Test Report for 12kW SHD Digital Scanner with 4ft and 6ft Open Array Antenna

To EN 60945: 2002 - Maritime navigation & radiocommunication equipment & systems - General requirements - Methods of measurement & required test results

Section 12 Safety Precautions

Test Report Number: 649/1086

Approved	Peter Bowen Compliance Manager		14/02/2008
Report	Andy Little Senior Compliance Engineer		14/02/2008
Report Date	14/02/2008	Test Date	14/02/2008

The test data and results contained within this report relate only to the items tested.

This report shall not be reproduced without the written approval of Raymarine Ltd.

Any reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. Any uncertainty evaluation has been carried out with reference to CISPR16-4:2002.

1 Purpose of Tests

To ascertain compliance with Section 12 of EN60945:2002.

2 Description of Equipment under Test (EUT)

(To include all equipment being tested)

Date of Receipt:	12/11/2007
Client:	Navigation Systems
Brand Name:	Raymarine
Product Range:	Radar Scanners
Country of Manufacture:	Hungary
Operational voltage:	12 / 24V d.c. nominal

Unit 1

Model Name or Number:	**12kW SHD Digital Scanner**
Unique Type Identification:	E52082
Serial Number:	EMC071219a
Circuit Diagram No(s) & Issue:	LNA 4346-028 Iss Q IF 4610-007 Iss H MOD/PSU 4610-043 Iss H
PCB Assembly No(s) & Issue:	LNA 4610-011 IF 4610-016 Iss E MOD/PSU 4610-010 Iss E
Software Version:	IF v0.34 MOD v0.25 FPGA v0.15
Modifications to Unit:	None

Unit 2

Model Name or Number:	**Voltage Boost Box**
Unique Type Identification:	E52091
Serial Number:	EMC071219c
Circuit Diagram No(s) & Issue:	6649-006 Iss D
PCB Assembly No(s) & Issue:	4649-005 Iss D
Software Version:	N/A
Modifications to Unit:	None

Unit 3

Model Name or Number:	**4 ft antenna for Open array radar**
Unique Type Identification:	M92693 (identical to E52083 and E52092 except for HD or SHD logo on antenna)
Serial Number:	EMC040707a
Modifications to Unit:	None

Unit 4

Model Name or Number:	**4 ft antenna for Open array radar**
Unique Type Identification:	E52093 identical to E52084 except for HD or SHD logo on antenna)
Serial Number:	0289016
Modifications to Unit:	None

Other Information:	

3 Protection against accidental access to dangerous voltages

EN60945 Section 12.1

The 12kW SHD Digital Open Array Radar Scanner is intended for outside installation and therefore meets stringent requirements for waterproofing under various climatic conditions. There are therefore no openings large enough to accept the probe specified in Section 12.1. Access to the interior of the equipment requires the use of a box or socket spanner. Warning labels, where appropriate, are displayed within the equipment and on protective covers, and within the User Handbook and Service Manual.

The VCM100 is intended for below-decks mounting. There are no voltages generated within the unit which exceed 50V d.c. The input, output and emergency stop switch terminals are accessible after removal of a cover which has a simple rotary fastener requiring a screwdriver or coin to operate. Further access to the single pcb requires the use of an allen key to remove the front cover of the unit. With the covers in place, there is no opening large enough to accept the test probe specified in Section 12.1.

4 Electromagnetic Radiofrequency Radiation

EN60945 Section 12.2

All Raymarine Leisure Marine Radar Owner's Handbooks and service Manuals include the following Safety statement:

> **Radio Frequency Radiation Hazard**. The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful particularly, to your eyes. DO NOT look at the antenna at close range. It is important that the radar is turned off whenever personnel are required to come close to the scanner assembly or associated equipment. It is recommended that the radar scanner is mounted out of range of personnel (above head height). Distances from the face of the radar at which RF radiation levels of 100 $W/m^2$and 10W/ m^2 exist, are given below.

Model	Distance to 100 W/m2 point	Distance to 10 W/m2 point
RA2048SHD (12 kW)	Worst case 0.25 M	Worst case 1.5 M
RA3072SHD (12 kW)	Worst case 0.20M	Worst case 2.0 M

When properly installed and operated, the use of this radar will conform to the requirements of:
• ANSI/IEEE C95.1-2005 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 Hz to 300 GHz.
• ICNIRP Guidelines 1998 - International Commission on Non-Ironising Radiation Protection: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300Ghz) 1998.

IEEE C95.1-2005 Table 9 (page 25) gives recommendations for maximum permissible exposure for uncontrolled environments. At 9.4GHz, the maximum is 10W/sq.m, averaged over approximately 16 minutes.

ICNIRP Guidelines 1998 Table 7 (page 18) similarly gives recommendations for maximum permissible exposure for uncontrolled environments. At 9.4GHz, the maximum is also 10W/sq.cm, averaged over 6 minutes.

The table above shows distances from the front face of the stationary antenna for levels of $100W/m^2$ and $10W/m^{2.}$ When operating normally, rotation of the antenna further reduces the effective power density (time averaged) by approximately 19dB.

The radar is fitted with software and hardware interlocks to prevent the radar transmitting with the antenna stationary, either due to software fault or a deliberate act by the operator. To transmit with the antenna stopped a hardware modification is required to the modulator PCB and special control software is required that is not available to the user.

Thus, for both U.S. and International recommendations, the power density produced in normal operation by the 12kW SHD Digital Open Array Radar Scanner, fitted with either a 4ft or 6ft antenna, is substantially less than the maximum advised limits.

5 Emission from Visual Display Unit

EN60945 Section 12.3

The 12kW SHD Digital Open Array Radar Scanner is a Radar Transceiver with no intrinsic display unit. This section therefore is not applicable.

6 X-Radiation

EN60945 Para 12.4

There are extremely low levels of X-radiation emitted from magnetrons. The manufacturers of the magnetrons used in the 12kW SHD Digital Open Array Radar Scanner advise that these levels only present a safety risk when the operating voltage exceeds 10kV. The design is such that the maximum voltage applied to the magnetron cannot exceed 6kV.

7 Conclusion

The Raymarine 12kW Super High Definition Digital Open Array Scanner (and its High Definition variant) complies with the applicable requirements of Section 12 of the standard referenced on page 1 of this report.

8 List of Test Equipment

Test Equipment Type	Manufacturer and Type Number	Serial Number	Cal Due Date
Semi-Anechoic Chamber, Site 3	Global EMC	GE002	**N/A**
Electromagnetic Monitor	Narda 8716	12098	**7/12/2008**
Isotropic Probe	Narda 8721	13034	**11/12/2008**
Power Supply Unit	Palstar PS30M	92534722	**07/03/2008**

In accordance with UKAS requirements, all measuring equipment is on a calibration cycle.