




**Test Report
for
4kW Digital Super High Definition
Open Array Radar Scanner**

**To EN60945:2002 - Maritime navigation & radiocommunication
equipment & systems - General requirements - Methods of
measurement & required test results**

Section 12: Safety Precautions

Test Report Number: 649/1047

Author	Peter Bowen EMC Team Leader		17/07/2007
Issue Date	17/07/2007	Test Dates	12/07/2007

This report shall not be reproduced except in full without the written approval of Raymarine UK 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

For the 4kW Digital Super High Definition (SHD) and High Definition (HD) Open Array Scanners, and the VCM100 Voltage Conversion Module:

To establish compliance with, or exemption from, the provisions of Section 12 of BSEN60945:2002.

2 Description of Equipment

Brand Name:	Raymarine
Model Name or Number:	4kW Digital SHD Open Array Radar Scanner
Unique Type Identification:	E52081 E52069 (Variant - 4kW Digital HD Open Array Scanner)
Serial Number:	EMC070530a
Country of Manufacture:	Hungary
Operational voltage :	42V dc from VCM100

Brand Name:	Raymarine
Model Name or Number:	VCM100 Voltage Conversion Module
Unique Type Identification:	E52091
Serial Number:	EMC070530c
Country of Manufacture:	Hungary
Operational voltage range:	12 - 24V dc (nominal) 10.7 - 31.2V dc (min - max)

Brand Name:	Raymarine
Model Name or Number:	4ft Antenna
Unique Type Identification:	M92693
Serial Number:	EMC040707a
Country of Manufacture:	Hungary
Operational voltage range:	Not Applicable

Brand Name:	Raymarine
Model Name or Number:	6ft Antenna
Unique Type Identification:	M92743
Serial Number:	EMC040707b
Country of Manufacture:	Hungary
Operational voltage range:	Not Applicable

3 Protection against accidental access to dangerous voltages EN60945 Section 12.1

The 4kW Digital SHD Open Array Radar Scanner (and its HD variant) 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. 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 alley 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:

Electromagnetic Energy. The radar scanner transmits electromagnetic energy. It is important that the radar is turned off whenever personnel are required to come close to the scanner to perform work on the scanner assembly or associated equipment.

It is recommended that the radar scanner is mounted out of range of personnel (above head height).

Do not look directly at the antenna at close range as your eyes are the most sensitive part of the body to electromagnetic energy.

When properly installed and operated, the use of this radar will conform to the requirements of

- (a) *IEEE C95.1-2005 - IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz*
- (b) *ICNIRP Guidelines 1998 - International Commission on Non-Ionising 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.

Measurements made with the antenna stationary show that the maximum power density from the 4kW Digital SHD Radar Scanner is 22.2W/sq.m., measured at the central front face of the 6ft open array antenna. For the 4ft open array antenna, the measurement is 22.0W/sq.m.

A level of 10W/sq.m is achieved at 26cm from the front of the 6ft open array antenna (31cm for the 4ft open array). Rotation of the antenna further reduces the effective power density (time averaged) by approximately 19dB.

As the radius of rotation of either antenna exceeds the distance from the centre at which 10W/sq.cm is achieved, it is not possible for persons in the vicinity to experience this power density from the product. Transmission with antenna stationary is prevented by the software and is available only to service personnel (unavailable to user).

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

NOTE:

The power measurements of the 4kW Digital SHD Open Array Radar Scanner given above were made at Raymarine's EMC Department by staff from Qinetic Ltd., Farnborough, under reference SES/EMES/1053, and are also considered to be applicable in all respects to the HD variant.

5 Emission from Visual Display Unit

EN60945 Section 12.3

The 4kW Digital SHD Open Array Radar Scanner (and its HD variant) 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 4kW Digital SHD Open Array Radar Scanner (and its HD variant) 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 4kW Digital Super High Definition 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.