



WASHINGTON LABORATORIES, LTD.

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FCC CERTIFICATION REPORT

prepared for

EMR Corporation

22402 North 19th Avenue
Phoenix, AZ 85027

FCC ID: M7G-UHF 450-70

November 5, 1998

WLL PROJECT #: 4717X

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STATEMENT OF QUALIFICATIONS

for

Chad M. Beattie

Washington Laboratories, Ltd.

I have seven years of electronics experience with an Associates in Electronic Systems Technology. The last year being directly involved in EMI testing. I am qualified to perform EMC testing to the methods described in this test report. The measurements taken within this report are accurate within my ability to perform the tests and within the tolerance of the measuring instrumentation.

By:

Chad M. Beattie
Compliance Engineer

Date: **November 5, 1998**



MANUFACTURING QUALITY R.F. FILTERING AND AMPLIFICATION PRODUCTS

Chief, Authorizations Branch
Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046

RE: LETTER OF AGENCY

This letter is to serve notice that Washington Laboratories, Ltd. is hereby authorized to act on our behalf in connection with the Application for Equipment Authorization attached herewith.

We certify that we are not subject to denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, U.S.C. 862. Further, no party, as defined in 47 CFR 1.2002(b), to the application is subject to denial of federal benefits, that includes FCC benefits.

Signed,

A handwritten signature in black ink, which appears to read "William F. Liske", is written over a horizontal line.

William F. Liske
President
EMR Corporation

FCC CERTIFICATION REPORT

For

EMR Corporation

1.0 Introduction

This report has been prepared on behalf of EMR Corporation in support of their application for FCC Certification under Part 90 of the FCC Rules and Regulations.

The Equipment Under Test was a 19" Rack Mounted UHF Power Amplifier (Model UHF 450-70).

All measurements were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code 200066-0) as an independent FCC test laboratory.

Measurements were made on the Equipment Under Test in accordance with FCC Rule Part 2, specifically the requirements stipulated in:

- 2.985 RF Power Output
- 2.987 Modulation Characteristics
- 2.989 Occupied Bandwidth
- 2.991 Spurious Emissions at Antenna Terminals
- 2.993 Field Strength of Spurious Radiation
- 2.995 Frequency Stability

All results reported herein relate only to the item tested. This report shall not be used to claim product endorsement by NVLAP or any agency of the US Government. The measurement uncertainty of the data contained herein is ± 2.3 dB. Refer to Appendix B for Statement of Measurement Uncertainty.

1.1 Summary

The UHF Amplifier complies with the technical requirements of Part 90 of the FCC Rules and Regulations.

2.0 Description of Equipment Under Test (EUT)

The UHF Amplifier series is intended for use in commercial communication systems. Applications include land mobile repeaters, trunking, and data systems. The amplifier is a 70 watt power amplifier operating in the frequency range of 450-490 MHz. The amplifier is powered by an externally supplied 13.6 VDC power source. Testing was performed at the low (450 MHz), middle (470 MHz), and high (490 MHz) frequencies of operation for the amplifier.

3.0 Test Configuration

3.1 RF Output Power (FCC Rule Part 2.985)

The input of the UHF Amplifier was connected to the output of the Tait Electronics T2000II mobile radio (FCC ID: CAS 2000-6231). The RF input power from the T2000II transmitter was 4 Watts at 450 MHz and 4.3 Watts at 470 and 490 MHz. The output from the amplifier was connected to a 40 Watt attenuator and then to the input of an HP 8564E RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the 40 dB attenuator. The RF output power across a 50 ohm load termination was measured directly by the analyzer.

RESULTS: The measured RF output power at 450 MHz was 48.18 dBm, or 65.8 W.

RESULTS: The measured RF output power at 470 MHz was 48.7 dBm, or 74.1 W.

RESULTS: The measured RF output power at 490 MHz was 48.17 dBm, or 65.6 W.

3.2 Modulation Characteristics (FCC Rule Part 2.987)

The EUT does not contain any modulating limiting circuitry or low pass filtering since the unit provides only amplification of the RF signal supplied from a FCC approved device. The amplifier does not change the frequency deviation of the radio.

3.3 Occupied Bandwidth (FCC Rule Part 2.989)

The EUT does not contain any circuitry that will increase the bandwidth since the unit provides only amplification of the RF signal supplied from a FCC approved device. The amplifier does not change the bandwidth of the radio.

3.4 Spurious Emissions at Antenna Terminals (FCC Rule Part 2.991)

Spurious emissions were measured by connecting the antenna terminal of the amplifier to the input of an HP 8564E spectrum analyzer. The amplifier was supplied with a 2400 Hz modulated signal from a mobile radio (FCC ID: CAS 2000-6231). Per Section 90.210(d) of the FCC Rules, any emission shall be attenuated below the unmodulated carrier power by the following:

- 1) On any frequency from the center of the authorized bandwidth f_o to 5.625 kHz removed from f_o : 0 dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88 \text{ kHz})$ dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5: At least $50 + 10 \log (P)$ dB or 70 dB whichever is the lesser attenuation.

For the EUT:

$$@ 450 \text{ MHz } 50 + 10 \log 65.8 \text{ W} = 68.2 \text{ dB}$$

$$@ 470 \text{ MHz } 50 + 10 \log 74.1 \text{ W} = 68.7 \text{ dB}$$

$$@ 490 \text{ MHz } 50 + 10 \log 65.6 \text{ W} = 68.2 \text{ dB}$$

The emissions were checked up to the tenth harmonic of the carrier frequency (4.9 GHz) of the mobile radio; all emissions above 1 GHz were suppressed at least 73 dB below the unmodulated carrier level. Appendix A1, A2 and A3 show plots of the spurious emissions up to a frequency of 5 GHz.

RESULTS: All frequencies removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz are suppressed by at least $7.27(f_d - 2.88 \text{ kHz}) \text{ dB}$.

RESULTS: All frequencies removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz are suppressed by at least $50 + 10\log(P) \text{ dB}$. The amplifier was tested at the high, low and middle of its operating frequency range.

LIMIT: 68.2 dB @ 450 MHz and 490 MHz operation
68.7 dB @ 470 MHz operation

Appendix A3, A4 and A5 are spurious emissions plots of the input signal supplied to the input of the amplifier via the FCC approved radio.

3.5 Radiated Emissions Testing (FCC Rule Part 2.993)

The amplifier was tested with a mobile radio (FCC ID: CAS 2000-6231), which programmable for the frequency of operation for the amplifier. The unit was tested with a 50 ohm load (the output impedance of the antenna port) attached to the antenna port.

The EUT was placed on an 80 cm high, 1 X 1.5 meters non-conductive motorized turntable for radiated testing on a 3 meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. Horizontal and vertical field components were measured.

The output from the antenna was connected, via a preamplifier, to the input of the spectrum analyzer. The detector function was set to peak. The measurement bandwidth of the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth.

3.5.1 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limit, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 1. The AFc in dB/m is algebraically added to the Spectrum Analyzer Voltage in dBuV to obtain the Radiated Electric Field in dBuV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage: VdBuV

Composite Antenna Factor: AFcdB/m

Electric Field: EdBuV/m = VdBuV + AFcdB/m

To convert to linear units: EuV/m = antilog (EdBuV/m/20)

RESULTS: The EUT complies with the requirements. Data is recorded in Table 1.

LIMIT: 84.4 dBuV/m (16595.9 uV/m)

Table 1

FCC Part 90 3M Radiated Emissions Data - Site 2

CLIENT: EMR Corporation
 FCC ID: M7G-UHF 450-70
 DATE: 11 September 98
 BY: Chad M. Beattie
 JOB #: 4717X

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (QP) dBuV	Afo dB/m	E-Field dBuV/m	Limit dBuV/m	Margin dB
<i>Channel 11 (450 MHz)</i>								
900.00	V	135.0	1.5	24.0	32.2	56.2	84.4	-28.2
900.00	H	0.0	1.8	25.2	32.2	57.4	84.4	-27.0
1350.00	V	0.0	1.0	64.4	-14.2	50.2	84.4	-34.2
1350.00	H	270.0	1.0	58.7	-14.2	44.5	84.4	-39.9
1800.00	V	180.0	1.0	67.5	-9.0	58.5	84.4	-25.9
1800.00	H	135.0	1.0	63.6	-9.0	54.6	84.4	-29.8
2250.00	V	180.0	1.0	63.8	-6.8	57.0	84.4	-27.4
2250.00	H	180.0	1.0	47.5	-6.8	40.7	84.4	-43.7
2700.00	V	225.0	1.0	57.1	-6.9	50.2	84.4	-34.2
2700.00	H	225.0	1.0	56.7	-6.9	49.8	84.4	-34.6
3150.00	V	180.0	1.0	48.3	-6.8	41.5	84.4	-42.9
3150.00	H	180.0	1.0	46.0	-6.8	39.2	84.4	-45.2
3600.00	V	180.0	1.0	57.5	-5.8	51.7	84.4	-32.7
3600.00	H	225.0	1.0	54.8	-5.8	49.0	84.4	-35.4
4050.00	V	0.0	1.0	36.5	-5.1	31.4	84.4	-53.0
4050.00	H	180.0	1.0	36.1	-5.1	31.0	84.4	-53.4
4500.00	V	180.0	1.0	43.4	-4.1	39.3	84.4	-45.1
4500.00	H	180.0	1.0	42.0	-4.1	37.9	84.4	-46.5
<i>Channel 12 (470 MHz)</i>								
940.00	V	135.0	1.5	27.6	32.5	60.1	84.4	-24.3
940.00	H	0.0	2.0	26.7	32.5	59.2	84.4	-25.2
1410.00	V	0.0	1.0	61.0	-13.0	48.0	84.4	-36.4
1410.00	H	270.0	1.0	59.4	-13.0	46.4	84.4	-38.0
1880.00	V	180.0	1.0	64.7	-8.0	56.7	84.4	-27.7
1880.00	H	180.0	1.0	58.5	-8.0	50.5	84.4	-33.9
2350.00	V	180.0	1.0	61.0	-6.7	54.3	84.4	-30.1
2350.00	H	180.0	1.0	54.6	-6.7	47.9	84.4	-36.5
2820.00	V	180.0	1.0	57.3	-7.0	50.3	84.4	-34.1
2820.00	H	180.0	1.0	53.5	-7.0	46.5	84.4	-37.9
3290.00	V	135.0	1.0	46.5	-6.5	40.0	84.4	-44.4
3290.00	H	225.0	1.0	46.5	-6.5	40.0	84.4	-44.4
3760.00	V	180.0	1.0	52.0	-5.4	46.6	84.4	-37.8
3760.00	H	225.0	1.0	49.9	-5.4	44.5	84.4	-39.9
4230.00	V	225.0	1.0	35.4	-4.6	30.8	84.4	-53.6
4230.00	H	0.0	1.0	36.6	-4.6	32.0	84.4	-52.4

EMR Corporation
 M7G-UHF 450-70
 WLL Project # 4717X

Table 1 (cont'd.)

FCC Part 90 Class B 3M Radiated Emissions Data - Site 2

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (QP) dBuV	Afc dB/m	E-Field dBuV/m	Limit dBuV/m	Margin dB
<i>Channel 12 (470 MHz) cont'd.</i>								
4700.00	V	180.0	1.0	39.6	-3.6	36.0	84.4	-48.4
4700.00	H	180.0	1.0	42.2	-3.6	38.6	84.4	-45.8
<i>Channel 13 (490 MHz)</i>								
980.00	V	0.0	1.5	28.0	32.7	60.7	84.4	-23.7
980.00	H	180.0	2.0	22.9	32.7	55.6	84.4	-28.8
1470.00	V	180.0	1.0	56.9	-12.5	44.4	84.4	-40.0
1470.00	H	270.0	1.0	56.5	-12.5	44.0	84.4	-40.4
1960.00	V	180.0	1.0	64.2	-7.0	57.2	84.4	-27.2
1960.00	H	180.0	1.0	56.6	-7.0	49.6	84.4	-34.8
2450.00	V	180.0	1.0	45.5	-6.7	38.8	84.4	-45.6
2450.00	H	180.0	1.0	35.0	-6.7	28.3	84.4	-56.1
2940.00	V	180.0	1.0	71.8	-7.1	64.7	84.4	-19.7
2940.00	H	225.0	1.0	67.8	-7.1	60.7	84.4	-23.7
3430.00	V	225.0	1.0	65.0	-6.1	58.9	84.4	-25.5
3430.00	H	180.0	1.0	67.3	-6.1	61.2	84.4	-23.2
3920.00	V	180.0	1.0	44.1	-5.3	38.8	84.4	-45.6
3920.00	H	270.0	1.0	43.8	-5.3	38.5	84.4	-45.9
4410.00	V	0.0	1.0	48.8	-4.2	44.6	84.4	-39.8
4410.00	H	0.0	1.0	47.0	-4.2	42.8	84.4	-41.6
4900.00	V	180.0	1.0	32.6	-3.1	29.5	84.4	-54.9
4900.00	H	180.0	1.0	41.2	-3.1	38.1	84.4	-46.3

3.6 Frequency Stability (FCC Rule Part 2.995)

The requirements of Section 2.995 call for the carrier frequency to be stable under different power supply voltages and over a wide temperature extreme. The amplifier was not tested for frequency stability as it's purpose is only to amplify the signal from the transmitter.

3.7 Transient Frequency Behavior (FCC Part 90.214)

The requirements of Section 90.214 call out transient frequency behavior for the carrier frequency. The amplifier was not tested for the transient frequency behavior since it's purpose is to amplify the signal from the transmitter module and not produce a carrier frequency.

Table 2

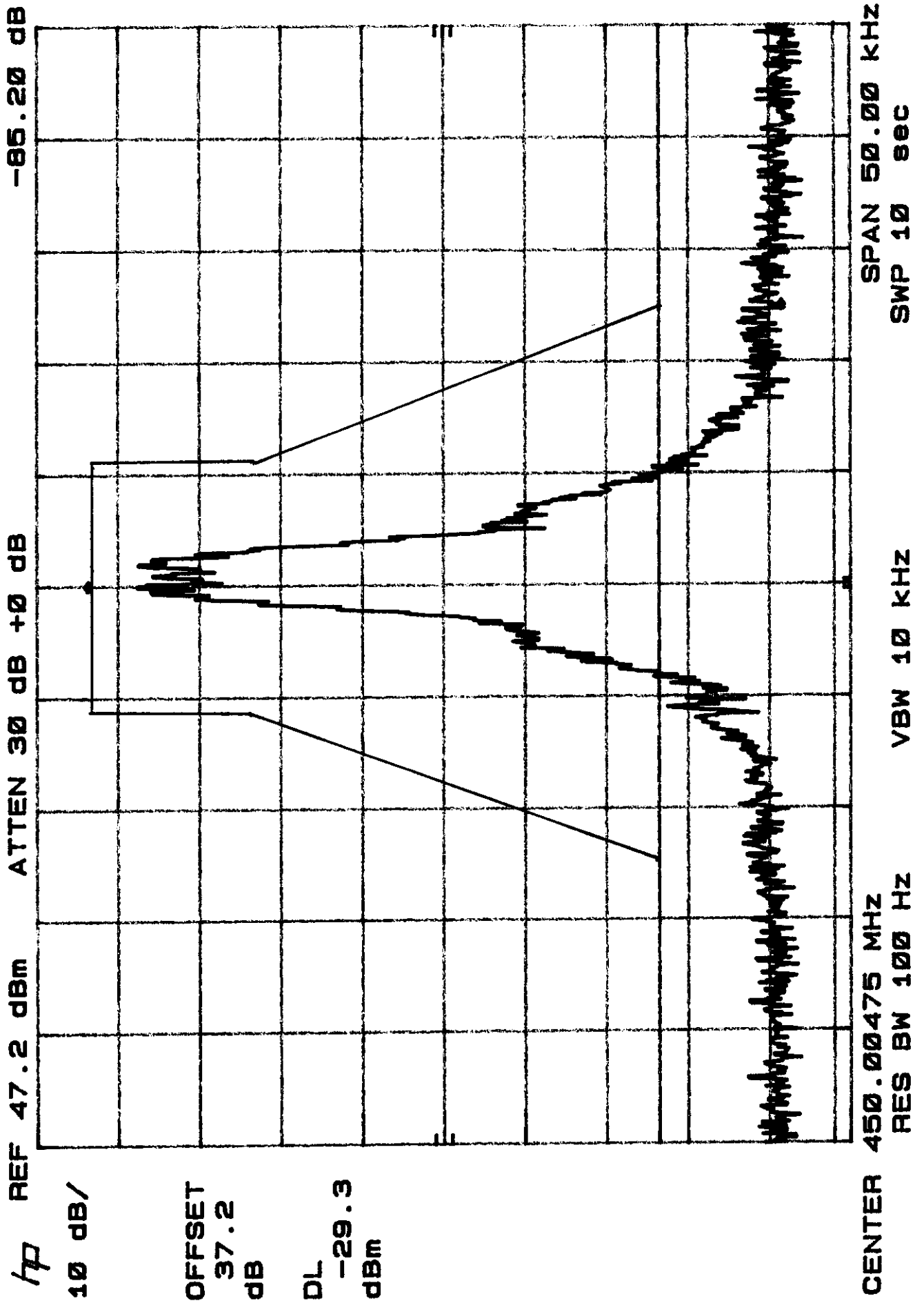
EMC Test Equipment Calibration Information

Equipment	Serial Number	Date Calibrated	Calibration Due
Antenna Research Associates, Inc. Biconical Log Periodic Antenna LPB-2520 (Site 1)	044	6/5/98	6/5/99
Antenna Research Associates, Inc. Biconical Log Periodic Antenna LPB-2520A (Site 2)	1118	10/1/97	10/1/98
Antenna Research Associates, Inc. Horn Antenna DRG-118/A	1010	9/9/98	9/9/99
Boonton Modulation Meter 82AD/01A/S10/S13	167219	4/28/98	4/28/99
Dressler Coupling/Decoupling Network CDN-T2	9607004B	10/15/97	10/15/98
Dressler Coupling/Decoupling Network CDN-M2	9606003B	10/15/97	10/15/98
Dressler Coupling/Decoupling Network CDN-M3	9607013B	10/15/97	10/15/98
Dressler Coupling/Decoupling Network CDN-S1	9609002B	10/15/97	10/15/98
Dressler Coupling/Decoupling Network CDN-S9	9610003C	10/15/97	10/15/98
Dressler Coupling/Decoupling Network CDN-S25	9612001C	10/15/97	10/15/98
Electromechanics Company Model 3301B Active Rod Antenna	2428	4/14/98	4/14/99
Electromechanics Company Model 3104P Biconical Antenna	3192	6/5/98	6/5/99
Electromechanics Company Biconical Antenna Model 3110B	1078	6/5/98	6/5/99
Electromechanics Company Biconilog Antenna Model 3143	1184	11/9/95	N/A
Electromechanics Company Log Periodic Antenna Model 3146A	1129	6/5/98	6/5/99
Electromechanics Company Log Periodic Antenna Model 3146	1709	6/5/98	6/5/99
Electromechanics Company Field Probe Set Model 7122	9202-1094	10/17/97	10/17/98
Electromechanics Company 8116-50-TS-100-N	962509	9/4/98	9/4/99
Electromechanics Company 8116-50-TS-100-N	962510	9/4/98	9/4/99
Electromechanics Company 8116-50-TS-100-N	962507	9/4/98	9/4/99
Electromechanics Company 8116-50-TS-100-N	962508	9/4/98	9/5/99
ENI 50 Watt Power Amplifier: 550LA	9306311	N/A	N/A
Fischer Custom Communications EM Injection Clamp F-2031	266	3/17/98	3/17/99
Haefely PEFT Generator Model PEFT.1	081 979-10	7/01/98	7/01/99
Haefely PSD 25B Electrostatic Discharge Simulator	082597-35	9/19/97	9/19/98
Haefely PSURGE 6.1 Surge Generator with Haefely PHV 30.2 Hybrid Network. With 16.1 Coupling/Decoupling Network	083295-08	9/23/97	9/23/98
Hewlett-Packard Preamplifier: HP 8447D	2727A06203	5/21/98	5/21/99
Hewlett-Packard Preamplifier: HP 8449B	3008A00729	11/20/97	11/20/98
Hewlett-Packard Quasi-Peak Adapter: HP 85650A (Site 1)	2811A01283	8/5/98	8/5/99
Hewlett-Packard Quasi-Peak Adapter: HP 85650A (Site 2)	3303A01786	6/24/98	6/24/99
Hewlett-Packard RF Preselector: HP 85685A (Site 1)	2817A00744	8/5/98	8/5/99
Hewlett-Packard RF Preselector: HP 85685A (Site 2)	3221A01395	6/24/99	6/24/99
Hewlett-Packard Function Generator: 3312A	1432A12339	5/13/96	N/A
Hewlett-Packard Spectrum Analyzer: HP 8564E	3643A00657	7/21/98	7/21/99
Hewlett-Packard Spectrum Analyzer: HP 8568B (Site 2)	2926U07140	6/24/98	6/24/99
Hewlett-Packard Spectrum Analyzer: HP 8568B (Site 1)	2928A04750	8/5/98	8/5/99
Hewlett-Packard Spectrum Analyzer: HP 8593A	3009A00739	6/15/98	6/15/99
Hewlett-Packard Signal Generator: HP 8656B	2926U8140	9/9/98	9/9/99
Hewlett-Packard Signal Generator: HP 8648C	3347A00242	5/20/98	5/20/99
Instruments for Industry 100 Watt Amplifier: SMX100	2095-0896	N/A	N/A
Kalmus 100 Watt Amplifier: 757LCB-CE	8256-1	N/A	N/A
KeyTek ECAT System w/E411, E4552 and E501 Modules	9305232	12/8/97	12/8/98
KeyTek ESD Simulator: MZ-15/EC	9604310	4/28/98	4/28/99
Kikusui PCR 2000L AC Power Supply	15030820	7/8/98	7/8/99
Racal Dana Frequency Counter 1992 S/N:	2806	2/19/98	2/19/99
Solar Electronics Current Probe 9215-1N	935005	1/19/98	1/19/99
Solar Electronics LISN 8012-50-R-24-BNC	8379493	8/13/98	8/13/99
Solar Electronics LISN 8028-50-TS-24-BNC	N/A	8/13/98	8/13/99
Solar Electronics LISN 8028-50-TS-24-BNC	N/A	8/13/98	8/13/99
Tektronix Oscilloscope TDS-540	B0101162	4/22/98	4/22/99
Wandel & Goltermann E-Field Probe Model EMR-200	K-0024	6/15/98	6/15/99
WLL S1 Coupling Network	CN01	10/15/97	10/15/98

APPENDIX A1

SPURIOUS EMISSIONS AT ANTENNA OUTPUT TERMINAL PLOT - 450 MHz

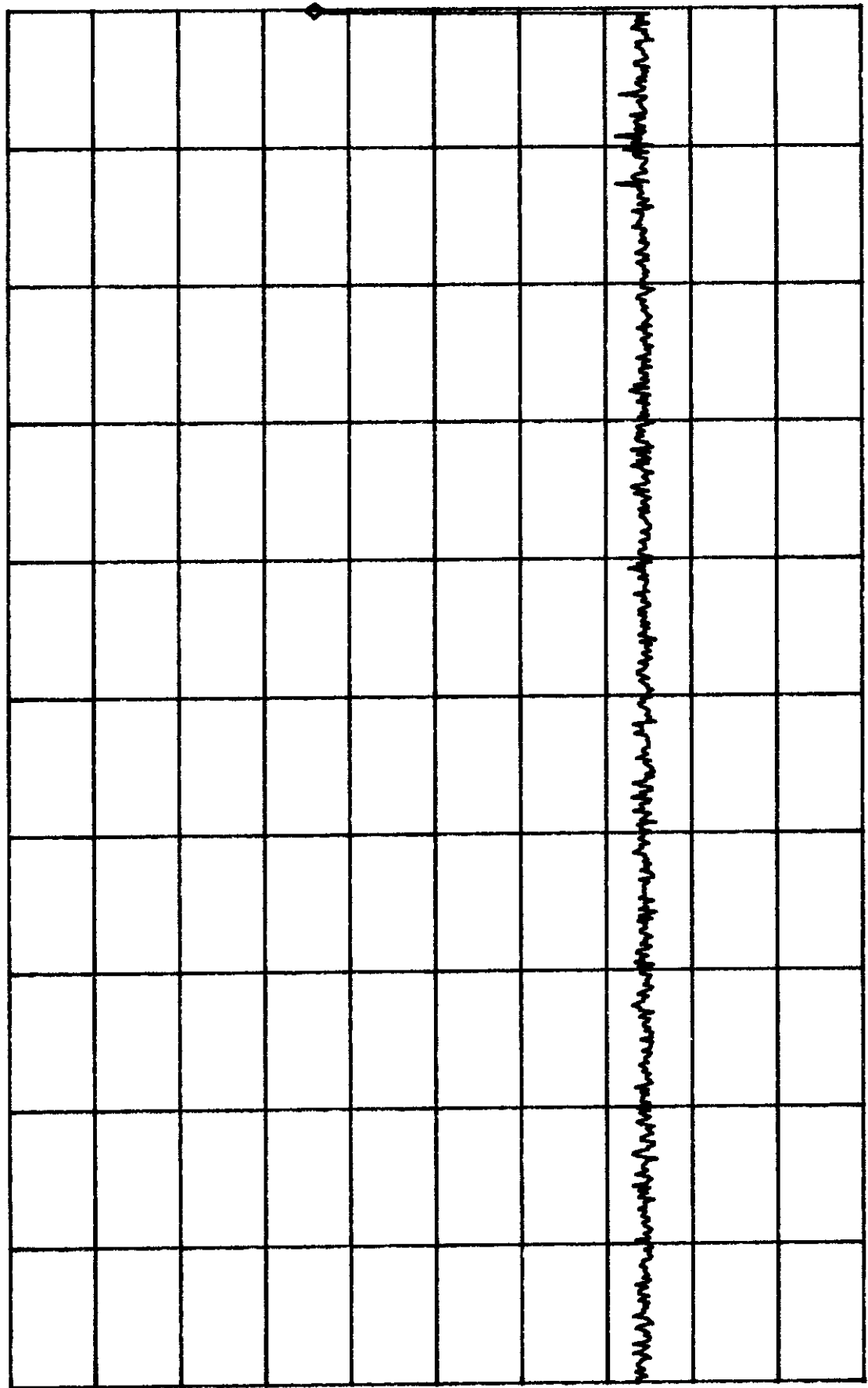
15 Sept. 98
CH11 @ 450 MHz
MKR Δ 12.50 KHz
-85.20 dB



ATTEN 20dB
RL 40.0dBm

MKR 3.00dBm
450.0MHz

10dB/



R

START 30.0MHz STOP 450.0MHz
*RBW 100kHz *VBW 30kHz SWP 350ms

80598

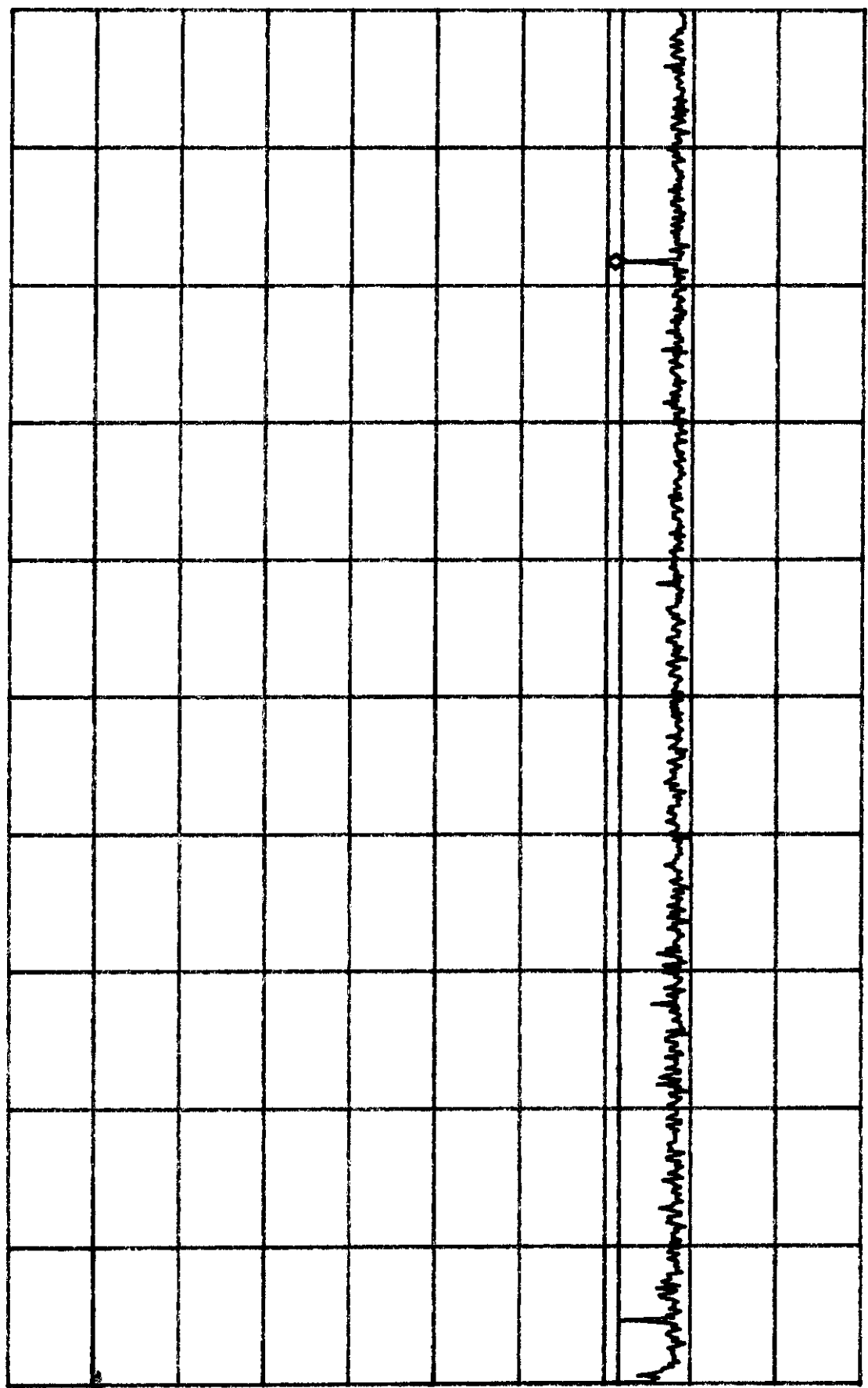
EMA RF AMP TX @ 450 MHz 4717H
MKR -20.16dBm

*ATTEN 20dB

RL 51.8dBm

10dB/

900.1MHz



R

START 450.0MHz STOP 1.0000GHz

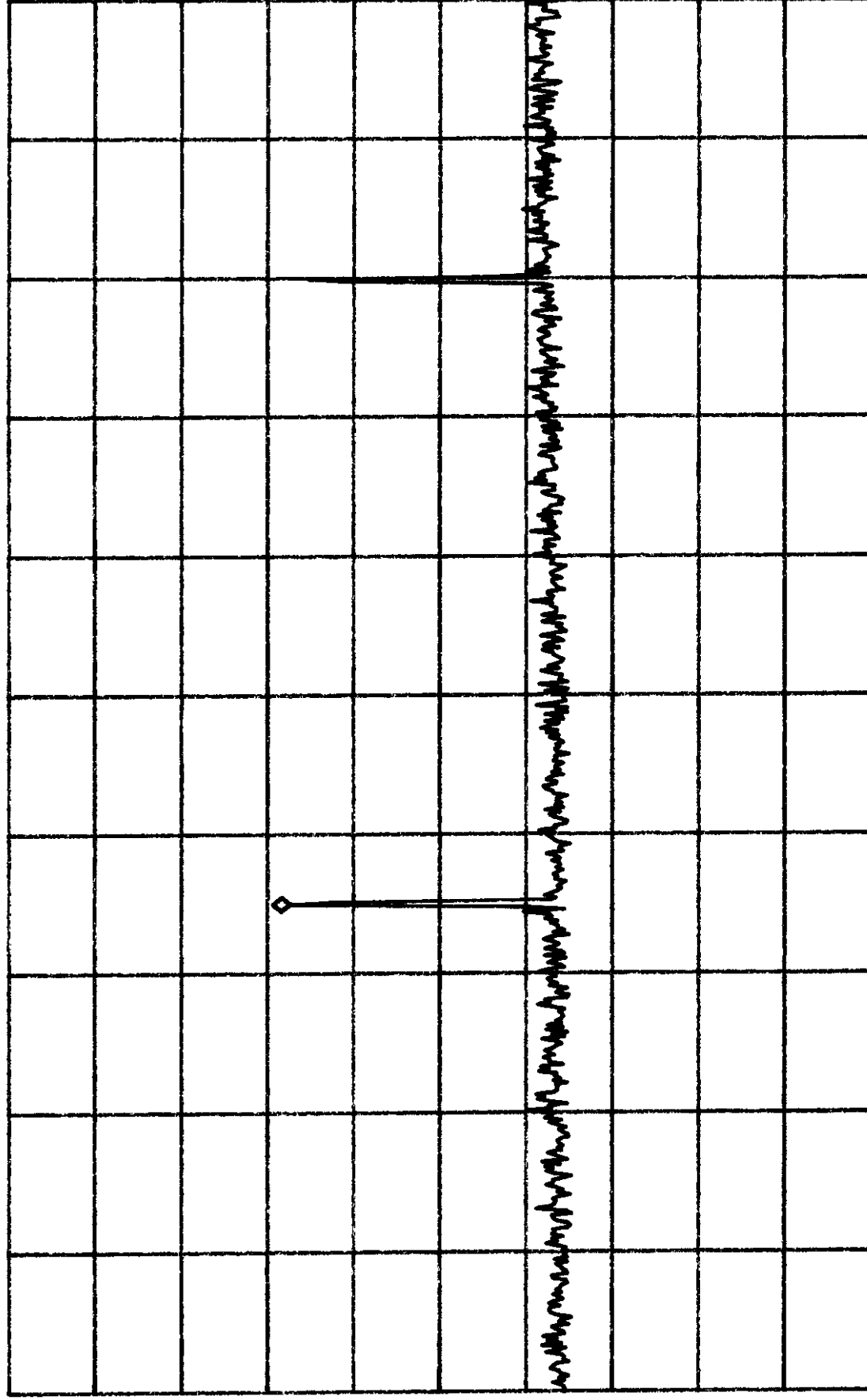
*RBW 100kHz *VBW 100kHz SWP 140ms

8 Oct 98
EMR RF AMP @ 450MHz TX 4717H
MKR -26.33dBm
1.350GHz

*ATTEN 0dB

RL -10.0dBm

5dB/



R

START 1.000GHz

STOP 2.000GHz

*RBW 1.0MHz

*VBW 1.0MHz

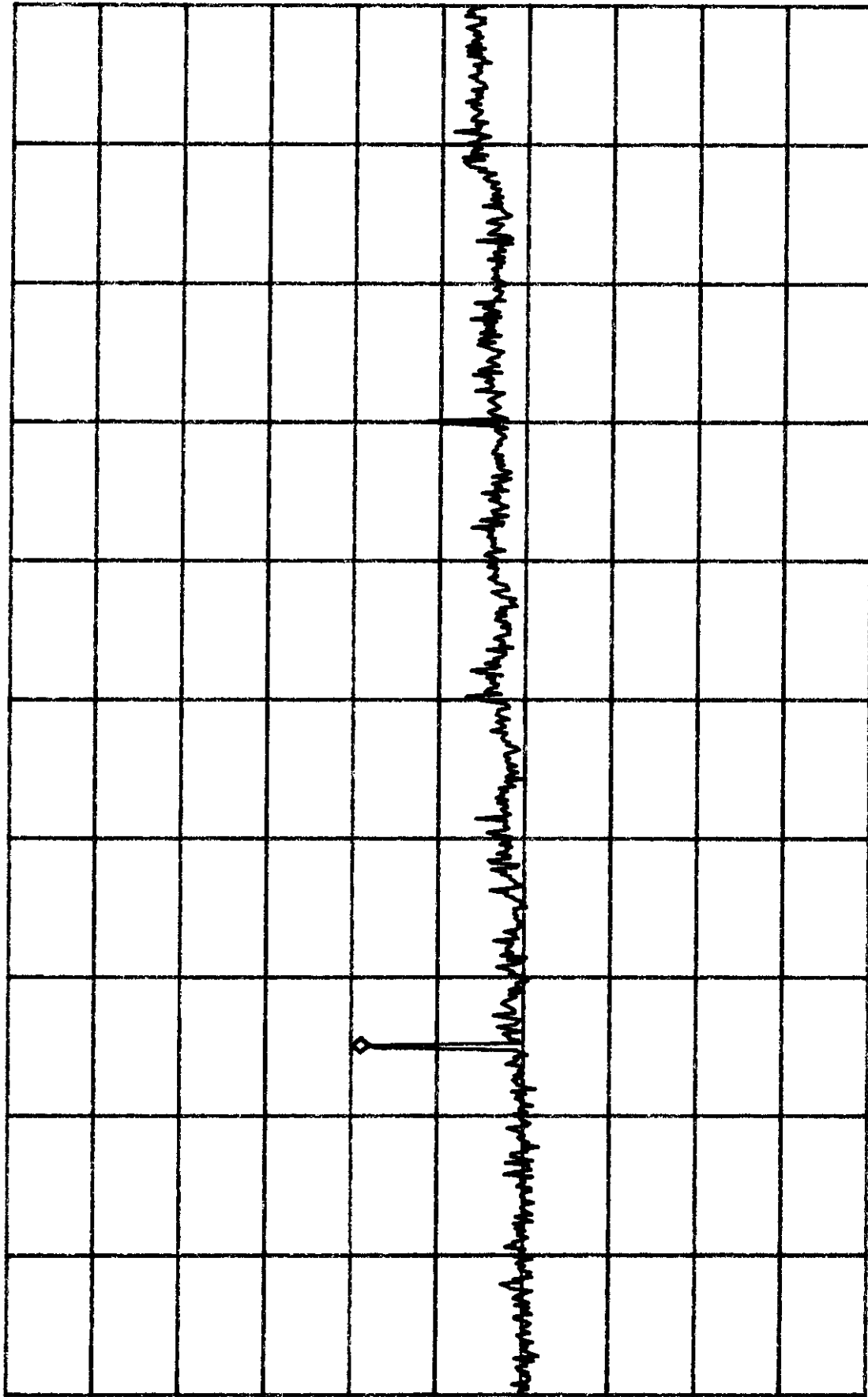
SWP 50.0ms

80098
EMR AF AMP TX @ 450MHz 47174
MKR -31.08dBm
2.252GHz

*ATTEN 0dB

RL -10.0dBm

5dB/



D

R

START 2.000GHz

STOP 3.000GHz

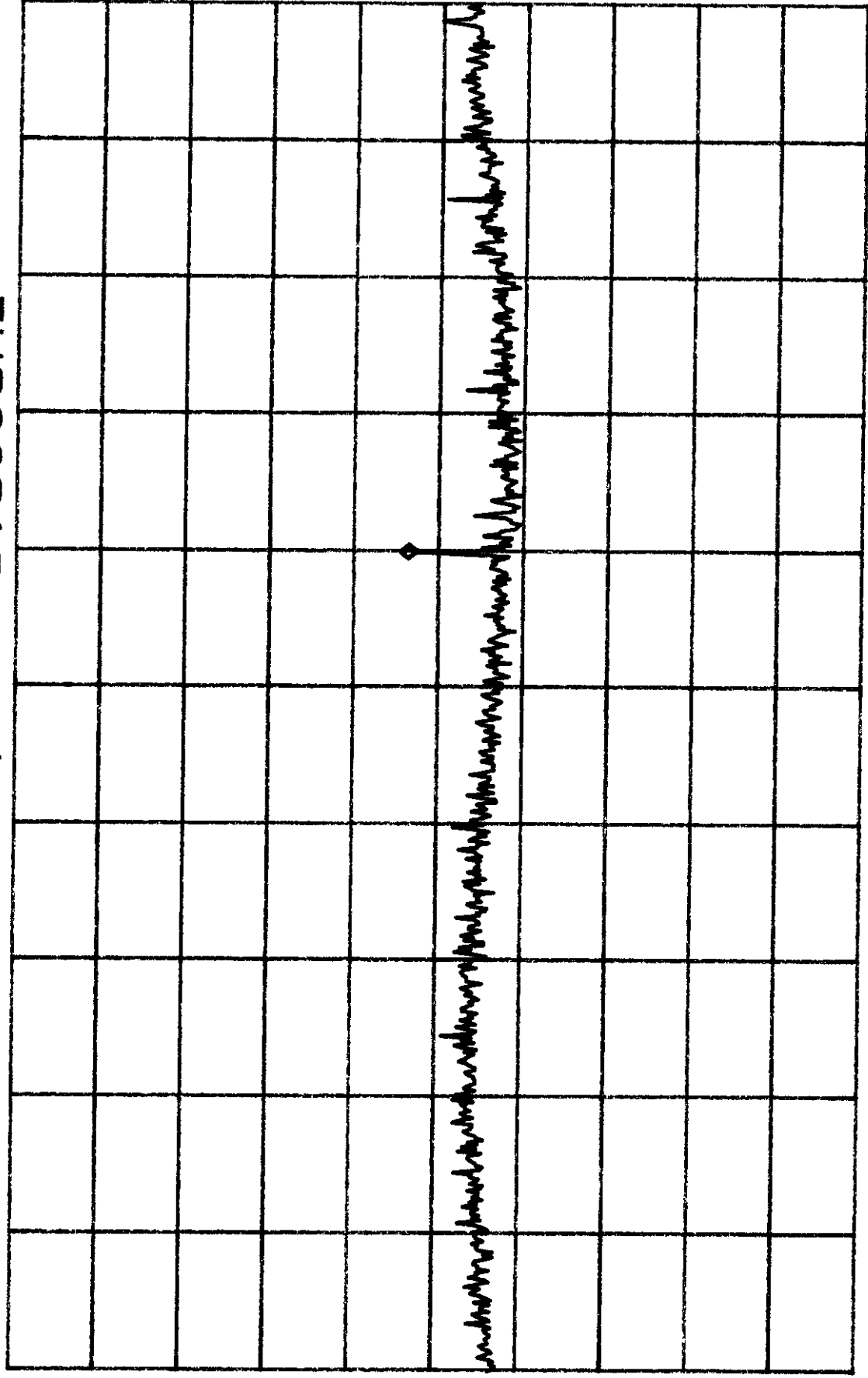
*RBW 1.0MHz

*VBW 1.0MHz

SWP 50.0ms

Oct 8, 98
EMR RF AMP TX @ 450MHz 47174
MKR -33.75dBm
3.600GHz

*ATTEN 0dB
RL -10.0dBm 5dB/



R

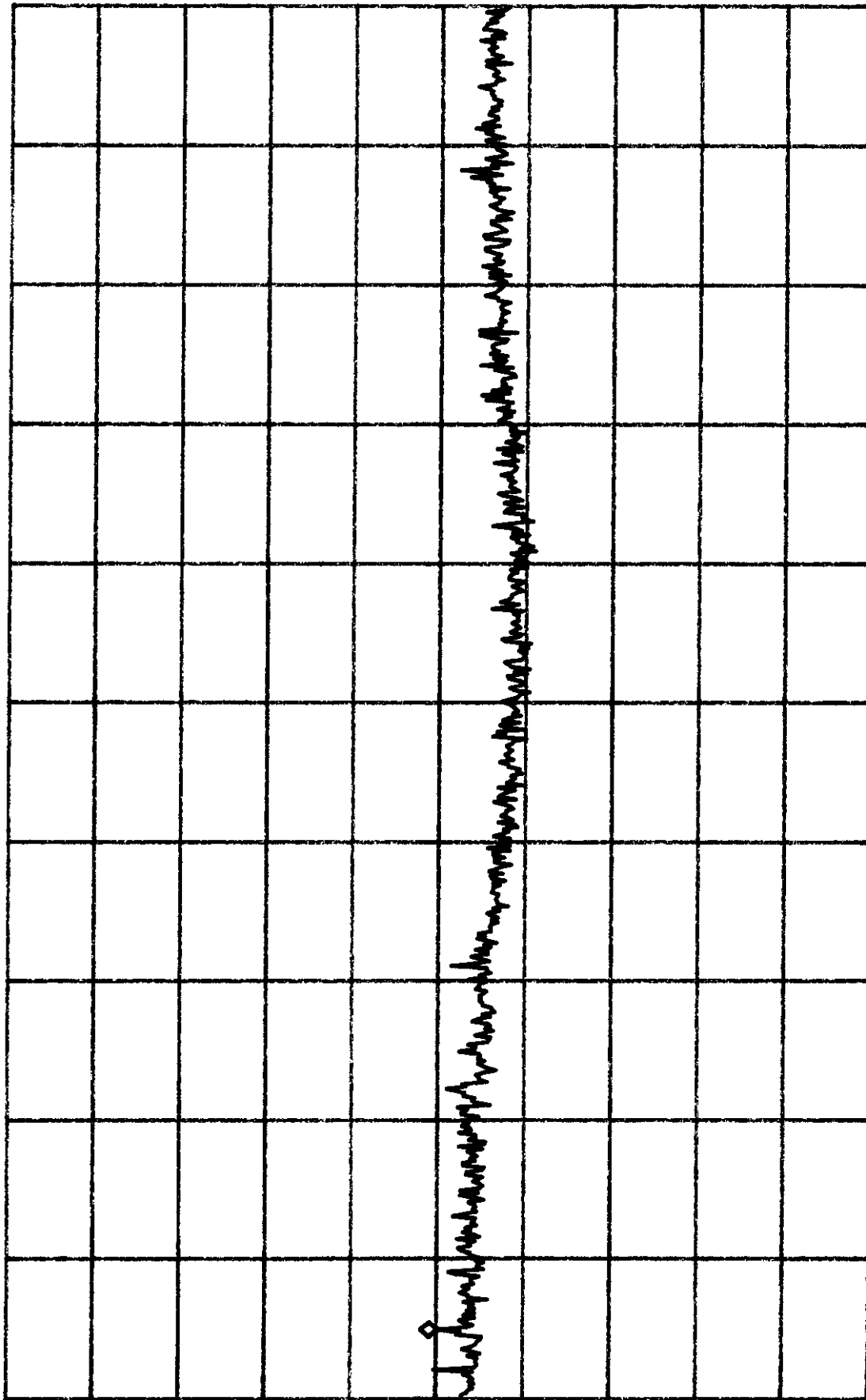
START 3.000GHz STOP 4.000GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

80598
CHR RF AMP TX @ 450MHz 4717H
MKR -35.08dBm
4.050GHZ

*ATTEN 0dB

RL -10.0dBm

5dB/



R

START 4.000GHZ

STOP 5.000GHZ

*RBW 1.0MHz

*VBW 1.0MHz

SWP 50.0ms

APPENDIX A2

SPURIOUS EMISSIONS AT ANTENNA OUTPUT TERMINAL PLOT – 470 MHz

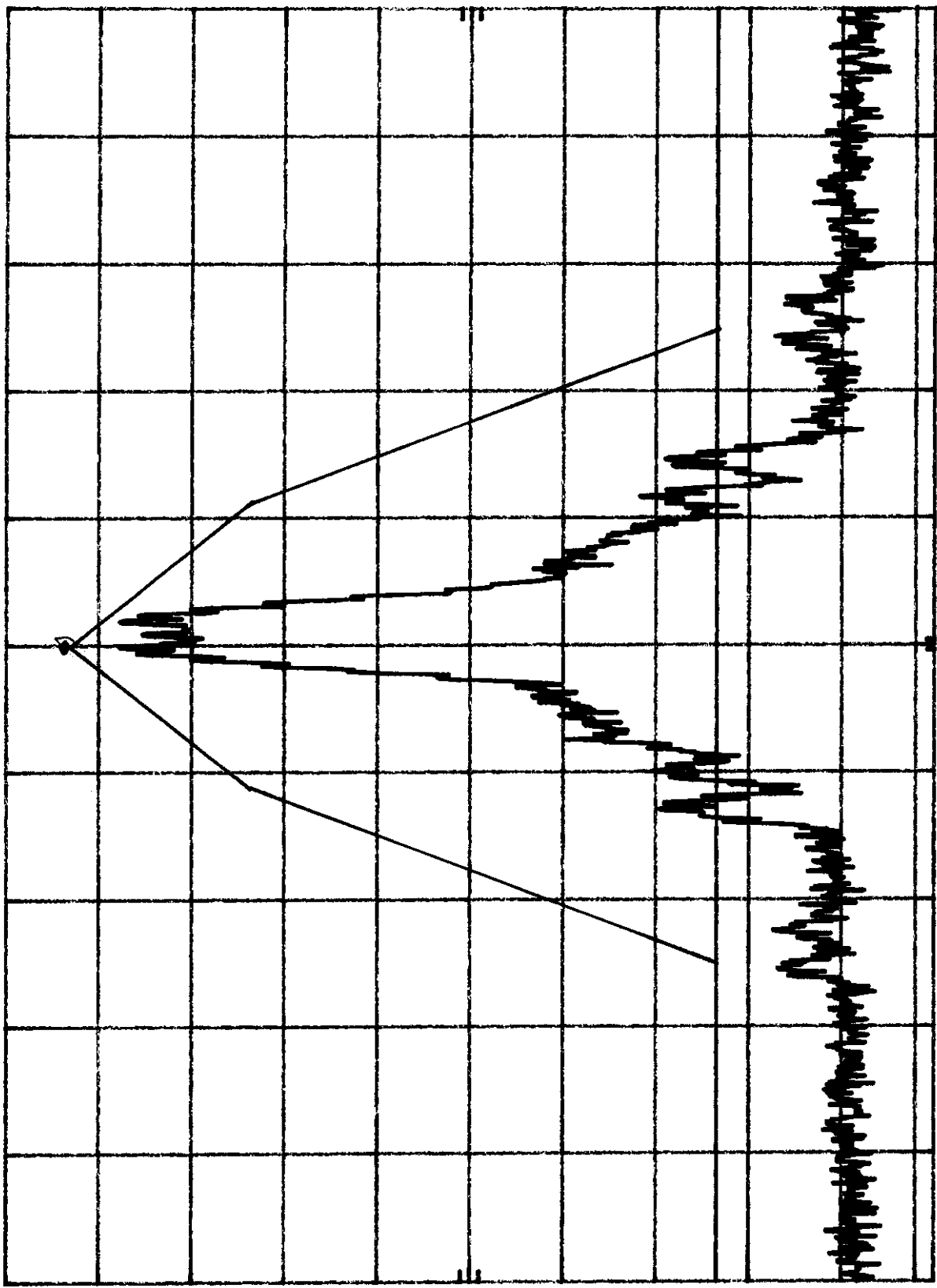
15 SEPT 98
CH 12 @ 470 MHz
MKR Δ 12.50 KHZ
-83.70 dB

hp REF 47.2 dBm ATTN 30 dB +0 dB

10 dB/

OFFSET
37.2
dB

DL
-29.4
dBm

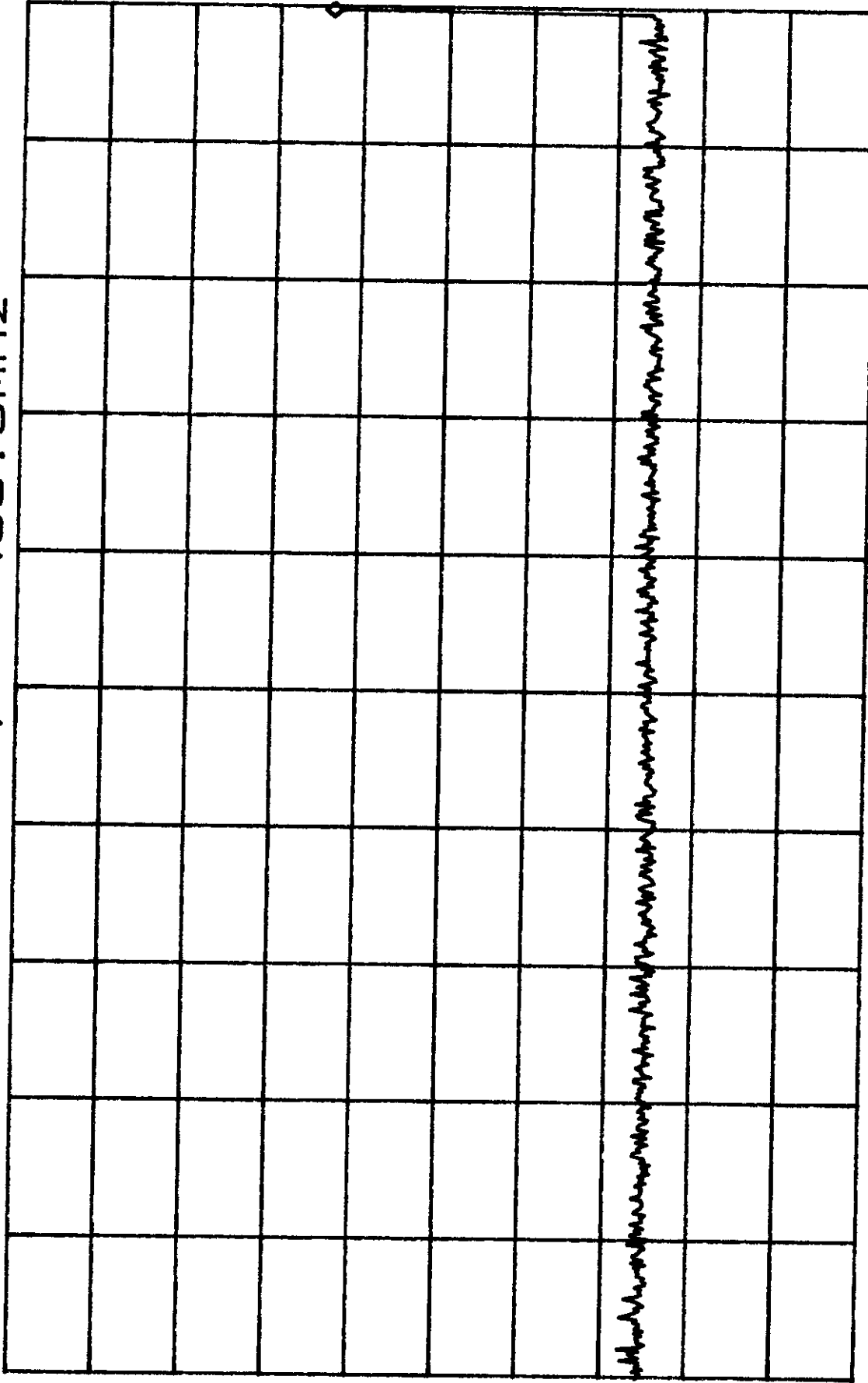


CENTER 470.00500 MHz
RES BW 100 Hz
SPAN 50.00 KHZ
SWP 10 sec
VBW 10 KHZ

ATTEN 20dB
RL 40.0dBm

MKR 2.67dBm
469.3MHz

10dB/



R

START 30.0MHz

STOP 470.0MHz

*RBW 100kHz

*VBW 30kHz

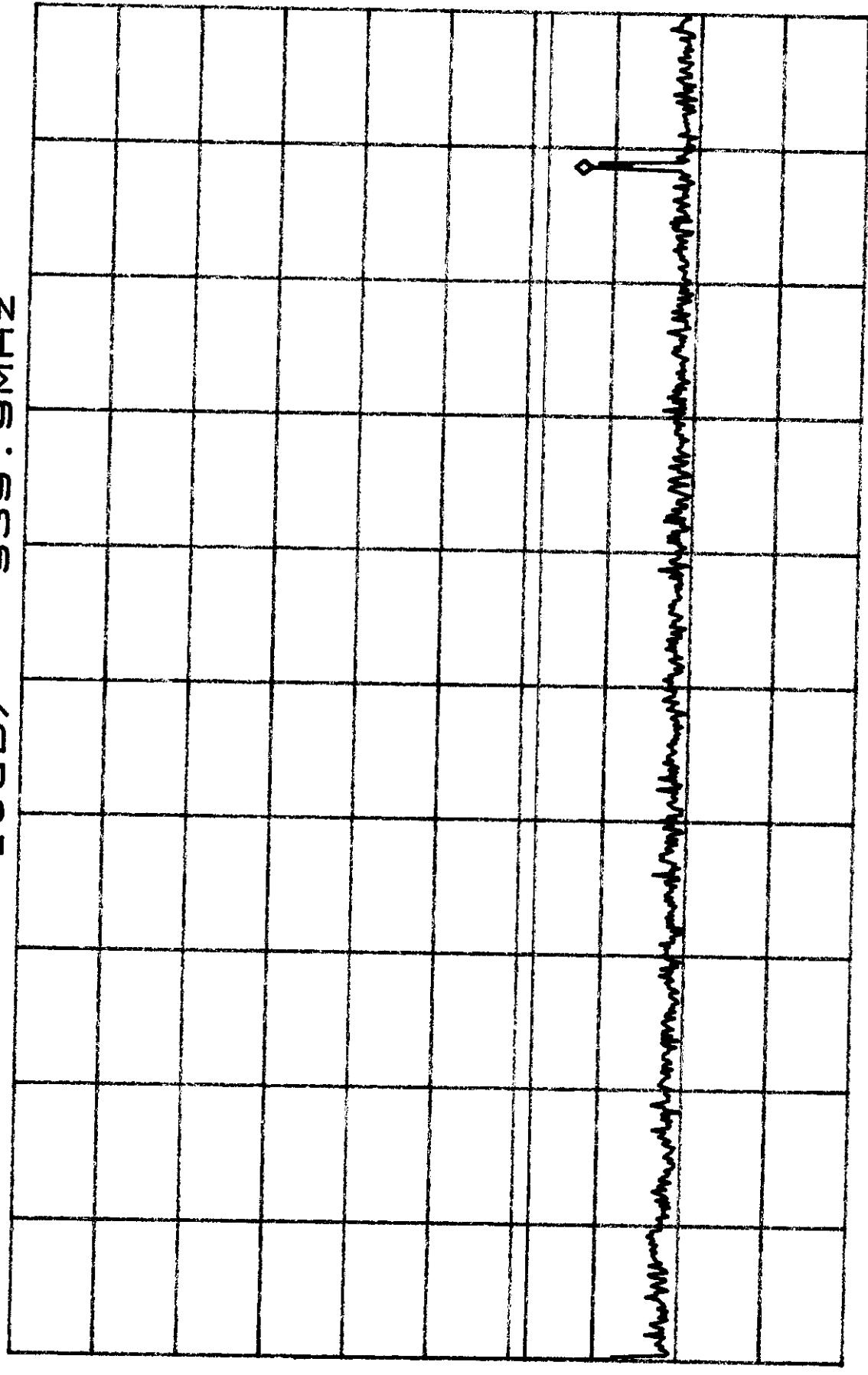
SWP 370ms

90098

EMR RF AMP TX @ 470 MHz 4707H
MKR -25.17dBm
939.9MHz

*ATTEN 10dB
RL 42.0dBm

10dB/

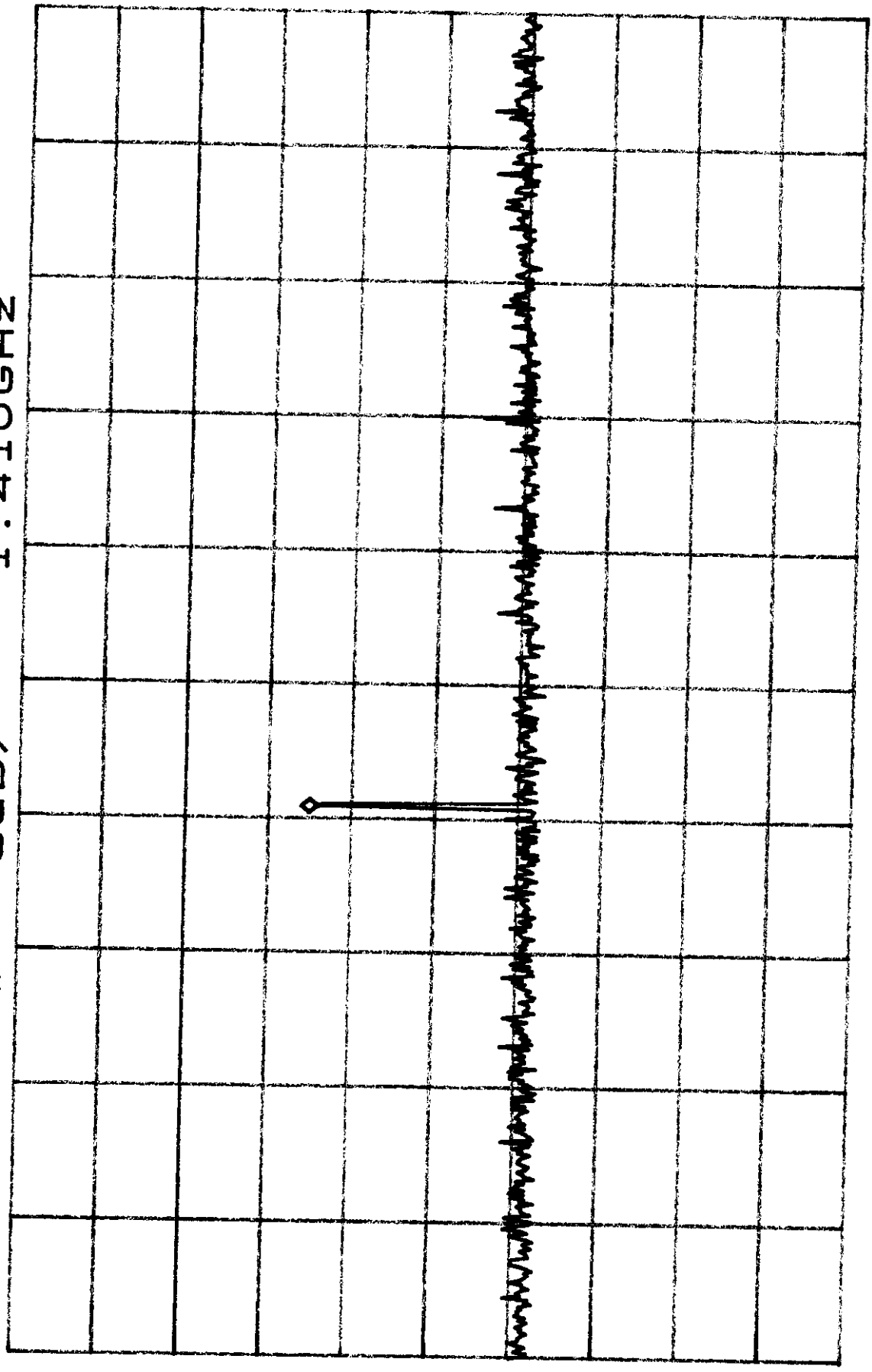


START 470.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 100kHz SWP 140ms

8 OCT 98
EMR RF AMP TX @ 470 MHz 47174
MKR -28.00dBm
1.410GHz

*ATTEN 0dB
RL -10.00dBm

5dB/



R

START 1.000GHz STOP 2.000GHz
*RBW 1.0MHz *VBW 3.0MHz SWP 50.0ms

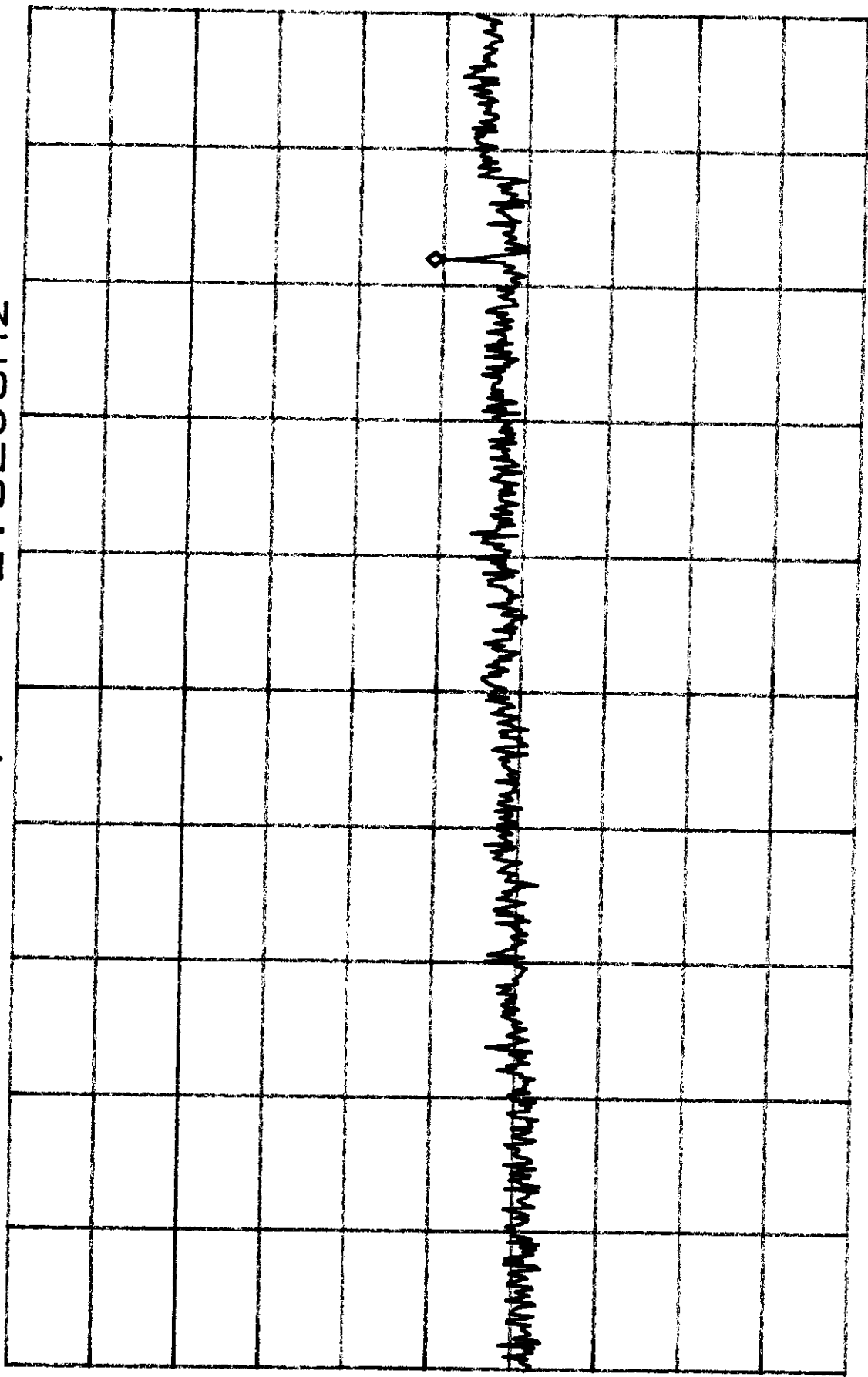
80098

ENR RF AMP TX @ 470MHz 4717H
MKR -35.00dBm
2.820GHz

*ATTEN 0dB

RL -10.0dBm

5dB/



R

START 2.000GHz

STOP 3.000GHz

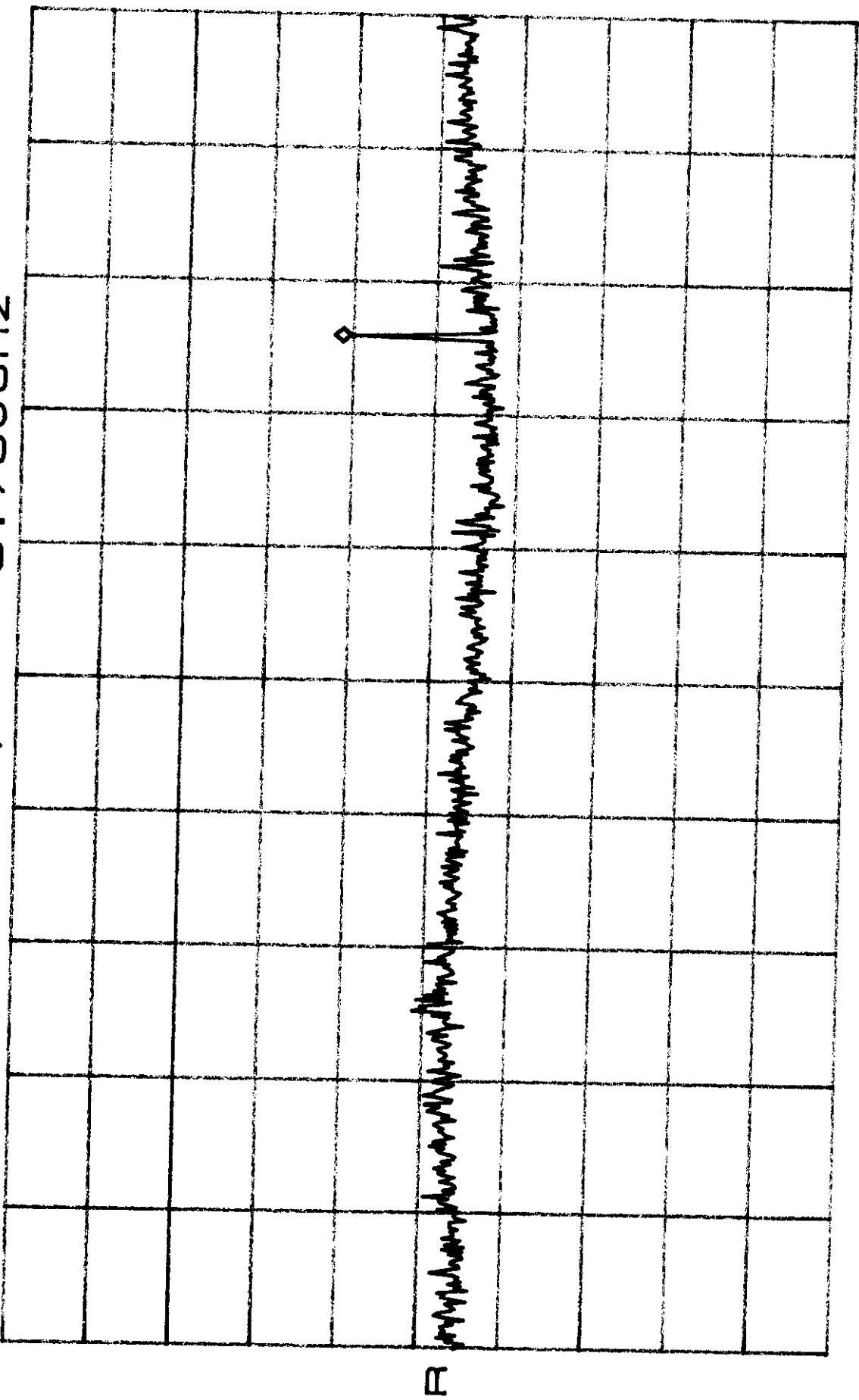
*RBW 1.0MHz

*VBW 3.0MHz

SWP 50.0ms

80098
ENR RF AMP TX @ 470MHz 471TH
MKR -29.92dBm
3.760GHz

*ATTEN 0dB
RL -10.0dBm 5dB/

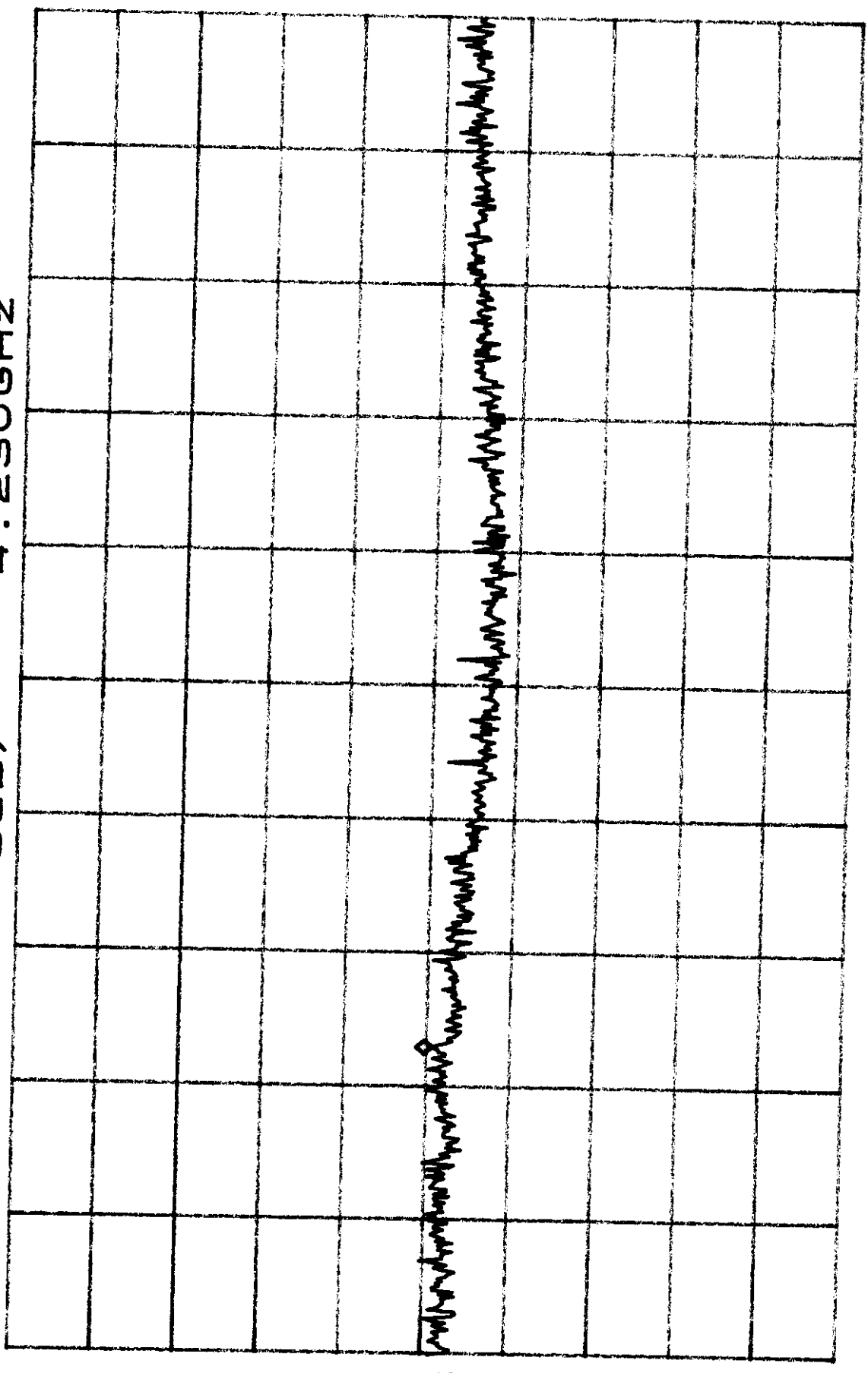


START 3.000GHz STOP 4.000GHz
*RBW 1.0MHz *VBW 3.0MHz SWP 50.0ms

8 Oct 98
EMR RF AMP TX @ 470MHz 47174
MKR -35.42dBm
4.230GHz

*ATTEN 0dB
RL -10.0dBm

5dB/



R

START 4.000GHz STOP 5.000GHz
*RBW 1.0MHz *VBW 3.0MHz SWP 50.0ms

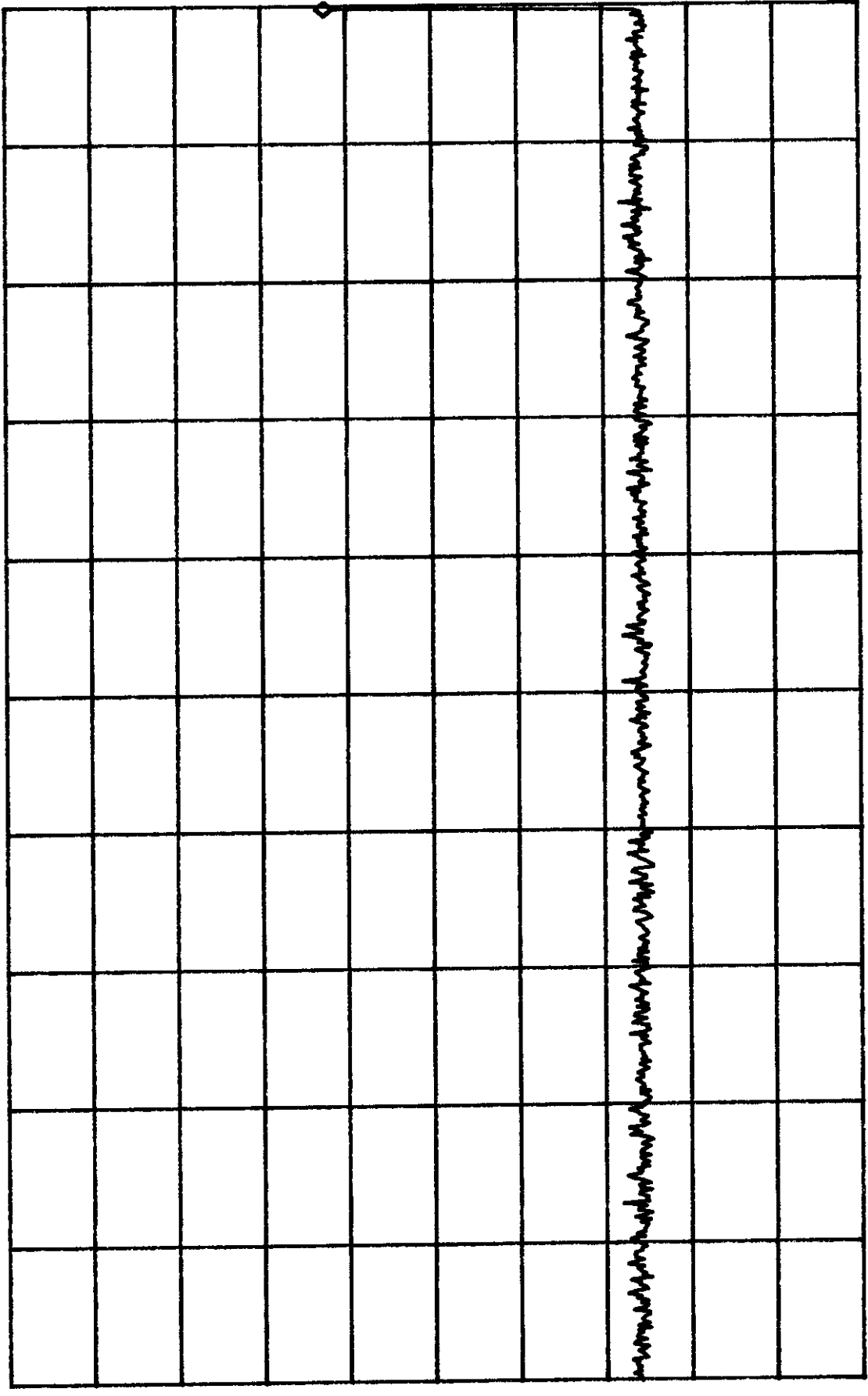
APPENDIX A3

SPURIOUS EMISSIONS AT ANTENNA OUTPUT TERMINAL PLOT – 490 MHz

ATTEN 20dB
RL 40.0dBm

MKR 1.50dBm
489.2MHz

10dB/



R

START 30.0MHz STOP 490.0MHz
*RBW 100kHz *VBW 30kHz SWP 390ms

15 Sept 98
CH13 @ 490 MHz

CH₁₃ @ 490MHz

MKR Δ 12.50 KHZ
-80.70 dB

-80.70 dB

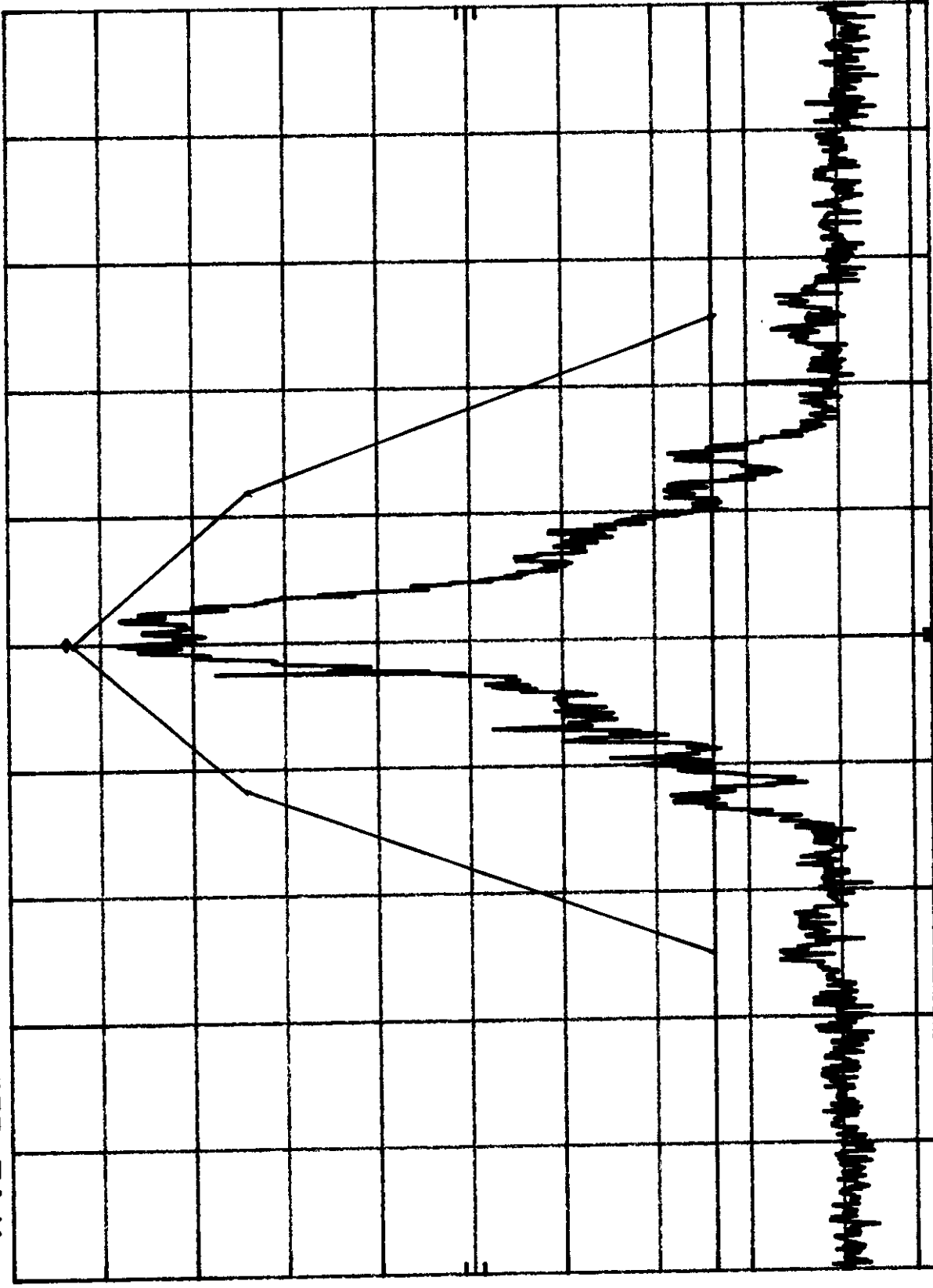


Д

10 dB/

OFFSET
37.2
dB

DL
-29.1
dBm



**CENTER 490.00515 MHZ
RES BW 100 HZ**

RES BW 100 Hz

VBW 10 KHZ

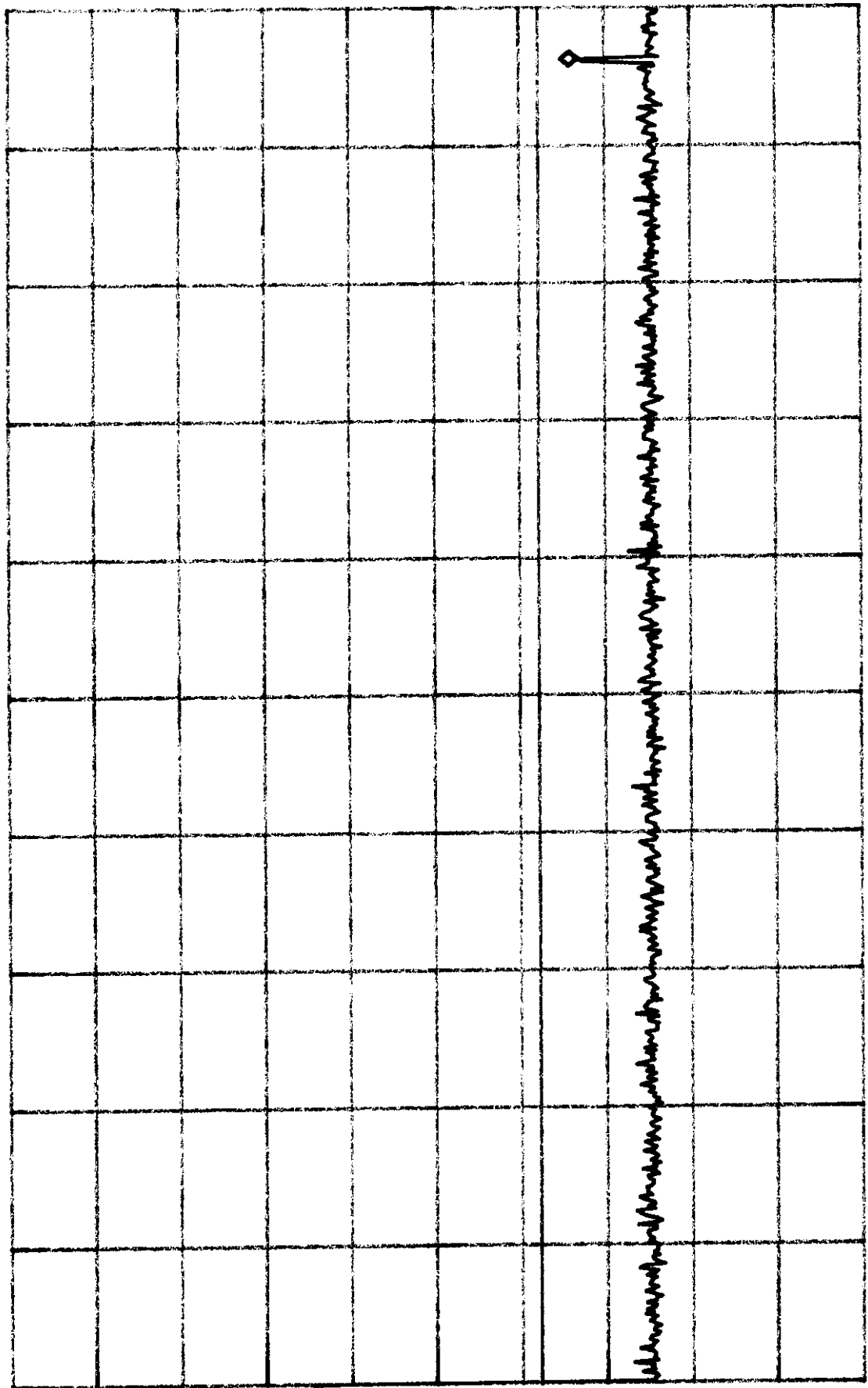
SPAN 50.00 KHZ
SWP 10 SEC

SWP 10 sec

80598
EMR RF AMP TX @ 490MHz 4717H
MKR -24.66dBm

*ATTEN 10dB
RL 42.3dBm

10dB/ 981.3MHz



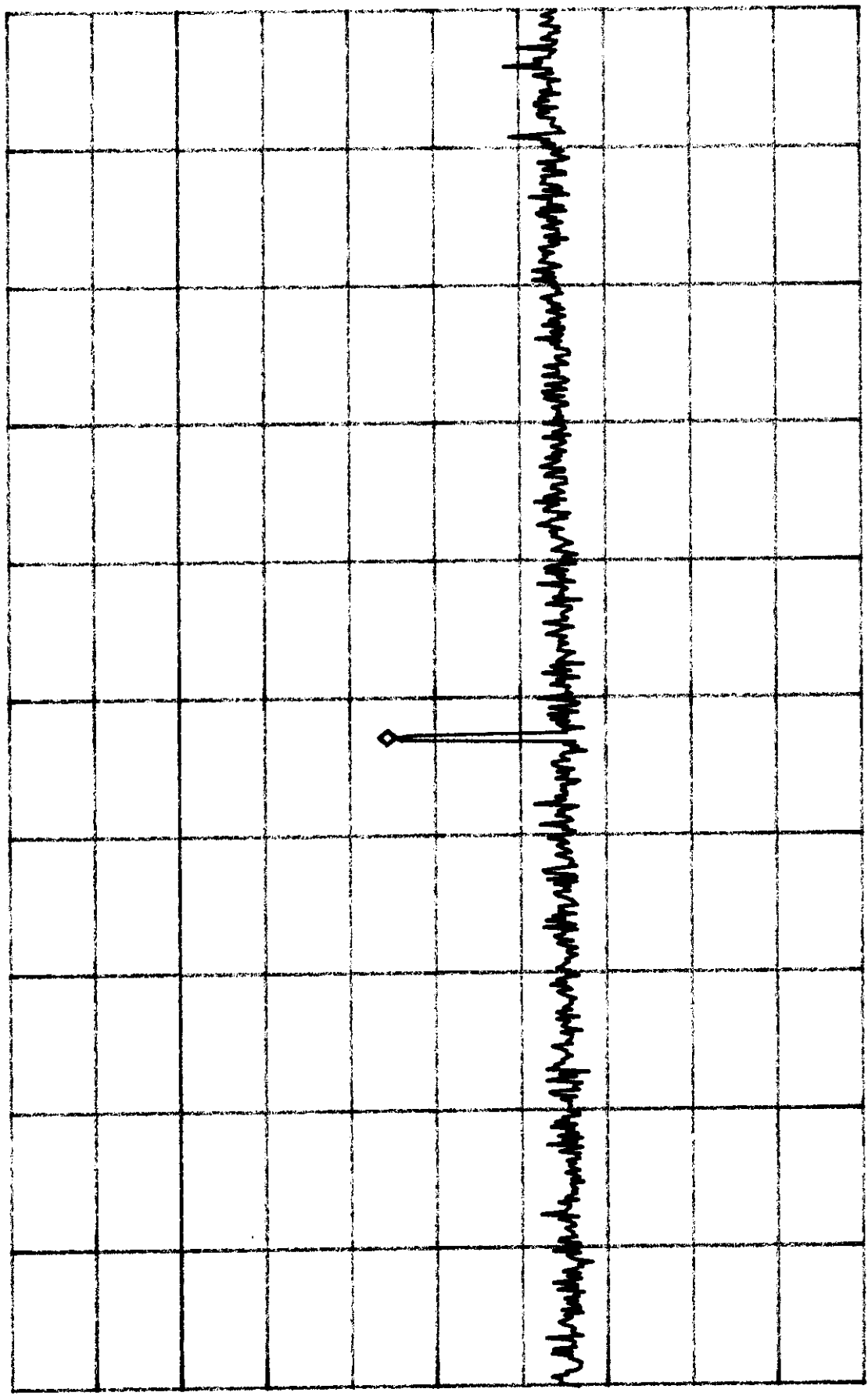
R

START 490.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 100kHz SWP 130ms

80098
EMR RF AMP TX @ 490MHz 47174
MKR -31.76dBm

*ATTEN 0dB
RL -9.0dBm

5dB/ 1.472GHz



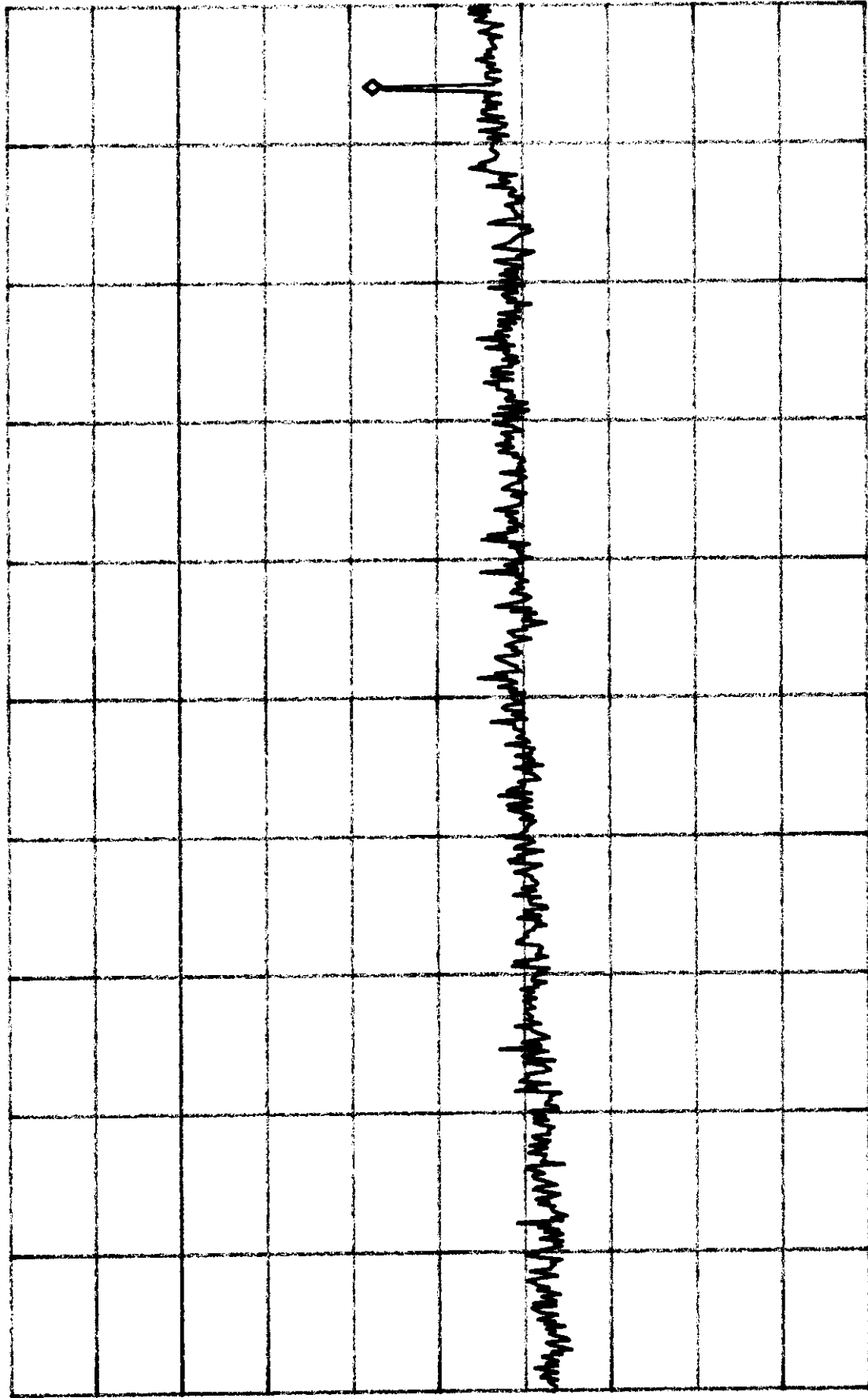
R

START 1.000GHz STOP 2.000GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

8 Oct 98
EHR RF AMP TX @ 490MHz 47174
MKR -31.83dBm
2.942GHz

*ATTEN 0dB
RL -9.2dBm

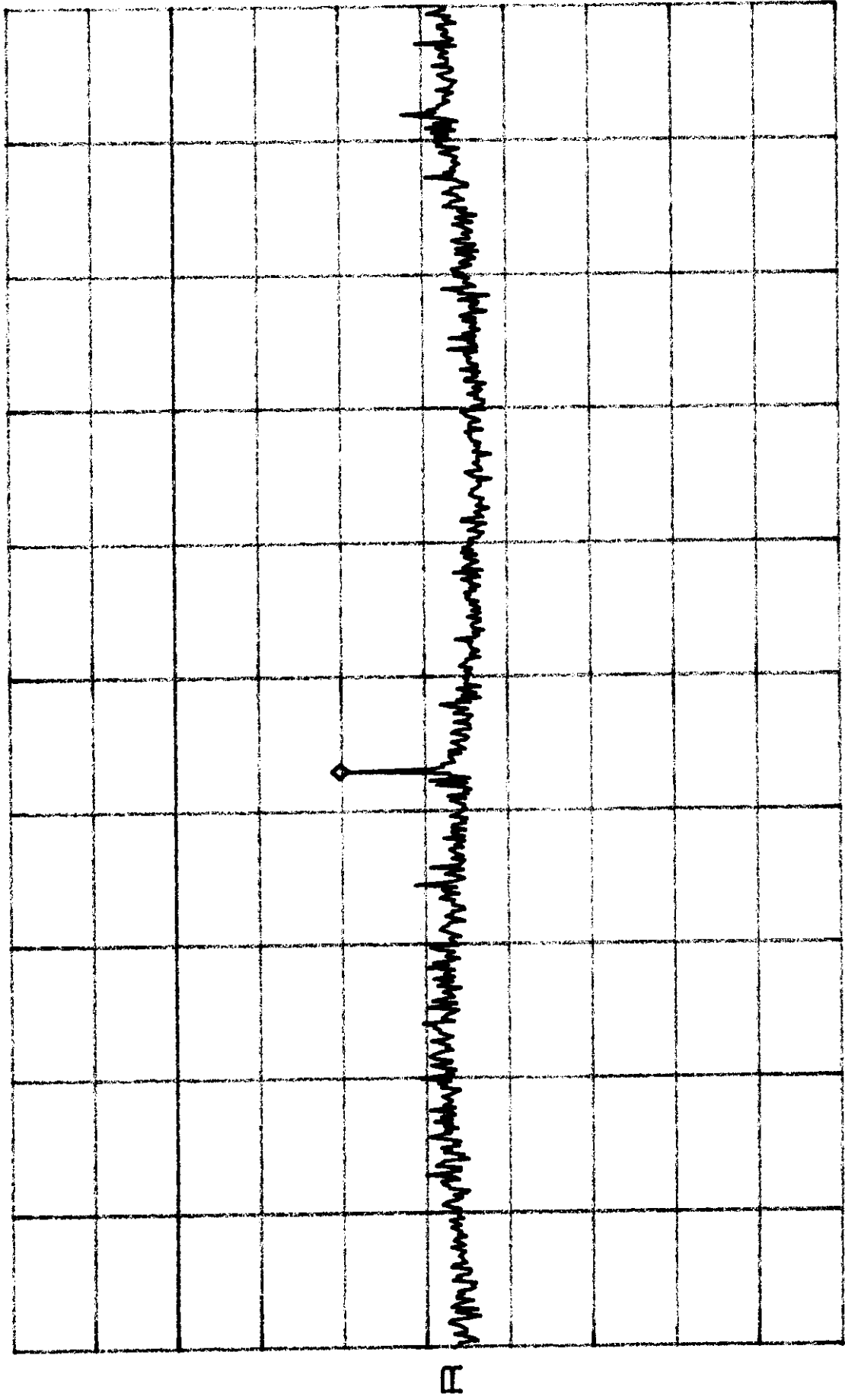
5dB/



R

START 2.000GHz STOP 3.000GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

80598
 EIR RE AMP TX @ 490MHz 411H
 MKR -30.42dBm
 *ATTEN 0dB
 RL -10.0dBm
 5dB/
 3.430GHz

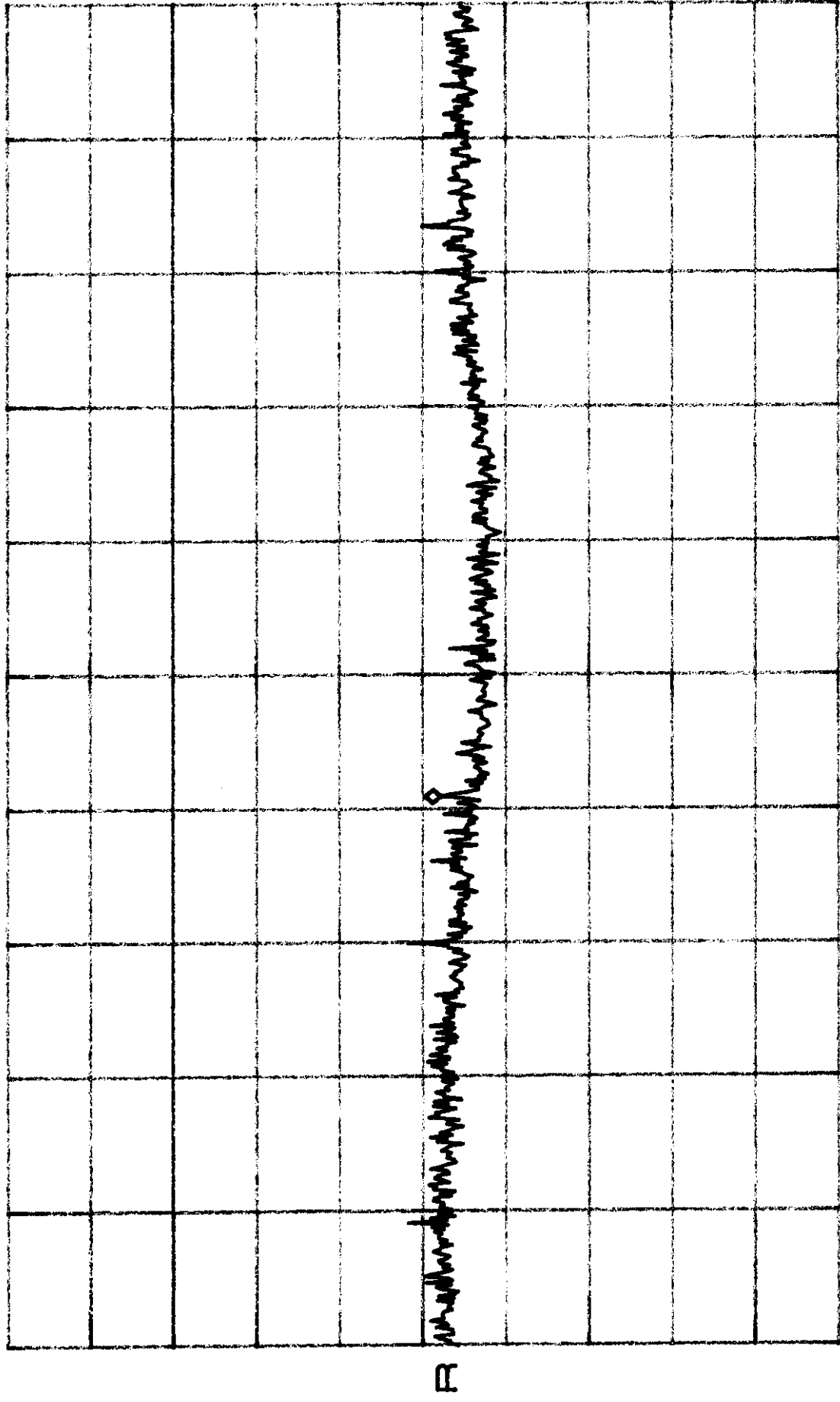


START 3.000GHz
 *RBW 1.0MHz *VBW 1.0MHz
 STOP 4.000GHz
 SWP 50.0ms

80798
EMR RF AMP TX @ 490MHz 4717H
MKR -36: 17dBm
4.410GHz

*ATTEN 0dB

RL -10.0dBm 5dB/



START 4.000GHz STOP 5.000GHz
*RBW 1.0MHz *VBW 1.0MHz SWP 50.0ms

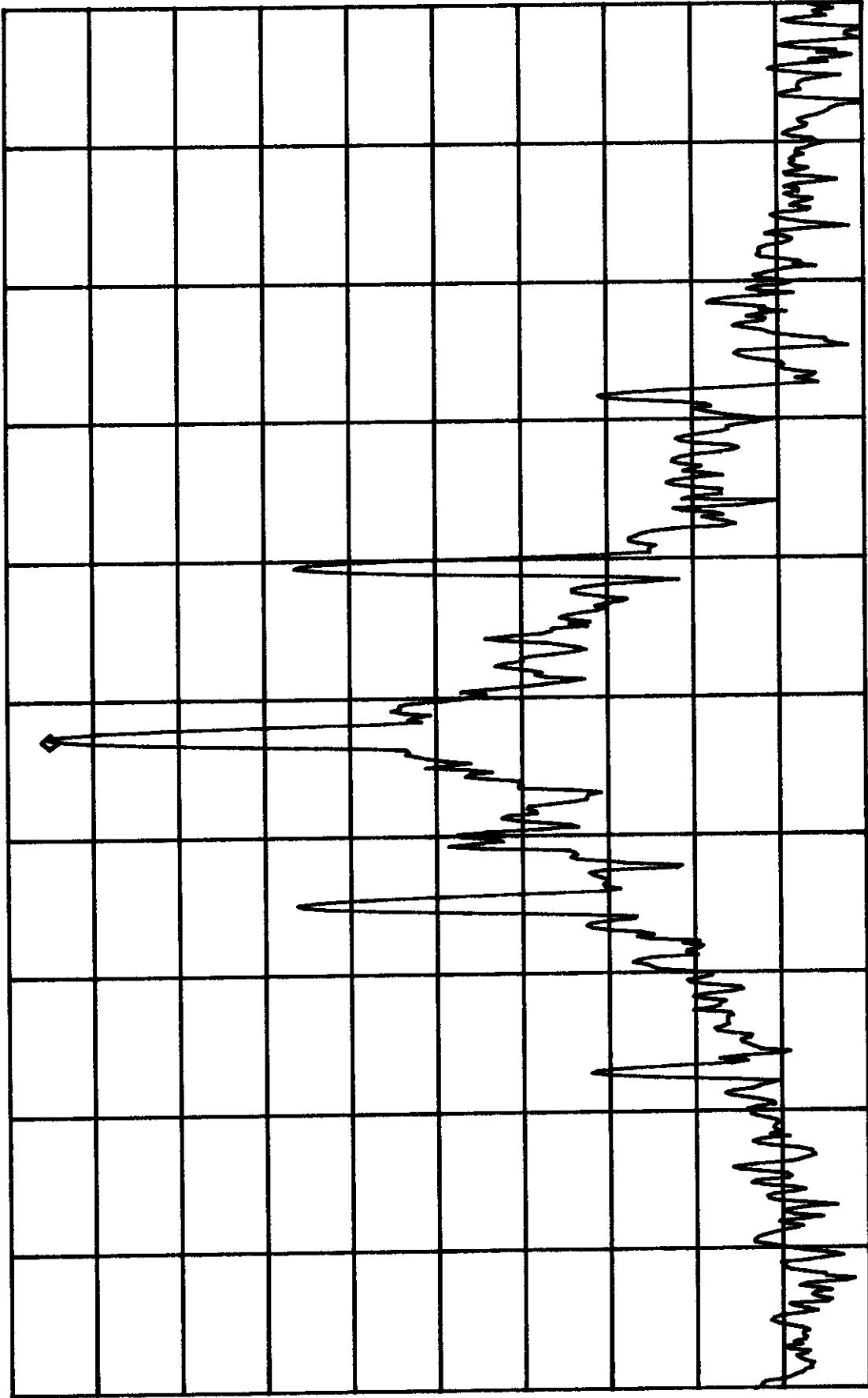
APPENDIX A4

SPURIOUS EMISSIONS PLOT OF INPUT TO AMPLIFIER – 450 MHz

ATTEN 10dB
RL 40.3dBm

MKR 34.33dBm
449.99943MHz

10dB/



R

CENTER 450.00000MHz SPAN 20.00KHz
*RBW 100Hz *VBW 10KHz SWP 1.60sec

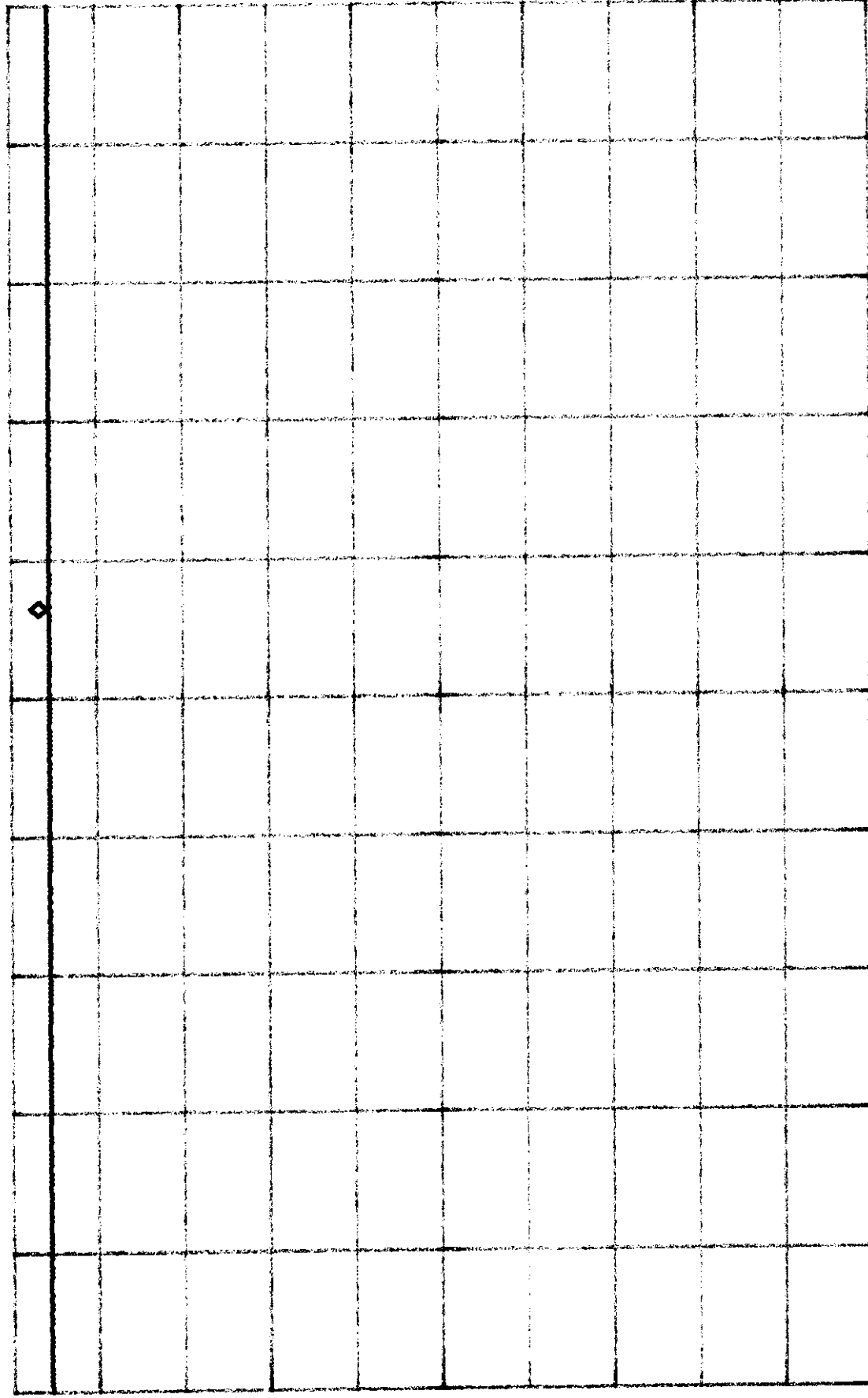
ATTEN 10dB

RL 40.3dBm

10dB/

28.250ms

MKR 36.00dBm



D

R

CENTER 450.000000MHZ

SPAN 0HZ

*RBW 2.0MHZ

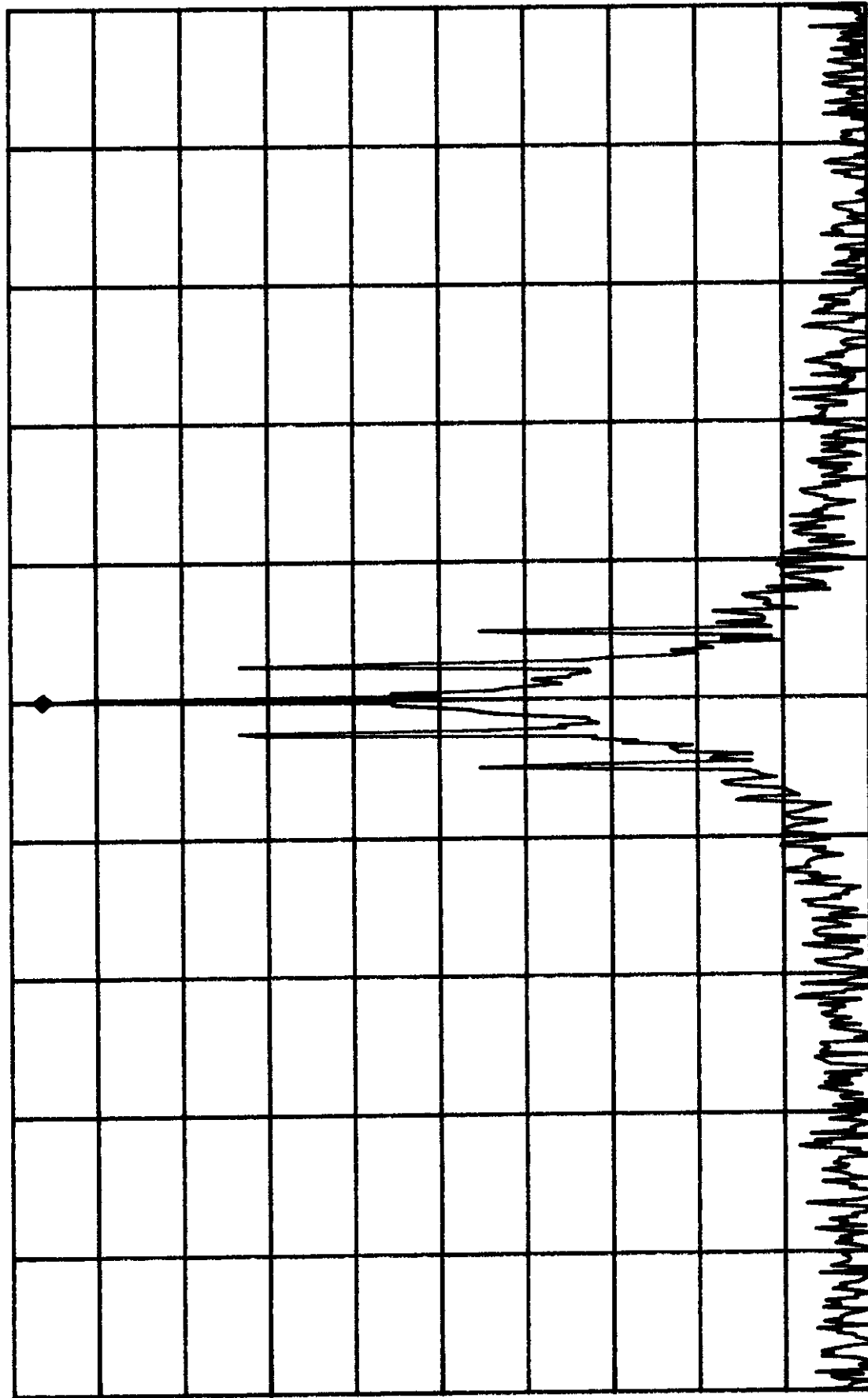
*VBW 3.0MHZ

SWP 50.0ms

ATTEN 10dB
RL 40.3dBm

MKR 35.50dBm
449.9995MHz

10dB/



R

CENTER 449.9995MHz

SPAN 100.0KHz

*RBW 100Hz

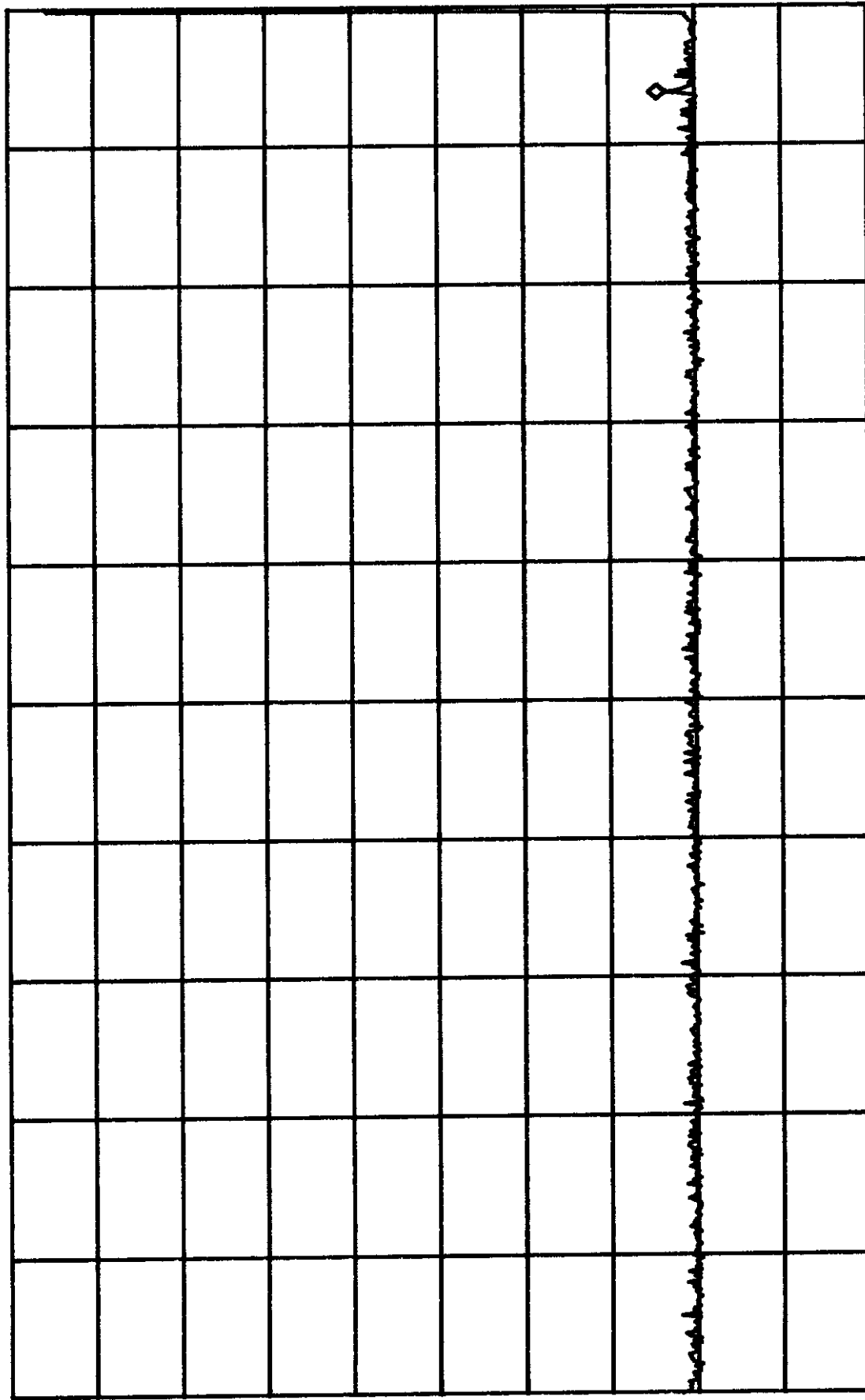
*VBW 10KHz

SWP 8.00sec

ATTEN 10dB
RL 40.3dBm

MKR -36.34dBm
424.1MHz

10dB/

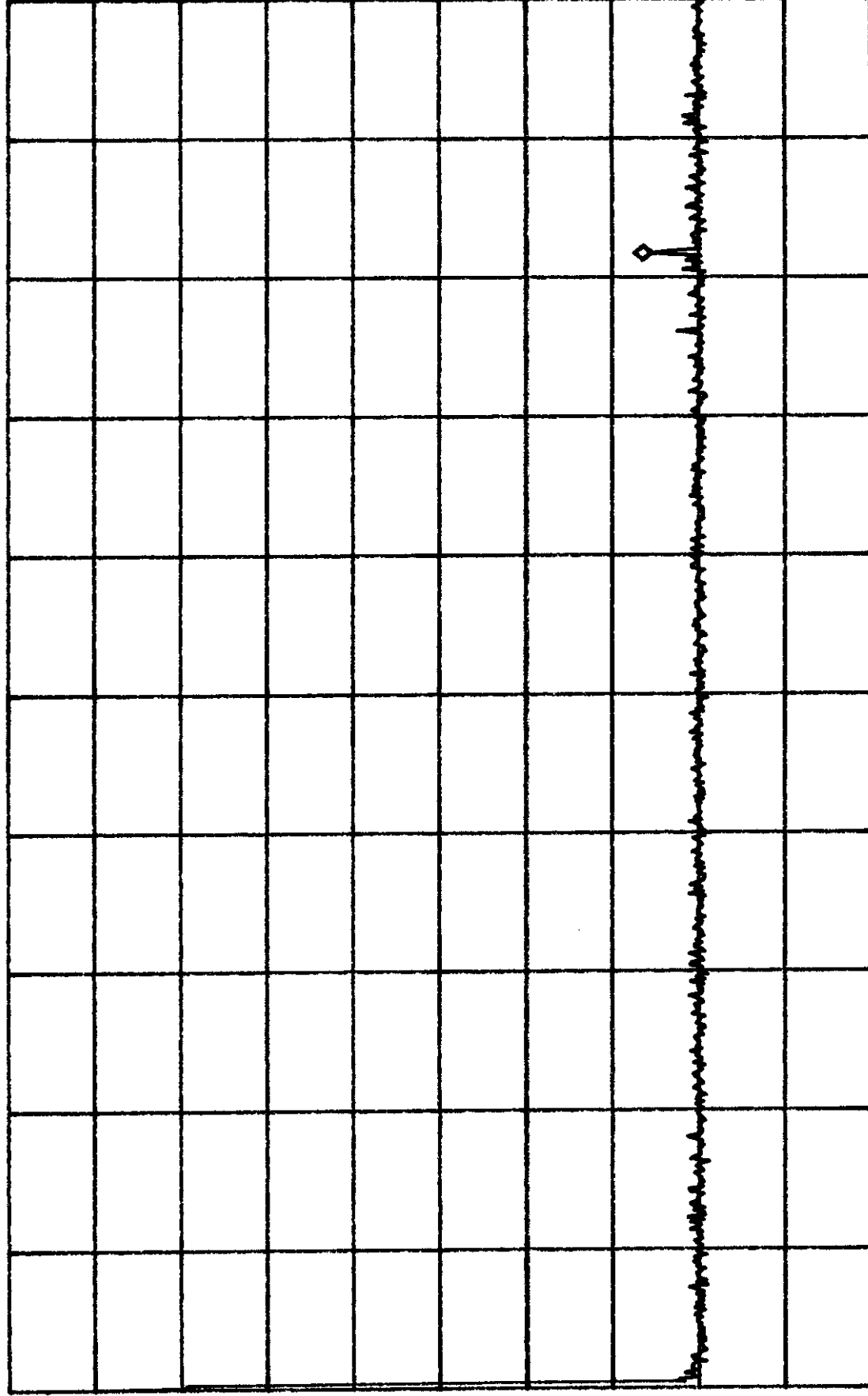


START 30.0MHz STOP 450.0MHz
*RBW 100kHz *VBW 30kHz SWP 360ms

ATTEN 10dB
RL 40.3dBm

MKR -34.20dBm
900.1MHz

10dB/

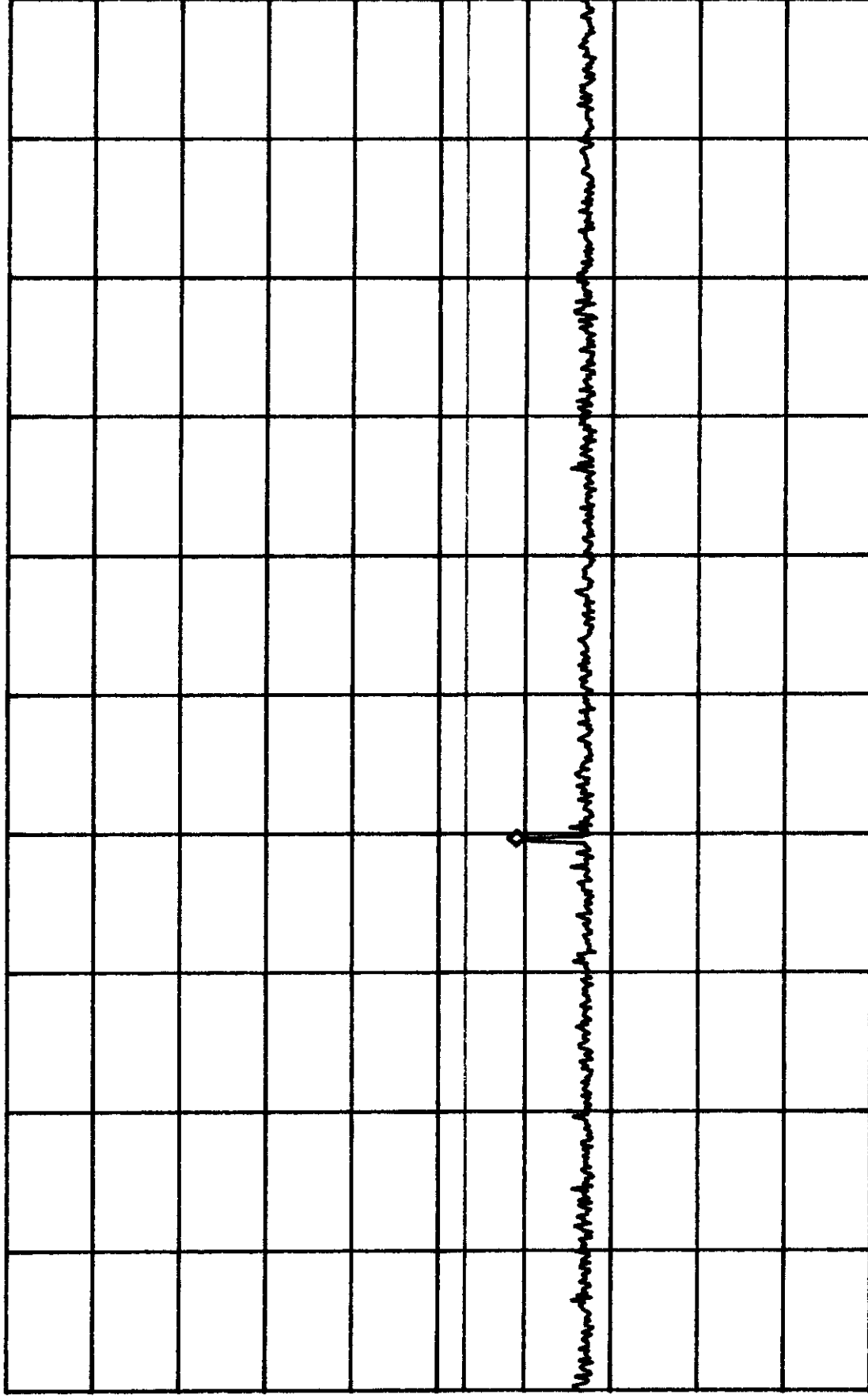


START 450.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 30kHz SWP 460ms

ATTEN 10dB
RL 33.3dBm

MKR -26.70dBm
1.397GHz

10dB/



D

R

START 1.000GHz
*RBW 1.0MHz

*VBW 1.0MHz

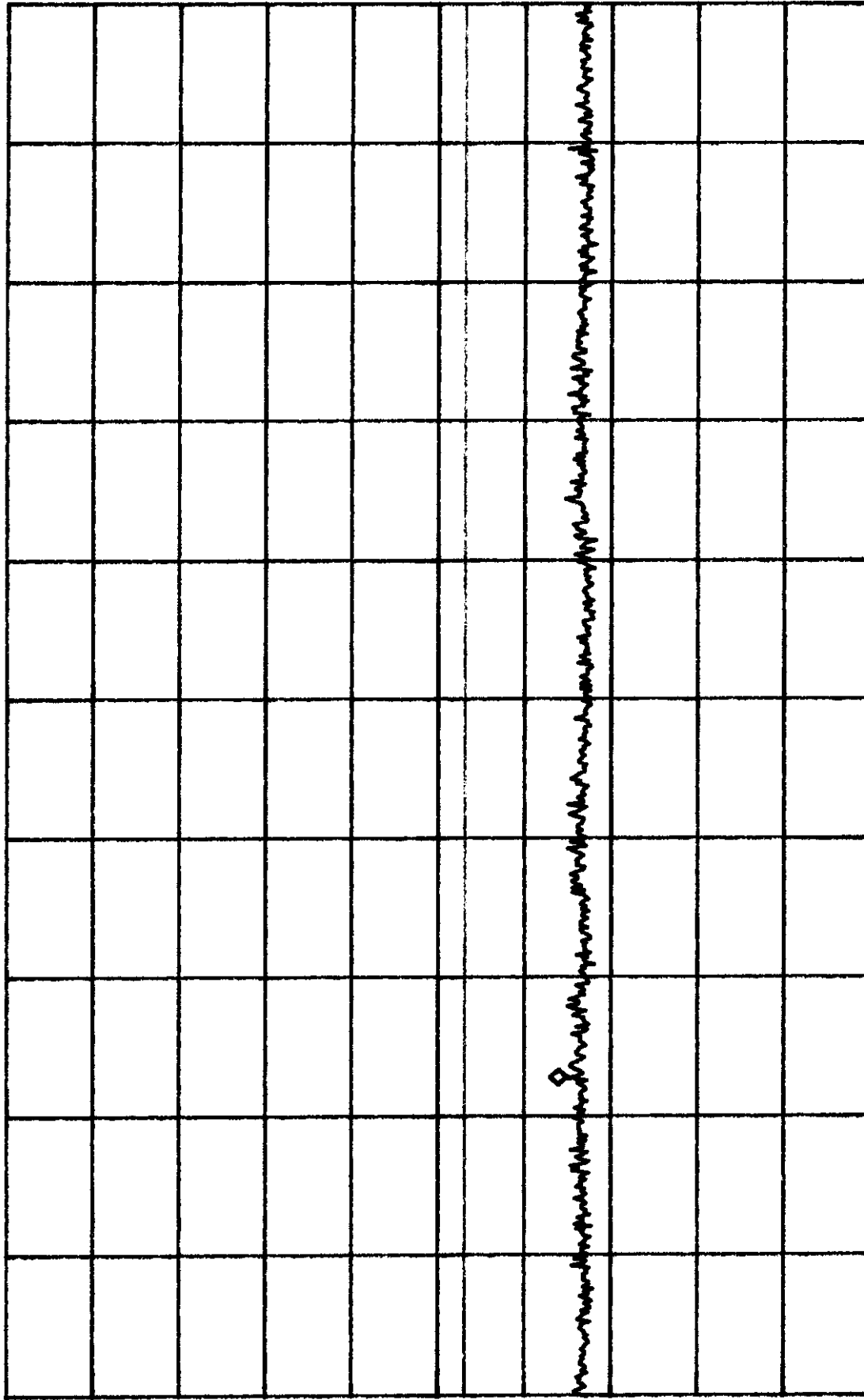
STOP 2.000GHz

SWP 50.0ms

ATTEN 10dB
RL 33.3dBm

MKR -31.70dBm
2.6856GHz

10dB/



START 2.000GHz
*RBW 1.0MHz

*VBW 1.0MHz

STOP 5.000GHz

SWP 60.0ms

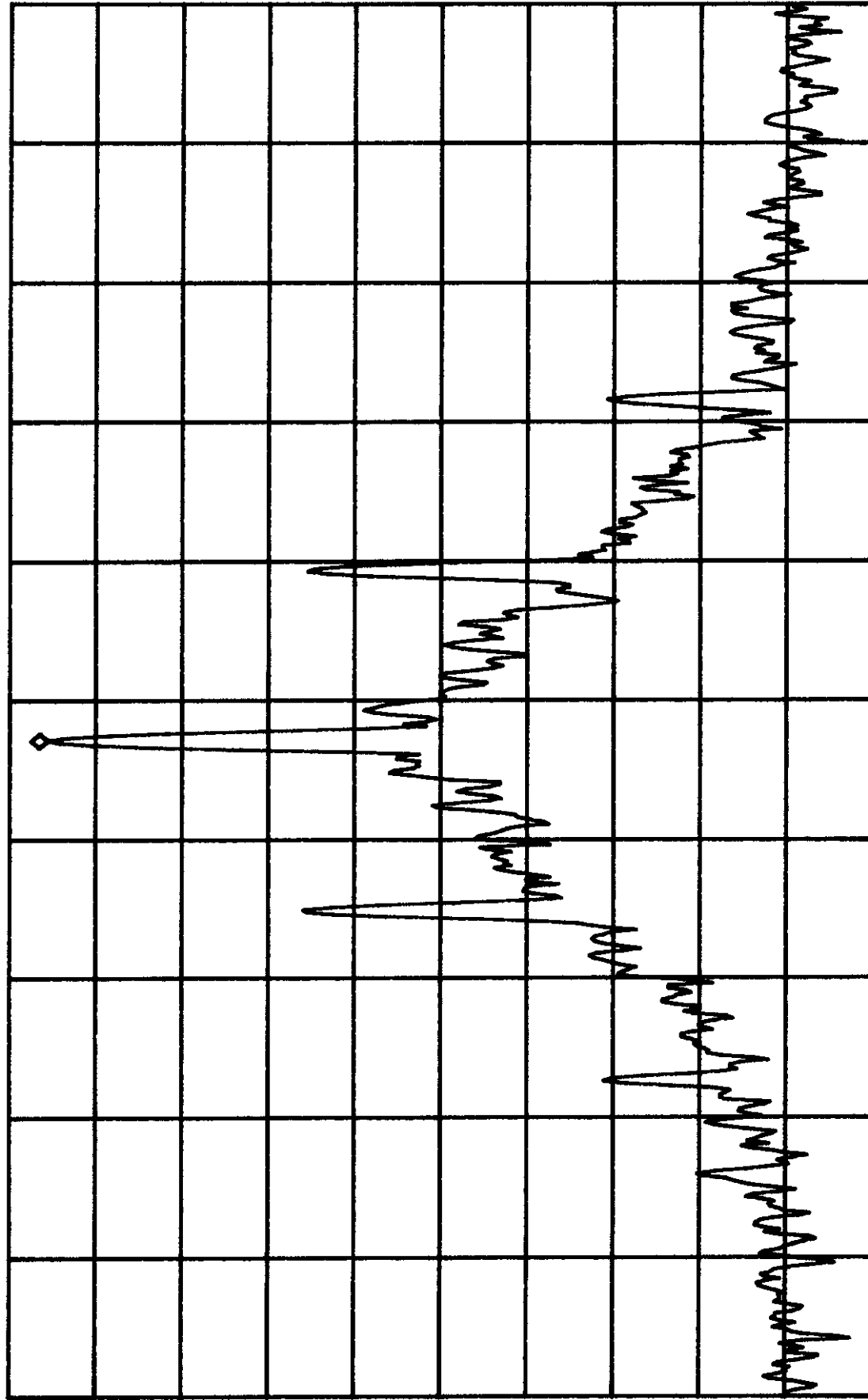
APPENDIX A5

SPURIOUS EMISSIONS PLOT OF INPUT TO AMPLIFIER – 470 MHz

ATTEN 10dB
RL 40.3dBm

MKR 35.83dBm
469.99943MHz

10dB/



R

CENTER 470.00000MHz

SPAN 20.00KHz

*RBW 100Hz

*VBW 10KHz

SWP 1.60sec

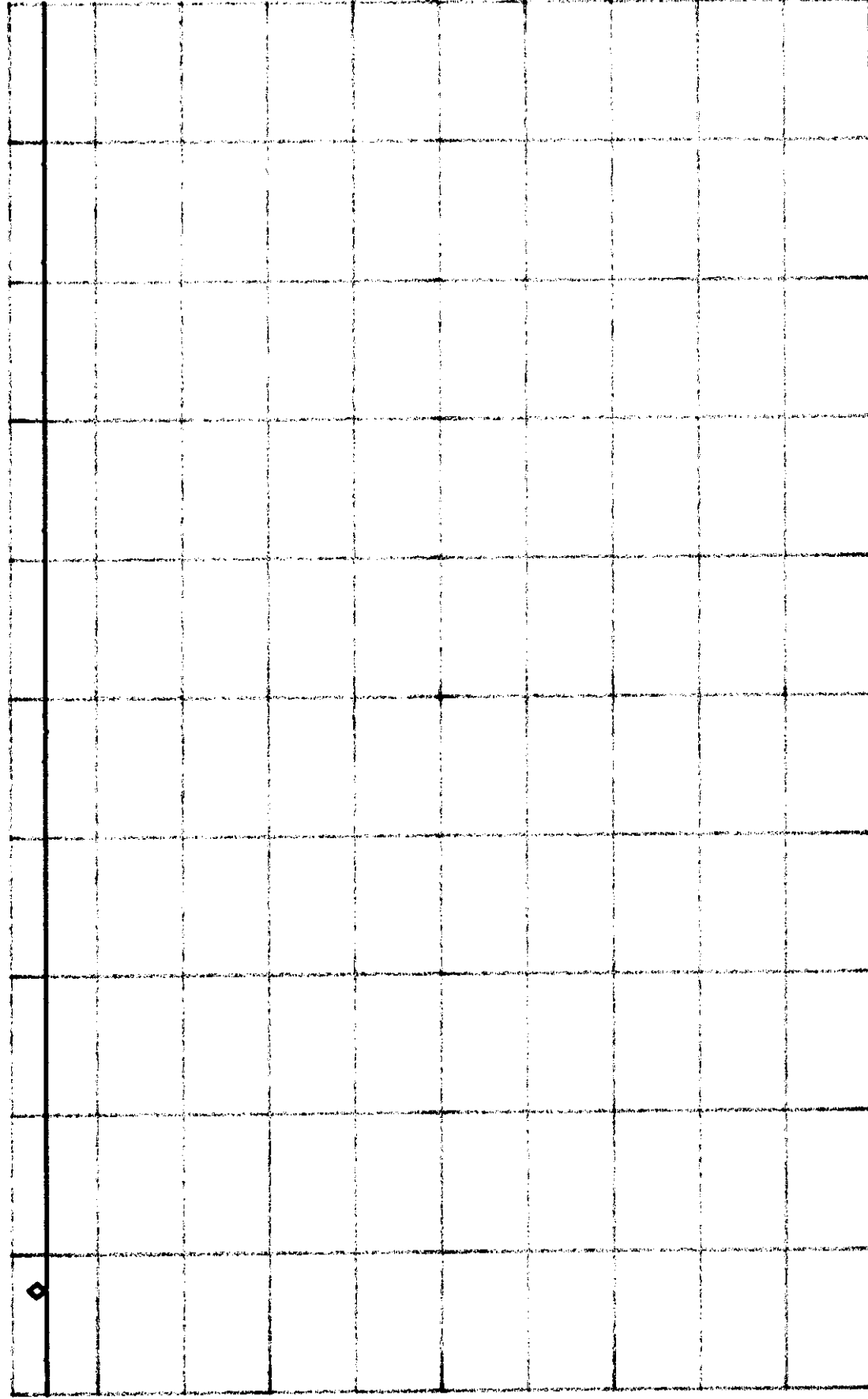
ATTEN 10dB

MKR 36.33dBm

RL 40.3dBm

3.750ms

10dB/



D

R

CENTER 470.00000MHZ

SPAN 0HZ

*RBW 2.0MHZ

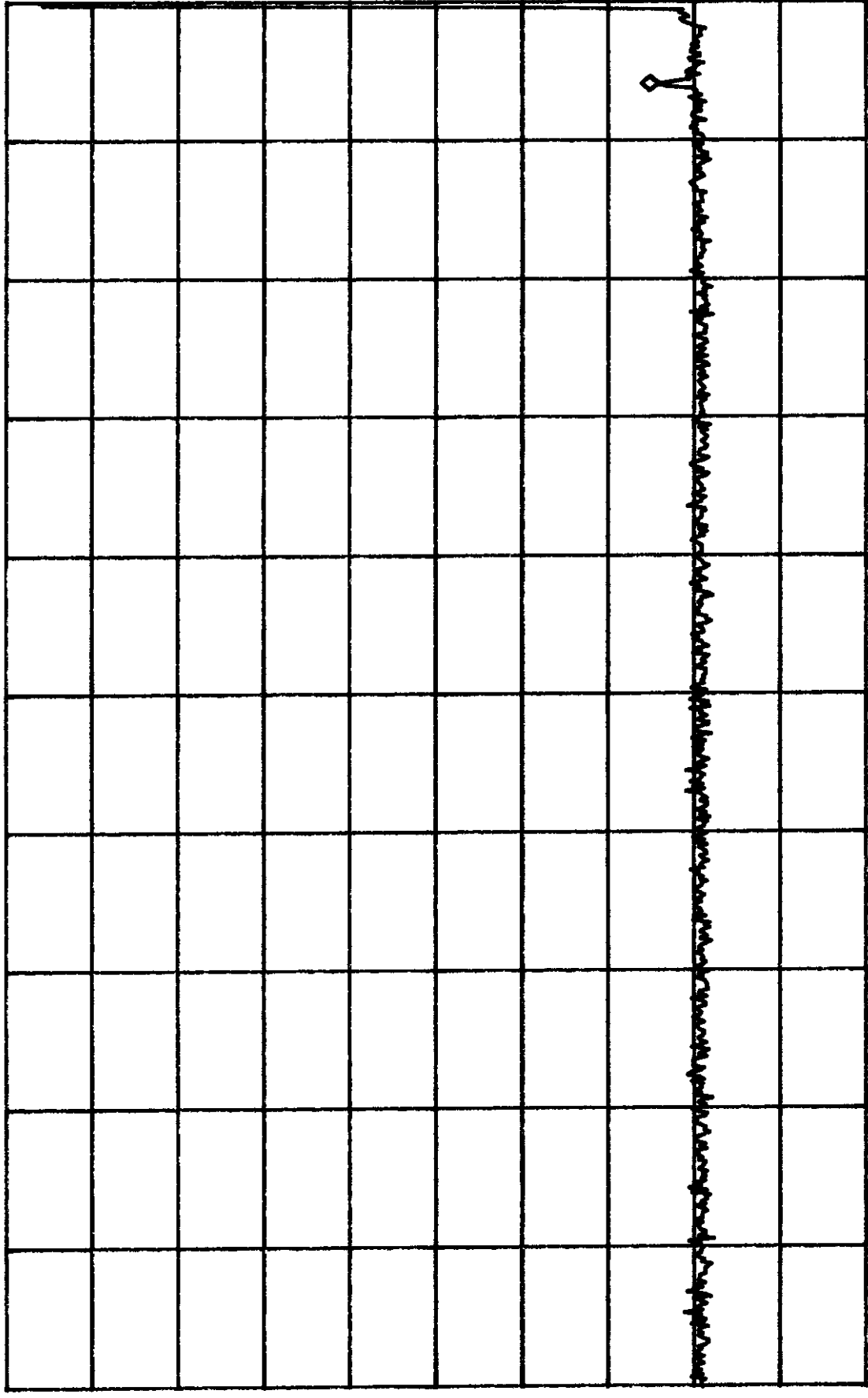
*VBW 3.0MHZ

SWP 50.0ms

ATTEN 10dB
RL 40.3dBm

10dB/

MKR -35.50dBm
444.3MHz

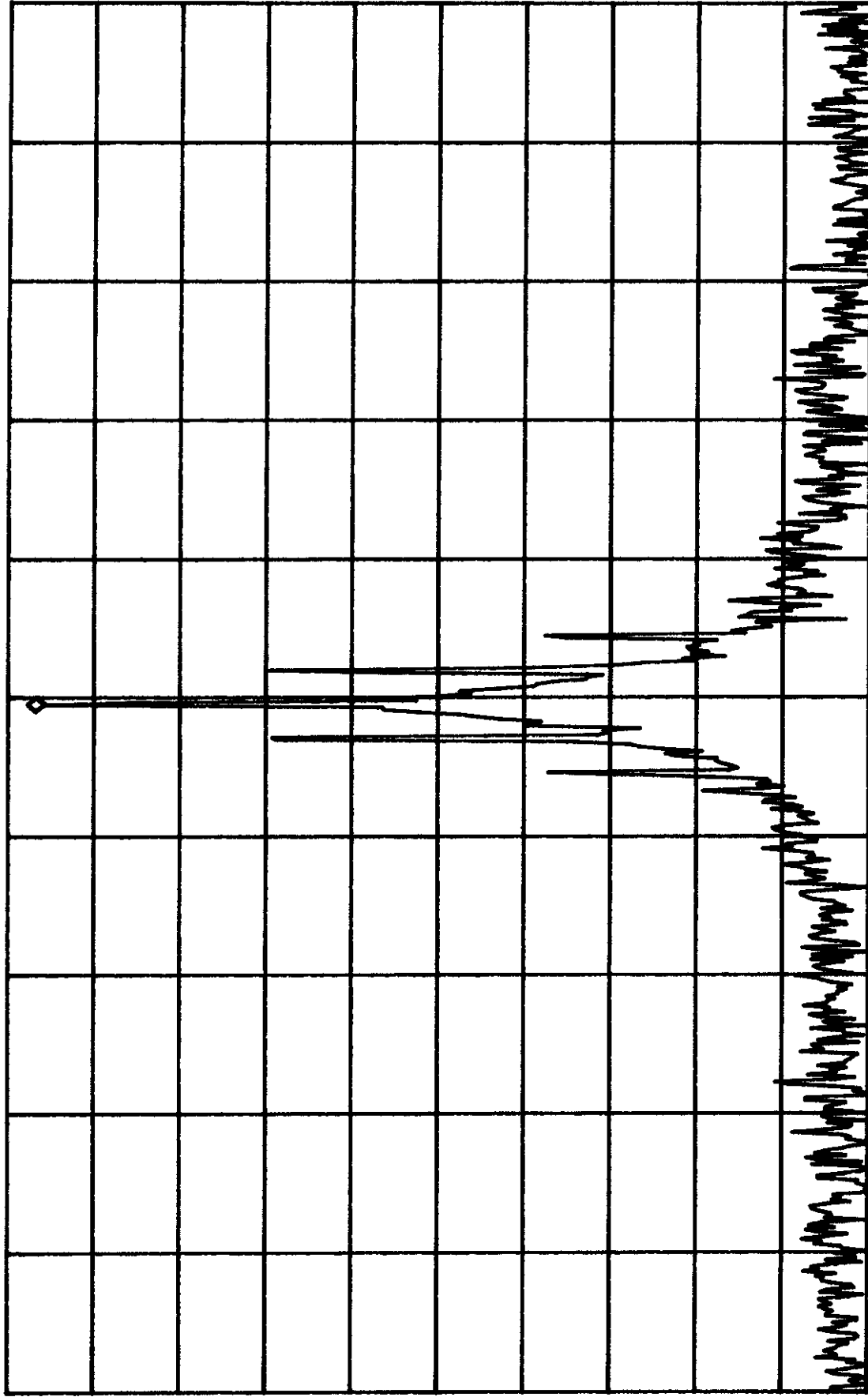


START 30.0MHz STOP 470.0MHz
*RBW 100kHz *VBW 30kHz SWP 370ms

ATTEN 10dB
RL 40.3dBm

MKR 36.00dBm
469.9995MHz

10dB/



R

CENTER 470.0000MHz

SPAN 100.0KHz

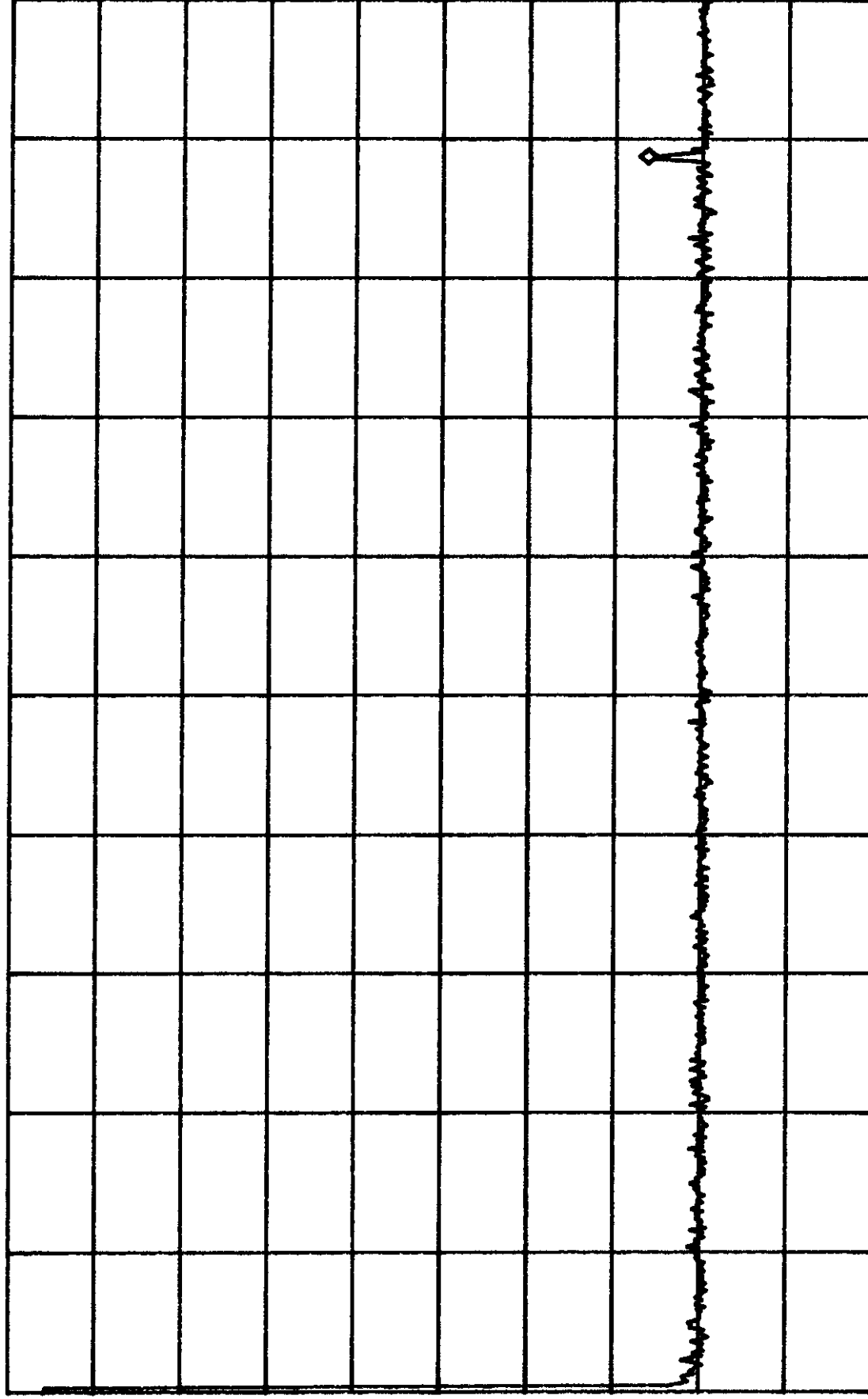
*RBW 100Hz

*VBW 10KHz

SWP 8.00sec

ATTEN 10dB
RL 40.3dBm

MKR -34.34dBm
940.8MHz
10dB/



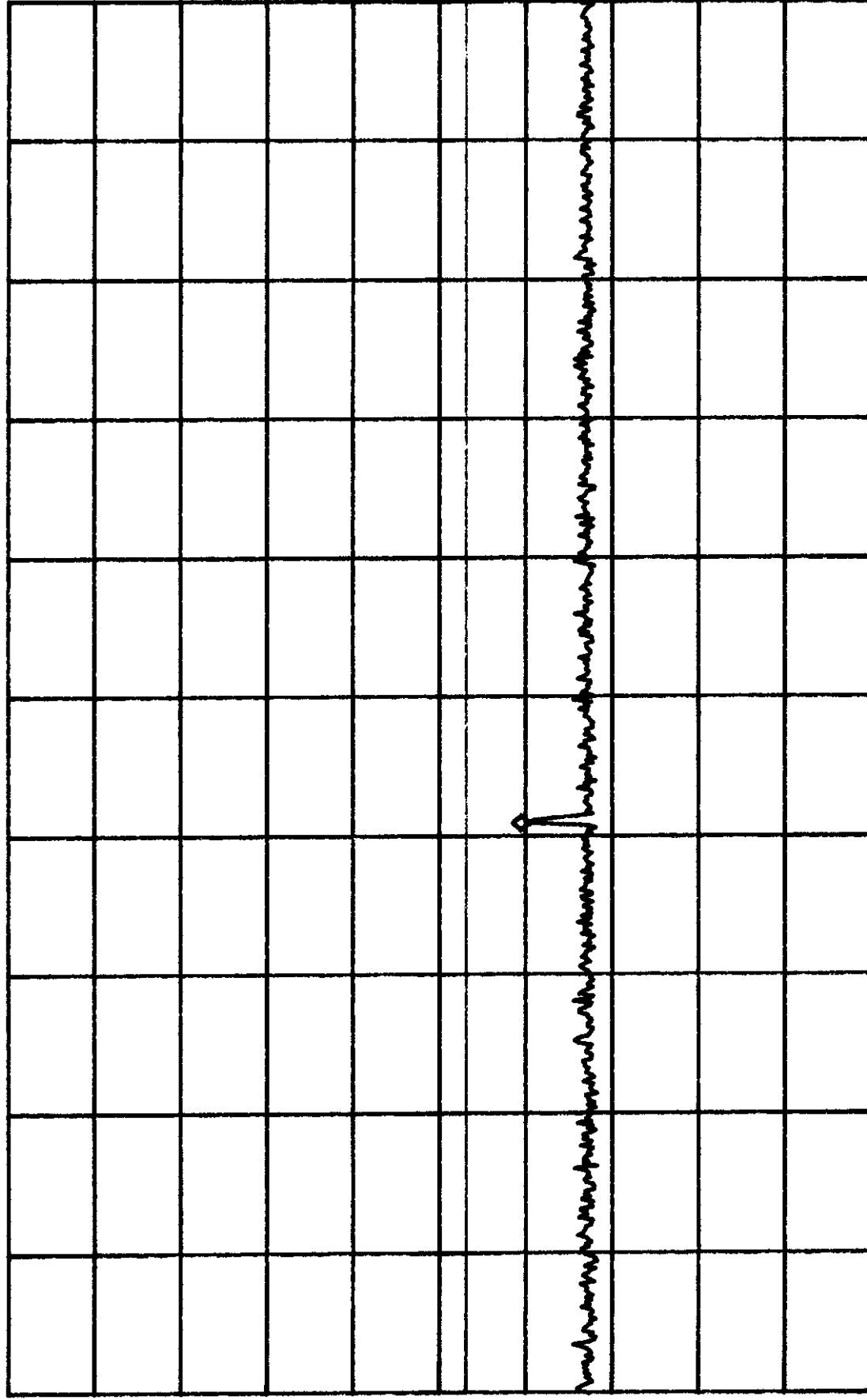
R

START 470.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 30kHz SWP 450ms

ATTEN 10dB
RL 33.3dBm

MKR -27.20dBm
1.410GHz

10dB/



D

R

START 1.000GHz

STOP 2.000GHz

*RBW 1.0MHz

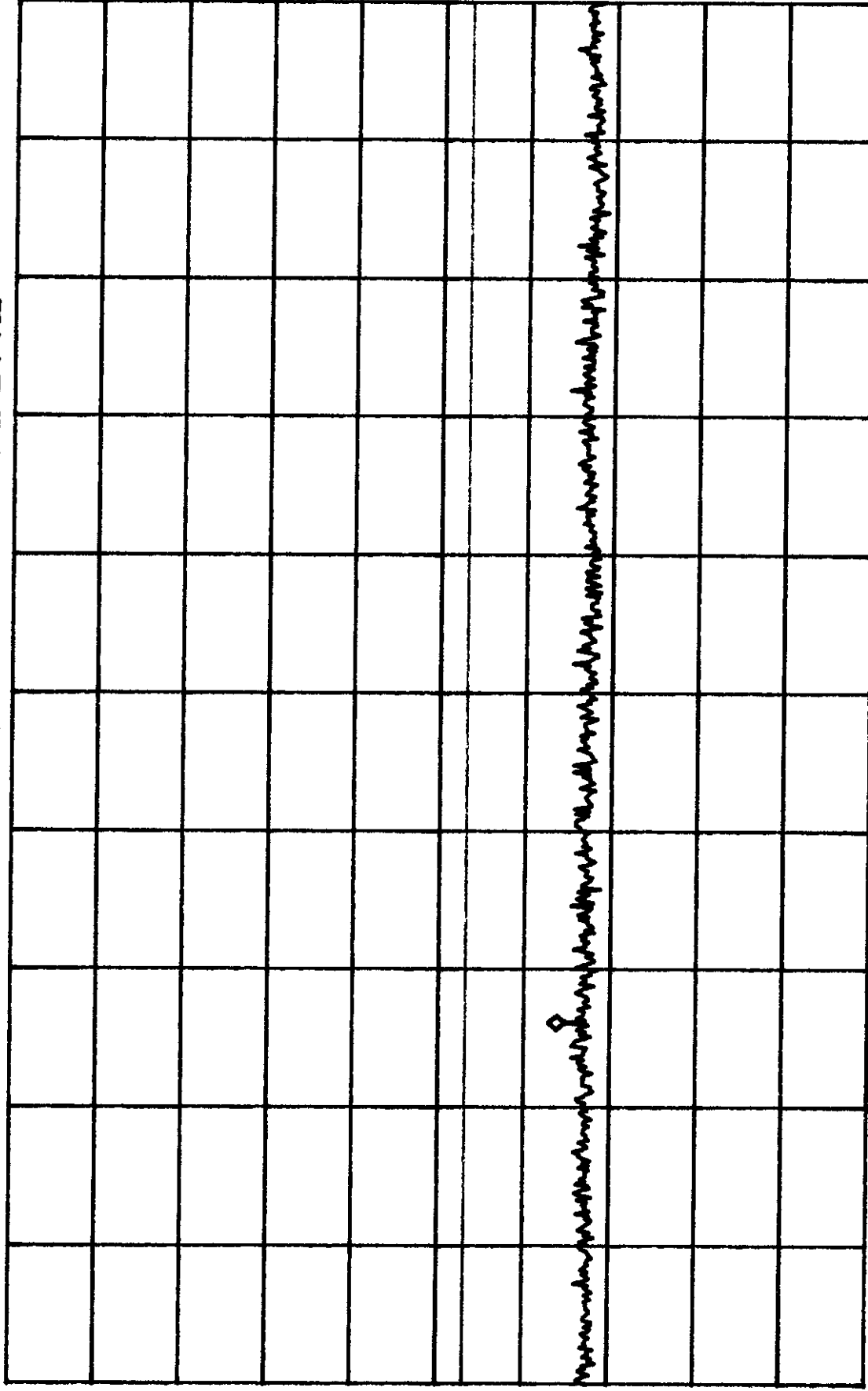
*VBW 1.0MHz

SWP 50.0ms

ATTEN 10dB
RL 33.3dBm

MKA -31.53dBm
2.785GHz

10dB/



R

START 2.000GHz

STOP 5.000GHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 60.0ms

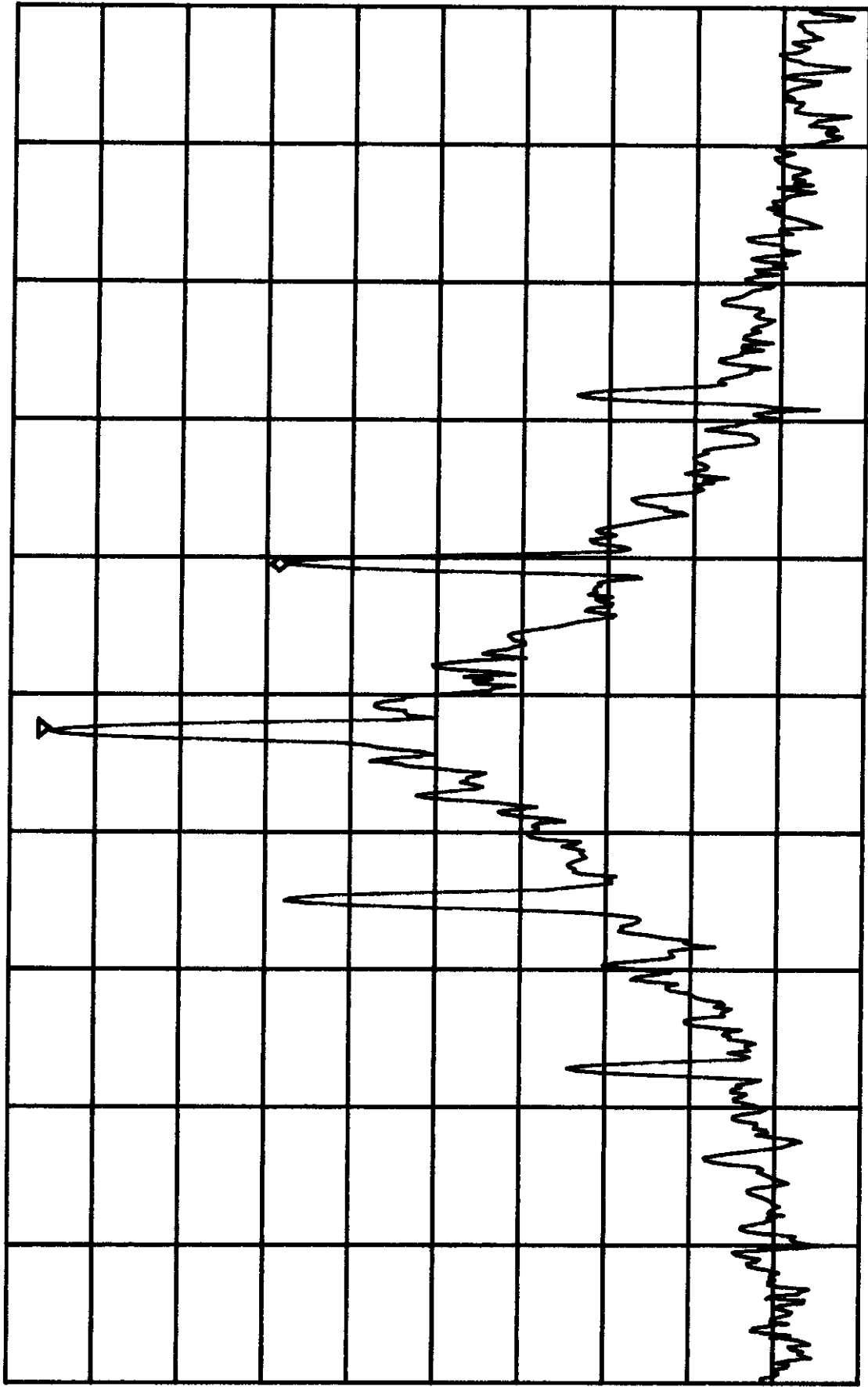
APPENDIX A6

SPURIOUS EMISSIONS PLOT OF INPUT TO AMPLIFIER – 490 MHz

ATTEN 10dB
RL 40.3dBm

ΔMKR -27.83dB
2.40kHz

10dB/



R

CENTER 490.00000MHZ

SPAN 20.00kHz

*RBW 100Hz

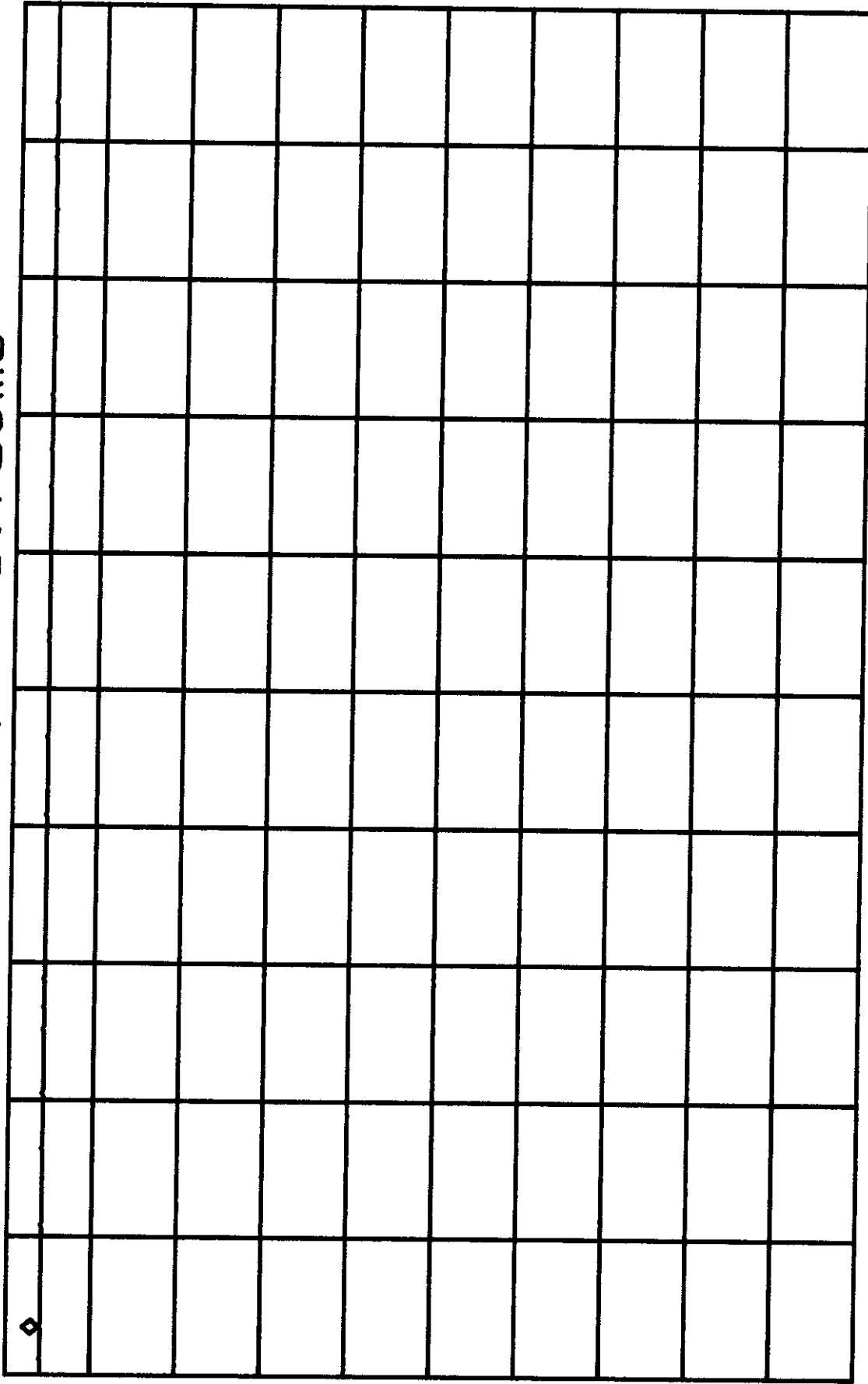
*VBW 10kHz

SWP 1.60sec

ATTEN 10dB
RL 40.3dBm

MKR 36.33dBm
1.750ms

10dB/



D

A

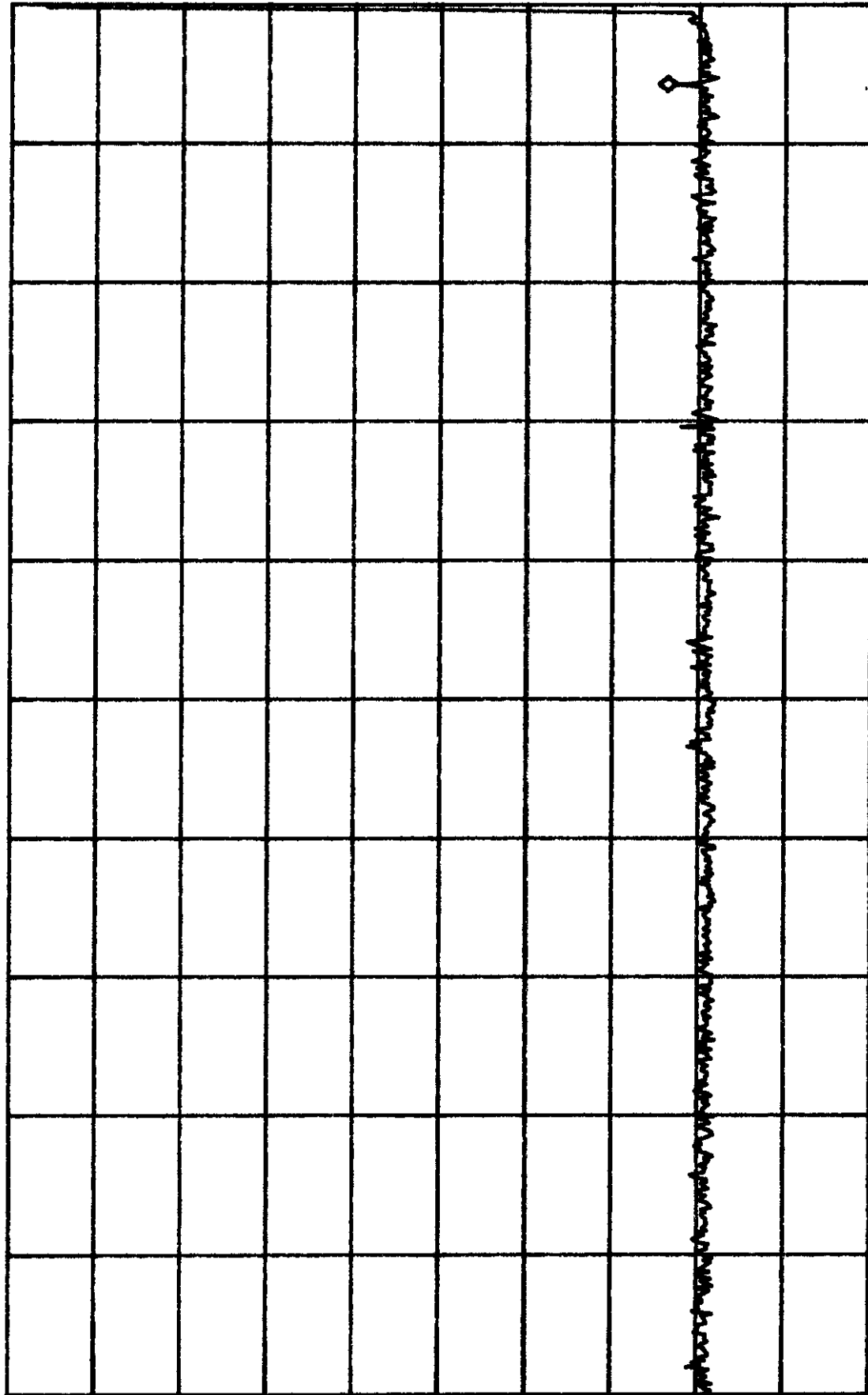
CENTER 490.000000MHZ
*RBW 2.0MHZ *VBW 3.0MHZ

SPAN OHZ
SWP 50.0ms

ATTEN 10dB
RL 40.3dBm

MKR -36.84dBm
463.9MHz

10dB/



R

START 30.0MHz

STOP 490.0MHz

*RBW 100kHz

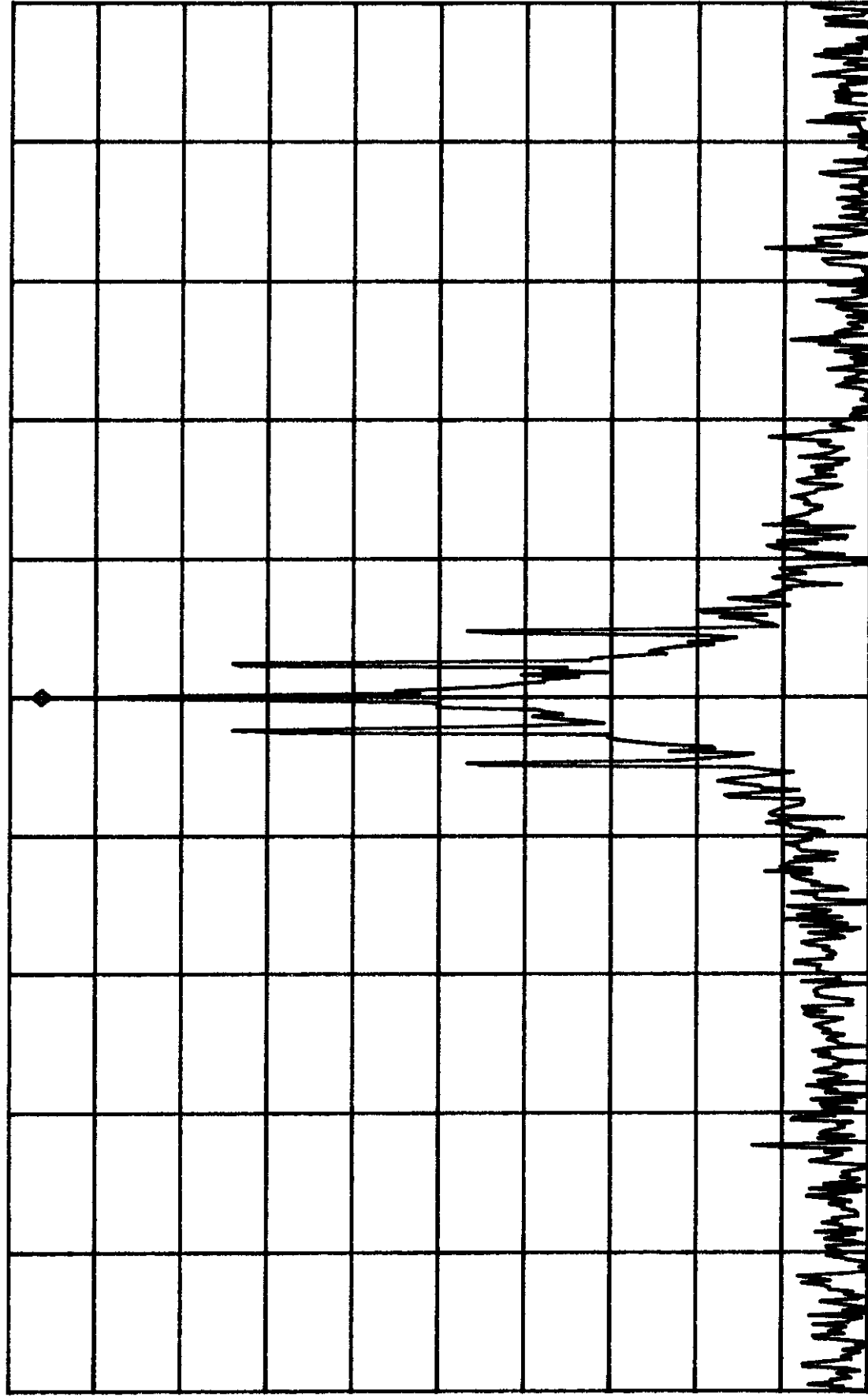
*VBW 30kHz

SWP 390ms

ATTEN 10dB
RL 40.3dBm

MKR 35.66dBm
489.9995MHz

10dB/



R

CENTER 489.9995MHz

SPAN 100.0KHz

*RBW 100Hz

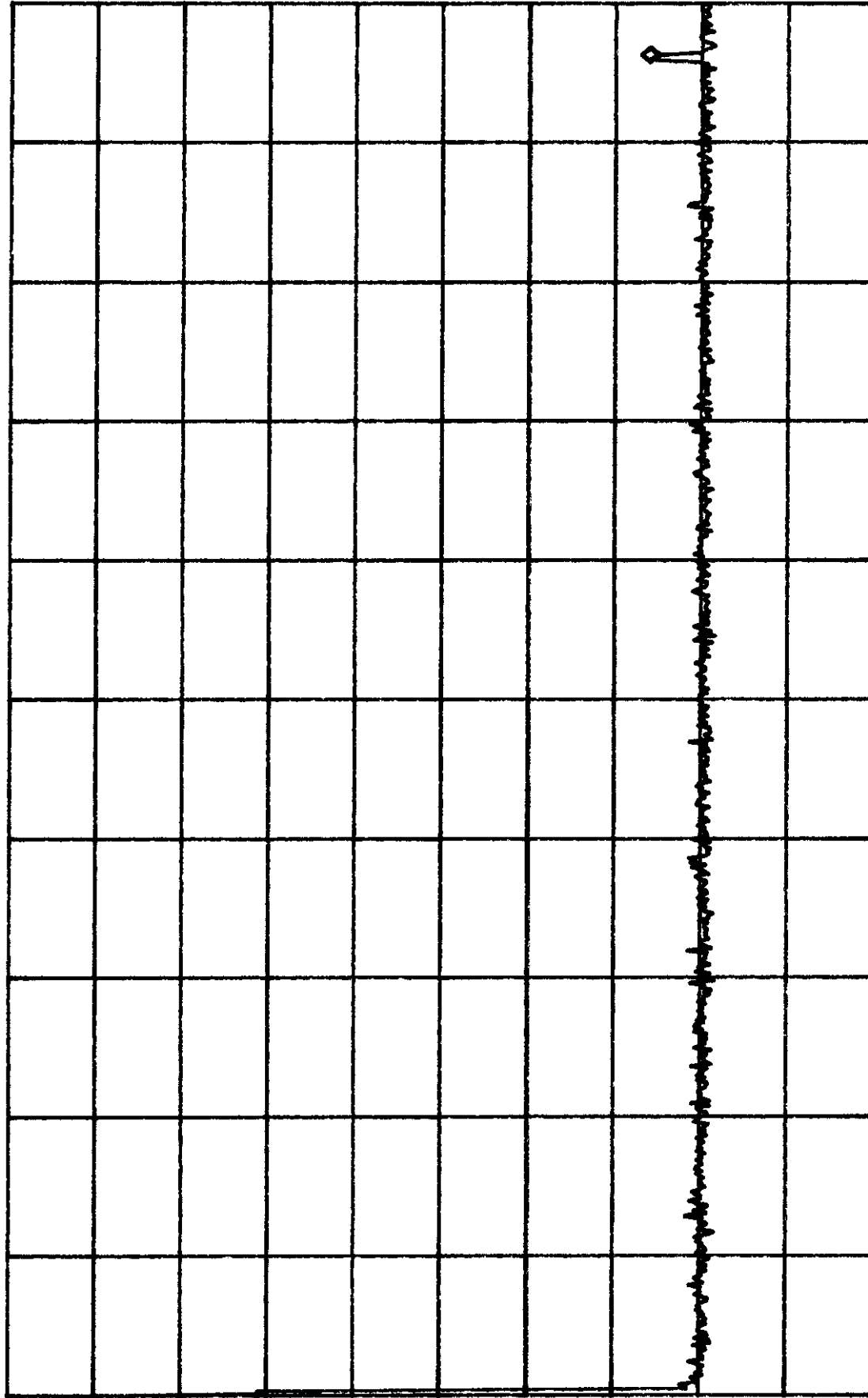
*VBW 10KHz

SWP 8.00sec

ATTEN 10dB
RL 40.3dBm

MKR -34.70dBm
981.3MHz

10dB/



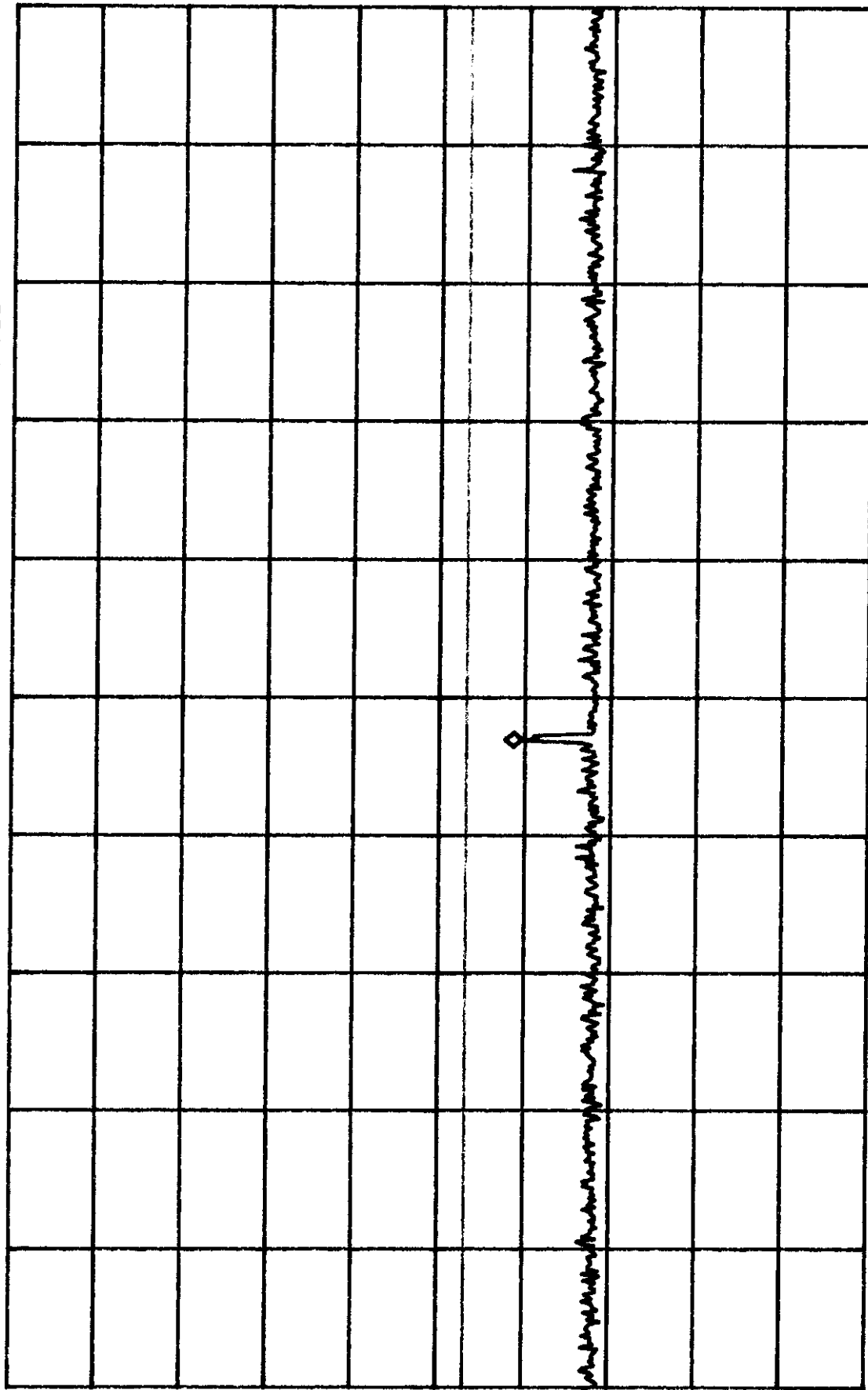
R

START 490.0MHz STOP 1.0000GHz
*RBW 100kHz *VBW 30kHz SWP 430ms

ATTEN 10dB
RL 33.3dBm

MKR -26.37dBm
1.470GHz

10dB/



R

START 1.000GHz

STOP 2.000GHz

*RBW 1.0MHz

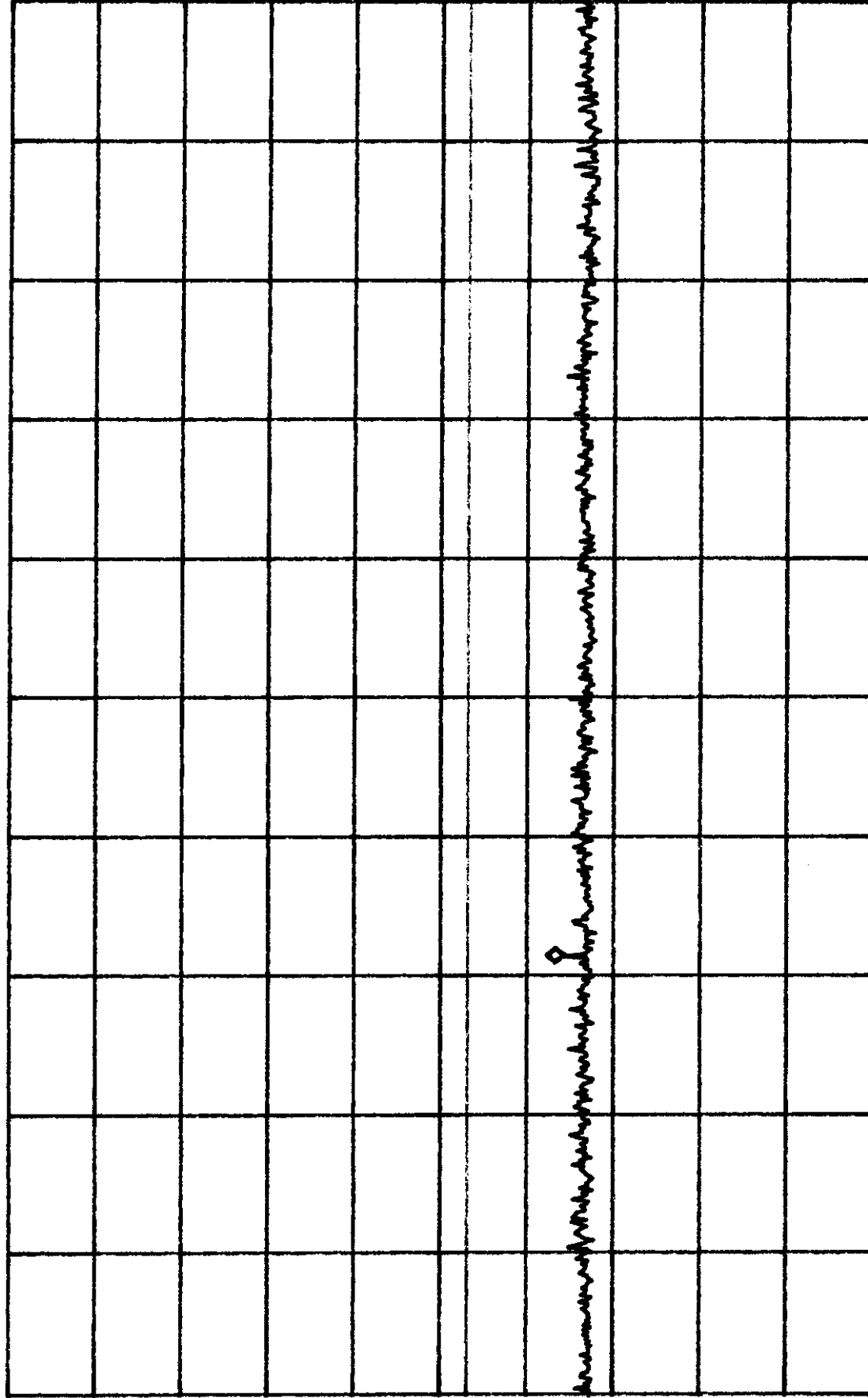
*VBW 1.0MHz

SWP 50.0ms

ATTEN 10dB
RL 33.3dBm

MKR -31.03dBm
2.945GHz

10dB/



START 2.000GHz

STOP 5.000GHz

*RBW 1.0MHz

*VBW 1.0MHz

SWP 60.0ms

APPENDIX B

STATEMENT OF MEASUREMENT UNCERTAINTY

For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ± 2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5 (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB