



# 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 6/8/2022

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(352) 472-5500 / [testing@timcoengr.com](mailto:testing@timcoengr.com)

## 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



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## 2.2 Testing was performed, reviewed by

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

Signature:

A handwritten signature in dark ink, appearing to read "Tim Royer", written over a horizontal line.

Sr. EMC Engineer  
EMC-003838-NE



Name & Title:

Tim Royer, EMC Engineer

Date of Signature

6/8/2022

Signature:

A handwritten signature in dark ink, appearing to read "Terri Allen", written over a horizontal line.

Name & Title:

Terri Allen, Technical Assistant

Date of Signature

6/8/2022



### 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:           | RAYHALO2000                                     |
| Brief Description | SIMRAD HALO 2000 SERIES Pulse Compression Radar |
| Model(s) #        | HALO 2000 SERIES                                |
| Firmware version  | 8.1.99.91                                       |
| Software version  | 8.1.99.91                                       |
| Serial Number     | 2106950004                                      |

| Technical Characteristics    |                         |
|------------------------------|-------------------------|
| Technology                   | Pulse Compression Radar |
| Frequency Range              | 9.3 GHz - 9.5 GHz       |
| RF O/P Power (Max.)          | 50W                     |
| Modulation                   | Pulse/ FM Chirp         |
| Bandwidth & Emission Class   | PON                     |
| Duty Cycle                   | 9.0 %                   |
| 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 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 <sup>2</sup> ) | 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 <sup>2</sup> )              | <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 <sup>2</sup> )              | <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 Equations

### POWER DENSITY

$$E(V/m) = \text{SQRT} ( 30 * P * G ) / d$$

$$Pd(W/m^2) = E^2 / 377$$

$$S = \text{EIRP} / ( 4 * \text{Pi} * D^2 )$$

Where:

S = Power density, in mW/cm<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power, in mW

D = Separation distance in cm

Power density is converted from units of mW/cm<sup>2</sup> to units of W/m<sup>2</sup> by multiplying by 10.

### DISTANCE

$$D = \text{SQRT} ( \text{EIRP} / ( 4 * \text{Pi} * S ) )$$

Where:

D = Separation distance in cm

EIRP = Equivalent Isotropic Radiated Power, in mW

S = Power density in mW/cm<sup>2</sup>

**SOURCE-BASED DUTY CYCLE** (When applicable (for example, multi-slot mobile phone applications) A duty cycle factor may be applied.)

$$\text{Source-based time-average EIRP} = ( \text{DC} / 100 ) * \text{EIRP}$$

Where:

DC = Duty Cycle in % as applicable.

EIRP = Equivalent Isotropic radiated Power, in mW



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## 5. RF Exposure Results

### MPE

| Frequency Band | Evaluation Distance (cm) | Max Power + Tolerance (dBm) | Antenna Gain (dBi) | Duty Cycle (%) | EIRP (W) | Power Density              | Limit for Uncontrolled Exposure | Limit for Controlled Exposure | Distance Required to meet Uncontrolled Exposure Limit (cm) |
|----------------|--------------------------|-----------------------------|--------------------|----------------|----------|----------------------------|---------------------------------|-------------------------------|--|
| 9300-9500 MHz  | 20                       | 66.03                       | 29.00              | 9%             | 4010.91  | 797.944 mW/cm <sup>2</sup> | 1 mW/cm <sup>2</sup>            | 5 mW/cm <sup>2</sup>          | 564.96   |

RESULT: Pass at DISTANCE 564.96 cm





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## 6. History of Test Report Changes

| Test Report #                  | Revision # | Description                | Date of Issue |
|--------------------------------|------------|----------------------------|---------------|
| TR_5479-21_FCC PT 1.1310/ MPE_ | 1          | Initial release            | 11/06/2021    |
|                                | 2          | Updated page 5, and page 8 | 3/18/2022     |
|                                | 3          | Updated Page 5, Added FVIN | 6/08/2022     |



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END OF TEST REPORT

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