REPORT ON

EMC Testing of the McMurdo NAV-7 NAVTEX Receiver

COMMERCIAL-IN-CONFIDENCE

Report No OO614796/02 Issue 3 **March 2006**

Product Service

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REPORT ON EMC Testing of the McMurdo NAV-7 NAVTEX Receiver

Report No OO614796/02 Issue 3

March 2006

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DATED **15th March 2006**

This issue 3 report corrects incorrect conducted emissions plots on pages 12 & 13.

Product Service

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SECTION 1

REPORT SUMMARY

EMC Testing of the McMurdo NAV-7 NAVTEX Receiver

1.1 STATUS

Equipment Under Test	NAV-7 NAVTEX Receiver
Objective	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
Name and Address of Client	McMurdo Limited Silverpoint Airport Service Road Hilsea PO3 5PB
Model Number	NAV-7
Serial Number	007
Test Plan/Issue/Date	N/A
Test Specification/Issue/Date	EN 60945 (2002) IEC 61097-6 (2005)*
Number of Items Tested	One
Security Classification of EUT	Unclassified
Incoming Release **Date**	Declaration of Build Status 22nd December 2005
Disposal	Held Pending Disposal
Order Number **Date**	1907 10th October 2005
Start of Test **Finish of Test**	21st December 2005 23rd January 2006
Related Documents	CISPR 16-1: 1999 EN 61000-4-2: 1995 EN 61000-4-3: 1995 EN 61000-4-4: 1995 EN 61000-4-6: 1996 EN 61000-4-8: 1993 *NUA

1.2 INTRODUCTION

The information contained in this report is intended to show verification of compliance of the McMurdo NAV-7 NAVTEX Receiver to the requirements of EN 60945 and Protection of Input Circuits to IEC 61097-6.

1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

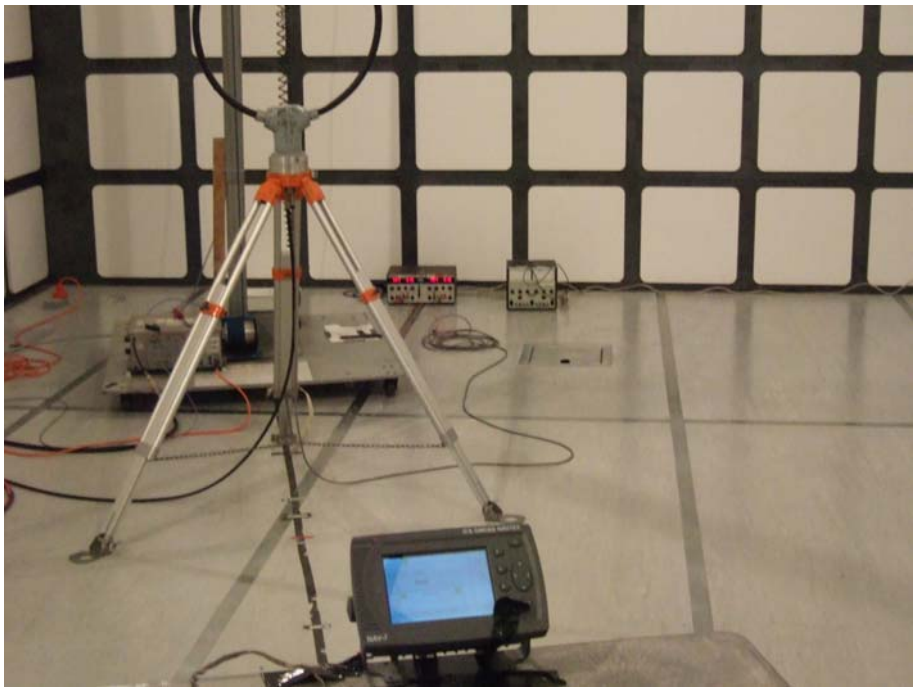
Test	Spec Clause	Test Description	Result	Base Standard
2.1	Table 5	Conducted Emissions 0.010MHz – 30MHz (DC Power Port)	Pass	EN 60945 Limit 9.2 and Fig 2
2.2	Table 5	Radiated Emissions 150kHz – 30MHz (Enclosure Port)	Pass	EN 60945 Limit 9.3.3 and Fig 4
2.3	Table 5	Radiated Emissions 30MHz – 2GHz (Enclosure Port)	Pass	EN 60945 Limit 9.3.3 and Fig 4
2.4	Table 6	Immunity to Conducted Radio Frequency Disturbance (DC, Signal and Control Ports)	Pass	EN 61000-4-6
2.5	Table 6	Immunity to Radiated Disturbance 80MHz – 2GHz (Enclosure Port)	Pass	EN 61000-4-3
2.6	Table 6	Immunity to Fast Transient Bursts (Signal and Control Ports)	Pass	EN 61000-4-4
2.7	Table 6	Immunity to Power Supply Failure (DC Power Ports)	Pass	EN 61000-4-11
2.8	Table 6	Immunity to Electrostatic Discharge (Enclosure Port)	Pass	EN 61000-4-2
2.9	Table 6	Immunity to Compass Safe Distance (Enclosure Port)	Pass	EN 61000-4-8
2.10	Table 6	Protection of Input Circuits*	Pass	IEC 61097-6

* NUA

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a McMurdo NAV-7 NAVTEX Receiver as shown in the photograph below. A full technical description can be found at McMurdo



Photograph of Equipment Under Test

1.4 PRODUCT INFORMATION

1.4.2 Modes of Operation

Modes of operation of the EUT during testing was as follows:

All testing was carried out in Receive Mode: The EUT receiving a 518kHz signal and decoding it.

1.4.3 Test Configuration

A PC generated data which was fed through a modem into the modulation input of a signal generator. The output of the signal generator was a 518kHz frequency modulated signal that was directly connected to the antenna port of the EUT.

1.4.4 Monitoring of Performance

The front panel of the EUT should read the same as the PC and have no errors displayed on screen.

1.4.5 Performance Criteria

The EUT shall continue to operate as intended during and after testing. No degradation of performance or loss of function is allowed.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure or open test area as appropriate.

The EUT was powered from a 24V dc supply.

Test Results

EN60945, Clause 5.3 states:

The measured test results shall be compared with the corresponding acceptable performance limits and the EUT shall pass the test only if the measured performance margin is favourable and greater than the measurement uncertainty. The test report shall show, for each test measurement, the test result, its associated measurement uncertainty, the acceptable performance limits, and the acceptable performance margin, as applicable.

The tests detailed in this report met the above test requirements.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards were made.

1.7 MODIFICATION RECORD

The table below details modifications made to the EUT during the test programme.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	Original sample Radiated Emissions (Magnetic and Electric Field) was carried out in modification state 0.	N/A	N/A
1	Added a 47µF non- polarised capacitor across C290 and C291 Conducted Emissions (DC Power Ports), Immunity to Conducted Radio Frequency Disturbance (DC, Signal and Control Ports), Immunity to Radiated Disturbance (Enclosure Port), Immunity to Fast Transient Burst (Signal and Control Ports), Immunity to Power Supply Failure (DC Power Ports) and Compass Safe Distance (Enclosure Port) was carried out in modification state 1.	Nick Taylor and Fadi Ibrahim	22nd December 2005
2	In addition to the modifications above, new software: Version 4 installed. On 35-700 (Display PCB) changed de-coupling capacitors. Immunity to Electrostatic Discharge (Enclosure Port) and Protection of Input Circuits was carried out in modification state 2.	Nick Taylor	23rd January 2006

SECTION 2

TEST DETAILS

EMC Testing of the McMurdo NAV-7 NAVTEX Receiver

2.1 CONDUCTED EMISSIONS - DC POWER PORTS

2.1.1 Specification Reference

EN 60945 Table 5, Clause 9.2

2.1.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.1.3 Date of Test

22nd December 2005

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The test was applied in accordance with the test method requirements of EN60945 Clause 9.2.

The EUT was set up within a shielded enclosure, powered up and correct operation verified.

Measurements were made on the EUT's Power Ports over the frequency range 10kHz to 30MHz.

A preliminary profile of the EUT's emissions was made, the profiling yielding a list of worst case emission frequencies.

Utilising the data gathered during the preliminary profiling, the emissions detected were then formally measured with CISPR Quasi-Peak and Average detector functions and the measured levels recorded.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

2.1.6 Environmental Conditions

Ambient Temperature	21°C
Relative Humidity	32%
Atmospheric Pressure	996mbar

2.1.7 Test Results

The EUT met the requirements of EN 60945 for Conducted Emissions on the DC Ports in modification state 1.

Test results are shown in the tables that follow.

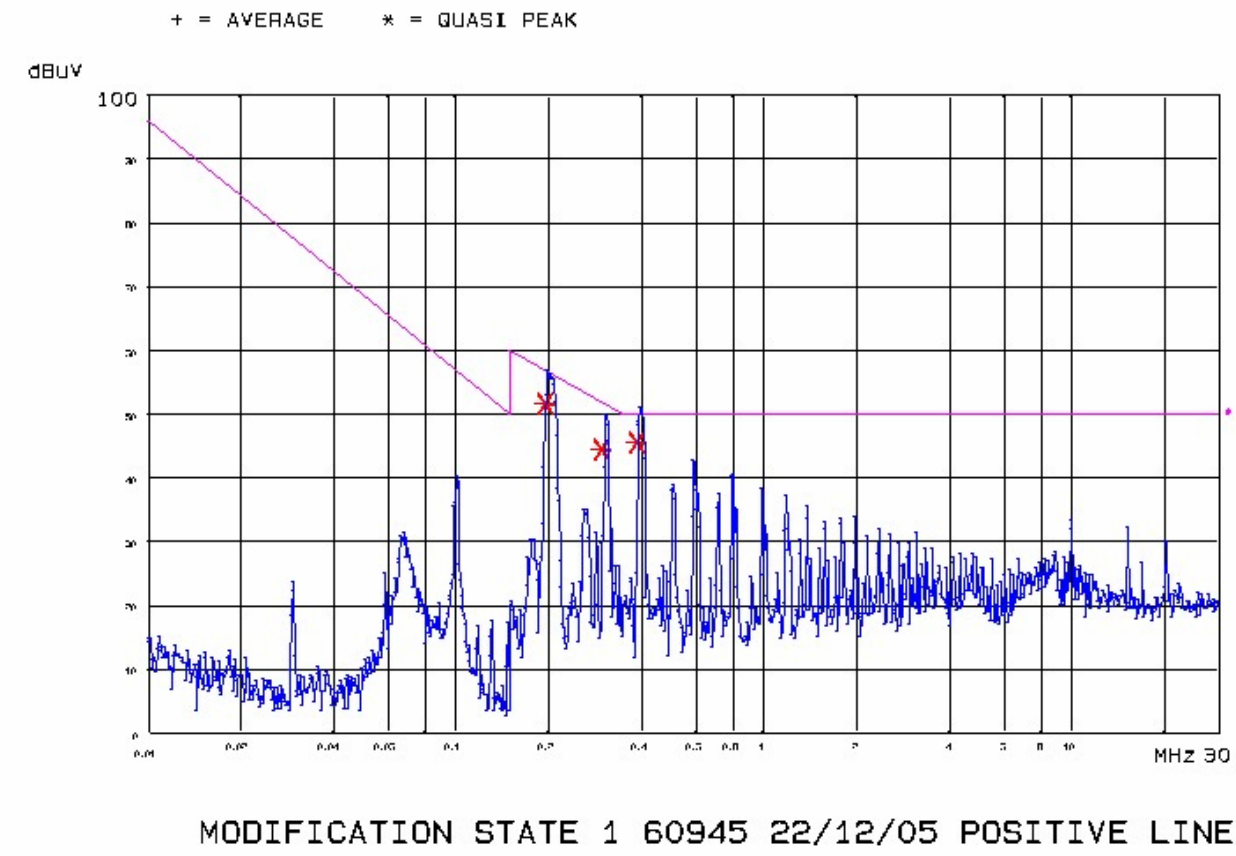
2.1 CONDUCTED EMISSIONS - DC POWER PORTS

2.1.7 **Test Results** - continued

Live Line Test Results

Frequency MHz	Quasi-Peak Level dBµV	Quasi-Peak Limit dBµV	Result
0.1964	52.1	57	Pass
0.3010	44.9	52	Pass
0.3927	46.1	50	Pass

The margin between the specification requirements and all other emissions was 7.1dB or more below the specified Quasi-Peak limit.



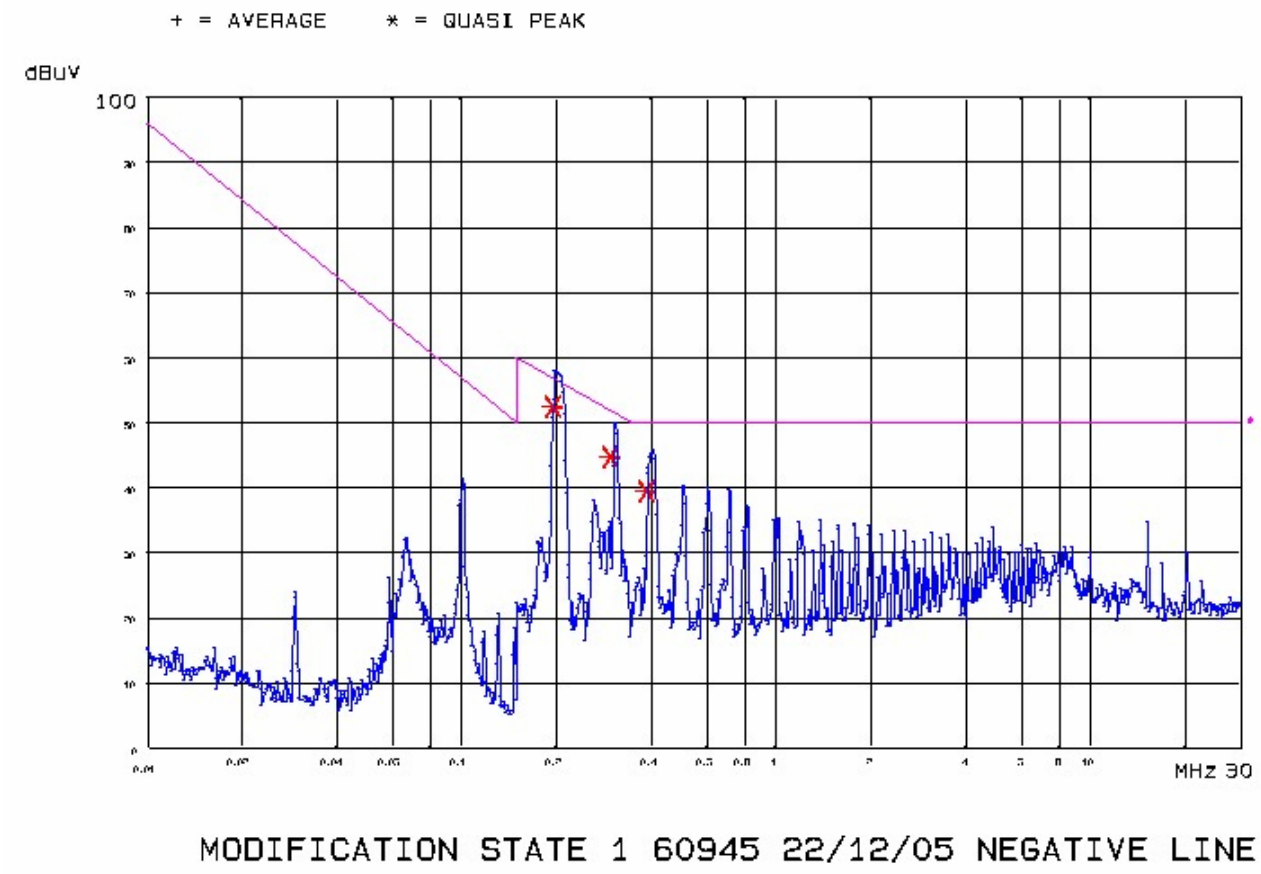
2.1 CONDUCTED EMISSIONS - DC POWER PORTS

2.1.7 **Test Results** - continued

Return Line Test Results

Frequency MHz	Quasi-Peak Level dBµV	Quasi-Peak Limit dBµV	Result
0.1965	52.9	57	Pass
0.3010	45.0	52	Pass
0.3929	39.8	50	Pass

The margin between the specification requirements and all other emissions was 10.2dB or more below the specified Quasi-Peak limit.



MODIFICATION STATE 1 60945 22/12/05 NEGATIVE LINE

2.2 RADIATED EMISSIONS MAGNETIC FIELD – ENCLOSURE PORT

2.2.1 Specification Reference

EN 60945 Clause 9.3

2.2 2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.2.3 Date of Test

21st December 2005

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 60945, Clause 9.3.

The EUT was set up within a shielded enclosure, powered up and correct operation verified.

Measurements were made over the frequency range 15kHz to 30MHz at a distance of 3m.

Measurements of emissions from the EUT were obtained with the Measurement Antenna (Magnetic Loop) configured to be Face On and then Edge On, in relation to the EUT, at a set height of 1.5 metres.

A preliminary profile of the EUT's emissions was made, the profiling yielding a list of worst case emission frequencies together with the EUT azimuth and antenna polarisation.

Utilising the data gathered during the preliminary profiling, the emissions detected were maximised by adjusting the antenna polarisation and turntable azimuth.

Emission levels were then formally measured with a CISPR Quasi-Peak detector function and the measured levels recorded.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

2.2.6 Environmental Conditions

Ambient Temperature	21°C
Relative Humidity	30%
Atmospheric Pressure	998mbar

2.2 RADIATED EMISSIONS MAGNETIC FIELD – ENCLOSURE PORT

2.2.7 Test Results

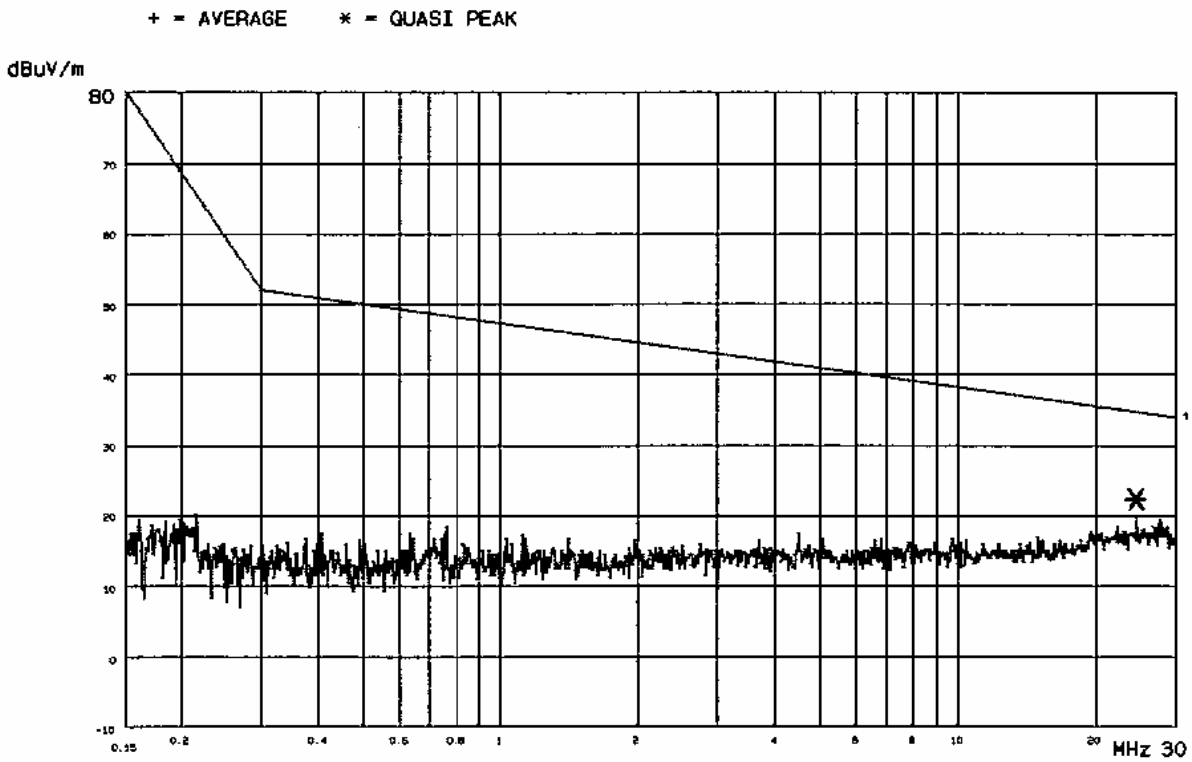
The EUT met the requirements of EN 60945 for Radiated Magnetic Emissions in modification state 0.

Test results are shown in the tables that follow.

Loop Antenna Face On Test Results

Frequency MHz	Field Strength at 3m dBµV/m	Specification Limit dBµV/m	Result
24.5579	22.7	34.7	Pass

The margin between the specification requirements and all other emissions was 12dB or more below the specification limit.



MAG EMISSIONS INCLDING MU EN 60945 2002 FACE ON

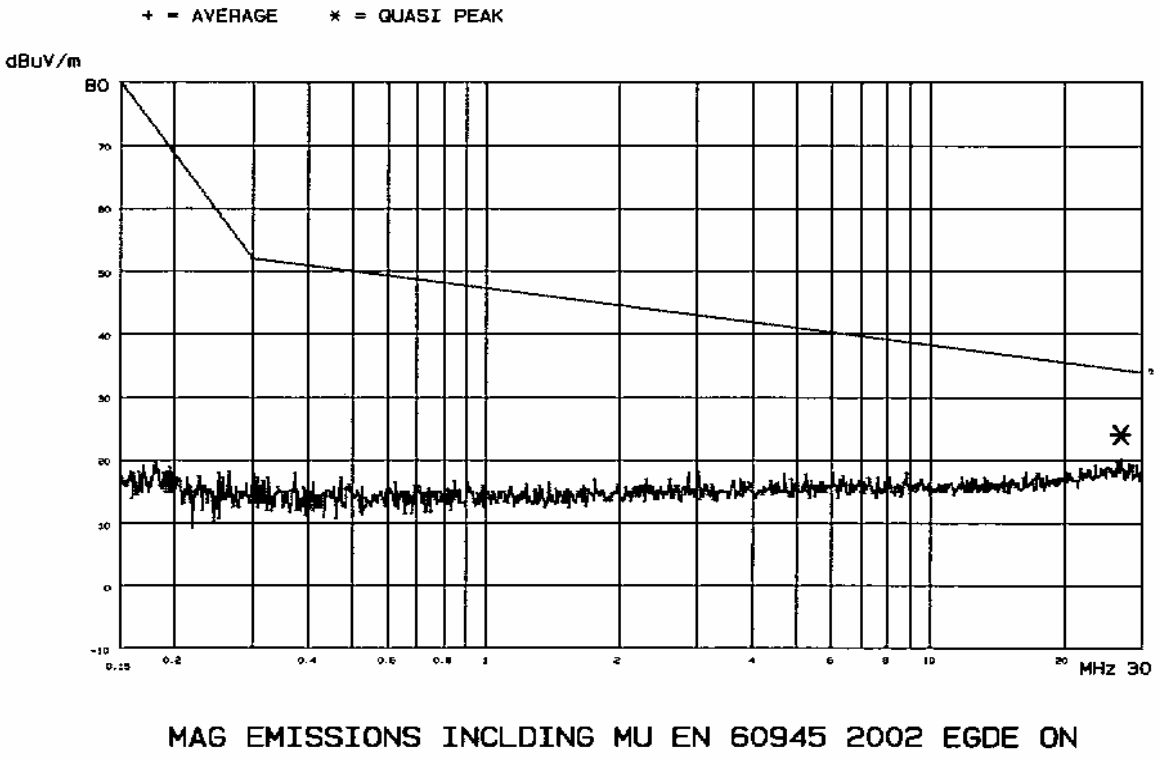
2.2 RADIATED EMISSIONS MAGNETIC FIELD – ENCLOSURE PORT

2.2.7 Test Results

Loop Antenna Edge On Test Results

Frequency MHz	Field Strength at 3m dBµV/m	Specification Limit dBµV/m	Result
26.9835	24.3	34.3	Pass

The margin between the specification requirements and all other emissions was 10dB or more below the specification limit.



MAG EMISSIONS INCLDING MU EN 60945 2002 EGDE ON

2.3 RADIATED EMISSIONS ELECTRIC FIELD – ENCLOSURE PORT

2.3.1 Specification Reference

EN 60945 Clause 9.3

2.3.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.3.3 Date of Test

21st December 2005

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 60945, Clause 9.3.

The EUT was set up on a remotely controlled turntable within a semi-anechoic Alternative Open Area Test Site [AOATS], powered up and correct operation verified.

Measurements were made over the frequency range 30MHz to 2GHz at a distance of 3m.

A preliminary profile of the EUT's emissions was made, the profiling yielding a list of worst case emission frequencies together with the EUT azimuth and antenna polarisation.

Utilising the data gathered during the preliminary profiling, the emissions detected were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emission levels were then formally measured with a CISPR Quasi-Peak detector function and the measured levels recorded.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

2.3.6 Environmental Conditions

Ambient Temperature	21°C
Relative Humidity	30%
Atmospheric Pressure	998mbar

2.3 RADIATED EMISSIONS ELECTRIC FIELD – ENCLOSURE PORT

2.3.7 Test Results

The EUT met the requirements of EN 60945 for Radiated Electric Field Emissions in modification state 0.

Test results are shown in the tables that follow.

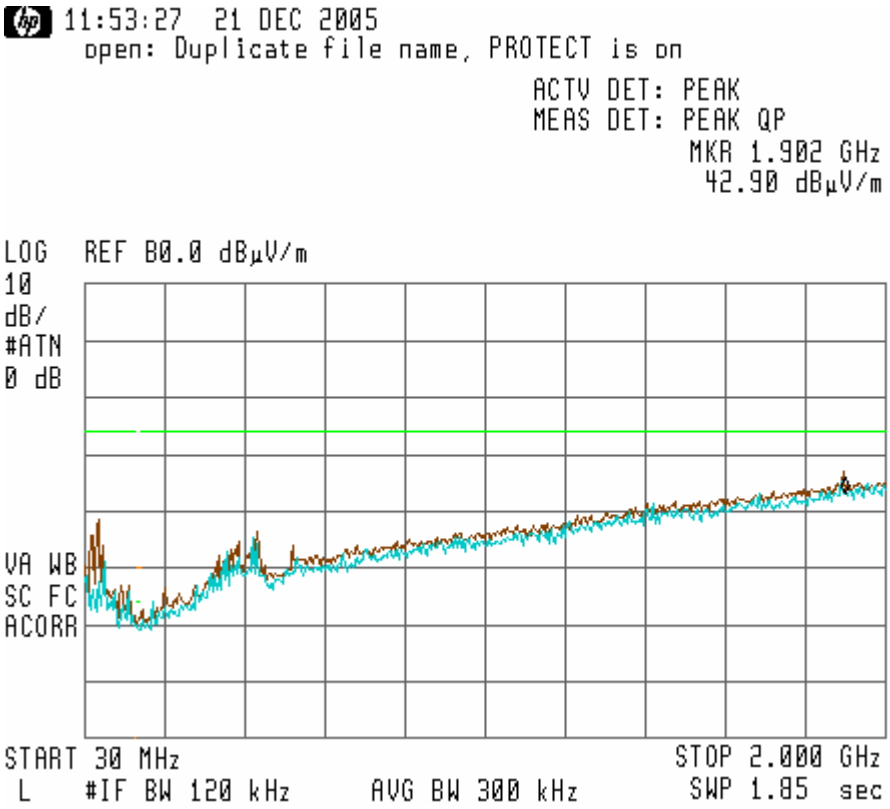
Measurements were made at 3m.

Frequency MHz	Antenna Polarisation	Height cm	Azimuth degree	Field Strength at 3m dBµV/m	Specification Limit dBµV/m	Result
55.92	Vertical	100	0	20.9	54.0	Pass
132.60	Vertical	103	3	24.6	54.0	Pass
157.50	Vertical	100	299	14.9	24.0	Pass
446.30	Vertical	100	180	32.0	54.0	Pass

The margin between the specification requirements and all other emissions was 9.1dB or more below the specification limit.

2.3 RADIATED EMISSIONS ELECTRIC FIELD – ENCLOSURE PORT

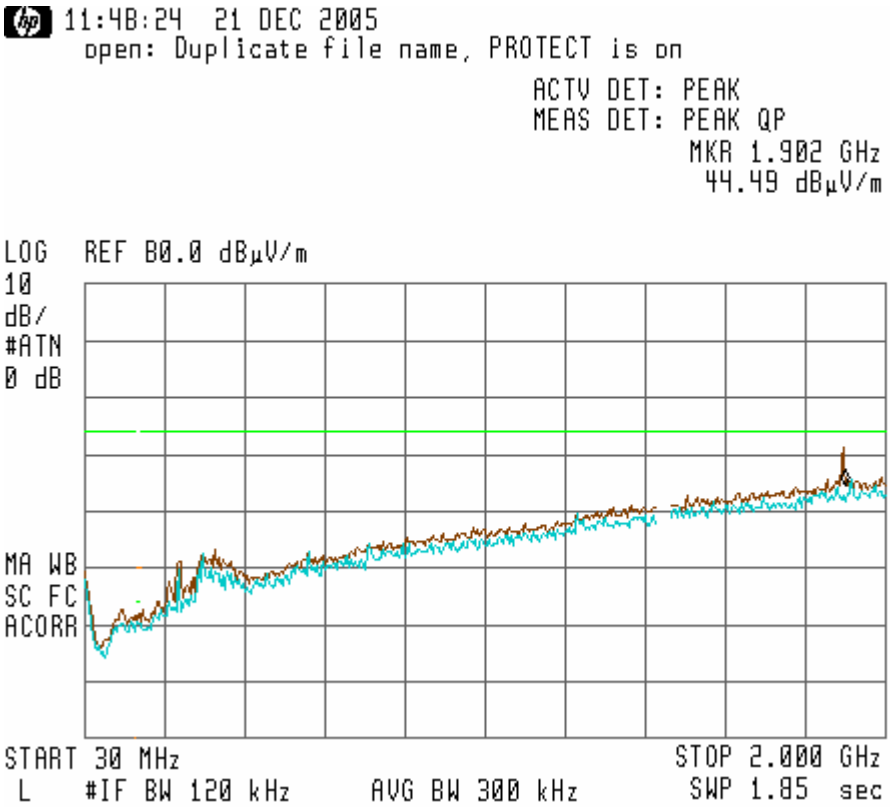
2.3.7 Test Results



Radiated Emissions Vertical Polarisation

2.3 RADIATED EMISSIONS ELECTRIC FIELD – ENCLOSURE PORT

2.3.7 Test Results



Radiated Emissions Horizontal Polarisation

2.4 IMMUNITY TO CONDUCTED RADIO FREQUENCY - DC POWER PORTS AND SIGNAL AND CONTROL PORTS

2.4.1 Specification Reference

EN 60945 Table 6, Clause 10.3

2.4.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.4.3 Date of Test

3rd January 2006

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-6.

The EUT was set up 100mm above a Ground Reference Plane within a shielded enclosure.

Test Level	:	3V rms (150kHz to 80MHz) and 10V rms (At the specified spot frequencies 2MHz, 3MHz, 4MHz, 6.2MHz, 8.2MHz, 12.6MHz, 16.5MHz, 18.8MHz, 22MHz and 25MHz.)
Modulation	:	80% amplitude at 400Hz
Dwell Times	:	3 seconds for each step

Signal and Control Lines.

Utilising a proprietary Test Generator an EM Clamp was calibrated to produce the required test levels over the frequency range 150kHz to 80MHz and at the specified spot frequencies.

The Clamp was fitted around the cable under test and the test was applied at the previously calibrated levels.

The test was applied to each of the following cables in turn:

Antenna Port Cable
D-Type Cable

2.4 IMMUNITY TO CONDUCTED RADIO FREQUENCY - DC POWER PORTS AND SIGNAL AND CONTROL PORTS

2.4.5 Test Procedure

DC Power Ports.

Utilising a proprietary Test Generator an EM Clamp was calibrated to produce the required test levels over the frequency range 150kHz to 80MHz and at the specified spot frequencies.

The Clamp was fitted around the cable under test and the test was applied at the previously calibrated levels.

An EM Clamp was used instead of a CDN because the power cable can also carry signal lines and was shielded and bonded at the power supply end.

The performance of the EUT was monitored throughout testing.

2.4.6 Environmental Conditions

Ambient Temperature	18.2°C
Relative Humidity	40%
Atmospheric Pressure	1021mbar

2.4.7 Test Results

The EUT met the requirements of EN 60945 for Immunity to Conducted Radio Frequency Disturbance in modification state 1.

2.5 IMMUNITY TO RADIATED DISTURBANCE – ENCLOSURE PORT

2.5.1 Specification Reference

EN 60945 Table 6, Clause 10.4

2.5.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.5.3 Date of Test

22nd December 2005

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-3.

The EUT was set up within a screened enclosure, aligned with the uniform field calibration plane, powered up and correct operation verified.

The test was applied in the frequency range 80MHz to 2000MHz to the front, rear, left hand and right hand sides of the EUT.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

Test Level	:	10V/m
Modulation	:	80% amplitude at 400Hz
Dwell Times	:	80MHz – 1GHz: 3 seconds for each step
	:	1GHz – 2GHz: 9 seconds for each step

2.5.6 Environmental Conditions

Ambient Temperature	18.2°C
Relative Humidity	40%
Atmospheric Pressure	1021mbar

2.5.7 Test Results

The EUT met the requirements of EN 60945 for Immunity to Radiated Disturbance in modification state 1.

2.6 IMMUNITY TO FAST TRANSIENT BURSTS - SIGNAL AND CONTROL PORTS

2.6.1 Specification Reference

EN 60945 Table 6, Clause 10.5

2.6.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.6.3 Date of Test

4th January 2006

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-4.

The EUT was set up within a test area, powered up and correct operation verified.

The EUT was set-up 80cm above the Ground Reference Plane. A series of Fast Transient Bursts meeting the specification were applied for a period of greater than 5 minutes as follows:-

Utilising a proprietary EFT Generator the test was applied to the EUT's Signal and Interconnection Ports (including the DC power cable as it also contains signal lines) via a Capacitive Clamp at a level of 1kV, the test was applied to each applicable cable in turn for a minimum period of 5 minutes. The test was applied for both Positive and Negative going transients.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

2.6.6 Environmental Conditions

Ambient Temperature	23°C
Relative Humidity	32%
Atmospheric Pressure	1024mbar

2.6 IMMUNITY TO FAST TRANSIENT BURSTS - SIGNAL AND CONTROL PORTS

2.6.7 Test Results

The EUT met the requirements of EN 60945 for Immunity to Fast Transient Bursts in modification state 1.

2.7 IMMUNITY TO POWER FAILURE - DC POWER PORTS

2.7.1 Specification Reference

EN 60945 Table 6, Clause 10.8

2.7.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.7.3 Date of Test

4th January 2006

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Procedure

The EUT was set-up and correct functioning verified. The DC voltage supplied to the EUT was then reduced by greater than 95% of the nominal DC supply for a period of 1 minute and then repeated 2 more times at 1minute intervals.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

2.7.6 Environmental Conditions

Ambient Temperature	23°C
Relative Humidity	32%
Atmospheric Pressure	1024mbar

2.7.7 Test Results

The EUT met the requirements of EN 60945 for Immunity to Power Supply Failure in modification state 1.

2.8 IMMUNITY TO ELECTROSTATIC DISCHARGE – ENCLOSURE PORT

2.8.1 Specification Reference

EN 60945 Table 6 Clause 10.9

2.8.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.8.3 Date of Test

23rd January 2006

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-2.

The EUT was set up on insulators 0.5mm above a Horizontal Coupling Plane within a test area, powered up and correct operation verified.

The test was applied with a proprietary ESD Simulator.

Air Discharge

At each applicable test point 10 positive and 10 negative Air discharges were applied at each of 2kV, 4kV and 8kV potentials. The interval between discharges was a minimum of 1 second.

Contact Discharge

At each applicable test point 10 positive and 10 negative Contact discharges were applied at each of 2kV, 4kV and 6kV potentials. The interval between discharges was a minimum of 1 second

Each vertical sides of the EUT was subjected to Vertical Coupled Plane (VCP) discharges of 2kV, 4kV and 6kV, 10 positive and 10 negative polarity.

The base of the EUT was subjected to Horizontal Coupled Plane (HCP) discharges of 2kV, 4kV and 6kV, 10 positive and 10 negative polarity.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

2.8 IMMUNITY TO ELECTROSTATIC DISCHARGE – ENCLOSURE PORT

2.8.6 Environmental Conditions

Ambient Temperature	20°C
Relative Humidity	32%
Atmospheric Pressure	1020mbar

2.8.7 Test Results

The EUT met the requirements of EN 60945 for Immunity to Electrostatic Discharges in modification state 2.

Details of the points tested and the results are presented in the following tables.

2.8 IMMUNITY TO ELECTROSTATIC DISCHARGE – ENCLOSURE PORT

2.8.7 **Test Results** - continued

Test Point		Contact Discharge						Air Discharge					
		2kV		4kV		6kV		2kV		4kV		8kV	
		+	-	+	-	+	-	+	-	+	-	+	-
Horizontal Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Coupling Plane		✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
A	Screen	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
B	Control Buttons	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
C	Top of EUT	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
D	Left Hand Side of EUT	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
E	Right Hand Side of EUT	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
F	Back of EUT	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
G	Cables	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
H	Antenna Cable Connector*	N/A	N/A	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
I	DC Power Connector	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
J	Mounting Bracket	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
K	Back Screws	✓*	✓*	✓*	✓*	✓*	✓*	N/A	N/A	N/A	N/A	N/A	N/A

*Testing was carried out with a rubber boot placed over the antenna cable connector.

Key to Results

✓ The EUT's performance was not impaired at this test point when the ESD pulse was applied

✓* No discharge occurred at this test point when the ESD pulse was applied.

N/A Test not applicable as defined in the specification.

2.9 COMPASS SAFE DISTANCE – ENCLOSURE PORT

2.9.1 Specification Reference

EN 60945 Table 6 Clause 11.2

2.9.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.9.3 Date of Test

5th January 2006

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Test Procedure

A wooden table aligned E-W was used with the compass set in the centre of the table and aligned to read zero. The table was marked to give a graduated scale of distance. The EUT was gradually moved towards the compass until a standard deviation of 0.3° was obtained. Each orientation of the EUT was tested in this manner with the measurement distance between the compass centre and the EUT being noted.

The test was repeated but with readings being taken when the compass gave a steering deviation of 1°

The local area Magnetic Flux density (H) at the site of testing was 18.3µT.

The above testing was performed twice with the EUT as follows:

a. In the magnetic condition in which it is received with the EUT unpowered.
b. After normalising with the EUT unpowered.
c. In the powered condition.

Prior to performing the tests in accordance with parts a and b above, the EUT was normalised by placing it into Helmholtz Coil Assembly and subjecting it to a magnetic field of 79A/m.

2.9.6 Environmental Conditions

Ambient Temperature	21°C
Relative Humidity	28%
Atmospheric Pressure	1014mbar

2.9 COMPASS SAFE DISTANCE – ENCLOSURE PORT

2.9.7 Test Results

The EUT met the requirements of EN 60945 (Clause 11.2 [Enclosure Port]) for Compass Safe Distance in modification state 2.

Details of the points tested and results are presented in the following tables.

Orientation of the EUT	Un-powered State		Normalised		Powered State	
	Deflection In Degrees (0.3°)	Distance From Compass (mm)	Deflection In Degrees (0.3°)	Distance From Compass (mm)	Deflection In Degrees (0.3°)	Distance From Compass (mm)
Front	0.3°	470	0.3°	360	0.3°	460
Left Hand Side	0.3°	430	0.3°	340	0.3°	360
Right Hand Side	0.3°	380	0.3°	370	0.3°	400
Back	0.3°	410	0.3°	360	0.3°	270
Top	0.3°	700	0.3°	490	0.3°	630
Bottom	0.3°	750	0.3°	870	0.3°	650

Standard Deviation

Orientation of the EUT	Un-powered State		Normalised State		Powered State	
	Deflection In Degrees (1°)	Distance From Compass (mm)	Deflection In Degrees (1°)	Distance From Compass (mm)	Deflection In Degrees (1°)	Distance From Compass (mm)
Front	1°	300	1°	250	1°	290
Left Hand Side	1°	300	1°	230	1°	270
Right Hand Side	1°	220	1°	230	1°	240
Back	1°	230	1°	230	1°	230
Top	1°	450	1°	340	1°	370
Bottom	1°	470	1°	520	1°	410

Steering Deviation

2.10 PROTECTION OF INPUT CIRCUITS

2.10.1 Specification Reference

IEC 61097-6*

2.10.2 Equipment Under Test

NAV-7 NAVTEX Receiver

2.10.3 Date of Test

23rd January 2006

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.5 Test Procedure

The signal generator level, at 1MHz, required to obtain 30V r.m.s into a 50ohm load was recorded.

The EUT was on a non-metallic surface, powered up and correct operation verified.

at an e.m.f level of 30V r.m.s

A 1MHz unmodulated signal was applied to the antenna input of the EUT at either the pre-calibrated signal generator level or 30V r.m.s measured on an oscilloscope at the antenna port, which ever was reached first, for a period of at least 15 minutes.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

2.12.6 Environmental Conditions

Ambient Temperature	20°C
Relative Humidity	32%
Atmospheric Pressure	1020mbar

2.12.7 Test Results

The EUT met the requirements of IEC 61097-6 for Protection of Input Circuits in modification state 2.

* NUA

SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.1 EMC - Conducted Emissions				
Test Receiver	Rohde & Schwarz	ESH3	13	30/09/2006
LISN	Rohde & Schwarz	ESH2-Z5	17	11/01/2006
Spectrum Analyser	Rohde & Schwarz	EZM	291	O/P MON
Transient Limiter	Hewlett Packard	11947A	1032	06/06/2006
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Section 2.2 EMC – Radiated Emissions Magnetic Field				
Test Receiver	Rohde & Schwarz	ESH3	13	30/09/2006
Spectrum Analyser	Rohde & Schwarz	EZM	291	O/P MON
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	25/06/2006
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Mast Controller	Inn-Co GmbH	CO 1000	1606	O/P MON
Turntable/Mast Controller	EMCO	2090	1607	O/P MON
Section 2.3 EMC - Radiated Emissions Electric Field				
Spectrum Analyser	Hewlett Packard	8542E	18	08/01/2006
Screened Room (5)	Rainford	Rainford	1545	01/03/2008
Mast Controller	Inn-Co GmbH	CO 1000	1606	O/P MON
Turntable/Mast Controller	EMCO	2090	1607	O/P MON
Bilog Antenna	Chase	CBL6143	2904	10/11/2007
Section 2.4 EMC - Conducted Immunity				
Attenuator (2 x 4dB)	Schaffner	INA 2070-1	221	02/07/2006
RF Generator + Attenuator	Schaffner	NSG2070-400	222	30/06/2006
Coupling Clamp	MEB Messelektronik	KEMZ-801	228	23/04/2006
Colour TV Monitor	Panasonic	WV-CP220-B	320	O/P MON
Attenuator 10dB 75W	Bird	8308-100	469	01/08/2006

3.1 TEST EQUIPMENT

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.5 EMC - Radiated Immunity				
Load (50ohm, 30W)	Diamond Antenna	DL-30N	219	O/P MON
Load	Diamond Antenna	DL-30N	220	O/P MON
Amplifier (0.8GHz-2.2GHz)	Unknown	ASO822-30L	258	O/P MON
Millivoltmeter	Rohde & Schwarz	URV-5	281	O/P MON
Sensor (10V)	Rohde & Schwarz	URV-Z2	282	O/P MON
Directional Coupler	Amp Research	DC6180	283	O/P MON
Colour TV Monitor	Panasonic	WV-CP220-B	320	O/P MON
Antenna	Schaffner	CLB 6143	322	O/P MON
FP2000 Field Probe	Amp Research	FP2000	722	20/06/2006
Isotropic Field Monitor	Amp Research	FM2000	1008	O/P MON
Screened Room (2)	Rainford	Rainford	1542	O/P MON
MARCONI 2031 SIG GEN	Marconi	2031	1845	12/09/2006
Amplifier (1GHz to 2.5GHz)	Unknown	PTC6341	2069	O/P MON
RF Power Amplifier	Amp Research	250W1000A	2844	O/P MON
Section 2.6 EMC - Fast Transient Bursts				
Capacity Coupling Clamp	Omiran	EFTC 105	298	O/P MON
BEST EMC V2.7	Schaffner		1935	18/07/2006
Section 2.8 EMC - Electrostatic Discharges				
Immunity Test Set	Schaffner	BEST EMC V2.7	295	31/08/2006
ESD Simulator	Schaffner	BEST ESD	296	31/08/2006
Section 2.9 Defence - Compass Safe Distance				
Sussex Helmholtz Coil	Various	88771	327	O/P MON
Magnetometer	Bartington	MAG01	671	10/05/2006
Magnetic Compass	Cassens & Plath	TYPE 11	672	18/07/2007
Power Supply Unit	Farnell	LT30-2	2045	O/P MON
Multimeter	Fluke	73	2071	14/01/2006

3.1 TEST EQUIPMENT

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.10 EMC - Protection of Input Circuits				
Signal Generator	Rohde & Schwarz	SMY01	49	08/06/2006
Amplifier (10kHz to 220MHz)	Amp Research	150LA	279	O/P MON
Attenuator 20dB 250W	Weinschel	45-20-43	473	01/08/2006
Oscilloscope	Tektronix	2445A	761	30/06/2006

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Substitution Antenna, Radiated Field	30MHz to 18GHz Amplitude	2.6dB
Discontinuous Interference	150kHz to 30MHz Amplitude	3.0dB*
Interference Power	30MHz to 300MHz Amplitude	3.0dB*
Radiated E-Field Susceptibility	26MHz to 2.5GHz Test Amplitude	1.4dB†
Conducted Susceptibility	100kHz to 250MHz Amplitude	1.8dB†
Power Frequency Magnetic Field	50Hz/60Hz Amplitude	0.45%
Magnetic Emissions	9kHz to 30MHz Amplitude	3.8dB*
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—

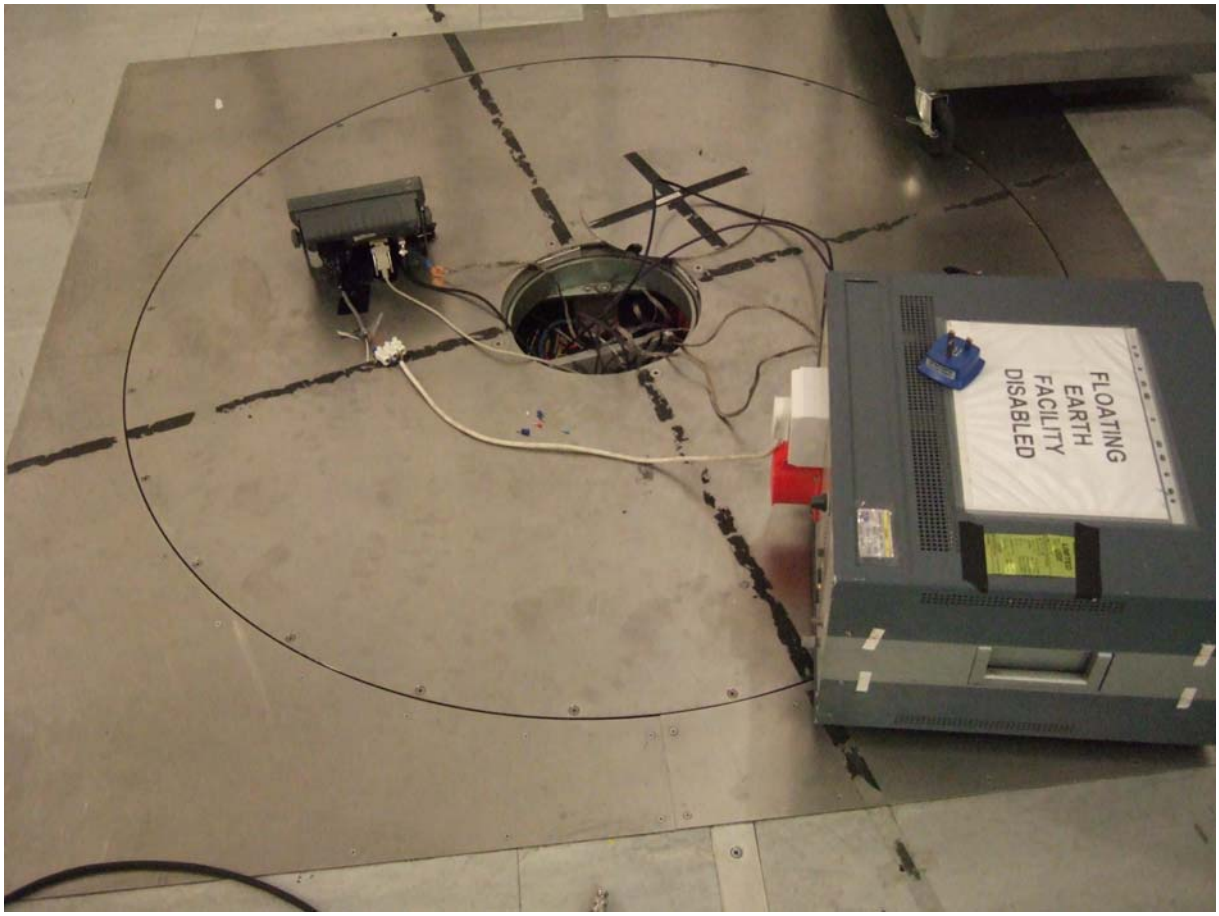
Worst case error for both Time and Frequency measurement 12 parts in 10^6.

* In accordance with CISPR 16-4
† In accordance with UKAS Lab 34

SECTION 4

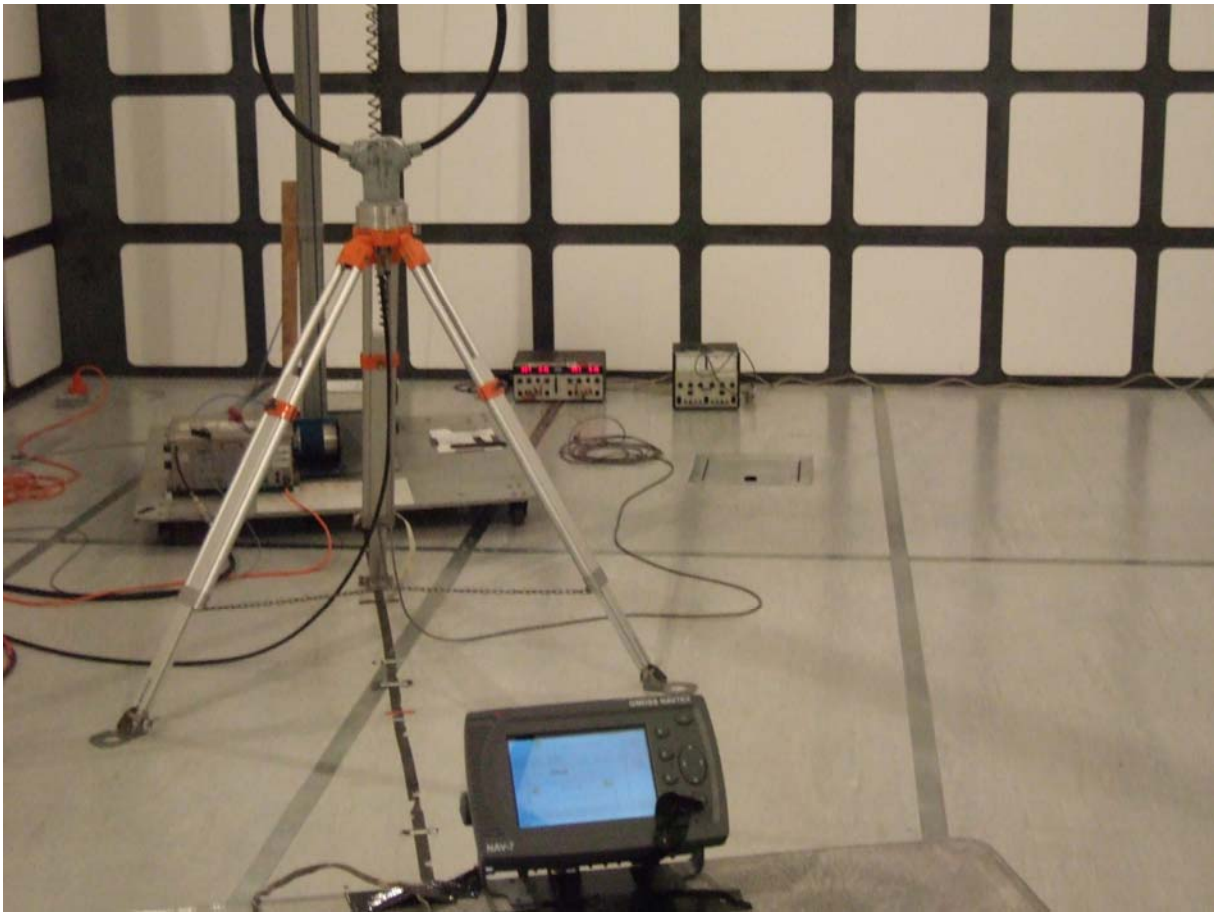
PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



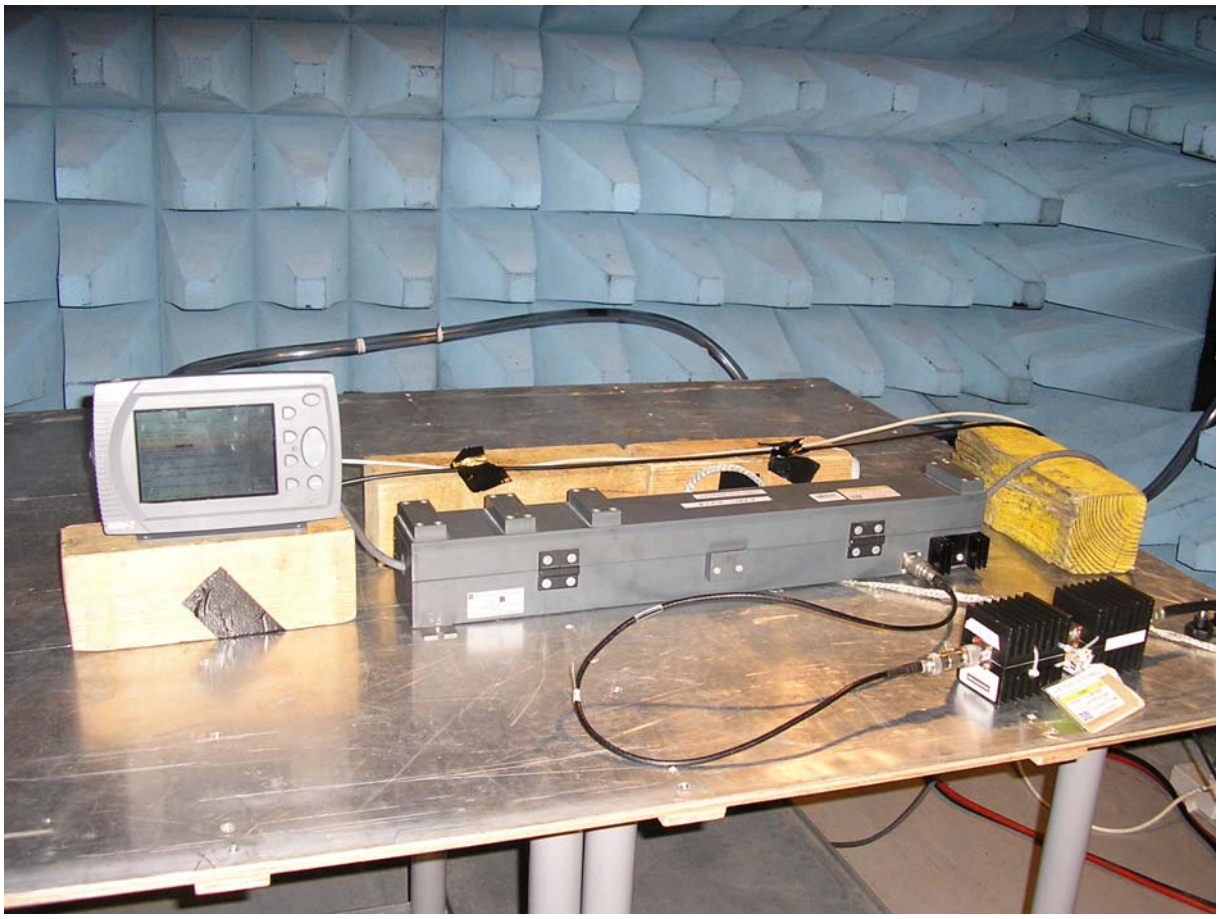
Conducted Emissions Setup

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



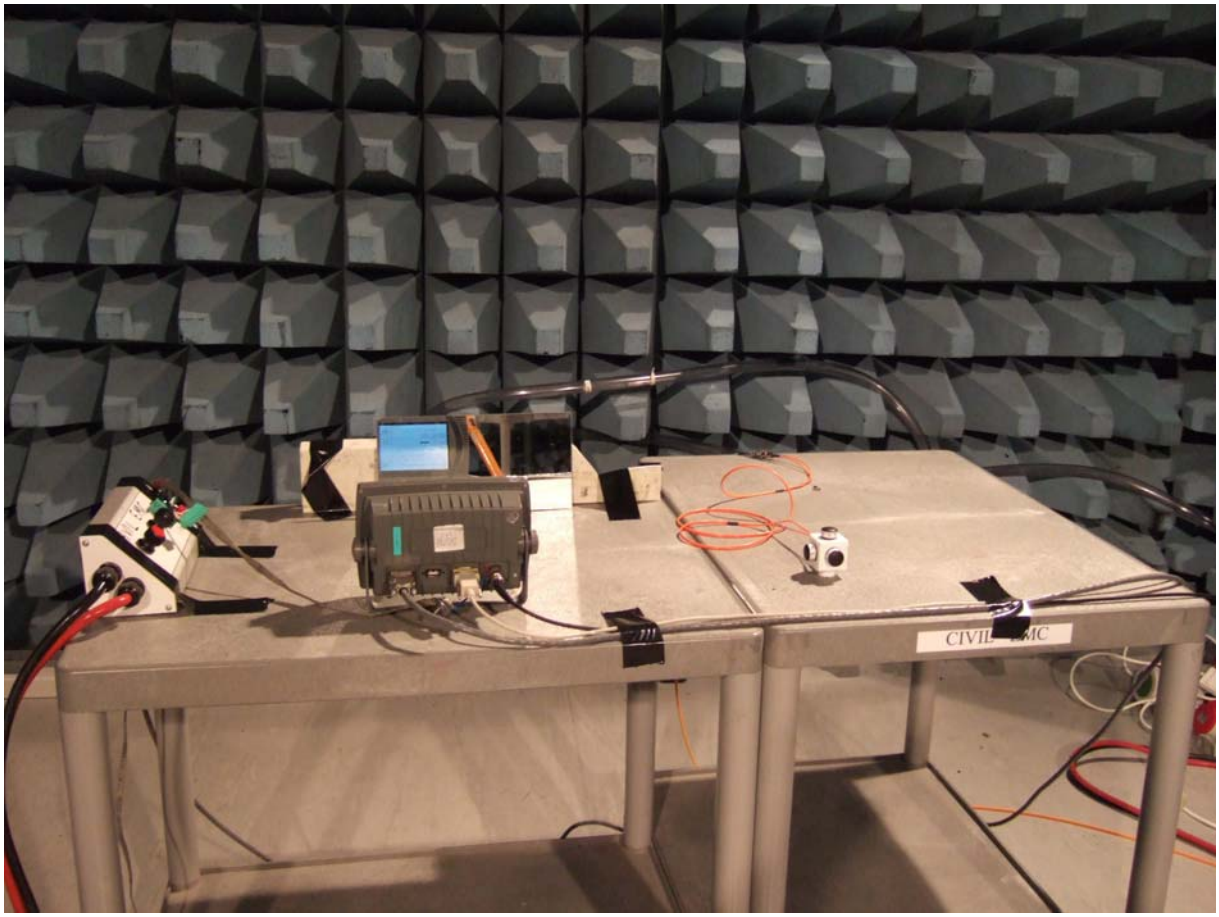
Radiated Emissions Setup

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Conducted Immunity Setup

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Radiated Immunity Setup

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).