

| | | | | | |
|------------|---------------------|-------|----------|------------|-------------|
| Client: | Proxim, Inc. | Date: | 2/24/99 | Test Engr: | Rudy Suy |
| Product: | 4110-05 | File: | T30505 | Proj. Eng: | Mark Briggs |
| Objective: | Final Qualification | Site: | SVOATS#2 | Contact: | Pete Garcia |
| Spec: | FCC Part 15 | Page: | 1 of 4 | Approved: | |
| Revision | 1.0 | | | | |

| |
|---|
| Ambient Conditions Temperature: 8.9 °C Humidity: 73 % |
|---|

Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to the specifications defined above.

Test Summary

Run #1 - Channel Separation and Utilization {15.247(a) (1)} see test data log.

Channel separation was measured and calculated to be 995.3KHz
(79 channels in 78.6 MHz)

The 20dB bandwidth was measured to be:

| | |
|-----------------|---------|
| Low Channel | 925 KHz |
| Central Channel | 958 KHz |
| High Channel | 942 KHz |

Run #1 - Output Power {15.247(b)} see test data log.

| | |
|-----------------|----------|
| Low Channel | 19.7 dBm |
| Central Channel | 19.8 dBm |
| High Channel | 19.8 dBm |

Maximum output power was 19.8 dBm (0.096 Watts), meeting maximum permitted of 1 Watt.

Run #3a - Maximized Radiated Emissions, 1-25 GHz , Channel #1 (Low Channel)

PASS Results: FCC B -3.4 dB Ave @ 1201.730 MHz Vertical

Run #3b - Maximized Radiated Emissions, 1-25 GHz , Channel #39 (Center Channel)

PASS Results: FCC B -7.3 dB Ave @ 1220.670 MHz Vertical

Run #3c - Maximized Radiated Emissions, 1-25 GHz , Channel #79 (High Channel)

PASS Results: FCC B -7.2 dB Ave @ 2486.960 MHz Vertical

| | | | | | |
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| Revision | 1.0 | | | | |

Equipment Under Test (EUT) General Description

The EUT Symphony PCI Card is a wireless LAN adapter with a low power frequency hopping spread spectrum (FHSS) radio system operating in the 2400-2483.5 MHz band. The Symphony PCI Card uses 79 channels, each 1 MHz wide. The system hops over one of 15 pseudo random sequences. On the average, each channel is used equally. Please refer to "RANGELAN2 Frequency Hopping Theory of Operation" attached to this submission. (Note that confidentiality has been requested for the Theory of Operation exhibit) Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment. The electrical rating of the EUT is 120/240 V, 50/60 Hz.

Equipment Under Test (EUT)

| Manufacturer/Model/Description | Serial Number | FCC ID Number |
|--|---------------|---------------|
| Proxim, Symphony PCI, Spread Spectrum Wireless LAN Adapter | A30392835 | IMK-ILCPCI |

Power Supply and Line Filters

| Description | Manufacturer | Model |
|-------------|--------------|-------|
| None | - | - |

The EUT power was derived from the host computer power supply.

Printed Wiring Boards in EUT

| Manufacturer/Description | Assembly # | Rev. | Serial Number | Crystals (MHz) |
|--------------------------|------------|------|---------------|----------------|
| Proxim PCI Card | 8400-0163 | 01 | A30392835 | 8, 32 |

Subassemblies in EUT

| Manufacturer/Description | Assembly Number | Rev. | Serial Number |
|--------------------------|-----------------|------|---------------|
| None | - | - | - |

EUT Enclosure(s)

The EUT does not have an enclosure as it is designed to be installed within the enclosure of a host computer.

| | | | | | |
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| Revision | 1.0 | | | | |

EMI Suppression Devices (filters, gaskets, etc.)

| Description | Manufacturer | Part Number |
|-------------|--------------|-------------|
| None | - | - |

Modifications

The following modifications were made to the EUT in order to comply with the requirements:

None

Local Support Equipment

| Manufacturer/Model/Description | Serial Number | FCC ID Number |
|--------------------------------|----------------|---------------|
| Dell, Dimension P133v, PC | 8Q28F | E2JHANNIBAD |
| Dell, D1728D-LS, Monitor | 04036A8M60 | A3LCMG737 |
| Dell, SK-1000REW, Keyboard | 12741-71H-9024 | GYUR26SK |
| Dell, M-S34, Mouse | LZA70606597 | DZL210472 |
| HP, 2225C+, Printer | 3028S76892 | DS16XU2225 |
| Proxim, Antenna 1900.0051 | - | - |

Remote Support Equipment

| Manufacturer/Model/Description | Serial Number | FCC ID Number |
|--------------------------------|---------------|---------------|
| None | - | - |

Interface Cabling

| Cable Description | Length (m) | From Unit/Port | To Unit/Port |
|-------------------------|------------|-------------------|--------------|
| Shielded Parallel Cable | 2.5 | PC/ Parralel | Printer |
| Shielded Keyboard Cable | 2.0 | PC/ Keyboard Port | Keyboard |
| Shielded Mouse Cable | 2.0 | PC/ Mouse Port | Mouse |
| Shielded Video Cable | 1.5 | PC/ Video Port | Monitor |
| Shielded Antenna Cable | 1.5 | PC/EUT RF Port | Antenna |

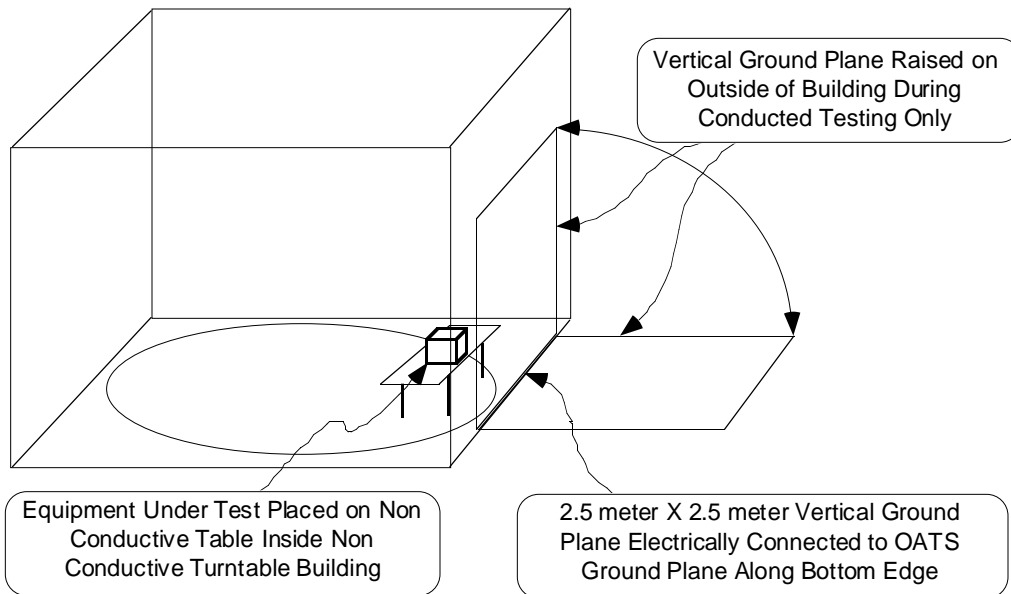
Test Software

The host PC contained test software running during testing which continuously exercised the EUT.

| | | | | | |
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| Spec: | FCC Part 15 | Page: | 4 of 4 | Approved: | |
| Revision | 1.0 | | | | |

General Test Conditions

During radiated testing, the host PC was connected to 120V, 60Hz power input. The host PC and all local support equipment were located on the turntable for radiated testing and conducted testing.



Test Data Tables

See attached data



Emissions Test Data

| | | | | | |
|-----------|---------------------|-----------|-----------|-------------|------------|
| Client: | Proxim, Inc. | Date: | 2/24/99 | Test Engr: | Rudy Suy |
| Product: | 4110-05 | File: | T30505 | Proj. Engr: | Mark H & B |
| Objective | Final Qualification | Site: | SVOATS #2 | Contact: | Jeff |
| Spec: | FCC Part 15 | Distance: | 3 m | Approved: | |

Ambient Conditions
 Temperature: 8 °C
 Humidity: 87 %

Elliott Lab equipment: Analyzer #284, Horn #487, pre-amp #870 & High pass filter #247

Run #1: Channel Separation and Utilization {15.247(a) (1)}

Channel separation was measured and calculated to be 995.3KHz (79 channels in 78.6 MHz)

The 20dB bandwidth was measured to be:

- Low Channel 925 KHz
- Center Channel 958 KHz
- High Channel 942 KHz

The 20dB bandwidth was measured using a 30kHz resolution bandwidth rather than 100 kHz bandwidth. Proxim have a waiver from the FCC allowing this deviation.

The channel separation exceeds the 20dB bandwidth and the 20dB bandwidth is less than 1MHz, therefore the unit complies.

Channel occupancy was 395 mSeconds with the unit transmitting a packet size of 1500 with a 0mS delay (worst case).

Each channel was used twice in a 60 second interval.

Unit meets the 0.4 Seconds per 30 second requirement.

Run #2: Output Power {15.247(b)}

- Low Channel 19.7 dBm
- Center Channel 19.8 dBm
- High Channel 19.8 dBm

Maximum output power was 19.8dBm (0.096 Watts), meeting the maximum permitted of 1 Watt.

Run #3a: Maximized radiated emissions, 1-25 GHz, Channel #1 (low channel)

FCC B in restricted bands, Frequencies not in restricted must be -20dB below the Fundamental in 100KHz Bandwidth.

All Readings have included AF, Cable Loss and Pre-Amp. gain.

| Frequency | Level | Pol | FCC B | FCC B | Detector | Azimuth | Height | Comments |
|-----------|--------|-----|-------|--------|-----------|---------|--------|----------|
| MHz | dBuV/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters | |
| 12010.730 | 50.6 | v | 54.0 | -3.4 | Avg | 210 | 1.0 | Note 1 |
| 12010.730 | 48.5 | h | 54.0 | -5.5 | Avg | 180 | 1.0 | Note 1 |
| 7205.583 | 44.8 | v | 54.0 | -9.2 | Avg | 210 | 1.0 | Note 1 |
| 12010.730 | 63.2 | v | 74.0 | -10.8 | Peak | 210 | 1.0 | |
| 4805.333 | 42.9 | v | 54.0 | -11.1 | Avg | 240 | 1.1 | Note 1 |
| 12010.730 | 61.9 | h | 74.0 | -12.1 | Peak | 180 | 1.0 | |
| 7205.583 | 39.1 | h | 54.0 | -14.9 | Avg | 260 | 1.0 | Note 1 |
| 4805.333 | 36.9 | h | 54.0 | -17.1 | Avg | 190 | 1.0 | Note 1 |
| 7205.583 | 55.8 | v | 74.0 | -18.2 | Peak | 210 | 1.0 | |
| 7205.583 | 52.6 | h | 74.0 | -21.4 | Peak | 260 | 1.0 | |
| 4804.333 | 51.2 | v | 74.0 | -22.8 | Peak | 240 | 1.1 | |
| 4804.333 | 48.8 | h | 74.0 | -25.2 | Peak | 190 | 1.0 | |

Note1 | 4dB was subtracted from the average reading for duty cycle correction factor (information was give from the client).



Emissions Test Data

| | | | | | |
|-----------|---------------------|-----------|-----------|-------------|------------|
| Client: | Proxim, Inc. | Date: | 2/24/99 | Test Engr: | Rudy Suy |
| Product: | 4110-05 | File: | T30505 | Proj. Engr: | Mark H & B |
| Objective | Final Qualification | Site: | SVOATS #2 | Contact: | Jeff |
| Spec: | FCC Part 15 | Distance: | 3 m | Approved: | |

Run #3b: Maximized radiated emissions, 1-25 GHz, Channel #39 (center channel)

FCC B in restricted bands, Frequencies not in restricted must be -20dB below the Fundamental in 100KHz Bandwidth.

All Readings have included AF, Cable Loss and Pre-Amp. gain.

| Frequency MHz | Level dBuV/m | Pol v/h | FCC B Limit | FCC B Margin | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------|------------|----------------|-----------------|-----------------------|--------------------|------------------|----------|
| 12200.670 | 46.7 | v | 54.0 | -7.3 | Avg | 240 | 1.0 | Note 1 |
| 7319.700 | 45.4 | v | 54.0 | -8.6 | Avg | 250 | 1.5 | Note 1 |
| 4880.075 | 44.5 | v | 54.0 | -9.5 | Avg | 280 | 1.0 | Note 1 |
| 12200.670 | 43.6 | h | 54.0 | -10.4 | Avg | 180 | 1.2 | Note 1 |
| 7319.700 | 42.7 | h | 54.0 | -11.3 | Avg | 250 | 1.2 | Note 1 |
| 12200.670 | 60.2 | v | 74.0 | -13.8 | Peak | 240 | 1.5 | |
| 4880.075 | 40.2 | h | 54.0 | -13.8 | Avg | 230 | 1.2 | Note 1 |
| 12200.670 | 58.6 | h | 74.0 | -15.4 | Peak | 180 | 1.2 | |
| 7319.700 | 55.7 | v | 74.0 | -18.3 | Peak | 250 | 1.5 | |
| 7319.700 | 54.6 | h | 74.0 | -19.4 | Peak | 250 | 1.2 | |
| 4880.075 | 52.7 | v | 74.0 | -21.3 | Peak | 280 | 1.0 | |
| 4880.075 | 49.7 | h | 74.0 | -24.3 | Peak | 230 | 1.2 | |

Note1 4dB was subtracted from the average reading for duty cycle correction factor (information was give from the client).

Run #3c: Maximized radiated emissions, 1-25 GHz, Channel #79 (high channel)

FCC B in restricted bands, Frequencies not in restricted must be -20dB below the Fundamental in 100KHz Bandwidth.

All Readings have included AF, Cable Loss and Pre-Amp. gain.

| Frequency MHz | Level dBuV/m | Pol v/h | FCC B Limit | FCC B Margin | Detector Pk/QP/Avg | Azimuth degrees | Height meters | Comments |
|------------------|-----------------|------------|----------------|-----------------|-----------------------|--------------------|------------------|---------------------------------------|
| 2486.960 | 46.8 | v | 54.0 | -7.2 | Avg | 200 | 1.0 | Band Edge, no signal only noise floor |
| 4960.058 | 45.7 | v | 54.0 | -8.3 | Avg | 220 | 1.1 | Note 1 |
| 7439.933 | 45.6 | v | 54.0 | -8.4 | Avg | 210 | 1.3 | Note 1 |
| 2486.960 | 63.7 | v | 74.0 | -10.4 | Peak | 200 | 1.0 | Band Edge, no signal only noise floor |
| 7439.933 | 43.4 | h | 54.0 | -10.6 | Avg | 160 | 1.1 | Note 1 |
| 1240.013 | 41.7 | v | 54.0 | -12.3 | Avg | 210 | 1.6 | Note 1 |
| 4960.058 | 41.5 | h | 54.0 | -12.5 | Avg | 220 | 1.1 | Note 1 |
| 1240.013 | 41.3 | h | 54.0 | -12.7 | Avg | 210 | 1.1 | Note 1 |
| 1240.013 | 58.3 | v | 74.0 | -15.7 | Peak | 210 | 1.6 | |
| 1240.013 | 57.1 | h | 74.0 | -16.9 | Peak | 210 | 1.1 | |
| 7439.933 | 55.2 | v | 74.0 | -18.8 | Peak | 210 | 1.3 | |
| 7439.933 | 54.6 | h | 74.0 | -19.4 | Peak | 160 | 1.1 | |
| 4960.058 | 54.0 | v | 74.0 | -20.0 | Peak | 220 | 1.1 | |
| 4960.058 | 51.6 | h | 74.0 | -22.4 | Peak | 220 | 1.1 | |

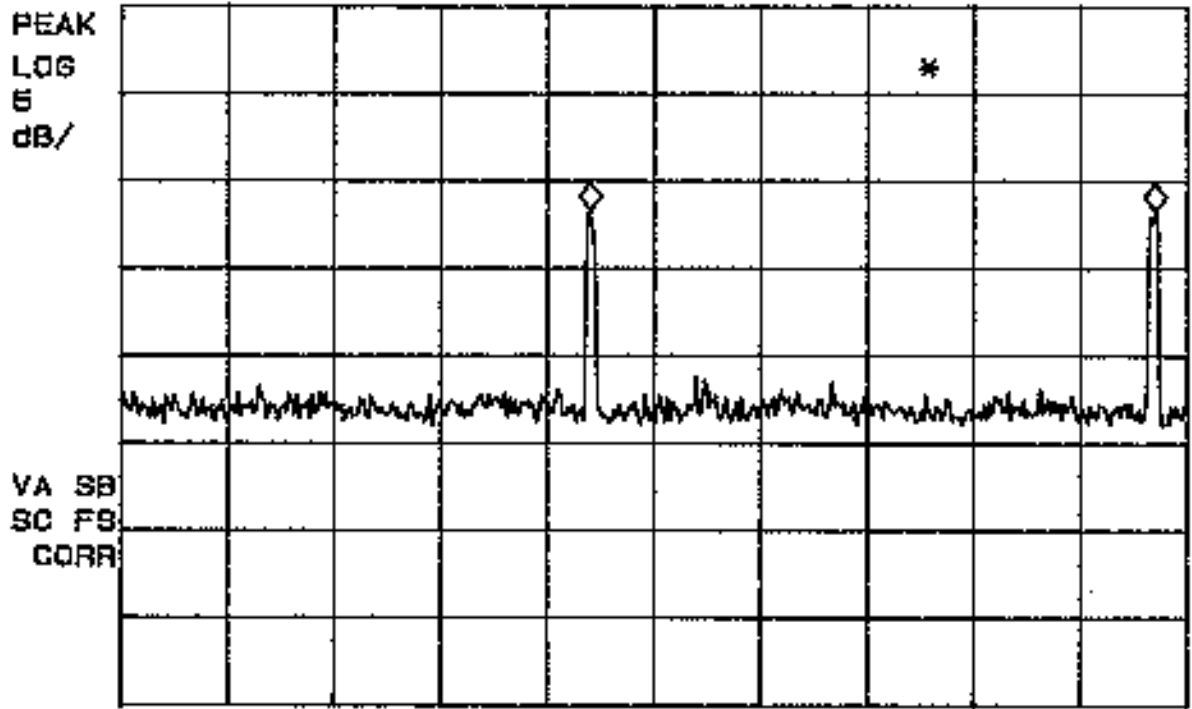
Note1 4dB was subtracted from the average reading for duty cycle correction factor (information was give from the client).

PROXIM
(Channel Occupancy)

12:47:03 FEB 25, 1999

MKR 31.800 sec
.00 dB

REF 107.0 dBμV #AT 70 dB

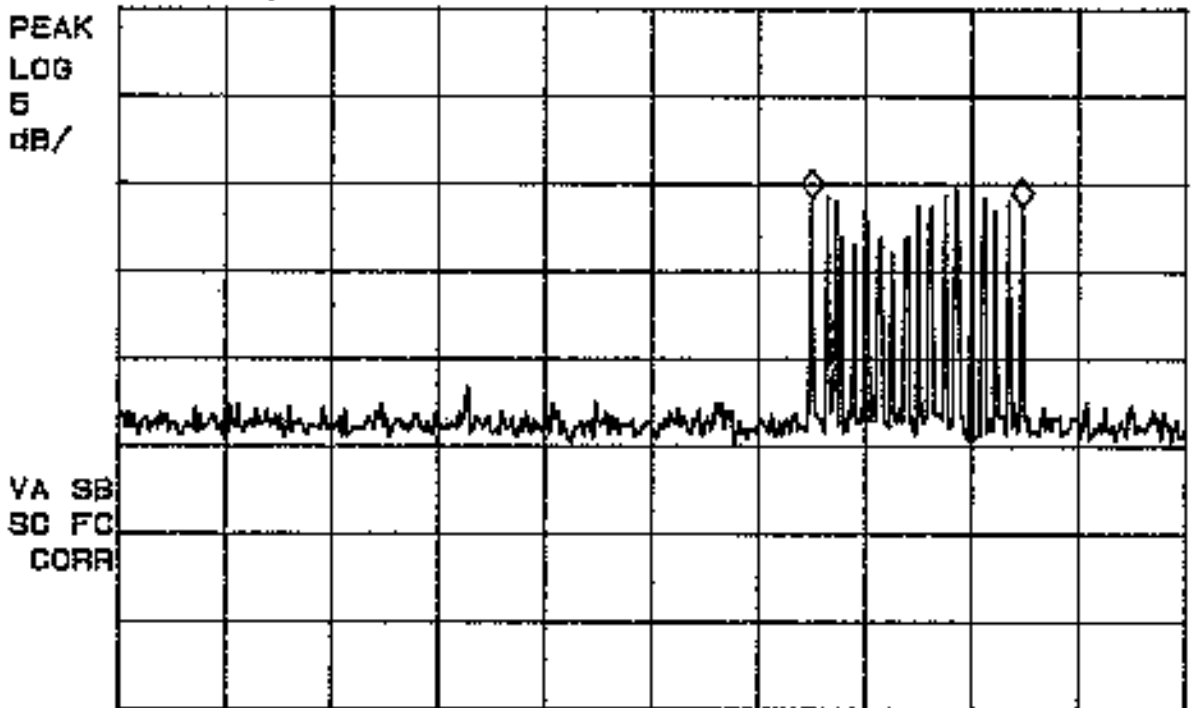


CENTER 2.4071261 GHz SPAN 0 Hz
#RES BW 30 KHz #VBW 3 MHz #SWP 60.0 sec

12:55:06 FEB 25, 1999

MKR 395.00 msec
-.49 dB

REF 107.0 dBμV #AT 60 dB

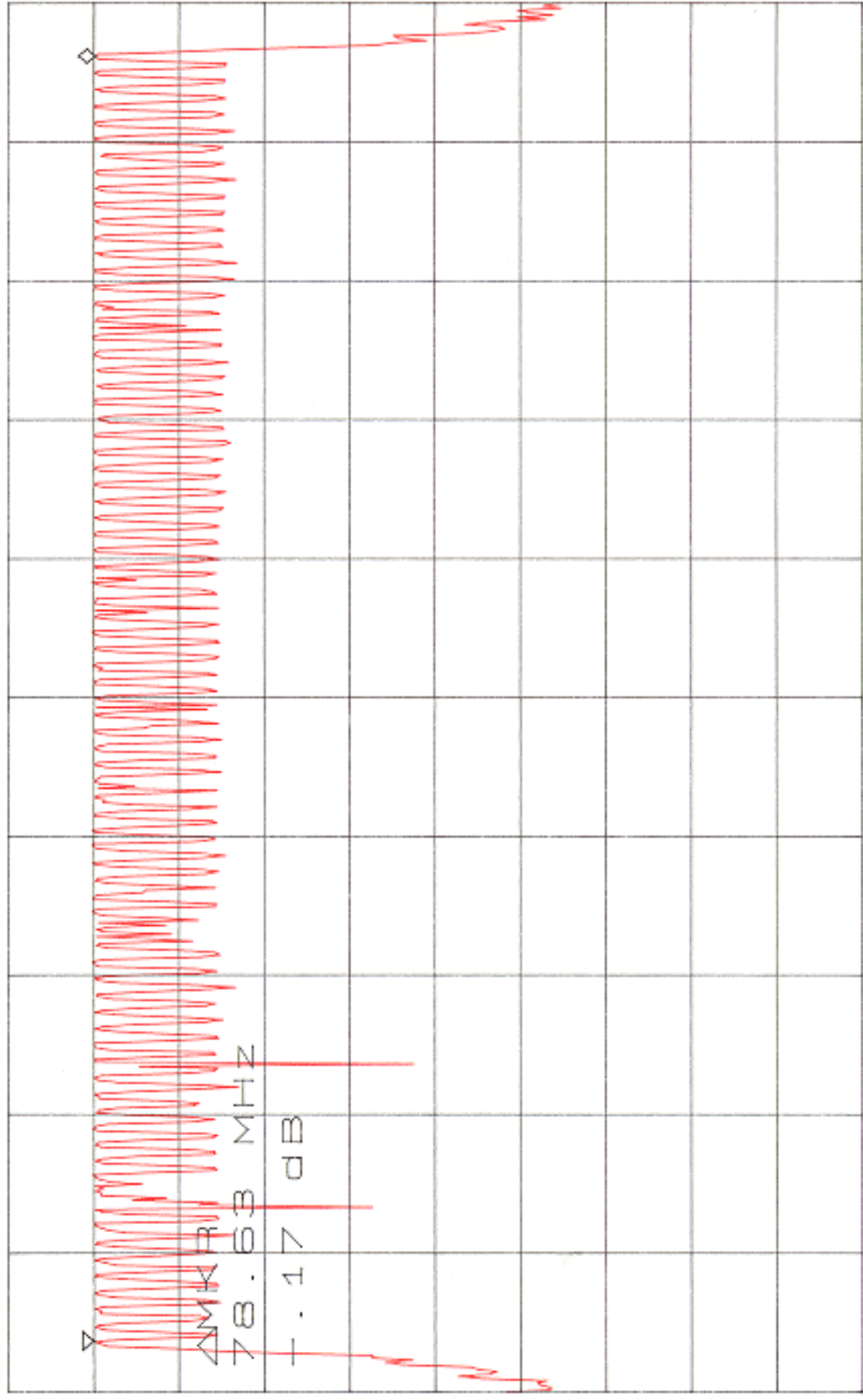


CENTER 2.407126 GHz SPAN 0 Hz
#RES BW 300 KHz #VBW 3 MHz #SWP 2.00 sec

ATTEN 40dB
RL 30.0dBm

Δ MKR - .17dB
78.63MHz

10dB/

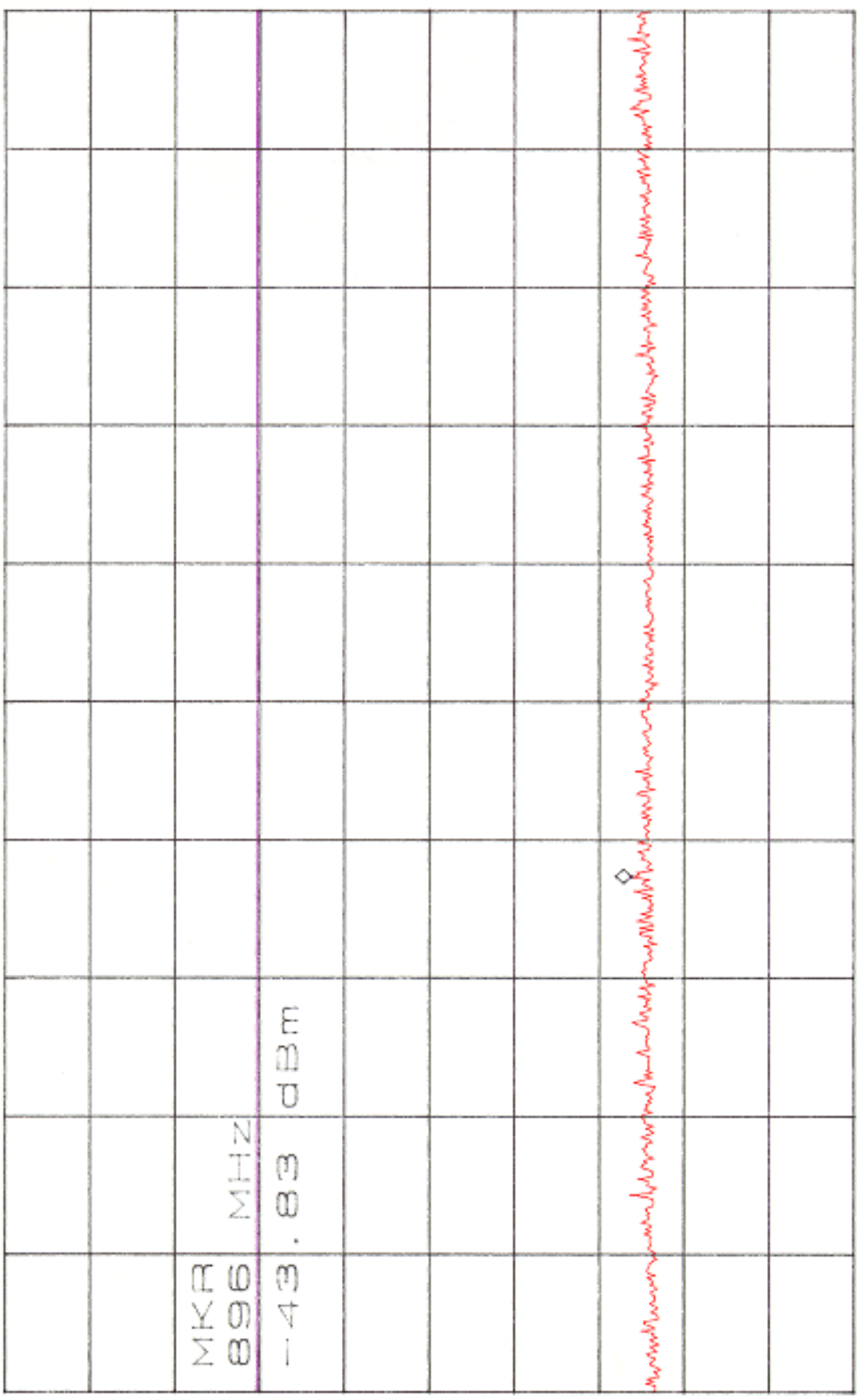


D

START 2.39900GHZ STOP 2.48400GHZ
*RBW 100KHZ *VBW 100KHZ SWP 50ms

CHANNEL 2

ATTEN 40dB MKR -43.83dBm
RL 30.0dBm 10dB/ 896MHz



START 30MHz STOP 2.350GHz
*RBW 100kHz *VBW 100kHz SWP 580ms

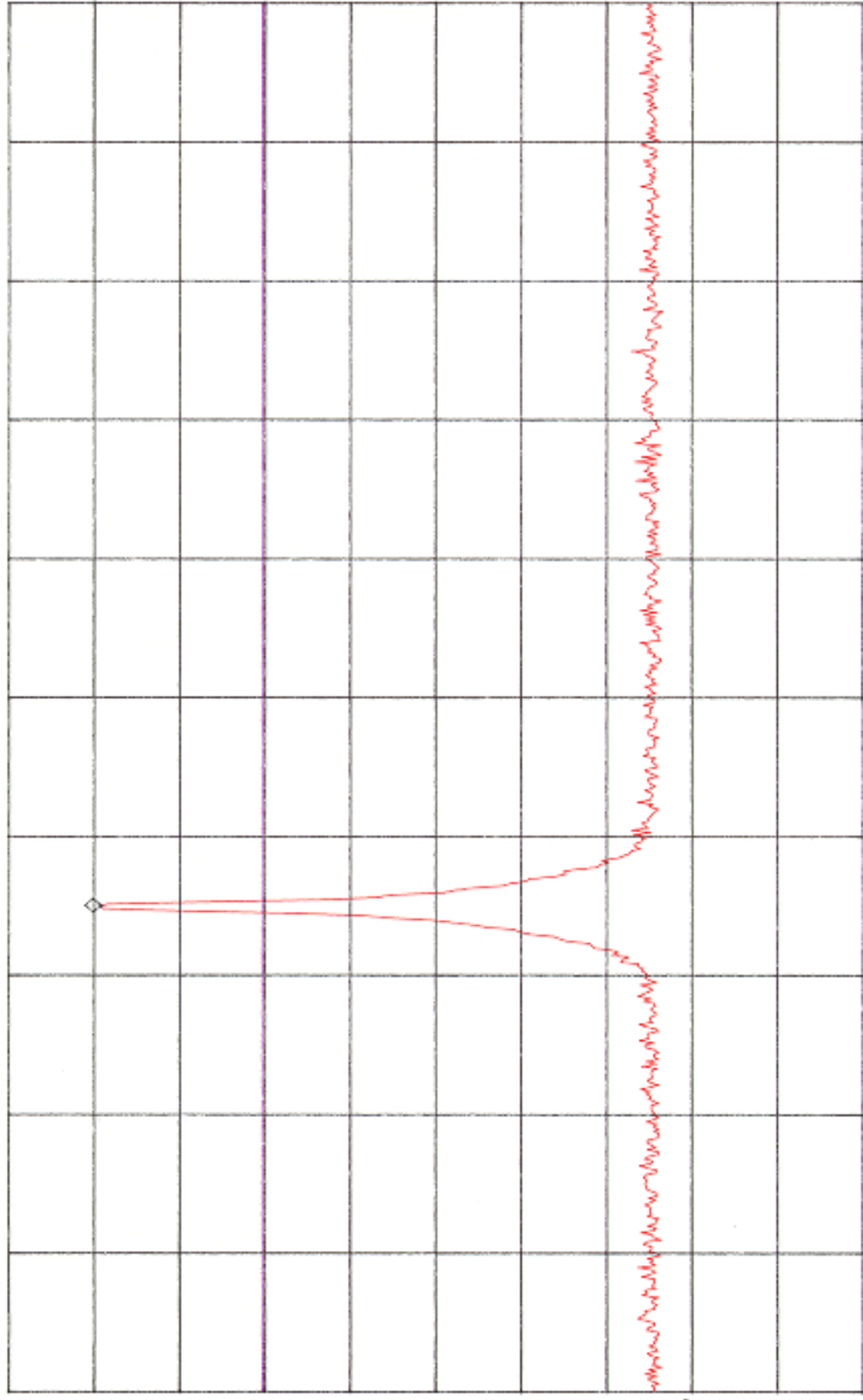
D

CHANNEL 1

ATTEN 40dB
RL 30.0dBm

MKR 19.17dBm
2.4025GHz

10dB/

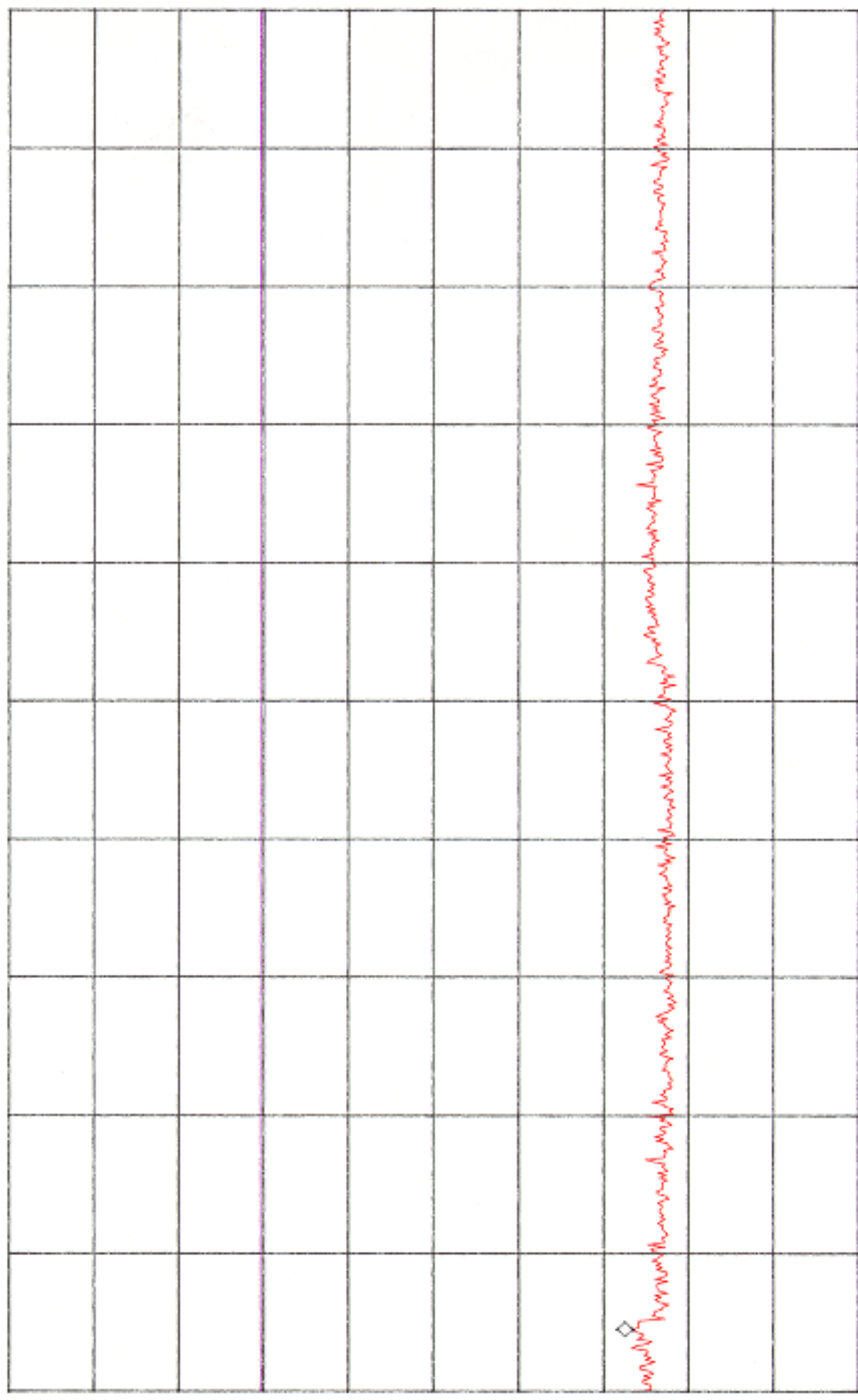


0

START 2.3500GHz STOP 2.5000GHz
*RBW 100kHz *VBW 100kHz SWP 50ms

CHANNEL 1

ATTEN 40dB MKR -43.50dBm
RL 30.0dBm 10dB/ 2.838GHz



D

START 2.500GHz STOP 40.000GHz
*RBW 400kHz *VBW 400kHz SWP 1.95sec

CHANNEL 1

ATTEN 40dB MKR -40.83dBm
RL 30.0dBm 10dB/ 22.78GHz



D

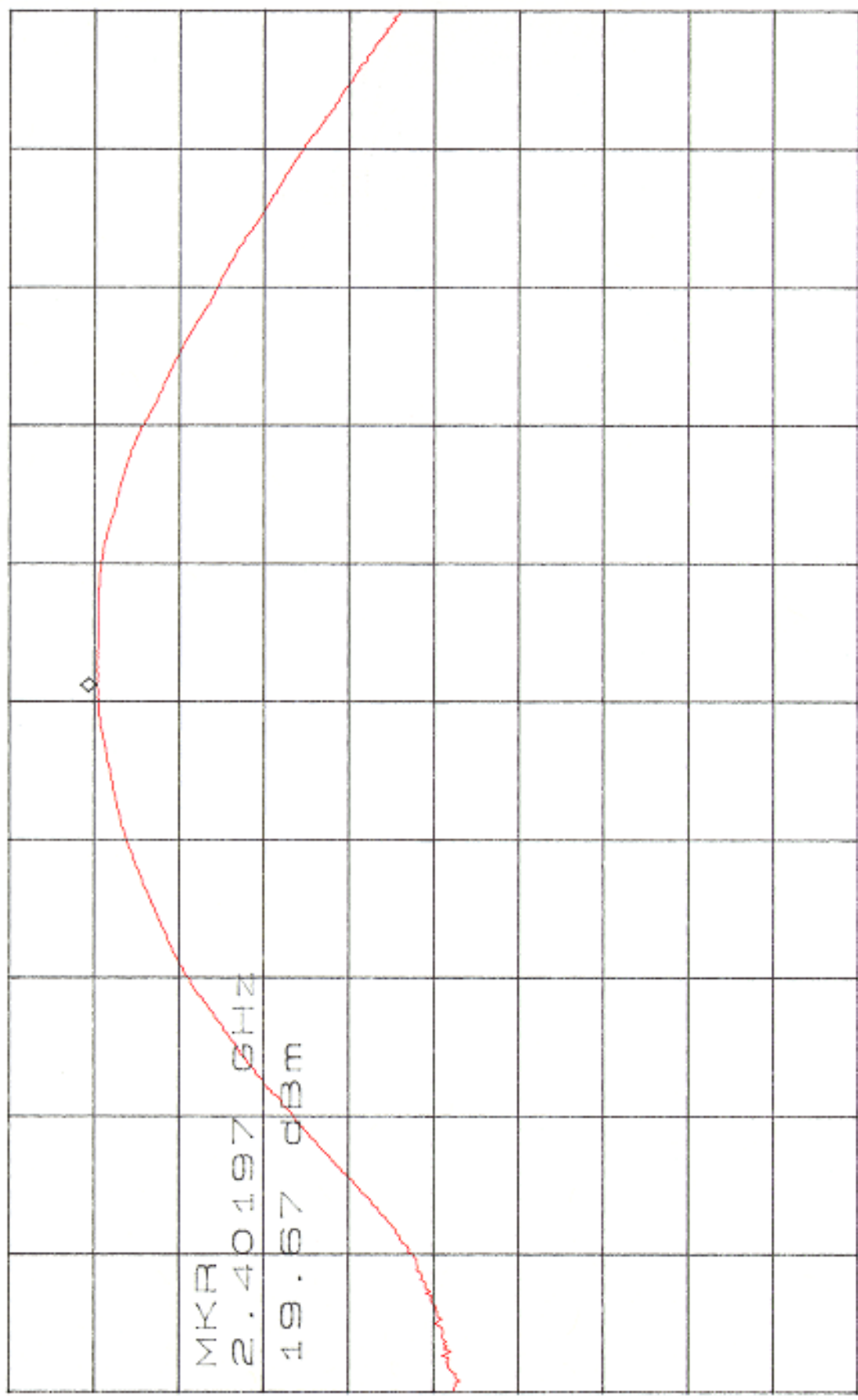
START 10.00GHz STOP 25.00GHz
*RBW 100kHz *VBW 100kHz SWP 3.8sec

CHANNEL 1

ATTEN 40dB
RL 30.0dBm

MKR 19.67dBm
2.40197GHz

10dB/



D

CENTER 2.401856GHz

SPAN 10.00MHz

*RBW 2.0MHz

*VBW 3.0MHz

SWP 50ms

CHANNEL 1

ATTEN 40dB
RL 30.0dBm

Δ MKR .83dB
925kHz

10dB/



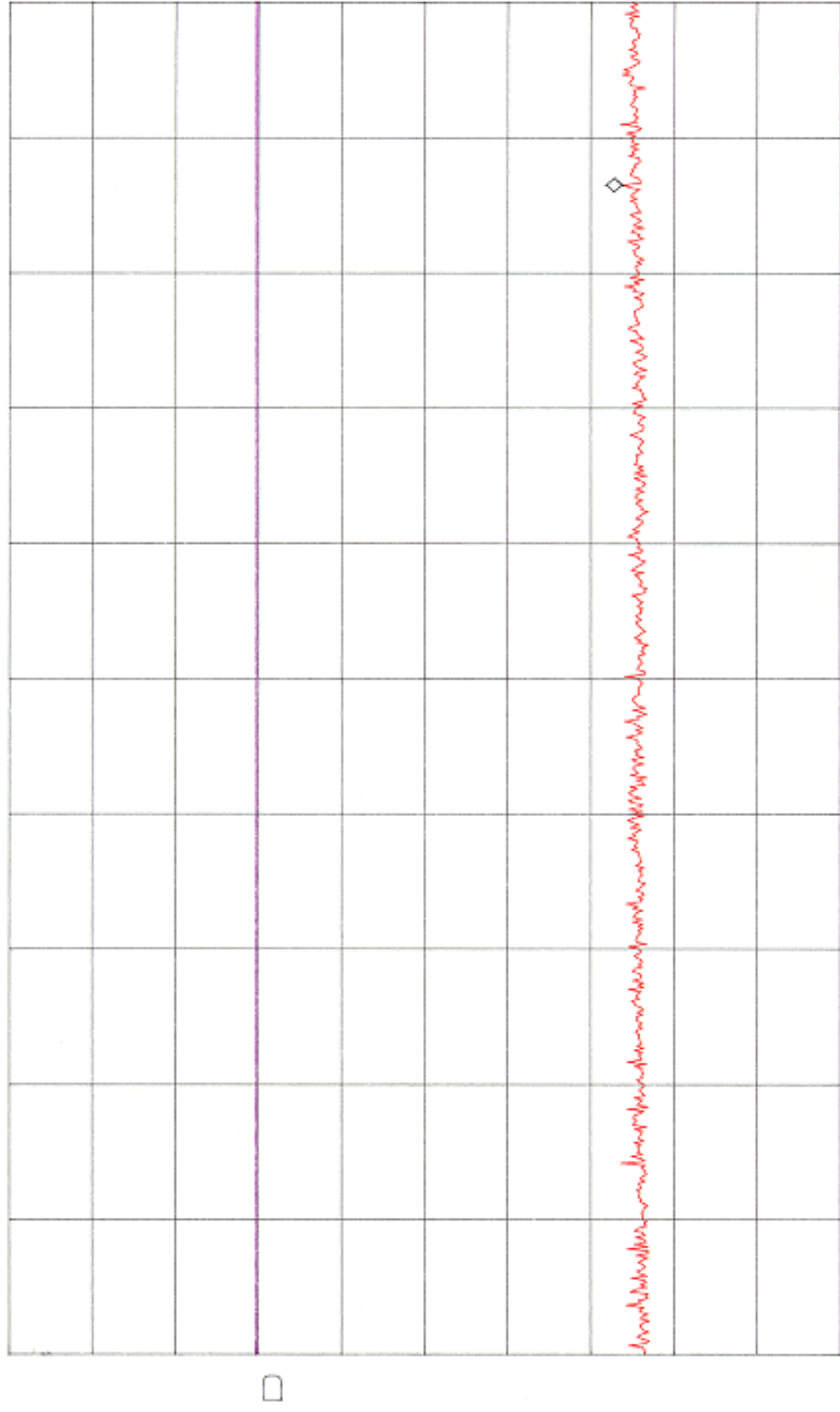
CENTER 2.402000GHZ
*RBW 30kHz *VBW 100kHz

SPAN 5.000MHZ
SWP 50ms

CHANNEL 39

ATTEN 40dB MKR -43.67dBm

RL 30.0dBm 10dB/ 2.037GHz



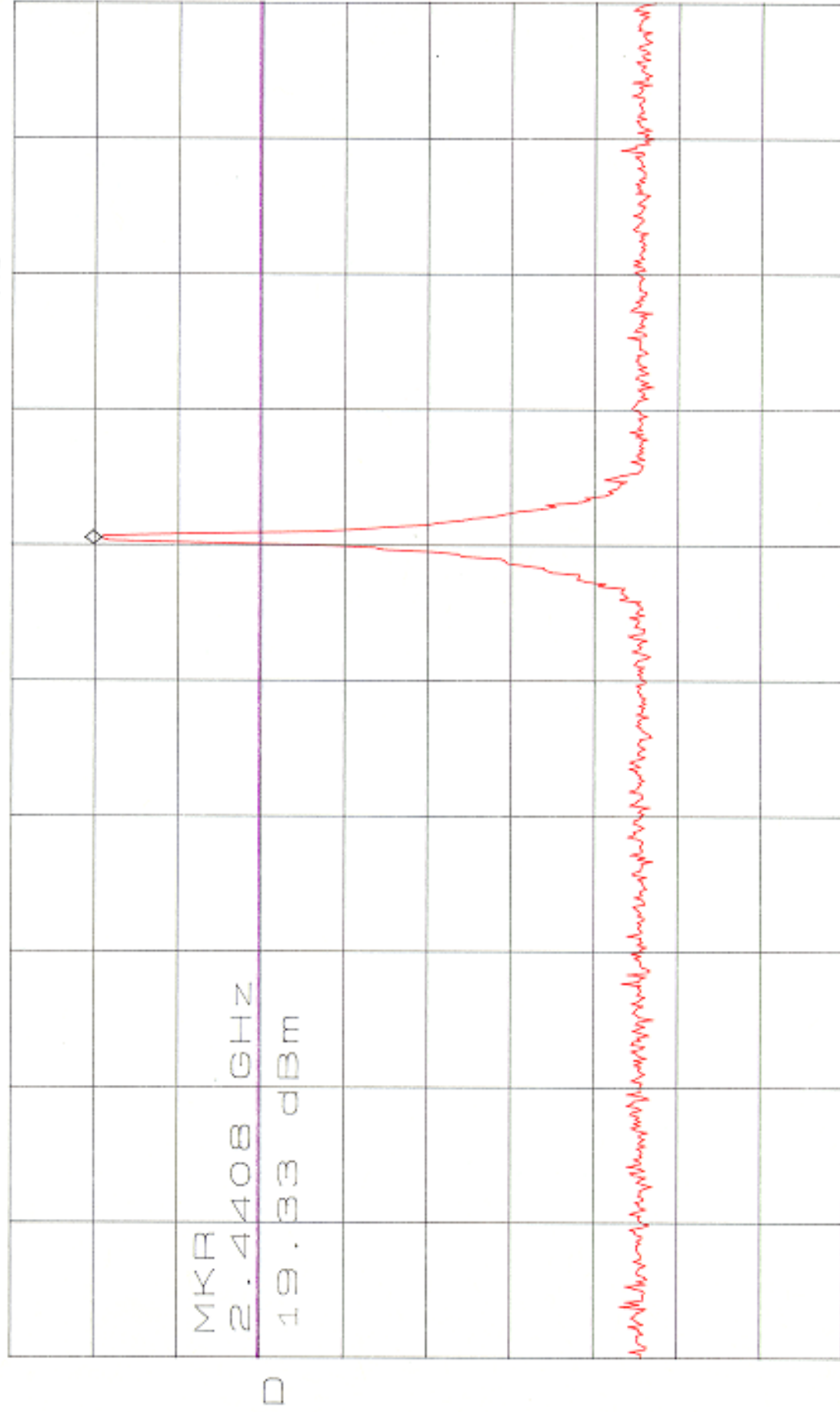
D

START 30MHz STOP 2.350GHz
*RBW 100kHz *VBW 100kHz SWP 580ms

CHANNEL 39

ATTEN 40dB
RL 30.0dBm

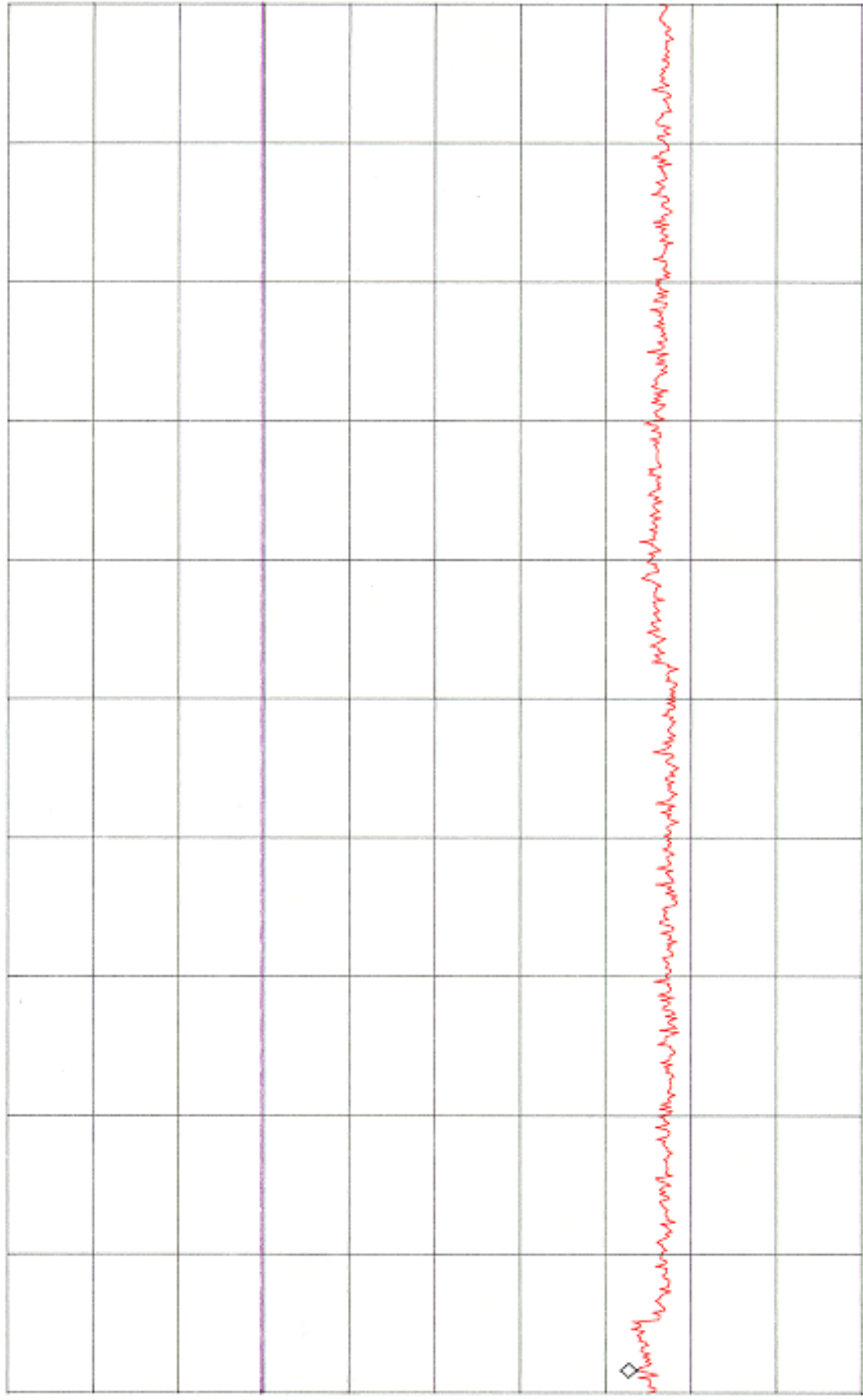
MKR 19.33dBm
2.4408GHz



START 2.3500GHZ STOP 2.5000GHZ
*RBW 100kHz *VBW 100kHz SWP 50ms

CHANNEL 39

ATTEN 40dB MKR -43.67dBm
RL 30.0dBm 10dB/ 2.625GHz



D

START 2.500GHz STOP 10.000GHz
*RBW 100kHz *VBW 100kHz SWP 1.9sec

CHANNEL 39

ATTEN 40dB MKR -41.17dBm
RL 30.0dBm 10dB/ 23.13GHz



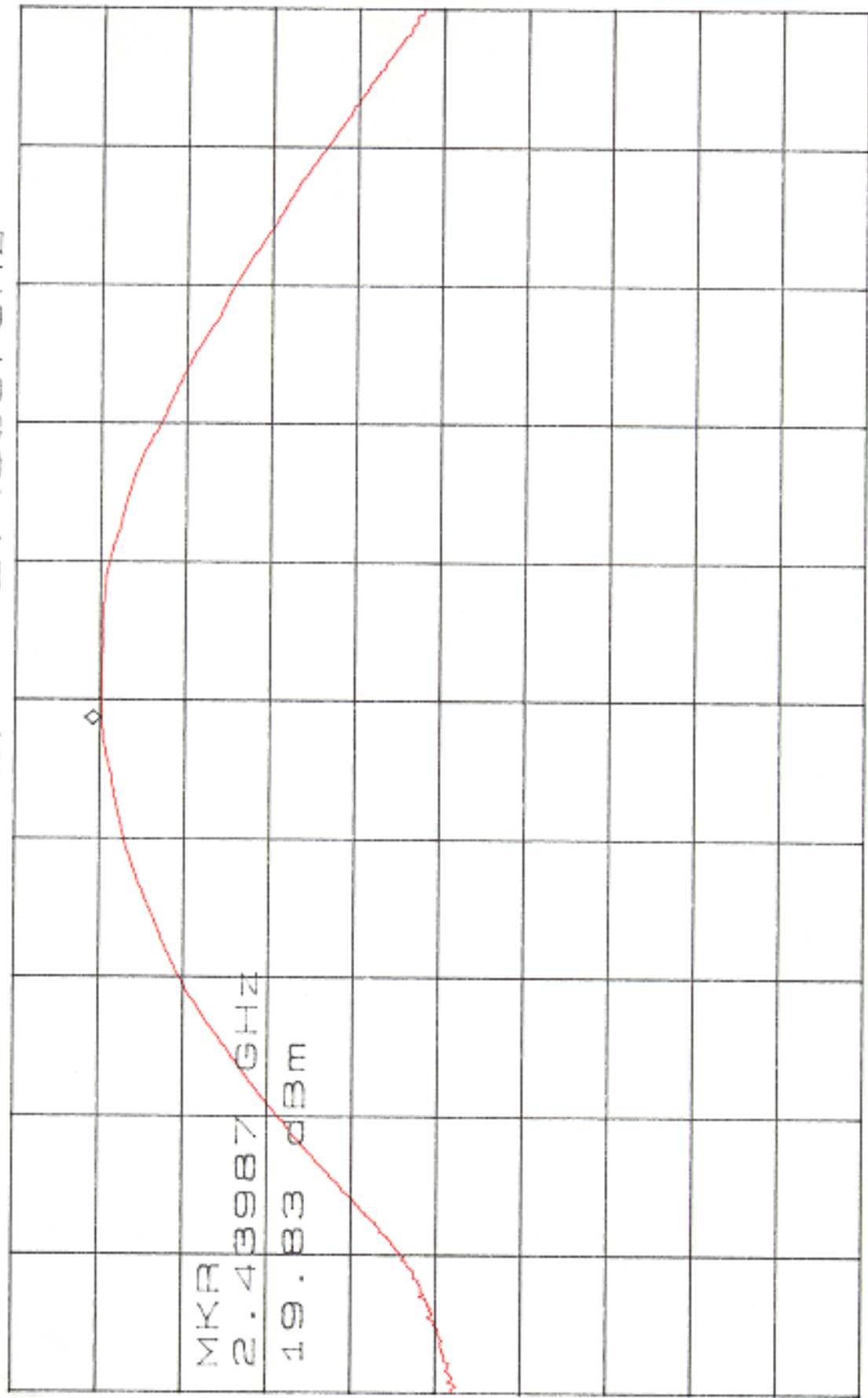
D

START 10.00GHz STOP 25.00GHz
*RBW 100kHz *VBW 100kHz SWP 3.8sec

CHANNEL 39

ATTEN 40dB
RL 30.0dBm

MKR 19.83dBm
2.43987GHZ



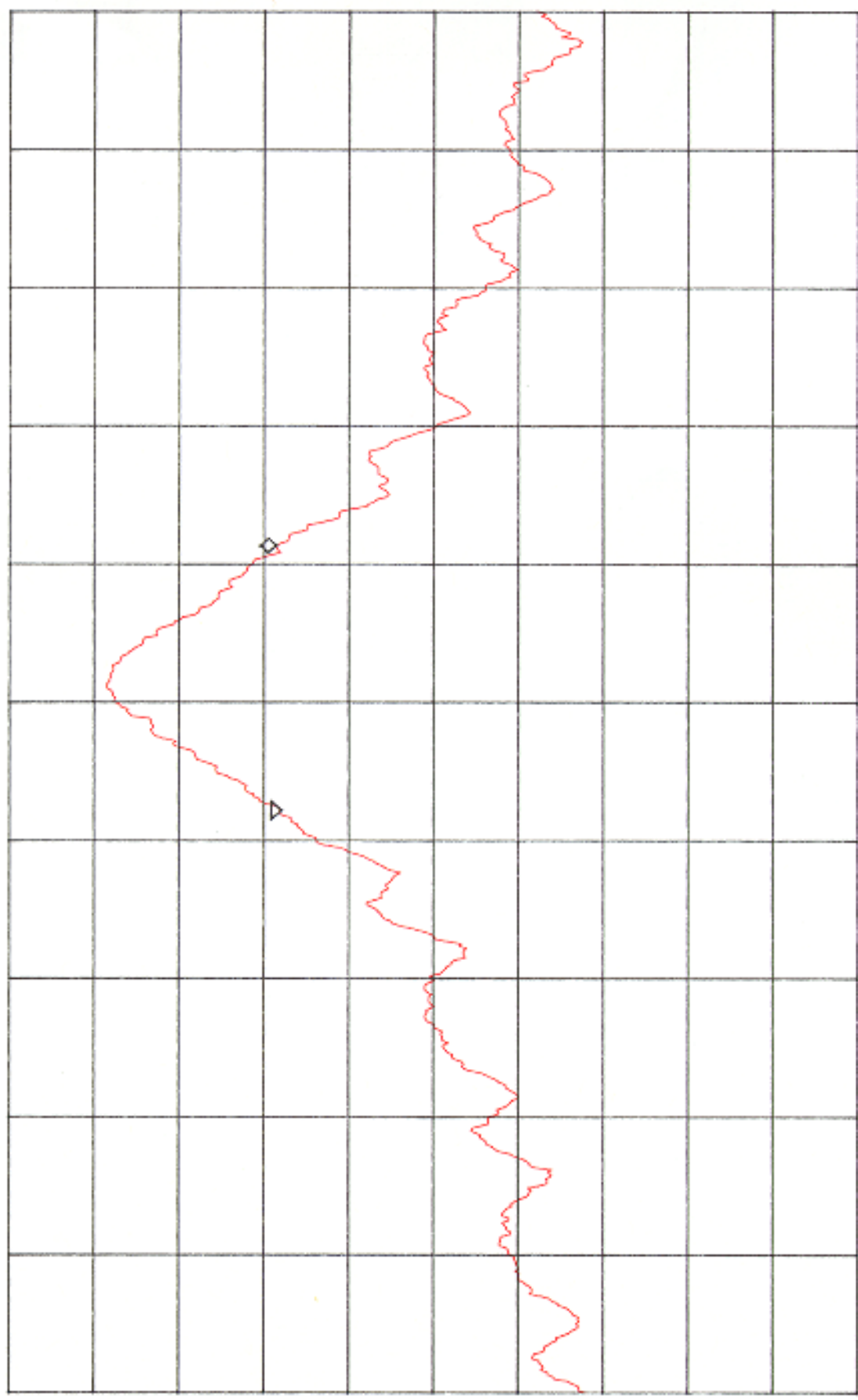
D

CENTER 2.44000GHZ SPAN 10.00MHZ
*RBW 2.0MHZ *VBW 3.0MHZ SWP 50ms

CHANNEL 39

ATTEN 40dB
RL 30.0dBm

Δ MKR .67dB
10dB/
958kHz

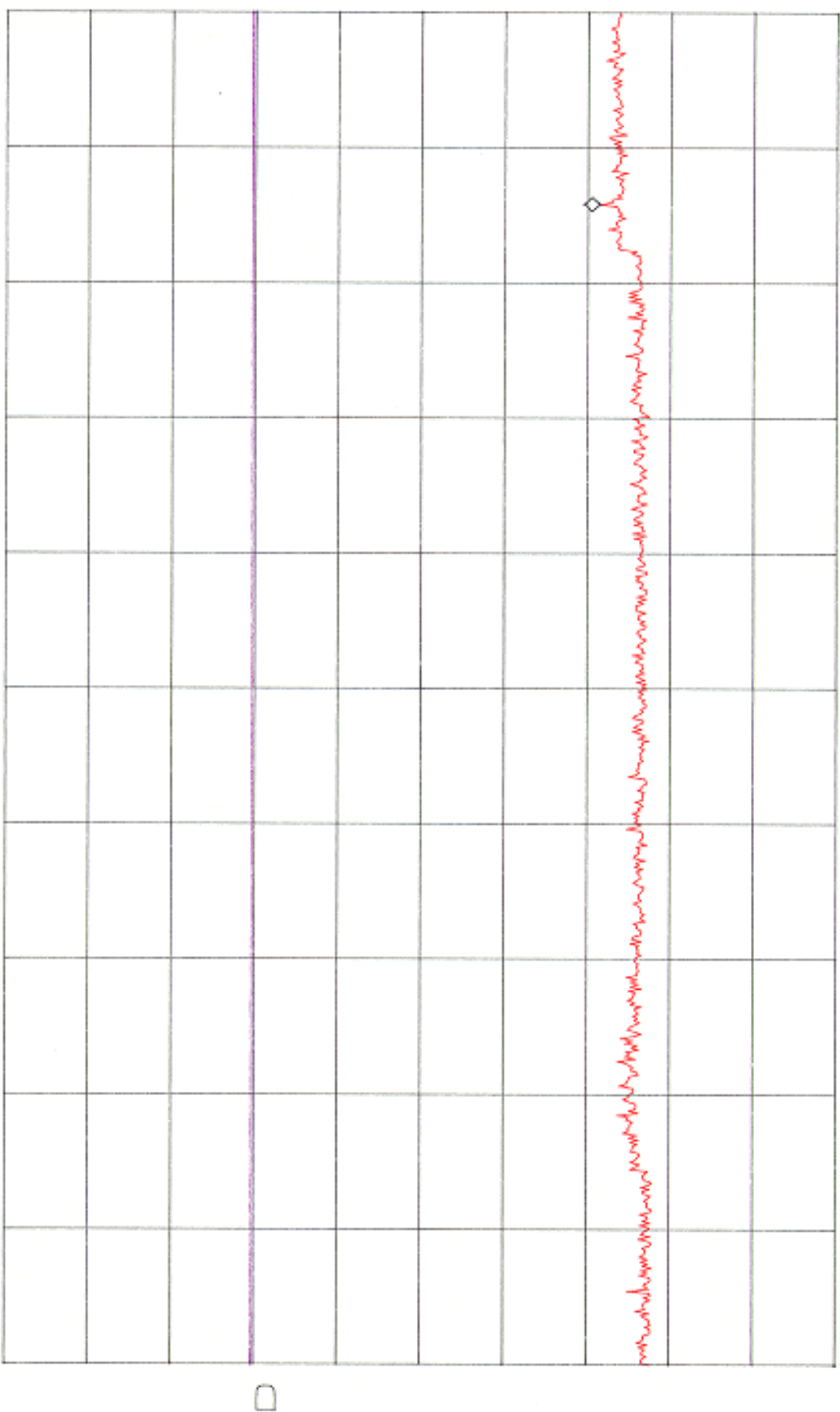


D

CENTER 2.440000GHZ
*RBW 30kHz *VBW 100kHz
SPAN 5.000MHZ SWP 50ms

CHANNEL 79

ATTEN 40dB MKR -41.50dBm
RL 30.0dBm 13.58GHz
10dB/

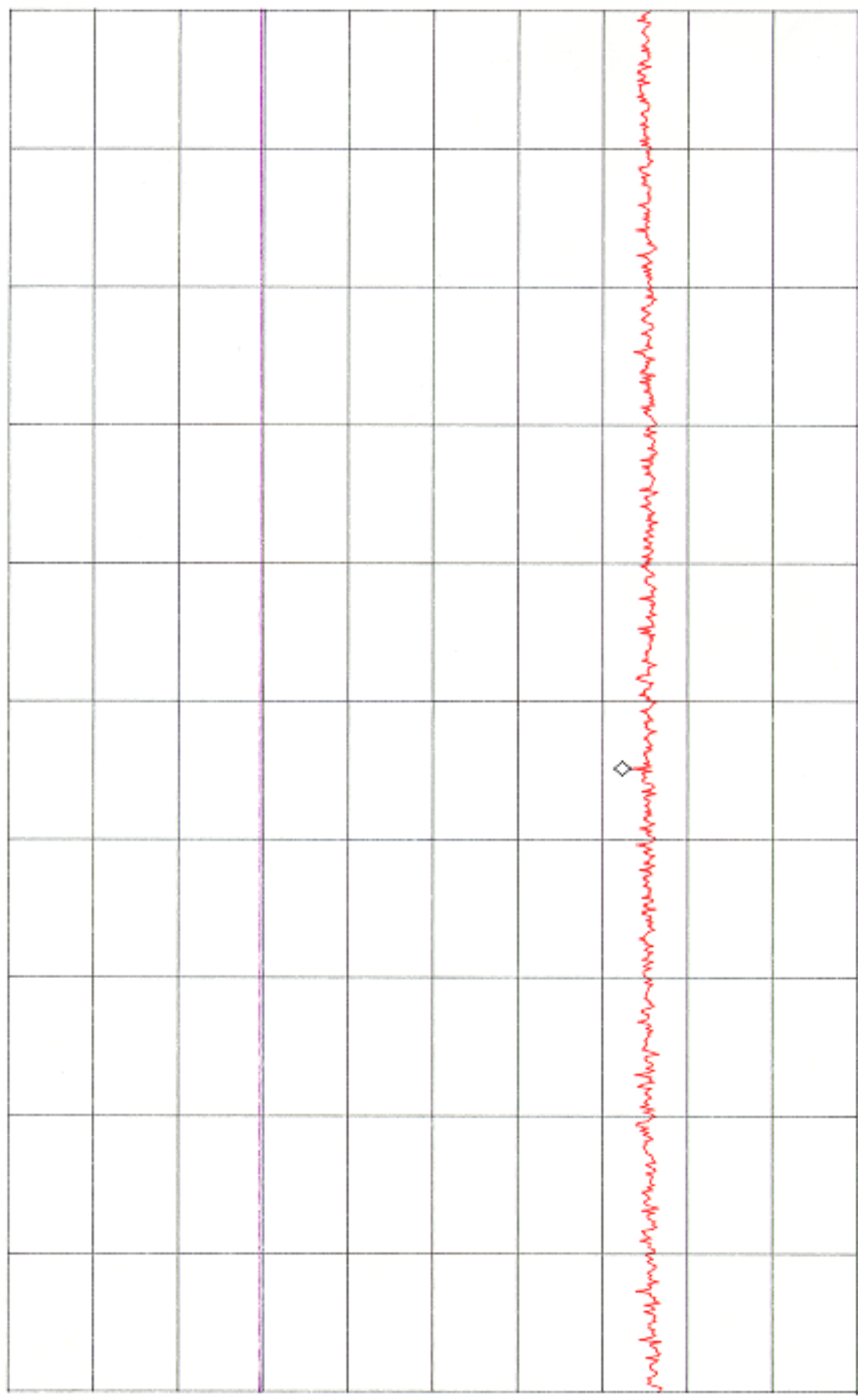


D

START 5.00GHz STOP 15.00GHz
*RBW 100kHz *VBW 100kHz SWP 2.5sec

CHANNEL 79

ATTEN 40dB MKR -43.33dBm
RL 30.0dBm 1.078GHZ

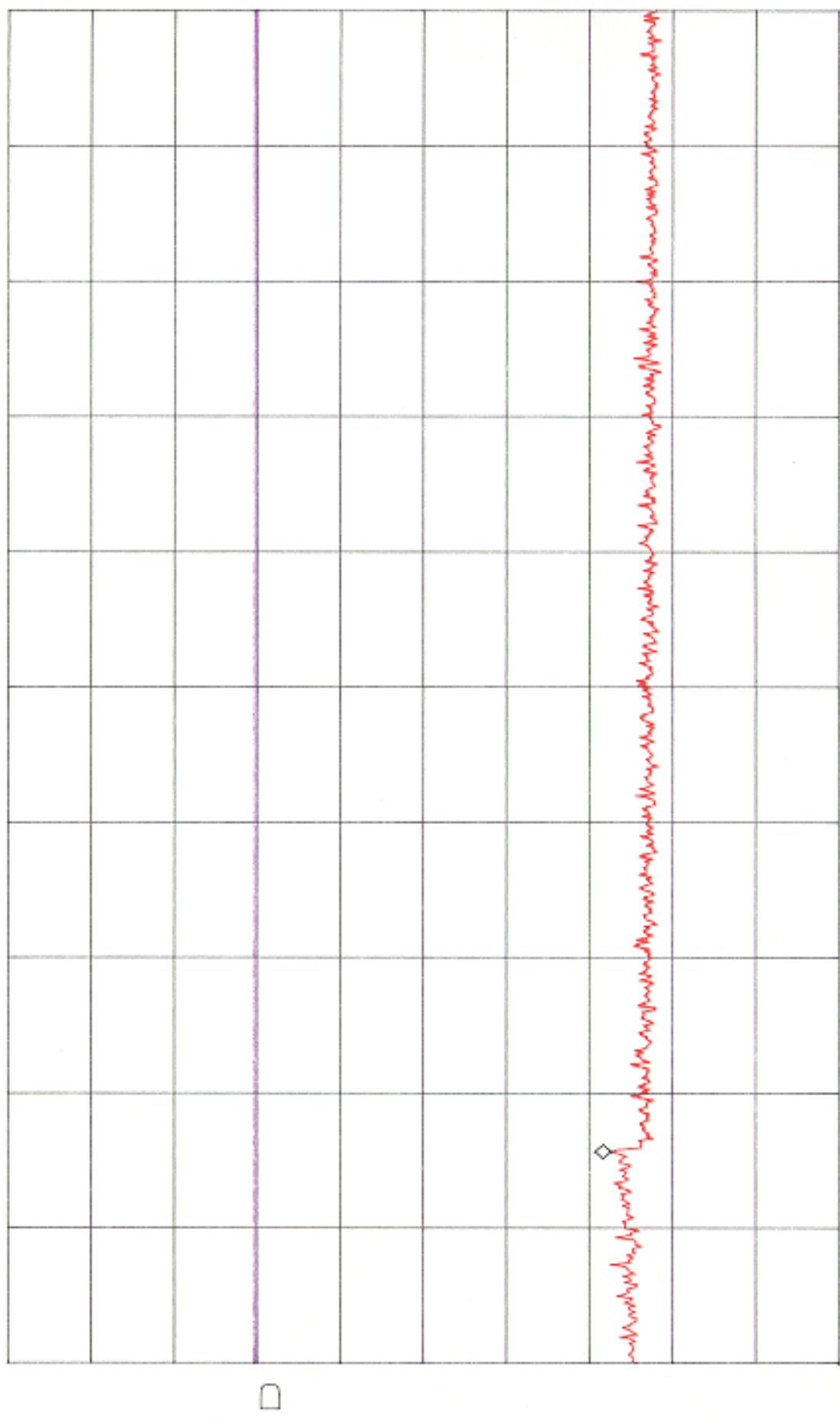


D

START 30MHz STOP 2.350GHz
*RBW 100kHz *VBW 100kHz SWP 580ms

CHANNEL 79

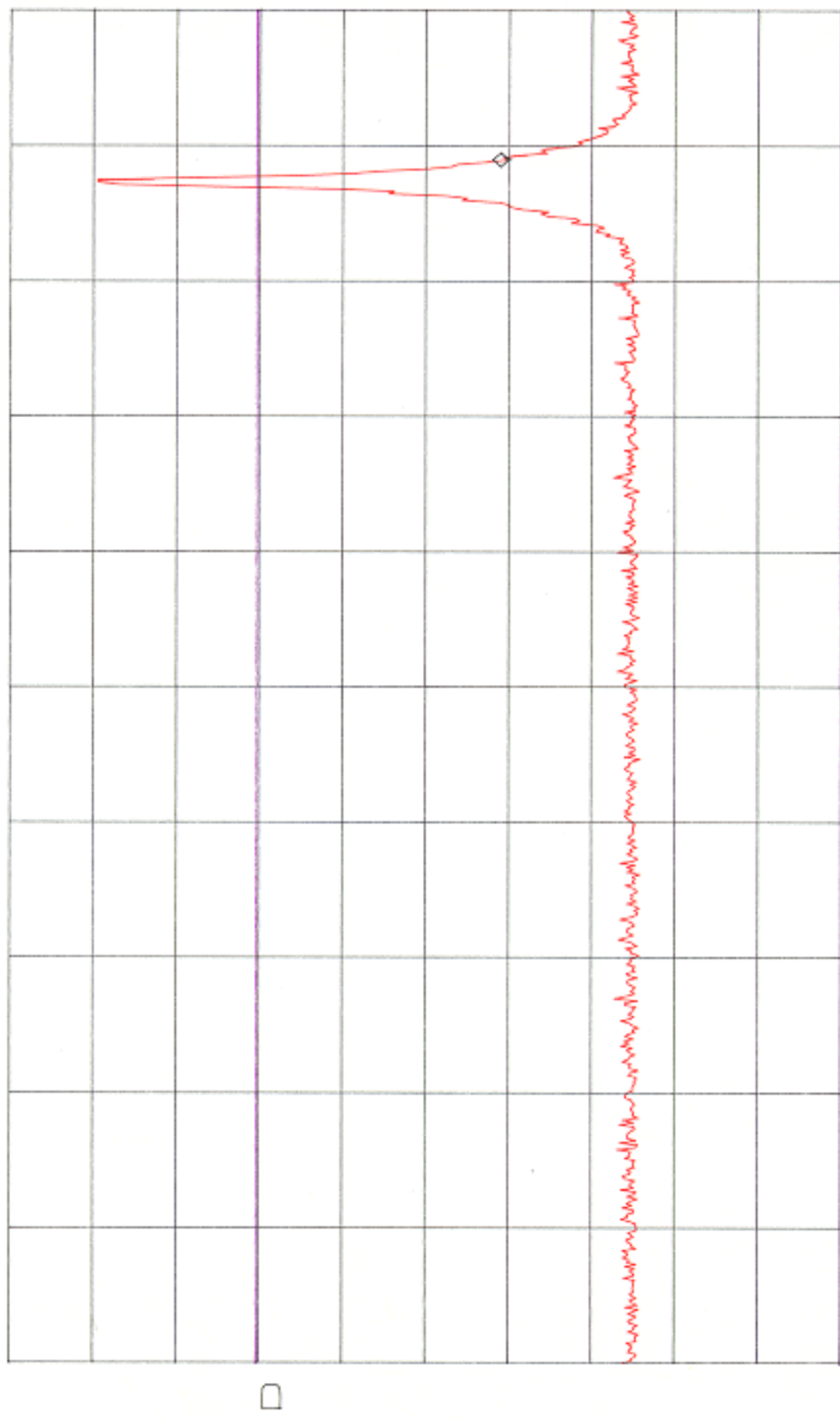
ATTEN 40dB MKR -42.67dBm
RL 30.0dBm 2.892GHz
10dB/



START 2.500GHz STOP 5.000GHz
*RBW 100kHz *VBW 100kHz SWP 630ms

CHANNEL 79

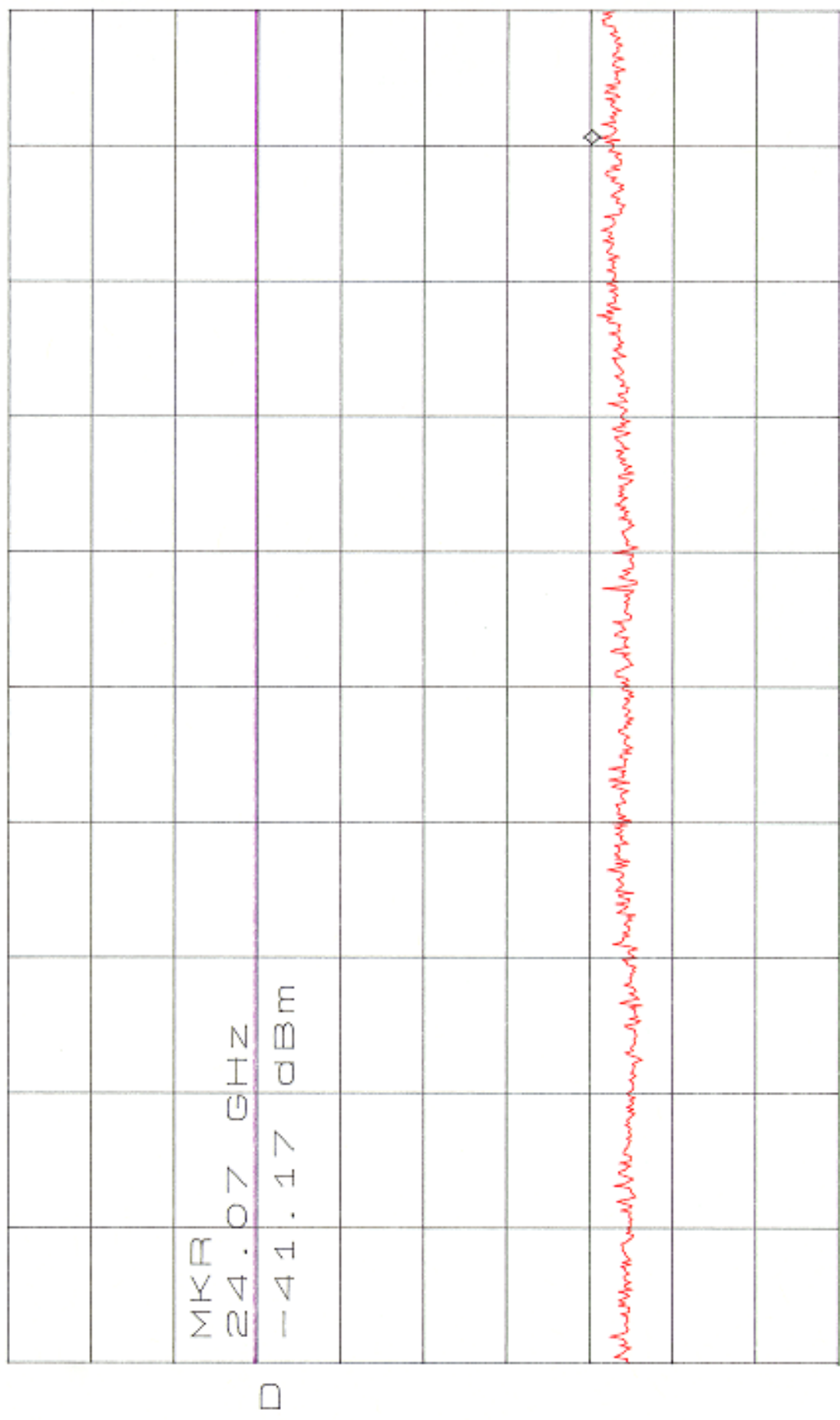
ATTEN 40dB MKR -30.00dBm
RL 30.0dBm 2.4835GHz
10dB/



START 2.3500GHZ STOP 2.5000GHZ
*RBW 100KHZ *VBW 100KHZ SWP 50ms

CHANNEL 79

ATTEN 40dB MKR -41.17dBm
RL 30.0dBm 24.07GHZ
10dB/



D
MKR
24.07 GHZ
-41.17 dBm

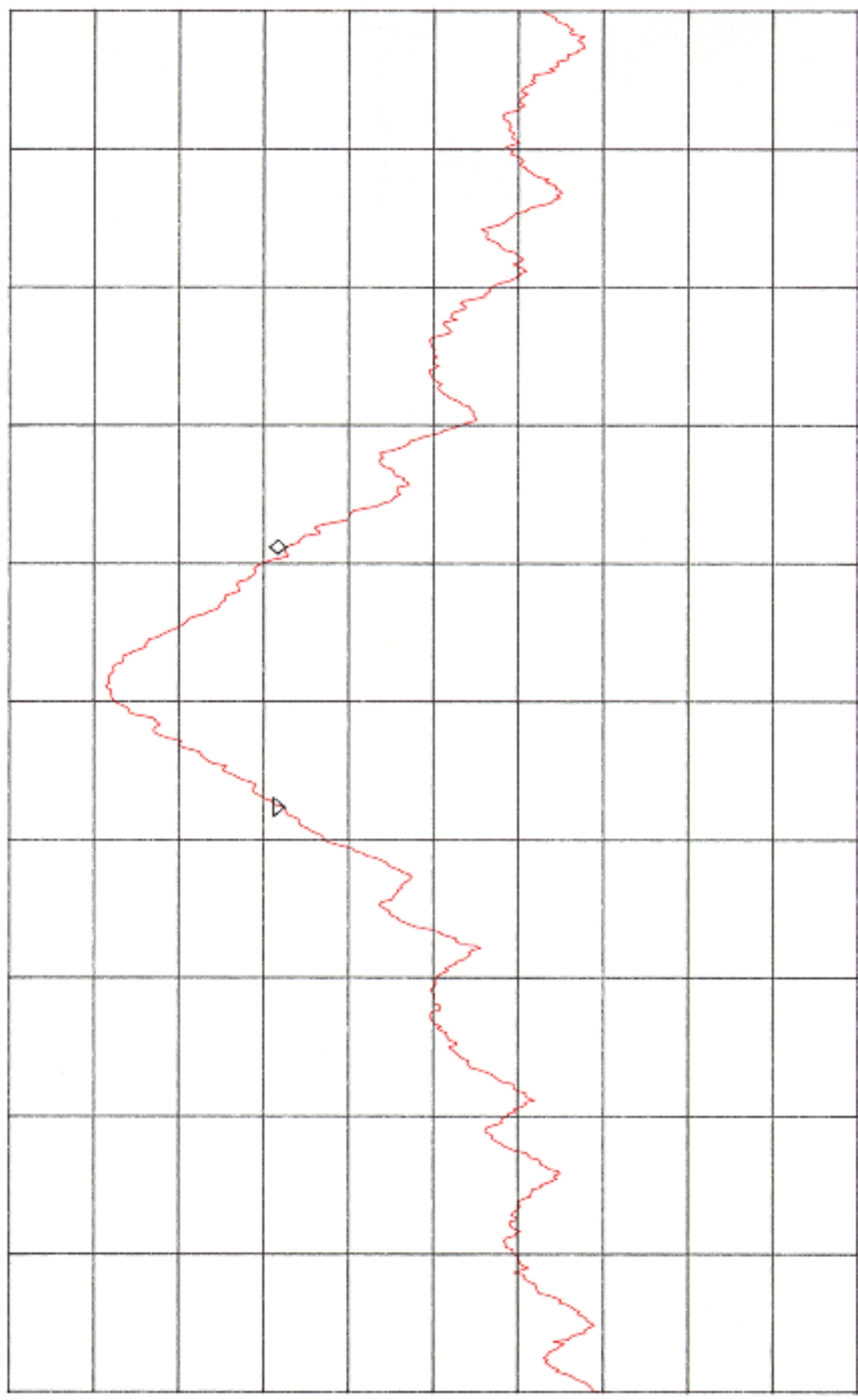
START 15.00GHZ STOP 25.00GHZ
*RBW 100KHZ *VBW 100KHZ SWP 2.5sec

CHANNEL 79

ATTEN 40dB
RL 30.0dBm

Δ MKR - .17dB
942kHz

10dB/



D

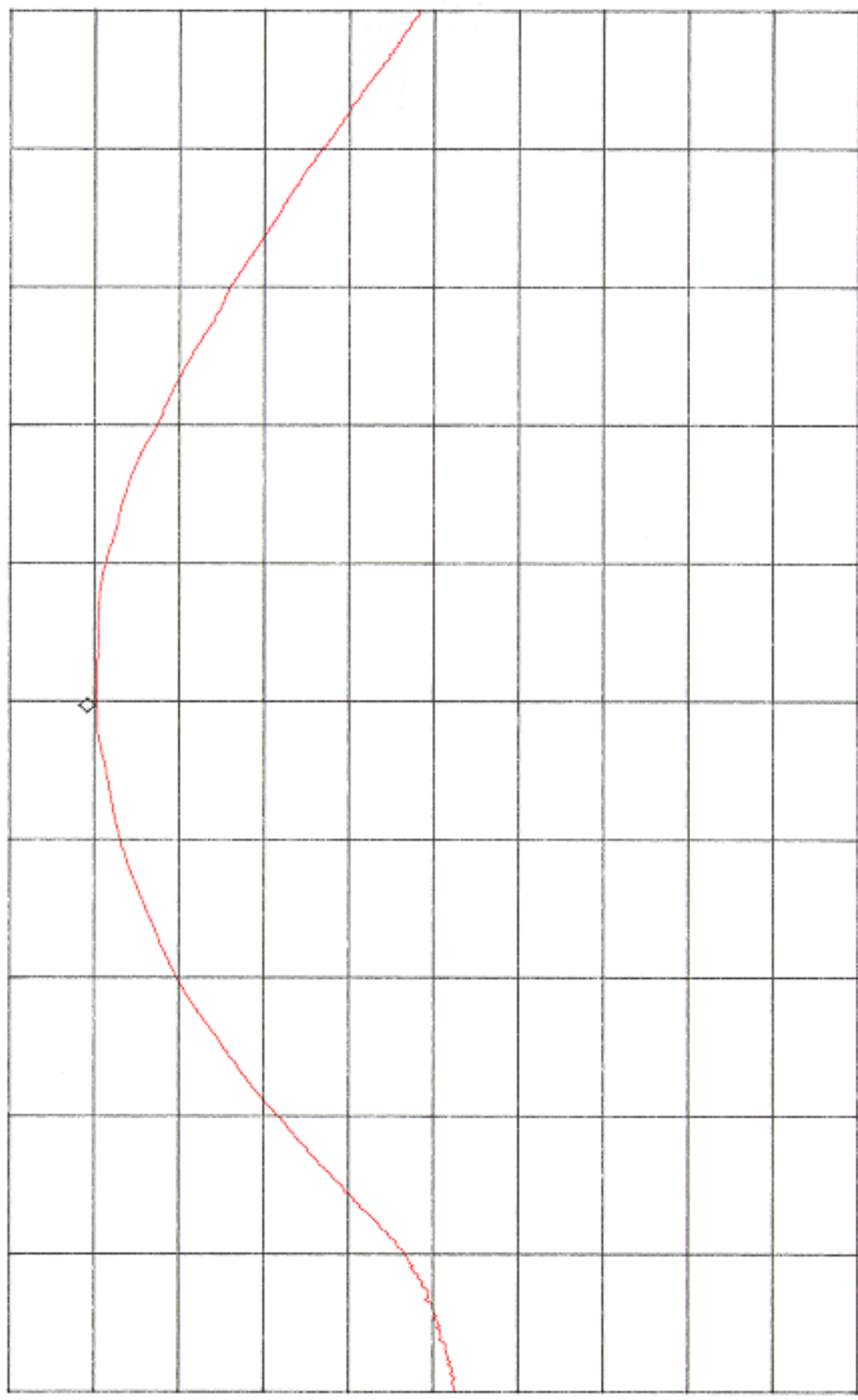
CENTER 2.480000GHZ SPAN 5.000MHZ
*RBW 30KHZ *VBW 100KHZ SWP 50ms

CHANNEL 79

ATTEN 40dB
RL 30.0dBm

MKFR 19.83dBm
2.47997GHz

10dB/



D

CENTER 2.48000GHz

*RBW 2.0MHz

*VBW 3.0MHz

SPAN 10.00MHz

SWP 50ms