**SGS-CSTC Standards Technical Services Co., Ltd.**
**Shenzhen Branch**

No. 1 Workshop, M-10, Middle section, Science & Technology Park,
Shenzhen, Guangdong, China 518057
Telephone: +86 (0) 755 2601 2053
Fax: +86 (0) 755 2671 0594
Email: ee.shenzhen@sgs.com



# RF Exposure Evaluation Report

| | |
|---|---|
| **Application No.:** | SZEM1807006922CR |
| **Applicant:** | Navico Inc. |
| **Address of Applicant:** | 4500 S. 129th East Avenue, Ste. 200, Tulsa, Oklahoma, 74134 United States |
| **Manufacturer:** | Navico Auckland Limited |
| **Address of Manufacturer:** | Arrenway Drive, Rosedale, Auckland, 0632 New Zealand |
| **Factory:** | Shenzhen Hytera Communications Corportion Limited |
| **Address of Factory:** | Hytera Techology Park, Baolong Industrial City, Longgang District, Shenzhen, China |
| **Product Name:** | Marine VHF Radio |
| **Model No.(EUT):** | Link-9 |
| **Trade Mark:** | LOWRANCE |
| **FCC ID:** | RAYVHFLINK9 |
| **Standards:** | 47 CFR Part 1.1307 (2016)<br>47 CFR Part 1.1310 (2016) |
| **Date of Receipt:** | 2018-07-31 |
| **Date of Test:** | 2018-08-10 to 2018-09-19 |
| **Date of Issue:** | 2018-09-25 |
| **Test Result :** | **PASS*** |

* In the configuration tested, the EUT complied with the standards specified above.

Keny Xu
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

# 2 Version

| Revision Record | | | | |
|---|---|---|---|---|
| **Version** | **Chapter** | **Date** | **Modifier** | **Remark** |
| 01 | | 2018-09-25 | | Original |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| **Authorized for issue by:** | | | | |
| | |  | | |
| | | **Edison Li /Project Engineer** | | |
| | |  | | |
| | | **Eric Fu /Reviewer** | | |

# 3 Contents

# 4 General Information

## 4.1 General Description of EUT

| | |
|---|---|
| Power supply: | 12 VDC battery system |
| Cable: | DC cable: longer than 300cm unshielded |
| Sample Type: | Mobile device |
| Transmitter Frequency Range: | 156.025MHz-157.425MHz |
| Receiver Frequency Range: | 156.05MHz-163.275MHz |
| AIS Receiver Frequency Range: | 161.975MHz(CH87), 162.025MHz(CH88) |
| GNSS Receiver Frequency Range: | 1559MHz-1610MHz(GLONASS:G1, GPS:L1) |
| Modulation Type: | Analog Voice: FM;<br>GNSS: BPSK |
| Frequency Spacing: | 25KHz |
| Emission Type: | 16K0G3E, 16K0G2B |
| Max Power: | 43.98dBm/30dBm |
| VHF Antenna Connectors: | SO-239(50 ohm, External Antenna) |
| VHF Antenna Gain: | 6dBi |
| GPS Antenna Connector: | SMA for External antenna;<br>Integral for Internal antenna |
| GPS Antenna Gain: | 1.5dBi |

## 4.2 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China 518057
Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594
No tests were sub-contracted.

## 4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• **VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• **FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• **Industry Canada (IC)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3..

## 4.4 Deviation from Standards

None.

## 4.5 Abnormalities from Standard Conditions

None.

## 4.6 Other Information Requested by the Customer

None.

# 5 RF Exposure Evaluation

## 5.1 RF Exposure Compliance Requirement

### 5.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—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 Exposures** | | | | |
| 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 |
| 300–1500 | ..... | ..... | f/300 | 6 |
| 1500–100,000 | ..... | ..... | 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 |
| 300–1500 | ..... | ..... | f/1500 | 30 |
| 1500–100,000 | ..... | ..... | 1.0 | 30 |

F= Frequency in MHz

Friis Formula

Friis transmission formula: $Pd = (Pout*G)/(4* Pi * R^2)$

Where

Pd = power density in $mW/cm^2$

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

For Uncontrolled Environment, the limit of MPE is 0.2 $mW/cm^2$ . If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

### 5.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

### 5.1.3 EUT RF Exposure Evaluation

### 1) Test Results

The best case gain of the antenna is 6dBi. 6dB logarithmic terms convert to numeric result is nearly 3.98.

| Test Frequency (MHz) | Maximun Antenna Gain (dBi) | Maximum Antenna Gain (Numeric) | Output Power (dBm) | Max Tune-up tolerance power (dBm) | Max Tune-up tolerance power*50% [a] (mW) | Power density ($mW/cm^2$) | Minimum Distance to Human body (cm) |
|---|---|---|---|---|---|---|---|
| 156.025 | 6 | 3.98 | 43.91 | 43.98 | 12501.73 | 0.20 | **140.72** |
| 156.025 | 6 | 3.98 | 29.43 | 30 | 500.00 | 0.20 | 28.14 |
| 156.300 | 6 | 3.98 | 43.79 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.300 | 6 | 3.98 | 30.00 | 30 | 500.00 | 0.20 | 28.14 |
| 156.650 | 6 | 3.98 | 43.9 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.650 | 6 | 3.98 | 29.88 | 30 | 500.00 | 0.20 | 28.14 |
| 156.800 | 6 | 3.98 | 43.91 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.800 | 6 | 3.98 | 30.00 | 30 | 500.00 | 0.20 | 28.14 |
| 157.425 | 6 | 3.98 | 43.92 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 157.425 | 6 | 3.98 | 29.97 | 30 | 500.00 | 0.20 | 28.14 |
| 156.525 | 6 | 3.98 | 43.95 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.525 | 6 | 3.98 | 29.49 | 30 | 500.00 | 0.20 | 28.14 |

Note [a]: These channels may be operated as half-duplex frequency channels.

The maximum rated power of duplex is 25W, the low rated power of duplex is 1W which declared by manufacturer.

Then the maximum rated power of half-duplex is 12.5W, the low rated power of half-duplex is 0.5W.

To satisfy RF exposure requirements, a separation distance of 140.72cm or more should be maintained between this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended.

End of Report