

**Application for Type Acceptance
for an RF Power Amplifier**

**TPL Communications
3370 San Fernando Rd. # 206
Los Angeles, CA 90065**

RF Power Amplifier:

Part # RS3-1DE-MSI

FCC ID: BBD3-1DE-S

Report # RA054493/80112

This report was prepared in accordance with the requirements of FCC rules and regulations Part 2, Subpart J, 2.981 thru 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**

24 March 1998

Table of Contents

Section	Title	Page #
1.0	ADMINISTRATIVE DATA	1
1.1	Certifications and Qualifications	1
1.2	Measurements Repeatability Information	1
Paragraph numbers in this report follow the application section numbers found in the FEDERAL COMMUNICATIONS COMMISSION Rules and Regulations, Part 2, Subpart J for Type Acceptance of electronic equipment.		
2.983(a)	Request for Type Acceptance	2
2.983(b)	Equipment Identification	2
2.983(c)	Anticipated Production	2
2.983(d)	Technical Description	3
2.983(d)(1)	Type or Types of Emissions	3
2.983(d)(2)	Frequency Range	3
2.983(d)(3)	Operating Power level	3
2.983(d)(4)	Maximum Power Allowed in Applicable part(s) of The Rules	4
2.983(d)(5)	Final RF Amplifier Input Power	4
2.983(d)(6)	Function of all Active Circuit Devices	4
2.983(d)(7)	Circuit Diagram	5
2.983(d)(8)	Instruction Book	5
2.983(d)(9)	Tune Up Procedure	5
	Figure 1. Circuit Diagrams	6
	Figure 2..Block Diagram (I/O Tests)	7
2.983(e)	Test Data	8
2.983(e)(1)	Measurement of RF Power Output Per 2.985 ..	8
2.983(e)(2)	Measurement of Modulation Characteristics Per 2.987(a)(1)	9
2.983(e)(3)	Measurement of Occupied Bandwidth Per 2.989	10
	Figure 3. Occupied Bandwidth (I/O Tests) ..	11
	Plots	12-21

Table of Contents

(Continued)

Section	Title	Page #
2.983(e) (4)	Measurement of Antenna Conducted Spurious Emission Per 2.991	22
	Plots Spurious Emissions	23-26
	Figure 4. Block Diagram Surious Emissions	27
2.983(e) (5)	Measurement of Radiated Spurious Per 2.993	28
	Table I	29-30
2.983(e) (6)	Measurement of Frequency Stability Per 2.995	31
2.983(e) (7)	Frequency Spectrum to be Investigated Per 2.997	31
2.983(f)	FCC ID: Label	32
2.983(g)	Photographs and/or Drawings Showing Equipment Construction Technique	33-39
2.983(h)	Description and Test Data for Encoding Device(s)	40
2.983(i)	Type Acceptance Data for an External power Amplifier used in the Amateur Radio Service Part 97	40
APPENDIX A	<i>Test Equipment</i>	A1
APPENDIX B	<i>Service/Operating Manual</i>	B1

1.0 **ADMINISTRATIVE DATA**

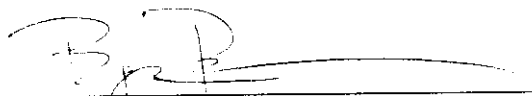
1.1 **Certifications and Qualifications**

I certify that the tests performed in order to obtain the technical data presented in this application were performed by **DNB ENGINEERING, INC.** 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 and system components. The system must have the same interconnecting cables arranged in identical placement to that shown in the setup photos, 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 environment on the date of test may result in measurement repeatability difficulties.

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


Bryan Broadus Par. 1.1
Manager, Test Department
DNB ENGINEERING, INC.
Phone # (714) 870-7781

2.983(a) **Request For Type Acceptance**

Name of Applicant: TPL Communications
3370 San Fernando Rd. # 206
Los Angeles, CA 90065

Applicant is: ☒ Manufacturer
☐ Vendor
☐ Licensee
☐ Prospective Licensee
☐ Other

Name of Manufacturer: TPL Communications

2.983(b) **Equipment Description**

The EUT is an RF Power Amplifier.

Part Number: RS3-1DE-MSI

FCC ID: BBD3-1DE-S

2.983(c) **Anticipated Production Quantity**

☐ One Unit
☒ Multiple Units

2.983(d) **Technical Description**

See the Service Manual Included in Appendix B
herein for the complete description.

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

F3E

2.983(d)(2) **Frequency Range**

136 - 175 MHz

2.983(d)(3) **Operating Power Level**

80 to 120 Watts

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

<u>Rules Part</u>	<u>Maximum Power (Watts)</u>
Part 22	500 Watts
Part 90	500 Watts

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

Measurement	162 MHz (80 W)	162 MHz (120 W)
Driver Voltage	N/A V	N/A V
Final Voltage	12 V	12 V
A Current	7.7 A	11.6 A
B Current	N/A A	N/A A
Total Current	93 W	140 W

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

Please refer to Appendix B.

2.983(d)(7) **Circuit Diagram**

Refer to Figure in Appendix B.

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

See Appendix B

2.983(d)(9) **Tune-Up Procedure**

Refer to Appendix B.

Circuit Diagram
2.983(d)(7)

SEE FIGURE IN APPENDIX B

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 115 VAC	85% Voltage 97.75 VDC	115% Voltage 132.25 VDC
162 MHz	80.0 W	80.0 W	80.0 W
162 MHz	120.0 W	120.0 W	120.0 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

RS3-10E-M51
UNMODULATED CARRIER.

120 WATTS

MKR 162.000 0 MHz
50.80 dBm

ATTEN 10 dB

REF 62.0 dBm

HP

10 dB/

POS PK

OFFSET

62.0

dB

DL

50.8

dBm

MARKER

162.000 0 MHz

50.80 dBm

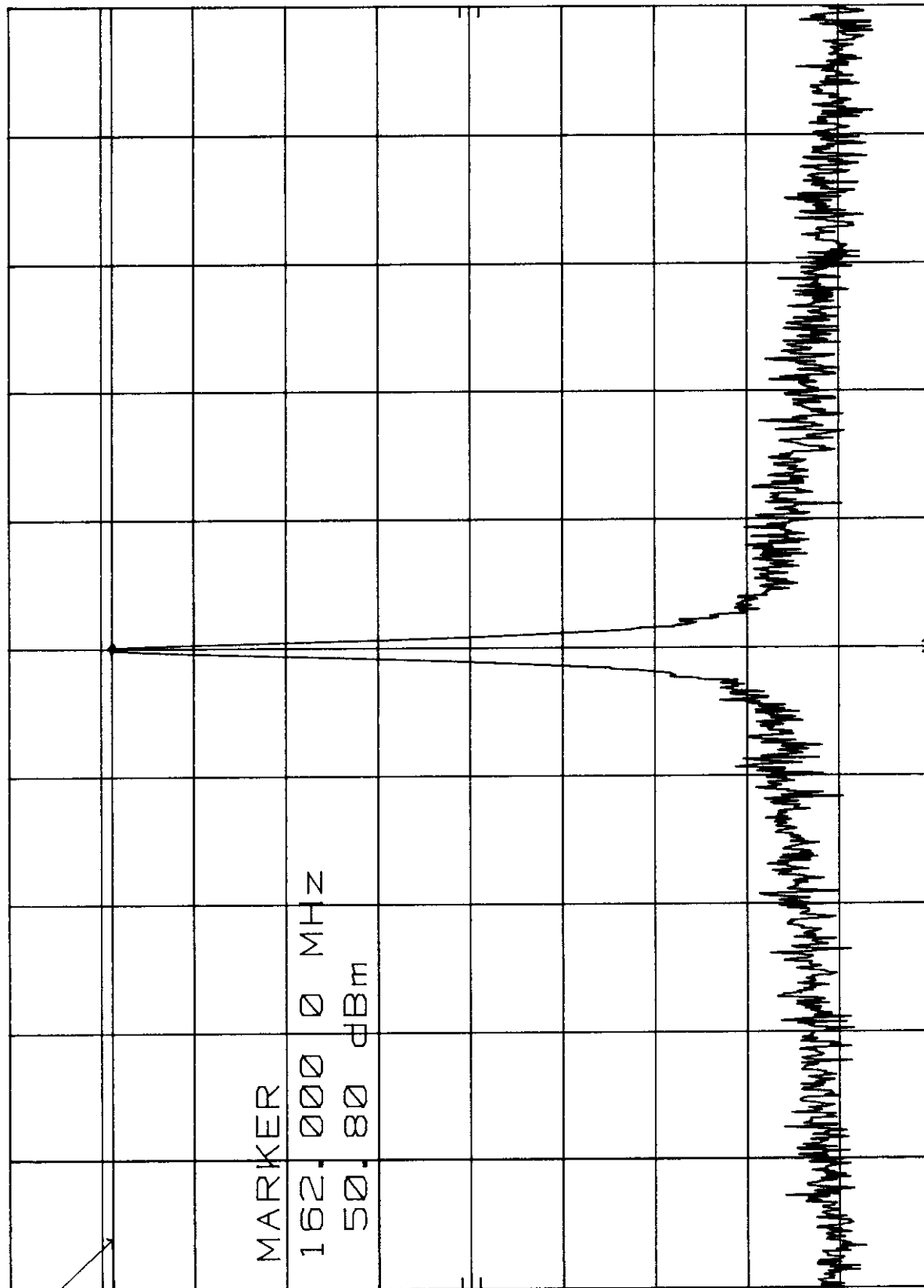
CENTER 162.000 MHz

RES BW 300 Hz

VBW 1 kHz

SPAN 100 kHz

SWP 3.00 sec



120 W477S
OCCUPIED BANDWIDTH PART 22

MRK 162.000 0 MHz
39.10 dBm

hp

10 dB/

POS PK

OFFSET

62.0
dB

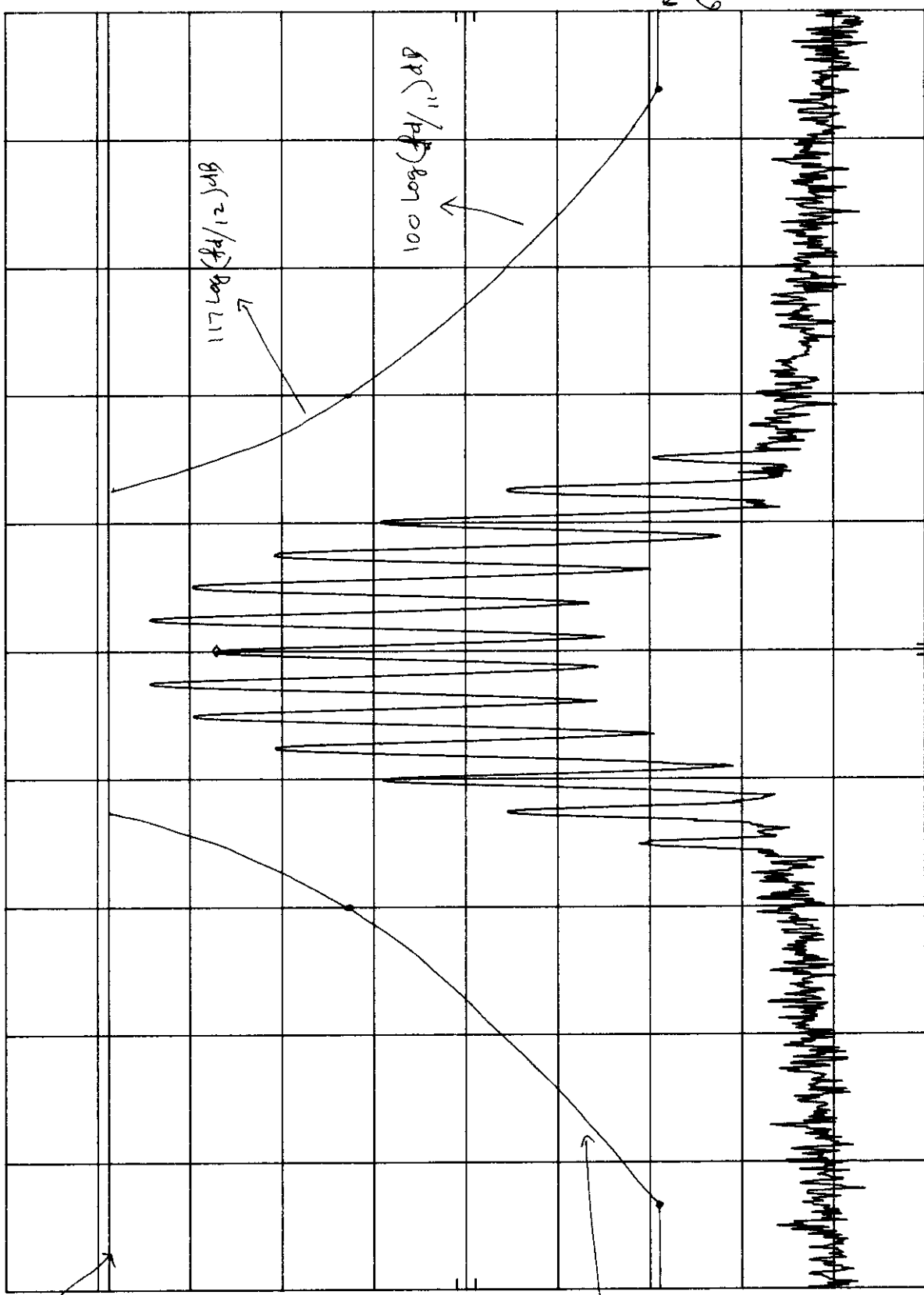
DL
50.8
dBm

FCC limit

ATTEN 10 dB

REF 62.0 dBm

CENTER 162.000 MHz
RES BW 300 Hz
SPAN 100 KHz
SWP 3.00 sec



120 WATTS
 1000 Hz - 1000 Hz
 OCCUPIED BANDWIDTH PART 90

MKR 162.000 0 MHz
 39.10 dBm

ATTEN 10 dB

REF 62.0 dBm

hp

10 dB/

POS PK

OFFSET

62.0

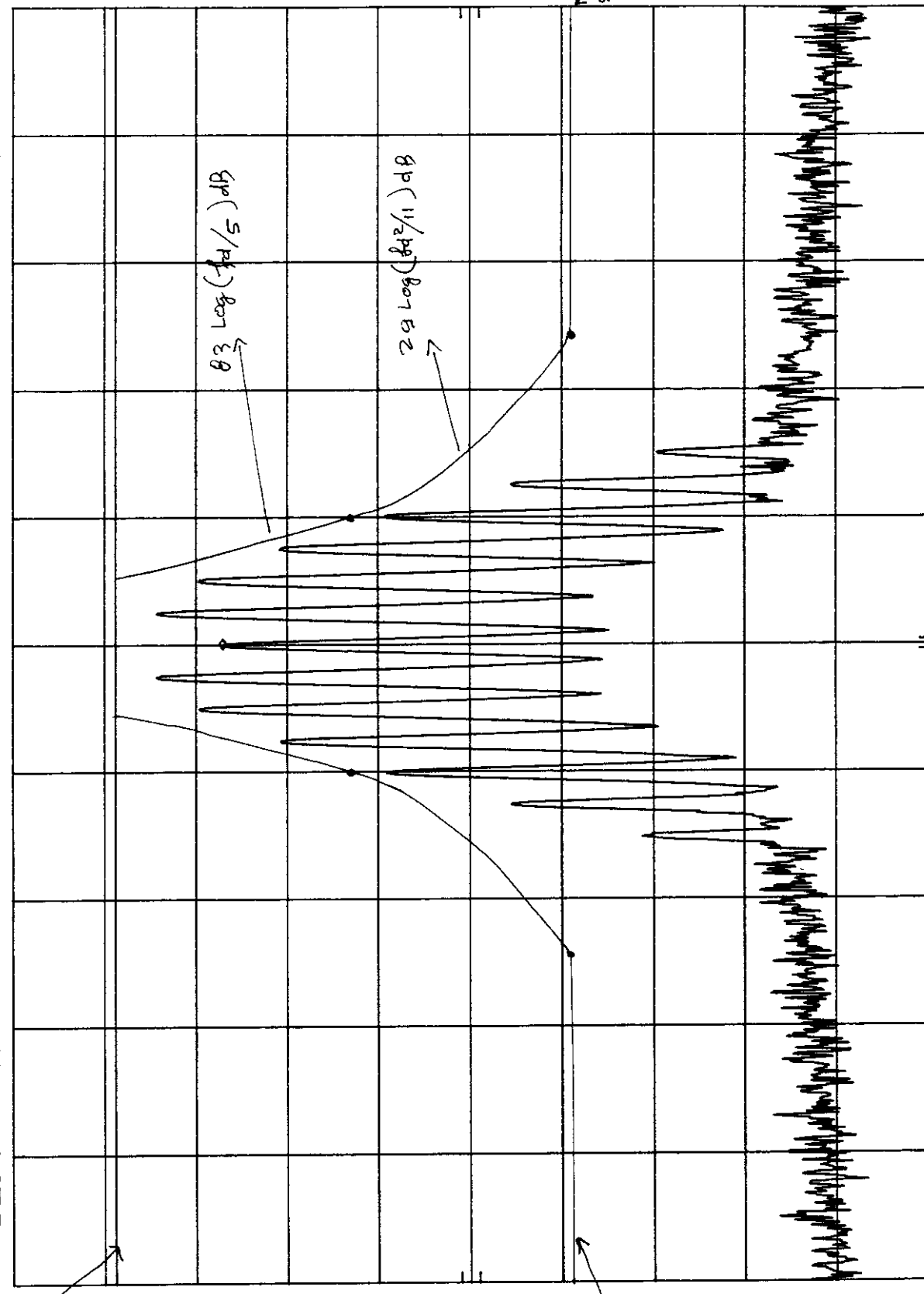
dB

DL

50.8

dBm

Fa LIMIT



SPAN 100 KHz
 SWP 3.00 sec

VBW 1 KHz

CENTER 162.000 MHz
 RES BW 300 Hz

80 WATTS

R399-1DE-M51
UNMODULATED CARRIER

~~HP~~

REF 62.0 dBm ATTN 10 dB MKR 162.000 0 MHz 49.00 dBm

10 dB/

POS PK

OFFSET
62.0

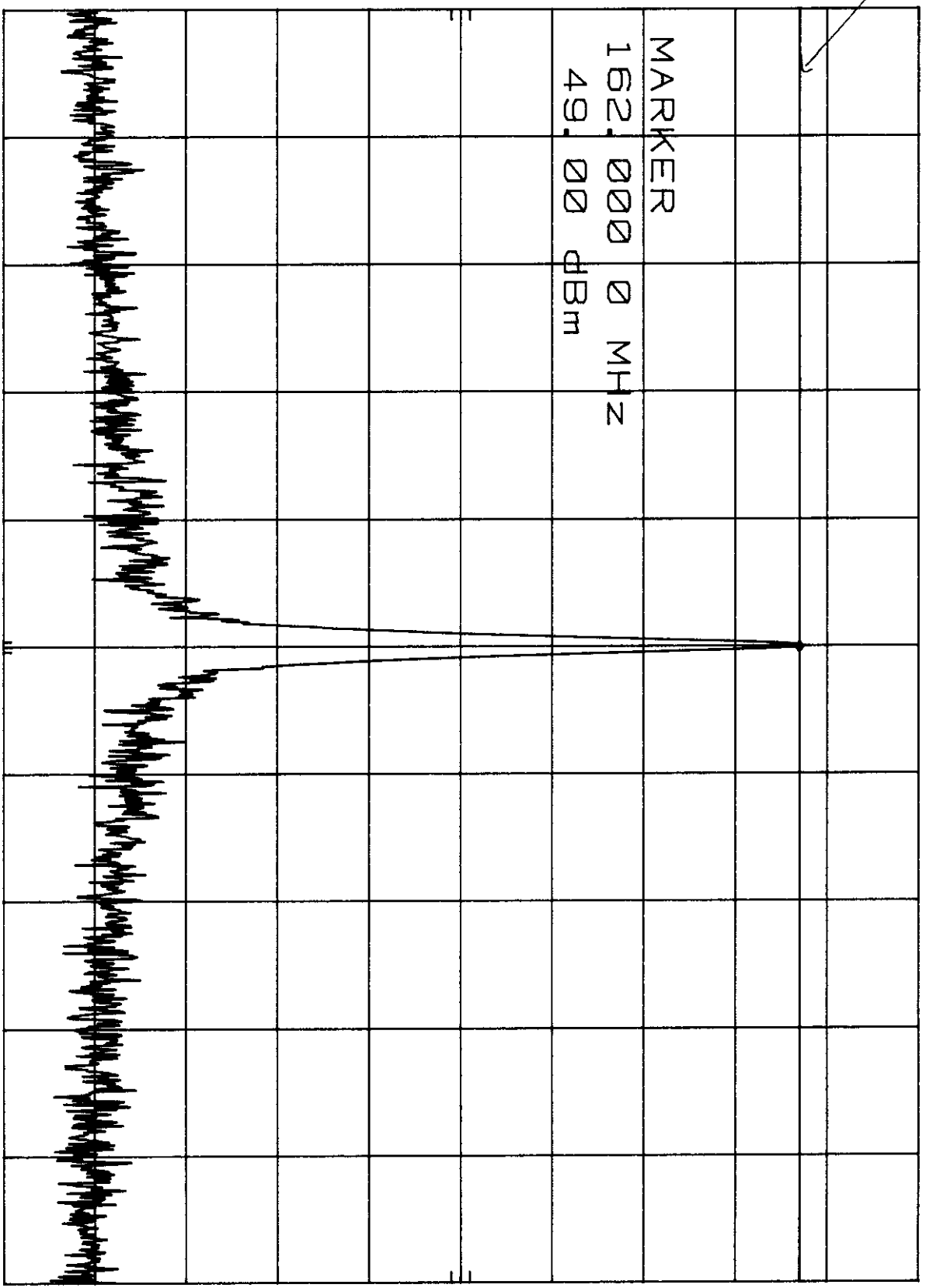
dB

DL

49.0
dBm

MARKER

162.000 0 MHz
49.00 dBm



CENTER 162.000 MHz RES BW 300 Hz VBW 1 kHz SWP 3.00 sec SPAN 100 kHz

80 Watts

RS3 - IDE - MS1
OCCUPIED BANDWIDTH PART 22

REF 62.0 dBm ATTEN 10 dB MKR 162.000 0 MHz 37.20 dBm

10 dB/

POS PK

OFFSET

62.0

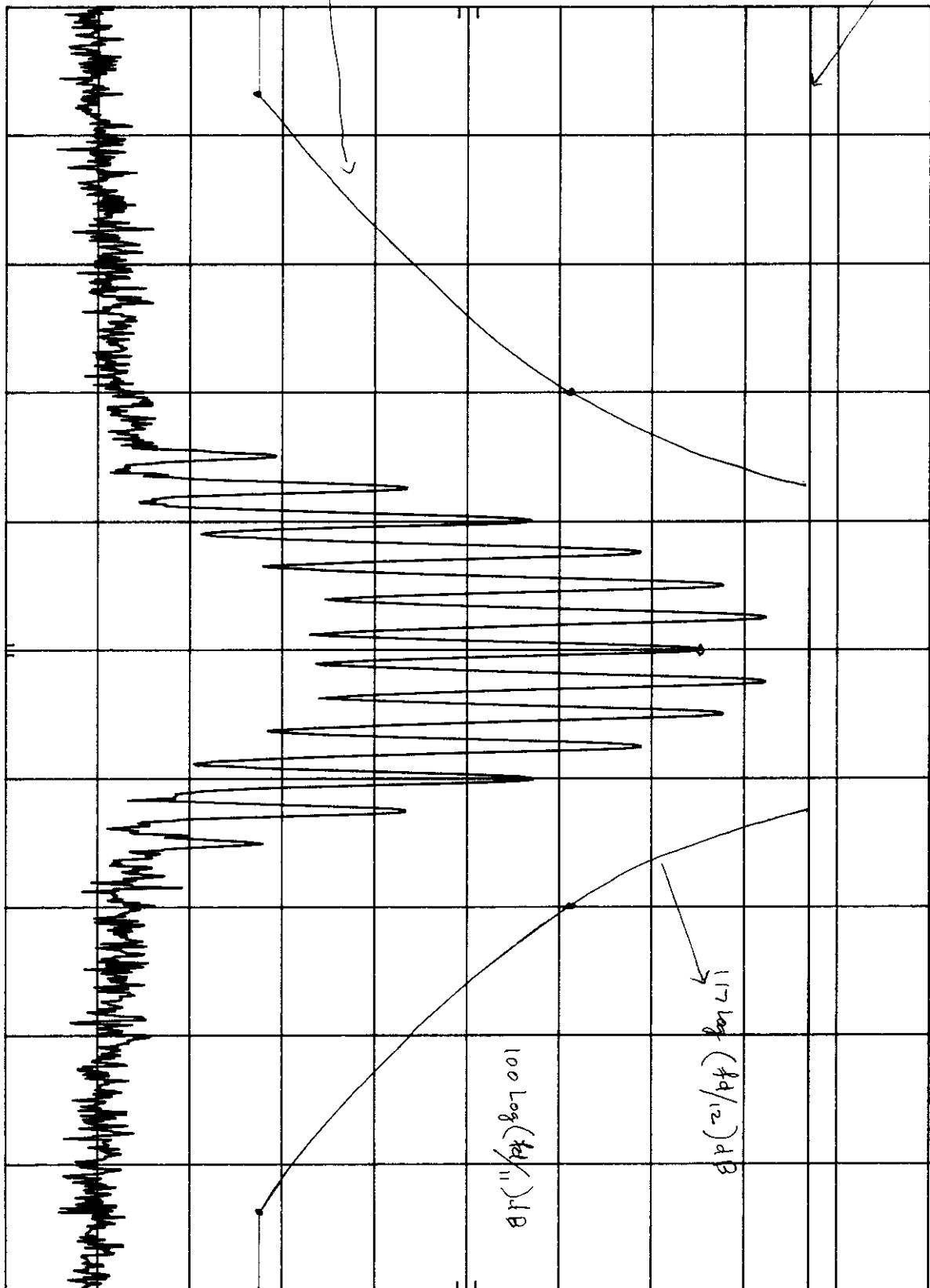
dB

DL

49.0

dBm

FCC Limit



CENTER 162.000 MHz

RES BW 300 Hz

VBW 1 kHz

SPAN 100 kHz

SMP 3.00 sec

80 Watts

RS3-IDE-MS1
OCCUPIED BANDWIDTH PART 90

REF 62.0 dBm ATTEN 10 dB

MKR 162.000 0 MHz
37.20 dBm

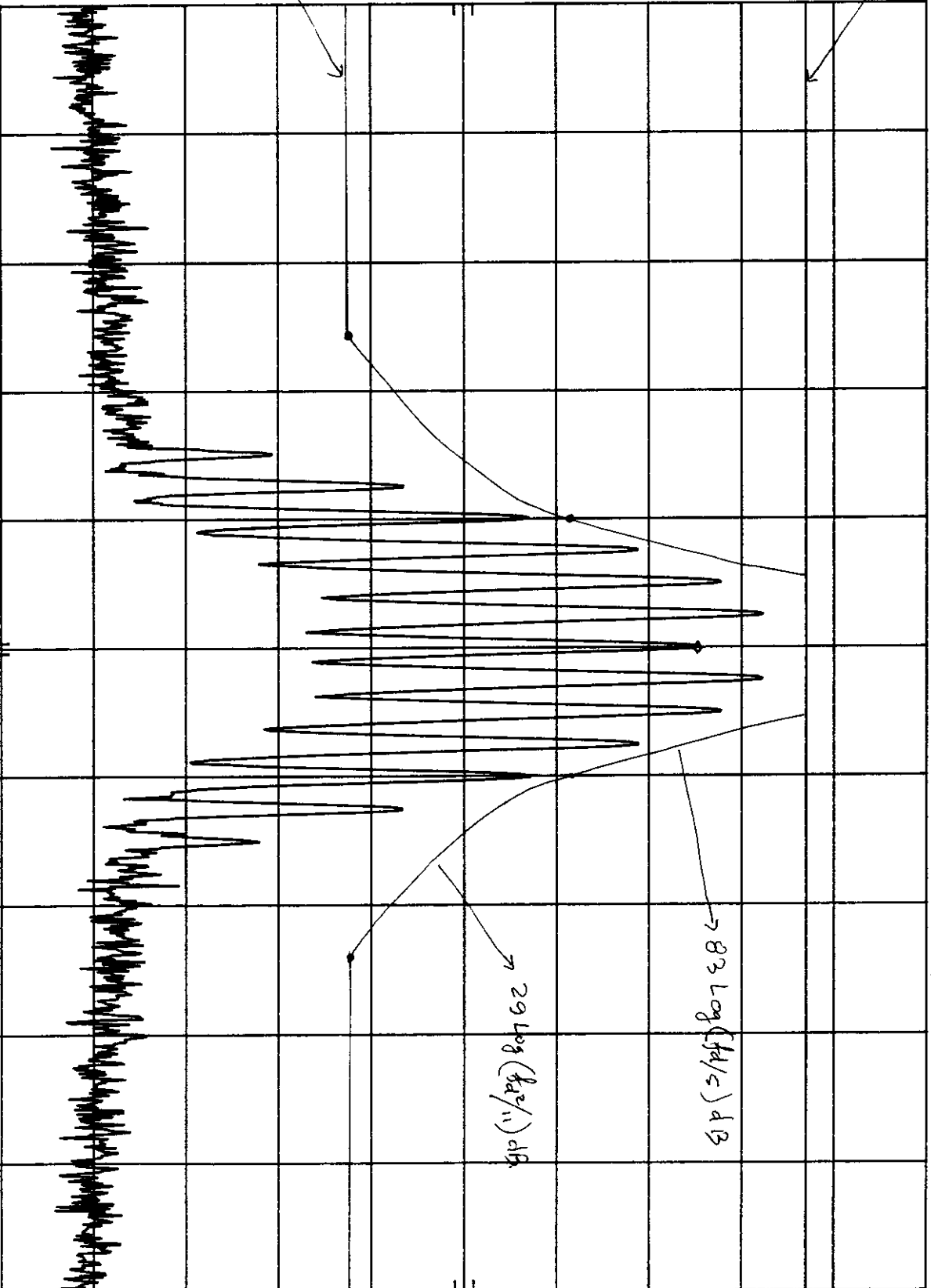
10 dB/

POS PK

OFFSET
62.0
dB

DL
49.0
dBm

FCC UNIT



CENTER 162.000 MHz

RES BW 300 Hz

VBW 1 kHz

SPAN 100 kHz
SWP 3.00 sec

FOR OUTPUT 120 WATTS.

DRIVER OUTPUT: UNMODULATED CARRIER

MKR 162.000 0 MHz

41.30 dBm

hp

REF 62.0 dBm ATTEN 10 dB

10 dB/

POS PK

OFFSET

62.0

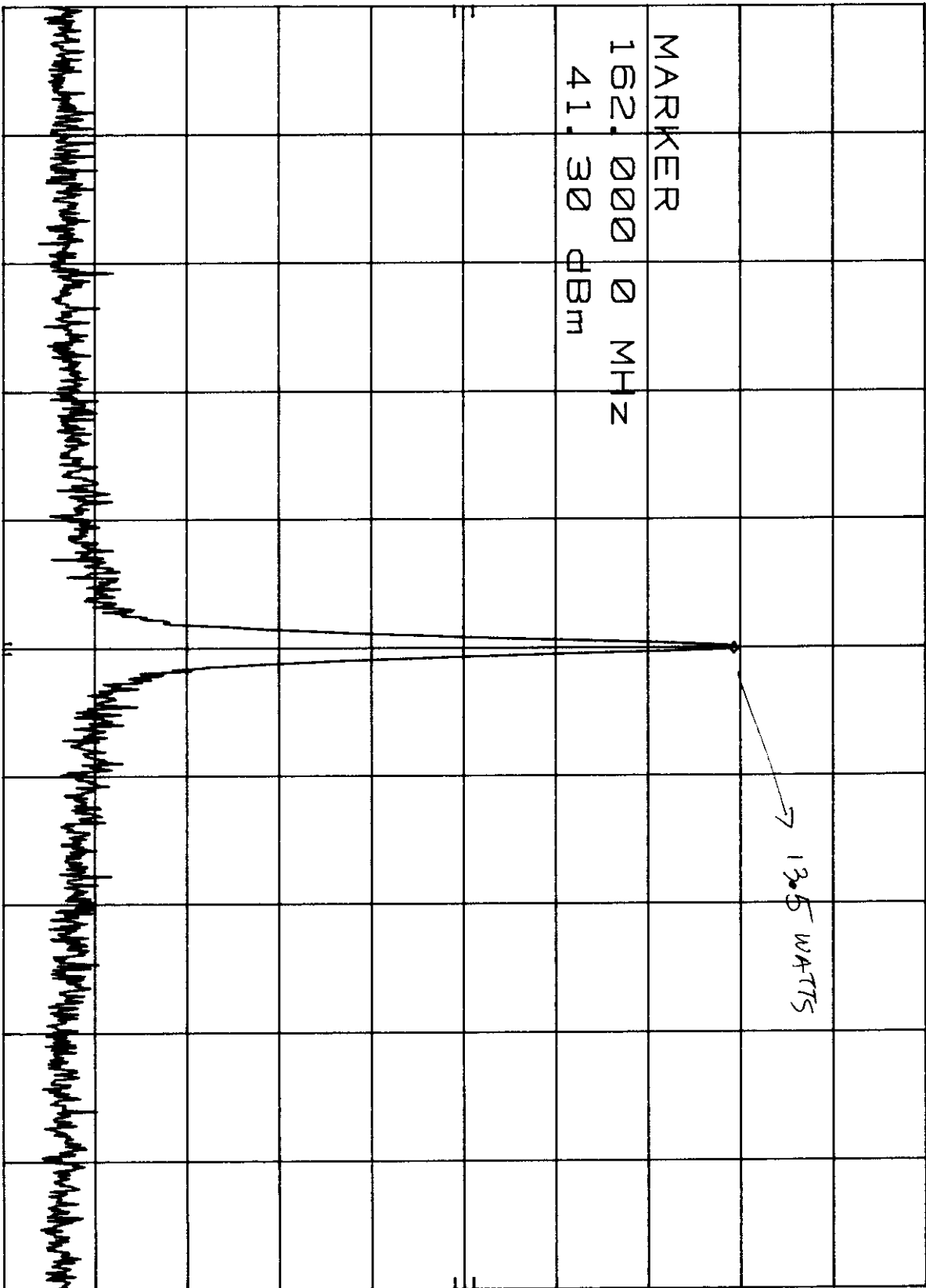
dB

MARKER

162.000 0 MHz

41.30 dBm

→ 120 WATTS



CENTER 162.000 MHz

RES BW 300 Hz

VBW 1 kHz

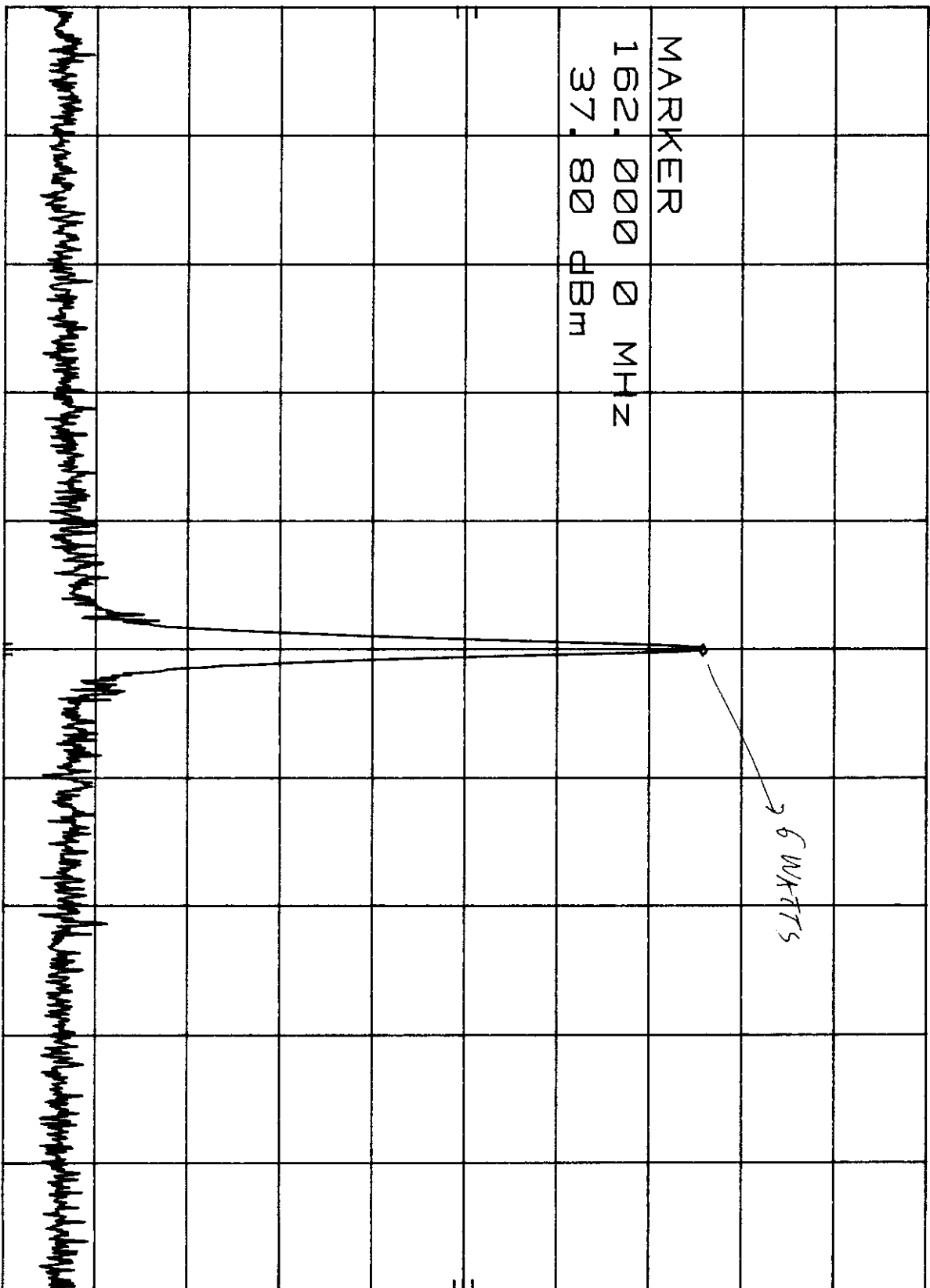
SPAN 100 kHz

SWP 3.00 sec

FOR OUTPUT 80 WATTS
DRIVER OUTPUT: UNMODULATED CARRIER

MR 162.000 0 MHz
37.80 dBm

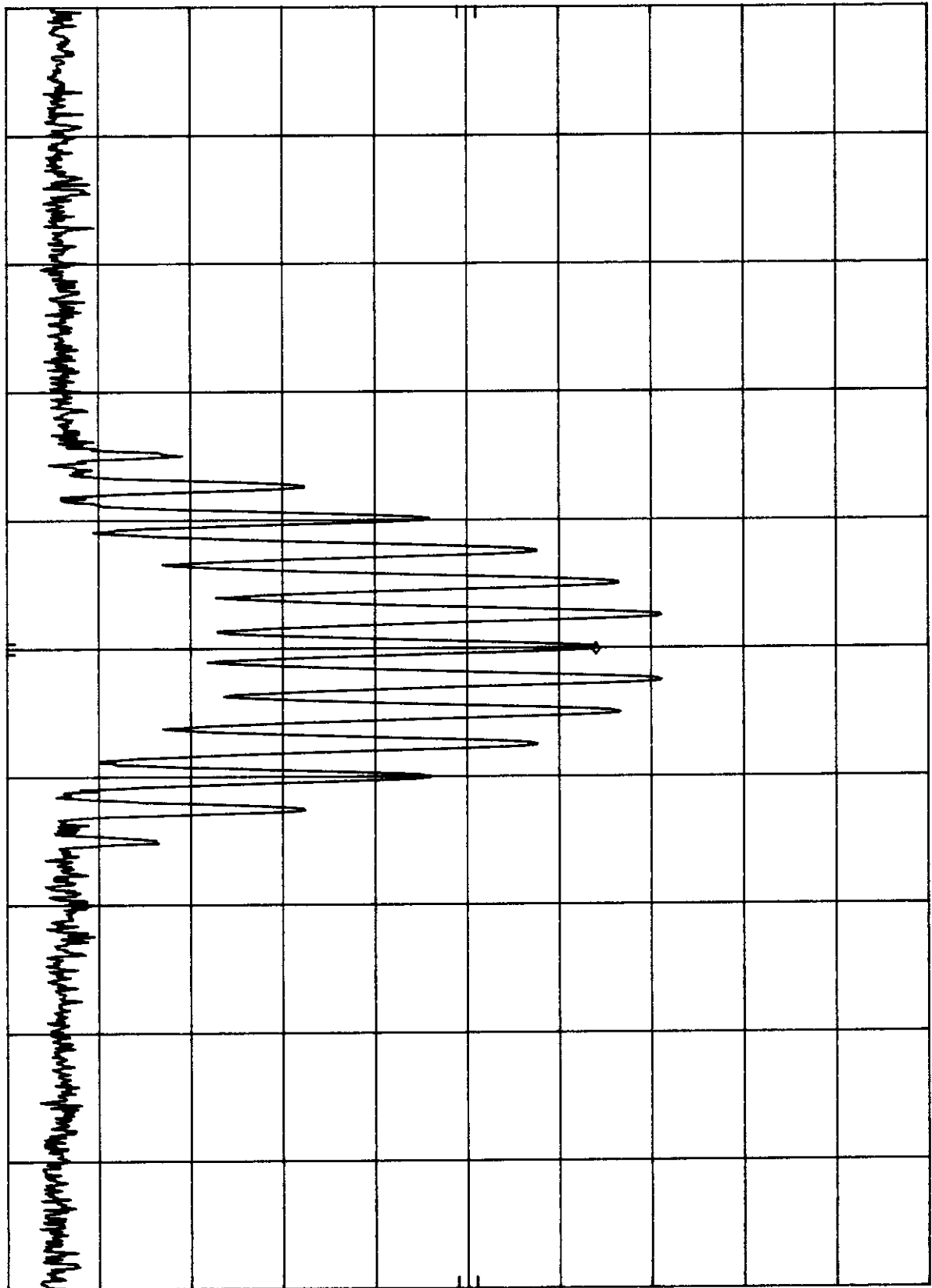
10 dB/
POS PK
OFFSET
62.0
dB



FOR OUTPUT 80 WATTS
DELIVER OUTPUT: MODULATED CARRIER

MR 162.000 0 MHz
26.00 dBm

hP REF 62.0 dBm ATTEN 10 dB
10 dB/
POS PK
OFFSET
62.0
dB



CENTER 162.000 MHz SPAN 100 kHz
RES BW 300 Hz VBW 1 kHz SWP 3.00 sec

FOR OUTPUT 120 WATTS
DRIVER OUTPUT: MODULATED CARRIER

HP REF 62.0 DBm ATTEN 10 DB MKR 162.000 0 MHZ 29.60 DBm

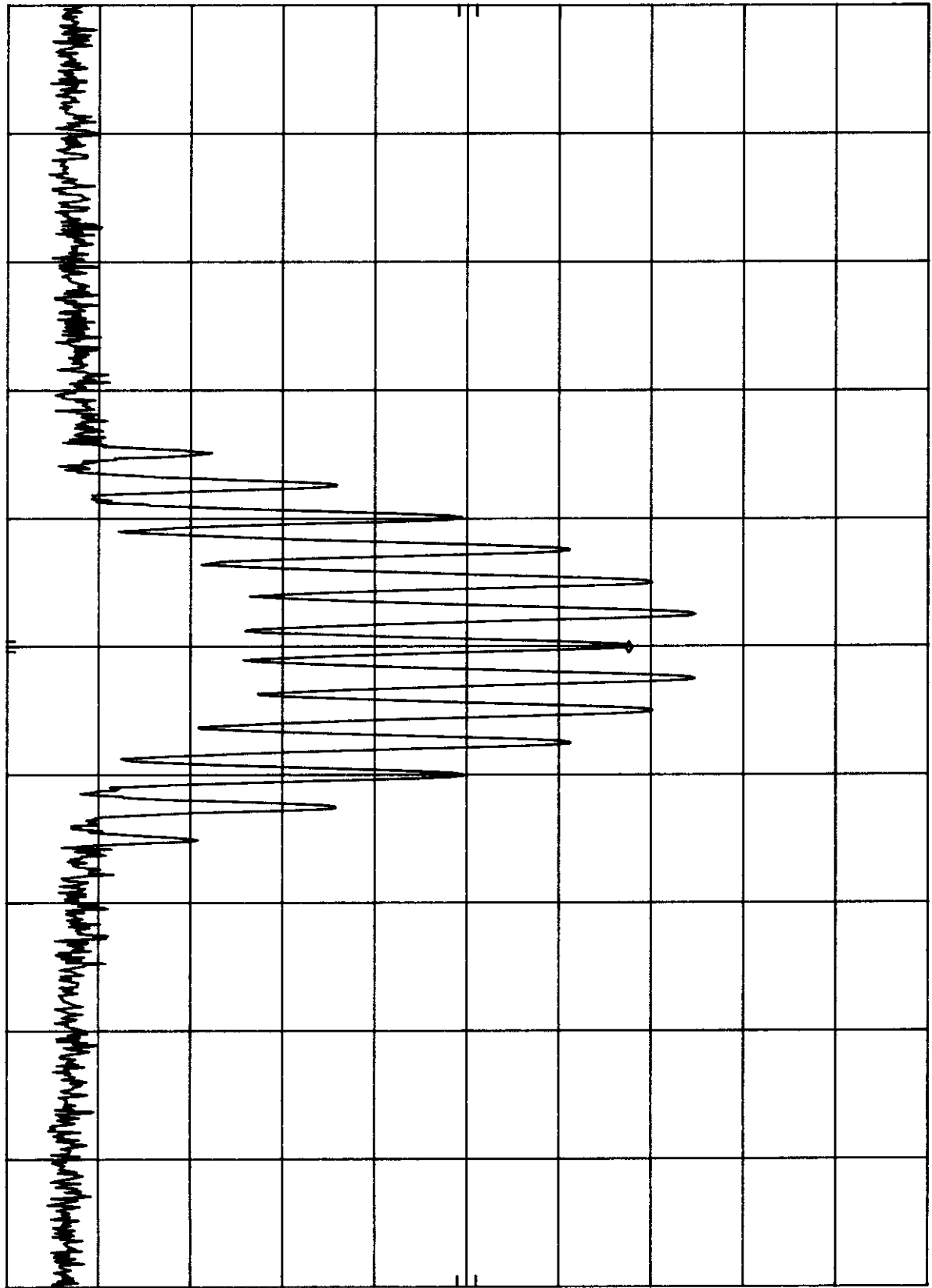
10 DB/

POS PK

OFFSET

62.0

dB



CENTER 162.000 MHZ SPAN 100 KHZ
RES BW 300 HZ VBW 1 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:

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

Where P_o = output in watts

$$= 43 + 10 \log_{10} (80)$$

$$= 62.0 \text{ dB}$$

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

Connect the equipment as shown in FIGURE 4.

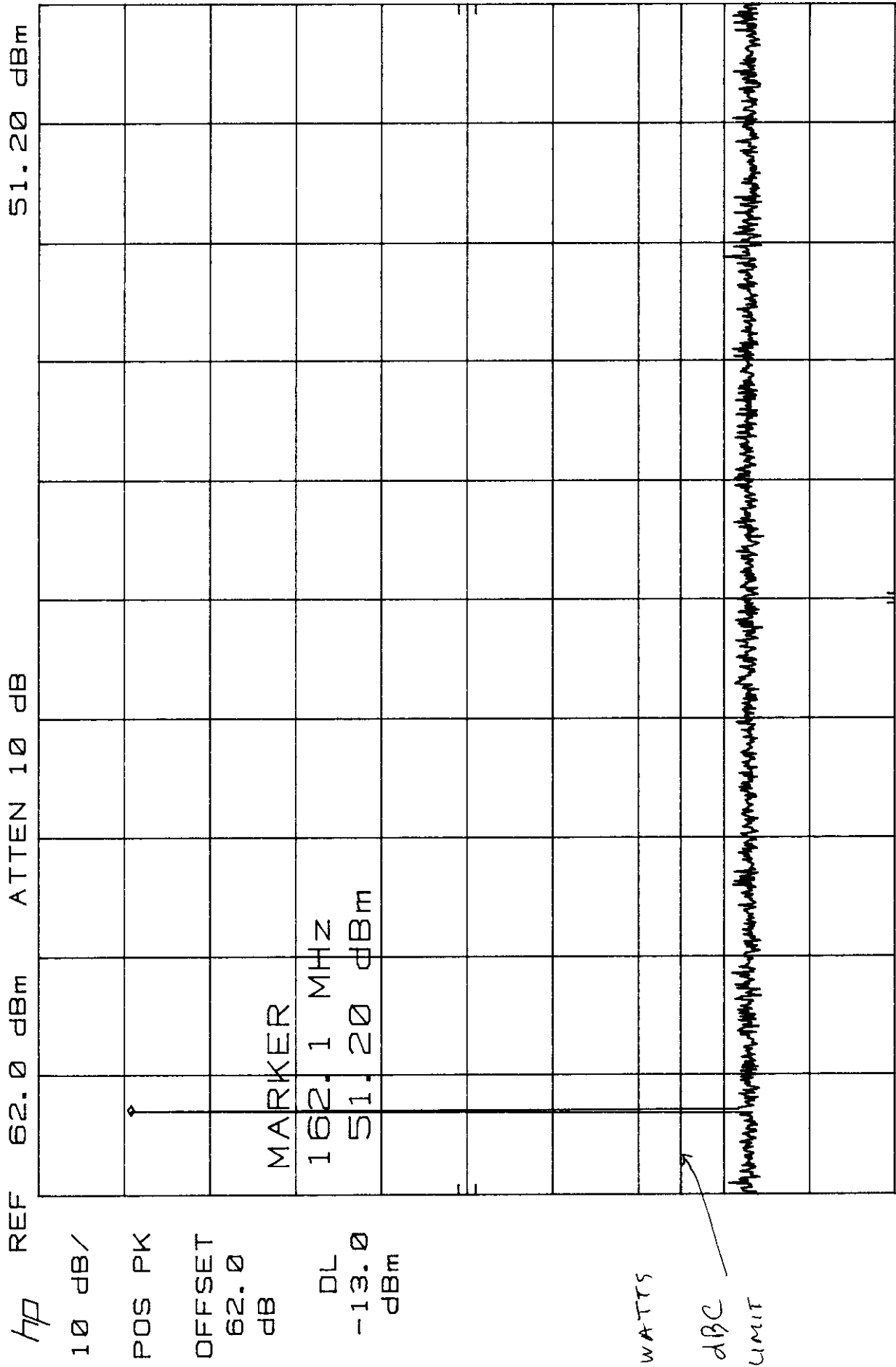
Adjust the audio oscillator so that the frequency deviation of the transmitter is 5 kHz at a modulation frequency of 2.5 kHz. Adjust the spectrum analyzer to display the modulated carrier.

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.

K83 - 10E - MS1
 ANTENNA CONDUCTED SPURIOUS
 MKR 162.1 MHz
 51.20 dBm



K83 - 10E - M137
 ANTENNA CONDUCTED SPURIOUS

HP REF 62.0 dBm ATTN 10 dB

10 dB/

POS PK

OFFSET

62.0
 dB

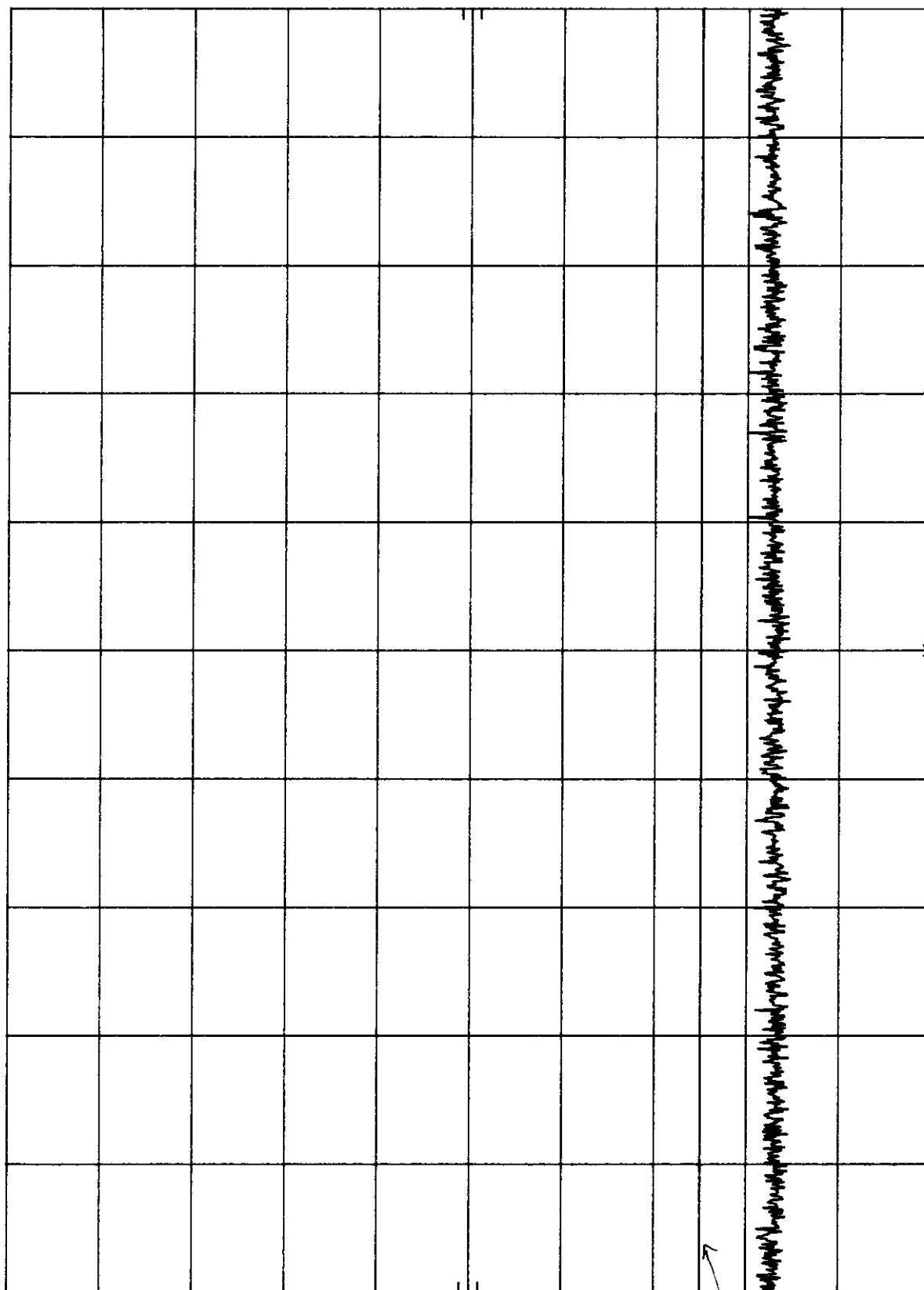
DL
 -13.0
 dBm

120 WATTS

63.8 dBc

FCC LIMIT

START 1.00 GHz RES BW 30 KHz VBW 100 KHz STOP 2.00 GHz SWP 3.00 sec



ANTENNA CONDUCTED SPURIOUS

MKR Δ 162.0 MHz
-64.30 dB

ATTEN 10 dB

REF 62.0 dBm

HP

10 dB/

POS PK

OFFSET

62.0

dB

DL

-13.0

dBm

START 100 MHz

RES BW 30 kHz

VBW 100 kHz

STOP 1.000 GHz

SWP 2.70 sec

MARKER Δ

162.0 MHz

-64.30 dB

80 WATTS

62 dBc

FCC UNIT.

RSB - IDE - M51
ANTENNA CONDUCTED SPURIOUS

hp REF 62.0 dBm ATTEN 10 dB

10 dB/

POS PK

OFFSET

62.0

dB

DL

-13.0

dBm

80 WATTS

62 dBc

FCC LIMIT.

START 1.00 GHz

RES BW 30 KHz

VBW 100 KHz

STOP 2.00 GHz

SWP 3.00 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 communications desired. The reduction in the level of these spurious emissions will not effect 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.

$$\text{Spurious attenuation dB} = 10 \log \frac{\text{Po Watts}}{\text{Calc spurious pwr}}$$

Test Results: See TABLE I.

All Radiated spuirious emissions are below the FCC specifications.

SPURIOUS RADIATED SIGNAL MEASUREMENTS

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

Date 3-11-95 Pass X Fail (at Freq.)
 UT Power Amplifier Operating Power 120 Watts
 Part No. R25-115-MST Operating Mode Subcarrier
 Serial No. Test Engineer Bryan Beaudou

FREQUENCY TUNED TO 162 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 CARR- IER (dBc)
	162						148.2	
H	324	72.6	17	1.3	22	76.3		71.9
H	486	79.8	19.7	2	22	80.1		68.1
H	648	78.0	21.2	2.4	22	79.6		68.6
H	810	71.7	22.5	3.2	22	75.4		72.8
H	972	69.1	24.8	3.8	22	75.7		72.5
H	1134	77.4	24.5	2.2	30	74.1		74.1
H	1296	74.7	25.0	2.3	30	72.0		76.2
H	1458	75.6	25.7	2.6	30	73.9		74.3
H	1620	71.1	26.3	2.7	30	70.1		78.1

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

R_o = Amplifier Output Impedance (Ohms) $R_o = 50 \Omega$

P_o = Amplifier Output Power (Watts) $P_o = 120 \text{ Watts}$

$$\text{Conversion From } \mu\text{V/m to dB}\mu\text{V/m} = (\mu\text{V/m}) \log \times 20$$

$$(25.796, \dots) \times 20 = 148.22 \text{ dB}\mu\text{V/m}$$

$$.333 (50 \times 120)^{1/2} = \mu\text{V/m}$$

$$\mu\text{V/m} = 25.79$$

SPURIOUS RADIATED SIGNAL MEASUREMENTS

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

Date 3-11-98 Pass X Fail (at Freq.)
 Unit Power Amplifier Operating Power 120 Watts
 Part No. RS3-1DE-MST Operating Mode Saturated
 Serial No. Test Engineer Bryan Brannous

FREQUENCY TUNED TO 162 MHz

ANT POL	FREQ MHz	SPECTRUM ANALYZER (dBμV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP GAIN (dB)		FUND FIELD STRENGTH dBμV/m	SPUR BELOW CARR- IER (dBc)
	162						148.2	
V	324	82.0	17	1.3	22	78.3		69.9
V	486	81.9	19.7	2	22	81.6		66.6
V	648	75.6	21.2	2.4	22	77.2		71.0
V	810	69.4	22.5	3.2	22	73.1		75.1
V	972	62.9	24.8	3.8	22	74.5		73.7
V	1134	73.3	24.5	2.2	30	72.0		76.2
V	1296	71.2	25.0	2.3	30	76.5		71.7
V	1458	73.4	25.7	2.6	30	71.7		76.5
V	1620	76.6	26.3	2.7	30	69.8		78.4

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

$$R_o = \text{Amplifier Output Impedance (Ohms)} \quad R_o = 50 \Omega$$

$$P_o = \text{Amplifier Output Power (Watts)} \quad P_o = 120 \text{ Watts}$$

$$\text{Conversion From } \mu\text{V/m to dB}\mu\text{V/m} = (\mu\text{V/m}) \log \times 20$$

$$(25,790,000)^{1/2} \times 20 = 148.22 \text{ dB}\mu\text{V/m}$$

$$.333 (50 \cdot 120)^{1/2} = \text{V/m}$$

$$\text{V/m} = 25.79$$

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.

2.983 (g) **Photographs and/or drawings showing equipment construction techniques.**

Note: The Main Circuit Board shown in these photos has no components on the reverse side.

- Photo 1 Main Circuit Board (Overall View)
- Photo 2 Main Circuit Board (View A)
- Photo 3 Main Circuit Board (View B)
- Photo 4 External Front View
- Photo 5 External Side View
- Photo 6 External Rear View

2.983(h) **Description and Test Data For Encoding Device(s)**

This section does not apply.

2.983(i) **Type acceptance Data For an External Power
Amplifier Used In Amateur Radio Service - Part 97**

This section does not apply