

**Application for Certification
For an RF Power Amplifier**

**Paradigm Wireless Communications
1672 McGaw Ave.
Irvine, CA 92614**

RF Power Amplifier:

Part # MS800-200

FCC ID: ___ MS800-200

REPORT # RC054737/00045

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.981 through 2.1005, Part 22, Part 90 and other applicable sections of the rules as indicated herein.

Prepared By:

Jake Tynes

**DNB Engineering, Inc.
3535 W. Commonwealth Ave.
Fullerton, CA 92833**

03 AUGUST 1999

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1.0 ADMINISTRATIVE DATA

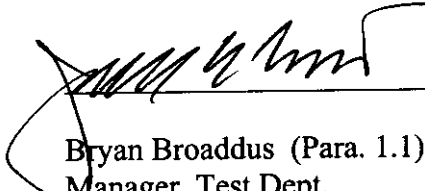
1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.981 through 2.1005, Part 22, and Part 90. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.

All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

 for B BROADDUS

Bryan Broaddus (Para. 1.1)
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DNB Engineering, Inc.
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2.983(a) Request for Type Acceptance

Name of Applicant: Paradigm Wireless Communications
1672 McGaw Ave.
Irvine, CA 92614

Applicant is: X Manufacturer
 Vendor
 Licensee
 Prospective Licensee
 Other

Name of Manufacturer: Paradigm Wireless Communications

2.983(b) Equipment Description

The EUT is an RF Power Amplifier

Part Number: MS800-200

FCC ID: ___ MS800-200

2.983(c) Anticipated Production Quantity

 One Unit
X Multiple Units

2.983(d) Technical Description

The EUT (Equipment Under Test) is a rack of four power amplifiers that can be operated individually (at 60 watts) or can be combined to yield 200 watts of power. Data has been included for both conditions with three types of modulation, i.e. CDMA, TDMA, and CW. In some cases only the "worst case data" is shown. See the Service Manual Included in Appendix B herein for the additional information.

2.983(d)(1) Type(s) of Emissions

N/A

2.983(d)(2) Frequency Range

869.040 MHz to 879.990 MHz

2.983(d)(3) Operating Power Level

60 Watts (1 Amp)
200 Watts (4 Amps)

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:

POWER OUTPUT

FREQUENCY	NOMINAL VOLTAGE 27 VDC	85% VOLTAGE 22.95 VDC	115% VOLTAGE 31.05 VDC
869 MHz	200 Watts	200 Watts	200 Watts
879 MHz	200 Watts	200 Watts	200 Watts

2.983(d)(7) Circuit Diagram

Refer to Figure in Appendix B.

2.983(d)(8) Instruction Book(s)

Refer to Appendix B.

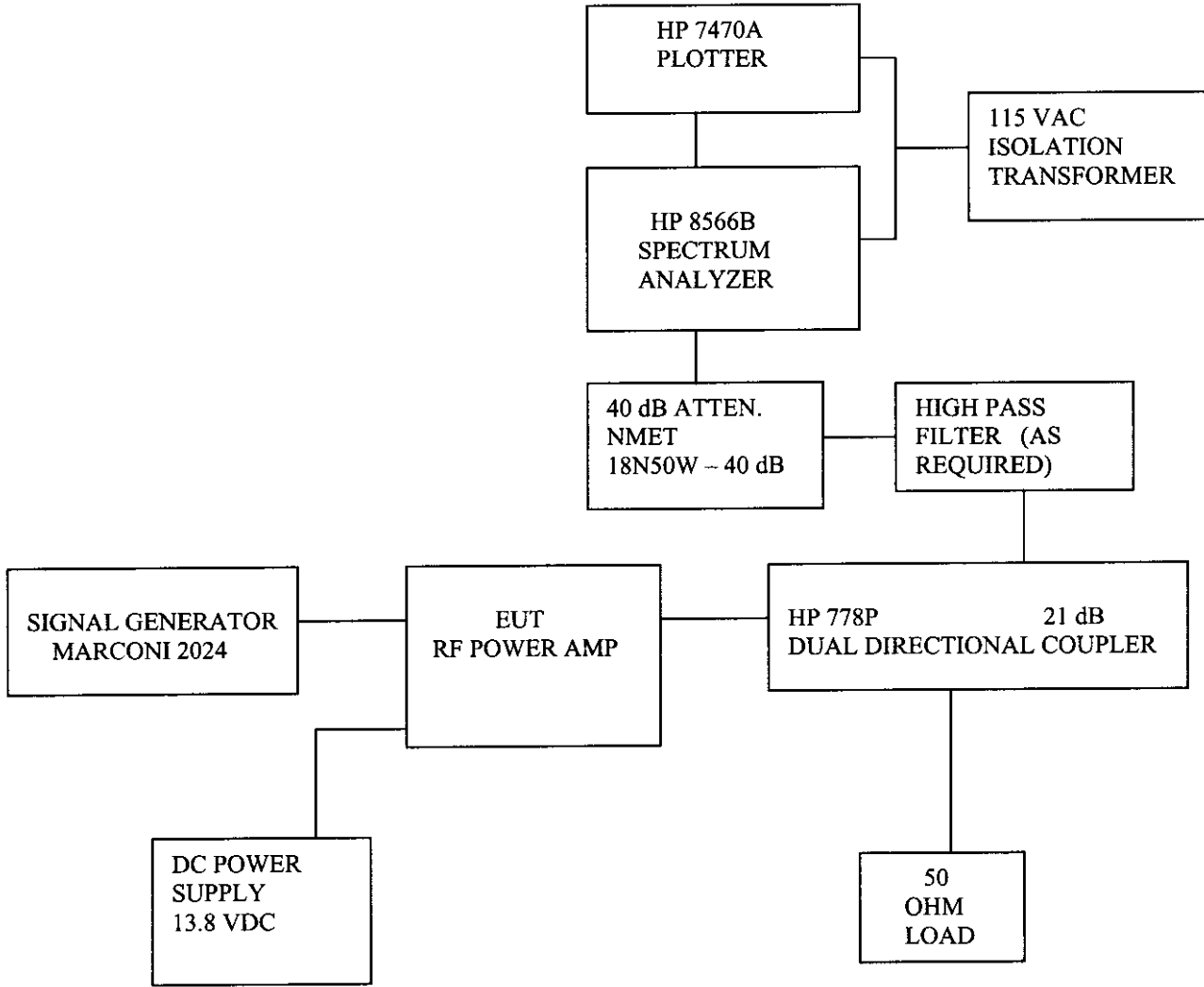
2.983(d)(9) Tune-Up Procedure

Refer to Appendix B.

FIGURE 1: Circuit Diagram 2.983(d) (7)

SEE FIGURE IN APPENDIX B.

**FIGURE 2: Block Diagram
(Power Input/Output tests)**



2.983(d)(4) Maximum Power Allowed in Applicable Part(s) of the Rules

RULES PART	MAXIMUM POWER (WATTS)
Part 22.757	500 Watts
Part 90.35	500 Watts

2.983(d)(5) Final RF Amplifier Input Power

See Appendix B

2.983(d)(6) Function of all Active Circuit Devices

Please Refer to Appendix B.

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 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.

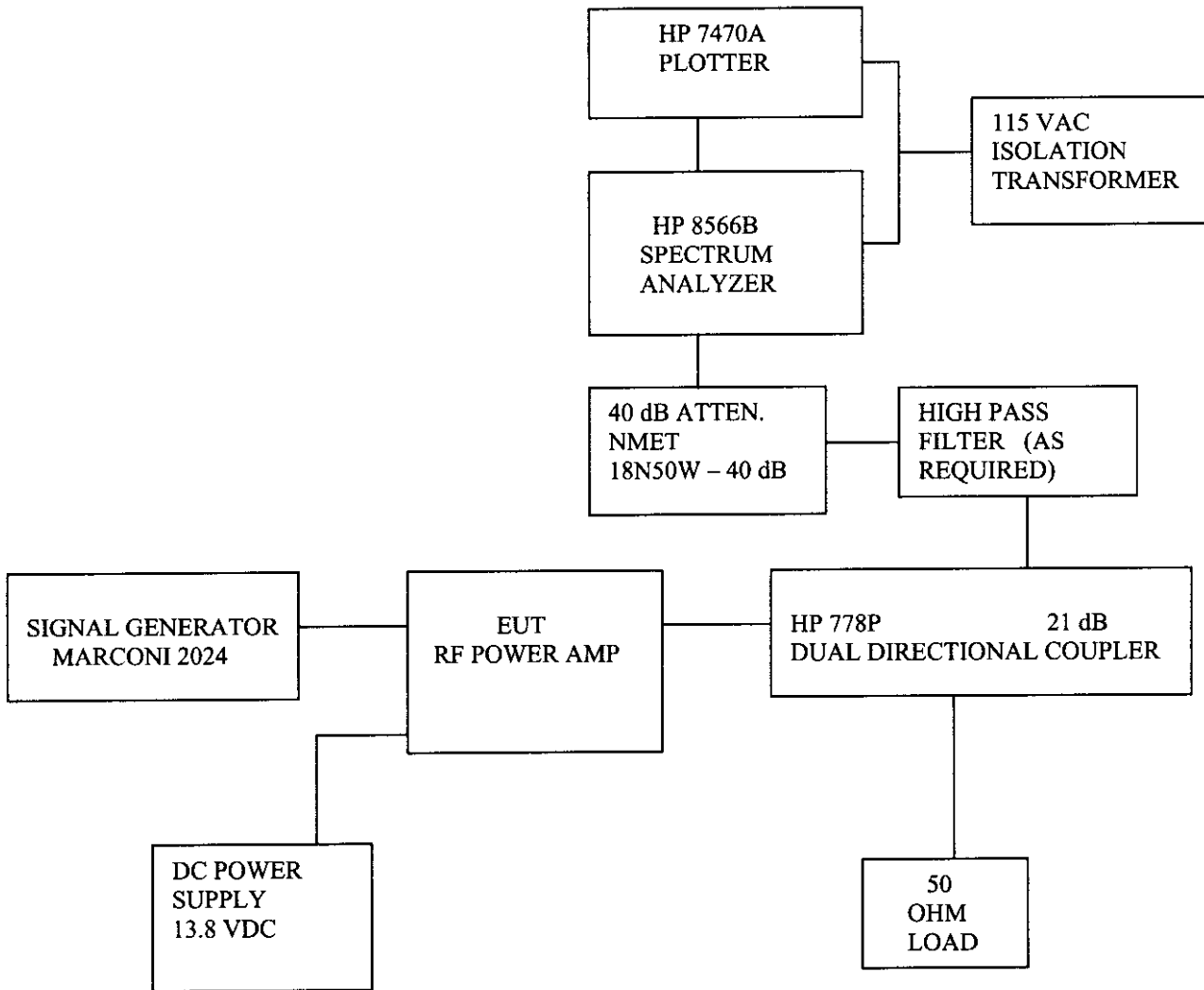
Test Results: See Plots following FIGURE 3.

The center frequency of the signal did not shift with modulation. The Spectrum Bandwidth was well within the limits specified in the FCC Regulations.

Notes:

This amplifier is part of a "feed forward system". As such, it has the ability to transmit multiple carriers within the 869.040 MHz to 879.990 MHz band. Therefore the emissions shall be contained within this band as stated in Part 22.901(d)(2). Plots have been provided that show the lowest and highest usable frequencies with CDMA, TDMA, and CW modulation.

**FIGURE 3: Block Diagram
(Occupied Bandwidth tests)**



1 Amplifier 50 watts CDMA Modulation (Band Edge)

RC054737/00045

LPA850(1) EMISSION CF=876.5 MKR 876.50 MHz
REF 47.0 dBm ATTEN 10 dB 39.70 dBm

hp

10 dB/

POS PK

OFFSET

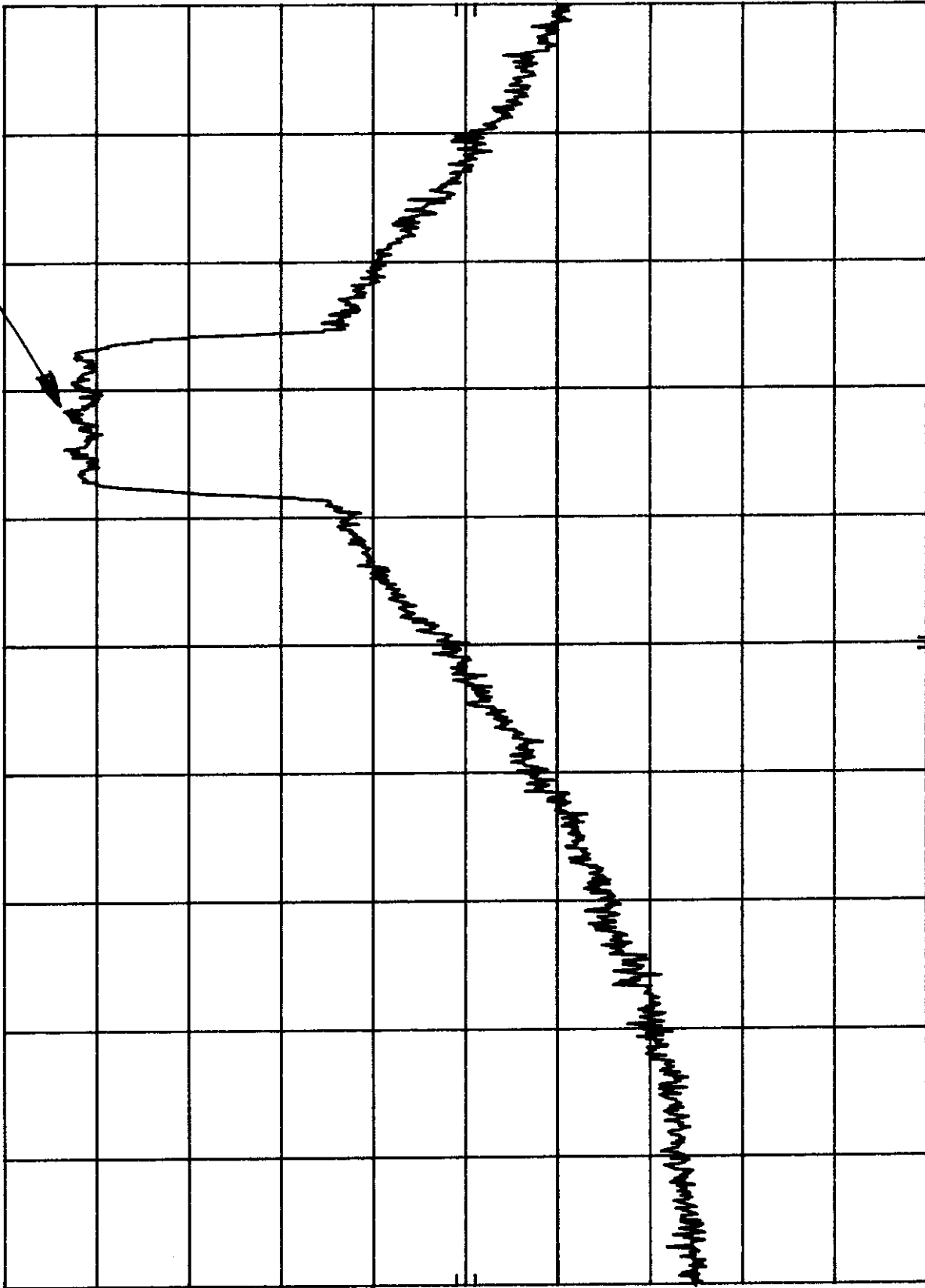
47.0 dB

DL -13.0 dBm

43+10log P0

Fcc LIMIT 60 dBc

Occupied Bandwidth



START 869.0 MHz

RES BW 30 KHZ

VBW 100 KHZ

STOP 879.9 MHz

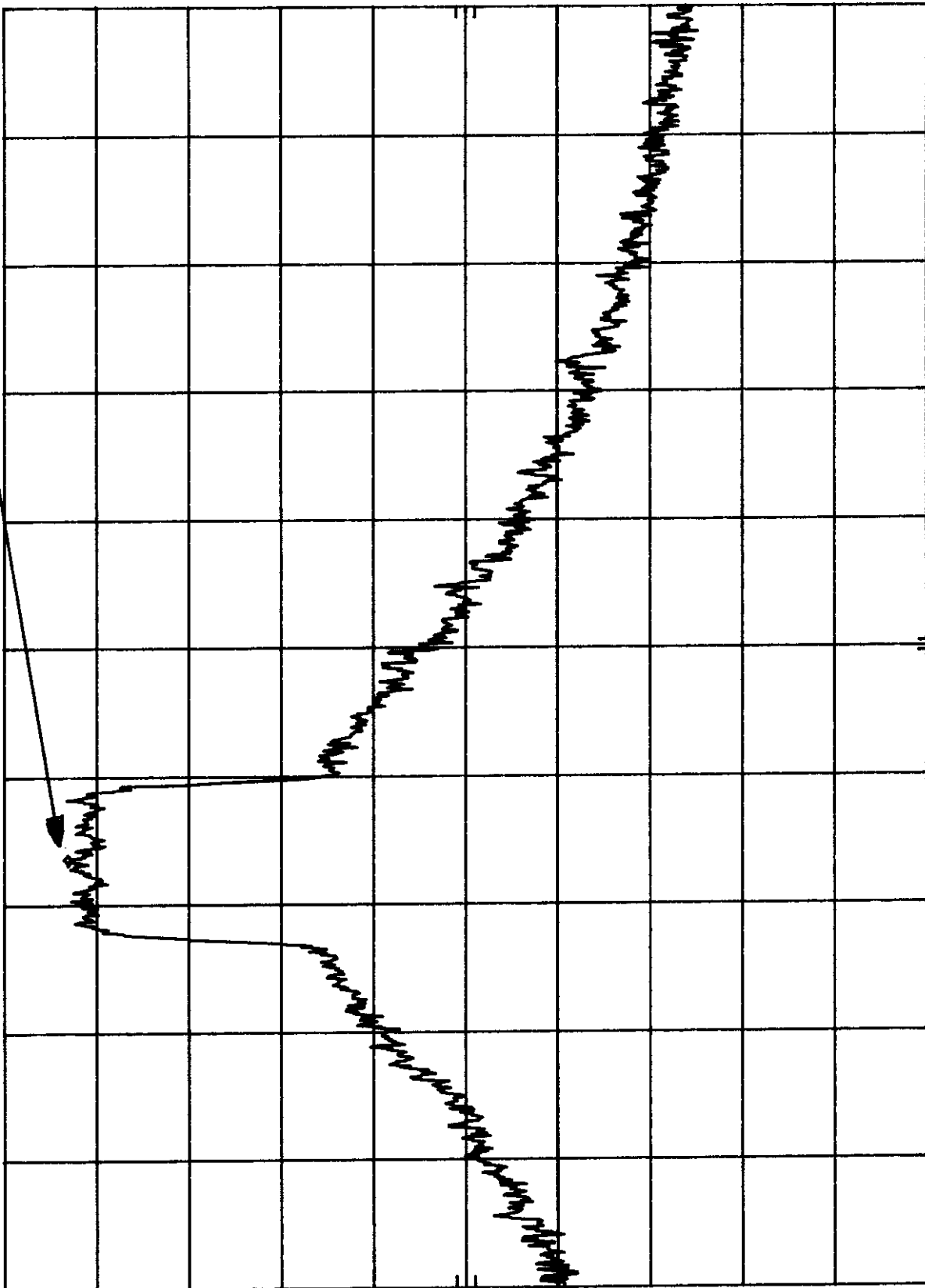
SWP 32.9 msec

Band edge Measurement

1 Amp, 50 watts CDMA

LPA850(1) EMISSION CF=872.7 MKR 872.70 MHz
REF 47.0 dBm ATTEN 10 dB 40.10 dBm

70



10 dB/

POS PK

OFFSET

47.0 dB

DL -13.0 dBm

431 dB/100 PO

FCC LIMIT 60 dBc

Occupied Bandwidth

START 869.0 MHz RES BW 30 KHZ
STOP 879.9 MHz SWP 32.9 msec
VBW 100 KHZ

1 Amplifier 50 Watts TDMA Band Edge Measurement

LPA850(1) EMISSION CF=869.200MHz TDMA MKR 869.206 MHz
REF 47.0 dBm ATTEN 10 dB 47.20 dBm

h₀

10 dB/

POS PK

OFFSET

47.0

dB

DL

-13.0

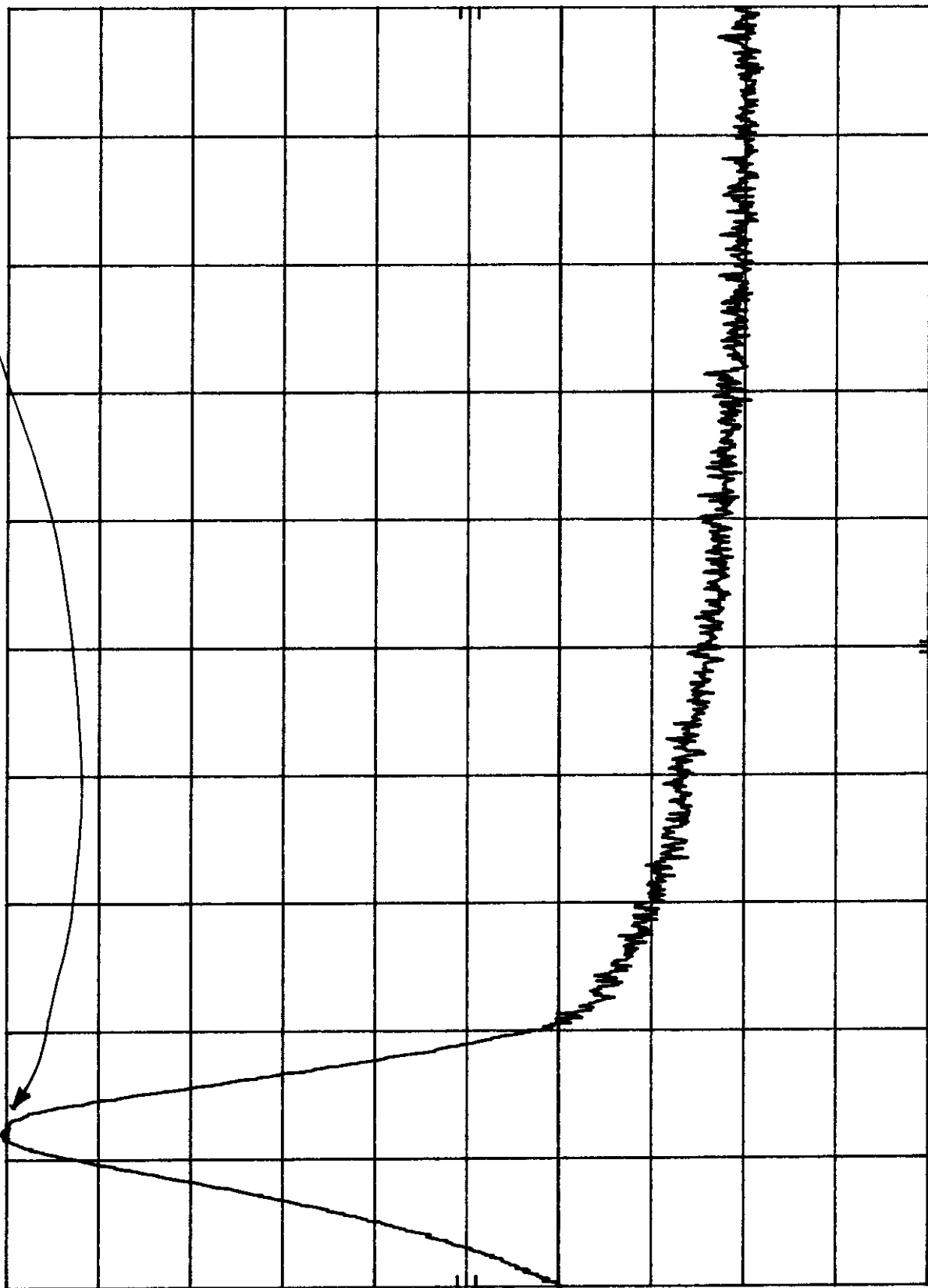
dBm

43 dBc =

Fcc limit

60 dBc

Occupied Bandwidth



START 869.04 MHz

RES BW 30 KHz

VBW 100 KHz

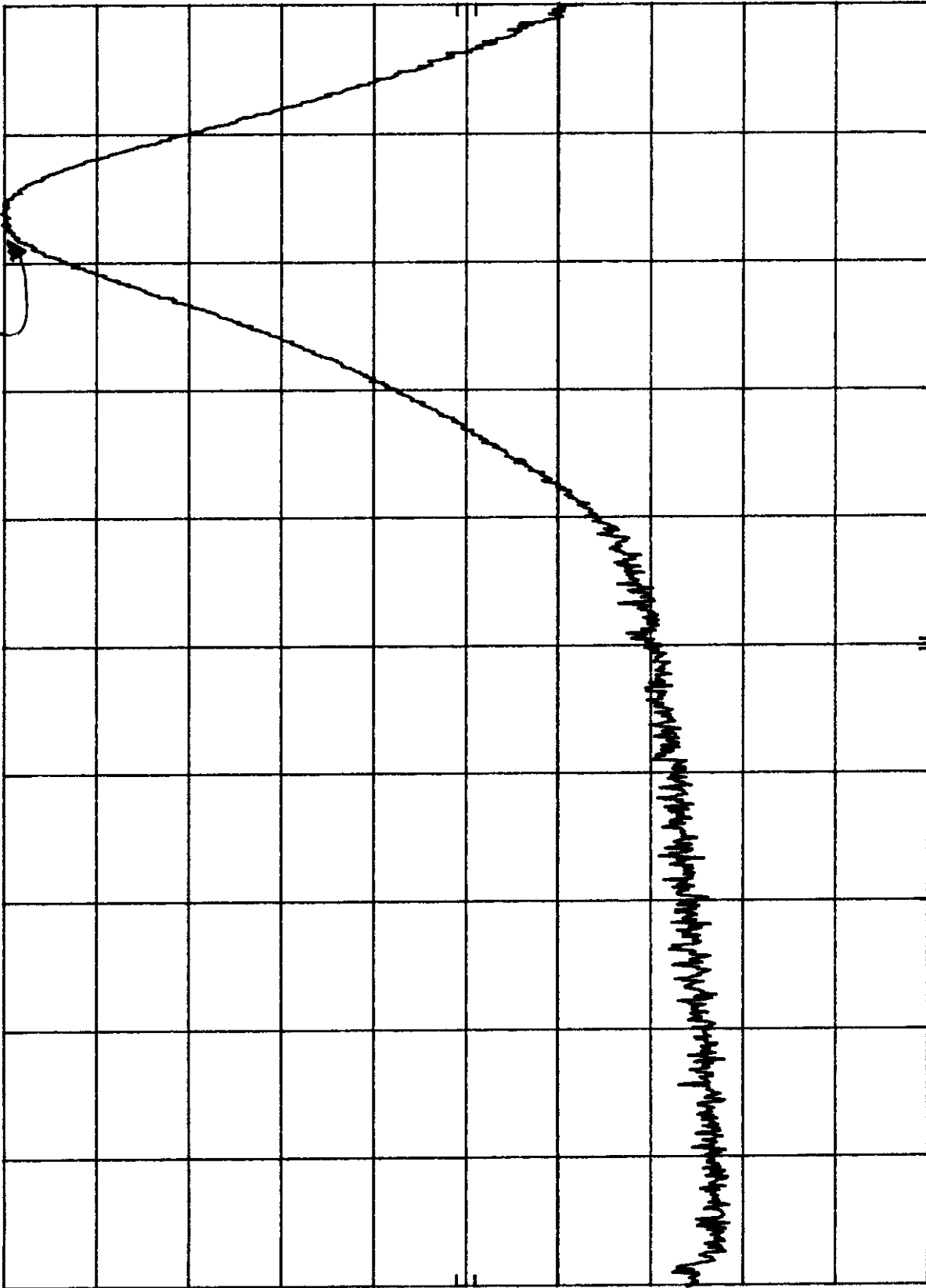
STOP 870.43 MHz

SWP 20.0 msec

1 Amplifier 50 Watts TDMA Band Edge Measurements

RC054737/00045

LPA850(1) EMISSION CF=879.860MHz TDMA MKR 879.860 0 MHz
REF 47.0 dBm ATTEN 10 dB 46.80 dBm



HP 10 dB/
POS PK
OFFSET 47.0 dB
DL -13.0 dBm

4310 dBm PO =

FCC LIMIT 60 dBc

Occupied Bandwidth

START 879.230 MHz RES BW 30 KHZ
STOP 879.990 MHz SWP 20.0 msec
VBW 100 KHZ

4 Amplifiers 200watts Band Edge Measurements TDMA

LPA850 (4) EMISSION CF 879.800MHz TDMA MKR 879.800 0 MHz
REF 53.0 DBm ATTEN 10 DB 53.40 DBm

10 DB/

POS PK

OFFSET 53.0 DB

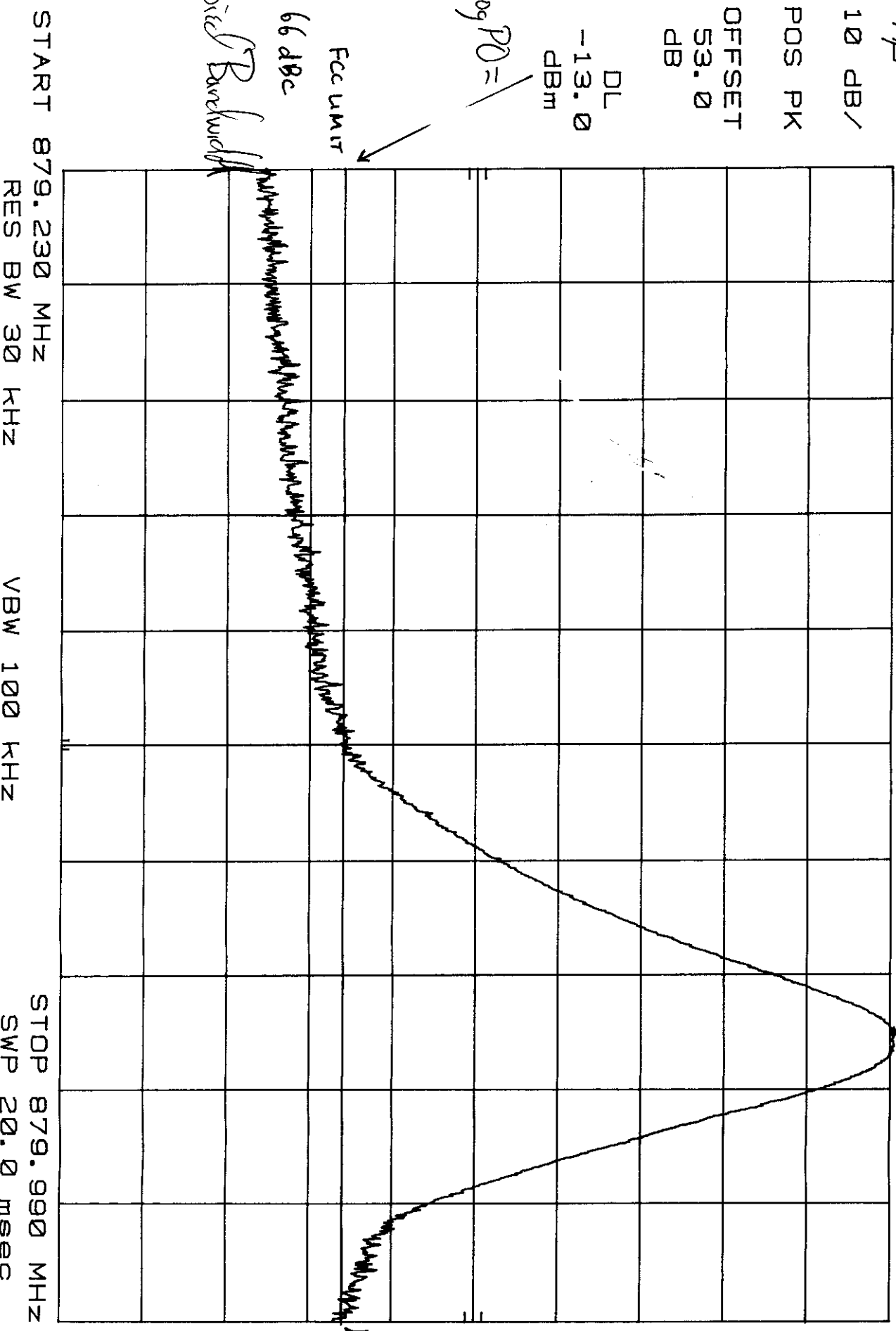
DL -13.0 DBm

43+10log PO =

FCC LIMIT

66 dBc

Occupied Bandwidth



RC054737/00045

4 Amplifiers 200Watts TDMA Band Edge Measurements

LPA850 (4) EMISSION CF=869.230MHz TDMA MKR 869.230 9 MHz
 REF 53.0 DBm ATTEN 10 DB 52.70 DBm

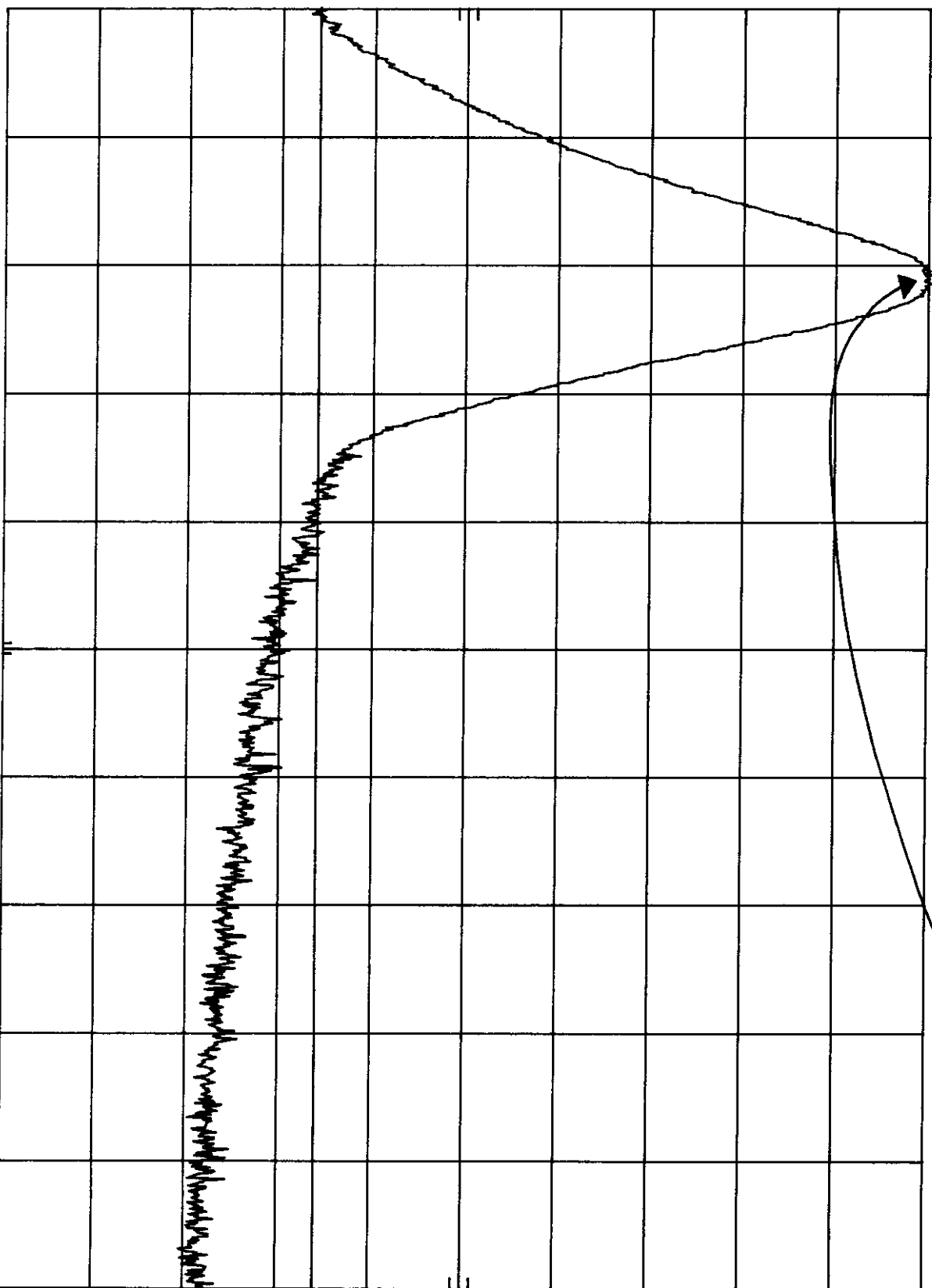
10 DB/
 POS PK
 OFFSET
 53.0
 DB

DL
 -13.0
 DBm

43+10log P_o

FCC limit
 66 DBc

Occupied
 Bandwidth



START 869.040 MHz
 RES BW 30 KHZ

VBW 100 KHZ

STOP 869.980 MHz
 SWP 20.0 msec

4 Amplifiers 200 watts CDMA Band Edge Measurements

HP LPA850 (4) EMISSION CF=872.510MHz CDMA MKR 872.51 MHz
 REF 53.0 dBm ATTN 10 dB 45.30 dBm

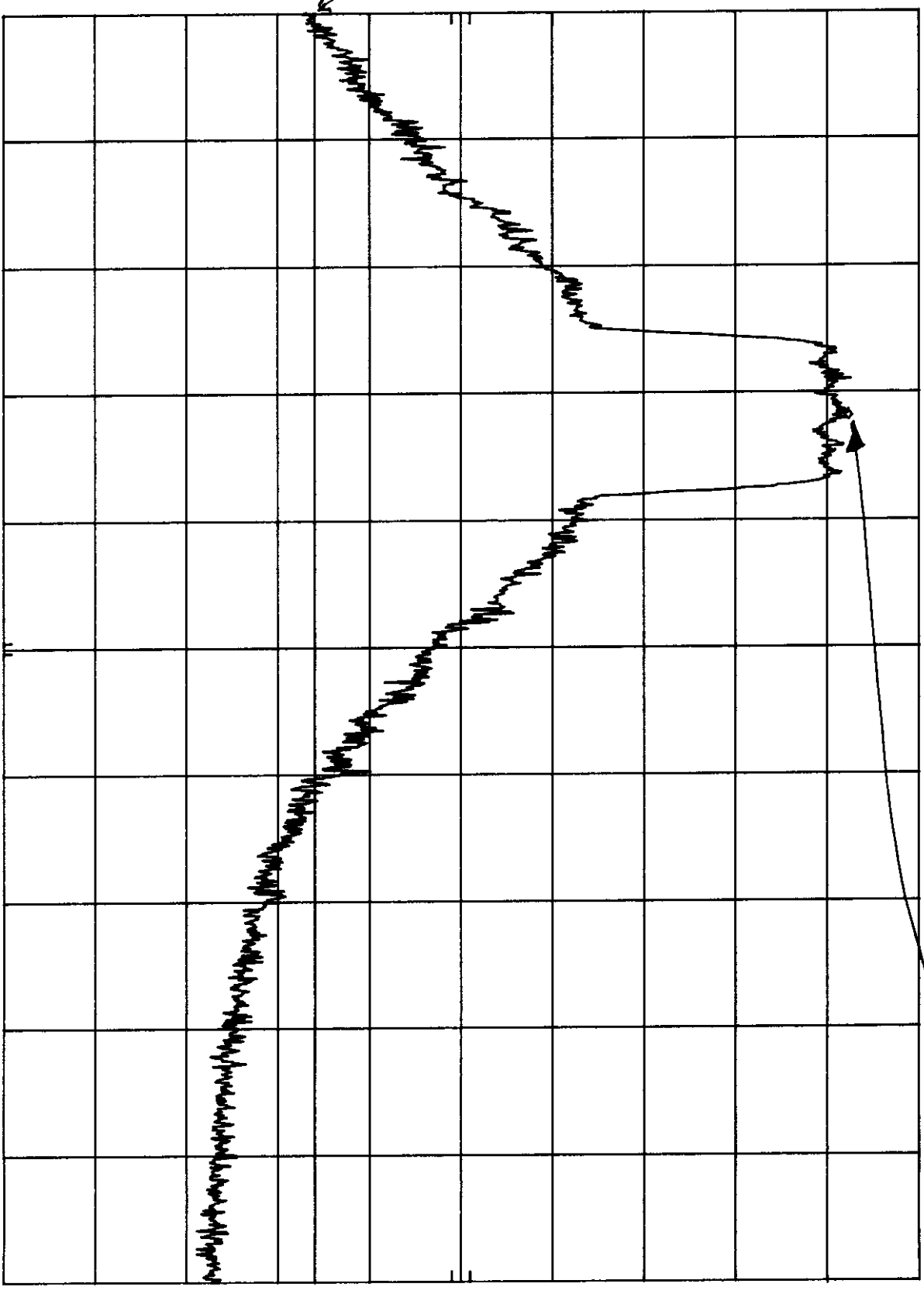
10 dB/
 POS PK
 OFFSET
 53.0
 DB

DL
 -13.0
 DBm

13 + 1/8 log P₀ =

Fcc limit
 66 dBc

Occupied
 Bandwidth



START 869.0 MHz STOP 879.9 MHz
 RES BW 30 KHz VBW 100 KHz SWP 32.9 msec

4 Amplifiers 200 watts CDMA Band Edge Measurements

HP LPA850(4) EMISSION CF=876.80MHZ CDMA
 REF 53.0 DBM ATTEN 10 DB MKR 876.80 MHZ
 43.60 DBM

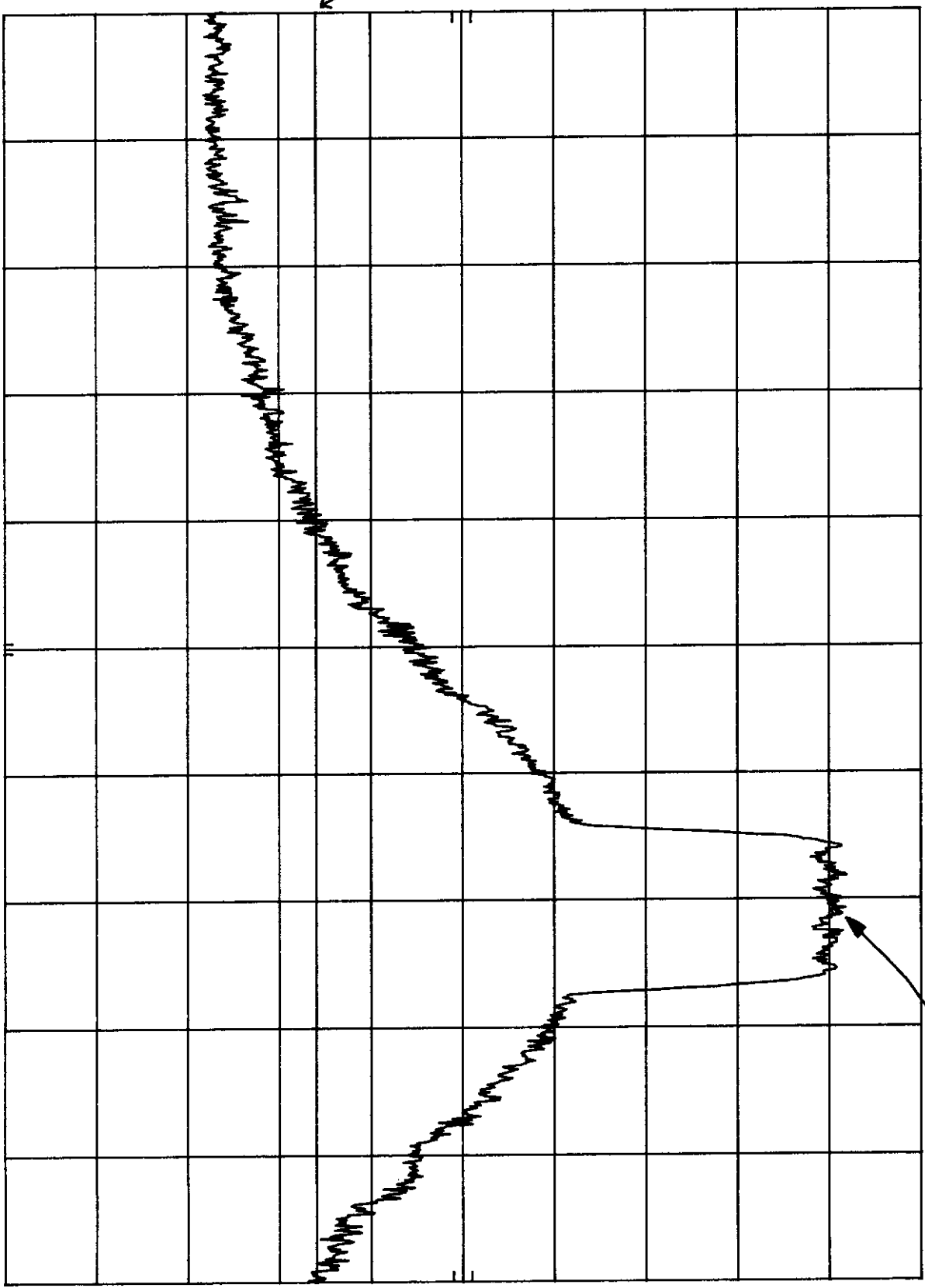
10 DB/
 POS PK
 OFFSET
 53.0
 DB

DL
 -13.0
 DBm

$13 + 10 \log P_{avg} PO =$

Fcc LIMIT
 66 dBc

Occupied
 Bandwidth



START 869.0 MHZ STOP 879.9 MHZ
 RES BW 30 KHZ VBW 100 KHZ SWP 32.9 msec

RC054737/00045

4 Amplifiers 200Watts CW Band Edge Measurements

LP850(4) EMISSION CF=879.780MHZ CW MKR 879.780 5 MHz
REF 53.0 dBm ATTEN 10 dB

HP
10 dB/
POS PK
OFFSET
53.0
dB

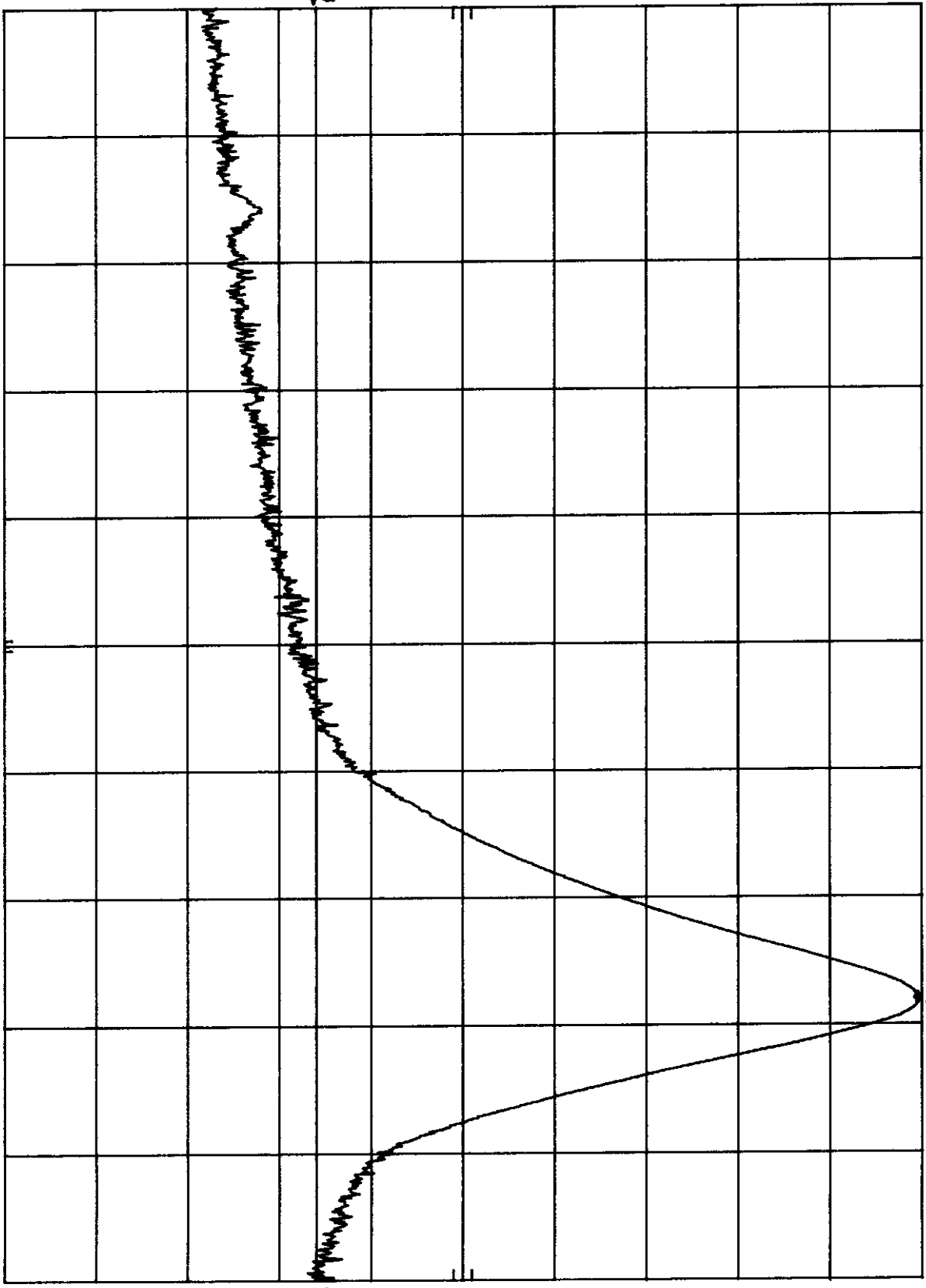
DL
-13.0
dBm

43410_{avg} PO

Fca limit
66 dBc

Occupied
Bandwidth

START 879.043 MHz RES BW 30 KHZ VBW 100 KHZ STOP 879.990 MHz
SWP 20.0 msec



RC054737/00045

4 Amplifiers 200 watts CW Band Edge Measurements

LPAB50(4) EMISSION CF=869.280MHZ CW MKR 869.280 3 MHz
REF 53.0 DBm ATTEN 10 DB 52.80 DBm

10 DB/

POS PK

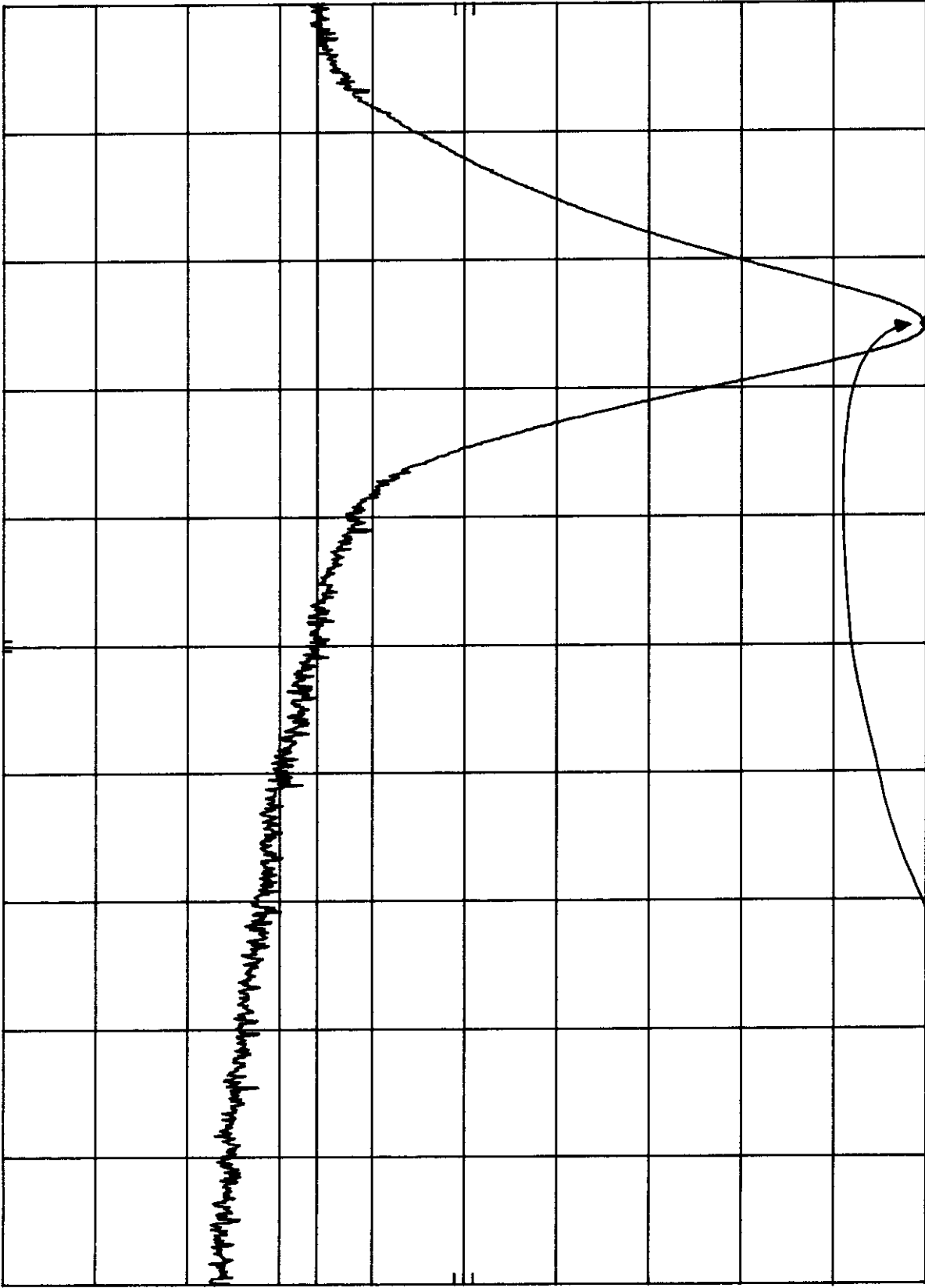
OFFSET 53.0 DB

DL -13.0 DBm

$43 + 10 \log P =$

FCC LIMIT 66 DBc

Occupied Bandwidth



START 869.040 MHZ RES BW 30 KHZ VBW 100 KHZ STOP 870.001 MHZ SWP 20.0 msec

RC054737/00045

Intermodulation Tests

Intermodulation:

An Intermodulation test was performed on this system utilizing 8 carrier frequencies at maximum power. Plots are supplied with one amplifier running and with all 4 amplifiers running. All emissions outside of the 869.040 MHz to 879.990 MHz band are attenuated below the FCC limit of $43 + 10 \log$ PO or 60 dBc for 50 watts and 66 dBc for 200 watts.

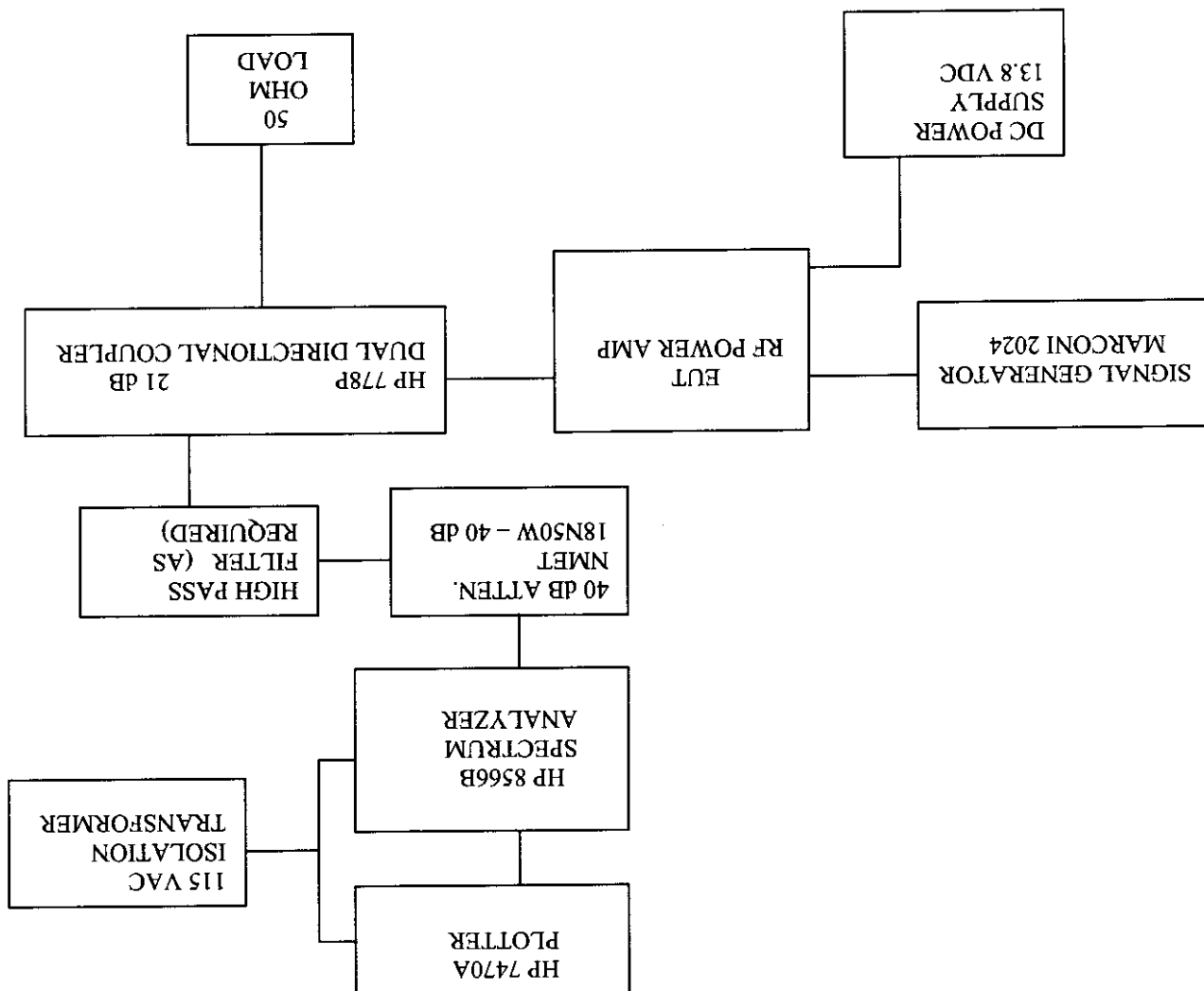


FIGURE 4: Block Diagram
(Intermodulation tests)

One Amplifier only 50 watts output

8 carriers

LPA850<1> INTERMODULATION DISTORTION
REF 47.0 dBm ATTEN 10 dB

10 dB/

POS PK

OFFSET
47.0

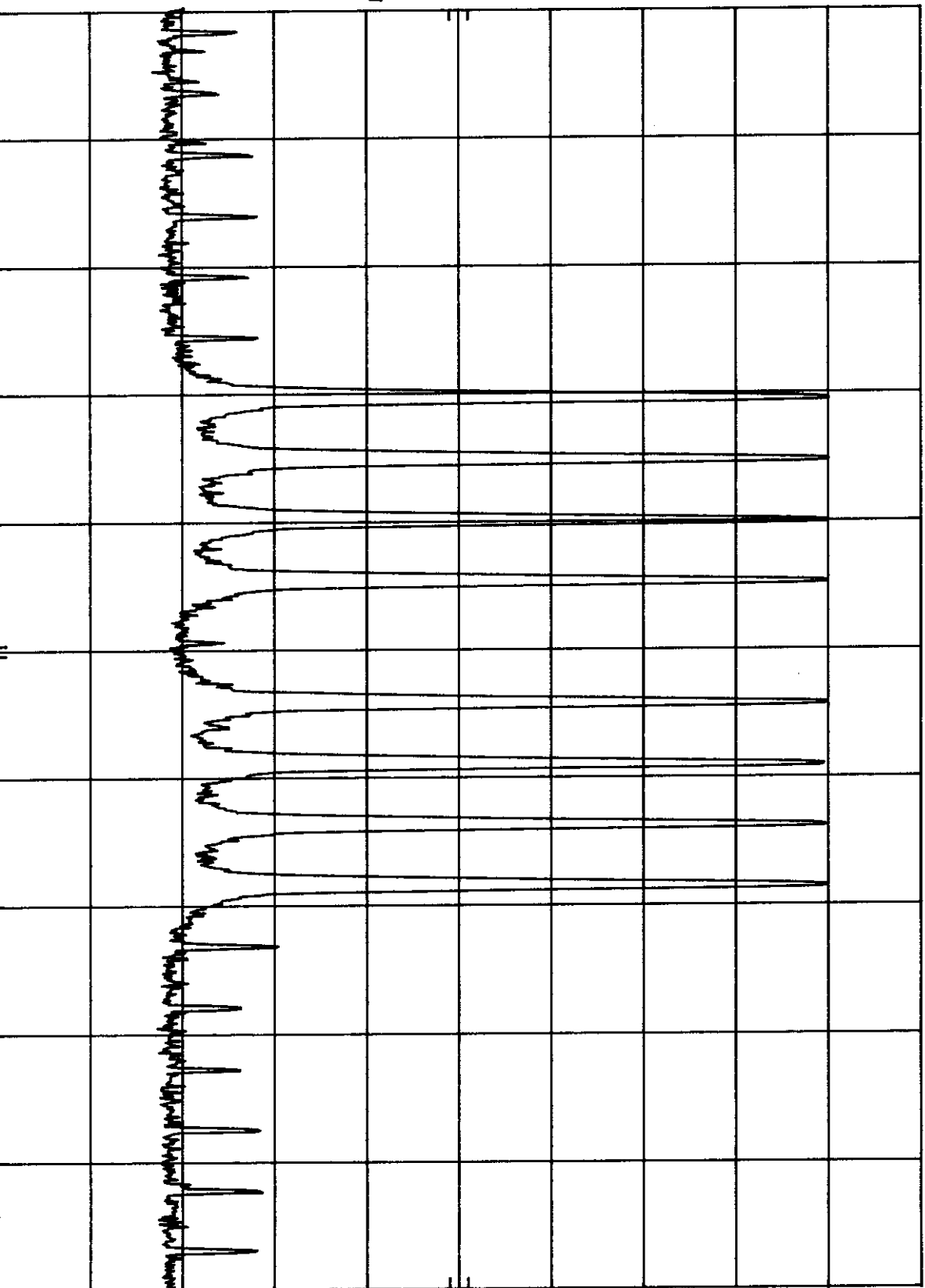
dB

DL

-13.0
dBm

413 + 18 log P₀

FCC UNIT
60 dBc



START 862.5 MHz
RES BW 30 KHz
VBW 100 KHz
STOP 883.5 MHz
SWP 63.0 msec

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One Amplifier only 50 watts output

8 carriers

HP

LPA850(1) INTERMODULATION DISTORTION

8 carriers

10 dB/

POS PK

OFFSET

47.0

DB

DL

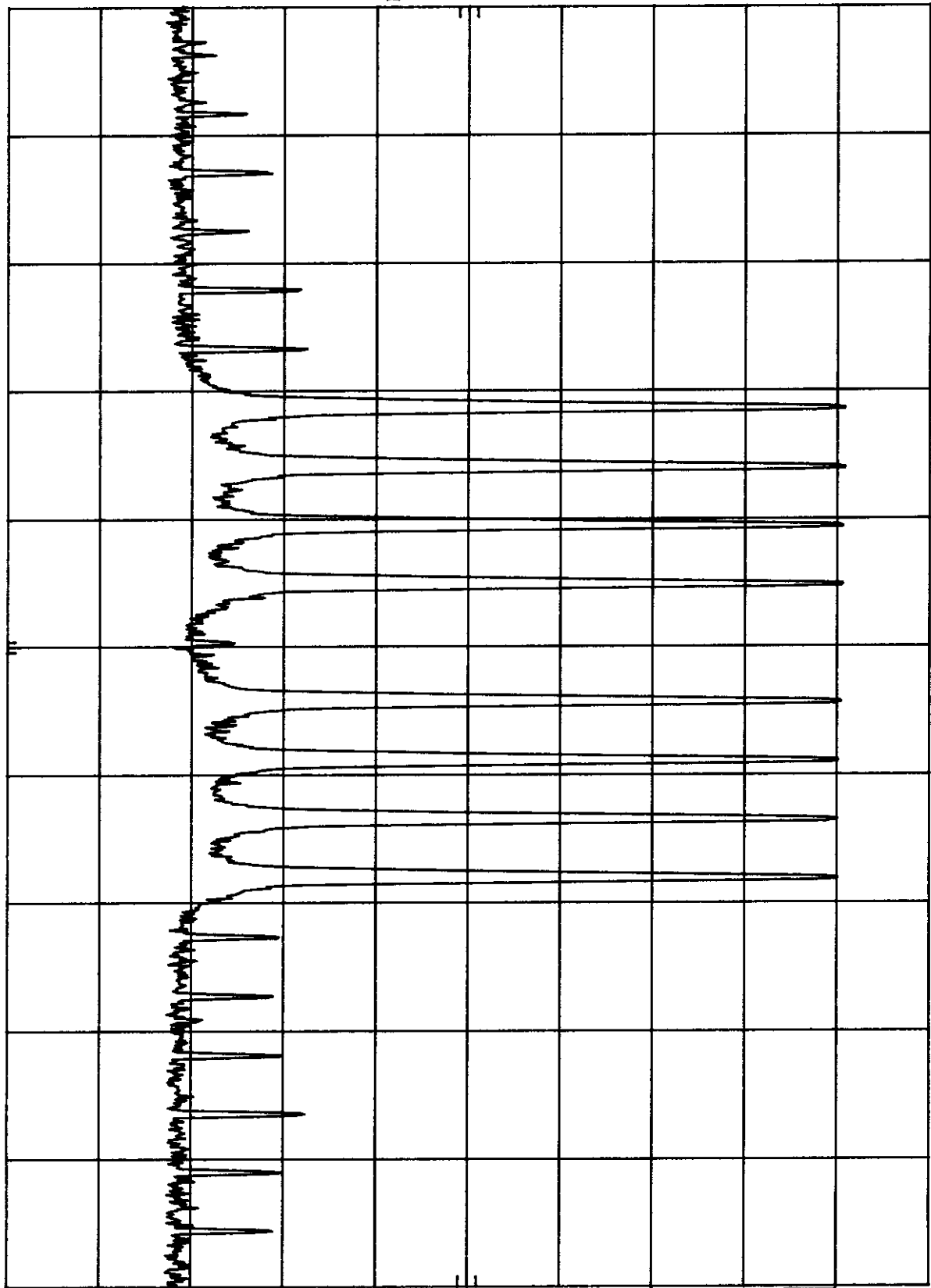
-13.0

DBm

FCC LIMIT

60 dBc

-13.0 dBm



START 879.1 MHz

RES BW 30 KHz

VBW 100 KHz

STOP 900.9 MHz

SWP 65.3 msec

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4 Amplifiers & carriers 200watts Output

LPAB50 (4) INTERMODULATION DISTORTION
REF 53.0 dBm ATTEN 10 dB

HP

10 dB/

POS PK

OFFSET
53.0
dB

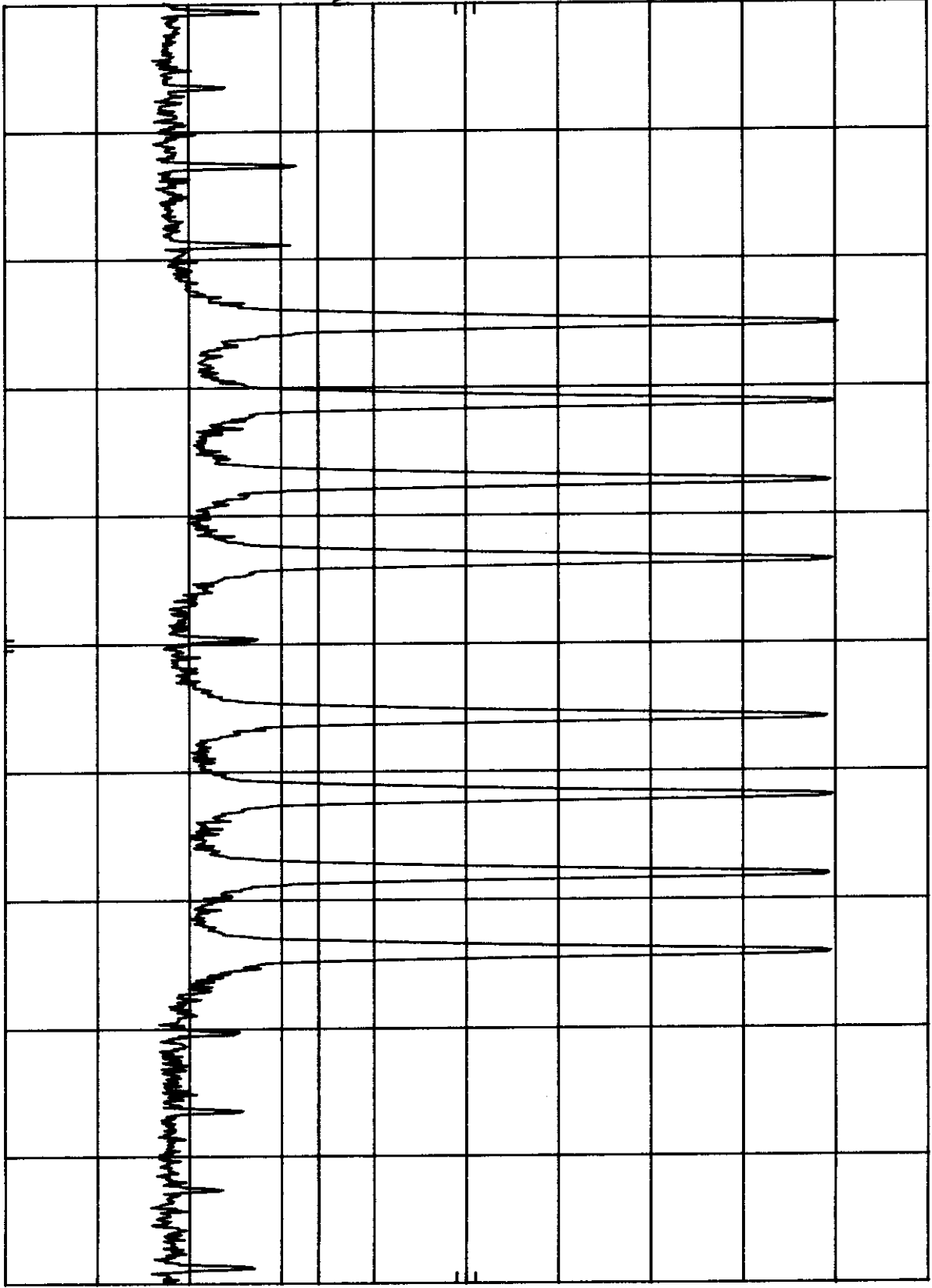
DL

-13.0
dBm

43.1 log P0

FCC LIMIT

66 dBc



CENTER 873.0 MHz

RES BW 30 kHz

VBW 100 kHz

SPAN 16.3 MHz
SWP 48.8 msec

RC054737/00045

4 Amplifiers 8 carriers 200 watts output

LPA850 (4) INTERMOD. DISTORTION 8 CHANNELS MKR 1.766 GHz
 REF 53.0 DBM ATTN 10 DB -28.70 DBM

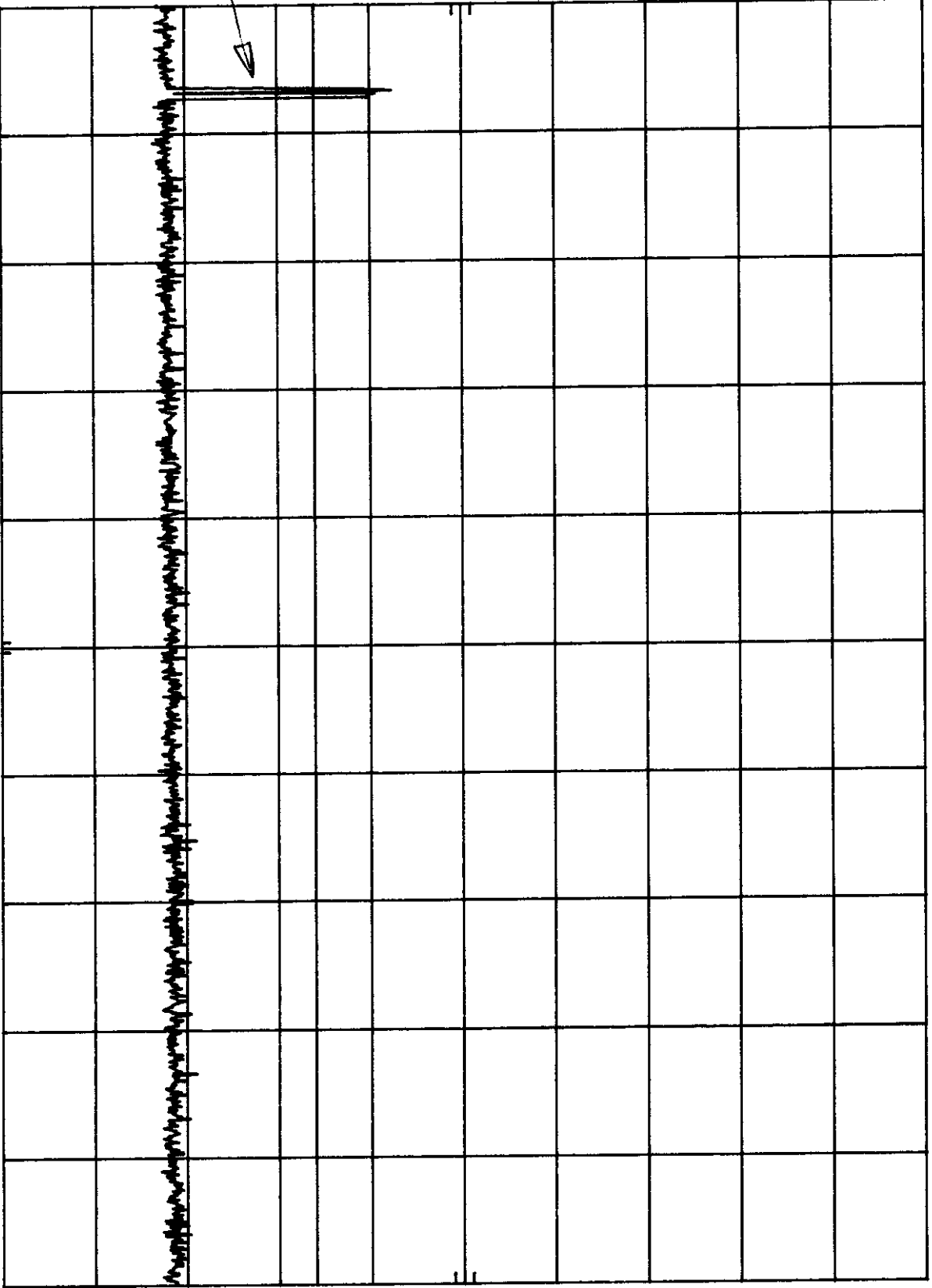
HP
 10 DB/
 POS PK
 OFFSET
 53.0
 DB

DL
 -13.0
 DBM

43710.03 PD

Fcc LIMIT
 66 dBc

SDdB notch
 Filter on
 Carrier



START 800 MHz RES BW 30 KHz VBW 100 KHz STOP 2.00 GHz SWP 3.60 sec

41 Amplifiers Scarpans 200 watts output

LPA850 (4) INTERMOD. DISTORTION 8 CHANNELS
REF 53.0 DBm ATTN 10 DB

h_p

10 DB/

POS PK

OFFSET

53.0

DB

DL

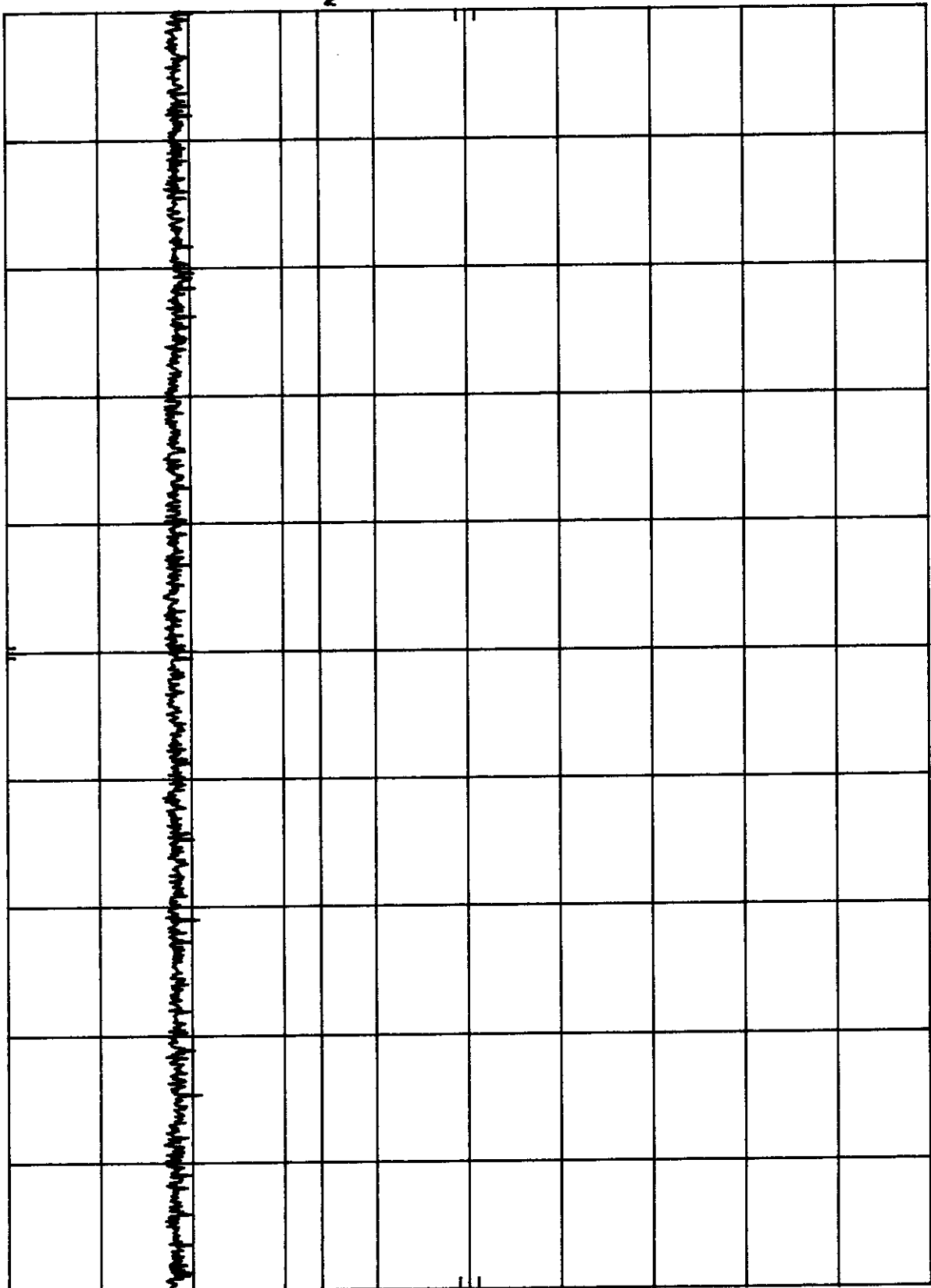
-13.0

DBm

43 dB D_{100g} PO

FCC LIMIT

66 dBc



START 2.00 GHz RES BW 30 KHZ VBW 100 KHZ SWP 11.4 sec STOP 5.80 GHz

RC054737/00045

4 Amplifiers 8 carriers 200 watts output

LPAB50 (4) INTERMOD. DISTORTION 8 CHANNELS
REF 53.0 dBm ATTN 10 dB

10 dB/

POS PK

OFFSET

53.0

dB

DL

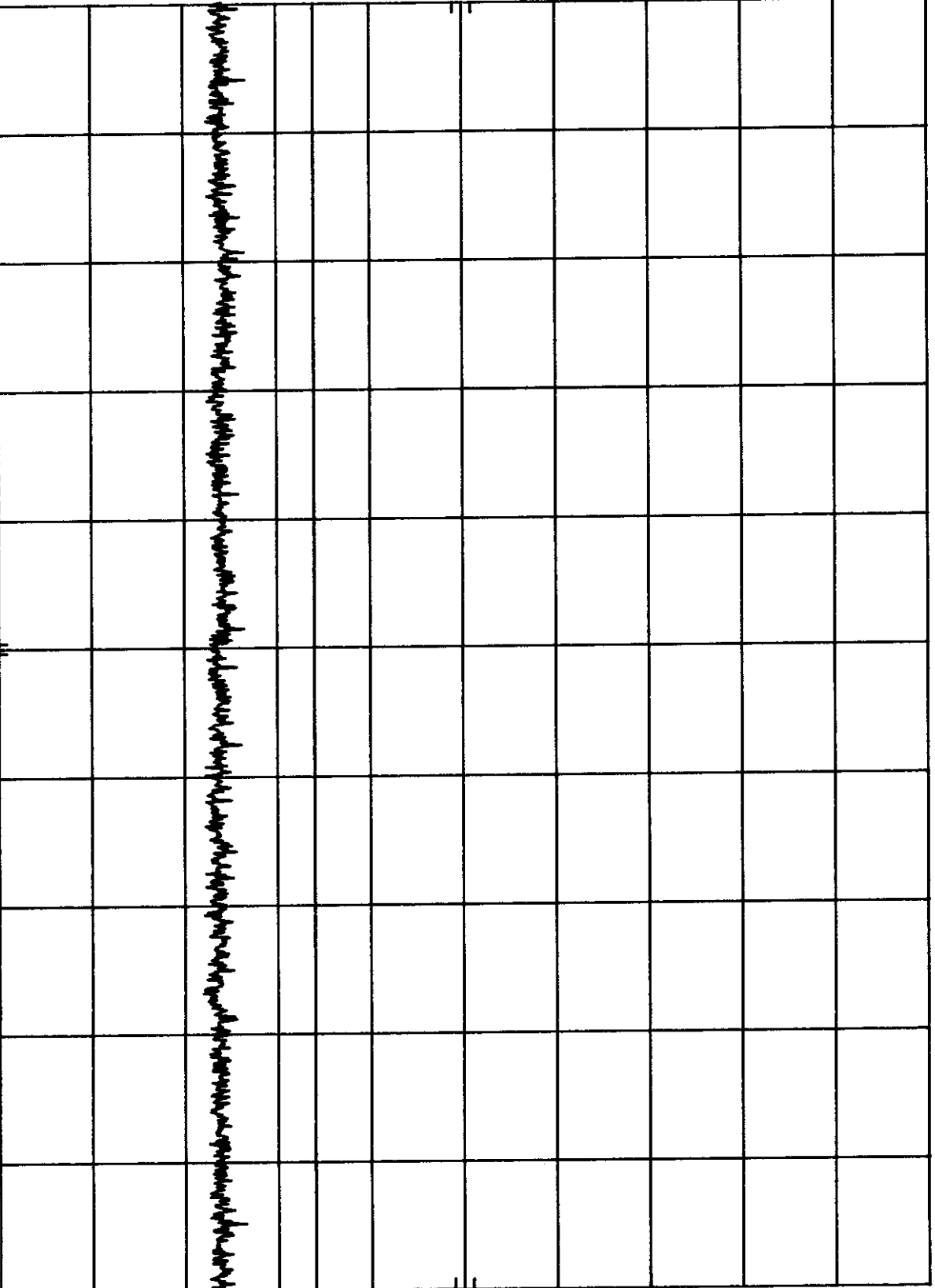
-13.0

dBm

43 + 10 log P_o

FCC LIMIT

66 dBc



START 5.80 GHz

RES BW 30 KHz

VBW 100 KHz

STOP 10.00 GHz

SWP 12.6 sec

RC054737/0045

**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:

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

Where P_o = Output in Watts

$$= 43 + 10 \log_{10} (45)$$

$$= 60 \text{ dB}$$

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

Connect the equipment as shown in FIGURE 4.

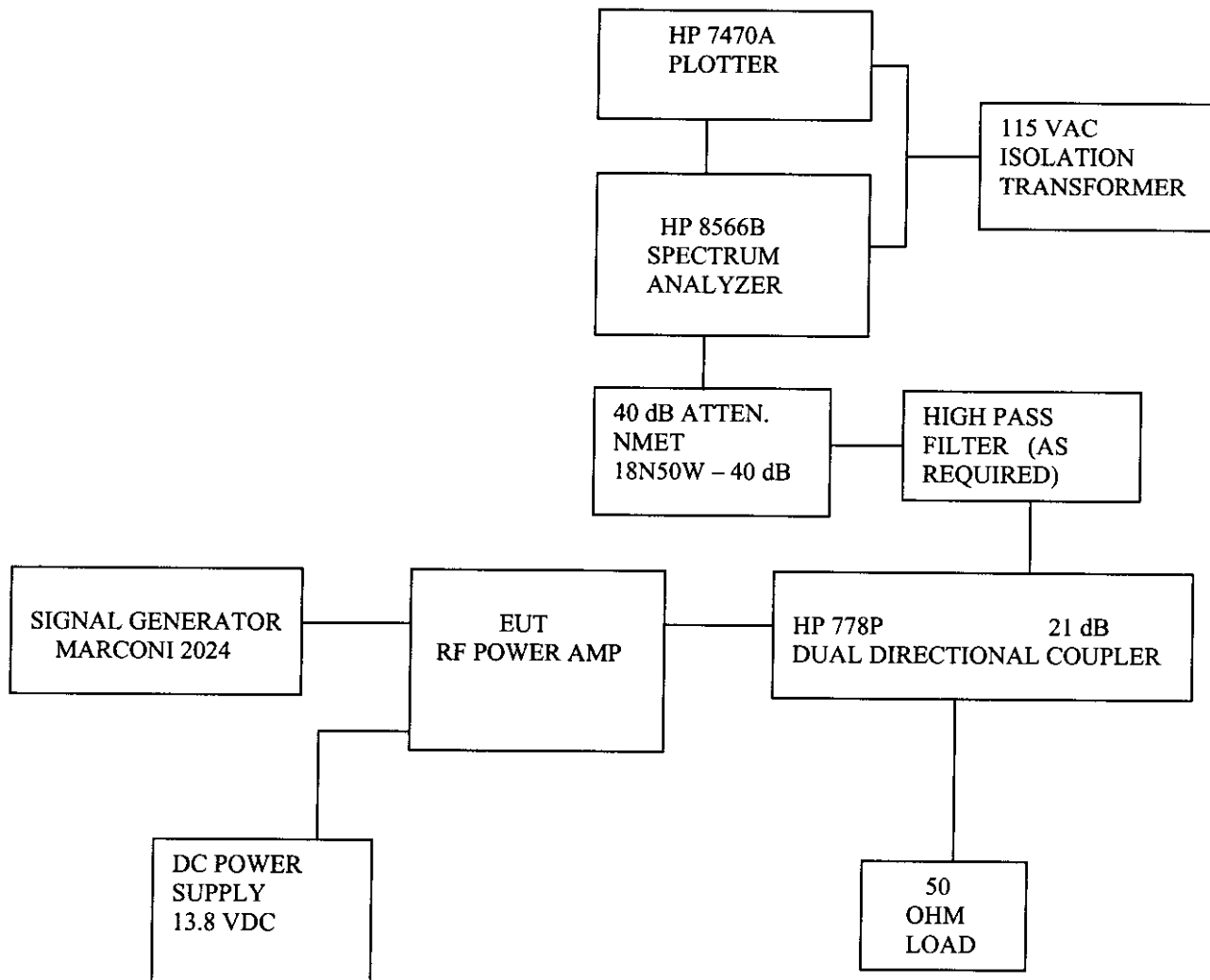
Adjust the Audio Oscillator so that the frequency deviation of the transmitter is a 5 kHz at a modulation frequency of 2.5 kHz. Adjust the Spectrum Analyzer to display the Modulated Carrier.

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.

**FIGURE 5: Block Diagram
(Spurious Emissions tests)**



4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=869MHz MKR Δ 868 MHz
REF 53.0 dBm ATTEN 10 dB -61.60 dB

RC054737/00045

HP

10 dB/

POS PK

OFFSET

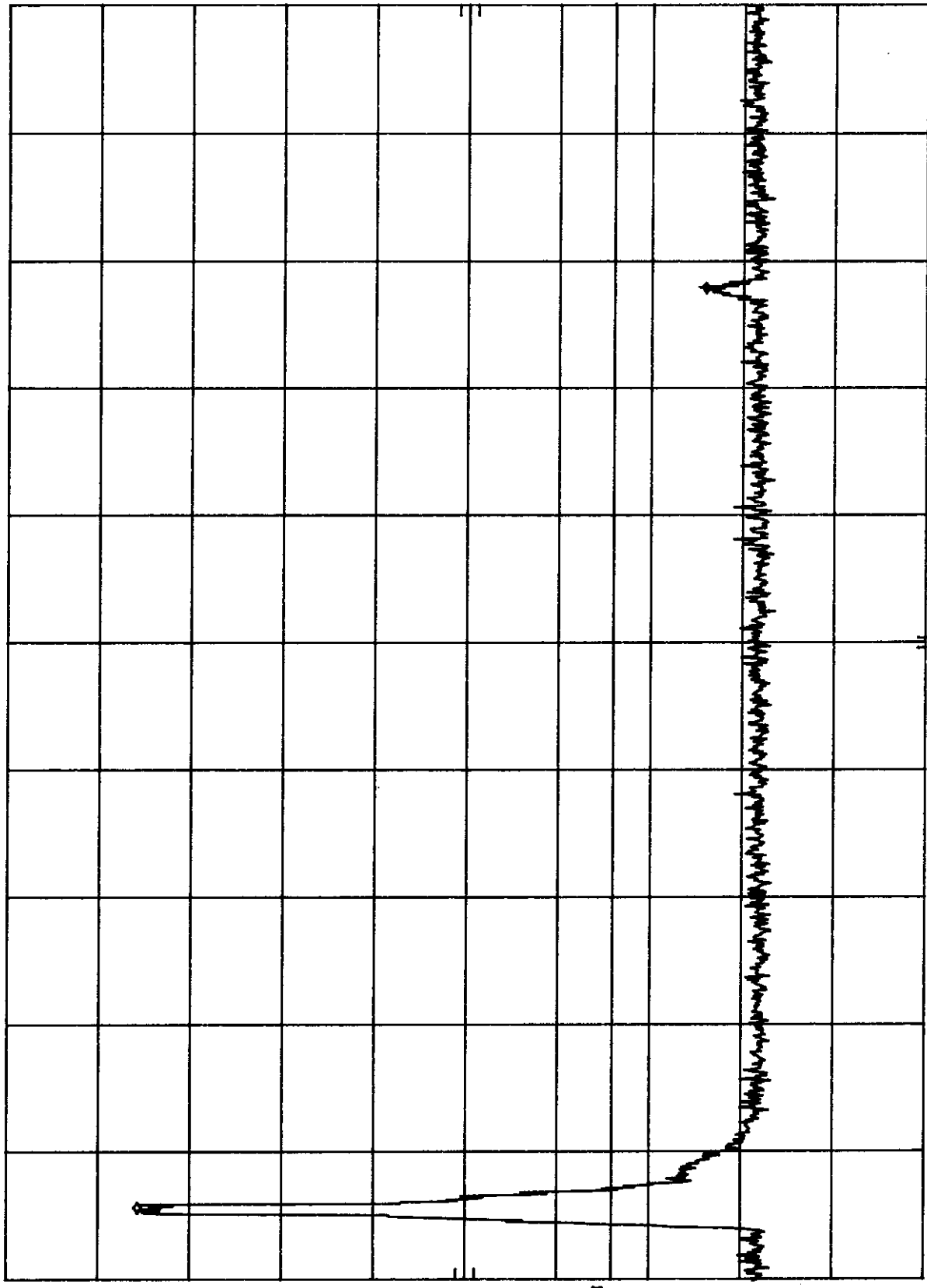
53.0 dB

DL

-13.0 dBm

$43 + 10 \log P_0 =$

FCC limit
66 dBc



START 800 MHz RES BW 30 KHZ VBW 100 KHZ STOP 2.00 GHz
SWP 3.60 sec

4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=869MHz
REF 53.0 dBm ATTEN 10 dB

HP

10 dB/

POS PK

OFFSET

53.0

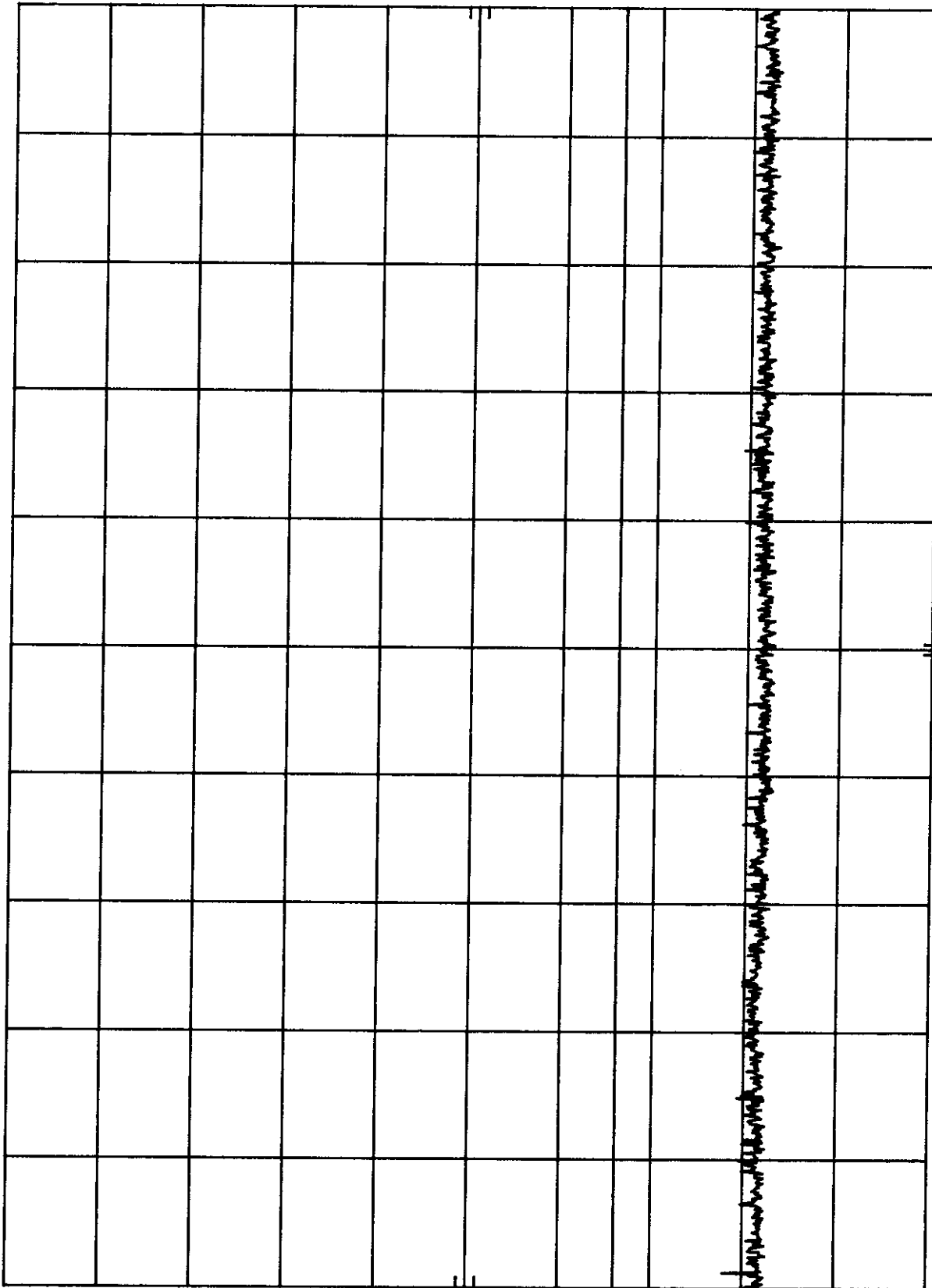
dB

DL

-13.0
dBm

FCC LIMIT

66 dBc



START 2.00 GHz

RES BW 30 KHz

VBW 100 KHz

STOP 5.80 GHz

SWP 11.4 sec

4 Amplifiers 200 watts

LPAB50(4) ANT. CONDUCTED SPURIOUS CF=869MHz
REF 53.0 dBm ATTEN 10 dB

HP

10 dB/

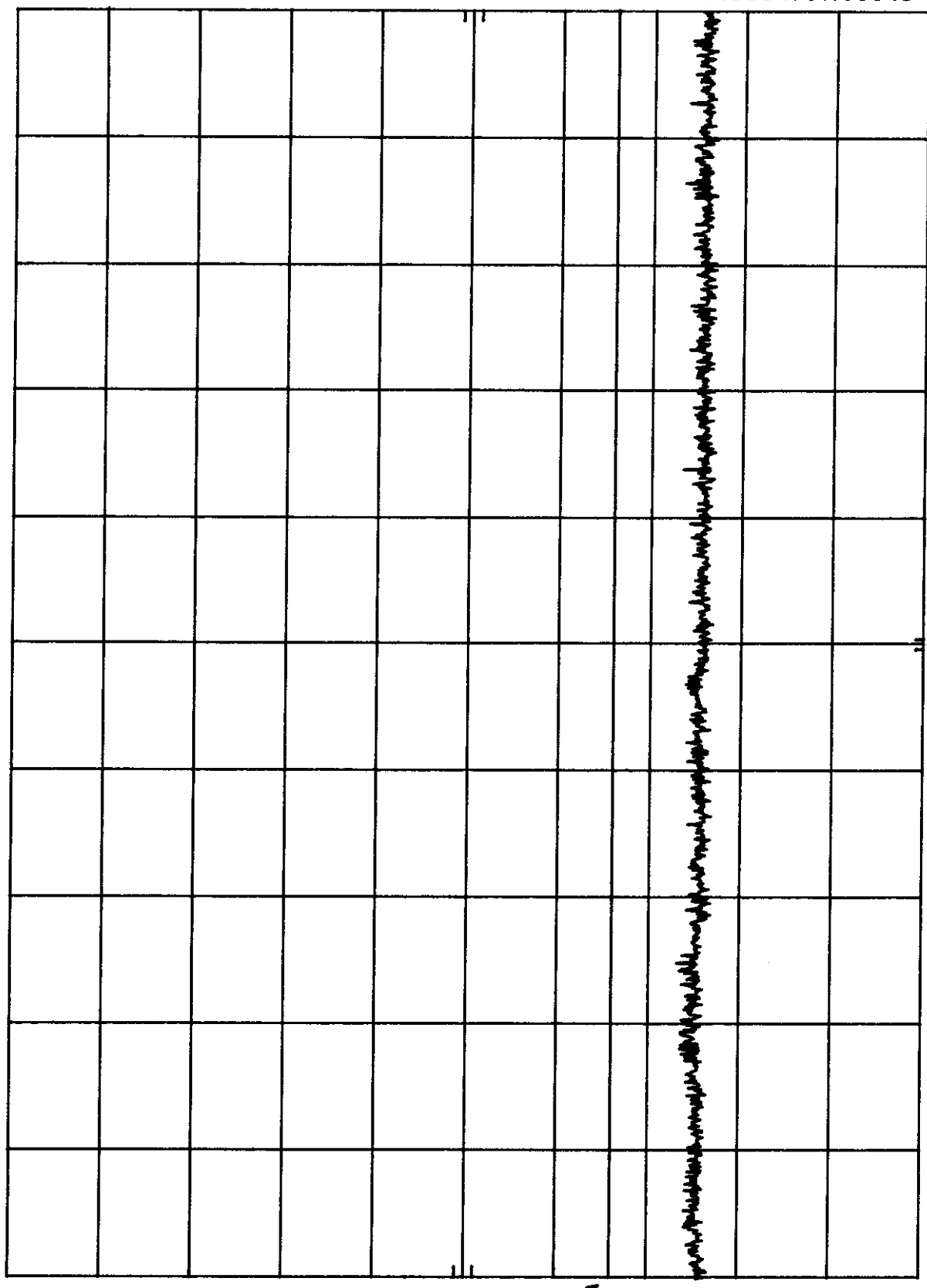
POS PK

OFFSET

53.0 dB

DL
-13.0 dBm

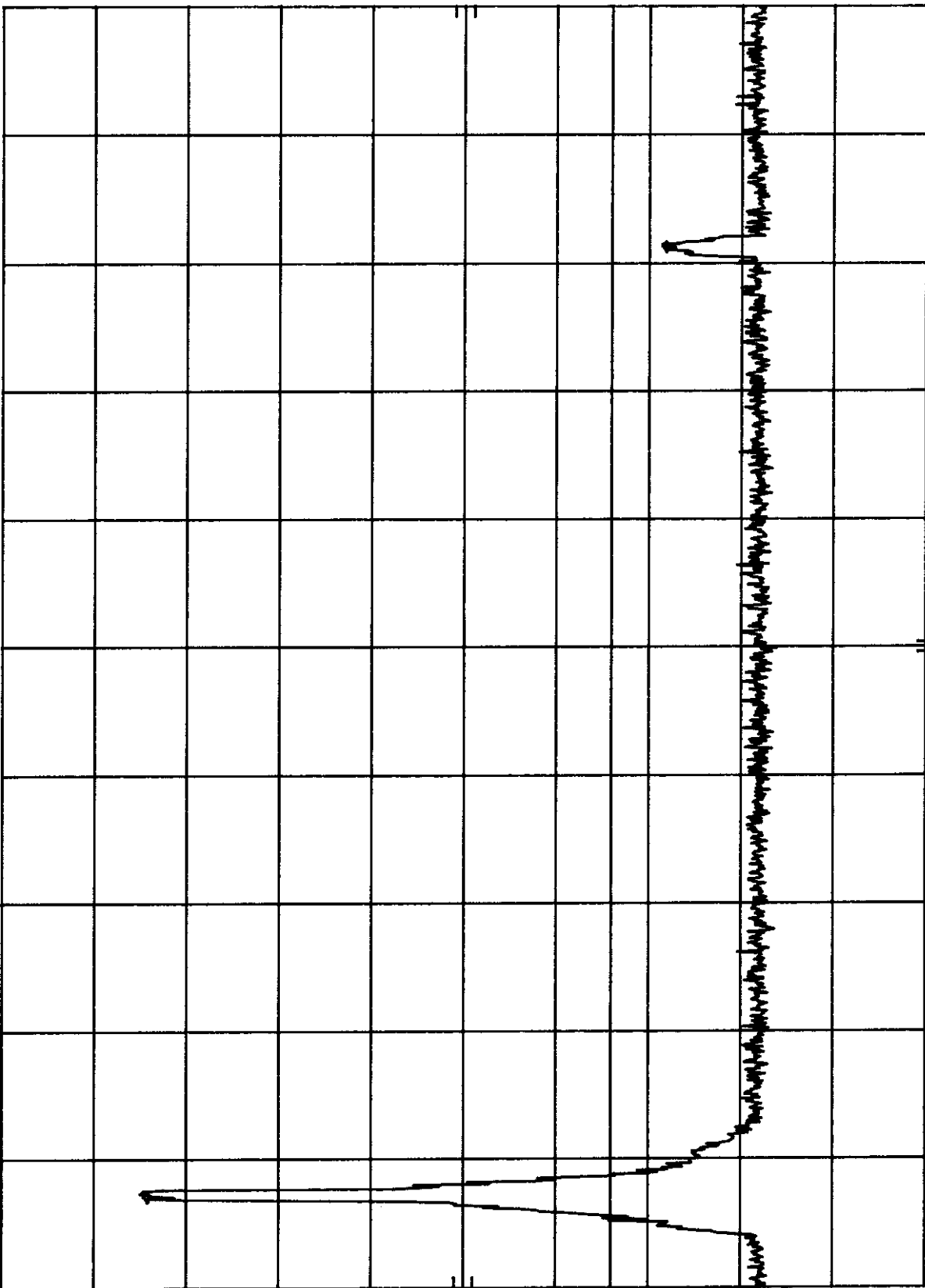
FCC LIMIT
66 dBc



START 5.80 GHz RES BW 30 kHz VBW 100 kHz STOP 10.00 GHz
 SWP 12.6 sec

4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=890MHz MKR Δ 890 MHz
REF 53.0 dBm ATTEN 10 dB -56.00 dB



START 800 MHz RES BW 30 kHz VBW 100 kHz STOP 2.00 GHz SWP 3.60 sec

4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=890MHz
REF 53.0 dBm ATTEN 10 dB

HP

10 dB/

POS PK

OFFSET

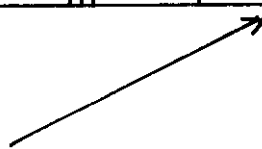
53.0

dB

DL

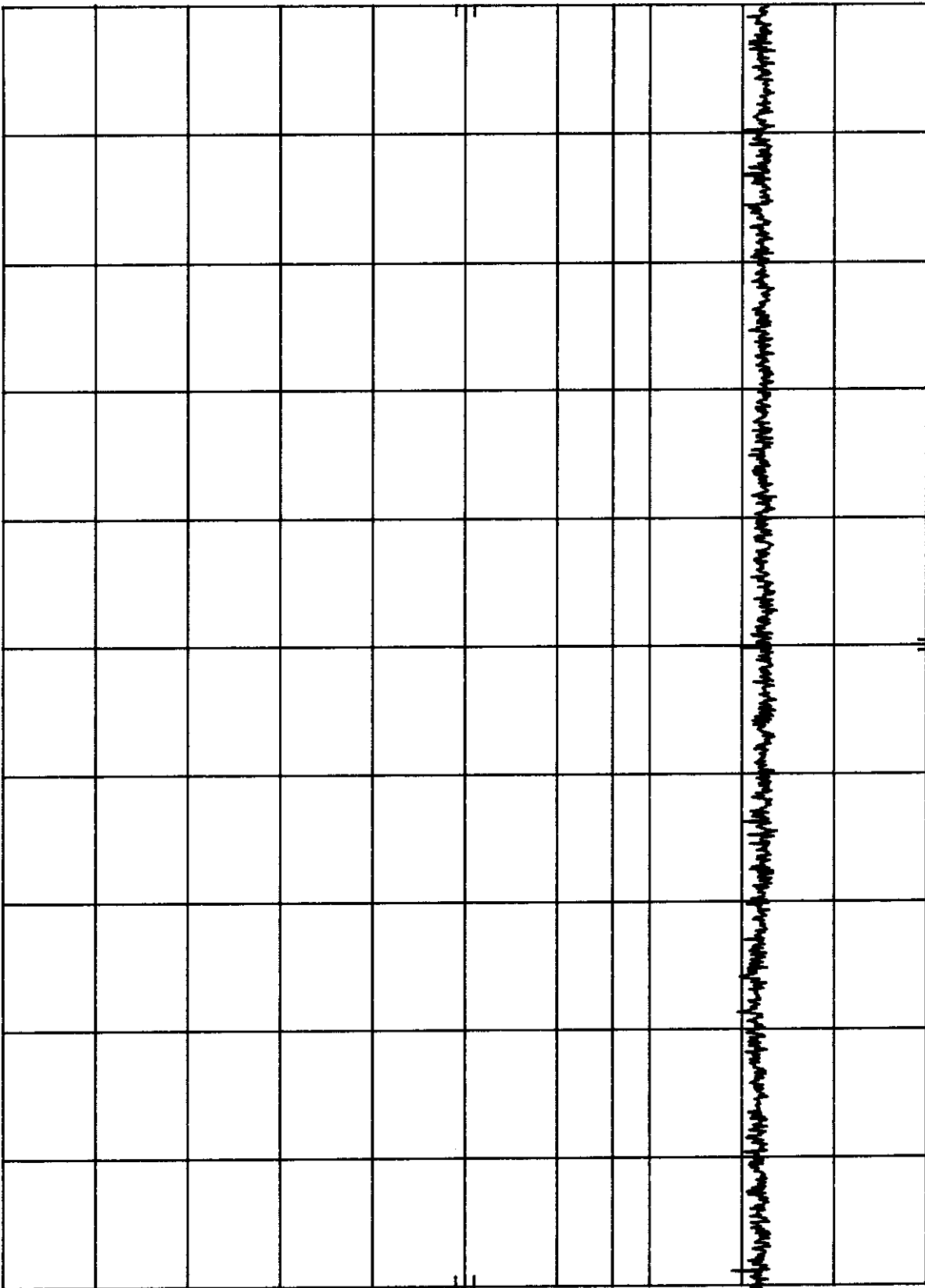
-13.0

dBm



FCC LIMIT

66 dBc



START 2.00 GHz

RES BW 30 kHz

VBW 100 kHz

STOP 5.80 GHz

SWP 11.4 sec

4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=890MHz
REF 53.0 dBm ATTEN 10 dB

RC054737/00045

HP

10 dB/

POS PK

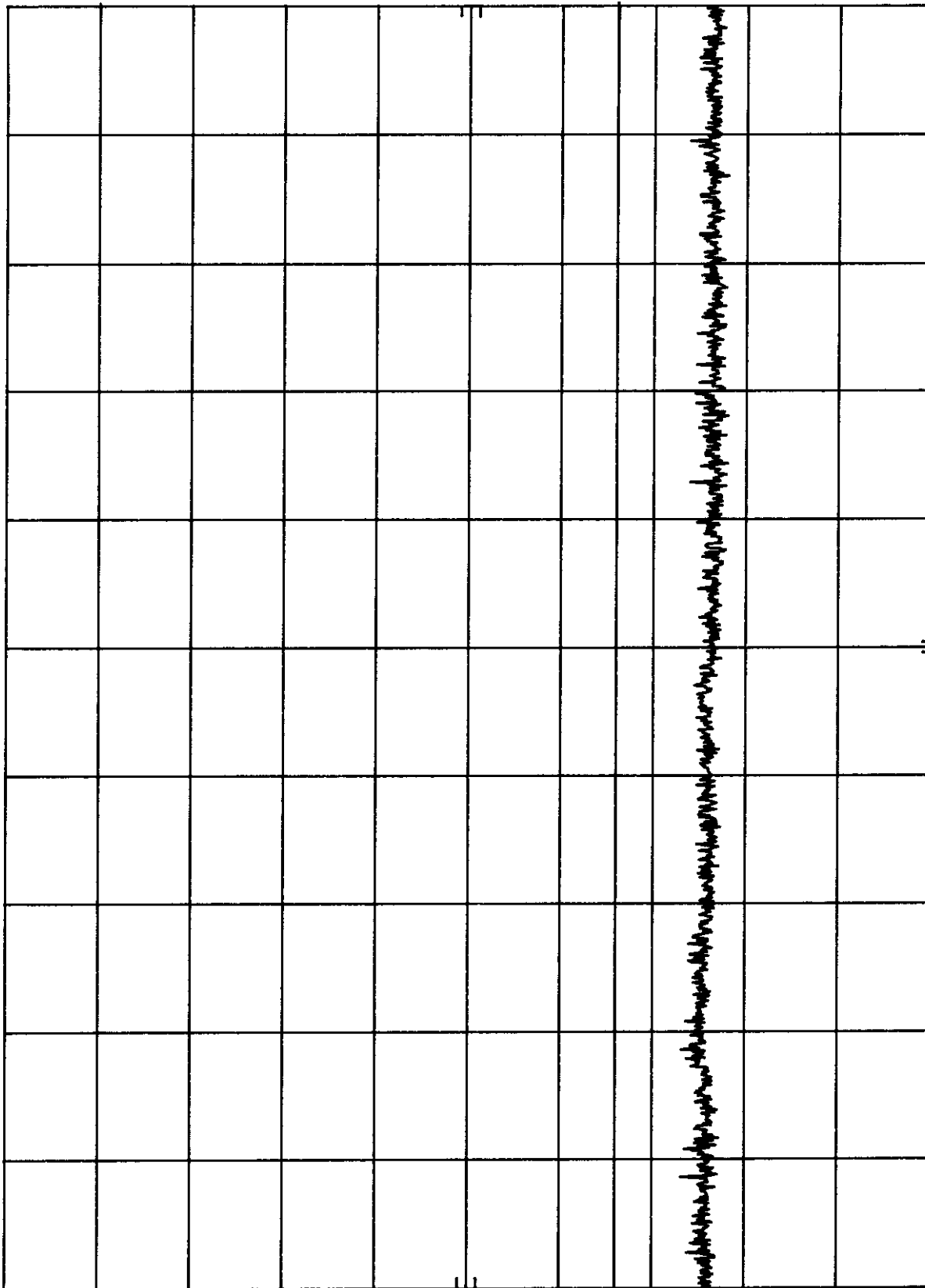
OFFSET

53.0
dB

DL
-13.0
dBm

Fcc UNIT

66 dBc

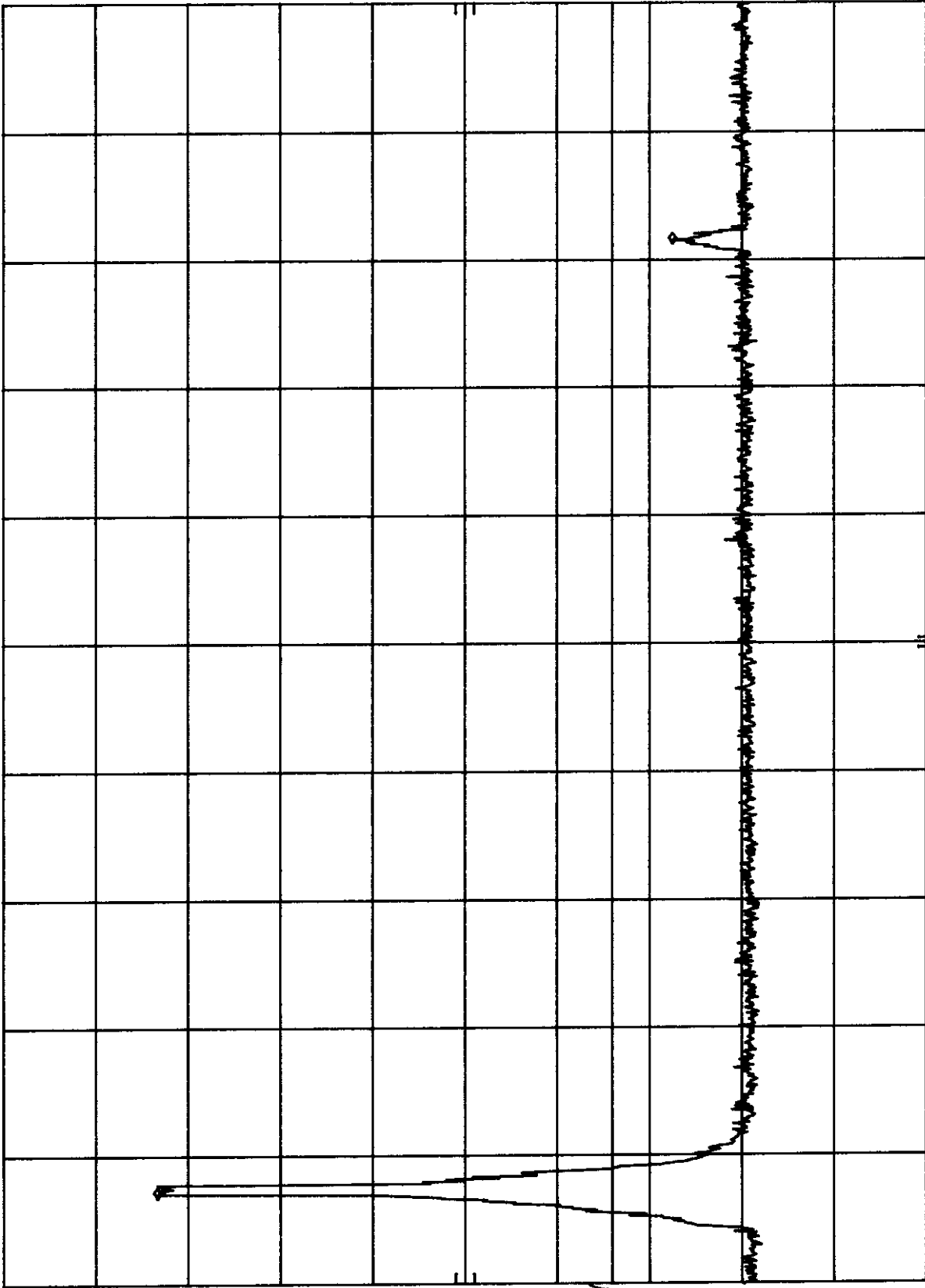


START 5.80 GHz RES BW 30 KHZ VBW 100 KHZ STOP 10.00 GHz
SWP 12.6 sec

4 Amplifiers 200 Watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=894MHz MKR Δ 894 MHz
REF 53.0 dBm ATTEN 10 dB -55.80 dB

HP



START 800 MHz RES BW 30 KHz VBW 100 KHz STOP 2.00 GHz SWP 3.60 sec

4 Amp Filters 200watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=894MHz
REF 53.0 dBm ATTEN 10 dB

hp

10 dB/

POS PK

OFFSET

53.0

dB

DL

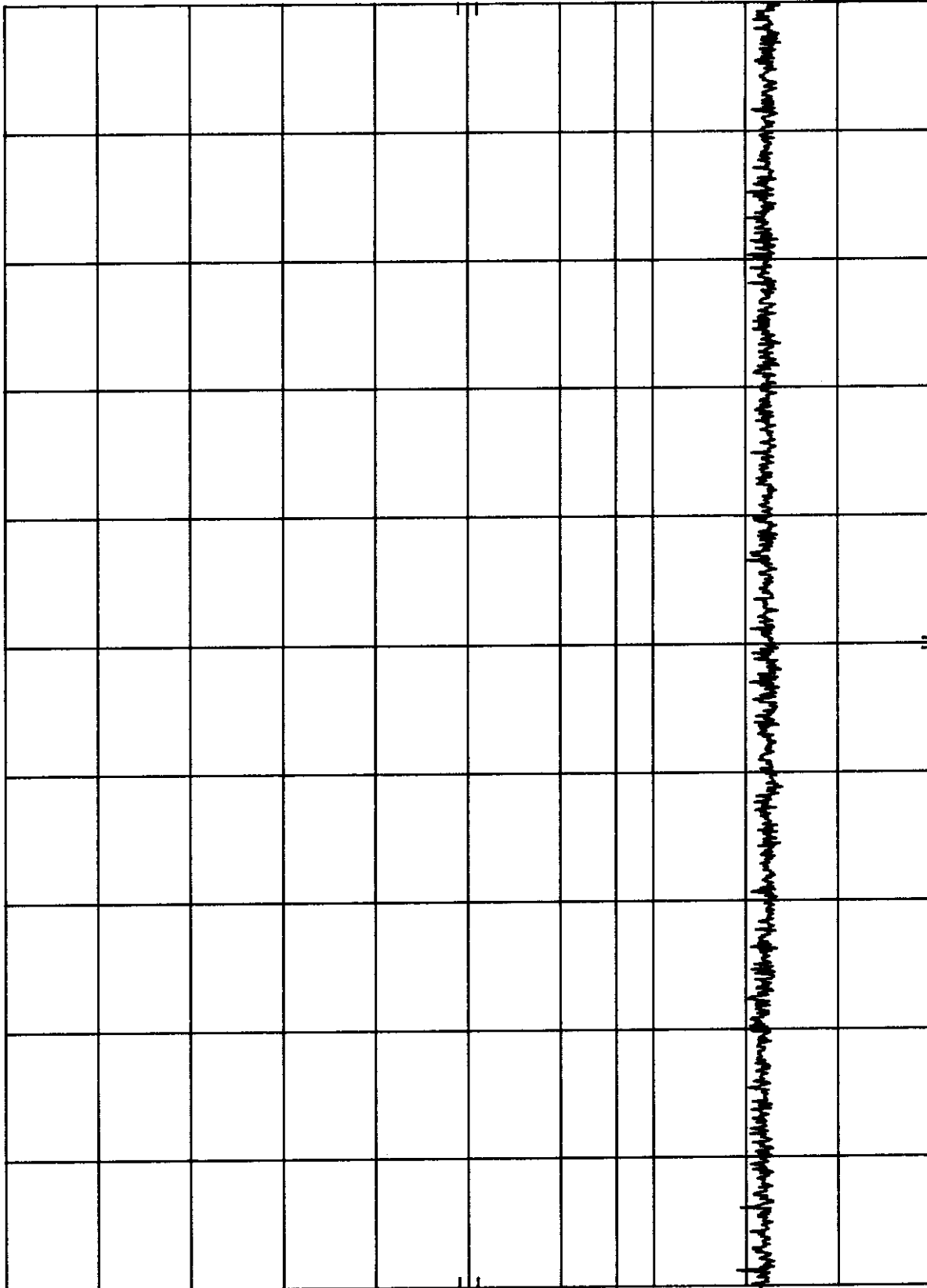
-13.0

dBm

40

FOL LIMIT

66 dbc



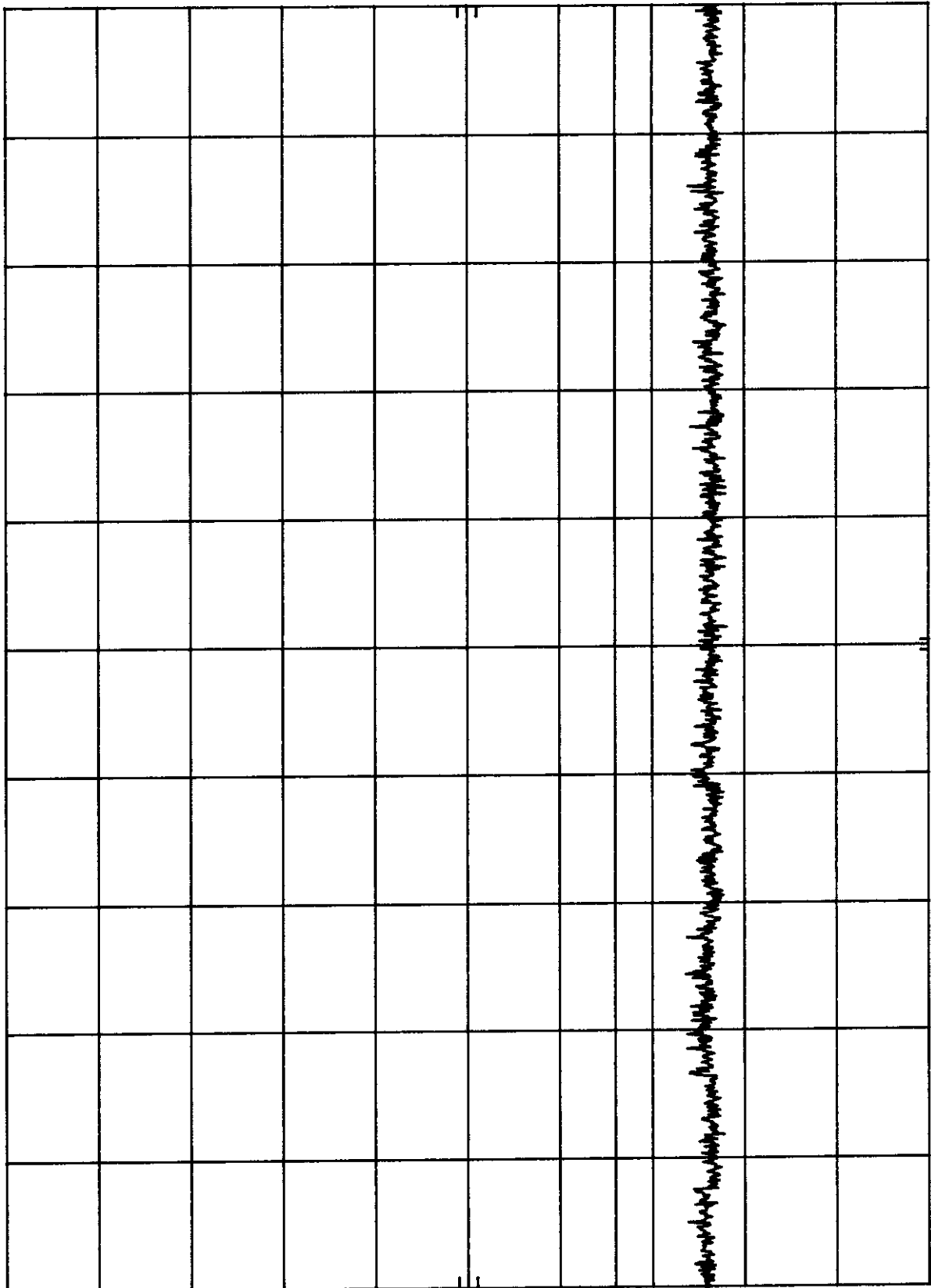
START 2.00 GHz RES BW 30 kHz VBW 100 kHz STOP 5.80 GHz
SWP 11.4 sec

4 Amplifiers 200 watts

LPA850(4) ANT. CONDUCTED SPURIOUS CF=894MHZ
REF 53.0 dBm ATTEN 10 dB

RC054737/00045

HP



10 dB/

POS PK

OFFSET

53.0 dB

DL
-13.0 dBm

Fcc limit

66 dBc

START 5.80 GHz RES BW 30 kHz VBW 100 kHz STOP 10.00 GHz SWP 12.6 sec

2.983(e)(5) Measurement of Radiated Spurious Emissions per 2.993

Definition:

Emissions from the equipment when connected into a non-radiating load 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.

Test Method: Per EIA RS 152-B.

Connect the equipment and follow the procedure described in paragraph 2.2.1.1 and paragraph 5.0. Measure the amplitude of each spurious radiated signal through the 10th harmonic. The level in dBuV/m is calculated on the following page. The spurious signals are then measured on the 3 meter range.

$$\text{Spurious attenuation dB} = 10 \log \frac{\text{Po Watts}}{\text{Calc. Spurious power}}$$

Test Results: See TABLE I on following Page.

All radiated spurious emissions are below the FCC Specifications.

SPURIOUS RADIATED SIGNAL MEASUREMENTS

(Ref: Part 2, Subpart J, 2.991 & 2.993)

Date 9-23-99 Pass X Fail (at Freq.)
 EUT Operating Power 200 watts
 Part No. Operating Mode CDMA Modulated
 Serial No. Test Engineer Bryan Broadus

FREQUENCY TUNED TO 890 MHz

ANT POL	FREQ MHz	SPECTRUM ANALYZER (dBμV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP GAIN (dB)	dBμV/m	FUND FIELD STRENGTH dBμV/m	SPUR BELOW CARRIER (dBc)
	890						150.3	
U	1780	77.5	27.2	8.0	42	70.7	}	79.6
U	2670	72.7	29.5	9.0		69.2		81.1
U	3560	65.0	32.0	9.0		64.0		86.3
H	4450	65.2	33.7	9.5		66.4		83.9
H	5340	59.1	34.0	10.5		61.6		88.7
V	6230	55.9	35.3	11		60.2		90.1
V	7120	49.8	36.9	12		56.7		93.6
V	8010	45.3	38.0	14		55.3		95.0
V	8900	46.6	38.0	14	42	56.6	150.3	93.7

Fundamental Field Strength (V/m) = $1/3 (R_o \times P_o)^{1/2} = 33V/m$

R_o = Amplifier Output Impedance (Ohms) 50

P_o = Amplifier Output Power (Watts) 200

Conversion from μV/m to dBμV/m = $(\mu V/m) \log \times 20 = 150.3 dB\mu V/m$

FCC Limit = $43 + 10 \log P_o = 66 dBc$

2.983(e)(6) Measurement of Frequency Stability per 2.995

The EUT is a power amplifier and contains no circuitry for generating or stabilizing the RF signal. The driver will be responsible for this task.

2.983(e)(7) Frequency Spectrum to be investigated per 2.997

The Frequency was searched from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency.