REPORT ON

Type Approval Testing of the McMurdo Ltd
S4 Search and Rescue Transponder in accordance with IEC 61097-1 (1992-07)
And IEC 60945 (2002-08)

COMMERCIAL-IN-CONFIDENCE

Report No RM 610860/01 Issue 1 Part 1 October 2003

TÜV PRODUCT SERVICE

BABT

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REPORT ON Type Approval Testing of the McMurdo Ltd S4 Search and Rescue Transponder in accordance with IEC 61097-1 (1992-07) and IEC 60945 (2002-08)

Report No. RM610860/01 Issue 1

PREPARED FOR

McMurdo Limited
Silver Point
Airport Service Road
Portsmouth
PO3 5PB

APPROVED BY

T J Pither
Quality Manager

DISTRIBUTION

McMurdo Ltd	Copies No. 1 & 2
TUV Product Service	Copy No. 3

UKAS TESTING
0141
Group

CONTENTS:-

Part 1

Manufacturer:	McMurdo Ltd
Type Designation:	S4
Serial No.:	S4/03/00001, S4/03/00002, S4/03/00003
Number of Samples Tested:	Three
Test Specification:	IEC 61097-1 (1997-07) IEC 60945 (2002-08)
Date of Receipt of Test Sample:	20th May 2003
Start of Test:	20th May 2003
Finish of Test:	16th September 2003
Test Engineer(s):	J. Holding A. Guy G. Lawler A. Douglas R. Hampton M. Larkin

TEST HOUSE DECLARATION

We, TUV Product Service of Segensworth Road, Titchfield, Fareham, Hampshire PO15 5RH, declare under our sole responsibility that the product :

Equipment :	Search and Rescue Transponder
Type :	McMurdo Ltd
Model :	S4
Serial Number :	S4/03/00001, S4/03/00002, S4/03/00003
Quantity :	Three

to which this declaration relates is in conformity with the following standard(s) or other normative document(s) :

IEC 61097-1 and IEC 60945

Detailed results are recorded in Test Report No. RM 610860/01 Issue 1

Place and date of issue : Fareham, October 2003

Signature : _____

T J Pither
Quality Manager

Date : 15th October 2003

APPLICANT'S DETAILS		
CATEGORY OF APPLICANT	(a) [✓]	Manufacturer
(Please tick relevant box)	(b) [ ]	Importer
	(c) [ ]	Distributor
	(d) [ ]	Agent

If box (b),(c) or (d)is ticked complete details in box below with respect to the manufacturer

COMPANY NAME : McMurdo Ltd

ADDRESS : Silver Point
Airport Service Road
Portsmouth
PO3 5PB
United Kingdom

NAME FOR CONTACT PURPOSES : Mr C P Hoffman

TELEPHONE No.: 023 92 623903 FAX No : 023 92 623996

Email :

MANUFACTURERS DETAILS	
COMPANY NAME :	As above
ADDRESS :	
NAME FOR CONTACT PURPOSES :	
TELEPHONE No :	FAX No :
	Email :

TYPE DESIGNATION[1]
The type designation may be either a single alphanumeric code or an alphanumeric/code divided into two parts. Please fill in EITHER : TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE / OR: TYPE DESIGNATION IN TWO PARTS: 1. EQUIPMENT SERIES NO.[2] ("MODEL NUMBER") / S / 4 / / / / / / / / / / / / / / / / / / AND 2. EQUIPMENT SPECIFIC NO.[3] ("IDENTIFICATION NO") / 8 / 6 / - / 0 / 0 / 0 / 0 / 1 / / / / / / / / / / / /

(1) This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment.

(2) This is the number, code or trade name used by the manufacturer to describe a series of 'family' of equipment of substantially the same mechanical construction which will include a number of related equipments. This number is often referred to as the "model no.".

(3) This is the manufacturer's identification number given to a specific equipment in the series or 'family' of equipments. It is often referred to as the "identification number".

TYPE OF SART	
[ ]	Fixed Installation in lifeboats, life rafts or on board ship.
[✓]	Portable unit
[ ]	Installed in a release mechanism and/or combined with a float free EPIRB.

BATTERY			
[ ]	Nickel Cadmium	[ ]	Lead Acid
[ ]	Mercury	[ ]	Leclanché
[ ]	Alkaline	[✓]	Lithium
[ ]	Other		
	Nominal Voltage	11.5 / 5.5Volts	End point voltage 10 / 5Volts

DECLARATIONS		
Does the equipment comply with the requirements of section 3.2.14 ?	[✓]	Yes
	[ ]	No
If no state reasons:		
Are the equipments submitted representative production models ?	[✓]	Yes
	[ ]	No
If not are the equipments pre-production models ?	[ ]	Yes
	[ ]	No
If pre-production equipments are submitted will the final production equipments be identical in <u>all</u> respects with the equipment tested ?		
	[ ]	Yes
	[ ]	No
If no supply full details :		
Will labelling of the equipment comply with the requirements of IEC 61097-1 ?	[✓]	Yes
	[ ]	No
If no supply full details:		

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature: Held on file at TUV Product Service

Name: N M Jordon

Position Held: Electronics Engineer

Date: 2/4/03

SECTION 1

TESTING IN ACCORDANCE WITH IEC 61097-1

Operational Requirements Clause 3.2

Clause No.

3.2.1 Activation of the unit requires operation of a single ring switch which is capable of being easily activated by unskilled personnel.

3.2.2 The unit is fitted with a means to prevent inadvertent activation. A security tab must be removed from the switch ring to enable the switch to move to the ON position.

3.2.3 The unit has a visual indication of correct operation. A flashing red light indicates that the S.A.R.T. is on, along with a buzzer sounding every 2 seconds.

3.2.4 The unit is capable of manual activation and deactivation. No provision is made for automatic operation.

3.2.5 The unit has a flashing red L.E.D. to indicate the standby condition i.e. activated but not triggered. The buzzer will not sound.

3.2.6 The equipment was set up ready for normal use and allowed to fall freely from a height of 20 metres into water. The unit suffered no mechanical damage and functioned correctly.

3.2.7 Test combined with clause 6.2.7.

3.2.8 The equipment was subjected to thermal shock and immersion test as specified. On completion the unit functioned correctly and no water ingress occurred. Tested as per clause 6.2.8.

3.2.9 The check for floating was performed (5 minutes). The unit was found to float, as per clause 6.2.9.

3.2.10 The unit is fitted with a 10 m buoyant lanyard suitable for use as a tether.

3.2.11 Corrosion test not performed. Materials information supplied; see Annex B.

3.2.12 Manufacturers material information supplied.; see Annex B.

3.2.13 The unit is made of highly visible orange coloured plastic.

3.2.14 The unit is of smooth external construction

Ambient Temperature.....22°C Relative Humidity.....47%

Drop Test Clause 6.2.6

A Drop test into water was carried out at Southampton Container Port.

The test was performed from a 40 metre crane, a cradle was lowered from the main body of the crane to a height of 20 metres and the test was carried out from there.

To double check the height of the cradle a cord and float, pre-measured to a length of 20 metres, was lowered to sea level from the cradle. With the float in the water the 20 metre mark on the cord was level with the handrail of the cradle.

A length of 70 metre length of rope was attached to the SART to allow it to be retrieved after the test. Approximately 40 metres of rope was let out over the side of the cradle to allow the SART to free fall when dropped.

The SART was subjected to the 20 metre drop.

The SART was retrieved from the water and inspected for damage. No damage to the test sample was found. A self test was performed satisfactorily post test.

A functional test was carried out once the unit was returned to the laboratory, the results are shown below.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9161.3	✓	9520.0

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

Test was performed using serial no S4/03/0002.

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 78
.....

Platform used for Drop Test

SART hitting water

Ambient Temperature.....24.5°C Relative Humidity.....45.5%

Environment : Immersion Clause 6.2.7

The unit was mounted vertically on a grill and weighted down and enough water was put in the chamber to cover the test sample.

A pressure of 100kPa was applied for period of 5 minutes.

The unit was removed from the chamber and inspected. No water ingress was detected, and the performance check performed successfully.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9165.3	✓	9526.0

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

Test was performed using serial no S4/03/00002

TEST EQUIPMENT USED
34, 35, 36, 42, 43, 44, 45, 47, 54, 55, 57, 58, 59, 60, 61

Ambient Temperature.....21.1°C Relative Humidity.....50.9%

Environment : Thermal Shock Clause 6.2.8

The test sample was placed in a climatic chamber overnight at a temperature of +60°C.

The unit was removed from the climatic chamber and immersed in water at a temperature of +15.1°C in a pressure chamber. The pressure of the chamber was set at 100kPa for 1 hour 11 minutes.

The test sample was then placed in a climatic chamber at a temperature of -15°C for 3 hours..

The unit was removed from the climatic chamber and immersed in water at a temperature of +17°C in a pressure chamber. The pressure of the chamber was set at 100kPa for 1 hour.

The unit was removed from the pressure chamber and inspected, no water ingress was detected.

The performance check was successfully completed.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9154.6	✓	9517

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

Test was performed using serial no S4/03/00002.

TEST EQUIPMENT USED
32, 33, 34, 35, 42, 43, 44, 45, 47, 54, 55, 57, 58, 59, 60, 61
…….....

Ambient Temperature.....28.7°C Relative Humidity.....47.4.%

Atmospheric Pressure…….1005mbar

Environment : Floatation Clause 6.2.9

Unit No S4/03/00002 was placed in a container filled with water. The unit stayed afloat for the required 5 minute duration.

TEST EQUIPMENT USED
34, 36, 42, 43, 44, 45
.....

Ambient Temperature.....20.1°C Relative Humidity.....59.7%

Battery capacity – 5.5V Battery Clause 6.3

Average Current in Standby at V_{nom} - $\mathbf{I_1}$	6.34mA
Average Current during interrogation(1) at V_{nom} - $\mathbf{I_2}$	6.35mA
Lowest voltage for correct operation	4.80V

Cell Type CR123A

Test Conditions	Initial Voltage	Voltage after 96 hours at $\mathbf{I_1}$	Voltage after further 8 hours at $\mathbf{I_2}$
T_{nom} 25ºC	6.397	5.880	5.864
T_{max}= + 55ºC	6.289	5.914	6.006
T_{min}= - 20ºC	6.451	5.523	5.525

Cell Type CR 2/3 AH

Test Conditions	Initial Voltage	Voltage after 96 hours at $\mathbf{I_1}$	Voltage after further 8 hours at $\mathbf{I_1}$
T_{nom} +25 ºC	6.377	5.889	5.879
T_{max}= + 55ºC	6.308	5.936	6.053
T_{min}= - 20ºC	6.480	5.499	5.502

(1) Continuous interrogation with a pulse repetition frequency of 1kHz

Limit Clause 6.3.2

Limit under normal and extreme test conditions	Final Voltage after 104 hours ≥ 4.80 V

TEST EQUIPMENT USED
65, 66, 67, 68, 69, 78
.....

Ambient Temperature.....20.1°C Relative Humidity.....59.7%

Battery capacity – 11.5V Battery Clause 6.3

Average Current in Standby at V_{nom} - $\mathbf{I_1}$	1.26mA
Average Current during interrogation(1) at V_{nom} - $\mathbf{I_2}$	43mA
Lowest voltage for correct operation	8.69V

Cell Type CR123A

Test Conditions	Initial Voltage	Voltage after 96 hours at $\mathbf{I_1}$	Voltage after further 8 hours at $\mathbf{I_2}$
T_{nom} 25ºC	12.923	11.914	11.540
T_{max}= + 55ºC	12.828	11.965	11.898
T_{min}= - 20ºC	12.981	11.288	10.445

Cell Type CR 2/3 AH

Test Conditions	Initial Voltage	Voltage after 96 hours at $\mathbf{I_1}$	Voltage after further 8 hours at $\mathbf{I_2}$
T_{nom} +25ºC	12.905	11.912	11.481
T_{max} +55ºC	12.877	12.015	11.922
T_{min} –20ºC	12.987	11.299	10.401

(1) Continuous interrogation with a pulse repetition frequency of 1kHz

Limit Clause 6.3.2

Limit under normal and extreme test conditions	Final Voltage after 104 hours ≥ 8.69 V

TEST EQUIPMENT USED
65, 66, 67, 68, 69, 78
.....

Ambient Temperature.....22.9°C Relative Humidity.....59.9%

Environment (temperature): Dry heat cycle Clause 6.4.1

The test sample was switched on and placed in a climatic chamber at room temperature. The chamber temperature was raised to +65°C, this temperature was maintained for 15 hours.

A performance check was successfully completed, and the unit returned to room temperature.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9158.1	✓	9519.0

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

Test was performed using serial no S4/03/00002

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 77, 78
.....

Ambient Temperature.....21.1°C Relative Humidity.....50.9%

Environment (temperature): Low temperature cycle Clause 6.4.2

The test sample was placed in a climatic chamber at room temperature, the temperature was decreased to -30°C and maintained for 15 hours 40 minutes. The chamber temperature was increased to -20°C which was reached in 15 minutes.

The unit was switched on for 2 hours during which time a performance check was successfully completed.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9156.2	✓	9540.0

Remarks: Unit interrogated using test signal 2
Performance check made during final 2 hours of cycle
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

This test was performed using serial no S4/03/00002

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 77, 78
.....

Range performance Clause 6.7

This test was carried out at the QinetiQ Fraser Range by QinetiQ Personnel. The results of this test are shown in QinetiQ Certificate Number: QinetiQ/S&E/MATS/R/TT 10/03-1, in Annex A of this report. This test is not covered by TUV Product Service UKAS Accreditation.

Labelling Clause 6.8

Photographs of the unit's labels are shown on pages 54 to 57 of this report.

Ambient Temperature.....23.1°C Relative Humidity.....50.9%

Receiver sensitivity Clause 6.9.3

Test Conditions	Test Signal	9.20 GHz (dBm)	9.35 GHz (dBm)	9.50 GHz (dBm)
T_{nom}=+ 23.1ºC	1	-54.85	-53.83	-54.28
	2	-57.85	-57.23	-57.28
Measurement Uncertainty (dB)		±0.3		

Limit Clause 6.9.3.2

Test Signal 1	< -37 dBm
Test Signal 2	< -50 dBm

Remarks

This test was performed using serial no S4/03/00001

TEST EQUIPMENT USED
47, 51, 52, 53, 57, 59, 61, 62, 63, 64, 78
.....

Ambient Temperature.....22°C Relative Humidity.....49.7%

Sweep characteristics - Frequency range Clause 6.9.4

Test Conditions	12 Sweeps	Minimum Frequency (GHz)	Maximum Frequency (GHz)
T_{nom}=+ 22ºC	✓	9155.3	9514.0
Measurement Uncertainty (MHz)		±5.0	

Limit Clause 6.9.4.2

12 Sweeps each covering the range 9.2 GHz (+0/-60 MHz) to 9.5 GHz (+60/-0 MHz)

Sweep characteristics - Sweep time Clause 6.9.4

Test Conditions	Forward Sweep Time (μs)	Return Sweep Time (μs)	First Sweep Type
T_{nom}=+ 22ºC	7.503	0.45	Return
Measurement Uncertainty (μs)	±0.022	±0.003	N/A

Limit Clause 6.9.4.2

Forward Sweep	7.5 ± 1.0 μs
Return Sweep	0.4 ± 0.1 μs

Sweep characteristics - Sweep profile Clause 6.9.4

Test Conditions	MAX Sweep Error (MHz)	MIN Sweep Error (MHz)
T_{nom}=+ 22ºC	15.465	-1.456
Measurement Uncertainty (MHz)	±2.5	

Limit Clause 6.9.4.2

MAX Sweep	Within ± 20 MHz of a linear Sweep between 9.2 and 9.5 GHz
MIN Sweep	

Remarks

This test was performed using the serial no S4/03/00002.

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 78
.....

Ambient Temperature.....23.3°C Relative Humidity.....53%

Radiated power Clause 6.9.5

Rotation(deg.)	dBm
0	30.818
15	30.898
30	31.518
45	31.378
60	31.278
75	31.768
90	32.698
105	33.218
120	32.978
135	32.188
150	30.918
165	30.118
180	31.138
195	32.168
210	32.218
225	31.408
240	30.298
255	30.458
270	31.598
285	32.998
300	33.948
315	33.978
330	33.338
345	32.018
360	30.678
Measurement Uncertainty (dB)	±0.6

Ambient Temperature.....23.3°C Relative Humidity.....53%

Radiated power-continued Clause 6.9.5

Maximum	34.048 dBm at 307º
Minimum	30.088 dBm at 165º
Range	3.96 dB
Measurement Uncertainty (dB)	± 0.6

Limit Clause 6.9.5.2

Minimum power	≥ 400 mW (+26 dBm)
Power Range	The maximum and minimum signals shall be within 4 dB

Remarks

This test was performed using serial no S4/03/00001

TEST EQUIPMENT USED
47, 51, 52, 53, 57, 59, 61, 62, 63, 64, 78
.....

Ambient Temperature.....22.3.°C Relative Humidity.....53%

Antenna characteristics Clause 6.9.6

Rotation (deg.)	+ 12.5° (dBm)	Variation from ref.(dB)	- 12.5° (dBm)	Variation from ref.(dB)
0.0	27.588	+1.588	29.468	+3.468
15.0	27.638	+1.638	30.648	+4.648
30.0	27.768	+1.768	31.818	+5.818
45.0	27.208	+1.208	32.118	+6.118
60.0	26.588	+0.588	31.778	+5.778
75.0	26.718	+0.718	31.908	+5.908
90.0	27.818	+1.818	32.678	+6.678
105.0	29.058	+3.058	33.178	+7.178
120.0	29.568	+3.568	33.218	+7.218
135.0	29.268	+3.268	32.708	+6.708
150.0	28.158	+2.158	31.898	+5.898
165.0	26.878	+0.878	30.898	+4.898
180.0	26.488	+0.488	30.348	+4.348
195.0	27.458	+1.458	31.878	+5.878
210.0	26.838	+0.838	32.358	+6.358
225.0	26.418	+0.418	32.388	+6.358
240.0	24.838	-1.162	32.608	+6.608
255.0	24.498	-1.502	33.108	+7.108
270.0	25.558	-0.442	33.308	+7.308
285.0	26.618	+0.618	33.848	+7.848
300.0	27.718	+1.718	33.828	+7.828
315.0	28.528	+2.528	33.118	+7.118
330.0	28.418	+2.418	31.868	+5.868
345.0	27.878	+1.878	30.228	+4.228
360.0	27.568	+1.568	29.388	+3.388
Measurement Uncertainty (dB)	± 0.6			

Ambient Temperature.....22.3°C Relative Humidity.....53%

Antenna characteristics - Continued Clause 6.9.6

Minimum	24.378	-1.622	30.918	4.918
Maximum	28.568	2.568	33.318	7.318
Measurement Uncertainty (dB)	± 0.6			

Limit Clause 6.9.6.2

Limit under normal test conditions	Power at ± 12.5° to the horizontal plane shall be greater than -2 dB relative to the signals required in clause 6.9.5.2. (+26dBm)

Remarks

This test was performed using serial no S4/03/00001

TEST EQUIPMENT USED
47, 51, 52, 53, 57, 59, 61, 62, 63, 64, 78
.....

Ambient Temperature.....21.2°C Relative Humidity.....48.2%

Recovery time following excitation Clause 6.9.7

Test Conditions	Recovery Time (μ s)
T_{nom}=+ 21.2ºC	7.56
Measurement Uncertainty (μ s)	±0.022

Limit Clause 6.9.7.2

Limit under normal test conditions	≤ 10 μ s

Remarks

This test was performed using serial no S4/03/00002.

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 63, 78
.....

Ambient Temperature.....23°C Relative Humidity.....46%

Delay - Receipt of radar interrogation and SART transmission Clause 6.9.8

Test Conditions	Delay Time (ns)
T_{nom}=+ 23ºC	162.0
Measurement Uncertainty (μ s)	±0.003

Limit Clause 6.9.8.2

Limit under normal test conditions	≤ 0.5 μ s

Remarks

This test was performed using serial no S4/03/00002.

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 63, 78
.....

Ambient Temperature.....21.9°C Relative Humidity.....46.7%

Receiver front end protection Clause 6.9.9

This test was carried out at the QinetiQ Fraser Range by QinetiQ Personnel. The results of this test are shown in QinetiQ Certificate Number: QinetiQ/S&E/MATS/R/TT 12/03-1, in Annex A of this report. This test is not covered by TUV Product Service UKAS Accreditation.

Remarks

A functional check was performed on serial no S4/03/00001 at TUV Product Service after the front end protection test to check the operation of the unit had not be adversely affected. The results are shown below.

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9162.6	✓	9523.0

Remarks: Unit interrogated using test signal 2
Performance check made during the final 2 hours of cycle
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 78
.....

SECTION 2

TESTING IN ACCORDANCE WITH IEC 60945

Ambient Temperature.....24°C Relative Humidity.....45%

Environment (temperature) : Damp Heat Clause 8.3

The test sample was placed in a climatic chamber and the temperature was raised to +40°C, and the relative humidity raised to 93%. These conditions were maintained for a period of 15 hours.

The unit was switched on and kept operational for a 2 hour period. During this time a performance check was successfully performed. On completion of the 2 hour period the climatic chamber was returned to room temperature.

Performance check : Sweep Characteristics

Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9163.10	✓	9516.00

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Remarks

Test was performed using serial no S4/03/00002.

TEST EQUIPMENT USED
32, 37, 47, 54, 55, 57, 58, 59, 60, 61, 78
.....

Ambient Temperature.....22.0°C Relative Humidity.....49.7%

Environment (temperature) : Vibration Clause 8.7

Remarks: Unit interrogated using test signal 2
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

Vibration testing was performed in 3 axis over the frequency ranges and levels as defined in clause 8.7.2. In each axis a resonant search was carried out and a 2 hour endurance test performed. Page 34 shows photgraphs of the unit as mounted during testing.

Vertical Axis - Resonance detected at 94.79Hz at 1.06g.
Two hour endurance test performed at 94.79Hz.
The Self Test Function was successfully operated.

Front/Back Axis - Resonance detected at 47.62Hz at 0.7g.
Two hour endurance test performed at 47.62Hz.
The Self Test Function was successfully operated.

Side/Side Axis - Resonance detected at 12.98Hz at 1.664g.
Two hour endurance test performed at 12.98Hz.
The Self Test Function was successfully operated.

On completion of testing in all 3 axis a funtional check was carried out.

Performance check : Sweep Characteristics

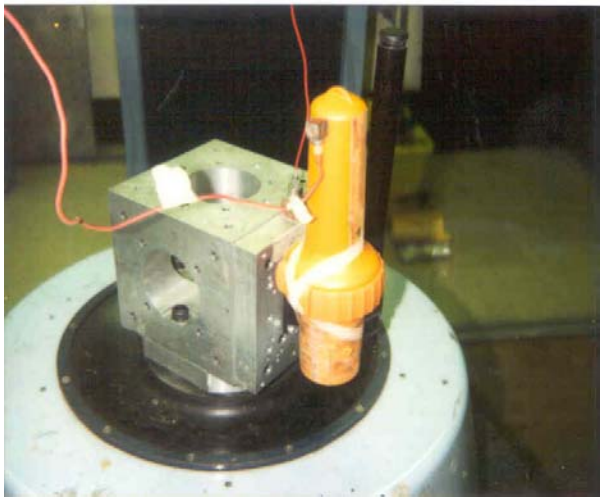
Modulation characteristics		
F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
9155.3	✓	9514.0

Remarks

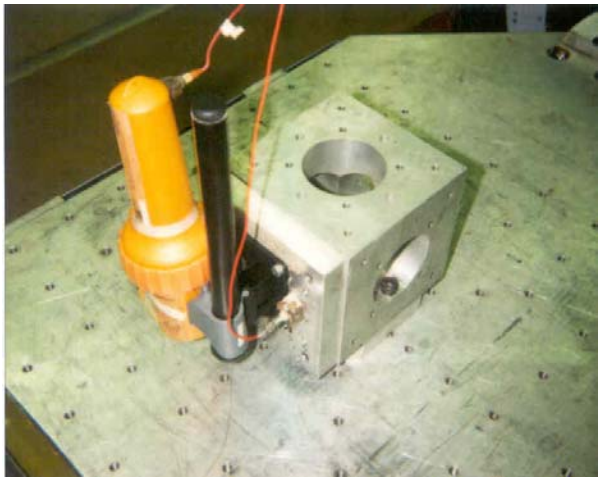
Test was performed using serial no S4/03/00002

TEST EQUIPMENT USED
47, 54, 55, 57, 58, 59, 60, 61, 78
.....

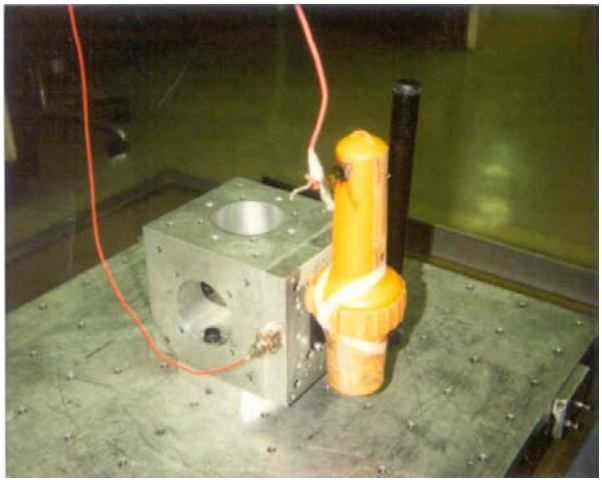
PHOTOGRAPHS OF TEST SAMPLE



Vertical Axis



Front/Back Axis



Side/Side Axis

RADIATED ELECTRIC FIELD EMISSIONS TEST PROCEDURE

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 1000MHz. The list of worst case emissions was then confirmed or updated. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emissions levels were then formally measured. The details of the worst case emissions were then recorded in the Job Log Book and are presented in the table below.

Radiated Electric Field Emissions measurements were made using a Hewlett Packard 8542E EMI Receiver.

The test was performed in accordance with EN 60945:2002.

RADIATED ELECTRIC FIELD EMISSIONS TEST RESULTS

Ambient Temperature 25.2 Relative Humidity 45.7% Atmospheric Pressure 1006 mbar.

The EUT met the requirements of EN 60945:2002 (Table 5 [Enclosure Port]) Radiated Electric Field Emissions test.

The emissions were measured at 3m.

The test was performed using serial no S4/03/00001.

Alternative Open Area Test Site Results: The levels of the 6 highest emissions measured in accordance with the specification are presented in Table 3 below: -

Emission Frequency	Antenna		Turntable Azimuth	Field Strength at 10m	Specification Limit	Pass / Fail
	Polarity	Height				
MHz	H/V	Cm	Degree	dBµV/m	dBµV/m	
49.99	V	150	000	20.4	54.0	Pass
159.7	V	150	000	-4.9	24.0	Pass
161.0	H	150	000	1.8	24.0	Pass
163.0	V	150	000	21.2	54.0	Pass
1000.0	V	150	000	28.0	54.0	Pass
1800.0	H	150	000	1.5	24.0	Pass

The margin between the specification requirements and all other emissions was 33.6 dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

H Horizontal Polarisation V Vertical Polarisation

Procedure Test Performed in accordance with EN 60945.

Performed by Matthew Larkin, EMC Engineer.

TEST EQUIPMENT USED
24, 25, 26, 27, 28, 29, 30, 31, 70
…….

Radiated Emissions Set up

RADIATED MAGNETIC FIELD EMISSIONS TEST PROCEDURE

ENCLOSURE PORT

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance. 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. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 150kHz to 30MHz. The list of worst case emissions was then confirmed or updated. Emission levels were maximised by adjusting the turntable azimuth. Emissions levels were then formally measured. The details of the worst case emissions were then recorded in the Job Log Book and are presented in the table below.

Radiated Magnetic Emission measurements were made using a Rohde & Schwarz ESH-3 Test Receiver and EZM Spectrum Monitor.

The test was performed in accordance with EN 60945: 2002.

RADIATED MAGNETIC FIELD EMISSIONS TEST RESULTS

ENCLOSURE PORT

Ambient Temperature 25.5°C Relative Humidity 45.7% Atmospheric Pressure 1006mPa

This test was performed using serial no S4/03/00003.

The EUT met the requirements of EN 60945:2002 (Table 5 [Enclosure Port]) Radiated Magnetic Field Emissions test.

The emissions were measured at 3m.

Alternative Open Area Test Site Results: The levels of the 6 highest emissions measured in accordance with the specification are presented in Table 4 below: -

Emission Frequency	Antenna		Field Strength at 3m	Specification Limit	Pass / Fail
	Polarity	Height			
MHz	F/E	cm	dBµV/m	dBµV/m	
0.4291	E	150	38.5	50.7	Pass
1.4293	F	150	34.1	50.7	Pass
0.4558	E	150	41.2	50.5	Pass
0.4707	F	150	32.2	50.2	Pass
3.7070	E	150	23.8	42.2	Pass
29.2412	E	150	15.7	34.2	Pass

The margin between the specification requirements and all other emissions was 20dB or more below the specification limit.

ABBREVIATIONS FOR ABOVE TABLE

E Edge On F Face On
MU Emission within Measurement Uncertainty

Procedure Test Performed in accordance with EN 60945: 2002.

Performed by Matthew Larkin, EMC Engineer.

TEST EQUIPMENT USED
1, 2, 3, 24, 29, 70
.....

Radiated Magnetic Field Emissions Set Up

IMMUNITY TO RADIATED INTERFERENCE TEST PROCEDURE

ENCLOSURE PORT

This test was initially performed using serial no S4/03/00001. The unit was tested in Receiver Mode and a spectrum analyser was used to monitor the Transmission Range of 9.2 to 9.5 GHz to watch for any activity. The units red LED was also monitored to watch for changes of state, in Receive Mode the LED flashes every 2 seconds.

The EUT was subjected to a field strength of 10V/m over the frequency range 80MHz to 2000MHz in both Horizontal and Vertical Polarisations. The carrier frequency was AM modulated with a 400Hz sinusoidal signal at a modulation depth of 80%.

IMMUNITY TO RADIATED INTERFERENCE TEST RESULTS

Ambient Temperature 24.1°C Relative Humidity 44.5% Atmospheric Pressure 1011 mbar.

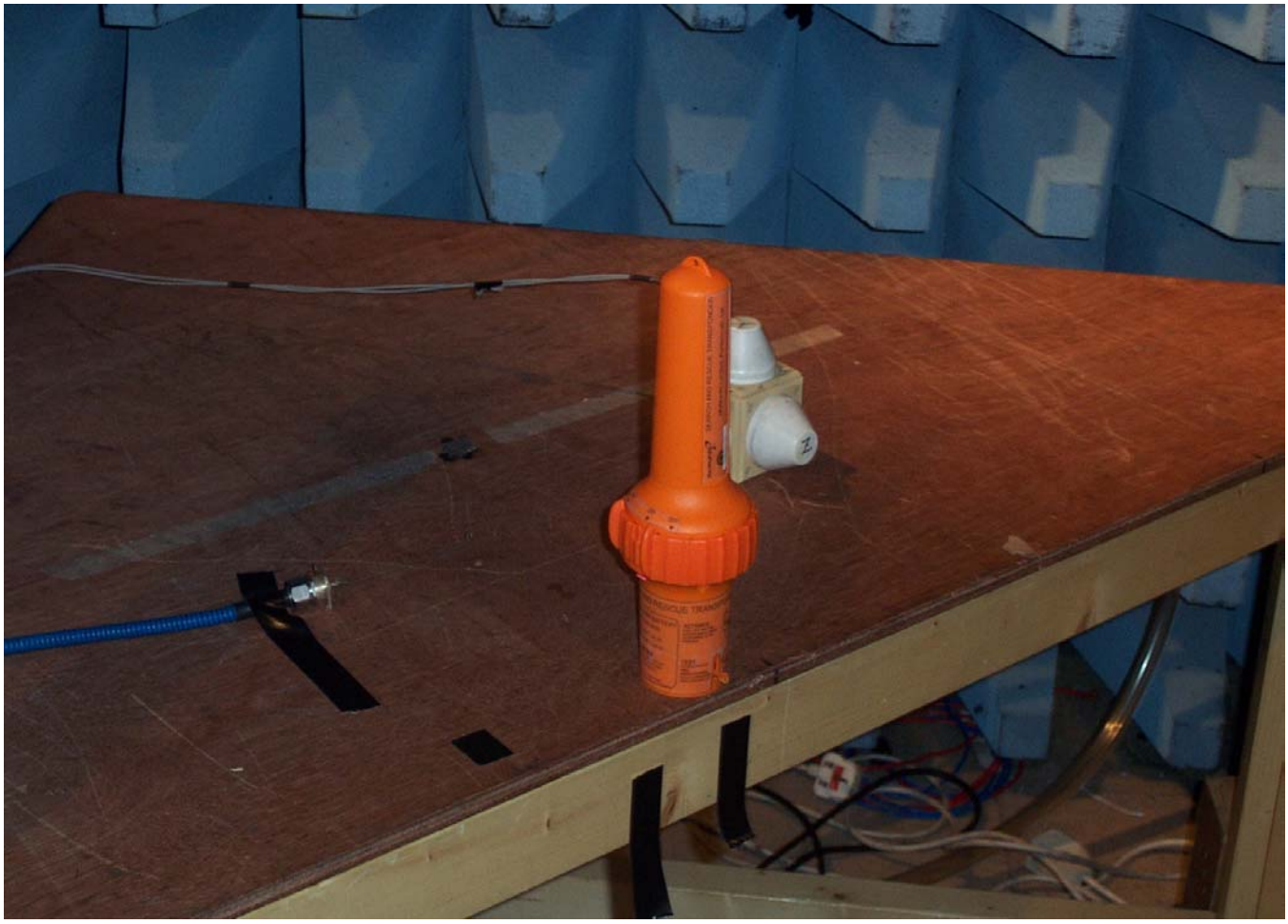
At various frequencies over the range 80MHz to 2GHz the unit was seen to go into transmit mode, and the LED was seen to switch on permanently showing the unit to be in Transmission Mode.

An investigation into the failures was carried out. A modification was made to the unit, an inductor was incorporated, see SART S4 failure Report in Annex B. A full retest was successfully completed using serial no S4/03/00003.

Procedure Test performed in accordance with EN 60945.

Performed by A Guy, EMC Engineer.

TEST EQUIPMENT USED
5, 6, 7, 9, 13, 15, 16, 17, 18, 19, 20, 21, 22, 24, 29
…….....



Radiated Immunity Set up

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST PROCEDURE

ENCLOSURE PORT

This test was performed using serial no S4/03/00001.

Air Discharge

A potential of 2kV, 4kV and 8kV was applied to each applicable test point. Where discharges occurred the potential was then applied a total of 20 times to each test point, 10 positive discharges and 10 negative discharges.

Contact Discharge

All user accessible conductive surfaces (Test points) were subjected to contact discharges of 2kV, 4kV and 6kV, 10 positive and 10 negative.

The EUT was functioning correctly prior to each test. During testing the EUT was switched off to represent it's state during storage and handling conditions. The correct operation of the EUT was monitored throughout each test by watching for any change of state, represented by the red LED and the audible 'beep' which would occur should the EUT switch on.

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST RESULTS

Ambient Temperature 22.2°C Relative Humidity 47.4% Atmospheric Pressure 1004 mbar.

The EUT met the requirements of EN 60945:2002 (Table 6 [Enclosure Port]) for Immunity to Electrostatic Discharge.

The EUT's operation, defined in accordance with the specification, was not impaired during testing.

Details of the points tested are presented in the table below.

IMMUNITY TO ELECTROSTATIC DISCHARGE TEST RESULTS - Continued

Test Points	Contact Discharge		Air Discharge	
	2kV, 4kV & 6kV		2kV, 4kV & 8kV	
	Positive	Negative	Positive	Negative
Horizontal Coupling Plane	✓	✓	N/A	N/A
Vertical Coupling Plane	✓	✓	N/A	N/A
Top Enclosure	N/A	N/A	✓*	✓*
Rotating Switch Area	N/A	N/A	✓*	✓*
Lower Enclosure	N/A	N/A	✓*	✓*
Bottom Enclosure	N/A	N/A	✓*	✓*
LED	N/A	N/A	✓*	✓*
Metal Screws	✓*	✓*	N/A	N/A

✓ 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.

TEST EQUIPMENT USED
10, 12, 24, 29, 73, 74, 75
.....

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
1	Receiver	ESH3	Rohde & Schwarz	872742/002
2	Spectrum Monitor	EZM	Rohde & Schwarz	892242/023
3	Loop Antenna 60cm	HFHR-22	Rohde & Schwarz	881058/38
4	16 Ω Load	16 Ω	TÜV	N/S
5	Amplifier	30W1000M7	Amplifier Research	17359
6	Spectrum Analyser	8562A	Hewlett Packard	3029A05390
7	Signal Generator	2031	Marconi	119748/061
8	Spectrum Analyser	8591A	Hewlett Packard	3202U02054
9	Amplifier	PTC6341	Unknown	7051
10	Simulator	Best ESD	Schaffner	1131
11	Analyser	8562A	Hewlett Packard	3029A05390
12	Amplifier	AS0822-30L	Unknown	1000311
13	Camera	WVCM140	Panasonic	07150064
14	Network	CDN 118	Schaffner	17621
15	Termination	50T-054	Weinschel	2101
16	Termination	50T-054	Weinschel	2101q
17	Sensor	URV5-Z2	Rohde & Schwarz	843240/080
18	Meter	URV-5	Rohde & Schwarz	881731-006
19	Directional Coupler	DC6180	Amp Research	19322
20	Sensor	FM2000	Amp Research	19078
21	Termination	50T-054	JFW	-
22	Antenna	CBL 6143	Schaffner	5053
23	Antenna	QPA-16	EMCO	621
24	Pressure Gauge	Diplex	Varioius	BO5/1-04B04
25	Screened Room	EAC54300	Siemens	n/a
26	Screened Room	HD 050	HD Gmbh	050-396
27	Antenna	CBL6143	Schaffner	-

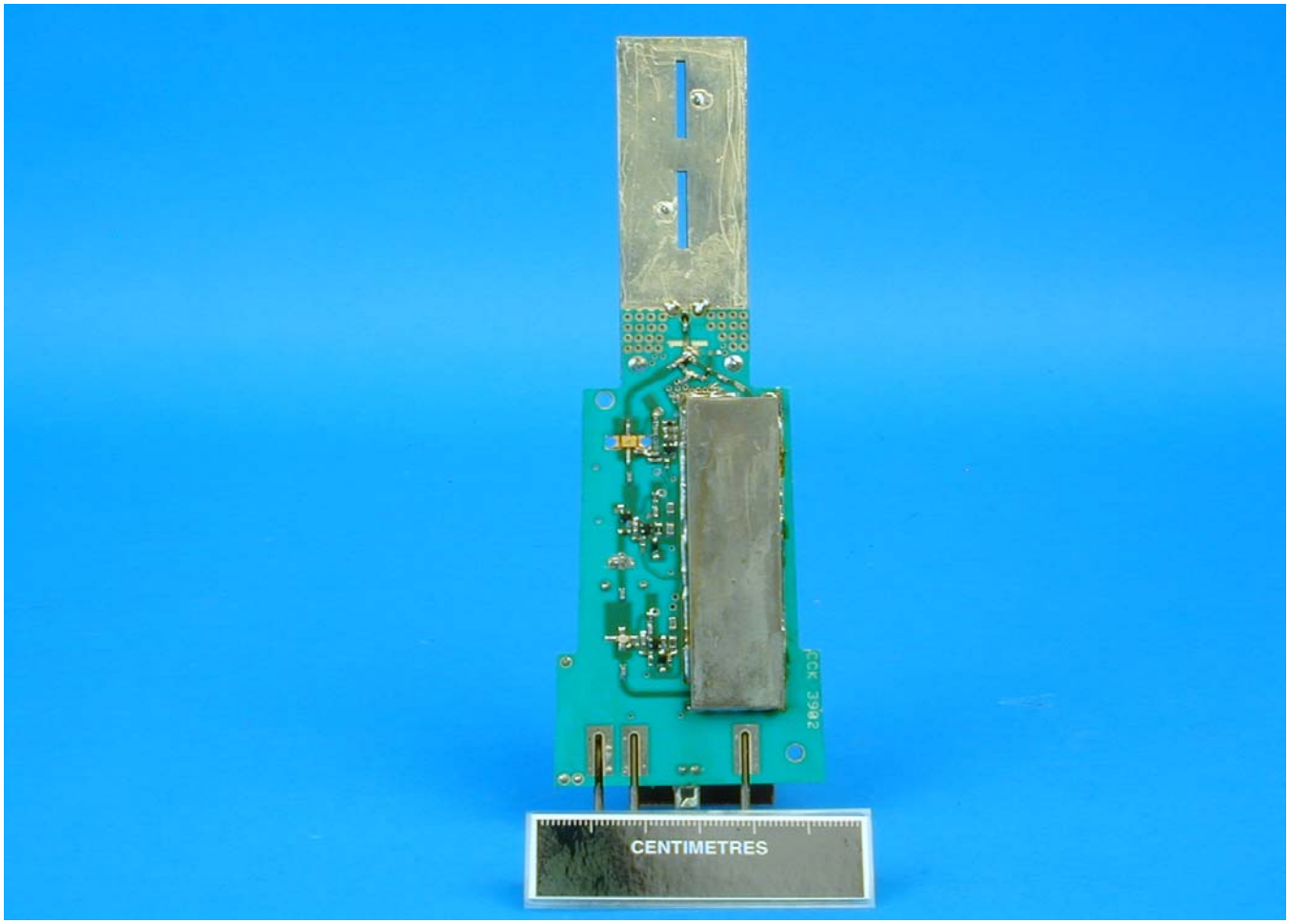
28	Receiver	8542E	Hewlett Packard	3617A00165_00154
29	Hygromer	A1-C80	Rotronic	10400016
30	Antenna Mast	2070	EMCO	-
31	Antenna Mast Controller	2090	EMCO	-
32	Logger	-	Anville	-
33	Chamber	Re1A	Climaire	A
34	Pressure Vessel	0 to 15 PSI	TUV	001
35	Pressure Gauge	DP1700	Druck	6099/92-1
36	Barometer	PPI502	Druck	50205
37	Chamber	Fisons 3	Fisons	-
38	Charge Amplifier	CA/04/N/H CU/04	Birchall	-
39	Accelerometer	2226C	Endevco	AFB30
40	Accelerometer	224C	Endevo	ET19
41	Vibration Equipment	VP85	Derritron	310
42	Timer	472-590	RS	-
43	Thermometer	2098T	Digitron	23
44	Thermocouple	T-Type	Labfacility	-
45	Hygrometer	A1 Hygromer	Rotronic	11446006
46	Controller	E1434A	Hewlett Packard	US41220720
47	Antenna	3115	EMCO	9704-5168
48	Amplifier	DC2500	Amp Research	28208
49	Capacitor	6512-016R	Solar	0308-02
50	Meter	2425	Bruel_Kjaer	900496
51	Printer	A9M0310Z	Various	6018585
52	Sensor	8481A	Hewlett Packard	2237A35732
53	Meter	436A	Hewlett Packard	1943U00782
54	Time Interval Analyser	5372A	Hewlett Packard	3141A01073
55	RF Mixer	HMXR-5001	Hewlett Packard	0489
56	Signal Generator	HP8657A	Hewlett Packard	3109A03515
57	Signal Generator	8673B	Hewlett Packard	2417A00437
58	Antenna	1624-20	Flann	326
59	Signal Source	2020	Analofic	91240016
60	Amplifier	-	Miteq	-

61	Signal Source	SWM02	Rohde & Schwarz	894631-014
62	Antenna	3115	EMCO	9005-3428
63	Oscilloscope	LC534L	Lecroy	LC5341147
64	Detector	8470B	Hewlett Packard	1822A15821
65	Voltmeter	3478A	Hewlett Packard	2301A04942
66	Ammeter	4002A	Racal	129707
67	Power Supply	-	Farnel	INV 2679
68	Power Supply	1506A	Weinschel	KA845
69	Load Box	-	TUV	-
70	Plotter	7550A	Hewlett Packard	-
71	Amplifier	150L	Amplifier Research	-
72	Monitor	CP 230/P	Panasonic	69D04701
73	ESD Generator	MZ-15EC	Keytech	9607440/9607249-250
74	ESD Generator	BEST EMC V2.7	Schaffner	200208-006SC
75	Spectrum Analyser	8657B	Hewlett Packard	3208402456
76	Chamber	906	Instron	ESO279
77	Chamber	VM 04/100	Hers Votsch	-
78	Hygromer	A1	Rotronic	11401036

View of S4 SART with mounting pole

View of S4 SART

Internal View 1



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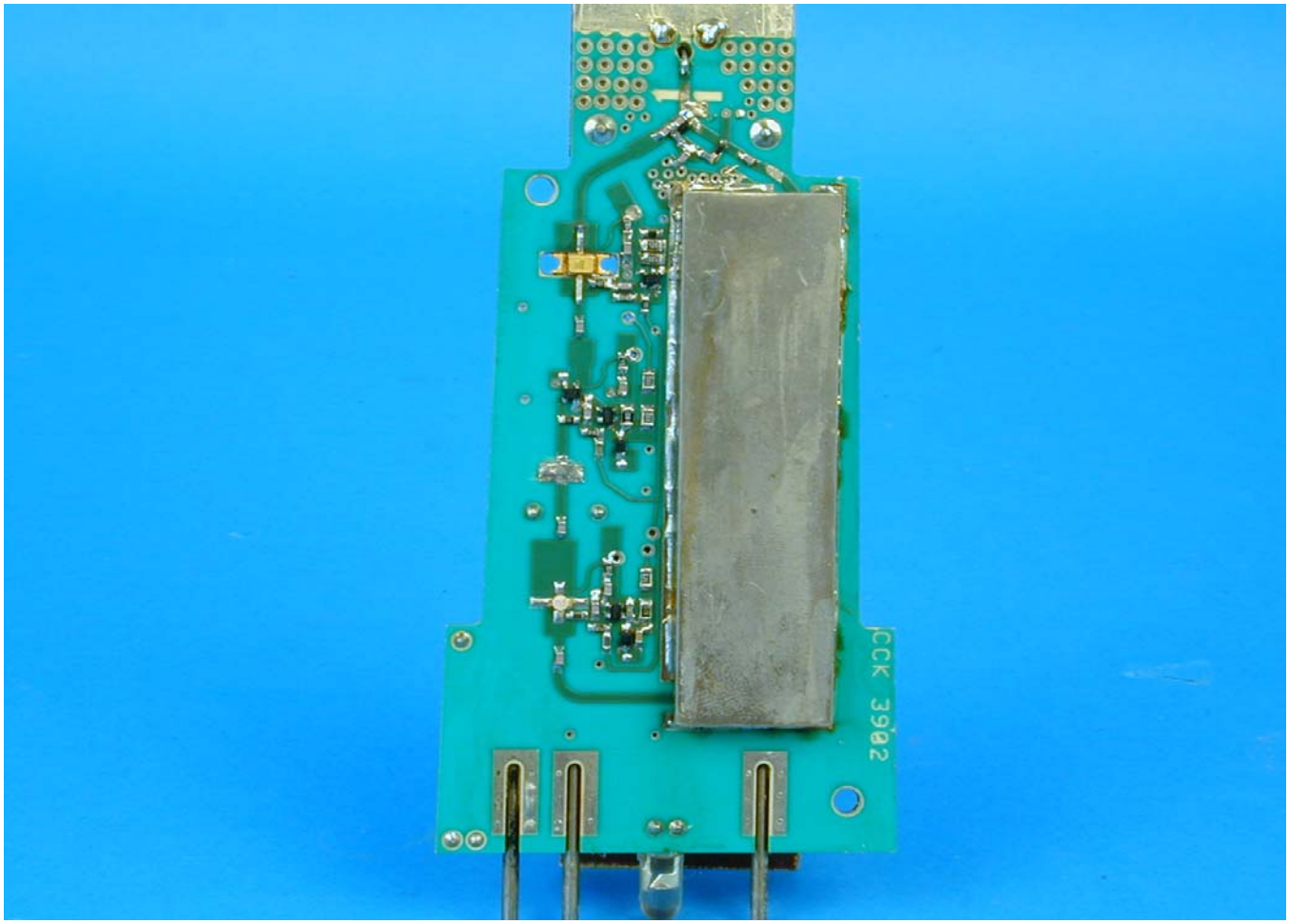
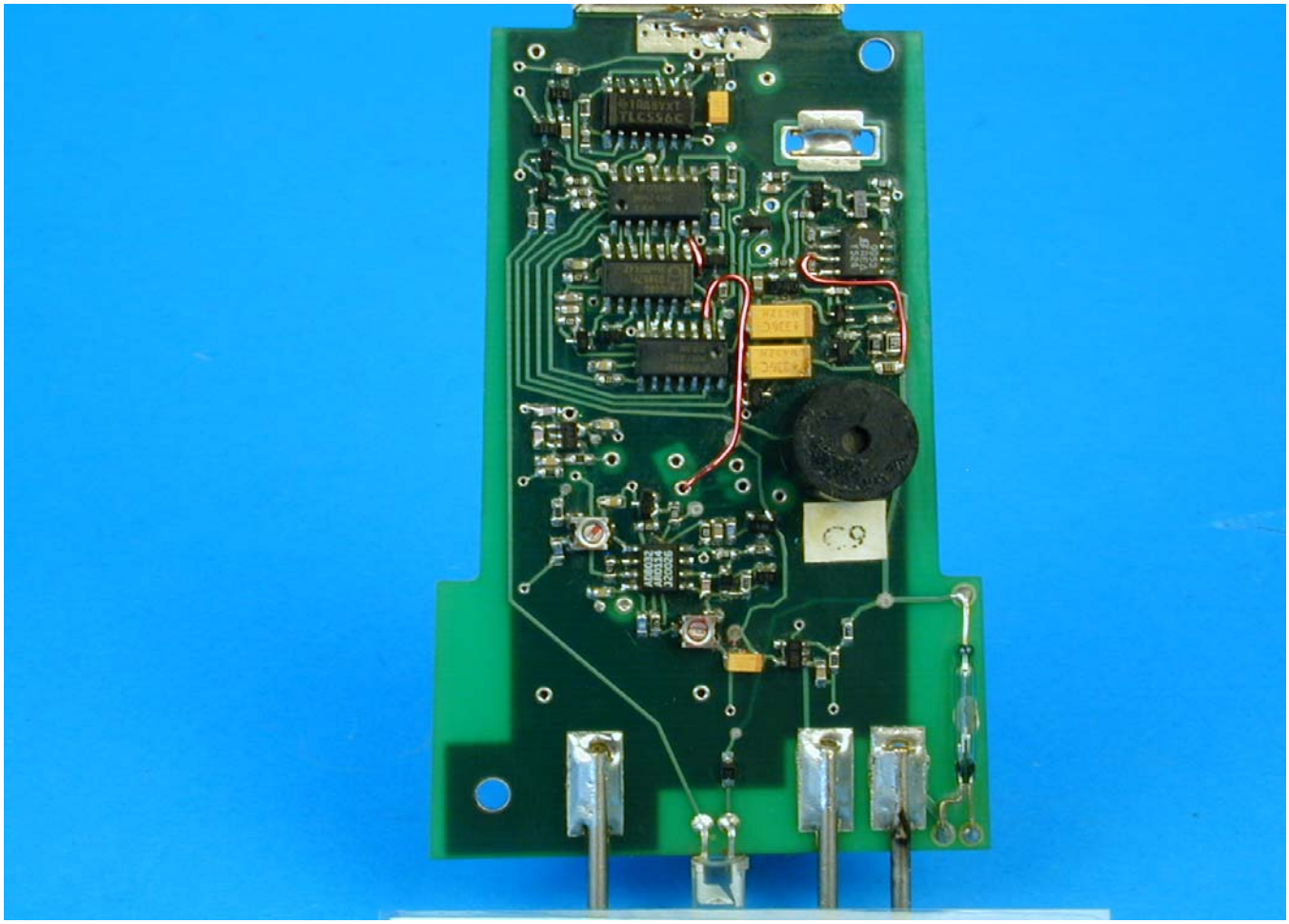


Internal View 3

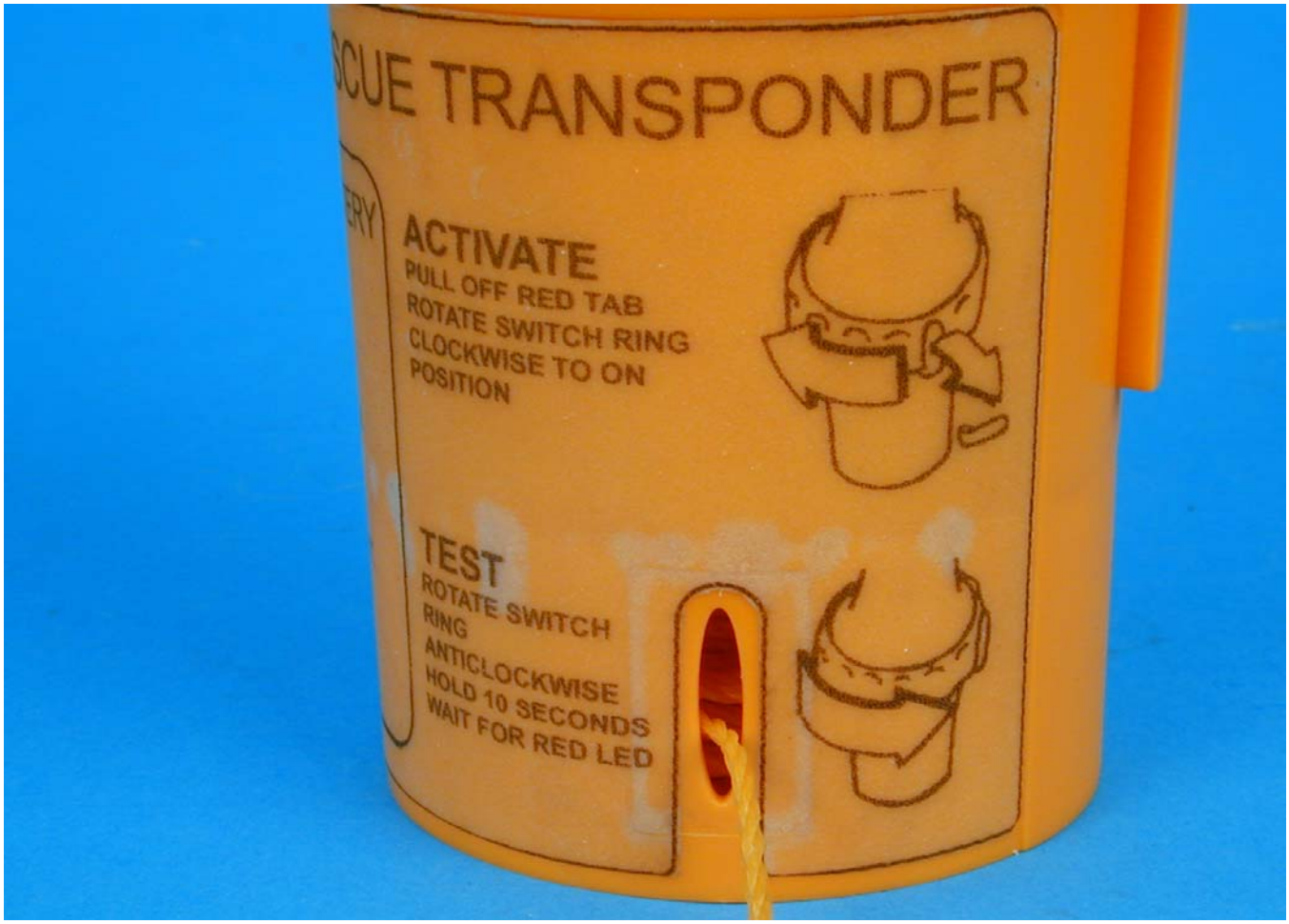


Internal View 4


mcmurdo
SEARCH AND
MOUNTING
11.5V LITHIUM
TYPE 86-
MANU DATE:
REPLACE BY:
NEVER
CHARGE, SHORT
PUNCTURE, DIS
OR INCINER
SPECIALIST

Label View 1

Label View 2



Label View 3

Label View 4

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Group

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