

## CHAPTER 10

# OPERATIONAL LIFE AND SELF TESTS

## **10.1. TEST SPECIFICATIONS AND PROGRAMME**

### **10.1.1 Operating Life Test**

Following :

- Section A10.1 of RTCM Recommended Standards for 406 MHz Satellite PLBs (Version 1.1 – June 19, 2002)
- Section A2.3 of C/S T.007 Cospas/Sarsat Standard ( Issue 3 – Revision 10 October 2003 )

- Using a fresh battery pack, turn ON the EUT (at the ambient temperature) for a period of time equal to the extension interval gived by the constructor . (See Test Results § 10.5.1)
- Place the EUT turned OFF inside climatic chamber stabilized at  $-20^{\circ}\text{C}$  (class II ) for a period of 2 hours minimum
- At the conclusion of this period the EUT is turned ON and continually monitor the following parameters until the end of the battery life :
  - Frequency (nominal carrier, short and medium term stability),
  - RF output power,
  - Homing transmitter peak envelope output power.

### **10.1.2 Self Test**

Following :

- Section A10.2 of RTCM Recommended Standards for 406 MHz Satellite PLBs (Version 1.1 – June 19, 2002)
- Section A3.6 of C/S T.007 Cospas/Sarsat Standard ( Issue 3 – Revision 10 October 2003 )
- For each test temperature  $-20 \pm 2^{\circ}\text{C}$ ,  $22 \pm 2^{\circ}\text{C}$  and  $55 \pm 2^{\circ}\text{C}$  place the EUT turned OFF inside climatic chamber stabilized at its temperature for a period of 2 hours minimum
- At the conclusion of this period the EUT is turned ON and monitor the following parameters :
  - 406 MHz RF output pulse duration,
  - Frame synchronzation pattern,
  - Only one burst of the 406 MHz RF signal ,.
  - 15 Hex ID of message ,
  - Audio sweeps or duration time of 121.5 MHz signal

## 10.2. EQUIPMENT UNDER TEST

### Beacon

Beacon Unit : 1/3 & 2/3  
Name : ACR / TeraFixTM 406GPS I/O PLB & TeraFixTM 406GPS I PLB  
Type : PLB200 & PLB201  
Number : 07 & 12  
Class : II

### Beacon Battery Type

Chemistry : Li-MnO<sub>2</sub>  
Manufacturer & model n° : SANYO – CR123A  
Size & number of cells : 2/3 A size & 2x4 cells

## 10.3. TEST SITE

Toulouse Space Center (C.S.T./ ITS) - Beacon certification laboratory .

## 10.4. TEST EQUIPMENT

- Climatic chamber: CLIMATS F.C.H. – Type: Austral 137H60/1,5E - S/N: S4880.
- Argos - Cospas/Sarsat Test Bench

## 10.5. RESULTS

These tests have been performed during the COSPAS-SARSAT Type Approval tests (chapter 9)

### 10.5.1 Operating Life Test results

Before these tests we have verified the manufacturer calculation of the loss in battery capacity due to self-testing as well as battery pack self-discharge during the useful lifetime of battery pack (see chapter 9 : C/S Type Approval Test Report § " OPERATING LIFE TEST RESULTS ON PLB 200 N° 07 & PLB 201 N° 12 " pages : PLB200-37 & PLB201-37 )

Following the "PLB-200 estimate calculations for battery drain prior to RTCM & Cospas/Sarsat Life Test" manufacturer note joint in annex the batteries packs capacity has been reduced by the Test Laboratory during 24 hours (2x12 hours) into 681 ohms load

**Total AMP-HOUR burn off battery for –20° C life test : 0.249 AMP-HOURS**

### 10.5.1.1 Test implementation

Beacon Unit : 1/3  
 Name : ACR / TeraFixTM 406GPS I/O PLB  
 Type : PLB200  
 Number : 07

| Date                         | Hour  | Operations                                                                                                                                                                      | Results                        |
|------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| July 13 <sup>th</sup> , 2004 | 13:00 | The beacon, in the ready condition, is thermally soaked at - 20° C in the temperature-controlled oven .                                                                         |                                |
| July 13 <sup>th</sup> , 2004 | 15:30 | The beacon in the oven at -20° C and connected into 50 Ohm load Argos Cospas Sarsat Test Bench is manually activated . Simultaneously an Automatic Operational Life Test begin. | OK                             |
| July 15 <sup>th</sup> , 2004 | 04:00 | End of Automatic Operational Life Test.                                                                                                                                         |                                |
| July 15 <sup>th</sup> , 2004 | 10:30 | Analysis of Operating Life Test Results :                                                                                                                                       | Correct during<br>≈ 34.5 hours |

Beacon Unit : 2/3  
 Name : ACR / TeraFixTM 406GPS I PLB  
 Type : PLB201  
 Number : 12

| Date                         | Hour  | Operations                                                                                                                                                                      | Results                        |
|------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| July 9 <sup>th</sup> , 2004  | 18:00 | The beacon, in the ready condition, is thermally soaked at - 20° C in the temperature-controlled oven .                                                                         |                                |
| July 10 <sup>th</sup> , 2004 | 06:30 | The beacon in the oven at -20° C and connected into 50 Ohm load Argos Cospas Sarsat Test Bench is manually activated . Simultaneously an Automatic Operational Life Test begin. | OK                             |
| July 11 <sup>th</sup> , 2004 | 18:00 | End of Automatic Operational Life Test.                                                                                                                                         |                                |
| July 12 <sup>th</sup> , 2004 | 08:30 | Analysis of Operating Life Test Results :                                                                                                                                       | Correct during<br>≈ 34.2 hours |

### 10.5.1.2 Electrical results of Operating Life Tests

Beacon Unit : 1/3  
 Name : ACR / TeraFixTM 406GPS I/O PLB  
 Type : PLB200  
 Number : 07  
 Date of test : July 13<sup>th</sup> to July 15<sup>th</sup>, 2004

| Burst<br>N° | $\Delta$ Frequency ( Hz )<br>( $F_{\text{beacon}} - 405978000$ Hz) | Temp. ( °C ) | P406 ( dBm ) | P121.5 ( dBm ) |
|-------------|--------------------------------------------------------------------|--------------|--------------|----------------|
| 1           | 49859,81                                                           | -19,6        | 38,0         | 19,1           |
| 2           | 49862,41                                                           | -19,9        | 38,0         | 19,2           |
| 3           | 49864,16                                                           | -20,0        | 38,0         | 19,2           |
| 4           | 49865,86                                                           | -20,1        | 38,0         | 19,2           |
| 5           | 49866,98                                                           | -20,1        | 38,0         | 19,2           |
| 6           | 49867,40                                                           | -20,1        | 38,0         | 19,2           |
| 7           | 49868,28                                                           | -20,1        | 38,0         | 19,2           |
| 8           | 49868,75                                                           | -20,1        | 38,0         | 19,2           |
| 9           | 49869,37                                                           | -20,1        | 38,0         | 19,2           |
| 10          | 49869,50                                                           | -20,1        | 38,0         | 19,2           |
| 11          | 49869,95                                                           | -20,2        | 38,0         | 19,2           |
| 12          | 49870,21                                                           | -20,1        | 38,0         | 19,2           |
| 13          | 49870,37                                                           | -20,1        | 38,0         | 19,2           |
| 14          | 49870,95                                                           | -20,1        | 38,0         | 19,2           |
| 15          | 49870,88                                                           | -20,1        | 38,0         | 19,2           |
| 16          | 49871,13                                                           | -20,1        | 38,0         | 19,2           |
| 17          | 49870,52                                                           | -20,1        | 38,0         | 19,2           |
| 18          | 49870,59                                                           | -20,1        | 38,0         | 19,2           |

Note : Meas = Burst number + 18

| Meas<br>N° | Temp.<br>( °C ) | Slope    | Sigma   | 406 MHz<br>Pw (dBm) | Short term | 121.5 MHz<br>Power (dBm) |
|------------|-----------------|----------|---------|---------------------|------------|--------------------------|
| 1          | -20,1           | 1,2E-9   | 2,7E-09 | 38,0                | 2,2E-10    | 19,2                     |
| 18         | -20,0           | 1,4E-10  | 7,1E-10 | 38,0                | 2,4E-10    | 19,2                     |
| 31         | -20,0           | 1,7E-11  | 6,6E-10 | 38,0                | 1,8E-10    | 19,2                     |
| 61         | -20,0           | -1,7E-11 | 6,4E-10 | 38,0                | 3,0E-10    | 19,2                     |
| 91         | -20,0           | 9,6E-11  | 4,9E-10 | 38,0                | 1,3E-10    | 19,2                     |
| 121        | -20,1           | -3,0E-11 | 7,1E-10 | 38,0                | 2,9E-10    | 19,2                     |
| 151        | -20,1           | -1,1E-11 | 6,0E-10 | 38,0                | 2,3E-10    | 19,2                     |
| 181        | -20,0           | 5,4E-11  | 7,0E-10 | 38,0                | 2,5E-10    | 19,2                     |
| 211        | -20,1           | -3,7E-11 | 4,3E-10 | 38,0                | 2,6E-10    | 19,2                     |
| 241        | -20,1           | -3,5E-11 | 6,3E-10 | 38,0                | 3,0E-10    | 19,2                     |
| 271        | -20,1           | 7,0E-11  | 5,0E-10 | 38,0                | 1,8E-10    | 19,2                     |
| 301        | -20,1           | 4,7E-11  | 5,5E-10 | 38,0                | 1,9E-10    | 19,2                     |
| 331        | -20,1           | -2,6E-12 | 6,6E-10 | 38,0                | 2,3E-10    | 19,2                     |
| 361        | -20,1           | 4,4E-11  | 7,4E-10 | 38,0                | 2,5E-10    | 19,2                     |
| 391        | -20,1           | 2,8E-11  | 4,4E-10 | 38,0                | 2,2E-10    | 19,2                     |
| 421        | -20,1           | 2,3E-11  | 6,9E-10 | 38,0                | 1,8E-10    | 19,2                     |
| 451        | -20,1           | -3,6E-11 | 8,7E-10 | 38,0                | 2,2E-10    | 19,2                     |
| 481        | -20,1           | -3,5E-11 | 6,3E-10 | 38,0                | 2,1E-10    | 19,2                     |
| 511        | -20,1           | 6,2E-11  | 7,9E-10 | 38,0                | 2,6E-10    | 19,2                     |
| 541        | -20,1           | -4,1E-11 | 4,5E-10 | 38,0                | 2,6E-10    | 19,2                     |
| 571        | -20,1           | 1,4E-11  | 5,7E-10 | 38,0                | 2,4E-10    | 19,2                     |
| 601        | -20,1           | -3,6E-11 | 5,1E-10 | 38,0                | 2,5E-10    | 19,2                     |
| 631        | -20,1           | 1,5E-10  | 4,7E-10 | 38,0                | 2,7E-10    | 19,2                     |
| 661        | -20,1           | 3,3E-12  | 5,4E-10 | 38,0                | 2,8E-10    | 19,2                     |
| 691        | -20,1           | -2,4E-11 | 7,5E-10 | 38,0                | 1,6E-10    | 19,2                     |
| 721        | -20,1           | 6,5E-11  | 7,1E-10 | 38,0                | 2,0E-10    | 19,2                     |
| 751        | -20,1           | -1,5E-11 | 5,3E-10 | 38,0                | 2,3E-10    | 19,2                     |
| 781        | -20,1           | 2,7E-12  | 6,4E-10 | 38,0                | 3,2E-10    | 19,2                     |
| 811        | -20,1           | -2,7E-11 | 5,1E-10 | 38,0                | 3,3E-10    | 19,2                     |
| 841        | -20,1           | 2,4E-11  | 6,4E-10 | 38,0                | 2,1E-10    | 19,2                     |

| Meas           | Temp. | Slope    | Sigma   | P406 | Short term | P121.5 |
|----------------|-------|----------|---------|------|------------|--------|
| 871            | -20,1 | -4,1E-11 | 4,5E-10 | 38,0 | 2,2E-10    | 19,2   |
| 901            | -20,1 | 6,3E-11  | 5,7E-10 | 38,0 | 2,5E-10    | 19,2   |
| 931            | -20,1 | 5,5E-11  | 6,4E-10 | 38,0 | 2,5E-10    | 19,2   |
| 961            | -20,1 | 1,9E-11  | 5,9E-10 | 38,0 | 2,7E-10    | 19,2   |
| 991            | -20,1 | -2,6E-11 | 6,9E-10 | 38,0 | 2,9E-10    | 19,2   |
| 1021           | -20,1 | -2,2E-11 | 4,9E-10 | 38,0 | 2,2E-10    | 19,2   |
| 1051           | -20,1 | 1,1E-10  | 3,6E-10 | 38,0 | 1,2E-10    | 19,2   |
| 1081           | -20,2 | 2,4E-11  | 8,1E-10 | 38,0 | 2,1E-10    | 19,2   |
| 1111           | -20,1 | -1,8E-11 | 6,3E-10 | 38,0 | 2,5E-10    | 19,2   |
| 1141           | -20,1 | 3,8E-11  | 6,4E-10 | 38,0 | 2,8E-10    | 19,2   |
| 1171           | -20,1 | 8,1E-11  | 5,0E-10 | 35,9 | 3,0E-10    | 19,2   |
| 1201           | -20,2 | 5,8E-12  | 7,0E-10 | 38,0 | 1,8E-10    | 19,2   |
| 1231           | -20,1 | -1,3E-11 | 5,4E-10 | 38,0 | 2,4E-10    | 19,2   |
| 1261           | -20,1 | -9,8E-11 | 6,4E-10 | 38,0 | 3,3E-10    | 19,2   |
| 1291           | -20,1 | 4,5E-11  | 7,0E-10 | 38,0 | 3,0E-10    | 19,2   |
| 1321           | -20,1 | -5,2E-11 | 5,6E-10 | 38,0 | 2,2E-10    | 19,2   |
| 1351           | -20,1 | -1,2E-10 | 6,5E-10 | 38,0 | 2,1E-10    | 19,2   |
| 1381           | -20,1 | -3,0E-12 | 5,2E-10 | 38,0 | 1,9E-10    | 19,2   |
| 1411           | -20,2 | 5,8E-11  | 4,8E-10 | 38,0 | 1,5E-10    | 19,2   |
| 1441           | -20,1 | 4,7E-12  | 6,4E-10 | 38,0 | 2,0E-10    | 19,2   |
| 1471           | -20,1 | -3,2E-11 | 5,5E-10 | 38,0 | 2,3E-10    | 19,2   |
| 1501           | -20,2 | -4,0E-11 | 5,0E-10 | 38,0 | 3,2E-10    | 19,2   |
| 1531           | -20,2 | 8,1E-11  | 5,3E-10 | 38,0 | 2,5E-10    | 19,2   |
| 1561           | -20,1 | 3,0E-11  | 5,3E-10 | 38,0 | 1,5E-10    | 19,2   |
| 1591           | -20,2 | -9,7E-11 | 3,6E-10 | 38,0 | 2,6E-10    | 19,2   |
| 1621           | -20,2 | 6,2E-11  | 6,4E-10 | 38,0 | 2,1E-10    | 19,2   |
| 1651           | -20,2 | 2,0E-11  | 6,1E-10 | 36,3 | 1,6E-10    | 19,2   |
| 1681           | -20,2 | 1,0E-11  | 4,2E-10 | 38,0 | 2,0E-10    | 19,2   |
| 1711           | -20,2 | 3,3E-11  | 7,1E-10 | 38,0 | 2,9E-10    | 19,2   |
| 1741<br>≈ 24 h | -20,2 | 1,5E-12  | 5,5E-10 | 38,0 | 2,3E-10    | 19,2   |
| 1771           | -20,2 | 5,6E-12  | 6,1E-10 | 38,0 | 1,9E-10    | 19,2   |
| 1801           | -20,2 | 2,3E-11  | 5,0E-10 | 38,0 | 2,7E-10    | 19,2   |
| 1831           | -20,2 | 5,5E-11  | 5,7E-10 | 38,0 | 2,9E-10    | 19,2   |
| 1861           | -20,2 | 3,4E-11  | 6,2E-10 | 38,0 | 2,0E-10    | 19,2   |
| 1891           | -20,2 | -1,2E-11 | 7,3E-10 | 38,0 | 2,7E-10    | 19,2   |
| 1921           | -20,2 | 1,2E-12  | 4,3E-10 | 38,0 | 2,3E-10    | 19,2   |
| 1951           | -20,2 | -3,0E-11 | 6,6E-10 | 38,0 | 2,0E-10    | 19,2   |
| 1981           | -20,2 | -3,6E-11 | 4,0E-10 | 38,0 | 2,1E-10    | 19,2   |
| 2011           | -20,2 | 1,7E-11  | 5,7E-10 | 38,0 | 2,6E-10    | 19,2   |
| 2041           | -20,2 | -1,3E-11 | 5,8E-10 | 38,0 | 1,8E-10    | 19,2   |
| 2071           | -20,2 | -1,2E-11 | 5,2E-10 | 38,0 | 1,7E-10    | 19,2   |
| 2101           | -20,2 | 8,6E-11  | 5,3E-10 | 38,0 | 2,1E-10    | 19,2   |
| 2131           | -20,2 | -9,1E-11 | 5,1E-10 | 38,0 | 2,6E-10    | 19,2   |
| 2161           | -20,2 | 3,4E-11  | 4,9E-10 | 38,0 | 1,2E-10    | 19,2   |
| 2191           | -20,2 | 4,0E-12  | 6,5E-10 | 38,0 | 2,8E-10    | 19,2   |
| 2221           | -20,2 | -3,0E-11 | 4,4E-10 | 38,0 | 2,6E-10    | 19,2   |
| 2251           | -20,3 | 2,7E-12  | 6,5E-10 | 37,9 | 3,0E-10    | 19,2   |
| 2281           | -20,2 | -5,6E-11 | 4,9E-10 | 37,8 | 3,0E-10    | 19,2   |
| 2311           | -20,2 | 1,6E-11  | 4,4E-10 | 37,6 | 3,4E-10    | 19,2   |
| 2341           | -20,2 | -4,5E-11 | 5,6E-10 | 37,3 | 4,9E-10    | 19,2   |
| 2371           | -20,3 | -1,2E-11 | 6,0E-10 | 37,1 | 2,3E-10    | 19,2   |

| Meas                 | Temp. | Slope    | Sigma   | P406 | Short term | P121.5 |
|----------------------|-------|----------|---------|------|------------|--------|
| 2401                 | -20,3 | -1,8E-11 | 6,1E-10 | 36,7 | 2,9E-10    | 19,2   |
| 2431                 | -20,3 | -6,2E-11 | 5,2E-10 | 36,3 | 1,7E-10    | 19,2   |
| 2461                 | -20,3 | 1,3E-11  | 5,7E-10 | 35,8 | 2,4E-10    | 19,2   |
| 2491<br>≈ 34.5 hours | -20,3 | -4,9E-11 | 7,1E-10 | 35,2 | 2,3E-10    | 19,1   |
| 2521                 | -20,3 | -2,4E-11 | 3,6E-10 | 34,3 | 2,2E-10    | 19,0   |
| 2551                 | -20,3 | -6,7E-11 | 5,9E-10 | 33,4 | 3,0E-10    | 18,9   |
| 2581                 | -20,3 | -2,8E-11 | 6,4E-10 | 32,1 | 2,3E-10    | 18,8   |
| 2611                 |       |          |         |      |            |        |
| 2641                 |       |          |         |      |            |        |

Beacon message after 24 of Operating Lifetime Test :  
**FFFE2F96EE3240072B80302DC5F78E0159E3**

See data and graphs of results on chapter 9 "C/S Type Approval Report -Ref E5503-ACR"

- pages : PLB200-37 to PLB200-46 for EUT 1/3 (PLB200)
- pages : PLB201-37 to PLB201-46 for EUT 2/3 (PLB201)

### 10.5.2 Self Test results

The Self Test has been done during Cospas / Sarsat Certification Test at three temperatures .

See Chapter 9 "C/S Type Approval Report -Ref E5503-ACR"

- pages : PLB200-26 to PLB200-28 for EUT 1/3 (PLB200)
- pages : PLB201-26 to PLB201-28 for EUT 2/3 (PLB201)