TESTING CENTER «OMEGA»

Approved by
Head of TC
TC "OMEGA"

_____ Bogach S.V.
June 29, 2016

TEST REPORT No. 16/185

Issue 2

Emergency Position Indicating Radio Beacon (EPIRB)
for compliance with IEC 61097-2 and IEC 60945

Model	**MT603G** **MT603FG**
Manufacturer	**Standard Communications Pty Ltd, Australia**

TESTING CENTER «OMEGA»	ACCREDITATION
P.O.B. No.37, Sevastopol, 299053, **Phone: +7 8692 537 072** **Fax: +7 8692 469 679** **E-mail: stcomega@stc-omega.biz**	**COSPAS-SARSAT Secretariat** **Reference No. CS497/F530 dated 21/09/1994**
	National Accreditation Agency Certificate of accreditation for compliance ISO 17025:2006 No. 2H339 valid until 17.05.2019
	Letter of FCC acceptance #181479 dated July 24, 2014
	IC registration of 3/10m OATS #8780A-1 dated May 29, 2013
	IC registration of 3m alternative test site #8780A-2 dated May 29, 2013
	Letter of USCG Acceptance for testing EPIRBs #16714/161.011/OMEGA dated February 7, 2008

Report on:	Emergency Position Indicating Radio Beacon (EPIRB) 406 MHz COSPAS–SARSAT modelMT603G, MT603FG
Prepared for:	Beacon Manufacturer: Standard Communications Pty Ltd 17 Gibbon Road, Winston Hills, NSW 2153, Australia Manufacturer representative: Kevan Wilson-Elswood Technical Compliance Manager Telephone number: +61 (0)2 8867 6063 kelswood@gme.net.au
Test commencement date	29.07.2015
Test completion date	25.05.2016

The results of this report shall be applied only to the tested samples

CONTENTS

Report Issue History

No	Data of issue	Report reissue reason
1	May 26, 2016	The initial issue
2	June 29, 2016	Editorial corrections

1. EQUIPMENT UNDER TEST

1.1 Equipment type	Emergency Position Indicating Radio Beacon (EPIRB)
1.2 Equipment model	MT603G, MT603FG
1.3 Equipment class	Class 2 (operating temperature range - 20°C to +55°C)
1.4 Equipment category	EPIRB model MT603G without a float free mechanism: - with Manual Release bracket EPIRB model MT603FG with a floatfree mechanism: - with Auto/Manual release housing.
1.5 Equipment serial number	1410407573 (MT603G) 1410407582 (MT603FG)
1.6 Equipment destination	Alarm message transmission of distressed accident via COSPAS-SARSAT satellite system
1.7 Equipment software/firmware version	OS0021 ver 1.00 (8/12/2014)

2. TEST PURPOSE

The purpose of tests is to confirm compliance of EPIRBs models MT603FG, MT603G with IEC 61097-2 (Ed. 3.0 2008) for 406 MHz satellite emergency position indicating radio beacon (EPIRBs) and the required tests of IEC 60945 (2002) as including IEC 60945 Corrigendum 1 (2008).

3. TEST CONDITIONS AND METHODS

Procedures, conditions and methods of testing correspond to requirements and methods of IEC 61097-2and IEC60945 (2002).

4. TEST PROGRAM

No	Test name	Requirements	Methods
1.	Message format and homing devices	A.1.1, 4.2 IEC 61097-2	5.1.10, 5.1.11, 5.1.7 IEC 61097-2
2.	Dry heat test	A.1.2, 3.6.1 b), 3.6.3, 3.7 a) d) IEC 61097-2; 8.1, 8.2 IEC 60945	5.17.1 IEC 61097-2;8.2 IEC 60945
3.	Damp heat test	A.1.3, 3.6.1 b), 3.6.3, 3.7 a) d) IEC 61097-2; 8.1, 8.3 IEC 60945	5.17.2 IEC 61097-2; 8.3 IEC 60945
4.	Vibration test	A.1.4, 3.6.4, 3.7 b) IEC 61097-2; 8.7.3 IEC 60945	5.17.6 IEC 61097-2; 8.7.2 IEC 60945
5.	Ruggedness test	A.1.5, 3.6.4, 3.7 b) IEC 61097-2	5.17.7 IEC 61097-2
6.	Drop test on hard surface	A.1.6, 3.3.2 c) IEC 61097-2; 8.6.1.3 IEC 60945	5.17.5.1 IEC 61097-2; 8.6.1.2 IEC 60945
7.	Drop into water	A.1.7, 3.3.2 c) IEC 61097-2; 8.6.2.3 IEC 60945	5.17.5.2 IEC 61097-2; 8.6.2.2 IEC 60945
8.	Thermal Shock	A.1.8, 3.3.2 a) IEC 61097-2; 8.5.3 IEC 60945	5.17.4 IEC 61097-2; 8.5.2 IEC 60945
9.	Immersion test	A.1.9, 3.3.2 a) IEC 61097-2; 8.9.2 IEC 60945	5.17.8, 5.3.2. IEC 61097-2; 8.9.2 IEC 60945
10.	Spurious emissions test	A.1.10, 5.19 IEC 61097-2	5.19 IEC 61097-2
11.	Battery capacity and low temperature test	A.1.11, 4.6.1 IEC 61097-2	5.15.1 IEC 61097-2
12.	COSPAS-SARSAT type approval tests	A.1.12 IEC 61097-2	A.3 C/S T.007
13.	Interference testing	A.1.13, 3.8 IEC 61097-2; 10.1, 10.4, 10.9 IEC 60945	5.8, 5.18 IEC 61097-2; 10.4, 10.9 IEC 60945
14.	Prevention of inadvertent activation	A.2.1, 3.3.1 a) IEC 61097-2	5.3.1, 5.5.1.1 IEC 61097-2
15.	Activation test	A.2.1, 3.3.3 b) d) f) IEC 61097-2	5.3.3.4 IEC 61097-2
16.	Self-test	A.2.1, 3.3.4 IEC 61097-2	5.3.4 IEC 61097-2
17.	Colour and retro-reflecting material	A.2.1, 3.3.5 IEC 61097-2	5.3.5 IEC 61097-2
18.	Lanyard	A.2.1, 3.3.6 IEC 61097-2	5.3.6 IEC 61097-2
19.	Exposure to marine environment[1)]	A.2.1, 3.3.7 IEC 61097-2	5.3.7 IEC 61097-2
20.	Ergonomics	A.2.1, 3.3.8 IEC 61097-2	5.3.8 IEC 61097-2
21.	Distress function	A.2.1, 3.4 IEC 61097-2	5.4 IEC 61097-2
22.	Construction materials[1)]	A.2.1, 3.5.1 d) e) IEC 61097-2	5.5.1.2 IEC 61097-2
23.	Ability to check the automatic release mechanism test	A.2.1, 3.5.3 IEC 61097-2	5.5.3 IEC 61097-2
24.	Manual release	A.2.1, 3.5.4 IEC 61097-2	5.5.4 IEC 61097-2

No	Test name	Requirements	Methods
25.	Battery expiry date indication	A.2.1, 4.6.3 IEC 61097-2	5.15.2 IEC 61097-2
26.	Reverse polarity protection	A.2.1, 4.6.4 IEC 61097-2	5.15.3 IEC 61097-2
27.	Automatic release mechanism and automatic activation test	A.2.2, 3.2 d) e), 3.5.1 a) IEC 61097-2	5.2.1 IEC 61097-2
28.	Stability and buoyancy test	A.2.3, 3.3.2 b) IEC 61097-2	5.3.2.2 IEC 61097-2
29.	Float-free activation test	A.2.4, 3.2 d) IEC 61097-2	5.2.1, 5.3.3.1 IEC 61097-2
30.	Safety[2)]	A.2.5, 3.10 IEC 61097-2	5.10 IEC 61097-2
31.	Compass safe distance	A.2.6 IEC 61097-2; 4.5.3 IEC 60945	5.20 IEC 61097-2; 11.2 IEC 60945
32.	Solar radiation test[1)]	A.2.7, 3.3.7, 3.5.1 e) IEC 61097-2; 8.10.4 IEC 60945	5.17.9 IEC 61097-2; 8.10.3 IEC 60945
33.	Oil resistance test[1)]	A.2.8, 3.3.7, 3.5.1 e) IEC 61097-2; 8.11.4 IEC 60945	5.17.10 IEC 61097-2; 8.11.3 IEC 60945
34.	Corrosion test [3)]	A.2.9, 3.3.7, 3.5.1 d) e) IEC 61097-2; 8.12.4 IEC 60945	5.17.11 IEC 61097-2; 8.12.3 IEC 60945
35.	Signal light test	A.2.10, 3.3.3 c) e) IEC 61097-2	5.3.3.3 IEC 61097-2
36.	GPS Receiver requirements	A.2.11, Annex B IEC 61097-2	IEC 61108-1
37.	121.5 MHz Homing device tests	D.3 IEC 61097-2	Annex D IEC 61097-2
38.	Wind speed test[4)]	3.6.2 IEC 61097-2	5.6.3 IEC 61097-2
39.	Maintenance check	3.9 IEC 61097-2	5.9 IEC 61097-2
40.	Equipment manuals check	3.11 IEC 61097-2	5.11 IEC 61097-2
41.	Labeling check	3.12.1 IEC 61097-2	5.12.1 IEC 61097-2
42.	Float-free arrangement labelling	3.12.2 IEC 61097-2	5.12.2 IEC 61097-2
43.	Installation test	3.13 IEC 61097-2	5.13 IEC 61097-2
44.	Check the possibility of manual release and capability be carried by one person	3.2 a) IEC 61097-2	5.2 IEC 61097-2
45.	Single integral EPIRB unit check	3.2 g) IEC 61097-2	5.2 IEC 61097-2
46.	Indication of previous activation check	3.3.9 IEC 61097-2	5.3.9 IEC 61097-2

Notes:

[1)] According to IEC61097-2 the Solar radiation test and Oil resistance test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the satellite EPIRB and the release mechanism would satisfy the test. The test results are in the Test Report 13/498 Issue 1.

[2)] According to IEC61097-2 safety precautions are verified by test and inspection of the evidence submitted by the manufacturer that the satellite EPIRB and the battery shall function safely under the conditions stated in 3.10. The manufacturer submitted evidences of compliance of EPIRBs to IEC61097-2, clause 3.10. The test was performed according to IEC60945.

[3)] According to IEC61097-2 the Corrosion test shall be waived where the manufacturer is able to produce evidence that the components, materials and finishes employed in the satellite EPIRB and the release mechanism would satisfy the test. The testing of MT603G, MT603FG was waived by the manufacturer as the test was conducted in accordance with RTCM 11000.2 A7.0 (Salt Fog). The test results are in the Test Report 16/224 Issue 3.

[4)] The Wind speed test (3.6.2, 5.6.3 IEC 61097-2) was not conducted dueto successful completion of test IEC61097-2 item 5.5.1.1.

5. TEST SCHEDULE

No.	Test name	Dates of test	Notes
1.	Message format and homing devices	14.12.2015,15.12.2015	
2.	Dry heat test	15.12.2015,16.12.2015	
3.	Damp heat test	17.12.2015, 18.12.2015,	
4.	Vibration test	11.01.2016, 12.01.2016, 13.01.2016	
5.	Ruggedness test	15.01.2016	
6.	Drop test on hard surface	19.01.2016	
7.	Drop into water	20.01.2016	
8.	Thermal Shock, Immersion test	21.01.2016-23.01.2016	
9.	Spurious emissions test	17.05.2016	
10.	Battery capacity and low temperature test	15.02.2016-18.02.2016	
11.	COSPAS-SARSAT type approval tests	27.01.2016 – 29.03.2016	
12.	Interference testing	11.03.2016, 17.03.2016	
13.	Prevention of inadvertent activation	12.04.2016	
14.	Activation test	13.04.2016	
15.	Self-test	27.01.2016- 29.01.2016	
16.	Colour and retro-reflecting material	18.04.2016	
17.	Lanyard	18.04.2016	
18.	Ergonomics	18.04.2016	
19.	Distress function	18.04.2016	
20.	Automatic release mechanism and automatic activation test	18.04.2016	
21.	Manual release	18.04.2016	
22.	Battery expiry date indication	19.04.2016	
23.	Reverse polarity protection	19.04.2016	
24.	Stability and buoyancy test	19.04.2016	
25.	Ability to check the automatic release mechanism test	21.04.2016	
26.	Float-free activation test	22.04.2016	
27.	Signal light test	24.05.2016-25.05.2016	
28.	GNSS Receiver requirements	04.05.2016-12.05.2016	
29.	Compass safe distance	25.04.16-26.04.16	
30.	121.5 MHz Homing device tests	18.05.2016	
31.	Installation test	05.05.2016	
32.	Maintenance check	05.05.2016	
33.	Equipment manuals check	05.05.2016	
34.	Labeling check	05.05.2016	
35.	Indication of previous activation check	05.05.2016	

6. TEST RESULTS

No.	Test	Result	Reference for detailed results of test
1.	Message format and homing devices	Passed	Annex 1
2.	Dry heat test	Passed	Annex 2
3.	Damp heat test	Passed	Annex 3
4.	Vibration test	Passed	Annex 4
5.	Ruggedness test	Passed	Annex 5
6.	Drop test on hard surface	Passed	Annex 6
7.	Drop into water	Passed	Annex 7
8.	Thermal Shock, Immersion test	Passed	Annex 8
9.	Spurious emissions test	Passed	Annex 9
10.	Battery capacity and low temperature test	Passed	Annex 10
11.	COSPAS-SARSAT type approval tests	Passed	C/S Test report No.16/116 C/S TAC is awaited
12.	Interference testing	Passed	Annex 11, Annex 12
13.	Activation test	Passed	Annex 13
14.	Self-test	Passed	Annex 14
15.	Signal light test	Passed	Annex 15
16.	Colour and retro-reflecting material	Passed	Annex 16
17.	Lanyard	Passed	Annex 17
18.	Stability and buoyancy test	Passed	Annex 18
19.	Prevention of inadvertent activation	Passed	Annex 19
20.	Float-free test at extreme temperature	Passed	Annex 19
21.	121.5 MHz Homing device tests	Passed	Annex 20
22.	Compass safe distance	Passed	Annex 21
23.	Manual release	Passed	Annex 21
24.	Corrosion test	Passed	Annex 22
25.	Ergonomics	Passed	Annex 23
26.	Distress function	Passed	Annex 24
27.	Labeling check	Passed	Annex 25
28.	Battery expiry date indication	Passed	Annex 25
29.	Reverse polarity protection	Passed	Annex 25
30.	Equipment manuals check	Passed	Annex 26
31.	Installation test	Passed	Annex 27
32.	Maintenance check	Passed	Annex 28
33.	Indication of previous activation check	Passed	Annex 29
34.	Automatic release mechanism and automatic activation test	Passed	Annex 30
35.	Safety	Passed	Annex 31
36.	Solar radiation test	Passed	Annex 31
37.	Oil resistance test	Passed	Annex 31
38.	GNSS Receiver requirements	Passed	Separate Test report No.16/184

7. CONCLUSION

Name and Location of Beacon Test Facility: **TESTING CENTER «OMEGA»**
Vakulenchuka, 29
Sevastopol, 299053

Date of Submission for Testing: **29.07.2015**

Applicable Standard:

Document	Edition
IEC 61097-2	Edition 3.0 (2008-01)
IEC 60945	Edition 4.0 (2002-08)

I hereby confirm that the 406 MHz beacon modelsMT603G, MT603FG described above have been successfully tested in accordance with the applicable standard and complies with the requirements as demonstrated in the attached report.

Dated June 29, 2016 Signed

V. Kovalenko
Departmentmanager

ANNEX 1.
MESSAGE FORMAT AND HOMING DEVICES

1.1 Performance Check

Equipment Under Test (EUT): 1) MT603G
2) MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 14.12.15, 15.12.15
Test Conditions:

- Ambient temperature: 17.0–23.6 °C
- Relative humidity: 46 - 59 %
- Atmospheric pressure: 758 - 759 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Performance Check	A.1.1, 4.2 IEC 61097-2	5.1.10, 5.1.11, 5.1.7 IEC 61097-2

TEST DESCRIPTION

EUT was activated and then following parameters were measured:
- the 406 MHz transmitted frequency (single burst only),
- the 406 MHz digital message and
- the presence of homing transmitter output.

TEST RESULT

Passed

TEST DETAILS

Summary table of performance check result of MT603G

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.039874
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Summary table of performance check result of MT603FG

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.0400258
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
2.	Temperature meter	gradient 2002	078	01.2017
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Semi-anechoic chamber	«Don»	1	08.2016
7.	Tuned dipole antenna	FCC-4	587A	09.2016
8.	Antennalogoperiodic	VULB9163	9163244	09.2018

1.2 Performance Test

Equipment Under Test (EUT): 1) MT603G
2) MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 14.12.15, 15.12.15
Test Conditions:
- Ambient temperature: 17.0–23.6 °C
- Relative humidity: 46 - 59 %
- Atmospheric pressure: 758 - 759 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Performance Test	A.1.1, 4.2 IEC 61097-2	5.1.10, 5.1.11, 5.1.7 IEC 61097-2

TEST DESCRIPTION

EUT was activated and then following parameters were measured as defined in C/S T.007 Annex A.2.1:
a) 406 MHz transmitted power output;
b) 406 MHz digital message;
c) 406 MHz digital message generator (Bit Rate and Stability (T.007 A.3.1.3) only);
d) 406 MHz modulation;
e) 406 MHz transmitted frequency; and
f) 406 MHz spurious output.

TEST RESULT

Passed

TEST DETAILS

Summary table of performance test MT603G

No	Parameter	Measured value
1	406 MHz transmitted power output, W	4.29 to 4.30
2	406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
3	406 MHz digital message generator (bit rate)	399.93 to 400.20
4	406 MHz modulation: +Phase deviation, rad -Phase deviation, rad Phase time rise, us Phase time fall, us Asymmetry, %	 -1.11 to -1.07 1.08 to 1.12 213.05 to 219.28 205.78 to 210.38 0.20 to 0.52
5	406 MHz transmitted frequency, MHz	406.0398720 to 406.0398730
6	406 MHz spurious emissions	Figure 1.1

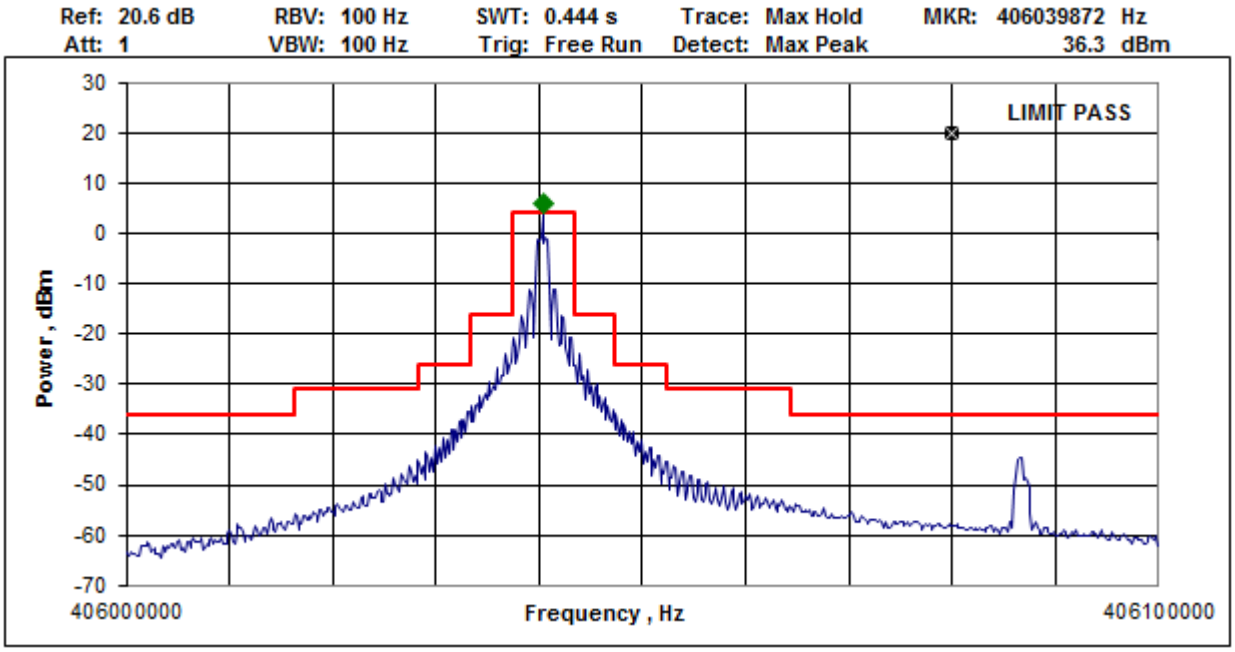


Figure 1.1 - 406 MHz spurious emissions MT603G

Summary table of performance test MT603FG

No	Parameter	Measured value
1	406 MHz transmitted power output, W	4.30
2	406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
3	406 MHz digital message generator (bit rate)	399.91 to 400.04
4	406 MHz modulation: +Phase deviation, rad -Phase deviation, rad Phase time rise, us Phase time fall, us Asymmetry, %	 -1.15 to -1.12 1.10 to 1.13 208.51 to 212.70 202.09 to 205.49 0.37 to 0.65
5	406 MHz transmitted frequency, MHz	406.0400200
6	406 MHz spurious emissions	Figure 1.2

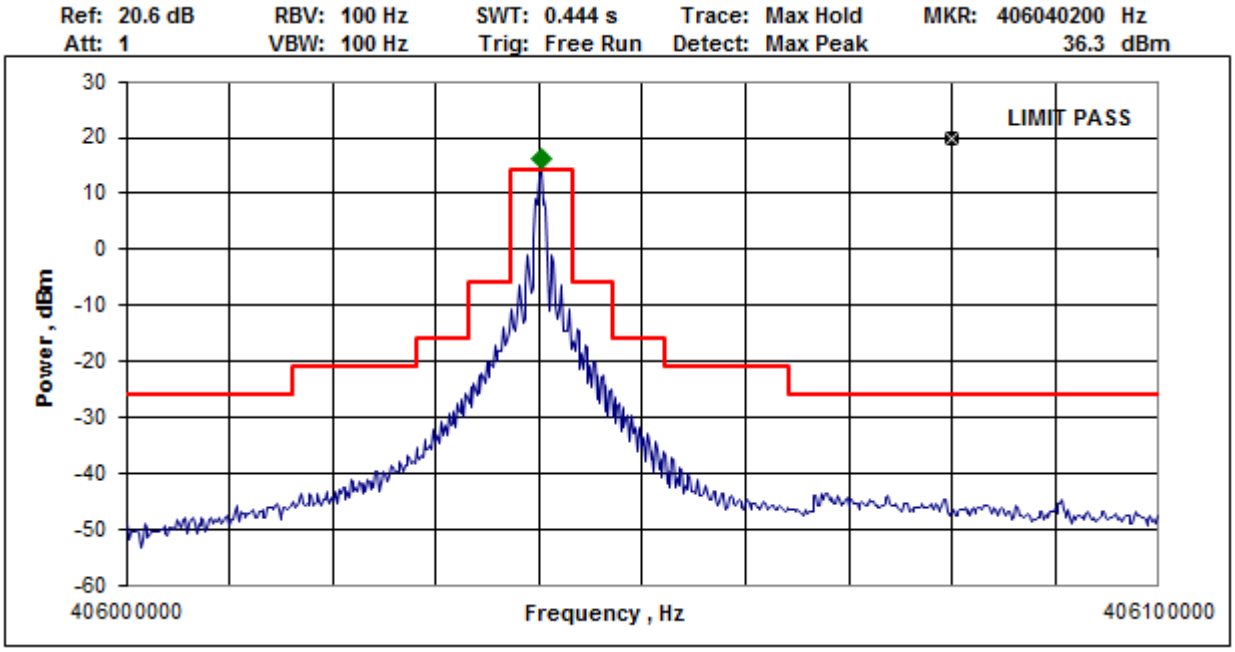


Figure 1.2 - 406 MHz spurious emissions MT603FG

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
9.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
10.	Temperature meter	gradient 2002	078	01.2017
11.	Hygrometer digital	HP 22-A	60974546	09.2016
12.	Beacon tester	BT100AVS	2315	07.2016
13.	Beacon tester	BT-611	1005	11.2016
14.	Semi-anechoic chamber	«Don»	1	08.2016
15.	Tuned dipole antenna	FCC-4	587A	09.2016
16.	Antennalogoperiodic	VULB9163	9163244	09.2018

ANNEX 2.
DRY HEAT TEST

Equipment Under Test (EUT): 1) MT603G
2) MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 15.12.2015, 16.12.15
Test Conditions:
- Ambient temperature: 16.1-21.7 °C
- Relative humidity: 45-48 %
- Atmospheric pressure: 765 mm/Hg

TEST PROGRAM

Item	Test name	Requirements	Methods
1	**Dry heat test**	A.1.2, 3.6.1 b), 3.6.3, 3.7 a) d) IEC 61097-2; 8.1, 8.2 IEC 60945	5.17.1 IEC 61097-2; 8.2 IEC 60945

TEST DESCRIPTION

The EUT shall be subjected to **Storage Test** of item 8.2.1 of IEC 60945 and **Functional Test** of item 8.2.2 of IEC 60945.

Storage Test (Item 8.2.1 of IEC 60945)
– The EUT shall be in position OFF.
– The EUT (the beacon) shall be placed according to the manufacturer's specifications with all connectors and fittings engaged in a temperature test chamber at normal room temperature and relative humidity.
– The temperature shall then be raised to +70 º C and maintained at +70 ± 3 º C during the whole performance test period.
– At the end of the test, the EUT shall be returned to normal environmental conditions and then subjected to a performance check.

Functional Test (Item 8.2.2 of IEC 60945)
– The EUT shall be in position ON.
– The EUT shall be placed in a temperature test chamber at normal room temperature and relative humidity.
– The temperature shall then be raised to +55 º C and maintained at +55 ± 3 º C during the whole performance test period.
– At the end of a soak period of 10 h at +55 ± 3 º C, the EUT shall be subjected to a performance test.
– At the end of the test, the EUT shall be returned to normal environmental conditions.

The requirements of the performance test and check shall be met.

Test Result Storage Test (Item 8.2.1 of IEC 60945):
– STEP 1. The EUT was switched OFF and was placed in the temperature test chamber at ambient temperature. The chamber temperature was raised to 70 ºC, and the EUT was allowed to stabilize at 70 ± 3 ºC for two hours.
– STEP 2. During the next 10-hour period, the temperature was maintained in the test chamber 70 ± 3 ºC.
– STEP 3. The test chamber temperature was reduced to ambient temperature, and EUT was allowed to stabilize at ambient temperature for two hours.
– STEP 4. The EUT was removed from the test chamber and was tested for compliance with the performance check.

Test Result Functional Test (Item 8.2.2 IEC 60945):
– STEP 1. The EUT was switched on and placed in the temperature test chamber at ambient temperature. The chamber temperature was raised to 55 º C.
– STEP 2. During the next 10-hour period, the temperature was maintained in the test chamber at 55 ± 3 º C.
– STEP 3. At the end of the exposure period, the EUT wassubjected to a performance test.
– STEP 4. The EUT was returned to normal environmental conditions.

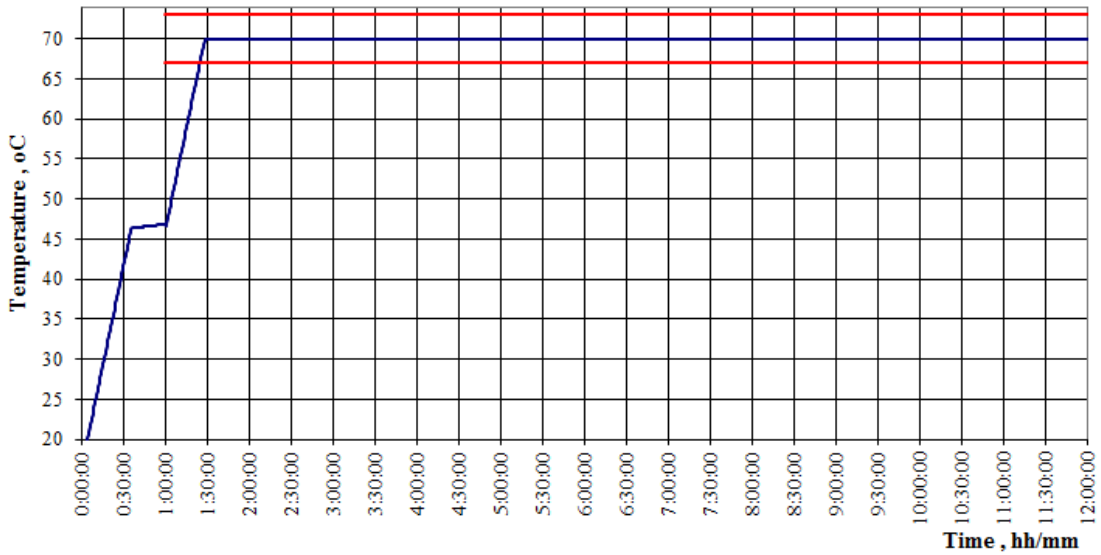


Figure 2.1 – Schedule of chamber temperature during Storage Test

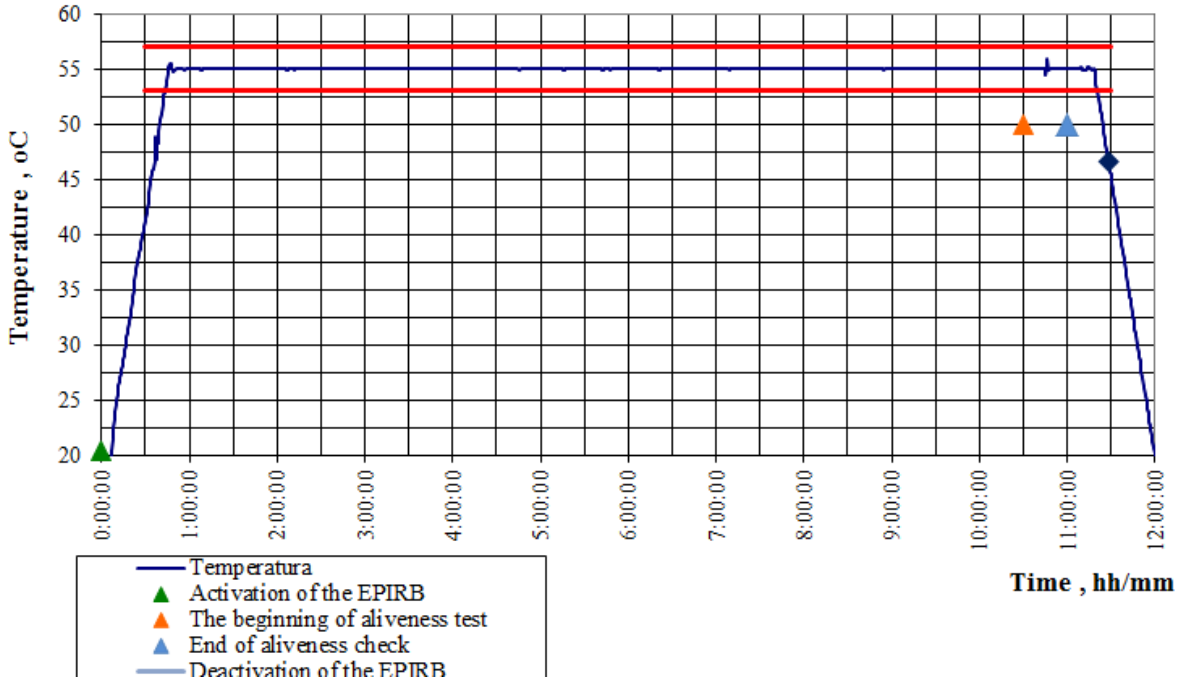


Figure 2.2 – Schedule of chamber temperature during Functional Test

TEST DETAILS

Summary table of performance test MT603G

No	Parameter	Measured value
1	406 MHz transmitted power output, W	4.25 to 4.26
2	406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
3	406 MHz digital message generator (bit rate)	399.95 to 400.23

4	406 MHz modulation: +Phase deviation, rad -Phase deviation, rad Phase time rise, us Phase time fall, us Asymmetry, %	 -1.16 to -1.07 1.08 to 1.17 196.66 to 213.57 189.45 to 205.16 0.15 to 0.94
5	406 MHz transmitted frequency, MHz	406.039894 to 406.039897
6	406 MHz spurious emissions	Figure 2.2

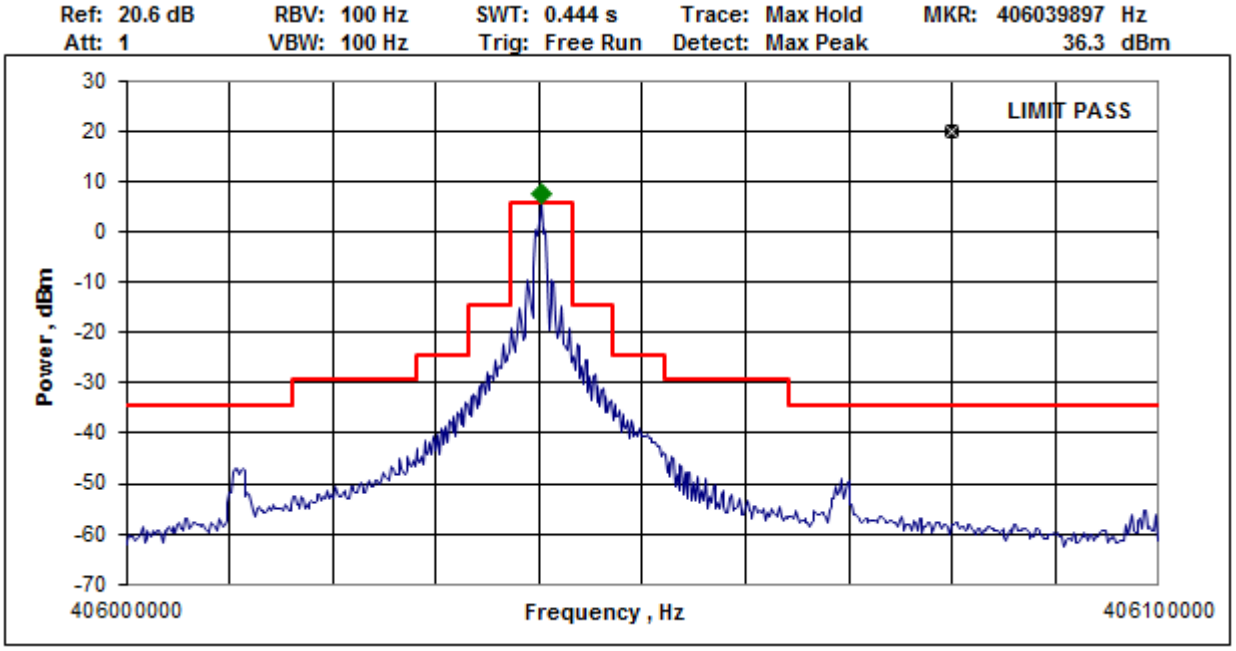


Figure 2.2 - 406 MHz spurious emissions MT603G

Summary table of performance test MT603FG

No	**Parameter**	**Measured value**
1	406 MHz transmitted power output, W	4.25 to 4.26
2	406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
3	406 MHz digital message generator (bit rate)	399.88 to 400.16
4	406 MHz modulation: +Phase deviation, rad -Phase deviation, rad Phase time rise, us Phase time fall, us Asymmetry, %	 -1.17 to -1.09 1.08 to 1.15 200.63 to 207.78 192.49 to 200.14 0.20 to 1.28
5	406 MHz transmitted frequency, MHz	406.039965 to 406.039968
6	406 MHz spurious emissions	Figure 2.3

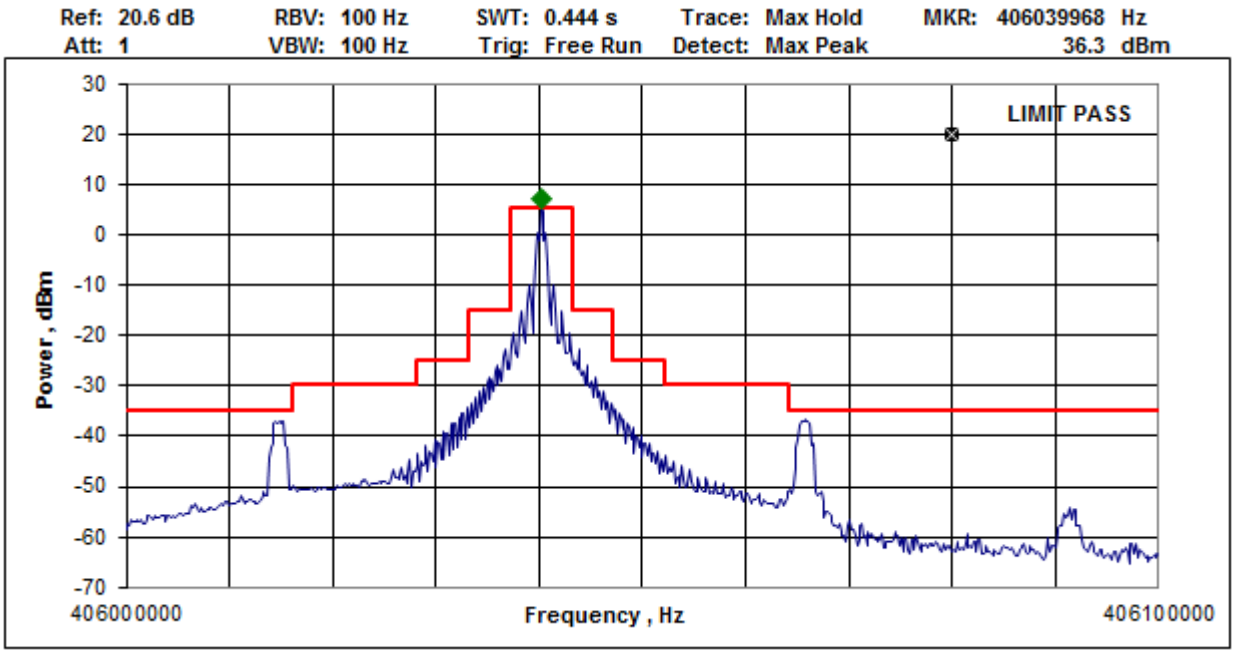


Figure 2.3 - 406 MHz spurious emissions MT603FG

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
2.	Temperature meter	gradient 2002	078	01.2017
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Tuned dipole antenna	FCC-4	587A	09.2016
7.	Antennalogoperiodic	VULB9163	9163244	09.2018

ANNEX 3.
DAMP HEAT TEST

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: from 17.12.15-18.12.15
Test Conditions:
- Ambient temperature: 15.2-15.8°C
- Relative humidity: 45-48%
- Atmospheric pressure: 765-768 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Damp heat test	A.1.3, 3.6.1 b), 3.6.3, 3.7 a) d) IEC 61097-2; 8.1, 8.3 IEC 60945	5.17.2 IEC 61097-2; 8.3 IEC 60945

TEST DESCRIPTION

EUT in mode OFF was placed in the climatic test chamber at ambient temperature and relative humidity. The temperature was raised to +40 ºC, and the relative humidity was raised to 93 % over the period of 3 hours.

During the next 10-hour period, the temperature was maintained in the climatic test chamber 40 ± 2 ºC and the relative humidity 93 % ± 3 %.

After exposure period of 10 hours EUT was activated and was kept operational at the temperature 40 ± 2 ºC and the relative humidity 93 % ± 3 % for 2 hours, during which period EUT was subjected to performance check.

At the end of the test period while EUT still in the chamber, the chamber was brought to room temperature during 1 hour.

TEST RESULT:
Passed

TEST DETAILS

Summary table of performance check

No	Parameter	Measured value
1	Activating the satellite EPIRB	Activated
2	The 406 MHz transmitted frequency, MHz	406.0400030 to 406.0400040
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	Present

Figure 3.1 – Test site

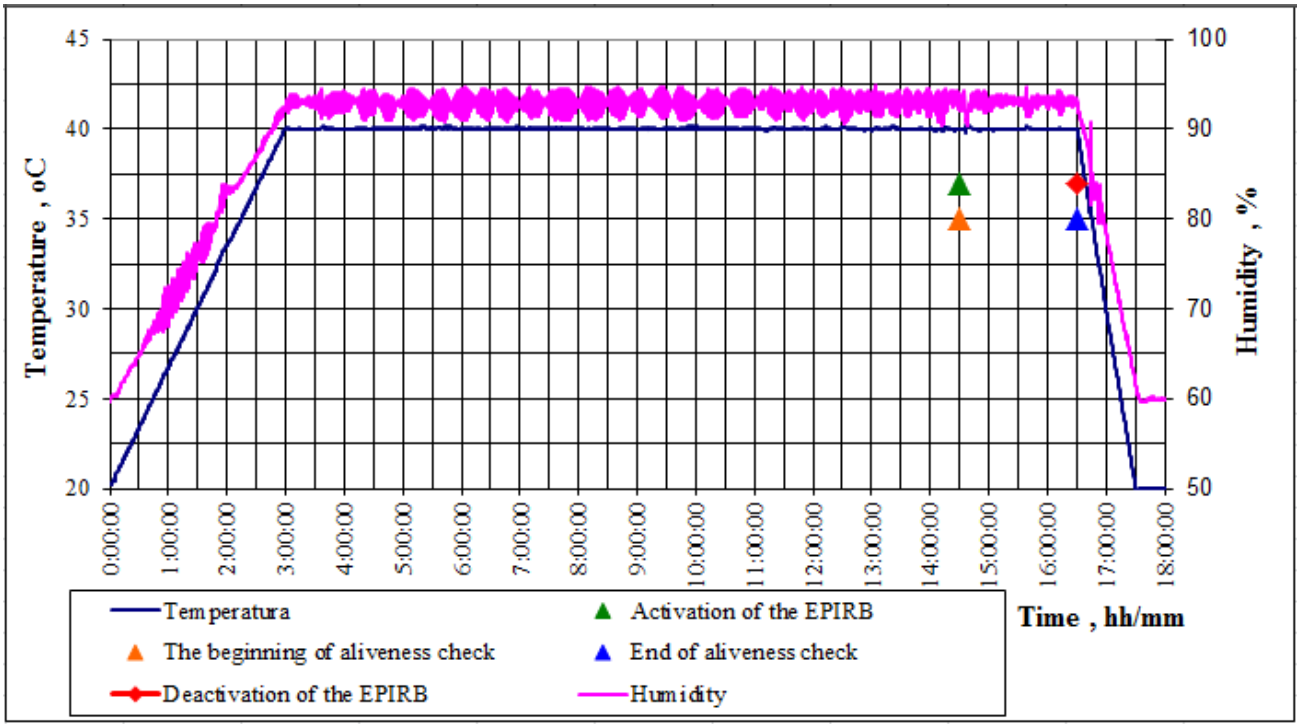


Figure 3.2 –Damp heat cycle conditions plot

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
2.	Temperature meter	gradient 2002	078	01.2017
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Spectrum analyzer	FSH8	105763	10.2016
7.	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 4.
VIBRATION TEST

Equipment Under Test (EUT): 1) MT603G
2) MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 11.01.16, 12.01.16, 13.01.16
Test Conditions:

- Ambient temperature: 15.3-19.3°C
- Relative humidity: 54-68 %
- Atmospheric pressure: 747-751 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Vibration test	A.1.4, 3.6.4, 3.7 b) IEC 61097-2; 8.7.3 IEC 60945	5.17.6 IEC 61097-2; 8.7.2 IEC 60945

TEST DESCRIPTION

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

Vibrations were conducted sequentially in vertical and two horizontal orthogonal axes.

EUT was subjected to sequentially vibration at all frequencies between:

2 Hz to 13.2 Hz with an excursion of ±1mm ±10%
above 13.2 Hz and up to 100 Hz with a constant acceleration of 7 m/s^2 (0.71 g)

The frequency sweep rate was less than 0.5 octaves/min. Sensors were fixed to EPIRB. A resonance search was carried out throughout the frequency sweep period. Then relative magnitude ratio was calculated as magnitude measured by a sensor fixed to the EUT divided to magnitude on the surface where the EUT is fastened.

During the resonance search EUT was externally observed by unaided aural and visual means. After resonance found EUT was subjected to vibration endurance test for 2 hours in vertical and two horizontal orthogonal axes with constant acceleration 7 m/s^2 at appropriate frequencies.

Performance check was carried out on completion of test.

TEST RESULT

Passed

TEST DETAILS FOR MT603G WITH MANUAL BRACKET

For vertical vibration in Z vertical axis EUT was fastened to the vibration table in its normal attitude using bracket (see Figure 4.1).

Figure 4.1 - General view of the test site vertical vibration (MT603G)

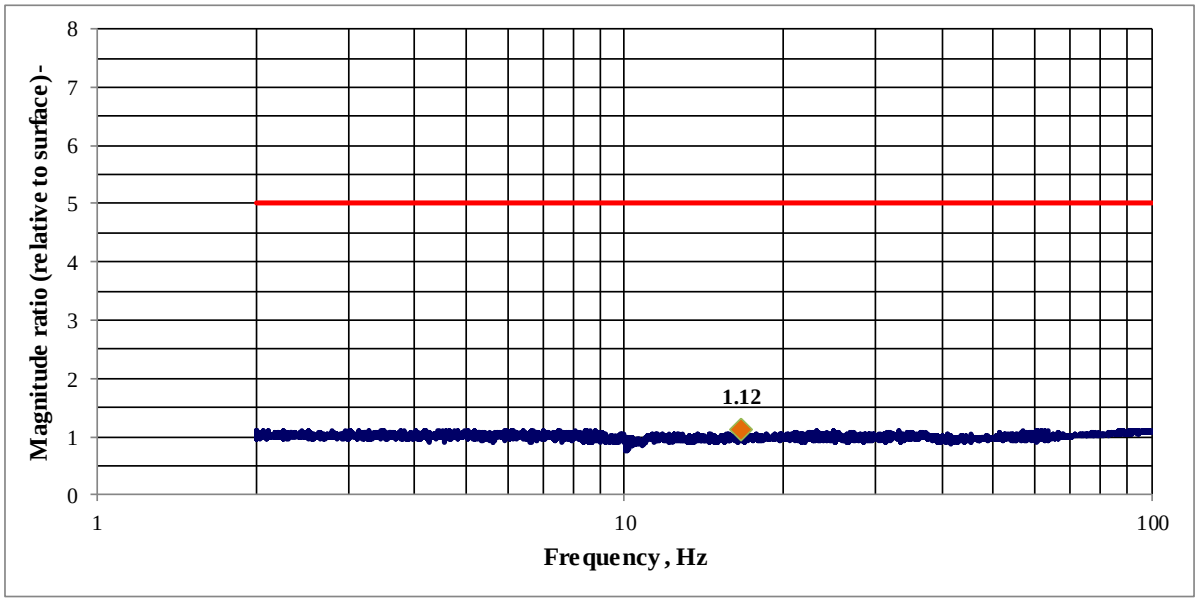


Figure 4.2 - Magnitude ratio vs. frequency during vibration on vertical axis Z (MT603G)

For horizontal vibration in X horizontal axis, EUT was then fastened to the vibration table in its normal attitude using bracket (see Figure 4.3).

Figure 4.3- General view of the horizontal axis X vibration test (MT603G)

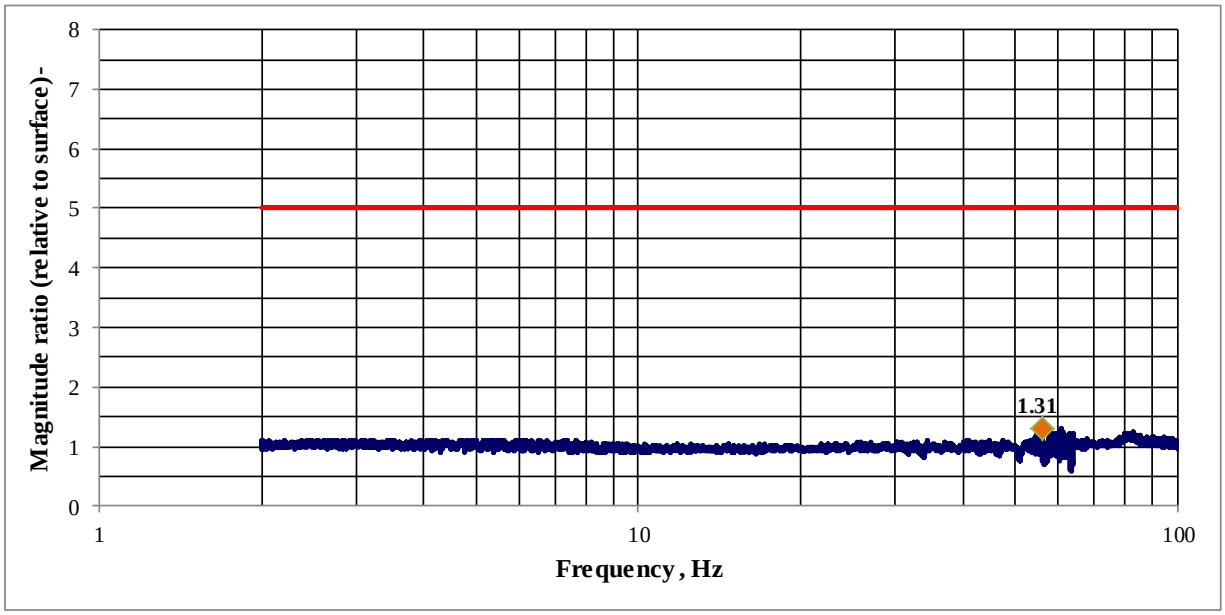


Figure 4.4 - Magnitude ratio vs. frequency during vibration on horizontal axis X (MT603G)

For horizontal vibration in Y axis, EUT was fastened to the vibration table in its normal attitude using bracket (see Figure 4.5).

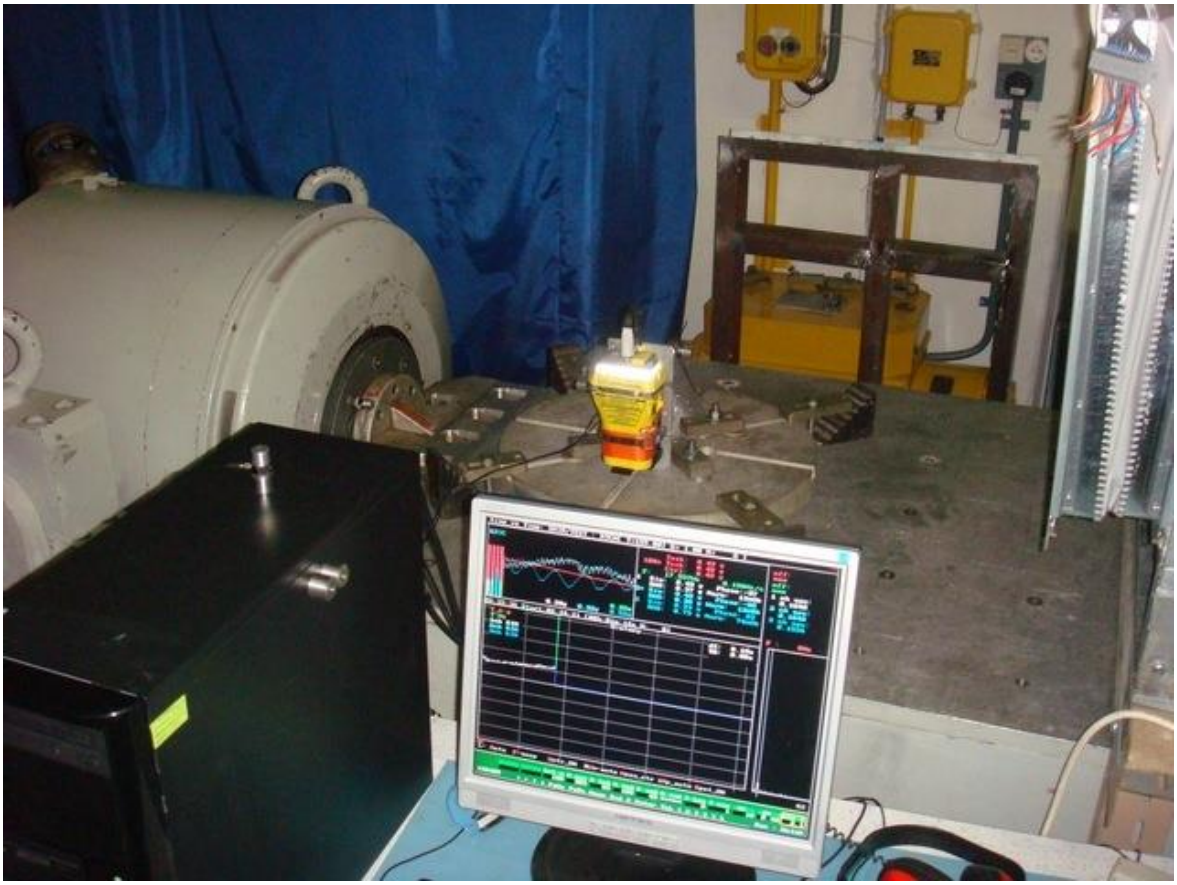


Figure 4.5 - General view of the horizontal Y vibration test (MT603G)

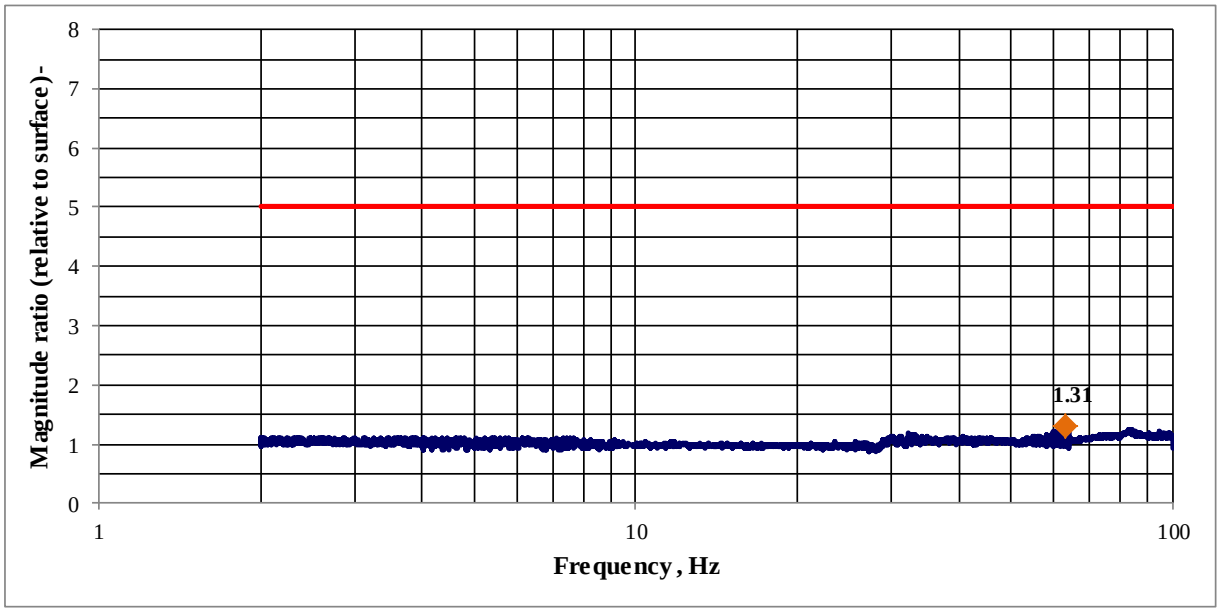


Figure 4.6- Magnitude ratio vs. frequency during vibration on horizontal axis Y (MT603G)

The EPIRBdid not activate during all the vibration tests.

Figure 4.7 - Resonance search (MT603G)

After resonance found EUT was subjected to vibration endurance test for 2 hours at 7 m/s^2 at following frequencies:

- Z axis: 16.63 Hz
- X axis: 56.27 Hz
- Y axis: 62.95 Hz

After endurance test EUT was subjected to performance check. Result of performance check is shown below.

Summary table of performance check

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.0400
3	The 406 MHz digital message	FFFED08C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST DETAILS FOR MT603FG WITH AUTO/MANUAL RELEASE HOUSING

For vertical vibration in Z vertical axis EUT was fastened to the vibration table in its normal attitude using bracket (see Figure 4.8).

Figure 4.8 - General view of the test site vertical vibration (MT603FG)

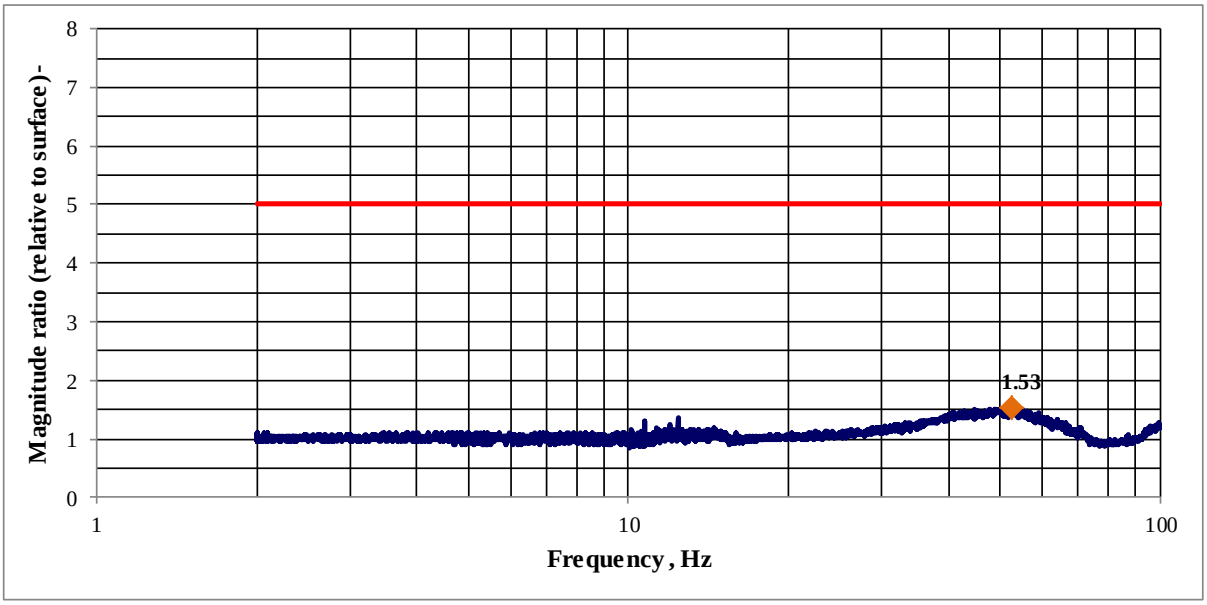


Figure 4.9 - Magnitude ratio vs. frequency during vibration on vertical axis Z (MT603FG)

For horizontal vibration in X horizontal axis, EUT was then fastened to the vibration table in its normal attitude using bracket (see Figure 4.10).

Figure 4.10- General view of the horizontal axis X vibration test (MT603FG)

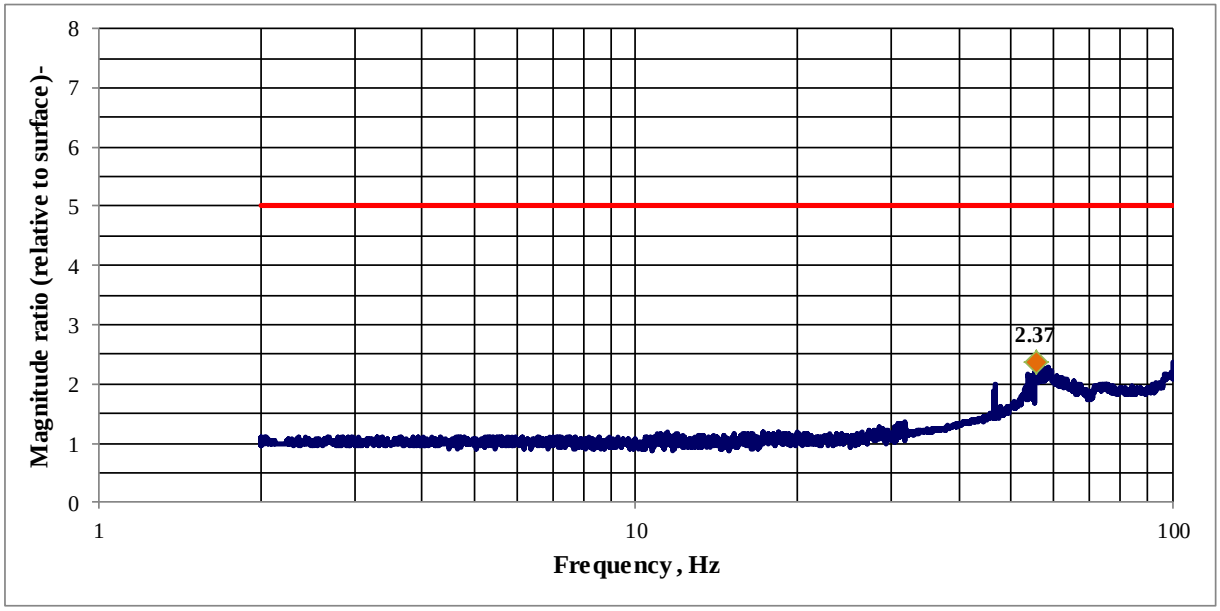


Figure 4.11 - Magnitude ratio vs. frequency during vibration on horizontal axis X (MT603FG)

For horizontal vibration in Y axis, EUT was fastened to the vibration table in its normal attitude using bracket (see Figure 4.12).

Figure 4.12 - General view of the horizontal Y vibration test (MT603FG)

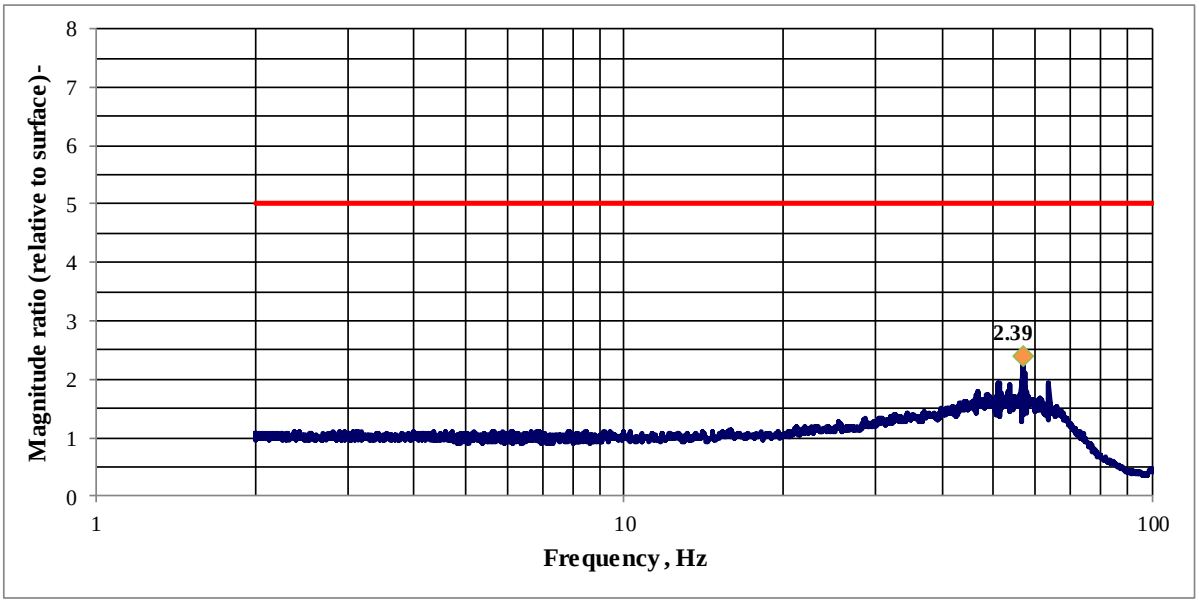


Figure 4.13- Magnitude ratio vs. frequency during vibration on horizontal axis Y (MT603FG)

The EPIRB did not activate during all the vibration tests.

Figure 4.14- Resonance search (MT603FG)

After resonance found EUT was subjected to vibration endurance test for 2 hours at 7 m/s^2 at following frequencies:

- Z axis: 52.42 Hz
- X axis: 55.69 Hz
- Y axis: 56.79 Hz

After endurance test EUT was subjected to performance check. Result of performance check is shown below.

Summary table of performance check

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.0402
3	The 406 MHz digital message	FFFED08C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Vibration table	Tiravib 5142	26/88	07.2017
2.	Digital vibration meter	V-1103A	1013/2	09.2016
3.	Digital system of impact control	Santek-Vibro	7-25	12.2016
4.	Oscilloscope	TDS 1002	C041673	02.2017
5.	Temperature meter	gradient 2002	078	01.2017
6.	Hygrometer digital	HP 22-A	60974546	09.2016
7.	Beacon tester	BT100AVS	2315	07.2016
8.	Beacon tester	BT-611	1005	11.2016
9.	Spectrum analyzer	FSH8	105763	10.2016
10.	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 5.
RUGGEDNESS TEST

Equipment Under Test (EUT): 1) MT603G
2) MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 15.01.16
Test Conditions:

- Ambient temperature: 15.8 °C
- Relative humidity: 47%
- Atmospheric pressure: 759 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Ruggedness test	A.1.5, 3.6.4, 3.7 b) IEC 61097-2	5.17.7 IEC 61097-2

TEST DESCRIPTION

The EUT was secured to the testing equipment through its normal attachmentsand mounted in the normal operating position. Additional straps or other holding means were not used.
The EUT was subjected to the bump test according to the following profile:

- Peak Acceleration: 98 m/s^2
- Pulse Duration: 16 ms
- Waveshape: Half-cycle Sinewave
- Test Axis: Vertical
- Number of Bumps: 4000

After completion of the ruggedness test a performance check was carried out.

Activation of the EUT during the ruggedness test was monitored.

TEST RESULT

Passed

TEST DETAILS

Activation of the EUT during the ruggedness test was monitored.The EUT was not switched on during the test and the EUT did not inadvertently activate during the test.

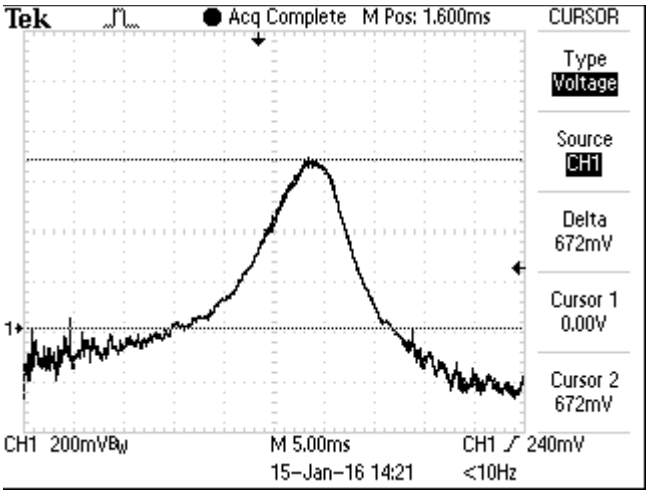


Figure 5.1 – Diagram of the bumptesting equipmentcontrol channel (15.9 ms, 98.1 m/s^2)

Figure 5.2 - Test Set-up. Vertical axis of the MT603G

Figure 5.3 - Test Set-up. Vertical axis of the MT603FG

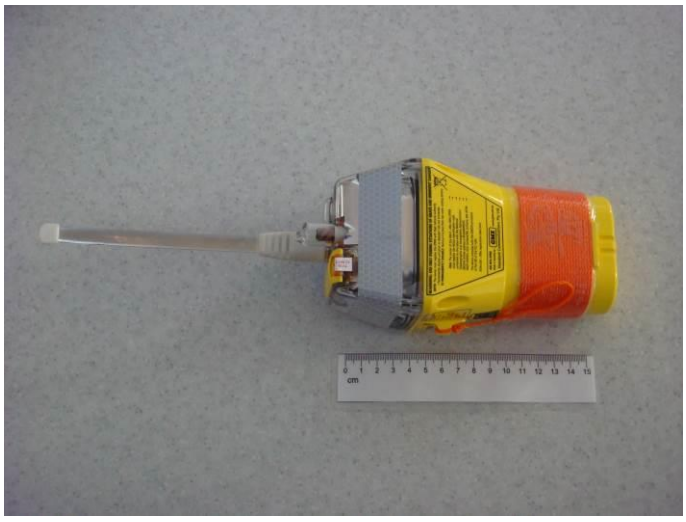


Figure 5.4 – View of the MT603Gupon completion of the ruggedness test

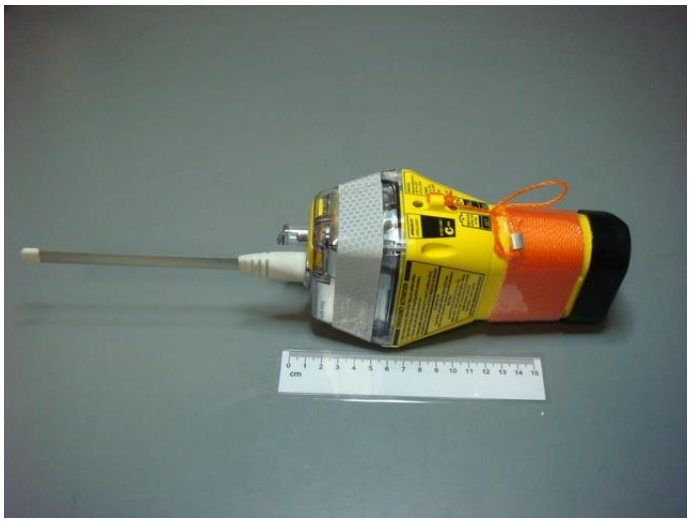


Figure 5.5 – View of the MT603FGupon completion of the ruggedness test

Figure 5.6 – View of the MT603FGupon completion of the ruggedness test

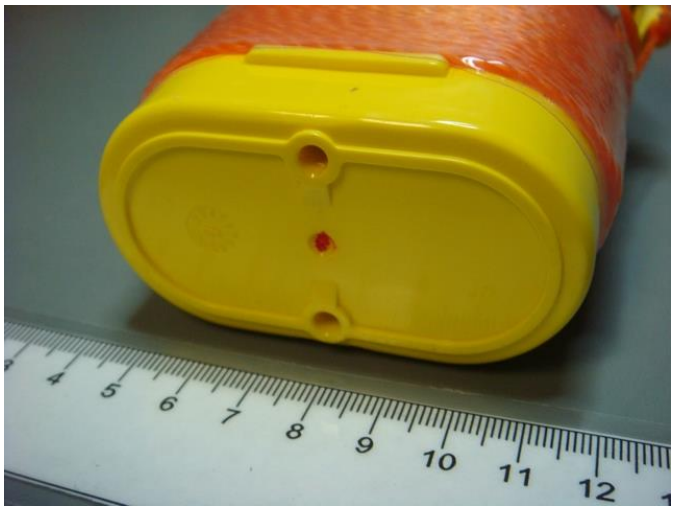


Figure 5.7 – View of the MT603G upon completion of the ruggedness test

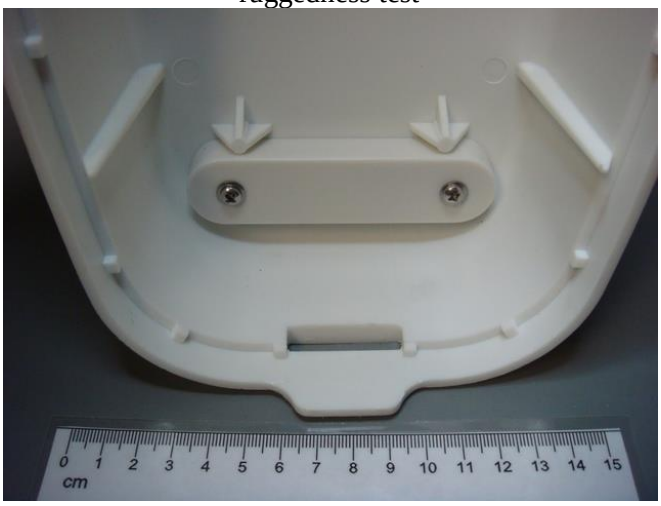


Figure 5.8– View of the MRH(MT603FG) upon completion of the ruggedness test

Summary table of performance check MT603G

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.039862632
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Summary table of performance check MT603FG

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.0400258
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Shock table	Tirashock 4110	41/88	07.2017
2.	Digital vibration meter	V-1103A	1013/2	09.2016
3.	Digital system of impact control	Santek-Vibro	7-25	12.2016
4.	Oscilloscope	TDS 1002	C041673	02.2017
5.	Temperature meter	gradient 2002	078	01.2017
6.	Hygrometer digital	HP 22-A	60974546	09.2016
7.	Beacon tester	BT100AVS	2315	07.2016
8.	Beacon tester	BT-611	1005	11.2016
9.	Spectrum analyzer	FSH8	105763	10.2016
10.	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 6.
DROP TEST ON HARD SURFACE

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 19.01.2016
Test Conditions:
- Ambient temperature: 16.5°C
- Relative humidity: 49%
- Atmospheric pressure: 750mm/Hg

TEST PROGRAM

Item	Test name	Requirements	Methods
1	Drop on hard surface test	A.1.6, 3.3.2 c) IEC 61097-2; 8.6.1.3 IEC 60945	5.17.5.1 IEC 61097-2; 8.6.1.2 IEC 60945

TEST DESCRIPTION

A series of six drops were carried out; one on each face of the EUT.

The test surface consists of a piece of solid hard wood with a thickness of 150 mm and a mass of 30 kg.

The height of the lowest part of the EUT relative to the test surface at the moment of release was 1000 mm ± 10 mm.

A series of six drops was carried out; one on each face of the EUT.

At the end of the test the EUT was subjected to a performance check and examined for external indications of damage.

TEST RESULT

Passed

TEST DELAILS

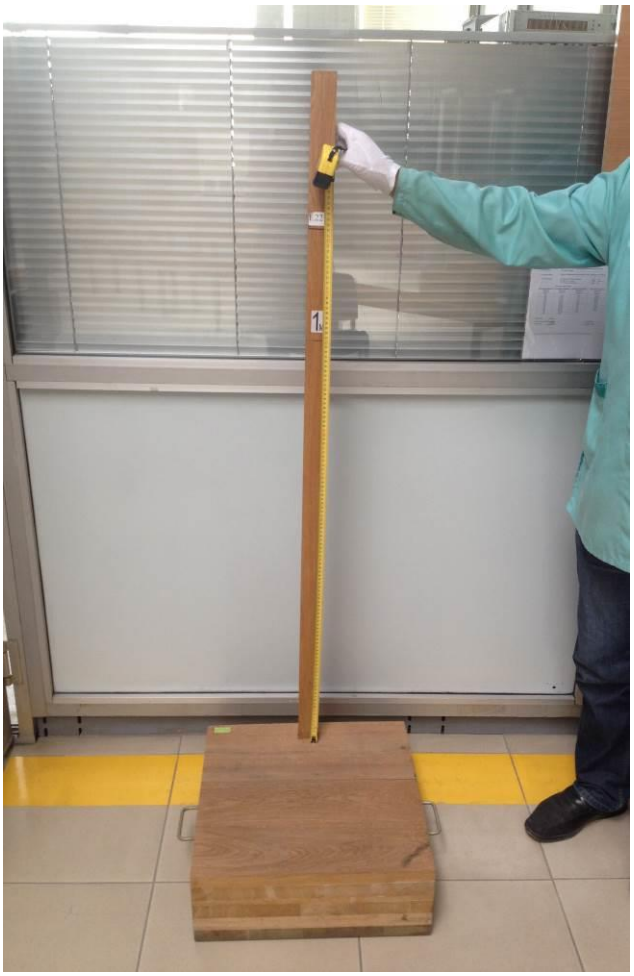


Figure 6.1 - Set-up for drop test

Figure6.2 - Thickness of wood test surface

Figure 6.3 - Dimensions of the wood test surface

Figure 6.4 - View EUT upon completion of the drop test

Figure 6.5 - View EUT upon completion of the drop test

Figure 6.6 - View EUT upon completion of the drop test

Figure 6.7 - View EUT upon completion of the drop test

Figure 6.8 - View EUT upon completion of the drop test

Figure 6.9 - View EUT upon completion of the drop test

No indication of damage was detected at the end of test.

Summary table of performance check

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.039992
3	The 406 MHz digital message	FFFED08C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
2.	Temperature meter	gradient 2002	078	01.2017
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Spectrum analyzer	FSH8	105763	10.2016
7.	Tuned dipole antenna	FCC-4	587A	09.2016
8.	Wooden drop installation	-	101231	01.2018

ANNEX 7.
DROP TEST INTO WATER

Equipment Under Test (EUT): MT603G
MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 20.01.16
Test Conditions:

- Ambient temperature: 15.1 °C
- Relative humidity: 46%
- Atmospheric pressure: 750 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Drop into water test	A.1.7, 3.3.2 c) IEC 61097-2; 8.6.2.3 IEC 60945	5.17.5.2 IEC 61097-2; 8.6.2.2 IEC 60945

TEST DESCRIPTION

The height of the lowest part of the EUT under test relative to the water surface at the moment of release was 20 m ± 1 m.

The three drops was initiated with a different orientation, namely:

- antenna vertically up,
- antenna vertically down and
- antenna horizontal.

At the end of the test EUT was subjected to a performance check, and then was examined for damage and for unwanted ingress of water.

TEST RESULT

Passed

TEST DETAILS

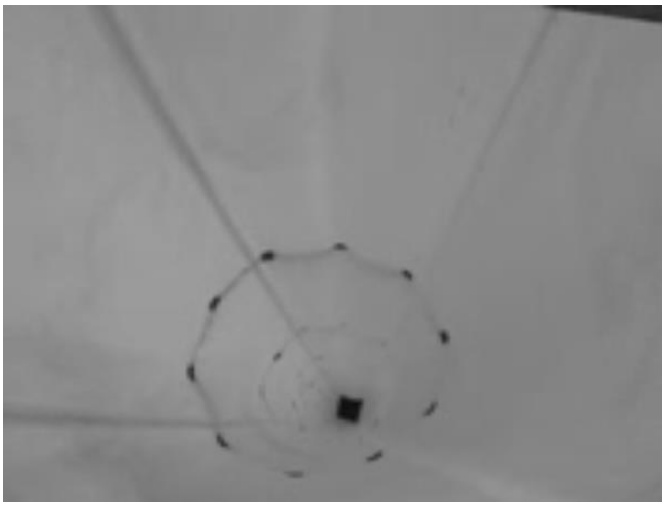


Figure 7.1 – Total view of test site of the drop test in water of MT603G from a height of 20 m

Figure 7.2 – View MT603G dropping in water with antenna horizontal

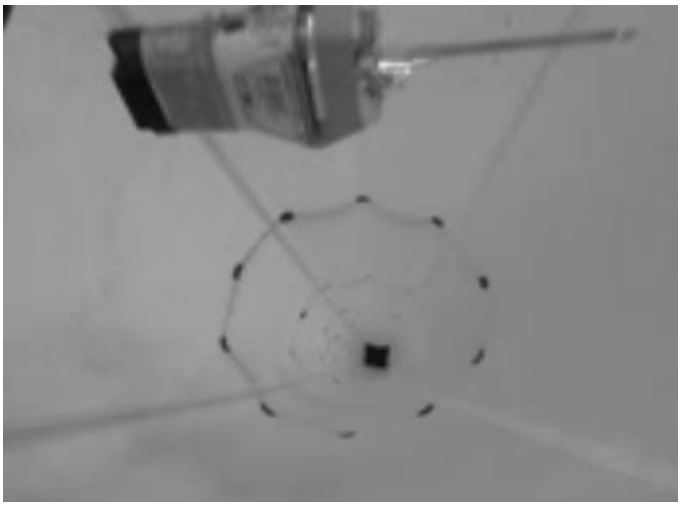


Figure 7.3 – View MT603FG dropping in water with antenna horizontal

Figure 7.4 – View MT603G dropping in water with antenna vertical down

Figure 7.5 – View MT603FG dropping in water with antenna vertical down

Figure 7.6 – View MT603G dropping in water with antenna vertical up

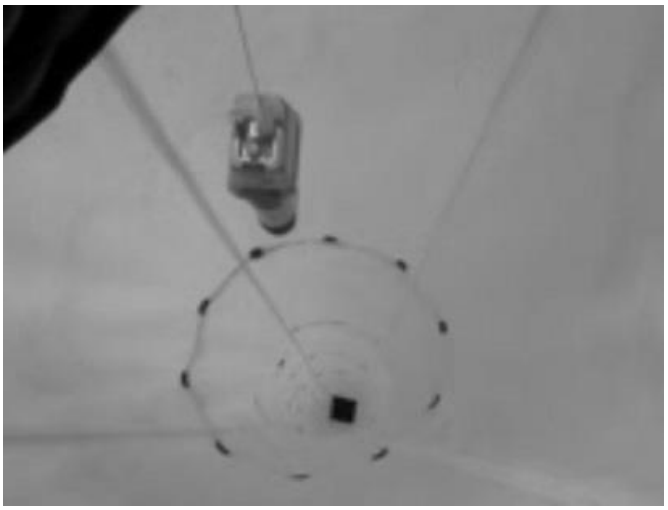


Figure 7.7 – View MT603FG dropping in water with antenna vertical up

No water ingress was detected inside of EUT on drop test completion.

Summary table of performance check of MT603G

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.039916
3	The 406 MHz digital message	FFFED08C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Summary table of performance check of MT603FG

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency	406.0400257
3	The 406 MHz digital message	FFFED08C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Hygrometer digital	HP 22-A	60974546	09.2016
2.	Beacon tester	BT100AVS	2315	07.2016
3.	Beacon tester	BT-611	1005	11.2016
4.	Spectrum analyzer	FSH8	105763	09.2016
5.	Tuned dipole antenna	FCC-4	587A	09.2016
6.	Free fall installation	SAPB-20	101377	05.2016

ANNEX 8.
THERMAL SHOCK, IMMERSION TEST

Equipment under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 21.01.2016-23.01.2016
Test Conditions:
- Ambient temperature: 23.4-25.6 °C
- Relative humidity: 50-67 %
- Atmospheric pressure: 752-762 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1	Thermal shock	A.1.8, 3.3.2 a) IEC 61097-2; 8.5.3 IEC 60945	5.17.4 IEC 61097-2; 8.5.2 IEC 60945
2	Immersion test	A.1.9, 3.3.2 a) IEC 61097-2; 8.9.2 IEC 60945	5.17.8, 5.3.2. IEC 61097-2; 8.9.2 IEC 60945

TEST DESCRIPTION

The beacon subjected to the Thermal Shock Test in position OFF.

The beacon was placed according to the manufacturer's specifications with all connectors and fittings engaged in a temperature test chamber at temperature + 70 ± 3 ° C for 1 h.

The beacon was then immersed in water at +25 °C ± 3 °C to a depth of 100 mm ± 5 mm, measured from the highest point of the beacon to the surface of the water, for a period of 48 h[1)].

This test was carried out in combination with the test per 5.17.8 Immersion test, of IEC 60945. A hydraulic pressure of 100 kPa (1 bar) was applied to the EUT for a period of 5 min.

At the end of the test the beacon was subjected to a performance check, and then was examined for damage and for unwanted ingress of water.

The requirements of the performance check were met.

There is no damage to the beacon or ingress of water.

TEST RESULT

Passed

- STEP 1. The EUT was switched OFF and placed in the climatic test chamberat temperature + 68 °C[2)] for 1 hour.
- STEP 2. The EUT was then immersed in water at +23 °C[2)] to a depth of 100 mm, measured from the highest point of the EUT to the surface of the water, for a period of 48 hours.
- STEP 3. After period of 48 hours the EUT was removed from the water.
- STEP 4.The EUT was then immediately immersed into the pressure vessel which had been filled with water at +17°C±2°C to a depth of 0.5 meter measured from the highest point of the equipment to the surface of the water.
- STEP 5. Then pressure was increased to 1.95 bar (relative to atmospheric pressure) that corresponds total depth of immersion of 20 meters and maintained for one hour.
- STEP 6. The EUT was removed from the water and wiped dry.
- STEP 7. The EUT was then examined for damage and for obvious unwanted ingress of water without opening as agreed with manufacturer.
- STEP 8. The EUT was then subjected to a performance check. The result of performance check was positive. Therefore the opening of the EUT to check for water ingress was delayed until the completion of immersion test.

[1)] The period 48 hours instead 1 hour was used to cover requirements of RTCM 11000.2.

[2)] This temperature was used to cover requirements of RTCM 11000.2 which requires +65 °C ± 3 °C for the EUT soaking and +25 °C ± 3 °C for the EUT immersion.

TEST DETAILS

Figure 8.1 – View of the Beacon in the temperature test chamber during the Thermal Shock Test

Figure 8.2 —View of the Beacon in the water during the Thermal Shock Test

Figure 8.3 — Hydraulic pressure set-up (1 bar)

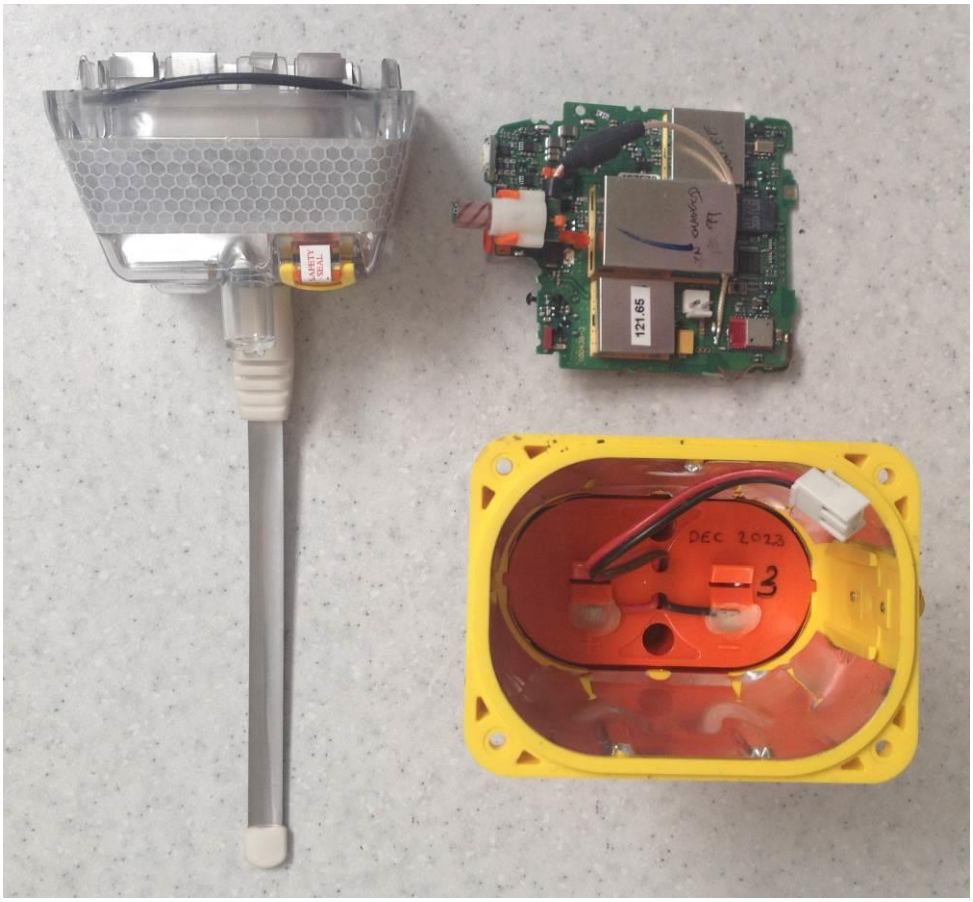


Figure 8.4 – View of the interiors of the Beacon upon completion of the Thermal Shock Test and Immersion Test

Figure 8.5 – View of the interiors of the Beacon upon completion of the Thermal Shock Test and Immersion Test

Neither water ingress, nor damage was detected on completion of the test. Performance check result is presented in table below.

Summary table of performance check

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.0400196
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
2.	Climatic chamber	KPK 400V	015	08.2016
3.	Temperature meter	gradient 2002	078	01.2017
4.	Hygrometer digital	HP 22-A	60974546	09.2016
5.	Beacon tester	BT100AVS	2315	07.2016
6.	Beacon tester	BT-611	1005	11.2016
7.	Spectrum analyzer	FSH8	105763	09.2016
8.	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 9.
SPURIOUS EMISSION TEST

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 17.05.16
Test Conditions:

- Ambient temperature 21.6 °C
- Relative humidity: 52 %
- Atmospheric pressure: 755 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1.	Spurious emission test	A.1.10, 5.19 IEC 61097-2	5.19 IEC 61097-2

TEST DESCRIPTION:

The 121.5 MHz spurious emission measurementswere performed only between bursts of 406 MHz signal.

The measurements carried out at the transmitter output at 50 Ohm using a spectrum analyzer with its bandwidth set to between 100 kHz and 120 kHz or its nearest setting thereto, over the following frequency bands:

108 MHz to 121 MHz,

122 MHz to 137 MHz,

156 MHz to 162 MHz, and

1 525 MHz to 1 610 MHz

The values of spurious emission within these bands compared with limit level 25 μW.

TEST RESULT

Passed

TEST DETAILS

The frequency bands	Measured maximal value	Frequency of maximal value	Limit level	Results
108 MHz to 121 MHz	7.6nW	121.000 MHz	25 μW	Pass
122 MHz to 137 MHz	57.4nW	122.071 MHz		Pass
156 MHz to 162 MHz	1.5nW	160.219 MHz		Pass
1 525 MHz to 1 610 MHz	1.5nW	1595.29 MHz		Pass

Photos of EPIRB1 and workplace during the test adduce below:

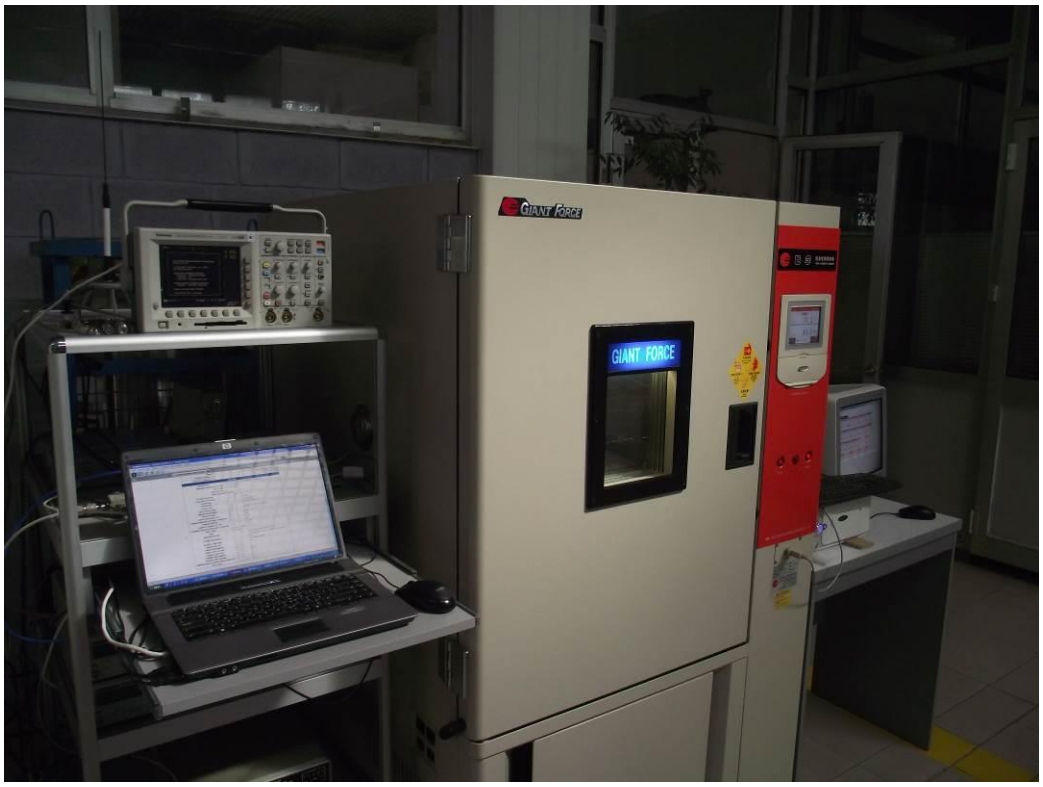


Figure 9.1 - View of the test site for the Spurious Emissions Test

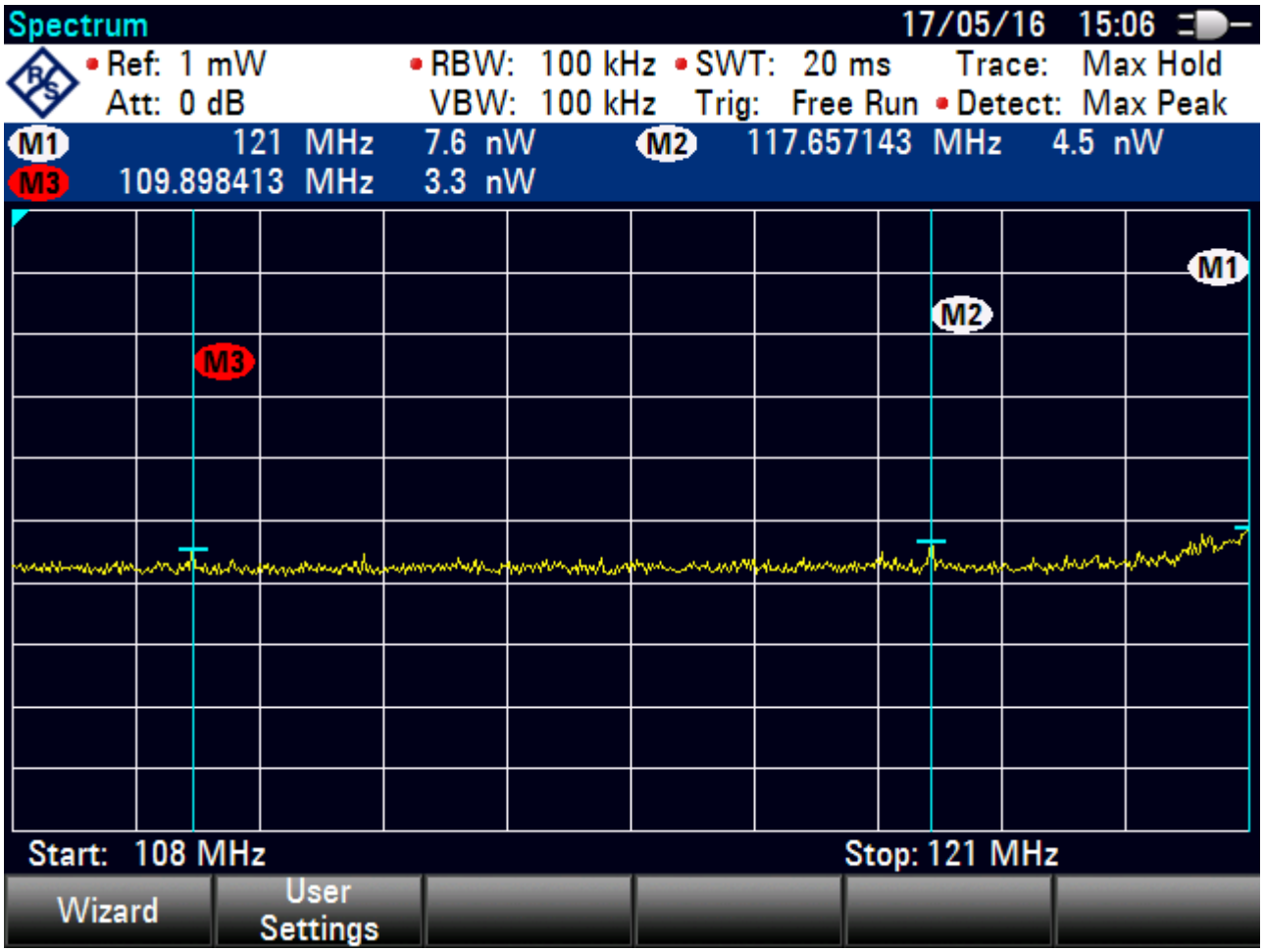


Figure 9.2 –121.5 MHz spurious emission in the frequency bands from 108 MHz to 121 MHz

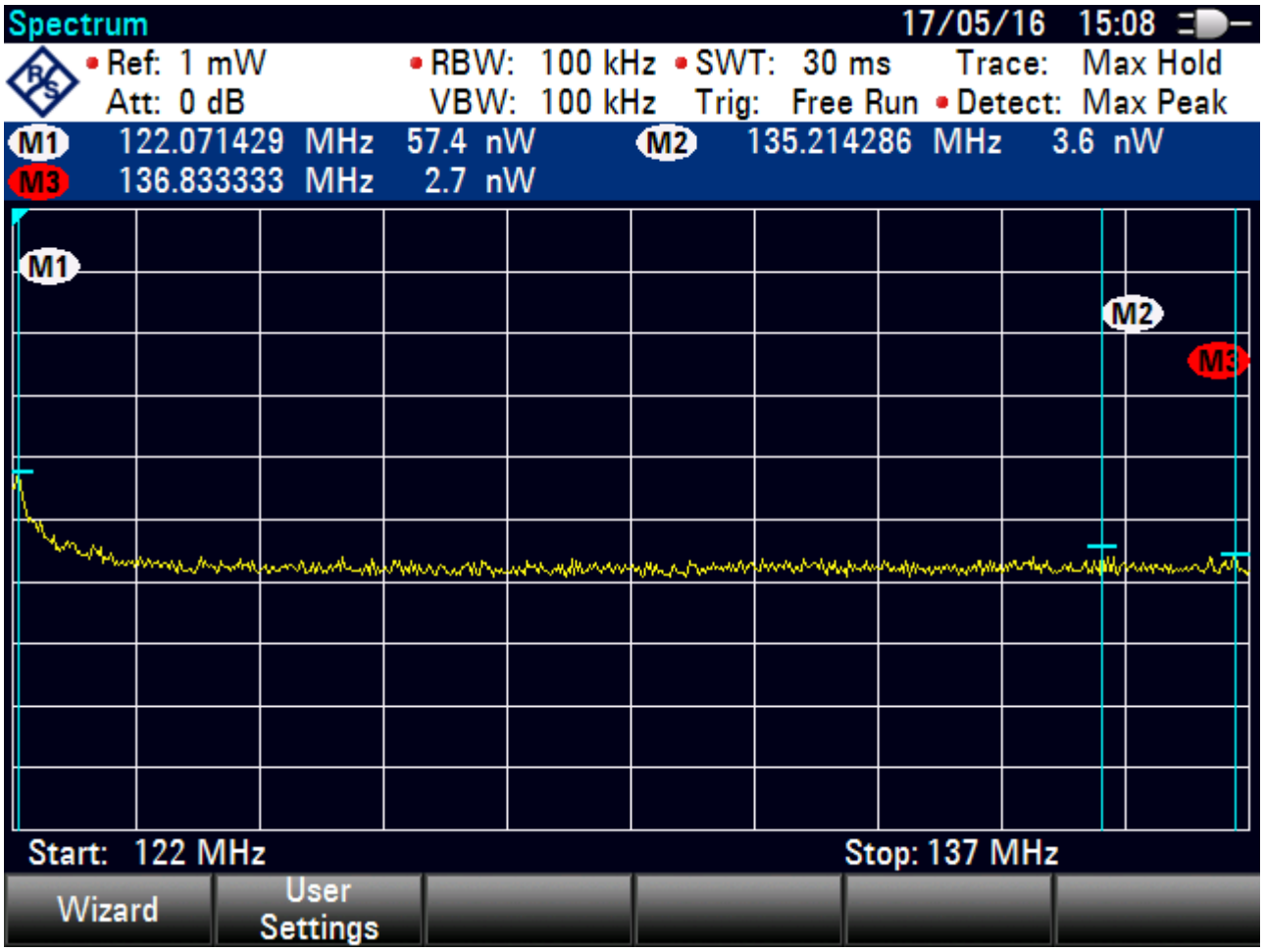


Figure 9.3 –121.5 MHz spurious emission in the frequency bands from 122 MHz to 137 MHz

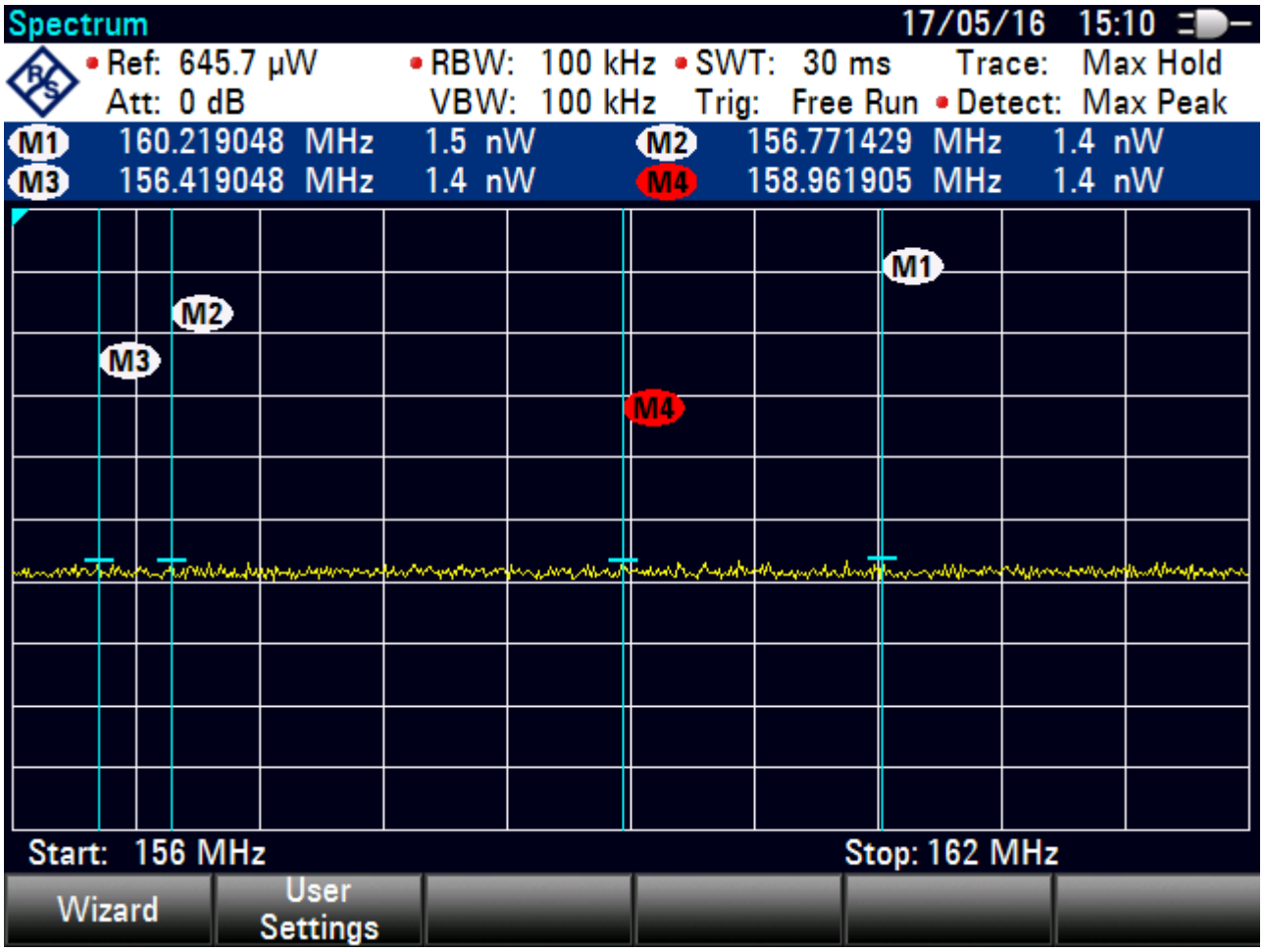


Figure 9.4 –121.5 MHz spurious emission in the frequency bands from 156 MHz to 162 MHz

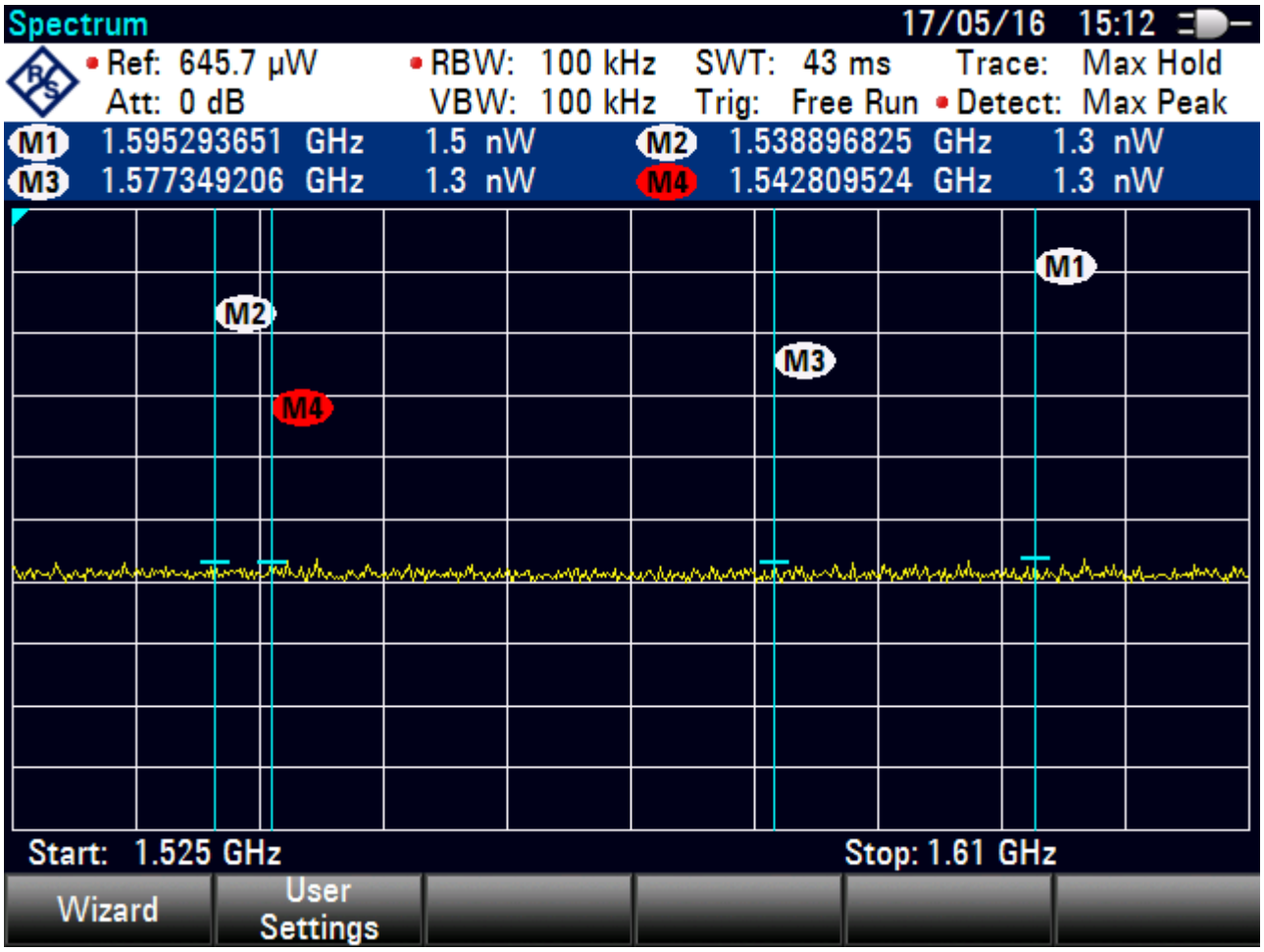


Figure 9.5 –121.5 MHz spurious emission in the frequency bands from 1 525 MHz to 1 610 MHz

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Temperature meter	gradient 2002	078	01.2017
2.	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Spectrum analyzer	FSH8	105763	10.2016

ANNEX 10.
BATTERY CAPACITY AND LOW-TEMPERATURE TEST

Equipment Under Test (EUT):MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 15.02.2016-18.02.2016
Test Conditions:

- Ambient temperature: 16.2-21.5°C
- Atmospheric pressure: 756-758 mm/Hg
- Relative air humidity: 45-69 %

TEST PROGRAM

No	Test name	Requirements	Methods
1	Battery capacity and low temperature test	A.1.11, 4.6.1 IEC 61097-2	5.15.1 IEC 61097-2, A.2.3 C/S T.007

TEST DESCRIPTION:

- The battery capacity and low-temperature test was combined with the COSPAS-SARSAT Type Approval operating lifetime test in accordance to C/S T.007 A.2.3 as allowed by IEC 61097-2, clause 5.15.1. The battery was partially discharged according to C/S T.007.
- EPIRB was placed in a chamber at normal room temperature. Then the temperature was reduced to and maintained at minus 30 °C for period of 10 hours.
- The chamber was heated to minus 20 °C, the heating of the chamber was completed within 20 minutes.
- The equipment has been manually activated in 30 minutes after the end of the period specified in the subclause above and then kept working continuously until power of 406 MHz transmitter was reduced to the minimal acceptable value.
- Parameters were measured immediately after activation of beacon except for the Medium Term Frequency Stability (the mean slope of the frequency and the residual frequency variation about the mean slope), which were computed after 15 minutes according to T.001 section 2.3.1;
- The total duration of the lifetime test was 77 hours 39 minutessince activation EUT till the power was reduced to 36.32 dBm;
- Matching network was used;
- GNSS signal was not available during the test.

Beacon manufacturer provided operating currents and pre-test battery discharge calculations.

Operational currents were verified by the testing laboratory with measurement results reported in Table 10.1 below.

During operating current measurement GNSS signal was not available.

Measured values do not exceed values provided by manufacturer.

Table 10.1: Beacon Operating Current

No.	Beacon Operating Modes	Mode: Manually selectable or Automatic	Measurement interval, sec	Average Current, mA	Peak Current, mA
1.	406 + 121 + GNSS Search	Automatic	102.5	89	2864
2.	406 + 121 + GNSS Sleep	Automatic	102.5	69	2789
3.	GNSS Self-test	Manual	130.2	46.5	2770
4.	Self-test	Manual	8.24	217.8	2780
5.	Stand-by	Automatic	20	0.001	0.001

Conclusion: the beacon in the operating mode has the maximum power consumption when the GPS receiver is activate in the absence of GNSS signal.

Current consumption was measured using circuit shown on Figure 10.1.

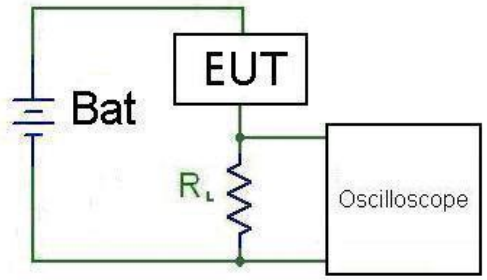


Figure 10.1 -The Circuit for Current Consumption Measurement

The value of the current calculated by equation: $I = \frac{U}{R}$, where ***I*** is a value of current (A), ***U*** is a value of voltage (V), ***R*** is a value of resistance (Ohm). Voltage was measured by digital oscilloscope with load R=0.1 Ohm.

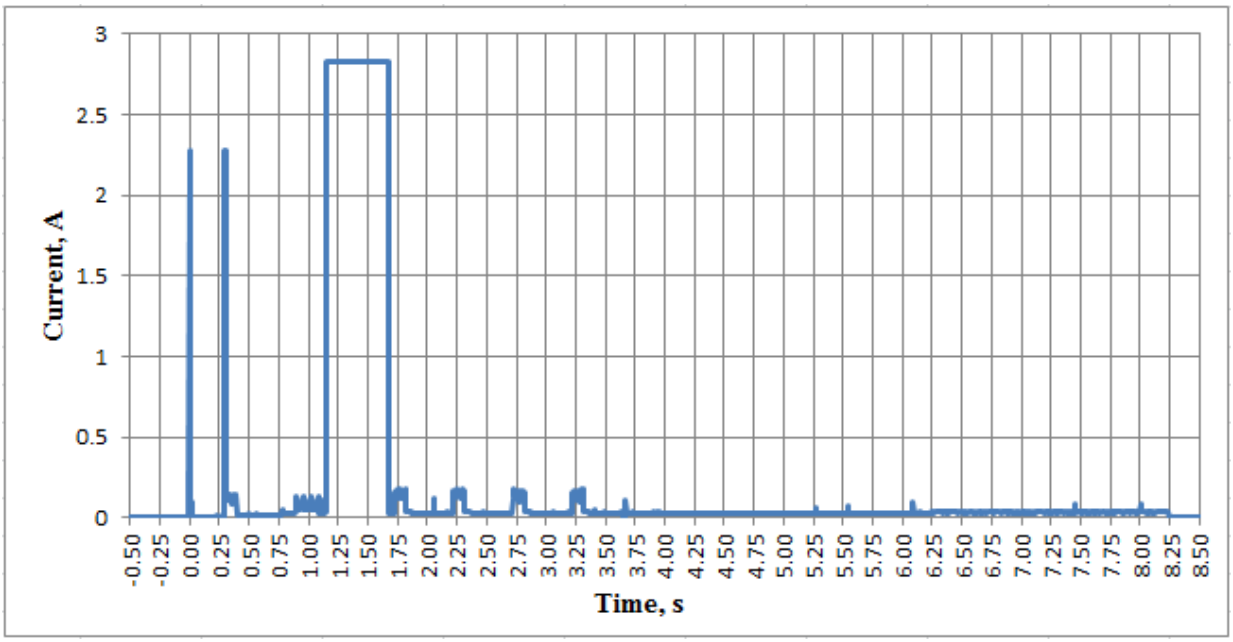


Figure 10.2 - Current during self-test

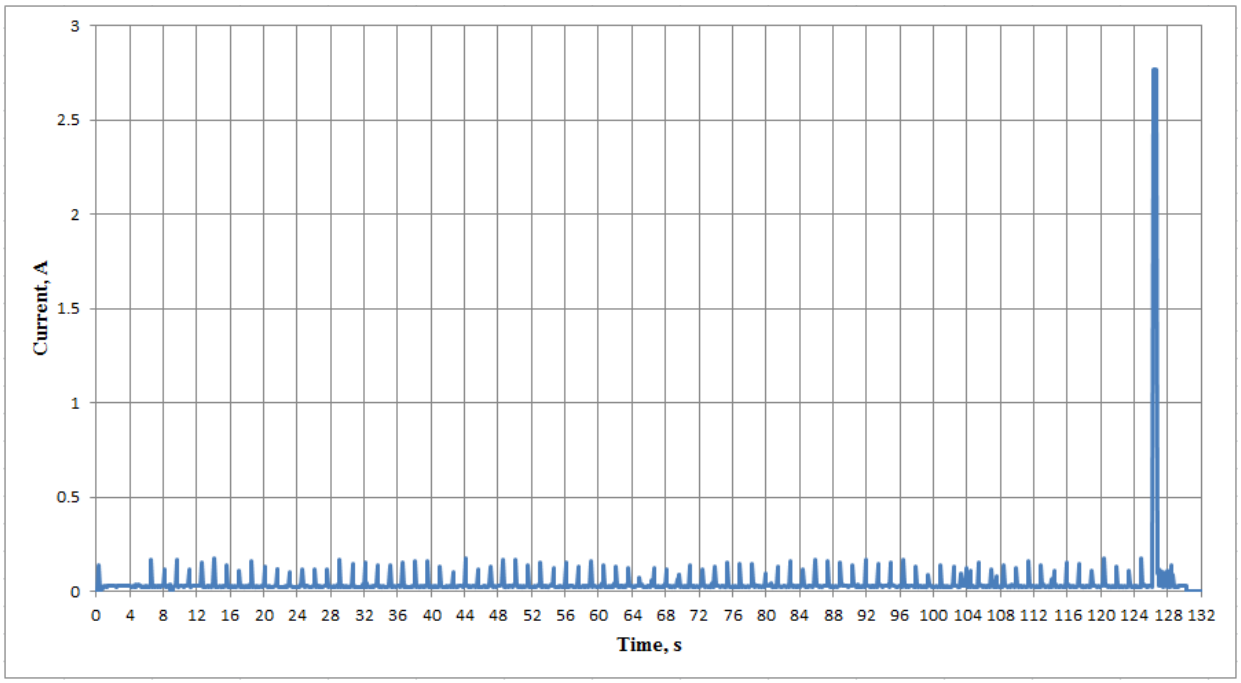


Figure 10.3 - Current during GNSS self-test

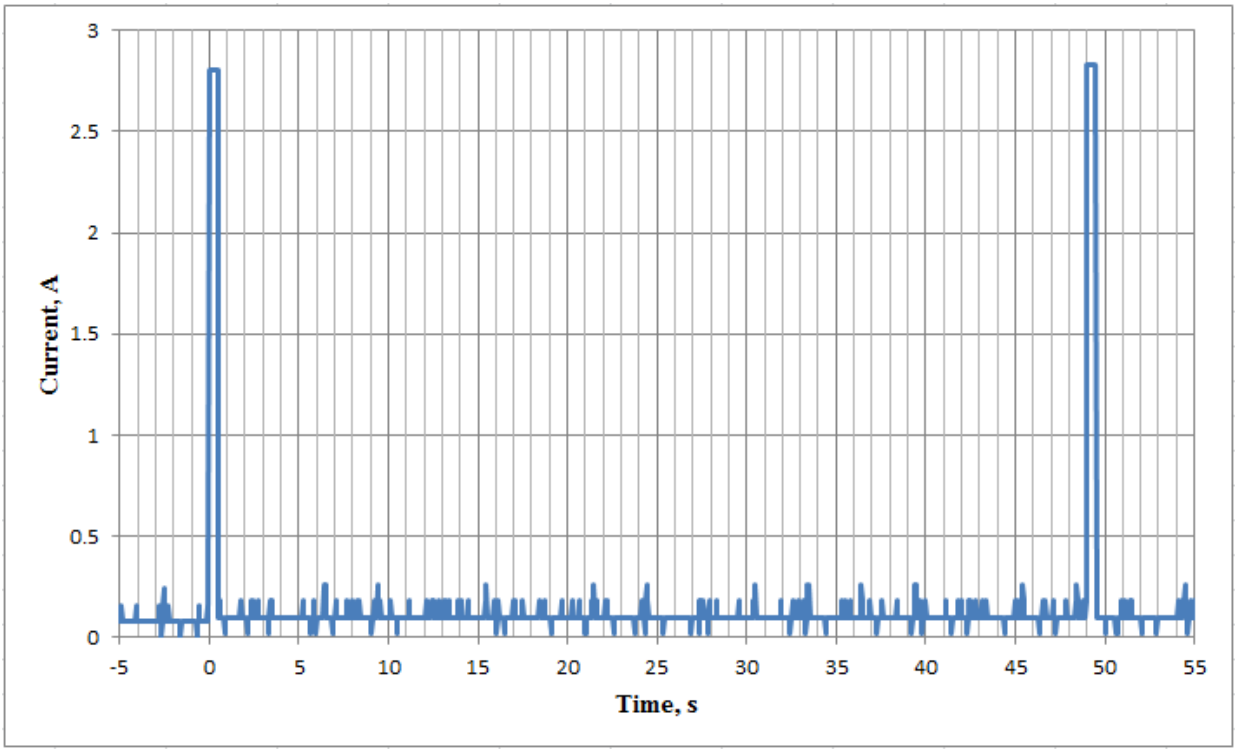


Figure 10.4 - GPS receiver is switching to GNSS search mode.

Table 10.2: Pre-test Battery Discharge Calculations as provided by manufacturer

Characteristic	Designation	Units	Value	Comments
Beacon manufacturers declared maximum allowed cell shelf-life (from date of cell manufacture to date of battery pack installation in the beacon)	T_{CS} or TCS	Years	1	
Declared beacon battery replacement period (from date of installation in the beacon to expiry date marked on the beacon)	T_{BR} or TBR	Years	7	
Battery pack electrical configuration	2 x D Cells series wired			
Cell model and cell chemistry	Saft LO26SX, $LiSO_2$			
Nominal cell capacity		A-hrs	7.75	
Nominal battery pack capacity	C_{BN}	A-hrs	7.75	
Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature	L_{SDC}	%	3	
Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC}/100)^{TBR+TCS}]$	L_{CBN}	A-hrs	1.68	
Number of self-tests per year	N_{ST}		12	
Average battery current during a self-test	I_{ST}	mA	221	
Maximum duration of a self-test	T_{ST}	sec	8.25	
Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * N_{ST} / 3600$	L_{ST}	mA-hrs	42.5	
Maximum Number of GNSS self-tests between battery replacements	N_{GST}		7	
Average battery current during a GNSS self-test of maximum duration	I_{GST}	mA	48	
Maximum duration of a GNSS self-test	T_{GST}	sec	130.2	
Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * N_{GST} / 3600$	L_{GST}	mA-hrs	12.2	
Average stand-by battery pack current	I_{SB}	mA	0.001	
Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$	L_{ISB}	mA-hrs	61.3	
Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + 1.65 * (L_{ST} + L_{GST} + L_{ISB})/1000 + L_{OTH}/1000$	L_{CDC}	A-hrs	1.87	

The pre-test battery discharge is calculated based on a discharge current approximating the maximum operational current (nominal 100 mA).
Production date of cells installed in the battery: 2013.03.
Duration of storage prior to the test: 2.92years.
The loss of energy due to the battery ageing:

$L_{AGEING} = C_{BN} - [C_{BN} * (1 - L_{SDC}/100)^{2.92}] = 0.66$ A-hrs.
Before the start of pre-discharge, the battery was discharged with current pulse 2 A duration of 10 seconds by the manufacturer's recommendations, because the battery was kept in the the test laboratory over 1 year.
$L_{PRE-DISCHARGE} = 2 * 10 / 3600 = 5.56$ mA-hrs

The final value of the discharge to take into account the cell ageing:
$L_{CDC} - L_{AGEING\_total} - L_{PRE-DISCHARGE} = 1.87$ A-hrs – 0.66 A-hrs – 0.00556 = 1.205 A-hrs.
The discharge current is 97.7 mA.
The time of pre-discharge of battery is:
1.205 A-hrs / 0.0977 A = 12.334 hrs.

The pre- test battery discharge was carried out before Lifetime test at room temperature on the unused battery. Discharge was carried out on resistive load using battery analyzer UBA5 (Vencon Technologies Inc., Canada). The discharge current was 97.7 mA, as current similar to beacon operational current. Discharge current 97.7 mA was confirmed by manufacturer. Duration of preliminary battery discharge with discharge current 97.7 mA was 12:20:01.

Lifetime test at minimum temperature -20°C with preliminary discharged battery was carried out for 77 hours 39 minutes. Mode of beacon peration during the Lifetime Test was 406MHz + Homer + GPS ON + Strobe Light ON. List of parameters measured during lifetime test are shown below.

List of test parameters

Measured parameters	**page No.**
Transmission frequency 406 MHz:	
Nominal frequency value	69
Short and average frequency stability	70
Maximum and minimum frequencystability values during test	67
Transmitter power output:	
Diagram of power output values during test	73
Maximum and minimum power output values during test	67
Message:	
Message contents	74

Table of measured parameters.

Message	
Contents (full)	:FFFE2F8C9F0018DFC0FF04F9E4379F3C0010

Test duration 77:39:27	Bursts received 5587	BCH error 0	Self-Test 0		
406 MHz Transmitter Parameters	**Limits**		**Measured**		
	min	**max**	**min**	**current**	**max**
Frequency, MHz	406.039	406.041	406.039949	406.039957	406.039957
Power, dBm	35	39	36.30	36.32	36.47
Slope	-1.00E-09	1.00E-09	-1.71E-10	-6.34E-12	1.76E-10
Residual variations	0.00E-09	3.00E-09	7.82E-11	1.20E-10	7.42E-10
Short term variations	0.00E-09	2.00E-09	2.77E-11	8.37E-11	1.26E-10
Power, dBm (at 48:00:06)	35	39	36.30	36.30	36.47

121.5 MHz Transmitter Parameters at the beginning of the test 00:15:00			
Carrier Frequency, Hz	121649700	**Low Sweep Frequency, Hz**	369
Power, dBm	12.63-12.70	**High Sweep Frequency, Hz**	1166
Sweep Period, sec	0.3	**Sweep Range, Hz**	797
Modulation Index, %	100		
121.5 MHz Transmitter Parameters at 48:00:00			
Carrier Frequency, Hz	121649681	**Low Sweep Frequency, Hz**	367
Power, dBm	12.61-12.72	**High Sweep Frequency, Hz**	1166
Sweep Period, sec	0.3	**Sweep Range, Hz**	799
Modulation Index, %	100		
121.5 MHz Transmitter Parameters at the end of the test 77:39:27			
Carrier Frequency, Hz	121649688	**Low Sweep Frequency, Hz**	370
Power, dBm	12.64-12.69	**High Sweep Frequency, Hz**	1166
Sweep Period, sec	0.3	**Sweep Range, Hz**	796
Modulation Index, %	100		

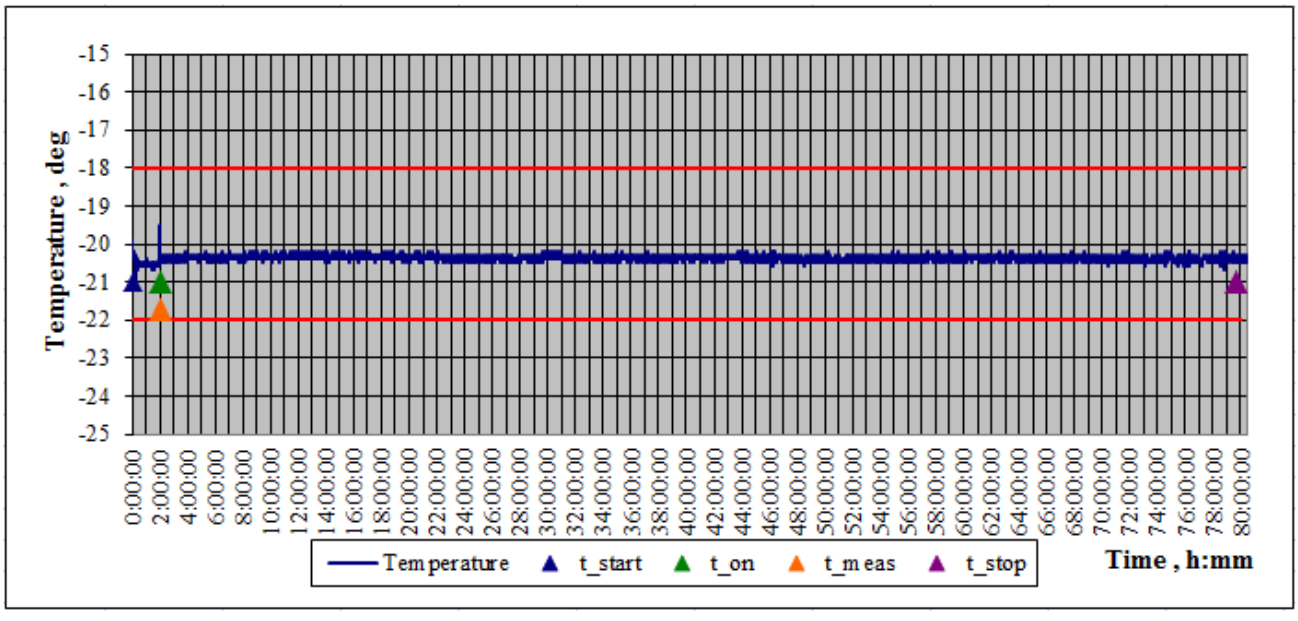


Figure 10.5– Temperature During The Test

Table of data measured during 30 minutes after activation of EUT.

Time (h:mm:ss)	Rep. period (s)	Power (dBm)	Frequency (MHz)	Slope	Residual variations	Short term variations	Digital message
0:01:00	0	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:01:48	48.4563	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:02:39	51.0027	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:03:31	51.4539	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:04:20	49.2996	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:05:10	49.4294	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:06:00	50.2289	36.44	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:06:49	49.4139	36.45	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:07:41	51.218	36.45	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:08:29	48.4904	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:09:20	50.754	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:10:11	50.9155	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:11:01	50.1545	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:11:50	48.7944	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:12:39	49.003	36.47	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:13:26	47.7733	36.47	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:14:19	52.443	36.46	_	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:15:09	50.2859	36.46	406.039957	-	-	-	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:15:59	49.7992	36.46	406.039955	-4.55E-09	1.35E-08	5.75E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:16:49	49.6549	36.47	406.039954	-3.53E-09	1.21E-08	5.75E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:17:37	48.3882	36.46	406.039952	-2.56E-09	1.01E-08	5.73E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:18:27	50.2726	36.46	406.039951	-1.71E-09	7.51E-09	5.67E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:19:20	52.3156	36.38	406.039950	-1.02E-09	4.73E-09	5.59E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:20:12	52.4012	36.38	406.039950	-5.47E-10	2.06E-09	5.90E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:21:01	49.2905	36.38	406.039949	-3.37E-10	1.06E-09	5.91E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:21:52	50.3604	36.39	406.039949	-2.28E-10	5.69E-10	5.40E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:22:43	51.5993	36.39	406.039949	-1.71E-10	3.63E-10	5.42E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:23:32	48.9854	36.39	406.039949	-1.25E-10	4.33E-10	5.44E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:24:23	50.3605	36.39	406.039949	-7.98E-11	5.12E-10	4.73E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:25:14	51.708	36.39	406.039949	-3.30E-11	6.23E-10	5.18E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:26:05	50.9864	36.39	406.039949	8.59E-12	6.92E-10	5.49E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:26:55	49.6959	36.38	406.039949	4.82E-11	6.67E-10	6.17E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:27:43	47.8306	36.38	406.039949	7.57E-11	6.70E-10	6.13E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:28:31	48.67	36.39	406.039949	1.00E-10	6.62E-10	5.86E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:29:19	47.5135	36.39	406.039949	1.37E-10	5.68E-10	6.32E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010
0:30:07	47.8781	36.39	406.039949	1.68E-10	4.58E-10	5.96E-11	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010

Note:

Column “Time”	Time from EPIRB activation.
Column “Rep. Period”	Values of repetition period measured after first message.
Columns Slope, Residual variations	Measured values met the requirements after allowing 15-minutes for beacon warm-up
ColumnShort-Termvariations	Short-Term Frequency variations measurements

a) Transmitted Frequency (according to C/S T.007 – section A.3.2.1)

- **Nominal Value (A.3.2.1.1)**

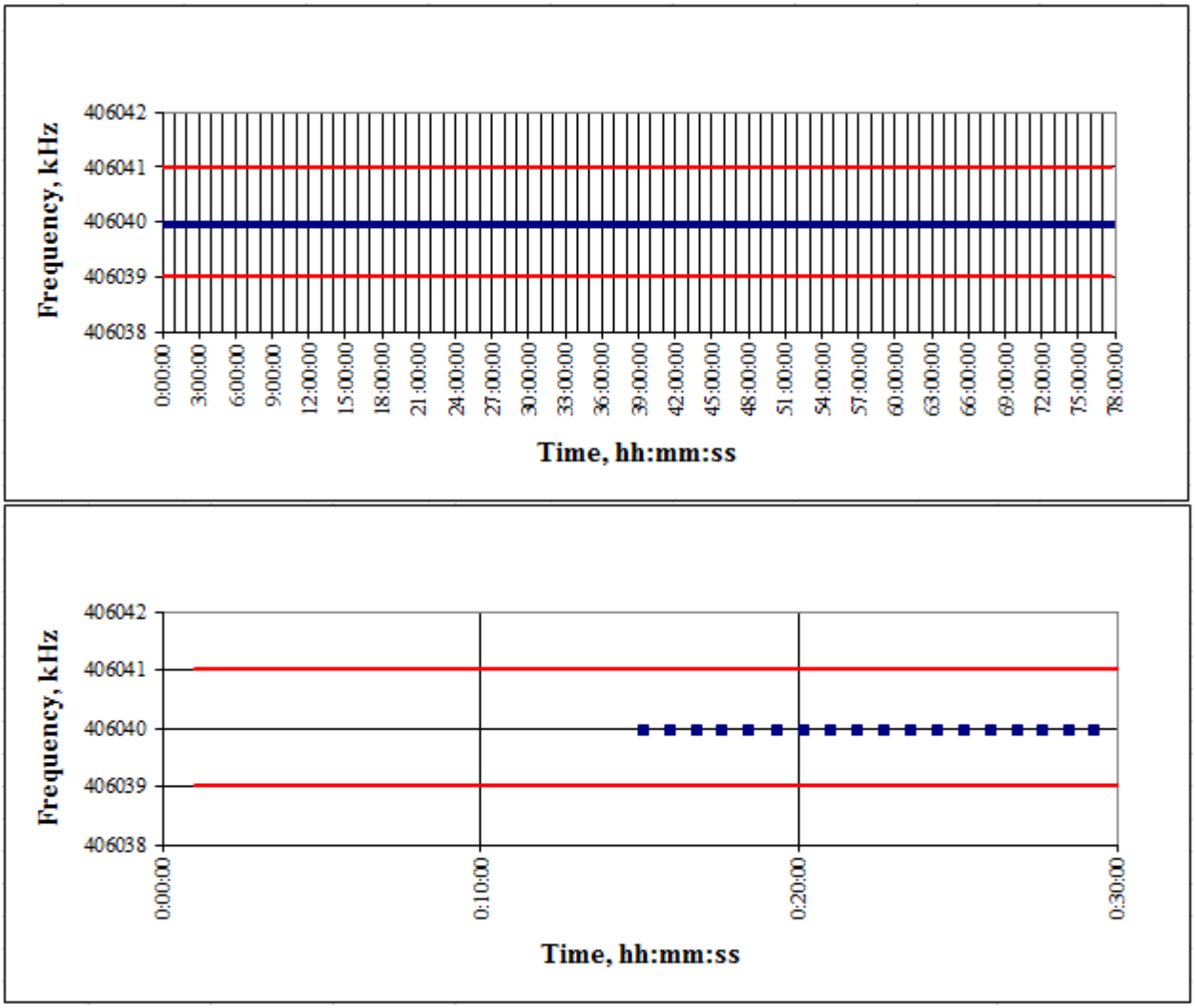


Figure 10.6 – Nominal Value of frequency

- **Short-Term Stability (A.3.2.1.2)**

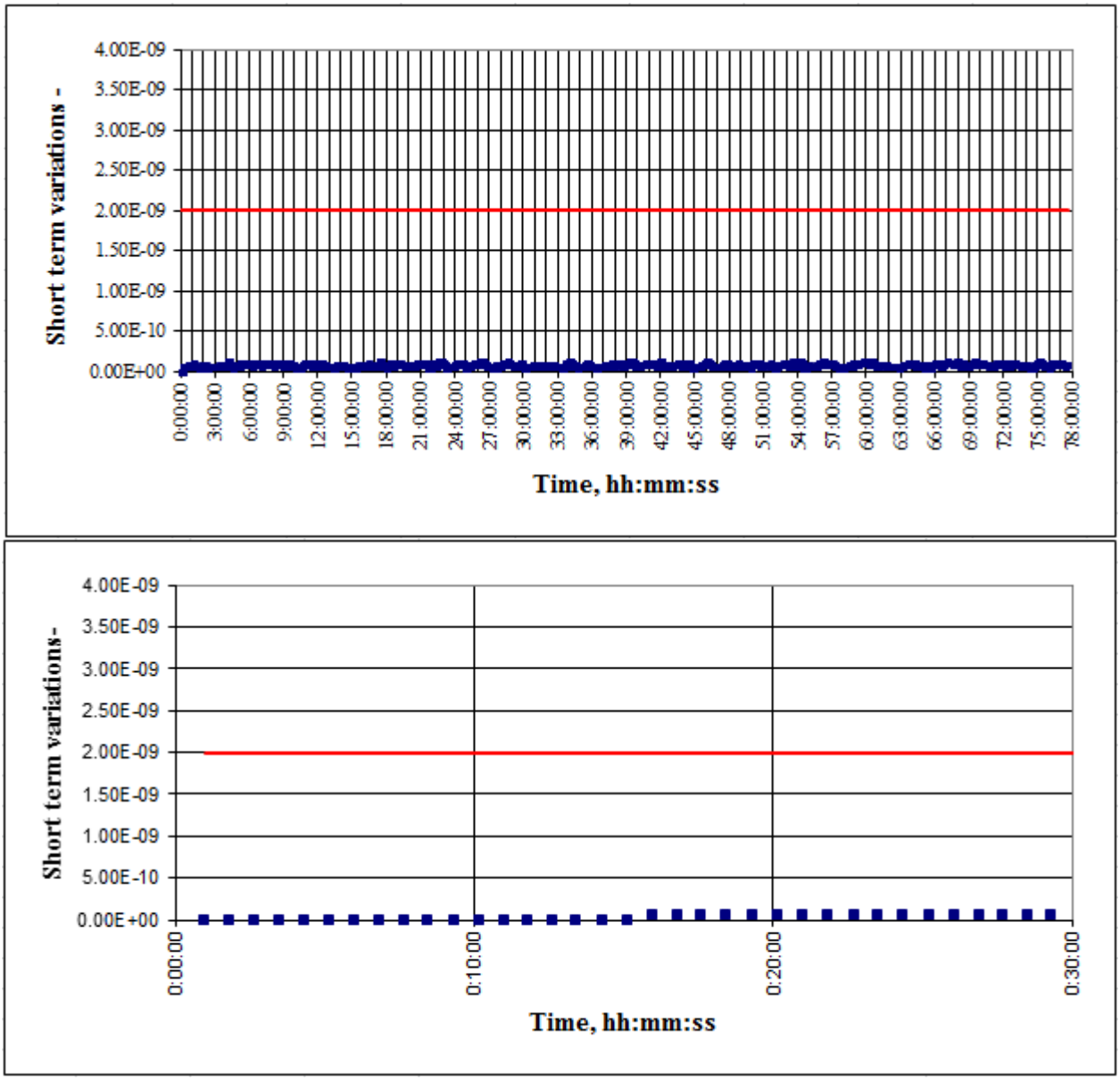


Figure 10.7 – Short-Term Stability

- **Medium-Term Stability (A.3.2.1.3)**

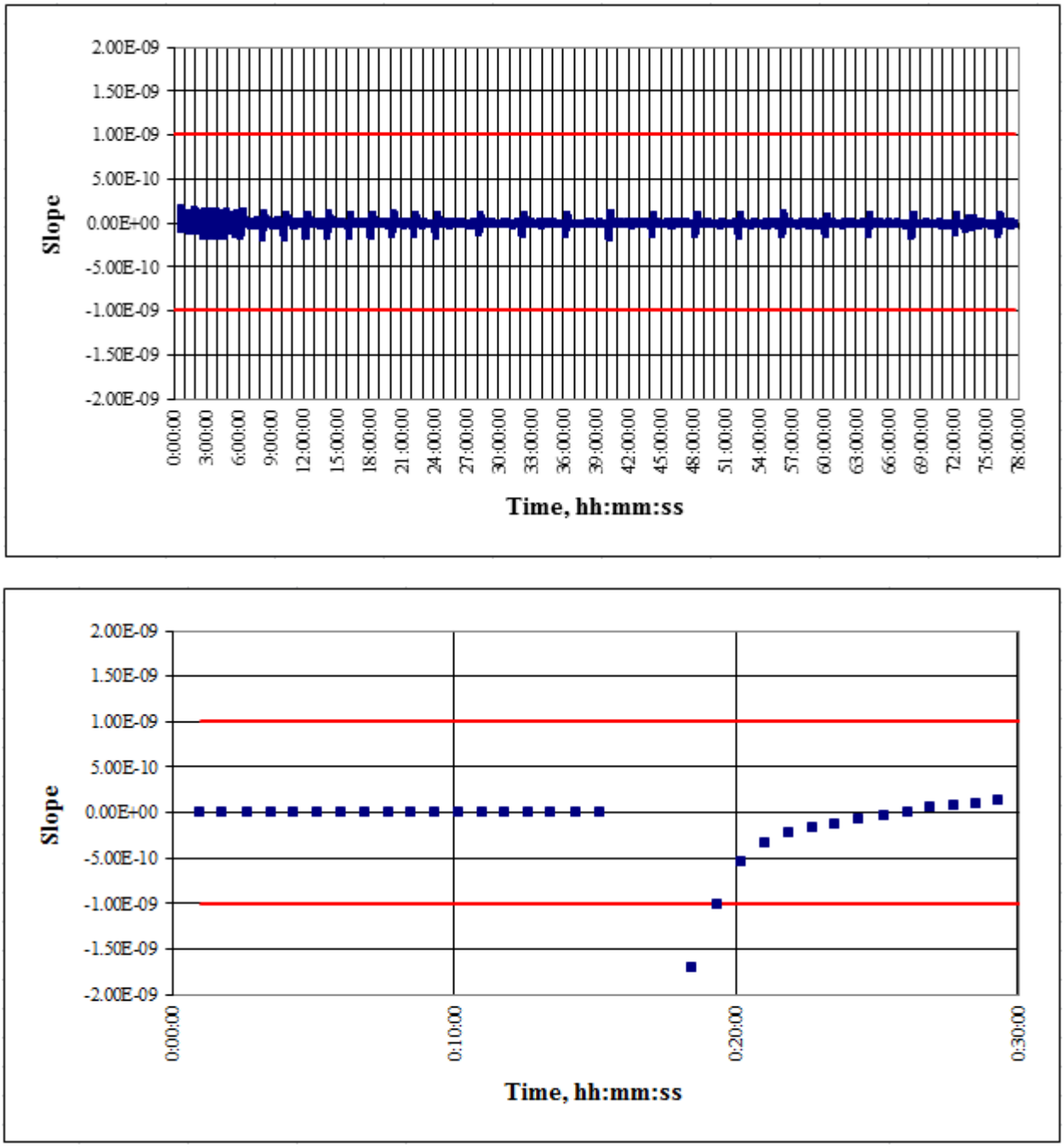


Figure 10.8 – Medium-Term Stability. Slope

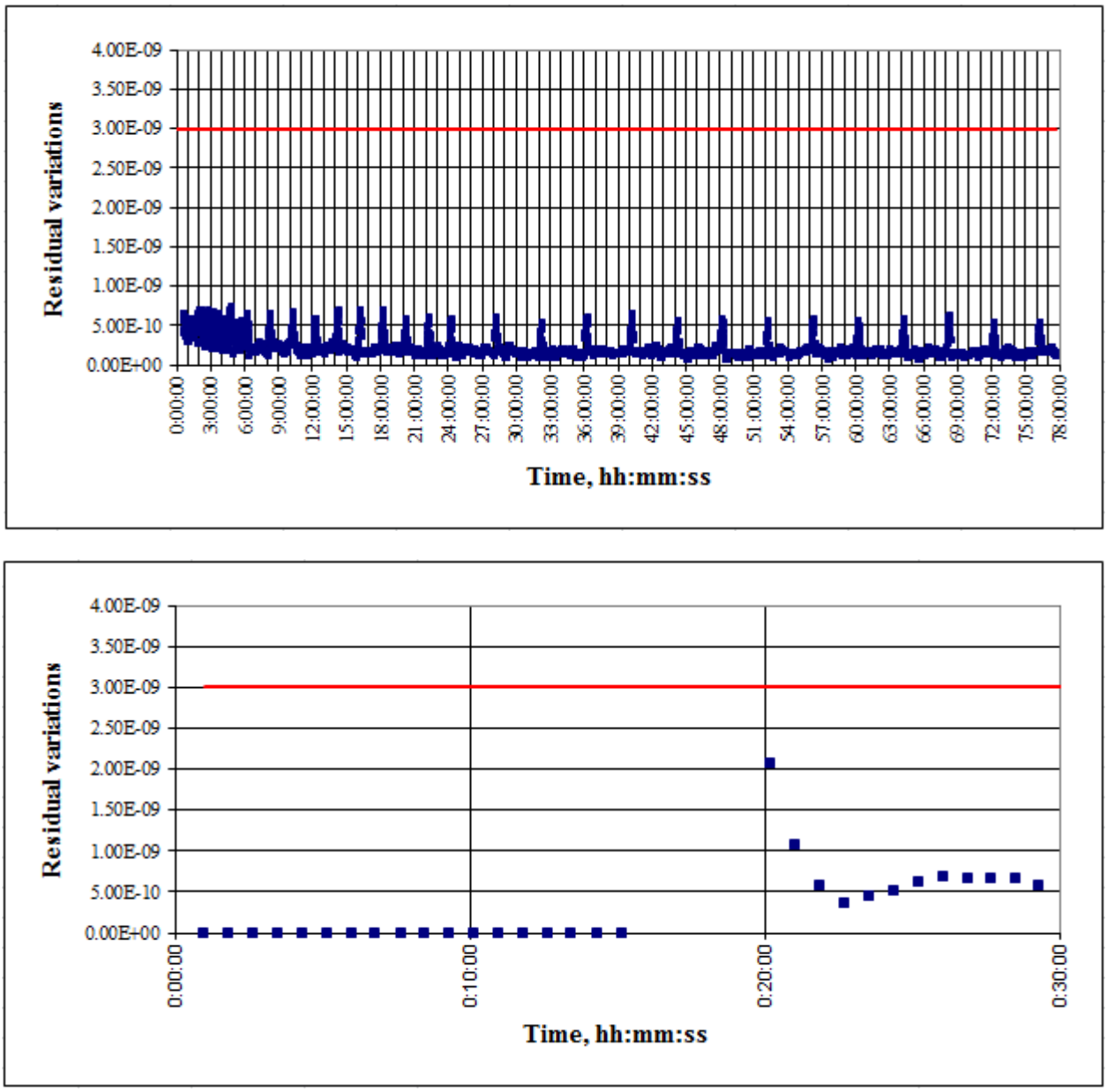
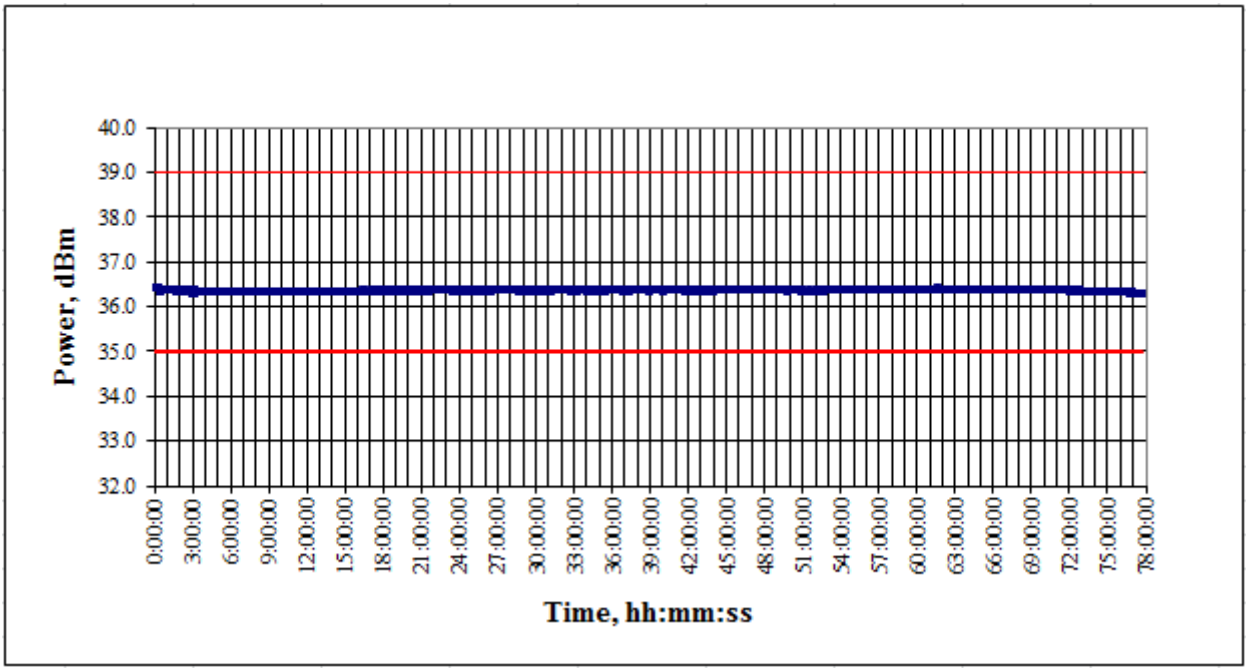


Figure 10.9 – Medium-Term Stability. Residual variations

b) Transmitter Power Output (according to C/S T.007 – section A.3.2.2.1).

- **Transmitter Power Output Level (A.3.2.2.1)**



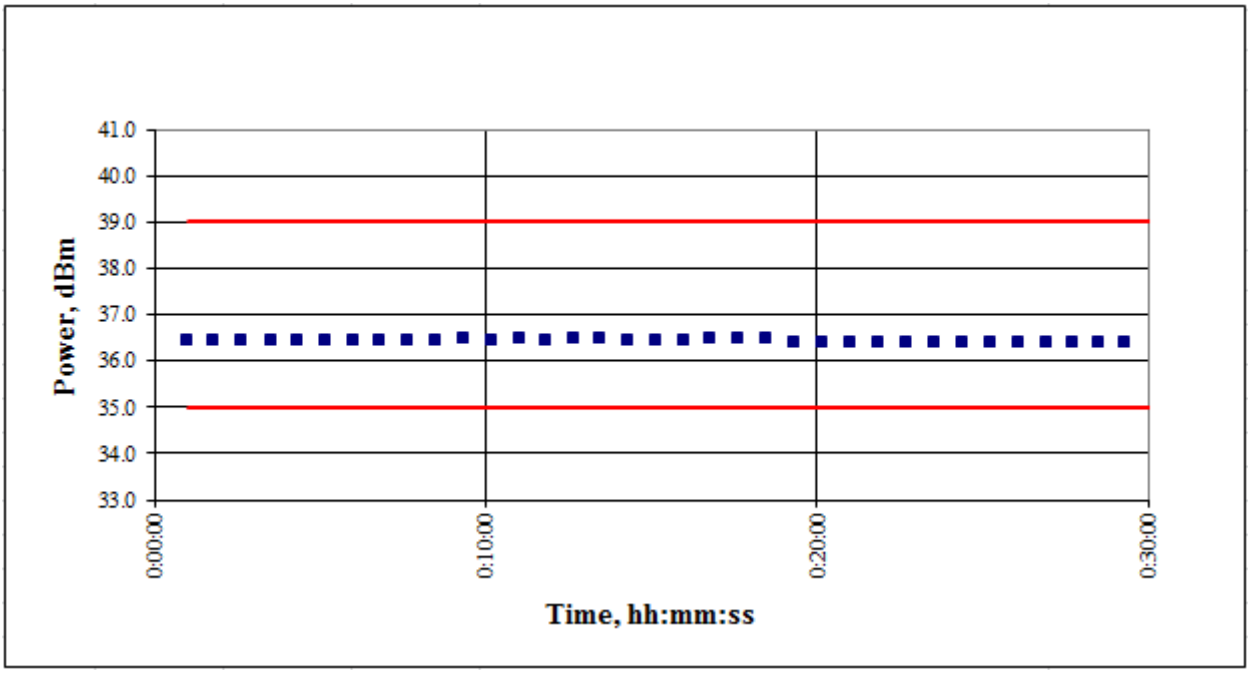


Figure 10.10 – Transmitter power during test

c) Message Coding (according to C/S T.007 - A.3.1.4)

Bursts received	5588
BCH error	0
Self test message	0
Full HEX message	FFFE2F8C9F0018DFC0FF04F9E4379F3C0010

Decoding Beacon Message
FullHexmessage: FFFE2F8C9F0018DFC0FF04F9E4379F3C0010

ITEM	BITS	VALUE
Bitsynchronization: 0x7FFF	1- 15	111 1111 1111 1111
Framesynchronization: 0x2F	16- 24	0 0010 1111
Protocol: Long National Location Protocol		
FormatFlag:LongMessage	25	1
Protocol Flag: Standard/National Protocol	26	0
CountryCode: 201 - Albania	27- 36	00 1100 1001
Identification type (protocol code): National Test Location Protocol	37- 40	1111
National ID Number (18 bits, i.e. max=0x3 FFFF): 0x0 0063	41- 58	00 0000 0000 0110 0011
Latitude:Undefined		
LatitudeBase:Undefined	59- 71	0 1111 1110 0000
Longitude:Undefined		
LonitudeBase:Undefined	72- 85	01 1111 1110 0000
BCH1: 0x13 E790	86-106	1 0011 1110 0111 1001 0000
Fixedbits (3 bits = 110): 6	107-109	110
Additional data type: Position Delta	110	1
Positiondatasource:Internal	111	1
Auxiliary Radio Locating Device: 121.5 MHz Radio Locating Device Included	112	1
LatitudeDelta:Undefined	113-119	100 1111
LongitudeDelta:Undefined	120-126	100 1111
Additional Beacon Identification (6bit, i.e. max value - 0x3F): 0x00	127-132	00 0000
BCH2: 0x010	133-144	0000 0001 0000

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1	Temperature meter	gradient 2002	078	01.2017
2	Climatic chamber	GTH 408-70-CP-AR-LN2	MAA1212-004	12.2016
3	Hygrometer digital	HP 22-A	60974546	09.2016
4	Beacon tester	BT100AVS	2315	09.2016
5	Beacon tester	BT-611	1005	11.2016
6	Spectrum analyzer	FSH8	105763	10.2016

ANNEX 11.
IMMUNITY TO RADIATED RADIO FREQUENCY DISTURBANCE

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 11.03.16
Test Conditions:

- Ambient temperature: 19-21.3 °C
- Relative humidity: 45-61%
- Atmospheric pressure: 748-754 mm/Hg
- Radiated disturbance: 10 V/m
- Range: 80 MHz - 2 GHz
- Equipment set- up: Table top

TEST PROGRAM

No	Test name	Requirements	Methods
1.	**Interference testing.** Immunity to radiated radio frequency disturbance	A.1.13, 3.8 IEC 61097-2; 10.1, 10.4, 10.9 IEC 60945	5.8, 5.18 IEC 61097-2; 10.4, 10.9 IEC 60945

TEST DESCRIPTION

Test was carried out according to IEC60945 clause 10.4 and IEC61000-4-6.

EUT was installed in the the RFsemi-anechoic chamber of a size 5.5 × 10 m and commensurate with the size of the EUT (figure 12.1, 12.2).

EUT was set in the area of uniform field on the wooden rotating table 0.8 m height. The uniform area is calibrated with the test room empty.

EUT was tested in two configurations:

1) Active: EUT was removed from release mechanism. EUT was set in centre of wooden rotating table and turned on for transmitting (Normal operation mode).

2) Idle mode: EUT was set in centre of wooden rotating table in deactivated mode.

EUT has not any associated cables.

The test was carried out as described in IEC 61000-4-3, at severity level 3 that equal 10 V/m.

EUT was installed in vertical position and the test was carried out with the generating antenna facing each of the four sides of the EUTin Active and Idle modes. Additionally the test was carried out with the generating antenna facing of the up side and bottom side of the EUTin Active and Idle modes.

Generating antenna was placed at both vertical and horizontal polarizations sequentially during test.

EUT is initially placed with one face coincident with the calibration plane.

EUT was placed in a modulated electric field of strength 10 V/m swept by step progressive 1% with respect to last momentary frequency over the frequency range 80 MHz to 2 GHz. The modulation is at 400 Hz ± 10 % to a depth of 80 % ± 10 %. Dwell time was 3 s for frequencies below 1 GHz and 9 s for frequencies above 1 GHz.

At first EUT was tested as configuration 1). The test was carried out with the influencing frequency swept for each frequency range with horizontal polarizations position of the generating antenna. The test was repeated for vertical polarizations position of the generating antenna.

All previous tests were repeated with the generating antenna facing each of another three sides of the EUT.

Then EUT was tested as configuration 2).

The antenna of beacon tester was placed at 2 meters (1.5 meters) distance from EUT to receive unwanted transmission if any emitted while EUT in Idle mode and to monitor transmission during the exposure for correct performance while EUT in Active mode.

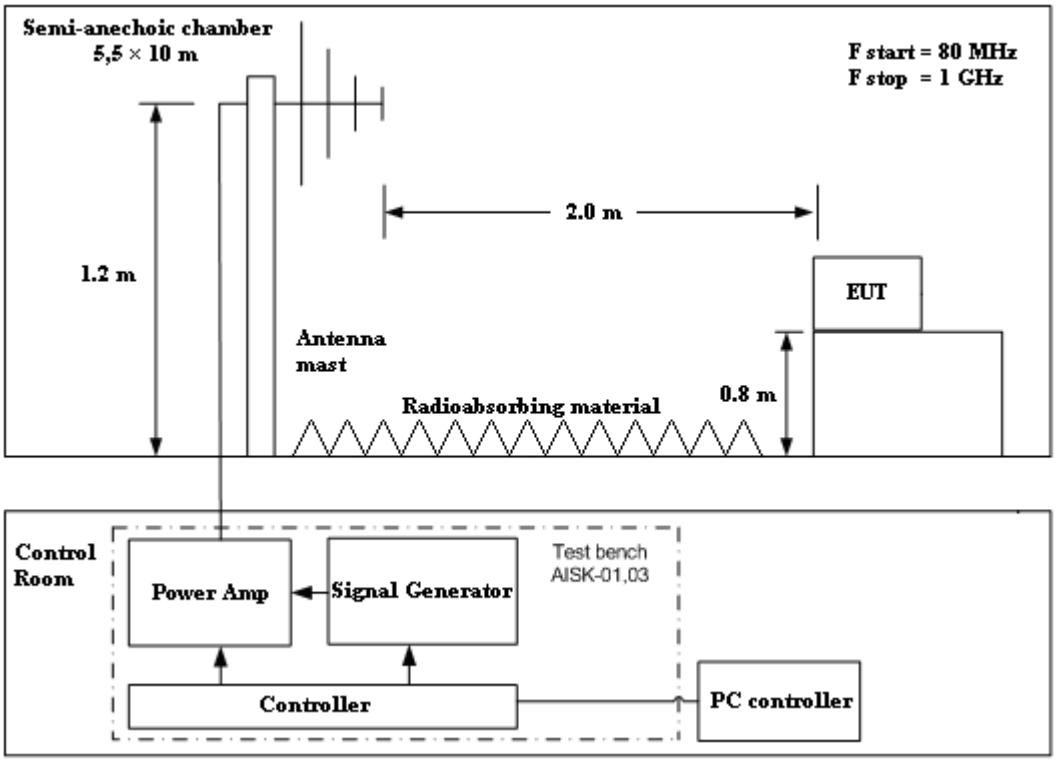


Figure 11.1 - Test set-up from 80 MHz to 1.0 GHz.

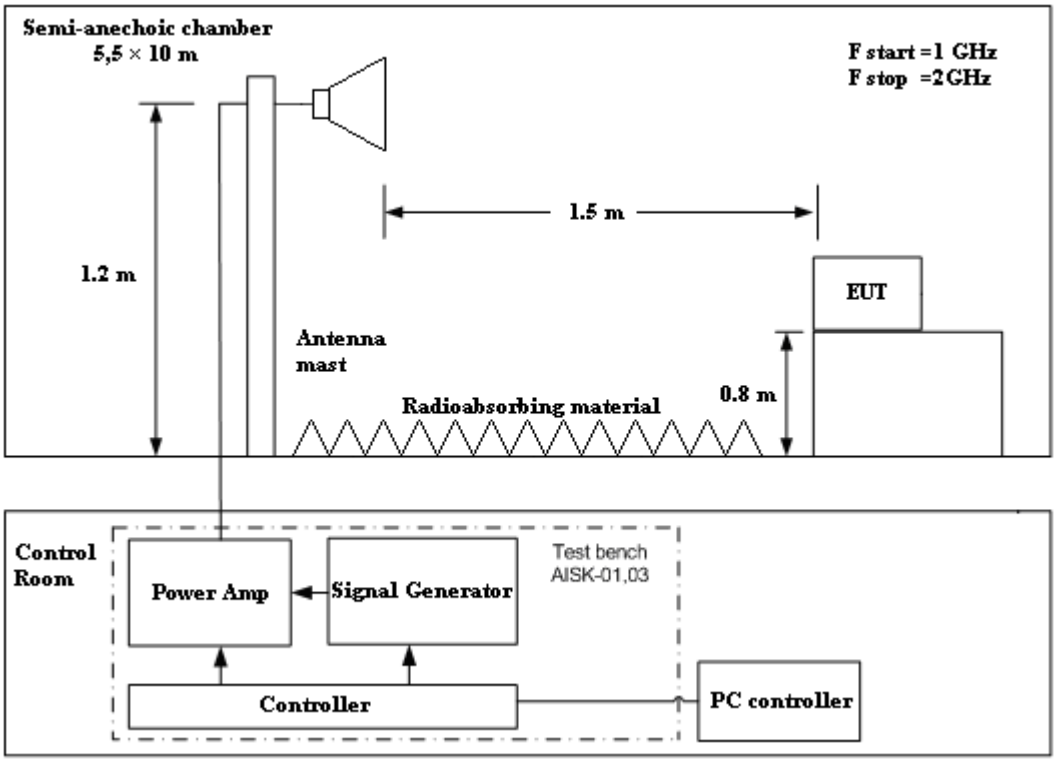


Figure 11.2 - Test set-up from 1.0 GHz to 2.0 GHz.

Performance check was carried out on completion of test.

EUT was checked during and after test with criteria A as following:

The EUT shall continue to operate as intended during and afterthe test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

TEST RESULT

Passed

TEST DETAILS

Figure 11.3 - General view of immunity test set-up. Vertical polarization.

Figure 11.4 - General view of immunity test set-up. Horizontal polarization.

Table 11.1.Immunity to radiated radio frequency disturbance.Test Results configuration 1

EUT position	Frequency range			
	80 MHz -1.0 GHz		1.0 GHz -2.0 GHz	
	Antenna polarization			
	Horizontal	Vertical	Horizontal	Vertical
left	√	√	√	√
rear	√	√	√	√
up	√	√	√	√
bottom	√	√	√	√

[1] - Symbol √ indicates that testing demonstrated conformance EUT to requirements (criteria A).

Table 11.2.Immunity to radiated radio frequency disturbance.Test Results in configuration 2

EUT position	Frequency range			
	80 MHz -1.0 GHz		1.0 GHz -2.0 GHz	
	Antenna polarization			
	Horizontal	Vertical	Horizontal	Vertical
left	√	√	√	√
rear	√	√	√	√
up	√	√	√	√
bottom	√	√	√	√

[1] - Symbol √ indicates that testing demonstrated conformance EUT to requirements (criteria A).

Table 11.3. Summary table of performance check for MT603FG during range (0.08 -1) GHz, vertical polarization

No	**Parameter**	**Measured value**
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.039876
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Table 11.4. Summary table of performance check for MT603FG during range (0.08-1) GHz, horizontal polarization

No	**Parameter**	**Measured value**
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.039957
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Table 11.5. Summary table of performance check for MT603FG during range (1-2) GHz, vertical polarization

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.039873
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

Table 11.6. Summary table of performance check for MT603FG during range (1-2) GHz, horizontal polarization

No	Parameter	Measured value
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.039869
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Temperature meter	gradient 2002	078	01.2017
2.	Test bench	AISK-01	468223.002	02.2017
3.	Test bench	AISK-03	468223.0027	02.2017
4.	Hygrometer digital	HP 22-A	60974546	09.2016
5.	Beacon tester	BT100AVS	2315	07.2016
6.	Beacon tester	BT-611	1005	11.2016
7.	Spectrum analyzer	FSH8	105763	10.2016
8.	Horn antenna	HP11966E model 3115	9903-5701	09.2016
9.	Antenna	R&S HL046E	100075	09.2016
10.	Antenna mast	Maturo AM 4.0	101450	N/A

ANNEX 12.
IMMUNITY TO ELECTROSTATIC DISCHARGE

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 17.03.16
Test Conditions:
- Ambient temperature: 25°C
- Relative humidity: 65%
- Atmospheric pressure: 749 mm/Hg

TEST PROGRAM

Item	Test name	Requirements item	Methods
1	**Interference testing.** Immunity to electrostatic discharge	A.1.13, 3.8 IEC 61097-2; 10.1, 10.4, 10.9 IEC 60945	5.8, 5.18 IEC 61097-2; 10.4, 10.9 IEC 60945

TEST DESCRIPTION

The test was carried out as described in IEC 61000-4-2 using an electrostatic discharge (ESD) generator, that was an energy storage capacitance of 150 pF and a discharge resistance of 330 Ω connected to a discharge tip.

The EUT was placed on, but insulated from, a metal ground plane which projected beyond the EUT on all sides (figure 13.1).

Discharges from the generator were applied to those points and surfaces that are accessible to personnel during normal usage. The ESD generator was held perpendicular to the surface. Each position was tested with 10 discharges positive and negative with intervals of 1 s between discharges.

In order to simulate discharges on objects placed or installed near to the EUT, 10 single contact discharges, positive and negative, were applied to the ground plane at positions on each side of, and 0.l m from, the EUT. A further 10 discharges were applied to the centre of one edge of a vertical coupling plane (VCP), with this plane in enough different positions so that the four faces of the EUT were completely illuminated.

The test levels were 6 kV contact discharge and 8 kV air discharge.

EUT was tested in two configurations:

1) Active: EUT was removed from release mechanism. EUT was set in centre of wooden rotating table and turned on for transmitting (Normal operation mode).

2) Idle mode: EUT was set in centre of wooden rotating table in deactivated mode.

The antenna of beacon tester was placed at 1 meters distance from EPIRB to receive unwanted transmission if any emitted while EUT in Idle mode.

EUT was checked during and after test with criteria B as following:

EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed.

TEST RESULT

Passed

TEST DETAILS

Table 12.1.Immunity to Electrostatic Discharge.EUT in Activemode

	Contact discharge to conducted surfaces and to coupling planes				Air discharge at insulating surfaces	
	Direct contact discharge		Indirect contact discharge			
Test voltage	Reaction of EUT	Result	Reaction of EUT	Result	Reaction of EUT	Result
+ 2 kV – 2 kV	absent	passed	absent	passed	n/a	n/a
+ 4 kV – 4 kV	absent	passed	absent	passed	n/a	n/a
+ 6 kV – 6 kV	absent	passed	absent	passed	n/a	n/a
+ 8 kV – 8 kV	n/a	n/a	n/a	n/a	absent	passed

Table 12.2.Immunity to Electrostatic Discharge Test Results. EUT in Idle mode

	Contact discharge To conducted surfaces and to coupling planes				Air discharge At insulating surfaces	
	Direct contact discharge		Indirect contact discharge			
Test voltage	Reaction of EUT	Result	Reaction of EUT	Result	Reaction of EUT	Result
+ 2 kV – 2 kV	no EPIRB's transmission	√	no EPIRB's transmission	√	n/a	n/a
+ 4 kV – 4 kV	no EPIRB's transmission	√	no EPIRB's transmission	√	n/a	n/a
+ 6 kV – 6 kV	no EPIRB's transmission	√	no EPIRB's transmission	√	n/a	n/a
+ 8 kV – 8 kV	n/a	n/a	n/a	n/a	no EPIRB's transmission	√

Table 12.3. Summary table of performance check for EUT after electrostatic discharge

No	**Parameter**	**Measured value**
1	Activating the satellite EPIRB	activated
2	The 406 MHz transmitted frequency, MHz	406.040065
3	The 406 MHz digital message	FFFE2F8C9E0000007FDFFA79ED3783E0F66C
4	15 HEX ID	193C000000FFBFF
5	Homing Transmitter output	present

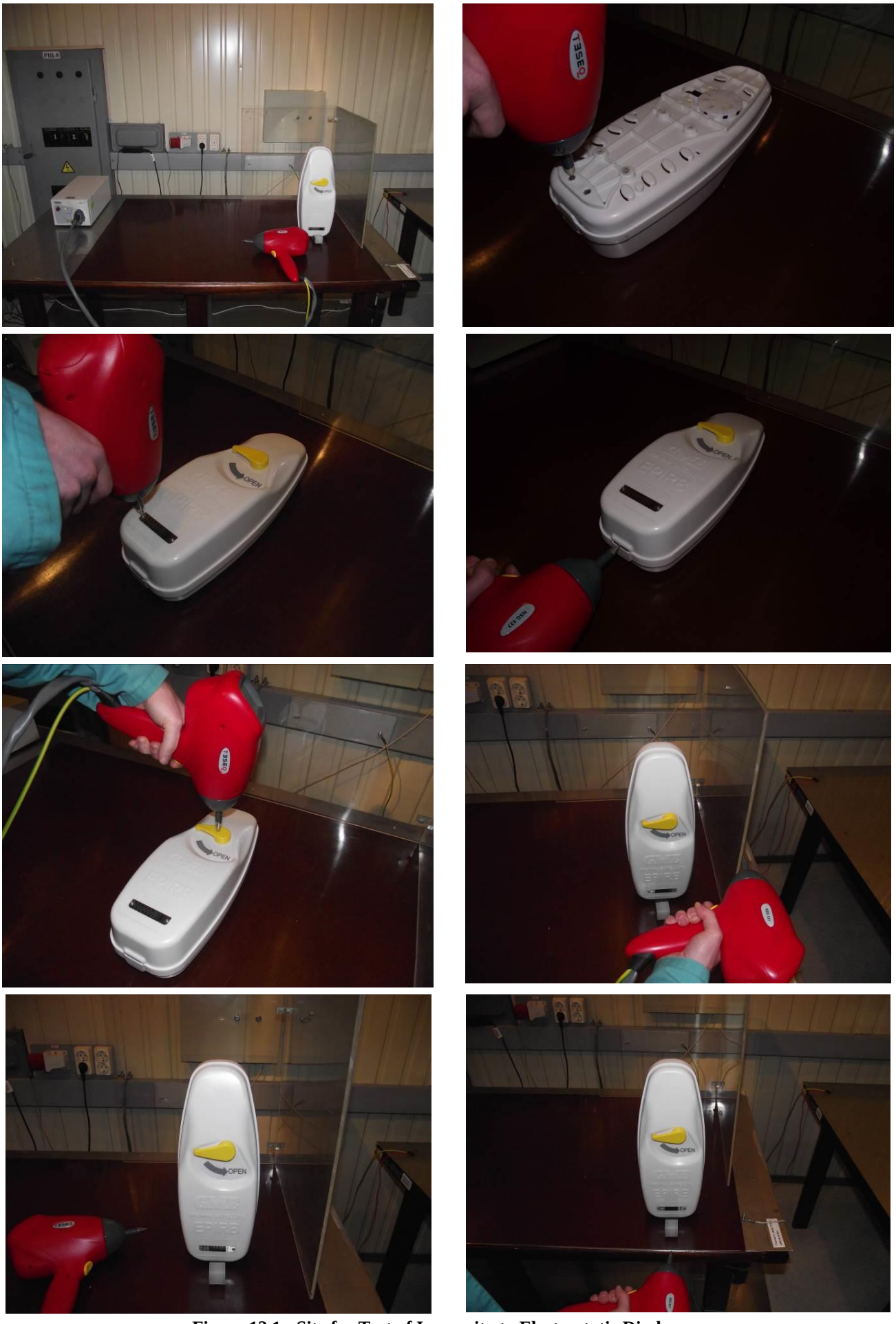


Figure 12.1 - Site for Test of Immunity to Electrostatic Discharge

Figure 12.2 - Site for Test of Immunity to Electrostatic Discharge

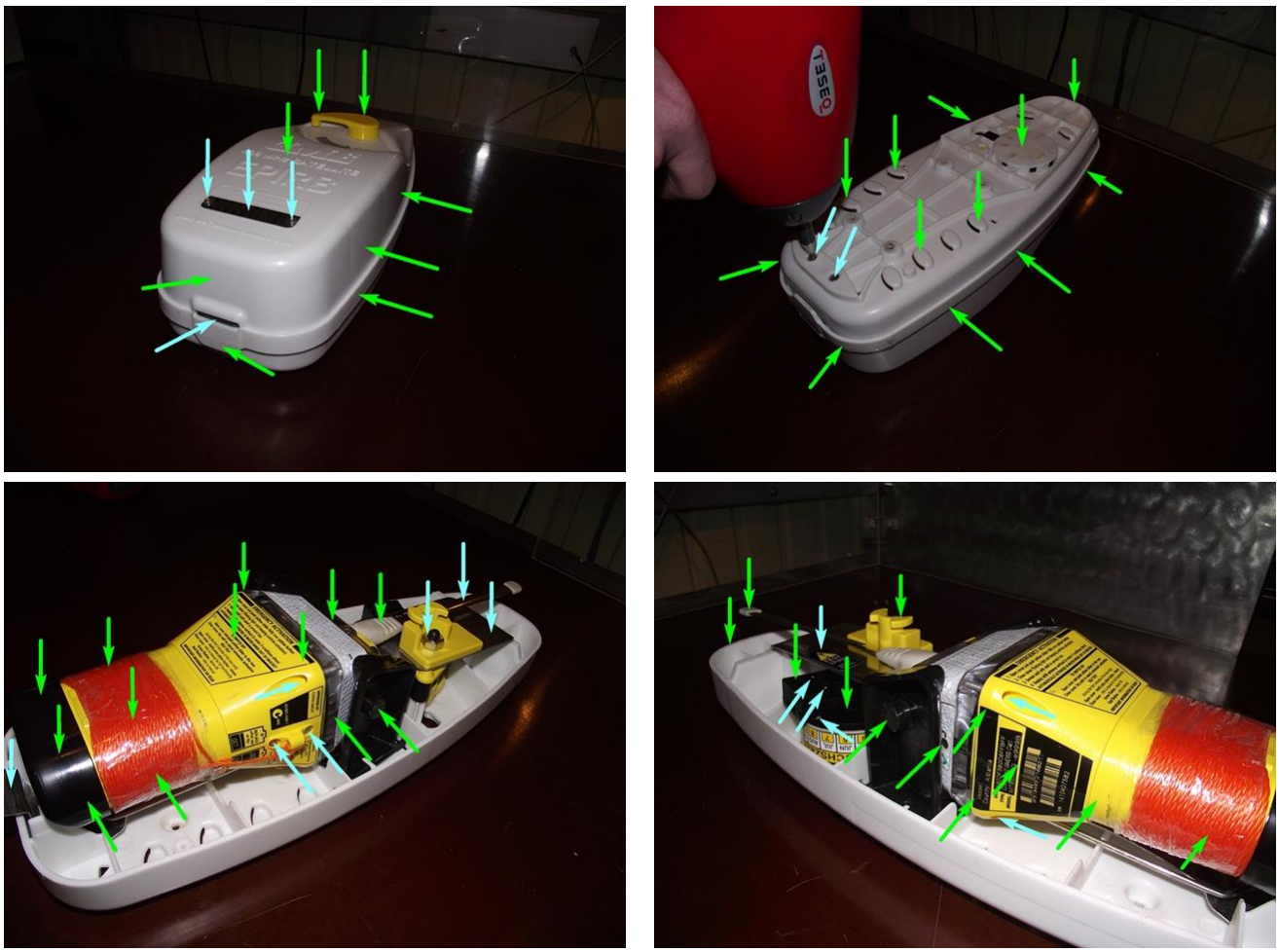


Figure 12.3 – Points for Test of Immunity to Electrostatic Discharge

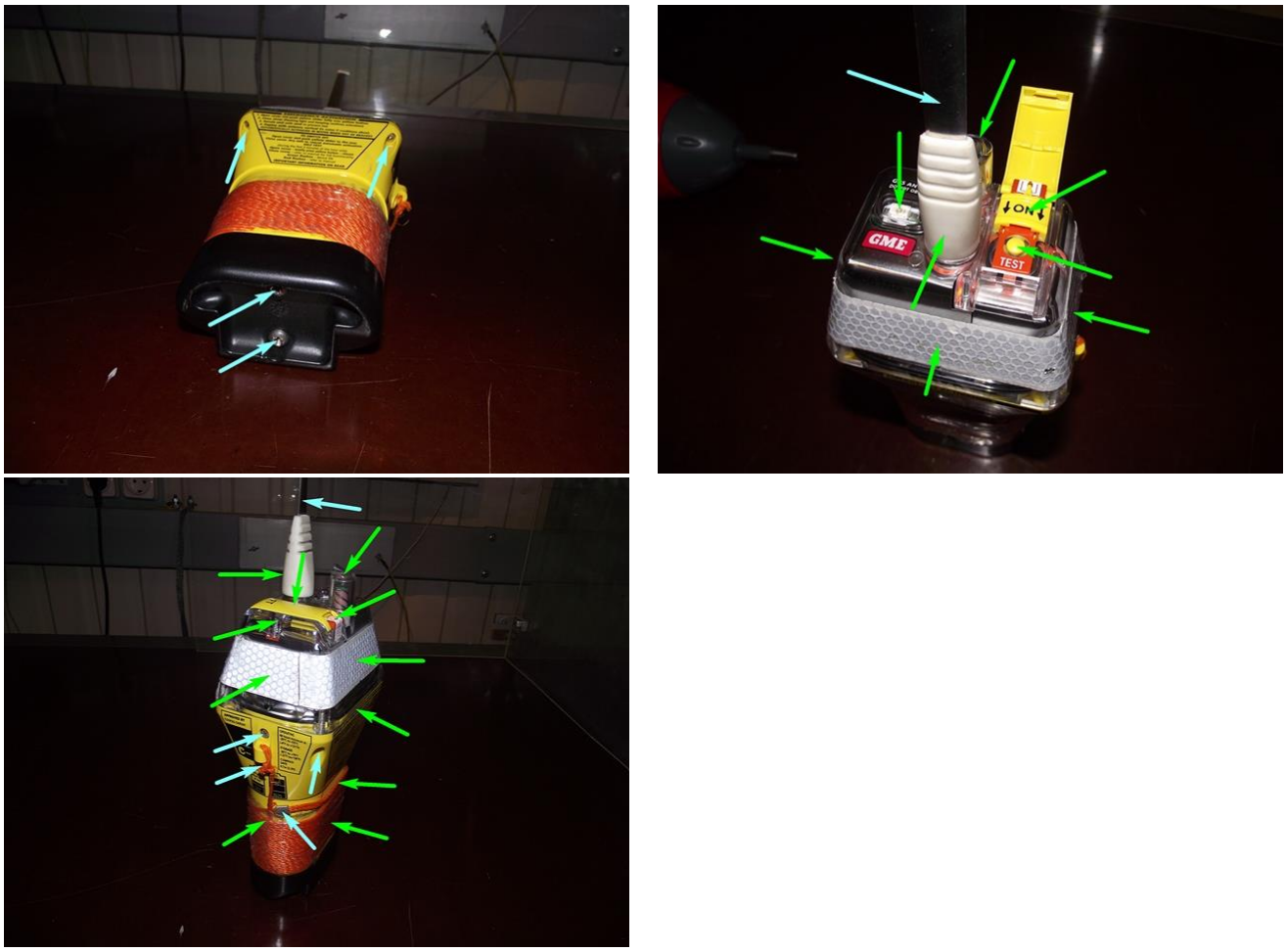


Figure 12.4 – Points for Test of Immunity to Electrostatic Discharge

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1	Temperature meter	gradient 2002	078	01.2017
2	Electrostatic discharge simulator	NSG 437	328	12.2016
3	Hygrometer digital	HP 22-A	60974546	09.2016
4	Beacon tester	BT100AVS	2315	07.2016
5	Beacon tester	BT-611	1005	11.2016
6	Spectrum analyzer	FSH8	105763	10.2016
7	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 13.
ACTIVATION TEST

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 17.02.16
Test Conditions:
- Ambient temperature: 19.2-27.4 °C
- Relative humidity: 45-58 %
- Atmospheric pressure: 752-760 mm/Hg

TEST PROGRAM

Item	Test name	Requirement item	Methods
1.1	Manual activation test	A.2.1, 3.3.3 d) IEC 61097-2	5.3.3.4 IEC 61097-2
1.2	Activation test for the distress signals emitted indication	A.2.1, 3.3.3 f) IEC 61097-2	5.3.3.4 IEC 61097-2
1.3	Repetitive manual activation and deactivation	A.2.1, 3.3.3 b) IEC 61097-2	5.3.3.2 IEC 61097-2
1.4	Float free activation test	A.2.4, 3.2 d), 3.3.3 a) IEC 61097-2	5.2.1, 5.3.3.1 IEC 61097-2

1.1. Manual Activation test

TEST DESCRIPTION

When the satellite EPIRB is manually activated, the low-duty cycle light was begin flashing within 2 s, in any lighting condition, and no distress signal was emitted until at least 47 s and at most 5 min after the satellite EPIRB has been manually activated.

TEST EQUIPMENT USED:

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Stop-watch	СОСпр-2б-2	2328	12.2016
2.	Hygrometer digital	HP 22-A	60974546	09.2016
3.	Oscilloscope	TDS-3052	B011258	02.2017
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Spectrum analyzer	FSH8	105763	10.2016
7.	Tuned dipole antenna	FCC-4	587A	09.2016

TEST RESULT

Passed

TEST DETAILS

Manual activation test was carried out. First burst delay was from 59.90 sec to 60.10 sec.
When the satellite EPIRB was manually activated, the low-duty cycle light was beginning flashing within 294ms, in any lighting condition.

Table 13.1 - Measured values

No. meas.	Time interval from the moment of beacon activation till the first distress burst
1	60.10 sec
2	59.90 sec
3	59.90 sec
Minimum value	59.90 sec
Maximum value	60.10 sec

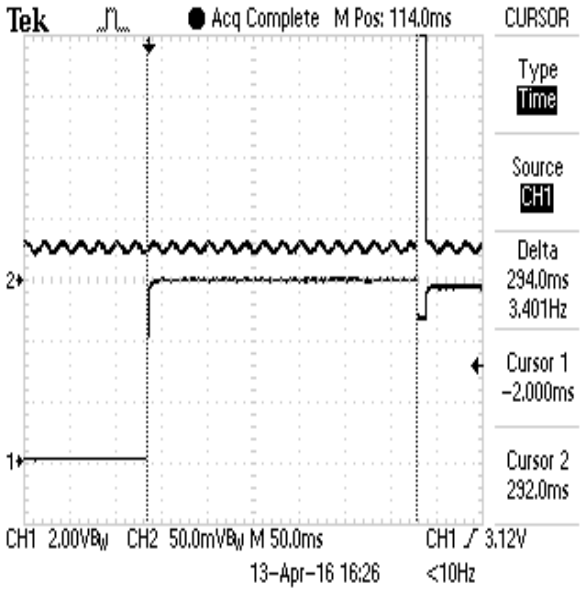


Figure 13.1 — Screenshot of the signal before first flash

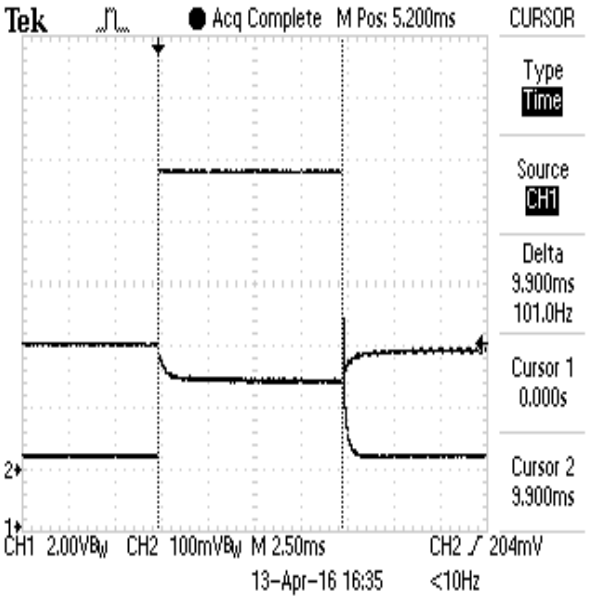


Figure 13.2 — Screenshot of the duration of the low-duty cycle light

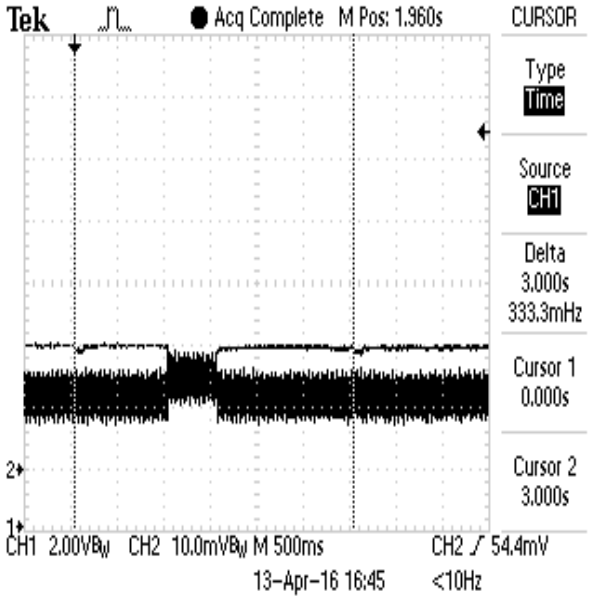


Figure 13.3 — Screenshot of the period between two flashes

1.2. Activation test for the distress signals emitted indication

TEST DESCRIPTION

The satellite EPIRB shall be provided with means to indicate that signals are being emitted.

The low-duty cycle light operating in accordance with 3.3.3 c) IEC 61097-2, is an acceptable indication.

TEST RESULT

Passed

TEST DETAILS

The indication was checked.

The indication is provided in the EUT by the red and green LEDs, white flash light LED and sound (beep and musical chime). The LED colour depends on working status of the EUT.

After activation the unit will initially beeponce and the strobe will flash, then after seven seconds the flashing strobe andbeeps will continue every 3 seconds to indicate the beacon is operating.

MT603FG will begin acquiring GPS satellites. When a positionis obtained, a musical chime will be heard and the green LED will flash rapidly for afew seconds. The green LED will then flash in sync with the strobe light to confirm avalid GPS position is being used.

Figure 13.4 — The strobe LED is flashes.

Figure 13.5 — The green LED is flashes.

Table 13.2 - Information about the indicators

Description of the light of indicators	**Status of the indicators**
GENERAL SELF TEST MODE	
GREEN LED flashes onceper second with no beeps.	After Initiate general self test. EPIRB is undergoing a General Self Test.
RED and GREEN LEDs flash simultaneously with beeps	EPIRB is undergoing a General Self test; however, the EPIRB has detected that anexcessive number of self test-shave been preformed. The user should limit further self teststo the recommended intervals inorder to conserve battery power.

4 GREEN or RED flashes with beeps	Test results – each flash indicatesthe result of a specific test· - GREEN flash and HIGH beep –PASS - RED flash and a LOW beep - FAIL Test 1 : Internal System Check Test 2 : Homer Transmitter Check Test 3 : 406MHz Transmitter Check Test 4: GPS Receiver Check
GPS SATELLITE ACQUISITION TEST	
GREEN LED flashes once per second with double beep.	EPIRB is undergoing a GPS test
Both RED and GREEN LEDs double flash with double beeps.	EPIRB is undergoing a GPS test HOWEVER there areless than 4 GPS tests remaining. The user should limit further GPS tests to the recommendedintervals
One long Red LED flashwith low beep	The GPS test count hasexpired. No further GPS tests can be performed
8 GREEN flashes and a musical chime	GPS test PASSED A GPS positional fix was acquired.
8 Red flashes and 8 low beeps	GPS test FAILED. No GPS positional fix was acquired.

1.3. Repetitive manual activation and deactivation and Float free activation test

TEST DESCRIPTION

The satellite EPIRB shall be automatically activated after floating free or when floating in the water, irrespective of the settings of any control.

The satellite EPIRB shall be capable of repetitive manual activationand manual deactivation.

Manual deactivation shall not prevent automatic activation of the satellite EPIRB when automatically released from its release mechanism or when floating in the water.

TEST RESULT

Passed

TEST DETAILS

The EUT was checked for activation when floating in water (a 0.1 % salt solution).

The test was repeated for all combinations of settings of controls.

Manual deactivation was checked when the EUT floated in the water.

The results are presented Table 13.3.

Table 13.3–Activation of the EUT

Control position		The EUT condition		The EUT position		Activation status	
ON	READY	Floating in water	Out of water	Out of the mounting bracket	In the mounting bracket	Activated	Non activated
×		×		×		×	
×		×			×	×	
×			×	×		×	
×			×		×	×	
	×	×		×		×	
	×	×			×		×
	×		×	×			×
	×		×		×		×

ANNEX 14.
SELF-TEST

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 27.01.2016- 29.01.2016
Test Conditions:
– Atmospheric pressure: 758–760 mm/Hg
– Relative air humidity: 45–53 %
– Temperature
Minimum: -20 °C
Maximum: +55 °C
Ambient: +20°C

TEST PROGRAM

Item	Test name	Requirements	Methods
1.1	Self Test Check	A.2.1, 3.3.4 IEC 61097-2	5.3.4 IEC 61097-2

TEST DESCRIPTION

The satellite EPIRB shall emit a singlemodulated burst which shall always provide the beacon 15 Hex ID. The frame synchronization pattern shall be "011010000".
For location protocol beacons, the content of the encoded position data field of the self-testmessage should be the default values specified in C/S T.001.
Successful completion of thetest shall be indicated.
Activation of the test facility shall reset automatically.
The 121.5 MHzauxiliary radio-locating device signal shall also be transmitted during the self-test, but it shallnot exceed 3 audio sweeps or 1 s, whichever is greater.
The self-test function shall performan internal check and indicate that RF power is being emitted at 406 MHz and at 121.5 MHz.

TEST RESULT

Passed

TEST DETAILS

The test was carried out for ambient temperature, maximum declared temperature and minimum declared temperature.

Table of measured parameters MT603FG at Ambient Temperature

Message			
Contents (full)	FFFED08C9E0000007FDFFA79ED3783E0F66C		
15 HEX ID	193C000000FFBFF		
Test duration 0 h 0 m	Bursts received 1	BCH error 0	Self-Test 1
406 MHz Transmitter Parameters	**Limits**		**Measured**
	min	**max**	**current**
Frequency, MHz	406.039	406.041	406.039967
Power, dBm	35	39	36.32
Total burst duration, ms	514.80	525.20	520.45
121.5 MHz Transmitter Parameters			
Carrier Frequency, Hz	121649850		
Power, dBm	12.96		
Self test 121.5 MHz transmission (<1 second or 3 sweeps)	Pass		

Table of measured parameters MT603FG at Maximum Temperature

Message			
Contents (full)	FFFED08C9E0000007FDFFA79ED3783E0F66C		
15 HEX ID	193C000000FFBFF		
Test duration 0 h 0 m	Bursts received 1	BCH error 0	Self-Test 1
406 MHz Transmitter Parameters	**Limits**		**Measured**
	min	**max**	**current**
Frequency, MHz	406.039	406.041	406.039926
Power, dBm	35	39	36.33
Total burst duration, ms	514.80	525.20	520.25
121.5 MHz Transmitter Parameters			
Carrier Frequency, Hz			121648983
Power, dBm			13.15
Self test 121.5 MHz transmission (<1 second or 3 sweeps)			Pass

Table of measured parametersMT603FG at Minimum Temperature

Message			
Contents (full)	FFFED08C9E0000007FDFFA79ED3783E0F66C		
15 HEX ID	193C000000FFBFF		
Test duration 0 h 0 m	Bursts received 1	BCH error 0	Self-Test 1
406 MHz Transmitter Parameters	**Limits**		**Measured**
	min	**max**	**current**
Frequency, MHz	406.039	406.041	406.039972
Power, dBm	35	39	36.43
Total burst duration, ms	514.80	525.20	520.40
121.5 MHz Transmitter Parameters			
Carrier Frequency, Hz			121649788
Power, dBm			12.78
Self test 121.5 MHz transmission (<1 second or 3 sweeps)			Pass

Table 14.1–Status of indication during self-test

Parameter	**Result**
Distinct indication of self-test start	The BUT beeps once and simultaneously the flashes by white strobelight once indicating that the self-test has started.
Distinct indication of RF-power being emitted	The BUT flashes by green LED indicating that the RF-power has emitted.
Indication of the self-test result	A long green LED indicates the EPIRB has completed and passed all the tests.
Distinct indication of insufficient battery capacity	After start the self-test the BUT beeps and flashes by red LED with simultaneously flashes by green LED indicating that the excessive number of self tests has been preformed.
Automatic termination of the self-test mode upon completion of the self-test and indication of the self-test results	The self-test mode automatically terminates upon completion of the self-test and indication of the self-test results.

Decoding Beacon Message
Full-HEX: FFFED08C9E0000007FDFFA79ED3783E0F66C

ITEM	BITS	VALUE
Bitsynchronization: 0x7FFF	1- 15	1111111 1111 1111
Framesynchronization: 0x2F	16- 24	0 1101 0000
Protocol: Long Standard Location Protocol		
FormatFlag:LongMessage	25	1
Protocol Flag: Standard/National Protocol	26	0
CountryCode: 201 - Albania	27- 36	00 1100 1001
Identification type (protocol code): Standard Test Location Protocol	37- 40	1110
Binary data (24 bits, i.e. max=0xFF FFFF): 0x00 0000	41- 64	0000 0000 0000 0000 0000 0000
Latitude:Undefined		
LatitudeBase:Undefined	65- 74	01 1111 1111
Longitude:Undefined		
LonitudeBase:Undefined	75- 85	011 1111 1111
BCH1: 0x09 E7B4	86-106	0 1001 1110 0111 1011 0100
Fixedbits (4 bits = 1101): 0xD	107-110	1101
Positiondatasource:Internal	111	1
Auxiliary Radio Locating Device: 121.5 MHz Radio Locating Device Included	112	1
LatitudeDelta:Undefined	113-122	10 0000 1111
LongitudeDelta:Undefined	123-132	10 0000 1111
BCH2: 0x66C	133-144	0110 0110 1100

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Climatic chamber	KTK-800	24708	10.2016
2.	Temperature meter	gradient 2002	078	01.2017
3.	Hygrometer digital	HP 22-A	60974546	09.2016
4.	Beacon tester	BT100AVS	2315	07.2016
5.	Beacon tester	BT-611	1005	11.2016
6.	Spectrum analyzer	FSH8	105763	10.2016
7.	Tuned dipole antenna	FCC-4	587A	09.2016

ANNEX 15.
SIGNAL LIGHT TEST

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 24.05.16-25.05.16
Test Conditions:

- Ambient temperature: 22.2-24.2°C
- Atmospheric pressure: 746-751 mm/Hg
- Relative air humidity: 45-60 %

TEST PROGRAM

No	Test name	Requirements	Method
1	Signal light test	A.2.10, 3.3.3 c) e) IEC 61097-2	5.3.3.3 IEC 61097-2

TEST DESCRIPTION

The effective luminous intensity, flash duration and flash rate were checked at the normal temperature and at the high and low extreme temperatures. The effective luminous intensity was defined by the following formula as indicated in IMO Resolution MSC.81 (70) - Testing of lifesaving appliances, 10.4.9:

$$\frac{\int_{t_1}^{t_2} j \cdot dt}{0.2 + (t_2 - t_1)}$$

where
j the instantaneous intensity;
0.2 theBlondel-Rey constant;
$t_2 - t_1$ the time limits of integration in seconds at which the intensity is j or greater.

The effective luminous intensity was at least an arithmetic mean of 1.97 cd over the entire upper hemisphere as determined below.

The flash rate was 20 times per minute.

The flash duration was 10^{-2} s.

The effective luminous intensity was measured at 49 points over the upper hemisphere of the satellite EPIRB.

The satellite EPIRB was floated in a container of fresh water to determine its waterline, which was marked on the body of the satellite EPIRB and used as the baseline for the following tests.

This line represents the 0° elevation plane used as a reference point for the following measurements.

The arithmetic mean effective luminous intensity of all 49 points was at least 1.97 cd. No points had an effective luminous intensity of less than 0.2 cd.

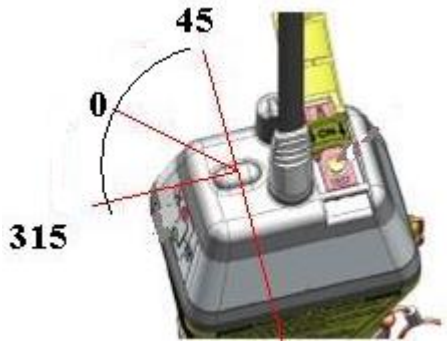


Figure 15.1 - the 0 degree azimuth with respect to the unit orientation.

TEST RESULT

Passed.

TEST DETAILS

Figure 15.2 –General view of test equipment for low-duty cycle light test

Figure 15.3 –General view of graphic luxmeter

Figure 15.4 –General view of rotation and inclination device inside of the climatic chamber

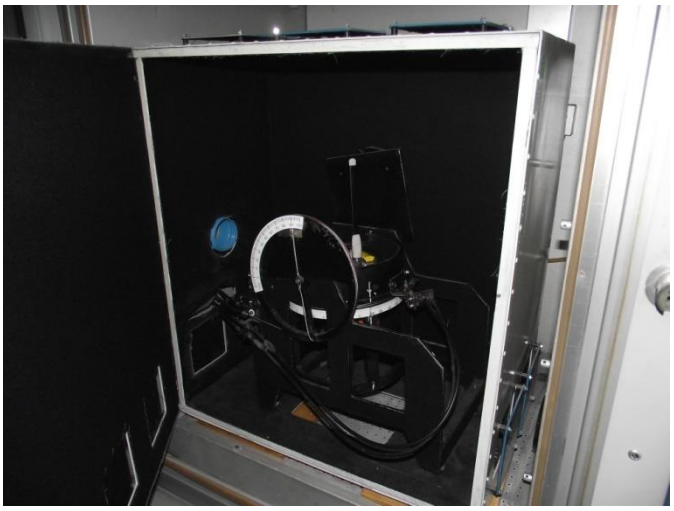


Figure 15.5 –Inside view of rotation and inclination device

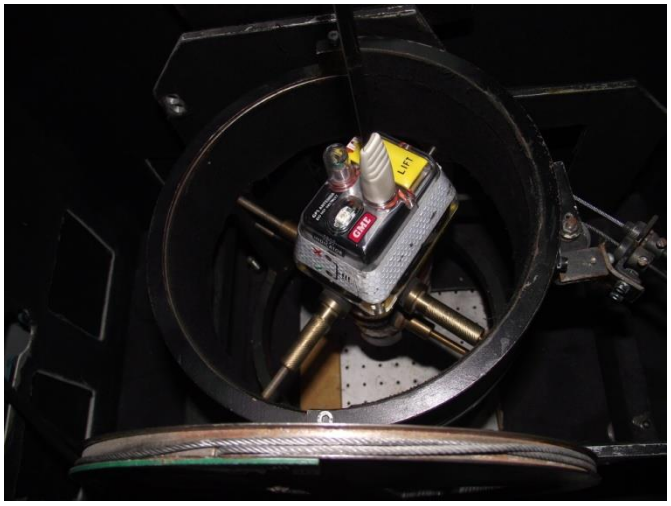


Figure 15.6 –The EUT in the climatic chamber

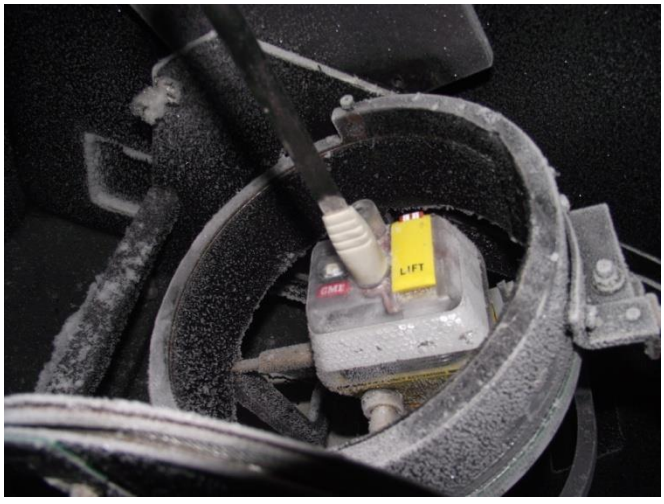


Figure 15.7 –View of the EUT upon completion of the low-duty cycle test at minimum temperature

Effective luminous intensity at -20°C

	Elevation								
Azimuth	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	1.14	2.05	2.79	3.09	3.43	2.75	2.66	2.97	3.11
45°	0.92	1.51	2.00	2.88					
90°	0.20	0.22	0.29	2.25	2.34	2.43	2.43	2.70	
135°	0.32	0.50	1.04	1.96					
180°	0.52	1.53	2.12	2.57	2.66	2.34	2.91	1.03	
225°	0.62	0.83	1.65	2.59					
270°	0.90	1.62	2.00	2.39	3.52	3.20	3.24	3.34	
315°	1.03	2.03	1.75	1.98					

Effective luminous intensity at 20°C

	Elevation								
Azimuth	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	1.08	1.72	3.20	3.61	3.83	3.06	2.79	2.97	3.15
45°	1.03	1.28	1.75	2.88					
90°	0.20	0.23	0.32	2.34	2.25	2.43	3.20	2.78	
135°	0.25	0.88	1.01	2.39					
180°	0.42	1.27	1.85	2.43	2.36	2.30	2.82	2.61	
225°	0.56	0.71	1.63	2.57					
270°	0.81	1.14	3.79	2.36	3.92	2.97	2.84	3.20	
315°	0.90	1.98	1.44	1.91					

Effective luminous intensity at 55°C

	Elevation								
Azimuth	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	1.02	1.89	3.11	3.56	3.70	2.97	2.70	2.84	3.15
45°	0.96	1.32	1.75	2.79					
90°	0.20	0.21	0.41	1.75	2.21	2.39	3.29	2.77	
135°	0.23	0.67	2.97	2.97					
180°	0.72	1.26	1.90	2.36	2.79	2.35	2.93	3.02	
225°	0.54	0.72	1.37	2.52					
270°	0.84	1.45	2.21	2.14	3.83	3.02	3.11	3.47	
315°	0.89	1.93	1.64	1.93					

Summary test result

No.	Temperature	Measured Luminous intensity		Limit		Conclusion
		Arithmetic mean	Minimum intensity	Arithmetic mean	Minimum intensity	
1	Minimal temperature -20 °C	1.97	0.20	≥ 0.5	≥ 0.2	Passed
2	Normal temperature 20 °C	2.03	0.20			Passed
3	Maximal temperature 55 °C	2.06	0.20			Passed

TEST EQUIPMENT

No	Name of test equipment	Type, model	ser. No	Calibration Due date
1.	Graphic luxmeter	LG-05	17	06.2016
2.	Climatic chamber	KPK-400V	015	01.2017
3.	Rotation and inclination device	RD-360/90	01	05.2016
4.	Temperature meter	Gradient -2002	078	01.2017
5.	Oscilloscope	TDS-3052	B011258	02.2017

ANNEX 16.
COLOUR AND RETRO-REFLECTION MATERIAL CHECK

Equipment Under Test (EUT): MT603FG

SW version: OS0021 ver 1.00 (8/12/2014)

Test Date: 18.04.16
Test Conditions:
- Ambient temperature: 21 °C
- Relative humidity: 48 %
- Atmospheric pressure: 755 mm/Hg

TEST PROGRAM

No	Test name	Requirements	Methods
1.	Colour and retro-reflection material check	A.2.1, 3.3.5 IEC 61097-2	5.3.5 IEC 61097-2

TEST DESCRIPTION:

The satellite EPIRB shall be highly visible yellow/orange colour and be fitted with retro-reflecting material.

The area of retro-reflective material visible above the water-line of the satellite EPIRB shall be at least 26 cm^2. This shall be achieved by retro-reflective material, at least 25 mm wide, with at least 5 cm^2 viewable from every angle on the horizon.

The retro-reflective material shall also meet the performance requirements of IMO Resolution A.658 (16) Annex 2.

TEST RESULT

Passed

TEST DETAILS

Width of lower side of retro-reflection material at long side of the antenna base W1= 89.99 mm
Width of upper side of retro-reflection material at long side of the antenna base W2= 77.45 mm
Width of lower side of retro-reflection material at short sideof the antenna base W3= 66.19 mm
Width of upper side of retro-reflection material at short side of the antenna base W4= 52.98 mm
Visible height of retro-reflection material H=25.02 mm
The area of retro-reflective material = 20.78+20.68+14.62+14.90 =70.97 cm^2
Maximum visible area viewable from 315and 225 angles on the horizon:

$0.5*[sqrt(W1^2+ W3^2) +sqrt(W2^2+ W4^2)]*H = 25.69\ cm^2$

Parameter	Test result	Result
EPIRB colour check	Yellow	Pass
Width check	Max 25.02 mm	Pass
The area of retro-reflective material visible above the water-line	70.97 cm^2	Pass
Visibility of retro-reflection material at 0° on the horizon (S1)	20.78 cm^2	Pass
Visibility of retro-reflection material at 90° on the horizon (S2)	14.62 cm^2	Pass
Visibility of retro-reflection material at 180° on the horizon (S3)	20.68 cm^2	Pass
Visibility of retro-reflection material at 270° on the horizon (S4)	14.90 cm^2	Pass

Figure 16.1 — Yellow colour of BUT

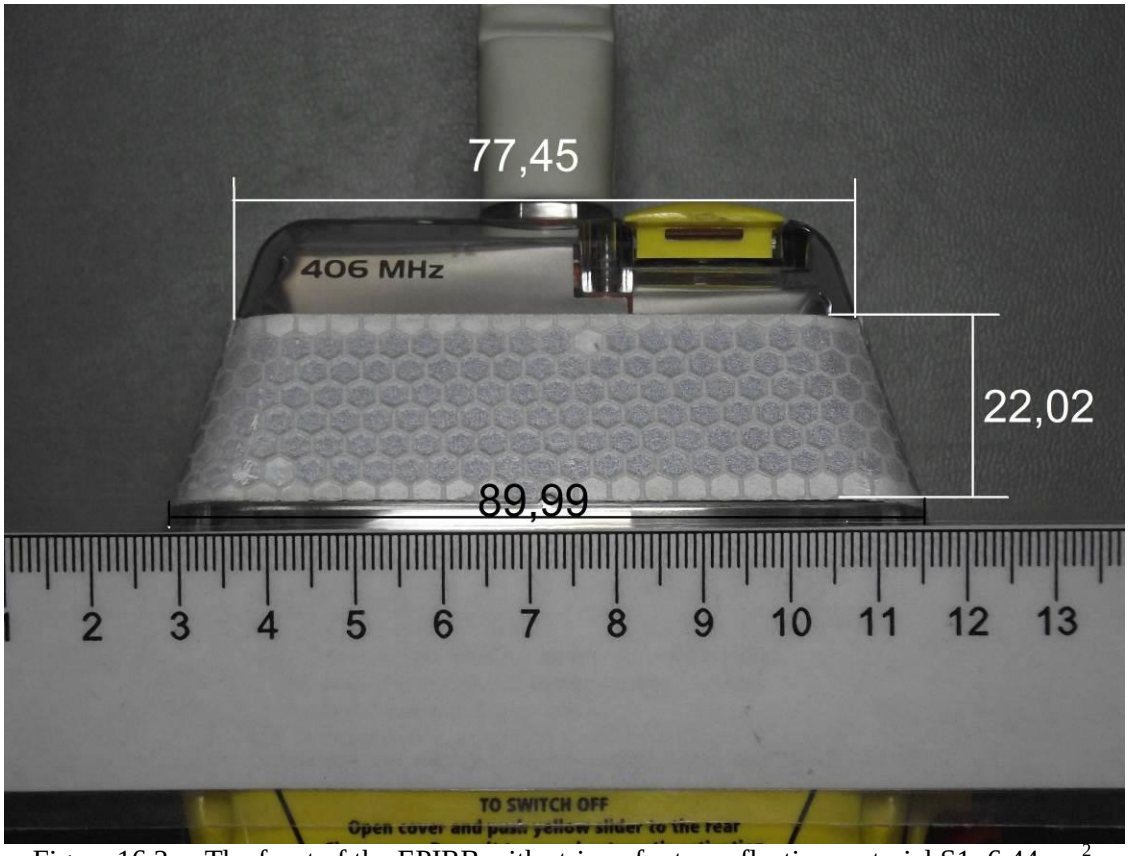


Figure 16.2 —The front of the EPIRB with stripe of retro-reflection material S1=6.44 cm^2