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# Report On

Radio Testing of the  
Raymarine Belgium BVBA Class D DSC  
In accordance with IEC 62238

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Document 75920234 Report 07 Issue 1

April 2013



Product Service

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**REPORT ON**

Radio Testing of the  
Raymarine Belgium BVBA Class D DSC  
In accordance with IEC 62238

Document 75920234 Report 07 Issue 1

April 2013

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**DATED**

19 April 2013



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## **SECTION 1**

### **REPORT SUMMARY**

Radio Testing of the  
Raymarine Belgium BVBA Class D DSC  
In accordance with IEC 62238



## 1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Radio Testing of the Raymarine Belgium BVBA Class D DSC to the requirements of IEC 62238.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Raymarine Belgium BVBA
Model Number(s)	RAY260
Serial Number(s)	Base No.4 BOX Sample 1
Number of Samples Tested	2
Test Specification/Issue/Date	IEC 62238 (2003-03)
Incoming Release Date	Application Form
Disposal Reference Number	Held Pending Disposal
Date	Not Applicable
Order Number	Not Applicable
Date	
Start of Test	N6506
	02 October 2012
Finish of Test	29 November 2012
Name of Engineer(s)	17 April 2013
	M Russell



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 62238 is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
DSC Radio				
2.1	8.14	Test of Generated Call Sequences	Pass	
2.2	9.13	Multiple Watch Characteristics	Pass	
2.3	10.3	DSC Receiver Adjacent Channel Selectivity	Pass	
2.4	10.5	DSC Receiver Intermodulation Response	Pass	
2.5	10.8	Verification of Correct Decoding of Various Types of DSC Calls	Pass	
2.6	10.9	Reaction to VTS and AIS Channel Management DSC Transmissions	Pass	
2.7	10.10	Simultaneous Reception	Pass	



## 1.3 APPLICATION FORM

APPLICANT'S DETAILS				
COMPANY NAME :	Raymarine UK Ltd			
ADDRESS :	Cartwright Drive, Fareham, Hampshire, PO15 5RJ			
NAME FOR CONTACT PURPOSES : Andy Little				
TELEPHONE NO: 01329 246897	FAX NO: ..... E-MAIL: andy.little@raymarine.com			
EQUIPMENT INFORMATION				
AIS Version (Unit tested)				
Model name/number	RAY260 VHF-AIS	Identification/Part number	E70088	
Non-AIS Version (Identical transmitter, AIS receiver module removed)				
Model name/number	RAY260 VHF	Identification/Part number	E70087	
Hardware Version Manufacturer	TO Raymarine	Software Version Country of Origin	0.4 China	
FCC ID	PJ5-RAY260.....	Industry Canada ID	4069B-RAY260	
Technical description (a brief description of the intended use and operation) Class D marine VHF radio				
<u>Supply Voltage:</u>				
[ <input checked="" type="checkbox"/> ]	AC mains	State AC voltage .....	V and AC frequency .....	Hz
[ <input checked="" type="checkbox"/> ]	DC (external)	State DC voltage 12 V	and DC current .....	6 A
[ <input type="checkbox"/> ]	DC (internal)	State DC voltage .....	V and Battery type .....	
<u>Frequency characteristics:</u>				
Transmitter Frequency range	155.5 MHz to 161.425 MHz	Channel spacing 12.5kHz (if channelized)		
Receiver Frequency range (if different)	155.5 MHz to 163.275 MHz	Channel spacing 12.5kHz (if channelized)		
Designated test frequencies:	Bottom: ..... MHz	Middle: ..... MHz	Top: ..... MHz	
Intermediate Frequencies : Working Chanel Receiver: 1 <sup>st</sup> IF Freq.: 21.6MHz, 2 <sup>nd</sup> IF Freq.: 455Hz				
Dedicated CH70 Receiver: 1 <sup>st</sup> IF Freq.: 45.1MHz, 2 <sup>nd</sup> IF Freq.: 455Hz				
Highest Internally Generated Frequency : 161.425MHz. Frequency of the Private channel M2.				
<u>Power characteristics:</u>				
Maximum transmitter power	25 W	Minimum transmitter power	1 W (if variable)	
[ <input checked="" type="checkbox"/> ]	Continuous transmission	State duty cycle .....		
[ <input checked="" type="checkbox"/> ]	Intermittent transmission	If intermittent, can transmitter be set to continuous transmit test mode? Y/N		
<u>Antenna characteristics:</u>				
[ <input checked="" type="checkbox"/> ]	Antenna connector	State impedance 50 ohm		
[ <input type="checkbox"/> ]	Temporary antenna connector	State impedance ..... ohm		
[ <input type="checkbox"/> ]	Integral antenna	State gain ..... dBi		
<u>Modulation characteristics:</u>				
[ <input type="checkbox"/> ]	Amplitude	[ <input type="checkbox"/> ]	Other	
[ <input checked="" type="checkbox"/> ]	Frequency	Details: .....		
[ <input type="checkbox"/> ]	Phase	(GMSK, QSPK etc)		
Can the transmitter operate un-modulated? Y				
ITU Class of emission: .....				
<u>Battery/Power Supply</u>				
Model name/number	N/A.....	Identification/Part number	.....	
Manufacturer	.....	Country of Origin	.....	
<u>Ancillaries (if applicable)</u>				



<u>Handset</u>			
Model name/number	RAYMIC260 Handset	Identification/Part number	A80196
Country of Origin: China			
<u>Active Speaker</u>			
Model name/number	RAY260 Active Speaker	Identification/Part number	A80199
Country of Origin: China			
<u>Passive Speaker</u>			
Model name/number	RAY260 Speaker	Identification/Part number	A80198
Country of Origin: China			
<u>Extreme conditions:</u>			
Maximum temperature	60 °C	Minimum temperature	-20 °C
Maximum supply voltage	15.6 V	Minimum supply voltage	10.8 V

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

Signature : Andy Little

Name : Andy Little

Position held : Compliance Manager

Date : 21<sup>st</sup> December 2012



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## 1.4 PRODUCT INFORMATION

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a Raymarine Belgium BVBA Class D DSC as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test



## 1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

## 1.6 MODIFICATION RECORD

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
<b>Serial Number: BOX Sample 1</b>			
0	As supplied by manufacturer.	N/A	N/A
1	Software update to alert the user of a received DSC distress call when other signals are present on channel 16	Stuart Archibald	15/04/2013
2	Software update to enable a test mode in which the DSC demodulated output from the DSC receiver is output at the same time the VHF receiver can receive on channel 16.	Stuart Archibald	17/04/2013

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



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## **SECTION 2**

### **TEST DETAILS**

Radio Testing of the  
Raymarine Belgium BVBA Class D DSC  
In accordance with IEC 62238



## 2.1 TEST OF GENERATED CALL SEQUENCES

### 2.1.1 Specification Reference

IEC 62238, Clause 8.14

### 2.1.2 Equipment Under Test and Modification State

RAY260 S/N: BOX Sample 1 - Modification State 1

### 2.1.3 Date of Test

9 April 2013

### 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 Environmental Conditions

Ambient Temperature	21.8°C
Relative Humidity	31.3%

### 2.1.6 Test Results

Call Sent	Received without error	Telecommand 1	Telecommand 2
Distress	Yes	100	126
All Ships Urgency	Yes	100	126
All Ships Safety	Yes	100	126
Individual Routine	Yes	100	126
Group Routine	Yes	100	126

#### Limit Clause 8.14.3

The requirements of ITU-R Recommendation M.493-10 regarding message composition and content shall be met.

The generated call shall be analyzed 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.



## 2.2 MULTIPLE WATCH CHARACTERISTICS

### 2.2.1 Specification Reference

IEC 62238, Clause 9.13

### 2.2.2 Equipment Under Test and Modification State

RAY260 S/N: BOX Sample 1 - Modification State 0

### 2.2.3 Date of Test

11 April 2013

### 2.2.4 Test Equipment Used

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

### 2.2.5 Environmental Conditions

Ambient Temperature 23.1°C  
Relative Humidity 36.7%

### 2.2.6 Test Results

Test Conditions		Scanning Time (s)	Dwell on priority (ms)	Dwell on Additional (s)
$T_{\text{nom}}$ (23.1°C)	$V_{\text{nom}}$ (12 V DC)	1.587	74.7	1.518
$T_{\text{min}}$ (-15.0°C)	$V_{\text{min}}$ (10.8 V DC)	1.576	74.2	1.573
$T_{\text{max}}$ (+55.0°C)	$V_{\text{max}}$ (15.6 V DC)	1.586	75.2	1.565

#### Duplex

Test Conditions		Scanning Time (s)	Dwell on priority (ms)	Dwell on Additional (s)
$T_{\text{nom}}$ (23.1°C)	$V_{\text{nom}}$ (12 V DC)	1.579	74.0	1.571
$T_{\text{min}}$ (-15.0°C)	$V_{\text{min}}$ (10.8 V DC)	1.574	74.4	1.559
$T_{\text{max}}$ (+55.0°C)	$V_{\text{max}}$ (15.6 V DC)	1.575	74.1	1.573

#### Limit Clause 9.13.3

Scanning Period	$\leq 2$ s
Dwell Time (Priority Channel)	$\leq 150$ ms
Dwell Time (Additional Channel)	Between 850 ms and 2 s

Rx Additional Channels used for testing: Simplex - CH72 - 156.625MHz Duplex - CH88 - 162.025MHz



## 2.3 DSC RECEIVER ADJACENT CHANNEL SELECTIVITY

### 2.3.1 Specification Reference

IEC 62238, Clause 10.3

### 2.3.2 Equipment Under Test and Modification State

RAY260 S/N: Base No.4 - Modification State 0

### 2.3.3 Date of Test

14 December 2012 & 18 December 2012

### 2.3.4 Test Equipment Used

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

### 2.3.5 Environmental Conditions

Ambient Temperature 20.8 - 24.3°C

Relative Humidity 27.4 - 36.3%

### 2.3.6 Test Results

12 V DC Supply

Test Conditions		Bit Error Ratio	
		156.525 MHz	
		+25 kHz	-25kHz
T <sub>nom</sub> (24.3°C)	V <sub>nom</sub> (12 V DC)	0	0
T <sub>min</sub> (-15.0°C)	V <sub>min</sub> (10.8 V DC)	0	0
T <sub>max</sub> (+55.0°C)	V <sub>max</sub> (15.6 V DC)	0	0

#### Limit Clause 10.3.3

The bit error ratio shall be less than 10<sup>-2</sup>



## 2.4 DSC RECEIVER INTERMODULATION RESPONSE

### 2.4.1 Specification Reference

IEC 62238, Clause 10.5

### 2.4.2 Equipment Under Test and Modification State

RAY260 S/N: Base No.4 - Modification State 0

### 2.4.3 Date of Test

14 December 2012

### 2.4.4 Test Equipment Used

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

### 2.4.5 Environmental Conditions

Ambient Temperature	24.8°C
Relative Humidity	36.7%

### 2.4.6 Test Results

12 V DC Supply

Frequency Increments of Unwanted Signals	Bit Error Rate
	156.525 MHz
+ 50/100 kHz	0
- 50/100 kHz	0

Limit Clause 10.5.3

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



## 2.5 VERIFICATION OF CORRECT DECODING OF VARIOUS TYPES OF DSC CALLS

### 2.5.1 Specification Reference

IEC 62238, Clause 10.8

### 2.5.2 Equipment Under Test and Modification State

RAY260 S/N: BOX Sample 1 - Modification State 0

### 2.5.3 Date of Test

9 April 2013

### 2.5.4 Test Equipment Used

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

### 2.5.5 Environmental Conditions

Ambient Temperature 23.2°C  
Relative Humidity 31.1%

### 2.5.6 Test Results

	Received (Y or N)	Telecommand 1	Telecommand 2
Distress	Y	100	126
All Ships Distress Ack	Y	110	126
All Ships Distress Relay	Y	112	126
All Ships Urgency	Y	100	126
All Ships Safety	Y	100	126
Individual Urgency	Y	100	126
Individual Safety	Y	100	126
Individual Routine	Y	100	126
Group Routine	Y	100	126



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

Limit Clause 10.8.3

The requirement of ITU-R Recommendation M.493.13 [5] regarding message composition and content shall be met.



## 2.6 REACTION TO VTS AND AIS CHANNEL MANAGEMENT DSC TRANSMISSIONS

### 2.6.1 Specification Reference

IEC 62238, Clause 10.9

### 2.6.2 Equipment Under Test and Modification State

RAY260 S/N: BOX Sample 1 - Modification State 0

### 2.6.3 Date of Test

10 April 2013

### 2.6.4 Test Equipment Used

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

### 2.6.5 Environmental Conditions

Ambient Temperature 24.0°C  
Relative Humidity 34.0%

### 2.6.6 Test Results

	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

#### Limit Clause 10.9.3

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



## 2.7 SIMULTANEOUS RECEPTION

### 2.7.1 Specification Reference

IEC 62238, Clause 10.10

### 2.7.2 Equipment Under Test and Modification State

RAY260 S/N: BOX Sample 1 - Modification State 2

### 2.7.3 Date of Test

17 April 2013

### 2.7.4 Test Equipment Used

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

### 2.7.5 Environmental Conditions

Ambient Temperature	24.2°C
Relative Humidity	41.9%

### 2.7.6 Test Results

#### 156.525 MHz

SINAD (dB) No DSC Signal	SINAD (dB) DSC Signal Applied	Bit Error Rate
38.8	38.5	2.6E-10

#### Limit Clause 10.10.3

SINAD Ratio (dB)	≥ 20 dB in presence of DSC Signal
Bit Error Rate	≤ 10 <sup>-2</sup>



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## **SECTION 3**

### **TEST EQUIPMENT USED**



### 3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
<b>Section 2.1 - DSC - Testing of Generated Call Sequences</b>					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
Modem (VHF DSC)	ICS	PLT02249	120	12	7-Feb-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Sensor Module	Hewlett Packard	11722A	1333	12	28-Aug-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Modulation Analyser	Hewlett Packard	8901B	3292	12	10-Dec-2013
Communications Receiver, AM, FM,& WFM	ICOM	IC-R5	3330	-	O/P Mon
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2013
<b>Section 2.2 - Multiple Watch Characteristics</b>					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
Digital Temperature Indicator + T/C	Fluke	51	412	12	16-Jan-2014
Temperature Chamber	Montford	2F3	467	-	O/P Mon
1GHz Digital Oscilloscope	Lecroy	9370M	612	12	24-Oct-2013
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Power Divider	Weinschel	1506A	3345	12	8-May-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
Signal Generator, 9kHz - 3GHz	Rohde & Schwarz	SMA 100A	3504	12	24-Aug-2013
<b>Section 2.3 - DSC Receiver Adjacent Channel Selectivity</b>					
Modulation Analyser	Hewlett Packard	8901B	45	12	18-Jul-2013
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TÜV SÜD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	5-Jul-2013
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
DC Power Supply	Hewlett Packard	6269B	326	-	TU
Digital Temperature Indicator + T/C	Fluke	51	412	12	6-Jan-2013
Temperature Chamber	Montford	2F3	467	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Sensor	Hewlett Packard	11722A	2787	12	28-Aug-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
DSC Pre-Emphasis Unit for VHF Modem	TÜV SÜD Product Service	RAB 200701	3314	12	8-Feb-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2013
True RMS Multimeter	Fluke	179	4007	12	16-Feb-2013



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
<b>Section 2.4 - DSC Receiver Intermodulation Response</b>					
Modulation Analyser	Hewlett Packard	8901B	45	12	18-Jul-2013
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMX	115	12	5-Jul-2013
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
DC Power Supply	Hewlett Packard	6269B	326	-	TU
Digital Temperature Indicator + T/C	Fluke	51	412	12	6-Jan-2013
Temperature Chamber	Montford	2F3	467	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	19-Jan-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Sensor	Hewlett Packard	11722A	2787	12	28-Aug-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	8-Feb-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2013
<b>Section 2.5 - Verification of Correct Decoding of Various Types of DSC Calls</b>					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
Modem (VHF DSC)	ICS	PLT02249	120	12	7-Feb-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Sensor Module	Hewlett Packard	11722A	1333	12	28-Aug-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Modulation Analyser	Hewlett Packard	8901B	3292	12	10-Dec-2013
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
<b>Section 2.6 - Reaction to VTS and AIS channel Management DSC Transmissions</b>					
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
Modem (VHF DSC)	ICS	PLT02249	120	12	7-Feb-2014
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Sensor Module	Hewlett Packard	11722A	1333	12	28-Aug-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Modulation Analyser	Hewlett Packard	8901B	3292	12	10-Dec-2013
Communications Receiver, AM, FM,& WFM	ICOM	IC-R5	3330	-	O/P Mon
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2013
DC - 8 GHz Attenuator	Lucas Weinschel	24-30-33	3963	12	27-Jun-2013
<b>Section 2.7 - Simultaneous Reception</b>					
Signal Generator	Rohde & Schwarz	SMG	42	12	12-Sep-2013
Audio Analyser	Hewlett Packard	8903B	44	12	28-Sep-2013
Digital Time Analyser	Marconi	2850-BS	80	-	TU
DSC Decoder/Encoder	TUV SUD Product Service	DSC TPOO1	81	-	TU
Signal Generator	Rohde & Schwarz	SMY 01	118	12	18-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Sensor Module	Hewlett Packard	11722A	1333	12	28-Aug-2013
Multimeter	Iso-tech	IDM101	2424	12	10-Sep-2013
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Modulation Analyser	Hewlett Packard	8901B	3292	12	10-Dec-2013
DSC Pre-Emphasis Unit for VHF Modem	TUV SUD Product Service	RAB 200701	3314	12	7-Feb-2014
Power Divider	Weinschel	1506A	3345	12	8-May-2013

TU – Traceability Unscheduled, O/P MON – Output Monitored with Calibrated Equipment



### 3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
Multiple Watch Characteristics	-
DSC Receiver Adjacent Channel Selectivity	$\pm 2.6$ dB
DSC Receiver Intermodulation Response	$\pm 1.7$ dB
Verification of Correct Decoding of Various Types of DSC Calls	-
Reaction to VTS and AIS Channel Management DSC Transmissions	-
Simultaneous Reception	$\pm 1.8$ dB
Test of Generated Call Sequences	-



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## **SECTION 4**

### **PHOTOGRAPHS**



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



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## **SECTION 5**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**



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## 5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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