



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

Report No.: SZEM180900844705
 Page: 1 of 8

RF Exposure Evaluation Report

Application No.: SZEM1809008447CR
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, RS40 ♣
 ♣ 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: RAYVHFERS40
Standards: 47 CFR Part 1.1307 (2016)
 47 CFR Part 1.1310 (2016)
Date of Receipt: 2018-09-20
Date of Test: 2018-09-26 to 2018-10-19
Date of Issue: 2018-10-29

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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Documents.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.



2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2018-10-29		Original

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



3 Contents

	Page
1 COVER PAGE	1
2 VERSION	2
3 CONTENTS	3
4 GENERAL INFORMATION	4
4.1 GENERAL DESCRIPTION OF EUT	4
4.2 TEST LOCATION.....	5
4.3 TEST FACILITY	5
4.4 DEVIATION FROM STANDARDS	5
4.5 ABNORMALITIES FROM STANDARD CONDITIONS.....	5
4.6 OTHER INFORMATION REQUESTED BY THE CUSTOMER	5
5 RF EXPOSURE EVALUATION	6
5.1 RF EXPOSURE COMPLIANCE REQUIREMENT	6
5.1.1 <i>Limits</i>	6
5.1.2 <i>Test Procedure</i>	6
5.1.3 <i>EUT RF Exposure Evaluation</i>	7



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:	VHF:156.025MHz-157.425MHz 802.11b/g/n HT20: 2412MHz-2462MHz
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:	VHF:FM for Analog 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
Rated Output Power:	VHF:25W/1W 802.11b/g/n HT20:18dBm
VHF Antenna Connectors:	SO-239(50 ohm, External Antenna)
VHF 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, RS40

Only the model V60 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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 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

For VHF Transmitter:

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	43.97	43.98	12501.73	0.20	140.72
156.025	6	3.98	29.05	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	29.02	30	500.00	0.20	28.14
156.650	6	3.98	43.91	43.98	12501.73	0.20	140.72
156.650	6	3.98	29.18	30	500.00	0.20	28.14
156.800	6	3.98	43.94	43.98	12501.73	0.20	140.72
156.800	6	3.98	29.08	30	500.00	0.20	28.14
157.425	6	3.98	43.89	43.98	12501.73	0.20	140.72
157.425	6	3.98	29.28	30	500.00	0.20	28.14
156.525	6	3.98	43.87	43.98	12501.73	0.20	140.72
156.525	6	3.98	28.39	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.

The minimum distance between this device and persons during device operation is 200 cm which declared by manufacturer. Through the calculation, the maximum power density at 200cm is:

$$P_d = (P_{out} * G) / (4 * \pi * R^2) = (12501.73 * 3.98) / (4 * 3.1416 * 200 * 200) = 0.0990 \text{ mW/cm}^2$$

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	Result
Low	2412MHz	18.00	63.10	0.0177	1.0	PASS



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

Report No.: SZEM180900844705

Page: 8 of 8

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

The SAR Exclusion Threshold Level:

= $CPD1 / LPD1 + CPD2 / LPD2$ (CPD = Calculation power density, LPD = Limit of power density)

= $(0.0990/0.2) + (0.0177/1) = 0.5127 < 1$

Since the source-based time-averaging conducted output power is well below the SAR low threshold level, so the EUT is considered to comply with SAR requirement without testing.

End of Report