Beacon Characteristics

Characteristic	Specification
Operating temperature range	Tmin = ____-20 C_____ Tmax= _____+55 C_____
Operating lifetime	_____50_____hours
Battery chemistry	$Li\text{-}Mn_2$, $LiS0_2$
Battery cell size and number of cells	D-size, 4 cells
Battery manufacturer	Ultra Life, SAFT
Battery pack manufacturer and part number	Ultra Life U10014, Saft L026SXC, Saft LM33600
Oscillator type (e.g. OCXO, MCXO, TCXO)	OCXO
Oscillator manufacturer	TES ELECTRONIC SOLUTIONS
Oscillator part name and number	EWOS 2520
Oscillator satisfies long-term frequency stability requirements (Yes or No)	YES
Antenna type (Integrated or External)	EXTERNAL
Antenna manufacturer	AMERI-KING CORPORATION
Antenna part name and number	WHIP ANT 451017-1 / ROD ANT 451017-2 BLADE ANT 451017-3 / PORTABLE ANT 451017-4
Navigation device type (Internal, External or None)	EXTERNAL
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)	YES
Features in beacon that ensures erroneous position data is encoded into the beacon message (Yes, No or N/A)	YES
Navigation device capable of supporting global coverage (Yes, No or N/A)	YES

Characteristic	Specification
For Internal Navigation Devices	
• Geodetic reference system (WGS 84 or GTRF)	
• GNSS receiver cold start forced at every beacon activation (Yes or No)	
• Navigation device manufacturer	
• Navigation device model name and part Number	
• GNSS system supported (e.g. GPS, GLONASS, Galileo)	
For External Navigation Devices	
• Data protocol for GNSS receiver to beacon interface	RS232 SERIAL DATA
• Physical interface for beacon to navigation device	SERIAL 3 WIRES RS232
• Electrical interface for beacon to navigation device	+/- 12 VOLT
• Navigation device model and manufacturer (if beacon designed to use specific devices)	GARMIN, HONEYWELL, TRIMBLE, IIMORROW, ARNAV, ETC.
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.)	LED LIGHT EXTINGUISHED : PASS LED LIGHT FLASHES : FAIL
• Self-test can be activated from beacon remote activation points (Yes or No)	NO

Characteristic	Specification
• 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)	NO
• Self-test can be activated directly at beacon (Yes or No)	YES
• List of Items checked by self-test	
• Self-test transmission burst duration (440 or 520 ms)	440 / 520 ms
• Self-test format bit (“0” or “1”)	0
Beacon includes a homer transmitter (if yes identify frequency of transmission)	121.5 MHz
• -Homer Transmit Power	23 dBm
• -Homer Duty Cycle %	40%
• -Duty Cycle of Homer Swept Tone	33-55%
Beacon includes a strobe light (Yes or No)	NO
• Strobe light intensity	
• Strobe light flash rate	
Beacon transmission repetition period satisfies C/S T.001 requirement that two beacon’s repetition periods are not synchronized 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.	NO
Beacon includes automatic activation mechanism (Yes or No)	YES

Dated: 07/07/06 .

Signed:  KEITH VAN, ENGINEERING MANAGER, AMERI-KING CORP

(Name, Position and Signature of Beacon Manufacturer Representative)

(Continued on Next Page)

G.2 INFORMATION PROVIDED BY THE COSPAS-SARSAT ACCEPTED TEST FACILITY

Name and Location of Beacon Test Facility: **INTESPACE LABORATORY, TOULOUSE, FRANCE**

Date of Submission for Testing: _____

Applicable C/S Standards:

Document	Issue	Revision
C/S T.001	3	7
C/S T.007	4	0

I hereby confirm that the 406 MHz beacon described above has been successfully tested in accordance with the Cospas-Sarsat 406 MHz Beacon 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.

Dated:..... Signed:.....
(Name, Position and Signature of Cospas-Sarsat Accepted Test Facility Representative)

ANNEX L

BEACON QUALITY ASSURANCE PLAN

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

AMERI-KING CORPORATION
17881 SAMPSON LANE
HUNTINGTON BEACH CA 92647
USA

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

AK-451-( ) SERIES
(model, part number)

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:

_____
_____
_____
_____
_____

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.

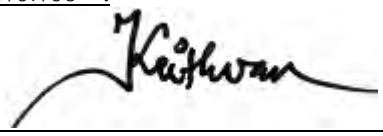
We agree to keep the test result sheet of every production beacon for inspection by Cospas-Sarsat, if required, for a minimum of 10 years.

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: 07/07/06 .

Signed:  KEITH VAN, ENGINEERING MANAGER, AMERI-KING CORP

(Name, Position and Signature of Beacon Manufacturer Representative)

- END OF ANNEX L -

ARTICLE II

DESIGN SPECIFICATION

REVISIONS					
REV	DESCRIPTION	CHANGED BY	DATE	APPROVED BY	DATE
NC-1	FIRST RELEASE	KEITH VAN	07/21/05	KEITH VAN	07/21/05
NC-2	R & D UPDATED	KEITH VAN	07/25/05	KEITH VAN	07/25/05
NC-3	R & D UPDATED	KEITH VAN	03/06/06	KEITH VAN	03/06/06
NC-4	PRODUCTION RELEASE	KEITH VAN	07/03/06	KEITH VAN	07/03/06

APPROVED	DATE	PROJECT NO	AMERI-KING CORPORATION 17881 SAMPSON LANE HUNTINGTON BEACH CA 92648			
PREPARER KEITH VAN	06/12/06	AK-451				
CHECKER						
PROJECT ENG KEITH VAN	06/12/06		TITLE DESIGN SPECIFICATION AK-451-( ) SERIES			
Q.C. MANAGER						
RELIABILITY						
PROGRAM			SIZE A	CODE IDENT NO 45099	DRAWING NO DS-AK451	REV NC-4
RELEASE APPROVAL			SCALE	WEIGHT	SHEET 1 OF 22	

TABLE OF CONTENTS

1 Engineering changes

Each amendment will be marked with a bar at the side. With a new issue all old bars are deleted and all pages will get the new issue number

1.1 List of Changes and supplements

issue	date	reason	affected pages	written by	checked by	accepted by
01	09.09.2004	first issue	all	R BENBOUHOUT		Thales
02	02.11.2004	Updated with Ameriking information	8,7,8,10,12,13,14,17	R BENBOUHOUT		Thales
01	March 02 2005	TES technical offer update	all	A CLEMENT	R BENBOUHOUT	TES
01	July 21 2005	TES technical offer update	all	A CLEMENT	R BENBOUHOUT	TES
02	July 25 2005	Adding information	5; 18; annex	A CLEMENT		TES
03	March 6th 2006	Updating		A CLEMENT		

1.2 Short description of changes and supplements

Ed1

Page affected § Description

Page 6:	**adding DO204 in reference documents.**
Page 8:	**modification for ON LED light in chapter 3.3.2.1.**
Page 9:	**modification for self test. In chapter 3.3.2.2.** **modification for the rate of serial data link in chapter 3.3.2.3.** **modification for GPS data protocol in chapter 3.3.2.4.**
Page 12 :	**modification for operating voltage in chapter 4.2.1.** **modification for 121/243MHz duration in chapter 4.2.2.** **modification for TES-Number in chapter 5.1.1.**
Page 14:	**modification for low and high temperature life duration in chapters 6.4 and 6.5**
Page 18:	**modification for software plan in chapter 7.2.** **Connectors update in chapter 8.1.**
Annex:	**DT003D367/A**
Pages 7; 12; 13; 17:	**modification of the TES circuit board reference C000260 in lieu of 004Q330.**
All :	**TES logo update**

Ed2

Page affected § Description

Page 18:	**additional reference for MOLEX connectors in chapter 8.1.**
Annex:	**DT003D367/B**

Ed3

Page affected § Description

Page 7 :	**Self-test mode modifications.**
Page 8:	**8 and 14 Volts is replaced by 8.7 and 14 Volts** **ON LED light modifications.**
Page 9:	**ARM/TEST/SERIAL modifications.**
Page 10:	**PCB size modifications.**
Page 12:	**diode against battery inverse polarity.**
Annex :	**DT003D367/C**

2 General information

2.1 Purpose of this document

The purpose of this document is the definition of all performance data necessary to develop the prototype modules, described as follows.

2.2 REFERENCE DOCUMENTS

[1] COSPAS/SARSAT T.001, Issue 3, Revision 6, October 2004

[2] COSPAS/SARSAT T.007, Issue 3, Revision 11, October 2004

[3] TSO C-91a, Emergency Locator Transmitter (ELT) Equipment, Federal Aviation Administration, 4/29/85

[3] TSO C-126, 406MHz Emergency Locator Transmitter (ELT) Equipment, Federal Aviation Administration, 12/23/92

[4] RTCA DO-178B, Software considerations in airborne systems and equipment certification, December 1992

[5] RTCA DO-183, Minimum Operational Performance Standards For Emergency Locator Transmitters, May 13, 1983

[6] ED-62, Minimum Operational Performance Specification For Aircraft Emergency Locator Transmitters (121.5/243 MHz and 406 MHz), May 1990

[7] EUROCAE ED-14D / RTCA DO160D.

[8] RTCA DO204. MOPS 406MHz ELT

Note: The normative documents applies to the full assembled ELT beacon. The TES electronic board shall be compliant only to the subset of electrical specification that can be checked at the board level (without the interfaces and mechanical housing of the ELT).

3 GENERAL PERFORMANCE

The radio transmitters and control section consist of one printed circuit board TES reference C000260.

3.1 Radio Transmitters

3.1.1 Function F1; 121.5 MHz Transmitter

AM power amplifier with modulator for Beacon mode .For technical data refer chapter 4.
The impedance of the TX port has to be 50 Ohms.

3.1.2 Function F2; 243 MHz Transmitter

AM power amplifier with modulator for Beacon mode. For technical data refer chapter 4.
The impedance of the TX port has to be 50 Ohms.

3.1.3 Function F3; 406.028 MHz Transmitter

Pulse power amplifier with phase-modulator and frequency standard, in accordance with &263$6_6$56$7 VSHFLILFDWLRQ as given in the document C/S T.001 and the technical data of chapter 4. The control and modulation signals must be generated by the control section. The timing of the transmission is given in the C/S T001 specification.

3.1.4 RF detector

Diodes pins detector used for self test on 121.5/243MHz and 406MHz output power level.
This signal is connected to the microcontroller.

3.1.5 Triplexer

The output signals of the transmit functions F1, F2, F3 are matched via a coupling network to a common RF antenna port.

3.1.6 Antenna interface

3.1.6.1 Output Impedance

The output impedance of the TES board is 50 ohms.

3.1.6.2 Matching circuit

The matching of the antenna is under Ameri-King responsibility.

3.2 Control Section

The control section contains 2 different functions.

- **Control function of the whole unit**
- **Power supply for the digital circuits and radio transmitters.**

3.2.1 Control function

The control function has to control all functions of the transmitter.

- **Serial Interface Mode.**
- **Beacon Mode.**

Generation of all the modulation signals as necessary in the Beacon Mode

- **AM modulation signal (up / down sweep) for F1 (121.5 MHz)**
- **AM modulation signal (up / down sweep) for F2 (243 MHz)**
- **Phase modulation signal for F3, 406.028 MHz**

A two wires interface (serial data link) is provided for programming , examination of data for bench or field testing and GPS data transmission to be inserted in the 406MHz signal.

Basic component of the control board is a microcontroller. All permanent data is stored in a non-volatile memory inside the microcontroller (flash).

3.2.2 Power supply section

Performing of all connections as required for the control section and the radio transmitters.
Generating from the battery voltage all power supplies as required for the control section and the radio transmitters.
The power supply is a high efficiency circuit and can manage battery voltage between 8.7 and 14 Volts.

3.3 Software

The software shall comply with RTCA DO 178B, level D.
Software development and documentation is done by TES , collaboration of Ameri-King may be necessary to write documents.

3.3.1 Hardware control

The software controls the following functions :

- *** RADIO CONTROL :**
  - **- PLL programming**
  - **- PLL lock detect (for SELF TEST)**
  - **- RF amplifiers gain control**
  - **- RF power measurements (for SELF TEST)**
- *** POWER MANAGEMENT CONTROL :**
  - **- Startup/ON/OFF/SELF TEST management**
  - **- Voltage levels control (for SELT TEST)**

3.3.2 Interfaces Management

3.3.2.1 I/O functional specification.

The Main switch has three positions : ARM/ON/OFF.
The Beacon inputs are alternate MAIN switch, momentary ON switch (for G switch and REMOTE ON switch) and momentary RESET switch (for manual RESET switch and remote RESET switch).
The Beacon outputs is flashing ON LED

Main switch alternate positions:
OFF : No battery power , no current consumption.
ARM/TEST/SERIAL Power ground is applied, very low consumption in ARM mode.
ON : ELT transmits immediately. The LED light flashes.

ON LED light
After self test :
Light steady extinguished, indicates RF signal transmission and ELT is good.
Light flashes continuously 2 seconds period and duty cycle 50% , indicates ELT total failure.
In Beacon or ARM mode :
Light flashes continuously 1 second ON every 5 seconds, indicates the ELT is manually activated “ON” or automatically activated by the by G switch (ARM mode) .
G switch
Momentary low activated (3 ms pulse) : ELT transmits immediately in ARM mode.

RESET switch
If pressed (momentary low activated, 10 ms), ELT transmission ceases immediately.

REMOTE

REMOTE ON switch in parallel with G switch (see upper paragraph)
REMOTE RESET switch in parallel with RESET switch (see upper paragraph)
REMOTE ON LED Light in parallel with ON LED Light (see upper paragraph)

3.3.2.2 ARM / SELF TEST / SERIAL management

If Main Switch is on ARM/TEST/SERIAL position:

- **The LED Light illuminates for 4 seconds then extinguishes, at this phase the beacon is listening to the serial link :**

If a valid command occurs during these 20 seconds , The SERIAL mode is then activated.
To leave the serial mode the Main Switch shall be switched OFF.
If no valid command is received within 20 seconds, the self test function is initiated.

- **Self test is 440 ms short message burst on the 406MHz signal, frame synchronization pattern is 011 010 000 (C/S T001).**
- **Self test is then 121/243MHz Continuous Wave during 1s.**

Checks are:

- **Correct ID stored in the EE prom .**
- **Power output level on 121/243/406MHz signal.**
- **Battery level and internal regulated voltage level .**
- **Lock signal from PLL**

Self test result is:

- **If the self test is passed, the LED is steady extinguished.**
- **If the self test is failed, the LED Light flashes as defined below :**

1 Flash: Internal Data stored in Memory at fault.
2 Flashes: Distress ID stored in Memory at fault.
3 Flashes: Battery Voltage is Low < Useful Life Battery Voltage setting. (< 9.50 Vdc)
4 Flashes: V cc Supplies for F3 or F1 or F2 at fault.
5 Flashes: F3 RF Power Level < 33 dbm.
7 Flashes: F1/F2 RF Power Level < 17 dbm.
9 Flashes: PLL locked in F3 or F1 or F2 at fault.
Continuous Flash: No F3/F1/F2 RF Output Power, ELT shuts down completely.

The self test result is also sent on serial link :

- self-test mode -
Internal regulator LDO output OK
Internal data stored in memory OK
Distress ID stored in memory OK
Micro controller Vcc OK
Battery Level OK
F1F2 power output level OK
F3 power output level OK
Internal power F1F2 regulator OK
Internal power F3 regulator OK
PLL locked in F1F2 mode OK
PLL locked in F3 mode OK

If self test OK the beacon turns in ARM mode, if not, the beacon should be switched "OFF".

3.3.2.3 ID programming
The user downloads the field programmable ID serial number by using the serial data link, the referenced "TES-OM-SAP100120" operator's manual describes the available commands.
The serial data link uses an ASCII format at 9600 Bauds. an HyperTerminal session is enough to change the ID.

The equipment prompt the user to change the Cospas / Sarsat ID. The user chose between following format:

- **15 Hexadecimal ID representation (bit 26 to bit 85) + short / long (bit 25)**
- **22 Hexadecimal ID representation (bit 25 to bit 112)**
- **30 Hexadecimal ID representation (bit 25 to bit 144)**

Bit of synchronization, frame of synchronization, BCH1 and / or BCH2 are computed by the microcontroller, then complete message, 122 or 144 bits are stored in FLASH.

3.3.2.4 GPS aviation data format

This part defines protocols that can be used for encoding data position into the F3 message.

Following case are implemented onto equipment, other combination does not modify the F3 message.

Format Flag bit 25	Protocol Flag bit 26	protocol code bit 37-40	protocol code bit 37-39	Location Protocol
0	0	2,3,4,5,6,7,12,14		Standard-Short Location Protocols
1	0	2,3,4,5,6,7,12,14		Standard Location Protocol
0	0	8,10,11,15		National-Short Location Protocol
1	0	8,10,11,15		National Location Protocol
x	1		1,2,3,6,7	User-Location Protocols

If the F3 message is able to code the position, in beacon mode, the serial data link is analyzed to find Aviation data messages Ident A,B.
The data of Ident A,B are used to extract the position, in degrees and minutes, and insert it into the F3 message..
Synchronization of the serial data link is done at 9600 Bauds.
See Appendix C.400 Series RS232 Aviation Data Format in Annex.

3.4 Design of the modules

3.4.1 Mechanical layout

The PCB layout and the component area (upper and rear side) of the PCB are defined in the mechanical drawings (see chapter 5).

The allowable PCB size is 2.5”W x 3.8”L x 0.069”H.
The maximum height is 17.2 mm.

3.4.2 Components

The modules are assembled with components like SMD and highly integrated devices.

4 TECHNICAL DATA

4.1 Radio Transmitters

4.1.1 Transmitter output power

F1; 121.5 MHz		
CW power without modulation	**:**	**≥ 23 dBm**
Occupied bandwidth	**:**	**+-12.5 KHz @ -25dB and +-25 KHz @ -35 dB**
F2; 243 MHz		
CW power without modulation	**:**	**≥ 23 dBm**
Occupied bandwidth	**:**	**+-12.5 KHz @ -25dB and +-25 KHz @ -35 dB**
F3; 406.028 MHz; Ppeak	**:**	**36 dBm min. and 39 dBm max**

4.1.2 Modulation

F1; 121.5 MHz	**:**	**- A9** **- 300Hz ... 1600Hz sweep freq (downward).** **- sweep repetition rate 2...4Hz** **- modulation factor between 0.85 and 1** **- modulation duty cycle between 33 and 55 %**
F2; 243 MHz	**:**	**- A9** **- 300Hz ... 1600Hz sweep freq (downward).** **- sweep repetition rate 2...4Hz** **- modulation factor between 0.85 and 1** **- modulation duty cycle between 33 and 55 %**
F3; 406.028 MHz	**:**	**In accordance to C/S-T.001**

4.1.3 Frequency accuracy

F1, 121.5 MHz	**:**	**≤ ± 50 ppm**
F2, 243 MHz	**:**	**≤ ± 50 ppm**
F3, 406.028 MHz	**:**	**≤ ± 1 kHz**

4.1.4 Frequency drift

F1, 121.5 MHz	**:**	**≤ 0.2 x 10-6/min (medium-term stability)**
F2, 243 MHz	**:**	**≤ 0.2 x 10-6/min (medium-term stability)**
F3, 406.028 MHz	**:**	**≤ 1.0 x 10-9 /min (medium-term stability)**
	:	**≤ 2.0 x 10-9/100 ms (short-term stability)**
	:	**≤ 3.0 x 10-9 (residual freq. variation)**
	:	**≤ +2 / -5 kHz within 5 years (long-term stability)**

4.1.5 RF-Output impedance

F1; 121.5 MHz	**:**	**50 Ohm ; VSRW better 1 : 1.5**
F2; 243 MHz	**:**	**50 Ohm ; VSRW better 1 : 1.5**
F3; 406.028 MHz	**:**	**50 Ohm ; VSWR better 1 : 1.5**

4.1.6 Spurious emissions

4.1.6.1 121.5 and 243 MHz transmitters
From 9 KHz to 10 th harmonic of the highest fundamental frequency, the level of any spurious shall be 35 dB below the un-modulated carrier.

4.1.6.2 406 MHz transmitter
see 406 MHz spectral mask figure 2-1 of C/S T001

4.2 Power supply
Under normal operating voltage all specified data must be fulfilled unless otherwise stated.

4.2.1 Operating Voltage
Normal operating voltage : 8.7V ... 14 V DC transmit mode.
A diode will prevent damage in case of polarity inversion of the battery.

4.2.2 Power / current consumption
Plugged on the AMERIKING battery pack, the ELT transmitter shall turn ON at minimum and maximum temperature:

- **406.028 MHz during 24 Hours**
- **121.5/243 MHz during 50 Hours**

The battery pack is composed of 4 Lithium D cells : Eagle Pitcher PT-2300, 16.5 Ah.
The electronic board shall be protected against inverse polarity of the battery pack, this protection is realized by
polarizing slot on board C000260 and a serial diode insertion .
The current consumption shall be less than 10µA in ARM mode

4.2.3 Temperature

Operational	**:**	**-20° C ... +60° C**
Storage	**:**	**-55° C ... +85° C**

5 Mechanical Data

5.1 Printed circuit board
See DT003D367 drawing in annex.

5.1.1 PCB

Outline	**:**	**TES-Number: C000260**
Material	**:**	**FR4/1.6 mm; ≥ 17m Cu; 6 layers**
Surface treatment	**:**	**Solder mask**
Pads and drilled pads	**:**	**partial tin plated**
Inscription	**:**	**TES drawing No : C000260 with index.**

6 Environmental conditions
The following tests will be performed by TES in accordance to applicable specification : DO-160D and COSPAS SARSAT T001.

6.1 Low temperature
Temperature : -20°C
The board C000260 shall be compliant with technical data described in chapter 4.

6.2 High Temperature
Temperature : +60°C
The board C000260 shall be compliant with technical data described in chapter 4.

6.3 Temperature variation
The ELT shall be subjected to the temperature variation of 5°C/minute as per DO-160D section 5.0 Category B
The board C000260 shall be compliant with technical data described in chapter 4.

6.4 Low Temperature life
Temperature : -20°C
The 406MHz emission is turned off after 24H, while the 121.5/243MHz transmitter continues to run until the batteries are dead (minimum 50H).
TES will need the whole beacon (without antenna) to perform this test.

6.5 High Temperature life
Temperature : +60°C
The 406MHz emission is turned off after 24H, while the 121.5/243MHz transmitter continues to run until the batteries are dead (minimum 50H).
TES will need the whole beacon (without antenna) to perform this test.

6.6 Frequency Stability with Temperature gradient
406.028MHz Transmitter shall comply with COSPAS SARSAT T001 requirements
This test shall be performed with the board C000260 in the ELT housing.

6.7 Thermal shock
406.028MHz Transmitter shall comply with COSPAS SARSAT T001 requirements
This test shall be performed with the board C000260 in the ELT housing.

7 DOCUMENTATION

7.1 Hardware

7.1.1 Form function prototypes

Prototypes will be delivered with a test report.
Tests are performed according the following test table .

ARM/SELF TEST /SERIAL modes : functional verification	
Beacon Mode : functional verification	
406MHz POWER OUTPUT F3	
	Transmitted power output
	Power output rise time
	Power output 1ms before burst
	DIGITAL MESSAGE
	bit sync
	frame sync
	BCH code
	DIGITAL MESSAGE GENERATOR
	total transmission time short message
	MODULATION
	Modulation Bi phase-L
	Modulation rise time
	Modulation fall time
	Modulation Phase deviation positive
	Modulation Phase deviation negative
	Modulation symmetry measurement
	406MHz TRANSMITTED FREQUENCY
	nominal value
	SPURIOUS EMISSION into 50 Ohms
	Spurious in Band (406-406,1MHz)
121.5MHz power F1	
	Modulation A9
	frequency accuracy on F1
	Spurious emission
243MHz power F2	
	Modulation A9
	frequency accuracy on F2
	Spurious emission
SELF TEST	
	battery test
	Tx power F1 F2 F3
	Self test result
	frame sync of the 406MHz signal
Current consumption	
	ARM mode current consumption
	Board Consumption without Tx on 121/243/406MHz
	Tx F3 current consumption
	Tx F1+F2 current consumption

7.1.2 initial samples

Initial samples will be delivered with a test report, electrical Part list and electrical circuit diagram, MTBF calculation is supplied by Ameri-King.
Test results are performed according the following test table:

ARM/SELF TEST /SERIAL modes : functional verification	
Beacon Mode : functional verification	
406MHz POWER OUTPUT F3	
	Transmitted power output
	Power output rise time
	Power output 1ms before burst
DIGITAL MESSAGE	
	bit sync
	Frame sync
	Format flag
	Protocol flag
	Identification/position data
	BCH code
	Emerg.code/nat.use/BCH
	Data message readable via serial data link
DIGITAL MESSAGE GENERATOR	
	Average
	Repetition rate
	Standard deviation
	Unique TR sequence
	bit rate
	Total transmission time short message
	Total transmission time long message
	Un modulated carrier
	First burst delay
MODULATION	
	Modulation Biphase-L
	Modulation rise time
	Modulation fall time
	Modulation Phase deviation positive
	Modulation Phase deviation negative
	Modulation symmetry measurement
406MHz TRANSMITTED FREQUENCY	
	Nominal value
	Short term stability
	Medium term stability
SPURIOUS EMISSION into 50 Ohms	
	Spurious in Band (406-406,1MHz)
406MHz VSWR CHECK after open/short circuit then while VSWR is 3:1	
	Nominal transmitted frequency value
	Modulation rise time
	Modulation fall time
	Modulation Phase deviation positive
	Modulation Phase deviation negative
	Modulation symmetry measurement
	Digital message
SELF-TEST MODE	

	Frame sync
	Format flag

	Single radiated burst
	Default position data
	Protection against repetitive self-test mode transmissions
	Single burst verification
	Provides for beacon 15 Hex ID
THERMAL SHOCK (30 DEG C CHANGE)	
	Transmitted frequency nominal value
	Transmitted frequency short term stability
	Transmitted frequency medium term stability, slope
	Transmitted frequency medium term stability residual variation
	Transmitter power output
	Digital message
OPERATING LIFETIME AT MINIMUM TEMPERATURE	
	Duration
	Transmitted frequency nominal value
	Transmitted frequency short term stability
	Transmitted frequency medium term stability, slope
	Transmitted frequency medium term stability residual variation
	Transmitter power output
	Digital message
TEMPERATURE GRADIENT (5 DEG C / H)	
	Transmitted frequency nominal value
	Transmitted frequency short term stability
	Transmitted frequency medium term stability, slope
	Transmitted frequency medium term stability residual variation
	Transmitter power output
	Digital message
LONG TERM FREQUENCY STABILITY	
	Data provided
PROTECTION AGAINST CONTINUOUS TRANSMISSION	
	Description provided
BEACON CODING SOFTWARE	
	Sample message provided for each coding option of the applicable coding protocol types
	Sample self test message provided for each coding option of the applicable coding protocol types
NAVIGATION SYSTEM	
	Position data default values
	Position acquisition time
	Encoded position data update interval
	Position data input interval
	Coarse position close to actual position
	Delta offset positive direction
	Delta offset negative direction
	Over range to 2 times coarse resolution
	Last valid position retained after navigation input lost
	Last valid position cleared when beacon reactived
	Design data provided for protection against beacon degradation due to navigation device,
	interface or signal failure or malfunction
121.5MHz power F1	
	F1 Energy distribution in Beacon mode
	F1 Mean power in Beacon mode with modulation
	modulation A9 F1
	frequency accuracy on F1

	frequency drift on F1
243MHz power F2	
	F2 Energy distribution in Beacon mode

	F2 Mean power with modulation in Beacon mode
	modulation A9 F2
	frequency accuracy on F2
	frequency drift on F2
Currnet consumption	
	Board Consumption without Tx on 121/243/406MHz
	ARM mode current consumption
	Tx F3 current consumption
	Tx F1+F2 current consumption

7.1.3 Serial products

Serial products are delivered with a test report.
Tests are performed according the following test table :

Software loading
Loading of the Unique TR sequence for 406MHz
Serial data link test
I/O test
ID programming test
Test of Power supply level
Current consumption in ARM mode
Current consumption with 406MHz in CW mode
Current consumption with 121.5/243MHz in CW mode
Current consumption with 121.5/243MHz in modulation mode
Power 121.5 MHz in CW mode
Power 243 MHz in CW mode
Power 406MHz in CW mode
Phase Modulation index on 406MHz output
AM Modulation index on 121.5MHz output
AM Modulation index on 243 MHz output
Maximum Power 121.5 MHz in AM mode
Maximum Power 243 MHz in AM mode
Board Consumption without Tx on 121/243/406MHz
Serial number entry

Temperature tests at –20°C and +60°C are done by sampling.
The acceptance quality level is NQA = 2.5 level 2.

The adhesive label on board C000260 will be :

YY : for year
WW : for week
NNN for numbering

AMERI-KING
(A-K part number)
YYWW-NNN

Example:
300 tested modules in week 26 of 2005 :
labels are : 0526-001 to 0526 300;
the next 300 tested modules in week 27
labels are : 0527-001 to 0527-300.

7.2 Software

The following software Development related documents will be available on site upon request . These documents are based on RTCA DO178B level D requirements.

Software development plan for FAA certification, shall be described by Ameri-King.

- **Plan for software aspects of certification.**
- **Software accomplishment summary.**
- **Software requirement specification**
- **Software design document**
- **Software product specification**
- **Software configuration index.**

8 PCB connectors

8.1 Connector to the AMERIKING Adapter PCB

The pins of the connector are defined below :

CONNECTOR 3: MOLEX KK7395	
Name	**Description**
+VBAT	Battery pack Voltage +
-VBAT	Battery pack Voltage-
CONNECTOR 1: SAMTEC NMS-110-02-T-DV or MOLEX 87381 2063	
Name	**Description**
VBAT	Fuse protected Battery Voltage +
-VBAT	Battery pack Voltage-
RXD	RS232 RX link
TXD	RS232 TX link
LED-ON	ELT LED indicator ON command
P7V3-243-COUP	7.3 V regulated power supply for LED indicator
SW-ARM	ARM mode command
SW-ON	ON mode command
SW-G-SWITCH	G SWITCH input
GND	GROUND
CONNECTOR 2: SAMTEC MMS-107-02-T-DV or MOLEX 87381 1463	
TCK	JTAG for programming micro-controller.
TDI	
TDO	
TMS	
RST-NM	
GND	
TX-C	
RX-C	
P3V3	
PM0_IN	used by TES for TEST
PM1_IN	
ON_406_IN	

8.2 RF Antenna Connector

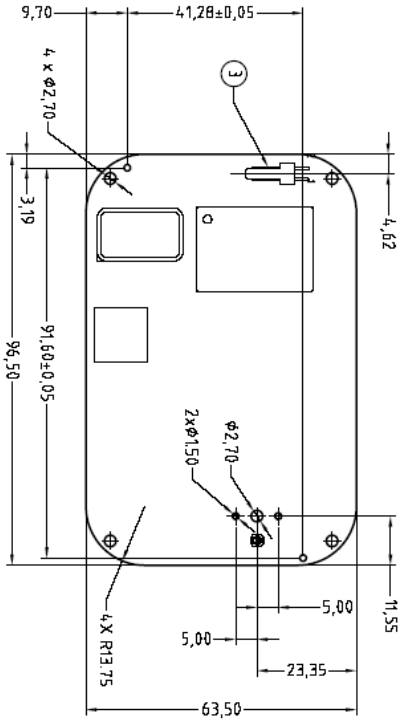
Type of PCB connector	**:**	**BNC connector**
	:	**Ameri-King drawing : N°45099 index A**
Impedance	**:**	**50 Ohms**

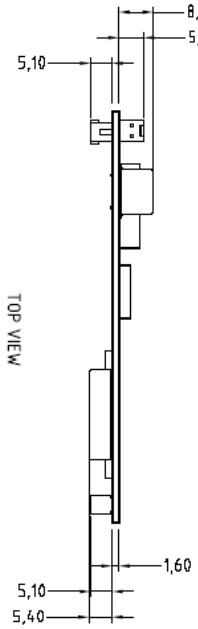
This connector is assembled by Ameri-King

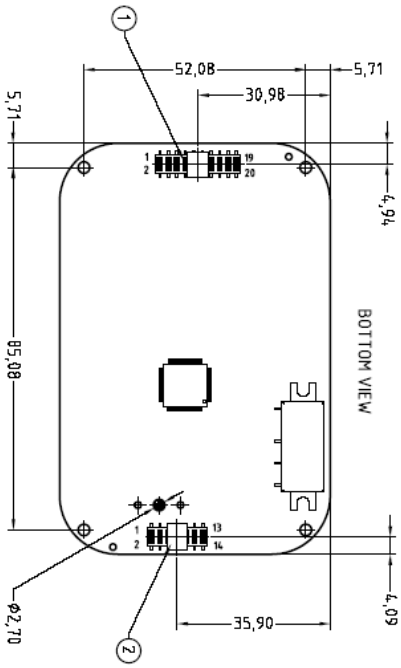
9 List of abbreviations

AK	**Ameri-King**
AM	**Amplitude modulation**
AUTO	**Automatically**
C/S	**COSPAS/SARSAT**
DF	**Frequency deviation**
ELT	**Emergency Locator Transmitter**
EUROCAE	**European commission for aeronautics**
F1	**Frequency 121.500 MHz**
F2	**Frequency 243.000 MHz**
F3	**Frequency 406.028 MHz**
GND	**Ground**
GPS	**Global Positioning System**
LED	**Light emitting diode**
MTBF	**Mean time between failures**
RF	**Radio frequency in-/ output**
RXD	**Serial input data line**
RTCA	**Radio technical commission for aeronautics**
SMD	**Surface mounted device(s)**
TX	**Transmit , transmitter**
TXD	**Serial output data line**
V batt	**Battery voltage**
V pp	**Peak-to-peak voltage**
VSWR	**Voltage standing wave ratio.**

10 ANNEX







Repere 1 : Connecteur SAMTEC Ref : MMS-110-02-T-DV

REP	FONCTION	REP	FONCTION
1	-VBAT	11	GND
2	-VBAT	12	GND
3	GND	13	LED-ON
4	GND	14	P7V3-243-COUP
5	VBAT	15	GND
6	VBAT	16	GND
7	GND	17	RESET
8	GND	18	SW-ARM
9	TXD	19	SW-ON
10	RXD	20	SW-G-SWITCH

Repere 2 : Connecteur SAMTEC Ref : MMS-107-02-T-DV

REP	FONCTION	REP	FONCTION
1	TDO-TDI	8	RX-C
2	P3V3	9	RST-NM
3	TDI	10	GND
4	P3V3	11	PM0-IN
5	TMS	12	PM1-IN
6	TX-C	13	ON-406-IN
7	TCK	14	

Repere 3 : Connecteur MOLEX KK7395 Ref: 22-05-7028

REP	FONCTION	REP	FONCTION
1	+VBAT	2	-VBAT

Appendix C. GARMIN GPS 400 Series RS-232 Aviation Data Format

C.1 ELECTRICAL INTERFACE

The output signals shall be compatible with RS-232C. Data shall be generated at 9600 baud with a word length of 8 bits, one stop bit, and no parity.

C.2 GENERALOUTPUT FORMAT

The 400 Series RS-232 data shall have the following general format:

- **STX - ASCII start-of-text character (02 hex)**
- **t1s - Type 1 output sequences (see following paragraphs for description)**
- **t2s - One or more type 2 output sentences (see following paragraphs for description)**
- **ETX - ASCII end-of-text character (03 hex)**

C.3 OUTPUT SENTENCE TYPE 1

The Type 1 output sentences shall have the following general format:

- **id - item designator (single ASCII alphabetic character)**
- **dddd - item data (1 to 10 printable ASCII characters)**
- **CR - ASCII carriage return character (0D hex)**
- **LF - ASCII line feed character (0A hex)***

Each Type 1 sentence shall be output by the 400 Series unit approximately once every second. The track, desired track, and bearing to waypoint angles, and the magnetic variation are output according to the current mode of the 400 Series unit (automatic magnetic heading, magnetic variation computed at last known position; true heading, magnetic variation E00.0 deg; or user-defined magnetic heading, magnetic variation as entered by user).

The following table describes the Type 1 output sentence item designator (id) and item data (dddd) fields. If data for these sentences is invalid or unavailable, dashes (".") are used to fill in all non-blank character positions.

***The line feed character is not output if the RS-232 port is configured as "Avtn no alt".**

ARTICLE III

EWOS 2520

EWOS 2520

19.999630 MHz OCXO
Oven Controlled Crystal Oscillator

ELECTRICAL CHARACTERISTICS

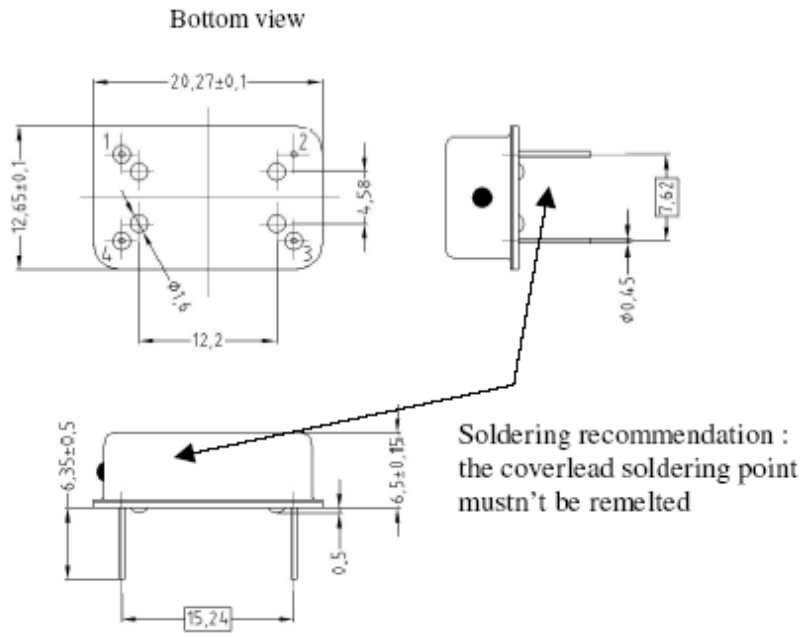
PARAMETER	Unit	Min.	Typ.	Max.	Note	Comments
OUTPUT FREQUENCY	MHz		19.999630			Nominal frequency
FREQUENCY TOLERANCE	ppm		± 2		1	25°C
TEMPERATURE RANGE						
Operating	°C	-40		+55	1	
Storage	°C	-55		+85	3	
SUPPLY VOLTAGE	V		5±5%			
SUPPLY CURRENT						
warm-up	mA			250	3	
Steady state / -40°C	mA		27	32	1	
Steady state / -20°C	mA		22	27	1	
Steady state / +25°C	mA		11	15	1	
Steady state / +55°C	mA		4	7	1	
OUTPUT LEVEL	Vpp	1	1.4		3	Clipped sinewave-DC cut Load 10 KΩ // 10 pF
FREQUENCY STABILITY						
Vs temperature variation	ppm			±0.5	1	-40°C to +55°C
Vs supply voltage variation	ppm			±0.2	3	5 V ± 5 %
Short term : - tau = 0.1 sec.			2^{E}-10	5^{E}-10	3	Allan variance
Medium term : - slope	/ min.			±1.10⁹	1	
- sigma				3.10⁹	1	
Aging (5 years)	ppm			±4.5	2	Over full temperature range
PHASE NOISE						
Offset from carrier :						
100 Hz	dBc/Hz			-120	3	

Notes : 1 . Parameter inspected at 100 %.
2 . Parameter guaranteed by periodical qualification.
3 . Parameter guaranteed by design and characterisation.

PACKAGE OUTLINE

Packing unit : 100 pieces in tray.

Marking : TES
EWOS 2520
19.999630 MHz
Date code
Serial number
Location of Pin 1



Pin nb	Function
1	DO NOT CONNECT
2	GROUND
3	RF OUT
4	POWER SUPPLY

RELIABILITY TEST

ITEM	TEST	REFERENCE
Vibrations	**10 to 2000 HZ** **0.75 mm until 10 G and then level** **90 mn per axe** **V=1oct/mn** **10 cycles per axe** **Vibrations following 3 directions**	NF EN 60068-2-6
Shocks	**500G during 4 ms in the 6 directions**	RTCA/DO-183
Crashworthiness	**100G / 23ms in the 6 directions**	RTCA/DO-183
Temperature cycling	**Thermal shocks** **Nb of cycles = 25** **Temperature = -55/+85°C** **Stabilisation = 30mn.**	NF EN 60068-2-14
Life test	1000 hours	—
Warm storage aging	1000 hours	—

Nota : If some tests already been made on similar products (on which this OCXO can be associated), they will not be made another time.

ARTICLE IV

PACT AK451

ABSTRACT:

Objective of this document is to provide data for protection against continuous transmission and repetitive selftest mode transmissions on transmitter board c000260 as required in the CS T.007 issue4 chapter 5 j i and iii

APPLICATION DOMAIN:

For product Ameriking 406Mhz ELT transmitter.

APPLICABLE DOCUMENT:

Cospas sarsat C/S T007 Issue4 november 2005

APPROBATION:

	Name	Function	Date & Visa
Writing by			
Approved by			
Approved by			

REVISION HISTORY:

Revision	Date	Updated By	Comments

2 TRANSMITTER OVERVIEW

2.1 Presentation

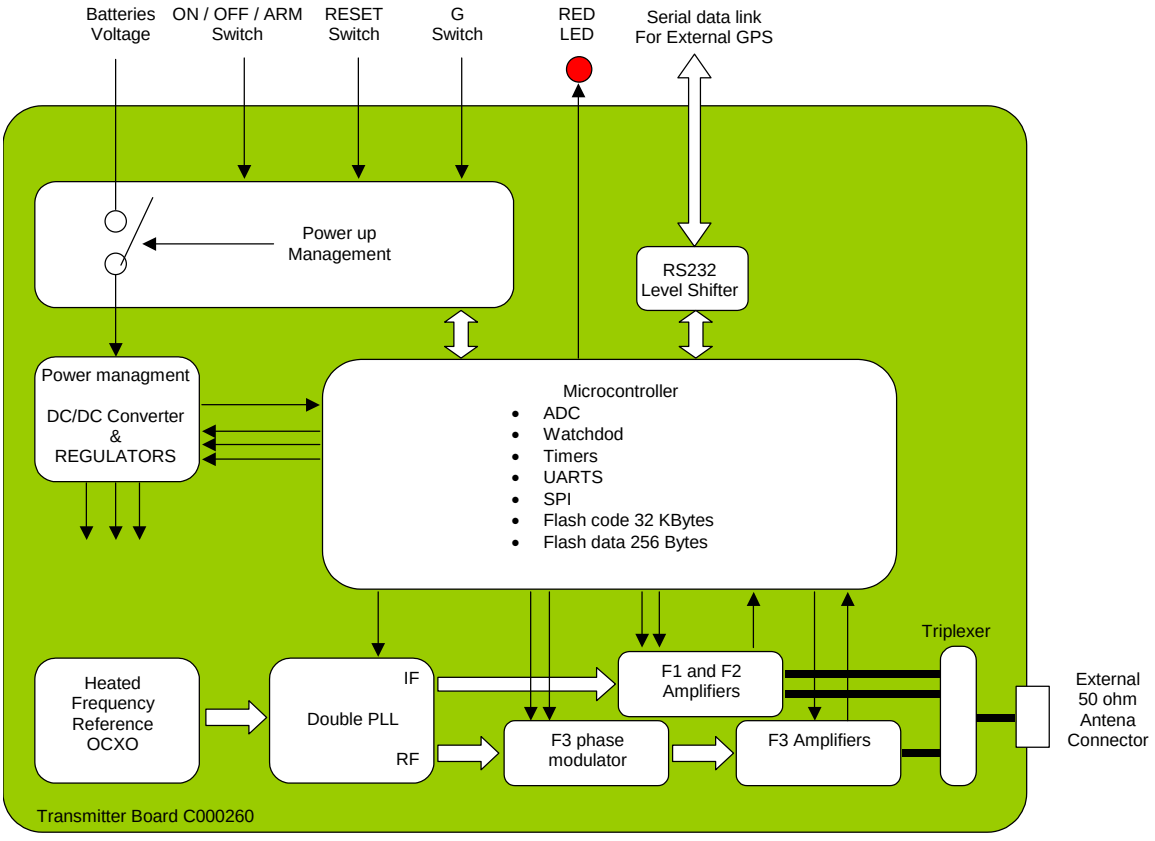
The transmitter board is made up of:

A power up management part that power the rest of the board if external conditions are present.

A power management part that generates different internal voltages,

A transmission part composed of:

- an OCXO referenced EWOS2520 that generates a frequency of 19.999630 MHz,
- a double PLL that generates F2 and F3 frequency, F2 is divided by 2 to generate F1,
- F1 amplifier stage at 121.5MHz
- F2 amplifier stage at 243 MHz
- F3 Phase modulator
- F3 amplifier stage at 406.028MHz
- A triplexer



1.2 Description for protection from repetitive selftest mode transmissions

For a selftest, the main switch of the beacon shall be put in “ARM” position by the operator :

- Internal power switch is enabled.
- the beacon generates a single selftest.
- Internal power switch is disabled although the switch is in “ARM” position.

For a new selftest, the main switch of the beacon shall be put in “OFF”, then in “ARM” position by the operator .

1.3 Description for protection against continuous transmission.

The 406MHz frequency synthesizer (PLL) is programmed and activated by the microcontoller.

The F3 amplifier is powered by :

- A 7.3V LDO regulator for the power amplifier with an enable command.
- A 5V LDO regulator for the 406MHz VCO with an enable command.
- A 5V LDO regulator for the pre-amplifier with an enable command.

A power detector on the output provides a DC level to the microcontroller.

The protection is active at two levels ; hardware and software :

Hardware protection are :

- A one second watchdog is used to prevent software levels failure.

Software protection is :

- When no 406MHz transmission is required, the microcontroller deactivates the 406MHz PLL and the three LDO regulators.
- After each transmission, the microcontroller deactivates the 406MHz PLL and the three LDO regulators and verifies the DC level of the detector.

in case of DC level detection, the microcontroller stops transmissions immediately, the internal power switch is disabled.

No 406MHz transmission superior to 1 second can be generated .

ARTICLE V

DATA FOR LONG TERM

ABSTRACT :
This document contains data for long term frequency stability on AmeriKing ELT transmitter reference TES C000260 as required in the CS T.007 issue4 chapter 5 j ii

APPLICATION DOMAIN:
For product Ameriking ELT transmitter.

APPROBATION:

	Name	Function	Date & Visa
Writing by	A.CLEMENT	Project leader	February,9th,2007
Approved by	J. CERISIER	AQ Manager	February,9th,2007
Approved by			

REVISION HISTORY:

Revision	Date	Updated By	Comments
00	21/06/06 16:42	Alain Clement	creation
01	08/02/07 17:35	Alain Clement	EWOS2520 and 2523 specifications update
02	09/02/07 08:56	Alain Clement	Files A6,A7,A9,A10.pdf in annex documents

TABLE OF CONTENTS:

1 INTRODUCTION

1.1 Document overview

Objective of this document is to provide data for long term stability concerning the transmitter included in the Ameri-King ELT..

1.2 Applicable documents

1.2.1 International normalization

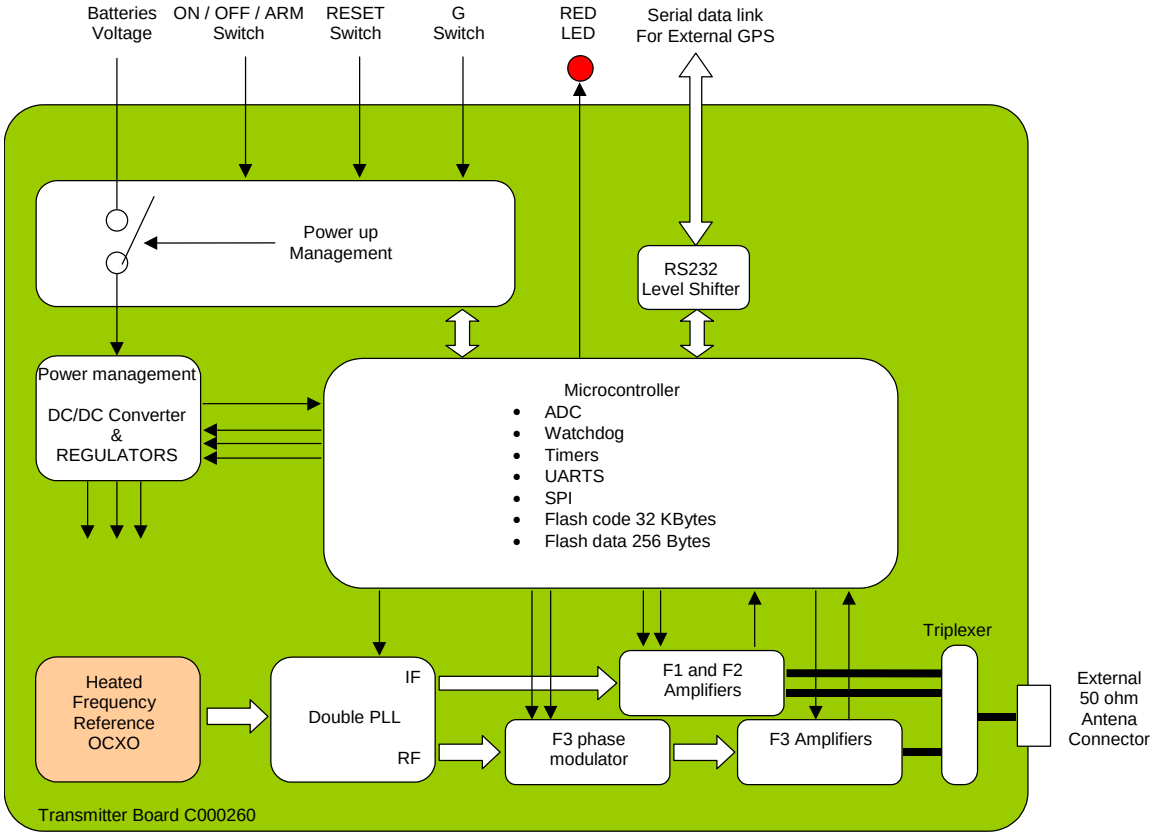
Cospas sarsat C/S T001 Issue3 rev7 november 2005

2 TRANSMITTER OVERVIEW

2.1 Presentation

The transmitter board is made up of:
A power up management part that power the rest of the board if external conditions are present.
A power management part that generates different internal voltages,
A transmission part composed of:

- an OCXO referenced EWOS2520 that generates a frequency of 19.999630 MHz,
- a double PLL that generates F2 and F3 frequency, F2 is divided by 2 to generate F1,
- F1 amplifier stage at 121.5MHz
- F2 amplifier stage at 243 MHz
- F3 Phase modulator
- F3 amplifier stage at 406.028MHz
- A triplexer



3 LONG TERM RESULTS.

The long term calculation were done on EWOS2523, this EWOS is the same structure as the EWOS2520. The only difference between the two oscillators is a value of a capacitor used for shitfing the frequency at the nominal value.

The EWOS_2523 is tuned at 20MHz (see Annex) .
The EWOS_2520 is tuned at 19.99630MHz in order to center the 406MHz at 406.028MHz

3.1 Data results

Four oscillators have been measured during 261 days, the results are

Electrical test	Spec. max	Spec. Min	Serial Number	EWOS02523 results		5 years Extrapolation
Long term aging	-7 E-6	+2 E-6		Aging (days)	Slope/month	Aging (5 years)
DF/F On specific OCXOs placed in a long term stability			A6	261	-3.149^{E-08}	-1.89^{E-06}
			A7	261	-4.453^{E-08}	-2.67^{E-06}
			A9	261	-2.651^{E-08}	-1.59^{E-06}
			A10	261	-6.588^{E-08}	-3.96^{E-06}

3.2 Graphs

A6

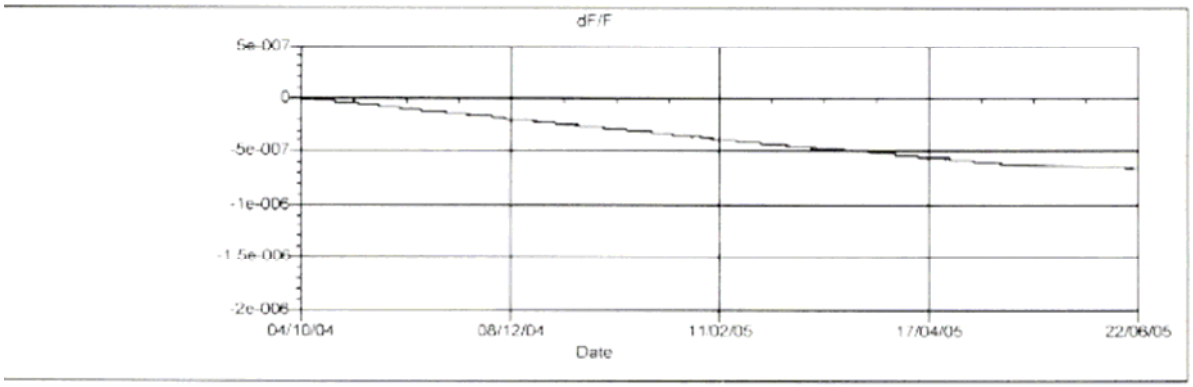
See document A6.pdf .

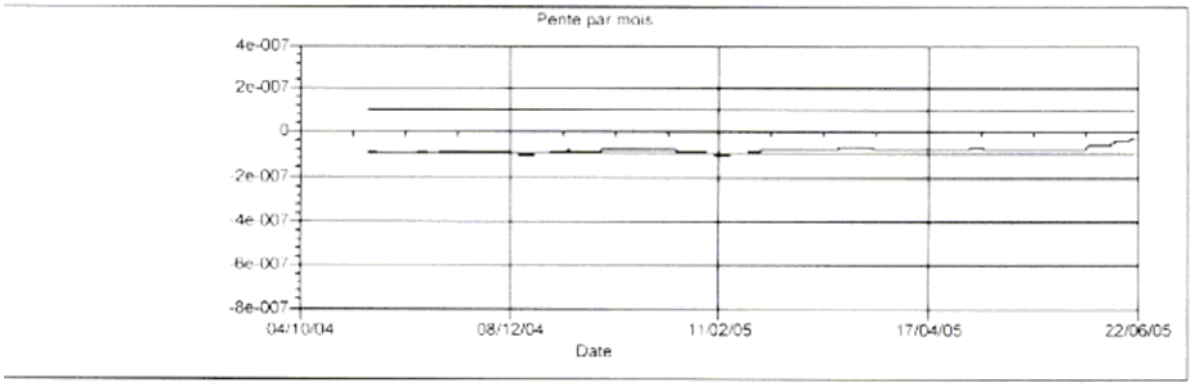
TES
Electronic Solutions

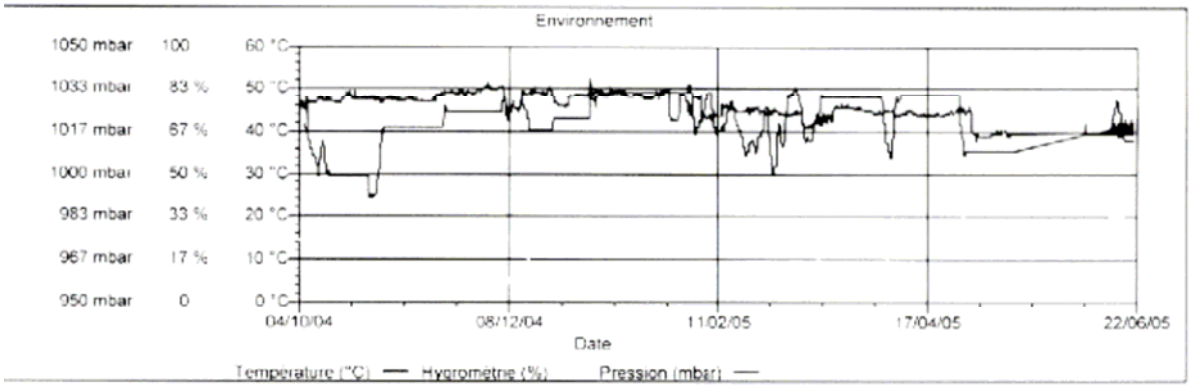
Référence	Lot/Série	Libellé	Tiroir
20 MHz Freq Nominale: 20.000000 Mhz	/ A6	qualif LP	2 / 16 positions 5 V. temp LM 35

Voie RF	Emplacement	Diagnostic
2	1	???

Mesure	Début	Fin	Freq Référence	dF/F	Pente
Vieillissement	04/10/2004	04/10/2006	19.99998991 MHz	-6.46628e-007 OK	-3.14839e-008 OK







A7

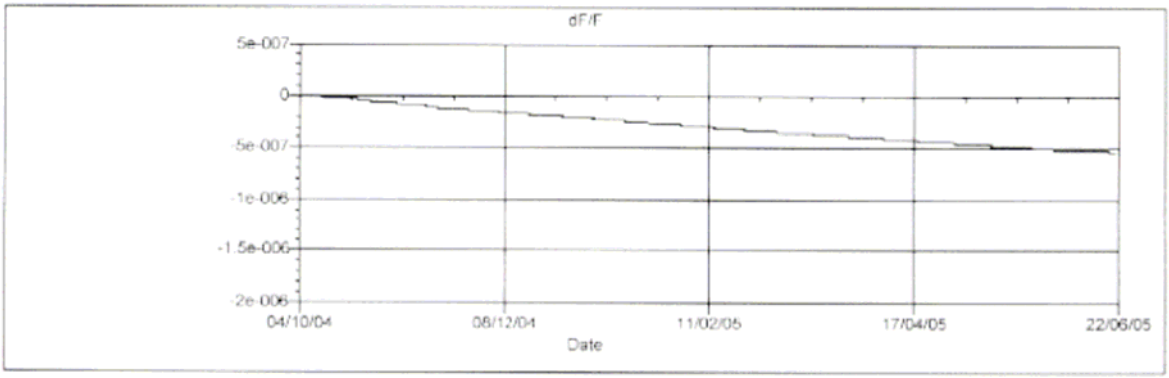
See document A7.pdf .

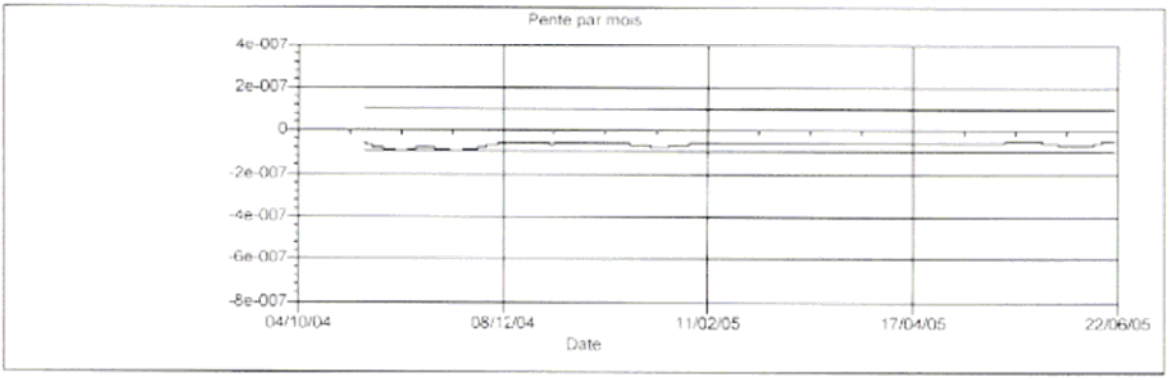
TES
Electronic Solutions

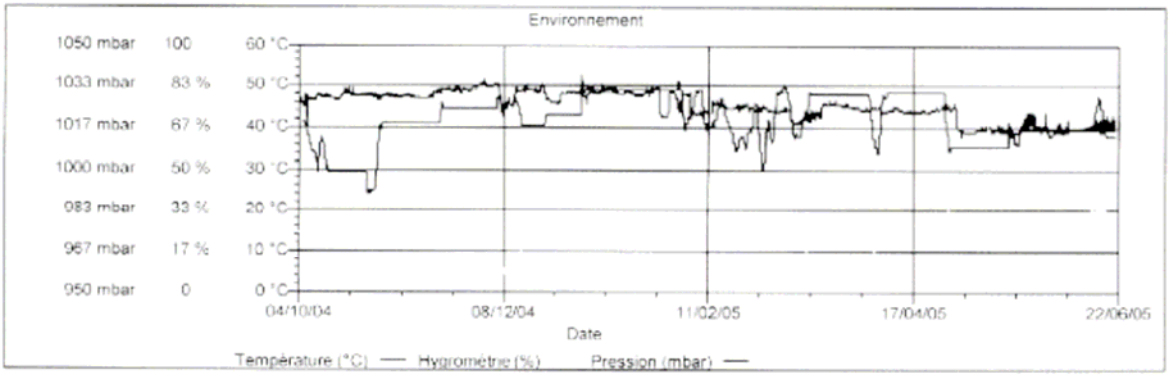
Référence	Lot/Série	Libellé	Tiroir
20 MHz Freq Nominale 20.000000 Mhz	/ A7	qualif LP	2 / 16 positions, 5 V, temp LM 35

Voie RF	Emplacement	Diagnostic
2	3	???

Mesure	Début	Fin	Freq Référence	dF/F	Pente
Vieillissement	04/10/2004	04/10/2006	19.99998675 MHz	-5.28111e-007 OK	-4.45264e-008 OK







A9

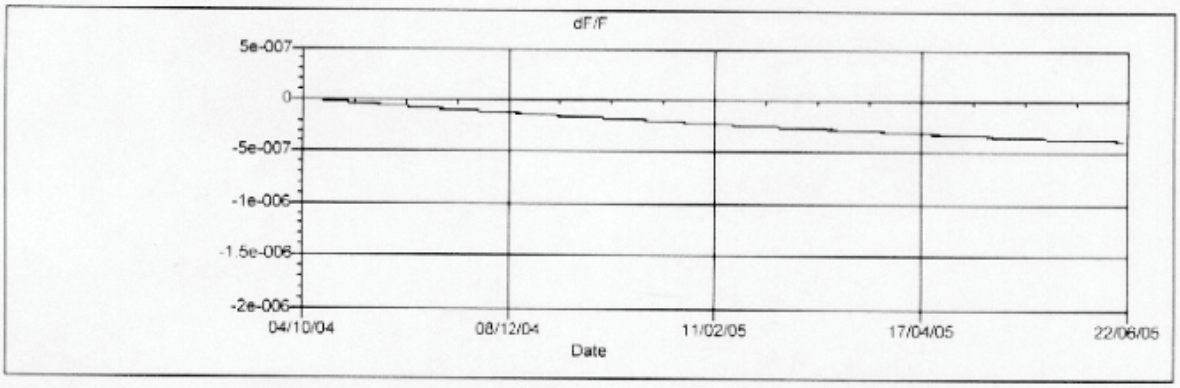
See document A9.pdf .

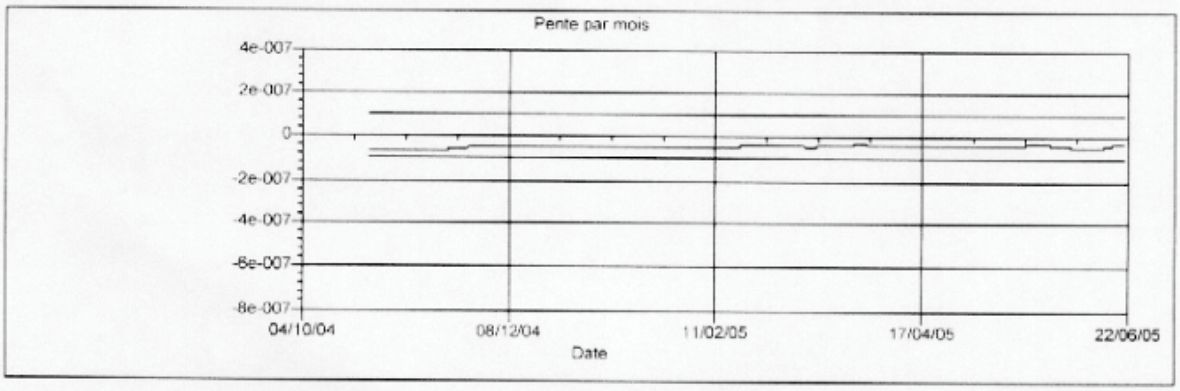
TES
Electronic Solutions

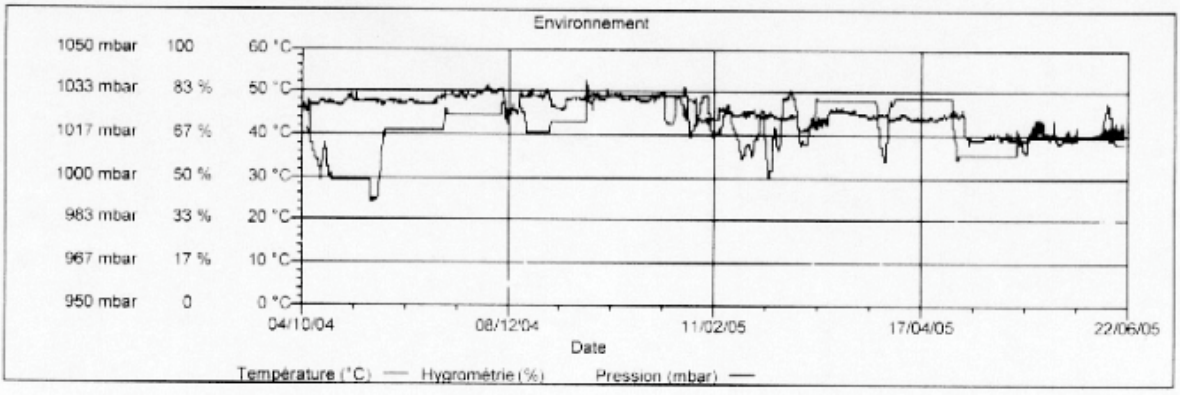
Référence	Lot/Série	Libellé	Tiroir
20 MHz Freq Nominale: 20.000000 Mhz	/ A9	qualif. LP	2 / 16 positions, 5 V, temp LM 35

Voie RF	Emplacement	Diagnostic	
2	14	???	

Mesure	Début	Fin	Freq Référence	dF/F	Pente
Vieillissement	04/10/2004	04/10/2006	20.00001491 MHz	-3.82121e-007 OK	-2.65093e-008 OK







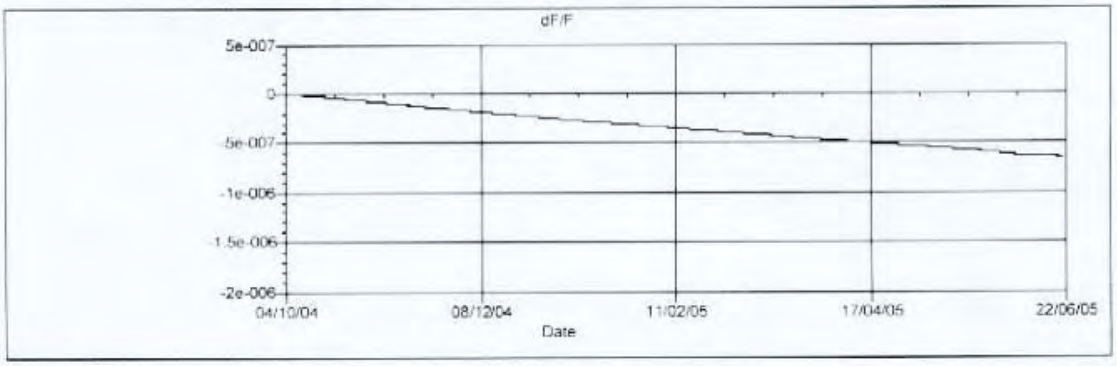
A10

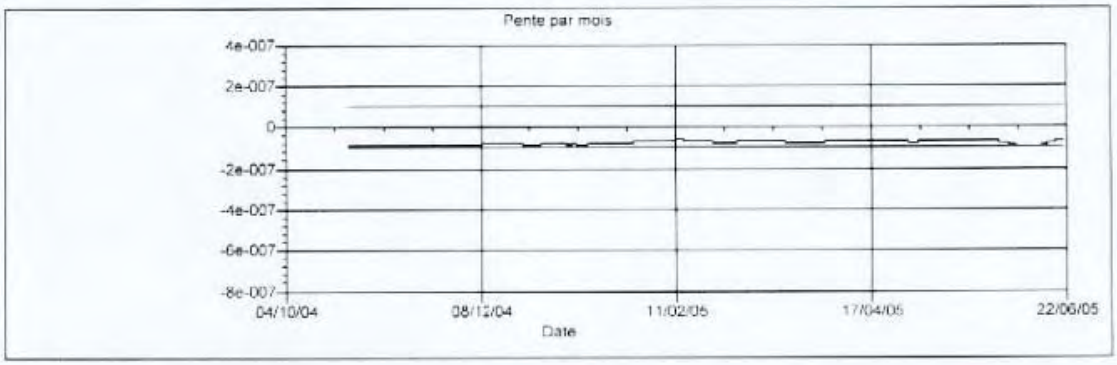
See document A10.pdf .

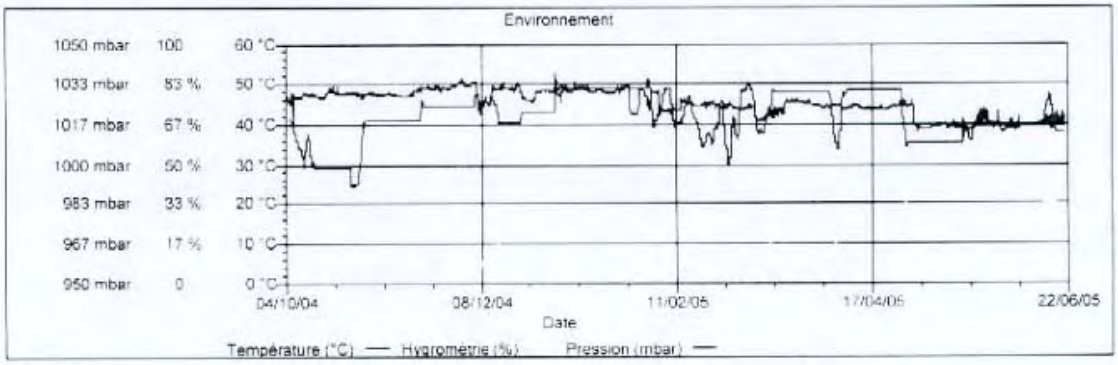
TES
Electronic Solutions

Référence	Lot/Série	Libellé	Tiroir
20 MHz Freq Nominale 20.000000 Mhz	/ A10	qualif LP	2 / 16 positions, 5 V, temp LM 35
Voie RF	**Emplacement**	**Diagnostic**	
2	15	???	

Mesure	Début	Fin	Freq Référence	dF/F	Pente
Vieillissement	04/10/2004	04/10/2006	20.00000126 MHz	-6.52153e-007 OK	-6.58706e-008 OK







4 CONCLUSION

The C/S requirement is 406.028MHz (-5KHz / +2 KHz) in 5 years.
Its corresponds to a DF/F : (-12.3^{E-06} ; $+4.92^{E-06}$)

The extrapolation on 5 years gives -3.96^{E-06} in the worst case that it is compliant with specifications.

5 ANNEX

See EWOS 2523 and EWOS 2520 specifications in annex documents EWOS_2523_A.pdf and EWOS 2520_A.pdf

TES Electronic Solutions

EWOS 2523

20 MHz OCXO

Oven Controlled Crystal Oscillator

ELECTRICAL CHARACTERISTICS

PARAMETER	Unit	Min.	Typ.	Max.	Note	Comments
OUTPUT FREQUENCY	MHz		20			Nominal frequency
FREQUENCY TOLERANCE	ppm		± 2		1	25°C
TEMPERATURE RANGE						
Operating	°C	-40		+55	1	
Storage	°C	-55		+85	3	
SUPPLY VOLTAGE	V		5±5%			
SUPPLY CURRENT						
warm-up	mA			250	3	
Steady state / -40°C	mA		27	32	1	
Steady state / -20°C	mA		22	27	1	
Steady state / +25°C	mA		11	15	1	
Steady state / +55°C	mA		4	7	1	
OUTPUT LEVEL	Vpp	1	1.4		3	Clipped sinewave-DC cut Load 10 KΩ // 10 pF
FREQUENCY STABILITY						
Vs temperature variation	ppm			±0.5	1	-40°C to +55°C
Vs supply voltage variation	ppm			±0.2	3	5 V ± 5 %
Short term : - tau = 0.1 sec.			2^E-10	5^E-10	3	Allan variance
Medium term : - slope	/ min.			±1.10⁹	1	
- sigma				3.10⁹	1	
Aging (5 years)	ppm			+2 / -7	2	Over full temperature range
PHASE NOISE						
Offset from carrier : 100 Hz	dBc/Hz			-120	3	

Notes :
1 . Parameter inspected at 100 %.
2 . Parameter guaranteed by periodical qualification.
3 . Parameter guaranteed by design and characterisation.

A	8/02/2007	J.M. TAROT	Mise à jour spécification en vieillissement		
.	31/05/2005	J.M. TAROT			
Rip : GR	Date :	Visa :	Qualité : JC	Date :	Visa :

TES Electronic Solutions

FICHE TECHNIQUE

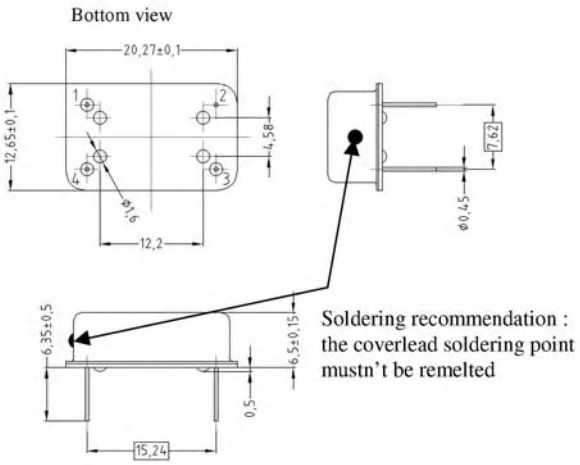
EWOS 2523

FT004Q420 | Page 1/2

PACKAGE OUTLINE

Packing unit : 100 pieces in tray.

Marking : TES
EWOS 2523
20 MHz
Date code
Serial number
Location of Pin 1



Pin nb	Function
1	DO NOT CONNECT
2	GROUND
3	RF OUT
4	POWER SUPPLY

RELIABILITY TEST

ITEM	TEST	REFERENCE
Vibrations	**10 to 2000 HZ** **0.75 mm until 10 G and then level** **90 mn per axe** **V=1oct/mn** **10 cycles per axe** **Vibrations following 3 directions**	NF EN 60068-2-6
Shocks	**500G during 4 ms in the 6 directions**	RTCA/DO-183
Crashworthiness	**100G / 23ms in the 6 directions**	RTCA/DO-183
Temperature cycling	**Thermal shocks** **Nb of cycles = 25** **Temperature = -55/+85°C** **Stabilisation = 30mn.**	NF EN 60068-2-14
Life test	1000 hours	—
Warm storage aging	1000 hours	—

Nota : If some tests already been made on similar products (on which this OCXO can be associated), they will not be made another time.

INDICE	DATE	AUTEUR	MODIFICATIONS		
Rip : GR	Date :	Visa :	Qualité : JC	Date :	Visa :
	TES Electronic Solutions		FICHE TECHNIQUE **EWOS 2523**		
			FT004Q420		Page 2/2

TES Electronic Solutions

EWOS 2520

19.999630 MHz OCXO

Oven Controlled Crystal Oscillator

ELECTRICAL CHARACTERISTICS

PARAMETER	Unit	Min.	Typ.	Max.	Note	Comments
OUTPUT FREQUENCY	MHz		19.999630			Nominal frequency
FREQUENCY TOLERANCE	ppm		± 2		1	25°C
TEMPERATURE RANGE						
Operating	°C	-40		+55	1	
Storage	°C	-55		+85	3	
SUPPLY VOLTAGE	V		5±5%			
SUPPLY CURRENT						
warm-up	mA			250	3	
Steady state / -40°C	mA		27	32	1	
Steady state / -20°C	mA		22	27	1	
Steady state / +25°C	mA		11	15	1	
Steady state / +55°C	mA		4	7	1	
OUTPUT LEVEL	Vpp	1	1.4		3	Clipped sinewave-DC cut Load 10 KΩ // 10 pF
FREQUENCY STABILITY						
Vs temperature variation	ppm			±0.5	1	-40°C to +55°C
Vs supply voltage variation	ppm			±0.2	3	5 V ± 5 %
Short term : - tau = 0.1 sec.			2^{E}-10	5^{E}-10	3	Allan variance
Medium term : - slope	/ min.			$\pm 1.10^{9}$	1	
- sigma				3.10^{9}	1	
Aging (5 years)	ppm			+2 / -7	2	Over full temperature range
PHASE NOISE						
Offset from carrier :						
100 Hz	dBc/Hz			-120	3	

Notes :
1. Parameter inspected at 100 %.
2. Parameter guaranteed by periodical qualification.
3. Parameter guaranteed by design and characterisation.

A	8/02/2007	J.M. TAROT	Mise à jour spécification en vieillissement		
.	21/02/2006	J.M. TAROT	Création		
INDICE	DATE	AUTEUR	MODIFICATIONS		
Rip : GR	Date :	Visa :	Qualité : JC	Date :	Visa :

TES Electronic Solutions

FICHE TECHNIQUE

EWOS 2520

FT004Q450/A — Page 1/2

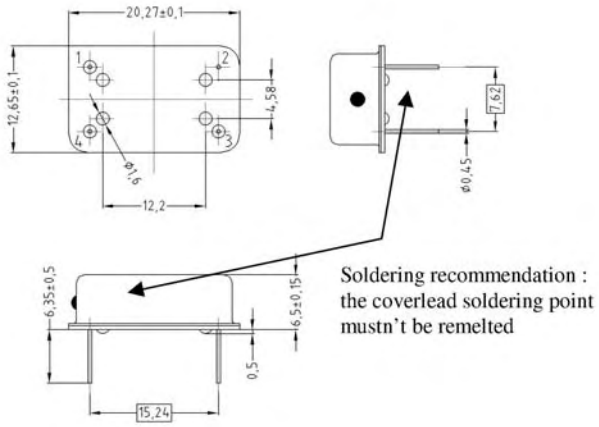
PACKAGE OUTLINE

Packing unit : 100 pieces in tray.

Marking :

TES
EWOS 2520
19.999630 MHz
Date code
Serial number
Location of Pin 1

Bottom view



Pin nb	Function
1	DO NOT CONNECT
2	GROUND
3	RF OUT
4	POWER SUPPLY

RELIABILITY TEST

ITEM	TEST	REFERENCE
Vibrations	**10 to 2000 HZ** **0.75 mm until 10 G and then level** **90 mn per axe** **V=1oct/mn** **10 cycles per axe** **Vibrations following 3 directions**	NF EN 60068-2-6
Shocks	**500G during 4 ms in the 6 directions**	RTCA/DO-183
Crashworthiness	**100G / 23ms in the 6 directions**	RTCA/DO-183
Temperature cycling	**Thermal shocks** **Nb of cycles = 25** **Temperature = -55/+85°C** **Stabilisation = 30mn.**	NF EN 60068-2-14
Life test	1000 hours	—
Warm storage aging	1000 hours	—

Nota : If some tests already been made on similar products (on which this OCXO can be associated), they will not be made another time.

A	8/02/2007	J.M. TAROT	Mise à jour spécification en vieillissement		
.	21/02/2006	J.M. TAROT	Création		
INDICE	DATE	AUTEUR	MODIFICATIONS		
Rip : GR	Date :	Visa :	Qualité : JC	Date :	Visa :
TES Electronic Solutions			FICHE TECHNIQUE **EWOS 2520**		
			FT004Q450/A		Page 2/2

ARTICLE VI

C000260 BOARD OUT

ABSTRACT:

This document contains data for output impedance of the board c000260

APPLICATION DOMAIN:

For product Ameriking ELT transmitter.

APPROBATION:

	Name	Function	Date & Visa
Writing by			
Approved by			
Approved by			

REVISION HISTORY:

Revision	Date	Updated By	Comments

TABLE OF CONTENTS:

1 INTRODUCTION

1.1 Document overview

Objective of this document is to provide data for the output impedance of the transmitter board c000260 as required in the CS T.007 issue4 chapter 5 k

1.2 Applicable documents

1.2.1 International normalization

Cospas sarsat C/S T007 Issue4 november 2005

2 TRANSMITTER OVERVIEW

2.1 Presentation

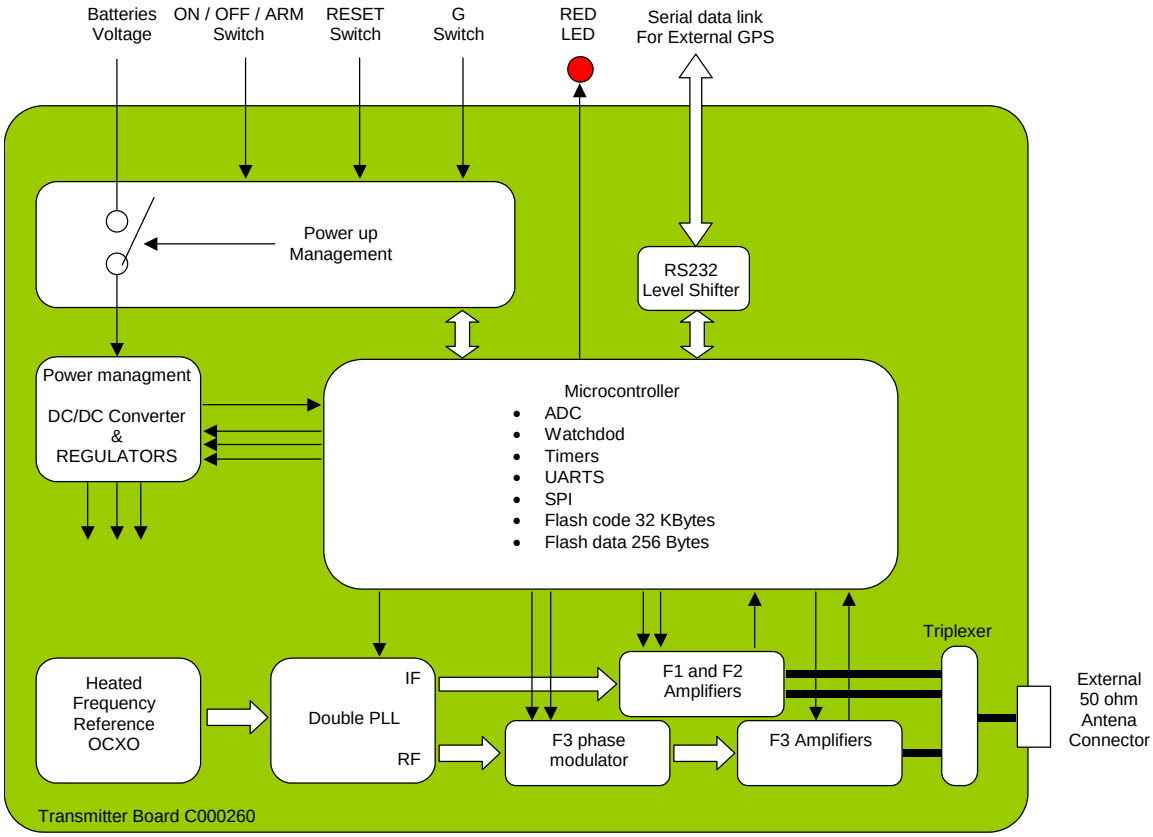
The transmitter board is made up of:

A power up management part that power the rest of the board if external conditions are present.

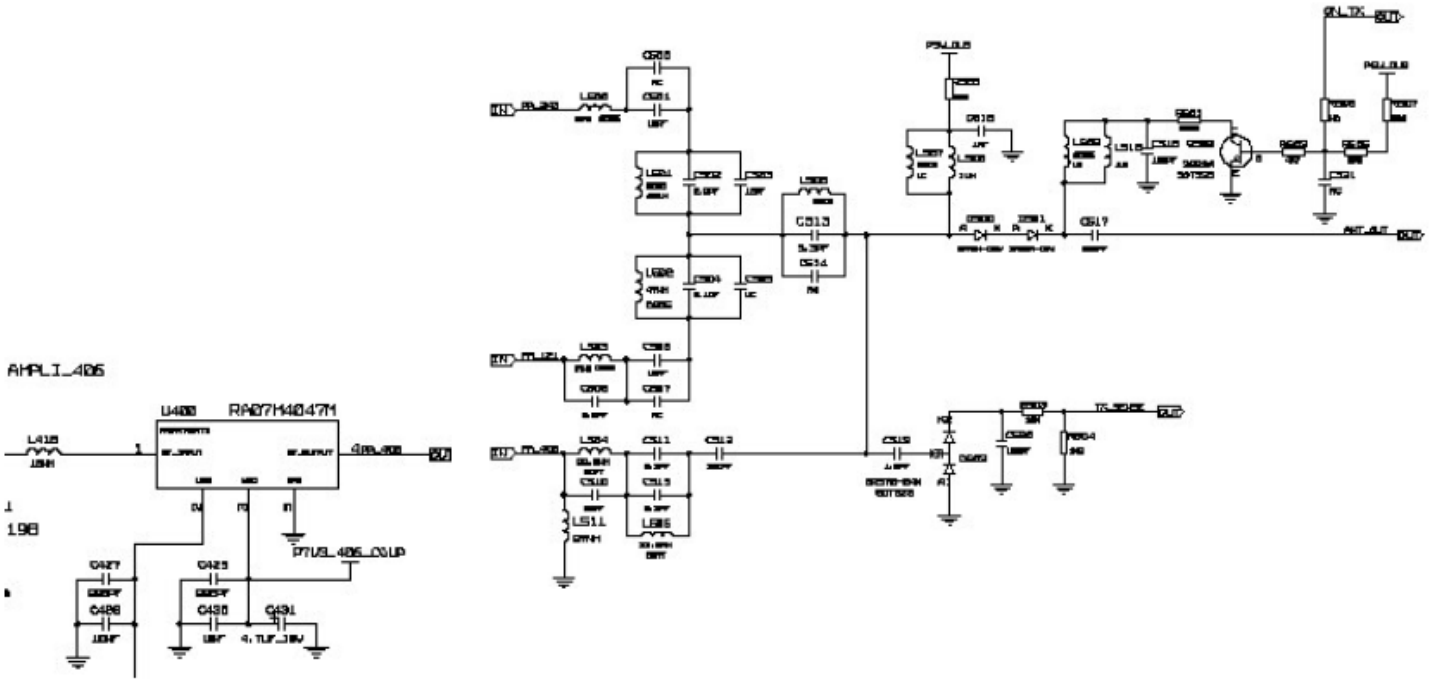
A power management part that generates different internal voltages,

A transmission part composed of:

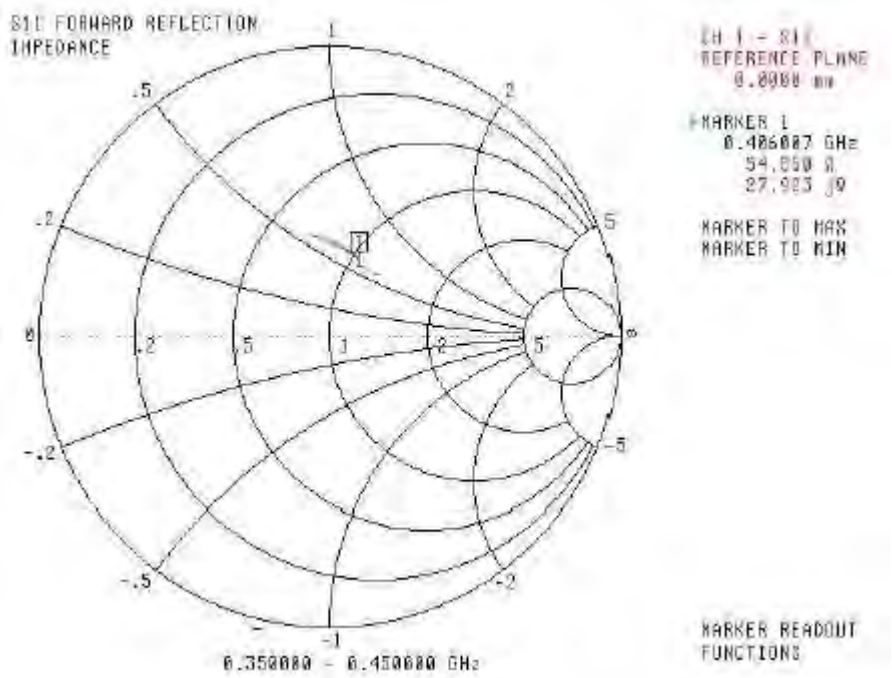
- an OCXO referenced EWOS2520 that generates a frequency of 19.999630 MHz,
- a double PLL that generates F2 and F3 frequency, F2 is divided by 2 to generate F1,
- F1 amplifier stage at 121.5MHz
- F2 amplifier stage at 243 MHz
- F3 Phase modulator
- F3 amplifier stage at 406.028MHz
- A triplexer



3.1 Schematic



3.2 Measurements

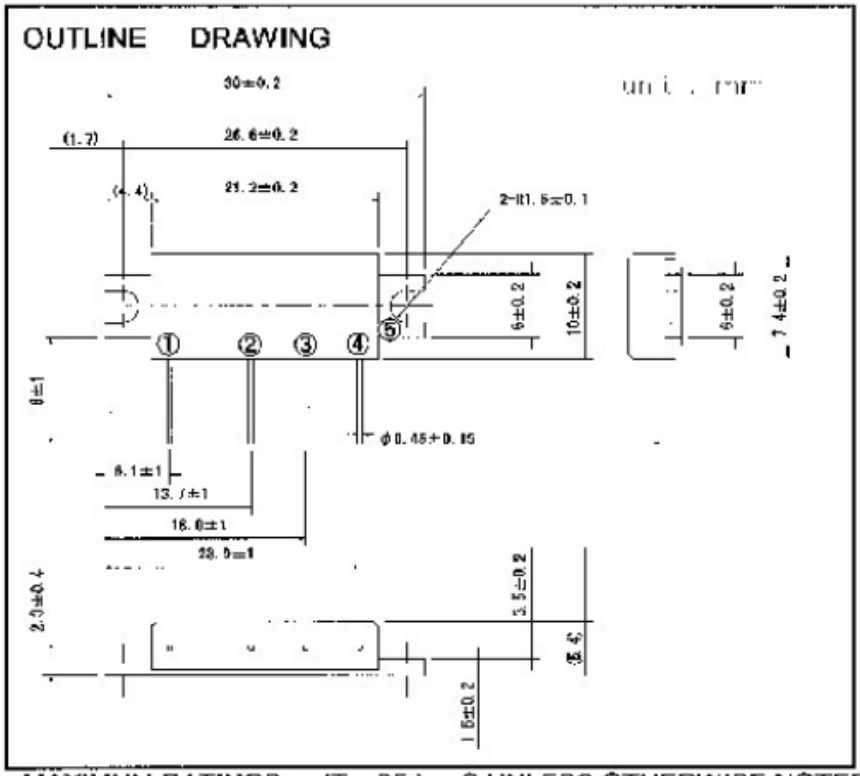


MITSUBISHI RF POWER MODULE

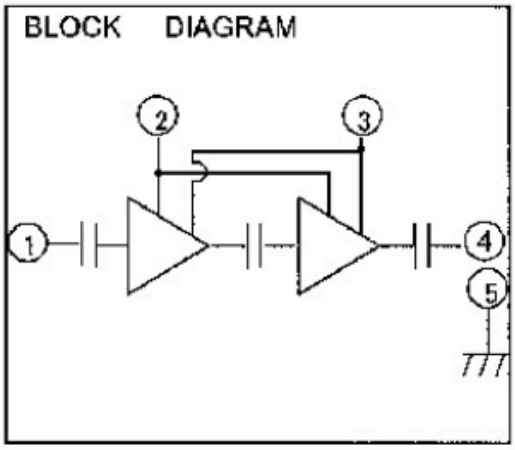
RA07M4047M

Silicon MOS FET Power Amplifier, 400-470MHz 7W PORTABLE RADIO

OUTLINE DRAWING



BLOCK DIAGRAM



PIN:

1 Pin :RF INPUT
2 VGG:GATE BIAS SUPPLY
3 VDD:DRAIN BIAS SUPPLY
4 Po :RF OUTPUT
5 GND:FIN

MAXIMUM RATINGS (Tc=25deg.C UNLESS OTHERWISE NOTED)

SYMBOL	PARAMETER	CONDITIONS	RATINGS	UNIT
V_{DD}	SUPPLY VOLTAGE	V_{GG}<3.5V,Zg=Zl=50ohm	9.2	V
V_{GG}	GATE BIAS VOLTAGE	V_{DD}<7.2V,Pin=0mW,Zg=Zl=50ohm	4	V
Pin	INPUT POWER	f=400-470MHz,Zg=Zl=50ohm	70	mW
Po	OUTPUT POWER	f=400-470MHz,Zg=Zl=50ohm	10	W
$T_{C(OP)}$	OPERATION CASE TEMPERATURE	f=400-470MHz,Zg=Zl=50ohm	-30 to +110	deg.C
Tstg	STORAGE TEMPERATURE		-40 to +110	deg.C

Note:Above parameters are guaranteed independently.

ELECTRICAL CHARACTERISTICS (Tc=25deg.C,Zg=Zl=50ohm UNLESS OTHERWISE NOTED)

SYMBOL	PARAMETER	CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
f	FREQUENCY RANGE		400		470	MHz
Po	OUTPUT POWER	Vdd=7.2V, Vgg=3.5V, Pin=50mW	7			W
Et	TOTAL EFFICIENCY	Po=6.5W, Vdd=7.2V, Pin=50mW, Vgg=adjust	40			%
2fo	2nd HARMONIC				-25	dBc
VSWR in	INPUT VSWR				4	-
	Stability	Zg=50ohm, Vdd=4.0 - 9.2V, LOAD VSWR = 4:1, Pin=25 – 70mW, Po<8W(Vgg Control)	No parasitic oscillation			
	LOAD VSWR TOLERANCE	Vdd=9.2V, Pin=50mW, Po=7.0W(Vgg Control), Zg=50ohm, LOAD VSWR = 20:1	No degradation or destroy			-

ABOVE PARAMETERS, RATINGS, LIMITS AND CONDITIONS ARE SUBJECT TO CHANGE .

ARTICLE VII

TYPE APPROVAL CERTIFICATE SAMPLE

TYPE APPROVAL CERTIFICATE

For a 406 Megahertz Distress Beacon for use with the Cospas-Sarsat Satellite System

Certificate Number: …xxx

Manufacturer:	**Ameri-King Corporation**, Huntington Beach, CA , USA
Beacon Type(s):	**ELT / PLB**
Beacon Model(s):	**AK-451**
Test Laboratory:	Intespace, Toulouse, France
Date of Test:	July 2006

Details of the beacon features and battery type are provided overleaf.

The Cospas-Sarsat Council hereby certifies that the 406 MHz Distress Beacon Model identified above is compatible with the Cospas-Sarsat System as defined in documents:

C/S T.001 Specification for Cospas-Sarsat 406 MHz Distress Beacon
Issue 3 – Rev. 7, November 2005

C/S T.007 Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard
Issue 4 - Rev. O , November 2005

Date Originally Issued: 10 July 2006
Date(s) Amended:

_____
D. Levesque
Head of Cospas-Sarsat Secretariat

NOTE, HOWEVER:

1. This certificate does not authorize the operation or sale of any 406 MHz distress beacon. Such authorization may require type acceptance by national administrations in countries where the beacon will be distributed, and may also be subject to national licensing requirements.

2. This certificate is intended only as a formal notification to the above identified manufacturer that the Cospas-Sarsat Council has determined, on the basis of test data of a beacon submitted by the manufacturer, that 406 MHz distress beacons of the type identified herein meet the standards for use with the Cospas-Sarsat System.

3. Although the manufacturer has formally stated that all beacons identified with the above model name(s) will meet the Cospas-Sarsat specification referenced above, this certificate is not a warranty and Cospas-Sarsat hereby expressly disclaims any and all liability arising out of or in connection with the issuance, use or misuse of the certificate.

4. This certificate is subject to revocation by the Cospas-Sarsat Council should the beacon type for which it is issued cease to meet the Cospas-Sarsat specification. A new certificate may be issued after satisfactory corrective action has been taken and correct performance demonstrated in accordance with the Cospas-Sarsat Type Approval Standard.

5. Cospas-Sarsat type approval testing requirements only address the electrical performance of the beacon at 406 MHz. Conformance of the beacon to operational and environmental requirements is the responsibility of national administrations.

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

Battery Details: **450 0010-1 UltraLife U 10014, Li Mn O2(4** D-cells)
450 0010-2 Saft LO 26 SXC, Li SO2 (4 D-cells)
450 0010-3 Saft LM 33600, Li Mn O2 (4 D-cells)

Operating Lifetime: **50** hours

Transmit Frequency: 406.028 MHz

Beacon Model Features:
- 121.5 MHz auxiliary radio locating device (50 mW, continuous)
- Automatic activation mechanism
- External navigation device (GPS): manufacturers: Garmin, Honeywell, Trimble etc.
- Self-test mode: one burst of 520 ms

Approved Beacon Message Protocols: Beacon is approved for use with the beacon message protocols blackened below:

USER PROTOCOLS	USER-LOCATION PROTOCOLS	LOCATION PROTOCOLS
▪ Maritime with MMSI	▪ Standard Location:	▪ EPIRB with MMSI
▪ Maritime with Radio Call Sign	▪ Maritime with Radio Call Sign	▪ Standard Location: EPIRB with Serial Number
▪ EPIRB Float Free with Serial Number	▪ EPIRB Float Free with Serial Number	❑ Standard Location: ELT with 24-bit Address
▪ EPIRB Non Float Free with Serial	▪ Number EPIRB Non Float Free with Serial	❑ Number Standard Location: ELT with Aircraft Operator Designator
▪ Radio Call Sign	▪ Radio Call Sign	❑ Standard Location: ELT with Serial Number
❑ Aviation	❑ Aviation	❑ Standard Location: PLB with Serial Number
❑ ELT with Serial Number	❑ ELT with Serial Number	▪ National Location: EPIRB
❑ ELT with Aircraft Operator and Serial Number	❑ ELT with Aircraft Operator and Serial Number	❑ National Location: ELT
❑ ELT with Aircraft 24-bit Address	❑ ELT with Aircraft 24-bit Address	❑ National Location: PLB
❑ PLB with Serial Number	❑ PLB with Serial Number	
❑ National (Short Format Message)		
❑ National (Long Format Message)		

ARTICLE VIII

BEACON LABEL

NAMEPLATE DRAWING

BEACON LABEL
NAME PLATE DRAWING

AMERI-KING CORP. MADE IN U.S.A.
California, U.S.A.

EMERGENCY LOCATOR TRANSMITTER

Model AK-451-( ) Series, Type: □AF □AP □S
FAA TSO C-126/91a approved JTS0-2C126 approved
FCC approved
RTCA DO-160d Environmental Categories
F1XBA[204/183][204/13]XR[204/183]XXSXXXXA[204/183]BXXXX
FREQ: 121.5 / 243.0 / 406.028 MHz
PERP. 50mW for 50HRS (121.5 & 243.0MHz)
EIRP: 100mW for 48 HRS (121.5 & 243.0 MHz)
PERP. 5W EIRP: 6dBW for 24 HRS (406.028 MHz)
Software Version A
Serial No.:

15 DIGIT HEX ID:
COUNTRY(THREE DIGIT CODE):

AMERI-KING CORP. MADE IN U.S.A.
California, U.S.A.

PLB PERSONAL LOCATOR BEACON

Model AK-451-( ) Series, Type: □ PLB

FCC approved

FREQ: 121.5 / 243.0 / 406.028 MHz
PERP. 50mW for 50HRS (121.5 & 243.0MHz)
EIRP: 100mW for 48 HRS (121.5 & 243.0 MHz)
PERP. 5W EIRP: 6dBW for 24 HRS (406.028 MHz)
Software Version A
Serial No.:

15 DIGIT HEX ID:
COUNTRY(THREE DIGIT CODE):

ARTICLE IX

BATTERY DATA

3 Volt, D-Size Cell

System: Lithium-Manganese Dioxide Non-Rechargeable

Part No: U10013

Product Drawings

Product Charts

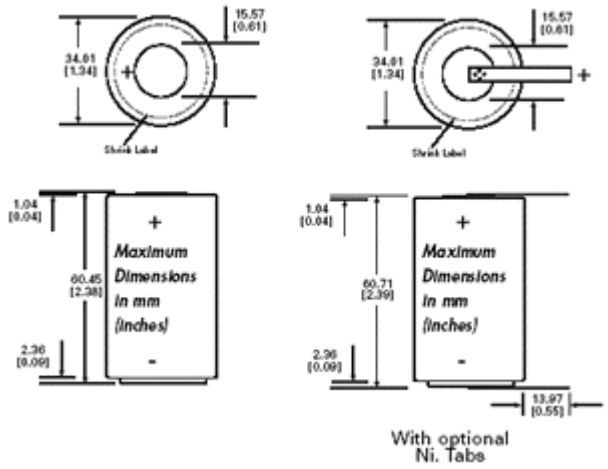
✓RoHS Exempt (see position statement)

Specifications

Voltage Range:	1.5 to 3.3 V
Average Voltage:	3.0 V
Nominal Capacity:	11.1 Ah @ 250 mA to 2 V @ 23° C
Max. Discharge:	3.3 A continuous
Pulse Capacity:	Up to 7.0 A Varies according to pulse characteristics, temperature, cell history, and the application. Consult Ultralife.
PTC: (re-settable fuse)	See note 3
Weight:	115 Grams
Operating Temp.:	-40° C to 72° C
Storage Temp.:	-40° C to 95° C
Exterior/Housing:	Hermetically sealed Ni-plated steel can, Mylar sleeve
Terminals/Connector:	Flat Ni-plated +/- End Caps (U10013 and U10014) Flat Ni-plated +/- End Caps with Nickel tabs (U10015 and U10016)
Safety:	UL Component recognized. Material Safety Datasheet - MSDS023.
Transportation:	Excepted - U.S.; Class 9 - Int'l. See note 1.
Note 1:	For a complete description of transportation regulations and definitions of the transportation classifications "Excepted" and "Class 9," refer to the Ultralife web site at www.ultralifebatteries.com.
Note 2:	U10013 and U10014, Flat Ni-plated +/- End Caps U10015 and U10016, Flat Ni-plated +/- End Caps with Nickel Tabs
Note 3:	U10014 and U10016 have PTC (resettable fuse) U10013 and U10015 do NOT

Product Drawings

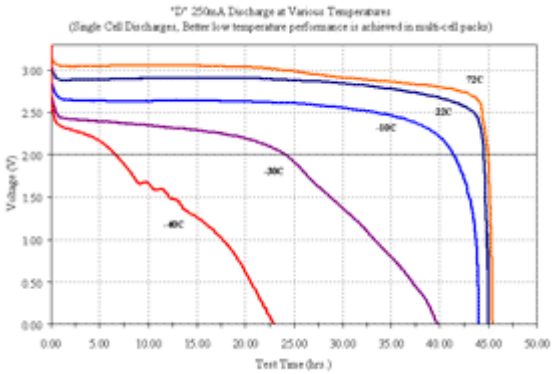
Top ^

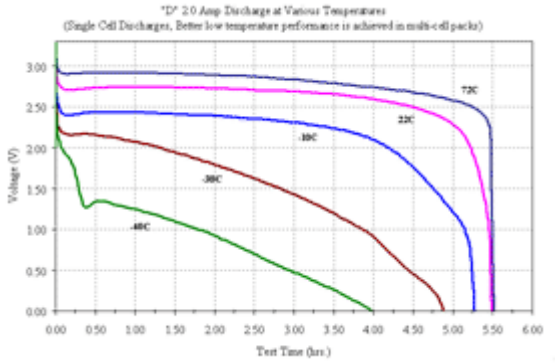


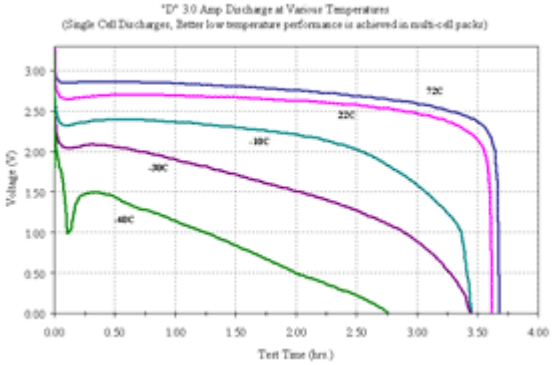
With optional
Ni. Tabs

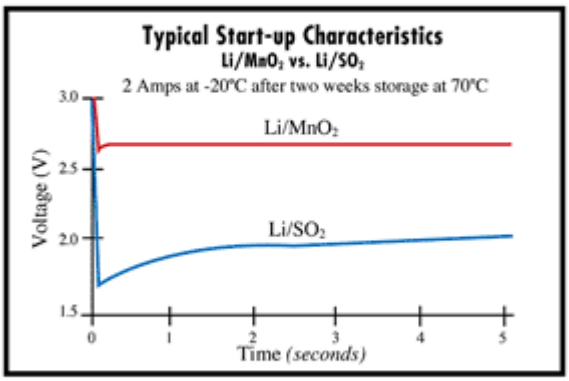
Product Charts

Top ^








Typical Start-up Characteristics
Li/MnO2 vs. Li/SO2
2 Amps at -20°C after two weeks storage at 70°C
Li/MnO2
Li/SO2
Voltage (V)
3.0
2.5
2.0
1.5
0
1
2
3
4
5
Time (seconds)

September 12, 2005

ULTRALIFE®
BATTERIES INC.

Shelf Life Statement for Lithium-Manganese Dioxide Cells

Lithium-manganese dioxide batteries manufactured by Ultralife Batteries, do not exhibit an actual self-discharge mechanism due to the physical separation of the lithium anode and manganese-dioxide cathode. What does occur, however, is a very gradual degradation of the chemistry over time, which can be equated to self-discharge from a capacity loss perspective. In that regard, you can expect a capacity loss of approximately 1.5% per year for our batteries. This loss occurs both in storage and in use. (Please note the chemistry degradation is accelerated at elevated temperatures.)

Mark Matthews
Product Manager, Primary Products
Ultralife Batteries, Inc
315-332-7100 x236
mmatthews@ulbi.com

Primary lithium batteries
LO 26 SX

3.0 V Primary lithium-sulfur dioxide (Li-SO_2)
High drain capability
D-size spiral cell

Benefits

- High and stable discharge voltage
- High pulse capability
- Performance not affected by cell orientation
- Long storage possible before use
- Ability to withstand extreme temperature

Key features

- Low self-discharge rate *(less than 3% after 1 year of storage at +20°C)*
- Hermetic glass-to-metal sealing
- Built-in safety vent *(at the negative end of the cell)*
- Restricted for transport *(class 9)*
- UL Component Recognition *(File Number MH 15076)*
- Meets shock, vibration and other environmental requirements of military specifications
- Made in the USA

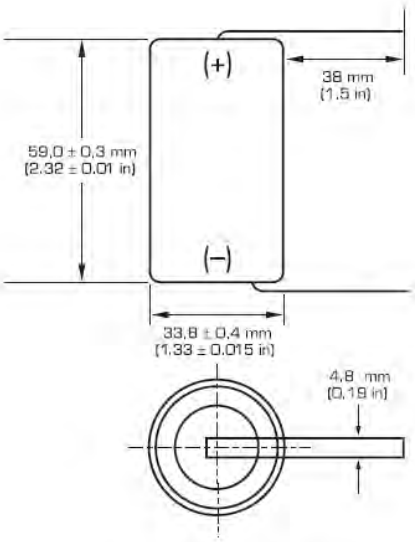
Main applications

- Radiocommunications and other military applications
- Beacons and Emergency Location Transmitters
- Sonobuoys
- Missiles

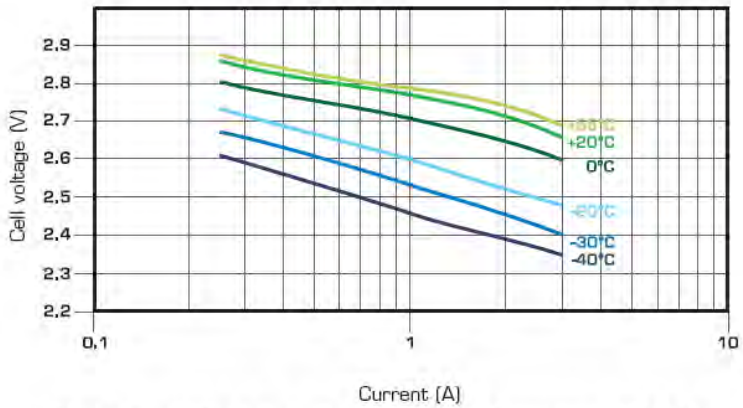
Cell size reference	R20 - D
Electrical characteristics	
(typical values for cells stored for one year or less)	
Nominal capacity *(at 0.25 A + 20°C 2.0 V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off)*	7.75 Ah
Open circuit voltage (at +20°C)	3.0 V
Nominal voltage (at 0.5 A +20°C)	2.8 V
Maximum recommended continuous current *(to avoid over-heating. Higher currents possible, consult Saft)*	2.5 A
Pulse capability : Typically up to 5 A. *(The voltage readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions. Consult Saft)*	
Storage *(recommended)* *(possible without leakage)*	+30°C (+86°F) max -60°C/+85°C (-76°F/+185°F)
Operating temperature range *(Short excursions up to +85°C possible at currents below 1 A)*	-60°C/+70°C (-76°F/+158°F)
Physical characteristics	
Diameter *(max)*	34.2 mm (1.345 in)
Height *(max; finish without radial tabs)*	59.3 mm (2.33 in)
Typical weight	85 g (3 oz)
Li metal content	2.4 g
Standard cell comes with resin potting in the topshell area and two radial 0.15 mm - thick nickel tabs	
Different configurations available on request.	

October 2005

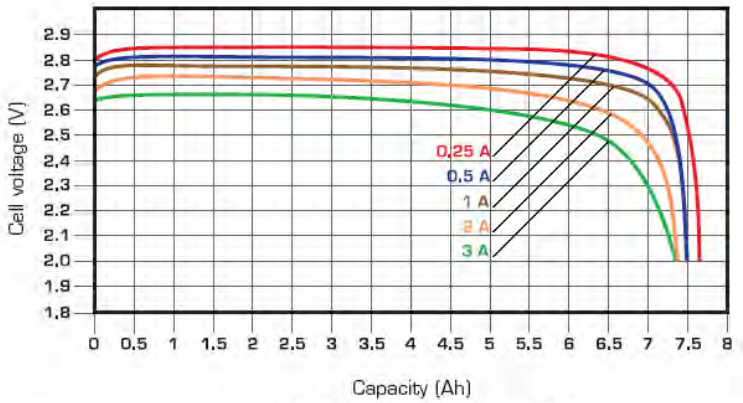
LO 26 SX



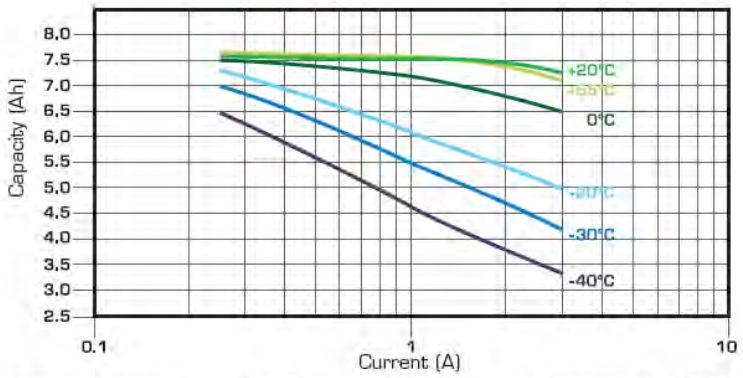
Overall dimensions



Voltage at mid-discharge versus Current and Temperature (2.0 V cut off)



Typical discharge profiles at +20°C



Capacity versus Current and Temperature (continuous discharges - 2.0 V cut off)

Handling precautions

- Cell is pressurised.
- Do not puncture, open or mutilate.
- Do not obstruct the safety vent mechanism.
- Do not short circuit or charge.
- Do not expose to fire or temperatures above +70°C (+158°F).

Saft
Specialty Battery Group
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Valdese NC 28690 - USA
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Doc. N° 31033-2-1005

For more details on primary lithium technologies please refer to Primary Lithium Batteries Selector Guide Doc N° 31048-2.

Published by the Communications Department.

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Société anonyme au capital de 31 944 000 €
RCS Bobigny B 383 703 873

Produced by Arthur Associates.

Primary lithium battery
LM 33600

3 V Primary lithium-manganese dioxide
High power
D-size spiral cell

For applications requesting excellent voltage response and operating life in -40°C/+70°C environments.

Benefits

- High voltage response, stable during most of the lifetime of the application
- High drain/pulse capability
- Minimum voltage delay after long dormant periods
- Competitive capacity at high current and low temperature
- Easy integration into compact system
- Low self-discharge rate *(less than 3% after 1 year of storage at +20°C)*

Key features

- Stainless steel container
- Hermetic glass-to-metal sealing
- Built-in safety vent
- Non-corrosive electrolyte
- Restricted for transport *(Class 9)*

Main applications

- Radiocommunication
- Buoys
- Measuring equipment
- Industrial applications
- Professional electronics
- Marine equipment
- ELTS, EPIRBS, etc...

Cell size references	UM1 – R20 – D

Electrical characteristics

(typical values relative to cells stored for one year or less at +30°C max.)

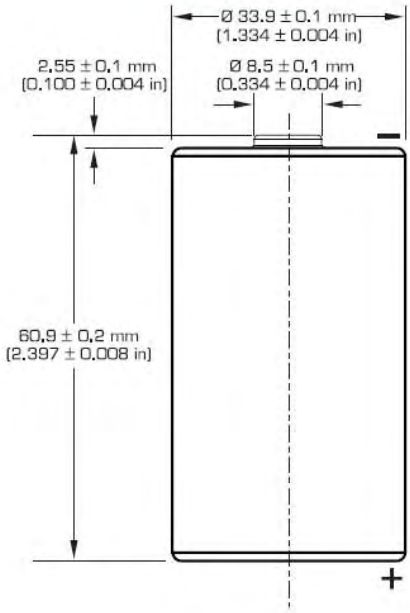
Nominal capacity *(at 250 mA +20°C 2.0 V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off)*		10.5 Ah
Open Circuit Voltage	(at + 20°C)	approx. 3.2 V
Nominal voltage	(under 1 mA at +20°C)	3.0 V
Pulse capability		4 A
Maximum recommended continuous current *(to maintain cell heating within safe limits)*		2.5 A
Storage	*(recommended)* *(for more severe conditions, consult Saft)*	+ 30°C (+ 86°F) max
Operating temperature range *(Operation below ambient T may lead to reduced capacity and lower voltage readings)*		- 40°C/+70°C (-40°F/+158°F)

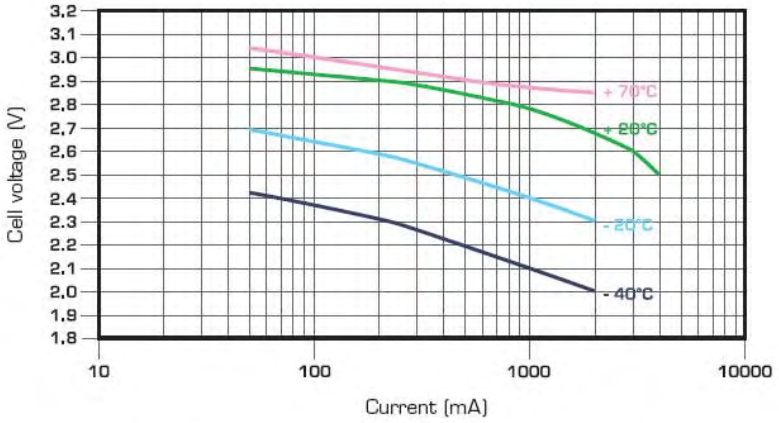
Physical characteristics

Diameter *(max)*		34 mm (1.338 in)
Height *(max)*		61.1 mm (2.405 in)
Typical weight		116 g (4.09 oz)
Li metal content		approx. 3.6 g
Available termination suffix		
	CN, CNR	radial tabs
	CNA (AX)	axial leads
	FL	flying leads... etc.

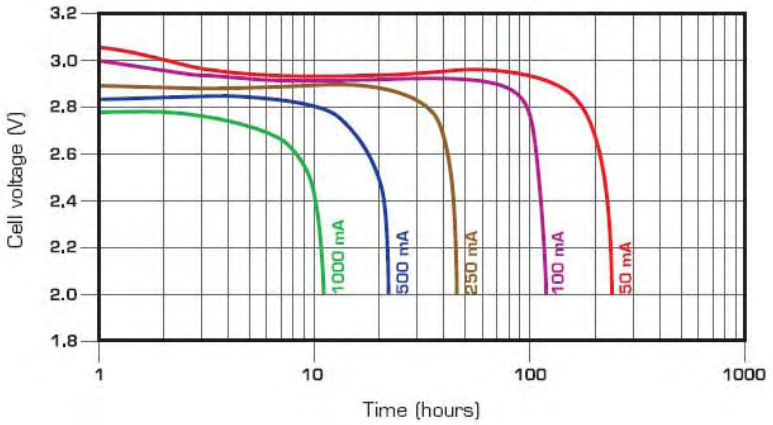
October 2006

LM 33600

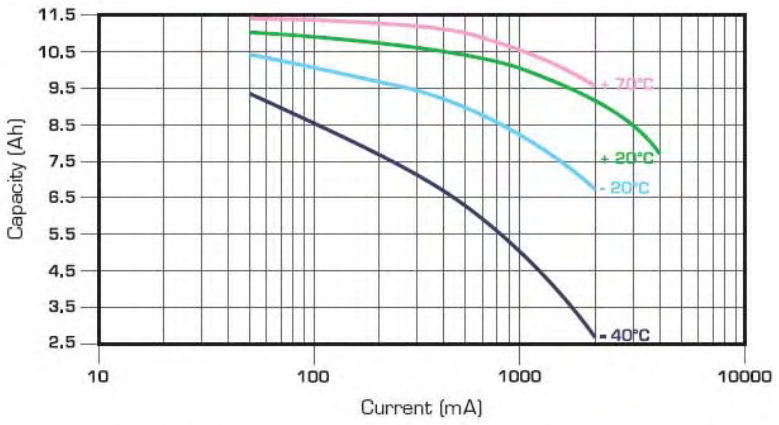




Voltage plateau versus Current and Temperature (at mid-discharge)



Typical discharge profiles at +20°C



Restored Capacity versus Current and Temperature (2.0 V cut off)

Storage

- The storage area should be clean, cool, dry and ventilated.

Warning

- Fire, explosion and burn hazard.
- Do not recharge, short circuit, crush, disassemble, heat above 70°C (158°F), incinerate, or expose contents to water.
- Do not solder directly to the cell (use tabbed cell versions instead).

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Doc. N° 31078-2-1006

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For more details on primary lithium technologies please refer to Primary Lithium Batteries Selector Guide Doc N° 31048-2.

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ARTICLE X

BROCHURE & PHOTOGRAPHS