

SZCCS-TRF-01 Rev. A/0 Aug01,2022

Report No.: FYCR220700028804

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### 1 Cover Page

RF Exposure Report

Application No.: FYCR2207000288AT

Applicant: Navico Inc.

Address of Applicant: 4500 S. 129th East Avenue, Ste. 200 Tulsa Oklahoma United States 74134

Manufacturer: Navico Auckland Limited

Address of Manufacturer: Arrenway Drive, Rosedale, Auckland, 0632 New Zealand

Factory: Shenzhen Fastrain Technology Co., Ltd.

Address of Factory: No.3 Baolong 4th Rd., Baolong Industrial Area, Longgang District,

Shenzhen, China

**Equipment Under Test (EUT):** 

**EUT Name:** Marin VHF Radio **Model No.:** V60-B, RS40-B •

Please refer to section 2 of this report which indicates which model was

actually tested and which were electrically identical.

Trade mark: B&G, SIMRAD FCC ID: RAYVHFRS40B

47 CFR Part 2.1091

Standard(s): 47 CFR Part 1.1310

47 CFR Part 1.1307

**Date of Receipt:** 2022-07-29

**Date of Test:** 2022-07-29 to 2022-08-11

**Date of Issue:** 2022-08-12

Test Result: Pass\*

Winkey Wang
Winkey Wang
EMC Technical Manager



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<sup>\*</sup> In the configuration tested, the EUT complied with the standards specified above.



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Revision Record								
Version	Chapter	Date	Date Modifier					
01		2022-08-12		Original				

Authorized for issue by:		
	Tree Zhan	
	Tree Zhan/Project Engineer	-
	WinkeyWarg	
	Winkey Wang/Reviewer	-



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### 3 General Information

#### 3.1 Details of E.U.T.

	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				



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#### 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.



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### 3.2 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc. Shenzhen branch.

Fuyong lab. Xinlong TechnoPark,Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China

Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

### 3.3 Test Facility

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

### • A2LA (Certificate No. 6606.01)

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6606.01.

### • FCC -Designation Number: CN1322

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

### • Innovation, Science and Economic Development Canada

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.



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# 4 Radio Spectrum Technical Requirement

### 4.1 RF Exposure

### 4.1.1 Requirement

In accordance with 47 CFR FCC Part 2.1091, this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

According to 47 CFR FCC Part 1.1310, 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 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Electric fier strength (MHz) (V/m)		Magnetic field strength (A/m) Occupational/Contr	Power density (mW/cm²)	Averaging time (minutes)	
3-3.0	614	1.63	*(100)	≤6	
3.0-30	1842/f	4.89/f	*(900/f²)	<6	
30-300	61.4	0.163	1.0	<6	
300-1,500			f/300	<6	
1,500-100,000			5	<6	
	(ii) Limits for Ger	neral Population/Und	ontrolled Exposure		
0.3-1.34	614	1.63	*(100)	<30	
1.34-30	824/f	2.19/f	*(180/f²)	<30	
30-300	27.5	0.073	0.2	<30	
300-1,500			f/1500	<30	
1,500-100,000			1.0	<30	
f = frequency in Mh	dz. * = Plane-wave equi	valent power density			



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#### 4.1.2 Method

According to IEEE C95.3:2002 section 5.5.1.1, the power density S at a point on the axis at a distance d from a transmitting antenna is given by the Friis free-space transmission formula:

$$S = \frac{PG}{4\pi d^2}$$

 $S = power density (mW/cm^2)$ 

P = the net power delivered to the antenna (mW)

G = gain of the antenna in linear scale

d = distance between observation point and center of the radiator (cm)

From the maximum EUT RF output power, as well as the gain of the used antenna, according toe the RF power density limit stated in above table, the mimimum distance between the antenna and human body will be calculated.

#### 4.1.3 Conclusion

### 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% <sup>a</sup> (mW)	Power density (mW/cm²)	Minimum Distance to Human body (cm)
156.025	6	3.98	43.91	43.98	12501.73	0.2	140.72
156.025	6	3.98	29.65	30.00	500.00	0.2	28.14
156.300	6	3.98	43.89	43.98	12501.73	0.2	140.72
156.300	6	3.98	29.54	30.00	500.00	0.2	28.14
156.650	6	3.98	43.88	43.98	12501.73	0.2	140.72
156.650	6	3.98	29.71	30.00	500.00	0.2	28.14
156.800	6	3.98	43.88	43.98	12501.73	0.2	140.72
156.800	6	3.98	29.55	30.00	500.00	0.2	28.14
157.425	6	3.98	43.9	43.98	12501.73	0.2	140.72
157.425	6	3.98	29.61	30.00	500.00	0.2	28.14
156.525	6	3.98	43.89	43.98	12501.73	0.2	140.72
162.025	6	3.98	32.64	34.50	1409.19	0.2	47.25

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



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#### 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:  $Pd = (Pout^*G)/(4^*Pi^*R^2) = (12501.73^*3.98)/(4^*3.1416^*210^*210) = 0.0898 \text{ mW/cm}^2$ 

#### 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:  $Pd = (Pout^*G)/(4^* Pi * R^2) = (1409.19*3.98)/(4*3.1416*210*210) = 0.0101 \text{ mW/cm}^2$ 

#### For 802.11b/q/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/cm²)	Limit	MPE Ratio	Result
High	2462MHz	15.5	35.48	0.0100	1.0	0.0100	PASS



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

The SAR Exclusion Threshold Level:

=CPD1 / LPD1 + CPD2 / LPD2 + CPD3 / LPD3 (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.

### 4.2 EUT Constructional Details

Refer to Appendix - external and internal photos for FYCR2207000288AT.

-- End of the Report--



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