TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: Raymarine Ltd
Base Station

Partial Testing FCC Part 15.247

Test Report Serial No:
RFI/MPTE1/RP46813JD06A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:  **PP**	
Tested By: Steven Wong 	**Checked By: Nigel Davison** 
Report Copy No: PDF01	
Issue Date: 18 January 2005	**Test Dates: 24 November 2004 to 30 November 2004**

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1. Client Information

Company Name:	Raymarine Ltd.
Address:	Quay Point Northarbour Road Portsmouth PO6 3TD
Contact Name:	Chris Bird

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:	Base Station
Unique Type Identification:	A18106
Serial Number:	C10
FCC ID Number:	PJ5BASE
Country of Manufacture:	UK
Date of Receipt:	24 November 2004

2.2. Description of EUT

The equipment under test is a gateway in conjunction with the S100 Controller and the Smart Controller. It acts as a bridge between a wired communication system (Seatalk) and the wireless products.

2.3. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

2.4. Additional Information Related to Testing

Power Supply Requirement:	DC Supply of 12 V DC Internal Battery supply of 2.4 V DC Ni-MH Rechargeable battery		
Intended Operating Environment:	Maritime		
Equipment Category:	Short Range (Low Power)		
Type of Unit:	Mobile (Vehicular Use, powered via vehicle regulated supply)		
Interface Ports:	Enclosure Antenna Port Seatalk (Power, 12 V and Seatalk data)		
Transmit Frequency Range:	2405 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	0	2405
	Middle	7	2440
	Top	15	2480
Receive Frequency Range:	2405 MHz to 2480 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	0	2405
	Middle	7	2440
	Top	15	2480

2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop
Brand Name:	Toshiba
Model Name or Number:	PA S401E A
Serial Number:	1 90 8855
Cable Length and Type:	RS232, 1 meter
Connected to Port:	Communication

Description:	Communication Interface Board
Brand Name:	None Stated
Model Name or Number:	None Stated
Serial Number:	None Stated
Cable Length and Type:	9 Pin Circular to RS232
Connected to Port:	Communication

3. Test Results

Reference:	FCC Part 15 Subpart C: 2003 (Section 15.247)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

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.

DA00-705 (2000)
Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

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.

4. Deviations from the Test Specification

The client has requested that RFI perform partial testing of this unit to FCC 15.247.

5. Operation of the EUT During Testing

5.1. Operating Modes

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

The EUT was set to transmit continuously with modulation, psuedo random data. Final measurements were performed on bottom, middle and top channel.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

EUT was connected to an external 12 V DC supply and connected to the laptop via a 9 pin circular interface, which is hard wired to the EUT.

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: 2003 Section 15.247(a)(2)	Antenna Terminals	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 2: 2003 Section 2.1049	Antenna Terminals	Complied
Transmitter Peak Power Spectral Density	C.F.R. 47 FCC Part 15: 2003 Section 15.247(d)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2003 Section 15.247(c)	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, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

7. Measurements, Examinations and Derived Results

7.1. General Comments

7.1.1. This section contains test results only.

7.1.2. 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.

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

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

7.2.2. Tests were performed to identify the 6 dB bandwidth of the fundamental signal.

Results:

Channel	Transmitter 6 dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Bottom	1.611	≥ 0.5	1.111	Complied
Middle	1.611	≥ 0.5	1.111	Complied
Top	1.611	≥ 0.5	1.111	Complied

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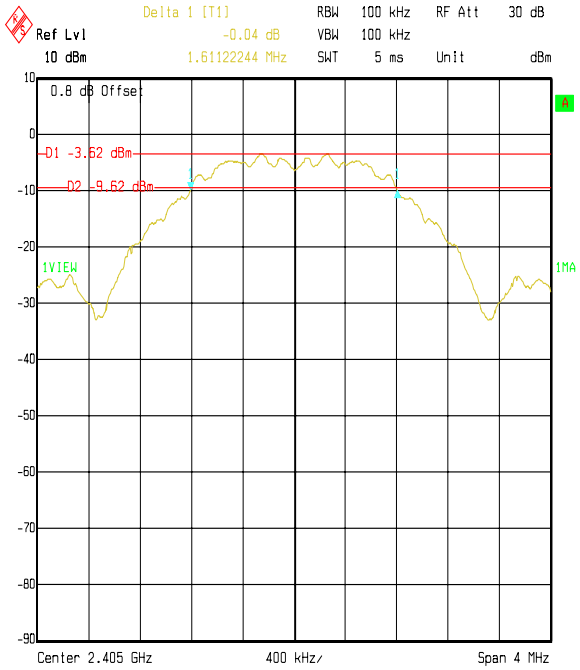
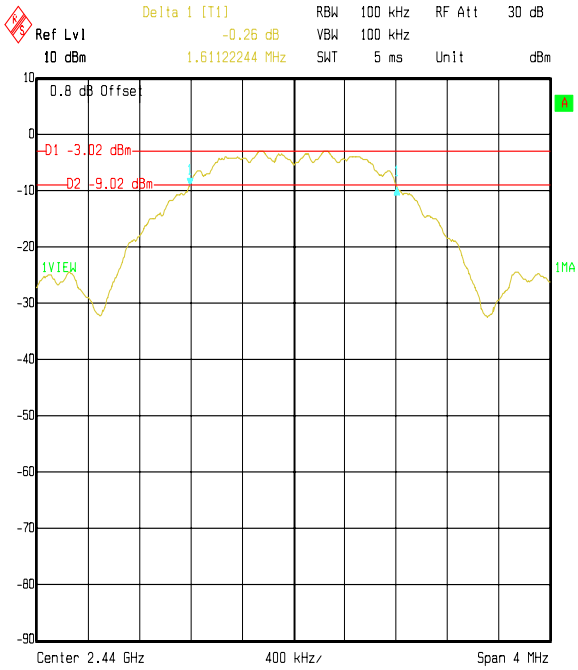
Transmitter Minimum 6 dB Bandwidth: Section 15.247(a)(2) (Continued)



Title: Raymarine EUT: Base Station. 6dB Bandwidth FCC P15.247
Comment A: 46813 Bottom Channel
Date: 24.NOV.2004 14:13:37



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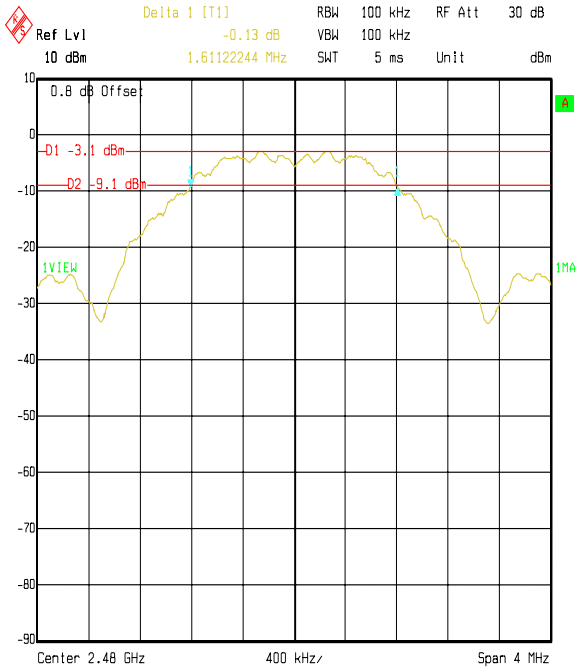

Title: Raymarine EUT: Base Station. 6dB Bandwidth FCC P15.247
Comment A: 46813 Top Channel
Date: 24.NOV.2004 14:29:49

7.3.Transmitter 20 dB Bandwidth: Section 2.1049

7.3.1. The EUT was configured as for 20 dB bandwidth measurements as described in Section 9 of this report.

7.3.2. Tests were performed to identify the 20 dB bandwidth.

Transmitter 20 dB Bandwidth (kHz)	Channel
2661.32265	Bottom
2685.37074	Middle
2677.35471	Top

Note: This test was performed, as it is a requirement for industry Canada approval.

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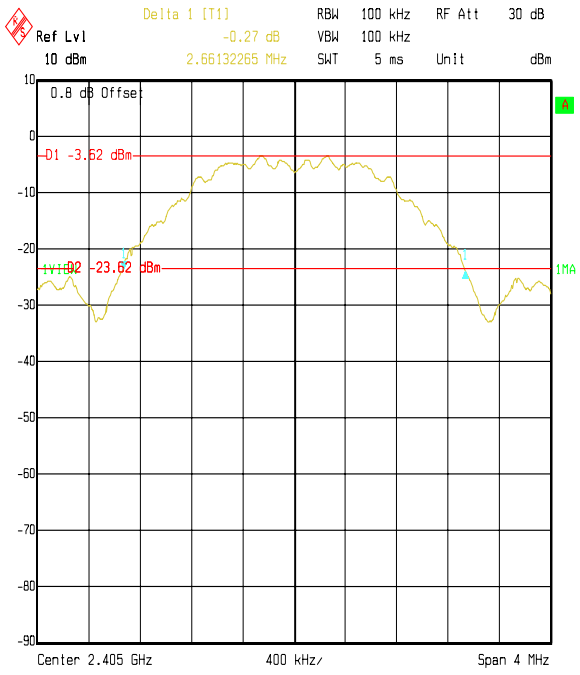
Transmitter 20 dB Bandwidth: Section 2.1049 (Continued)



Title: Raymarine EUT: Base Station. 20dB Bandwidth FCC P15.247
Comment A: 46813 Bottom Channel
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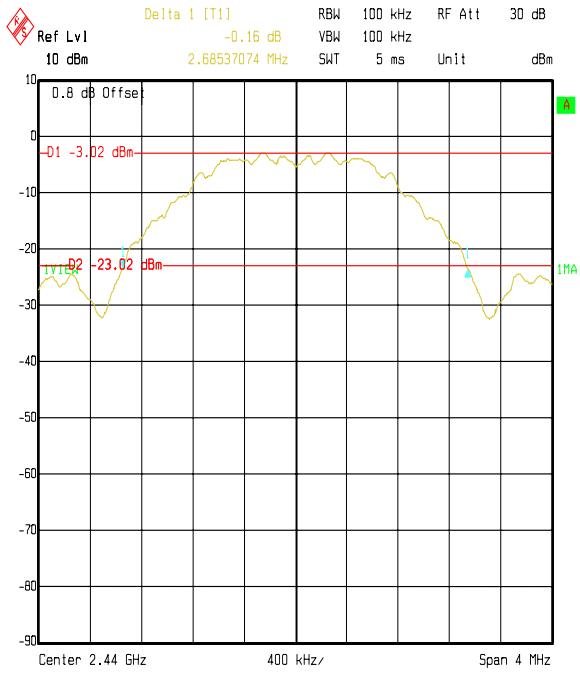
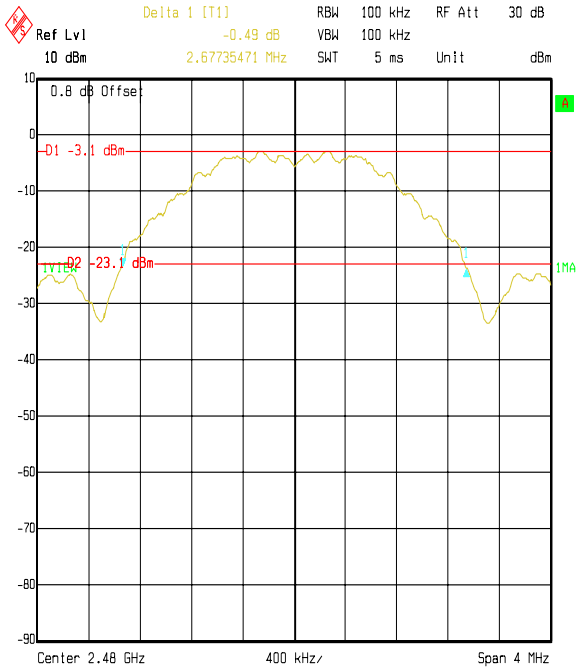


Title: Raymarine EUT: Base Station. 20dB Bandwidth FCC P15.247
Comment A: 46813 Middle Channel
Date: 24.NOV.2004 14:20:15



Title: Raymarine EUT: Base Station. 20dB Bandwidth FCC P15.247
Comment A: 46813 Top Channel
Date: 24.NOV.2004 14:29:01

7.4. Transmitter Peak Power Spectral Density: Section 15.247(d)

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

7.4.2. Tests were performed to identify the maximum peak power spectral density of the Fundamental.

Results:

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-16.0	8	24.0	Complied
Middle	-15.2	8	23.2	Complied
Top	-15.6	8	23.6	Complied

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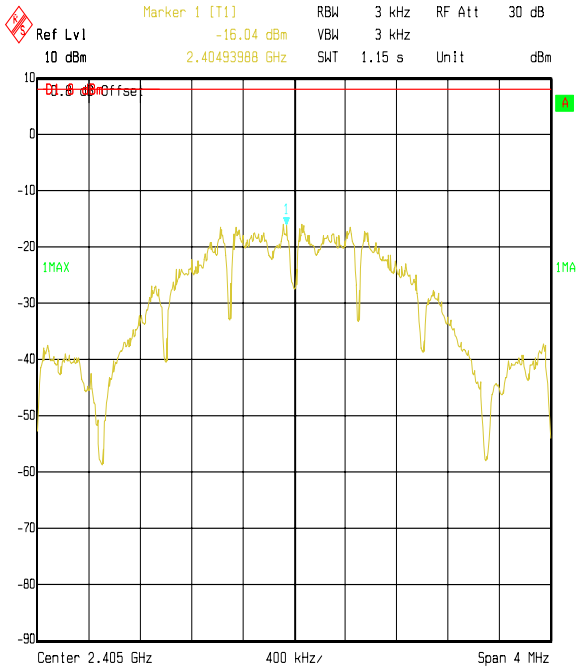
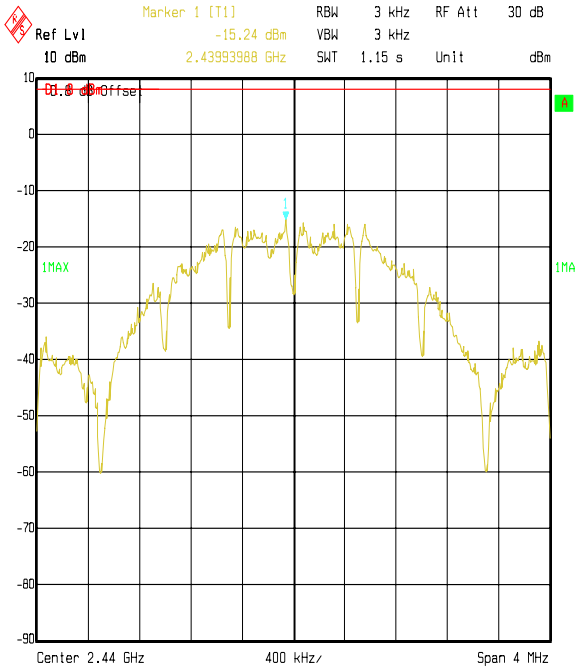
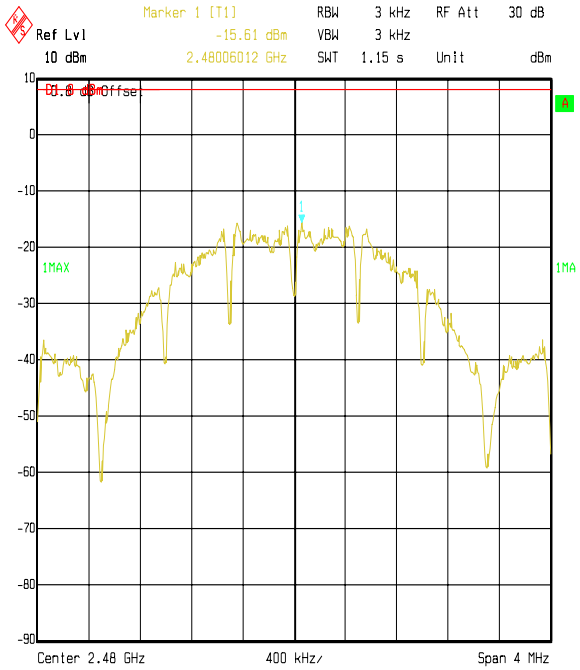
Transmitter Peak Power Spectral Density: Section 15.247(d) (Continued)



Title: Raymarine EUT: Base Station. Spectral Dens FCC P15.247
Comment A: 46813 Bottom Channel
Date: 24.NOV.2004 14:11:12



Title: Raymarine EUT: Base Station. Spectral Dens FCC P15.247
Comment A: 46813 Middle Channel
Date: 24.NOV.2004 14:22:31



Title: Raymarine EUT: Base Station. Spectral Dens FCC P15.247
Comment A: 46813 Top Channel
Date: 24.NOV.2004 14:25:52

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

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

7.5.2. Tests were performed to identify the transmitter maximum peak output power (EIRP) of the EUT.

7.5.3. The effective isotropic radiated power (EIRP) was calculated by adding the manufacturer's declared antenna gain to the figure measured for conducted RF output power.

Results:

Battery Powered Devices

Channel	Conducted RF O/P Power (dBm)	Stated Antenna Gain (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	0.4	4.1	4.5	30.0	25.5	Complied
Middle	0.7	4.1	4.8	30.0	25.2	Complied
Top	0.7	4.1	4.8	30.0	25.2	Complied

Note: As per the requirements of Public Notice DA 00-705, the stated antenna gain of the EUT is 4.1 dBi which, when added to the highest (worst case) measured conducted peak output power of 0.7 dBm (from the table above) gives a de facto EIRP of 4.8 dBm. This is in compliance with the requirements of Section 15.247(b)(1) for de facto EIRP limitation i.e. 1 Watt (30 dBm).

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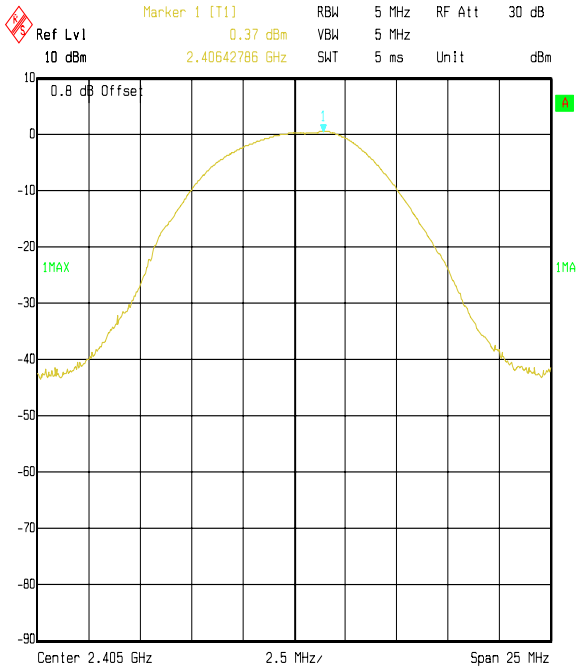
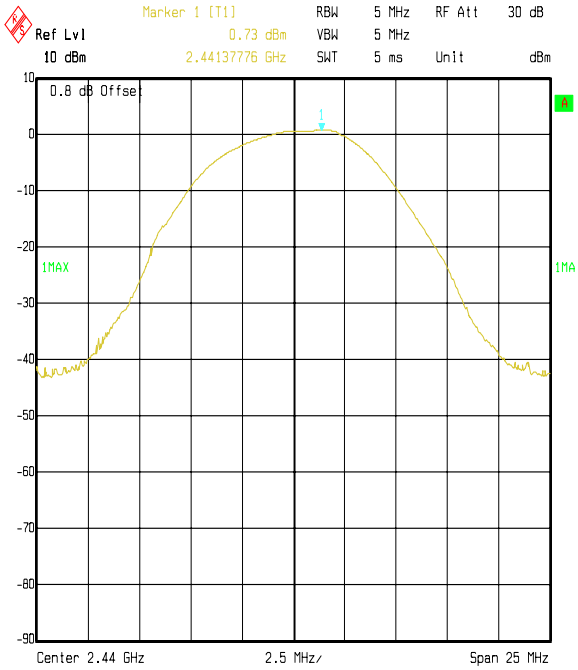
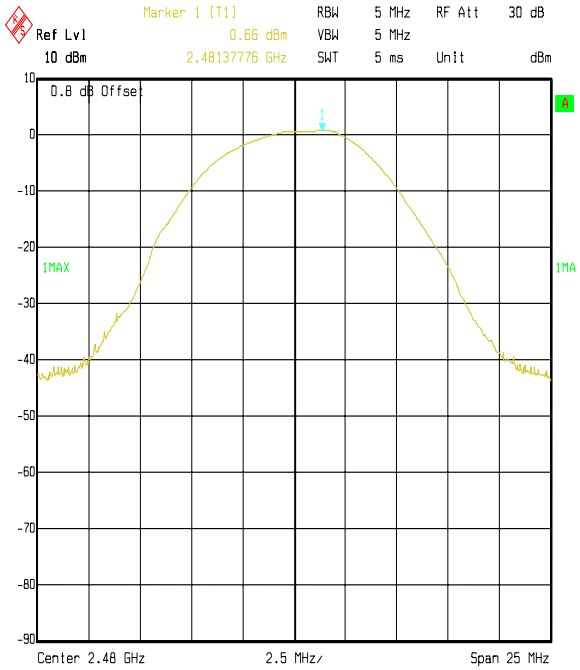
Transmitter Maximum Peak Output Power: Section 15.247(b)(3) (Continued)



Title: Raymarine EUT: Base Station. Peak Power FCC P15.247
Comment A: 46813 Bottom Channel
Date: 24.NOV.2004 14:09:51



Title: Raymarine EUT: Base Station. Peak Power FCC P15.247
Comment A: 46813 Middle Channel
Date: 24.NOV.2004 14:23:09



Title: Raymarine EUT: Base Station. Peak Power FCC P15.247
Comment A: 46813 Top Channel
Date: 24.NOV.2004 14:24:00

8. Measurement Uncertainty

8.1. 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.

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

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

8.4. 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%	+/- 0.46 dB
Spectral Power Density	Not applicable	95%	+/- 1.2 dB
6 dB / 20 dB Bandwidth	Not applicable	95%	+/- 0.12 %

8.5. 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.

9. Measurement Methods

9.1. Minimum 6 dB Bandwidth

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

Prior to testing being performed a suitable RF attenuator and cable 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 is 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.

9.2. Transmitter 20 dB Bandwidth

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

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.

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 cable 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 of greater than twice the 6 dB bandwidth. The trace was max held and a reading was taken at the peak point of the trace.

9.4. Peak Output Power

The EUT and spectrum analyser were configured as for conducted antenna port measurements and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

Prior to testing being performed a suitable RF attenuator and cable 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 using trace maximum hold and marker peak to search for the highest level.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A1256	Power supply	Farnell	11E30/1B	000378
C573	C573-N-N-2	Rosenberger	UFA210A-1-788-50x50	97E0936
G013	SMHU Signal Generator	Rohde & Schwarz	SMHU	894 055/003
M058	Multimeter	Fluke	79	54940691
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016
M198	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	827191/003
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075

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