

CHAPTER 11

A 11.0 - THERMAL SHOCK TESTS

11.1 TEST SPECIFICATIONS AND PROGRAMME

Following Section A11.0 of RTCM Recommended Standards for 406 MHz Satellite EPIRBs (Version 2.0 Feb 5,1997) :

11.1.1. LOW -TEMPERATURE THERMAL SHOCK

- With the beacon in the ready condition , place it in a temperature-controlled oven at - 30° C for a minimum of three hours.
- Remove the beacon from the oven and immerse it in fresh water at a temperature of 0° C to + 5° C. for 5- 10 seconds .
- Then control if the EUT is normally self activate within 5 minutes floating in water at that temperature .
- Remove the EUT from the water , deactivate it, set it to the ready position and place it in a temperature-controlled oven at - 40° C for a minimum of three hours.
- Immerse the beacon in salt water (5 % NaCl) at a temperature of - 2° C to + 5° C for 10 seconds .
- Then control if the EUT is normally self activate within 5 minutes floating in water at that temperature .
- After 15 minutes floating, the electrical measurements should be nominal.

Note : These electrical measurements and results are used for the COSPAS-SARSAT Type Approval Tests Report (chapter 12)

11.1.2. HIGH-TEMPERATURE THERMAL SHOCK

- Proceed as described in § 11.2.1. but with oven temperature at + 70° C and the water maintained between 25° C and 35° C.

11.2. EQUIPMENT UNDER TEST

Beacon Unit : 2/2
Name : JOTRON
Type : TRON 40GPS
Number : 7001

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.
- Fresh or salt water container .
- KEITHLEY thermometer/multimeter ,Type : 2000, S/N 0678112 with CU-CT thermocoupler.
- Argos - Cospas/Sarsat Test Bench

11.5. TEST RESULTS OF LOW-TEMPERATURE THERMAL SHOCK

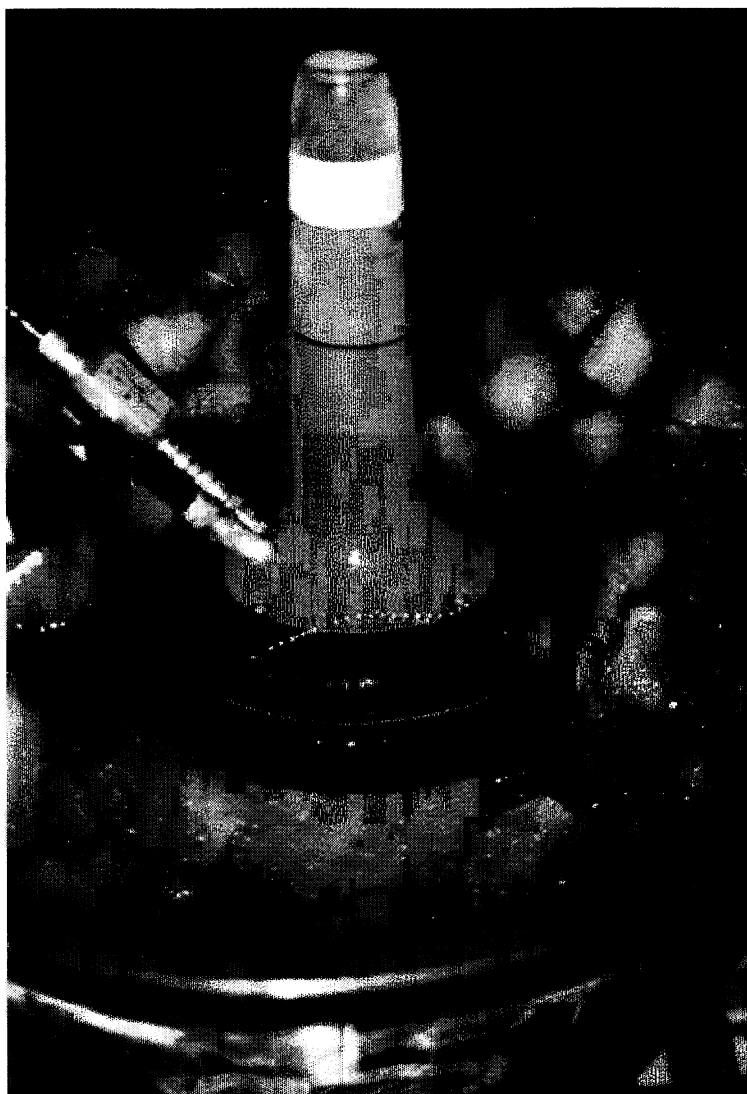
11.5.1 Test implementation

Date	Hour	Operations	Results
22 June 2000	18:45	The beacon, in the ready condition, is thermally soaked at - 30° C in the temperature-controlled oven .	
23 June 2000	8:00	The beacon is immersed in fresh water at 0° C within 10 seconds then floated for 5 minutes .	Self activation : OK
23 June 2000	8:20	The beacon, in the ready condition, is thermally soaked at - 31° C in the temperature-controlled oven .	
	11:29	The beacon is immersed in salt water at 0.1 ° C within 10 seconds then floated for 5 minutes .	Self activation : OK
	11:34	Then, the beacon, in float free position and in salt water at 0° C is connected to the test bench and an electrical test are conducted during 2 hours .	The results are nominal after 20 minutes.

11.5.2 Electrical results of Low-Temperature Thermal Shock Test

23 June 2000 Low-temperature thermal shock test : - 31° to 0.1° C See photo, data and graphs next pages	PARAMETERS	RESULTS AFTER 20 MIN.
	Nominal carrier frequency (406.025 MHz $\pm$ 0.002 MHz)	406.025011 MHz
	RF output power (5 W or 37 dBm $\pm$ 2)	37.4 dBm
	Short term frequency stability ($< 2 \times 10^{-9}$ /100 ms)	$\leq 2 \times 10^{-10}$ /100 ms
	Mean slope ($< \pm 1 \times 10^{-9}$ /mn)	$< 1 \times 10^{-9}$ /mn
	Residual frequency variation ($< 3 \times 10^{-9}$)	$\leq 2 \times 10^{-9}$

LOW-TEMPERATURE THERMAL SHOCK PHOTO



**THERMAL SHOCK TEST RESULT ON
TRON 40GPS JOTRON
N° 7001**

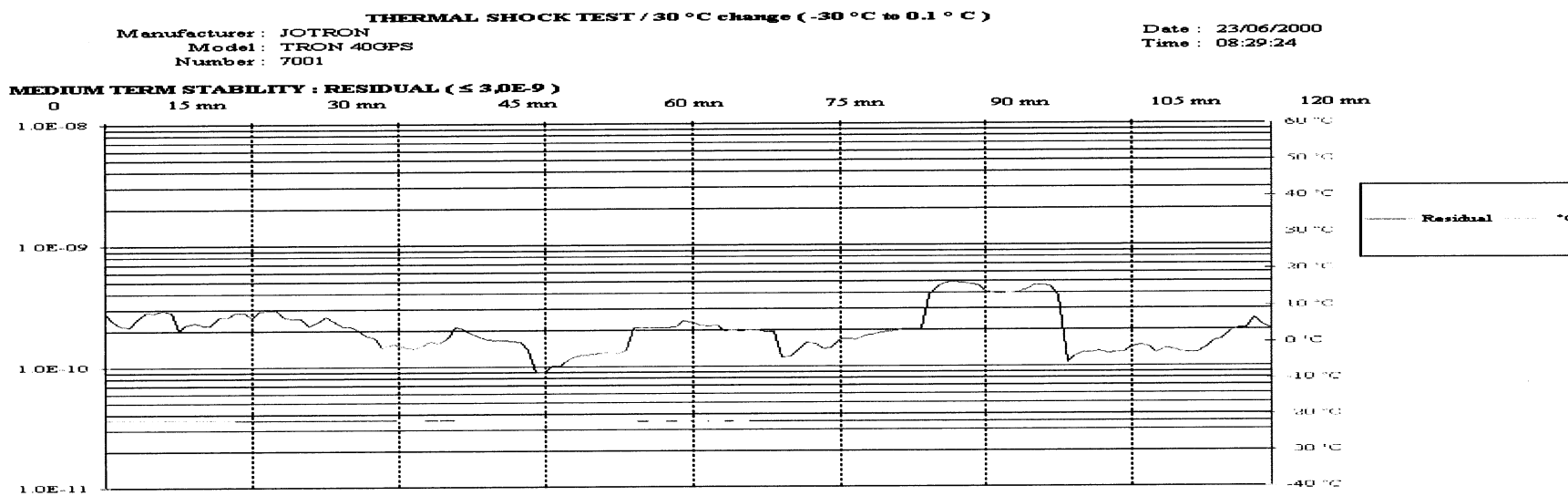
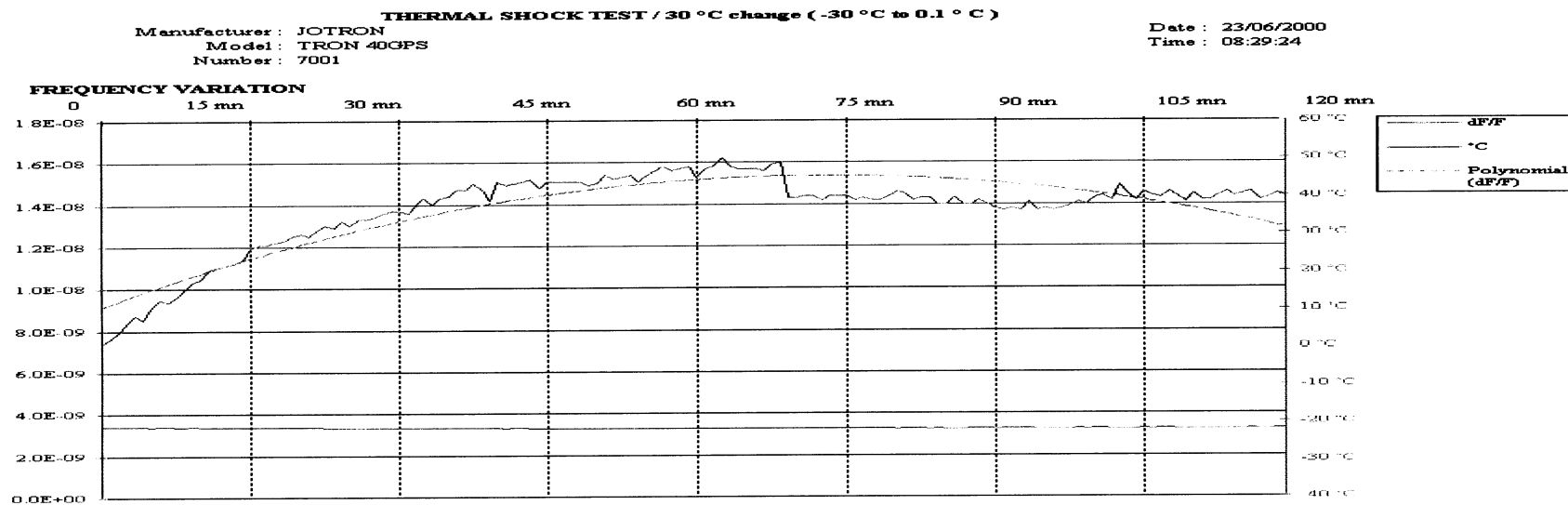
-30°C to 0.1°C

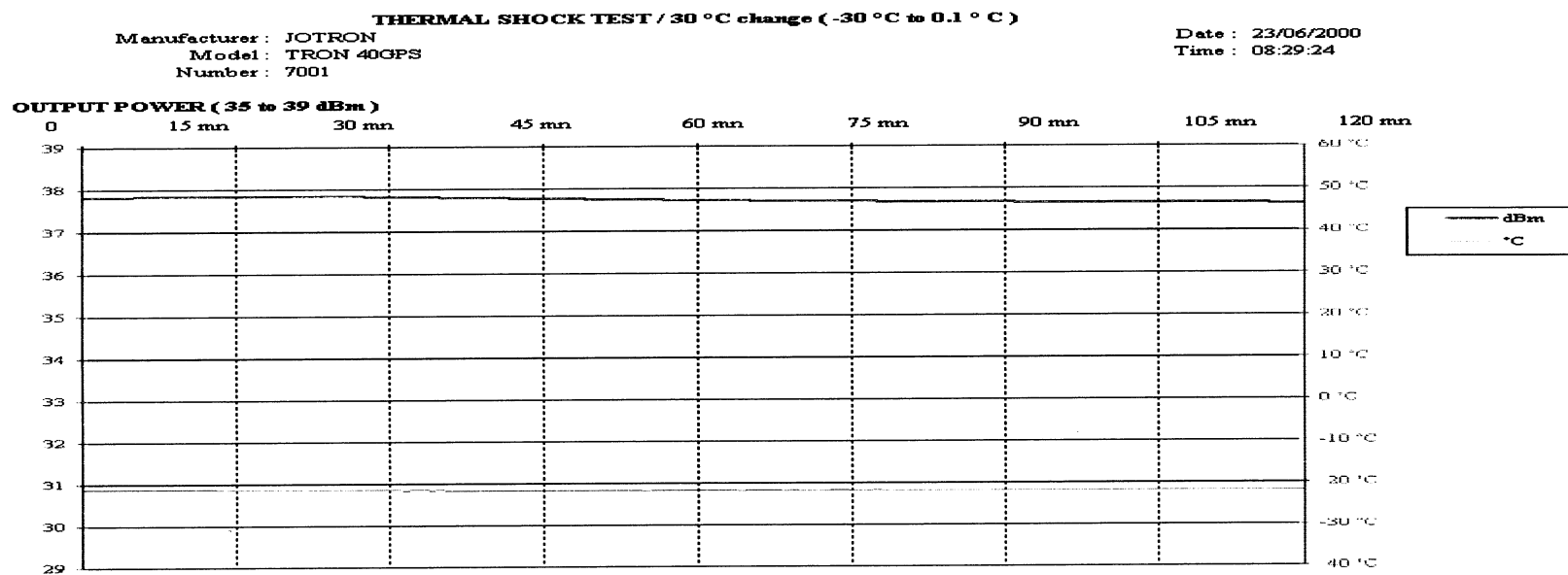
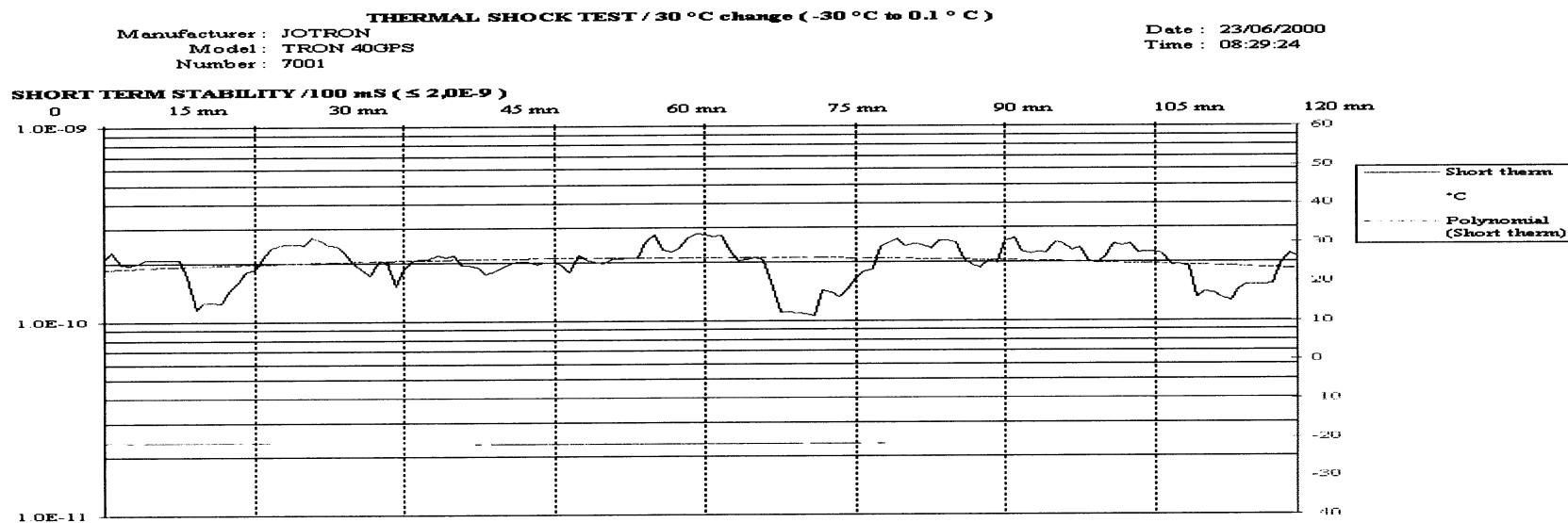
Temperature Soak : -30°C
 Temperature Measure : 0.1°C

No	Δ Frequency (Hz)	Temp. (°C)	P406 (dBm)	P121.5 (dBm)
1	50281.00	-31.8	38.4	16.5
2	50144.50	-1.8	37.9	45.1
3	50141.21	-1.7	38.0	45.1
4	50139.08	-1.7	37.9	45.0
5	50136.93	-1.8	37.7	45.2
6	50134.98	-1.7	37.6	45.2
7	50133.24	-1.8	37.6	45.1
8	50131.46	-1.8	37.6	45.1
9	50129.84	-1.8	37.7	44.9
10	50128.29	-1.9	37.7	44.9
11	50124.39	-1.5	37.7	44.9
12	50122.25	-2.0	37.6	44.8
13	50120.75	-1.7	37.5	44.9
14	50119.38	-1.9	37.5	44.8
15	50117.61	-1.9	37.5	44.9
16	50115.95	-1.9	37.5	44.8
17	50114.26	-1.9	37.5	44.7
18	50112.73	-1.9	37.5	44.8

No	Temp.	Slope	Sigma	P406	Short term	P121.5
1	-1.9	-5.7E-9	1.9E-9	37.6	2.1E-10	44.6
31	-1.7	-3.9E-10	4.4E-10	37.6	1.5E-10	44.4
61	-1.6	-5.7E-11	2.5E-10	37.6	1.8E-10	44.5
91	-1.4	-6.7E-11	1.9E-10	37.6	2.0E-10	44.5
121	-1.1	-1.5E-11	1.2E-10	37.6	1.5E-10	44.5

Beacon message at the end of Thermal Shock Test :
FFFE2F901E1E24002B80374C89B78E014CDA





11.6. TEST RESULTS OF HIGHT-TEMPERATURE THERMAL SHOCK

11.6.1 Test implementation

Date	Hour	Operations	Results
23 June 2000	15:40	The beacon, in the ready condition, is thermally soaked at + 70° C in the temperature-controlled oven .	
24 June 2000	9:30	The beacon is immersed in fresh water at 33° C within 10 seconds then floated for 5 minutes .	Self activation : OK
24 June 2000	10:00	The beacon, in the ready condition, is thermally soaked at + 70° C in the temperature-controlled oven .	
	13:36	The beacon is immersed in salt water at 31 ° C within 10 seconds then floated for 5 minutes .	Self activation : OK
	13:41	Then, the beacon, in float free position and in salt water at 31° C is connected to the test bench and an electrical test are conducted during 2 hours .	The results are nominal after 20 minutes.

11.6.2 Electrical results of Hight-Temperature Thermal Shock Test

24 June 2000	PARAMETERS	RESULTS AFTER 20 MIN.
Hight -temperature thermal shock test : +70 ° to + 31° C See photo, data and graphs next pages	Nominal carrier frequency (406.025 MHz ± 0.002 MHz)	406.025062 MHz
	RF output power (5 W or 37 dBm ± 2)	37.4 dBm
	Short term frequency stability ($< 2 \times 10^{-9}/100 \text{ ms}$)	$\leq 8 \times 10^{-10}/100 \text{ ms}$
	Mean slope ($< \pm 1 \times 10^{-9}/\text{mn}$)	$< 1 \times 10^{-9}/\text{mn}$
	Residual frequency variation ($< 3 \times 10^{-9}$)	$\leq 1 \times 10^{-9}$

HIGH-TEMPERATURE THERMAL SHOCK PHOTO



Pente et Sigma (Mesures)

Mesures du 24 Jun 1990 13:41:25

Constructeur : JOTRON
 Type : TRON 40GPS
 Numero : 7001
 Reference INTESPACE : M2393-1
 Type : SARSAT

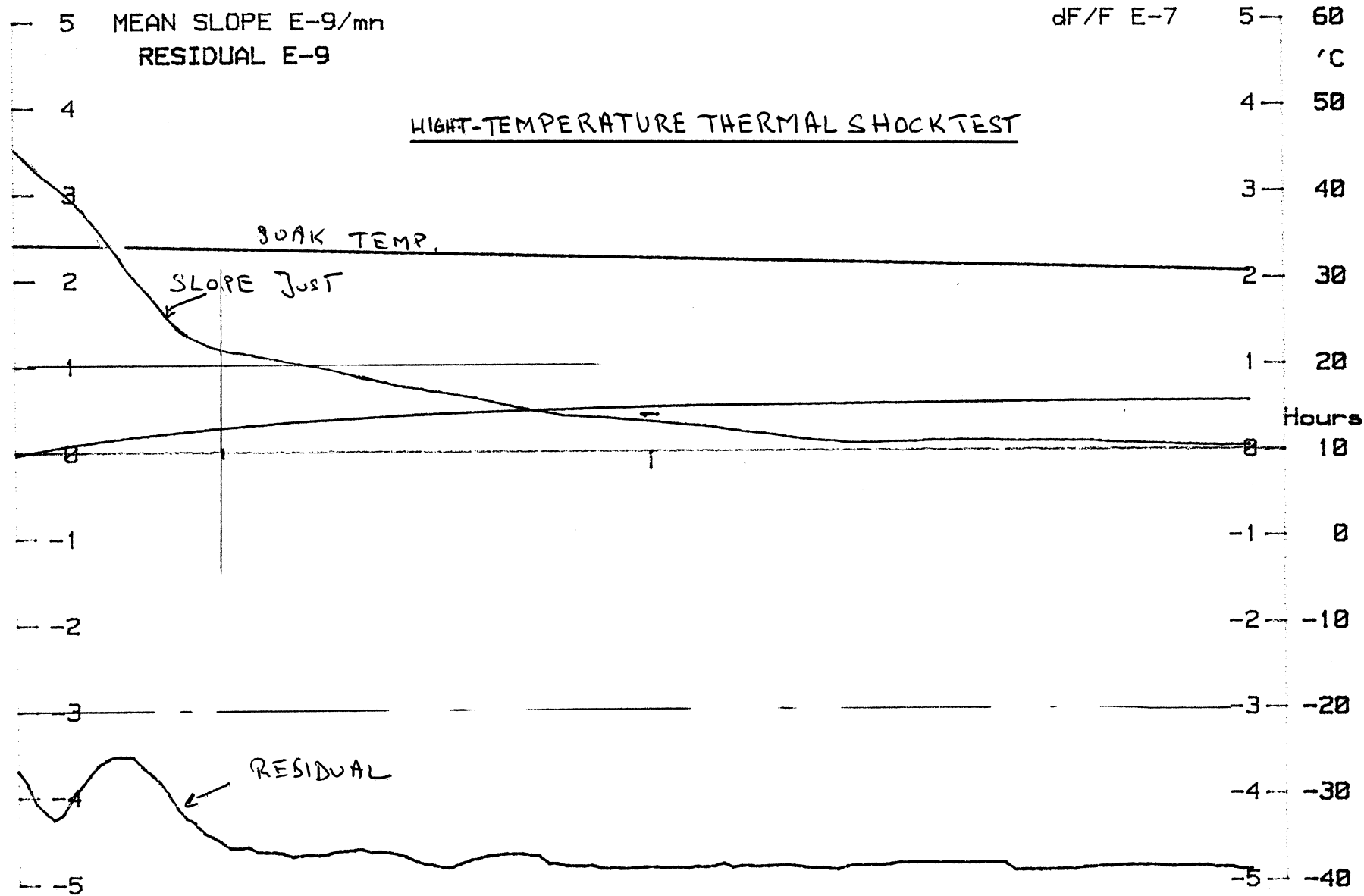
	Freq	Temp.	P406
1	50040.95	63.52	37.21
2	50042.46	33.53	37.21
3	50044.21	33.30	37.24
4	50045.73	33.08	37.24
5	50047.38	33.89	37.25
6	50048.89	33.68	37.26
7	50049.99	33.60	37.29
8	50051.08	33.49	37.29
9	50052.26	33.37	37.31
10	50053.43	33.10	37.32
11	50054.59	32.95	37.33
12	50055.70	32.67	37.34
13	50056.94	32.66	37.35
14	50057.89	32.48	37.36
15	50059.09	32.42	37.37
16	50060.19	32.28	37.37
17	50061.18	31.97	37.38
18	50062.21	31.88	37.38

No	Temp	Slope	Sigma	P406	Short term
1	31.85	+3.5E-09	+1.1E-09	37.3	+1.3E-10
18	31.66	+1.2E-09	+8.0E-10	37.4	+1.7E-10
31	31.52	+1.2E-09	+2.9E-10	37.5	+2.1E-10
61	31.44	+4.6E-10	+2.1E-10	37.5	+1.7E-10
91	31.39	+1.3E-10	+1.5E-10	37.5	+1.8E-10
121	31.35	+1.1E-10	+1.6E-10	37.5	+2.2E-10

Nbre d'erreurs de mesure recuperees : 0

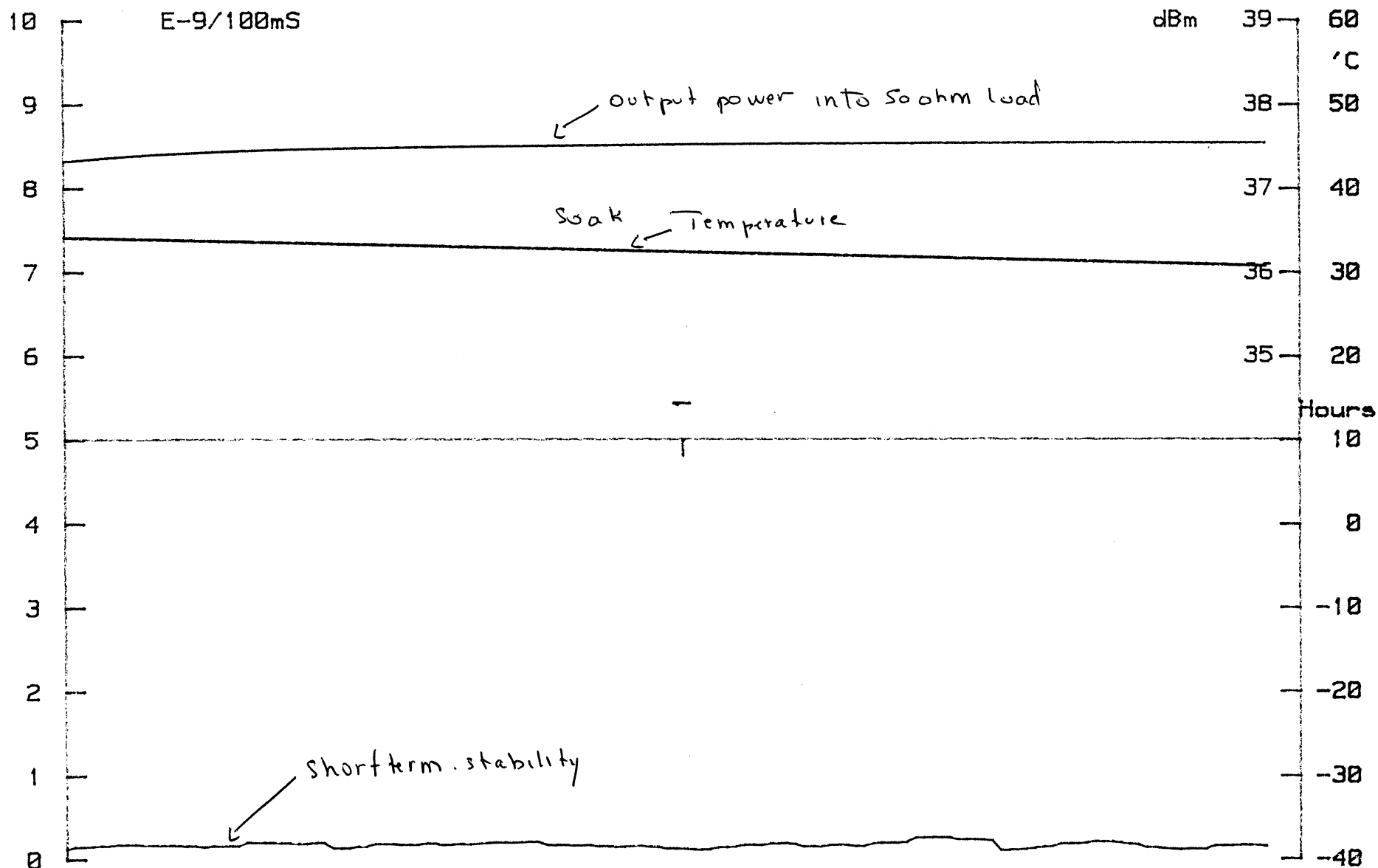
MEDIUM TERM STABILITY

BEACON MANUFACTURER MODEL SERIAL Nr DATE TIME 0
 JOTRON TRON 40GPS 7001 24 Jun 2000 13:41:20



HIGH-TEMPERATURE THERMAL SHOCK OUTPUT POWER and SHORT TERM STABILITY

BEACON MANUFACTURER MODEL SERIAL Nr DATE TIME 0
JOTRON TRON 40GPS 7001 24 Jun 2000 13:41:20



ITS : M2393-RTCM & CNES : DSO/RC//AS 2000-224