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

Table of Contents

(Continued)

1.0 ADMINISTRATIVE DATA

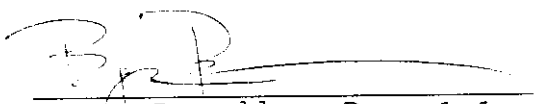
1.1 Certifications and Qualifications

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 Broaddus 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:
_X_ 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
_X_ 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

Rules Part	Maximum Power (Watts)
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:

	POWER OUTPUT		
Frequency	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 Bandwith per 2.989**

Definition: Occupied bandwith, that is the frequency bandwith 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.

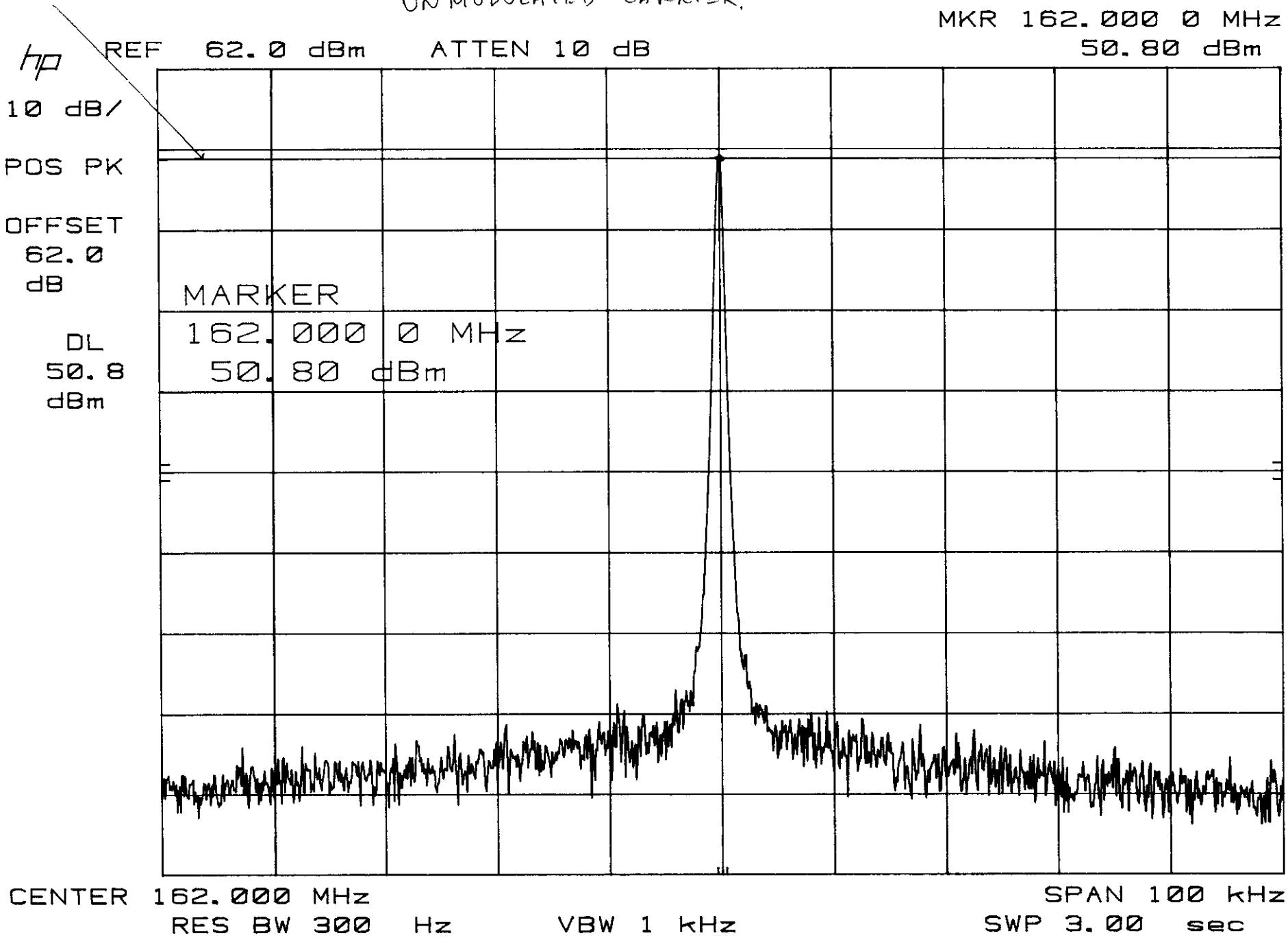
Test Results: See Plots following Figure 3.

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

120 WATTS

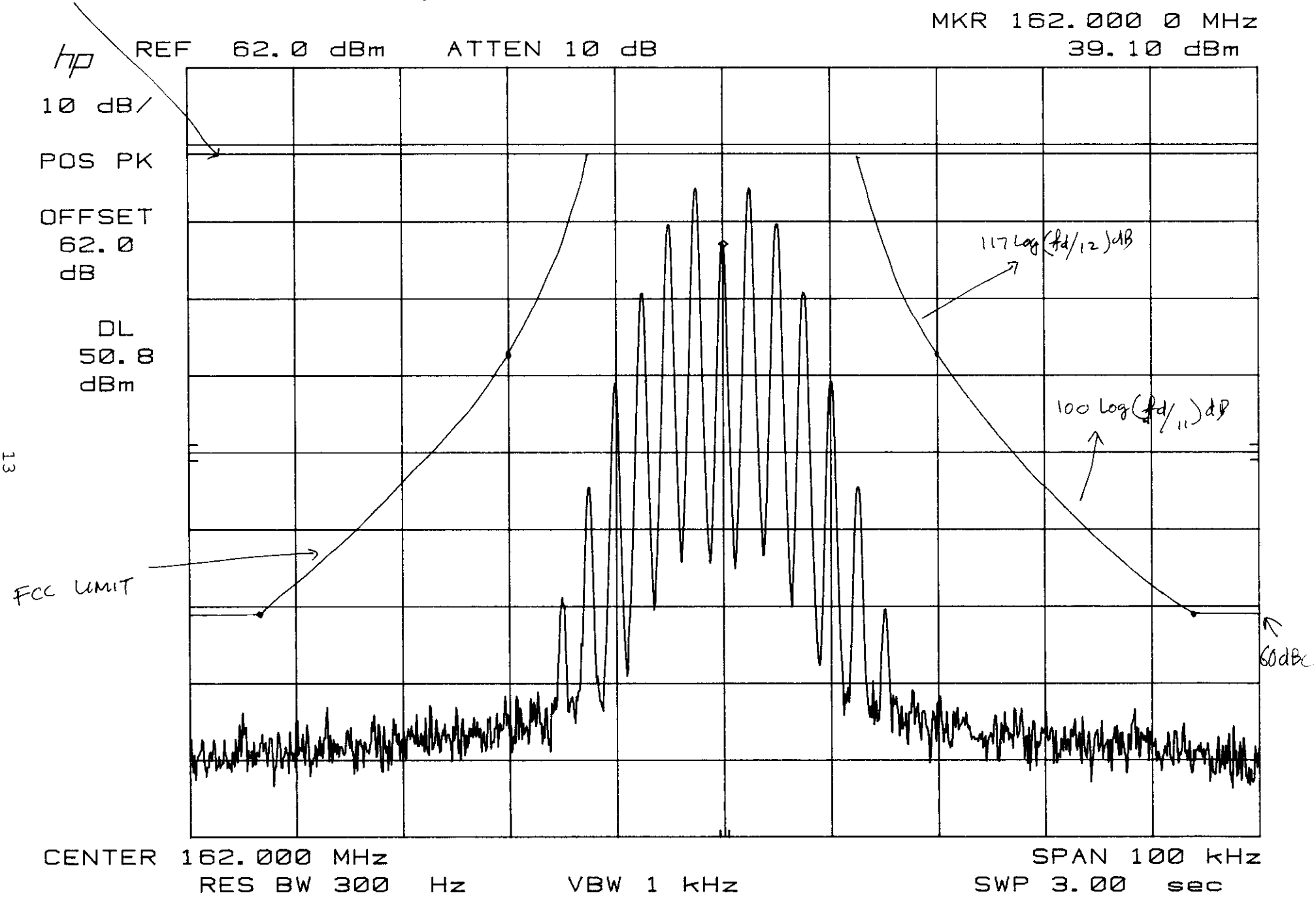
RS3 - IDE - MST

UNMODULATED CARRIER.



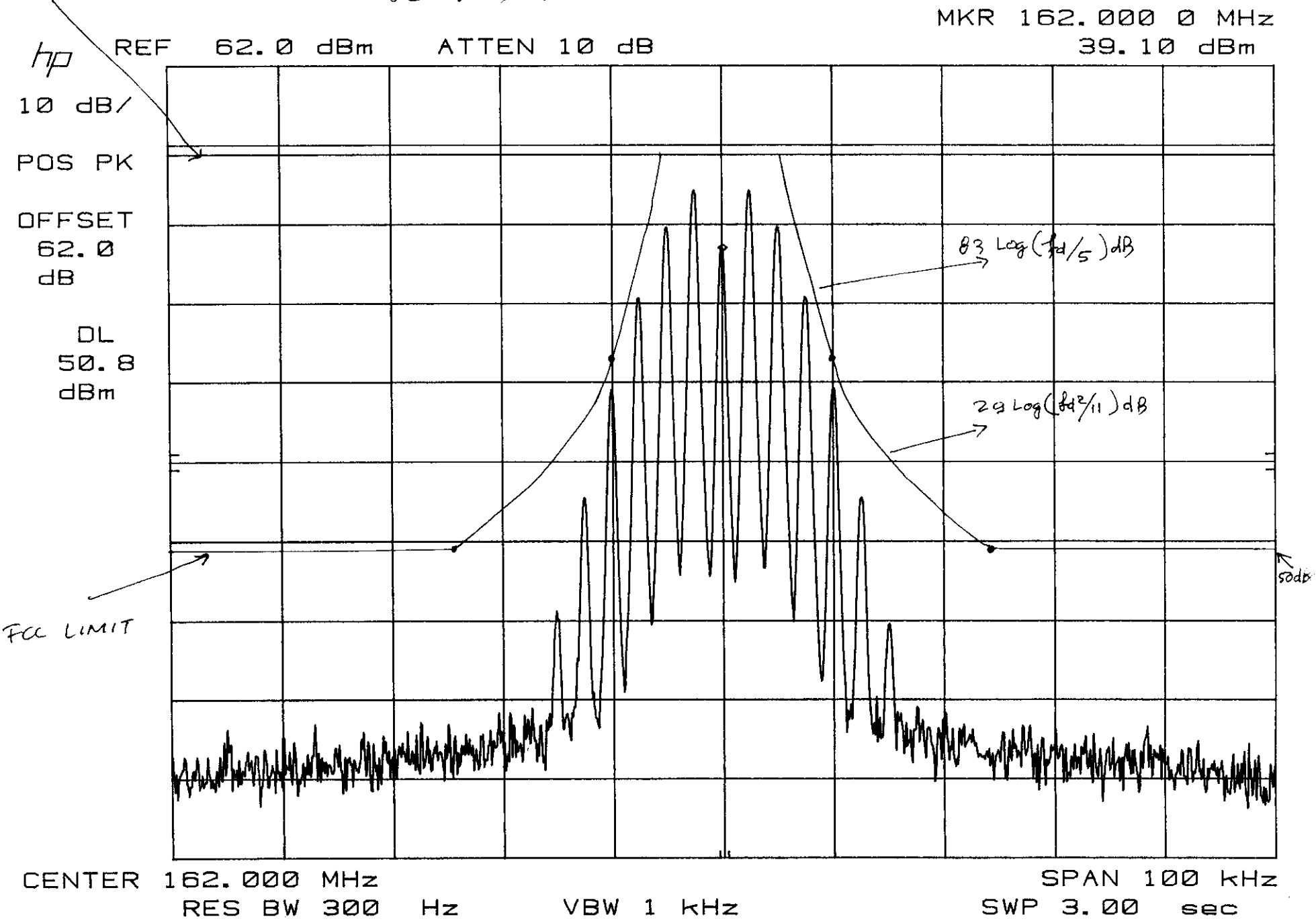
120 WATTS

RS / OCCUPIED BANDWIDTH PART 22



120 WATTS

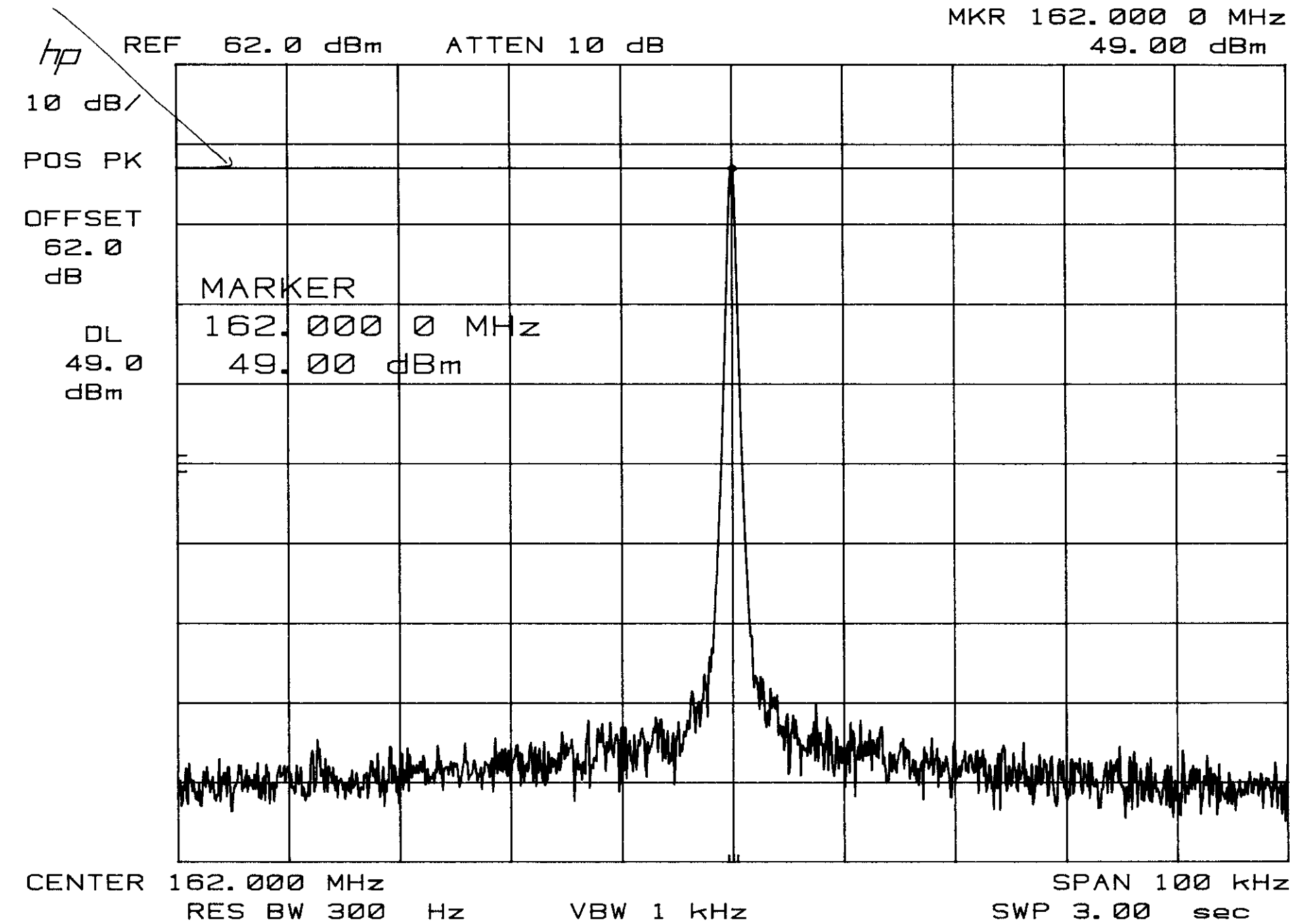
RS93-1DL-1 [illegible]
OCCUPIED BANDWIDTH PART 90



RS3-IDE-MS1

UNMODULATED CARRIER

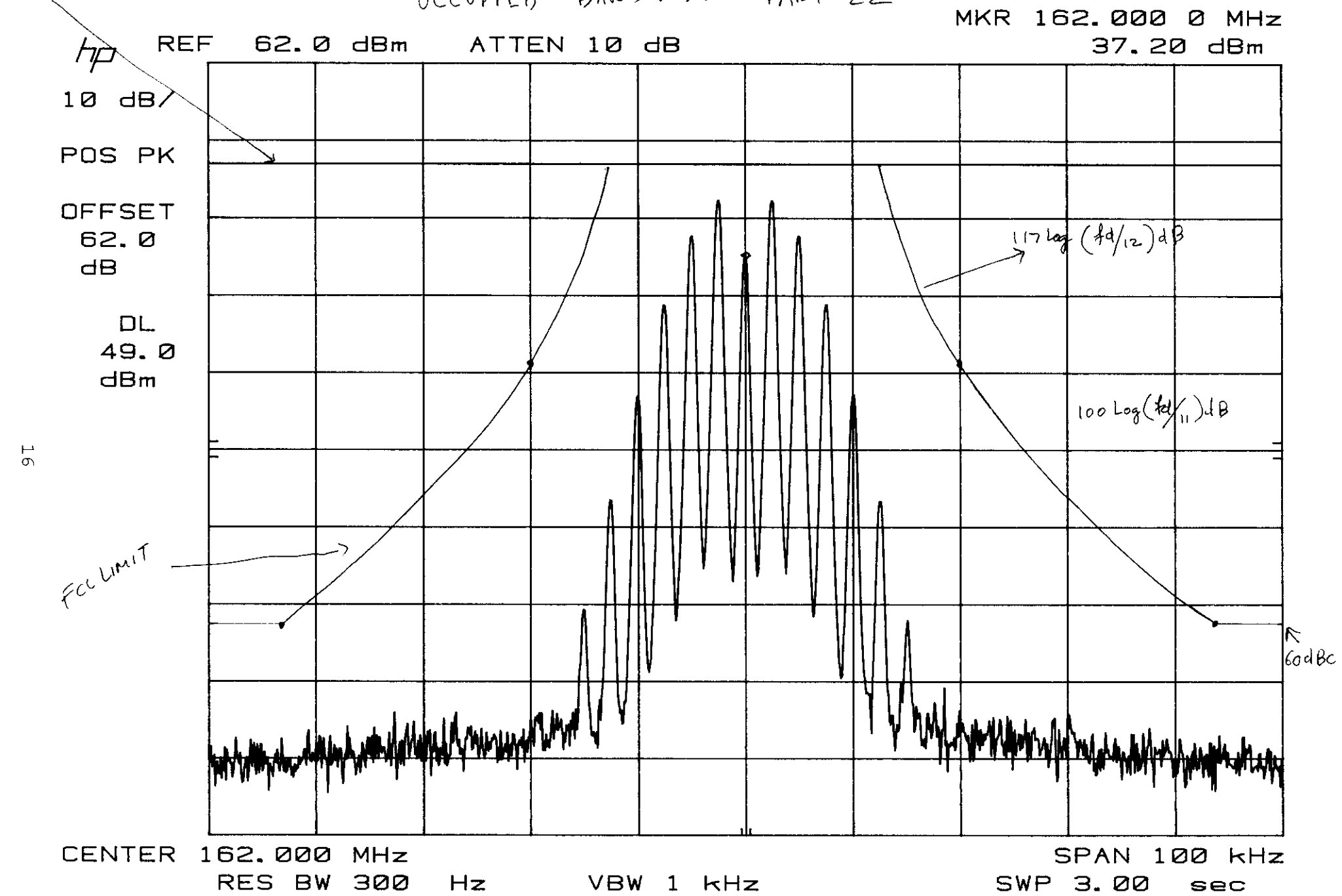
80 WATTS



80 WATTS

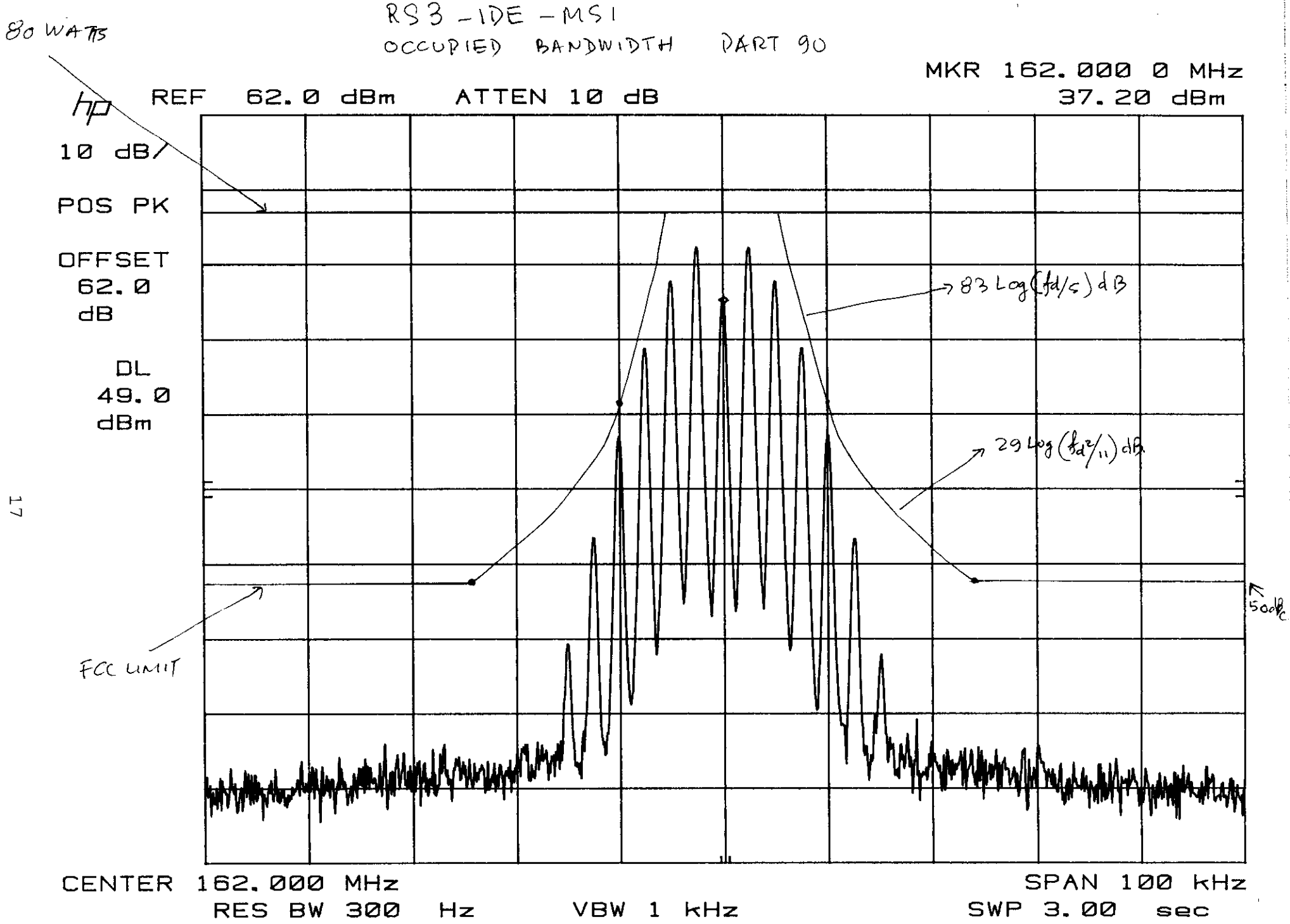
RS3-IDE - MS1

OCCUPIED BANDWIDTH PART 22



RS3 - IDE - MS1

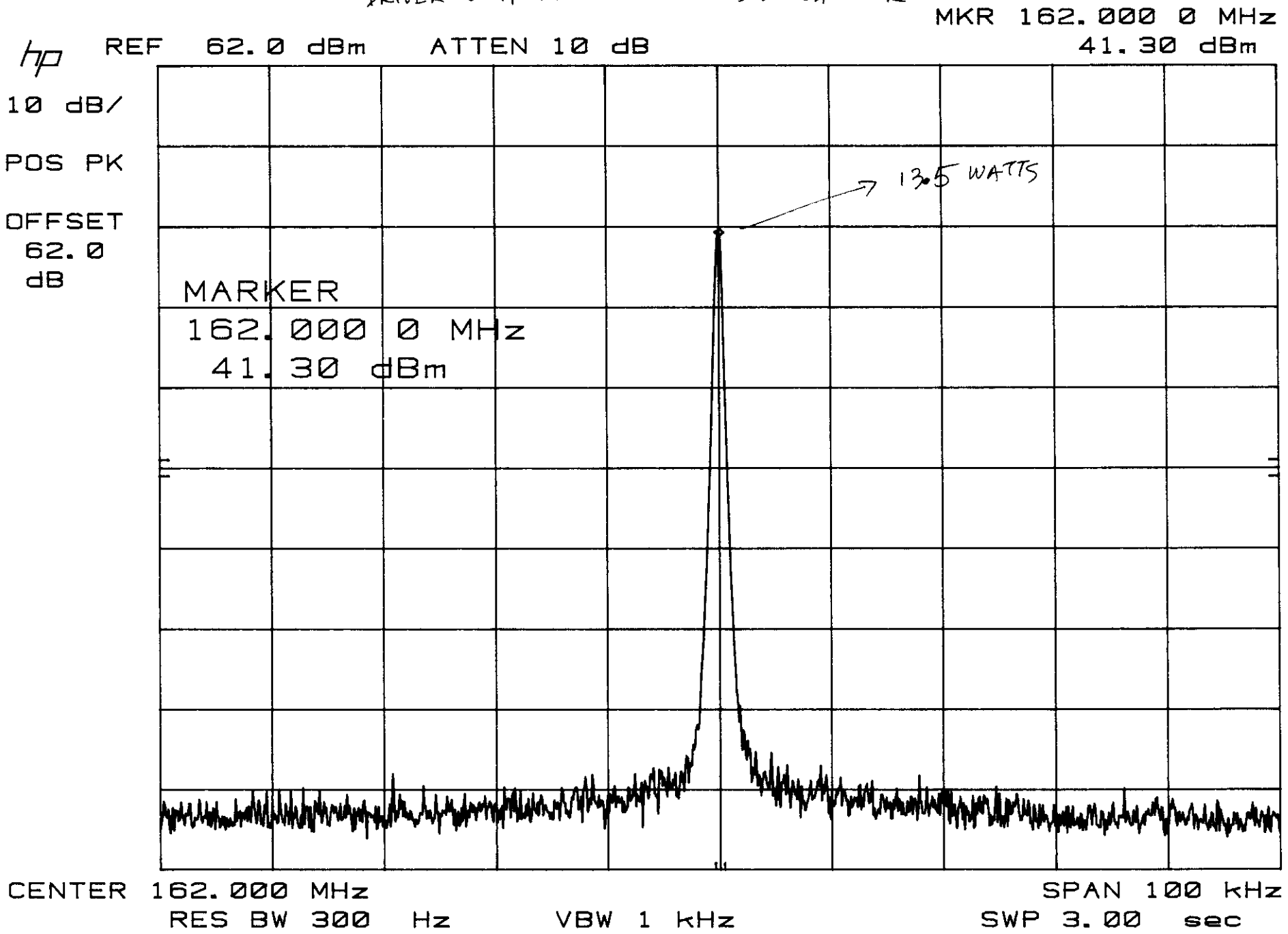
OCCUPIED BANDWIDTH PART 90



17

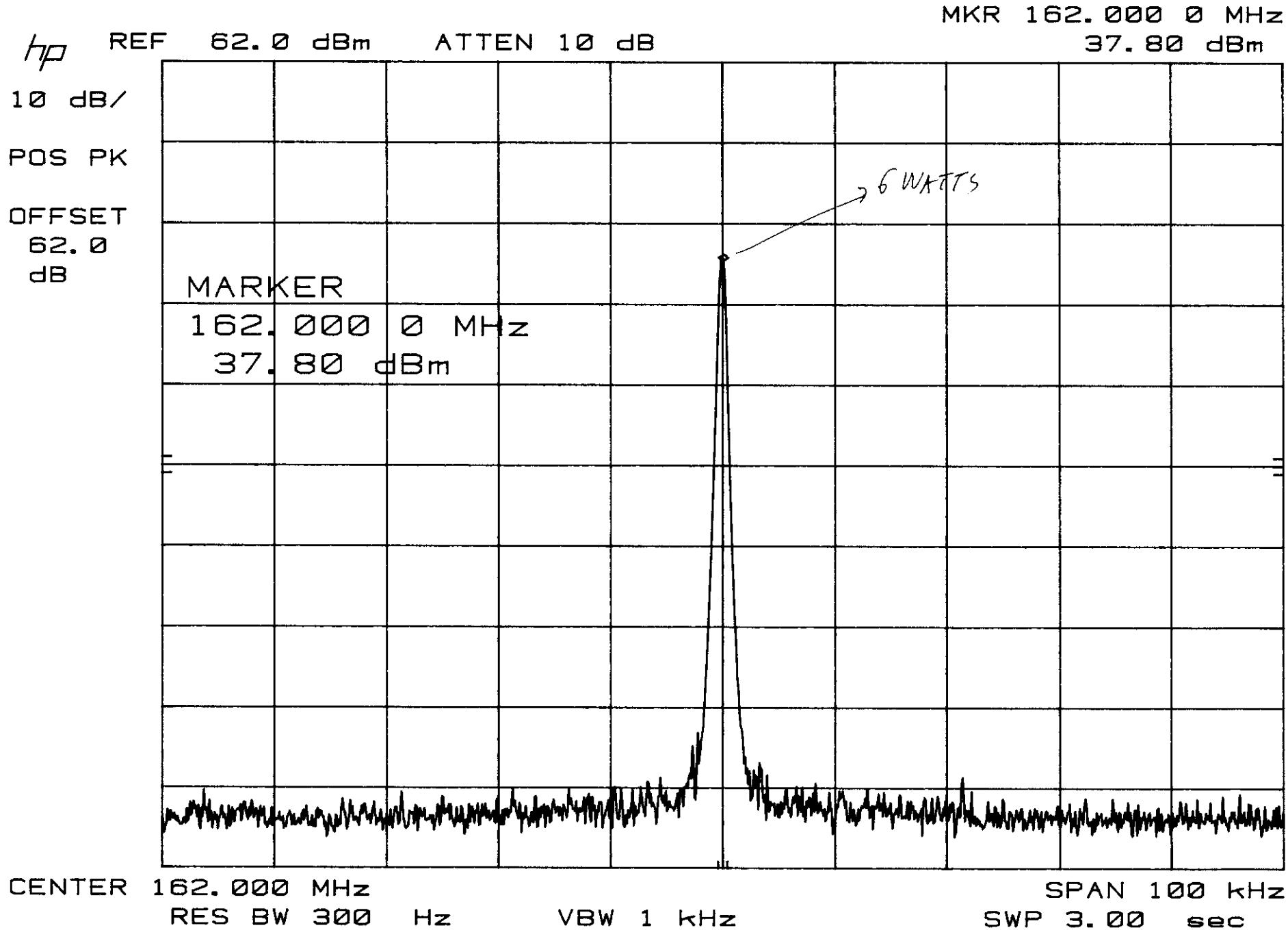
FOR OUTPUT 120 WATTS.

DRIVER OUTPUT: UNMODULATED CARRIER



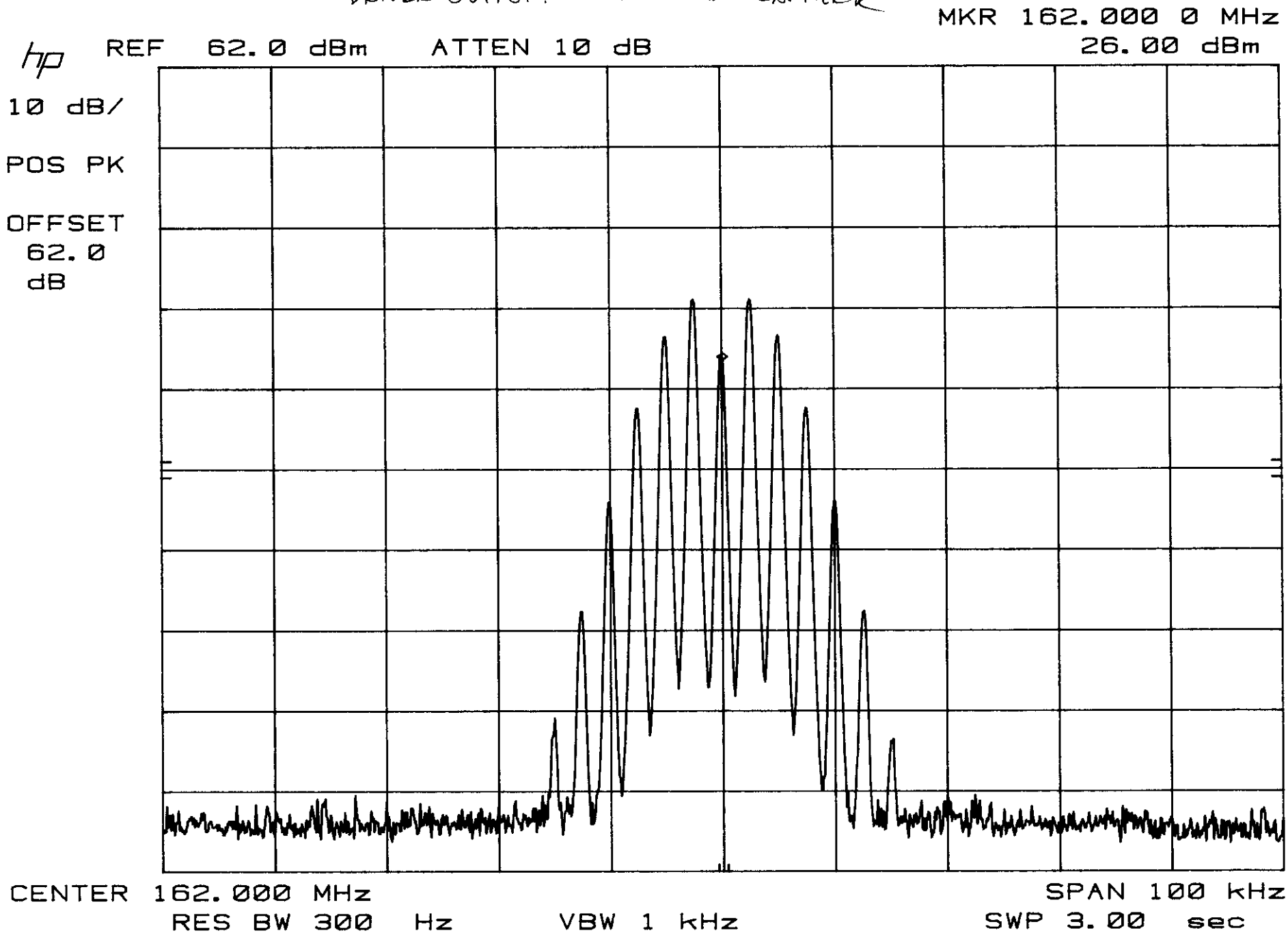
FOR OUTPUT 80 WATTS

DRIVER OUTPUT : UNMODULATED CARRIER

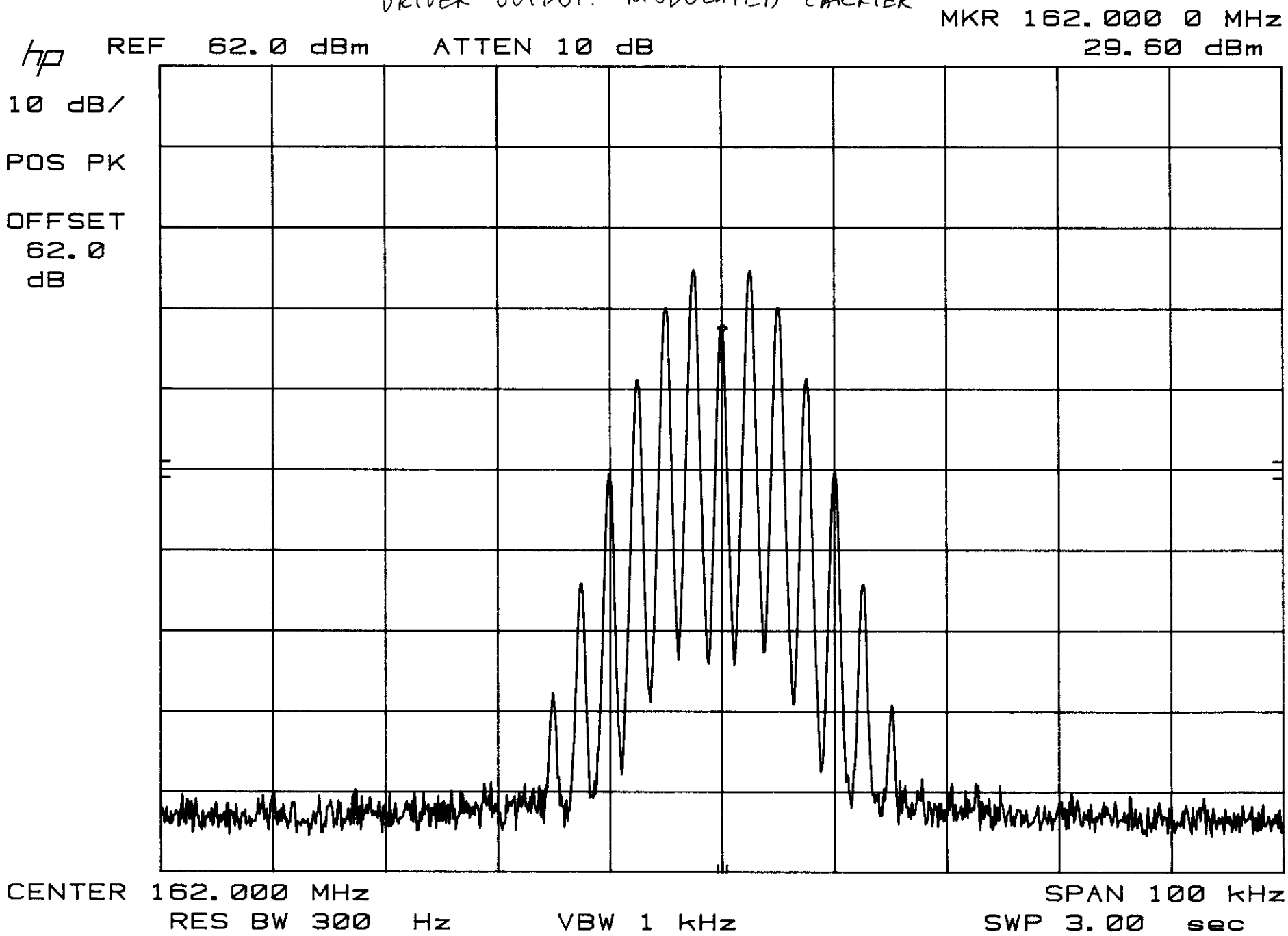


FOR OUTPUT 80 WATTS

DRIVER OUTPUT: MODULATED CARRIER



FOR OUTPUT 120 WATTS
DRIVER OUTPUT: MODULATED CARRIER



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:

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

Where Po = output in watts

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

$= 62.0$ 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.

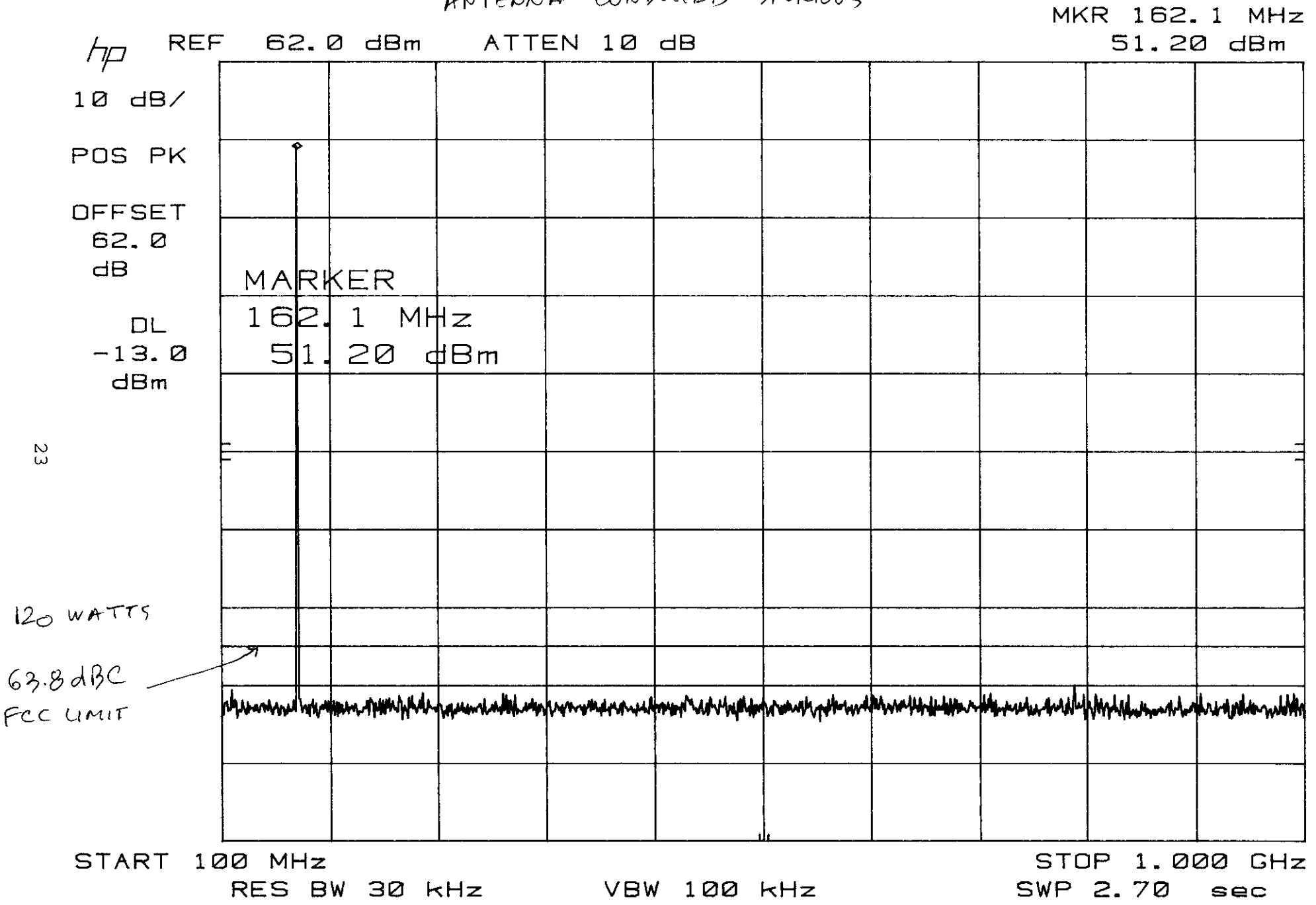
Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10th harmonic of the carrier frequency.

Test Results: See Plots Following Figure 4.

All spuirious antenna conducted emissions are below the FCC specifications.

RSB - TDE - MST

ANTENNA CONDUCTED SPURIOUS



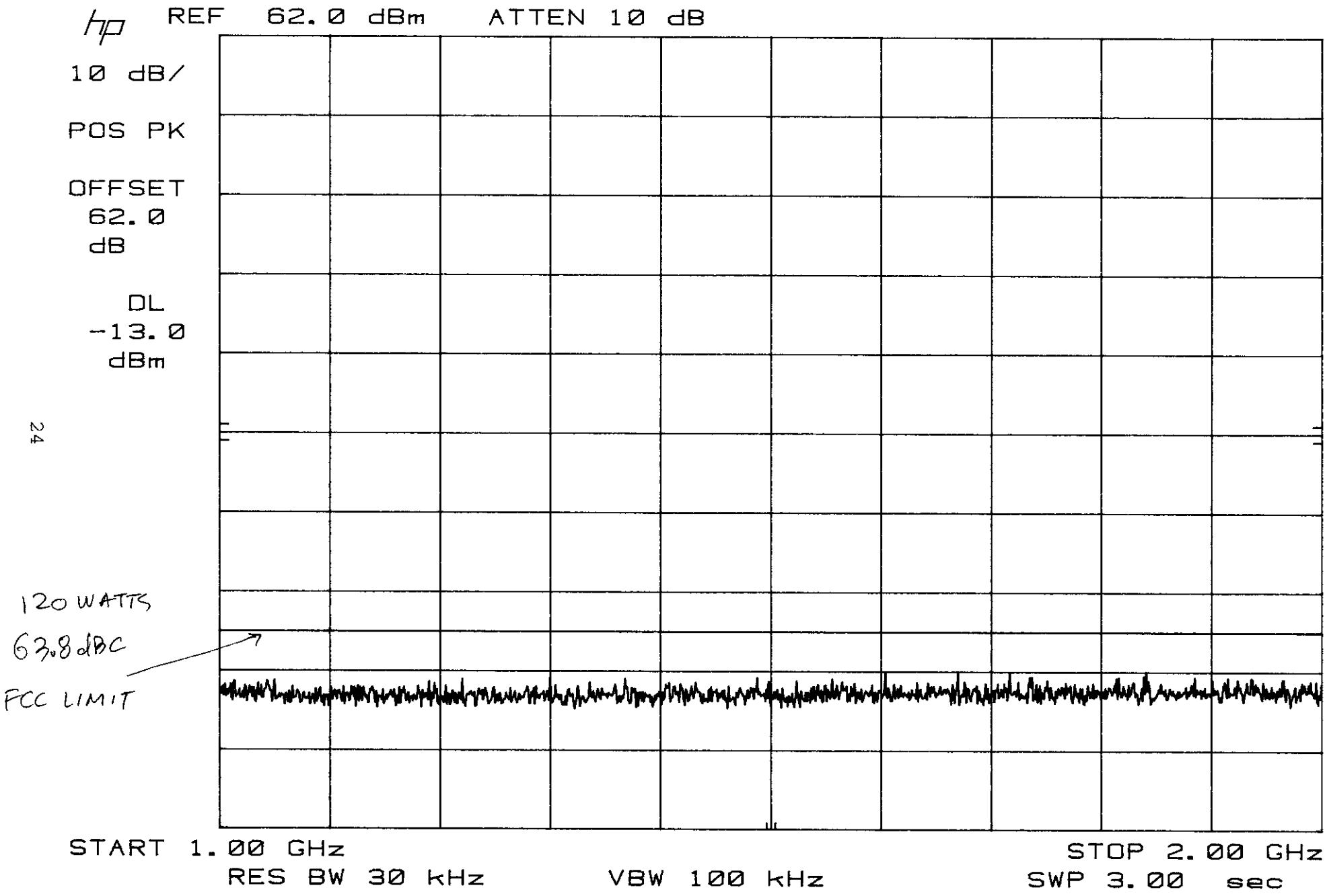
120 WATTS

63.8 dBC

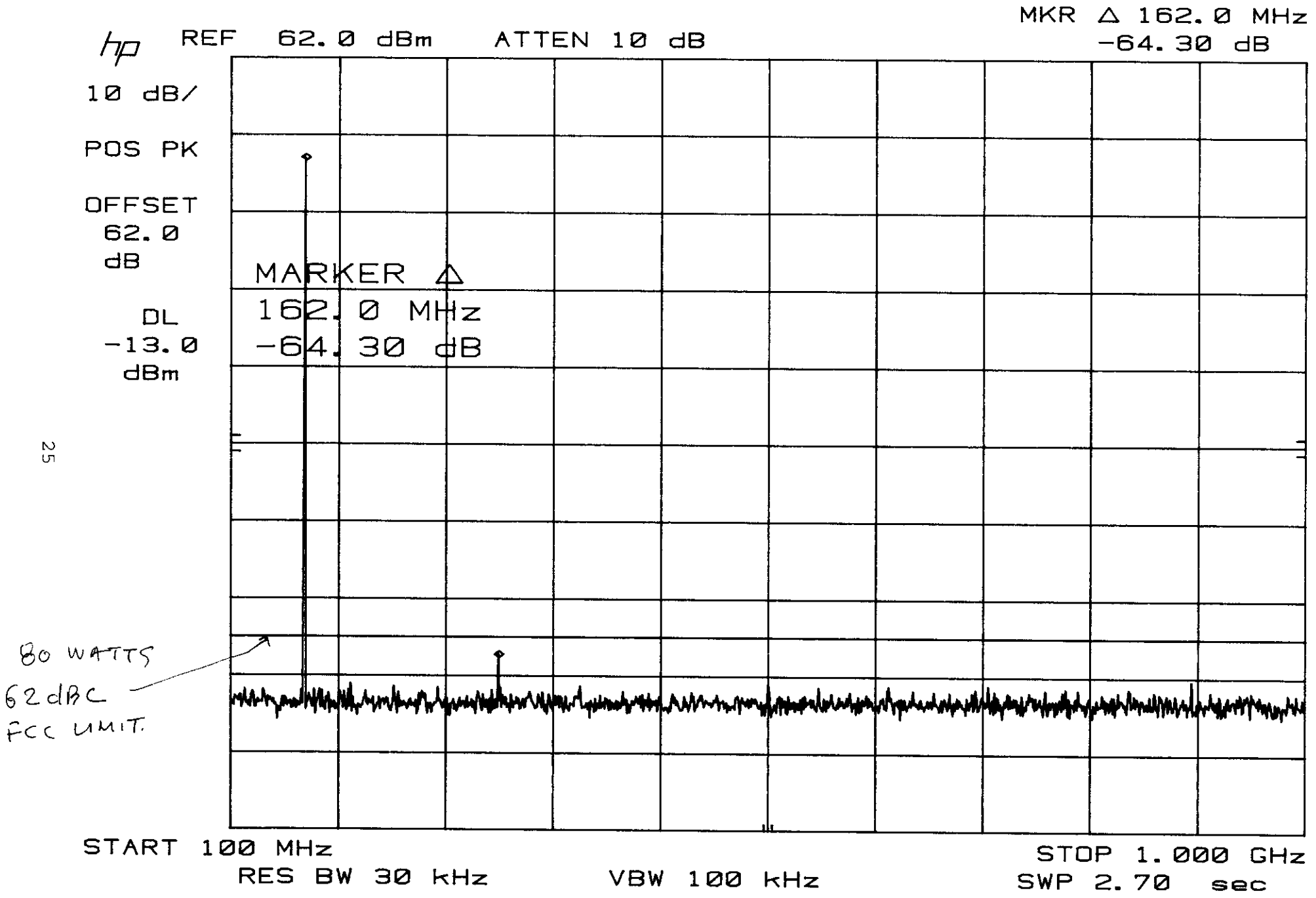
FCC LIMIT

RSS - 10E - PT57

ANTENNA CONDUCTED SPURIOUS



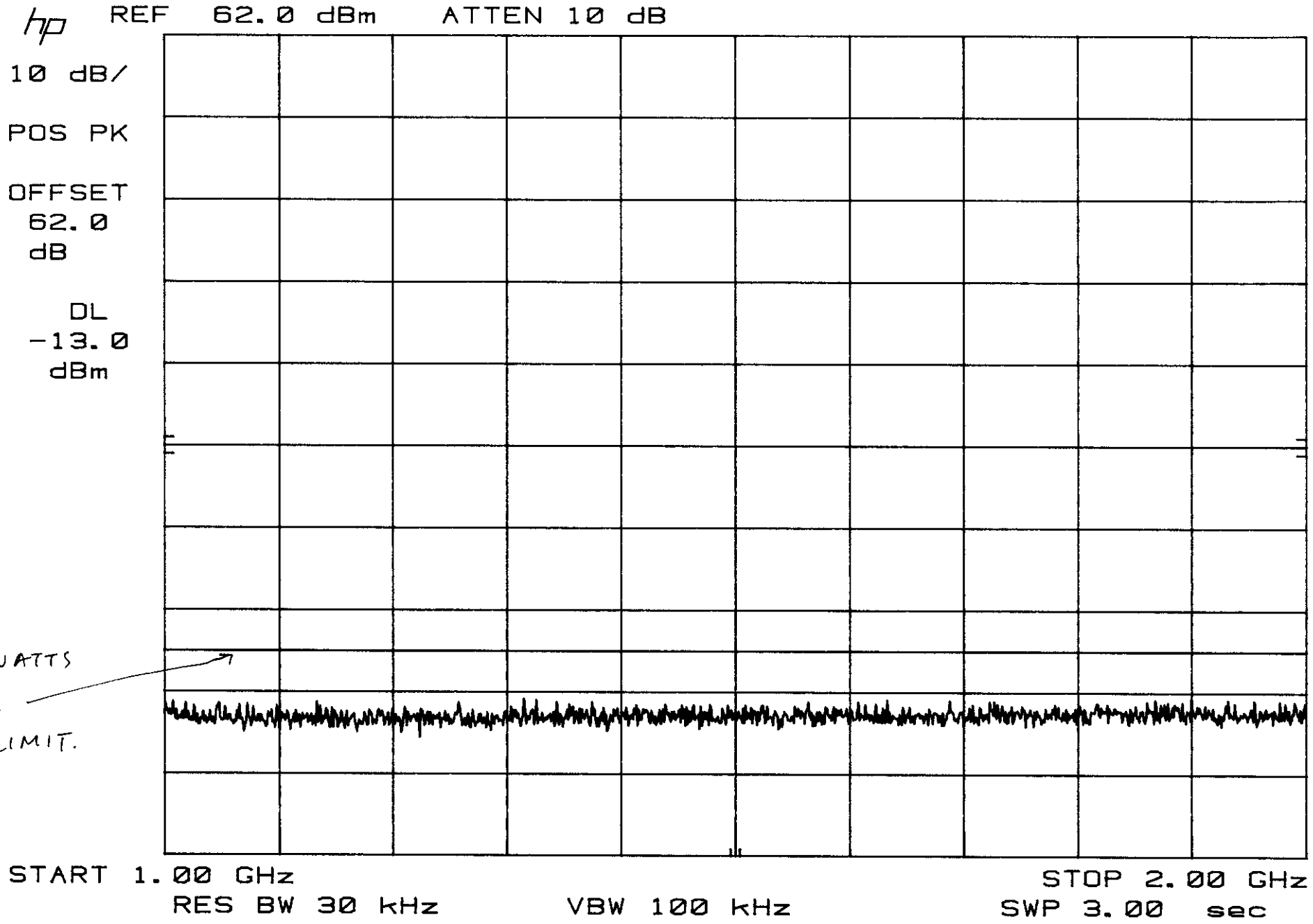
ANTENNA CONDUCTED SPURIOUS



80 WATTS
62dBC
FCC LIMIT.

RS3 - IDE - MST

ANTENNA CONDUCTED SPURIOUS



80 WATTS

62dBC

FCC LIMIT.

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)

ate 3-11-96 Pass X Fail ____ (at Freq. ____)

UT Power Amplifier Operating Power 120 Watts

art No. RS3-1K5-M5T Operating Mode Swept

erial No. ____ Test Engineer Bryan Brandis

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	76.5		71.9
H	486	79.8	19.7	2	22	80.1		68.1
H	648	78.6	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	25.6	2.3	30	72.6		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

Fundamental Field Strength (V/m) = 1/3 (Ro x Po)$^{1/2}$

Ro = Amplifier Output Impedance (Ohms) Ro = 50Ω

Po = Amplifier Output Power (Watts) Po = 120 watts

Conversion From μV/m to dBμV/m = (μV/m)$^{\log}$ x 20

$(25.79 \times 10^{6})^{\log} \cdot 20 = 148.22$ dBμV/m

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

$V/m = 25.79$

SPURIOUS RADIATED SIGNAL MEASUREMENTS

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

ate 3-11-98 Pass X Fail ____ (at Freq. ____)

UT Power Amplifier Operating Power 120 Watts

art No. RS3-1DE-M5T Operating Mode Saturated

erial No. ____ Test Engineer Bryan Brandon

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	
V	324	58.0	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	67.9	24.8	3.8	22	74.5		73.7
V	1134	75.3	24.5	2.2	30	72.0		76.2
V	1296	77.2	25.0	2.3	30	76.5		71.7
V	1458	78.4	25.7	2.6	30	71.7		76.5
V	1620	78.0	26.3	2.7	30	69.8		78.4

Fundamental Field Strength (V/m) = 1/3 (Ro x Po)$^{1/2}$

Ro = Amplifier Output Impedance (Ohms) Ro = 50Ω

Po = Amplifier Output Power (Watts) Po = 120 watts

Conversion From μV/m to dBμV/m = (V/m)$^{\log}$ x 20

$(25,790,000)^{\log} \cdot 20 = 148.22$ dBμV/m

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

$V/m = 25.79$

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