

CHAPTER 12

A12.0	COSPAS - SARSAT TYPE APPROVAL TESTS REPORT
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Toulouse, 13 October 2000

INTESPACE reference : M2393

TEST REPORT OF 406 MHz DISTRESS BEACON

MANUFACTURER : JOTRON

BEACON MODEL : TRON 40GPS

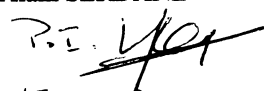
Written : 13 October 2000

By : Gerard PEYROU

Visa : 

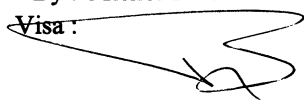
Approved : 13 October 2000

By : Alain SERDANE

Visa : 

Quality Control : 18-10-00

By : Michel BRUNEL

Visa : 

Distribution :

- Mr	Fred Ivar TALLAKSEN	JOTRON	(1 copy)
- Mr	S. MIKAILOV	COSPAS/SARSAT Sec	(1 copy)
- Mr	L. FOURCADE	CNES - CT/RC/AD/LM	(1 copy)
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Accréditation
N° 1-0743
Scope
given
on request



1 - ADMINISTRATION

1.1. WORK ORDER

Manufacturer : JOTRON

Address : P.O. Box 85 - 3280 TJODALYNG, NORWAY

Represented by : Mr Fred Ivar TALLAKSEN

1.2. INTESPACE TEST CENTER

The test operations was conducted by : Mr G. PEYROU

1.3. SCHEDULE

Start of test: 08 mars 2000

End of test : 31 juillet 2000

1.4. WORK REFERENCE : **M2393**

1.5. EQUIPMENT UNDER TEST

The results from this test report concern only the equipment here after referenced :

- Commercial designation :
- Model : TRON 40GPS
- Sériat number: 7000 and 7001

2 - TEST FACILITIES

- ARGOS - COSPAS/SARSAT Certification Test Bench.
- Anechoic chamber for antenna test .
- Toulouse CNES MCC .

3 - STANDARDS AND TEST PROCEDURES APPLICABLE

COSPAS-SARSAT standards :

- "C/S T. 001- Issue 3 - Revision 3 - October 1999 "
- "C/S T. 007- Issue 3 - Revision 6 - October 1999"

INTESPACE Radio Beacon Test Procédures :

- | | |
|---|------------------------|
| - " COSPAS-SARSAT Certification Test" | Réf. ITS : 572 AP/QA |
| - " 406 MHz Characteristic Antenna Test " | Réf. ITS : 566 AP/QA |
| - " Radio Beacon Test Report " | Réf. ITS : 579 AP/QA-f |

4 - RESULTS

See the following pages :

- application form for a COSPAS-SARSAT 406 MHz beacon Type Approval Certificate,
- summary of 406 MHz beacon test results
- test results : data and graphs
- and manufacturer technical data Annex A

ITS - AP/MT M2393
CNES - DSO/RC//AS N° 2000-136

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

Beacon Manufacturer : JOTRON

Beacon model : TRON 40GPS

Beacon Number : 7000 and 7001

Name and Location of Beacon Test Facility : INTESPACE / CNES Toulouse

Beacon Type : Aviation : ☐ Land : ☐ Maritime : ☒

Antenna Model : Internal

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

Specified Operating Lifetime : 24 hr ☐ 48 hr ☒ Other ☐ Specify :

Beacon Battery Type(s)

Chemistry : Li-SOCl₂
Manufacturer & model n° : SAFT LSH20
Size & number of cells : Dx4

Extra Features in Beacon	No	Yes	Details
a) Auxiliary Radio-Locating Device :	☐	☒	Frequency : 121.5 MHz Power : 20 dBm +/-3 dBm Tx. Duty Cycle : 100 %
b) Transmits Encoded Position Data	☐	☒	Nav. Device : Internal Type : GPS Manufacturer : Connexant Model : Jupiter LP TU30-D160
c) Transmits Long Message (144 bits)	☐	☒	
c) Automatic Activation :	☐	☒	
d) Built-in Strobe light :	☐	☒	Intensity : 0.85 Flash rate : 21
e) Self-test mode	☐	☒	
f) Other	☒	☐	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/ST T.001) as demonstrated in the attached report.

Dated : 13/10/2000

Signed : 
(for test facility)

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} -20°C (±3)	T _{amb.} 22°C (±3)	T _{max.} 55°C (±3)	
1 - POWER OUTPUT						
o transmitter power output	35 - 39	dBm	36,6	37,7	37,4	Graphs p, 20, 23 and 26 Graphs pages 14 to 16
o Power output rise time	< 5	ms	0,44	0,50	0,44	
o power output 1 ms before burst	must be < -10 dBm	√ *	√	√	√	
2 - DIGITAL MESSAGE						Data and graphs pages 17 to 26
Bits number						
o bit sync	15 bits "1"	√	√	√	√	
o frame sync	9 bits (000101111)	√	√	√	√	
o format flag	1 bit	√	1	1	1	
o protocol flag	1 bit	√	0	0	0	
o identification/position code	59 bits	√	√	√	√	
o BCH code	21 bits	√	√	√	√	
o emerg. code/nat. use/supplem. data	6 bits	data bits	110111	110111	110111	
o additional data/BCH (if applicable)	32 bits		√	√	√	
o position error (if applicable)	< 5	km	Def. Pos.	0,255 km	Def. Pos.	

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} -20°C (±3)	T _{amb.} 22°C (±3)	T _{max.} 55°C (±3)	
3 - DIGITAL MESSAGE GENERATOR						
o repetition rate *** :						Data and graphs pages 17 to 26
	minimum T _R =	47,5	seconds	48,5	48,5	
o bit rate	maximum T _R =	52,5	seconds	52,5	52,5	
	minimum f _b =	396	bits/sec.	398,84	398,85	
o total transmission time :	maximum f _b =	404	bits/sec.	398,88	398,87	
	short message =	435.6 - 444.4	ms			
o CW preamble	long message (optional) =	514.8 - 525.2	ms	521,87	521,94	
	minimum T _I =	158,4	ms	159,65	159,72	
o first burst delay	maximum T _I =	161,6	ms	160,83	160,90	
		> 47,5	seconds	64	63	

Table C2 : SUMMARY OF 406 MHz BEACON TEST RESULTS

Ref : M2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} -20°C (±3)	T _{amb.} 22°C (±3)	T _{max.} 55°C (±3)	
4 - MODULATION o biphase-L o rise time o fall time o phase deviation : positive o phase deviation : negative o symmetry measurement	√	√	√	√	√	Data and graphs pages 17 to 26
	50 - 250	microsec.	60	60	60	Just
	50 - 250	microsec.	50	60	60	Better > 100 microsec.
	+ (1.0 to 1.2)	radians	+ 1,01	+ 1,06	+ 1,16	See manufacturer note
	- (1.0 to 1.2)	radians	- 1,09	- 1,17	- 1,15	Annex A
	≤ 0.05		+ 0,0159	+ 0,0040	+ 0,0160	
5 - 406 MHz TRANSMITTED FREQUENCY o nominal value o short term stability o medium term stability o slope o residual frequency variation	406.023 - 406.027 or 406.027 - 406.029***	MHz	406,0251340	406,0251055	406,0250611	Data pages 18, 21 and 24
	$\leq 2 \times 10^{-9}$	/100 ms	3,05E-10	6,84E-10	1,24E-10	
	$(-1 \text{ to } +1) \times 10^{-9}$	/minute	-1,34E-11	-5,34E-11	-7,41E-11	
	$\leq 3 \times 10^{-9}$		1,87E-10	2,36E-10	3,20E-10	
6 - SPURIOUS EMISSION **** (into 50 ohms) o in-band (406.0 - 406.1 MHz)	see spurious emission mask in C/S T.001	√	√	√	√	See graphs pages 27 to 30 Just See manufacturer note Annex A

Table C2 : SUMMARY OF 406 MHz BEACON TEST RESULTS

Ref : M2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS			COMMENTS
			T _{min.} -20°C (±3)	T _{amb.} 22°C (±3)	T _{max.} 55°C (±3)	
7 - 406 MHz VSWR CHECK after open circuit, short circuit, then while VSWR is 3:1, measure : o nominal transmitted frequency Modulation : o rise time o fall time o phase deviation : positive o phase deviation : negative o symmetry measurement o digital message	406.023 - 406.027 or 406.027 - 406.029***	MHz	406,0251337	406,0251028	406,0250587	See data and graphs pages 31 to 37 Just . Better > 100 microsec.
	50 - 250	microsec.	60	50	60	
	50 - 250	microsec.	50	60	60	
	+ (1.0 to 1.2)	radians	1,01	1,09	1,13	
	- (1.0 to 1.2)	radians	-1,11	-1,15	-1,18	
	≤ 0.05	✓	+ 0,0199	+ 0,0080	+ 0,0040	
	must be correct	✓	✓	✓	✓	
8 - SELF-TEST MODE (if applicable) o frame sync o format flag o single radiated burst o default position data (if applicable) o description provided o design data provided on protection against repetitive self-test mode transmissions o single burst verification o provides for beacon 15 Hex ID	9 bits (011010000)	✓	✓	✓	✓	Data pages 42 to 44 Manufacturer doc. Annex A Data page 43
	1/0	bit	1	1	1	
	≤ 440 / 520 (+1%)	ms	522,33	521,92	522,25	
	must be correct	✓	✓	✓	✓	
	protection provided	✓	✓	✓	✓	
	one burst	✓	✓	✓	✓	
	must be correct	✓	✓	✓	✓	

Table C2. SUMMARY OF 406 MHz BEACON TEST RESULTS

Rev. 2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS	COMMENTS
9 - THERMAL SHOCK (30° C change)				Data and graphs pages 45 to 52
o Soak temperature :		°C	Tsoak = -30	
o Measurement temperature :		°C	TMeas = 0,1	
the following parameters are to be met within 15 minutes of beacon and maintained for 2 hours				
o Transmitted frequency :		MHz	406,025095 / 406,025118	
- nominal value	406,023 - 406,027 or 406,027 - 406,029***			
- short term stability	$\leq 2 \times 10^{-9}$	/100 ms	1,8E-10	
- medium term stability :	$(-1 \text{ to } +1) \times 10^{-9}$	/minute	-9,3E-10 1,47E-09	
- residual frequency variation	$\leq 3 \times 10^{-9}$			
o Transmitted power output	35 - 39	dBm	37,4	
o Digital message	must be correct	✓	✓	

Table C.2 SUMMARY OF 406 MHz BEACON TEST RESULTS

Rev. 2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS	COMMENTS
10 - OPERATING LIFETIME AT MINIMUM TEMPERATURE ****				
o Duration	> 24	hours	75 - 2 hours* = 73 hours at Tmin -20 °C	Data and graphs pages 53 to 70
o Transmitted frequency :				* time corresponding to the 4 years rated life
- nominal value	406.023 - 406.027 or 406.027 - 406.029***	MHz	406,025128 / 406,0251356	battery consumption
- short term stability		/100 ms	< 4,9E-10	
- medium term stability		/minute	-2E-10 / 2E-10	
. slope	(-1 to +1) x 10 ⁻⁹		< 4E-10	
. residual frequency variation	≤ 3 x 10 ⁻⁹		37,1 / 37,8	
o Transmitted power output	35 - 39	dBm		
o Digital message	must be correct	✓	✓	
11 - TEMPERATURE GRADIENT **** (5° C/hr)				
o Transmitted frequency :				
- nominal value	406.023 - 406.027 or 406.027 - 406.029***	MHz	406,025048267 / 406,025135993	Data and graphs pages 71 to 81
- short term stability	≤ 2 x 10 ⁻⁹	/100 ms	< 4,0E-10	
- medium term stability		/minute	-5E-10 / 5E-10	
. slope	(-1 to +1) x 10 ⁻⁹		< 6,0E-10	
. residual frequency variation	≤ 3 x 10 ⁻⁹		36,5 / 37,2	
o Transmitted power output	35 - 39	dBm		
o Digital message	must be correct	✓	✓	
12 - LONG TERM FREQUENCY STABILITY				
o Data provided	406.023 - 406.027 or 406.027 - 406.029***	MHz		Constructor explanations in Annex A
		✓	✓	

Table C2 : SUMMARY OF 406 MHz BEACON TEST RESULTS

Ref : M2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS	COMMENTS
13 - PROTECTION AGAINST CONTINUOUS TRANSMISSION o Description provided	≤ 45	seconds ✓	✓	Constructor explanations in Annex A
14 - SATELLITE QUALITATIVE TESTS **** o Results provided	successfully located by satellites / LUT	✓	✓	Data and graphs pages 82 to 92
15 - ANTENNA CHARACTERISTICS o Polarization o VSWR o ERP _{max} EOL o ERP _{min} EOL o azimuth gain variation at 40° elevation angle	linear or RHCP ≤ 1.5 ≤ 20 ≥ 1.6 ≤ 3	✓ ✓ - Watts Watts dB	✓ not applicable 17,7 3,1 0,2	Antenna test report pages 93 to 102
16 - BEACON CODING SOFTWARE o sample message provided for each coding option of the applicable coding protocol types o sample messages provided , if applicable, with encoded positions at least 5 km apart o sample self-test message provided for each coding option of the applicable coding protocol types	must be correct (attach to report) must be correct (attach to report) must be correct (attach to report)	✓ ✓ ✓	✓ ✓ ✓	See data page 112

Table C2 : SUMMARY OF 406 MHz BEACON TEST RESULTS

Ref : M2393

PARAMÈTRES TO BE MEASURED DURING TESTS	RANGE OF SPECIFICATION	UNITS	TEST RESULTS	COMMENTS
17 - NAVIGATION SYSTEM**** (as applicable)				
o position data default values	must be correct	✓	✓	See data page 103
o position acquisition time	< 30	minutes	27:04	Normally before 8 minutes
o encoded position data update interval	> 20	minutes	20:58	27:04 minutes is the time obtained with a
o position data input update interval	20 / 1	minutes	N/A	low navigation signal in the Test Lab
(as applicable)				
o delta offset :				
- positive direction	must be correct	✓	✓	
- negative direction	must be correct	✓	✓	
- overrange to 2 times coarse res.	must be correct	✓	✓	
o last valid position :				
- retained after nav signal lost	4	hours	4:06	
- cleared when beacon reactivated	must be correct	✓	✓	
o design data provided on protection against beacon degradation due to navigation device, interface or signal failure or malfunction	no degradation	✓	✓	See manufacturer doc Annex A

* The ticks mark ✓ can be used where indicated to record that the requirement is met (no value needs to be shown).

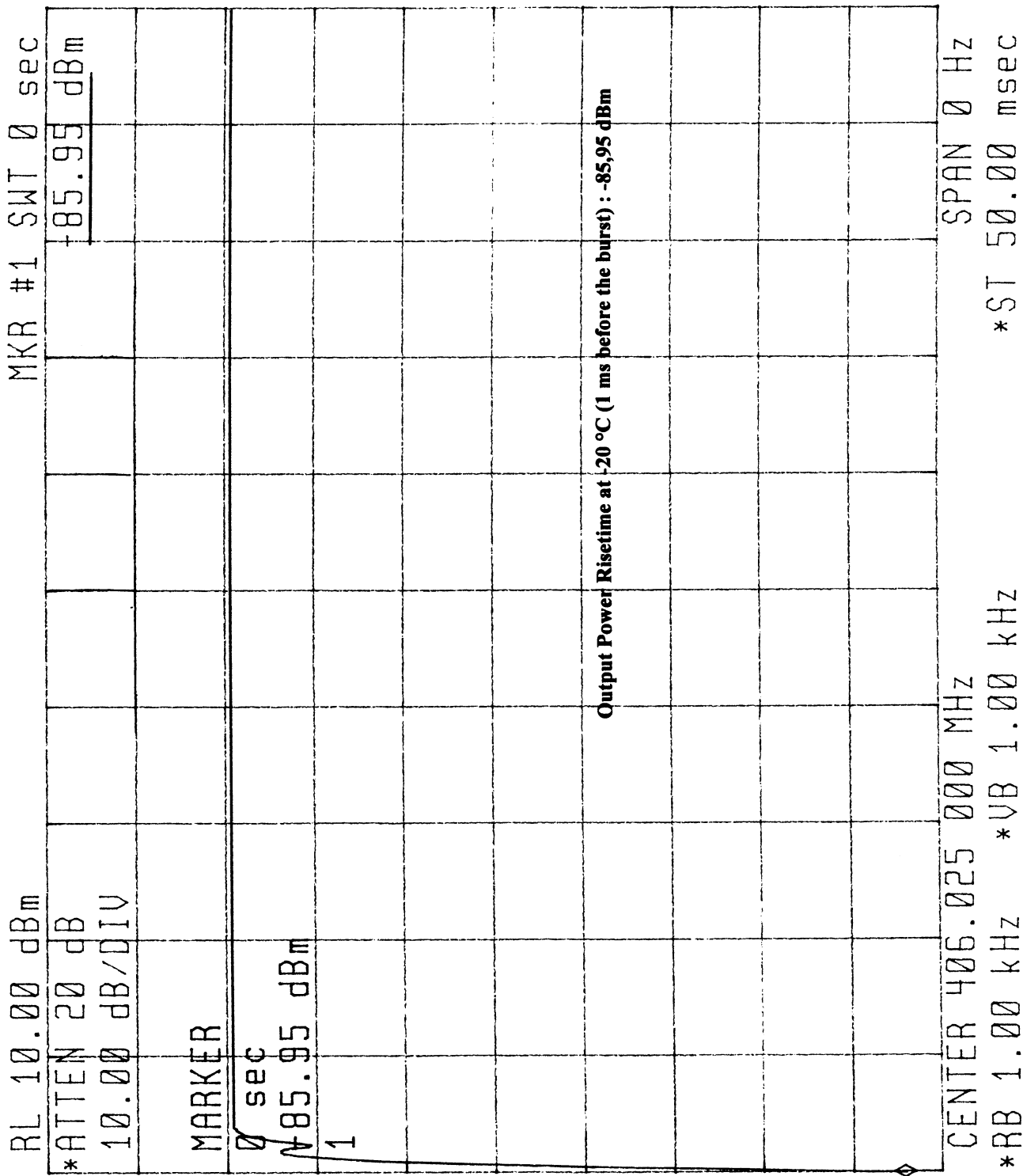
** If $(T_{R \max} - T_{R \min}) \leq 1$ second, the manufacturer must provide a technical explanation, as describes in section A3.1.1.

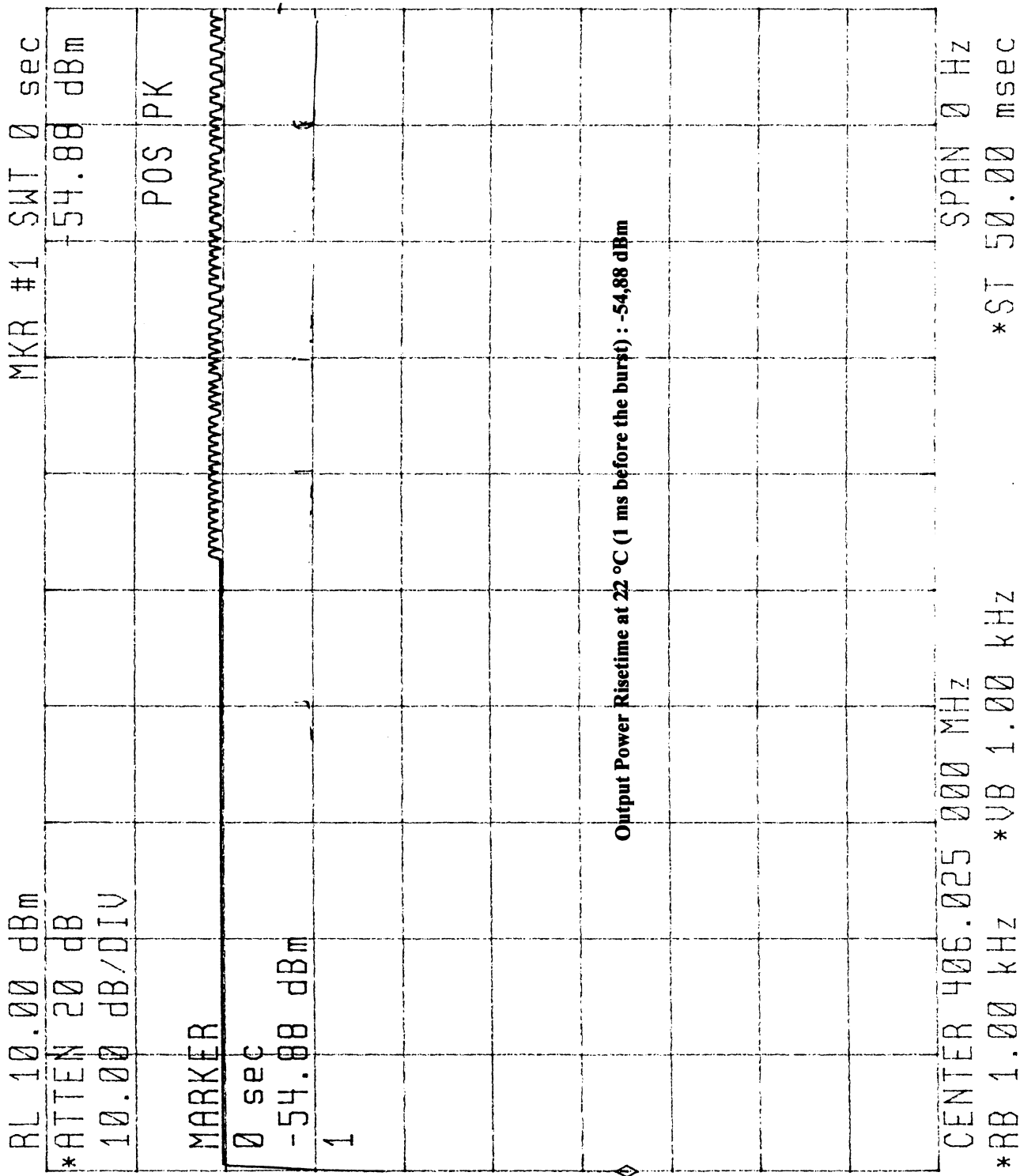
*** From 1 January 2000 new 406MHz beacon models submitted for type approval can be set to transmit at $406.028 \text{ MHz} \pm 1 \text{ kHz}$. The transmitted frequency shall not vary more than $+ 2 \text{ kHz} / - 5 \text{ kHz}$ from 406.028 MHz in 5 years. It shall not vary more than 2 parts in 10^6 in 100 ms. After 1 January 2002, all new beacon models submitted for the type approval must be set at the frequency $406.028 \text{ MHz} \pm 1 \text{ kHz}$ and satisfy the above stability requirements.

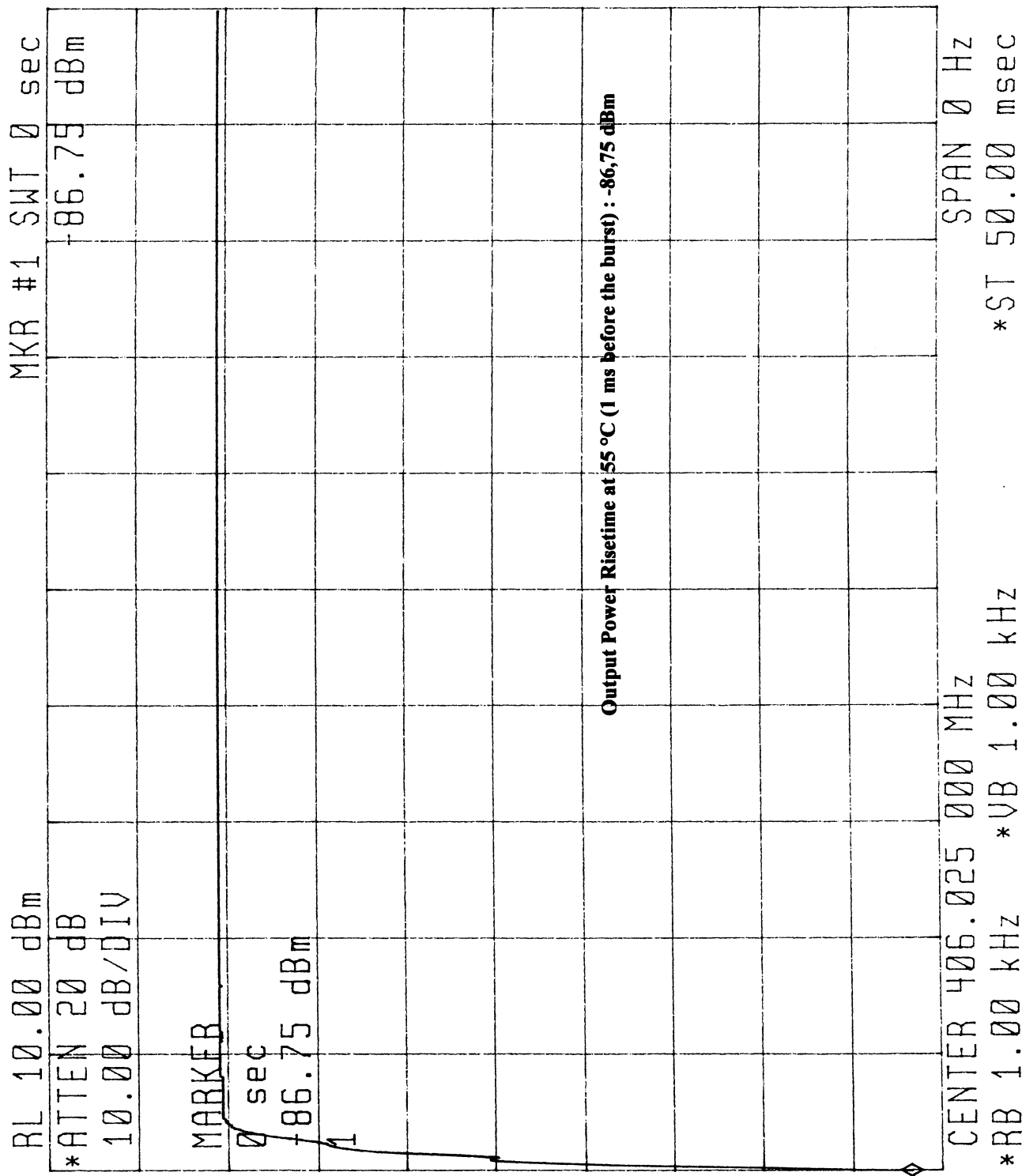
**** attach graphs of test results for test number 6, 9, 10 and 11 and a summary table of results for test number 14, and, if applicable, test number 17.

TRANSMITTER OUTPUT POWER RISE TIME TEST RESULT ON
TRON 40GPS JOTRON
N° 7001
(1 ms before 10 % of the burst)

at -20° C, 22° C and 55° C







**CERTIFICATION TEST RESULTS ON
TRON 40GPS JOTRON
N° 7001**

at -20° C, 22° C and 55° C

Certification Test at -20°C

Date of test : 24 May 2000

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

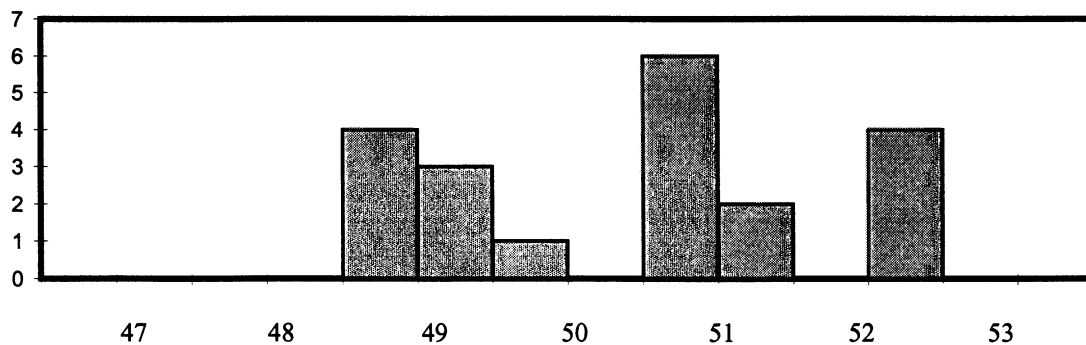
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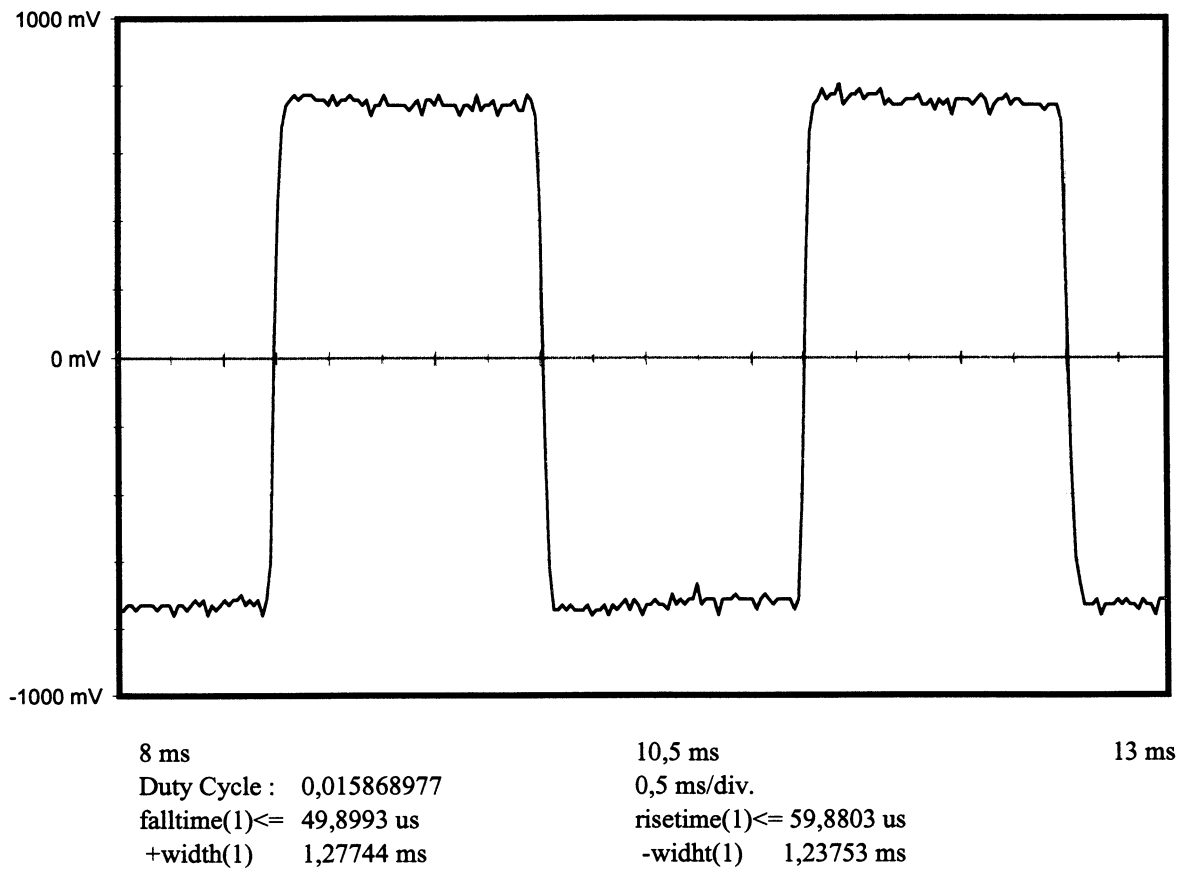
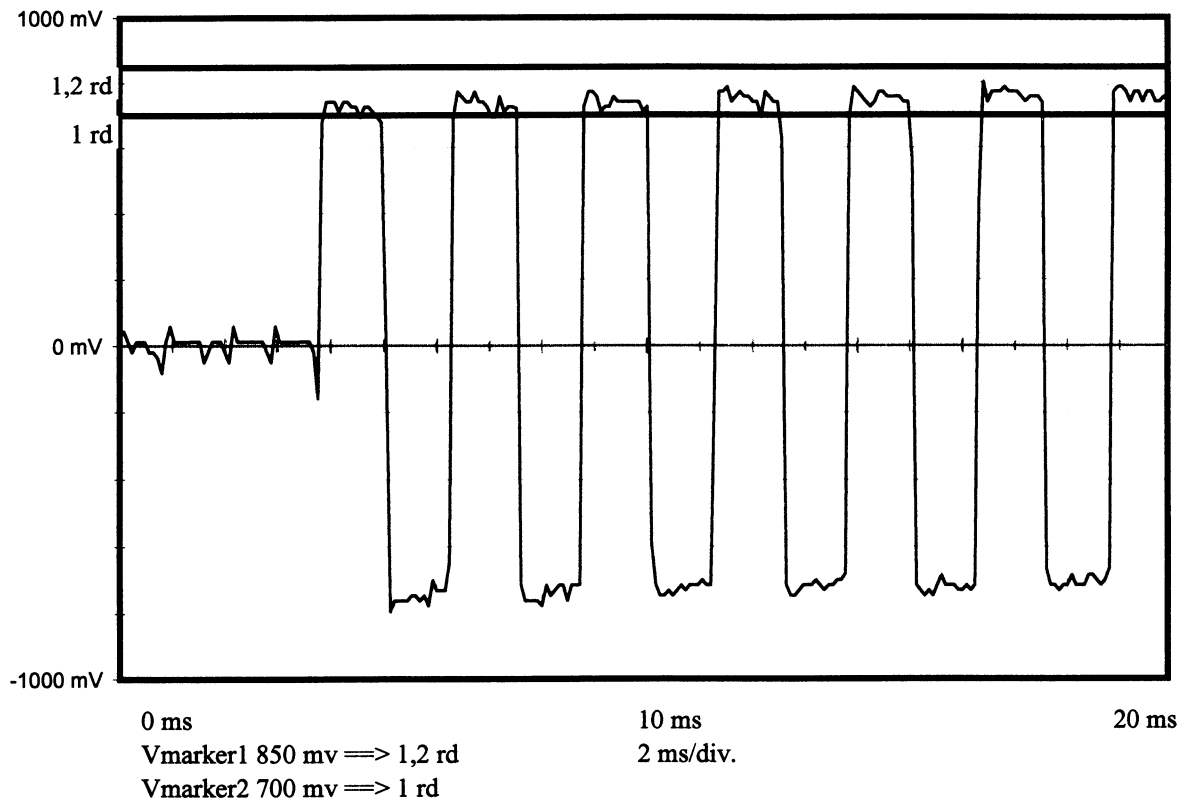
Message

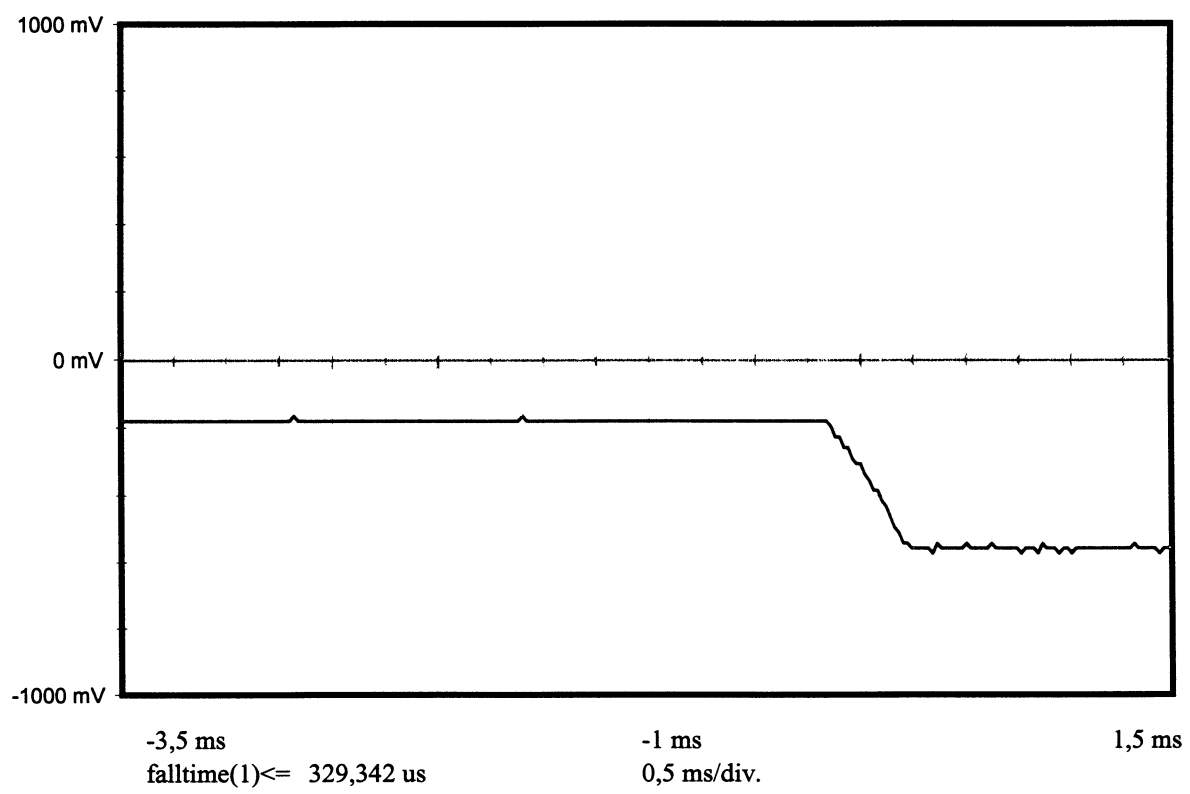
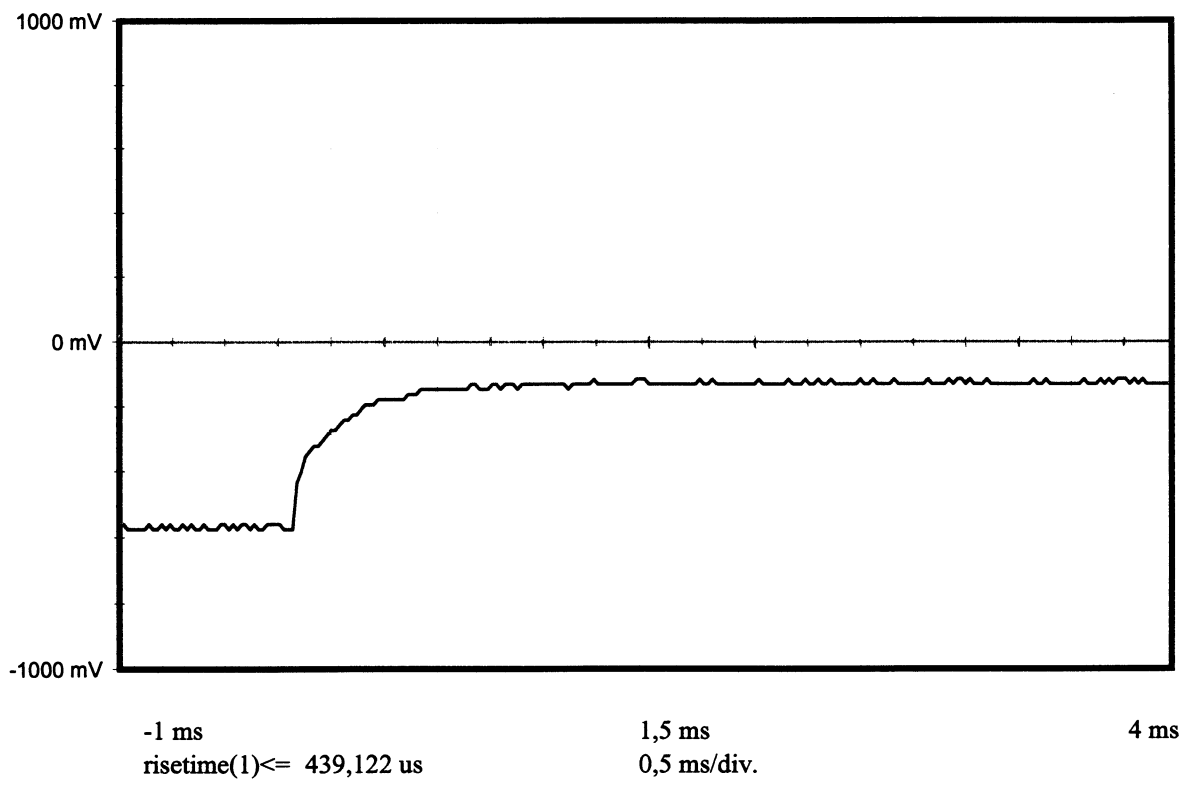
Message received		FFFE2F901E1E24007FDFFC15A17783E0F66C
Format Flag	25	1
Protocol flag	26	0
Ident./Position code (Hex)	27-85	303C3C4800FFBFF
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data Bits	41-64	0001111000100100000000000
Identification Used	41-64	
Calculated BCH1	25-85	105685
Readed BCH1	86-106	105685
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	66C
Readed BCH2	133-144	66C
Latitude position		North 127° 46' 0"
Longitude position		East 255° 46' 0"
Delta position		Default Pos.

Electrical and other parameters

CW preamble	ms	158,4 <	< 162,6	160,20
Total transmission time	ms	513,8 <	< 526,2	521,87
Modulation frequency	Hz	395,4 <	< 404,6	398,86
Phase deviation : total	rd		<= 2,40	2,10
Phase deviation : positive	rd	1,00 <	< 1,20	1,01
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,09
Symmetry measurement	%		<= 5 %	1,59
Nominal frequency : F2	Hz			406025133,96
Short term2				2,02E-10
Short term3				3,05E-10
Slope				-1,34E-11
Residual				1,87E-10
406 MHz power output	dBm			36,6
Homing frequency	MHz			121,501
121,5 MHz power output	dBm			24,8
Soak temperature	°C			-19,5
Extra feature				No







Certification Test at 22°C

Date of test : 18 May 1990

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

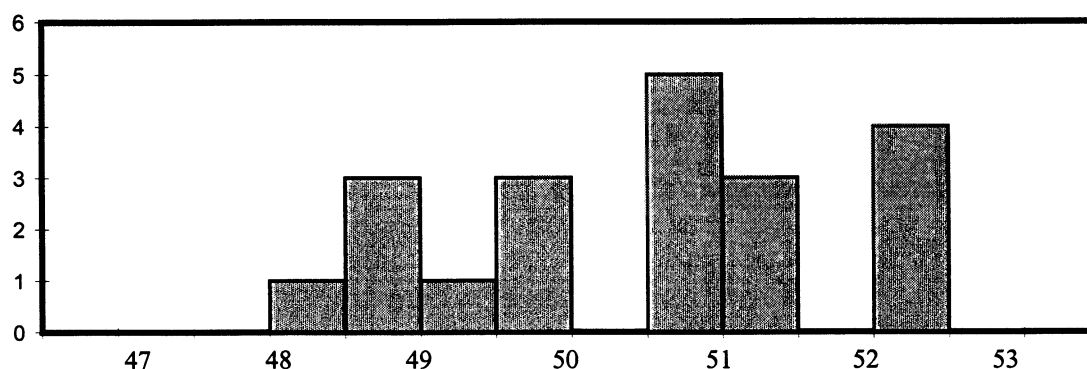
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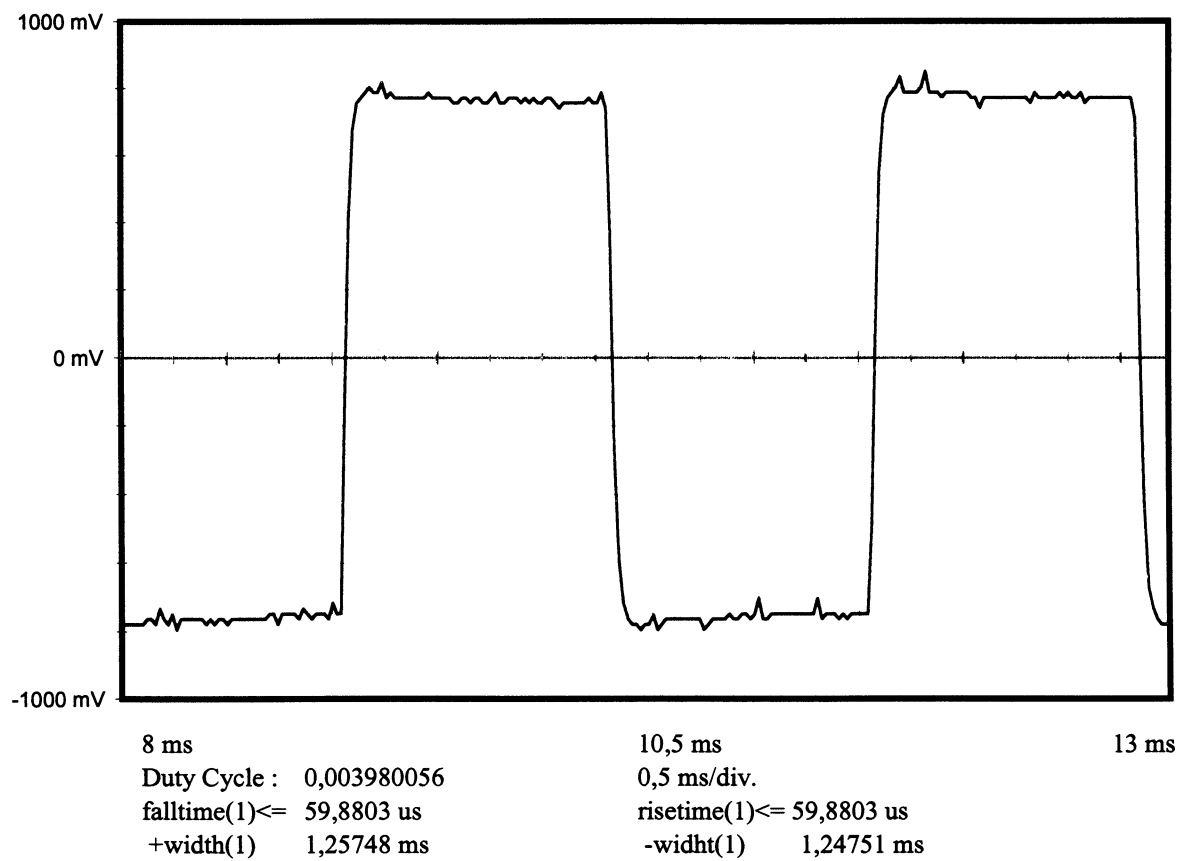
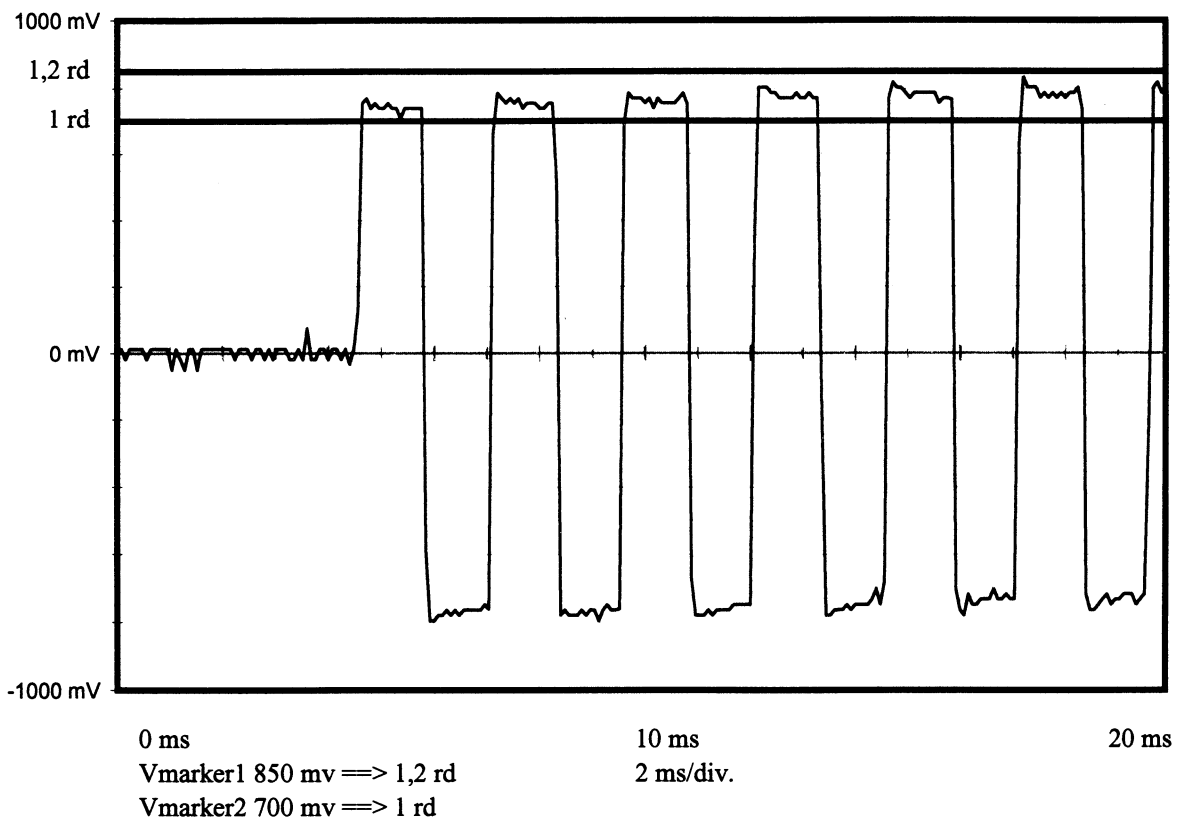
Message

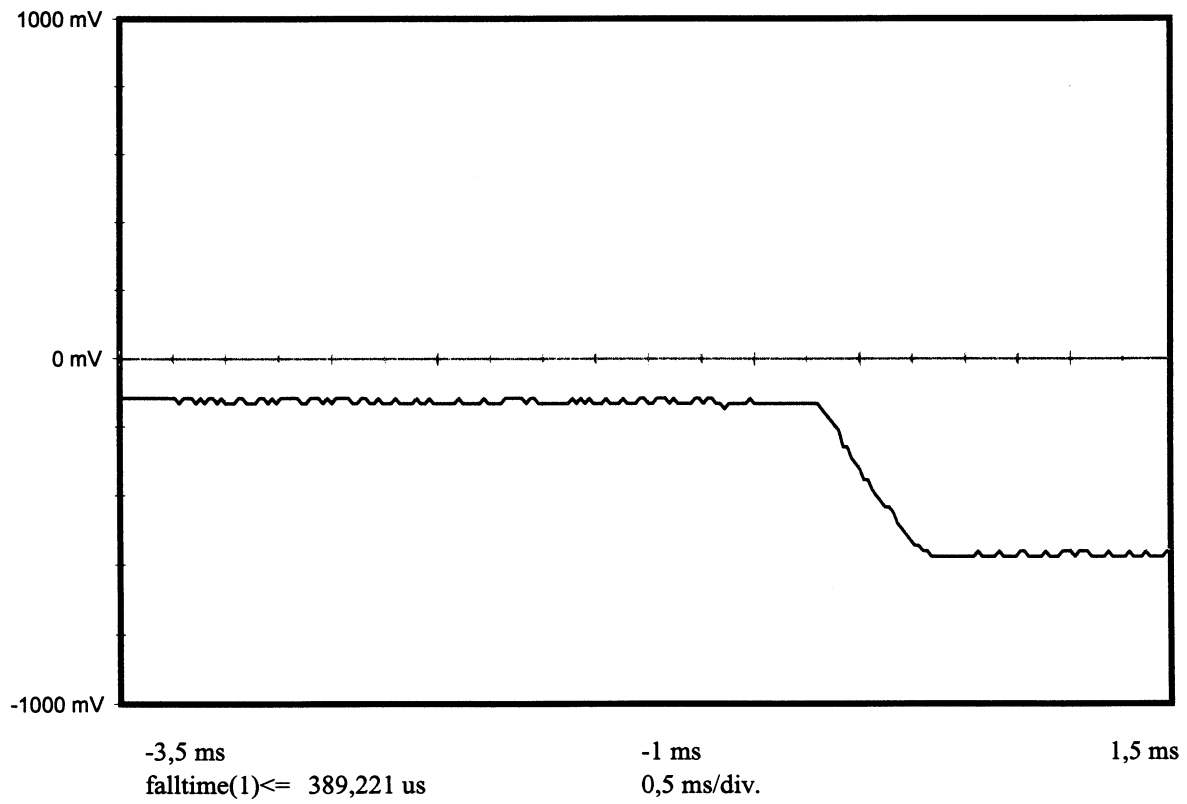
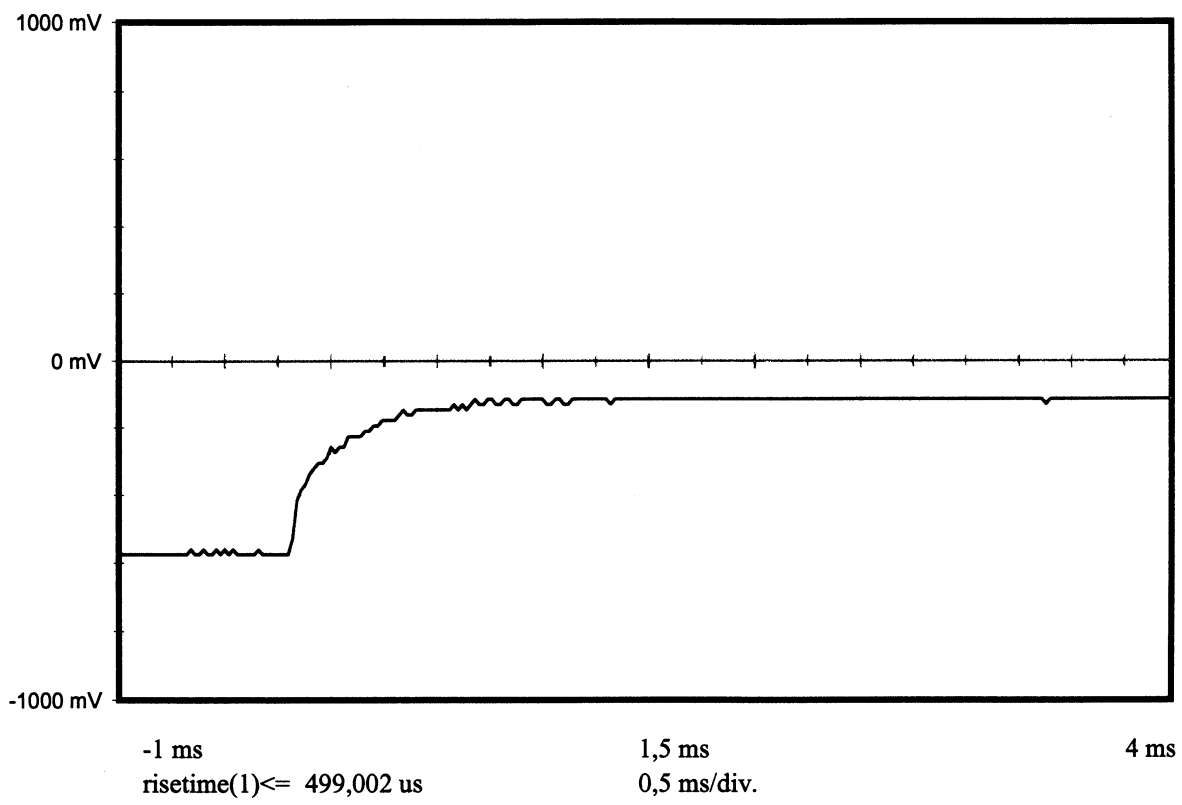
Message received		FFFE2F901E1E24002B80374C89B78E0159E3
Format Flag	25	1
Protocol flag	26	0
Ident./Position code	27-85	303C3C480057006
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data	41-64	000111100010010000000000
Identification Used	41-64	
Calculated BCH1	25-85	1D3226
Readed BCH1	86-106	1D3226
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	9000
Readed BCH2	133-144	9000
Latitude position		North 43° 33' 32"
Longitude position		East 1° 28' 40"
Delta position		0,255 km

Electrical and other parameters

CW preamble	ms	158,4 <	< 162,6	160,39
Total transmission time	ms	434,6 <	< 445,4	521,99
Modulation frequency	Hz	395,4 <	< 404,6	398,86
Phase deviation : total	rd		<= 2,40	2,23
Phase deviation : positive	rd	1,00 <	< 1,20	1,06
Phase deviation : negative	rd	-1,20 <	< -1,00	-1,17
Symmetry measurement	%		<= 5 %	0,40
Nominal frequency : F2	Hz			406025105,45
Short term2				1,40E-10
Short term3				6,84E-10
Slope				-5,34E-11
Residual				2,36E-10
406 MHz power output	dBm			37,7
Homing frequency	MHz			121,5007
121,5 MHz power output	dBm			23,6
Soak temperature	°C			20,8
Extra feature				No







Certification Test at 55°C

Date of test : 12 May 2000

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

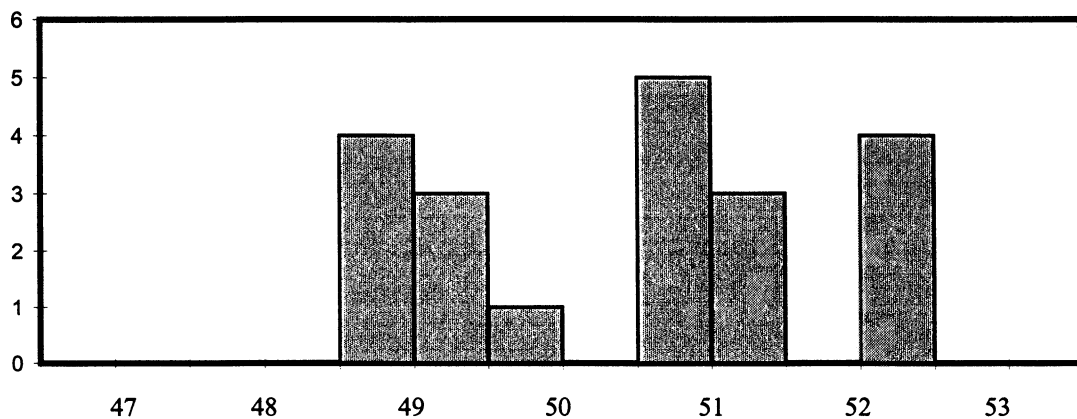
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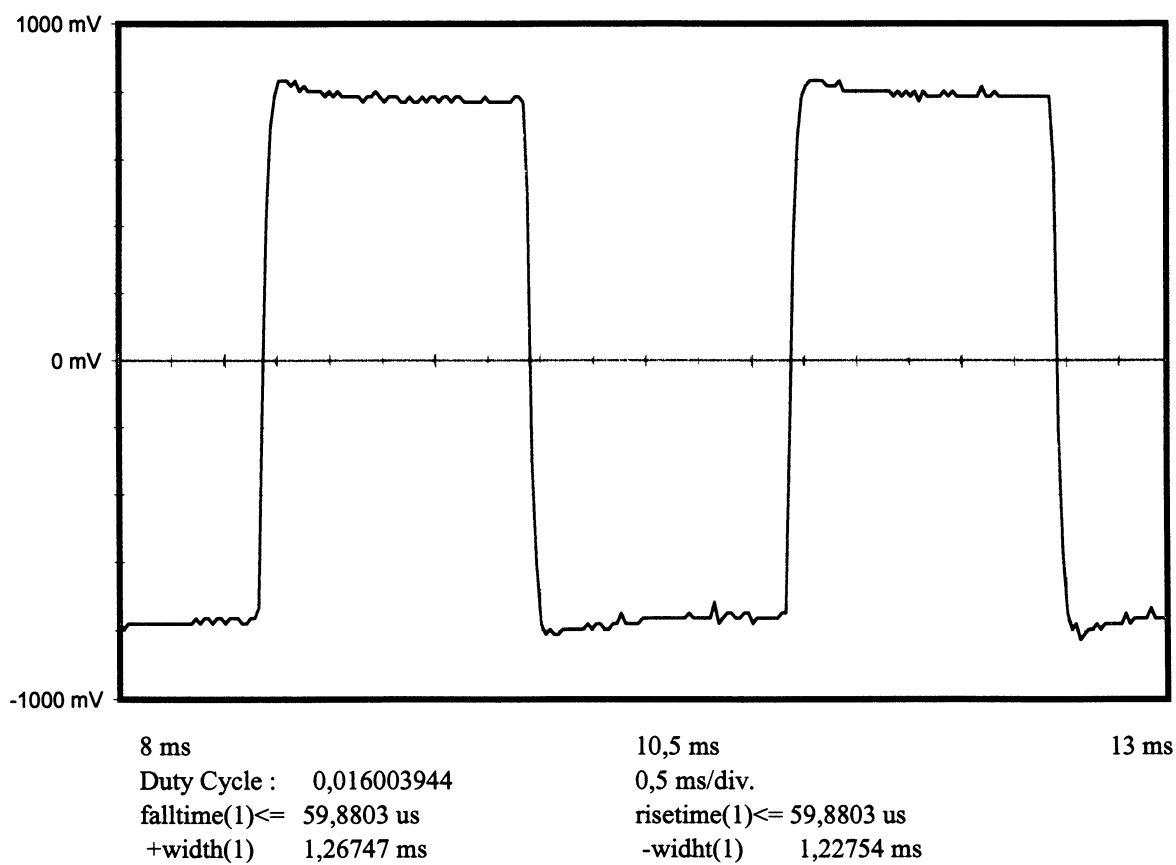
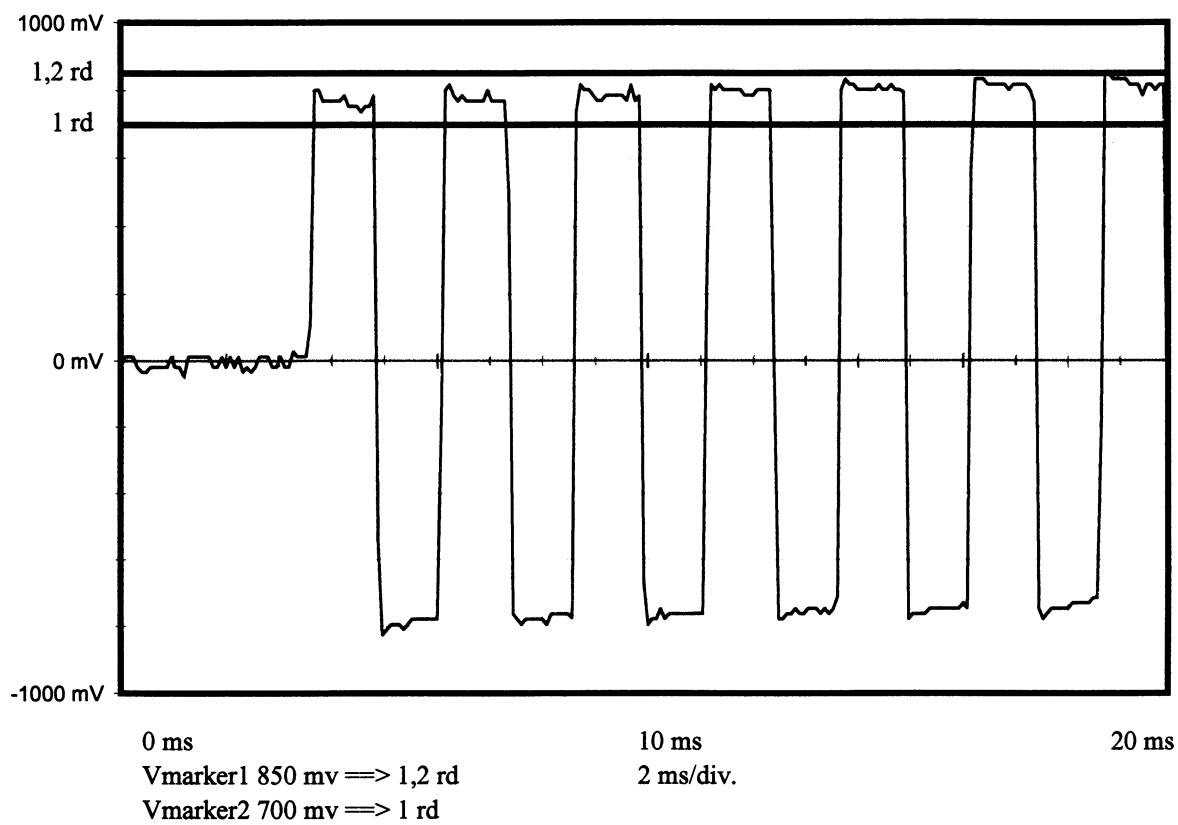
Message

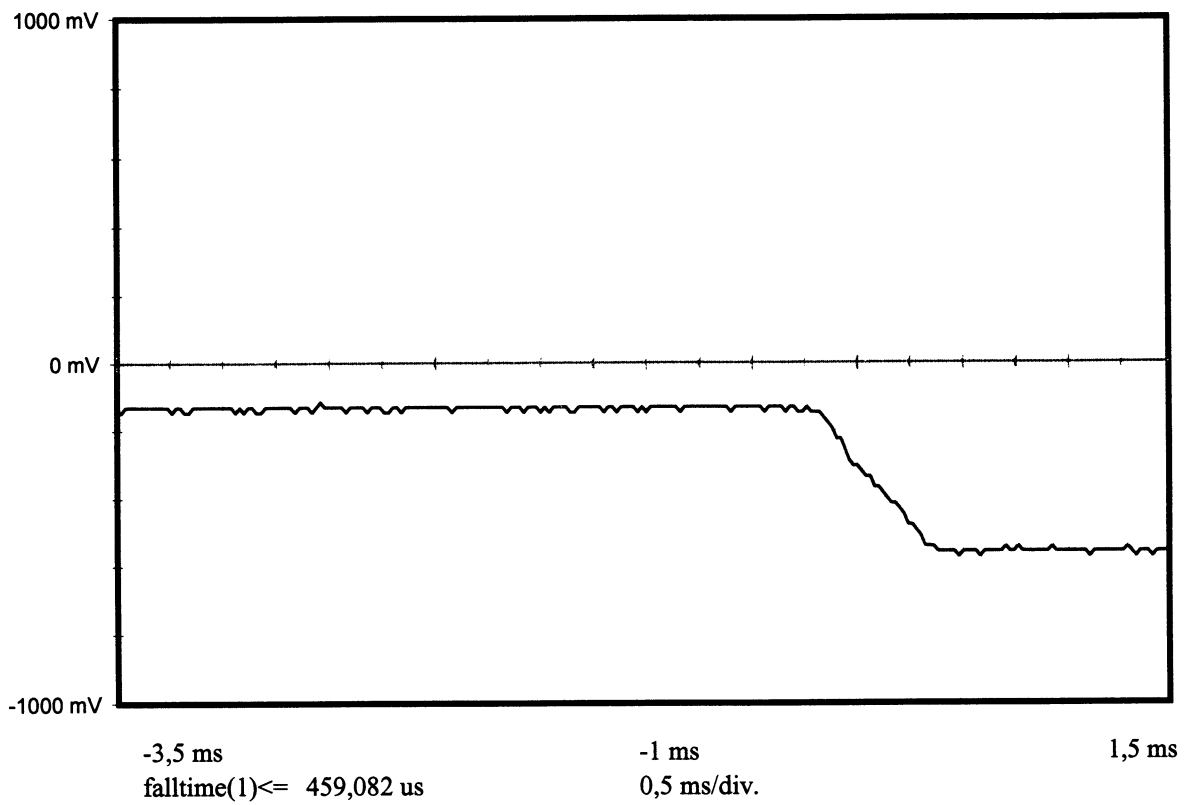
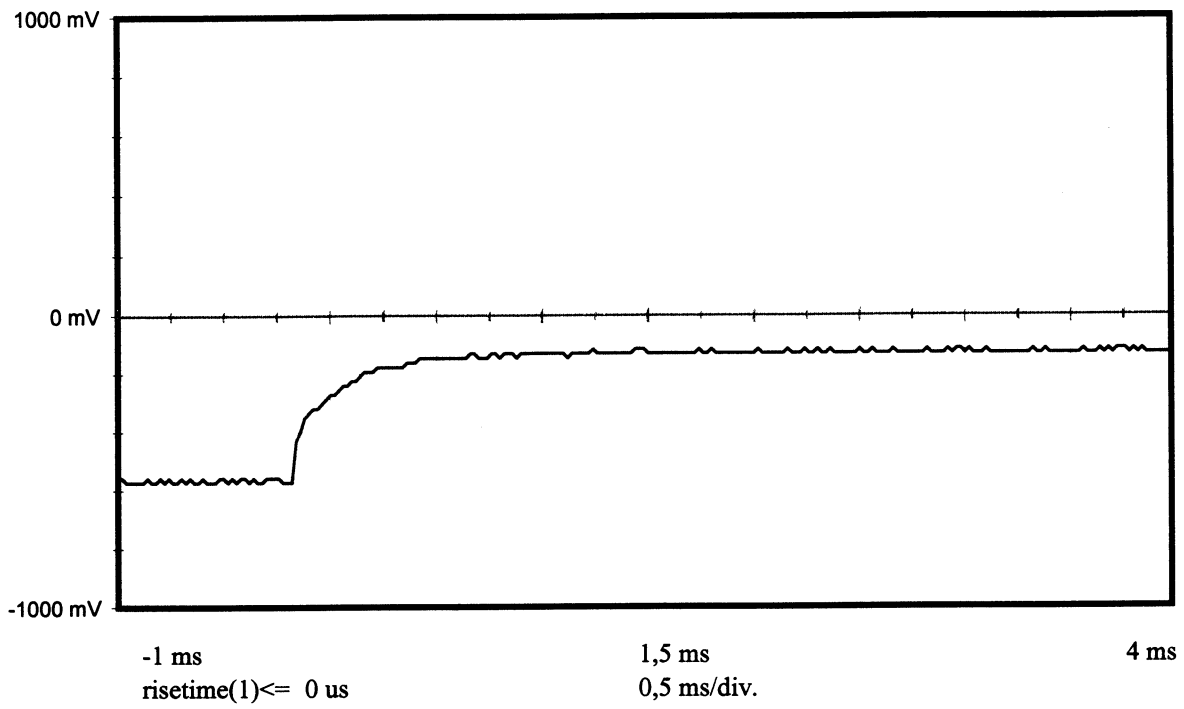
Message received		FFFE2F901E1E24007FDFFC15A17783E0F66C
Format Flag	25	1
Protocol flag	26	0
Ident./Position code	27-85	303C3C4800FFBFF
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data	41-64	000111100010010000000000
Identification Used	41-64	
Calculated BCH1	25-85	105685
Readed BCH1	86-106	105685
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	66C
Readed BCH2	133-144	66C
Latitude position		North 127° 46' 0"
Longitude position		East 255° 46' 0"
Delta position		Default Pos.

Electrical and other parameters

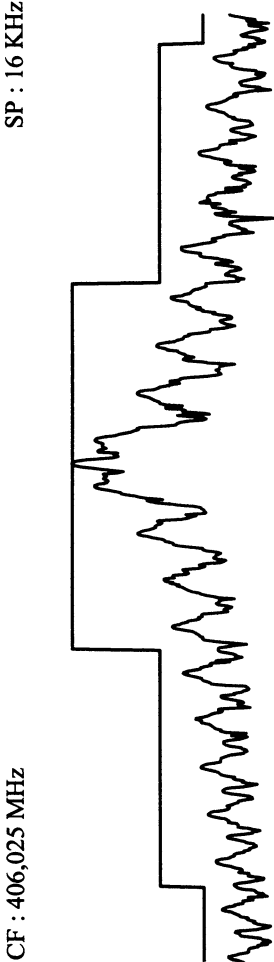
CW preamble	ms	158,4 < < 162,6	160,27
Total transmission time	ms	434,6 < < 445,4	521,94
Modulation frequency	Hz	395,4 < < 404,6	398,64
Phase deviation : total	rd	<=2,40	2,31
Phase deviation : positive	rd	1,00 < < 1,20	1,16
Phase deviation : negative	rd	-1,20 < < -1,00	-1,15
Symmetry measurement	%	<=5 %	1,60
Nominal frequency : F2	Hz		406025061,07
Short term2			1,70E-10
Short term3			1,24E-10
Slope			-7,41E-11
Residual			3,20E-10
406 MHz power output	dBm		37,4
Homing frequency	MHz		121,501
121,5 MHz power output	dBm		22,2
Soak temperature	°C		56,2
Extra feature			No







SPURIOUS EMISSIONS RESULTS
TRON 40GPS JOTRON
N° 7001
at -20° C, 22° C and 55° C



JOTRON
TRON 40GPS
7001
Certification nominale
406 MHz
-20 °C

Rb : 0,1 KHz

SP : 50 KHz

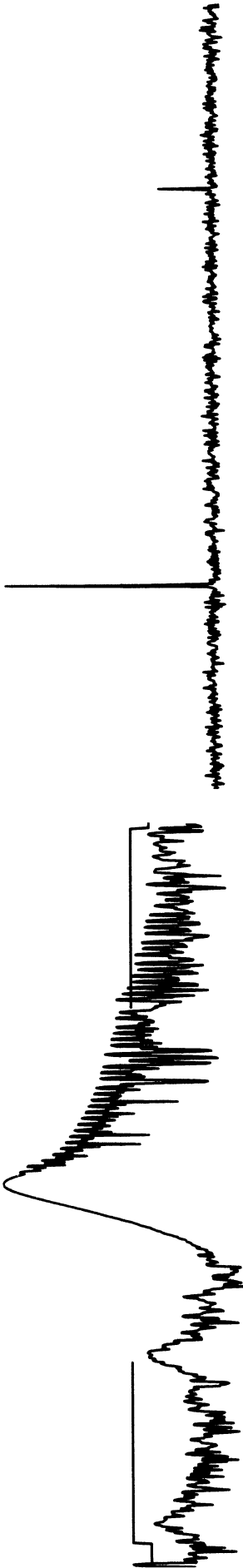
10 dB/div.

Delta : -42,05 dB

St : 4,8 S

SP : 800000 KHz

CF : 406,025 MHz



Rb : 1 KHz

St : 0,305 S

10 dB/div.

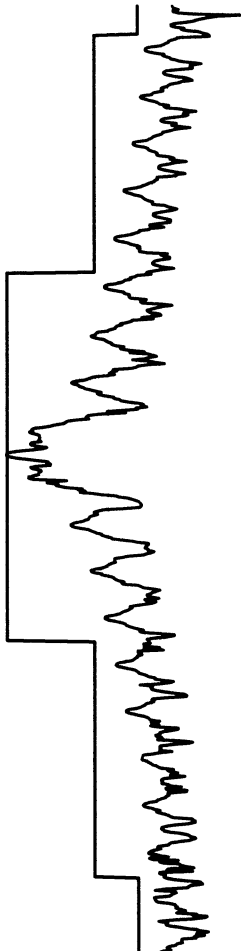
Rb : 100 KHz

St : 0,24 S

CF : 406,025 MHz

SP : 16 KHz

JOTRON
TRON 40GPS
7001
Certification nominale
406 MHz
22 °C



St : 4,8 S

10 dB/div.

Rb : 0,1 KHz

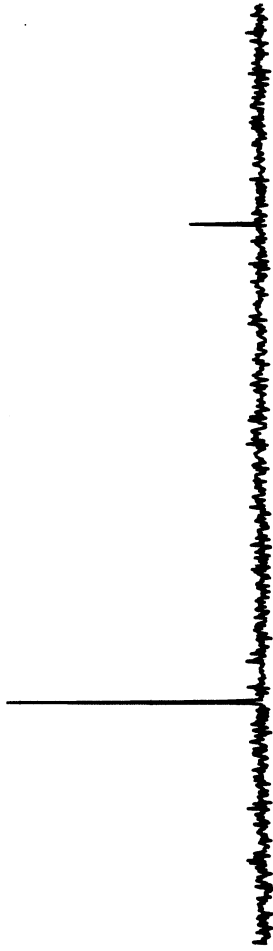
SP : 80000 KHz

Delta : -41,98 dB

CF : 600 MHz

SP : 50 KHz

CF : 406,025 MHz



St : 0,24 S

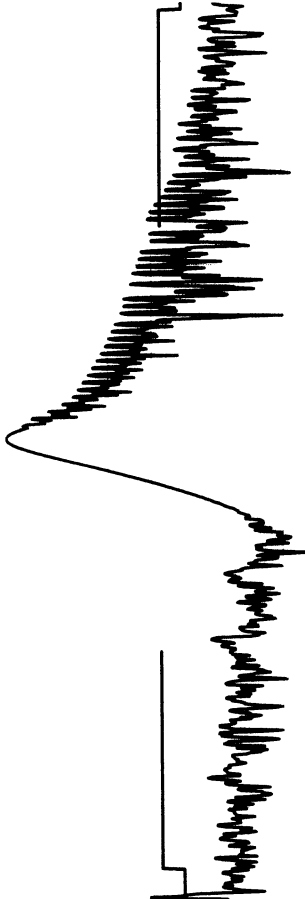
10 dB/div.

Rb : 100 KHz

St : 0,305 S

10 dB/div.

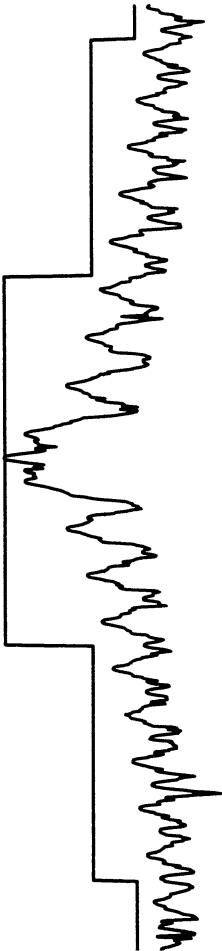
Rb : 1 KHz



JOTRON
TRON 40GPS
7001
Certification nominale
406 MHz
55 °C

CF : 406,025 MHz

SP : 16 KHz



CF : 406,025 MHz

Rb : 0,1 KHz

10 dB/div.

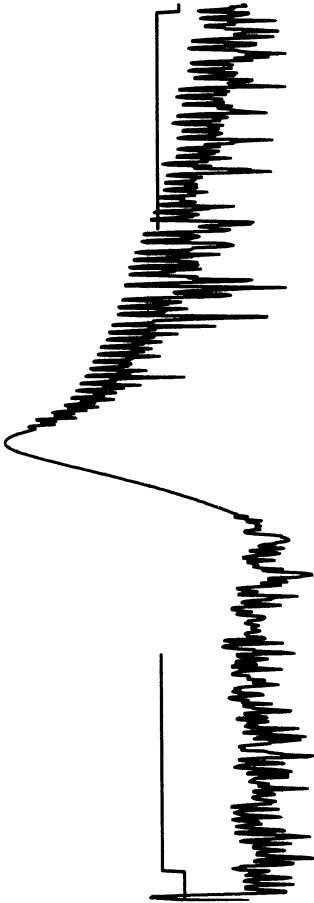
St : 4,8 S

SP : 50 KHz

CF : 600 MHz

Delta : -41,68 dB

SP : 80000 KHz



Rb : 1 KHz

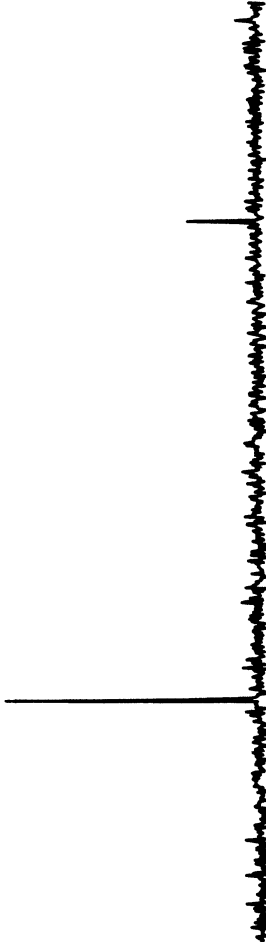
10 dB/div.

St : 0,305 S

Rb : 100 KHz

10 dB/div.

St : 0,24 S



**406 MHz VSWR 3:1 TEST RESULTS ON
TRON 40GPS JOTRON
N° 7001**

at -20° C, 22° C and 55° C

Certification Test VSWR at -20°C

Date of test : 24 May 2000

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

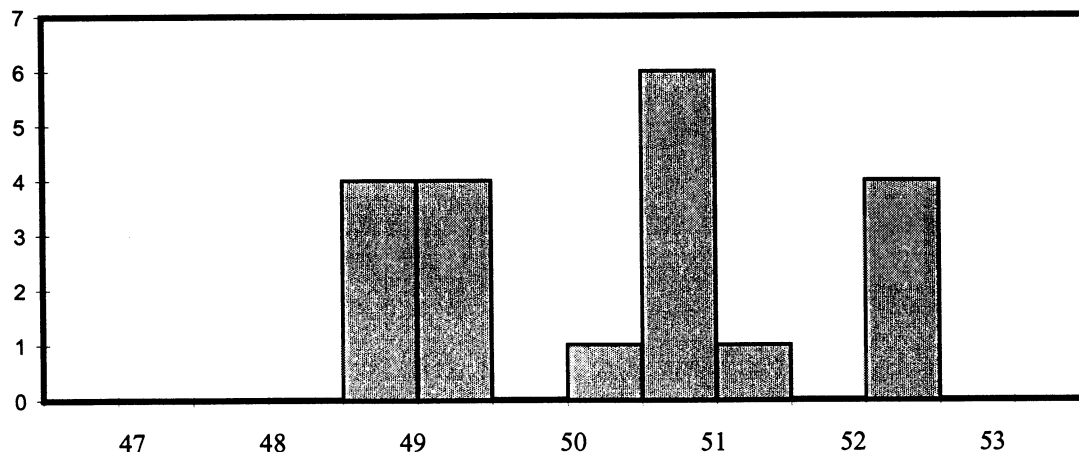
Number : 7001

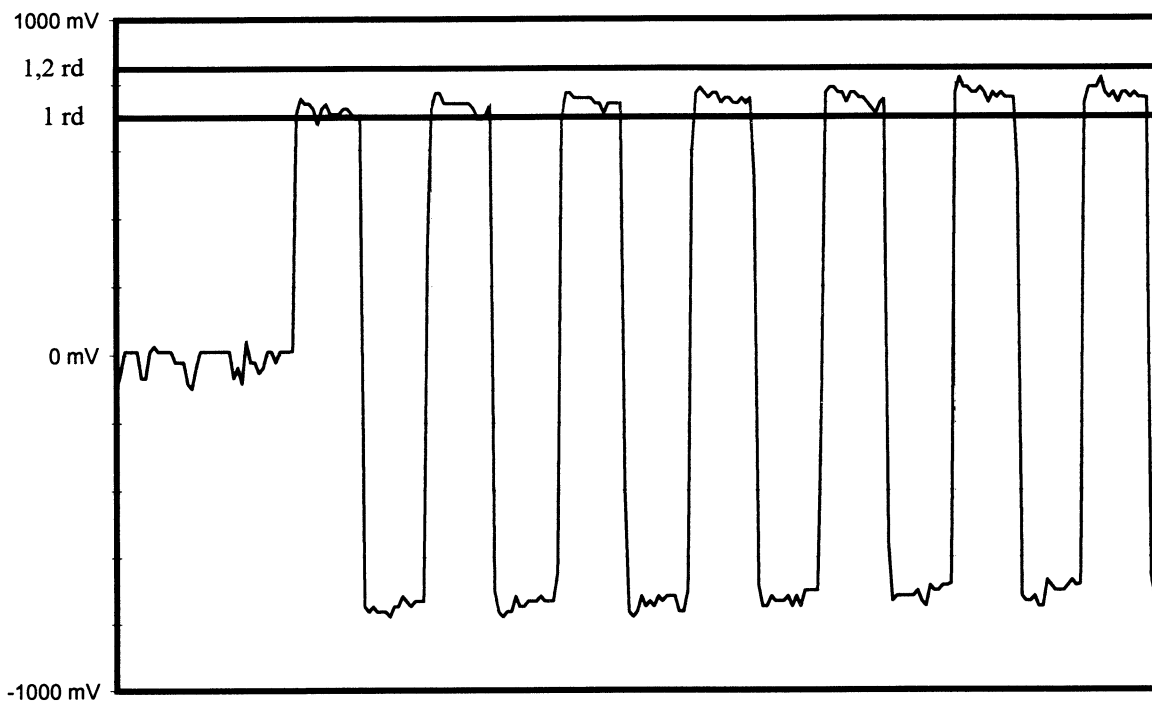
Message

Message received		FFFE2F901E1E24002B80374C89B78E0159E3
Format Flag	25	1
Protocol flag	26	0
Ident./Position code	27-85	303C3C480057006
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data	41-64	000111100010010000000000
Identification Used	41-64	
Calculated BCH1	25-85	1D3226
Readed BCH1	86-106	1D3226
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	9000
Readed BCH2	147-144	9000
Latitude position		North 43° 33' 32"
Longitude position		East 1° 28' 40"
Delta position		0,255 km

Electrical and other parameters

Rise time Modulation	ms	0,0599
Fall time Modulation	ms	0,0399
Phase deviation : positive	rd 1,00 < < 1,20	1,01
Phase deviation : negative	rd -1,20 < < -1,00	-1,11
Symmetry measurement	% <=5 %	1,99
Nominal frequency : F2	Hz	406025133,66

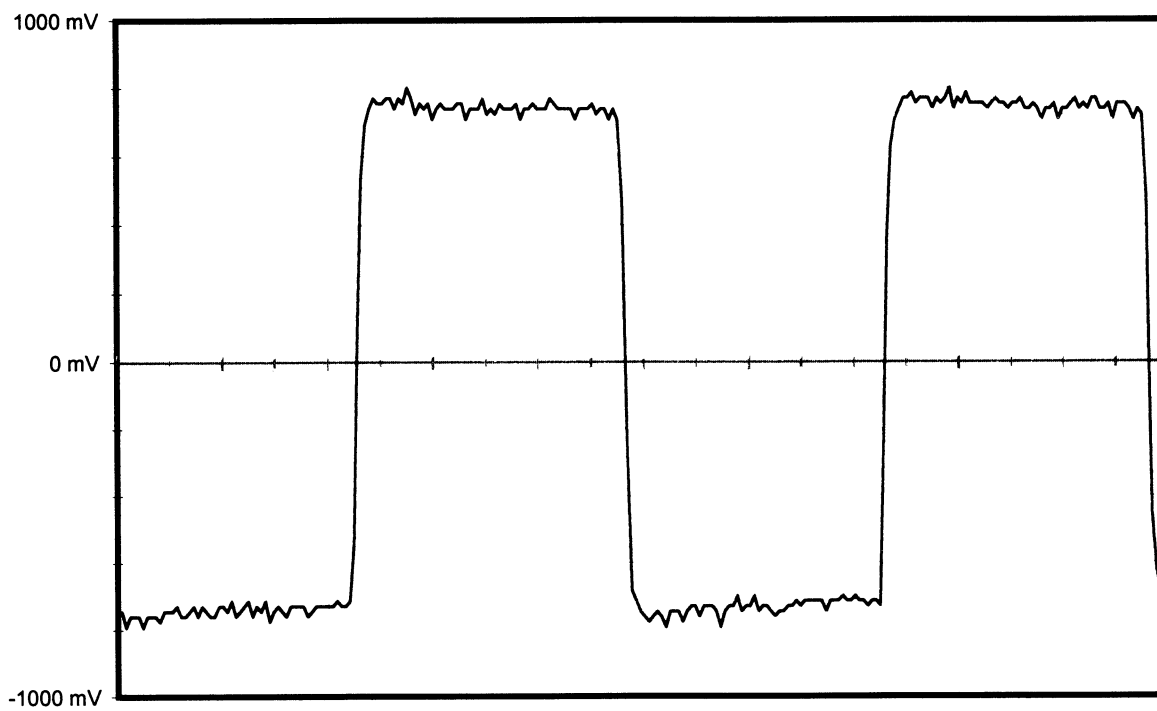




Vmarker1 850 mV ==> 1,2 rd

2 ms/div.

Vmarker2 700 mV ==> 1 rd



Duty Cycle : 0,019920319

0,5 ms/div.

falltime(1) <= 49,9202 us

risetime(1) <= 59,8794 us

+width(1) 1,27744 ms

-width(1) 1,22754 ms

Certification Test VSWR at 22°C

Date of test : 18 May 1990

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

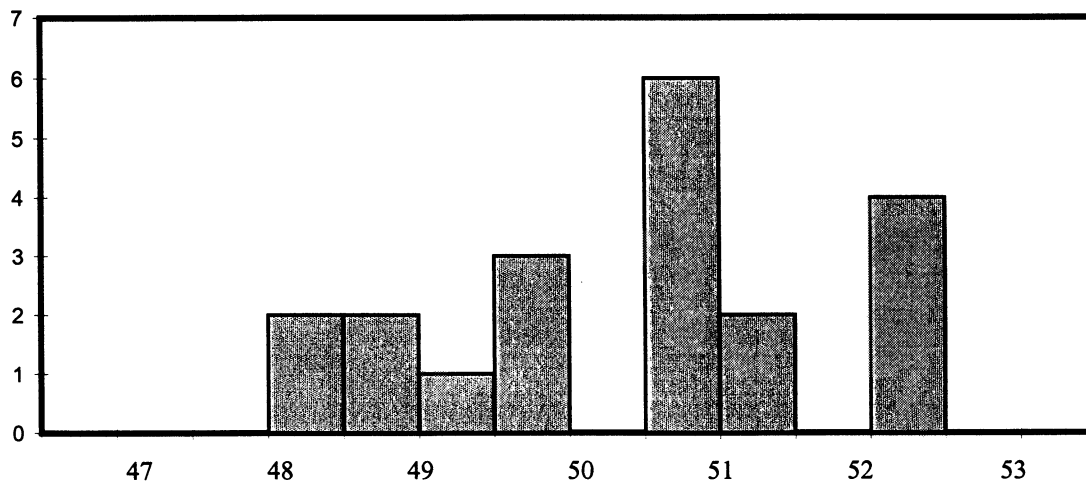
Number : 7001

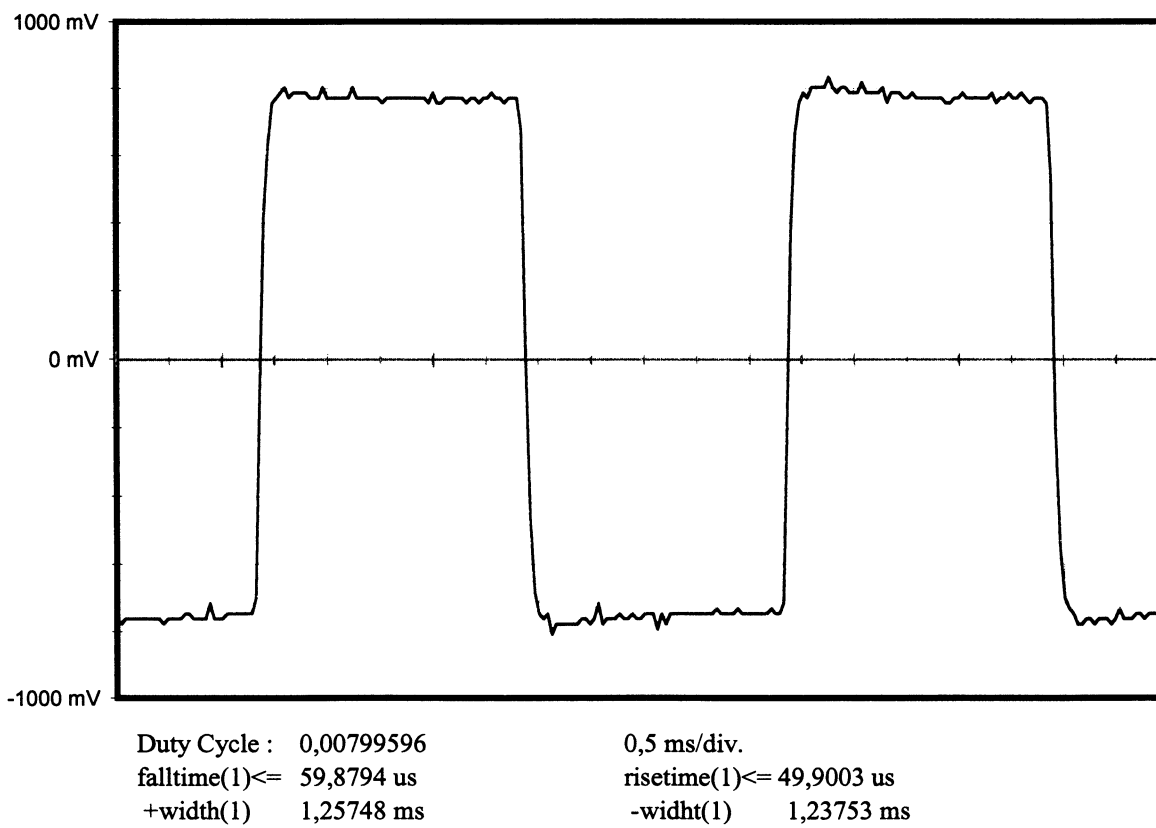
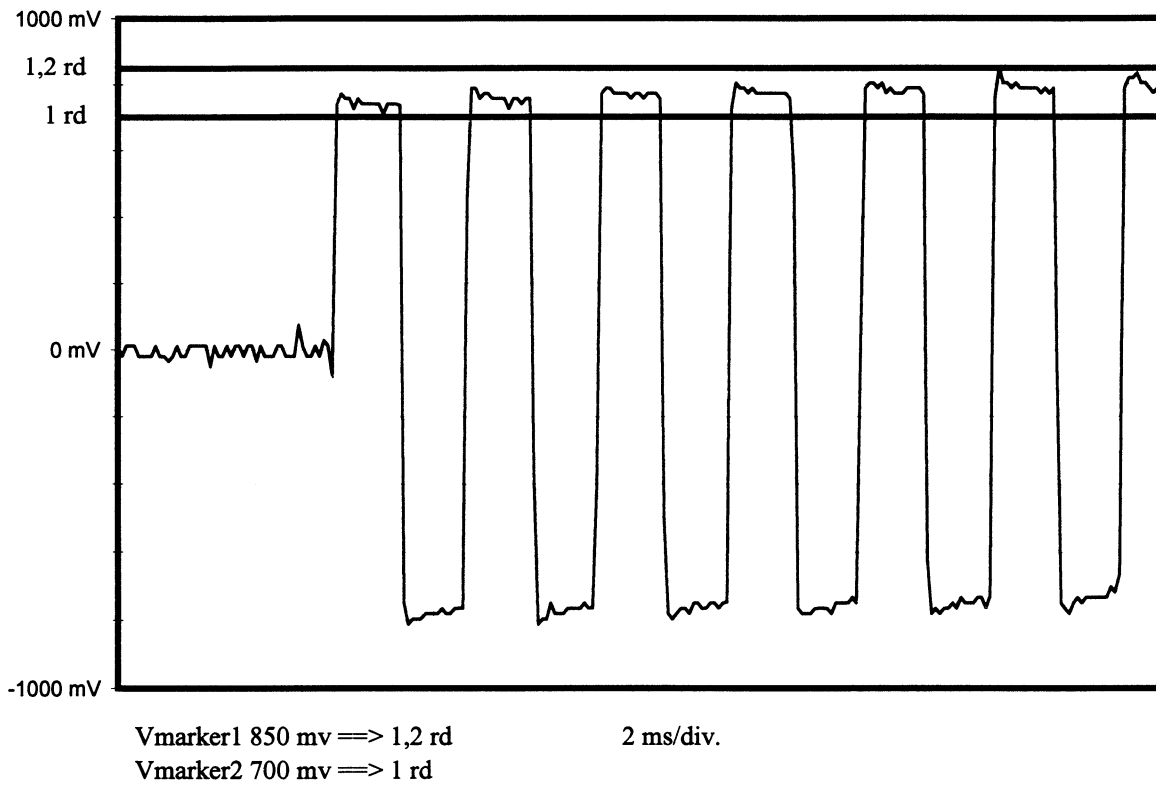
Message

Message received		FFFE2F901E1E24007FDFFC15A17783E0F66C
Format Flag	25	1
Protocol flag	26	0
Ident./Position code	27-85	303C3C4800FFBFF
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data	41-64	000111100010010000000000
Identification Used	41-64	
Calculated BCH1	25-85	105685
Readed BCH1	86-106	105685
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	66C
Readed BCH2	147-144	66C
Latitude position		North 127° 46' 0"
Longitude position		East 255° 46' 0"
Delta position		Default Pos.

Electrical and other parameters

Rise time Modulation	ms	0,0499
Fall time Modulation	ms	0,0599
Phase deviation : positive	rd 1,00 < < 1,20	1,09
Phase deviation : negative	rd -1,20 < < -1,00	-1,15
Symmetry measurement	% <=5 %	0,80
Nominal frequency : F2	Hz	406025102,83





Certification Test VSWR at 55°C

Date of test : 18 May 1990

Manufacturer : JOTRON

Beacon Type : TRON 40GPS

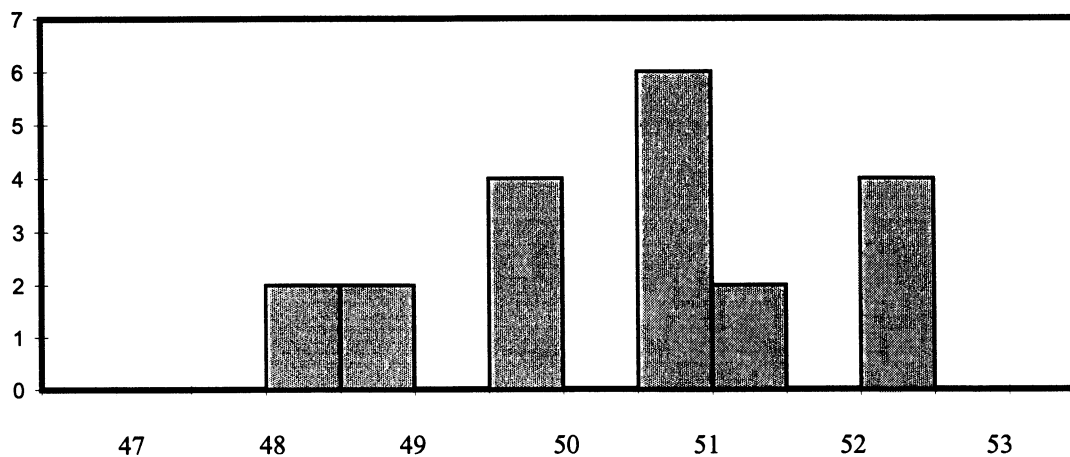
Number : 7001

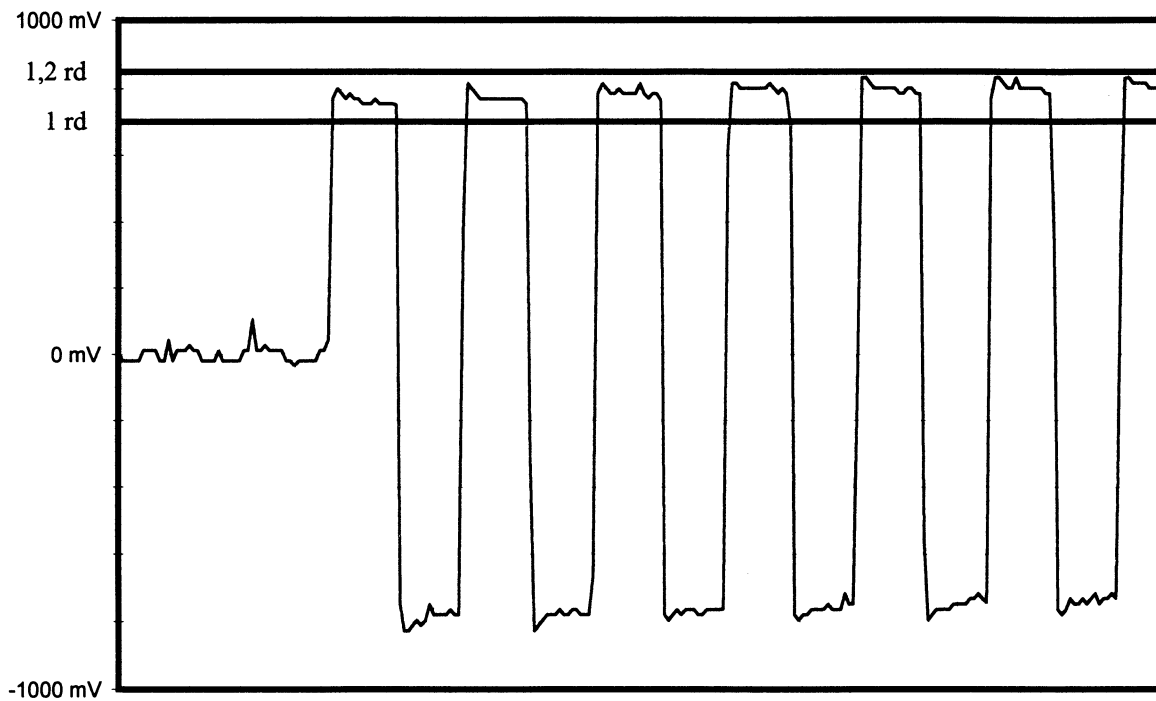
Message

Message received		FFFE2F901E1E24007FDFFC15A17783E0F66C
Format Flag	25	1
Protocol flag	26	0
Ident./Position code	27-85	303C3C4800FFBFF
Country Code/Country	27-36	257 / NORWAY
Protocol Code : U/Std-Nat	37-39/37-40	1110
Protocol Code Used	37-39/37-40	Test-Standard Location
Identification Data	41-64	000111100010010000000000
Identification Used	41-64	
Calculated BCH1	25-85	105685
Readed BCH1	86-106	105685
Em.cod/nat.use/supp.data	107-112	110111
Fixed Data '1101'	107-110	1101
Encod pos data	111	1 Internal
Homing	112	1
Calculated BCH2	107-132	66C
Readed BCH2	147-144	66C
Latitude position		North 127° 46' 0"
Longitude position		East 255° 46' 0"
Delta position		Default Pos.

Electrical and other parameters

Rise time Modulation	ms	0,0599
Fall time Modulation	ms	0,0599
Phase deviation : positive	rd 1,00 < < 1,20	1,13
Phase deviation : negative	rd -1,20 < < -1,00	-1,18
Symmetry measurement	% <=5 %	0,40
Nominal frequency : F2	Hz	406025058,70

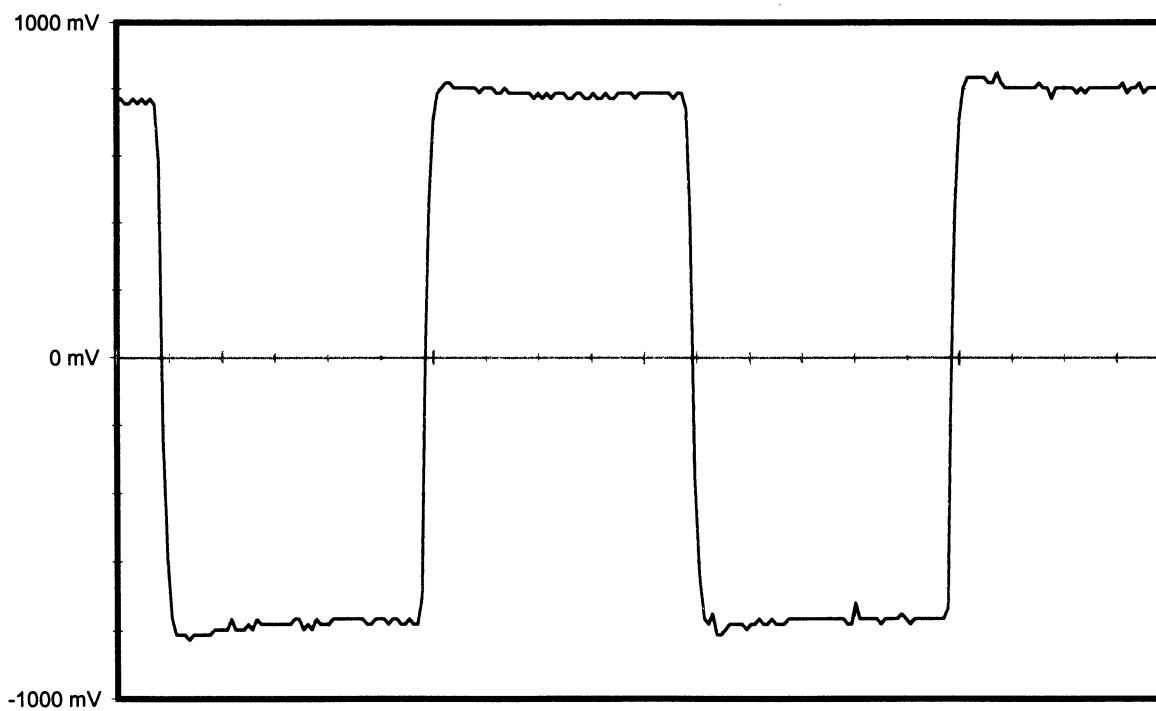




Vmarker1 850 mv ==> 1,2 rd

2 ms/div.

Vmarker2 700 mv ==> 1 rd



Duty Cycle : 0,00398804

0,5 ms/div.

falltime(1) <= 59,8803 us

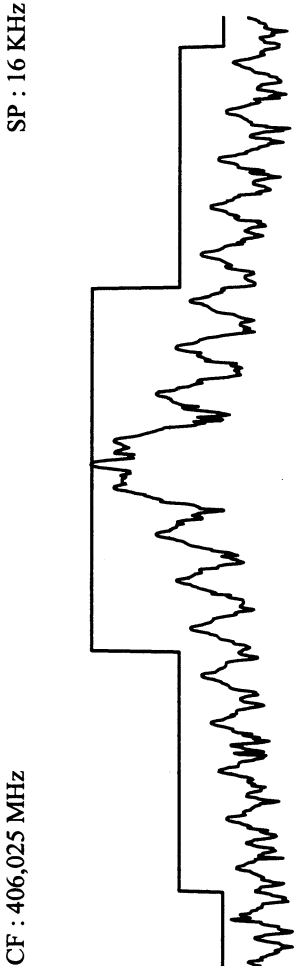
risetime(1) <= 59,8803 us

+width(1) 1,25749 ms

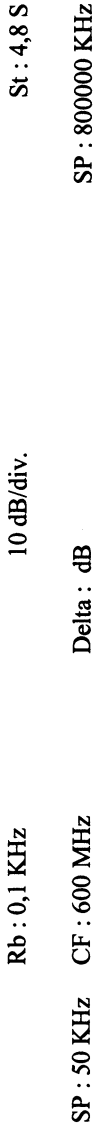
-width(1) 1,2475 ms

VSWR SPURIOUS EMISSIONS RESULTS
TRON 40GPS JOTRON
N° 7001

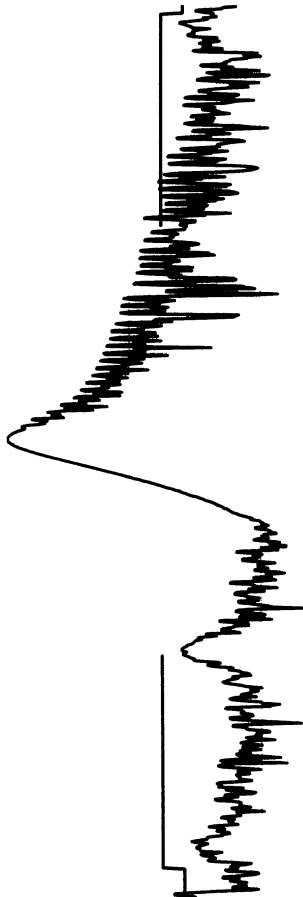
at -20° C, 22° C and 55° C



JOTRON
TRON 40GPS
7001
Certification VSWR
406 MHz
-20 °C



CF : 406,025 MHz



Rb : 1 KHz

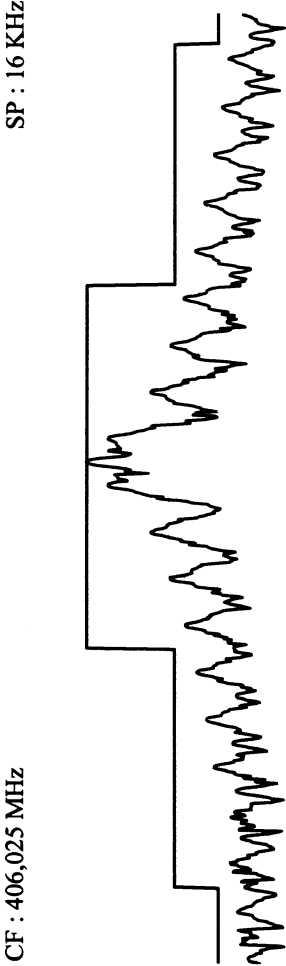
10 dB/div.

St : 0,305 S

Rb : 100 KHz

10 dB/div.

St : 0,24 S

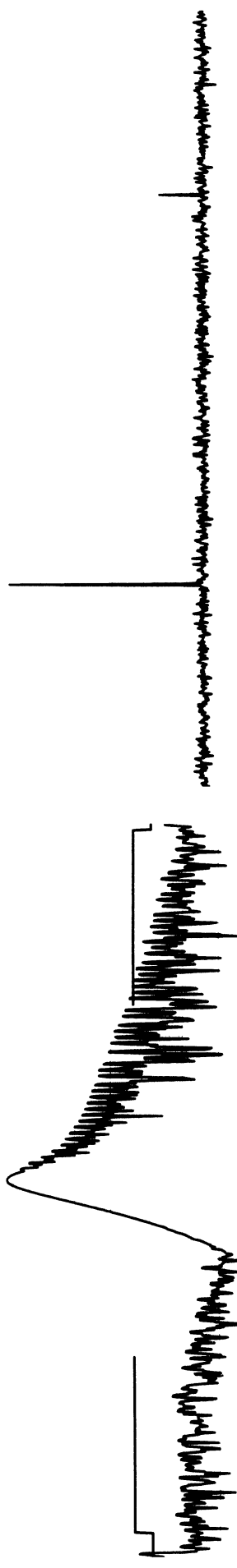


JOTRON
TRON 40GPS
7001
Certification VSWR
406 MHz
22 °C

SP : 50 KHz Rb : 0,1 KHz 10 dB/div. St : 4,8 S

Delta : dB SP : 800000 KHz

CF : 406,025 MHz

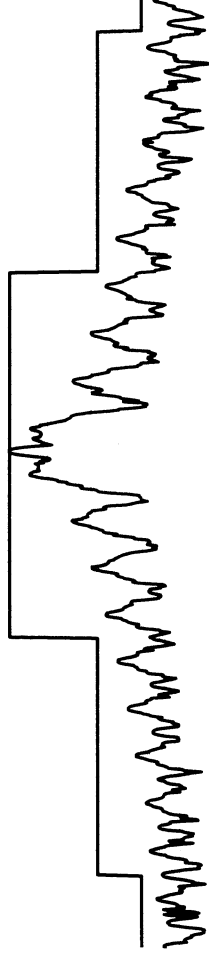


Rb : 1 KHz 10 dB/div. St : 0,305 S Rb : 100 KHz 10 dB/div. St : 0,24 S

JOTRON
TRON 40GPS
7001
Certification VSWR
406 MHz
55 °C

CF : 406,025 MHz

SP : 16 KHz



CF : 406,025 MHz

Rb : 0,1 KHz

10 dB/div.

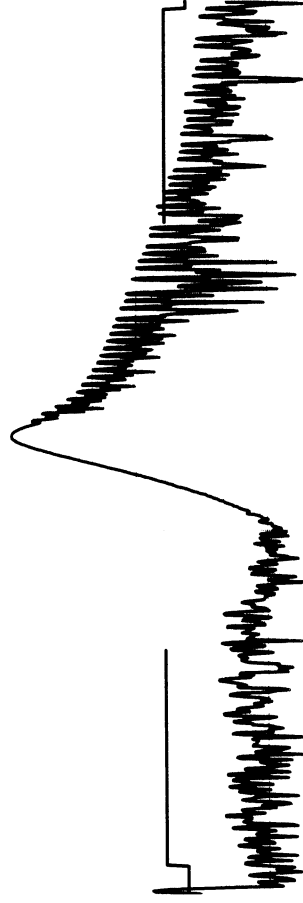
St : 4,8 S

SP : 50 KHz

CF : 600 MHz

Delta : dB

SP : 800000 KHz



Rb : 1 KHz

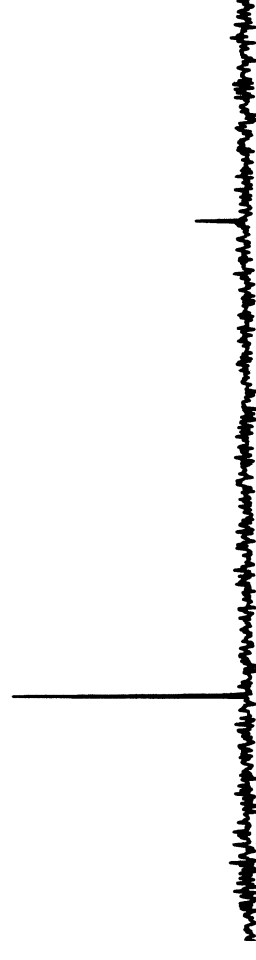
10 dB/div.

St : 0,305 S

Rb : 100 KHz

10 dB/div.

St : 0,24 S



**SELF-TEST MODE CONTROL ON
TRON 40GPS JOTRON
N° 7001**

at -20° C, 22° C and 55° C

Message at -20°C

Manufacturer	JOTRON
Beacon model	TRON 40GPS
Serial number	7001
Date of test	24 May 2000
Temperature	-19,8
Message received	FF FED0901E1E24007FDFFC15A17783E0F66C
Frame synchro. pattern	011010000

Total transmission time	ms 513.8< <526.2	522,33
Isself test burst at		0:00:14

Message at 22°C

Manufacturer	JOTRON
Beacon model	TRON 40GPS
Serial number	7001
Date of test	18 May 2000
Temperature	22,9
Message received	FF FED0901E1E24007FDFFC15A17783E0F66C
Frame synchro. pattern	011010000

Total transmission time	ms 513.8< <526.2	521,92
Isself test burst at		0:00:13

Message at 55 °C

Manufacturer	JOTRON
Beacon model	TRON 40GPS
Serial number	7001
Date of test	12 May 2000
Temperature	55,6
Message received	FF FED0901E1E24007FDFFC15A17783E0F66C
Frame synchro. pattern	011010000

Total transmission time	ms 513.8< <526.2	522,25
Isself test burst at		0:00:13

406 MHz BEACON SELF-TEST CHARACTERISTICS

406 MHz beacon Model(s) : TRON 40GPS

Answer (X)

	Yes	No
1. Does beacon have a self-test mode ?	☒	☐
If yes :		
♦ does self-test have a separate switch position ?	☒	☐
♦ does self-test switch automatically return to normal position when released ? if not, how long until the first "distress" message is emitted : 15 seconds	☐	☒
♦ does self-test transmit a 406 MHz signal ?	☒	☐
if yes :		
- unmodulated signal only	☐	☐
- normal data, but with inverted frame synchronization pattern	☒	☐
- 1 burst only	☒	☐
♦ does self-test transmit a 121.5 MHz signal ?	☒	☐
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) ?	☐	☒
2. Result of self-test is indicated by :		
♦ pass/fail display indicator light	☒	☐
♦ strobe light flash	☒	☐
♦ other (please specify) :	☐	☐
3. Can the self-test be performed without removing the beacon from its mounting bracket ?	☐	☒
4. What parameters are internally tested by the self-test ?		
♦ battery voltage	☒	☐
♦ RF power	☒	☐
♦ approximate RF frequency	☐	☒
♦ phase locked loop	☒	☐
♦ other (please specify) : 121.5 power & beacon software	☒	☐
5. Do the above characteristics apply to this beacon model :		
♦ for all countries where beacon is sold ,	☒	☐
if no, please specify :		
♦ for all production serial numbers ?	☒	☐
if no, specify :		

6. Comments

**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

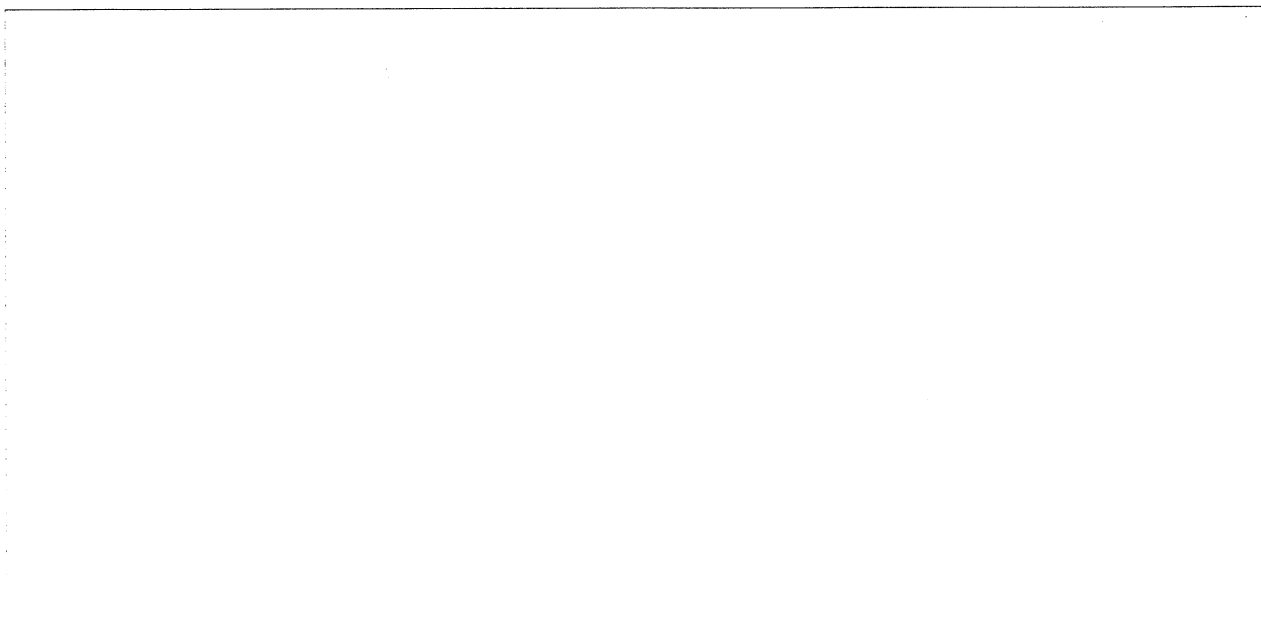
No	Δ Frequency (Hz)	Temp. (°C)	P406 (dBm)	P121.5 (dBm)
1	50281,00	-31,8	38,4	16,5
2	50144,50	-1,8	37,9	45,1
3	50141,21	-1,7	38,0	45,1
4	50139,08	-1,7	37,9	45,0
5	50136,93	-1,8	37,7	45,2
6	50134,98	-1,7	37,6	45,2
7	50133,24	-1,8	37,6	45,1
8	50131,46	-1,8	37,6	45,1
9	50129,84	-1,8	37,7	44,9
10	50128,29	-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

Frequency variation

406025118



406025095

— Initial tracing — Smoothed tracing

THERMAL SHOCK TEST / 30 °C change (-30 °C to 0,1 °C)

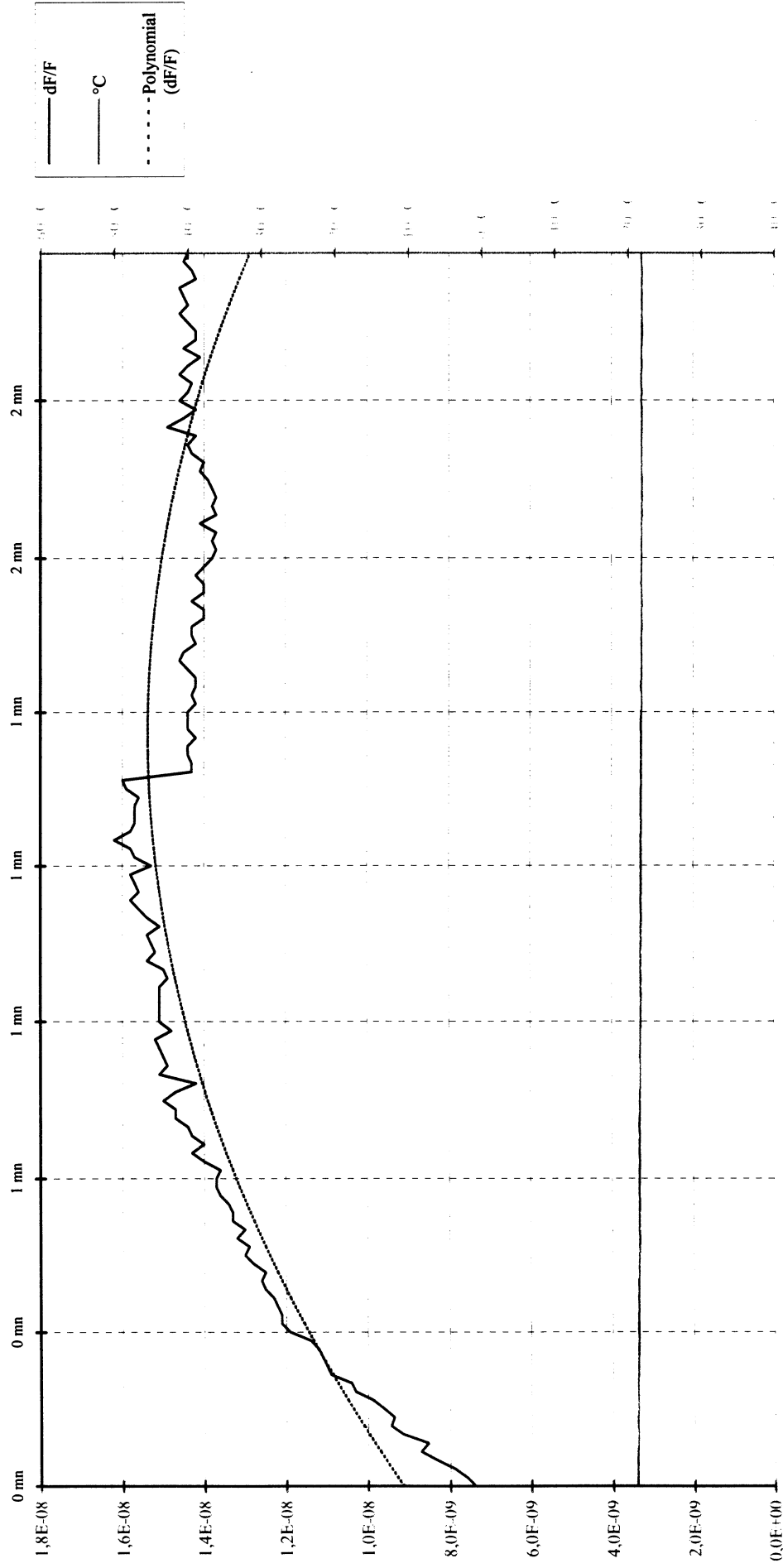
Manufacturer : JOTRON

Model : TRON 40GPS

Number : 7001

Date : 23/06/2000
Time : 08:29:24

FREQUENCY VARIATION

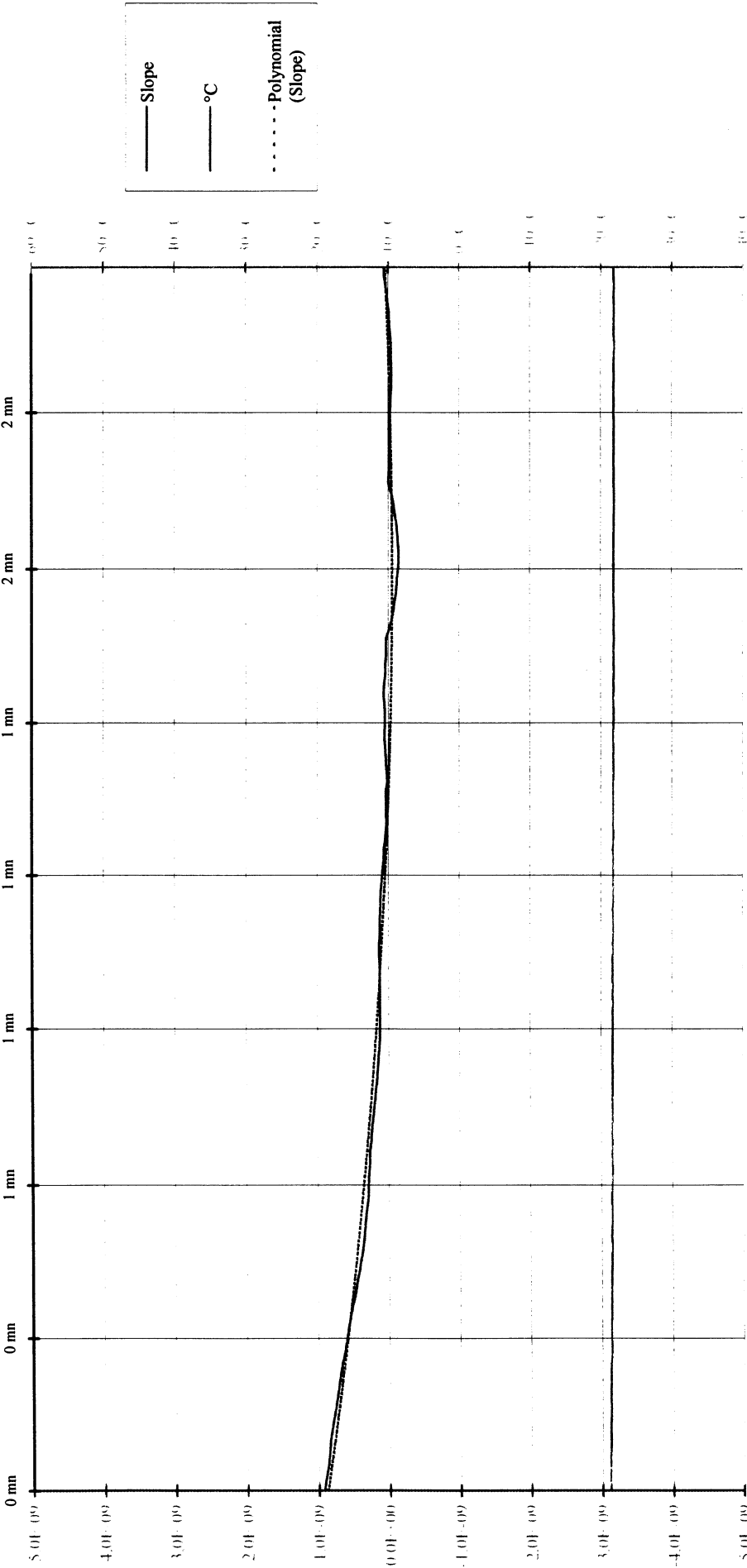


THERMAL SHOCK TEST / 30 °C change (-30 °C to 0,1 °C)

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

Date : 23/06/2000
Time : 08:29:24

MEDIUM TERM STABILITY : MEAN SLOPE /mm (-1,0E-9 to 1,0E-9)



THERMAL SHOCK TEST / 30 °C change (-30 °C to 0,1 °C)

Manufacturer : JOTRON

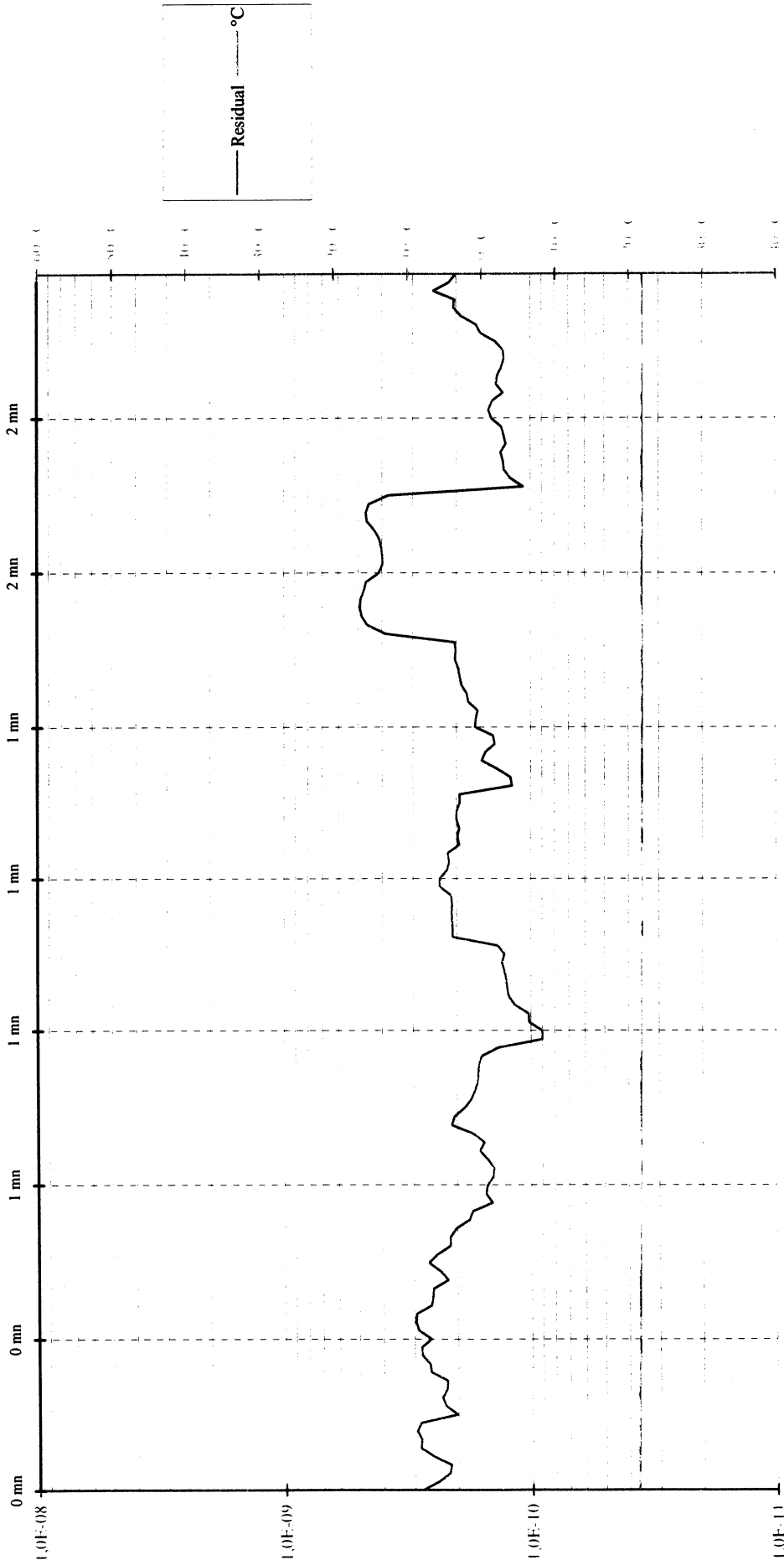
Model : TRON 40GPS

Number : 7001

Date : 23/06/2000

Time : 08:29:24

MEDIUM TERM STABILITY : RESIDUAL ($\leq 3,0E-9$)

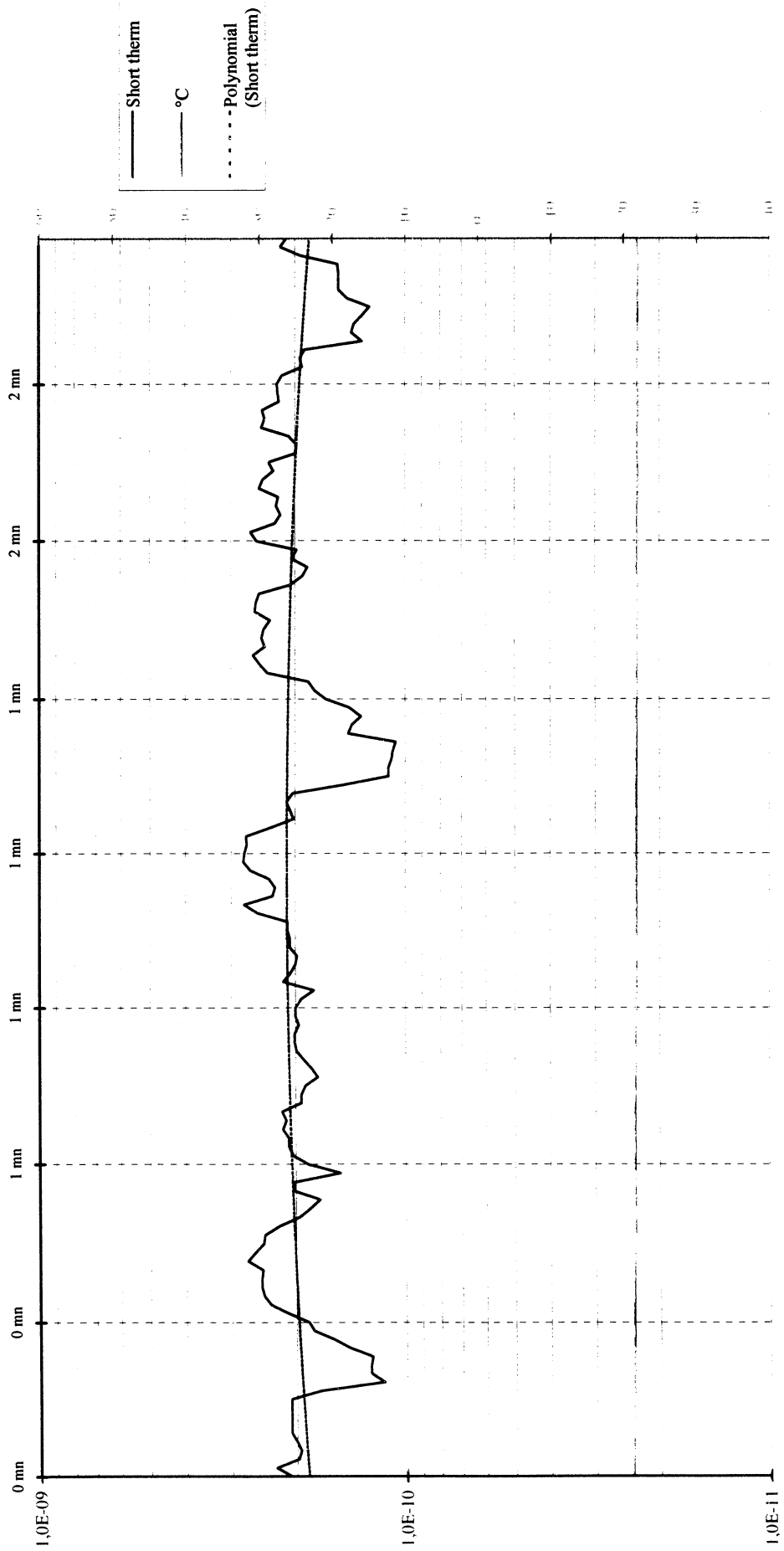


THERMAL SHOCK TEST / 30 °C change (-30 °C to 0,1 °C)

Date : 23/06/2000
Time : 08:29:24

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

SHORT TERM STABILITY /100 mS (≤ 2,0E-9)



THERMAL SHOCK TEST / 30 °C change (-30 °C to 0,1 °C)

Manufacturer : JOTRON

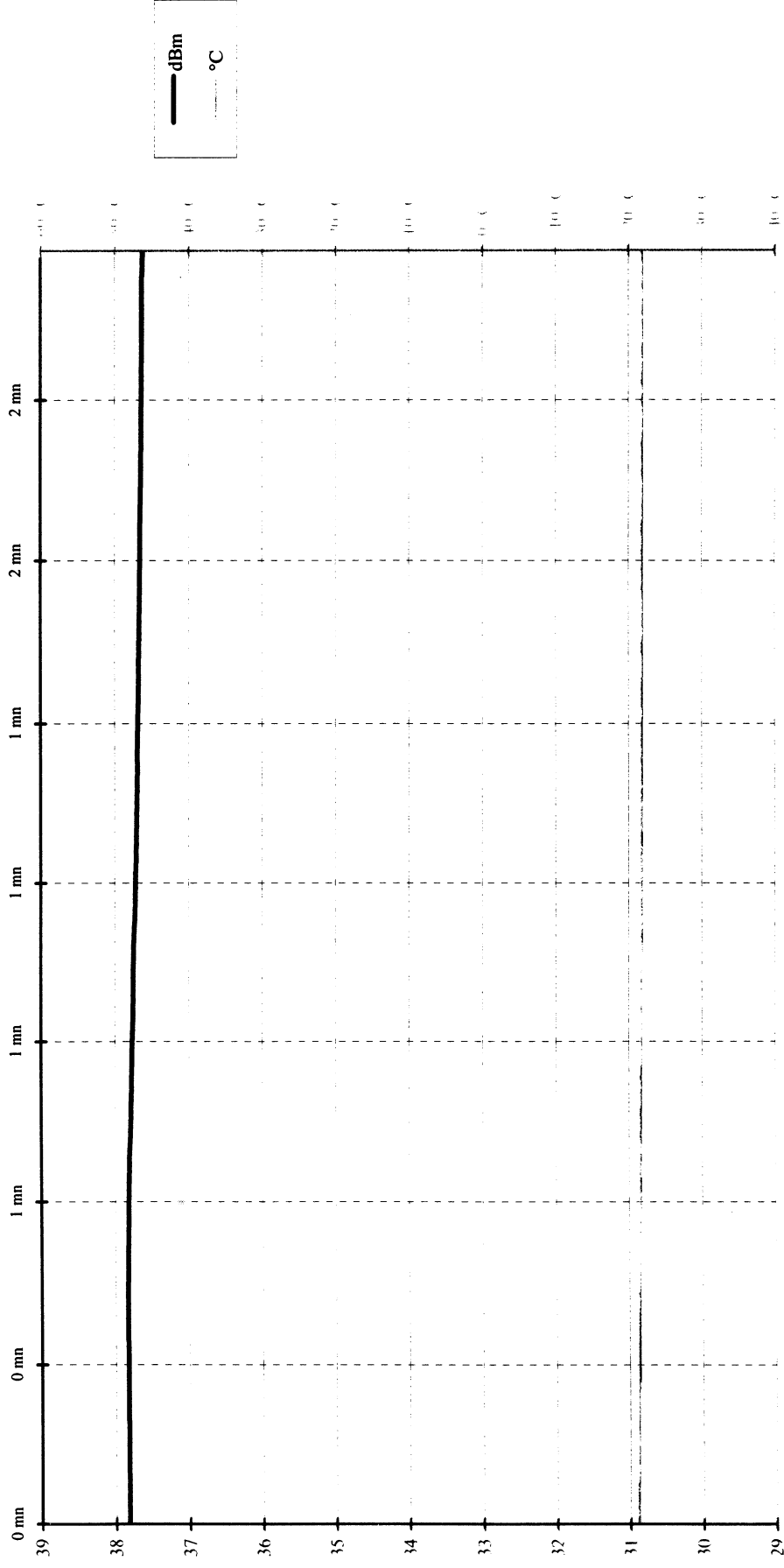
Model : TRON 40GPS

Number : 7001

Date : 23/06/2000

Time : 08:29:24

OUTPUT POWER (35 to 39 dBm)



**OPERATING LIFE TEST RESULTS ON
TRON 40GPS JOTRON
N° 7001
-20 °C**

Average Current Drain Control

Prior to Operating Lifetime Test at Minimum Temperature we have examined the Beacon Manufacturer calculation of average current drain prior to beacon activation over the rated life battery pack .

We can see JOTRON description and calculation exemple in Annex A

Note : The manufacturer have evaluated the battery capacity requirement for 4 years in equivalent time of beacon nominal functioning .

We have verified this estimation by checking alls consumption period .

Standards used for the measurements :

- Hewlett Packard Clip On DC milliammeter - model 428B - s/n : G621-01320,
- W + W Electronics Graphic Recorder - model 314 - s/n : 3582172

1) Average Current consumption during normal 406 operation (1 repetition period)

- Xenon flash consumption during 1 repetition period :

$$17 \text{ flashes} \times 0.150 \text{ sec} \times 0.65 \text{ A} = 1.6575 \text{ A.sec}$$

- 406 burst :

$$1 \times 1.05 \text{ A} \times 0.52 \text{ sec} = 0.546 \text{ A.sec}$$

- Basic current consumption during 1 repetition period :

$$0.16 \text{ A} \times 50 \text{ sec} = 8 \text{ A.sec}$$

Total current consumption during 1 repetition period : 10.2035 A.sec

Average of current consumed during 1 repetition period :

$$10.2035 / 50 \text{ sec} = 0.20407 \text{ Amps} \quad \approx \mathbf{0.200 \text{ Amps}}$$

2) Average Current consumption during 1 Self Test operation

- Xenon flash consumption :

$$1 \text{ flash} \times 0.150 \text{ sec} \times 0.65 \text{ A} = 0.0975 \text{ A.sec}$$

- 406 burst :

$$1 \times 1.05 \text{ A} \times 0.52 \text{ sec} = 0.546 \text{ A.sec}$$

- Basic current consumption :

$$0.05 \text{ A} \times 14 \text{ sec} = 0.7 \text{ A.sec}$$

Total current consumption during 1 Self Test operation : 1.3435 A.sec

Average of current consumed during 1 Self Test operation :

$$1.3435 \text{ A.sec} / 15 \text{ sec} = 0.08957 \text{ Amps} \quad \approx \mathbf{0.090 \text{ Amps}}$$

3) Current consumption comparison :

- between Self Test and Normal operation :

$$0.09 \text{ A} / 0.2 \text{ A} = \mathbf{0.45}$$

- between "Off" mode (Manufacturer estimation) and Normal operation :

$$0.0000005 \text{ A} / 0.2 \text{ A} = \mathbf{0.0000025}$$

4) Equivalent normal operation time of battery current consumption during its rated life

- Equivalent time of Self Test consumption :

15 sec x 52 weeks x 4 years x 0.45 = 1404 sec's = **23.4 min**

- Equivalent time of "Off mode" consumption :

525600 min x 4 years x 0.0000025 = **5.256 min**

Total ≈ 29 min

For the Operating Life Test at the Minimum Temperature we haven't discharge a battery pack
We have taken account of Manufacturer equivalent time estimation, **one hour** of normal operation .

Applying the 1.65 Coefficient Factor this equivalent time estimation is rounded at **2 hours**

Operating Lifetime results at -20° C :

The duration of operating lifetime result is **2 hours** decreased

No	Δ Frequency (Hz)	Temp. (°C)	P406 (dBm)	P121.5 (dBm)
1	50122,44	-20,7	37,8	25,1
2	50122,86	-20,7	37,8	24,8
3	50123,22	-20,8	37,8	24,9
4	50123,68	-20,8	37,8	24,9
5	50124,18	-20,8	37,8	25,0
6	50124,50	-20,8	37,8	25,0
7	50124,70	-20,8	37,8	25,0
8	50124,98	-20,9	37,8	25,0
9	50125,26	-20,8	37,8	25,0
10	50125,44	-20,9	37,8	25,0
11	50125,99	-20,9	37,8	25,0
12	50126,28	-21,0	37,8	24,9
13	50126,56	-21,0	37,8	24,8
14	50126,88	-21,0	37,8	24,9
15	50127,24	-21,0	37,8	24,9
16	50127,43	-21,0	37,8	25,1
17	50127,68	-21,1	37,8	25,1
18	50128,03	-21,1	37,8	25,1

No	Temp.	Slope	Sigma	P406	Short term	P121.5
1	-21,1	9,2E-10	2,8E-10	37,8	2,1E-10	25,1
18	-21,4	6,2E-10	2,8E-10	37,8	1,8E-10	25,1
31	-21,5	3,5E-10	2,1E-10	37,8	2,0E-10	25,1
61	-21,7	1,2E-10	1,3E-10	37,7	2,0E-10	25,0
91	-21,8	4,7E-11	1,7E-10	37,7	1,6E-10	25,0
121	-21,9	-1,3E-11	1,3E-10	37,6	2,1E-10	25,0
151	-21,9	4,4E-11	2,3E-10	37,6	2,3E-10	25,0
181	-21,9	-2,5E-11	1,4E-10	37,6	1,9E-10	25,0
211	-21,9	1,2E-11	1,6E-10	37,6	2,8E-10	25,0
241	-21,9	-3,2E-11	1,7E-10	37,6	1,8E-10	25,0
271	-21,9	-4,7E-12	1,4E-10	37,6	2,0E-10	25,0
301	-21,9	-3,1E-11	1,9E-10	37,6	1,6E-10	25,0
331	-21,8	1,1E-12	2,5E-10	37,6	2,6E-10	25,0
361	-21,8	-1,4E-11	1,3E-10	37,6	1,5E-10	25,0
391	-21,7	-3,6E-11	1,8E-10	37,6	1,7E-10	25,0
421	-21,9	-1,2E-10	2,3E-10	37,6	2,0E-10	25,0
451	-21,9	-1,5E-11	2,0E-10	37,6	1,8E-10	25,2
481	-21,8	-8,7E-12	1,4E-10	37,6	1,4E-10	25,1
511	-21,8	-3,7E-11	2,5E-10	37,6	2,7E-10	25,0
541	-21,9	-1,3E-11	1,8E-10	37,6	1,6E-10	25,1
571	-21,9	-2,6E-11	2,5E-10	37,6	3,0E-10	25,1
601	-21,9	-1,1E-10	3,8E-10	37,6	1,4E-10	25,1
631	-21,8	2,0E-11	1,7E-10	37,6	1,5E-10	25,1
661	-21,9	-2,1E-11	1,8E-10	37,6	2,2E-10	25,1
691	-21,8	-1,8E-11	2,4E-10	37,6	3,0E-10	24,9
721	-21,9	-4,9E-12	1,5E-10	37,6	1,7E-10	25,0
751	-21,9	-6,1E-13	1,6E-10	37,6	2,3E-10	25,1
781	-21,9	-2,1E-11	2,2E-10	37,6	1,6E-10	25,1
811	-21,9	-4,0E-11	1,3E-10	37,6	2,3E-10	25,1
841	-21,9	-1,8E-11	1,3E-10	37,6	1,9E-10	25,1
871	-21,8	1,5E-11	1,8E-10	37,6	2,8E-10	25,0
901	-21,9	-5,3E-12	1,6E-10	37,6	2,2E-10	25,0
931	-21,9	-1,7E-11	1,5E-10	37,6	2,0E-10	25,1
961	-21,9	8,1E-12	1,4E-10	37,6	1,7E-10	25,1
991	-21,9	2,9E-11	2,1E-10	37,6	2,8E-10	25,1
1021	-22,0	-9,0E-13	1,6E-10	37,6	2,2E-10	25,1
1051	-22,0	1,8E-11	1,8E-10	37,6	3,4E-10	25,1
1081	-22,1	-1,7E-11	1,5E-10	37,6	2,1E-10	25,1
1111	-22,2	-2,1E-12	2,5E-10	37,6	2,9E-10	24,9
1141	-22,3	5,1E-12	2,3E-10	37,6	2,4E-10	25,0
1171	-22,3	-1,1E-11	1,4E-10	37,6	2,7E-10	24,9
1201	-22,4	-1,8E-11	1,5E-10	37,6	2,2E-10	25,1
1231	-22,4	-1,5E-11	1,6E-10	37,6	1,8E-10	25,1
1261	-22,4	3,6E-12	2,0E-10	37,6	2,5E-10	25,1
1291	-22,4	-1,5E-11	1,4E-10	37,6	1,9E-10	24,9
1321	-22,4	-2,0E-11	1,6E-10	37,6	2,2E-10	25,1
1351	-22,4	-7,0E-12	1,9E-10	37,6	1,9E-10	25,1
1381	-22,5	3,2E-11	1,5E-10	37,6	2,6E-10	25,1
1411	-22,6	-9,7E-12	1,5E-10	37,5	2,3E-10	25,1

No	Temp.	Slope	Sigma	P406	Short term	P121.5
1441	-22,6	-7,4E-12	1,6E-10	37,5	2,6E-10	25,1
1471	-22,6	-5,9E-11	2,8E-10	37,5	1,4E-10	25,1
1501	-22,6	4,3E-11	1,8E-10	37,5	2,4E-10	25,1
1531	-22,6	5,3E-11	1,2E-10	37,5	1,2E-10	24,9
1561	-22,5	5,6E-11	2,1E-10	37,5	2,2E-10	25,0
1591	-22,5	9,7E-12	1,7E-10	37,5	2,6E-10	25,1
1621	-22,5	4,2E-12	1,7E-10	37,5	1,2E-10	24,9
1651	-22,5	1,5E-11	1,6E-10	37,5	1,8E-10	24,9
1681	-22,5	3,3E-12	1,3E-10	37,5	2,6E-10	25,3
1711	-22,6	6,2E-12	2,0E-10	37,5	2,8E-10	25,1
1741	-22,6	-6,8E-12	2,1E-10	37,5	2,3E-10	24,9
1771	-22,6	1,8E-11	1,9E-10	37,5	1,9E-10	25,1
1801	-22,6	-1,1E-11	1,2E-10	37,5	1,3E-10	25,1
1831	-22,6	-2,3E-11	2,5E-10	37,5	2,9E-10	24,9
1861	-22,6	-1,3E-11	1,9E-10	37,5	2,5E-10	25,3
1891	-22,5	-3,6E-12	2,0E-10	37,5	2,1E-10	24,9
1921	-22,4	5,0E-12	2,4E-10	37,5	3,3E-10	24,9
1951	-22,4	-7,2E-11	2,6E-10	37,5	3,0E-10	24,9
1981	-22,5	1,1E-11	1,9E-10	37,5	2,5E-10	25,3
2011	-22,5	8,4E-12	1,7E-10	37,5	2,6E-10	25,1
2041	-22,5	2,5E-11	2,2E-10	37,5	1,7E-10	25,0
2071	-22,4	8,9E-12	1,8E-10	37,5	1,9E-10	24,9
2101	-22,4	2,5E-12	1,7E-10	37,5	2,0E-10	24,9
2131	-22,3	-2,3E-11	1,8E-10	37,5	2,8E-10	25,1
2161	-22,3	2,1E-11	1,6E-10	37,5	2,4E-10	25,1
2191	-22,3	4,3E-12	2,0E-10	37,5	1,9E-10	25,1
2221	-22,2	5,6E-12	1,9E-10	37,5	2,8E-10	25,1
2251	-22,3	-7,1E-12	1,9E-10	37,4	1,4E-10	25,1
2281	-22,3	1,4E-11	1,8E-10	37,4	2,7E-10	25,1
2311	-22,2	2,9E-11	2,3E-10	37,4	2,4E-10	25,1
2341	-22,1	6,8E-11	1,8E-10	37,4	1,4E-10	24,9
2371	-22,2	3,8E-12	1,8E-10	37,4	1,9E-10	25,1
2401	-22,2	-2,9E-11	1,8E-10	37,4	2,3E-10	25,1
2431	-22,2	1,5E-11	2,0E-10	37,4	2,4E-10	25,1
2461	-22,3	1,0E-11	2,0E-10	37,4	2,7E-10	25,1
2491	-22,2	-2,4E-13	2,2E-10	37,4	2,8E-10	24,9
2521	-22,3	-9,4E-12	2,2E-10	37,4	3,2E-10	24,9
2551	-22,3	-1,5E-12	1,4E-10	37,4	2,8E-10	24,9
2581	-22,2	8,0E-12	2,1E-10	37,4	2,7E-10	24,9
2611	-22,3	-1,3E-11	1,2E-10	37,4	1,7E-10	24,9
2641	-22,3	-1,7E-12	1,8E-10	37,4	1,6E-10	24,9
2671	-22,3	-1,1E-11	1,4E-10	37,4	1,5E-10	25,1
2701	-22,4	6,1E-12	1,9E-10	37,4	2,0E-10	25,0
2731	-22,5	2,5E-11	2,0E-10	37,3	2,6E-10	24,8
2761	-22,5	3,6E-11	1,8E-10	37,3	1,6E-10	24,9
2791	-22,5	1,5E-11	1,5E-10	37,3	2,0E-10	24,9
2821	-22,7	1,4E-11	1,6E-10	37,3	2,4E-10	24,9
2851	-22,7	3,1E-11	2,1E-10	37,3	2,2E-10	25,0
2881	-22,8	-2,4E-11	1,4E-10	37,3	2,3E-10	24,9
2911	-22,8	-6,3E-11	2,5E-10	37,3	1,8E-10	24,9
2941	-22,9	-5,0E-12	1,9E-10	37,3	2,5E-10	24,9

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h

No	Temp.	Slope	Sigma	P406	Short term	P121.5
2971	-22,9	2,2E-11	1,7E-10	37,3	2,2E-10	25,0
3001	-22,9	9,8E-12	1,8E-10	37,3	2,6E-10	25,0
3031	-22,9	-1,6E-11	2,0E-10	37,3	3,1E-10	25,0
3061	-23,0	8,1E-12	2,0E-10	37,3	2,4E-10	25,0
3091	-22,9	2,7E-11	1,9E-10	37,3	2,0E-10	25,0
3121	-22,9	-6,6E-12	2,0E-10	37,3	1,3E-10	25,0
3151	-22,9	-2,3E-12	2,4E-10	37,3	2,3E-10	25,0
3181	-22,9	-5,9E-11	2,5E-10	37,2	1,8E-10	25,0
3211	-22,9	-2,4E-11	3,4E-10	37,2	2,6E-10	25,0
3241	-22,9	-1,0E-11	3,4E-10	37,2	1,1E-10	25,0
3271	-22,8	9,2E-11	2,2E-10	37,2	2,6E-10	25,0
3301	-22,8	1,9E-11	2,1E-10	37,2	3,2E-10	25,0
3331	-22,8	-4,5E-12	1,4E-10	37,2	1,5E-10	25,0
3361	-22,7	1,6E-11	1,7E-10	37,2	2,4E-10	25,0
3391	-22,7	1,4E-12	2,1E-10	37,2	2,4E-10	25,0
3421	-22,7	7,6E-13	2,4E-10	37,2	2,2E-10	25,0
3451	-22,8	2,4E-11	1,2E-10	37,2	2,1E-10	24,8
3481	-22,8	1,2E-11	1,9E-10	37,2	3,3E-10	24,8
3511	-22,9	2,3E-11	2,1E-10	37,2	2,0E-10	24,8
3541	-22,9	4,9E-12	1,4E-10	37,2	1,8E-10	24,8
3571	-22,9	-4,1E-11	2,3E-10	37,1	2,0E-10	24,8
3601	-22,9	7,7E-13	1,8E-10	37,1	2,2E-10	24,8
3631	-22,9	1,3E-11	2,0E-10	37,1	2,4E-10	24,8
3661	-22,8	2,1E-12	1,4E-10	37,1	1,9E-10	24,9
3691	-22,7	3,0E-11	1,5E-10	37,1	2,3E-10	25,0
3721	-22,6	2,3E-11	2,4E-10	37,1	2,0E-10	25,0
3751	-22,6	5,6E-12	1,8E-10	37,1	2,3E-10	25,0
3781	-22,6	-2,9E-12	1,6E-10	37,1	1,5E-10	25,0
3811	-22,5	2,0E-11	1,6E-10	37,1	1,8E-10	25,0
3811	-22,5	-1,2E-11	1,8E-10	37,1	2,5E-10	25,0
3841	-22,5	2,0E-12	1,5E-10	37,1	1,9E-10	25,0
3871	-22,5	2,3E-11	1,9E-10	37,1	1,8E-10	24,9
3901	-22,4	3,5E-12	2,3E-10	37,1	2,6E-10	24,8
3931	-22,4	-4,4E-11	1,4E-10	37,1	2,2E-10	24,8
3961	-22,3	3,3E-12	1,8E-10	37,1	2,0E-10	24,8
3991	-22,3	-8,3E-12	1,8E-10	37,1	1,8E-10	24,8
4021	-22,3	3,0E-11	1,2E-10	37,0	2,2E-10	24,7
4051	-22,3	1,4E-11	2,6E-10	37,0	3,2E-10	24,8
4081	-22,2	3,2E-11	1,6E-10	37,0	1,4E-10	25,0
4111	-22,2	1,1E-11	1,9E-10	37,0	2,2E-10	24,8
4141	-22,2	3,3E-11	1,0E-10	37,0	1,8E-10	24,9
4171	-22,3	-3,8E-12	1,9E-10	37,0	2,2E-10	24,9
4201	-22,3	-2,5E-11	1,8E-10	37,0	1,9E-10	24,9
4231	-22,3	-2,0E-11	2,0E-10	37,0	1,9E-10	25,0
4261	-22,3	2,6E-13	1,6E-10	37,0	2,0E-10	24,9
4291	-22,3	-7,9E-13	1,5E-10	37,0	1,5E-10	24,9
4321	-22,2	-6,9E-12	2,4E-10	37,0	1,6E-10	25,0
4351	-22,3	9,2E-12	2,0E-10	37,0	2,1E-10	25,0
4381	-22,3	2,1E-12	1,6E-10	37,0	1,5E-10	24,9
4411	-22,3	1,3E-11	2,1E-10	36,9	2,3E-10	24,9
4441	-22,3	1,1E-11	1,6E-10	36,9	1,3E-10	24,8
4471	-22,3	-1,5E-10	3,9E-10	36,9	2,6E-10	24,8

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No	Temp.	Slope	Sigma	P406	Short term	P121.5
4501	-22,3	1,0E-11	1,8E-10	36,9	1,8E-10	24,9
4531	-22,4	5,6E-11	1,5E-10	36,9	1,9E-10	24,9
4561	-22,4	1,0E-11	2,3E-10	36,9	1,6E-10	24,9
4591	-22,4	7,3E-12	1,8E-10	36,9	2,0E-10	24,9
4621	-22,3	1,3E-11	1,6E-10	36,9	2,2E-10	24,9
4651	-22,3	-7,2E-12	1,7E-10	36,9	1,9E-10	24,8
4681	-22,3	-1,5E-11	1,7E-10	36,8	1,8E-10	24,9
4711	-22,3	-8,2E-12	2,1E-10	36,8	1,3E-10	24,9
4741	-22,3	6,0E-12	1,1E-10	36,8	1,9E-10	24,7
4771	-22,5	1,2E-11	2,3E-10	36,8	2,4E-10	24,9
4801	-22,5	1,2E-11	9,0E-11	36,8	2,6E-10	24,9
4831	-22,6	-1,1E-11	1,8E-10	36,7	2,1E-10	24,9
4861	-22,6	-2,8E-12	2,7E-10	36,7	2,5E-10	24,9
4891	-22,7	9,8E-12	1,1E-10	36,7	1,7E-10	24,9
4921	-22,7	3,7E-11	1,5E-10	36,7	1,8E-10	24,8
4951	-22,7	-3,5E-11	4,3E-10	36,6	2,4E-10	24,8
4981	-22,6	-8,5E-11	3,4E-10	36,6	2,2E-10	24,6
5011	-22,6	2,9E-11	1,7E-10	36,6	2,2E-10	24,7
5041	-22,6	2,0E-11	1,8E-10	36,6	1,6E-10	24,7
5071	-22,7	1,4E-11	1,9E-10	36,5	2,6E-10	24,7
5101	-22,6	-1,8E-11	1,8E-10	36,5	2,3E-10	24,6
5131	-22,7	2,0E-11	1,6E-10	36,4	1,5E-10	24,6
5161	-22,7	2,8E-11	1,8E-10	36,4	2,3E-10	24,8
5191	-22,7	-6,2E-12	1,4E-10	36,3	2,1E-10	24,6
5221	-22,7	-3,0E-11	1,6E-10	36,2	2,3E-10	24,6
5251	-22,7	2,2E-11	2,2E-10	36,2	3,2E-10	24,6
5281	-22,6	1,8E-12	1,5E-10	36,1	1,9E-10	24,6
5311	-22,7	1,2E-13	1,6E-10	36,0	2,9E-10	24,7
5341	-22,6	-1,5E-11	1,6E-10	35,9	2,8E-10	24,6
5371	-22,6	-2,4E-11	1,9E-10	35,7	2,8E-10	24,5
5401	-22,5	1,6E-11	2,0E-10	35,5	2,3E-10	24,4
5431	-22,5	1,3E-11	1,2E-10	35,1	2,2E-10	24,1

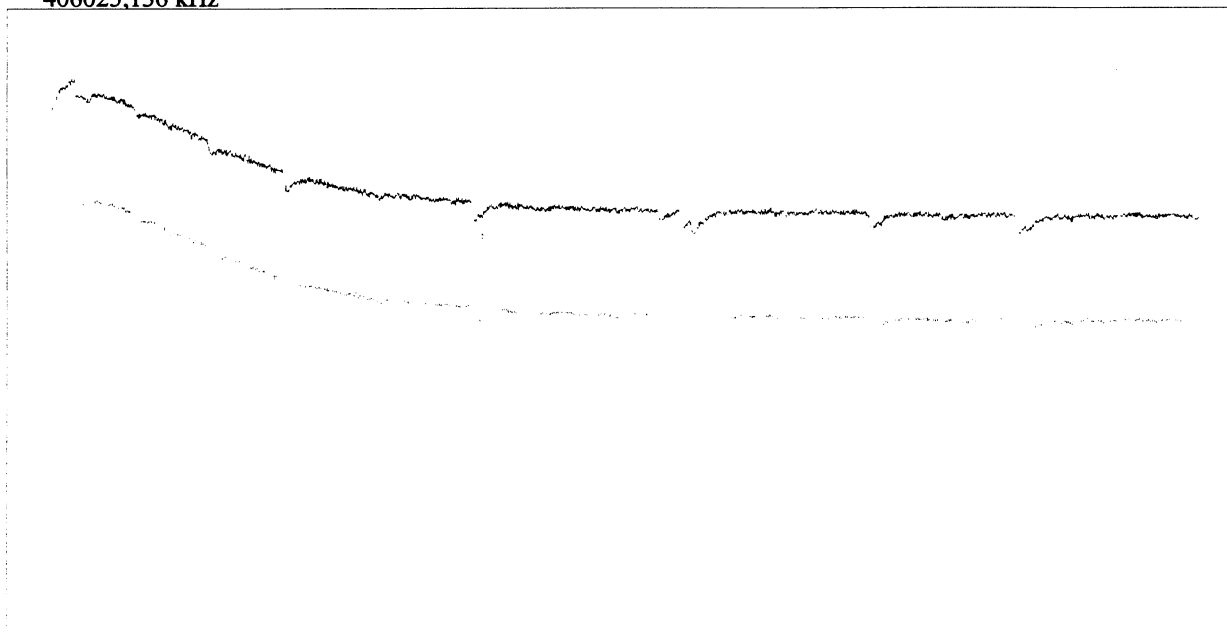
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Beacon message after 48 hours of Operating Lifetime Test :

FFFE2F901E1E24002B80374C89B78E014CDA

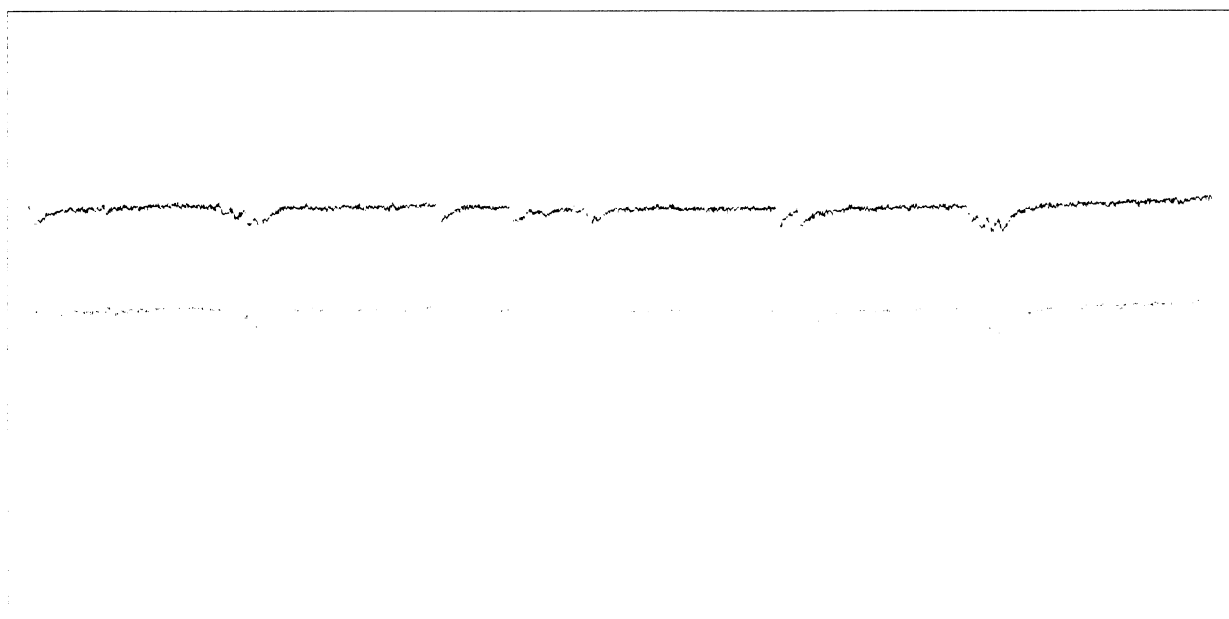
Frequency variation

406025,136 kHz



406025,128 kHz

406025,136 kHz



406025,128 kHz

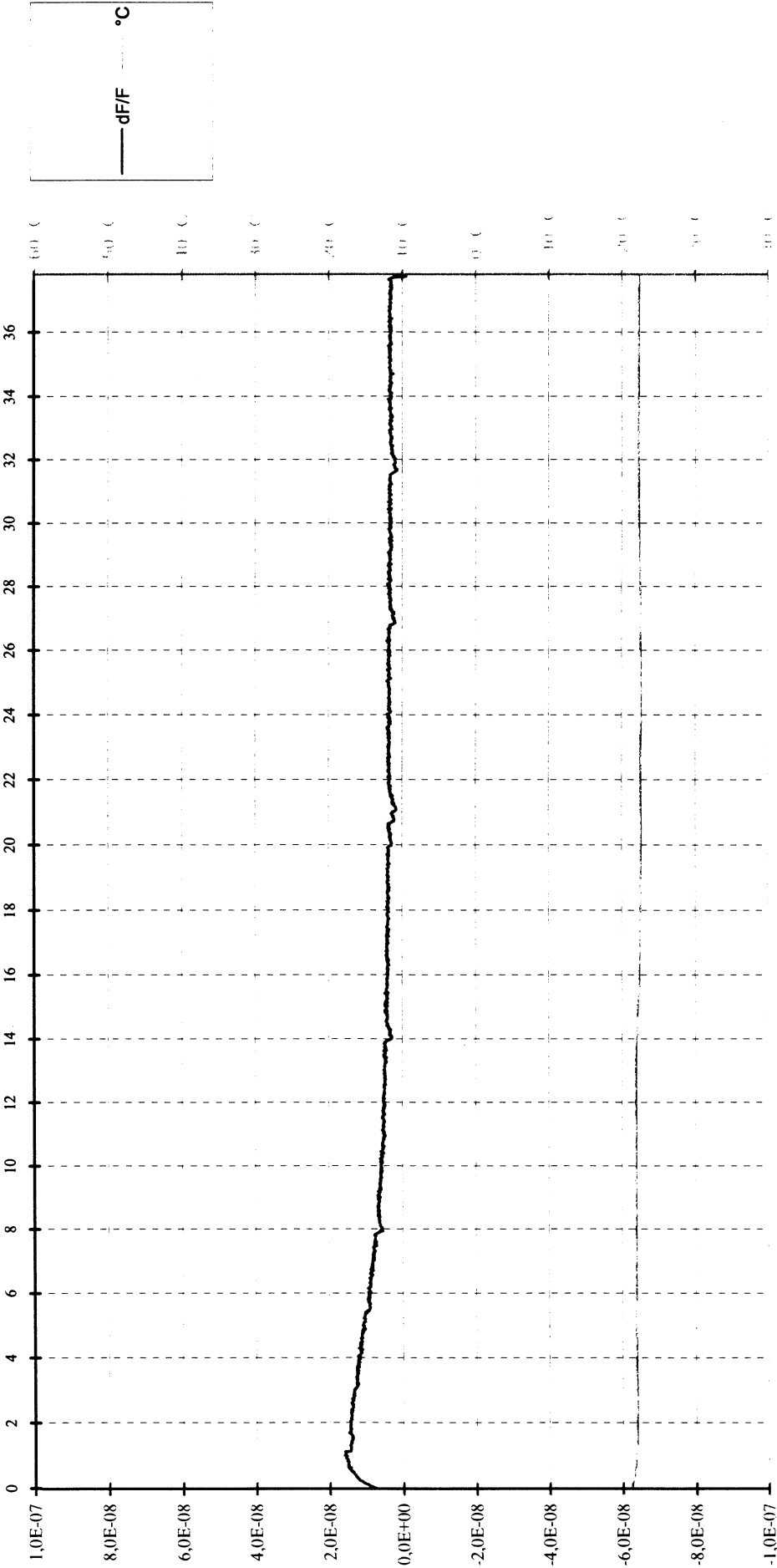
— Initial tracing — Smoothed tracing

LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

Date : 30/06/2000
Time : 17:27:37

FREQUENCY VARIATION

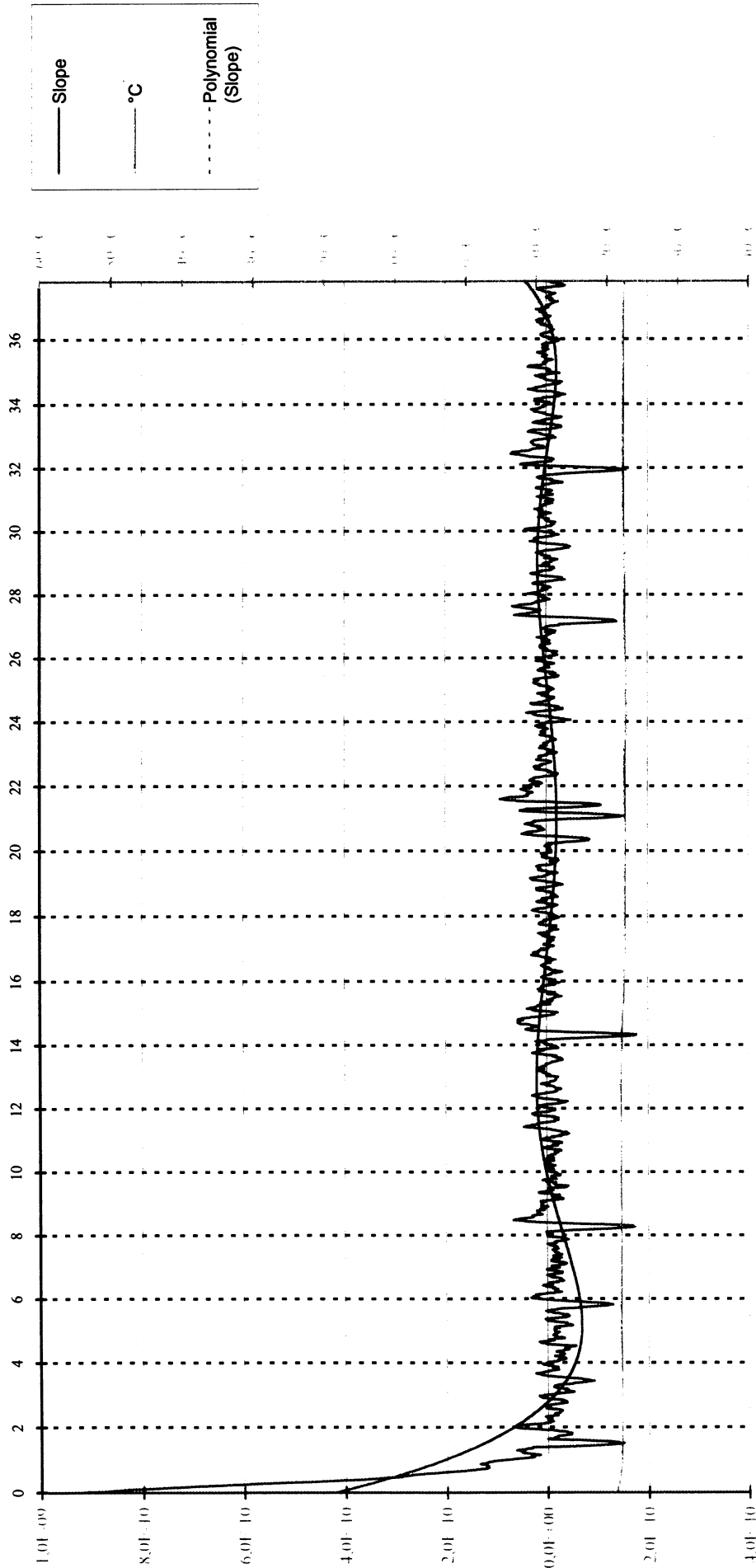


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

Date : 30/06/2000
Time : 17:27:37

MEDIUM TERM STABILITY : MEAN SLOPE /mn (-1,0E-9 to 1,0E-9)

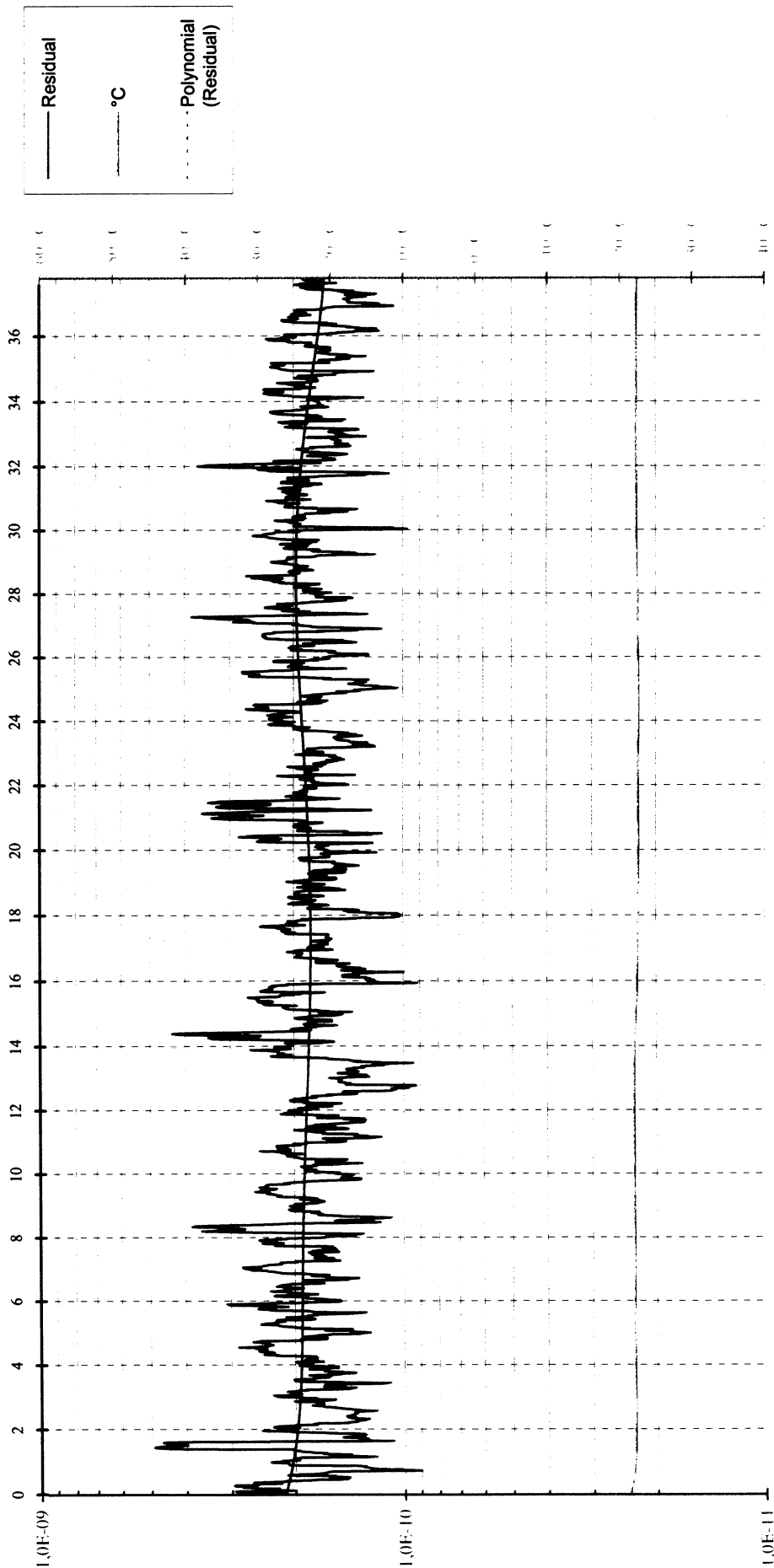


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

Date : 30/06/2000
Time : 17:27:37

MEDIUM TERM STABILITY : RESIDUAL ($\leq 3,0E-9$)

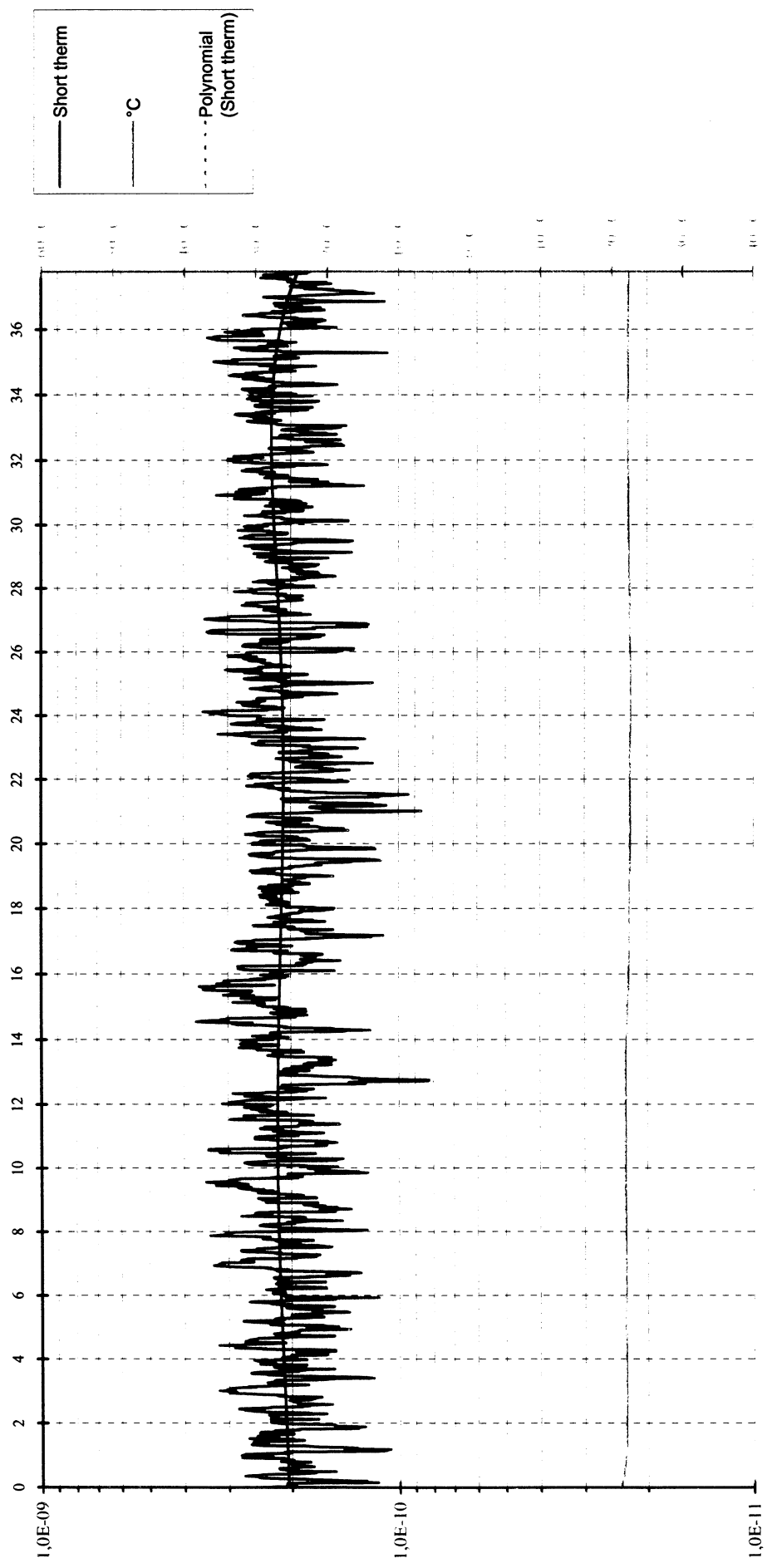


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Number : 7001

Date : 30/06/2000
Time : 17:27:37

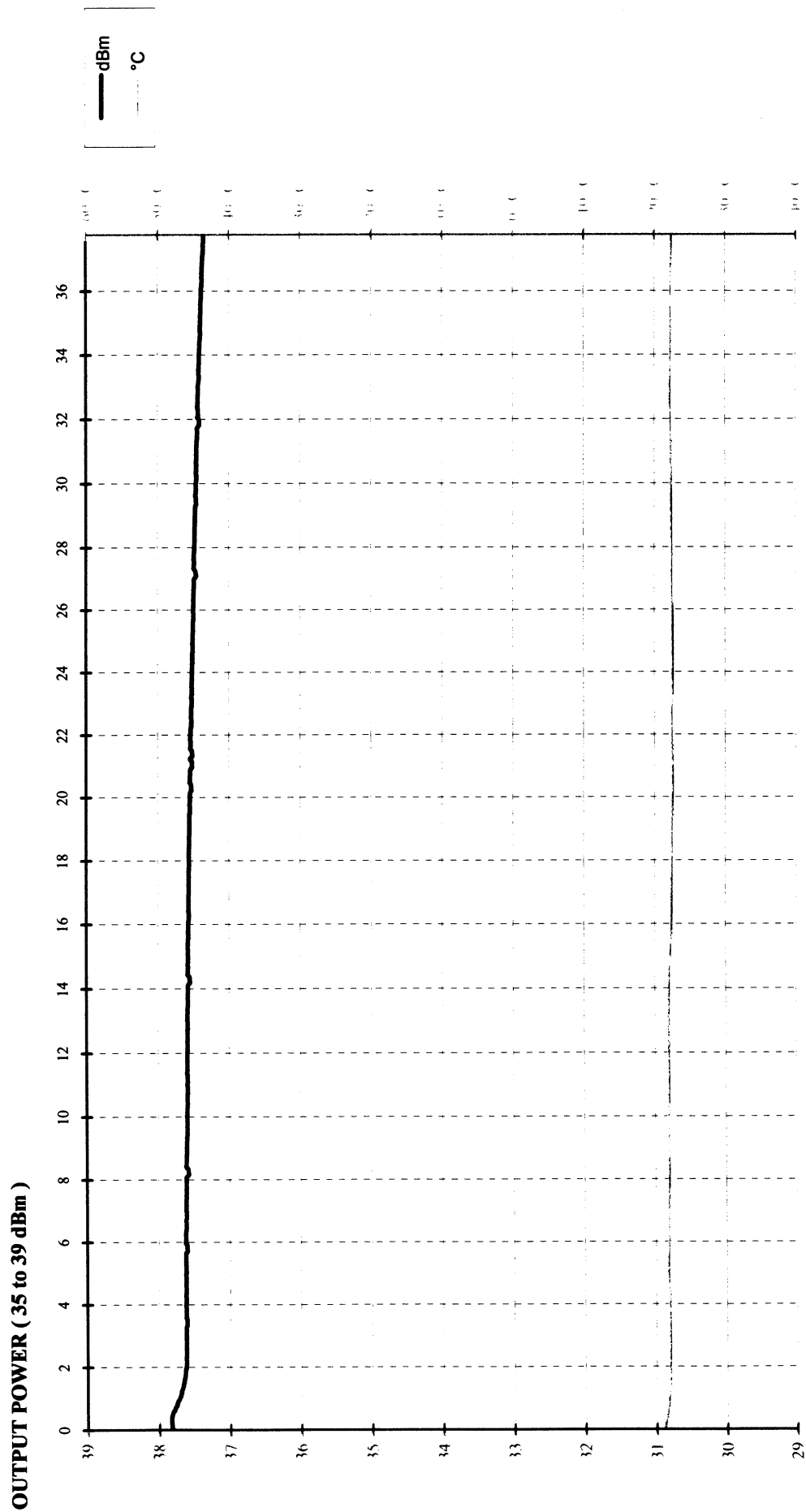
SHORT TERM STABILITY /100 ms ($\leq 2,0E-9$)



LIFE TEST AT -20 °C

Manufacturer : JOTRON
 Model : TRON 40GPS
 Numero : 7001

Date : 30/06/2000
 Time : 17:27:37

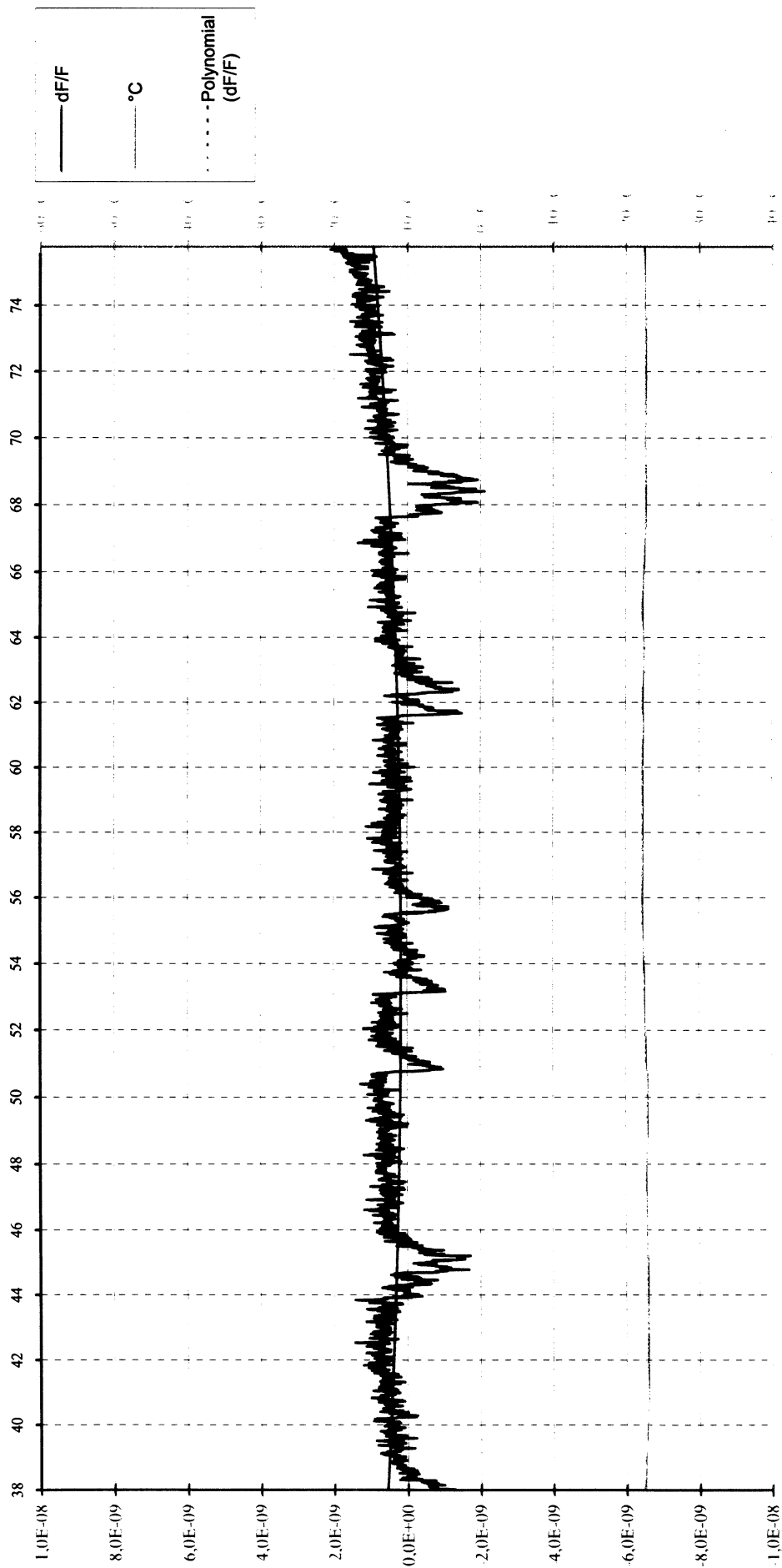


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Numero : 7001

Date : 30/06/2000
Time : 17:27:37

FREQUENCY VARIATION

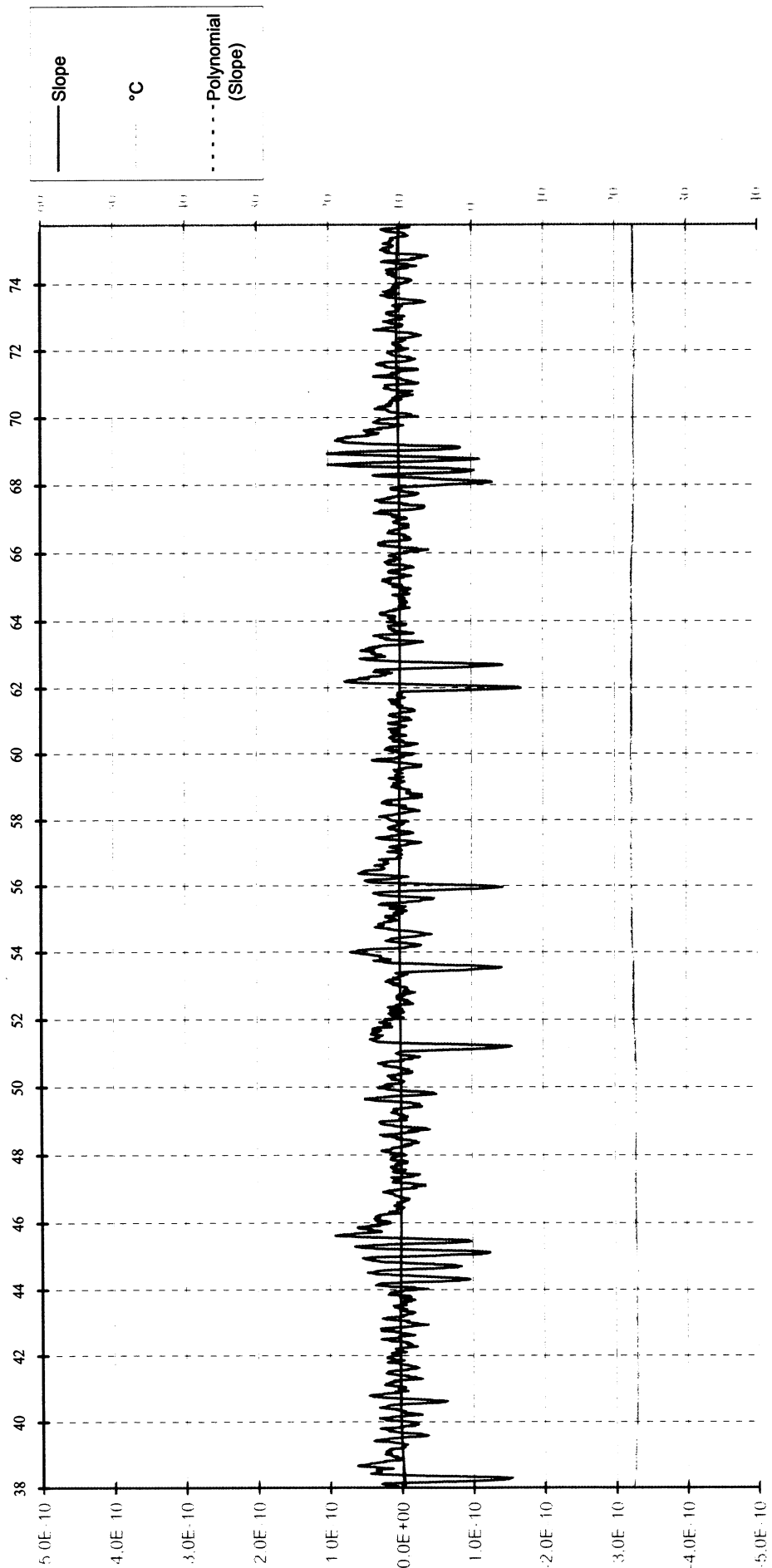


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Numero : 7001

Date : 30/06/2000
Time : 17:27:37

MEDIUM TERM STABILITY : MEAN SLOPE /mn (-1,0E-9 to 1,0E-9)

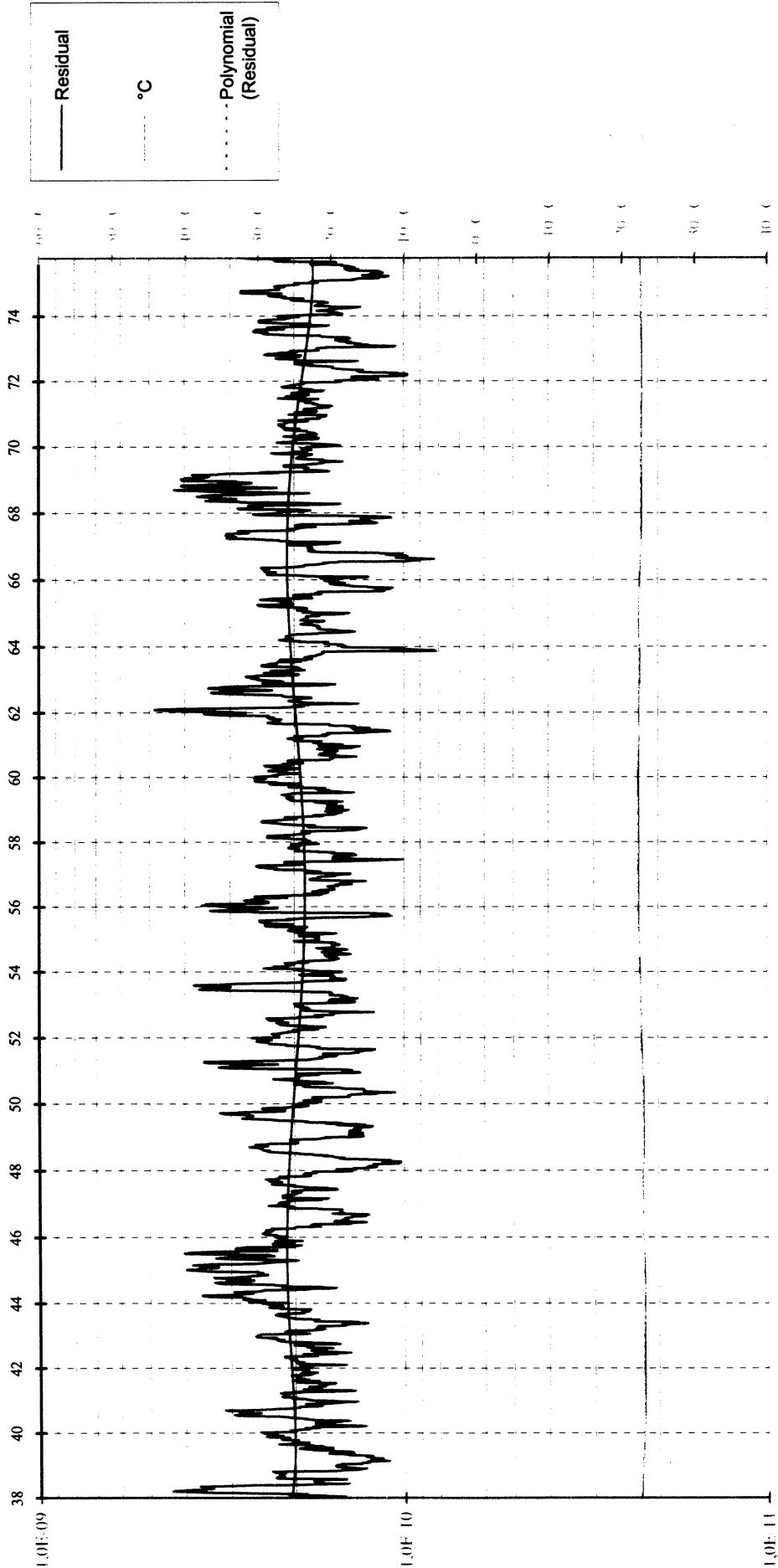


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Numero : 7001

Date : 30/06/2000
Time : 17:27:37

MEDIUM TERM STABILITY : RESIDUAL ($\leq 3,0E-9$)

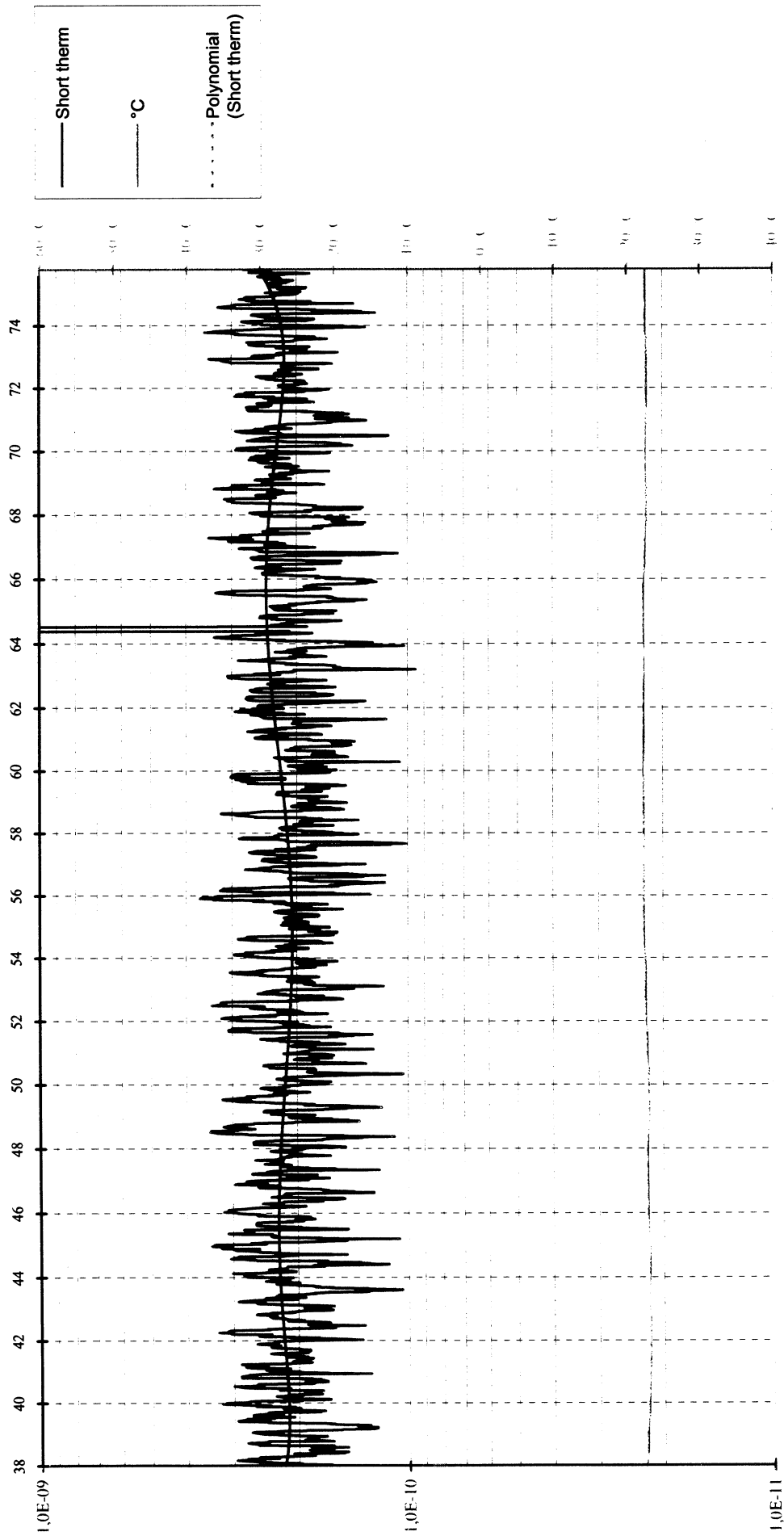


LIFE TEST AT -20 °C

Date : 30/06/2000
Time : 17:27:37

Manufacturer : JOTRON
Model : TRON 40GPS
Numero : 7001

SHORT TERM STABILITY /100 mS ($\leq 2,0E-9$)

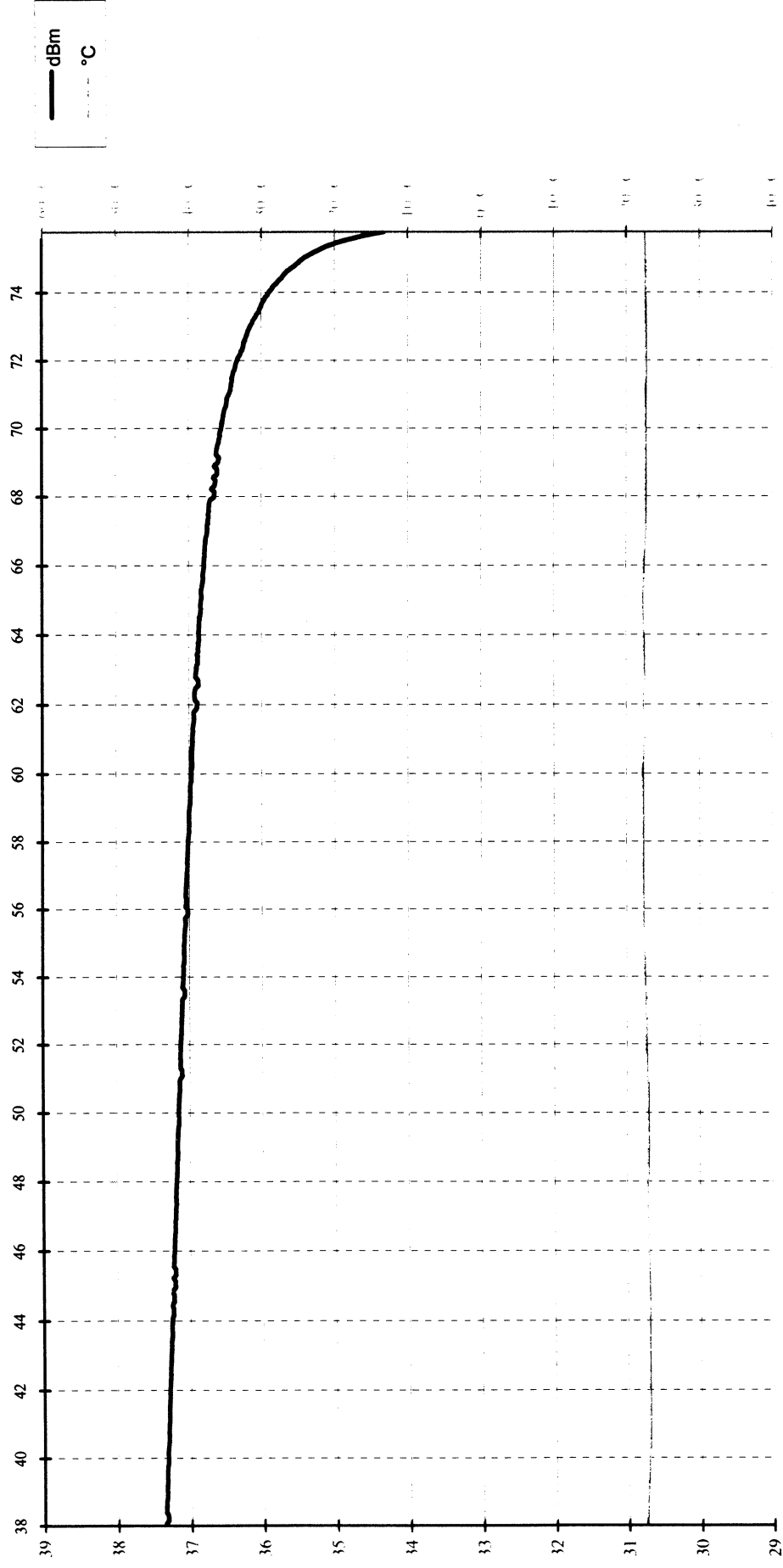


LIFE TEST AT -20 °C

Manufacturer : JOTRON
Model : TRON 40GPS
Numero : 7001

Date : 30/06/2000
Time : 17:27:37

OUTPUT POWER (35 to 39 dBm)



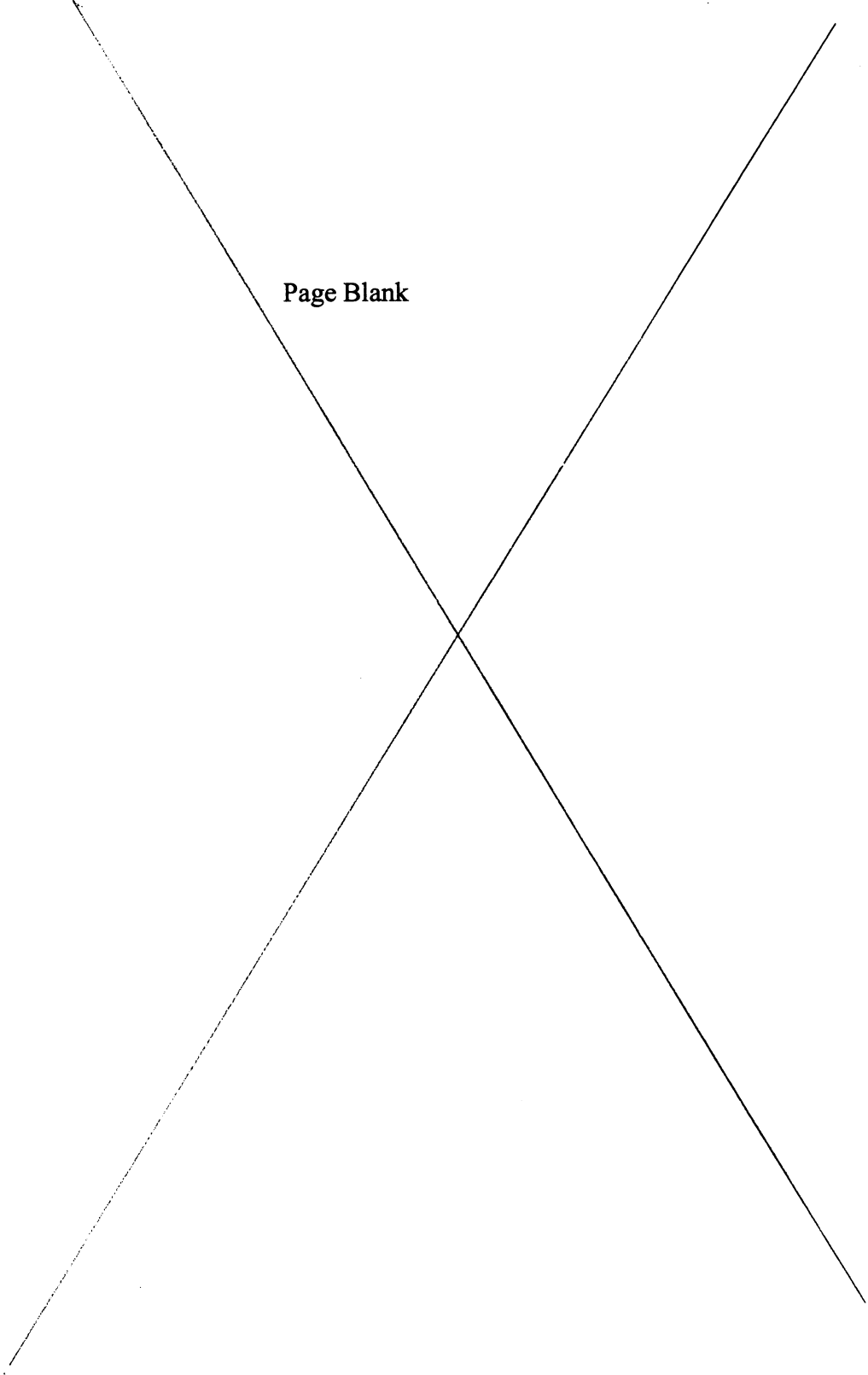
**TEMPERATURE GRADIENT TEST RESULT ON
TRON 40GPS JOTRON
N° 7001**

at -20° C, 22° C and 55° C

No	Δ Frequency (Hz)	Temp. (°C)	P406 (dBm)	P121.5 (dBm)
1	50119,77	-19,6	37,4	25,1
2	50120,12	-19,6	37,4	25,0
3	50120,59	-19,6	37,4	25,0
4	50120,77	-19,6	37,4	25,0
5	50121,22	-19,7	37,4	24,9
6	50121,40	-19,7	37,4	24,8
7	50121,73	-19,7	37,4	24,9
8	50122,20	-19,6	37,4	24,9
9	50122,63	-19,6	37,4	24,9
10	50122,79	-19,7	37,4	25,0
11	50123,40	-19,7	37,4	25,0
12	50123,73	-19,7	37,4	24,9
13	50124,07	-19,7	37,4	25,0
14	50124,22	-19,7	37,4	25,0
15	50124,77	-19,7	37,3	24,9
16	50125,10	-19,7	37,3	24,9
17	50125,58	-19,7	37,3	24,9
18	50125,82	-19,7	37,3	24,9

No	Temp.	Slope	Sigma	P406	Short term	P121.5
1	-19,7	1,1E-9	2,4E-10	37,4	2,1E-10	24,9
18	-19,8	7,6E-10	3,4E-10	37,3	3,0E-10	24,8
31	-19,9	4,7E-10	3,2E-10	37,2	2,3E-10	24,9
61	-19,9	5,3E-11	5,7E-10	36,9	1,9E-10	24,9
91	-19,9	5,9E-11	2,0E-10	36,7	9,6E-11	25,0
121	-19,9	-2,7E-11	2,0E-10	36,7	1,7E-10	25,0
151	-19,8	-5,9E-11	3,1E-10	36,7	2,5E-10	25,0
181	-18,4	-4,8E-11	1,6E-10	36,7	2,8E-10	25,0
211	-16,3	-1,9E-10	1,6E-10	36,7	2,6E-10	24,9
241	-14,2	-2,5E-10	2,2E-10	36,7	2,3E-10	24,9
271	-12,1	-3,2E-10	1,6E-10	36,8	1,8E-10	24,9
301	-10,0	-3,7E-10	1,3E-10	36,8	1,7E-10	24,9
331	-7,9	-3,6E-10	1,3E-10	36,9	1,8E-10	24,7
361	-5,8	-4,0E-10	2,6E-10	36,9	2,6E-10	24,6
391	-3,7	-3,8E-10	1,8E-10	37,0	2,5E-10	24,6
421	-1,6	-2,8E-10	1,7E-10	37,1	2,0E-10	24,6
451	0,5	-2,2E-10	1,3E-10	37,1	1,3E-10	24,4
481	2,6	-1,4E-10	2,0E-10	37,2	1,9E-10	24,4
511	4,7	-5,5E-11	1,9E-10	37,2	2,0E-10	24,4
541	6,8	-2,0E-11	2,3E-10	37,3	2,4E-10	24,3
571	8,9	2,1E-11	2,0E-10	37,3	1,9E-10	24,3
601	11,0	1,9E-11	1,9E-10	37,4	1,6E-10	24,1
631	13,1	-2,2E-11	1,8E-10	37,4	1,7E-10	24,0
661	15,2	-5,8E-11	1,5E-10	37,5	1,7E-10	24,0
691	17,3	-1,2E-10	1,8E-10	37,5	1,8E-10	23,9
721	19,4	-1,6E-10	1,7E-10	37,6	2,0E-10	23,9
751	21,5	-2,3E-10	1,3E-10	37,6	2,2E-10	23,9
781	23,6	-2,4E-10	1,8E-10	37,6	1,5E-10	23,8
811	25,6	-2,7E-10	2,1E-10	37,6	2,7E-10	23,6
841	27,7	-2,6E-10	1,4E-10	37,6	2,2E-10	23,5

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A large 'X' mark is drawn across the page, consisting of two intersecting diagonal lines. The lines are black and extend from the top-left and bottom-right corners towards the center, and from the top-right and bottom-left corners towards the center, meeting at a central point.

No	Temp.	Slope	Sigma	P406	Short term	P121.5
871	29,8	-2,1E-10	1,5E-10	37,6	2,1E-10	23,3
901	31,9	-2,1E-10	2,1E-10	37,6	3,0E-10	23,3
931	34,0	-2,4E-10	9,4E-11	37,6	1,8E-10	23,2
961	36,1	-2,7E-10	1,4E-10	37,5	1,3E-10	23,2
991	38,2	-3,0E-10	1,7E-10	37,5	1,7E-10	23,1
1021	40,3	-3,3E-10	2,2E-10	37,5	1,7E-10	22,9
1051	42,4	-3,1E-10	1,1E-10	37,5	2,0E-10	23,0
1081	44,5	-2,8E-10	1,3E-10	37,5	1,1E-10	22,7
1111	46,6	-2,6E-10	1,1E-10	37,5	1,5E-10	22,8
1141	48,7	-2,6E-10	1,9E-10	37,4	2,7E-10	22,7
1171	50,8	-2,9E-10	1,6E-10	37,4	1,5E-10	22,6
1201	52,9	-3,3E-10	1,5E-10	37,4	2,0E-10	22,5
1231	55,0	-3,2E-10	1,5E-10	37,4	1,8E-10	22,4
1261	55,6	-2,3E-10	1,5E-10	37,3	2,8E-10	22,3
1291	55,7	-8,2E-11	1,3E-10	37,3	1,7E-10	22,3
1321	55,8	-2,6E-11	1,8E-10	37,3	1,8E-10	22,2
1351	56,0	-1,0E-11	1,4E-10	37,3	1,9E-10	22,1
1381	55,9	-2,8E-11	1,4E-10	37,3	1,7E-10	22,1
1411	53,8	7,9E-11	1,7E-10	37,3	1,9E-10	22,2
1441	51,7	2,3E-10	1,7E-10	37,3	2,4E-10	22,2
1471	49,6	2,8E-10	1,5E-10	37,4	1,3E-10	22,4
1501	47,5	3,5E-10	1,9E-10	37,4	1,9E-10	22,5
1531	45,4	3,7E-10	1,1E-10	37,4	1,8E-10	22,6
1561	43,3	3,2E-10	1,7E-10	37,4	1,7E-10	22,7
1591	41,2	3,1E-10	1,6E-10	37,4	1,9E-10	22,8
1621	39,0	3,1E-10	9,9E-11	37,5	1,5E-10	22,8
1651	36,9	3,0E-10	1,5E-10	37,5	1,7E-10	23,0
1681	34,8	3,3E-10	1,0E-10	37,5	1,9E-10	23,1
1711	32,7	3,3E-10	1,3E-10	37,6	2,0E-10	23,2
1741	30,6	3,3E-10	9,6E-11	37,6	1,2E-10	23,3
1771	28,5	2,9E-10	1,4E-10	37,6	2,2E-10	23,4
1801	26,4	2,5E-10	1,1E-10	37,6	1,9E-10	23,3
1831	24,3	2,5E-10	1,5E-10	37,6	1,5E-10	23,5
1861	22,2	2,8E-10	1,3E-10	37,6	2,6E-10	23,6
1891	20,0	2,5E-10	2,9E-10	37,6	1,8E-10	23,7
1921	17,9	3,4E-10	1,7E-10	37,6	1,9E-10	23,7
1951	15,8	2,5E-10	1,7E-10	37,6	2,5E-10	23,9
1981	13,7	2,2E-10	1,8E-10	37,6	2,5E-10	23,9
2011	11,6	1,7E-10	8,7E-11	37,6	1,1E-10	24,1
2041	9,5	1,2E-10	1,5E-10	37,5	1,5E-10	24,1
2071	7,4	8,4E-11	1,3E-10	37,5	1,9E-10	24,1
2101	5,3	4,6E-11	1,3E-10	37,4	2,0E-10	24,1
2131	3,2	3,4E-11	1,6E-10	37,4	2,4E-10	24,3
2161	1,0	1,5E-11	1,3E-10	37,3	1,4E-10	24,4
2191	-1,1	3,4E-11	9,6E-11	37,3	2,4E-10	24,5
2221	-3,2	7,9E-11	1,6E-10	37,2	2,2E-10	24,5
2251	-5,3	1,5E-10	1,2E-10	37,2	1,3E-10	24,6
2281	-7,4	2,6E-10	1,2E-10	37,1	1,2E-10	24,5
2311	-9,5	3,2E-10	2,3E-10	37,0	2,6E-10	24,5
2341	-11,6	3,6E-10	2,3E-10	37,0	3,0E-10	24,8
2371	-13,7	4,1E-10	2,0E-10	36,9	2,3E-10	24,8