

TEST 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
Standards: 47 CFR Part 80
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*
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* In the configuration tested, the EUT complied with the standards specified above.



Winkey Wang
EMC Technical Manager



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Compliance Certification Services (Kunshan) Inc. Shenzhen Branch

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

Report No.: FYCR220700028802

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

Authorized for issue by:			
			
		<hr/>	
		Tree Zhan/Project Engineer	
			
		<hr/>	
		Winkey Wang/Reviewer	



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1 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 80	N/A	47 CFR Part 80.3(e),	Pass

Item	Standard	Method	Requirement	Result
Spurious Emissions at antenna Terminals	47 CFR Part 80	ANSI/TIA-603-E-2016 ANSI C63.26:2015	47 CFR Part 2.1047, 80.211(f)(3)	Pass
Transmitter power	47 CFR Part 80		47 CFR Part 2.1046, 80.215	Pass
Transmitter Carrier Power Reduction	47 CFR Part 80		47 CFR Part 80.215(e)(f)	N/A

Note:

N/A: Not Applicable, Hand-held portable transmitters are not required to comply with the automatic reduction of carrier power.

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.

This report is prepared for FCC class II permissive change.

The original approval by TCB, FCC ID:RAYVHFRS40B, Granted on 05/28/2019.

Review this report and original report, this report just replaces the MCU, but the specification is the same as previous, according to the declaration from the applicant, the models in this report and models in original report were identical, only difference with being the supplier of the MCU, considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.

Therefore in this report Spurious Emissions at antenna Terminals, Transmitter power and Transmitter Carrier Power Reduction were fully retested on model V60-B and shown the data in this report.



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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
AIS Transmitter Frequency Range:	161.975MHz(CH87), 162.025MHz(CH88)
DSC Transmitter Frequency Range:	156.525MHz(CH70)
Modulation Type:	VHF:FM for Analog; DSC:FSK AIS:GMSK
Frequency Spacing:	VHF: 25KHz
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

3.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
DC power	NOISEKEN	BP-4610	9105713
Coaxial Attenuator	Provided by client	TS4	HYT168793



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3.3 Measurement Uncertainty

Test Item	Measurement Uncertainty
Maximum Conducted Output Power	± 0.8dB
Radiated Emissions below 1GHz	± 3.1dB (Below 1GHz)
Radiated Emissions which fall in the restricted bands	± 4.4dB (Above 1GHz)
Radiated Emissions Above 1GHz	± 4.4dB (Above 1GHz)



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3.4 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.

3.5 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.

3.6 Deviation from Standards

None

3.7 Abnormalities from Standard Conditions

None



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4 Equipment List

RF Conducted Test					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Programmable Temperature & Humidity Chamber	Votsch Industrietechnik GmbH	VT 4002	SEM002-15	2022/7/12	2023/7/11
MXA Signal Analyzer	Agilent	N9020A	SEM004-20	2022/7/12	2023/7/11
Signal Generator	Agilent	N5173B	SEM006-05	2022/7/12	2023/7/11
ESG Vector Signal Generator	Agilent	E4438C	SEM006-15	2022/7/12	2023/7/11
Power Sensor	Erika Fiedler	U2021XA	SEM009-15	2022/7/12	2023/7/11
Power Sensor	Erika Fiedler	U2021XA	SEM009-16	2022/7/12	2023/7/11
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	SEM010-08	2022/7/12	2023/7/11
Programmable DC Source	Chroma	62024P-80-60	SEM011-09	2022/7/12	2023/7/11
Attenuator	Huber+Suhner	6620_SMA-50-1	SEM021-09	2022/7/12	2023/7/11
Spectrum Analyzer	Rohde & Schwarz	FSU43	SEM004-08	2022/3/22	2023/3/21

Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-33	2021/9/25	2024/9/24
Biconical Antenna	Schwarzbeck	VUBA9117	SEM003-35	2021/12/26	2024/12/25
Loop Antenna	ETS-LINDGREN	6502	SEM003-36	2021/9/26	2024/9/25
MXE EMI receiver	Agilent	N9038A	SEM004-05	2022/7/12	2023/7/11
Pre-amplifier	HP	8447D	SEM005-02	2022/7/12	2023/7/11
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2021/7/11	2024/7/10
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9120D	SEM003-32	2021/9/26	2024/9/25
Double-ridged waveguide	ETS-LINDGREN	3117	SEM003-34	2021/9/25	2024/9/24



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horn					
Spectrum Analyzer	Rohde & Schwarz	101288	SEM004-08	2022/7/12	2023/7/11
Low Noise Amplifier	CLAVIIO	BDLNA-0118-352810	SEM005-05	2022/7/12	2023/7/11
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2022/7/12	2023/7/11
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2022/7/12	2023/7/11
Pre-amplifier	TST PASS	LNA04080G30	SEM005-27	2022/4/15	2023/4/14
Pre-amplifier	TST PASS	LNA10180G45	SEM005-28	2022/4/15	2023/4/14

Radiated Spurious Emissions Below 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021/7/13	2024/7/12
Trilog-Broadband Antenna	Schwarzbeck	VULB9168	SEM003-33	2021/9/25	2024/9/24
Biconical Antenna	Schwarzbeck	VUBA9117	SEM003-35	2021/12/26	2024/12/25
Loop Antenna	ETS-LINDGREN	6502	SEM003-36	2021/9/26	2024/9/25
MXE EMI receiver	Agilent	N9038A	SEM004-05	2022/7/12	2023/7/11
Pre-amplifier	HP	8447D	SEM005-02	2022/7/12	2023/7/11

Radiated Spurious Emissions Above 1GHz					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021/7/13	2024/7/12
MXE EMI receiver	Agilent	N9038A	SEM004-05	2022/7/12	2023/7/11
Pre-amplifier	HP	8447D	SEM005-02	2022/7/12	2023/7/11
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	SEM003-15	2021/7/11	2024/7/10
Broad-Band Horn Antenna	Schwarzbeck	BBHA 9120D	SEM003-32	2021/9/26	2024/9/25
Double-ridged waveguide horn	ETS-LINDGREN	3117	SEM003-34	2021/9/25	2024/9/24
Spectrum Analyzer	Rohde & Schwarz	101288	SEM004-08	2022/7/12	2023/7/11



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Low Noise Amplifier	CLAVIIO	BDLNA-0118-352810	SEM005-05	2022/7/12	2023/7/11
Pre-amplifier	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2022/7/12	2023/7/11
Pre-amplifier	Rohde & Schwarz	CH14-H052	SEM005-17	2022/7/12	2023/7/11
Pre-amplifier	TST PASS	LNA04080G30	SEM005-27	2022/4/15	2023/4/14
Pre-amplifier	TST PASS	LNA10180G45	SEM005-28	2022/4/15	2023/4/14

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-22	2022-07-12	2023-07-11
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-23	2022-07-12	2023-07-11
Barometer	DUMAI	DYM3	SEM002-24	2022-07-12	2023-07-11



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5 Radio Spectrum Technical Requirement

5.1 Antenna Requirement

5.1.1 Test Requirement:

47 CFR Part Part 80.81

5.1.2 Conclusion

80.81 Requirements:

All telephony emissions of a ship station or a marine utility station on board ship within the frequency band 30-200 MHz must be vertically polarized.

EUT Antenna:

Antenna location: Refer to Internal photos.



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6 Radio Spectrum Matter Test Results

6.1 Transmitter Unwanted Emissions(Radiated)

- Test Requirement: 47 CFR FCC Part2.1047 & FCC Part 80.211(f)
- Test Method: ANSI/TIA-603-E:2016
- Limit:
- (f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
 - (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
 - (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
 - (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

6.1.1 E.U.T. Operation

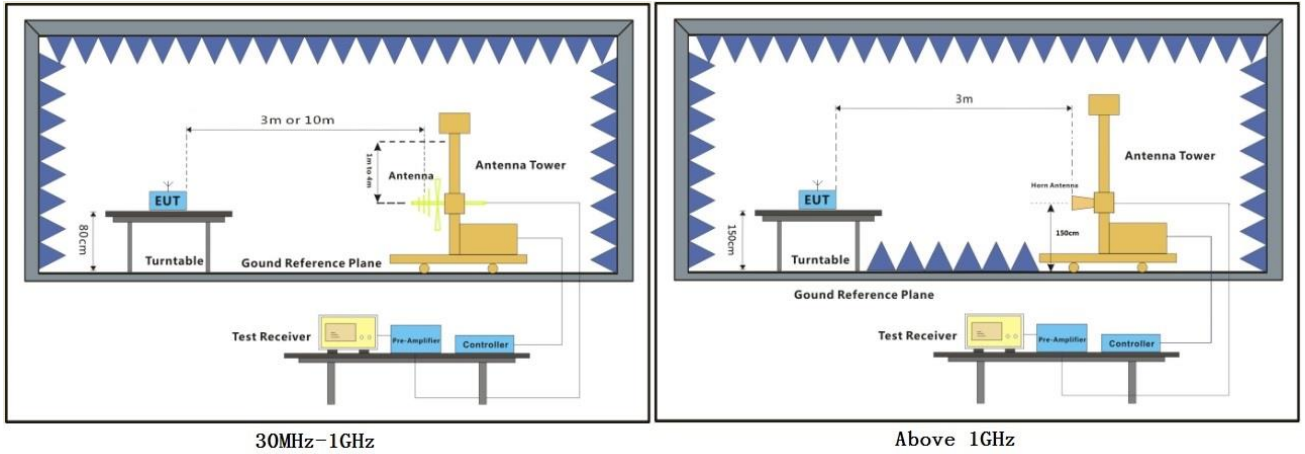
- Operating Environment:
- Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
- Test mode: 02: TX mode, Keep the EUT in transmitting mode.



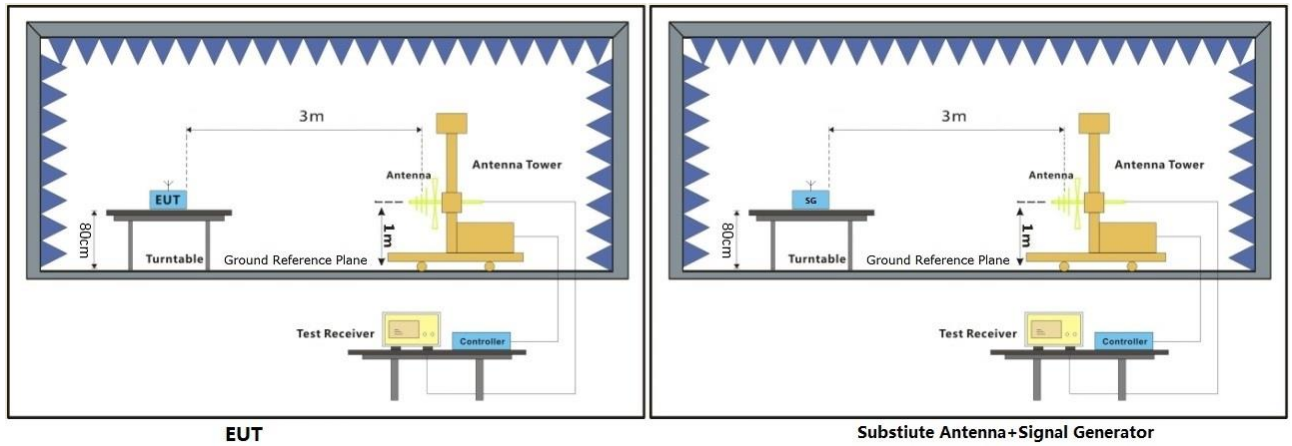
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6.1.2 E.U.T. Operation



Radiation Emission Test Setup



Substitution Test Setup



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6.1.3 Measurement Data

Test Procedure:

- (1) On a test site, the EUT shall be placed on a turntable and in the position closest to the normal use as declared by the user.
- (2) The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3) The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- (4) The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5) The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6) The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7) The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8) The maximum signal level detected by the measuring receiver shall be noted.
- (9) The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10) Replace the antenna with a proper Antenna (substitution antenna).
- (11) The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12) The substitution antenna shall be connected to a calibrated signal generator.
- (13) If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14) The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15) The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- (16) The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- (17) The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

The detailed test data see: Appendix FCC data.

Note: The disturbance below 1GHz was very low and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.



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6.2 Transmitter Power

Test Requirement: 47 CFR FCC Part2.1046 & FCC Part 80.215
 Test Method: ANSI/TIA-603-E:2016
 Limit:

e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.
 (1) Ship stations 156-162 MHz—25W⁶

⁶Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

(g) The carrier power of ship station radiotelephone transmitters, except portable transmitters, operating in the 156-162 MHz band must be at least 8 but not more than 25 watts. Transmitters that use 12 volt lead acid storage batteries as a primary power source must be measured with a primary voltage between 12.2 and 13.7 volts DC. Additionally, unless otherwise indicated, equipment in radiotelephone ship stations operating in the 156-162 MHz band must meet the following requirements:

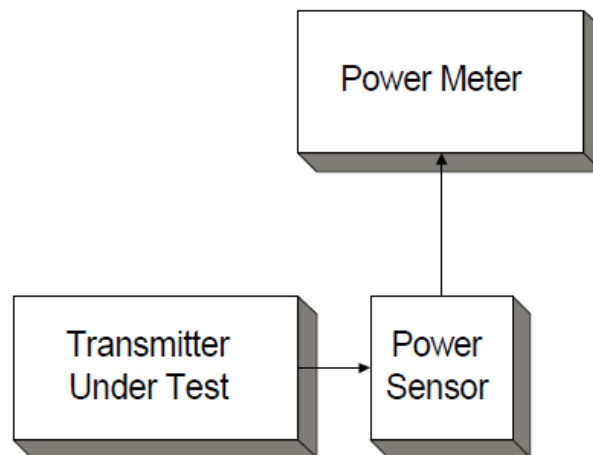
- (1) All transmitters and remote control units must be capable of reducing the carrier power to one watt or less;
- (2) Except as indicated in (g)(4) of this section, all transmitters manufactured after January 21, 1987, or in use after January 21, 1997, must automatically reduce the carrier power to one watt or less when the transmitter is tuned to 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;

6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar
 Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.2.2 Test Setup Diagram



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6.2.3 Measurement Data

The detailed test data see: Appendix FCC data.



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6.3 Transmitter Carrier Power Reduction

Test Requirement 47 CFR FCC Part 80.215
 Test Method: ANSI/TIA-603-E:2016
 Limit:

e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(1) Ship stations 156-162 MHz—25W6

6Reducible to 1 watt or less, except for transmitters limited to public correspondence channels and used in an automated system.

(g) The carrier power of ship station radiotelephone transmitters, except portable transmitters, operating in the 156-162 MHz band must be at least 8 but not more than 25 watts. Transmitters that use 12 volt lead acid storage batteries as a primary power source must be measured with a primary voltage between 12.2 and 13.7 volts DC. Additionally, unless otherwise indicated, equipment in radiotelephone ship stations operating in the 156-162 MHz band must meet the following requirements:

- (1) All transmitters and remote control units must be capable of reducing the carrier power to one watt or less;
- (2) Except as indicated in (g)(4) of this section, all transmitters manufactured after January 21, 1987, or in use after January 21, 1997, must automatically reduce the carrier power to one watt or less when the transmitter is tuned to 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;

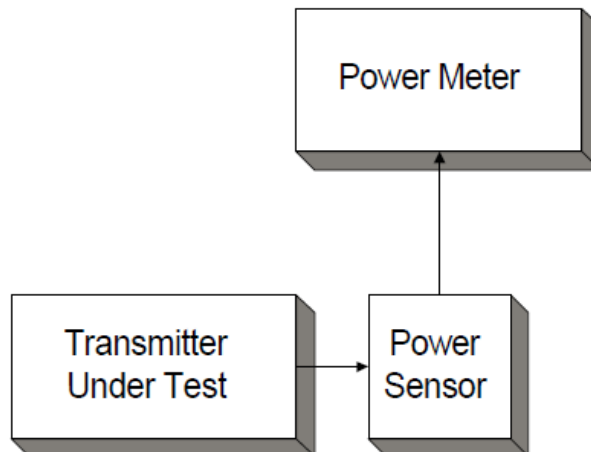
6.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.2 °C Humidity: 56.5 % RH Atmospheric Pressure: 1020 mbar

Test mode: 02: TX mode, Keep the EUT in transmitting mode.

6.3.2 Test Setup Diagram



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6.3.3 Measurement Data

The detailed test data see: Appendix FCC data.



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7 Photographs

7.1 Test Setup

Refer to appendix - Test Setup Photos for FYCR2207000288AT.

7.2 EUT Constructional Details

Refer to appendix - External and Internal Photos for FYCR2207000288AT.



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8 Appendix FCC data.

1. Transmitter Unwanted Emission(Radiated)

Assigned Frequency:156.025MHz, Modulation Type: FM								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1001.477	-55.41	2.64	5.17	-55.03	-13	-42.03	Horizontal	Pass
1313.264	-54.53	2.64	5.17	-54.15	-13	-41.15	Horizontal	Pass
1986.255	-55.78	3.77	7.43	-54.27	-13	-41.27	Horizontal	Pass
1005.064	-55.92	2.64	5.17	-55.54	-13	-42.54	Vertical	Pass
1311.072	-54.16	2.64	5.17	-53.78	-13	-40.78	Vertical	Pass
1854.302	-56.87	3.77	7.43	-55.36	-13	-42.36	Vertical	Pass

Assigned Frequency:161.6MHz, Modulation Type: FM								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1001.877	-55.15	2.64	5.17	-54.77	-13	-41.77	Horizontal	Pass
1311.245	-54.54	2.64	5.17	-54.16	-13	-41.16	Horizontal	Pass
1985.362	-55.84	3.77	7.43	-54.33	-13	-41.33	Horizontal	Pass
1003.275	-57.13	2.64	5.17	-56.75	-13	-43.75	Vertical	Pass
1515.542	-58.36	3.77	7.43	-56.85	-13	-43.85	Vertical	Pass
1895.742	-57.72	3.77	7.43	-56.21	-13	-43.21	Vertical	Pass



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Assigned Frequency:156.525MHz, Modulation Type: FSK								
Frequency (MHz)	S.G. Power (dBm)	Cable loss (dB)	Antenna Gain(dBi)	EIRP (dBm)	Limit (dBm)	Over Limit(dB)	Polarization (H/V)	Result
1001.776	-56.65	2.64	5.17	-56.27	-13	-43.27	Horizontal	Pass
1386.543	-56.71	2.64	5.17	-56.33	-13	-43.33	Horizontal	Pass
1987.487	-56.58	3.77	7.43	-55.07	-13	-42.07	Horizontal	Pass
1001.259	-56.71	2.64	5.17	-56.33	-13	-43.33	Vertical	Pass
1374.512	-55.56	2.64	5.17	-55.18	-13	-42.18	Vertical	Pass
1859.674	-56.55	3.77	7.43	-55.04	-13	-42.04	Vertical	Pass

Note: All modes and modulation have been tested worst test result, All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit, Only record the worst test result.



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2. Transmitter Power

Test Voltage (V Dc)	Test Frequency (MHz)	Power Level	Output Power(dBm)	Output Power(W)	Limit	
12	156.025	Max	43.91	24.60	25W	
		Low	29.65	0.92	1W	
	156.300	Max	43.89	24.49	25W	
		Low	29.54	0.90	1W	
	156.650	Max	43.88	24.43	25W	
		Low	29.71	0.94	1W	
	156.800	Max	43.88	24.43	25W	
		Low	29.55	0.90	1W	
	157.425	Max	43.9	24.55	25W	
		Low	29.61	0.91	1W	
	156.525	Max	43.89	24.49	25W	
	162.025	/		32.64	1.84	See Note
				ERP:38.49	ERP:7.06	See Note

Note:

- 1). The high power is 25W, the low power is 1W for VHF/DSC, and the nominal power of AIS is 2W that declared by manufacturer.
- 2). The transmitter output power not exceeding 25 watts and an ERP not exceeding 18 watts.
- 2). ERP=EIRP-2.15, EIRP=Conducted Power+Antenna Gain(dBi).



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3. Transmitter Carrier Power Reduction

Test Voltage (V Dc)	Test Frequency (MHz)	Power Level	Default Power (W)	Limit	Result
12	156.375	Low	0.72	one watt or less	Pass
	156.650	Low	0.80	one watt or less	Pass
	156.775	Low	0.80	one watt or less	Pass
	156.825	Low	0.81	one watt or less	Pass
	156.850	Low	0.80	one watt or less	Pass
	156.875	Low	0.74	one watt or less	Pass
	156.525	Low	0.72	one watt or less	Pass

Note:

- 1).All transmitters units must be capable of reducing the carrier power to one watt or less;
- 2).All transmitters must automatically reduce the carrier power to one watt or less when transmitting on 156.375 MHz or 156.650 MHz, and must be provided with a manual override switch which when held by an operator will permit full carrier power operation on 156.375 MHz and 156.650 MHz;
- 3).All transmitters must be capable of tuning to 156.775MHz and 156.825MHz and must automatically reduce the carrier power to one watt or less, with no manual override capability, when the transmitter is tuned to either 156.775MHz or 156.825MHz;

-End of Report-



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