An IIA Company

Test Report - FCC PART 1.1310 / MPE
Applicant: Navico Inc.

Approved for Release By:

Signature: Bruno Clavier

Name & Title: Bruno Clavier, General Manager

Date of Signature 8/12/2022

Table of Contents

1. Customer Information

Applicant: Navico Inc.
Address: 4500 S. 129th East Avenue
Suite 200
Tulsa Oklahoma, 74134-5885, United States

2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA"). Testing was performed at Timco's permanent laboratory located at 849 NW State Road 45, Newberry, Florida 32669

FCC test firm # 578780
FCC Designation # US1070
FCC site registration is under A2LA certificate # 0955.01
ISED Canada test site registration # 2056A
EU Notified Body # 1177
For all designations see A2LA scope # 0955.01

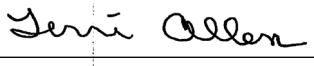
2.2 Testing was performed, reviewed by

Dates of Testing: 10/29/2021 – 11/18/2021

Signature:  Sr. EMC Engineer EMC-003838-NE

Name & Title: Tim Royer, EMC Engineer

Date of Signature 8/12/2022

Signature: 

Name & Title: Terri Allen, Technical Assistant

Date of Signature 8/12/2022

3. Test Sample(s) (EUT/DUT)

The test sample was received: 10/29/2021

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

Identification	
FCC ID:	RAYHALO3000
Brief Description	SIMRAD HALO 3000 SERIES Pulse Compression Radar
Model(s) #	HALO 3000 SERIES
Firmware version	n/a
Software version	8.1.99.91
Serial Number	2106951005

Technical Characteristics	
Technology	Pulse Compression Radar
Frequency Range	9.3 GHz – 9.5 GHz
Rated RF O/P Power	130 W
Modulation	Pulse/ FM Chirp
Bandwidth & Emission Class	PON
Duty Cycle	8.0 %
Antenna Connector	WR90
Voltage Rating (AC or Batt.)	12V DC

Antenna Characteristics		
Frequency Range	Mode / BW	Antenna Gain
9.3 GHz – 9.5 GHz	n/a	29 dBi

4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance:

The following guidance FCC KDB 447498 D01 General RF Exposure Guidance v06 and FCC KDB 865664 D02 RF Exposure Reporting v01r02 sec. 2.2 was used for RF exposure evaluation as per FCC Part 1.1310 and FCC Part 2.1091 and part 2.1093. Full test results are available in this report.

4.1.1 FCC Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging Time (minutes)
A Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
B Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*($180/f^2$)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

4.2 Applied Limits and Regulatory Limits:

1) FCC PART 1.1310

5. Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Emissions	± 3.14 dB
Radiated Emissions (9kHz – 30 MHz)	± 3.08 dB
Radiated Emissions (30 – 200 MHz)	± 2.16 dB
Radiated Emissions (200 – 1000 MHz)	± 2.15 dB
Radiated Emissions (1 GHz – 18 GHz)	± 2.14 dB
Radiated Emissions (18 GHz – 40 GHz)	± 2.31 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6. Environmental Conditions

6.1 Temperature & Humidity

Measurements performed at the test site did not exceed the following:

Parameter	Measurement
Temperature	23 C +/- 5%
Humidity	55% +/- 5%
Barometric Pressure	30.05 in Hg
Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.	

7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer's model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

7.1 List of Test Equipment

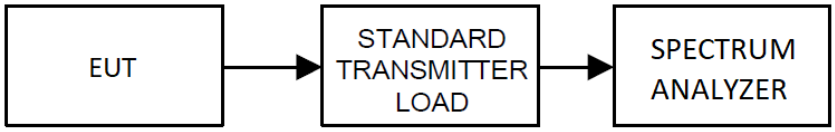
Test Equipment						
Type	Device	Manufacturer	Model	SN#	Current Cal	Cal Due
Field Probe Meter	E-Field, H-Field, B-Field Probe Handheld Meter	Wave Control	SMP2	20SN1400	8/19/20	8/19/2023
Field Probe	E-Field Probe	Wave Control	WPF8	20WP041171	8/19/20	8/19/2023

Software			
Software	Author	Version	Validation on
ESU Firmware	Rohde & Schwarz	4.43 SP3; BIOS v5.1-24-3	2018
RSCommander	Rohde & Schwarz	1.6.4	2014
ScopeExplorer	LeCroy	v2.25.0.0	2009
Field Strength	Timco	v4.10.7.0	2016

7.2 RF Output Power

Limits from FCC Parts 2.1046(a), and 90.205 (r); and test procedure from ANSI C63.26-2015.

Test Setup



Mode	Center Freq (MHz)	Duty Cycle (%)	Measured output (dBm)	Loss (dB)	Mean Power (dBm)	Mean Power (W)	Peak Power (W)
64 nm	9390.00	6.63%	-4.40	43.50	39.100	8.128	122.599
0.125 nm	9390.00	0.01%	-31.80	43.50	11.700	0.015	147.911
1.5 nm	9390.00	2.86%	-7.90	43.50	35.600	3.631	126.950
6 nm	9390.00	10.03%	-3.10	43.50	40.400	10.965	109.320
1nm	9408.00	2.89%	-7.90	43.50	35.600	3.631	125.633
2 nm	9434.00	6.73%	-5.40	43.50	38.100	6.457	95.937
0.75 nm	9452.00	2.89%	-7.90	43.50	35.600	3.631	125.633
4nm	9476.00	10.03%	-2.60	43.50	40.900	12.303	122.659
12 nm	9496.00	10.03%	-2.70	43.50	40.800	12.023	119.867

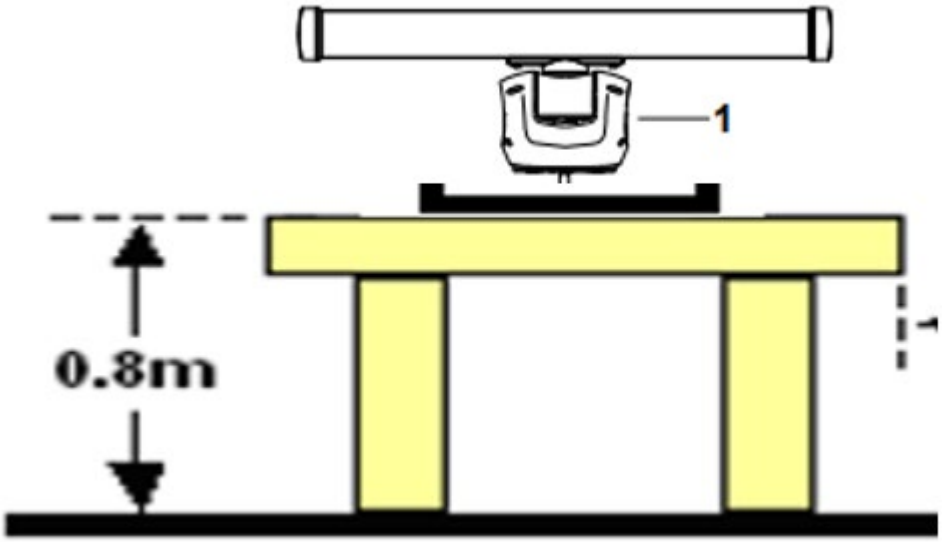
Note: The mean power was calculated based on formula:

Pa = Pm*DC

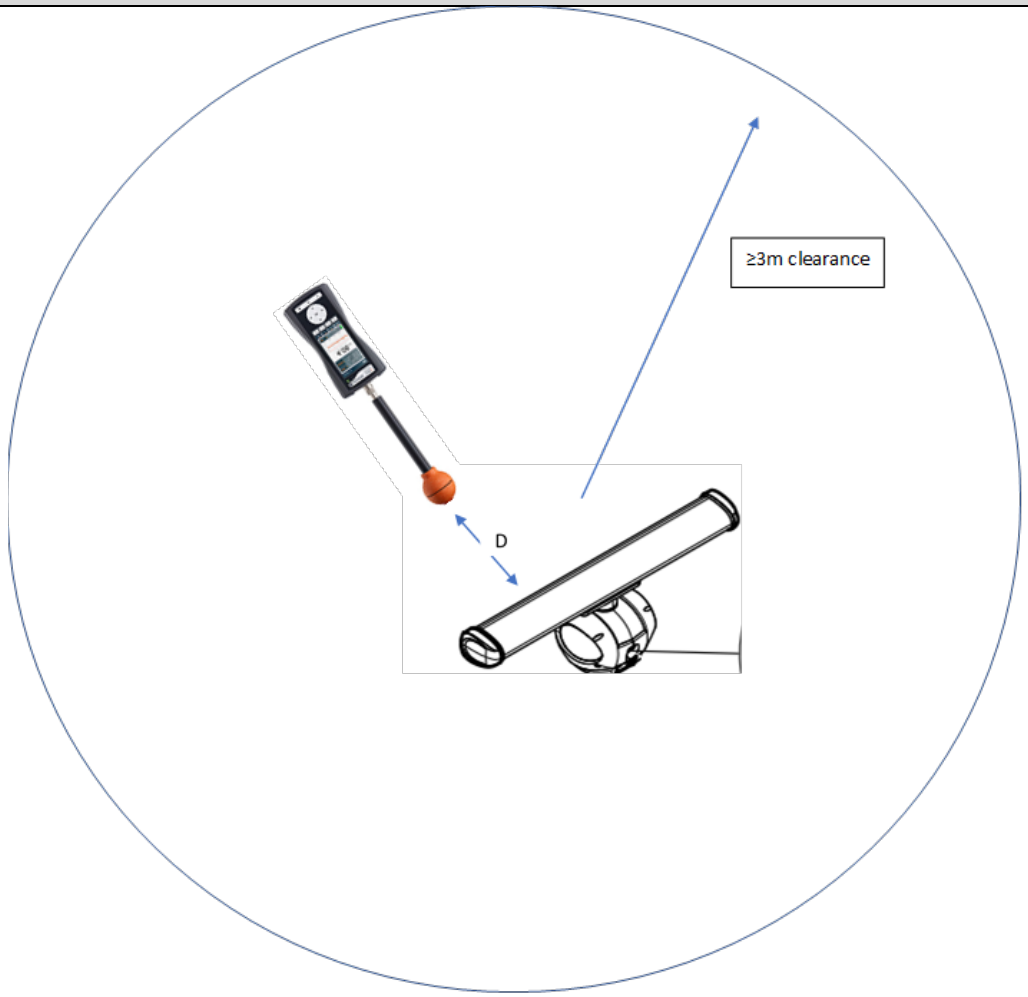
8. RF Exposure Results

MPE Measurements		
Bird 1/8 mi. 150ns		
Distance	Measurement	Distance
3 ft	1 mW/ cm2	158.45 cm
4 ft	1 mW/ cm2	177.79 cm
6 ft	1 mW/ cm2	177.97 cm

MPE Measurement Setup



MPE Measurement



9. History of Test Report Changes

Test Report #	Revision #	Description	Date of Issue
TR_5474-21_FCC PT 1.1310/ MPE_	1	Initial release	2/01/2022
	2	Updated Pages 5, 8	3/18/2022
	3	Removed Section 4, updated page 8	5/25/2022
	4	Updated page 7	6/6/2022
	5	Added sections 4.2 – 7.1, updated pages 9 & 10	7/28/2022
	6	Updated Page 5	7/29/2022
	7	Added section 7.2 updated page10	8/5/2022
	8	Updated page 9	8/12/2022

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END OF TEST REPORT