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
451 MHz	70.0 W	70.0 W	70.0 W
470 MHz	70.0 W	70.0 W	70.0 W
451 MHz	100.0 W	100.0 W	100.0 W
470 MHz	100.0 W	100.0 W	100.0 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

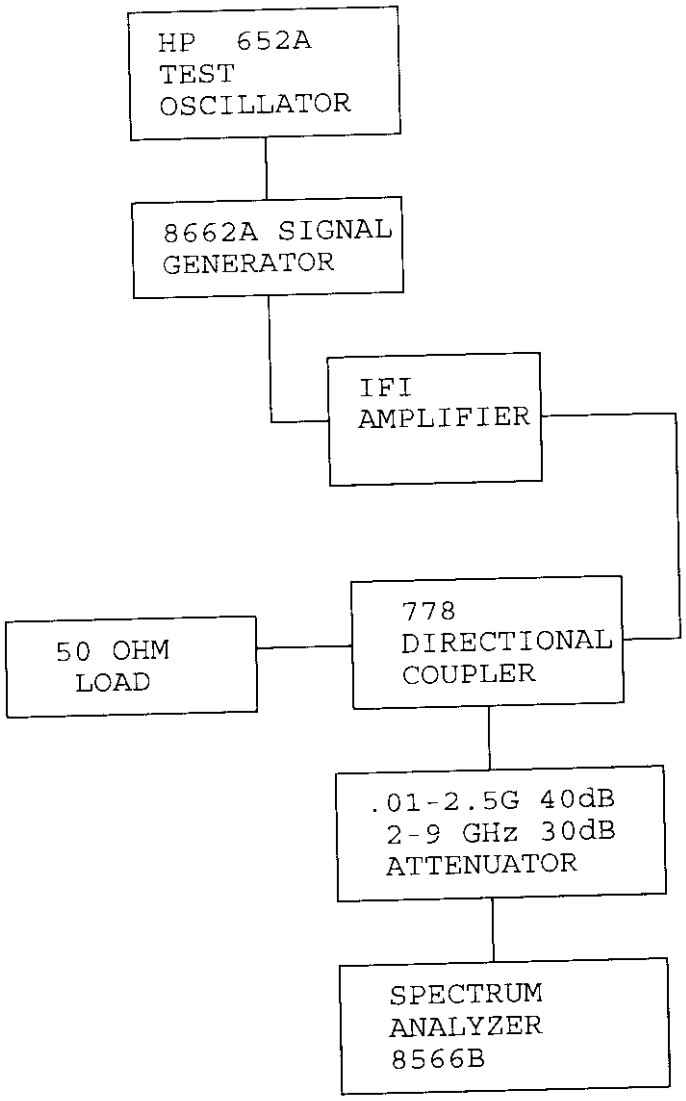
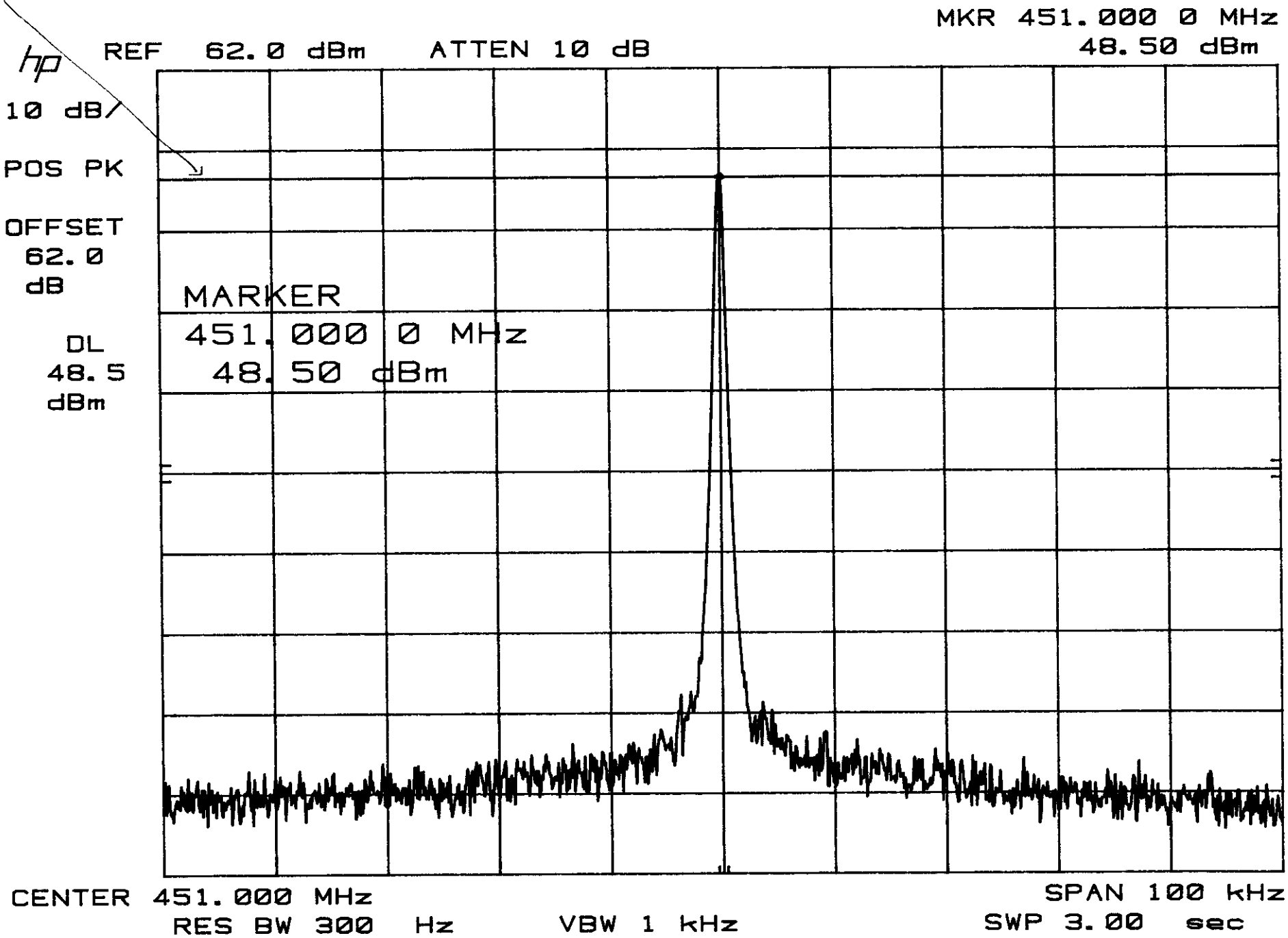


FIGURE 3. BLOCK DIAGRAM.
(OCCUPIED BANDWITH)

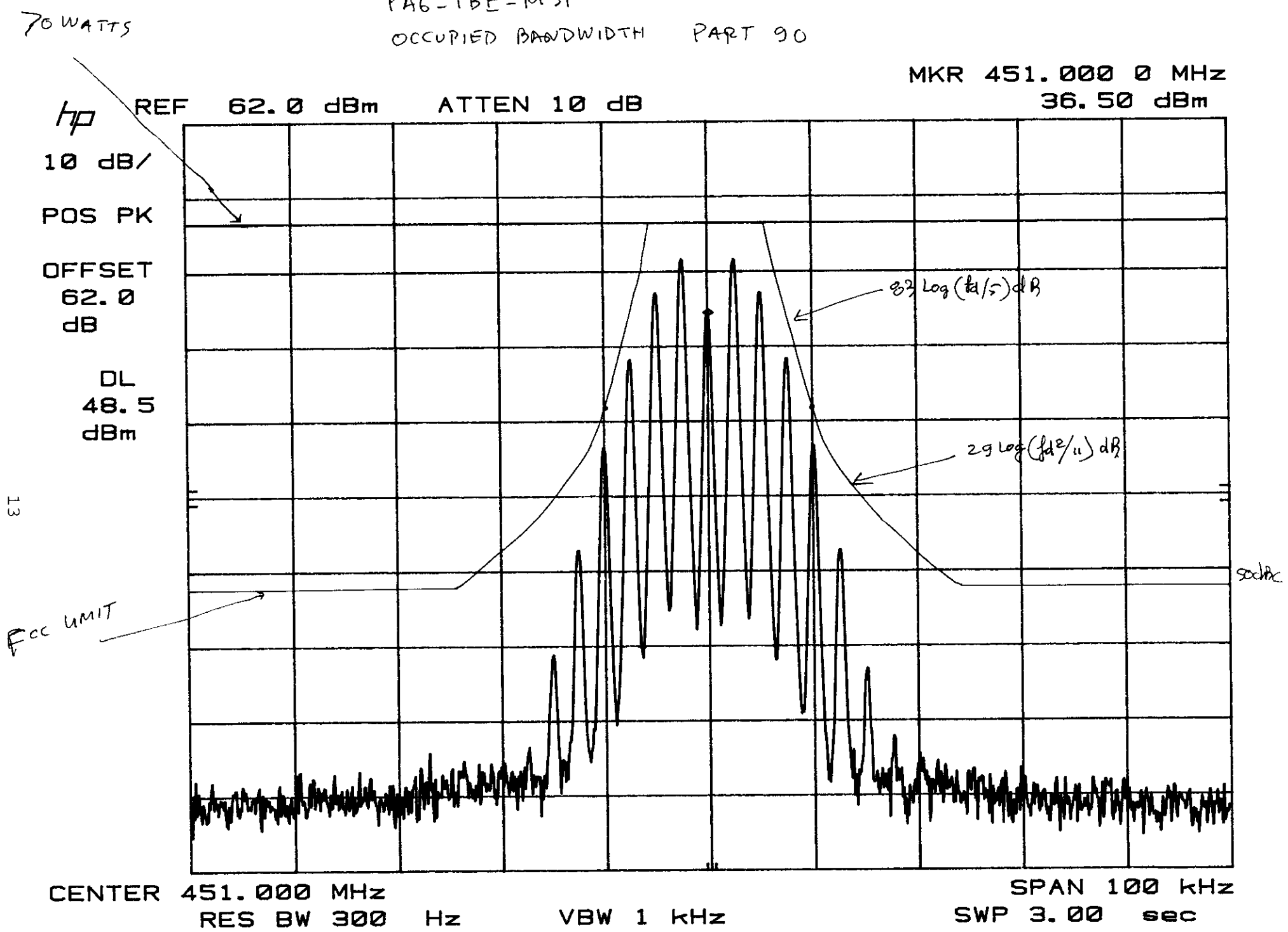
70 WATT

PA6-1BE-MS1
UNMODULATED CARRIER



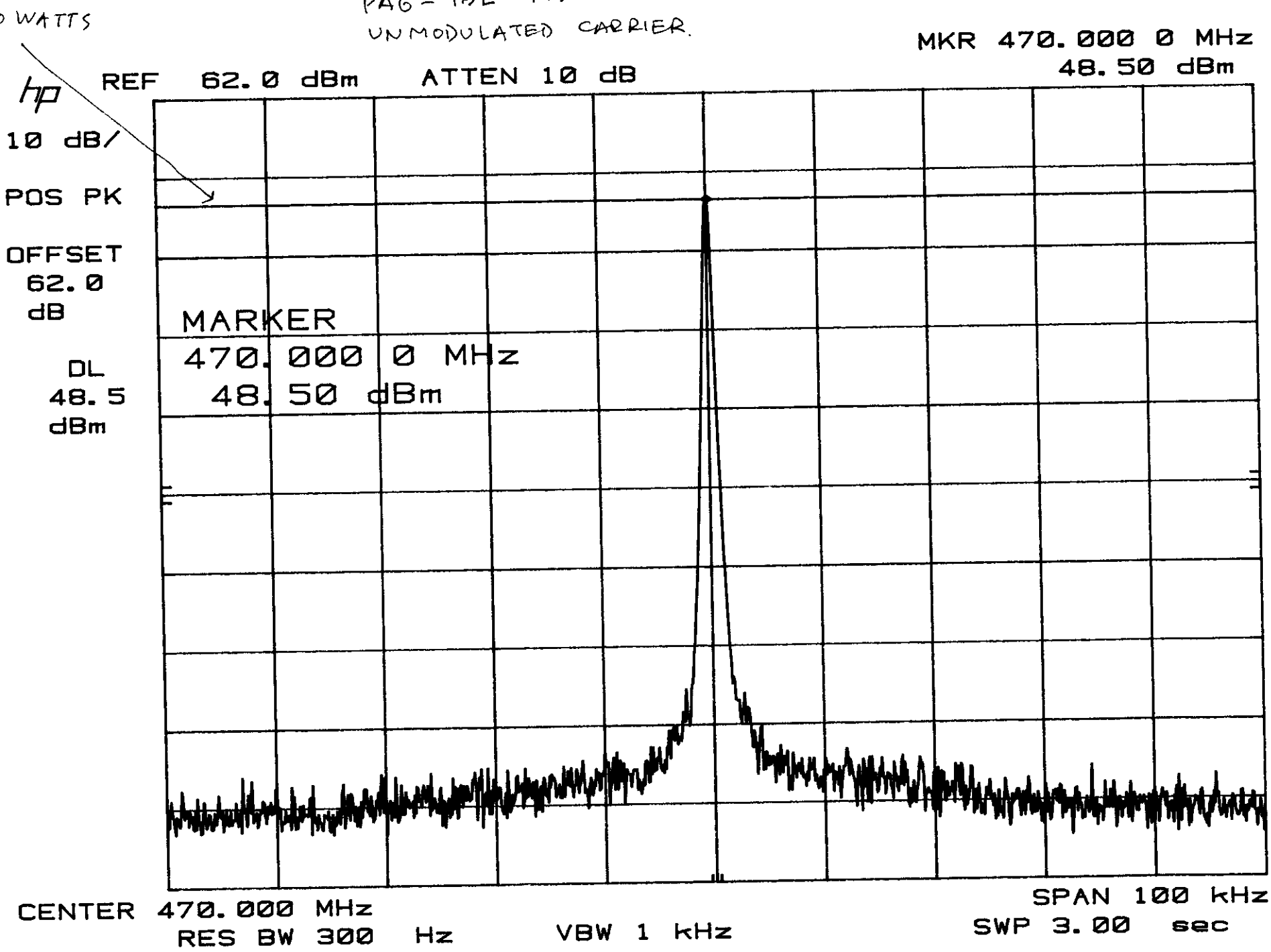
PAG-1BE-MS1

OCCUPIED BANDWIDTH PART 90



70 WATTS

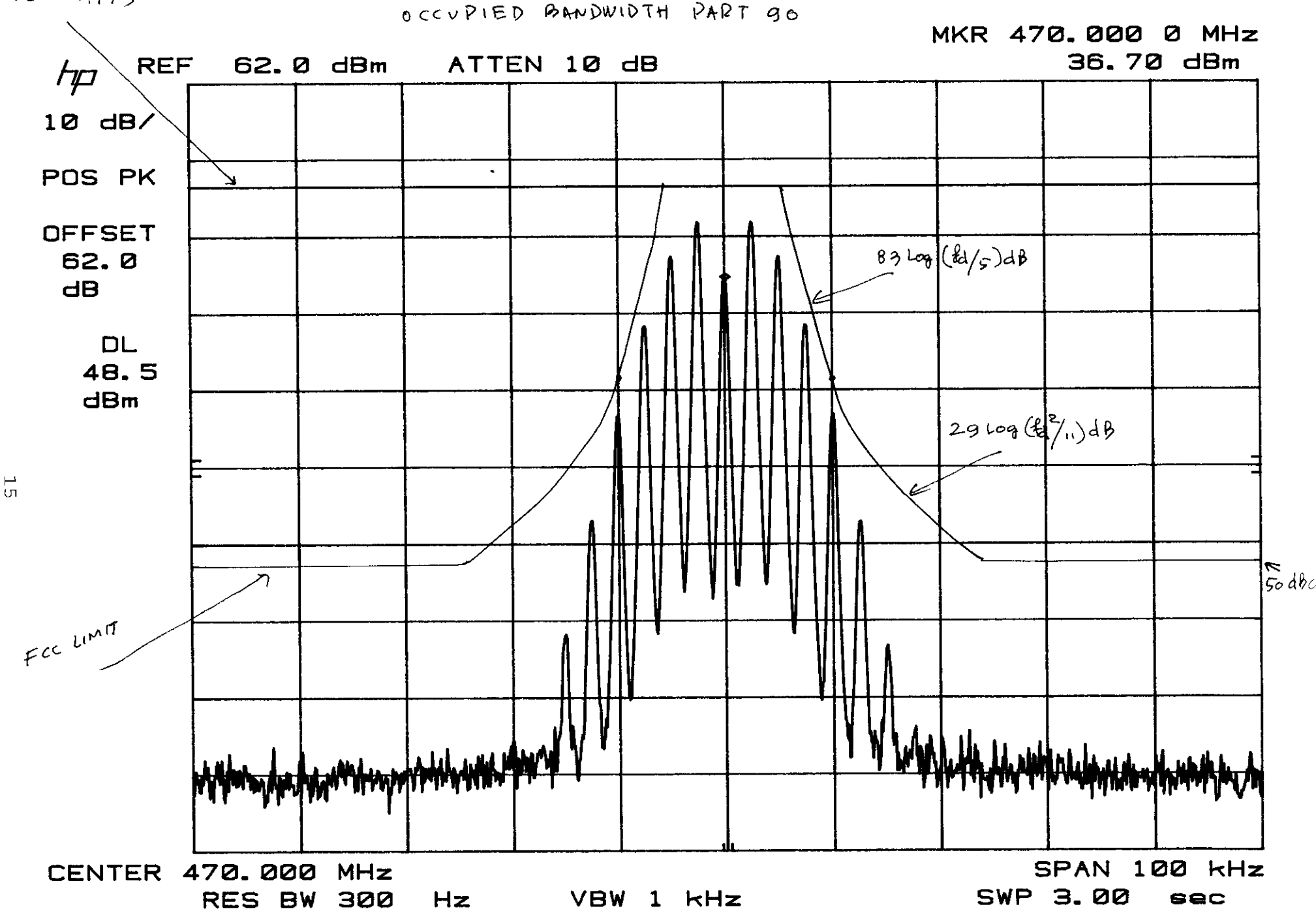
PAG - 1BE - MS1
UNMODULATED CARRIER.



70 WATTS

PAG-1BE-MS1

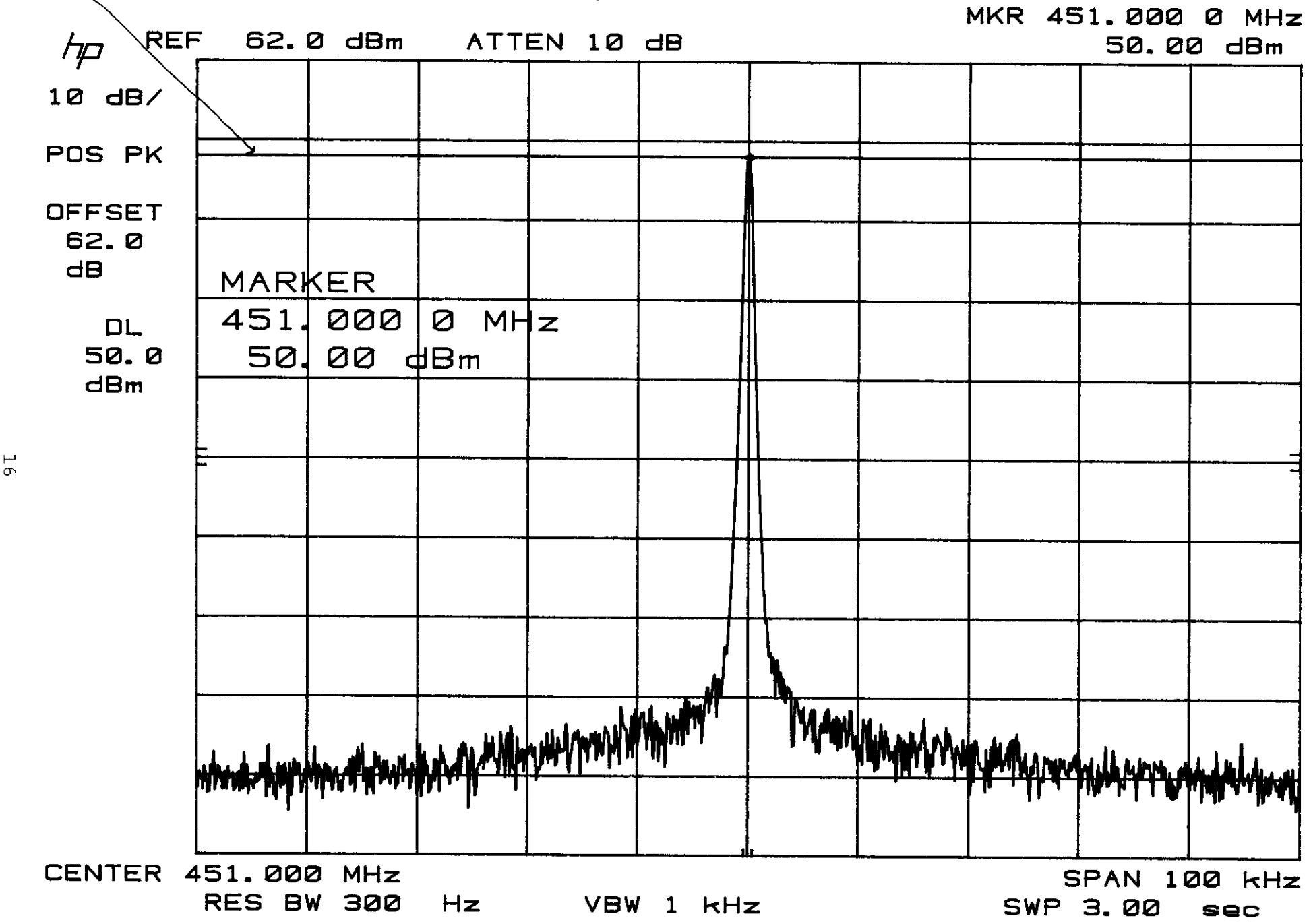
OCCUPIED BANDWIDTH PART 90



100 WATTS

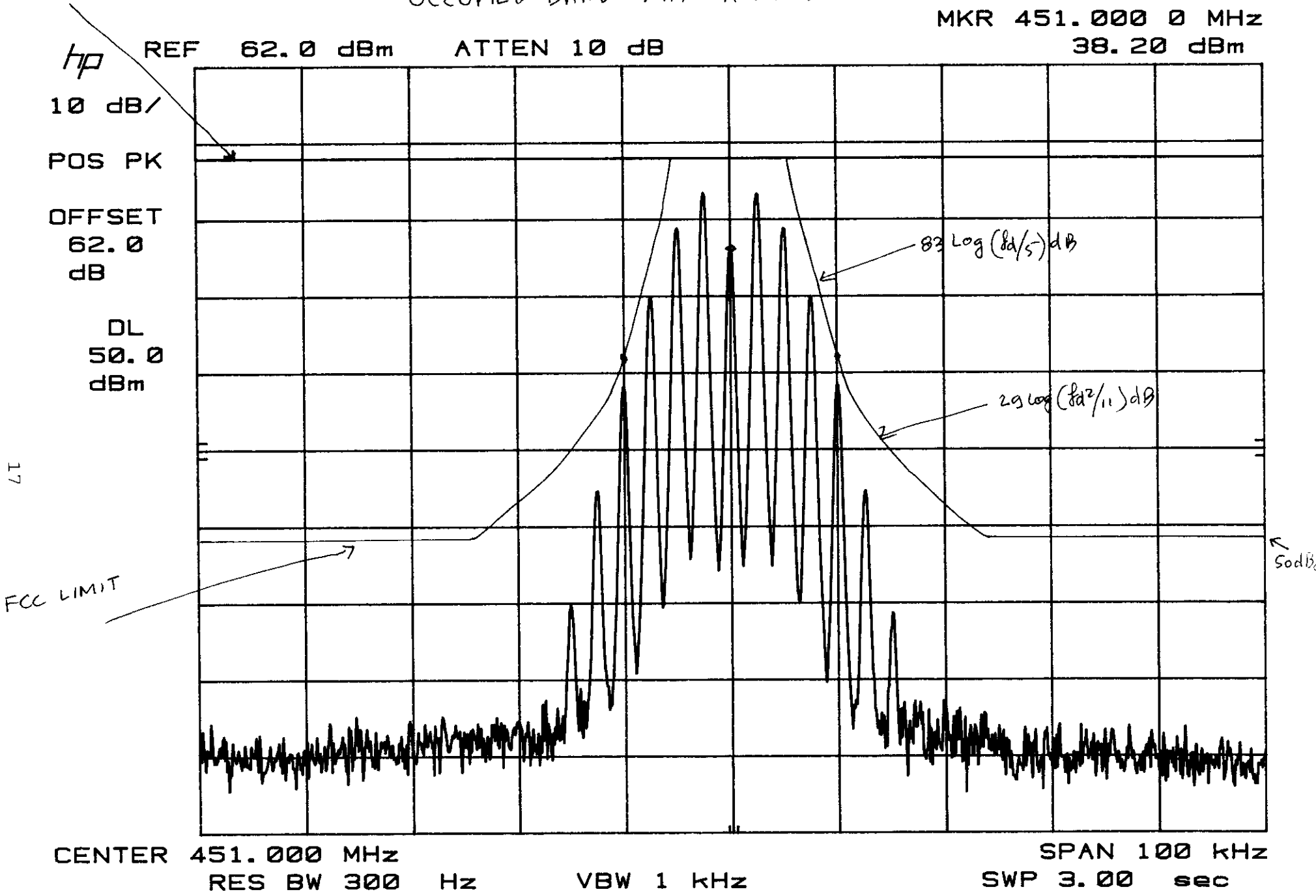
PA6-1BE-MS1

UNMODULATED CARRIER



PA6 - 1BE - MSI

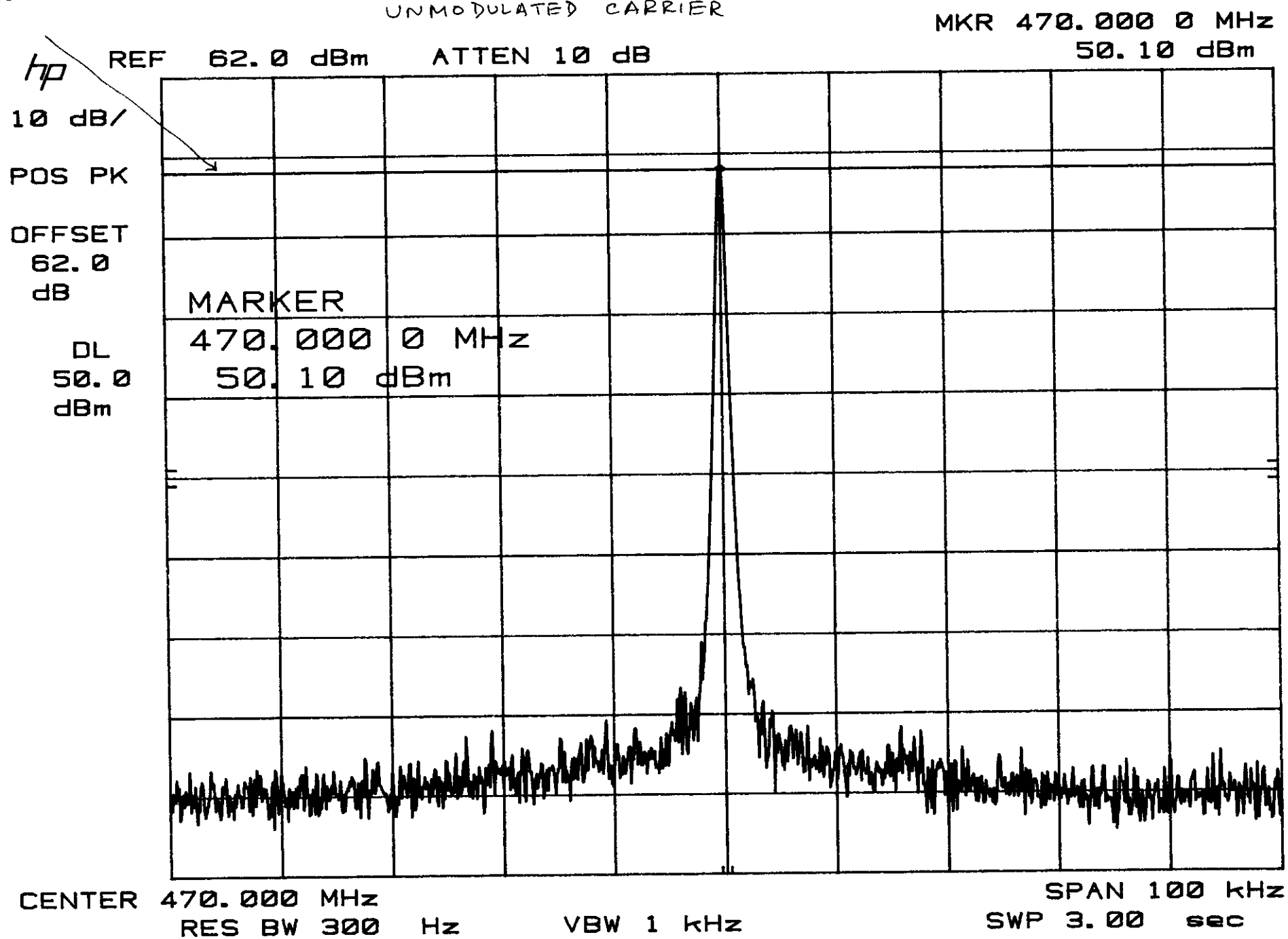
OCCUPIED BANDWIDTH PART 90



17

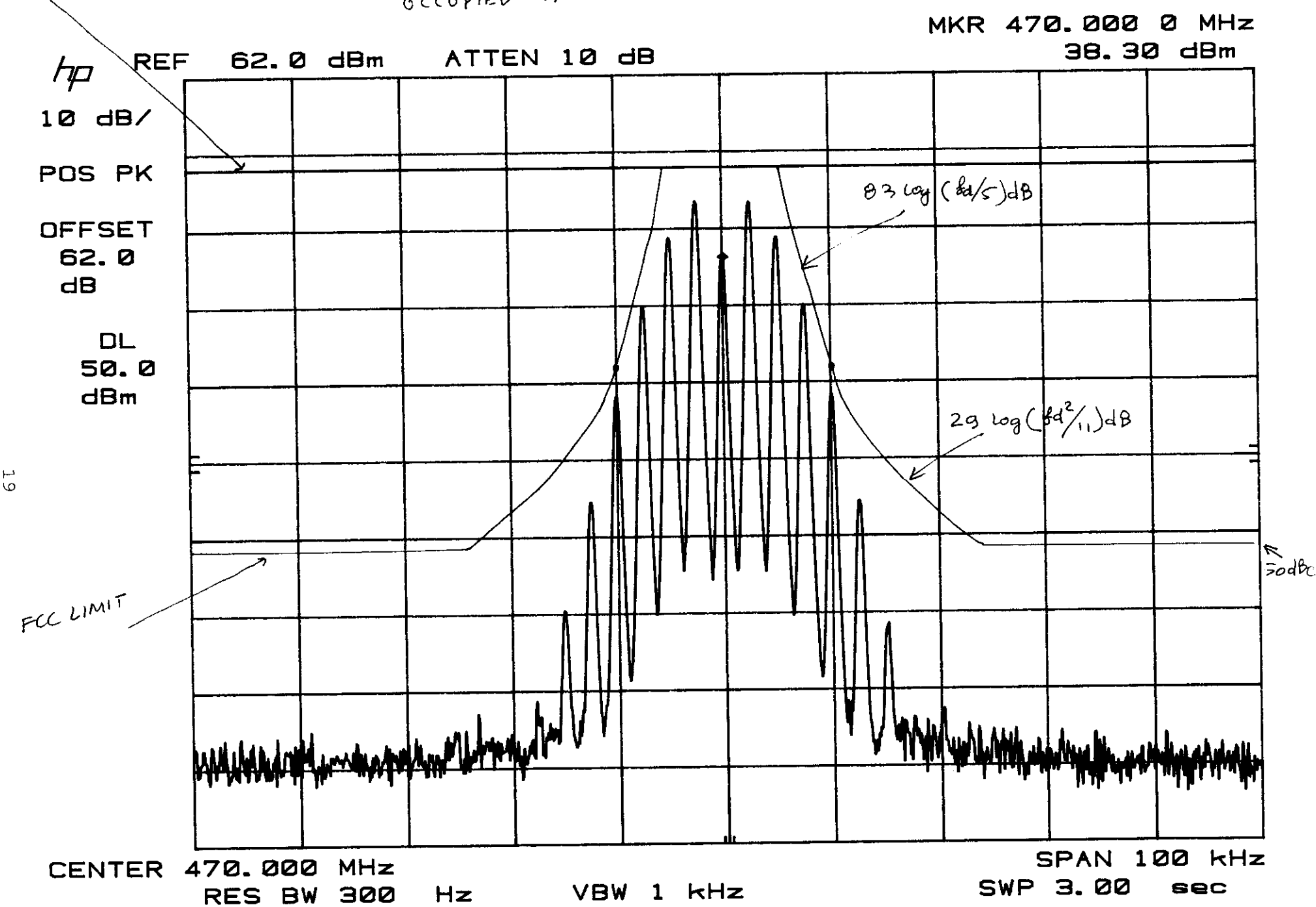
100 WATTS

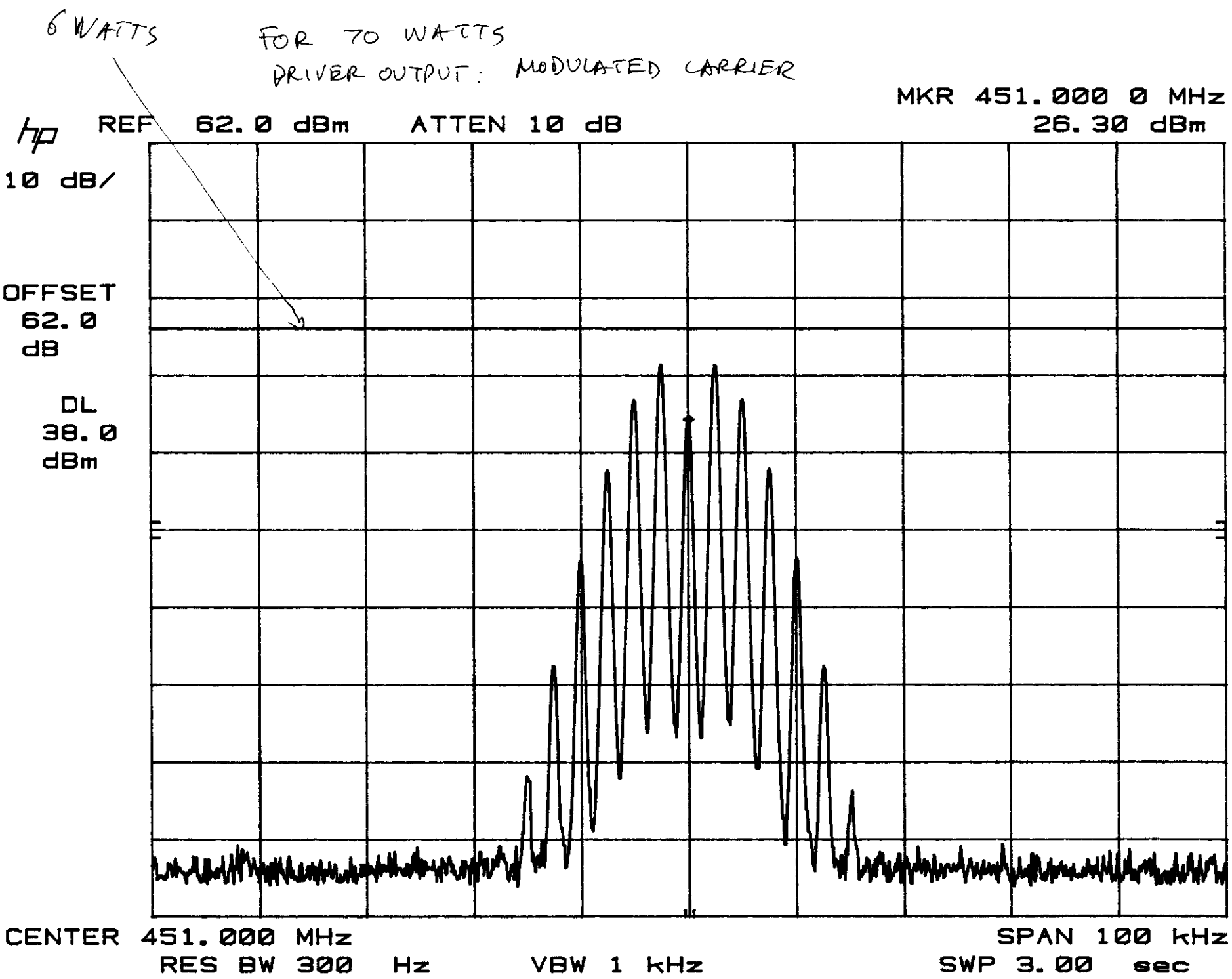
PA6 - 1BE - MS1
UNMODULATED CARRIER



100 WATTS

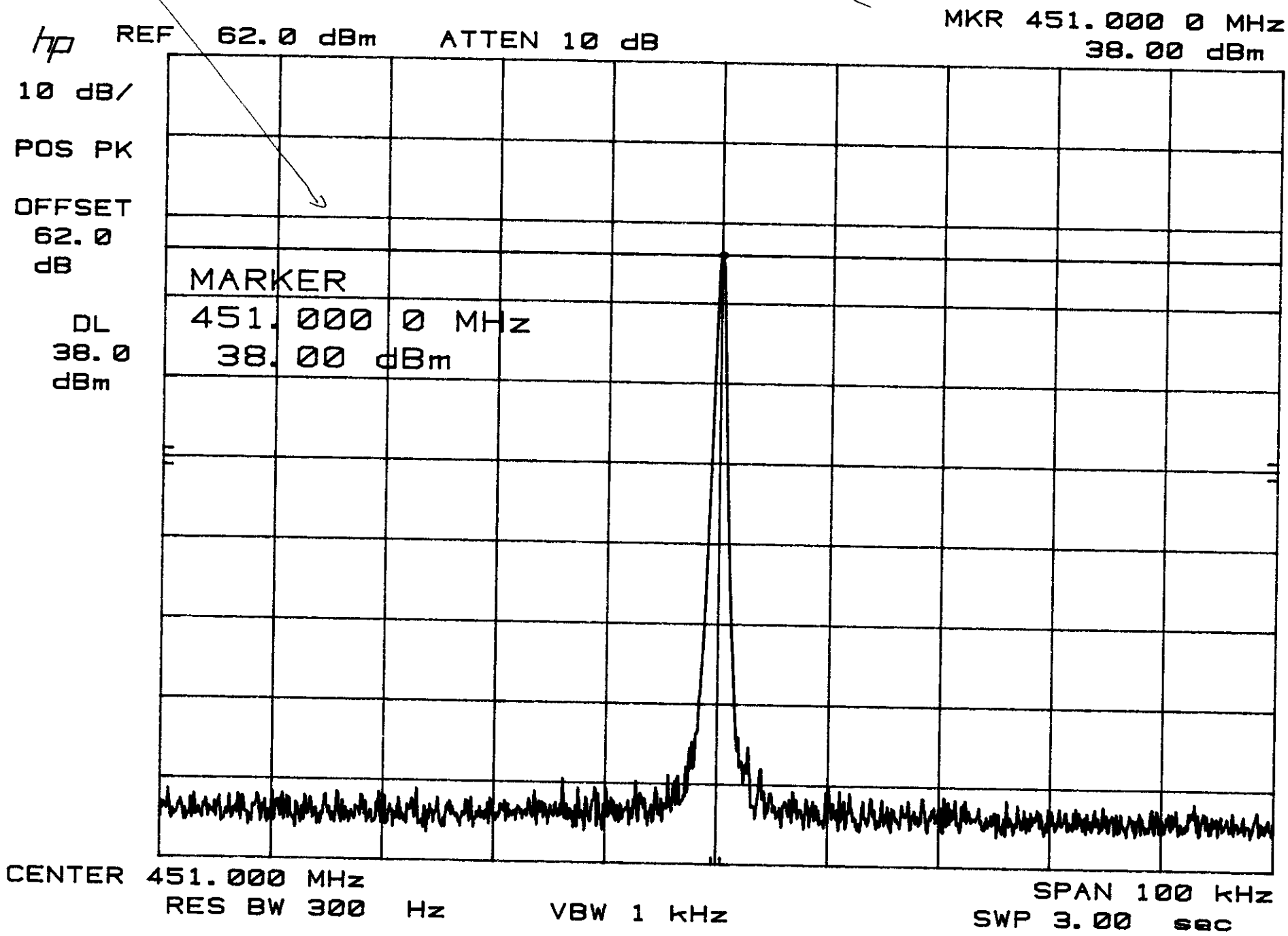
PAG-1BE-MS1
OCCUPIED BANDWIDTH PART 90




6 WATTS
FOR 70 WATTS
DRIVER OUTPUT: MODULATED CARRIER
MKR 451.000 0 MHz
REF 62.0 dBm
ATTEN 10 dB
26.30 dBm
10 dB/
OFFSET
62.0
dB
DL
38.0
dBm
CENTER 451.000 MHz
SPAN 100 kHz
RES BW 300 Hz
VBW 1 kHz
SWP 3.00 sec

6 WATTS

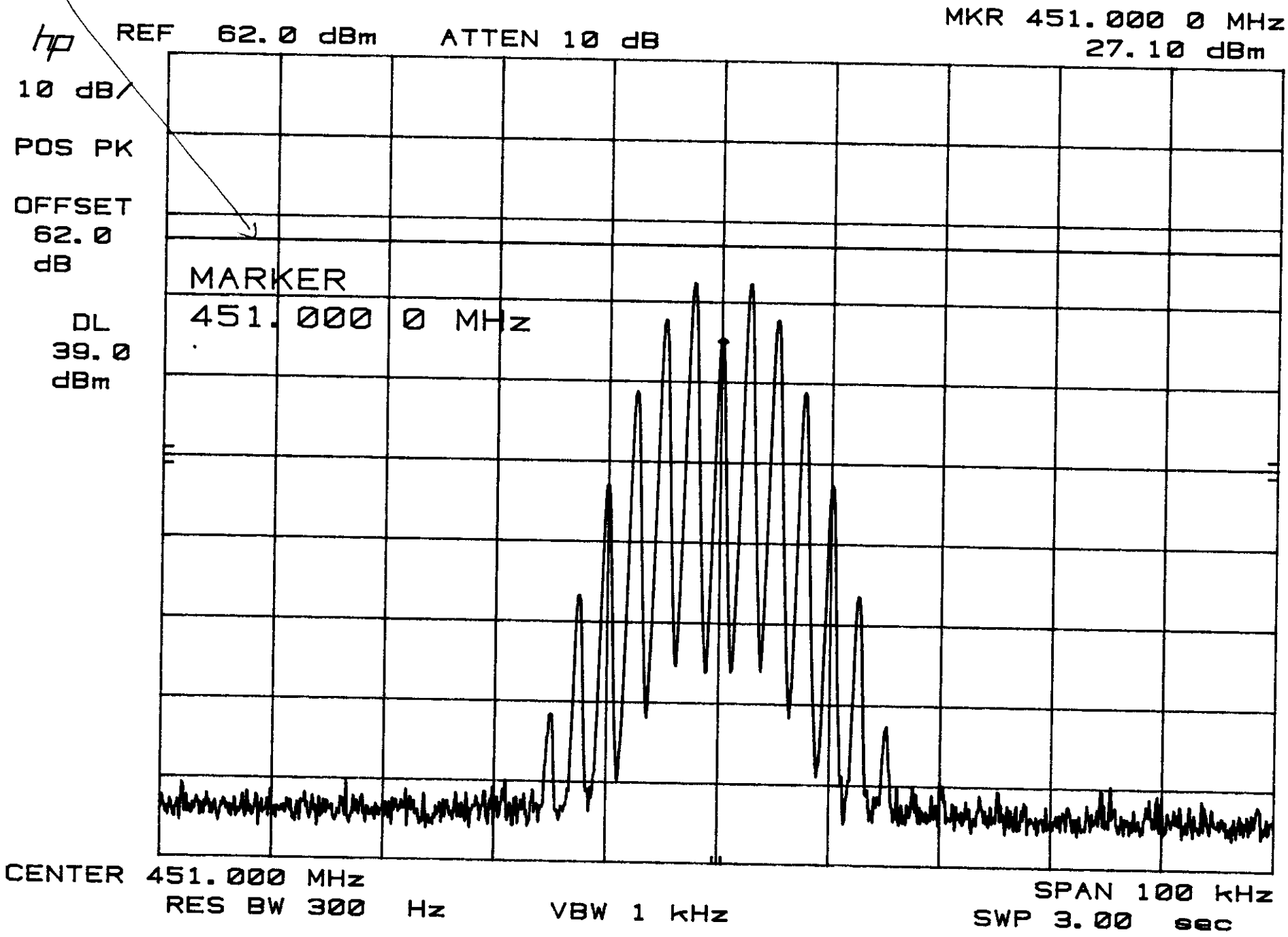
FOR 70 WATTS OUTPUT
DRIVER OUTPUT : MODULATED CARRIER



8 WATTS

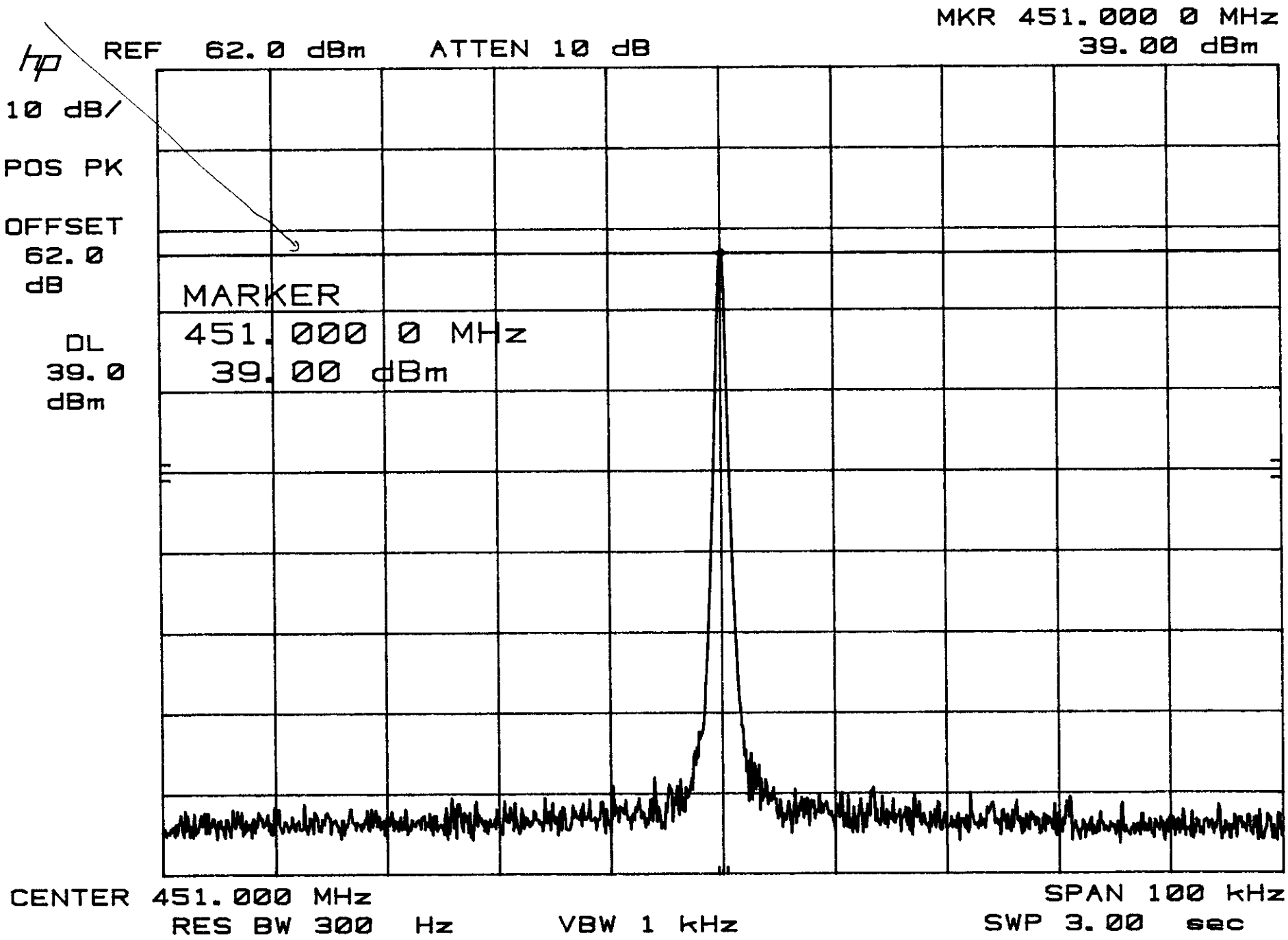
FOR 100 WATTS OUTPUT

DRIVER OUTPUT : MODULATED CARRIER



8 WATTS

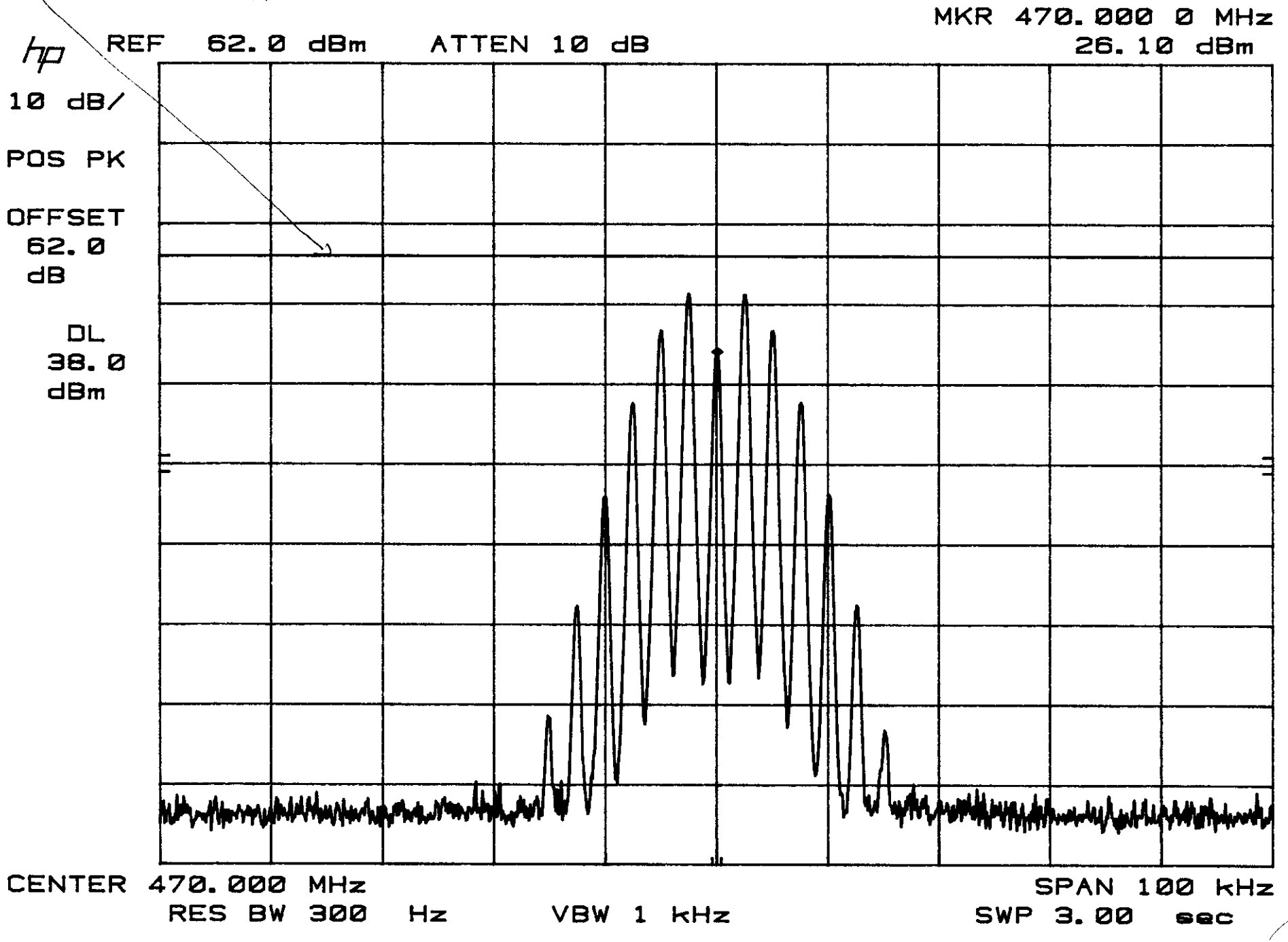
FOR 100 WATTS OUTPUT
DRIVER OUTPUT: UNMODULATED CARRIER



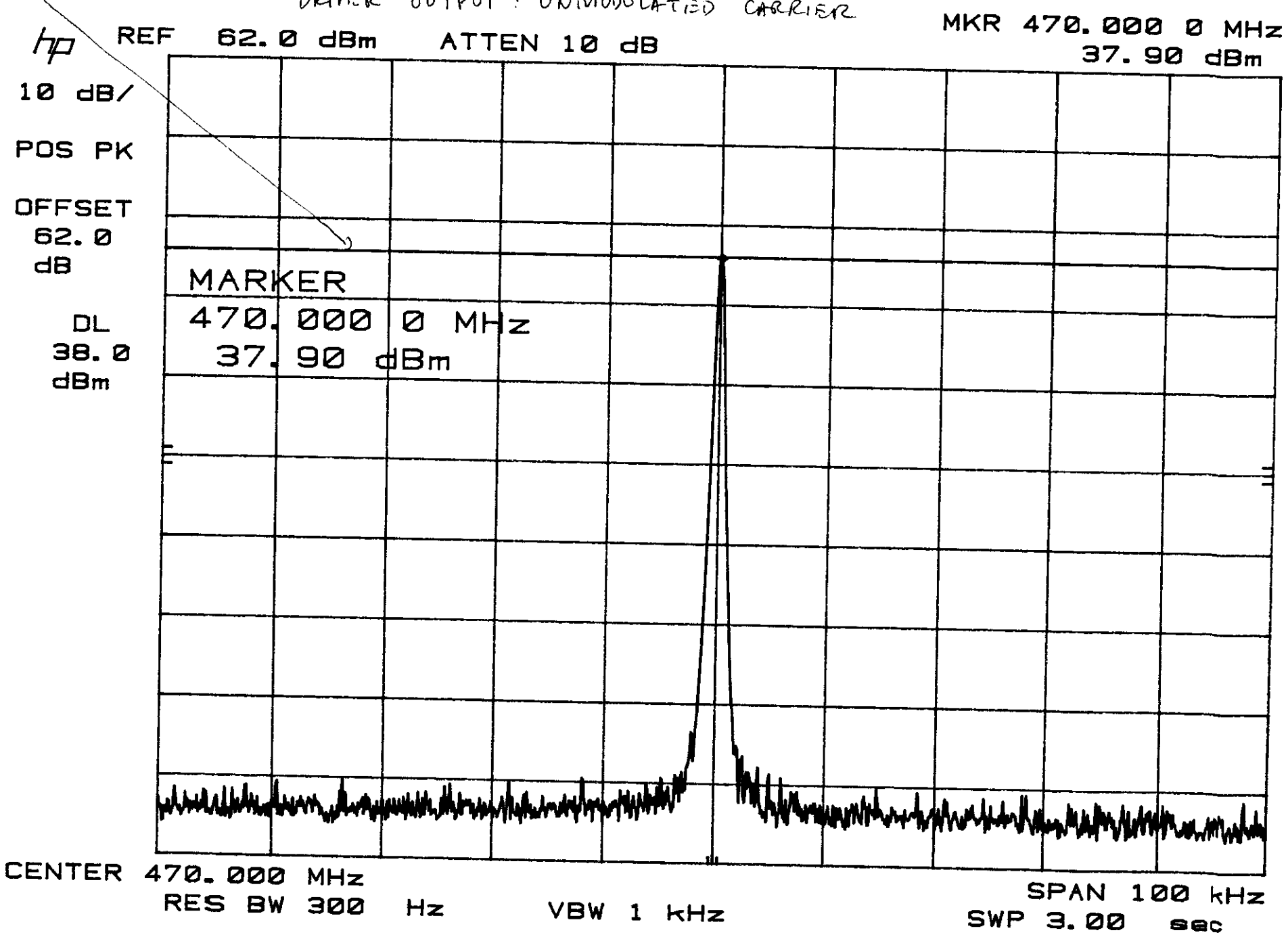
6 WATTS

FOR 100 WATTS OUPUT.

DRIVER OUTPUT: MODULATED CARRIER

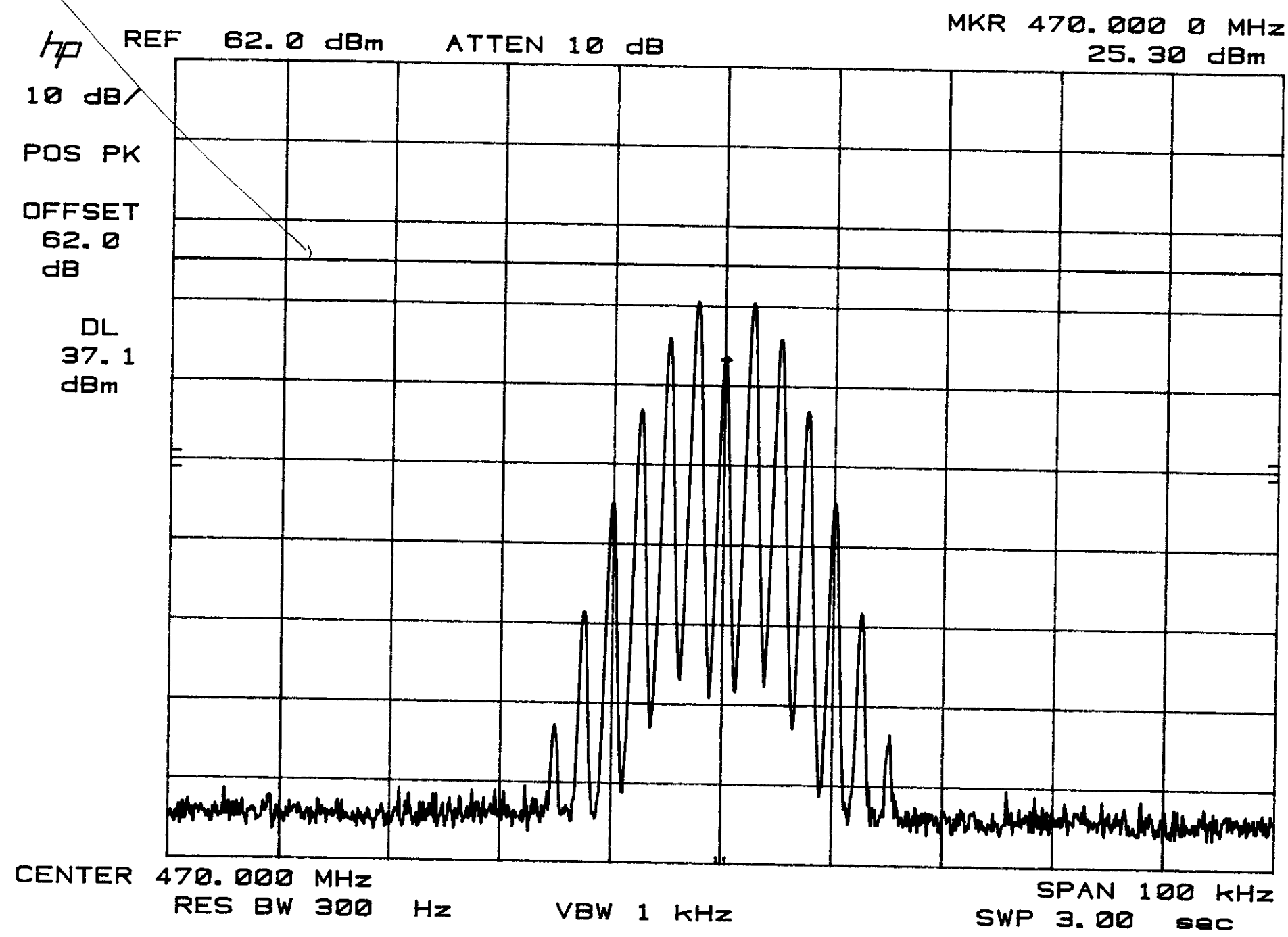


6 WATTS FOR 100 WATTS OUTPUT.
DRIVER OUTPUT : UNMODULATED CARRIER



FOR 10 WATTS OUTPUT

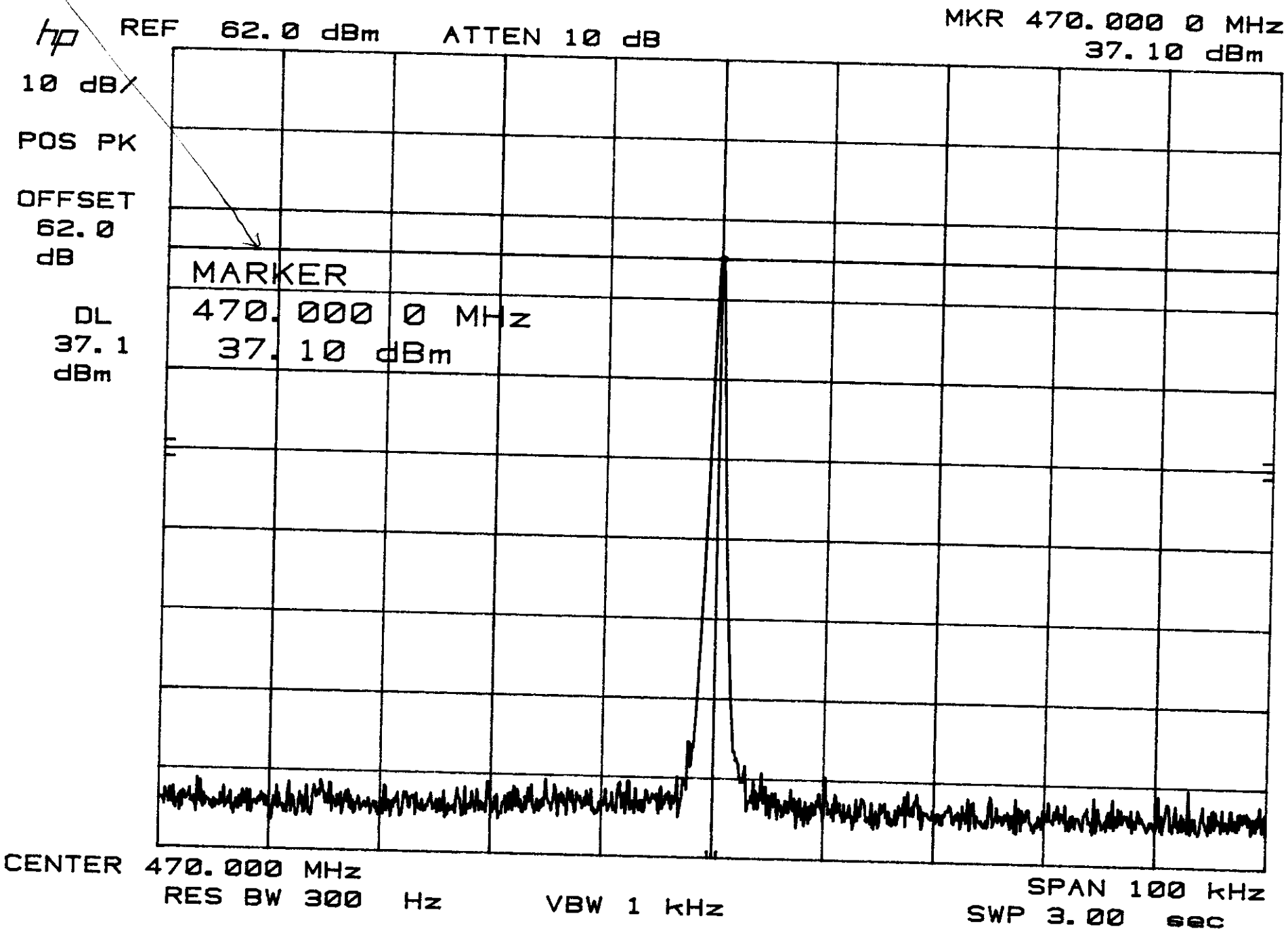
DRIVER OUTPUT : MODULATED CARRIER



SW

FOR 70 WATTS OUTPUT.

DRIVER OUTPUT : UNMODULATED 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:

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

Where Po = output in watts

$$= 43 + 10 \log_{10} (70)$$

$$= 61.5 \text{ dB}$$

and

$$= 43 + 10 \log_{10} (100)$$

$$= 63.0 \text{ dB}$$

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

Connect the equipment as shown in FIGURE 4.

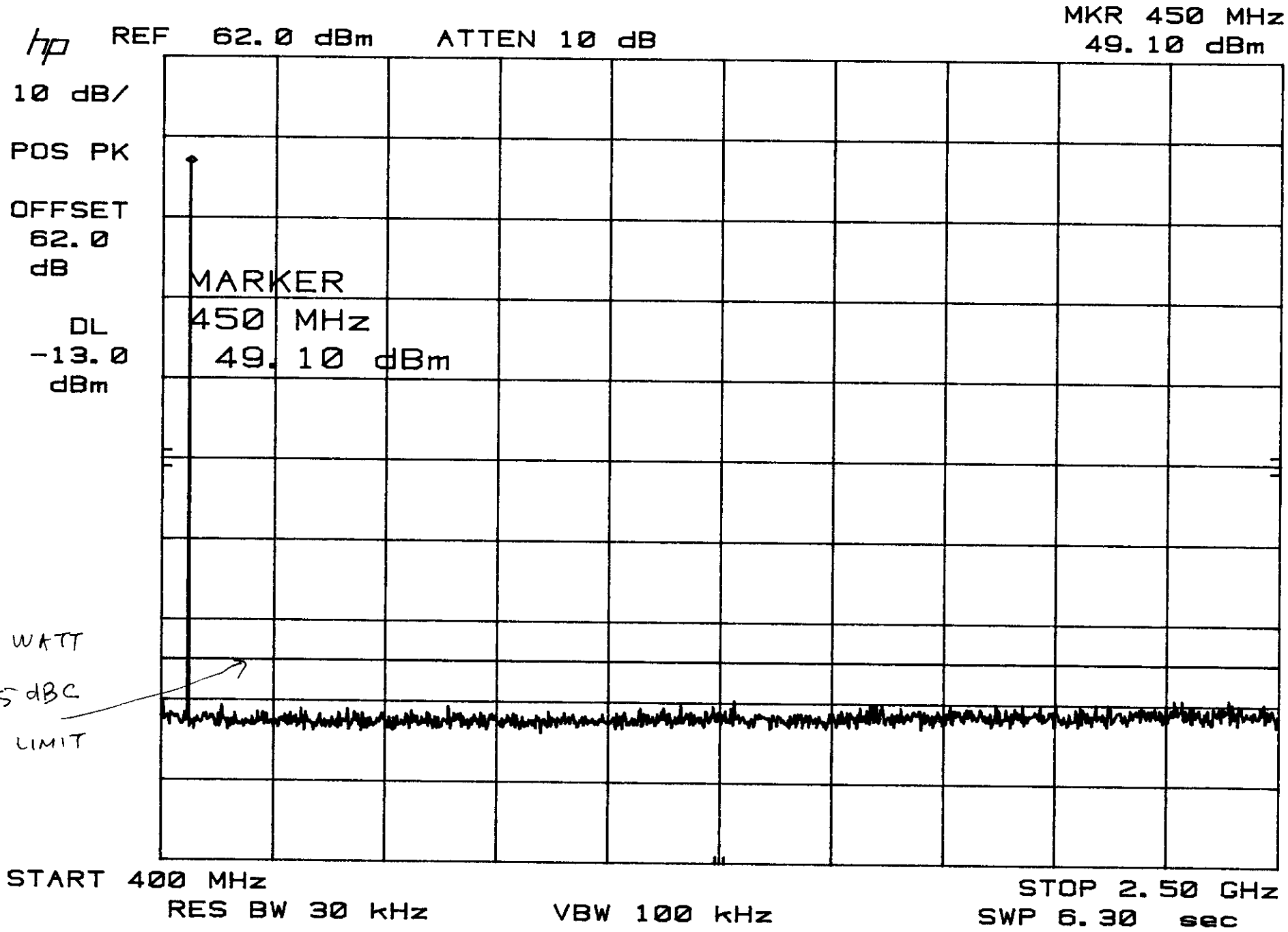
Adjust the audio oscillator so that the frequency deviation of the transmitter is 5 kHz at a modulation frequency of 2.5 kHz. Adjust the spectrum analyzer to display the modulated carrier.

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

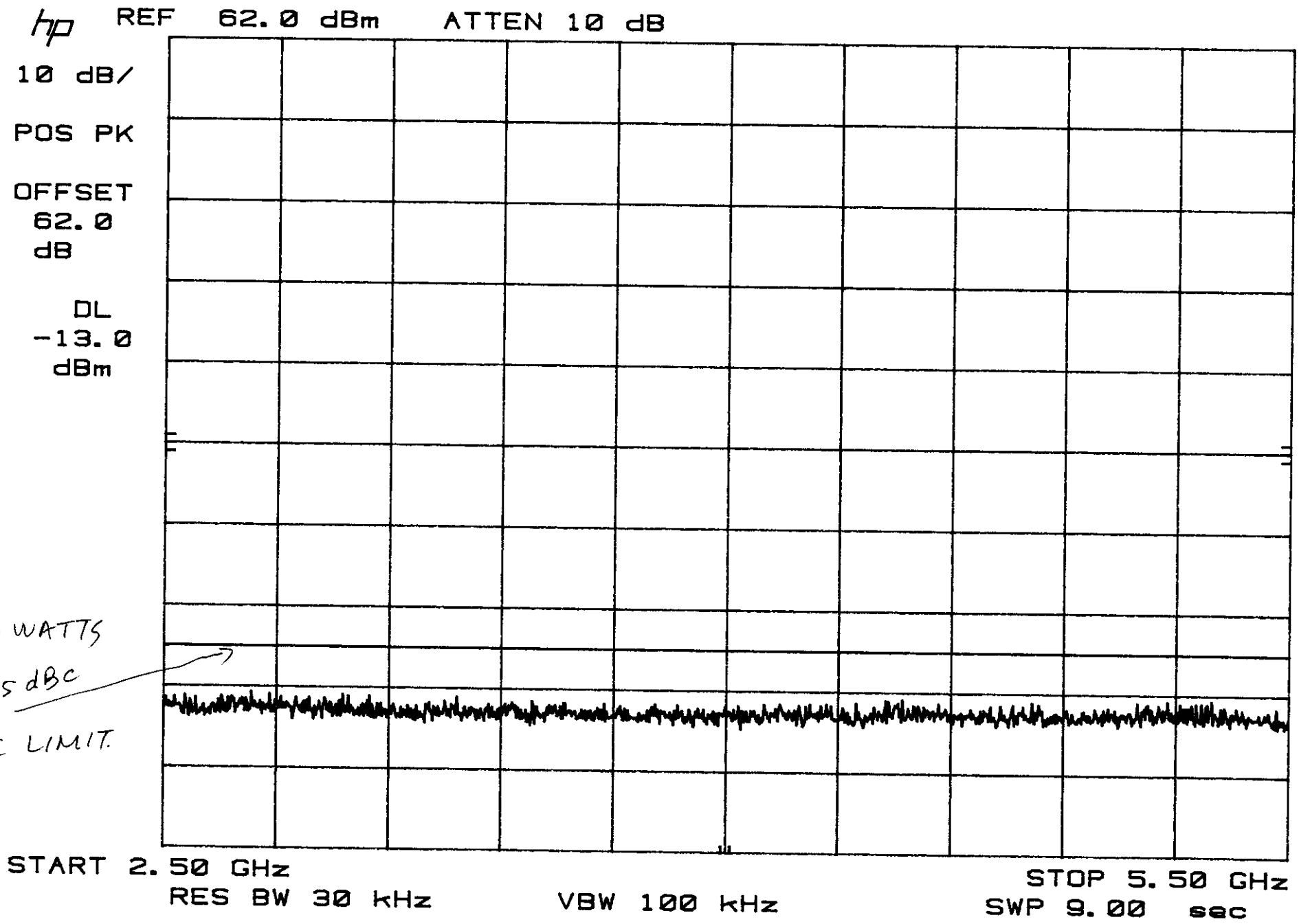
Test Results: See Plots Following Figure 4.

All spuirious antenna conducted emissions are below the FCC specifications.

PAG-1BE-MS1
ANTENNA CONDUCTED SPURIOUS

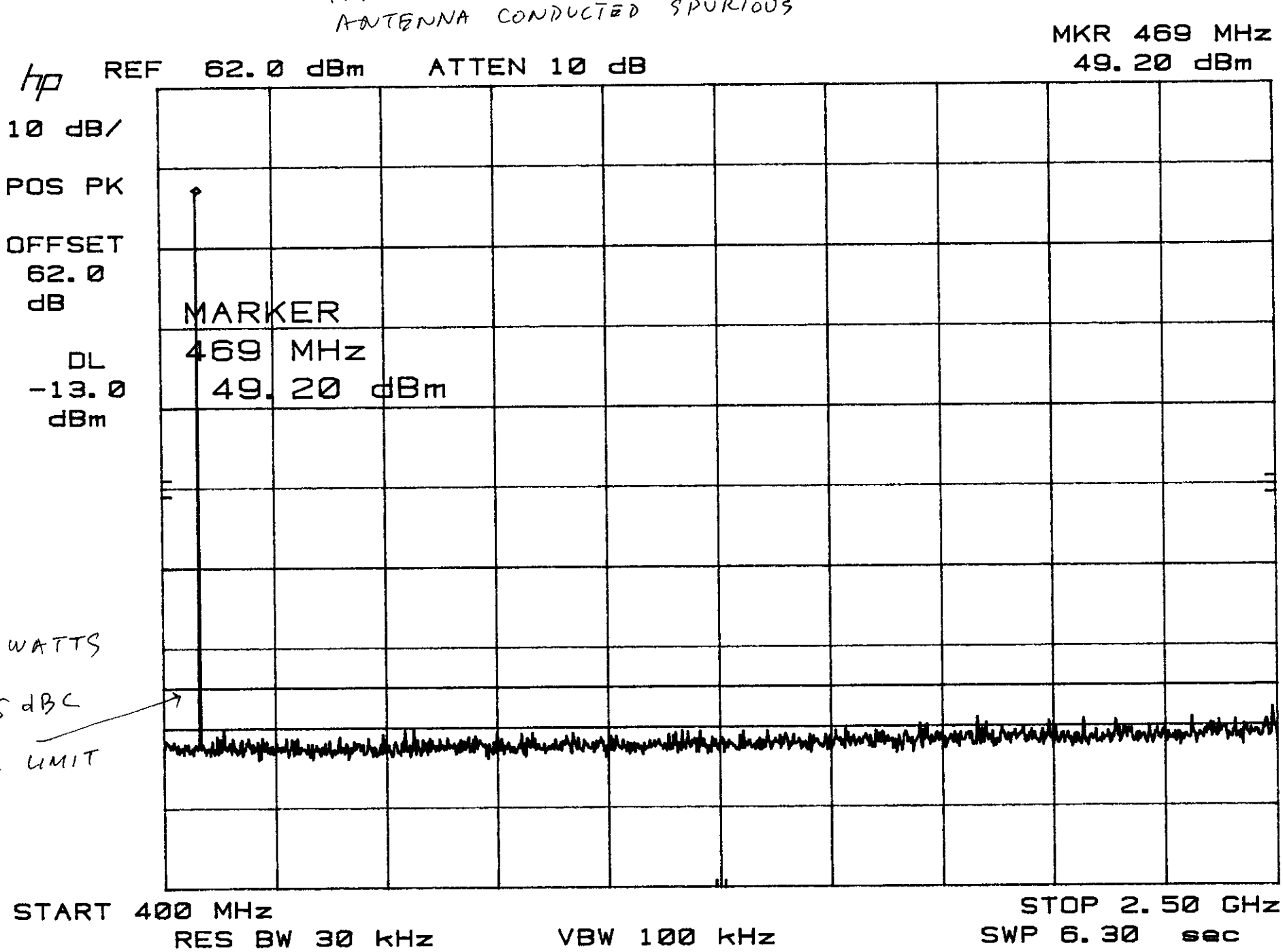


PA6 - 1BE - MS1
ANTENNA CONDUCTED SPURIOUS



70 WATTS
61.5 dBc
FCC LIMIT

PAG-IBE-MS1
ANTENNA CONDUCTED SPURIOUS



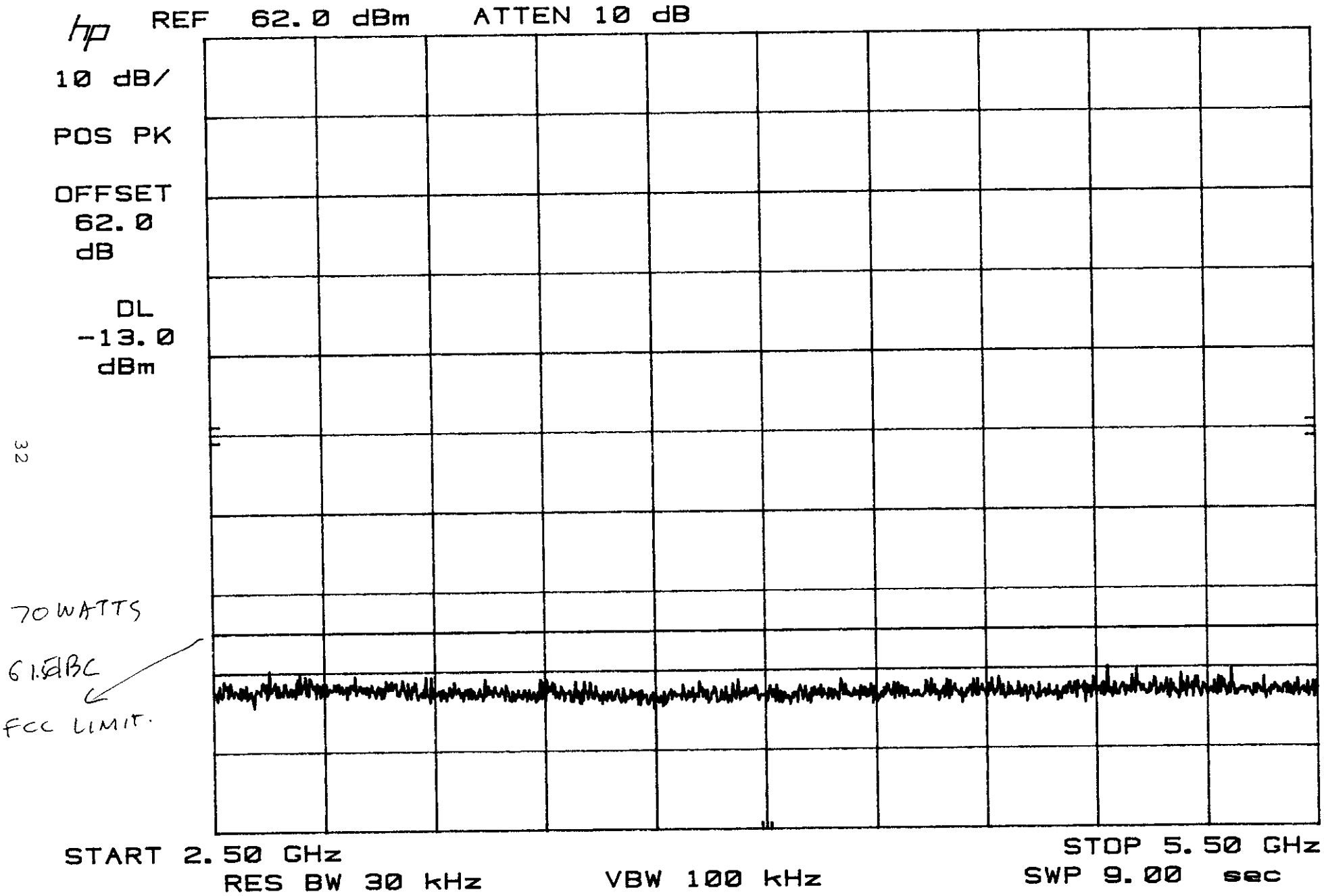
31

70 WATTS

61.5 dBC

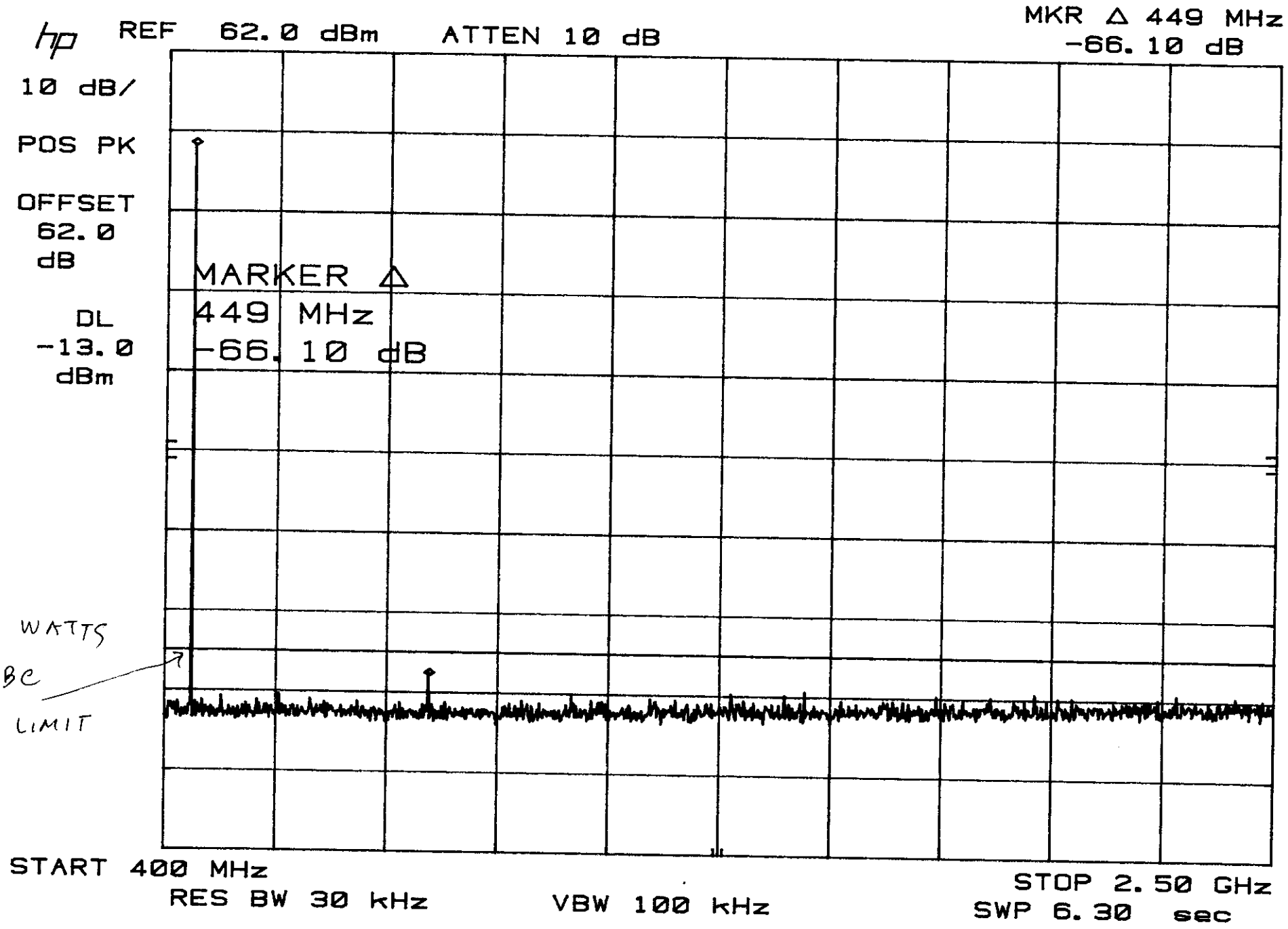
FCC LIMIT

PAG-1BE-MS1
ANTENNA CONDUCTED SPURIOUS



70 WATTS
61.5dBC
FCC LIMIT.

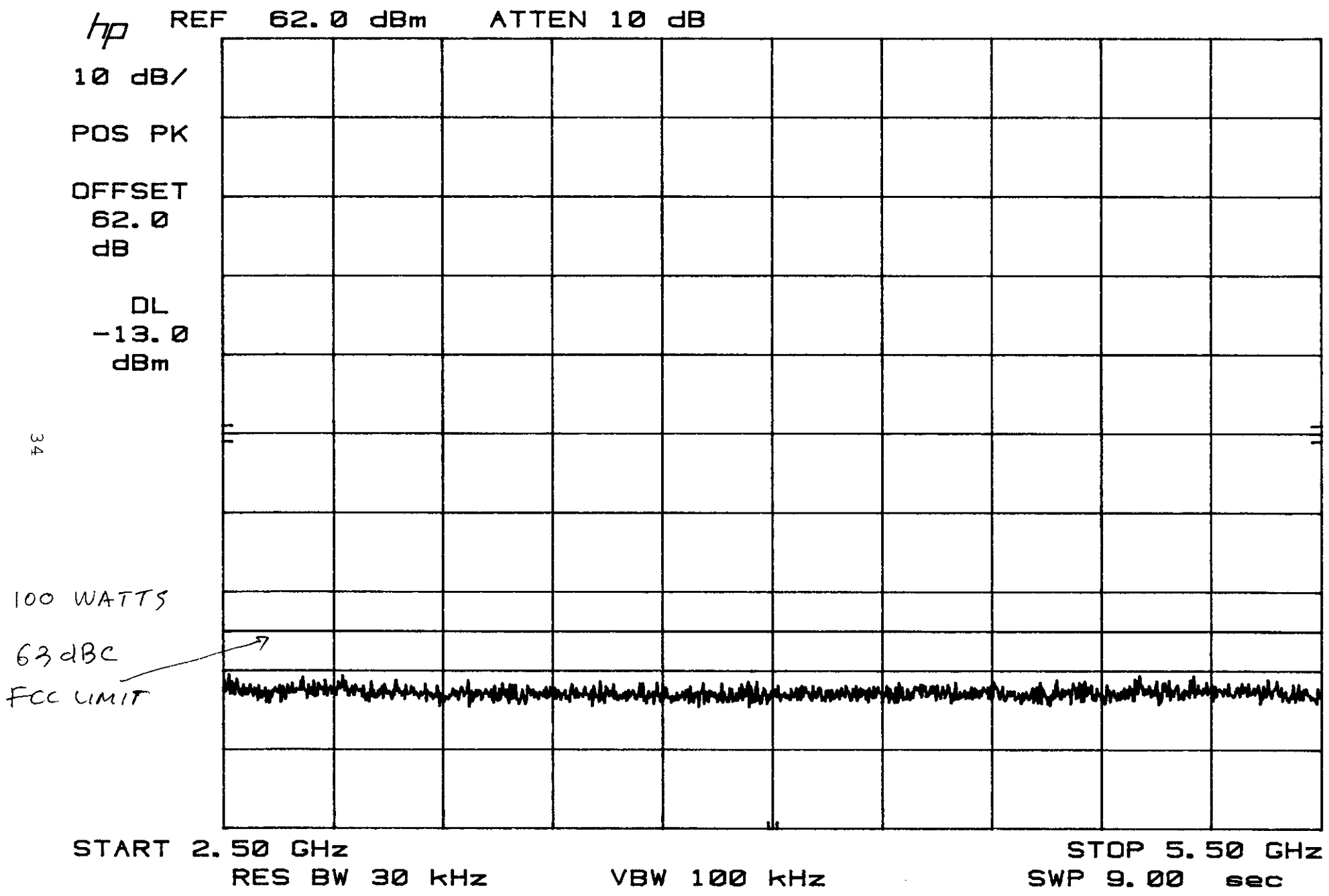
PA6 - IBE-MSI
ANTENNA CONDUCTED SPURIOUS



100 WATTS
63 dBc
FCC LIMIT

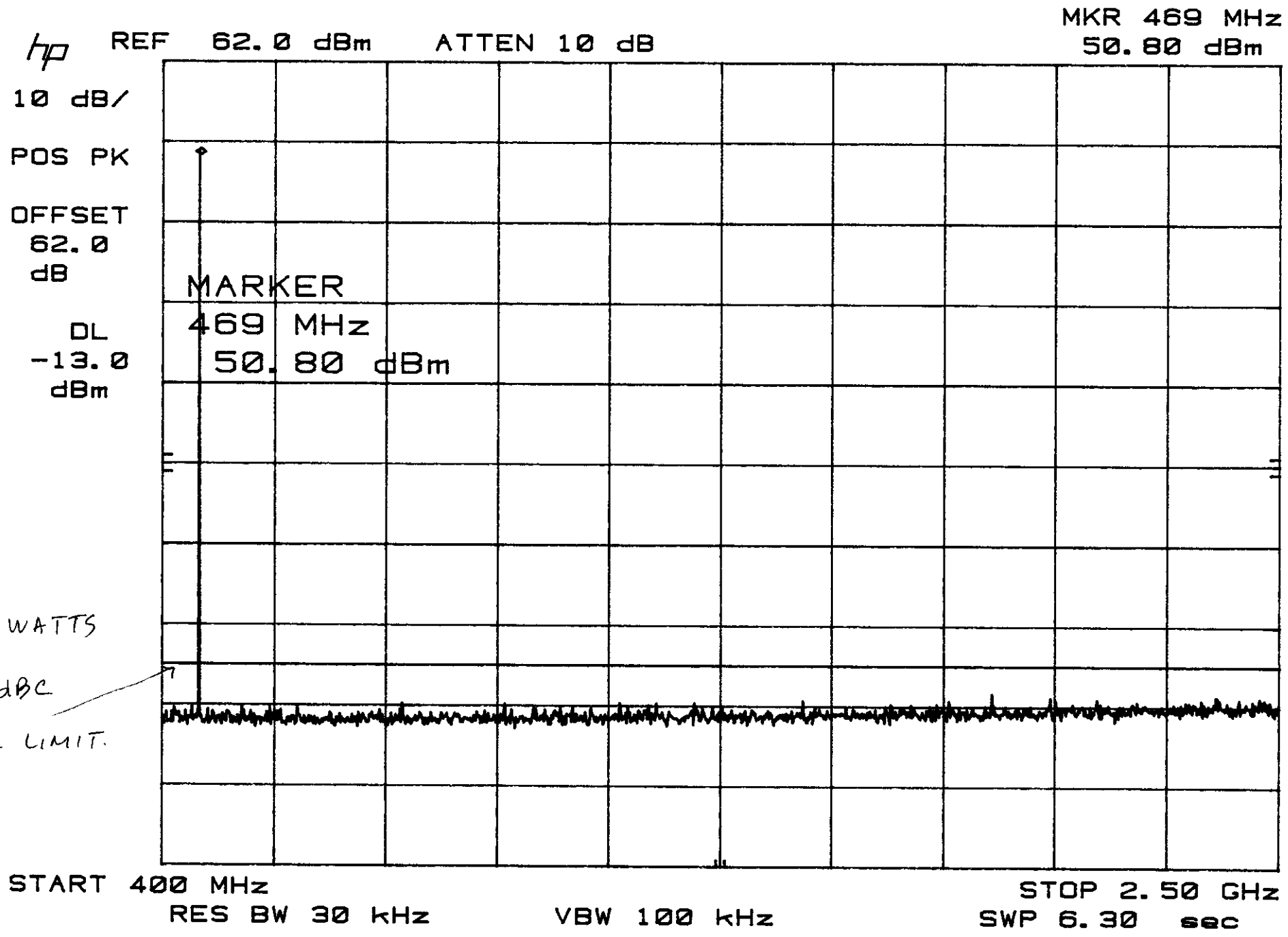
PAG - 1BE - MS1

ANTENNA CONDUCTED SPURIOUS



PAG - 1BE - MS1

ANTENNA CONDUCTED SPURIOUS

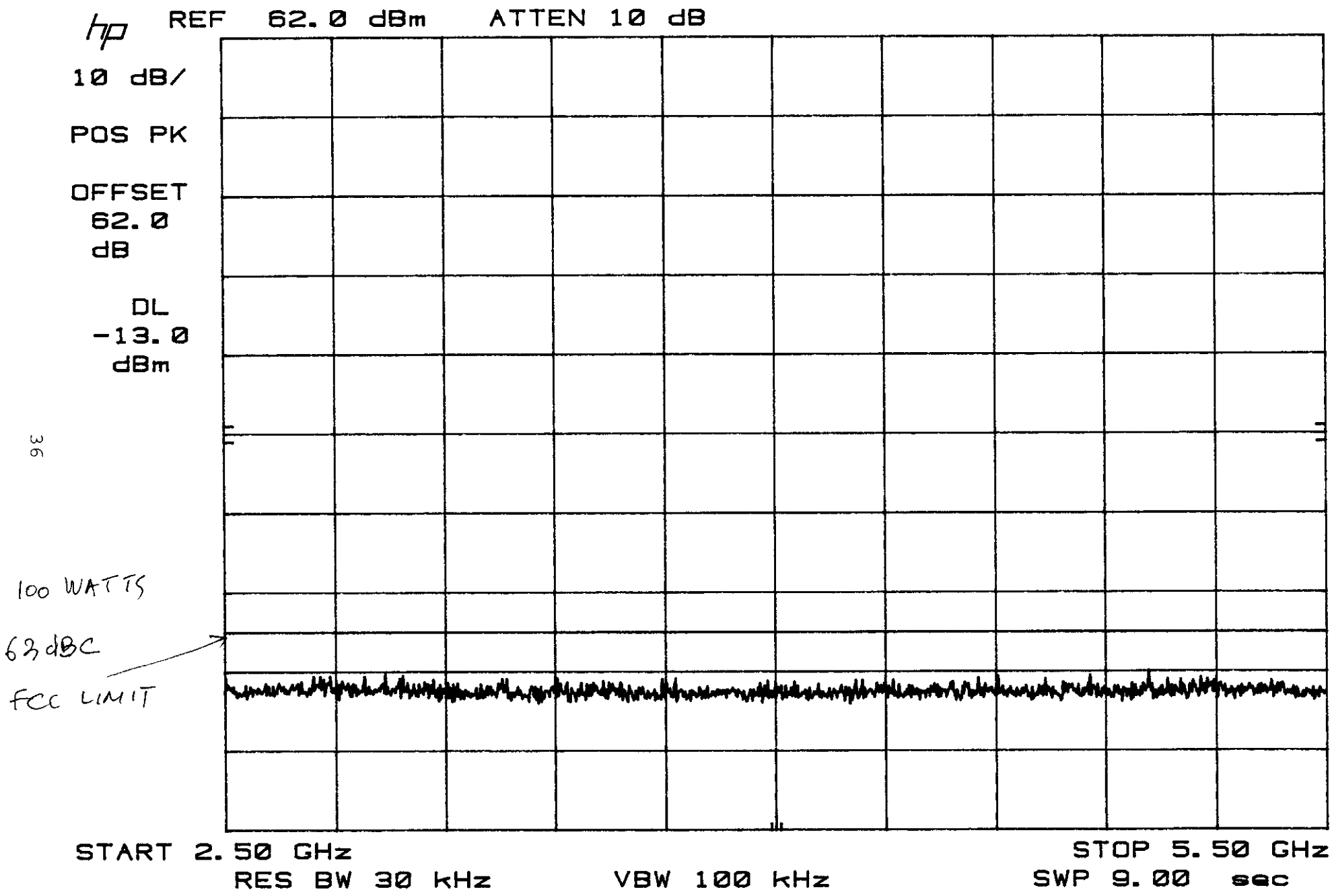


100 WATTS

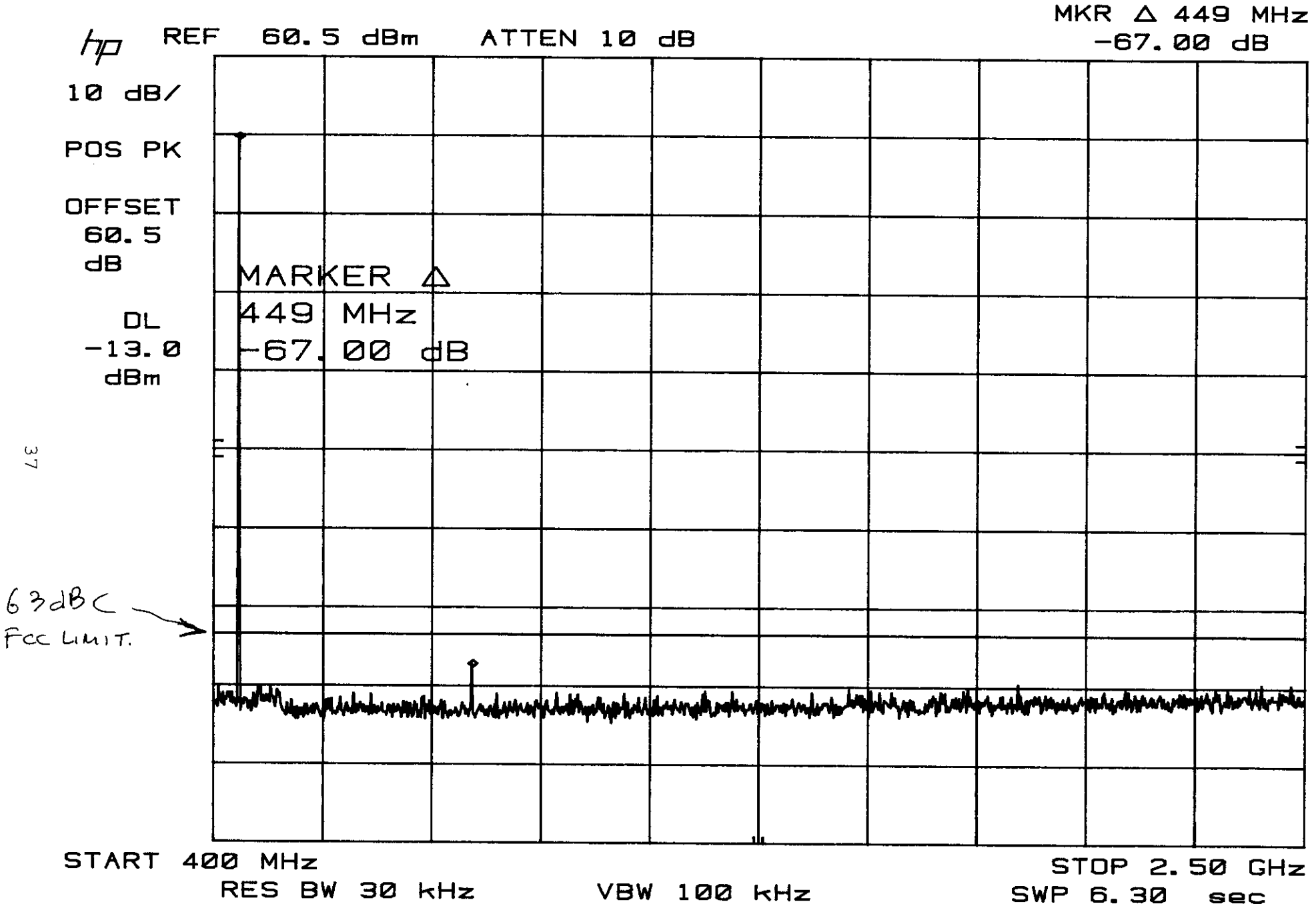
63 dBC

FCC LIMIT.

PA6-1BE-MS1
ANTENNA CONDUCTED SPURIOUS



ANTENNA CONDUCTED SPURIOUS
PAG - IEE - LMS



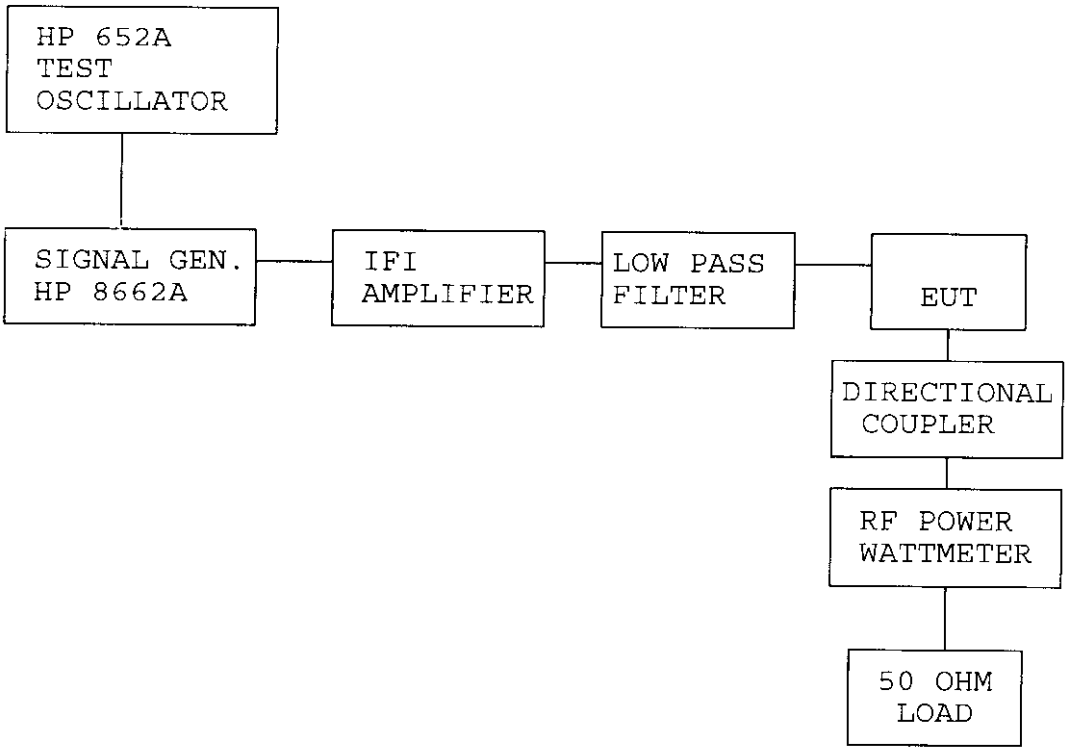


FIGURE 4. BLOCK DIAGRAM.
(SPURIOUS EMISSIONS TEST)

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 4-24-98 Pass X Fail ____ (at Freq. ____)

EUT RF Power Amplifier Operating Power 100 watts

Part No. PAG-1BE-MSI Operating Mode Saturated

Serial No. ____ Test Engineer Bryan Broadous

FREQUENCY TUNED TO 451 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)
V	902	79.6	23.9	6.2	30	79.7	147.4	67.7
V	1353	76.1	25.1	6.8	30	78.0		69.4
V	1804	71.8	28.0	7.4	30	77.2		70.2
V	2255	66.3	28.7	7.9	30	72.9		74.5
V	2706	64.0	29.8	8.5	30	72.3		75.1
V	3157	60.2	31.5	9.5	30	71.2		76.2
V	3608	58.4	32.2	10.4	30	71.0		76.4
V	4059	58.5	33.0	11.6	30	73.1		74.3
V	4510	53.0	33.5	12.7	30	69.2		78.2

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

Ro = Amplifier Output Impedance (Ohms)

Po = Amplifier Output Power (Watts)

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

FCC Limit = $43 + 10 \cdot (PO^{log}) = 63dB$

SPURIOUS RADIATED SIGNAL MEASUREMENTS

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

Date 4-24-98 Pass X Fail _____ (at Freq. _____)

EUT RF Power Amplifier Operating Power 100 watts

Part No. PAG-1BE-MSI Operating Mode Saturated

Serial No. _____ Test Engineer Bryan Broadous

FREQUENCY TUNED TO 451 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)
H	902	79.0	23.9	6.2	30	79.1	147.4	68.3
H	1353	75.1	25.1	6.8	30	77.0		70.4
H	1804	72.9	28.0	7.4	30	78.3		69.1
H	2255	67.2	28.7	7.9	30	73.8		73.6
H	2706	67.3	29.8	8.5	30	75.6		71.8
H	3157	66.5	31.5	9.5	30	77.5		69.9
H	3608	59.7	32.2	10.4	30	72.3		75.1
H	4059	58.2	33.0	11.6	30	72.8		74.6
H	4510	54.9	33.5	12.7	30	71.1		76.3

Fundamental Field Strength (V/m) = 1/3 (Ro x Po)^{½}

Ro = Amplifier Output Impedance (Ohms)

Po = Amplifier Output Power (Watts)

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

FCC Limit = 43 + 10·(PO^{Log}) = 63 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.

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

APPENDIX A

TEST EQUIPMENT

DNB ENGINEERING, INC.
EMC TEST EQUIPMENT

MANUFACTURER	DESCRIPTION	MODEL
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
Polarad	Plug-in 2-22 GHz	26290B
Telonics	Signal Generator 3.7 to 8.4 GHz	1107E
Wiltron	Sweep Generator	4053A
Hewlett Packard	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
	Signal Generator	8654A

DNB ENGINEERING, INC.
EMC TEST EQUIPMENT

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

DNB ENGINEERING, INC.
EMC TEST EQUIPMENT

Solar	Coupling Network	7835-896
Solar	LISN (5 μh)	6338-5
Solar	LISN (50 μh)	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 50Ω Load	376NM
Eaton	WBA 500 - 1000 MHz	15100B
ENI	WBA 250 KHz - 150 MHz	3100LA
ENI	WBA 1.5 - 500 MHz	550l
Avantek	Low Noise Amplifier 6-12.4 GHz	AFT12635
Hewlett Packard	500 MHz Digitizing Oscilloscope	54111D
Tenney	Temperature Chamber	THjr

DNB ENGINEERING, INC.
EMC TEST EQUIPMENT

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	50Ω Load 10 W 50's	80-53
Stoddart	50Ω Load	90514
Micro Lab	50Ω Load	TB-5MN
Tekscan	50Ω Attenuator Kit	FP-50
Tenuline	50Ω 100 W 20 dB Attenuator	8343-200
Micro Lab	50Ω 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

MANUFACTURER	DESCRIPTION	MODEL
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