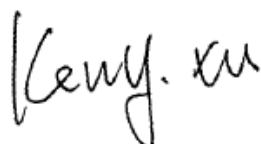


RF Exposure Evaluation Report

Application No.: SZEM1901010132CR
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 Corporation Limited
Address of Factory: Hytera Technology Park, Baolong Industrial City, Longgang District, Shenzhen, China
Product Name: Marine VHF Radio
Model No.(EUT): V60-B, RS40-B ✱
 ✱ Please refer to section 4.1 of this report which indicates which model was actually tested and which were electrically identical.
Trade Mark: B&G, SIMRAD
FCC ID: RAYVHF40B
Standards: 47 CFR Part 1.1307 (2016)
 47 CFR Part 1.1310 (2016)
Date of Receipt: 2019-01-07
Date of Test: 2019-03-11 to 2019-04-11
Date of Issue: 2019-04-17

| | |
|----------------------|--------------|
| Test Result : | PASS* |
|----------------------|--------------|

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



Keny Xu
EMC Laboratory Manager



2 Version

| <i>Revision Record</i> | | | | |
|------------------------|----------------|-------------|-----------------|---------------|
| <i>Version</i> | <i>Chapter</i> | <i>Date</i> | <i>Modifier</i> | <i>Remark</i> |
| 01 | | 2019-04-17 | | Original |
| | | | | |
| | | | | |

| | | | |
|---------------------------------|--|---|--|
| Authorized for issue by: | | | |
| | |  | |
| | | <hr/> Edison Li /Project Engineer | |
| | |  | |
| | | <hr/> Eric Fu /Reviewer | |



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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 |
| Internal Source: | More than 108MHz |
| Transmitter Frequency Range: | VHF:156.025MHz-157.425MHz 802.11b/g/n HT20: 2412MHz-2462MHz |
| AIS Transmitter Frequency Range: | 161.975MHz(CH87), 162.025MHz(CH88) |
| DSC Transmitter Frequency Range: | 156.525MHz(CH70) |
| GNSS Receiver Frequency Range: | 1559MHz-1610MHz(GLONASS:G1, GPS:L1) |
| Modulation Type: | VHF:FM for Analog; DSC:FSK; AIS:GMSK; GNSS: BPSK; 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n(HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM) |
| Frequency Spacing: | VHF: 25KHz 802.11b/g/n HT20: 5MHz |
| Channel Numbers: | 802.11b/g/n HT20: 11 Channels |
| Emission Type: | 16K0G3E for VHF; 16K0G2B for DSC; |
| Rated Output Power: | 25W/1W for VHF/DSC; 2W for AIS; |
| VHF/DSC Antenna Connectors: | SO-239(50 ohm, External Antenna) |
| AIS Antenna Connectors: | SO-239(50 ohm, External Antenna) |
| VHF/DSC Antenna Gain: | 6dBi |
| AIS Antenna Gain: | 6dBi |
| GPS Antenna Connector: | SMA for External antenna; Integral for Internal antenna |
| GPS Antenna Gain: | 1.5dBi |
| WiFi Antenna Type: | Integral |
| WiFi Antenna Gain: | 1.5dBi |





Remark:

Model No.: V60-B, RS40-B

Only the model V60-B was tested, since the electrical circuit design, layout, components used, internal wiring and functions were identical for all the above models, with only differences are the trade name and model no. for trading purpose.



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.

- **Innovation, Science and Economic Development Canada**

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

CAB identifier: CN0006.

IC#: 4620C.

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: $Pd = (Pout \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

Pd = power density in mW/cm²

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/cm². 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) | Maximum 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 | 43.77 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.025 | 6 | 3.98 | 28.96 | 30 | 500.00 | 0.20 | 28.14 |
| 156.300 | 6 | 3.98 | 43.9 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.300 | 6 | 3.98 | 28.92 | 30 | 500.00 | 0.20 | 28.14 |
| 156.650 | 6 | 3.98 | 43.73 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.650 | 6 | 3.98 | 28.66 | 30 | 500.00 | 0.20 | 28.14 |
| 156.800 | 6 | 3.98 | 43.62 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.800 | 6 | 3.98 | 28.55 | 30 | 500.00 | 0.20 | 28.14 |
| 157.425 | 6 | 3.98 | 43.79 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 157.425 | 6 | 3.98 | 28.68 | 30 | 500.00 | 0.20 | 28.14 |
| 156.525 | 6 | 3.98 | 43.51 | 43.98 | 12501.73 | 0.20 | 140.72 |
| 156.525 | 6 | 3.98 | 28.47 | 30 | 500.00 | 0.20 | 28.14 |
| 162.025 | 6 | 3.98 | 32.5 | 34.5 | 1409.19 | 0.20 | 47.25 |

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

For VHF Transmitter:

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.

The minimum distance between this device and persons during device operation is 210 cm which declared by manufacturer. Through the calculation, the maximum power density at 210cm is:

$$Pd = (Pout \cdot G) / (4 \cdot \pi \cdot R^2) = (12501.73 \cdot 3.98) / (4 \cdot 3.1416 \cdot 210 \cdot 210) = 0.0898 \text{ mW/cm}^2$$

For AIS Transmitter:

The rated power is 2W, which declared by manufacturer. Then the rated power of half-duplex is 1W.

To satisfy RF exposure requirements, a separation distance of 47.25cm 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.

The minimum distance between this device and persons during device operation is 210 cm which declared by manufacturer. Through the calculation, the maximum power density at 210cm is:

$$Pd = (Pout \cdot G) / (4 \cdot \pi \cdot R^2) = (1409.19 \cdot 3.98) / (4 \cdot 3.1416 \cdot 210 \cdot 210) = 0.0101 \text{ mW/cm}^2$$



For 802.11b/g/n HT20:

The best case gain of the antenna is 1.5dBi. 1.5dB logarithmic terms convert to numeric result is nearly 1.41
The max tune-up tolerance power Into Antenna & RF Exposure Evaluation Distance:

| Channel | Frequency (MHz) | Max tune-up tolerance power(dBm) | Max tune-up Tolerance power to Antenna (mW) | Power Density at R = 20 cm (mW/cm ²) | Limit | MPE Ratio | Result |
|---------|-----------------|----------------------------------|---|--|-------|-----------|--------|
| Middle | 2437MHz | 15.5 | 35.48 | 0.0100 | 1.0 | 0.0100 | PASS |

The simultaneous transmission result between of 2.4G WiFi, VHF and AIS:

The SAR Exclusion Threshold Level:

$$=CPD1 / LPD1 + CPD2 / LPD2 + CPD3 / LPD3 \text{ (CPD = Calculation power density, LPD = Limit of power density)}$$

$$= (0.0898/0.2) + (0.0101/0.2) + (0.0100/1) = 0.5095 < 1$$

Since the SAR Exclusion Threshold Level is well below the SAR low threshold level, so the EUT is considered to comply with SAR requirement without testing.

End of Report

