

APPENDIX A
TEST EQUIPMENT

DNB ENGINEERING, INC. EMC TEST EQUIPMENT

<u>MANUFACTURER</u>	<u>DESCRIPTION</u>	<u>MODEL</u>
Hewlett Packard	Spectrum Analyzer	8566B
Hewlett Packard	Spectrum Analyzer	8568B
Hewlett Packard	Quasi Peak Adapter	85650A
Hewlett Packard	Computer/Controller	9825T
Hewlett Packard	Frequency Counter	5245L
Hewlett Packard	Printer	9876A
Hewlett Packard	Counter Plug-in	5253B
Hewlett Packard	Plotter	9872C
Hewlett Packard	Plotter	7470A
Hewlett Packard	Frequency Synthesizer	9662A
Hewlett Packard	Sweep Main Frame	8620C
Hewlett Packard	Plug-in 2-22 GHz	26290B
Polarad	Signal Generator 3.7 to 8.4 GHz	1107E
Telonics	Sweep Generator	4053A
Wiltron	Sweep Generator	6653A
Hewlett Packard	Signal Generator	614A
Hewlett Packard	Signal Generator	616B
Hewlett Packard	Signal Generator	618B
Hewlett Packard	Signal Generator	620B
Hewlett Packard	Signal Generator	626A
Hewlett Packard	Signal Generator	628A
Hewlett Packard	Signal Generator	8654A

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Hewlett Packard	Signal Generator	8662A
Hewlett Packard	RF Voltmeter	3406A
Solar	Pulse Generator	8282-1
Solar (2)	Clamp on Probe	6747-1
Electro-Metrics	Clamp on Probe	PCL-10
Electro-Metrics	Clamp on Probe	PCL-25
Electro-Metrics	Loop Sensor	ELS-10
Electro-Metrics	Electro-Static Field Probe	EFP-25
Electro-Metrics	LISN	FCC-5-2
Solar	LISN	8012-50-r-24 BNC
Solar	Audio Isolation Transformer	6220-1A
Solar	Isolation Transformer	7032-1
Solar (14)	10 mfd Capacitors	6212-106R
Schaffner EMC, Inc.	Absorbing Clamp	MDS 21
Solar	100 W Audio Amplifier	6552-1A
Solar (2)	LISN	8018-50-TS-24 BNC
Stoddart	FIM	NM-12T
Krohn-Hite	Audio Oscillator	4400
Stoddart	FIM	URM-6
IFI	Field Strength Meter	EFS-1
Solar	Precision Resistor	7144-1.0
Solar	Precision Resistor	7144-10.0
Solar	Coupling Network	7835-891

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Solar	Coupling Network	7835-896
Solar	LISN (5 μ h)	6338-5
Solar	LISN (50 μ h)	6338-57
Solar	High Pass Filter	7205-.35
Solar	High Pass Filter	7205-2.4
Mini Circuits	Amplifier Wide Band	ZHL42
Mini Circuits	Amplifier Wide Band	ZHL-1042J
Mini Circuits	Amplifier Wide Band	ZHL32A
Mini Circuits	Amplifier Wide Band	ZHL-1A
Mini Circuits	Amplifier Wide Band	ZHL2-8
ENI	Amplifier	510L
ENI	Amplifier	350L
Hewlett Packard	Preamplifier	11975A
Hewlett Packard	Preamplifier	8349A
IFI	1 kHz - 200 MHz Amplifier (15 Watt)	5300L
Narda	400 W 50 Ω Load	376NM
Eaton	WBA 500 - 1000 MHz	15100B
ENI	WBA 250 KHz - 150 MHz	3100LA
ENI	WBA 1.5 - 500 MHz	5501
Avantek	Low Noise Amplifier 6-12.4 GHz	AFT12635
Hewlett Packard	500 MHz Digitizing Oscilloscope	54111D
Tenney	Temperature Chamber	THjr

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Hewlett Packard	5 Hz - 200 MHz Network Analyzer	3577A
Hewlett Packard	Frequency Doubler	11721A
Hewlett Packard	Harmonic Mixers	11970A
Hewlett Packard	Harmonic Mixers	11970K
Hewlett Packard	Computer/Controller	9836
Hewlett Packard	Computer/Controller	9826
Avantest	Spectrum Analyzer	TR4131E
Hewlett Packard	Spectrum Analyzer	8558B
Hewlett Packard	Spectrum Analyzer	8554L
Hewlett Packard	Pulse Generator	212A
Hewlett Packard	Pulse Generator	214A
Hewlett Packard	Pulse Generator	215A
Tektronix	Oscilloscope	453A
John Fluke	High Voltage power Supply	408A
LeCroy	Digital Storage Scope (125 MHz)	9400
Biddle	Micro Ohm Meter	247800
Hewlett Packard	Pulse Modulator	11720A
Topaz	Ultra Isolation Transformer (2.5 kVA)	0211T21SR
ENI	Ultra Isolation Transformer (2.5 kVA)	91002-22
Singer (5)	Current Probe	91550-2
Stoddart (4)	Current Probe	91550-1

DNB ENGINEERING, INC. EMC TEST EQUIPMENT

Hewlett Packard	Dual Directional Coupler	778D
Narda	Dual Directional Coupler	3022
Narda	Directional Coupler	3045C-20
Narda	Directional Coupler	3003-20
Narda	Directional Coupler	3002-10
Narda	Directional Coupler	23964
Narda (2)	Directional Coupler	22355
Narda	Power Divider	4326-2
Narda	Power Divider	4035C
Narda	Power Divider	4033C
Englemann	Power Divider	PSK-210
Bird	50 Ω Load 10 W 50's	80-53
Stoddart	50 Ω Load	90514
Micro Lab	50 Ω Load	TB-5MN
Tekscan	50 Ω Attenuator Kit	FP-50
Tenuline	50 Ω 100 W 20 dB Attenuator	8343-200
Micro Lab	50 Ω 40 dB Attenuator	AD-40N
Hughes	20 Watt TWT L Band	1277H04
Hughes	20 Watt TWT C Band	1277H04
Hughes	10 Watt TWT S Band	1177H
Hughes	10 X/Ku Band	1177H
IFI	2kW cw 1 kHz - 200 MHz Wide Band Power Amp	410ULP
DNB Engineering	EMP Pin/Wire Test Set	844

DNB ENGINEERING, INC.

EMC TEST EQUIPMENT

ANTENNAS

<u>MANUFACTURER</u>	<u>DESCRIPTION</u>	<u>MODEL</u>
AIL (3)	Dipole	DM105A-T1, T2, & T3
EMCO	Biconical	3109
EMCO	Log Periodic	3146
EMCO	Parallel Element	3107
Eaton	Vertical Rod	74607-1
Eaton (2)	Vertical Rod	75492-1
Ailtech	Loop	94608-1
Singer	Loop	LP-105 ASC
Electro-Metrics (2)	Biconical	BIA-25
Electro-Metrics (2)	Conical Log Spiral	LCA-25
Electro-Metrics (2)	Loop	ALP-10
Electro-Metrics (2)	Loop	ARL-25
Electro-Metrics (2)	Broadband Dipole	DBA-25
Electro-Metrics (3)	Turnable Dipole	TA-25, 25-1, & 25-2
EMCO	Double Ridge Guide	311525
Electro-Metrics (2)	Vertical Rod	RVR-25
Alpha	Standard Gain Horn	K861
Alpha	Standard Gain Horn	A861
Alpha	Standard Gain Horn	KV861
Solar	Loop Antenna	7429-1
Electro-Metrics	E Field SensorHorn	EFP-25

Circuit Diagram
2.983(d) (7)

SEE FIGURE IN APPENDIX B

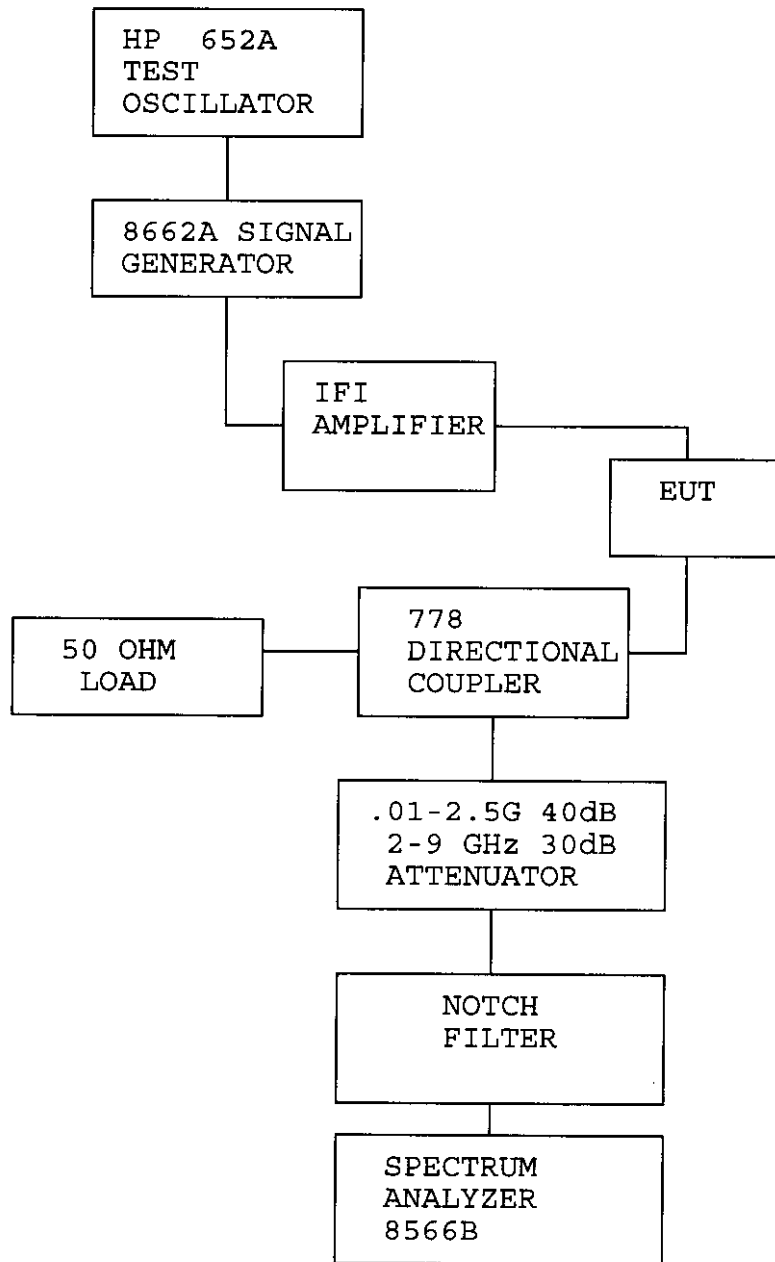


FIGURE 2. BLOCK DIAGRAM.
(POWER INPUT/OUTPUT TESTS)

2.983(e) **Test Data**

Refer to 2.983(e) (1) through 2.983(e) (7)

2.983(e) (1) **Measurement of RF Power Output per 2.985**

Definition: For RF Power Amplifiers.

Test Method: See Figure 2.
Output power is measured across a precision 50 ohm load with a wide-band sampling RF voltmeter.

Test Results:

Frequency	POWER OUTPUT		
	Nominal Voltage 13.8 VDC	85% Voltage 11.73 VDC	115% Voltage 15.87 VDC
806 MHz	26 W	26 W	26 W
870 MHz	12 W	12 W	12 W

2.983(e)(2) **Measurement of Modulation Characteristics per
2.987(b)(1)**

This EUT is a power amplifier and contains no circuitry to modify the RF signal provided by the driver except to raise the power level.

2.983 (e) (3) **Measurement of Occupied Bandwidth per 2.989**

Definition: Occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean power radiated by a given emission.

Test Method: Connect the equipment per Figure 3.

Measurements were made with the modulating signal at 2.5 kHz with 5 kHz of FM deviation.

Test Results: See Plots following Figure 3.

The center frequency of the signal did not shift with modulation. The spectrum bandwidth was well within the limits specified in the FCC regulations

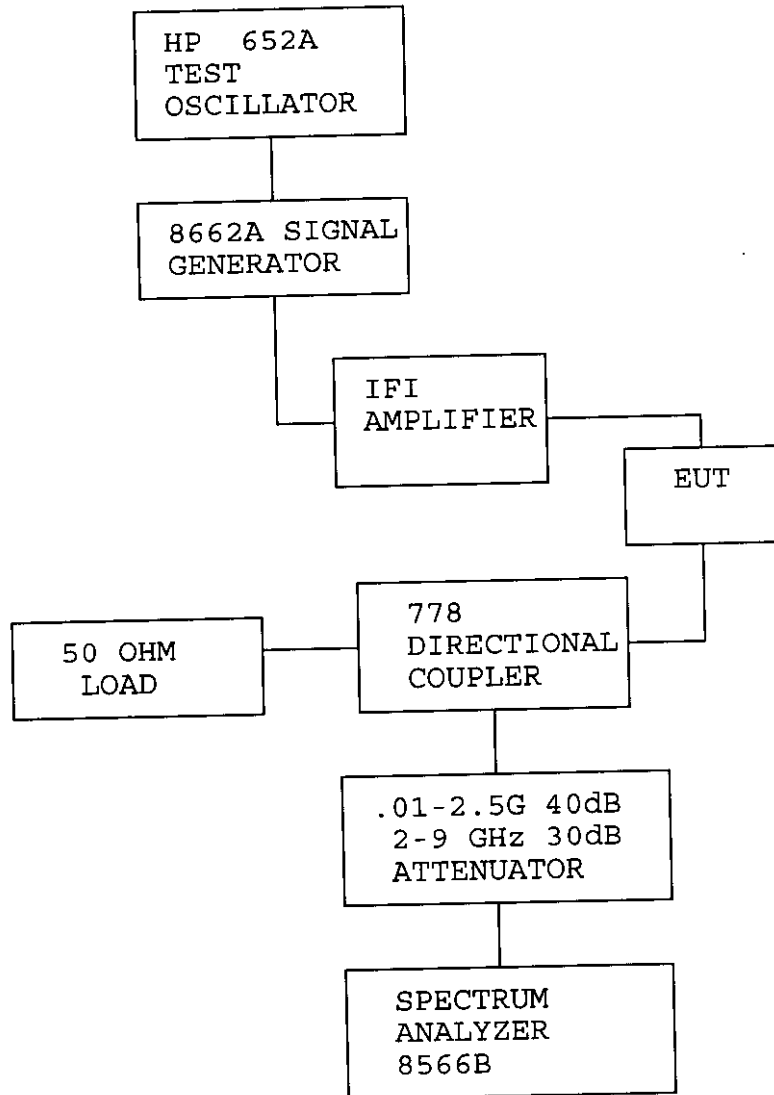


FIGURE 3. BLOCK DIAGRAM.
(OCCUPIED BANDWIDTH)

PA8-1AA-M UNMODULATED CARRIER
 REF 44.0 dBm ATTN 10 dB
 MKR 805.999 4 MHz
 44.10 dBm

hpo

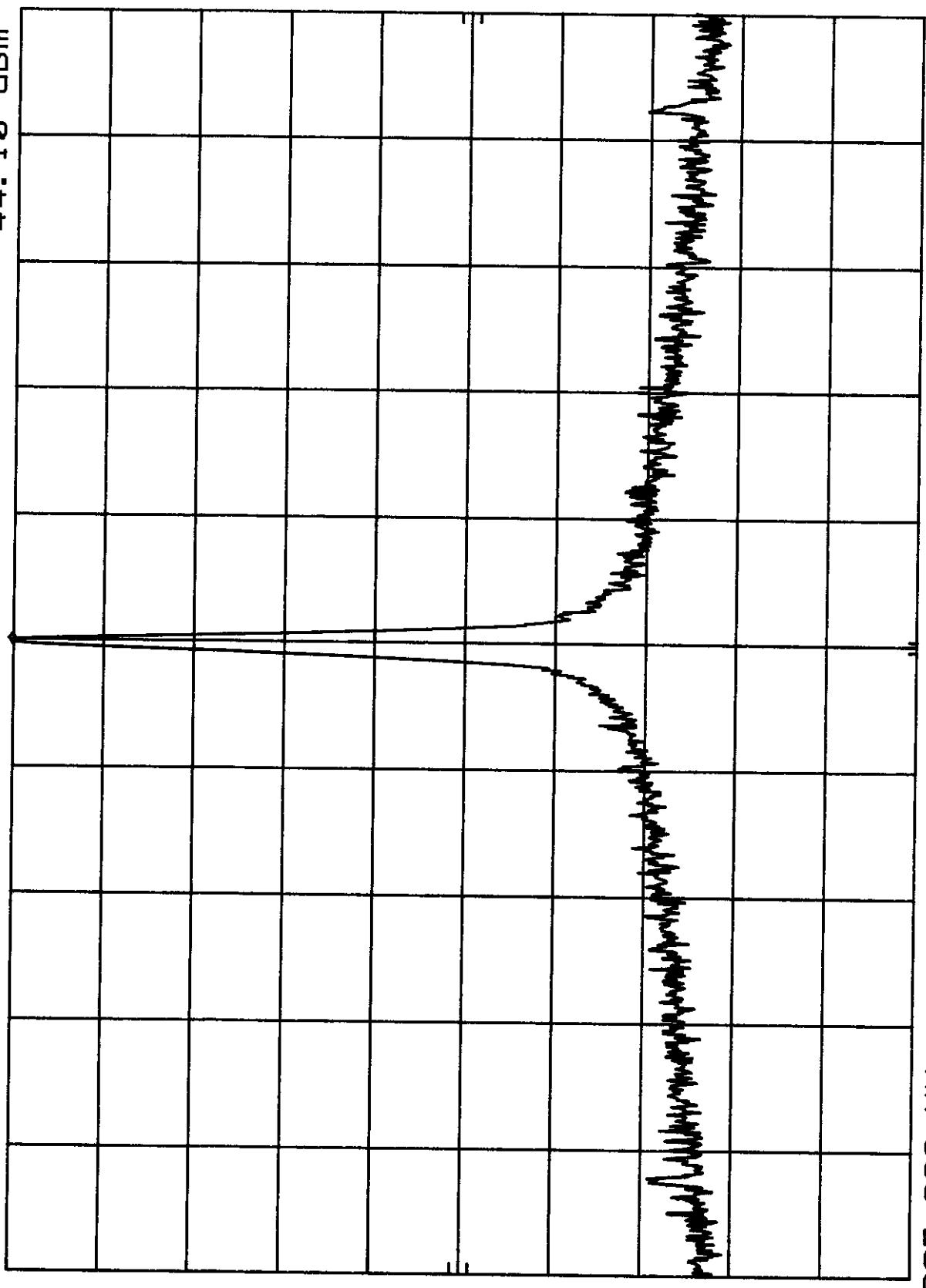
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 805.999 MHz
 RES BW 300 Hz
 SPAN 100 kHz
 SWP 3.00 sec
 VBW 1 kHz

PA8-1AA-M OCCUPIED BANDWIDTH PART 90 MKR 805.999 4 MHz
 REF 44.0 dBm ATTN 10 dB 30.40 dBm

HP

10 dB/

POS PK

OFFSET

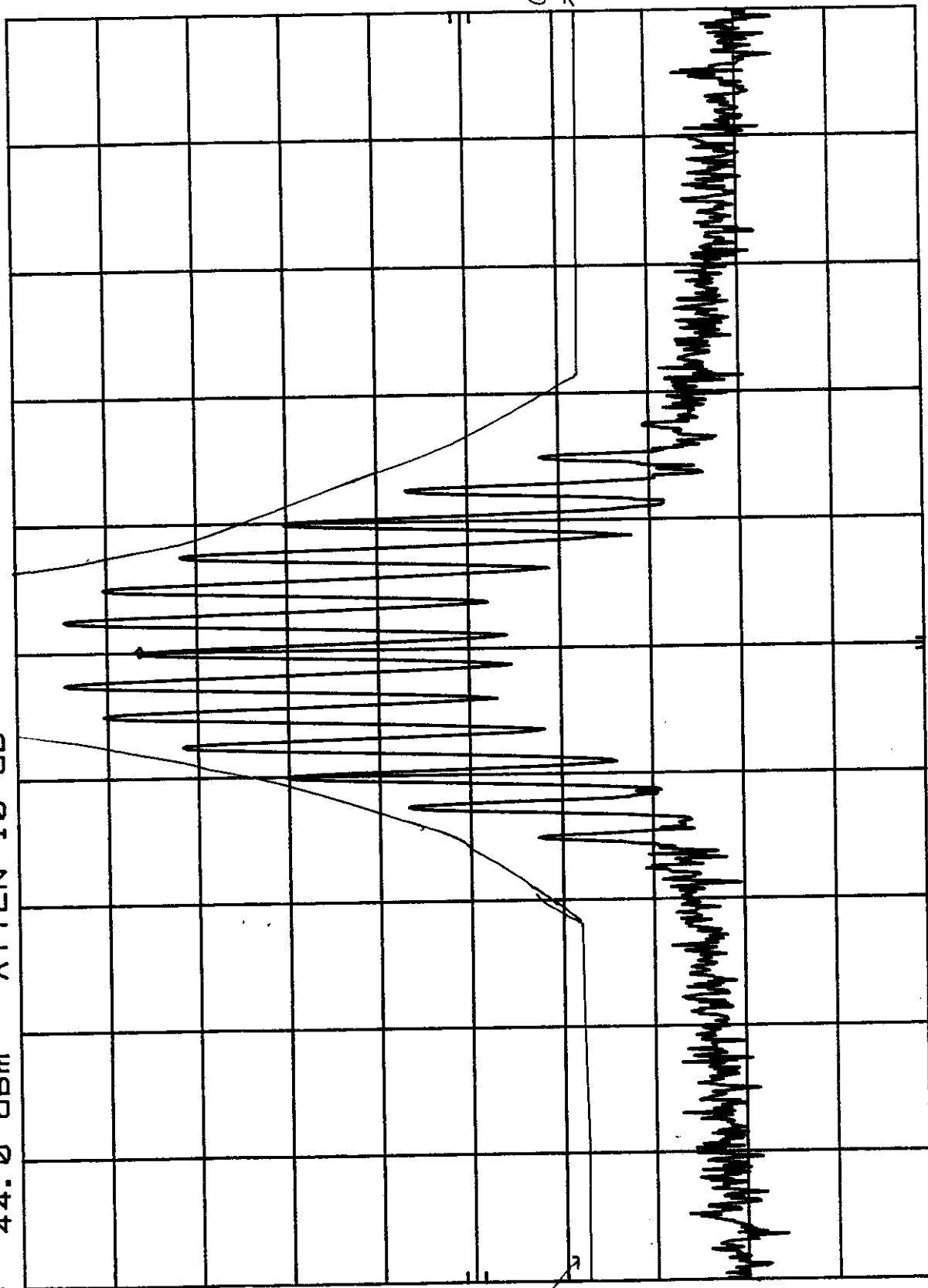
60.6

dB

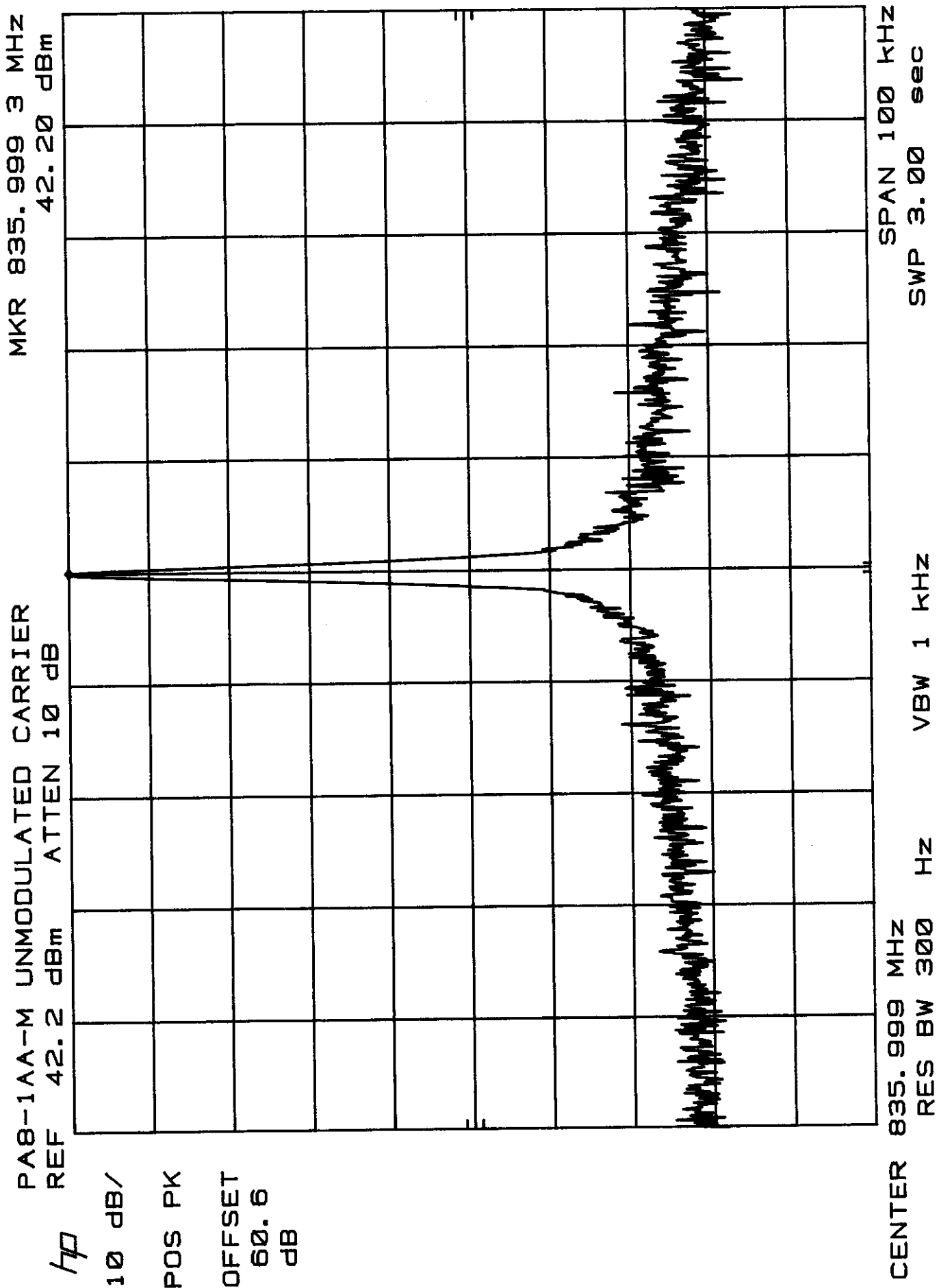
13

EMISSION MASK G

69dBc



CENTER 805.999 MHz RES BW 300 Hz VBW 1 kHz SPAN 100 kHz SWP 3.00 sec



PA8-1AA-M OCCUPIED BANDWIDTH PART 90 MKR 835.999 4 MHz
REF 42.2 dBm ATEN 10 dB 29.00 dBm

HP

10 dB/

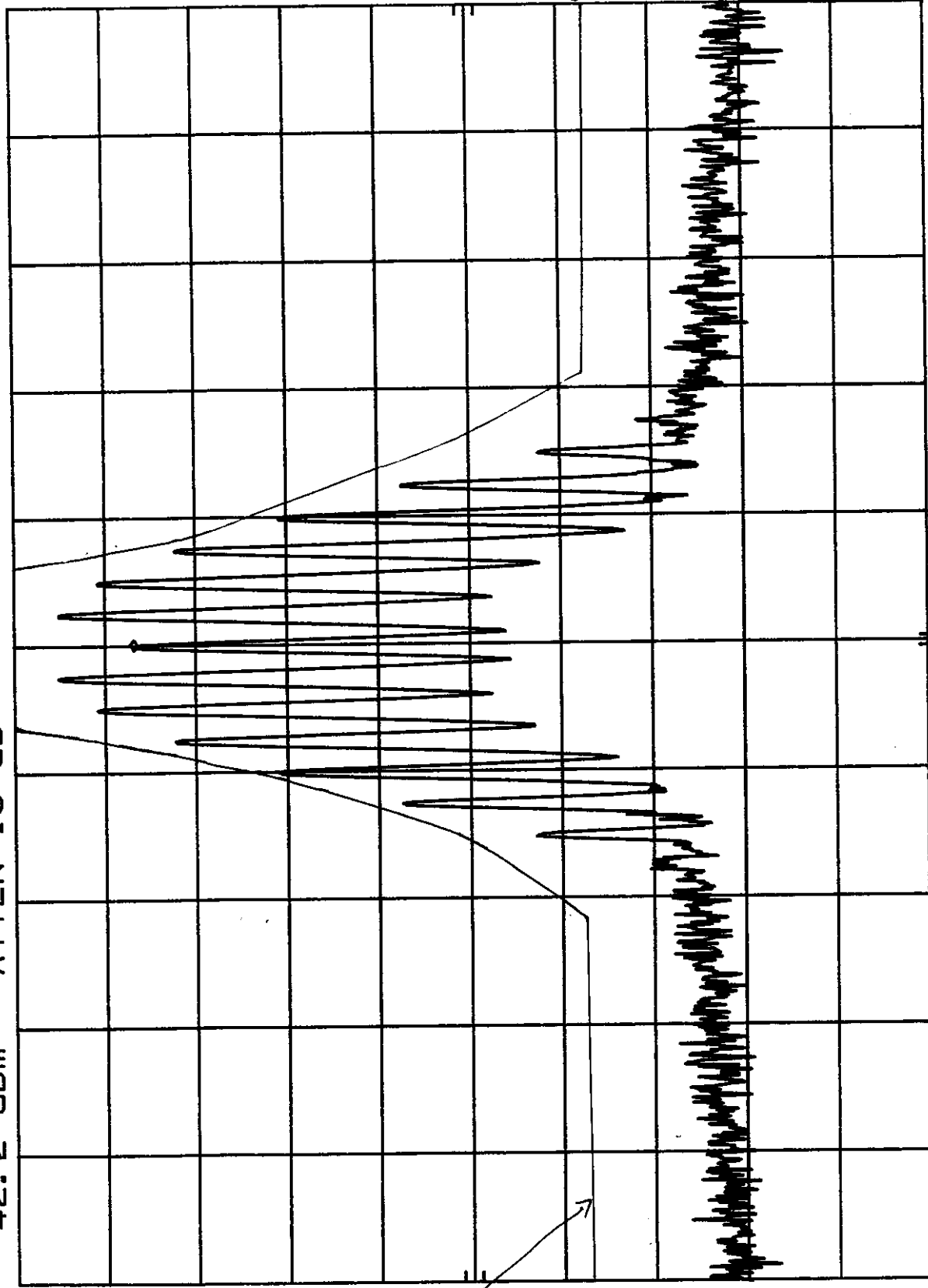
POS PK

OFFSET

60.6

dB

EMISSION MARK G
15

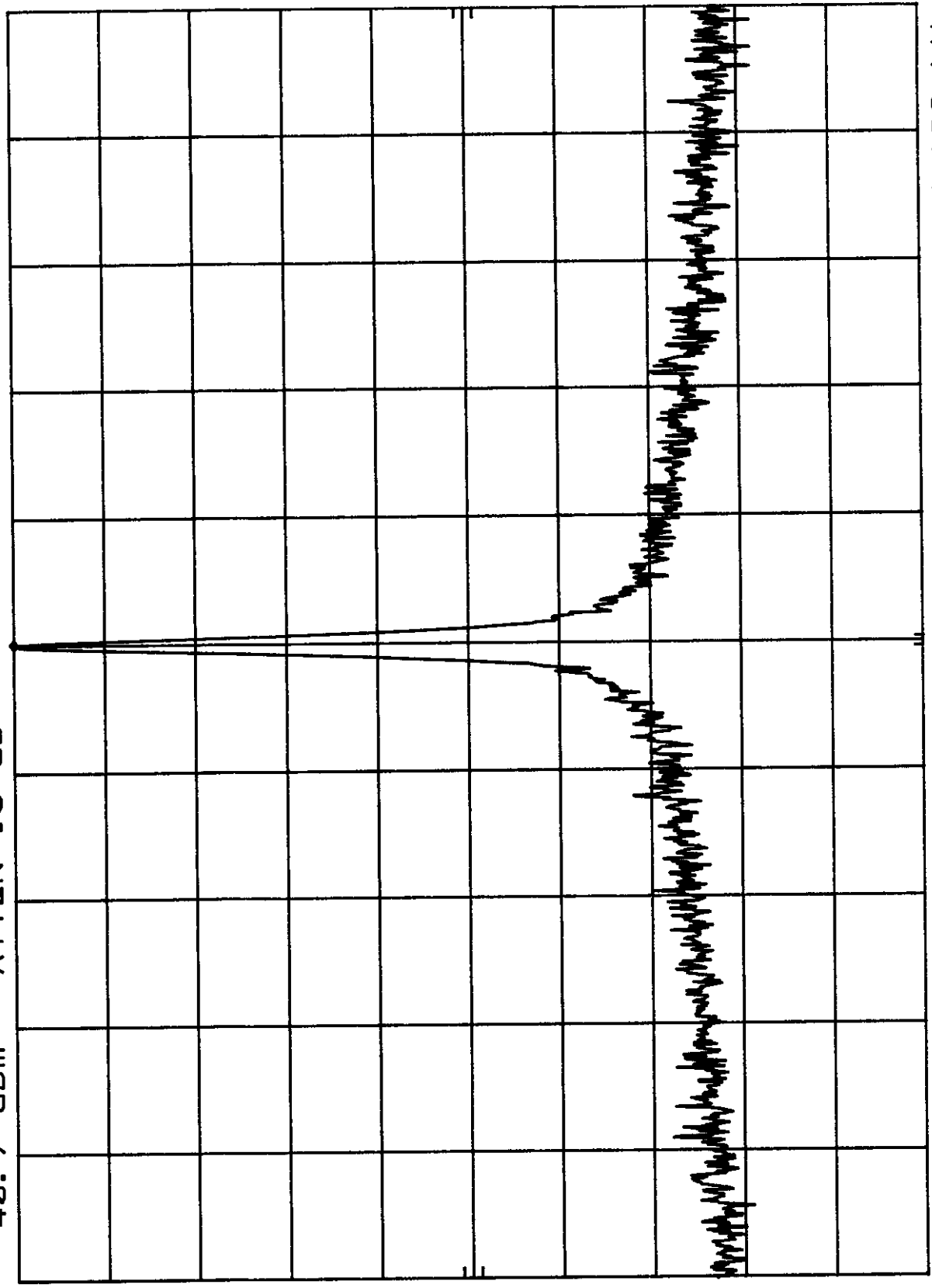


CENTER 835.999 MHz RES BW 300 Hz SPAN 100 KHz SWP 3.00 sec

PA8-1AA-M UNMODULATED CARRIER
 REF 40.7 dBm MKR 865.999 3 MHz
 ATTN 10 dB
 40.70 dBm

HP

10 dB/
 POS PK
 OFFSET
 60.6
 dB

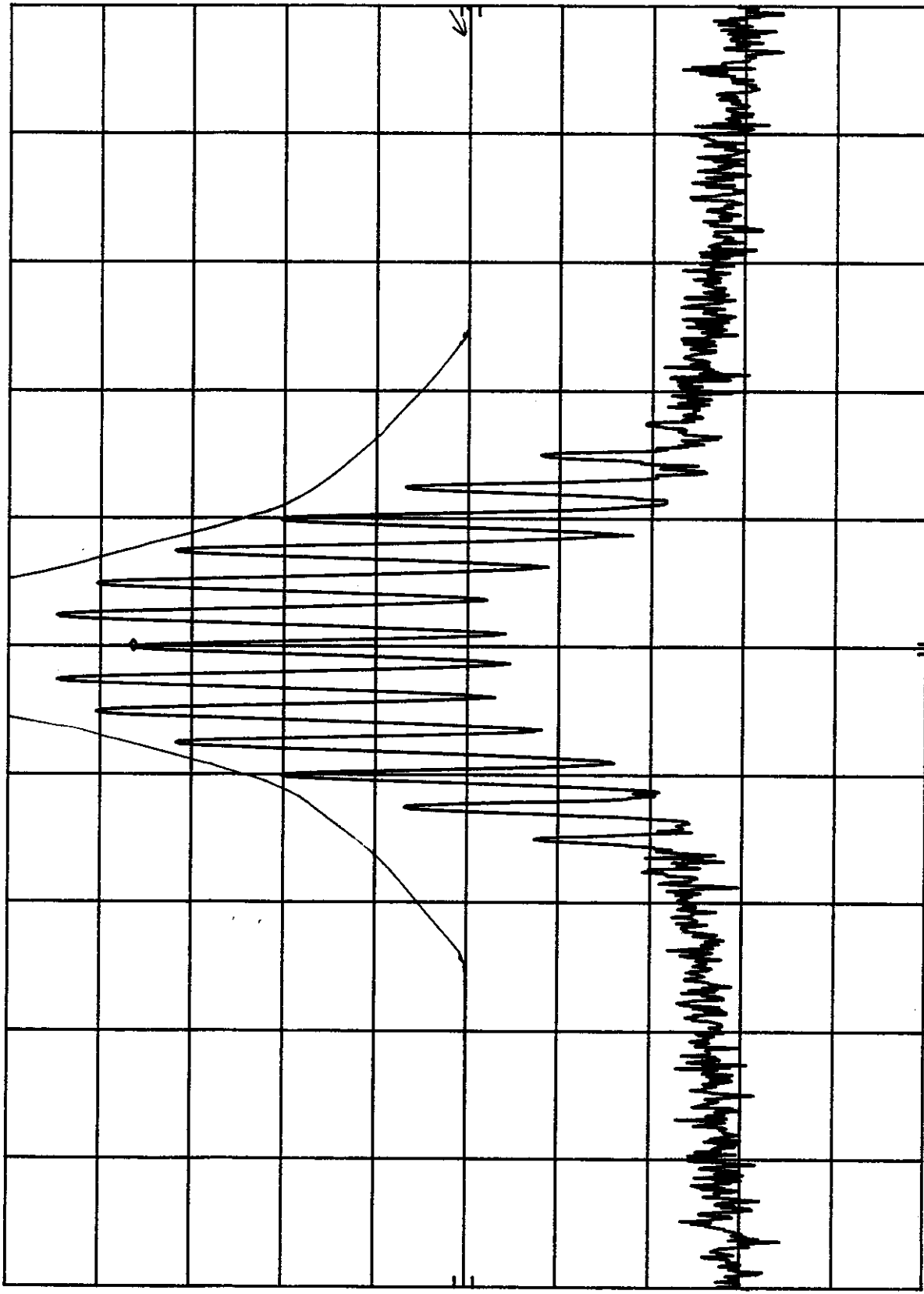


CENTER 865.999 MHz SPAN 100 KHz
 RES BW 300 Hz SWP 3.00 sec
 VBW 1 KHz

PA8-1AA-M OCCUPIED BANDWIDTH PART 90 MKR 805.999 4 MHz
 REF 44.0 dBm ATTEN 10 dB 30.40 dBm

hp

10 dB/
 POS PK
 OFFSET
 60.6
 dB



CENTER 805.999 MHz RES BW 300 Hz SPAN 100 KHz SWP 3.00 sec
 VBW 1 KHz

DRIVER OUTPUT UNMODULATED CARRIER MKR 865.999 3 MHz
 REF 34.7 dBm ATEN 10 dB 34.70 dBm

HP

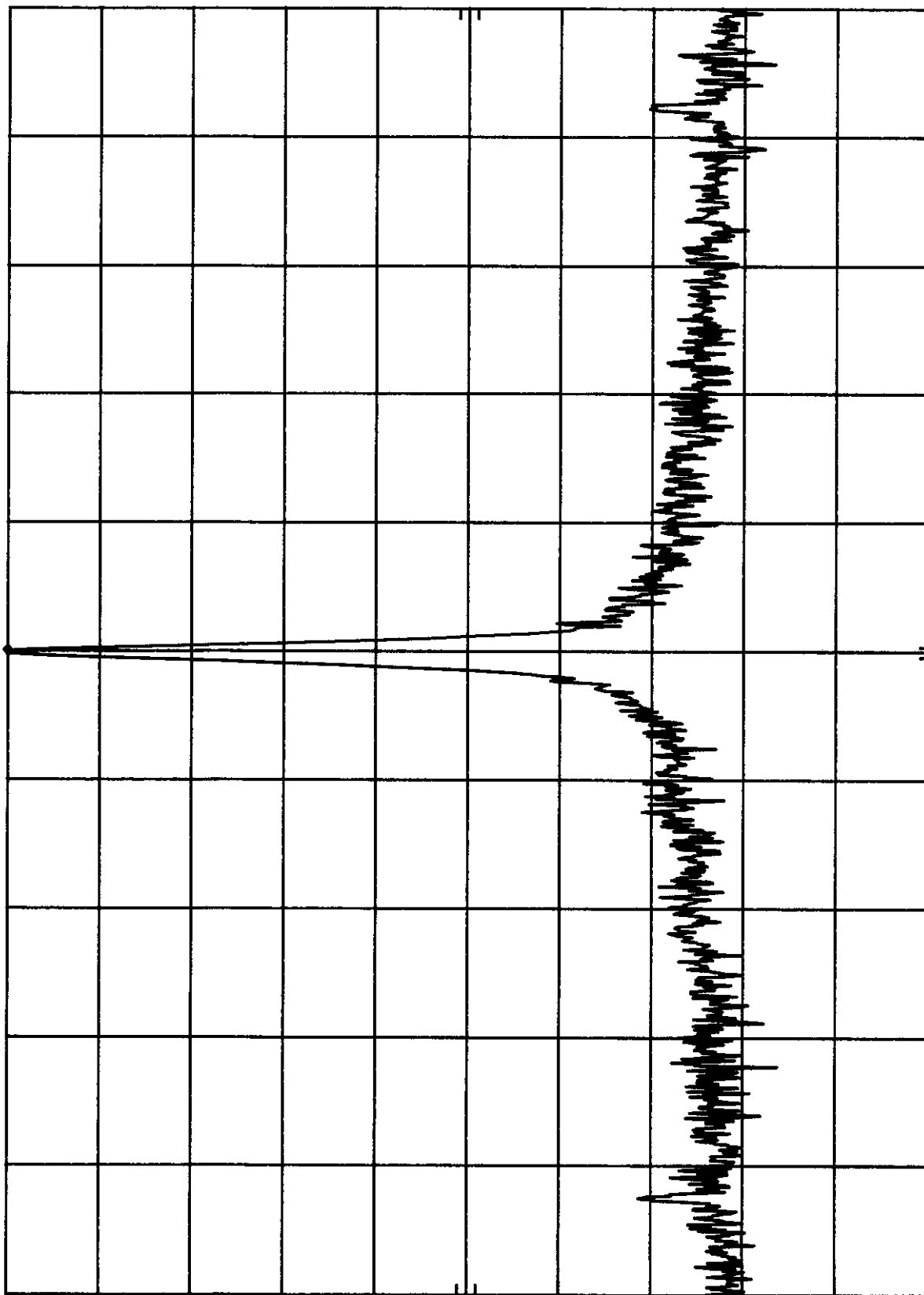
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 865.999 MHz RES BW 300 Hz
 SPAN 100 KHz SWP 3.00 sec

DRIVER OUTPUT UNMODULATED CARRIER MKR 835.999 3 MHz
 REF 34.7 dBm ATTN 10 dB 34.70 dBm

hp

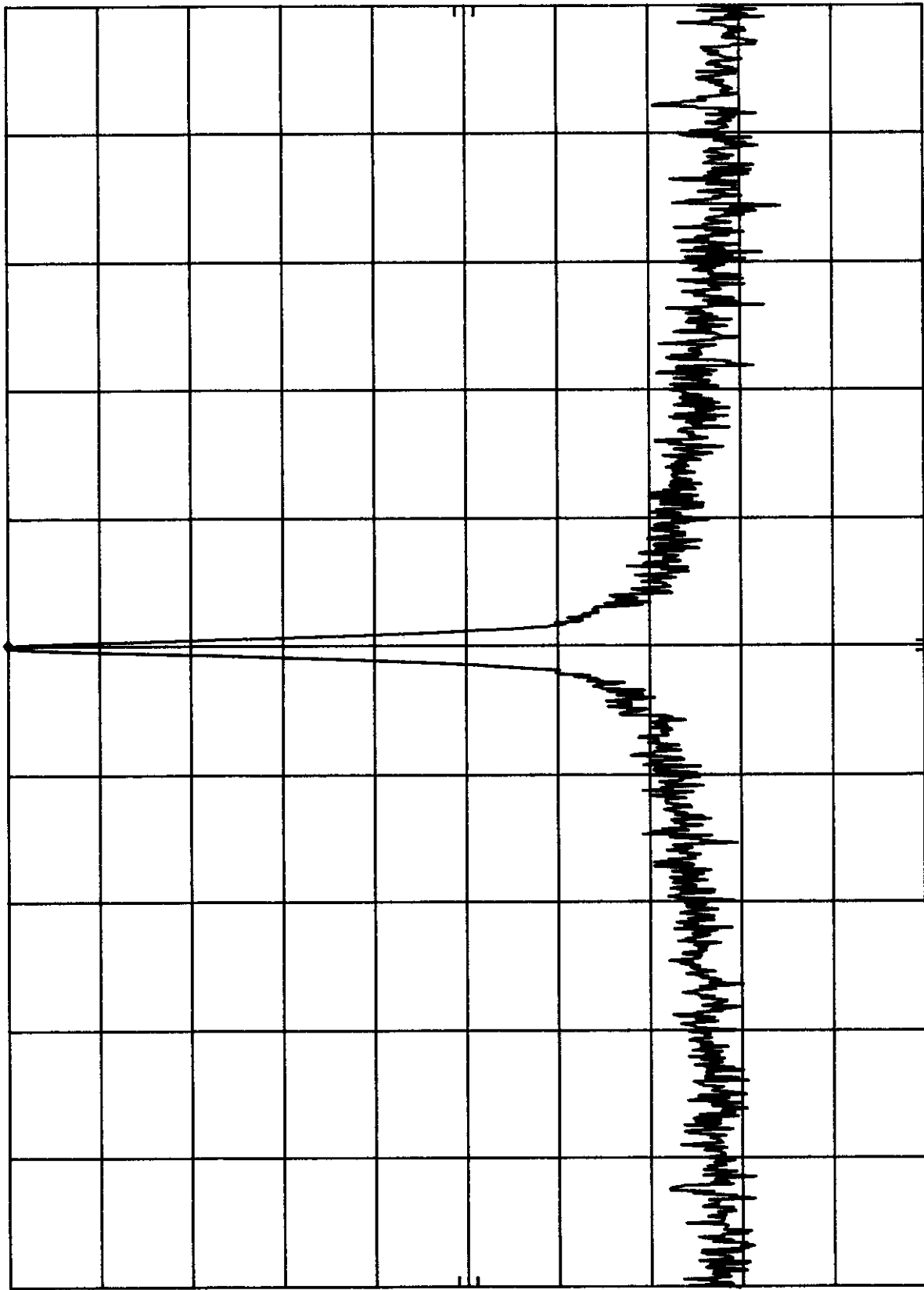
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 835.999 MHz RES BW 300 Hz SPAN 100 KHz
 SWP 3.00 sec VBW 1 KHz

DRIVER OUTPUT UNMODULATED CARRIER MKR 805.999 3 MHz
REF 34.7 dBm ATTEN 10 dB 34.70 dBm

hp

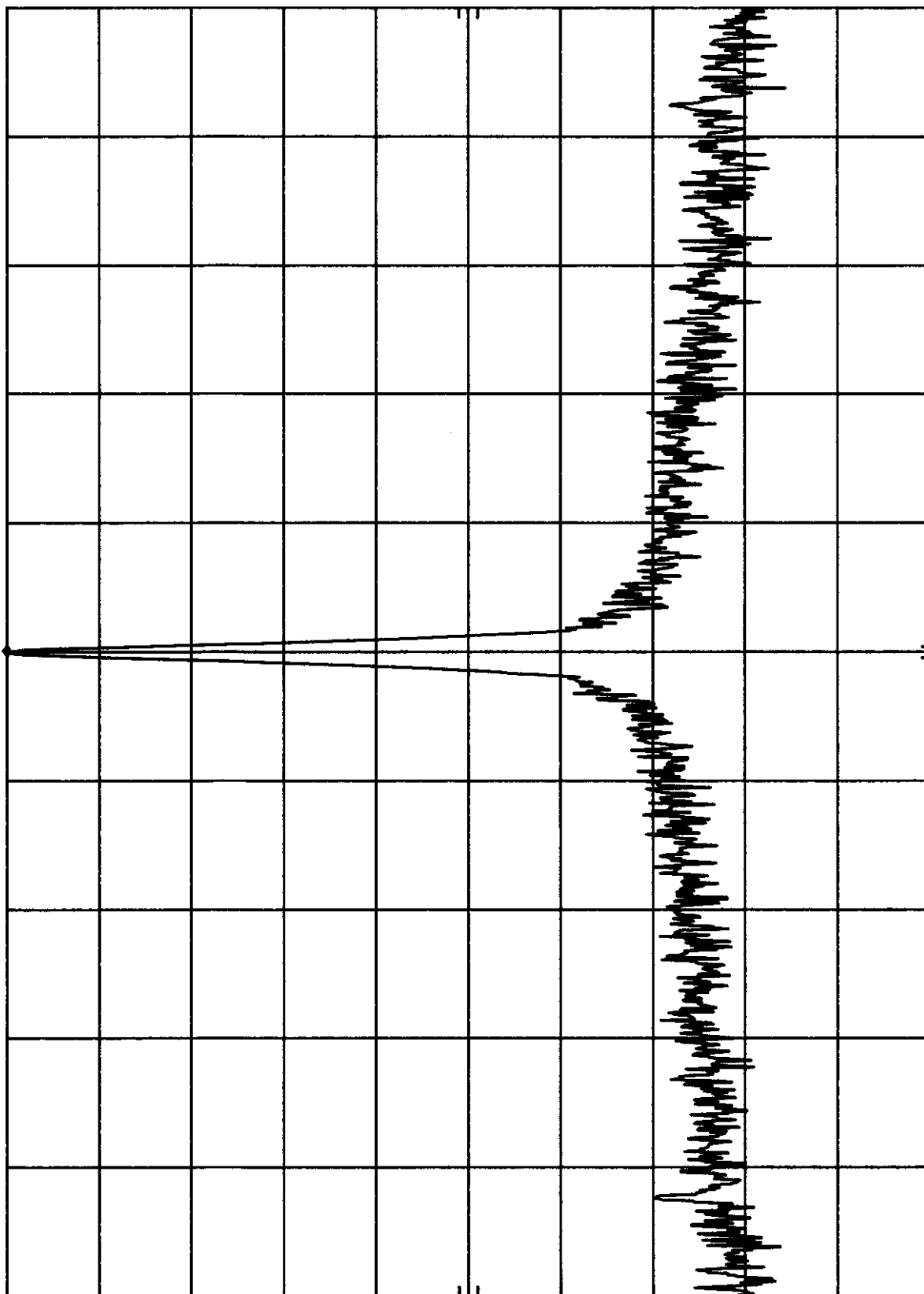
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 805.999 MHz RES BW 300 Hz HZ VBW 1 KHz SWP 3.00 sec SPAN 100 KHz

DRIVER OUTPUT MODULATED CARRIER MKR 865.999 3 MHz
 REF 34.7 dBm ATTN 10 dB 21.60 dBm

h₀

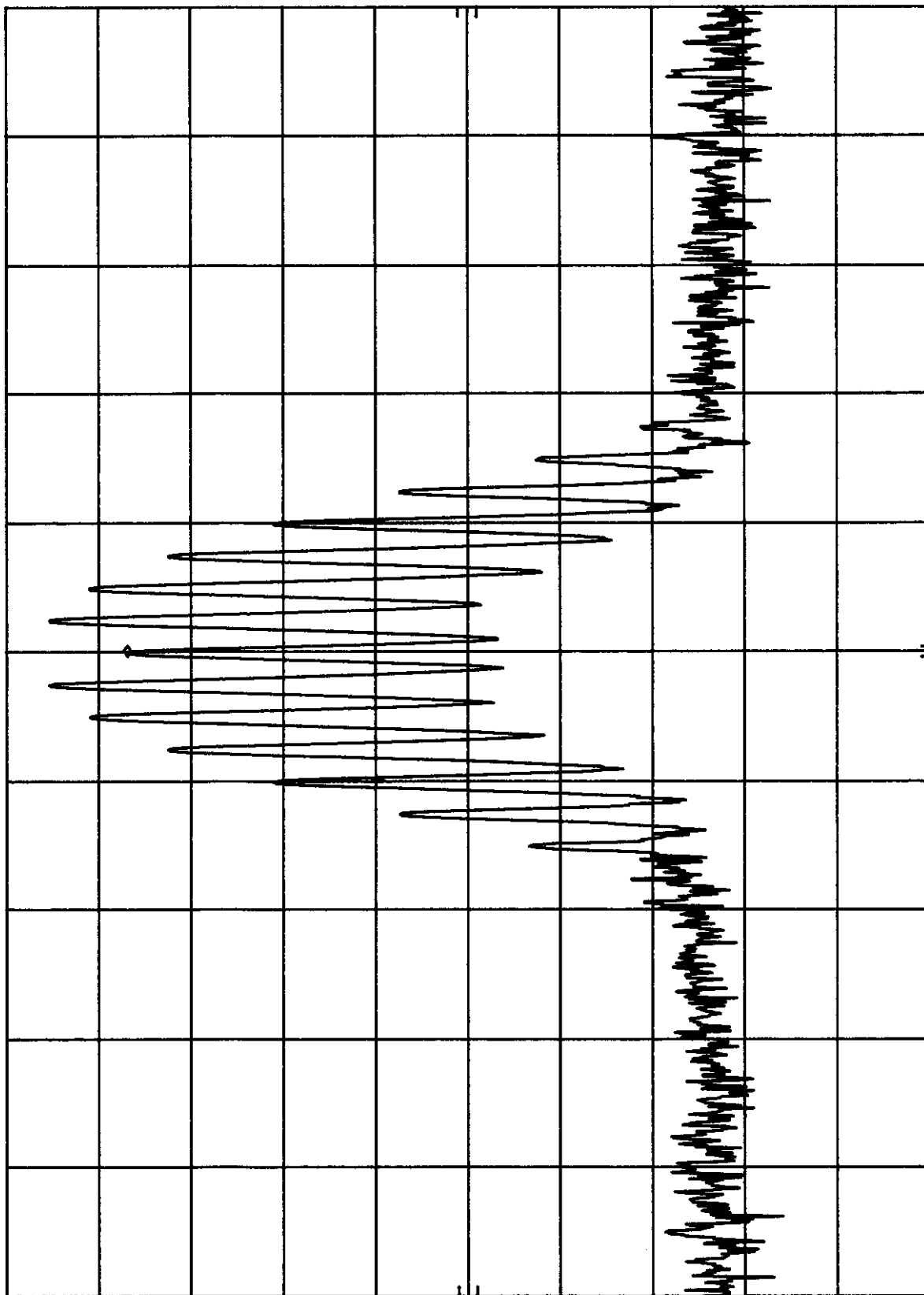
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 865.999 MHz RES BW 300 Hz VBW 1 KHz SPAN 100 KHz SWP 3.00 sec

DRIVER OUTPUT MODULATED CARRIER
REF 34.7 dBm ATTN 10 dB MKR 835.999 3 MHz
21.60 dBm

hp

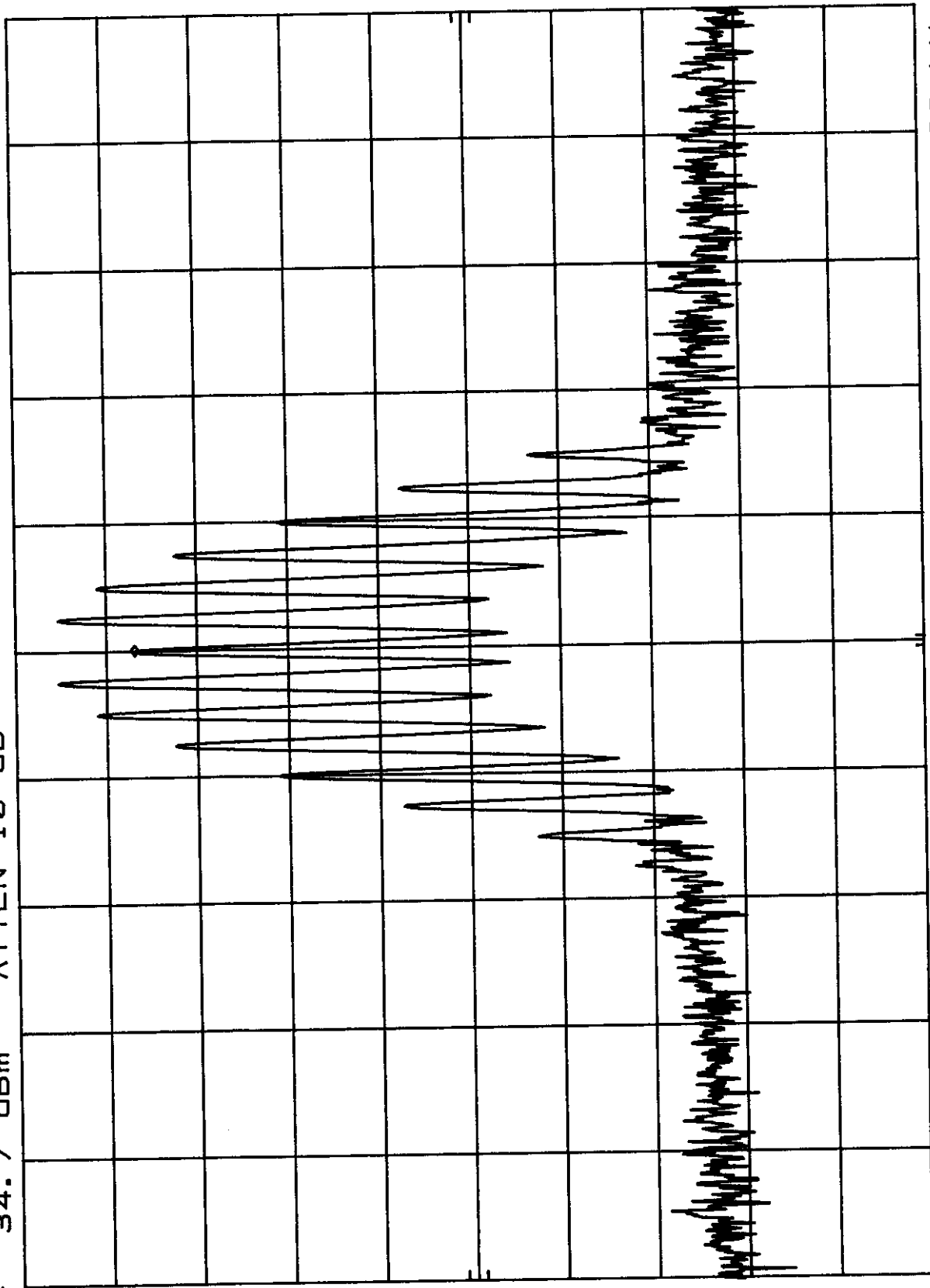
10 dB/

POS PK

OFFSET

60.6

dB



CENTER 835.999 MHz
RES BW 300 Hz
SPAN 100 kHz
SWP 3.00 sec

DRIVER OUTPUT MODULATED CARRIER
REF 34.7 dBm ATTEN 10 dB MKR 805.999 3 MHz
21.70 dBm

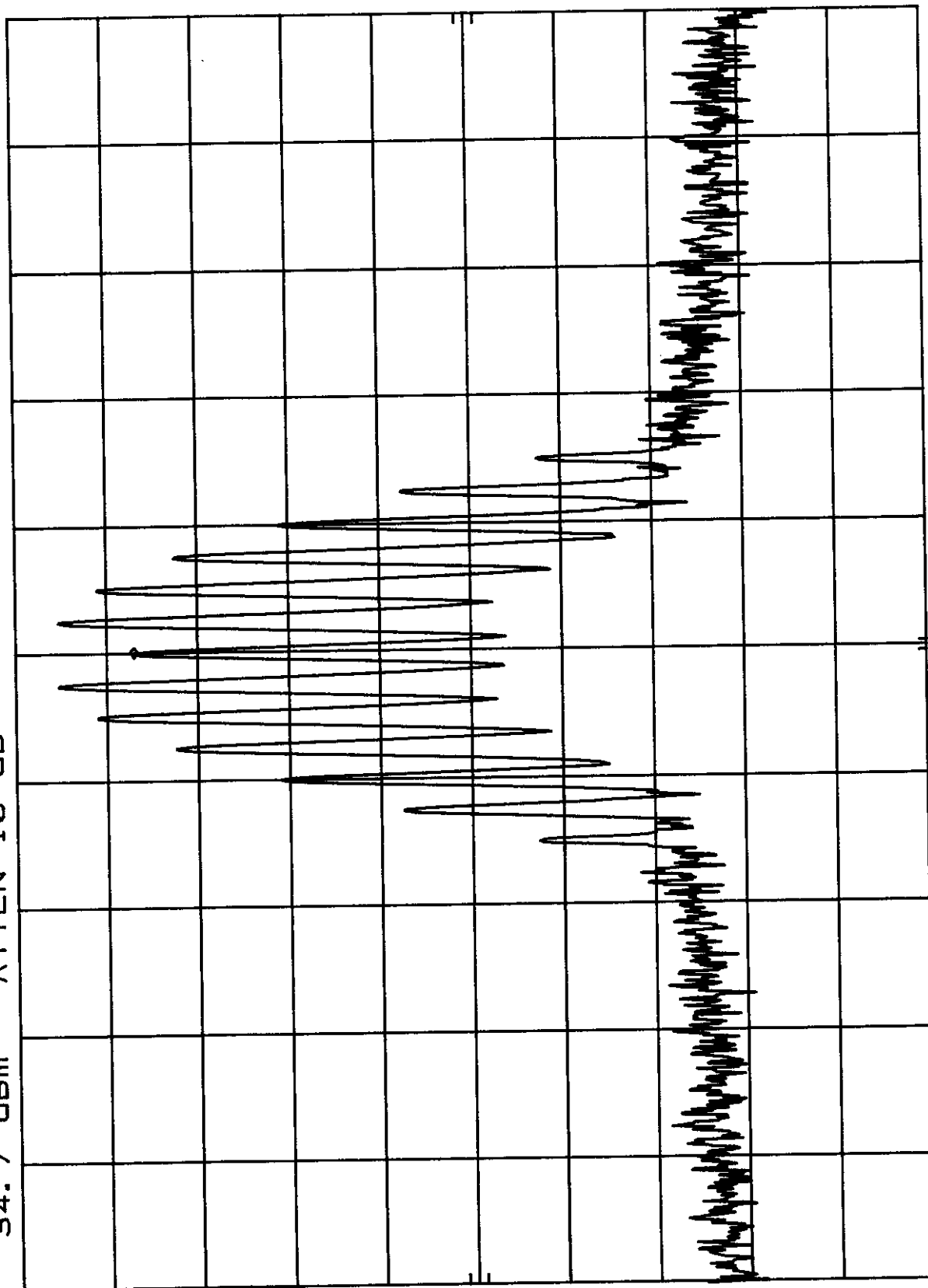
hp

10 dB/

POS PK

OFFSET

60.6
dB



CENTER 805.999 MHz RES BW 300 Hz VBW 1 kHz SPAN 100 kHz SWP 3.00 sec

2.983(e) (4) **Measurement of Antenna Conducted Spurious
Emissions Per 2.991**

Definition: Conducted Spurious Emissions are emissions at the antenna terminals on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communication desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted.

Conducted spurious emissions shall be attenuated below the maximum level of the carrier frequency in accordance with the following formula:

$$\text{Spurious attenuation in dB} = 43 + 10 \log_{10} P_o$$

$$\begin{aligned} \text{Where } P_o &= \text{output in watts} \\ &= 43 + 10 \log_{10} (25) \\ &= 56.9 \text{ dB} \end{aligned}$$

Test Method: Per EIA RS 152-B, Paragraph 4.

Connect the equipment as shown in FIGURE 4.

Adjust the audio oscillator so that the frequency deviation of the transmitter is 5 kHz at a modulation frequency of 2.5 kHz. Adjust the spectrum analyzer to display the modulated carrier.

Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency.

Test Results: See Plots Following Figure 4.

All spurious antenna conducted emissions are below the FCC specifications.

PA8-1AA-M ANTENNA CONDUCTED SPURIOUS MKR Δ 1.610 GHz
 REF 44.1 dBm ATTEN 10 dB -60.70 dB

HP

10 dB/

POS PK

OFFSET

50.0

dB

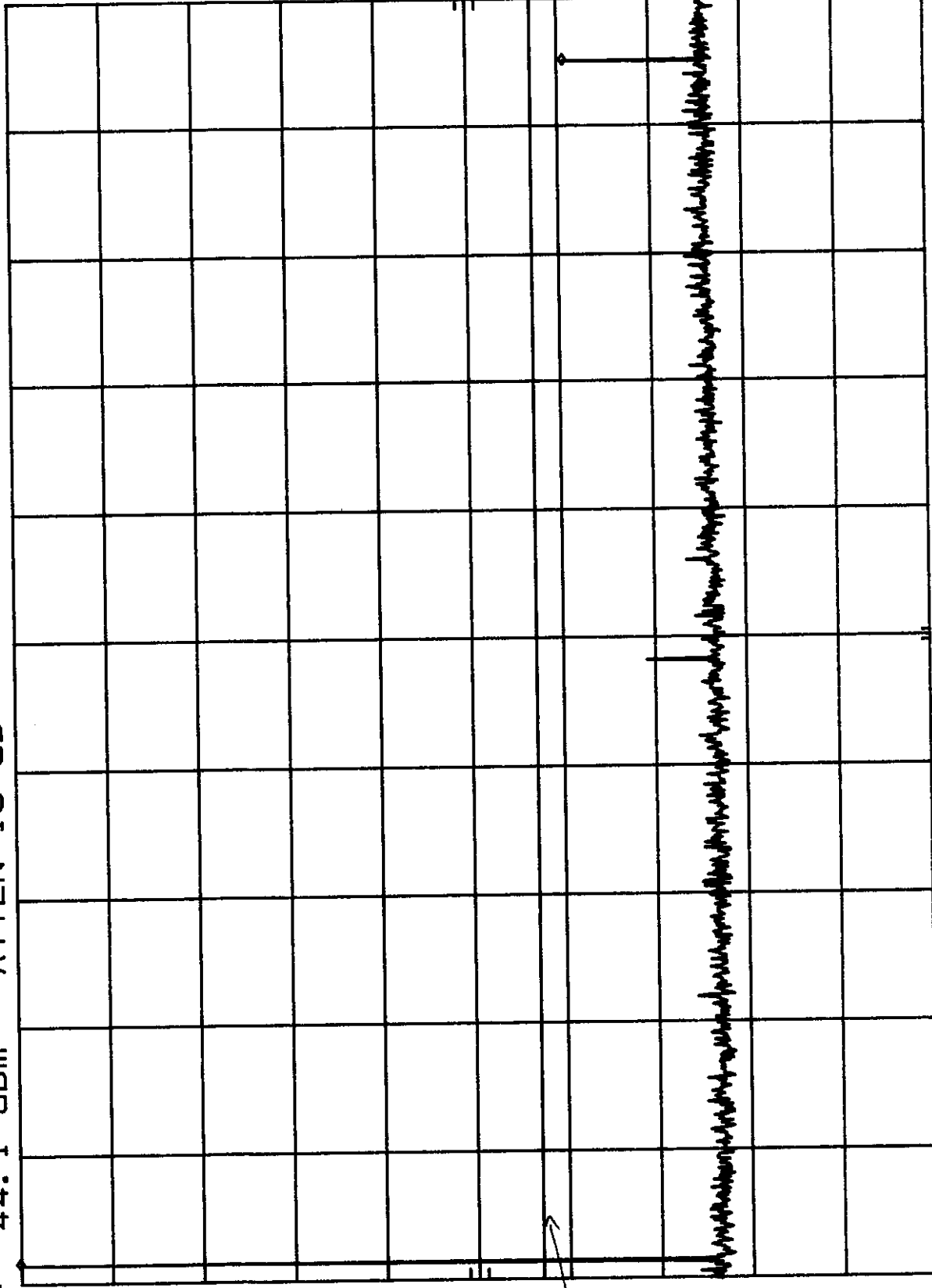
DL

-13.0

dBm

F_{cc} limit

57 dBc



START 780 MHz

RES BW 30 kHz

VBW 100 kHz

STOP 2.50 GHz

SWP 5.16 sec

PAB-1AA-M ANTENNA CONDUCTED SPURIOUS

REF 44.0 dBm ATTEN 10 dB

hp

10 dB/

POS PK

OFFSET

50.0

dB

DL

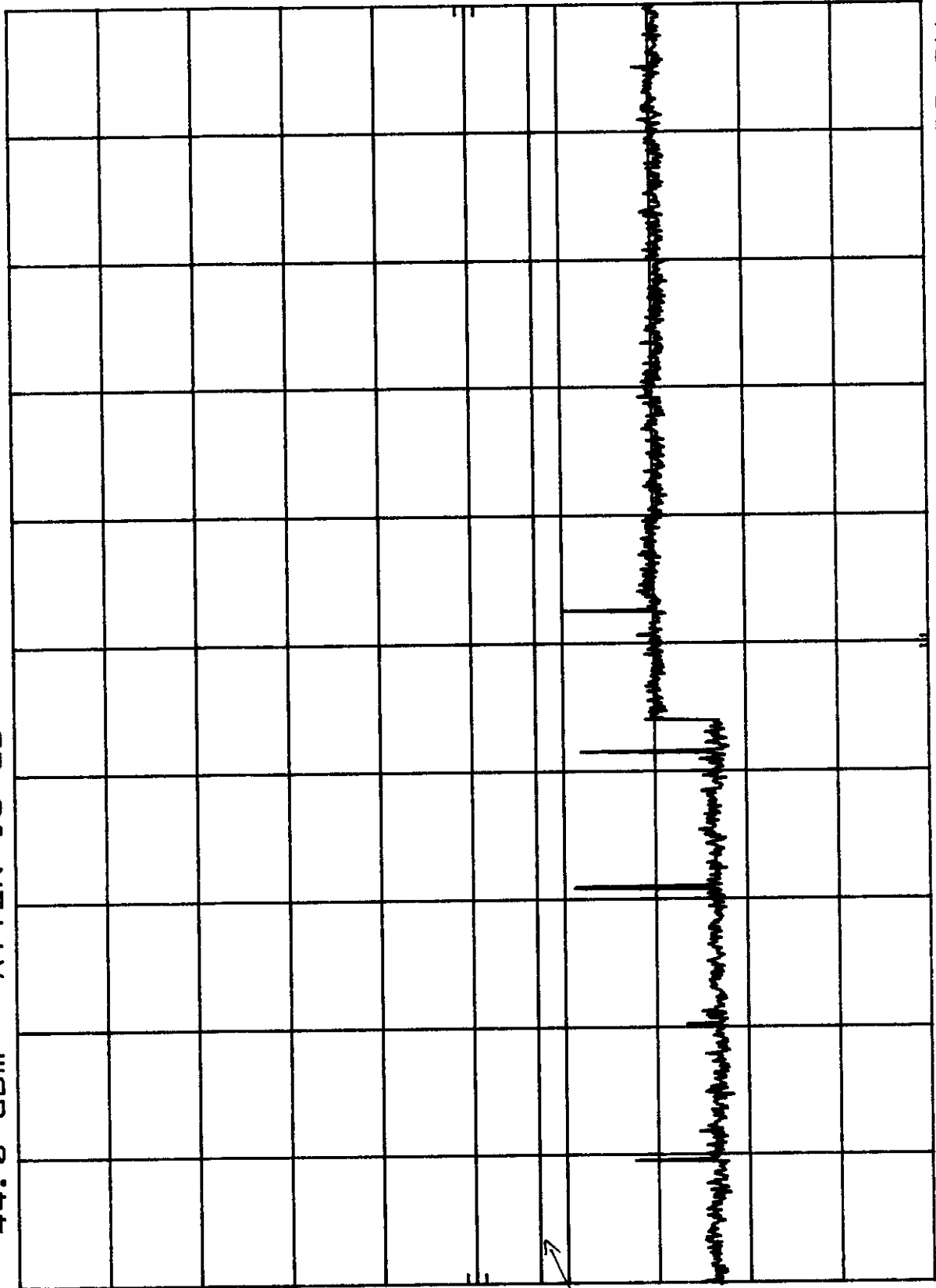
-13.0

dBm

26

FCC LIMIT

57 dBc



START 2.50 GHz STOP 10.00 GHz

RES BW 30 kHz SWP 22.5 sec

VBW 100 kHz

PA8-1AA-M ANTENNA CONDUCTED SPURIOUS
REF 44.0 dBm ATTEN 10 dB

MKR Δ 835 MHz
-67.10 dB

hp

10 dB/

POS PK

OFFSET

50.0
dB

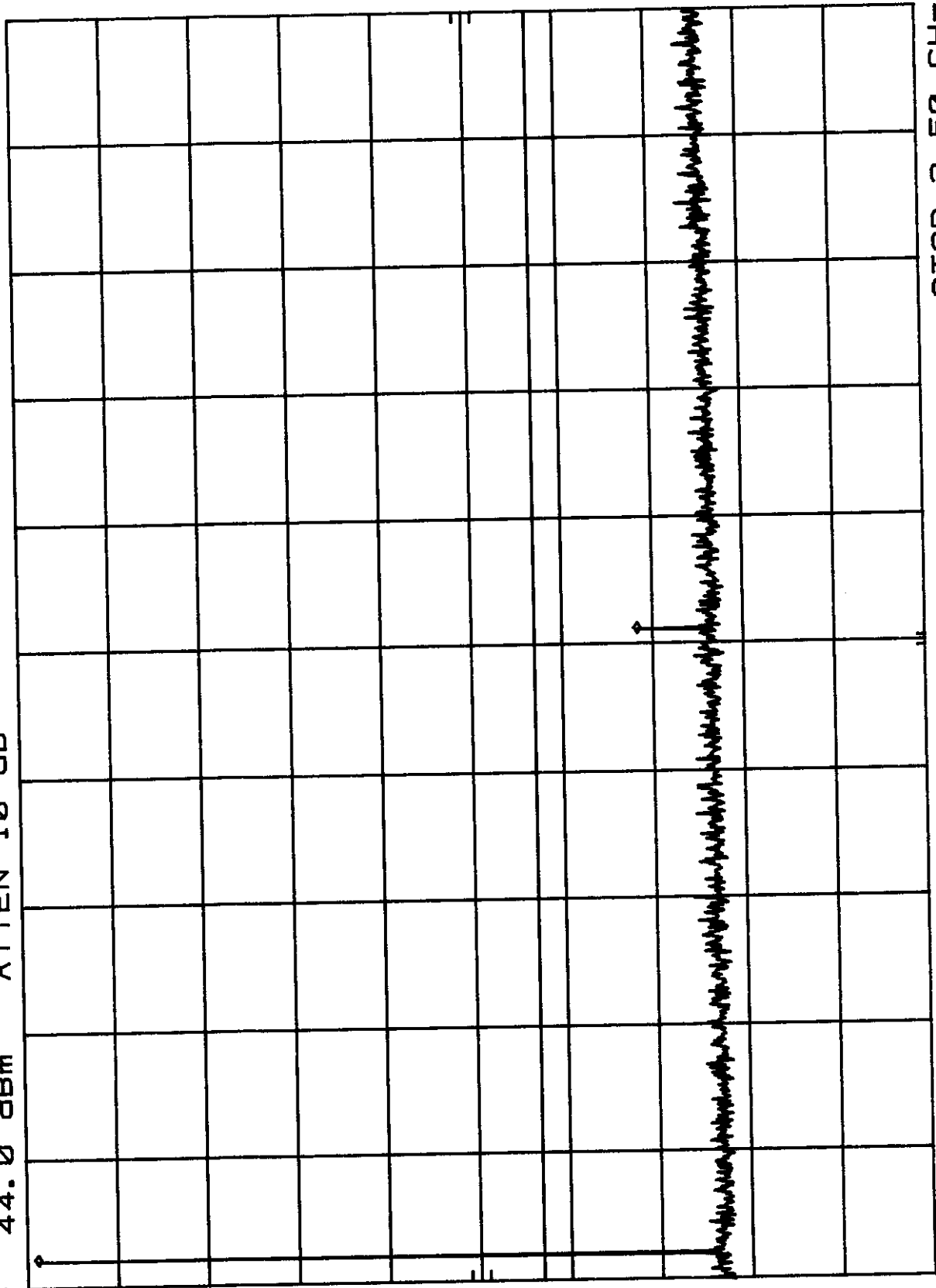
DL

-13.0
dBm

27

FCC limit

57dBc



START 800 MHz

RES BW 30 kHz

VBW 100 kHz

STOP 2.50 GHz
SWP 5.10 sec

PA8-1AA-M ANTENNA CONDUCTED SPURIOUS
MKR 3.340 GHz
-18.80 dBm

HP

10 dB/

POS PK

OFFSET

50.0

dB

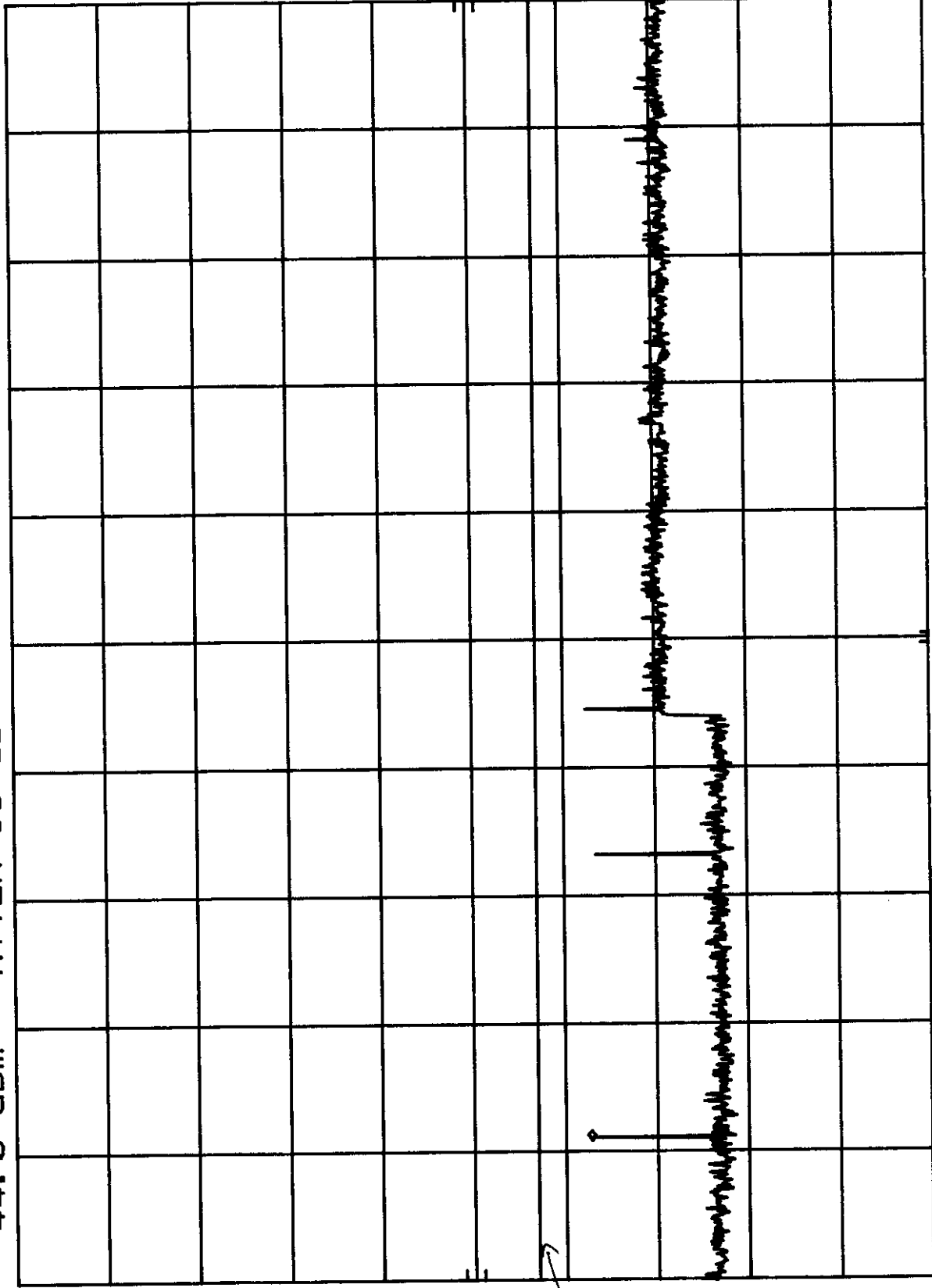
DL

-13.0

dBm

2nd FCC UNIT

57 dBc



START 2.50 GHz

RES BW 30 KHz

VBW 100 KHz

STOP 10.00 GHz

SWP 22.5 sec

PAB-1AA-M ANTENNA CONDUCTED SPURIOUS
MKR 3.340 GHz
-33.90 dBm

REF 44.0 dBm ATTEN 10 dB

hp

10 dB/

POS PK

OFFSET

50.0

dB

DL

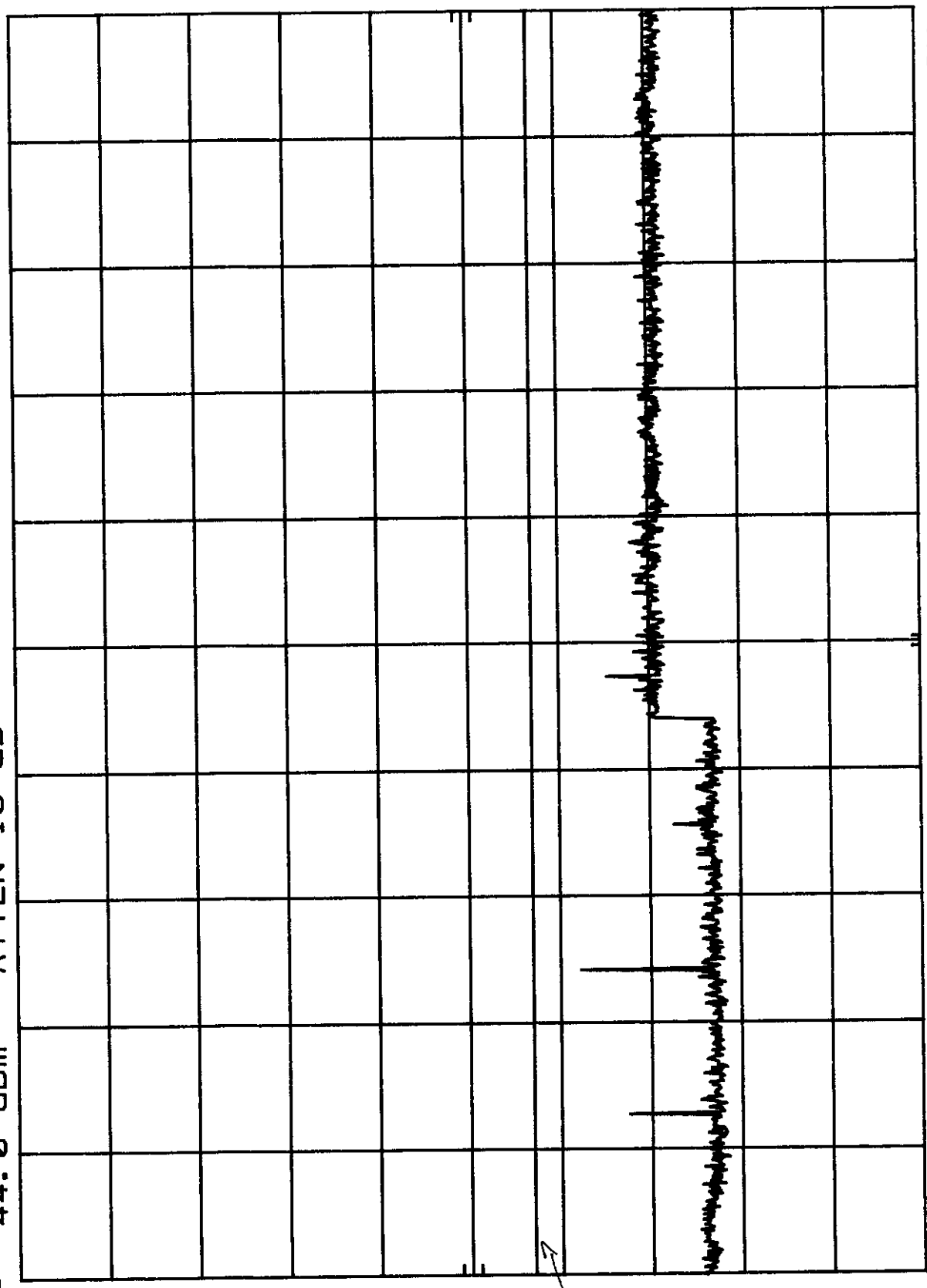
-13.0

dBm

29

FCC UNIT

57 dBc



START 2.50 GHz
RES BW 30 KHz

STOP 10.00 GHz
SWP 22.5 sec

VBW 100 KHz

PA8-1AA-M ANTENNA CONDUCTED SPURIOUS

MKR 865 MHz
41.60 dBm

REF 44.0 dBm ATTN 10 dB

HP

10 dB/

POS PK

OFFSET

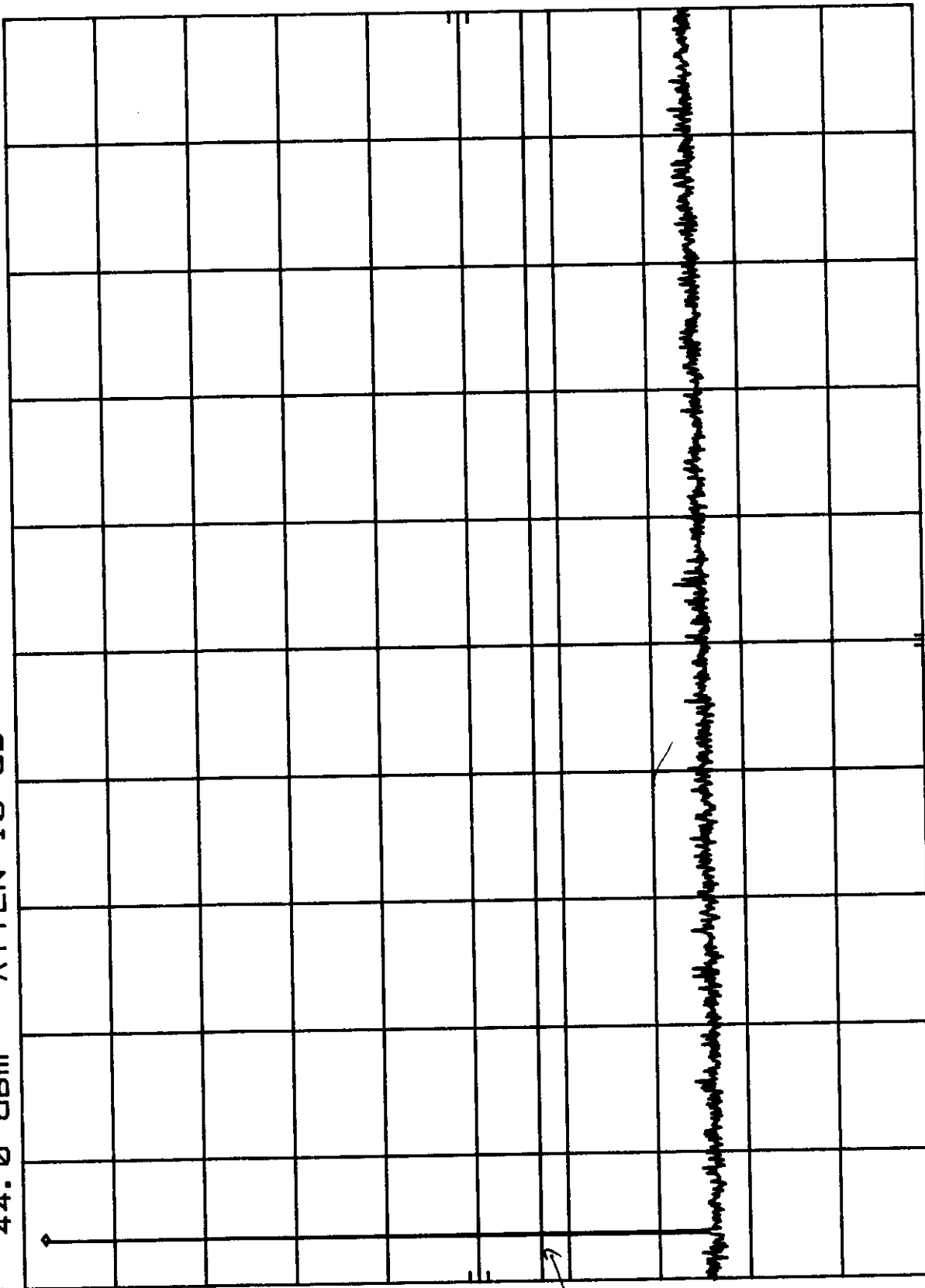
50.0
dB

DL

-13.0
dBm

30 Foc Limit

57 dBc



START 800 MHz

RES BW 30 kHz

VBW 100 kHz

STOP 2.50 GHz

SWP 5.10 sec