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Project 13862-10

Tideland Signal Corporation E-Navcon System

FCC/IC Test Report

Prepared for: Tideland Signal Corporation 4310 Directors Row Houston, TX 77092

Ву

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

April 10, 2014

Reviewed by:

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Regulatory Design Engineer

Written by:

Eric Lifsey EMC Engineer

Revision History							
Revision Date Author Description of Change(s)							
00	March 4, 2014	Eric Lifsey	First Draft				
01 April 8, 2014		Eric Lifsey	Revised per Larry Finn comments.				
02 April 10, 2014		Eric Lifsey	Revised per Dale Williams comments.				

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1.0 Scope

This is a report on testing for the Tideland E-Navcon navigational aid for the regulatory requirements of USA/FCC and Canada/IC.

2.0 Applicable Standards

Table 2-1: Applicable Standards for E-Navcon

Standard	Description			
CFR Title 47 15.209	Radiated Emission limits; general requirements.			
CFR Title 47 1.1310	Radiofrequency Exposure Limits			
CFR Title 47 Part 80	Stations in the Maritime Services			
RSS-Gen Issue 3:2010	General Requirements and Information for the Certification of Radio Apparatus			
RSS-102 Issue 4:2010	Radio Frequency (RF) Exposure, Compliance of Radiocommunication Apparatus (All Frequency Bands)			
RSS-182 Issue 5:2012	Maritime Radio Transmitters and Receivers in the Band 156-162.5 MHz			

Required RF Tests 2.1

Ensuring the output power correlates with the previously measured data is intended to support the use of existing test reports for the E- Navcon FCC submission without full retesting.

The TCB, ACB, has indicated this is a viable approach to demonstrate that the hardware has not changed since the previous analysis.

Table 2-2: Required RF Tests

Test	Description	Method Standard
Power	Output Power, AIS AtoN (156MHz – 162.5MHz)	80.215, IEC 60232-2 Ed. 1
Power	Output Power, Racon X Band (9300MHz – 9500MHz)	80.215(n)(3)
MPE	RF Exposure Calculation	FCC 1.1310, RSS-102, EN 62311

2.2 Required EMC Tests

Table 2-3: Required EMC Tests

Test	Description	Method Standard
Emissions	Conducted Emissions, DC Power Port; 10kHz – 30MHz	CISPR 16-2
Emissions	Radiated emissions, Enclosure; 150kHz to 2GHz	CISPR 16-2, ANSI C63.4
Emissions	Radiated emissions; Enclosure; 2GHz – 40GHz	ANSI C63.4

Applicable Previous Certifications 2.3

Table 2-4: Referenced Certifications

EUT Section Maker Description	Existing Agency Identifiers		
Alltek Marine Electronics Corp., AIS AtoN (156MHz – 162.5MHz)	FCC ID: WZ7ATON-301-303		
Tideland Signal Corporation, Racon X Band (9300MHz – 9500MHz)	FCC ID: FAZSBCN2SYS6A		

Certificated Equipment Included In Design

This device is a composite of two previously certified devices combined into a single sealed enclosure; the individual device certifications are described below.

2.4.1 AIS AtoN

The integrated AIS AtoN device has been previously evaluated for compliance to the relevant test standards. Expertise 11-114370 from Phoenix Test Lab (EU ID 0700) attests to the compliance of the Mando 301/303 AIS AtoN device (also referred to as the Informer V10-1 and V10-3). FCC ID: WZ7ATON-301-303.

2.4.2 Racon

The integrated X-band Racon uses the same hardware as was previously certified under FCC ID: FAZSBCN2SYS6A. The only difference between the Racon integrated into the E-Navcon is the removal of the S-band modules. As the X-band and S-band RF modules operated independently of one another, the depopulated X-band Racon is considered electrically identical to that of the original device.

3.0 Equipment Under Test

3.1 Description

The E-Navcon device is a maritime navigational aid comprised of an AIS AtoN device and an X-Band Racon. Both devices are housed in the same sealed and pressurized enclosure. Each device functions independently of the other. Both are powered by 12 VDC from a common external source, typically a battery.

The device is intended for use on land, stationary off-shore platforms, buoys or other stationary locations where a navigational aid is required.

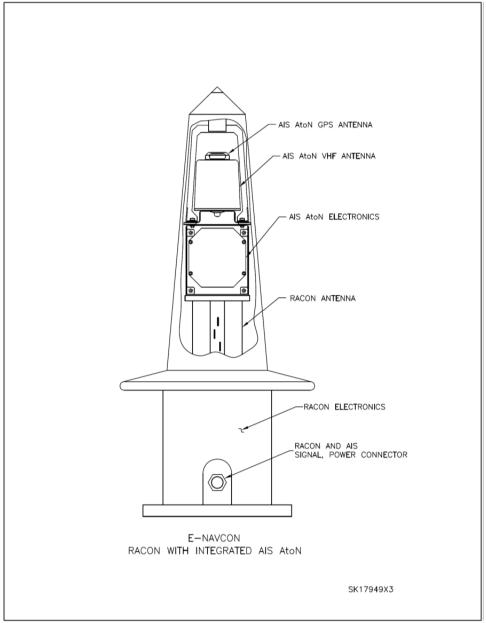


Figure 1: E-Navcon System Cutaway View Diagram

Integrated X-Band Racon Specifications 3.2

Frequency of Operation

X-Band 9300 to 9500 MHz

Frequency Matching Accuracy

Long Radar Pulses ± 2 MHz

Short Radar Pulses ± 2 MHz

- Minimum Output Power to Antenna: > 0.56 Watts (27.5 dBm)
- Pulse width Response: 50 nanoseconds to 200 nanoseconds
- Racon Response Display Scaling:

[Pulse width (± 50 nanoseconds typical) Racon Response (± 5 µs typical)]

745 to 200 nanoseconds: 100% of selected value 405 to 745 nanoseconds: 75% of selected value 195 to 405 nanoseconds: 50% of selected value 50 to 195 nanoseconds: 25% of selected value

System sensitivity:

X-Band <-45 dBm

- Maximum Response Rate (either band): 8 KHz
- Maximum Response Delay: < 667 nanoseconds (100 meters on display)
- Radar Blanking connections available
- Programmable ON/OFF Times:

Quiescent Period: 0 – 60 seconds Extended Quiescent Period Selectable

Active Period: 0 – 60 seconds

Antenna Specifications:

X-Band:

Gain: 6 dBi

Horizontal Polarization

Vertical Divergence: 22 degrees

Effective Radiated Power: > 2.25 Watts

Integrated AIS AtoN Specifications 3.3

The AIS AtoN is fully compliant to the technical specifications:

Defined in IEC 62320-2 Defined in ITU-R M.1371-3

IALA A-126

TDMA Transmitter

TX Frequency: 156.025 MHz -162.025 MHz

Transmitter Power: 12.5 W max. Channel Bandwidth: 25 kHz

AIS Output

As defined in ITU-R.M.1371: Message 6, Message 8, Message 12, Message 14,

Message 21, and Message 25

System (Common) Specifications 3.4

Power Supply Input Voltage (standard): 9.0 – 15.6 VDC

Power Supply Input Voltage (optional): 9.0 – 36.0 VDC

Nominal Racon Power Consumption:

Light Traffic: 0.75 Watts Heavy Traffic: 1.06 Watts

Quiescent Power Consumption: 0.05 Watts

Nominal AIS Power Consumption for Message 21:

Type 1 Typical Power Consumption: < 0.5 Ah/day @13.6 v Type 3 Typical Power Consumption: < 1.0 Ah/day @13.6 v

- Lightning Surge Protection: 1 millisecond at 3000 volts; IEC 60945; CE
- Rated IP-66 (320 k/h driving rain)/ IP68 (submersion to 10 meters indefinitely)
- Unit can be pressurized for additional protection.
- Diameter (including lift ring): 353 mm (13.9 in)
- Height: 797 mm (31.4 in)
- Weight (includes 4.5 m cable and mounting hardware): 13 kg (28 lbs)
- Base Housing Material: Aluminum
- Temperature Operating Range: -40°C to +55°C

Intentionally Generated Frequencies 3.5

Table 3-3: Intentionally Generated Signals

Type Name		Frequency	Description		
Carrier	AIS AtoN TX	156 – 162.5MHz	RF Output of AIS AtoN		
Carrier	Racon	9300 – 9500 MHz	RF Output of Racon		

9500MHz is the highest frequency generated by the EUT. For FCC emissions measurements, the EUT will be investigated up to 40GHz per 47 CFR 15.33a(1).

4.0 EUT Essential Operation

4.1 EUT Test Setup

4.1.1 Racon Device Testing

For immunity and output power testing, the Racon will be pinged with a signal generator to initiate a return message. The Racon responds at 9.39982 GHz regardless of the frequency in which it is interrogated. The signal generator should be configured to a frequency between 9300 and 9500MHz (well away from 9.39982GHz), with a pulse width of 50 to 200ns. A signal is sent to the Racon from a signal generator and horn antenna. A 2nd horn antenna is connected to a spectrum analyzer to measure radiated power and capture the transmitted Morse-coded CW response.

4.1.2 AIS AtoN Device Testing

The AIS device transmits autonomously on a periodic basis, and does so only when a GPS signal is acquired. The AIS EUT for this test is specifically programmed to transmit on additional time slots to facilitate measurement of power. This EUT transmits on 162.025MHz.

5.0 Antenna Construction Review

The antenna construction is reviewed to determine whether the design allows for unauthorized modification or substitution of the EUT antennas.

This procedure is to the requirements of FCC 15.203.

Results 5.1

As shipped from the factory, the entire device including all antennas, is enclosed in a non-conductive gas-pressurized vessel. It has a single external connector that carries only DC power and serial port signals. The user and installer have no access to the antennas or antenna ports internal to the EUT.

The EUT meets the relevant requirements.

6.0 Emission Tests

The following sections report measurements of unintentional emissions.

The EUT was configured and operated in a manner consistent with typical applications.

Conducted Emissions, DC Power Port; 10 kHz – 30 MHz 6.1

The EUT DC power supply cord was cut to the required length to reach from wiring termination box to the LISN. Power supply cords for any peripheral equipment were powered from an auxiliary LISN. Excess interface cable lengths were coiled on the reference plane surface. The conducted emissions were maximized, by varying the operating states and configuration of the EUT.

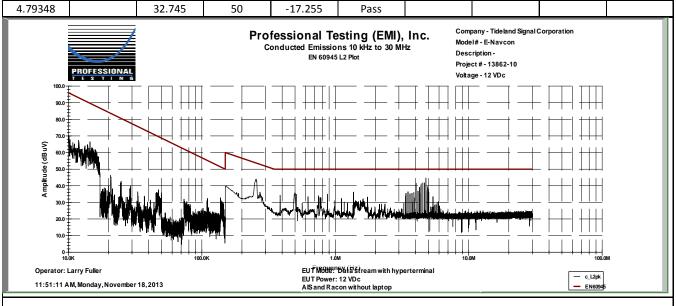
The tests were performed in an 8' x 8' RayProof modular shielded room. The EUT was placed on a metallic reference plane. Where earth bonding was provided on the EUT, the earth connection was attached to the reference plane.

Once normal EUT operation was verified on the diagnostic port, the laptop computer was removed from the test setup. The diagnostic port is used only during installation or update of the EUT settings.

Results of the emission measurements appear in the following pages. The EUT satisfied the relevant requirements.

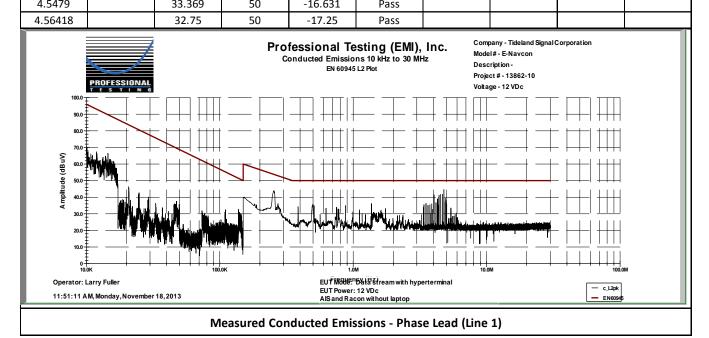
Professional Testing, EMI, Inc.								
Test Method: CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Method of measurement of disturbance and immunity								
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results							
Section:	Section 9 Electromagnetic emission – I	Methods of testing and requi	red test results					
Test Date(s):	11/18/2013	EUT Serial #:	7066					
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 Meuller					
Condu	cted Emissions Test Results Data Sl	Page: 1 of 2	2					

EU	EUT Line Voltage:			VDC	EUT Line Frequency:			N/A	Hz
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	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				



	Professional Testing, EMI, Inc.							
CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Method of measurement of disturbance and immunity								
IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment and systems - General Requirements - Methods of testing and required test results								
nber: 13862-10 Test Technician: Larry Fuller rder #: 116585 Rev 1 Supervisor: Rob McCollough								
	of							

EUT Line Voltage:			12	VDC	EUT Line Frequency:			N/A	Hz
Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	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				



Professional Testing, EMI, Inc.										
Tost Mothod:	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods									
rest ivietilou.	- Part 2: Methods	of measurement	of disturbance and in	nmunity						
	IEC 60945, Fourth	Edition, 2002-08	Maritime navigation a	and radio communication equipment						
In accordance with: 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 #:	7066						
Customer:	Tideland Signal C	orporation	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 Meuller						
	Co	onducted Emission	s Test Equipment Lis	t						
Tile! Softwa	re Version:	4.1.A.0, April 14,	2009, 11:01:00PM							
Test Pi	rofile:	Profile#: CE_2010	Otil, dated December	16, 2010						

	rest i fome.	1 1011	romem ce_rotom, dated becember 10, 20						
#	Manufacturer	Model	Equipment Nomenclature	Seri					

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1842	НР	8568B	Spectrum Analyzer	2732A03633	5/17/2014
0045	НР	85662A	Spec Anal Dsply for AN1842	2816A16413	N/A
0990	НР	85685A	RF Preselector	3010A01119	8/29/2014
1281	НР	85650A	Quasi Peak Adapter	2043A00063	6/5/2014
C109	НР	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

Radiated emissions, Enclosure: 150 kHz – 2 GHz, and 2 GHz – 26.5 GHz

The tests were performed in a 10 meter semi-anechoic shielded room. The EUT was placed on a rotatable non-metallic table 80 cm above the reference plane. Where earth bonding was provided on the EUT, the earth connection was attached to the reference plane.

Support and 12 VDC power source, including a laptop verifying operation of the EUT, were placed in the chambers sub-chamber area below the reference plane.

The E-Navcon device is required to conform to the limits shown below in table 5-1 for conducted and radiated emissions limits in the 'Exposed' category. The conducted limits apply only to the DC input power connection of the EUT. Measurements are to be performed as specified in IEC 60945-1 ed.4.

Portable Protected Exposed Submerged Conducted 10 kHz - 150 kHz 63 mV - 0,3 mV (96 dBµV - 50 dBµV) 150 kHz - 350 kHz 1 mV - 0.3 mV (60 dByV - 50 dByV)emissions 350 kHz - 30 MHz 0,3 mV (50 dBµV) (9.2)150 kHz - 300 kHz Radiated 10 mV/m – 316 μV/m (80 dBμV/m – 52 dBμV/m) emissions 300 kHz - 30 MHz 316 μ V/m - 50 μ V/m (52 dB μ V/m - 34 dB μ V/m) (9.3)30 MHz - 2 GHz 500 μV/m (54 dBμV/m) except for 156 MHz - 165 MHz

16 μV/m (24 dBμV/m) quasi-peak or 32 µV/m (30 dBµV/m) peak

Table 5-1: Emissions Limits

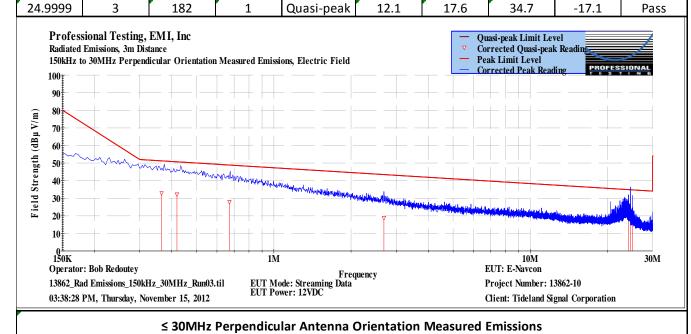
Radiated emissions above 2 GHz are required to be below 500µV/m when measured at a distance of 3m per 47 CFR 15.209.

Results of the emission measurements appear in the following pages. The EUT satisfied the relevant requirements.

6.2.1 Radiated emissions, Enclosure; 150 kHz to 30 MHz

			Profes	sional Te	sting, EN	VII, Inc.			
Test Meth	od:		•	or radio disturb of disturbance		•	ing apparatus	and methods	- Part 2:
n accorda	nce with:			2002-08 Mariti lethods of testi				equipment an	d systems
ection:				emission – Met		•	, , , , , , , , , , , , , , , , , , , ,		
est Date(s):		2 - 11/16/20		EUT Serial		7066		
ustomer:			gnal Corpoi	ration	EUT Part #:		None		
roject Nu urchase (13862-10 None Listed	<u>.</u>		Test Techni		Bob Redou	•	
quip. Und		E-Navcon	u		Supervisor: Witness' Na		Rob McCol None	lougn	
чир. оп			********	Dec He Dete		arric.		4	- (4
FUT I				t Results Data	<u> </u>	5	Pa		of 1
	ine Voltage a Orientatio		2 VDC Parall			ver Frequen ency Range	-	N/A Below 30	MU-
Antenn		Mode of Ope		<u> </u>	riequi		reaming Da		IVITIZ
requency		EUT	Antenna		Recorded	Corrected	_		
Measured (MHz)	Distance (Meters)	Direction (Degrees)	Height (Meters)	Detector Function	Amplitude (dBµV)		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	315 217	1	Quasi-peak	10.3 17.8	17.605 24.224	35.5 35.0	-17.9	Pass
23.3125 24.5784	3	348	1	Quasi-peak Quasi-peak	21.4	27.272	34.8	-10.8 -7.5	Pass Pass
Radiated	sional Testing, I Emissions, 3m Dis to 30MHz Paralle	tance I Orientation Meas		Raymand Mallyngh	May the state of t	Co	asi-peak Limit Lev rrected Quasi-peal ak Limit Level rrected Peak Read	k Reading	SIGNAL
10									

Tideland Signal Corporation, E-Navcon System, Project 13862-10												
	Professional Testing, EMI, Inc.											
Test Metho	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity											
In accordan	nce with:	•	•	2002-08 Mariti ethods of testi	•			equipment an	d systems -			
Section:		Section 9 Ele	ctromagnetic	emission – Met	thods of testin	g and require	d test results					
Test Date(s	s):	11/15/2012	2 - 11/16/20)12	EUT Serial	#:	7066					
Customer:		Tideland Si	gnal Corpoi	ration	EUT Part #:		None					
Project Nur	mber:	13862-10			Test Techni	ician:	Bob Redou	tey				
Purchase O	rder #:	None Liste	d		Supervisor:	Supervisor: Rob McCollough						
Equip. Und	er Test:	E-Navcon			Witness' Name: None							
	F	Radiated Em	issions Test	Results Data	a Sheet		Pa	ge: 1	of 1			
EUT Li	ne Voltage:	: 1	2 VDC		EUT Power Frequency: - N/A							
Antenna	o Orientatio	n:	Perpendi	cular	Frequency Range: Below 30MH				MHz			
	EUT N	lode of Ope	eration:		Streaming Data							
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	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			
244627	3	259	1	Quasi-peak	12.8	18.9	34.8	-16.0	Pass			
24.1627	3	233		Quasi peak	12.0	10.5	37.0	10.0	1 033			



olocuro: 20 MHz to 1 CHz

6.2.2 Ra	adiated e	emissior	is, Enclo	sure; 30	MHz to	1 GHz			
			Profess	sional Te	sting, EN	VII, Inc.			
Test Metho	od:			or radio disturb of disturbance			ing apparatus	and methods	- Part 2:
In accordan	ice with:			2002-08 Mariti ethods of testi				equipment an	d systems -
Section:		Section 9 Ele	ctromagnetic	emission – Met	hods of testin	g and require	d test results		
Test Date(s):	11/15/201	2 - 11/16/20)12	EUT Serial	#:	7066		
Customer:		Tideland S	gnal Corpo	ration	EUT Part #:		None		
Project Nur	nber:	13862-10			Test Techni	ician:	Bob Redout	•	
Purchase O	rder #:	None Liste	d		Supervisor:		Rob McColl	ough	
Equip. Und	er Test:	E-Navcon		Witness' N	ame:	None			
	F	Radiated Em	issions Test	Results Data	a Sheet		Pag	ge: 1	of 1
EUT Li	ne Voltage:	: 1	2 VDC		EUT Pow	er Frequen	cy: -	N/A	
Antenna	Orientatio	on:	Vertic	al	Frequ	ency Range:		30MHz to	1GHz
	EUT N	lode of Op	eration:			St	reaming Dat	ta	
Frequency Measured	Test Distance	EUT Direction	Antenna Height	Detector Function	Recorded Amplitude	Corrected Level	Limit Level (dBµV/m)	Margin (dB)	Test Results
(MHz)	(Meters)	(Degrees)	(Meters)		(dBµV)	(dBµV/m)	` ' '	. ,	
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
Radiated 30MHz - 60	sional Testing, Emissions, 10m Di 1GHz Vertical Po		Emissions	·		▽ Cor — Pea	asi-peak Limit Leve rected Quasi-peak k Limit Level rected Peak Value	Reading	SIONAL
Field Strength (dBµV/m)	Marin Colonia						The state of the s		

EUT: E-Navcon Project Number: 13862-10

Client: Tideland Signal Corporation

Frequency EUT Mode: Streaming Data EUT Power: 12VDC

100M

Operator: Bob Redoutey

13862_Rad Emissions_3M_Run02.til 12:30:37 PM, Thursday, November 15, 2012

		Tide	eland Signa	Corporati	on, E-Nav	con Syster	n, Project	13862-10		
		Profes	sional Te	sting, El	VII, 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:		•	2002-08 Mariti ethods of testi	•			equipment an	d systems -		
Section:	Section 9 Ele	ctromagnetic	emission – Met	thods of testin	g and require	d test results				
Test Date(s): 11/15/2012 - 11/16/2012 EUT Serial #: 7066										
Customer:	Tideland Si	gnal Corpoi	ration	EUT Part #:		None				
Project Number:	13862-10			Test Techn	ician:	Bob Redou	tey			
Purchase Order #:	None Liste	d .		Supervisor		Rob McColl	ough			
Equip. Under Test:	E-Navcon			Witness' N	ame:	None				
Radiated Emissions Test Results Data Sheet Page: 1 of 1										
EUT Line Voltage: 12 VDC EUT Power Frequency: - N/A										
Antenna Orientation	on:	Horizor	ntal	Frequ	ency Range:		30MHz to	1GHz		
EUT I	Mode of Ope	ration:			St	reaming Da	ta			
Frequency Test Measured Distance (MHz) (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	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		
Professional Testing Radiated Emissions, 10m I 30MHz - 1GHz Horizonta 60 50 40 40 20 40 20 40 40 40	Distance	d Emissions			CorPea	asi-peak Limit Lev rected Quasi-peak ik Limit Level rected Peak Value	Reading	SIONAL		

EUT Mode: Streaming Data EUT Power: 12VDC

1G

EUT: E-Navcon

Project Number: 13862-10

Client: Tideland Signal Corporation

100M

30M Operator: Bob Redoutey

 $13862_Rad\ Emissions_3M_Run02.til$

12:30:37 PM, Thursday, November 15, 2012

6.2.3 Radiated emissions, Enclosure; 156 MHz to 165 MHz

			Profes	sional Te	sting, El	VII, Inc.				
est Metho	d:		•	or radio disturb of disturbance		•	ing apparat	us and me	thods	- Part 2:
n accordan	ice with:			2002-08 Mariti lethods of testi	_			on equipm	ent and	d systems
ection:				emission – Met	thods of testin	g and require	d test resu	lts		
est Date(s):	11/15/201	2 - 11/16/20	012	EUT Serial	#:	7066			
ustomer:		Y	gnal Corpo	ration	EUT Part #:		None			
roject Nun		13862-10			Test Techn	ician:	Bob Red	•		
urchase O		None Liste	<u>t</u>		Supervisor		Rob McC	ollough		
quip. Und	er Test:	E-Navcon			Witness' N	ame:	None			
	F	Radiated Em	issions Tes	t Results Data	a Sheet			Page:	1	of 1
EUT Li	ne Voltage	: 1	2 VDC		EUT Pow	er Frequen	су:	-	N/A	
Antenna	Orientatio	n:	Vertic	al	Frequ	ency Range:		30MF	Iz to 1	.GHz
	EUT N	Node of Ope	eration:			St	reaming	Data		
requency	Test	EUT	Antenna		Recorded	Corrected				
/leasured	Distance	Direction	Height	Detector	Amplitude	Level	Limit Lev	el Mar	gin	Test
(MHz)	(Meters)	(Degrees)	(Meters)	Function	(dBµV)	(dBµV/m)	(dBμV/n	n) (di	В)	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.		Pass
161.158	3	26	2.03	Peak	14.6	28.1	30.0	-1.		Pass
162.253	3	100	3.08	Quasi-peak	22.9	8.627	24.0	-15		Pass
163.343	3	252	1.75	Quasi-peak	31.4	17.273	24.0	-6.		Pass
164.081	3	131	1.56	Quasi-peak	34.9	20.858	24.0	-3.		Pass
Radiated 156-165M 60 50 50	sional Testing, Emissions, 3m Dis Hz Vertical Pola		issions			∇ CorPea	asi-peak Limit rected Quasi-p k Limit Level rected Peak V	eak Readin	HOFESS	IONAL.
Field Strength (dB tV)			Mary Mary		WALL AND THE			A ANNOUNCE OF	Market M.	WW
-10 -156M Operator: 13862_Rad	: Bob Redoutey d Emissions_156_1 PM, Thursday, No	65MHz_Run03.til	EUT Me	Fred ode: Streaming Data wer: 12VDC	quency	P	UT: E-Navcon roject Number		ration	165M

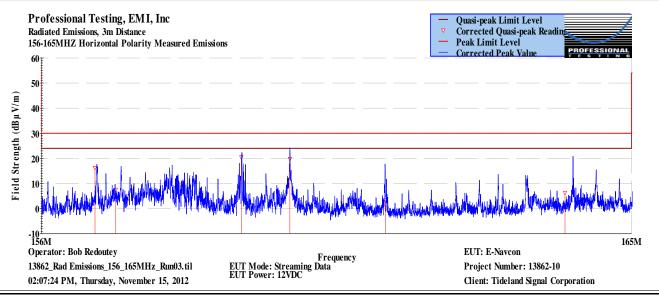
			vcon System, Project 13662-10						
	Professional To	esting, EMI, Inc.							
CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods - Part 2: Methods of measurement of disturbance and immunity									
In accordance with:	IEC 60945, Fourth Edition, 2002-08 Mari General Requirements - Methods of tes	•	ommunication equipment and systems - ts						
Section:	tion: Section 9 Electromagnetic emission – Methods of testing and required test results								
Test Date(s):	11/15/2012 - 11/16/2012	EUT Serial #:	7066						
Customer:	Tideland Signal Corporation	EUT Part #:	None						
Project Number:	13862-10	Test Technician:	Bob Redoutey						
Purchase Order #:	None Listed	Supervisor:	Rob McCollough						
Equip. Under Test:	E-Navcon	Witness' Name:	None						
	Radiated Emissions Test Results Da	ta Sheet	Page: 1 of 1						

	Radiat	ed Emissio	ns Test Results Data	a Sheet	Page:	1	of	1
	EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A		
	Antenna Orientation:	H	lorizontal	Frequency Range:	30N	/IHz to	1GHz	
ſ		• • • • •						

EUT	Mode	of Op	eration:	
-----	------	-------	----------	--

Streaming Data

Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	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





6.2.4 Radiated emissions, Enclosure; 1 GHz to 2 GHz

			Profess	sional Te	sting, EN	VII, Inc.				
est Metho	d:			or radio disturb of disturbance			ing appa	aratus ar	nd methods	- Part 2:
n accordan	ice with:			2002-08 Mariti ethods of testi				ation eq	Juipment an	d systems
ection:		Section 9 Elec	ctromagnetic	emission – Met	hods of testin	g and require	d test r	esults		
est Date(s):	11/15/2012			EUT Serial		7066			
ustomer:		Tideland Si	gnal Corpoi	ration	EUT Part #:	:	None			
roject Nur		13862-10	_		Test Techn		_	edoute	•	
urchase O		None Listed	<u>1</u>		Supervisor:		_	/cCollo	ugh	
quip. Und	er Test:	E-Navcon			Witness' N	ame:	None			
	F	Radiated Em	issions Test	Results Data	Sheet			Page	e: 1	of 1
EUT Li	ne Voltage:	: 1	2 VDC		EUT Pow	er Frequen	су:	-	N/A	
Antenna	Orientatio	n:	Vertic	al	Frequ	ency Range:			Above 10	6Hz
	EUT N	/lode of Ope	ration:			St	reamii	ng Data	9	
requency	Test	EUT	Antenna		Recorded	Corrected				
Measured	Distance	Direction	Height	Detector	Amplitude	Level	Limit		Margin	Test
(MHz)	(Meters)	(Degrees)	(Meters)	Function	(dBμV)	(dBµV/m)	(dBμ\	//m)	(dB)	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
Radiated 1	ional Testing, Emissions, 3m Dis Vertical Polarity		S			▽ Cor — Pea	k Limit L	erage Read		SIONAL I N 6
Field Strength (dBp 20 20 20 20 20 20 20 20 20 20 20 20 20	an and an and an and an and an	المراجعة والمعروفية وا	genislanden om de hannelden	ara harang bilang and alapa	profesiology theory at house at	hindratura di seria	- delprocede in the description	a naga digin kankan kan kan ka	denie addinie a denie adenie addinie	2G
10 [‡] 1G Operator	: Bob Redoutey				uency	E	UT: E-Na	vcon		

			Tide	land Signal	Corporati	on, E-Navo	con Syster	n, Project	13862-10
			Profes	sional Te	sting, EN	VII, Inc.			
Test Metho	d:			or radio disturb of disturbance			ing apparatus	and methods	- Part 2:
In accordan	ice with:			2002-08 Mariti ethods of testi				equipment an	d systems -
Section:		Section 9 Elec	tromagnetic	emission – Met	hods of testin	ng and require	d test results		
Test Date(s):	11/15/2012			EUT Serial	#:	7066		
Customer:		Tideland Si	gnal Corpoi	ation	EUT Part #:		None		
Project Nur		13862-10			Test Techn		Bob Redou	•	
Purchase O		None Listed	l		Supervisor:		Rob McColl	ough	
Equip. Und	er Test:	E-Navcon			Witness' N	ame:	None		
	R	adiated Em	issions Test	Results Data	Sheet		Pa	ge: 1	of 1
EUT Li	ne Voltage:	1	2 VDC		EUT Pow	ver Frequen	cy:	N/A	
Antenna	Orientatio	n:	Horizor	ntal	Frequ	ency Range:		Above 10	iHz
	EUT N	lode of Ope	ration:			St	reaming Da	ta	
Frequency Measured	Test Distance	EUT Direction	Antenna Height	Detector Function	Recorded Amplitude		Limit Level (dBµV/m)	Margin (dB)	Test Results
(MHz)	(Meters)	(Degrees)	(Meters)	0	(dBµV)	(dBµV/m)	540	22.2	D
1108.79	3	136	<u>1</u>	Quasi-peak	83.1	30.7	54.0	-23.3	Pass
1253.61	3	72		Quasi-peak	84.2	33.2	54.0	-20.8	Pass
1284.58 1671.22	3	301 76	<u>1</u> 1	Quasi-peak Quasi-peak	84 84.1	32.8 33.2	54.0 54.0	-21.1 -20.8	Pass Pass
Profess Radiated	cional Testing, Emissions, 3m Dist Horizontal Polarit	,	ions			— Avo	erage Limit Level rrected Average R ak Limit Level rrected Peak Read	eading	
rrength (dB µV/m) 90 100 100 100 100 100 100 100									
Eield Strength 30 10 1G Operator	: Bob Redoutey	palaintendenne del de pentre delle	washing and a second	Free	uency		EUT: E-Navcon	tam-karangan pengangan berapakan berah	2G
_	12 1_18GHz_Rad l AM, Friday, Nove	Emissions_110212.t mber 16, 2012		de: Streaming Data wer: 12VDC	· ·v		Project Number: 13 Client: Tideland Sig		

> 1GHz Horizontal Antenna Polarity Measured Emissions

Radiated emissions Enclosure: 1 GHz to 18 GHz

5.2.5 Ra	adiated 6	emission	is, Encid	sure, i c	GHz to 18	8 GHZ					
			Profess	sional Te	sting, EN	VII, Inc.					
Test Metho	od:			ds of Measurer e Range of 9 kH				_		ical and	I
n accordan	nce with:	FCC Part 15.1 Emissions Lin		ederal Regulat	tions Part 47, S	Subpart B - Un	intentiona	l Radiator	s, Radi	ated	
Section:		15.109									
est Date(s	s):	11/15/2012	2 - 11/16/20)12	EUT Serial		7066				
ustomer:		_	gnal Corpor	ation	EUT Part #:	1	None				
roject Nur		13862-10			Test Techni		Bob Red				
urchase O		None Lister	<u> </u>		Supervisor:		Rob McC	Collough			
quip. Und	er Test:	E-Navcon			Witness' Na	ame:	None				
	F	Radiated Em	issions Test	Results Dat	a Sheet			Page:	1	of	1
EUT Li	ne Voltage:	: 1	2 VDC		EUT Pow	er Frequen	су:	-	N/A		
Antenna	Orientatio	n:	Vertic	al	Freque	ency Range:		Ab	ove 10	3Hz	
	EUT N	Node of Ope	eration:			St	reaming	Data			
Frequency	Test	EUT	Antenna	Detector	Recorded	Corrected	limait Lau		!	т.	-+
Measured	Distance	Direction	Height	Detector	Amplitude	Level	Limit Lev		rgin	Te	
(MHz)	(Meters)	(Degrees)	(Meters)	Function	(dBµV)	(dBµV/m)	(dBμV/n	n) (°	IB)	Resu	JITS
1005.11	3	204	1	Average	75.3	21.84	60.0	-3	8.1	Pas	ss
1211.79	3	219	1	Average	76.4	25.016	60.0	-3	4.9	Pas	SS
1284.98	3	267	1	Average	75.9	24.769	60.0	-3.	5.2	Pas	SS
1488.44	3	249	1	Average	76.4	24.442	60.0	-3	5.5	Pas	SS
2953.88	3	294	1	Average	75.3	28.503	60.0	-3	1.5	Pas	SS
4532.72	3	293	1	Average	74.7	29.925	60.0	-3	0.0	Pas	SS
8685.15	3	325	1	Average	63.9	34.048	60.0		5.9	Pas	SS
14774.9	3	304	1	Average	60.2	36.637	60.0	-2	3.3	Pas	SS
Radiated 1	sional Testing, Emissions, 3m Dis Vertical Polarity		ns			▽ Cor — Pea	rage Limit Le rected Averag k Limit Level rected Peak R	ge Reading	PROFES:	SIONAL	
80											
<u>≅</u> 70 —							_				
1 60 1 7 7 7 80 1 80 1 80 1 80 1 80 1 80 1 80 1 80 1 80						· · ·					
± 50 _											
rengt —					and heart the state of the stat		, a	مدورينات المشاشل	الماران	duard and	
13S p 40	A STATE OF THE PARTY OF THE PAR	ted disease with the state of the state of						A CONTRACTOR OF THE PARTY OF TH	**************************************	Total State of the	
Field Strength (dBµV/m) 80 90 90 10 10 10 10 10 10 10 1	— — — — — — — — — — — — — — — — — — —			<mark>7</mark> -	-		-		-		
20 —	$ \stackrel{\vee}{+}$ $\stackrel{\neg}{+}$								-		
Ŧ											
10 IG							10G				

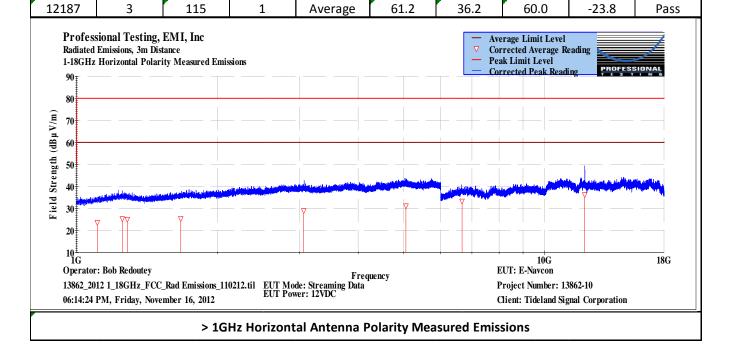
Project Number: 13862-10 Client: Tideland Signal Corporation

13862_2012 1_18GHz_FCC_Rad Emissions_110212.til EUT Mode: Streaming Data 06:14:24 PM, Friday, November 16, 2012

		Tideland Sigi	nal Corporation, E-Na	avcon S	ystem, P	roject	1386	<u> 2-10</u>
	Pr	ofessional 1	Testing, EMI, Inc					
Test Method:			rement of Radio-Noise Emi			•	ical and	d
In accordance with:	FCC Part 15.109 - 0 Emissions Limits	Code of Federal Reg	ulations Part 47, Subpart B -	Unintenti	onal Radiato	ors, Radia	ated	
Section:	15.109							
Test Date(s):	11/15/2012 - 11	1/16/2012	EUT Serial #:	7066				
Customer:	Tideland Signal	Corporation	EUT Part #:	None				
Project Number:	13862-10		Test Technician:	Bob F	Redoutey			
Purchase Order #:	None Listed		Supervisor:	Rob I	McCollough	า		
Equip. Under Test:	E-Navcon		Witness' Name:	None				
	Radiated Emissio	ns Test Results D	ata Sheet		Page:	1	of	1
FIIT Line Voltage	a· 12	VDC	FLIT Power Frequ	ency.	_	N/A		

Radiat	ed Emission	is Test Results Data	a Sneet	Page:	1	ot	1
EUT Line Voltage:	12	VDC	EUT Power Frequency:	-	N/A		
Antenna Orientation:	н	orizontal	Frequency Range:	Ab	ove 10	SHz	

	EUT N	lode of Ope	eration:		Streaming Data					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results	
1108.79	3	136	1	Average	76	23.6	60.0	-36.4	Pass	
1253.61	3	72	1	Average	76.3	25.3	60.0	-34.7	Pass	
1284.58	3	301	1	Average	76.2	25.1	60.0	-34.9	Pass	
1671.22	3	76	1	Average	76.3	25.4	60.0	-34.6	Pass	
3059.53	3	294	1	Average	75.8	29.0	60.0	-31.0	Pass	
5059.48	3	183	1	Average	74.7	31.2	60.0	-28.8	Pass	
6665.88	3	318	1	Average	71.8	33.3	60.0	-26.6	Pass	



6.2.6 Radiated emissions, Enclosure; 18 GHz to 26.5 GHz

			Profess	sional Te	sting, El	VII, Inc.			
Test Method	l:			ds of Measure Range of 9 kl					rical and
In accordance	e with:	FCC Part 15.1 Emissions Lin		ederal Regula	tions Part 47, S	Subpart B - Un	intentional R	adiators, Radi	ated
Section:		15.109					_		
Test Date(s)			2 - 11/16/20		EUT Serial	#:	7066		
Customer:			gnal Corpor	ation	EUT Part #:		None		
Project Num		13862-10			Test Techn		Bob Redou	•	
Purchase Or		None Lister	<u> </u>		Supervisor:		Rob McCol	lough	
Equip. Unde	r Test:	E-Navcon			Witness' N	ame:	None		
	R	Radiated Em	issions Test	Results Dat	a Sheet		Pa	ge: 1	of 1
EUT Lin	e Voltage:	. 1	2 VDC		EUT Pow	ver Frequen	cy:	- N/A	
Antenna	Orientatio	n:	Vertic	al	Frequ	ency Range:		Above 10	GHz
	EUT N	lode of Ope	ration:			St	reaming Da	ita	
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level (dBµV/m)	Margin (dB)	Test Results
18562.3		(Degrees)	-	Avorage	33.3	29.00	60.0	21.0	Dace
20366.4	3	111	<u> </u>	Average Average	34.6	30.8	60.0	-31.0 -29.2	Pass Pass
22956.3	3	262	1	Average	34.9	33.2	60.0	-26.8	Pass
24361.5	3	143	1	Average	35.2	34.6	60.0	-25.4	Pass
Radiated E	,	EMI, Inc red at 1m and Scal rity Measured Em				▽ Cor — Pea	erage Limit Level rrected Average I ak Limit Level rrected Peak Rea	Reading	SIONAL
Field Strength 20 20 20 20 20 20 20 20 20 20 20 20 20	V	(padinating paning)	Y		e de la constitución de la const	Y	Ÿ	A CONTRACTOR OF THE CONTRACTOR	26.5G
•	Bob Redoutey Kband_FCC.til			Fre de: Streaming Data ver: 12VDC	quency		EUT: E-Navcon Project Number: 1	3862-10	

Measured Di	e with: Deer: Her #: Test: Re Voltage: Orientatio	FCC Part 15.1 Emissions Lin 15.109 11/15/2012 Tideland Si 13862-10 None Listed E-Navcon	2003: "Method uipment in the 109 - Code of F nits 2 - 11/16/20 gnal Corpor		nent of Radio- iz to 40 GHz" (ions Part 47, S EUT Serial # EUT Part #: Test Techni Supervisor: Witness' Na	Noise Emissic (incorporated Subpart B - Un	7066 None Bob Redou	, see §15.38). Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia	ated
In accordance of Section: Test Date(s): Customer: Project Number Purchase Orde Equip. Under T EUT Line of Section of Section: Antenna Or Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	e with: Deer: Her #: Test: Re Voltage: Orientatio	FCC Part 15.1 Emissions Lin 15.109 11/15/2012 Tideland Si 13862-10 None Listed E-Navcon	uipment in the 1.09 - Code of F nits 2 - 11/16/20 gnal Corpor d	e Range of 9 kH Federal Regulat 112 Pation	EUT Serial # EUT Part #: Test Techni Supervisor: Witness' Na	(incorporated Subpart B - Un #: ician:	7066 None Bob Redou	, see §15.38). Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia Radiators, Radia	ated
Section: Test Date(s): Customer: Project Numbe Purchase Orde Equip. Under T EUT Line V Antenna Or Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	oer: der #: Test: R e Voltage: Orientatio	Emissions Lin 15.109 11/15/2012 Tideland Si 13862-10 None Listed E-Navcon	nits 2 - 11/16/20 gnal Corpor d	o12 ation	EUT Serial # EUT Part #: Test Techni Supervisor: Witness' Na	#: ician:	7066 None Bob Redou Rob McCo None	utey Ilough	
Test Date(s): Customer: Project Numbe Purchase Orde Equip. Under T EUT Line V Antenna Or Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	der #: Test: R e Voltage: Orientatio	11/15/2017 Tideland Si 13862-10 None Listed E-Navcon Radiated Em	gnal Corpor	ation	EUT Part #: Test Techni Supervisor: Witness' Na	ician:	None Bob Redou Rob McCo None	llough	
Customer: Project Numbe Purchase Orde Equip. Under T EUT Line V Antenna Or Frequency Measured Di (MHz) (N 18571.9 20333.2 22177.9	der #: Test: R e Voltage: Orientatio	Tideland Si 13862-10 None Listed E-Navcon Radiated Em	gnal Corpor	ation	EUT Part #: Test Techni Supervisor: Witness' Na	ician:	None Bob Redou Rob McCo None	llough	
Project Number Purchase Orde Equip. Under T EUT Line V Antenna Or Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	der #: Test: R e Voltage: Orientatio	13862-10 None Listed E-Navcon Radiated Em	d issions Test		Test Techni Supervisor: Witness' Na	ician:	Bob Redou Rob McCo None	llough	
Frequency Measured (MHz) (NHz) 20333.2 22177.9	der #: Test: R e Voltage: Orientatio	None Listed E-Navcon Radiated Em	issions Test	Results Data	Supervisor: Witness' Na		Rob McCo None	llough	
EUT Line V Antenna Or Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	Test: R e Voltage: Orientatio	E-Navcon Radiated Em	issions Test	Results Data	Witness' Na		None		
Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	R e Voltage: Orientatio	Radiated Em		Results Data		ame:			
Frequency Measured (MHz) (N 18571.9 20333.2 22177.9	e Voltage: Orientatio	1		Results Data	Sheet		D:	.go. 1	
Antenna Or Frequency Measured (MHz) (M 18571.9 20333.2 22177.9	Orientatio		2 VDC				٠,٠	ige: 1	of 1
Frequency Measured (MHz) (N 18571.9 20333.2 22177.9		n·			EUT Pow	er Frequen	су:	- N/A	
Measured (MHz) (N 18571.9 20333.2 22177.9	EUT N	•••	Horizon	ital	Freque	ency Range:	}	Above 10	iHz
Measured (MHz) (N 18571.9 20333.2 22177.9	EUT Mode of Operation: Streaming Data								
18571.9 20333.2 22177.9	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBµV)	Corrected Level (dBµV/m)	Limit Level		Test Results
20333.2 22177.9	3	310	1	Average	33.1	29.0	60.0	-31.0	Pass
22177.9	3	302	1	Average	34.6	20.3	60.0	-31.0	Pass
,	3	75	1	Average	34.7	22.2	60.0	-37.8	Pass
	3	234	1	Average	35.3	34.7	60.0	-25.2	Pass
	nissions, Measur	EMI, Inc ed at 1m and Scal plarity Measured I				▽ Cor — Pea	rage Limit Level rected Average I k Limit Level rected Peak Rea	Reading	IONAL I N 6
20 10 18.0G Operator: Bob	Y	A CONTRACTOR OF THE PARTY OF TH	¥	Freque: Streaming Data	y uency		UT: E-Navcon		26.5G

> 1GHz Horizontal Antenna Polarity Measured Emissions

6.2.7 Radiated emissions, Enclosure; Measurement Bandwidths

	Professional Te	esting, EMI, Inc.	
Test Method:	CISPR 16-2: Specification for radio d	isturbance and immunit	y measuring apparatus and methods
rest Method:	- Part 2: Methods of measurement	of disturbance and imm	unity
	IEC 60945, Fourth Edition, 2002-08 I	Maritime navigation and	radio communication equipment
In accordance with:	and systems - General Requirement	s - Methods of testing a	nd required test results
Section:	Section 9 Electromagnetic emission	 Methods of testing an 	d required test results
Test Date(s):	11/15/2012 - 11/16/2012	EUT Serial #:	7066
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	None Listed	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Bandwidth and Measurement Time Used for Testing - 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.

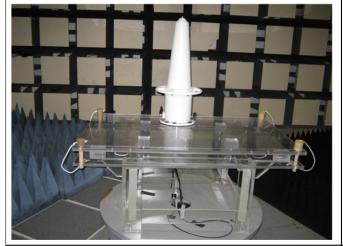
^{5.} The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

6.2.8 Radiated emissions, Enclosure; Setup Photographs

	Professional	Testing, EMI, Inc	с.
Test Method:	CISPR 16-2: Specification for radi	o disturbance and immu	unity measuring apparatus and methods
rest iviethou:	- Part 2: Methods of measureme	nt of disturbance and in	nmunity
	IEC 60945, Fourth Edition, 2002-0	8 Maritime navigation	and radio communication equipment
In accordance with:	and systems - General Requireme	ents - Methods of testin	g and required test results
Section:	Section 9 Electromagnetic emissi	on – Methods of testing	and required test results
Test Date(s):	11/15/2012 - 11/16/2012	EUT Serial #:	7066
Customer:	Tideland Signal Corporation	EUT Part #:	None
Project Number:	13862-10	Test Technician:	Bob Redoutey
Purchase Order #:	None Listed	Supervisor:	Rob McCollough
Equip. Under Test:	E-Navcon	Witness' Name:	None

Radiated Emissions Photographs

Page: 1 of 1





Front Rear



Support Equipment

6.2.9 Radiated emissions, Enclosure; Equipment List

0.2.7			<u> </u>						
		Profes	sional Te	sting, EMI, Inc.					
Test Metho	u.			sturbance and immunity f disturbance and immu		atus and methods			
		•	-	aritime navigation and		• •			
In accordan Section:					and required test results nd required test results				
Test Date(s)		5/2012 - 11/16/201		EUT Serial #:	7066	iits			
Customer:		and Signal Corpora		EUT Part #:	None				
Project Nun Purchase O			-	Test Technician:	Rob McCollough				
Equip. Unde		Listed /con		Supervisor: Witness' Name:	None				
			•						
				Test Equipment List					
Til	le! Software Version	,		0, 08:38:52 AM					
	Test Profile:	Radia	ited Emission	s_Profile Version Octob	er 12, 2011	Calibration			
Asset #	Manufacturer	Model	Equipm	ent Nomenclature	Serial Number	Due Date			
1509A	Braden	N/A	TDK 10M C	hamber, 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 Ar	nalyzer, 3 Hz - 26.5 GHz	MY45304903	6/19/2013			
1926	ETS-Lindgren	3142D	Antenna, Bio	conilog, 26 MHz - 6 GHz	00135454	7/24/2013			
C027	N/A	RG214	Cable	Coax, N-N, 25m	none	9/7/2013			
1327	EMCO	1050	Control	ler, Antenna Mast	none	N/A			
0942	EMCO	11968D	Τι	urntable, 4ft.	9510-1835	N/A			
1969	HP	11713A	Attenua	ator/Switch Driver	3748A04113	N/A			
6	EMCO	6502	Antenna, Lo	oop, Active, .01-30MHz	1030	4/26/2013			
1509B	Braden	N/A	TDK 10M Ch	namber, VSWR > 1 GHz	DAC-012915-005	4/8/2013			
1594	Miteq	AFS44-00102650	Amplifie	er, 1-26.5GHz, 42dB	none	10/15/2013			
2004	Miteq	AFS44-00101800- 2S-10P-44	Amplifi	er, 40dB, .1-18GHz	0	12/12/2012			
C030	N/A	0	Cable	Coax, N-N, 30m	none	9/7/2013			
1780	ETS-Lindgren	3117	1	Double Ridged Guide rn, 1 - 18 GHz	00110313	1/19/2013			
1325	EMCO	1050	Control	ler, Antenna Mast	9003-1461	N/A			

6.3 Radiated emissions, Enclosure; 26.5 to 40 GHz

The tests were performed in a semi-anechoic shielded room. The EUT was placed on a rotatable non-metallic table 80 cm above the reference plane. Where earth bonding was provided on the EUT, the earth connection was attached to the reference plane.

Support equipment, including a laptop verifying operation of the EUT, were placed on the table. The lead-based 12 Volt battery source was placed on the lower section of the turntable.

Measurement equipment was also located inside the chamber such that signals were captured directly from horn antenna to the external harmonic mixer. The spectrum analyzer hosting the harmonic mixer was supplied with the conversion loss data for the harmonic mixer. To overcome path loss the measurement distance was 0.5 meters. The number of sweep points was increased from default 600 to 2000 to improve frequency granularity.

Radiated emissions above 26.5 GHz are required to be under 500 μ V/m as measured at a distance of 3 meters per 47 CFR 15.209. This limit becomes 69.6 dB μ V/m at 0.5 meters.

Results of the emission measurements appear in the following pages. Measurement was performed using peak detection and max-hold during the entire turntable rotation. No emissions were identified from the EUT. The EUT satisfied the relevant requirements.

6.3.1 Radiated emissions, Enclosure; 26.5 to 40 GHz

		Professiona	l Te	sting, EMI,	Inc.					
Test Method:		2003: "Methods of Me uipment in the Range					·		ical and	d
In accordance with:	FCC Part 15.2 Limits	09 - Code of Federal I	Regulat	ions Part 47, Subp	art C - Int	entional	Radiators,	Radiate	d Emiss	sions
Section:	15.209									
Test Date(s):	2/28/2014	8/2014 EUT Serial #: 7065								
Customer:	Tideland Si	gnal Corporation		EUT Part #:		None				
Project Number:	13862-10			Test Technicia	n:	Eric Lif	sey			
Purchase Order #:	None Listed	1		Supervisor:		Rob M	cCollough	1		
Equip. Under Test:	E-Navcon			Witness' Name	e:	None				
ı	Radiated Em	issions Test Result	ts Data	Sheet			Page:	1	of	1
EUT Line Voltage	: 1	2 VDC		EUT Power I	Frequen	су:	- N/A			
Antenna Orientatio	on:	Vertical		Frequency Range: Above 1GHz						
EUT N	Mode of Ope	ration:			St	reamin	g Data			
Agilent 13:	-24-00 F	eb 28, 2014	1							
	A STATE OF A STATE OF THE STATE									
Ref 87 dB µ V	.21.00	Ext Mix					Mkr1	27.4 39.95		
Ref 87 dB µ V Norm		No. 100 III Control of the Control o								
Ref 87 dB µ V Norm Log 10		No. 100 III Control of the Control o								μ۷
Ref 87 dB µ V Norm Log		No. 100 III Control of the Control o								μ۷
Ref 87 dB µ V Norm Log 10		No. 100 III Control of the Control o								μ۷
Ref 87 dB µ V Norm Log 10		No. 100 III Control of the Control o								μ۷
Ref 87 dB µ V Norm Log 10		No. 100 III Control of the Control o								μ۷
Ref 87 dBµV Norm Log 10 dB/		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/ LgAv V1 S2 S3 FC		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/ LgAv V1 S2 S3 FC A £(f): FTun		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/ LgAv V1 S2 S3 FC A £(f):		No. 100 III Control of the Control o								μ۷
Ref 87 dBpV Norm Log 10 dB/ LgAv V1 S2 S3 FC A £(f): FTun	Ø GHz	Ext Mix		3 MHz	Sweer	33.		an 13	dB	# *

		Pro	fessiona	ıl Testi	ng, EMI, I	lnc.			
Test Method:					of Radio-Noise 40 GHz" (incorp			_	ical and
In accordance with:	FCC Part Limits	t 15.209 - Co	de of Federal I	Regulations	Part 47, Subpar	t C - Intention	nal Radiators,	Radiate	d Emissions
Section:	15.209								
Test Date(s):	2/28/2	014		EU	Serial #:	7065			
Customer:		ideland Signal Corporation			Fart #:	None	<u> </u>		
Project Number:	13862-	3862-10			t Technician:	Eric L	.ifsey		
Purchase Order #:	None L	lone Listed			ervisor:	Rob I	McColloug	h	
Equip. Under Test:	E-Navo	-Navcon Witness' Name: No				None	?		
	Radiated	d Emission:	s Test Result	ts Data Sh	eet		Page:	1	of 1
EUT Line Voltage	::	12	VDC		UT Power Fr	equency:	-	N/A	
Antenna Orientati	on:	He	orizontal		Frequency l	Range:	ge: Above 1GHz		
EUT I	Mode of	Operation	ո։		Streaming Data				
Agilent 13	:28:20	7 Feb	28, 2014	4					
Ref 87 dB µ V			Ext Mix				Mkr1		26 GH 'dB µ V
Norm Log 10 dB/									*
LgAv	† \$			-	الدود وفاحت دوروناه د	teat the street last	-		-

VBW 3 MHz

Span 13.5 GHz Sweep 33.85 ms (2000 pts)

Center 33.250 0 GHz #Res BW 1 MHz

6.3.2 Radiated emissions, Bandwidths

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: Section:	and systems - General R	EC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment nd systems - General Requirements - Methods of testing and required test results ection 9 Electromagnetic emission – Methods of testing and required test results					
Test Date(s): Customer:	2/28/2014 Tideland Signal Corpora	tion	EUT Serial #: 7065 EUT Part #: None				
Project Number: Purchase Order #:	13862-10 None Listed		Test Technician: Eric Lifsey Supervisor: Rob McCollough				
Equip. Under Test: Radia	E-Navcon ted Emissions Bandwidtl	h and Meas	Witness' Na urement Tim		None esting - Peak	c Scan	
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)			per of s Used	Measurement Time per Range	
26500	40000	10	000		1	Multiple Sweeps	

6.3.3 Radiated emissions, Enclosure; Equipment List

	Professional Testing, EMI, Inc.									
Test Method	d:	•		isturbance and immunity of disturbance and immu	• • • • • • • • • • • • • • • • • • • •	atus and methods				
	IEC (0945, Fourth Editio	n, 2002-08 N	Maritime navigation and	radio communicati	on equipment				
In accordance	ce with: and	systems - General R	Requirement	s - Methods of testing ar	d required test res	sults				
Section:	Sect	on 9 Electromagnet	tic emission	 Methods of testing and 	l required test resu	ılts				
Test Date(s)	: 2/28	/2014		EUT Serial #:	7065					
Customer:	Tide	and Signal Corpora	ition	EUT Part #:	None					
Project Num	nber: 1386	2-10		Test Technician:	Eric Lifsey					
Purchase Or		e Listed		Supervisor:	Rob McCollough					
Equip. Unde	er Test: E-Na	vcon		Witness' Name:	None					
		Radiate	ed Emissions	Test Equipment List						
Til	e! Software Vers	on: 4.2.A	, May 23, 20:	10, 08:38:52 AM						
	Test Profile:	Radia	ted Emissio	ns_Profile Version Octob	er 12, 2011					
Asset #	Manufacturer	Model	Equipr	ment Nomenclature	Serial Number	Calibration Due Date				
1930	Agilent	E4440A-239	Spectrum A	Analyzer, 3 Hz - 26.5 GHz	MY45304903	7/11/2015				
942	EMCO	11968D	Т	Furntable, 4ft.	9510-1835	N/A				
1509B	Braden	N/A	TDK 10M C	Chamber, VSWR > 1 GHz	DAC-012915-005	7/16/2014				
1325	EMCO	1050	Contro	oller, Antenna Mast	9003-1461	N/A				
2063	НР	11970A	Mixer, Ha	armonic, 26.5 - 40 GHz	3003A08717	N/A				
1735	Pasternack	PE9850-20	Ante	enna, horn, WR28	N/A	N/A				

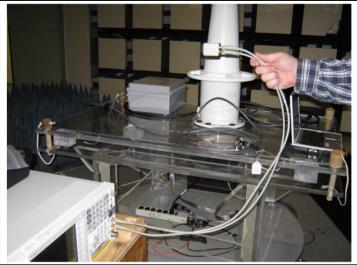
6.3.4 Radiated emissions, Enclosure; Setup Photographs

Professional Testing, EMI, Inc.								
Tost Mathod	CISPR 16-2: Specification for radio disturbance and immunity measuring apparatus and methods							
rest Method:	- Part 2: Methods of measurement of disturbance and immunity							
	IEC 60945, Fourth Edition, 2002-08 Maritime navigation and radio communication equipment							
In accordance with:	and systems - General Requirements - Methods of testing and required test results							
Section:	Section 9 Electromagnetic emissi	on – Methods of testing	and required test results					
Test Date(s):	2/28/2014	EUT Serial #:	7065					
Customer:	Tideland Signal Corporation	EUT Part #:	None					
Project Number:	13862-10	Test Technician:	Eric Lifsey					
Purchase Order #:	None Listed	,						
Equip. Under Test:	E-Navcon	Witness' Name:	None					

Radiated Emissions Photographs







EUT EUT and Measurement Equipment

7.0 Fundamental Output Power, AIS AtoN

7.1 Procedure

The EUT was placed on a non-conductive support 3 meters from the measurement antenna and turned a full rotation to find and record the maximum emission.

Results 7.2

To function/transmit, the EUT required an outdoor measurement to enable the AIS transmitter as a GPS signal is required for the AIS protocol to synchronize to the selected TDMA time slot.

	Professional Testing (EMI), Inc. Radiated Emissions Measured Outdoors										
V 3.0	V 3.0										
Client:	Tideland				Polarity:	Vertical		Distance:	3	meter	
Test Date:	May 20, 201	3			EUT:	E-Navcon, A	IS AtoN				
Voltage:	Voltage: Battery Powered Serial #: 7065										
Frequency:	n/a				Project #:	13862-15					
Technician:	Eric Lifsey				Test Type:	RF P	ower	Class:	N	J/A	
		Corrected	l Level = Rec	orded Level	- Amplifier G	ain + Antenn	a Factor + C	able Loss			
	EUT	Antenna	Recorded		Antenna		Corrected				
Frequency	Direction	Elevation	Level	Amplifier	Factor	Cable Loss	Level			Detector	
(GHz)	(degrees)	(Meters)	(dBuV)	Gain (dB)	(dB/m)	(dB)	(dBuV/m)	EIRP (W)		Function	
0.161976	0	1	112.64	0.0	12.9	1.40	126.9	1.47		Peak	

	Professional Testing (EMI), Inc. Radiated Emissions Measured Outdoors										
V 3.0	V 3.0										
Client:	Tideland				Polarity:	Horizontal		Distance:	3	meter	
Test Date:	Test Date: May 20, 2013 EUT: E-Navcon, AIS AtoN										
Voltage: Battery Powered Serial #: 7065											
Frequency:	n/a				Project #:	13862-15					
Technician:	Eric Lifsey				Test Type:	RF F	Power	Class:	N	I/A	
		Corrected	l Level = Rec	orded Level	- Amplifier G	ain + Antenn	a Factor + C	Cable Loss			
	EUT	Antenna	Recorded		Antenna		Corrected				
Frequency	Direction	Elevation	Level	Amplifier	Factor	Cable Loss	Level			Detector	
(GHz)	(degrees)	(Meters)	(dBuV)	Gain (dB)	(dB/m)	(dB)	(dBuV/m)	EIRP (W)		Function	
0.16204	90	1	102.72	0.0	12.9	1.40	117.0	0.15		Peak	

Results Compared to Regulatory Limit FCC 80.215(c)(2) Marine utility stations.

EIRP Measured, Peak	EIRP Limit, Peak
1.47 W (31.7 dBm)	10 W (40 dBm)

Tideland Signal Corporation, E-Navcon System, Project 13862-10

Equipment List

Asset Number	Make / Model	Description	Calibration Due
C235	Unknown	Cable SMA-SMA	9/3/2013
0943	EMCO 3110B	Antenna, Bicon	12/04/2013
Rental	Rohde FSP-30	Spectrum Analyzer	1/29/2015

8.0 Fundamental Output Power, RACON, X Band

8.1 Procedure

The EUT is placed on a motorized 80 cm high non-conductive turntable, 1 meter from the measurement antenna, and turned a full rotation to find to record the maximum emission. The EUT transmits only when it receives a pulsed signal in the X band. A signal generator is connected to an extra horn antenna to direct a pulse modulated in-band signal at the EUT to create an artificial interrogation signal. The EUT transmitted response is recorded for peak amplitude and recorded in the time domain to verify the Morse code signal which clearly identifies the EUT as source of the signal.

8.2 Results

The interrogation signal successfully provoked the EUT into transmitting the expected Morse code signal which decoded as the Morse letter Q. Maximum polarity was determined manually then the measurement was recorded.

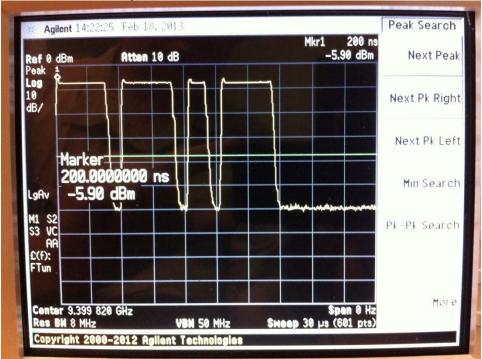
Calibration of the interrogation signal generator and stimulation antenna was not required as they did not affect the measurement.

V 3.0	Professional Testing (EMI), Inc. Radiated Emissions Measured Indoors V 3.0										
Client:	Tideland				Polarity:	Horizontal		Distance:		1	meter
Test Date:	February 18,	2013			EUT:	E-Navcon, R	ACON Secti	on			
Voltage:	Battery Powe	ered			Serial #:	7065					
Frequency:	n/a				Project #:	13862-15					
Technician:	Eric Lifsey				Test Type:	RF P	ower	Class:		N	V/A
		Corre	cted Level =	Recorded Le	vel - Amplifi	er Gain + Ant	enna Factor	+ Cable Loss	S		
Frequency: MHz	Height / Table	FS in dBm Measured	FS in dBμV Converted	Cable Loss	Antenna Factor	FS in dBµV/m Corrected	EIRP dBm				
9399.82	1.3 / 340	-5.9	101.1	6.7	37.7	145.5	40.73				

Results Compared to Regulatory Limit FCC 80.215(n)(3)

	y
EIRP	EIRP
Measured, Peak	Limit, Peak
11.83 W (40.73 dBm)	20 W (43 dBm)





Equipment List

Asset Number	Make / Model	Description	Calibration Due
C092	Pasternack	Cable	2/18/2013
0267	EMCO 3115	Antenna, Horn	11/15/2013
MY46180615	Agilent E4446A	Spectrum Analyzer	2/14/2013
0547	Gigatronics	Signal Generator	NCR*
Unspecified	EMCO unspecified horn	Antenna, Horn	NCR*

^{*}Calibration not required for this test.

9.0 RF Exposure Calculation

Collocated RF exposure will be calculated using the maximum output power as measured elsewhere in this report. As this device is to be fielded and used without operator intervention and in locations typically not accessed by personnel, the exposure distance to be used for MPE calculations will be 1 meter. The Racon and AIS AtoN output field density shall be summed to calculate the combined maximum RF exposure and demonstrate compliance with applicable standards.

The results of power measurement and intended use/proximity are compared against the requirements for safety of RF exposure. The co-location sum of exposure is performed.

9.1 Criteria

Section Reference	Date
FCC 2.1091, FCC OET Bulletin 65, RSS-102, EN 62311	March 4, 2014

Procedure 9.2

Using measurement of peak power and intended application, determine the permissible exposure level or whether additional exposure tests (SAR) are indicated. Justify conclusion for selected exposure area and separation distance.

Results 9.3

This composite device is located in typically remote locations on waterway navigational hazards or buoys. It is installed or serviced by trained individuals only. A separation distance of 1 meter was selected for Occupational Controlled exposure and applied to limit calculation.

Antenna port power was determined from a radiated measurement. As both devices operate/transmit independently and closely colocated, the evaluation requires the exposure contributions to be summed.

156 MHz AiS

Measured Power
EIRP
1469.3 mW*

^{*}This is the peak measurement.

9300 MHz RACON

0000 MILE 11/10011
Measured Power
EIRP
11830 mW*

^{*}This is the peak measurement.

Limit of MPE for SAR Exclusion Threshold for 156-162 MHz, Occupational/Controlled:

$$f_{(MHz)} = 30 - 300 \text{ MHz} = 1.0 \text{ mW/cm}^2$$

Ref. FCC Bulletin OET-65 Table 1(A)

Field density is determined at 100 cm as:

$$S = EIRP / (4 \pi 100^2)$$

Ref. FCC Bulletin OET-65 Equation (4)

 $S = 1469.3 \, \text{mW} / 125663.7 \, \text{cm}^2$

 $S = 0.0117 \text{ mW/cm}^2$

Percentage of Exposure: 0.0117 / 1.0 = 1.17%

Limit of MPE for SAR Exclusion Threshold for 9300 MHz, Occupational/Controlled:

Ref. FCC Bulletin OET-65 Table 1(A)

Field density is determined at 100 cm as:

$$S = EIRP / (4 \pi 100^2)$$

Ref. FCC Bulletin OET-65 Equation (4)

 $S = 11830 \text{ mW} / 125663.7 \text{ cm}^2$

 $S = 0.0941 \text{ mW/cm}^2$

Percentage of Exposure: 0.0941 / 5.0 = 1.88%

Percentages are summed below to determine co-location total exposure.

Total exposure: 1.17% + 1.88% = 3.05%

The summed power is below the SAR Exclusion Threshold of 100%, it therefore meets the criteria for exclusion from SAR testing.