**PUBLIC ENTERPRISE TESTING CENTER «OMEGA»**

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**Approved by**
**Director**
**PE TC "OMEGA"**
**_____ Belikov N.I.**
**December 14, 2011**

# TEST REPORT No. 11/10
**Issue 4**

**on type approval of COSPAS-SARSAT**
**Emergency Position Indicating Radio Beacon (EPIRB)**

**Model** **Tron 60S**
**Manufacturer** **Jotron AS, Norway**

**Volume 2**

**Sevastopol**
**2011**

# CONTENTS [1]



[1] - documents provided by customer are only numbered through the whole volume by Omega, but have no header *PE TC «Omega» Test Report 11/10 Vol. 2 Iss. 4*. Page number is placed in upper right corner of every page.

| **Issue History** | | |
|---|---|---|
| **No** | **Data of issue** | **Report reissue reason** |
| 1 | 12.08.2011 | The initial issue. |
| 2 | 10.10.2011 | Updated:<br>Analysis and calculations pre-test battery discharge<br>Beacon data sheet (User's manual)<br>Electric diagram of beacon battery pack<br>Protection from repetitive self-test mode transmissions<br>Beacon quality assurance plan<br>Amended:<br>Extension of battery replacement period |
| 3 | 25.11.2011 | Updated:<br>Application for Cospas-Sarsat 406NHz beacon type approval<br>User Manual<br>Protection from repetitive self-test mode transmissions |
| 4 | 14.12.2011 | Test report 11/10 Vol. 1 is reissued. |

# Application for a Cospas-Sarsat 406 MHz beacon type approval

# ANNEX G

# APPLICATION FOR A COSPAS-SARSAT 406 MHz BEACON TYPE APPROVAL CERTIFICATE

## G.1 INFORMATION PROVIDED BY THE BEACON MANUFACTURER

**Beacon Manufacturer and Beacon Model**

| | |
|---|---|
| **Beacon Manufacturer** | Jotron AS |
| **Beacon Model** | Tron 60S |
| **Other Model Names** | |

**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 | X |
| **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)** | | |

**Beacon Characteristics**

| **Characteristic** | **Specification** |
|---|---|
| Operating frequency | 406,037MHz |
| Operating temperature range | Tmin =-20 Tmax=+55 degree C |
| Operating lifetime | 48 hours |

| Characteristic | Specification |
|---|---|
| Battery chemistry | Lithium/Iron Disulfide ($Li/FeS_2$) |
| Battery cell model name, size and number of cells | L91, AA, 8 cells |
| Battery cell manufacturer | Energizer |
| Battery pack manufacturer and part number | UAB Jotron, Lithuania, X-83095 |
| Battery pack replacement period | 5 years |
| Oscillator type (e.g. OCXO, MCXO, TCXO) | TCXO |
| Oscillator manufacturer | Rakon |
| Oscillator part name and number | Rakon E4520LF |
| Oscillator satisfies long-term frequency stability requirements (Yes or No) | YES |
| Antenna type: Integral or Other (e.g. External, Detachable – specify type) | Intergral combined antenna for 406MHz 121,5MHz and low duty-cycle light at the top |
| Antenna manufacturer | SHANGHAI KEWL C. Ltd., China |
| Antenna part name and number | Complete Antenna, X-83088 |
| 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<br>- Geodetic reference system (WGS 84 or GTRF)<br>- GNSS receiver cold start forced at every beacon activation (Yes or No)<br>- Navigation device manufacturer<br>- Navigation device model name and part Number<br>- GNSS system supported (e.g. GPS, GLONASS, Galileo) | |

| Characteristic | Specification | |
|---|---|---|
| For External Navigation Devices | | |
| - Data protocol for GNSS receiver to beacon interface | | |
| - Physical interface for beacon to navigation device | | |
| - Electrical interface for beacon to navigation device | | |
| - Part number of the external navigation interface device (if applicable) | | |
| - Navigation device model and manufacturer (if beacon designed to use specific devices) | | |
| **Self-Test Mode Characteristics:** | Self-Test Mode | Optional GNSS Self-Test Mode |
| - 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.) | Number of Strobe light flashes. One flash=OK | |
| - 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, 121.5MHz | |
| - Self-test can be activated directly at beacon (Yes or No) | Yes | |
| - List of Items checked by self-test | Supported in product manuals | |
| - Self-test transmission burst duration (440 or 520 ms) | 440ms | |
| - Self-test format bit ("0" or "1") | "0" | |
| - Maximum duration of self-test | 6 seconds if OK | |

| Characteristic | Specification | |
|---|---|---|
| - Maximum number of GNSS Self Tests (beacons with internal navigation devices only) | N/A | N/A |
| - Self-test results in transmission of a single burst, irrespectively of the test result (Yes or No) | N/A | |
| - Maximum number of self-tests during battery pack replacement period | N/A | N/A |

| Message Coding Protocols: | (x) | Tick the boxes below against the intended protocol options |
|---|---|---|
| User Protocol (tick where appropriate) | X | Maritime with MMSI |
| | X | Maritime with Radio Call Sign |
| | X | EPIRB Float Free with Serial Number |
| | | EPIRB Non Float Free with Serial Number |
| | X | Radio Call Sign |
| | | Aviation |
| | | ELT with Serial Number |
| | | ELT with Aircraft Operator and Serial Number |
| | | ELT with Aircraft 24-bit Address |
| | | PLB with Serial Number |
| | | National (Short Message Format) |
| | | National (Long Message Format) |
| Standard Location Protocol (tick where appropriate) | | EPIRB with MMSI |
| | | EPIRB with Serial Number |
| | | ELT with 24-bit Address |
| | | ELT with Aircraft Operator Designator |
| | | ELT with Serial Number |
| | | PLB with Serial Number |
| National Location Protocol (tick where appropriate) | | National Location: EPIRB |
| | | National Location: ELT |
| | | National Location: PLB |
| User Location Protocol (tick where appropriate) | | Maritime with MMSI |
| | | Maritime with Radio Call Sign |
| | | EPIRB Float Free with Serial Number |
| | | EPIRB Non Float Free with Serial Number |
| | | Radio Call Sign |
| | | Aviation |
| | | ELT with Serial Number |
| | | ELT with Aircraft Operator and Serial Number |
| | | ELT with Aircraft 24-bit Address |
| | | PLB with Serial Number |

| Characteristic | Specification |
|---|---|
| Beacon includes a homer transmitter (if yes identify frequency of transmission) | 121,5 MHz |
| -Homer Transmit Power | 17 dBm +/-3dB |
| -Homer Transmitter Duty Cycle | 96 % |
| -Duty Cycle of Homer Swept Tone | 37 % |
| Beacon includes a strobe light (Yes or No) | Yes |
| - Strobe light intensity | >0.75cd |
| - 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, remote control, external audio and light indicators, external activation device). List details on a separate sheet if insufficient space to describe. | N/A |
| Beacon includes automatic activation mechanism (Yes or No) Specify type of automatic beacon activation mechanism | Yes Sea water contacts |
| Beacon includes software or hardware features and functions not listed above and non-related to 406 MHz (Yes or No) List features and use a separate sheet if insufficient space | No |

Dated: 23.11.11 Signed: Stig Erik Helland / R&D Director, Stig Erik Helland

(Name, Position and Signature of Beacon Manufacturer Representative)

**(Continued on Next Page)**

# Sample messages generated by beacon coding software

| | | |
|---|---|---|
| JOTRON | Sample Message | 200804 |
| | *Tron 60S* | Page 1(1) |

| ***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 | `fffe2f50141861b2c866893ab150` | `fffed050141861b2c866893ab150` |
| Maritime User Protocol with Radio Call Sign | `fffe2f50154f065b24868a11be10` | `fffed050154f065b24868a11be10` |
| Serial User: Float-Free EPIRB with Serial Number | `fffe2f5016a06072001729f413d0` | `fffed05016a06072001729f413d0` |
| Radio Call Sign User Protocol | `fffe2f501d4f065b55468ef28750` | `fffed0501d4f065b55468ef28750` |

# Analysis and calculations pre-test battery discharge before the operating lifetime at minimum temperature test

## APPENDIX E TO ANNEX F

## BEACON OPERATING CURRENT AND PRE-TEST DISCHARGE CALCULATIONS

### Table F-E.1: Beacon Operating Current

| Beacon Operating Modes | Mode: Manually selectable or Automatic | Measurement interval, sec | Average Current, mA | Peak Current, mA |
|---|---|---|---|---|
| Activated | Automatic | 50 seconds | 36mA | 1100mA |
| Self-Test | Manual | 6 seconds | 110mA | 1100mA |
| Standby | Automatic / Manual | NA | 500nA | 500nA |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

### Table F-E.2: Pre-test Battery Discharge Calculations

| Characteristic | Designation | Units | Value | Comments |
|---|---|---|---|---|
| Beacon battery replacement period (from date of cell manufacture) | $T_{BR}$ or TBR | Number of years | **10** | |
| Battery pack electrical configuration | | | | |
| Cell model and cell chemistry | | | | |
| Nominal cell capacity | | A-hrs | **3.1** | |
| Nominal battery pack capacity | $C_{BN}$ | A-hrs | **3.1** | |
| Annual battery cell capacity loss (self-discharge) due to aging, as specified by cell manufacturer at ambient temperature | $L_{SDC}$ | % | **0.7** | |
| Calculated battery pack capacity loss due to self-discharge: $L_{CBN} = C_{BN} - [C_{BN} * (1 - L_{SDC}/100)^{TBR}]$ | $\mathbf{L_{CBN}}$ | A-hrs | **0.21** | |
| Number of self-tests per year | $N_{ST}$ | | **12** | |
| Average battery current during a self-test | $I_{ST}$ | mA | **110** | |
| Maximum duration of a self-test | $T_{ST}$ | sec | **6** | |
| Calculated battery pack capacity loss due to self-tests during battery replacement period: $L_{ST} = I_{ST} * T_{ST} * T_{BR} * N_{ST} / 3600$ | $\mathbf{L_{ST}}$ | mA-hrs | **22** | |
| Maximum Number of GNSS self-tests between battery replacements | $N_{GST}$ | | **-** | |
| Average battery current during a GNSS self-test of maximum duration | $I_{GST}$ | mA | **-** | |
| Maximum duration of a GNSS self-test | $T_{GST}$ | sec | **-** | |
| Calculated battery pack capacity loss due to GNSS self-tests during battery replacement period: $L_{GST} = I_{GST} * T_{GST} * N_{GST} / 3600$ | $\mathbf{L_{GST}}$ | mA-hrs | **0** | |
| Average stand-by battery pack current | $I_{SB}$ | mA | **0.0005** | |
| Battery pack capacity loss due to constant operation of circuitry prior to beacon activation: $L_{ISB} = I_{SB} * T_{BR} * 8760$ | $\mathbf{L_{ISB}}$ | mA-hrs | **43.8** | |
| Calculated value of the battery pack pre-test discharge $L_{CDC} = L_{CBN} + 1.65 * (L_{ST} + L_{GST} + L_{ISB})/1000$ | $\mathbf{L_{CDC}}$ | A-hrs | **0.32** | |

- END OF ANNEX F -

# Beacon data sheet

USERS MANUAL

# Tron 60S
# Tron 60GPS

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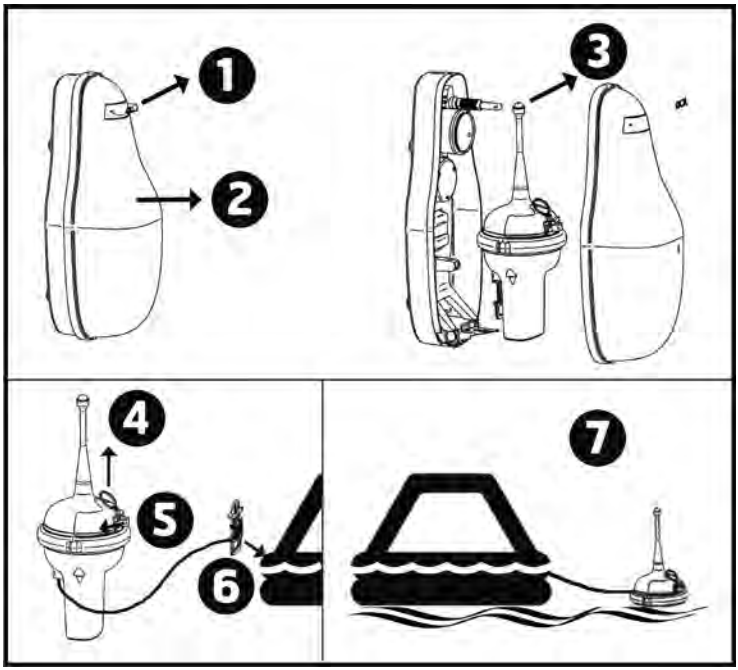
# AMENDMENT RECORDS

| Amend-ment no | By | Date | Page(s) | Vers. | Reason for change |
|---|---|---|---|---|---|
| 1 | TH | 23.12.2010 | Total 32 | A | New Manual |
| 2 | TH | 25.02.2011 | Ch. 3.1.2 | B | Changed battery info |
| 3 | TH | 18.04.2011 | Page 13-29 | C | Re-arranged pic-tures/drawings |
| 4 | TH | 19.09.2011 | Page 15, 22-25 | D | Info update |
| 5 | BR | 10.11.2011 | Page 24 | E | Info update on test |
| 6 | | | | | |
| 7 | | | | | |



**EC Declaration of Conformity, available at www.jotron.com**

# ABBREVIATIONS AND DEFINITIONS

**BAUD**
Transmission rate unit of measurement for binary coded data (bit per second)

**BIT**
Short form of Binary Digit. The smallest element of data in a binary-coded value

**BPS**
Bits Per Second

**COSPAS**
COsmicheskaya Sistyema Poiska Avariynich Sudov (Space System for the Search of Vessels in Distress)

**EPIRB**
Emergency Position Indicating Radio Beacon

**GLOBAL POSITIONING SYSTEM (GPS)**
The NAVSTAR Global Positioning System, which consists of orbiting satellites, a network of ground control stations, and user positioning and navigation equipment. The system has 24 satellites plus 3 active spare satellites in six orbital planes about 20,200 kilometers above the earth.

**IEC**
International Electro-technical Commission

**IMO**
International Maritime Organization

**IBRD**
International 406MHz Beacon Registration Database

**ITU**
International Telecommunication Union

**LED**
Light Emitting Diode

**LUT**
Local User Terminal (Ground Station)

**MCA**
Marine and Coastguard Agency (UK)

**MCC**
Mission Control Centre

**NOAA**
National Oceanic and Atmospheric Administration (USA)

**RCC**
Rescue Coordination Centre

**SARSAT**
Search and Rescue Satellite-Aided Tracking System

**SBM**
Shore Based Maintenance – as required by SOLAS regulation IV/15.9.2 of SOLAS 1974 as amended with, in accordance with MSC/Circ. 1039 guidelines for Shore-Based Maintenance (SBM) of Satellite EPIRBs within 5 years if:

Passenger ships (> 12 passengers) and cargo ships (> 300GT) engaged in International voyages, shall perform SBM as follows:

- Latest by the date of the EPIRB label with this text, or the battery Label, whichever is first.
- When this EPIRB becomes due for SBM in accordance with national requirements.

**VHF**
Very High Frequency -A set of frequencies in the 30-300MHz region.

# IMPORTANT

The information in this book has been carefully checked and is believed to be accurate. However, no responsibility is assumed for inaccuracies.

This equipment contains CMOS integrated circuits. Observe handling precautions to avoid static discharges which may damage these devices. Jotron AS reserves the right to make changes without further notice to any products or modules described herein to improve reliability, function or design. Jotron AS does not assume any liability arising out of the application or use of the described product.

# WARNING / IMPORTANT

Jotron AS is a prime manufacturer of safety equipment designed for rescue of human lives and their property. For safety equipment to be effective in line with the design parameters it is important that they are handled, stowed and maintained in compliance with the manufacturers instructions. Jotron AS can not be held responsible for any damage caused due to incorrect use of the equipment or breach of laid down procedures or for failure of any specific component or other parts of the equipment.

The chapter covering battery replacement is added for information only. Jotron AS does not take any responsibility for improper disassembling/assembling of the beacon. We strongly recommend all service to be done by authorized Jotron AS agents. In addition to normal service, Jotron AS agents have the necessary equipment and education to test the operational functions of the beacon. Non-original maintenance and/or service parts may destroy the equipment function and performance.

# PRODUCT SAFETY DATA SHEET

| | |
|---|---|
| **PRODUCT NAME:** | Energizer Battery |
| **TYPE NO.:** | L91, L92, EA91, EA92 Volts: 1.5 |
| **TRADE NAMES:** | ULTIMATE (L91, L92); ADVANCED (EA91, EA92) |
| **APPROXIMATE WEIGHT:** | 7.6 g. (L92, EA92) – 14.5 g. (L91, EA91) |
| **CHEMICAL SYSTEM:** | Lithium Iron Disulfide |
| **DESIGNED FOR RECHARGE:** | No |

## HAZARDS IDENTIFICATION

Under normal conditions of use, the battery is hermetically sealed.
Ingestion: Swallowing a battery can be harmful.
Inhalation: Contents of an open battery can cause respiratory irritation.
Skin Contact: Contents of an open battery can cause skin irritation.
Eye Contact: Contents of an open battery can cause severe irritation.

## FIRST AID MEASURES

Ingestion: Do not induce vomiting or give food or drink. Seek medical attention immediately. CALL NATIONAL BATTERY INGESTION HOTLINE for advice and follow-up (202-625-3333) collect day or night.
Inhalation: Provide fresh air and seek medical attention.
Skin Contact: Remove contaminated clothing and wash skin with soap and water.
Eye Contact: Immediately flush eyes thoroughly with water for at least 15 minutes, lifting upper and lower lids, until no evidence of the chemical remains. Seek medical attention.

**Note: Carbon black is listed as a possible carcinogen by International Agency for Research on Cancer (IARC).**

## FIRE FIGHTING MEASURES

In case of fire where lithium batteries are present, flood area with water or smother with a Class D fire extinguishant appropriate for lithium metal, such as Lith-X. Water may not extinguish burning batteries but will cool the adjacent batteries and control the spread of fire. Burning batteries will burn themselves out. Virtually all fires involving lithium batteries can be controlled by flooding

with water. However, the contents of the battery will react with water and form hydrogen gas. In a confined space, hydrogen gas can form an explosive mixture. In this situation, smothering agents are recommended. A smothering agent will extinguish burning lithium batteries.

Emergency Responders should wear self-contained breathing apparatus. Burning lithium-iron disulfide batteries produce toxic and corrosive lithium hydroxide fumes and sulfur dioxide gas.

**HANDLING AND STORAGE**

Storage: Store in a cool, well ventilated area. Elevated temperatures can result in shortened battery life. In locations that handle large quantities of lithium batteries, such as warehouses, lithium batteries should be isolated from unnecessary combustibles.

Mechanical Containment: If potting or sealing the battery in an airtight or watertight container is required, consult your Energizer Battery Manufacturing, Inc. representative for precautionary suggestions. Do not obstruct safety release vents on batteries. Encapsulation of batteries will not allow cell venting and can cause high pressure rupture.

Handling: Accidental short circuit for a few seconds will not seriously affect the battery. Prolonged short circuit will cause the battery to lose energy, generate significant heat and can cause the safety release vent to open. Sources of short circuits include jumbled batteries in bulk containers, metal jewelry, metal covered tables or metal belts used for assembly of batteries into devices. Damaging a lithium battery may result in an internal short circuit.

- The contents of an open battery, including a vented battery, when exposed to water, may result in a fire and/or explosion. Crushed or damaged batteries may result in a fire.
- If soldering or welding to the battery is required, consult your Energizer representative for proper precautions to prevent seal damage or short circuit.

Charging: This battery is manufactured in a charged state. It is not designed for recharging. Recharging can cause battery leakage or, in some cases, high pressure rupture. Inadvertent charging can occur if a battery is installed backwards.

Labeling: If the Energizer label or package warnings are not visible, it is important to provide a package and/or device label stating:

**- WARNING:**
Battery can explode or leak and cause burns if installed backwards, disassembled, charged, or exposed to water, fire or
high temperature. Where accidental ingestion of small batteries is possible, the label should include:
**- WARNING:**
(1) Keep away from small children. If swallowed, promptly see doctor. Battery can explode or leak and cause burns if installed backwards, disassembled, charged, or exposed to water, fire or high temperature.

# TEST AND MAINTENANCE RECORD

| DATE | N/T/B | SIGN | INSP |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**N= New EPIRB installed, T= Test, B= New battery**

# TEST OF RADIO EQUIPMENT

**Monthly:**
Float-free and manual EPIRBs to be checked using the means provided for testing on the equipment. Check data for periodical maintenance requirement for float-free EPIRB.

**False alerts transmitted by EPIRB**
False alerts are a serious problem for the rescue service. Nearly 90% of EPIRB initiated distress alerts turn out to be false alarms.

If for any reason, your EPIRB should cause a false alarm, it is most important that you contact the nearest search and rescue authority and tell them it was a false alarm. They can then stand down any rescue service (coast radio station

or appropriate CES or RCC). Use any means at your disposal to make contact. Switch off the distress alarm by de-activating your EPIRB, as soon as possible.

If your beacon is activated in a non-distress situation or a distress situation which has been resolved and you no longer require assistance, contact the nearest search and rescue authorities via the most expeditious means available with the following information:

- Beacon ID number (15 character UIN):
- Position (At time of activation):
- Date of Activation:
- Time of Activation (Time zone):
- Duration of Activation:
- Beacon marke and model:
- Vessel Name/ID:
- Circumstances/cause (if known):

**USA**

The United States search and rescue authority is the U.S. Coast Guard. The primary points of
contact are:

Pacific Ocean Area
USCG Pacific Area Command Centre
Tel: +1 (510)-437-3701

Atlantic Ocean / Gulf of Mexico Area
USCG Atlantic Area Command Centre
Tel: +1 (757)-398-6231

From Any Location
USCG Headquarters Command Centre
Tel: +1 (800)-323-7233

# TABLE OF CONTENTS

# 1 GENERAL DESCRIPTION

The Tron 60S/GPS is emergency equipment consisting of:
- Tron 60S/GPS Cospas-Sarsat emergency EPIRB
- One of the following brackets:
- FB-60 - Automatic float free bracket.
- MB-60 - Manual bracket.

The Tron 60S/GPS EPIRB is developed to meet the regulations and rules for use on vessels and life rafts in the maritime service. Tron 60S/GPS meets the following specifications for 406 MHz EPIRBs for use in search and rescue operations at sea.

See "Declaration of Conformity" document at www.Jotron.com for information of required standards.

## 1.1 TRON 60S/GPS

The Tron 60S/GPS is buoyant, and is designed to automatically release and activate in case of an emergency where the EPIRB and its bracket is submerged into the sea. The Tron 60S/GPS can also be operated as a manual EPIRB, by manually releasing it from its bracket and then activating it.

Two different brackets are currently available for the Tron 60S/GPS. MB-60 is the manual bracket and FB-60 is the automatic bracket with cover. The manual bracket comes without the hydrostatic release mechanism and is used to store the beacon inside the wheelhouse or other protected places. The automatic bracket is mounted in a free space outside where the beacon can be released automatically.

The purpose of the Tron 60S/GPS is to give a primary alarm to the search and rescue authorities. The EPIRB gives an immediate alarm when activated, transmitting the ID of the ship in distress. Care must be taken not to activate the EPIRB unless in an emergency situation, in such cases the user will be held responsible. For periodic testing a test function is implemented. During the test cycle the EPIRB does a self-test on the transmitters and on the battery status. No emergency signal is transmitted during the self-test.

The battery of the EPIRB will last for at least 48 hours from activation of the EPIRB.

## 1.2 SYSTEM DESCRIPTION

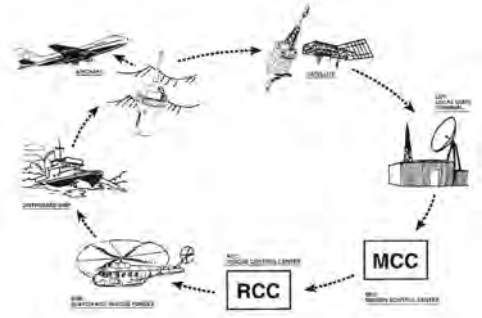
The Cospas-Sarsat system was introduced in 1982 as a worldwide search and rescue system with the help of satellites covering the earth's surface. Since the introduction of the system more than 28000 persons have been rescued by the Cospas-Sarsat system (2009). Currently the system consists of 5 functional satellites in a polar orbit constellation, these satellites cover the entire earth's surface and receive the emergency signal from the 406 MHz transmitter within the Tron 60S/GPS, more polar orbiting satellites will be available in the future, giving a faster location and rescue time.

In addition several geostationary satellites are equipped with a 406 MHz transponder, these satellites are not able to locate the Tron 60S/GPS but will give an early warning to the rescue forces, minimising the time from an emergency occurs till the rescue forces are at the site.

Each emergency EPIRB in the system is programmed with its own unique code, therefore it is vital that the ships data that is given to the dealer you obtained your Tron 60S/GPS, is correct. It is also important that your EPIRB is registered in the database for each country. This database is normally located in the same country that the ship is registered.

### 1.2.1 SIGNAL DETECTION

When the Tron 60S/GPS is activated (manually or automatically) it transmits on the frequencies 121.5 MHz and 406.037 MHz. An analogue signal is emitted on 121.5 MHz and a digital signal is transmitted on 406.037 MHz. After the Tron 60S/GPS is activated, the next passing satellite will detect the transmitted signal and relay it to an antenna at a ground station, called LUT.




The International Cospas-Sarsat System has ceased satellite processing of 121.5/243 MHz beacons from 1 February 2009.

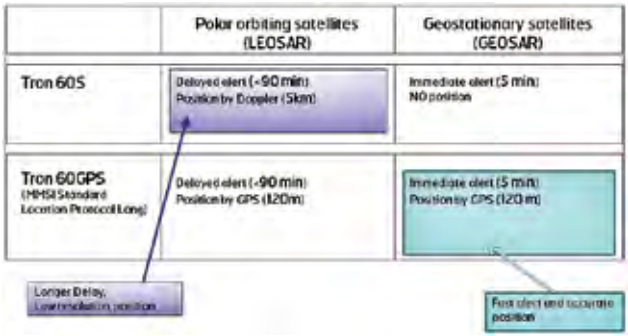
### 1.2.2 DISTRESS LOCATION DETERMINATION


The location of the distress signal is determined by taking measurements of the doppler shift of the EPIRB frequency when the satellite first approach and then pass the EPIRB.

The actual frequency is heard at the time of closest approach (TCA). Knowing the position of the satellite and using the received doppler signal information, it is possible to determine the location of the Tron 60S/GPS from the satellite at the TCA. At the LUT, actually two positions are calculated. One is the actual position (A) and the other is the mirror image (B) position. A second satellite pass confirms the correct location (A). Doppler-only accuracy is within 5 km (3 mi) (3.1 statute miles or 2.6 nautical miles)— that is, the position is sufficiently accurate for SAR purposes even after only one pass. What's more, the most likely of the two 'mirror' positions can be determined valid with 98.5% accuracy after only one satellite pass. This accuracy can be increased to 99.3% using so-called "combined Leo-Geo processing," and this technique also enables accurate positions to be generated with as little as two or three bursts from the beacon (i.e. less than 4 minutes of transmission) and thus greatly increases the chances of being found even if the beacon is ultimately consumed by fire or is otherwise destroyed

#### 1.2.2.1 GPS ADVANTAGE

Tron 60GPS has been designed to operate with the Cospas-Sarsat system and will enhance further the lifesaving capabilities of conventional beacons.
Please see below comparison between Tron 60S and Tron 60GPS depending on detection by polar orbiting or geostationary satellites.



GPS position is updated every 5 minutes, and can also be tested in SELF TEST (On previous models, position updates was only allowed every 20 minutes and NOT allowed to be tested in SELF TEST)

### 1.2.3 EPIRB REGISTRATION

Normally the MCC will contact the vessel or the contact person registered in a shipping register and/or an EPIRB register (Ships owner, family member etc.) before alerting the RCC. This is to determine if the alarm from the EPIRB for some reason is a false alarm, and an expensive rescue operation can be avoided. Because of this it is important that the ships data is correct in the shipping register or in the EPIRB database.

You should register your beacon with the national authority associated with the country code in the hexadecimal identification (15 Hex ID) of your beacon. You can register your beacon online with the Cospas-Sarsat IBRD if your country does not provide a registration facility and your country has allowed direct registration in the IBRD: www.406registration.com

If your country operates a national beacon registry, consult the document C/S S.007 "Cospas-Sarsat Handbook of Beacon Regulations" available at www.cospas-sarsat.org to obtain the point of contact.
Some EPIRB registration links:
USA: http://www.beaconregistration.noaa.gov
UK: http://www.mcga.gov.uk (search for "EPIRB registration")

**USA**

Vessel owners shall advise NOAA in writing upon change of vessel or EPIRB ownership. Transfer of EPIRB to another vessel, or any other change in registration information, NOAA will provide registrants with proof of registration and change of registration postcards.

# 2 TECHNICAL SPECIFICATIONS

## 2.1 GENERAL

| | |
|---|---|
| Battery: | Lithium metal, 10.7V/2,6Ah, 5 years service life |
| Housing: | Polycarbonate w/ 10% glassfibre |
| Dimensions: | |
| • Height: | 340 mm |
| • Max diameter: | 128mm |
| • Weight: | 680 gram |
| Materials: | Polycarbonate |
| Compass safe distance: | 1 m |
| Temperature operating: | -20°C to + 55°C |
| Temperature storage: | -40°C to + 55°C |
| Operating life: | Minimum 48 hours at -20°C |

## 2.2 COSPAS-SARSAT TRANSMITTER

| | |
|---|---|
| Frequency: | 406.037 MHz ±2 ppm |
| Output power: | 5W ±2 dB |
| Protocols: | Tron 60S/GPS: Maritime, Serialized, Radio Call sign |
| Modulation: | Phase modulation 1.1 ±0.1 rad |
| Data encoding: | Bi Phase L |
| Stability: | Short term <- 2x10e |
| | Medium term <- 10e |
| | Residual noise <- 3x10e |
| | Bit rate: 400 b/s |
| Antenna: | Omni directonal |

## 2.3 NAVIGATION DEVICE

| | |
|---|---|
| Type: | 22 Channel GPS Receiver |
| Antenna: | Chip type |

## 2.4 HOMING TRANSMITTER

| | |
|---|---|
| Frequency: | 121.500 MHz |
| Output power: | Up to 100 mW |
| Modulation: | A9, AM sweep tone between 300Hz and 1600Hz |
| | Sweep range: 700 Hz |
| | Sweep rate: 2.5 Hz |
| Stability: | 10 ppm over temperature range |
| Antenna: | Omni directional |

## 2.5 BRACKETS

### 2.5.1 FLOAT FREE BRACKET FB-60

Materials: Luran S/ ABS
Dimensions (hwd): (385 x 151 x 148) cm
Weight: 850 g
Release mechanism: Jotron HRU kit (part. no. 86218)

### 2.5.2 MANUAL BRACKET MB-60

Materials: PA6 + 30% fibre glas (Polyamide)
Dimensions (hwd): (156x 134 x 98.5) cm
Weight: 150 g

# 3 EPIRB DESCRIPTION

## 3.1 GENERAL

The Tron 60S/GPS consists of upper and lower house mounted together withan equator ring with gasket. Tron 60S/GPS consists of the following main parts:

- Main module with antenna
- Battery module

### 3.1.1 MAIN MODULE WITH ANTENNA

The EPIRB module consists of:

- The main board including all electronic circuitry and the main switch
- Antenna with flash LED

### 3.1.2 BATTERY MODULE

The Battery module supplies the EPIRB module with 10.7VDC power to keep the EPIRB transmitters active for 48 hours when activated, and for test sequences. The battery pack is attached inside the lower house. The housing is made of polycarbonate. In the lower part of the housing there is one reed contact, which is activated by a magnet in the release mechanism. This is the safety switch, which prevents the seawater contacts from activating the beacon while placed in the mounting bracket.

The seawater contacts are also mounted in the battery module, and are connected to the electronic unit via the battery connector. The batteries are mounted in a plastic battery holder.

# 4 INSTALLATION

## 4.1 BRACKETS

Two different brackets are currently available for the Tron 60S/GPS.

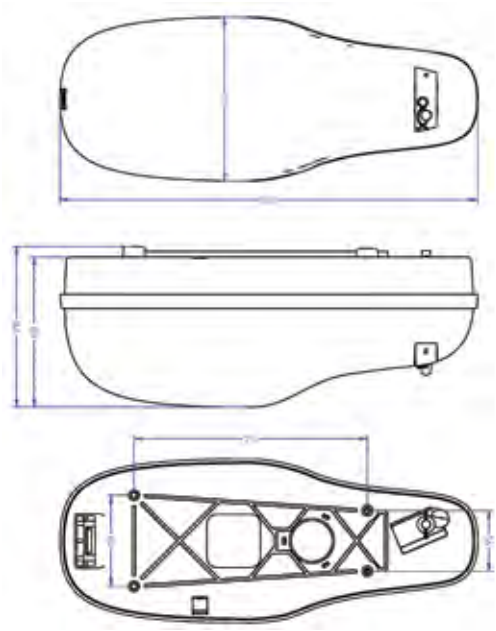
### 4.1.1 FLOAT FREE BRACKET FB-60

# WARNING:

**DO NOT INSTALL THE EPIRB NEAR STRONG MAGNETIC FIELDS THAT COULD ACTIVATE THE BEACON**

When the Tron 60S/GPS is mounted in the float-free bracket, FB-60, it will operate as an automatic float free unit. The satellite float-free EPIRB should be located/installed so that the following requirements are fulfilled:

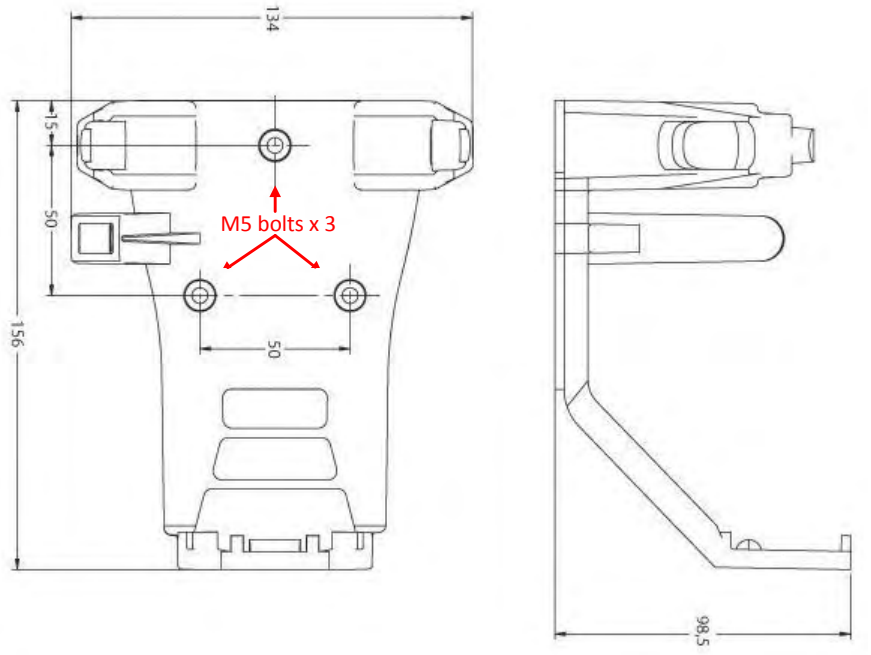
- The EPIRB should, with greatest possible probability, float-free and avoid being caught in railings, superstructure, etc., if the ship sinks.
- The EPIRB should be located so that it may be easily released manually and brought to the survival craft by one person. It should therefore not be located in a radar mast or any other places which can only be reached by vertical ladder.



The location should be well protected from environmental conditions such as direct seaspray, chemicals, oil, exhaust and vibrations.

### 4.1.2 MANUAL BRACKET MB-60

When the Tron 60S/GPS is mounted in the MB-60 bracket, it will operate as a manual unit. This bracket is typically used to store the EPIRB inside the wheel-house or other protected areas of the ship. When the Tron 60S/GPS is mounted in the MB-60 bracket, it must be manually removed before any operation can take place, therefore the bracket should be mounted in an easily accessible place where it can be removed in a hurry in case of an emergency.




### 4.1.3 MOUNTING THE FB-60/MB-60 BRACKETS

The bracket is mounted with 5mm bolts according to the drawing. Use the bolts supplied with the bracket. The bracket could be mounted in either a vertical or horizontal position, whichever is the best regarding maintenance and operation. A vertical position is recommended.

## 5 OPERATION INSTRUCTIONS

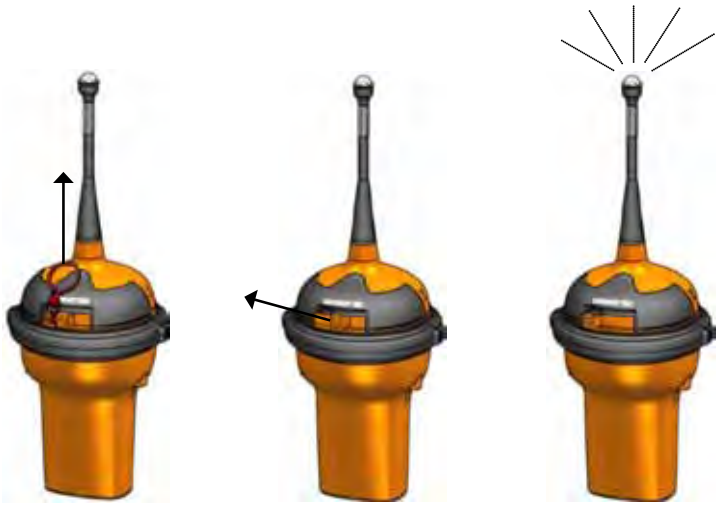
# WARNING

- USE ONLY DURING SITUATIONS OF GRAVE AND IMMINENT DANGER
- REPLACE THE BATTERY AFTER THE SATELLITE EPIRB IS OPERATED FOR ANY PURPOSE OTHER THAN A TEST

The Tron 60S/GPS is designed to be operated either manually or automatically. The EPIRB is always armed, that is the EPIRB will automatically start to transmit when the EPIRB is out of the bracket and deployed into water. In the lower part of the EPIRB there is an automatic safety switch. This switch prevents the sea-water contacts from operating the EPIRB (caused by ice, sea-spray etc.) as long as the EPIRB is placed in its bracket.

### 5.1 MANUAL OPERATION

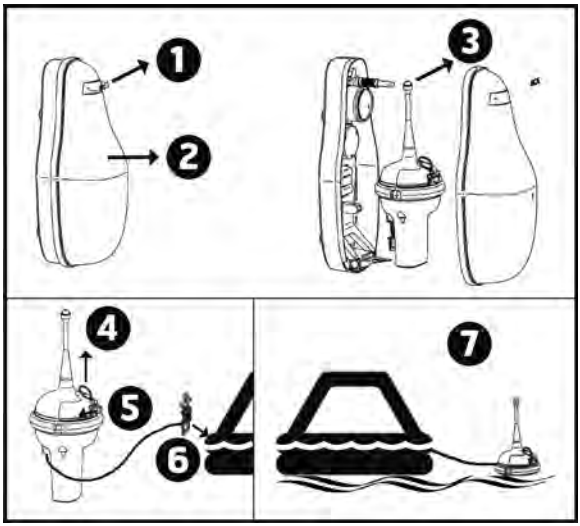
### 5.1.1 OUT OF BRACKET



1 2 3

Regarding the 3 pictures above, follow instructions from 4-5 on page 23.

### 5.1.2 FLOAT FREE BRACKET FB-60



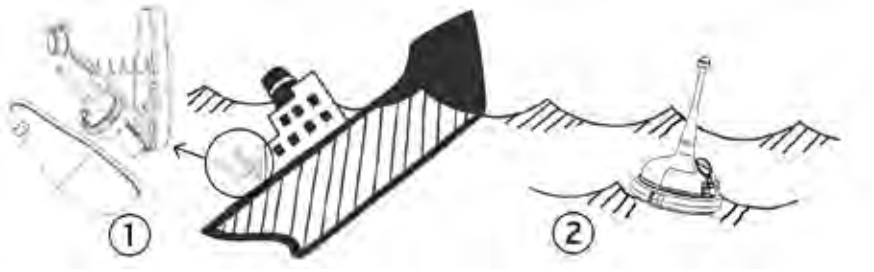

For operation of the beacon in the bracket please follow instructions 1 to 7.

It is not recommended to operate the beacon inside a life raft or under a cover or canopy. Do NOT tie the lanyard to the ship in distress, as this will prevent the unit to functioning if the ship sinks.

1. Remove the locking pin from the bracket (FB-60)
2. Remove the FB-60 cover
3. Take out the EPIRB from the bracket
4. Pull the locking pin holding the main switch.
5. Move main switch to the left, to ON position. The LED indicator, located at the top of the antenna, will start to flash, indicating that the EPIRB is operating.
6. Tie the beacon lanyard to you or to the survival craft
7. If possible keep the EPIRB in an open area, away from any metal objects (ship construction etc.) that may limit the satellite coverage. This is especially important for Tron 60GPS, since it needs good reception to obtain a GPS position.

**NOTE: To stop transmission, move the main switch to READY position.**

## 5.2 AUTOMATIC OPERATION - FLOAT FREE BRACKET FB-60




1. The Tron 60S/GPS will automatically release from the bracket, float to the surface and start to transmit when the EPIRB, in its bracket is deployed into water at a depth of app. 2-4 meters (6 - 13 feet).
2. Transmission will continue until the EPIRB is lifted out of the water, and dried off. The transmission can also be stopped by placing the EPIRB in the bracket.

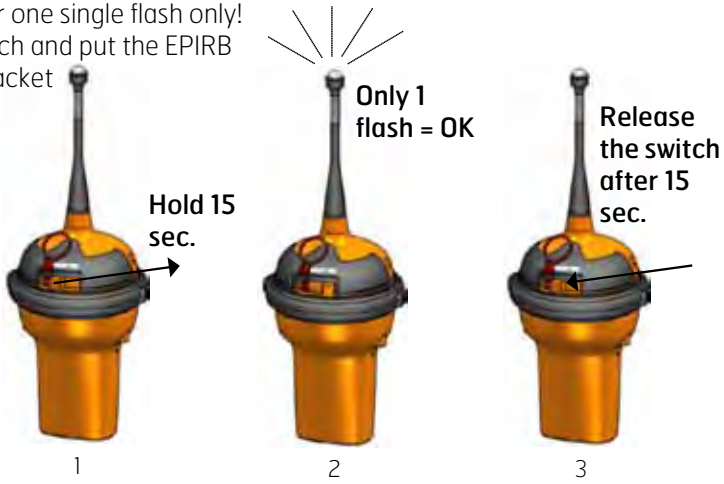
## 5.3 TEST

To perform the self-test, the EPIRB has to be removed from the bracket.
FB-60 bracket: Release FB-60 top cover by removing the locking pin.

## WARNING

**The EPIRB can drop out of the FB-60 bracket when releasing top cover**

1. Push and hold switch in TEST position for 15 seconds. Keep hands and other objects away from the antenna.
2. Test passed after one single flash only!
3. Release the switch and put the EPIRB back into the bracket



**GPS TEST:**
**NOTE: Limit this test to max. once/month as this test will reduce lifetime of EPIRB battery! The Tron60 GPS has maximum 60 GPS TESTs that can be performed during battery lifetime.**

1. Move Switch to TEST twice within 3 seconds and release
2. EPIRB will BEEP shortly every 3 seconds until GPS position acquired
3. OK = 2 BEEPS (see below description if Not OK)
4. Normal SELFTEST is performed after GPS TEST and position transmitted on 406.037 MHz. GPS position may be received on an EPIRB Tester for verification

There are two possible error conditions during this test:
a) 5 BEEPS = Did not acquire GPS position
b) 10 -" - = Number of GPS TEST above limit (>60)

**EPIRB ERROR MESSAGES**
If the self test detects a fault in the EPIRB module, one or more of the following indications are shown:

| Number of flashes: | Fault indication: |
|---|---|
| 1 | NONE |
| 2 | Low power on 406 MHz transmitter |
| 3 | Low battery voltage |
| 4 | Low power on 121.5 MHz transmitter |
| 5 | PLL on 406 MHz transmitter out of lock |
| 6 | PLL on 121.5 MHz transmitter out of lock |
| 7 | EPIRB module not programmed or programming not complete |

## 6 PERIODICAL CONTROL

**Every Month:**
Perform EPIRB self-test.
What the self-test actually does is to send out a short test signal on 121,5 and 406,037MHz, testing the output of the transmitter. While transmitting the test signal, the battery voltage, output power and phase lock is tested.

During the test of the 406MHz transmitter a test message is transmitted, this test message is coded with a special synchronization code and will not be recognized as real alert by the Cospas-Sarsat satellites. Carry out visual inspection for defects on both the Tron 60S/GPS and Bracket. The Tron 60S/GPS should be easily removed and replaced in the Bracket. Make sure that the Tron 60S/GPS and Bracket is not painted or otherwise covered with chemicals, oil, etc.

Check the expiry date of the EPIRB Battery and the Hydrostatic Release Mechanism. Check the presence of a firmly attached lanyard in good condition and that it is neatly stowed and is not tied to the vessel or the mounting bracket. If the Tron 60S/GPS is the main EPIRB on board, these rules must be followed:

**Every 12th month:**
If the Tron 60S/GPS is the main EPIRB on board and the ship falls under national regulation and/or the SOLAS regulations of SBM, these rules must be followed: Perform extended annual test according to IMO's MSC/Circ.1040 (Annual testing of 406 MHz satellite EPIRBs) as required by SOLAS IV/15.9.This test can be carried out by one of Jotron AS authorized representatives or any other service provider in possession of a Tron UNIDEC, Tron DEC or any other Cospas/Sarsat EPIRB tester/decoder.

**Every 2ndYear:**
Hydrostatic Release Mechanism including Plastic Bolt on the Float Free Brackets must be replaced. (Check expiry date on label).

**Every 5thYear:**
- Battery change
- SBM (see 7.1)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Tron 60S

## 6.1 SERVICE PROCEDURE 2011

### WARRANTY CLAIM

Warranty claims are valid until 5 years from delivery from our warehouse. The warranty is valid as long as service and battery replacement are carried out by authorized Jotron distributors or agents.
All products are warranted against workmanship and factory defect, in material. Any warranty claims must be sent to Jotron, in writing.

Jotron reserve the right to decide whether a defective unit is within warranty terms and conditions.

If Jotron make a decision of repairing a defective product, a written description of the claim and a Jotron RMA number, should follow the unit when returning it back to Jotron's factory.

Please be noted that un-protective electronics board MUST be packed in anti-static bag, before returning to Jotron's factory.

Any costs related to transportation and/or workmanship linked up to the return of the product being repaired shall be covered by the customer.

Jotron's obligations during warranty replacement;
- Replace defective unit, including any programming
- Delivery terms: DAP Incoterms 2010 by regular freight to "Place" (Airport)

Service agent's obligations during warranty claims:
- Supply replacement unit from own stock if available
- If agreed, return defective unit to Jotron
- Electronic units must be shipped in antistatic bags or covered with Jotron's plastic cover

### SERVICE – NOT WARRANTY CLAIM

Service, such as testing, installation, programming, replacement, marking and battery exchange are provided by an authorized Jotron service agent. Jotron do not meet the cost for services mentioned above. Distributor or service agent should stock the most commonly needed spare parts.

# 7 MAINTENANCE

## 7.1 EPIRB MODULE / BATTERY MODULE

If the EPIRB is fitted on a vessel which requires GMDSS compliant equipment, the EPIRB shall be tested and approved as required by SOLAS regulation IV/15.9.2 of SOLAS 1974 as amended with, in accordance with MSC/Circ.1039 guidelines for shore-based maintenance of Satellite EPIRBs within 5 years, or by the date of battery expiry, whichever comes first.

### 7.1.1 CHANGE OF BATTERY

The Tron 60S/GPS battery must be changed at Jotron SBM authorized work-shop to be GMDSS compliant.

If your Tron 60S/GPS is not under any international or national regulations, battery can be change by authorized Jotron representatives/partners/dealers.

## 7.2 HYDROSTATIC RELEASE REPLACEMENT

# WARNING

**Only Jotron approved hydrostatic release is acceptable for use**

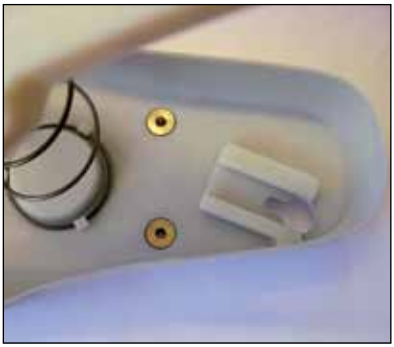
### 7.2.1 REPLACING THE RELEASE MECHANISM IN FB-60 BRACKET

1. Release and remove FB-60 top cover by removing the locking split pin (1). WARNING! The EPIRB can drop out of the FB-60 bracket when releasing the top cover. Remove the EPIRB from the bracket.
2. Press down the spring-loaded bracket plate and remove the hydrostatic unit by sliding it out of its locking slot. See arrow for direction.(2).
3. Check the expiry date of the new hydrostatic release mechanism (3). The date should be approximately two years from the date of purchase.
4. Install a new hydrostatic unit by pressing down the spring loaded bracket plate and sliding the unit into its locking slot (4).
5. Refit the EPIRB and the FB-60 top cover. Be sure that the top cover is locked at the bottom end and that the top end are fixed at hydrostatic re-lease mechanism rod. Replace The locking split pin (1)

1

2

3



4

## 8 SPARE PARTS

86225 Battery kit, Tron 60S/Tron 60GPS
86218 Hydrostat kit
85621 FB-60
85620 MB-60

**NOTE: Keep the original satellite EPIRB packaging, since it may be needed if the EPIRB has to be shipped for servicing. UN requirements for shipping some batteries as hazardous goods require certain packaging standards and labelling**

# 9 SERVICE AGENTS

Please look at www.jotron.com for Marine Service Agents.

Jotron Group subsidiary companies:

**Jotron UK Ltd.**
Crosland Park
Cramlington
NE23 1LA
United Kingdom
Tel +44 1670 712000
Fax +44 1670 590265
E-mail: sales@jotron.com

**Jotron Asia Pte. Ltd.**
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19 Loyang Way #04-26
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Fax +65 65429415
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**Jotron USA, Inc.**
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Fax: +47 33 08 35 01
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**Jotron USA, Inc.**
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sales@jotron.com

# Brochure

# NEW

## Float-free and manual EPIRB

For commercial, fishing and yachting





**SAFETY NEVER COMPROMISED**

- ▶ No transport restriction
- ▶ 5 years warranty
- ▶ Compact design
- ▶ Sealed unit
- ▶ Optimal visibility

# Tron 60S
# Tron 60GPS

JOTRON

www.jotron.com

# Tron 60S/Tron 60GPS

Small, compact and sealed GMDSS EPIRB. Complies to IMO, SOLAS regulation. Optimal visibility is achieved with high-intensity LED, located at the top of the antenna. No transport restriction due to the use of non-dangerous goods batteries. The new EPIRB is supplied either with manual or float-free bracket.

## SPECIFICATIONS

| | |
|---|---|
| **TECHNICAL** | |
| Battery: | Lithium, 5 years service life |
| Dimensions:<br>• H/W/D:<br>• Max diameter: | <br>340 mm /xxx/xxx<br>128mm |
| Weight: | 680 gram |
| Materials: | Polycarbonate |
| Compass safe distance: | 1 m |
| Temperature range: | -20°C to + 55°C |
| Operating life: | Minimum 48 hours at -20°C |
| Antenna: | Omni directonal |
| Frequency: | 406.037 MHz |
| Output power: | 5W |
| Homing frequency: | 121.500 MHz |
| Output power: | Up to 100 mW |
| Protocols: | Tron 60S/Tron 60GPS: Maritime, Serialized, Radio Call sign |
| Nav. device: | 22 Channel GPS Receiver |
| **ACCESSORIES** | |
| Brackets:<br><br>Battery: | Float-free: FB-60<br>Manual: MB-60<br>Replacement kit |
| Hydrostatic release: | HRU kit |
| **WARRANTY** | 5 years |

Float-free bracket

Manual bracket

**Agent/Distributor:**



v.B

www.jotron.com

## CONTACT INFORMATION

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# Technical data for battery

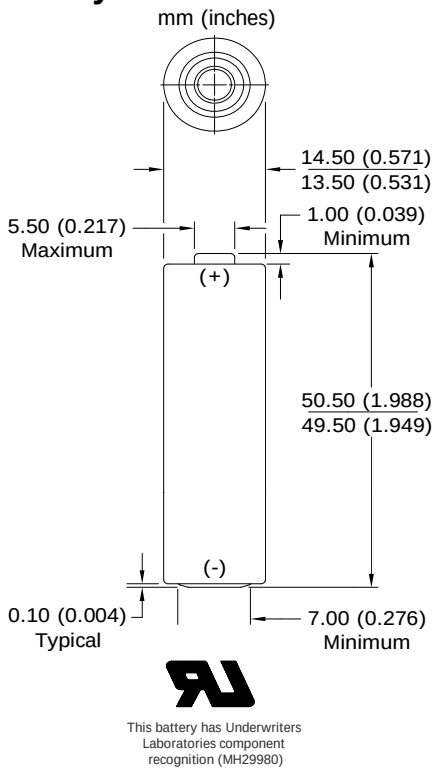
1-800-383-7323 US/CAN
www.energizer.com

# ENERGIZER L91

Ultimate Lithium

AA


## Industry Standard Dimensions




This battery has Underwriters Laboratories component recognition (MH29980)

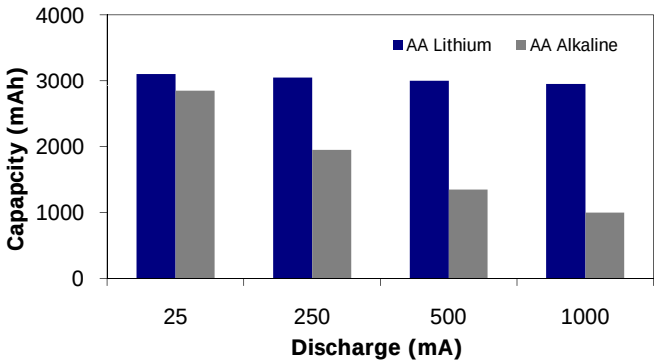
## Specifications

| | |
|---|---|
| **Classification:** | "Cylindrical Lithium" |
| **Chemical System:** | Lithium/Iron Disulfide ($Li/FeS_2$) |
| **Designation:** | ANSI 15-LF, IEC-FR6 |
| **Nominal Voltage:** | 1.5 Volts |
| **Storage Temp:** | -40°C to 60°C (-40°F to 140°F) |
| **Operating Temp:** | -40°C to 60°C (-40°F to 140°F) |
| **Typical Weight:** | 14.5 grams (0.5 oz.) |
| **Typical Volume:** | 8.0 cubic centimeters (0.5 cubic inch) |
| **Max Discharge:** | 2.0 Amps Continuous |
| (single battery only) | 3.0 Amps Pulse (2 sec on / 8 sec off) |
| **Max Rev Current:** | 2 uA |
| **Typical Li Content:** | 0.98 grams (0.03 oz.) |
| **Typical IR:** | 90 to 150 milliohms* |
| **Shelf Life:** | 15 years at 21°C (90% of rated capacity) |
| **Transportation:** | For complete details, please reference: |
| Global (except US): | Special Provision A45 of the International Air Transport Association Dangerous Goods Regulations |
| United States: | 49 CFR 173.185 |

* For additional information, please reference the IR technical white paper.

## Milliamp-Hours Capacity

Constant Current Discharge to 0.9 Volts at 21°C

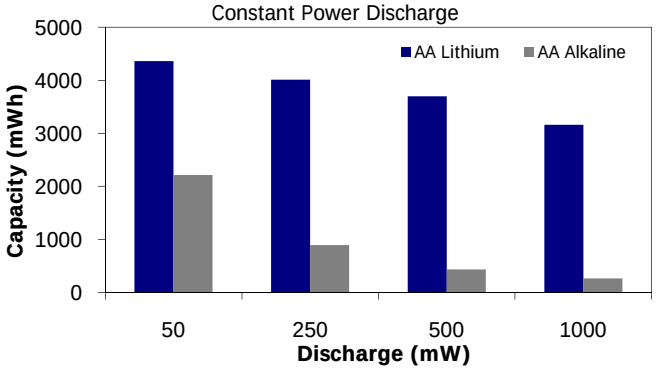



## Milliwatt-Hours Capacity at Cold/Room Temperature

Constant Power Discharge to 1.0 Volts at 0°C and 21°C

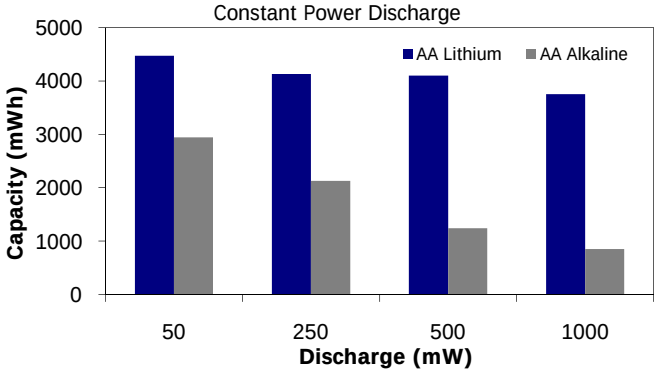
### Cold Temperature (0°C)

Constant Power Discharge




### Room Temperature (21°C)

Constant Power Discharge




## Important Notice

This datasheet contains typical information specific to products manufactured at the time of its publication.

1-800-383-7323 US/CAN
www.energizer.com

# ENERGIZER L91

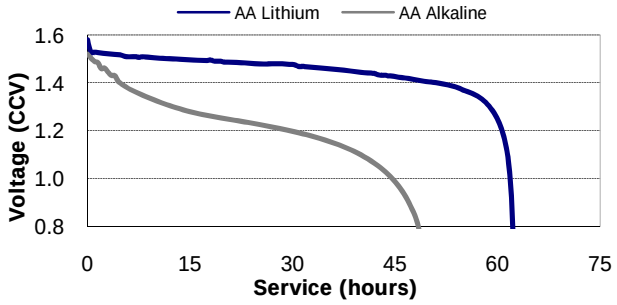
AA

## Typical Discharge Curve Characteristics

Constant Current Discharge at 21°C (low and high drains)

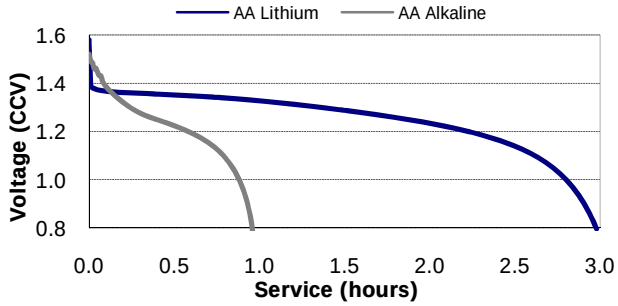
### Low Drain Performance

50mA Continuous (21°C)



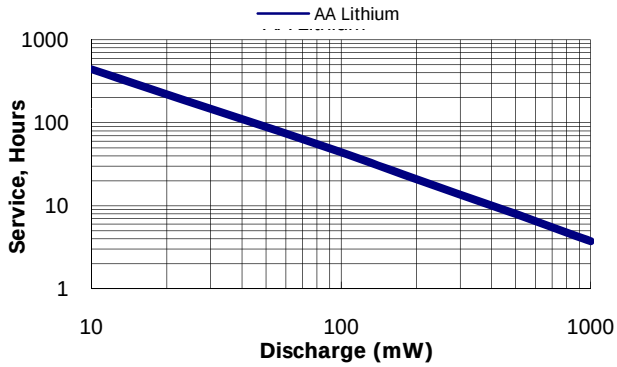

### High Drain Performance

1000mA Continuous (21°C)



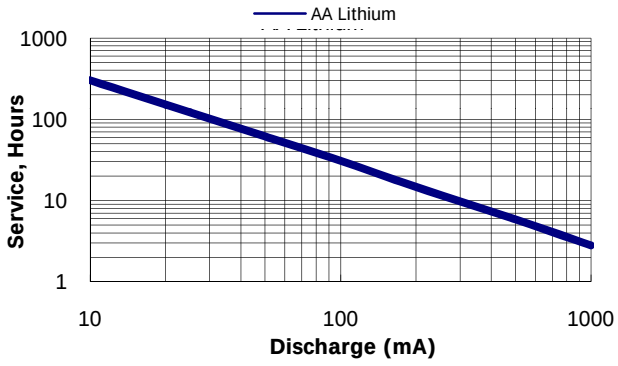

## Constant Power Performance

Typical Characteristics to 1.0 Volts (21°C)




## Constant Current Performance

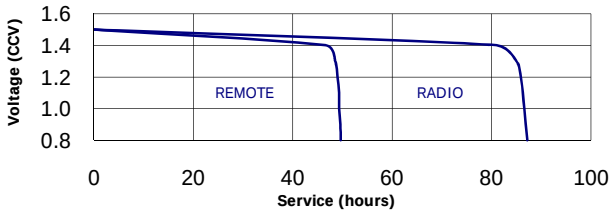
Typical Characteristics to 1.0 Volts (21°C)




## Application Tests (21°C)

**REMOTE**
**24 ohm 15 sec/min 8 hrs/day**

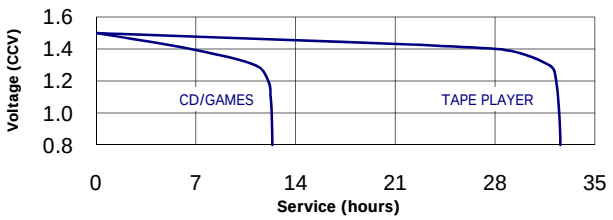
**RADIO**
**43 ohm 4 hrs/day**




## Application Tests (21°C)

**CD/GAMES**
**250 mA 1 hr/day**

**DIGITAL AUDIO**
**100 mA 1 hr/day**

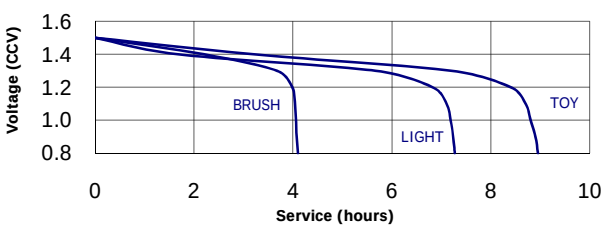



## Application Tests (21°C)

**TOOTHBRUSH**
**500 mA 1/13 min 24 hrs/day**

**PORTABLE LIGHTING**
**3.3 ohm LIF**

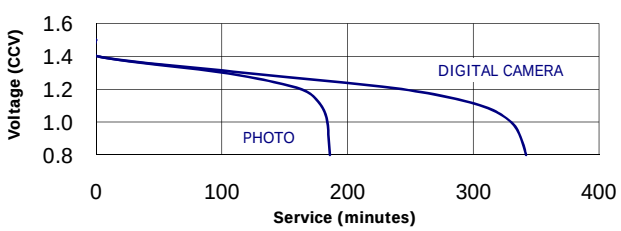
**TOY**
**3.9 ohm 1 hr/day**




## Industry Standard Tests (21°C)

**PHOTOFLASH**
**1K mA 10 sec/min 1 hr/day**

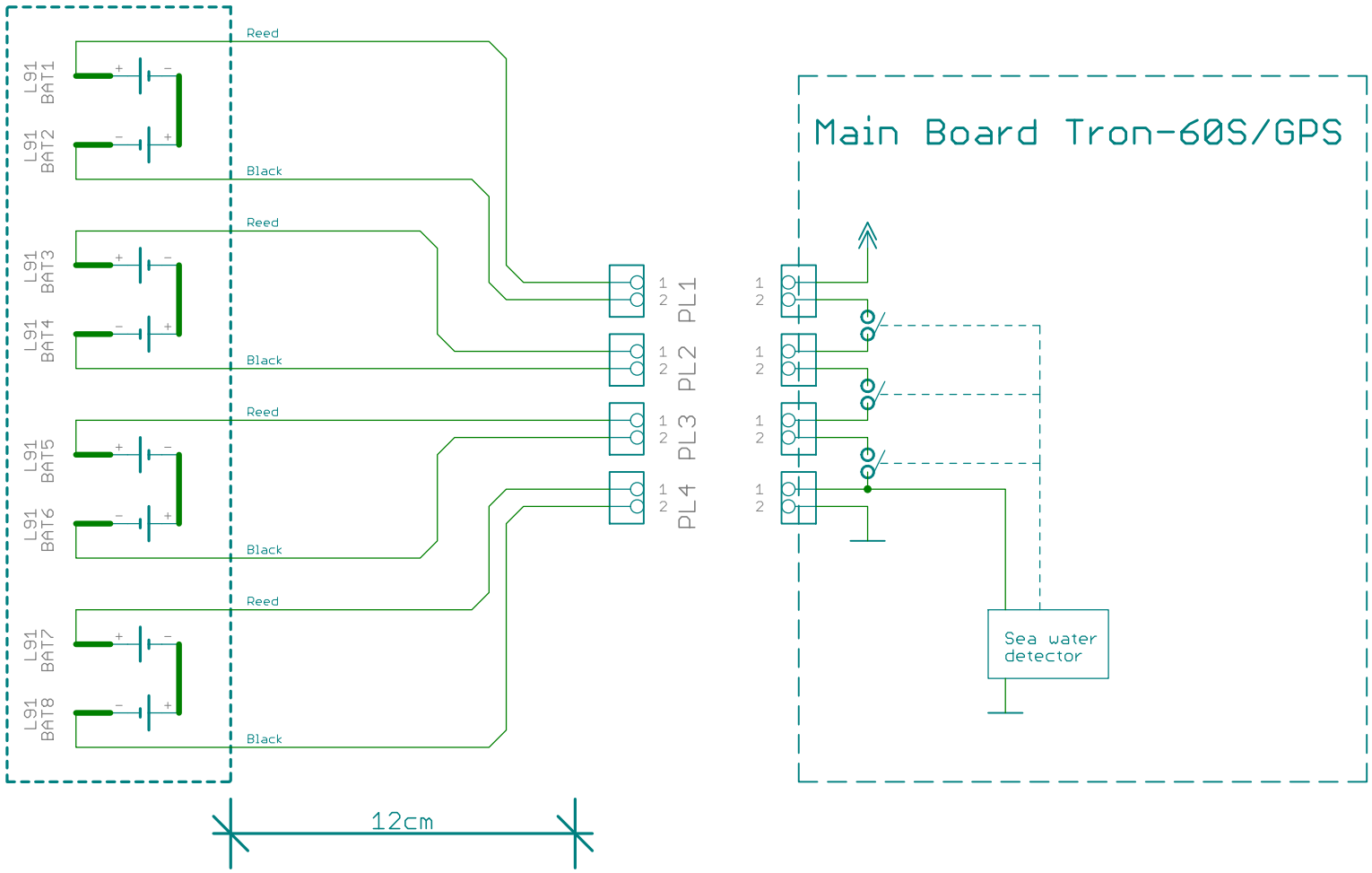
**DIGITAL CAMERA**
**1.5/.65K mW 2/.1/27.9s 10X**




## Important Notice

This datasheet contains typical information specific to products manufactured at the time of its publication.

# Electric diagram of beacon battery pack




| Symb | EM no | Change | Date: | Sign. |
|---|---|---|---|---|
| | 05404 | Changed connector | | |

= Nickle Band
= AWG24 multi-wire
= Battery container (Jotron 83089+83090)
L91 = Energizer L91
J1 = Molex 0874390800



| Approved | Draft: | Date: |
|---|---|---|
| | ØE | 20100215 |

Battery Module
Tron 60S/GPS

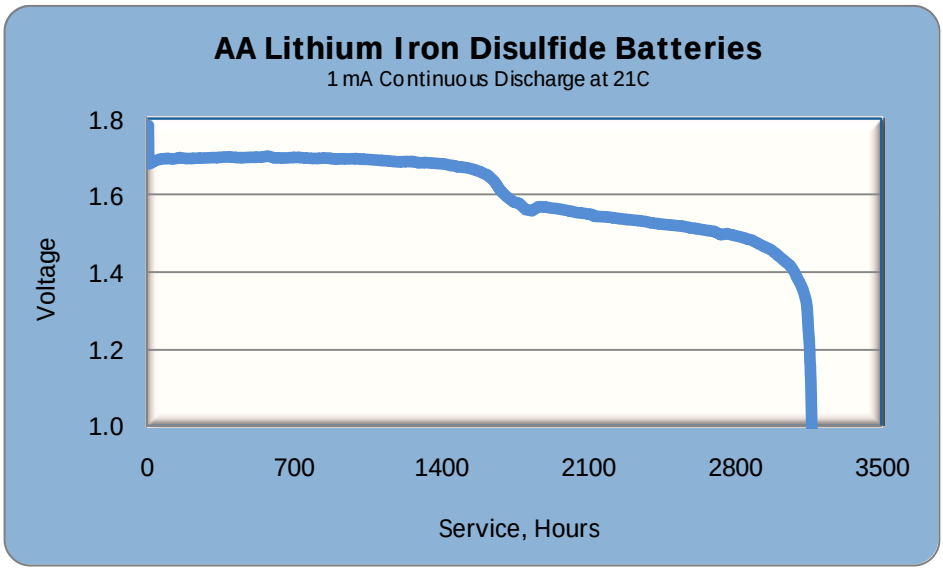
JOTRON

| Replaces draft | Repl. by draft |
|---|---|
| | |

E-83095

Sheet: 1/1
Rev: 1137

# Battery shelf-life definition

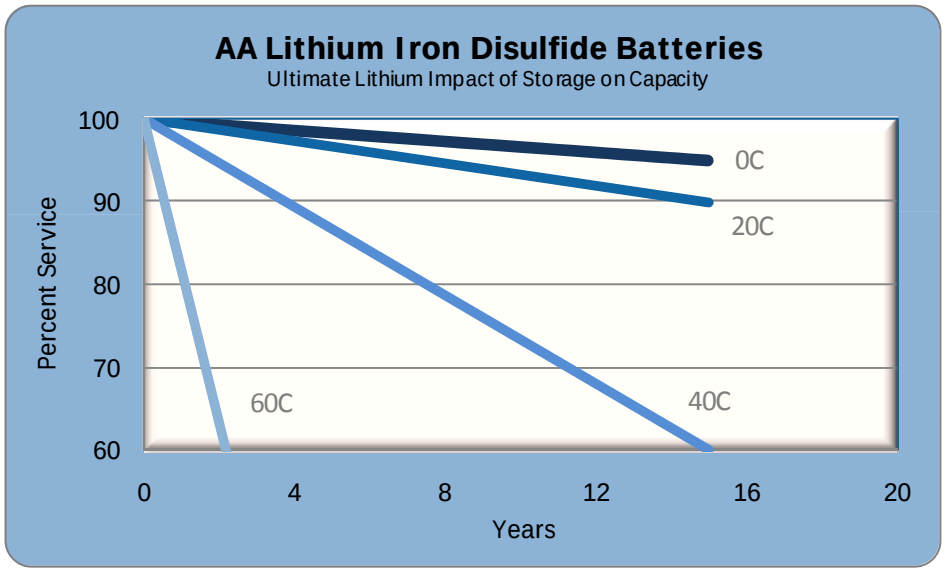



(fig. 14) Two Stage Discharge

## Shelf Life:

Shelf life can be defined as the time at which a battery will deliver approximately 80% of its original capacity (fig. 15). Predicting battery shelf life is done in various ways. Typically, elevated temperature storage is used to accelerate those processes that cause degradation. This method is convenient, but is not always reliable because increasing cell temperature can introduce a new mode of degradation that is not present in batteries stored at lower temperatures. This could yield an underestimate of the true shelf life. Another method for predicting shelf life is microcalorimetry that measures the heat output from batteries and provides an estimate of the chemical changes occurring inside the battery. *Energizer*® has tested $LiFeS_2$ cells using all of these methods.

Lithium iron disulfide batteries will lose approximately 0.6 % of their capacity per year when stored at room temperature, 21°C. Because of the very low level of impurities in the materials used and the high degree of seal effectiveness used with lithium batteries, the shelf life after high temperature storage is far better compared to aqueous systems. The recommended storage temperature for lithium batteries is -40°C to 60°C. Exposing lithium batteries to temperatures above 60°C can cause the insulating label to shrink and expose the battery's steel can to potential external short circuits.



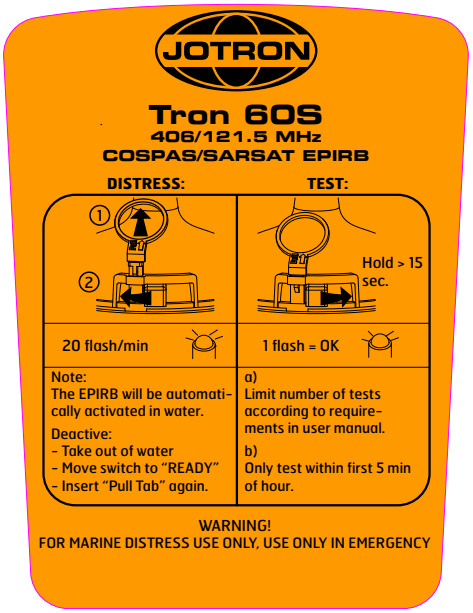

(fig. 15) Impact of storage

## Testing / Care / Warnings:

The lithium iron disulfide construction incorporates many safety features and extensive quality checks during manufacture on each and every battery. The design includes two safety devices to provide protection against abusive conditions such as short circuit, charging, forced discharge and overheating. These two safety devices are a resettable thermal switch or PTC (Positive Thermal Coefficient) and a pressure relief vent. The PTC protects against electrical abuse scenarios by limiting the current when the PTC temperature exceeds 85°C. As the battery heats during abuse, the resistance of the PTC rapidly increases and significantly limits the amount of current flowing through the battery, thus allowing the battery to cool. When the PTC cools to below the activation temperature, its resistance returns to a normal level allowing normal battery use. The PTC is extremely effective in safely handling electrical abuse conditions.

Below is an example of an “AA” size lithium iron disulfide battery subjected to a direct short showing that the PTC reduces the current within seconds to a safe level (fig 16).

# Copy of beacon labels




Print: Black

| Rev. | Date | Sign. | Description | EM No. |
|---|---|---|---|---|
| P-2 | 17.12.10 | TN | Sec version | nnnn |
| P-1 | 24.11.10 | TN | First version | nnnn |

Material: ORACAL 751 (transparent)



Surface Treatment:

Approved:

Draft: TN

Date: 24.11.10

LABEL
FRONT
Tron 60S

Size: A4

Scale: 1 : 1

Sheet: 1 / 1

X-85846

Rev: P-2

**EPIRB type: Tron 60S/60GPS**
**406/121.5 MHz satellite EPIRB, Class 2(-20°C to 55°C)**
**Jotron AS, Norway, www.jotron.com**

Folie: ORACAL 751 TRANSPARENT
Colour: Light grey (edge)
Colour: Black (text)

| Rev. | Date | Sign. | Description/Change |
|---|---|---|---|
| A | 08.12.10 | AD | First version. |

Material:



Surface Treatment:

Scale: 1 : 1

Approved:

Draft: AD

Date: ------

LABEL
EPIRB TYPE
FB-7

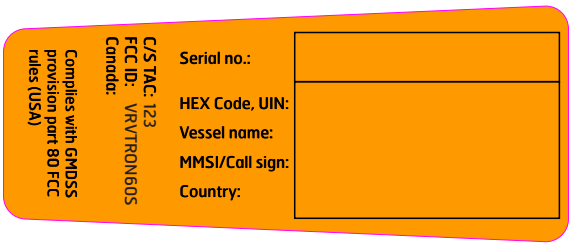
Replaces draft:

Repl. by draft:

X-86214

Sheet: 1 / 1

Rev: A

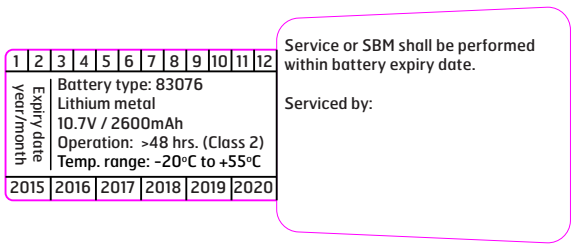



Print: Black

| | | | | |
|---|---|---|---|---|
| P-2 | 17.12.10 | TN | Sec version | nnnn |
| P-1 | 24.11.10 | TN | First version | nnnn |
| Rev. | Date | Sign. | Description | EM No. |

| | | | |
|---|---|---|---|
| Material: ORACAL 751 (transparent) | | | This drawing is property of Jotron AS and must not be duplicated or used for manucaturing of any parts disclosed herin without permission from Jotron AS. |
| Surface Treatment: | | | JOTRON |
| Approved: | Draft: TN | Date: 24.11.10 | |

| | | | |
|---|---|---|---|
| LABEL<br>LEFT<br>Tron 60S/GPS | Size: A4 | Scale: 1 : 1 | Sheet: 1 / 1 |
| | X-85848 | | Rev: P-2 |




Print: Black

| | | | | |
|---|---|---|---|---|
| P-3 | 24.02.11 | TN | 10,7V/2600mAh was 7,2V/10600mAh | nnnn |
| P-2 | 17.12.10 | TN | Sec version | nnnn |
| P-1 | 24.11.10 | TN | First version | nnnn |
| Rev. | Date | Sign. | Description | EM No. |

Material: ORACAL 751 (transparent



Surface Treatment:

Approved:

Draft: TN

Date: 24.11.10

LABEL
RIGHT
Tron 60S/GPS

Size: A4

Scale: 1 : 1

Sheet: 1 / 1

X-85849

Rev: P-3

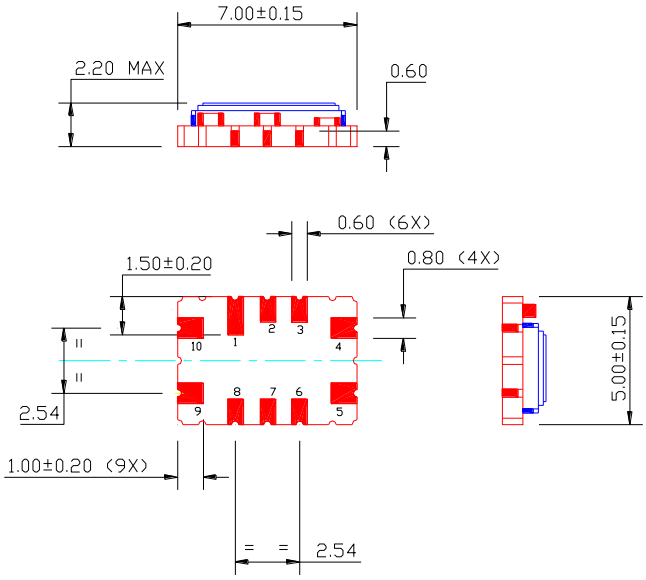
# Data sheet for the reference oscillator

# Oscillator Specification: E4520LF(T)

Issue 3, 9th July 2008, LN4661

*Designed for use in "Cospas-Sarsat" Emergency Beacon Applications*

## Outline in mm




### Pad Connections

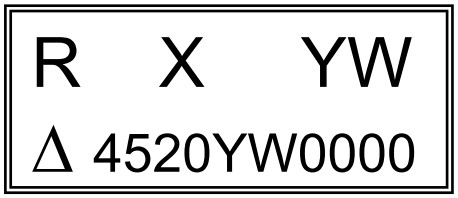
1. Do not connect
2. NC
3. DC Coupled Output (do not connect)
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)

**Marking** includes

R
Manufacturing identifier (x).
Crystal manufacture date.
Pad 1 / Static Sensitivity Identifier (Δ)
Abbreviated Part Number (4520)
Device date code (YW)
Serial Number (0000)




## 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% | ≤ 8 ns |
| Fall time, 90% to 10% | ≤ 8 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 |

# Oscillator Specification: E4520LF(T)

Issue 3, 9th July 2008, LN4661

*Designed for use in "Cospas-Sarsat" Emergency Beacon Applications*

Medium term stability specified and measured according to C/S T.001 & T.007* (averaged over 18 measurements in 15 minute period, and following 15 minute power up period)

| | |
|---|---|
| Mean Slope dF/dt | |
| Steady state conditions | ≤ ± 0.7 ppb/min |
| During and 15 minutes after variable temperature conditions | ≤ ± 1.0 ppb/min (dT/dt ≤ ± 5ºC / hour) |
| Residual dF from slope | ≤ ± 2.0 ppb (dT/dt ≤ ± 5ºC / hour) |
| Test results shipped with each device, identified by date and serial number, retained for 10 years. | |
| 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

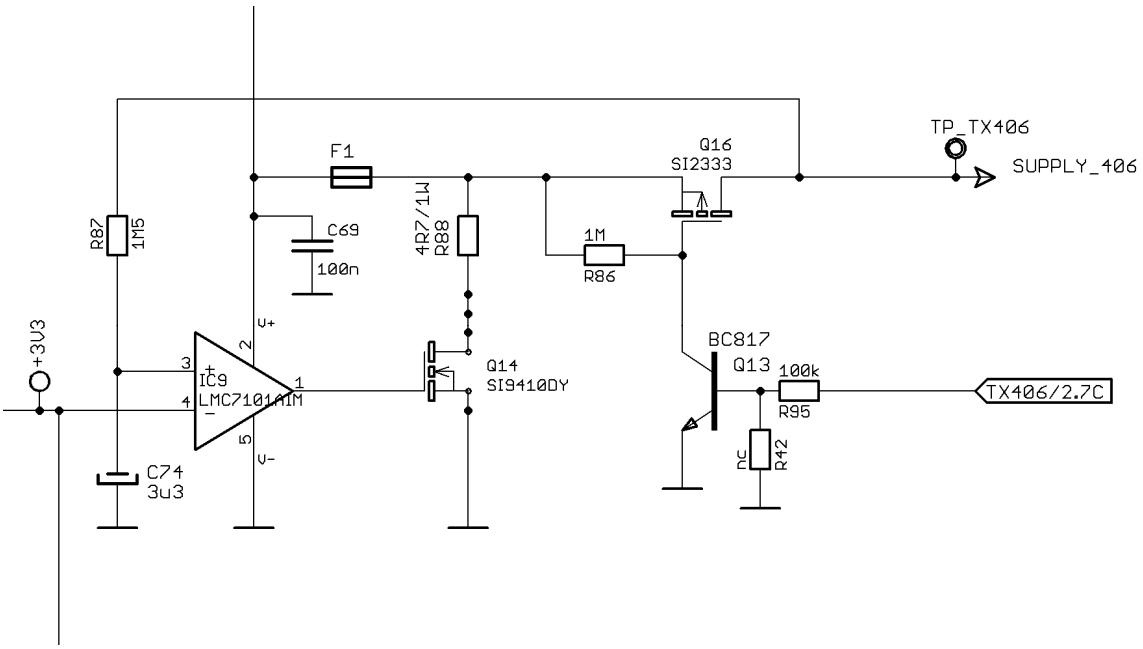
**Environmental:**

| | |
|---|---|
| Operating Temperature Range: | -20 to +55°C |
| Storage Temperature Range: | -55 to +125°C |
| Vibration | IEC 60068-2-6 Test Fc, 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, 980$ms^{-2}$ 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 |
| Packaging | Parts ordered with suffix 'T' are supplied on Tape-and-Reel. |

* COSPAS SARSAT 406MHz distress beacons specification C/S T.001 (Issue 3, Revision 8, NOV 2007) and C/S T.007 (Issue 4, Revision 2, NOV 2007)

# Protection against continuous transmission

# Parameter 13 - Protection against continuous transmission




Please take a look at the figure. 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.

# Frequency stability requirements over 5 years

Jotron AS
Jotron UK Ltd.
Jotron Phontech AS
Jotron Consultas AS
Jotron Asia Pte. Ltd.
Jotron USA, Inc.
UAB Jotron



## Oscillator Aging

Tron 60S/GPS are using an oscillator from Rakon of type E4520LT

### Key figures from manufactory

Aging first year : < ±1.0ppm.
Aging 10 years: <±3.0ppm

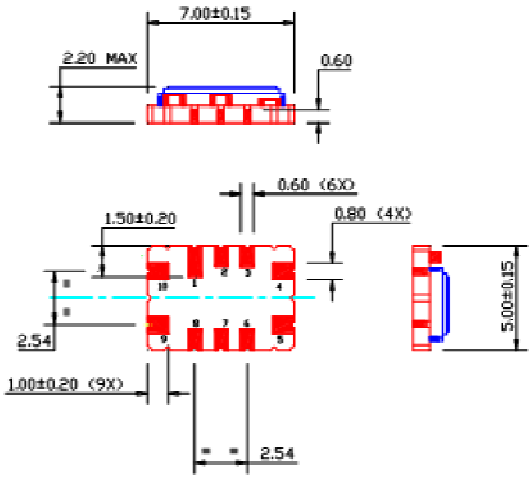
### Conclusion:

This oscillator meets the frequency stability requirements over 5 years.

**Oscillator Specification: E4520LF(T)**
Issue 3, 9th July 2008, LN4661

*Designed for use in "Cospas-Sarsat" Emergency Beacon Applications*

**Outline in mm**

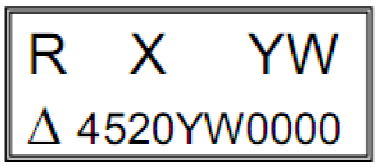



**Pad Connections**
1. Do not connect
2. NC
3. DC Coupled Output (do not connect)
4. GND
5. RF Output
6. NC
7. NC
8. Tri-State Control (Enable)*
9. Supply, +Vs
10. Do not connect

* leave unconnected if not required

Weight 170mg (typical)

**Marking** includes
R
Manufacturing identifier (x).
Crystal manufacture date.
Pad 1 / Static Sensitivity Identifier (Δ)
Abbreviated Part Number (4520)
Device date code (YW)
Serial Number (0000)




**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% | ≤ 8 ns |
| Fall time, 90% to 10% | ≤ 8 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 |

**Page 1 of 2**

## Oscillator Specification: E4520LF(T)

Issue 3, 9th July 2008, LN4661

*Designed for use in "Cospas-Sarsat" Emergency Beacon Applications*

Medium term stability specified and measured according to C/S T.001 & T.007* (averaged over 18 measurements in 15 minute period, and following 15 minute power up period)

| | |
|---|---|
| Mean Slope dF/dt | |
| Steady state conditions | ≤ ± 0.7 ppb/min |
| During and 15 minutes after variable temperature conditions | ≤ ± 1.0 ppb/min (dT/dt ≤ ± 5°C / hour) |
| Residual dF from slope | ≤ ± 2.0 ppb (dT/dt ≤ ± 5°C / hour) |
| Test results shipped with each device, identified by date and serial number, retained for 10 years. | |
| 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, 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, 980$ms^{-2}$ 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 |
| Packaging | Parts ordered with suffix 'T' are supplied on Tape-and-Reel. |

* COSPAS SARSAT 406MHz distress beacons specification C/S T.001 (Issue 3, Revision 8, NOV 2007) and C/S T.007 (Issue 4, Revision 2, NOV 2007)

**Page 2 of 2**

# Tron 60GPS

rakon

## TEST REPORT

| | |
|---|---|
| Report number | 2008-034A |
| Date of issue | 20th August 2008 |
| Product description | Temperature Compensated Crystal Oscillator (TCXO) |
| Product type | CFPT-9000 |
| Rakon Part number | E4520LFT |
| Construction | Surface mount; 7.0x5.0mm, 10-pad |
| Output Frequency | 12.688656 MHz |
| Class | II |
| Number tested | 19 |

## TESTS PERFORMED

Mid Term Frequency stability (MTS) over a 6-month period. Data is used to predict the performance of the device over a 5-year period.

Test sequence

1) Measure MTS over the temperature range -20°C to +55°C to -20°C
2) Store for 3-month at room temperature (+20°C ± 5°C)
3) Measure MTS over the temperature range -20°C to +55°C to -20°C
4) Store for a further 3-months at room temperature (+20°C ± 5°C)
5) Measure MTS over the temperature range -20°C to +55°C to -20°C

Note: One additional measurement was made as the requirement changed part way through this testing to measure monthly.

Note: This testing was completed prior to the decision to split the Slope requirement into Static Slope & Gradient Slope.

Applicable standard: Cospas-Sarsat T.007, issue 4, revision 3

## SUMMARY OF TEST RESULTS

| TEST | PASS | FAIL | REMARKS |
|---|---|---|---|
| Residual (5-year prediction) | 19 | 0 | Minimum Cpk = 3.15 |
| Minimum Negative Slope (5-year prediction) | 19 | 0 | Minimum Cpk = 4.50 |
| Maximum Positive Slope (5-year prediction | 19 | 0 | Minimum Cpk = 5.38 |
| Aging Mid Frequency (5-year prediction) | 19 | 0 | Minimum Cpk = 21.18 |

## CONCLUSIONS

The conclusion reached following the analysis of the data contained within this report indicates that the failure rate for this product after 5-years operation will be less than 5 ppm.

Testing conducted by: Ian Payne
Report prepared by: David R Woodall
Report approved by: David R Woodall



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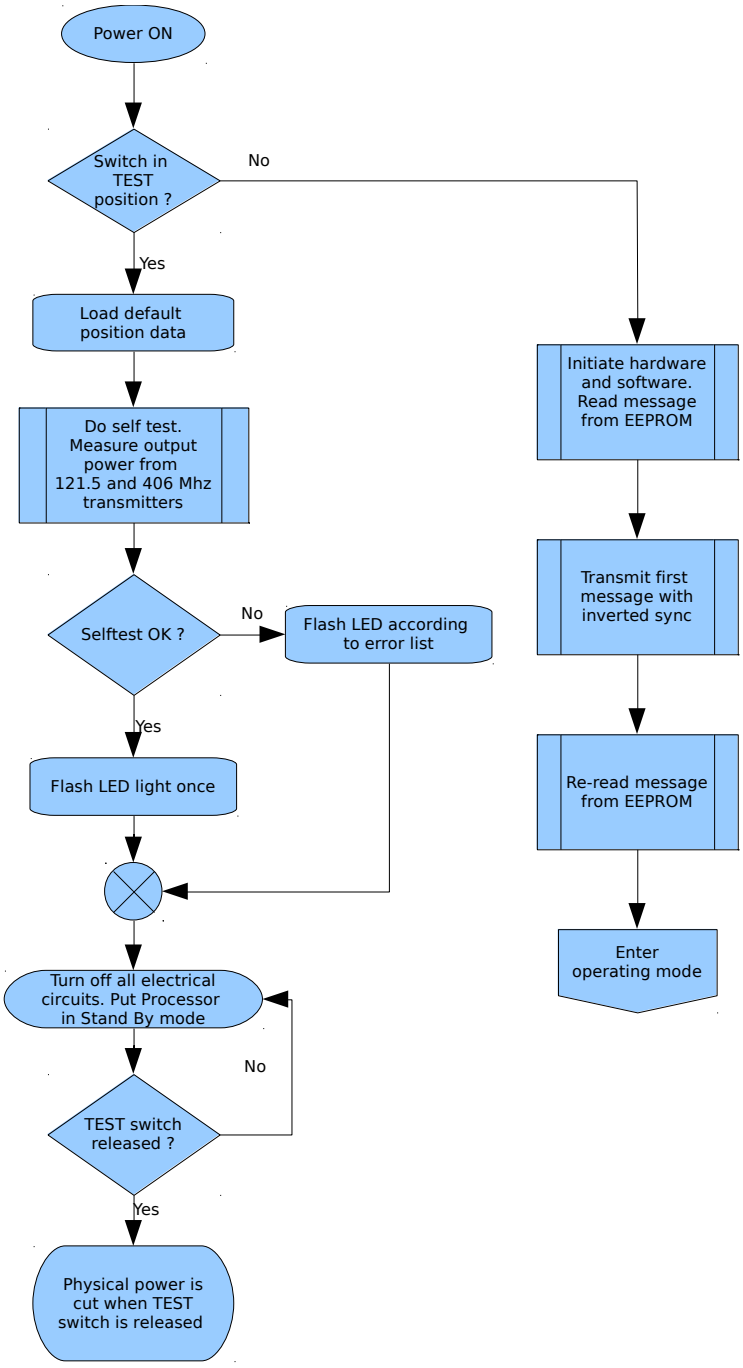
Dowsett House, Sadler Road, Lincoln, LN6 3RS, England
Registered Office: Mitre House, 160 Aldersgate Street, London EC1A 4DD
Registered Number: 05128090
www.rakon.com

## Protection from repetitive self-test mode transmissions

## Protection From Repetitive Self-Test Mode Transmissions

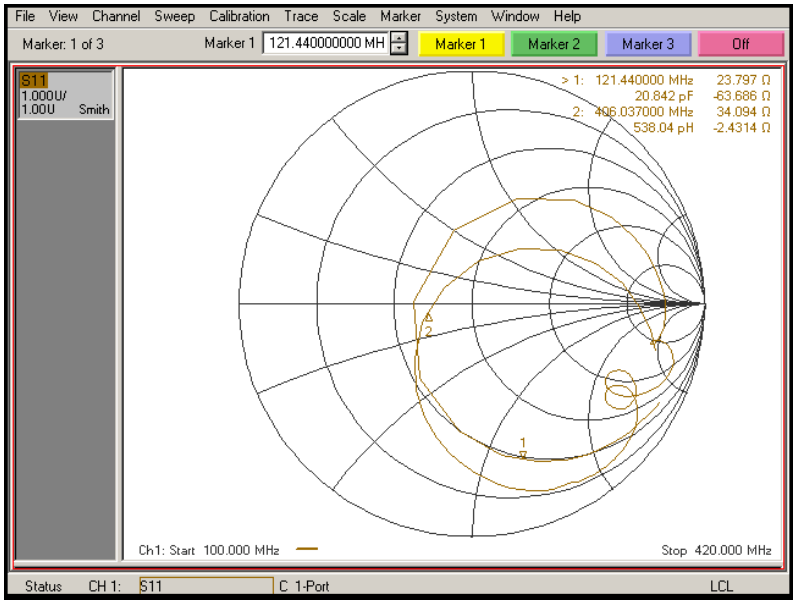
In self-test, the beacon is powered by a separate test switch, and a TEST signal will activate the self-test routine. After the microcontroller has performed the self-test routine, the microcontroller turns off all electrical circuits. Then the program runs in a wait loop until the TEST switch is released. Please see figure below.



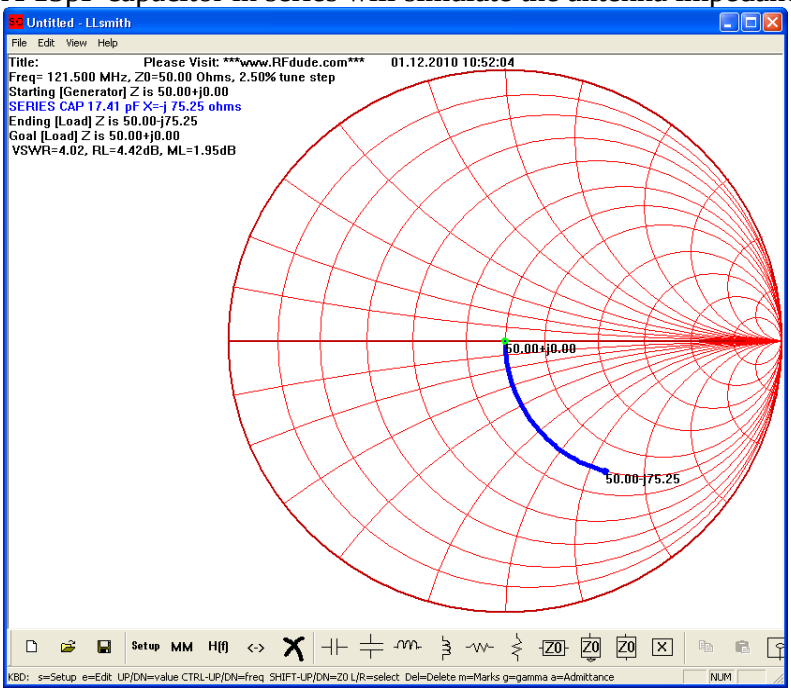
# Technical description and analysis of the matching network supplied for testing purposes

The antenna simulator is a test circuit that shall simulate the antenna impedance and transform the impedance to 50 ohm in the test connector. This document describes antenna impedance measured on an earth plane, and how the impedance is matched to correct impedance. The Antenna simulator has also a similar led as in the Tron 60S antenna, for simulating the correct current consumption in the flash period.

1. Measured antenna impedance. Marker 1 is impedance to 121.5 MHz and Marker 2 is 406 MHz. We can easy see that antenna not is matched to 50 ohm.

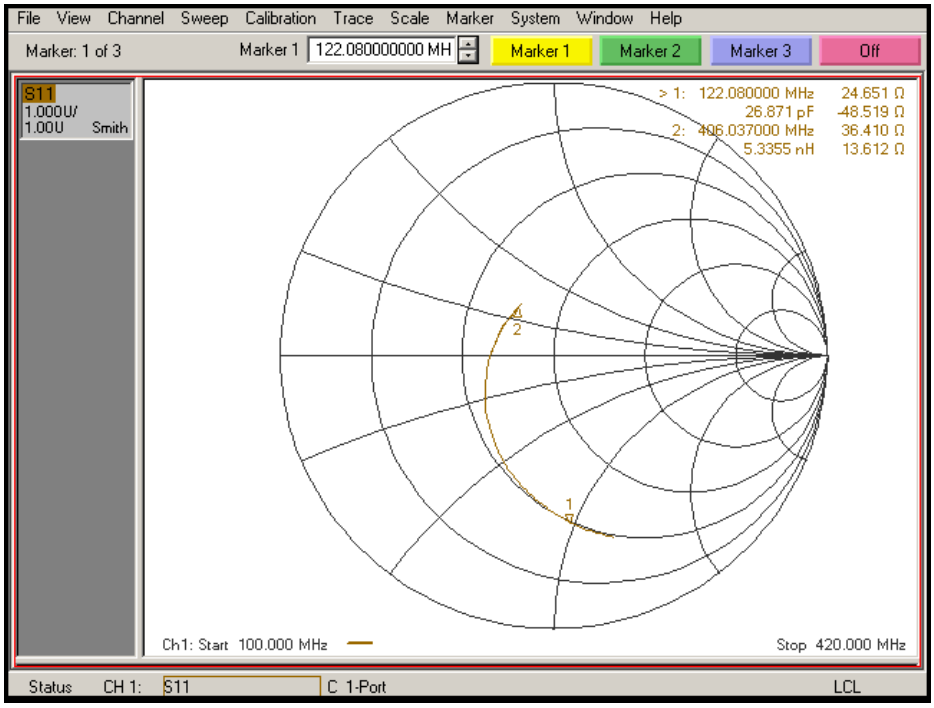



2. A 15pF capacitor in series will simulate the antenna impedance at 121.5MHz.

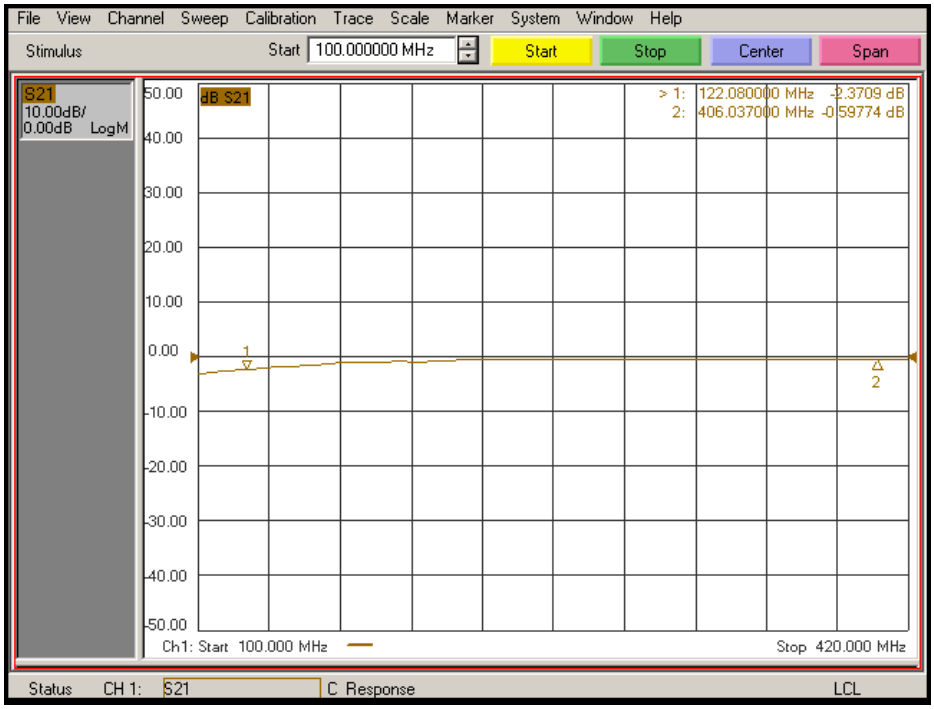


| | | |
|---|---|---|
| JOTRON | Antenna simulator | 01.12.10 |
| | Tron 60 S | Page 2(2) |

3. Antenna simulator, 15pF in series with antenna connector. Impedance at 121.5MHz and 406 is near the actual antenna impedance.




4. Typical conversion loss in match is ~2.4 dB at 121.5MHz and ~ 0.6 dB at 406MHz.



# Beacon quality assurance plan

**ANNEX L**

**BEACON QUALITY ASSURANCE PLAN**

We, manufacturer of Cospas-Sarsat 406 MHz beacons (Manufacturer name and address)

**Jotron AS**

**P.O. Box 54, 3281 Tjodalyng, Norway**

confirm that ALL PRODUCTION UNITS of the following beacon model(s),

(model, hardware part number, firmware part number, software version or part number)

**Tron 60S (Hardware part number: X-83070, Software version 1.04)**

will meet the Cospas-Sarsat specification and technical requirements in a similar manner to the units subjected for type approval testing. To this effect all production units will be subjected to following tests at ambient temperature:

- Digital message
- Bit rate
- Rise and fall times of the modulation waveform
- Modulation Index (positive/negative)
- Output power
- Frequency stability (short, medium)*

Note*: *Beacon manufacturer shall provide technical data on the beacon frequency generation to demonstrate that the frequency stability tests at ambient temperature are sufficient for ensuring that each production beacon will exhibit frequency stability performance similar to the beacon submitted for type approval over the complete operating temperature range. If such assurance of adequate performance over the complete operating temperature range cannot be deduced from the technical data provided and the frequency stability test results at ambient temperature, a thermal gradient test shall be performed on all production units.*

- Other tests:

**See appendix example of testreport showing all tests performed at each unit.**

All TCXO devices that are received from the TCXO manufacturer (RAKON) for assembly of TRON 60GPS/TRON60S production beacons will be inspected to ensure that the RAKON factory test data sheets associated with those TCXO parts demonstrate the following performances, when tested against temperature gradient test in accordance with C/S T.001:

- Maximum value of residual frequency variation would not exceed 2.0 ppb
- Maximum and minimum values of MTS-slope, at steady temperature conditions, would not exceed ± 0.7 ppb/min
- Maximum and minimum values of MTS-slope, at changing temperature conditions, would not exceed ± 1.7 ppb/min.

We confirm that the above tests will be performed as appropriate to ensure that the complete beacon satisfies Cospas-Sarsat requirements, as demonstrated by the test unit submitted for type approval.

We agree to keep the test result sheet of every production beacon for inspection by Cospas- Sarsat, if required, for a minimum of 10 years.

We confirm that the above tests will be performed as appropriate to ensure that the complete beacon satisfies Cospas-Sarsat requirements, as demonstrated by the test unit submitted for type approval. We agree to keep the test result sheet of every production beacon for inspection by Cospas- Sarsat, if required, for a minimum of 10 years.

We confirm that Cospas-Sarsat representative(s) have the right to visit our premises to witness the production and testing process of the above-mentioned beacons. We understand that the cost related to the visit is to be borne by Cospas-Sarsat.

We also accept that, upon official notification of Cospas-Sarsat, we may be required to resubmit a unit of the above beacon model selected by Cospas-Sarsat for the testing of parameters chosen at Cospas-Sarsat discretion at a Cospas-Sarsat accepted test facility selected by the Cospas-Sarsat. We understand that the cost of the testing shall be borne by Cospas-Sarsat.

We understand that the Cospas-Sarsat Type Approval Certificate is subject to revocation should the beacon type for which it was issued, or its modifications, cease to meet the Cospas-Sarsat specifications, or Cospas-Sarsat has determined that this quality assurance plan is not implemented in a satisfactory manner.

Dated: 26.09.2011 Signed: STIG-ERIK HELLAND, R&D DIRECTOR, Stig Erik Helland

(Name, Position and Signature of Beacon Manufacturer Representative)

- END OF ANNEX L –

Ref: Ind:

# Beacon Test Results

file name

Beacon serial number

Type Tron 605

Version

Beacon OK

Operator Date

## 406MHz Measurements

Max (dBm) 39
RF Power (dBm) 37.11
min (dBm) 35
Power OK

Frequency (hz) 406035736.4
Frequency OK
Max Delta Frequency (hz) 1000

Short term frequency stability
Allan Variance/100ms 3.62E-10
Max Allan variance 2E-9
Short term OK

Numeric message (hex)
FF FE 2F 50 16 AD 03 96 00 00 EA 8D 9A D0 03 00 00 00
no error bit

Medium term frequency stability
Slope/min -9.5E-11
Max Slope/min 1E-9
Slope OK

Burst N° 18
Nb Burst OK for medium term
Lock GPS status valid if GPS option present
OK
Sigma/min 1.53E-10
Max Sigma/min 3E-9
Sigma OK

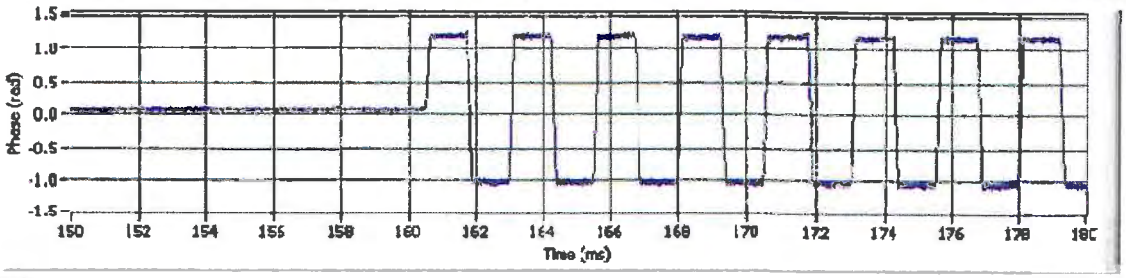
Max 404
BitRate/s 399.72
Min 396
BitRate OK

Max (µs) 250
Rise time(µs) 132
Min (µs) 50
OK

Max (µs) 250
Fall time (µs) 132
Min (µs) 50
OK

Max pos. phase deviation (rad) 1.2
Positive phase deviation (rad) 1.139
Min Pos. phase deviation (rad) 1
OK

Max Neg. phase deviation (rad) -1
Negative phase deviation (rad) -1.094
Min Neg phase deviation (rad) -1.2
OK




## 121.5MHz Measurements

Max (dBm) 21.5
RF power (dBm) 18.98
Min (dBm) 10
Power OK

Frequency (hz) 121499380.81
Max Delta Frequency (hz) 9000
Frequency OK

Modulation Factor (%) 99.5285
Min Mod. Factor (%) 85
Mod. Factor OK

## Current Measurements

Max (A) 1.9
406MHz current (A) 1.68

Max (mA) 65
121.5MHz current (mA) 49

Max (mA) 60
Quiescent_current (mA) 22

Current OK

| Test at 20°C | Test at +55°C | Test at -20°C | Test at -40°C | Immersion test | GPS test |
|---|---|---|---|---|---|
| Visa | Visa | Visa | Visa | Visa | Visa |

# Software change description




# Change description for software version 1.02

## Problem:

When beacon activated with GPS signal received, and gets a position within 50 seconds, bits 17-24 are inverted for all messages.

## Reason:

When the beacon is activated, the message is read from the eeprom. The bits 17-24 are then inverted. This test message is sent within 10 seconds. Then the message is reread from eeprom and sent 50 seconds after activation. Due to a fault in software the message was not reread if a valid GPS position appears within the first 50 seconds.

## Scope:

This problem only applies to the GPS version of the product. On Tron-60S the GPS are absent and the function ***Gps_valid()*** will never return true. Therefore, in practical use, the function is therefore unaltered for Tron-60S.




## Solution:

Always read message from eeprom before adding position data. The function ***messageUpdate()*** are called before each transition of the 406 MHz message.

**Code before the change:**

```
void messageUpdate(void)
{
   if (Gps_valid() )
   {// New GPS position OR last position NOT timed out
      char chLat = Gps_getNS();
      char chLon = Gps_getEW();
      char *pchLatPos = Gps_getLat(NULL);
      char *pchLonPos = Gps_getLon(NULL);

      // This position is legal in 4 hour
      bm_setPosition(chLat, pchLatPos, chLon, pchLonPos);
   }
   else
   {// 4 hours has passed.... reload message from eeprom
      getContentFromE2prom();
   }
}
```

**Code after the change:**

```
void messageUpdate(void)
{
   getContentFromE2prom();       // Restore message from eeprom
   if (Gps_valid() )
   {// New GPS position OR last position NOT timed out
      char chLat = Gps_getNS();
      char chLon = Gps_getEW();
      char *pchLatPos = Gps_getLat(NULL);
      char *pchLonPos = Gps_getLon(NULL);

      // This position is legal for 4 hour
      bm_setPosition(chLat, pchLatPos, chLon, pchLonPos);
   }
}
```

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# Tron 60GPS

## Change description for software version 1.03

### Problem:

The homing device (121.5MHZ transmitter) is modulated with a tone with duty-cycle 37% from the µP. The RF-synth is outputting a duty-cycle between 29 and 45% and this does not comply with required 33 to 55% (IEC61097-2 and RTCM 77-2002).

### Reason:

The RF-synth has a Gaussian filter on the modulation pin. This filter creates interference with modulation the sweep. This is the reason for the variations in the duty-cycle.

### Scope:

This problem only applies to the 121.5MHz transmitter.

### Solution:

Turn off the Gaussian filter. This is only affecting one bit in the source code and in the modulation register in the RF-synth.

**Code before the change:**

```
#define MOD_121          0x0100379E  // Gaussian OOK=ON
```

**Code after the change:**

```
#define MOD_121          0x0100378E  // Gaussian OOK=OFF
```

# Tron 60GPS

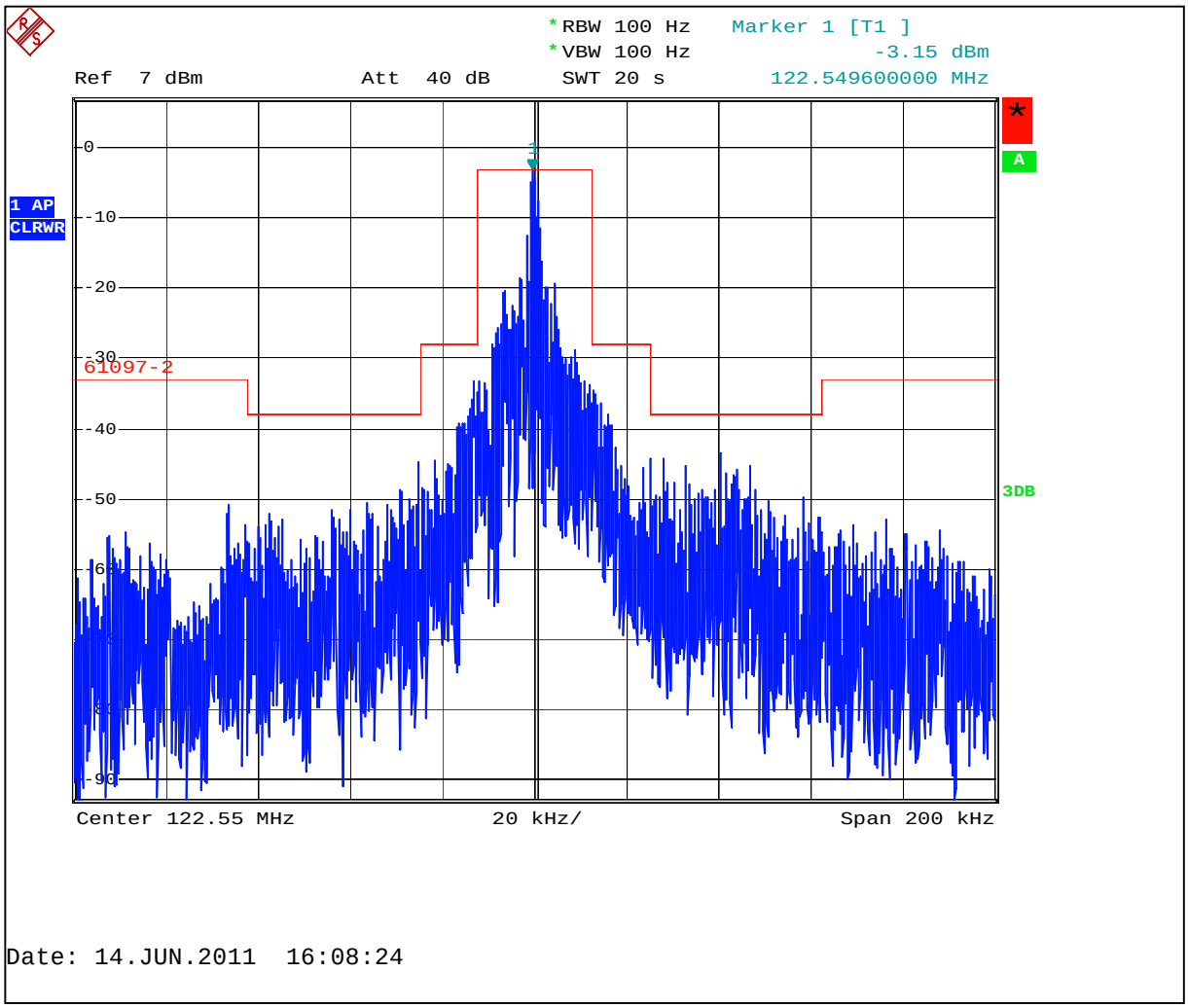


Figure 1 Spurious with Gaussian filter (SW. Ver. 1.02)

# Tron 60GPS

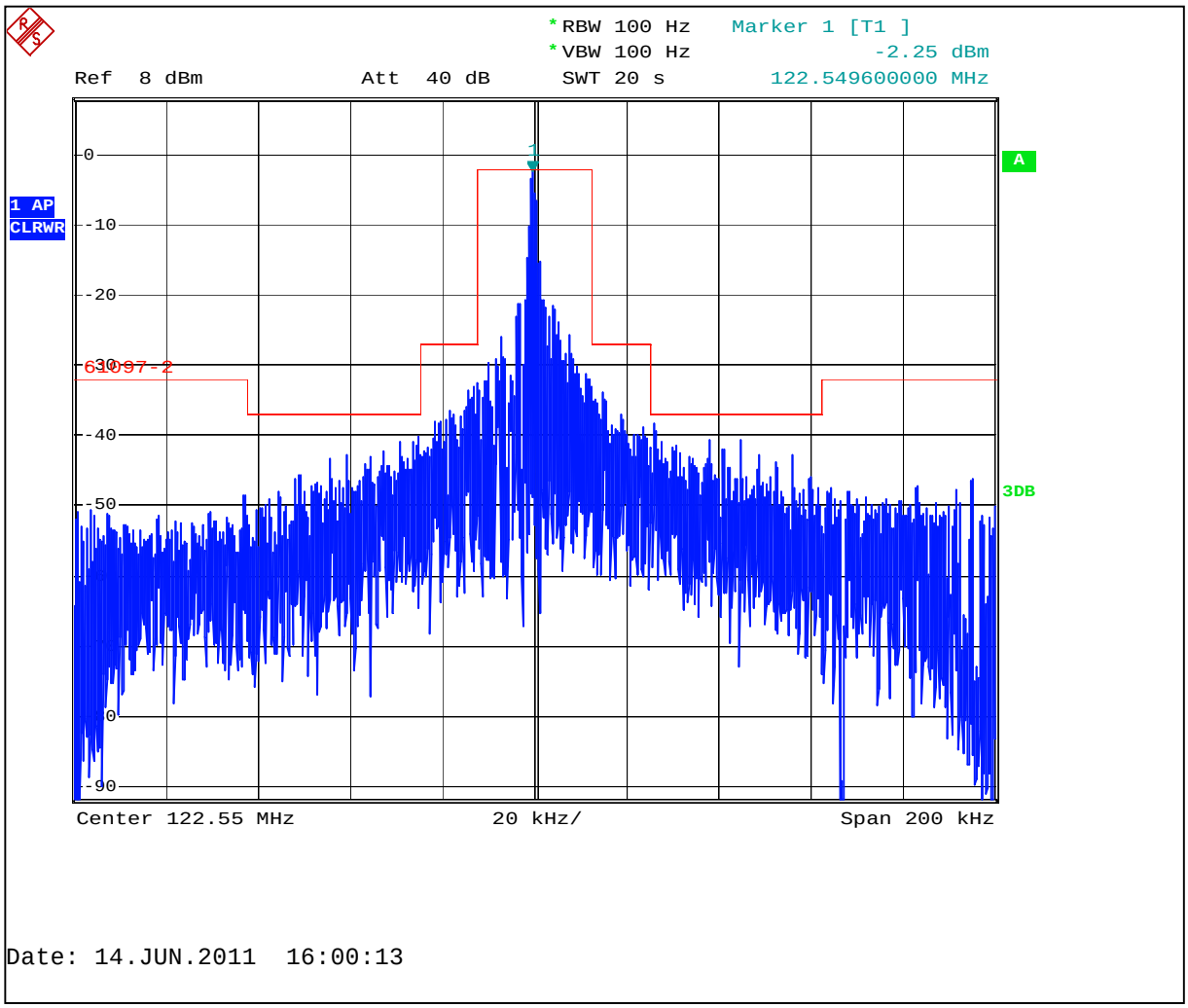


Figure 2 Spurious without Gaussian filter (SW. Ver. 1.03)

# Tron 60GPS

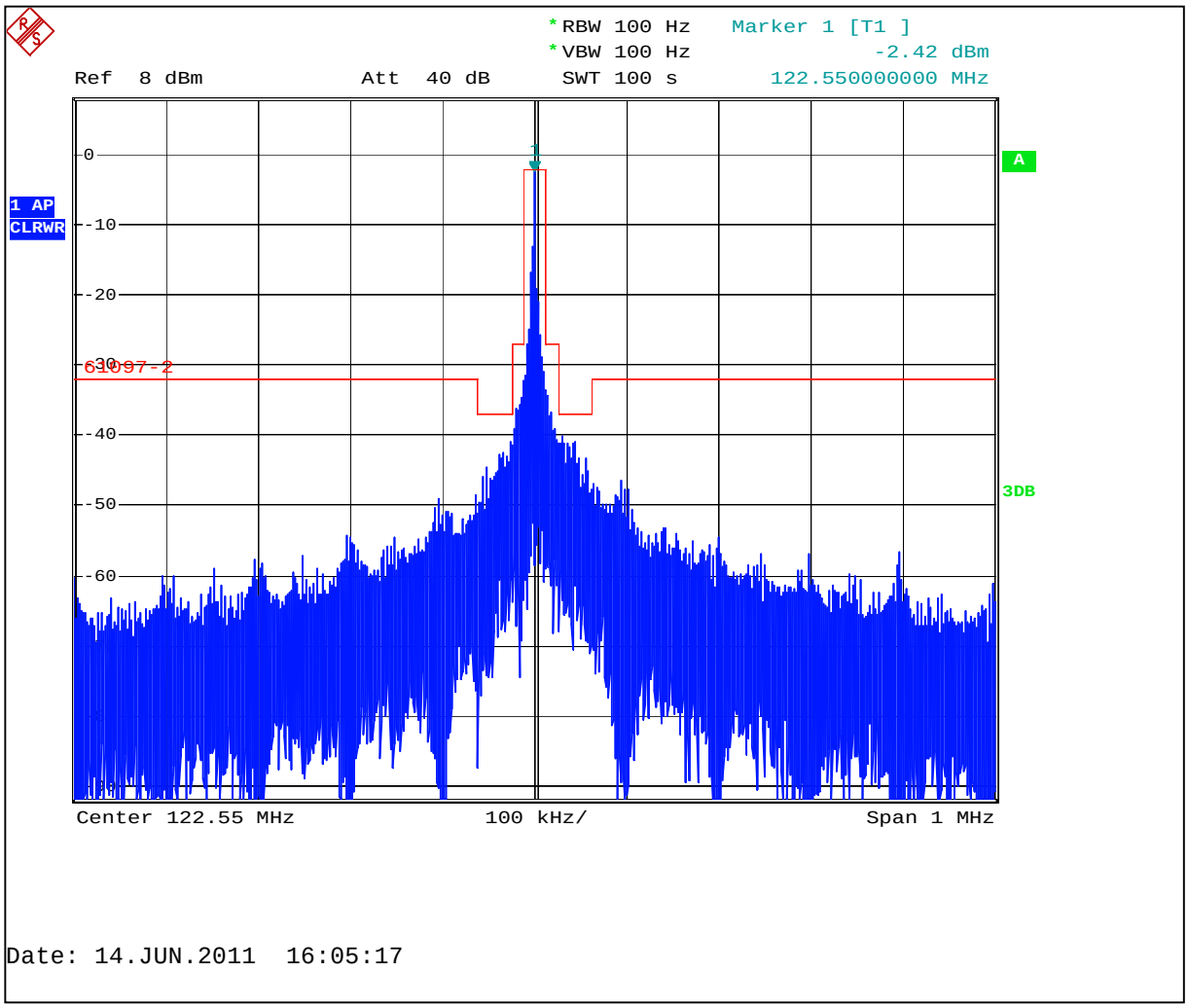


Figure 3 Wider span, 1MHz, (SW. Ver. 1.02)

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# Tron 60GPS

## Change description for software version 1.04

### Problem:

T.007 - A.3.8.7 test for User Location Protocol failed.
Item 9 and 10 are failed:
- bits 108-132 are 0B40B40 instead of 0B3CB40 for i.9;
- bits 108-132 are 14918A8 instead of 14918A7 for i.10

### Reason:

Round off to 4 seconds needed by the Standard Location Protocol was done in a place where also User Location Protocol was influenced.

### Scope:

This problem only applies to Tron 60GPS with User Location Protocol.

### Solution:

Round off to 4 seconds into the Standard Location Protocol section of the function as shown in the code snippet below.




## Code before the change:

```
void bm_setPosition(char chLat, char* pchLatPos,char chLon, char* pchLonPos)
{
uint32 LatSeconds =   ((convPosToSec(pchLatPos)+2)/4)*4;
uint32 LonSeconds = ((convPosToSec(pchLonPos)+2)/4)*4;
if (!bm_isUser())
{  //Standard Location protocol
      encode(65,1,(chLat=='S'));
      encode(75,1,(chLon=='W'));
      setPositionInitial(LatSeconds,LonSeconds);
      calculateBCH1();
}
else
{  //User-Location protocol
if (bm_isLong())
{ // User protocol position
      LatSeconds = (LatSeconds+120)/240; // Round off to nearest 4 minute
      LonSeconds = (LonSeconds+120)/240;
      encode(108,1,(chLat=='S'));
      encode(109,7,(LatSeconds / 15));
      encode(116,4,(LatSeconds % 15));
      encode(120,1,(chLon=='W'));
      encode(121,8,(LonSeconds / 15));
      encode(129,4,(LonSeconds % 15));
      calculateBCH2();
     }
}
```

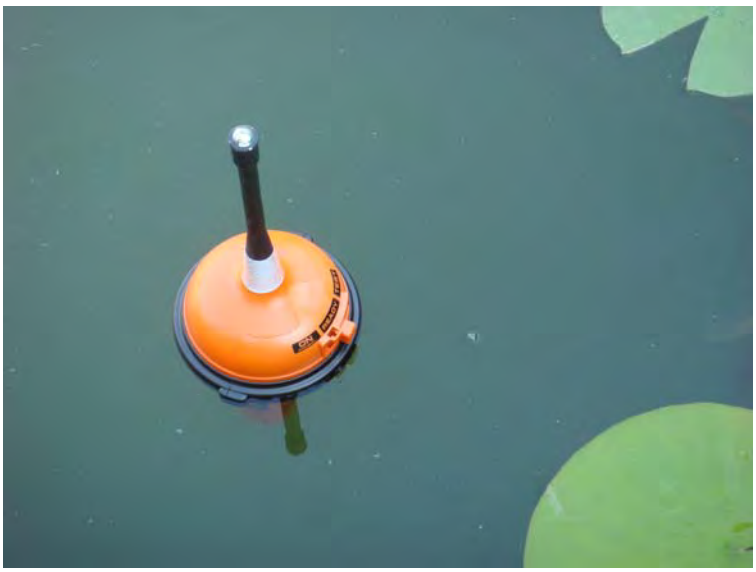
## Code after the change:

```
void bm_setPosition(char chLat, char* pchLatPos,char chLon, char* pchLonPos)
{
uint32 LatSeconds =  ((convPosToSec(pchLatPos)));
uint32 LonSeconds = ((convPosToSec(pchLonPos)));
if (!bm_isUser())
{  //Standard Location protocol
      LatSeconds = ((LatSeconds+2)/4)*4;    // Round off to nearest 4 second
      LonSeconds = ((LonSeconds+2)/4)*4;
      encode(65,1,(chLat=='S'));
      encode(75,1,(chLon=='W'));
      setPositionInitial(LatSeconds,LonSeconds);
      calculateBCH1();
}
else
{  //User-Location protocol
if (bm_isLong())
{ // User protocol position
      LatSeconds = (LatSeconds+120)/240; // Round off to nearest 4 minute
      LonSeconds = (LonSeconds+120)/240;
      encode(108,1,(chLat=='S'));
      encode(109,7,(LatSeconds / 15));
      encode(116,4,(LatSeconds % 15));
      encode(120,1,(chLon=='W'));
      encode(121,8,(LonSeconds / 15));
      encode(129,4,(LonSeconds % 15));
      calculateBCH2();
     }
}
```

# Photos of beacon in operational scenarios

Beacon on the ground

Beacon held in the hand above ground



Beacon floating in the water

# Extension of battery replacement period

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Jotron USA, Inc.
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March 7 2011

# Reason for extended battery replacement period

Jotron have experience an increased demand for our EPIRB`s in the "pleasure and leisure"-market, the last few year. We are now consider developing a tamper-proof EPIRB, were the total life-time of the product will be 10-years.

We know from experience that EPIRB`s installed on-board vessels that are not under national or international regulations, have a higher rate of failure due to replacement of batteries by private persons and not authorized agents. Typical failures can be broken connector between electronic-unit and battery-module, missing gaskets between plastic-parts (battery-house and electronic-house) etc.

As a responsible EPIRB manufacture, we believe that developing an EPIRB that meets 10 years battery life-time will reduce the possibility of failure, based on the idea of a tamper-proof design.

The expected battery cell storage before installation of the battery pack in the beacon is one year.

Jan Erik Sæter

Product Manager
Maritime