DEPARTMENT OF THE ARMY
US ARMY WHITE SANDS MISSILE RANGE
ELECTRONIC PROVING GROUND
FORT HUACHUCA, ARIZONA 85613-7110

REPLY TO
ATTENTION OF

May 6, 1999

Communications Branch
Satellite Test Bed

Dr. Daniel Ch'en
Microwave Monolithics, Inc.
465 E. Easy Street
Simi Valley, CA 93065

Dear Dr. Ch'en:

Attached is a copy of the packet sent to the Cospas-Sarsat Secretariat in London for Type Approval Certification of the Microwave Monolithics, Inc. Beacon, Model MicroPLB (No. MBT-040600). The packet consists of the following documentation as per Section 5 of C/S T.007:

TAB A: Application for a Cospas-Sarsat 406 MHz Beacon Type Approval Certificate
TAB B: Beacon Operating Instructions and a Technical Data Sheet
TAB C. Brochure of the Beacon
TAB D. Specified operating temperature range (also see Tab A)
TAB E. Description of continuous transmission, long term frequency stability, and randomization of repetition rate
TAB F. Matching network
TAB G. Not applicable
TAB H. Description of Self-Test Mode
TAB I. Description of Power Source, Battery Chemistry, etc.
TAB J. Test Report
TAB K. Data Sheets (see app A of report)
TAB L. Technical Data for Protection Mechanism
TAB M. Copy of Beacon Label

Please take a moment to complete the enclosed customer comment form. Your suggestions and comments are important to us.

If you require further information, please contact Mrs. Anthony at (520) 538-3831.

Sincerely,

James L. Cole
Chief, C4I Test Division

Attachment

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

Beacon Manufacturer: Microwave Monolithics Incorporated

Beacon Model: MBT-040600

Name and Location of Beacon Test Facility: Electronic Proving Ground, Ft. Huachuca AZ, USA

Beacon Type: Aviation: [ ] Land: [X] Maritime: [ ]

Specified Operating Temperature Range: -20 °C to 55 °C

Specified Operating Lifetime: 24 hr. [X] 48 hr. [ ] Other [ ] Specify: _____

Beacon Battery Type(s):
Chemistry: Lithium/Manganese Dioxide

Manufacturer & model no.: Duracell DL2/3A

Size & number of cells: 2/3A, 6 cells

Extra Features in Beacon:	**No**	**Yes**	**Details**
a) Auxiliary Radio-Locating Device:	[ ]	[X]	Frequency: 121.5MHz Power: 25mW -0, +6 dB Tx. Duty Cycle: 50%
b) Transmits Encoded Position Data:	[ ]	[X]	Nav. Device (Internal or External) External Type (GPS, GLONASS, etc.) GPS Manufacturer N/A Model N/A
c) Transmits Long Message (144 bits):	[ ]	[X]	
d) Automatic Activation:	[X]	[ ]	
e) Built-in Strobe Light:	[X]	[ ]	Intensity: _____ Flash rate: _____
f) Self-test mode	[ ]	[X]	
g) Other:	[X]	[ ]	Specify: _____

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

Dated: 6 May 1999 Signed: Thomas J. Richter
(for test facility)

Send to: Cospas-Sarsat Secretariat, Inmarsat, 99 City Road, London EC1Y 1AX, United Kingdom

COSPAS/SARSAT
EMERGENCY LOCATOR BEACON
MODEL No. MBT-040600

OPERATING FREQUENCY: 406.025 MHz
(optional) 121.5 MHz

OPERATING TEMPERATURE:-20° C to +55° C
(Class 2)

THIS SATELLITE PLB WILL NOT FLOAT!

OPERATING INSTRUCTIONS:

1) Remove cover to deploy antenna
2) Pull activator pin completely out
3) Following automatic self test, beacon will automatically activate
4) Blinking green indicates transmission

SELF TEST INSTRUCTIONS:

1) Remove cover
2) Pull activator pin completely out
3) Green indicates proper operation, red indicates possible failure
4) Replace activator pin within 30 seconds to avoid false alarms

Battery Type: DOT Approved Li/MnO_2

Battery Expiration Date:

Serial No:

ID Code:

MICROWAVE MONOLITHICS INCORPORATED
SIMI VALLEY, CA 93065

OPERATING INSTRUCTIONS

MicroPLB™

MINIATURE SARSAT PERSONAL LOCATOR BEACON (PLB)
MODEL No. MBT-040600

FREQUENCY	406.025 MHz
POWER	5 Watts
MODULATION	Phase Modulation: ± 1.1 Radians
SHORT TERM STABILITY	2×10^{-9}
MEDIUM TERM STABILITY	1×10^{-9}
HOMING SIGNAL (Optional)	121.5 MHz
CASE	High Impact Resistant Plastic
SIZE	1" x 2 ¼" x 4 ¾" (including battery pack and undeployed antenna)
WEIGHT	9 Oz.
ANTENNA	Protected by Case, Easily Deployed Antenna Vertical With Largest Face of Case Horizontal.
BATTERY PACK	Lithium Battery, Approved by DOT for Transportation by All Common Carriers.
OPERATING MODES	Off, Test, Transmit
ACTIVATION	Two Conscious Actions Required
INDICATORS	Flashing LEDs
OPERATING LIFE	24 Hrs. Minimum
OPERATING TEMPERATURE	-20° to +55°C (Class 2)
DUSTPROOF	Sealed Against Dust Penetration
WATER RESISTANT	No Leakage at 1 Meter Depth for 1 Hr.
COSPAS/SARSAT APPROVAL	Pending

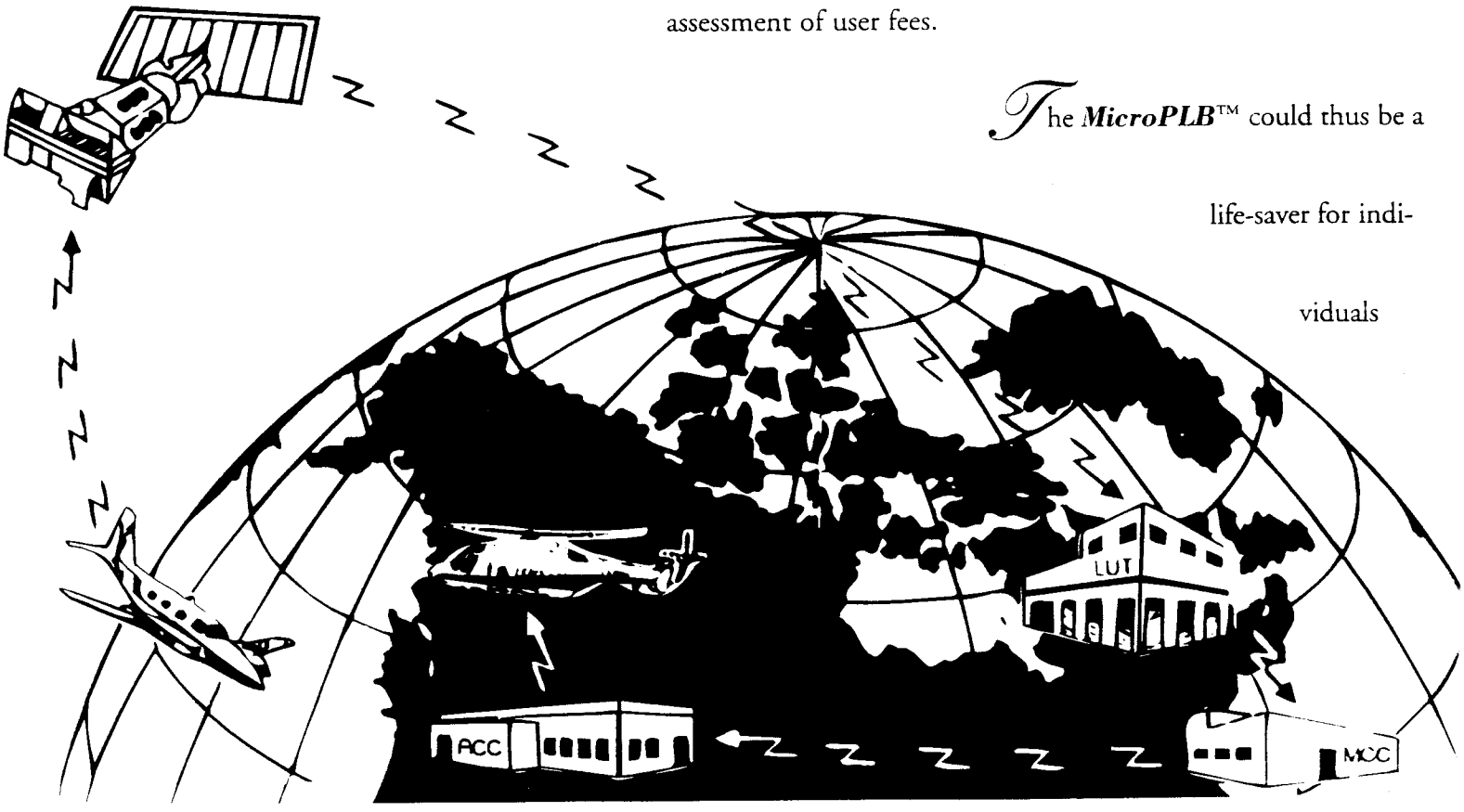
This document contains information on a new product. Specifications and information herein are subject to change without notice.

Microwave Monolithics Incorporated
2263 Ward Avenue
Simi Valley, California 93065, USA
Voice: 805-584-6642
FAX: 805-584-9594

MicroPLB™ - 406MHz

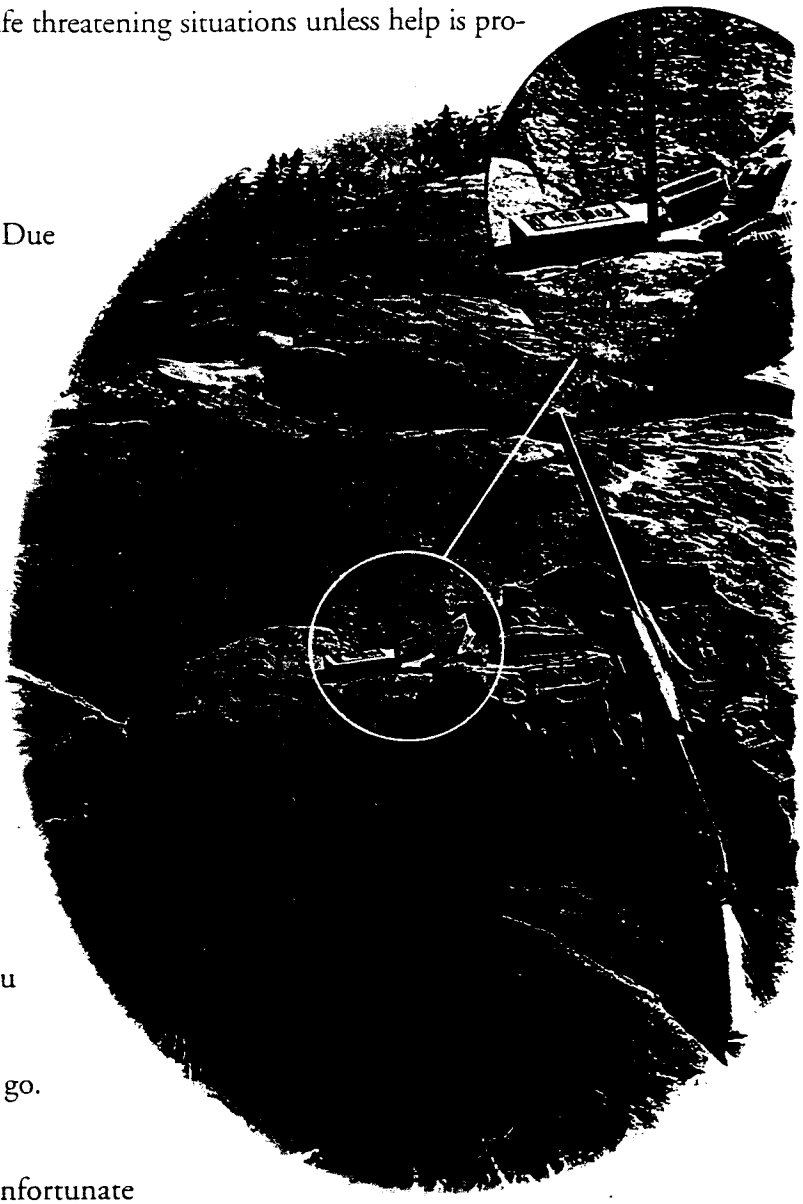
The ***MicroPLB***™ 406 Personal Locator Beacon is a COSPAS/SARSAT* transmitter which, when activated, emits a 406 MHz distress signal to a constellation of internationally funded and operated satellite receivers. Your need for assistance, your location anywhere on earth (often accurate to within one kilometer over all terrain as well as at sea), and your PLB's unique ID code are automatically deciphered and forwarded to central monitoring stations (operated by the U.S. National Oceanic and Atmospheric Administration, NOAA), which in turn notify appropriate rescue organizations. Rescue personnel are guided directly to the emergency location by the specified position and a separate 121.5 MHz homing signal which can also be transmitted by the beacon. This proven, fully operational, all weather SARSAT* system operates world wide 24 hours a day, and has already assisted in the rescue of many many people worldwide. It is operated and maintained by an international consortium, and the ground stations and notification network are Government funded and operated without the assessment of user fees.

The ***MicroPLB***™ could thus be a life-saver for individuals

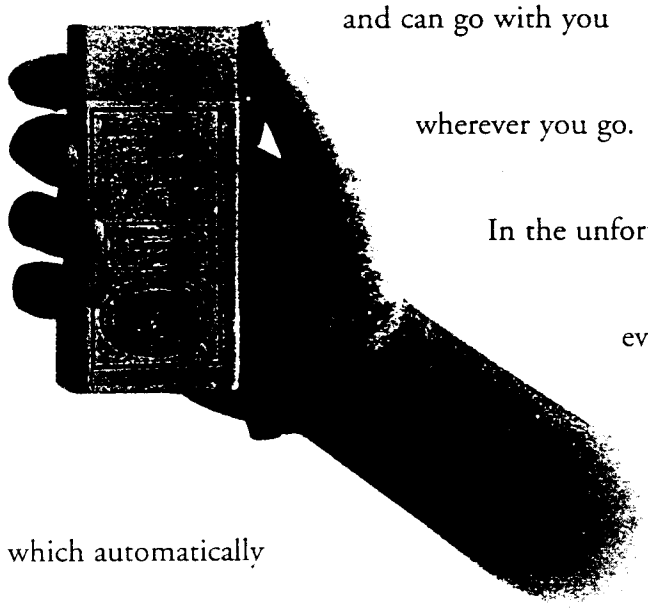


*SARSAT: *Search and Rescue Satellite-Aided Tracking* COSPAS: *Space System for Search of Vessels in Distress (acronym from the Russian language)*

engaged in activities such as hiking, hunting, mountain climbing, boating, flying, crosscountry skiing, etc., where even a simple accident may rapidly lead to dangerous and/or life threatening situations unless help is provided in a timely fashion.



The ***MicroPLB***™ is truly a pocket sized unit. Due to its advanced NASA supported transmitter technology, it is the ONLY PLB to use a safe lithium battery approved by the U.S. Department of Transportation for carriage via all commercial transportation, including commercial passenger aircraft. The ***MicroPLB***™ is safe, easy to carry, and can go with you wherever you go.



In the unfortunate event that rescue help is needed, it is easily activated and could save your life. Simply remove the cover, which automatically deploys the antenna, and pull out the activator plug. These actions can even be performed by injured individuals wearing gloves in the dark.

USA • CANADA • FRANCE • RUSSIA
COSPAS SARSAT

MicroPLB™

MINIATURE SARSAT PERSONAL LOCATOR BEACON (PLB)
MODEL No. MBT-040600

FREQUENCY	406.025 MHz
POWER	5 Watts
MODULATION	Phase Modulation: ± 1.1 Radians
SHORT TERM STABILITY	2×10^{-9}
MEDIUM TERM STABILITY	1×10^{-9}
HOMING SIGNAL (Optional)	121.5 MHz
CASE	High Impact Resistant Plastic
SIZE	1" x 2 ¼" x 4 ¾" (including battery pack and undeployed antenna)
WEIGHT	9 Oz.
ANTENNA	Protected by Case, Easily Deployed Antenna Vertical With Largest Face of Case Horizontal.
BATTERY PACK	Lithium Battery, Approved by DOT for Transportation by All Common Carriers.
OPERATING MODES	Off, Test, Transmit
ACTIVATION	Two Conscious Actions Required
INDICATORS	Flashing LEDs
OPERATING LIFE	24 Hrs. Minimum
OPERATING TEMPERATURE	-20° to +55°C (Class 2)
DUSTPROOF	Sealed Against Dust Penetration
WATER RESISTANT	No Leakage at 1 Meter Depth for 1 Hr.
COSPAS/SARSAT APPROVAL	Pending

This document contains information on a new product. Specifications and information herein are subject to change without notice.

Microwave Monolithics Incorporated
2263 Ward Avenue
Simi Valley, California 93065, USA
Voice: 805-584-6642
FAX: 805-584-9594

Specified operating temperatures: -20° C to +55° C (See TAB A)

T.007 paragraph 5-e

1. *Description to demonstrate that the design provides protection against continuous transmission:*

The MicroPLB beacon contains an independent timer connected between the microcontroller, which controls the functions of the beacon, and the power amplifier, which generates the transmitted signal. The input of this timer is connected to a control line of the microcontroller, and the output of this timer is connected to the 'ENABLE' line of the power amplifier. The input to the timer is also the '/RESET' line for the timer. The timer has a nominal interval of 2 seconds.

The operation of the timer is as follows:

While the input is 'OFF', the output is always 'OFF'.

When the input is set to 'ON', the output is set to 'ON' and the internal timing circuit is started.

If the input is set to 'OFF' again in less than 2 seconds, the output is set to 'OFF' and the internal timing circuit is stopped and reset.

If the input remains 'ON' after 2 seconds, the timing circuit sets the output to 'OFF' and holds the output 'OFF' indefinitely.

When the input is subsequently set to 'OFF', the output remains 'OFF' and the timing circuit is stopped and reset. The timer, now in its initial state, is ready for the next 'ON' signal at its input.

With the timer connected between the microcontroller and the power amplifier, the sequence of events during a transmission cycle is as follows:

(1) The control line of the microcontroller, the input of the timer, the output of the timer, and the enable line of the power amplifier, are initially all 'OFF'.

(2) At the beginning of the transmission the microcontroller sets the control line to 'ON'.

The timer, with its input set to 'ON' by the microcontroller, sets its output to 'ON' and starts its timing circuit.

The power amplifier, with its ENABLE line set to 'ON' by the timer, turns on and starts to transmit the 406 MHz signal.

(3) At the end of the transmission, the microcontroller sets the control line to 'OFF'.

The timer, with its input set to 'OFF' by the microcontroller, sets its output to 'OFF' and stops/resets its timing circuit.

The power amplifier, with its ENABLE line set to 'OFF' by the timer, turns off and stops the 406 MHz signal.

(4) If the input of the timer is not set to 'OFF' within 2 seconds after it is set to 'ON', the timer sets its output to 'OFF', turning the power amplifier off and stopping the 406 MHz signal.

Therefore the independent timer assures that continuous 406 MHz transmission does not occur.

T.007 paragraph 5-e (cont.)

2. *Description to demonstrate that the design provides protection meets the long term frequency stability requirement:*

In section 2.3.1 of document C/S T.001, it is stated that 'the transmitted frequency shall not vary more than ± 5 kHz in 5 years including the initial offset' (of ± 2 kHz). The MicroPLB beacon uses a quartz resonator to generate the 406 MHz signal. The manufacturer of the quartz resonator guarantees the long term stability (aging) of the quartz resonator to be less than ± 0.8 parts per million (ppm) per year. At 406 MHz, the change in frequency is less than ± 1.6 kHz over 5 years. Therefore, the transmitted frequency of the MicroPLB beacon will not vary more than ± 3.6 kHz in 5 years, including 'worst case' initial offset of 2 kHz.

T.007 paragraph 5-e (cont.)

3. *Description to demonstrate that the design will have randomization of repetition rate in different production runs:*

Randomization of repetition rate of 406 MHz transmissions is provided by the microcontroller firmware (program) inside the MicroPLB beacon. An 8-bit pseudo-random number generator is used to change the repetition rate after each transmission. Every time a new number is to be generated, the 8-bit number is left-shifted (least-significant-bit towards most-significant-bit), with the result of the logical operation of [(bit-2 OR bit-3) XOR bit-7] used as the new bit-0. This result in a pseudo-random sequence of 255 (255 different values before any number is repeated).

The starting number ('seed') in the pseudo-random sequence for each MicroPLB beacon is derived from the unique serial number of that beacon. This maximizes the randomness of repetition rates among different beacons.

50 Ohm Matching Network

The matching network used to provide a 50 ohm output for certification testing consisted of a single inductor / capacitor "L – Section". No corrections were made to the measured data to account for the losses of this matching network.

Not applicable

406 MHz BEACON SELF-TEST CHARACTERISTICS

406 MHz Beacon Model(s): MBT-040600

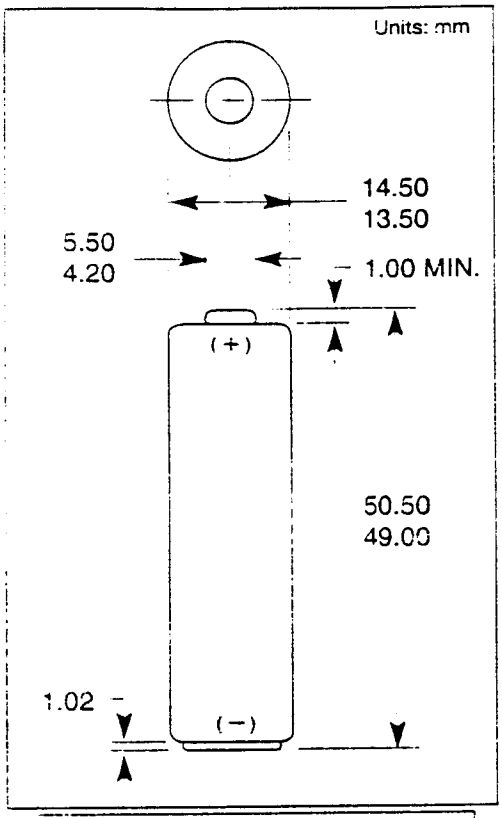
	Answer (√) Yes	No
1. Does beacon have a self-test mode ?	X	
if yes :		
• does self-test have a separate switch position ?		X
• does self-test switch automatically return to normal position when released ? if not, how long until the first "distress" message is emitted:_____		
• does self-test transmit a 406 MHz signal ?	X	
if yes:		
- unmodulated signal only		
- normal data, but with inverted frame synchronization pattern	X	
- 1 burst only	X	
- 2 bursts only		
- 3 or more bursts		
• does self-test transmit a 121.5 MHz signal ?		X
if yes:		
- for less than 1 second		
- continually while self-test switch is activated		
- other (please specify) : _____		
• does self-test transmit any other frequency (e.g. 243 MHz) ?		X
2. Result of self-test is indicated by:		
• pass/fail display indicator light	X	
• strobe light flash		X
• other (please specify) : _____		
3. Can the self-test be performed without removing the beacon from its mounting bracket ?		X
4. What parameters are internally tested by the self-test ?		
• battery voltage	X	
• RF power		X
• approximate RF frequency		X
• phase locked loop		X
• other (please specify) : Firmware, Prior Usage	X	
5. Do the above characteristics apply to this beacon model:		
• **for all countries where beacon is sold ?**	X	
if no, please specify : _____		
• **for all production serial numbers?**	X	
if no, please specify : _____		

6. Comments:

_____

MX1500

Size: AA (LR6)
Alkaline-Manganese Dioxide Battery
for High Tech Devices



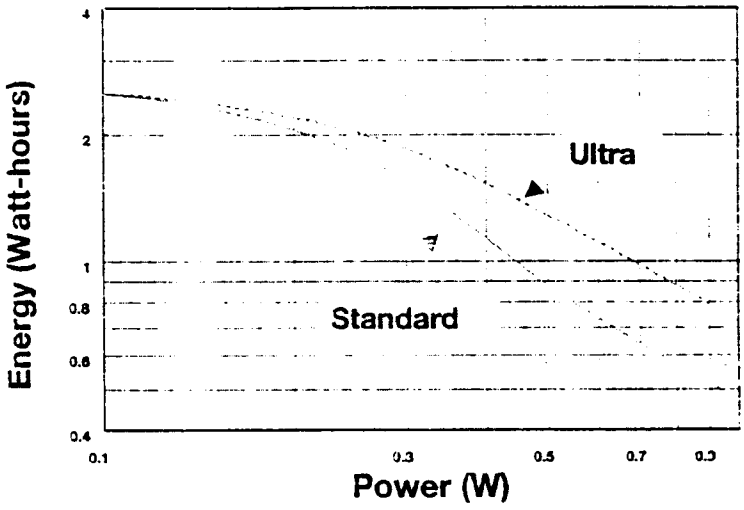
Nominal Voltage: 1.5 Volt
Nominal Weight: 23.6 g (0.83 oz.)
Nominal Volume: 8.4 cm³ (0.51 in.³)
Operating Temp. -20°C to 54°C

Duracell Ultra:

High Power Alkaline Batteries for High Drain Applications

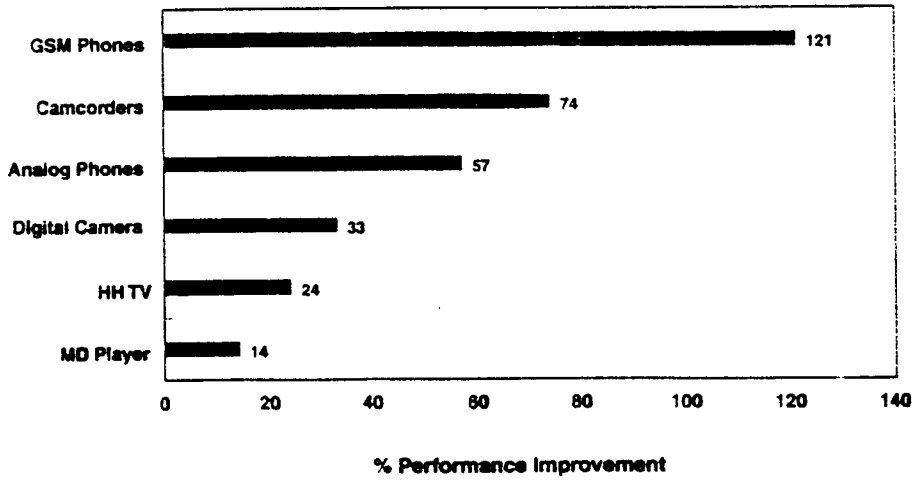
- Increased energy output at high current loads
- Optimized for use with high power devices
- No trade off in lower power performance
- No dimensional changes

ULTRA vs. Standard AA Alkaline

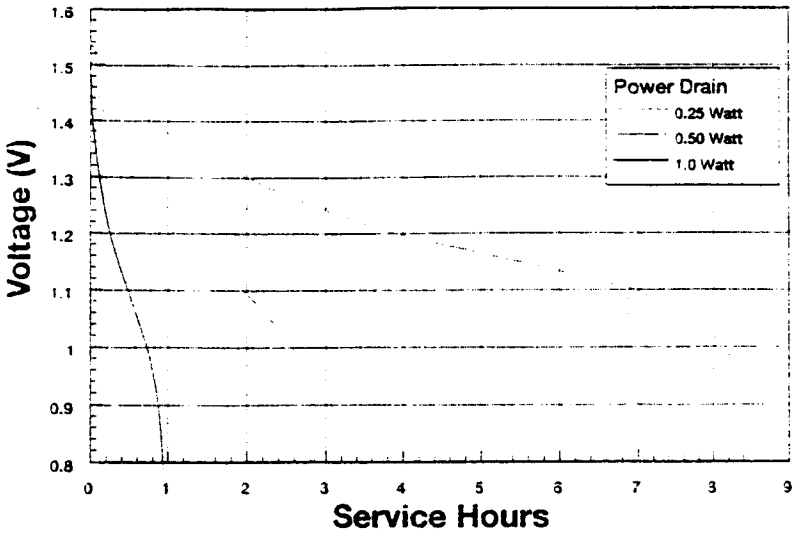


Note: Delivered energy to a 1.0 V end voltage - discharged @ 20°C

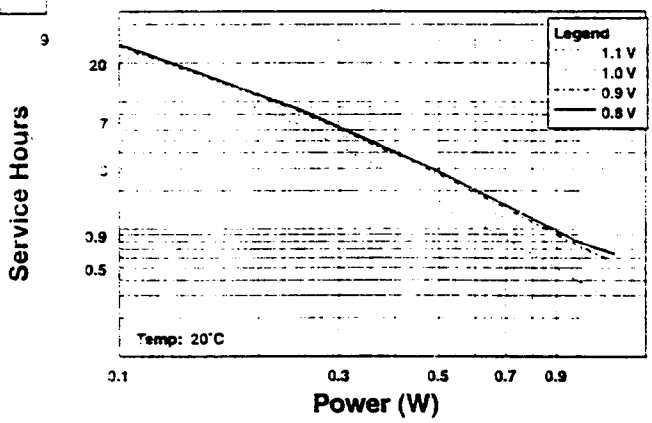
Duracell Ultra Performance vs. Ordinary AA



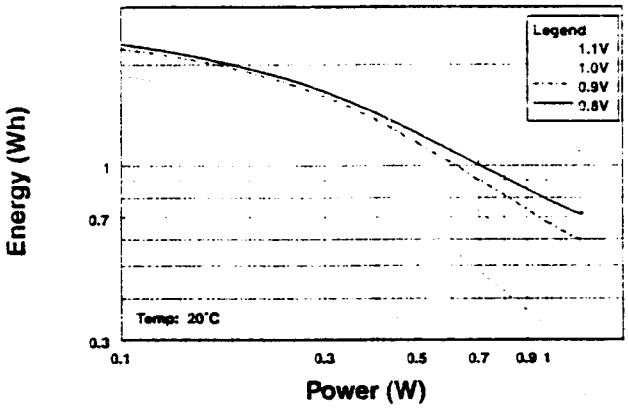
Discharge Characteristics at 20°C (70°F)



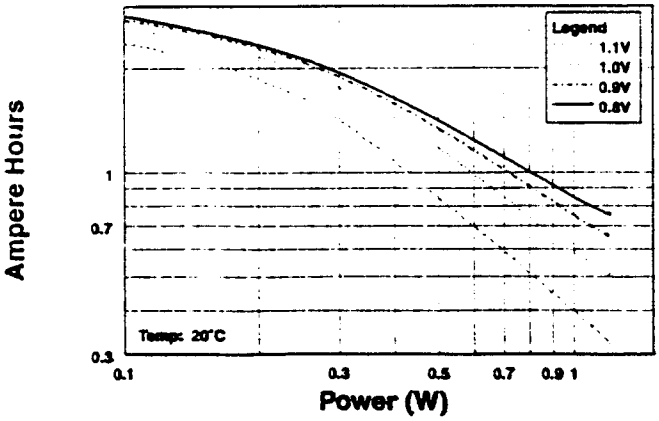
Service Hours vs Power Drain



Delivered Energy vs Power Drain



Delivered Capacity vs Power Drain



DURACELL
Berkshire Corporate Park
Bethel, CT 06801 U.S.A.
Telephone: Toll-free 1-800-431-2656
Outside North America: 203-791-3274
Facsimile: 203-791-3273
Internet: www.duracellnpt.com

DURACELL ULTRA

Printed in U.S.A. on recycled paper, please recycle after use.
MX1500 - 6/98

Data Sheets (see app A of report)

T.007 paragraph 5-1

for beacons designed to transmit encoded position data, technical data showing that the design incorporates a protection mechanism to ensure the 406 MHz signal is not degraded by a malfunction of the navigation component or a failure of the navigation component to acquire valid data;

The MicroPLB beacon is designed to accept position information from an external GPS receiver. It does not contain an internal GPS receiver or any other navigation device. The transmission of the 406 MHz signal by the MicroPLB beacon is completely independent of the external GPS receiver.

The sequence of events during activation of a MicroPLB beacon with GPS capability is as follows:

(1) Prior to activation of the beacon, the external GPS receiver should have already acquired a valid position and a cable should be connected between the data output port of the GPS receiver and the data input port of the beacon.

(2) The beacon is activated.

(3) After the beacon has performed the self-test function, it examines the data from its input port and determines if valid position data are present. The beacon will attempt to acquire position data for up to 15 seconds. It will abort the attempt to acquire if no valid position data within 15 seconds.

If valid position data are present, the beacon codes the position information according to the 'National Location Protocol' (section A3.3.7 of document C/S T.001) and stores the coded message in memory. The beacon then transmits the coded message approximately every 50 seconds per C/S T.001 specifications until it is deactivated.

If no valid position data is found (after 15 seconds), the beacon uses the 'default values' for the 'National Location Protocol' (sections A3.2 and A3.3.7 of document C/S T.001) and stores the coded message in memory. The beacon then transmits the coded message approximately every 50 seconds per C/S T.001 specifications until it is deactivated.

(4) The first transmission occurs approximately 60 seconds after activation, and subsequent transmissions occur approximately 50 seconds apart.

The MicroPLB beacon including its power source is completely contained in its own housing, and is entirely separate from the external GPS receiver. The beacon only checks for valid position data from the external GPS receiver through its input port for a short period immediately after activation. If valid position data are found within this period, the beacon uses the information and codes its message according to the 'National Location Protocol'. If no valid position data is found within this period, the beacon codes its message using the 'default values' for the 'National Location Protocol'. In either case beacon will transmit the 406 MHz signal completely independent of the external GPS receiver. Therefore any malfunction or failure of the navigation component will not degrade the 406 MHz signal from the MicroPLB beacon.

COSPAS/SARSAT
EMERGENCY LOCATOR BEACON
MODEL No. MBT-040600

OPERATING FREQUENCY: 406.025 MHz
(optional) 121.5 MHz

OPERATING TEMPERATURE:-20° C to +55° C
(Class 2)

THIS SATELLITE PLB WILL NOT FLOAT!

OPERATING INSTRUCTIONS:

1) **Remove cover to deploy antenna**
2) **Pull activator pin completely out**
3) **Following automatic self test, beacon will automatically activate**
4) **Blinking green indicates transmission**

SELF TEST INSTRUCTIONS:

1) **Remove cover**
2) **Pull activator pin completely out**
3) **Green indicates proper operation, red indicates possible failure**
4) **Replace activator pin within 30 seconds to avoid false alarms**

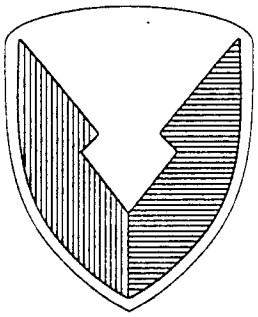
Battery Type: DOT Approved Li/MnO_2

Battery Expiration Date:

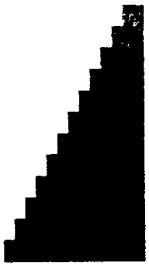
Serial No:

ID Code:

MICROWAVE MONOLITHICS INCORPORATED
SIMI VALLEY, CA 93065



TECOM Project No. 6-ES-075-SAR-003
EPG Publication No. R-99-05-001X



Type Approval Certification Test Report for the

Microwave Monolithics, Inc. Cospas-Sarsat Beacon

May 1999

by Karen L. Anthony and Edwin H. Iriye

Communications Branch, C4I Test Division
Electronic Proving Ground, Fort Huachuca, Arizona 85613-7110

Prepared for Microwave Monolithics, Inc., 465 E. Easy Street, Simi Valley, California 93065

Other requests for this document must be referred to Microwave Monolithics, Inc.

US Army Test and Evaluation Command
Aberdeen Proving Ground, MD 21005-5055

Disposition Instructions

Destroy this report in accordance with appropriate regulations when no longer needed. Do not return it to the originator.

Disclaimer

The use of trade names in this report does not constitute an official endorsement or approval of the use of such commercial hardware and software. This report may not be cited for the purpose of advertisement.