

TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Raymarine UK Ltd Lifetag Man Overboard Detection (Tag)

Partial Testing To: FCC Part 15.247: 2004 (Subpart C)

Test Report Serial No: RFI/MPTE1/RP48098JD05A

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager:			
Tested By: Raul Recio	Checked By: Steven Wong		
pp taraffaran	Slinghonghong		
Report Copy No: PDF01			
Issue Date: 25 April 2006	Test Dates: 10 April 2006 to 11 April 2006		

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TEST REPORT

S.No. RFI/MPTE1/RP48098JD05A

Page 2 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

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TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 3 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

Table of Contents

1. Client Information	4
2. Equipment Under Test (EUT)	5
3. Test Results	7
4. Deviations from the Test Specification	8
5. Operation of the EUT during Testing	9
6. Summary of Test Results	10
7. Measurements, Examinations and Derived Results	11
8. Measurement Uncertainty	24
9. Measurement Methods	25
Appendix 1. Test Equipment Used	30
Appendix 2. Test Configuration Drawings	31

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 4 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

1. Client Information

Company Name:	Raymarine UK Ltd
Address:	Robinson Way Anchorage Park PO3 5TD
Contact Name:	Mr M Howes

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 5 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Brand Name:	Raymarine
Model Name or Number:	LifeTag, E15026
Serial Number:	001
FCC ID Number:	PJ5-LLT
Hardware Revision:	3015-394 Issue C
Software Revision:	0.4
Country of Manufacture:	Hungry
Date of Receipt:	27 March 2006

Brand Name:	Raymarine
Model Name or Number:	Base Station, A18130
Serial Number:	002
FCC ID Number:	PJ5-LLT
Hardware Revision:	3015-395 Issue D
Software Revision:	0.4
Country of Manufacture:	Hungry
Date of Receipt:	27 March 2006

2.2. Description of EUT

The equipment under test is a wireless marine man over board alarm system. Its function is to detect a man over board condition which occurs when the RF link is broken.

2.3. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 6 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

2.4. Additional Information Related to Testing

Power Supply Requirement:	DC Supply of 3 V	DC Supply of 3 V		
Intended Operating Environment:	Commercial	Commercial		
Equipment Category:	Short Range Devi	ce – Alarm (Marin	e)	
Type of Unit:	Portable (Standald	Portable (Standalone battery powered device)		
Transmit Frequency Range:	2.4 GHz to 2.4835	2.4 GHz to 2.4835 GHz		
Transmit Channels Tested:	Channel ID	Channel ID Channel Frequency (MHz)		
	В	11	2405	
	12	18	2440	
	1A	26	2480	
Receive Frequency Range:	2.4 GHz to 2.4835 GHz			
Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)	
	В	11	2405	
	12	18	2440	
	1A	26	2480	
Maximum Peak Power Output (EIRP)	2.6 dBm			

2.5. Port Identification

Port	Description	Type/Length	Applicable
1	RF Port	SMA	Υ

2.6. Support Equipment

No support equipment was used to exercise the EUT during testing.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 7 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

3. Test Results

Reference:	FCC Part 15.247: 2004 Subpart C	
Title:	Code of Federal Regulations, Part 15.247 (47CFR22) (Intentional Radiators operating within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz)	

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003

Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

3.2. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

TEST REPORT

S.No. RFI/MPTE1/RP48098JD05A

Page 8 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

4. Deviations from the Test Specification

None.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 9 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

5. Operation of the EUT during Testing

5.1. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated.

Transmitting a constant stream of packets.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

A development board was used for programming the EUT into transmit mode. The development board was connected to a computer using a 5 m RS232 cable. All tests were performed using a SMA RF port for conducted emissions.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 10 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Transmitter Minimum 6 dB Bandwidth	C.F.R. 47 FCC Part 15: 2004 Section 15.247(a)(2)	Antenna Terminals	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 15: 2004 Section 2.1049	Antenna Terminals	Complied
Transmitter Peak Power Spectral Density	C.F.R. 47 FCC Part 15: 2004 Section 15.247(e)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2004 Section 15.247(b)(3)	Antenna Terminals	Complied
Transmitter Conducted Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.247 (d)	Antenna Terminals	Complied
Transmitter Band Edge Conducted Emissions	C.F.R. 47 FCC Part 15: 2004 Section 15.247(d)	Antenna Terminals	Complied

6.1. Location of Tests

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Pavilion A, Ashwood Park, Ashwood Way, Hampshire, RG23 8BG.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 11 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

No radiated spurious emissions tests to FCC Part 15.47. Only partial testing was performed at the request by the customer.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 12 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7.2. Test Results

7.2.1. Transmitter Minimum 6 dB Bandwidth: Section 15.247(a)(2)

The EUT was configured for 6 dB bandwidth measurements as described in section 9 of this report. Tests were performed to identify the 6 dB bandwidth.

Results:

Channel	Transmitter 6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	1.656	≥0.5	1.156	Complied
Middle	1.643	≥0.5	1.143	Complied
Тор	1.627	≥0.5	1.127	Complied

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

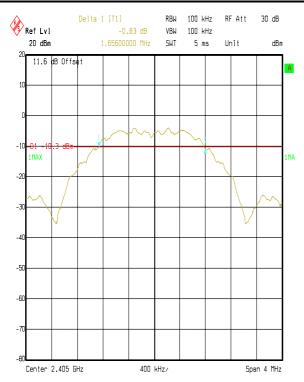
Page 13 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

FCC Part 15.247: 2004 (Subpart C) To:

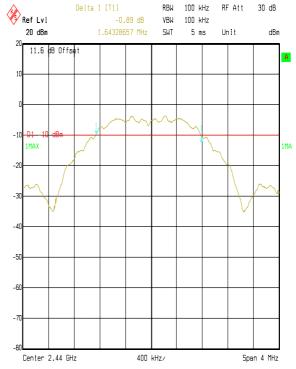
Transmitter Minimum 6 dB Bandwidth: Section 15.247(a)(2) (Continued)



Title: Raymarine UK Ltd
Comment A: RF Remote control system (tag). 6 dB Bandwidth.
Date: 10.APR.2006 15:03:33



Title: Raymarine UK Ltd
Comment A: RF Remote control system (tag). 6 dB Bandwidth(top).
Date: 10.APR.2006 15:10:52



Title: Raymarine UK Ltd
Comment A: RF Remote control system (tag). 6 dB Bandwidth(mdl).
Date: 10.APR.2006 15:07:31

Date:

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 14 of 32

Test of: **Raymarine UK Ltd**

Lifetag Man Overboard Detection (Tag)

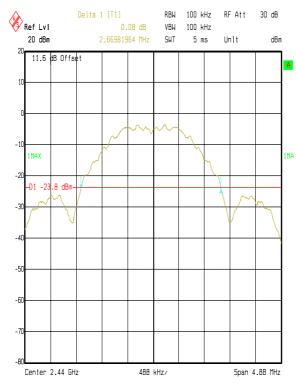
To: FCC Part 15.247: 2004 (Subpart C)

7.2.2. Transmitter 20 dB Bandwidth: Section 2.1049

The EUT was configured for 20 dB bandwidth measurements as described in section 9 of this report. Tests were performed to identify the 20 dB bandwidth.

Results:

Transmitter 20 dB Bandwidth (kHz)
2669.82



Comment A: RF Remote control system (tag). 20 dB Bandwidth(mid). Date: 10.APR.2006 15:24:52

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 15 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7.2.3. Transmitter Peak Power Spectral Density: Section 15.247(e)

The EUT was configured for transmitter peak power spectral density measurements as described in section 9 of this report.

Tests were performed to identify the transmitter peak power spectral density.

Results:

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-16.3	8	24.3	Complied
Middle	-16.2	8	24.2	Complied
Тор	-16.1	8	24.1	Complied

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

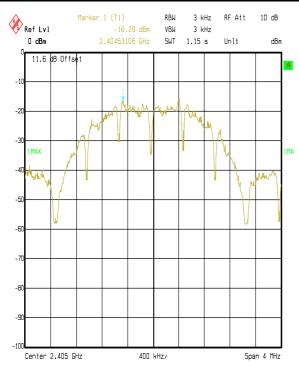
Page 16 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

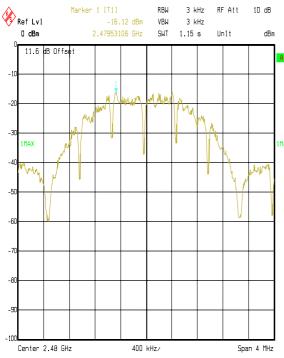
FCC Part 15.247: 2004 (Subpart C) To:

Transmitter Peak Power Spectral Density: Section 15.247(e) (Complied)



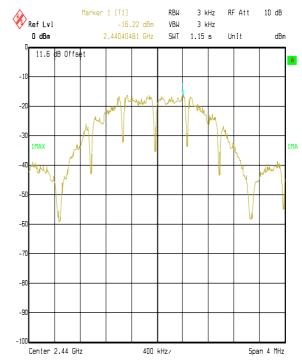
Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). Peak Power Spectral Density(

bot). 10.APR.2006 15:33:03 Date:



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). Peak Power Spectral Density(

top). 10.APR.2006 15:35:01



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). Peak Power Spectral Density(

mid). 10.APR.2006 15:30:59 Date:

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 17 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7.2.4. Transmitter Maximum Peak Output Power: Section 15.247(b)(3)

The EUT was configured for transmitter peak output power measurements as described in section 9 of this report.

Results:

Battery Powered Devices

Channel	Conducted RF O/P Power (dBm)	Stated Antenna Gain (dB)	ERP or EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	-0.2	2.4	2.2	30.0	27.8	Complied
Middle	0.2	2.4	2.6	30.0	27.4	Complied
Тор	0.0	2.4	2.4	30.0	27.6	Complied

Note(s):

1. As per the method stated in section 15.247(b)(3), the standard antenna gain of the EUT is 2.4 dBi which, then added to the highest (worst case) measured conducted output power of 0.2 dBm (from the table above) gives a de facto EIRP of 2.6 dBm. This is in compliance with the requirements of section 15.247(b)(3) for de facto EIRP limitation i.e. 1 Watt (30 dBm).

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

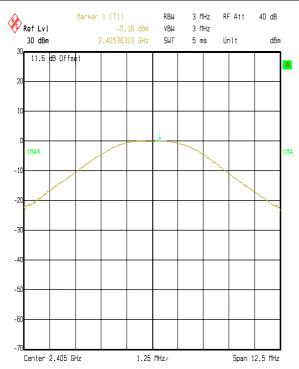
Page 18 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

FCC Part 15.247: 2004 (Subpart C) To:

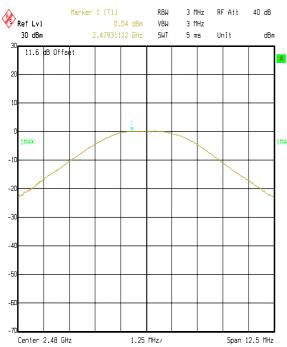
Transmitter Maximum Peak Output Power: Section 15.247(b)(3) (Continued)



Title: Raymarine UK Ltd

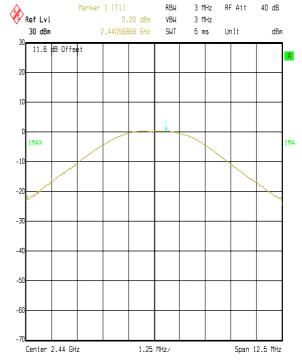
Comment A: RF Remote control system (tag). Maximum Peak Output Power(bo

Date: 10.APR.2006 16:07:52



p). 10.APR.2006 15:44:28

Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). Maximum Peak Output Рожег(to



Title: Raymarine UK Ltd

Comment A: RF Remote control system (tag). Maximum Peak Output Power(mi

10.APR.2006 15:59:14 Date:

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 19 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7.2.5. Transmitter Conducted Emissions: Section 15.247(d)

The EUT was configured for transmitter conducted emissions measurements as described in section 9 of this report.

Tests were performed to identify the maximum transmitter conducted emission levels.

The limit lines shown in the plots below are set to a level 20 dB below the measured highest fundamental peak power.

Results:

Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
4810.928	-32.8	-29.1	-20.0	9.1	Complied
7216.503	-40.8	-37.1	-20.0	17.1	Complied

Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
4878.949	-36.2	-32.5	-20.0	12.5	Complied
7321.737	-40.8	-37.1	-20.0	17.1	Complied

Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
4958.930	-40.9	-37.2	-20.0	17.2	Complied
7438.457	-41.3	37.6	-20.0	17.6	Complied

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A Page 20 of 32

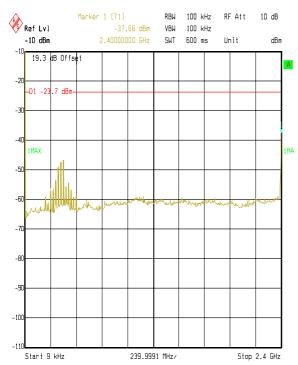
Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

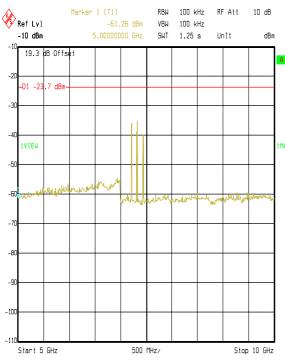
Lifetag Man Overboard Detection (Tag)

FCC Part 15.247: 2004 (Subpart C) To:

Transmitter Conducted Emissions: Section 15.247(d) (Continued)

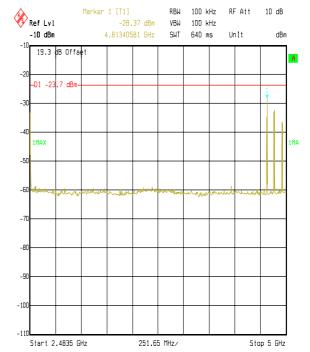


Comment A: RF Remote control system (tag). TX Conducted Emissions(top). Date: 10.APR.2006 16:42:52



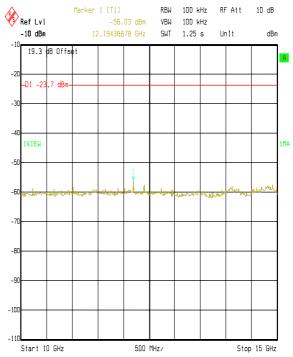
Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). TX Conducted Emissions (top

middle bottom). 10.APR.2006 16:58:52



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). TX Conducted Emissions (top

middle bottom). 10.APR.2006 16:45:35 Date:



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). TX Conducted Emissions (top

middle bottom). 10.APR.2006 17:20:00

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

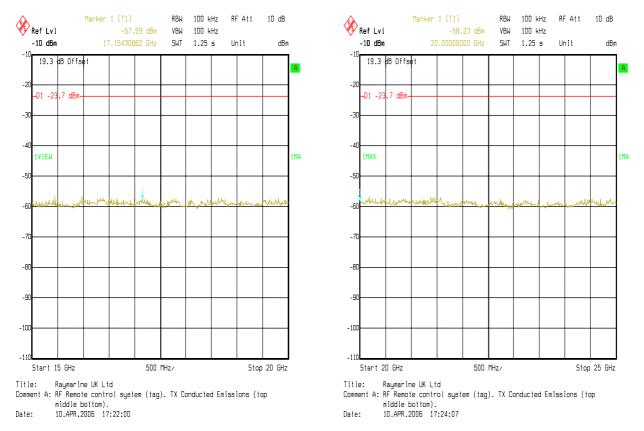
Page 21 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Conducted Emissions: Section 15.247(d) (Continued)



Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 22 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

7.2.6. Transmitter Band Edge Conducted Emissions: Section 15.247(d)

The EUT was configured for transmitter conducted emissions measurements as described in section 9 of this report.

Tests were performed to identify the maximum conducted band edge emission levels.

The limit lines shown in the plots below are set to a level 20 dB below the measured fundamental peak power of the channels closest to the lower and upper band edge.

Results:

Peak Power Level:

Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
2400.000	-47.3	-43.6	-20.0	23.6	Complied
2483.500	-40.9	-37.2	-20.0	17.4	Complied

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

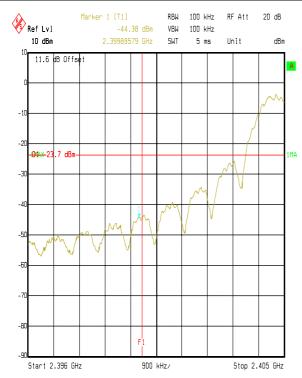
Page 23 of 32

Test of: **Raymarine UK Ltd**

Lifetag Man Overboard Detection (Tag)

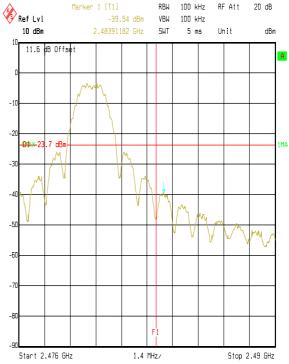
To: FCC Part 15.247: 2004 (Subpart C)

Transmitter Band Edge Conducted Emissions: Section 15.247(d) (Continued)



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). TX Band Edge Conducted Emiss

ions (bottom). 10.APR.2006 18:11:52 Date:



Title: Raymarine UK Ltd Comment A: RF Remote control system (tag). TX Band Edge Conducted Emiss

ions (top). 10.APR.2006 17:59:18

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 24 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Transmitter Maximum Peak Output Power	Not applicable	95%	±0.28 dB
Conducted Emissions Antenna Port	30 MHz to 40 GHz	95%	±2.62 dB
Spectral Power Density	Not applicable	95%	±0.28 dB
6 dB/20 dB Bandwidth	Not applicable	95%	±0.12 %

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 25 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

9. Measurement Methods

9.1. Conducted Antenna Port Emissions

Conducted antenna port emissions measurements were performed using a 100 kHz bandwidth in accordance with the standard against the appropriate limits.

Prior to testing being performed a suitable RF attenuator and cable, were calibrated for the required frequency range. For each measurement range the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

Initial measurements covering the entire measurement band in the form of swept scans were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which final measurements were necessary. To make the final measurements a peak detector was used in conjunction with the appropriate detector IF measuring bandwidth.

Repetitive scans were performed to allow for emissions with low repetition rates.

Scans were performed to the upper frequency limits as stated in 15.33(a)(1)

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 26 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

Minimum 6 dB Bandwidth

The EUT and spectrum analyser were configured as for conducted antenna port emissions.

Prior to testing being performed a suitable RF attenuator and cables were calibrated for the required frequencies. For each frequency the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

To determine the 6 dB bandwidth, a resolution bandwidth of 100 kHz was used, which approximates to 1% of the 6 dB bandwidth. A video bandwidth of 100 kHz was used. The analyser was set to a span of greater than twice the 6 dB bandwidth and for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference established 6 dB below the peak level. The bandwidth was determined at the points where the 6 dB reference crossed the profile of the emission.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 27 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

9.2. Transmitter 20 dB Bandwidth

The EUT and spectrum analyser was configured as for transmitter conducted antenna port emissions.

To determine the occupied bandwidth, a resolution bandwidth of 100 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of a least the same value was used. The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20 dB below the peak level. The bandwidth was determined at the points where the 20 dB reference crossed the profile of the emission.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 28 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

9.3. Spectral Power Density

The EUT and spectrum analyser were configured as for conducted antenna port emissions measurements.

Prior to testing being performed a suitable RF attenuator and cables were calibrated for the required frequencies. For each frequency the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

Prior to the measurement being taken the spectrum analyser was tuned to the fundamental frequency of the EUT.

A resolution bandwidth of 3 kHz was selected and the analyser was set to a span greater than twice the 6 dB bandwidth. The trace was max held and a reading was taken at the peak point of the trace.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 29 of 32 Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

9.4. Peak Output Power

The EUT and spectrum analyser were configured as for conducted antenna port emissions measurements.

Prior to testing being performed a suitable RF attenuator and cables were calibrated for the required frequencies. For each frequency to be measured, the calibrated level of the attenuator and cable were entered as an offset into a spectrum analyser to compensate for the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained from the spectrum analyser as the peak measurement using the peak detector function and a resolution bandwidth of 3 MHz, which is greater than the 20 dB bandwidth of the emission being measured.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 30 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A1252	Band reject filter	Wainwright instruments Gmbh	WRCA314/316/318 -6EE	4
A1396	10dB/18GHz/50Ohm Attenuator	HUBER + SUHNER AG	757987	6810.17.B
C1171	k-Type Cable	Microcoax	None	None
L0775	Hewlett Packard 437B Power Meter	HP	437B	3125U14631
M1010	HP 8485A	Hewlett Packard	8485A	3318A12380
M1242	FSEM30 Spectrum Analyser	Rohde & Schwarz, Inc.	FSEM30	845986_022
S011	D.C. PSU	INSTEK	PR-3010H	9401270

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Issue Date: 25 April 2006

Page 31 of 32

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\48098JD05\EMICON	Test configuration for measurement of conducted emissions.

TEST REPORT S.No. RFI/MPTE1/RP48098JD05A

Page 32 of 32

Issue Date: 25 April 2006

Test of: Raymarine UK Ltd

Lifetag Man Overboard Detection (Tag)

To: FCC Part 15.247: 2004 (Subpart C)

DRG\48098JD05\EMICON

