CHAPTER 3

VIBRATION TEST

5.1 ADMINISTRATIVE INFORMATION

3.1.1 CLIENT
ACR Electronics Inc.

3.1.2. REPRESENTATIVES PRESENT
For the Client : C. HAVENS ACR & G. PEYROU ITS/EQ
For the Test Laboratory : J. M. BUCHMAN

3.1.3. DATES
Start of test : 25 June 2004
End of test : 28 June 2004

3.1.4. INTESPACE FILE REFERENCE : E5503-RTCM

3.2. UNIT UNDER TEST (UUT)

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

3.3. PURPOSE OF THE TEST

Functional checkout of hardware after vibration testing.

3.4. TEST EQUIPMENT

3.4.1. TEST DEVICES
Electrodynamic vibration table, type 27 with GR3
Spectral Dynamics SD2225 digital control panel

3.4.2. METROLOGICAL EQUIPMENT
Vibration Control : accelerometer (analysis and processing)
Vibration Measurements : Spectral Dynamics SD2225
Electrical Beacon Checking : Argos - Cospas/Sarsat Test Bench.

3.5. TEST PROCEDURE

3.5.1. AXIS (See photograph in § 3.7)
X-axis : parallel to the Beacon fixing plane and Beacon « widthways »
Y-axis : perpendicular to the Beacon fixing plane
Z-axis : parallel to the Beacon fixing plane and Beacon « lengthways »

3.5.2. MOUNTING

The beacon in its bracket is secured to a light-alloy supporting square.
The complete assembly is firmly attached to the moving part of the vibration table according to the required axis.

3.5.3. TEST SPECIFICATIONS AND SEQUENCE

Vibrations following Section A3.0 of RTCM Recommended Standards for 406 MHz Satellite PLBs (Version 1.1 Feb 4, 2003)

Sinewave vibrations on three axis :

Frequency (Hz)	**Peak to Peak Amplitude (mm)**
4-10	5
10-15	1.6
15-25	0.8
25-33	0.4

Sweep rate : 1.2 oct/min

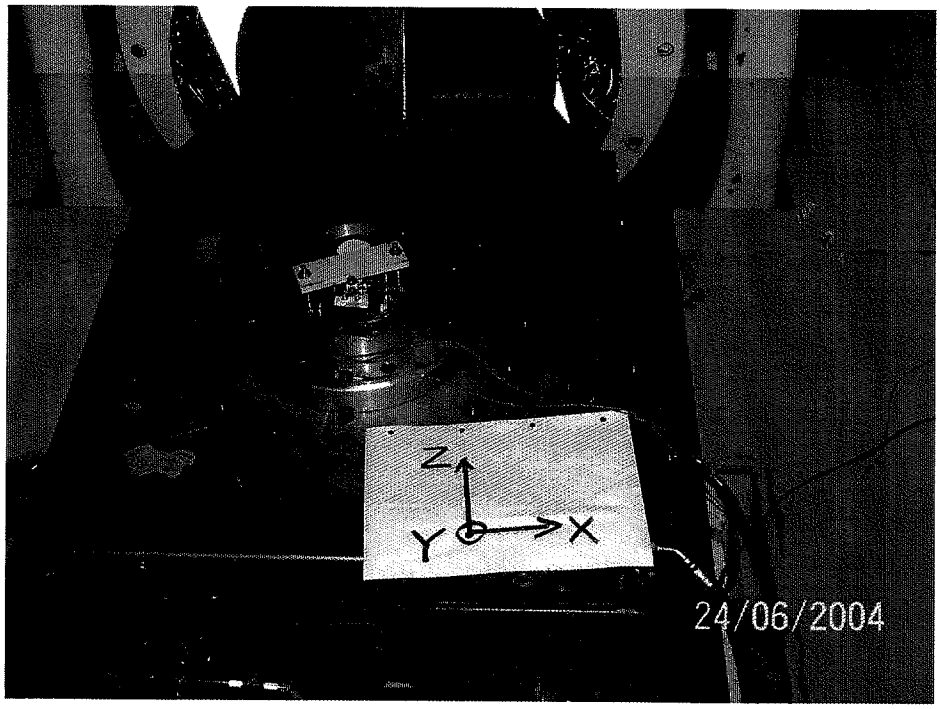
Duration : 30 minutes on each axis

Beacon contol : Visual inspection and Aliveness test after the Vibrations Tests

3.6 LIST OF SERVO AND CONTROL SENSORS

Sensor	Location	N° acc.	Cable	Sensivity pC/g
P (servo)	Screwed on test holder sheet	CP91	BU03	9.24
1X (control)	Glued on the Beacon	12889	BU13	2.97
1Y (control)	Glued on the Beacon	5368	Rge	6.44
1Z (control)	Glued on the Beacon	2574	BU11	6.435

3.7. PHOTOGRAPH



5.8. TEST SCHEDULE

Date / Test n°	Specifications	Paragraph	Events - Observations	
			Test equipment	Unit under test
June 25th, 2004 **001Y**	Sinewave vibrations : Y axis 5 mm p-p from 4 to 10 Hz 1.6 mm p-p from 10 to 15 Hz 0.8 mm p-p from 15 to 25 Hz 0.4 mm p-p from 25 to 33 Hz Sweep duration : 2 min 30 s Total test duration : 30 min	3.9.1	Nominal.	Set up the beacon on test table on Yaxis. Functional testing : nominal.
June 28th, 2004 **003X**	Sinewave vibrations : X axis 5 mm p-p from 4 to 10 Hz 1.6 mm p-p from 10 to 15 Hz 0.8 mm p-p from 15 to 25 Hz 0.4 mm p-p from 25 to 33 Hz Sweep duration : 2 min 30 s Total test duration : 30 min	3.9.2	Nominal	Set up the beacon on test table on X axis Functional testing : nominal.

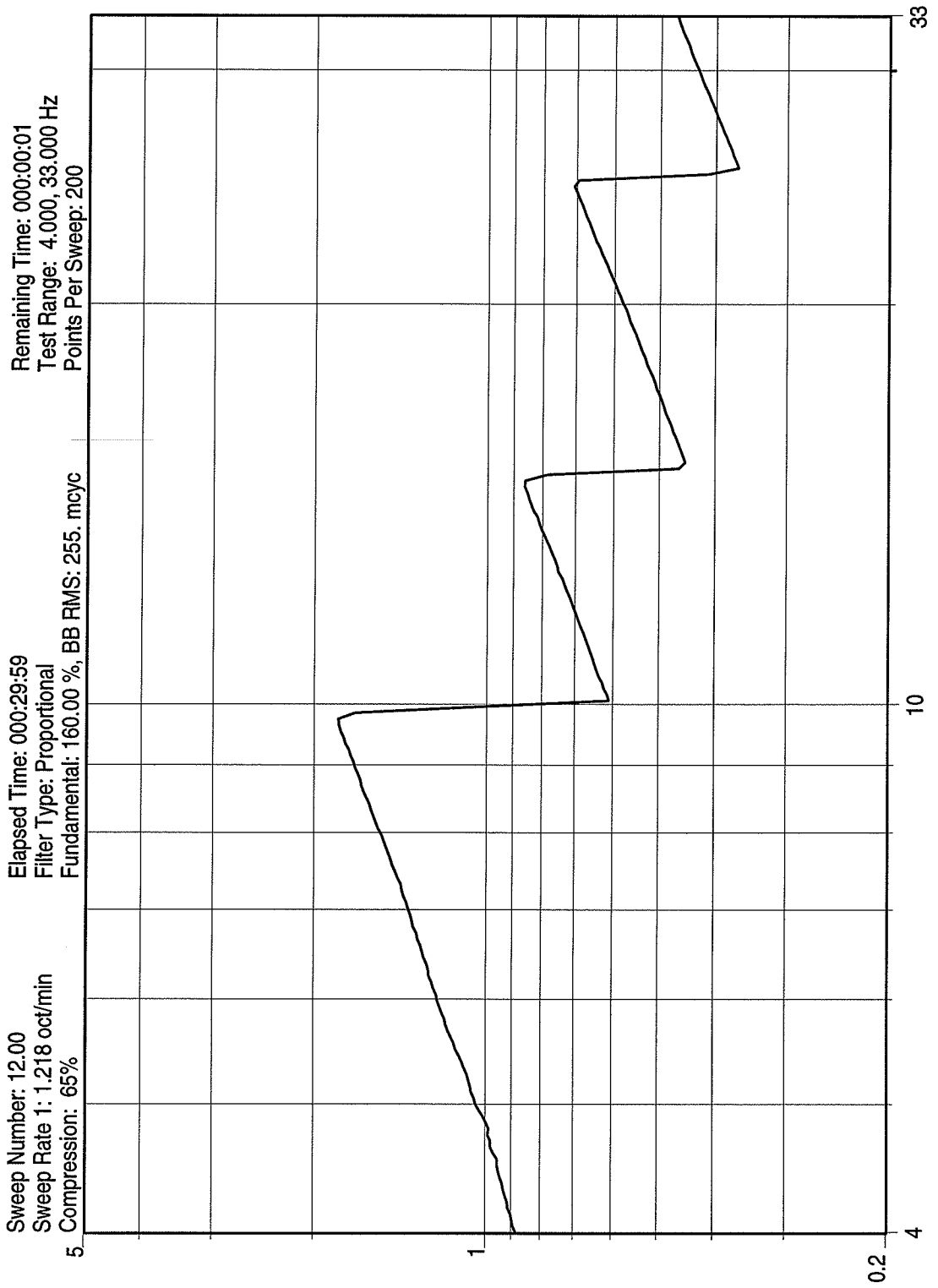
Date / Test n°	Specifications	Paragraph	Events - Observations	
			Test equipment	Unit under test
June 28th, 2004 **004Z**	Sinewave vibrations : Z axis 5 mm p-p from 4 to 10 Hz 1.6 mm p-p from 10 to 15 Hz 0.8 mm p-p from 15 to 25 Hz 0.4 mm p-p from 25 to 33 Hz Sweep duration : 2 min 30 s Total test duration : 30 min	3.9.3	Nominal	Set up the beacon on test table on Z axis Functional testing : nominal Removal of beacon
Visual inspection		3.9.4.1		Nothing abnormal to note
PLB Aliveness Test		3.9.4.2	Cospas Sarsat Test Bench	Nominal

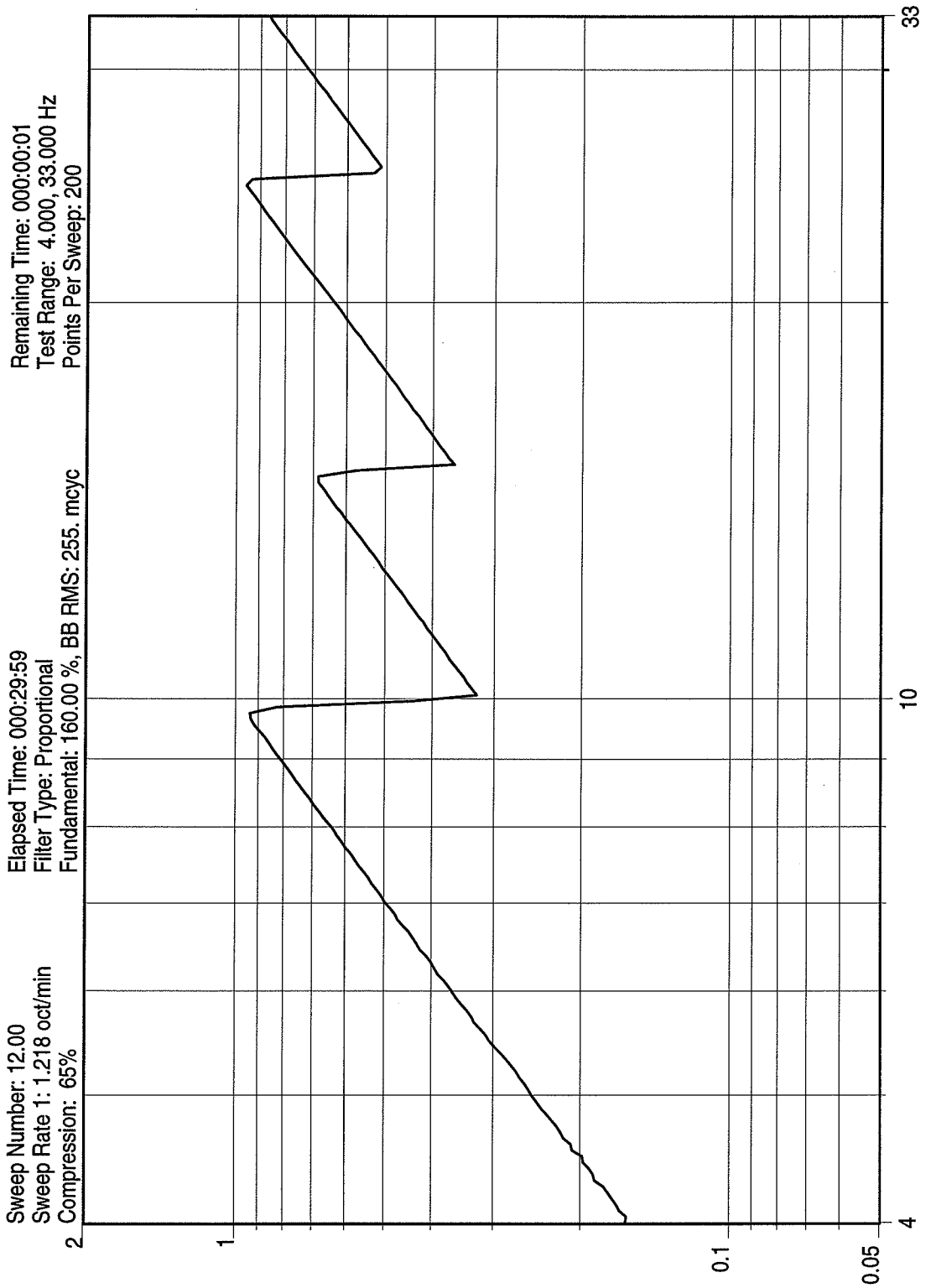
3.9. TEST RESULTS

3.9.1. RESULTS OF Y VIBRATION AXIS

sine message log
1.00000

%Test: RTCM.001
%Log: /user/client/e5503/sine/log/RTCM.001.log
06/24/04
18:01:12 Nulling Internal Offsets.
18:01:49 Nulling Completed.
18:01:50 Loop Check Started...
18:01:50 Measuring Ambient Noise...
18:01:59 Searching for Threshold...
18:02:05 Loop Check Completed.
18:02:07 Increasing to Test Level...
18:02:10 Minimum Drive Reached.
18:03:23 Start Level Reached.
18:03:23 Test Starts at 4.000 Hz
18:05:53 Saved Sweep Number 1.00
18:08:23 Saved Sweep Number 2.00
18:10:53 Saved Sweep Number 3.00
18:13:23 Saved Sweep Number 4.00
18:15:53 Saved Sweep Number 5.00
18:18:23 Saved Sweep Number 6.00
18:20:53 Saved Sweep Number 7.00
18:23:23 Saved Sweep Number 8.00
18:25:52 Saved Sweep Number 9.00
18:28:23 Saved Sweep Number 10.00
18:30:52 Saved Sweep Number 11.00
18:33:23 Shutdown Initiated...
18:33:27 Saved Sweep Number 12.00

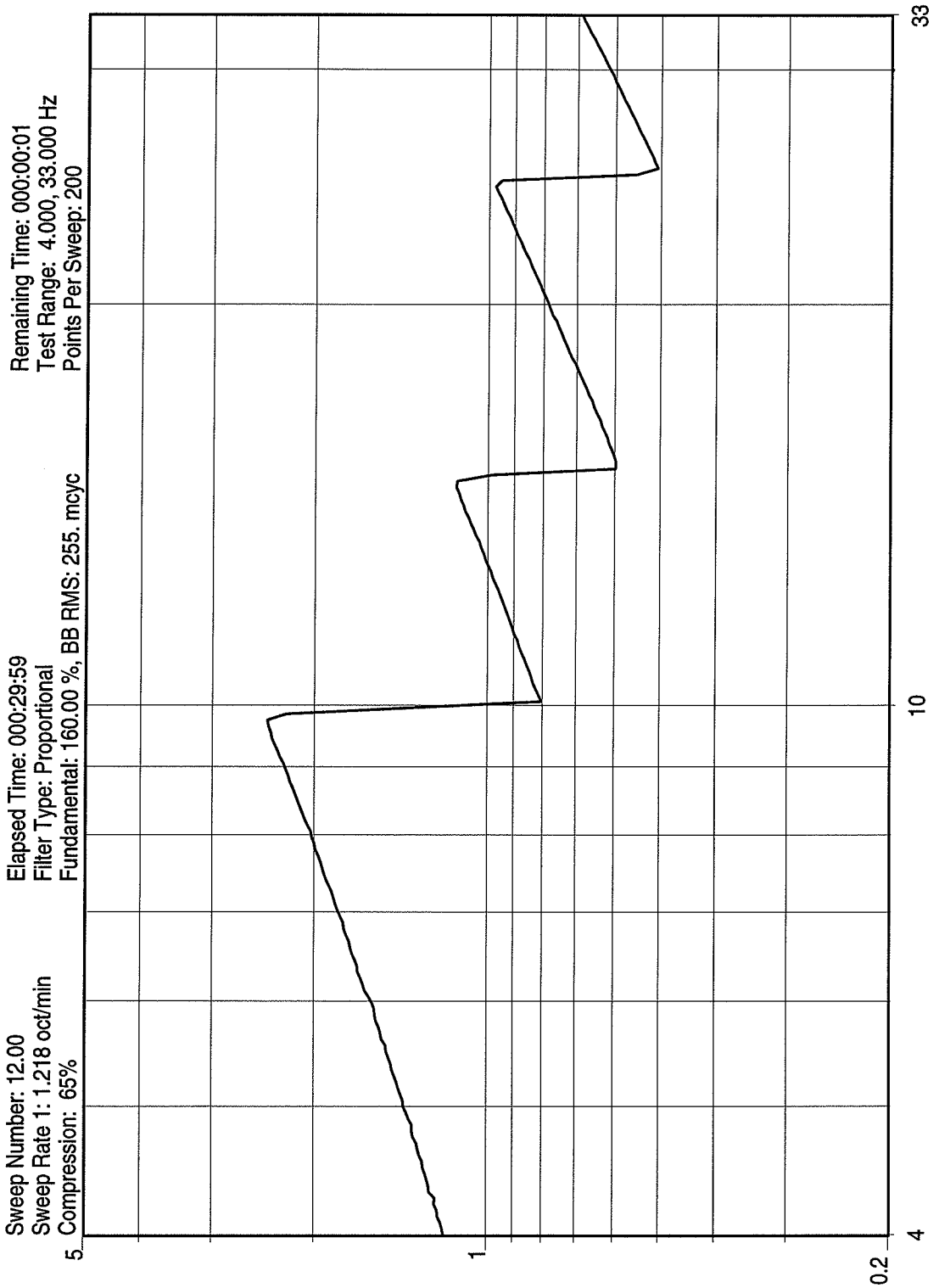

Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
5
1
0.2
4
10
33
Log
Frequency (Hz)
Drive
Log
V (0-pk)
RTCM VIBRATION TEST _ RTCM_Axe Y
E5503 - Beacon ACR PLB 200/201 S/N : 07
Sine Data Review Name: RTCM.001
18:33:27
Thu Jun 24 2004

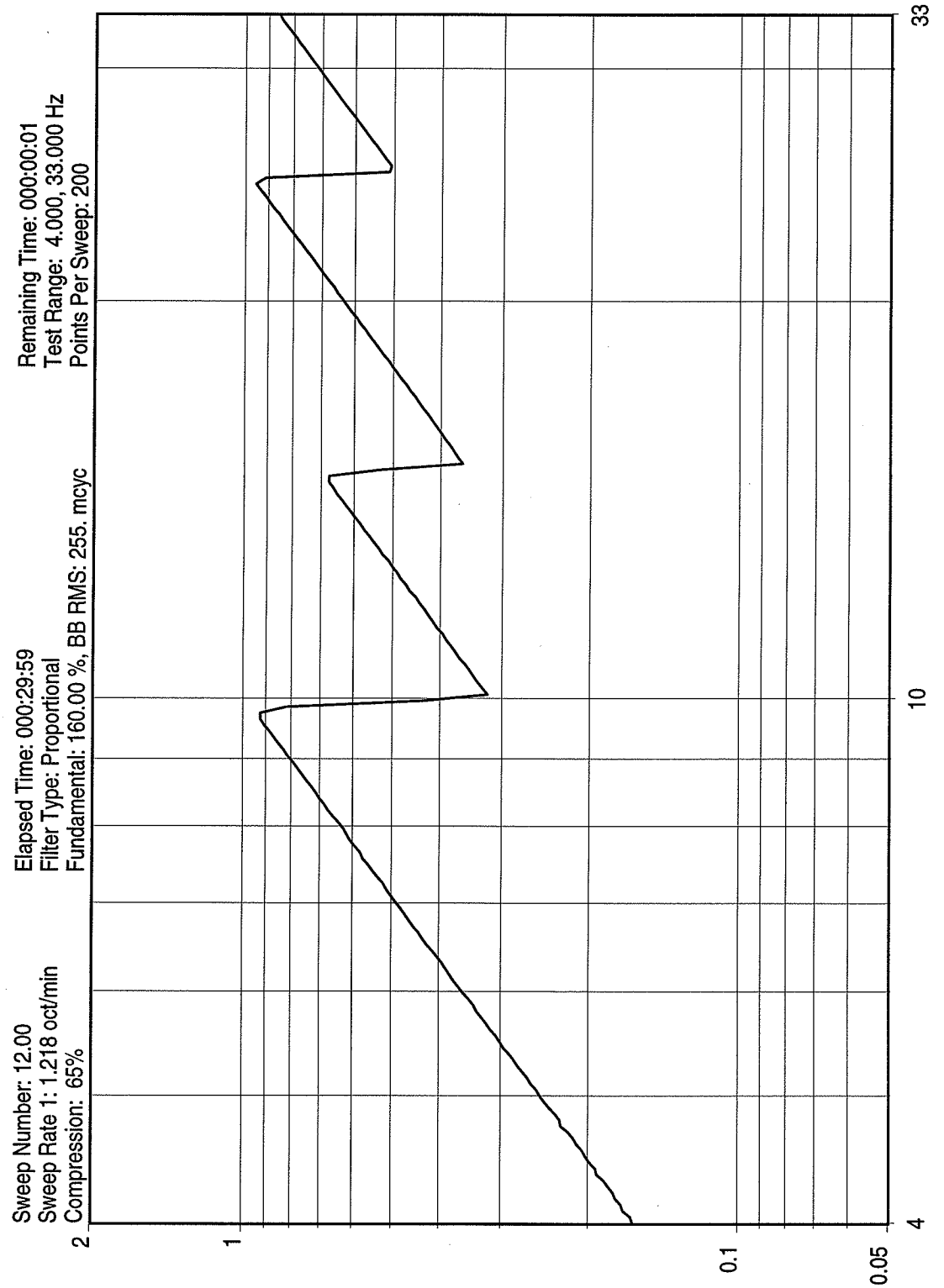

Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
Auxiliary
Fundamental
3
2
1
0.1
0.05
Log
Acceleration
g (0-pk)
4
10
33
Log
Frequency (Hz)
1Y SENSOR
RTCM VIBRATION TEST _ RTCM_Axe Y
E5503 - Beacon ACR PLB 200/201 S/N : 07
Sine Data Review Name: RTCM.001
18:33:27
Thu Jun 24 2004

3.9.2. RESULTS OF X VIBRATION AXIS

Site message log
1.00000

```
%Test: RTCM.003
%Log: /user/client/e5503/sine/log/RTCM.003.log
06/28/04
09:37:34 Loop Check Started...
09:37:34 Measuring Ambient Noise...
09:38:01 Searching for Threshold...
09:38:06 Loop Check Completed.
09:40:10 Increasing to Test Level...
09:40:54 Start Level Reached.
09:40:54 Test Starts at 4.000 Hz
09:43:24 Saved Sweep Number 1.00
09:45:54 Saved Sweep Number 2.00
09:48:24 Saved Sweep Number 3.00
09:50:54 Saved Sweep Number 4.00
09:53:24 Saved Sweep Number 5.00
09:55:54 Saved Sweep Number 6.00
09:58:24 Saved Sweep Number 7.00
10:00:54 Saved Sweep Number 8.00
10:03:24 Saved Sweep Number 9.00
10:05:54 Saved Sweep Number 10.00
10:08:24 Saved Sweep Number 11.00
10:10:54 Shutdown Initiated...
10:10:59 Saved Sweep Number 12.00
```

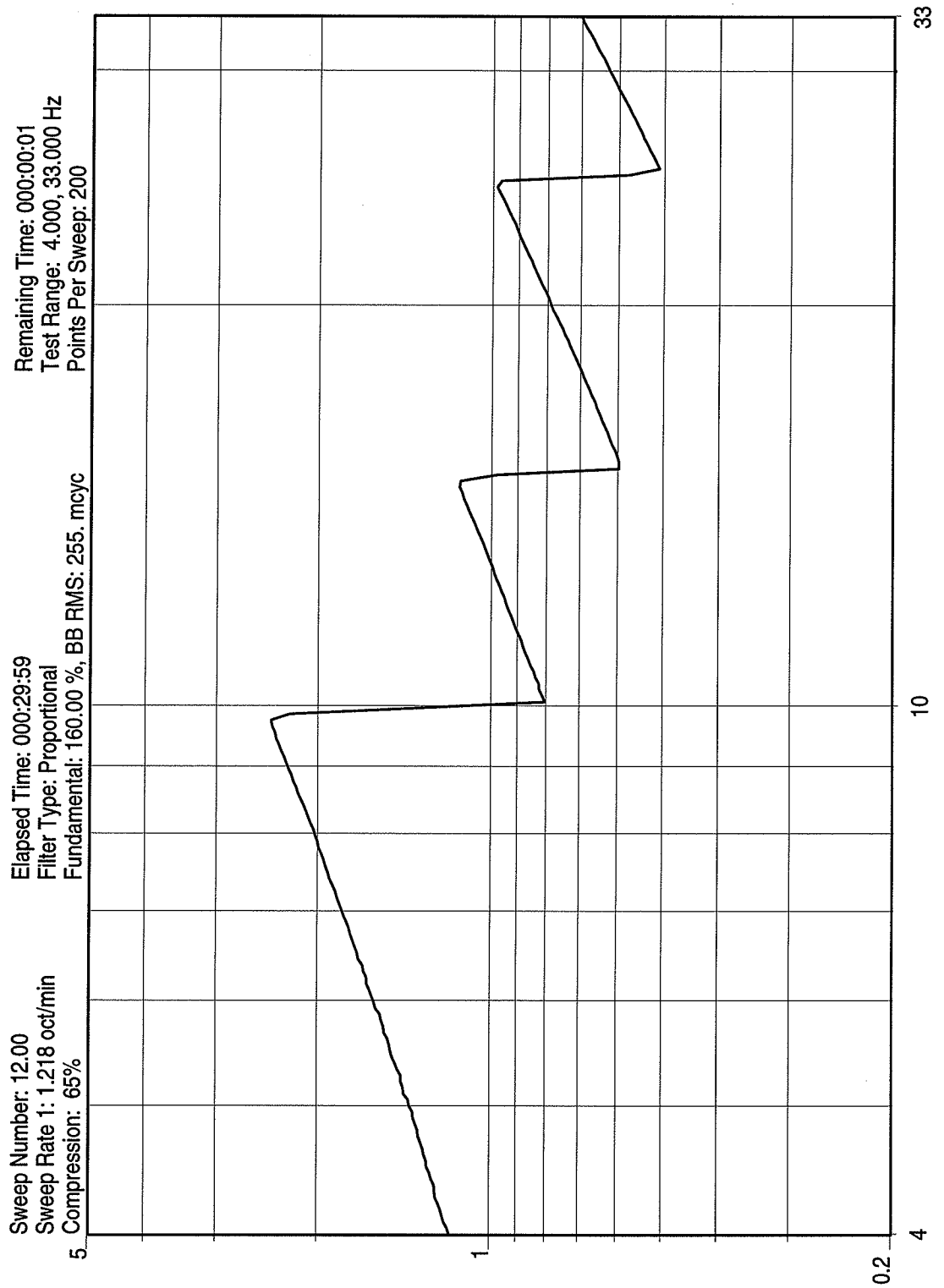

Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
5
1
0.2
4
10
33
Log
Frequency (Hz)
Drive
Log
V (0-pk)
RTCM VIBRATION TEST _ RTCM_Axe X
E5503 - Beacon ACR PLB 200/201 S/N : 07
Sine Test Name: RTCM.003
10:19:38
28-Jun-2004

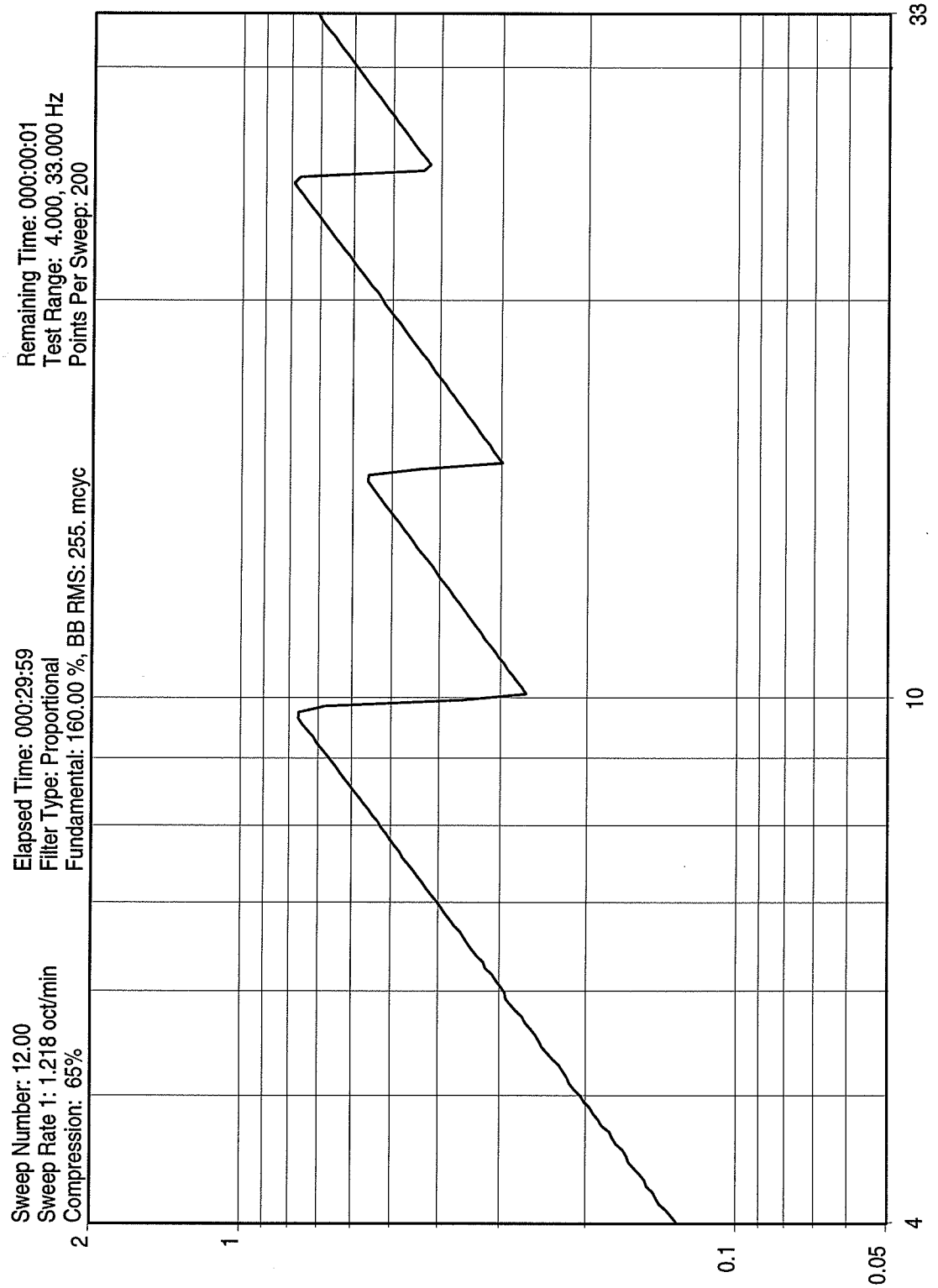

Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
Auxiliary
Fundamental
Log
Acceleration
g (0-pk)
2
1
0.1
0.05
Log
4
10
33
Frequency (Hz)
1X SENSOR
RTCM VIBRATION TEST _ RTCM_Axe X
1X SENSOR
Sine Test Name: RTCM.003
10:19:42
28-Jun-2004

3.9.3. RESULTS OF Z VIBRATION AXIS

```
1.00000

%Test: RTCM.004Z
%Log: /user/client/e5503/sine/log/RTCM.004.log
06/28/04
16:09:05 Nulling Internal Offsets.
16:09:10 Nulling Completed.
16:09:11 Loop Check Started...
16:09:11 Measuring Ambient Noise...
16:09:22 Searching for Threshold...
16:09:28 Loop Check Completed.
16:09:38 Increasing to Test Level...
16:10:18 Start Level Reached.
16:10:18 Test Starts at 4.000 Hz
16:12:48 Saved Sweep Number 1.00
16:15:18 Saved Sweep Number 2.00
16:17:48 Saved Sweep Number 3.00
16:20:18 Saved Sweep Number 4.00
16:22:48 Saved Sweep Number 5.00
16:25:18 Saved Sweep Number 6.00
16:27:48 Saved Sweep Number 7.00
16:30:18 Saved Sweep Number 8.00
16:32:48 Saved Sweep Number 9.00
16:35:18 Saved Sweep Number 10.00
16:37:48 Saved Sweep Number 11.00
16:40:18 Shutdown Initiated...
16:40:23 Saved Sweep Number 12.00
```


Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
5
1
0.2
4
10
33
Log
Frequency (Hz)
Drive
Log
Voltage
V (0-pk)
RTCM VIBRATION TEST _ RTCM_Axe Z
E5503 - Beacon ACR PLB 200/201 S/N : 07
Sine Test Name: RTCM.004
16:40:21
28-Jun-2004


Sweep Number: 12.00
Sweep Rate 1: 1.218 oct/min
Compression: 65%
Elapsed Time: 000:29:59
Filter Type: Proportional
Fundamental: 160.00 %, BB RMS: 255. mcyc
Remaining Time: 000:00:01
Test Range: 4.000, 33.000 Hz
Points Per Sweep: 200
Auxiliary
Fundamental
Log
Acceleration
g (0-pk)
4
2
1
0.1
0.05
4
10
33
Log
Frequency (Hz)
1Z SENSOR
RTCM VIBRATION TEST _ RTCM_Axe Z
E5503 - Beacon ACR PLB 200/201 S/N : 07
Sine Test Name: RTCM.004
16:40:21
28-Jun-2004

3.9.4. BEACON CHECKOUT

Test using a portable test bench and visual inspection confirmed that the beacon does not activate in an untimely manner during vibration testing.

3.9.5. FINAL CONTROL

3.9.5.1.External mechanical inspection.

A visual inspection was done on all external mechanical parts.

Result : nominal.

3.9.5.2.Aliveness test results

Result : nominal.

Data and graphs are reported next page

VIBRATION ALIVENESS TEST RESULTS

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

Date : June 29th, 2004

406 MHz Measurements

1 - Environmental Temperature (° C)			+ 22° C
2 - POWER OUTPUT			
- Transmission power	dBm	37 ± 2	37.17
- Power risetime	ms	< 5	-
- Power falltime	ms	< 5	-
3 - SPURIOUS OUTPUT *			
- In band - Carrier harmonics			OK
4 -DIGITAL MESSAGE GENERATOR *			
- Repetition rate			-
- Bit rate	bits/S	400 ± 4	398.35
- Transmission time	ms	440 ± 4.4 / 520 ± 5.2	522.43
- CW preamble	ms	160 ± 1.6	160.70
5 – DIGITAL MESSAGE *			
- Bit and frame sync	bits	1-24	FFFE2F
- Format flag	bit	25	1
- Protocol flag	bit	26	0
- Country code	bits	27-36	0366
- Protocol	bits	37-40	1110
- Encoded Position Data Source	bits	111	1
- Homing	bits	112	1
- BCH 1 code read / calculated	bits	86-106 / 25-85	00B717 / 00B717
- BCH 2 code read / calculated	bits	133-144 / 107-132	9E3 / 9E3
6 - FREQUENCY	KHz	406 025 ± 2 or	
- Nominal value		406 028 ± 1	406 027.875
- Short term stability		$< 210^{-9}$/100 ms	3.5×10^{-10}

* See data and graphs next pages

Laboratoire de certification — After Vibrations and Bumps tests
Controle balise ARGOS/SARSAT

Constructeur	ACR
Modele	PLB 200
Numero de serie	7
Reference	E5503-07
Type	SARSAT
Date de l'essai	29 JUN 2004 17:13:43
Temperature	22.2 °C

Message balise

Message recu	(1-144):	FFFE2F96EE3240072B80302DC5F78E0159E3
Format flag	(25):	1
Protocole flag	(26):	0
Code pays	(27-36):	0366
Pays	:	USA
Code protocole	(37-40):	1110
Protocole utilise	:	Standard - Test
Identification	:	
Numero	:	
BCH 1 lu/calcule	(86-106/25-85):	00B717/00B717
BCH 2 lu/calcule	(133-144/107-132):	9E3/9E3
Pos. Data Source	(111):	Internal
121.5 MHz Homing	(112):	Yes
Position GPS de reference lab	:	N 43°33'34'' E 1°28'48
Position GPS	:	Yes
Position GPS par defaut	:	No
Latitude position	:	43.5°3'32'' Nord
Longitude position	:	.5°58'40'' Est
Delta position	:	.254984532731 km

Controle message

Duree de la porteuse pure	160.70ms +- 0.00
Duree de l'emission	522.43 ms
Frequence de modulation	398.35Hz +- 0.00

Stabilite de frequence

Frequence moyenne F2		406027874.84 Hz
STGMA2	F2-F1	3.901E-10
SIGMA3	F3-F2	3.535E-10

Mesures d'indice

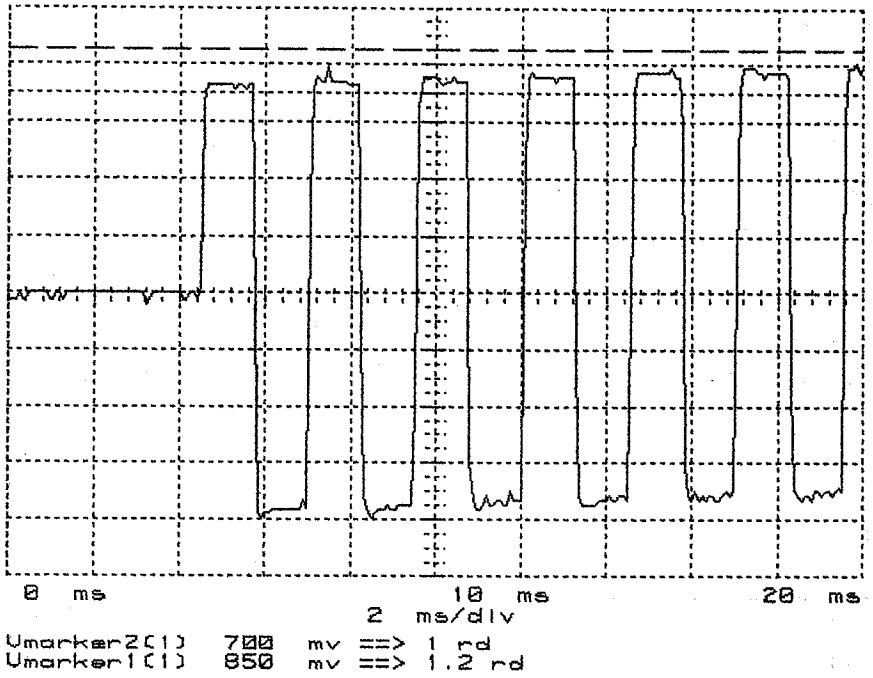
F	F1	G1
49875.35	250	61
49875.23	250	61

Excursion de phase totale	rd	<= 2.48		2.20
Excursion de phase positive	rd	0.96<	<1.24	1.09
Excursion de phase negative	rd	-1.24<	<-0.96	-1.11
Symetrie de l'excursion	%	<= 5		.88

Mesures de puissance

Puissance	dBm	37.17

Oscillo



Spectre de frequence