Part 1

Test Report for S1000 Autopilot

To CFR 47 Chapter 1 FCC Rules Part 15 Radio Frequency Devices

Radiated Spurious Emissions & Maximum permissible exposure

Test Report Number: 590/1029

Approved	Adil Abbas International Compliance Manager		10/01/2005
Technical Check	Peter Bowen Senior EMC Test Engineer		06/01/2005
Administrative Check	Chris Bird Approvals Manager		05/01/2005
Report	Andy Little EMC Engineer		06/12/2005
Report Date	29/12/2004	Test Date	16/12/2004 to 23/12/2004

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1 Purpose of Tests

The purpose of the tests was to demonstrate that the EUT (Raymarine S1000 Autopilot) meets the requirements of FCC rules 15.247 (d) & (i) with respect to radiated spurious emissions when operating within the 2400–2483.5 MHz band and with regard to exposure levels of RF energy from the EUT.

This report will form part of a grant application to be submitted to both FCC and Industry Canada.

2 Description of Equipment under Test (EUT)

(To include all equipment being tested)

Date of Receipt:	2nd December 2004
Client:	Data Vessel and Control Group, Raymarine
Brand Name:	Raymarine
Product Range:	RF remote products
Country of Manufacture:	United Kingdom
Operational voltage range:	8 V – 16 V d.c. (12 V d.c. nominal)

Unit 1

Model Name or Number:	**S1000 Autopilot**
Unique Type Identification:	A18107
Serial Number:	EMC021204a
Circuit Diagram Number(s) & Issue:	4590-002 Issue k
PCB Assembly Number(s) & Issue:	3015-344 Issue d
Software Version:	Ember Range test Software Version 1.0 September 1st 2004. 15:40:28
Modifications to Unit:	Short Circuit removed between starpoint YY" and HD-PWR. Change crystals XTL2 and XTL6 to Raymarine part number 9602CE32P768 Disconnect V-Supply from IC12, pin61

Unit 2

Model Name or Number:	**Octopus Hydraulic Pump with Motor**
Unique Type Identification:	A18108
Serial Number:	EMC031204a
Circuit Diagram Number(s) & Issue:	N/A
PCB Assembly Number(s) & Issue:	N/A
Software Version:	N/A
Modifications to Unit:	Pump removed and replaced with fan that has been optimised to provide 2.5A load.

Other Information:	

3 Description of Auxiliary Equipment

(To include all equipment associated with the EUT(s) which are NOT directly subjected to the test)

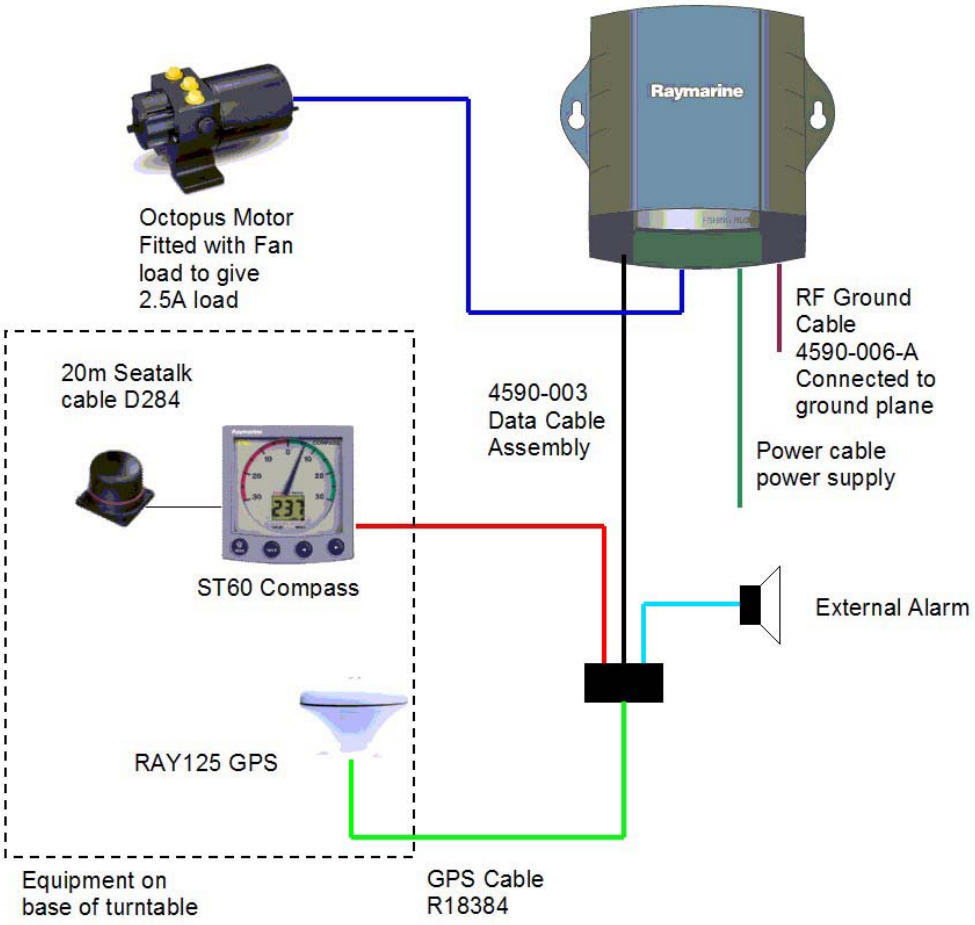
Item	Unique Type Identification & Serial Number
Seatalk compass instrument	ST60 Compass A22007 ser # EMC004
Fluxgate compass transducer	Z130 ser # EMC004
NMEA GPS	RS125 E32042 Ser #EMC041102

4 General

Supply Voltage	Ambient Temperature	Relative Humidity
12 d.c.	20 - 22°C	30 - 33%

5 Test Configuration

(See Section 2 Description of Equipment under Test (EUT) and Section 6 Description of Auxiliary Equipment for Description of Equipment)



Title	Description
Test Set-up and Operating Mode	Set-up as per diagram Section 5 and photographs in section 7. The EUT was connected via 2m of power cable to a 12-volt power supply, 20m of SeaTalk cable to a ST60 compass and a NMEA RAY125 GPS via its own full-length cable. In the receive mode below 2GHz the EUT was tested in parallel with the S100 Controller, also in receive mode; these units are sold together as a system. Using special test software to enable efficient testing of the EUT the RF section was configured to continuous transmission or receiving mode as required during the course of the testing. Channels on which the RF section was operating were selected as required. The pilot motor was set to run at 50% duty cycle, 20kHz pwm via a RS232 terminal which was disconnected prior to the start of testing.

6 Description of Test Chamber

The test chamber used for the radiated emissions measurements is FCC listed (registration no. 970522) and registered with Industry Canada (registration no. IC 4069-1).

The test site is within a fully enclosed chamber on a ground plane of dimensions 9.3 x 6.3m. The walls, ceiling and door are completely lined with 6.7mm thickness Samwha ferrite tiles. Additional hybrid pyramidal absorber, type SLM500 and SLM850 is fitted to areas of the ceiling, sidewalls and the end wall nearest the turntable. The test volume is a cylinder 2m in height and 1.5m in diameter centred on the axis of the turntable.

The ground plane consists of galvanised steel sheets continuously bonded together with copper strip. The sheets at the edges of the ground plane are bonded, in a similar manner, to the walls of the chamber. To prevent flexing or warping, the edges of each individual steel sheet of the ground plane are secured to a wooden deck with screws at 10cm intervals.

The non-conductive turntable has the following characteristics:

a) mounted on the ground plane
b) fibre optic remote control
c) base diameter of 1.2m
d) base platform height 2cm above ground plane
e) hole in centre for EUT grounding and power source
f) power to centre via 20mm steel conduit bonded to ground plane
g) 360 degree rotation
h) the turntable, drive belt, drive shaft, couplings and turntable base are non-conductive.
i) A metallic shielded enclosure, located against the wall of the chamber, contains the motor and the electronics required to rotate the turntable.

The receiving antenna mast has the following characteristics:

a) fibre optic remote control
b) 1-4 metre search height
c) pneumatic antenna polarization change
d) the mast, carrier, boom, platform and drive belt are non-conductive.
e) A metallic shielded enclosure, located at the base of the tower, contains the motor and the electronics required to control the antenna carrier.

7 Photographs

Figure 1 View from within chamber showing turntable base and mast set-up.

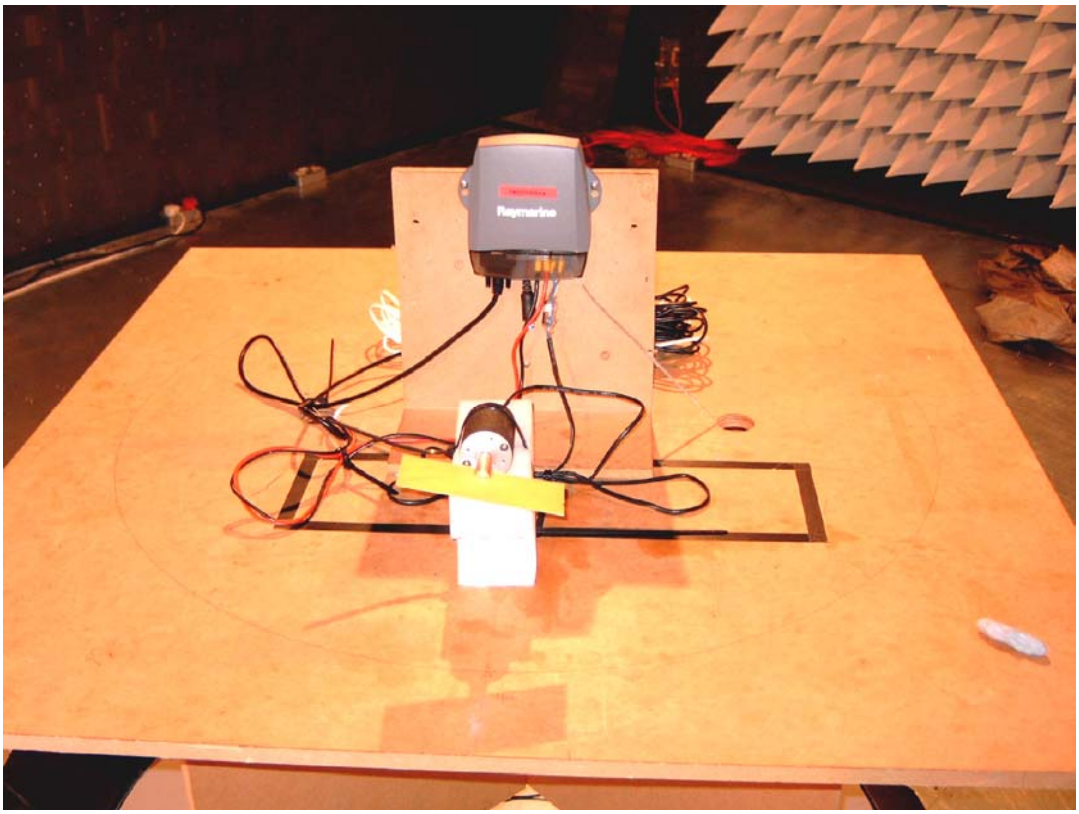


Figure 2 EUT mounted on supporting bracket on turntable in test chamber.

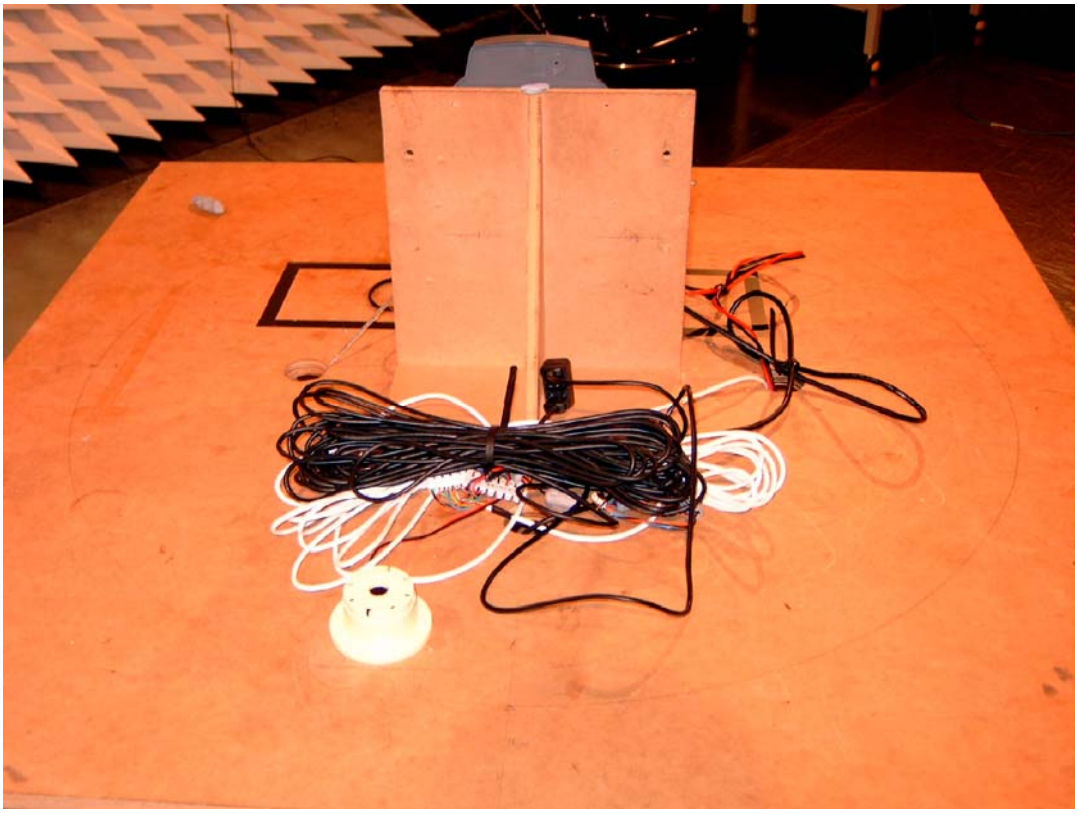


Figure 3 Rear view of EUT setup

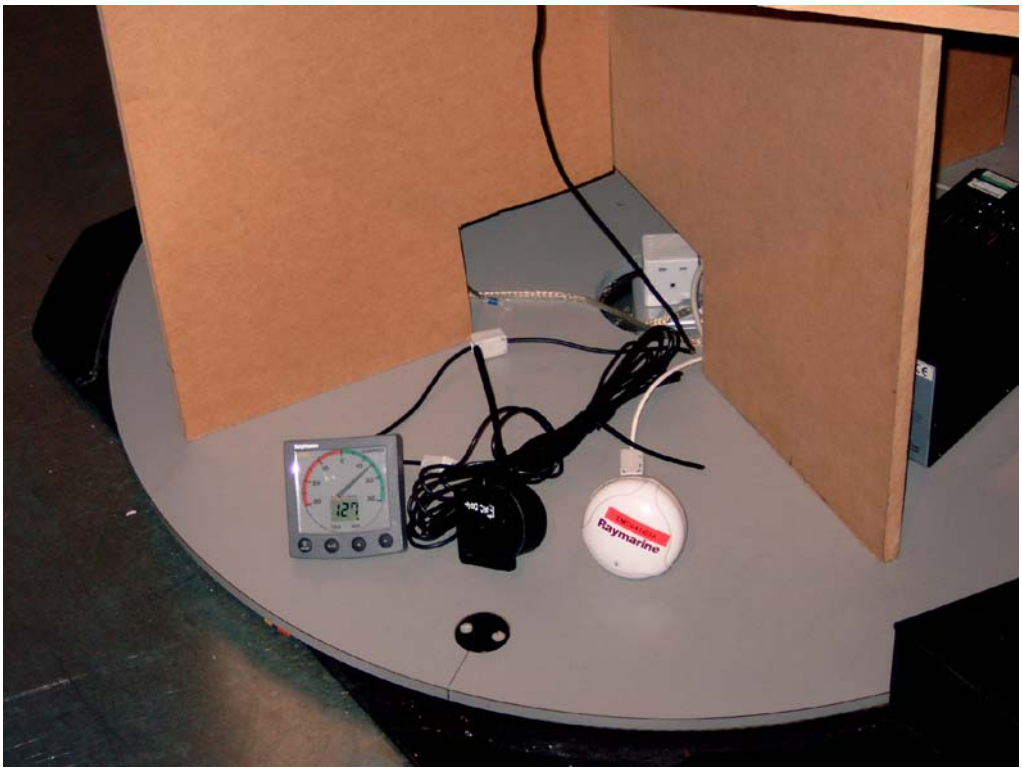


Figure 4 Auxiliary equipment located on turntable base.

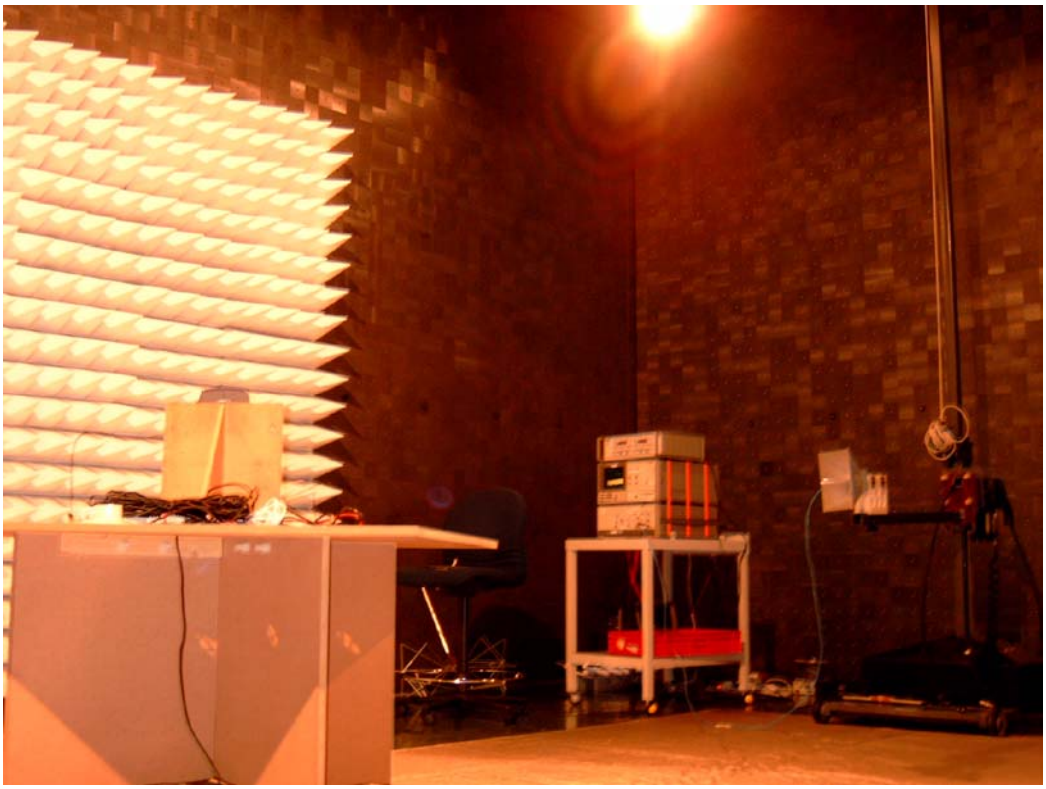


Figure 5 Set up in chamber for 2GHz-7GHz measurements at 3m.

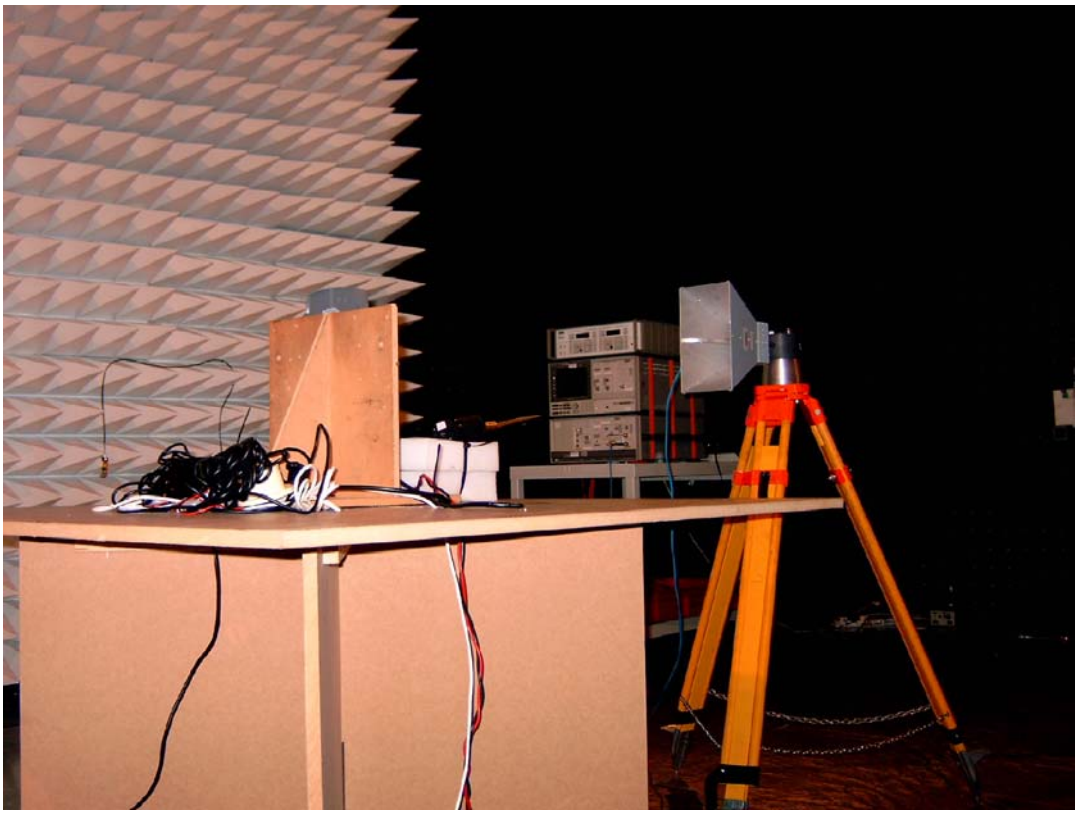


Figure 6 Set up showing measurements above 7GHz at 1m.