



IEC 62238  
TEST REPORT

For

**FURUNO USA**

4400 NW Pacific Rim, Camas, WA 98607, United States Of America

**Model: FM-4850**

<b>Report Type:</b> Original Report	<b>Product Type:</b> MARINE VHF RADIOTELEPHONE
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Furuno USA Inc*'s product, model number: *FM-4850 (IC: 1281B-FM4850D)* or the "EUT" in this report was a *MARINE VHF RADIOTELEPHONE*, which was measured approximately: 25.2 cm (H) x 16.2 cm (W) x 5.3 cm (D) for base, 15.0 cm (H) x 6.5 cm (W) x 4.5 cm (D) for handset, rated with input voltage: DC 12.0V.

\* All measurement and test data in this report was gathered from production sample serial number: 180601004 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-06-01.

Frequency Range	Transmitter: 156.025-157.425 MHz Receiver: 156.025~162.0375 MHz
Modulation Type	FM/DSC
Channel Separation	25kHz
Rated Output Power	High power level 25W Low power level 1.0W

### Objective

This test report is prepared on behalf of *Garmin International Inc* in accordance with IEC 62238.

### Related Submittal(s)/Grant(s)

No related submittal(s)

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the IEC 62238 First edition 2003-03, Maritime navigation and radiocommunication equipment and systems-VHF radiotelephone equipment incorporating Class "D" Digital Selective Calling (DSC)-Methods of testing and required test results.

### Measurement Uncertainty

Parameter	uncertainty
Temperature	±1 °C
Supply voltages	±0.4%

## **SYSTEM TEST CONFIGURATION**

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### **Description of Test Configuration**

The system was configured for testing in a DSC mode in accordance with IEC 62238.

### **Equipment Modifications**

No modification was made to the EUT tested.

### **Support Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>
Everfine	DC power supply	WY5015	1109009

**SUMMARY OF TEST RESULTS**

<b>IEC 62238 Rules</b>	<b>Description of Test</b>	<b>Results</b>
§7.4	Vibration Test	Compliance
§7.5	Temperature Tests	Compliance
§8.14	Test of Generated Call Sequences	Compliance
§9.13	Multiple Watch Characteristics	Compliance
§10.3	DSC Receiver Adjacent Channel Selectivity	Compliance
§10.5	DSC Receiver Intermodulation Response	Compliance
§10.8	Verification of Correct Decoding of Various Types of DSC Calls	Compliance
§10.9	Reaction to VTS and AIS Channel Management DSC Transmissions	Compliance
§10.10	Simultaneous Reception	Compliance

Note: A brief summary of the tests carried out in accordance with IEC 62238 standards.

**TEST EQUIPMENT LIST**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
CMI	Vibration Tester	ACT2000-S06L	N/A	2018-06-03	2019-06-03
ESPEC	Temperature & Humidity Chamber	EL-10KA	09107726	2017-11-22	2018-11-22
Hewlett-Packard	Signal Generator	8657A	3217A04699	2017-12-18	2018-12-17
HP	ESG Series Signal Generator	E4422B	MY41000355	2017-12-14	2018-12-14
H&P	Modulation Analyzer	8901B	3438A05208	2017-08-29	2018-08-29
Agilent	RF Communication test set	8920A	3325U00859	2018-06-03	2019-06-03
Agilent	Universal Frequency Center	53220A	N/A	2017-10-09	2018-10-08
Aeroflex	Digital Radio Test Set	3920	1000003253	2017-09-06	2018-09-05
Hyetra	DSC Decoder/Encoder	N/A	N/A	NCR	NCR

## §7.4 VIBRATION TEST

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### Applicable Standard

The vibration test shall be performed as in IEC 62238, Clause 7.4

### Limit:

The requirement of the performance check shall be met.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

#### Test Levels:

- 2Hz to 5Hz and up to 13.2Hz with and excursion of  $\pm 1.43\text{mm} \pm 10\%$  ( $9.8\text{m/s}^2$  maximum acceleration at 13.2Hz)
- Above 13.2Hz and up to 600Hz with a constant acceleration of 1g
- Nominal test voltage = +12Vdc

Endurance Test for 2 hour sat each resonant frequency or frequency with a g level  $\geq 5$  times the drive g level. If no resonant frequencies or frequency with a g level  $\geq 5$  times the drive g level are found endurance test shall be performed at 30Hz.

**Test Result:** Compliance.

## §7.5 TEMPERATURE TEST

### Applicable Standard

The dry heat cycle shall be performed as in IEC 60945. Tests and performance checks at extreme power supply conditions shall be performed under the environmental conditions as follow:

Environment	Normal power supply	Extreme power supply
Dry heat	Performance test	Performance check

### Limit:

The requirement of the performance check shall be met.

### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

Environmental Conditions		Temperature	Voltage (V <sub>DC</sub> )	Test Period(Hour)	Results
Dry Heat	Storage Test	70±1°C	-	15	Compliance
	Functional Test	55±1°C	15.6	15	Compliance
			12.0	15	Compliance
			10.8	15	Compliance



## §8.14 TEST OF GENNERATED CALL SEQUENCES

### Applicable Standard

According to IEC 62238, Clause 8.14

### Limit:

The requirement of ITU-R Recommendation M.493-10/M.493-13/ M.493-14 regarding message composition and content shall be met.

The generated call shall be analysed with the calibrated apparatus for correct configuration of the signal format, including time diversity.

It shall be verified that, after transmission of a DSC call, the transmitter re-tunes to the original channel. However, in the case of a distress call, the transmitter shall tune to channel 16 and automatically select the maximum power.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

Format specifier	Category	1 <sup>st</sup> telecommand (symbol No.)	2 <sup>st</sup> telecommand (symbol No.)
Distress	-	112	132
All Ships	Urgency	112	132
All Ships	Safety	112	132
Individual	Routine	112	132
Group	Routine	112	132

### §9.13 MULTIPLE WATCH CHARACTERISTICS

#### Applicable Standard

According to IEC 62238, Clause 9.13

#### Limit:

Test Project	Requirement
Scanning Period	≤2s
Dwell Time (Priority Channel)	≤150ms
Dwell Time (Additional Channel)	Between 850 ms and 2s

#### Test Data

##### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	53 %
ATM Pressure:	101.0 kPa

The testing was performed by Shawn Xiao on 2018-06-25.

**Test Result:** Compliance. Please refer to following table.

Test Conditions		Scanning Time(s)	Dwell on Priority (ms)	Dwell on Additional (s)
Temperature(°C)	Voltage (V <sub>DC</sub> )			
-15	15.6	1.55	125	1.62
	12.0	1.58	122	1.62
	10.8	1.58	120	1.64
+25	12.0	1.58	122	1.62
+55	15.6	1.54	125	1.62
	12.0	1.56	122	1.63
	10.8	1.60	125	1.62

**§10.3 DSC RECEIVER ADJACENT CHANNEL SELECTIVITY**

**Applicable Standard**

According to IEC 62238, Clause 10.3

**Limit:**

The bit error ratio shall be less than  $10^{-2}$

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

Test Conditions		Bit Error Ratio	
Temperature(°C)	Voltage (V <sub>DC</sub> )	156.525MHz	
		+25 kHz	-25 kHz
-15	15.6	≤0.5	≤0.5
	12.0		
	10.8		
+25	12.0		
+55	15.6		
	12.0		
	10.8		

## §10.5 DSC RECEIVER INTERMODULATION RESPONSE

### Applicable Standard

According to IEC 62238, Clause 10.5

### Limit:

The BER shall not exceed  $10^{-2}$

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

Frequency Increments of Unwanted Signals	Bit Error Rate
	156.525 MHz
+50/100 kHz	$\leq 0.5$
-50/100 kHz	$\leq 0.5$

## §10.8 VERIFICATION OF CORRECT DECODING OF VARIOUS TYPES OF DSC CALLS

### Applicable Standard

According to IEC 62238, Clause 10.8

### Limit:

The requirement of ITU-R Recommendation M.493-10/M.493-13/ M.493-14 regarding message composition and content shall be met.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following tables.

Format specifier	Category	1 <sup>st</sup> telecommand (symbol No.)	2 <sup>st</sup> telecommand (symbol No.)
Distress	-	112	126
Individual Distress Relay	-	115	132
All ships Distress Relay	-	115	132
All Ships	Urgency	116	134
All Ships	Safety	110	130
Individual	Routine	122	132
Individual	Safety	120	131
Individual	Urgency	124	131
Group	Routine	118	128

	<b>Confirm (Y or N)</b>
Confirm that the decoded call sequences at the output of the receiver have been examined for correct technical format, including error check characteristics:	Y
Error found:	N
Confirm that the checks have been made to ensure accordance between printer output and display:	Y
Error found:	N
It has been verified that the equipment is capable of switching to a channel identified in the DSC call:	Y

## §10.9 REACTION TO VTS AND AIS CHANNEL MANAGEMENT DSC TRANSMISSIONS

### Applicable Standard

According to IEC 62238, Clause 10.8

### Limit:

The equipment shall not sound an alarm, display a message (an accurate, informative display is permissible but not required), transmit a message a reponse or suggest a transmitted response, lock up, or require operator intervention.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

	Confirm (Y or N)
Not sound an alarm	Y
Not display a message (An accurate informative display is permissible but not required)	Y
Not transmit a response	Y
Not suggest a transmitted response	Y
Not lock up	Y
Not require operator intervention	Y

**§10.10 SIMULTANEOUS RECEPTION**

**Applicable Standard**

According to IEC 62238, Clause 10.8

**Limit:**

Test Project	Requirement
SINAD Ratio (dB)	$\geq 20$ dB in presence of DSC Signal
Bit Error Rate	$\leq 10^{-2}$

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	53 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Shawn Xiao on 2018-06-25.*

**Test Result:** Compliance. Please refer to following table.

SINAD (dB) No DSC Signal	SINAD (dB) DSC Signal Applied	Bit Error Rate
35.3	34.5	Less than $10^{-2}$

**\*\*\*\*\* END OF REPORT \*\*\*\*\***