

TEST REPORT
FCC Part 24, Subpart E

Spectrian

Power Amplifier
Model No.: Oriole

FCC ID: I20-ORIOLE1

Report # J98026572

Date of Report: September 30, 1998

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FCC Part 24

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

Table of Contents

1.0	Introduction	
1.1	Test Summary	1
1.2	Product Description	2
2.0	RF Power Output	3
2.1	Test Procedure	3
2.2	Test Equipment	3
2.3	Test Results	3
3.0	Radiated Power	4
3.1	Test Procedure	4
	3.2 Test Equipment	4
3.3	Test Results	4
4.0	Occupied Bandwidth, Emission limits	5
4.1	Test Procedure	5
4.2	Test Equipment	5
4.3	Test Results	5
5.0	Out-of-Band Emissions at Antenna Terminals	6
5.1	Test Procedure	6
5.2	Test Equipment	6
5.3	Test Results	6
6.0	Field Strength of Spurious Radiation	8
6.1	Test Procedure	8
6.2	Test Equipment	8
6.3	Test Configuration Setup - Radiated Emissions	9
6.4	Test Results	10
7.0	Line Conducted Emissions	14
7.1	Test Procedure	14
7.2	Test Configuration Setup - Line Conducted Emissions	15
7.3	Test Results	16
8.0	Frequency Stability vs Temperature	17
8.1	Test Procedure	17
8.2	Test Equipment	17
8.3	Test Results	17
9.1	Test Procedure	18
9.2	Test Equipment	18
9.3	Test Results	18

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

1.0 Introduction

1.1 Test Summary

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
2.985	RF Power Output	Pass	3
24.232(a)	Radiated Power	Pass	4
2.989(h), 24.238	Occupied Bandwidth, Emission limits	Pass	5
2.991	Spurious emissions at antenna terminals	Pass	7
2.993, 15.109	Field Strength of Spurious Radiation	Pass	12
15.107	Line Conducted Emissions	N/A	-
2.995(a), 24.235	Frequency Stability vs. Temperature	N/A	-
2.995(d)(1), 24.235	Frequency Stability vs. Voltage	N/A	-

David Chernomordik

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9/5/98
Date

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

1.2 Product Description

The EUT is a Model: Oriole, CDMA Power Amplifier, 1930 MHz - 1990 MHz frequency range,. manufactured by Spectrian.

For more details, refer to the users manual.

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Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

2.0 RF Power Output, FCC §2.985(a)

2.1 Test Procedure

The amplifier's output was connected to a power meter and spectrum analyzer through a calibrated coaxial attenuator and directional coupler. The CDMA test signal was applied to the amplifier's input from a signal generator, and the input level was adjusted to obtain 42.5 dBm average output power.

2.2 Test Equipment

Hewlett Packard 8482A Power Sensor, 438A Power Meter
Hewlett Packard 8594E Spectrum Analyzer, 9 kHz - 2.9 GHz
Tektronix AWG2021 Arbitrary Waveform Generator
Hewlett Packard E4432B Signal Generator, 250 kHz-3 GHz

2.3 Test Results

The average output power is 42.5 dBm (or 17.8 W), measured with a power meter.

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Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

3.0 Radiated Power, FCC §24.232 (a)

Requirement: The Equivalent Isotropically Radiated Power (EIRP) shall not exceed 1640 Watts.

3.1 Test Procedure

The EMCO 3115 Double Ridged Horn Antenna was connected to the amplifier's output. The EUT was positioned on a non-conductive turntable in an anechoic chamber.

The radiated emission at the fundamental frequency was measured at 3 m distance with a test antenna and spectrum analyzer. The maximum emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading was recorded.

The EIRP was calculated as follows:

$$\text{EIRP}_{(\text{dBm})} = E_{(\text{dBuV/m})} + 20 \log D - 10 \log 30 - 10 \log G - 90$$

where D = 3m, distance

G = 5.9, gain of the horn antenna.

3.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz

EMCO 3115 Double-Ridged Horn antenna, 1-18 GHz

3.3 Test Results

Refer to the table below.

Frequency MHz	Spectrum Analyzer Reading dB(uV)	Antenna Factor dB(1/m)	Cable loss dB	Field Strength dB(uV/m)	EIRP dBm
1931	114.7	29.1	1.5	145.3	42.4
1960	115.0	29.1	1.5	145.6	42.7
1989	115.2	29.1	1.5	145.8	42.9

Judgement: Passed

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Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

4.0 Occupied Bandwidth, Emission limits. FCC §2.989(h), §24.238.

Requirements:

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10\log(P)$, dB

4.1 Test Procedure

The RF output of the EUT was connected to the input of the spectrum analyzer through sufficient attenuation.

The spectrum with no modulation was plotted. The EUT was set up to transmit a CDMA signal and the spectrum with modulation was plotted. The measurements were made for lowest frequency (F=1931 MHz) and for highest frequency (F=1989 MHz).

4.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
HP 7470A Plotter

4.3 Test Results

For test results, refer to the attached plots 4.3.a.- 4.3.d shown emission on the amplifier's output.

PLOT NUMBER	DESCRIPTION
4.3.a	F=1931 MHz, Resolution bandwidth 30 kHz
4.3.b	F=1931 MHz, Resolution bandwidth 10 kHz
4.3.c	F=1989 MHz, Resolution bandwidth 30 kHz
4.3.d	F=1989 MHz, Resolution bandwidth 10 kHz

Note:

The plots with 30 kHz spectrum analyzer resolution bandwidth show marginal compliance with the Requirements (the emissions on the band edge shall not exceed -13 dBm). According to the FCC §24.238, these measurements may be made with 1% of the 26 dB emission bandwidth, which is approximately 1.4 MHz.(e.g. 14 kHz). As can be seen from the plots 4.3.b and 4.3.d, with resolution bandwidth 10 kHz, the emissions on the band edges are well below the limit.

The EUT passed the test.

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Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

5.0 Out-of-Band Emissions at Antenna Terminals , FCC §2.991

Requirements:

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least $43 + 10\log(P)$, dB

5.1 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The CDMA test signal was set up. Sufficient scans were made to show the out-of-band emissions if any up to 10th harmonic for 3 frequencies: 1931 MHz, 1960 MHz, 1989 MHz.

5.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
HP 7470A Plotter

5.3 Test Results

Refer to the attached plots: 5.3.a - 5.3.o.

The EUT passed the test.

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Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

Plots of Out-of Band-Emissions at antenna terminal.

PLOT NUMBER	DESCRIPTION
5.3.a	F=1931 MHz, scan 1MHz - 30 MHz
5.3.b	F=1931 MHz, scan 30 MHz - 1 GHz
5.3.c	F=1931 MHz, scan 1 GHz - 2.5 GHz
5.3.d	F=1931 MHz, scan 2.5 GHz - 10 GHz
5.3.e	F=1931 MHz, scan 10 GHz - 20 GHz
5.3.f	F=1960 MHz, scan 1MHz - 30 MHz
5.3.g	F=1960 MHz, scan 30 MHz - 1 GHz
5.3.h	F=1960 MHz, scan 1 GHz - 2.5 GHz
5.3.i	F=1960 MHz, scan 2.5 GHz - 10 GHz
5.3.j	F=1960 MHz, scan 10 GHz - 20 GHz
5.3.k	F=1989 MHz, scan 1MHz - 30 MHz
5.3.l	F=1989 MHz, scan 30 MHz - 1 GHz
5.3.m	F=1989 MHz, scan 1 GHz - 2.5 GHz
5.3.n	F=1989 MHz, scan 2.5 GHz - 10 GHz
5.3.o	F=1989 MHz, scan 10 GHz - 20 GHz

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

6.0 Field Strength of Spurious Radiation, FCC § 2.993, §15.109

6.1 Test Procedure

A 50 Ohm coaxial load was connected to the amplifier's output. A CDMA test signal was applied to the amplifier's input, and the output power was set up to 42.5 dBm.

The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

The spurious harmonic attenuation was calculated as the difference between Field Strength (E) in dB(uV/m) at the fundamental frequency and at the spurious emission frequency. The Field Strength at fundamental frequency was calculated using the following formula:

$$E_{(\text{dBuV/m})} = P_{(\text{dBm})} + 10 \log 30 - 20 \log D + 90$$

where D = 3 m, distance

P = 42.5 dBm, output power.

6.2 Test Equipment

HP 8566B Spectrum Analyzer, 100 Hz - 22 GHz
CDI P950 Preamplifier, 30 - 1000 MHz
CDI P1000+ Preamplifier, 1-10 GHz
Avantek AFT-18855 Preamplifier, 8-18 GHz
Mini-Circuits ALO/400/-8023 Preamplifier, 18-40 GHz
CDI B100 Biconical Antenna, 30-200 MHz
EMCO 3143 Log-Periodic Antenna, 200-1000 MHz
EMCO 3115 Double-Ridged Horn Antenna, 1-18 GHz
EMCO 3160-09 Horn Antenna, 18-26.5 GHz
High Pass Filter

INTERTEK TESTING SERVICES - Menlo Park

Date of Test: September 17-22, 1998

Spectrian, Power Amplifier

6.4 Test Results

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1931 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1931	-	-	-	-	-	-	137.7	-	-
3862	V	41.0	32.5	-27.9	2.3	0	47.9	89.8	-34.3
5793	V	31.2	35.0	-26.0	2.8	0	43.0	94.7	-39.2
7724	V	30.0	37.5	-26.0	3.4	0	44.9	92.8	-37.3
9655	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11586	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13517	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15448	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17379	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19310	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance
Limit of spurious emission attenuation equals $43 + 10 \log P = 55.5$ dB
Reading with (*) is a noise floor
** Measurements were made at 1 m distance.

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1960 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1960	-	-	-	-	-	-	137.7	-	-
3920	H	40.9	32.5	-27.9	2.3	0	47.8	89.9	-34.4
5880	H	35.8	35.0	-26.0	2.8	0	47.6	90.1	-34.6
7840	V	29.5	37.5	-26.0	3.4	0	44.4	93.3	-37.8
9800	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11760	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13720	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15680	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17640	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19600	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance
Limit of spurious emission attenuation equals $43 + 10 \log P = 55.5$ dB
Reading with (*) is a noise floor
** Measurements were made at 1 m distance.

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

Spurious Harmonic Attenuation

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1989 MHz, The Output is terminated with dummy load

Frequency MHz	Antenna Pol.	SA Reading dB(uV)	Antenna Factor dB(1/m)	Pre-amp. Correct. dB	Cable loss dB	Distance Correct. dB	Field Strength dB(uV/m)	Spurious attenuat. dB	Margin dB
1989	-	-	-	-	-	-	137.7	-	-
3978	V	39.5	32.5	-27.9	2.3	0	46.4	91.3	-35.8
5967	V	33.3	35.0	-26.0	2.8	0	45.1	92.6	-37.1
7956	V	29.1	37.5	-26.0	3.4	0	44.0	93.7	-38.2
9945	V&H	27.0 *	38.2	-26.0	3.8	0	43.0	94.7	-39.2
11934	V&H	29.0 *	39.0	-32.5	5.6	0	41.1	96.6	-41.1
13923	V&H	31.0 *	41.7	-32.5	6.2	0	46.4	91.3	-35.8
15912	V&H	32.0 *	41.4	-32.5	6.9	0	47.8	89.9	-34.4
17901	V&H	33.0 *	45.0	-32.5	7.5	-9.5**	43.5	94.2	-38.7
19890	V&H	37.5 *	44.5	-33.0	8.2	-9.5**	47.7	90.0	-34.5

Note: Measurements were made at 3 m distance

Limit of spurious emission attenuation equals $43 + 10 \log P = 55.5$ dB

Reading with (*) is a noise floor

** Measurements were made at 1 m distance.

Justification: Passed

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

FCC Part 15.109 Radiated Emission

Test site: #1
Test Engineer: D. Chernomordik
Operation Mode: Transmitting at 1960 MHz, The Output is terminated with dummy load.

Frequency MHz	Antenna Polarization V/H	Reading at 3 m dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Corrected Reading dB(uV/m)	Limit at 3 m dB(uV/m)	Margin dB
No emissions were detected above the noise floor level which is at least 20 dB below the limit							

Note: All measurements were made at 3 m distance.
Frequency range investigated is from 30 to 1000 MHz.

Justification: Passed

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

7.0 Line Conducted Emissions, FCC § 15.107

7.1 Test Procedure

Test procedure described in the ANSI C63.4 Standard was employed.

The EUT was connected to an AC line through the LISNs.

Both HOT and NEUTRAL leads were tested.

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

7.2 Test Configuration Setup - Line Conducted Emissions

Not Applicable.

INTERTEK TESTING SERVICES - Menlo Park

Date of Test: September 17-22, 1998

Spectrian, Power Amplifier

7.3 Test Results

Not Applicable.

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

8.0 Frequency Stability vs Temperature, FCC § 2.995(a), 24.135(a)

8.1 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer via feedthrough attenuators. The EUT was placed inside the temperature chamber. The RF output cable exited the chamber through an opening.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the spectrum analyzer.

8.2 Test Equipment

Thermotron Ind. Temperature Chamber, Model S-8C
Hewlett Packard 8591E Spectrum Analyzer

8.3 Test Results

Not Applicable

INTERTEK TESTING SERVICES - Menlo Park

Spectrian, Power Amplifier

Date of Test: September 17-22, 1998

9.0 Frequency Stability vs Voltage, FCC 2.995(d)(2), 24.135(a)

9.1 Test Procedure

An external variable AC power source was connected to the EUT. The frequency of the transmitter was measured for 115 % of the AC nominal value and for 85 % of the nominal value.

9.2 Test Equipment

Hewlett Packard 8591E Spectrum Analyzer

9.3 Test Results.

Not Applicable.

Plot 5.3.6

MKR 665.4 MHz
-29.20 dBm

h_p

REF 42.5 dBm

ATTEN 20 dB

10 dB/

OFFSET

43.6

dB

DL

-13.0

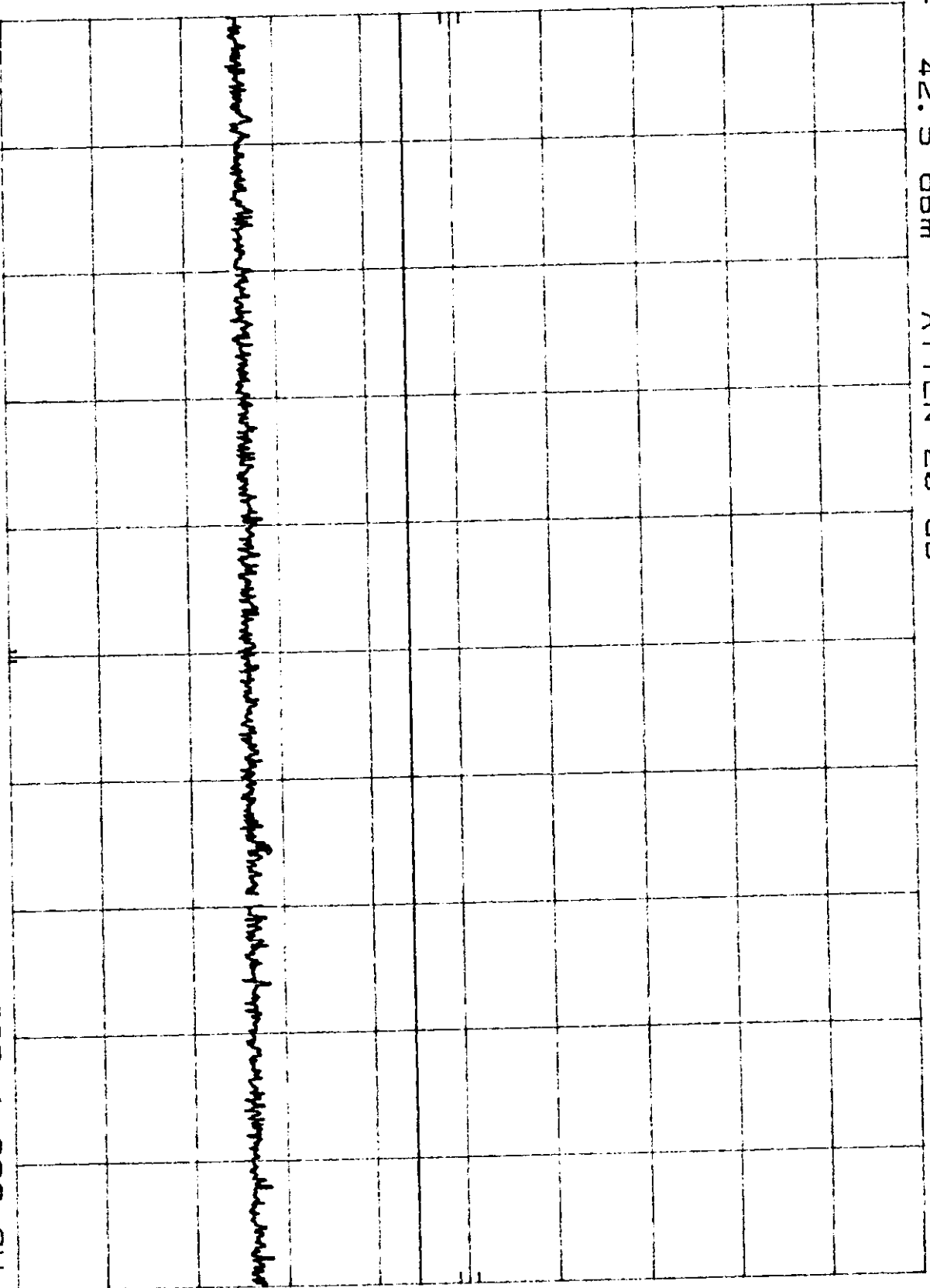
dBm

START 30 MHz

RES BW 30 kHz

VBW 30 kHz

STOP 1.000 GHz
SWP 2.91 sec



hp

REF 42.5 dBm

ATTEN 20 dB

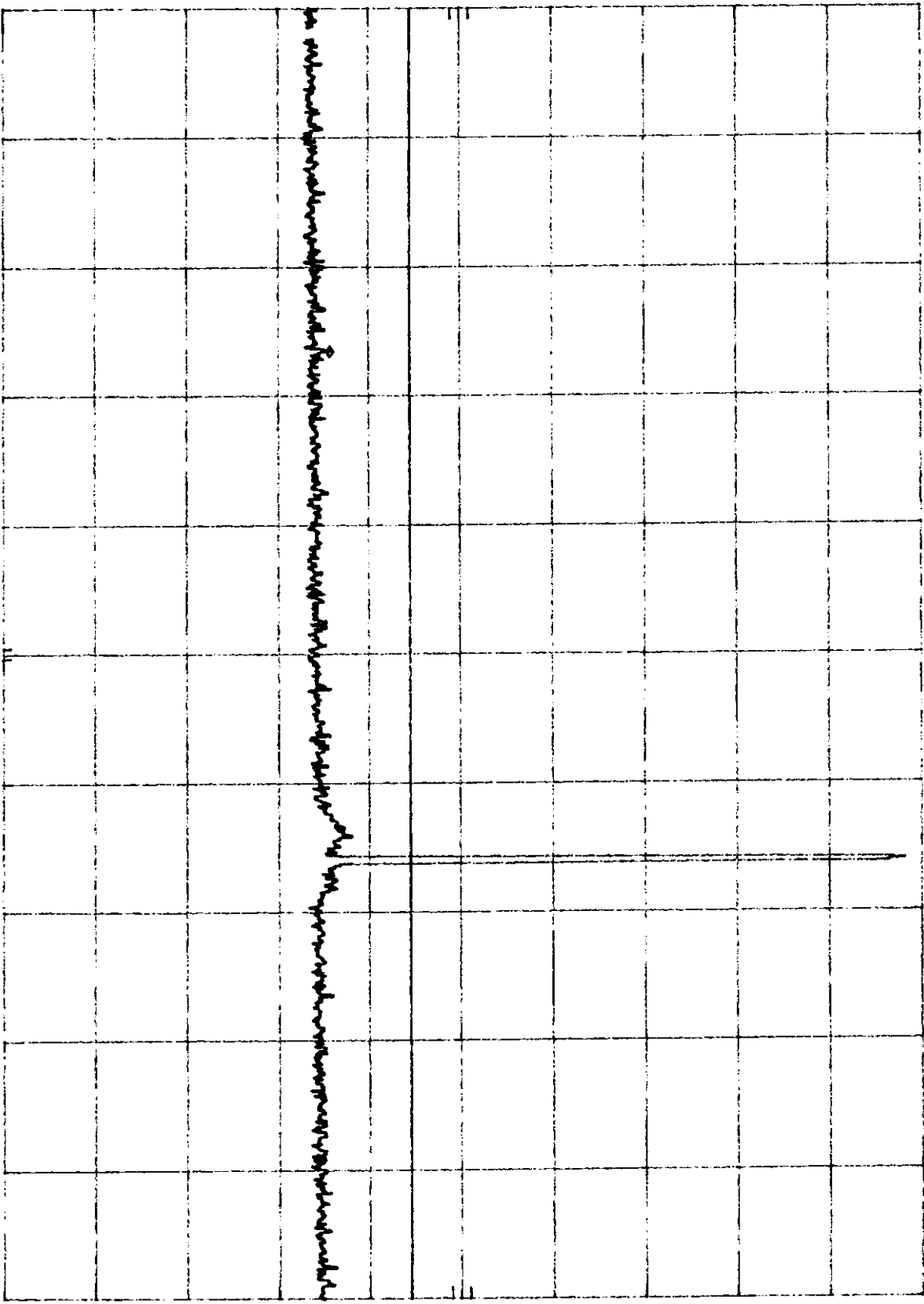
Plot 5.3. m

MKR 1.398 GHz
-21.70 dBm

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 1.00 GHz

RES BW 100 KHz

VBW 100 KHz

SWP 450 msec

STOP 2.50 GHz

Plot 5.3.2

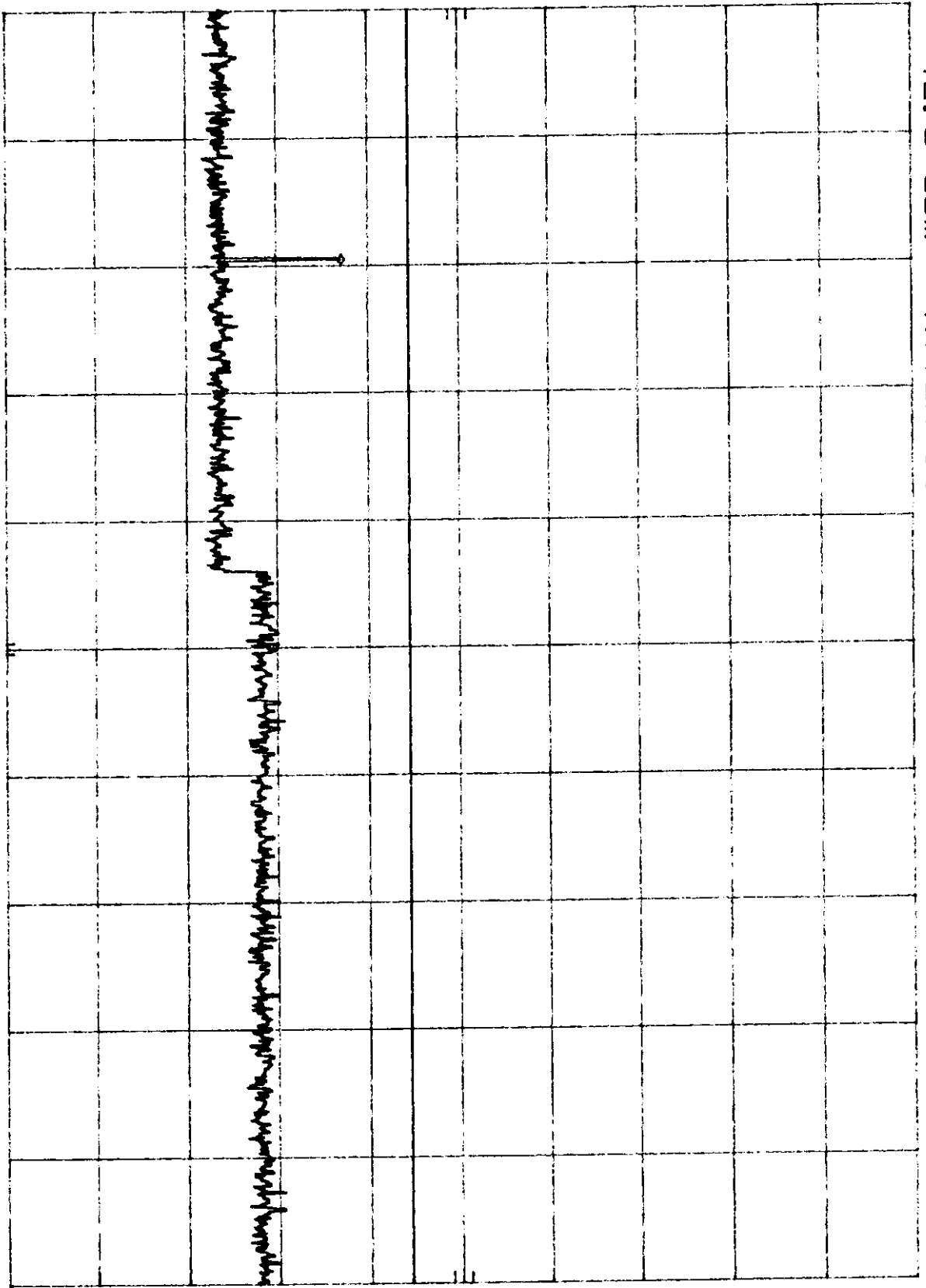
MKR 3.963 GHz
-20.40 dBm

h₀ REF 42.5 dBm ATTN 10 dB

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 2.50 GHz RES BW 100 kHz VBW 100 kHz STOP 10.00 GHz
SWP 2.25 sec

REF 33.5 dBm ATTEN 0 dB

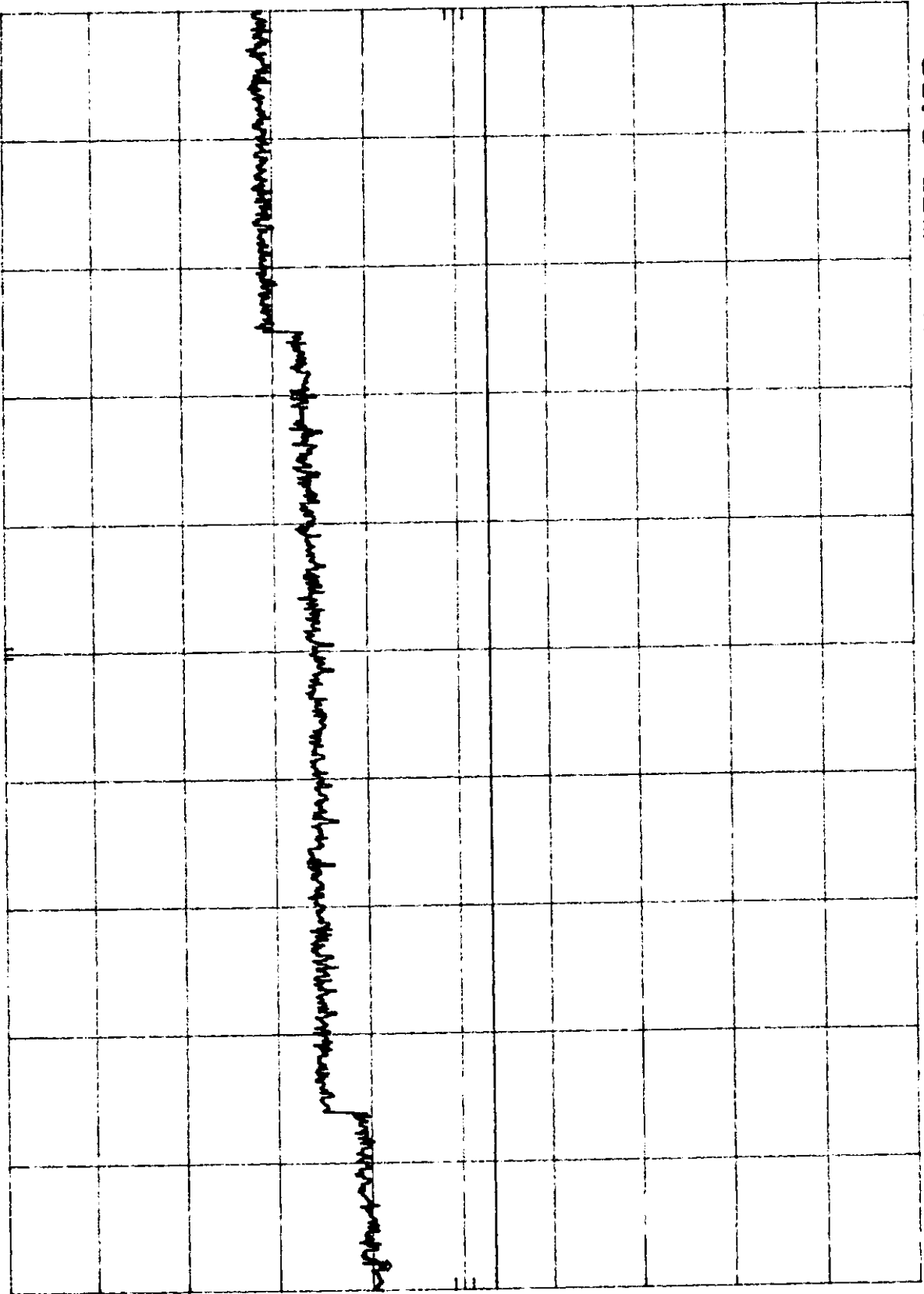
Plot 5.3.0

MKR 19.80 GHz
-25.00 dBm

h₀ 10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 10.0 GHz RES BW 100 kHz VBW 100 kHz STOP 20.0 GHz
SWP 3.00 sec

HP

REF 42.5 dBm

ATTEN 20 dB

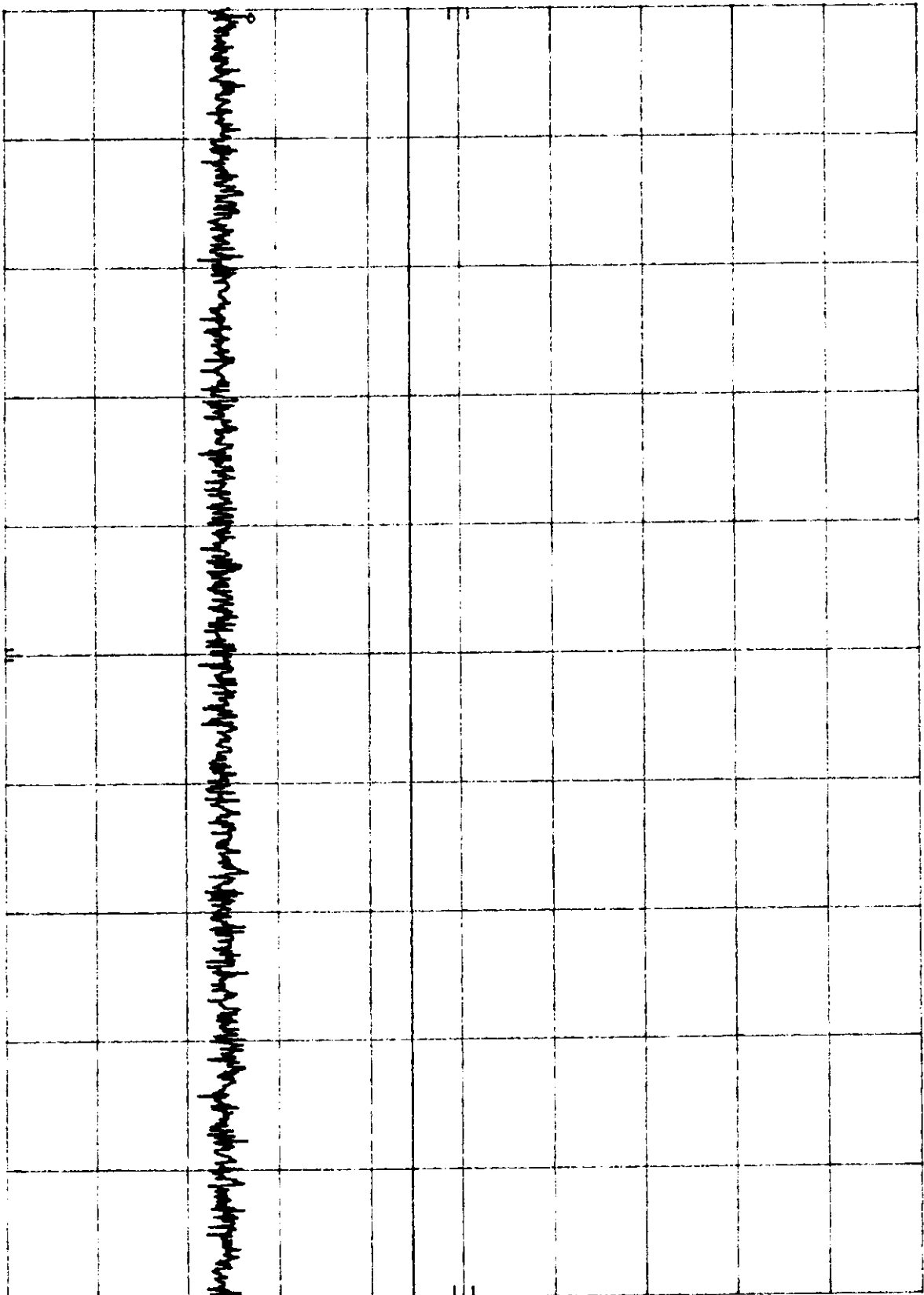
Plot 5.3.2

MKR 1.17 MHz
-30.10 dBm

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 1.0 MHz

RES BW 30 kHz

VBW 30 kHz

SWP 87.0 msec

STOP 30.0 MHz

Plot 5.3.b

MKR 753.6 MHz
-28.80 dBm

h_p REF 42.5 dBm ATTEN 20 dB

10 dB/

OFFSET

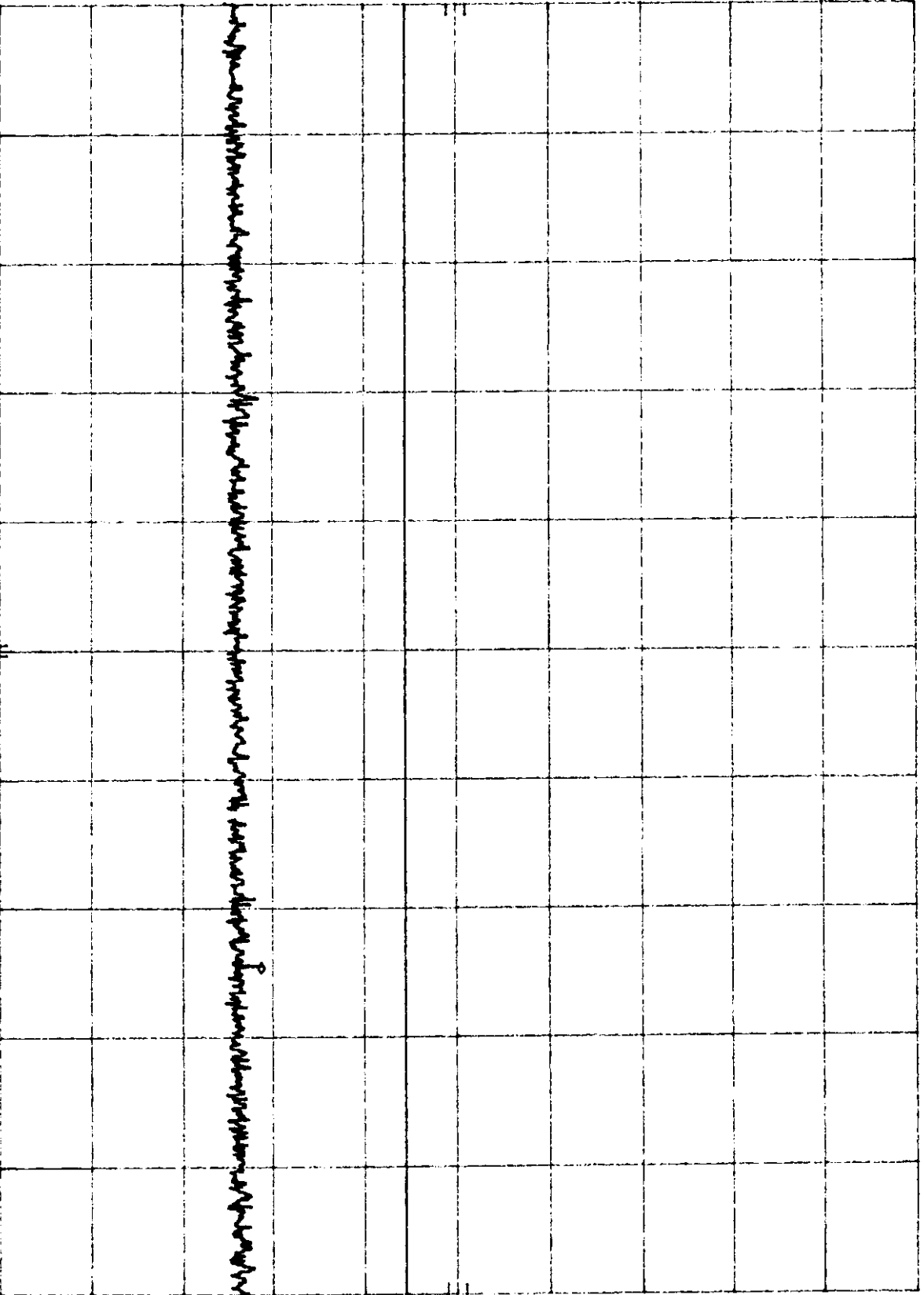
43.6

dB

DL

-13.0

dBm



START 30 MHz

RES BW 30 kHz

VBW 30 kHz

STOP 1.000 GHz
SWP 2.91 sec

Plot 5.3.c

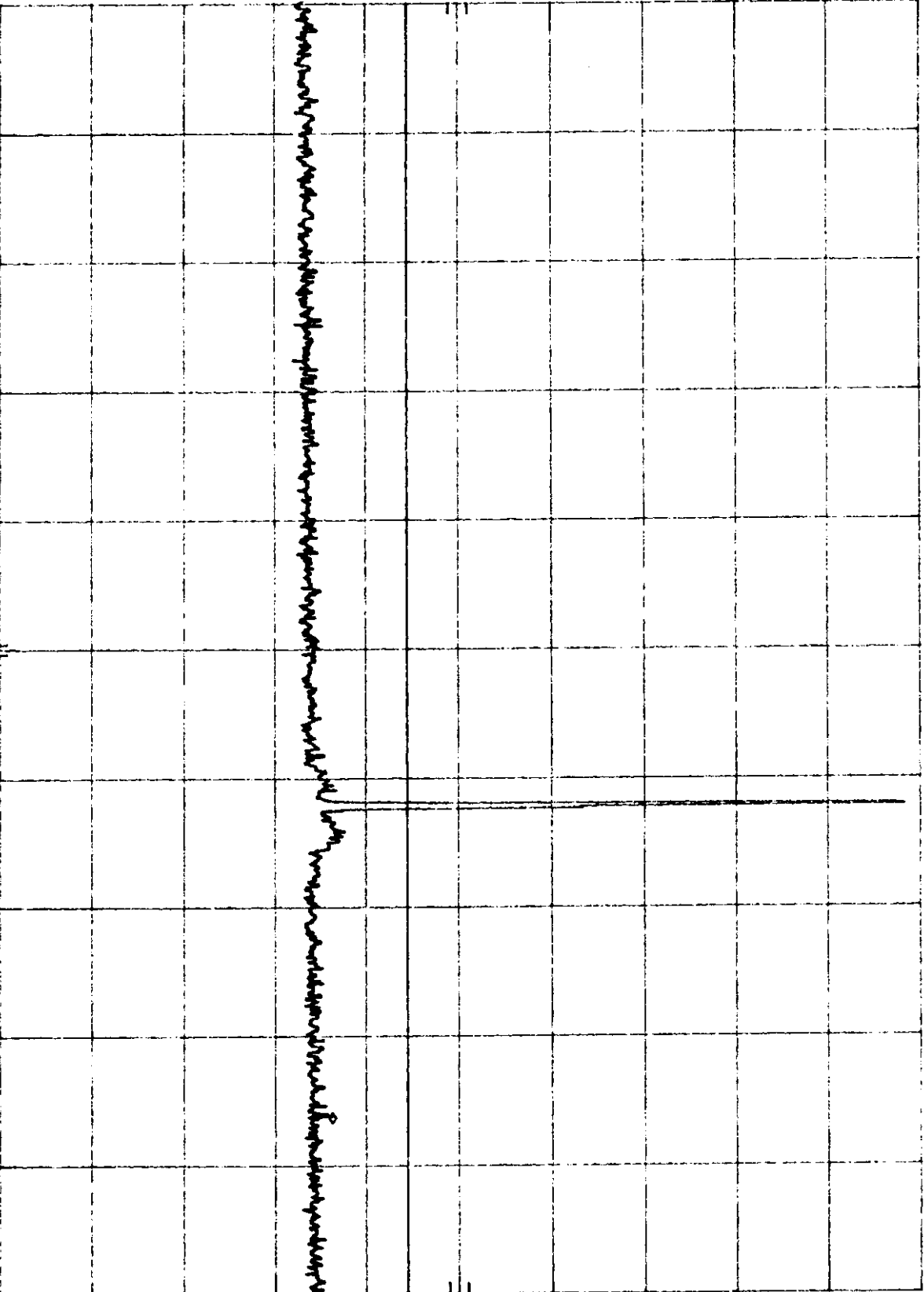
MKR 2.293 GHz
-21.20 dBm

h_p REF 42.5 dBm ATTN 20 dB

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 1.00 GHz RES BW 100 KHz VBW 100 KHz STOP 2.50 GHz SWP 450 msec

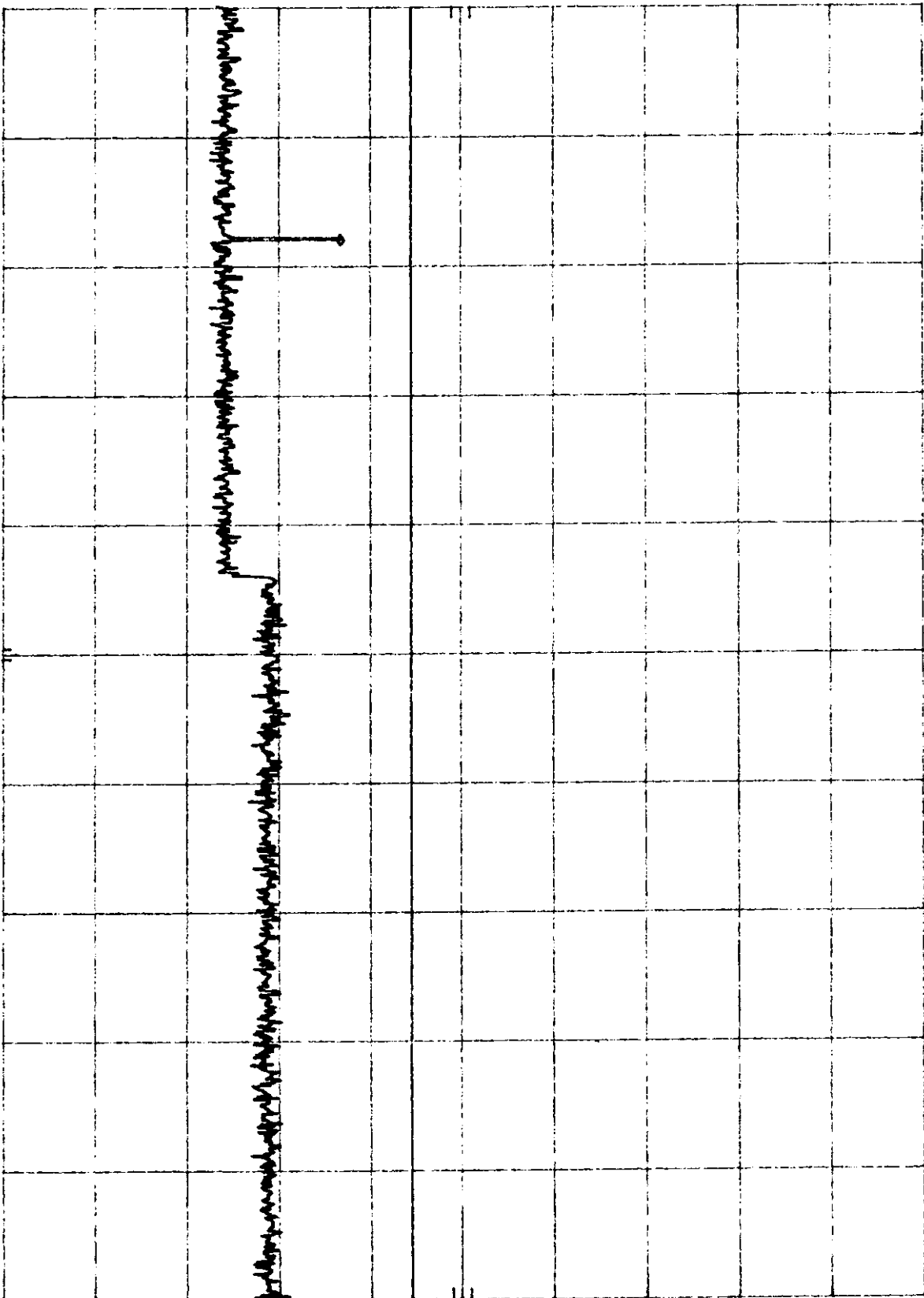
Plot 5.3.d

MKR 3.843 GHz
-20.80 dBm

h_p REF 42.5 dBm ATTEN 10 dB
10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 2.50 GHz

RES BW 100 kHz

VBW 100 kHz

STOP 10.00 GHz
SWP 2.25 sec

HP

REF 33.5 dBm

ATTEN 0 dB

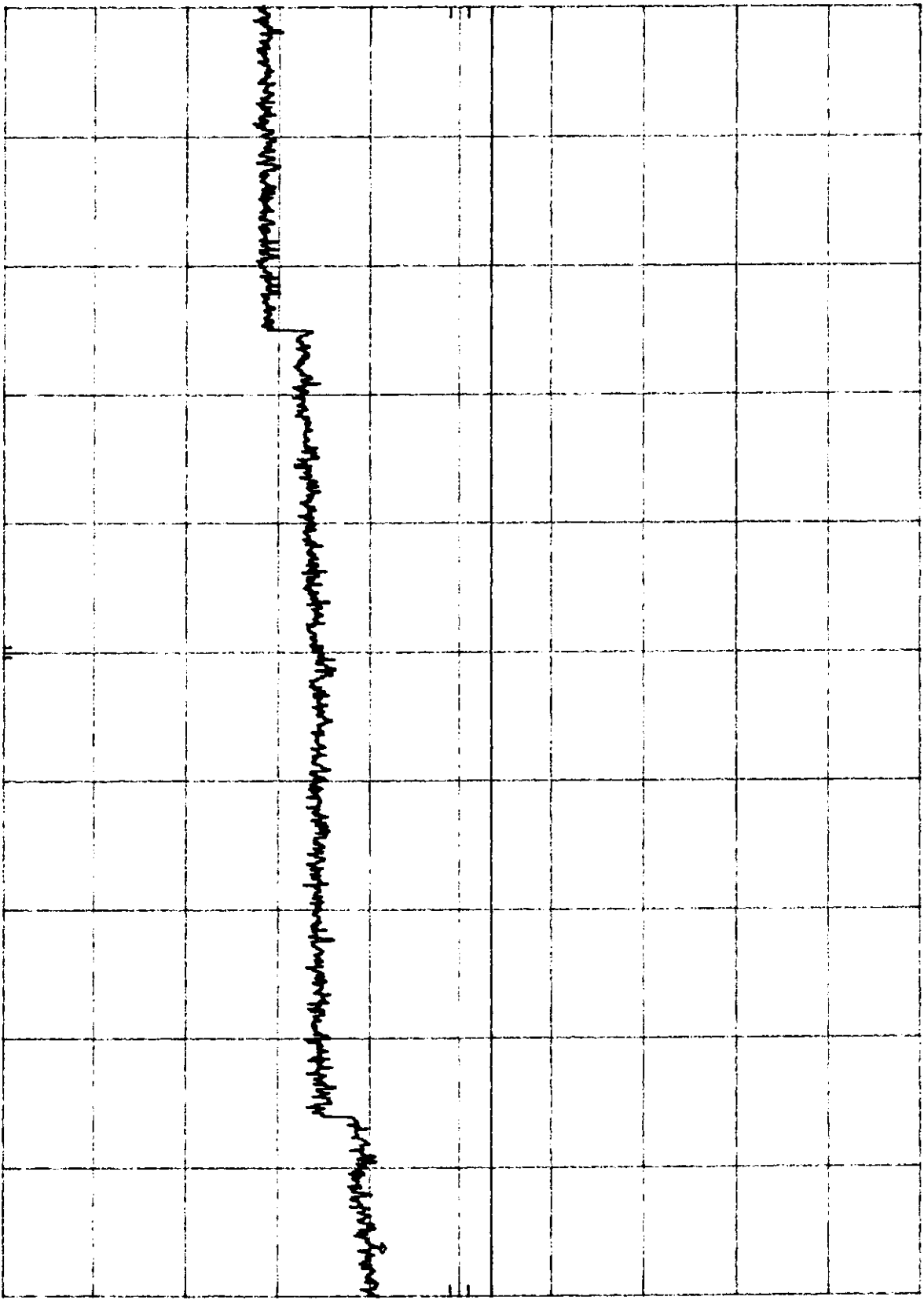
Plot 5.3.e

MKR 19.62 GHz
-25.10 dBm

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 10.0 GHz

RES BW 100 kHz

VBW 100 kHz

STOP 20.0 GHz
SWP 3.00 sec

Plot 5.3.4

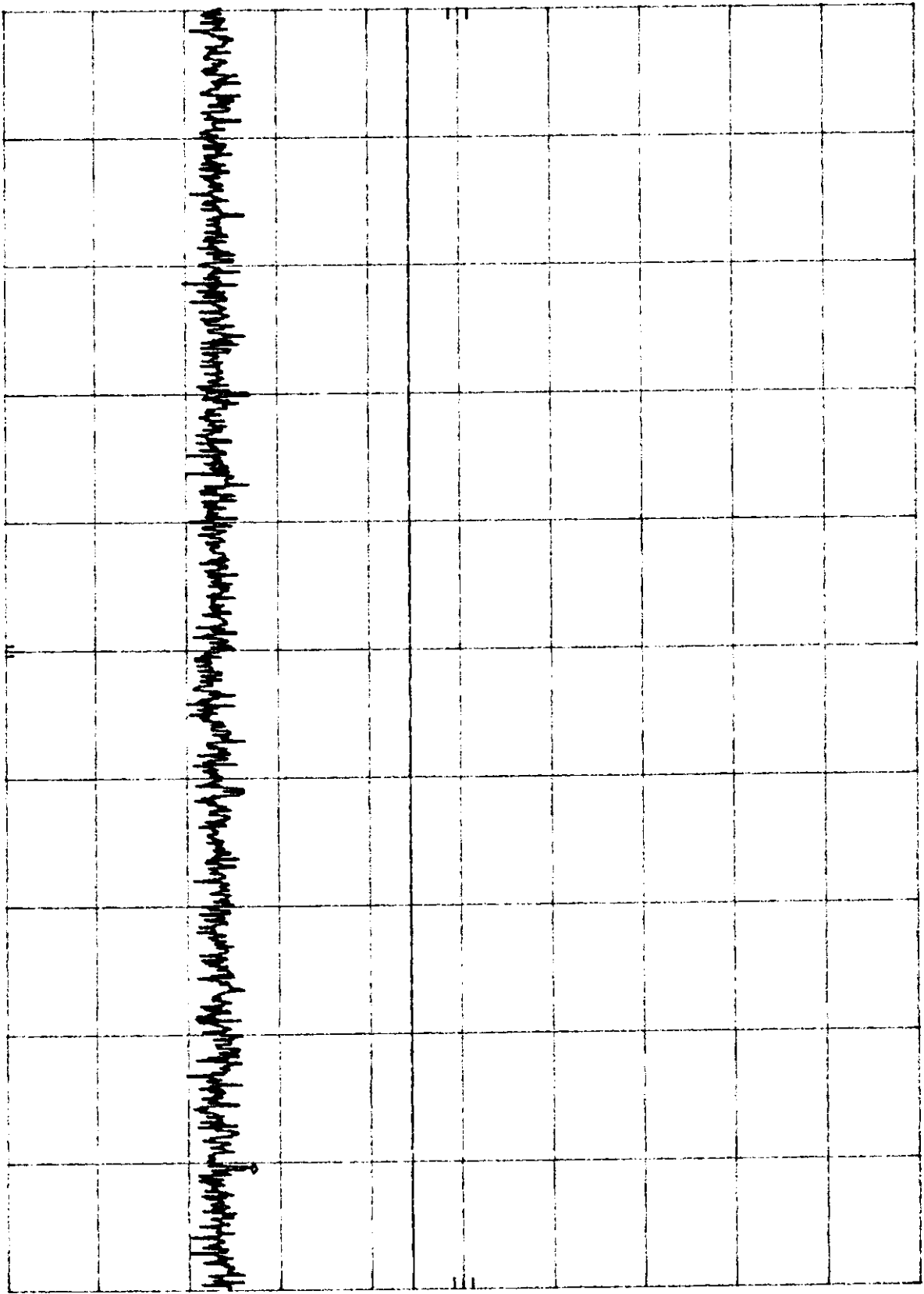
MKR 27.22 MHz
-30.40 dBm

HP REF 42.5 dBm ATTEN 20 dB

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 1.0 MHz RES BW 30 kHz VBW 30 kHz STOP 30.0 MHz
SWP 87.0 msec

Plot 5.3.8

MKR 348.2 MHz
-29.50 dBm

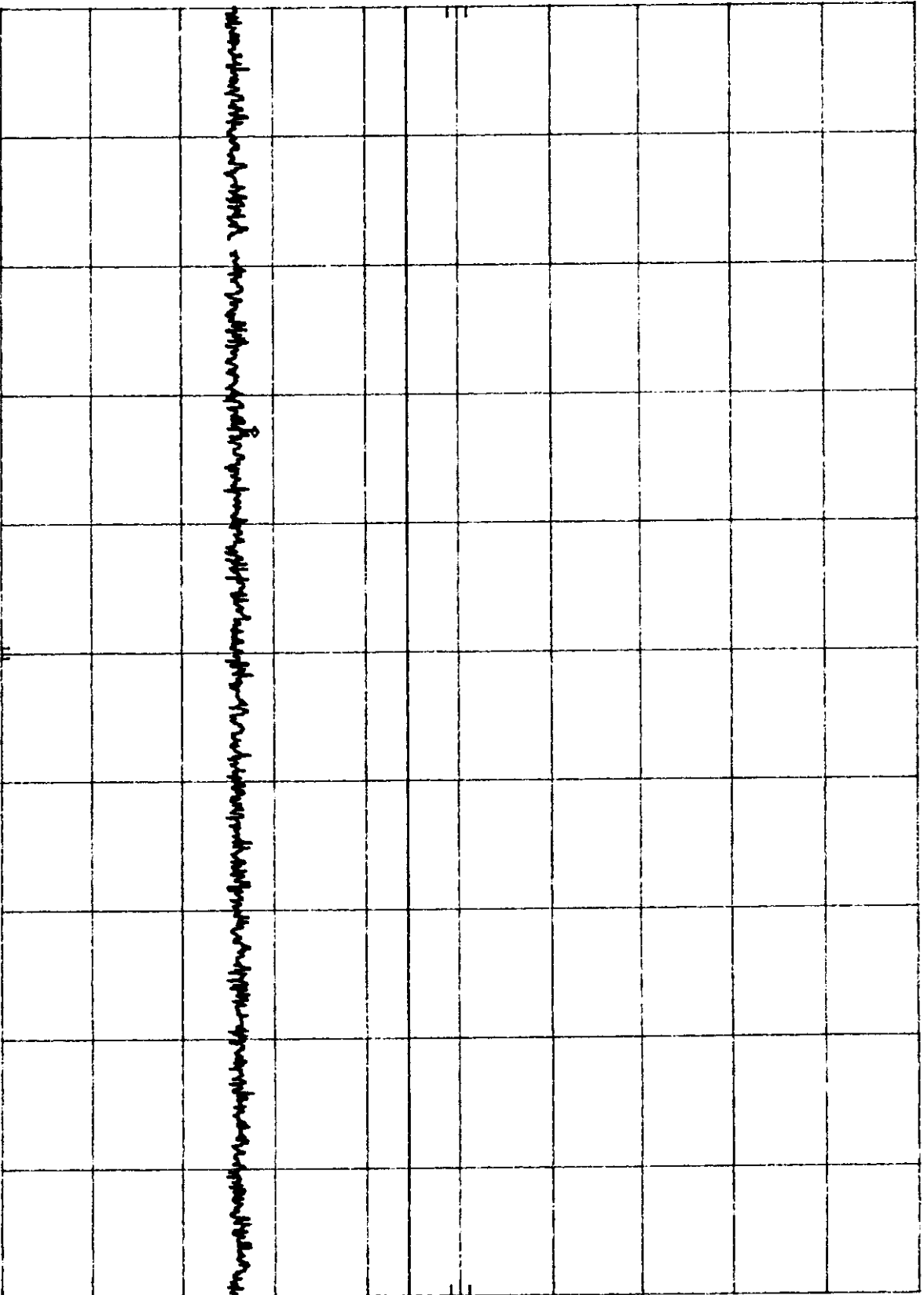
hpd REF 42.5 dBm ATTN 20 dB

10 dB/

OFFSET
43.6
dB

DL

-13.0
dBm



START 30 MHz

RES BW 30 kHz

VBW 30 kHz

STOP 1.000 GHz
SWP 2.91 sec

Plot 5.3.h

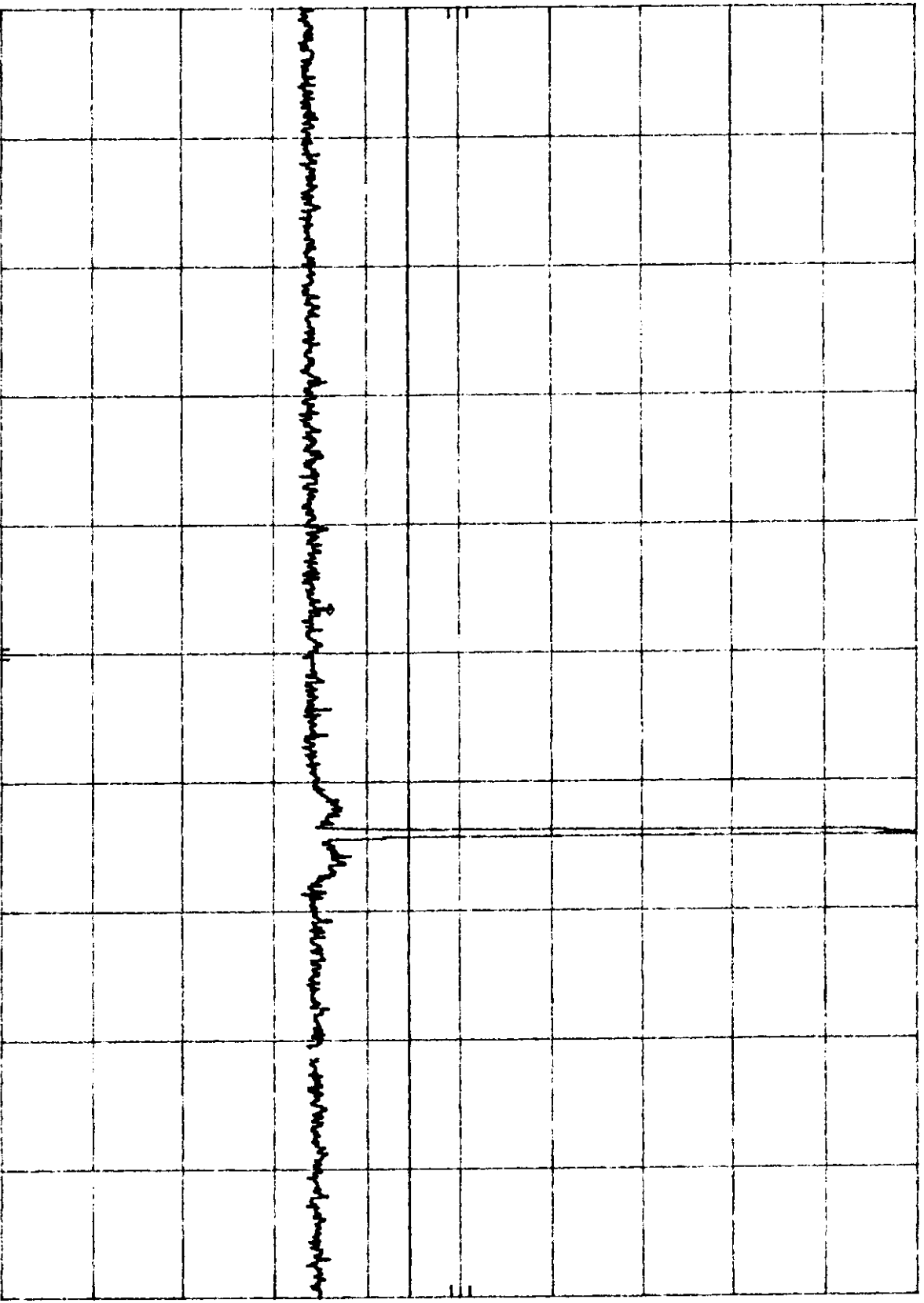
MKR 1.698 GHz
-21.40 dBm

HP REF 42.5 dBm ATTEN 20 dB

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 1.00 GHz

RES BW 100 KHz

VBW 100 KHz

STOP 2.50 GHz
SWP 450 msec

Plot 5.3.2

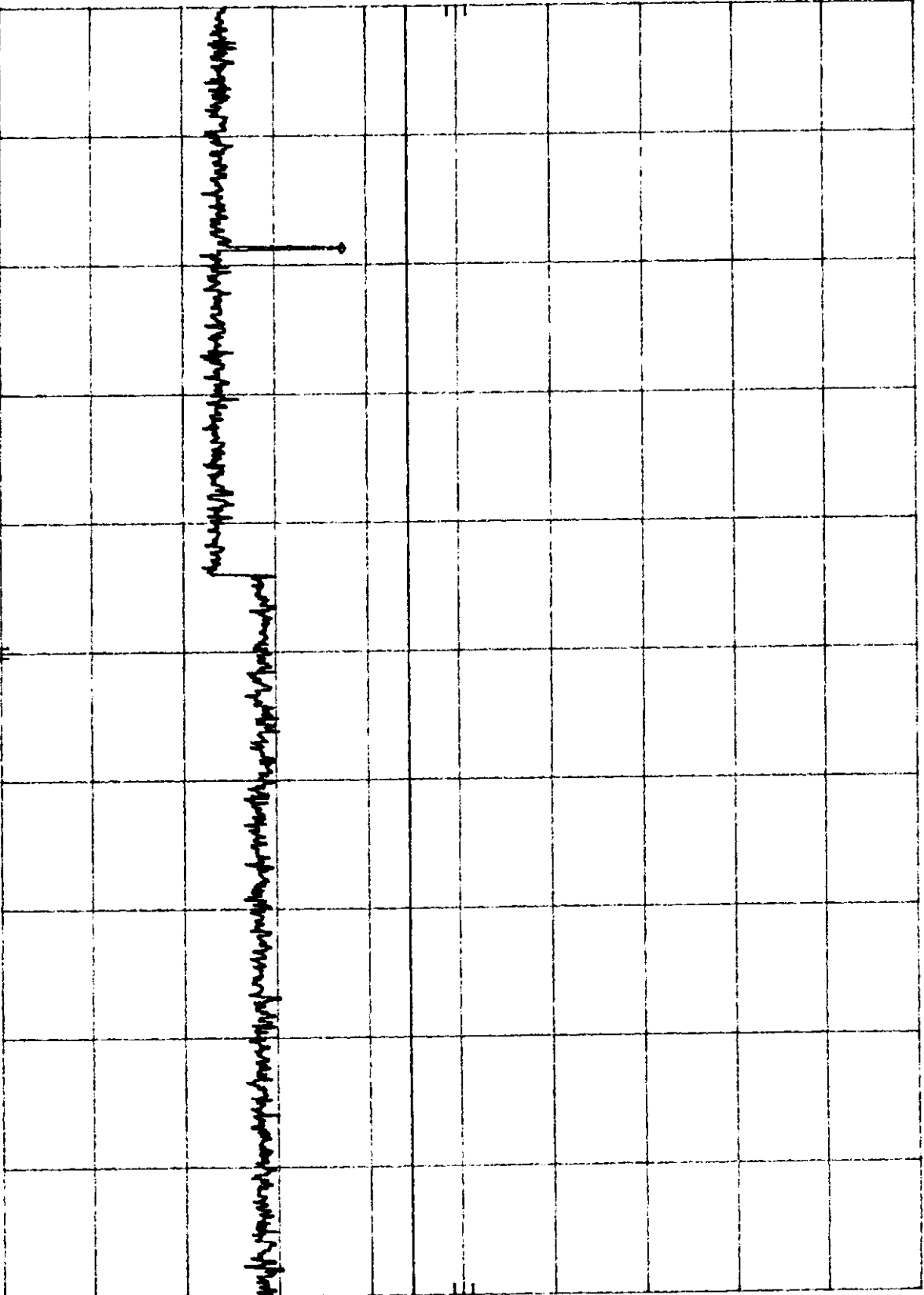
MKR 3.903 GHz
-20.10 dBm

h_p REF 42.5 dBm ATTN 10 dB

10 dB/

OFFSET
43.6
dB

DL
-13.0
dBm



START 2.50 GHz RES BW 100 kHz VBW 100 kHz STOP 10.00 GHz
SWP 2.25 sec

Plot 8.3.5

MKR 19.92 GHz

-24.70 dBm

hp

REF 33.5 dBm

ATTEN 0 dB

10 dB/

OFFSET

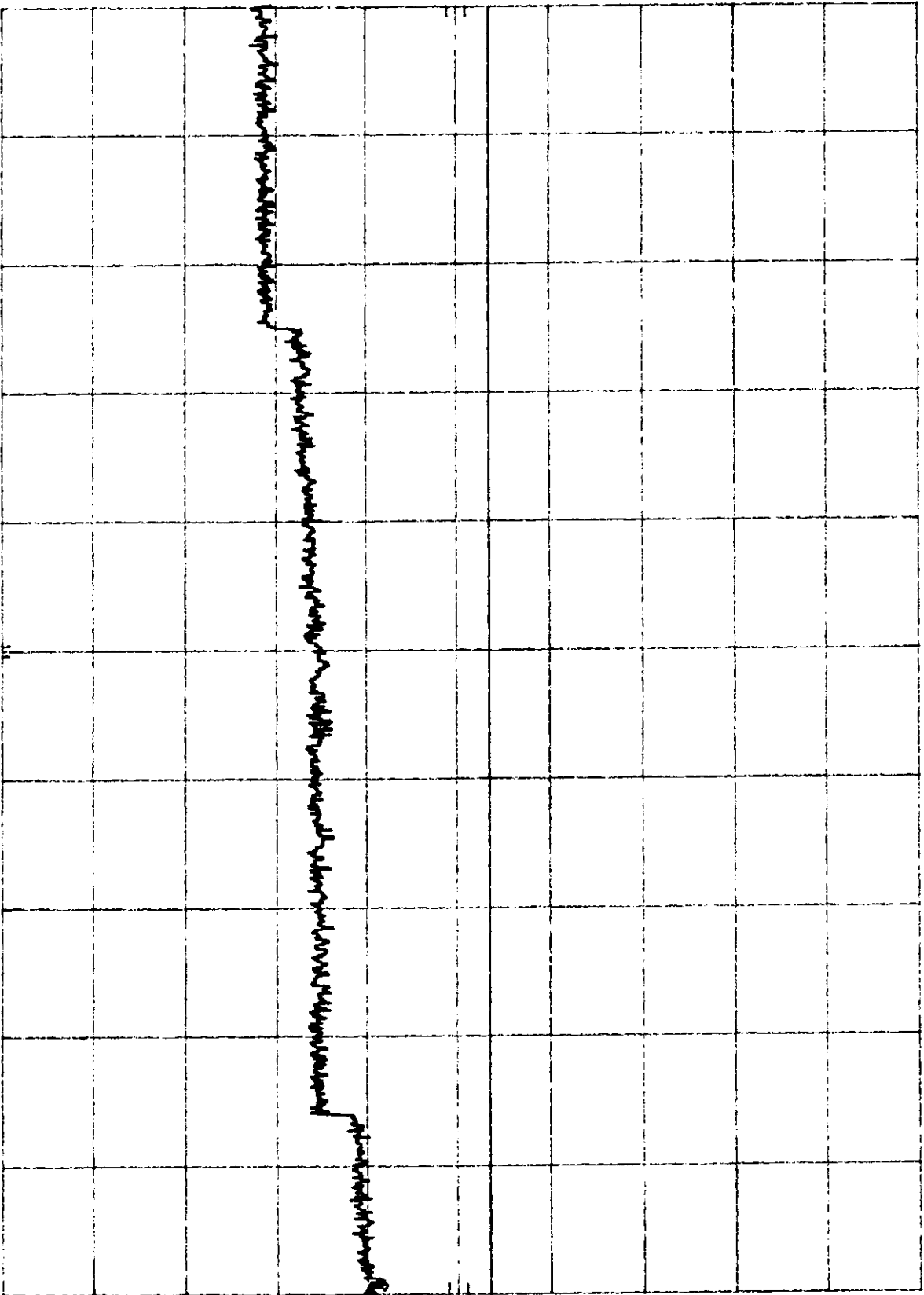
43.6

dB

DL

-13.0

dBm



START 10.0 GHz

RES BW 100 kHz

VBW 100 kHz

STOP 20.0 GHz

SWP 3.00 sec

Plot. 5.3.K

MKR 14.57 MHz
-30.20 dBm

hp

REF 42.5 dBm ATTEN 20 dB

10 dB/

OFFSET

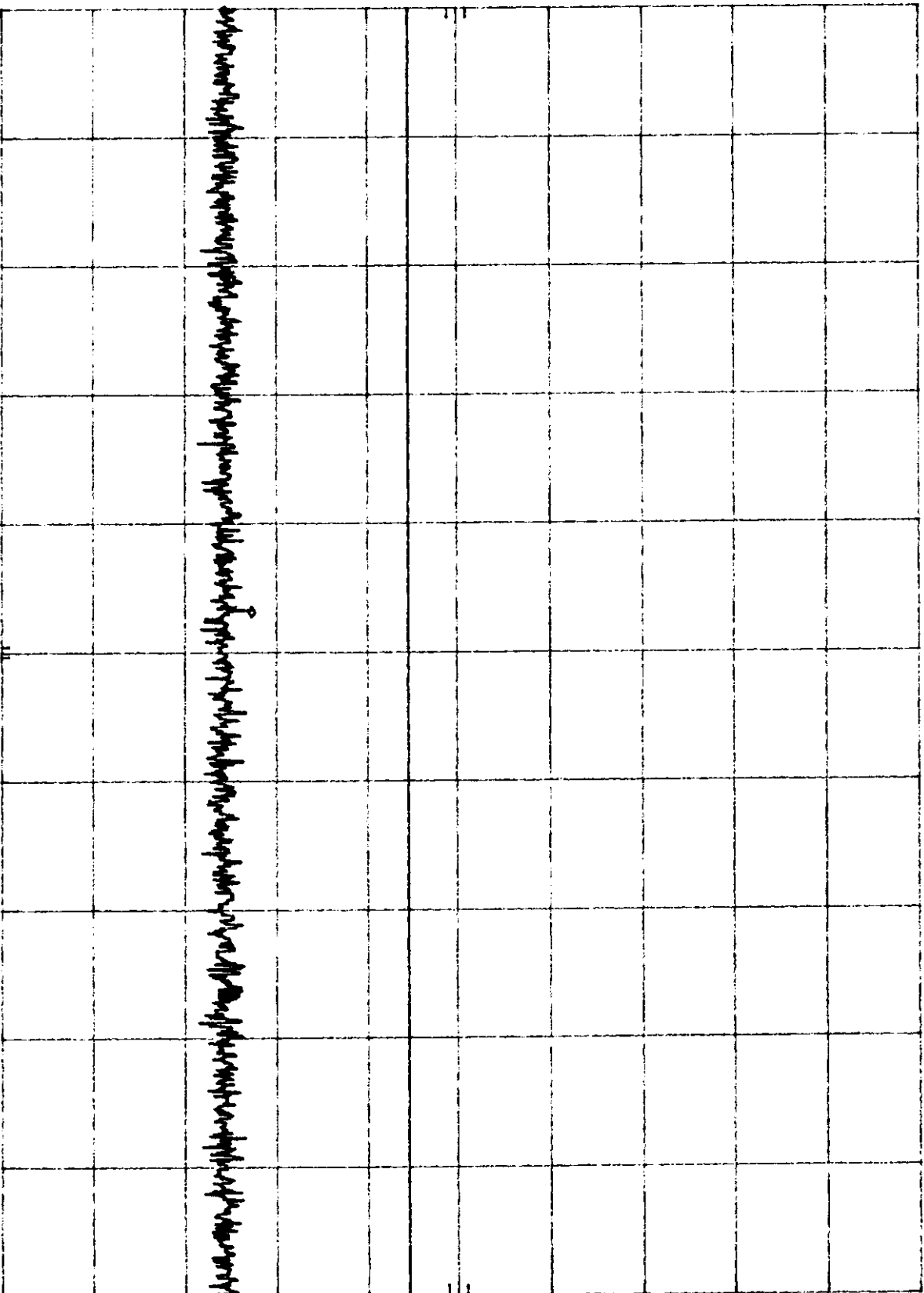
43.6

dB

DL

-13.0

dBm



START 1.0 MHz

RES BW 30 kHz

VBW 30 kHz

SWP 87.0 msec

STOP 30.0 MHz

10:27:35 SEP 22, 1998
/p

Plot 4.3.2
MKR 1.930000 GHz

REF 42.5 dBm #AT 20 dB

-13.02 dBm

SMPL

LOG

10

dB/

OFFST

43.6

dB

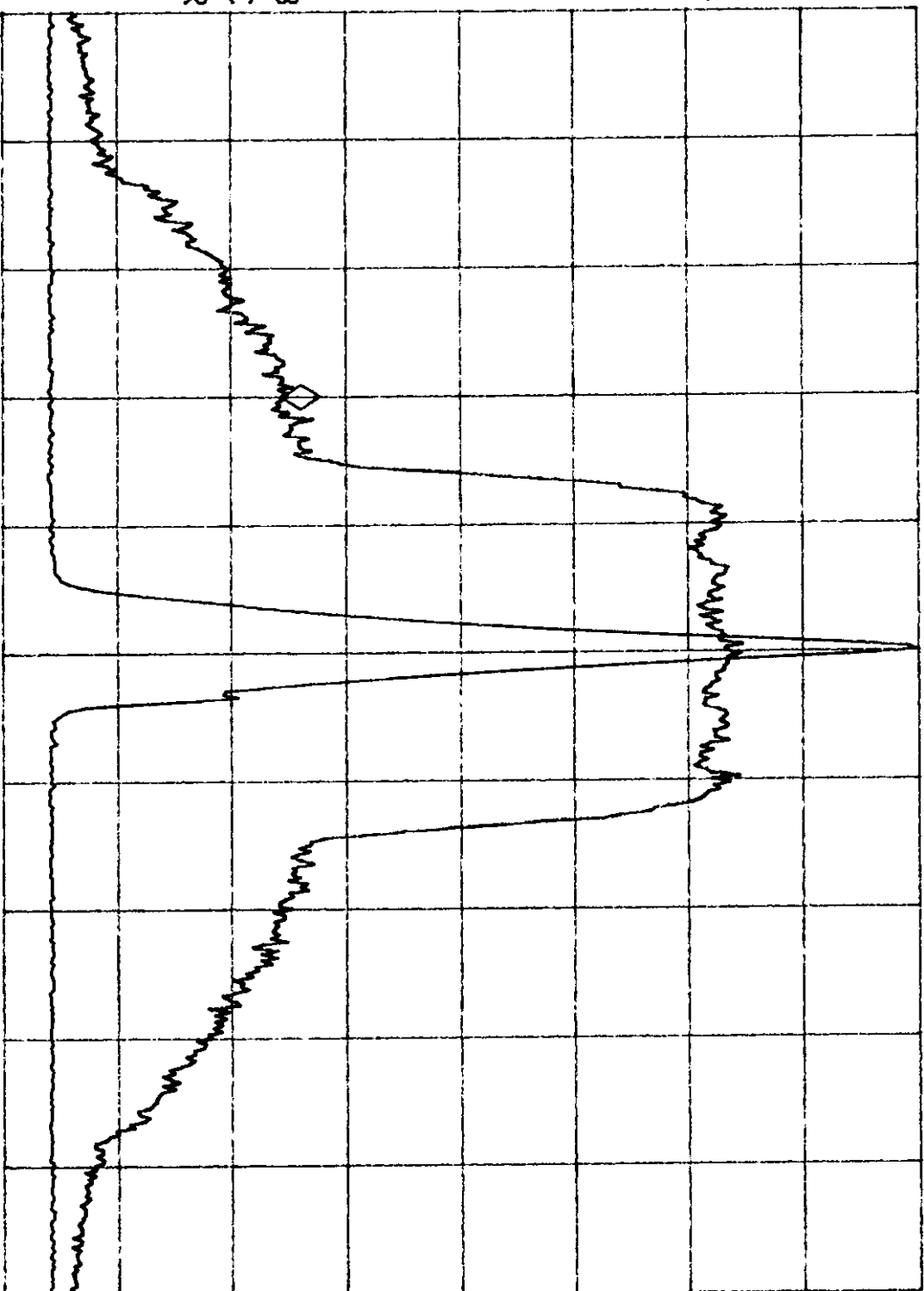
AVC

50

VA VB

SC FC

CORR



CENTER 1.931000 GHz

#RES BW 30 KHz

VBW 30 KHz

SPAN 5.000 MHz

SWP 20.0 msec

10:51:11 SEP 22, 1998

Plot 4.3.6
MKR 1.930000 GHz
-17.60 dBm

REF 42.5 dBm #AT 20 dB

SMPL

LOG

10

dB/

OFFST

43.6

dB

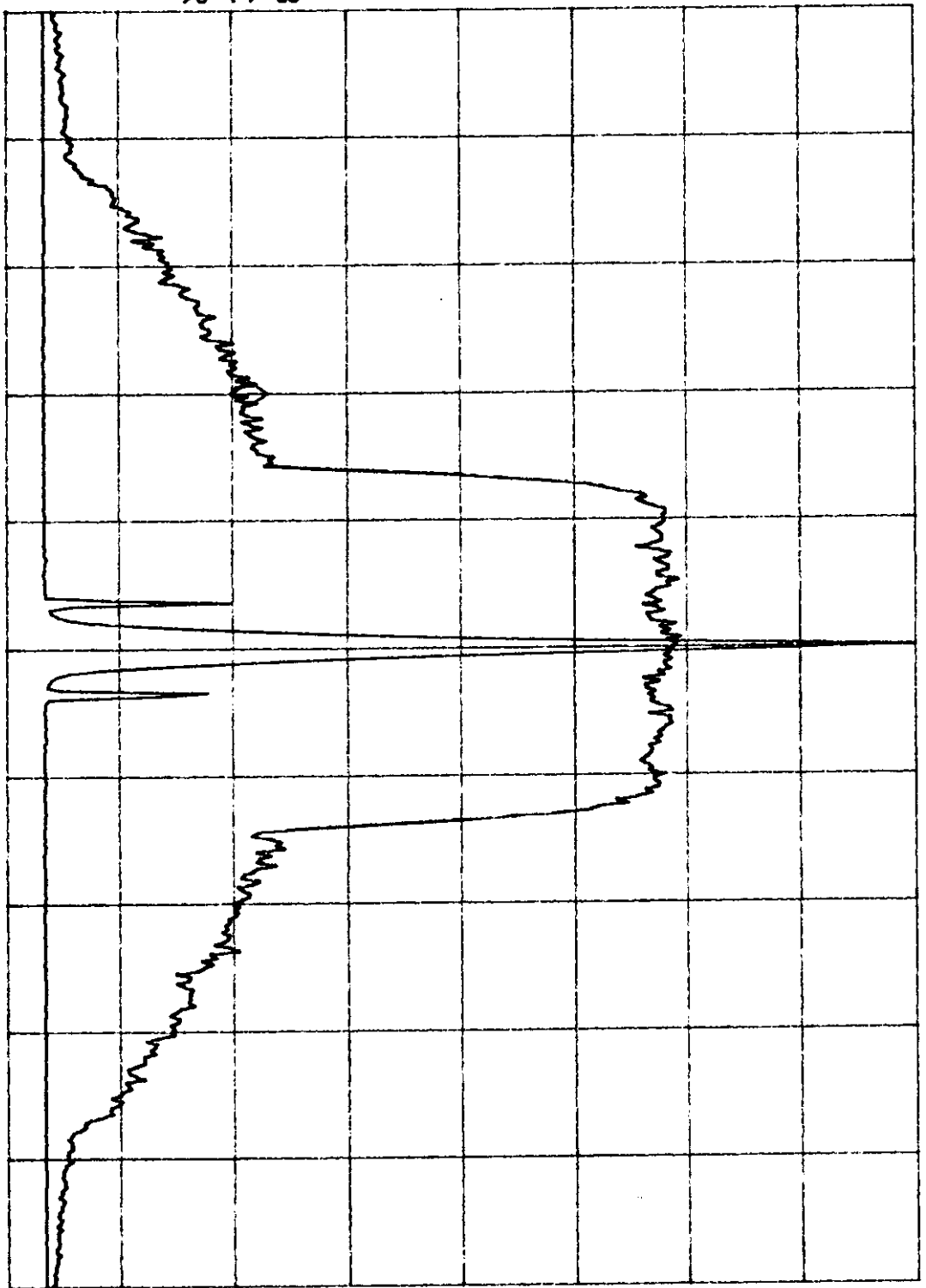
AVG

50

VA VB

SC FC

CORR



CENTER 1.931000 GHz

#RES BW 10 KHz

VBW 10 KHz

SPAN 5.000 MHz

#SWP 300 msec

11:06:20 SEP 22, 1998

Plot 4.3.c

REF 42.5 dBm #AT 20 dB

MKR 1.990000 GHz
-13.44 dBm

SMP L

LOG

10

dB/

OFFST

43.6

dB

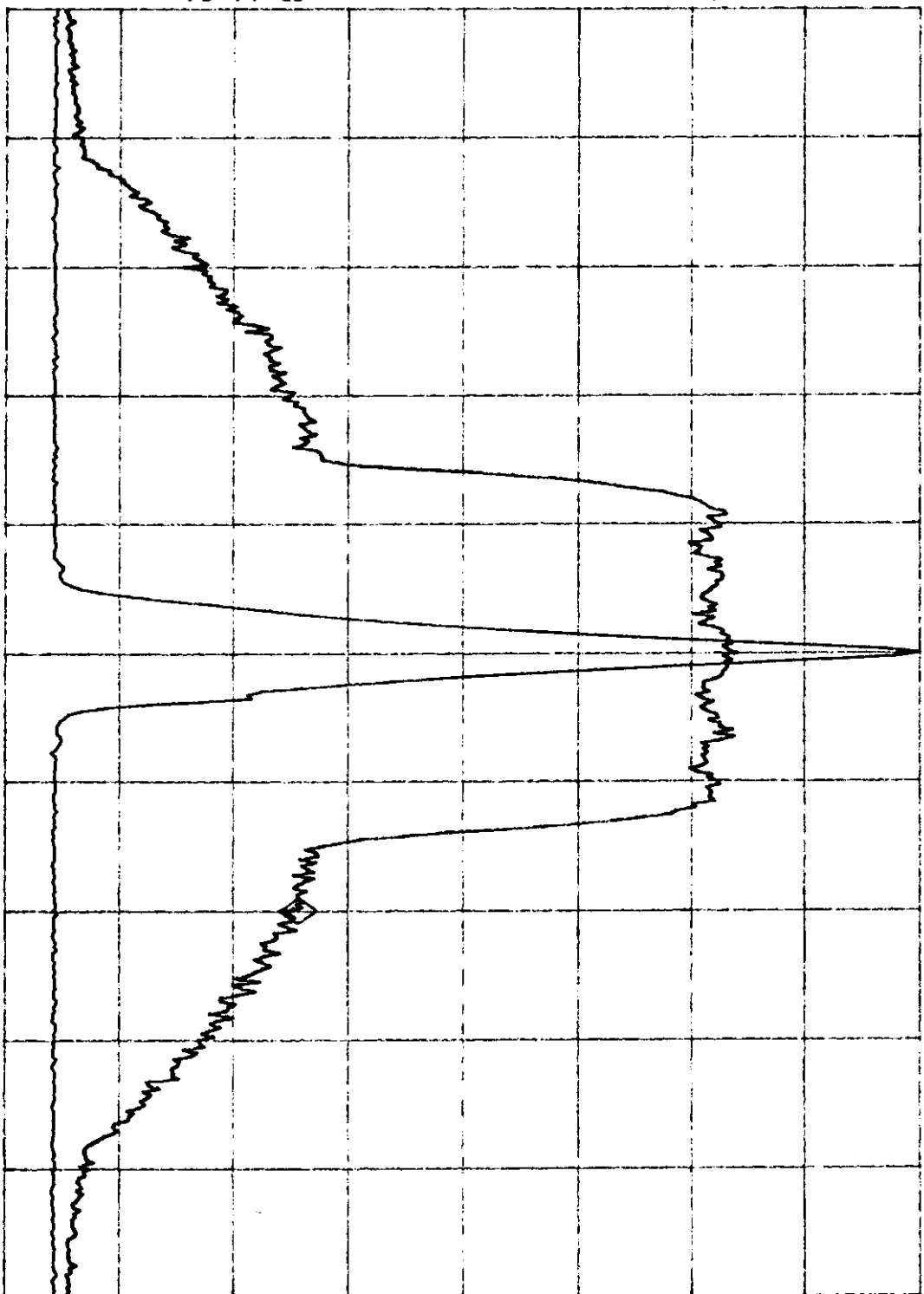
AVG

50

VA VB

SC FC

CORR



CENTER 1.989000 GHz

#RES BW 30 KHz

VBW 30 KHz

SPAN 5.000 MHz

#SWP 300 msec

11:01:49 SEP 22, 1998
/p

Plot 4.3.d

MKR 1.990000 GHz

REF 42.5 dBm #AT 20 dB

-15.61 dBm

SMPL

LOG

10

dB/

OFFST

43.6

dB

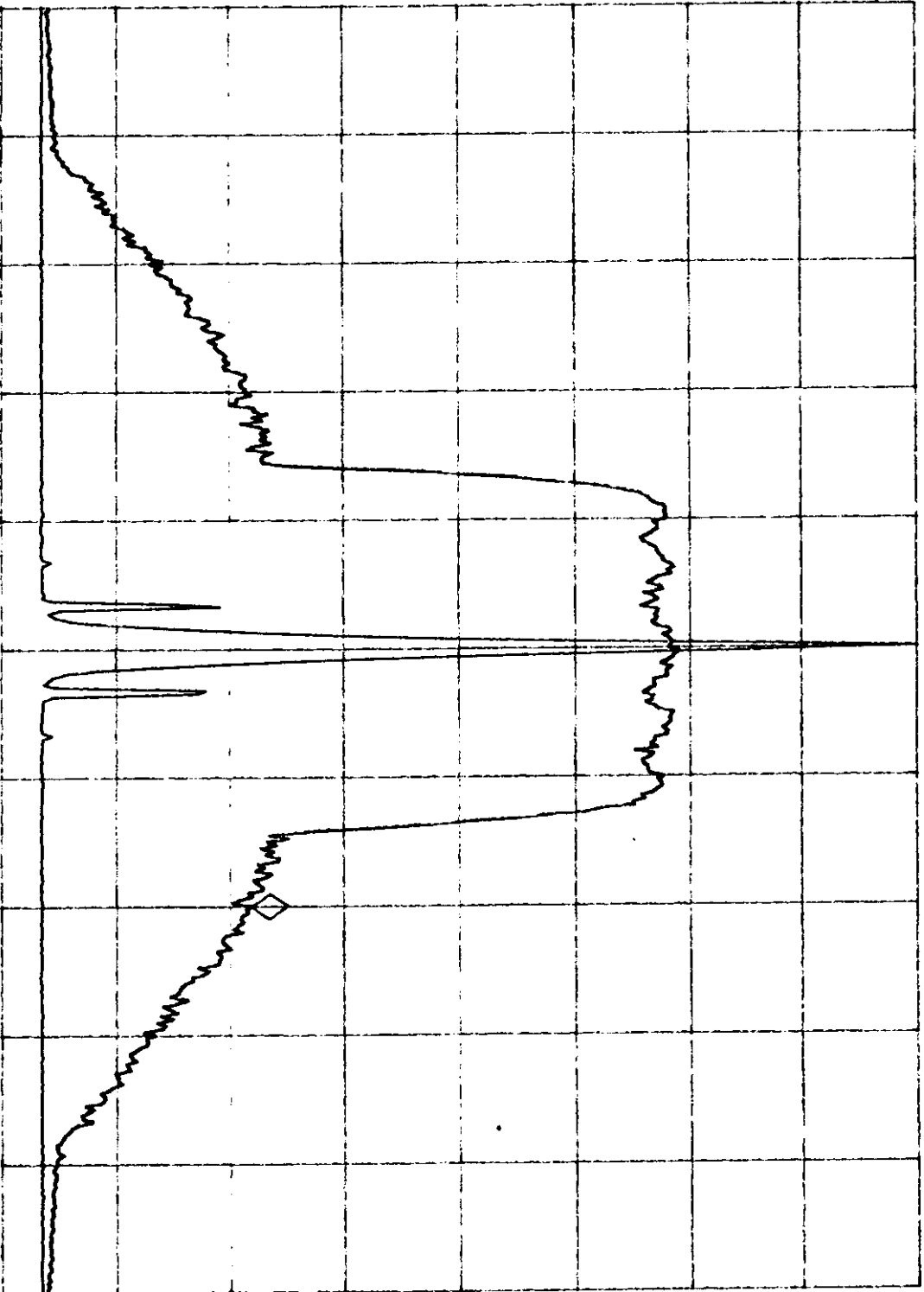
AVG

50

V A V B

SC FC

CORR



CENTER 1.989000 GHz

SPAN 5.000 MHz

#RES BW 10 kHz

VBW 10 kHz

#SWP 300 msec