

PUBLIC ENTERPRISE TESTING CENTER “OMEGA”

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acting director**

PE TC “OMEGA”

Bogach S.V.

September 23, 2010



TEST REPORT NO. 10/591

Search and Rescue Transponder “SafeSea S100”

for compliance with IEC61097-1 (Second edition 2007-06) and IEC60945 (Fourth edition 2002-08)

Manufacturer “Ocean Signal Ltd.”, Great Britain

Sevastopol

2010

PUBLIC ENTERPRISE TESTING CENTER "OMEGA" COSPAS-SARSAT Secretariat reference No. CS497/F530 21/09/1994	29 Vakulenchuk Str., Sevastopol, 99053, Ukraine ph. +380 692 24 03 73 fax +380 692 46 96 79 E-mail:stcomega@stc-omega.biz
Ministry of Transport Russian Federation Certificate of accreditation of testing laboratory No. AKP.0510-14 PTH valid until 19.05.2015	
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National Accreditation Agency of Ukraine. Certificate of accreditation for compliance DSTU ISO/IEC 17025:2006 No. 2H339 valid until 17.05.2011	

Basis:	Contract No 10-512/20-383	
Equipment under test:	Search and Rescue Transponder "SafeSea S100"	
Manufacturer:	Ocean Signal Ltd., Great Britain	
Applicant:	Ocean Signal Ltd.", Great Britain	
Start Date of Tests:	04.08.10	
Date of Completion of Tests:	16.09.10	
Test report shall be delivered to:	Ocean Signal Ltd.	Copy No.1
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Tests results cover just tested samples only.

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CONTENTS

	Page No.
1. EQUIPMENT UNDER TEST	4
1.1 Equipment Category	4
1.2 Trade Name of the Equipment	4
1.3 Model	4
1.4 Serial Number	4
1.5 Function of the Equipment	4
1.6 Documentation submitted with the product	4
1.7 Technical specification	4
2. TEST PURPOSE	5
3. TEST PROGRAMME AND METHODS OF TESTING	5
4. TEST CONDITIONS	8
5. TEST SCHEDULE	9
6. TEST RESULTS	11
7. CONCLUSION	14
APPENDIX A Tests Results For Search and Rescue Transponder “SafeSea S100”	15
Appendix A1 Check the package contents and compliance of SART with instructions	16
Appendix A2 Check labelling of SART	23
Appendix A3 Technical characteristics test in standard climatic conditions at nominal voltage of the power supply	26
Appendix A4 Check SART operation under low power voltage	31
Appendix A5 Low temperature cycle	34
Appendix A6 Dry heat storage test (at temperature +65 °C)	38
Appendix A7 Dry heat functional test (at temperature +55 °C)	42
Appendix A8 Damp heat functional test	45
Appendix A9 Vibration test	49
Appendix A10 Check SART floating	57
Appendix A11 Drop into water test	58
Appendix A12 Water tightness and thermal shock	65
Appendix A13 Check of radiated emissions from enclosure port	70
Appendix A14 Battery capacity at normal condition temperature	73
Appendix A15 Battery capacity at minus 20 °C	75
Appendix A16 Battery capacity at + 55 °C	76
Appendix A17 Immunity to radiated radiofrequency disturbance of 10 V/m in band 80 to 2000 MHz	77
Appendix A18 Testing of immunity to electrostatic discharge	81
Appendix A19 Compass safe distance	85
Appendix A20 Check receiver protection (28 dBW/m ² at radar distance 20m)	89
Appendix A21 Range performance	95
Appendix A22 Oil resistance check	96
Appendix A23 Corrosion	102
Appendix A24 Buoyancy and length of lanyard	103
Appendix A25 Solar radiation	104
Appendix A26 Antenna height	105
Appendix A27 Antenna characteristics, Polarisation	106
APPENDIX B TEST EQUIPMENT USED AND MEASUREMENT UNCERTAINTIES	108
APPENDIX C Solar radiation test results	110
APPENDIX D Salt fog test results	118
APPENDIX E Materials Declaration	126

1. EQUIPMENT UNDER TEST

1.1 Equipment Category	Radar Transponder for marine search and rescue (SART) operating at 9 GHz
1.2 Trade Name of the Equipment	SafeSea
1.3 Model	S100
1.4 Serial Number	003 with 6 sets of lithium battery packs type LB1S (further No. 1, No. 2, No. 3, No. 4, No. 5, No. 6)
1.5 Function of the Equipment	The Equipment shall be capable of indicating the location of a unit in distress on the assisting unit's radar(s) by responding with emission of radio waves in 9 GHz band in the presence of 3 cm band emissions from radar stations.

1.6 Documentation submitted with the product

Draft User Manual for the SafeSea S100 Search and Rescue Transponder.

1.7 Technical specification

Name of the parameter and measures	Rated value
Frequency band of emitting signal, MHz	9200 to 9500
Effective isotropic radiated power, mW (dBm)	not less than 400 (26)
RF pulse emission, μ s	100
Quantity of frequency tunings of the response signal	12
Form of sweep	
- Forward sweep time, μ s	$7,5 \pm 1,0$
- Return sweep time, μ s	$0,4 \pm 0,1$
Sweep rate, MHz per 5 μ s	200
Duration of operation, not less than, h	
- in stand-by condition	96
- transmission mode while being continuously interrogated with a pulse repetition frequency of 1 kHz (after 96 h in stand-by condition)	8
Recovery time following excitation, not more than, μ s	10
Delay between receipt of radar signal and start of transmission, not more than, μ s	0,5
Polarisation	horizontal
Effective receiver sensitivity, better than, dBm	- 50
The weight of the transponder, not more than, kg	0,93
The length of the transponder, not more than, mm	370
The diameter of the transponder, not more than, mm	87
Effective antenna height, not less than, m	1 (see Note)

NOTE Effective antenna height for SART mounted on the attached telescopic pole.

Power supply	Lithium Iron disulfide (Li/FeS ₂) battery pack type LB1S manufactured by "Ocean Signal, Ltd." (Great Britain)
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Nominal power supply voltage, V	6,0
Minimum power supply voltage at which the transponder complies performance requirements, V	4,5

2. TEST PURPOSE

Test purpose is to confirm compliance of Search and Rescue Transponder “SafeSea S100” with standards IEC61097-1 (Second edition 2007-06) (hereinafter IEC61097-1) and IEC60945 (Fourth edition 2002-08) (hereinafter IEC60945) items: 4.5.1, 4.5.3, 4.7, 4.8, 4.9, 8.1, 8.2, 8.3, 8.5, 8.6.2, 8.7, 8.9.2, 8.11, 9.3.3, 10.1, 10.4, 10.9, 11.2.

3. TEST PROGRAMME AND METHODS OF TESTING

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.
1. Check labelling of SART	IEC61097-1 IEC60945	4 a), 4 b) 4.9	IEC61097-1 IEC60945	6.8 15
2. Technical characteristics test in standard climatic conditions at nominal voltage of the power supply:	IEC60945			
2.1. Effective receiver sensitivity test	IEC61097-1	5.8 paragraph 1	IEC61097-1	6.9.3
2.2. E.i.r.p. test	IEC61097-1	5.7	IEC61097-1	6.9.5
2.3. Frequency band test	IEC61097-1	5.1	IEC61097-1	6.9.4
2.4. Pulse emission test	IEC61097-1	5.6	IEC61097-1	6.9.4
2.5. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	IEC61097-1	5.3	IEC61097-1	6.9.4
2.6. Number of response signal sweeps tests	IEC61097-1	5.4	IEC61097-1	6.9.4
2.7. Recovery time	IEC61097-1	5.11	IEC61097-1	6.9.7
2.8. Form of sweep (sawtooth) tests	IEC61097-1	5.5	IEC61097-1	6.9.4
2.9. Check delay between receipt of radar signal and start of transmission	IEC61097-1	5.13	IEC61097-1	6.9.8
3. Check SART operation under low power voltage:				
3.1. Determining the lowest voltage at which the device will operate correctly	IEC61097-1	6.3.1 (a)	IEC61097-1	6.3.1 (a)
3.2. Frequency band test	IEC61097-1	5.1	IEC61097-1	6.9.4
3.3. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	IEC61097-1	5.3	IEC61097-1	6.9.4

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.
3.4. Number of response signal sweeps tests	IEC61097-1	5.4	IEC61097-1	6.9.4
3.5. Form of sweep (sawtooth) tests	IEC61097-1	5.5	IEC61097-1	6.9.4
4. Battery capacity at normal condition temperature	IEC61097-1	3.3	IEC61097-1	6.3.2 b)
5. Battery capacity at minus 20 °C	IEC61097-1	3.3	IEC61097-1	6.3.2 b)
6. Battery capacity at + 55 °C	IEC61097-1	3.3	IEC61097-1	6.3.2 b)
7. Check current and power consumption	IEC61097-1	6.3.2	IEC61097-1	6.3.1 b)
8. Low Temperature storage test at minus 30 °C	IEC61097-1	3.4	IEC61097-1	6.4.2.1
9. Low Temperature functional test at minus 20 °C	IEC61097-1 IEC60945	5.10 8.1, 7.1	IEC61097-1 IEC60945	6.4.2.2 8.4.2.2
10. Dry heat storage test at +65 °C	IEC61097-1 IEC60945	3.4, 5.10 8.1	IEC61097-1 IEC60945	6.4.1 8.2.1.2
11. Dry heat functional test at +55 °C	IEC61097-1 IEC60945	3.4, 5.10 8.1, 7.1	IEC61097-1 IEC60945	6.4.1 8.2.2.2
12. Vibration test	IEC60945	8.7	IEC60945	8.7
13. Damp heat functional test	IEC60945	8.3	IEC60945	8.3
14. Check SART floating	IEC61097-1	3.2 i)	IEC61097-1	6.2 i)
15. Drop into water test	IEC61097-1	3.2 f)	IEC61097-1	6.2 f)
16. Water tightness and thermal shock	IEC61097-1	3.2 h)	IEC61097-1	6.2 h)
17. Immersion test (100 kPa 5 min)	IEC61097-1	3.2 g)	IEC61097-1	6.2 g)
18. Check of radiated emissions from enclosure port	IEC60945	9.3.2	IEC60945	9.3.2
19. Immunity to radiated radiofrequency disturbance	IEC60945	10.4	IEC60945	10.4
20. Immunity to electrostatic discharge	IEC60945	10.9	IEC60945	10.9
21. Compass safe distance	IEC60945	11.2.3	IEC60945	11.2.2

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.
22. Check receiver protection (28 dBW/m ² at radar distance 20m)	IEC61097-1	5.8 paragraph 2	IEC61097-1	6.9.9
23. Range performance	IEC61097-1	3.7	IEC61097-1 ITU-R M.628-4	6.7.1 Annex 2
24. Oil resistance	IEC61097-1	3.2 k)	IEC61097-1 IEC60945	6.2 k) 8.11.3
25. Corrosion	IEC61097-1	3.2 k)	IEC61097-1 IEC60945	6.2 k) 8.12.1
26. Buoyancy and length of lanyard	IEC61097-1	3.2 j)	IEC61097-1	6.2 j)
27. Solar radiation	IEC61097-1	3.2 l)	IEC61097-1 IEC60945	6.2 l) 8.10.3
28. Antenna height	IEC61097-1	3.2 o), 3.5, 5.12	IEC61097-1	6.2 o), 6.5
29. Antenna characteristics	IEC61097-1	3.6, 5.14, 5.15	IEC61097-1	6.6.1
30. Polarisation	IEC61097-1	5.2	IEC61097-1	6.6.2

4. TEST CONDITIONS

The procedure and test conditions comply with the requirements of international standards IEC 61097-1, IEC 60945.

Climatic conditions:

Normal environmental conditions (IEC 60945 5.2.1):

temperature 15 °C to 35 °C;

relative humidity 20 % to 75 %.

Extreme environmental conditions (IEC 61097-1 5.10):

Ambient temperature range: -20 °C to + 55 °C

Storage temperature range: -30 °C to + 65 °C

Accuracy of maintenance of climatic conditions:

- Temperature $\pm 2^{\circ}\text{C}$
- Humidity $\pm 3\%$

Powered by the set of regular Lithium Iron disulfide (Li/FeS₂) battery pack type LB1S manufactured by "Ocean Signal, Ltd." (Great Britain), except for tests at reduced voltage.

Accuracy of measurement of voltage $\pm 2\%$.

Actual climatic conditions during all tests are given in Appendix A to the Test Report.

Functional test signals

Test signal 1. The signal shall be a pulsed carrier with a repetition frequency of 3 kHz. The rise time and decay time between the 10 % and 90 % values of the pulse amplitude shall be 20 ns \pm 5 ns. The duration of the pulses between the 90 % values shall be 80 ns \pm 10 ns.

Test signal 2. The signal shall be a pulsed carrier with a repetition frequency of 1 kHz. The rise time and decay time between the 10 % and 90 % values of the pulse amplitude shall be 20 ns \pm 5 ns.

The duration of the pulses between the 90 % values shall be 500 ns \pm 50 ns.

Test signal 3. The signal shall be a pulsed carrier with a repetition frequency of 1 kHz. The rise time and decay time between the 10 % and 90 % values of the pulse amplitude shall be 20 ns \pm 5 ns. The duration of the pulses between the 90 % values shall be 1 μs \pm 0,1 μs .

5. TEST SCHEDULE

Schedule of the tests of Search and Rescue Transponder "SafeSea S100"

Parameter to be tested	Date of testing
1. Check labelling of SART	14.08.2010
2. Technical characteristics test in standard climatic conditions at nominal voltage of the power supply:	4.08.2010
2.1. Effective receiver sensitivity test	4.08.2010
2.2. E.i.r.p. test	4.08.2010
2.3. Frequency band test	4.08.2010
2.4. Pulse emission test	4.08.2010
2.5. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	4.08.2010
2.6. Number of response signal sweeps tests	4.08.2010
2.7. Recovery time	4.08.2010
2.8. Form of sweep (sawtooth) tests	4.08.2010
2.9. Check delay between receipt of radar signal and start of transmission	4.08.2010
3. Check SART operation under low power voltage:	4.08.2010
3.1. Frequency band test	4.08.2010
3.2. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	4.08.2010
3.3. Number of response signal sweeps tests	4.08.2010
3.4. Form of sweep (sawtooth) tests	4.08.2010
4. Battery capacity at normal condition temperature	7.08 - 11.08.2010
5. Battery capacity at minus 20 °C	7.08 - 11.08.2010
6. Battery capacity at + 55 °C	7.08 - 11.08.2010
7. Check current and power consumption	04.08.2010
8. Low Temperature storage test at (minus) 30 °C	4.08 - 5.08.2010
9. Low Temperature functional test at (minus) 20 °C	4.08 - 5.08.2010
10. Dry heat storage test at +65 °C	06.08.2010
11. Dry heat functional test at +55 °C	07.08.2010
12. Vibration test	09.08.2010
13. Damp heat functional test	7.08 - 8.08.2010
14. Check SART floating	09.08.2010
15. Drop into water test	09.08.2010
16. Water tightness and thermal shock	10.08.2010
17. Immersion test (100 kPa 5 min)	10.08.2010

Parameter to be tested	Date of testing
18. Check of radiated emissions from enclosure port	11.08.2010
19. Immunity to radiated radiofrequency disturbance	11.08.2010
20. Immunity to electrostatic discharge	11.08.2010
21. Compass safe distance	19.08.2010
22. Check receiver protection (28 dBW/m ² at radar distance 20m)	16.08.2010
23. Range performance	19.08.2010
24. Oil resistance	23.08.2010
25. Corrosion	16.09.2010 (date of inspection of documents)
26. Buoyancy and length of lanyard	15.09.2010
27. Solar radiation	16.09.2010 (date of inspection of documents)
28. Antenna height	15.09.2010
29. Antenna characteristics	16.09.2010 (date of inspection of documents)
30. Polarisation	16.09.2010 (date of inspection of documents)

6. TEST RESULTS

Summary of test results are given in Table 1.

Detailed test results are given in Appendix A and its parts.

Table 1.

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.	Test result
1. Check the package contents and compliance of SART with instructions.	IEC 60945	4.7, 4.8			Pass (See Appendix A1)
2. Check labelling of SART	IEC61097-1 IEC60945	4 a), 4 b) 4.9	IEC61097-1 IEC60945	6.8 15	Pass (See Appendix A2)
3. Technical characteristics test in standard climatic conditions at nominal voltage of the power supply:					
3.1. Effective receiver sensitivity test	IEC61097-1	5.8 paragraph 1	IEC61097-1	6.9.3	Pass (See Appendix A3)
3.2. E.i.r.p. test	IEC61097-1	5.7	IEC61097-1	6.9.5	Pass (See Appendix A3)
3.3. Frequency band test	IEC61097-1	5.1	IEC61097-1	6.9.4	Pass (See Appendix A3)
3.4. Pulse emission test	IEC61097-1	5.6	IEC61097-1	6.9.4	Pass (See Appendix A3)
3.5. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	IEC61097-1	5.3	IEC61097-1	6.9.4	Pass (See Appendix A3)
3.6. Recovery time	IEC61097-1	5.11	IEC61097-1	6.9.7	Pass (See Appendix A3)
3.7. Form of sweep (sawtooth) tests	IEC61097-1	5.5	IEC61097-1	6.9.4	Pass (See Appendix A3)
3.8. Number of response signal sweeps tests	IEC61097-1	5.4	IEC61097-1	6.9.4	Pass (See Appendix A3)
3.9. Check delay between receipt of radar signal and start of transmission	IEC61097-1	5.13	IEC61097-1	6.9.8	Pass (See Appendix A3)
4. Check SART operation under low power voltage:					
4.1. Frequency band test	IEC61097-1	5.1	IEC61097-1	6.9.4	Pass (See Appendix A4)
4.2. Sweep rate, the nonlinearity of frequency tuning, start point of returning back of the signal tests	IEC61097-1	5.3	IEC61097-1	6.9.4	Pass (See Appendix A4)

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.	Test result
4.3. Number of response signal sweeps tests	IEC61097-1	5.4	IEC61097-1	6.9.4	Pass (See Appendix A4)
4.4. Form of sweep (sawtooth) tests	IEC61097-1	5.5	IEC61097-1	6.9.4	Pass (See Appendix A4)
5. Check current and power consumption	IEC61097-1	6.3.2	IEC61097-1	6.3.1 b)	Pass (See Appendix A3)
6. Battery capacity at normal condition temperature	IEC61097-1	3.3	IEC61097-1	6.3.2 b)	Pass (See Appendix A14)
7. Battery capacity at minus 20 °C	IEC61097-1	3.3	IEC61097-1	6.3.2 b)	Pass (See Appendix A15)
8. Battery capacity at + 55 °C	IEC61097-1	3.3	IEC61097-1	6.3.2 b)	Pass (See Appendix A16)
9. Low Temperature storage test at (minus) 30 °C	IEC61097-1	3.4	IEC61097-1	6.4.2.1	Pass (See Appendix A5)
10. Low Temperature functional test at (minus) 20 °C	IEC61097-1 IEC60945	5.10 8.1, 7.1	IEC61097-1 IEC60945	6.4.2.2 8.4.2.2	Pass (See Appendix A5)
11. Dry heat storage test at +65 °C	IEC61097-1 IEC60945	3.4, 5.10 8.1	IEC61097-1 IEC60945	6.4.1 8.2.1.2	Pass (See Appendix A6)
12. Dry heat functional test at +55 °C	IEC61097-1 IEC60945	3.4, 5.10 8.1, 7.1	IEC61097-1 IEC60945	6.4.1 8.2.2.2	Pass (See Appendix A7)
13. Vibration test	IEC60945	8.7	IEC60945	8.7	Pass (See Appendix A9)
14. Damp heat functional test	IEC60945	8.3	IEC60945	8.3	Pass (See Appendix A8)
15. Check SART floating	IEC61097-1	3.2 i)	IEC61097-1	6.2 i)	Pass (See Appendix A10)
16. Drop into water test	IEC61097-1	3.2 f)	IEC61097-1	6.2 f)	Pass (See Appendix A11)
17. Water tightness and thermal shock	IEC61097-1	3.2 h)	IEC61097-1	6.2 h)	Pass (See Appendix A12)
18. Immersion test (100 kPa 5 min)	IEC61097-1	3.2 g)	IEC61097-1	6.2 g)	Pass (See Appendix A12) Note. This test was associated with water tightness and thermal shock
19. Spurious emission test	IEC60945	9.3.3	IEC60945	9.3.2	Pass (See Appendix A13)
20. Immunity to radiated radiofrequency disturbance	IEC60945	10.4	IEC60945	10.4	Pass (See Appendix A17)

Parameter to be tested	Standard of requirements	Standard item No.	Standard of methods	Standard item No.	Test result
21. Immunity to electrostatic discharge	IEC60945	10.9	IEC60945	10.9	Pass (See Appendix A18)
22. Compass safe distance	IEC60945	11.2.3	IEC60945	11.2.2	Pass (See Appendix A19)
23. Check receiver protection (28 dBW/m2 at radar distance 20m)	IEC61097-1	5.8 paragraph 2	IEC61097-1	6.9.9	Pass (See Appendix A20)
24. Range performance	IEC61097-1	3.7	IEC61097-1 ITU-R M.628-4	6.7, 6.7.1 -6.7.4 Annex 2	Pass (See Appendix A21)
25. Oil resistance	IEC61097-1	3.2 k)	IEC61097-1 IEC60945	6.2 k) 8.11.3	Pass (See Appendix A22)
26. Corrosion	IEC61097-1	3.2 k)	IEC61097-1 IEC60945	6.2 k) 8.12.1	Pass (See Appendix A23)
27. Buoyancy and length of lanyard	IEC61097-1	3.2 j)	IEC61097-1	6.2 j)	Pass (See Appendix A24)
28. Solar radiation	IEC61097-1	3.2 l)	IEC61097-1 IEC60945	6.2 l) 8.10.3	Pass (See Appendix A25)
29. Antenna height	IEC61097-1	3.2 o), 3.5, 5.12	IEC61097-1	6.2 o), 6.5	Pass (See Appendix A26)
30. Antenna characteristics	IEC61097-1	3.6, 5.14, 5.15	IEC61097-1	6.6.1	Pass (See Appendix A27)
31. Polarisation	IEC61097-1	5.2	IEC61097-1	6.6.2	Pass (See Appendix A27)

Test Engineer



Volsky I. S.

7. CONCLUSION

Sample of Search and Rescue Transponder “SafeSea S100” Serial No 003 made by “Ocean Signal Ltd.” with 6 sets of lithium battery packs type LB1S made by “Ocean Signal Ltd.” (Great Britain) have been tested in accordance with standards IEC61097-1 (Second edition 2007-06) and IEC60945 (Fourth edition 2002-08) items: 4.5.1, 4.5.3, 4.7, 4.8, 4.9, 8.1, 8.2, 8.3, 8.5, 8.6.2, 8.7, 8.9.2, 8.11, 9.3, 10.1, 10.4, 10.9, 11.2.

Sample of Search and Rescue Transponder “SafeSea S100” Serial No 003 complies with the requirements of standards IEC61097-1 and IEC60945 (2002) items: 4.5.1, 4.5.3, 4.7, 4.8, 4.9, 8.1, 8.2, 8.3, 8.5, 8.6.2, 8.7, 8.9.2, 8.11, 9.3, 10.1, 10.4, 10.9, 11.2.

Manager of department



Yurasov E.S.

APPENDIX A

Tests Results For Search and Rescue Transponder “SafeSea S100”

TEST REPORT NO. 10/591

Search and Rescue Transponder “SafeSea S100”

for compliance with IEC61097-1 and IEC60945

Manufacturer “Ocean Signal Ltd.”, Great Britain

Appendix A1**Check the package contents and compliance of SART with instructions**

Standard	IEC 60945 4.7, 4.8
Model of SART	SafeSea S100
Serial Number	No. 003
Sample Number of battery pack	No. 1, No. 2, No. 3, No. 4, No. 5, No. 6
Date of Tests	14.08.2010
Ambient air temperature	30 °C
Ambient air humidity	54 %

Test results:

	Kit Parts of SART	quantity	availability
1.	bracket	1	1
2.	Search and Rescue Transponder (SART)	1	1
3.	pole	1	1
4.	User Manual	1	1

Documentation submitted - Draft User Manual contains information about SART structure, technical specifications, operating instructions and order maintenance, replacement battery elements, check SART with the help of ship radar. SART repair does not specify. Documentation is made in English. The amount of information is sufficient for proper operation and maintenance of SART.

SART set provided corresponds to the set listed in Draft User Manual.

Requirements IEC 60945 4.7, 4.8

Adequate information must be provided in order to permit the proper operation, maintenance and repair.

Requirements to the completeness

SART package contents shall comply with the list specified in the accompanying operational documentation



Photo 1 – SART "SafeSea S100"



Photo 2 – SART "SafeSea S100"



Photo 3 – SART “SafeSea S100”



Photo 4 – SART “SafeSea S100”



Photo 5 – SART “SafeSea S100”



Photo 6 – Pole, SART “SafeSea S100”



Photo 7 – Pole, SART "SafeSea S100"



Photo 8 - battery, SART "SafeSea S100"



Photo 9 – SART “SafeSea S100”



Photo 10 – Pole, SART “SafeSea S100”

Conclusion

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements IEC 60945 4.7, 4.8
Sample No. 1	yes

Appendix A2

Check labelling of SART

Standard	IEC 61097-1 item 4 a), 4 b) IEC60945 item 4.9
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Model of SART	SafeSea S100
Serial Number	No. 003
Sample Number of battery pack	No. 1
Date of Tests	14.08.2010
Ambient air temperature	30 °C
Ambient air humidity	54 %

Requirements of IEC 61097-1 4 a), 4 b)	Results of check
In addition to the items specified in IMO Resolution A.694 (17), the following shall be clearly indicated on the exterior of the equipment: - Brief operation instructions (in English) - expire date (in English) for the primary battery used (expire date is battery replacement date).	yes yes
Requirements of IEC60945 item 4.9	
Each device equipment must be provided with following labeling on the outside, clearly distinguishable under normal conditions of equipment installed: 1. Information about manufacturer 2. Type number of radio equipment and its name, under which the type approval was conducted 3. Serial Number	yes yes yes



Photo 11 – SART “SafeSea S100” with battery, labeling



Photo 12 – SART “SafeSea S100” labeling



Photo 13– SART “SafeSea S100” labeling



Photo 14 – Battery, SART “SafeSea S100” labelling

Conclusion

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements IEC 61097-1 item 4 a), 4 b) IEC60945 item 4.9
Sample No. 1	yes

Appendix A3

Technical characteristics test in standard climatic conditions at nominal voltage of the power supply

Standard	IEC 61097-1 item.5
Model of SART	SafeSea S100
Serial Numbers	No. 003
Sample Number of battery pack	No. 1
Date of Tests	04.08.2010
Ambient air temperature	30 °C
Ambient air humidity	54 %
Rated voltage	6.0 V

Tests of SART " SafeSea S100" were conducted at ambient temperature along with battery pack (No. 1).
Current consumptions have been measured with the help of oscilloscope TDS3052B across the load of 0,3 Ohm.

Standard 61097-1 requirement	Name of the parameter	Rated value	Measured value
5.8	Effective receiver sensitivity (for test signal 1)	not more than -37 dBm	-51,61 (at 9200 MHz) -51,42 (at 9350 MHz) -52,51 (at 9500 MHz)
5.8	Effective receiver sensitivity (for test signal 2)	not more than -50 dBm	-51,92 (at 9200 MHz) -52,0 (at 9350 MHz) -52,61 (at 9500 MHz)
5.7	Effective isotropic radiated power	not less than 400 mW	460 mW
5.1	High frequency of radiated power	(9500+60) MHz	9516,3 MHz
5.1	Low frequency of radiated power	(9200-60) MHz	9175,0 MHz
5.6	RF pulse emission	100 μ s	94,0 μ s
5.3 6.9.4.2	Sweep rate 200 MHz per 5 μ s Sweep profile	within \pm 20 MHz of the linear sweep between the 9 200 MHz and the 9 500 MHz	253.8 MHz per 5 μ s MAX Sweep deviation: +7,6 MHz MIN Sweep deviation: -7,3 MHz
5.4	Response signal check	12	12
5.11	Recovery time following excitation (for test signal 3)	not more than 10 μ s	6.74 μ s
5.5	Forward sweep time	(7,5 \pm 1) μ s	7,46 μ s
5.5	Return sweep time	(0,4 \pm 0,1) μ s	0.320 μ s
5.13	Delay between receipt of radar signal and start of transmission	not more than 0.5 μ s	0.22 μ s
6.1	Definition time for which technical requirement of 61097-1 shall be met	Within 5 min	Less then 5 min
6.3.1 b)	Average current measurement of standby (I ₁) and transmitting (I ₂) mode		I ₁ =17 mA; I ₂ =78 mA

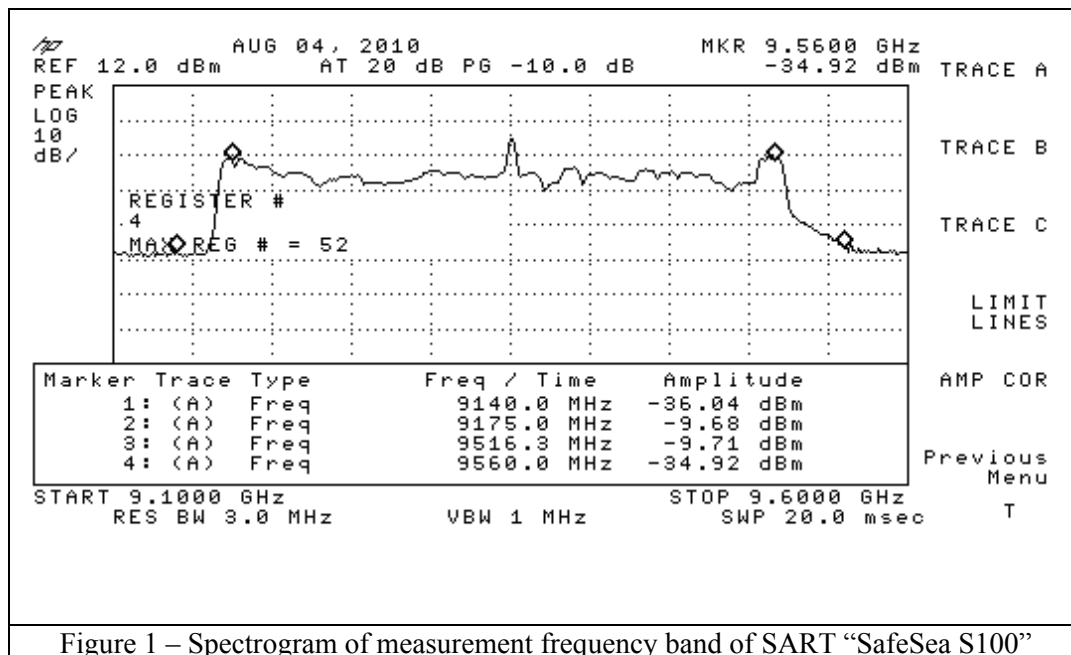


Figure 1 – Spectrogram of measurement frequency band of SART “SafeSea S100”

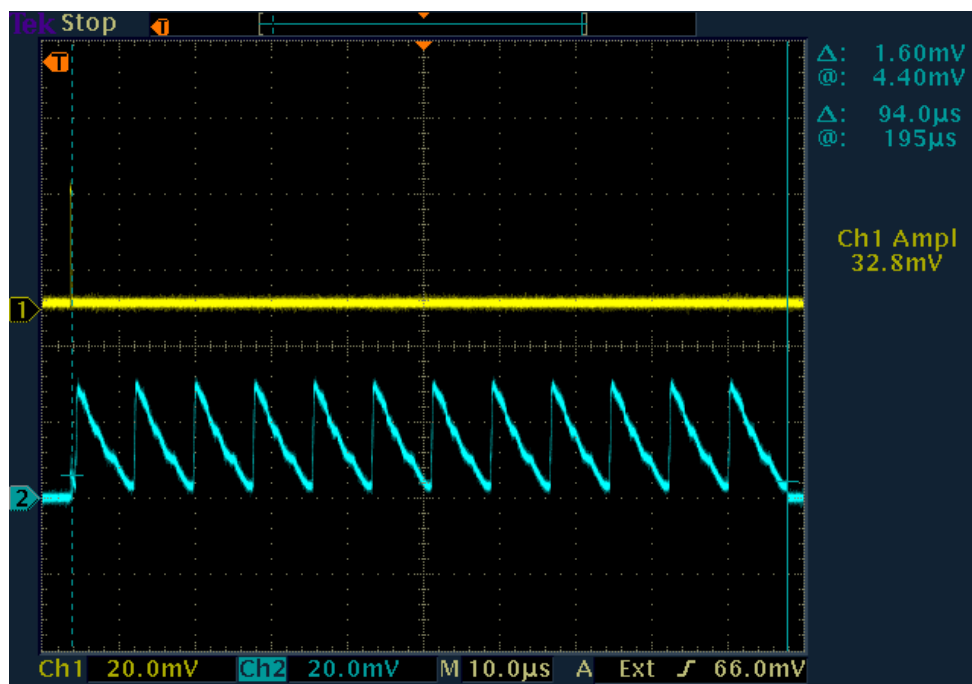
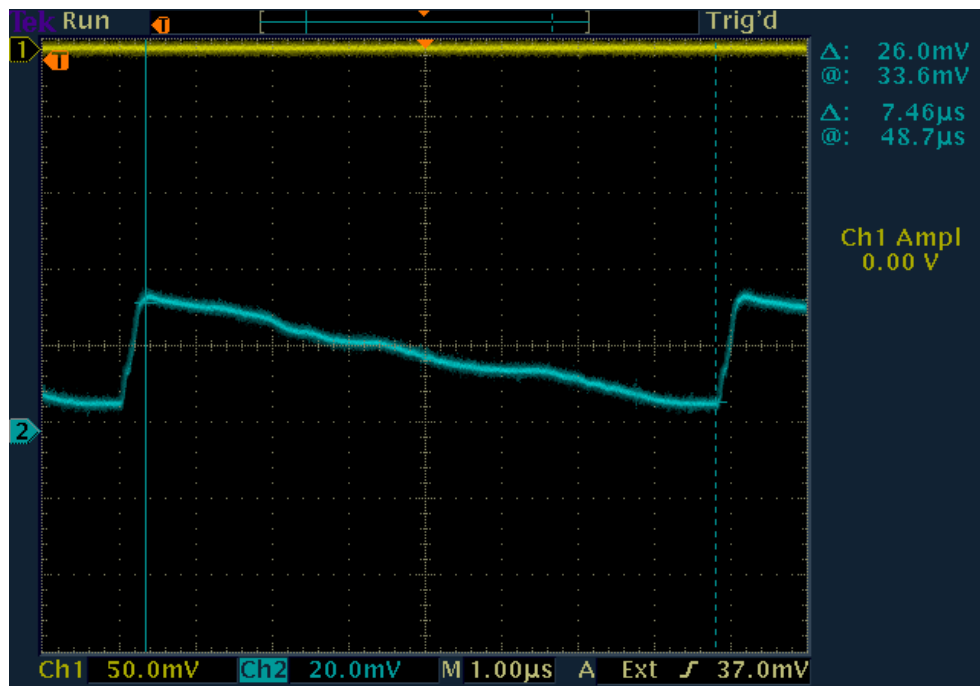


Figure 2 – 12 frequency sweeps of the response signal of SART “SafeSea S100”

Note: The oscillogram shows forward and return sweeps of radio frequency during SART response. The oscillogram is got after detection of signal with use of linear slope of resonance envelope of waveguide resonance contour. Resonance contour is tuned on frequency low 9100 MHz. Resonance contour has linear slope of resonance envelope from 9200 MHz - 9500 MHz. Maximum amplitude of detected signal on the oscillogram corresponds with minimum SART response frequency. Minimum amplitude of detected signal on the oscillogram corresponds with maximum SART response frequency.



Note: The oscillogram shows one forward sweep of radio frequency during SART response. The oscillogram is got after detection of signal with use of linear slop of resonance envelope of waveguide resonance contour. Maximum amplitude of detected signal on the oscillogram corresponds with minimum SART response frequency. Minimum amplitude of detected signal on the oscillogram corresponds with maximum SART response frequency. Duration of the frequency forward sweep is measured from moment of maximum amplitude on oscillogram to the moment of minimum amplitude on oscillogram.

Figure 3 – Forward sweep time of the response signal of SART “SafeSea S100”

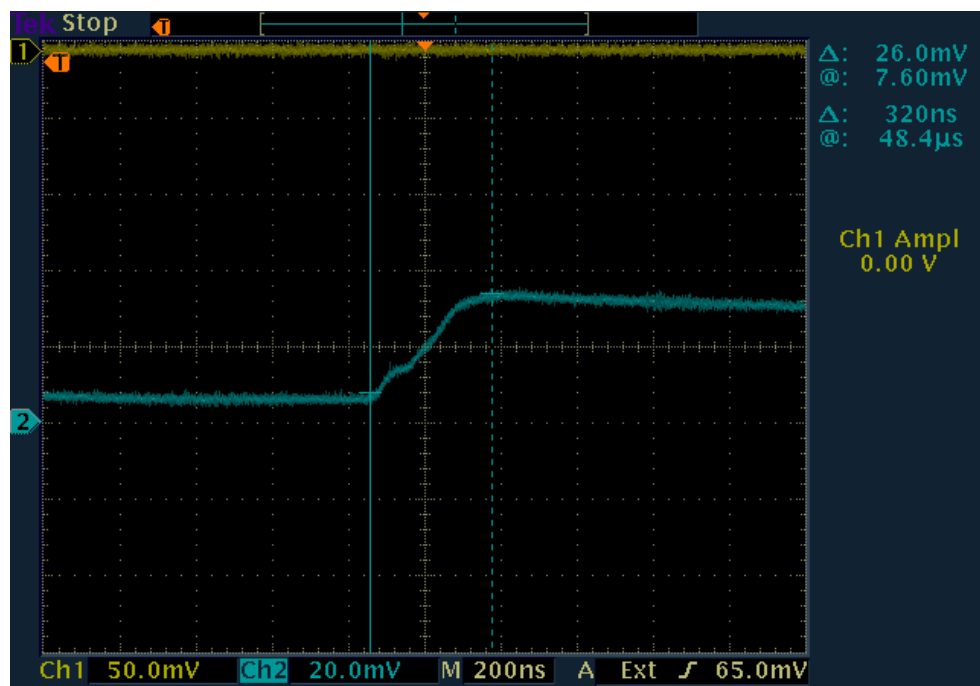


Figure 4 – Return sweep time of the response signal of SART “SafeSea S100”

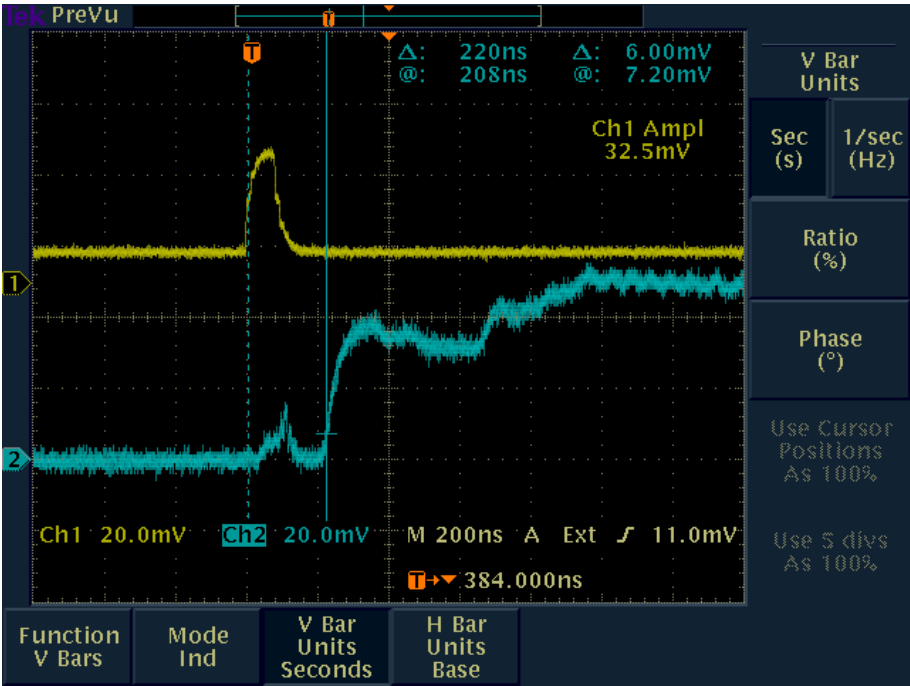


Figure 5– Delay between receipt of radar signal and start of transmission

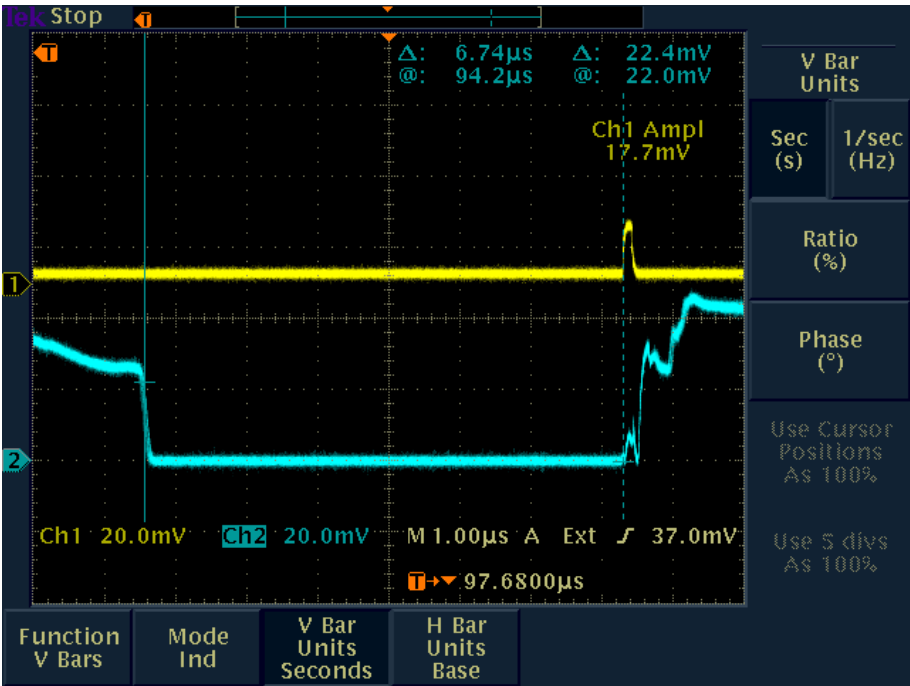
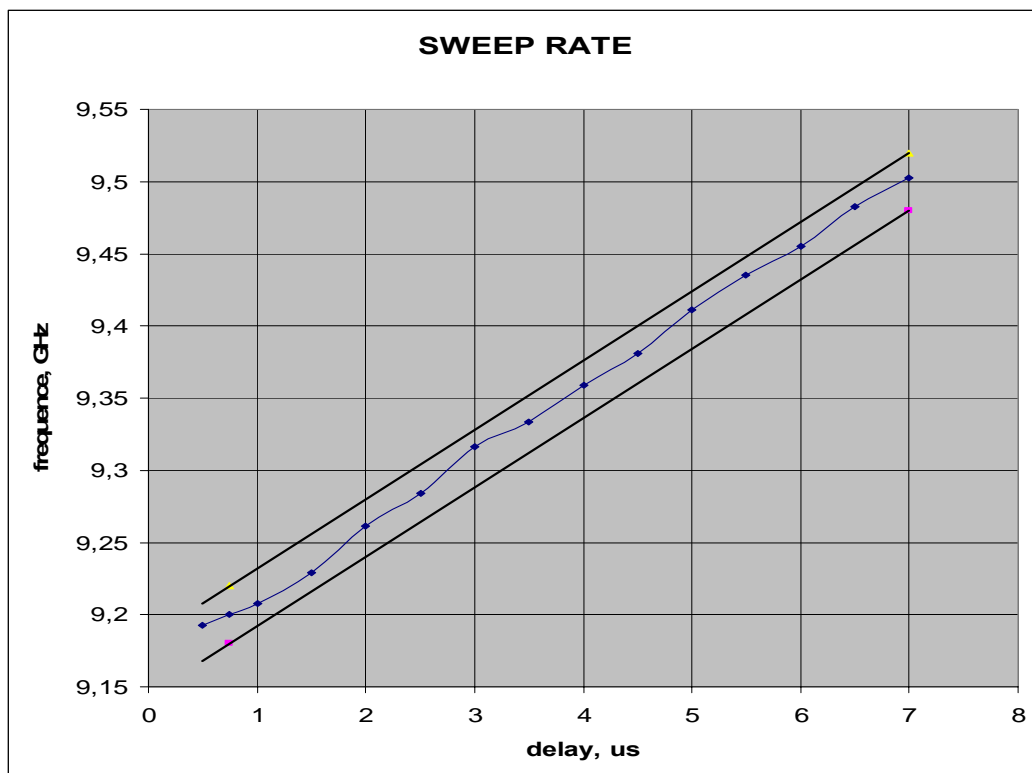


Figure 6 –Recovery time following excitation

Sweep profile calculates using method by turn frequency measurements during forward sweep with the time delays through 0,5 us between 9200 MHz and 9500 MHz.

Table.

Delay, us	Frequency, MHz	Proximal line, MHz	Delta from linear, MHz	Status	Pass/Fail
0,5	9192,5	-	-	out range	-
0.75	9200	9200	0	begin	-
1	9207,5	9212,1	4,6		Pass
1,5	9228,7	9236,3	7,6	+max	Pass
2	9261,2	9260,5	-0,7		Pass
2,5	9283,7	9284,7	1		Pass
3	9316,2	9308,9	-7,3	-max	Pass
3,5	9333,7	9333,1	-0,6		Pass
4	9358,7	9357,3	-1,4		Pass
4,5	9381,2	9381,5	0,3		Pass
5	9411,2	9405,7	-5,5		Pass
5,5	9435	9429,9	-5,1		Pass
6	9455	9454,1	-0,9		Pass
6,5	9482,5	9478,3	-4,2		Pass
7	9502,5	9502,5	0	finish	-



Graphic 1. Linear sweep profile

TEST EQUIPMENT USED:

8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

Conclusion

Search and Rescue Transponder "SafeSea S100"	conforms to the requirements of IEC 61097-1 5.1, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.11, 5.13, 6.1
Sample No. 1	yes

Appendix A4

Check SART operation under low power voltage

Standard	IEC 61097-1 items 5.1, 5.3, 5.4, 5.5, 6.3.1
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Model of SART	SafeSea S100
Serial Numbers	No. 003
Sample Number of battery pack	No. 1
Date of Tests	04.08.2010
The temperature inside of the climatic chamber	20 °C

Tests of SART " SafeSea S100" were conducted at a temperature of +20 ° C along with an external power supply. Current consumptions have been measured with the help of oscilloscope TDS3052B across the load of 0,3 Ohm.

The lowest voltage at which device operate correctly has been measured.

The voltage of external power supply has been gradually decreased and correct operation has been monitored.

Criterion of correct operation was uninterrupted SART transmission during interrogating with test signal 2.

The lowest voltage at which device operate correctly has been determined as 4.5 V.

Test results:

Specification item	Name of the parameter	Rated value	Measured value
5.1	High frequency of radiated power	(9500+60) MHz	9516,3 MHz
5.1	Low frequency of radiated power	(9200-60) MHz	9175,8 MHz
5.3 6.9.4.2	Sweep rate 200 MHz per 5µs Sweep profile	within ±20 MHz of the linear sweep between the 9 200 MHz and the 9 500 MHz	256.3 MHz per 5µs MAX Sweep deviation: 13.4 MHz MIN Sweep deviation: -11.2 MHz
5.4	Response signal check	12	12
5.6	RF pulse emission	100 µs	93,6 µs
5.5	Forward sweep time	(7,5 ± 1) µs	7,46 µs
5.5	Return sweep time	(0,4 ± 0,1) µs	0,332 µs
6.3.1 a)	The lowest voltage at which device operate correctly		4.5 V
6.3.1 b)	Average current measurement of standby (I ₁) and transmitting (I ₂) mode at minimum voltage		I ₁ =14,5 mA; I ₂ =72,2 mA

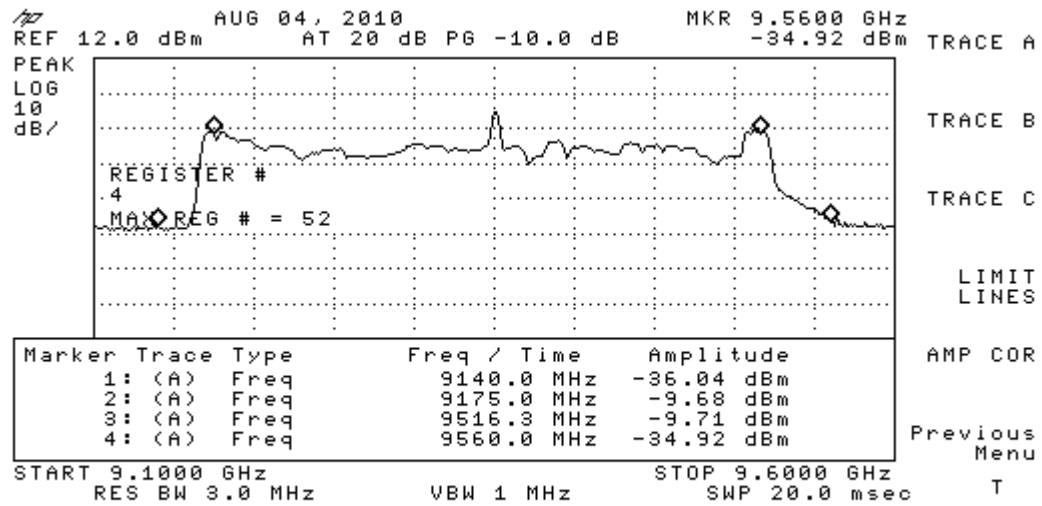


Figure 7 – Spectrogram of measurement frequency band of SART “SafeSea S100” at minimum voltage of the power supply

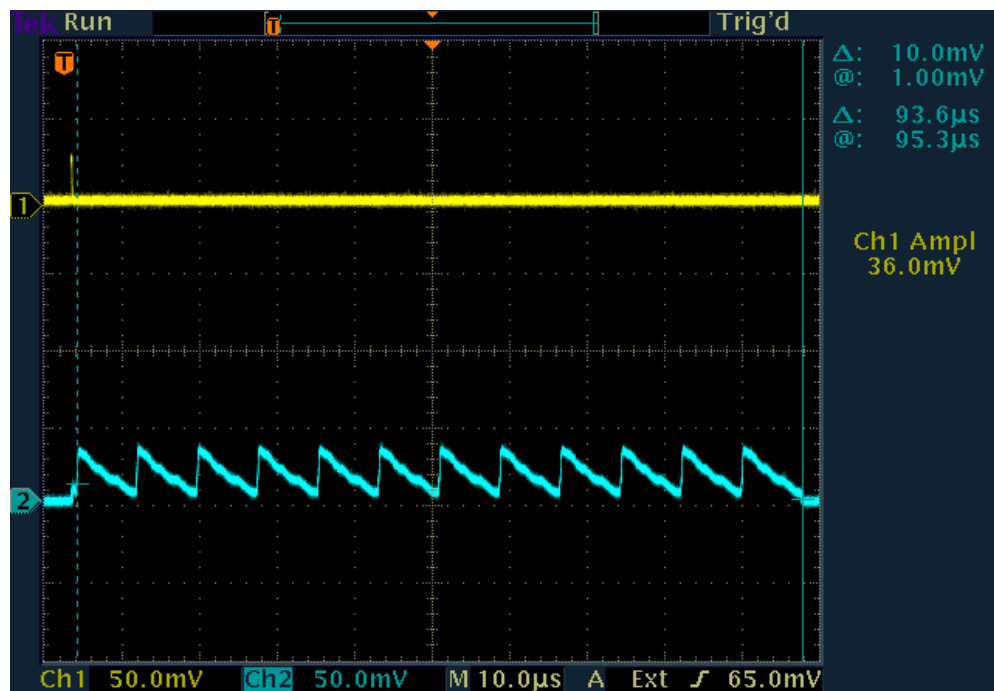


Figure 8 – 12 frequency sweeps of the response signal of SART “SafeSea S100” at minimum voltage of the power supply

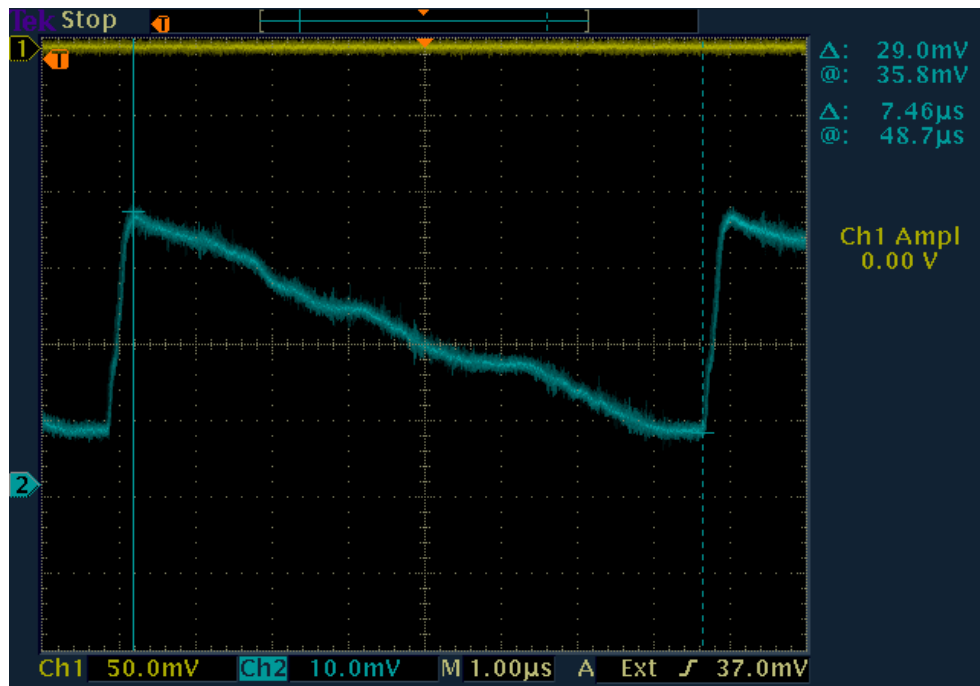


Figure 9 – Forward sweep time of the response signal of SART “SafeSea S100” at minimum voltage of the power supply

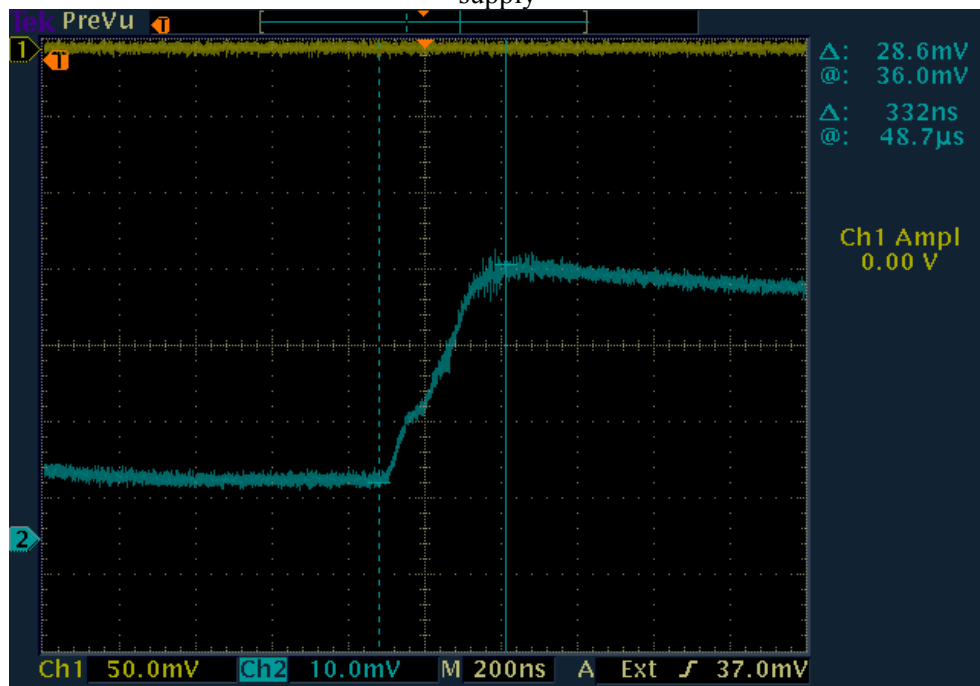


Figure 10 – Return sweep time of the response signal of SART “SafeSea S100” at minimum voltage of the power supply

TEST EQUIPMENT USED:

8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

Conclusion

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of IEC 61097-1 5.1, 5.3, 5.4, 5.5, 6.3.1
Sample No. 1	yes

Appendix A5

Low temperature cycle

(low temperature storage test (minus 30 °C) and low temperature functional test (minus) 20 °C)

Standard	IEC 61097-1 items 3.4, 5.10, 6.4.2
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Model of SART	SafeSea S100
Serial Numbers	No. 003
Sample Number of battery pack	No. 1
Date of Tests	4-5.08.2010
The temperature inside of the climatic chamber	minus 30 °C, then minus 20 °C

The SART has been placed to the climatic chamber in turned off condition.

The temperature inside the climatic chamber was set to (minus) 30 °C (minimal stowage temperature of the SART). Retention interval was 10 h. Then the temperature inside the climatic chamber was set to (minus) 20 °C (minimal operation temperature of the SART). The interval of temperature rising was 30 min.

Then the SART has been turned on.

Pending of 2 h the SART parameters were under control:

Specification item	Name of the parameter	Rated value	Measured value
5.1	High frequency of radiated power	(9500+60) MHz	9508,8 MHz
5.1	Low frequency of radiated power	(9200-60) MHz	9183,8 MHz
5.6	RF pulse emission	100 µs	94,0 µs
5.5	Forward sweep time	(7,5±1) µs	7,48 µs
5.5	Return sweep time	(0,4±0,1) µs	0,328 µs
5.4	Quantity of frequency tunings of the response signal	12	12

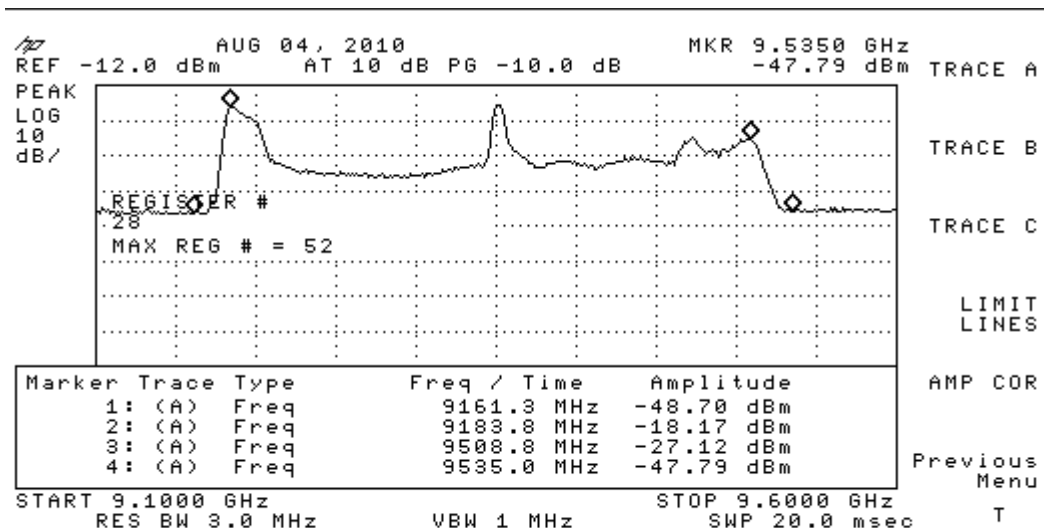


Figure 11 – Spectrogram of measurement frequency band of SART "SafeSea S100"

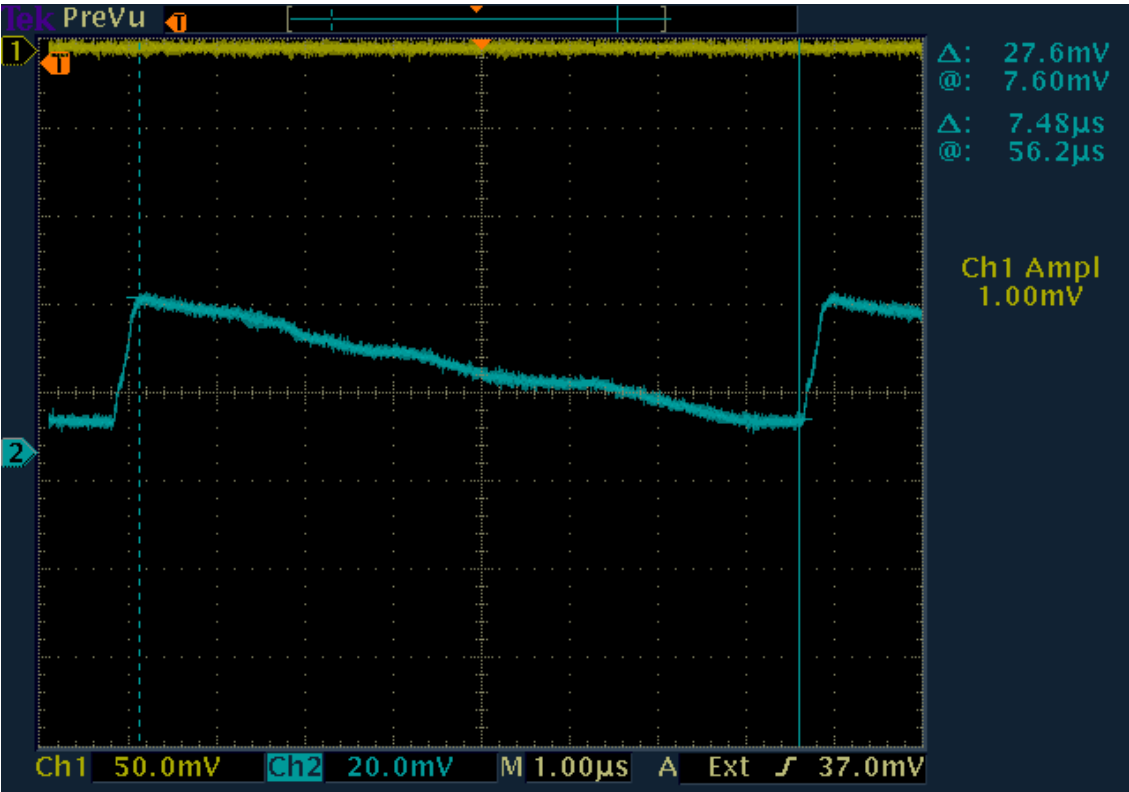


Figure 12 – Forward sweep time of the response signal of SART “SafeSea S100”

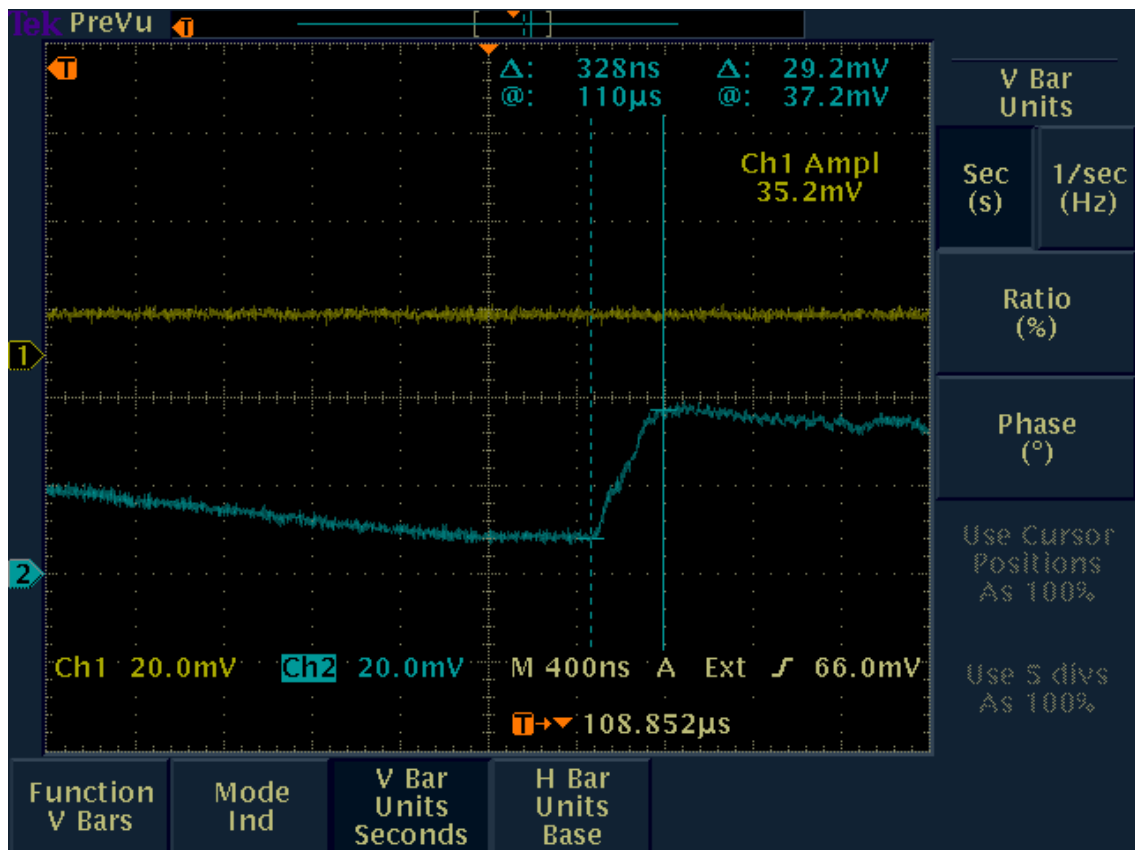


Figure 13 – Return sweep time of the response signal of SART “SafeSea S100”

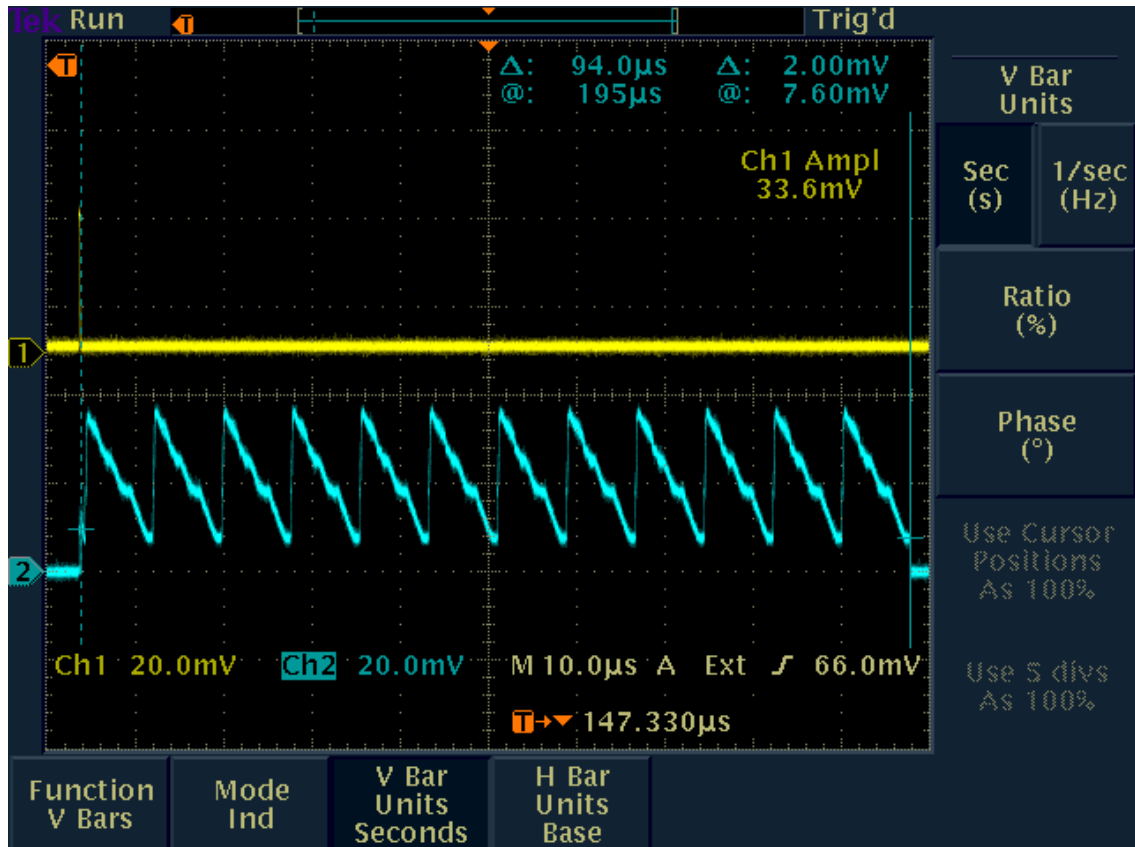


Figure 14 – 12 frequency sweeps of the response signal of SART “SafeSea S100”

Test results:

The SART complies with IEC 61097-1 3.4, 5.10

Requirements of IEC 61097-1 3.4, 5.10

The SART shall be so designed as to be able to operate under ambient temperatures of -20 °C. It shall not be damaged in stowage throughout the temperature of -30 °C.

TEST EQUIPMENT USED:

5, 8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

Conclusion

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of IEC 61097-1 3.4, 5.10, IEC 60945 8.4.2.2
Sample No. 1	yes

Appendix A6

Dry heat storage test (at temperature +65 °C)

Standard	IEC 61097-1 item 3.4
Model of SART	SafeSea S100
Serial Numbers	No. 003
Sample Number of battery pack	No. 1
Date of Tests	6.08.2010
The temperature inside of the climatic chamber	+65 °C, then +20 °C

The SART has been placed to the climatic chamber in turned off condition.

The temperature inside the climatic chamber was set to +65 °C (maximum stowage temperature of the SART). Retention interval was 10 h.

Then the temperature inside the climatic chamber was set to + 20 °C (nominal temperature) for 2 h.

Then the SART has been turned on and put to the test.

Tests results are listed in the table below:

Specification item	Name of the parameter	Rated value	Measured value
5.1	High frequency of radiated power	(9500+60) MHz	9505,0 MHz
5.1	Low frequency of radiated power	(9200-60) MHz	9180,0 MHz
5.6	RF pulse emission	100 µs	94,0 µs
5.5	Forward sweep time	(7,5±1) µs	7,42 µs
5.5	Return sweep time	(0,4±0,1) µs	0,32 µs
5.4	Quantity of frequency tunings of the response signal	12	12

Test results:

The SART complies with IEC 61097-1 3.4, 5.10

Requirements of IEC 61097-1 3.4, IEC 60945 8.2.1.2

The SART shall not be damaged in storage throughout the temperature of +65 °C.

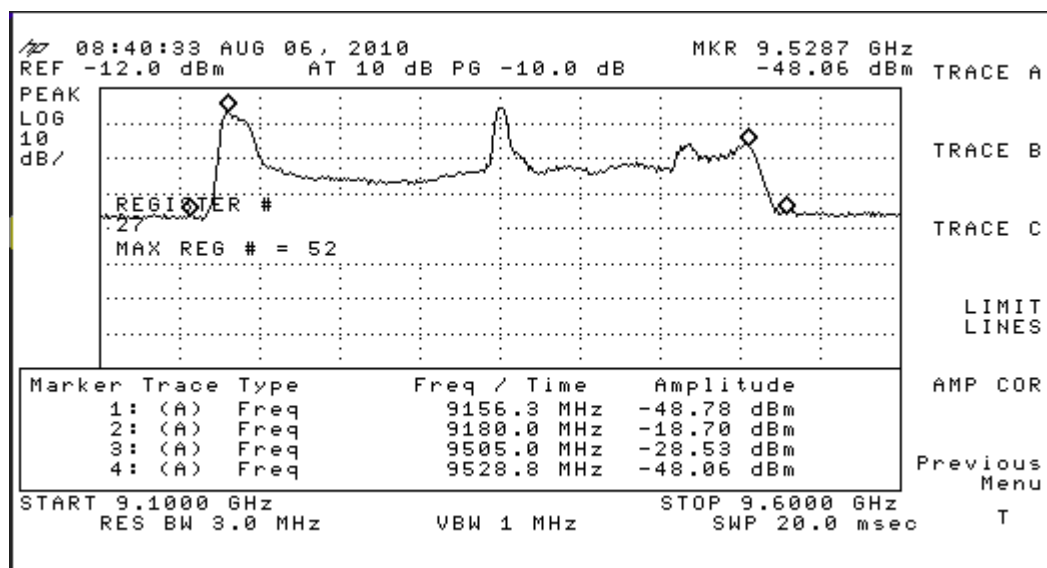


Figure 15 – Spectrogram of measurement frequency band of SART "SafeSea S100"

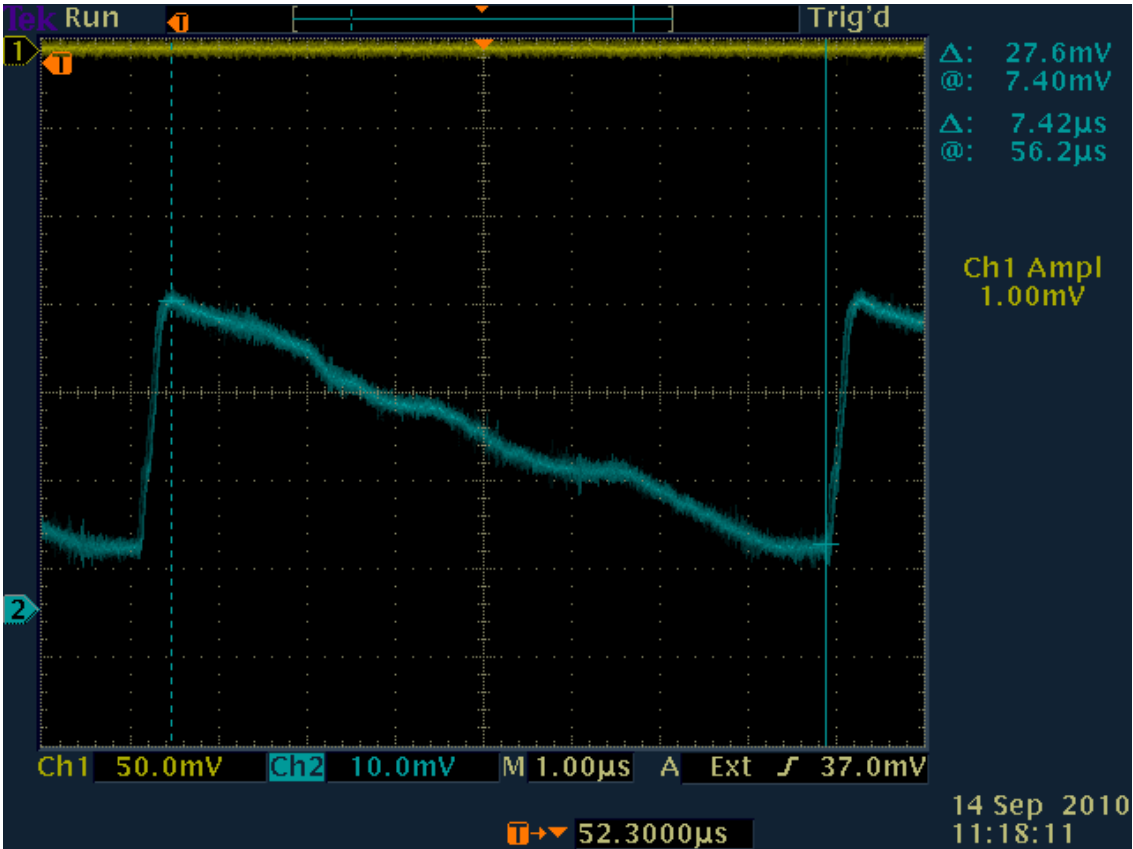


Figure 16 – Forward sweep time of the response signal of SART “SafeSea S100”

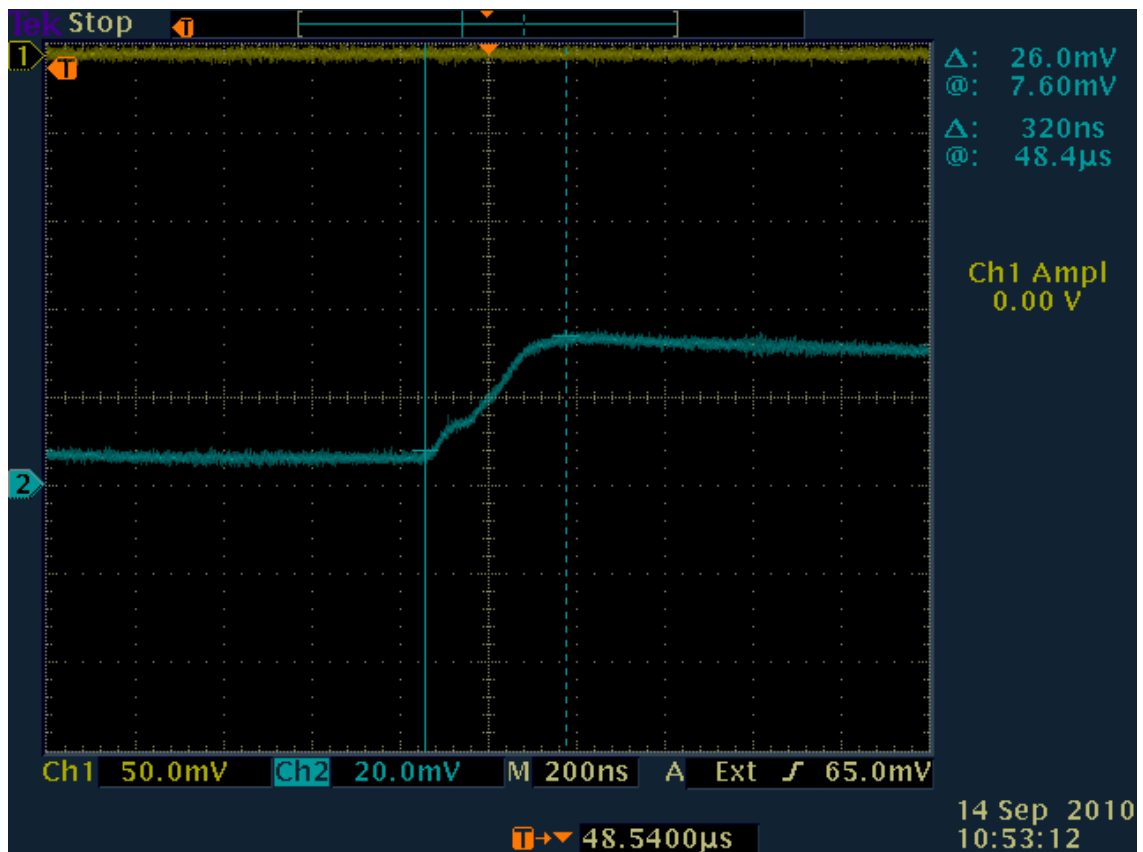


Figure 17 – Return sweep time of the response signal of SART “SafeSea S100”

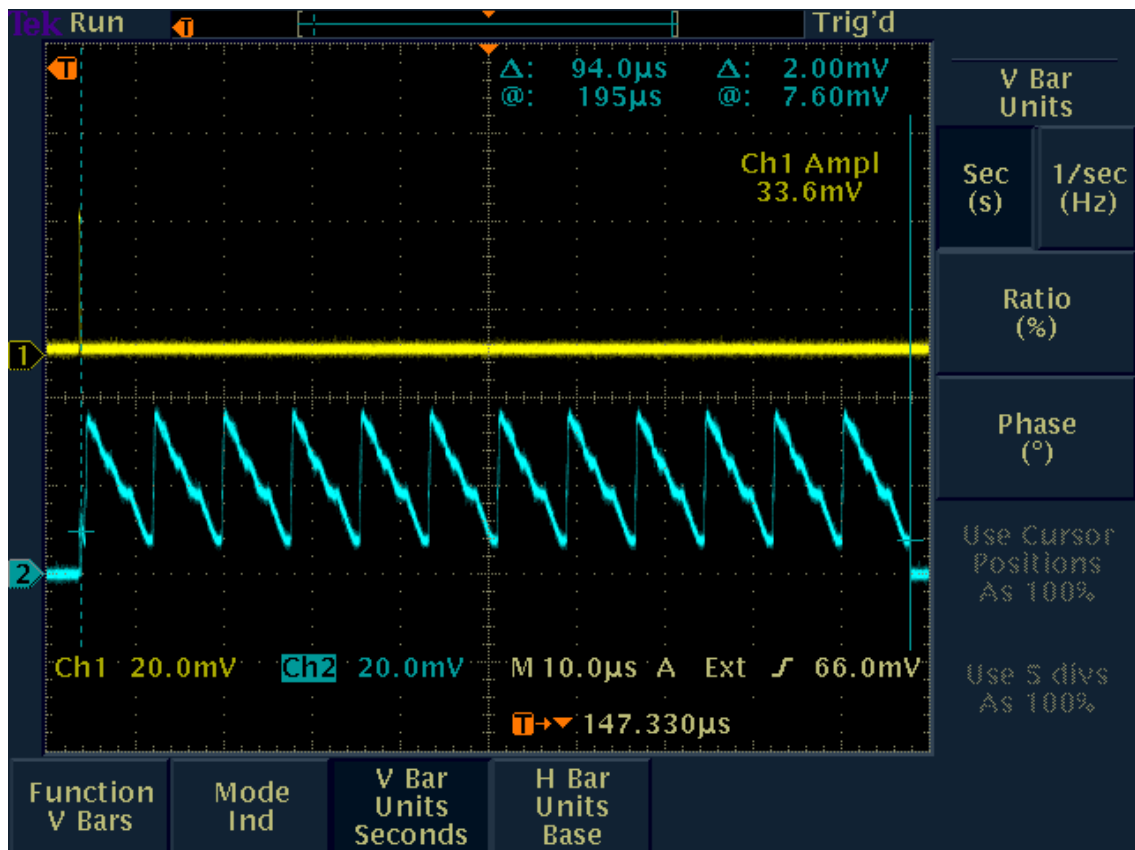


Figure 18 – 12 frequency sweeps of the response signal of SART “SafeSea S100”

TEST EQUIPMENT USED:

5, 8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

Conclusion

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of IEC 61097-1 3.4, 5.10 IEC 60945 8.2.1.2
Sample No. 1	yes

Appendix A7

Dry heat functional test (at temperature +55 °C)

Standard	Standard IEC 61097-1 item 3.4
Model SART	SafeSea S100
Serial number	No. 003
Sample number of battery pack	No.1
Date of test	07.08.2010
The temperature of the climate chamber	+55 °C

SART placed in a climatic chamber in the included state.

Then the temperature in the climate chamber increases to + 55 ° C (maximal temperature of working range SART)

Duration of work SART at a temperature + 55 ° C was 10 hours.

For the last 2 hours checked the parameters of SART.

The results of measurements are shown in the table below

Item	Parameter	Requirements	Results
5.1	High frequency	(9500+60) MHz	9516,3 MHz
5.1	Low frequency	(9200-60) MHz	9175,0 MHz
5.6	RF pulse emission	100 μ s	93,8 μ s
5.5	Forward sweep time	(7,5 \pm 1) μ s	7,44 μ s
5.5	Return sweep time	(0,4 \pm 0,1) μ s	0,33 μ s
5.4	Response signal	12	12

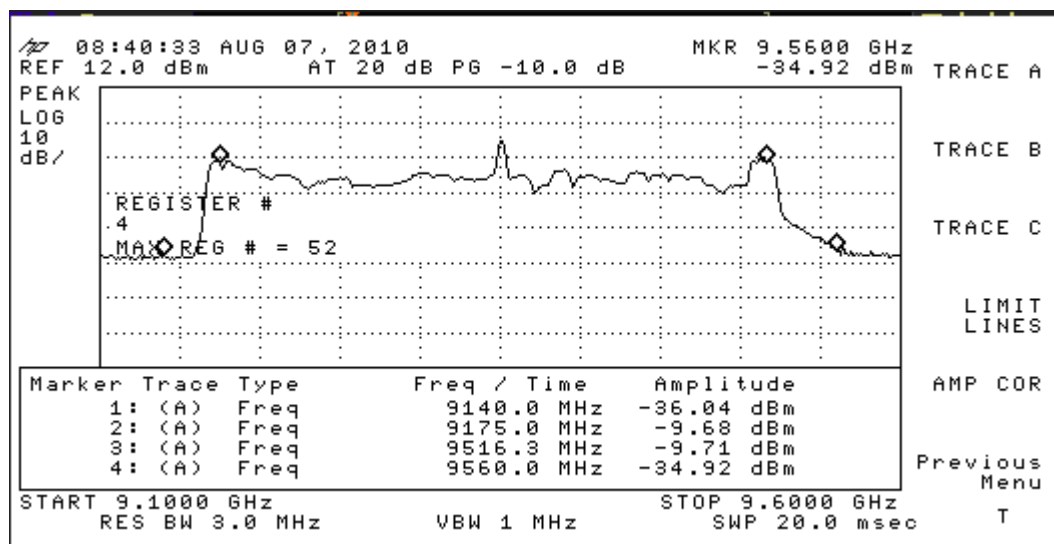


Figure 19 – Spectrogram measurement frequency range SART « SafeSea S100»

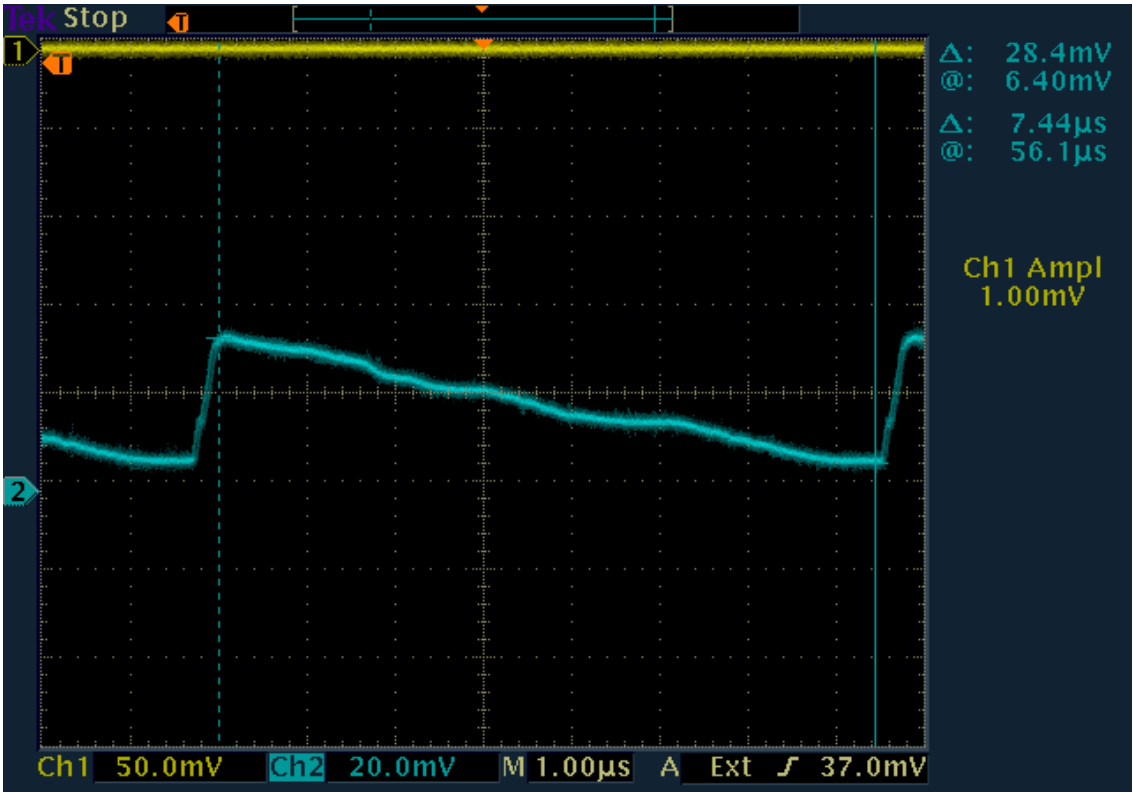


Figure 20 – Forward sweep time

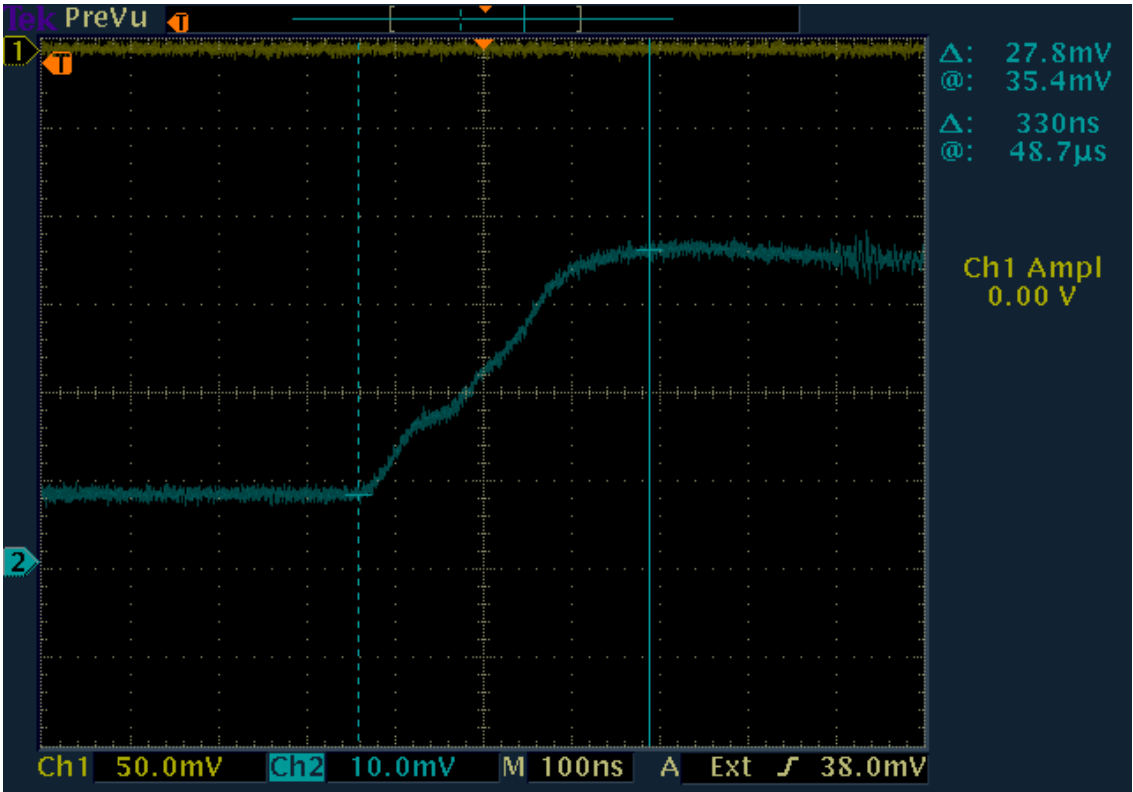


Figure 21 – Return sweep time

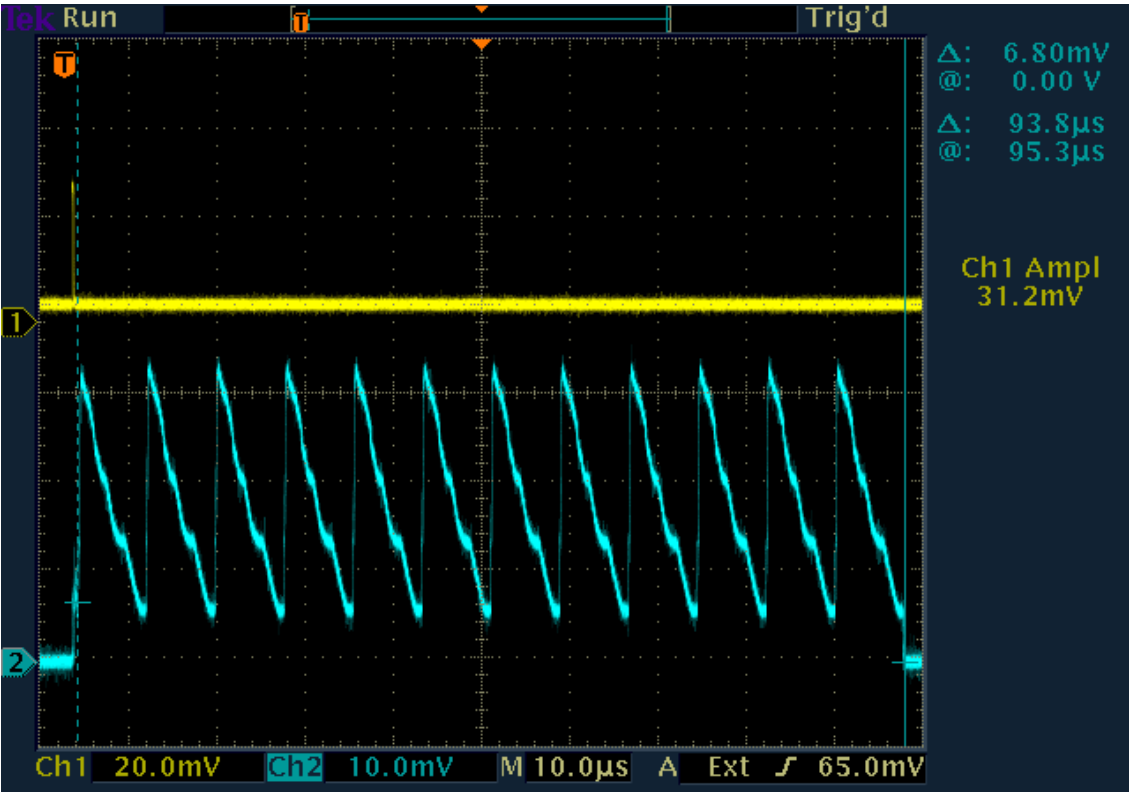


Figure 22 – 12 sweeps of the response signal

TEST EQUIPMENT USED:
5, 8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

CONCLUSION

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of standard IEC 61097-1 item 3.4 standard IEC 60945 item 8.2.2.2
Sample No 1	yes

Appendix A8

Damp heat functional test

Standard	IEC 60945 item 8.3
Model SART	SafeSea S100
Serial number	No. 003
Sample number of battery pack	No.2
Date of test	7-8.08.2010
The temperature of the climate chamber	(40±2) °C and humidity (93±3) %

Test conditions

SART put in climatic chamber at normal conditions (20±2) °C, after that temperature increases to (40±2) °C, and humidity to (93±3) % during 3 hours. SART was maintained 10.5 hours at a temperature (40 ± 2) °C and relative humidity (93 ± 3)%. Then SART was switched on during 2 hours and was subjected to a performance check under irradiation TC2 .Then climatic chamber was brought to room temperature in 2 h.

After that functional test was conducted.

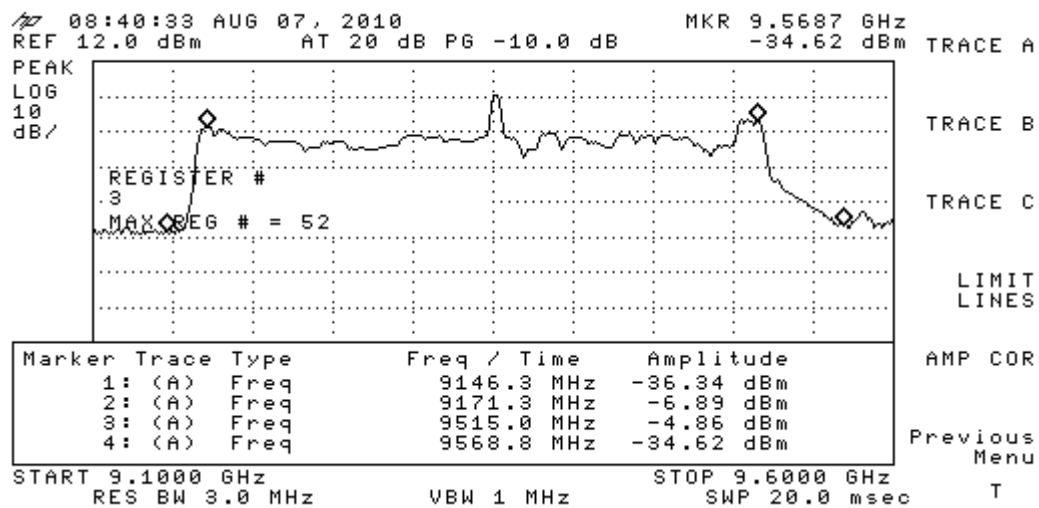


Figure 23– Spectrogram measurement frequency range SART “SafeSea S100”
High humidity.

The results of measurements are shown in the table below:

Item	Parameter	Requirements	Results
5.1	High frequency	(9500+60) MHz	9516,3 MHz
5.1	Low frequency	(9200-60) MHz	9175,0 MHz
5.6	RF pulse emission	100 μ s	94,4 μ s
5.5	Forward sweep time	(7,5 \pm 1) us	7,46 μ s
5.5	Return sweep time	(0,4 \pm 0,1) us	0,320 μ s
5.4	Response signal	12	12

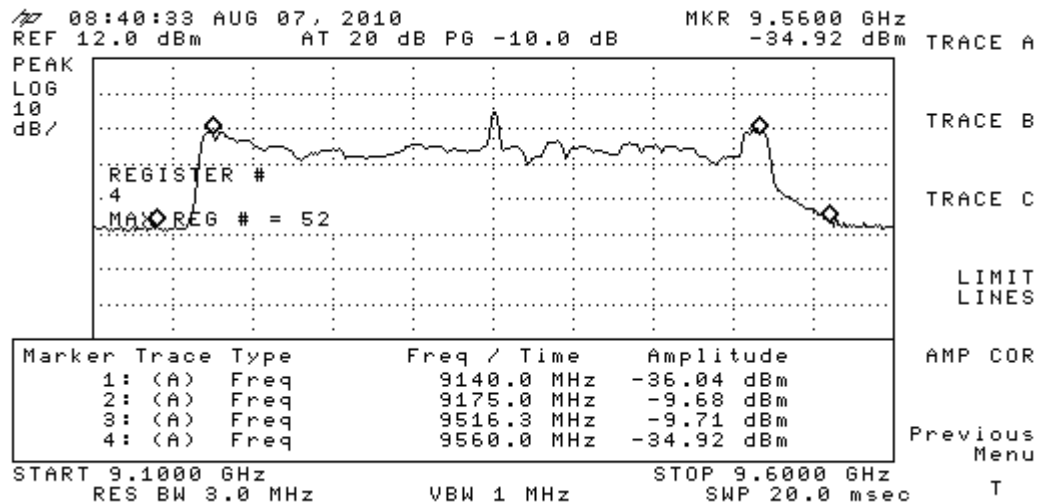


Figure 24– Spectrogram measurement frequency range SART “SafeSea S100”
 Normal condition after test.

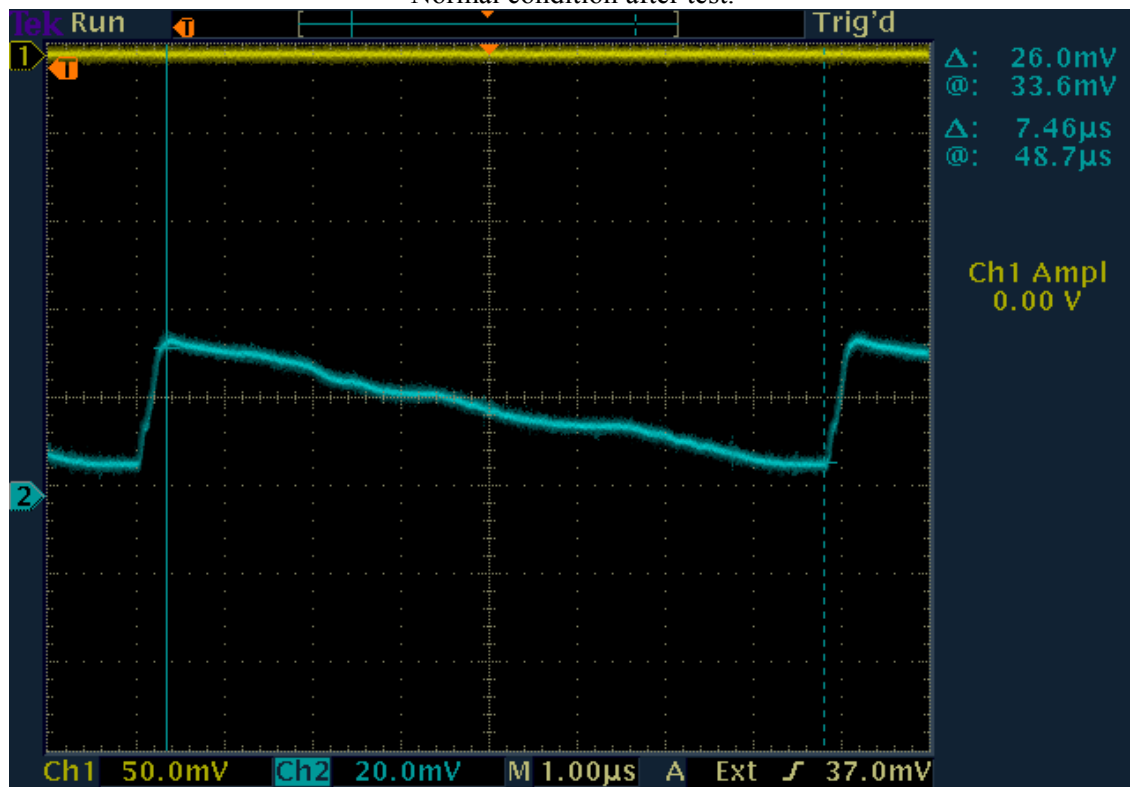


Figure 25 – Forward sweep time

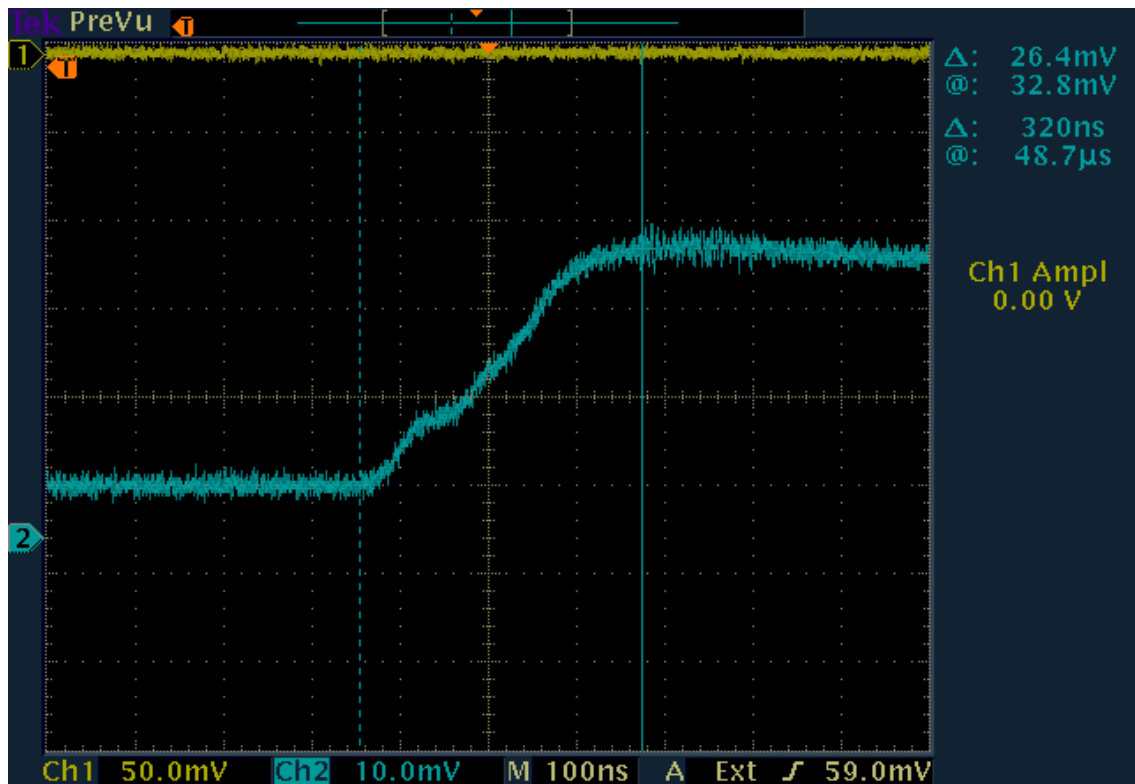


Figure 26– Return sweep time

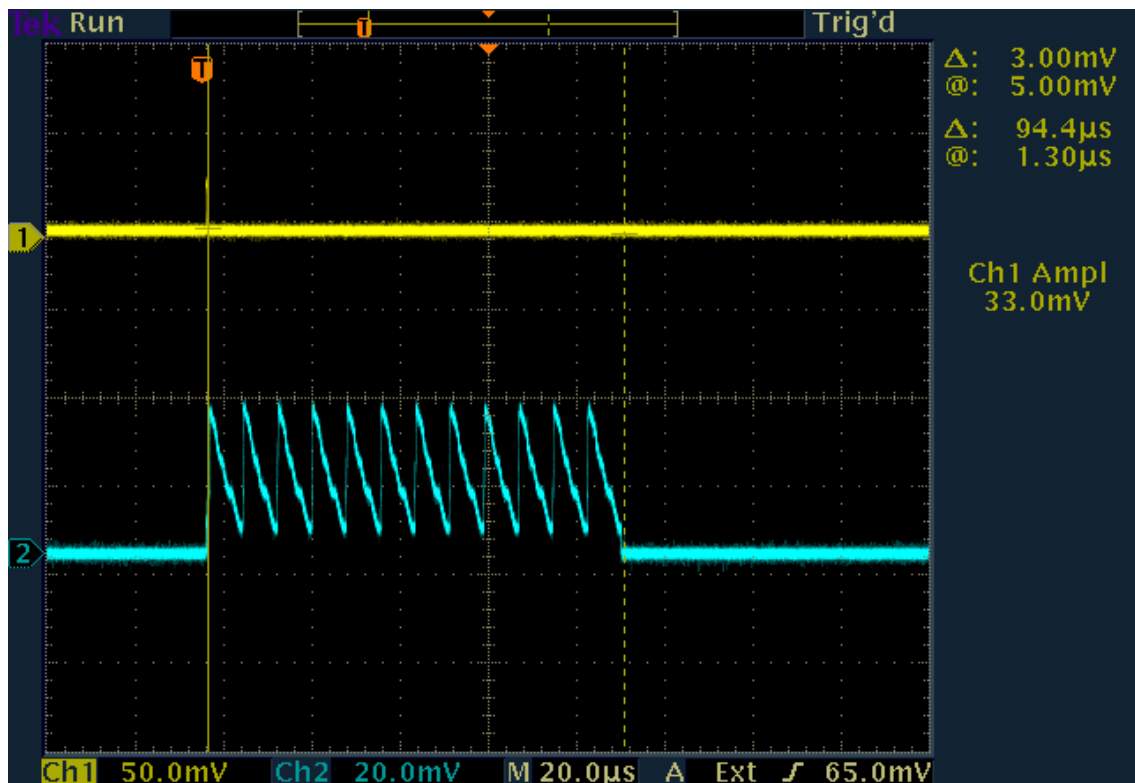


Figure 27– 12 sweeps of the response signal

Test results:

Check after the high humidity confirmed operability SART. Functioning SART is equal to the requirements of technical specifications for the items 8.3 of the standard IEC 60945

Requirements of the standard IEC 60945 item 8.3

SART should operate in conditions of high humidity

TEST EQUIPMENT USED:

5, 8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

CONCLUSION

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of the standard IEC 60945 item 8.3
Sample No 1	yes

Appendix A9

Vibration test

Standard	IEC 60945 item 8.7
Model SART	SafeSea S100
Serial number	No. 003
Sample number of battery pack	No.1
Date of test	09.08.2010
Ambient temperature	30 °C
Ambient humidity	54 %

Test conditions

Testing was performed in accordance to the methods of the standard IEC 60945 item 8.7

The SART was subjected to sinusoidal vertical vibration at all frequencies between:

-2 HZ to 13.2 HZ with an excursion of $\pm 1\text{mm} \pm 10\%$

-above 13.2 HZ and up to 100 HZ with a constant acceleration of 7 m/s^2

SART was subjected to sinusoidal horizontal vibration at all frequencies between:

– 2 Hz to 5 Hz and up to 13,2 Hz with an excursion of $\pm 1\text{ mm}$ (7 m/s^2 maximum acceleration at 13,2 Hz);

– above 13,2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s^2 .

The frequency sweep rate was less then 0.5 octaves/min.

A criterion for detecting resonance: as measured by a sensor fixed to the outside of the SART at the location where obvious signs of resonance have been observed, has a magnitude ratio ≥ 5 measured relative to the surface where the SART is fastened.

Situation SART - its operational (storage in the cassette, vertically attached to the simulator of the ship bulkheads).

Number of directions of vibration -3 direction (vertical and two horizontal orthogonal).

Since the vertical and horizontal vibration resonances were absent, so the tests of resistance to vibration were carried out at a frequency of 30 Hz lasting 2 hours in each direction.

Performance check was carried out at least once during each endurance test period, and once before the end of each endurance test period.

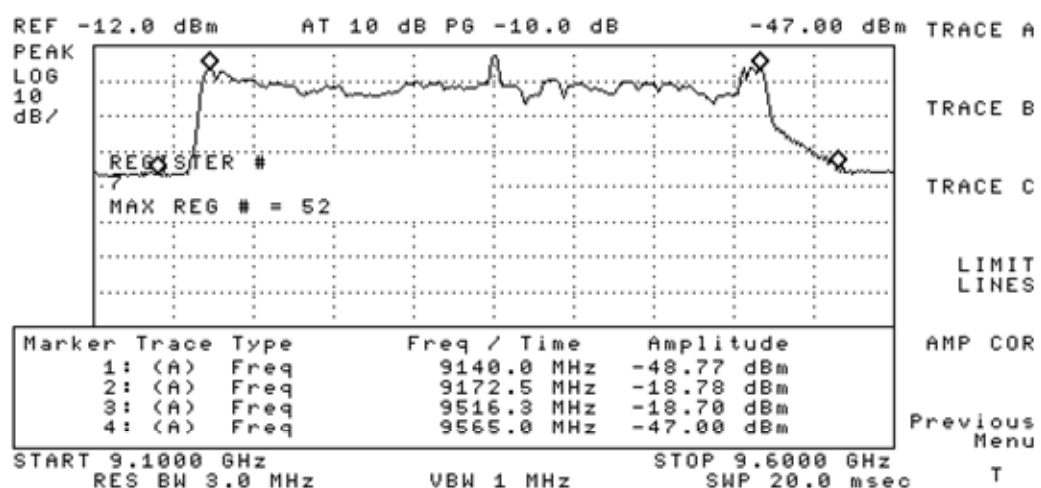


Figure 28– Spectrogram measurement frequency range SART « SafeSea S100»
(at the beginning of the vertical vibration test).

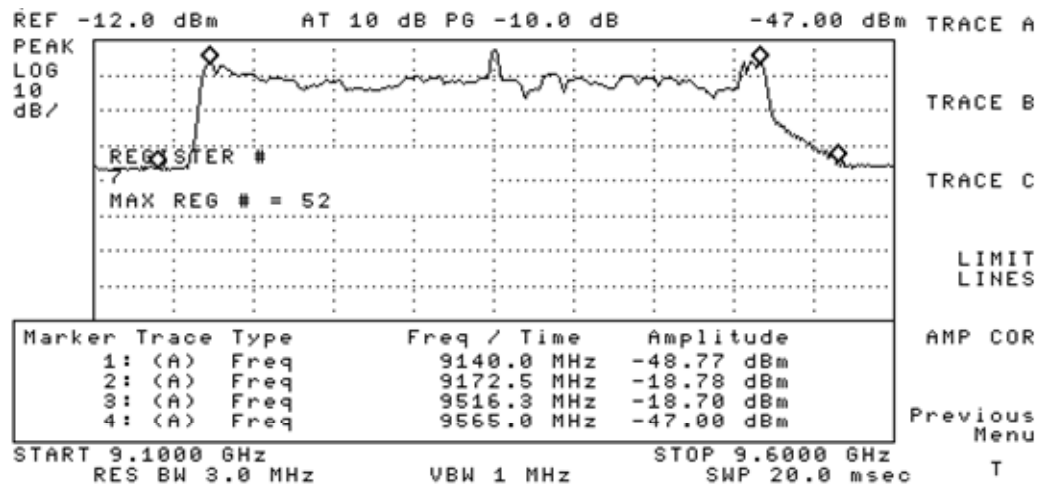


Figure 29 – Spectrogram measurement frequency range SART « SafeSea S100» (at the end of the vertical vibration test).

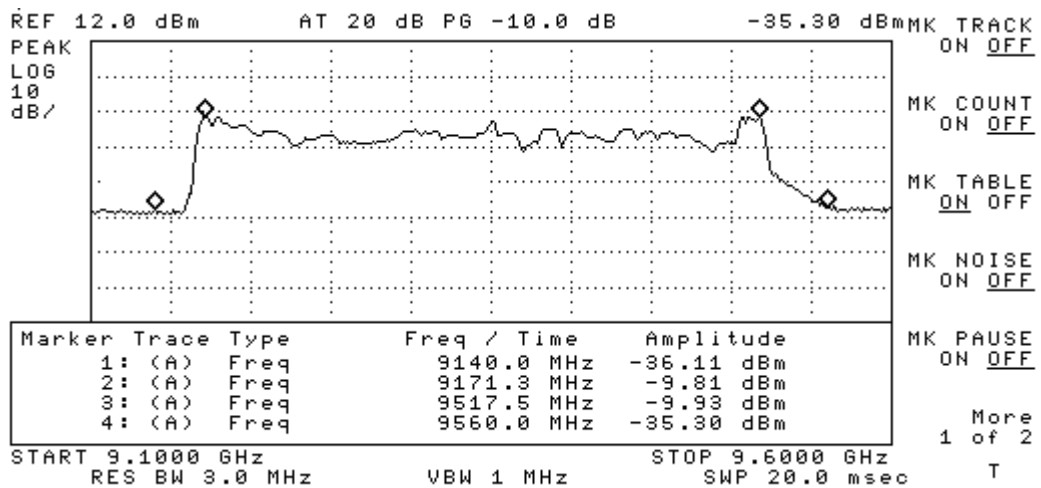


Figure 30– Spectrogram measurement frequency range SART “SafeSea S100”, (at the beginning of the horizontal vibration test by axis "X").

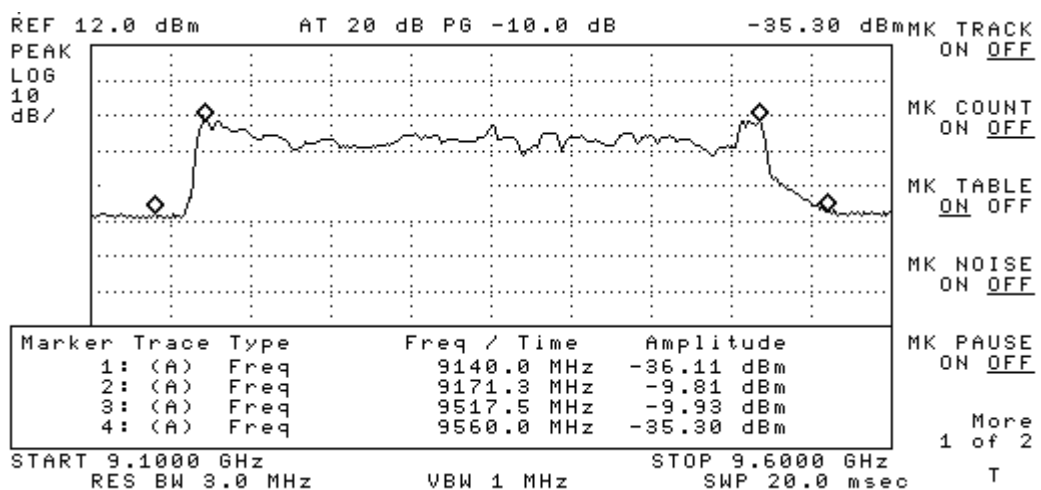


Figure 31 – Spectrogram measurement frequency range SART “SafeSea S100”, (at the end of the horizontal vibration test by axis "X").

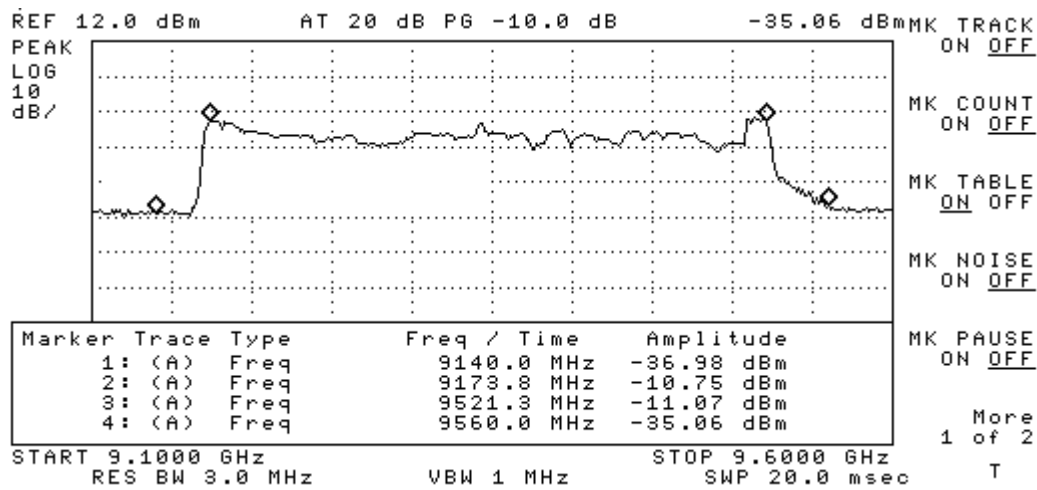


Figure 32– Spectrogram measurement frequency range SART “SafeSea S100”,
(at the beginning of the horizontal vibration test by axis "Y").

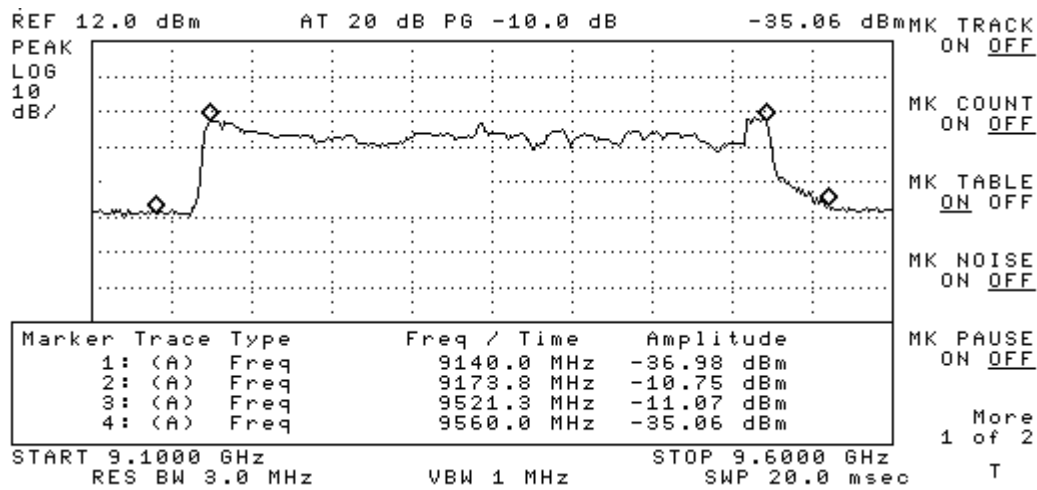


Figure 33– Spectrogram measurement frequency range SART “SafeSea S100”,
(at the end of the horizontal vibration test by axis "Y").

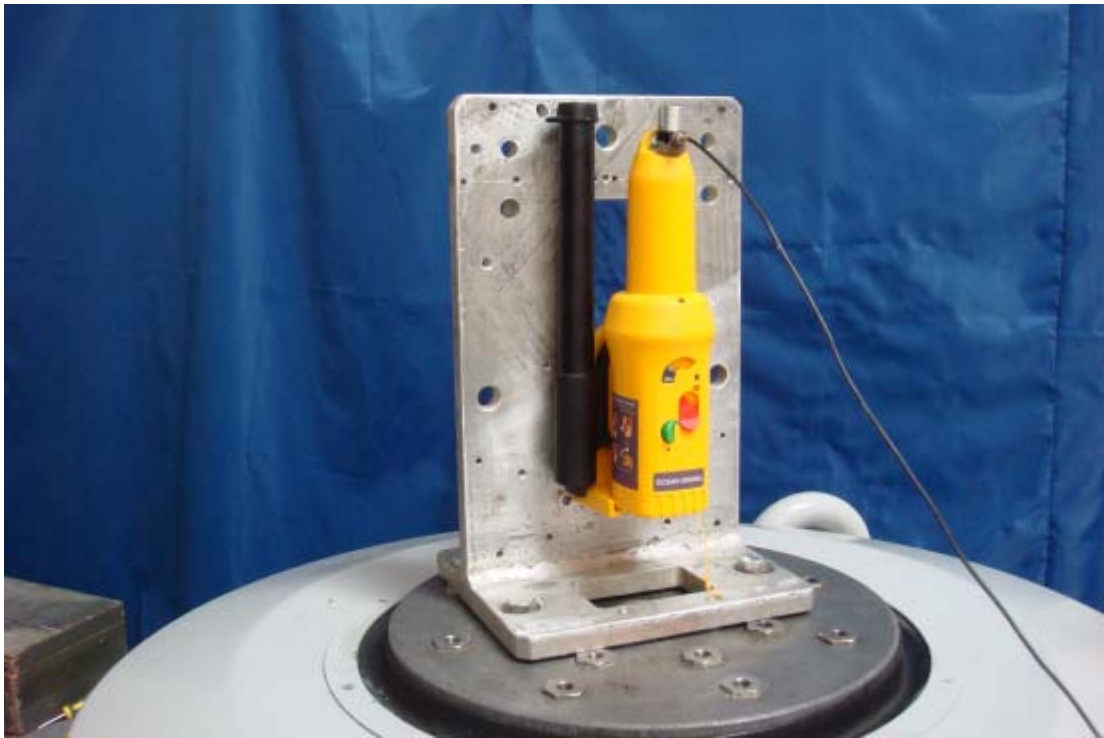


Photo 15 – vertical vibration



Photo 16 – horizontal vibration (axis X)



Photo 17– horizontal vibration (axis Y)



Photo 18 – Indications on the display of a given acceleration. 0,7g

The results of measurements after the tests are shown in the table below:

Item	Parameter	Requirements	Results
5.1	High frequency	(9500+60) MHz	9511,3 MHz
5.1	Low frequency	(9200-60) MHz	9187,5 MHz
5.6	RF pulse emission	100 μ s	94,2 μ s
5.5	Forward sweep time	(7,5 \pm 1) μ s	7,46 μ s
5.5	Return sweep time	(0,4 \pm 0,1) μ s	0,34 μ s
5.4	Response signal	12	12

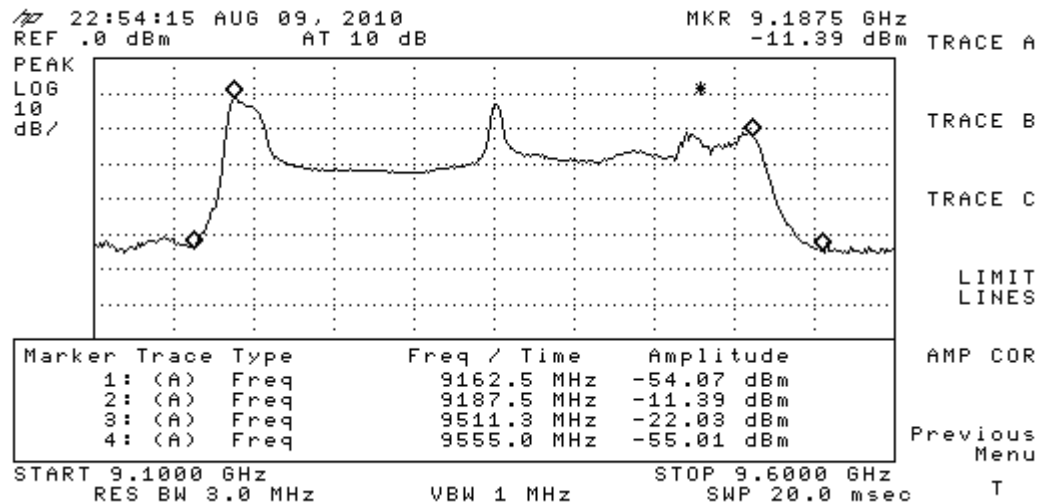


Figure 34– Spectrogram measurement frequency range SART « SafeSea S100».

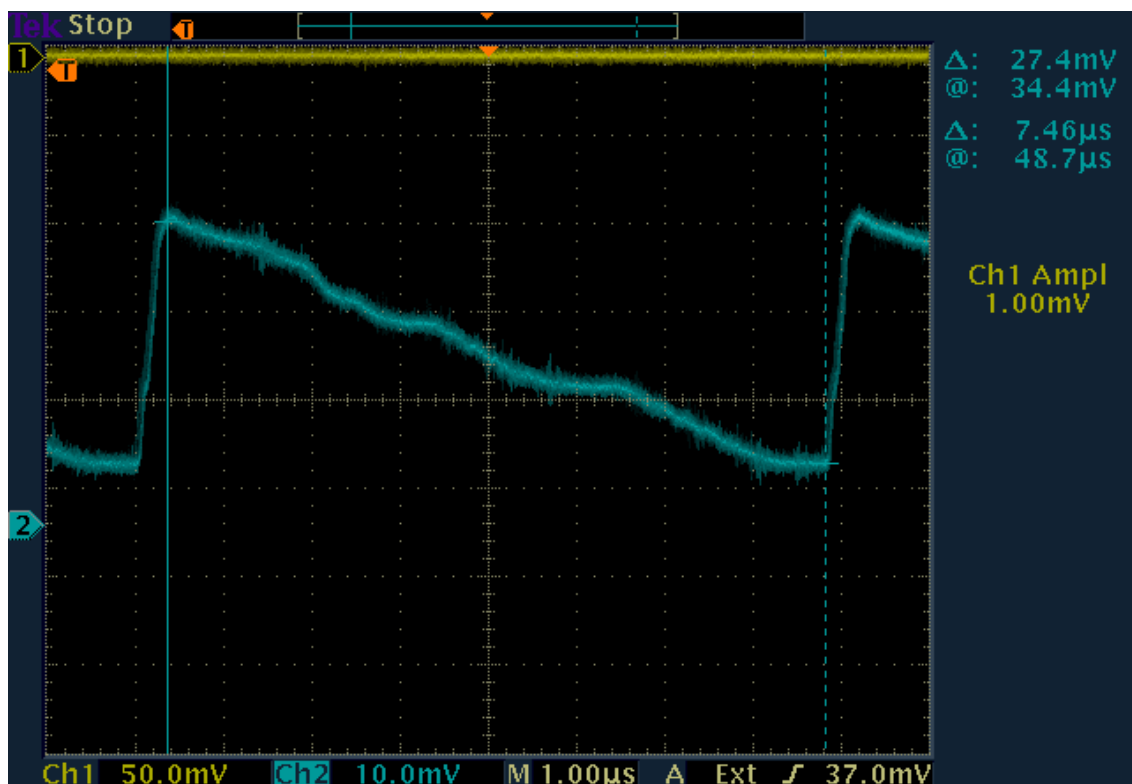


Figure 35 – Forward sweep time

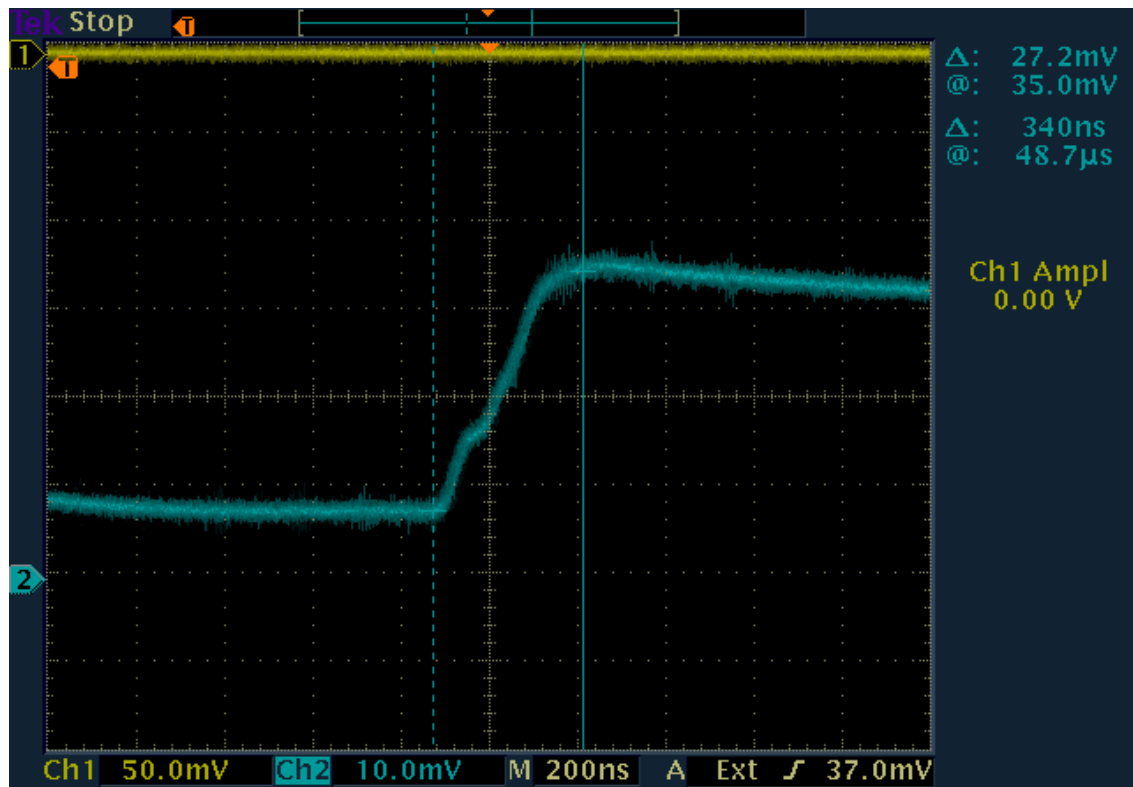


Figure 36 – Return sweep time

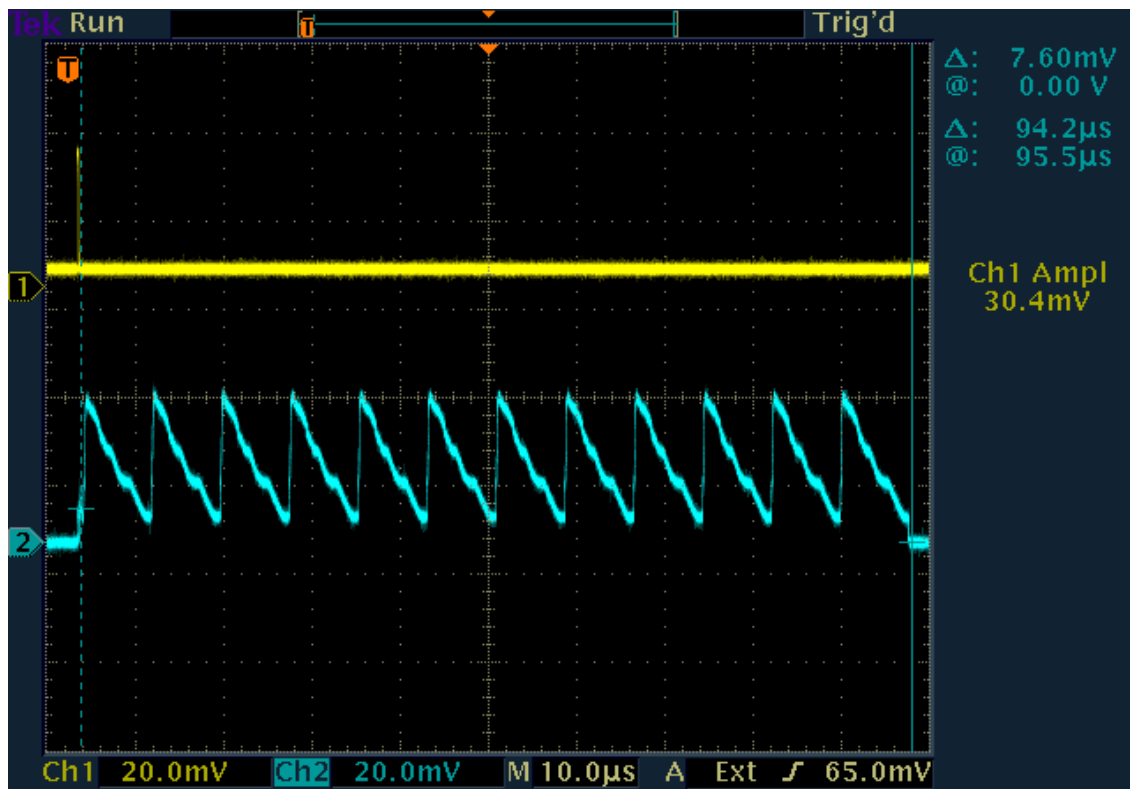


Figure 37– 12 sweeps of the response signal

Test results:

Control SART during the vibration test has confirmed its efficiency and sustainability. Functioning SART is equal to the requirements of the standard IEC 60945 item 8.7

Requirements of the standard IEC 60945 item 8.3

SART should be resistant to vibration.

TEST EQUIPMENT USED:

6, 8, 9, 11, 12, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

CONCLUSION

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of the standard IEC 60945 item 8.7
Sample No 1	yes

Appendix A10

Check SART floating

Standard	IEC 61097-1 item 3.2 i)
Model SART	SafeSea S100
Serial number	No. 003
Sample number of battery pack	No.1
Date of test	09.08.2010
Ambient temperature	30 °C
Ambient humidity	54 %

Test results:

SART is capable of floating

Requirements of the standard IEC 61097-1 item 3.2 i)

SART shall be capable of floating if it is not an integral part of the survival craft.



Photo 19 – SART floating

TEST EQUIPMENT USED:

33

CONCLUSION

Search and Rescue Transponder "SafeSea S100"	conforms to the requirements of the standard IEC 61097-1 item 3.2 i)
Sample No 1	yes

Appendix A11**Drop into water test**

Standard	IEC 61097-1 item 3.2 f)
Model SART	SafeSea S100
Serial number	No. 003
Sample number of battery pack	No.1
Date of test	09.08.2010
Ambient temperature	29 °C
Ambient humidity	53 %
Sample under test	No. 003

Test conditions

Drop test into the water carry out on the special "free fall" installation" (owner PE TC "Omega", see photo 20). The height was 20,1 m.

A series of 3 drops was carried out. Each drop was performed with 3 different fixed positions SART (antenna up, the antenna sideways and antenna another sideways).

At the end of the test the SART was subjected to a performance check.



Photo 20 – Point for drop test into the water from a height of 20.1 m..



Photo 21– Point for drop test into the water from a height of 20.1 m. Pole is attached.



Photo 22 – Dropping of the sample. The antenna position to the up.



Photo 23– Dropping of the sample. The antenna position to the up. Pole is attached.



Photo 24– Dropping of the sample. The antenna position to the side.



Photo 25 – Dropping of the sample. The antenna position to the side.

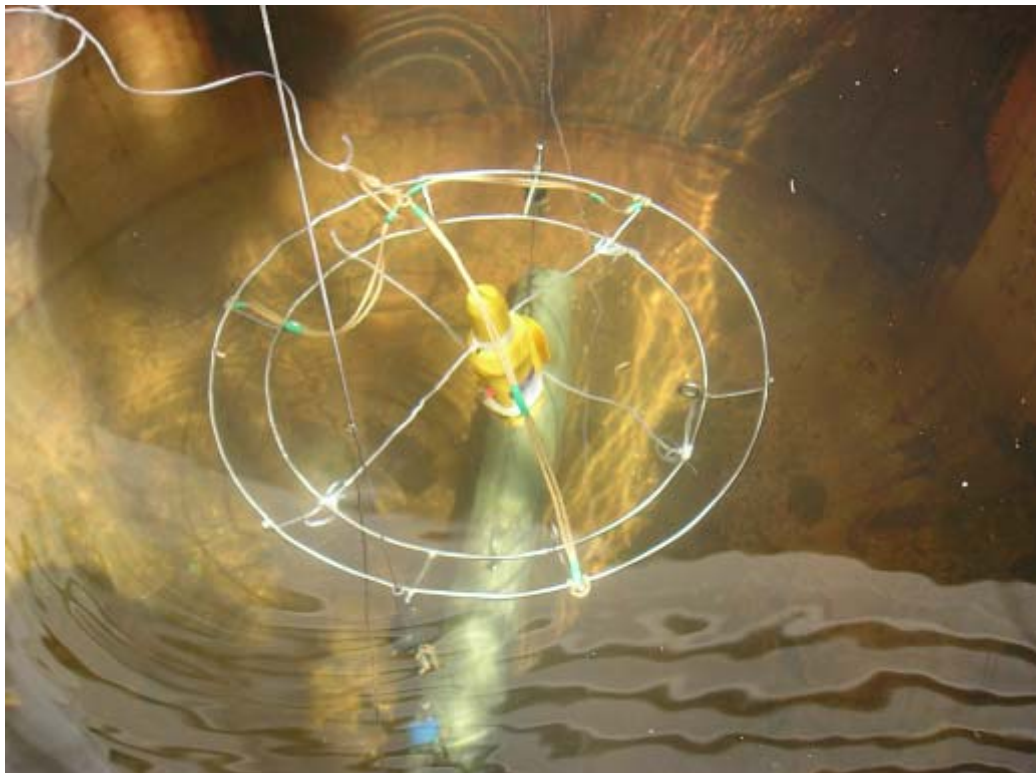


Photo 26– The sample after dropping at the antenna to the up.

The results of measurements after the tests in the table below:

Item	Parameter	Requirements	Results
5.1	High frequency	(9500+60) MHz	9520,0 MHz
5.1	Low frequency	(9200-60) MHz	9168,8 MHz
5.6	RF pulse emission	100 μ s	93,8 μ s
5.5	Forward sweep time	(7,5 \pm 1) μ s	7,52 μ s
5.5	Return sweep time	(0,4 \pm 0,1) μ s	0,328 μ s
5.4	Response signal	12	12

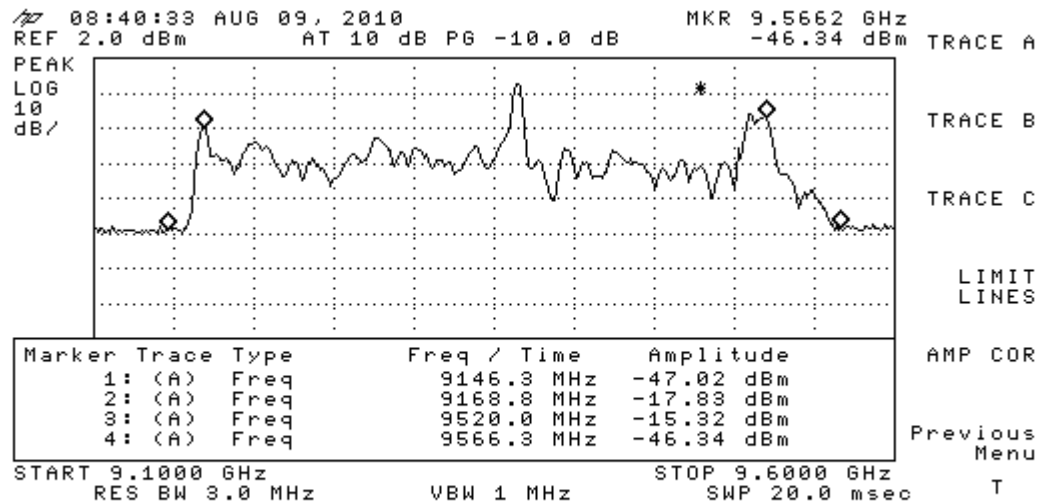


Figure 38– Spectrogram measurement frequency range SART “SafeSea S100”

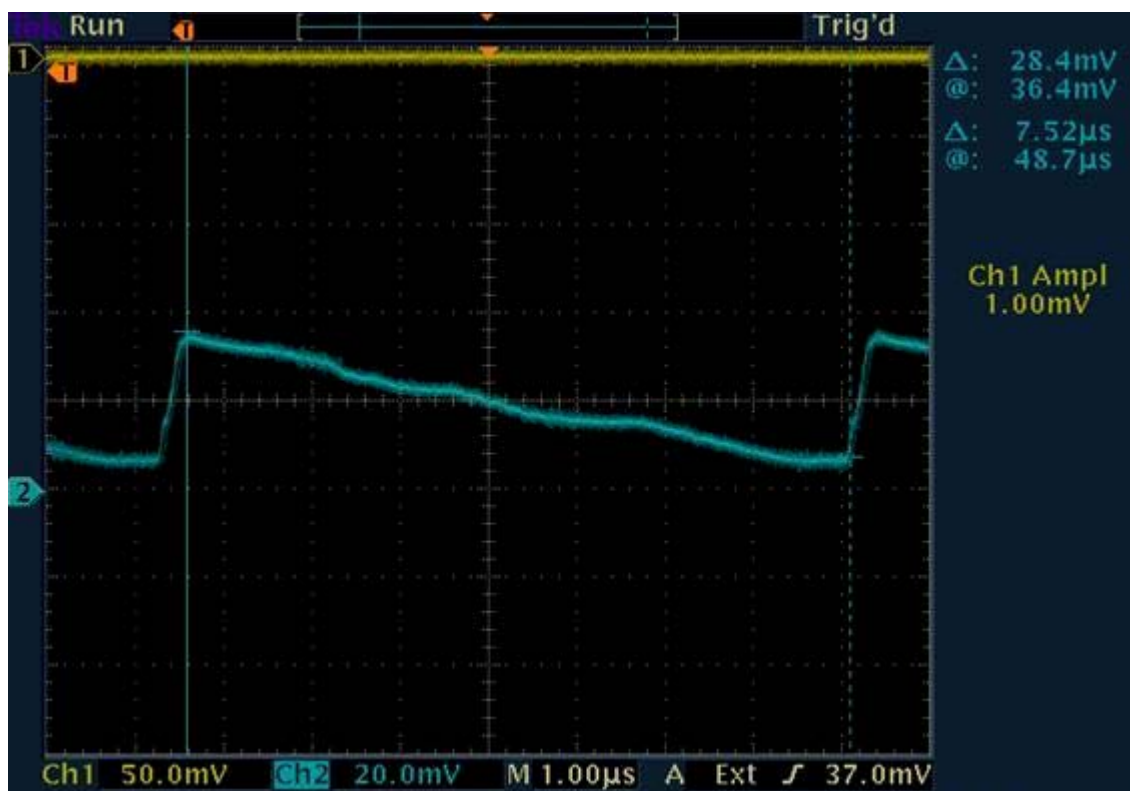


Figure 39– Forward sweep time

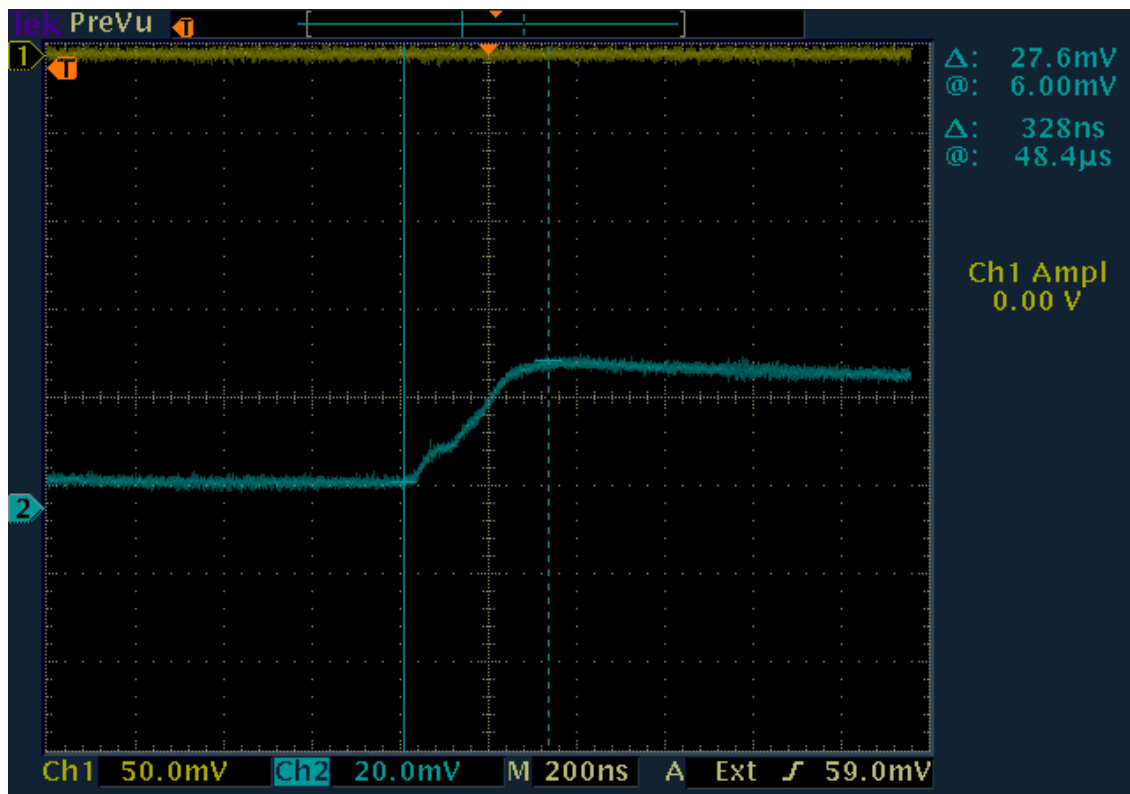


Figure 40– Return sweep time

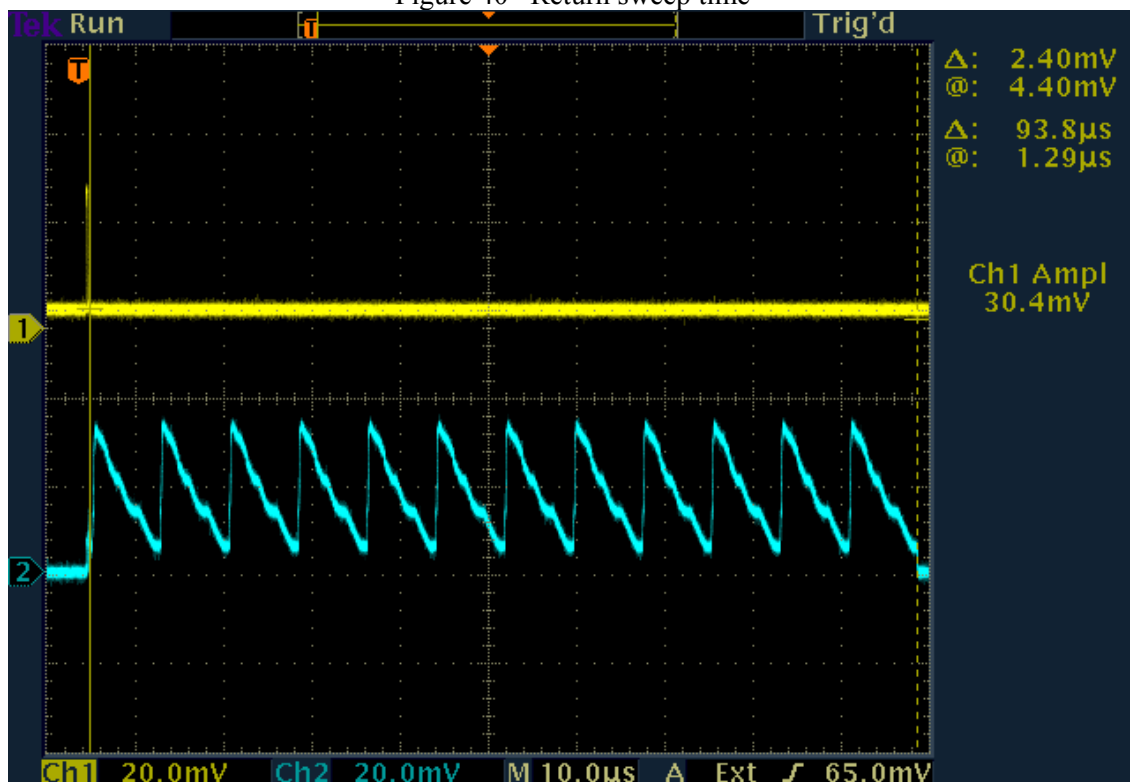


Figure 41– 12 sweeps of the response signal

Test results:

Check after exposure confirmed the absence of damage SART, the lack of penetration of water into the SART. Functioning SART is equal to the requirements.

The pole was detached by drop.

Results required

SART shall be capable of withstanding without damage drops from height of 20 m into water.

TEST EQUIPMENT USED:

8, 9, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 38, 39.

CONCLUSION

Search and Rescue Transponder “SafeSea S100”	conforms to the requirements of the standard IEC 61097-1 item 3.2 f)
Sample No 1	yes