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Report On

FCC and IC Testing of the
Garmin International Inc
VHF200 fixed mount marine radio

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FCC ID: IPH-GARVHF12
IC ID: 1792A-GARVHF12

Document 75904785 Report 06 Issue 1

February 2009



Product Service

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COMMERCIAL-IN-CONFIDENCE

REPORT ON

FCC and IC Testing of the
Garmin International Inc
VHF200 fixed mount marine radio

Document 75904785 Report 06 Issue 1

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PREPARED FOR

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PREPARED BY



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EMC Engineer

APPROVED BY



J Adams
Authorised Signatory



M Jenkins
Authorised Signatory

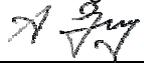
DATED

06 February 2009

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 CFR 47: Part 80 and RSS-Gen Issue 2. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);



A Guy



J Holcombe



M P Hardy





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SECTION 1

REPORT SUMMARY

FCC and IC Testing of the
Garmin International Inc
VHF200 fixed mount marine radio



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Garmin International Inc VHF200 fixed mount marine radio to the requirements of FCC CFR 47 Part 80: 2006 and RSS-182 Issue 4: 2003.

Objective	To perform FCC and IC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification for the series of tests carried out.
Manufacturer	Garmin International
Model Number(s)	VHF 200
Declared Variant	VHF 100
Serial Number(s)	No.1 No.3
Software Version	2.00
Hardware Version	1.00 or Later
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 80: 2006 RSS-182 Issue 4: 2003
Incoming Release Date	Declaration of Build Status 17 October 2008
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	144892 Rev 0 18 September 2008
Start of Test	13 January 2009
Finish of Test	16 January 2009
Name of Engineer(s)	A Guy J Holcombe M P Hardy
Related Document(s)	ANSI 63.4: 2003

This test report demonstrates testing to FCC CFR 47 Part 80:2006, however the results and limits have been compared to the latest published version of FCC CFR 47 Part 80:2008, and there are no differences that affect the results and limits contained within this test report.



Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 80: 2006 and RSS-182 Issue 4: 2003 , is shown below.

Configuration 1 - Normal							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Base Standard
	FCC	IC					
2.1	80.211(f)(3)	4.4 / 6.3	Radiated Emissions (Enclosure Port)	Transmit	1	Pass	-
				Receive		N/A	
2.2	80.141 (d)	3.7	Transmitter Time Out Timer	Transmit	0	Pass	
2.3	80.209(a)	4.2 / 6.1	Frequency Stability Under Voltage Variations	Transmit	0	Pass	
2.4	80.209(a)	4.2 / 6.1	Frequency Stability Under Temperature Variations	Transmit	0	Pass	
2.5	80.211(f)(1)(2)	6.3.1 / 6.6	Emission Limitations (Emission Mask)	Transmit	0	Pass	
2.6	80.205(a)	3.9 General / 3.4 (e)	Occupied Bandwidth	Transmit	0	Pass	
2.7	80.211(c)(f)(3)	4.4 / 6.3	Emission Limitations (Conducted Transmitter Spurious)	Transmit	0	Pass	
2.8	80.213		Modulation Characteristics	Transmit	0	Pass	
2.9	80.215	4.3 / 6.2 / 3.7	Transmitter Power	Transmit	0	Pass	
2.10	80.217(b)	N/A	Suppression of Interference Aboard Ships	Receive	0	Pass	
2.11	80.215 (e)(g)(1)(2)(3)	3.7	Transmitter Carrier Power Reduction	Transmit	0	Pass	
2.12	80.215 (a)(2)	3.4(b)	Transmitter Frequency Deviation	Transmit	0	Pass	
2.13	80.213 (d)	3.4(b)	Transmitter Frequency Deviation (DSC)	Transmit	0	Pass	
	15.109	6.7	Receiver Spurious Emissions	Receive		Pass*	
2.14	80.213(d)	3.4(b)	Transmitter Audio Frequency Response	Transmit	0	Pass	
2.15	80.225	3.9, 6.4(b)	Frequency Tolerance of B and Y States	Transmit	0	Pass	
2.16	80.225	3.9	Modulation Index (DSC)	Transmit	0	Pass	
2.17	80.225	3.9	Modulation Rate (DSC)	Transmit	0	Pass	

* Refer to 75904785 Report 05.

N/A – Not Applicable



Product Service

1.3 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	
MANUFACTURER	Garmin International
TYPE	VHF200 (VHF100 as a listed variant)
PART NUMBER	VHF200
SERIAL NUMBER	TBD
HARDWARE VERSION	1.00 or later
SOFTWARE VERSION	2.00
TRANSMITTER OPERATING RANGE	156.025MHz to 157.425 MHz
RECEIVER OPERATING RANGE	156.025MHz to 163.275MHz
COUNTRY OF ORIGIN	China
INTERMEDIATE FREQUENCIES	1 st – 21.6MHz, 2 nd – 450kHz
ITU DESIGNATION OF EMISSION	16K0G3EJN, 16K0G2BJN
HIGHEST INTERNALLY GENERATED FREQUENCY	163Mhz
OUTPUT POWER (W or dBm)	1W or 25W
FCC ID	IPH-GARVHF12
INDUSTRY CANADA ID	1792A-GARVHF12
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	The VHF200 is a fixed mount Class D DSC VHF marine radio.
BATTERY/POWER SUPPLY (not applicable – vehicle direct wired)	
MODULES (not applicable)	
ANCILLARIES (none - not applicable)	

Signature

17 Oct 2008

Date

(Serial numbers on products)

Declaration of Build Status Serial Number

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



1.4 APPLICATION FORM

APPLICANT'S DETAILS	
CATEGORY OF APPLICANT (please tick relevant box opposite)	
(a) <input checked="" type="checkbox"/>	MANUFACTURER
(b) <input type="checkbox"/>	IMPORTER
(c) <input type="checkbox"/>	DISTRIBUTOR
(d) <input type="checkbox"/>	AGENT
If box (b), (c) or (d) is ticked complete details in box below with respect to the manufacturer	
COMPANY NAME :	Garmin International, Inc.
ADDRESS :	1200 E. 151st Street Olathe, KS 66062-3426 USA
NAME FOR CONTACT PURPOSES :	Al Sundoro
TELEPHONE NO : +1 913-440-5463	FAX NO : +1 913 397-8282
	E-MAIL : engelhard.sundoro@garmin.com

MANUFACTURER'S DETAILS	
COMPANY NAME :	Kanematsu Corporation
ADDRESS :	2-1 Seavans N Bldg, Shibaura-1 Chome, Minato-ku, Tokyo, 105-8005, Japan
NAME FOR CONTACT PURPOSES :	Kotaro Sugiyama
TELEPHONE NO : +81-3-5440-8300	FAX NO : +81-3-5440-6515
	E-MAIL : kotaro_sugiyama@kanematsu.co.jp



Product Service

TYPE DESIGNATION (1)

The type designation may be either a single alphanumeric code or an alphanumeric/code divided into two parts.

Please fill in

TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE

For EU/Australia/NZ/International

For USA/Canada:

VHF 200i (**VHF100i** as a listed variant)

VHF 200 (VHF100 as a listed variant)

- (1) This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment. It may contain information in coded form on the characteristics of the equipment e.g. frequency, power. The manufacturer is free to choose the form of the type designation.
- (2) This is the number, code or trade name used by the manufacturer to describe a series or 'family' of equipment of substantially the same mechanical and electrical construction which will include a number of related equipments. This number is often referred to as the "model number".
- (3) This is the manufacturer's identification number given to a specific equipment in the series or 'family' of equipments. It is often referred to as the "identification number".



TYPE OF EQUIPMENT	
<input type="checkbox"/>	<u>Base Station</u> (Equipment fitted with an antenna socket for use with an external antenna, and intended for use in a fixed location).
<input checked="" type="checkbox"/>	<u>Mobile Station</u> (Mobile equipment fitted with an antenna socket, for use with an external antenna, normally used in a vehicle or as a transportable station).
<input type="checkbox"/>	<u>Handportable</u> (fitted with an antenna socket)
<input type="checkbox"/>	(without an external antenna socket integral antenna equipment, but fitted with a permanent internal or a temporary internal 50 ohm R.F. connector which allows access to the transmitter output and the receiver input)
<input type="checkbox"/>	<u>Other</u>

BASE STATION
Not Applicable
MOBILE STATION
<input type="checkbox"/> Transmitter <input type="checkbox"/> Receiver <input checked="" type="checkbox"/> Transceiver <input type="checkbox"/> Remote Control Head
HANDPORTABLE
Not Applicable



Product Service

TRANSMITTER TECHNICAL CHARACTERISTICS	
TRANSMITTER FREQUENCY	
Method of frequency generation	
<input type="checkbox"/>	CRYSTAL
<input checked="" type="checkbox"/>	SYNTHESIZER
<input type="checkbox"/>	OTHER
TRANSMITTER CHANNEL SWITCHING FREQUENCY RANGE	
156.025 MHz – 157.425 MHz (MHz Range)	
TRANSMITTER FREQUENCY ALIGNMENT RANGE (6)	
Not Applicable	



Product Service

TRANSMITTER RF POWER CHARACTERISTICS	
MAXIMUM RATED TRANSMITTER OUTPUT POWER as stated by manufacturer 25 W AT TRANSMITTER RF OUTPUT CONNECTOR (as declared by manufacturer)	
Is transmitter intended for : Continuous duty <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Intermittent duty <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If intermittent state DUTY CYCLE 5% TX, 5% RX, 90% Idle	
Is transmitter output power variable?	
Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<input type="checkbox"/> continuously variable <input checked="" type="checkbox"/> stepped 25 dB per step 25 maximum RF output power (Watts) 1 minimum RF output power (Watts)	The power can be set for 1W or 25W

TRANSMITTER - MODULATION	
<input checked="" type="checkbox"/>	FREQUENCY (FM 5 kHz)
<input type="checkbox"/>	Phase



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TRANSMITTER MODULATION INPUT CHARACTERISTICS		
Modulation input signal level for 60% of maximum deviation at at		
Microphone socket	12mV	Impedance 2k Ohms
Accessory socket	12mV	Impedance 2k Ohms
Other (4)	mV	Impedance Ohms
Lowest audio modulation frequency transmitted by the equipment		
Hz		

(4) For use where direct connection is provided for test purposes.

TRANSMITTER MODULATION INPUT CHARACTERISTICS (ETS 300 113 Only)
Not Applicable

INTERFACE FOR DATA TRANSMISSION (ETS 300 113 only)
Not Applicable



RECEIVER TECHNICAL CHARACTERISTICS	
RECEIVER - FREQUENCY	
METHOD OF FREQUENCY GENERATION	
<input type="checkbox"/>	CRYSTAL
<input checked="" type="checkbox"/>	SYNTHESIZER
<input type="checkbox"/>	OTHER
INTERMEDIATE FREQUENCIES	
<input checked="" type="checkbox"/>	1st 21.6 MHz
<input checked="" type="checkbox"/>	2nd 450 kHz
<input type="checkbox"/>	3rd Not Applicable
Is local oscillator injection frequency higher or lower than the receiver nominal frequency?	
<input type="checkbox"/>	Higher
<input checked="" type="checkbox"/>	Lower
RECEIVER CHANNEL SWITCHING FREQUENCY RANGE	
156.025 MHz – 163.275 MHz (MHz Range)	
RECEIVER FREQUENCY ALIGNMENT RANGE	
Not Applicable	



Product Service

RECEIVER AUDIO (AF) CHARACTERISTICS			
MAXIMUM RATED AUDIO (AF) FREQUENCY OUTPUT POWER			
INTO LOUDSPEAKER	Watts		
TO LINE	Watts		
INTO EARPIECE	Watts		
BALANCED		[<input checked="" type="checkbox"/>]	NO
UNBALANCED		[<input checked="" type="checkbox"/>]	YES
Does connection carry DC voltage?		[<input checked="" type="checkbox"/>]	NO
If yes, state value	Not Applicable		
Normal Audio load impedance			
AT LOUDSPEAKER	4 ohms		
AT EARPIECE	16 ohms		
AT LINE OUTPUT	Not Applicable		
At audio accessory connection or facility socket (if fitted)			
Output	2 Watts		
Impedance	4 ohms		
Max input level at audio accessory socket			
	mV		
Impedance	ohms		



TRANSMITTER AND RECEIVER CHARACTERISTICS	
ITU DESIGNATION OR CLASS OF EMISSION	16K0G3EJN, 16K0G2BJN
CHANNEL SEPARATION	25kHz
State the maximum number of channels over which the equipment can operate	73 Channels

EXTREME TEMPERATURE RANGE over which equipment is to be type tested	
[<input checked="" type="checkbox"/>]	-15°C to +55°C

CONSTRUCTION OF EQUIPMENT	
[<input checked="" type="checkbox"/>]	Single unit (5)

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

AUTOMATIC EQUIPMENT SWITCH OFF	
If the equipment is designed to automatically switch off at a predetermined voltage level which is higher or lower in value than the battery minimum and minimum calculated values this shall be clearly stated.	
[]	Applies V Cut-off voltage
[]	Does not apply



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POWER SOURCE
12 DC Voltage (V)
6 DC Maximum Current (A)
BATTERY
Not Applicable

SIGNALLING (See note (c)) (I-ETS 300 219 only)
Not Applicable



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DUPLEX OPERATION (BASE STATION ONLY)

Not Applicable

COMMUNAL SITE OPERATION (1)

Not Applicable



ALIGNMENT RANGE	
<p>The definition of the alignment range AR1 and AR2 are given in Sub Clauses 3.1.2 and 3.1.3 of the Standard. The applicant should ensure that the sample equipment(s) submitted are operational on the appropriate channel(s) as given in Sub Clauses 3.1.5 through to 3.1.11 and tick the appropriate box.</p>	
3.1.5	One sample single channel equipment of category AR1 []
or 3.1.6	Three samples of single channel equipments of category AR2 []
or 3.1.7	One sample two channel equipment of category AR1 []
or 3.1.8	Three samples of two channel equipment of category AR2 []
or 3.1.9	One sample multichannel equipment of category AR1 []
or 3.1.10	Three samples of multichannel equipment of category AR2 []
or 3.1.11	One sample of multichannel equipment of category AR2 where the switching range equals the alignment range []
<p>If more than one option of the equipment is being submitted with different Type Designations, one or three samples, as appropriate, of each version shall be submitted.</p>	

CHANNEL IDENTIFICATION			
<p>Each equipment, whether one or more submitted for tests shall carry clear identification (such as a serial number), together with the frequencies associated with the channel identification displayed on the equipment.</p>			
Equipment Identification eg Serial Number	Channel No.	Transmit Nominal Freq MHz	Receive Nominal Freq MHz
Sample 1	60	156,025	160,625
	16	156,800	156,800
	88	157,425	157,425
Sample 2	60	156,025	160,625
	16	156,800	156,800
	88	157,425	157,425



OTHER ITEMS SUPPLIED		
Spare batteries e.g. (portable equipment)	[]	Yes
	[✓]	No
Battery charging device	[]	Yes
	[✓]	No
Special tools for dismantling equipment	[]	Yes
	[✓]	No
Encoder	[]	Yes
	[✓]	No
Test interface box (if applicable) or where appropriate the RF test fixture	[✓]	Yes
	[]	No
Full documentation on equipment (Handbook and circuit diagrams)	[✓]	Yes
	[]	No
Others	[]	Yes
	[]	No
If Yes, please specify :		



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DECLARATION		
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 <u>all</u> respects with the equipment tested	[✓]	Yes
	[]	No
If no supply full details		
Will labelling of the equipment comply with the Requirements of appropriate standards ?	[✓]	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 : David Heald

Position held : Engineer

Date : 17 November 2008

TUV 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.



1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The Equipment Under Test (EUT) was a Garmin International Inc VHF200 fixed mount marine radio as shown in the photograph below. A full technical description can be found in the Manufacturers documentation.



Equipment Under Test



1.5.2 Test Configuration

Configuration 1: Normal

The EUT was configured in accordance with FCC CFR 47 Part 80 and RSS-182 Issue 4.

When tested on an audio channel the EUT was modulated by a 2500Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level was established at the frequency of maximum response of the audio modulating circuit. When DSC Modulation was required (channel 70), the EUT was modulated with the customer test mode internal modulation.

1.5.3 EUT Cable / Port Identification

Port	Max Cable Length specified	Usage	Type	Screened
DC Power	1.5m	EUT Power	2 core	No
Signal	10.0m	Extension	Multicore	Yes
Signal	0.5m	Speaker	Multicore	Yes

1.5.4 Modes of Operation

Modes of operation of each EUT during testing were as follows:

Mode 1 - Transmit

Mode 2 – Receive

Information on the specific test modes utilised are detailed in the test procedure for each individual test.



1.6 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

The EUT was powered from a 12V DC supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 Octagon House, Fareham Test Laboratory

1.7 DEVIATIONS FROM THE STANDARD

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

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 by the customer Radio Firm Ware Version: 1229 Remote Handset Firmware version: 1016 (Serial: No.3 only)	N/A	N/A
0	As supplied by the customer Radio Firm Ware Version: 1229 Remote Handset Firmware version: 1206 (Serial: No.1 only)	N/A	N/A
1	Firmware found to be incorrect as did not activate remote handset, EUT updated by client Radio Firm Ware Version: 1229 Remote Handset Firmware version: 1206 (Serial Number: No.3)	Mr Hajime	14 January 2009



Product Service

SECTION 2

TEST DETAILS

FCC and IC Testing of the
Garmin International Inc
VHF200 fixed mount marine radio



Product Service

2.1 RADIATED EMISSIONS (ENCLOSURE PORT)

2.1.1 Specification Reference

FCC CFR 47 Part 80: 2006, Clause 80.211(f)(3)
 RSS-182 Issue 4: 2003 , Clause 4.4 / 6.3

2.1.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.3

2.1.3 Date of Test and Modification State

14 to 15 January 2009 - Modification State 1

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 Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 80.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.1.6 Environmental Conditions

	14 January 2009	15 January 2009
Ambient Temperature	20.9°C	23.6°C
Relative Humidity	33%	27%
Atmospheric Pressure	1009mbar	1010mbar



2.1.7 Test Results

For the period of testing the EUT met the requirements of FCC CFR 47 Part 80: and RSS-182 Issue 4: for Radiated Emissions (Enclosure Port).

The test results are shown below.

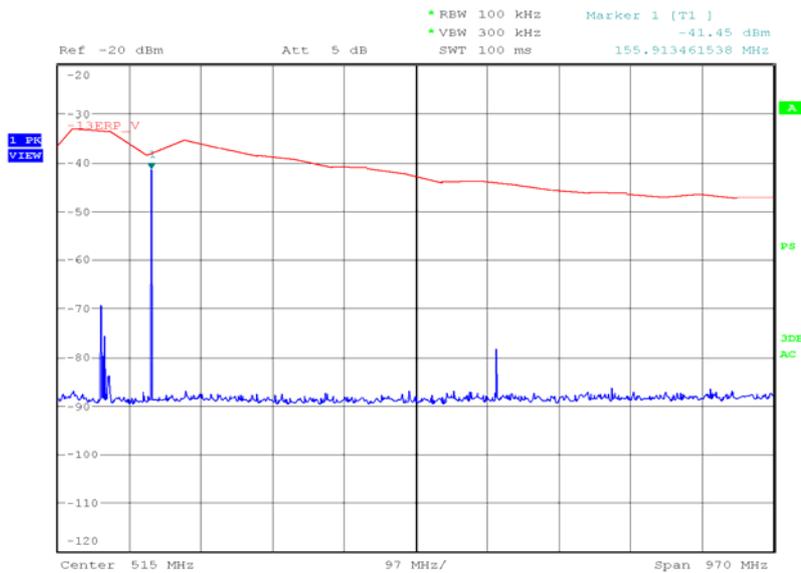
Configuration 1 - Mode 1

Channels 01A (Bottom), 16 (Middle), 88 (Top) and DSC Channel 70 were investigated. No emissions were detected within 30dB of the limit on any of the four channels selected except for the intentional frequency.

Bottom Channel 01A (156.050MHz)

30MHz to 1GHz

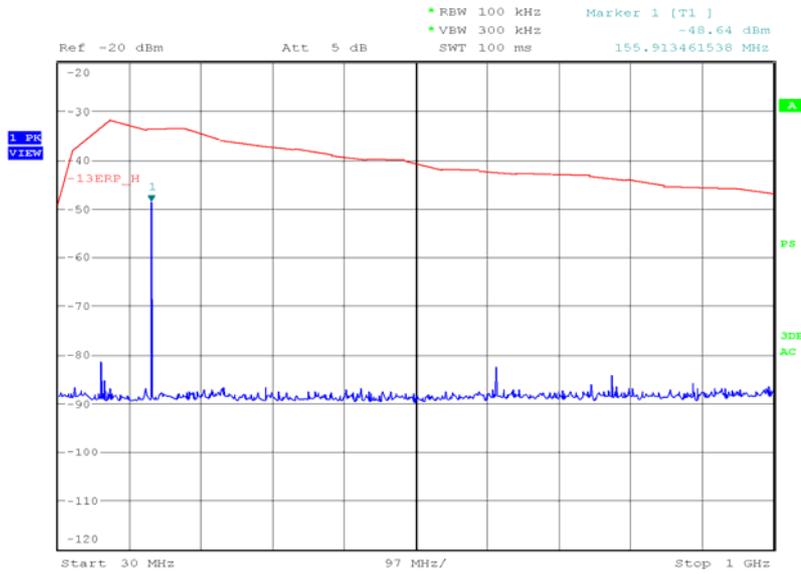
Vertical



Date: 15.JAN.2009 22:46:19



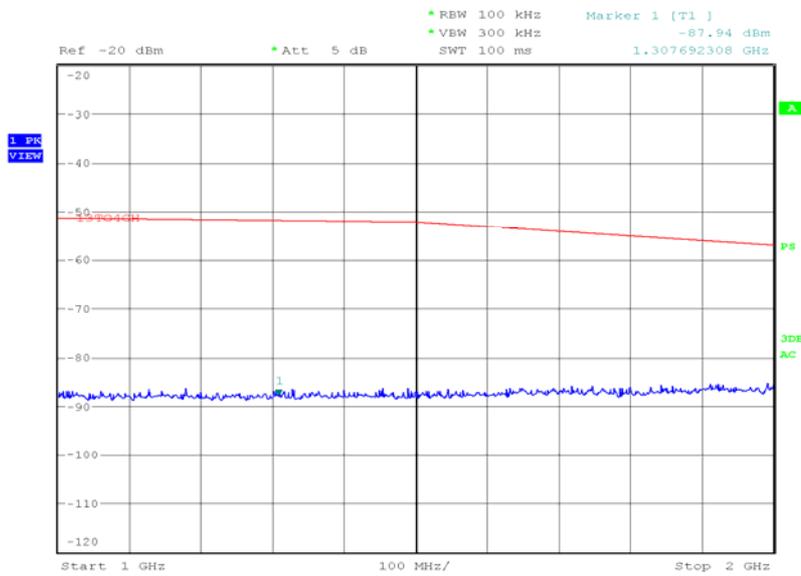
Horizontal



Date: 15.JAN.2009 22:52:23

1GHz to 2GHz

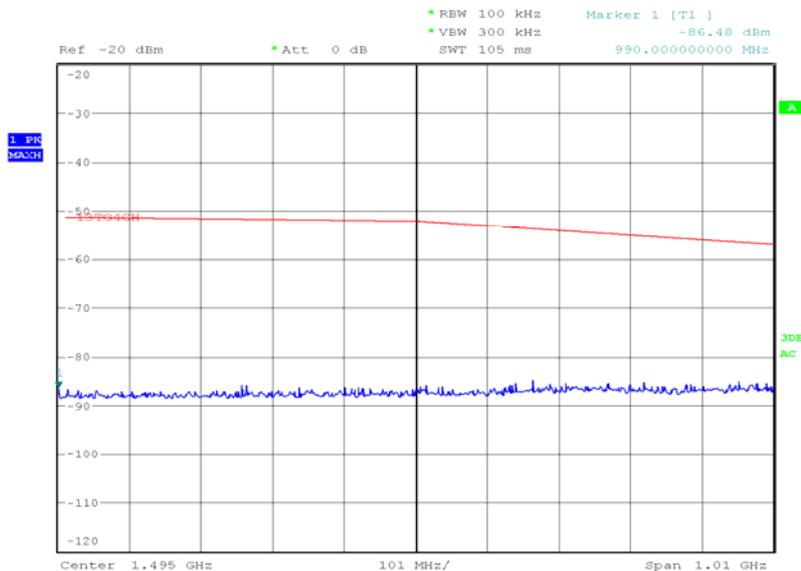
Vertical



Date: 15.JAN.2009 23:27:02



Horizontal

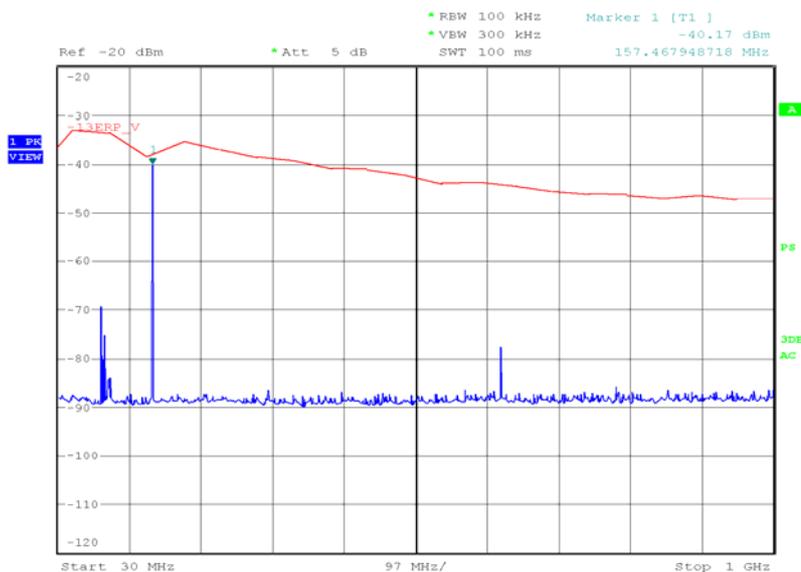


Date: 14.JAN.2009 12:12:44

Top Channel 88A (157.425MHz)

30MHz to 1GHz

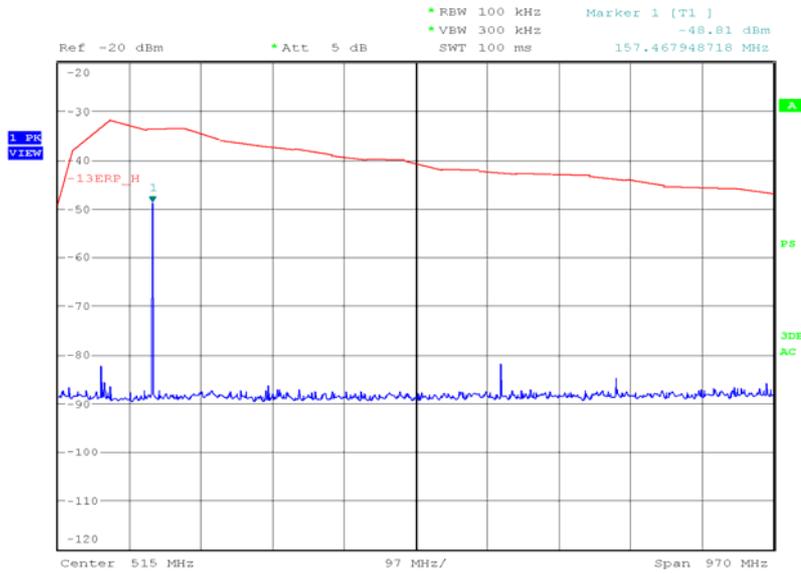
Vertical



Date: 16.JAN.2009 00:48:02



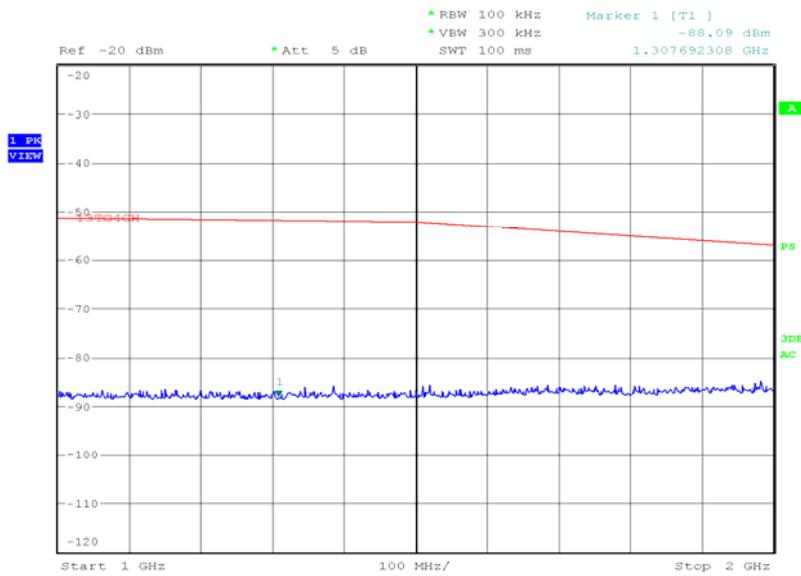
Horizontal



Date: 16.JAN.2009 00:01:06

1GHz to 2GHz

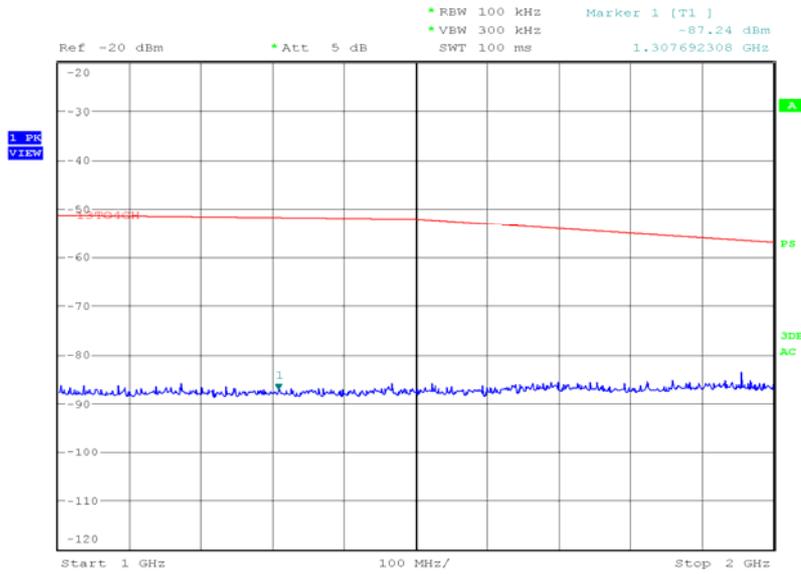
Vertical



Date: 15.JAN.2009 23:53:56



Horizontal

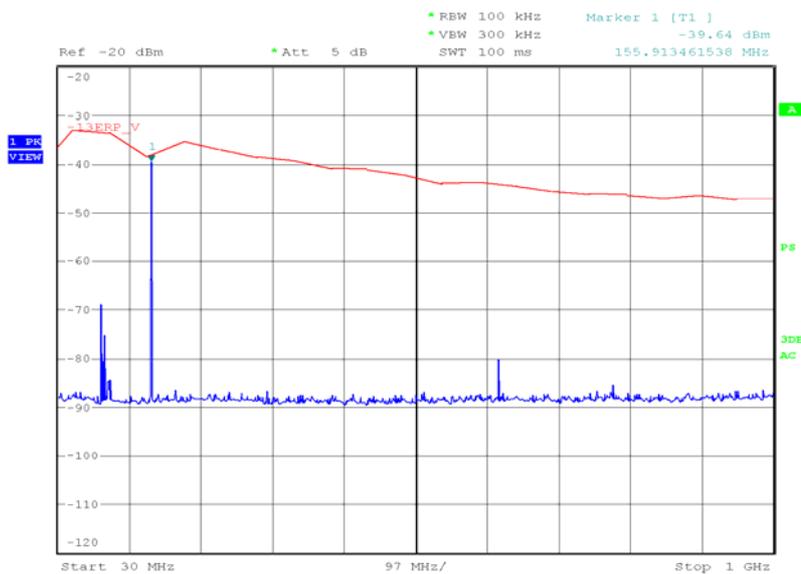


Date: 15.JAN.2009 23:57:33

DCS Channel 70 (156.525MHz)

30MHz to 1GHz

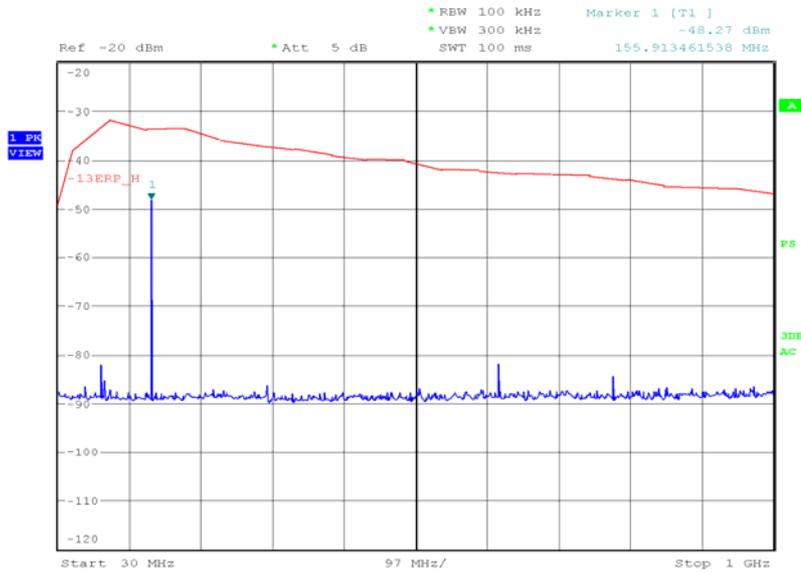
Vertical



Date: 16.JAN.2009 01:30:16



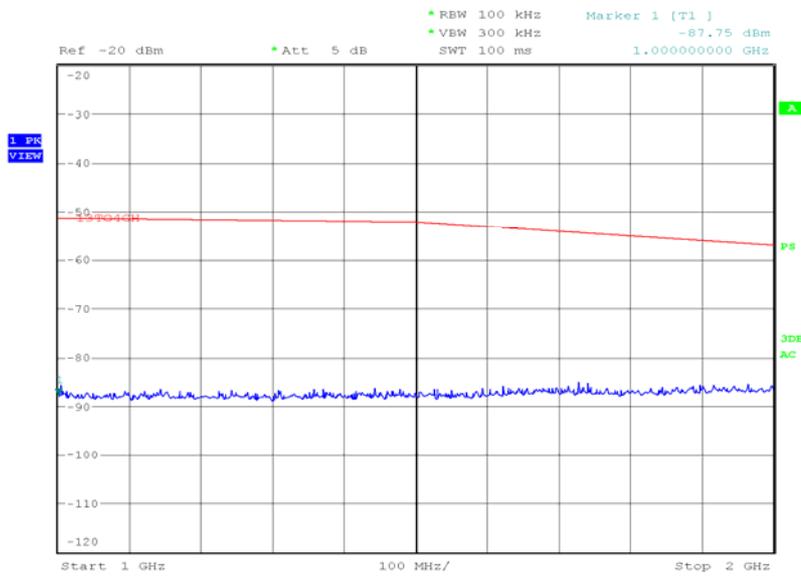
Horizontal



Date: 16.JAN.2009 01:47:55

1GHz to 2GHz

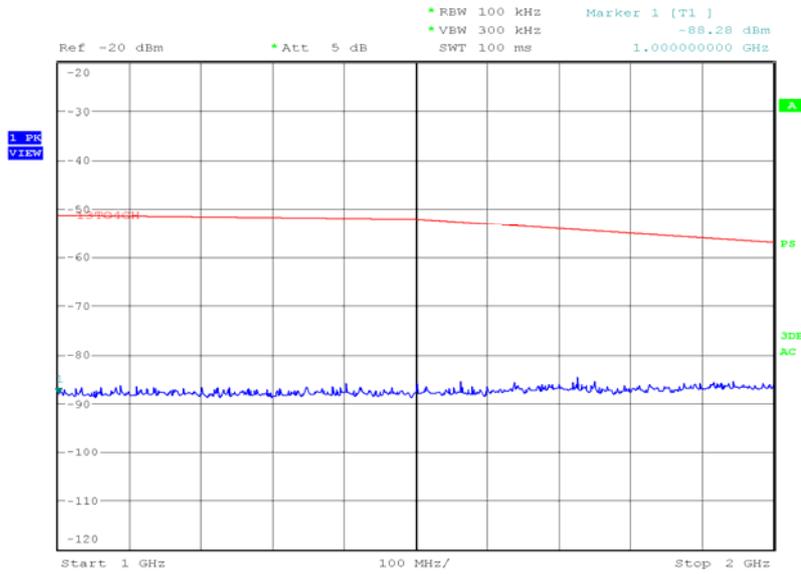
Vertical



Date: 16.JAN.2009 02:27:52



Horizontal



Date: 16.JAN.2009 01:50:55



Product Service

2.2 TRANSMITTER TIME OUT TIMER

2.2.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.141 (d)
 RSS-182 Issue 4: 2003 Clause 3.7

2.2.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.2.3 Date of Test and Modification State

13 January 2009 - Modification State 0

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 Test Procedure

The EUT was activated on channel 01 and maintained an output power of +43.43 dBm for a period of 5 minutes. After 5 minutes the EUT stops transmitting and the display shows a timeout warning. The EUT then enters into receive mode.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.2.6 Environmental Conditions

13 January 2009
 Ambient Temperature 22°C
 Relative Humidity 43%

2.2.7 Test Results

The TOT circuitry shall be enabled when utilising a manually operated press-to-talk (PTT) switch.

Test Condition	Transmission Time (min)
	156.050 MHz
Transmission Period (min)	5.00
Measurement Uncertainty (s)	±0.5

Limit Clause
 Industry Canada 3.7
 FCC 80.141(d)

The TOT shall activate within 5 minutes of constant temperature ±10%



Product Service

2.3 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

2.3.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.209(a)
RSS-182 Issue 4: 2003 Clause 4.2, 6.1 and 3.9

2.3.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.3.3 Date of Test and Modification State

13 January 2009 - Modification State 0

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 Test Procedure

The EUT was set to transmit an unmodulated carrier on channels 01, 16, 70 and 88 at maximum power. Using a frequency counter, the frequency error was measured and the result recorded. For test purposes channel 70 was offset to 156.500MHz.

The voltage to the EUT was varied as shown in the table of results at a temperature of 20°C.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.3.6 Environmental Conditions

	13 January 2009
Ambient Temperature	21°C
Relative Humidity	44%



Product Service

2.3.7 Test Results

Channel: 01 Frequency: 156.050 MHz

DC Voltage (V)	Test Frequency (MHz)	Error (kHz)	Limit (kHz)
10.2	156.050	-0.044	±1.56025
12.0	156.050	-0.090	±1.56025
13.8	156.050	-0.105	±1.56025

Channel: 16 Frequency: 156.800 MHz

DC Voltage (V)	Test Frequency (MHz)	Error (kHz)	Limit (kHz)
10.2	156.800	-0.261	± 1.5680
12.0	156.800	-0.246	± 1.5680
13.8	156.800	-0.236	± 1.5680

Channel: 88 Frequency: 157.425 MHz

DC Voltage (V)	Test Frequency (MHz)	Error (kHz)	Limit (kHz)
10.2	157.425	-0.247	±1.57425
12.0	157.425	-0.250	±1.57425
13.8	157.425	-0.255	±1.57425

Channel: 70 Frequency: 156.500 MHz

DC Voltage (V)	Test Frequency (MHz)	Error (kHz)	Limit (kHz)
10.2	156.500	-0.258	±1.56500
12.0	156.500	-0.256	±1.56500
13.8	156.500	-0.256	±1.56500

Limit:
 Industry Canada Clause 6.1
 FCC Clause 80.209(a)

±1.56025 kHz / ± 1.57425 kHz or 10ppm



Product Service

2.4 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.4.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.209(a)
RSS-182 Issue 4: 2003 Clause 6.2, 6.1 and 3.9

2.4.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.4.3 Date of Test and Modification State

16 January 2009 - Modification State 0

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 Test Procedure

The EUT was set to transmit an unmodulated carrier on channels 01, 16, 70 and 88 at maximum power. Using a frequency counter, the frequency error was measured and the result recorded. The temperature was adjusted between -20° and +55° in 10° steps.

For test purposes channel 70 was offset to 156.500MHz

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.4.6 Environmental Conditions

	16 January 2009
Ambient Temperature	22°C
Relative Humidity	34%



2.4.7 Test Results

Configuration 1 – Mode 1

Transmitting at 25W

Bottom Channel: 01 Frequency: 156.050 MHz

Temperature Interval °C	Test Frequency (MHz)	Deviation (Hz)	Error (ppm)
-20	156.050	+12	±1.56
-15	156.050	+229	±1.56
-10	156.050	+298	±1.56
0	156.050	+289	±1.56
+10	156.050	+136	±1.56
+20	156.050	-77	±1.56
+30	156.050	-242	±1.56
+40	156.050	-261	±1.56
+50	156.050	-335	±1.56
+55	156.050	-242	±1.56

Middle Channel: 16 Frequency: 156.800 MHz

Temperature Interval °C	Test Frequency (MHz)	Deviation (Hz)	Error (ppm)
-20	156.800	-303	±1.57
-15	156.800	+221	±1.57
-10	156.800	+306	±1.57
0	156.800	+310	±1.57
+10	156.800	+106	±1.57
+20	156.800	-48	±1.57
+30	156.800	-308	±1.57
+40	156.800	-229	±1.57
+50	156.800	-330	±1.57
+55	156.800	-265	±1.57



Product Service

Top Channel: 88 Frequency: 157.425 MHz

Temperature Interval °C	Test Frequency (MHz)	Deviation (Hz)	Error (ppm)
-20	157.425	-103	±1.57
-15	157.425	+255	±1.57
-10	157.425	+300	±1.57
0	157.425	+276	±1.57
+10	157.425	+183	±1.57
+20	157.425	-100	±1.57
+30	157.425	-297	±1.57
+40	157.425	-297	±1.57
+50	157.425	-330	±1.57
+55	157.425	-225	±1.57

DSC Channel: 70 Frequency: 156.500 MHz

Temperature Interval °C	Test Frequency (MHz)	Deviation (Hz)	Error (ppm)
-20	156.500	+35	±1.57
-15	156.500	+203	±1.57
-10	156.500	+314	±1.57
0	156.500	+325	±1.57
+10	156.500	+85	±1.57
+20	156.500	-30	±1.57
+30	156.500	-315	±1.57
+40	156.500	-319	±1.57
+50	156.500	-308	±1.57
+55	156.500	-170	±1.57

Limit:
 Industry Canada Clause 4.2
 FCC Clause 80.209(a)

± 1.56025kHz / ± 1.57425kHz or 10ppm



Product Service

2.5 EMISSION LIMITATIONS (EMISSION MASK)

2.5.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.211(f)(1)(2)
 RSS-182 Issue 4: 2003 Clause 6.3.1 and 6.6

2.5.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.5.3 Date of Test and Modification State

13 January 2009 - Modification State 0

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 Test Procedure

The EUT was initially connected to a Modulation Analyser and the EUT set to transmit. Using an Audio Analyser, an audio frequency was swept between 300Hz to 5kHz to find the frequency which produced the highest deviation.

The amplitude at this frequency was then increased to give a deviation of 2.5kHz.

The amplitude and frequency levels were 5.4mV at 2.5kHz

Then at a frequency of 2.5kHz the amplitude recorded above was increased by 16dB to provide the Final Modulated level.

The EUT transmitting on full power was then connected to a Spectrum Analyser via a 30dB Attenuator. The modulated carrier was checked (for the bottom, middle and top channels and channel 70 of the EUT) against the emission mask. For channel 70 the EUT was configured to transmit B, Y states and dotting pattern

The Path Loss was recorded and the worst case loss was entered as a Reference Level Offset

Total Path loss = 30.0

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.5.6 Environmental Conditions

	13 January 2009
Ambient Temperature	23°C
Relative Humidity	39%

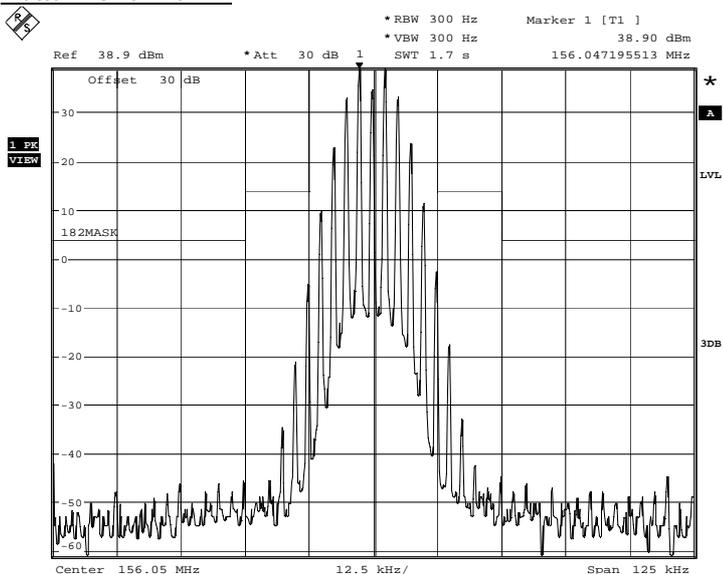


Product Service

2.5.7 Test Results

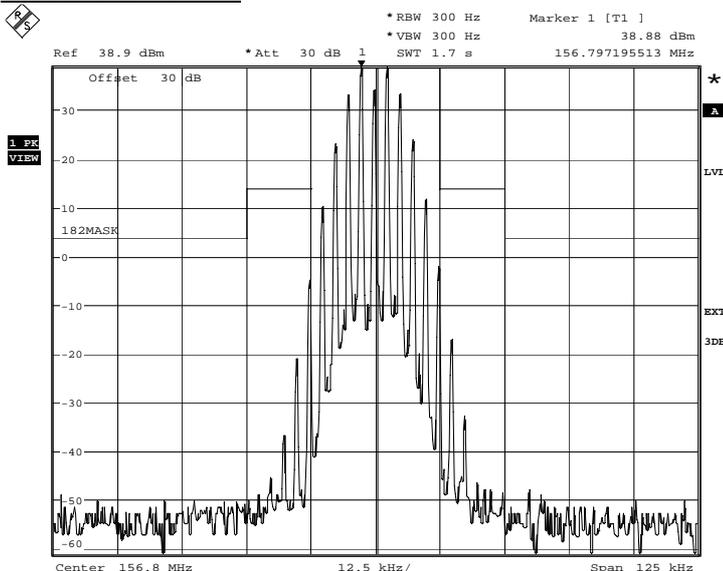
Transmitting at 25W

Bottom Channel - 1



Date: 16.JAN.2009 09:15:41

Middle Channel - 16

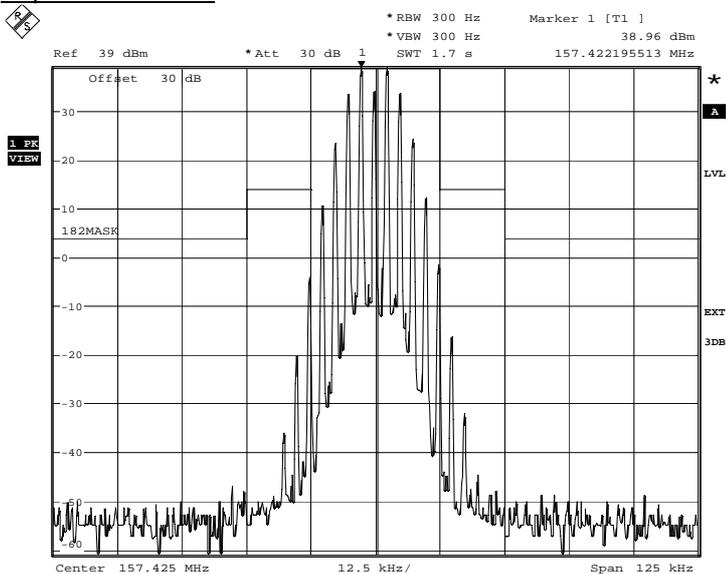


Date: 13.JAN.2009 15:26:04



Product Service

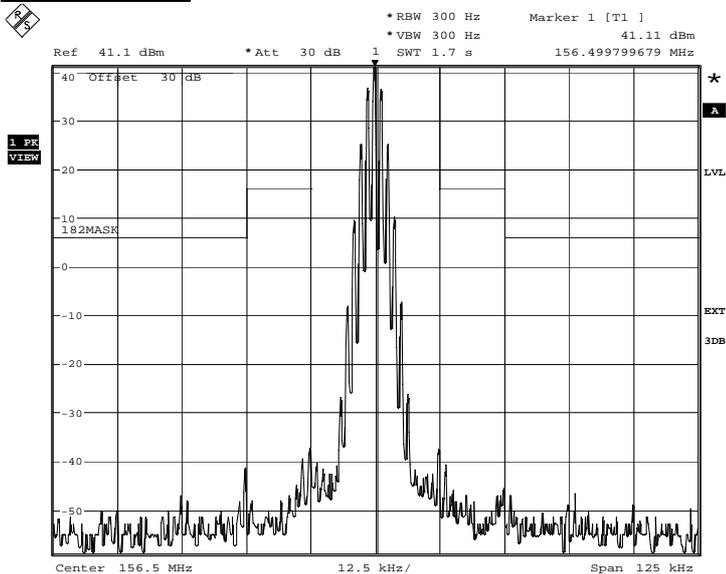
Top Channel – 88



Date: 13.JAN.2009 15:29:40

DSC Channel – 70

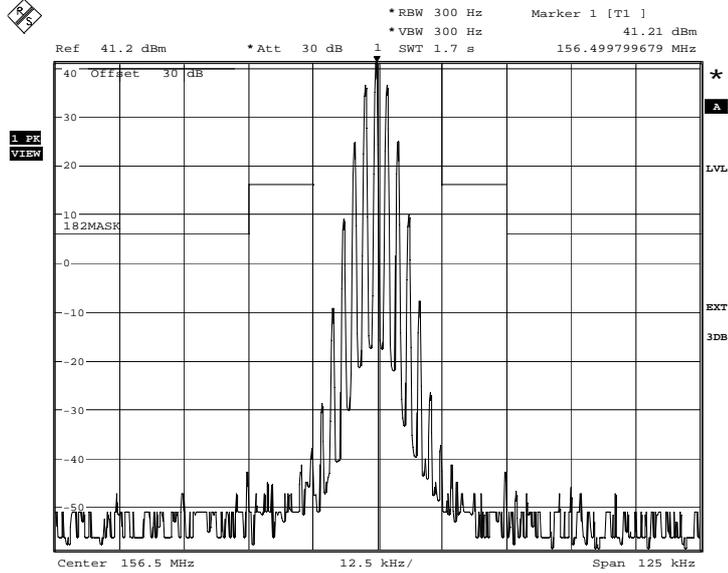
Y-State 1300Hz



Date: 13.JAN.2009 15:40:37

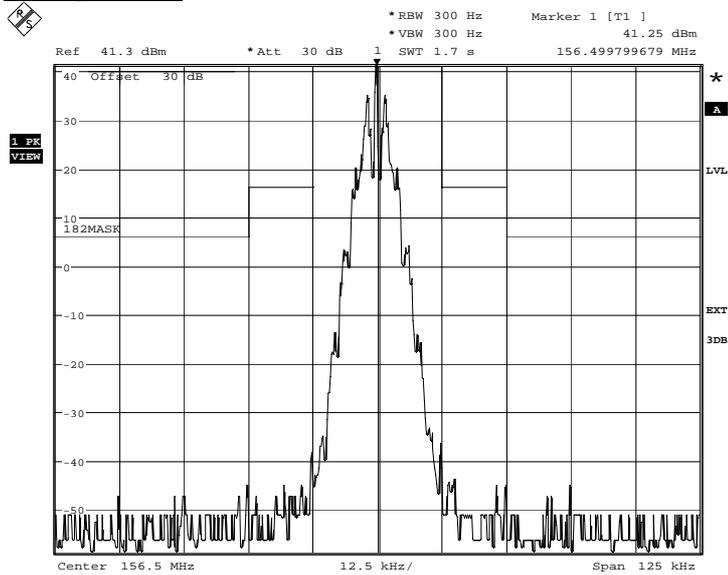


B-State 2100Hz



Date: 13.JAN.2009 15:42:09

Dotting Pattern



Date: 13.JAN.2009 15:43:58



Product Service

2.6 OCCUPIED BANDWIDTH

2.6.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.205(a)
RSS-182 Issue 4: 2003 Clause 3.4(d) and (e), 3.9

2.6.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.6.3 Date of Test and Modification State

13 January 2009 - Modification State 0

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 Test Procedure

The EUT is declared as having an emission designator of: 16K0G3E.
For voice applications this equates to an Authorised Bandwidth of: G3E (16kHz).
For data applications this equates to an Authorised Bandwidth of: G2B (16kHz).

Initially, the EUT was connected via a 30dB Attenuator to a Modulation Analyser, which was set to measure the Deviation. From the results in 80.213, the audio frequency for a set input level which produces the highest level of deviation was 2.5kHz. Thus, the Audio Analyser was set to supply the EUT with an audio tone of 2.5kHz at an amplitude which produced a deviation corresponding to 50% of the maximum permissible frequency deviation, (± 2.5 kHz). The level was then increased on the audio analyser by 16dB.

The Modulation Analyser was then replaced with a Spectrum Analyser and the 99% Bandwidth was measured. The measurements were performed on Channel 16, bottom and top channels and channel 70 on maximum power levels.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.6.6 Environmental Conditions

	13 January 2009
Ambient Temperature	23°C
Relative Humidity	34%



Product Service

2.6.7 Test Results

Configuration 1 - Mode 1

Channel Number/Frequency	Power Level (W)	Result (kHz)	Authorised Bandwidth (kHz)
01 / 156.050MHz	25	14.98	20
16 / 156.800MHz	25	11.85	20
88 / 157.425MHz	25	11.77	20
70 / 156.500MHz	25	1300 = 5.12 2100 = 8.33 Dotting = 5.76	16

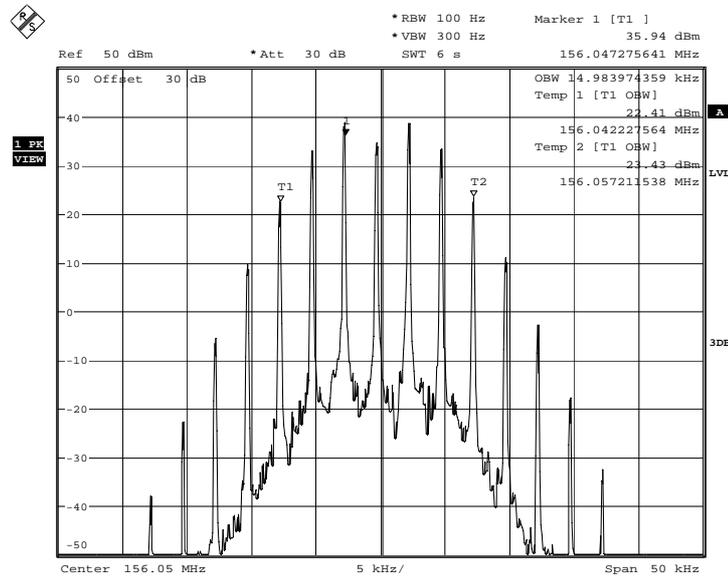
Limit:
Industry Canada Clause 3.4(d)(e)
FCC Clause 80.205(d)

(d) The nominal authorised channel bandwidth for voice is 20kHz
(e) For data modulation, an authorised bandwidth of 16 kHz is permitted.

The test result plots are presented below.

Transmitting at 25W

Bottom Channel – 1

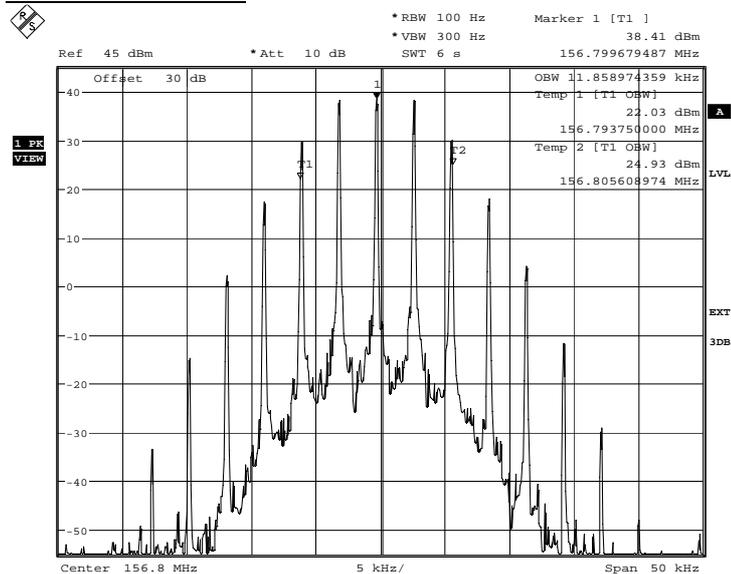


Date: 16.JAN.2009 09:23:09



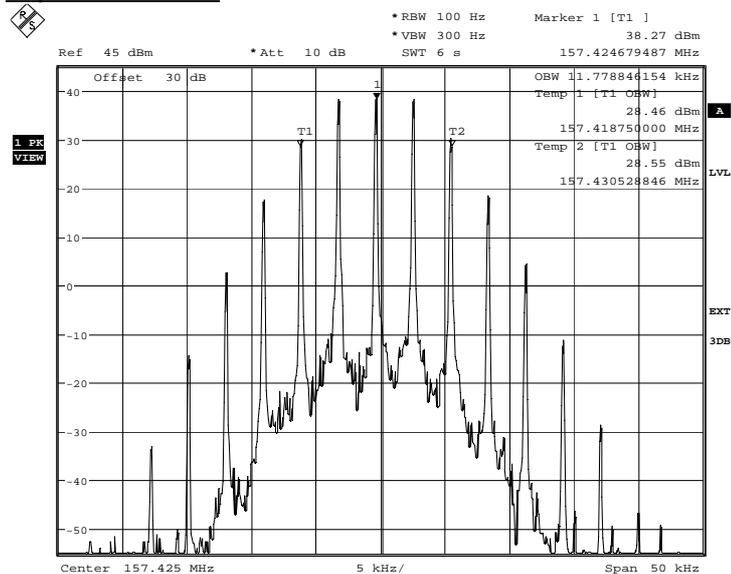
Product Service

Middle Channel - 16



Date: 13.JAN.2009 16:55:29

Top Channel - 88



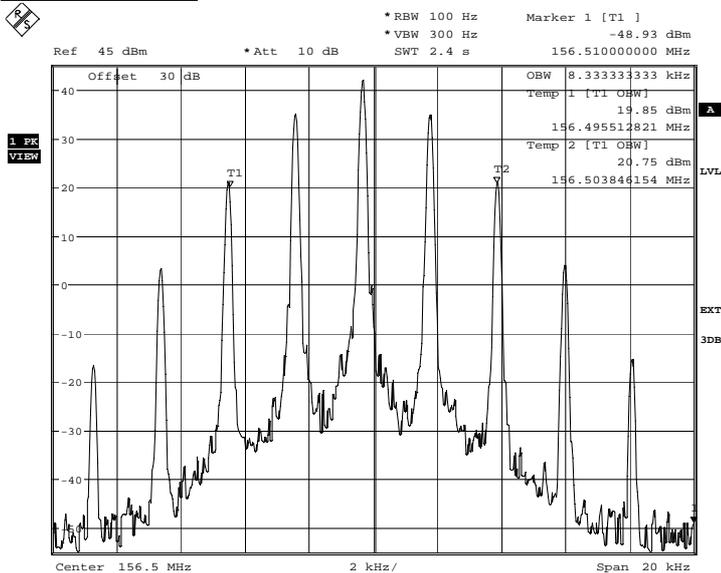
Date: 13.JAN.2009 16:57:03



Product Service

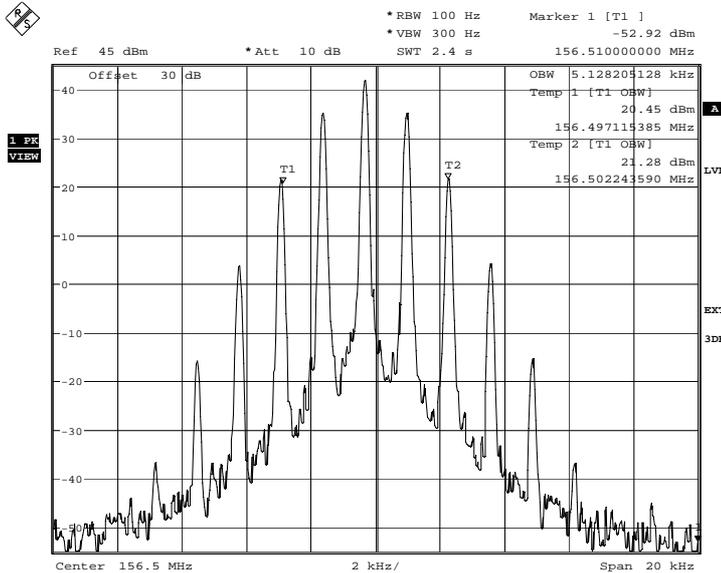
DSC Channel 70

Y-State 1300 Hz



Date: 13.JAN.2009 17:08:25

B-State 2100 Hz

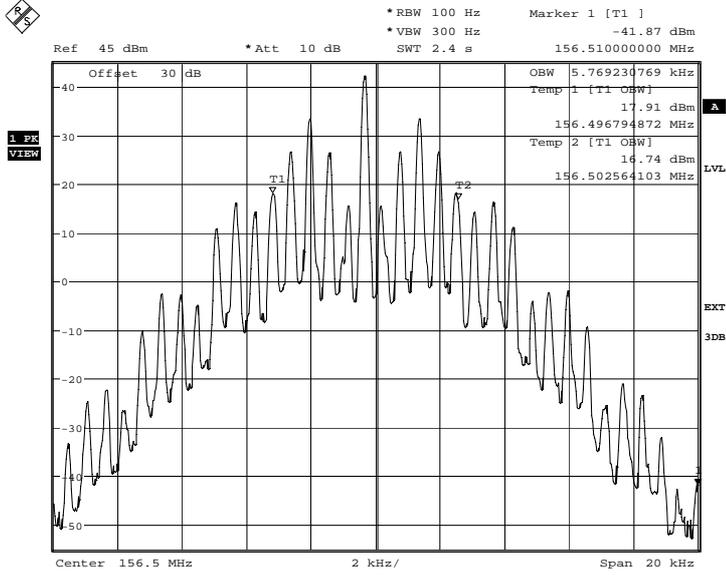


Date: 13.JAN.2009 17:06:32



Product Service

Dotting Pattern



Date: 13.JAN.2009 17:09:49



Product Service

2.7 EMISSION LIMITATIONS (CONDUCTED TRANSMITTER SPURIOUS)

2.7.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.211(c)(f)(3)
 RSS-182 Issue 4: 2003 Clause 4.4 and 6.3

2.7.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.7.3 Date of Test and Modification State

14 January 2009 - Modification State 0

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 Test Procedure

The EUT transmitting on full power, was connected to a Spectrum Analyser via 30dB of attenuation in the 9kHz – 300MHz frequency range and via a 30dB attenuator with 300MHz High Pass Filter in the 300MHz – 2GHz frequency range.

The EUT was checked (for bottom, middle, top channels and channel 70 of the EUT) against the specification limit for all emissions >250% removed from the assigned frequency, between 9kHz – 2GHz frequency range.

The Path Loss for each frequency range was recorded and the worst case loss was entered as a Reference Level Offset.

Total Path loss (9kHz - 300MHz) = 30.0dB
 Total Path loss (300MHz - 1GHz) = 31.5dB
 Total Path loss (1GHz - 2GHz) = 32.9dB

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

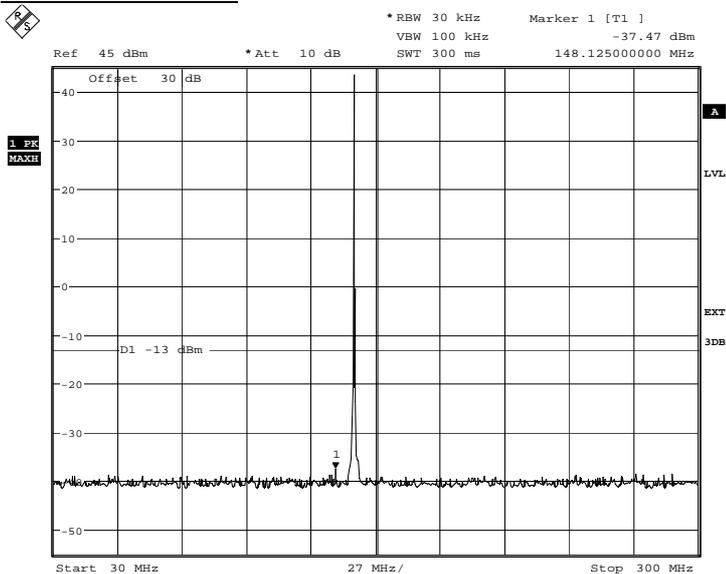
2.7.6 Environmental Conditions

	14 January 2009
Ambient Temperature	22°C
Relative Humidity	32%



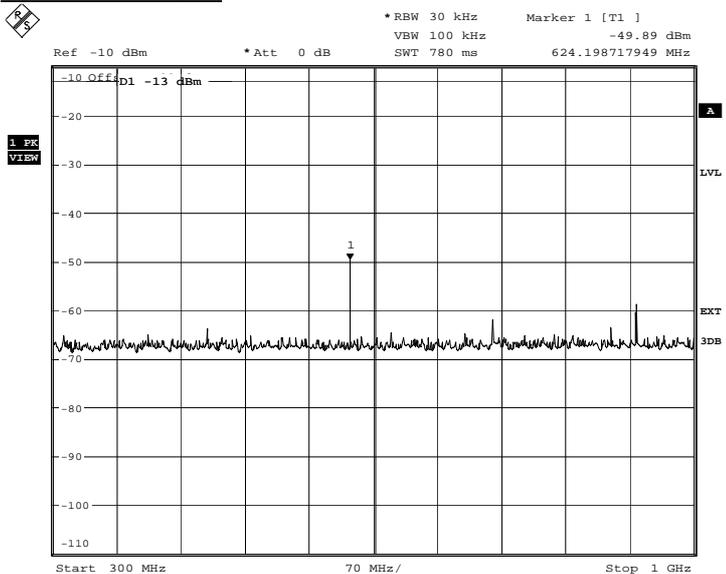
Product Service

30 MHz to 300 MHz



Date: 14.JAN.2009 13:20:12

300 MHz to 1 GHz

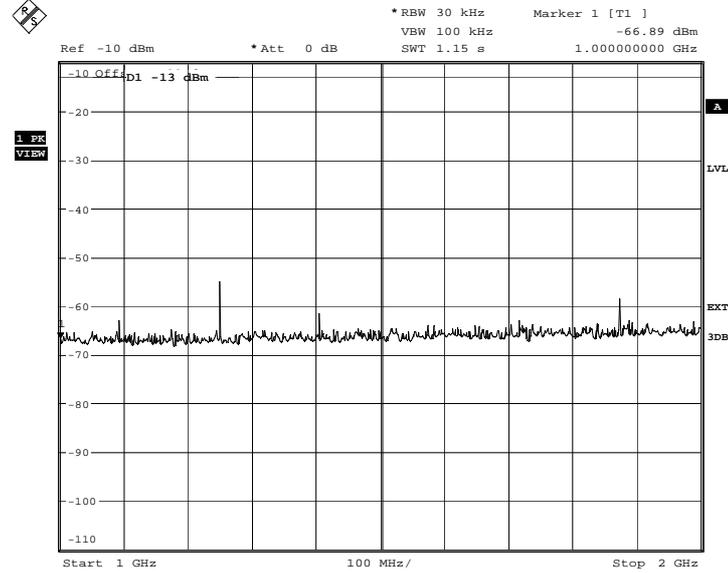


Date: 14.JAN.2009 13:27:46



Product Service

1 GHz to 2 GHz



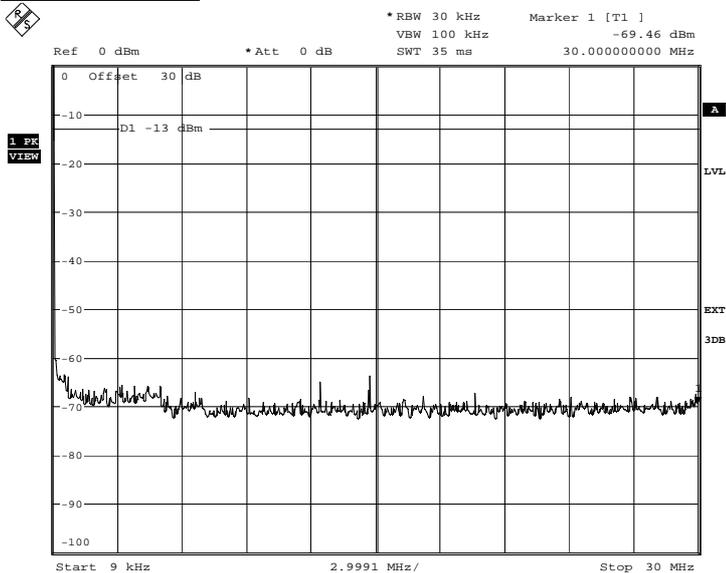
Date: 14.JAN.2009 13:28:52



Product Service

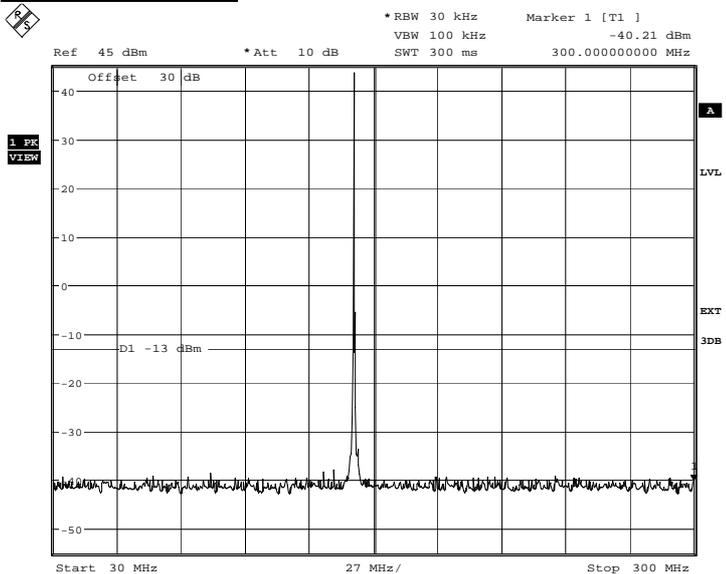
Middle Channel – 16

9 kHz to 30 MHz



Date: 14.JAN.2009 13:47:47

30 MHz to 300 MHz

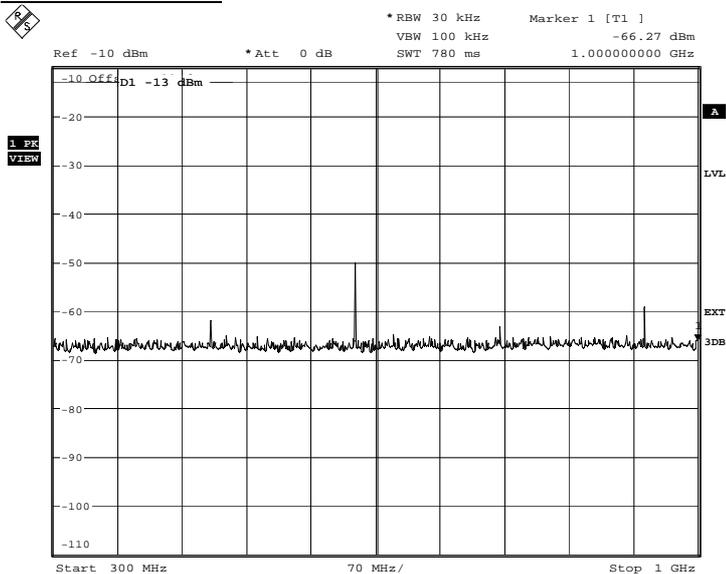


Date: 14.JAN.2009 13:44:13



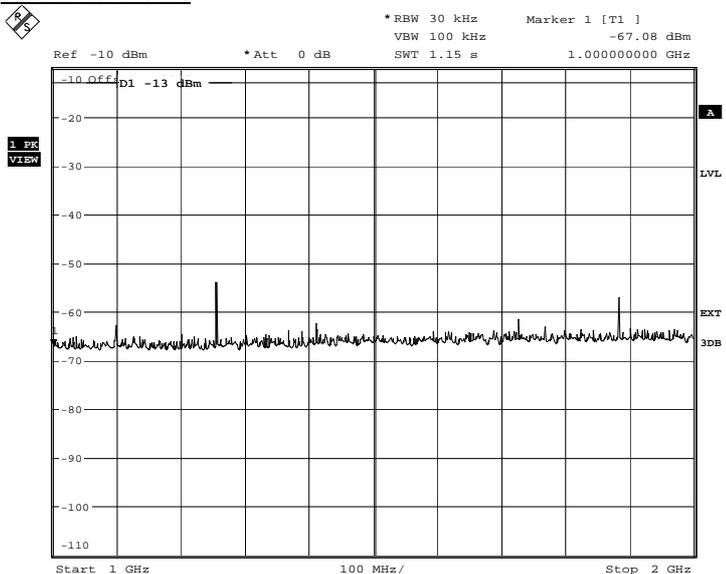
Product Service

300 MHz to 1 GHz



Date: 14.JAN.2009 13:35:18

1 GHz to 2 GHz



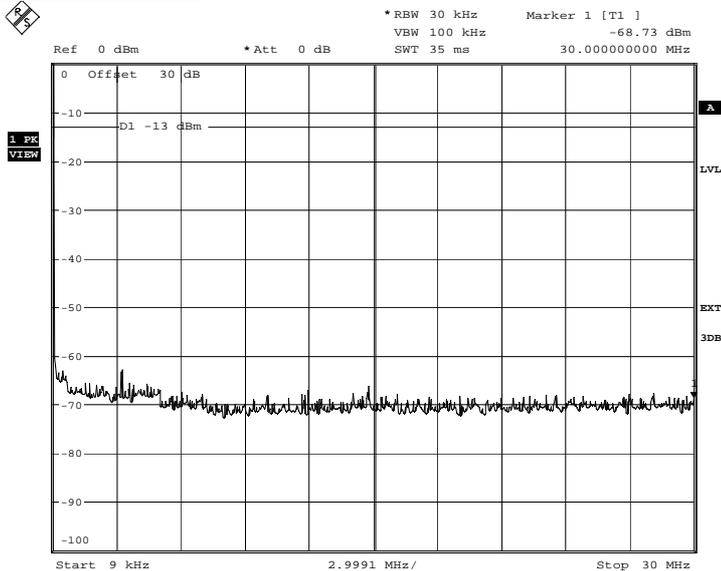
Date: 14.JAN.2009 13:33:36



Product Service

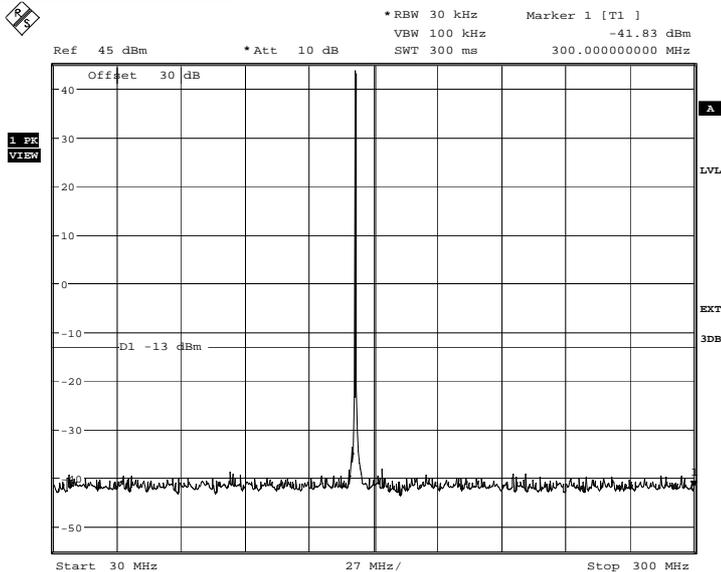
Top Channel – 88

9 kHz to 30 MHz



Date: 14.JAN.2009 13:48:45

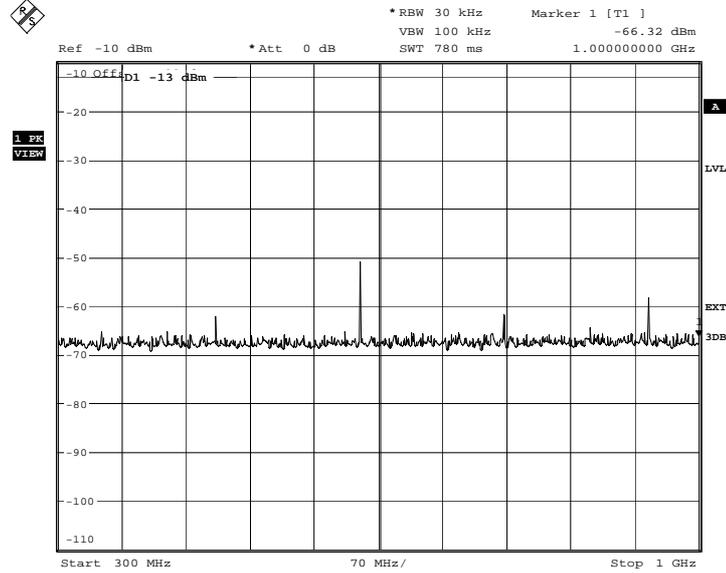
30 MHz to 300 MHz



Date: 14.JAN.2009 13:42:58

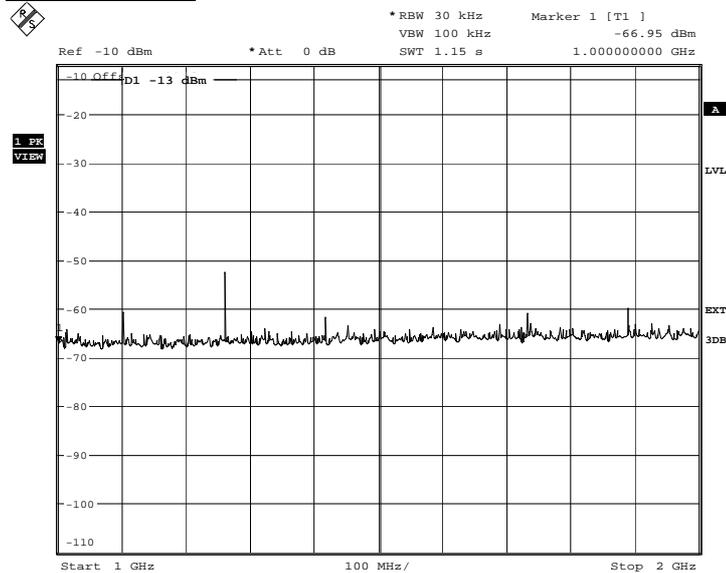


300 MHz to 1 GHz



Date: 14.JAN.2009 13:40:16

1 GHz to 2 GHz



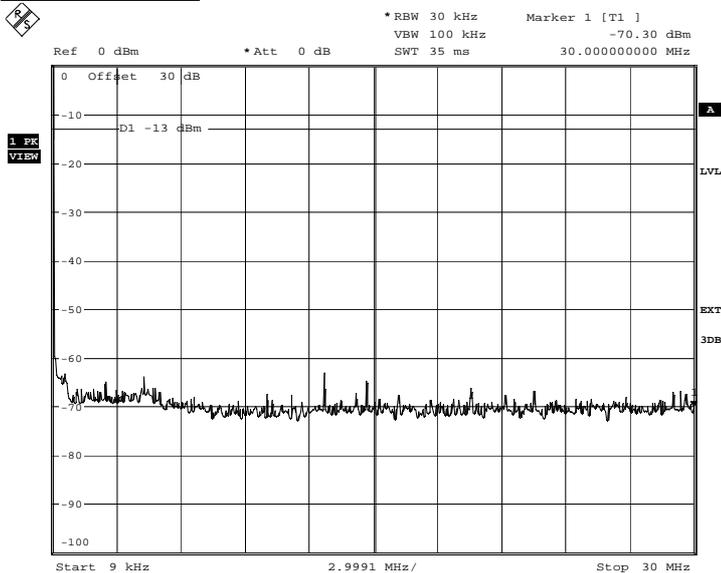
Date: 14.JAN.2009 13:37:57



Product Service

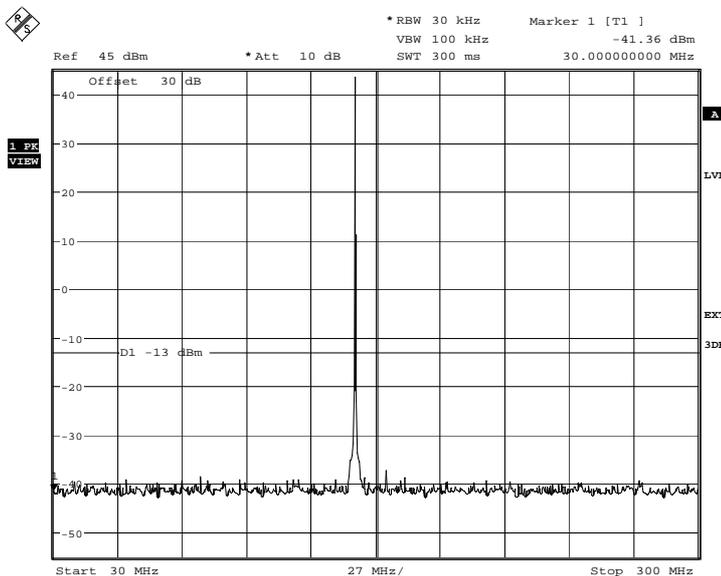
DSC Channel 70

9 kHz to 30 MHz



Date: 14.JAN.2009 14:01:33

30 MHz to 300 MHz

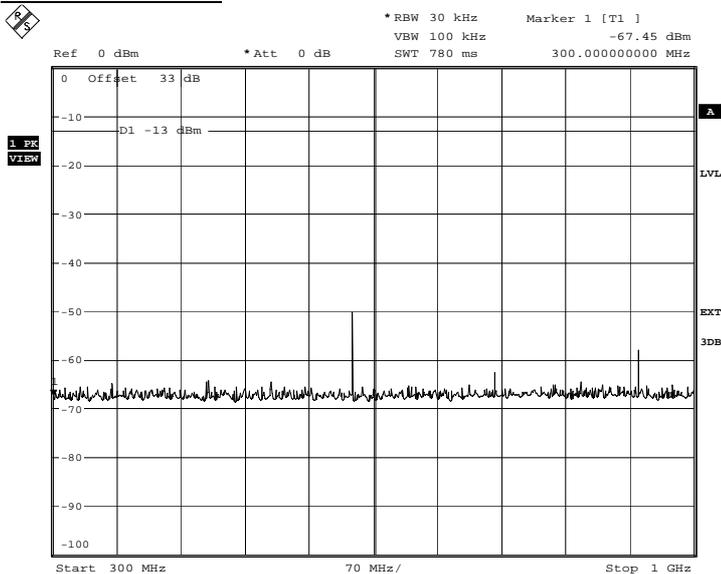


Date: 14.JAN.2009 14:03:05



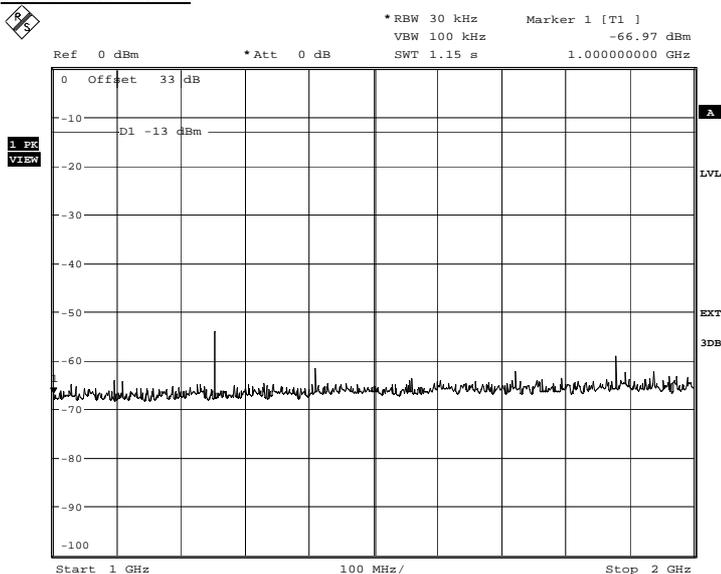
Product Service

300 MHz to 1 GHz



Date: 14.JAN.2009 14:04:40

1 GHz to 2 GHz



Date: 14.JAN.2009 14:05:38



Product Service

2.8 MODULATION CHARACTERISTICS

2.8.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 2.1047(a)

2.8.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.8.3 Date of Test and Modification State

15 January 2009 - Modification State 0

2.8.4 Test Equipment Used

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

2.8.5 Test Procedure

A curve has been produced displaying the frequency response of the audio modulating circuit over a range of 100Hz to 5kHz. The plot shows the data for all of the circuitry installed between the microphone input and the modulated stage.

The EUT was connected to a Modulation Analyser via a 30dB Attenuator. An Audio Analyser was connected to the microphone input at a set voltage level and the frequency varied between 100Hz and 5kHz. The demodulated audio was measured and plotted as a graph, which is shown overleaf.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.8.6 Environmental Conditions

	15 January 2009
Ambient Temperature	23°C
Relative Humidity	33%



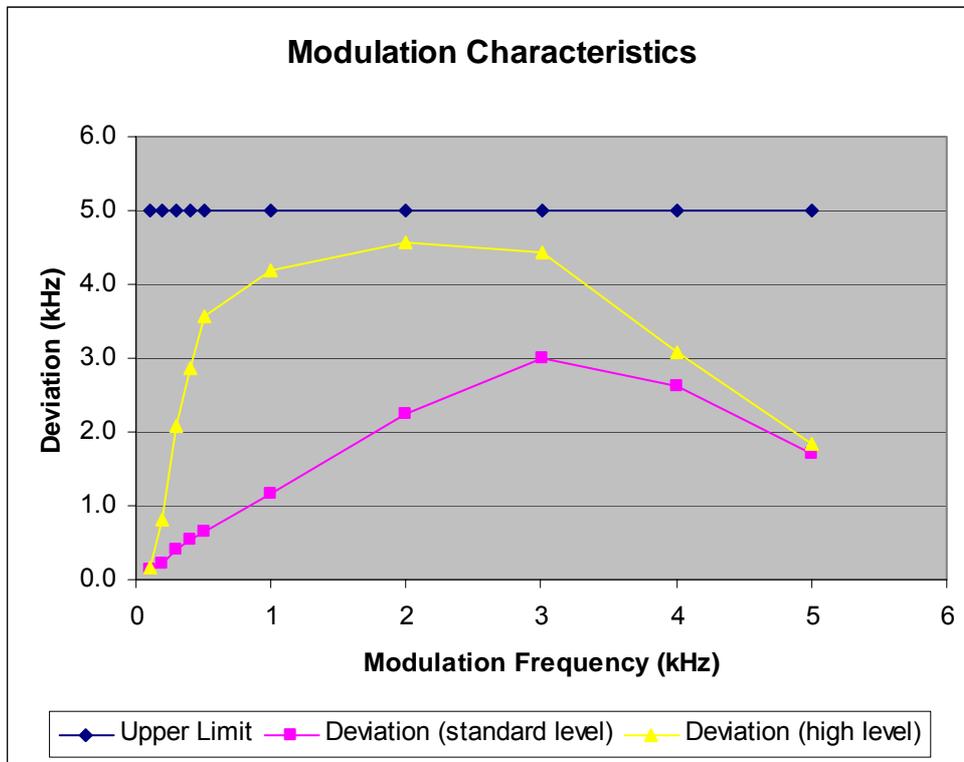
2.8.7 Test Results

Configuration 1 – Mode 1

Two sets of results are shown in the table below. One gives the audio frequency curve as described on the previous page. The curve has been plotted and is shown overleaf. The second set of data gives the maximum frequency deviation where the peak response is determined from the frequency response curve. The audio input was then increased until a deviation of 3kHz was measured on the Modulation Analyser. The audio input was then increased by 16dB.

MODULATION FREQUENCY (Hz)	MAXIMUM DEVIATION (kHz)	
	CH 16	CH16 Amplitude Increased By 16dB
Lowest frequency	-	-
100	0.241	0.923
200	0.359	1.635
300	0.474	2.374
400	0.586	3.101
500	0.711	3.790
1000	1.279	4.480
2000	2.442	4.710
3000	2.956	4.070
4000	1.412	1.595
5000	0.567	0.600
Maximum Deviation (kHz)	2.956	4.710
Measurement uncertainty (Hz)	± 85	

The test result plot is presented overleaf.





Product Service

2.9 TRANSMITTER POWER

2.9.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.215
RSS-182 Issue 4: 2003 Clause 3.7, 3.9, 4.3 and 6.2

2.9.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.9.3 Date of Test and Modification State

14 January 2009 - Modification State 0

2.9.4 Test Equipment Used

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

2.9.5 Test Procedure

The EUT was connected via 10dB and 20dB attenuators to a power meter and sensor. The path loss between the EUT and the power sensor was measured and recorded. The power meter reading was adjusted by the path loss value.

The emissions designator for the EUT is declared as G3E. The measurement of G3E designations is defined as being Carrier Power. The Carrier Power was measured in a modulated state for FCC and Unmodulated for IC. DSC power was measured for B, Y and dotting modulations.

The carrier power was measured on the top, middle and bottom channels of the operating frequency band and channel 70 at maximum and minimum power levels.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.9.6 Environmental Conditions

	14 January 2009
Ambient Temperature	20°C
Relative Humidity	32%



Product Service

2.9.7 Test Results

Configuration 1 – Mode 1

Maximum Power – 25W

Frequency (MHz)	Result (dBm) Modulated	Result (W)	Result (dBm) Unmodulated	Result (W)
01 / 156.050	43.82	24.09	43.82	24.09
16 / 156.800	43.83	24.36	43.79	24.93
88 / 157.425	43.90	24.54	43.90	24.54
70 / 156.525	B = 43.85 Y = 43.84 Dot = 43.82	B = 24.26 Y = 24.21 Dot = 24.09	-	-

Minimum Power - 1W

Test Mode	Result (dBm) Modulated	Result (W)	Result (dBm) Unmodulated	Result (W)
01 / 156.050	29.59	0.909	29.59	0.909
16 / 156.800	29.61	0.914	29.61	0.914
88 / 157.425	29.67	0.927	29.67	0.927

Limit:
FCC Clause 80.215(g)

≥ 8 and 25 W

Industry Canada

43.98dBm ± 1dB (≤1W) and 6W to 25W



Product Service

2.10 SUPPRESSION OF INTERFERENCE ABOARD SHIPS

2.10.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.217 (b)

2.10.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.10.3 Date of Test and Modification State

14 January 2009 - Modification State 0

2.10.4 Test Equipment Used

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

2.10.5 Test Procedure

The EUT was connected to a spectrum Analyser via a cable.

No external attenuation was inserted as there is no carrier present in this mode of operation. The emissions were measured from 9kHz to 2GHz. Both the DSC and Voice receivers were active during the test.

The manufacturer declares a maximum antenna gain of 3dBi to be used with the EUT. Thus, in accordance with 80.217(b), the 3dBi gain has been accounted for in the limit line and the deviation of the limits are shown in the table below.

Frequency of Interfering Emissions (MHz)	Power to Artificial Antenna (μ W)	Power to Artificial Antenna (dBm)	Power to Artificial Antenna including Maximum Declared Antenna Gain (dB)
<30	14.45^{-6}	-78.4	-753.4
30 – 100	141.25^{-6}	-68.5	-65.5
100 – 300	1.34^{-3}	-58.7	-55.7
300 - 2000	14.79^{-3}	-48.3	-45.3

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.10.6 Environmental Conditions

14 January 2009
 Ambient Temperature 21°C
 Relative Humidity 33%

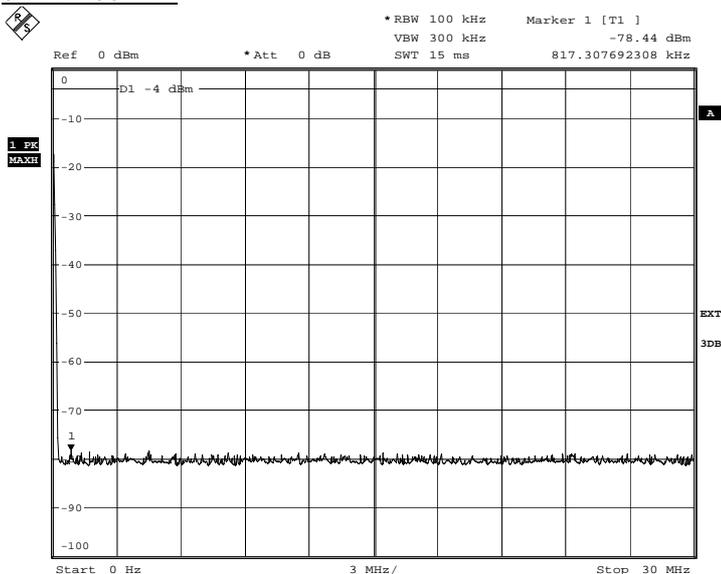


Product Service

2.10.7 Test Results

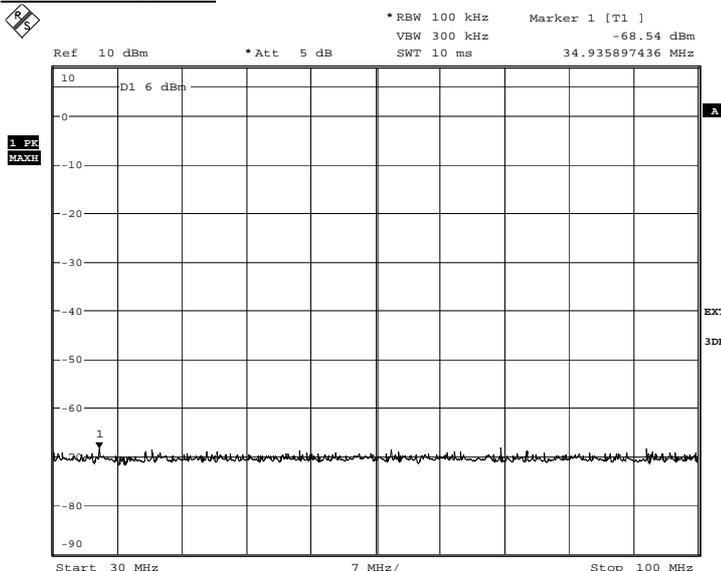
Configuration 1 – Mode 1

0kHz – 30MHz



Date: 14.JAN.2009 10:52:03

30MHz – 100MHz

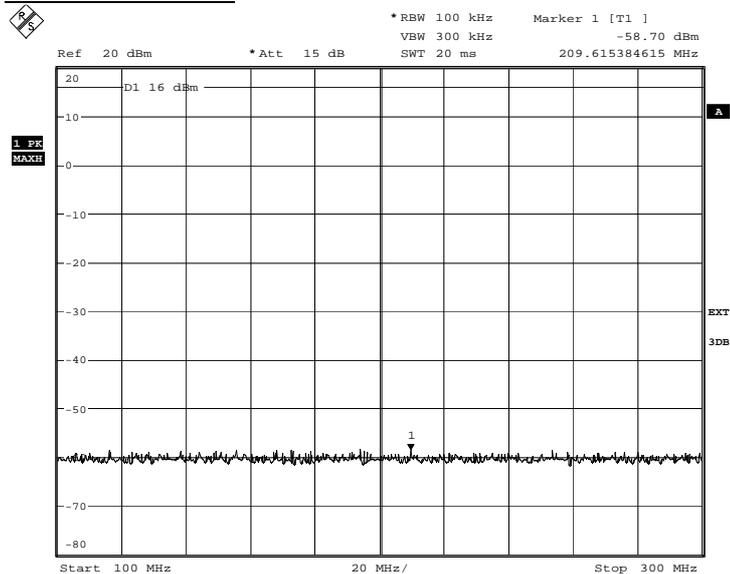


Date: 14.JAN.2009 10:55:06



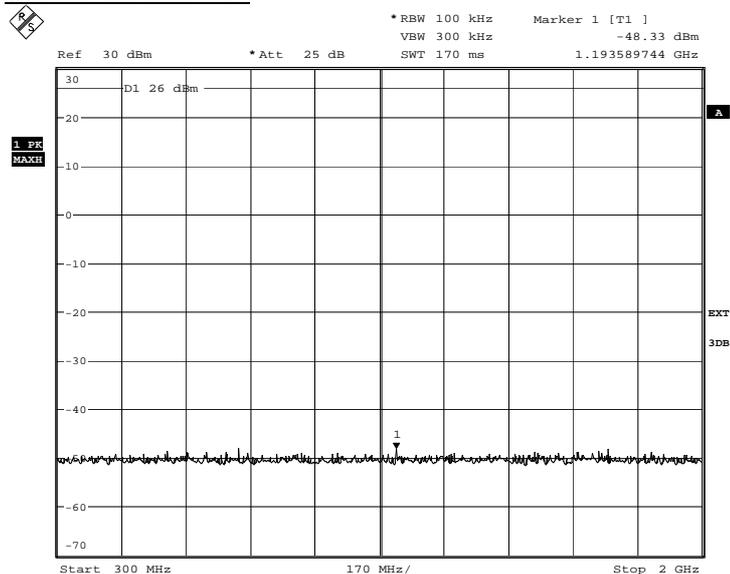
Product Service

100MHz – 300MHz



Date: 14.JAN.2009 10:56:48

300MHz – 1000MHz



Date: 14.JAN.2009 10:58:22



Product Service

2.11 TRANSMITTER CARRIER POWER REDUCTION

2.11.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.215 (e)(g)(1)(2)(3)
RSS-182 Issue 4: 2003 Clause 3.7

2.11.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.11.3 Date of Test and Modification State

14 January 2009 - Modification State 0

2.11.4 Test Equipment Used

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

2.11.5 Test Procedure

The EUT was connected via a 30dB attenuator to a spectrum analyser. The path loss between the EUT and the spectrum analyser was measured and recorded. The analyser reading was adjusted by the path loss value.

The carrier power was measured on the following channels and the carrier power reduction was assessed.

156.375 MHz, 156.650 MHz, 156.775 MHz and 156.825 MHz.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.11.6 Environmental Conditions

	14 January 2009
Ambient Temperature	22°C
Relative Humidity	31%



Product Service

2.11.7 Test Results

Configuration 1 – Mode 1

Channel Number / Frequency (MHz)	Default Power (W)	Manual Override to 25 W Possible (Yes or No)
67 / 156.375	0.931	Yes
13 / 156.650	0.938	Yes
75 / 156.775	0.939	No
76 / 156.825	0.940	No

Limit

All transmit and remote control units must be capable of reducing the carrier power to 1 W or less.
All transmitters must automatically reduce the carrier power to 1W or less when transmitting on 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.
All transmitters must be capable of tuning to 156.775 MHz and 156.825 MHz and must automatically reduce the carrier power to 1W or less, with no manual override capability, when the transmitter is tuned to either 156.775 MHz or 156.825 MHz.



Product Service

2.12 TRANSMITTER FREQUENCY DEVIATION

2.12.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.213 (a)(2)
RSS-182 Issue 4: 2003 Clause 3.4(b)

2.12.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.12.3 Date of Test and Modification State

15 January 2009 - Modification State 0

2.12.4 Test Equipment Used

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

2.12.5 Test Procedure

The audio frequency which produced maximum deviation was found, 2.8 kHz. The input level of this audio frequency was set to give ± 2.5 kHz deviation, 5.05 mV then increased by 20 dB, 50.52 mV.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.12.6 Environmental Conditions

	15 January 2009
Ambient Temperature	23°C
Relative Humidity	34%



Product Service

2.12.7 Test Results

Configuration 1 – Mode 1

12.0 V supply

Power level at which measurement was carried out 25W.

Modulation 20 dB above normal	Maximum Deviation (Hz)
	Channel 16
Maximum Deviation (kHz)	±4.39

Power level at which measurement was carried out 1W.

Modulation 20 dB above normal	Maximum Deviation (Hz)
	Channel 16
Maximum Deviation (kHz)	±4.39

Limit

The frequency deviation corresponding to 100% modulation shall approach ± 5 kHz as nearly as practicable. In no event shall the frequency deviation exceed ± 5 KHz.



Product Service

2.13 TRANSMITTER FREQUENCY DEVIATION (DSC)

2.13.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.213 (d)
 RSS-182 Issue 4: 2003 Clause 3.4(b)

2.13.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.1

2.13.3 Date of Test and Modification State

13 January 2009 - Modification State 0

2.13.4 Test Equipment Used

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

2.13.5 Test Procedure

The EUT was connected to a modulation analyser via a 30 dB attenuator and a power sensor. The EUT was set to transmit and modulated with the following DSC tones:

Space (B), Mark (Y) and dotting pattern.

The modulation for each tone was measured.

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.13.6 Environmental Conditions

13 January 2009
 Ambient Temperature 23°C
 Relative Humidity 36%

2.13.7 Test Results

Configuration 1 – Mode 1

Test Condition	Frequency Deviation (kHz)
	156.525
Space (B)	2.222
Mark (Y)	1.427
Dotting Pattern	2.225

Limit

Maximum Permissible Deviation	± 5 KHz.
-------------------------------	----------



Product Service

2.14 TRANSMITTER AUDIO FREQUENCY RESPONSE

2.14.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.213 (d)
RSS-182 Issue 4: 2003 Clause 3.4(b)

2.14.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.2

2.14.3 Date of Test and Modification State

21 October 2008 - Modification State 0

2.14.4 Test Equipment Used

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

2.14.5 Test Procedure

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.14.6 Environmental Conditions

	21 October 2008
Ambient Temperature	21°C
Relative Humidity	33%

2.14.7 Test Results

Configuration 1 – Mode 1

Modulation Frequency (Hz)	Frequency Response (dB relative to 1 kHz)
	156.800 MHz
300	-10.24
400	-7.71
500	-6.00
600	-4.35
800	-1.94
1000	0 (ref)
1500	+3.55
2000	+5.95
2500	+7.45
3000	+7.58
Measurement Uncertainty	± 27.2



Product Service

Remarks

The table on the previous page shows the pre-emphasis characteristics of the EUT.



Product Service

2.15 FREQUENCY TOLERANCE OF B AND Y STATES (DSC)

2.15.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.225
 RSS-182 Issue 4: 2003 Clause 3.9, 6.4 (b)

2.15.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.2

2.15.3 Date of Test and Modification State

15 January 2009 - Modification State 0

2.15.4 Test Equipment Used

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

2.15.5 Test Procedure

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.15.6 Environmental Conditions

15 January 2009
 Ambient Temperature 21°C
 Relative Humidity 38%

2.15.7 Test Results

Configuration 1 – Mode 1

Power level at which the measurement was carried out: 25W.

Test Conditions		Demodulation Signal Frequency (Hz)	
		B State	Y State
T _{nom} (21°C)	V _{nom} (12.0 V)	2100.51	1300.00

Limit

The measured frequency from the demodulator at any time for the B state shall be within 2100 Hz ± 10 Hz and for the Y State within 1300 Hz ± 10Hz.



Product Service

2.16 MODULATION INDEX (DSC)

2.16.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.225
 RSS-182 Issue 4: 2003 Clause 3.9

2.16.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.2

2.16.3 Date of Test and Modification State

21 November 2008 - Modification State 0

2.16.4 Test Equipment Used

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

2.16.5 Test Procedure

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.16.6 Environmental Conditions

21 November 2008
 Ambient Temperature 21°C
 Relative Humidity 38%

2.16.7 Test Results

Configuration 1 – Mode 1

Power level at which the measurement was carried out: 25W.

Test Conditions		Modulation Index	
		B State	Y State
T _{nom} (21°C)	V _{nom} (12.0 V)	1.856	2.028

Limit

The modulation index shall be 2.0 ± 10 %
--



Product Service

2.17 MODULATION RATE (DSC)

2.17.1 Specification Reference

FCC CFR 47 Part 80: 2006 Clause 80.225
 RSS-182 Issue 4: 2003 Clause 3.9

2.17.2 Equipment Under Test

VHF200 fixed mount marine radio, S/N: No.2

2.17.3 Date of Test and Modification State

21 November 2008 - Modification State 0

2.17.4 Test Equipment Used

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

2.17.5 Test Procedure

The test performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1

2.17.6 Environmental Conditions

	21 November 2008
Ambient Temperature	21°C
Relative Humidity	38%

2.17.7 Test Results

Configuration 1 – Mode 1

Power level at which the measurement was carried out: 25W.

Test Conditions		Modulation Index		
		Hz	Bit/s	Error (PPM)
T _{nom} (21°C)	V _{nom} (13.2 V)	599.999	1200	1.667

Limit

The frequency shall be 600 Hz ± 30 ppm corresponding to a modulation rate of 1200 bauds (bits/s)



Product Service

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
Section 2.10 Radio (Rx) - Suppression of Interference Aboard Ships					
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	21-May-2009
Section 2.14 Radio (Tx) - Audio Frequency Response					
Attenuator (30dB/ 50W)	Bird	8321	46	12	29-Nov-2008
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	13-Dec-2008
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
Audio Analyser	Hewlett Packard	8903B	1881	12	2-Oct-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009
Section 2.7 Radio (Tx) - Conducted Spurious Emissions					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	1-Mar-2009
High Pass Filter	Mini-Circuits	NHP-300	1640	12	12-Aug-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	3-Jun-2009
Multimeter	Fluke	77 Series II	3067	12	15-May-2009
Thermocouple Thermometer	Fluke	51	3174	12	26-Jun-2009
Attenuator (20dB, 150W)	Narda	769-20	3367	12	9-May-2009
Attenuator (10dB, 150W)	Narda	769-10	3368	12	9-May-2009
Attenuator (30dB, 150W)	Narda	769-30	3369	12	9-May-2009
Tunable Notch Filter	Wainwright	WRCD 130.0/170.0-0.05/50-5EEK	3412	-	TU
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	28-Nov-2009
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	21-May-2009
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	16-Apr-2009
Section 2.15 Radio (Tx) - DSC - Frequency Error					
Attenuator (30dB/ 50W)	Bird	8321	46	12	29-Nov-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	1-Mar-2009
Hygromer	Rotronic	A1	2138	12	13-May-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009
Multimeter	Fluke	77 Series II	3067	12	15-May-2009
Thermocouple Thermometer	Fluke	51	3174	12	26-Jun-2009
Attenuator (30dB, 150W)	Narda	769-30	3369	12	9-May-2009



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.16 Radio (Tx) - DSC - Modulation Index					
Attenuator (30dB/ 50W)	Bird	8321	46	12	29-Nov-2008
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	1-Mar-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009
Multimeter	Fluke	77 Series II	3067	12	15-May-2009
Section 2.17 Radio (Tx) - DSC - Modulation Rate					
Attenuator (30dB/ 50W)	Bird	8321	46	12	29-Nov-2008
DSC Decoder/Encoder	TUV	DSC TPOO1	81	6	TU
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Counter	Hewlett Packard	53181A	159	12	22-May-2009
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	1-Mar-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009
Multimeter	Fluke	77 Series II	3067	12	15-May-2009
Section 2.5 Radio (Tx) - Emission Mask					
Audio Analyser	Hewlett Packard	8903B	44	12	15-Jul-2009
Signal Generator	Hewlett Packard	ESG4000A	61	12	2-May-2009
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Attenuator (20dB, 50W)	Aeroflex / Weinschel	47-20-34	3165	12	30-May-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	21-May-2009
Section 2.3 and 2.4 Radio (Tx) - Frequency Characteristics					
Climatic Chamber	Heraeus Votsch	VM 04/100	85	-	O/P Mon
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009
Multimeter	Fluke	77 Series II	3067	12	15-May-2009
Thermocouple Thermometer	Fluke	51	3174	12	26-Jun-2009
Attenuator (30dB, 150W)	Narda	769-30	3369	12	9-May-2009
Section 2.12 and 2.13 Radio (Tx) - Frequency Deviation					
Audio Analyser	Hewlett Packard	8903B	44	12	15-Jul-2009
Attenuator (30dB/ 50W)	Bird	8321	46	12	29-Nov-2008
Power Supply Unit	Hewlett Packard	6269B	113	-	O/P Mon
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	Fluke	75 Mk3	455	12	13-Dec-2008
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Modulation Analyser	Hewlett Packard	8901B	773	12	9-May-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Audio Analyser	Hewlett Packard	8903B	1881	12	2-Oct-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Hygromer	Rotronic	Hygropalm	2404	12	5-Dec-2008
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Sensor	Hewlett Packard	11722A	2787	12	22-Aug-2009



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.12 and 2.13 Radio (Tx) - Frequency Deviation					
Attenuator (20dB, 50W)	Aeroflex / Weinschel	47-20-34	3165	12	30-May-2009
Thermocouple Thermometer	Fluke	51	3174	12	26-Jun-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Attenuator (20dB, 150W)	Narda	769-20	3367	12	9-May-2009
Section 2.9 and 2.11 Radio (Tx) - Maximum Peak Output Power					
Audio Analyser	Hewlett Packard	8903B	44	12	15-Jul-2009
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Attenuator (20dB, 50W)	Aeroflex / Weinschel	47-20-34	3165	12	30-May-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Section 2.8 Radio (Tx) - Modulation Characteristics					
Audio Analyser	Hewlett Packard	8903B	44	12	15-Jul-2009
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Attenuator (20dB, 150W)	Narda	769-20	3367	12	9-May-2009
Section 2.6 Radio (Tx) - Occupied Bandwidth					
Audio Analyser	Hewlett Packard	8903B	44	12	15-Jul-2009
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Attenuator (20dB, 50W)	Aeroflex / Weinschel	47-20-34	3165	12	30-May-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	21-May-2009
Section 2.2 Radio (Tx) - Time Out Timer					
Attenuator (10dB/250W)	Weinschel	45-10-43	477	12	18-Jun-2009
Sensor Module	Hewlett Packard	11722A	1333	12	11-Nov-2009
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygromer	Rotronic	A1	2138	12	13-May-2009
Multimeter	Iso-tech	IDM101	2424	12	3-Sep-2009
Stop Clock	R.S Components	RS328 061	2674	-	TU
Attenuator (20dB, 50W)	Aeroflex / Weinschel	47-20-34	3165	12	30-May-2009
Modulation Analyser	Hewlett Packard	8901B	3292	12	21-Nov-2009
Section 2.1 - Radiated Emissions					
Spectrum Analyser	Hewlett Packard	8562A	14	12	11-Jun-2009
Modulation Analyser	Hewlett Packard	8901B	45	12	8-Jul-2009
Antenna (Bilog)	Schaffner	CBL6143	287	24	21-Jan-2010
Load (50ohm, 30W)	JFW	50T-054	351	12	18-Jun-2009
50ohm Load (50W)	Weinschel	M1426	361	12	5-Sep-2009
Attenuator 30dB 250W	Weinschel	45-30-43	382	12	28-Jan-2009
Attenuator (20dB, 250W)	Weinschel	45-20-43	473	12	6-Nov-2009



Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - Radiated Emissions					
Screened Room (5)	Rainford	Rainford	1545	36	11-Feb-2011
Signal Generator	Rohde & Schwarz	SMR40	1589	12	30-Oct-2009
Mast Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Turntable/Mast Controller	EMCO	2090	1607	-	TU
Signal Generator	Marconi	2031	1845	12	21-Oct-2009
Audio Analyser	Hewlett Packard	8903B	2212	12	16-Dec-2009
Antenna (Bilog)	Chase	CBL6143	2904	24	28-Nov-2009
Comb Generator	Schaffner	RSG1000	3034	-	TU
Attenuator (10dB, 2W)	Pasternack	PE7004-10	3085	12	20-Mar-2009
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	25-Jul-2009
Signal Generator, 9kHz to 6GHz	Rohde & Schwarz	SMB 100A	3500	12	20-May-2009
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	20-Aug-2009

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*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Conducted Emissions, ISN	150kHz to 30MHz Amplitude	2.1dB
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
Discontinuous Interference	150kHz to 30MHz Amplitude	3.0dB*
Interference Power	30MHz to 300MHz Amplitude	3.0dB*
Radiated E-Field Susceptibility	26MHz to 2.5GHz Test Amplitude	1.4dB†
Conducted Susceptibility	100kHz to 250MHz Amplitude	1.8dB†
DC Input Ripple Immunity	Current Voltage	0.45% 0.91%
Power Frequency Magnetic Field	50Hz/60Hz Amplitude	0.45%
Magnetic Emissions	9kHz to 30MHz Amplitude	3.4dB*
Magnetic Field/Flux iaw EN 50366	10Hz to 400kHz	2.64%
Harmonics and Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2 and EN 61000-3-3	—
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—
Surge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5	—
Vehicle Transients	The test was applied using proprietary equipment that meets the requirements of ISO 7637-1 and 2	—
Compass Safe Distance	Azimuth Accuracy	0.10°

Worst case error for both Time and Frequency measurement 12 parts in 10⁶.

* In accordance with CISPR 16-4

† In accordance with UKAS Lab 34

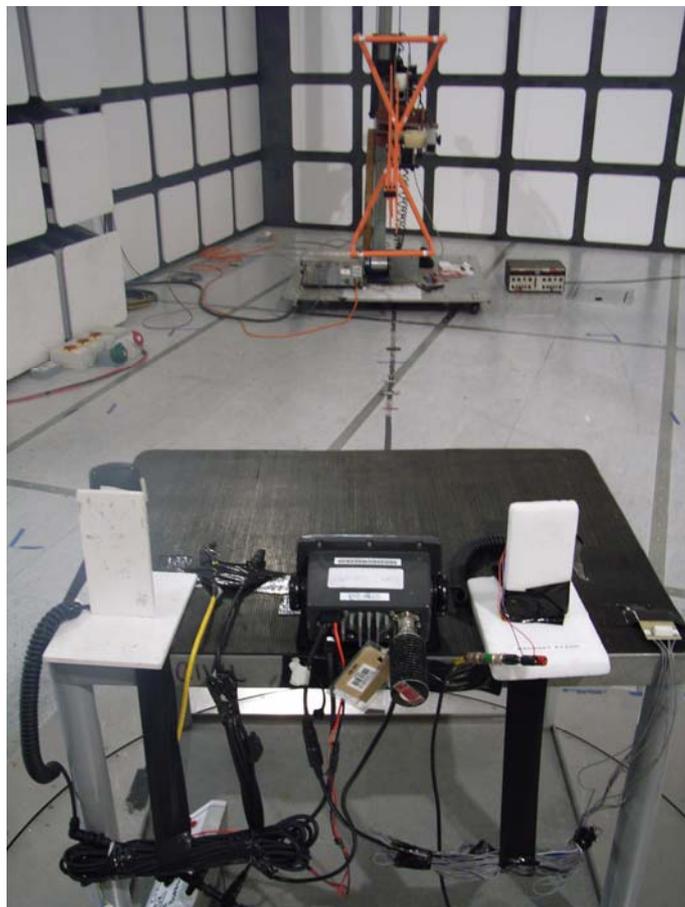


Product Service

SECTION 4

PHOTOGRAPHS

4.1 TEST SET UP PHOTOGRAPHS



Radiated Emissions (Enclosure Port)



Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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