CHAPTER 11

OPERATIONAL LIFE AND SELF TESTS

11.1. TEST SPECIFICATIONS AND PROGRAMME

11.1.1 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 4 – Revision 1 October 2006)

• Using a fresh battery pack, turn ON the EUT (at the ambient temperature) for a period of time equal to the extension interval give by the constructor (3.74 hours) . (See Chapter 10 & Appendix A)

•Place the EUT turned OFF inside climatic chamber stabilized at - 20° 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.

11.1.2 Self Test

Following :
- Section A11.2 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 ± 2°C, 22 ± 2°C and 55± 2°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 puse 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

11.2. EQUIPMENT UNDER TEST

Beacon

Beacon Unit	:	1/2 (with 50 ohm output)
Name	:	MARTEC / KANNAD
Type	:	XS3 GPS
Number	:	UT1

Class : II
Cat : I

Beacon Battery :
Chemistry : Lithium
Size and number of cells : DL123 / 6 cells
Manufacturer & model n° : DURACELL
Pack manufacturer and part number : Williamson / WILLPA1655

11.3. TEST SITE

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

11.4. TEST EQUIPMENT

• Climatic chamber: CLIMATS F.C.H. – Type: Austral 137H60/1,5E - S/N: S4880.

• Argos - Cospas/Sarsat Test Bench

11.5. RESULTS

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

11.5.1 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 10 : C/S Type Approval Test Report § " OPERATING LIFE TEST RESULTS ON MARTEC/KANNAD XS3 GPS UT1")

Following the § 8.7 “Battery discharge calculation” from manufacturer documentation joint in annex C of Appendix A the batteries packs capacity has been reduced by the Test Laboratory during 3.74 hours at ambient Lab temperature.

11.5.1.1 Test implementation

Beacon Unit	:	1/2 (with 50 ohm output)
Name	:	MARTEC / KANNAD
Type	:	XS3 GPS
Number	:	UT1

Date	Hour	Operations	Results
November 2nd, 2007	08:00	The beacon, in the ready condition, is thermally saoked at - 20° C in the temperature-controled oven .	
November 2nd, 2007	10:30	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 begins.	OK
November 3th, 2007	16:30	End of Automatic Operational Life Test.	
November 5th, 2007	08:30	Analysis of Operating Life Test Results :	Correct during ≈ 28 hours

11.5.1.2 Electrical results of Operating Life Tests

Warm Up	Δ Frequency (Hz)	Temp. (°C)	P406 (dBm)	P121.5 (dBm)
1	49879,08	-20,7	36,5	0,0
2	49875,21	-20,8	36,5	0,0
3	49872,47	-20,6	36,5	19,1
4	49870,15	-20,6	36,5	19,1
5	49869,23	-20,5	36,5	19,1
6	49868,97	-20,8	36,5	19,1
7	49868,84	-20,5	36,5	19,1
8	49868,73	-20,7	36,5	19,1
9	49868,72	-20,7	36,5	19,1
10	49868,52	-20,7	36,5	19,1
11	49868,46	-20,6	36,5	19,1
12	49868,40	-20,7	36,5	19,1
13	49868,31	-20,7	36,5	19,1
14	49868,31	-20,7	36,5	19,1
15	49868,27	-20,7	36,5	19,1
16	49868,18	-20,5	36,5	19,1
17	49868,30	-20,6	36,5	19,1
18	49868,18	-20,7	36,5	19,1

No = number of 406 MHz burst -18

No	Temp.	Slope	Sigma	P406	Short term	P121.5
1	-20,8	-7,0E-10	3,1E-09	36,5	1,7E-10	19,1
18	-20,7	-5,4E-11	1,9E-10	36,5	8,3E-11	19,1
31	-20,6	-1,1E-11	1,5E-10	36,5	7,3E-11	19,1
61	-20,6	2,2E-11	9,2E-11	36,5	7,3E-11	19,1
91	-20,7	-1,2E-11	1,1E-10	36,5	9,5E-11	19,1
121	-20,7	1,4E-11	1,1E-10	36,5	8,5E-11	19,1
151	-20,7	2,2E-11	8,2E-11	36,5	6,8E-11	19,1
181	-20,7	1,6E-11	9,0E-11	36,5	7,3E-11	19,1
211	-20,7	6,6E-12	2,0E-10	36,5	7,3E-11	19,1
241	-20,6	1,1E-11	1,3E-10	36,5	9,2E-11	19,1
271	-20,6	1,8E-11	1,6E-10	36,5	7,9E-11	19,1
301	-20,7	2,1E-11	1,2E-10	36,5	6,2E-11	19,1
331	-20,7	5,1E-11	1,7E-10	36,5	9,2E-11	19,1
361	-20,8	3,6E-12	1,6E-10	36,5	7,8E-11	19,1
391	-20,7	1,0E-11	2,4E-10	36,5	6,0E-11	19,1
421	-20,8	2,3E-11	1,9E-10	36,5	7,9E-11	19,1
451	-20,7	1,0E-11	1,3E-10	36,5	9,2E-11	19,1
481	-20,6	6,4E-14	1,7E-10	36,5	8,7E-11	19,1
511	-20,6	-7,3E-13	8,0E-11	36,5	6,4E-11	19,1
541	-20,7	-1,3E-11	1,5E-10	36,5	6,9E-11	19,1
571	-20,6	-1,1E-11	1,1E-10	36,5	1,1E-10	19,1
601	-20,8	1,2E-11	1,1E-10	36,5	8,3E-11	19,1
631	-20,6	2,0E-12	8,2E-11	36,5	8,8E-11	19,1
661	-20,8	4,9E-12	1,1E-10	36,5	5,9E-11	19,1
691	-20,8	7,4E-12	2,1E-10	36,5	7,9E-11	19,1
721	-20,7	3,8E-12	6,9E-11	36,5	7,6E-11	19,1
751	-20,7	4,1E-12	1,7E-10	36,5	9,2E-11	19,1
781	-20,7	-1,1E-11	2,2E-10	36,5	8,0E-11	19,1
811	-20,7	-1,7E-12	1,6E-10	36,5	6,2E-11	19,1
841	-20,7	1,4E-11	1,8E-10	36,5	7,1E-11	19,1

No	Temp.	Slope	Sigma	P406	Short term	P121.5	
871	-20,7	2,5E-11	1,9E-10	36,5	6,6E-11	19,1	
901	-20,6	-1,0E-11	8,6E-11	36,5	8,3E-11	19,1	
931	-20,7	7,3E-12	1,9E-10	36,5	7,6E-11	19,1	
961	-20,6	4,5E-12	2,2E-10	36,5	6,8E-11	19,1	
991	-20,6	2,1E-12	1,1E-10	36,5	8,1E-11	19,1	
1021	-20,7	-1,5E-12	9,4E-11	36,5	8,4E-11	19,1	
1051	-20,8	-6,7E-13	7,4E-11	36,5	6,4E-11	19,1	
1081	-20,7	-3,3E-12	1,0E-10	36,5	1,1E-10	19,1	
1111	-20,6	-5,6E-12	8,3E-11	36,5	7,1E-11	19,1	
1141	-20,7	8,6E-12	8,8E-11	36,5	7,2E-11	19,1	
1171	-20,7	-2,2E-11	1,2E-10	36,5	6,5E-11	19,1	
1201	-20,7	-2,2E-11	1,2E-10	36,5	7,3E-11	19,1	
1231	-20,7	-2,5E-12	9,0E-11	36,5	8,7E-11	19,1	
1261	-20,6	7,5E-12	1,1E-10	36,5	7,7E-11	19,1	
1291	-20,6	-5,8E-12	1,9E-10	36,5	8,2E-11	19,1	
1321	-20,6	1,4E-11	1,6E-10	36,5	7,7E-11	19,1	
1351	-20,6	-7,5E-12	9,7E-11	36,5	7,7E-11	19,1	
1381	-20,7	-5,6E-12	1,2E-10	36,5	7,5E-11	19,1	
1411	-20,7	1,3E-11	2,3E-10	36,5	9,8E-11	19,1	
1441	-20,7	1,7E-11	2,2E-10	36,5	7,6E-11	19,1	
1471	-20,7	5,0E-12	1,4E-10	36,5	1,1E-10	19,1	
1501	-20,6	1,1E-11	1,7E-10	36,5	9,3E-11	19,1	
1531	-20,6	1,4E-11	5,6E-11	36,5	8,4E-11	19,1	
1561	-20,8	3,3E-12	1,1E-10	36,5	8,0E-11	19,1	
1591	-20,7	4,0E-12	7,6E-11	36,5	1,1E-10	19,1	
1621	-20,6	2,9E-12	1,0E-10	36,5	8,6E-11	19,1	
1651	-20,8	1,4E-12	1,8E-10	36,5	9,0E-11	19,1	
1681	-20,7	-1,2E-11	6,1E-11	36,5	1,3E-10	19,1	
1711	-20,6	1,4E-11	1,5E-10	36,5	2,4E-10	19,1	
1741	-20,6	1,3E-12	2,0E-10	36,5	2,8E-10	19,1	24h
1771	-20,7	1,5E-11	2,9E-10	36,5	3,3E-10	19,1	
1801	-20,6	-1,4E-11	2,2E-10	36,5	2,0E-10	19,1	
1831	-20,6	6,9E-13	2,1E-10	36,5	1,4E-10	19,1	
1861	-20,7	1,4E-11	2,0E-10	36,5	1,2E-10	19,1	
1891	-20,8	4,3E-12	1,8E-10	36,5	1,2E-10	19,1	
1921	-20,6	5,4E-12	1,4E-10	36,5	1,2E-10	19,1	
1951	-20,6	1,1E-11	8,7E-11	36,5	7,2E-11	19,1	
1981	-20,7	1,9E-11	1,5E-10	36,5	6,4E-10	19,1	
2011	-20,7	-1,9E-11	2,3E-10	36,5	1,7E-9	19,1	
2026	-20,7	-9,1E-10	2,8E-09	36,5	1,3E-9	19,1	28h
2041	-20,6	1,1E-8	2,1E-08	35,9	6,2E-9	19,1	
2071	-20,6	2,7E-10	1,3E-09	34,5	3,0E-9	19,1	
2101	-20,7	3,4E-10	1,1E-09	34,0	2,7E-9	19,1	
2131	-20,6	1,1E-10	1,3E-09	33,4	1,9E-9	18,8	
2161	-20,7	1,5E-10	2,6E-10	32,9	1,5E-9	18,2	
2191	-20,7	-5,2E-10	4,1E-09	27,9	2,1E-9	12,2	
2221							

Sample beacon message during the Operating Lifetime Test :

FFFE2F8E3E2293E02B8036AFFAF78E4141F0
FFFE2F8E3E2293E02B8036AFFAF78E014CDA
FFFE2F8E3E2293E02B8036AFFAF78E0159E3
FFFE2F8E3E2293E02B8036AFFAF78E412A5F
FFFE2F8E3E2293E02B8036AFFAF78E4154C9
FFFE2F8E3E2293E02B8036AFFAF78E4141F0
FFFE2F8E3E2293E02B8036AFFAF78E416B82

See data and graphs of results on chapter 10 "C/S Type Approval Report " pages 46 to 59

11.5.2 Self Test results

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

See Chapter 10 "C/S Type Approval Report " 10 "C/S Type Approval Report " pages 38 to 39

Message at -20°C

Manufacturer	MARTEC / KANNAD
Beacon model	XS3-GPS
Serial number	UT1
Date of test	13-sept-07
Temperature	-18,6
Message received	FFFED08E3E2293E07FDFFDF6D23783E0F66C
Frame synchro. pattern	011010000
15 Hex ID	1C7C4527C0FFBFF

Total transmission time	ms	514.8<	< 525.2	519,63

Message at 22°C

Manufacturer	MARTEC / KANNAD
Beacon model	XS3-GPS
Serial number	UT1
Date of test	26-sept-07
Temperature	22,9
Message received	FFFED08E3E2293E07FDFFDF6D23783E0F66C
Frame synchro. pattern	011010000
15 Hex ID	1C7C4527C0FFBFF

Total transmission time	ms	514.8<	<525.2	519,40

Message at 55 °C

Manufacturer	MARTEC / KANNAD
Beacon model	XS3-GPS
Serial number	UT1
Date of test	12-sept-07
Temperature	55,1
Message received	FFFED08E3E2293E07FDFFDF6D23783E0F66C
Frame synchro. pattern	011010000
15 Hex ID	1C7C4527C0FFBFF

Total transmission time	ms	514.8<	<525.2	519,16

121.5 MHz : 2 sweeps < 1 sec

FFFED08E3E2293E07FDFFDF6D23783E0F66C

Self Test message decode

ITEM	BITS	VALUE
Message format: long format	25	1
Protocol: Location Protocol	26	0
Country code: 227	27-36	0011100011
Type of location protocol: Standard Location - Test	37-40	1110
Test Protocol: Test Protocol (No Decode information in bits 41 to 64)	41-64	0010001010010011111100000
Latitude Sign: default	65	0
Latitude Degrees: default	66-72	1111111
Latitude Minutes: default	73-74	11
Longitude Sign: default	75	0
Longitude Degrees: default	76-83	11111111
Longitude Minutes: default	84-85	11
BCH 1 Encoded:	86-106	10111111011011001001000
BCH 1 Calculated:	N/A	10111111011011001001000
Fixed bits (1101): Pass	107-110	1101
Position Data: Encoded Position Data Source From Internal Navigation Device	111	1
Aux Device: 121.5 MHz homer	112	1
Latitude Offset Sign: default	113	1
Latitude Offset Minutes: default	114-118	00000
Latitude Offset Seconds: default	119-122	1111
Longitude Offset Sign: default	123	1
Longitude Offset Minutes: default	124-128	00000
Longitude Offset Seconds: default	129-132	1111
BCH 2 Encoded:	133-144	011001101100
BCH 2 Calculated:	N/A	011001101100
Composite Latitude: default	N/A	Composite Longitude: default
15 Hex ID:	N/A	1C7C4527C0FFBFF