Product Service

Choose certainty.
Add value.

Report On

RF Exposure Assessment of the
Raymarine UK Ltd
RAY260 DSC Class D VHF Radio

FCC ID:PJ5-RAY260
IC ID: 4069B-RAY260

Document 75920234 Report 06 Issue 1 February 2013

Product Service

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

REPORT ON

RF Exposure Assessment of the
Raymarine UK Ltd
RAY260 DSC Class D VHF Radio

Document 75920234 Report 06 Issue 1

February 2013

PREPARED FOR

Raymarine UK Ltd
Cartwright Drive
Fareham
Hampshire
PO15 5RJ

PREPARED BY

S Jones
Project Manager

APPROVED BY

M Jenkins
Authorised Signatory

DATED

07 February 2013

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
Raymarine UK Ltd
RAY260 DSC Class D VHF Radio

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the Raymarine UK Ltd RAY260 DSC Class D VHF Radio to the requirements of the applied test specifications.

Objective	To perform RF Exposure Assessment to determine the Equipment Under Test's (EUT's) compliance of the applied rules.
Applicant	Raymarine UK Ltd
Manufacturer	Raymarine UK Ltd
Manufacturing Description	DSC Class D VHF Radio
Model Number(s)	RAY260
Test Specification/Issue/Date	EN 62311:2008 OET Bulletin 65 Edition 97-01 August 1997 RSS-102 Issue 4 March 2010 Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard: 2003
Related Document(s)	Council Recommendation 1999/519/EC:1999 FCC CFR 47 Part 1: 2011 FCC CFR 47 Part 2: 2011 Health Canada's Safety Code 6 ARPANSA ICNIRP 1998 National Council on Radiation Protection and Measurements (NRPC) - Report No. 86(1986) EN 50383:2002 IEEE Std C95.1-2005 Australian Standard 2772.2 – 1988

1.2 BRIEF SUMMARY OF RESULTS

1.2.1 General Public Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 1.5 m (150cm)	General Public Exposure Limit	Application
1.995	25000	S	0.18 W/m^2	2 W/m^2	ICNIRP
		S	0.018 mW/cm^2	0.2 mW/cm^2	FCC 47 CFR § 1.1310
		S	0.18 W/m^2	2 W/m^2	Canada's RF Safety Code 6
		S	0.18 W/m^2	2 W/m^2	ARPANSA
		E	2.58 V/m	28 V/m	ICNIRP
		E	2.58 V/m	27.5 V/m	FCC 47 CFR § 1.1310
		E	2.58 V/m	28 V/m	Canada's RF Safety Code 6
		E	2.58 V/m	27.4 V/m	ARPANSA
		H	0.01 A/m	0.073 A/m	ICNIRP
		H	0.01 A/m	0.073 A/m	FCC 47 CFR § 1.1310
		H	0.01 A/m	0.073 A/m	Canada's RF Safety Code 6
		H	0.01 A/m	0.0729 A/m	ARPANSA

The calculations have shown that they **meet** the General Public Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **150**cm, the point of investigation.

1.2.2 Occupational Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 1.5 m (150cm)	Occupational Exposure Limit	Application
1.995	25000	S	0.18 W/m^2	10 W/m^2	ICNIRP
		S	0.018 mW/cm^2	1 mW/cm^2	FCC 47 CFR § 1.1310
		S	0.18 W/m^2	10 W/m^2	Canada's RF Safety Code 6
		S	0.18 W/m^2	10 W/m^2	ARPANSA
		E	2.58 V/m	61 V/m	ICNIRP
		E	2.58 V/m	61.4 V/m	FCC 47 CFR § 1.1310
		E	2.58 V/m	60 V/m	Canada's RF Safety Code 6
		E	2.58 V/m	61.4 V/m	ARPANSA
		H	0.01 A/m	0.16 A/m	ICNIRP
		H	0.01 A/m	0.163 A/m	FCC 47 CFR § 1.1310
		H	0.01 A/m	0.163 A/m	Canada's RF Safety Code 6
		H	0.01 A/m	0.163 A/m	ARPANSA

The calculations have shown that they **meet** the Occupational Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **150 cm,** the point of investigation.

1.3 PRODUCT INFORMATION

1.3.1 Attestation

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 MHz) - General public. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s).

1.3.2 Technical Description

The Equipment under test was a Raymarine UK Ltd RAY260 DSC Class D VHF Radio. A full technical description can be found in the manufacturer's documentation.

All reported calculations were carried out on the relevant information supplied for the RAY260 DSC Class D VHF Radio to demonstrate compliance with the applied test specification(s) the sample assessed was found to comply with the requirements of the applied rules.

1.4 SUMMARY

The RF exposure assessment is based upon the following criteria:

The RAY260 DSC Class D VHF Radio operates in the frequency range of 155.5 – 161.425 MHz.

Gain	3 dBi
Power	25 W
Distance	1.5 m (150 cm)
Duty Cycle	10%

SECTION 2

TEST DETAILS

2.1 RATIONALE FOR ASSESSMENT OF THE RF EXPOSURE

The aim of the assessment report is to evaluate the compliance boundary for a set of given input power(s) according to the basic restrictions (directly or indirectly via compliance with reference levels) related to human exposure to radio frequency electromagnetic fields.
The chosen assessment method to establish the compliance boundary in the far-field region is the reference method as defined in EN50383:2002 Clause 5.2; E-field or H-field calculation. The method of calculation used is defined in EN50383:2002; Clause 8.2.2, 8.2.3 and 8.2.4.
The calculated values have been compared with limits provided in the ICNIRP guidelines.
Calculations can be made in three separate regions, based on distance from the antenna. These are called:

- far-field region,
- radiating near-field region,
- reactive near-field region.

The theory that defines these regions is given in EN50383:2002 Annex A.

Far-field region

As shown in EN50383 Annex A, the far-field calculations are accurate when the distance, r, from an antenna of length D to a point of investigation is greater than

$$r = \frac{2D^2}{\lambda}$$

Where, r is the distance from the antenna to the point of investigation.

Radiating near-field region

The radiating near-field region of an antenna of length D as shown in EN50383 Annex A, this region is defined by

$$\frac{\lambda}{4} < r > \frac{2D^2}{\lambda}$$

Reactive near-field region

The reactive near-field region of an antenna as shown in EN50383 Annex A, this region is defined by

$$r \leq \frac{\lambda}{4}$$

Where, r is the distance from the antenna to the point of investigation.
Recommend λ/4 as the boundary between the radiated near-field and reactive near-field for RF exposure compliance assessment.

2.2 DEFINED LIMITS

Normative Reference: ICNIRP Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz). Table A4, Reference Levels for General Public Exposure to Time Varying Electric & Magnetic Fields. Vol 15 No.2. 2004. The defined limits are in accordance with 47 CFR § 1.1310 Radiofrequency radiation exposure limits.

Reference levels for general public exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 155.5 MHz

Power density (W/m^2)	= 2	ICNIRP
Power density (mW/cm^2)	= 0.2	FCC 47 CFR § 1.1310
Power density (W/m^2)	= 2	Canada's RF Safety Code 6
Power density (W/m^2)	= 2	Australian Radiation Protection Series Publication No. 3
E-Field (Vm-1)	= 28	ICNIRP
E-Field (Vm-1)	= 27.5	FCC 47 CFR § 1.1310
E-Field (Vm-1)	= 28	Canada's RF Safety Code 6
E-Field (Vm-1)	= 27.4	Australian Radiation Protection Series Publication No. 3
H-Field (Am-1)	= 0.073	ICNIRP
H-Field (Am-1)	= 0.073	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.073	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.0729	Australian Radiation Protection Series Publication No. 3

Reference levels for occupational exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 155.5 MHz

Power density (W/m^2)	= 10	ICNIRP
Power density (mW/cm^2)	= 1	FCC 47 CFR § 1.1310
Power density (W/m^2)	= 10	Canada's RF Safety Code 6
Power density (W/m^2)	= 10	Australian Radiation Protection Series Publication No. 3
E-Field (Vm-1)	= 61	ICNIRP
E-Field (Vm-1)	= 61.4	FCC 47 CFR § 1.1310
E-Field (Vm-1)	= 60	Canada's RF Safety Code 6
E-Field (Vm-1)	= 61.4	Australian Radiation Protection Series Publication No. 3
H-Field (Am-1)	= 0.16	ICNIRP
H-Field (Am-1)	= 0.163	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.163	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.163	Australian Radiation Protection Series Publication No. 3

2.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

Frequency (MHz)	$\lambda = \frac{3x10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
155.5	1.92926045016077	192.926045016077	0.482315112540193	48.2315112540193
158.4625	1.89319239567721	189.319239567721	0.473298098919303	47.3298098919303
161.425	1.85844819575654	185.844819575654	0.464612048939136	46.4612048939136

2.4 FAR FIELD CALCULATIONS

The following calculations are based on: 3 dBi gain antenna

P = 25 (Power (Watts)) or 25000 (Power milliwatts)
G = 1.995 (Numeric Gain)
r = 150 (Distance (centimetres)) or 1.5(Distance (meters))

The power flux:

$$S = \frac{PG_{(\theta,\phi)}}{4\pi r^2}$$

S = 0.18 W/m2

S= 0.018 mW/cm^2

The electric field strength:

$$E = \frac{\sqrt{30PG}_{(\theta,\phi)}}{r}$$

E = 2.58 V/m

The magnetic field strength:

$$H = \frac{E}{\eta_o}$$

H = 0.01 A/m

The calculations meet the General Public Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the General Public Exposure Levels described in the FCC 47CFR§1.1310.
The calculations meet the General Public Exposure Levels described in the Canada's RF Safety Code 6.
The calculations meet the General Public Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

The calculations meet the Occupational Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the Occupational Exposure Levels described in the FCC 47CFR§1.1310
The calculations meet the Occupational Exposure Levels described in the Canada's RF Safety Code 6
The calculations meet the Occupational Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

Product Service

SECTION 3

DISCLAIMERS AND COPYRIGHT

3.1 DISCLAIMERS AND COPYRIGHT

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