EN 60945: 2002, Section 9; CISPR 16-2: 1996			
Conducted Emissions	N/A	DC Power Line: 10 kHz to 30 MHz	11/18/2013
Radiated Emissions	N/A	150 kHz to 40 GHz	11/15/2012 – 11/16/2012
EN 60945: 2002, Section 10; ETSI EN 301 489-1 v1.9.2			
IEC 61000-4-2: 1995	Criterion A	Air Discharge: 2, 4, & 8 kV Contact Discharge: 2, 4 & 6 kV	6/14/2013
IEC 61000-4-3: 1995	Criterion A	10 V/m (80 MHz to 2 GHz) 3 V/m (2 to 2.7 GHz)	11/19/2012 – 11/20/2012
IEC 61000-4-4: 1995	Criterion A	DC Mains: 2 kV, 5/50 ns, 5 kHz I/O Line: 1 kV, 5/50 ns, 5 kHz	2/28/2014
IEC 61000-4-6: 1996	Criterion A	DC Power Line: 3 Vrms at 150 kHz to 80 MHz 10 Vrms at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25, 40, & 48 MHz Signal Cable Port: 3 Vrms at 150 kHz to 80 MHz 10 Vrms at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25, 40, & 48 MHz	11/19/2012

I, Robert McCollough, for Professional Testing (EMI), Inc., being familiar with the electromagnetic compatibility rules and test procedures, have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Robert McCollough
Director of Testing Services

NVLAP Lab Code 200062-0

This report has been reviewed and accepted by Tideland Signal Corporation. The undersigned is responsible for ensuring that the E-Navcon by Tideland Signal Corporation will continue to comply with the applicable rules.

_____
Representative of Tideland Signal Corporation

1.0 Introduction

1.1 Scope

The purpose of the EMC testing was to determine compliance with specific emissions and immunity standards. This report describes the extent to which the equipment under test (EUT) conformed to the standards to which it was tested and the manner in which that testing was conducted.

1.2 EUT Description

The EUT is the E-Navcon by Tideland Signal Corporation, which is a navigational aid comprised of an AIS AtoN device and an X-Band Racon. Both devices are housed in the same enclosure and function independently of one another. The device is intended for use on land, stationary off-shore platforms, buoys, or other stationary locations where navigational aid is required. The system tested consisted of the following:

Table 1.2.1: Equipment Under Test

EUT	**Manufacturer**	**Model**	**Serial #**		**Description**
	Tideland Signal Corporation	E-Navcon	7065		Navigational Aid
Peripheral Equipment	**Manufacturer**	**Model**	**Serial #**		**Description**
	Tideland Signal Corporation	Junction Box	None		Junction Box
	Dell	Latitude C610	CN-0X076-48643-64C-5563		Notebook Computer to Monitor EUT functions
Cables	**Quantity**	**Length**	**Shielded or Unshielded?**		**Description**
	1	20 feet	Shielded		Serial Port Cable to Computer
	1	15 feet	Shielded		Cable Bundle from Junction Box to EUT
Oscillator Frequencies	AIS AtoN Transmit/Receive, 156 to 162.5 MHz; transmits at 162 end.				
	RACON Transmit/Receive: 9300 to 9500 MHz.				

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations. It was operated using 12 VDC. The operation of the AIS AtoN portion of the system requires GPS signals; otherwise, it does not transmit. AIS transmit power is 25 Watts. It transmits very briefly and only in a GPS-based time slot, spaced by 1 to 2 minutes. The EUT was visually monitored for anomalies during testing and checked for functionality upon completion of each test.

2.0 Applicable Documents

The following documents were used as reference for the test procedures specified herein.

Document Identifier/Revision	Title/Description	Date of Publication
EN 60945	Maritime Navigation and Radio Communication Equipment and Systems – General Requirements Methods of Testing and Required Test Results	2002
ETSI EN 301 489-1 v1.9.2	Electromagnetic Compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements	2011-09
CISPR 11	Industrial, Scientific and Medical Equipment – Radio-Frequency Disturbance Characteristics – Limits and Methods of Measurement	2009
CISPR 16-1	Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods – Part 1: Radio Disturbance and Immunity Measuring Apparatus	1999
CISPR 16-2	Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods – Methods of Measurement of Disturbances and Immunity	1996
IEC 61000-4-3	Electromagnetic Compatibility for Electrical and Electronic Equipment, Part 3: Immunity to Radiated, Radio Frequency, Electromagnetic Fields	1995
IEC 61000-4-6	Electromagnetic Compatibility – Basic Immunity Standard – Conducted Disturbances Induced by Radio-Frequency Fields – Immunity Test	1996
IEC 61000-4-8	Electromagnetic Compatibility (EMC) – / Part 4: Testing and Measurement Techniques – Section 8: Power Frequency Magnetic Field immunity Test Basic EMC Publication	1993 A1: 2000

2.1 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

3.0 Electromagnetic Emissions Testing

Professional Testing (EMI), Inc. (PTI), follows the guidelines of NIST for all uncertainty calculations, estimates and expressions thereof for EMC testing. A copy of PTI's policy for EMC Measurement Uncertainty is provided in Appendix A.

3.1 Conducted Emissions Mains Terminal Measurements

Conducted emissions measurements were made to determine the line-to-ground radio noise from each DC power-input terminal of the EUT Conducted Emissions measurements were performed at Professional Testing, located in Austin, Texas.

3.1.1 Test Procedure

The tests were performed in a RayProof modular shielded room. The measurements were taken using a line impedance stabilization network (LISN). A spectrum analyzer and a quasi-peak adapter with a measurement bandwidth of 9 kHz were used to record the conducted emissions.

The power cord in excess of the distance folded back and forth forming a bundle 30 to 40 cm long in the approximate center of the cable. Power supply cords for the peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were separately bundled in a non-inductive arrangement at the approximate center of the cable with the bundle 30 to 40 centimeters in length. The conducted emissions were maximized, by varying the operating states and configuration of the EUT. The configuration of the shielded room showing the location of the EUT and the measurement equipment is given as Figure 3.1.1.1. Although a laptop computer was used to monitor EUT functions during other tests, it was not used during conducted emissions testing.

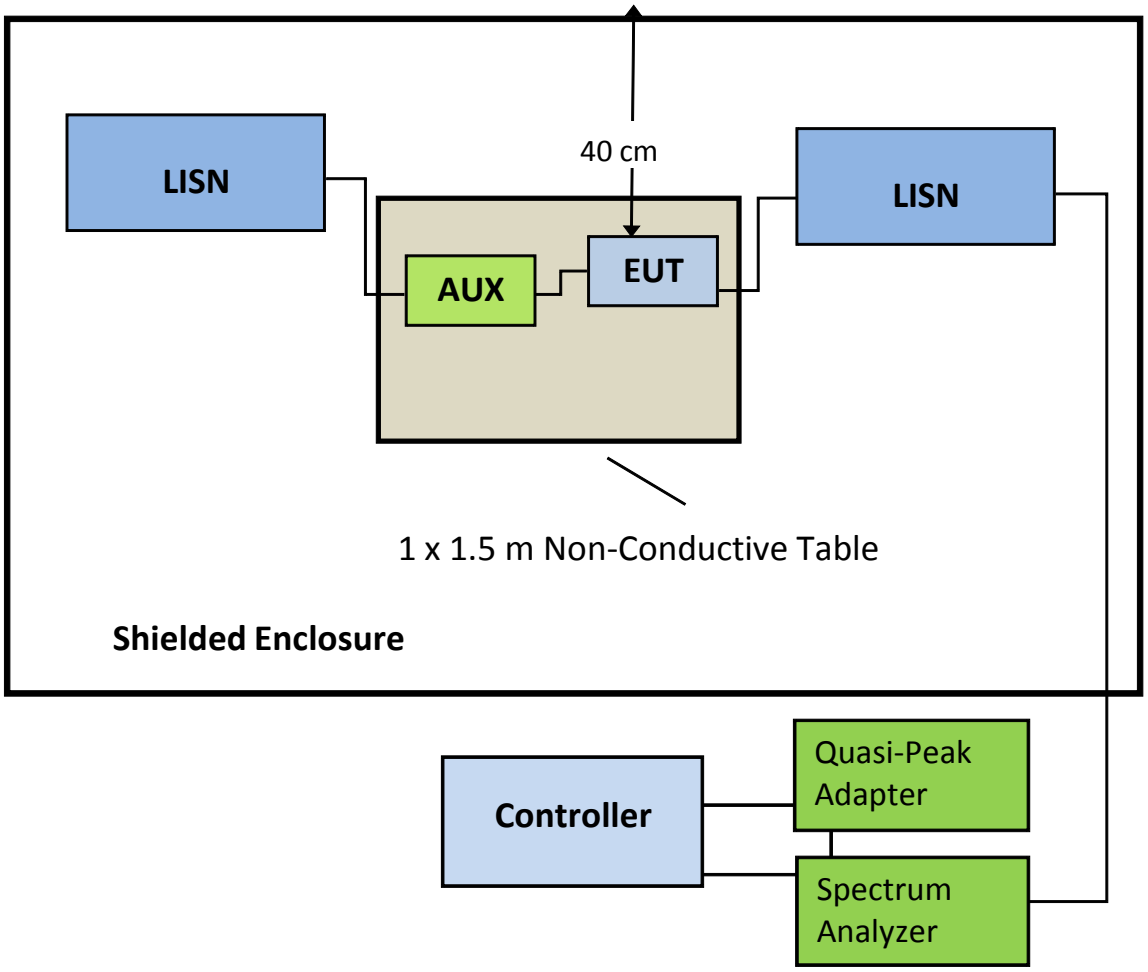


Figure 3.1.1.1: Conducted Emissions Test Setup

3.1.2 Test Criteria

The IEC 60945: 2002, CISPR 16-1 conducted emissions limits are given below.

Frequency	Protected	Exposed	Submerged
10 kHz to 150 kHz	63 mV – 0.3 mV (96 dµBV – 50 dµBV)		
150 kHz to 350 kHz	1 mV – 0.3 mV (60 dµBV – 50 dµBV)		
350 kHz to 30 MHz	0.3 mV (50 dµBV)		

3.1.3 Test Results

During testing on November 18, 2013, the conducted emissions generated by the DC power lines of the EUT were measured to be below the EN 60945: 2002 maximum criteria.

Table 3.1.3.1: Conducted Emissions Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Section 9 Electromagnetic emission – Methods of testing and required test results**		
Test Date(s):	**11/18/2013**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Larry Fuller**
Purchase Order #:	**116585 Rev 1**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**Paul Mueller**

Conducted Emissions Test Equipment List	
Tile! Software Version:	**4.1.A.0, April 14, 2009, 11:01:00PM**
Test Profile:	**Profile#: CE_2010.til, dated December 16, 2010**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1842	HP	8568B	Spectrum Analyzer	2732A03633	5/17/2014
0045	HP	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0990	HP	85685A	RF Preselector	3010A01119	8/29/2014
1281	HP	85650A	Quasi Peak Adapter	2043A00063	6/5/2014
C109	HP	none	Cable 19 inch BNC (grey)	none	7/10/2014
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	7/10/2014
C108	Pomona	RG-223	Cable 5.5 ft BNC RG-223 (black)	none	7/10/2014
0939	EMCO	3825/2	LISN, 10kHz-100MHz	9603-2521	10/31/2014
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	10/31/2014

Table 3.1.3.2: Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time

Professional Testing, EMI, Inc.			
Test Method:	**CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Section 9 Electromagnetic emission – Methods of testing and required test results**		
Test Date(s):	**11/18/2013**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Larry Fuller**
Purchase Order #:	**116585 Rev 1**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**Paul Mueller**

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time

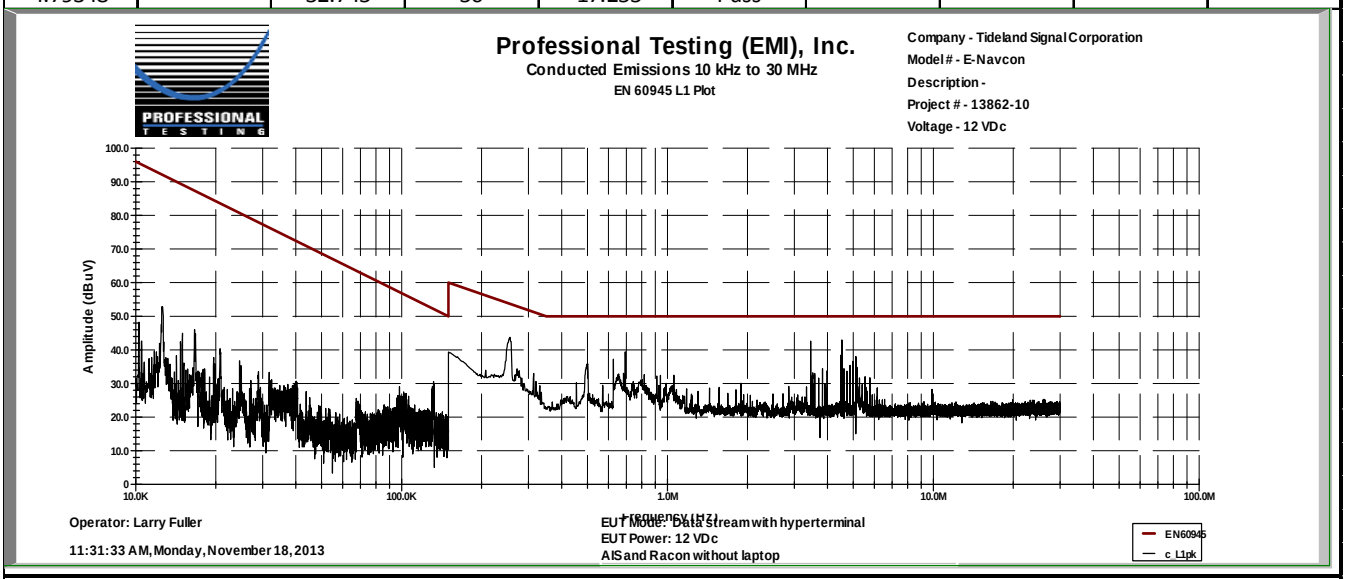
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps

*Notes:
1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

Table 3.1.3.3: Conducted Emissions Test Results, Neutral Lead

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/18/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Larry Fuller
Purchase Order #:	116585 Rev 1	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	Paul Mueller

Conducted Emissions Test Results Data Sheet - Neutral Lead								Page:	1 of 2
EUT Line Voltage:		12	VDc		EUT Line Frequency:			N/A	Hz
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading	Quasi-peak Detector Limit	Quasi-peak Detector Margin	Quasi-peak Detector Test	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.139574		25.437	51.224	-25.787	Pass				
0.139655		16.407	51.214	-34.807	Pass				
0.140485		15.845	51.113	-35.268	Pass				
0.142055		16.023	50.924	-34.902	Pass				
0.142268		25.882	50.899	-25.017	Pass				
0.26307		42.748	53.37	-10.622	Pass				
4.04651		29.431	50	-20.569	Pass				
4.39094		30.052	50	-19.948	Pass				
4.56398		33.978	50	-16.022	Pass				
4.66926		31.311	50	-18.689	Pass				
4.79348		32.745	50	-17.255	Pass				

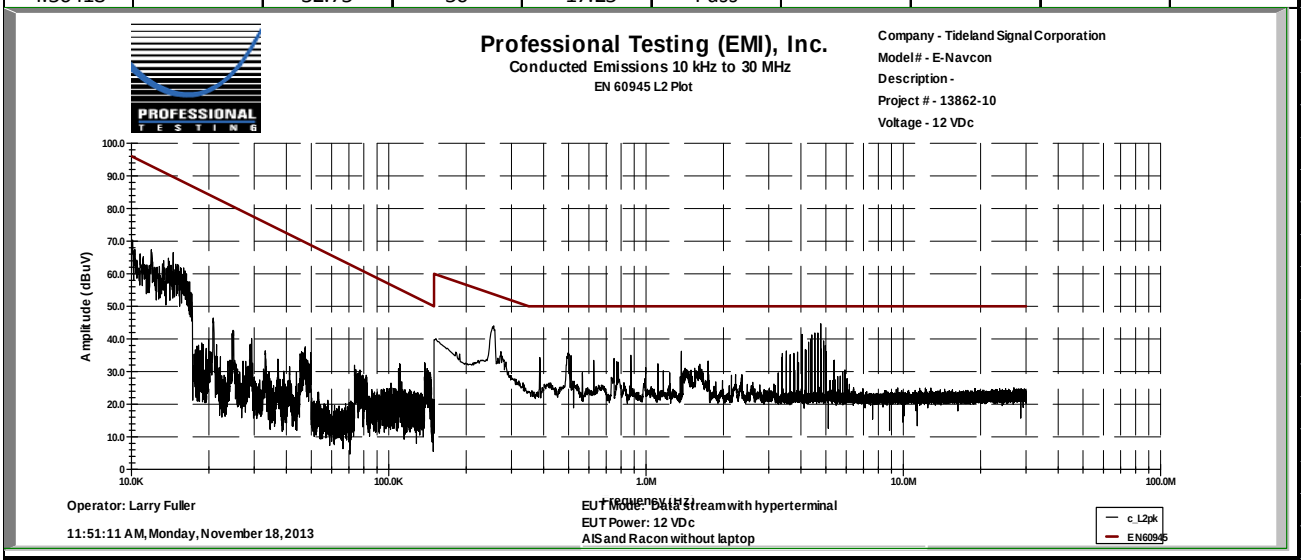


Measured Conducted Emissions - Neutral Lead

Table 3.1.3.4: Conducted Emissions Test Results, Phase Lead

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/18/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Larry Fuller
Purchase Order #:	116585 Rev 1	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	Paul Mueller

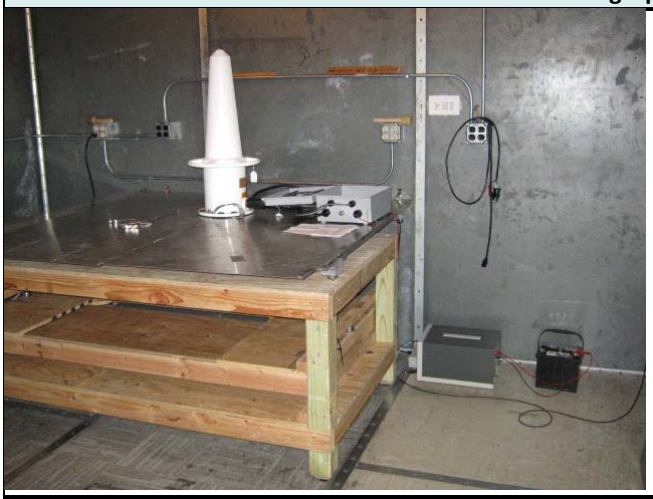
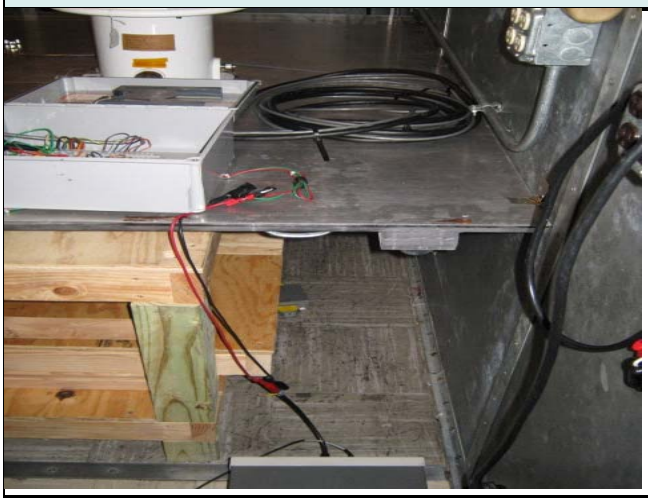
Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1)								Page:	2 of 2
EUT Line Voltage:		12	VDc		EUT Line Frequency:			N/A	Hz
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading	Quasi-peak Detector Limit	Quasi-peak Detector Margin	Quasi-peak Detector Test	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.131264		18.349	52.266	-33.918	Pass				
0.131338		15.949	52.257	-36.308	Pass				
0.132536		24.487	52.103	-27.615	Pass				
0.132854		24.437	52.062	-27.625	Pass				
0.132998		15.597	52.043	-36.446	Pass				
0.26632		41.969	53.225	-11.256	Pass				
0.66167		24.589	50	-25.411	Pass				
3.44792		23.621	50	-26.379	Pass				
4.45369		30.256	50	-19.744	Pass				
4.5479		33.369	50	-16.631	Pass				
4.56418		32.75	50	-17.25	Pass				



Measured Conducted Emissions - Phase Lead (Line 1)

Table 3.1.3.5: Conducted Emissions Test Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/18/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Larry Fuller
Purchase Order #:	116585 Rev 1	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	Paul Mueller

Conducted Emissions Photographs	Page: 1 of 1
	
EUT	EUT
	
Cable View	

3.2 Radiated Emissions Measurements

Radiated emissions measurements were made at the Professional Testing Site 45, located in Austin, Texas, to determine the radio frequency noise radiated from the EUT. The test methods used were CISPR 16-1 and CISPR 16-2 with the criteria of EN 60945: 2002.

3.2.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable which allows 360 degree rotation.

A measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT. Over the frequency range of 150 kHz to 30 MHz, the active rod antenna was located at a distance of 3 meters from the EUT. The height of this antenna was maintained at 1 meter. From 30 MHz to 200 MHz, a bi-conical antenna was used. From 200 MHz to 1 GHz, a log periodic antenna was used. For testing from 1 GHz to 2 GHz, a ridge guide horn antenna was used.

The radiated emissions were maximized by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters (above 30 MHz). A spectrum analyzer with peak detection was used to find the maximums of the radiated emissions during the variability testing. All final measurements in the frequency range of 150 kHz to 30 MHz and 156 MHz to 165 MHz were taken using a quasi-peak adapter with a measurement bandwidth of 9 kHz. Final measurements below 1 GHz were taken using a quasi-peak adapter with a measurement bandwidth of 120 kHz.

For frequencies greater than 1GHz, a measurement antenna was positioned at a constant height of 1 meter and at a distance of 3 meter from the closest point of the EUT. Average measurements were taken using a spectrum analyzer to find the maximums of the microwave radiated emissions. Final measurements above 1 GHz were taken using an average detector with a resolution bandwidth of 1 MHz. A diagram showing the test setup is given as Figure 3.2.1.1.

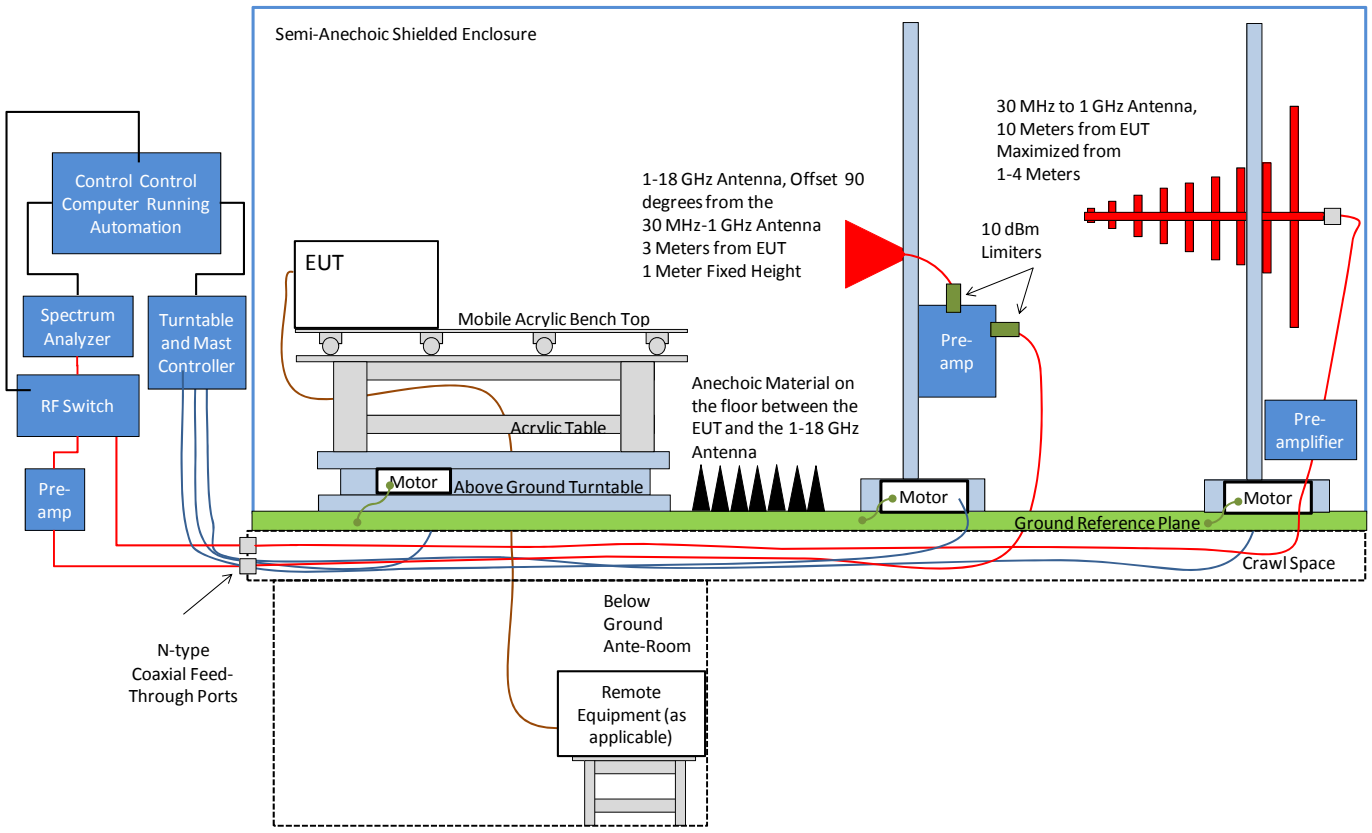


Figure 3.2.1.1: Radiated Emissions Test Setup

3.2.2 Test Criteria

The radiated emissions limits for IEC 60945: 2002, CISPR 16-1 are given below.

Frequency	Portable	Protected	Exposed
150 kHz to 300 kHz	10 mV/m – 316 µV/m (80 dBµV/m – 52 dBµV/m)		
300 kHz to 30 MHz	316 µV/m – 50 µV/m (52 dBµV/m – 34 dBµV/m)		
30 MHz to 2 GHz	500 µV/m (54 dBµV/m) except for:		
156 MHz to 165 MHz	16 µV/m (24 dBµV/m) quasi-peak or 32 µV/m (30 dBµV/m) peak		

3.2.3 Test Results

During testing on November 15 and 16, 2012, the emissions identified from the EUT were maximized at each frequency. The radiated emissions generated by EUT were below the IEC 60945: 2002 CISPR 16-1 maximum criteria.

Table 3.2.3.1: Radiated Emissions Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Section 9 Electromagnetic emission – Methods of testing and required test results**		
Test Date(s):	**11/15/2012 – 11/16/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Emissions Test Equipment List					
Tile! Software Version:		**4.2.A, May 23, 2010, 08:38:52 AM**			
Test Profile:		**Radiated Emissions_Profile Version October 12, 2011**			
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	7/27/2013
0586	HP	8447D	Preamp, 0.1-1300MHz, 26dB	1726A01364	12/21/2012
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY45304903	6/19/2013
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	00135454	7/24/2013
C027	N/A	RG214	Cable Coax, N-N, 25m	none	9/7/2013
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
6	EMCO	6502	Antenna, Loop, Active, .01-30MHz	1030	4/26/2013
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	4/8/2013
1594	Miteq	AFS44-00102650	Amplifier, 1-26.5GHz, 42dB	none	10/15/2013
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	12/12/2012
C030	N/A	0	Cable Coax, N-N, 30m	none	9/7/2013
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide	00110313	1/19/2013
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A

Table 3.2.3.2: Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time – Peak Scan

Professional Testing, EMI, Inc.			
Test Method:	**CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test**		
Section:	**Section 9 Electromagnetic emission – Methods of testing and required test results**		
Test Date(s):	**11/15/2012 – 11/16/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan				
Frequency Band Start (MHz)	**Frequency Band Stop (MHz)**	**6 dB Bandwidth (kHz)**	**Number of Ranges Used**	**Measurement Time per Range**
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	300	2	Multiple Sweeps

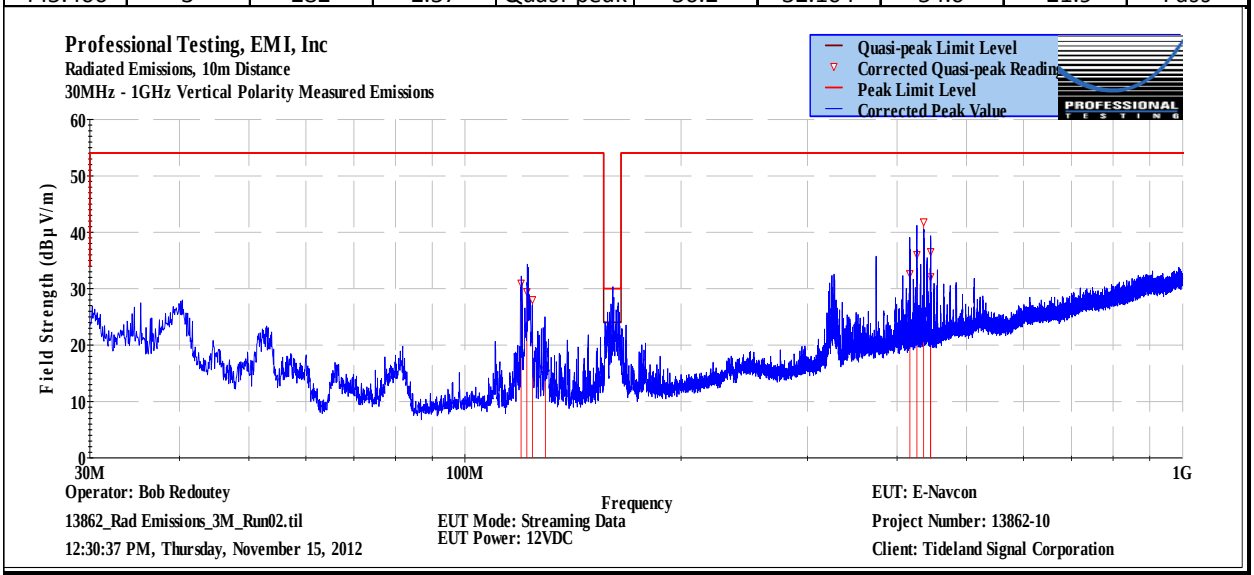
*Notes:
1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.
4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.
5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

Table 3.2.3.3: Radiated Emissions Test Results, 30 MHz to 1 GHz, Vertical Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Streaming Data	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
119.697	3	39	1.9	Quasi-peak	47.1	30.98	54.0	-23.0	Pass
121.971	3	34	2.87	Quasi-peak	45.6	29.469	54.0	-24.5	Pass
124.131	3	141	2.69	Quasi-peak	44.2	28.054	54.0	-25.9	Pass
129.412	3	219	2.06	Quasi-peak	31.8	15.571	54.0	-38.4	Pass
416.695	3	52	1.57	Quasi-peak	37.4	32.666	54.0	-21.3	Pass
426.371	3	274	2.28	Quasi-peak	40.4	36.055	54.0	-17.9	Pass
435.678	3	209	2.09	Quasi-peak	46.1	41.844	54.0	-12.2	Pass
445.406	3	282	2.57	Quasi-peak	36.2	32.104	54.0	-21.9	Pass



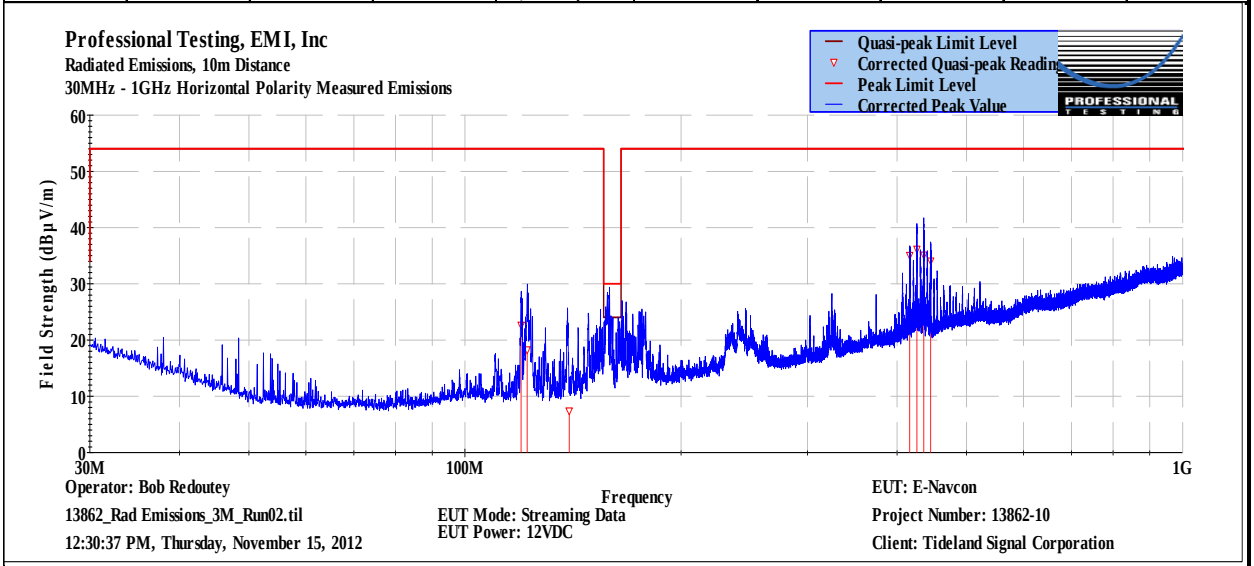
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 3.2.3.4: Radiated Emissions Test Results, 30 MHz to 1 GHz, Horizontal Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Streaming Data	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
119.716	3	305	2.97	Quasi-peak	38.8	22.7	54.0	-31.3	Pass
122.077	3	24	2.5	Quasi-peak	34.4	18.3	54.0	-35.7	Pass
139.704	3	197	1.89	Quasi-peak	23.1	7.4	54.0	-46.6	Pass
416.646	3	124	2.58	Quasi-peak	39.7	35.0	54.0	-19.0	Pass
426.366	3	346	2.04	Quasi-peak	40.5	36.2	54.0	-17.8	Pass
435.891	3	350	1.6	Quasi-peak	39.3	35.1	54.0	-18.9	Pass
445.586	3	98	1.89	Quasi-peak	38.2	34.1	54.0	-19.9	Pass



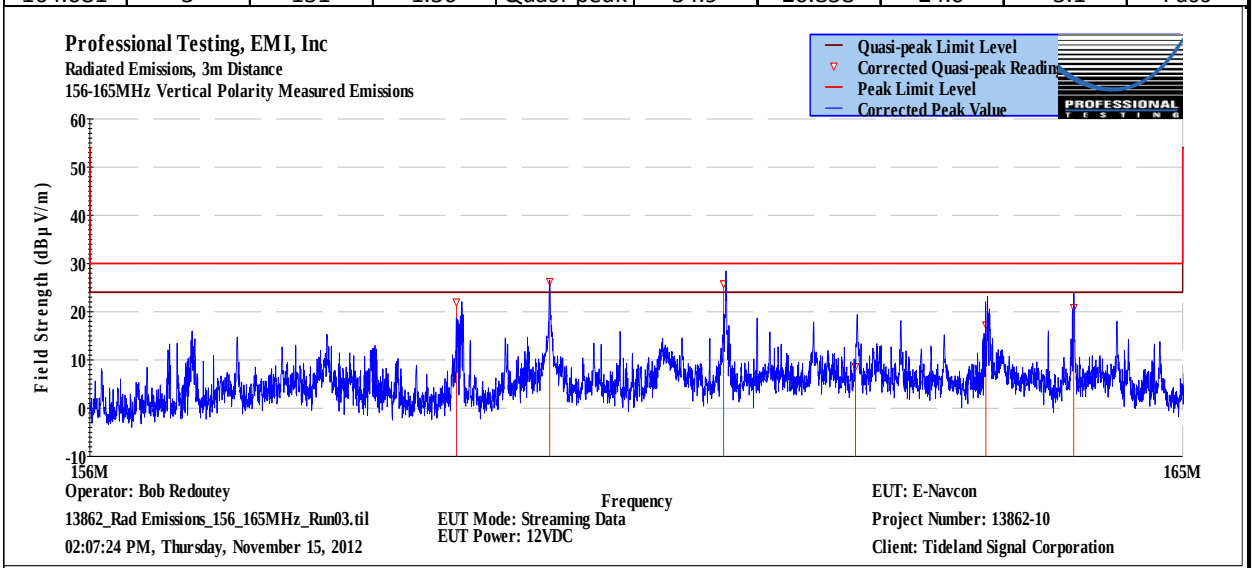
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 3.2.3.5: Radiated Emissions Test Results, 156 to 165 MHz, Vertical Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz	
EUT Mode of Operation:			Streaming Data		

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
158.963	3	99	2.47	Quasi-peak	36.6	22.03	24.0	-2.0	Pass
159.726	3	51	1.82	Peak	41.3	26.3	30.0	-3.7	Pass
161.158	3	26	2.03	Peak	14.6	28.1	30.0	-1.9	Pass
162.253	3	100	3.08	Quasi-peak	22.9	8.627	24.0	-15.4	Pass
163.343	3	252	1.75	Quasi-peak	31.4	17.273	24.0	-6.7	Pass
164.081	3	131	1.56	Quasi-peak	34.9	20.858	24.0	-3.1	Pass



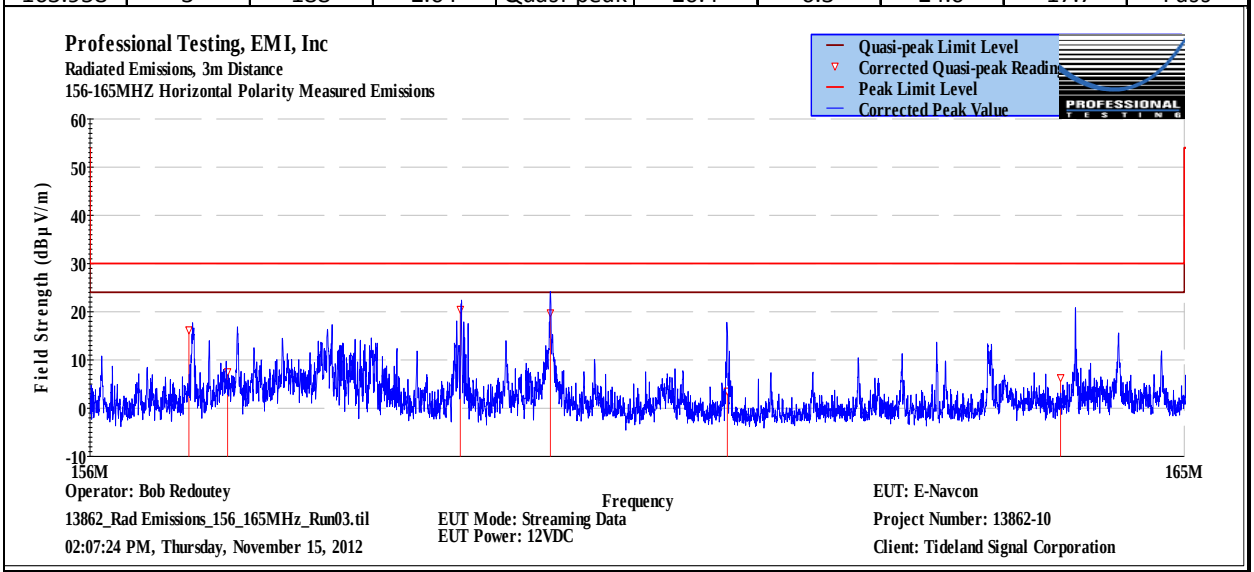
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 3.2.3.6: Radiated Emissions Test Results, 156 to 165 MHz, Horizontal Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Horizontal	Frequency Range:	30MHz to 1GHz
EUT Mode of Operation:		Streaming Data	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
156.794	3	337	2.58	Quasi-peak	30.9	16.3	24.0	-7.7	Pass
157.105	3	346	1.7	Quasi-peak	22.2	7.6	24.0	-16.4	Pass
158.99	3	332	2.16	Quasi-peak	35.1	20.5	24.0	-3.5	Pass
159.726	3	350	3.24	Quasi-peak	34.3	19.8	24.0	-4.2	Pass
161.182	3	34	3.5	Quasi-peak	17.9	3.6	24.0	-20.4	Pass
163.958	3	188	2.04	Quasi-peak	20.4	6.3	24.0	-17.7	Pass



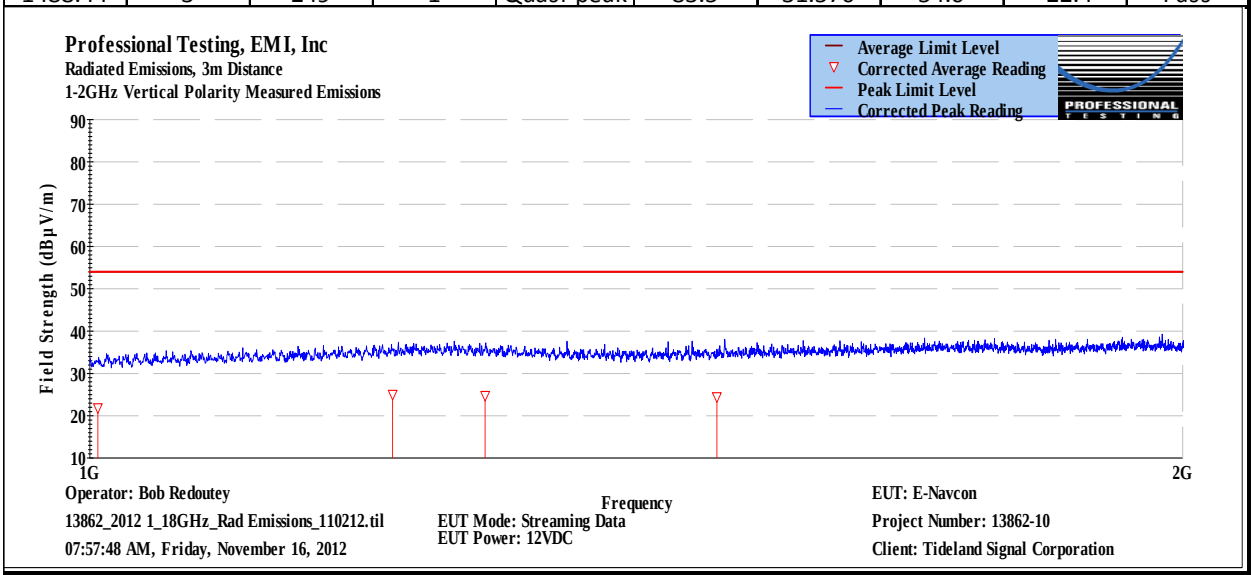
≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 3.2.3.7: Radiated Emissions Test Results, 1 to 2 GHz, Vertical Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet					Page: 1 of 1
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Streaming Data		

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1005.11	3	204	1	Quasi-peak	84	30.58	54.0	-23.4	Pass
1211.79	3	219	1	Quasi-peak	84	32.637	54.0	-21.4	Pass
1284.98	3	267	1	Quasi-peak	84.1	32.951	54.0	-21.0	Pass
1488.44	3	249	1	Quasi-peak	83.5	31.576	54.0	-22.4	Pass



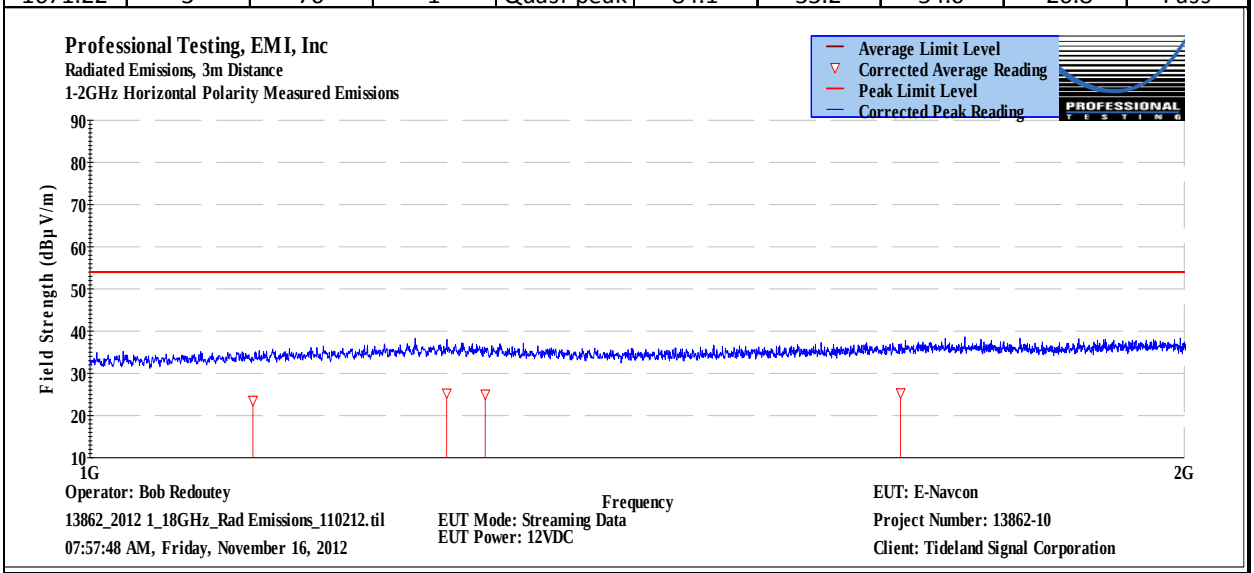
> 1GHz Vertical Antenna Polarity Measured Emissions

Table 3.2.3.8: Radiated Emissions Test Results, 1 to 2 GHz, Horizontal Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet					Page: 1 of 1
EUT Line Voltage:	12 VDC		EUT Power Frequency:	-	N/A
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz	
EUT Mode of Operation:			Streaming Data		

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
1108.79	3	136	1	Quasi-peak	83.1	30.7	54.0	-23.3	Pass
1253.61	3	72	1	Quasi-peak	84.2	33.2	54.0	-20.8	Pass
1284.58	3	301	1	Quasi-peak	84	32.8	54.0	-21.1	Pass
1671.22	3	76	1	Quasi-peak	84.1	33.2	54.0	-20.8	Pass



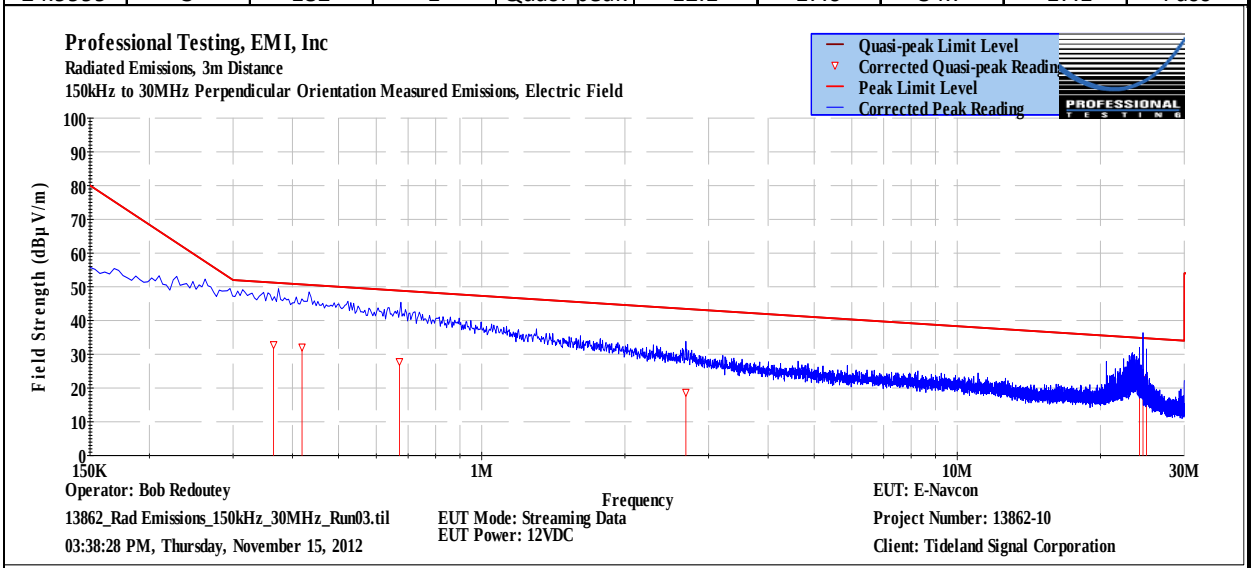
> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 3.2.3.9: Radiated Emissions Test Results, 150 kHz to 30 MHz, Perpendicular Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Perpendicular	Frequency Range:	Below 30MHz
EUT Mode of Operation:		Streaming Data	

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
0.365052	3	319	1	Quasi-peak	23.1	32.9	51.2	-18.4	Pass
0.418898	3	217	1	Quasi-peak	22.4	32.2	50.7	-18.5	Pass
0.671316	3	336	1	Quasi-peak	17.9	27.9	48.8	-21.0	Pass
2.68709	3	212	1	Quasi-peak	8.8	18.7	43.4	-24.7	Pass
24.1627	3	259	1	Quasi-peak	12.8	18.9	34.8	-16.0	Pass
24.5783	3	303	1	Quasi-peak	16.8	22.6	34.8	-12.2	Pass
24.9999	3	182	1	Quasi-peak	12.1	17.6	34.7	-17.1	Pass



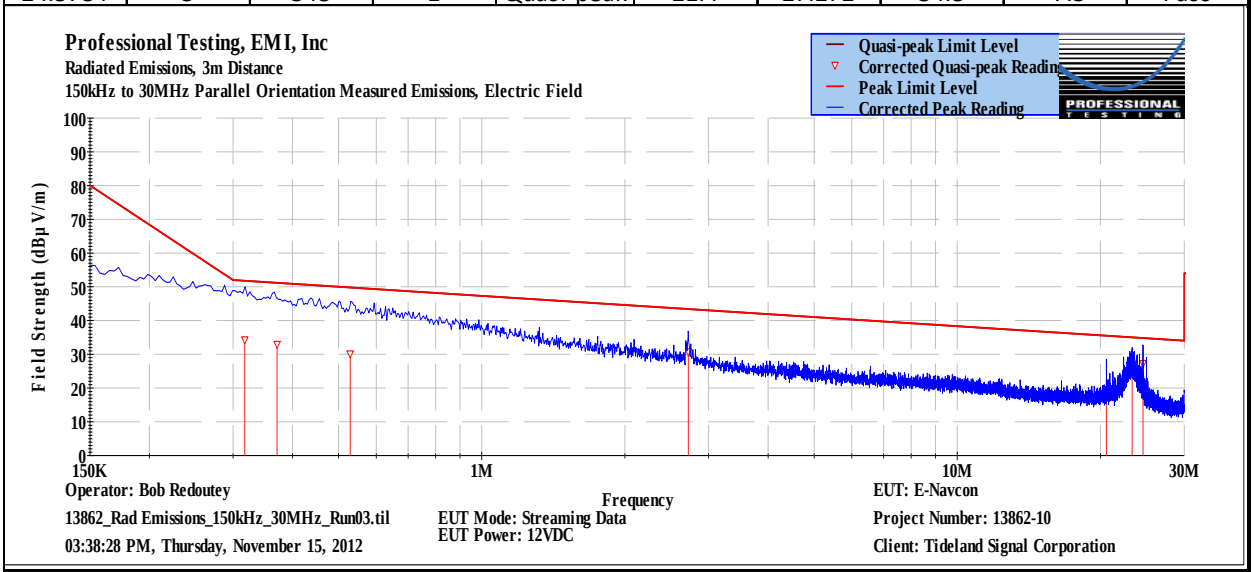
≤ 30MHz Perpendicular Antenna Orientation Measured Emissions

Table 3.2.3.10: Radiated Emissions Test Results, 150 kHz to 30 MHz, Parallel Polarization

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	12 VDC	EUT Power Frequency:	- N/A
Antenna Orientation:	Parallel	Frequency Range:	Below 30MHz
EUT Mode of Operation:		Streaming Data	

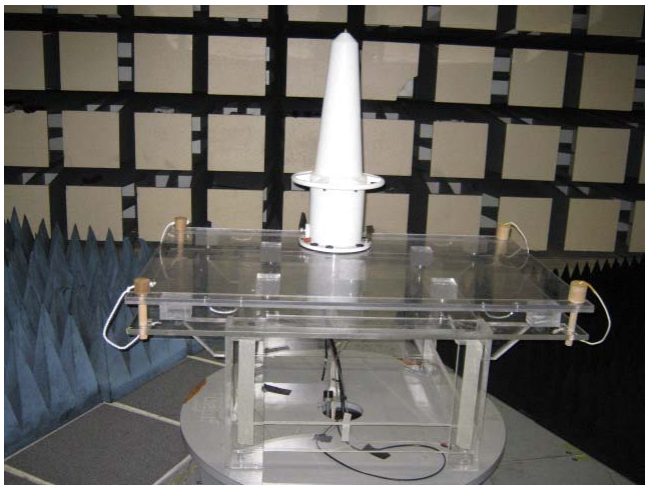
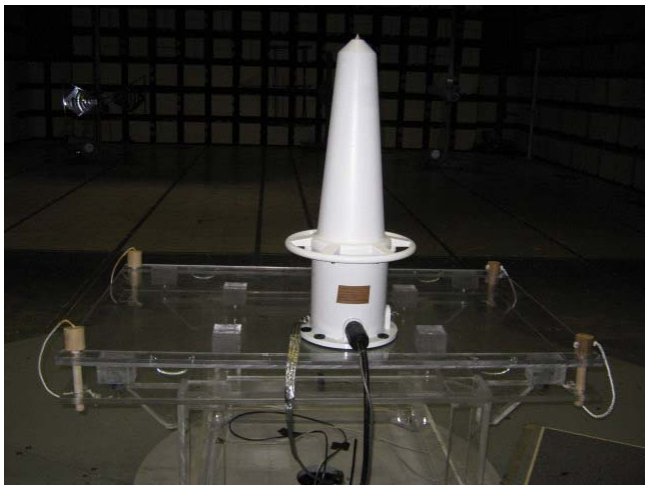
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
0.317578	3	60	1	Quasi-peak	24.4	34.29	51.8	-17.5	Pass
0.371176	3	316	1	Quasi-peak	23.2	32.979	51.2	-18.2	Pass
0.528827	3	292	1	Quasi-peak	20.2	30.158	49.8	-19.6	Pass
2.71872	3	111	1	Quasi-peak	20.8	30.712	43.4	-12.7	Pass
20.5828	3	315	1	Quasi-peak	10.3	17.605	35.5	-17.9	Pass
23.3125	3	217	1	Quasi-peak	17.8	24.224	35.0	-10.8	Pass
24.5784	3	348	1	Quasi-peak	21.4	27.272	34.8	-7.5	Pass



≤ 30MHz Parallel Antenna Orientation Measured Emissions

Table 3.2.3.11: Radiated Emissions Test Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Section 9 Electromagnetic emission – Methods of testing and required test results		
Test Date(s):	11/15/2012 – 11/16/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Photographs	Page: 1 of 1
	
Front	Rear
	
Support Equipment	

4.0 Electromagnetic Immunity Testing

4.1 Performance Criteria

EUT performance during testing was classified by the following criteria:

Performance Criterion A	Normal performance within equipment specifications.
Performance Criterion B	Degradation or loss of function or performance that is self-recoverable when the interfering signal is removed.
Performance Criterion C	Degradation or loss of function or performance that requires system reset or operator intervention when the interfering signal is removed.

4.2 Electrostatic Discharge Testing

4.2.1 Test Procedures

Electrostatic discharge immunity testing was performed using the procedures of IEC 61000-4-2. The EUT was placed in the approximate center of a ground reference plane (GRP) and was powered and operated in a normal configuration. The EUT was observed for any indications of erratic operation. Positive and negative air discharges of 2 kV, 4 kV, and 8 kV were applied to non-metallic test locations listed this report. Positive and negative contact discharges of 2 kV, 4 kV, and 6 kV were applied to any metallic test locations listed in the data sheets in this section of the report.

The positive and negative contact discharges were also applied to the horizontal coupling plane at a distance of 0.1 m around the periphery of the EUT and to the center of one edge of a 0.5 m by 0.5 m vertical coupling plane. Each discharge was applied a minimum of 10 times. A diagram showing the test setup is given as Figure 4.2.1.1.

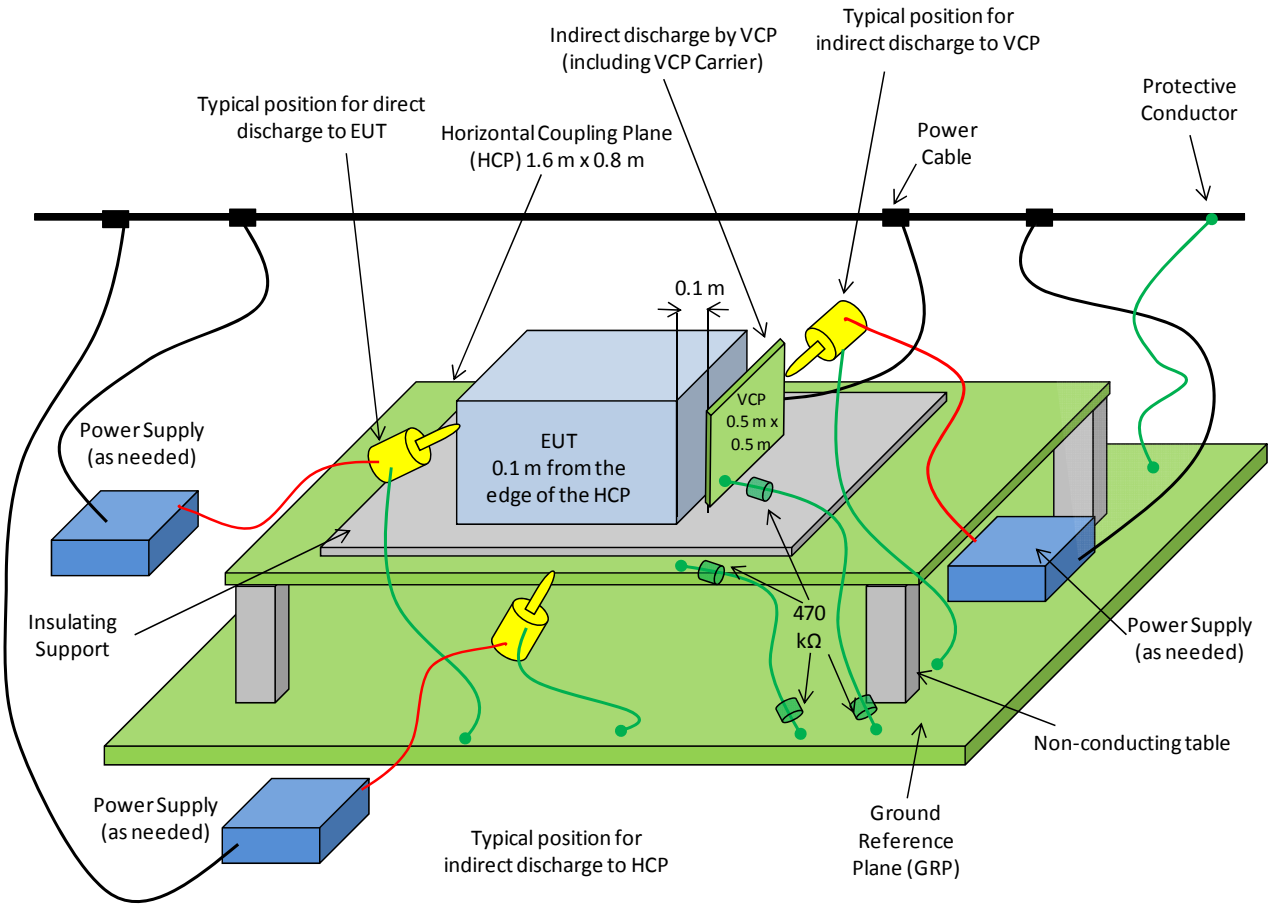


Figure 4.2.1.1: Electrostatic Discharge Immunity Test Setup

4.2.2 Performance Criteria

During the performance of electrostatic discharge immunity testing, only performance criterion A and performance criterion B were allowed. No performance criterion C failures were allowed.

4.2.3 Test Results

The EUT was subjected to electrostatic discharge immunity testing on June 14, 2013. No adverse indications were noted during the performance of the test. Therefore, the EUT met the performance criterion A.

Table 4.2.3.1: Electrostatic Discharge Immunity Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.9**		
Test Date(s):	**6/14/2013**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey / Eric Lifsey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Electrostatic Discharge Immunity Test Equipment List					
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
0951	EMC-Partner	ESD3000	ESD Simulator	62	1/17/2015

Table 4.2.3.2: Electrostatic Discharge Immunity Test Results, Air Discharge

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.9		
Test Date(s):	6/14/2013	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey / Eric Lifsey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Electrostatic Discharge Immunity Test Results Data Sheet					Page:	1 of 1
EUT Mode of Operation:	Streaming text data					
EUT Line Voltage:	12	VDC	**EUT Power Frequency:**	-	N/A	

Part 1 - Air Discharge to the EUT

Air Discharge Test Point	Air Discharge Location Description	Air Discharge Test Level	Pulse Polarity	Number of Discharges Applied	Performance Criterion Required	Performance Criterion Achieved	Test Result
1	Circular Middle Seam	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		8kV	Positve	10	B	A	Pass
		8kV	Negative	10	B	A	Pass
2	Exterior Areas of EUT	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		8kV	Positve	10	B	A	Pass
		8kV	Negative	10	B	A	Pass

Table 4.2.3.3: Electrostatic Discharge Immunity Test Results, Contact Discharge

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.9		
Test Date(s):	6/14/2013	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey / Eric Lifsey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Electrostatic Discharge Immunity Test Results Data Sheet					Page:	1 of 1
EUT Mode of Operation:	Streaming text data					
EUT Line Voltage:	12	VDC	**EUT Power Frequency:**	-	N/A	

Part 2 - Contact Discharge to the EUT

Contact Discharge Test Point	Contact Discharge Location Description	Contact Discharge Test Level	Pulse Polarity	Number of Discharges Applied	Performance Criterion Required	Performance Criterion Achieved	Test Result
1	Ground Strap Connection	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6KV	Positve	10	B	A	Pass
		6KV	Negative	10	B	A	Pass
2	Data / Power Connector	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6KV	Positve	10	B	A	Pass
		6KV	Negative	10	B	A	Pass
3	Assembly Screws	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6KV	Positve	10	B	A	Pass
		6KV	Negative	10	B	A	Pass
4	Pressure Connector	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6KV	Positve	10	B	A	Pass
		6KV	Negative	10	B	A	Pass
5	Top Lightning Strike Point	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6KV	Positve	10	B	A	Pass
		6KV	Negative	10	B	A	Pass

Table 4.2.3.4: Electrostatic Discharge Immunity Test Results, Contact Discharge to the Horizontal Coupling Plane

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.9		
Test Date(s):	6/14/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey / Eric Lifsey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Electrostatic Discharge Immunity Test Results Data Sheet					Page: 1 of 2
EUT Mode of Operation:	Streaming text data				
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A

Part 3 - Contact Discharge to the Vertical and Horizontal Coupling Planes

CP Discharge Test Point	CP Discharge Location Description	CP Discharge Test Level	Pulse Polarity	Number of Discharges Applied	Performance Criterion Required	Performance Criterion Achieved	Test Result
1	Horizontal Ground Plane, EUT Left Side	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass
2	Horizontal Ground Plane, EUT Right Side	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass
3	Horizontal Ground Plane, EUT Rear	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass
4	Horizontal Ground Plane, EUT Front	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass

Table 4.2.3.5: Electrostatic Discharge Immunity Test Results, Contact Discharge to the Vertical Coupling Plane

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.9**		
Test Date(s):	**6/14/2013**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey / Eric Lifsey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Electrostatic Discharge Immunity Test Results Data Sheet					**Page:**	**2 of 2**
EUT Mode of Operation:	**Streaming text data**					
EUT Line Voltage:	**12**	**VDC**	**EUT Power Frequency:**	**-**	**N/A**	

Part 3 - Contact Discharge to the Vertical and Horizontal Coupling Planes

CP Discharge Test Point	CP Discharge Location Description	CP Discharge Test Level	Pulse Polarity	Number of Discharges Applied	Performance Criterion Required	Performance Criterion Achieved	Test Result
5	Vertical Coupling Plane, EUT Left Side	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass
6	Vertical Coupling Plane, EUT Right Side	2kV	Positve	10	B	A	Pass
		2kV	Negative	10	B	A	Pass
		4kV	Positve	10	B	A	Pass
		4kV	Negative	10	B	A	Pass
		6kV	Positve	10	B	A	Pass
		6kV	Negative	10	B	A	Pass

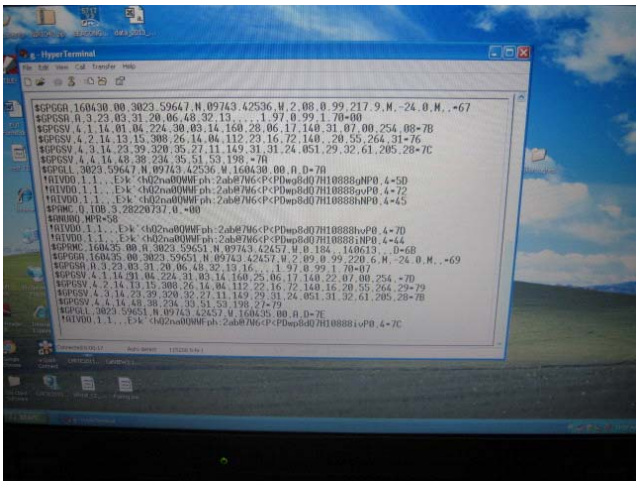
Table 4.2.3.6: Electrostatic Discharge Immunity Test Setup Photographs, Page 1

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.9		
Test Date(s):	6/14/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey / Eric Lifsey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Electrostatic Discharge Immunity Photographs	Page: 1 of 2
	
EUT Back Side	EUT Front Side
	
Support Equipment	Signals monitored on Analyzer

Table 4.2.3.7: Electrostatic Discharge Immunity Test Setup Photographs, Page 2

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-2: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.9		
Test Date(s):	6/14/2013	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey / Eric Lifsey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Electrostatic Discharge Immunity Photographs	Page: 2 of 2
	
Data monitored on notebook computer	VCP
	
HGP	

4.3 Radiated Immunity Test

4.3.1 Test Procedures

Radiated immunity testing was performed on the EUT using the procedures of IEC 61000-4-3. The testing was performed to determine the ability of the EUT to function properly while immersed in an electromagnetic field of 10 V/m at 80 MHz to 2 GHz and 3 V/m at 2 to 2.7 GHz, with 1 kHz at 80% amplitude modulation.

The testing was performed in a shielded enclosure with anechoic material placed throughout the enclosure to minimize reflections. The transmit antenna was located at a distance of 3 meters from the EUT. All other field generation equipment and monitoring equipment was placed outside the test enclosure.

Drive levels to the transmit antenna were monitored and maintained at the levels established by the initial field calibration described in this report. Testing was performed utilizing linearly polarized antennas, with the EUT exposed to both vertically and horizontally polarized fields. A diagram showing the test setup is given as Figure 4.3.1.1.

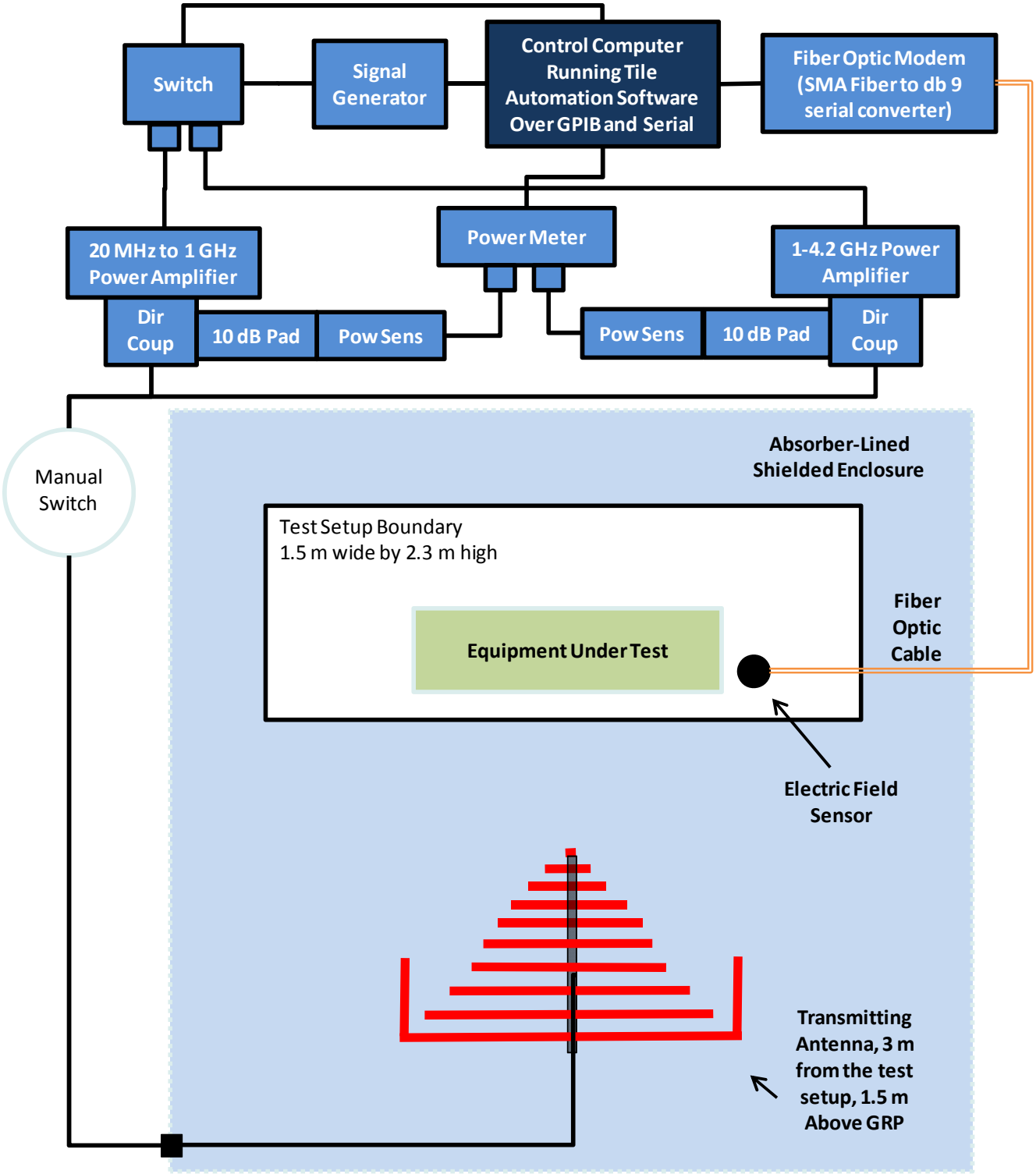


Figure 4.3.1.1: Radiated Immunity Test Setup

4.3.2 Field Generation

Calibration of the radiated field intensity was performed prior to testing of the EUT. For the input power levels required to generate the desired continuous wave (CW) field intensities at the plane of the EUT were established. The frequency band was covered in steps of one percent of the fundamental frequency. For frequencies of 80 to 240 MHz, the bi-conical transmit antenna was placed 3 meters from the plane of the EUT. For frequencies of 240 to 1,000 MHz the double-ridged horn transmit antenna was placed 3 meters from the plane of the EUT. Calibration of the field was performed in both horizontal and vertical antenna polarizations.

4.3.3 Performance Criteria

During performance of radiated immunity testing, only performance criterion A was allowed. Performance criterion B or performance criterion C failures were disallowed.

4.3.4 Test Results

The EUT was subjected to radiated immunity in both vertical and horizontal polarizations testing on November 19 and 20, 2012. No adverse indications were noted during the performance of the test. Therefore, the EUT met criterion A.

Table 4.3.4.1: Radiated Immunity Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.4.2**		
Test Date(s):	**11/19/2012 – 11/20/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Immunity Test Equipment List					
Test Software Version:	**Tile Version 3.4.K.15, October 13, 2006, 11:21:00 AM**				
Test Profile Used:	**61000-4-3_09/06/2011.til**				
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
80-1000 MHz Test Equipment					
1816	Agilent	N5181A	Generator, MXG Analog Signal	MY49060847	8/26/2016
1509C	Braden	N/A	TDK 10M Chamber, radiated immunity	DAC-012915-005	2/17/2015
1093	Boonton	4532	RF Power Meter	51501	8/6/2014
1503	Boonton	57318	Peak Power Sensor, .1-18GHz	3983	8/9/2014
1848	Ophir	5127FE	Amplifier, RF Power, 20-1000 MHz, 200W	1082	N/A
1025	Philco	642A-Z	Coupler, Directional .03-1GHz	171	7/10/2014
1846	ETS-Lindgren	4340-01XPC	CCTV System	126554	N/A
1681	ETS-Lindgren	HI-6053	Isotropic Electric Field Probe	82799	2/10/2015
1850	ETS-Lindgren	3140B	Antenna, Biconilog 26-3000 MHz	00126505	NCR
0931	JFW	50FHC-010-20	Attenuator, N, 10dB 20W	none	N/A
1940	Agilent	11713A	Switch Driver	MY44322006	N/A
1945	Agilent	87206B SP6T	Switch, Coaxial, 6-port, DC - 26.5 GHz	MY42140544	N/A
1-2.7 GHz Test Equipment (additional to equipment above)					
1554	AR	25S1G4A	Amplifier, 25W, 44dB, .800-4.2GHz	3131651	N/A
0832	Narda	3022	Coupler, Bi-Directional 1-4GHz	5015	N/A
1845	IFI	M406	Amplifier, RF Power, 10KHz-220MHz, 1000W	0375-1037	N/A

Table 4.3.4.2: Radiated Immunity Test Results, Page 1

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Immunity Test Results Data Sheet							Page:	1 of 9	
EUT Mode of Operation:	Streaming Data								
EUT Line Voltage:	12	VDC			EUT Power Frequency:	-	N/A		
Frequency Range	Antenna Polarity	Test Level	EUT Face Illuminated	Modulation Parameters	Frequency Step Size	Dwell Time at Each Frequency	Performance Criterion Required	Performance Criterion Achieved	Test Results
0.08 - 1.0 GHz	Horizontal	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Vertical	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Horizontal	10 V/m	Left Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Vertical	10 V/m	Left Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Horizontal	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Vertical	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Horizontal	10 V/m	Right Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
0.08 - 1.0 GHz	Vertical	10 V/m	Right Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass

Radiated Immunity Spot Frequencies									
EUT - Specific Spot Frequencies					Standard Specific Spot Frequencies				
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
None									

Table 4.3.4.3: Radiated Immunity Test Results, Page 2

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.4.2**		
Test Date(s):	**11/19/2012 – 11/20/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Immunity Test Results Data Sheet								**Page:**	**2**	**of**	**9**
EUT Mode of Operation:	**Streaming Data**										
EUT Line Voltage:	**12**	**VDC**			**EUT Power Frequency:**	**-**	**N/A**				

Frequency Range	Antenna Polarity	Test Level	EUT Face Illuminated	Modulation Parameters	Frequency Step Size	Dwell Time at Each Frequency	Performance Criterion Required	Performance Criterion Achieved	Test Results
1.0 - 1.4 GHz	Horizontal	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Vertical	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Horizontal	10 V/m	Left Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Vertical	10 V/m	Left Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Horizontal	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Vertical	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Horizontal	10 V/m	Right Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.0 - 1.4 GHz	Vertical	10 V/m	Right Side	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass

Table 4.3.4.4: Radiated Immunity Test Results, Page 3

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.4.2**		
Test Date(s):	**11/19/2012 – 11/20/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Immunity Test Results Data Sheet **Page: 3 of 9**

EUT Mode of Operation: **Streaming Data**

EUT Line Voltage: **12** **VDC** **EUT Power Frequency:** **-** **N/A**

Frequency Range	Antenna Polarity	Test Level	EUT Face Illuminated	Modulation Parameters	Frequency Step Size	Dwell Time at Each Frequency	Performance Criterion Required	Performance Criterion Achieved	Test Results
1.4 - 2GHz	Horizontal	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Vertical	10 V/m	Front	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Left	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Left	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Rear	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Right	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
1.4 - 2GHz	Horizontal	10 V/m	Right	80% AM (400 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass

Table 4.3.4.5: Radiated Immunity Test Results, Page 4

Professional Testing, EMI, Inc.			
Test Method:	**CENELEC EN 61000-4-3 (2006): Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test**		
In accordance with:	**ETSI EN 301 489-1 V1.8.1 (2008-04) Harmonized European Standard (Telecommunications series) Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements**		
Section:	**Section 9.2 - Radio frequency electromagnetic field (80 MHz to 1000 MHz and 1400 MHz to 2700 MHz)**		
Test Date(s):	**11/19/2012 – 11/20/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Radiated Immunity Test Results Data Sheet							**Page:**	**4**	**of**	**9**
EUT Mode of Operation:	**Streaming Data**									
EUT Line Voltage:	**12**	**VDC**		**EUT Power Frequency:**	**-**	**N/A**				

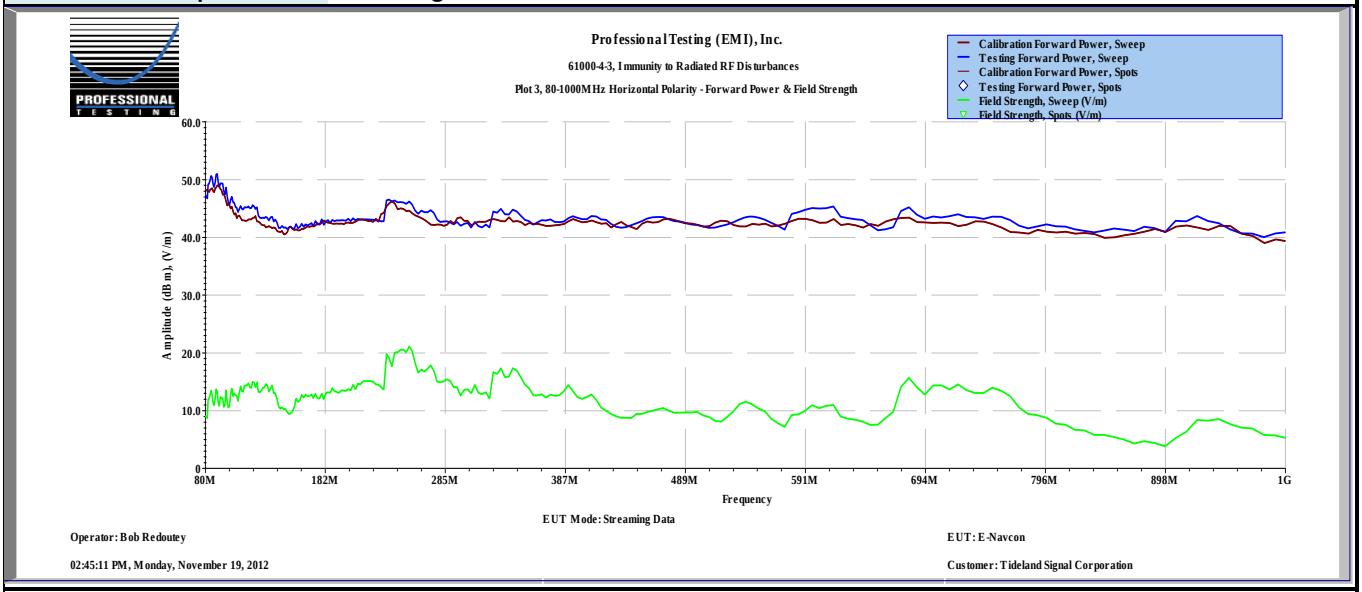
Frequency Range	Antenna Polarity	Test Level	EUT Face Illuminated	Modulation Parameters	Frequency Step Size	Dwell Time at Each Frequency	Performance Criterion Required	Performance Criterion Achieved	Test Results
2 - 2.7GHz	Horizontal	3 V/m	Front	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Vertical	3 V/m	Front	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Left	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Left	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Rear	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Rear	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Right	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass
2 - 2.7GHz	Horizontal	3 V/m	Right	80% (1000 Hz)	0.01	Steps: 2 s, Spots: 60 s	A	A	Pass

Table 4.3.4.6: Radiated Immunity Test Results, Page 5

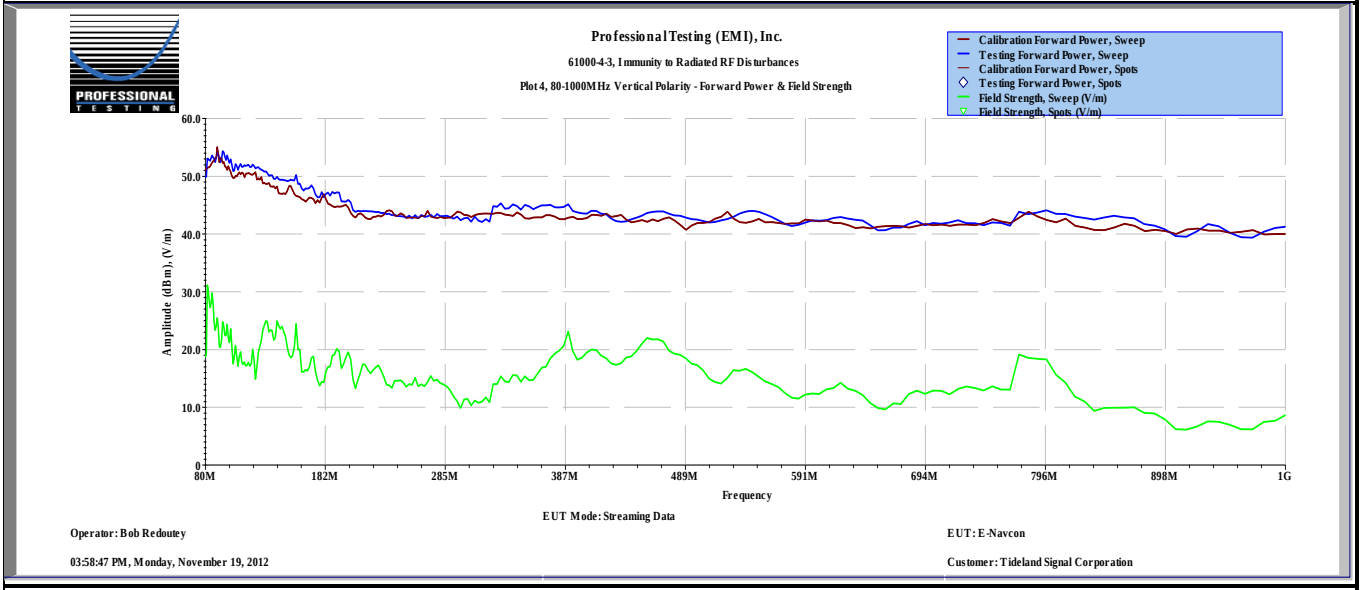
Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Radiated Immunity Test Results Data Sheet **Page: 5 of 9**

EUT Mode of Operation: Streaming Data



Graphical Data - 80MHz to 1000MHz, Horizontal Polarity



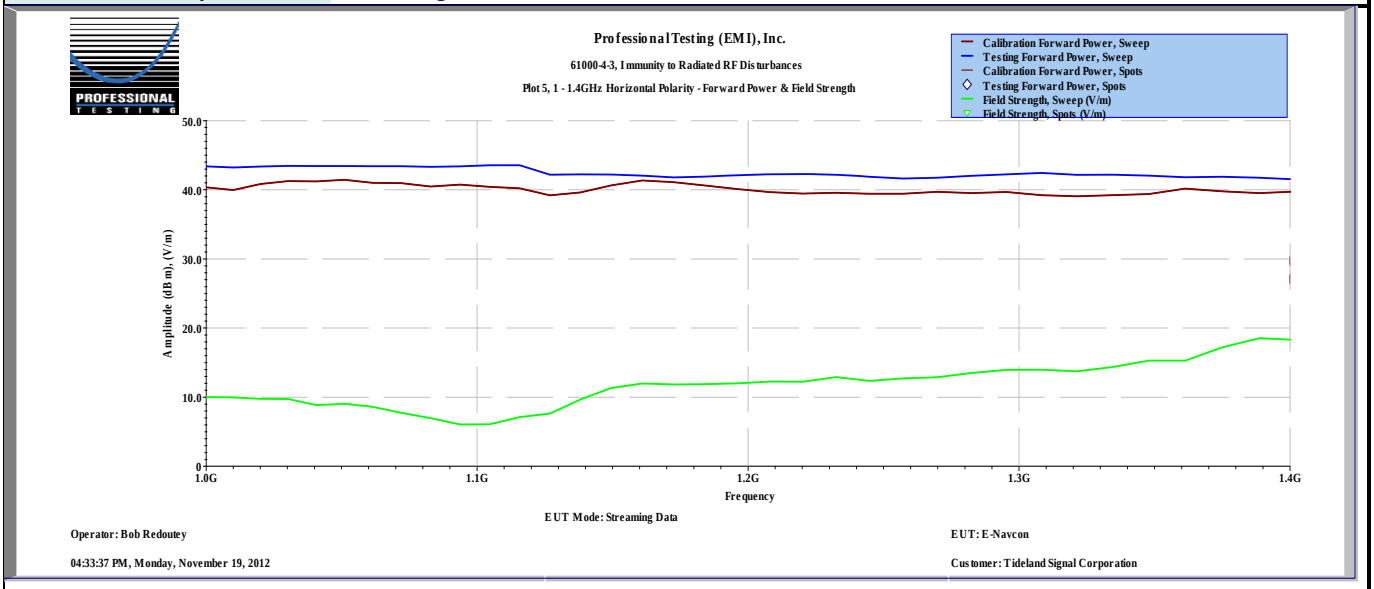
Graphical Data - 80MHz to 1000MHz, Vertical Polarity

Table 4.3.4.7: Radiated Immunity Test Results, Page 6

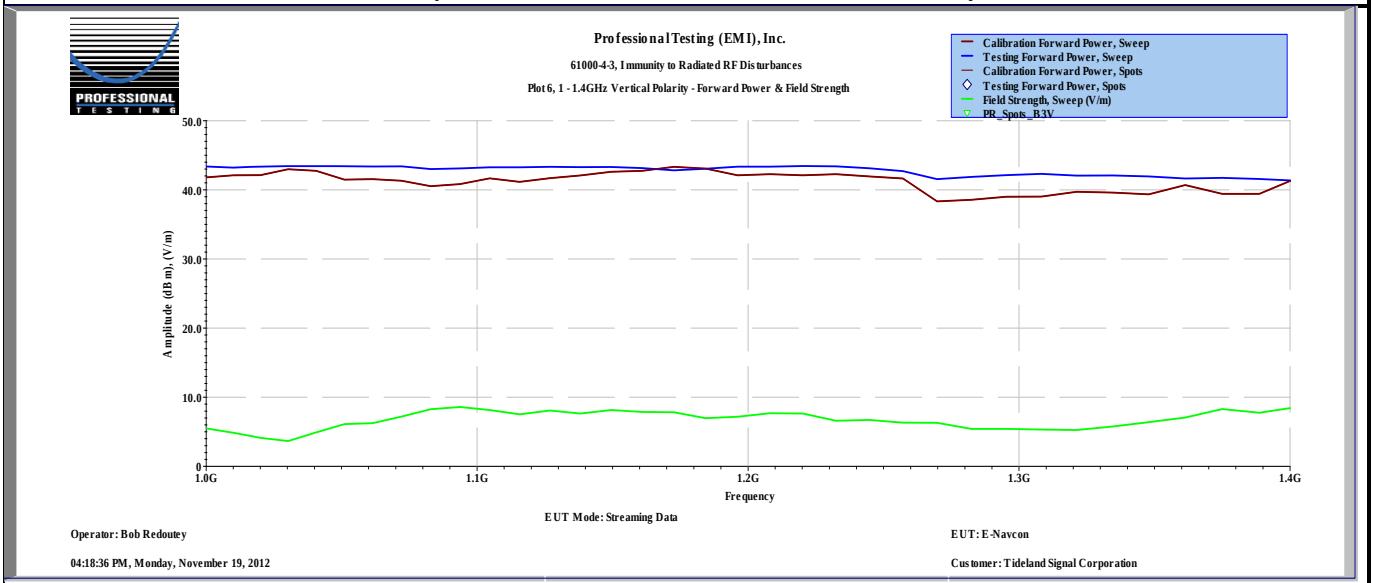
Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Radiated Immunity Test Results Data Sheet **Page: 6 of 9**

EUT Mode of Operation: Streaming Data



Graphical Data - 1GHz to 1.4GHz, Horizontal Polarity



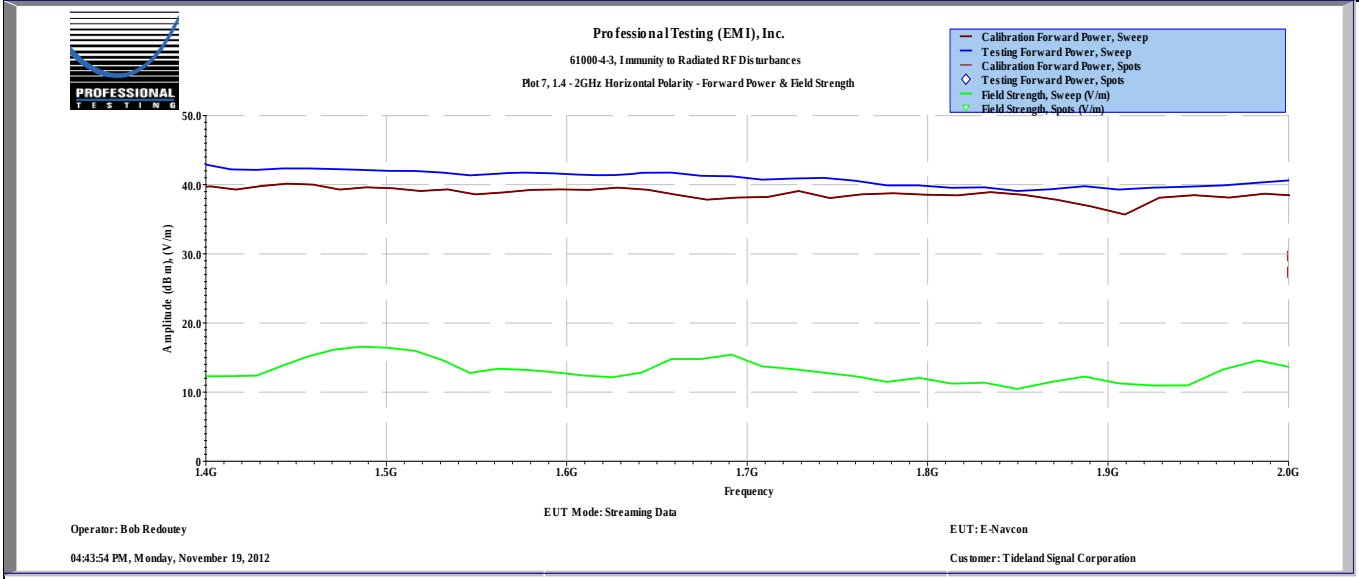
Graphical Data - 1GHz to 1.4GHz, Vertical Polarity

Table 4.3.4.8: Radiated Immunity Test Results, Page 7

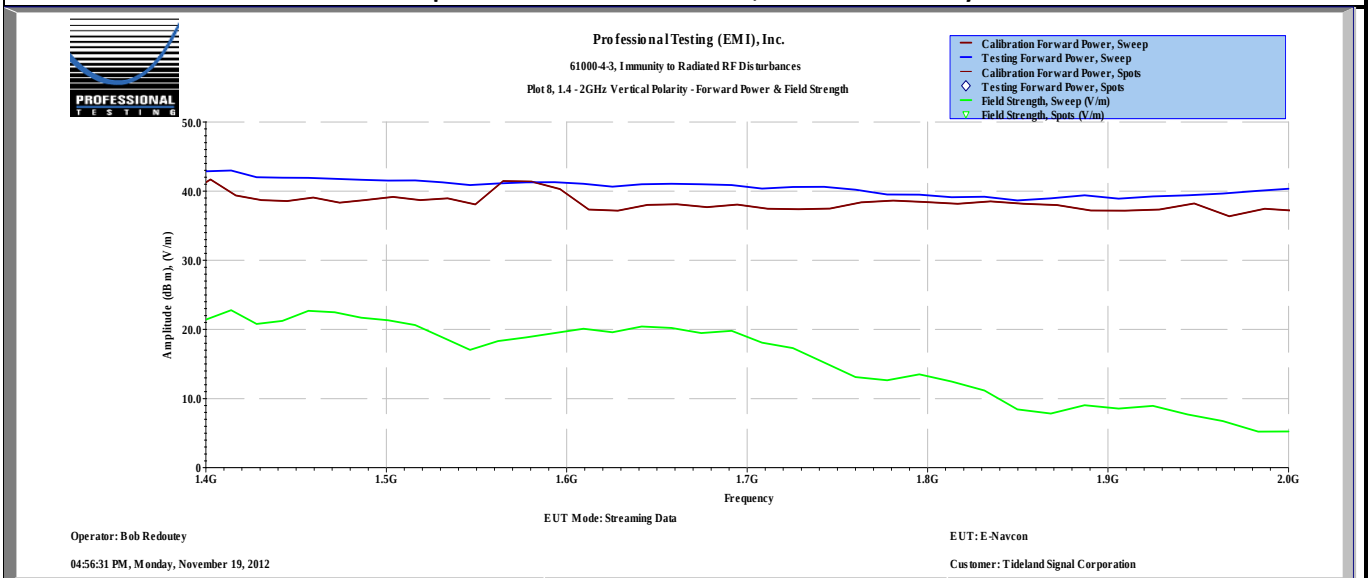
Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Immunity Test Results Data Sheet **Page: 7 of 9**

EUT Mode of Operation: Streaming Data



Graphical Data - 1.4GHz to 2GHz, Horizontal Polarity

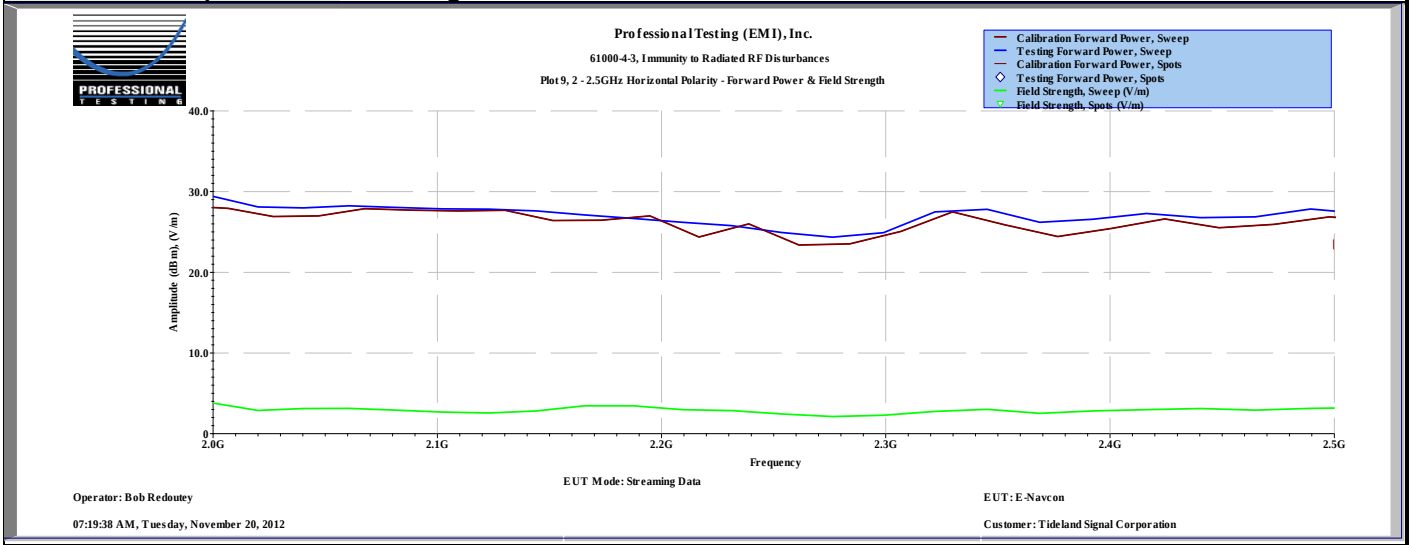


Graphical Data - 1.4GHz to 2GHz, Vertical Polarity

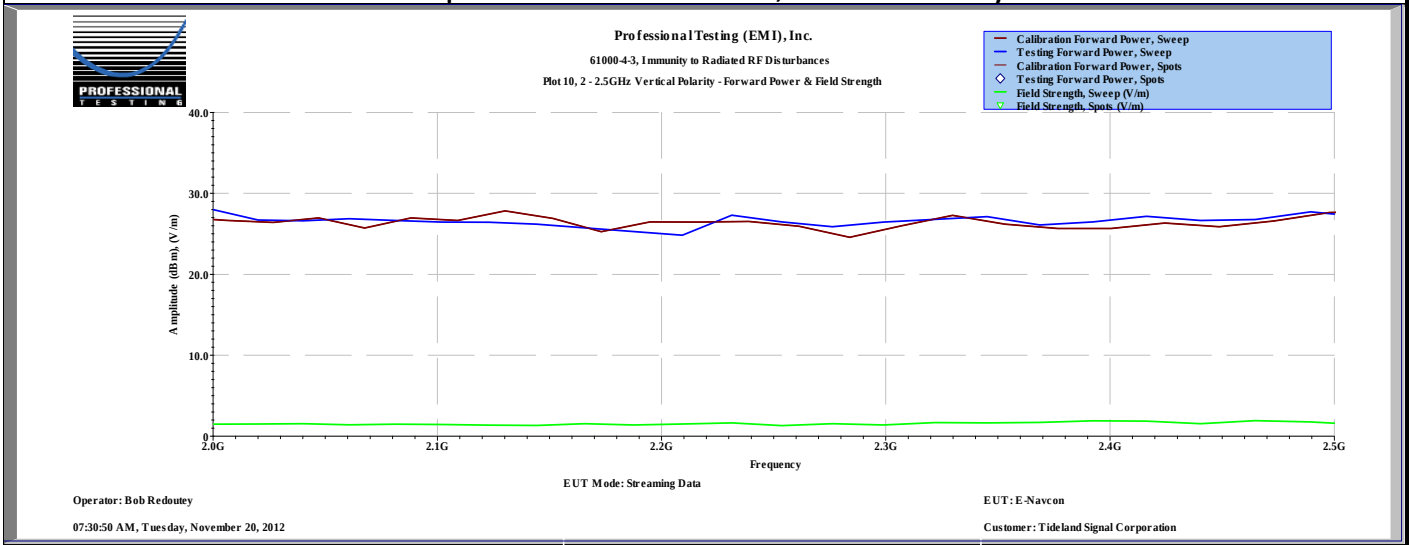
Table 4.3.4.9: Radiated Immunity Test Results, Page 8

Professional Testing, EMI, Inc.			
Test Method:	CENELEC EN 61000-4-3 (2006): Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test		
In accordance with:	ETSI EN 301 489-1 V1.8.1 (2008-04) Harmonized European Standard (Telecommunications series) Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements		
Section:	Section 9.2 - Radio frequency electromagnetic field (80 MHz to 1000 MHz and 1400 MHz to 2700 MHz)		
Test Date(s):	11/19/2012 – 11/20/2012	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Radiated Immunity Test Results Data Sheet	Page: 8 of 9
EUT Mode of Operation:	Streaming Data



Graphical Data - 2GHz to 2.5GHz, Horizontal Polarity



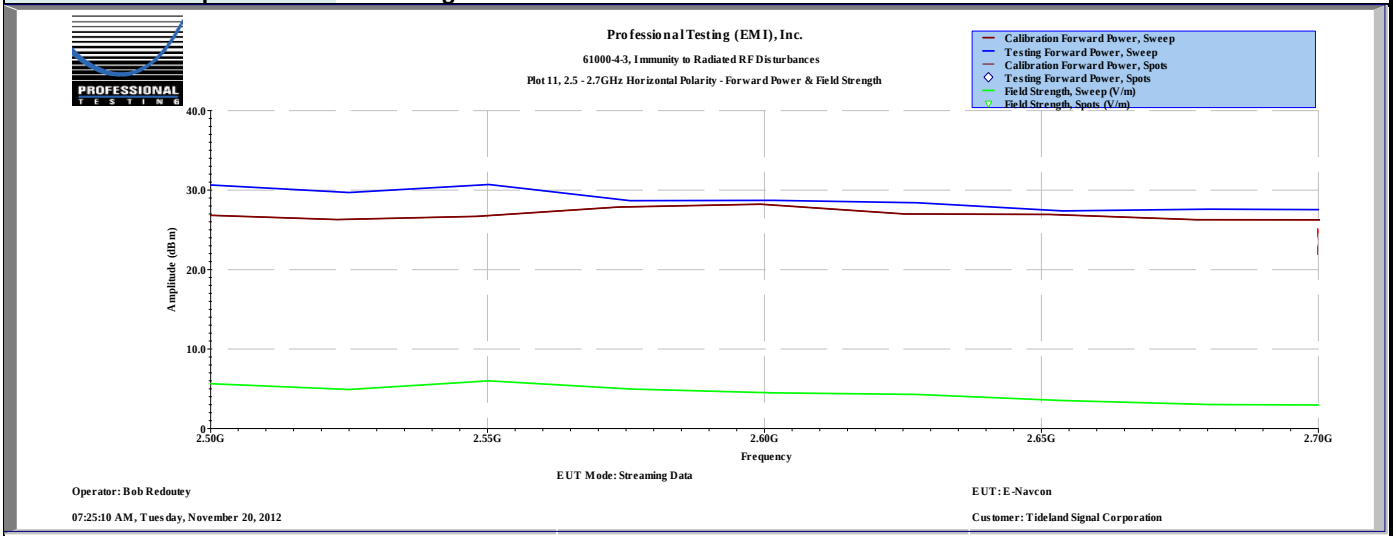
Graphical Data - 2GHz to 2.5GHz, Vertical Polarity

Table 4.3.4.10: Radiated Immunity Test Results, Page 9

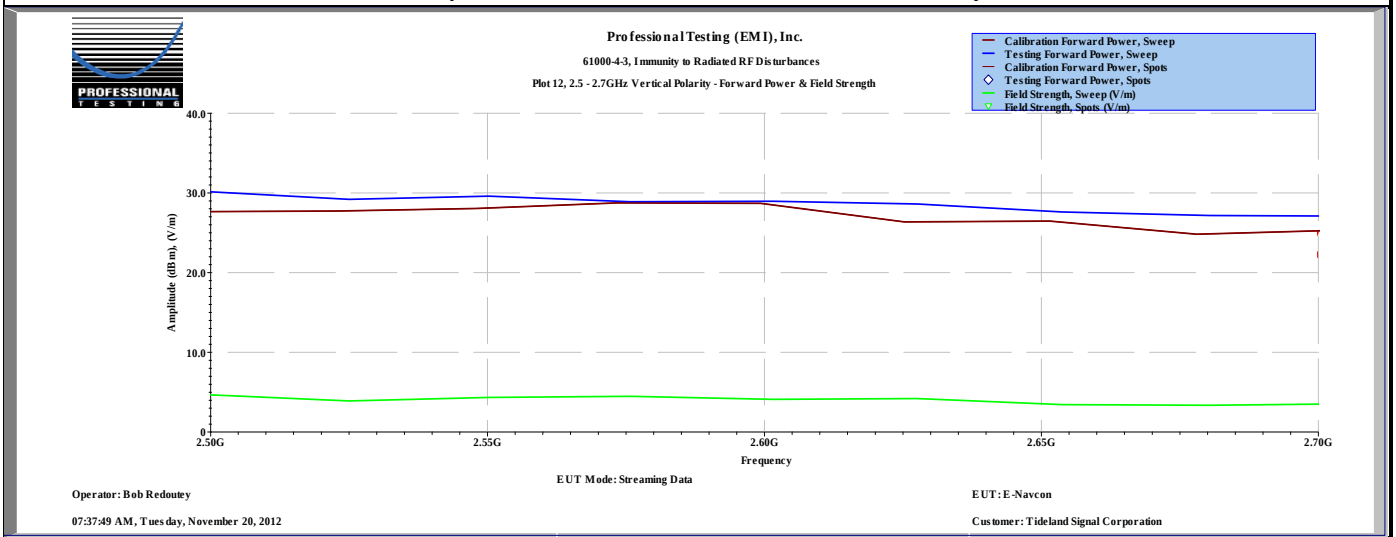
Professional Testing, EMI, Inc.			
Test Method:	CENELEC EN 61000-4-3 (2006): Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test		
In accordance with:	ETSI EN 301 489-1 V1.8.1 (2008-04) Harmonized European Standard (Telecommunications series) Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements		
Section:	Section 9.2 - Radio frequency electromagnetic field (80 MHz to 1000 MHz and 1400 MHz to 2700 MHz)		
Test Date(s):	11/19/2012 – 11/20/2012	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

Radiated Immunity Test Results Data Sheet **Page: 9 of 9**

EUT Mode of Operation: Streaming Data



Graphical Data - 2.5GHz to 2.7GHz, Vertical Polarity



Graphical Data - 2.5GHz to 2.7GHz, Horizontal Polarity

Table 4.3.4.11: Radiated Immunity Test Setup Photographs, Page 1

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

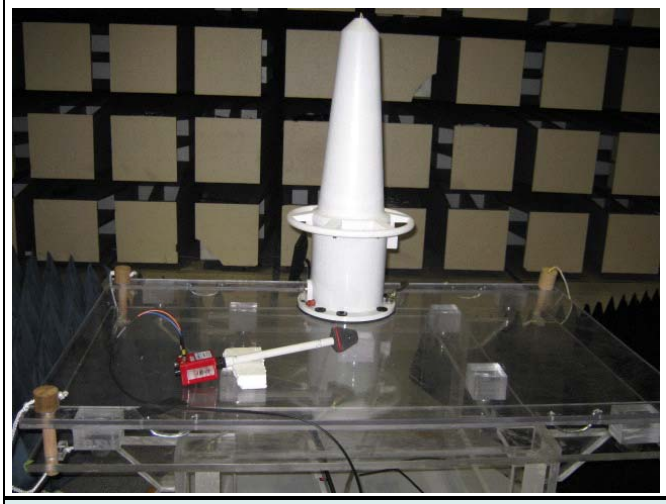
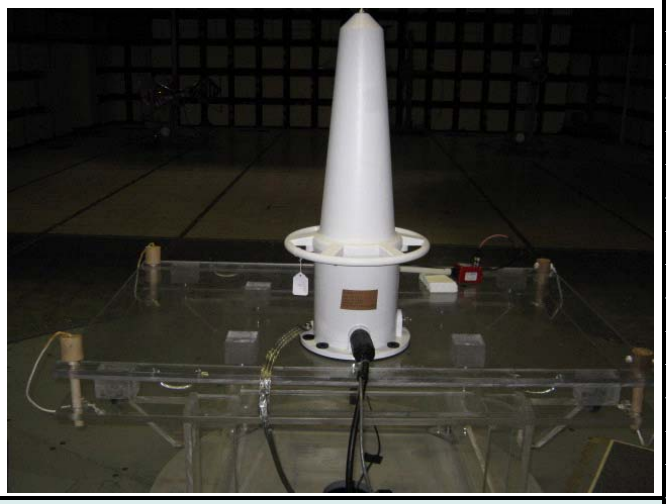
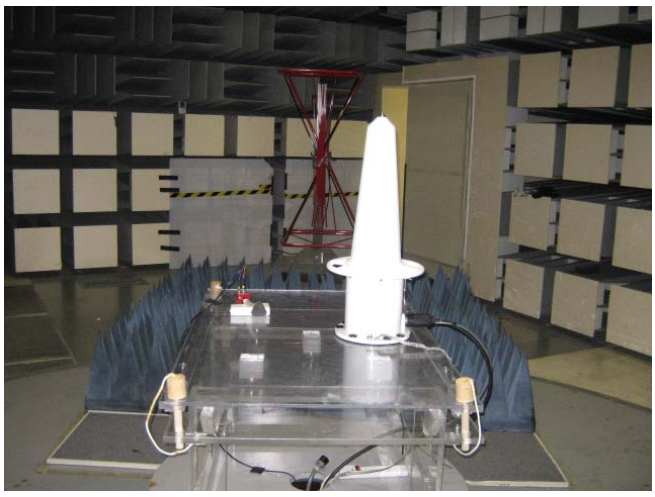
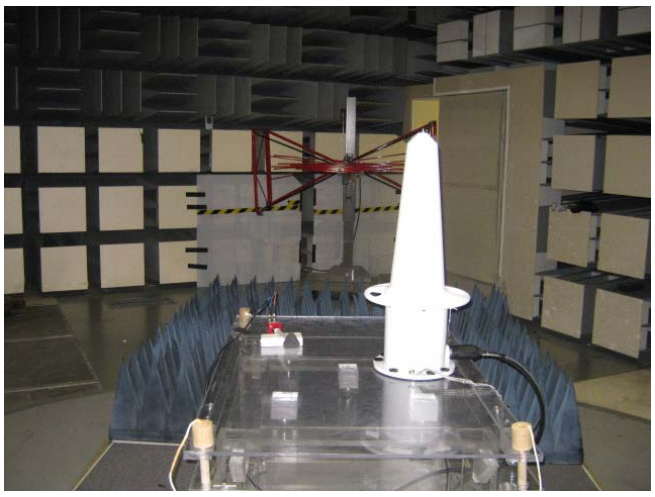
Radiated Immunity Photographs	Page: 1 of 2
	
Front	Rear
	
Vertical	Horizontal

Table 4.3.4.12: Radiated Immunity Test Setup Photographs, Page 2

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-3: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.4.2		
Test Date(s):	11/19/2012 – 11/20/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Immunity Photographs	Page: 2 of 2
	
Support Equipment	

4.4 Electrical Fast Transient/Burst Immunity Testing

4.4.1 Test Procedures

Electrical fast transient/burst immunity testing was performed on the EUT using the procedures of IEC 61000-4-4. The EUT was placed in the approximate center of the GRP and was powered and operated in a normal configuration. The EUT was observed for any indications of erratic operation. The coupling clamp was used to apply transients to I/O lines, while transients were applied to any power leads through the use of the burst generators back-filters. For each discharge sequence, the duration was one minute with a one-minute pause between sequences. The EUT was subjected to 0.50 , 1 kV, and 2 kV transients to DC power input leads and 0.50 kV and 1.0 kV transients to any interconnecting cables greater than 3 meters in length. The transient/burst pulse was performed with a 5 kHz repetition rate. Both positive and negative polarity transients were applied. Diagrams showing the test setups are given as Figures 4.4.1.1, 4.4.1.2, and 4.4.1.3.

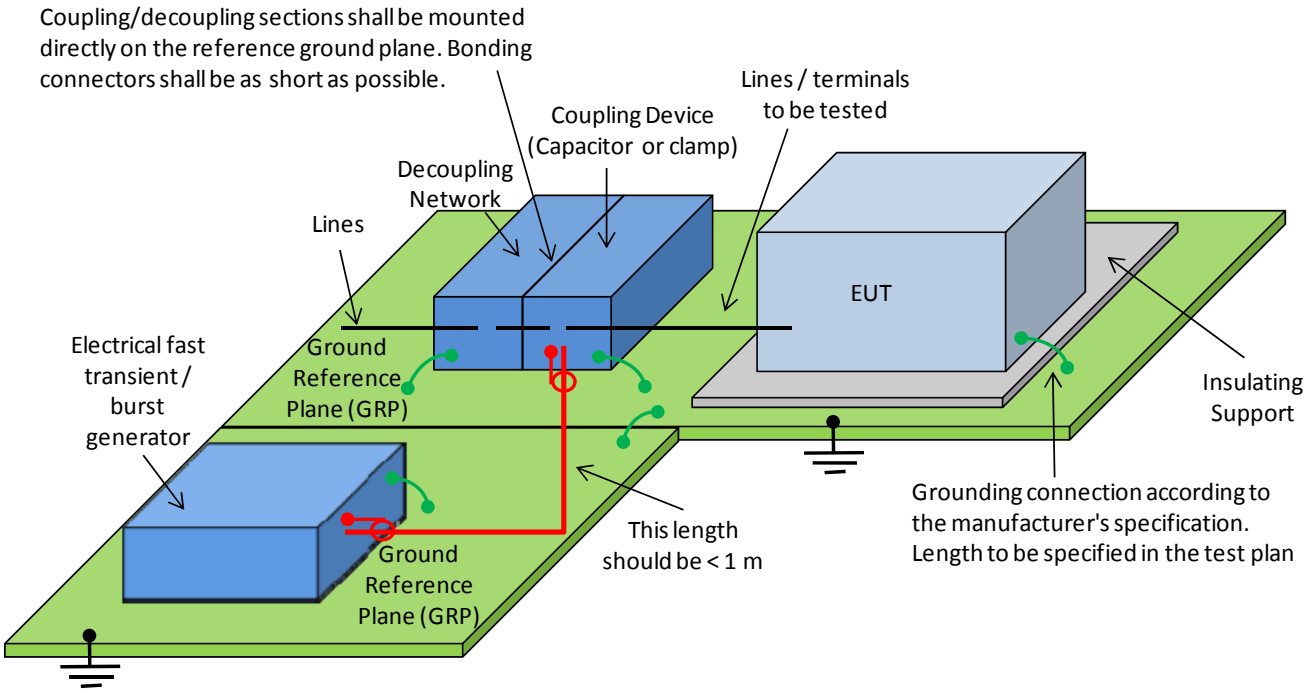


Figure 4.4.1.1: Electrical Fast Transient/Burst Immunity Test Setup

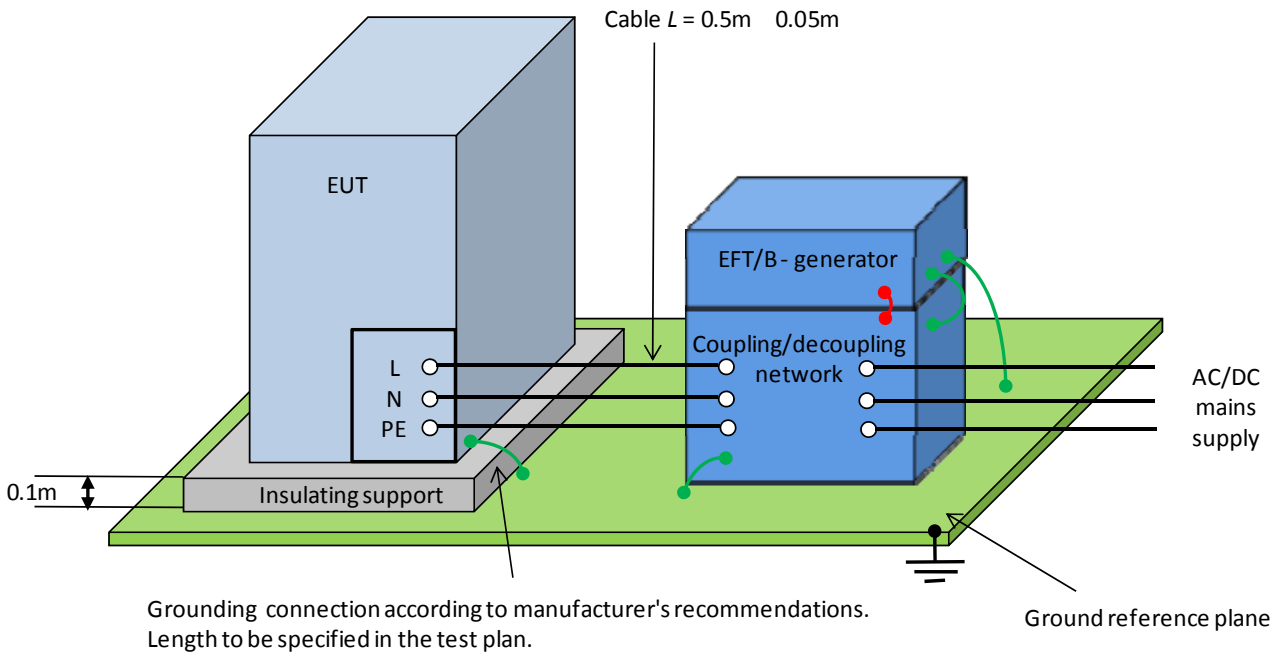
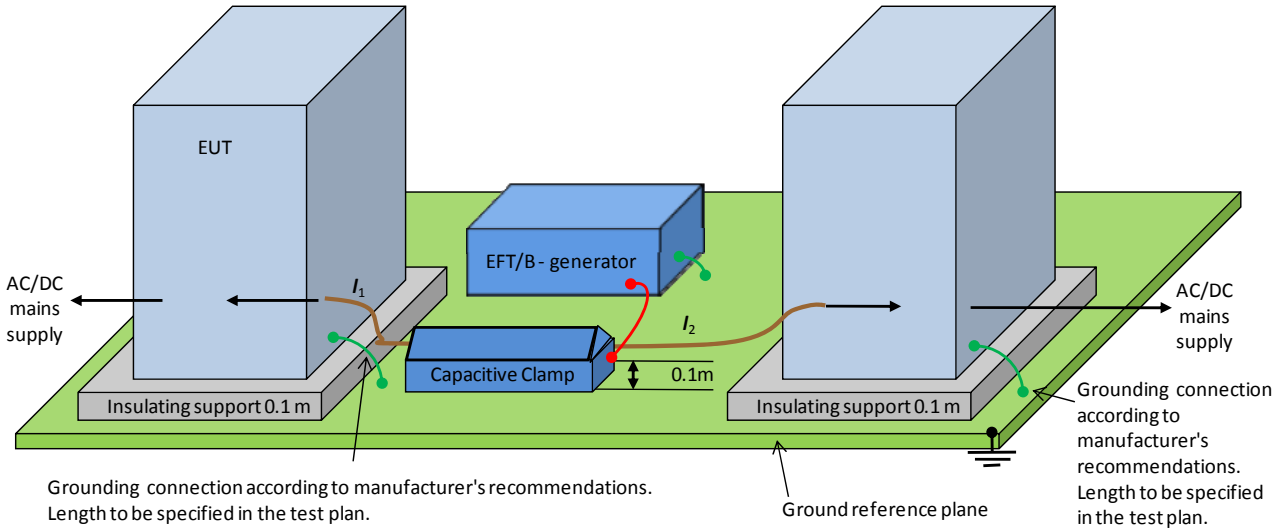


Figure 4.4.1.2: Electrical Fast Transient/Burst Immunity Test Setup Direct Coupling of the Test Voltage to AC/DC Power Supply Ports/Terminal for Laboratory Purposes (Figure 9)



When both EUTs are tested simultaneously: *l1= l2 = 0,5 m ± 0,05 m between the clamp and the EUT being tested.*
When only one EUT is tested, a decoupling network must be inserted between the capacitive coupling and the non-tested EUT.

Figure 4.4.1.3: Electrical Fast Transient /Burst Immunity Test Setup Application of the Test Voltage by the Capacitive Coupling Clamp for Laboratory Test Purposes (Figure 10)

4.4.2 Performance Criteria

During the performance of electrical fast transient/burst immunity testing, only performance criterion A and performance criterion B were allowed. Performance criterion C failures were disallowed.

4.4.3 Test Results

The EUT was subjected to electrical fast transient/burst immunity testing on February 28, 2014. No adverse indications were noted during the performance of the test. Therefore, the EUT met performance criterion A.

Table 4.4.3.1: Electrical Fast Transient/Burst Immunity Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-4: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.5**		
Test Date(s):	**2/28/2014**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Electrical Fast Transient / Burst Immunity Test Equipment List					
Test Software Version:	**WinPats Version 3.28, Haefely Test AG**				
Asset #	**Manufacturer**	**Model**	**Equipment Nomenclature**	**Serial Number**	**Calibration Due Date**
1150	Haefely	PEFT 093 584.1	EFT Tester (used with Asset #1289)	083 383.11	7/16/2014
1289	Haefely	FP-EFT 093 593.1	Filter, Coupling (used with Asset #1150)	083 318 01	7/16/2014
1302	Haefely	093 596.1	Clamp, Capacitive, EFT CISPR	083 369-19	7/2/2014

Table 4.4.3.2: Electrical Fast Transient/Burst Immunity Test Results, DC Power Ports

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-4: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.5**		
Test Date(s):	**2/28/2014**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Electrical Fast Transient / Burst Immunity Test Results Data Sheet **Page: 1 of 1**

Part 2 - d.c. power ports
(excluding equipment marketed with an a.c./d.c. power converter)

EUT Mode of Operation: **Streaming Data**

EUT Line Voltage: **12** **VDC**

Line Tested	Test Level & Polarity	Pulse Repetition Frequency	Burst Duration	Burst Period	Test Duration	Coupling Method	Perfomance Criterion Required	Perfomance Criterion Achieved	Test Result
L1 (Hot Lead)	0.5kV Positive	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	0.5kV Positive	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L1 (Hot Lead)	0.5kV Negative	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	0.5kV Negative	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L1 (Hot Lead)	1.0kV Positive	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	1.0kV Positive	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L1 (Hot Lead)	1.0kV Negative	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	1.0kV Negative	5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L1 (Hot Lead)	2.0kV Positive	2.5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	2.0kV Positive	2.5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L1 (Hot Lead)	2.0kV Negative	2.5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass
L2 (Return	2.0kV Negative	2.5 kHz	15 mS	300 mS	5 minutes	CDN	B	A	Pass

Table 4.4.3.3: Electrical Fast Transient/Burst Immunity Test Results, I/O Ports

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-4: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6 - Electromagnetic Immunity, and Section 10.5**		
Test Date(s):	**2/28/2014**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Electrical Fast Transient / Burst Immunity Test Results Data Sheet **Page: 1 of 1**

Part 3 - Immunity, I/O Cables, Signal Cables, Telecommunications Cables, etc.

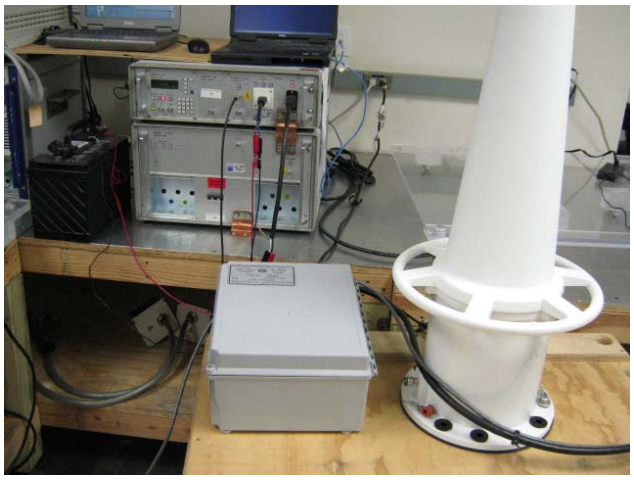
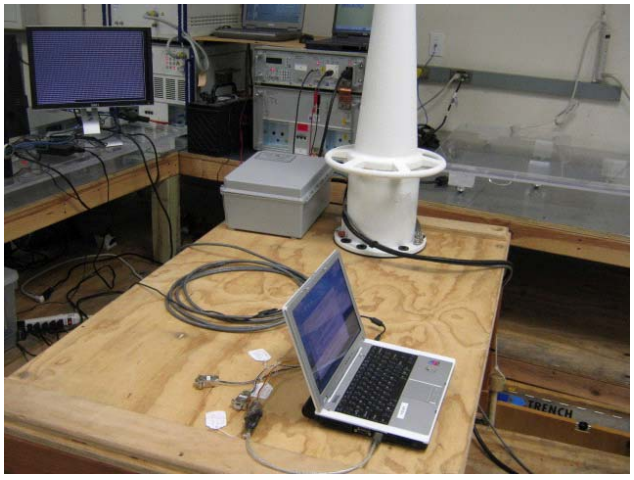
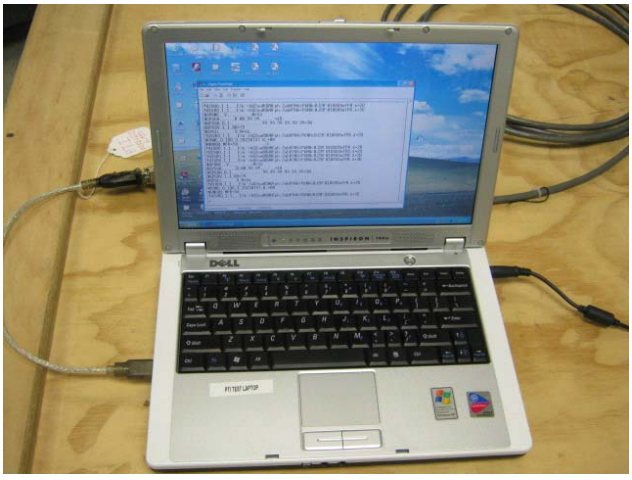
EUT Mode of Operation: **Streaming Data**

EUT Line Voltage: **12** **VDC** **EUT Power Frequency:** **-** **N/A**

Line Tested	Test Level & Polarity	Pulse Repetition Frequency	Burst Duration	Burst Period	Test Duration	Coupling Method	Perfomance Criterion Required	Perfomance Criterion Achieved	Test Result
Signal Lines	0.5kV Positive	5 kHz	15 mS	300 mS	5 minutes	Capacitive Clamp	B	A	Pass
	0.5kV Negative	5 kHz	15 mS	300 mS	5 minutes	Capacitive Clamp	B	A	Pass
	1.0kV Positive	5 kHz	15 mS	300 mS	5 minutes	Capacitive Clamp	B	A	Pass
	1.0kV Negative	5 kHz	15 mS	300 mS	5 minutes	Capacitive Clamp	B	A	Pass

Table 4.4.3.4: Electrical Fast Transient/Burst Immunity Test Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-4: 1995, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6 - Electromagnetic Immunity, and Section 10.5		
Test Date(s):	2/28/2014	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Electrical Fast Transient / Burst Immunity Photographs	Page: 1 of 1
	
EUT DC Mains Under Test	EUT I/O Under Test
	
EUT Test Setup	Support Equipment

4.5 Conducted Immunity Test

4.5.1 Test Procedures

Conducted immunity testing was performed using the procedures of IEC 61000-4-6. The EUT was placed in the approximate center and 10 cm above the reference ground plane and was powered and operated in a normal configuration. Injection to the AC power leads was performed with an M3 injection network. Testing of any signal input leads was performed via current clamp on the leads. Testing was performed on both the DC power line and the I/O power line at 3 Vrms, AM at 400 Hz, at 80% amplitude modulation injection over the frequency range 150 kHz to
80 MHz and also at 10 Vrms at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, and 25 MHz. A diagram showing the test setup is given as Figure 4.3.1.1.

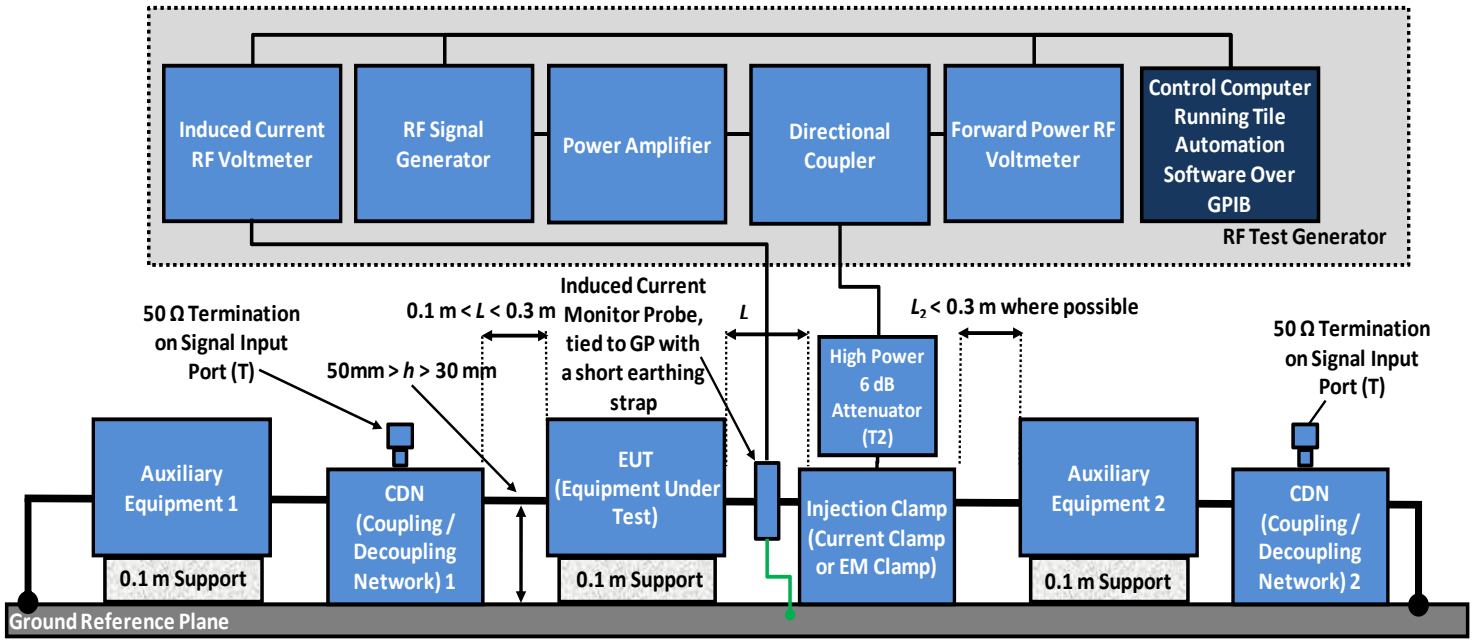


Figure 4.3.1.1: Conducted Immunity Test Setup
Injection Clamp (Current Clamp) Tests

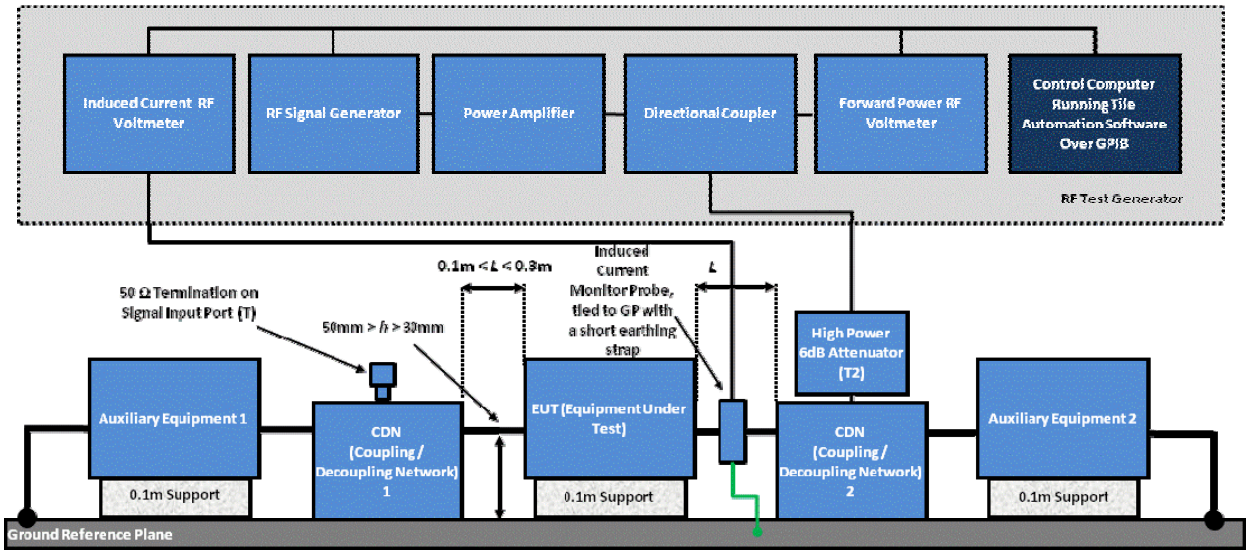


Figure 4.3.1.2: Conducted Immunity Test Setup
CDN Tests (Coupling Decoupling Networks)

4.5.2 Performance Criteria

During performance of conducted RF immunity testing only performance criterion A was allowed. Performance criterion B or performance criterion C failures were disallowed.

4.5.3 Test Results

The EUT was subjected to the conducted RF immunity testing on November 19, 2012. No adverse indications were noted during the performance of the test. Therefore, the EUT met performance criterion A.

Table 4.5.3.1: Conducted Immunity Test Equipment

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6**		
Test Date(s):	**11/19/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

Conducted Immunity Test Equipment List	
Test Software Version:	**Tile Version 3.4.K.15, October 13, 2006, 11:21:00 AM**
Test Profile Used:	**CI_2011_R0 Version 03-28-2011.til**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1366	HP	437B	Power Meter	3125U13078	7/10/2014
1092	HP	8657B	Generator, Signal	3427U05972	9/20/2014
1226	AR	100L	Amplifier, 100W, 50dB, 10kHz-220MHz	2232	N/A
1305	HD Com Corp	HDC5091-10	Coupler, Directional	31605-6	N/A
1043	JFW	50FH-006-300	Attenuator, N, 6dB 300W	None	1/22/2015
1132	AilTech	91550-1M	Probe, Current, 10kHz-100MHz	1856	1/8/2015
1409	FCC	801-M2-16A	CDN, 150kHz-230MHz, 16A	1019	4/21/2013
1359	Schaffner	CIC-8101	Clamp, EM Injection	238	N/A

Table 4.5.3.2: Conducted Immunity Test Results, DC Mains, Page 1

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6		
Test Date(s):	11/19/2012	**EUT Serial #:**	7065
Customer:	Tideland Signal Corporation	**EUT Part #:**	None
Project Number:	13862-10	**Test Technician:**	Bob Redoutey
Purchase Order #:	116585	**Supervisor:**	Rob McCollough
Equip. Under Test:	E-Navcon	**Witness' Name:**	None

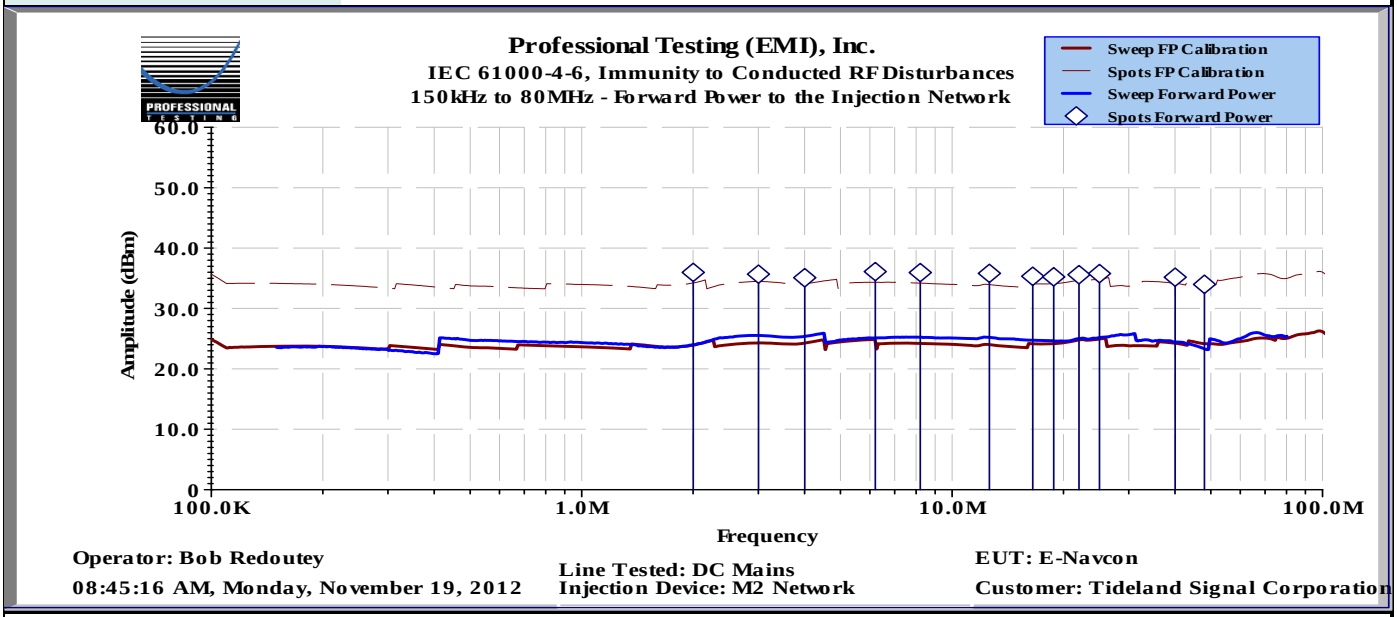
Conducted Immunity Test Results Data Sheet				Page:	1 of 2
EUT Mode of Operation:	Streaming Data				
EUT Line Tested:	DC Mains				
Injection Method Used:	M2 Network				
EUT Line Voltage:	12 VDC	**EUT Power Frequency:**	-	N/A	

Frequency Range (MHz)	Test Level (Volts rms)	Modulation Parameters	Dwell Time	Frequency Step Size	Performance Criterion Required	Performance Criterion Achieved	Test Results
0.01 - 0.15	Not Applicable						
0.15 - 6.765	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
6.765 - 6.795	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
6.795 - 13.553	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
13.553 - 13.567	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
13.567 - 26.957	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
26.957 - 27.283	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
27.283 - 40.66	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
40.66 - 40.7	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
40.7 - 47	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
47 - 68	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
68 - 80	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
80 - 230	Not Applicable						

Conducted Immunity Spot Frequencies									
EUT-Specific Spot Frequencies					Standard Specific-Spot Frequencies				
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
None					2.000	12.600	40.000		
					3.000	16.500	48.000		
					4.000	18.800			
					6.200	22.000			
					8.200	25.000			

Table 4.5.3.3: Conducted Immunity Test Results, DC Mains, Page 2

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6		
Test Date(s):	11/19/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None
Conducted Immunity Test Results Data Sheet		Page:	2 of 2
EUT Line Tested:	DC Mains		



Forward Power to the Coupling Device - 150 kHz to 80 MHz

Table 4.5.3.4: Conducted Immunity Test Results, Signal Cable Port, Page 1

Professional Testing, EMI, Inc.			
Test Method:	**IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields**		
In accordance with:	**IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results**		
Section:	**Table 6**		
Test Date(s):	**11/19/2012**	**EUT Serial #:**	**7065**
Customer:	**Tideland Signal Corporation**	**EUT Part #:**	**None**
Project Number:	**13862-10**	**Test Technician:**	**Bob Redoutey**
Purchase Order #:	**116585**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**E-Navcon**	**Witness' Name:**	**None**

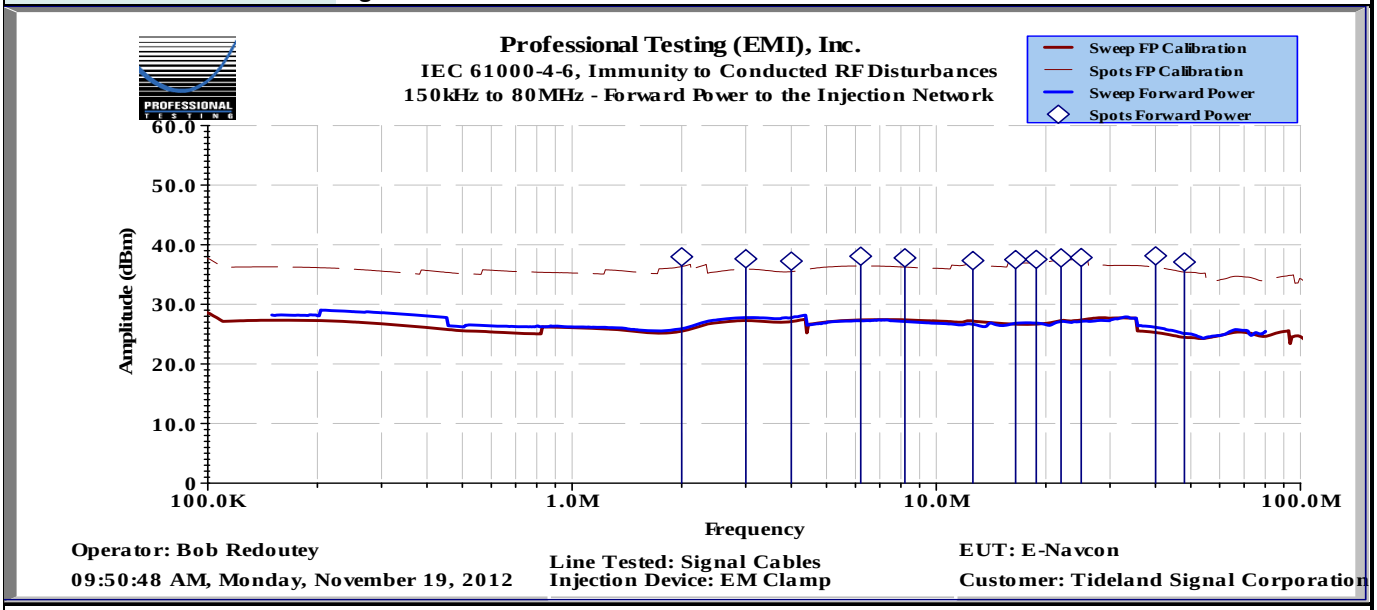
Conducted Immunity Test Results Data Sheet				Page:	1 of 2
EUT Mode of Operation:	**Streaming Data**				
EUT Line Tested:	**Signal Cable**				
Injection Method Used:	**EM Clamp**				
EUT Line Voltage:	**12**	**VDC**	**EUT Power Frequency:**	**-**	**N/A**

Frequency Range (MHz)	Test Level (Volts rms)	Modulation Parameters	Dwell Time	Frequency Step Size	Performance Criterion Required	Performance Criterion Achieved	Test Results
0.01 - 0.15	Not Applicable						
0.15 - 6.765	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
6.765 - 6.795	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
6.795 - 13.553	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
13.553 - 13.567	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
13.567 - 26.957	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
26.957 - 27.283	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
27.283 - 40.66	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
40.66 - 40.7	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
40.7 - 47	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
47 - 68	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
68 - 80	Swept freq's 3Vrms, Spot freq's 10Vrms	AM, 400Hz ±10%, depth 80% ±10%	Step Freq's: 2 S, Spot Freq's: 60 S	1% fo	A	A	Pass
80 - 230	Not Applicable						

Conducted Immunity Spot Frequencies									
EUT-Specific Spot Frequencies					Standard Specific-Spot Frequencies				
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
None					2.000	12.600	40.000		
					3.000	16.500	48.000		
					4.000	18.800			
					6.200	22.000			
					8.200	25.000			

Table 4.5.3.5: Conducted Immunity Test Results, Signal Cable Port, Page 2

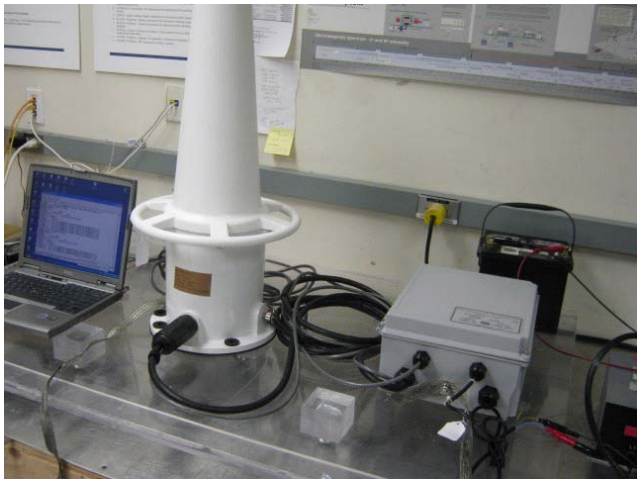
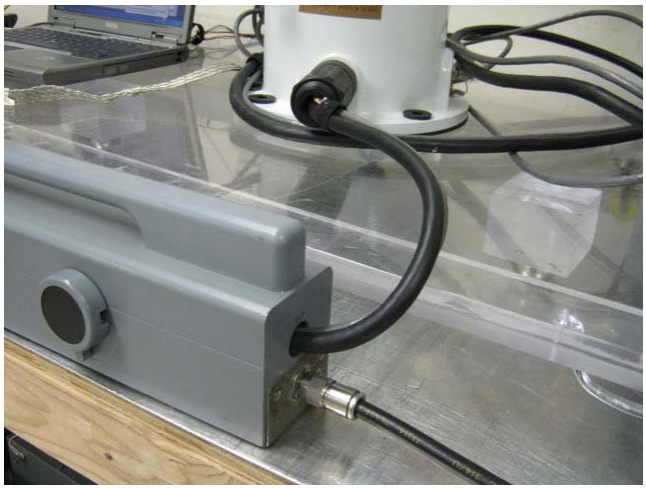
Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6		
Test Date(s):	11/19/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None
Conducted Immunity Test Results Data Sheet		Page:	2 of 2
EUT Line Tested:	Signal Cable		



Forward Power to the Coupling Device - 150 kHz to 80 MHz

Table 4.5.3.6: Conducted Immunity Test Setup Photographs

Professional Testing, EMI, Inc.			
Test Method:	IEC 61000-4-6: 1996, Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields		
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results		
Section:	Table 6		
Test Date(s):	11/19/2012	EUT Serial #:	7065
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	116585	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Conducted Immunity Photographs	Page: 1 of 1
	
EUT with Support Equipment	EUT Setup
	
DC Mains Under Test	Signal Cable Under Test

Appendix A: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

Rationale and Summary of Expanded Uncertainty

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Table 1: Summary of Measurement Uncertainties for Site 45

Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7

Appendix B: Accreditations

Laboratory Accreditation

NVLAP accreditation to ISO/IEC 17025: 2005 with the following scope of accreditation:
NVLAP Lab code 200062-0

- EN 60945 (2002)
- EN 61326-1 (2006)
- IEC 61000-4-2, Ed. 1.2 (2001) + A1, A2; EN 61000-4-2
- IEC 61000-4-3, Ed. 2.0 (2002-03); EN 61000-4-3 (2002)
- IEC 61000-4-4(1995), A1(2000), A2(2001); EN 61000-4-4
- IEC 61000-4-6, Ed. 2.0 (2003-05); EN 61000-4-6
- CISPR 16-2-1 Ed. 2.0 (2008)
- CISPR 16-2-2 Ed. 1.2 (2005)
- CISPR 16-2-3 (2006) Ed. 2
- CISPR 16-2-4 (2003)