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Report On

Emergency Beacon Limited Testing of the
Jotron AS
Tron 40S MkII

Document 75900217 Report 03 Issue 3 January 2008

TUV Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk

REPORT ON

Emergency Beacons Limited Testing of the
Jotron AS
Tron 40S MkII

Document 75900217 Report 03 Issue 3

January 2008

PREPARED FOR

Jotron AS
Østbyveien 1
P O Box 54
3280 Tjodalyng
Norway

PREPARED BY

R Hampton
Test Engineer

APPROVED BY

M J Hardy
Authorised Signatory

DATED 31 January 2008

Product Service

Section **Page No**

SECTION 1

REPORT SUMMARY

Emergency Beacons Limited Testing of the
Jotron AS
Tron 40S MkII

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Jotron AS Tron 40S MkII to the requirements of T.007 Issue 4 – Rev 1 October 2006.

Objective	To perform Emergency Beacon Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.	
Manufacturer	Jotron AS	
Model Number(s)	Tron 40S MkII	
Serial Number(s)	75900217_02 75900217_34	Tron 40S MkII Tron 40S MkII (50 ohm load)
Number of Samples Tested	Two	
Test Specification/Issue/Date	Cospas-Sarsat T.007 Issue 4 – Rev 1 October 2006	
Date of Receipt of Test Samples	24 November 2006 (75900217_02) 05 December 2007 (75900217_34)	
Order Number Date	PO0637001 02 October 2006	
Start of Test	29 November 2007	
Finish of Test	13 December 2007	
Name of Engineer(s)	R Henley R Hampton I Tebby	

1.2 APPLICATION FORM

1.2.1 Beacon Manufacturer and Beacon Model

Beacon Manufacturer	Jotron AS
Beacon Model	Tron 40S MkII

1.2.2 Beacon Type and Operational Configurations

Beacon Type	**Beacon used while:**	**Tick where appropriate**
EPIRB	Floating in water or on deck or in a safety raft	☒
PLB	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Survival	On ground and above ground	☐
	On ground and above ground and floating in water	☐
ELT Auto Fixed	Fixed ELT with aircraft external antenna	☐
ELT Auto Portable	In aircraft with an external antenna	☐
	On ground, above ground, or in a safety raft with an integrated antenna	☐
ELT Auto Deployable	Deployable ELT with attached antenna	☐
Other (specify)		☐

1.2.3 Beacon Characteristics

Characteristic	**Specification**
Operating temperature range	Tmin = -20°C Tmax = +55°C
Operating lifetime	48 hours
Battery chemistry	Litium-thionyl chloride
Battery cell size and number of cells	C-size LSH14 light, 4
Battery manufacturer	SAFT
Battery pack manufacturer and part number	Jotron AS, X-83056
Oscillator type (e.g. OCXO, MCXO, TCXO)	TCXO
Oscillator manufacturer	C-MAC
Oscillator part name and number	C-MAC E4520LF
Oscillator satisfies long-term frequency stability requirements (Yes or No)	Yes

Characteristic	Specification
Antenna type (Integrated or External)	Integrated
Antenna manufacturer	Jotron AS
Antenna part name and number	X-83053
Navigation device type (Internal, External or None)	None
Features in beacon that prevent degradation to 406 MHz signal or beacon lifetime resulting from a failure of navigation device or failure to acquire position data (Yes, No, or N/A)	N/A
Features in beacon that ensures erroneous position data is not encoded into the beacon message (Yes, No or N/A)	N/A
Navigation device capable of supporting global coverage (Yes, No or N/A)	N/A
For Internal Navigation Devices	
- Geodetic reference system (WGS 84 or GTRF)	N/A
- GNSS receiver cold start forced at every beacon activation (Yes or No)	N/A
- Navigation device manufacturer	N/A
- Navigation device model name and part Number	N/A
- GNSS system supported (e.g. GPS, GLONASS, Galileo)	N/A
For External Navigation Devices	
- Data protocol for GNSS receiver to beacon interface	N/A
- Physical interface for beacon to navigation device	N/A
- Electrical interface for beacon to navigation device	N/A
- Navigation device model and manufacturer (if beacon designed to use specific devices)	N/A

Characteristic	Specification
Self-Test Mode Characteristics	
- Self-test has separate switch position (Yes or No)	Yes
- Self-test switch automatically returns to normal position when released (Yes or No)	Yes
- Self-test activation can cause an operational mode transmission (Yes or No)	No
- Self-test causes a single beacon self-test message burst only regardless of how long the self-test activation mechanism applied (Yes or No)	Yes
- Results of self-test indicated by (e.g. Pass / Fail Indicator Light, Strobe Light, etc.)	Strobe Light
- Self-test can be activated from beacon remote activation points (Yes or No)	No
- Self-test performs an internal check and indicates that RF power emitted at 406 MHz and 121.5 MHz if beacon includes a 121.5 MHz homer (Yes or No)	Yes
- Self-test transmits a signal(s) other than at 406 MHz (Yes & details or No)	Yes, 121.5 MHz
- Self-test can be activated directly at beacon (Yes or No)	Yes
- List of Items checked by self-test	Included in Manuals
- Self-test transmission burst duration (440 or 520 ms)	Both supported
- Self-test format bit (“0” or “1”)	Both supported
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5MHz
-Homer Transmit Power	20dBm
-Homer Duty Cycle	96%
-Duty Cycle of Homer Swept Tone	37%

Characteristic	Specification
Beacon includes a strobe light (Yes or No)	Yes
- Strobe light intensity	Average of 1.9cd
- Strobe light flash rate	21 per minute
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon's repetition periods are not synchronised closer than a few seconds over 5 minute period, and the time intervals between transmissions are randomly distributed on the interval 47.5 to 52.5 seconds (Yes or No)	Yes
Other ancillary devices (e.g. voice transceiver). List details on a separate sheet if insufficient space to describe.	None
Beacon includes automatic activation mechanism (Yes or No)	Yes

1.2.4 Information Provided by the Cospas-Sarsat Accepted Test Facility

Name and Location of Beacon Test Facility: TUV Product Service Ltd, United Kingdom

Date of Submission for Testing: October 2007

Applicable C/S Standards:

Document	Issue	Revision	Date
C/S T.001	**3**	**7**	**Nov-05**
C/S T.007	**4**	**1**	**Oct-06**

I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the Cospas-Sarsat Type Approval Standard (C/S T.007) and complies with the Specification for Cospas-Sarsat 406 MHz Distress Beacons (C/S T.001) as demonstrated in the attached report.

Signed: M Hardy

Name: M J Hardy

Position Held: Authorised Signatory

Date: 31 January 2008

1.2.5 Applicant Details

Company Name	Jotron AS		
Address	Østbyveien 1 PO Box 54 3280 Tjodalyng Norway		
Category of Applicant	☒ Manufacturer	☐ Importer	
	☐ Distributor	☐ Agent	
Contact Name	Eirik Storjordet	Telephone	+47 33139714
Email	eirik.storjordet@jotron.com	Facsimile	+47 33126780

1.2.6 Manufacturer Details

Company Name	See Applicant Details		
Address	N/A		
Contact Name	N/A	Telephone	N/A
Email	N/A	Facsimile	N/A

1.2.7 Declaration of Build Status

Hardware Version	000	
- PCB Revision	Main Board: 0738	(New revision which is updated with changes during the approval progress)
	Antenna board: 0721	(Earlier 0643 is modified as 0721. 0721 has the same electrical and antenna performance as 0643)
- Battery Model	05404	
Software Version	1.08	

1.2.8 Applicant's Declaration

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

Signed: _____

Name: Eirik Storjordet

Position Held: Certification Manager

Date: 27.04.2007

1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was a Jotron AS Tron 40S MkII as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.

Equipment Under Test

1.3.2 Physical Test Configuration

The Equipment Under Test (EUT) was operated using its own power source (internal battery). One EUT was configured so that the antenna port was connected to the 50Ω test system using a coaxial cable. The test configuration for all tests is identical with the exception of Satellite Qualitative test.

The second EUT was a fully packaged beacon, similar to the proposed production beacons equipped with its proper antenna. This EUT was used to perform the Satellite Qualitative tests. The test configuration for these tests is a function of the beacon type and the operational environments supported by the beacon, as declared by the manufacturer.

1.3.3 Modes of Operation

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

Self-test:

- Main switch to "Test“ position
- Self-test routine as described in Application form, above.

Operating:

- Main switch to "On“ position
- 121 Homer active
- 243 Homer not present
- Physical configuration as below

1.4 MODIFICATIONS

No modifications were made to the test sample during testing.

1.5 REPORT MODIFICATION RECORD

Issue 1 – First Issue.
Issue 2 – Revised as per C/S worksheet 1 (21 December 2007).
Issue 3 – Update of oscillator part number on page 5.

SECTION 2

TEST DETAILS

Emergency Beacons Limited Testing of the
Jotron AS
Tron 40S MkII

TEST RESULTS TABLE

Parameter		Limits	Units	Test Results T_{min} (-20°C)	Test Results T_{amb} (24°C)	Test Results T_{max} (+55°C)	Comments
2. Digital Message Coding		Bit Numbers					Test Sample: 75900217_34 **Result: Pass**
Bit Sync	1 - 15	15 bits "1"	P / F	P	P	P	Decoded Message: Page 16
Frame sync	16 - 24	"000101111"	P / F	P	P	P	
Format flag	25	1 bit	bit value	0	0	0	
Protocol flag	26	1 bit	bit value	1	1	1	
Identification / position data	27 - 85	59 bits	P / F	P	P	P	
BCH code	86 -106	21 bits	P / F	P	P	P	
Emerg. Code/nat. use/supplem. Data	107 - 112	6 bits	bit value	010000	010000	010000	
Additional data / BCH (if applicable)	112 - 144	32 bits	P / F	N/A	N/A	N/A	
Position Error (if applicable)		< 5	km	N/A	N/A	N/A	
3. Digital Message Generator							Test Sample: 75900217_34 **Result: Pass**
Repetition rate, T_R:							
Average T_R		48.5 ≤ T_{Ravg} ≤ 51.5	seconds	50.181	50.283	49.766	
Minimum T_R		47.5 ≤ T_{Rmin} ≤ 48.0	seconds	47.812	47.672	47.656	
Maximum T_R		52.0 ≤ T_{Rmax} ≤ 52.5	seconds	52.453	52.391	52.328	
Standard deviation		0.5 - 2.0	seconds	1.759	1.572	1.645	
Bit rate							
Minimum fb		≥ 396	bits/sec	399.675	399.675	399.682	
Maximum fb		≤ 404	bits/sec	399.707	399.695	399.705	
Total transmission time							
Short message		435.6 - 444.4	ms	440.429	440.415	440.436	
Long message		514.8 - 525.2	ms	N/A	N/A	N/A	
Unmodulated carrier							
Minimum T1		≥ 158.4	ms	160.592	160.585	160.593	
Maximum T1		≤ 161.6	ms	160.627	160.629	160.636	
First burst delay		≥ 47.5	seconds	50.1	50.1	50.1	Note: Self-test transmission omitted from count, self-test occurred after approximately 2 seconds

Parameter	Limits	Units	Test Results			Comments
			T_{min} (-20°C)	T_{amb} (24°C)	T_{max} (+55°C)	
6. Spurious Emissions into 50ohms						Test Sample: 75900217_34 **Result: Pass**
In band (406.0 – 406.1 MHz)	C/S T.001 mask	P / F	P	P	P	Spectrum plots: Page 19
8. Self-test Mode						Test Sample: 75900217_34 **Result: Pass**
Frame sync	011010000	P / F	P	P	P	Decoded Message: Page 20
Format flag	1 / 0	bit value	0	0	0	
Single radiated burst	≤440 / 520 (±1%)	ms	440.2564	440.1695	440.1573	
Default position data (if applicable)	correct	P / F	N/A	N/A	N/A	
Description	provided	Y / N		Y		
Design data on protection against repetitive self-test mode transmissions	provided	Y / N		Y		
Single burst verification	one burst	P / F	P	P	P	
Provides for 15 Hex ID	correct	P / F	P	P	P	
121.5 MHz RF power (if applicable)	self-test checks that RF power emitted	Y / N		Y		
406 MHz power	self-test checks that RF power emitted	Y / N		Y		
14. Satellite Qualitative Tests						Test Sample: 75900217_?? **Result: Pass**
Test Configuration	As per C/S T.007		Floating in water	Figure B.5		
15 Hex ID Decoded by LUT	correct	P / F	P	P		Test Data: Page 21
Doppler Location results with error ≤5km	≥80	%	92.9	92.9		
16. Beacon Coding Software						Test Sample: 75900217_34 **Result: Pass**
Sample message for each coding option of the applicable coding types	correct	P / F		P		
Sample self-test message for each coding option of the applicable coding types	correct	P / F		P		

2.1 DIGITAL MESSAGE CODING

2.1.1 Equipment Under Test

Tron 40S MkII, Serial Number 101

2.1.2 Date of Test

07, 10 and 11 December 2007

2.1.3 Test Equipment Used

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

2.1.4 Test Results

Digital Message at Ambient Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A02D4001940017D              A02D4001940017D Default_Id
 30 Hex (Bits 25-144) = 5016A000CA000BEFC00FD000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0000 0010 1101 0100 0000 0000 0001 1001 0100 0000 0000 0001 0111 1101
   1111 1000 0000 0001 1111 1010 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      257 NORWAY                           0100 0000 01
User Protocol      37- 39        3 Serialized                                011
Beacon type        40- 42        2 Float Free EPIRB                          010
Certification type 43            1 Cospas-Sarsat                              1
Serial Number      44- 63      101                      0000 0000 0000 0110 0101
Cosp-Sar Spare     64- 73        0                                0000 0000 00
Cosp-Sar Cert #    74- 83       95                                0001 0111 11
Homing             84- 85        1 121.5                                    01
BCH Encoded        86-106          Errors=0           1111 1000 0000 0001 1111 1
BCH Generated      86-106                             1111 1000 0000 0001 1111 1
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            1 Both Automatic and Manual                  1
National Use      109-112                                                0000
```

Digital Message at Minimum Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A02D4001940017D              A02D4001940017D Default_Id
 30 Hex (Bits 25-144) = 5016A000CA000BEFC00FD000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0000 0010 1101 0100 0000 0000 0001 1001 0100 0000 0000 0001 0111 1101
   1111 1000 0000 0001 1111 1010 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      257 NORWAY                           0100 0000 01
User Protocol      37- 39        3 Serialized                                011
Beacon type        40- 42        2 Float Free EPIRB                          010
Certification type 43            1 Cospas-Sarsat                              1
Serial Number      44- 63      101                        0000 0000 0000 0110 0101
Cosp-Sar Spare     64- 73        0                                  0000 0000 00
Cosp-Sar Cert #    74- 83       95                                  0001 0111 11
Homing             84- 85        1 121.5                                      01
BCH Encoded        86-106          Errors=0           1111 1000 0000 0001 1111 1
BCH Generated      86-106                             1111 1000 0000 0001 1111 1
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            1 Both Automatic and Manual                  1
National Use      109-112                                                  0000
```

Digital Message at Maximum Temperature

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A02D4001940017D              A02D4001940017D Default_Id
 30 Hex (Bits 25-144) = 5016A000CA000BEFC00FD000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0000 0010 1101 0100 0000 0000 0001 1001 0100 0000 0000 0001 0111 1101
   1111 1000 0000 0001 1111 1010 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      257 NORWAY                           0100 0000 01
User Protocol      37- 39        3 Serialized                                011
Beacon type        40- 42        2 Float Free EPIRB                          010
Certification type 43            1 Cospas-Sarsat                               1
Serial Number      44- 63      101                          0000 0000 0000 0110 0101
Cosp-Sar Spare     64- 73        0                                  0000 0000 00
Cosp-Sar Cert #    74- 83       95                                  0001 0111 11
Homing             84- 85        1 121.5                                     01
BCH Encoded        86-106          Errors=0           1111 1000 0000 0001 1111 1
BCH Generated      86-106                             1111 1000 0000 0001 1111 1
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            1 Both Automatic and Manual                  1
National Use      109-112                                                  0000
```

2.2 SPURIOUS EMISSIONS

2.2.1 Equipment Under Test

Tron 40S MkII, Serial Number 101

2.2.2 Date of Test

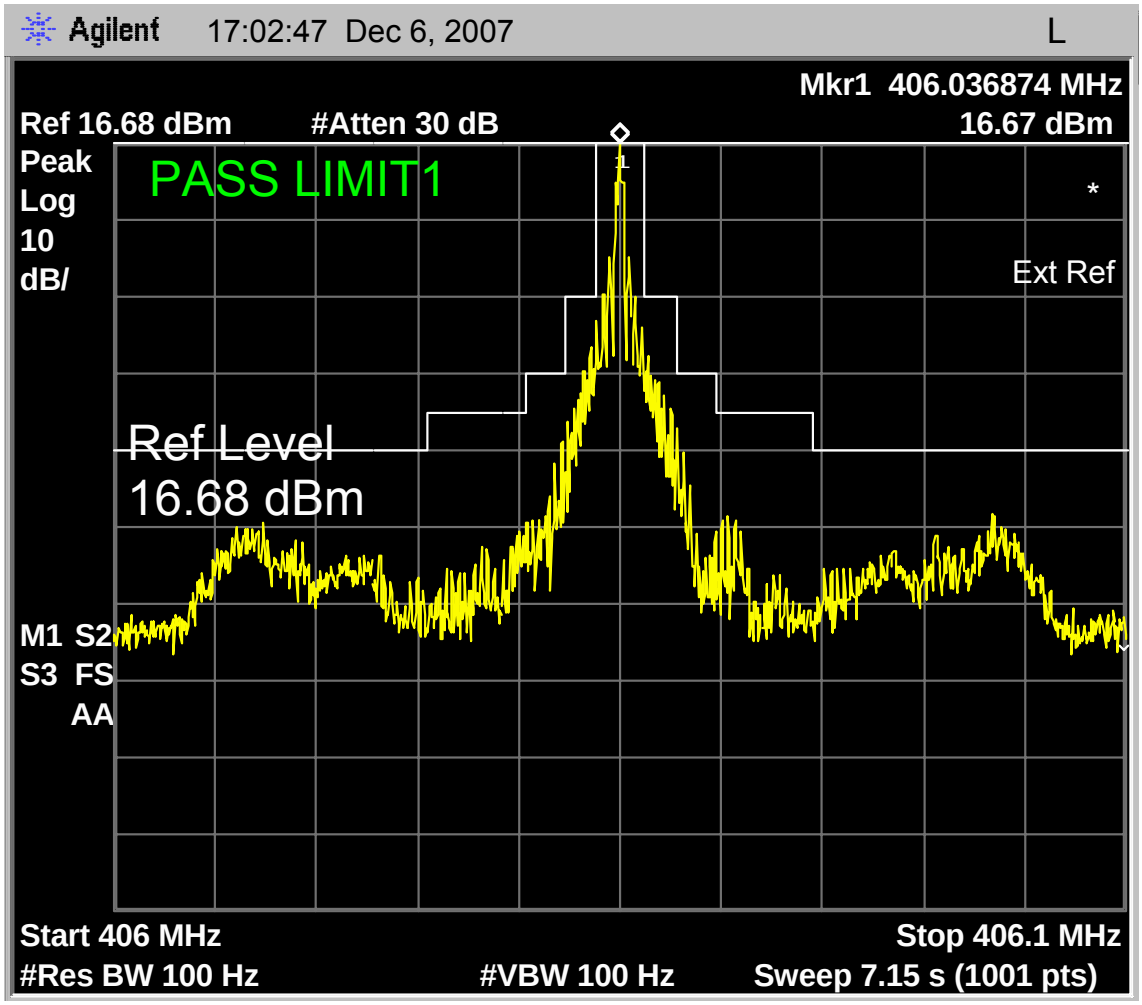
06 December 2007

2.2.3 Test Equipment Used

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

2.2.4 Test Results

Spurious Emissions at Ambient, Maximum and Minimum Temperatures



2.3 SELF-TEST MODE – DECODED MESSAGE

2.3.1 Equipment Under Test

Tron 40S MkII, Serial Number 101

2.3.2 Date of Test

07, 10 and 11 December 2007

2.3.3 Test Equipment Used

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

2.3.4 Test Results

Digital Message

```
Beacon Id Format......... 22 Hex Id, Short Message, Bits 25-112
 15 Hex (Bits 26- 85) = A02D4001940017D              A02D4001940017D Default_Id
 30 Hex (Bits 25-144) = 5016A000CA000BEFC00FD000000000

   26   30   34   38   42   46   50   54   58   62   66   70   74   78   82
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
 0 1010 0000 0010 1101 0100 0000 0000 0001 1001 0100 0000 0000 0001 0111 1101
   1111 1000 0000 0001 1111 1010 0000 0000 0000 0000 0000 0000 0000 0000 000
   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
   86   90   94   98  102  106  110  114  118  122  126  130  134  138  142

Field Name        Bit Pos    Value Decode                                  Bits
----------        -------    ----- ------                                  ----
Format Flag        25            0 Short Message                              0
Protocol Flag      26            1 User                                       1
MID                27- 36      257 NORWAY                           0100 0000 01
User Protocol      37- 39        3 Serialized                                011
Beacon type        40- 42        2 Float Free EPIRB                          010
Certification type 43            1 Cospas-Sarsat                              1
Serial Number      44- 63      101                      0000 0000 0000 0110 0101
Cosp-Sar Spare     64- 73        0                                0000 0000 00
Cosp-Sar Cert #    74- 83       95                                0001 0111 11
Homing             84- 85        1 121.5                                    01
BCH Encoded        86-106          Errors=0           1111 1000 0000 0001 1111 1
BCH Generated      86-106                             1111 1000 0000 0001 1111 1
Emergency Cd Flag 107            0 National Use                               0
Beacon Activation 108            1 Both Automatic and Manual                  1
National Use      109-112                                                0000
```

2.4 SATELLITE QUALITATIVE TESTS

2.4.1 Equipment Under Test

Tron 40S MkII, Serial Number 003

2.4.2 Date of Test and Modification State

Configuration 1 – 6th December 2007, 16:50 GMT to 7th December 2007, 09:30 GMT
Configuration 2 – 12th December 2007, 17:25 GMT to 13th December 2007, 09:10 GMT

2.4.3 Test Equipment Used

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

2.4.4 Test Results

Configuration 1

Beacon 15 Hex ID: A03D3 CFCF4 00001
Actual location of the test beacon : Latitude: 050° 49.091'N
Longitude: 001° 11.870'W

Beacon test configuration
(e.g. on dry ground, floating in water etc) : Floating in water

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (kM)
S11	5876	A03D3 CFCF4 00001	50.81166	-1.19766	-120.08	09:04:51	-11.561	0.725
S7	49734	A03D3 CFCF4 00001	50.82769	-1.15593	-123.18	07:36:51	14.450	3.126
S8	37153	A03D3 CFCF4 00001	50.81574	-1.19680	-121.83	06:31:01	11.410	0.281
S8	37152	A03D3 CFCF4 00001	50.81779	-1.20727	-122.08	04:50:43	-3.467	0.664
S8	37151	A03D3 CFCF4 00001	50.81358	-1.19482	-118.57	03:08:57	-19.518	0.554
S7	49732	A03D3 CFCF4 00001	50.83953	-1.27319	-124.83	04:17:01	-15.809	5.797
S10	13124	A03D3 CFCF4 00001	50.81821	-1.19738	-121.29	03:32:45	10.013	0.032
S10	13123	A03D3 CFCF4 00001	50.81618	-1.20294	-121.22	01:52:11	-5.128	0.422
S11	5870	A03D3 CFCF4 00001	50.82087	-1.19469	-114.81	22:34:00	-15.967	0.371
S9	28330	A03D3 CFCF4 00001	50.82019	-1.19314	-124.74	23:15:09	-17.365	0.398
S9	28329	A03D3 CFCF4 00001	50.82491	-1.18258	-120.41	21:34:20	-1.471	1.306
S9	28328	A03D3 CFCF4 00001	50.82531	-1.20572	-124.44	19:54:56	13.127	0.966
S11	5868	A03D3 CFCF4 00001	50.82863	-1.20320	-121.92	19:13:43	14.289	1.221
S7	49726	A03D3 CFCF4 00001	50.83215	-1.17928	-121.39	17:47:32	-11.774	2.026

$$\text{Ratio of successful solutions} = \frac{\text{number of Doppler solution within 5km with } 1° < \text{CTA} < 21°}{\text{number of satellite passes over test duration with } 1° < \text{CTA} < 21°}$$

$$= \frac{13}{14} = 92.9\%$$

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Configuration 2

Beacon 15 Hex ID: A03D3 CFCF4 00001
Actual location of the test beacon: Latitude: 052° 14.447'N
Longitude: 001° 43.970'W

Beacon test configuration
(e.g. on dry ground, floating in water etc) : C/S T.007 Figure B.5

Satellite ID	Satellite Pass Number	15 Hex ID Provided by LUT	Doppler Latitude	Doppler Longitude	Mean Rx Power (dBm)	TCA	CTA (deg)	Location Error (kM)
S9	28421	A03D3 CFCF4 00001	52.23787	-1.71966	-127.36	09:05:18	-16.517	0.953
S11	5961	A03D3 CFCF4 00001	52.23932	-1.71771	-123.35	08:39:54	-15.685	1.042
S7	49819	A03D3 CFCF4 00001	52.24647	-1.68209	-125.22	06:53:51	7.659	3.510
S7	49818	A03D3 CFCF4 00001	52.24099	-1.76794	-122.82	05:13:59	-7.176	2.389
S10	13209	A03D3 CFCF4 00001	52.23883	-1.72248	-130.81	04:10:19	14.001	0.737
S8	37236	A03D3 CFCF4 00001	52.23776	-1.72109	-126.03	03:39:08	-15.120	0.867
S10	13207	A03D3 CFCF4 00001	52.23632	-1.72391	-127.71	00:48:38	-15.383	0.784
S9	28415	A03D3 CFCF4 00001	52.24381	-1.72011	-122.62	22:36:20	-10.939	0.929
S11	5955	A03D3 CFCF4 00001	52.24323	-1.71981	-121.32	22:09:53	-11.805	0.927
S9	28414	A03D3 CFCF4 00001	52.24831	-1.72622	-125.19	20:56:04	4.178	0.950
S11	5954	A03D3 CFCF4 00001	52.24518	-1.72523	-121.27	20:29:22	3.388	0.712
S11	5953	A03D3 CFCF4 00001	52.24240	-1.72475	-120.33	18:50:14	16.636	0.579
S9	28413	A03D3 CFCF4 00001	52.24707	-1.73442	-129.00	19:17:10	17.277	0.707
S7	49812	A03D3 CFCF4 00001	52.19329	-1.86448	-130.64	18:45:35	-20.237	10.401

$$\text{Ratio of successful solutions} = \frac{\text{number of Doppler solution within 5km with } 1° < \text{CTA} < 21°}{\text{number of satellite passes over test duration with } 1° < \text{CTA} < 21°}$$

$$= \frac{13}{14} = 92.9\%$$

2.5 BEACON CODING SOFTWARE

2.5.1 Equipment Under Test

Tron 40S MkII, Serial Number 101

2.5.2 Date of Test

12 and 13 December 2007

2.5.3 Test Equipment Used

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

2.5.4 Test Results

Examples of User Protocol Beacon Messages

Protocol	Operational Message (in hexadecimal including bit and frame synchronisation bits)	Self-Test Message (in hexadecimal including bit and frame synchronisation bits)
Maritime User Protocol with MMSI	FFFE2F 4C9418618618668A26F190	FFFED0 4C9418618618668A26F190
Maritime User Protocol with Radio Call Sign	FFFE2F 4C9526F6F06B268C679110	FFFED0 4C9526F6F06B268C679110
Radio Call Sign User Protocol	FFFE2F 4C9DBDBC1A55468D215510	FFFED0 4C9DBDBC1A55468D215510
Serial User: Float Free EPIRB with Serial Number	FFFE2F 4C96A000CA000BE83A1890	FFFED0 4C96A000CA000BE83A1890
Serial User: Non Float Free EPIRB with Serial Number	FFFE2F 4C972000CA000BEDF8EB00	FFFED0 4C972000CA000BEDF8EB00
Aviation User Protocol	N/A	N/A
Serial User: ELT with Serial Number	N/A	N/A
Serial User: ELT with Aircraft Operator Designator & Serial Number	N/A	N/A
Serial User: ELT with Aircraft 24-bit address	N/A	N/A
Serial User: PLB with Serial Number	N/A	N/A
National User (Short)	N/T	N/T
National User (Long)	N/T	N/T

Key:
N/A = Not Applicable
N/T = Not Tested

Protocol	Operational Message	(in hexadecimal including bit and frame synchronisation bits)	Self-Test Message (in hexadecimal including bit and frame synchronisation bits)	GNSS Self Test Message (if applicable, in hexadecimal, including bit and frame synchronisation bits)
	Location A	Location B		Location A
Standard Location: EPIRB with MMSI	N/A	N/A	N/A	N/A
Standard Location: EPIRB with Serial Number	N/A	N/A	N/A	N/A
Standard Location: ELT with 24-bit Address	N/A	N/A	N/A	N/A
Standard Location: ELT with Serial Number	N/A	N/A	N/A	N/A
Standard Location: ELT with Aircraft Operator Designator	N/A	N/A	N/A	N/A
Standard Location: PLB with Serial Number	N/A	N/A	N/A	N/A
National Location: EPIRB	N/A	N/A	N/A	N/A
National Location: ELT	N/A	N/A	N/A	N/A
National Location: PLB	N/A	N/A	N/A	N/A
User Location	N/A	N/A	N/A	N/A

Key:
N/A = Not Applicable

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT

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

Instrument	Manufacturer	Type No	TE Number	Calibration Due
Section 2.5 - Beacon Coding Software				
Beacon Tester	WS Technologies	BT 100S	87	TU
Section 2.1 and 2.3 - Constant Temperature Tests				
Power Meter	Hewlett Packard	436A	83	11-Aug-2008
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	22-Dec-2007
Signal Generator	Hewlett Packard	8644A	96	11-Jan-2008
Load (50ohm, 15W)	Diamond Antenna	DL-30N	822	5-Sep-2008
Termination (50ohm, 15W)	Radio Spares	612-192	2416	5-Sep-2008
Stop Clock	R.S Components	RS328 061	2674	TU
Beacon RF Unit	TUV	N/A	3066	TU
Hygrometer	Rotronic	I-1000	3068	25-Apr-2008
Termination (50ohm, 15W)	Diamond Antenna	DL-30N	3097	16-Mar-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Attenuator (3dB, 20W)	Aeroflex / Weinschel	23-3-34	3161	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
Bandpass Filter	Trilithic	5BE406/35-1-AA	3207	18-Sep-2008
Time Interval Analyser	Yokogawa	TA720 704510	3253	6-Nov-2008
Scope Corder	Yokogawa	DL750 701210	3254	6-Nov-2008
Power Sensor	Agilent	8482A	3290	26-Nov-2008
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	18-Apr-2008
Cable (1m, N Type)	Rhophase	NPS-1601-1000-NPS	3351	18-Apr-2008
Cable (2m, N Type)	Rhophase	NPS-1601-2000-NPS	3359	18-Apr-2008
Section 2.2 - Spurious Emissions				
Climatic Chamber	Heraeus Votsch	VM 04/100	85	O/P Mon
Rubidium Frequency Standard	Quartzlock	A10-B	92	22-Dec-2007
Load (50ohm, 15W)	Diamond Antenna	DL-30N	822	5-Sep-2008
Attenuator (20dB, 10W)	Aeroflex / Weinschel	23-20-34	3158	30-May-2008
Thermocouple Thermometer	Fluke	51	3172	18-Jun-2008
ESA-E Series Spectrum Analyser	Agilent	E4402B	3348	16-Apr-2008
Cable (1m, N type)	Rhophase	NPS-1601-1000-NPS	3350	18-Apr-2008

TU – Traceability Unscheduled
OP MON – Output Monitored with Calibrated Equipment

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)

Tron 40S MkII

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

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

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

ANNEX A

APPLICANT'S DATA

1 Parameter 8. Selftest mode

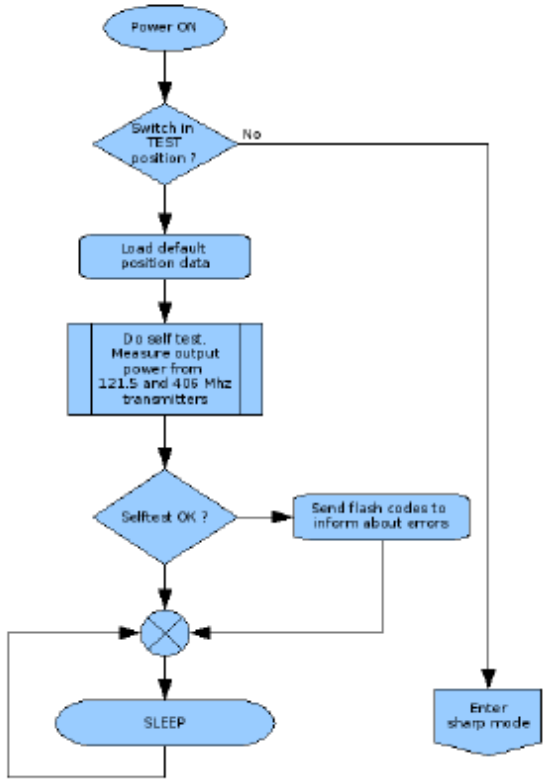


Figure 1

Design data on protection against repetitive self-tests

In selftest, the beacon will be powered by a separate test switch, and a TEST signal will activate the selftest routine.

After the microcontroller has performed the selftest routine , it goes into a infinite loop, which it does nothing. The microcontroller is in sleep most of the time in the infinite loop, and will do nothing until the beacon is reactivated. Please see figure1 for further information.

Default position Data (40 GPS Mk II)

Every time the beacon is activated, the "default position data" is loaded into the test message.

2 Single burst verification

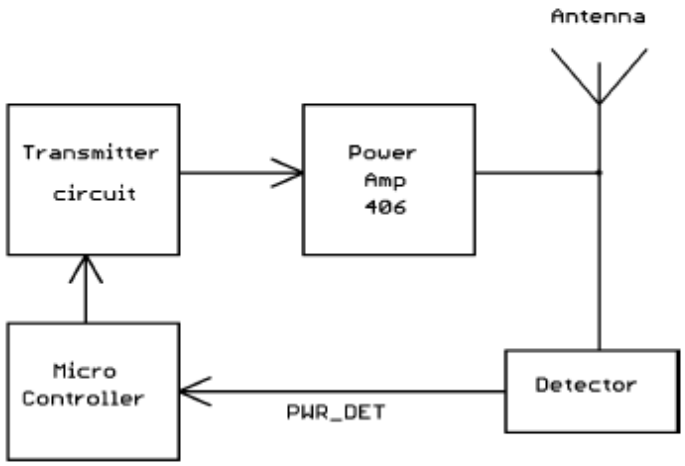


Figure 2

In the selftest mode the 406 test burst will be verified by a detected voltage generated on the RF-output at the transmitter. The RF-voltage is rectified (PWR_DET) and measured by the microcontroller during the 406 burst transmission. If the detected voltage is below the limit, the microcontroller will return a error code on the LED flash.

3 Parameter 12 - Oscillator Aging

- First Year ≤ 1ppm
- Ten year ≤ 3 ppm

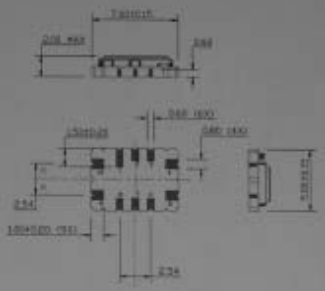
Datasheet of oscillator used in Tron 40S/GPS mkII, page 1.

C-MAC MicroTechnology

Oscillator Specification: E4520LF
Issue 1, 24th October 2006

Designed for use in "Copas-Sarsat" Emergency Beacon Applications

Outline in mm



Pad Connections
1. Do not connect
2. NC
3. DC Coupled Output (do not connec
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)

Marking includes
C-MAC
Manufacturing identifier (xx)
Pad 1 / Static Sensitivity Identifier (Δ)
Abbreviated Part Number (4520)
Device date code (YW)
Serial Number (0000)

CMAC xx
Δ 4520YW0000

Electrical

Nominal Frequency, Fo	12.688656 MHz
Supply Voltage, Vs	3.3 V ± 10%
Input Current	≤ 4.0 mA
Output:	
Type	HCMOS
Load	15 pF
Vol	≤ 0.1 * Vs
Voh	≥ 0.9 * Vs
Duty cycle @ 50%	45% to 55%
Rise time, 10% to 90%	≤ 6 ns
Fall time, 90% to 10%	≤ 6 ns
Frequency Stability	
Calibration Tolerance at 25°C	≤ ± 0.5 ppm
Temperature, -20°C to 55°C	≤ ± 0.2 ppm [±(Fmax-Fmin)/2Fo]
Supply Voltage, ± 10%	≤ ± 0.1 ppm reference to frequency at 3.3V
Load, ± 5pF	≤ ± 0.1 ppm reference to frequency at 15 pF
Allan Variance (tau=100ms)	≤ 1.0 ppb

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Author: Ø. Eggen/A. Fredriksen *0749* *03-12-2007*

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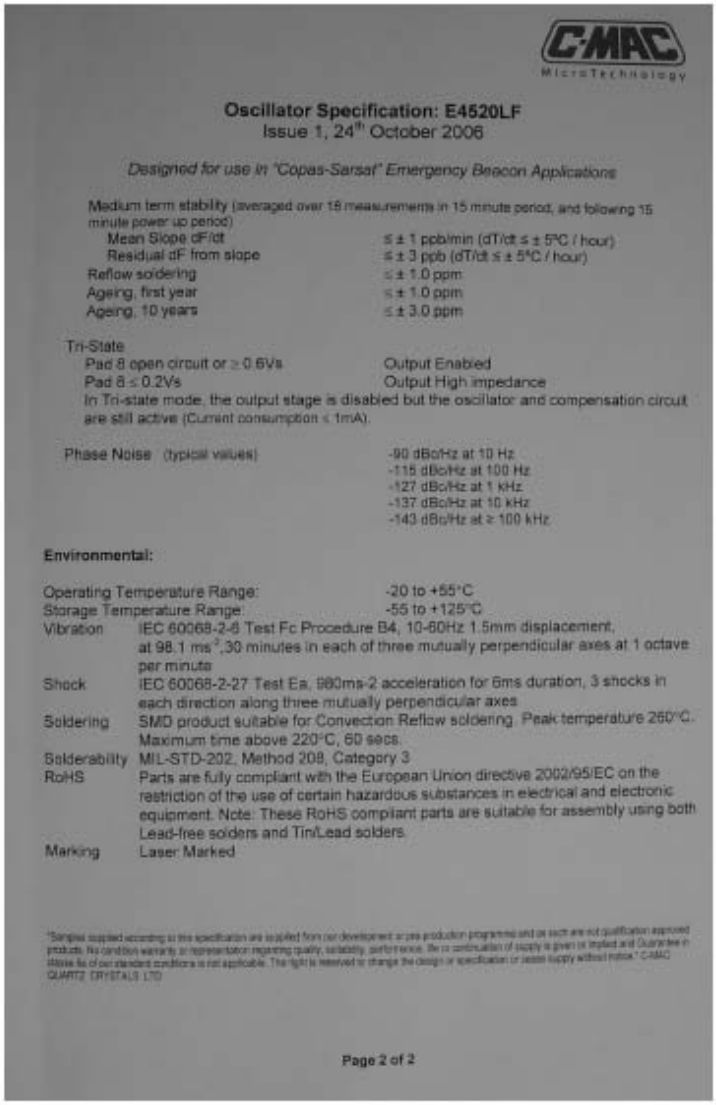

C-MAC MicroTechnology

Oscillator Specification: E4520LF
Issue 1, 24th October 2006

Designed for use in "Copas-Sarsat" Emergency Beacon Applications

Medium term stability (averaged over 16 measurements in 15 minute period, and following 15 minute power up period)

Mean Slope dF/dt	≤ ± 1 ppb/min (dT/dt ≤ ± 5°C / hour)
Residual dF from slope	≤ ± 3 ppb (dT/dt ≤ ± 5°C / hour)
Reflow soldering	≤ ± 1.0 ppm
Ageing, first year	≤ ± 1.0 ppm
Ageing, 10 years	≤ ± 3.0 ppm

Tri-State

Pad 8 open circuit or ≥ 0.6Vs	Output Enabled
Pad 8 ≤ 0.2Vs	Output High impedance

In Tri-state mode, the output stage is disabled but the oscillator and compensation circuit are still active (Current consumption ≤ 1mA).

Phase Noise (typical values)

-90 dBc/Hz at 10 Hz
-115 dBc/Hz at 100 Hz
-127 dBc/Hz at 1 kHz
-137 dBc/Hz at 10 kHz
-143 dBc/Hz at ≥ 100 kHz

Environmental:

Operating Temperature Range:	-20 to +55°C
Storage Temperature Range:	-55 to +125°C
Vibration	IEC 60068-2-6 Test Fc Procedure B4, 10-60Hz 1.5mm displacement, at 98.1 ms^{-2},30 minutes in each of three mutually perpendicular axes at 1 octave per minute
Shock	IEC 60068-2-27 Test Ea, 980ms-2 acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes
Soldering	SMD product suitable for Convection Reflow soldering. Peak temperature 260°C. Maximum time above 220°C, 60 secs.
Solderability	MIL-STD-202, Method 208, Category 3
RoHS	Parts are fully compliant with the European Union directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Note: These RoHS compliant parts are suitable for assembly using both Lead-free solders and Tin/Lead solders.
Marking	Laser Marked

Samples supplied according to this specification are supplied from our development or pre production programmes and as such are not qualification approved products. No condition warranty or representation regarding quality, suitability, performance, life or continuation of supply is given or implied and Guarantee in relation to all our standard conditions is not applicable. The right is reserved to change the design or specification or cease supply without notice. C-MAC QUARTZ CRYSTALS LTD

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Figure 3

4 Parameter 13 - Protection against continuous transmission

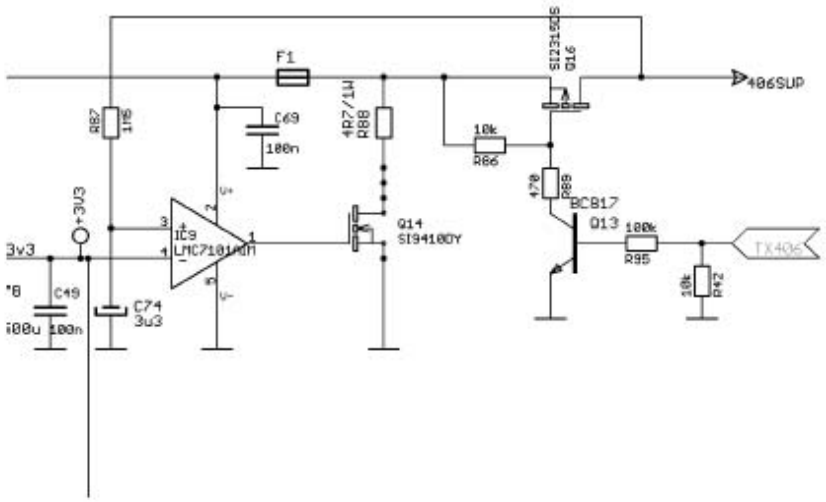

Figure 4

Please take a look at figure 4. If a continuous transmission occur, C74 will charge trough R87. When the voltage on IC9 pin 3 is higher than 3.3 V the output (#1) on IC 9 will go high, Q14 will conduct, and a 1.5 A current will destroy the fuse, F1. The 406SUP voltage is not longer present and will prevent the 406 transmitter.

5

Parameter 17

Beacon degradation due to navigation device, interface signal failure or malfunction

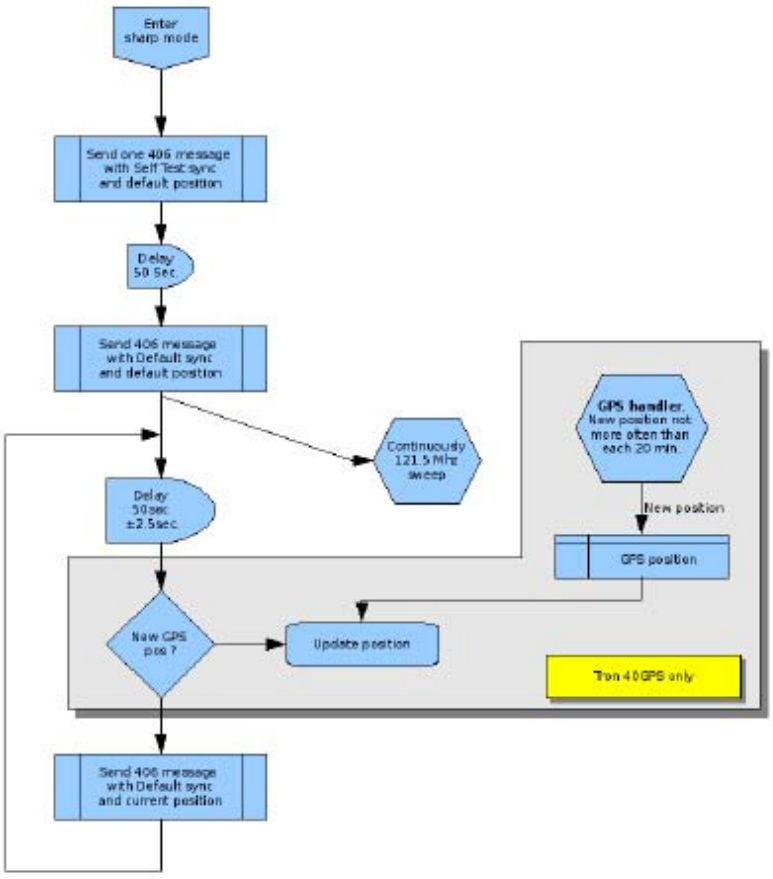

Figure 5

In the sharp mode, the beacon is activated by the sharp-mode switch. The microcontroller skip the selftest routine.

The program enters an infinit loop with 406 MHz transmission every 47.5-52.5 Sec, flash every 2.88 S, and a swept tone on 121.5 MHz between the 406 transmissions. For Tron 40GPS MkII the position gets an update when the GPS has a new position, but not more often than each 20 minute.
Please see blockdiagram above for further information.

Author: Ø. Eggen/A. Fredriksen *0749* *03-12-2007*