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## REPORT ON

Limited FCC Part 80 and Industry Canada RSS-182 Testing  
of a Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC)

**COMMERCIAL-IN-CONFIDENCE**

Report No RM615608/03 Issue 1

May 2007

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**REPORT ON**

Limited FCC Part 80 and Industry Canada RSS-182 Testing of a  
Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC)

FCC ID: PJ5VHFGEN1  
Industry Canada ID: 4069A-VHFGEN1


Report No RM615608/03 Issue 1

May 2007

**PREPARED FOR**

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**PREPARED BY**

  
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**APPROVED BY**

  
\_\_\_\_\_  
J Adams  
Authorised Signatory

**DATED**


15<sup>th</sup> May 2007

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**ENGINEERING STATEMENT**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC Part 80 and RSS-182. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;

  
\_\_\_\_\_  
J Holcombe



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## **SECTION 1**

### **REPORT SUMMARY**

Limited FCC Part 80 and Industry Canada, RSS-182 Testing  
of a Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC)



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## 1.1 STATUS

<b>Equipment Under Test</b>	RAY55 Fixed Mount VHF (with Class D DSC)
<b>Objective</b>	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
<b>Name and Address of Client</b>	Raymarine Anchorage Park Portsmouth Hampshire PO3 5TD United Kingdom
<b>Type</b>	RAY55
<b>Product Code</b>	E43032
<b>Serial Number(s)</b>	03
<b>Hardware Version</b>	1.00
<b>Firmware Issue</b>	1.00
<b>Occupied Bandwidth</b>	15.13 (VOICE) 12.725 (DSC)
<b>Emission Designator</b>	16K0G3EJN (VOICE) 16K0G2BJN (DSC)
<b>Declared Variants</b>	None
<b>Test Specification/Issue/Date</b>	FCC CFR 47: Part 2: 2003 FCC CFR 47: Part 80: 2005 RSS-182: 2003
<b>Number of Items Tested</b>	One
<b>Security Classification of EUT</b>	Commercial-in-Confidence
<b>Incoming Release Date</b>	Declaration of Build Status 8 <sup>th</sup> November 2006
<b>Disposal</b>	Held pending disposal
<b>Order Number Date</b>	FTL1888 17 <sup>th</sup> October 2006
<b>Date of Test</b>	11 <sup>th</sup> May 2007
<b>Related Documents</b>	ANSI C63.4: 2001 RSS-212, Issue 1: 1999



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## 1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Raymarine RAY55 Fixed Mount VHF (with Class D DSC) to the requirements of FCC Part 80 and Industry Canada Radio Specifications RSS-182.

Testing has been performed under the following site accreditations:

FCC Accreditation  
90987 Octagon House, Fareham Test Laboratory.

Industry Canada Accreditation  
IC4270 Octagon House, Fareham Test Laboratory.



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**1.3 BRIEF SUMMARY OF RESULTS**

A brief summary of the tests carried out is shown below.

FCC Part 80  
 Industry Canada - RSS-182.

Section	Spec Clause	Test Description	Result	Comments
	FCC Industry Canada			
2.1	FCC Part 80.211 FCC Part 2.1053 RSS-182 4.4, 6.3.1	Emission Limitations (Radiated Transmitter Spurious) Measurements required: Field strength of spurious radiation.	Pass	



**1.4 APPLICATION FORM**

<b>APPLICANT'S DETAILS</b>	
CATEGORY OF APPLICANT (please tick relevant box opposite)	(a) <input checked="" type="checkbox"/> MANUFACTURER
	(b) <input type="checkbox"/> IMPORTER
If box (b), (c) or (d) is ticked complete details in box below with respect to the manufacturer	(c) <input type="checkbox"/> DISTRIBUTOR
	(d) <input type="checkbox"/> AGENT
COMPANY NAME :	Raymarine plc.
ADDRESS :	Quay Point Northarbour Road Portsmouth, Hampshire PO6 3TD United Kingdom
NAME FOR CONTACT PURPOSES :	J.D.Walsh
TELEPHONE NO :01234 22600 FAX NO :	
	TELEX NO :

<b>MANUFACTURER'S DETAILS</b>	
COMPANY NAME :	As above
ADDRESS :	
NAME FOR CONTACT PURPOSES :	
TELEPHONE NO :	FAX NO :
	TELEX NO :







**1.4 APPLICATION FORM**

TYPE OF EQUIPMENT	
<input type="checkbox"/>	Transmitter
<input checked="" type="checkbox"/>	Transmitter/Receiver
<input type="checkbox"/>	Receiver
<input checked="" type="checkbox"/>	Simplex on single-frequency channels
<input checked="" type="checkbox"/>	Simplex on two-frequency channels
<input type="checkbox"/>	Duplex
<input type="checkbox"/>	Separate DSC unit
<input checked="" type="checkbox"/>	Integrated DSC units
<input type="checkbox"/>	Integrated analogue selective calling decoder
<b>Interfaces</b>	
<input type="checkbox"/>	DSC at audio level
<input type="checkbox"/>	DSC at DC level
<input type="checkbox"/>	Printer
<input checked="" type="checkbox"/>	External loudspeaker
<input type="checkbox"/>	DSC watchkeeping receiver antenna output
<input type="checkbox"/>	DSC watchkeeping receiver control



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**1.4 APPLICATION FORM**

<b>DUPLEX OPERATION</b>		
Is the equipment intended for		
Duplex operation	[   ]	Yes
	[✓ ]	No
Is the equipment fitted with separate transmitter and receiver antenna sockets		
	[   ]	Yes
	[✓ ]	No
Is the equipment fitted with a duplex filter as an integral part of the equipment with a single antenna connection socket		
	[   ]	Yes
	[✓ ]	No
Is the duplex filter externally fitted and connected to the main equipment by co-axial cable(s)		
	[   ]	Yes
	[✓ ]	No
Type and make of duplex filter		
.....		



**1.4 APPLICATION FORM**

<b>TRANSMITTER AND RECEIVER CHARACTERISTICS</b>	
NUMBER OF CHANNELS:	
<input type="checkbox"/> [all ]	ITU channels
<input type="checkbox"/> [all ]	USA channels
<input type="checkbox"/> [8 ]	PRIVATE channels
<input type="checkbox"/> [6 ]	WEATHER channels (Rx Only)
<input type="checkbox"/> [ ]	MEMORY channels
DSC CHANNEL(S) (if provided)	
<input type="checkbox"/> [ ]	
<input type="checkbox"/> [ ]	Other :
CHANNEL SEPARATION :	25 kHz
ITU designation of class of emission(s) : G3E for speech, G2B for DSC	
ANTENNA IMPEDANCE : 50 ohm	



**1.4 APPLICATION FORM**

<b>TRANSMITTER TECHNICAL CHARACTERISTICS</b>	
<b>TRANSMITTER FREQUENCY</b>	
Method of frequency generation	
<input type="checkbox"/>	CRYSTAL
<input checked="" type="checkbox"/>	SYNTHESIZER
<input type="checkbox"/>	OTHER
Transmitter frequency bands : 156.025MHz to 157.425MHz	
<b>TRANSMITTER MODULATION</b>	
Modulation method : FM	
Occupied bandwidth :16KHz	
Maximum frequency deviations : 5Hz	
<b>TRANSMITTER MODULATION INPUT CHARACTERISTICS</b>	
Impedance :2k ohm	
<input type="checkbox"/>	balanced
<input checked="" type="checkbox"/>	unbalanced



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**1.4 APPLICATION FORM**

<b>TRANSMITTER RF POWER CHARACTERISTICS</b>	
RATED TRANSMITTER OUTPUT POWER (as stated by the manufacturer)	
Maximum output power :	25W
Reduced output power :	1W
Output power switch :	<input checked="" type="checkbox"/> Yes
	<input type="checkbox"/> No



1.4 APPLICATION FORM

TRANSMITTER AND RECEIVER POWER SOURCE (1)	
<input type="checkbox"/>	<del>AC MAINS</del> State voltage: <del>    </del> V <input type="checkbox"/> <del>Single phase</del>
	AC MAINS FREQUENCY <input type="checkbox"/> Three phase
	DC Voltage : 12V
	DC Maximum Current (A) : 6A
<input type="checkbox"/>	Other:
BATTERY	
<input type="checkbox"/>	<del>Nickel Cadmium</del>
<input type="checkbox"/>	<del>Mercury</del>
<input type="checkbox"/>	<del>Alkaline</del>
<input type="checkbox"/>	<del>Lead acid (Vehicle regulated)</del>
<input type="checkbox"/>	<del>Leclanche</del>
<input type="checkbox"/>	<del>Lithium</del>
<input type="checkbox"/>	<del>Other</del>
Volts nominal: . End point voltage as quoted by equipment manufacturer: 10.6 V. (Refer to Clause 4.9.2 and 4.10.3 of the Standard when completing the above)	

(1) If a transmitter and receiver use the same power source, this should be declared. In such cases only the box for the transmitter power source should be filled in.



**1.4 APPLICATION FORM**

<b>RECEIVER TECHNICAL CHARACTERISTICS</b>	
<b>RECEIVER FREQUENCY</b>	
Method of frequency generation :	
<input type="checkbox"/>	CRYSTAL
<input checked="" type="checkbox"/>	SYNTHESISER
<input type="checkbox"/>	OTHER :
Intermediate frequencies :	
[21.6]	MHz
[455]	kHz
[ ]	3rd
Receiver frequency channels : 156.025MHz to 163.275MHz	
Is local oscillator injection frequency higher or lower than the receiver nominal frequency?	
<input type="checkbox"/>	Higher
<input checked="" type="checkbox"/>	Lower





**1.4 APPLICATION FORM**

<b>RECEIVER MODULATION OUTPUT CHARACTERISTICS</b>	
RATED AUDIO OUTPUT POWER (as stated by the manufacturer)	
Loudspeaker :	2 W
Earphone :	W
<b>RECEIVER MULTIPLE WATCH FACILITIES</b>	
Dual watch facilities :	
	<input checked="" type="checkbox"/> Yes
	<input type="checkbox"/> No
If Yes, then :	
Selection of priority channel possible ? :	
	<input type="checkbox"/> Yes
	<input checked="" type="checkbox"/> No (= 16Ch)
Multiple watch facilities :	
	<input checked="" type="checkbox"/> Yes
	<input type="checkbox"/> No
If Yes, then :	
Selection of priority channel possible ? :	
	<input type="checkbox"/> Yes
	<input checked="" type="checkbox"/> No (= 16Ch )
Number of additional channels selectable : 56	
Scan time programmable ? :	
	<input type="checkbox"/> Yes
	<input checked="" type="checkbox"/> No



1.4 APPLICATION FORM

RECEIVER POWER SOURCE (1)	
<input type="checkbox"/> <del>AC MAINS</del>	State voltage: _____ V <input type="checkbox"/> <del>Single phase</del>
<input type="checkbox"/> <del>AC MAINS FREQUENCY</del>	<input type="checkbox"/> <del>Three phase</del>
DC Voltage (V) : <b>12V</b>	
DC Maximum Current : <b>2A</b>	
<input type="checkbox"/> Other	
<b>BATTERY</b>	
<input type="checkbox"/> <del>Nickel Cadmium</del>	
<input type="checkbox"/> <del>Mercury</del>	
<input type="checkbox"/> <del>Alkaline</del>	
<input type="checkbox"/> <del>Lead acid (Vehicle regulated)</del>	
<input type="checkbox"/> <del>Leclanche</del>	
<input type="checkbox"/> <del>Lithium</del>	
<input type="checkbox"/> <del>Other</del>	
Volts nominal: . End point voltage as quoted by equipment manufacturer 10.6V. (Refer to Clause 4.9.2 and 4.10.3 of the Standard when completing the above)	

(1) If a transmitter and receiver use the same power source, this should be declared. In such cases only the box for the transmitter power source should be filled in.



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**1.4 APPLICATION FORM**

<b>CONSTRUCTION OF THE EQUIPMENT</b>	
<input checked="" type="checkbox"/> [ ]	Single unit (1)
[ ]	Multiple units
If multiple units, describe each one clearly :	
<b>TEMPERATURE RANGES</b> over which the equipment is to be tested	
[ ]	+15°C to +35°C
<input checked="" type="checkbox"/> [ ]	-15°C to +55°C
[ ]	Other

(1) Unit means a physically separate item of the equipment.



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**1.4 APPLICATION FORM**

<b>OTHER ITEMS SUPPLIED</b>		
Spare batteries	[ ]	Yes
	[ ]	No
Battery charging device	[ ]	Yes
	[ ]	No
Special tools for dismantling equipment	[ ]	Yes
	[ ]	No
Test interface box (if applicable)	[ ]	Yes
	[ ]	No
Full documentation on equipment (Handbook and circuit diagrams)	[ ]	Yes
	[ ]	No
Others	[ ]	Yes
	[ ]	No
If Yes, please specify :		



**1.4 APPLICATION FORM**

<b>DECLARATION</b>		
Are the equipments submitted representative production models ?	[ ]	Yes
	[✓ ]	No
If not are the equipments pre-production models ?	[✓ ]	Yes
	[ ]	No
If pre-production equipments are submitted will the final production equipments be identical in all respects with the equipment tested.	[ ]	Yes
	[ ]	No
If no supply full details		
Is the Test Report to be used as part of a Type Approval Application ?	[ ]	Yes
	[✓ ]	No
If yes, has the product, any direct engineering predecessor, or variant ever been granted Type Approval in any EEC member country ?	[ ]	Yes
	[✓ ]	No
If yes supply full details :		
Will labelling of the equipment comply with the requirements of ETS 300 338 ?	[ ]	Yes
	[ ]	No
If no supply full details		

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature :

Name : J.D Walsh

Position held : Consultant

Date : 6<sup>th</sup> November 2006

TUV Product Service formally certifies that the manufacturer's declaration as typed out in this report, is a true and accurate record of the original received from the applicant.



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## **1.5 PRODUCT INFORMATION**

### **1.5.1 Technical Description**

The Equipment Under Test (EUT) was a Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC) Marine Radio.

The EUT is fitted with an NMEA port.

### **1.5.2 Modes of Operation**


The EUT was operated as described under the specific test Sections.



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**1.5 PRODUCT INFORMATION**

**1.5.4 Declaration of Build Status**

<b>Manufacturer</b>	Raymarine
<b>Country of origin</b>	Japan Raymarine PLC
<b>UK Agent</b>	Marine VHF with Class D DSC & ATIS
<b>Technical Description</b>	
<b>Model No</b>	RAY55 E43032 RAY55 VHF Radio with removable microphone
<b>Product Code</b>	E43032
<b>Serial No</b>	03
<b>Drawing Number</b>	
<b>Build Status</b>	Pre production
<b>Firmware Issue</b>	10/23
<b>FCC ID</b>	PJ5VHFGEN1
<b>IC ID</b>	4069A-VHFGEN1
<b>Signature</b>	
<b>Date</b>	8 Nov 2006
<b>D of B S Serial No</b>	RM615608-03

*Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.*

*No responsibility will be accepted by BABT/TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.*



**1.6 TEST CONDITIONS**

The EUT was set-up simulating a typical user installation at the Test Laboratory, as listed in Section 1.2 and tested in accordance with the applicable specification.

For all tests, the Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC) was powered by a 12V dc power supply.

**1.7 DEVIATIONS FROM THE STANDARD**

Not Applicable

**1.8 MODIFICATION RECORD**

The table below details modifications made to the EUT during the test programme. The Modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied	N/A	
1	Modifications to Ray55: R-SP401/100 ohm is added on the RX Audio Line (M-AF) Value change of JP401 (0 ohm to 100 ohm) C461/1000pF is added on the VR2 between the Volume Line and GND R-SP02/100 ohm is added on the RX Audio Line (M-AF) Value change of JP001 (0 ohm to 100 ohm) R-SP03/1k ohm is added on the Power Switch Line Change component. L012/2.2uH Inductor is changed to 2.2k ohm resistor. Value change of both R024 & R025 (4.7k ohm to 2.2k) Value change of R029 (100 ohm to 150 ohm) R026 / 470 ohm → Not Used Modifications to Raymic: IC604 component changed. TDA7056AT→TDA7056B C619 value change 470uF → 1000uF CN601 2 pins added to connector IC609 component added P/N TA78L05 Voltage: 5V R665 / component added 5.1ohm Wire connection made from CN601 to IC604	Raymarine plc	Prior to testing

All testing was conducted at Modification State 1 unless stated otherwise.





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## **SECTION 2**

### **TEST RESULTS**

Limited FCC Part 80 and Industry Canada RSS-182  
Testing of a Raymarine plc RAY55 Fixed Mount VHF (with Class D DSC)



## **2.1 EMISSION LIMITATIONS (RADIATED TRANSMITTER SPURIOUS)**

### **2.1.1 Specification Reference**

FCC Part 80.211 (c) 2.1053  
Industry Canada RSS-182 Sections 4.4, 6.3.1

### **2.1.2 Equipment Under Test**

RAY55 Fixed Mount VHF (with Class D DSC)

### **2.1.3 Date of Test**

11<sup>th</sup> May 2007

### **2.1.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.1.5 Test Procedure**

The EUT was set up in accordance with the manufacturer's instruction in a semi-anechoic chamber conforming to the requirements of ANSI-C63.4.

The frequency spectrum was investigated between 30MHz and 2000MHz. Where emissions were present, they were measured at a distance of 3m. A height search between 1 and 4m was carried out and the EUT rotated through 360° to maximise the response.

The receivers detector was set to peak and max hold function utilised. Below 1GHz an RBW of 100kHz and VBW of 300kHz was used. Above 1GHz on RBW of 1MHz and VBW of 3MHz was used.

The EUT was tested on bottom, middle and top channels for audio and channel 70 for DSC on maximum power with modulation applied in accordance with FCC Part 80.211 (c) 2.1053 and RSS-182 Section 4.4.

### **2.1.6 Test Results**

The EUT met the requirements of FCC Part 80.211 (c) 2.1053 and Industry Canada RSS-182 Sections 4.4, 6.3.1. No emissions attributable to the EUT were detected within 20dB below the limit. Therefore no table of results is presented.



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### **SECTION 3**

### **TEST EQUIPMENT**



### 3.1 TEST EQUIPMENT

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	TE Number	Calibration Due
<b>Section 2.1 EMC - Radiated Emissions</b>				
Spectrum Analyser	Hewlett Packard	8542E	18	09/02/2008
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Mast Controller	Inn-Co GmbH	CO 1000	1606	TU
Turntable/Mast Controller	EMCO	2090	1607	TU
DC Power Supply Unit	Hewlett Packard	6267B	1901	TU
Multimeter	Iso-tech	Iso Tech IDM101	2417	08/08/2007
Bilog Antenna	Chase	CBL6143	2904	10/11/2007
Comb Generator	Schaffner	RSG1000	3034	TU

TU Traceability Unscheduled

### 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB

Worst case error for both Time and Frequency measurement 12 parts in 10<sup>6</sup>.

\* In accordance with CISPR 16-4



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## **SECTION 4**

### **PHOTOGRAPHS**



**4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)**



Set up photo for Radiated Emissions



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4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Label for RAY55



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## **SECTION 5**

### **DISCLAIMERS AND COPYRIGHT**





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## 5.1 DISCLAIMERS AND COPYRIGHT

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