

FCC Part 15.247 Test Report
for
Western Multiplex
on the
Spread Spectrum Radio
Model: 31350
FCC ID: HZB-S24-08

Test Report #: J99022866g
Date of Report: January 21, 2000

Job #: J99022866
Date of Test: December 8 and 20, 1999

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<i>Xi-Ming Yang</i>	Xi-Ming Yang, Test Engineer
<i>David Chernomordik</i>	David Chernomordik, Ph.D., EMC Site Manager

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Western Multiplex, Model No. 31350
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1.0 Summary of Tests

MODEL: 31550
FCC ID: HZB-S24-08

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Pass
6 dB Bandwidth	15.247(a)(2)	Pass
Max. Power Density	15.247(d)	Pass
Out of Band Antenna Conducted Emission	15.247(c)	Pass
Out of Band Radiated Emission	15.247(c)	Not Applicable
Radiated Emission in Restricted Bands	15.35(b)(c)	Pass
AC Conducted Emission	15.207	Pass
Radiated Emission from Digital Part	15.109	Pass
Radiated Emission from Receiver L.O.	15.109	Not Applicable
Processing Gain Measurements	15.247(e)	Provided by applicant
Antenna Requirement	15.203	Pass

Test Engineer: Xi-Ming Yang
 Xi-Ming Yang

Date: 1-21-2000

EMC Site Manager: David Chernomordik
 David Chernomordik, Ph.D.
 EMC Site Manager

Date: 01/25/2000

Western Multiplex, Model No. 31350
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2.0 General Description

2.1 Product Description

The EUT is a spread spectrum radio used for point-to-point fixed wireless interconnection.

A pre-production version of the sample was received on December 8, 1999 in good condition.

Overview of Spread Spectrum Radio

Applicant	Western Multiplex
Trade Name & Model No.	Western Multiplex / 31350
FCC Identifier	HZB-S24-08
Use of Product	Point-to-point fixed wireless interconnect
Manufacturer & Model of Spread Spectrum Module	Western Multiplex
Type of Transmission	Direct Sequence
Rated RF Output (mW)	190
Frequency Range (MHz)	2408-2467
Number of Channel(s)	4
Antenna(s) & Gain, dBi	27.7
Processing Gain Measurements	<input checked="" type="checkbox"/> Will be provided to ITS for submission with the application <input type="checkbox"/> Will be provided directly to the FCC reviewing engineer by the client or manufacturer of the spread spectrum module
Antenna Requirement	<input type="checkbox"/> The EUT uses a permanently connected antenna. <input type="checkbox"/> The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector. <input checked="" type="checkbox"/> The EUT requires professional installation (attach supporting documentation if using this option).
Manufacturer name & address	Western Multiplex 1196 Borregas Ave Sunnyvale CA 94089

2.2 Related Submittal(s) Grants

Western Multiplex, Model No. 31350
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2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is site 1. This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

Western Multiplex, Model No. 31350
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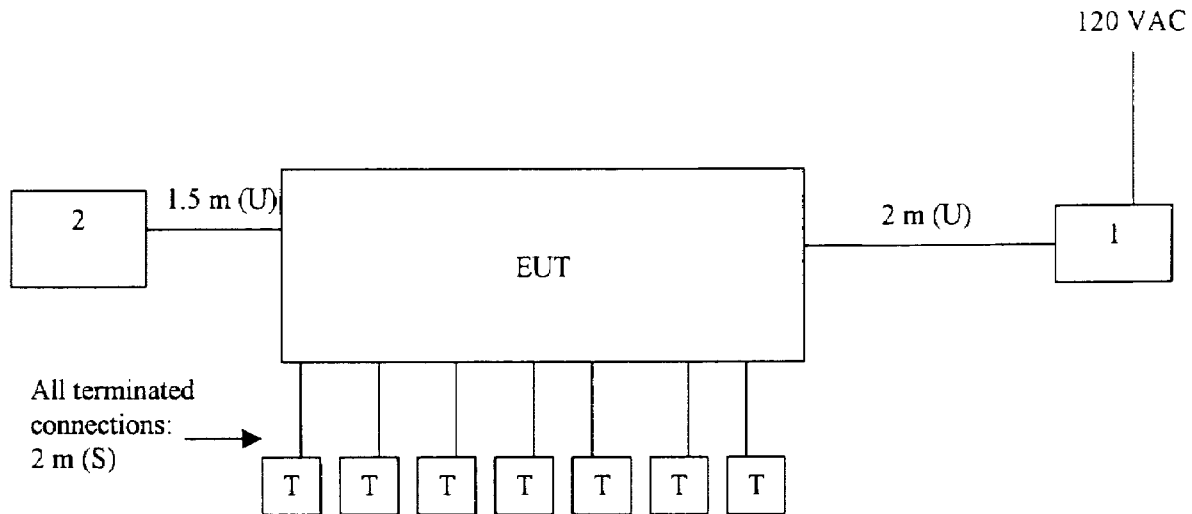
Date of Test: December 8 & 20, 1999

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	DC Power Supply	TPS-4000	917003
2	Antenna	P-24A48G	N/A

3.2 Block Diagram of Test Setup



* = EUT	S = Shielded,	F = With Ferrite
** = No ferrites on video cable	U = Unshielded	

3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power without modulation.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

3.5 Mode of Operation During Test

For emissions testing, the EUT was setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. The transmittign signal was set to low, middle, and high frequencies.

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3.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Glenayre Western Multiplex prior to compliance testing):

No modifications were made by Intertek Testing Services

3.7 Additions, deviations and exclusions from standards

No additions, deviations, or exclusions were made to the standard.

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4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals. FCC Rules 15.247(b):

 The antenna port of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals. The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for maximum RES BW and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).

For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6)/3 dB.

Max. antenna gain = 27.7		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2408.0	22.8	189.5
Mid Channel: 2449.0	22.8	190.0
High Channel: 2467.0	22.8	190.0

Cable loss: 0 dBExternal Attenuation: 0 dB

Cable loss, external attenuation:

 included in OFFSET function added to SA raw readingEUT maximum allowed peak output power = $30 - (27.7 - 6) / 3 = 22.8$ dBm

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4.2 Minimum 6 dB RF Bandwidth. FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	Min. 6 dB Bandwidth
2408.0	9.10 MHz

Refer to the following plots for 6 dB bandwidth sharp:

- Plot 2a: Low Channel 6 dB RF Bandwidth
- Plot 2b: Mid Channel 6 dB RF Bandwidth
- Plot 2c: High Channel 6 dB RF Bandwidth

Plot 2.a.

MKR Δ 9.10 MHz
0.50 dB

ATTEN 40 dB

REF 31.0 dBm

hp

10 dB/

OFFSET

1.0
dB

DL

7.9
dBm



CENTER 2.408 0 GHz
RES BW 100 kHz
VBW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec

Plot 2b

MKR Δ 9.12 MHz
0.40 dB

ATTEN 30 dB

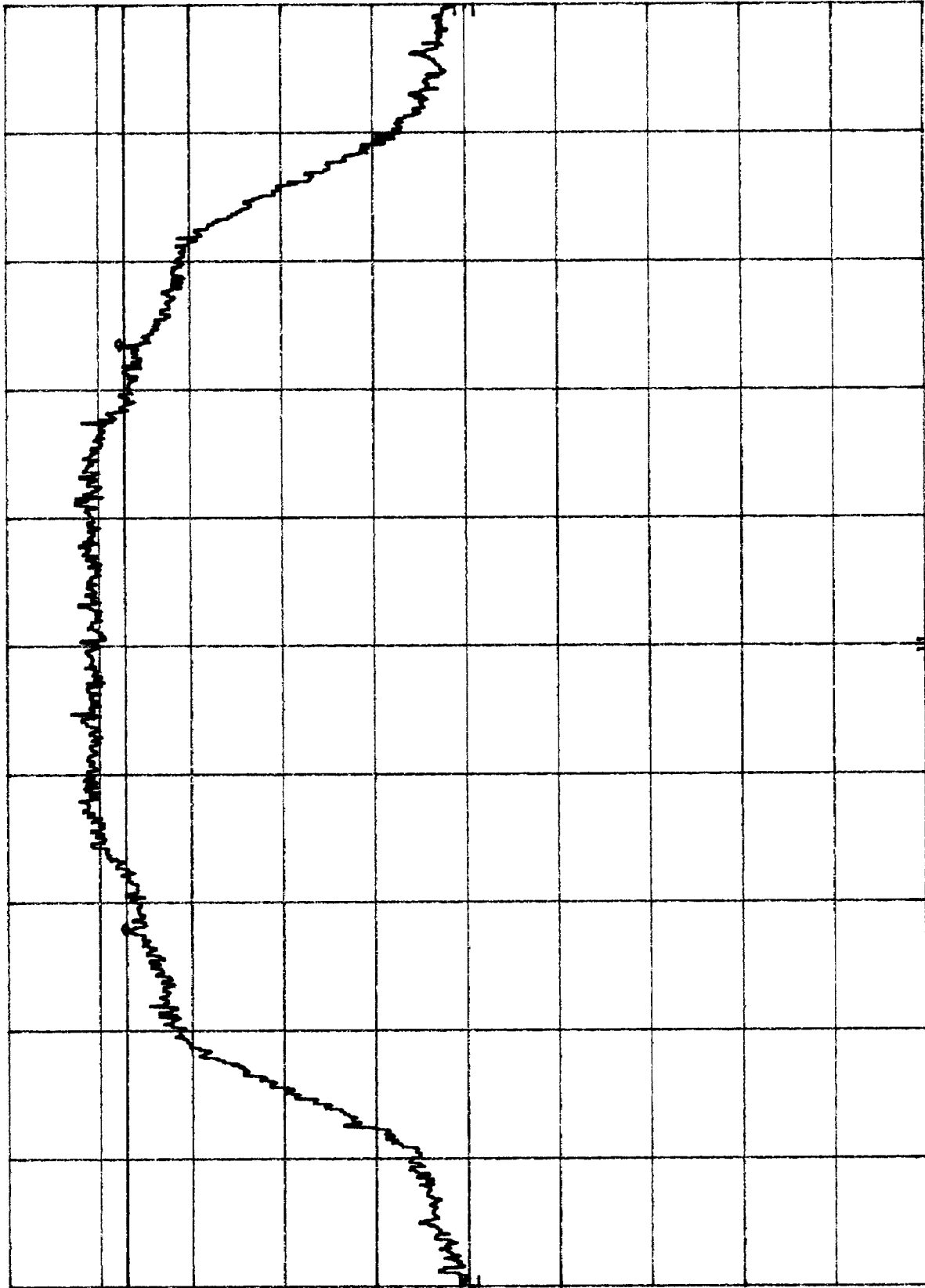
REF 21.0 dBm

HP

10 dB/

OFFSET
1.0
dB

DL
8.1
dBm



SPAN 20.0 MHz
SWP 20.0 msec

VBW 100 kHz

CENTER 2.449 0 GHz
RES BW 100 kHz

Plot 2C

MKR Δ 9.16 MHz
0.90 dB

ATTEN 30 dB

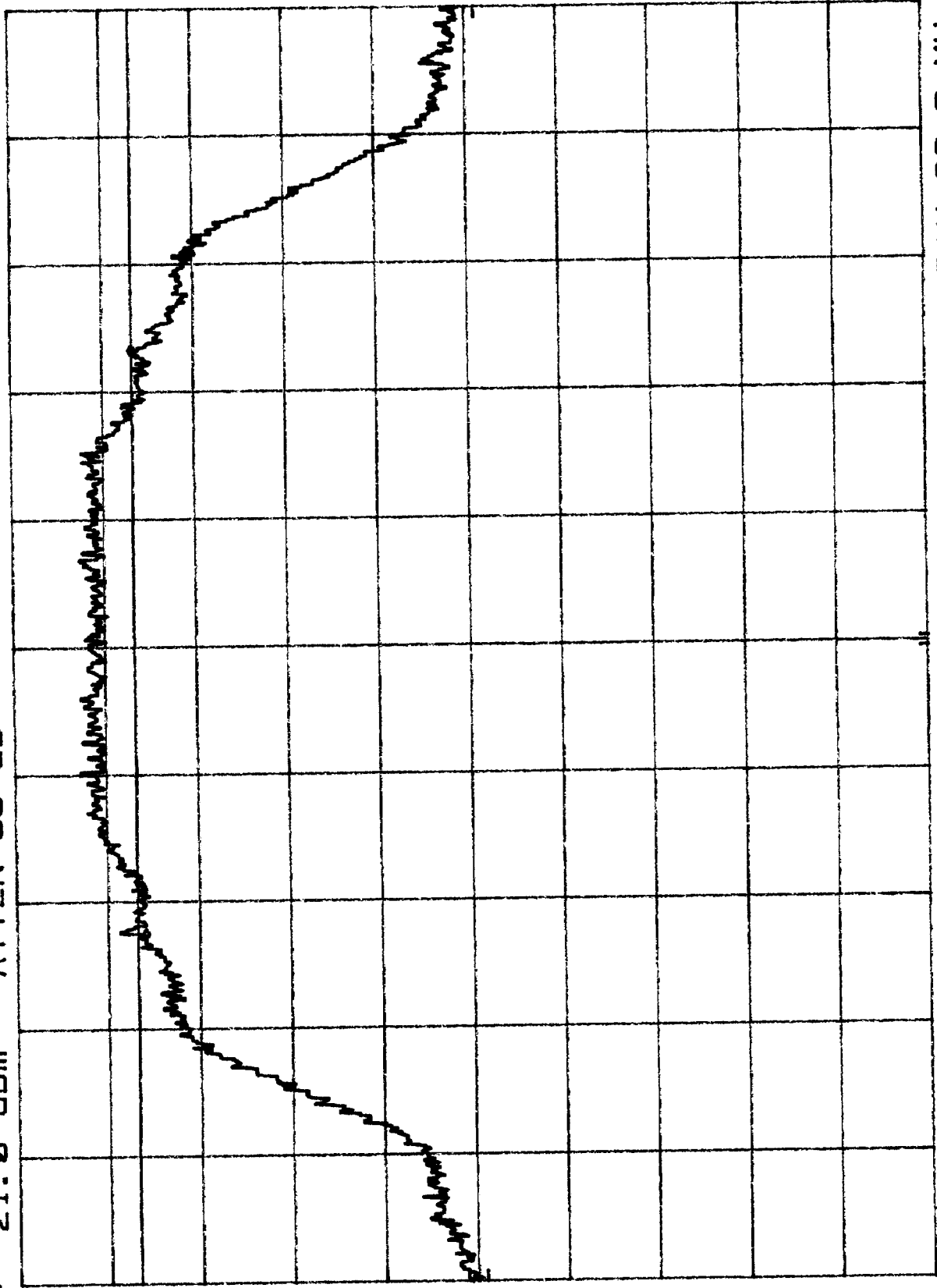
REF 21.0 dBm

hp

10 dB/

OFFSET
1.0
dB

DL
7.8
dBm



CENTER 2.467 GHz
RES BW 100 kHz
SPAN 20.0 MHz
SWP 20.0 msec
VBW 100 kHz

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4.3 Maximum Power Density Reading, FCC Rule 15.247(d):

The spectrum analyzer RES BW was set to 3 kHz. The START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs. The specification calls for a 1 second interval at each 3 kHz bandwidth; total SWEEP TIME is calculated as follows:

$$\text{SWEEP TIME (SEC)} = (\text{Fstop, kHz} - \text{Fstart, kHz}) / 3 \text{ kHz}$$

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

Frequency (MHz)	Power Density (dBm)
2449	-0.3

Frequency Span = 2100 kHz

Sweep Time = 2100 Frequency Span / 3 kHz
= 700 seconds

Refer to the following plots for power density data:

- Plot 3.a.1-3.s.2: Low Channel Power Density
- Plot 3.b.1-3.b.2: Mid Channel Power Density
- Plot 3.c.1-3.c.2: High Channel Power Density

Plot 3.a.1

HP

REF 31.0 DBm

ATTEN 40 DB

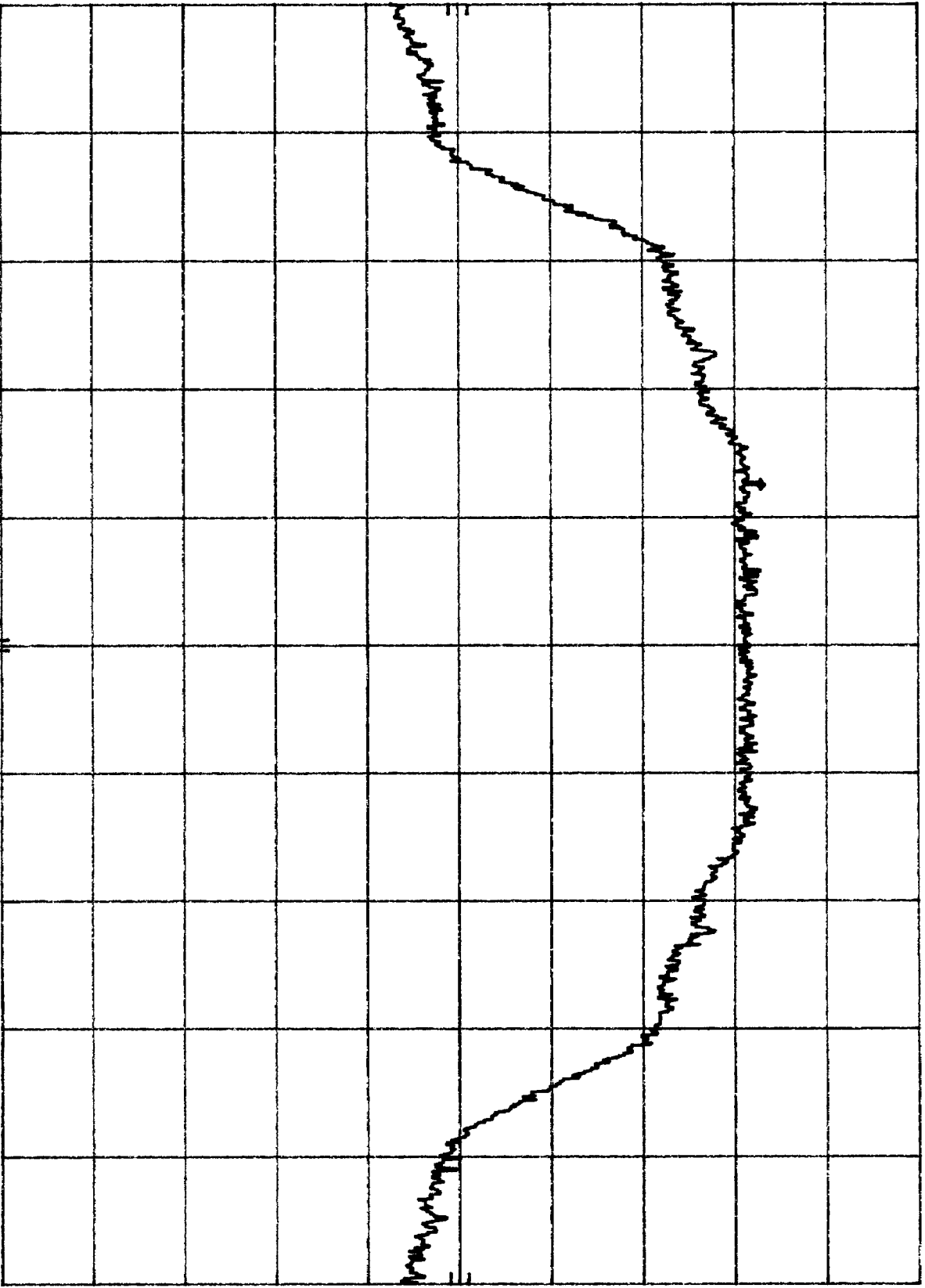
MKR 2.405 48 GHZ
13.90 DBm

10 DB/

OFFSET

1.0

dB



CENTER 2.408 0 GHZ

RES BW 100 KHZ

VBW 100 KHZ

SPAN 20.0 MHZ
SWP 20.0 msec

Plot 3.0.2

HP

REF 31.0 dBm

ATTEN 40 DB

MKR 2.405 497 GHz

0.00 dBm

10 DB/

OFFSET

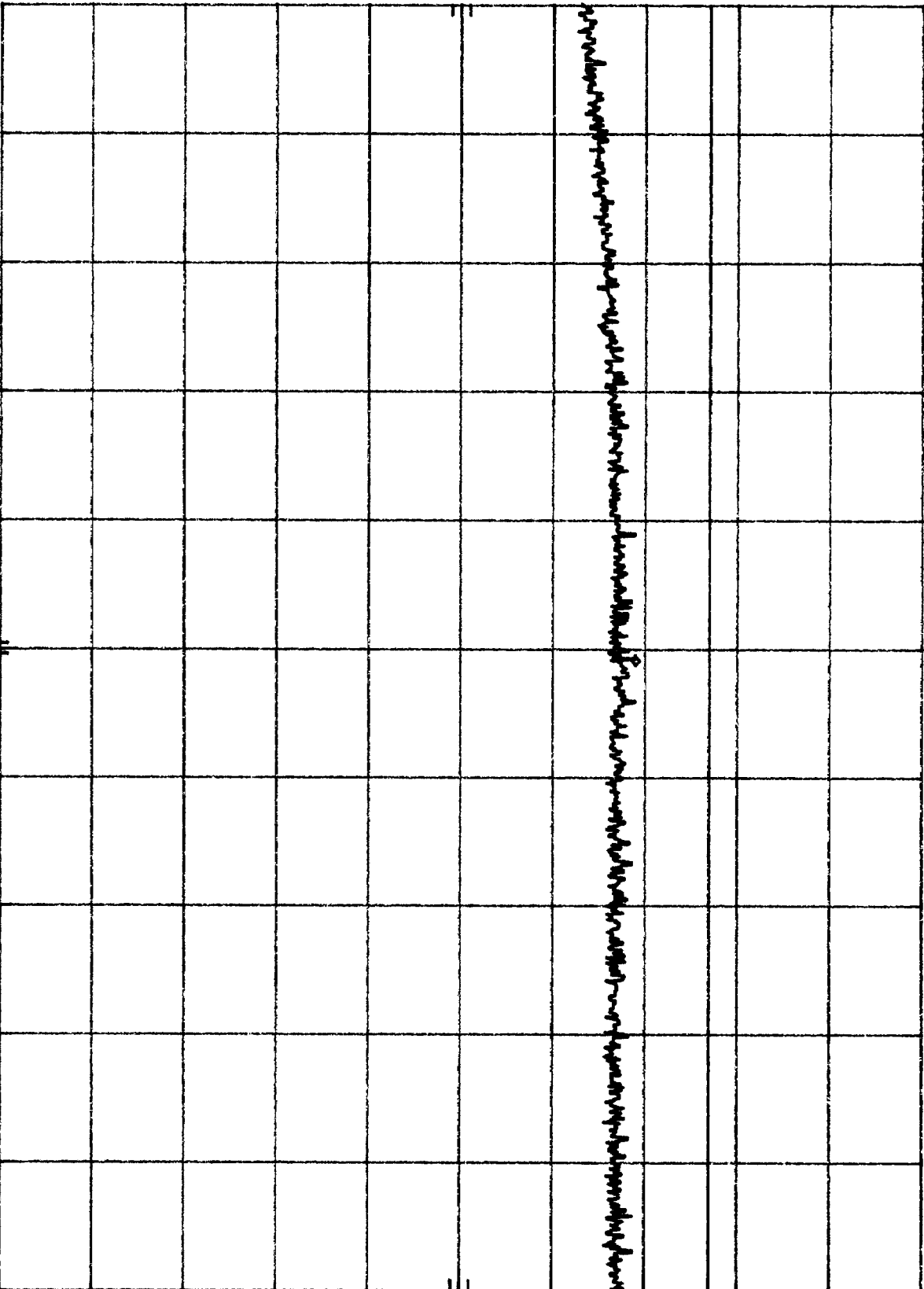
1.0

dB

DL

8.0

dBm



CENTER 2.405 48 GHz

RES BW 3 KHZ

VBW 3 KHZ

SPAN 2.10 MHz

SWP 700 sec

Plot 3.b.1

HP

REF 21.0 DBm

ATTEN 30 DB

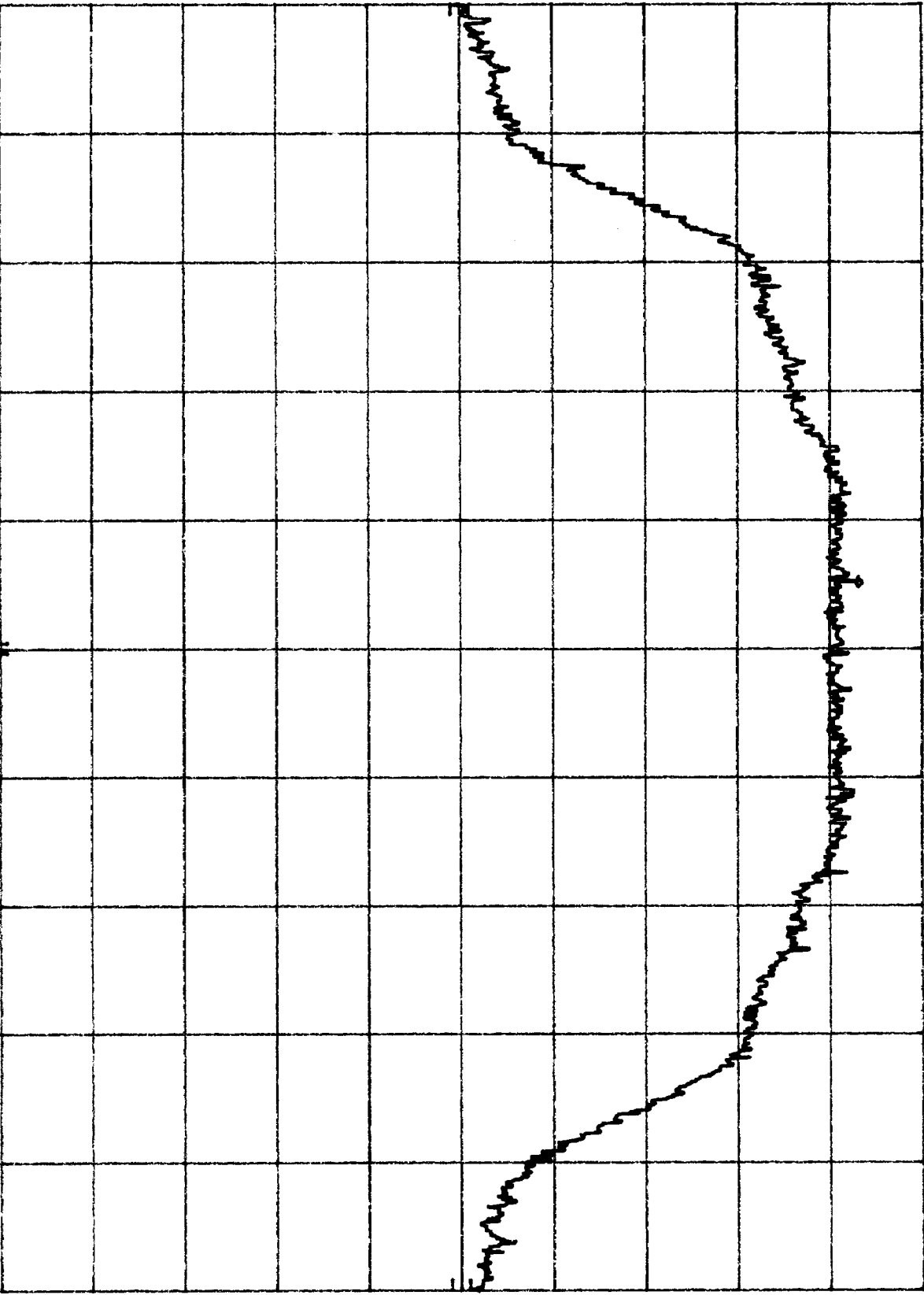
MKR 2.447 96 GHZ
14.10 DBm

10 DB/

OFFSET

1.0

DB



CENTER 2.449 0 GHZ

RES BW 100 KHZ

VBW 100 KHZ

SPAN 20.0 MHZ
SWP 20.0 msec

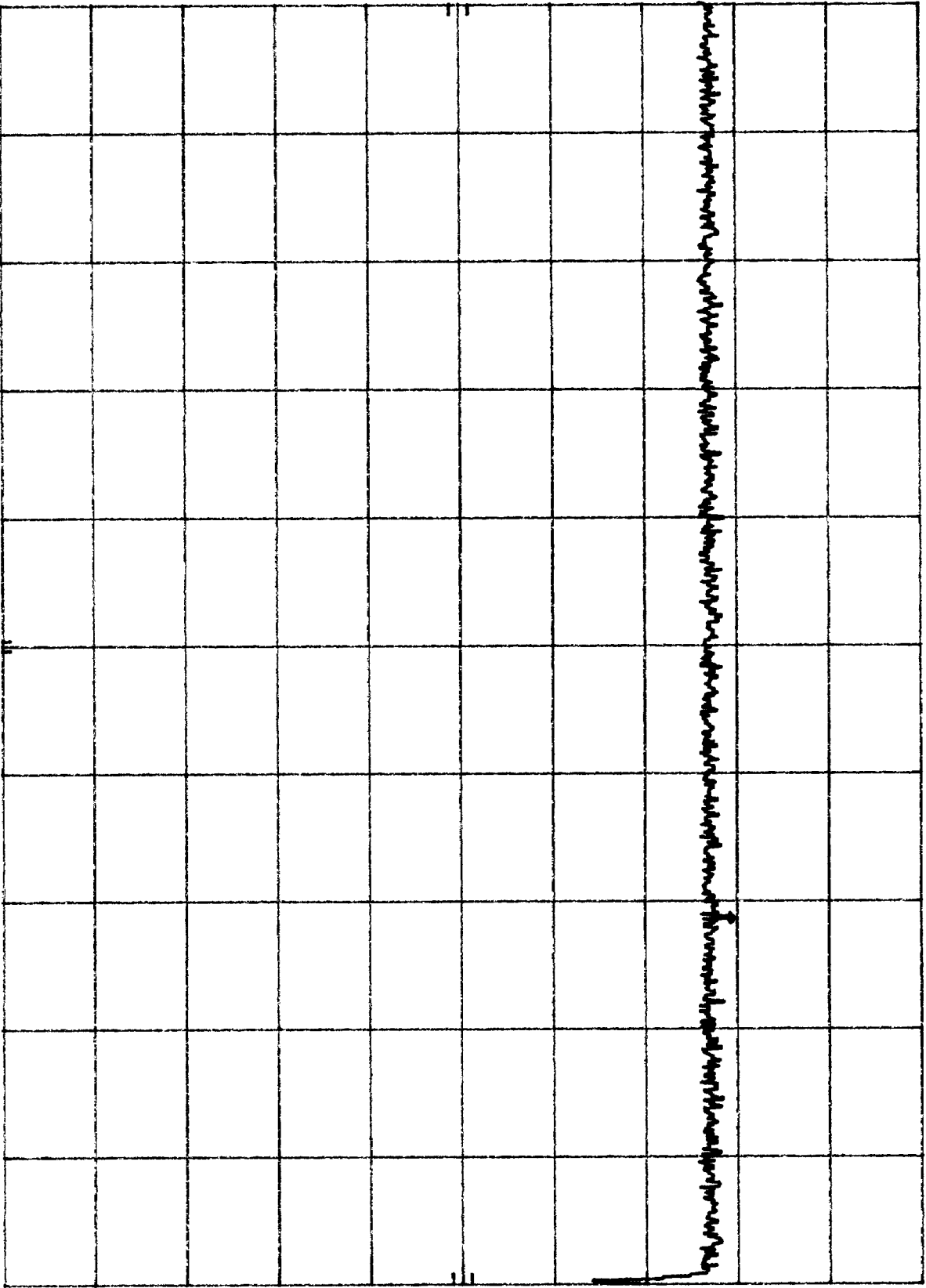
Plot 3.6.2

HP REF 21.0 DBm ATTEN 30 DB

MKR 2.448 407 GHZ 0.30 DBm

10 DB/

OFFSET
1.0
DB



CENTER 2.447 96 GHZ
RES BW 3 KHZ
VBW 3 KHZ
SPAN 2.10 MHZ
SWP 700 sec

Plot 3.0.1

HP

REF 21.0 DBm

ATTEN 30 DB

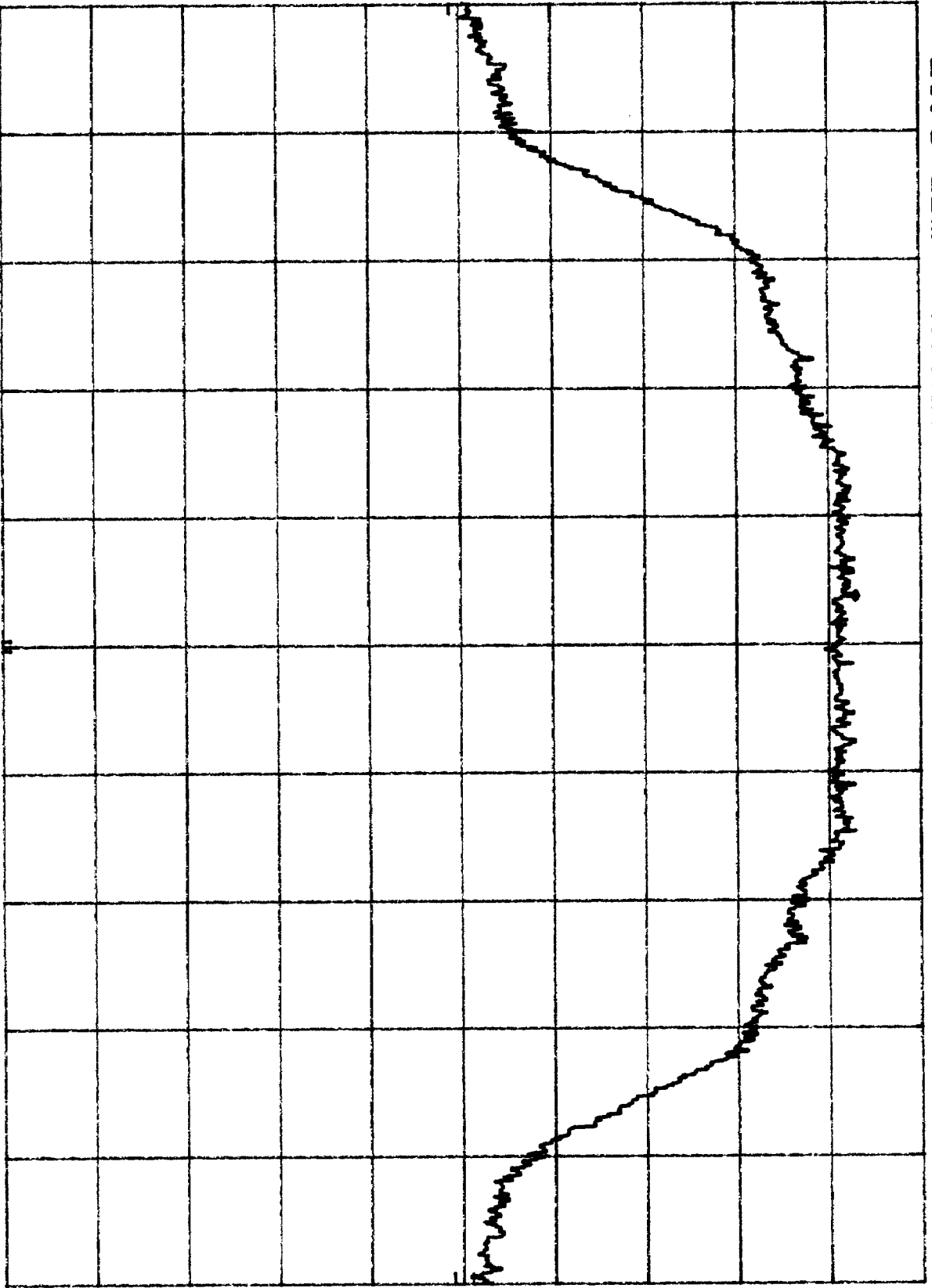
MKR 2.466 24 GHz
13.90 DBm

10 DB/

OFFSET

1.0

DB



CENTER 2.467 0 GHz
RES BW 100 KHz

VBW 100 KHz

SPAN 20.0 MHz
SWP 20.0 msec

Plot 3.C.2

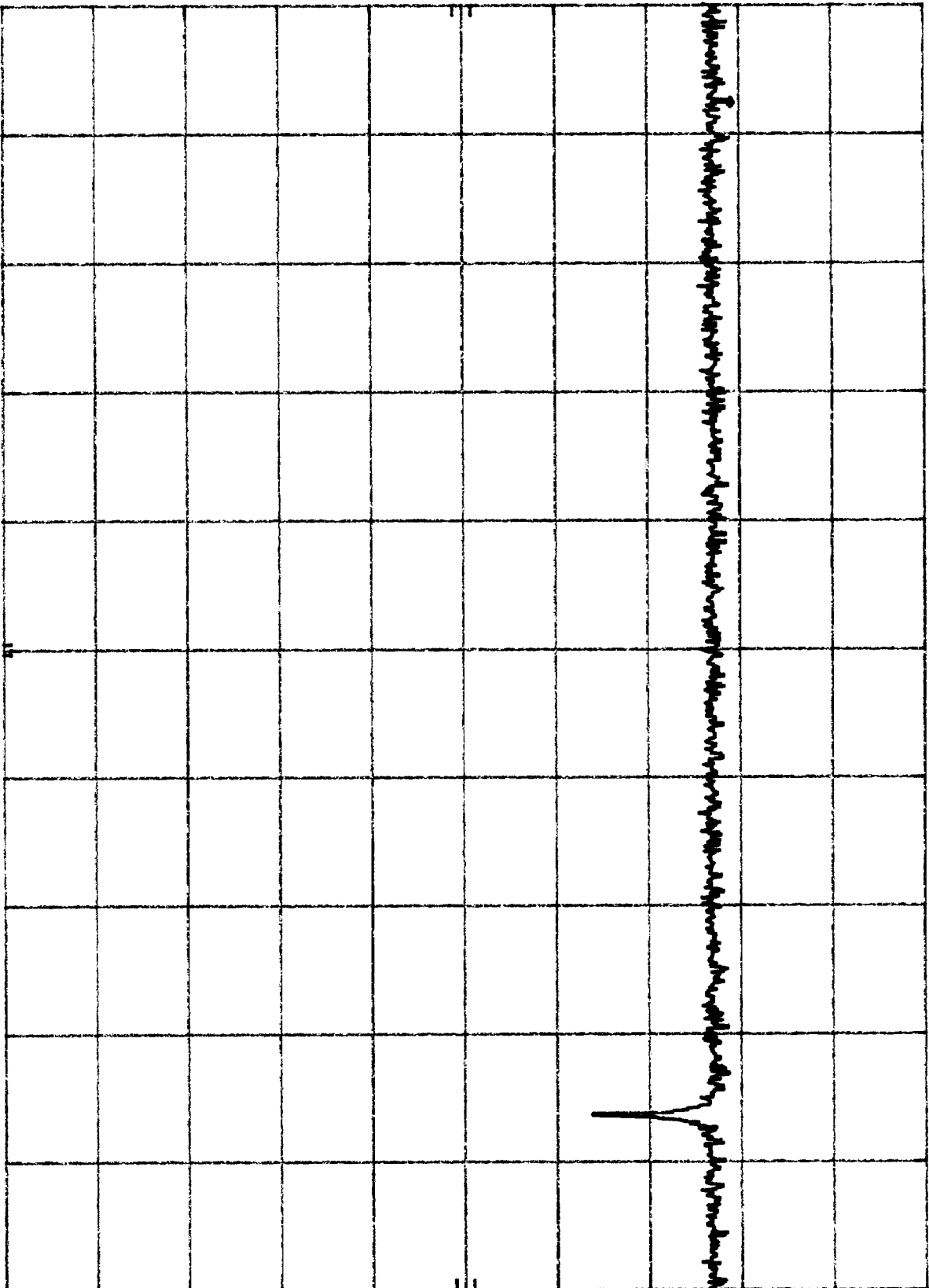
HP REF 21.0 dBm ATTEN 30 dB

MKR 2.465 348 GHz 0.10 dBm

10 dB/

OFFSET

1.0
dB



CENTER 2.466 24 GHz
RES BW 3 KHz

VBW 3 KHz

SPAN 2.10 MHz
SWP 700 sec

4.4 Out of Band Conducted Emissions, FCC Rule 15.247(c):

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

Refer to the following plots for out of band conducted emissions data:

Plot 4.a.1 – 4.a.8: Low Channel Emissions

Plot 4.b.1 – 4.b.7: Mid Channel Emissions

Plot 4.c.1 – 4.c.8: High Channel Emissions

Plot 4.2.1

HP

REF 21.0 dBm

ATTEN 30 DB

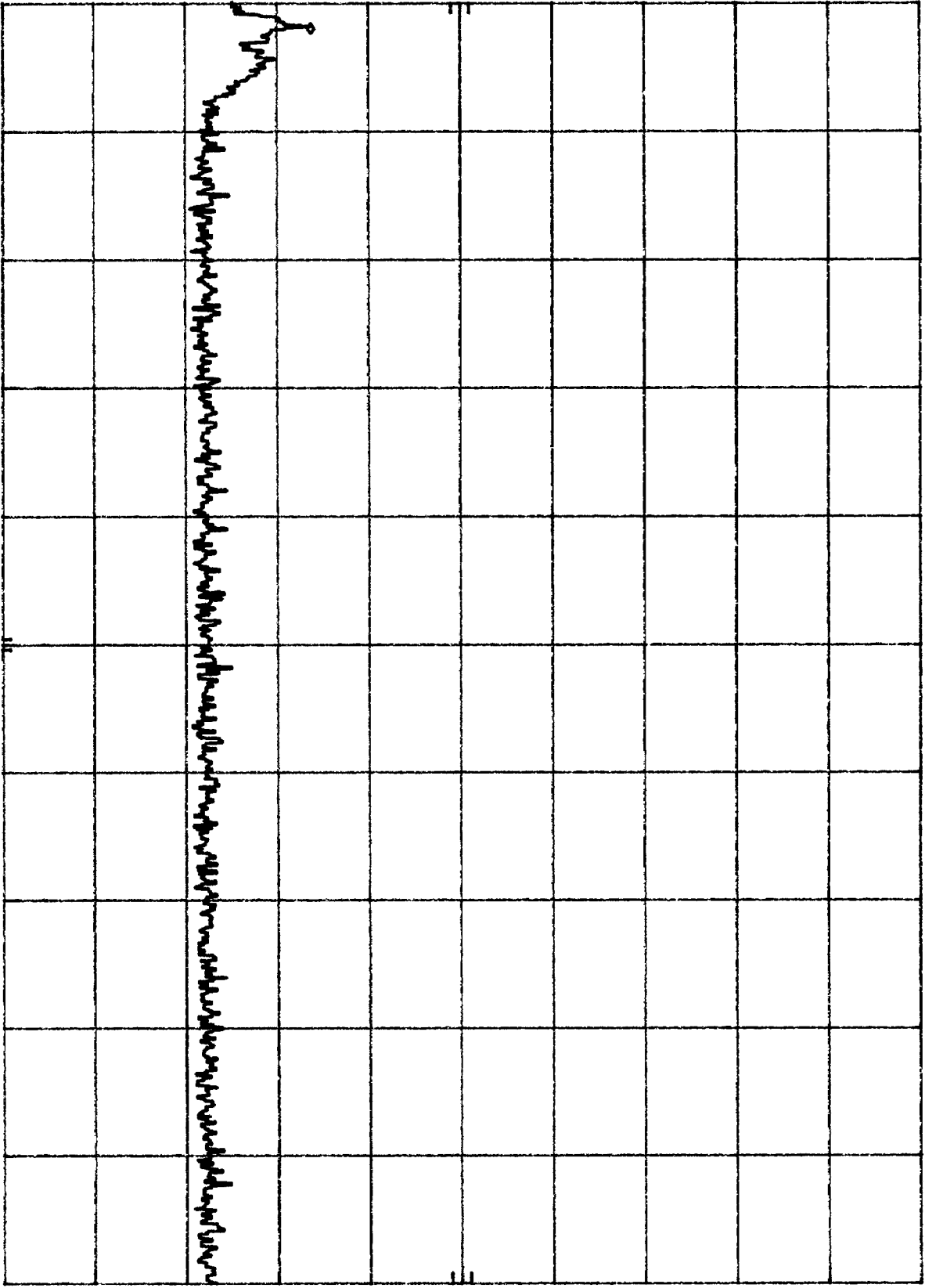
MKR 2.88 MHz
-45.30 dBm

10 DB/

OFFSET

1.0

DB



START 1.0 MHz

RES BW 100 KHZ

VBW 100 KHZ

STOP 100.0 MHz
SWP 29.7 msec

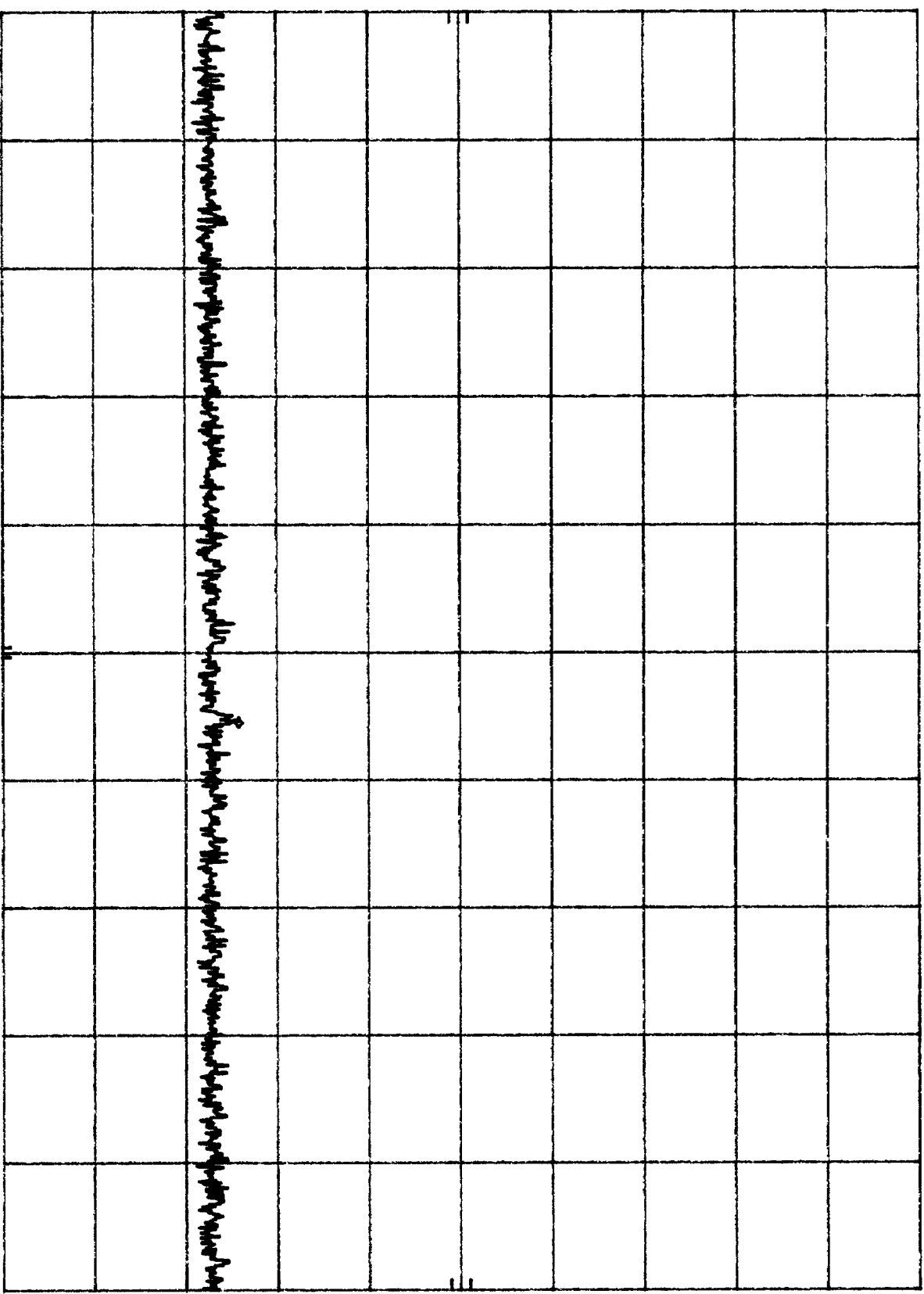
Plot 4.0.2

HP REF 21.0 dBm ATTEN 30 dB

MKR 598.6 MHz
-53.20 dBm

10 dB/

OFFSET
1.0
dB



START 100 MHz RES BW 100 KHZ VBW 100 KHZ STOP 1.000 GHz
 SWP 270 msec

Plot 4.2.3

HP

REF 21.0 dBm

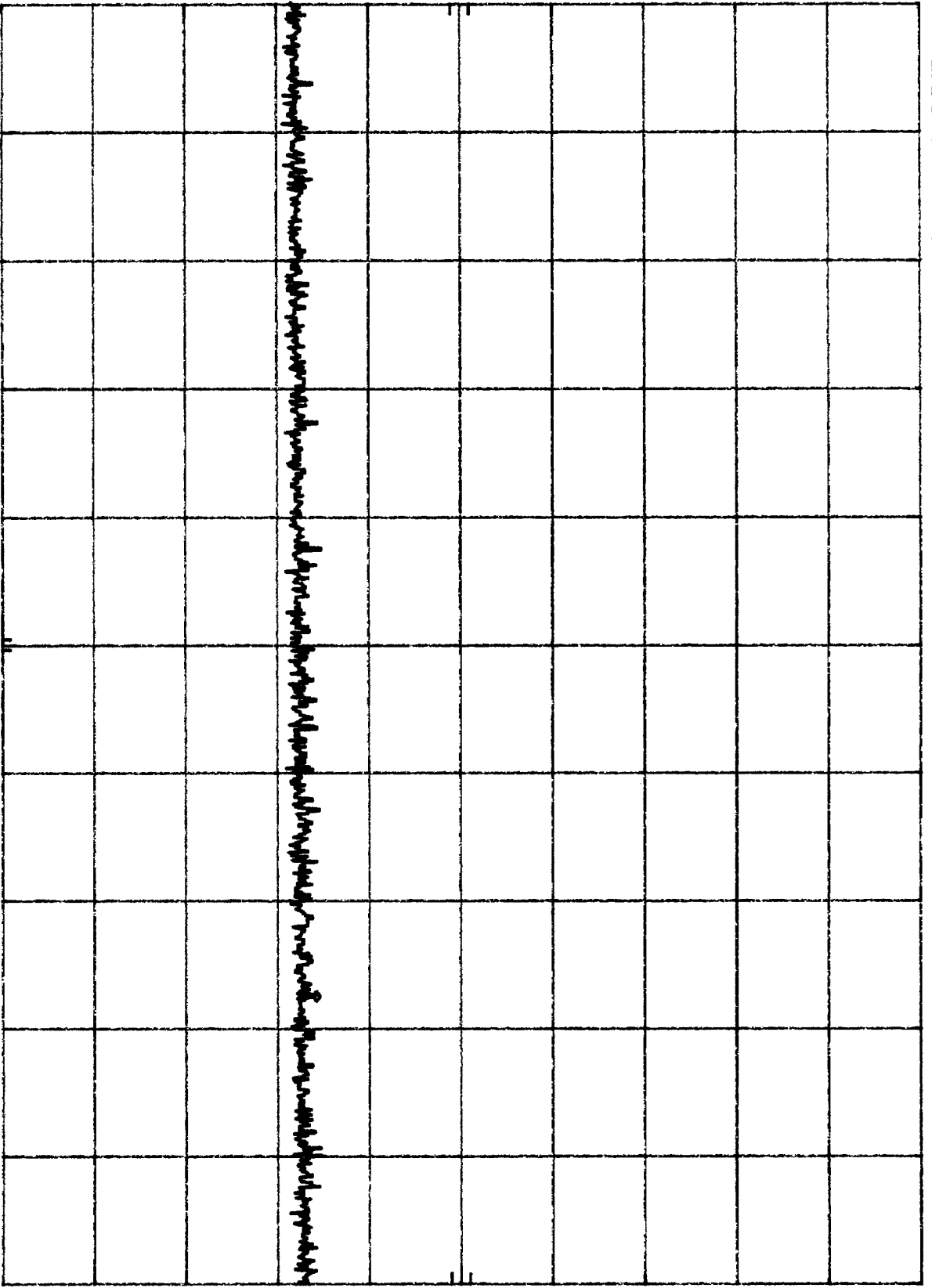
ATTEN 40 dB

MKR 2.076 GHz
-44.80 dBm

10 dB/

OFFSET
1.0

dB



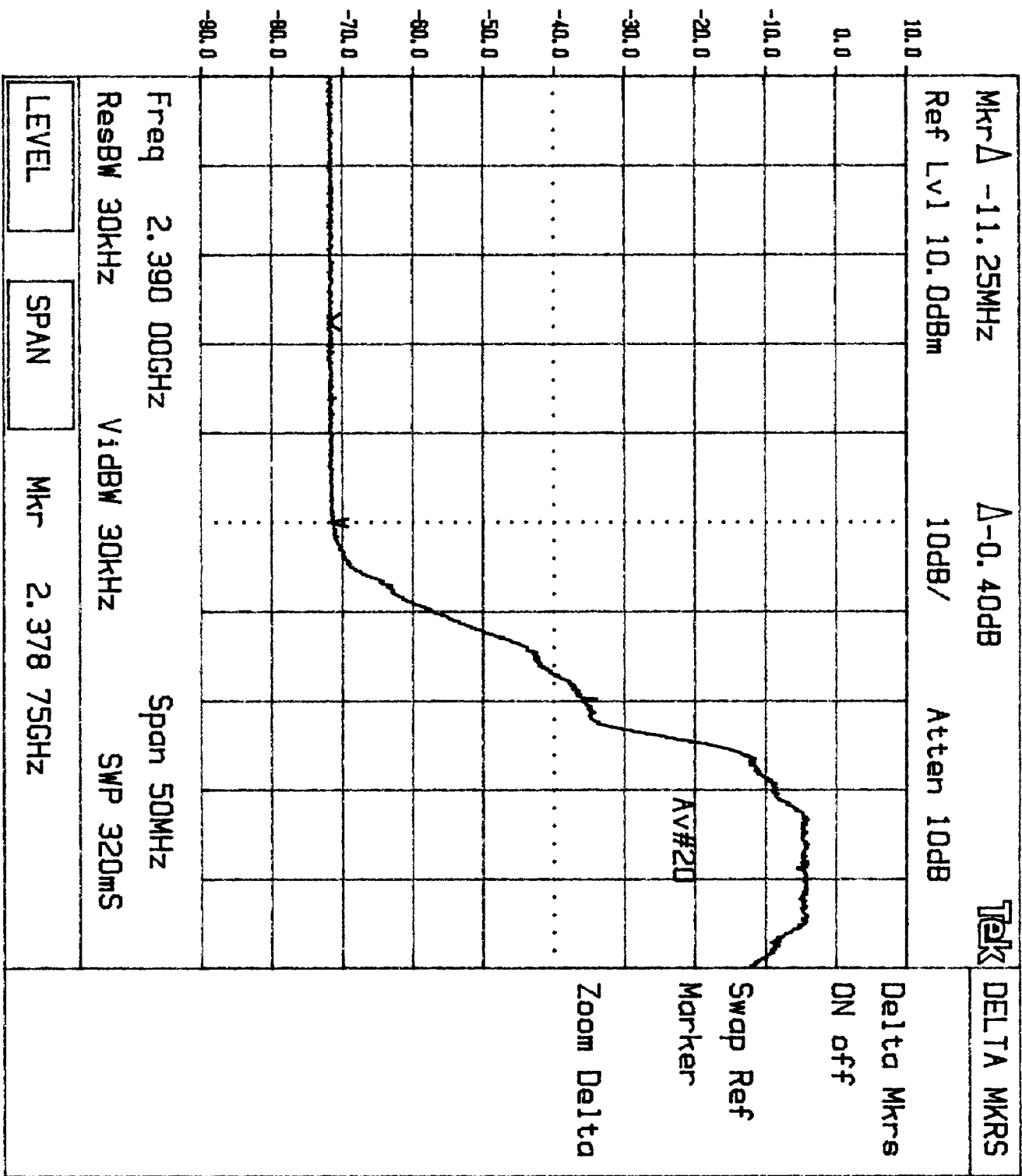
START 1.00 GHz

RES BW 100 KHZ

VBW 100 KHZ

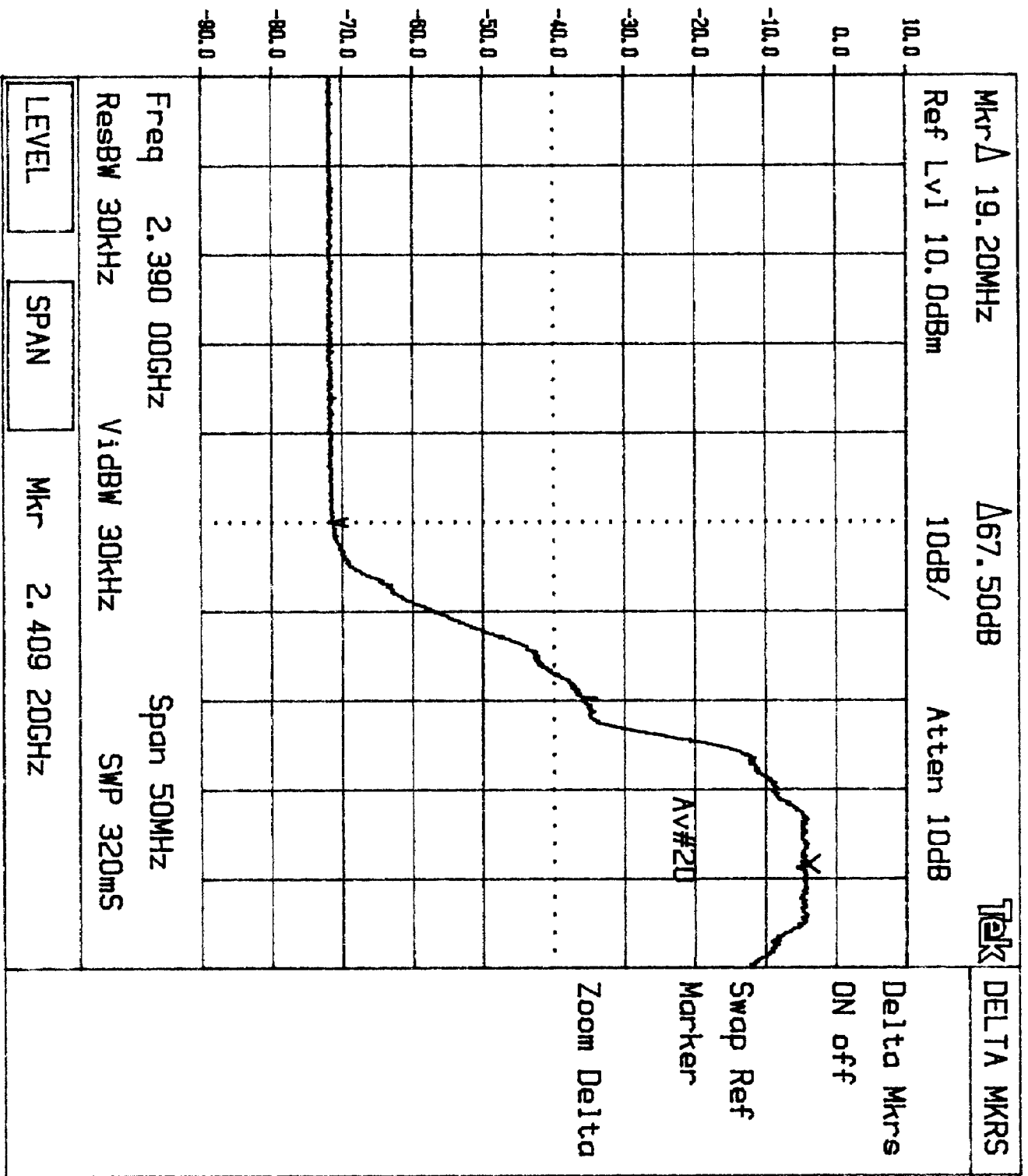
STOP 2.39 GHz
SWP 417 msec

Plot 4.0.4



Knob 2 Knob 1 Keypad Taktronix 2784

Plot 4.a.5.



Knob 2 Knob 1 Keypad Taktronix 2784

Plot 4.0.6

MKR Δ-7.35 MHz
-35.10 dB

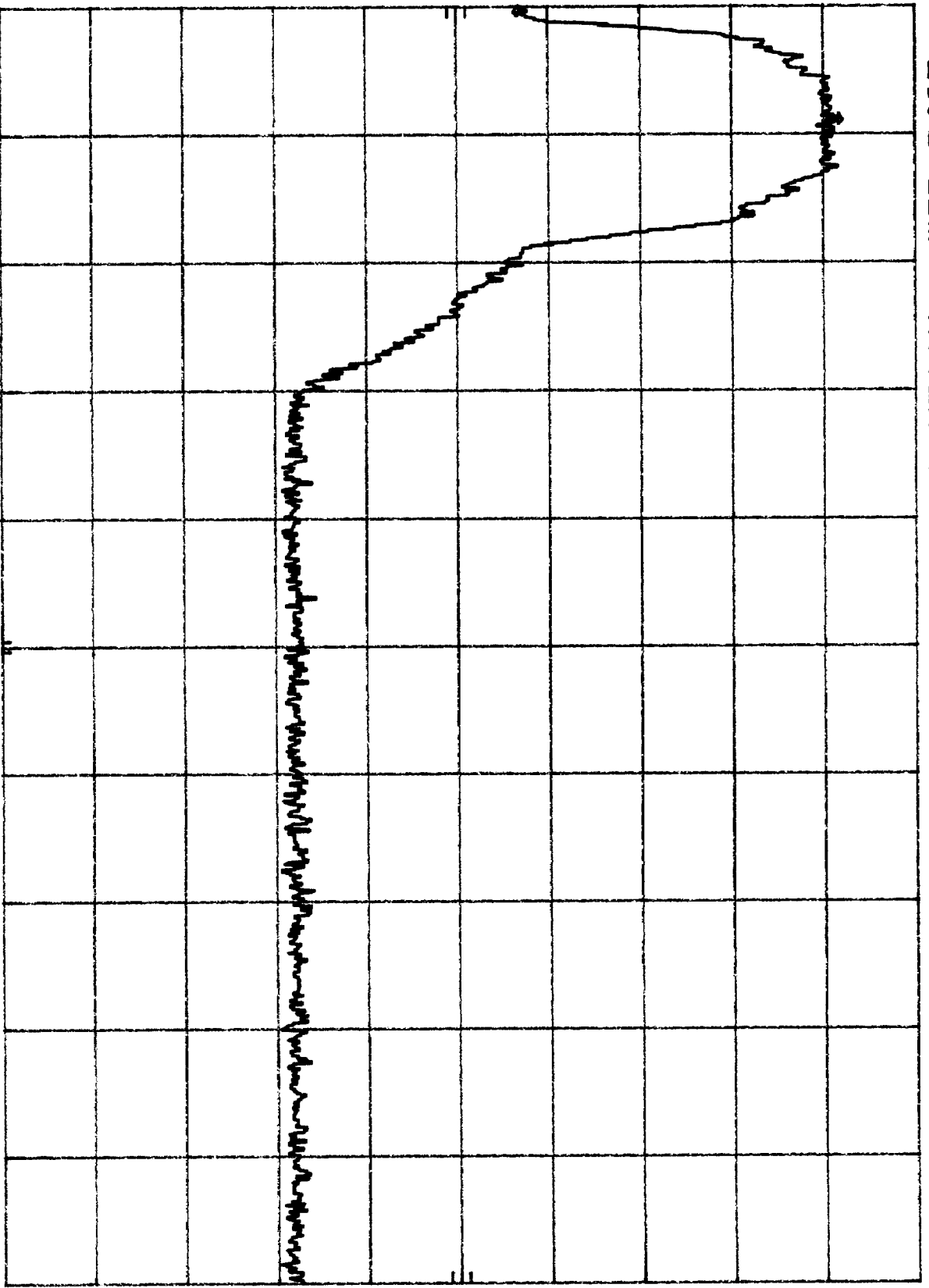
HP

REF 21.0 dBm

ATTEN 40 dB

10 dB/

OFFSET
1.0
dB



START 2.400 GHz
RES BW 100 KHZ

VBW 100 KHZ

STOP 2.483 5 GHz
SWP 25.1 msec

Plot 4.a.7

HP

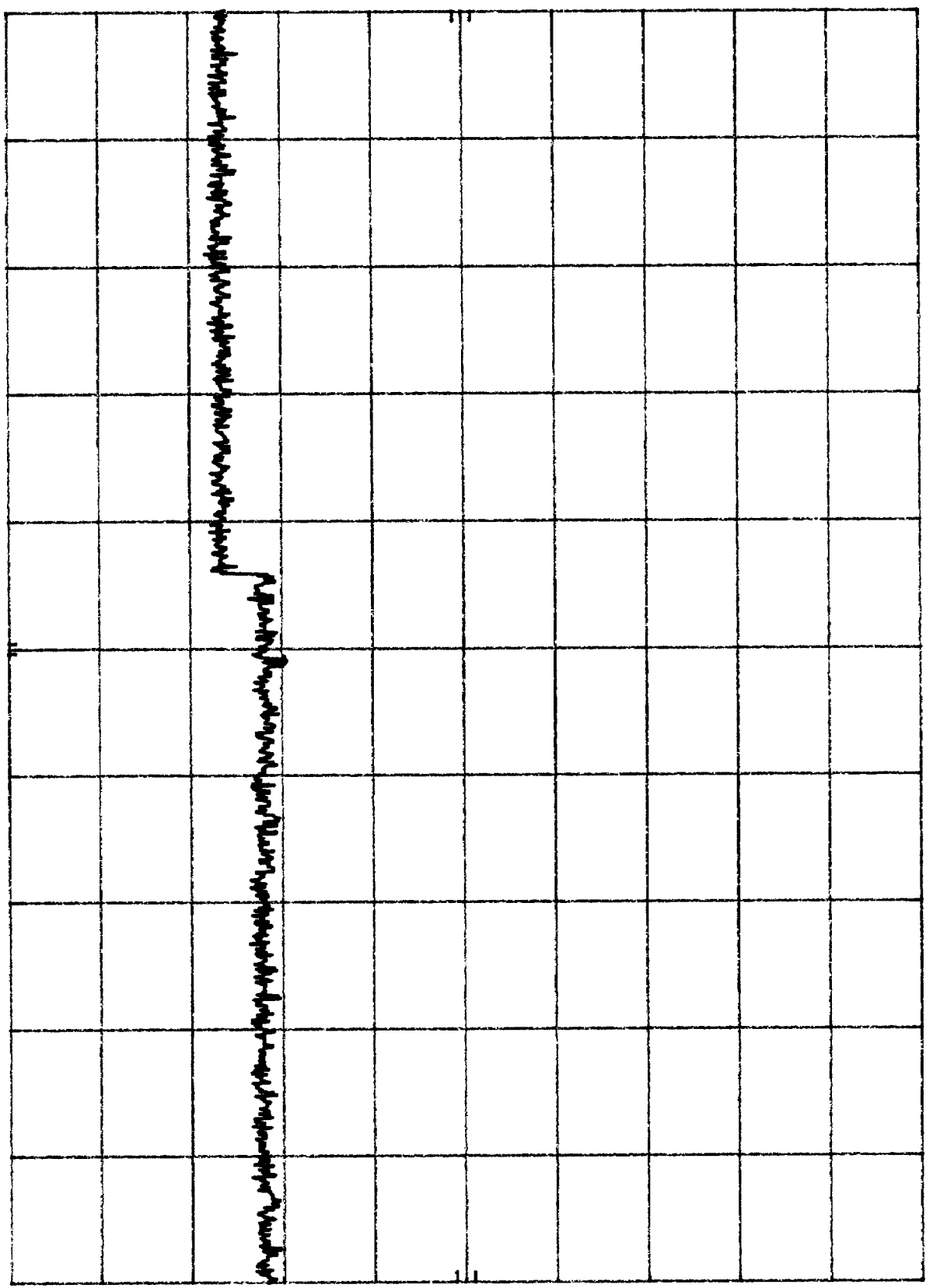
REF 21.0 DBm

ATTEN 30 DB

MKR 6.309 GHZ
-48.80 DBm

10 DB/

OFFSET
1.0
DB



START 2.48 GHZ RES BW 100 KHZ VBW 100 KHZ STOP 10.00 GHZ
 SWP 2.25 sec

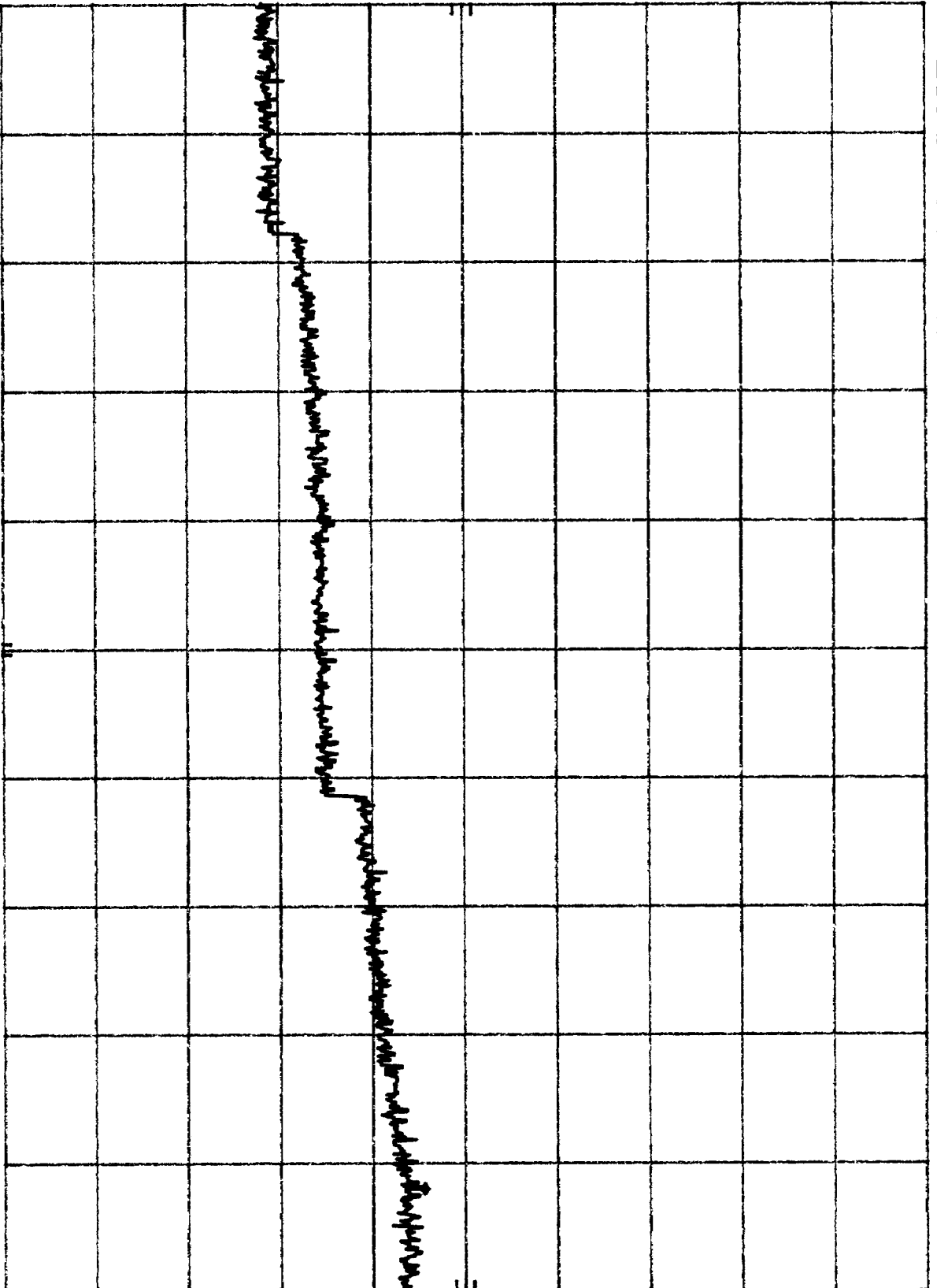
Plot 4.2.8

MKR 22.87 GHz
-33.40 dBm

HP REF 21.0 dBm ATTN 30 dB

10 dB/

OFFSET
1.0
dB



START 10.0 GHz RES BW 100 KHZ VBW 100 KHZ STOP 24.0 GHz
SWP 4.20 sec

Plot 4.b.1

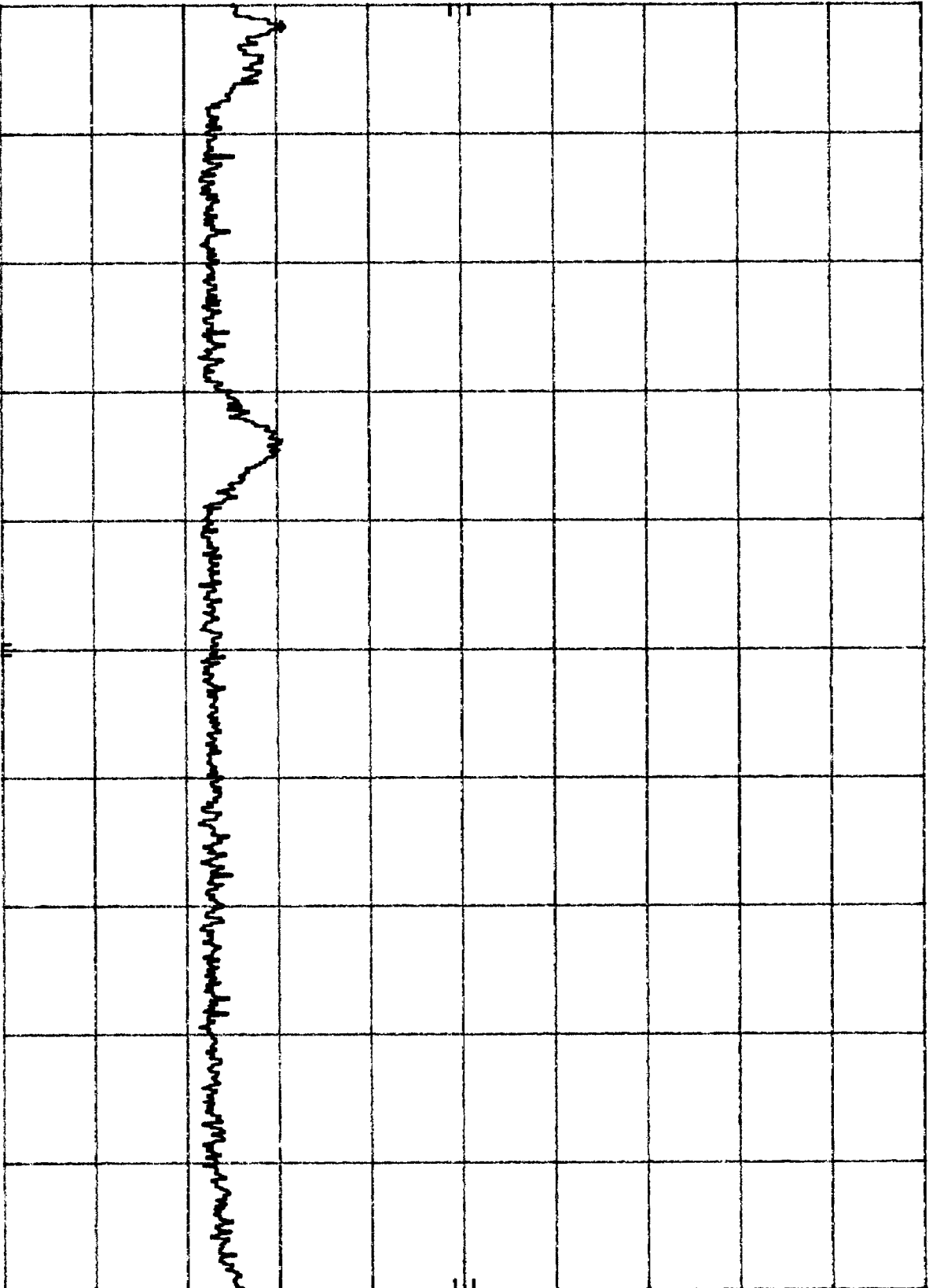
REF 21.0 dBm

ATTEN 30 dB

MKR 2.58 MHz
-48.40 dBm

10 dB/

OFFSET
1.0
dB



START 1.0 MHz

RES BW 100 KHZ

VBW 100 KHZ

STOP 100.0 MHz
SWP 29.7 msec

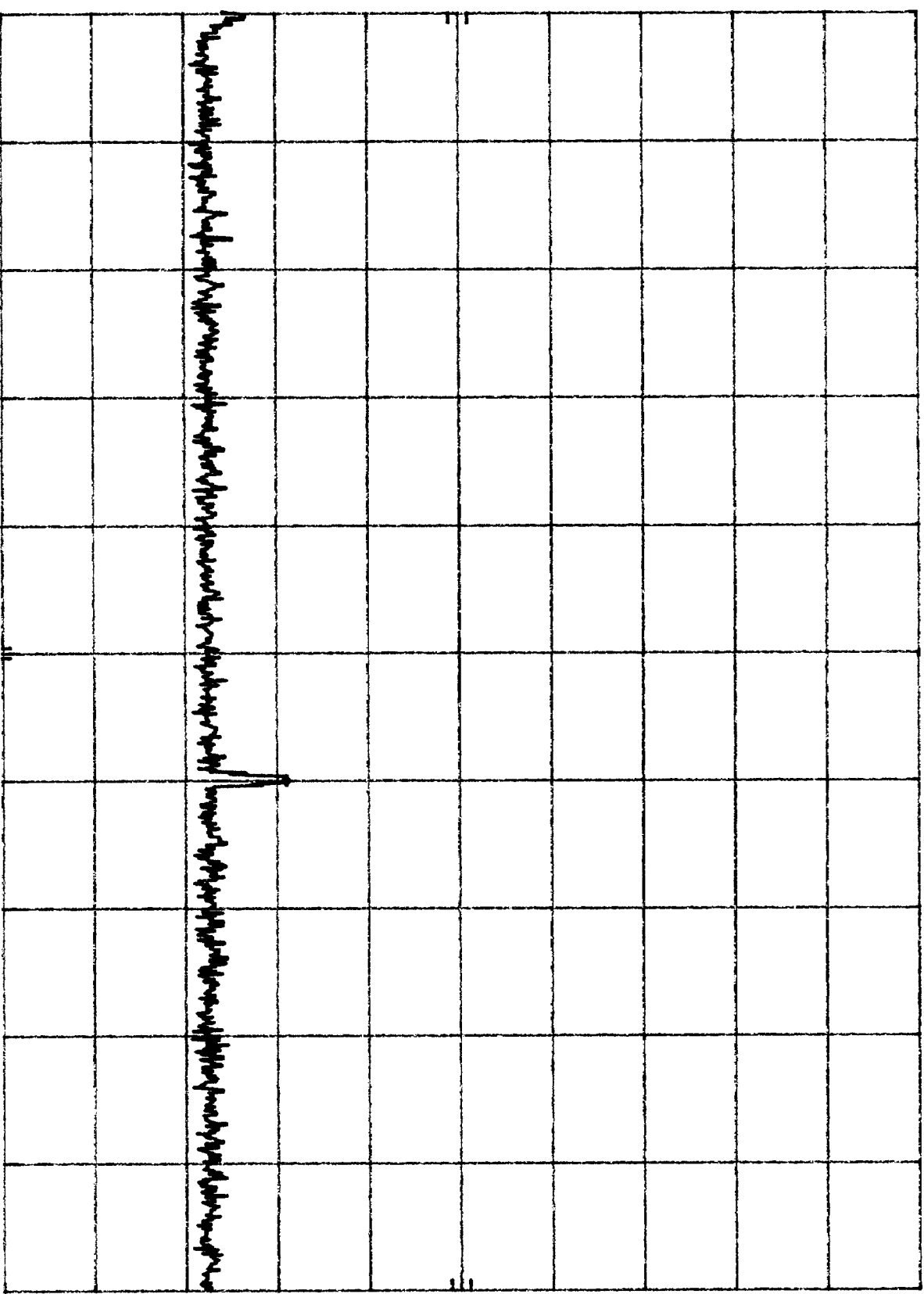
Plot 4.b.2

HP REF 21.0 DBm ATTEN 30 DB

MKR 639.1 MHz
-48.00 DBm

10 DB/

OFFSET
1.0
DB



START 100 MHz RES BW 100 KHZ VBW 100 KHZ STOP 1.000 GHz
SWP 270 msec

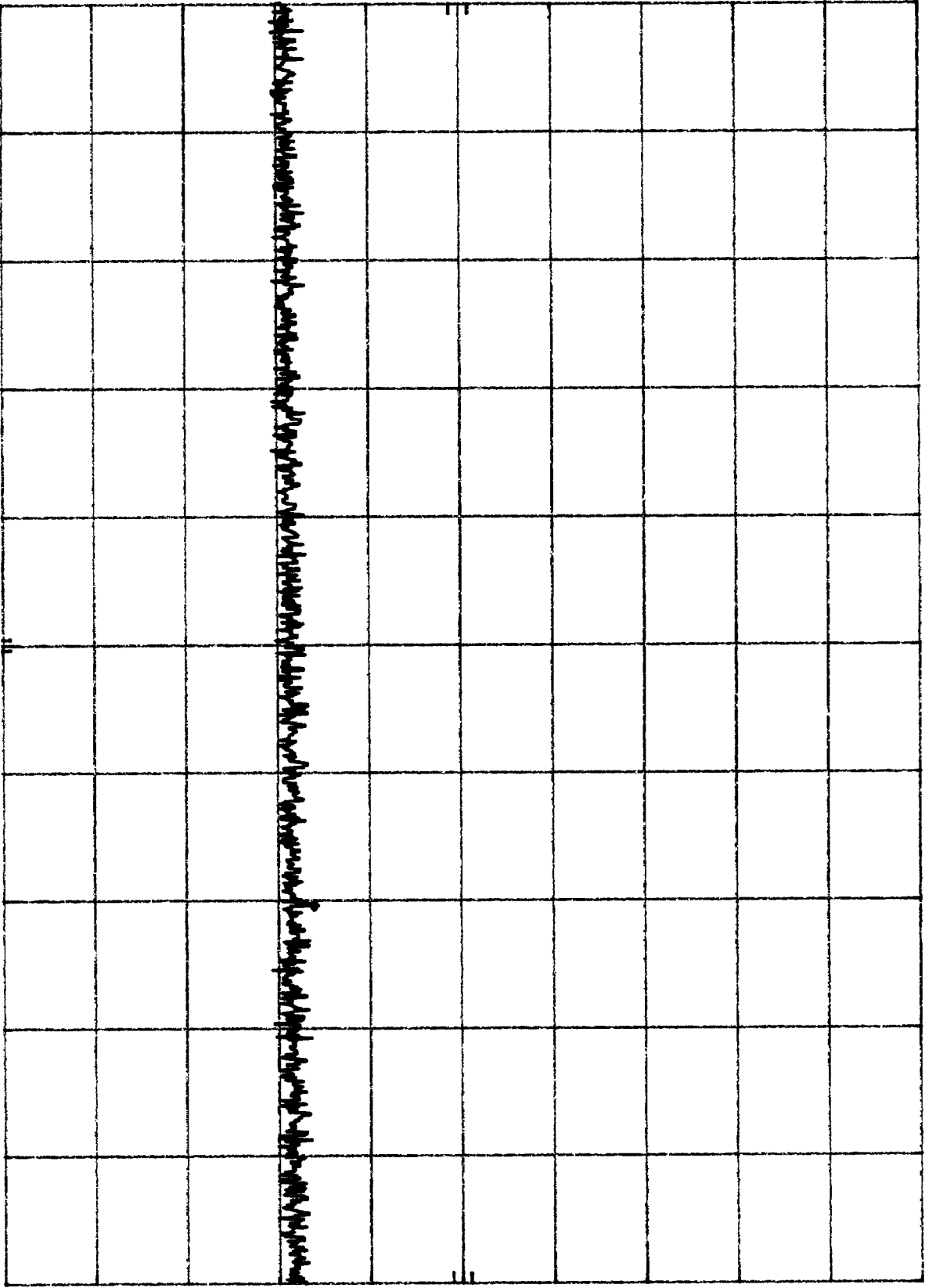
Plot 4.6.3

HP REF 21.0 DBm ATTEN 40 DB

MKR 1.984 GHz
-45.10 DBm

10 DB/

OFFSET
1.0
DB



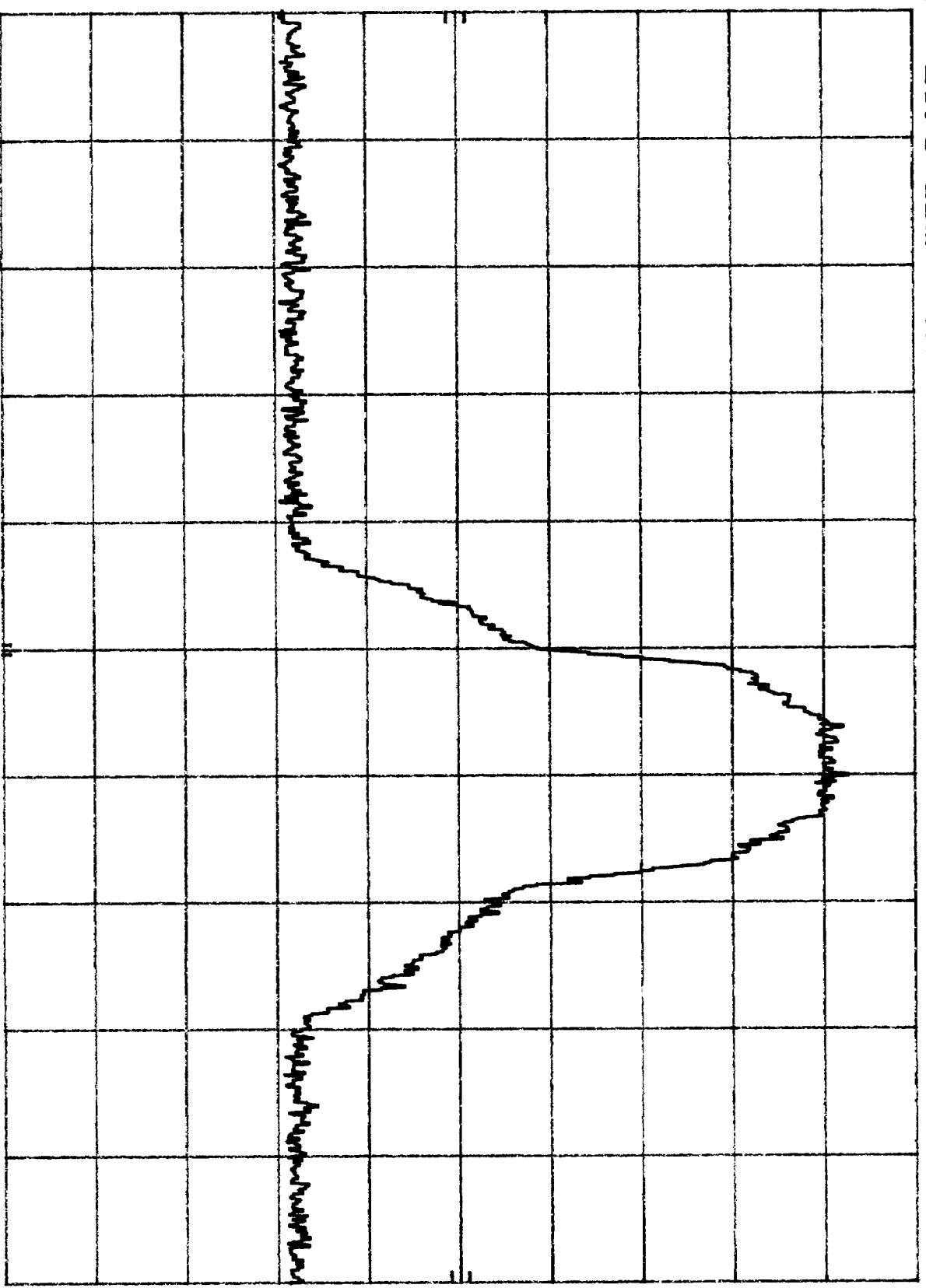
START 1.00 GHz RES BW 100 KHZ VBW 100 KHZ STOP 2.40 GHz
SWP 420 msec

Plot 4.b.4

HP REF 21.0 DBm ATTEN 40 DB

10 DB/

OFFSET
1.0
DB



START 2.400 0 GHz RES BW 100 KHZ VBW 100 KHZ STOP 2.483 5 GHz SWP 25.1 msec

Plot 4.6.5

HP

REF 21.0 dBm

ATTEN 30 dB

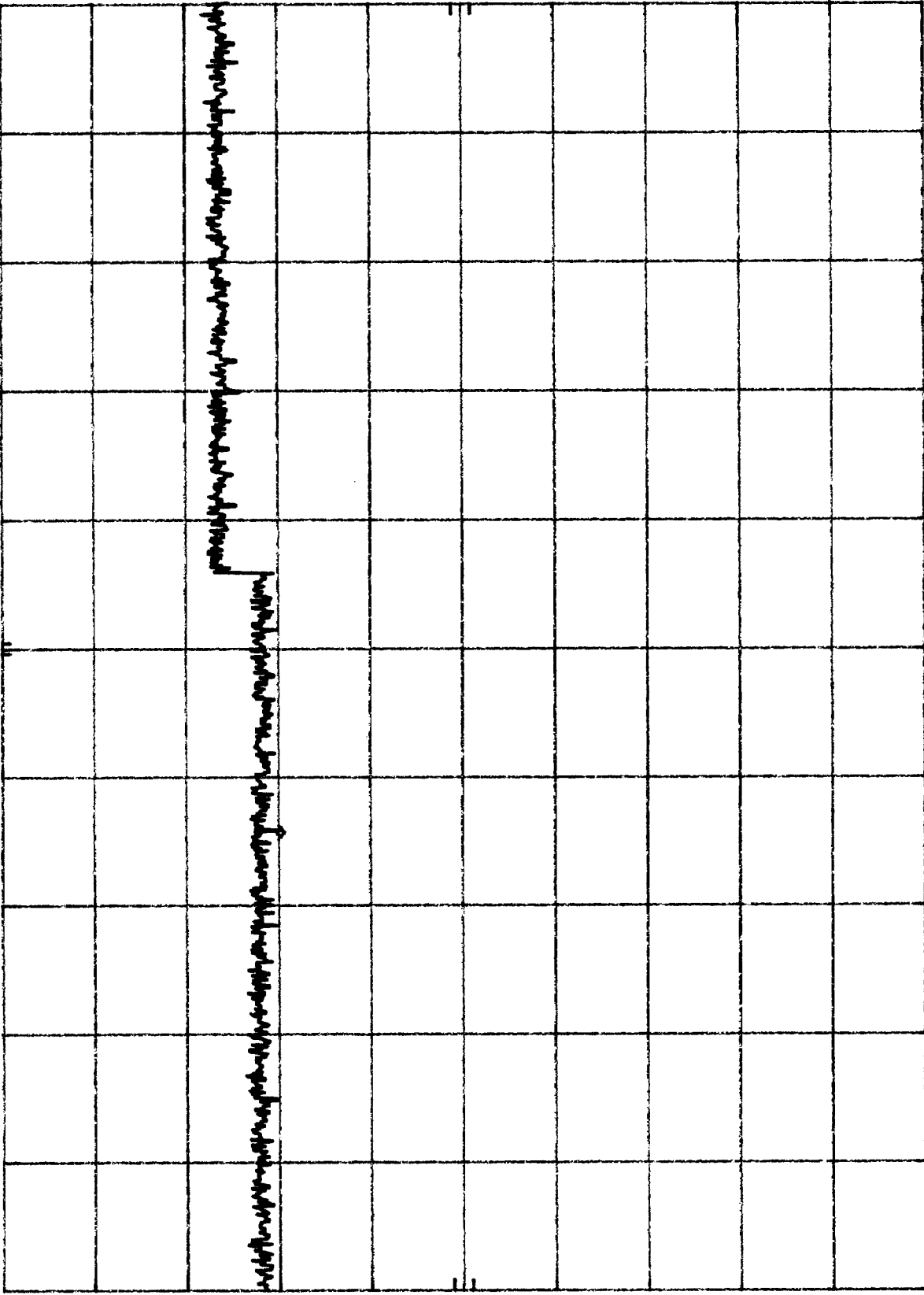
MKR 7.309 GHz
-48.80 dBm

10 dB/

OFFSET

1.0

dB



START 2.48 GHz

RES BW 100 KHZ

VBW 100 KHZ

STOP 10.00 GHz
SWP 2.25 sec

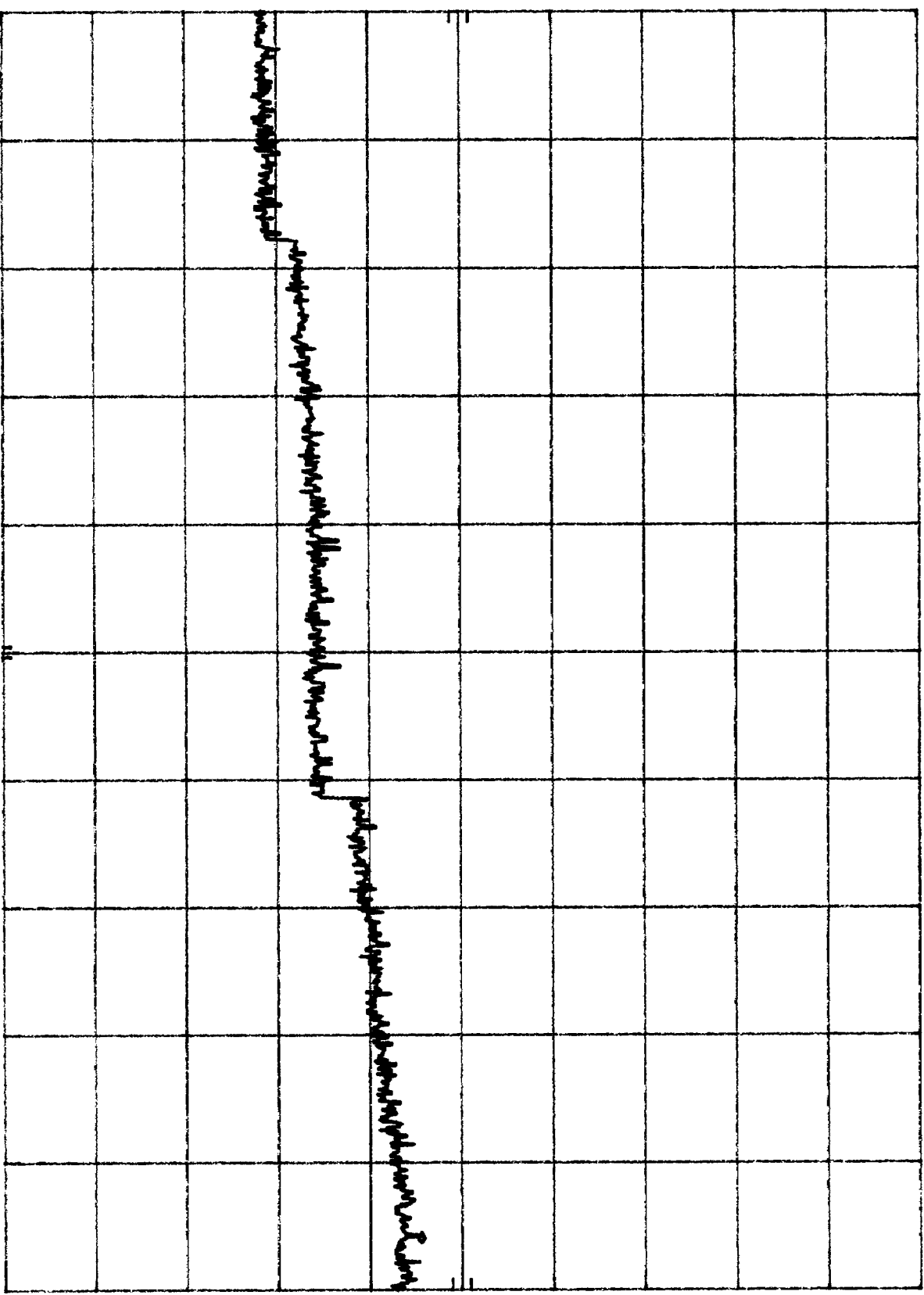
Plot 4.6.6

HP REF 21.0 DBm ATTEN 30 DB

MKR 23.41 GHz
-33.40 DBm

10 DB/

OFFSET
1.0
DB



START 10.0 GHz RES BW 100 KHZ VBW 100 KHZ SWP 4.20 sec
STOP 24.0 GHz

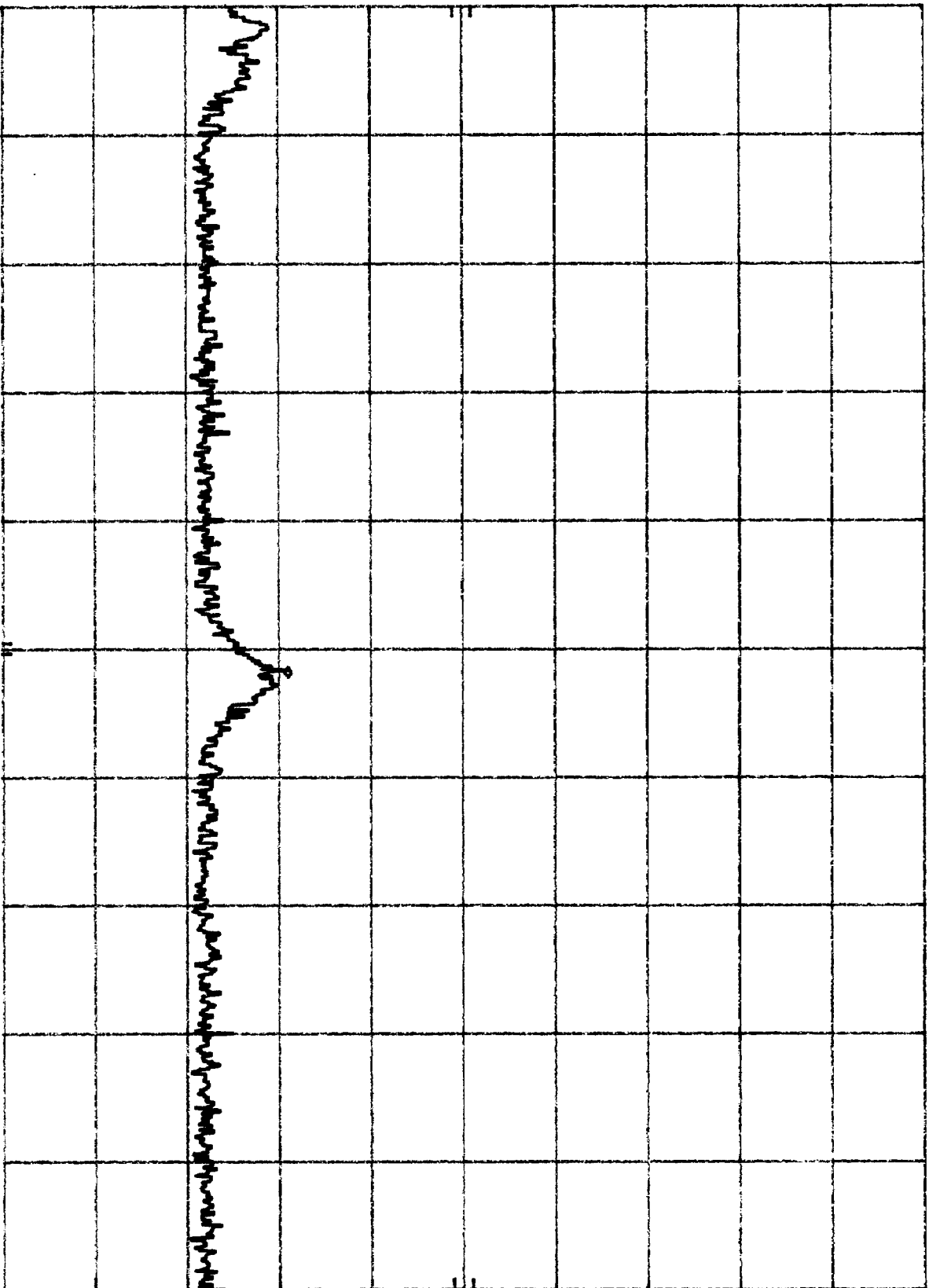
Plot 4.c.1

HP REF 21.0 dBm ATTEN 30 dB

MKR 52.18 MHz
-48.00 dBm

10 dB/

OFFSET
1.0
dB



START 1.0 MHz RES BW 100 KHZ VBW 100 KHZ STOP 100.0 MHz
SWP 29.7 msec

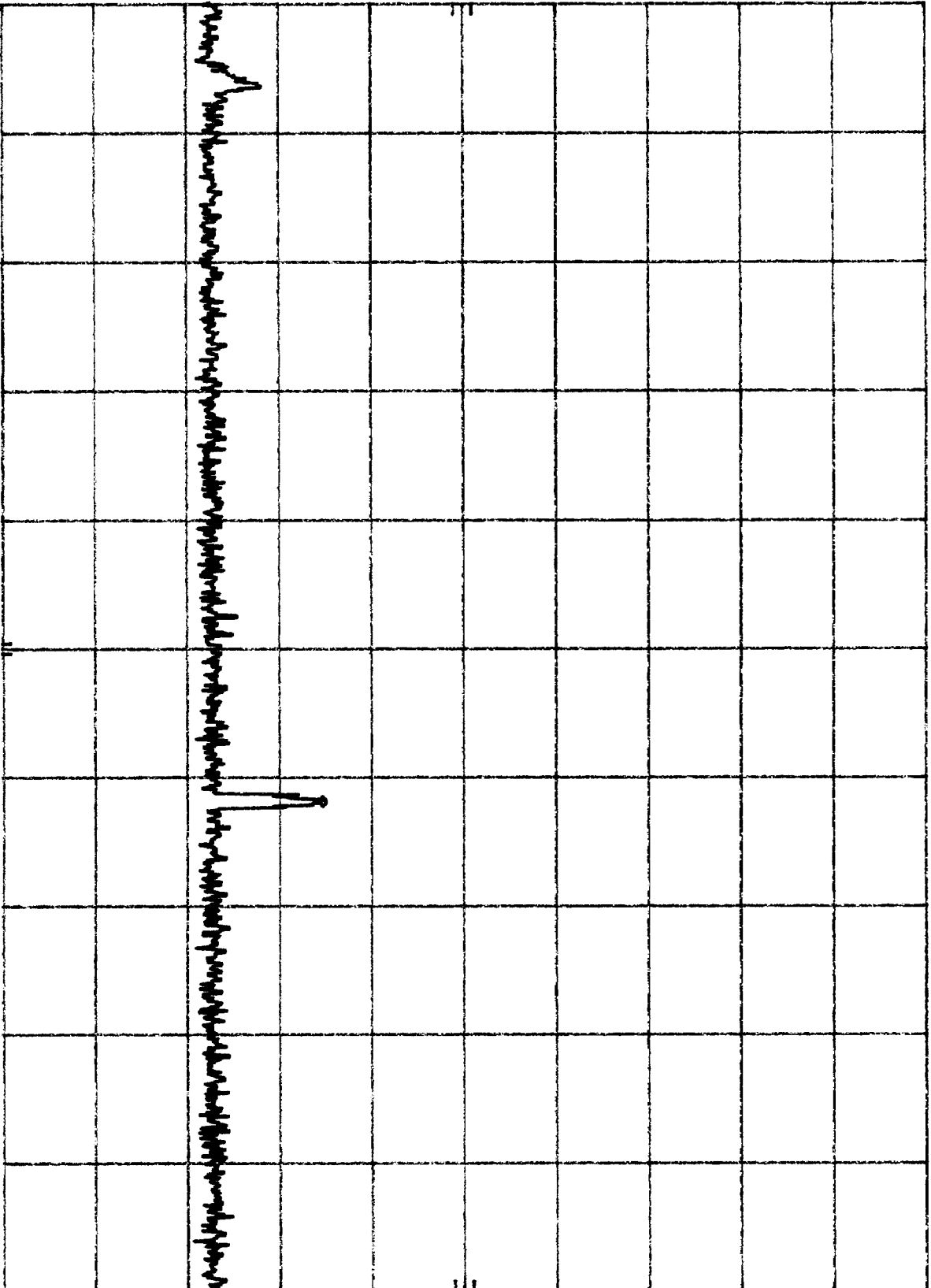
Plot 4.C.2

MKR 656.2 MHz
-44.30 dBm

HP REF 21.0 dBm ATTN 30 dB

10 dB/

OFFSET
1.0
dB



START 100 MHz RES BW 100 KHZ VBW 100 KHZ STOP 1.000 GHz
SWP 270 msec

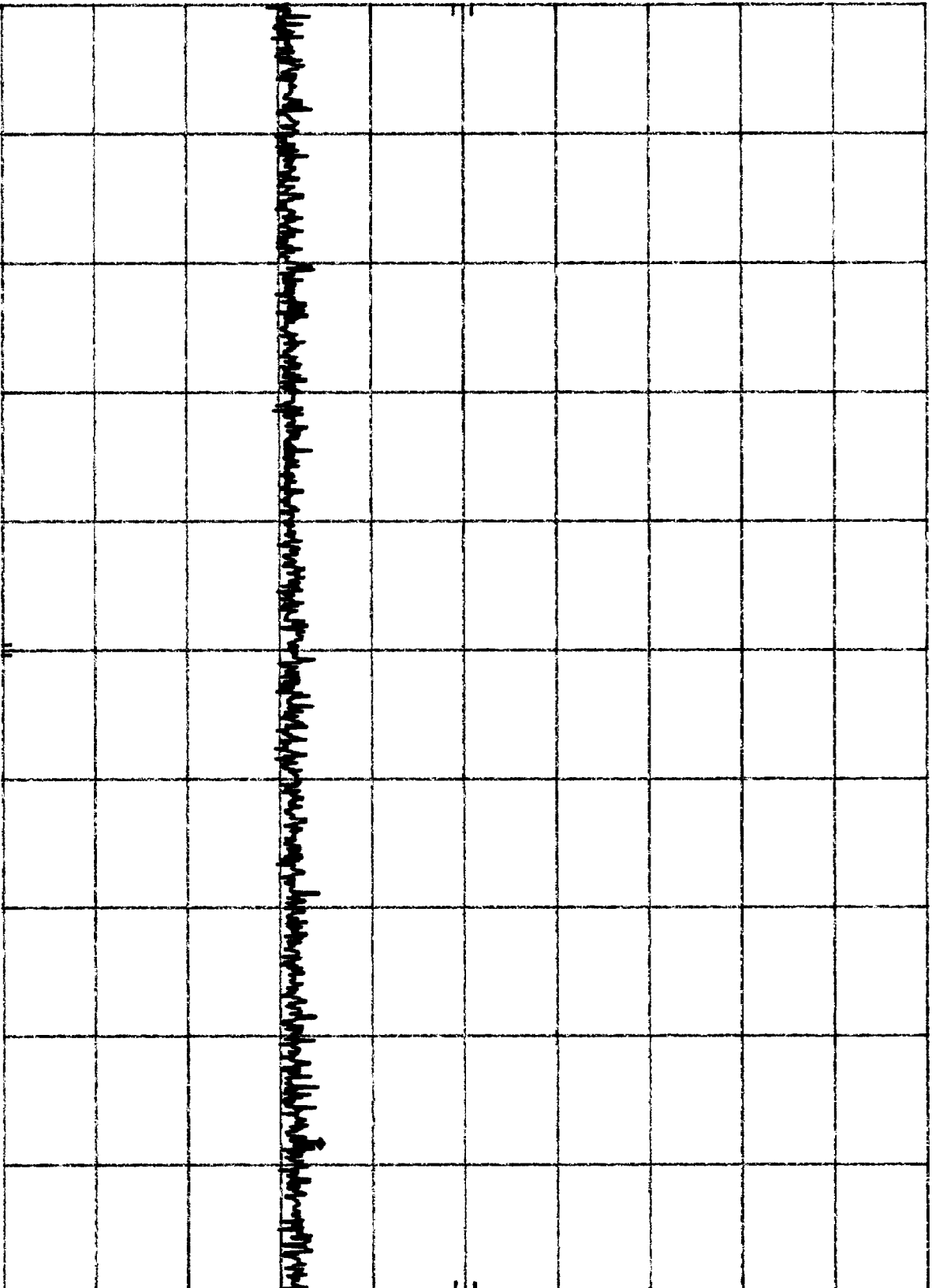
Plot 4.C.3

HP REF 21.0 dBm ATTN 40 dB

MKR 2.236 GHz
-44.70 dBm

10 dB/

OFFSET
1.0
dB



START 1.00 GHz RES BW 100 KHZ VBW 100 KHZ STOP 2.40 GHz
SWP 420 msec

Plot 4.C.4

HP REF 21.0 DBm

ATTEN 40 DB

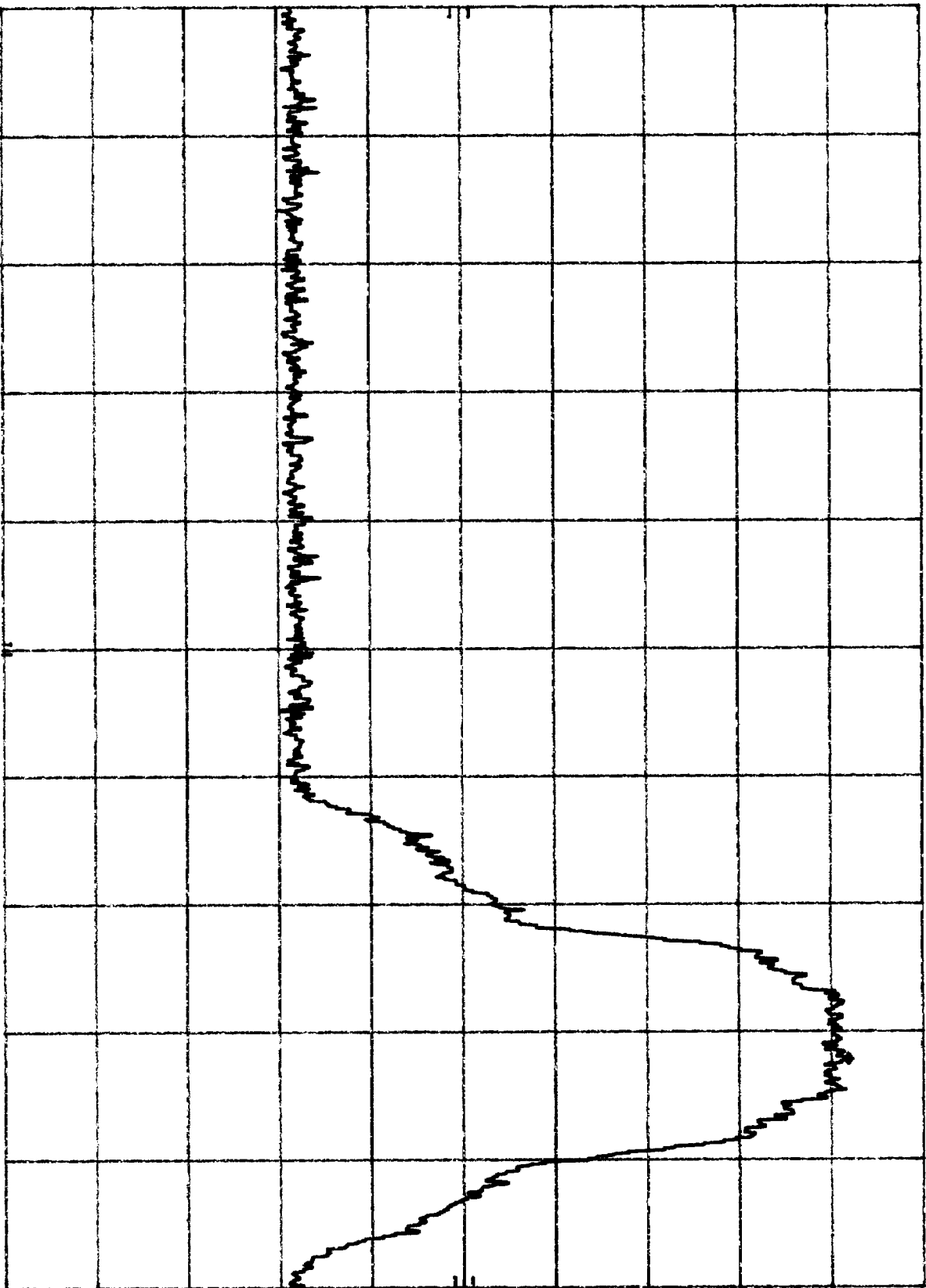
MKR Δ 14.95 MHz
-60.30 DB

10 DB/

OFFSET

1.0

DB



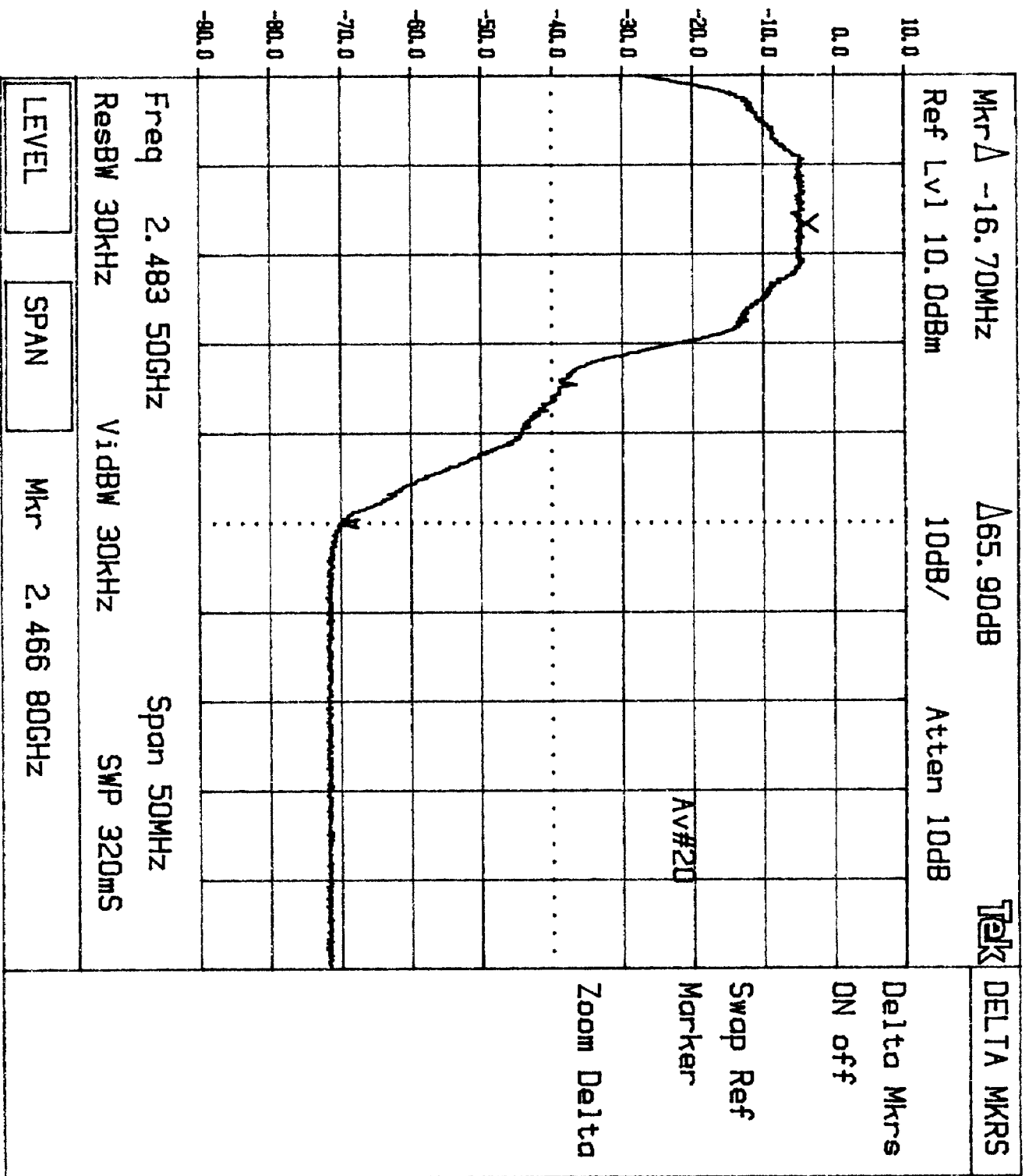
START 2.400 0 GHz

RES BW 100 KHZ

VBW 100 KHZ

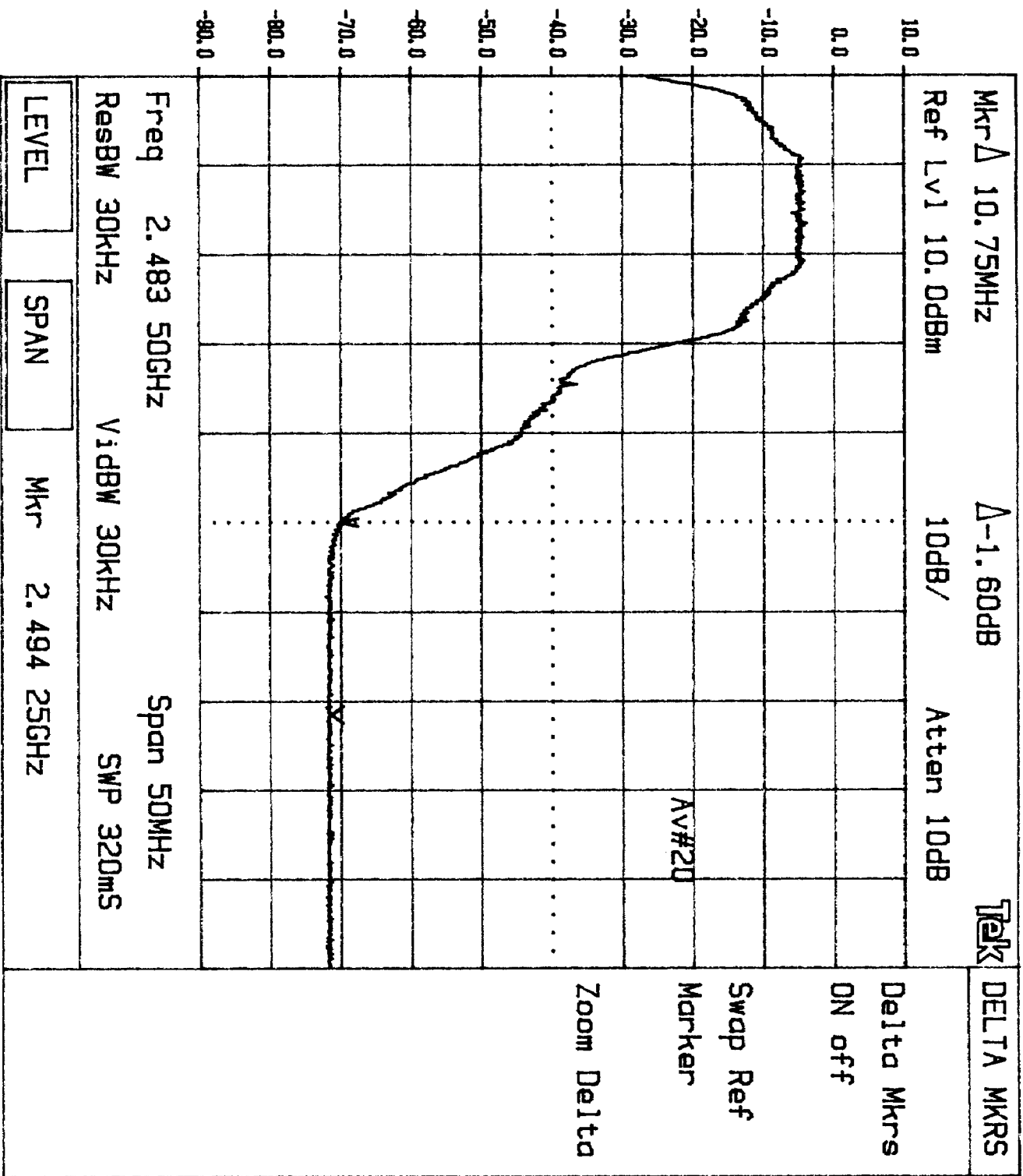
STOP 2.483 5 GHz
SWP 25.1 msec

Plot 4.C.5



Knob 2 Knob 1 Keypad Tektronix 2784

Plot 4.C.6



Knob 2

Knob 1

Keypad

Tektronix

2784

Plot 4.C.7

MKR 6.054 GHz

HP REF 21.0 DBm

ATTEN 30 DB

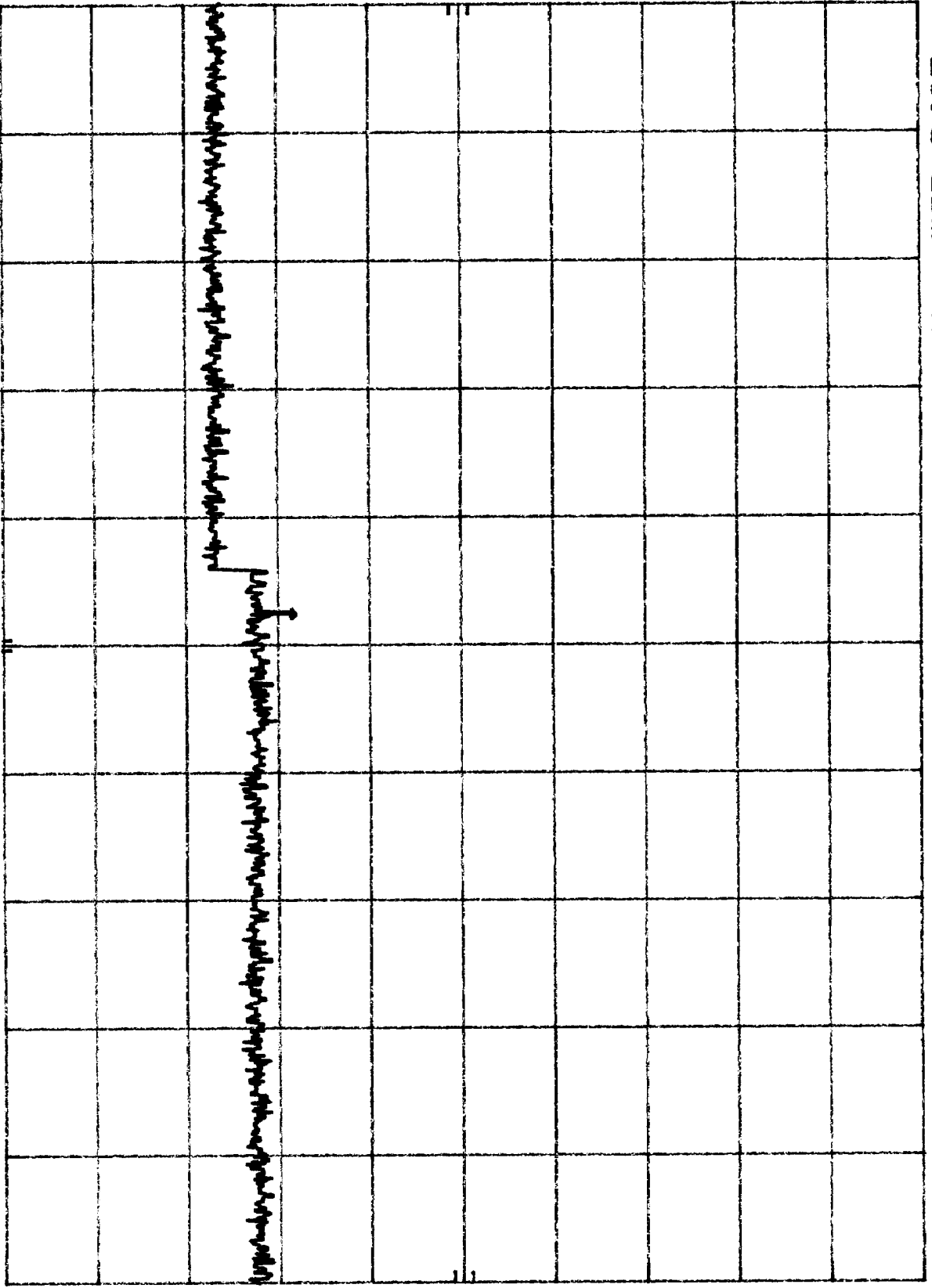
-47.40 DBm

10 DB/

OFFSET

1.0

DB



START 2.48 GHz

RES BW 100 KHZ

VBW 100 KHZ

STOP 10.00 GHz

SWP 2.25 sec

Plot 4. C. 8

MKR 23.99 GHz
-33.50 dBm

HP

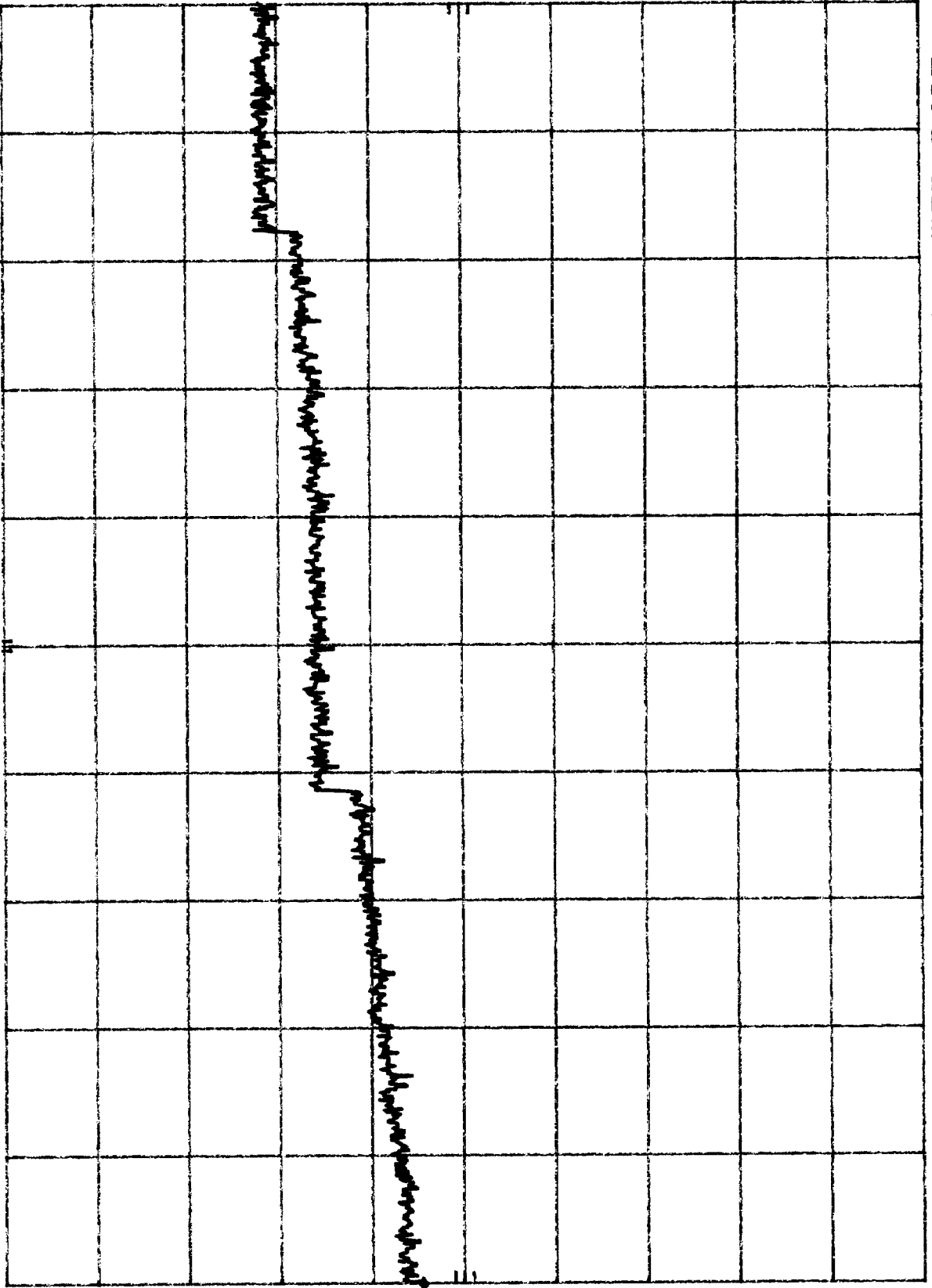
REF 21.0 dBm ATTEN 30 dB

10 dB/

OFFSET

1.0

dB



START 10.0 GHz RES BW 100 KHZ VBW 100 KHZ STOP 24.0 GHz
SWP 4.20 sec

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4.5 Out of Band Radiated Emissions (for emissions in 4. above that are less than 26 dB below carrier), FCC Rule 15.247(c):

For out of band emissions that are close to the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

- Not required
- See attached data sheet

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4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to 24000.00 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak and average detection.

To show compliance on the band edge frequency (2483.5 MHz) and up to 2500 MHz, the "delta" method was used. See notes on the next page. The same method was used to show compliance in the band 2310-2390 MHz.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.6 Transmitter Radiated Emissions in Restricted Bands, FCC Rule 15.35(b), (c):

Radiated emission measurements were performed from 30 MHz to 24000.00 MHz. Analyzer resolution is 100 kHz or greater for 30 MHz to 1000 MHz, 1 MHz for >1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak and average detection.

To show compliance on the band edge frequency (2483.5 MHz) and up to 2500 MHz, the "delta" method was used. See notes on the next page. The same method was used to show compliance in the band 2310-2390 MHz.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The field strength at the bandedge frequencies was calculated as follows:

For the bandedge at 2390 MHz calculation:

- From the plot 4.a.4 (Signal plus Noise) – Noise = 0.4 dB < 1 dB, for 1 dB, signal is 6.87 dB lower than noise floor.
- From the plot 4.a.5, delta is 67.5 dB.

Therefore, the total delta is $67.5 + 6.87 = 74.37$ dB.

The field strength at 2390 MHz:

Peak level $132.6 - 74.37 = 58.2$ dB μ V/m

Average level $125.9 - 74.37 = 51.53$ dB μ V/m

For the bandedge at 2483.5 MHz calculation:

- From the plot 4.c.6 (Signal plus Noise) – Noise = 1.6 dB, for 1.6 dB, signal is 5.11 dB lower than noise floor.
- From the plot 4.c.5, delta is 65.9 dB.

Therefore, the total delta is $65.9 + 5.11 = 71.0$ dB.

The field strength at 2483.5 MHz:

Peak level $132.4 - 71.0 = 61.4$ dB μ V/m

Average level $125.9 - 71.0 = 53.5$ dB μ V/m

Radiated Emissions Test Data

Company: Glenayre Western Multiplex	Model #: 4XE1	Standard: FCC § 15.247 (R.B.)
EUT:	S/N #:	Limits: 11
Project #: J99032175	Test Date: December 22, 1999	Test Distance: 3 meters
Test Mode: Tx @ 2449MHz	Engineer: Xi-Ming Y.	Duty Relaxation: 0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	21	8	10	13	0	0	12	0
Model:	LPB-2520A	EMCO 3115	3160-9	CDL P100 0	AFT18855	ACO/400	None	None	Gm_M+ L	None

Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
4898.00	33.0	Peak	8	8	V	33.5	28.1	3.2	0.0	41.6	74.0	-32.4
4898.00	24.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	32.6	54.0	-21.4
7347.00	34.0	Peak	8	8	V	38.0	28.0	4.3	0.0	48.3	74.0	-25.7
7347.00	25.0	Ave.	8	8	V	38.0	28.0	4.3	0.0	39.3	54.0	-14.7
12245.00	35.0	Peak	8	10	V	42.5	39.1	5.9	0.0	44.3	74.0	-29.8
12245.00	25.0	Ave.	8	10	V	42.5	39.1	5.9	0.0	34.3	54.0	-19.8
19592.00	41.0	Peak	21	13	V	40.3	23.3	7.7	-9.5	56.2	74.0	-17.8
19592.00	31.0	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.2	54.0	-7.8
22041.00	42.0	Peak	21	13	V	40.3	23.3	7.9	-9.5	57.4	74.0	-16.6
22041.00	32.0	Ave.	21	13	V	40.3	23.3	7.9	-9.5	47.4	54.0	-6.6

Notes:

- a) D.C.F.: Distance Correction Factor
- b) Insert. Loss (dB) = Cable A + Cable B + Cable C.
- c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss - Transducer Loss - Duty Relaxation (transmitter only).
- d) Negative signs (-) in Margin column signify levels below the limits.
- e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

Radiated Emissions Test Data

Company: Glenayre Western Multiplex	Model #: XE21	Standard	FCC § 15.247 (R.B.)
EUT:	S/N #:	Limits	11
Project #: J99032175	Test Date: December 22 1999	Test Distance	3 meters
Test Mode: Tx @ 2467MHz	Engineer: Xi-Ming Y.	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	11	8	21	8	10	0	0	0	12	0
Model:	LPG-2520A	EMCO-3115	3160-9	CDI_P100-0	AFT18855	None	None	None	Gm_M+L	None

Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2467.00	100.5	Peak	8	0	V	29.6	0.0	2.3	0.0	132.4		
2467.00	93.0	Ave.	8	0	V	29.6	0.0	2.3	0.0	124.9		
2483.50										61.4	74.0	-12.6
2483.50										53.5	54.0	-0.5
4934.00	33.0	Peak	8	8	V	33.5	28.1	3.2	0.0	41.6	74.0	-32.4
4934.00	24.0	Ave.	8	8	V	33.5	28.1	3.2	0.0	32.6	54.0	-21.4
7401.00	34.0	Peak	8	8	H	36.8	28.0	4.3	0.0	47.1	74.0	-26.9
7401.00	25.0	Ave.	8	8	H	36.8	28.0	4.3	0.0	38.1	54.0	-15.9
12335.00	35.0	Peak	8	10	V	42.5	39.1	5.9	0.0	44.3	74.0	-29.8
12335.00	25.0	Ave.	8	10	V	42.5	39.1	5.9	0.0	34.3	54.0	-19.8
19736.00	41.0	Peak	21	13	V	40.3	23.3	7.7	-9.5	56.2	74.0	-17.8
19736.00	31.0	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.2	54.0	-7.8
22203.00	42.0	Peak	21	13	V	40.3	23.3	7.9	-9.5	57.4	74.0	-16.6
22203.00	32.0	Ave.	21	13	V	40.3	23.3	7.9	-9.5	47.4	54.0	-6.6

- Notes:**
- a) D.C.F.: Distance Correction Factor
 - b) Insert Loss (dB) = Cable A + Cable B + Cable C
 - c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only)
 - d) Negative signs (-) in Margin column signify levels below the limits.
 - e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

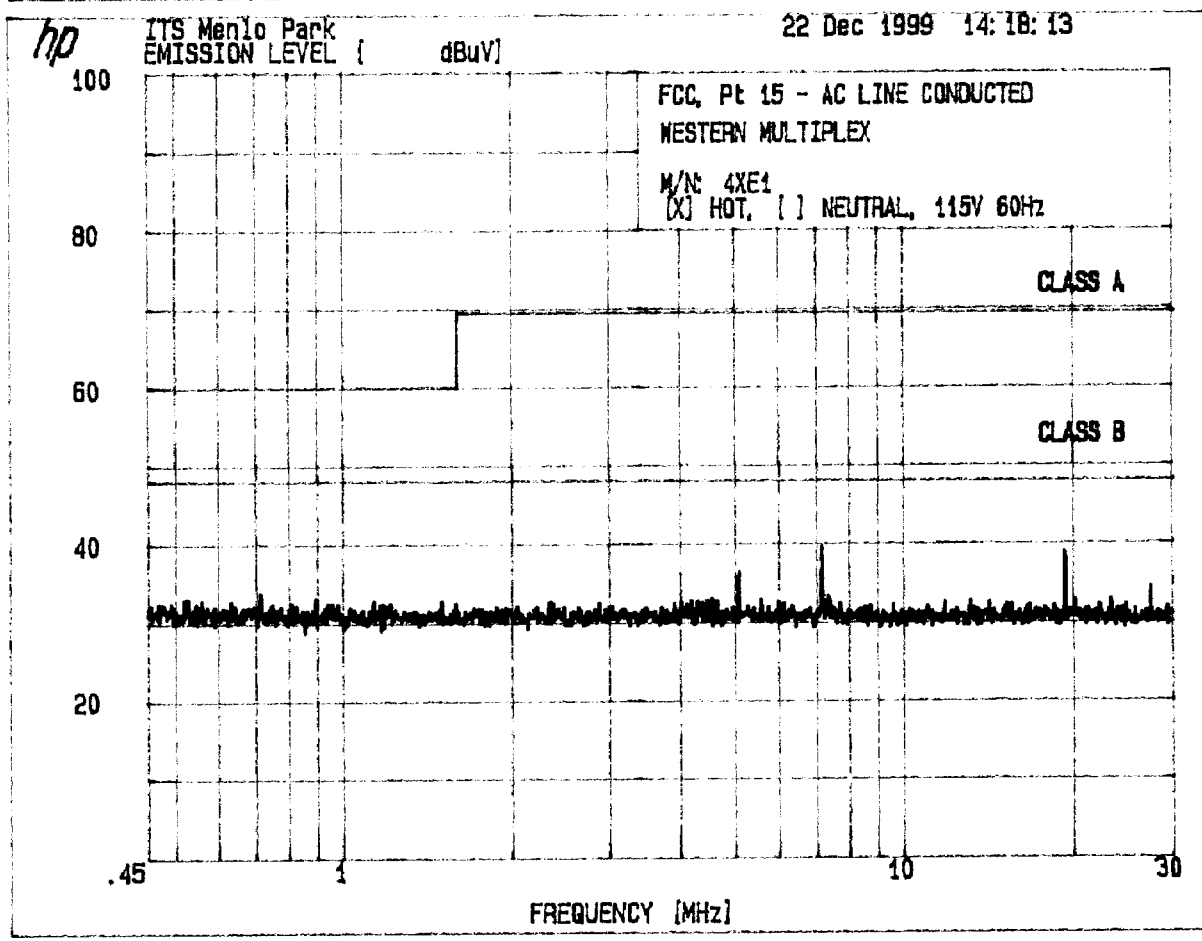
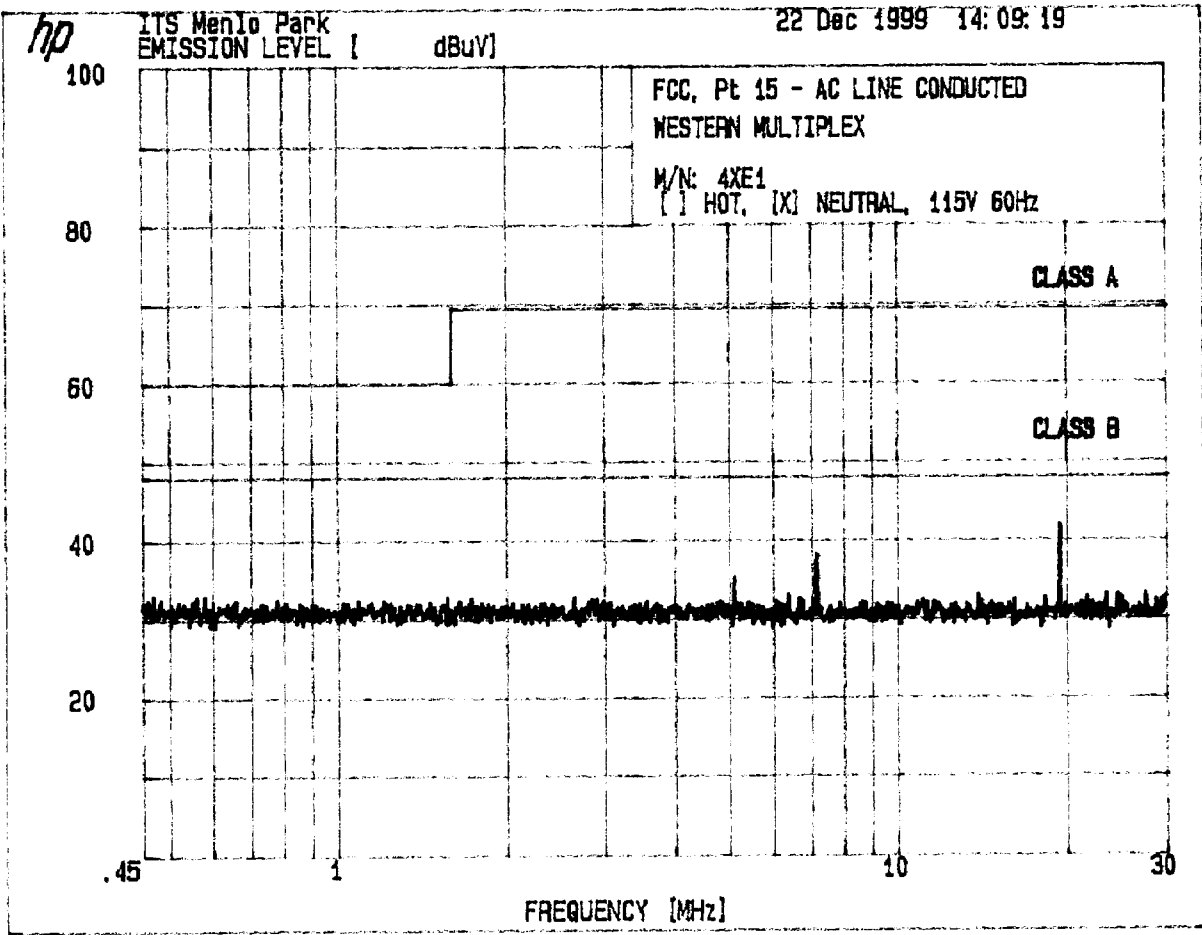
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4.7 AC Line Conducted Emission, FCC Rule 15.207:

Not required; battery operation only

Test data attached



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4.8 Radiated Emissions from Digital Section of Transceiver (Transmitter), FCC Ref: 15.109

- Not required - No digital part
- Test results are attached
- Included in the separate DOC report.

**Radiated Emissions
Test Data**

Company: Glenayre Western Multiplex	Model #: 4XE1	Standard: FCC § 15B
EUT:	S/N #:	Limits: 2
Project #: J99032175	Test Date: December 22, 1999	Test Distance: 3 meters
Test Mode:	Engineer: Xi-Ming Y.	Duty Relaxation: 0 dB

Number:	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
	11	8	6	5	10	13	0	0	1	0
Model:	LPS 2520A	EMCO 3115	EMCO 3145	CDI_P250	AFT18895	ACO400	None	None	Site 1	None

Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D.C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/G	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
179.44	41.0	Peak	11	5	V	10.4	18.9	1.2	0.0	33.7	43.5	-9.8
233.27	41.0	Peak	11	5	H	12.5	18.4	1.6	0.0	36.7	46.0	-9.3
251.20	42.7	Peak	11	5	H	12.9	18.2	1.6	0.0	39.0	46.0	-7.0
260.16	38.0	Peak	11	5	H	13.2	18.2	1.6	0.0	34.6	46.0	-11.4
269.16	46.0	Peak	11	5	H	13.5	18.2	1.6	0.0	42.9	46.0	-3.1
292.89	35.0	Peak	11	5	H	13.3	17.8	1.6	0.0	32.1	46.0	-13.9
412.72	41.0	Peak	11	5	H	16.0	16.9	2.1	0.0	42.2	46.0	-3.8
466.54	39.0	Peak	11	5	H	17.3	16.5	2.0	0.0	41.8	46.0	-4.2
574.23	30.0	Peak	11	5	H	19.2	15.8	2.7	0.0	36.1	46.0	-9.9

Notes:

- a) D.C.F.: Distance Correction Factor
- b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
- c) Net (dB) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
- d) Negative signs (-) in Margin column signify levels below the limits.
- e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

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- 4.9 Radiated Emissions from Receiver Section of Transceiver (L.O. Radiation), FCC Ref: 15.109, 15.111
- Not required - EUT operation above 960 MHz only
 - Not required - EUT is transmitter only
 - Not performed; exempt until June 1999
 - Test results are attached

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4.10 Processing Gain Measurements, FCC Rule 15.247(e)

The processing gain shall be determined from the ratio in dB of the signal to noise ratio with the system spreading code turned OFF, to the signal to noise ratio with the system spreading code turned ON, as measured at the demodulated output of the receiver. The processing gain shall be at least 10 dB for a direct sequence spread spectrum system.

	Refer to attached test procedure and data sheets.
	Refer to circuit analysis and processing gain calculations provided by manufacturer.
X	Refer to Exhibit 13 of FCC Application

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4.11 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEEP function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Duty cycle = Maximum ON time in 100 msec/100

Duty cycle correction, dB = $20 * \log(\text{DC})$

	See attached spectrum analyzer chart(s) for transmitter timing
	See transmitter timing diagram provided by manufacturer
X	No duty cycle was applied

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5.0 Document History

Revision/Job Number	Date	Change
1.0 / J99022866g	1/21/00	Original document