

WYLE

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP



(NASA-CR-178812) A DATA BASE AND ANALYSIS
PROGRAM FOR SHUTTLE MAIN ENGINE DYNAMIC
PRESSURE MEASUREMENTS. APPENDIX E: DATA
BASE PLOTS FOR SSME TESTS 750-112 THROUGH
750-118 Final Report (Wyle Labs., Inc.)

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Unclas
06056

G3/20



research REPORT

WYLE LABORATORIES - RESEARCH STAFF
TECHNICAL REPORT 66338-01

A DATA BASE AND ANALYSIS PROGRAM
FOR SHUTTLE MAIN ENGINE
DYNAMIC PRESSURE MEASUREMENTS
APPENDIX E

DATA BASE PLOTS FOR SSME TESTS
750-112 through 750-118

by

Thomas Coffin

A final report of
work performed under contract NAS8-34343

for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812

January 1986

FOREWORD

This report describes a dynamic pressure data base and data base management system developed to characterize the Space Shuttle Main Engine (SSME) dynamic pressure environment. The data base represents dynamic pressure measurements obtained during single engine hot firing tests of the SSME. Software is provided to permit statistical evaluation of selected measurements under specified operating conditions. An interpolation scheme is also included to estimate spectral trends with SSME power level. This report was prepared by Wyle Laboratories Scientific Services and Systems Group for the National Aeronautics and Space Administration, George C. Marshall Space Flight Center. The work was performed under NASA contract NAS 8-34343, entitled "Flow Dynamic Environments in High Performance Rocket Engines."

The author wishes to acknowledge the contribution to this study by Dr. G. Meares, Chief Architect of the data base management software described herein. Messrs. B. Dobbs and D. Duck contributed long hours over a digitizer pad to accomplish data base input. The singular value decomposition software for spectrum interpolation was developed by Dr. J. Jong. Mr. T. Nesman, MSFC technical contract monitor, provided continuing support through informal project reviews and served as a focal point for definition of SSME data requirements.

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor</u> (Time History or PSD)	<u>Maximum</u> <u>Frequency</u> (Hz)	<u>Time</u> <u>Slice</u> (Sec)
112	THRUST	20,000	30
	LPOP DS PR		150
	HPOP BAL CAV PR2		280
	HPOP BAL CAV PR1		30
	HPOT TURB DR PR		150
	LPFP DS PR		280
	LPOP DS PR		30
	HPOP BAL CAV PR2		150
	MCC HOT GAS IN PR		280
	LPOT TURB DR PR		30
	OPB PC PR		150
	HEX OUTLET		280
	THRUST		30
	LPOP DS PR		150
	HPOP BAL CAV PR2		280
113	HPOP BAL CAV PR1	5,000	30
	HPOP DS PR		150
	MCC HOT GAS IN PR		280
	PBP DS PR		30
	LPOP DS PR		150
	HPOP BAL CAV PR2		280

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
113	HPOP BAL CAV PR2	20,000	30
	↓	↓	150
	HPOP DS PR	5,000	280
	↓	↓	30
	↓	↓	150
	↓	↓	280
	MCC HOT GAS IN PR	20,000	30
	↓	↓	150
	↓	↓	280
	↓	↓	30
	MCC HOT GAS IN PR	40,000	150
	↓	↓	280
	PBP DS PR	5,000	30
	↓	↓	150
	↓	↓	280
	↓	↓	30
	LFPF DS PR	20,000	150
	↓	↓	280
	↓	↓	30
	LPOP TURB DR PR	5,000	150
↓	↓	280	
↓	↓	30	
OPB PC PR	20,000	150	
↓	↓	280	
↓	↓	30	
MCC LONG ACCEL 1	5,000	150	
↓	↓	280	
OPB PC PR DC	40,000	280	
↓	↓	30	
↓	↓	150	
↓	↓	280	
↓	↓	30	
↓	↓	150	
↓	↓	280	
114	THRUST		
↓	LPOP DS PR		
	HPOP BAL CAV PR2		

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
114	HPOP BAL CAV PR1	20,000	30
	HPOP DS PR		150
	MCC HOT GAS IN PR		280
	PBP DS PR		30
	LPOT TURB DR PR		150
	LPOP DS PR		280
	HPOP BAL CAV PR2		30
	HPOP DS PR		150
	MCC HOT GAS IN PR		280
	PBP DS PR		30
	LPFP DS PR		150
	LPOT TURB DR PR		280
	OPB PC PR		30
	HPOP DS PR		150
	THRUST		280
	LPOP DS PR		30
	HPOP BAL CAV PR2		150
HPOP BAL CAV PR1	280		
MCC HOT GAS IN PR	30		
PBP DS PR	150		
HPFP DS PR	280		
LPOP DS PR	30		
115		20,000	150
			280

DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
115	HPOP BAL CAV PR2	5,000	30
			150
			280
		20,000	30
			150
			280
	MCC HOT GAS IN PR		30
			150
			280
		40,000	30
			150
			280
	PBP DS PR	20,000	30
			150
			280
	LPFP DS PR		30
			150
			280
	LPOT TURB DR PR	5,000	30
			150
		280	
	20,000	30	
		150	
		280	
	OPB PC PR		30
			150
	HPFP DS PR		30
			150
			280
	HOT GAS MAN PR3		30
			150
			280
	OPB PC PR DC		30
			150
			280
116	THRUST		
	LPOP DS PR		
	HPOP BAL CAV PR2		
	HPOP BAL CAV PR1		
	HPOP DS PR		
	MCC HOT GAS IN PR		
	PBP DS PR		
	OPB PC PR		
	HPFP DS PR		
	HOT GAS MAN PR3		
	HPFP BAL CAV PR		

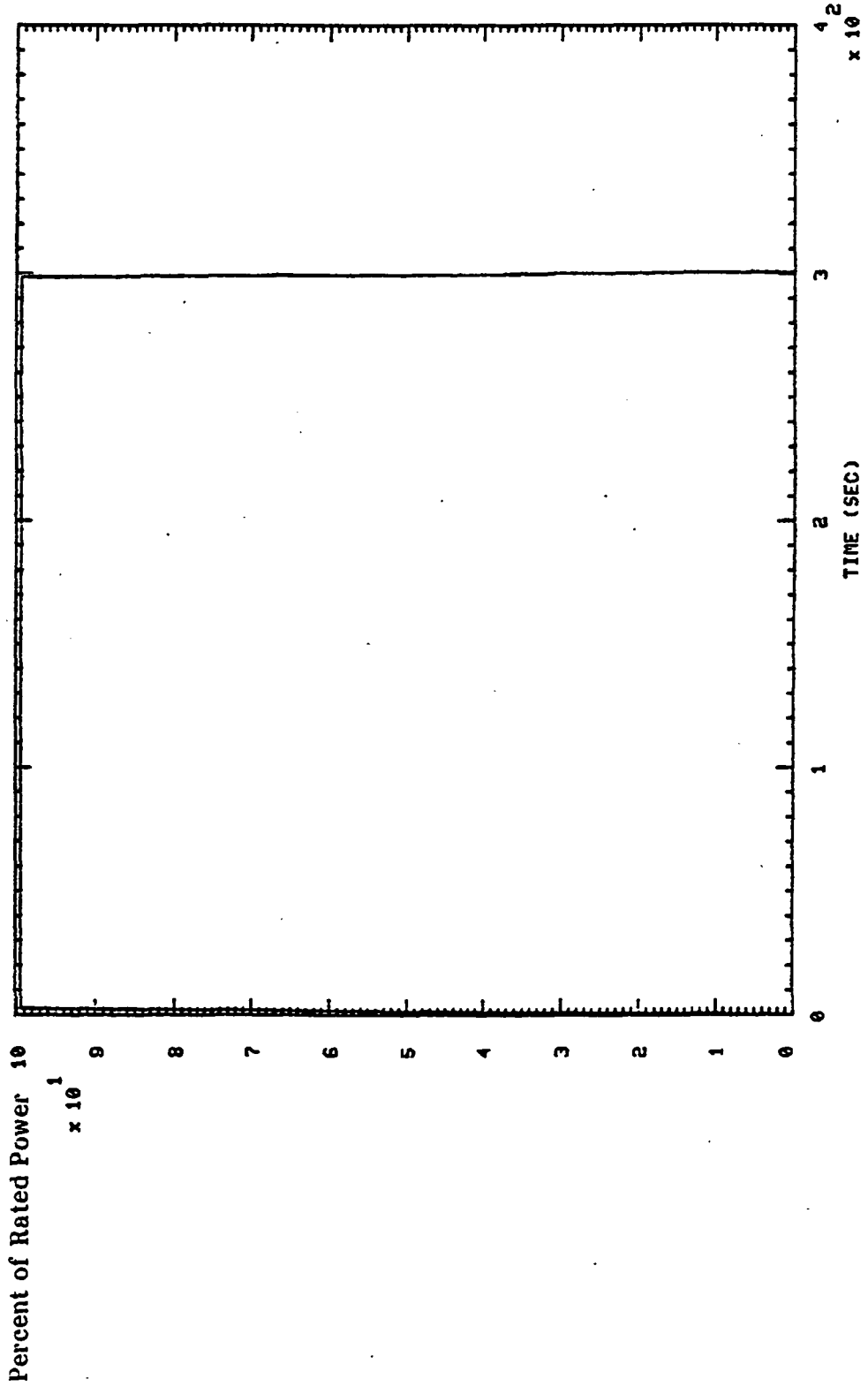
DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
116	LPOP DS PR	5,000	30
			150
			280
		20,000	30
			150
			280
	HPOP BAL CAV PR2	5,000	30
			150
			280
		20,000	30
			150
			280
	HPOP DS PR		30
			150
			280
	MCC HOT GAS IN PR		30
			150
			280
		40,000	30
			150
			280
	PBP DS PR	5,000	30
			150
			280
		20,000	30
			150
			280
	LFPF DS PR		30
		150	
		280	
LPOT TURB DR PR	5,000	30	
		150	
		280	
	20,000	30	
		150	
		280	
OPB PC PR		30	
		150	
		280	
HPFP DS PR		30	
		150	
		280	
HOT GAS MAN PR3		30	
		150	
		280	

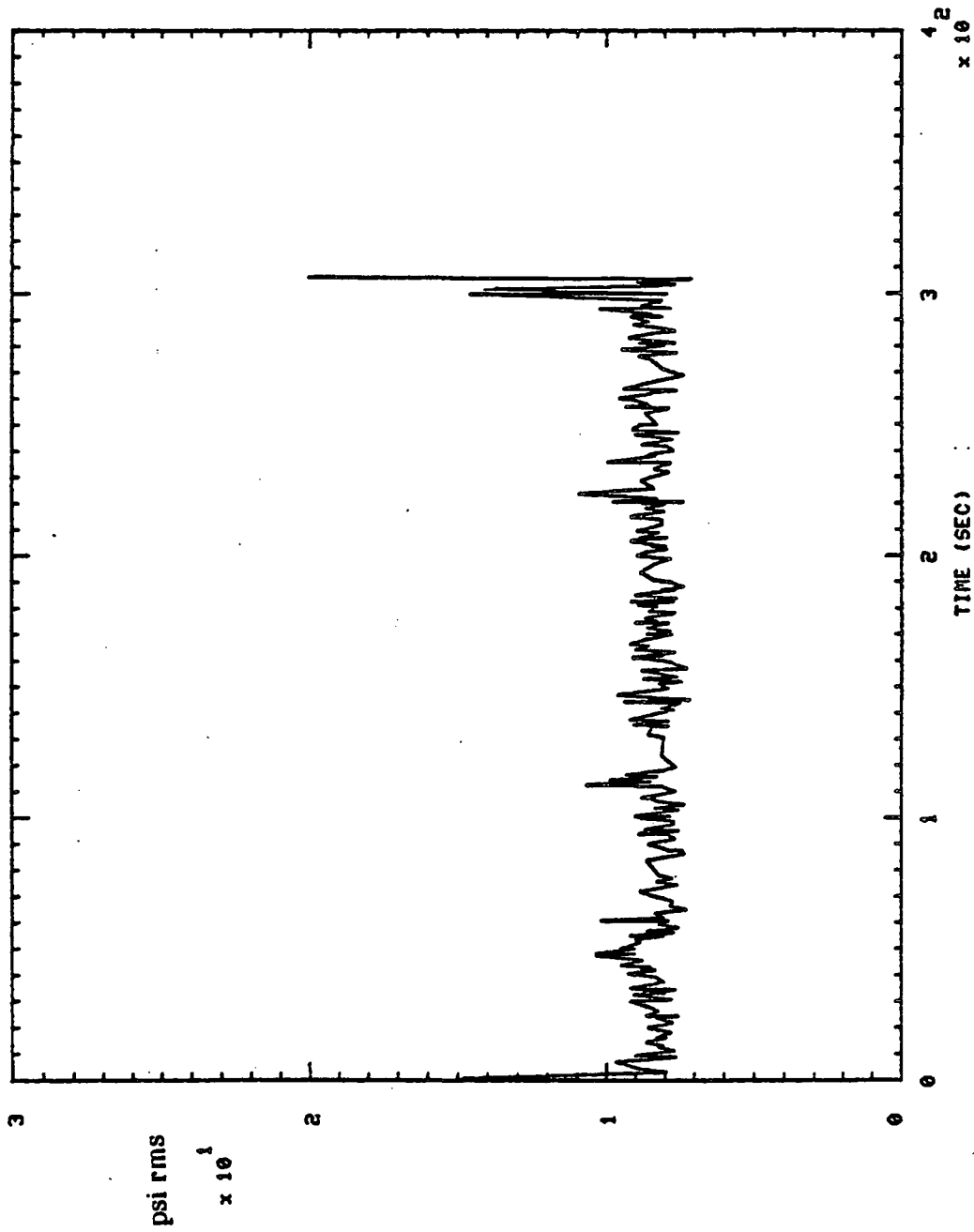
DATA PLOT LISTING FOR TEST STAND A3 (Continued)

<u>Test</u>	<u>Channel Descriptor (Time History or PSD)</u>	<u>Maximum Frequency (Hz)</u>	<u>Time Slice (Sec)</u>
117	HPFP DS PR	20,000	30
			150
			297
	HPFP BAL CAV PR		30
			150
			297
118	OPB PC PR DC	20,000	30
			150
			297
	THRUST		30
	LPOP DS PR		150
	HPOP BAL CAV PR1		280
	PBP DS PR		30
	LPOP DS PR		150
			280
	MCC HOT GAS IN PR		30
			150
			280
		40,000	30
			150
			280
	PBP DS PR	20,000	30
			150
			280
	HPFP BAL CAV PR		30
			150
			280
	OPB PC PR DC		30
		150	
		280	

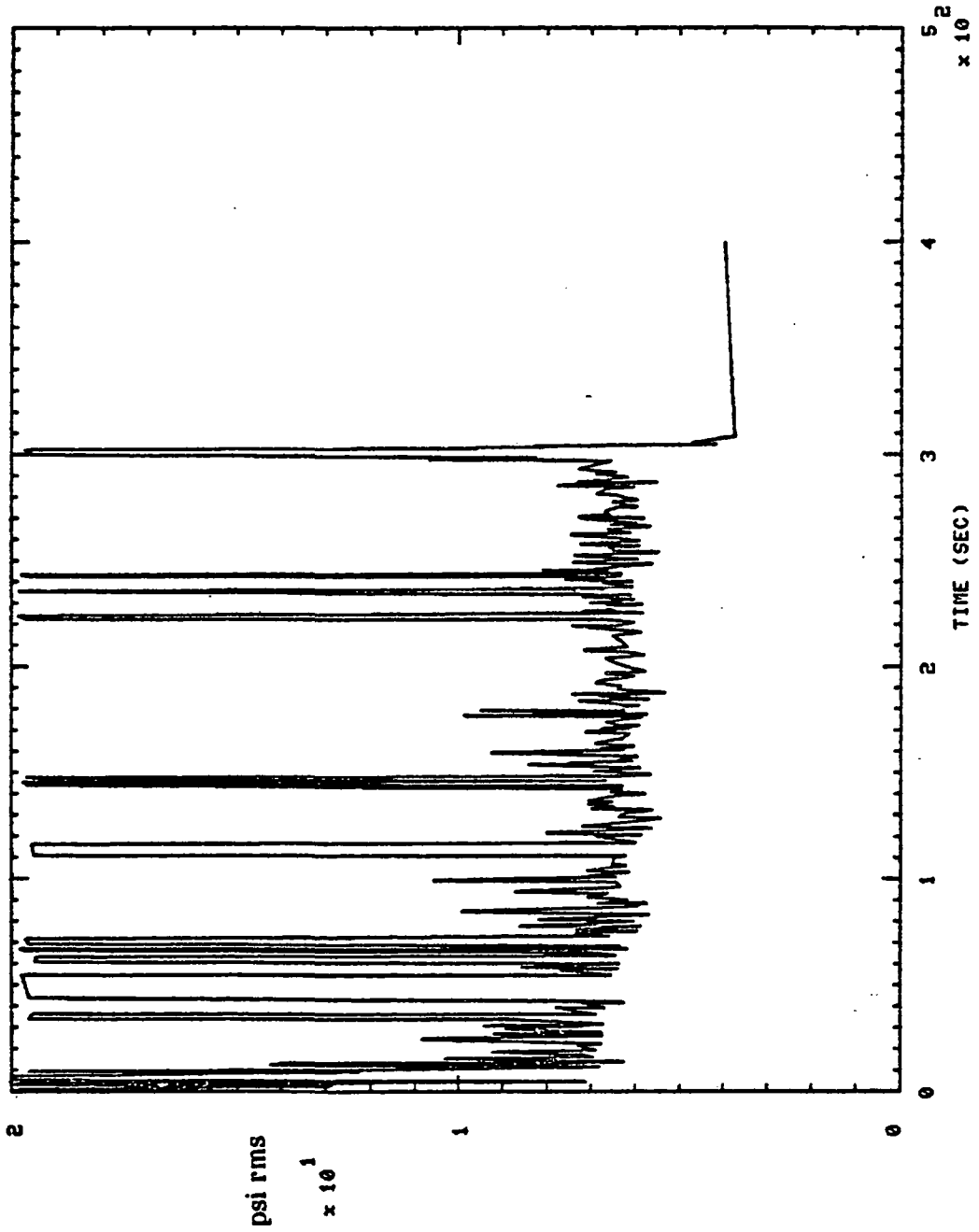
750112 THRUST (UNFILTERED)



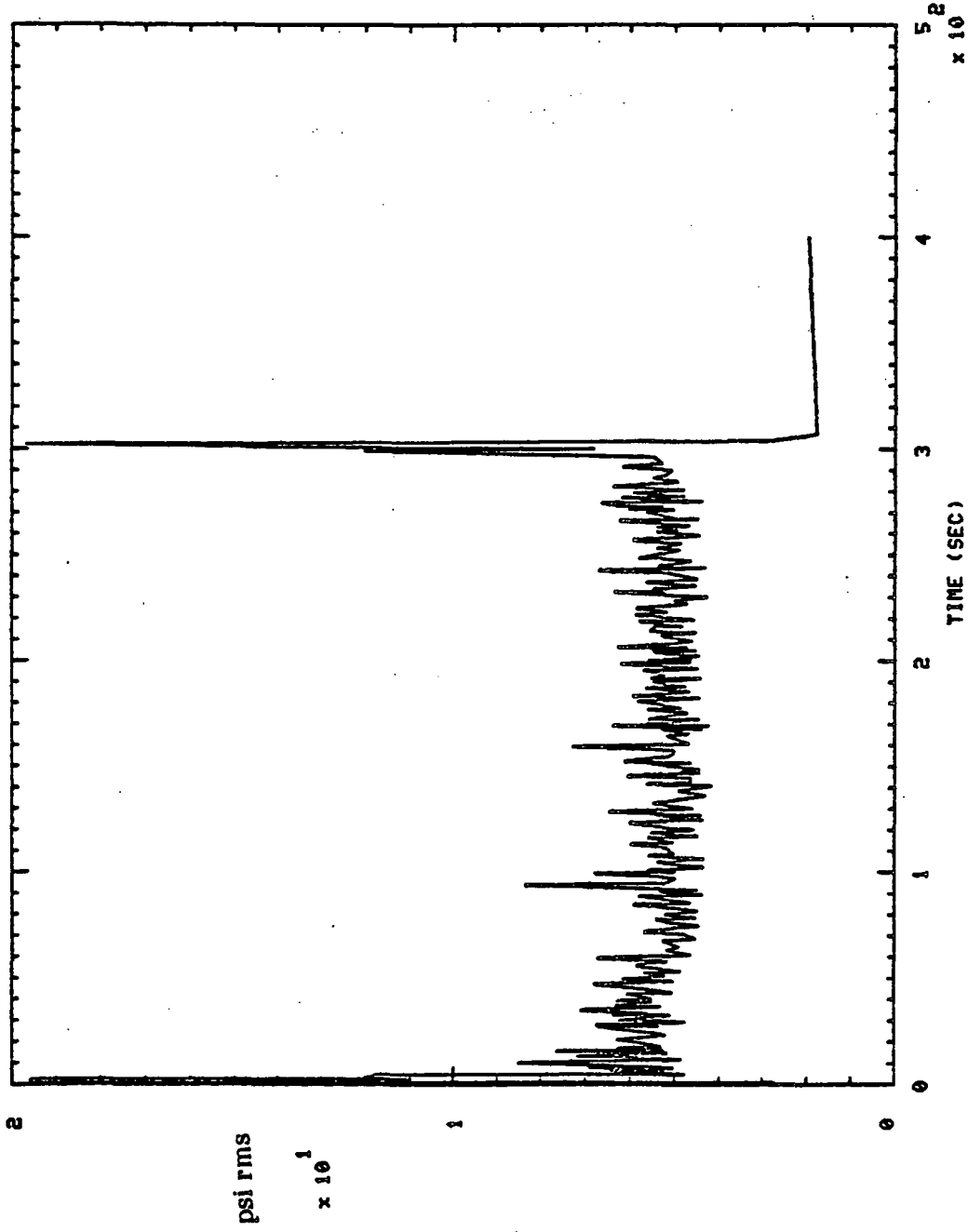
750112 LPOP DS PR (1 - 20K HZ)



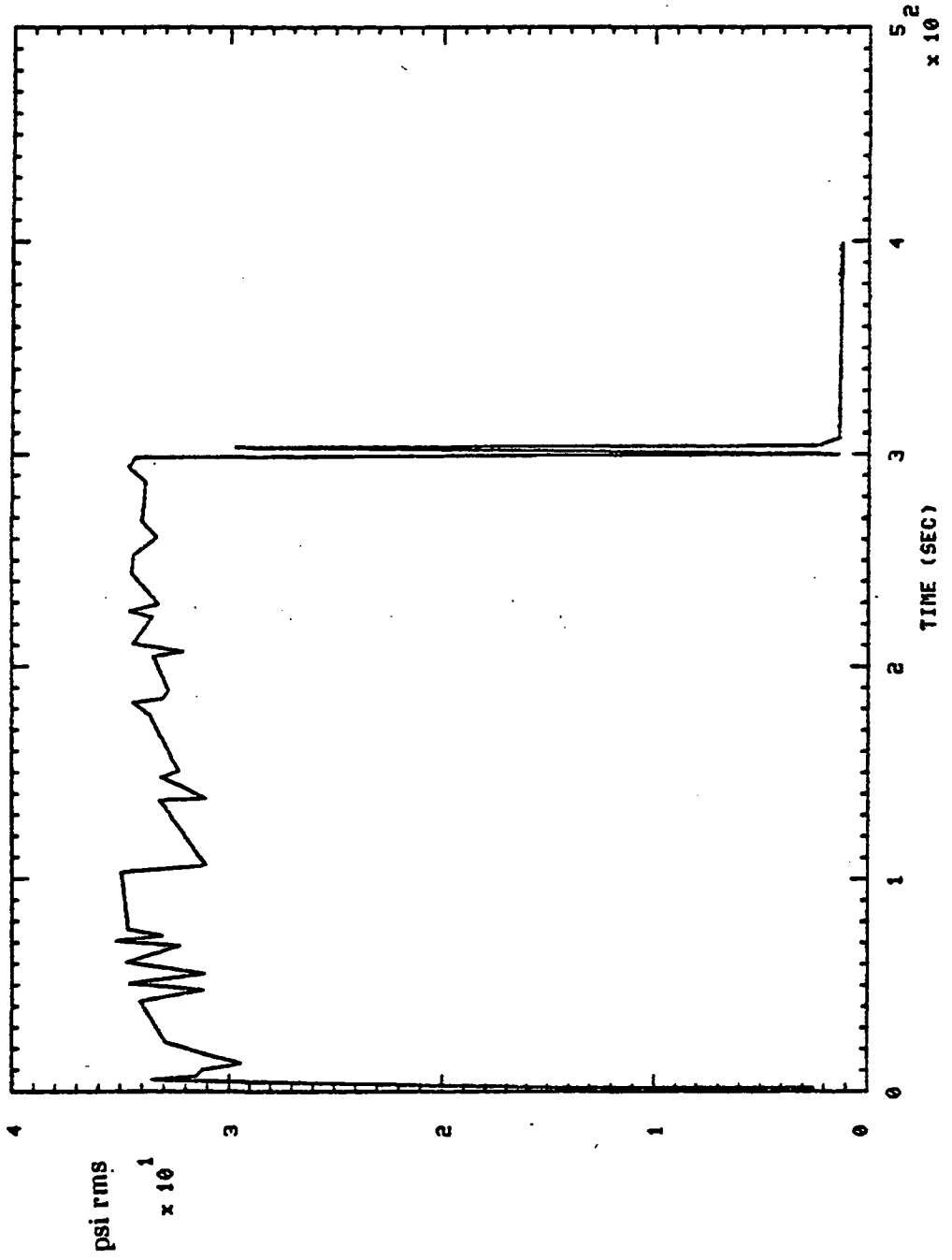
750112 HPOP BAL CAU PR2 (1 - 20K HZ)



750112 HPOP BAL CAU PR1 (1 - 20K HZ)

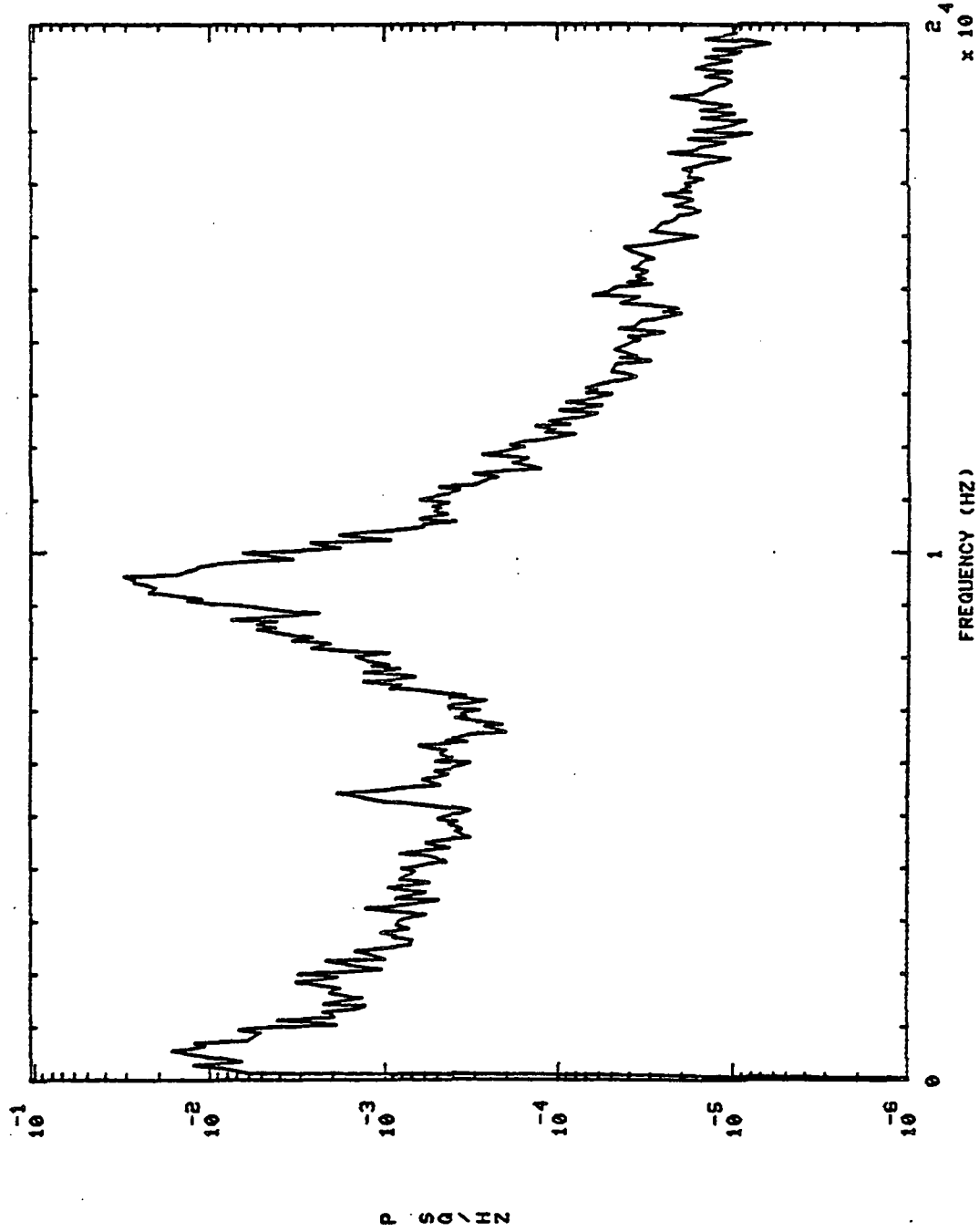


750112 LPOT TURB DR PR (1 - 20K HZ)



S+ 30.01H0,'S

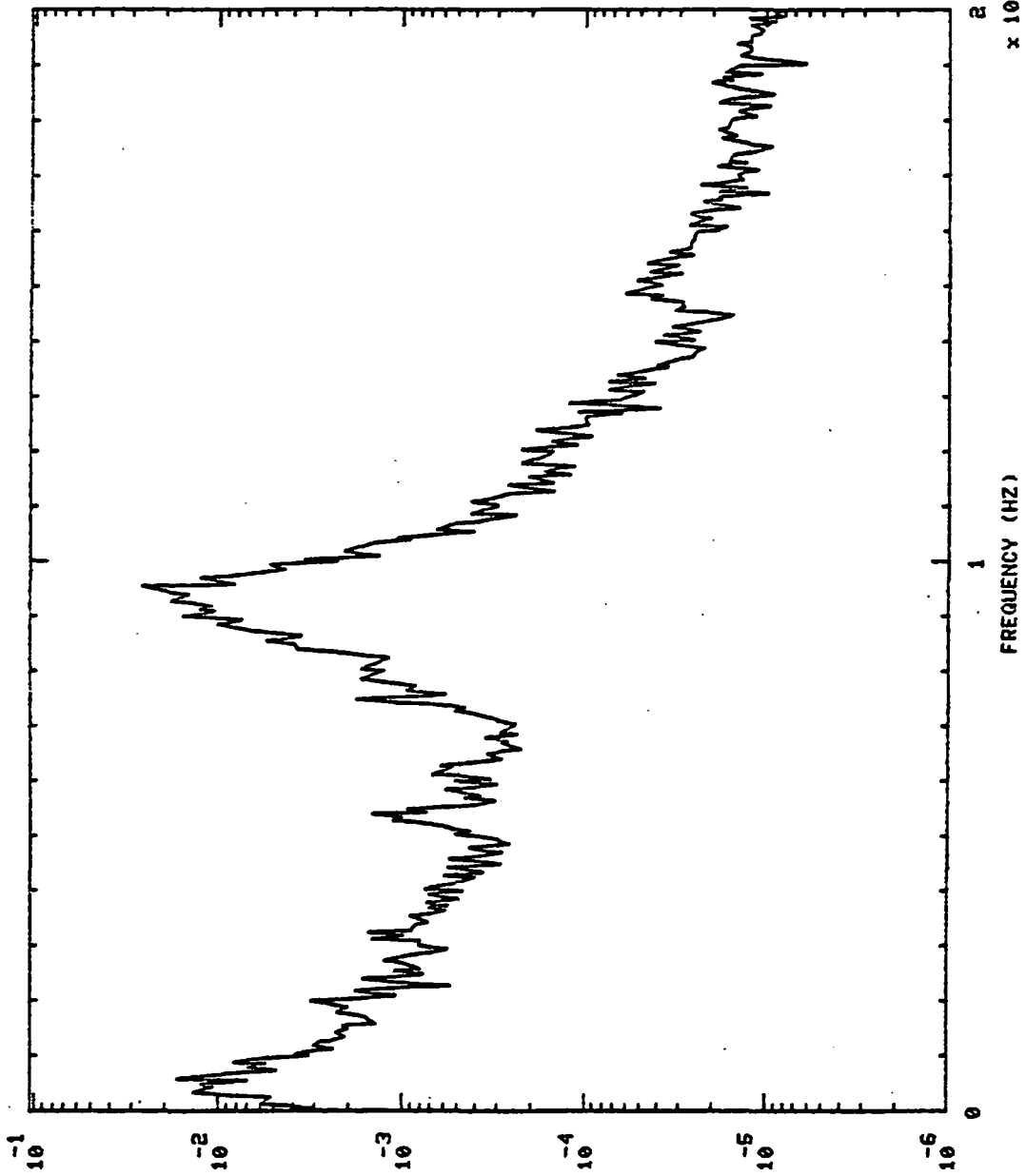
750112 LPFP DS PR



S+ 150.01H0, 'S

LPFP D5 PR

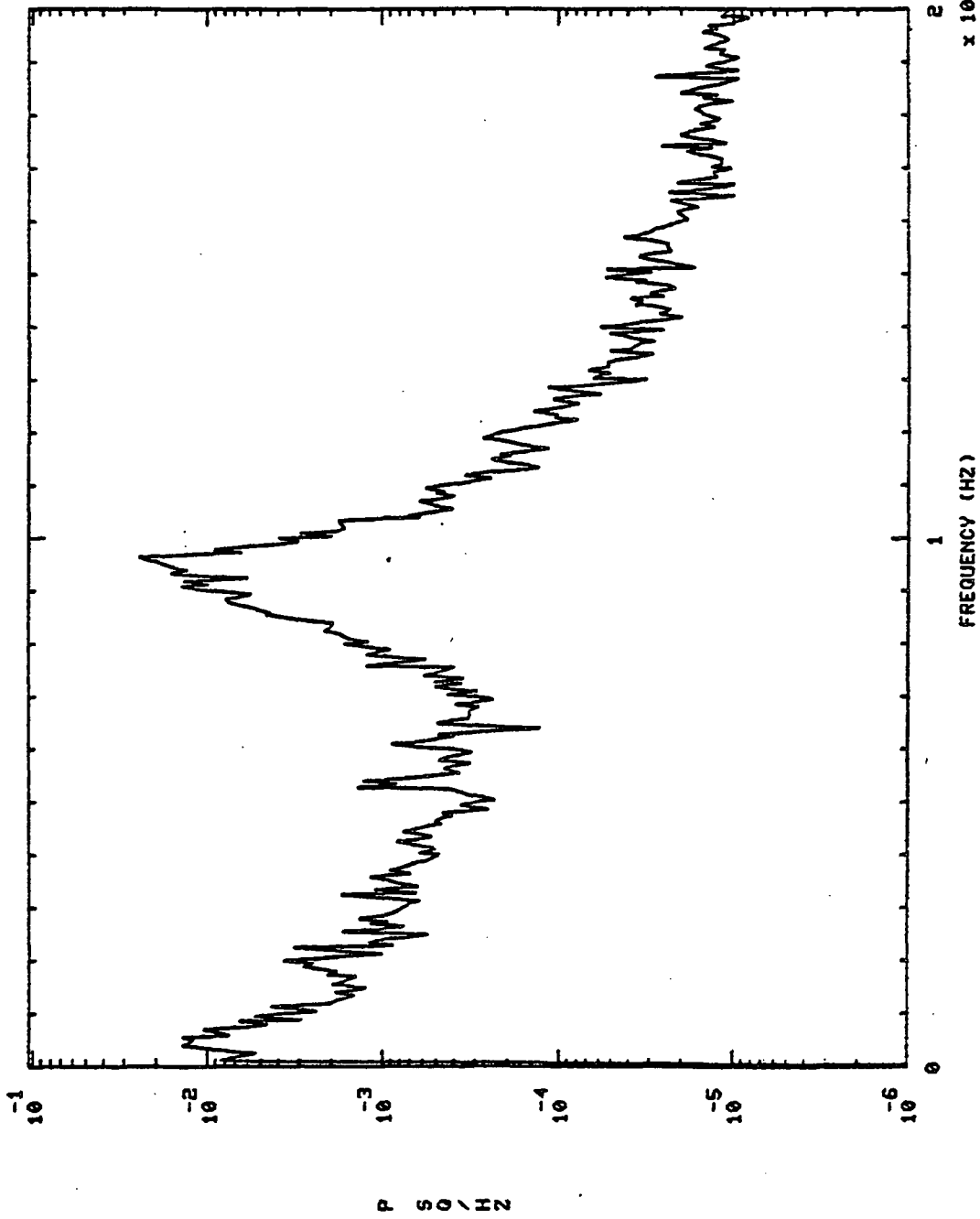
750112



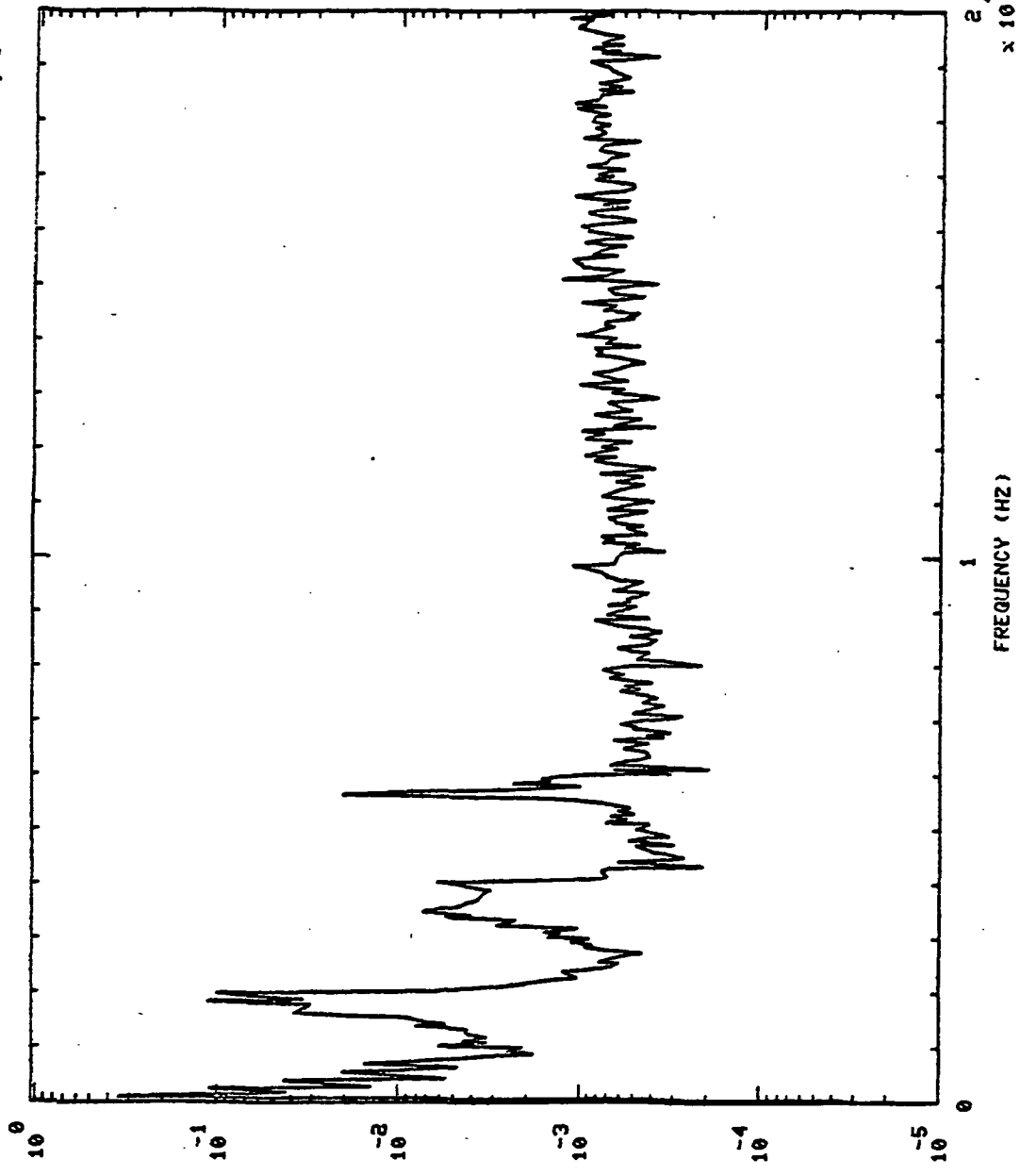
P S D \ HZ

S+ 280.01H0, 'S

750112 LPFP DS PR



750112 LPOP DS PR S+ 30.01H0,'S



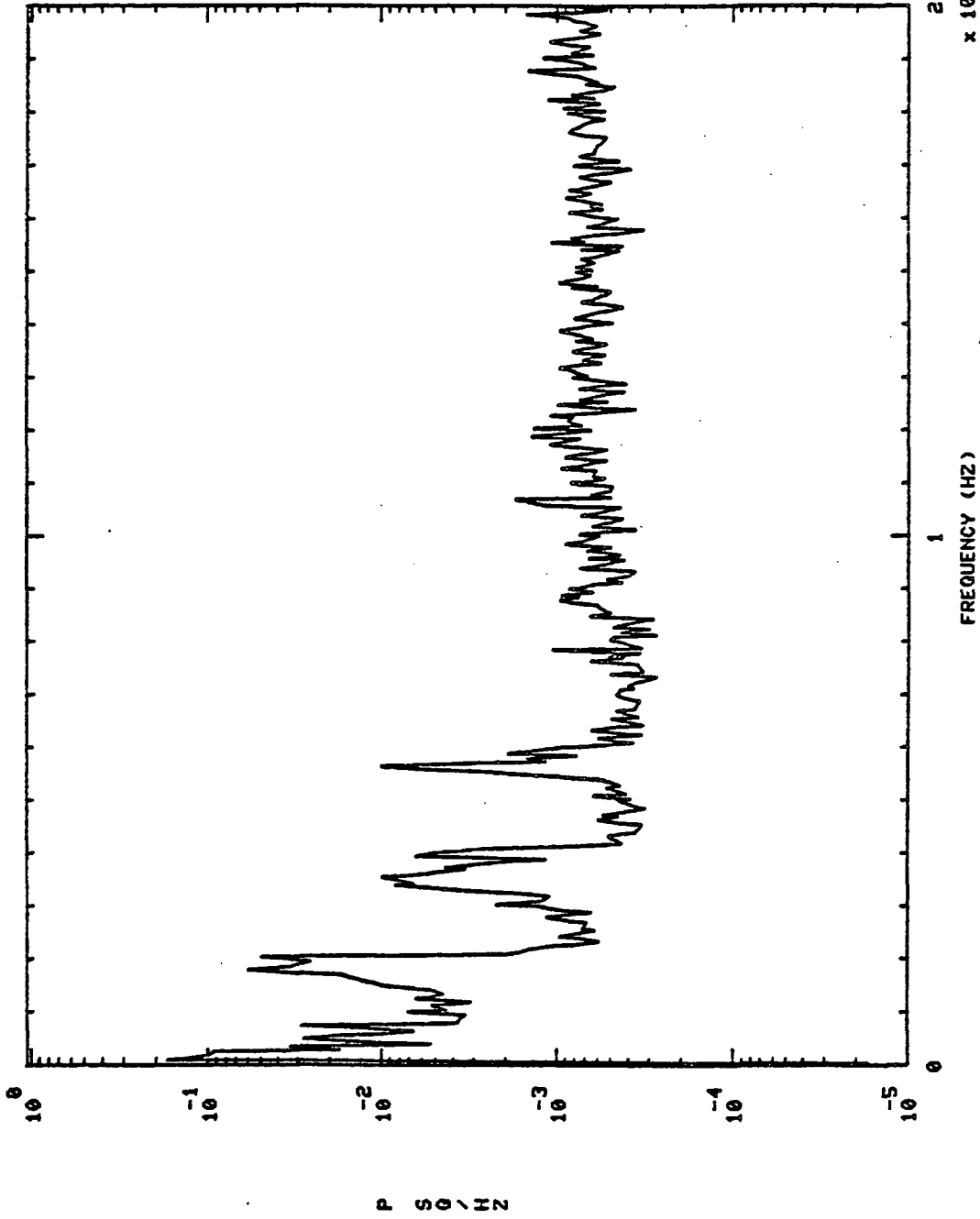
P SQ\HZ

2.4×10^4

FREQUENCY (HZ)

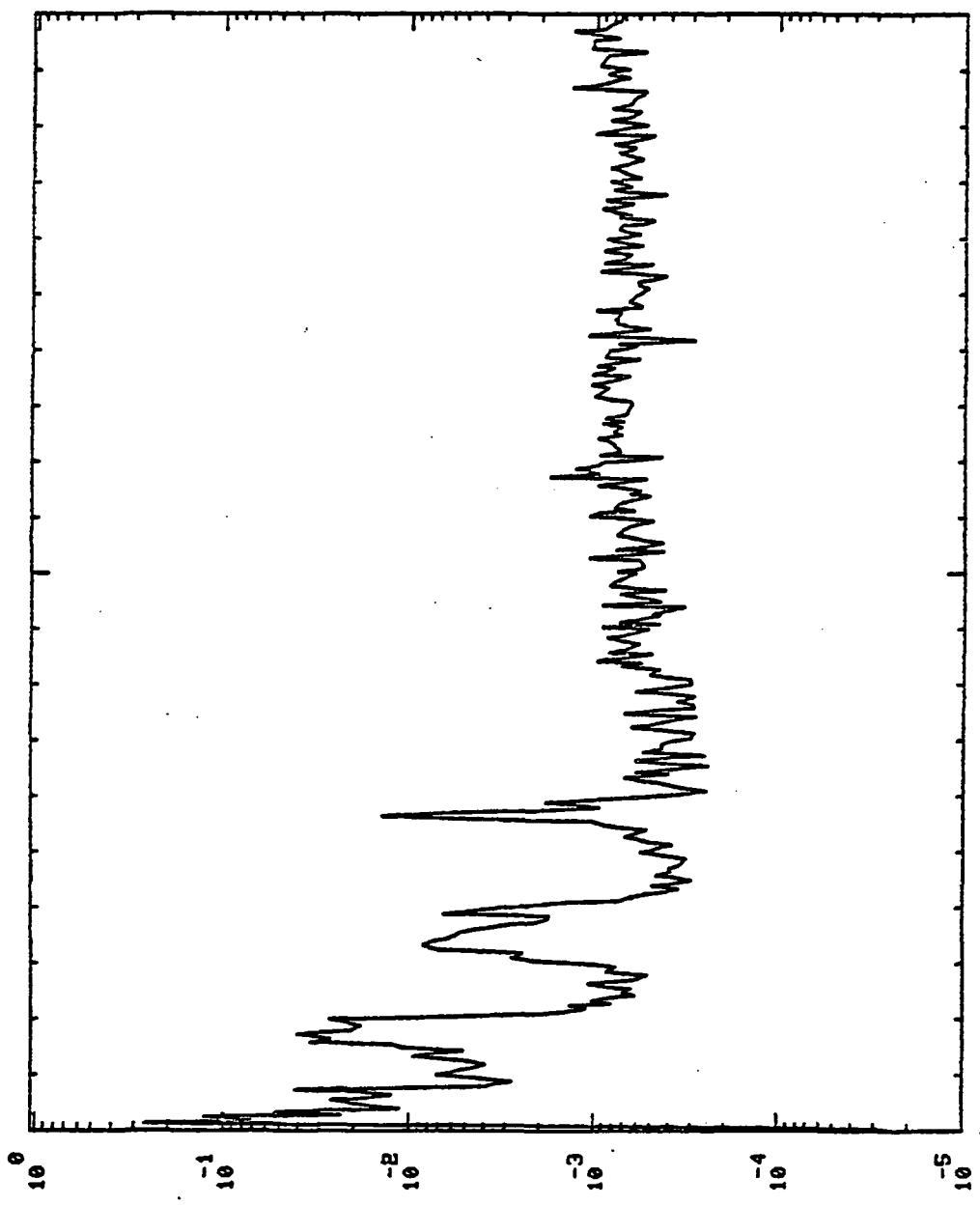
S+ 150.01H0,'S

750112 LPOP DS PR



S+ 280.01H0, 'S

750112 LPOP DS PR

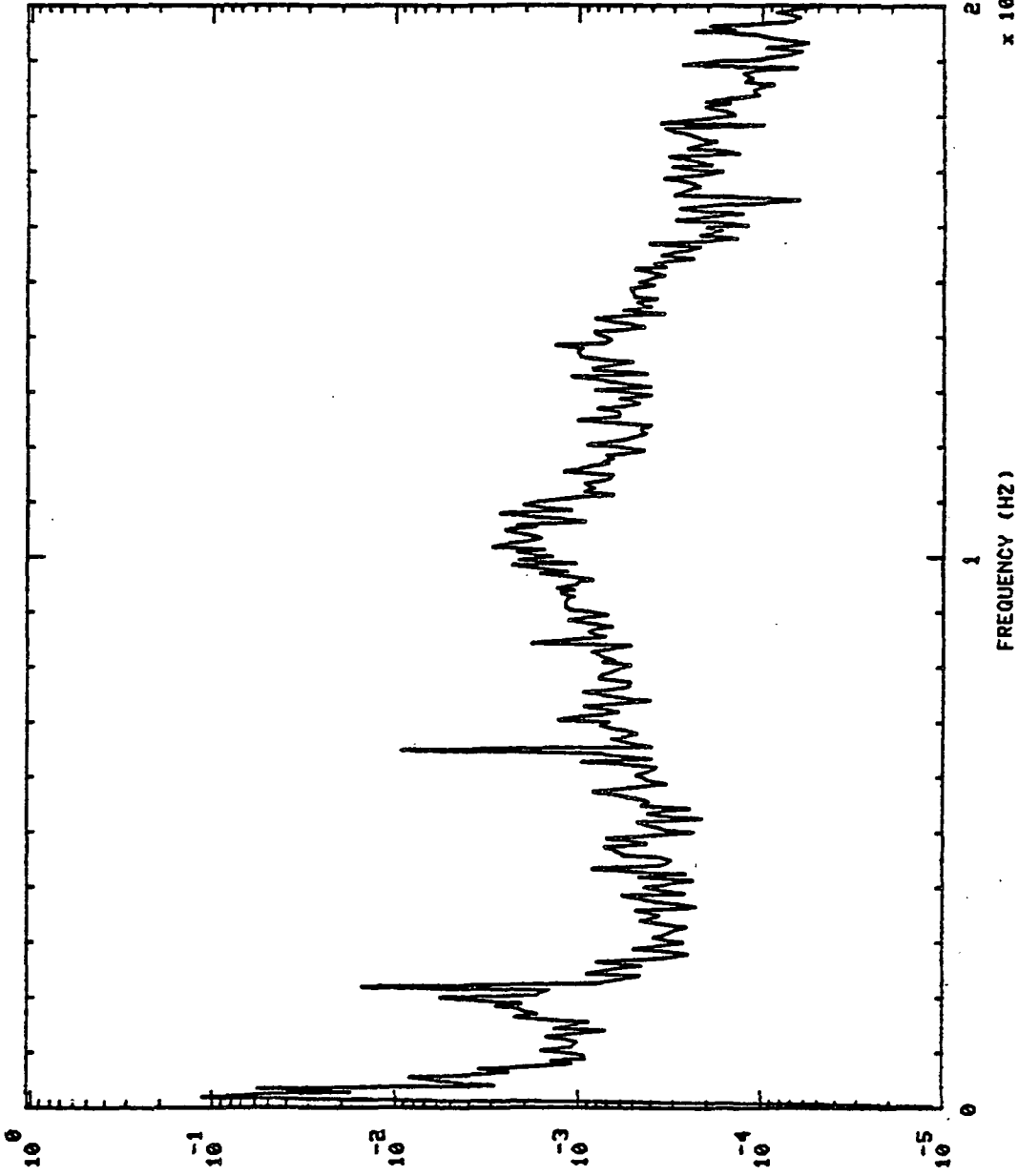


10⁴
x 10

1
FREQUENCY (HZ)

P S D / H Z

750112 HPOP BAL CAU PR2 S+ 30.0110.'S

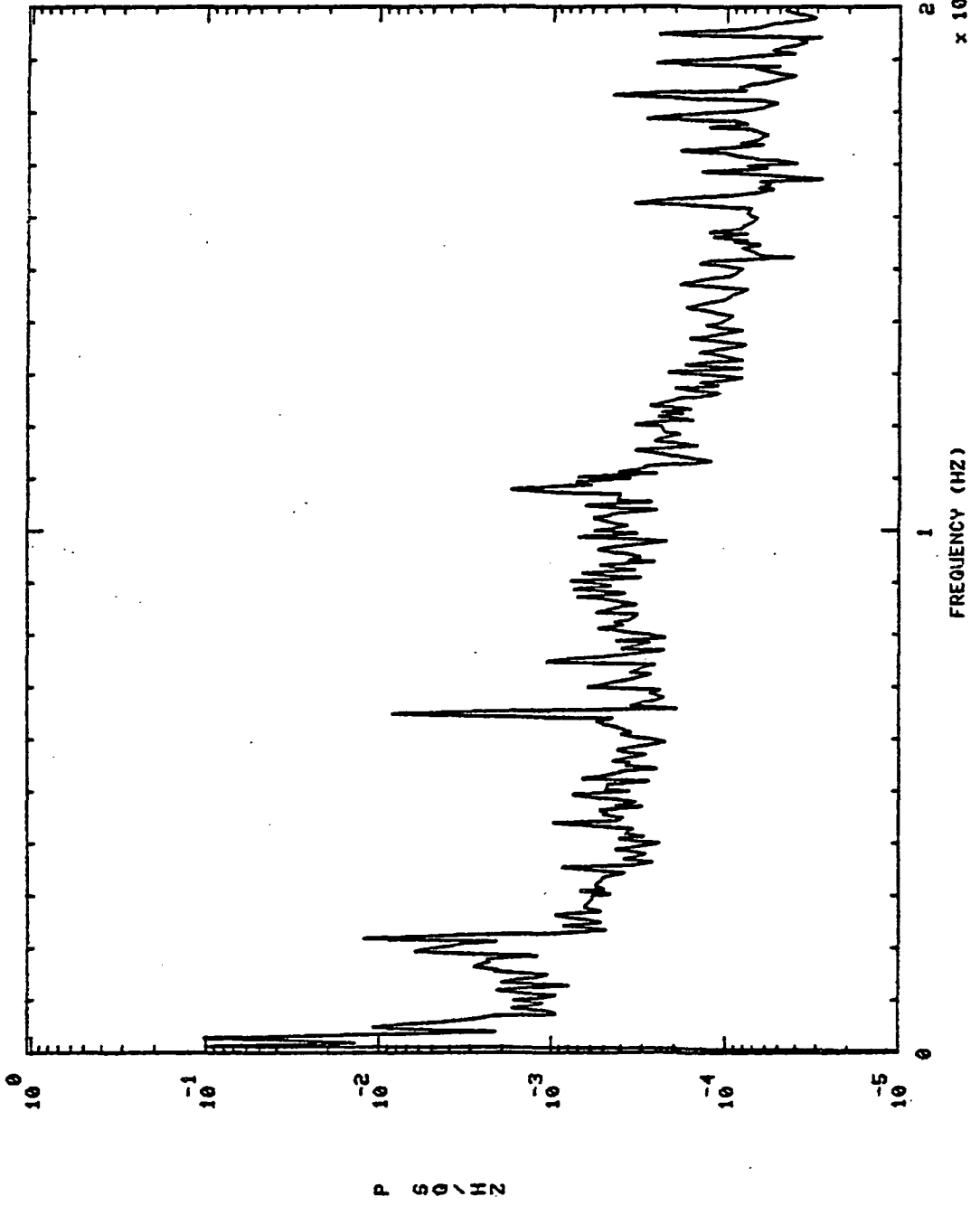


P S D \ H Z

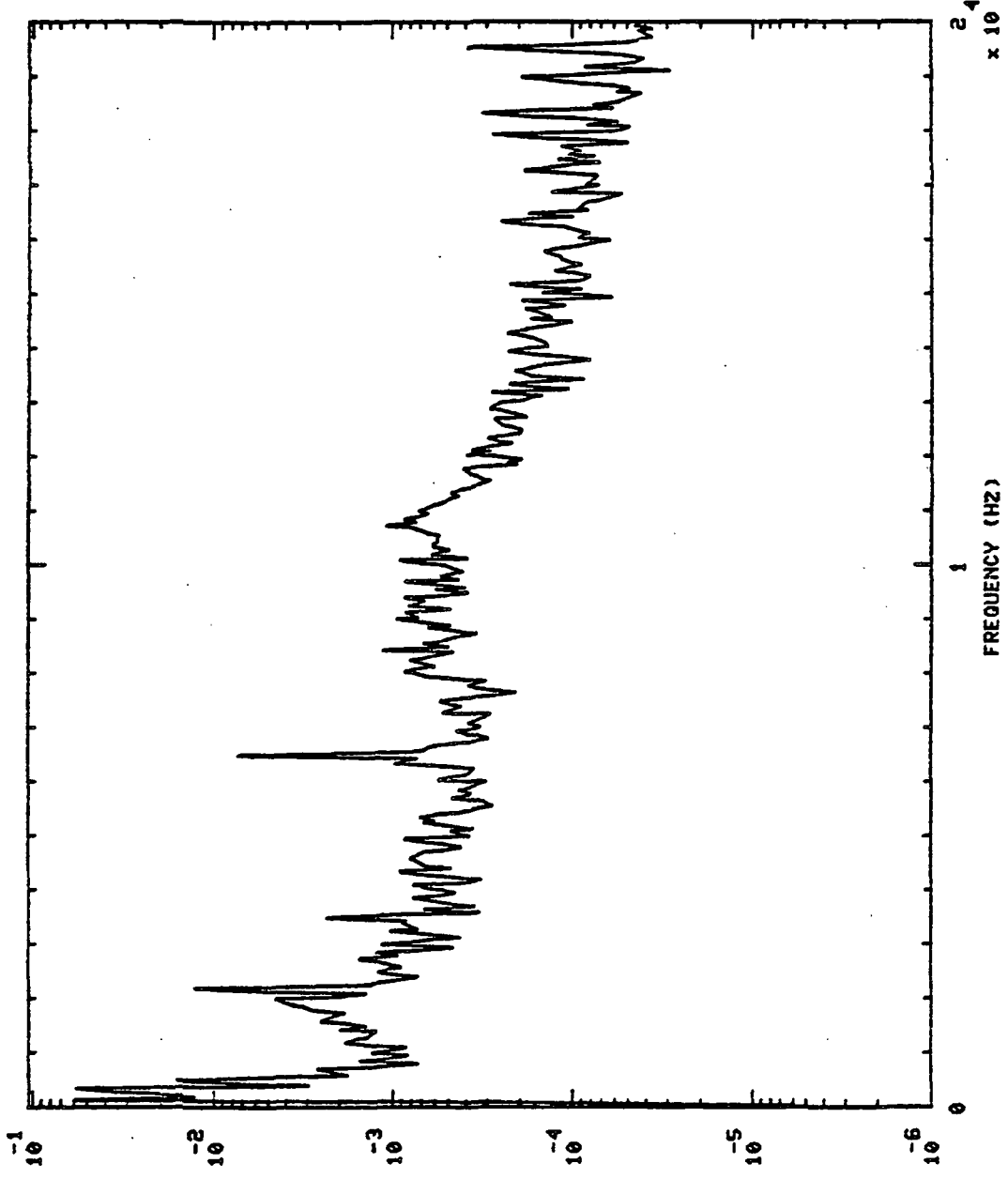
10^4
 $\times 10^4$

FREQUENCY (HZ)

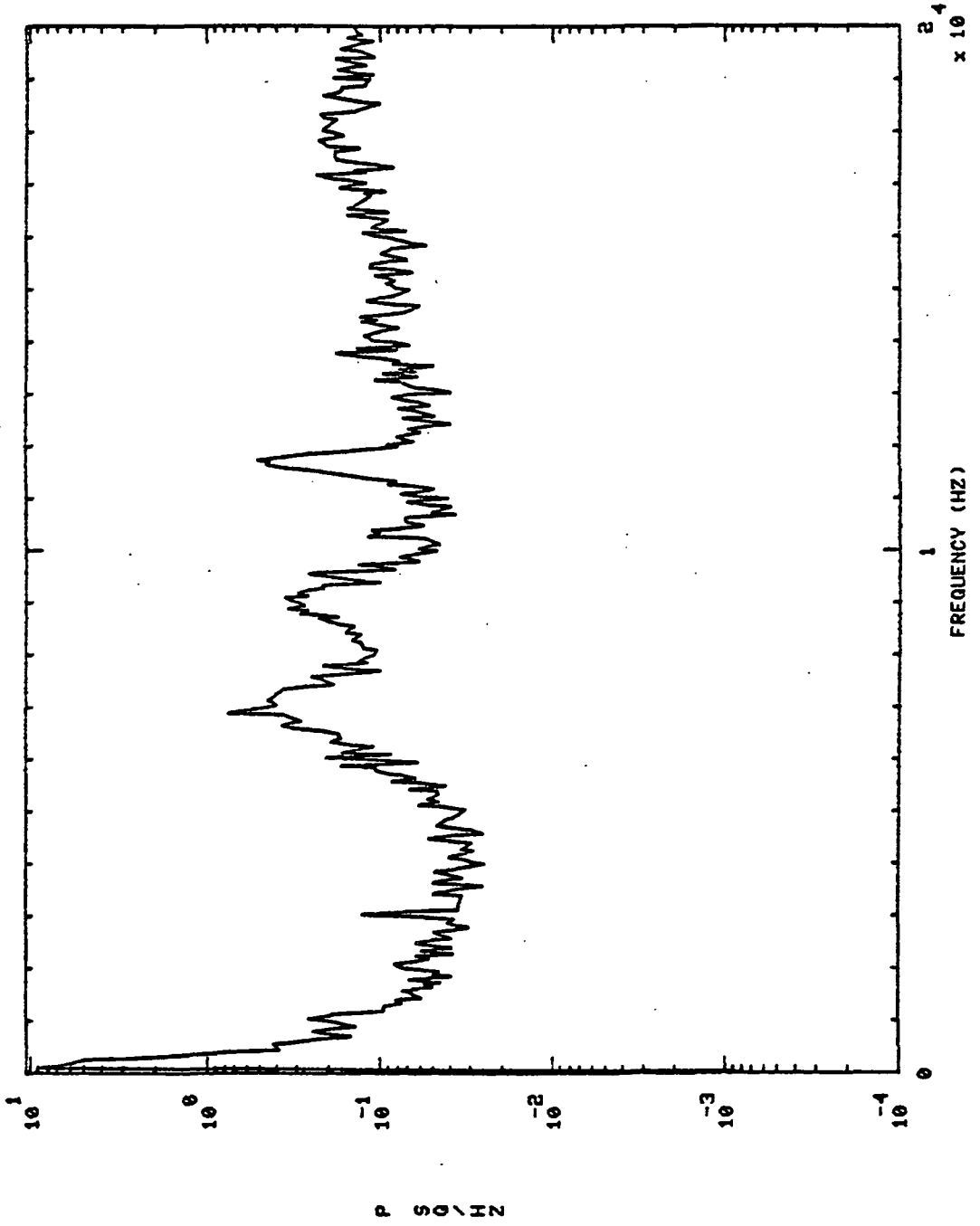
750112 HPOP BAL CAU PR2 S+ 150.01H0,'S



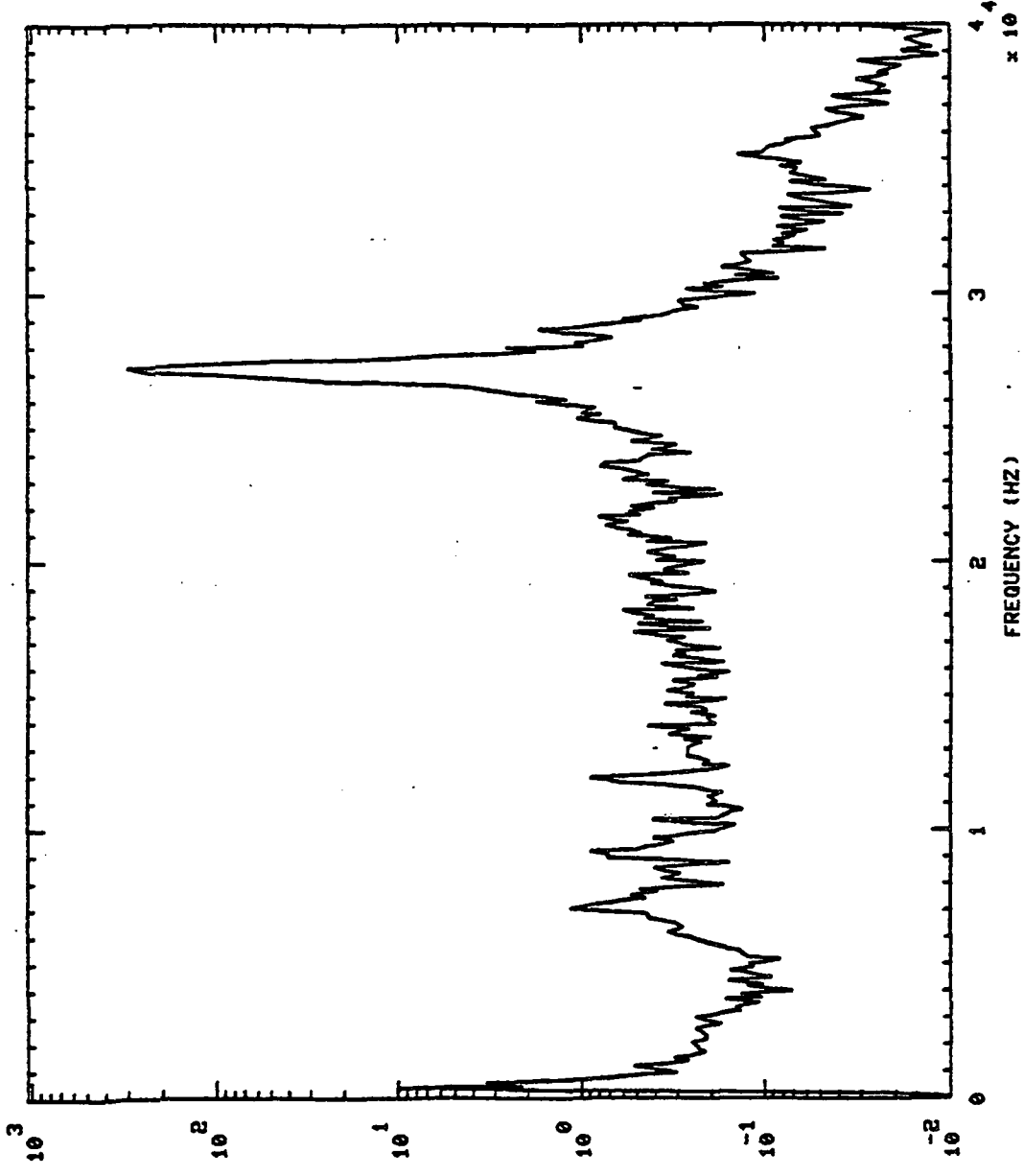
750112 HPOP BAL CAU PR2 S+ 280.01H0,'S



750112 MCC HOT GAS IN PR S+ 30.01H0,'S



750112 MCC HOT GAS IN PR S+ 30.01H0,'S

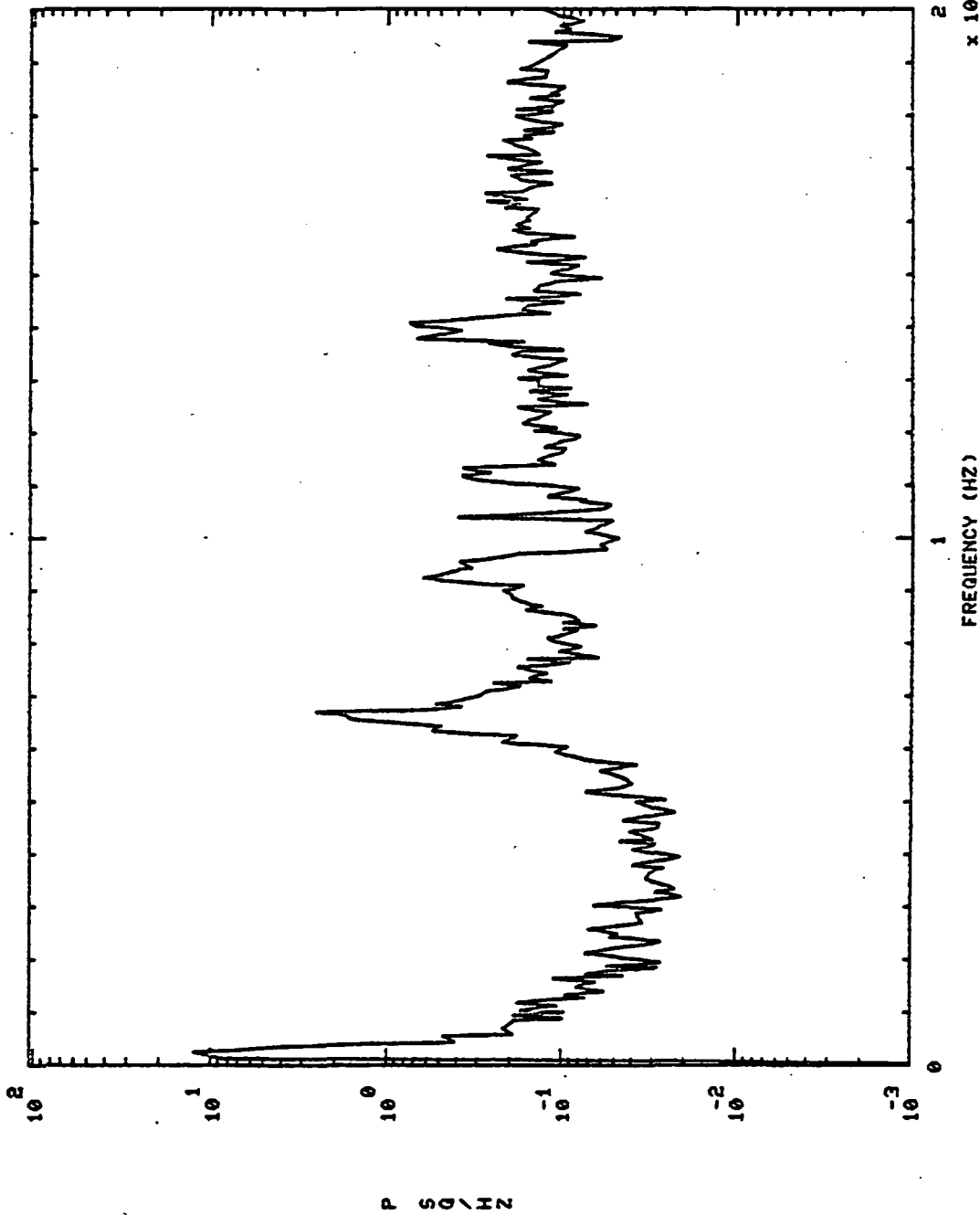


P S D IN

750112 MCC HOT GAS IN PR S+ 150.01H0,'S

750112 MCC HOT GAS IN PR

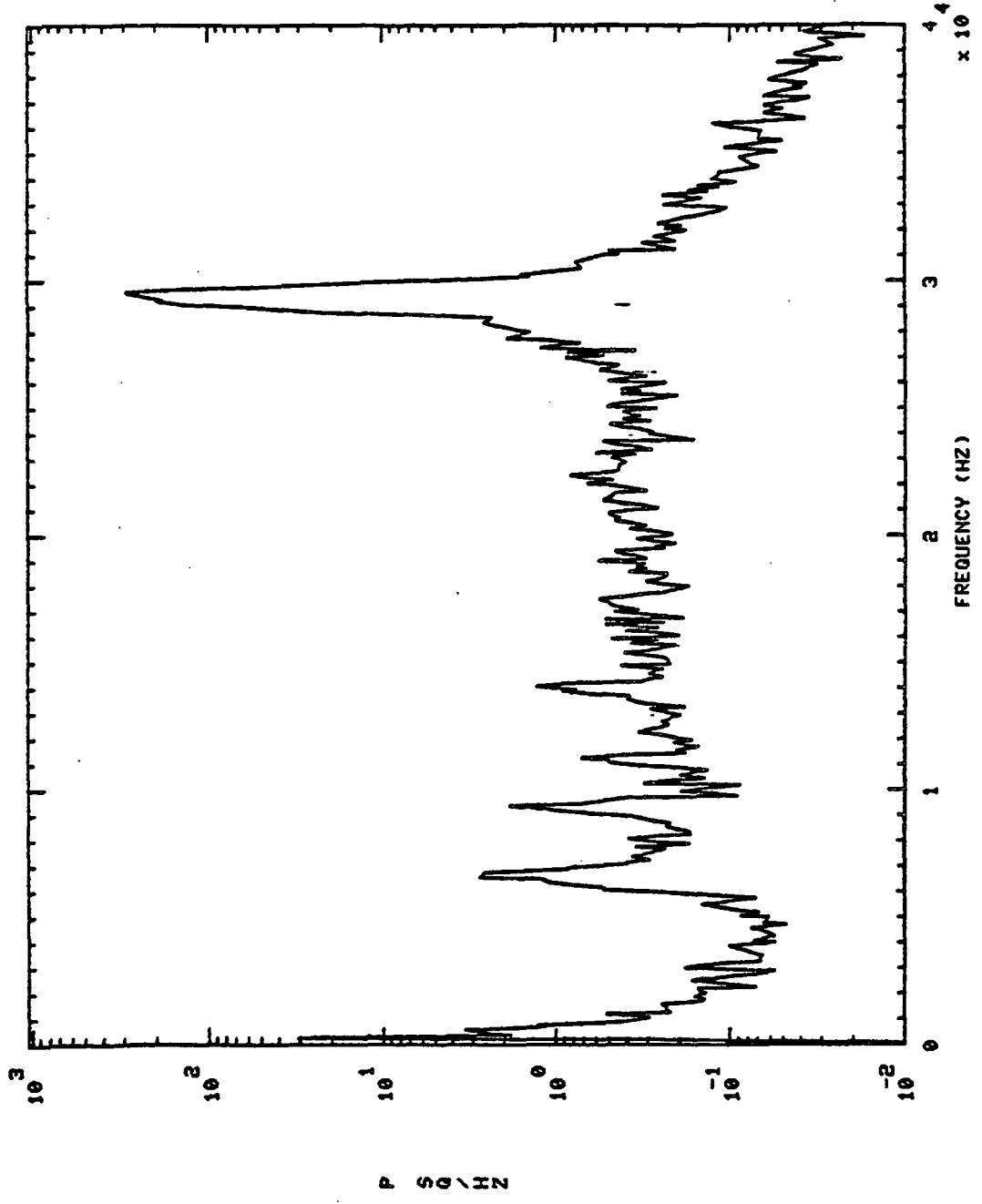
750112



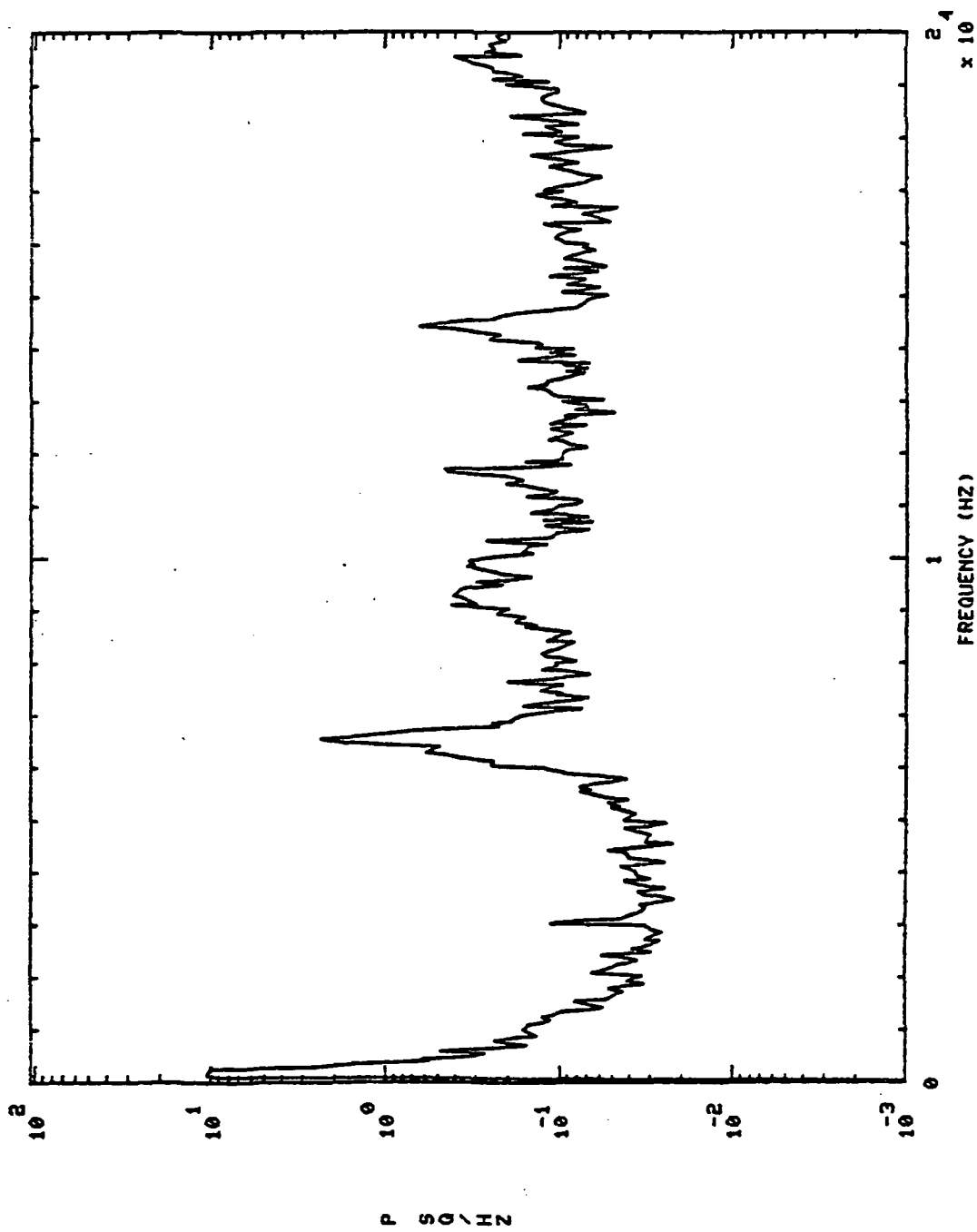
BT 150.0110, '8

1000 1000 1000 1000 1000

1000000



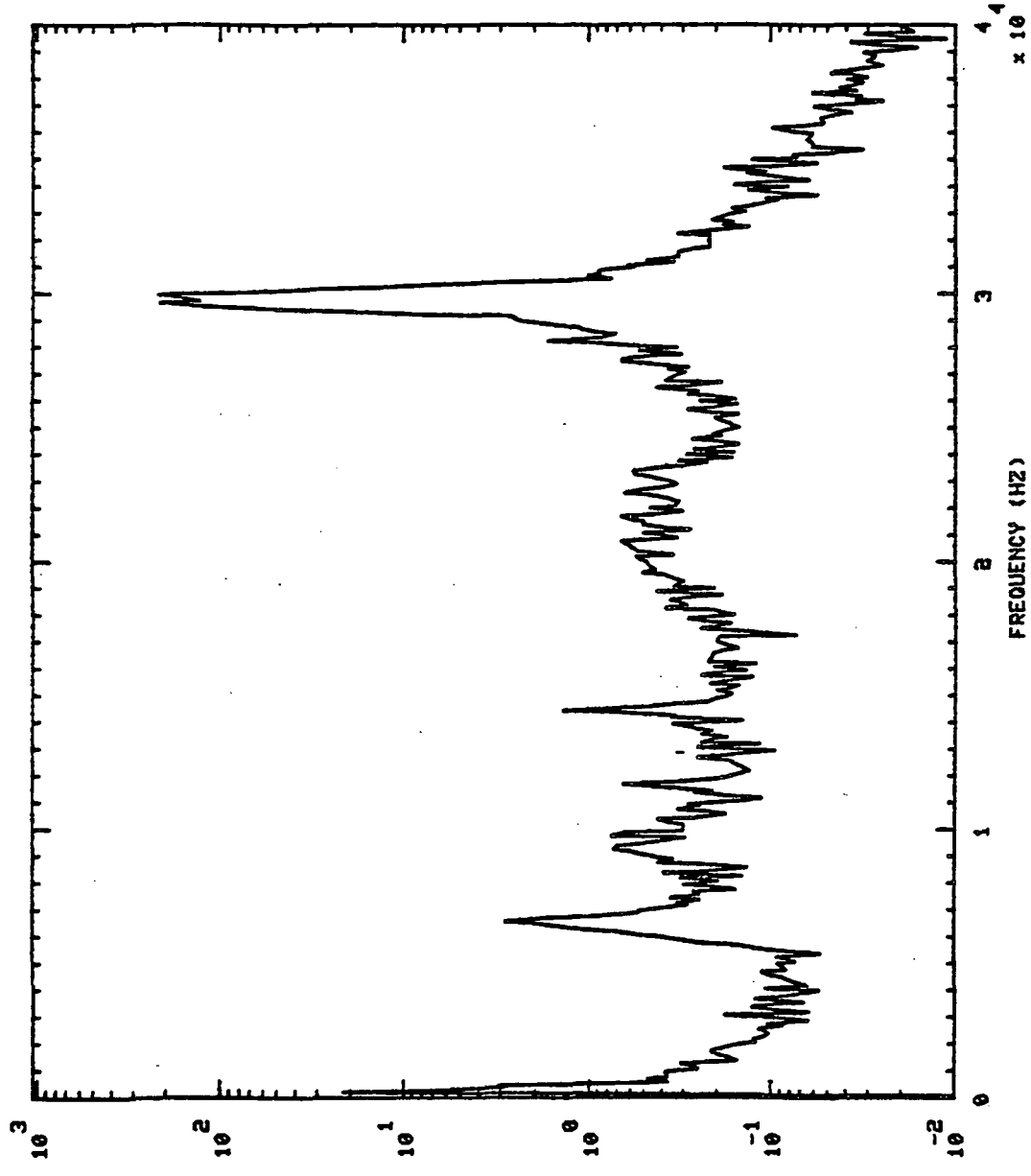
750112 MCC HOT GAS IN PR S+ 280.01H0,'S



S+ 280.0140, 'S

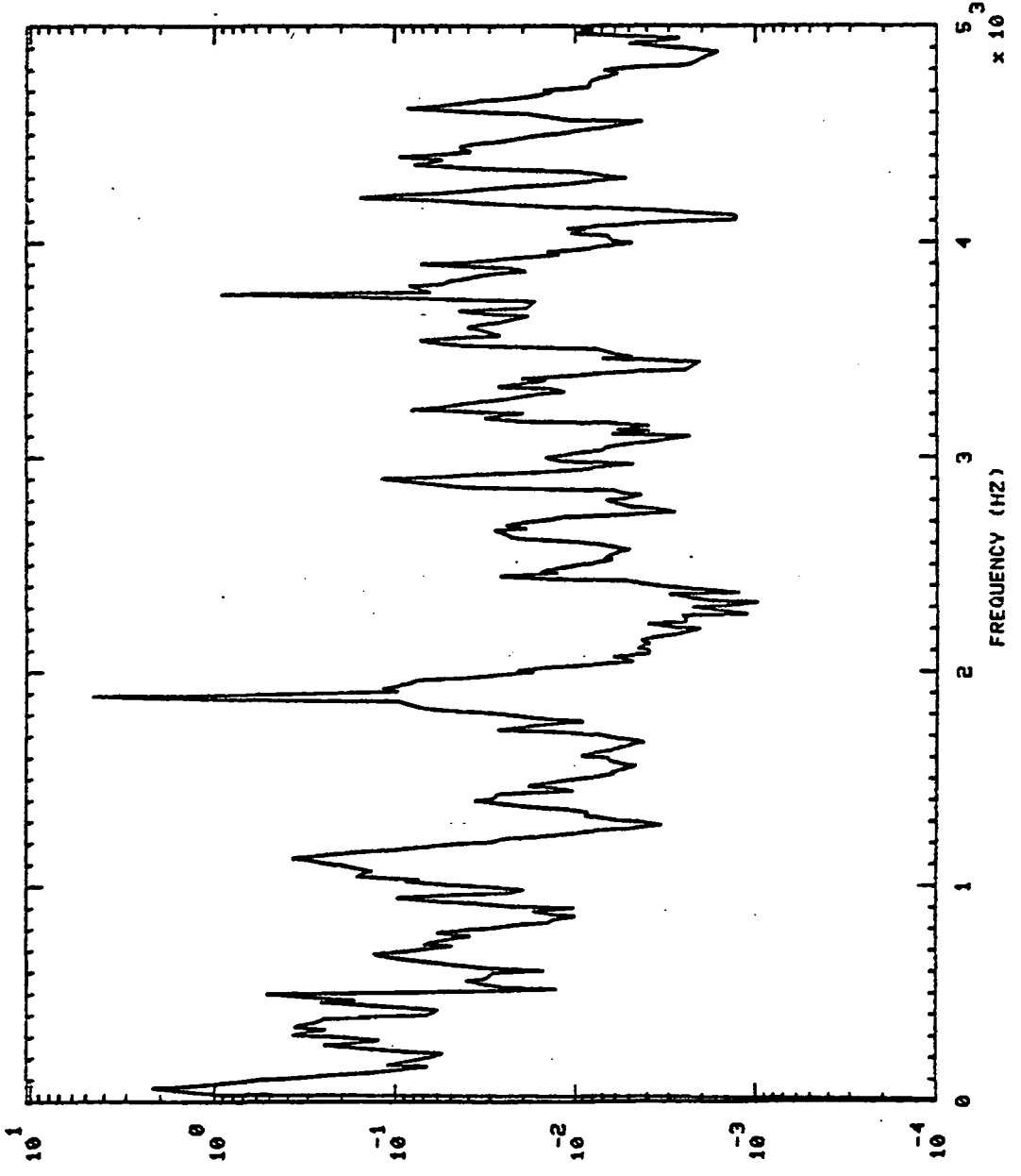
TCU MUI GAS IN PK

(S0112



P 50 \ IN

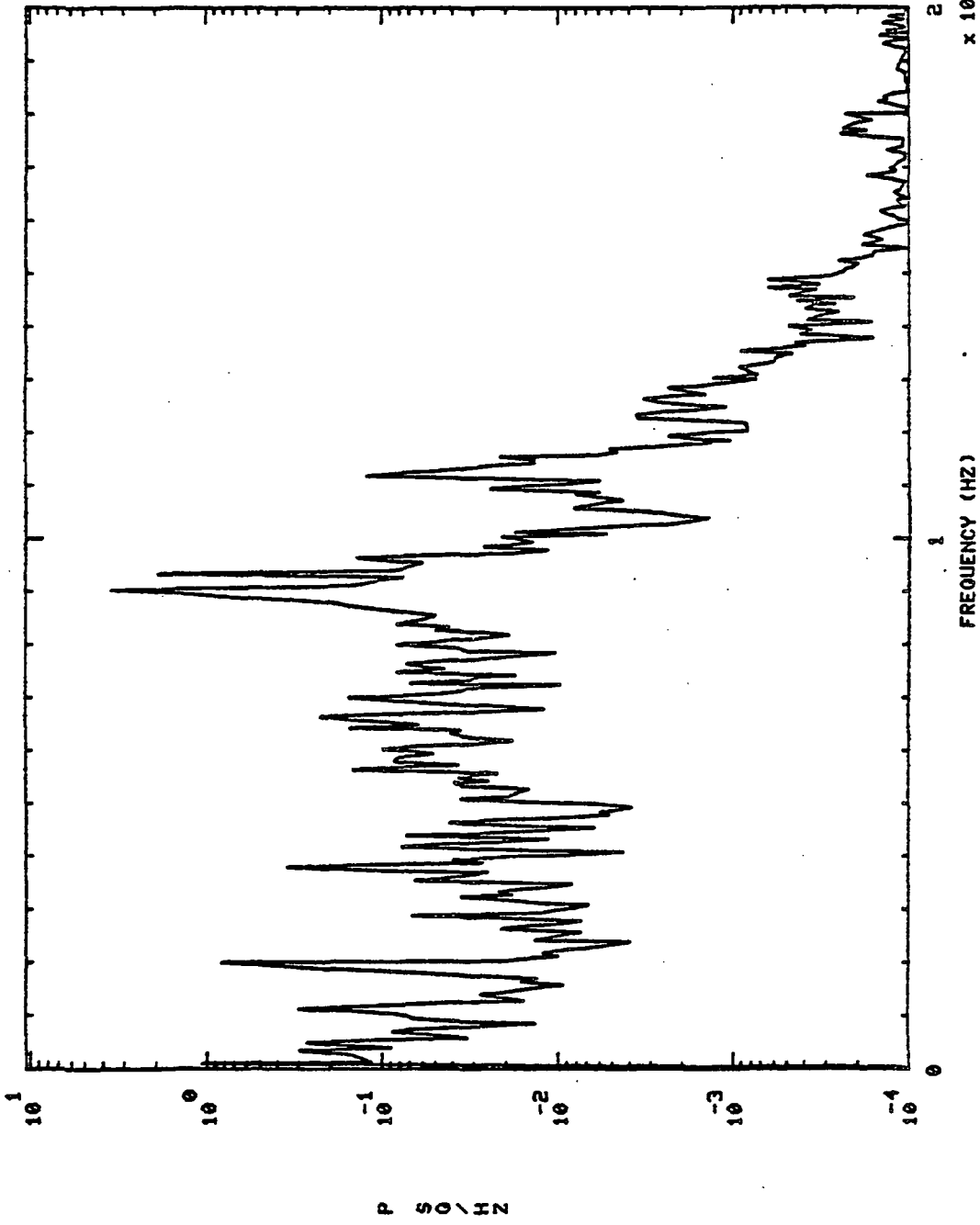
750112 LPOT TURB DR PR S+ 30.01H0,'S



P SQ/MZ

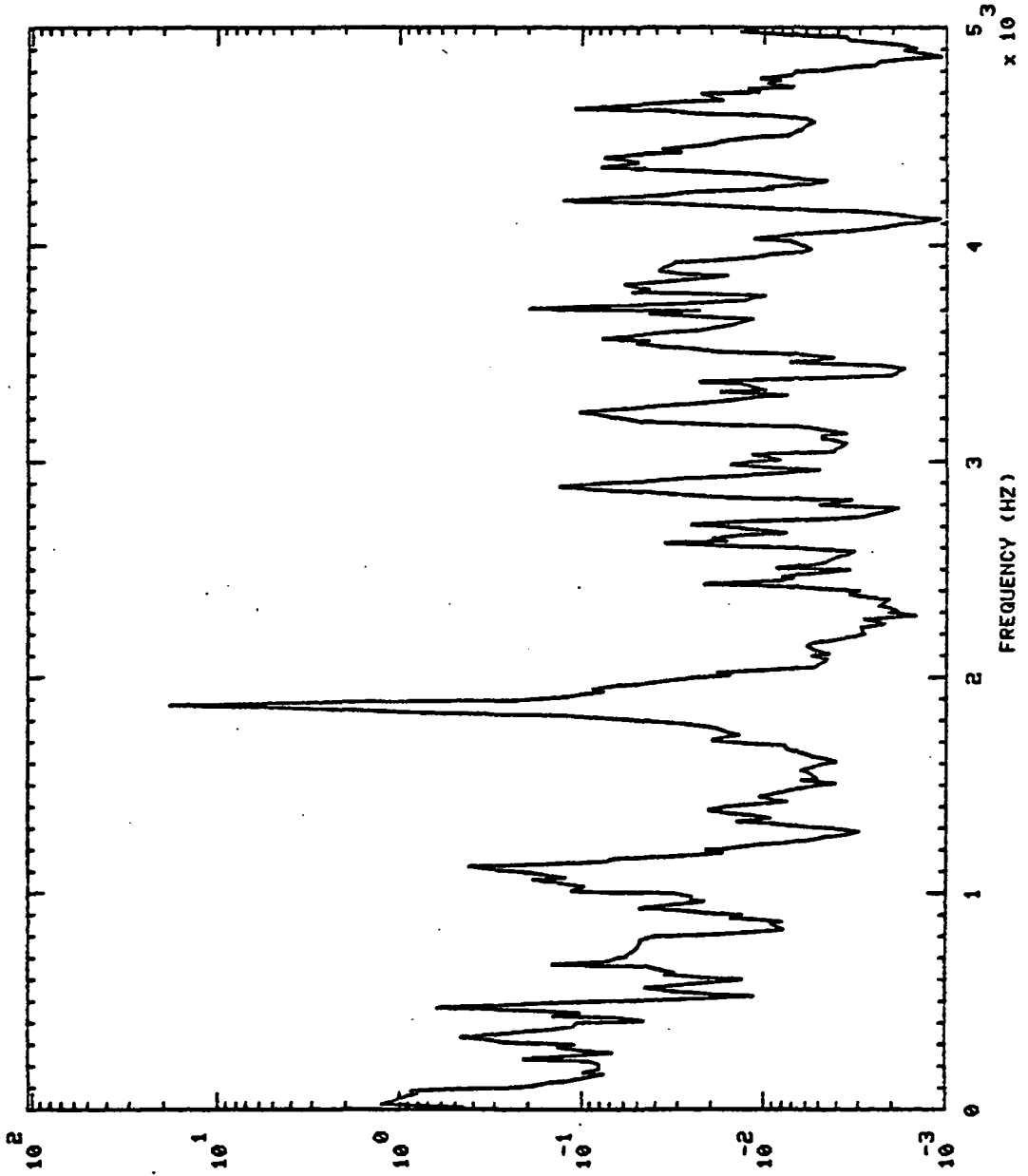
S+ 30.01H0,'S

750112 LPOT TURB DR PR



750112 LPOT TURB DR PR S+ 150.01H0,'S

750112 LPOT TURB DR PR

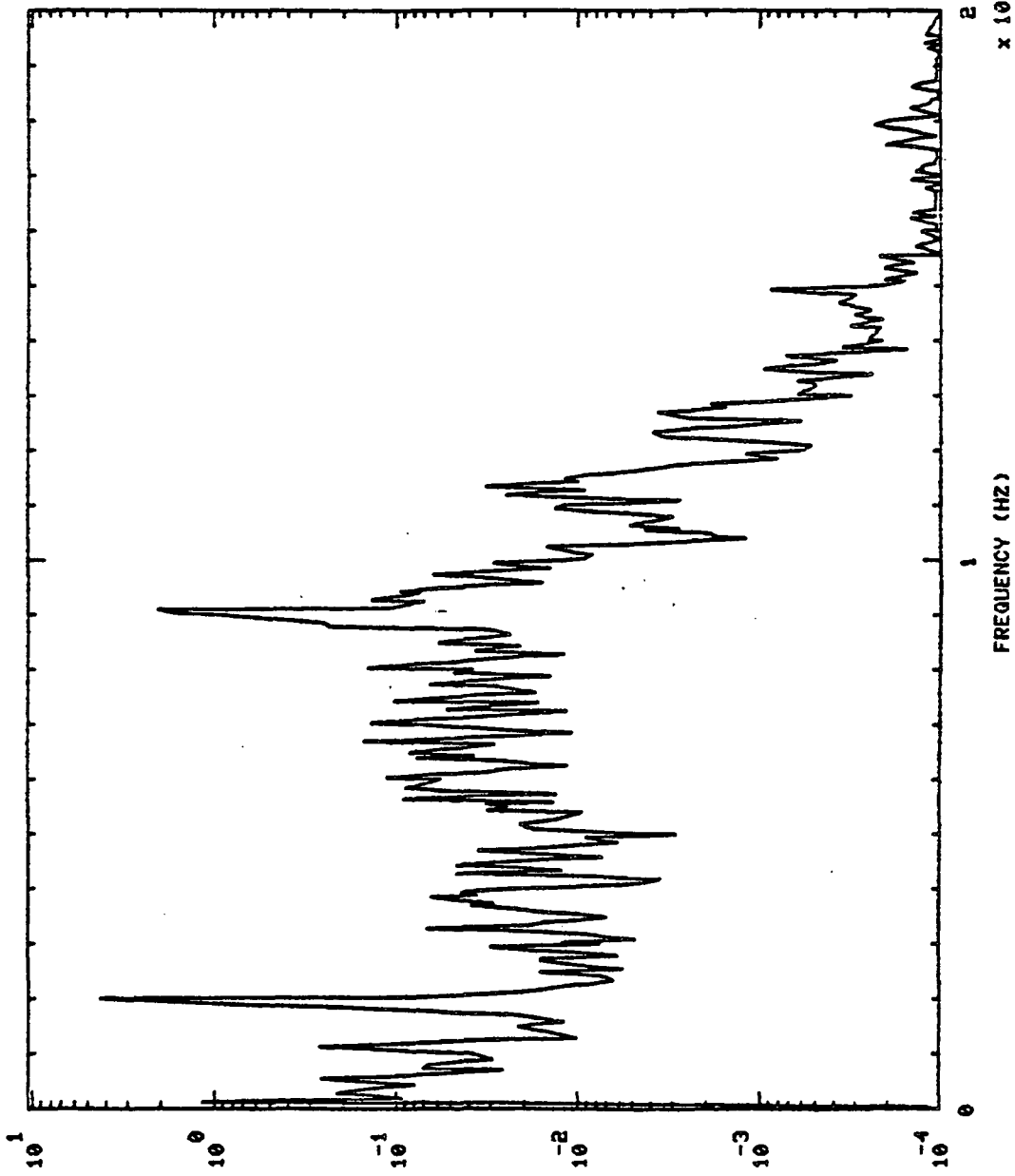


P S D / HZ

St 150.01H0, 'S

LPOT TURB DR PR

750112



P S G / H Z

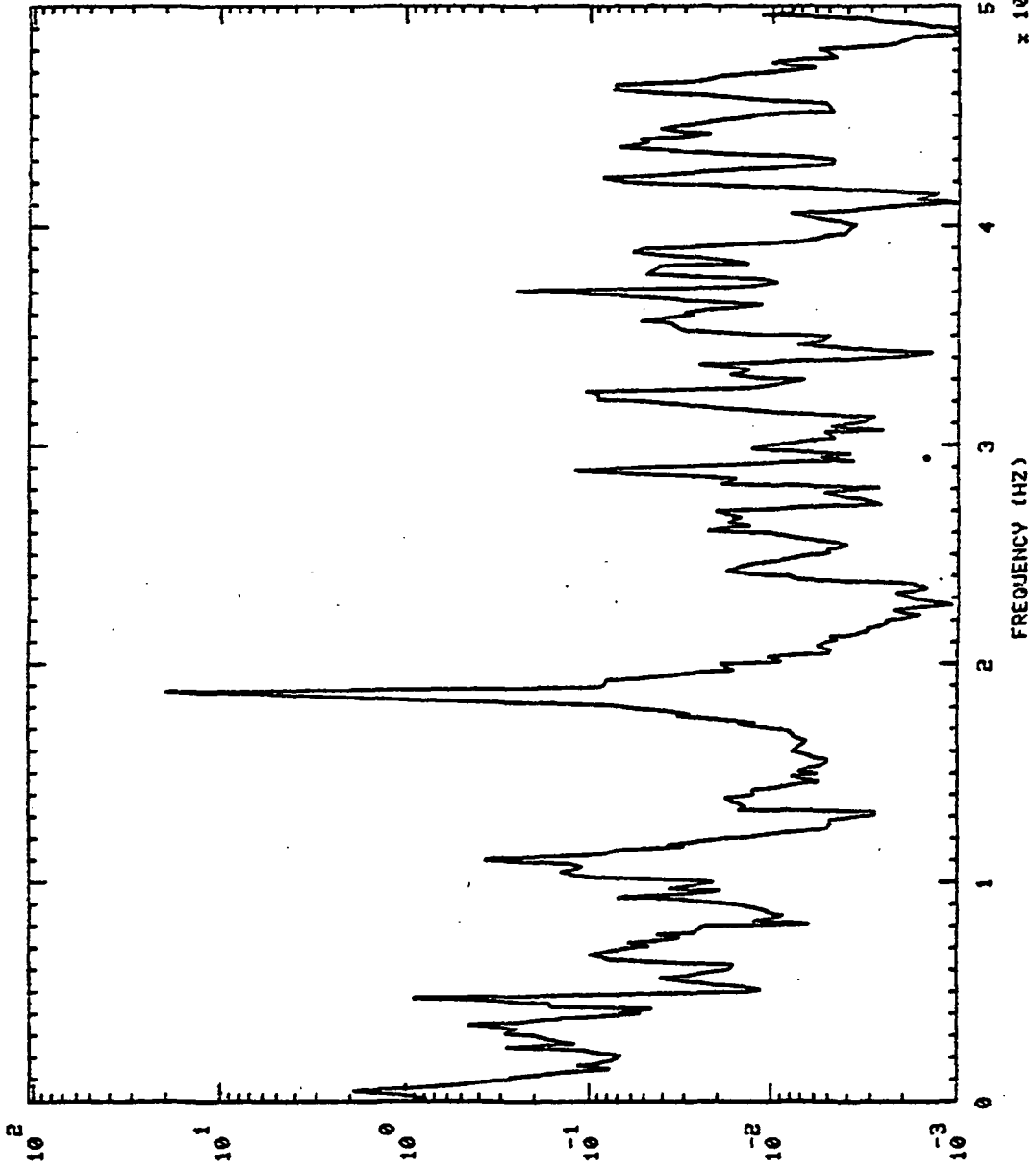
FREQUENCY (HZ)

10^4
 $\times 10$

750112 LPOT TURB DR PR S+ 280.01H0,'S

750112 LPOT TURB DR PR

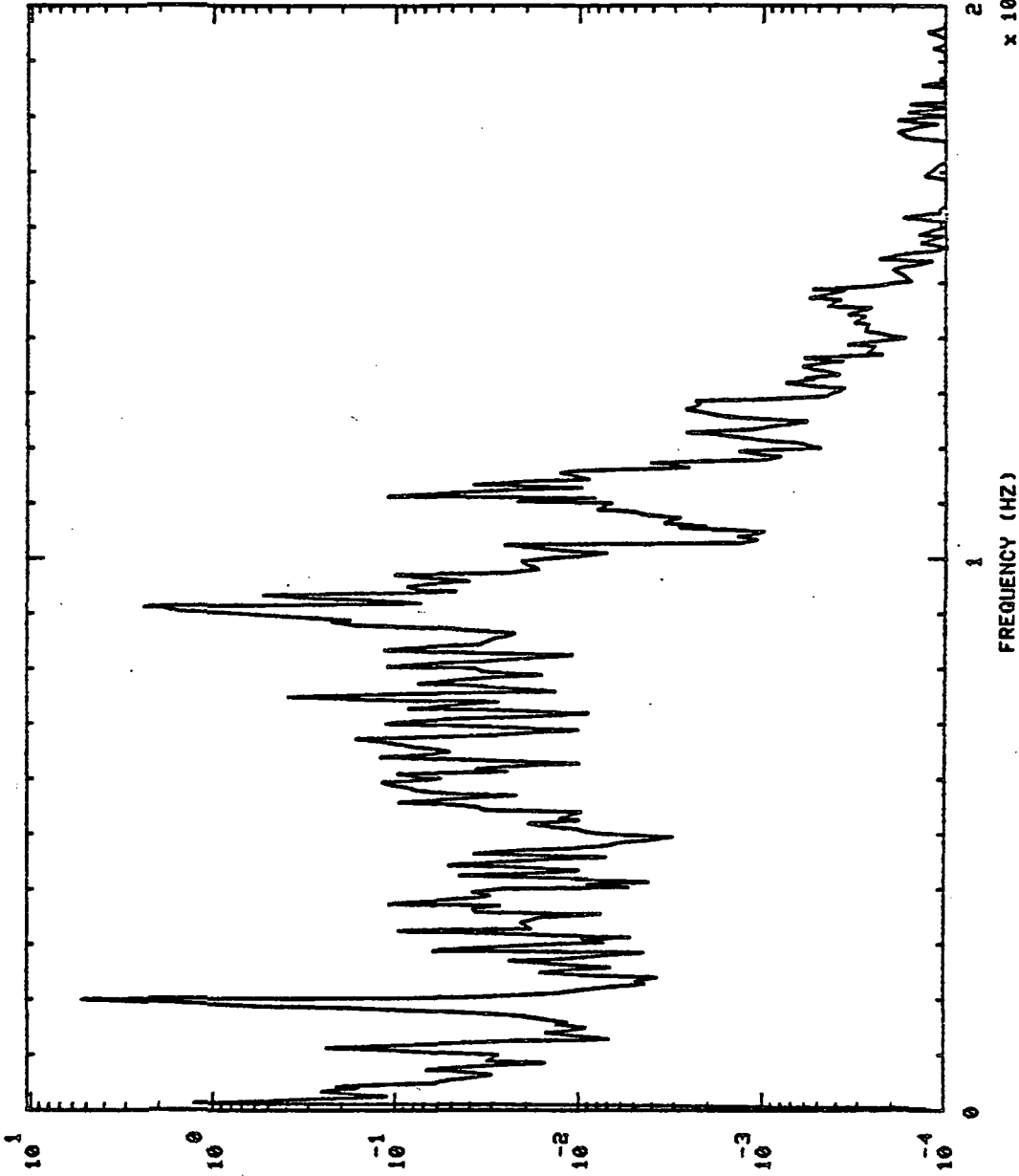
750112



P S D / HZ

S+ 280.01H0,'S

750112 LPOT TURB DR PR

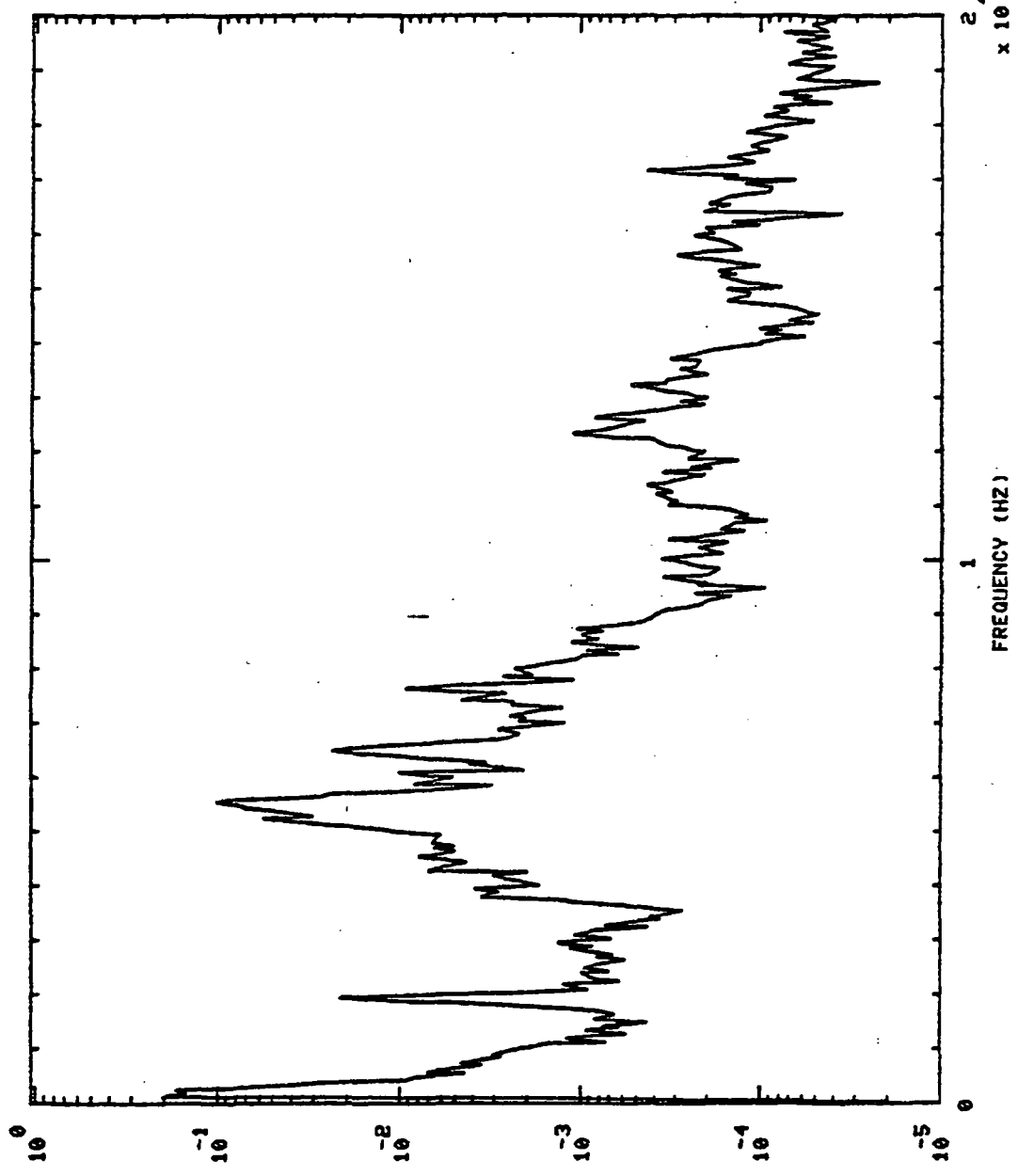


P S O \ HZ

10^2
 $\times 10^4$

FREQUENCY (HZ)

750112 OPB PC PR S+ 30.01H0,'S



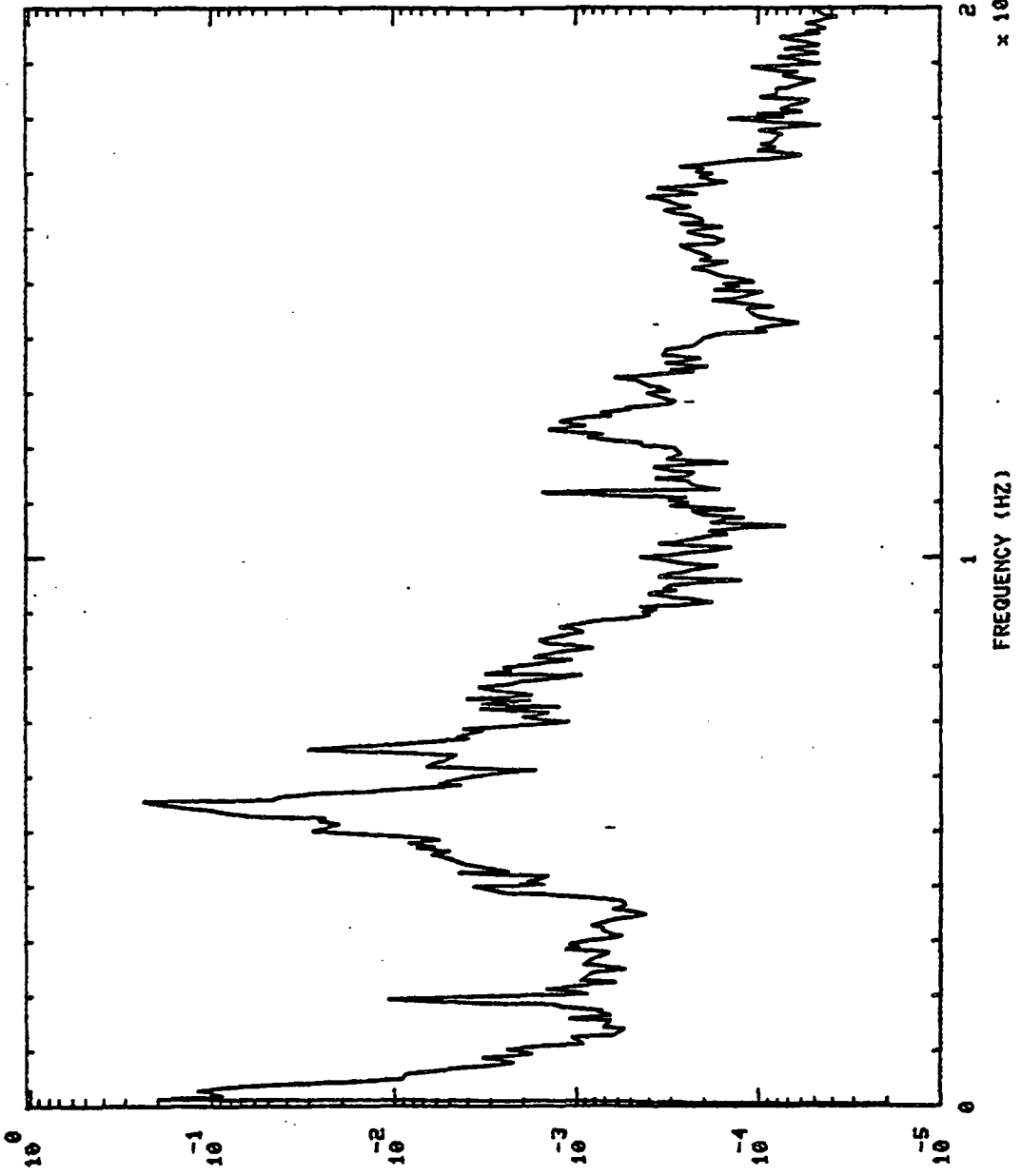
P S O \ H Z

FREQUENCY (HZ) x 10⁴

6+ 150.01HG, 'S

OPB FC PR

750112



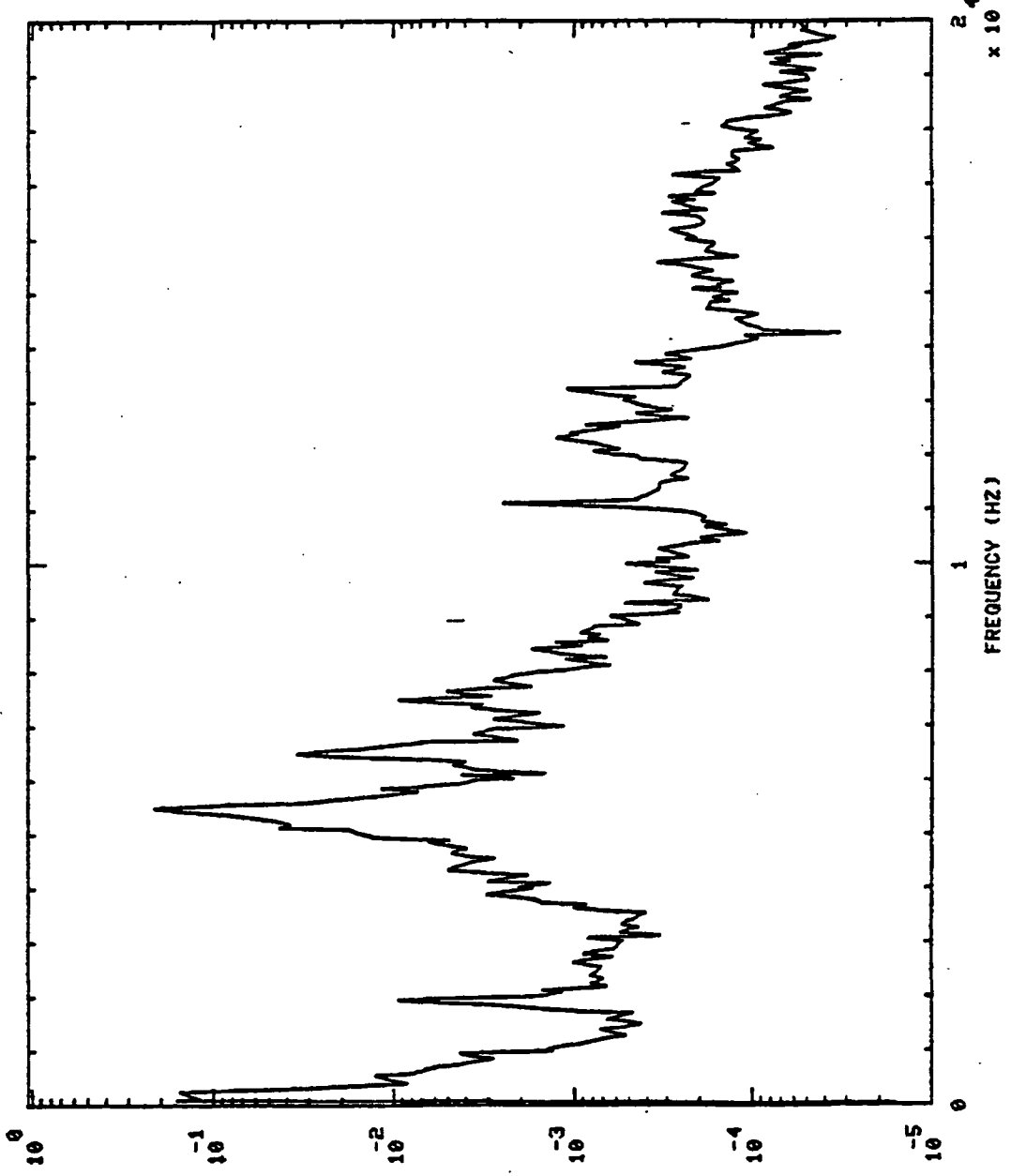
P SC / Hz

FREQUENCY (HZ)

$\times 10^4$

S+ 280.0140,'S

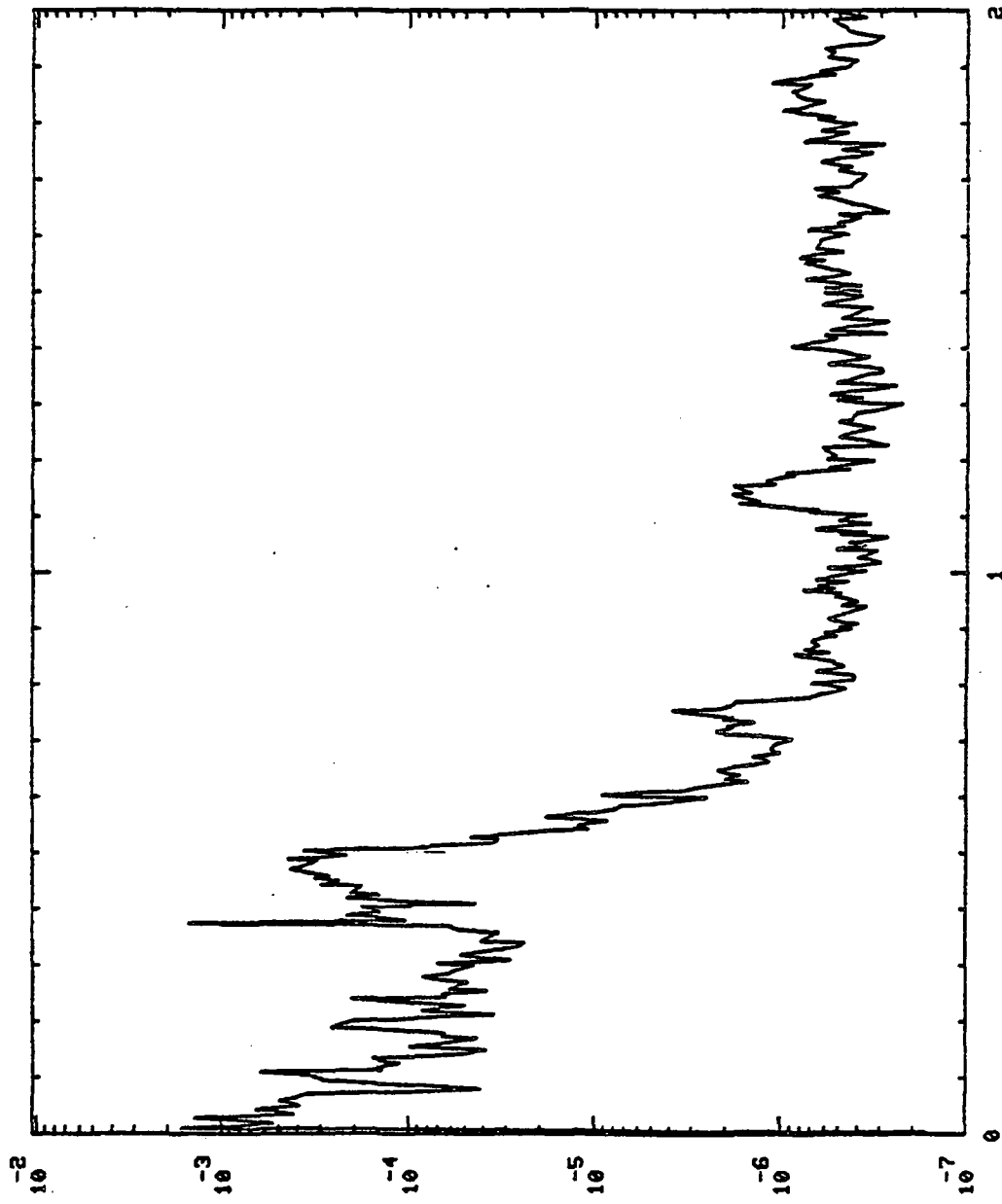
750112 OPB PC PR



P
S
O
/
H
Z

2.4
x 10^4
FREQUENCY (HZ)

750112 HEX OUTLET S+ 30.01H0,'S



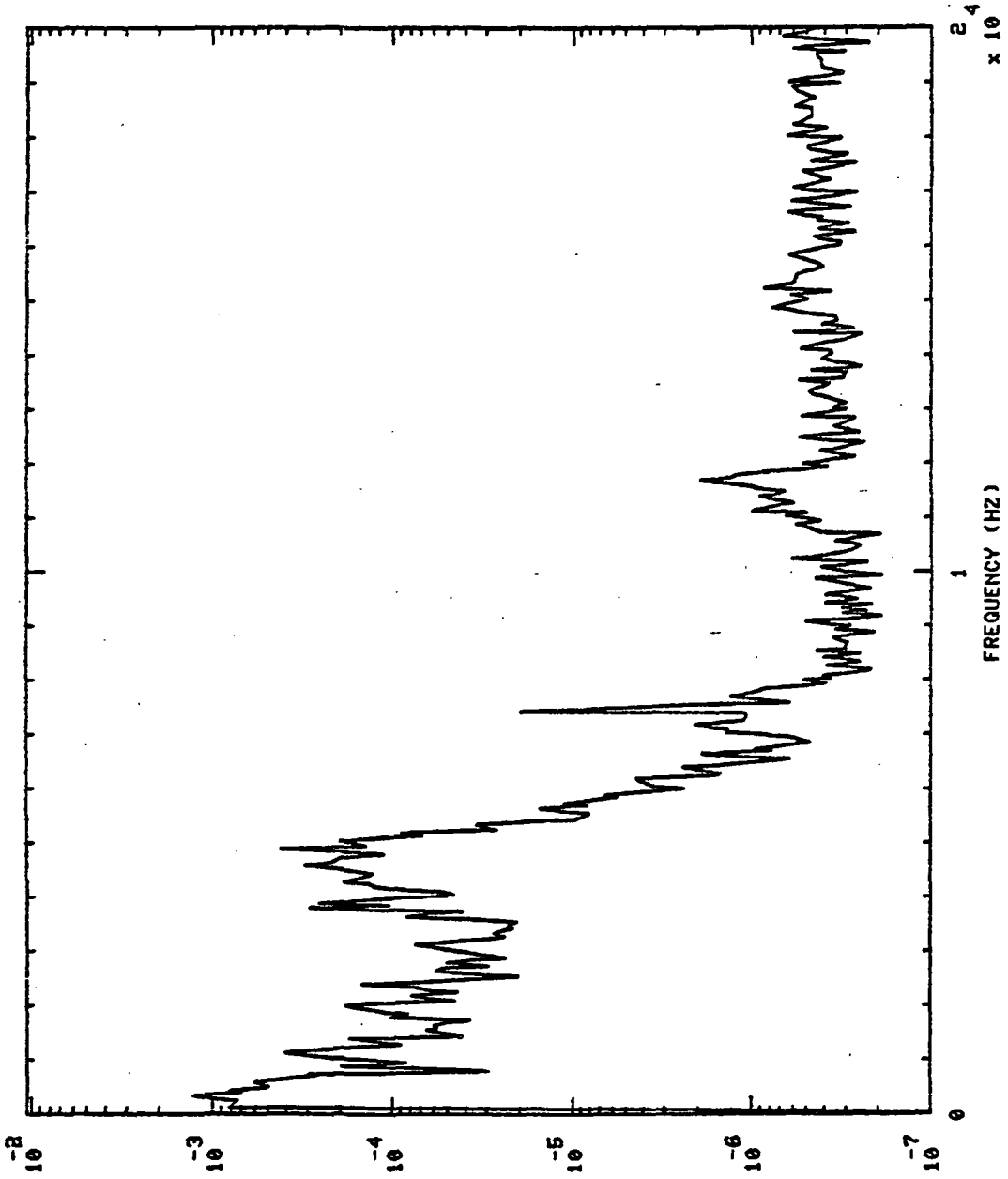
P SQ / HZ

2.4
x 10⁴

FREQUENCY (HZ)

0

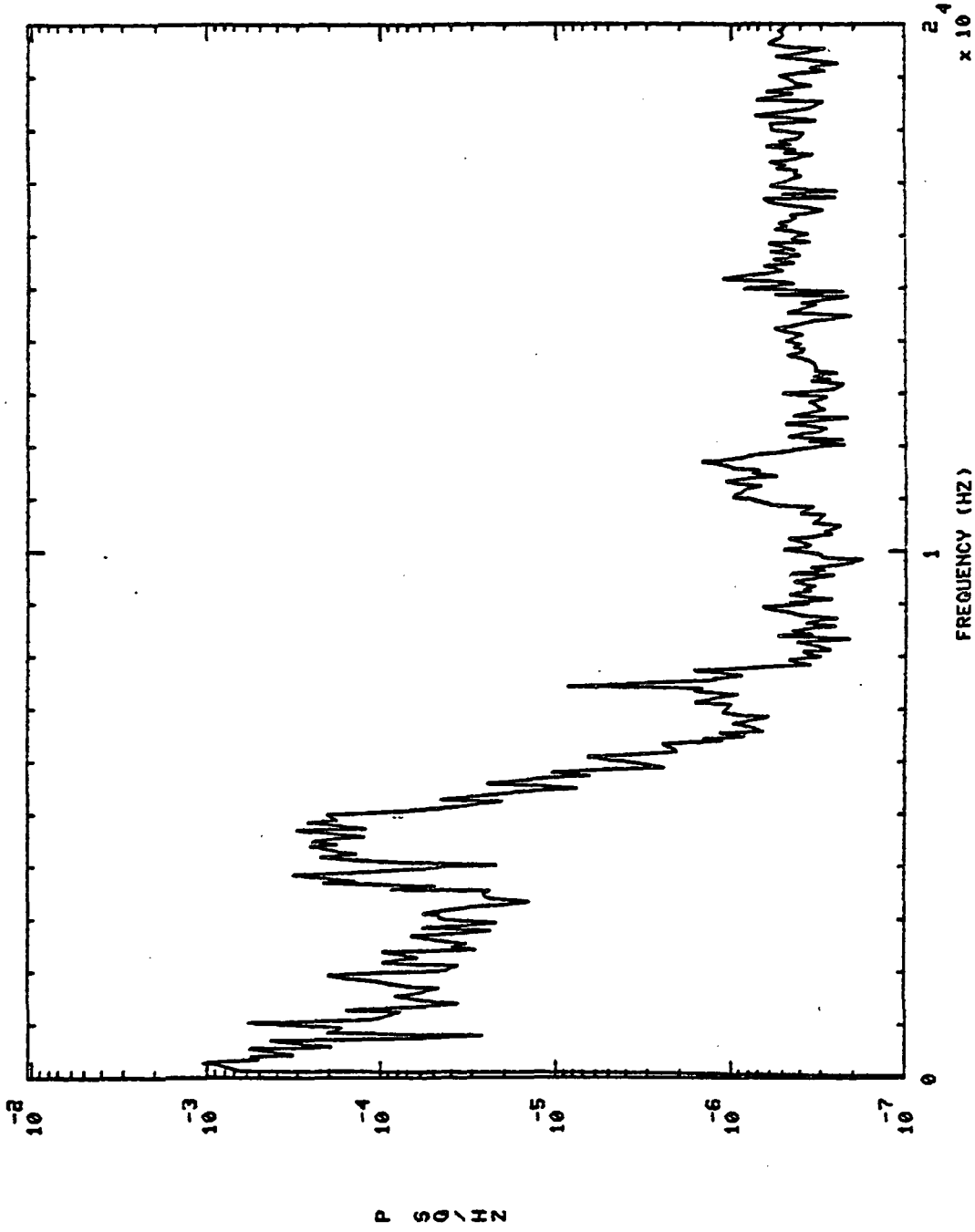
750112 HEX OUTLET S+ 150.01H0,'S



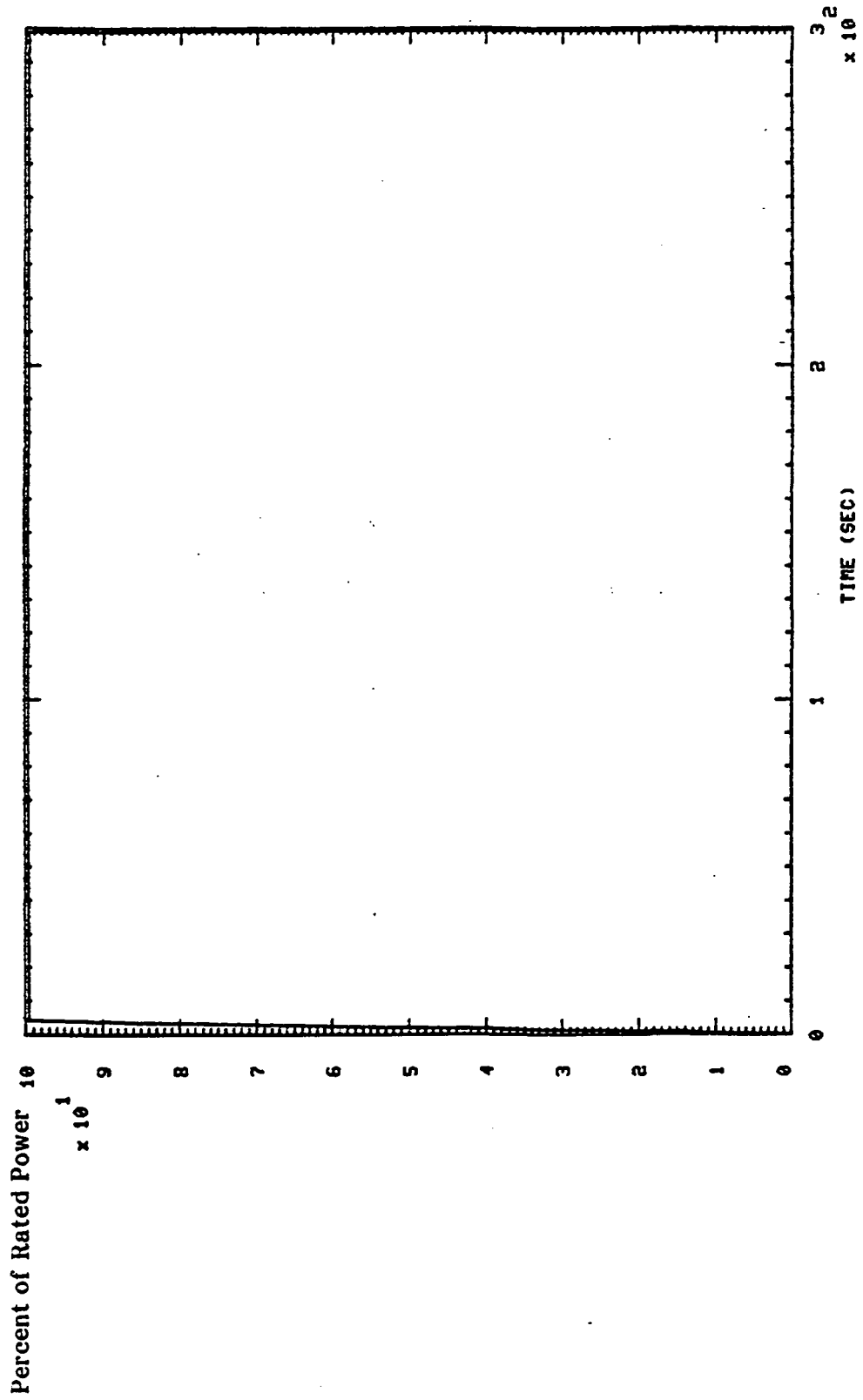
P S D \ H Z

St 280.0140,'S

750112 HEX OUTLET

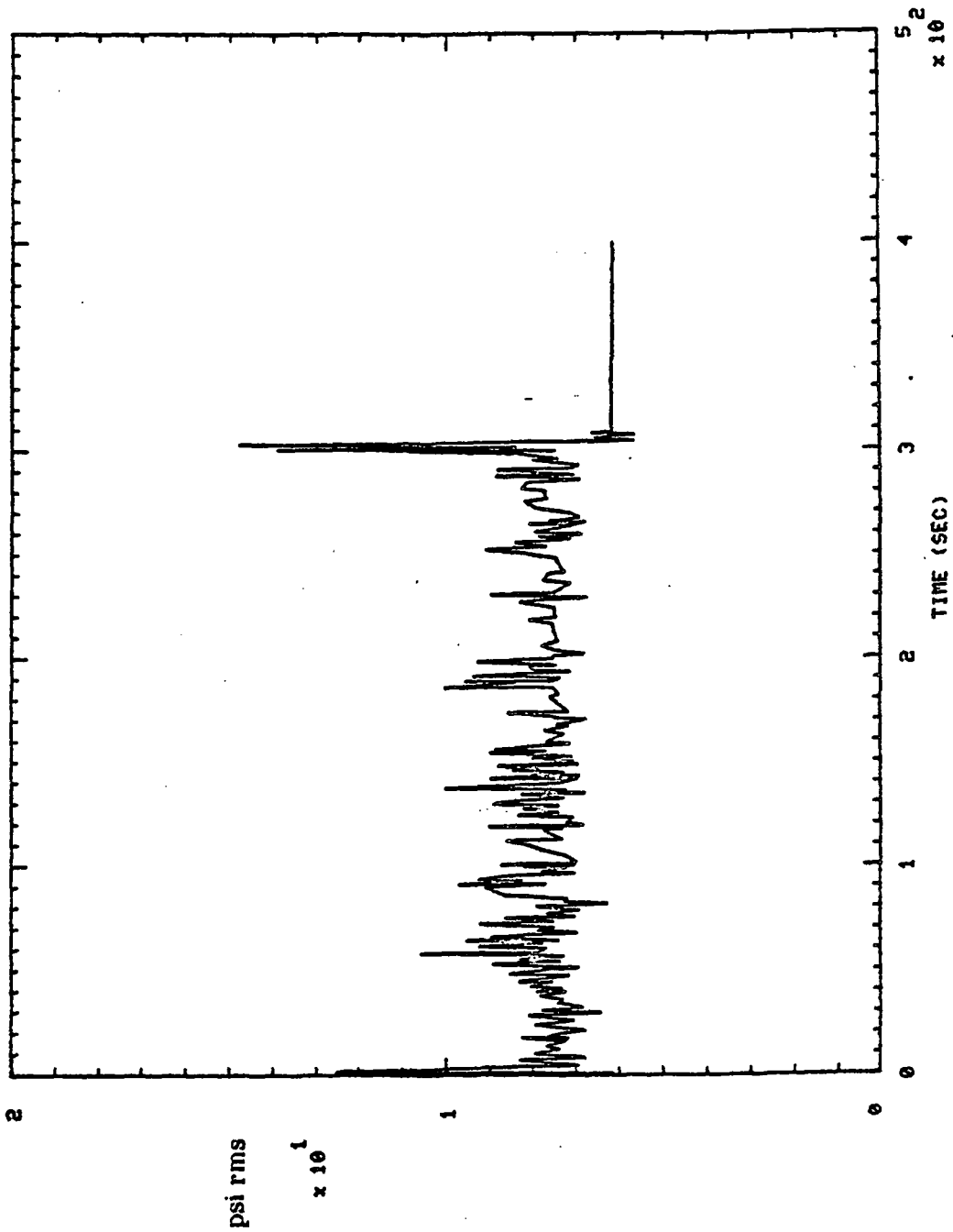


750113 THRUST (UNFILTERED)

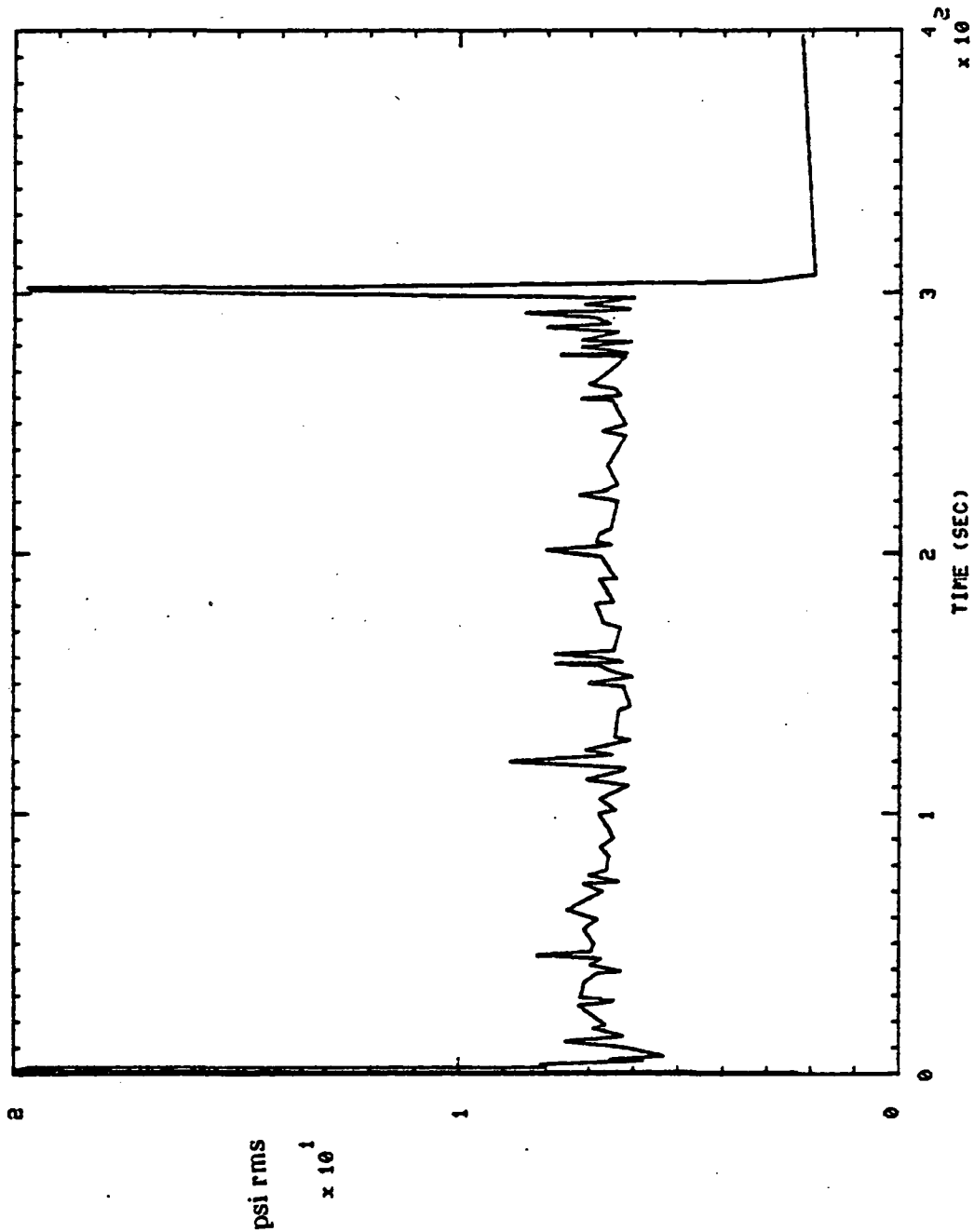


(1 - 20K HZ)

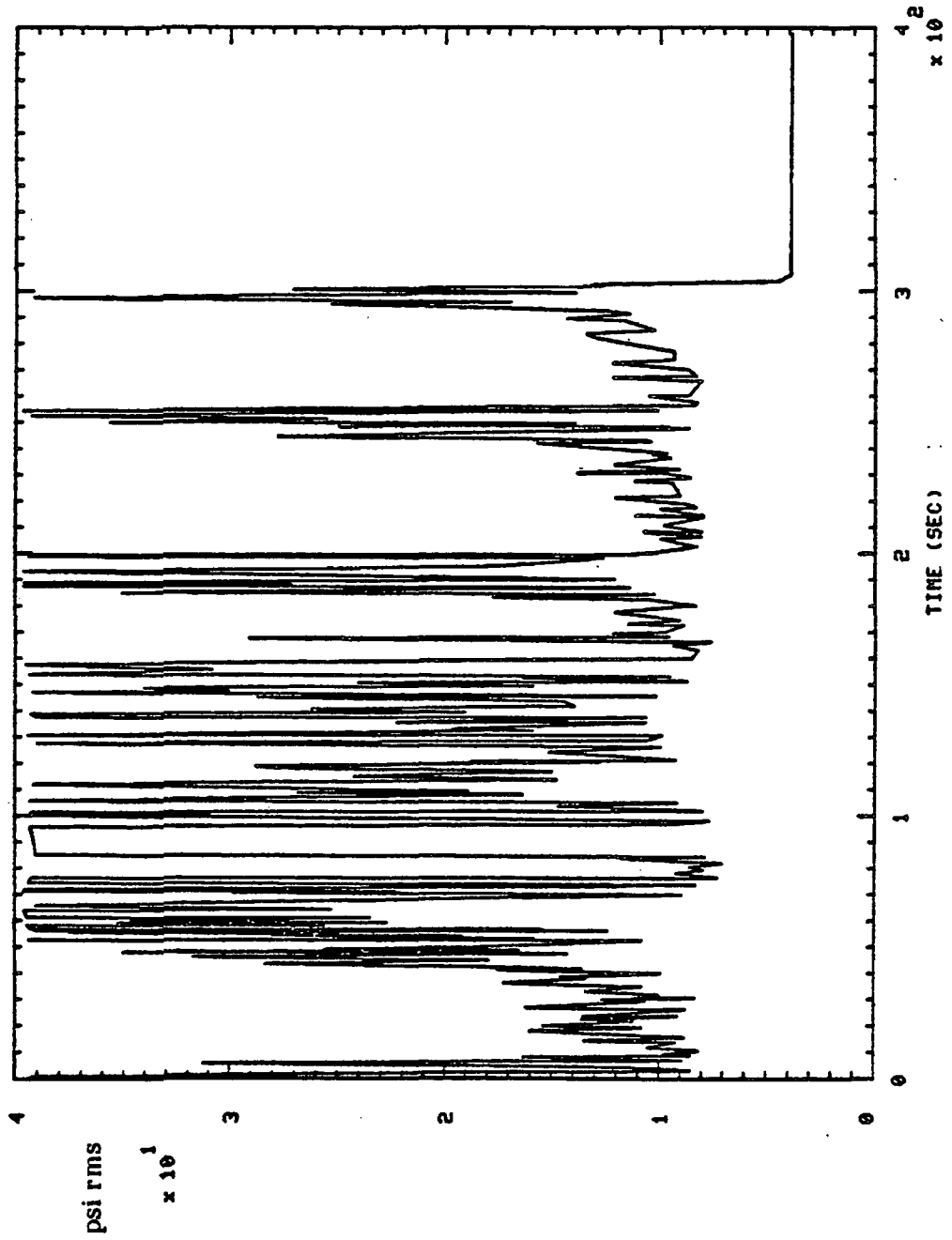
750113 LPOP DS PR



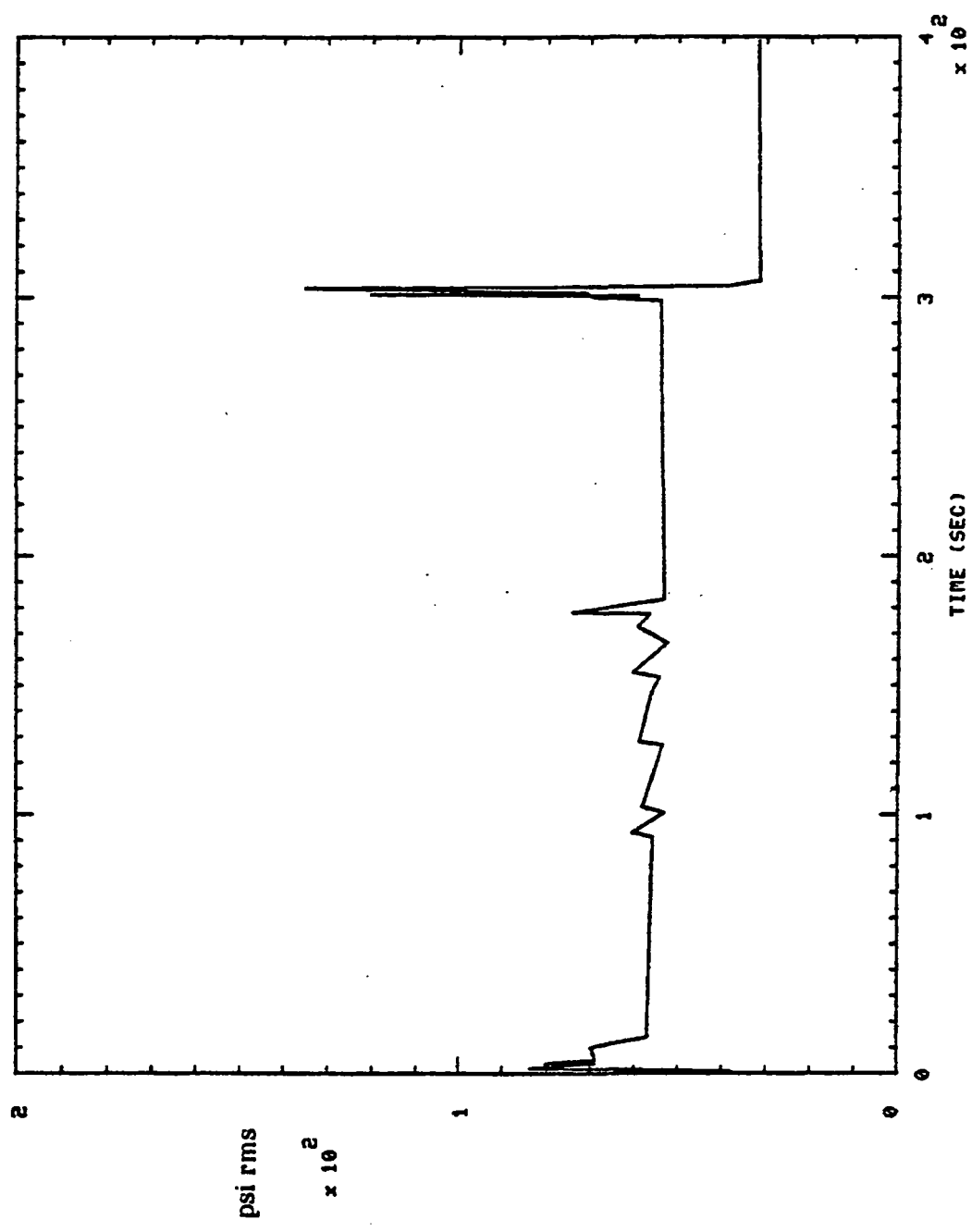
750113 HPOP BAL CAU PRE (1 - 20K HZ)



750113 HPOP BAL CAU PR1 (1 - 20K HZ)



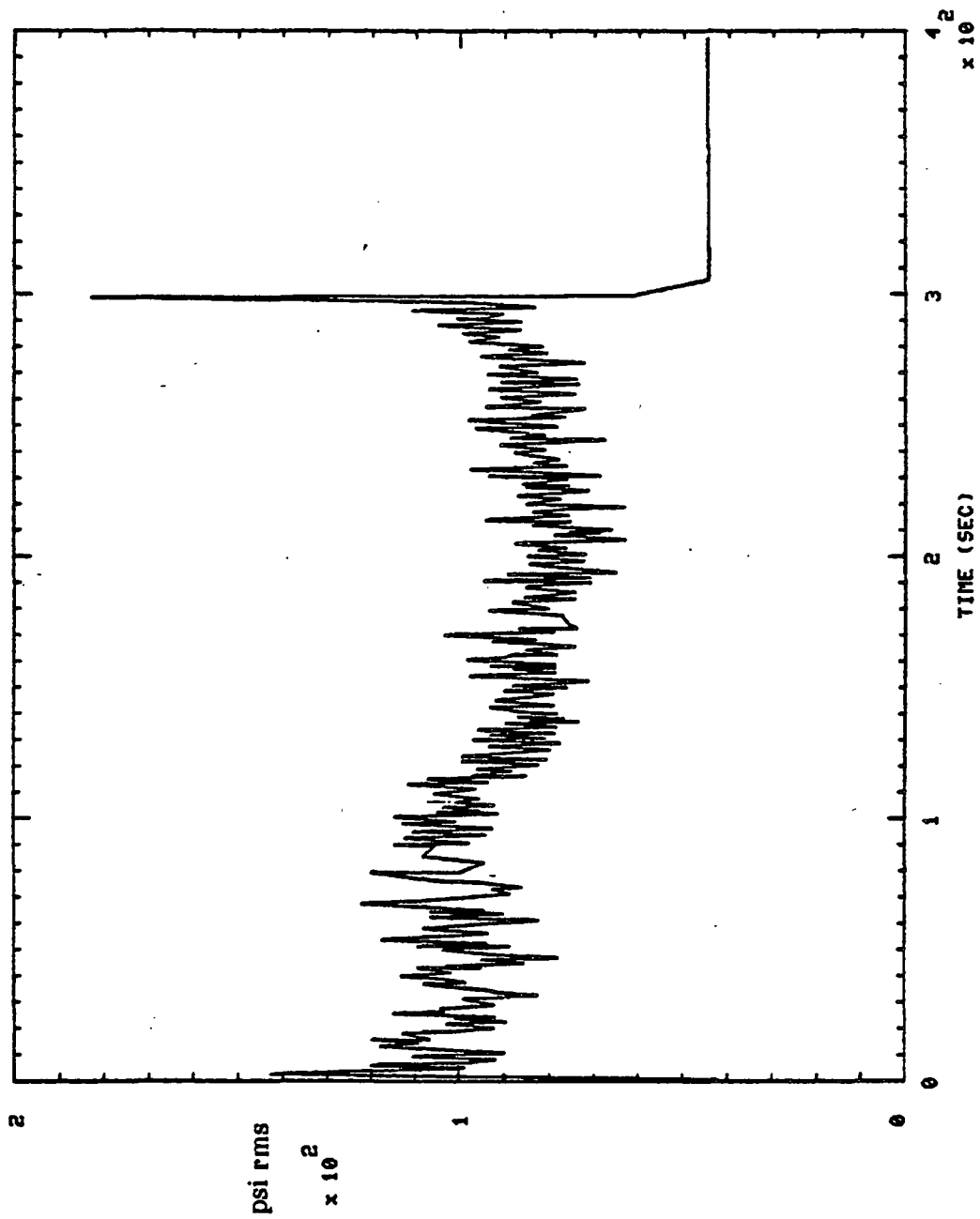
750113 HPOP DS PR (1 - 20K HZ)



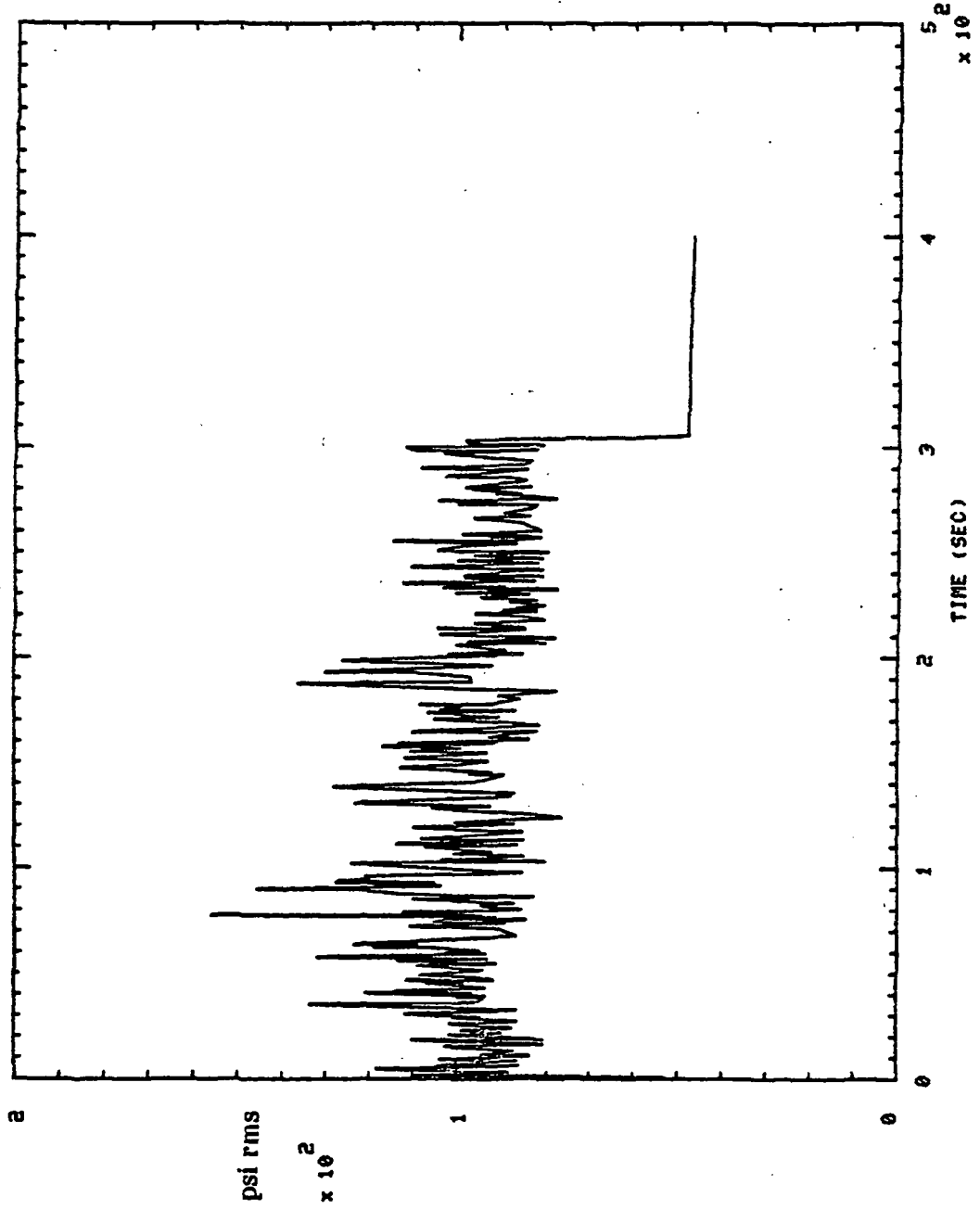
(1 - 20K HZ)

MCC HOT GAS IN PR

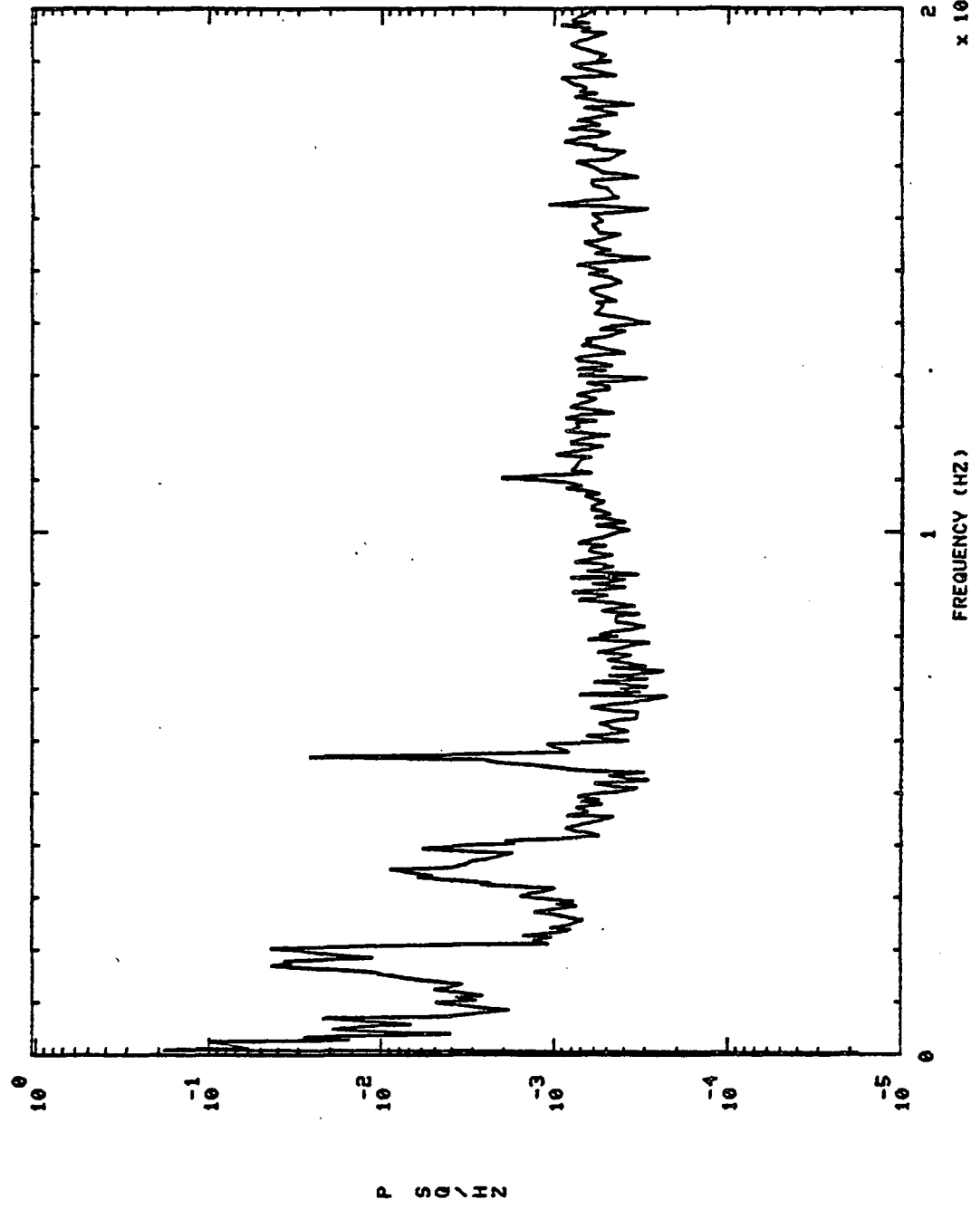
750113



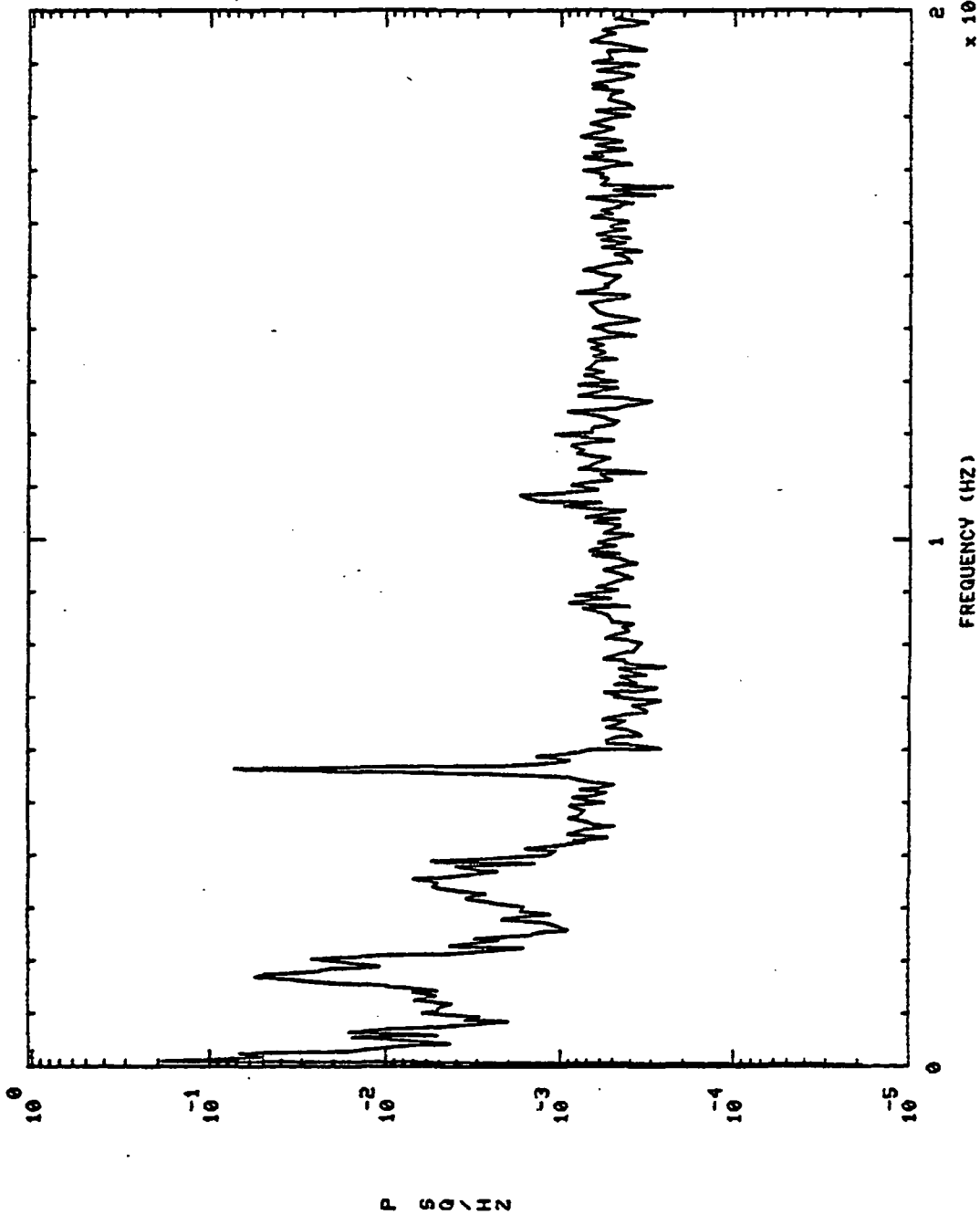
750113 PBP DS PR (1 - 20K HZ)



750113 LPOP DS PR ST 30.01H0,'S

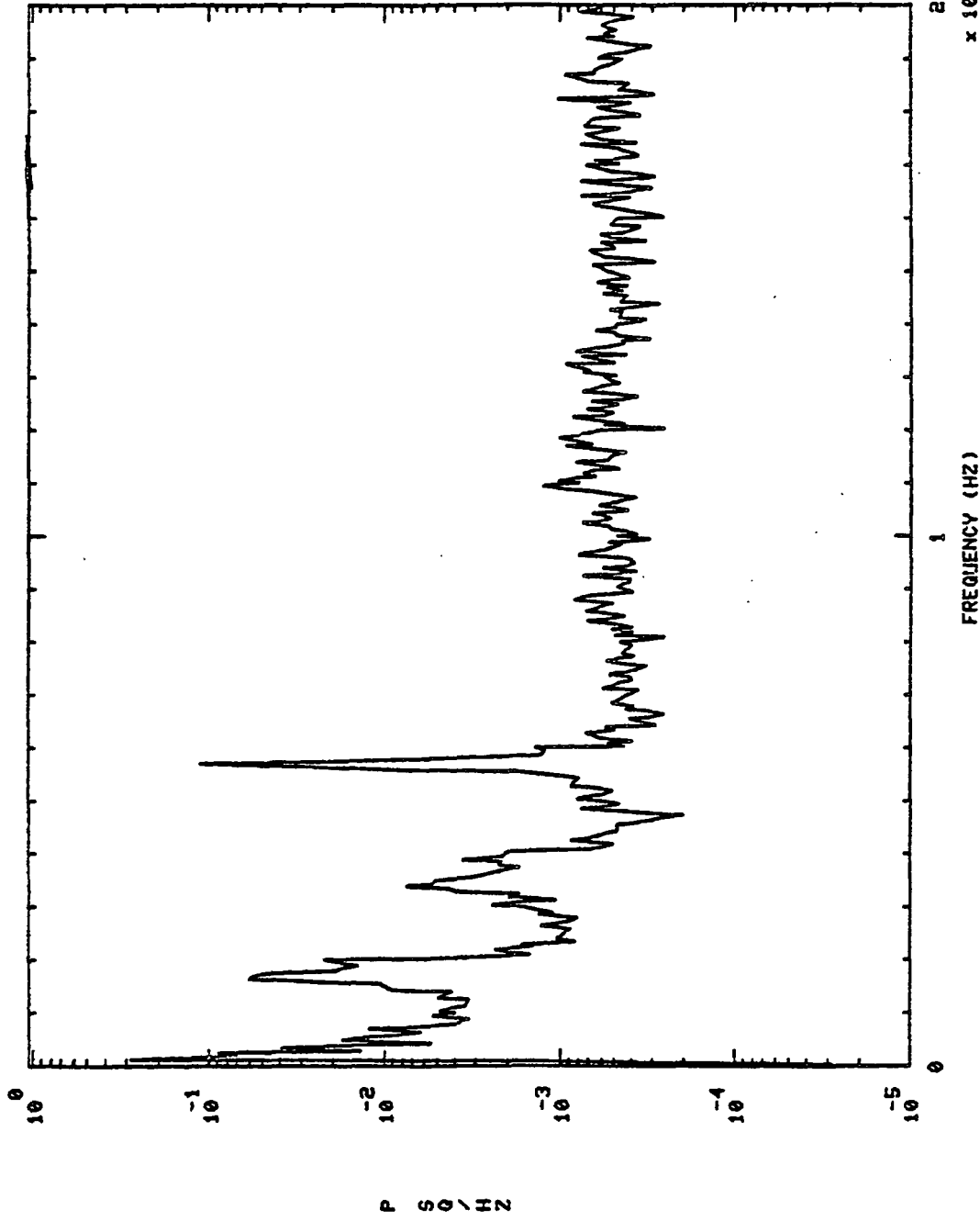


750113 LPOP DS PR S+ 150.01H0.'S

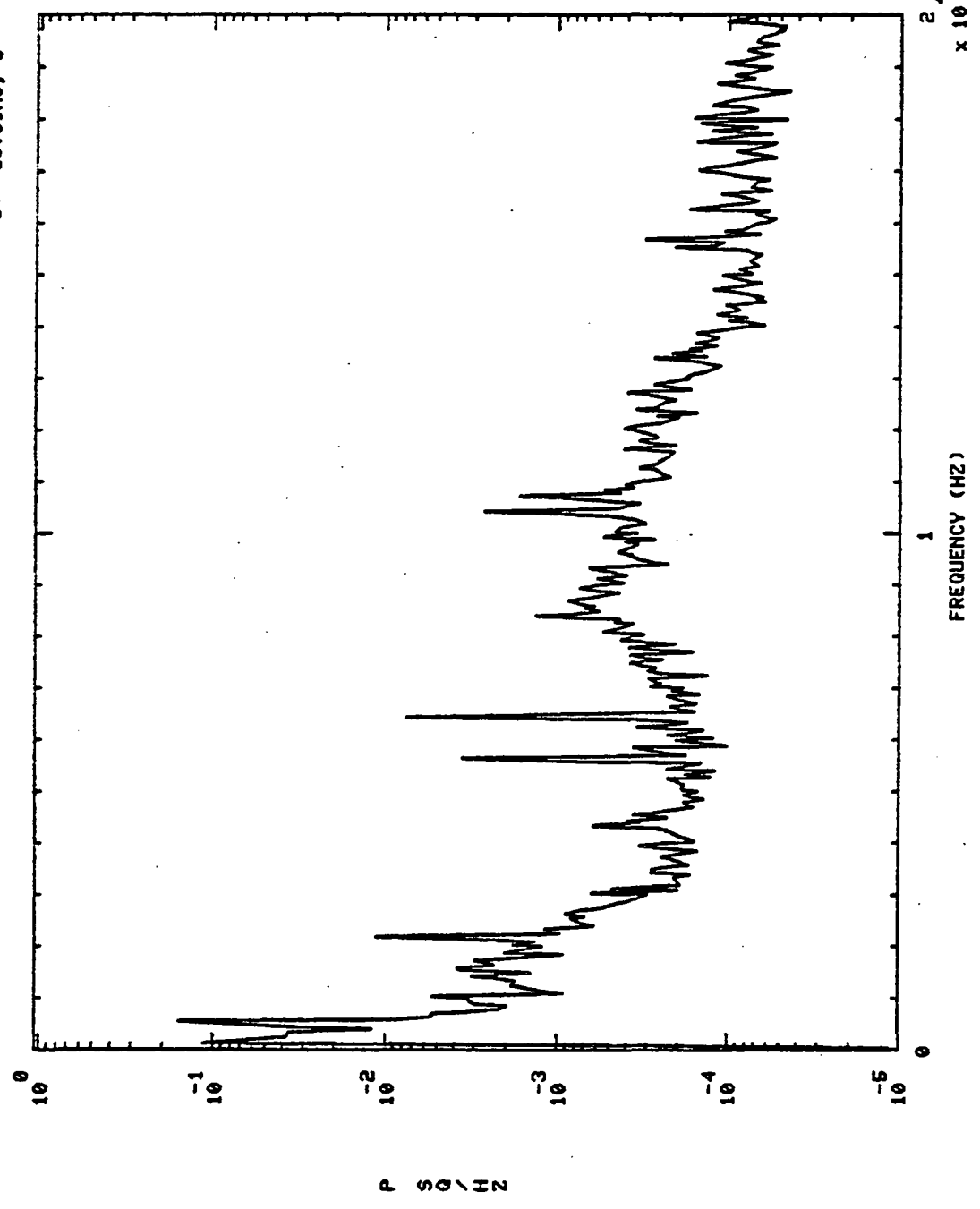


ST 280.01H0,'S

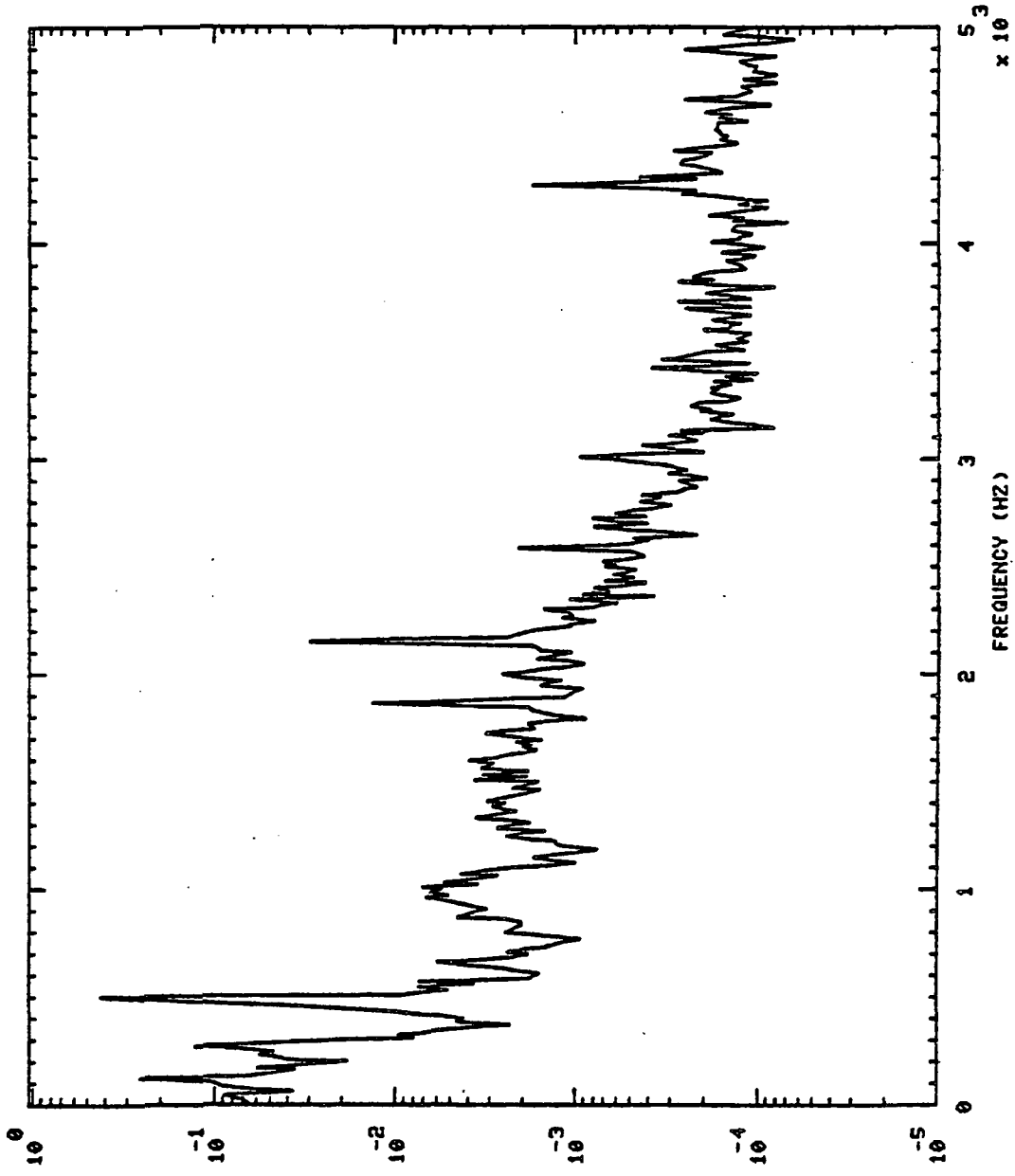
750113 LPOP DS PR



750113 HPOP BAL CAU PRZ S+ 30.01H0,'S

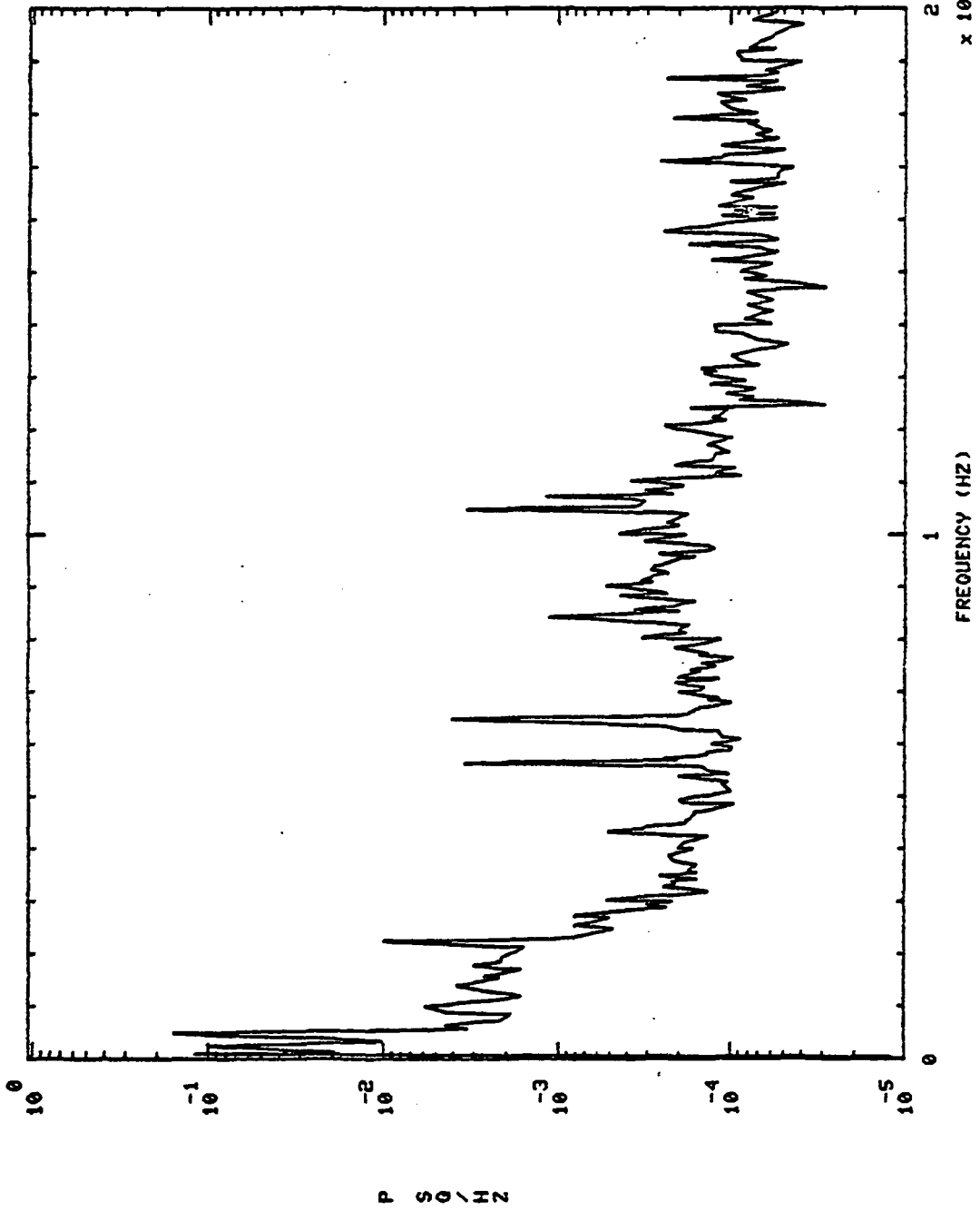


750113 HPOP BAL CAU PR2 S+ 150.01H0.'S

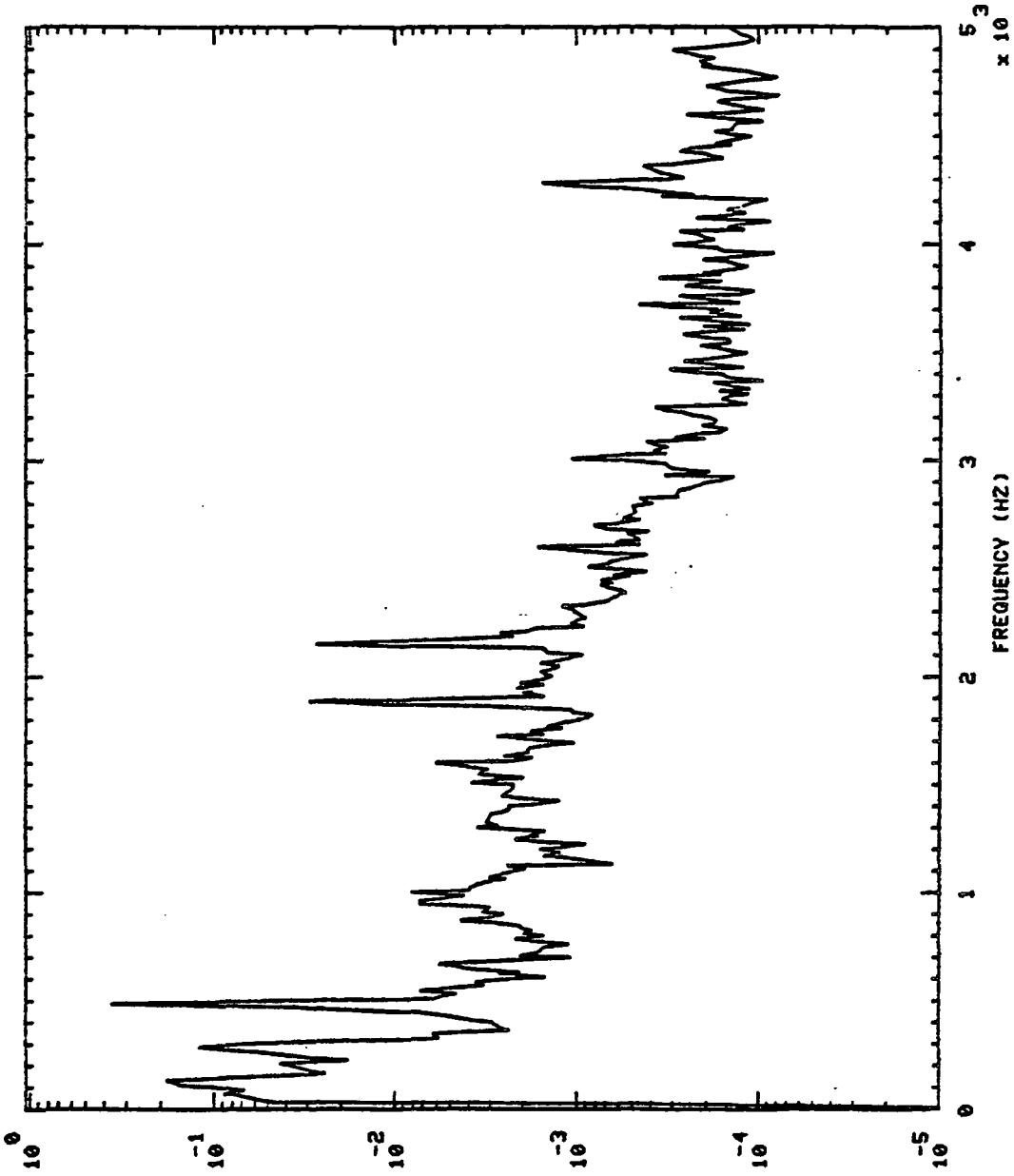


P S O \ IN

750113 HPOP BAL CAU PR2 S+ 150.01H0,'S

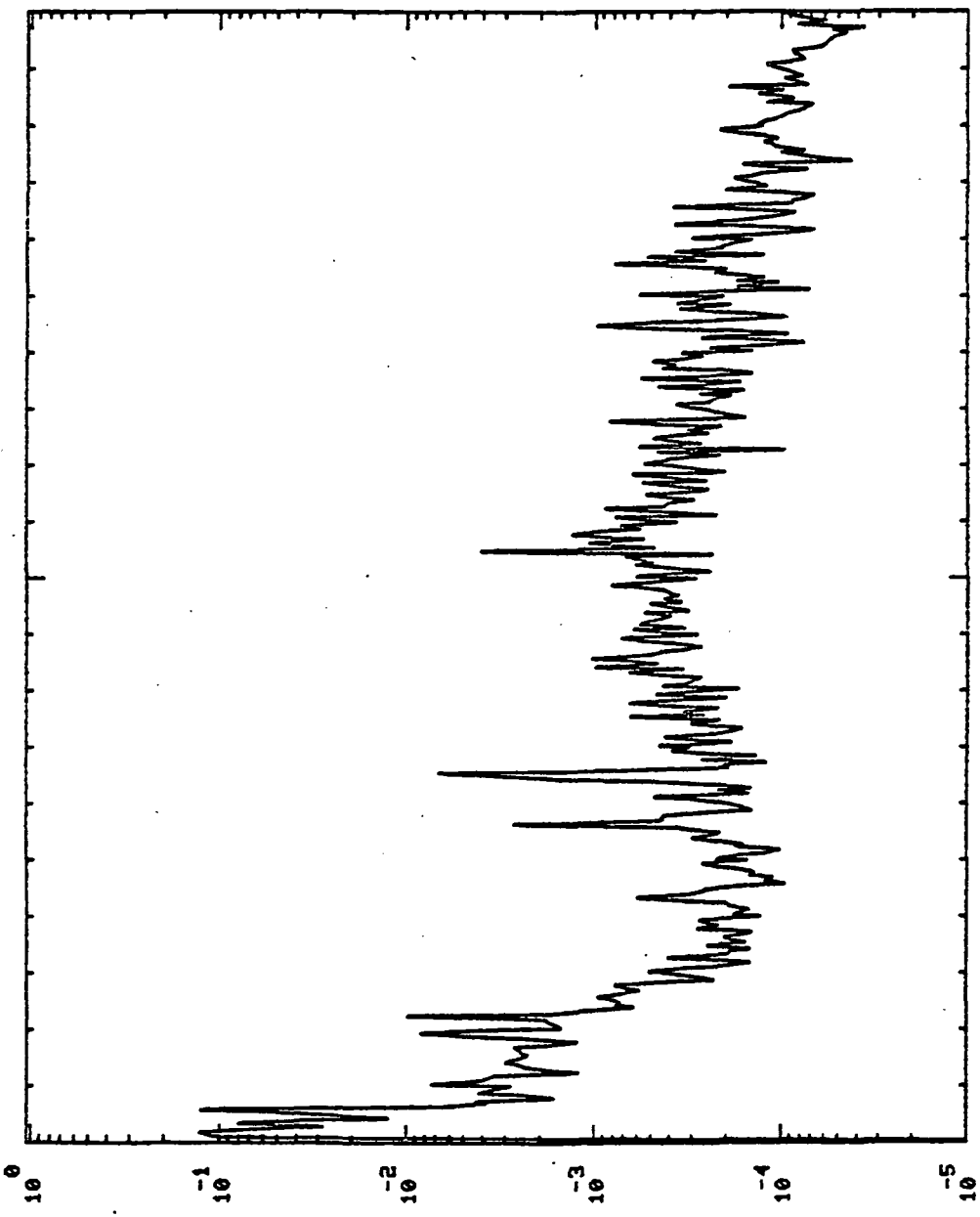


750113 HPOP BAL CAU PR2 S+ 280.01H0,'S



P S \ IN

750113 HPOP BAL CAU PR2 S+ 280.01H0,'S

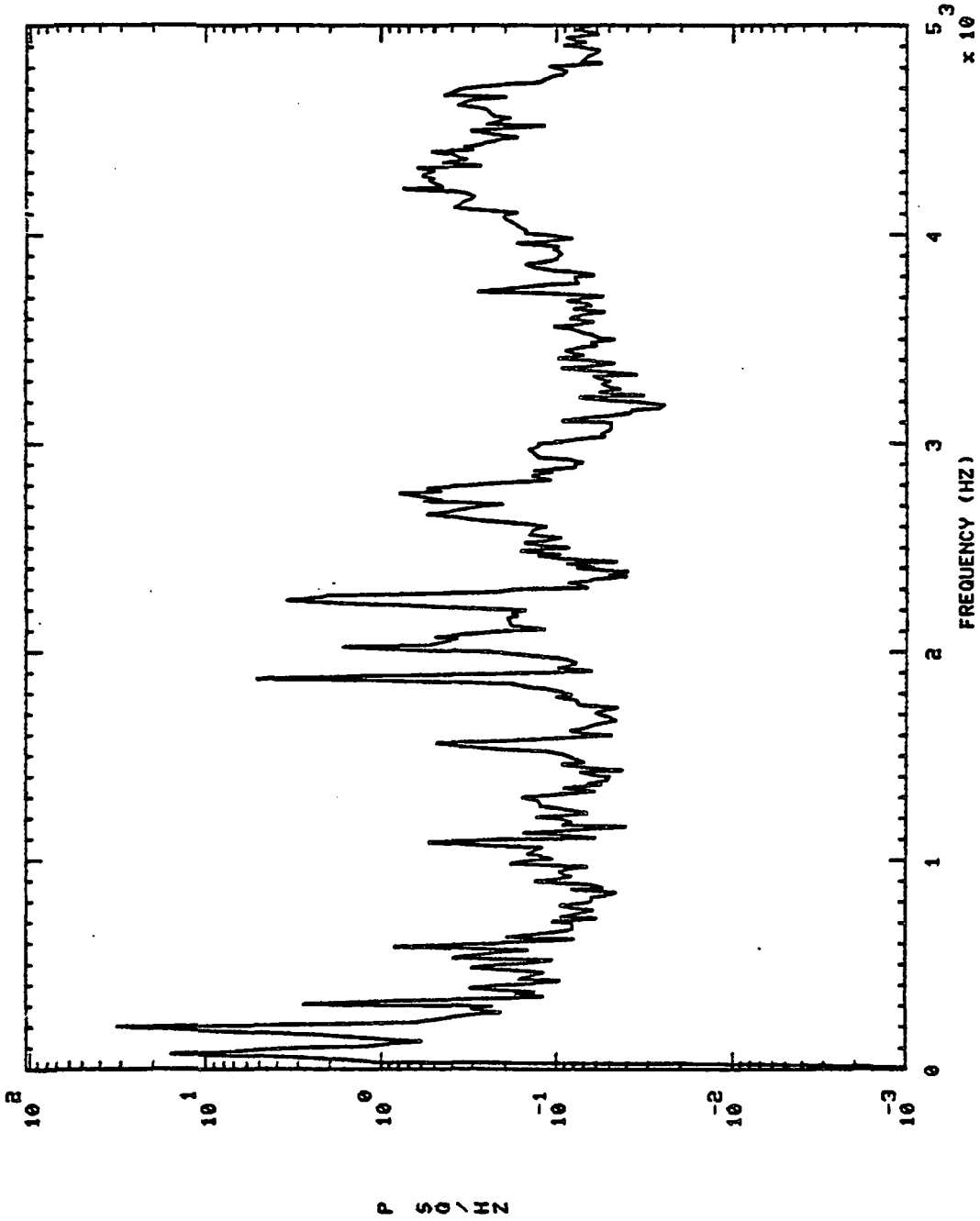


PSD / HZ

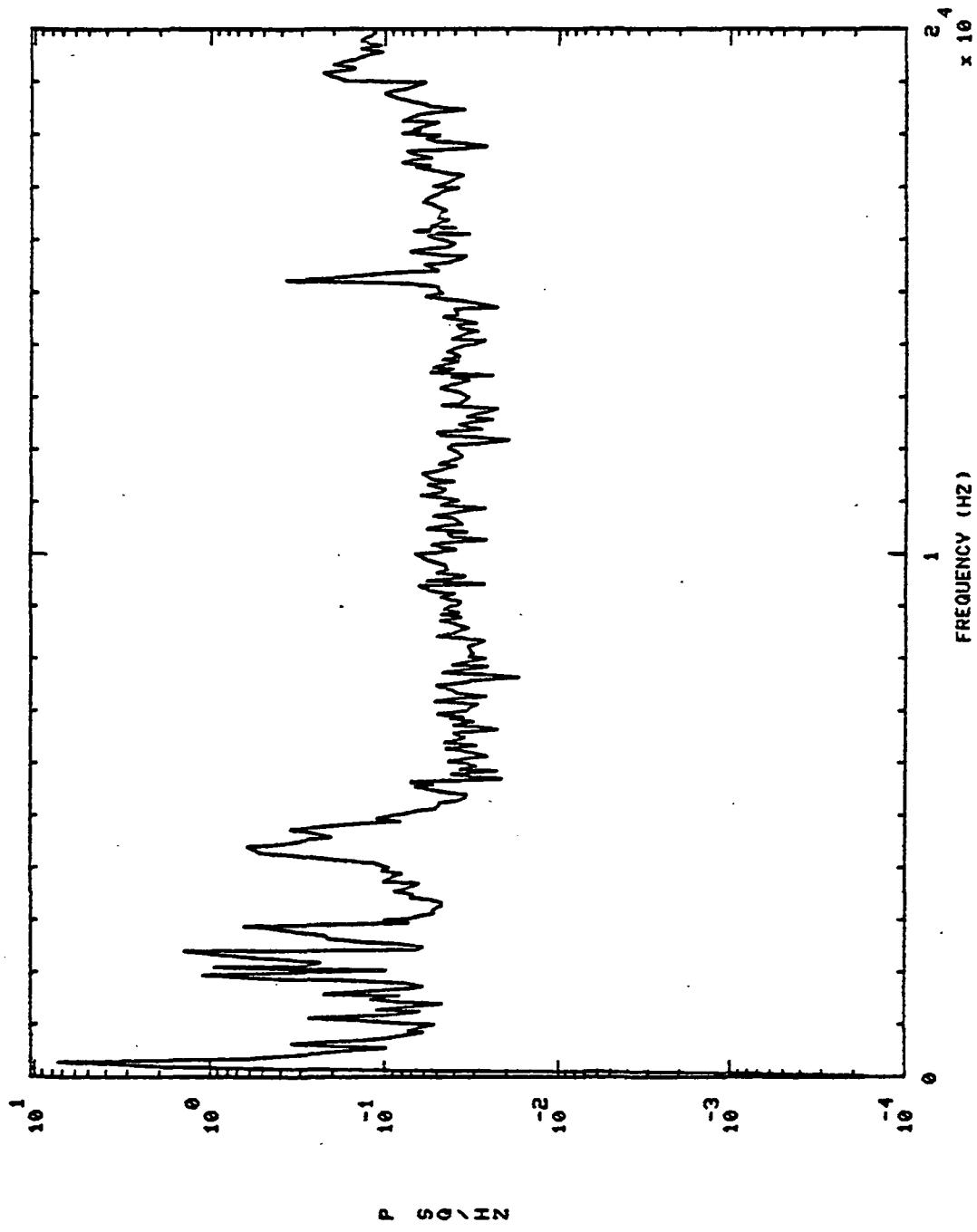
2.4
x 10⁴

FREQUENCY (HZ)

750113 HPOP D5 PR S+ 30.01H0, 'S

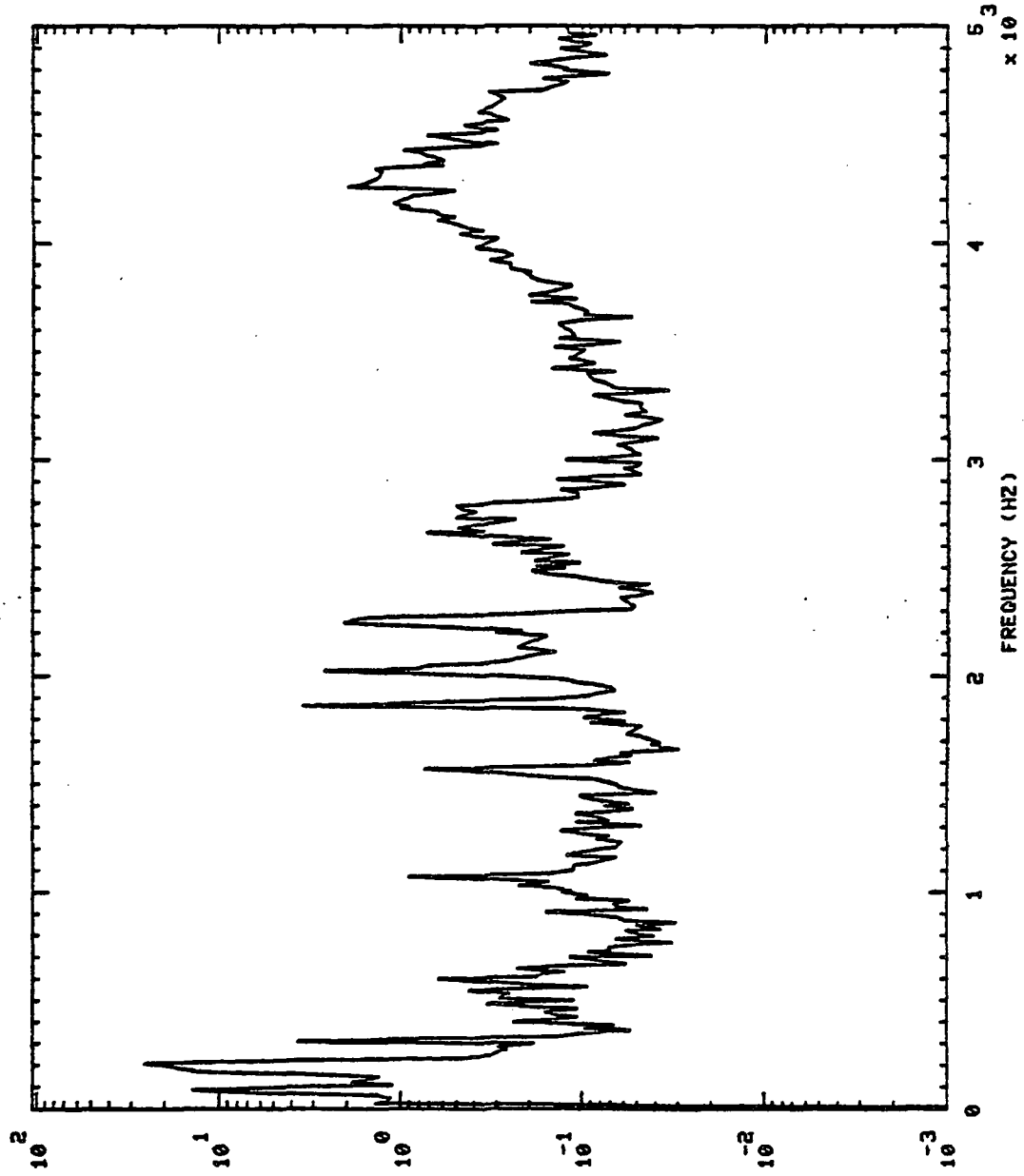


750113 HPOP DS PR S+ 30.01H0.'S



S+ 150.01H0,'S

750113 HPOP DS PR

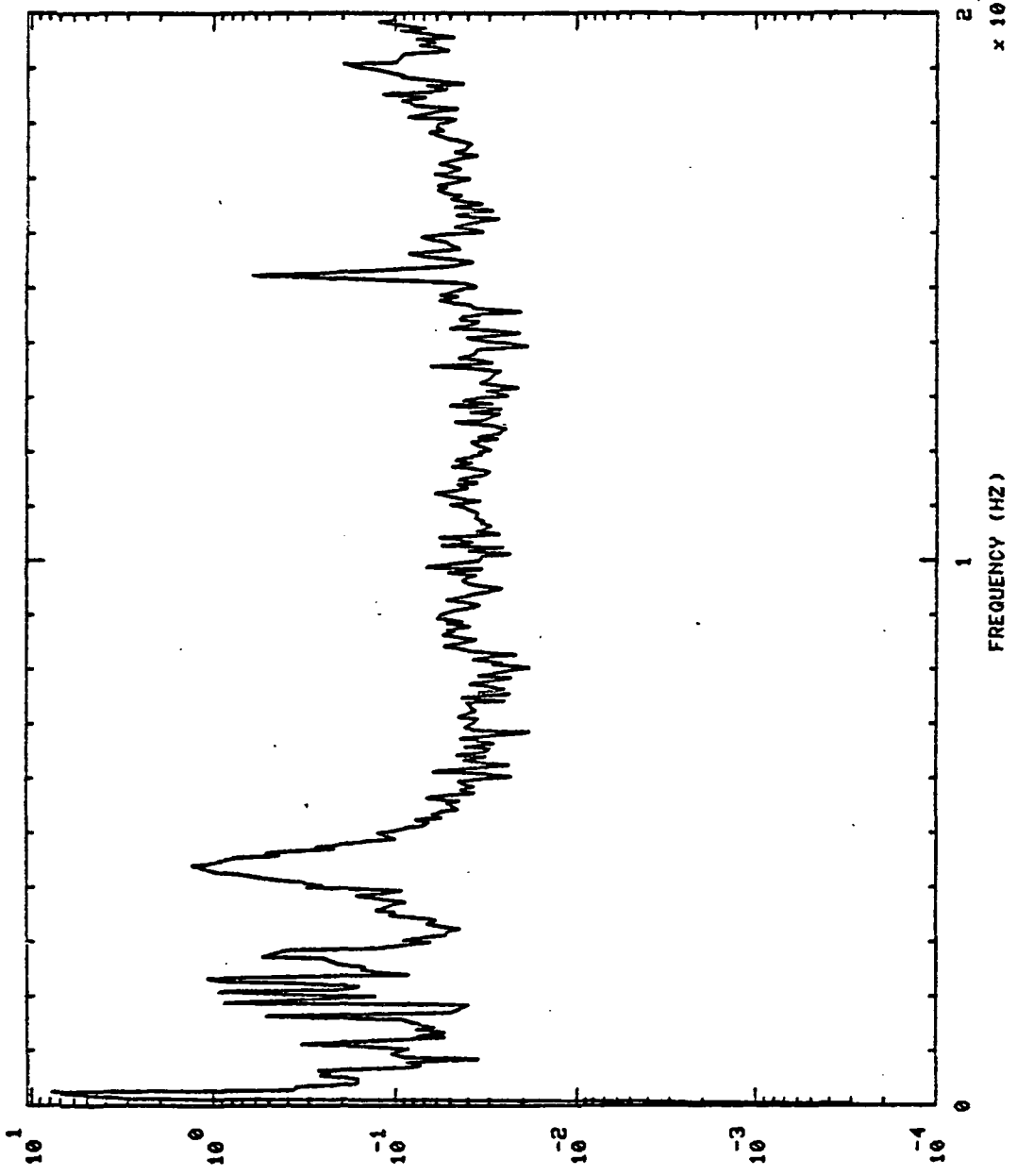


P S G / H 2

S+ 150.01H0.'5

HFOP DS PR

750113



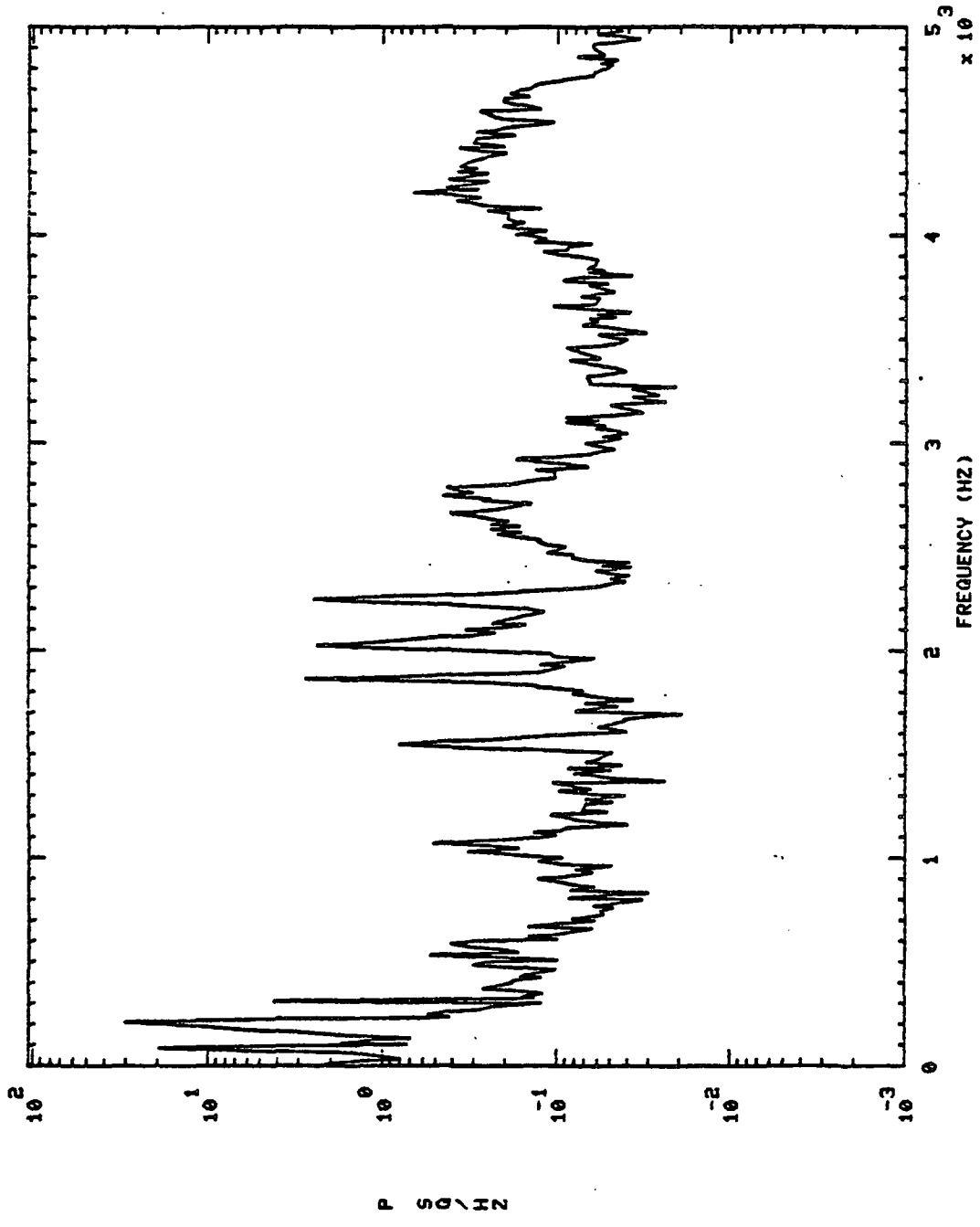
P SQ \ HZ

FREQUENCY (HZ)

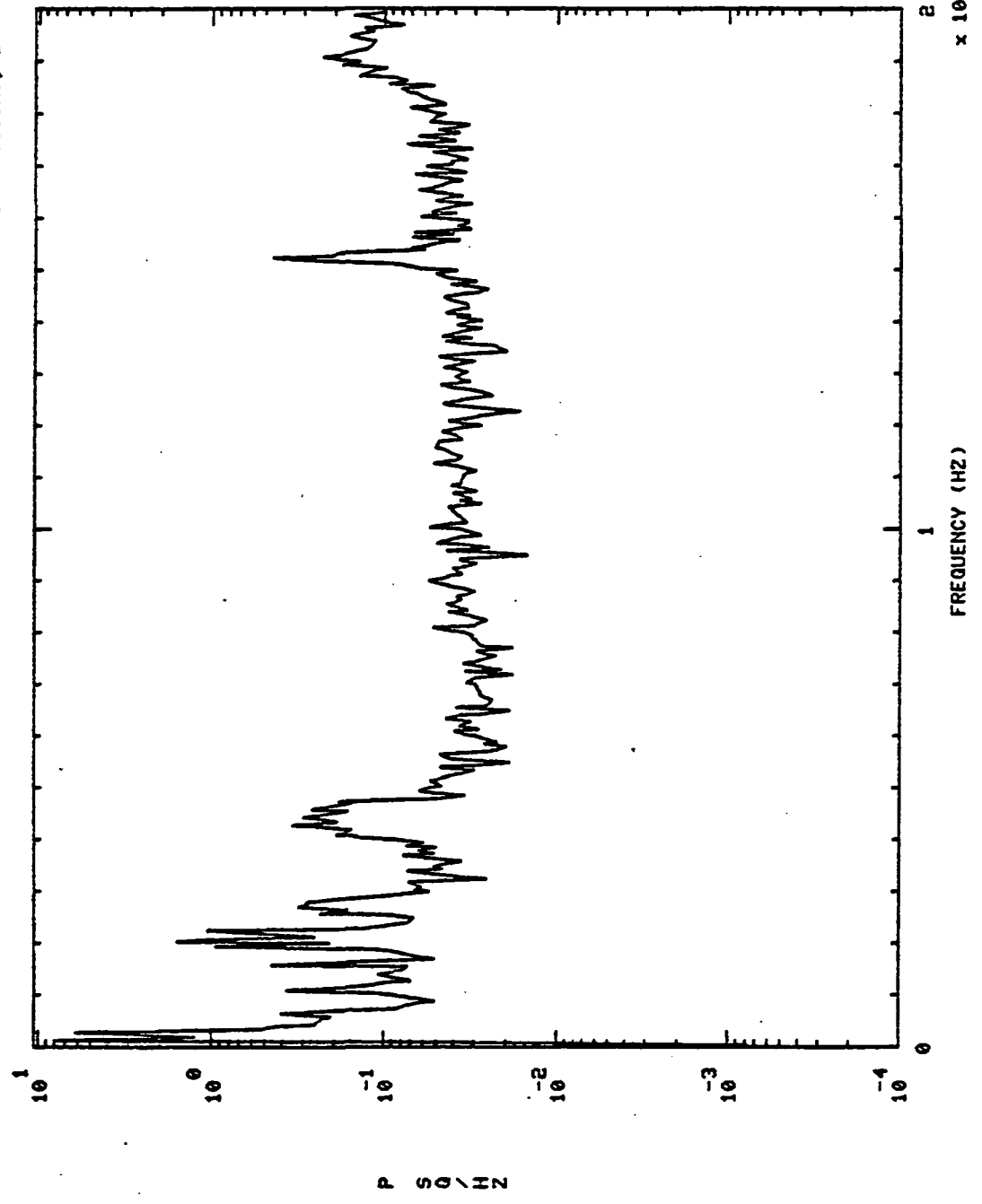
2.4
x 10⁴

S+ 280.0140, 'S

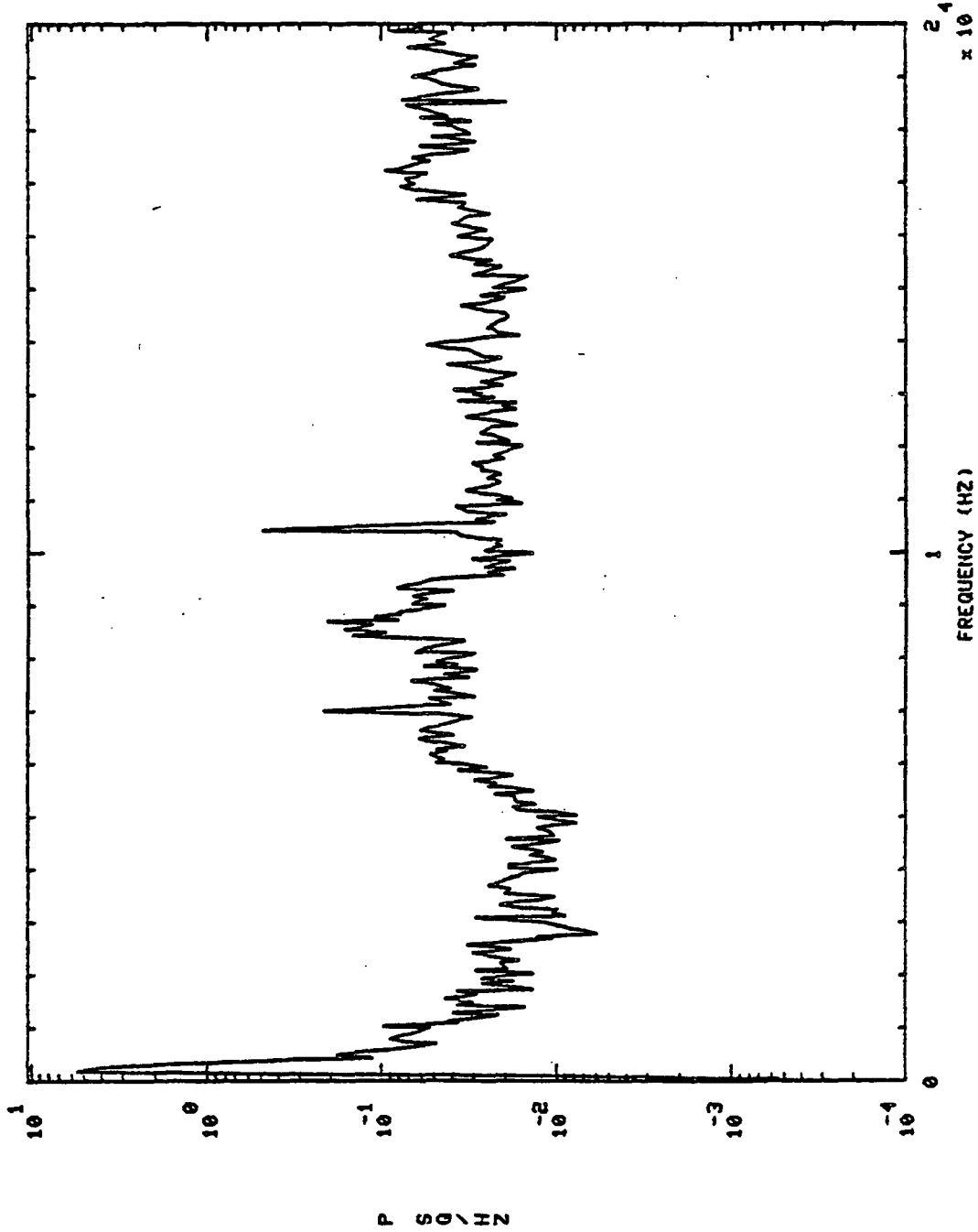
750113 HFOP DS PR



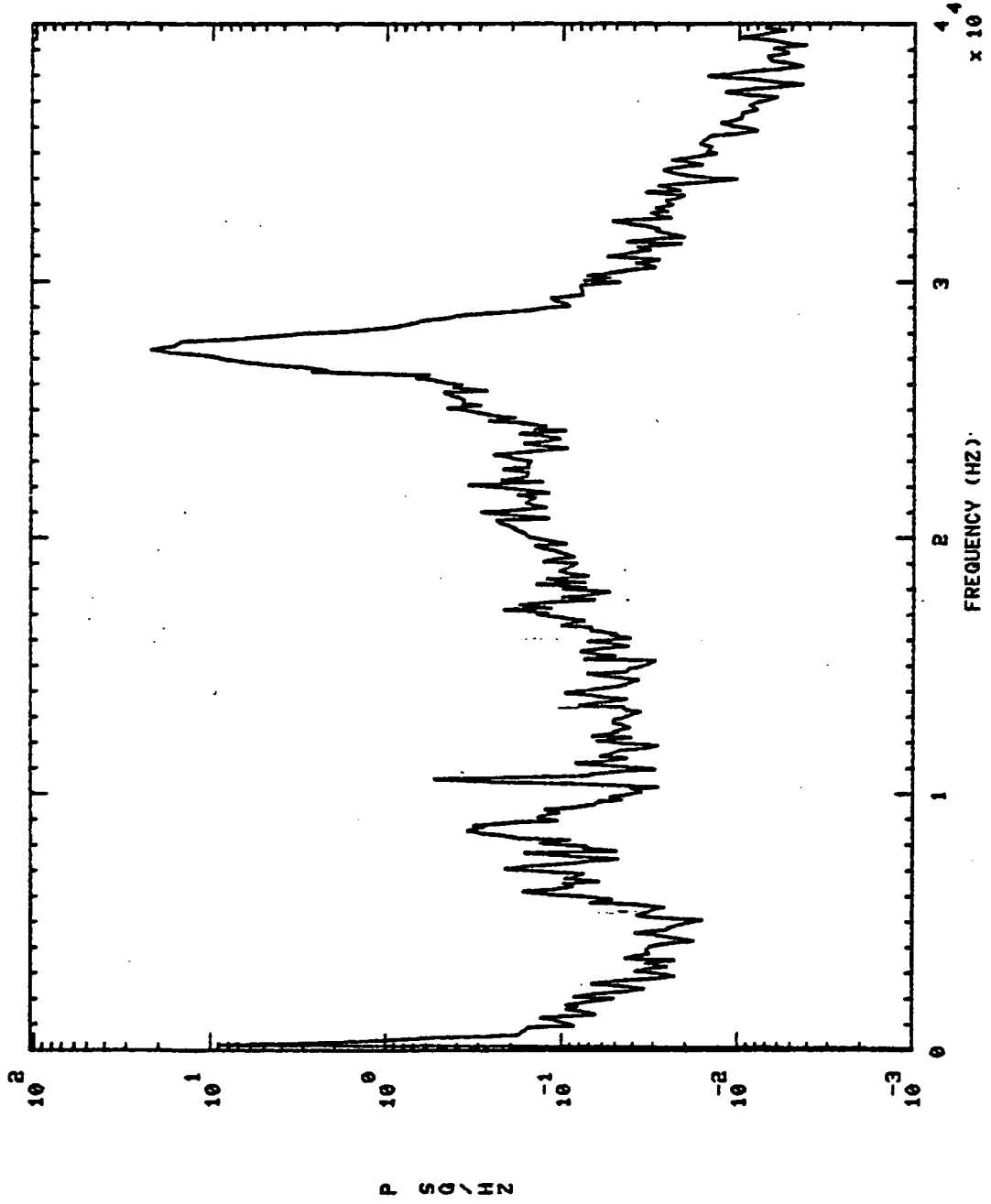
750113 HPOP DS PR S+ 280.01H0,'S



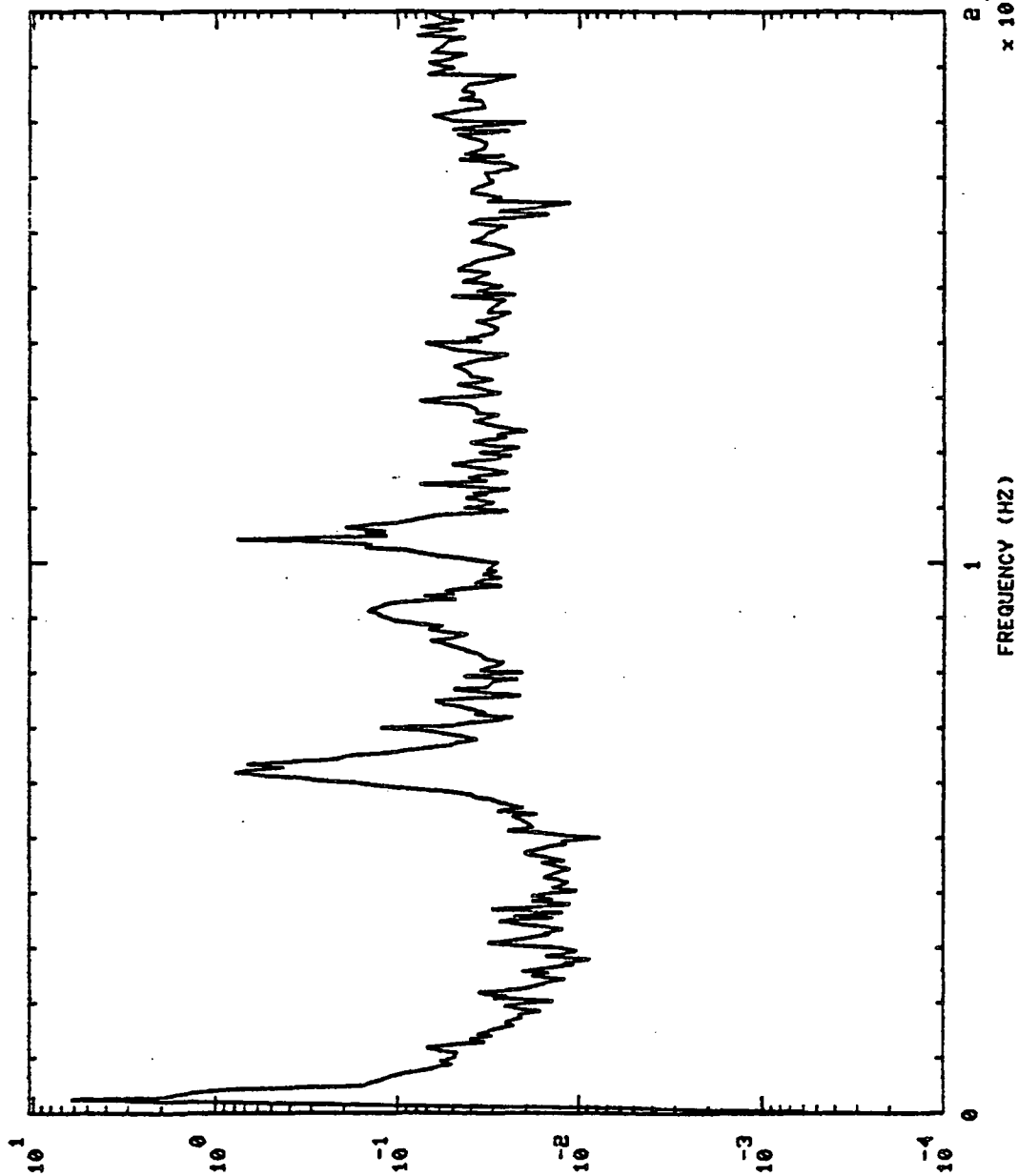
750113 MCC HOT GAS IN PR S+ 30.01H0,'S



759113 MCC HOT GAS IN PR 5+ 30.01H0.'S



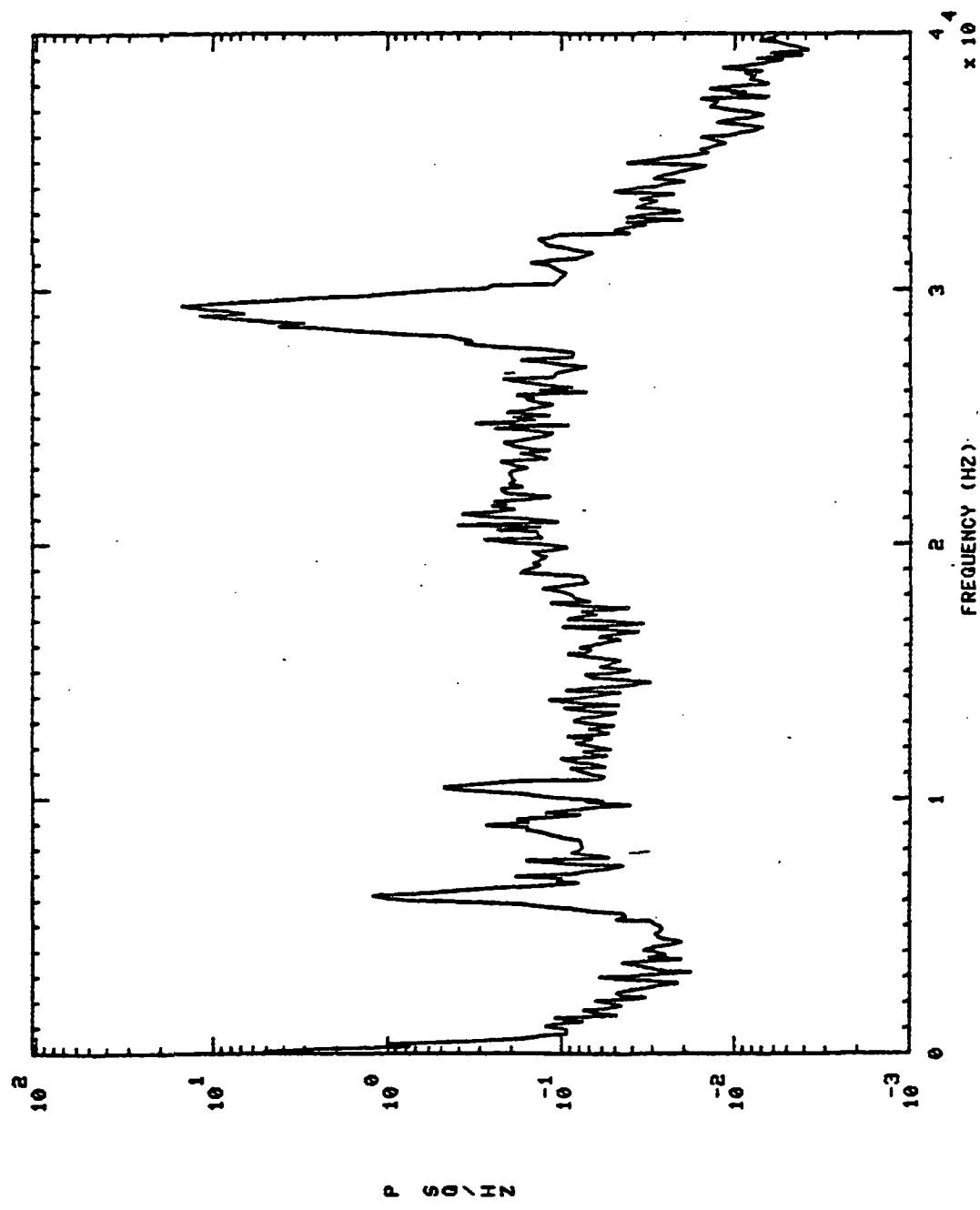
750113 MCC HOT GAS IN PR S+ 150.01H0,'S



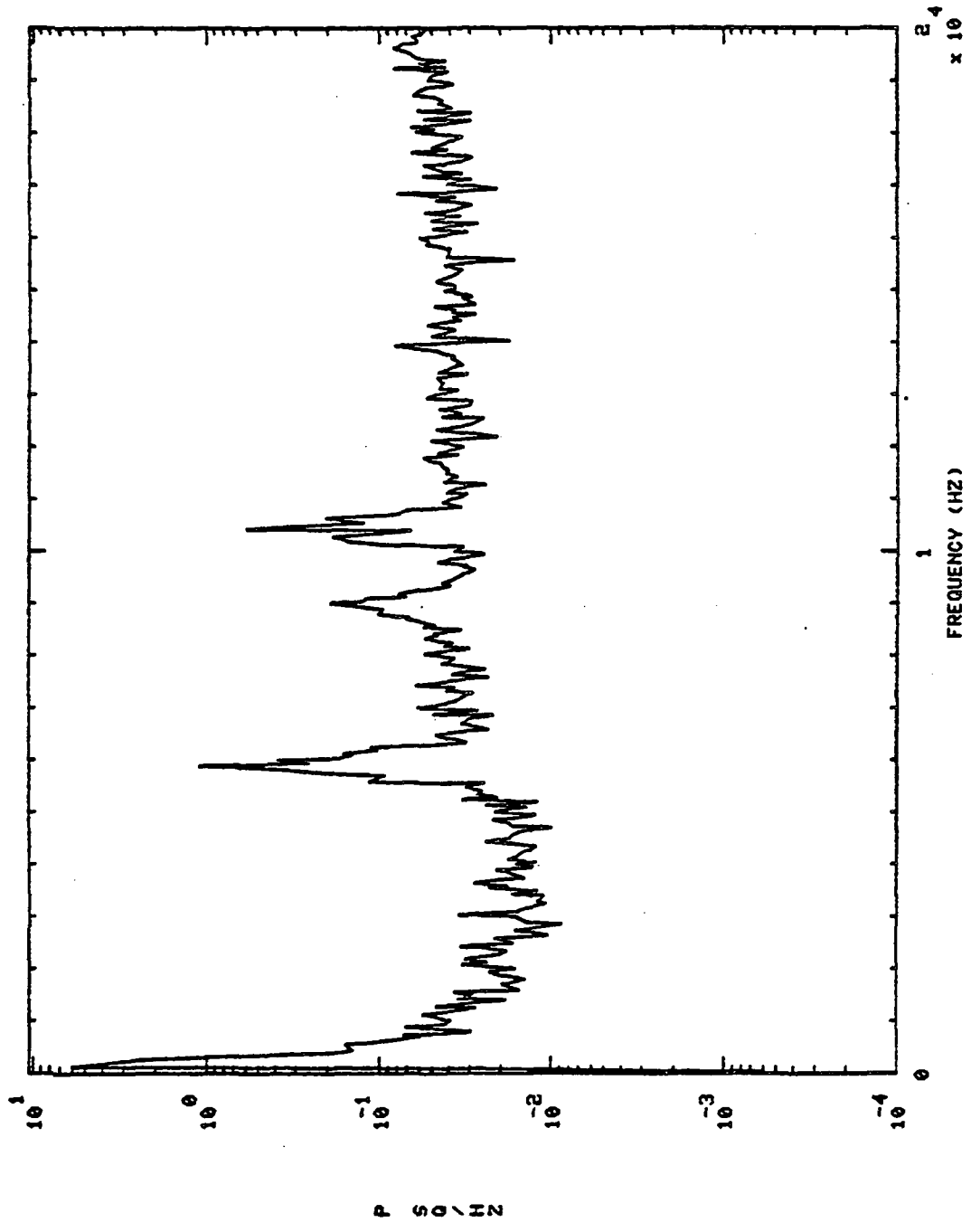
P S D \ H Z

10⁴
x 10

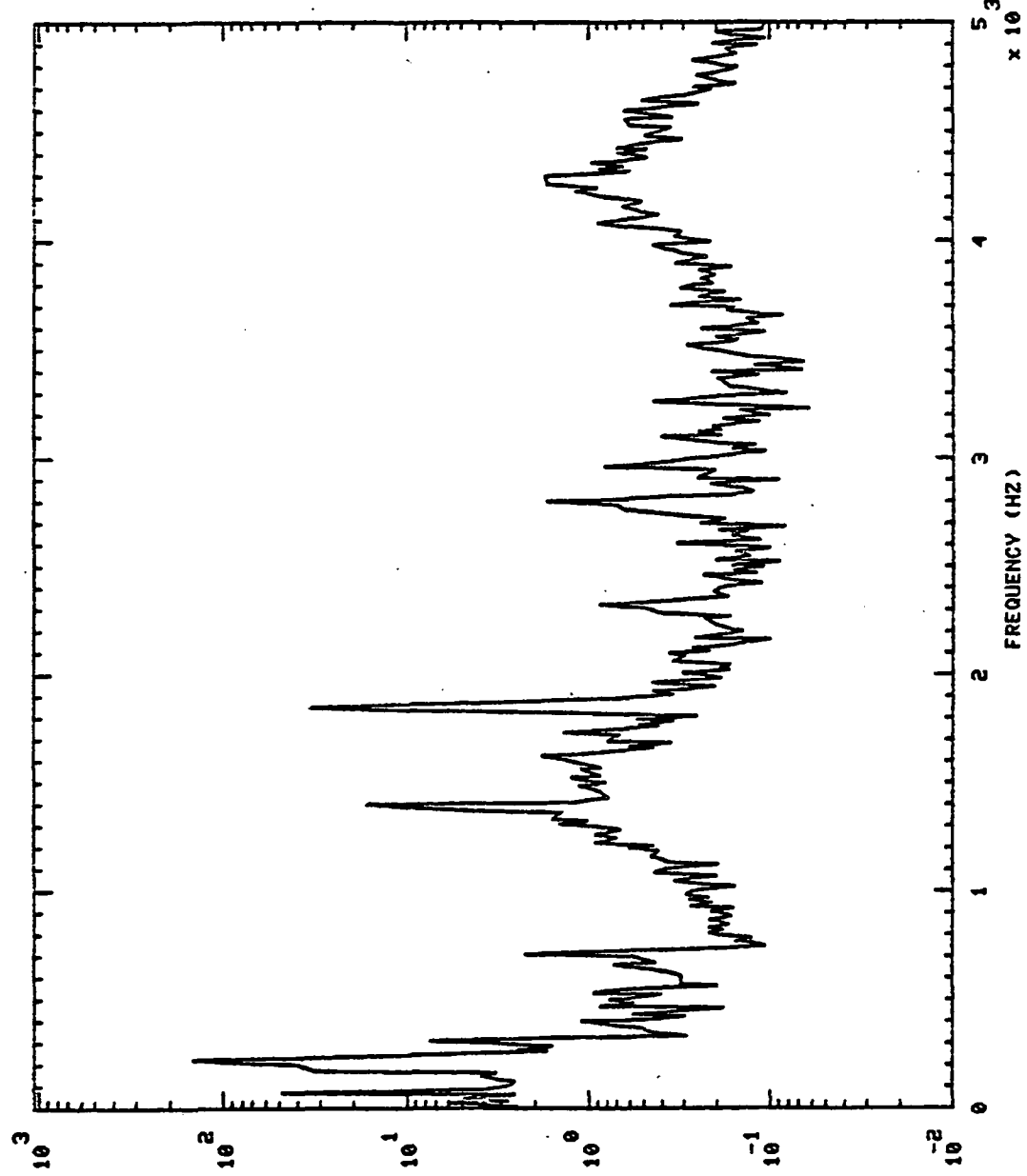
750113 MCC HOT GAS IN PR S+ 150.01H0,'S



750113 MCC HOT GAS IN PR S+ 280.01H0.'S

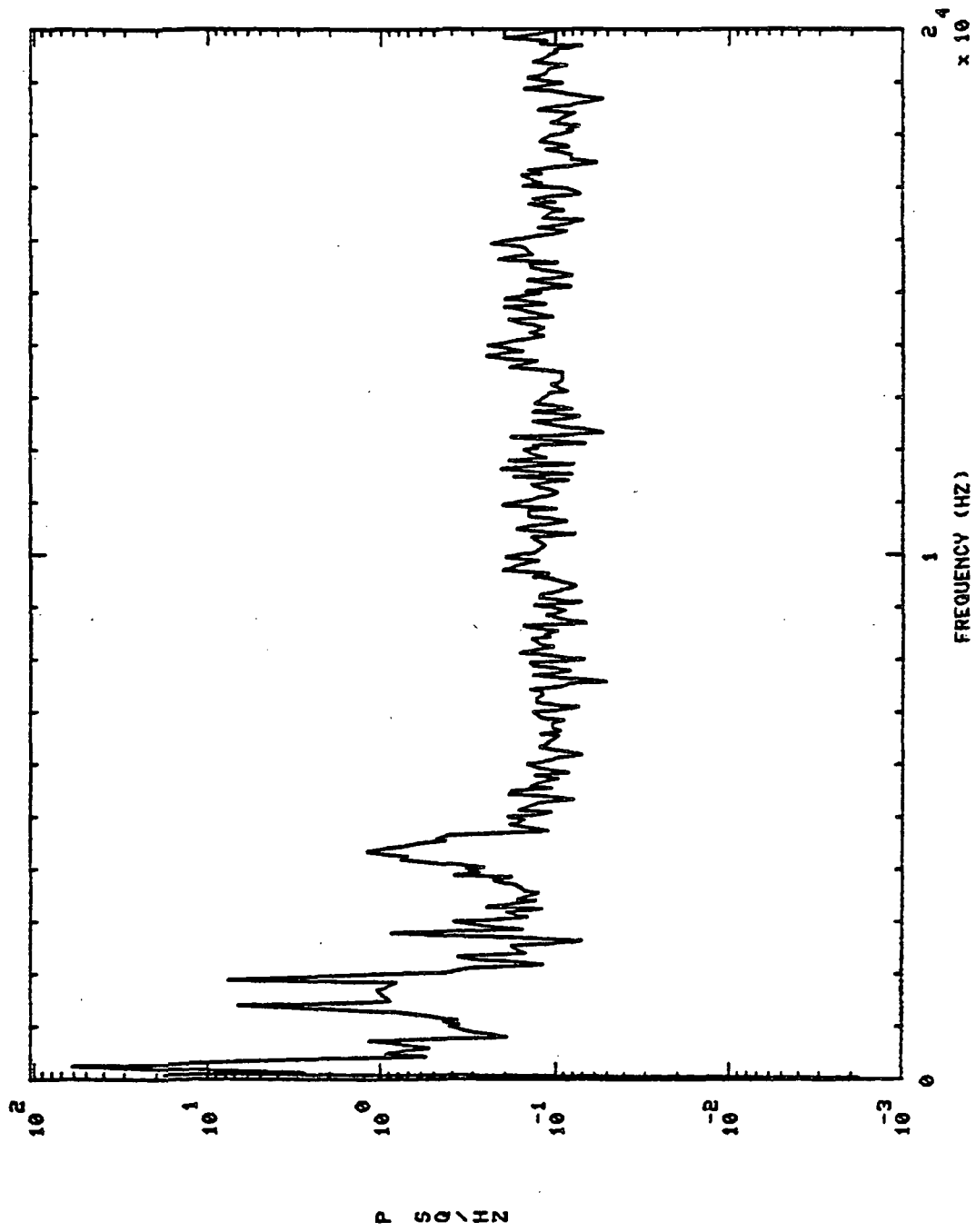


750113 PBP DS PR S+ 30.01H0,'S



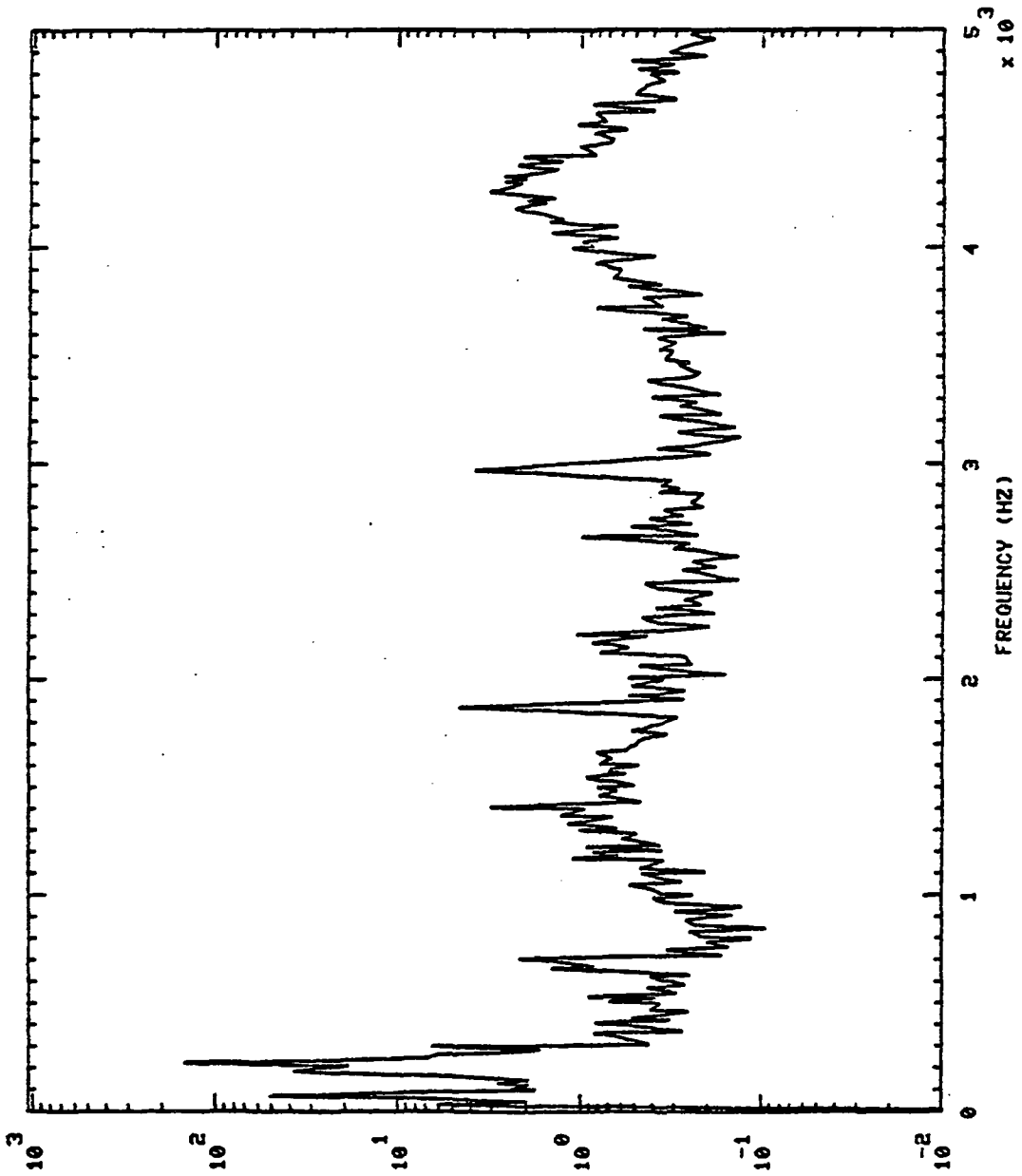
PSD / HZ

750113 PBP DS PR S+ 30.01H0,'S



S+ 150.0100, '9

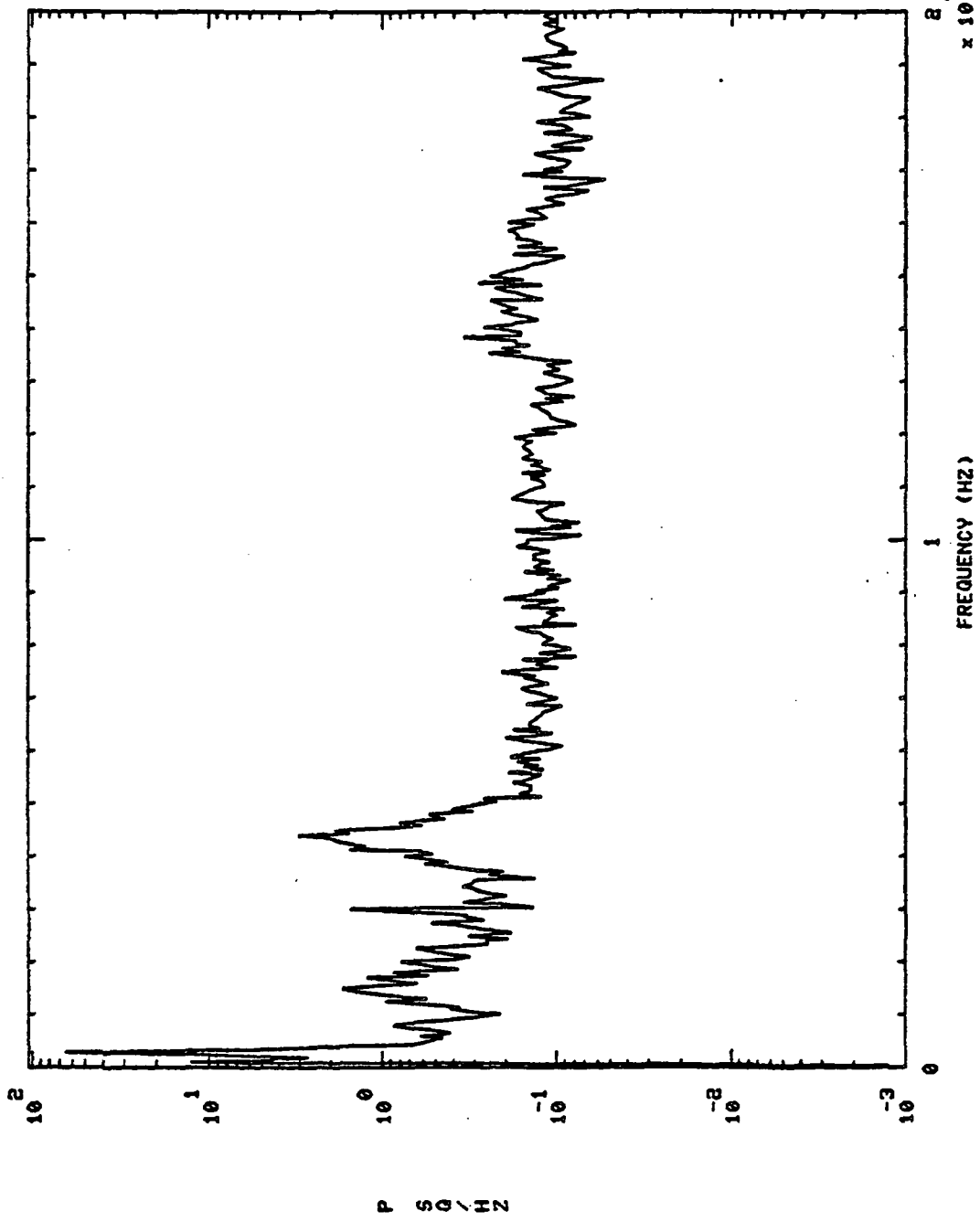
750113 PBP DS PR



P S O / H Z

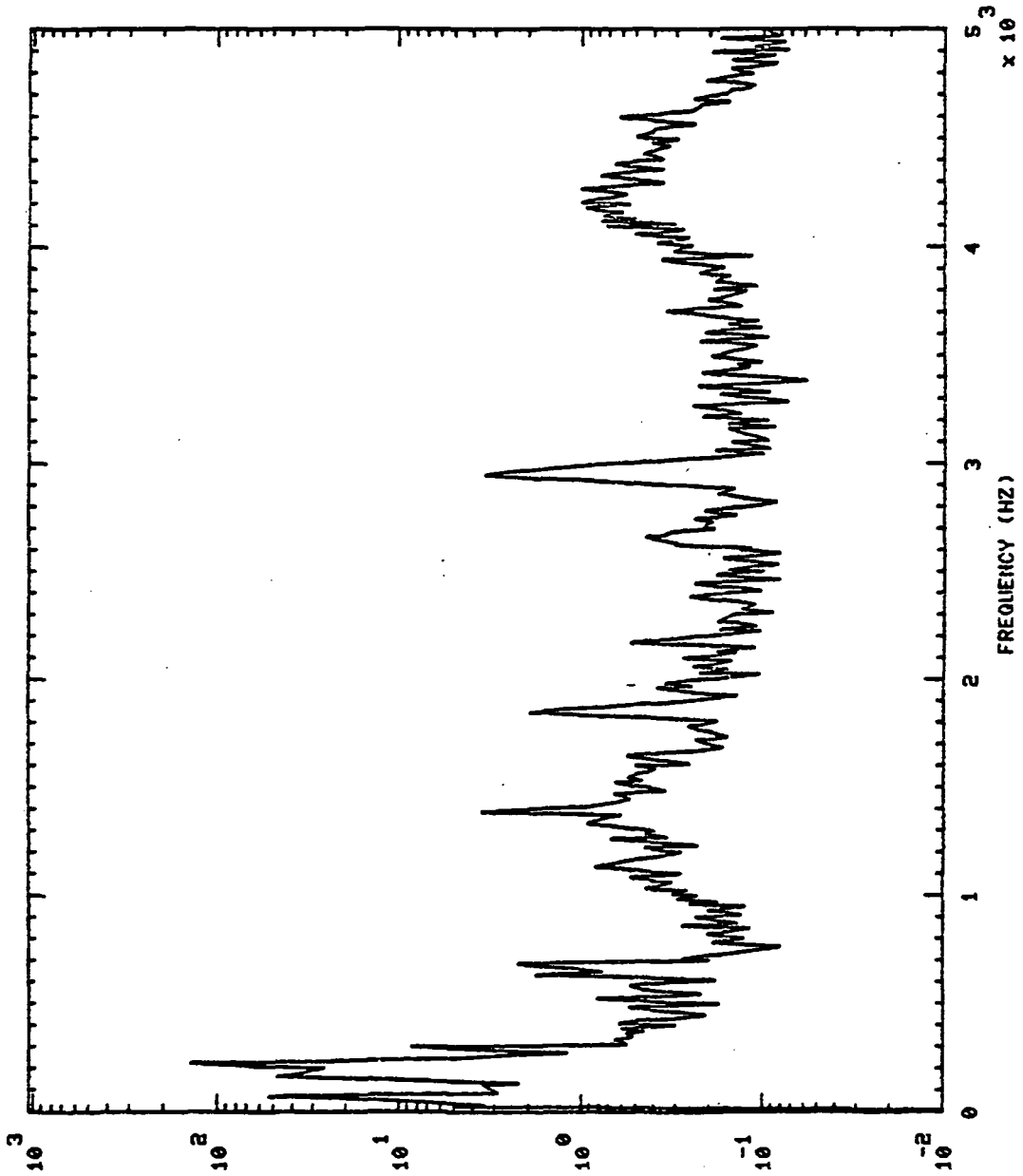
S+ 150.01H0,'S

750113 PBP DS PR



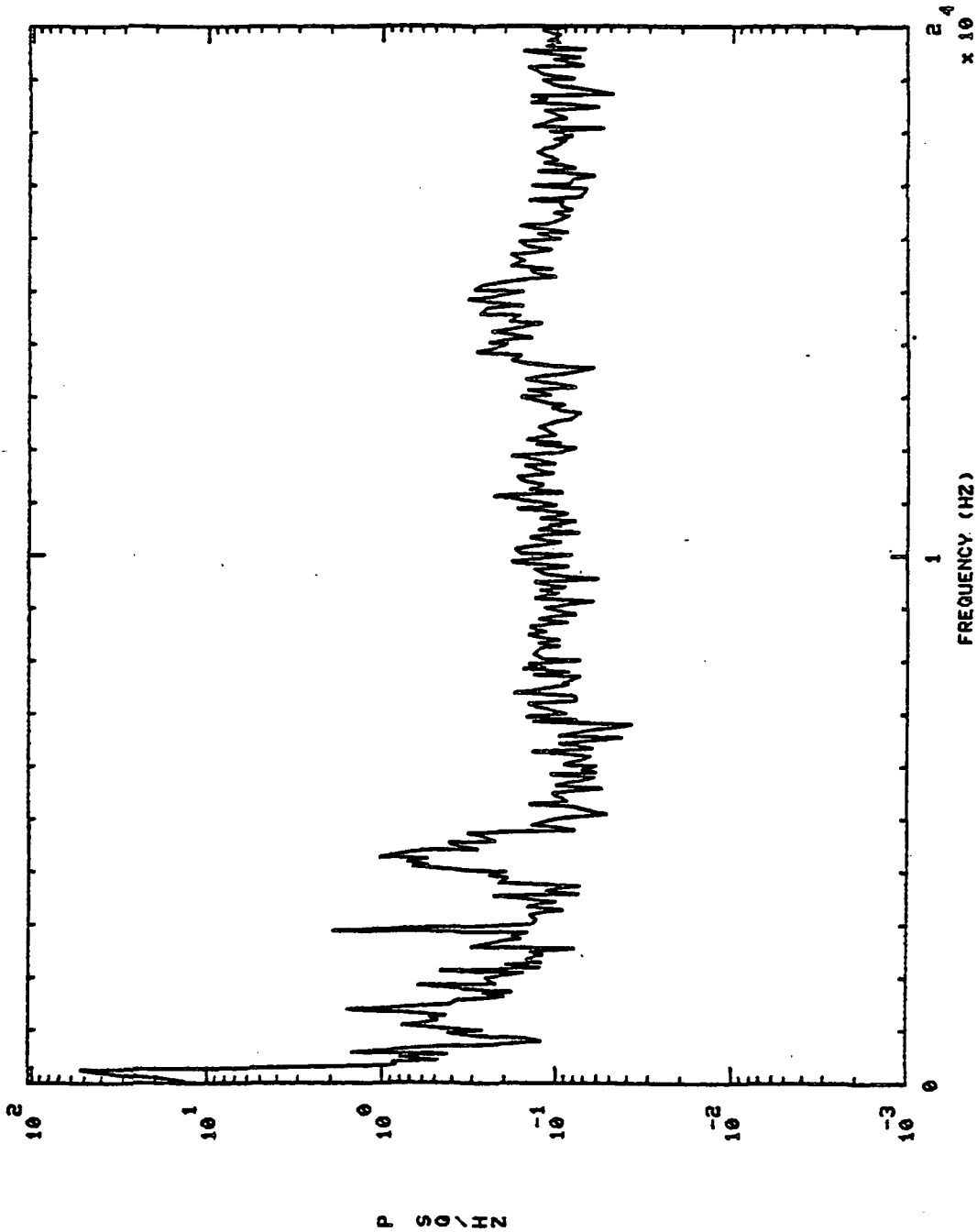
S+ 280.0140,'S

750113 PBP DS PR

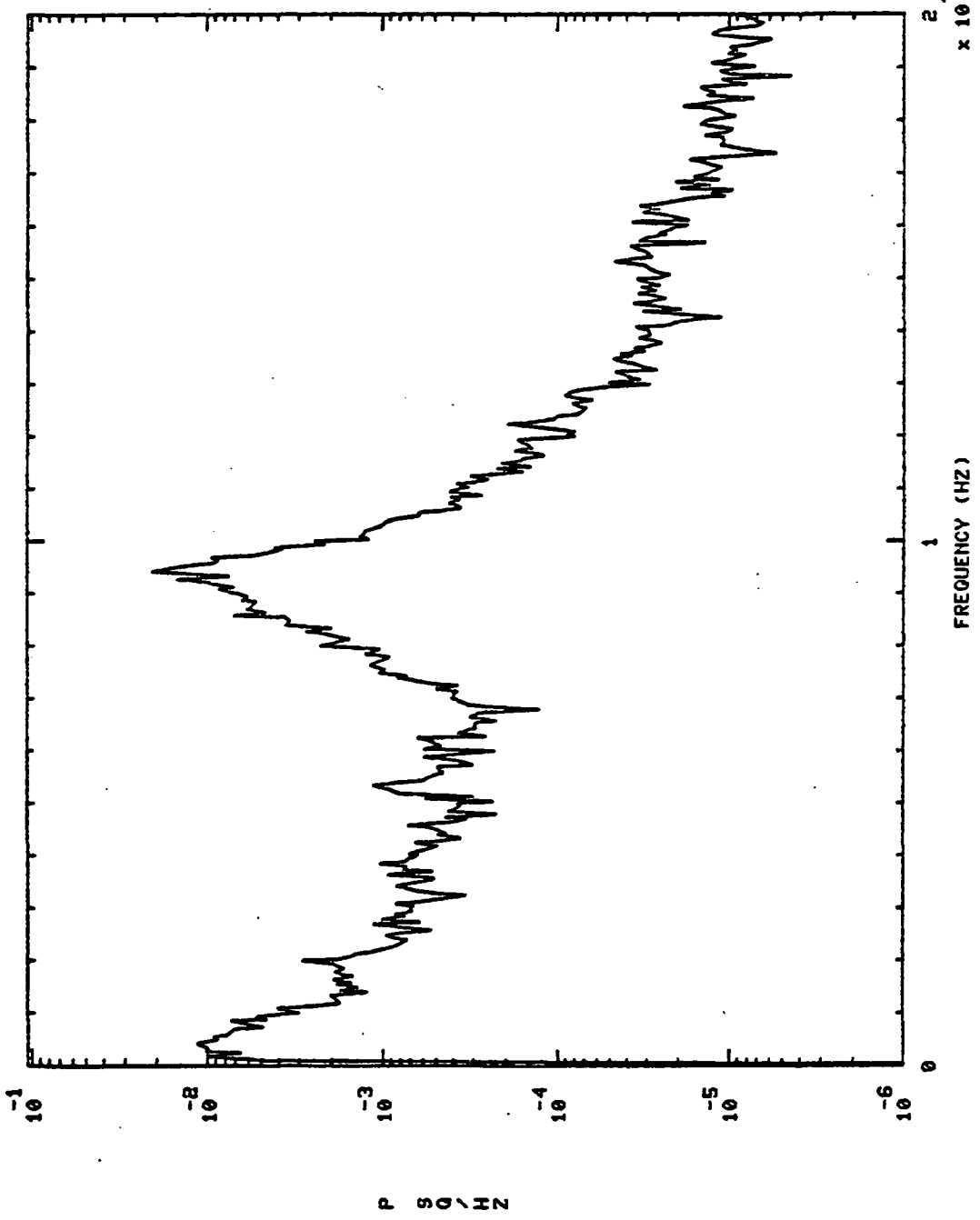


P
S
D
/
H
Z

750113 PBP DS PR S+ 280.01H0,'S



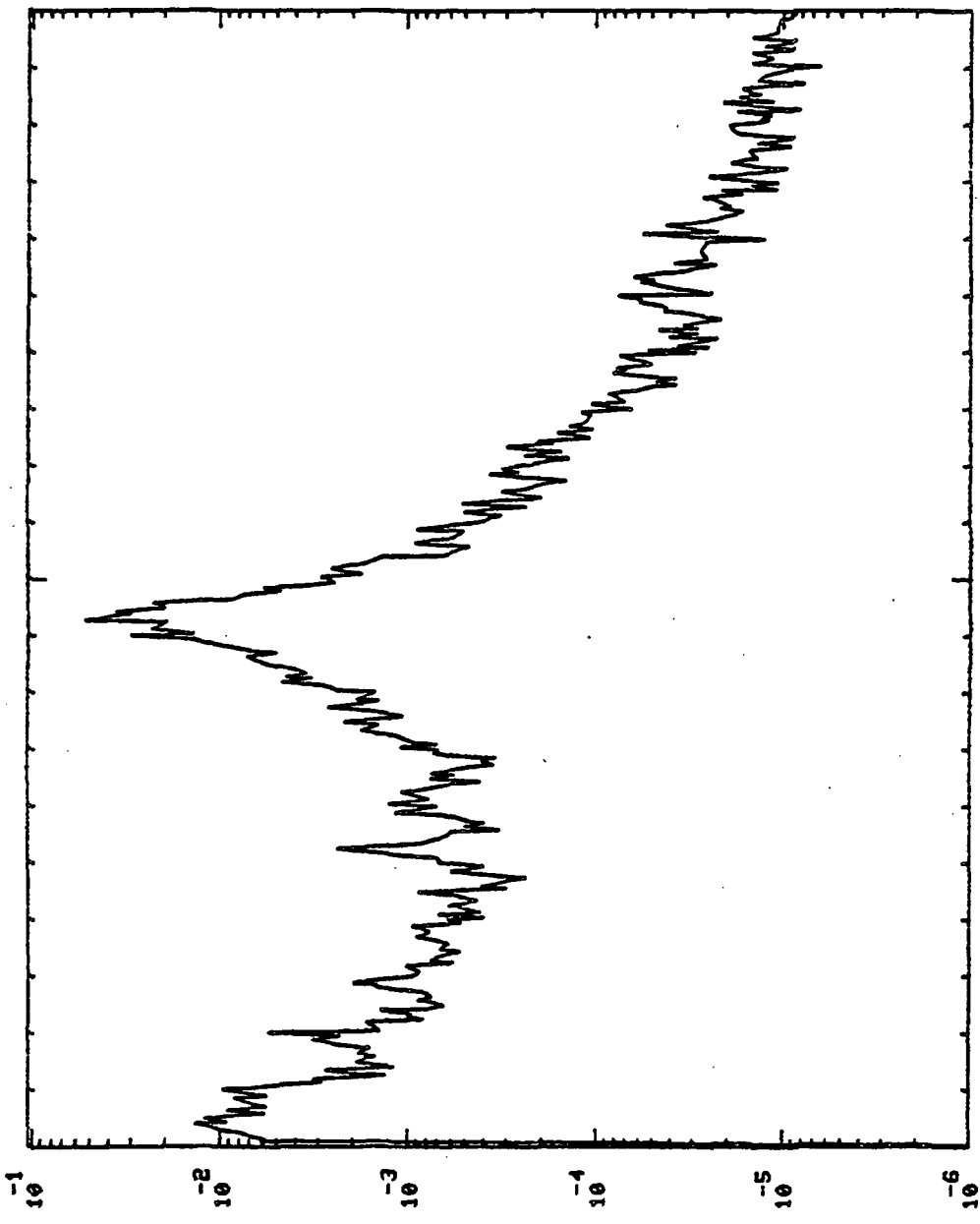
750113 LPFP DS PR S+ 30.01H0,'S



S+ 150.0100,'S

LPFP DS PR

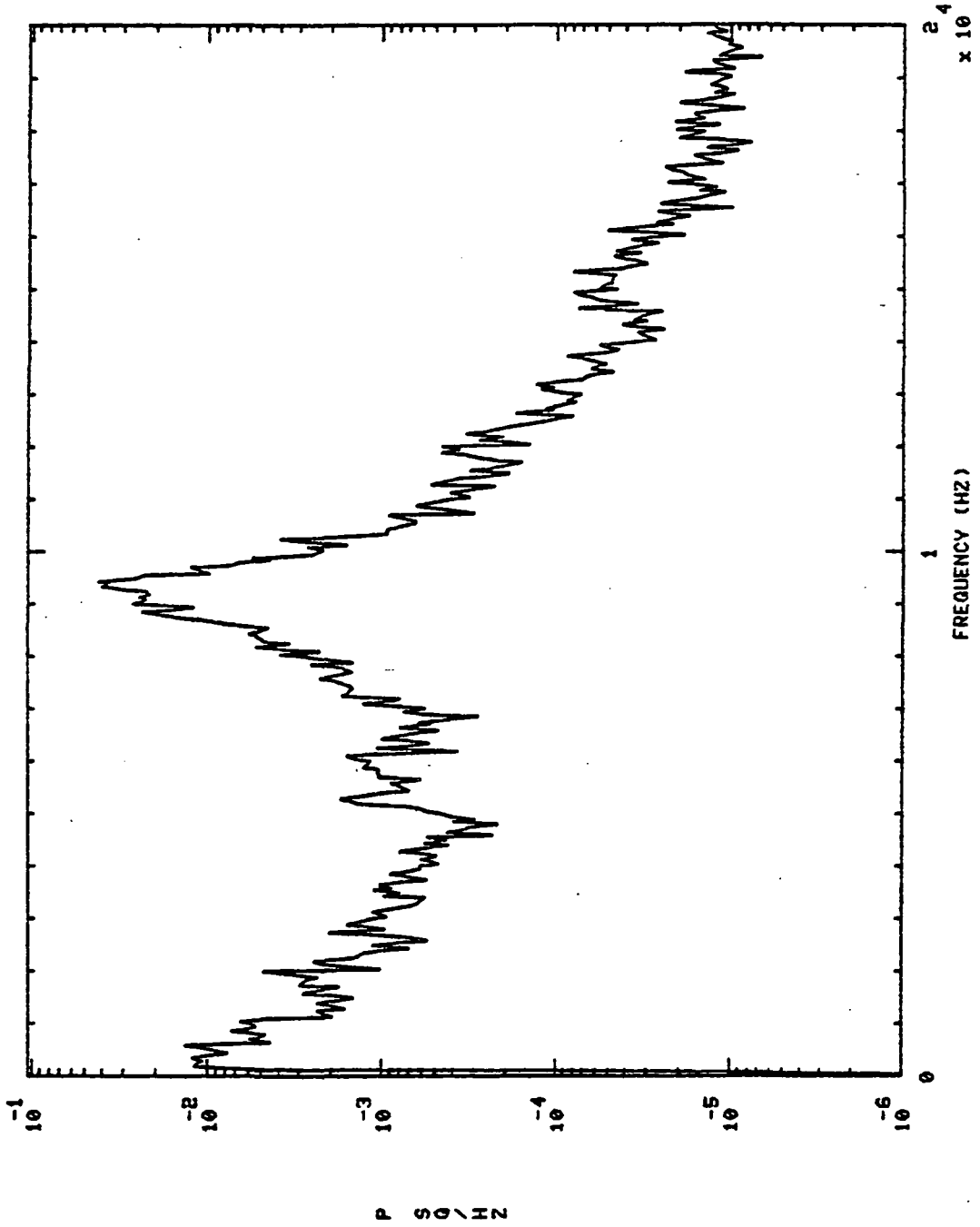
750113



P S D / H Z

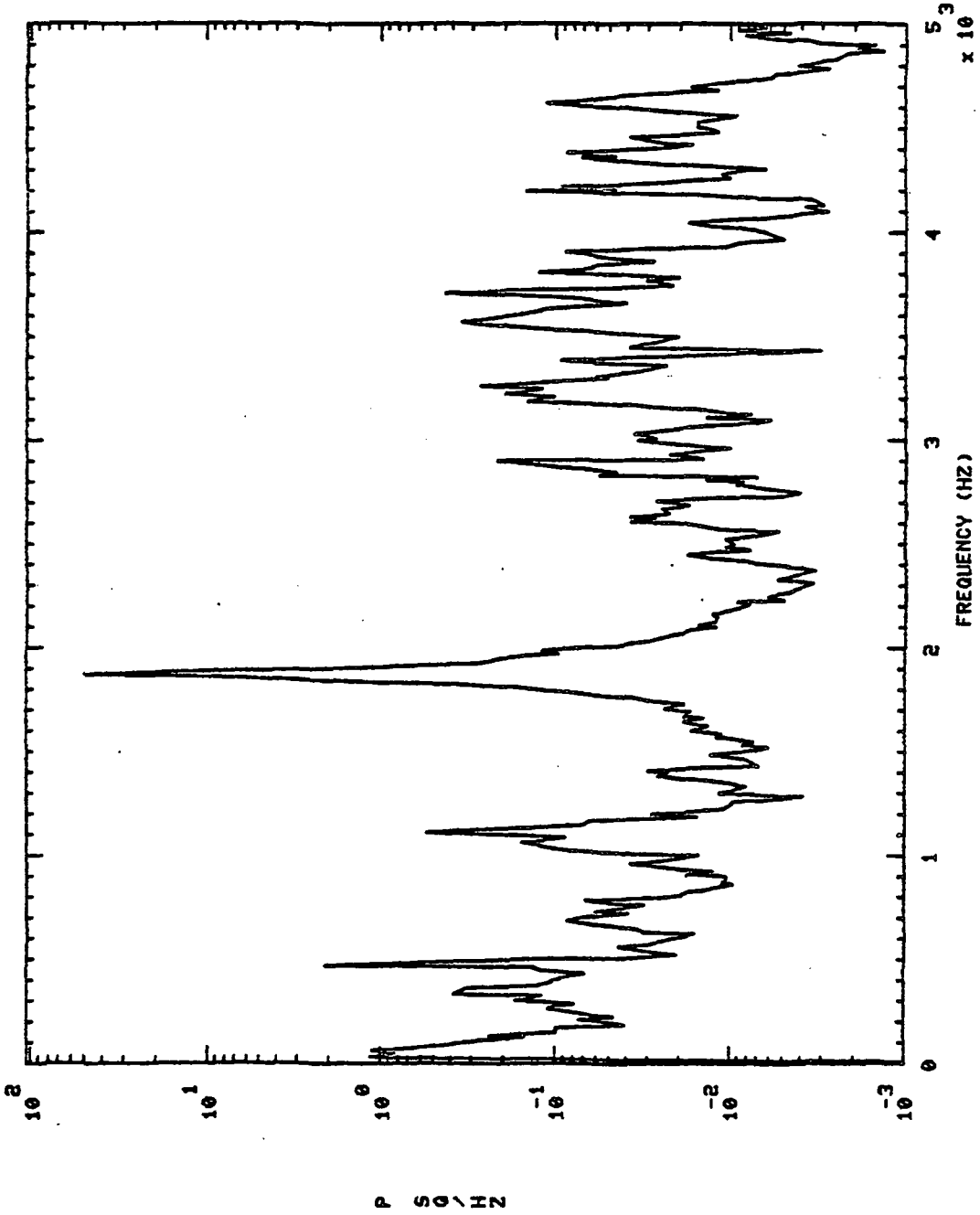
FREQUENCY (HZ) $\times 10^4$

750113 LPFP DS PR S+ 280.01H0,'S



750113 LPOT TURB DR PR S+ 30.01H0,'S

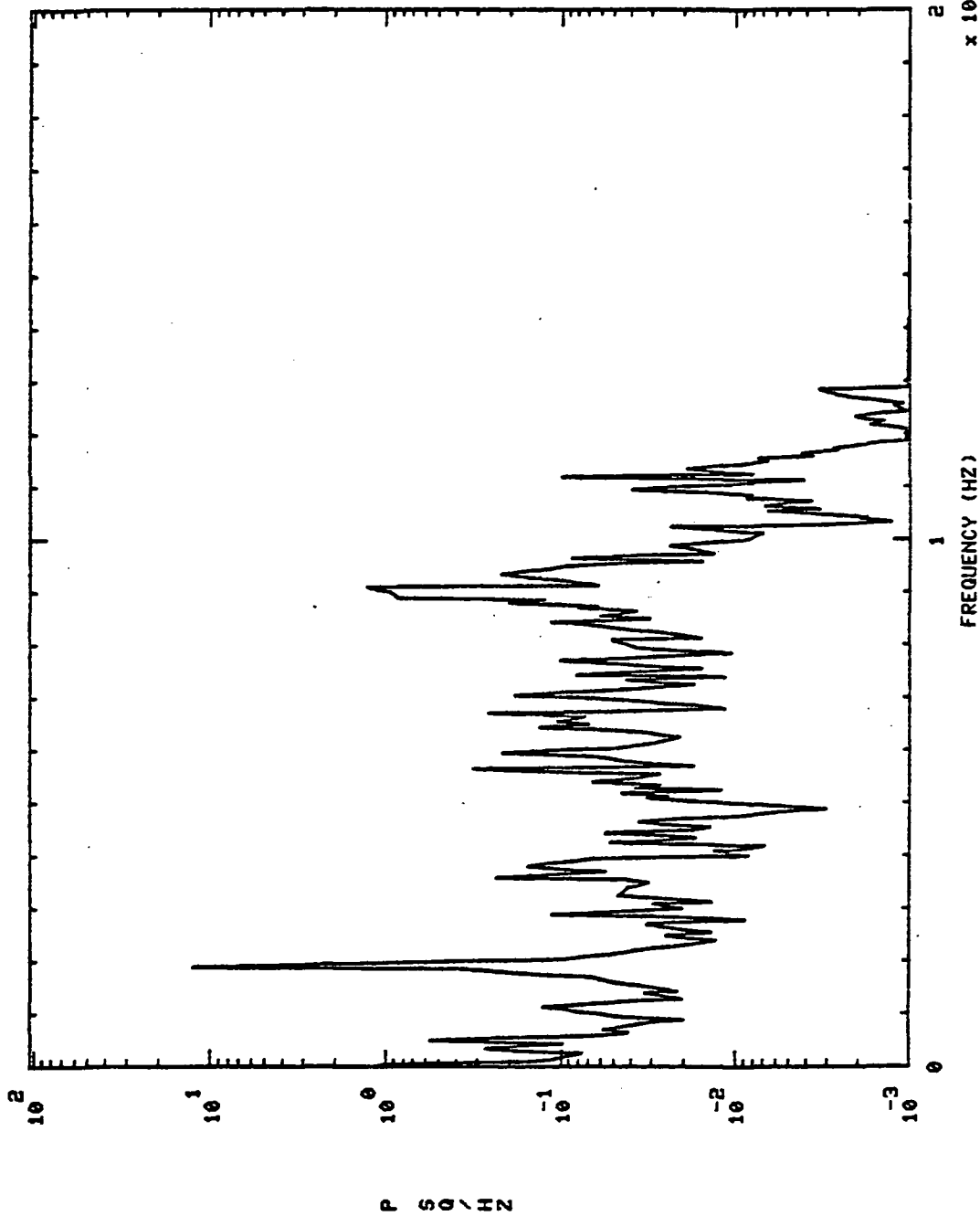
750113 LPOT TURB DR PR



750113 LPOT TURB DR PR S+ 30.01HG,'S

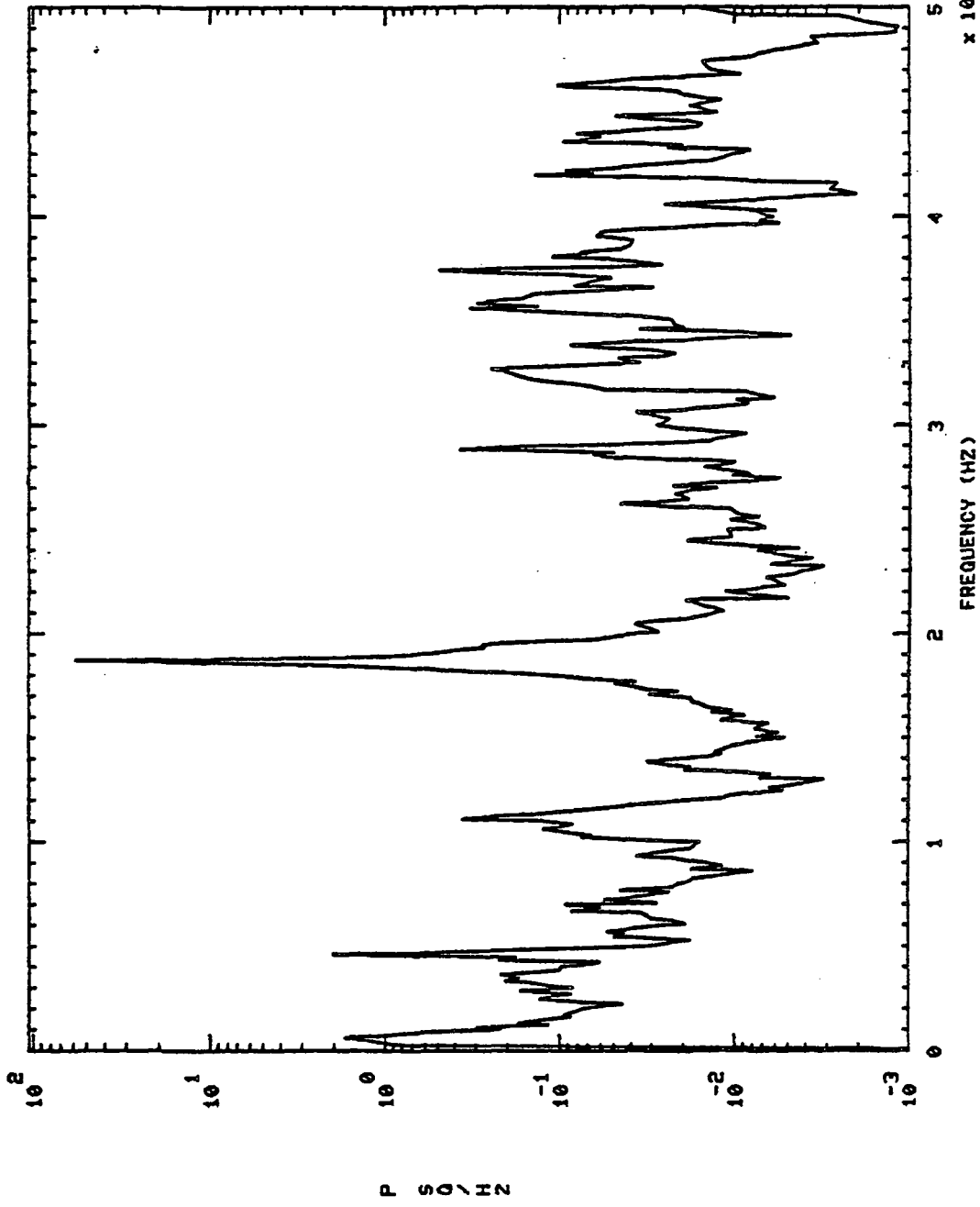
750113 LPOT TURB DR PR

750113



S+ 150.01H0,'S

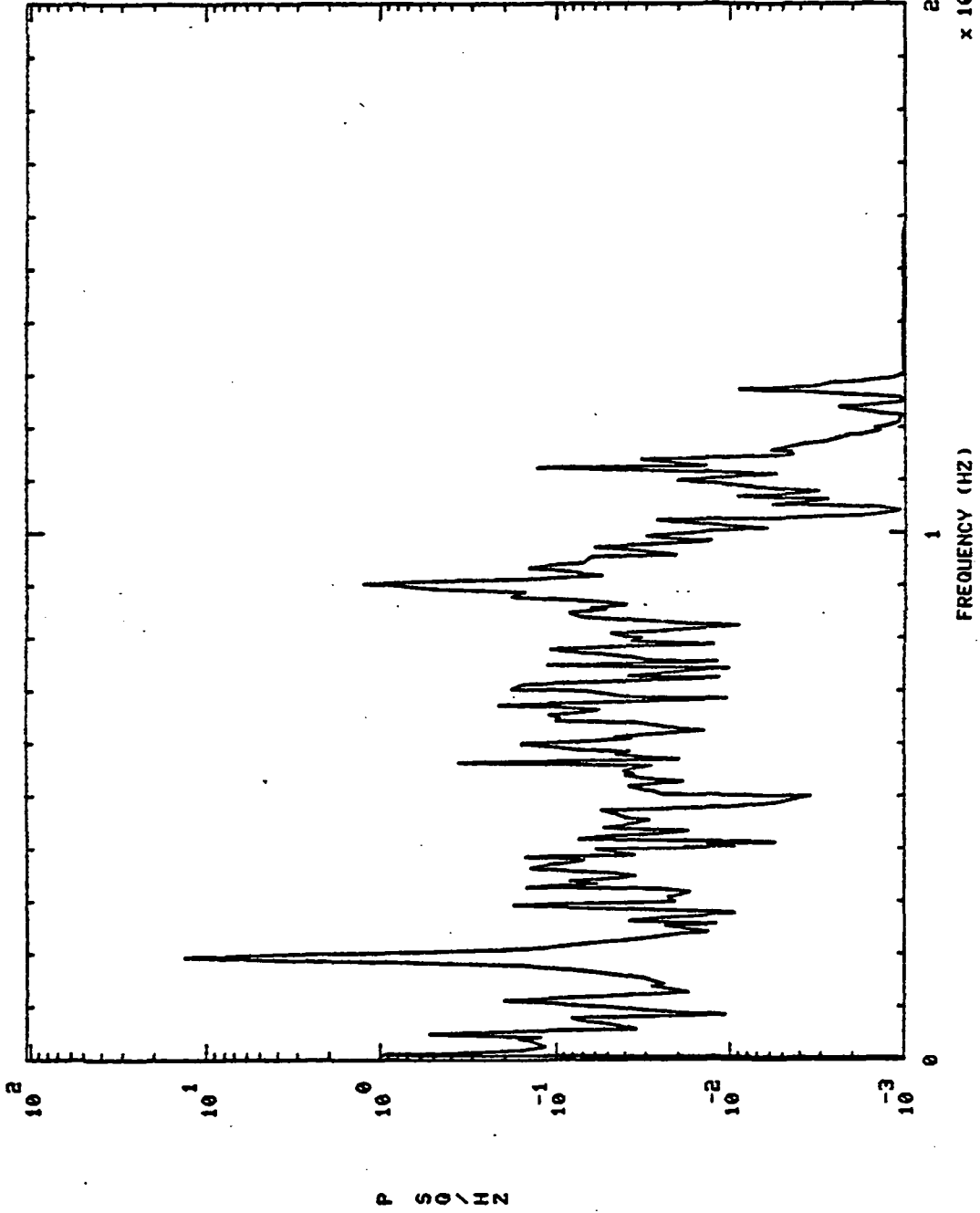
750113 LPOT TURB DR PR



S+ 150.01H0,'S

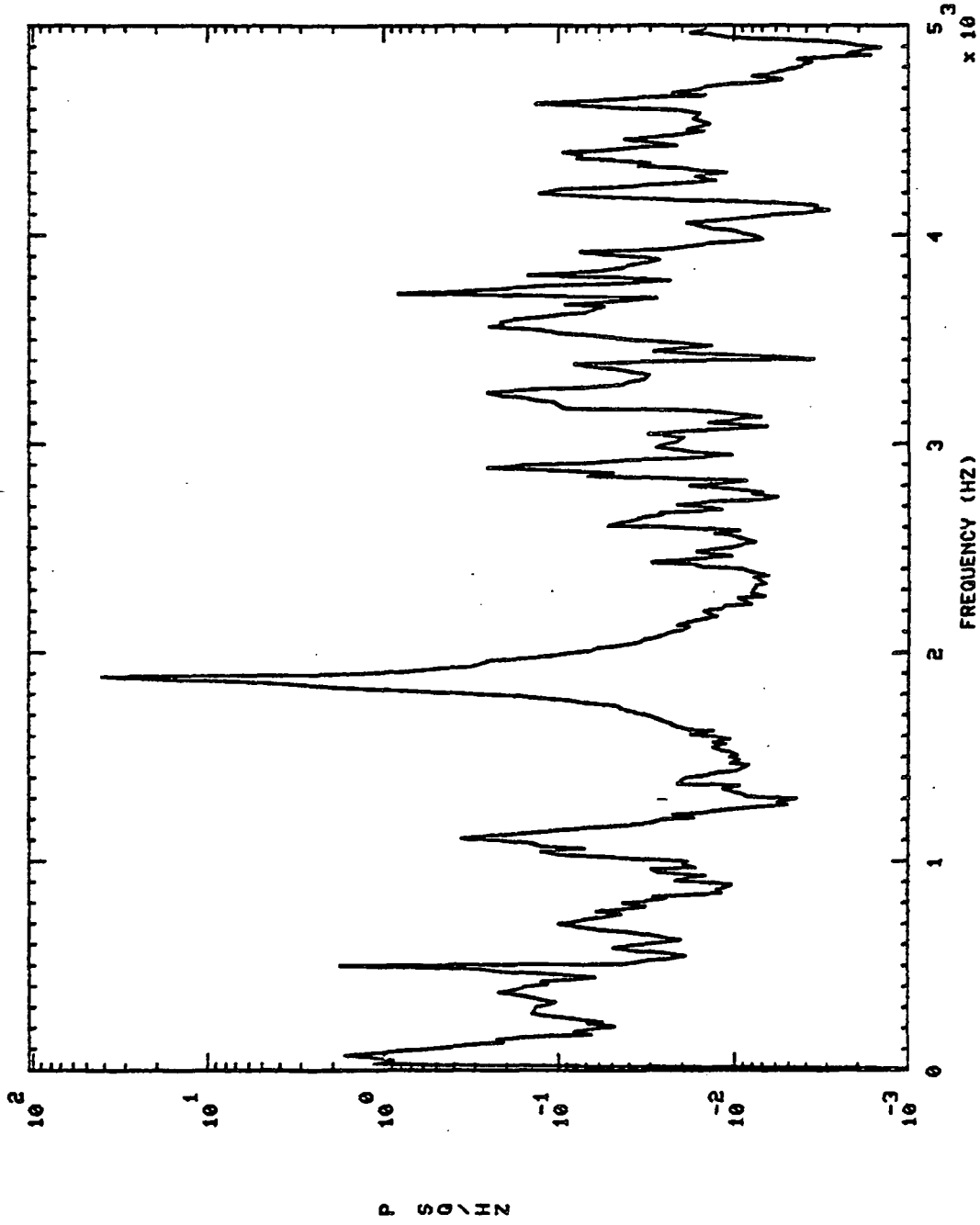
LPOT TURB DR PR

750113



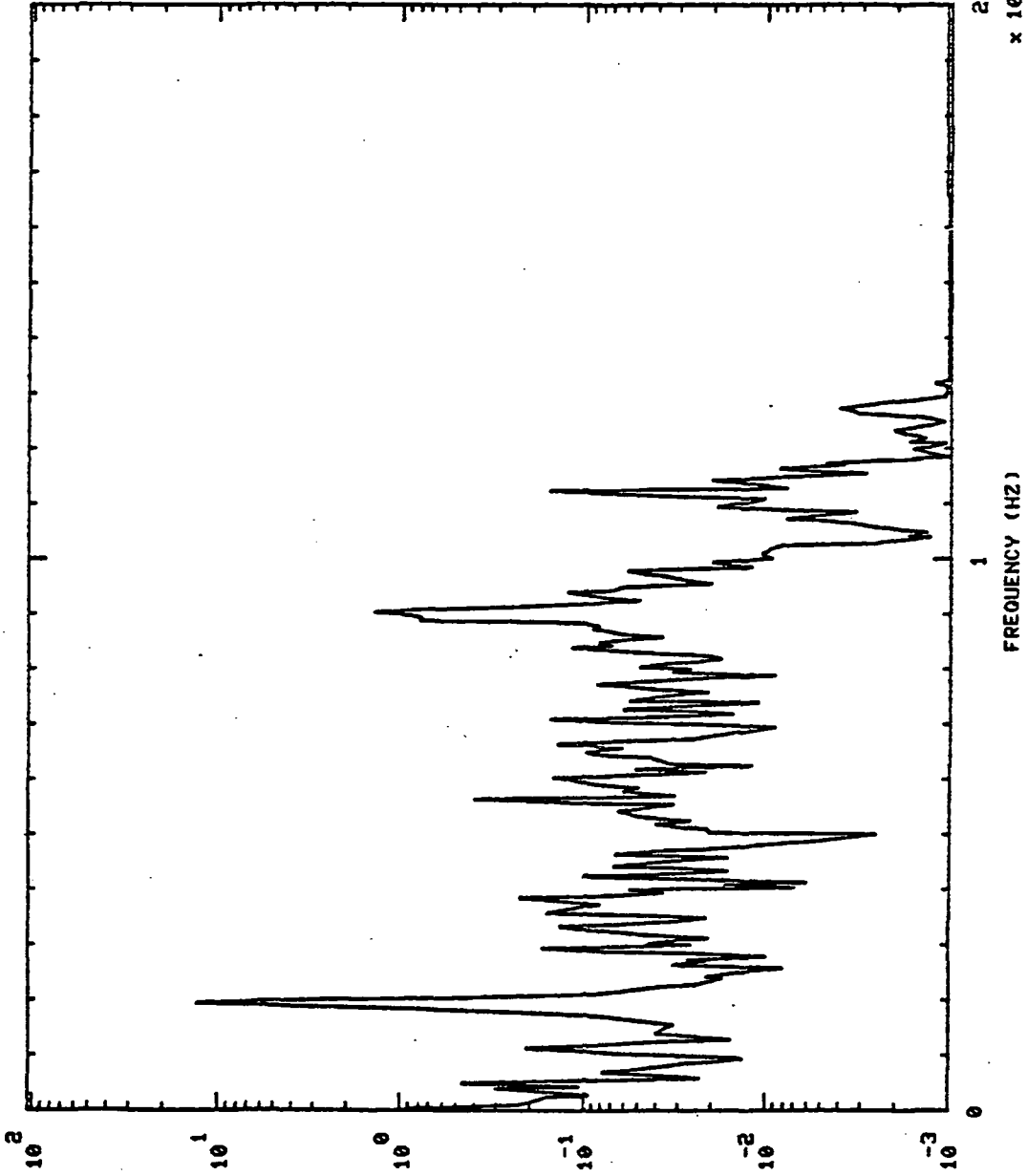
S+ 280.01H0, 'S

750113 LPOT TURB DR PR



S+ 280.01H0,'S

750113 LPOT TURB DR PR

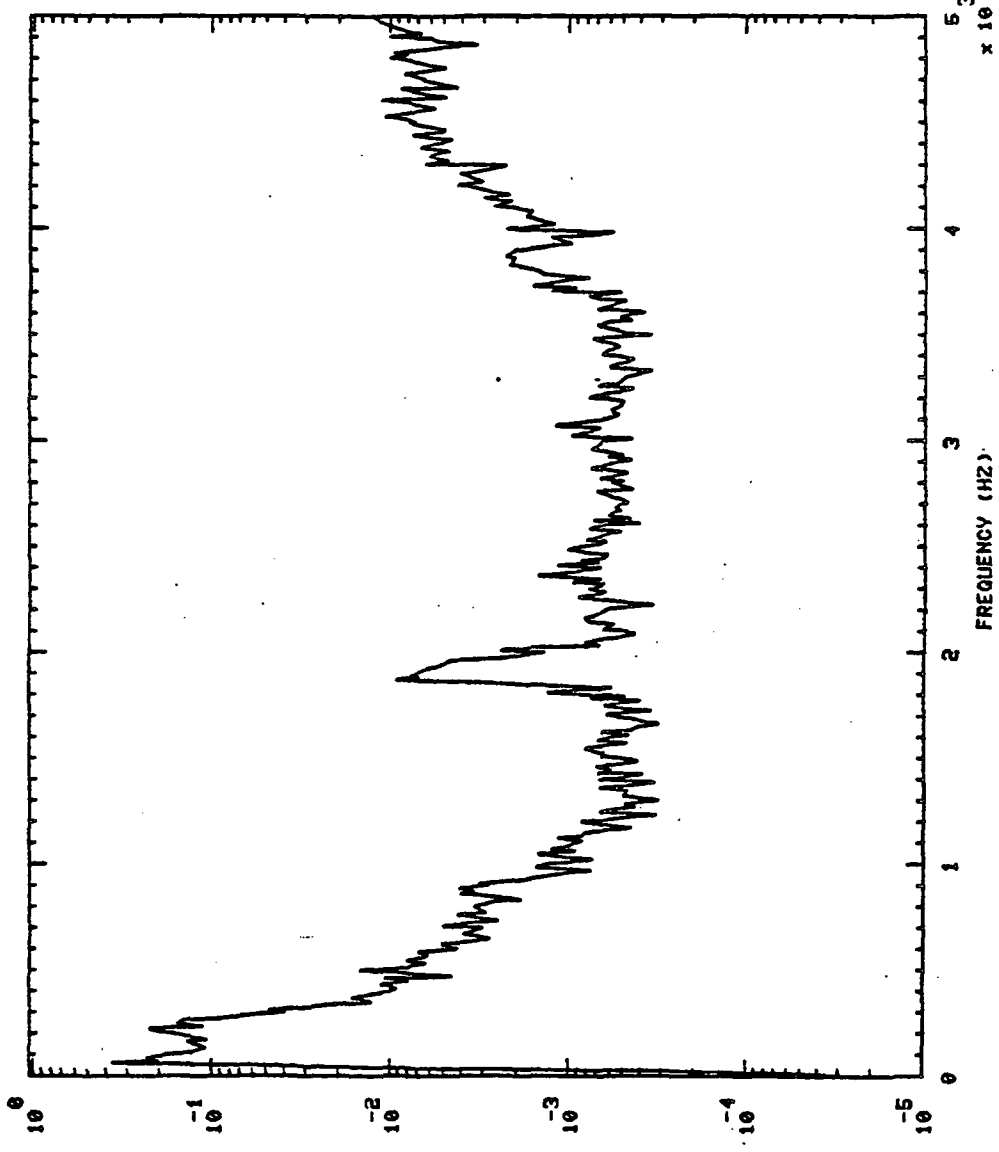


P S D / HZ

FREQUENCY (HZ)

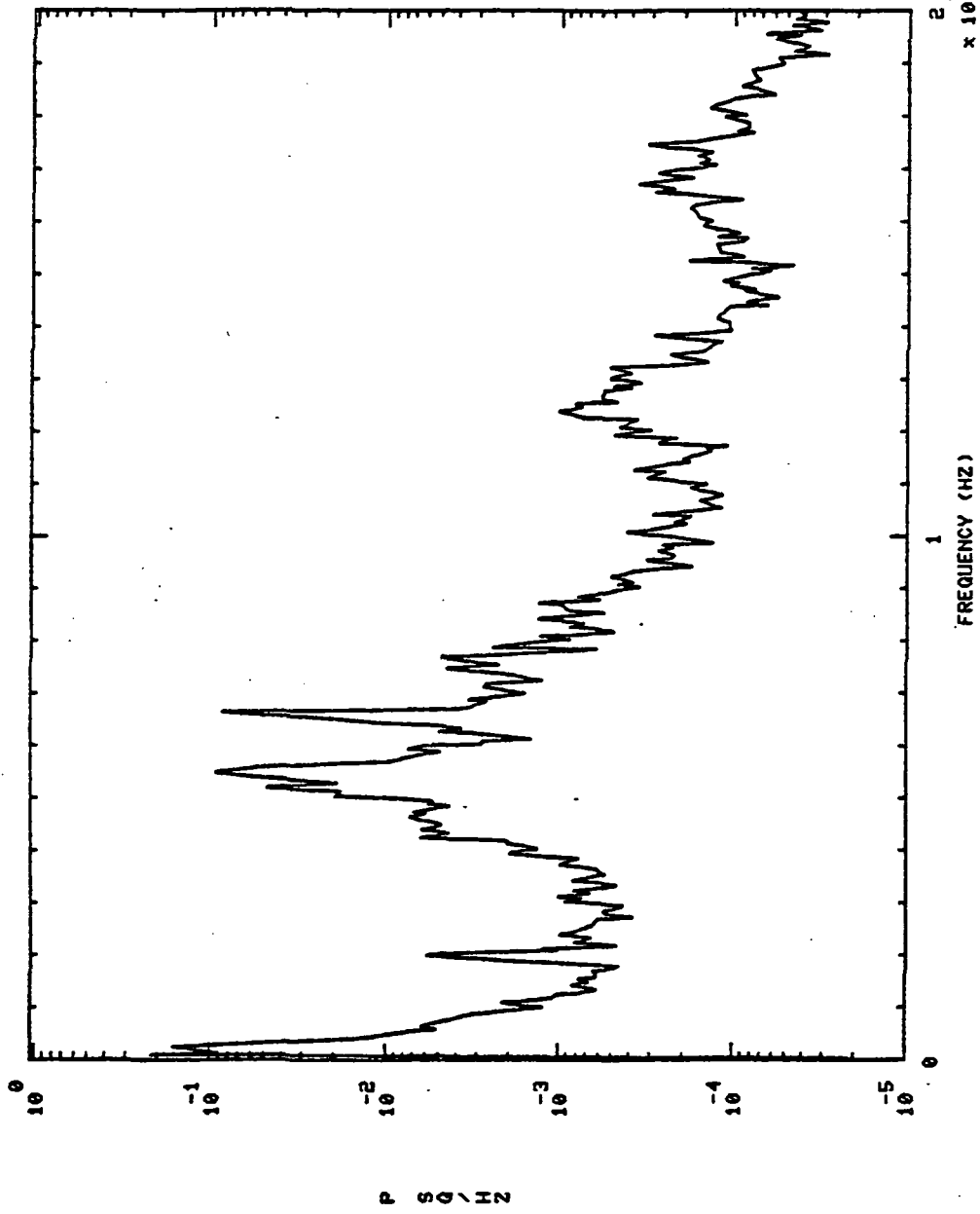
$\times 10^4$

750113 0FB PC PR S+ 30.01H0.'S

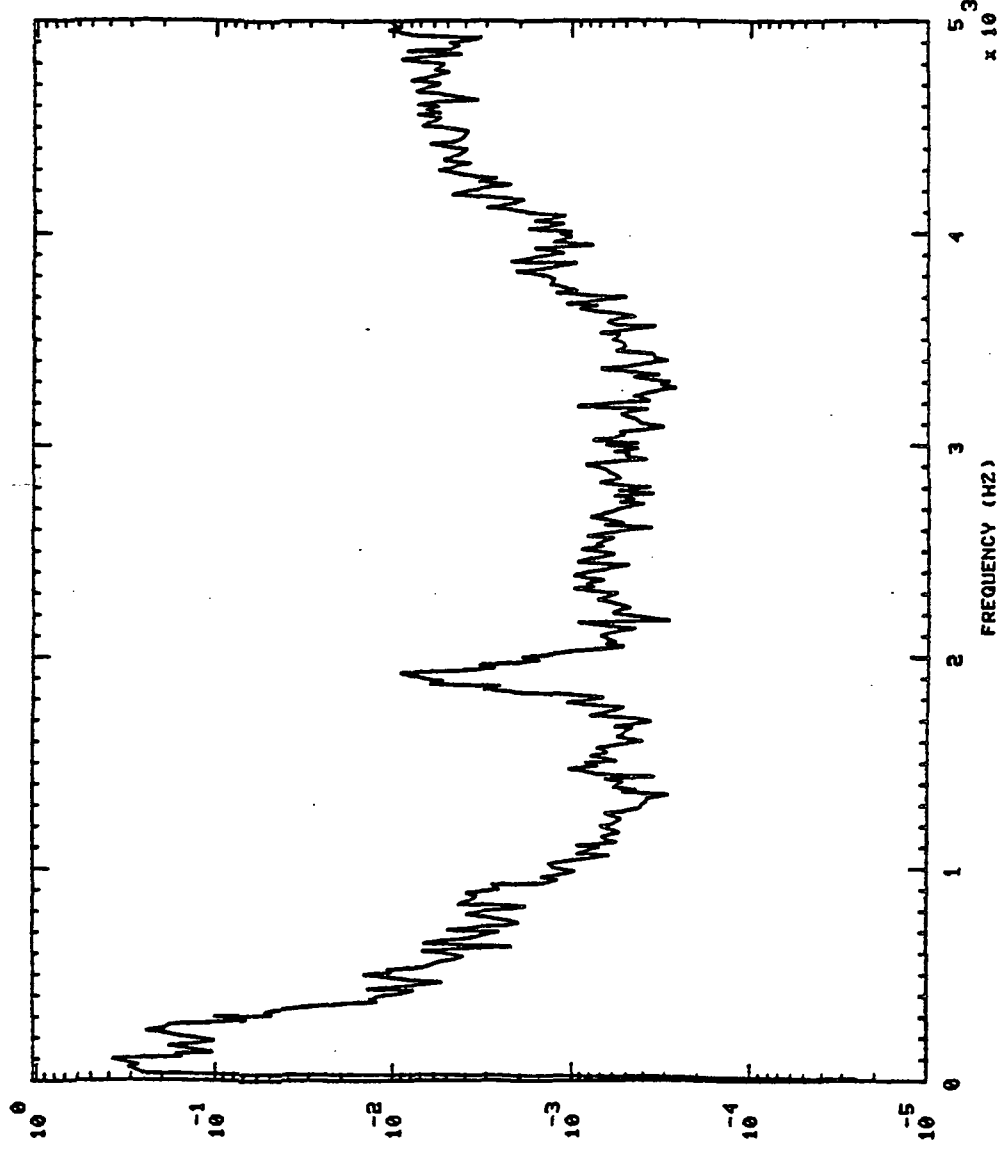


P S \ IN

750113 OPB PC PR S+ 30.0140.'S



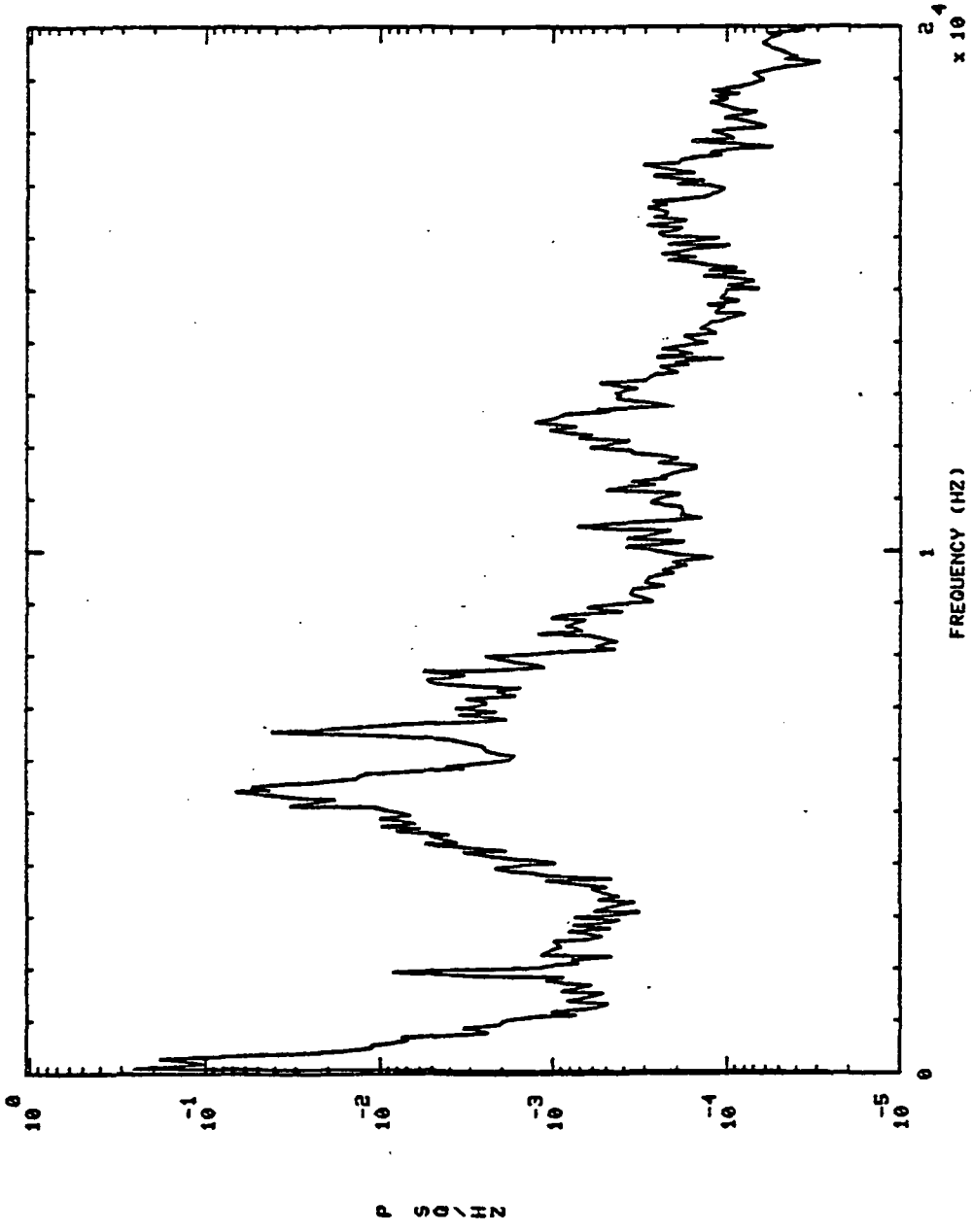
750113 OPB PC PR S+ 150.01H0,'S



P S O \ H Z

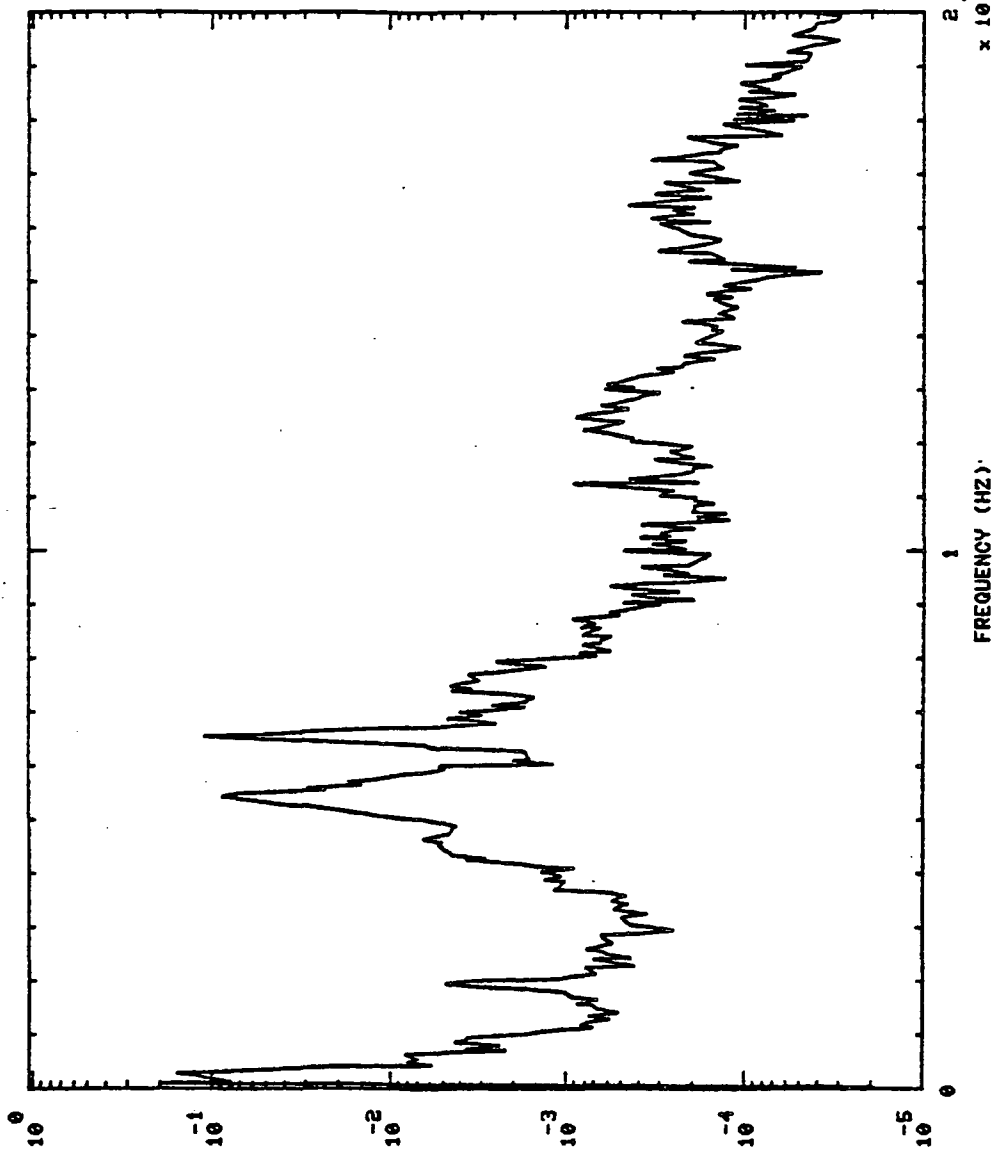
S+ 150.01H0,'S

750113 OPB PC PR



S+ 280.01H0,'S

750113 OPB PC PR



$\times 10^4$

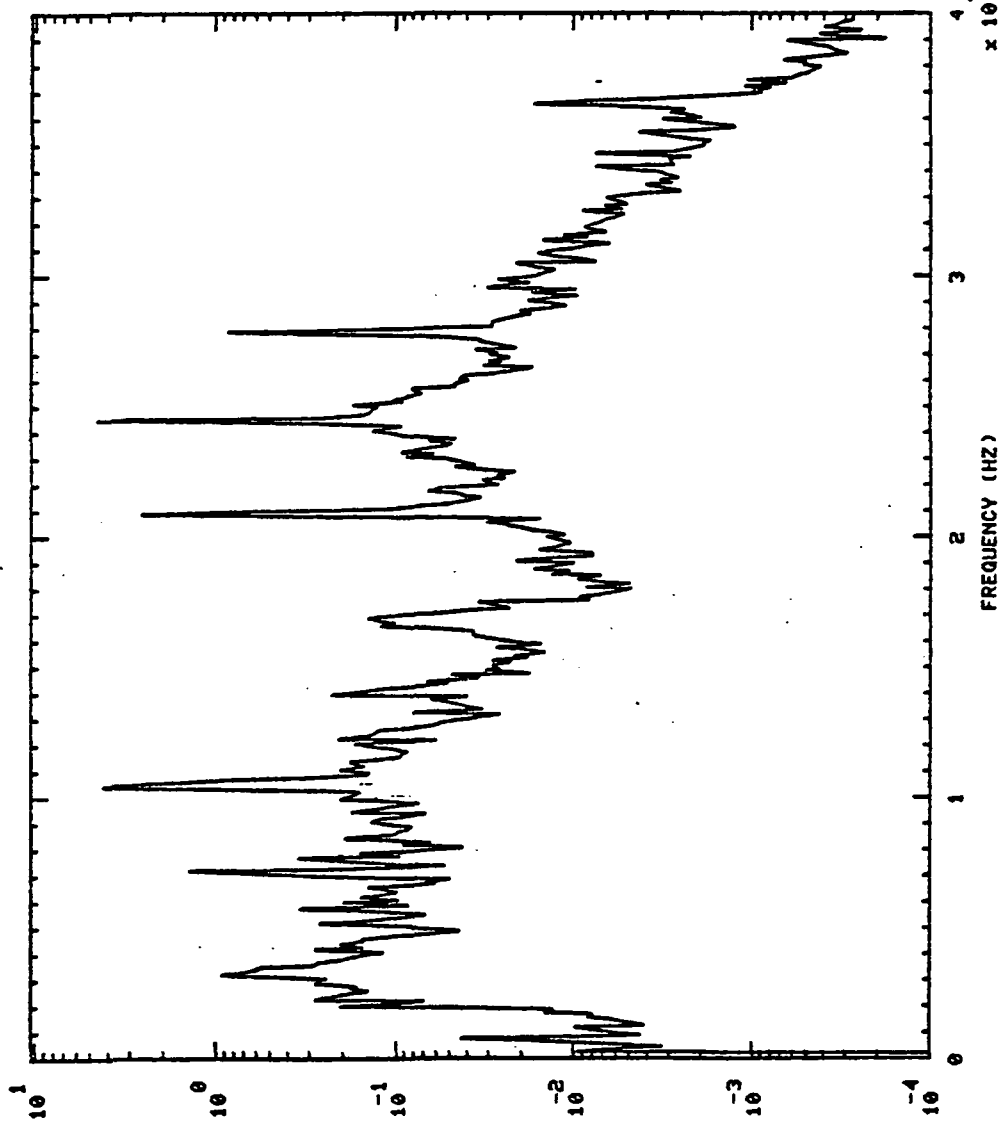
FREQUENCY (HZ)

P SO/HZ

S+ 280.01H0, '5

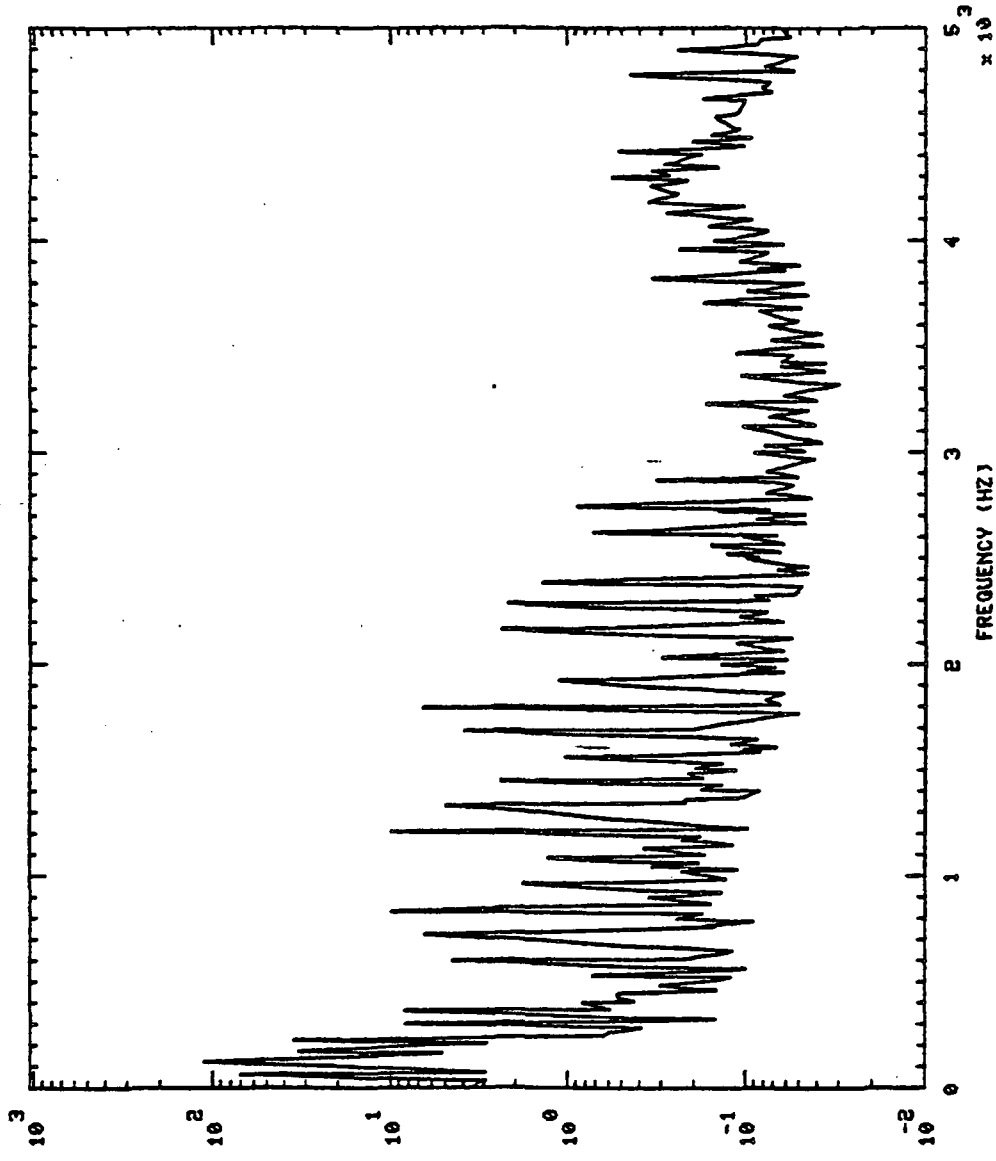
MCC LONG ACCEL 1

750113



P S D \ HZ

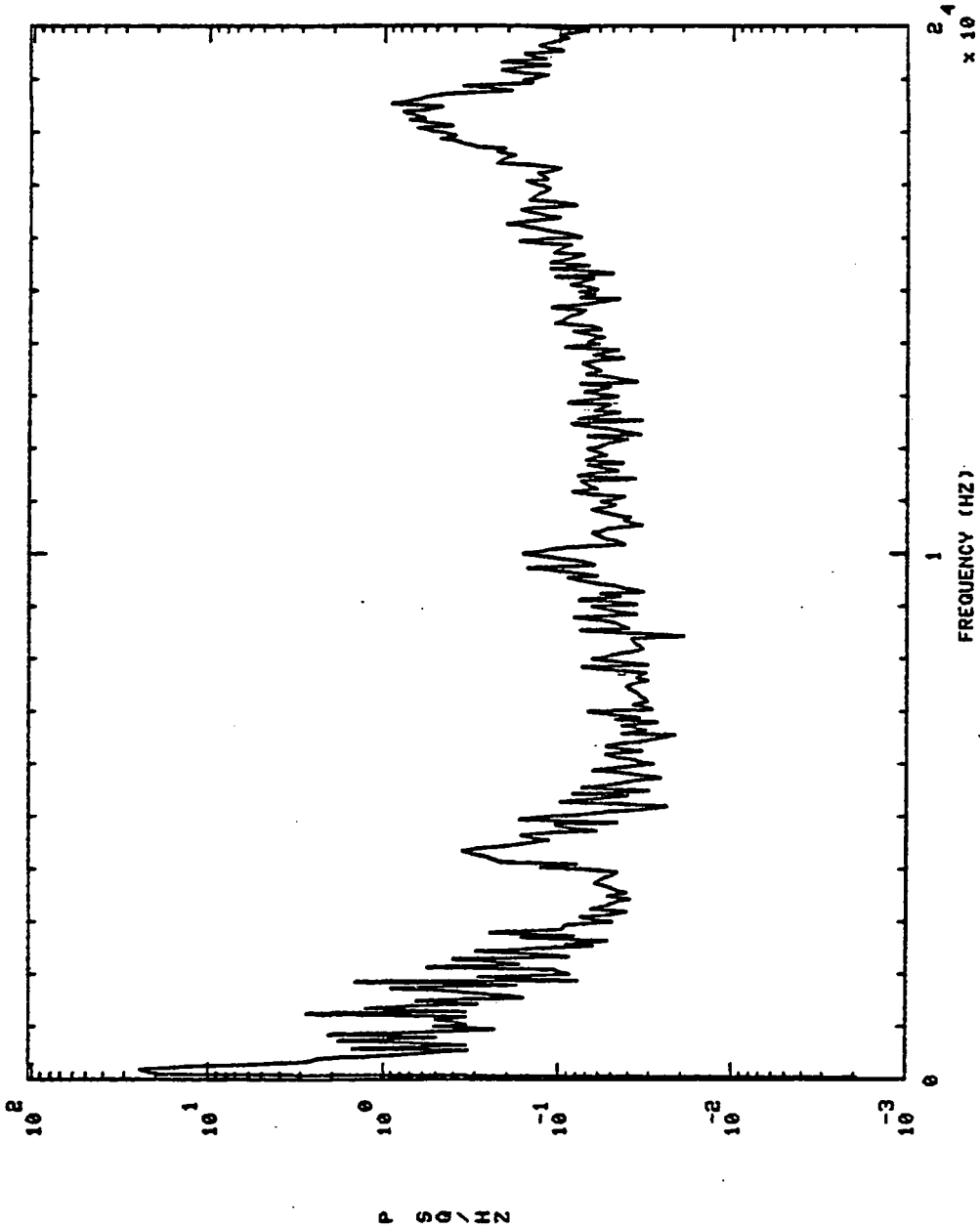
750113 OPB PC PR DC S+ 30.01H0,'S



P S D \ H Z

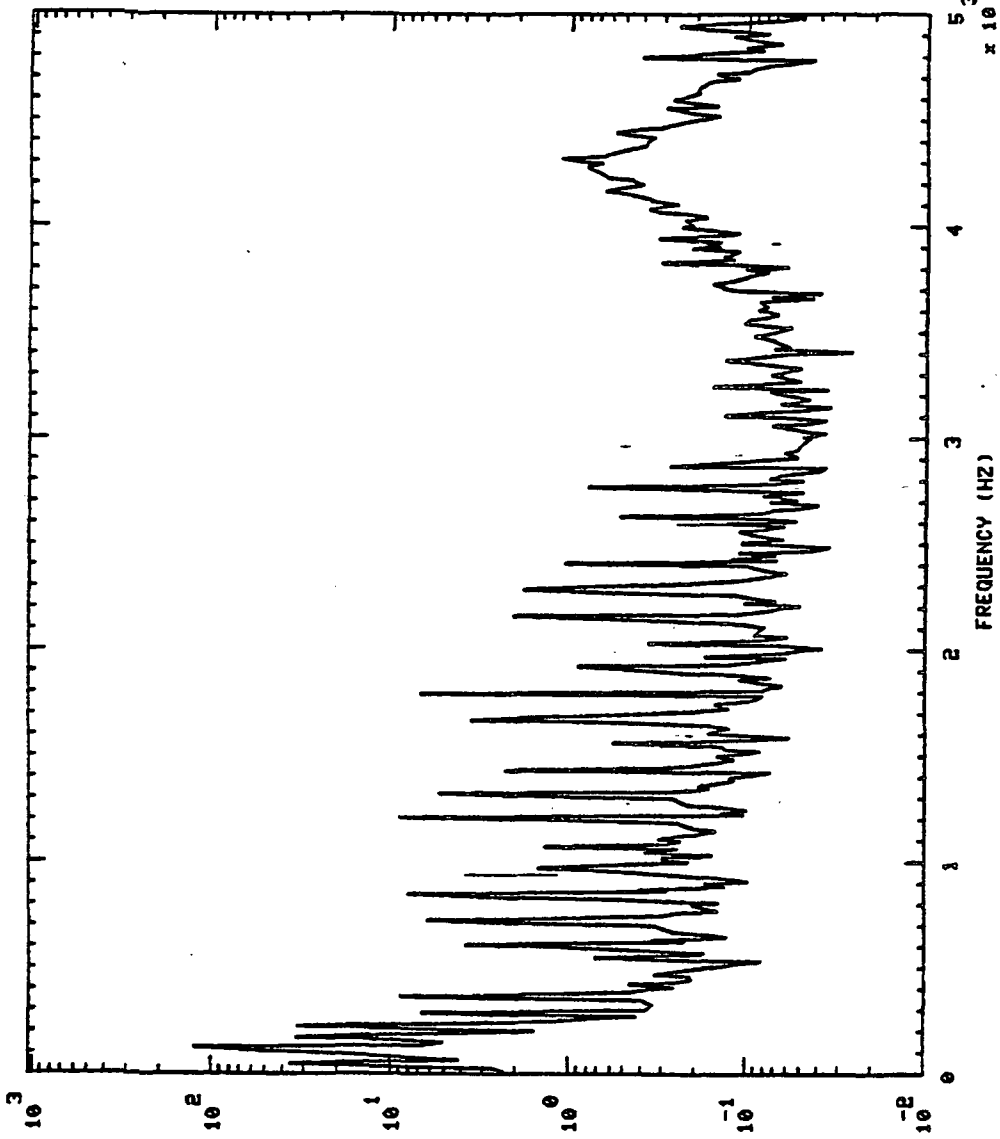
S+ 30.01H0.'S

750113 OPB PC PR DC



S+ 150.01H0.'S

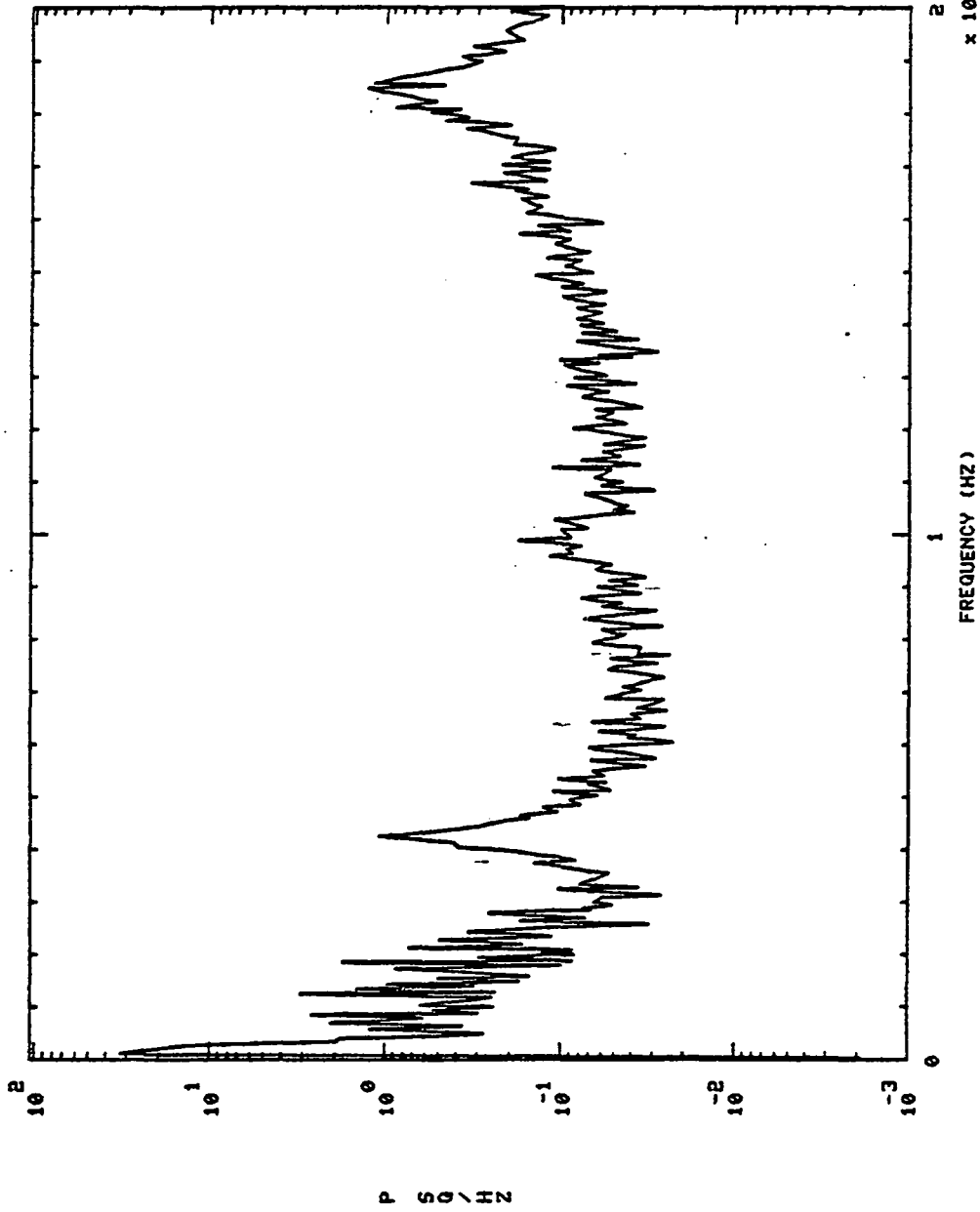
750113 OPB PC PR DC



S+ 150.01H0.'S

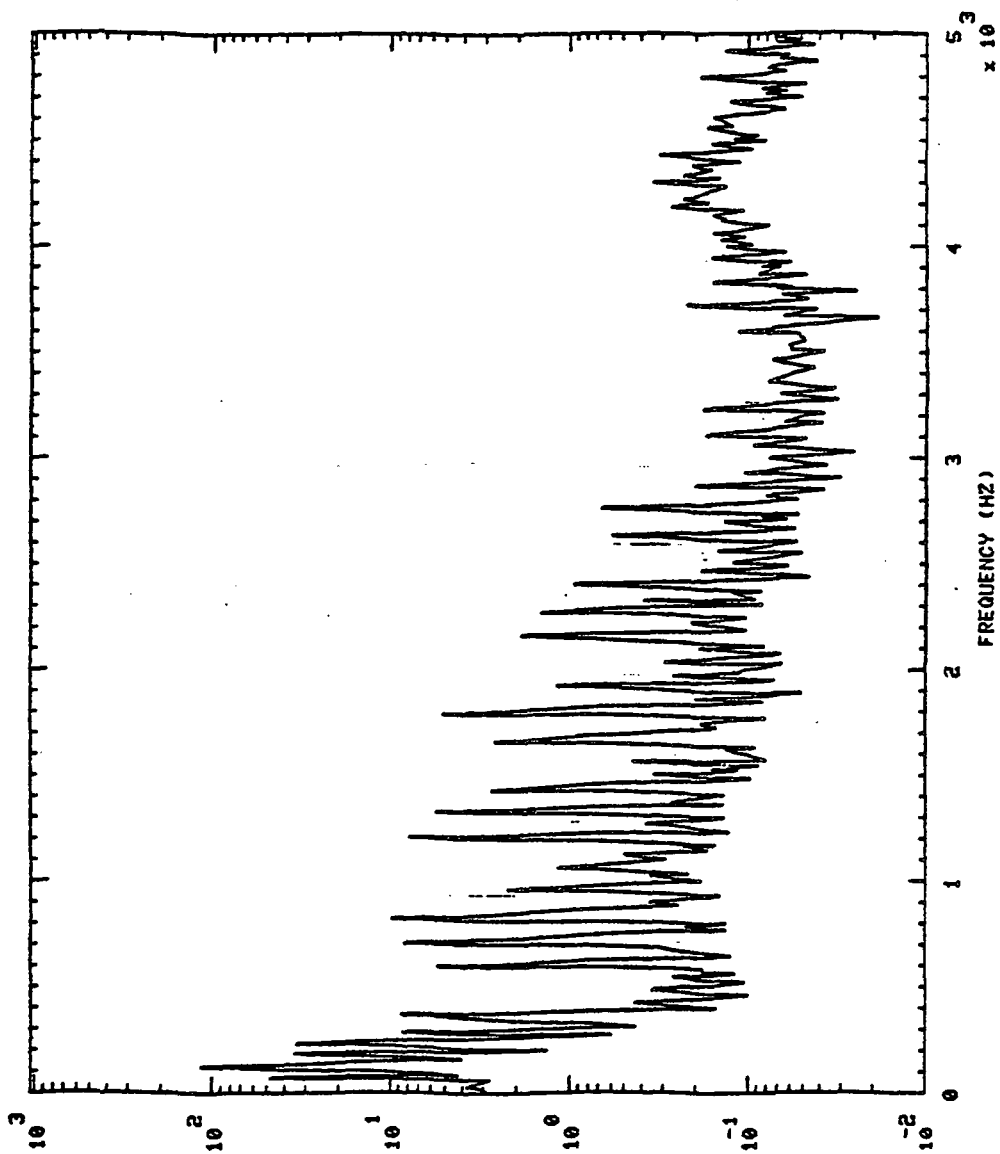
OPB PC PR DC

750113



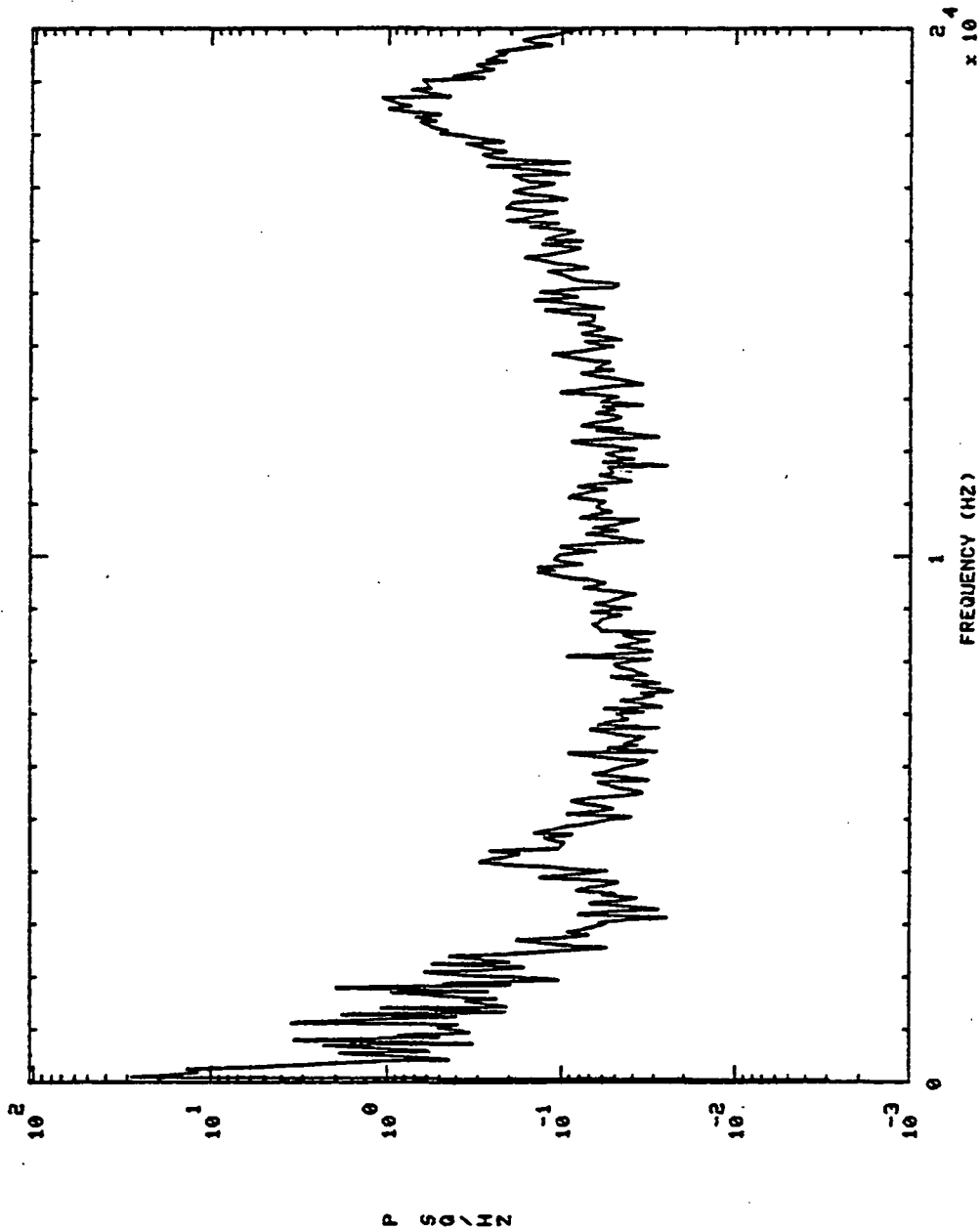
S+ 280.0

750113 OPB PC PR DC

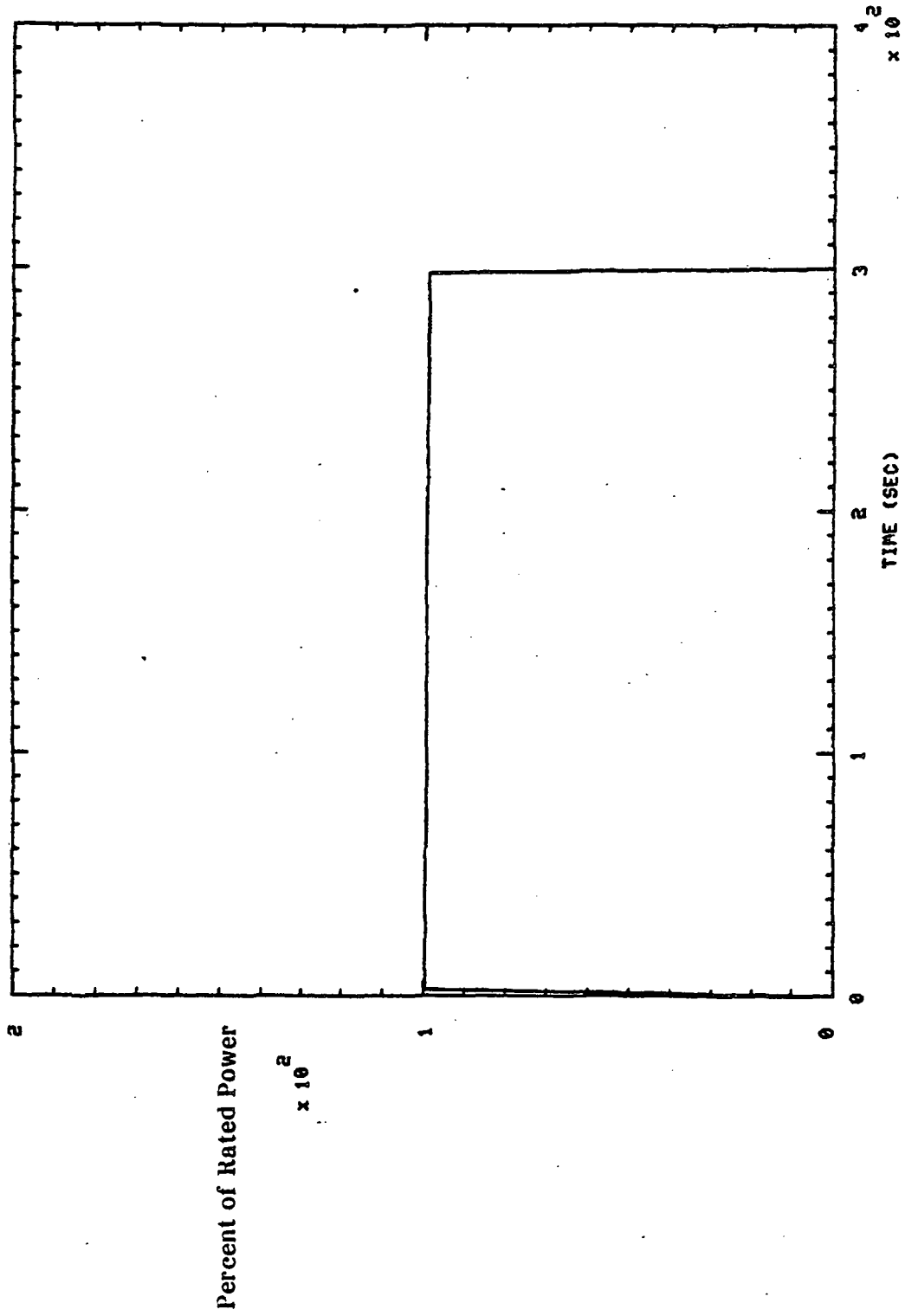


P S D / H Z

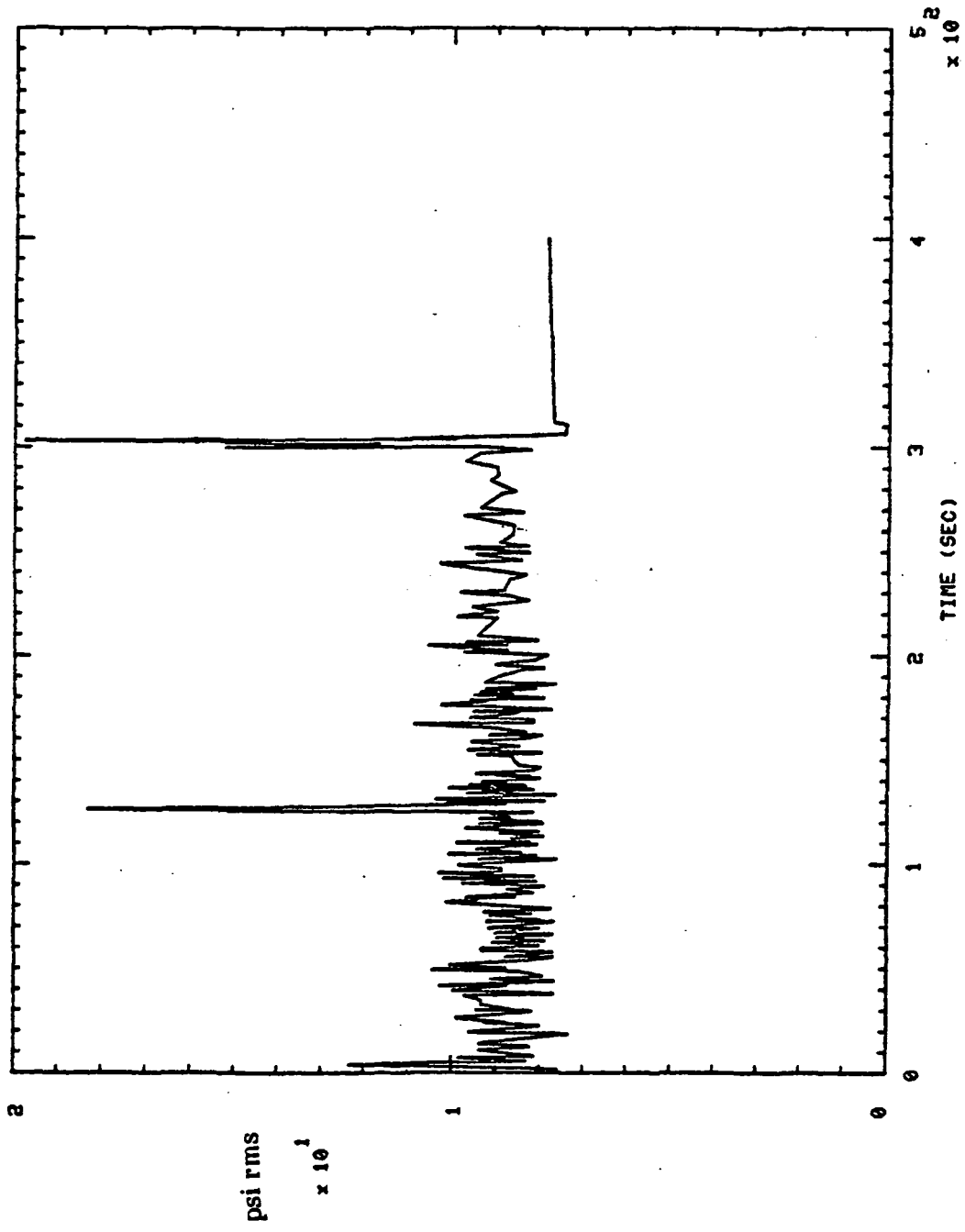
750113 OPB PC PR DC S+ 280.01H0,'S



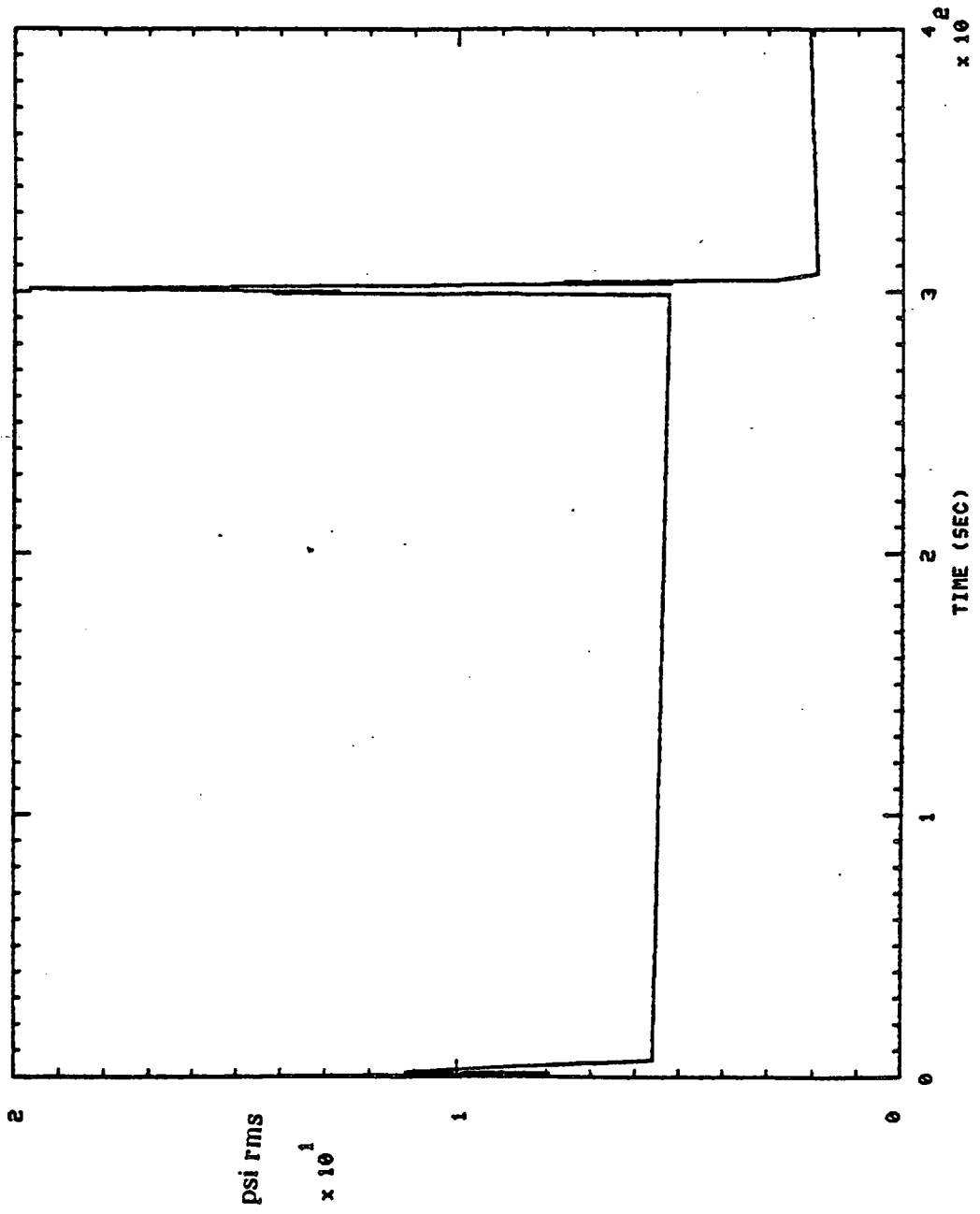
750114 THRUST (UNFILTERED)



750114 LPOP DS PR (1 - 20K HZ)



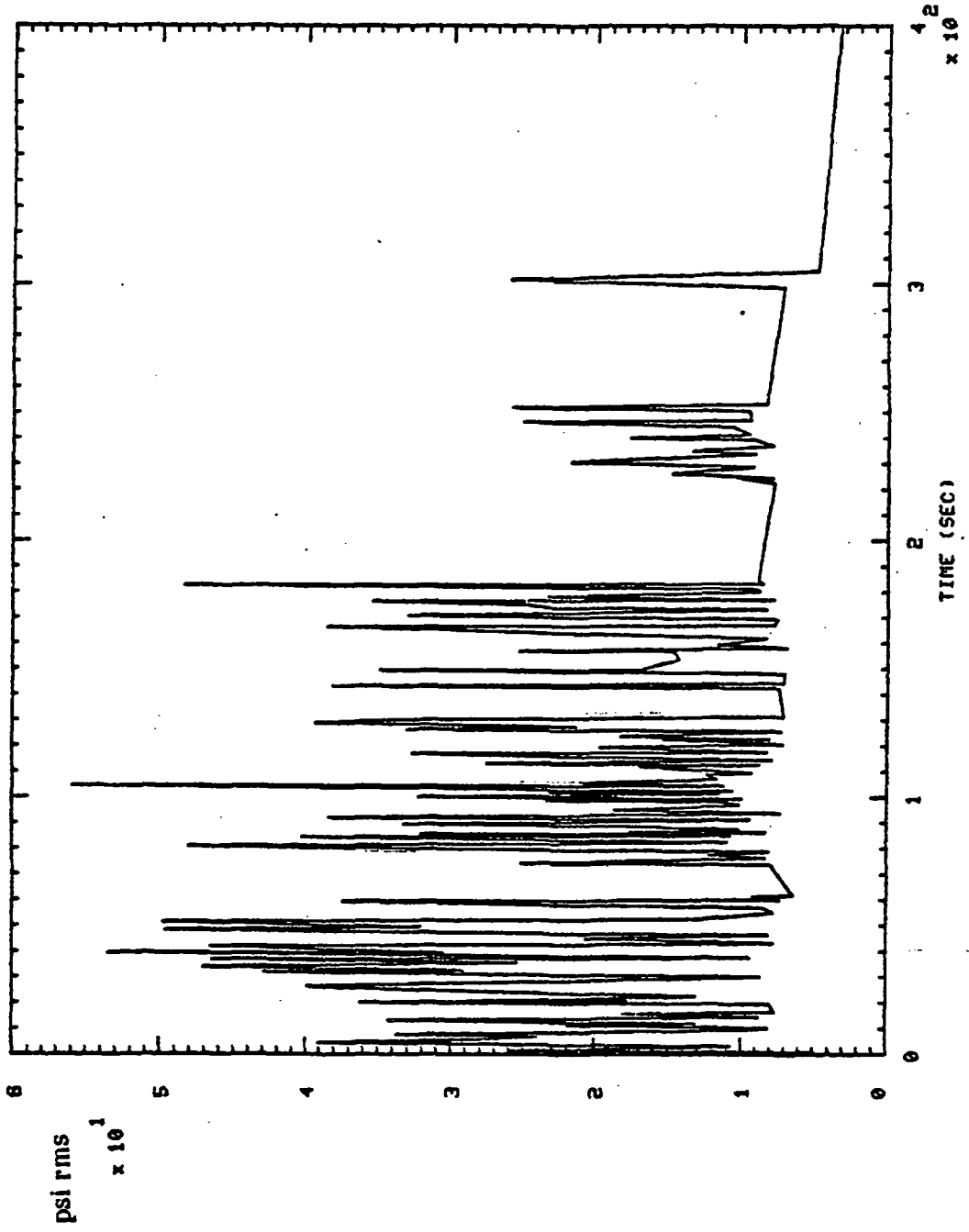
750114 HPOP BAL CAU PR2 (1 - 20K HZ)



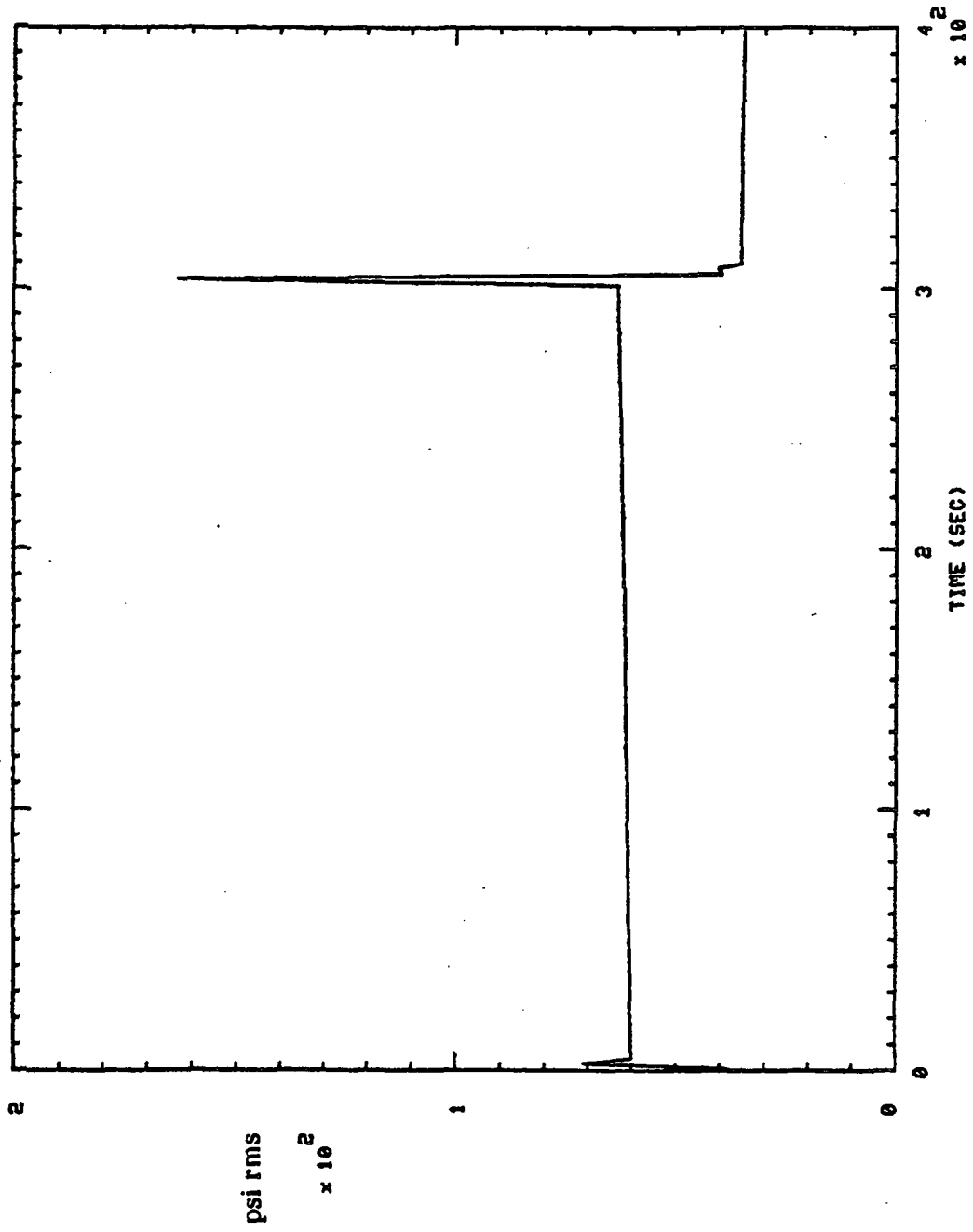
C.2

(1 - 20K HZ)

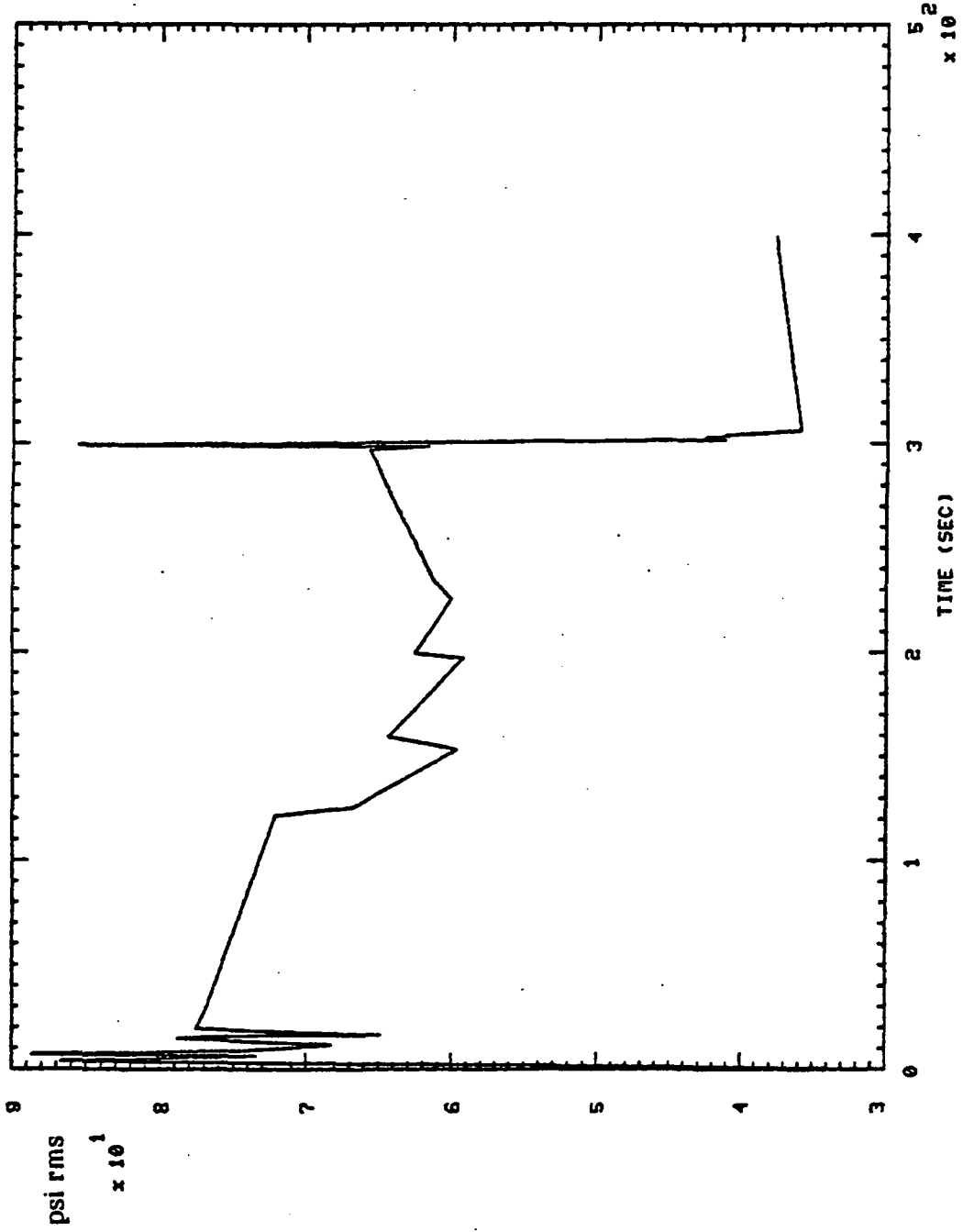
750114 HPOP BAL CAU PR1



750114 HPOP DS PR (1 - 20K HZ)

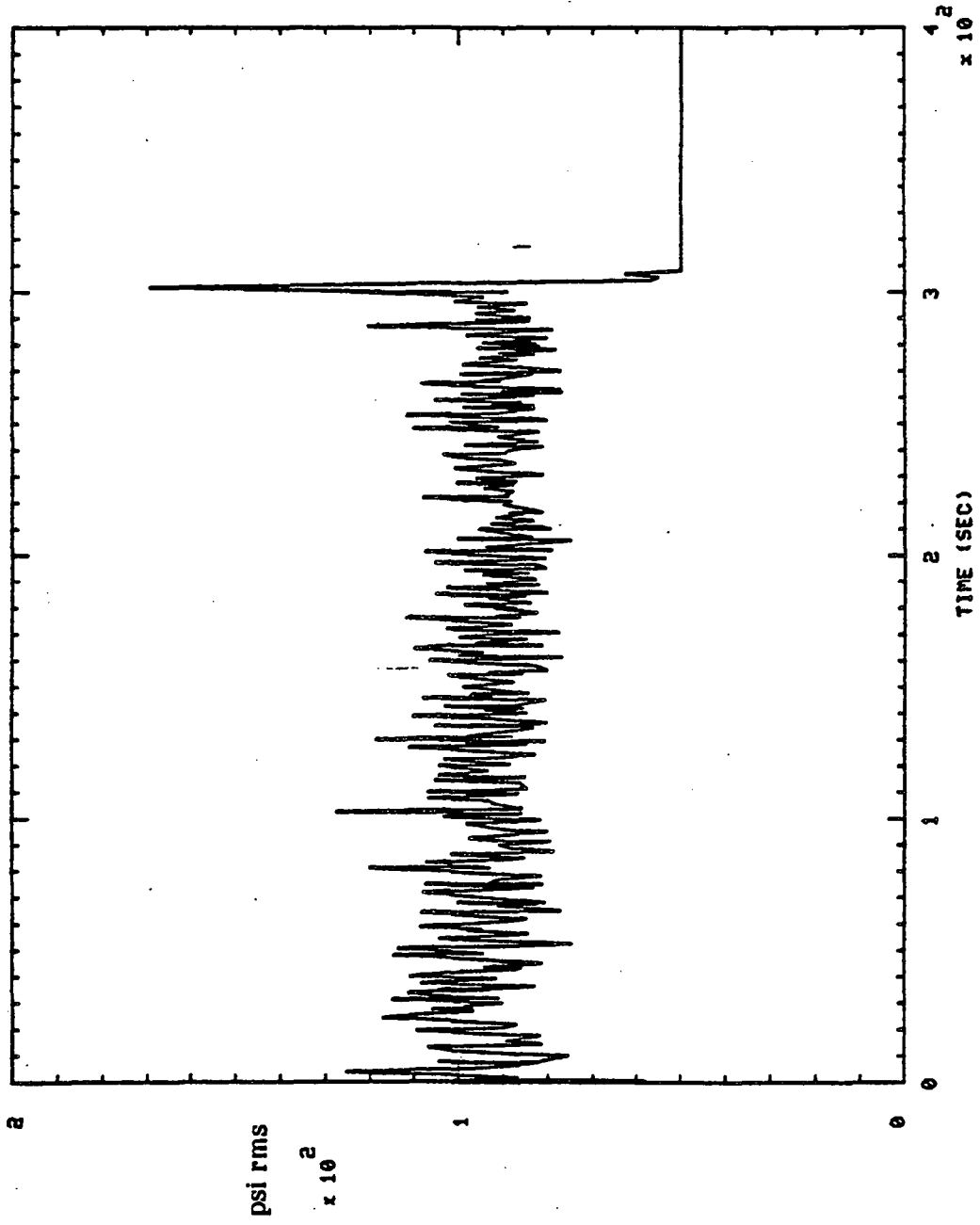


750114 NCC HOT GAS IN PR (1 - 20K HZ)



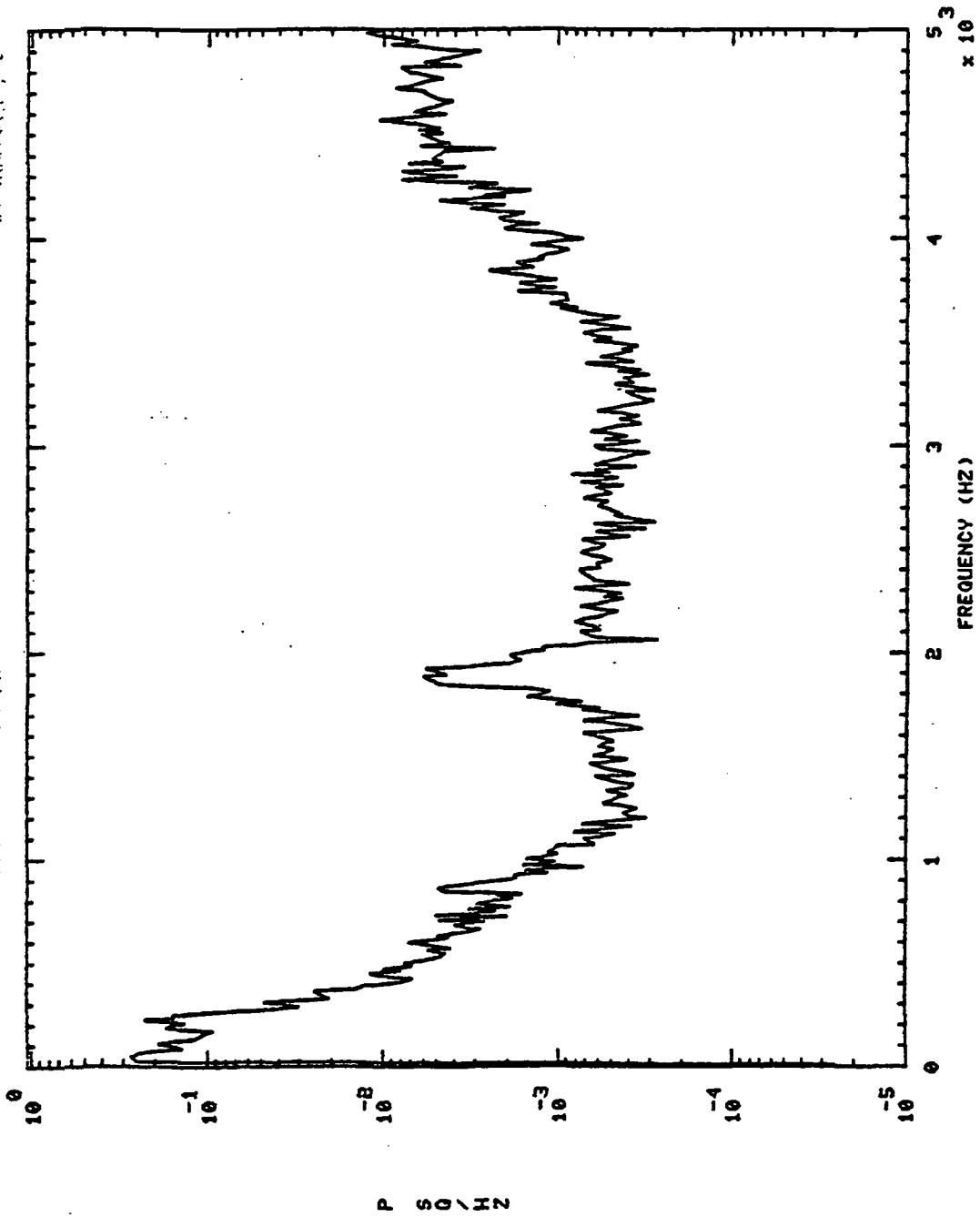
(1 - 20K HZ)

750114 PBP DS PR



ST 280.010.15

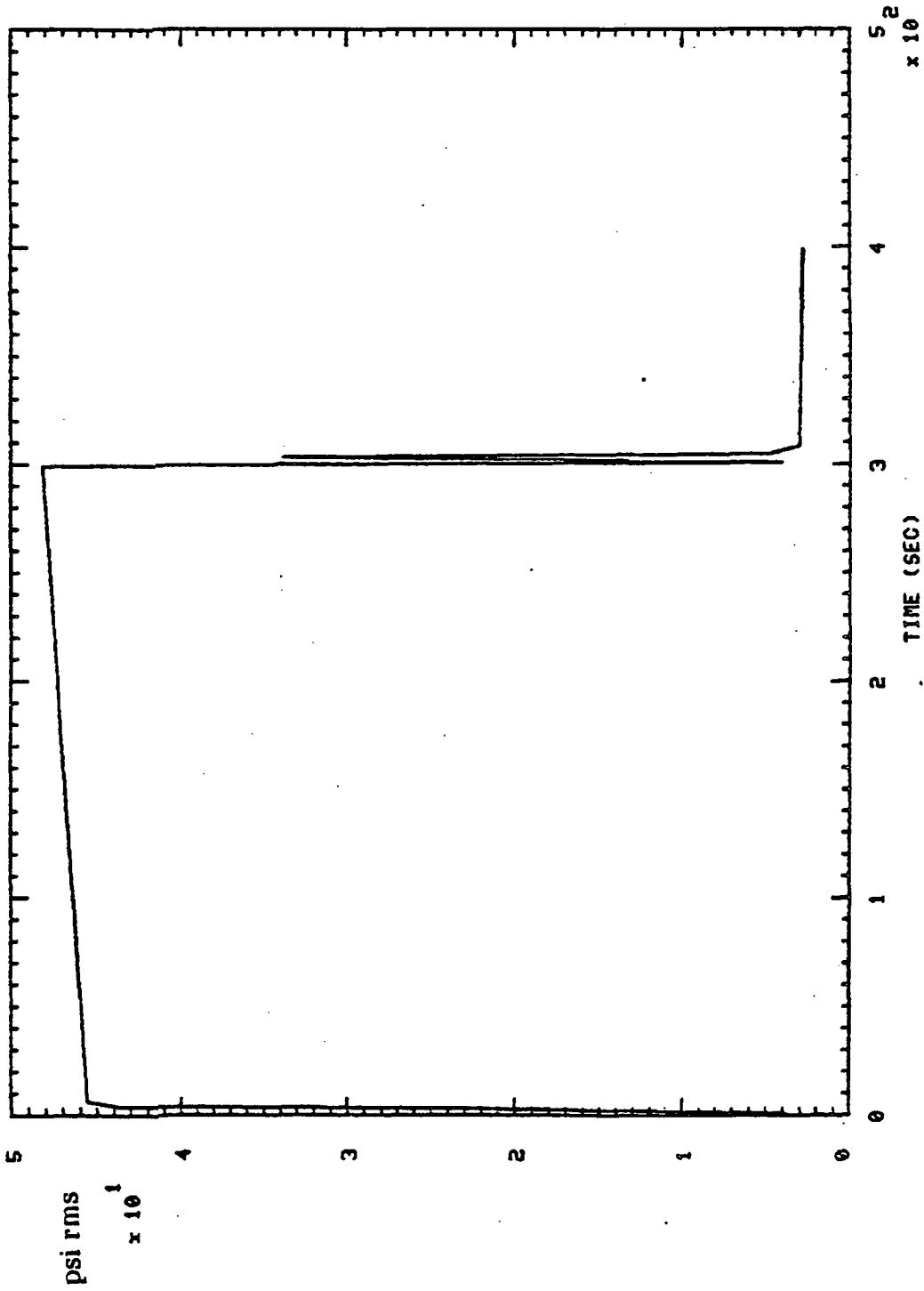
750113 OPB PC PR



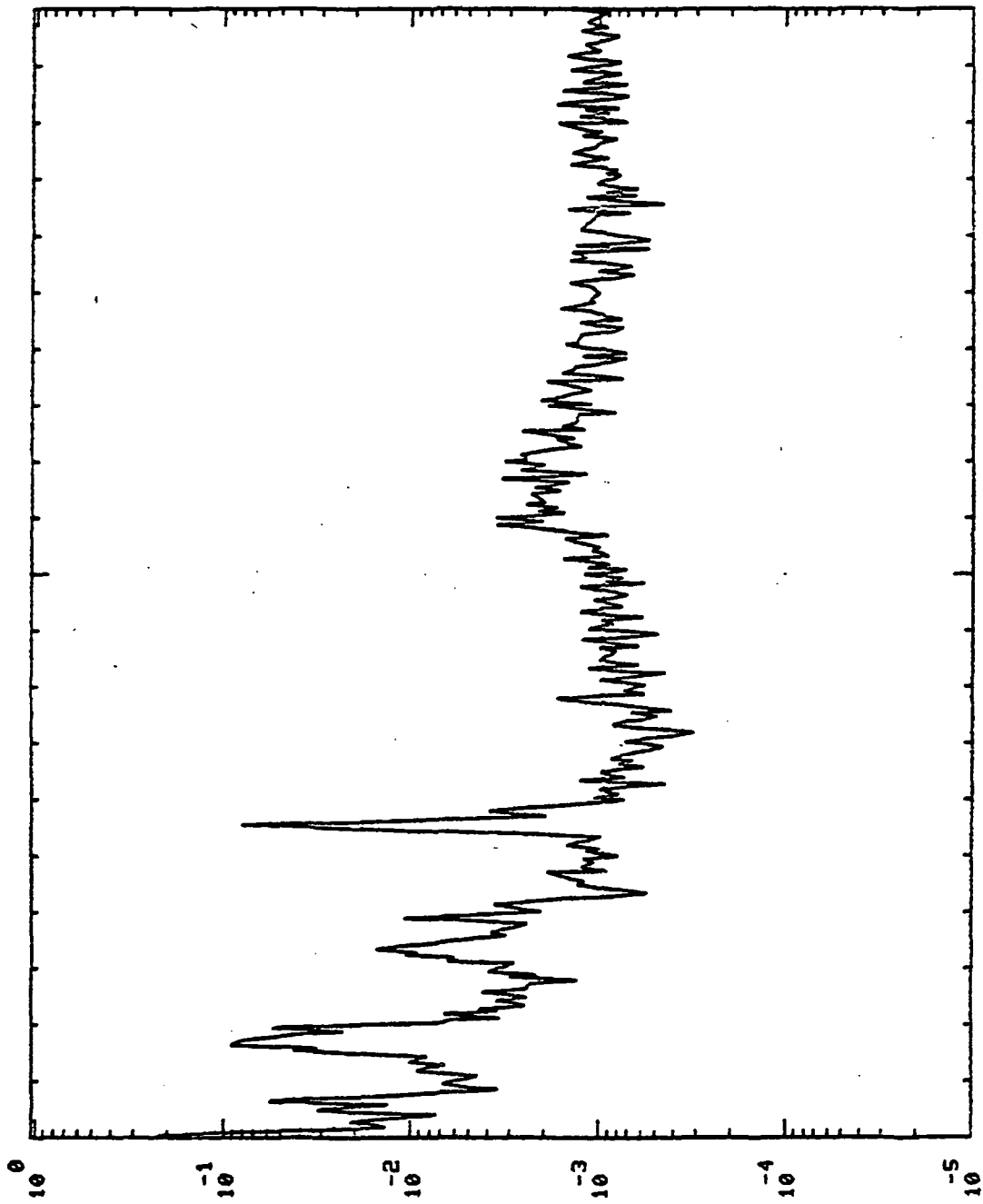
750114

LPOT TURB DR PR

(1 - 20K HZ)



750114 LPOP DS PR S+ 30.01H0, 'S



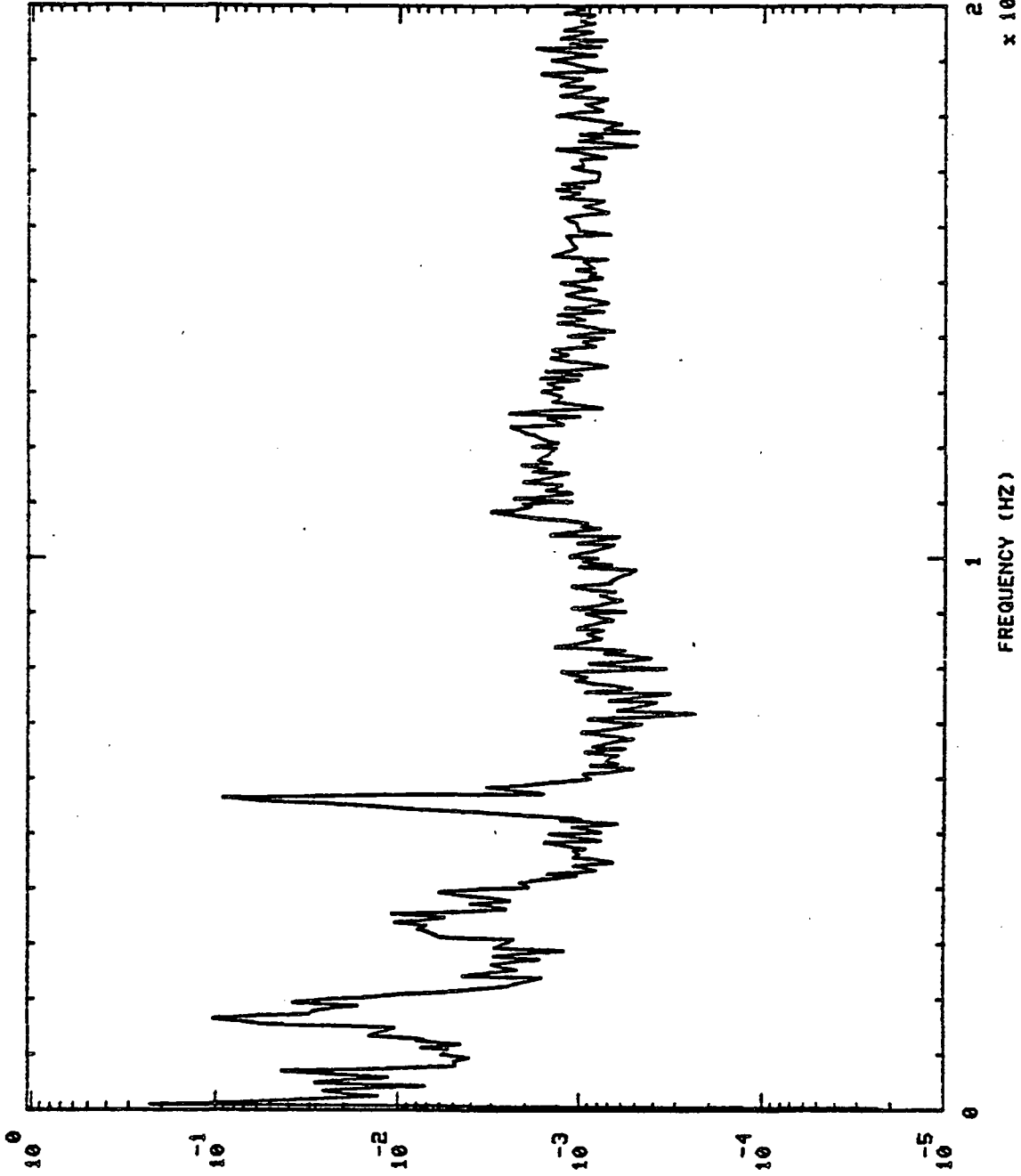
P S D \ H Z

FREQUENCY (HZ) $\times 10^1$

S+ 150.01H0,'S

LPOP DS PR

750114

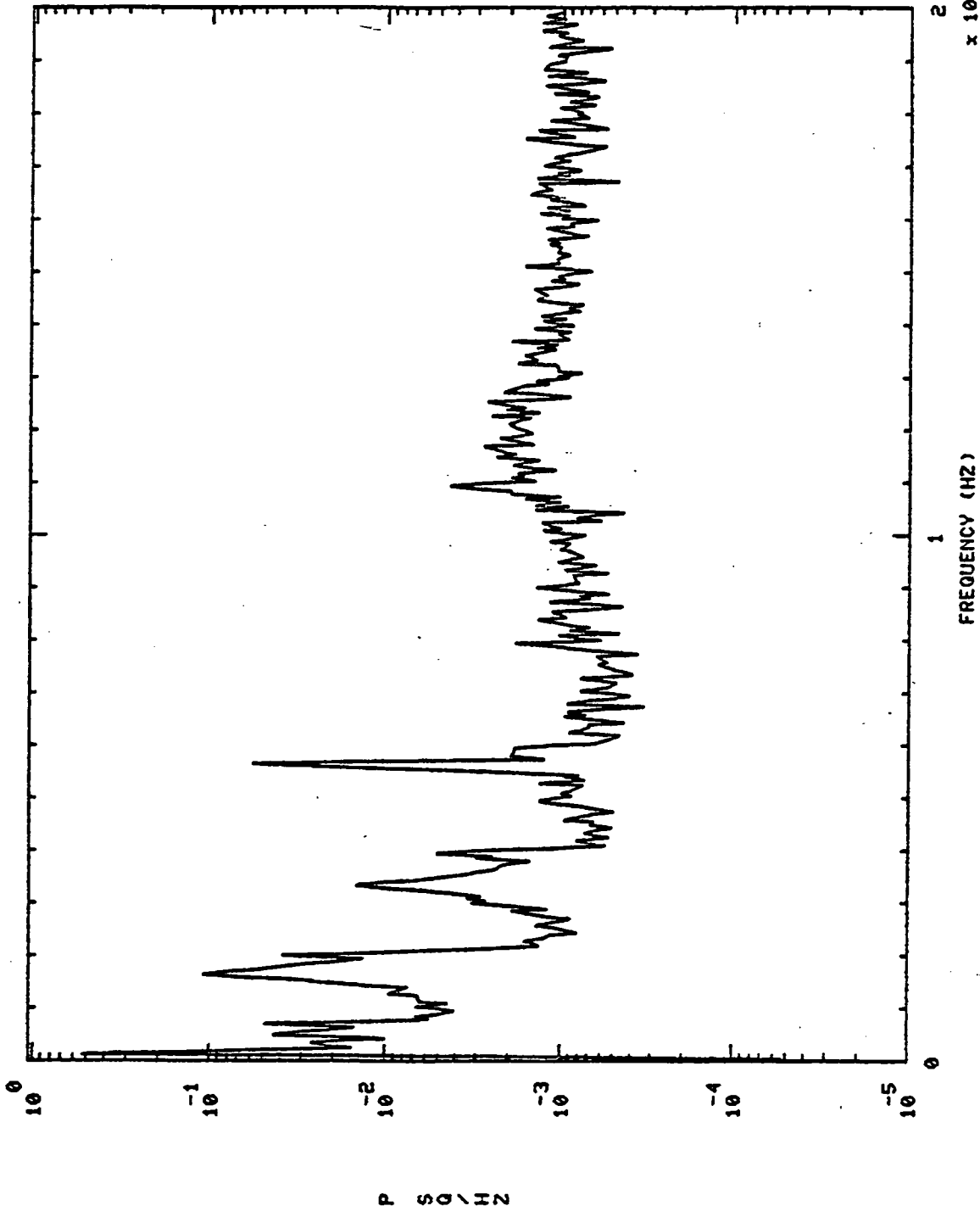


P S D \ H Z

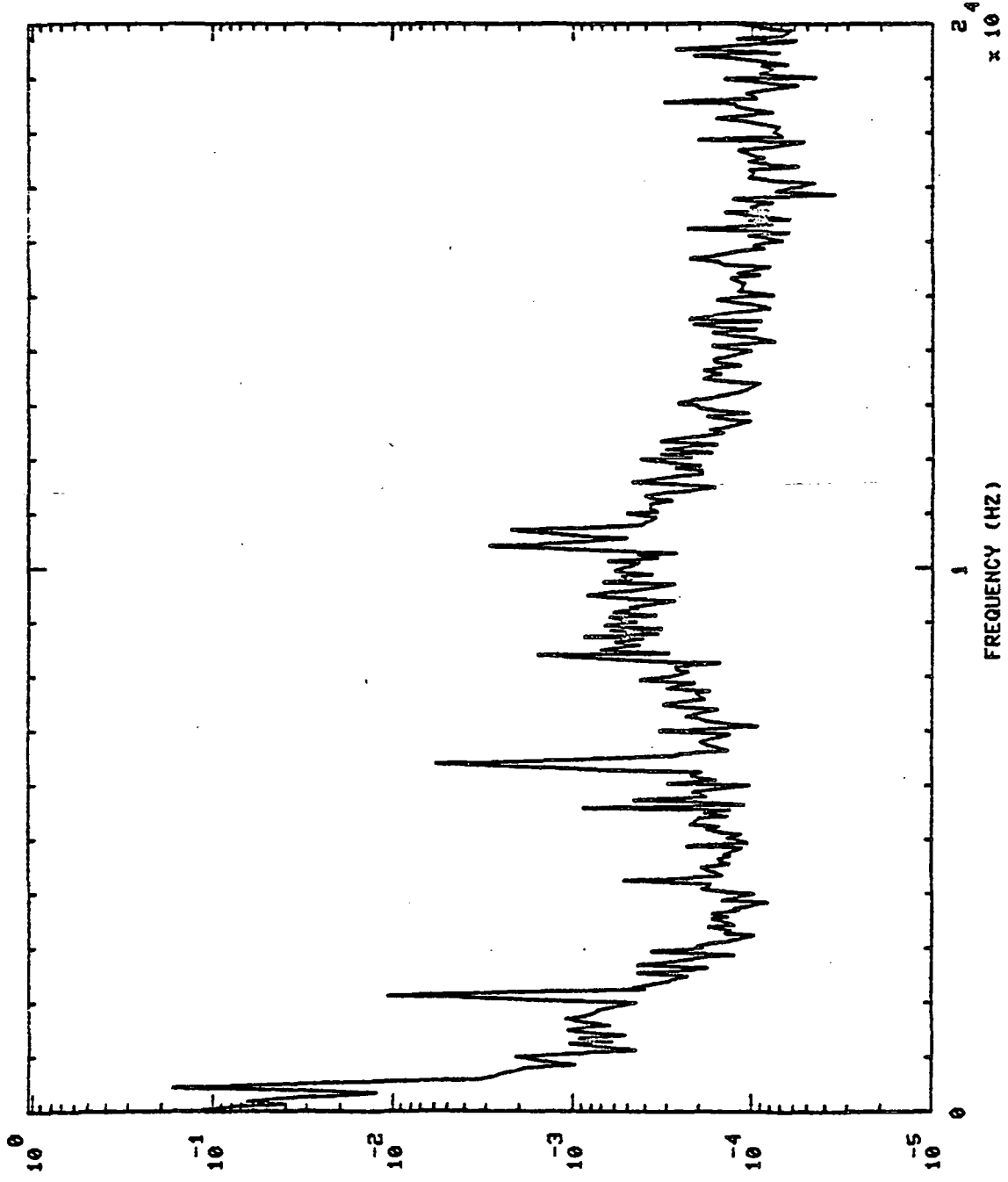
2.4
x 10⁴

FREQUENCY (HZ)

750114 LPOP DS PR S+ 280.01H0.'S

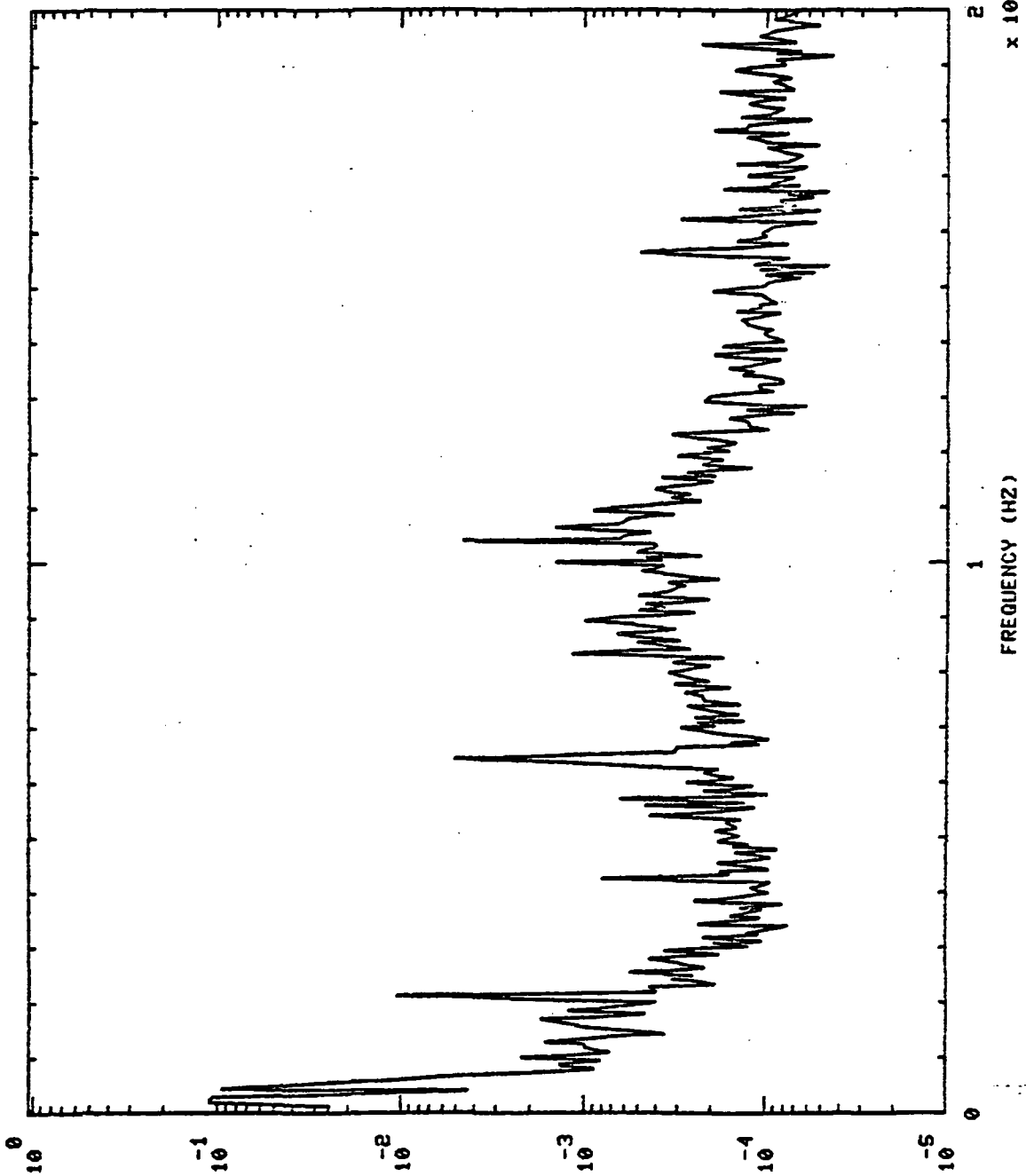


750114 HPOP BAL CAU PR2 S+ 30.01H0,'S



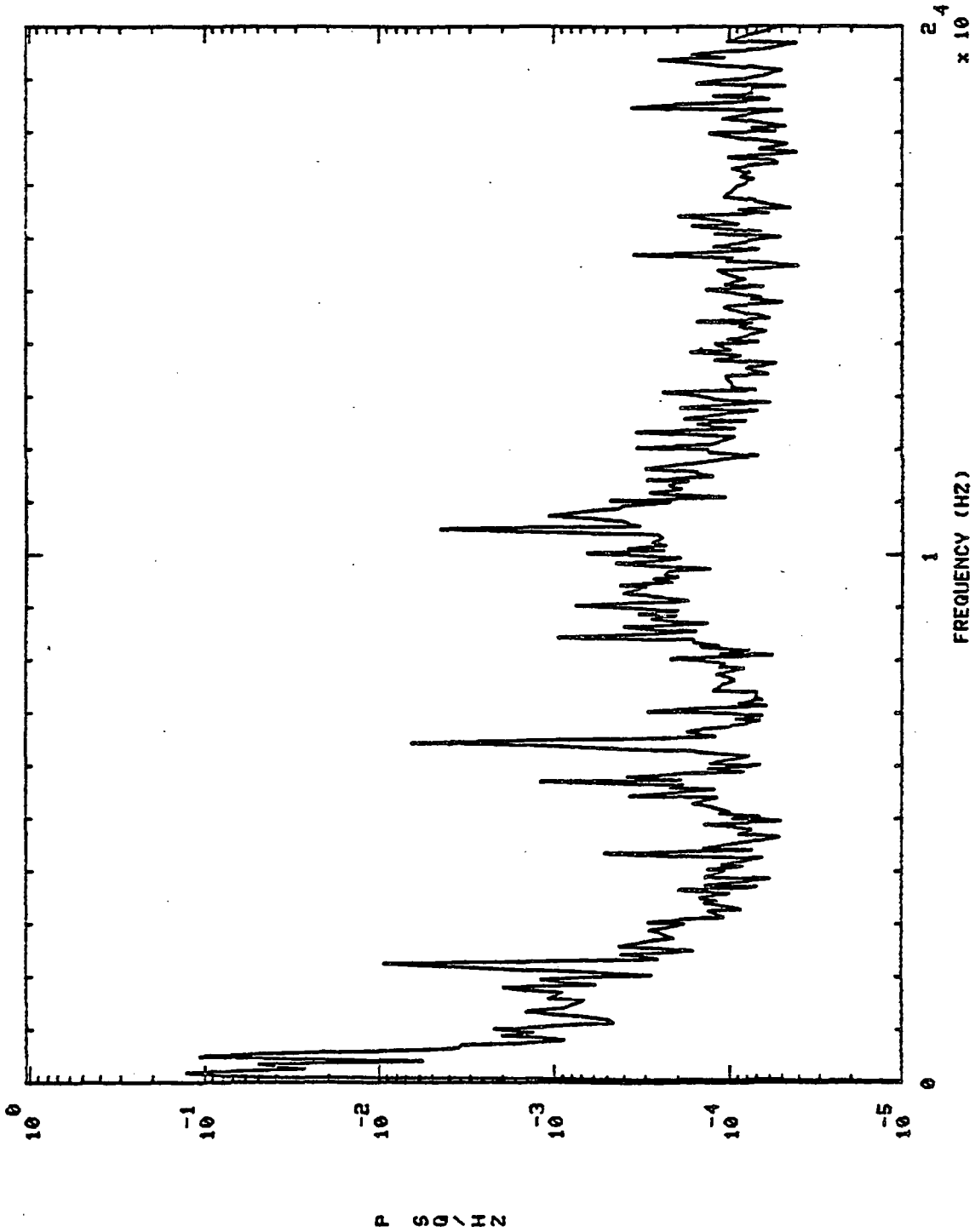
P SQ / HZ

750114 MPOP BAL CAU PR2 S+ 150.01H0,'S

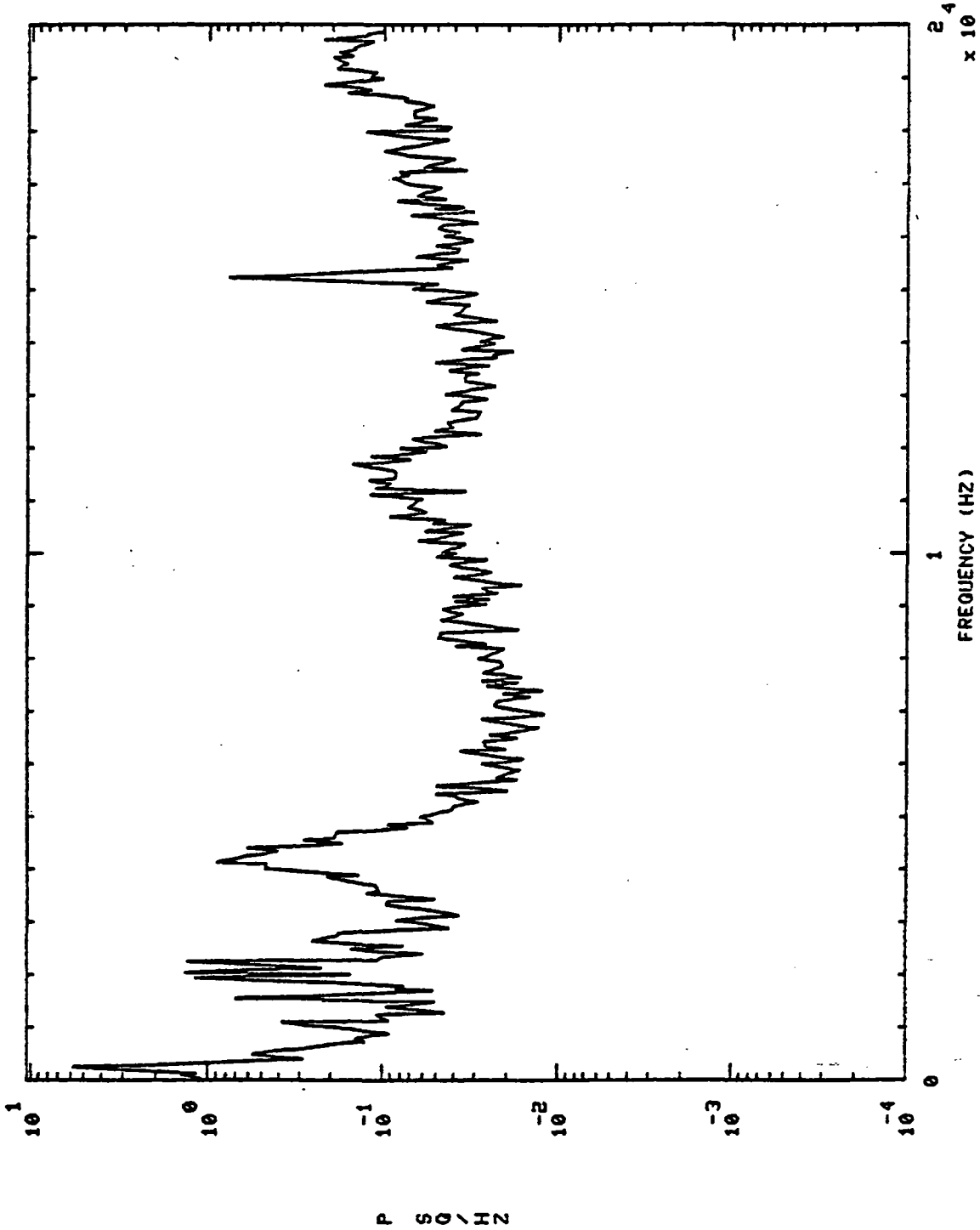


P S D N

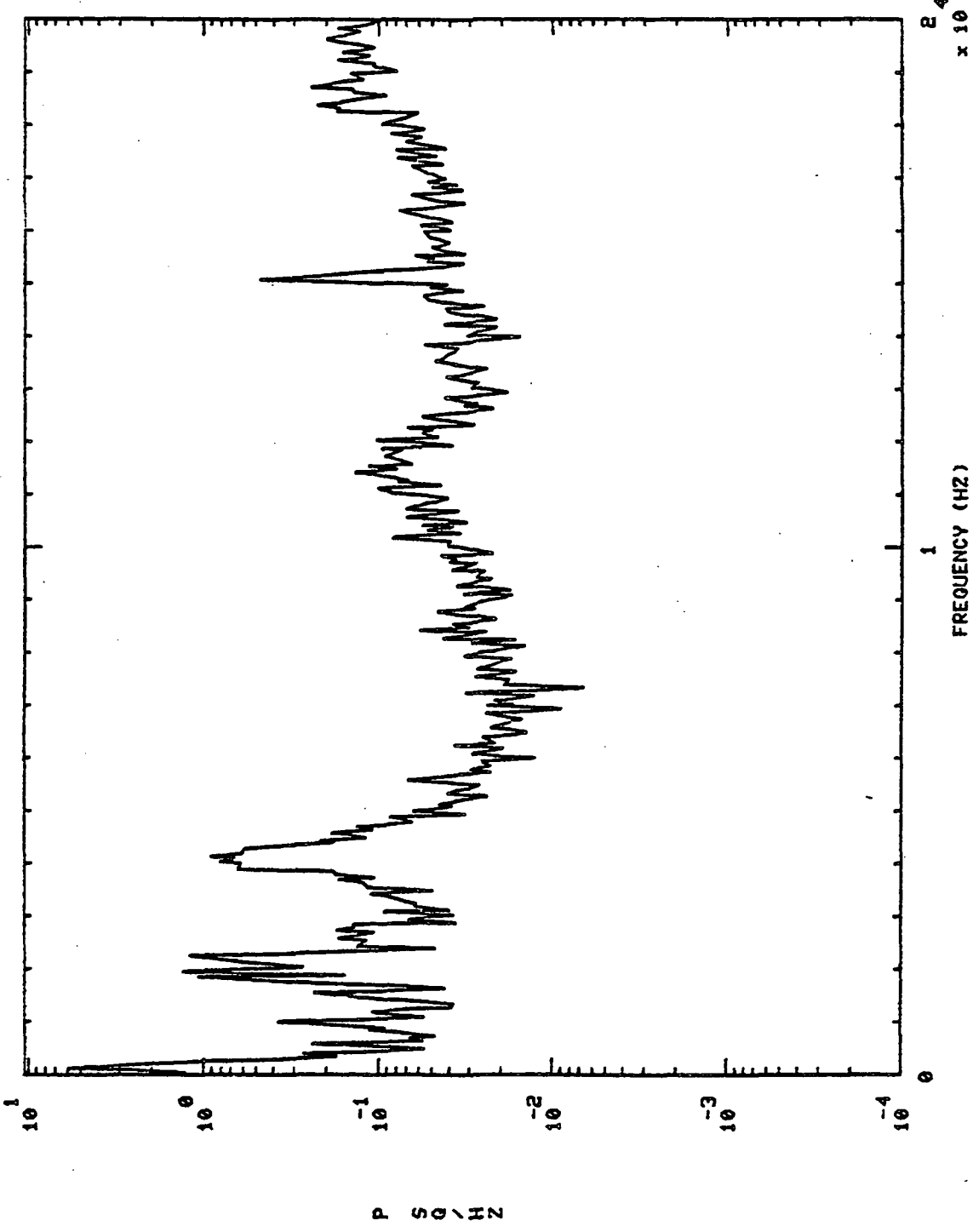
750114 HPOP BAL CAU PR2 S+ 280.01H0,'S



750114 HPOP DS PR S+ 30.01H0,'S



750114 HPOP DS PR S: 150.01H0,'S

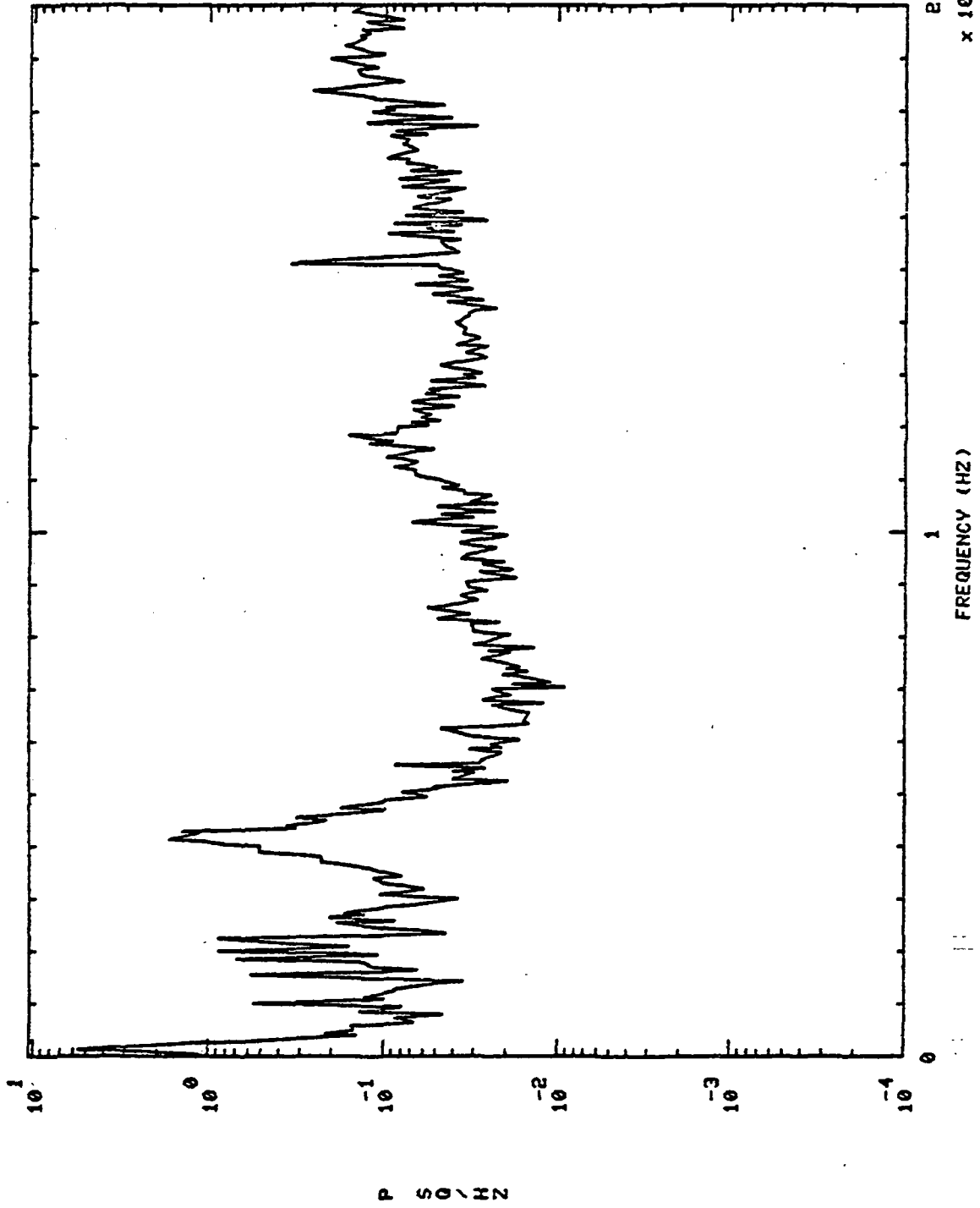


10⁴
x 10

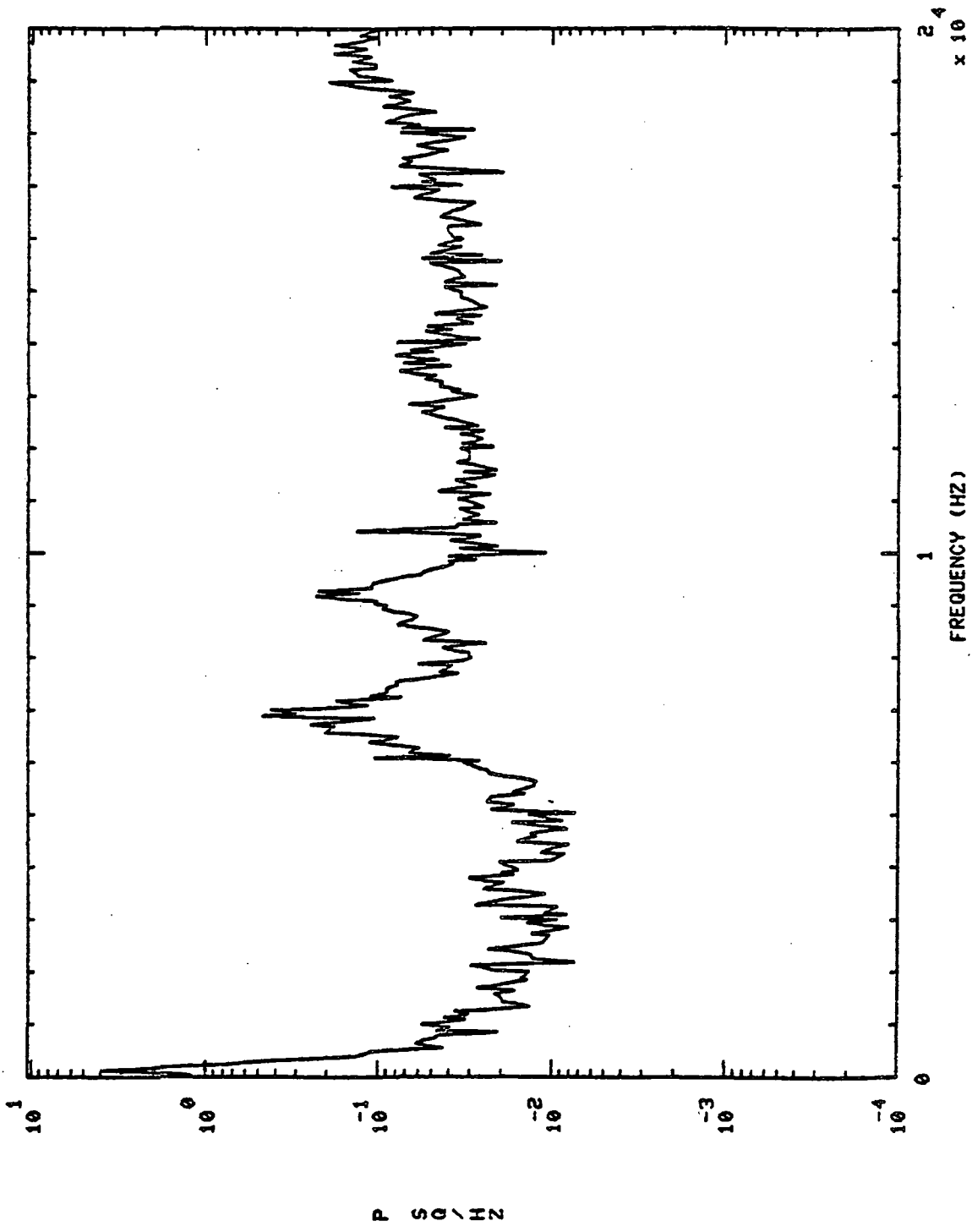
1
FREQUENCY (HZ)

S+ 280.01H0,'S

750114 HPOP DS PR

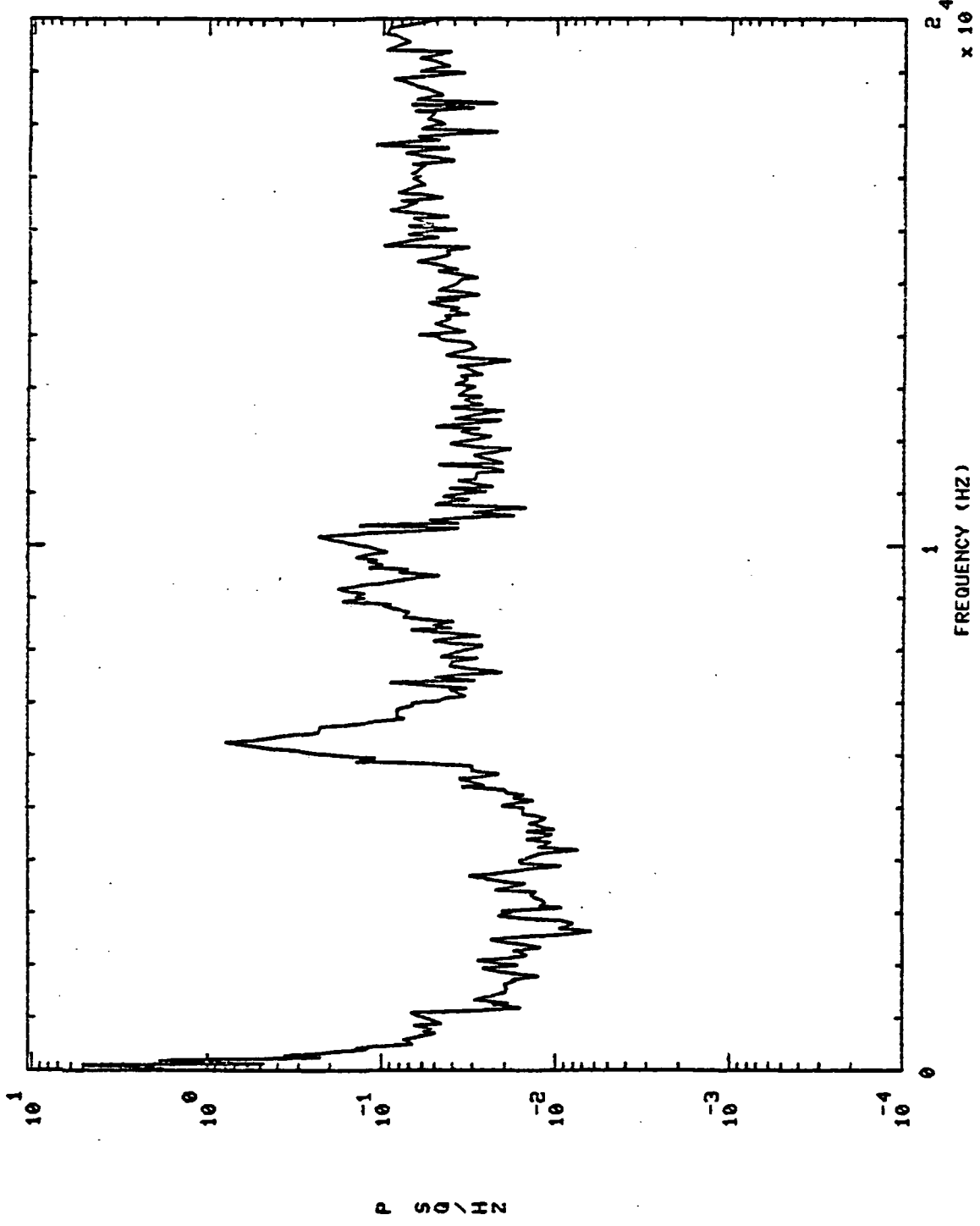


750114 MCC HOT GAS IN PR S+ 30.01H0,'S

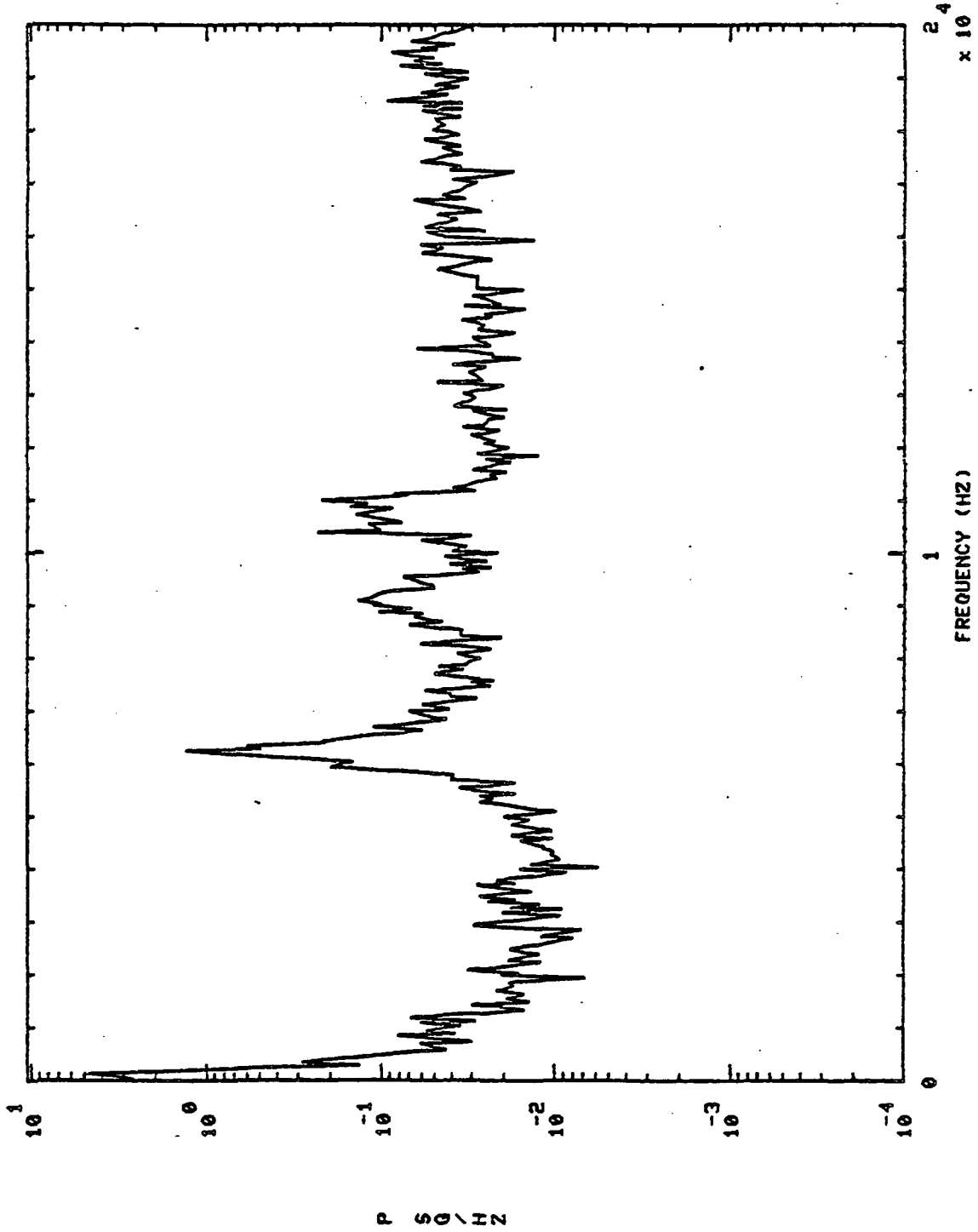


2 4
x 10

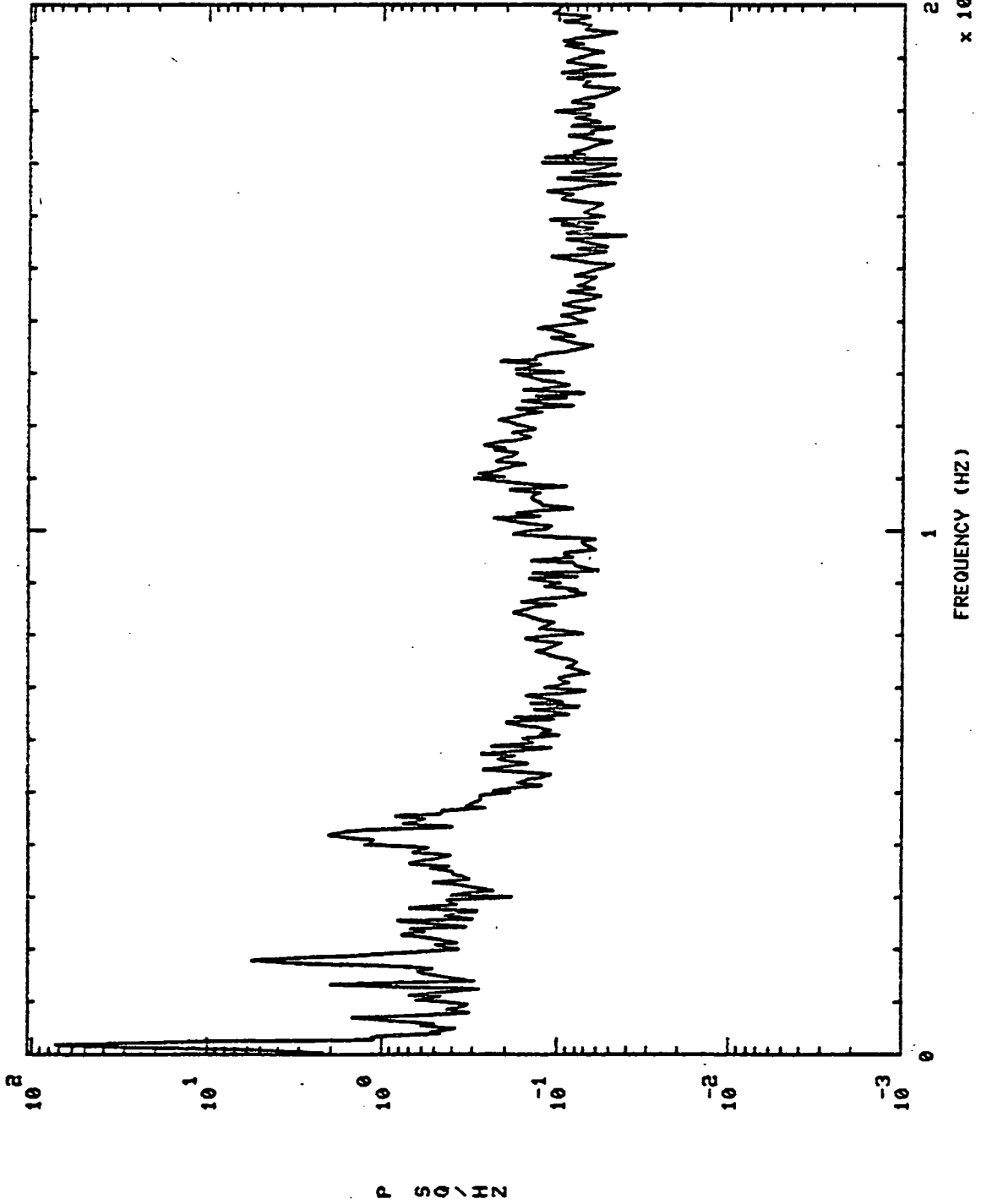
750114 MCC HOT GAS IN PR S+ 150.01H0.'S



750114 MCC HOT GAS IN PR S+ 280.01H0,'S

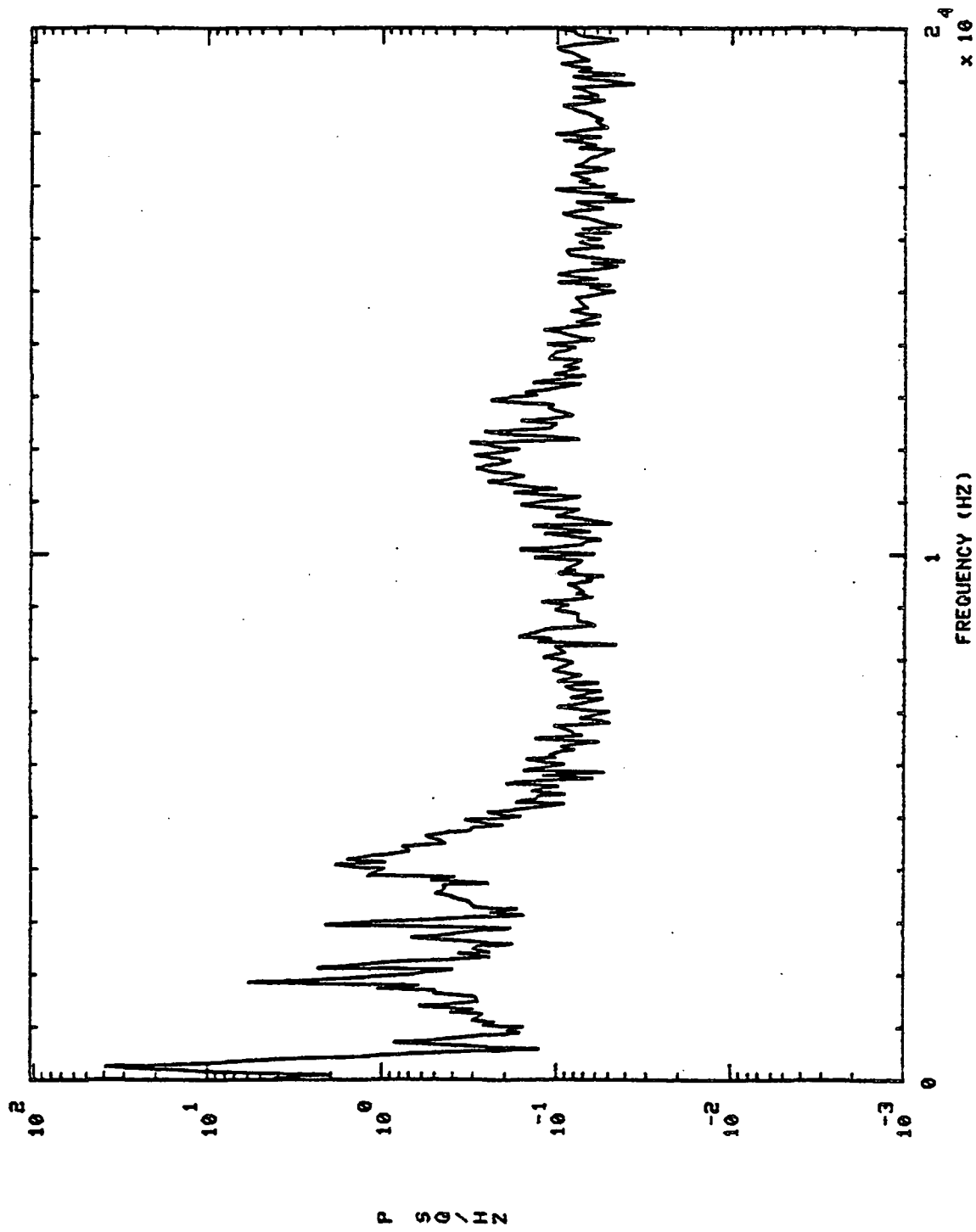


750114 P8P DS PR S+ 30.01H0,'S



S+ 150.01H0,'S

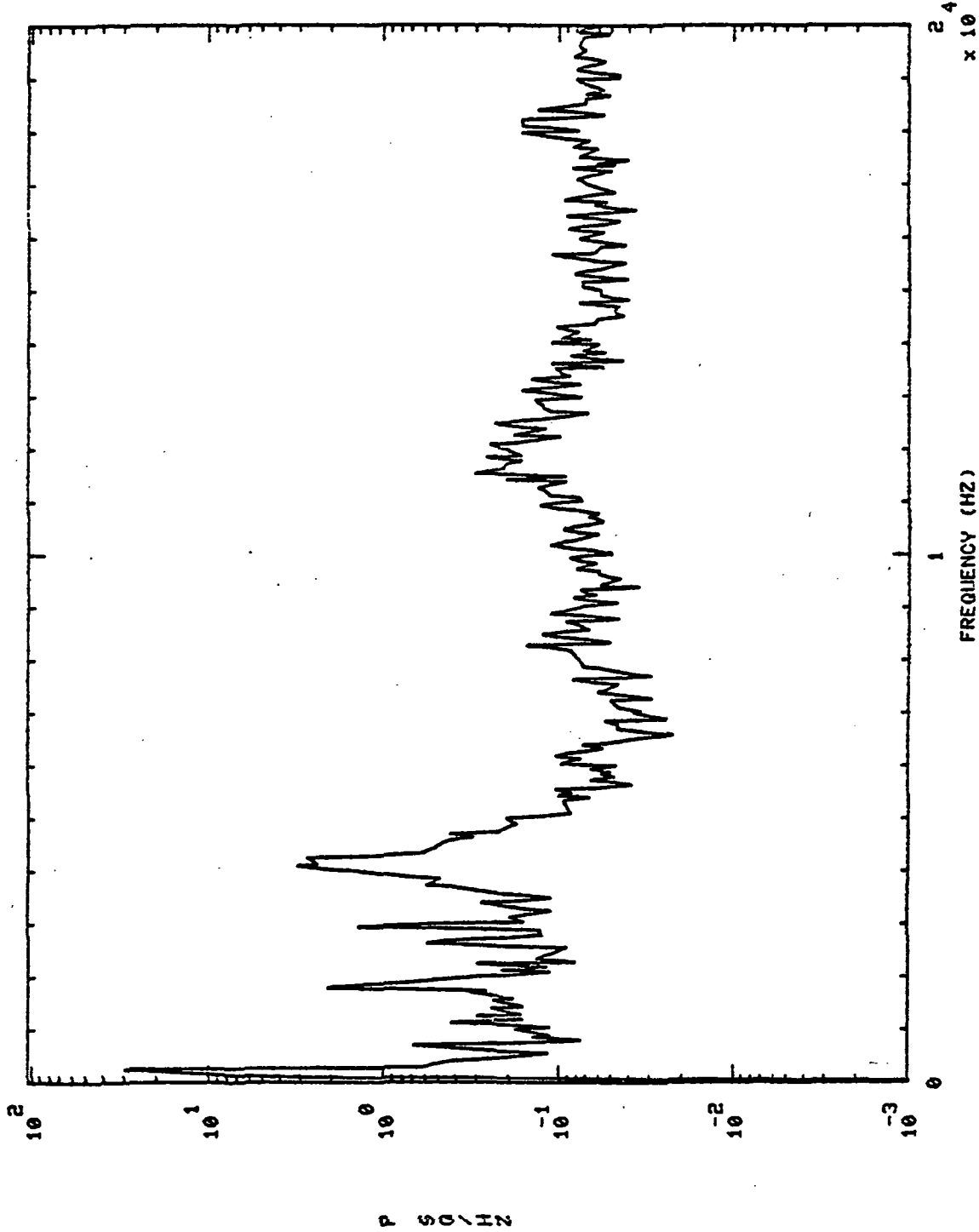
750114 PBP DS PR



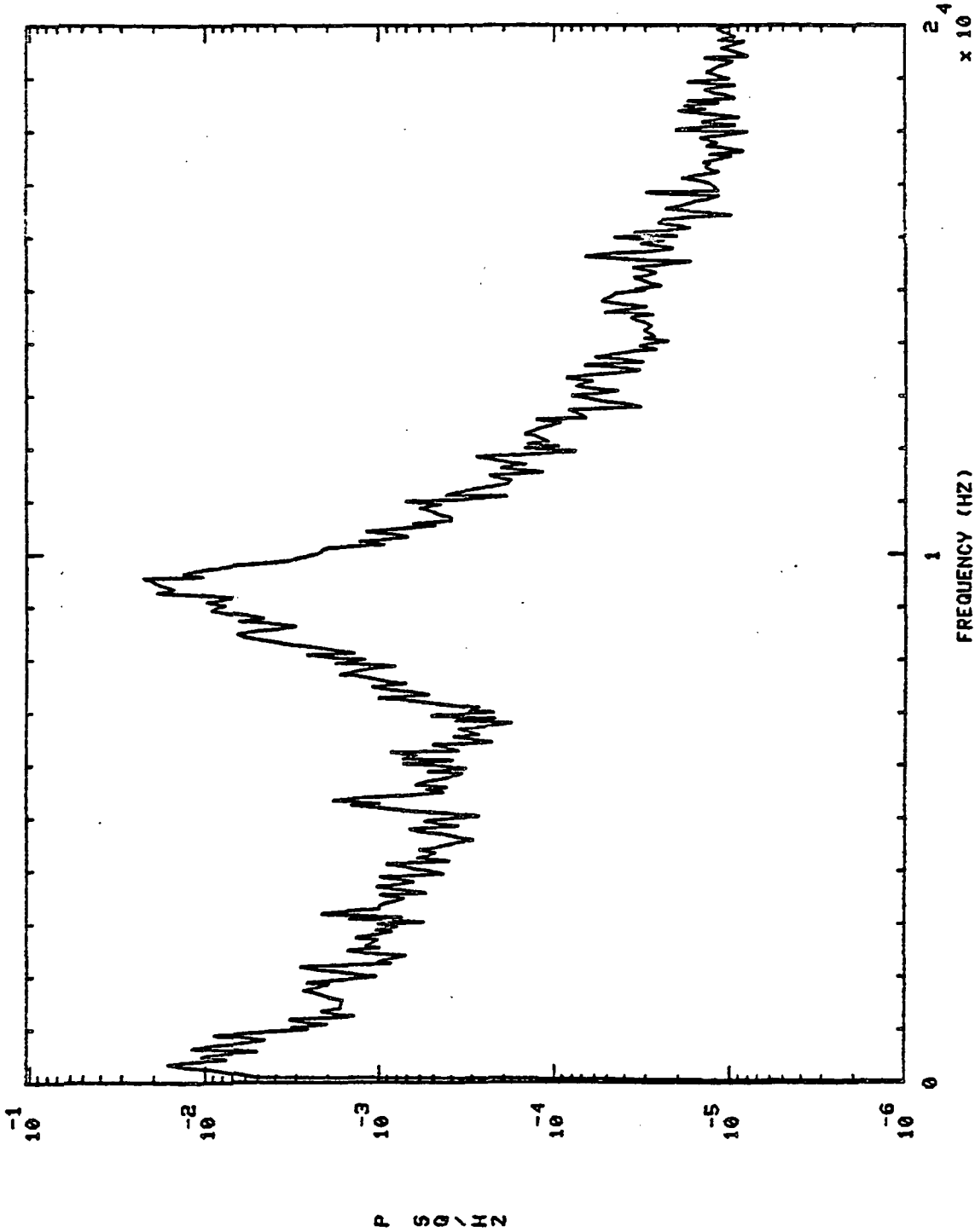
5+ 280.01H0,'S

PBP DS PR

750114

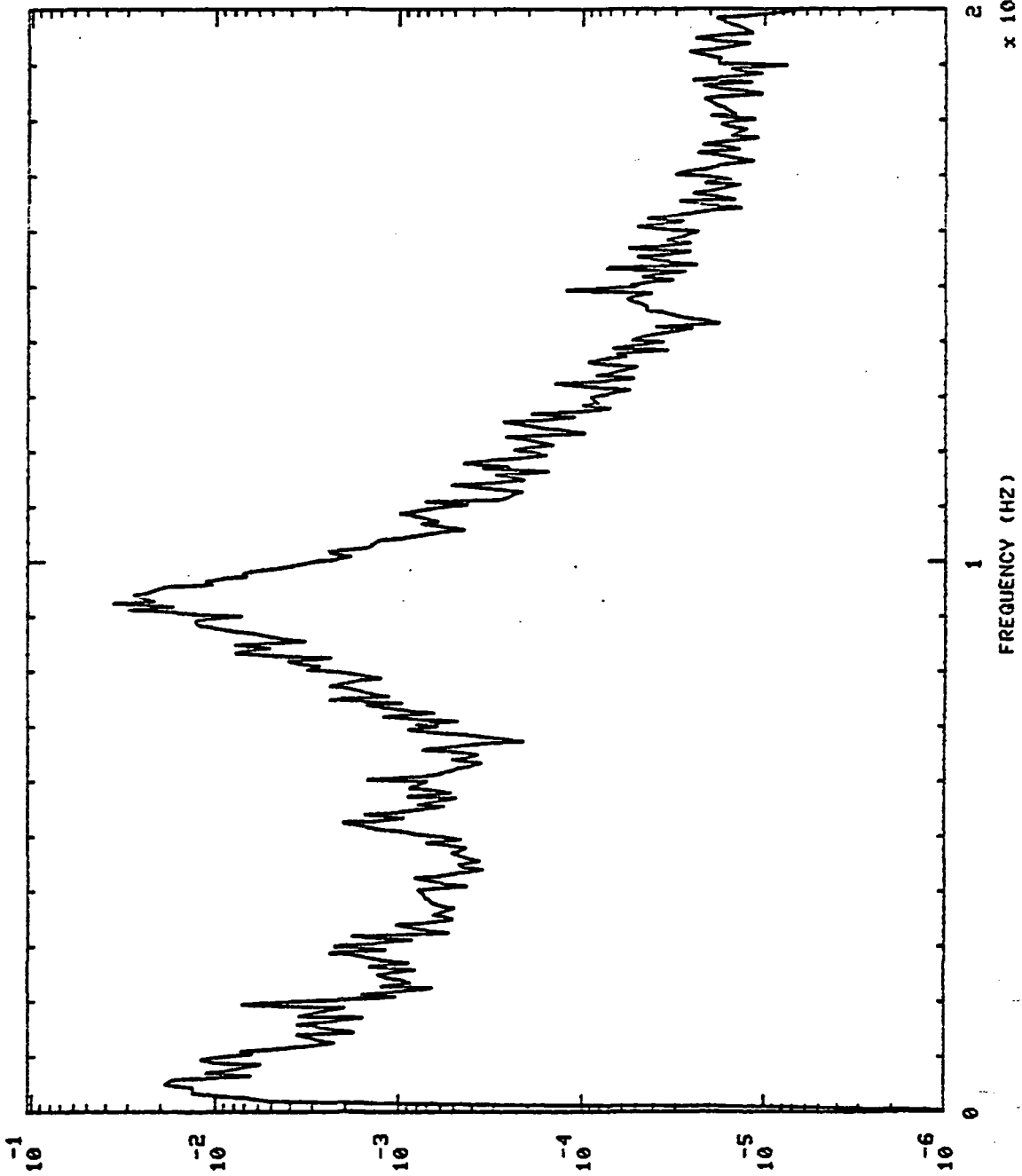


750114 LPFP DS PR S+ 30.01H0,'S



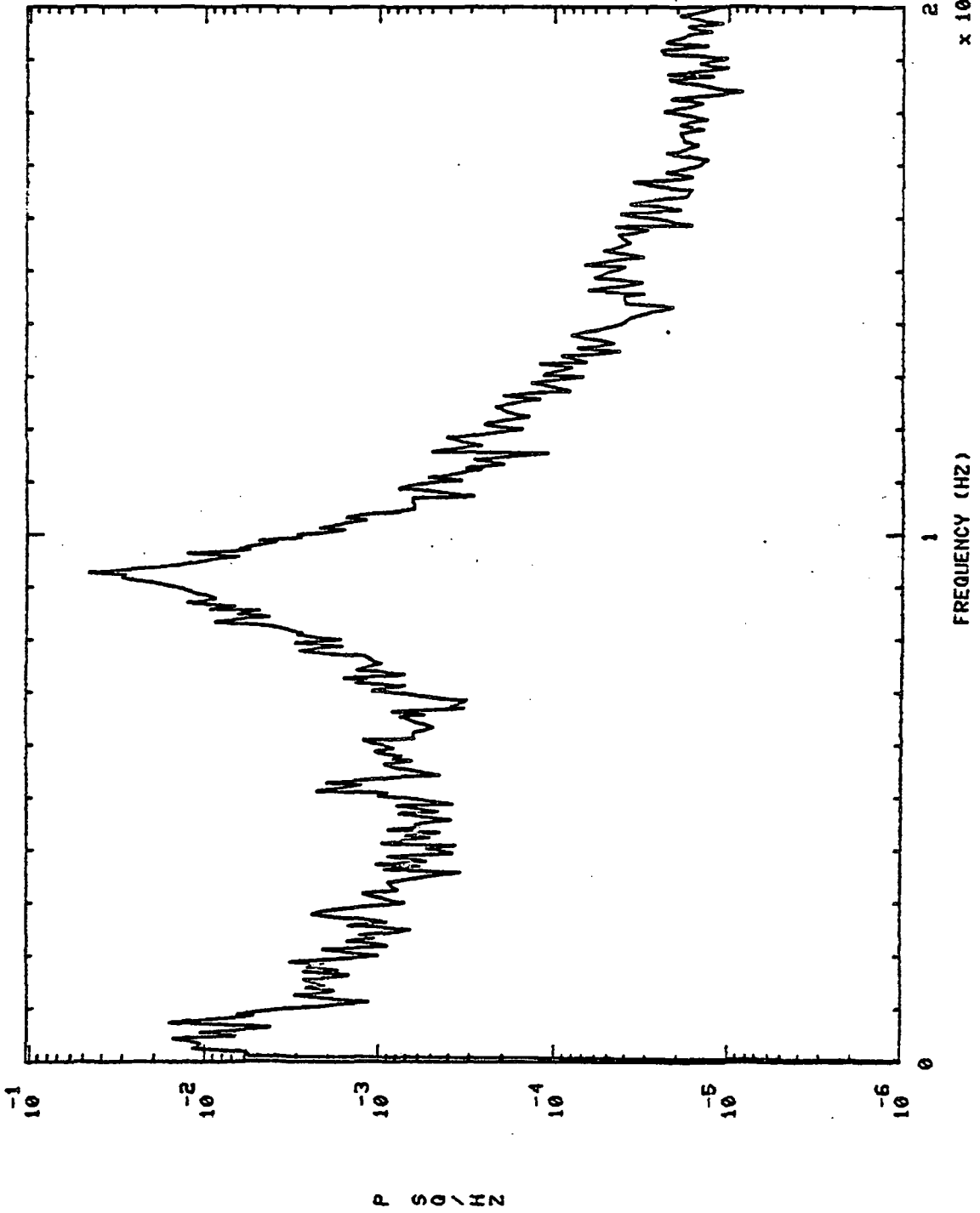
S+ 150.01H0,'S

750114 LPFP DS PR



P SQ/HZ

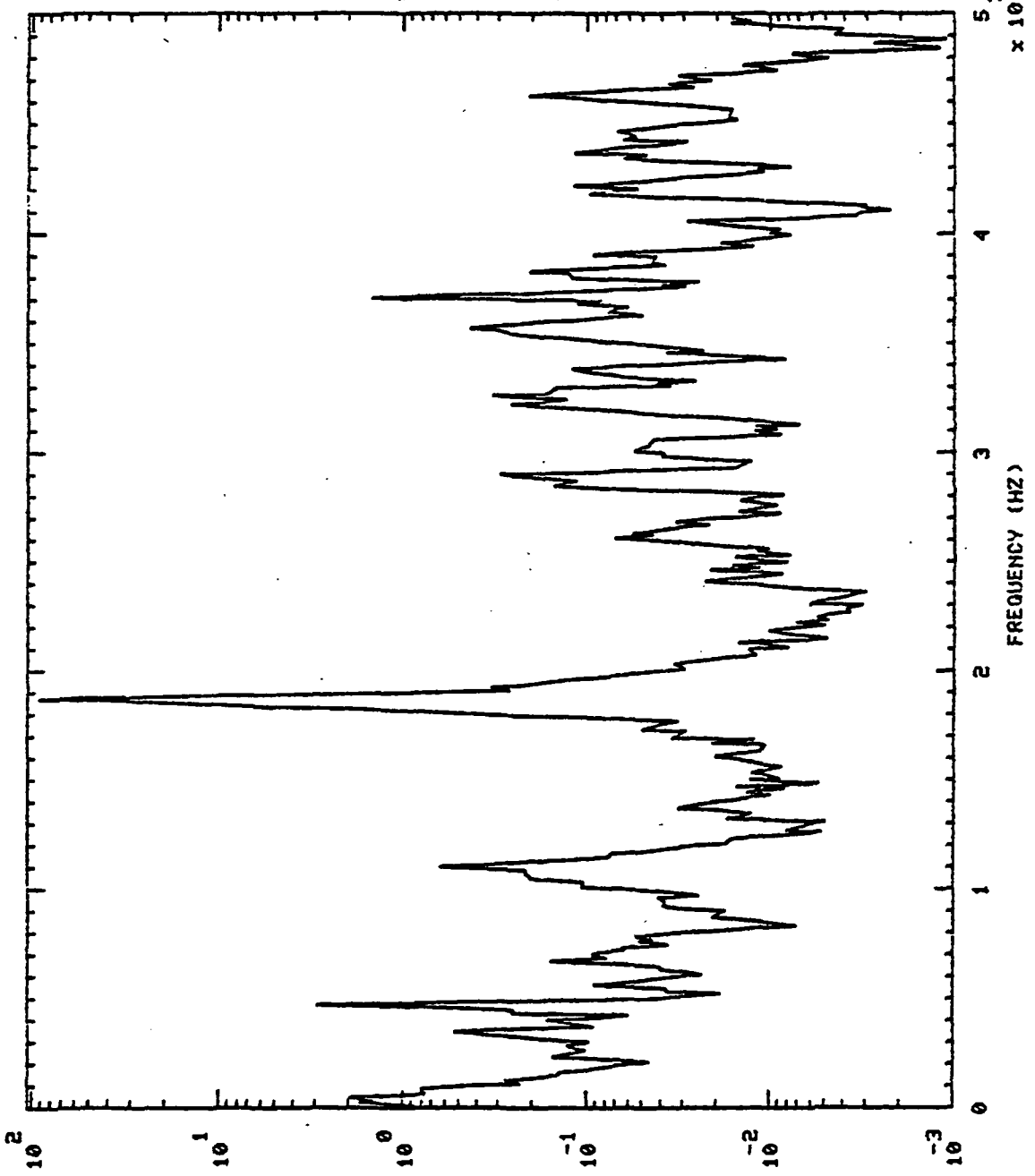
750114 LFFP DS PR S+ 280.01H0,'S



750114 LPOT TURB DR PR S+ 30.01H0.'S

750114 LPOT TURB DR PR

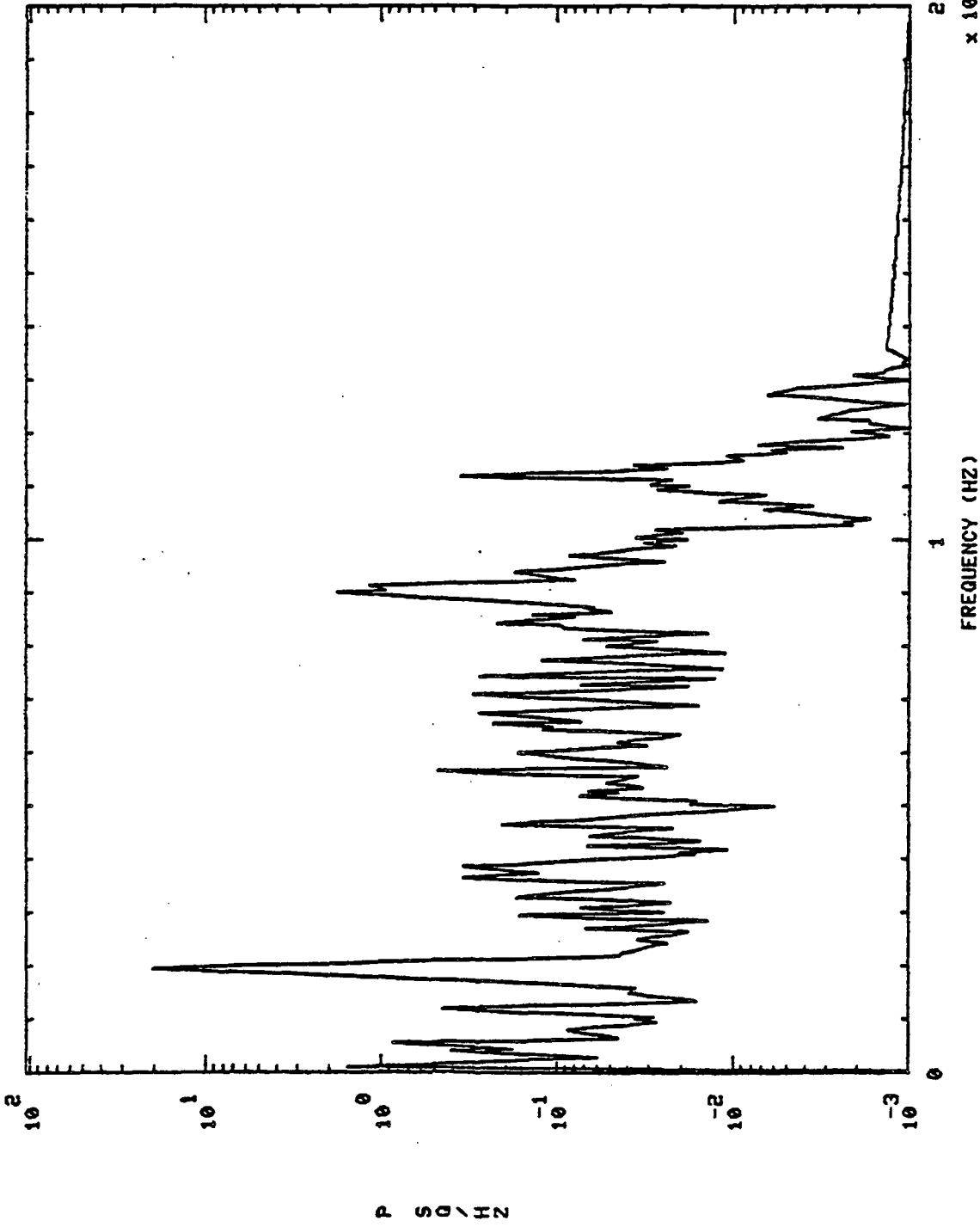
750114 LPOT TURB DR PR



P S D / H Z

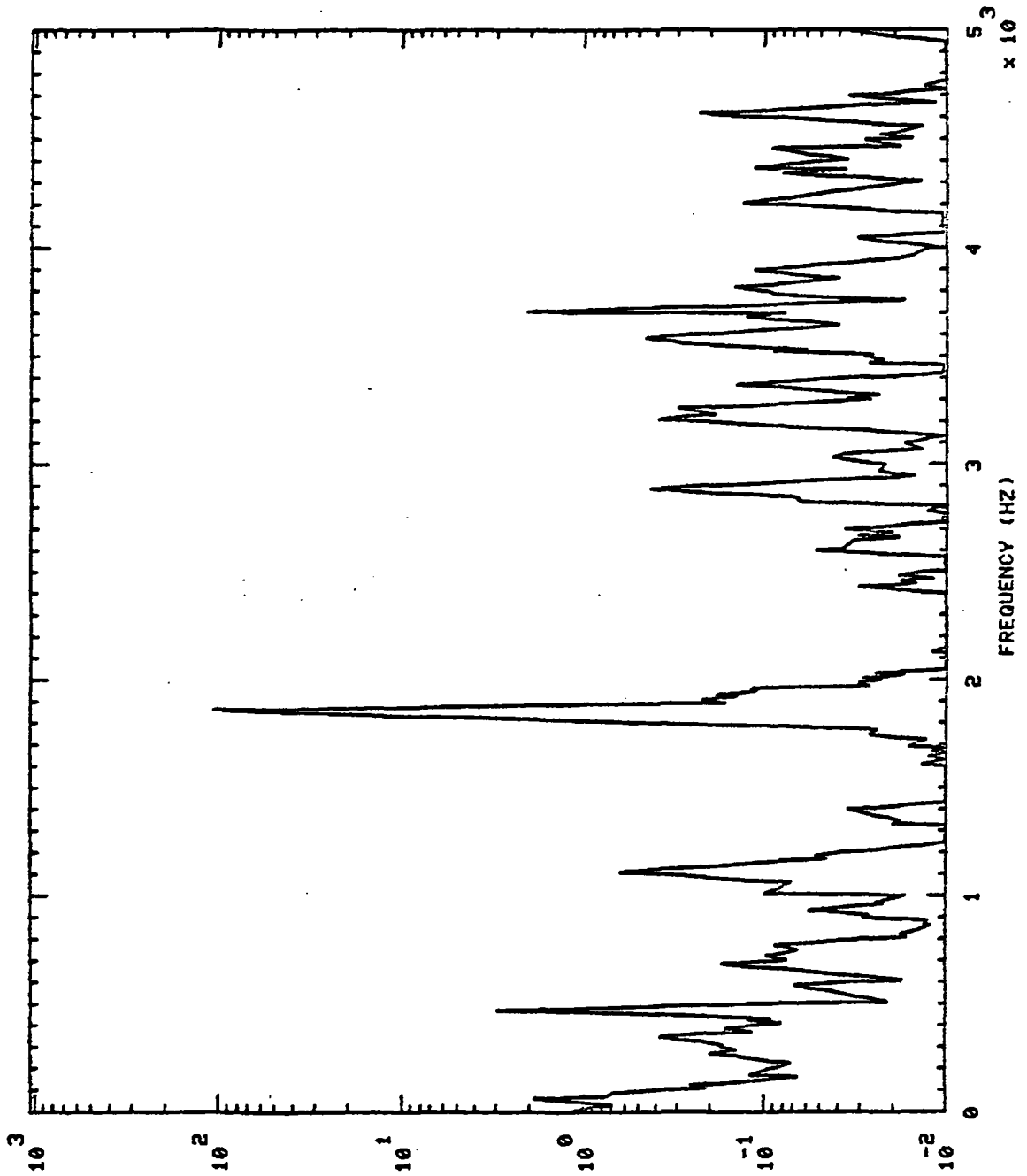
S+ 30.01H0,'S

750114 LPOT TURB DR PR



S+ 150.01H0,'S

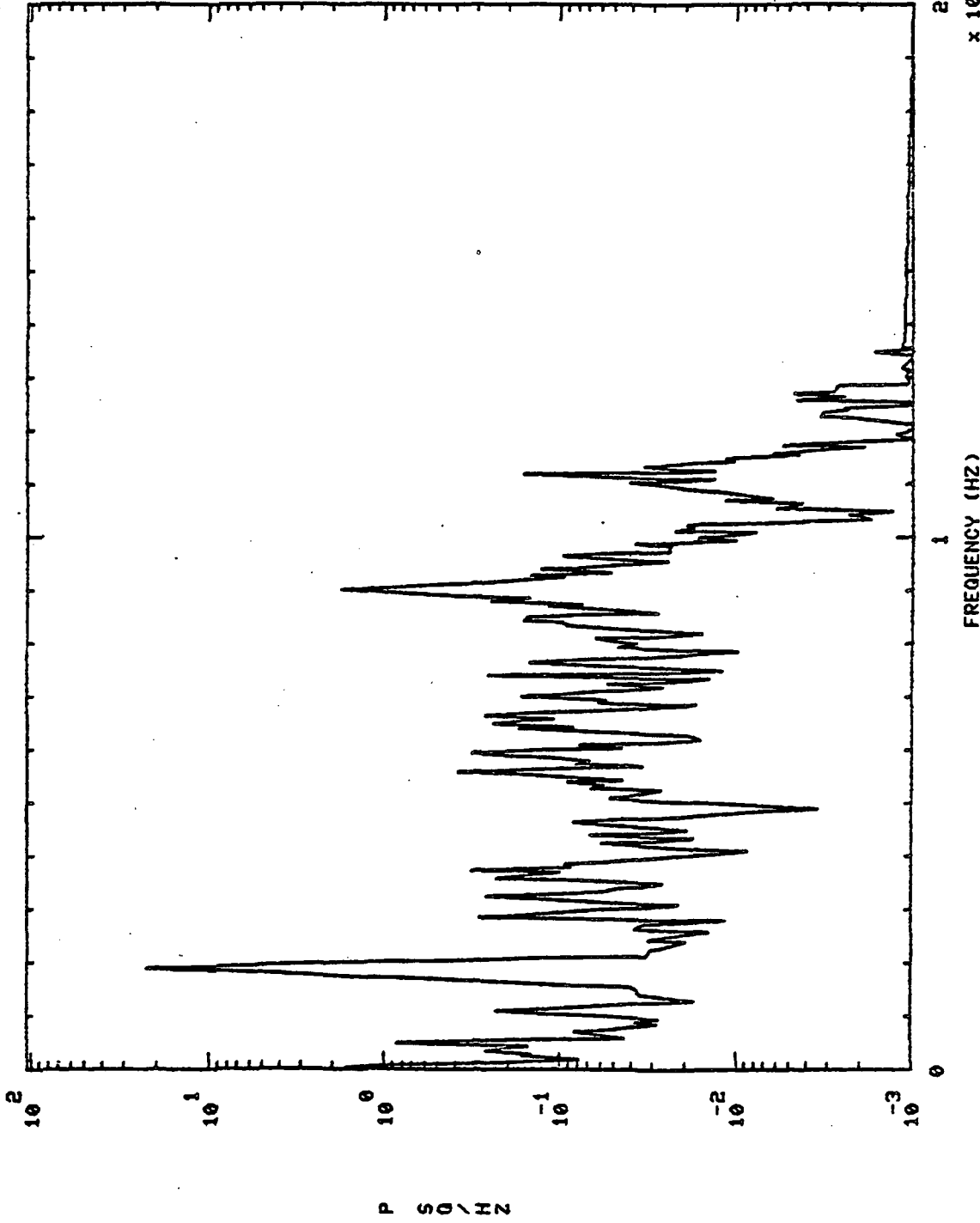
750114 LPOT TURB DR PR



P SQ/HZ

S+ 150.0140,'S

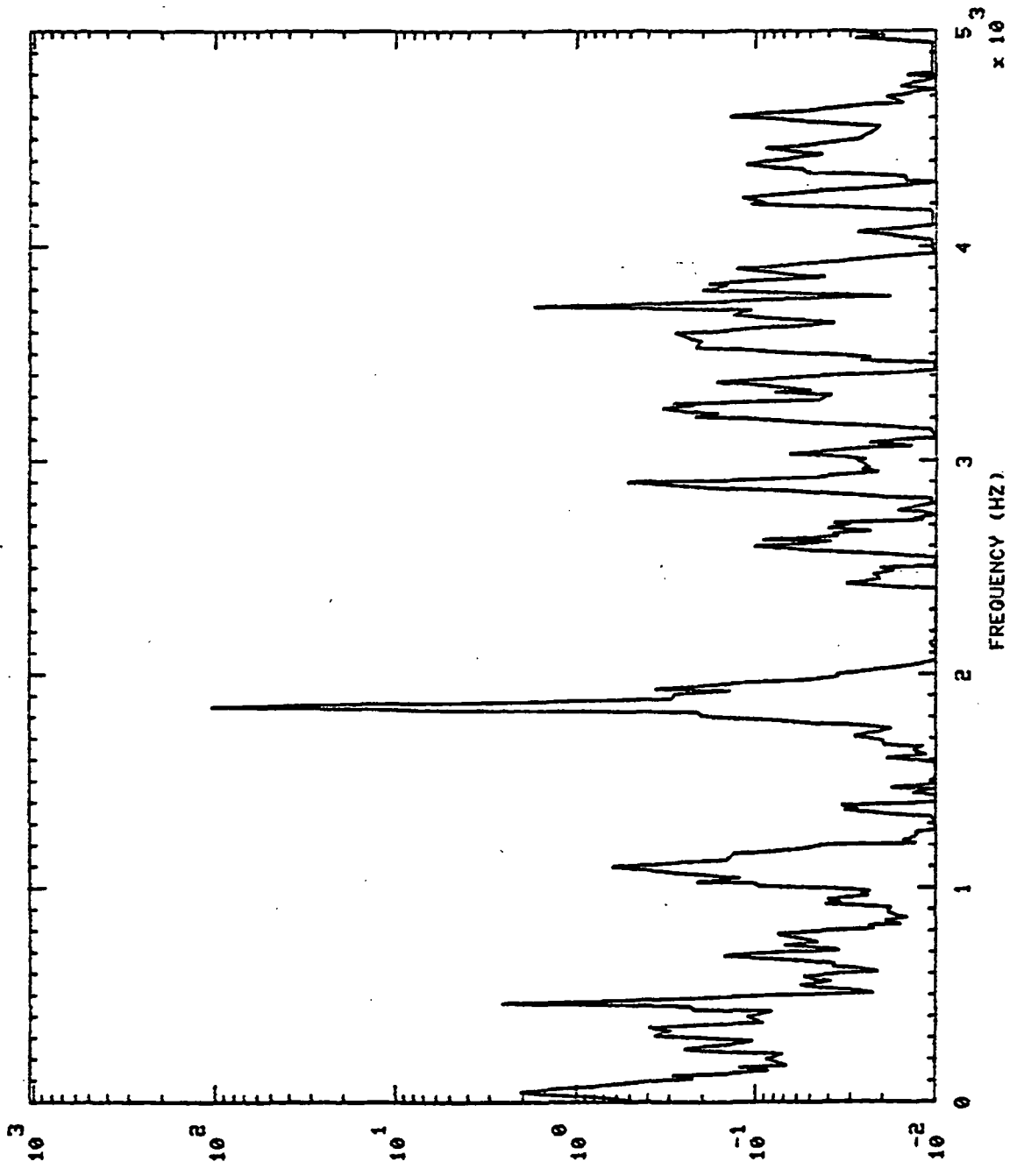
750114 LPOT TURD DR PR



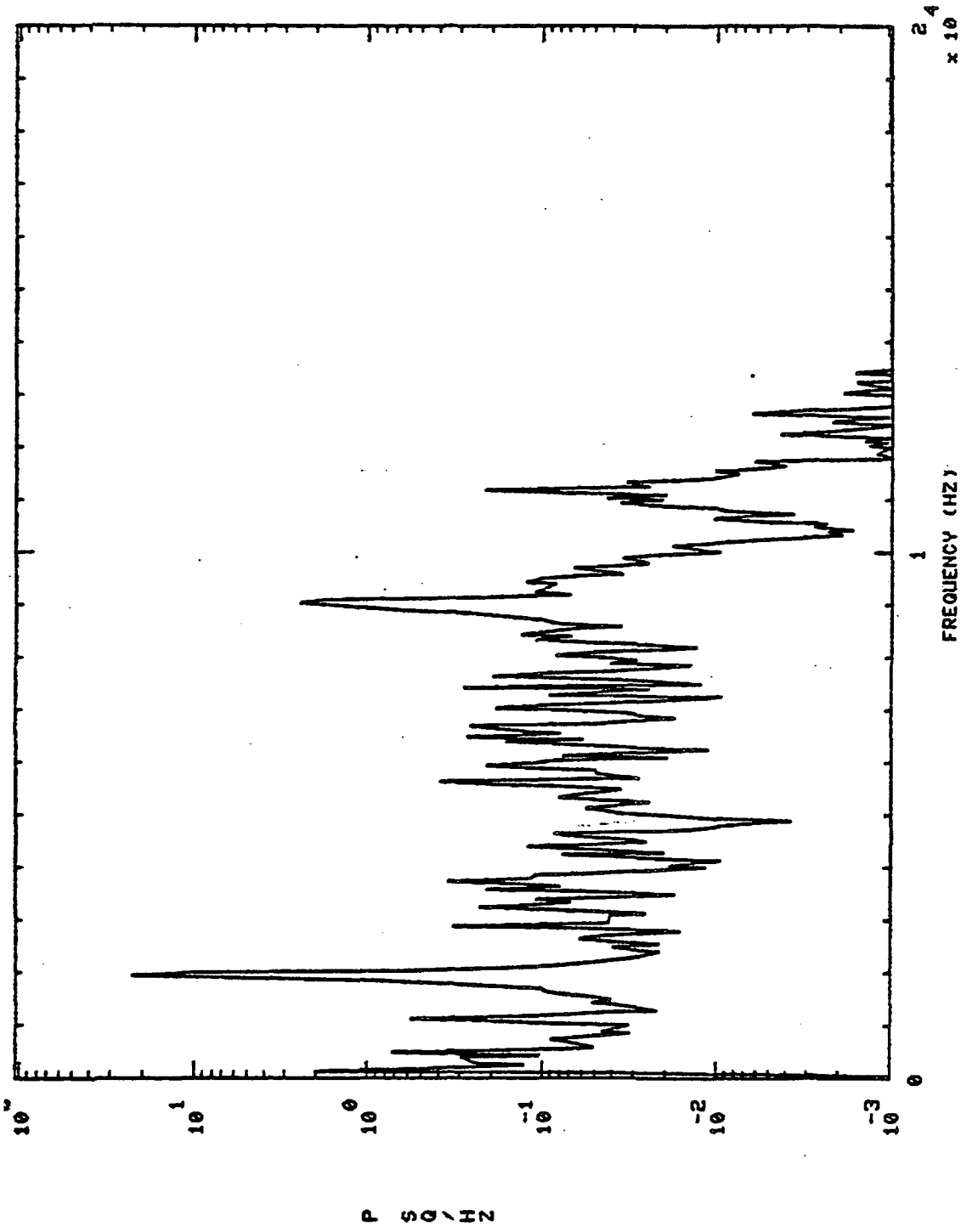
2⁴
x 10

FREQUENCY (HZ)

750114 LPOT TURB DR PR S+ 280.01H0,'S

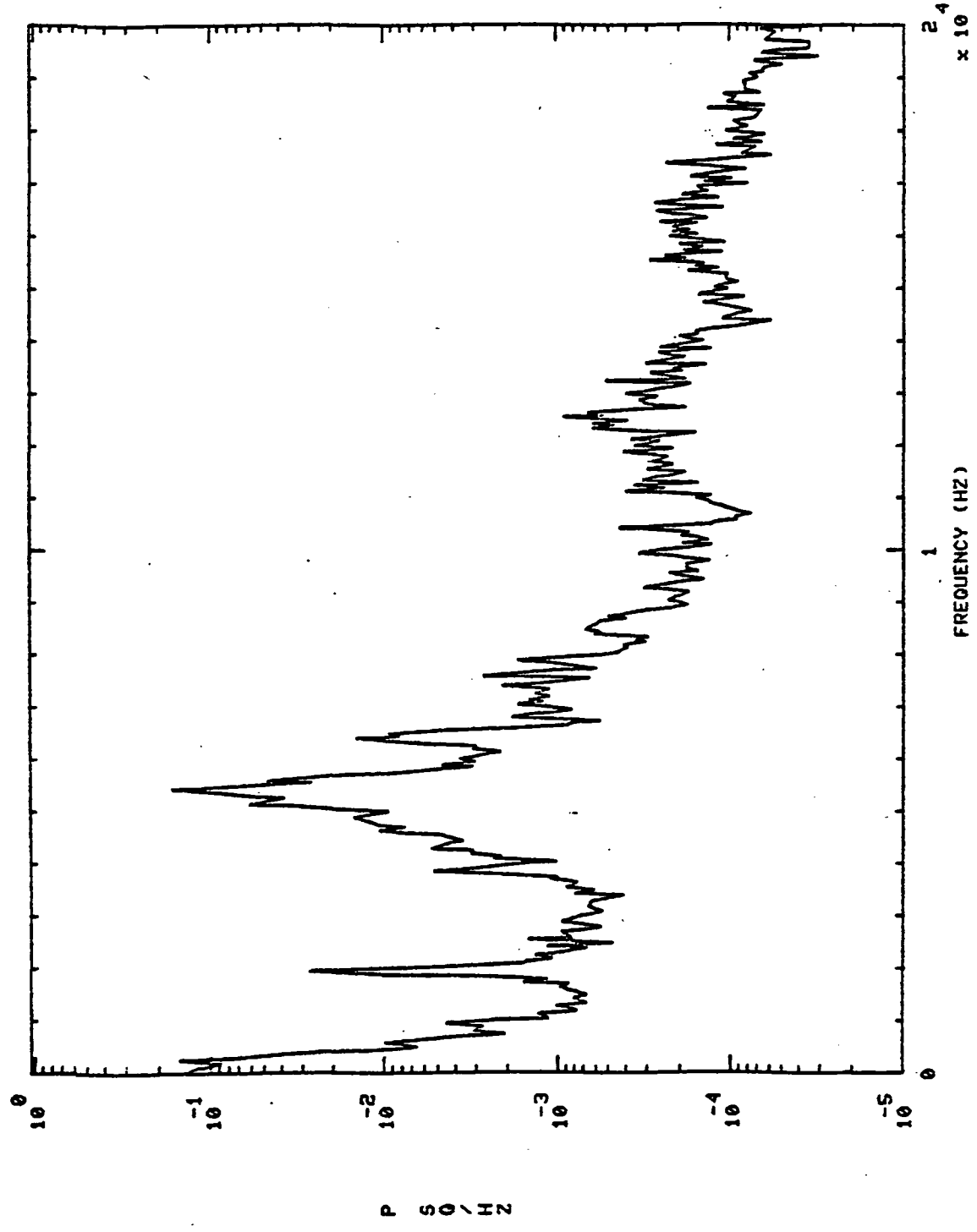


P S D / H Z

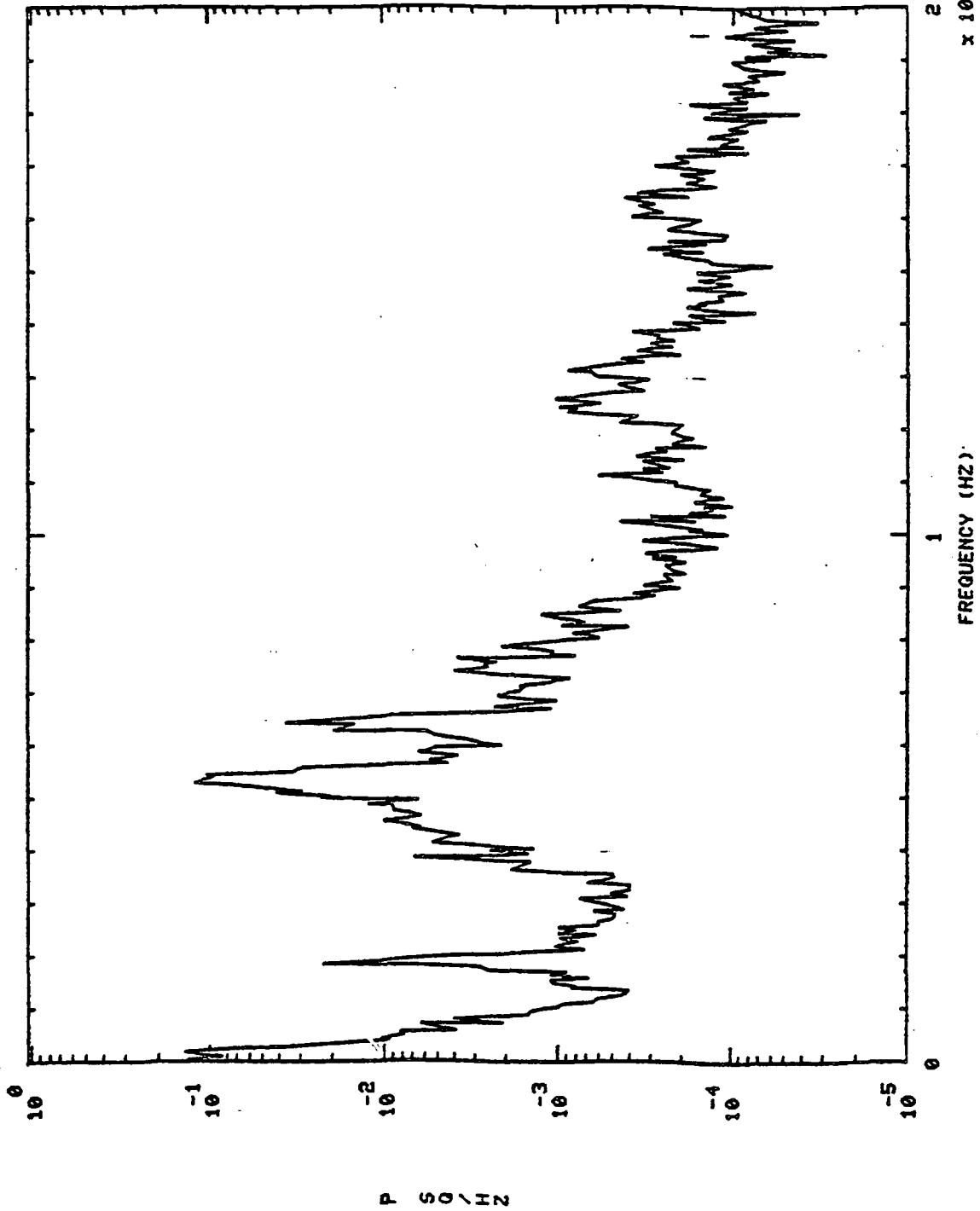


S+ 30.0

750114 OPB PC PR

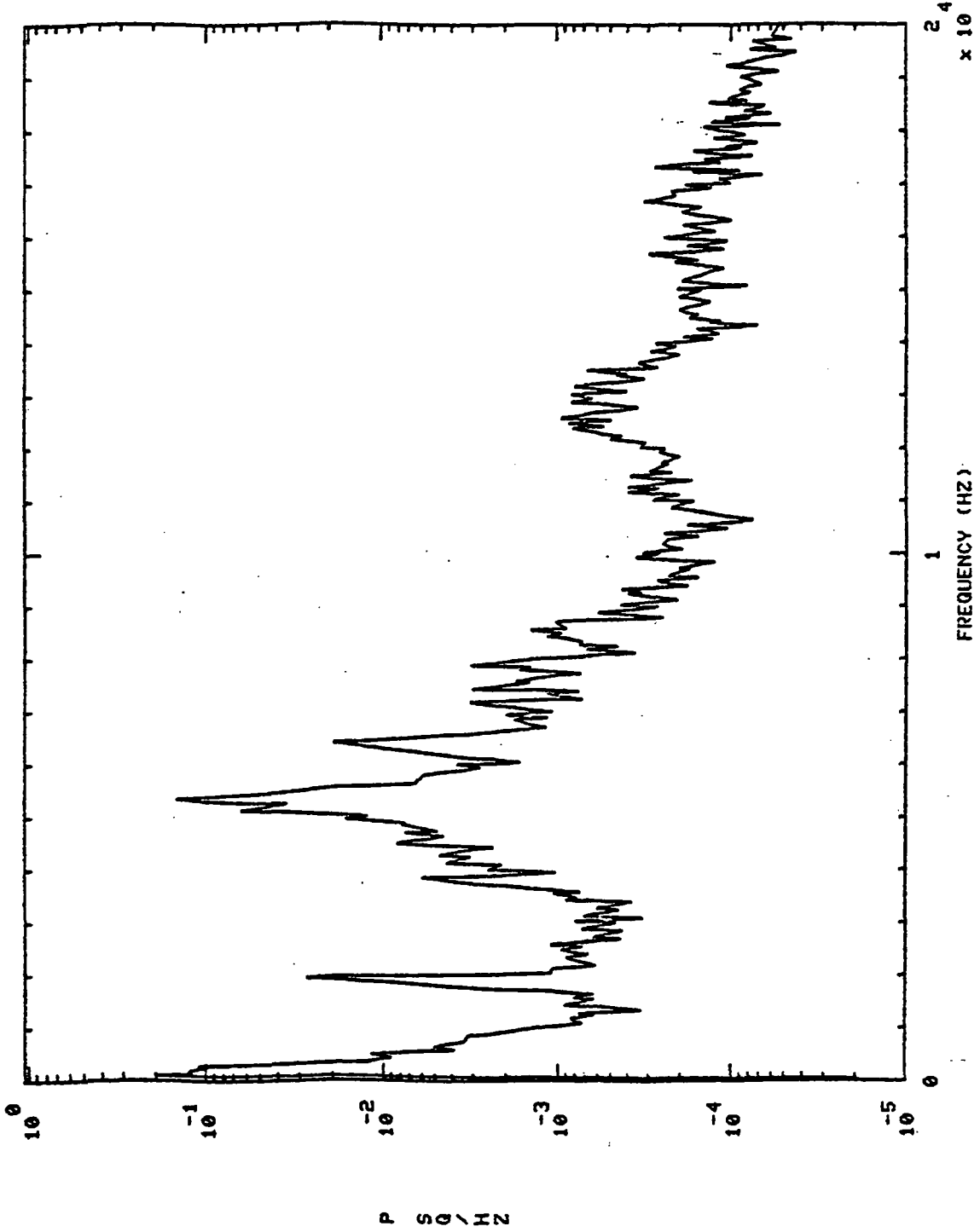


750114 OPB PC PR S+ 150.0



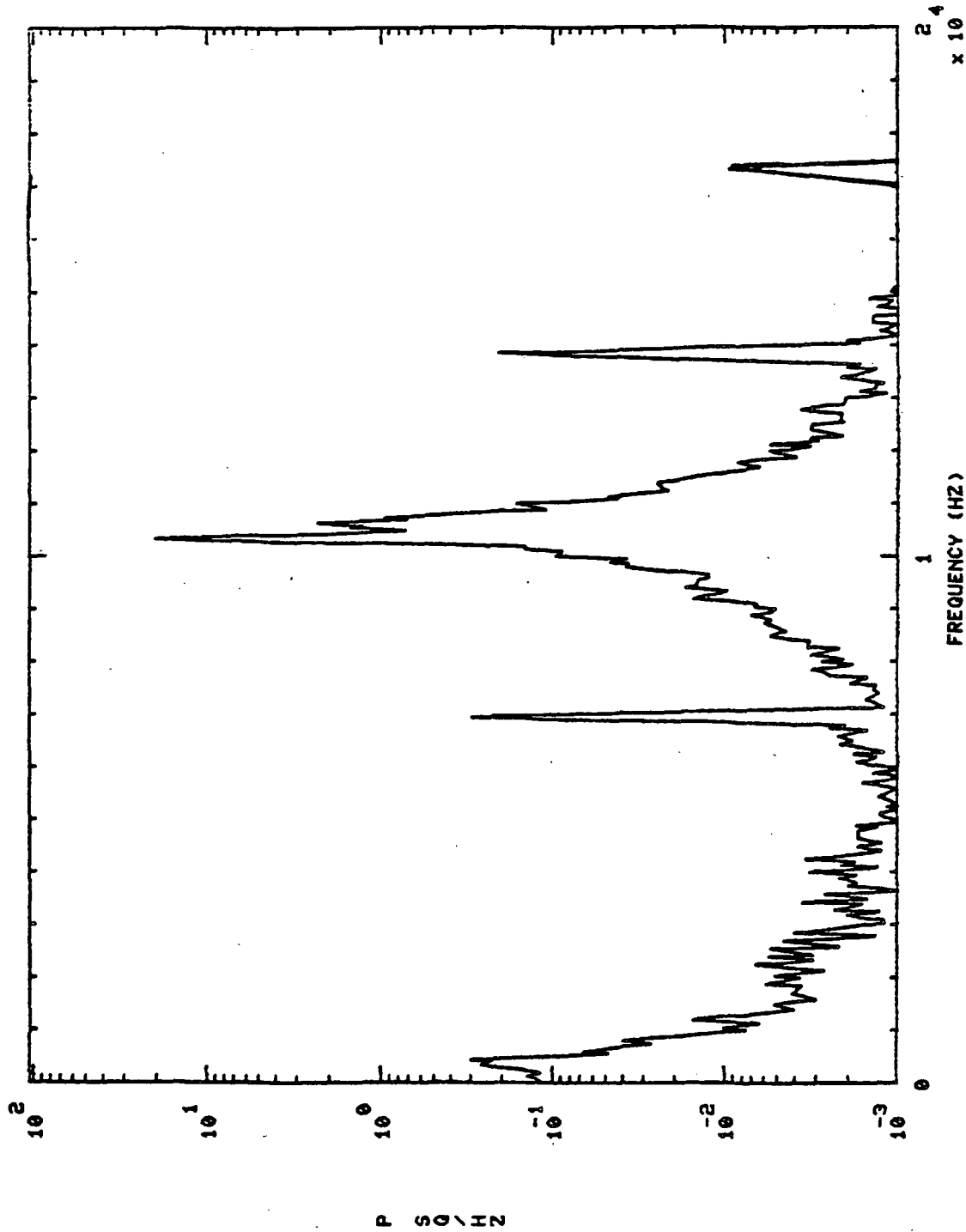
S+ 280.0

750114 OPB PC PR



5 + 30.01H0,'S

750114 HPFP DS PR

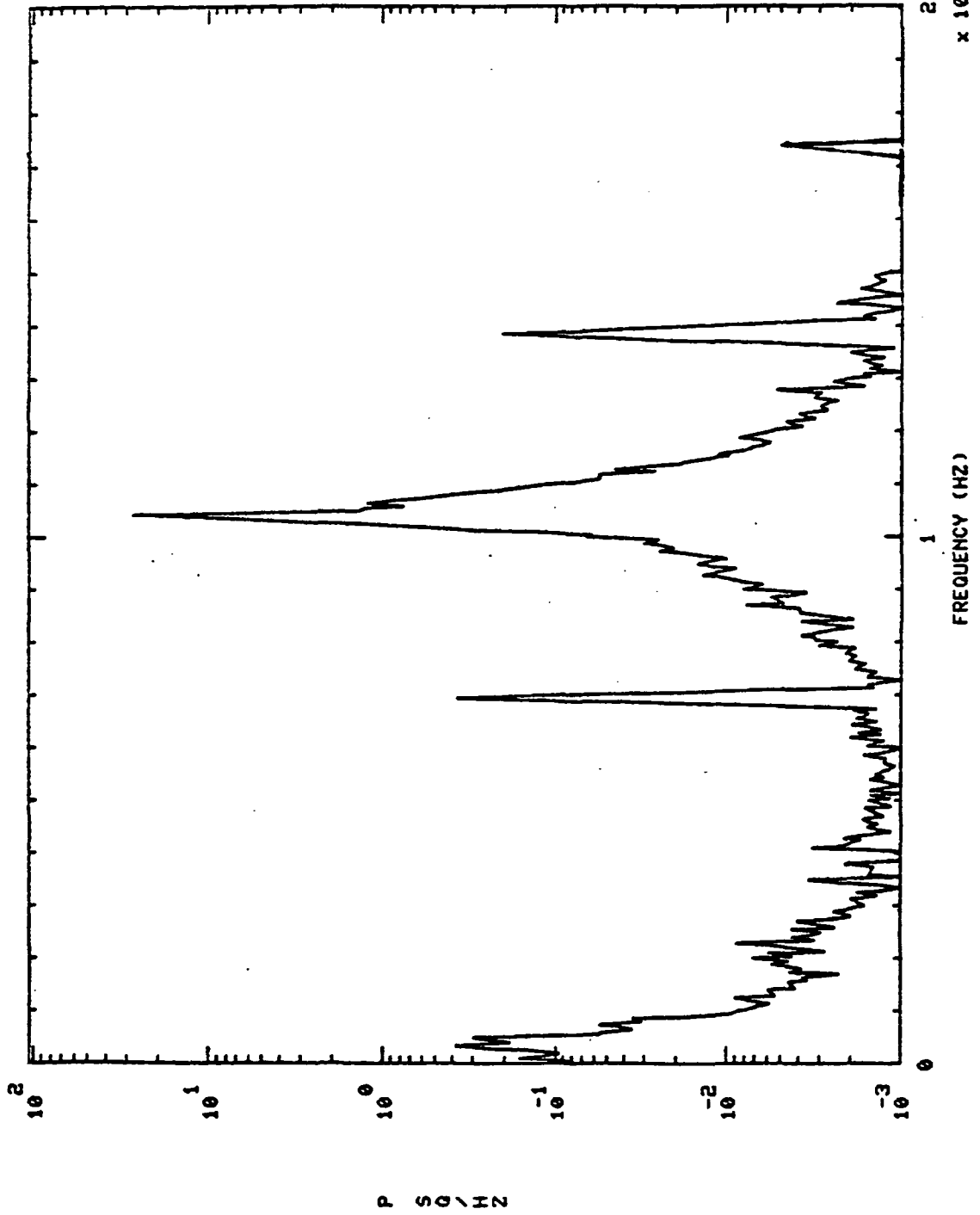


2^4
 $\times 10$

FREQUENCY (HZ)

S+ 150.01H0,'S

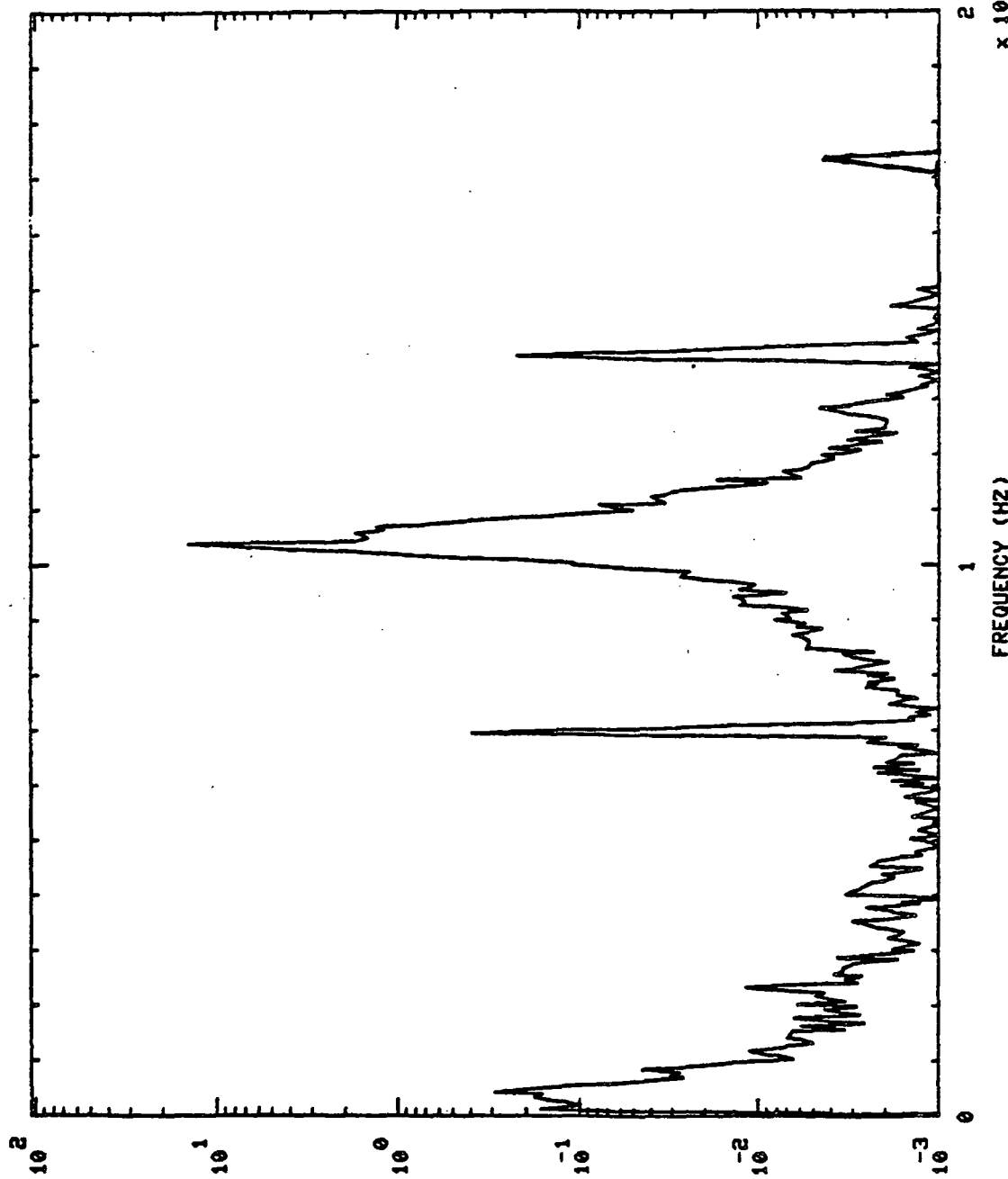
750114 HPFP DS PR



S+ 280.01H0.'S

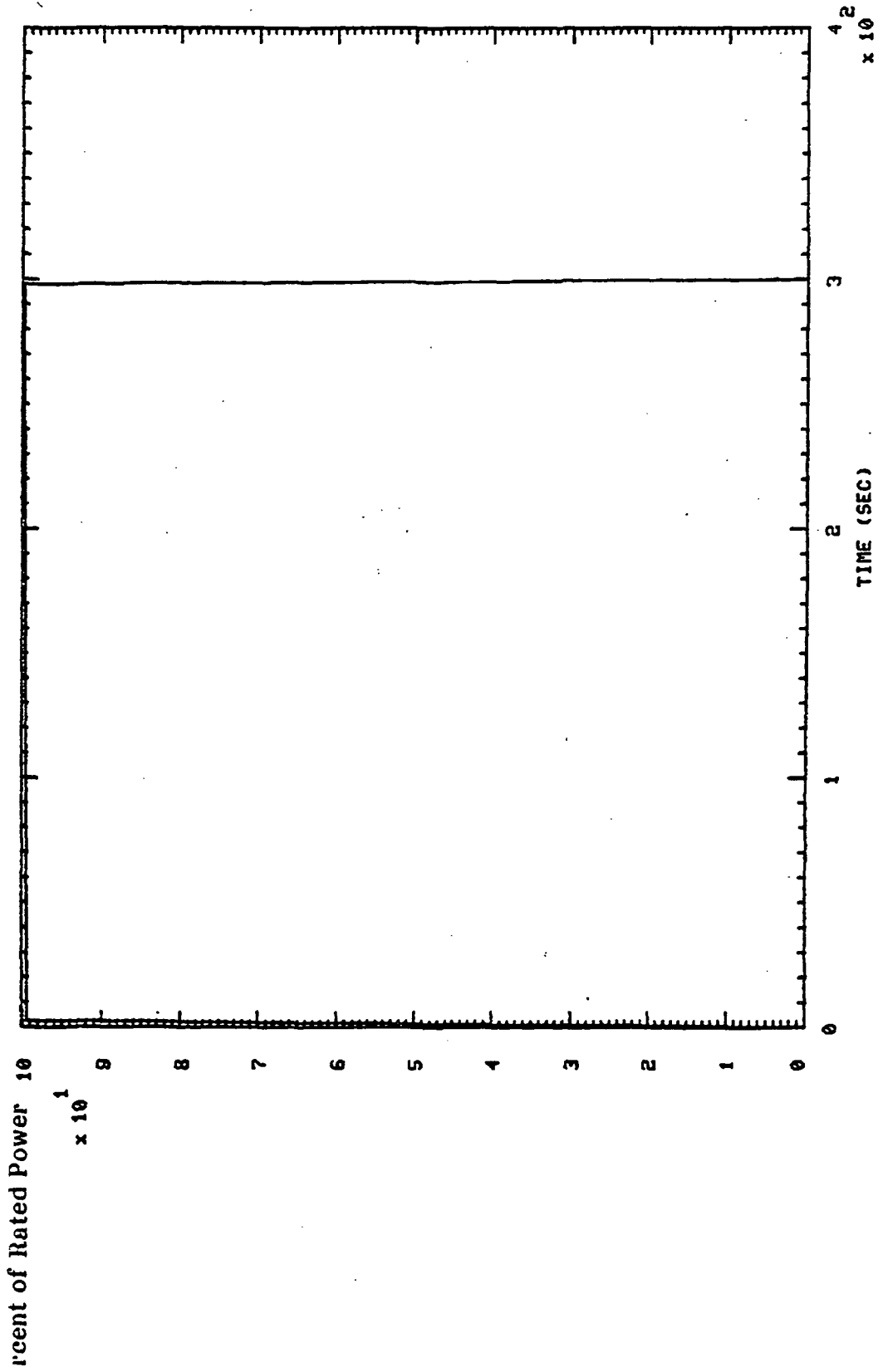
HPFP DS PR

750114

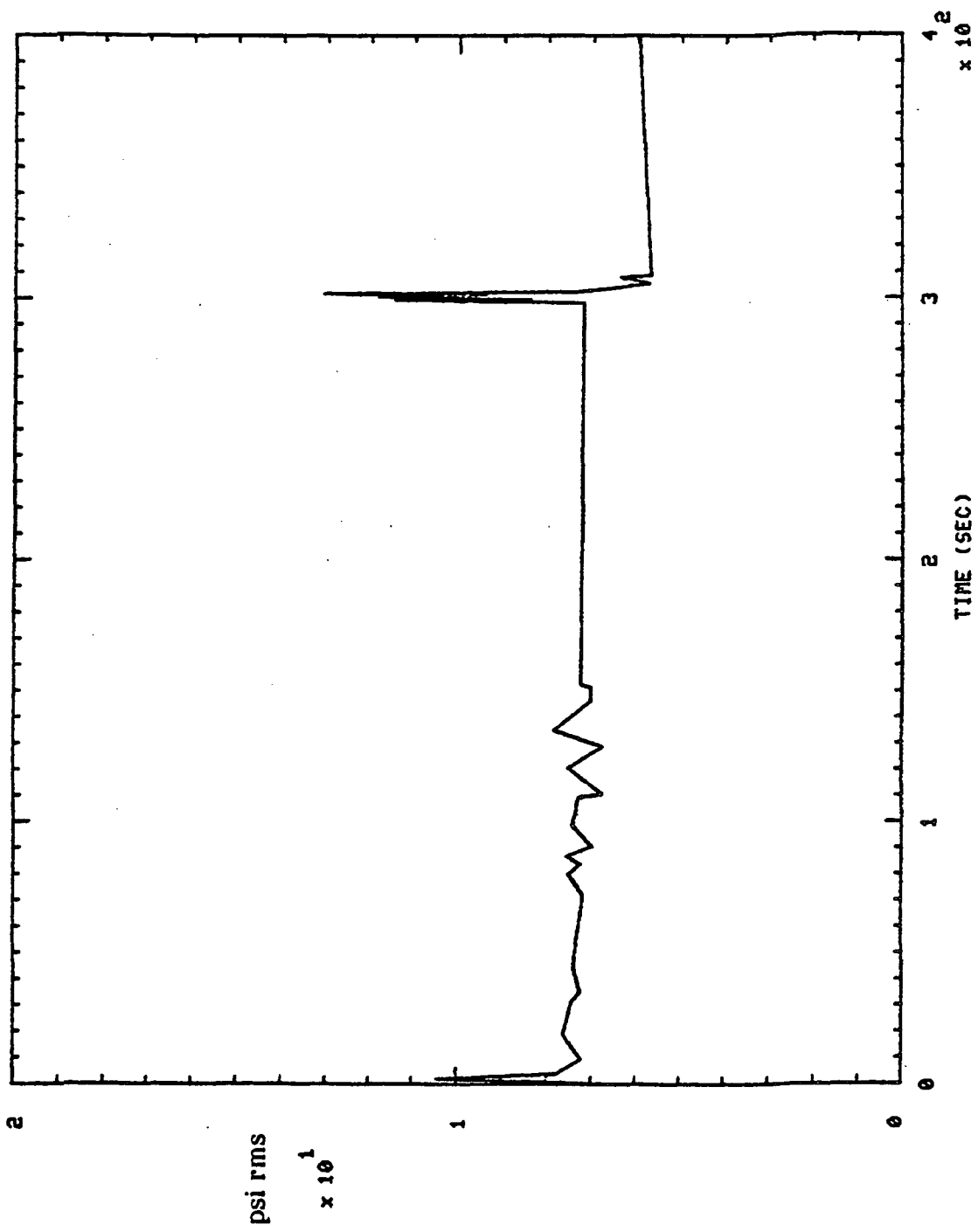


750115 THRUST

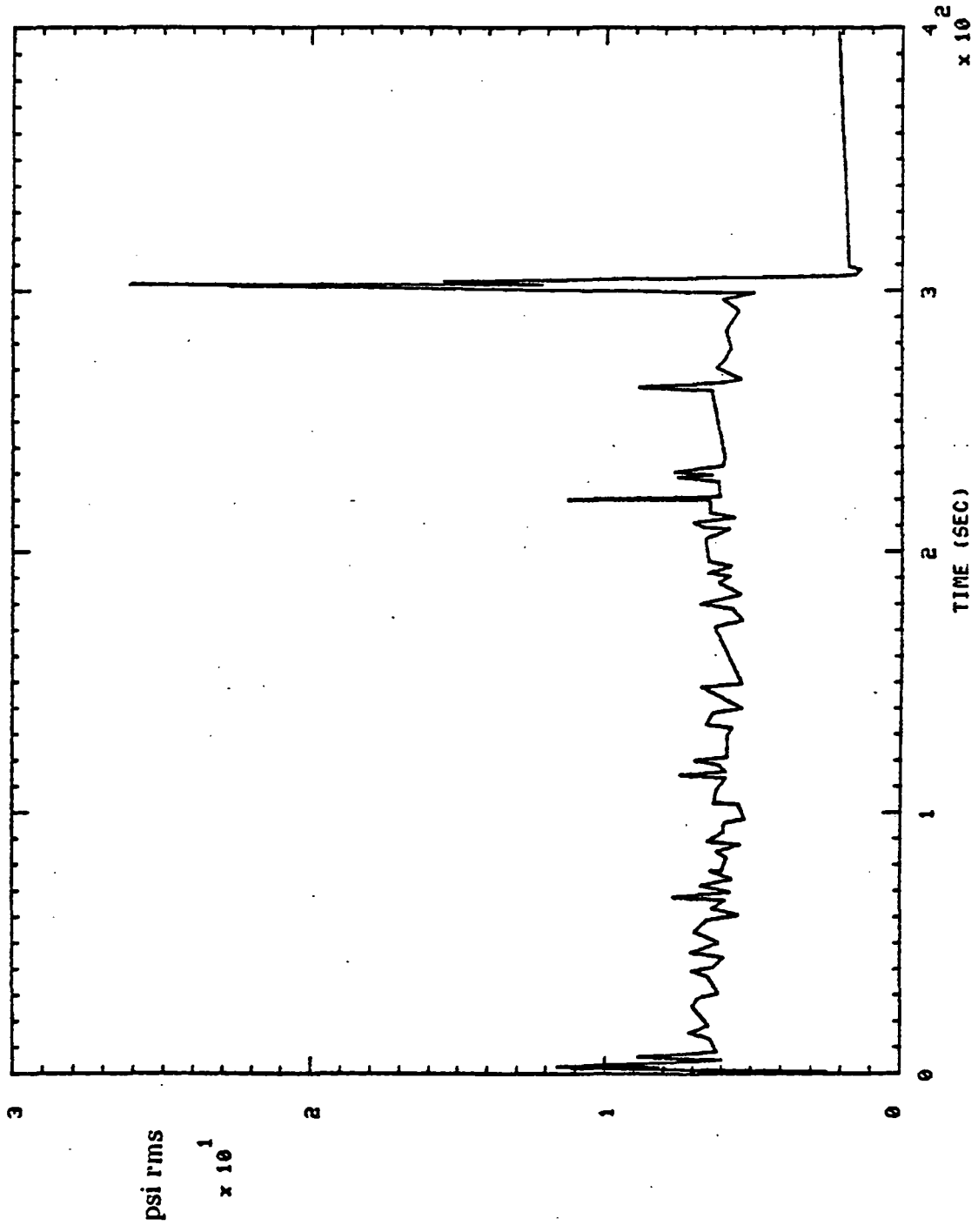
(UNFILTERED)



750115 LPOP DS PR (1 - 20K HZ)



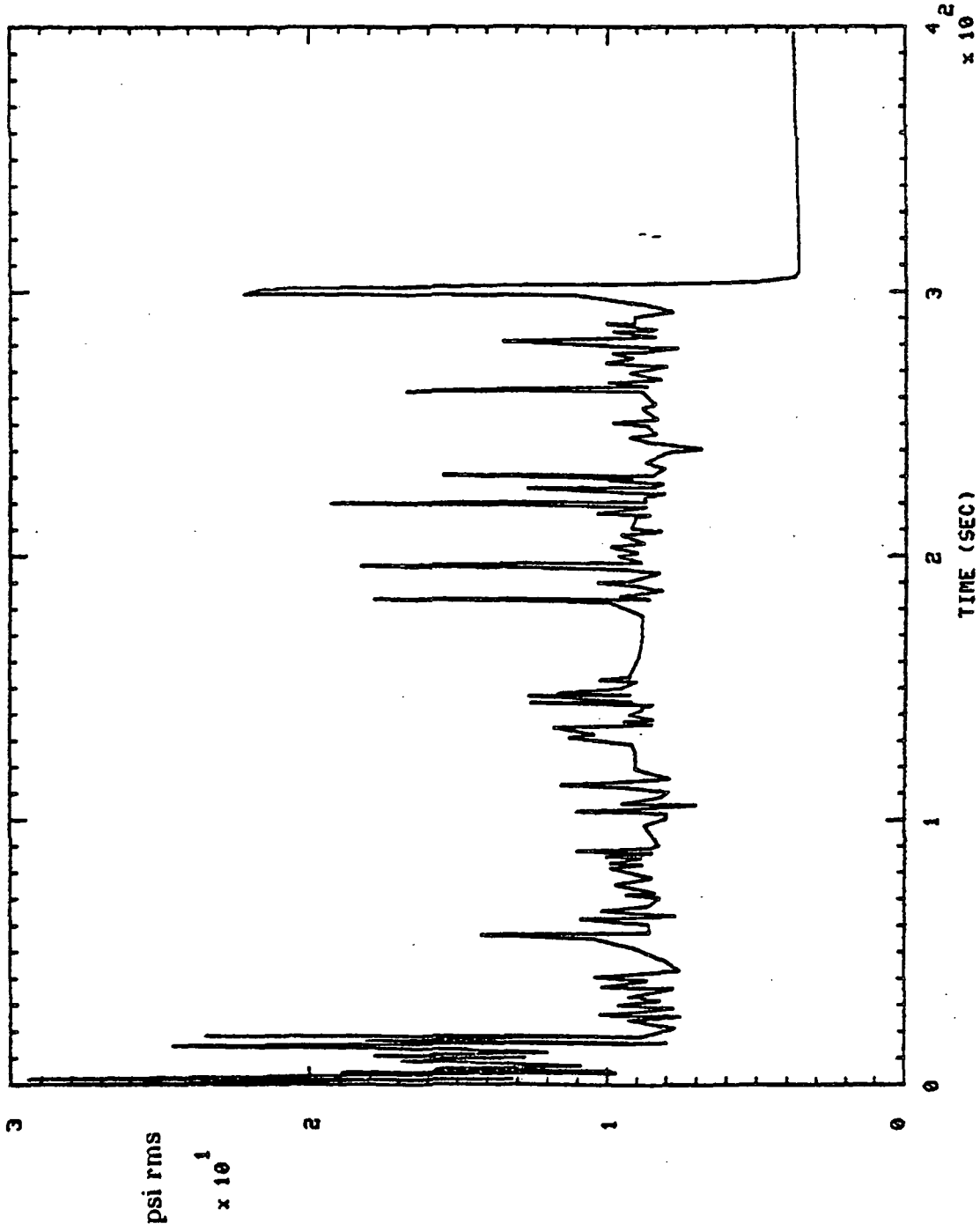
750115 HPOP BAL CAU PR2 (1 - 20K HZ)



750115

HPOP BAL CAU PRI

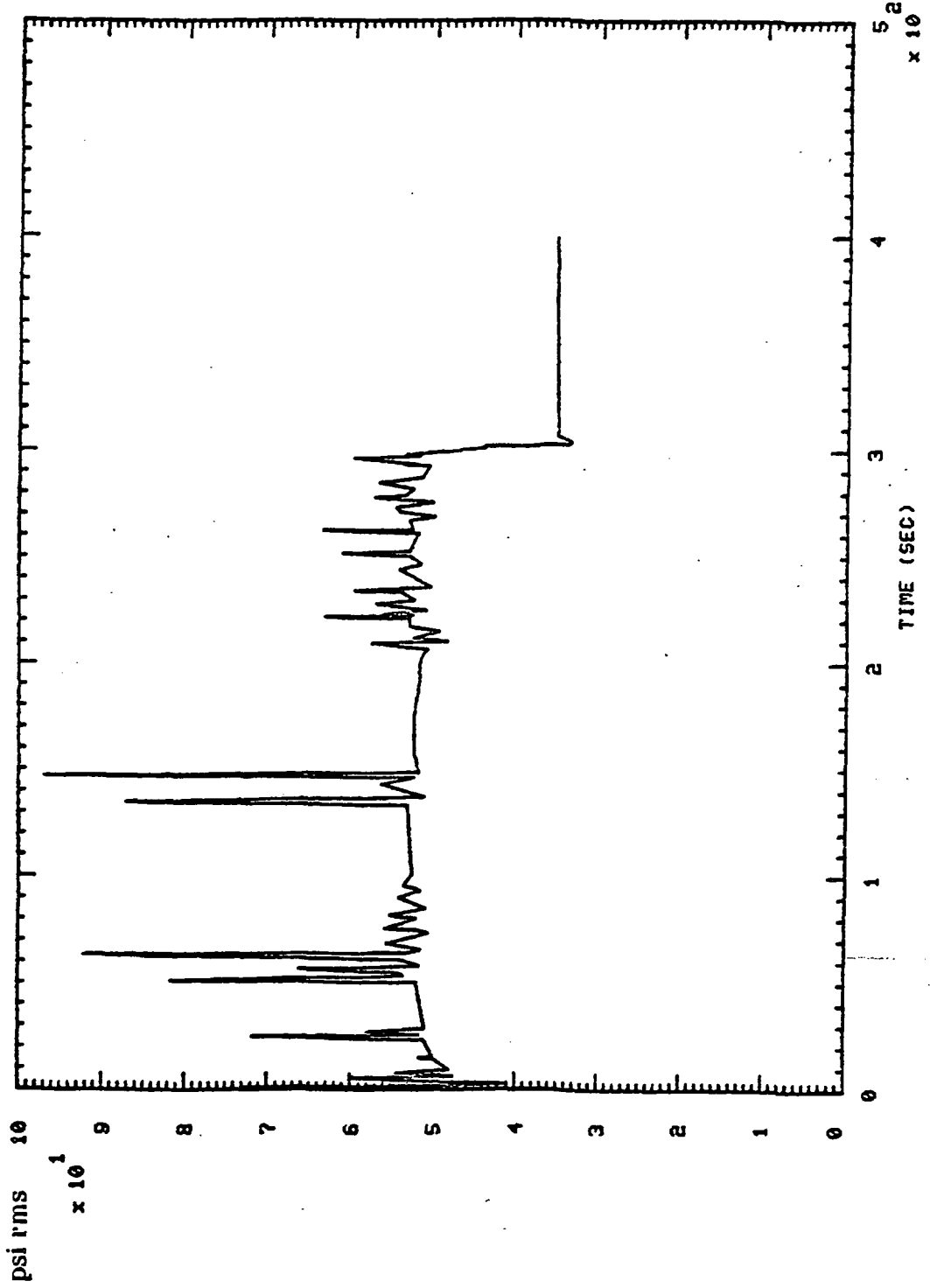
(1 - 20K HZ)



750115

MCC HOT GAS IN PR

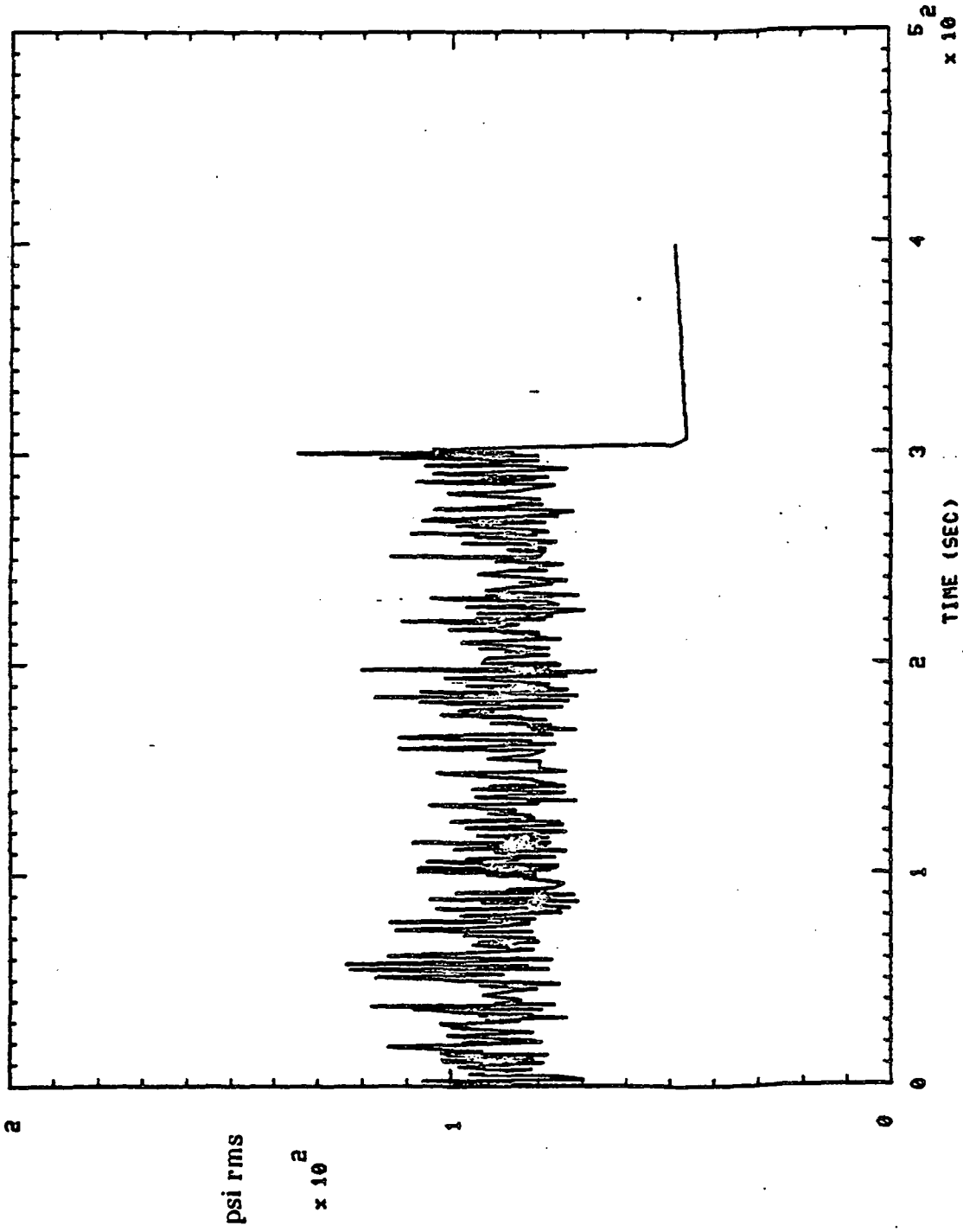
(1 - 20K HZ)



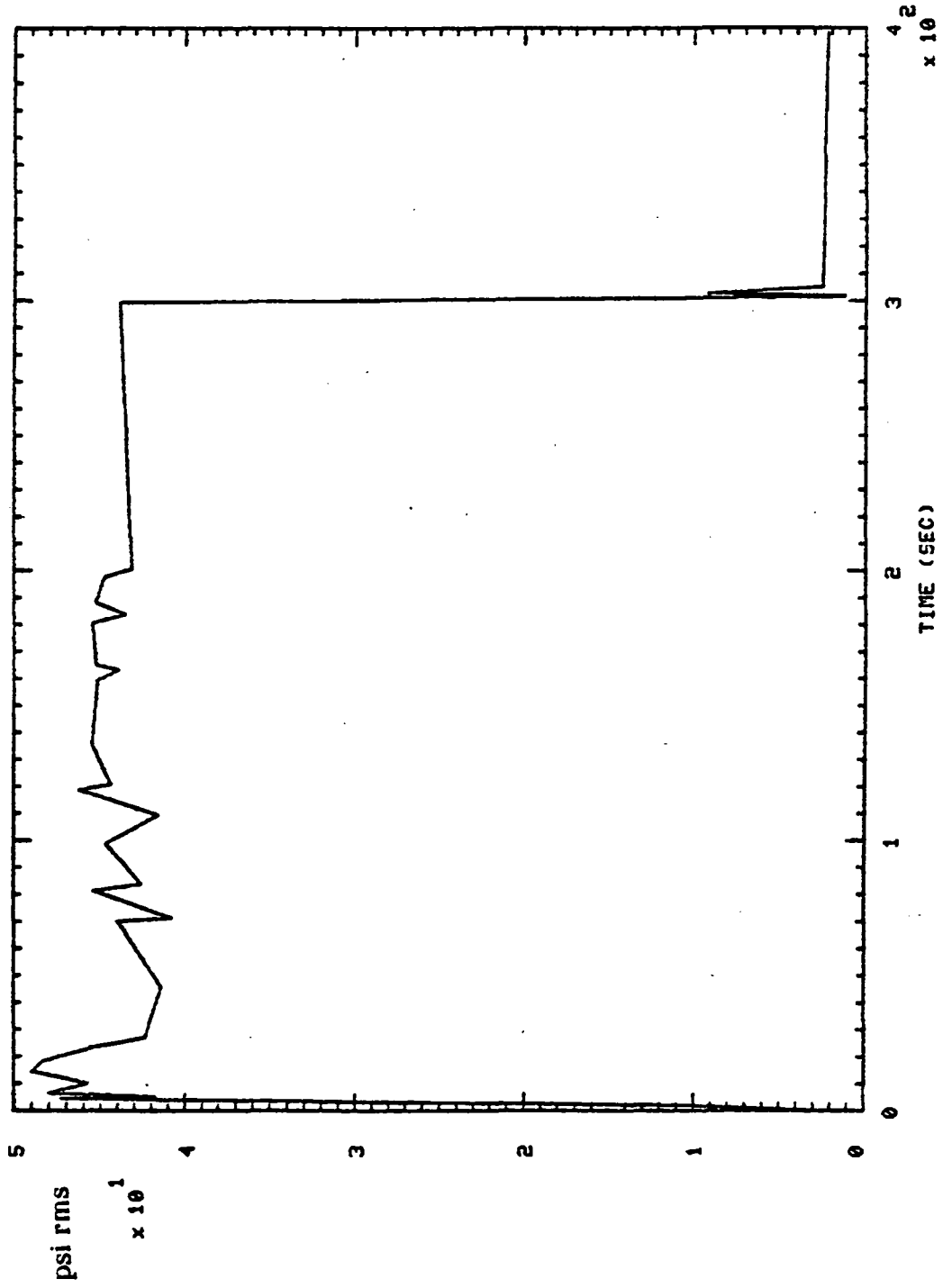
750115

PBP DS PR

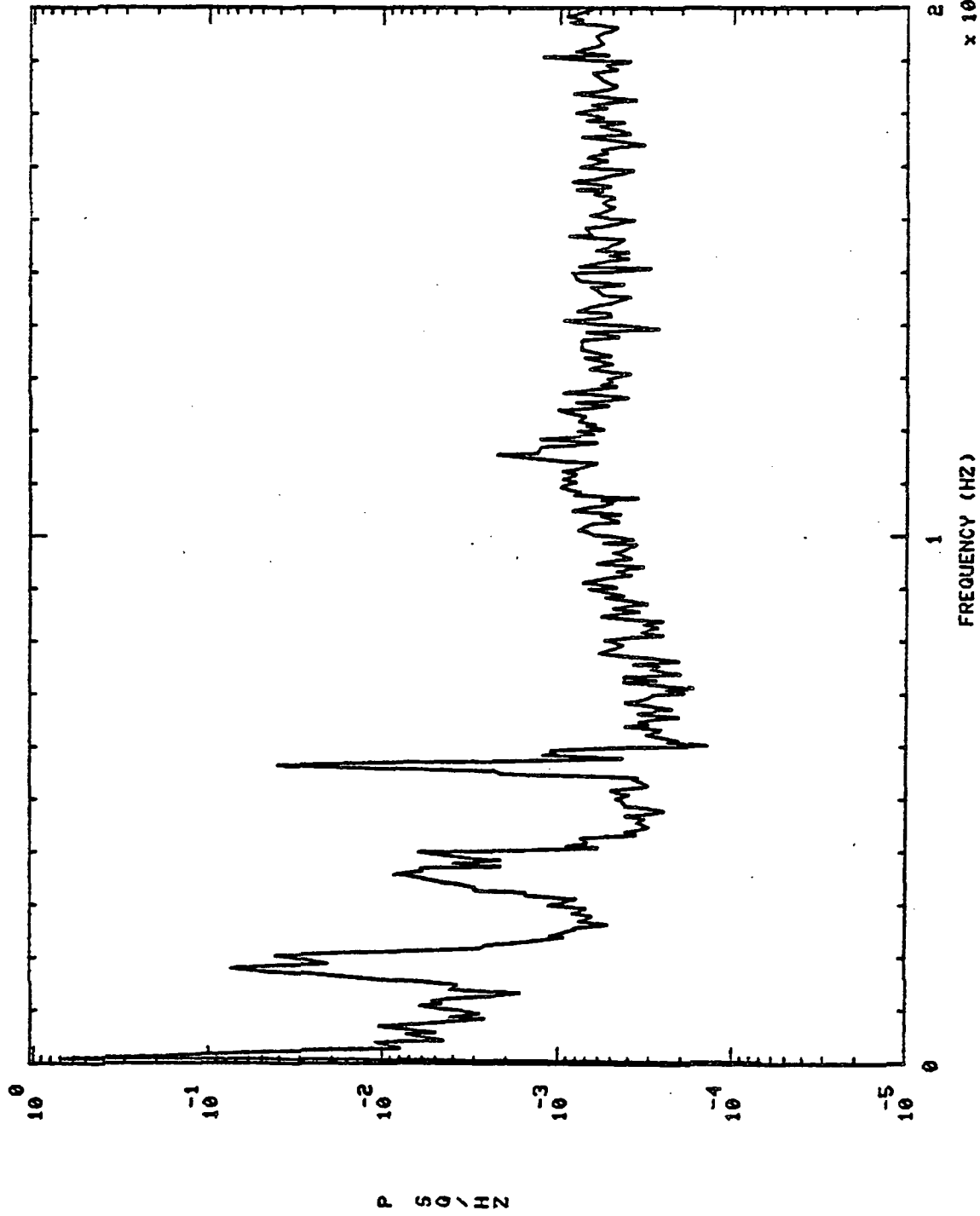
(1 - 20K HZ)



750115 MPFP DS PR (1 - 20K HZ)

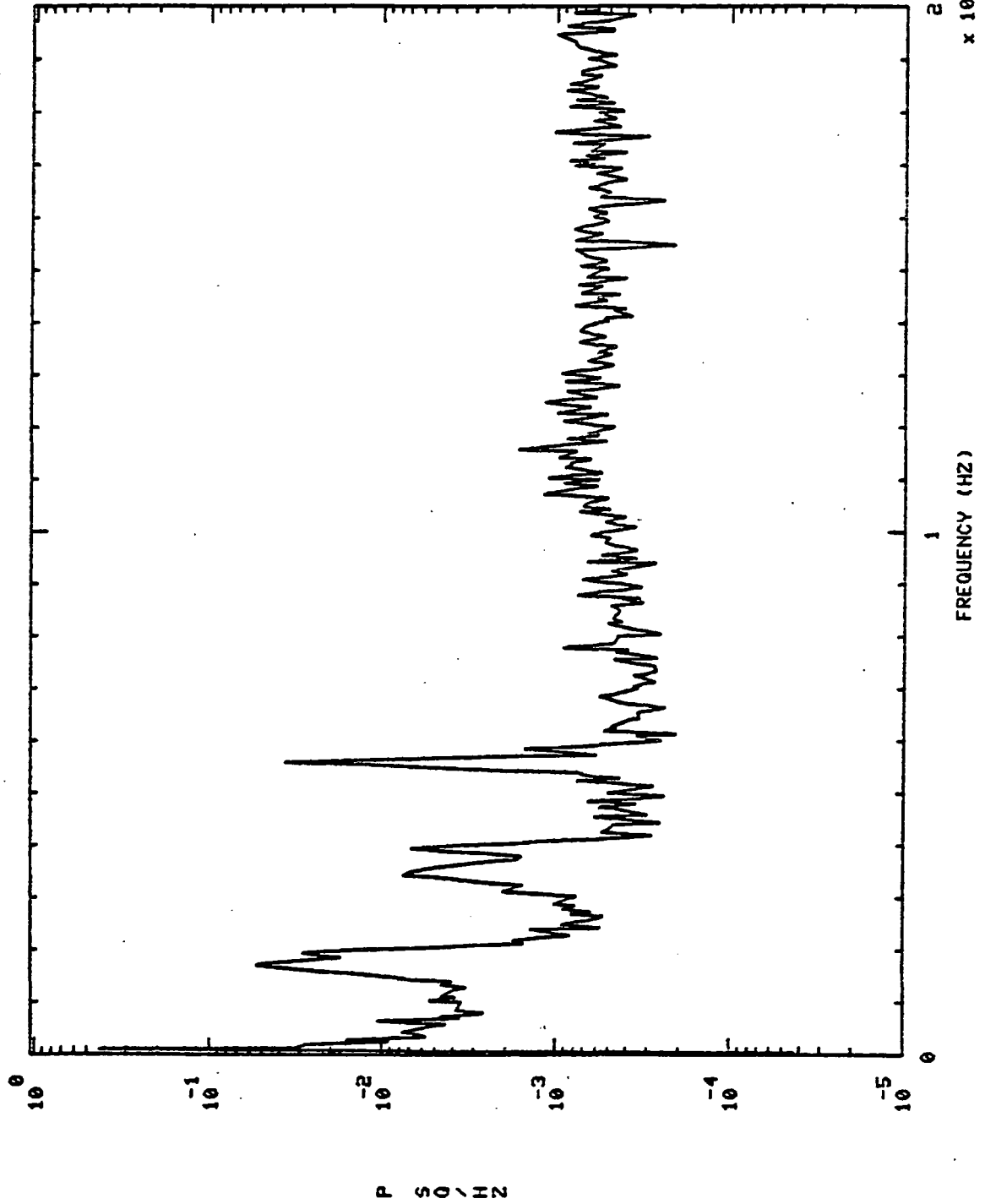


750115 LPOP DS PR S+ 30.01H0,'S



S+ 150.01H0,'S

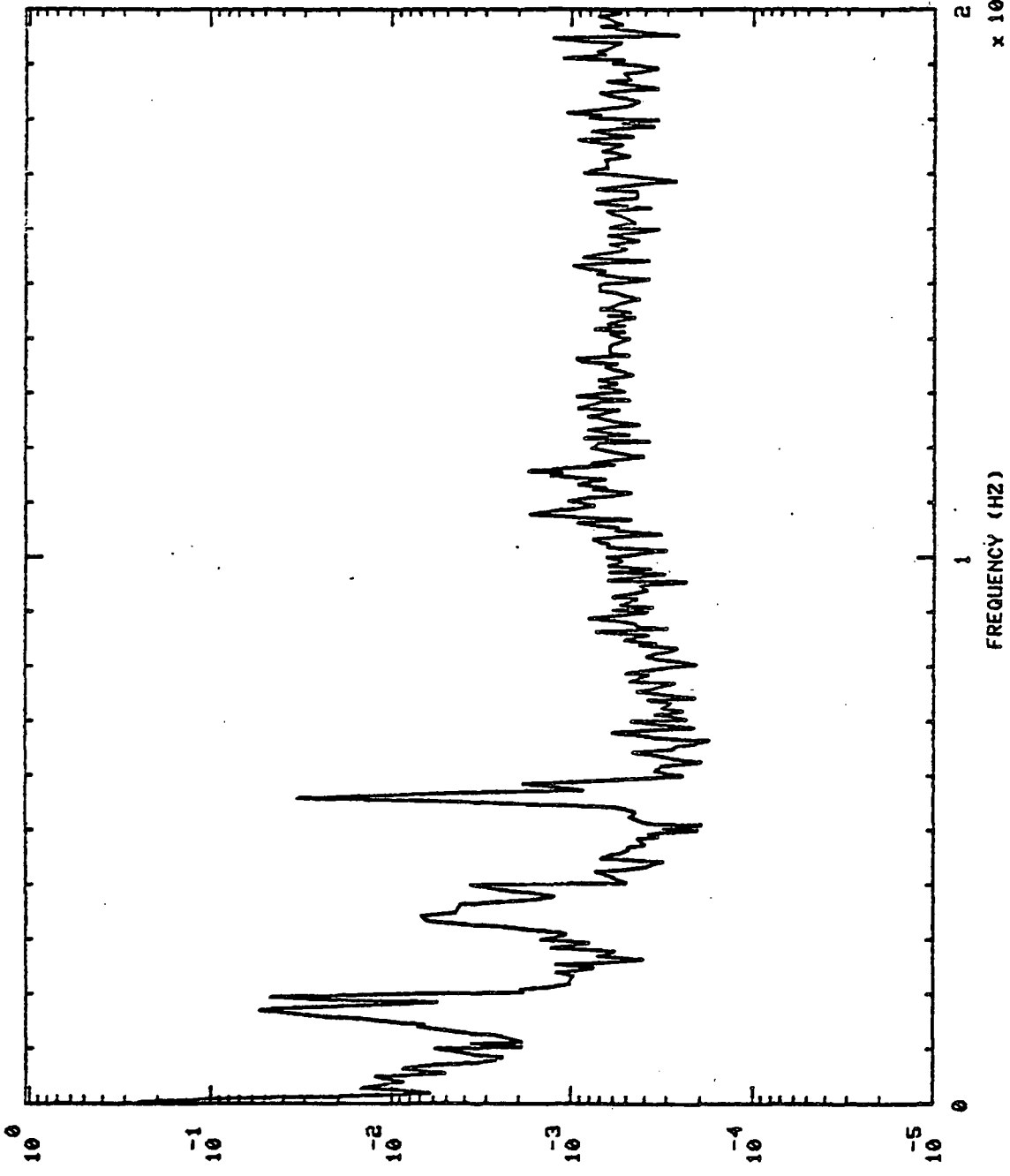
750115 LPOP DS PR



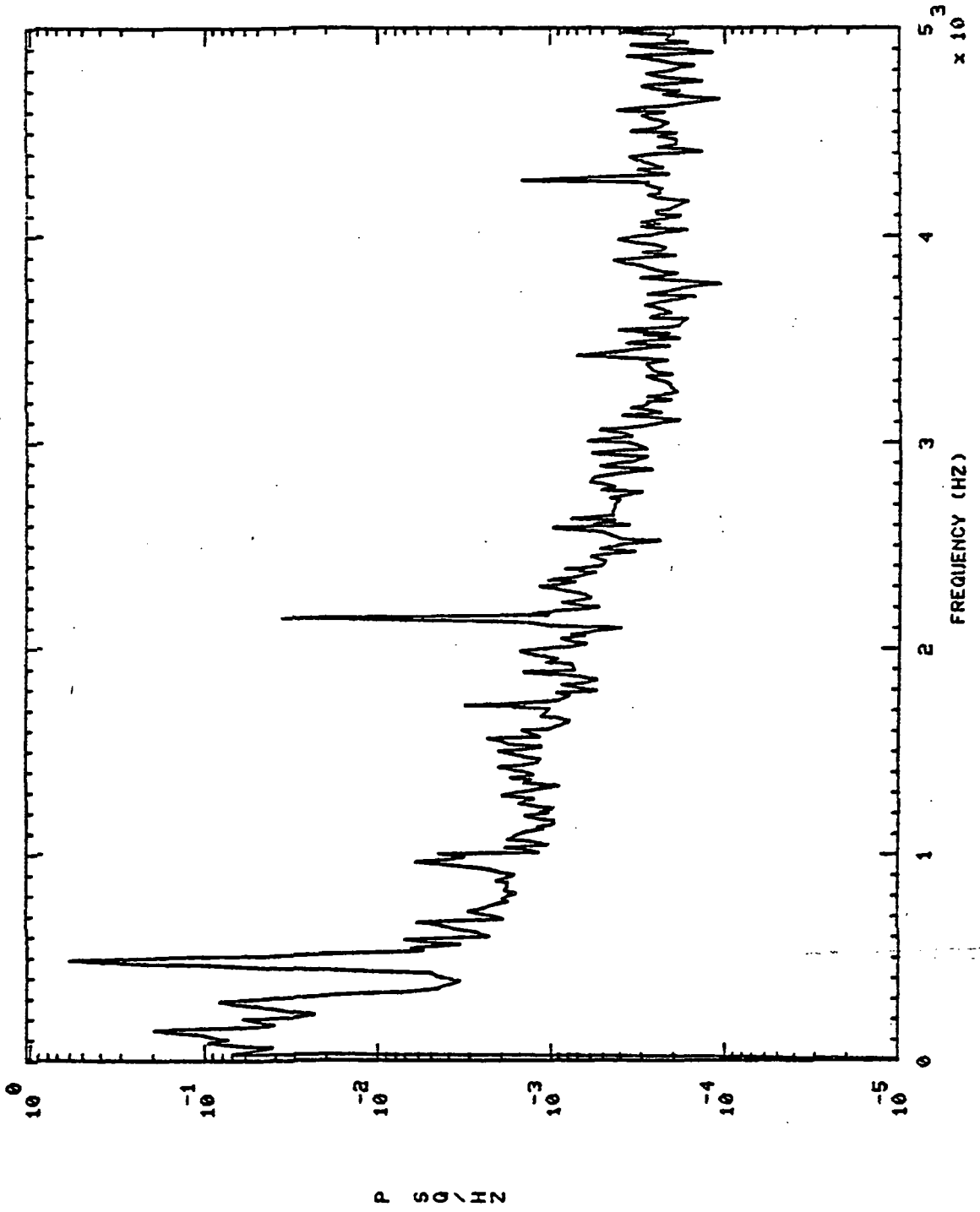
S+ 280.01H0,'S

LPOP DS PR

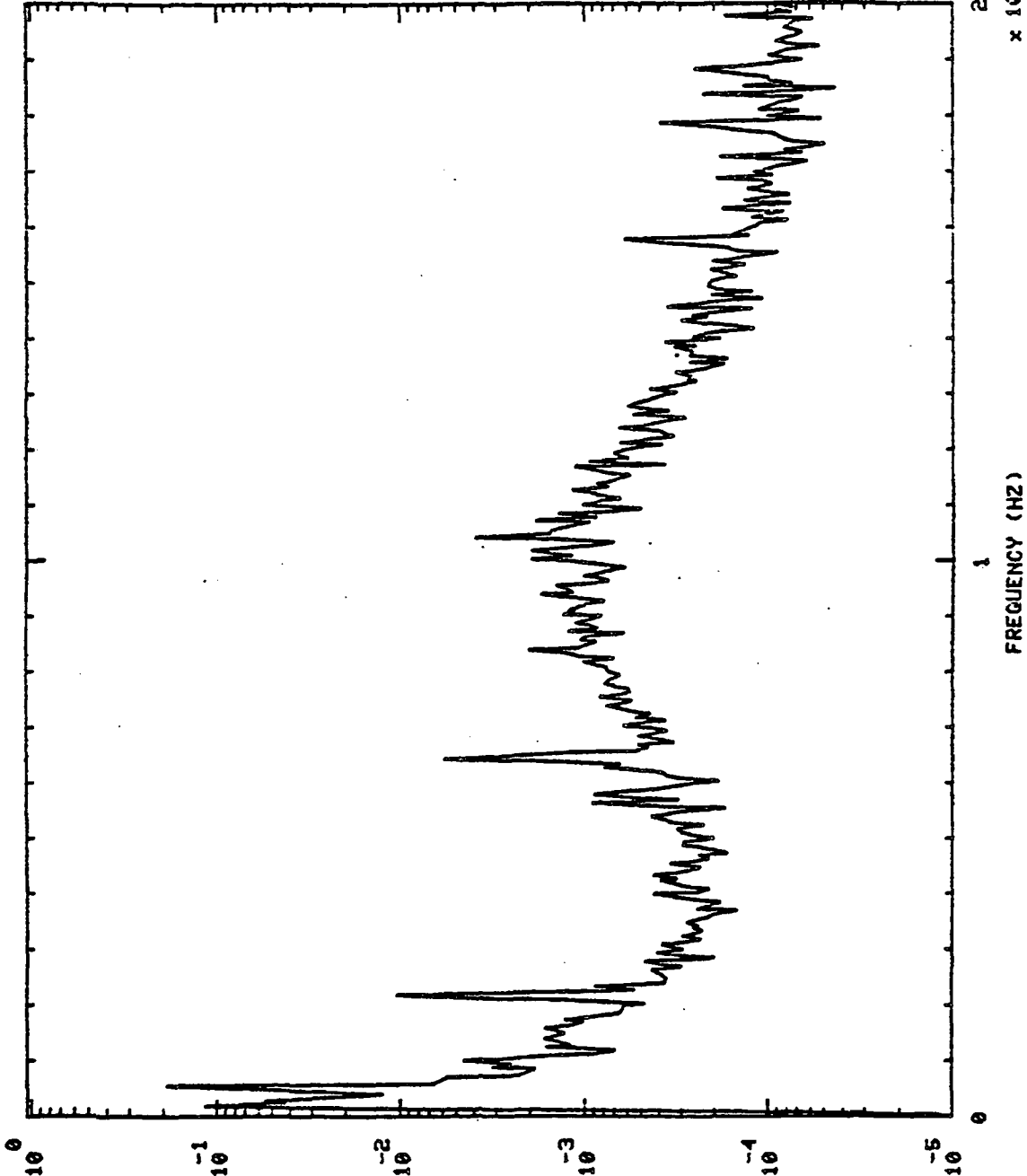
750115



750115 HPOP BAL CAU PR2 St 30.01H0,'S

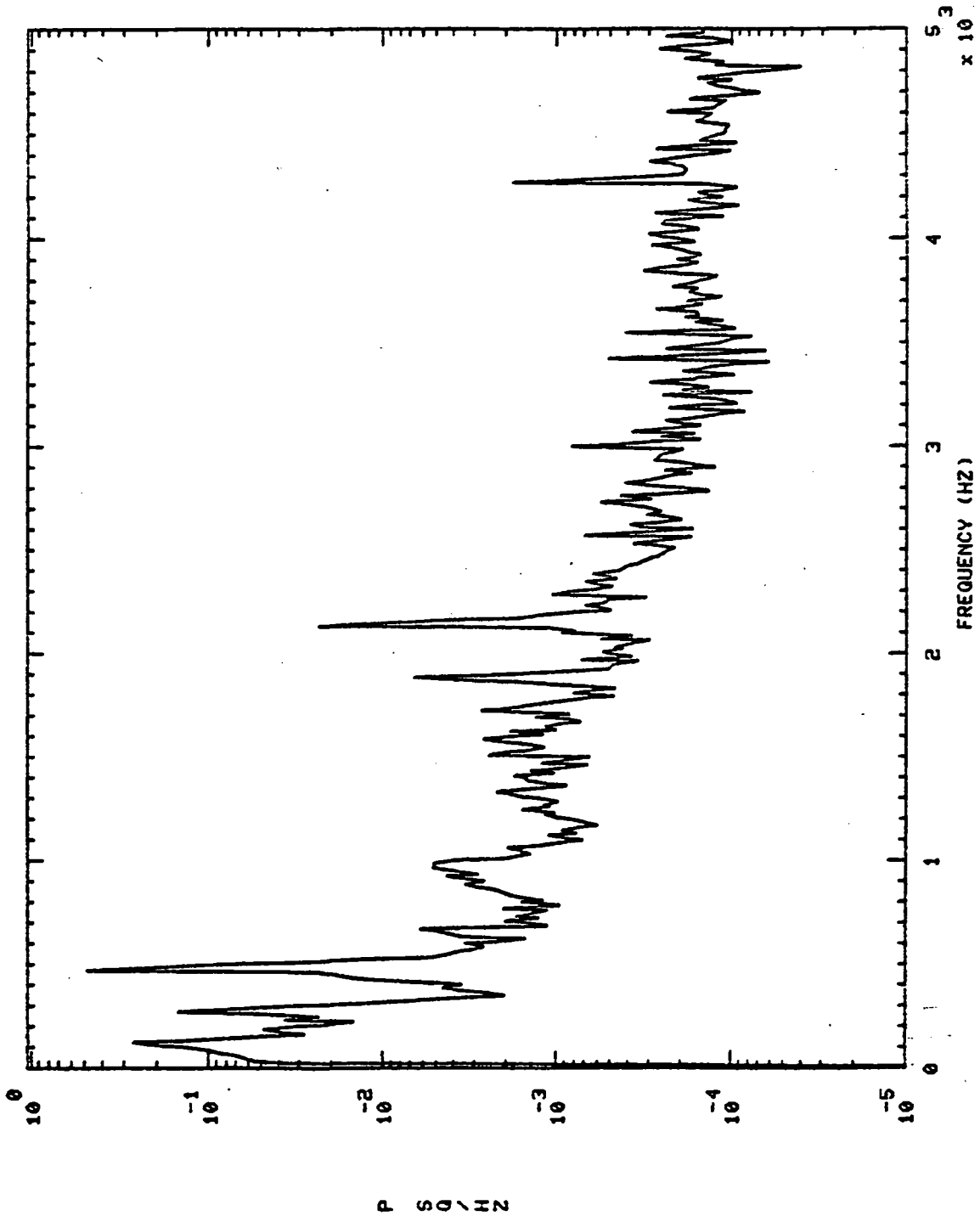


750115 MPOP BAL CAU PR2 S+ 30.01H0,'S

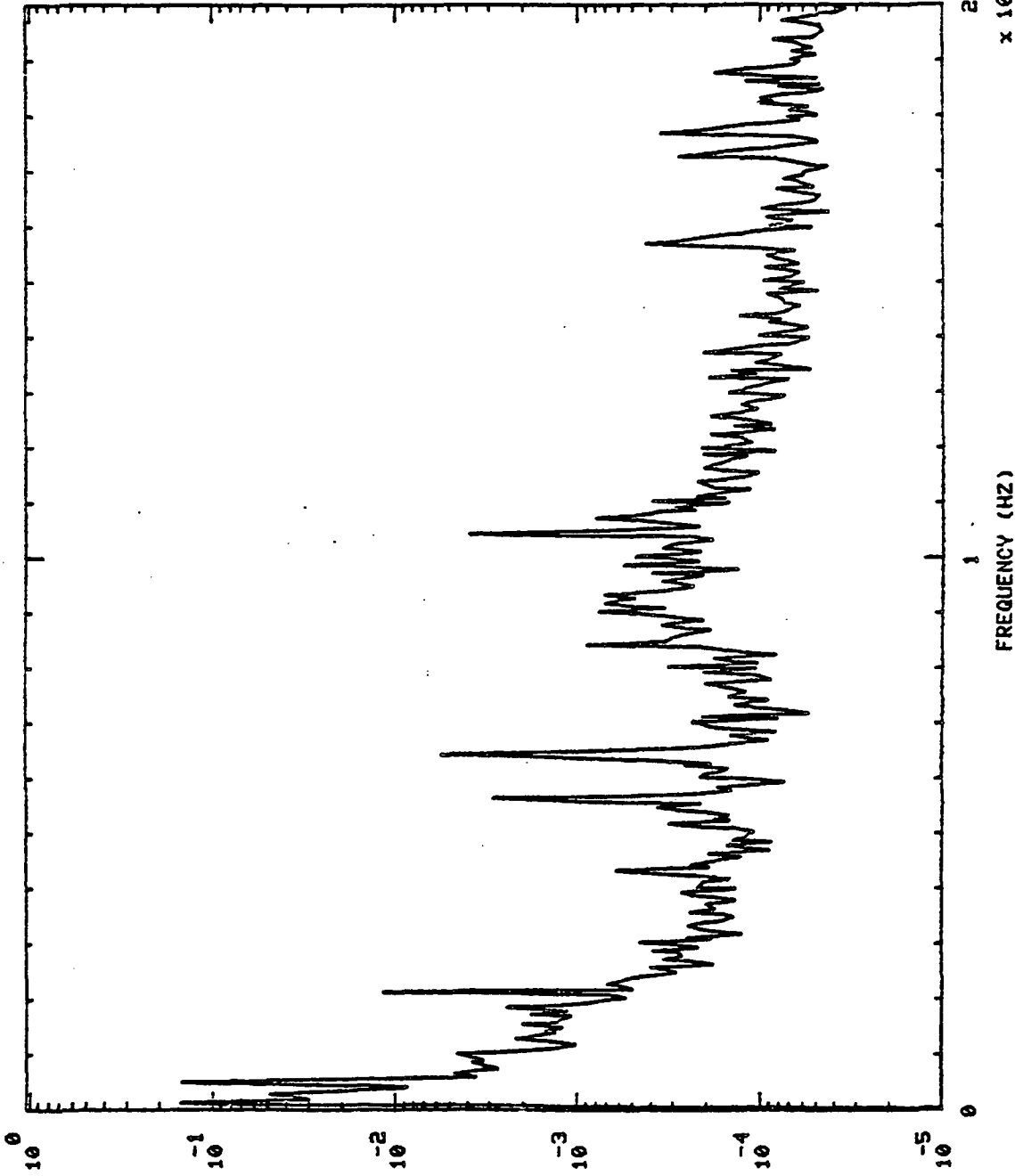


P 50\HZ

750115 HPOP BAL CAU PRE S+ 150.01H0.'S



750115 HPOP BAL CAU PR2 S+ 150.01H0.'S

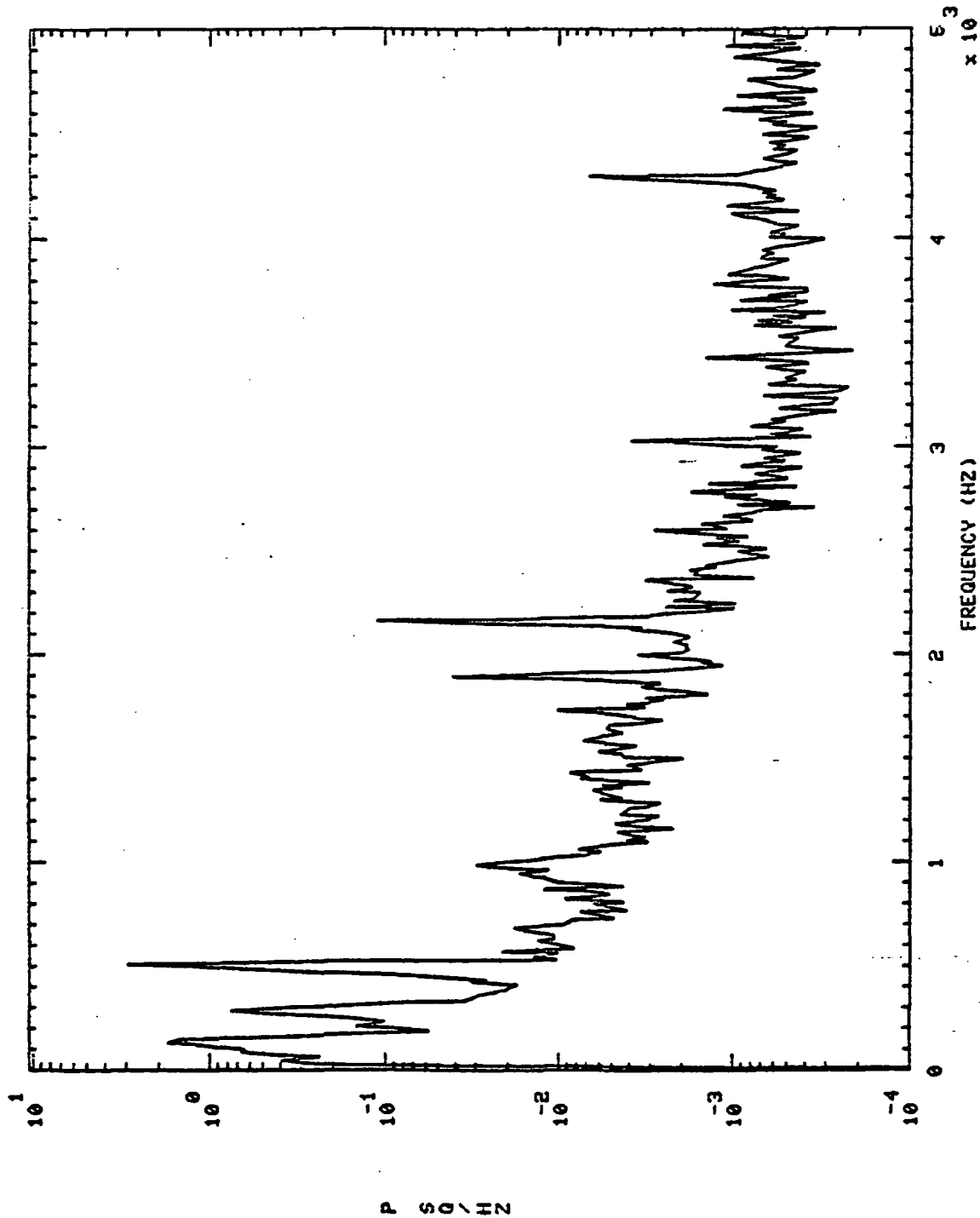


P SQ\HZ

FREQUENCY (HZ)

2.4
x 10⁴

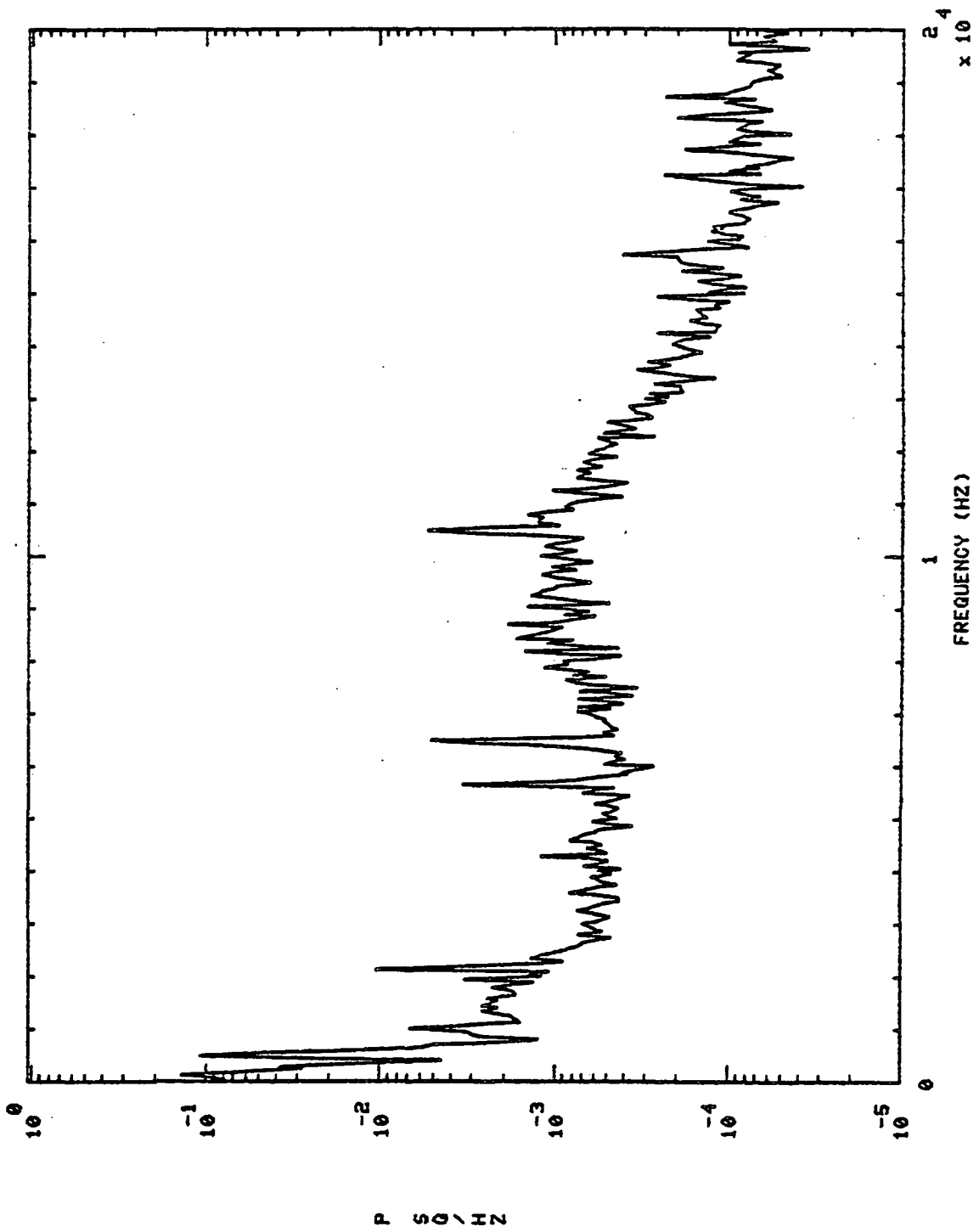
750115 HPOP BAL CAU PR2 S+ 280.0140,'S



750115

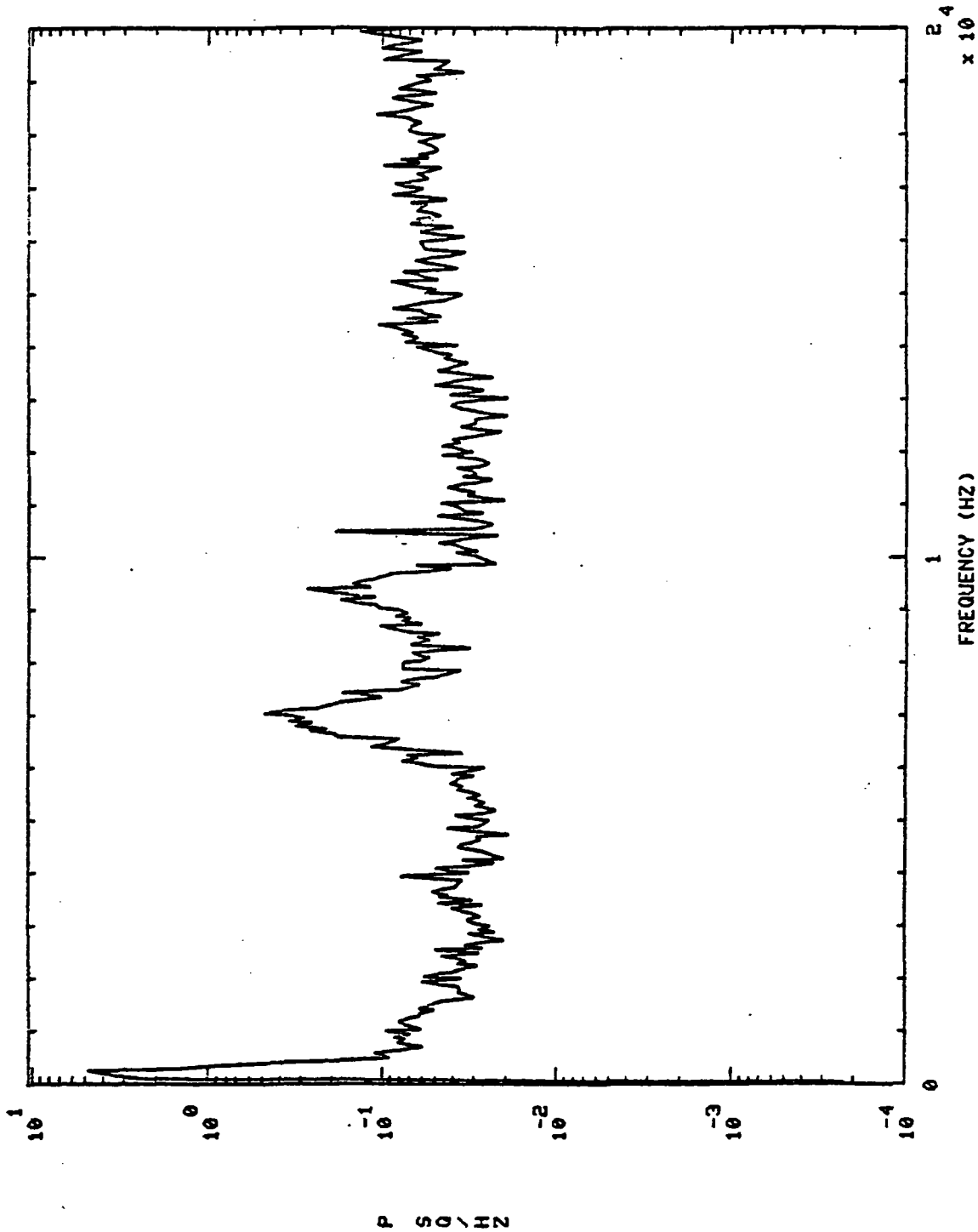
HPOP BAL CAU PR2

S+ 280.01H0,'S



750115 MCC HOT GAS IN PR S: 30.01H0.'S

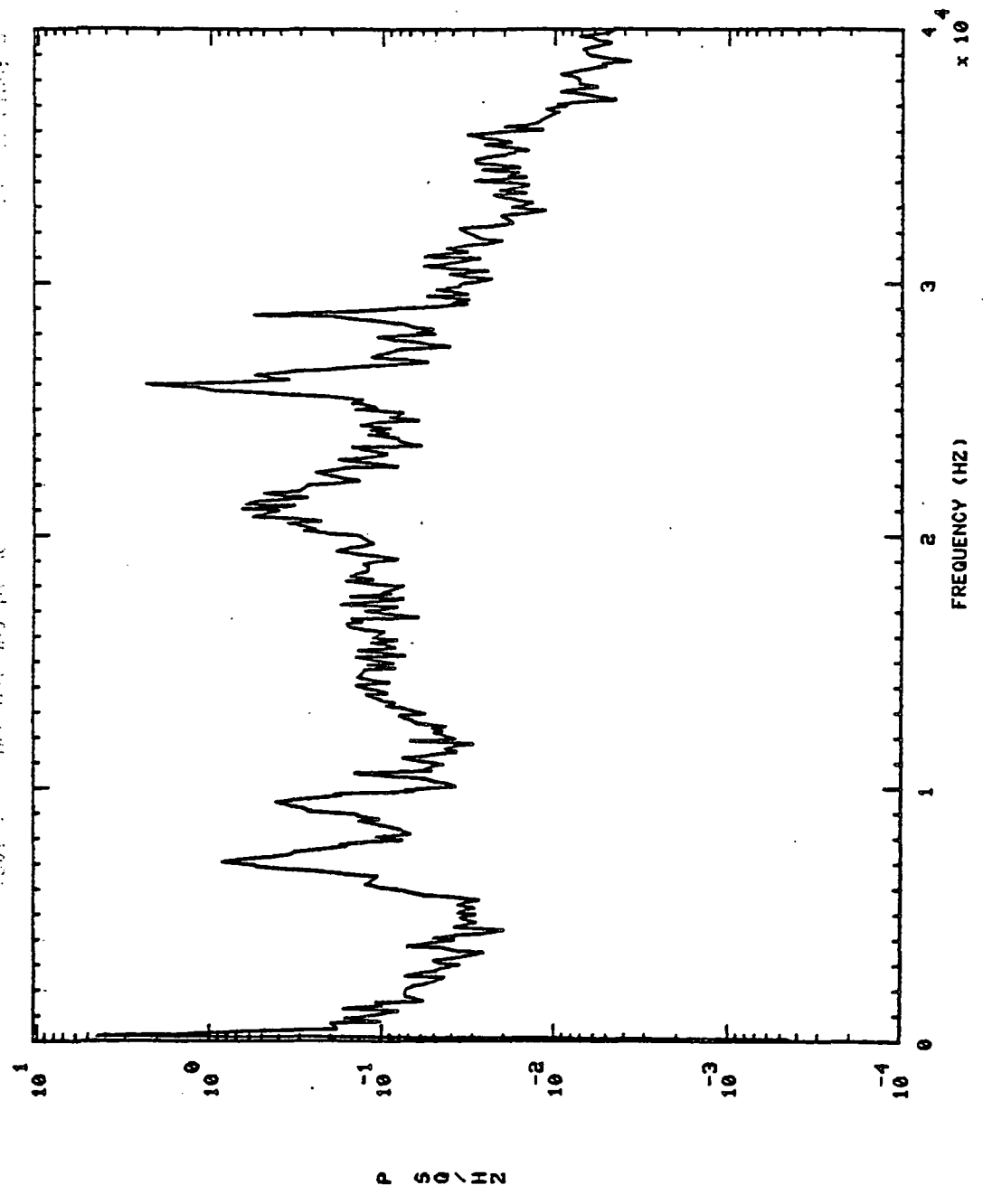
750115 MCC HOT GAS IN PR



St 30.01H0, S

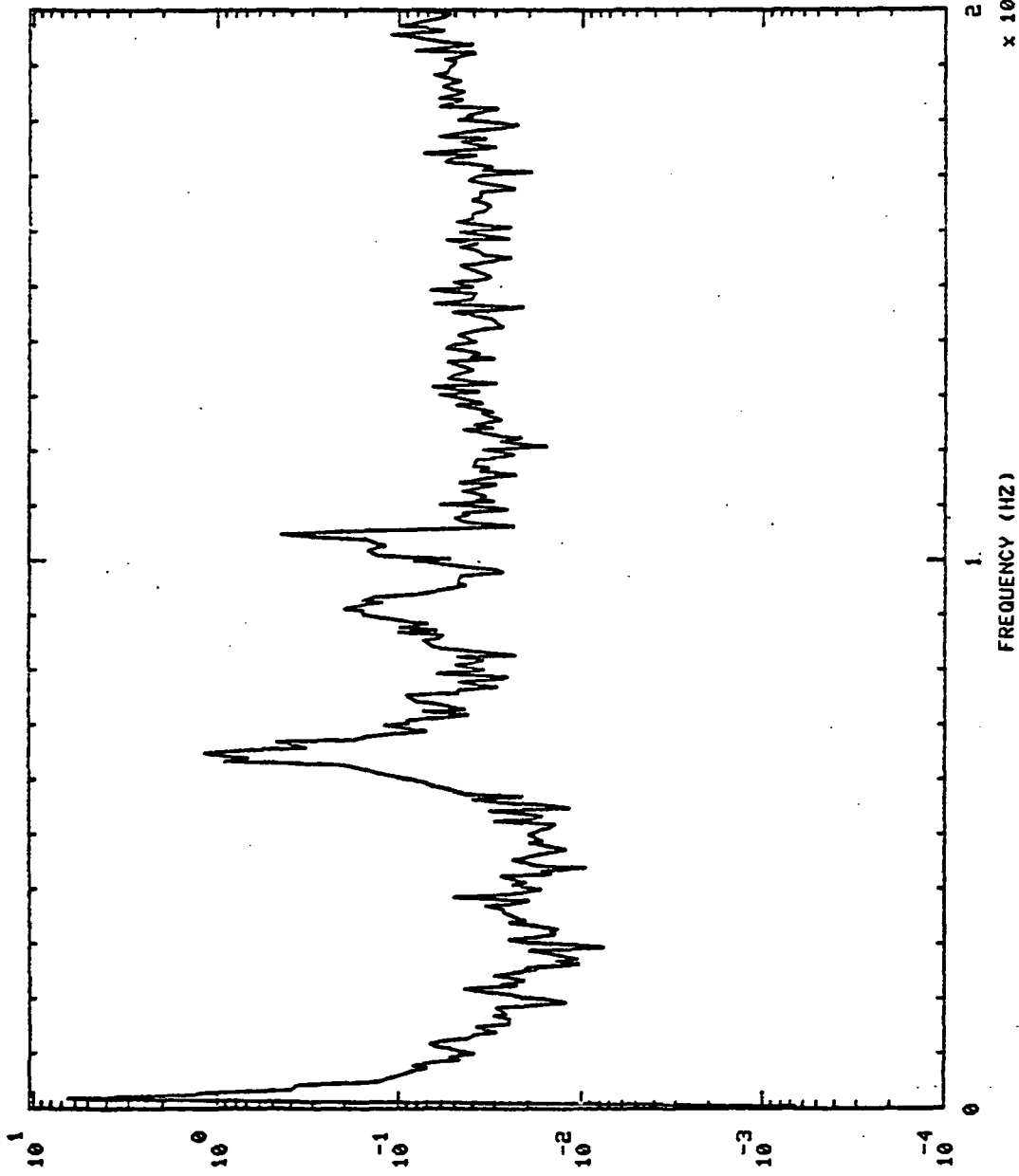
MCC HOT GAS IN PR

750115



750115 MCC HOT GAS IN PR S+ 150.01H0,'S

750115 MCC HOT GAS IN PR

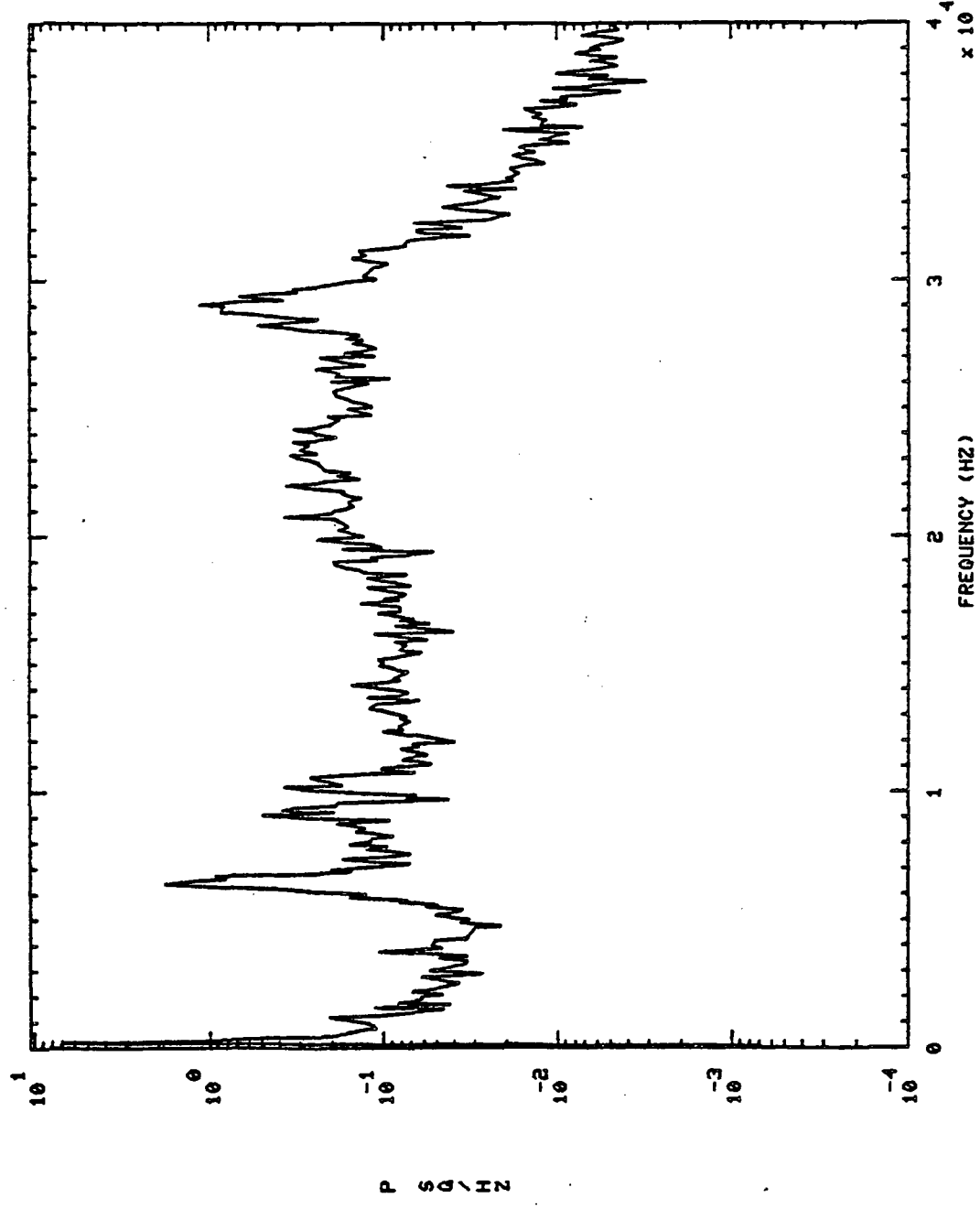


P S D / H Z

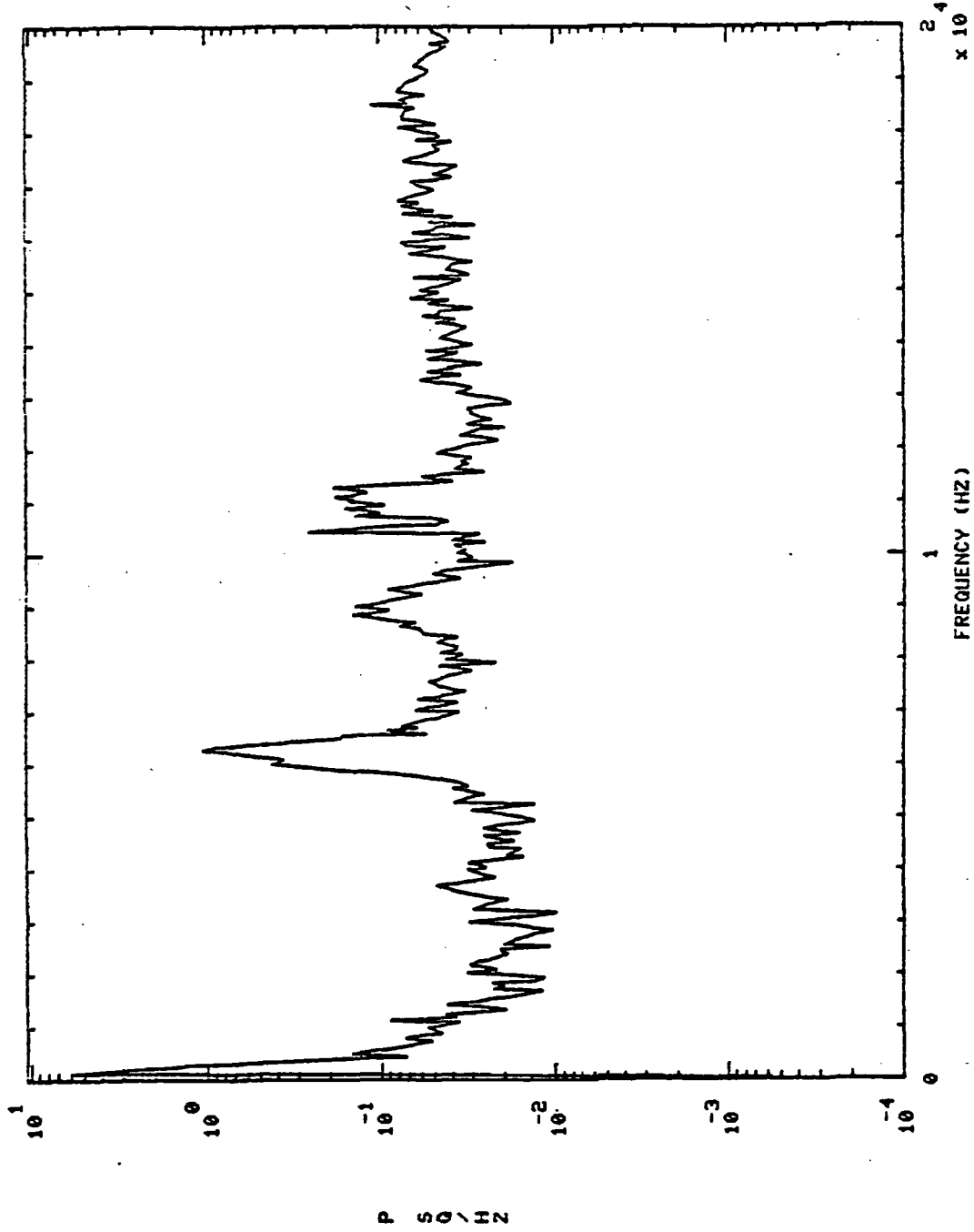
FREQUENCY (HZ)

x 10⁴

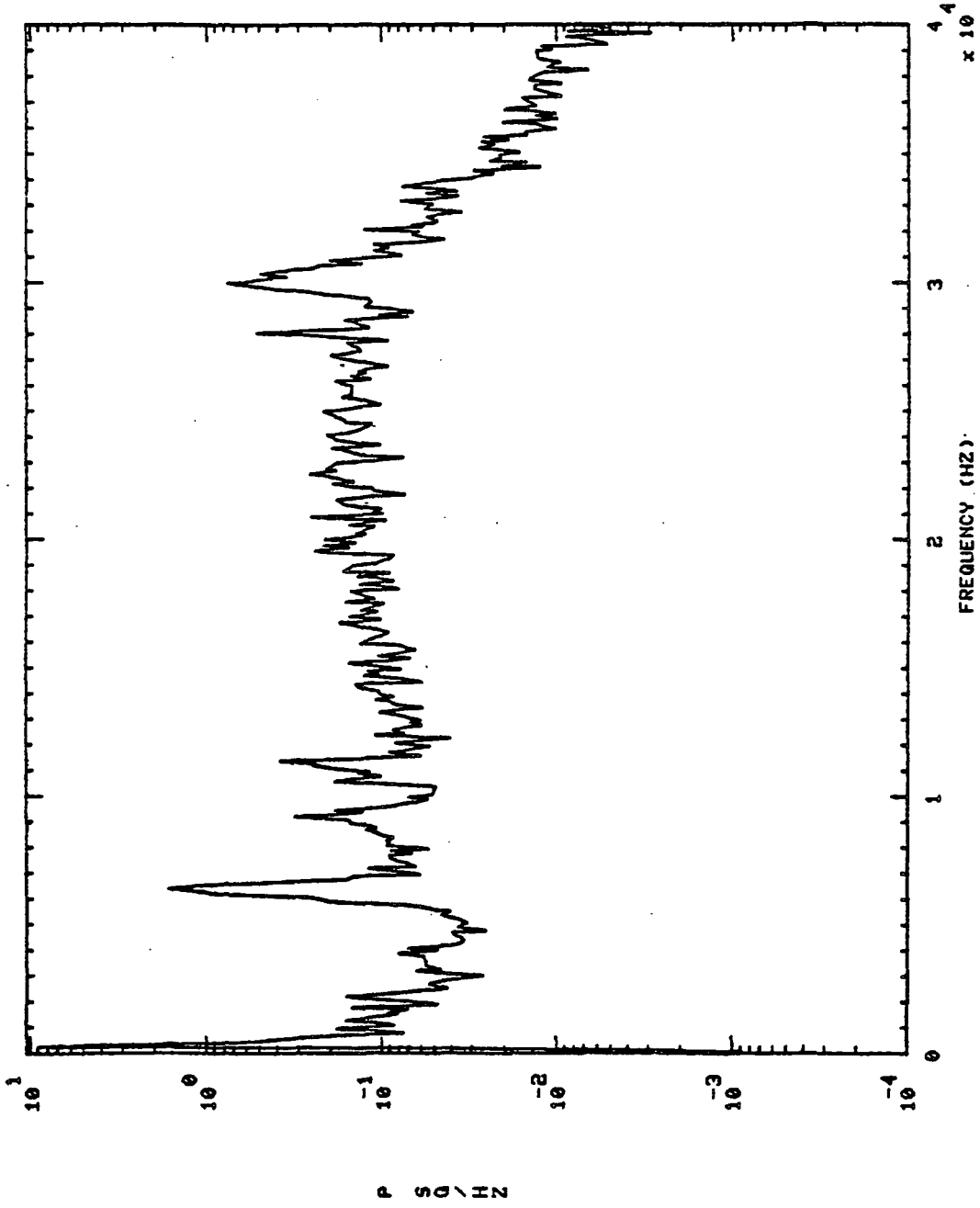
750115 MCC HOT GAS IN PR S+ 150.01H0, 'S



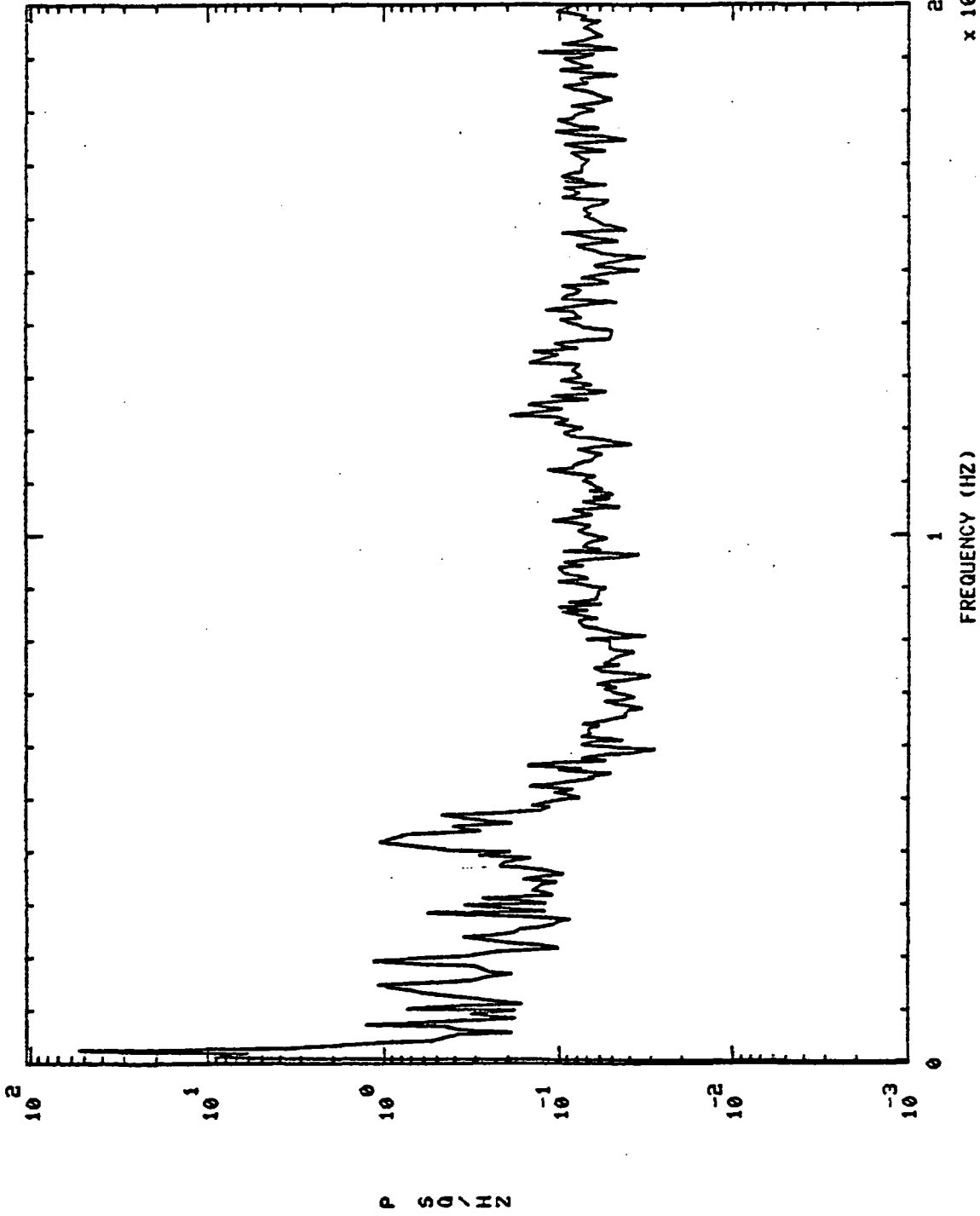
750115 MCC HOT GAS IN PR S+ 230.01H0,'S



750115 MCC HOT GAS IN PR S+ 280.01H0,'S



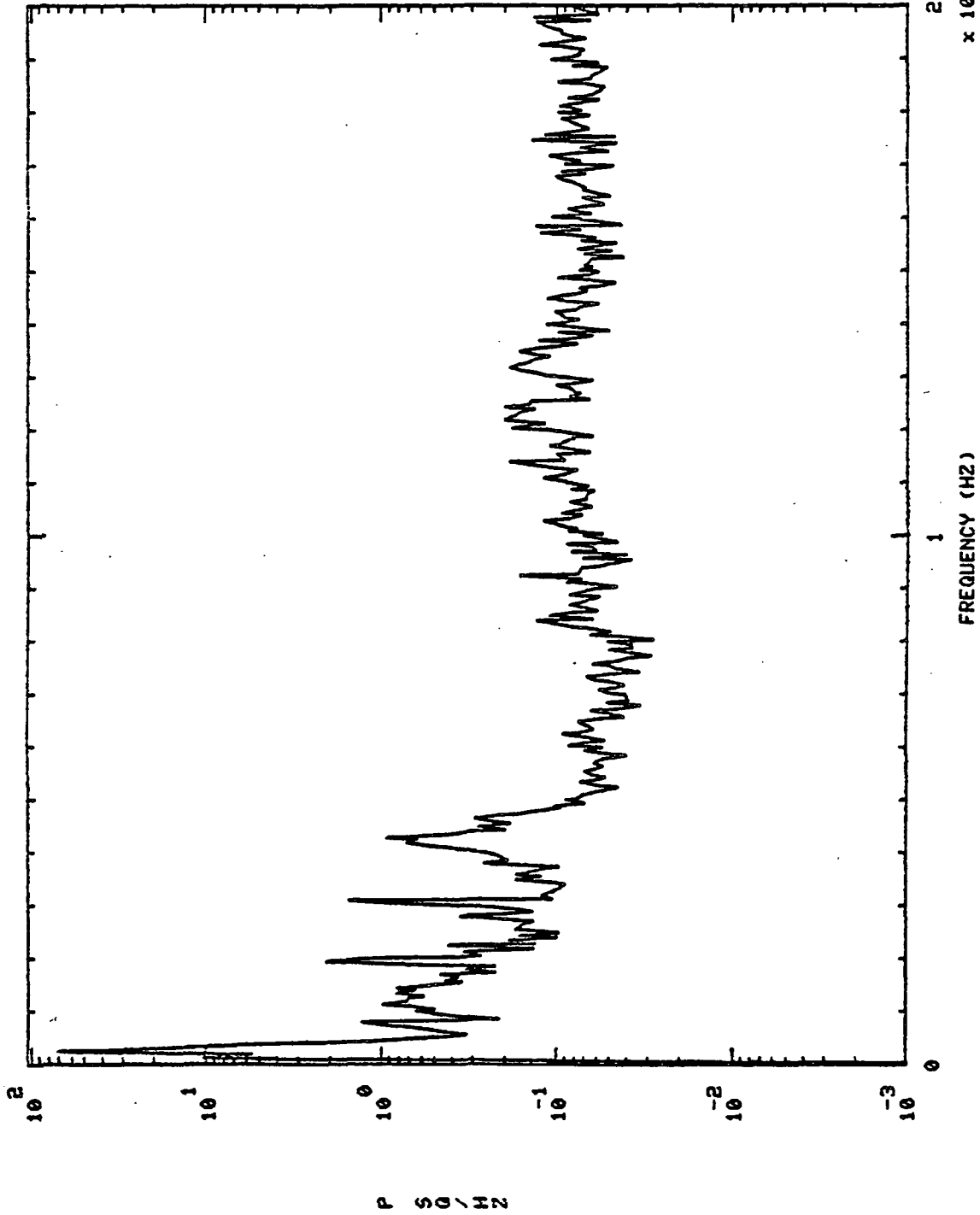
750115 PBP DS PR S+ 30.01H0,'S



S+ 150.01H0,'S

PBP DS PR

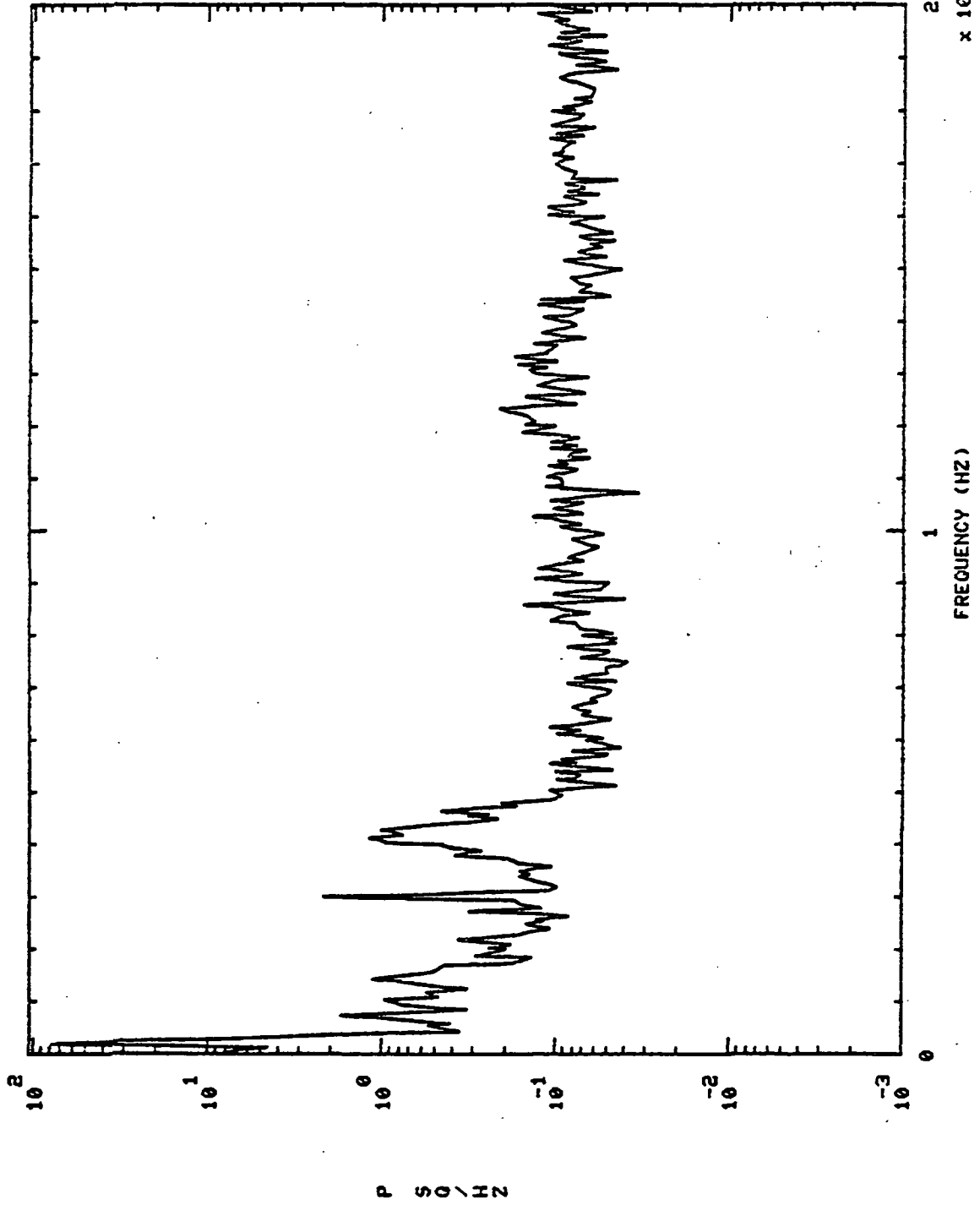
750115



S+ 280.01H0,'S

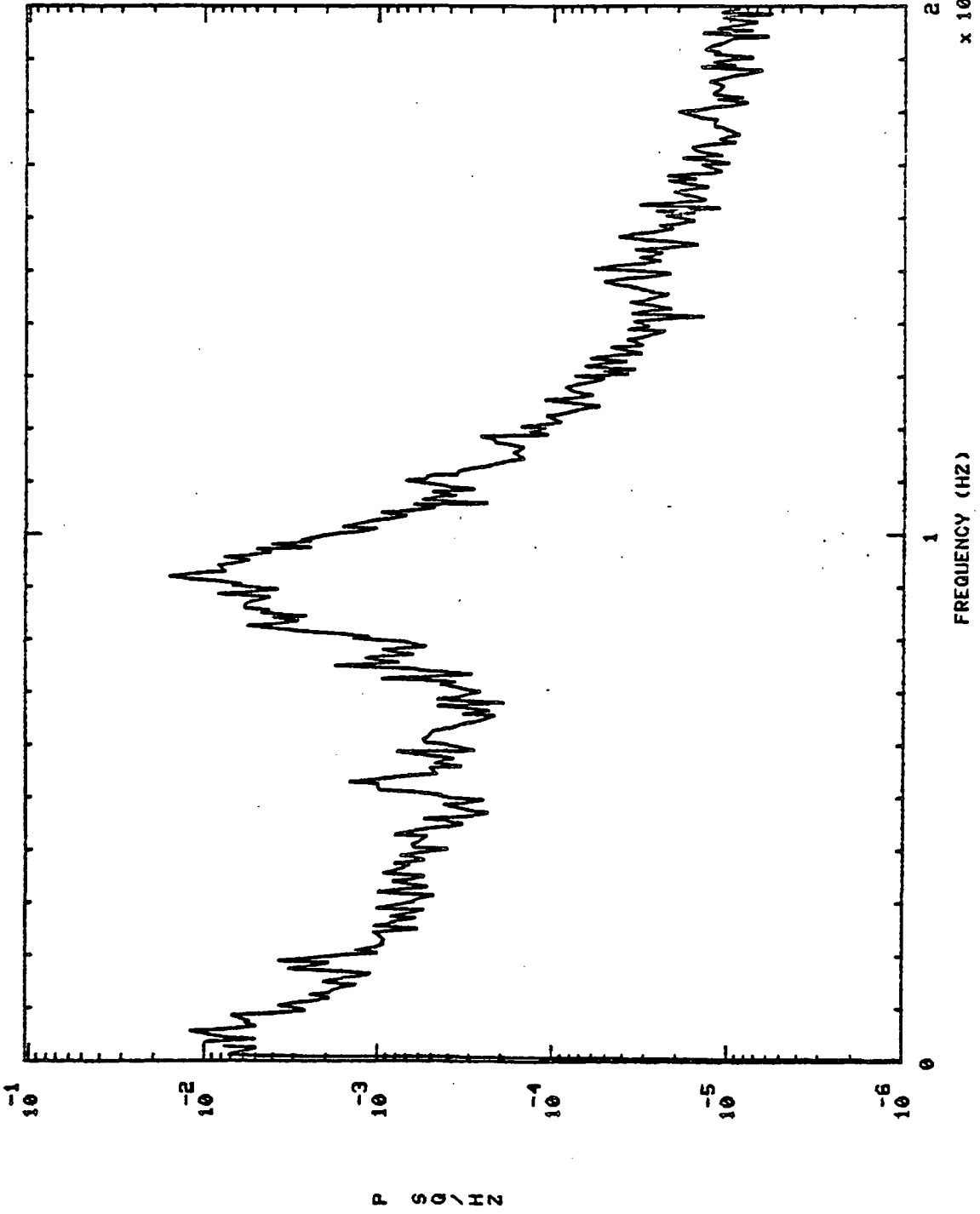
PBP DS PR

750115

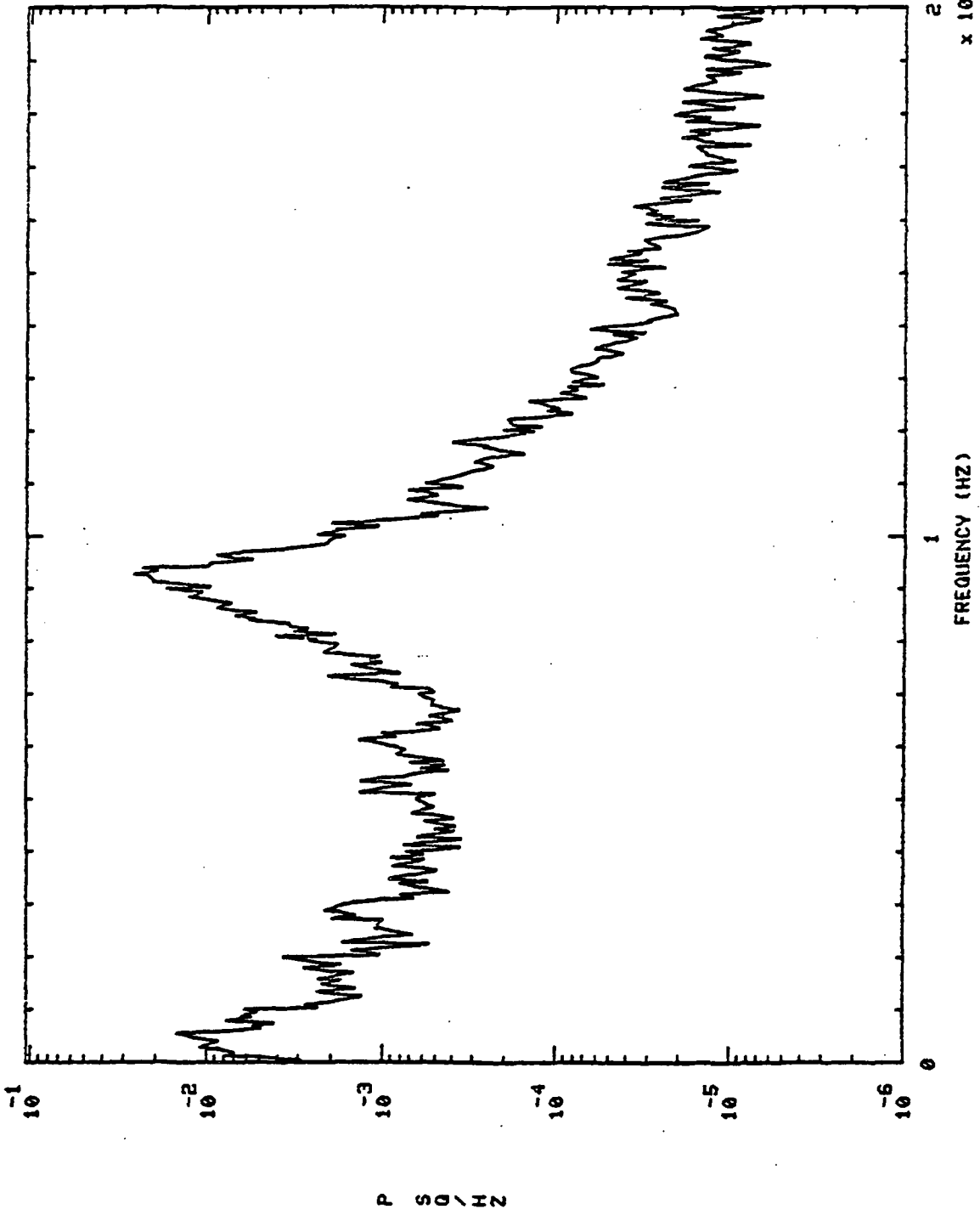


ST 30.01H0,'S

750115 LPFP DS PR



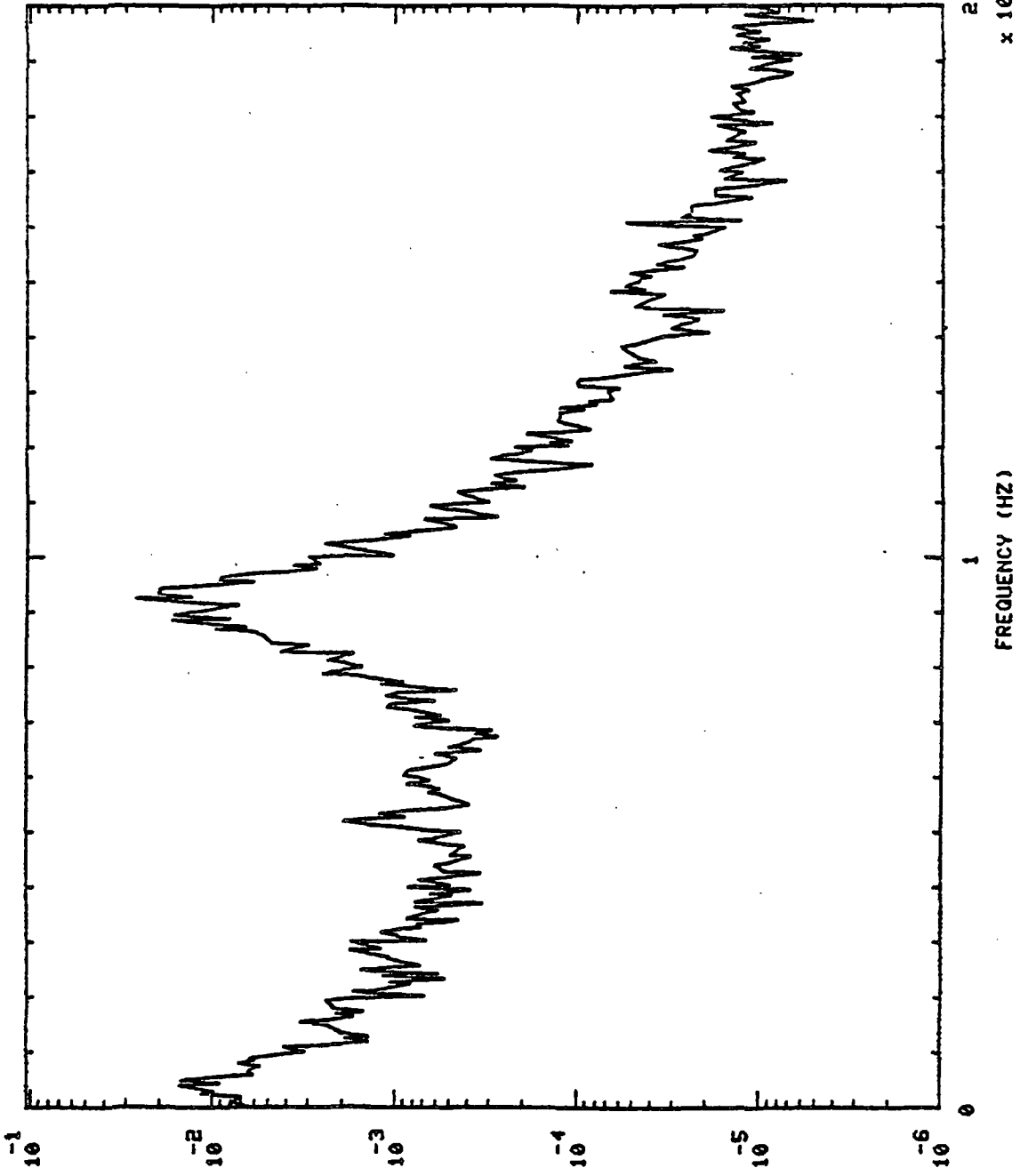
750115 LPFP DS PR S+ 150.01H0,'S



S+ 280.01H0,'S

750115 LPFP DS PR

750115

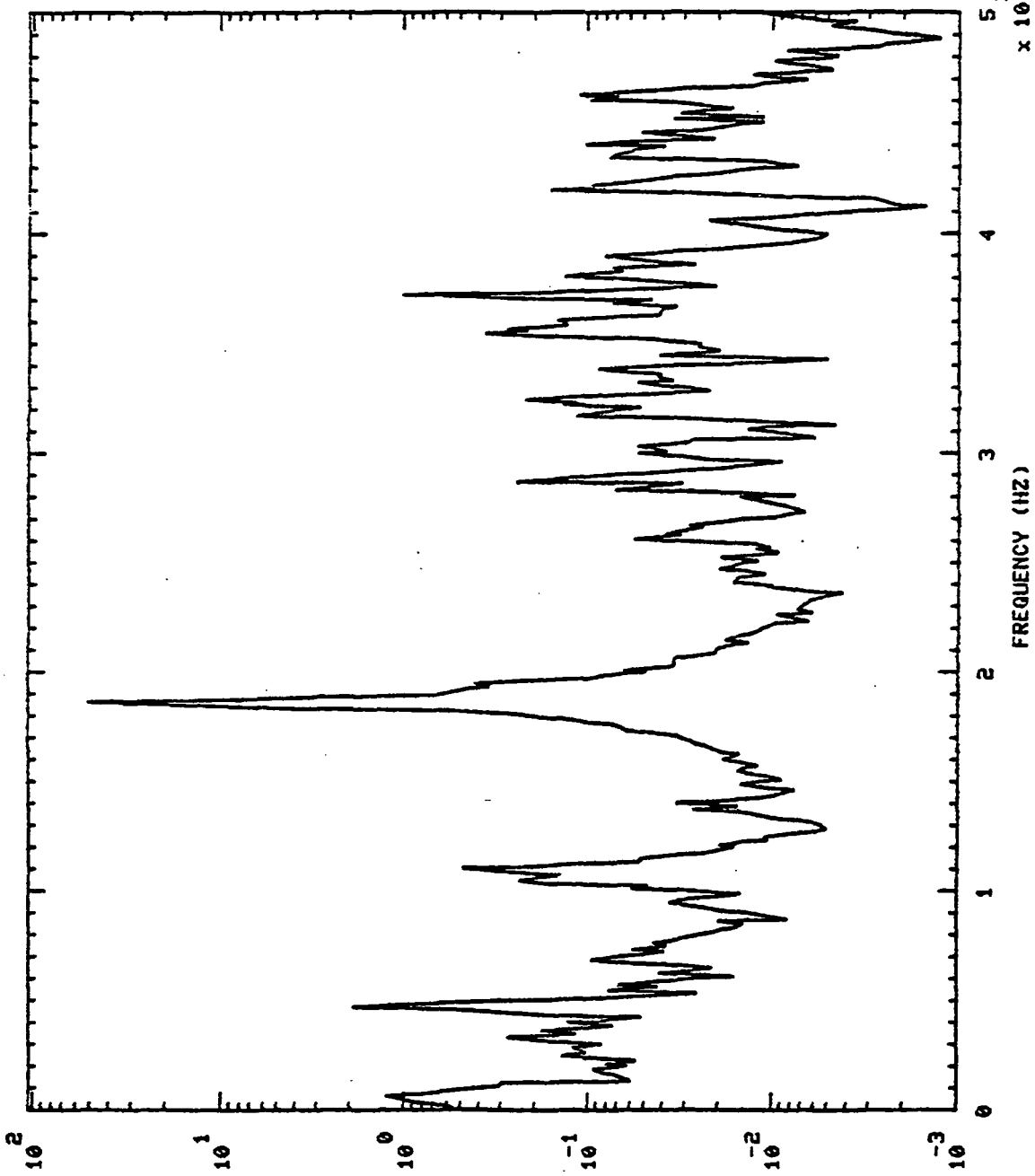


PSD / HZ

10^2
 $\times 10^4$

FREQUENCY (HZ)

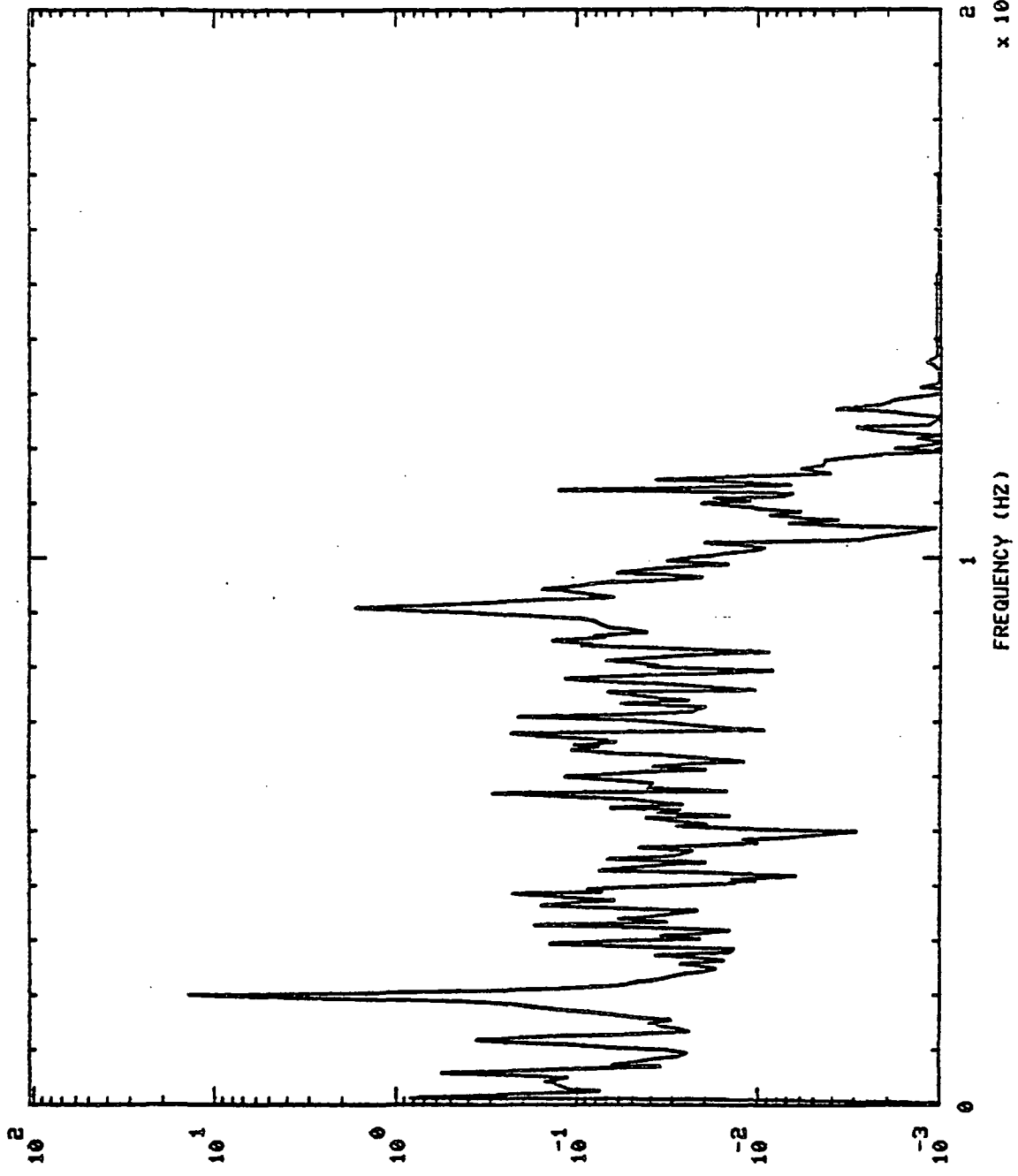
750115 LPOT TURB DR PR St 30.01H0,'S



P S D \ H Z

S+ 30.01H0,'S

750115 LPOT TURB DR PR



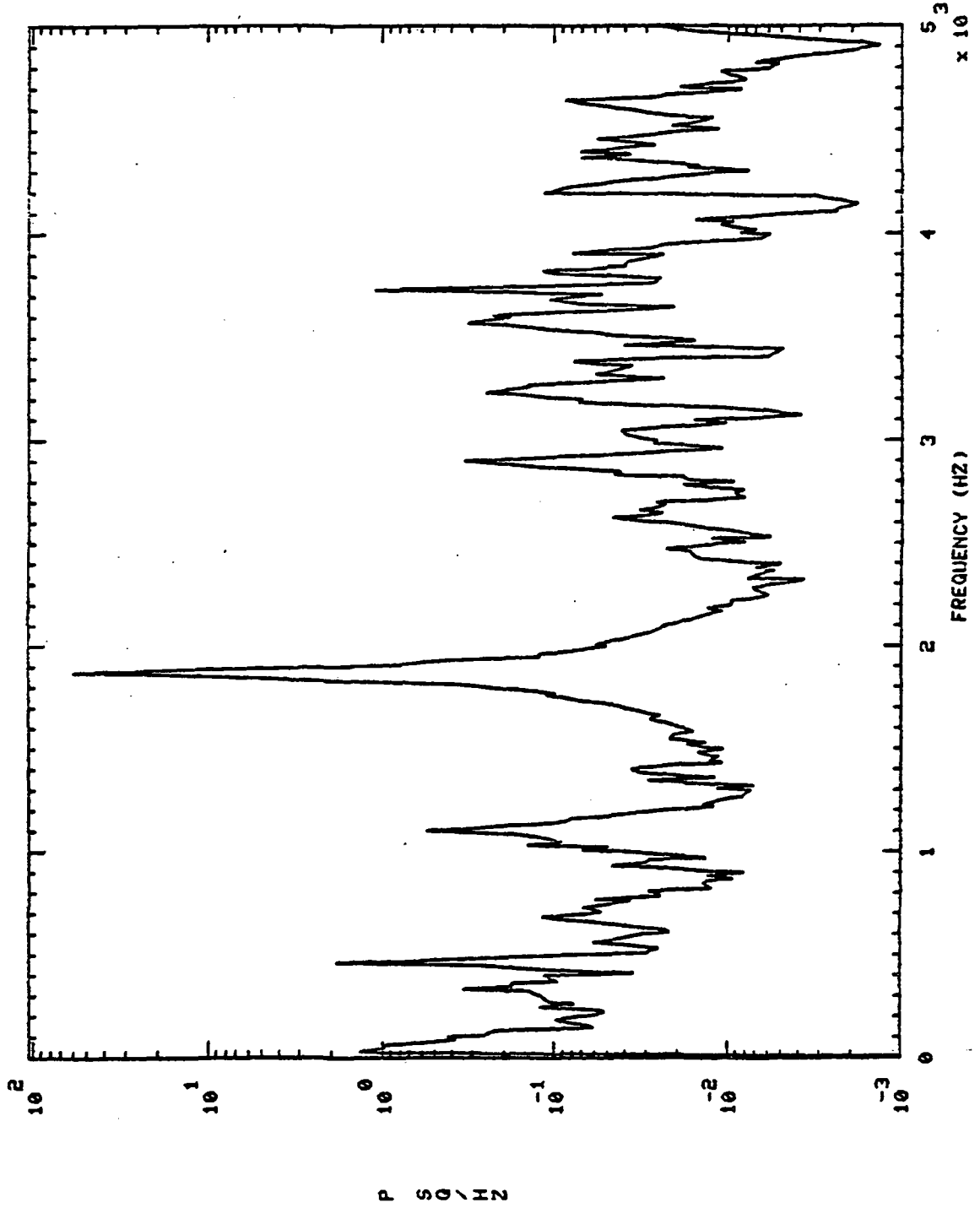
P SQ \ HZ

FREQUENCY (HZ)

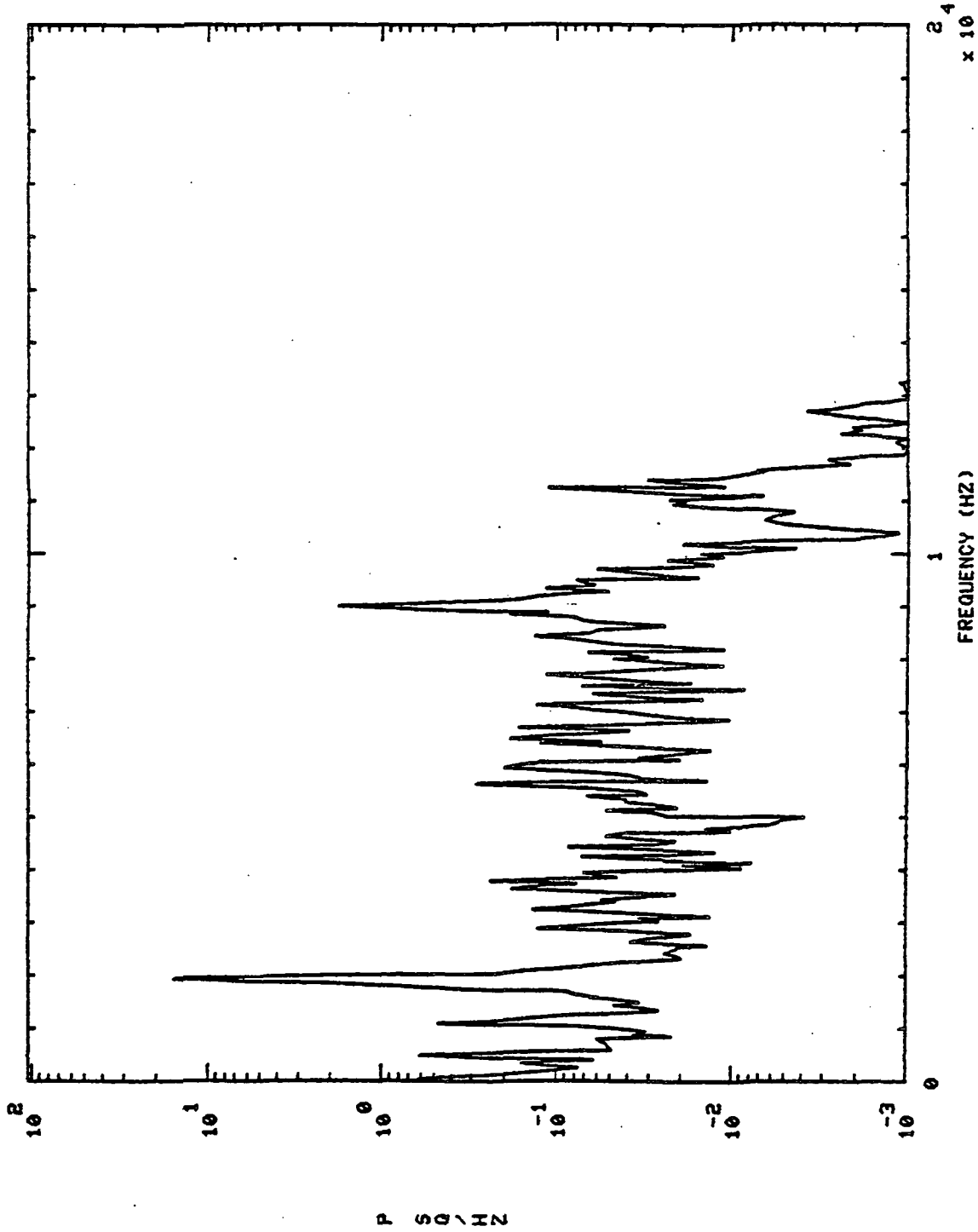
10^4
 $\times 10$

750115 LPOT TURB DR PR

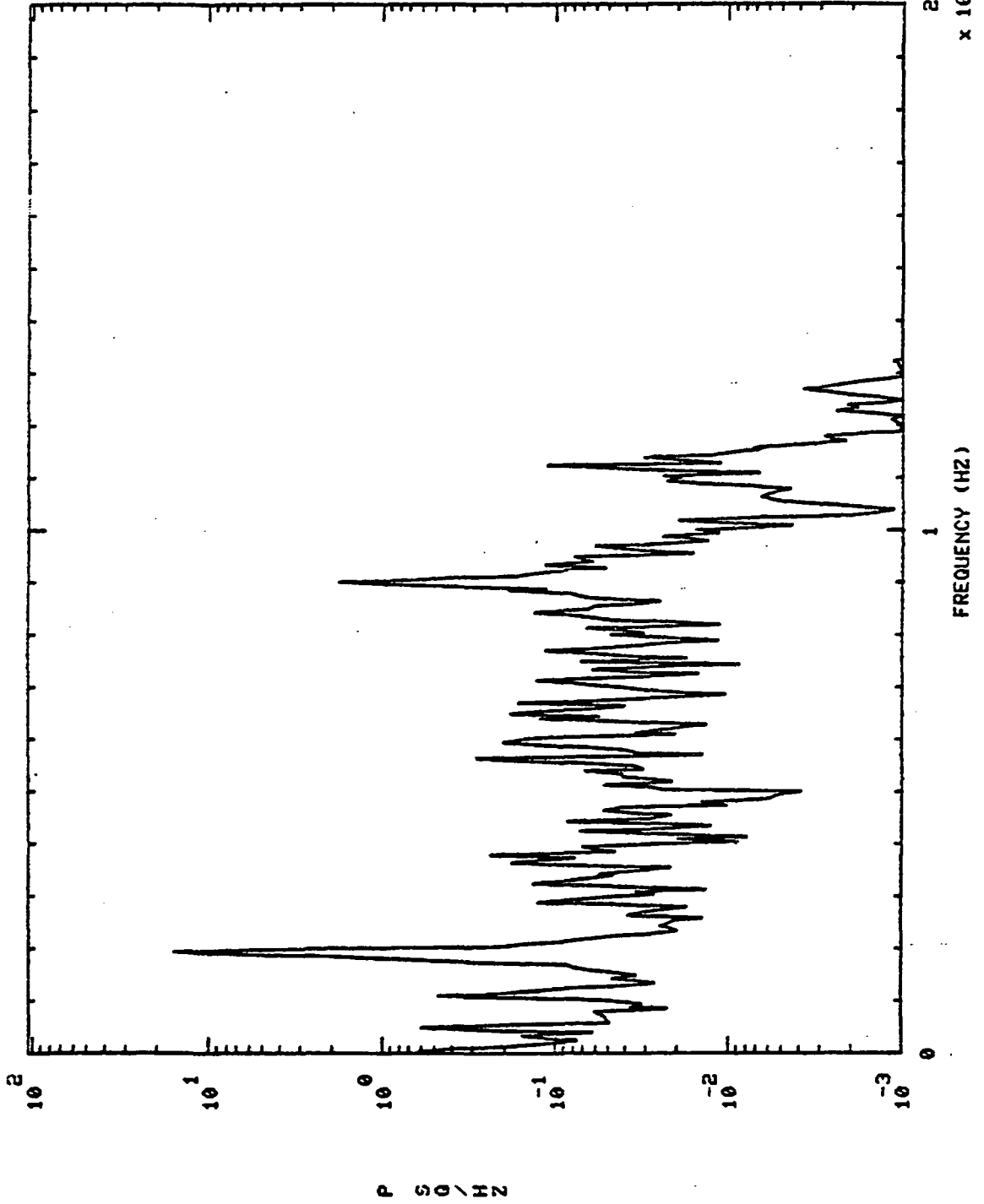
St 150.01H0, 'S



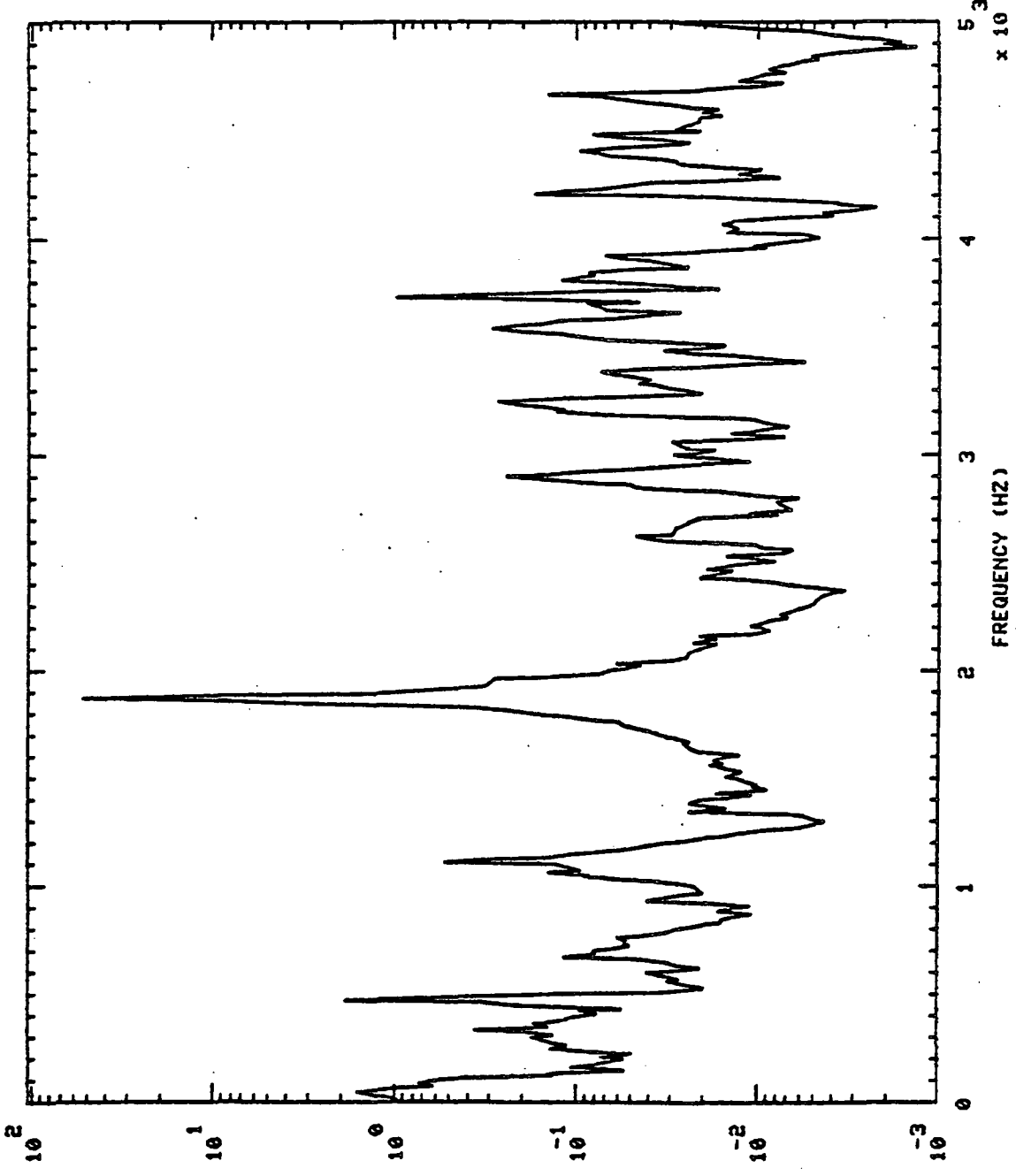
750115 LP0T TURB DR PR S+ 150.01H0,'S



750115 LPOT TURB DR PR S+ 150.01H0,'6

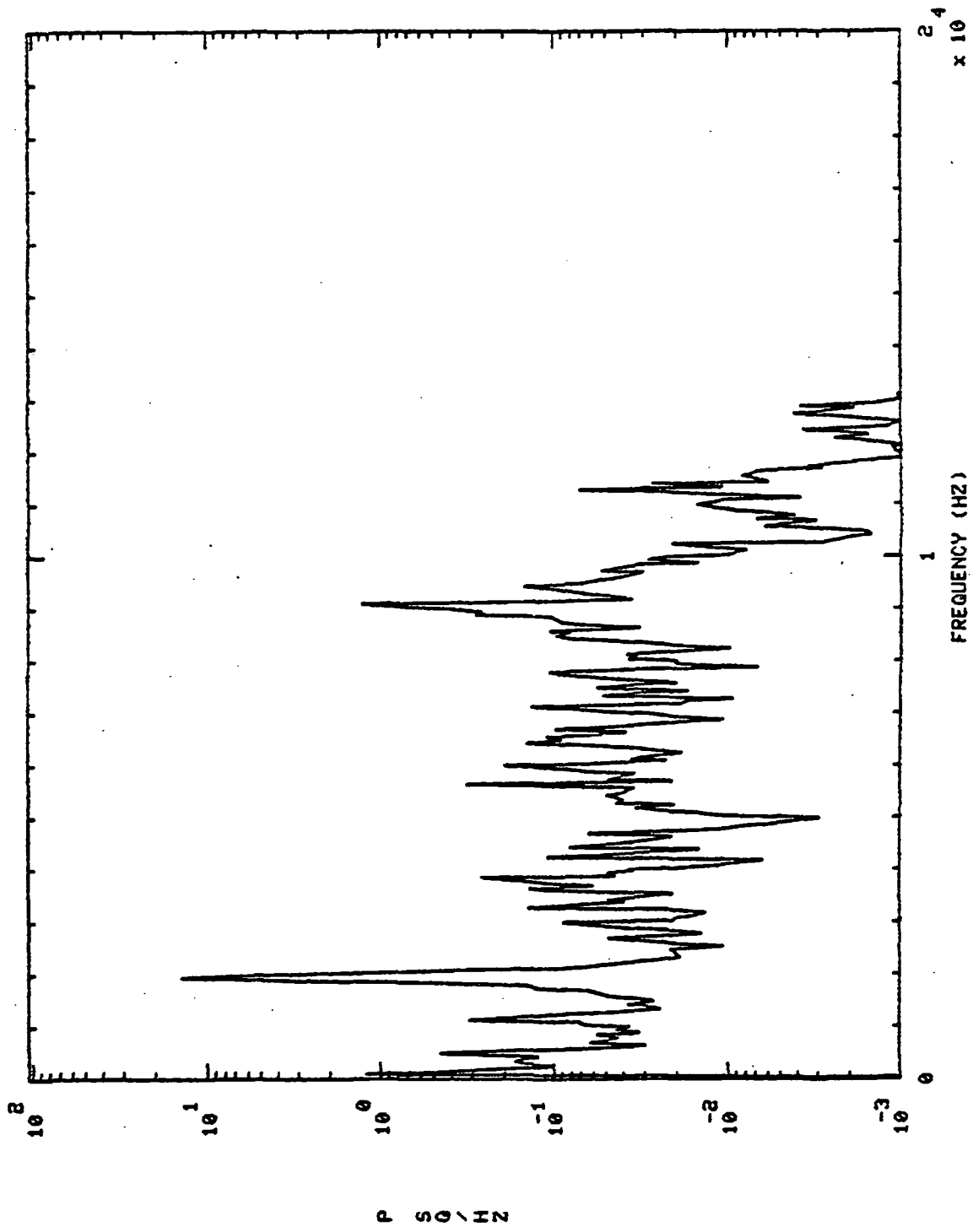


750115 LPOT TURB DR PR S+ 280.01H0,'S

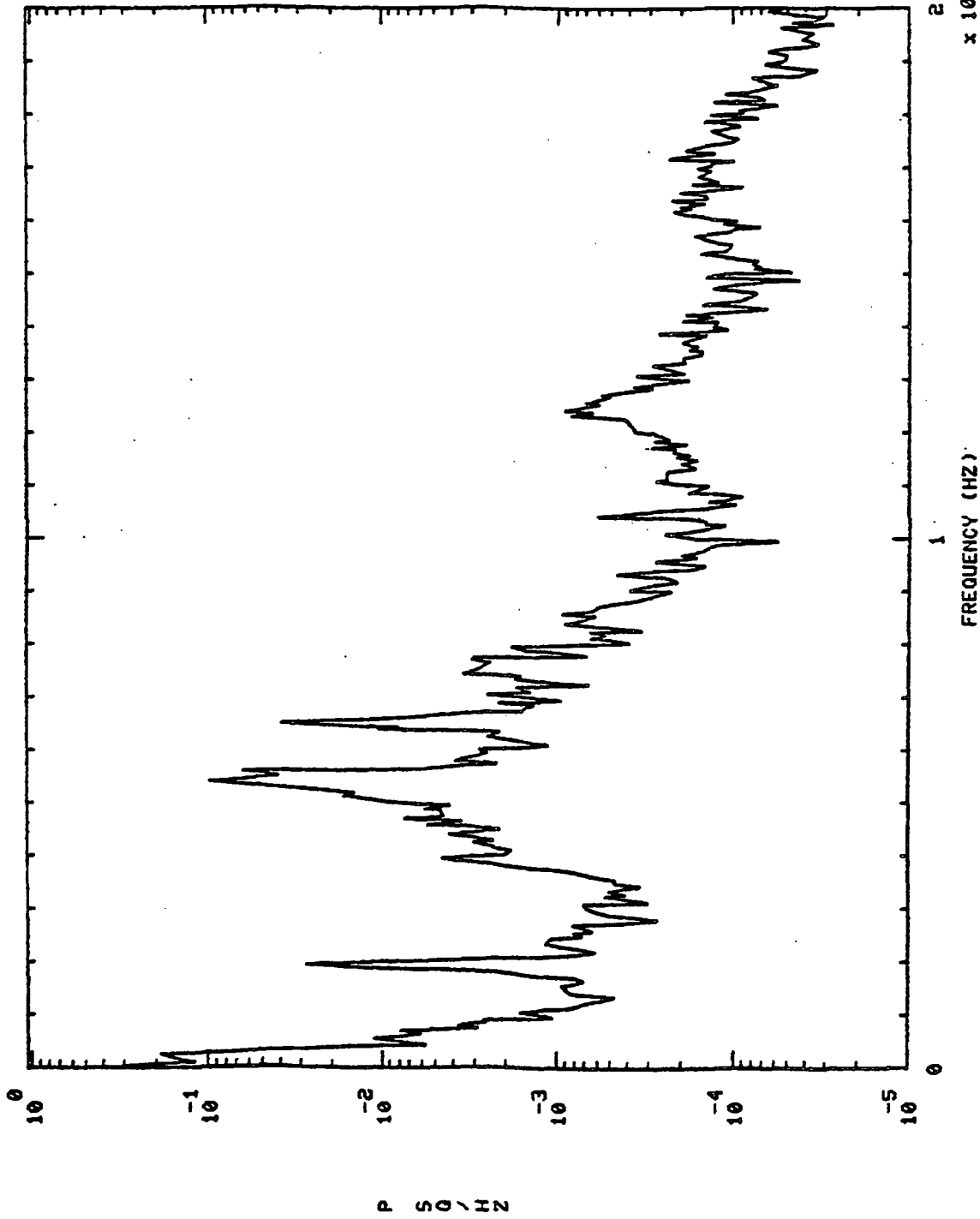


P 50 \ HN

750115 LPOT TURB DR PR S+ 280.01H0,'S

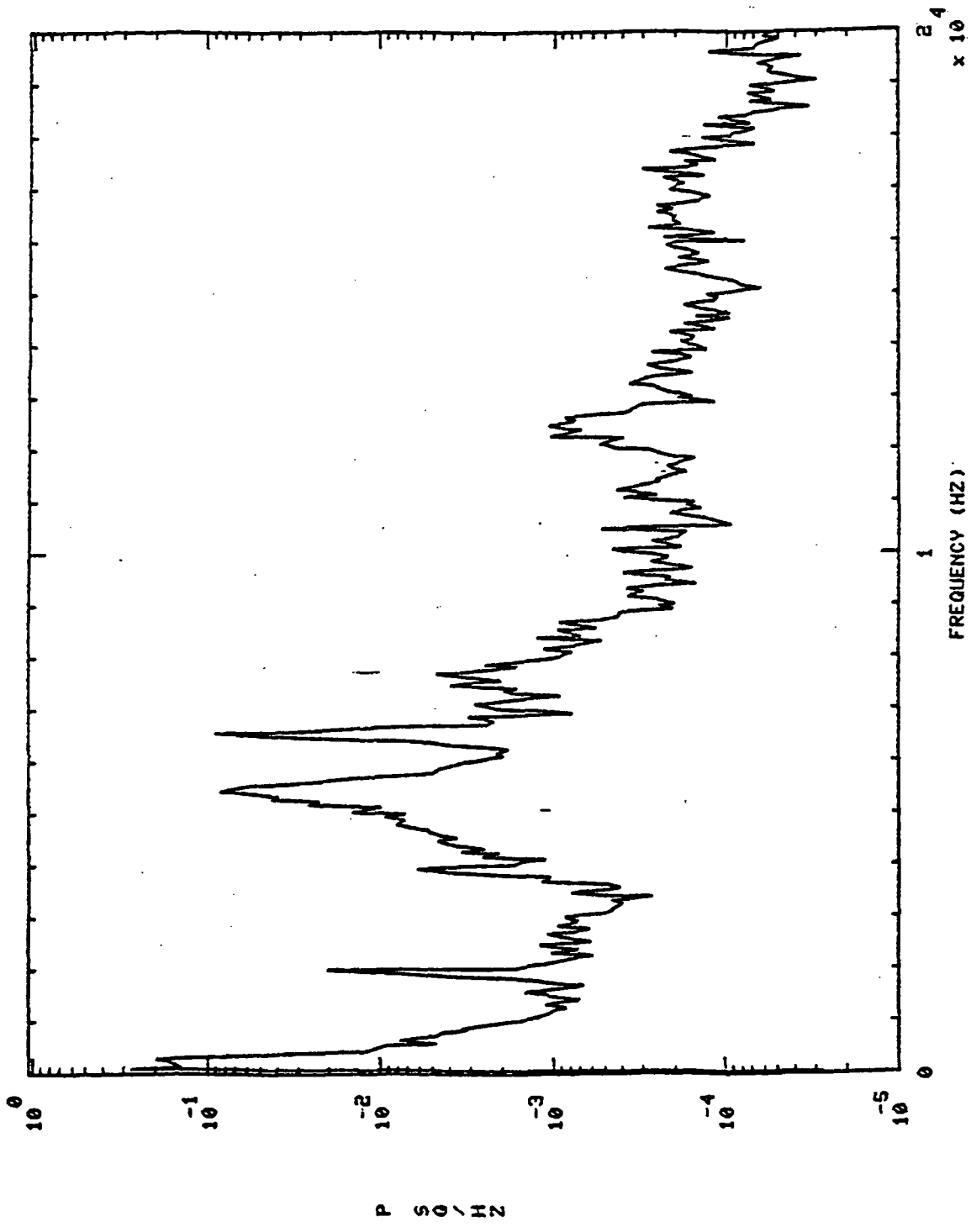


750115 OPB PC PR S+ 30.0



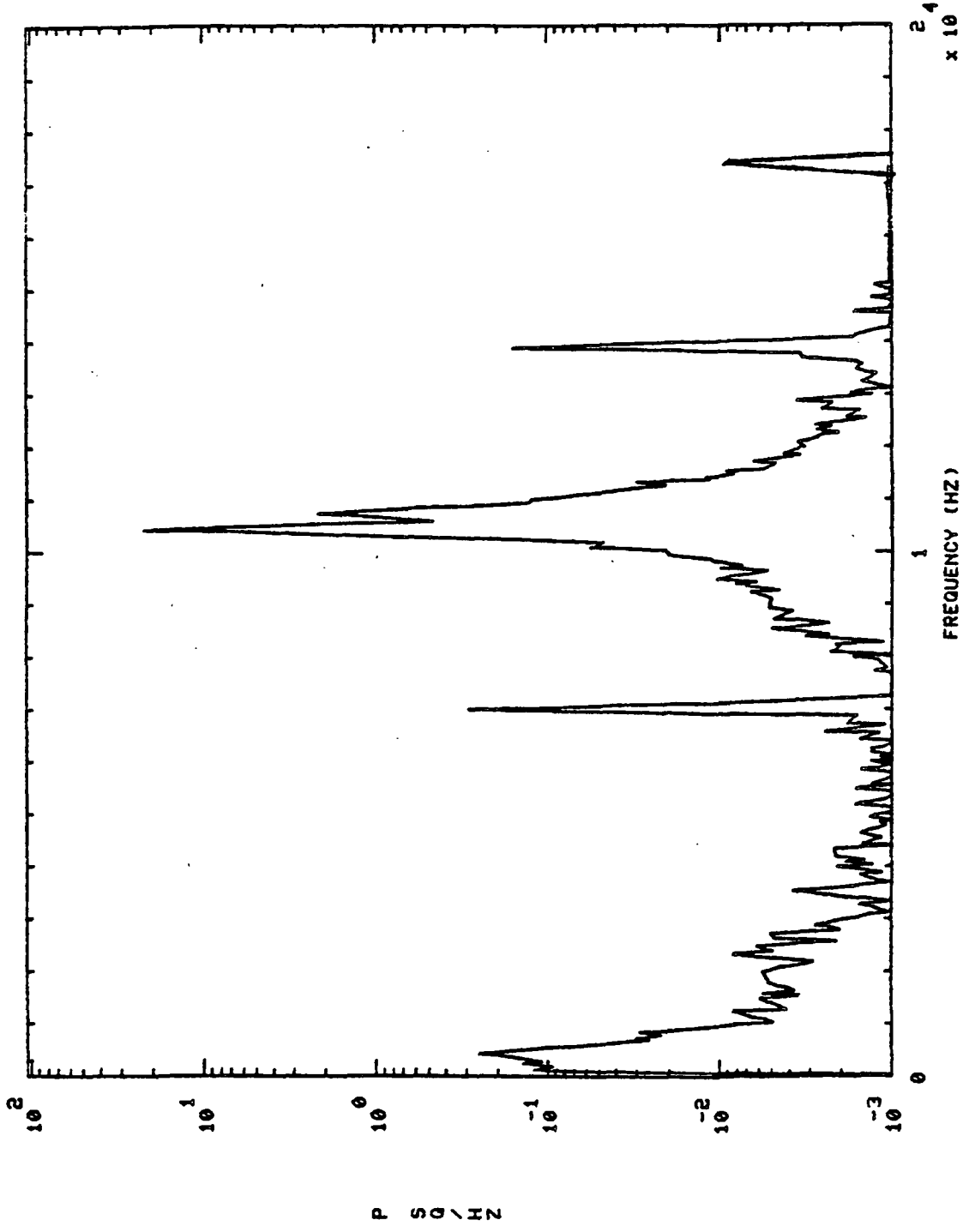
S+ 150.0

750115 OPB PC PR



S+ 30.01H0,'S

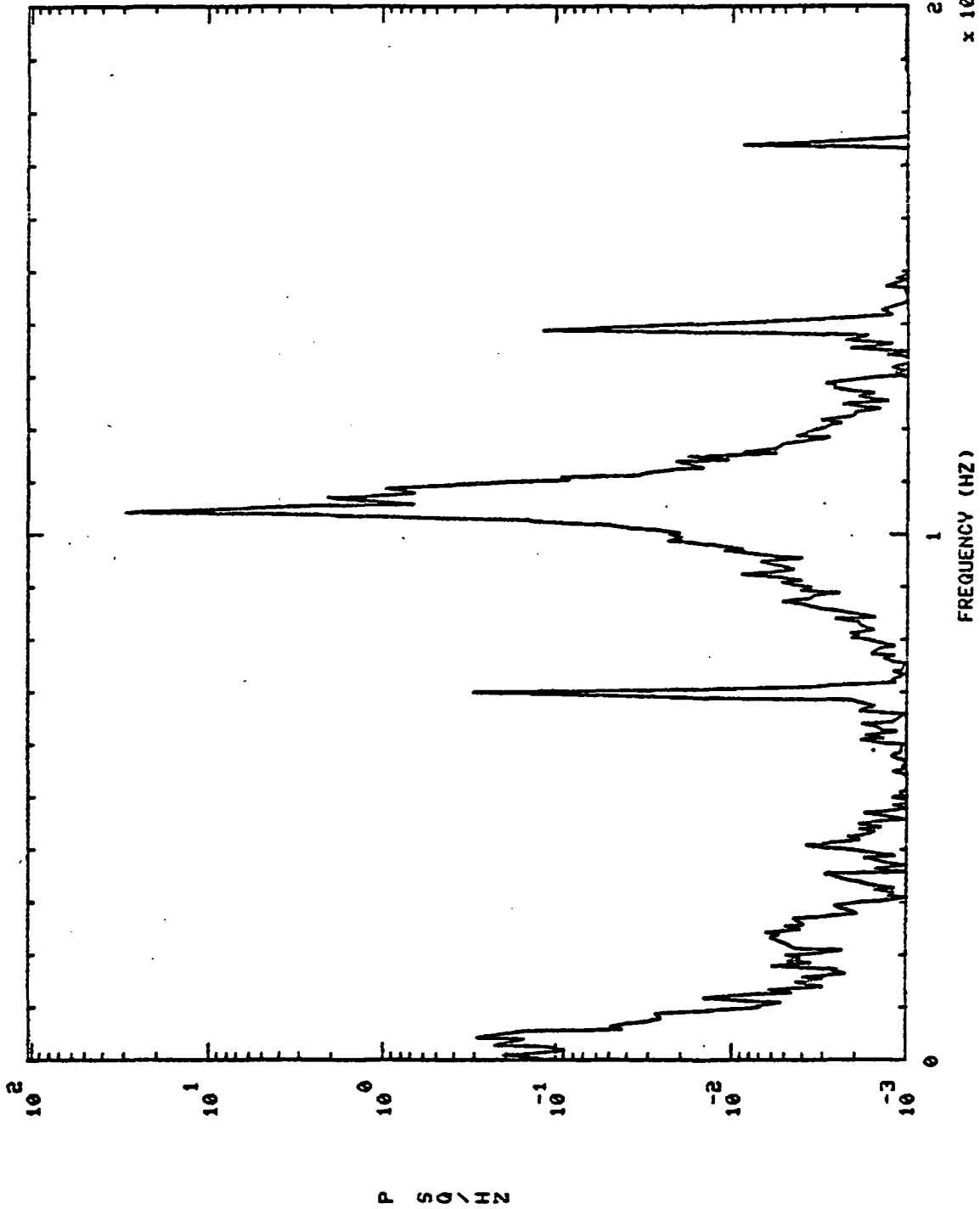
750115 HPFP DS PR



S+ 150.01H0, 'S

HPFP DS PR

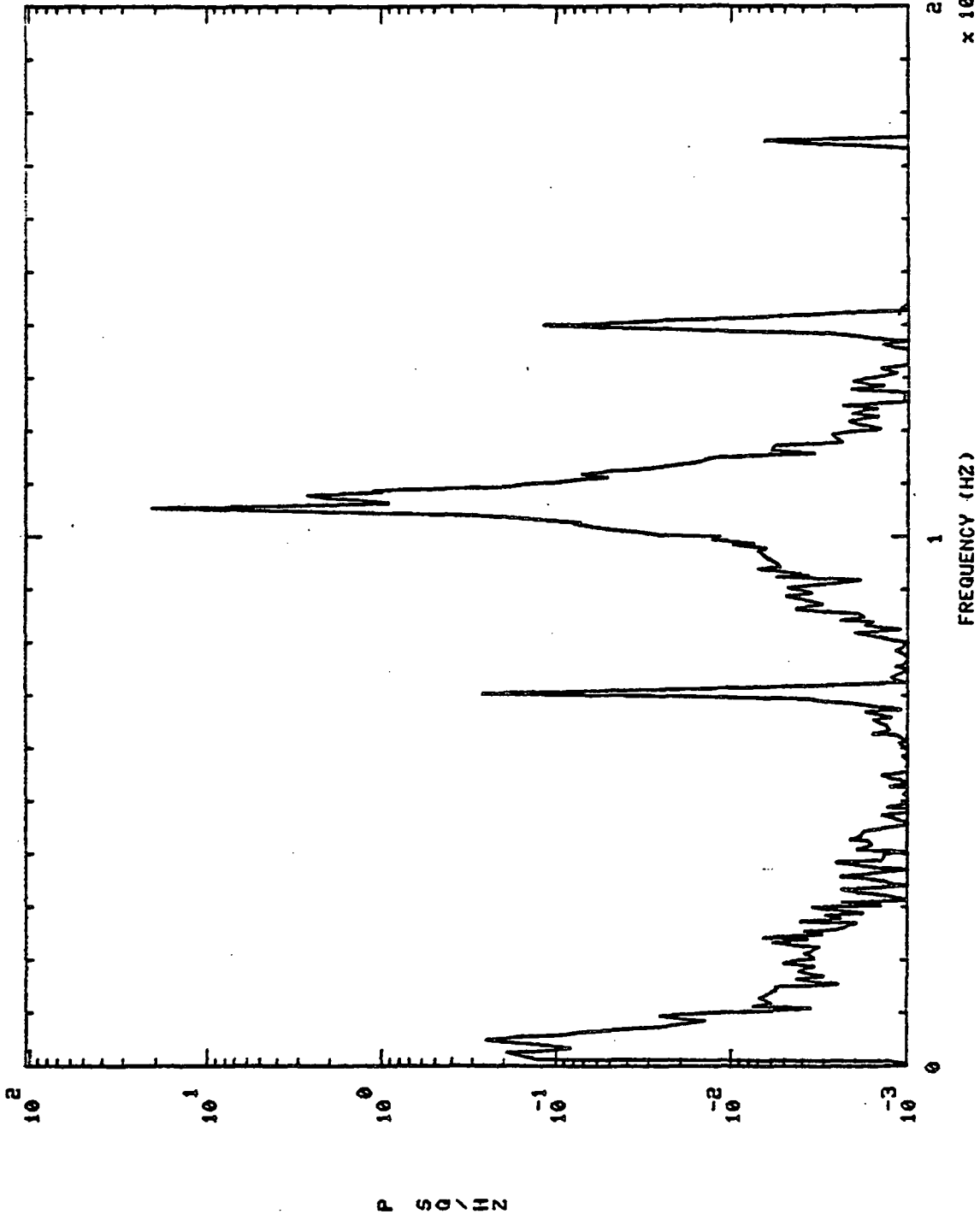
750115



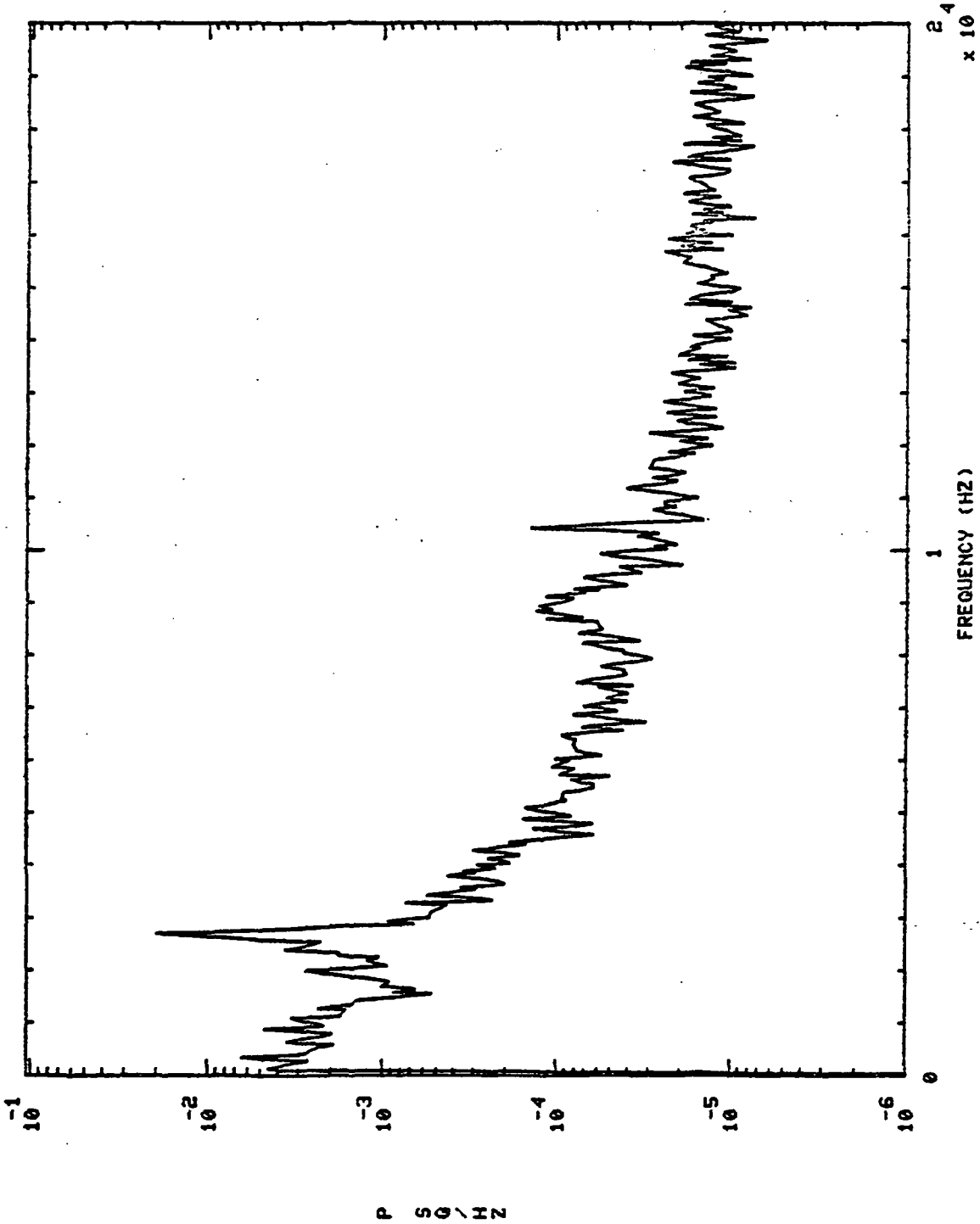
S+ 280.01H0,'S

HPFP DS PR

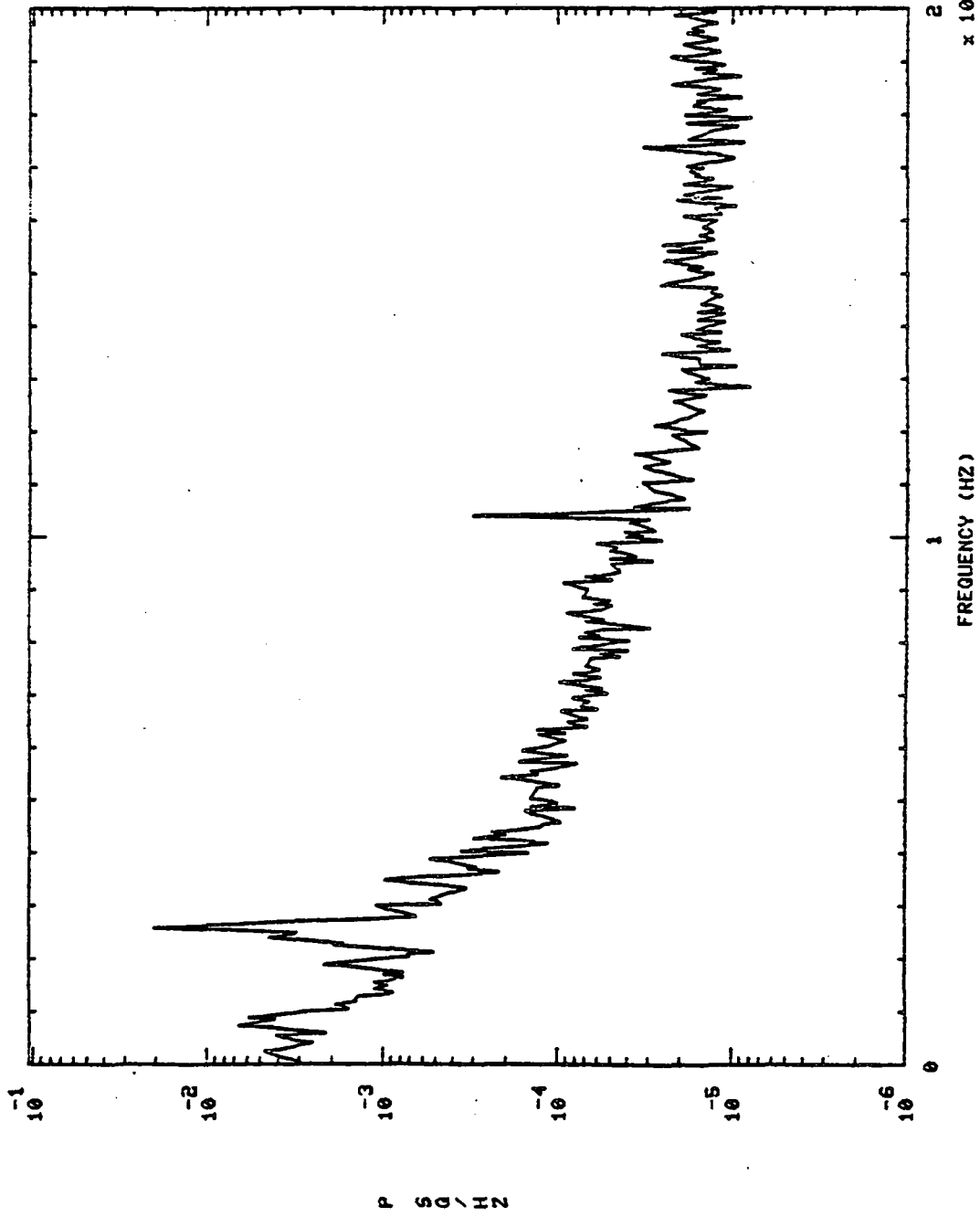
750115



750115 HOT GAS MAN PR3 S+ 30.01H0,'S

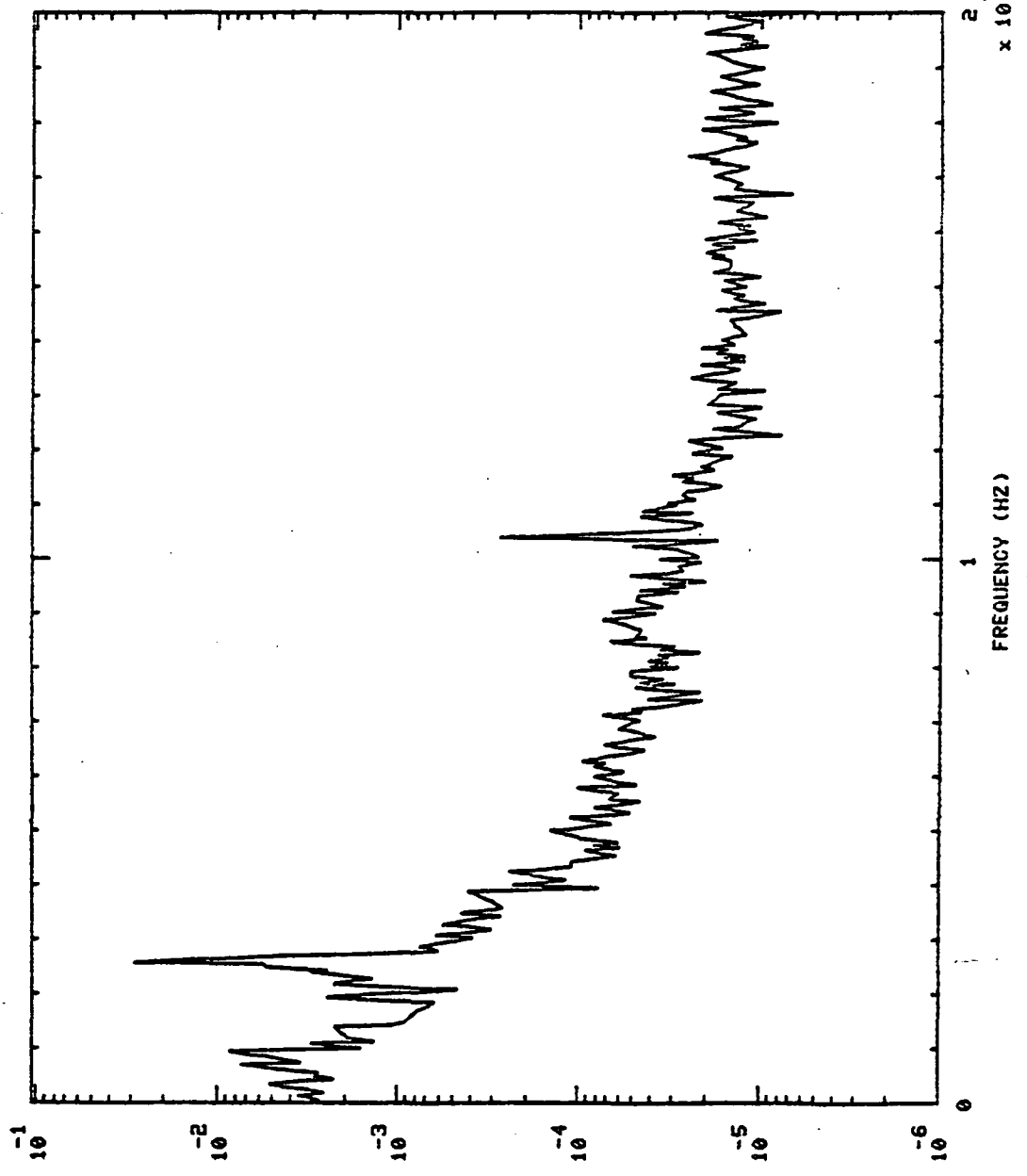


750115 HOT GAS MAN PR3 S+ 150.01H0,'S



2.4×10^4

750115 HOT GAS MAN PR3 S+ 280.01H0,'S

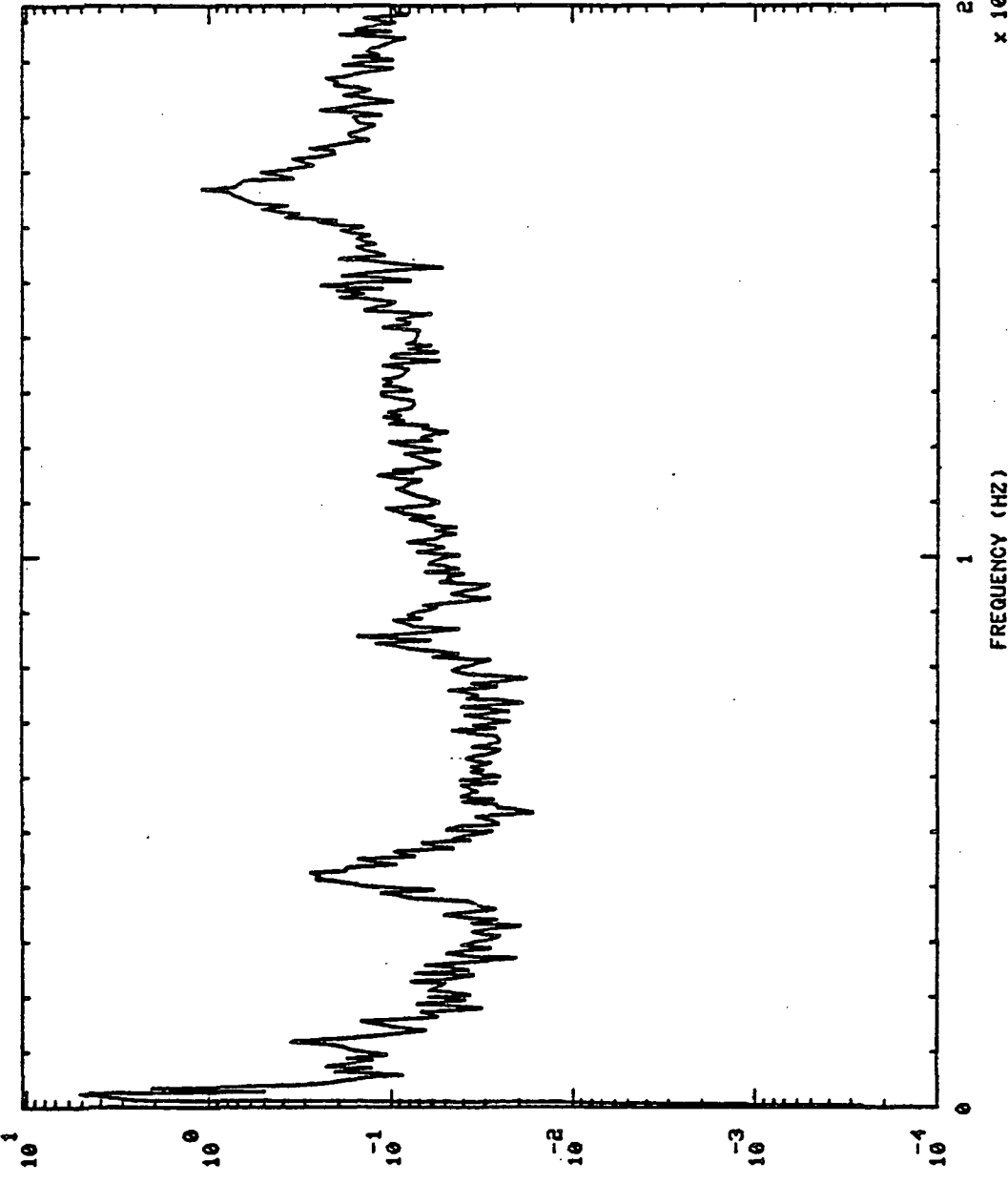


P S D / H Z

S+ 30.01H0,'S

OPB PC PR DC

750115

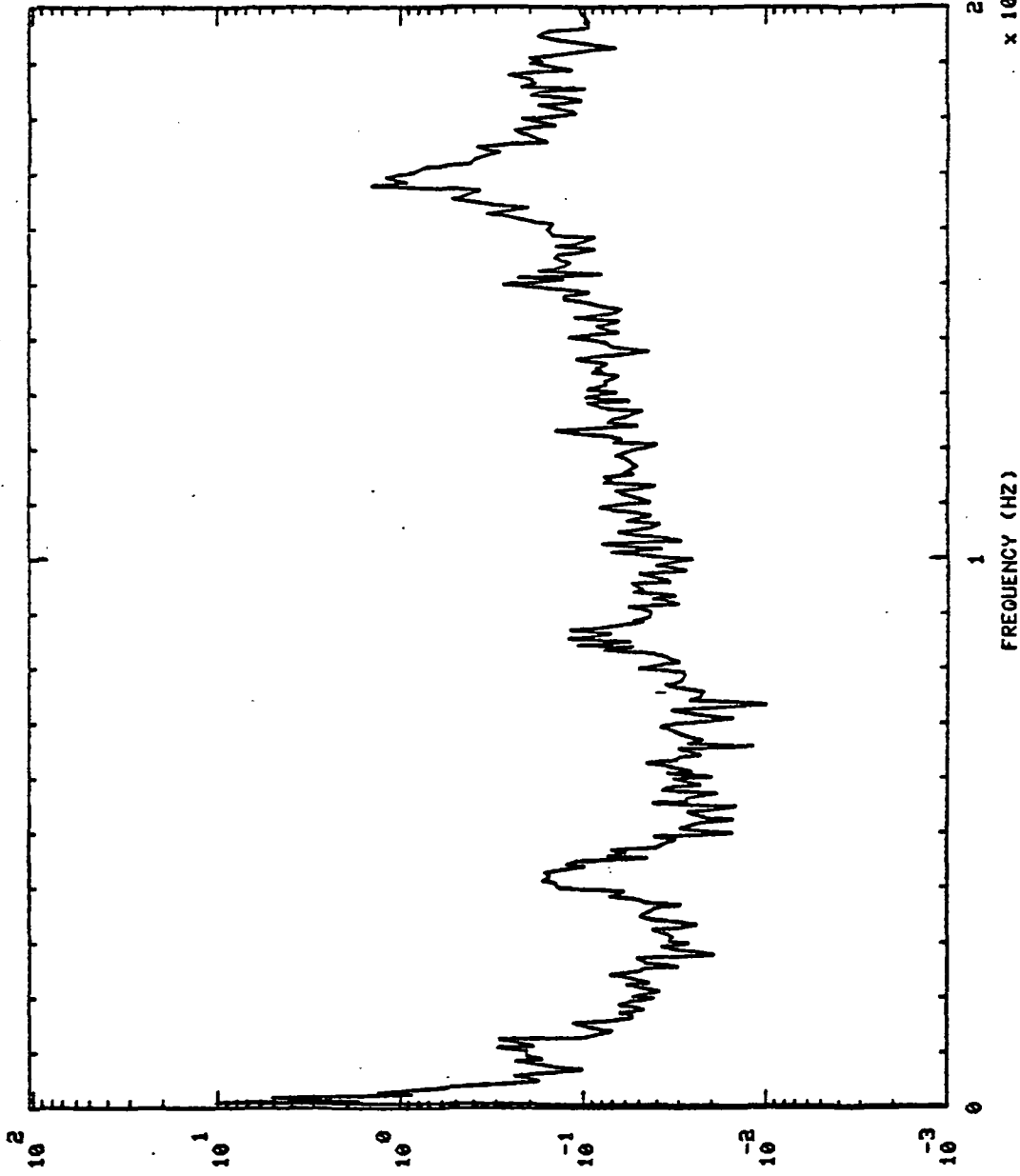


P
S
Q
\
H
Z

2.4
x 10^4

1
FREQUENCY (HZ)

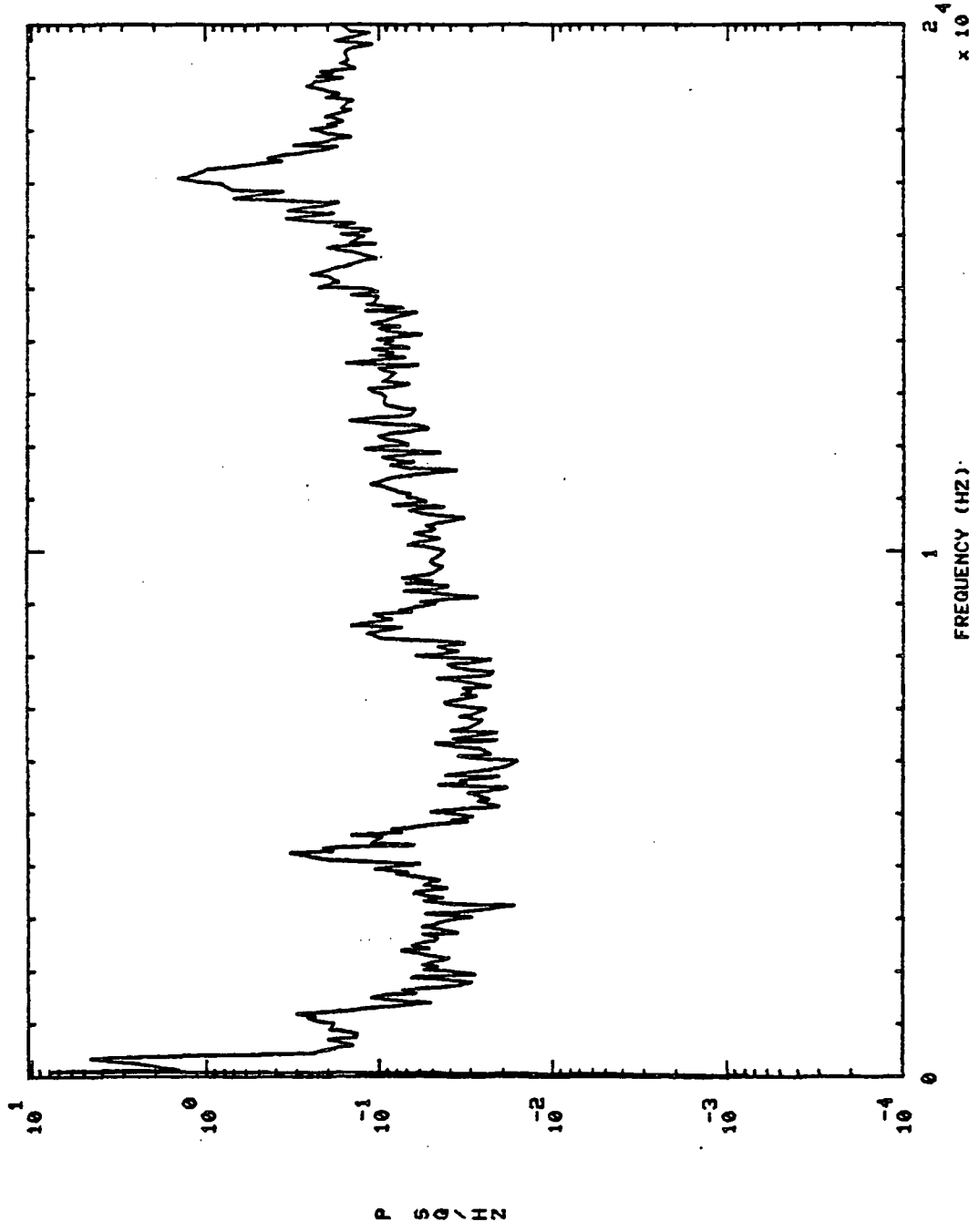
750115 OPB FC PR DC S+ 150.01H0,'S



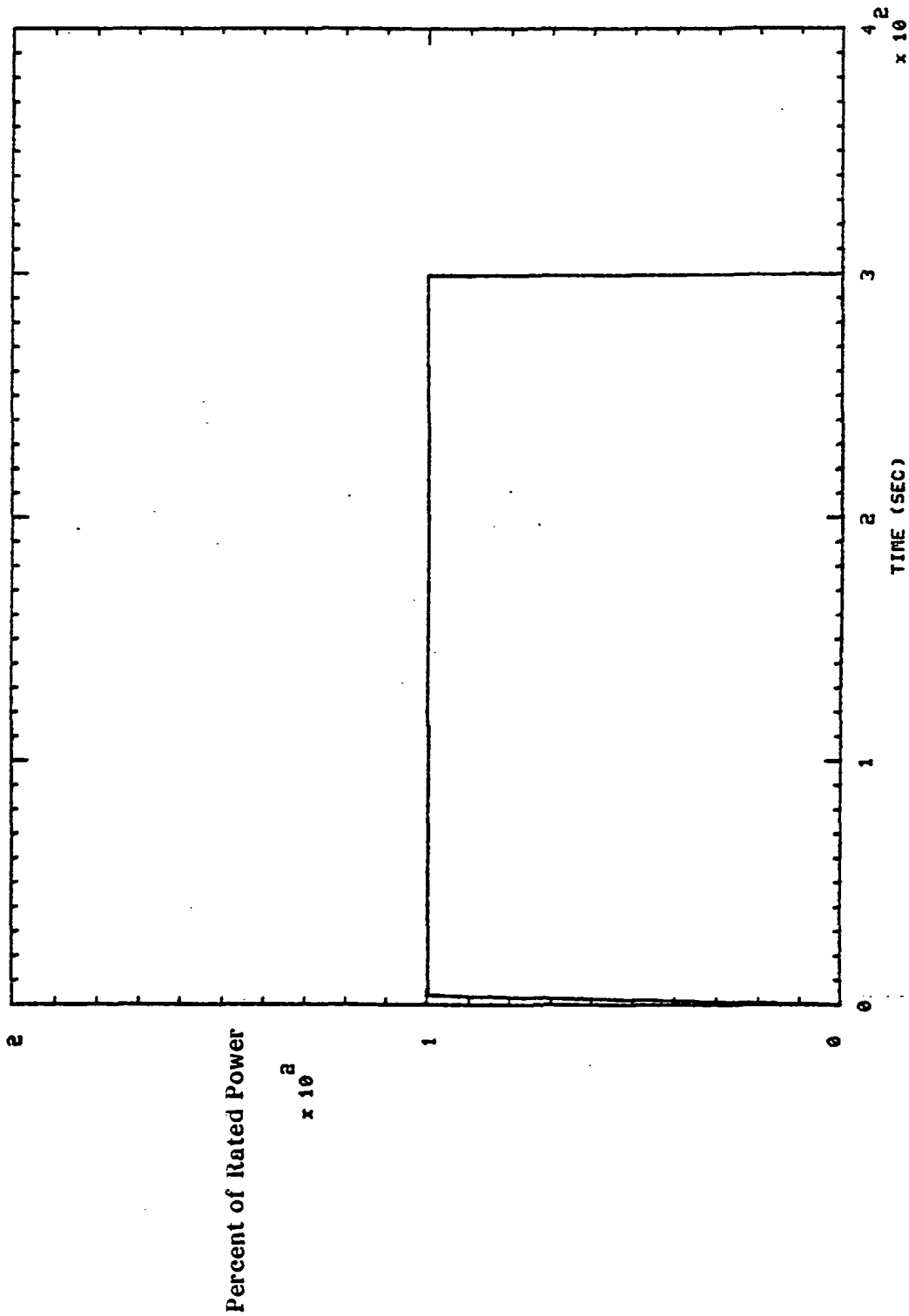
P S D / H Z

FREQUENCY (HZ) x 10⁴

750115 OPB PC PR DC S+ 280.01H0,'S

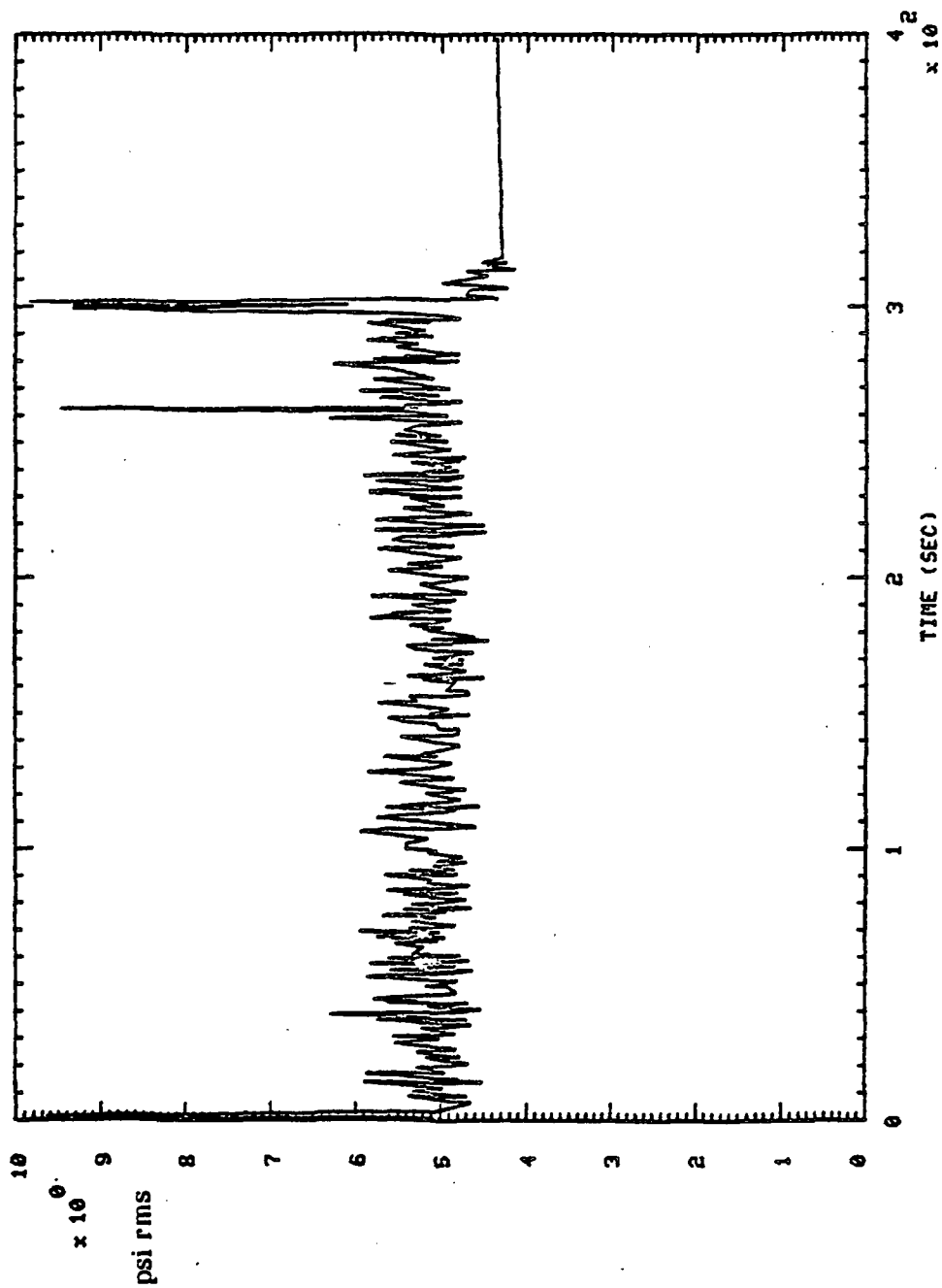


750116 THRUST (UNFILTERED)

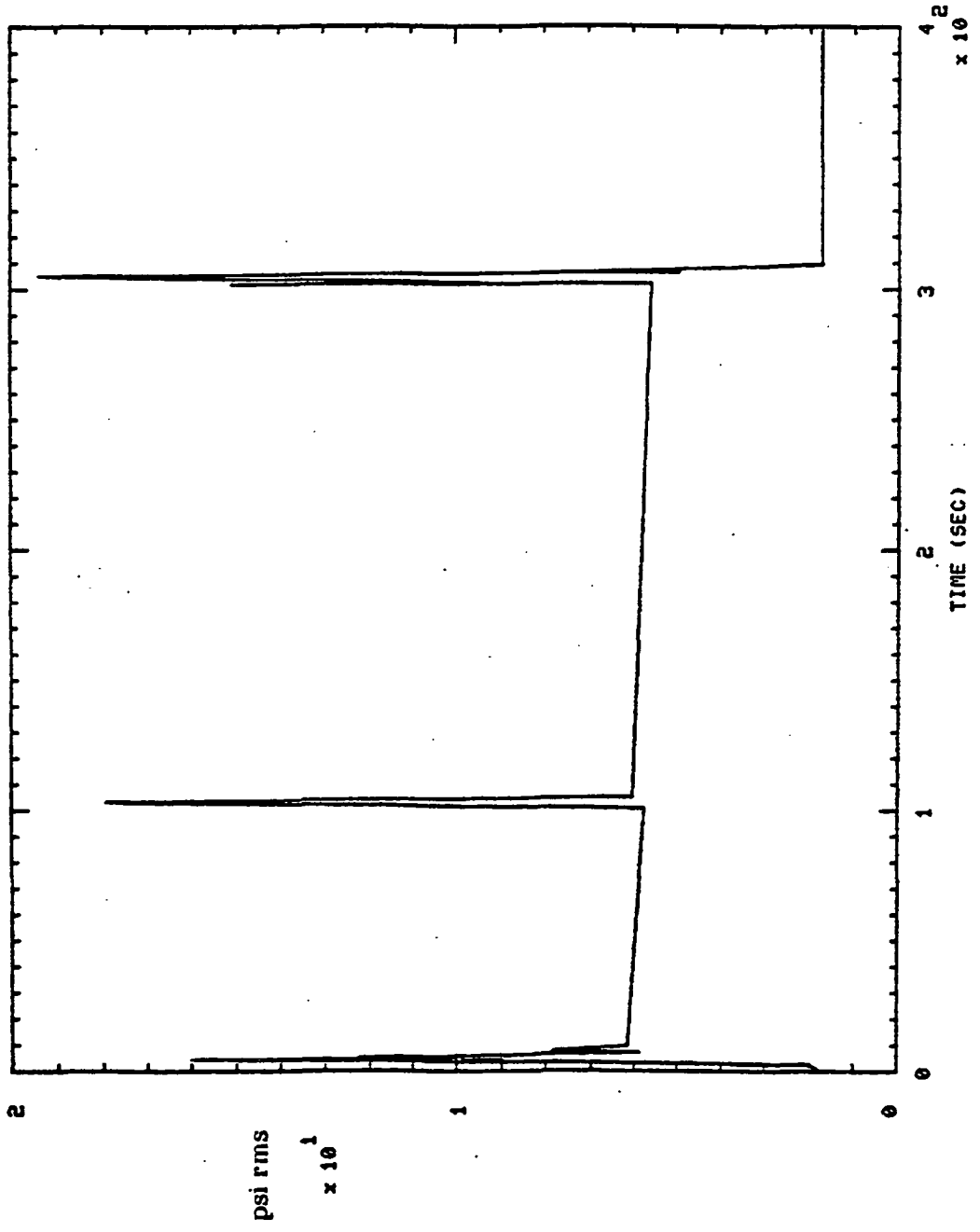


750116 LPOP DS PR

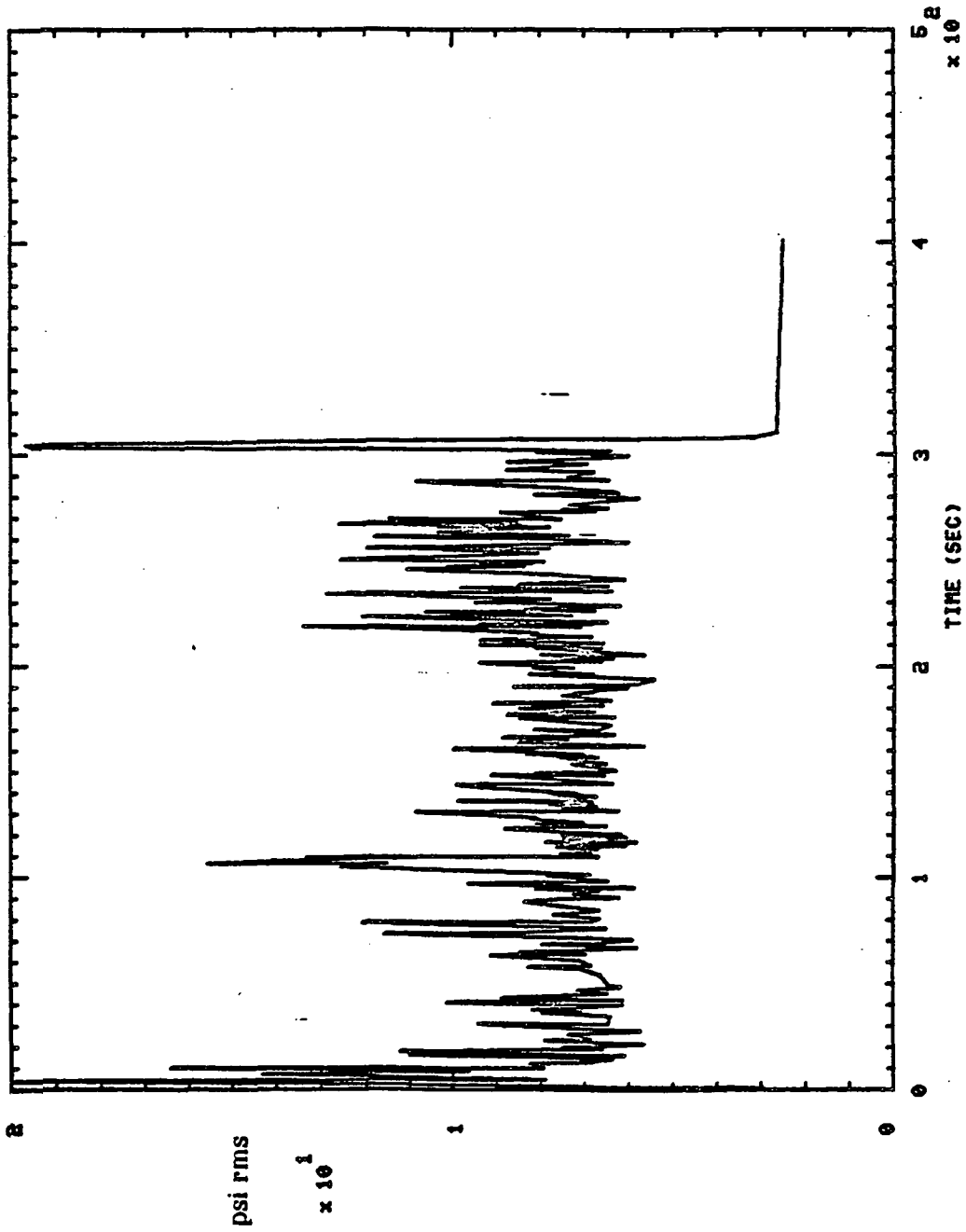
(1 - 20K HZ)



750116 HPOP BAL CAU PR2 (1 - 20K HZ)

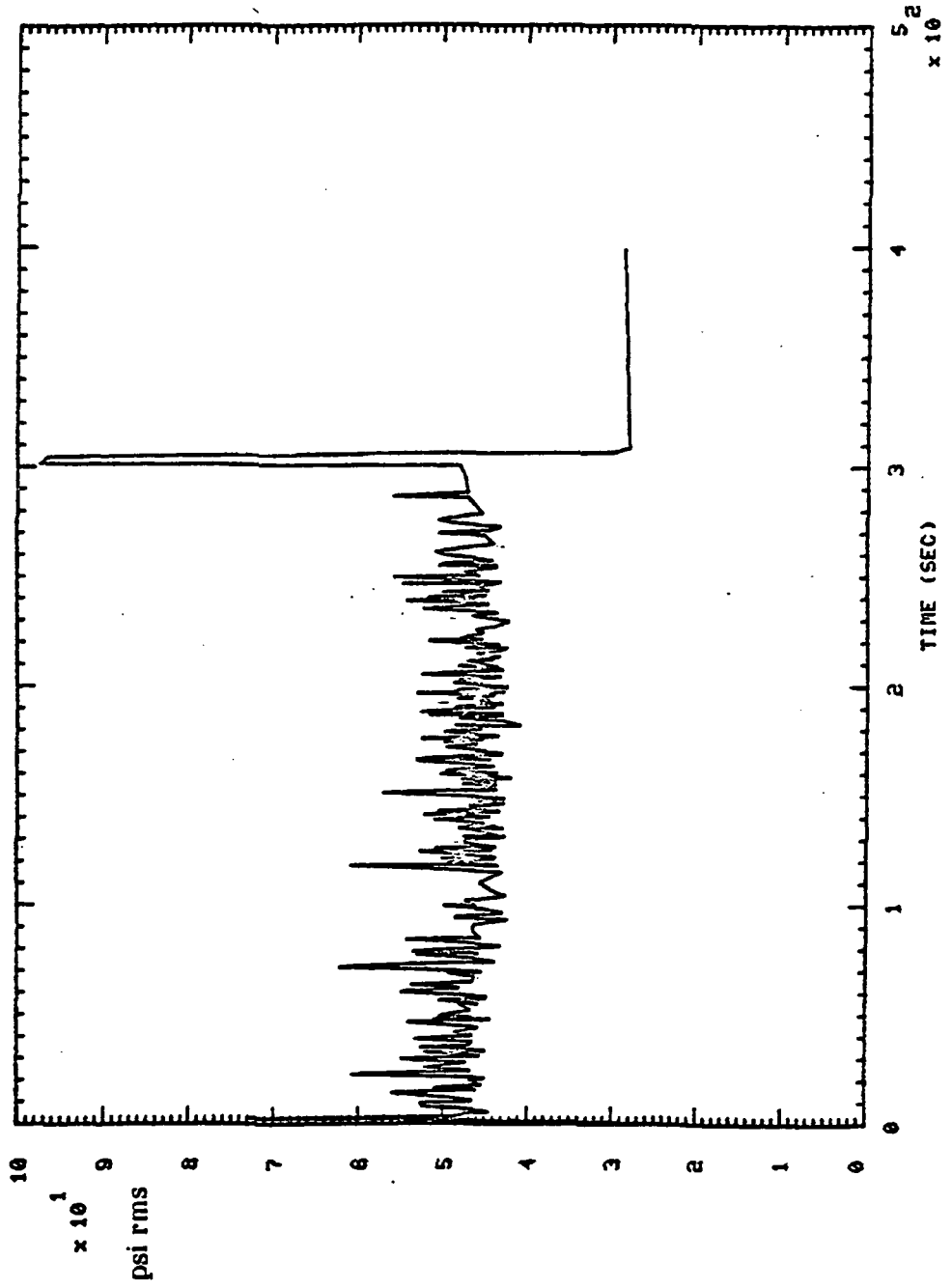


750116 HPOP BAL CAU PR1 (1 - 20K HZ) 204



(1 - 20K HZ)

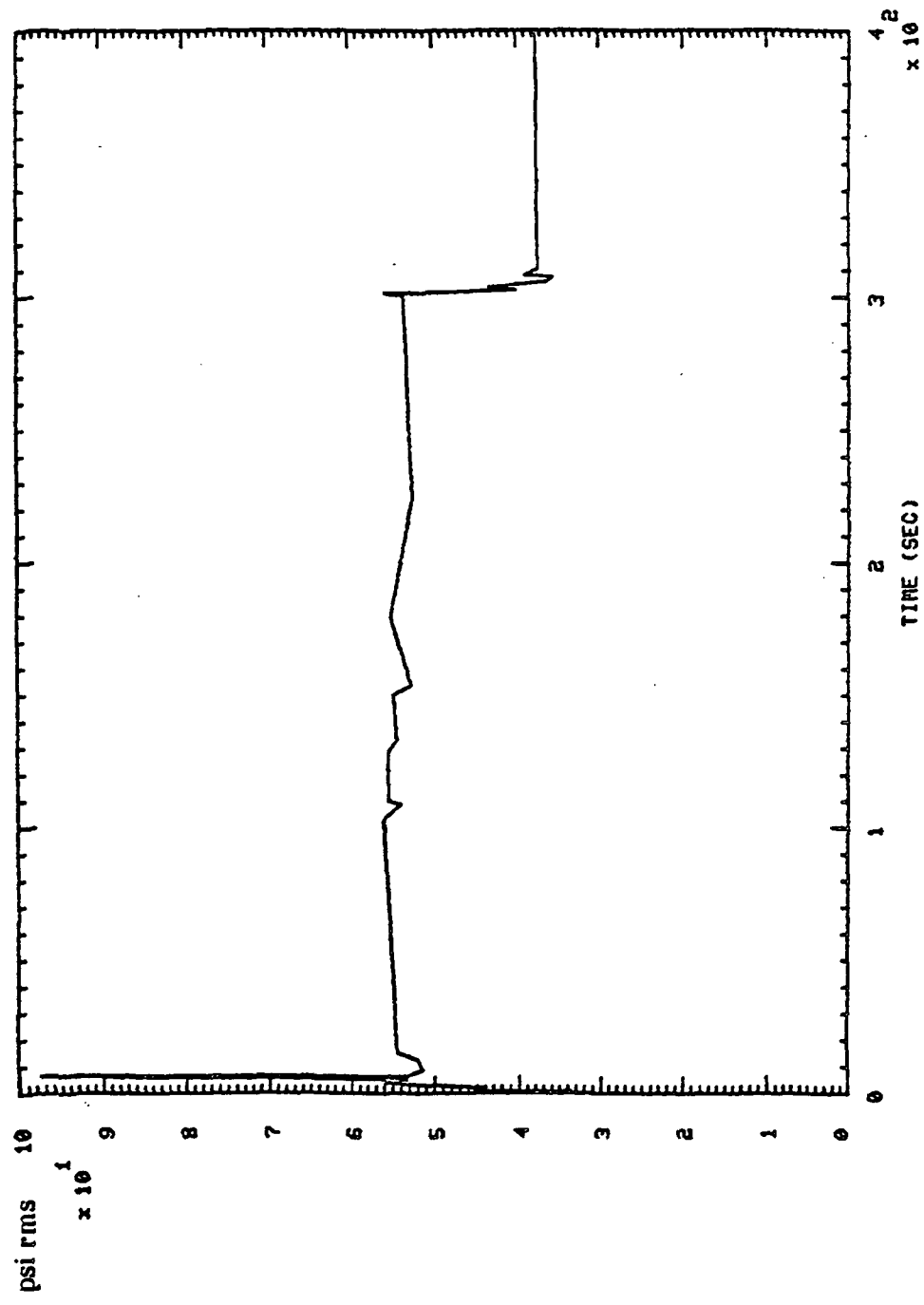
750116 HPOP DS PR



750116

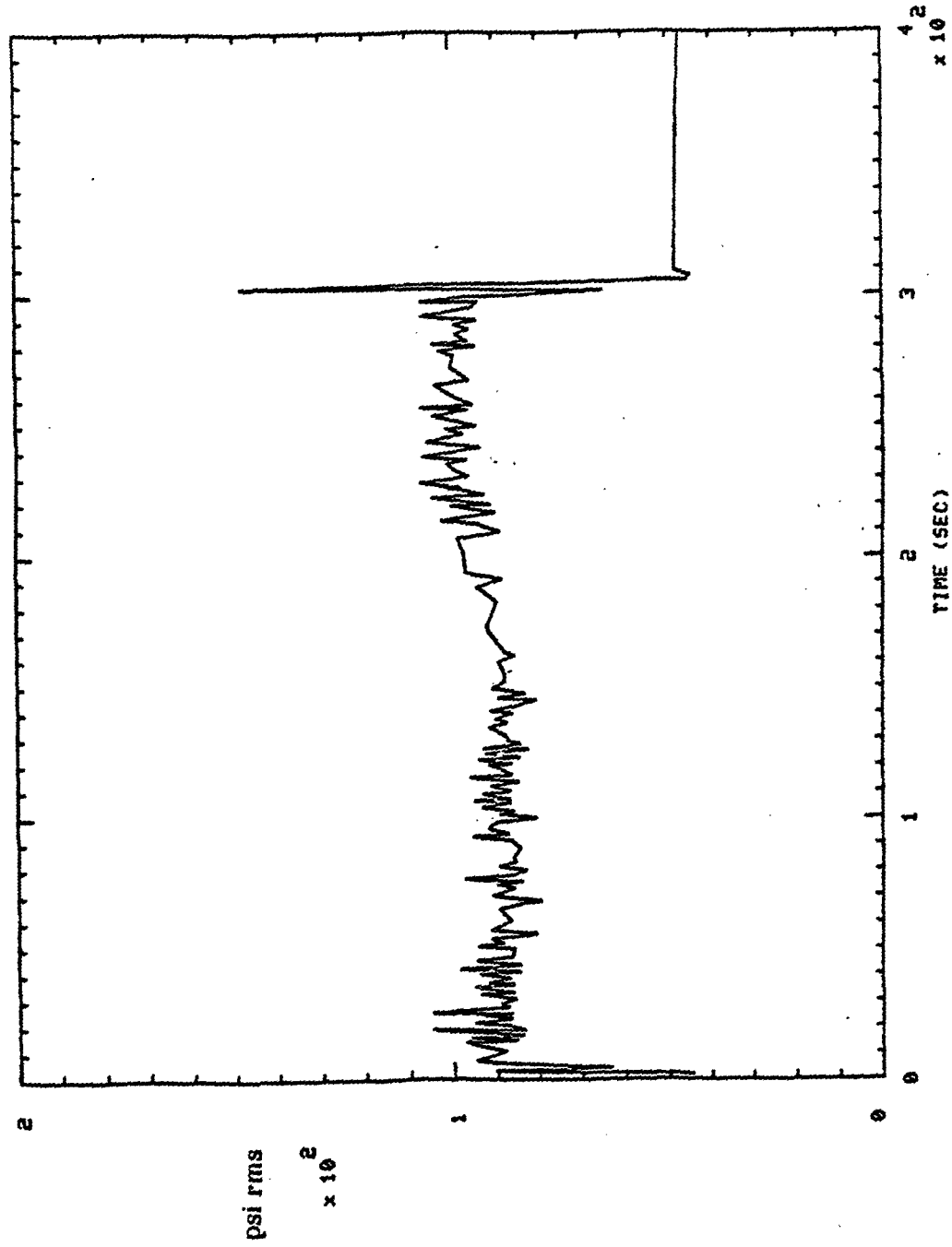
MCC HOT GAS IN PR

(1 - 20K HZ)



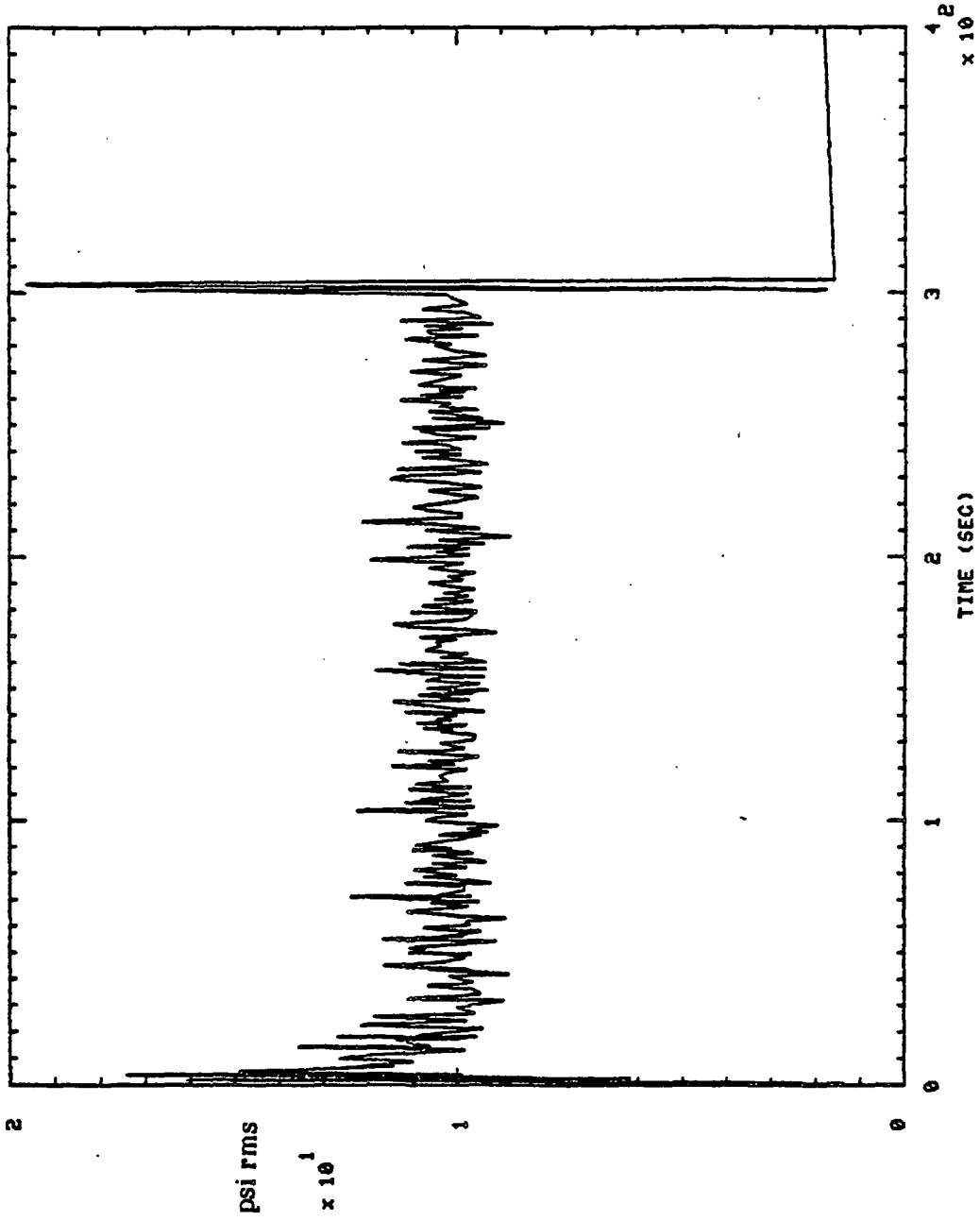
(1 - 20K HZ)

750116 PBP DS PR

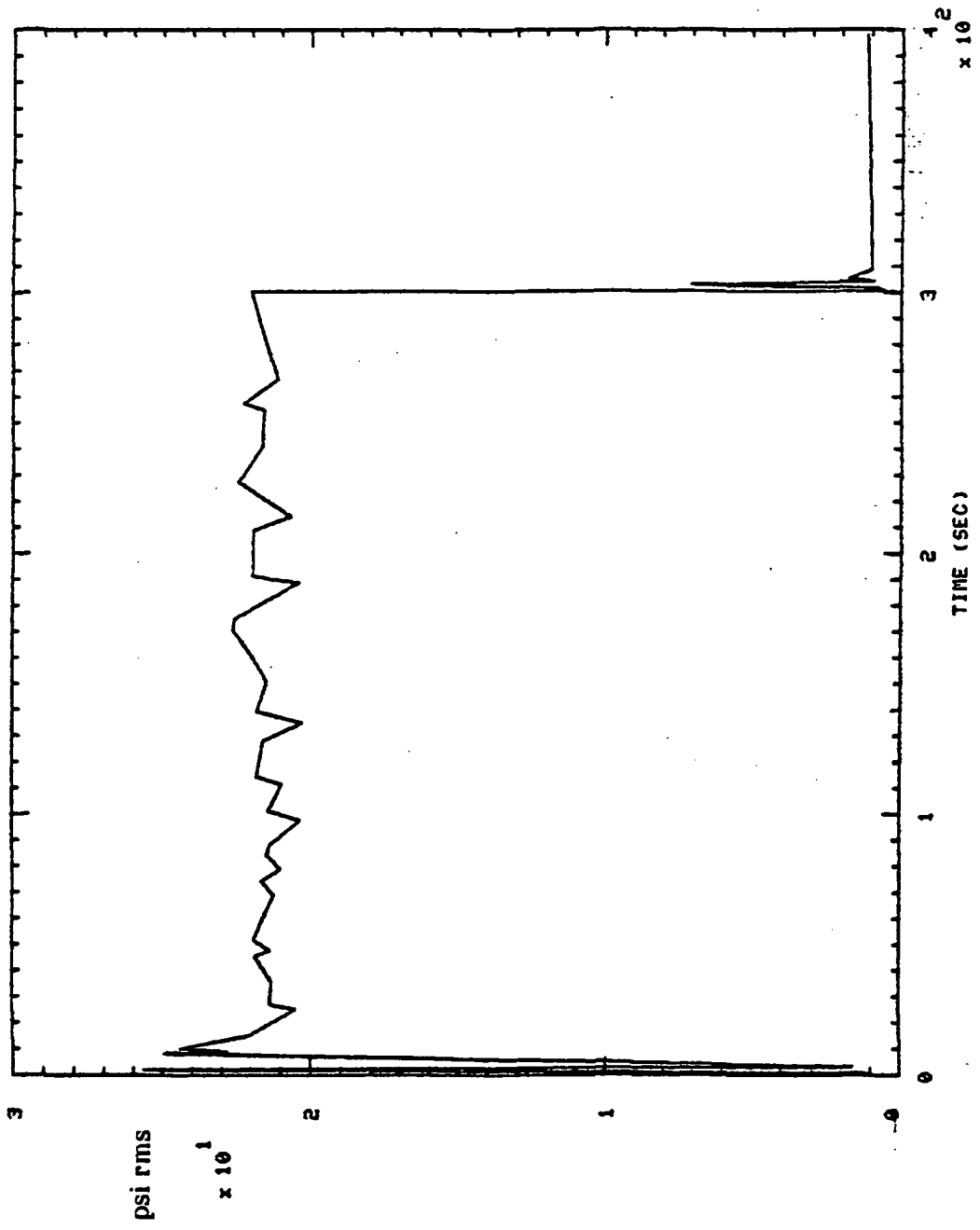


750116 OPB PC PR

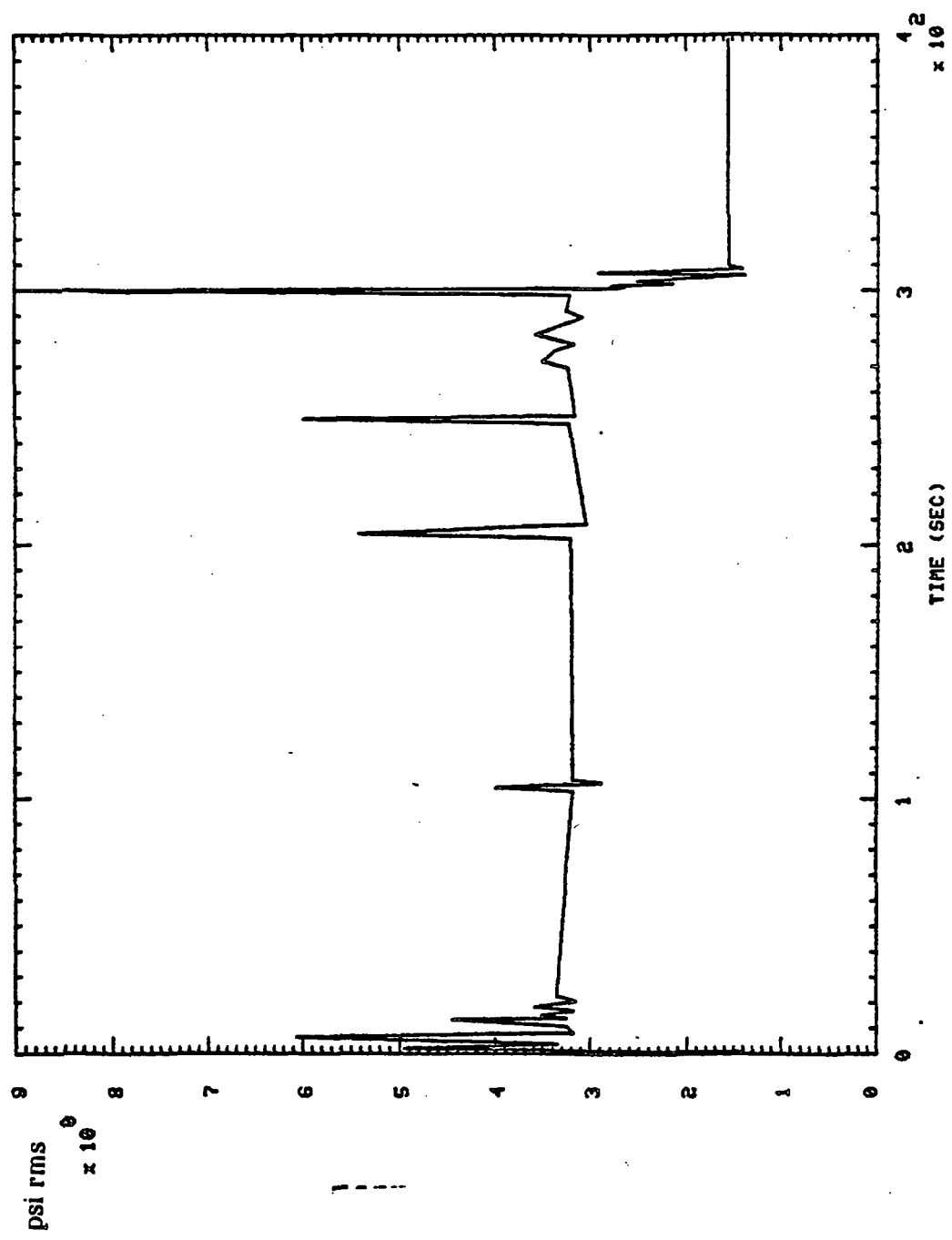
(1 - 20K HZ)



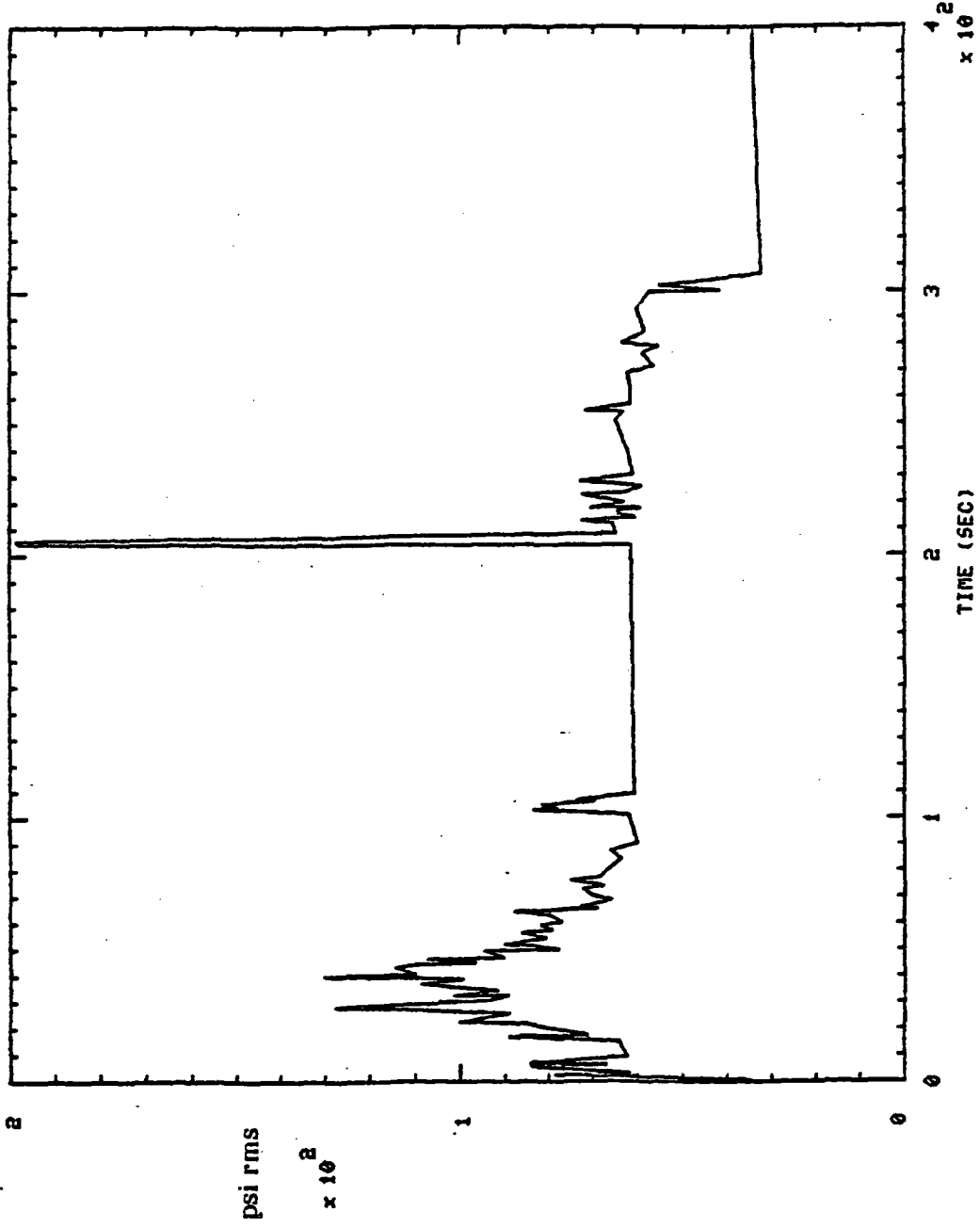
750116 HPFP DS PR (1 - 20K HZ)



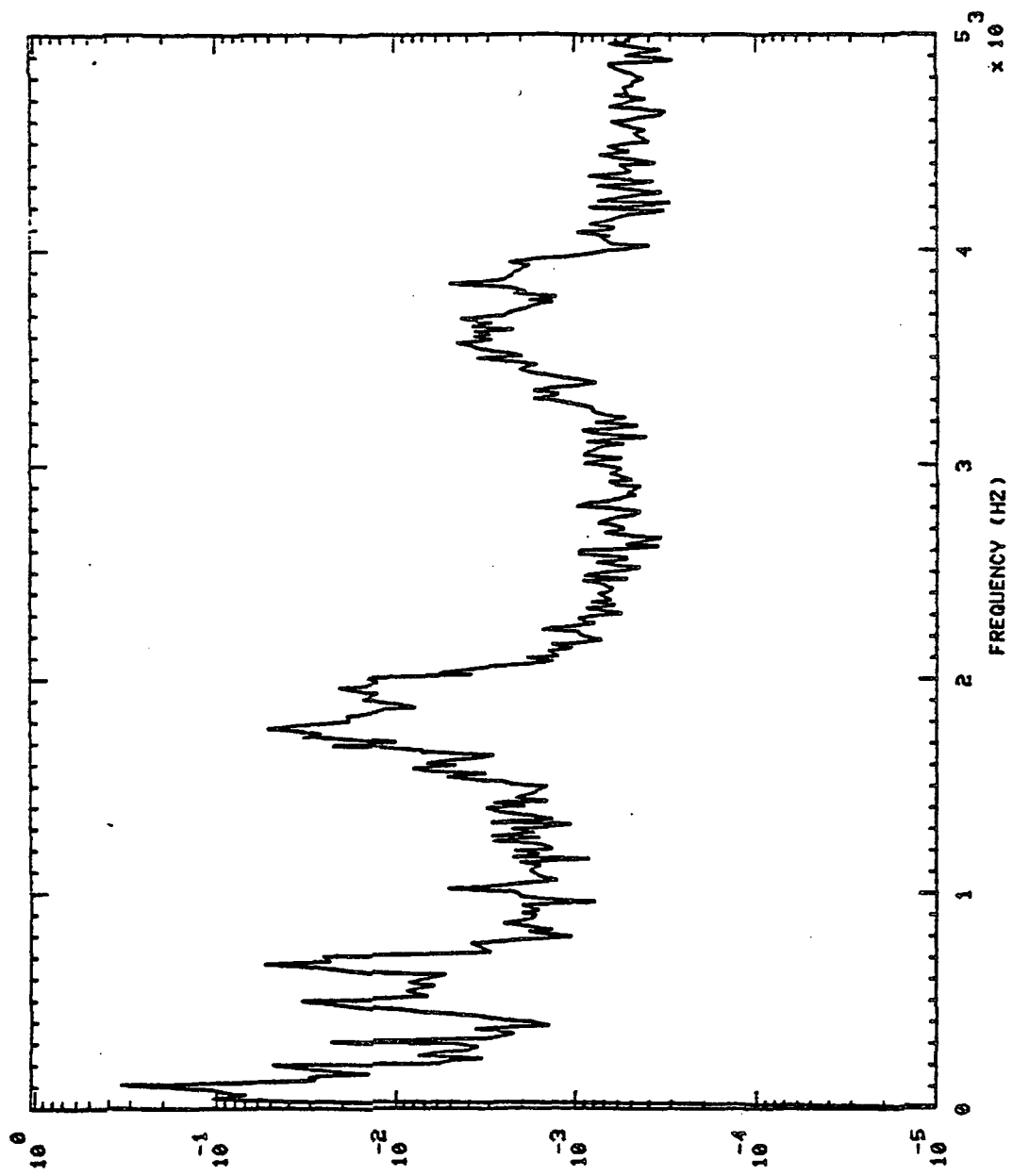
750116 HOT GAS MAN PR3 (1 - 20K HZ)



750116 HPFP BAL CAU PR (1 - 20K HZ)

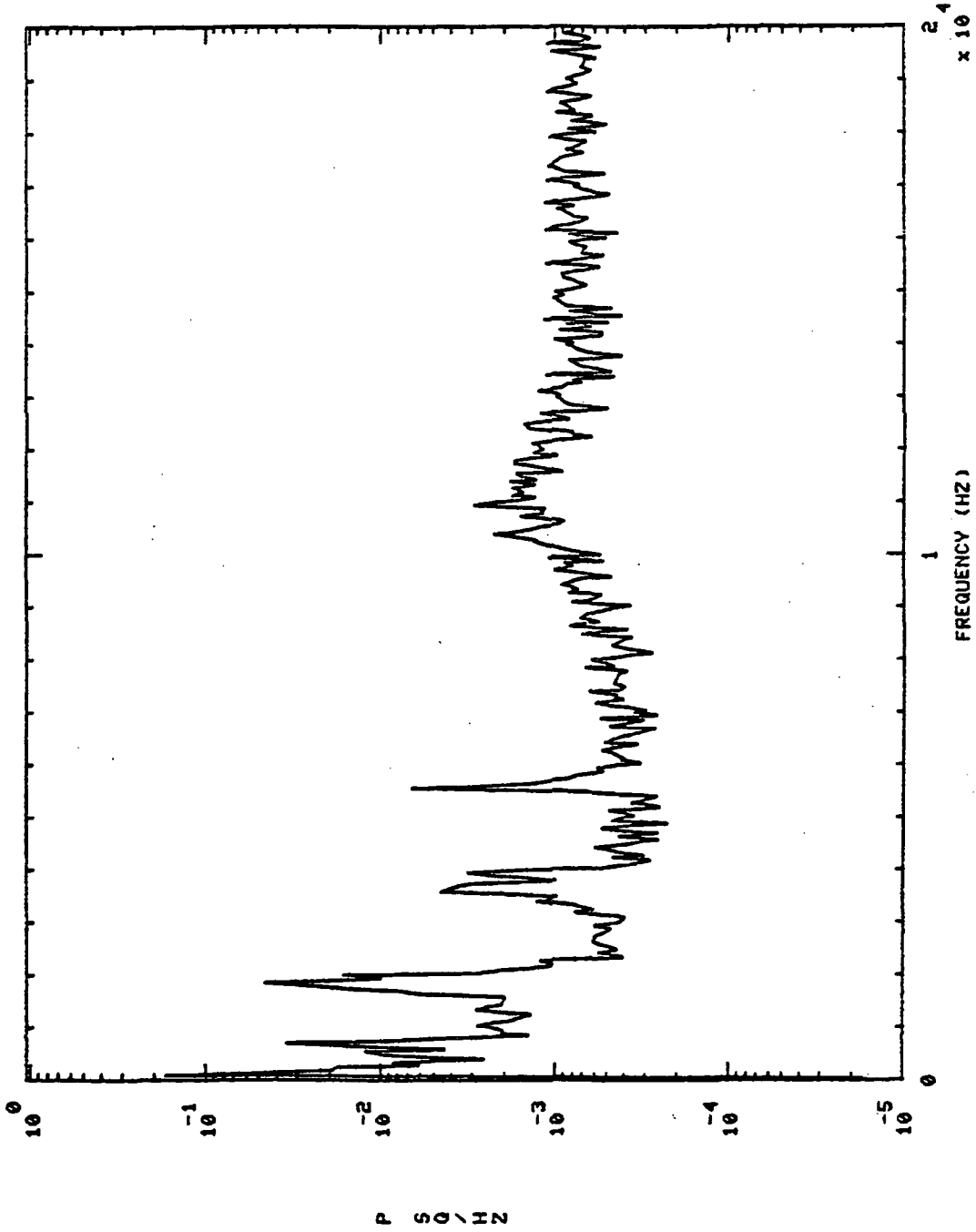


750116 LPOP DS PR S+ 30.01H0,'S



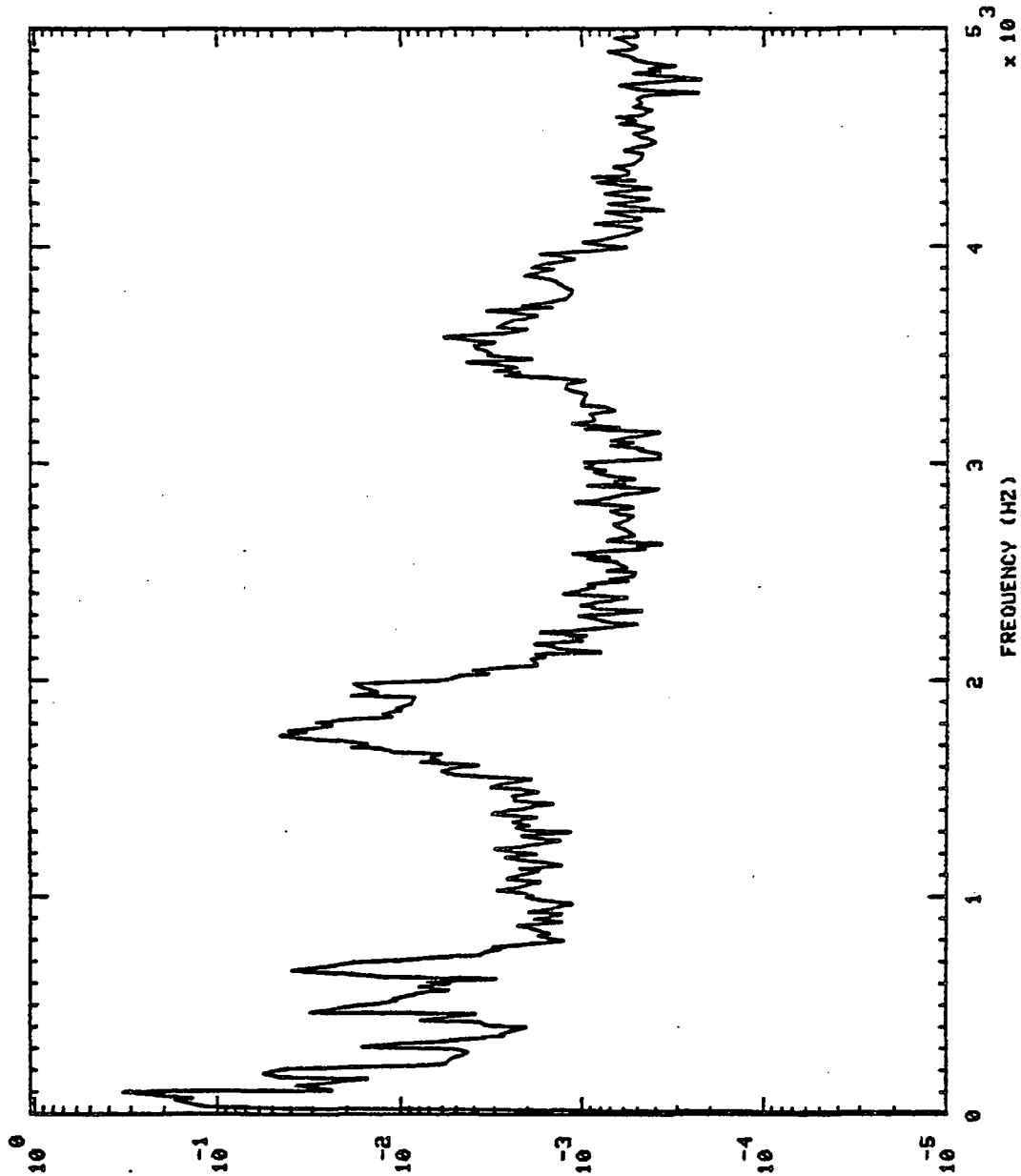
P S D \ H Z

750116 LPOP DS PR S+ 30.01H0,'S



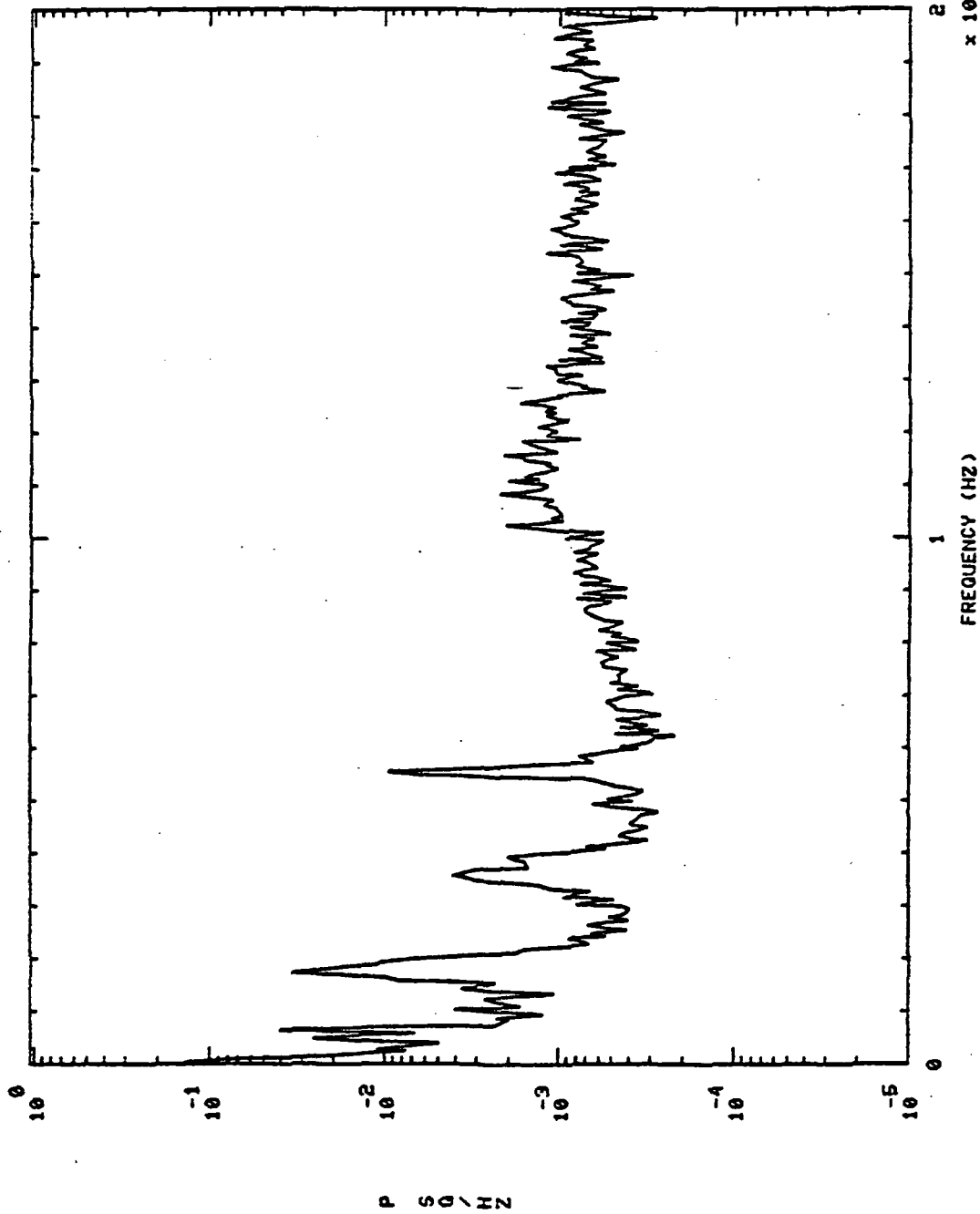
S+ 150.01H0,'S

750116 LPOP DS PR



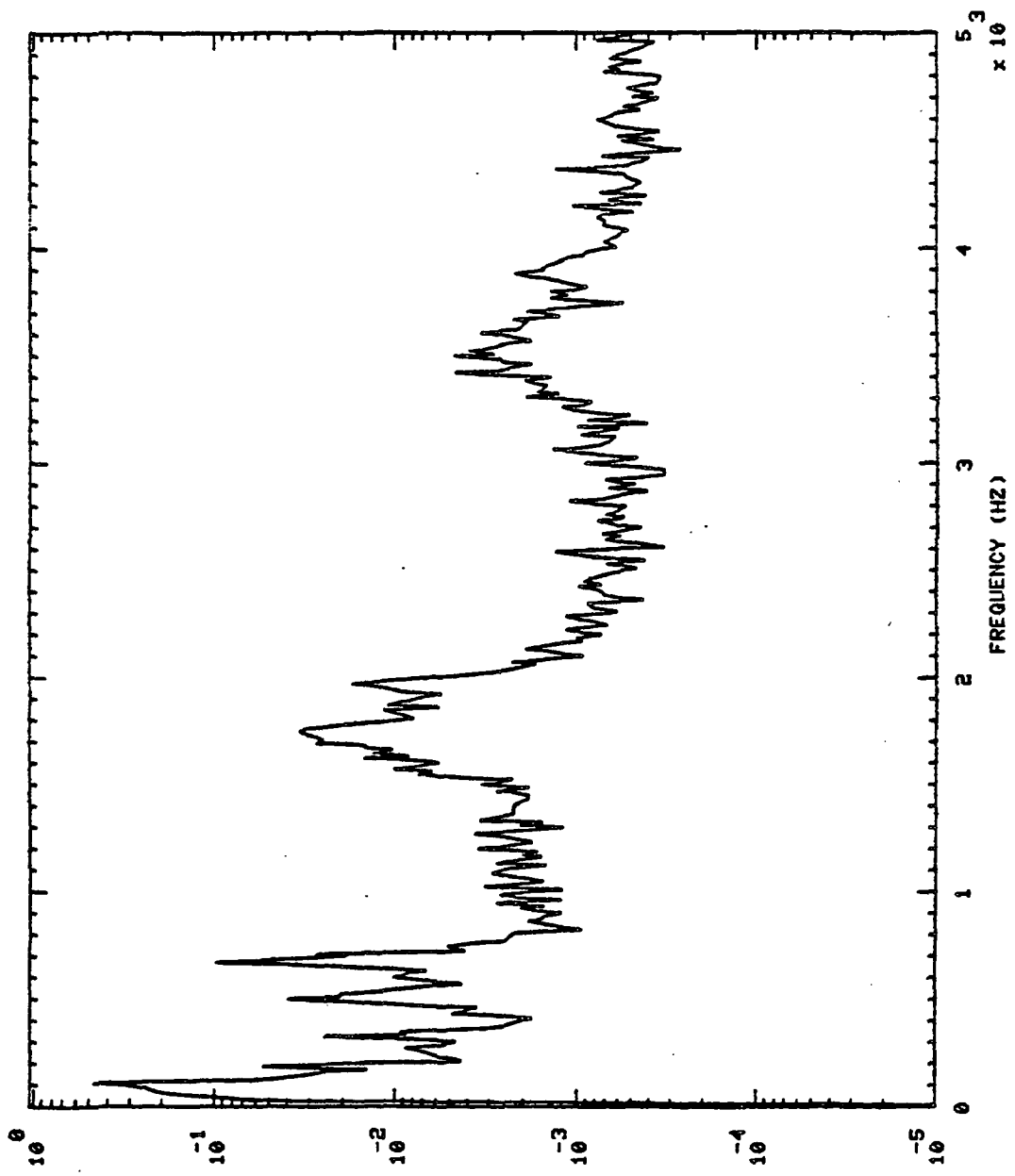
P SQ/HZ

750116 LPOP DS PR S+ 150.01H0,'S



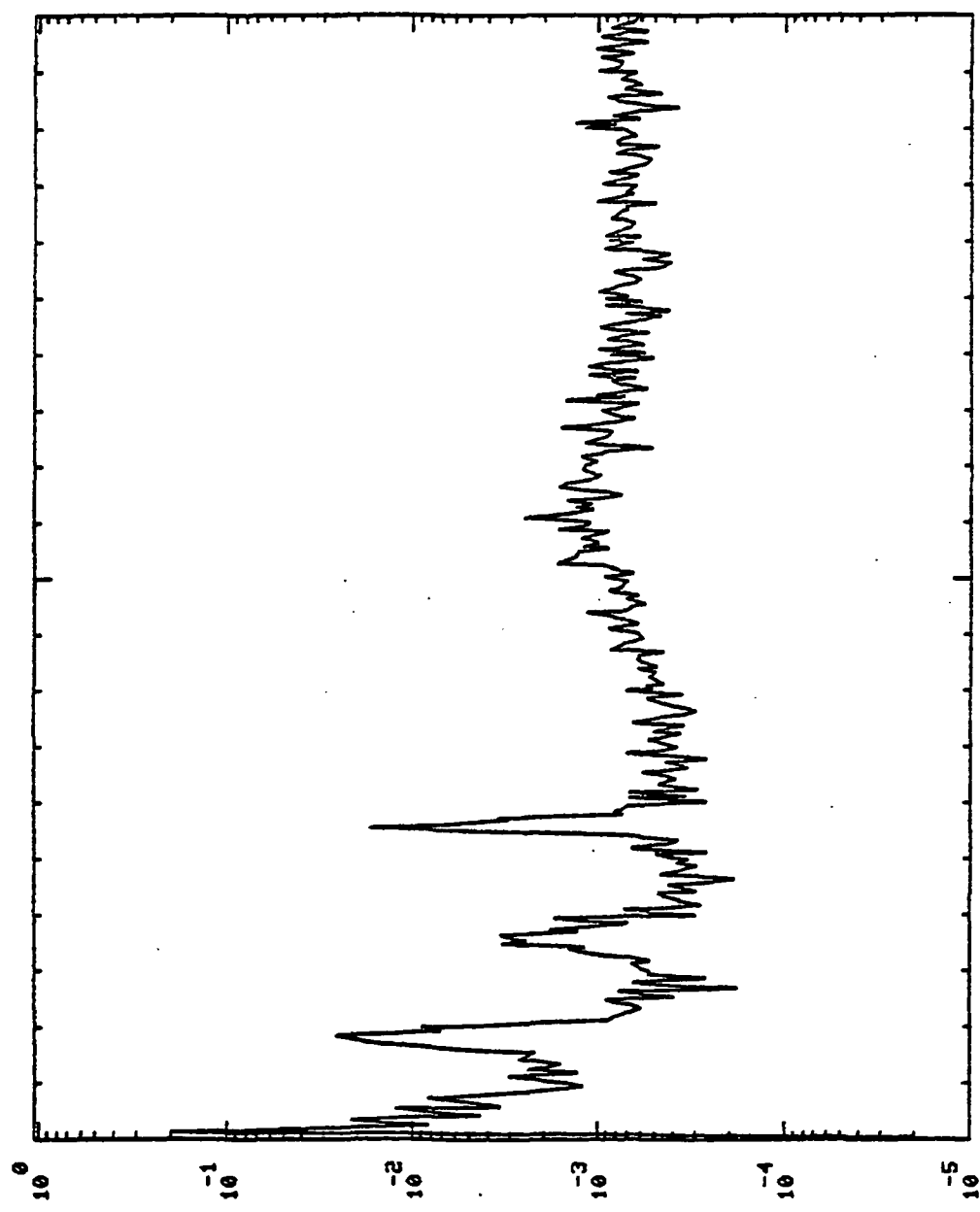
C-3

750116 LPOP DS PR S+ 280.01H0,'S



P SQ/HZ

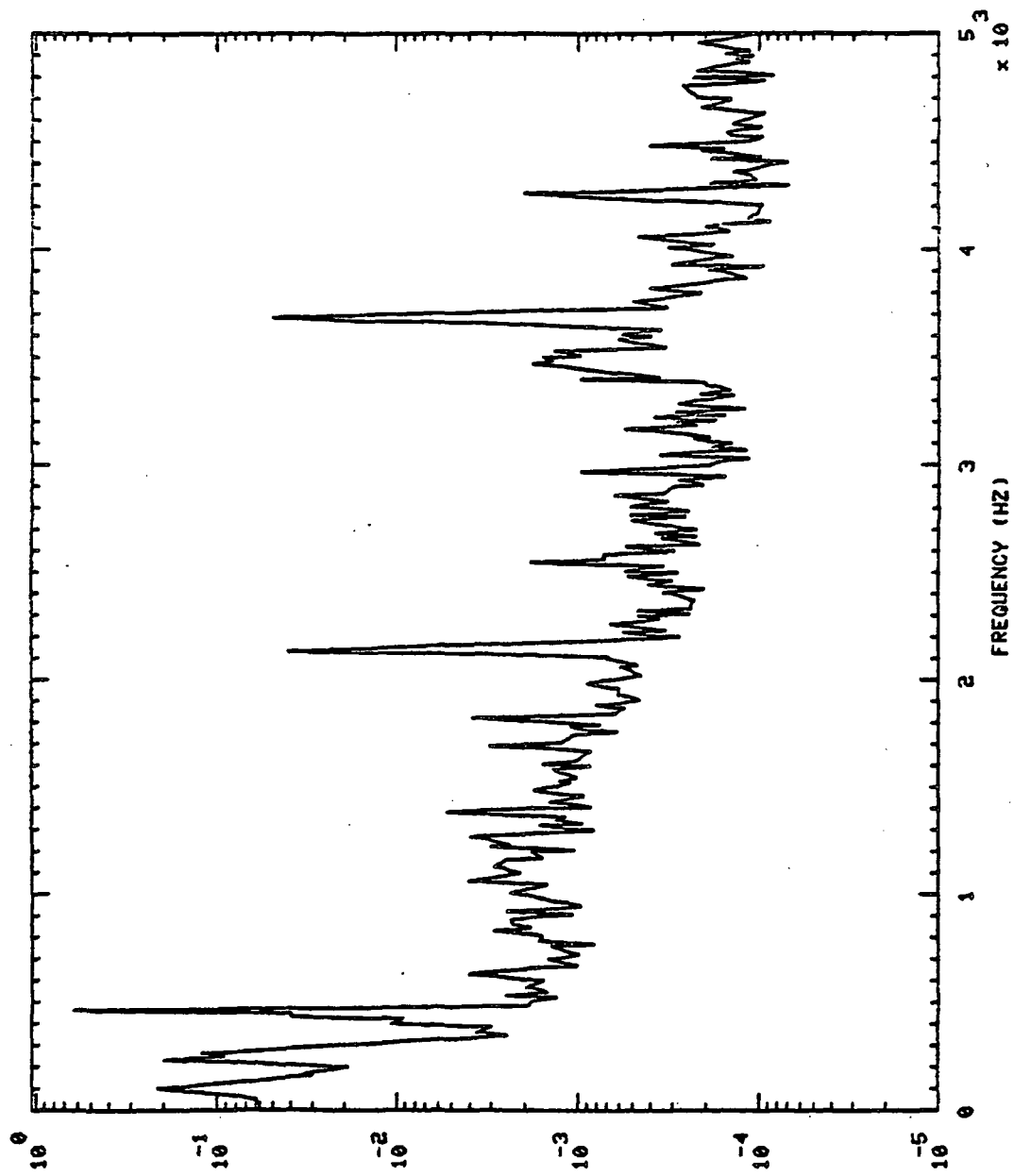
750116 LPOP DS PR S+ 280.01H0,'S



P S D / H Z

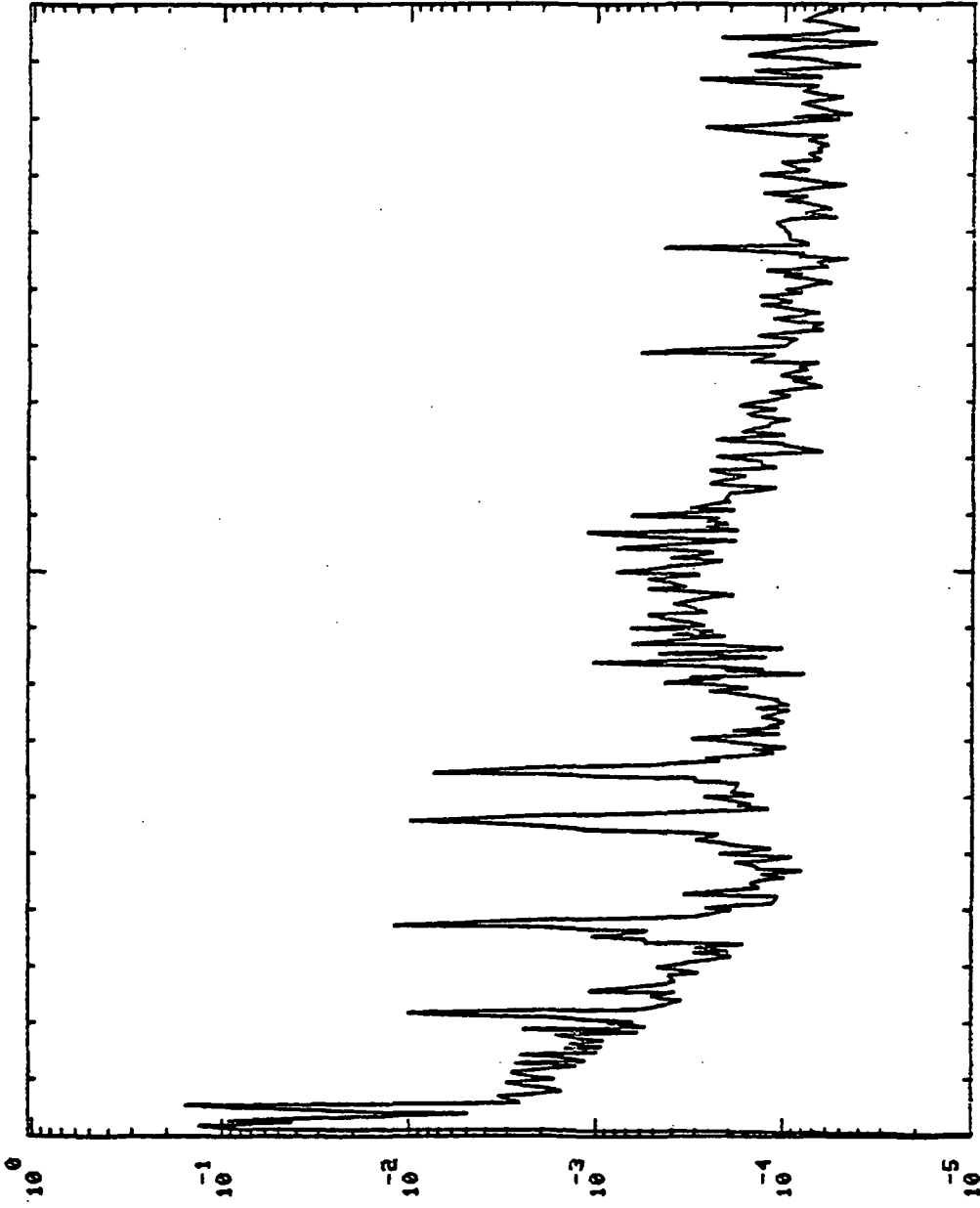
FREQUENCY (HZ) x 10⁴

750116 HPOP BAL CAU PR2 57 30.0110,'S



P S D \ HZ

750116 NPOP BAL CAU PR2 S+ 30.01H0.'S

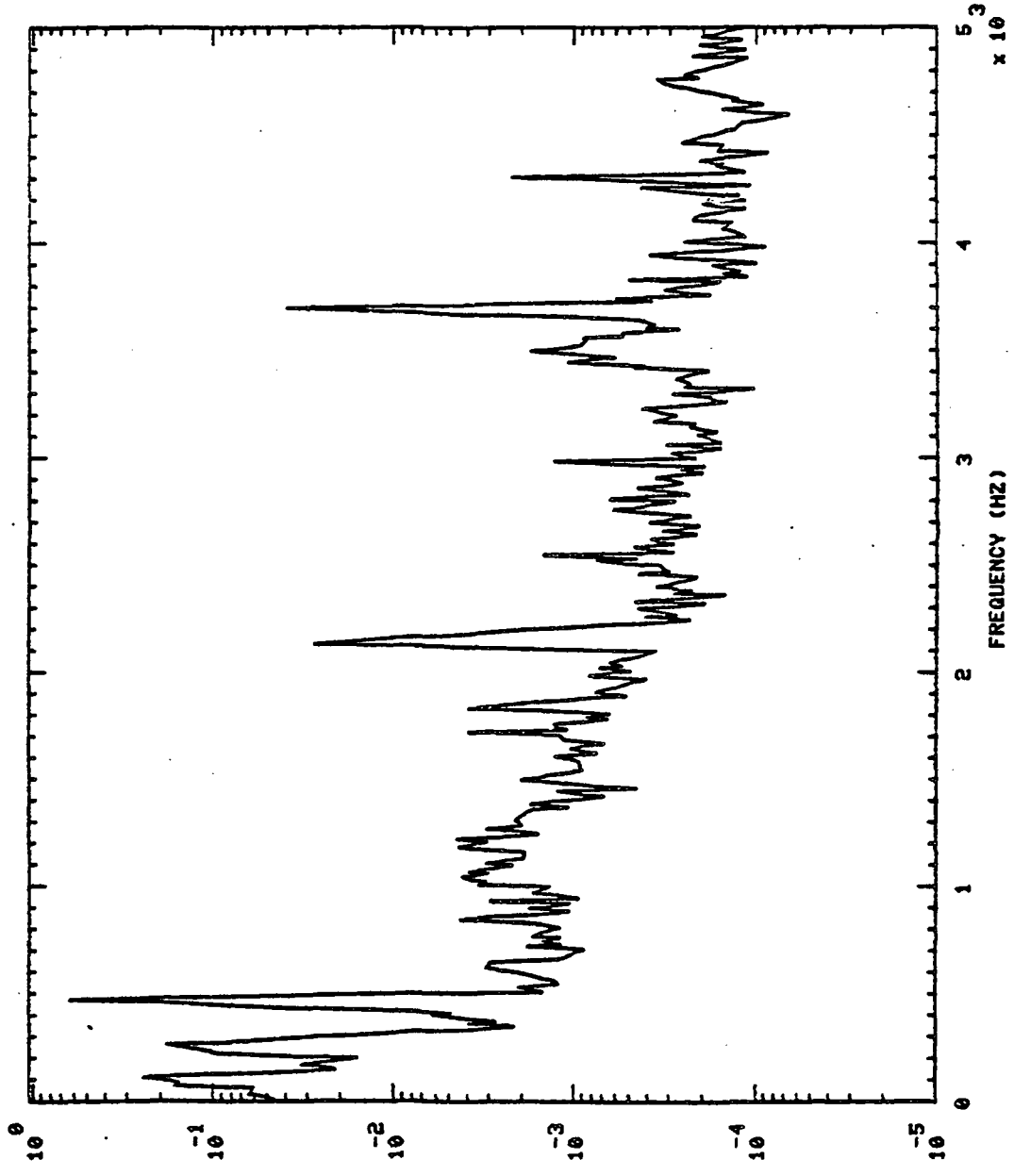


P SQ/HZ

2.4
x 10⁴

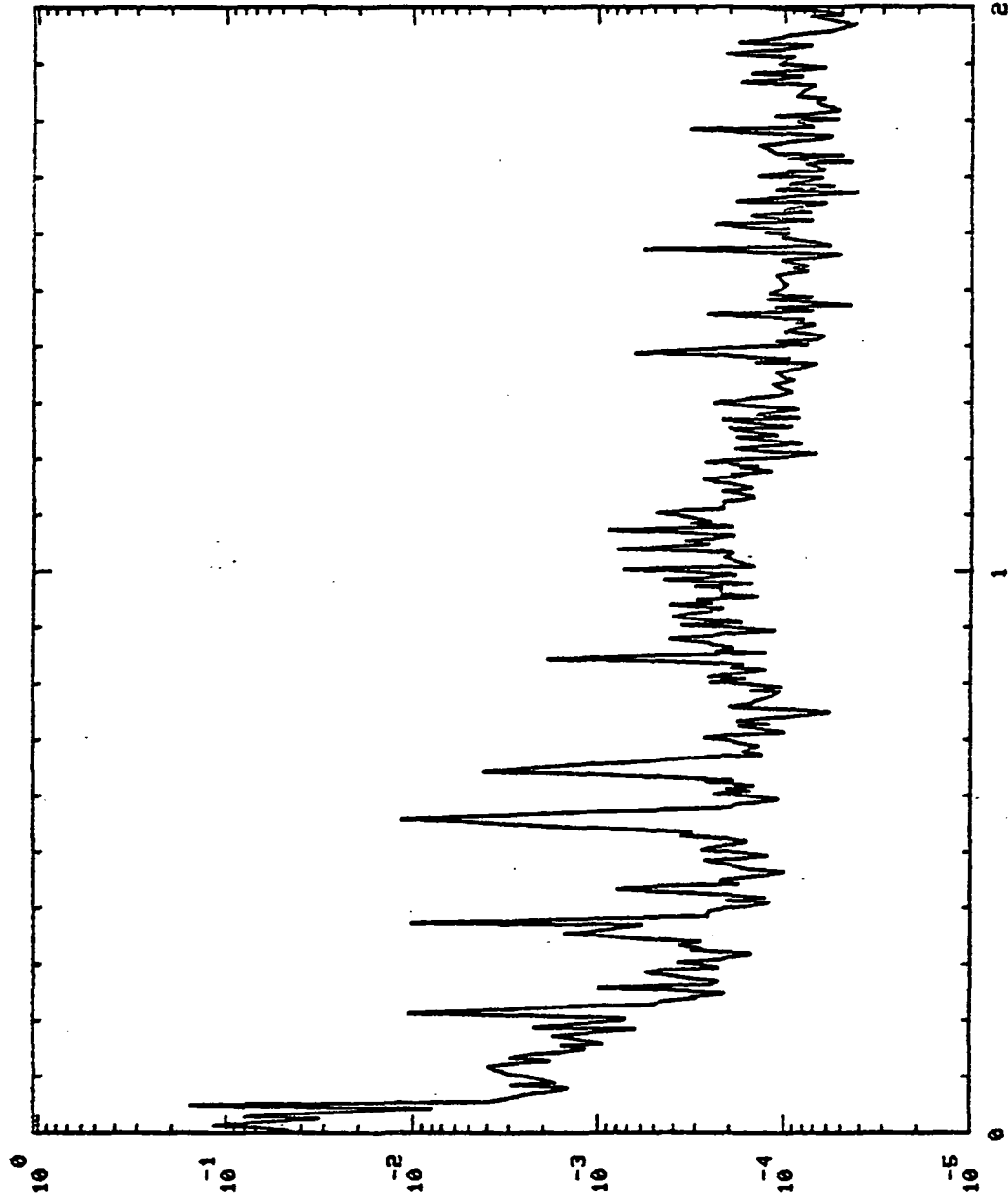
FREQUENCY (HZ)

750116 NPOP BAL CAU PRE S+ 150.01140,'S



P S Q \ H Z

750116 HPOP BAL CAU PR2 S+ 150.01H0,'S

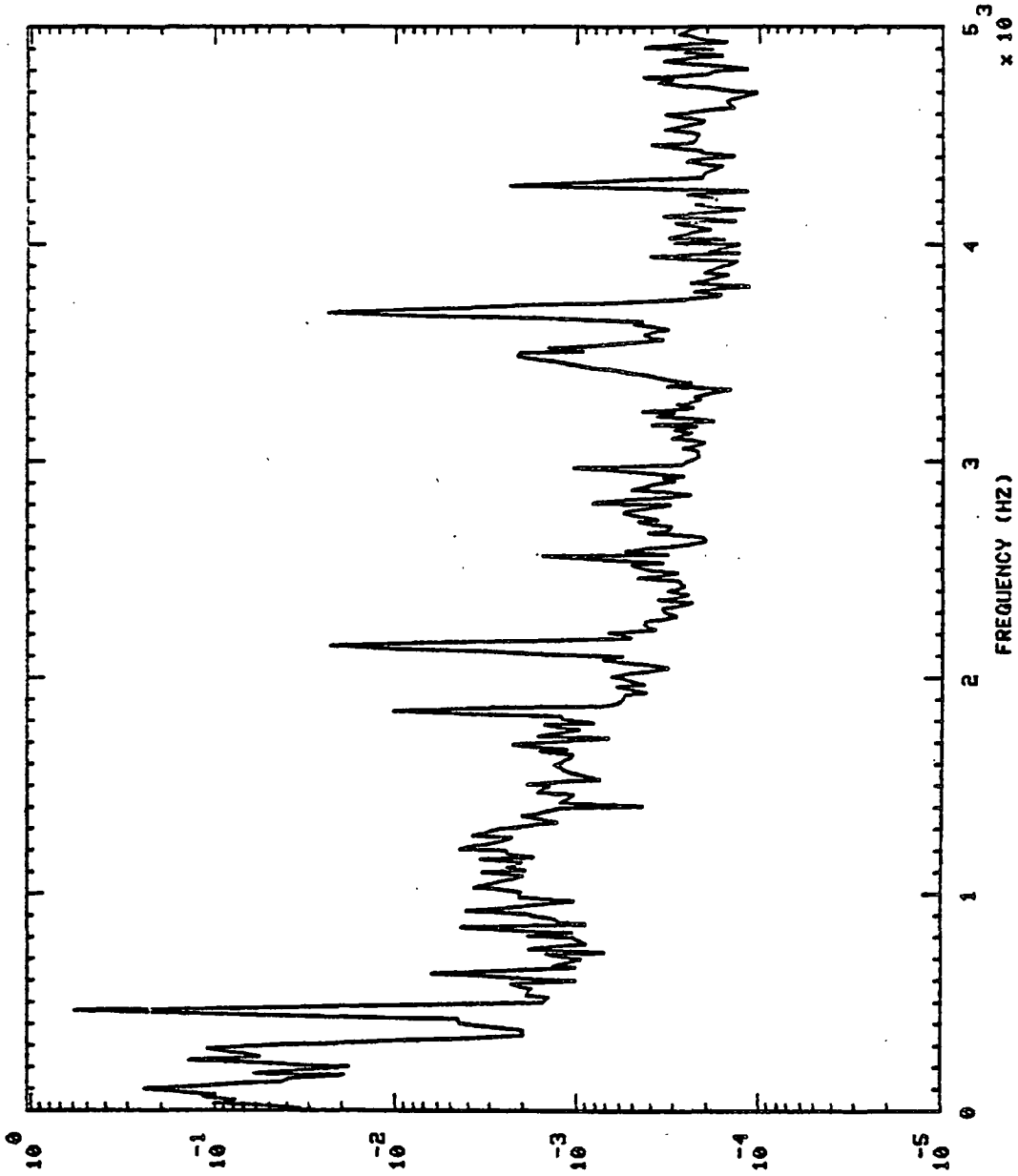


P S D IN

FREQUENCY (HZ)

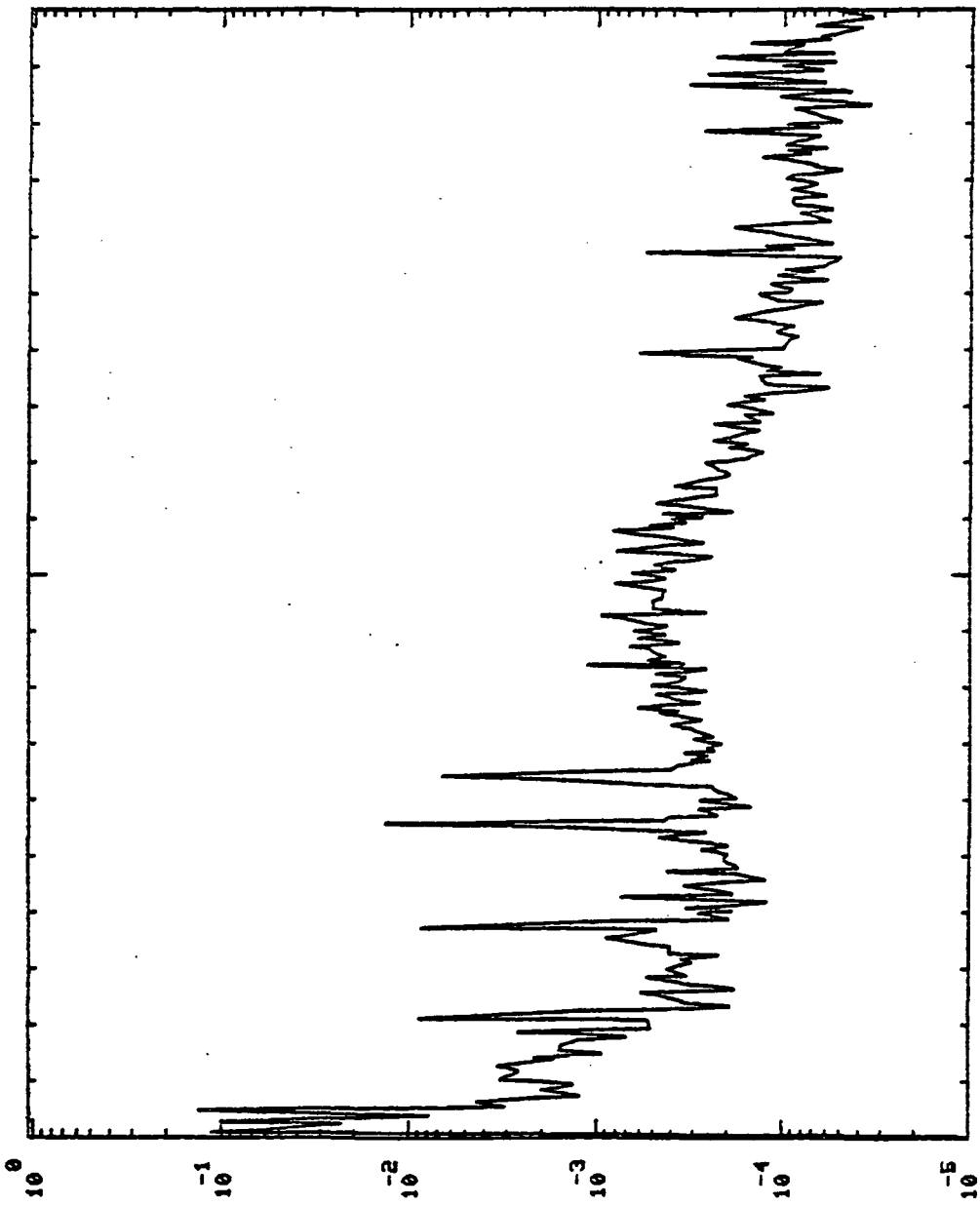
2.4×10^4

750116 HPOP BAL CAU PR2 S+ 280.01H0.'S



P S Q \ HZ

750116 HPOP BAL CAU PR2 S+ 280.01H0,'S

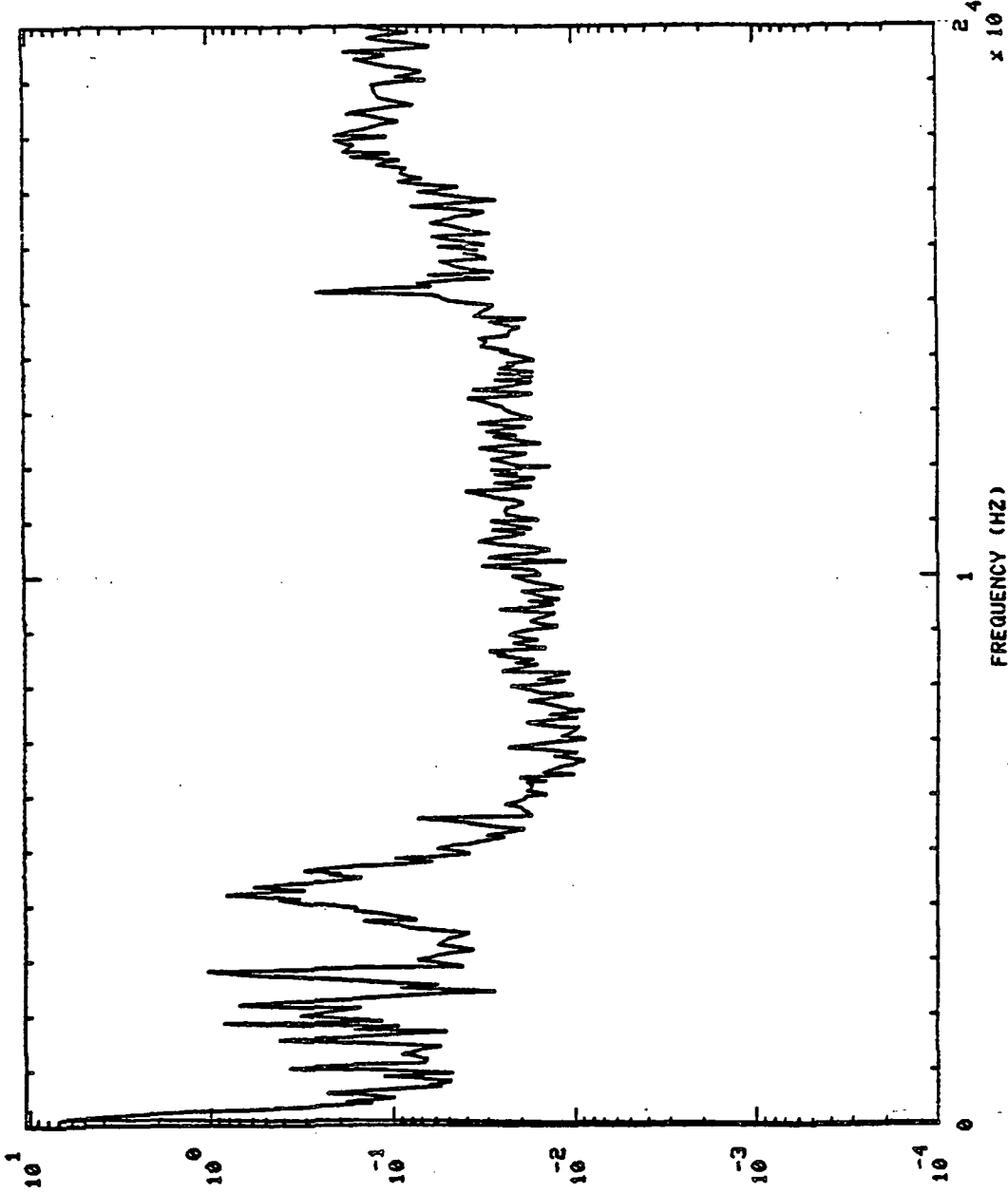


P S/D HN

FREQUENCY (HZ) $\times 10^4$

S+ 30.01H0,'S

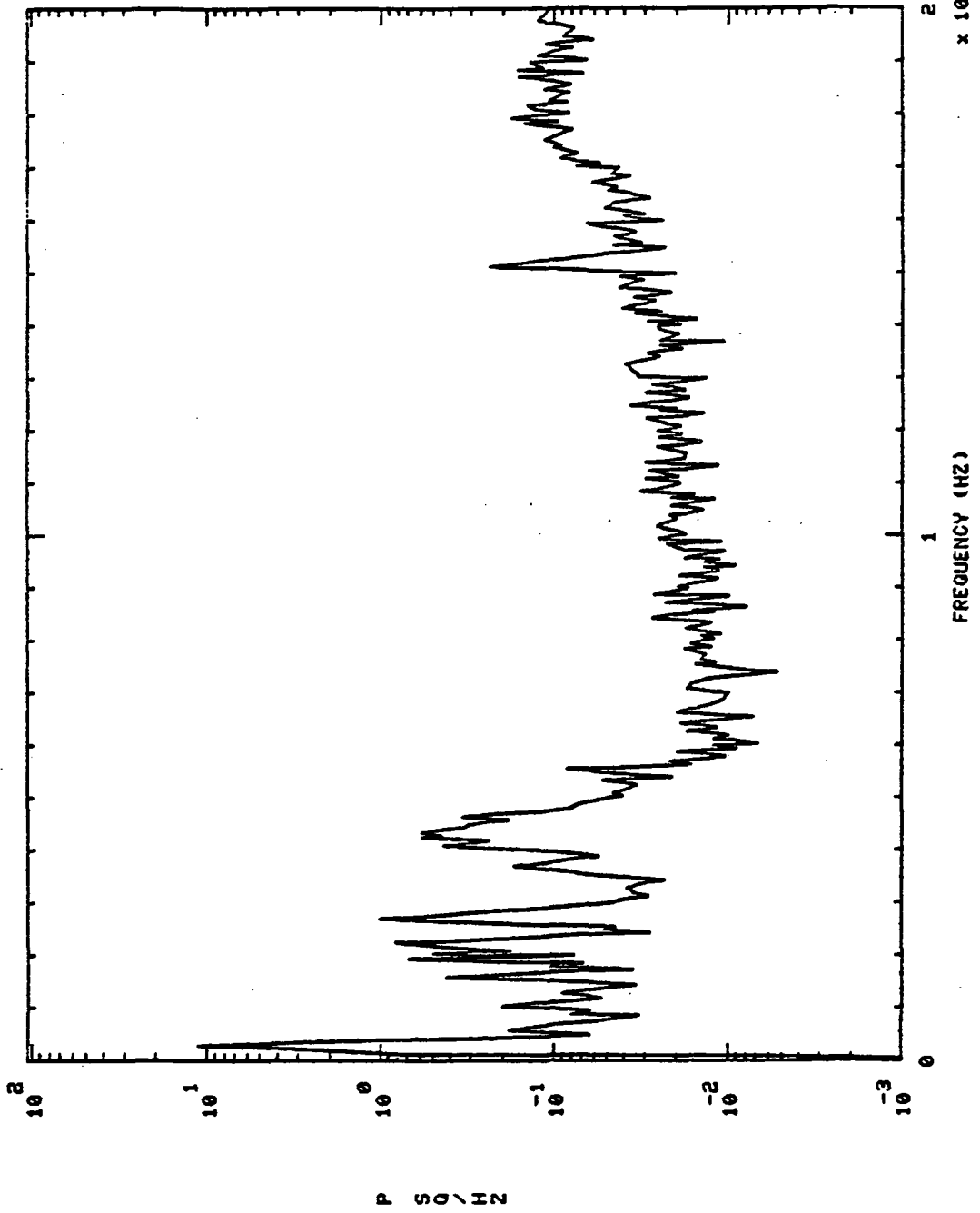
750116 HPOP DS PR



1111

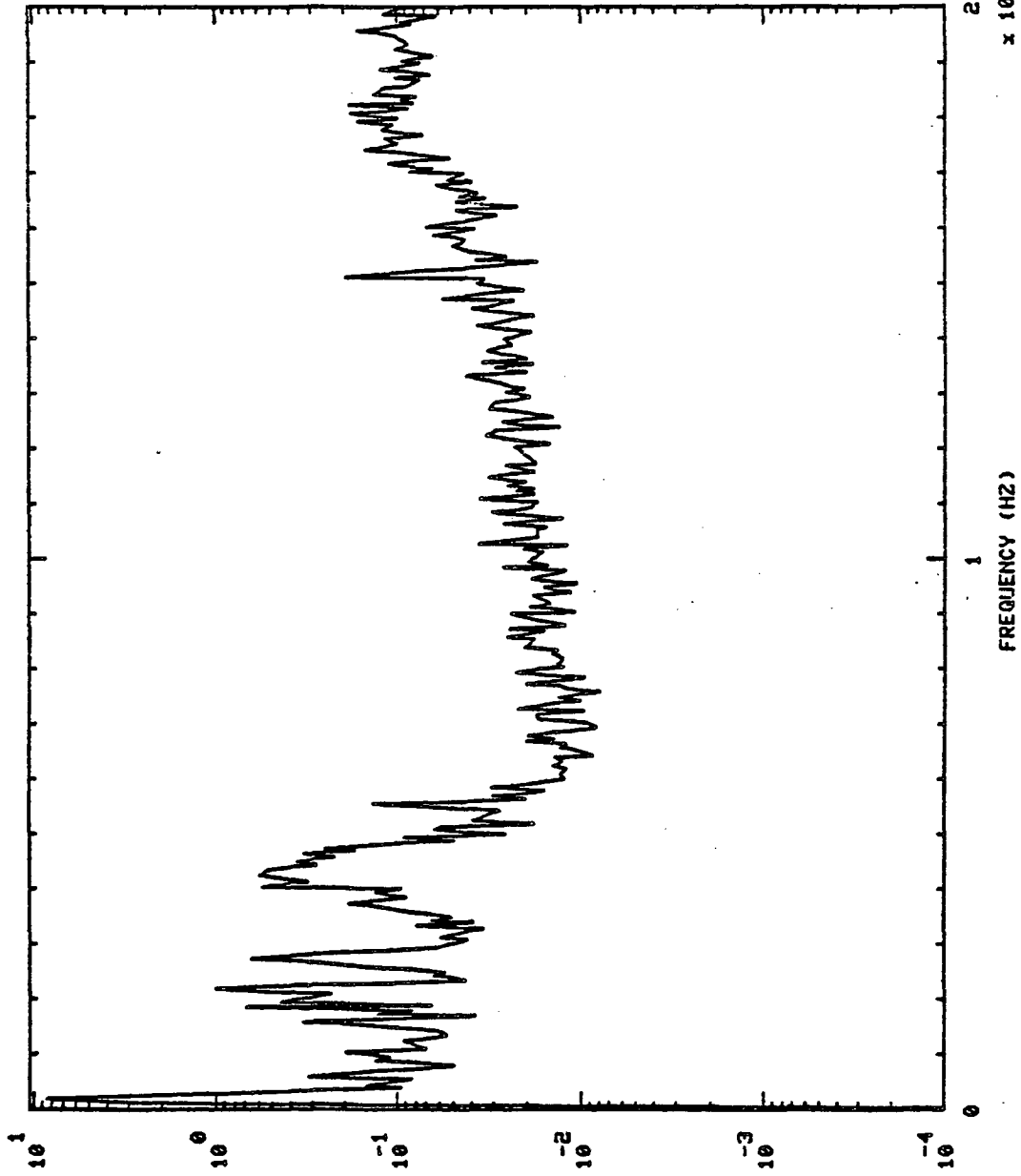
S+ 150.01H0,'S

750116 HPOP DS PR

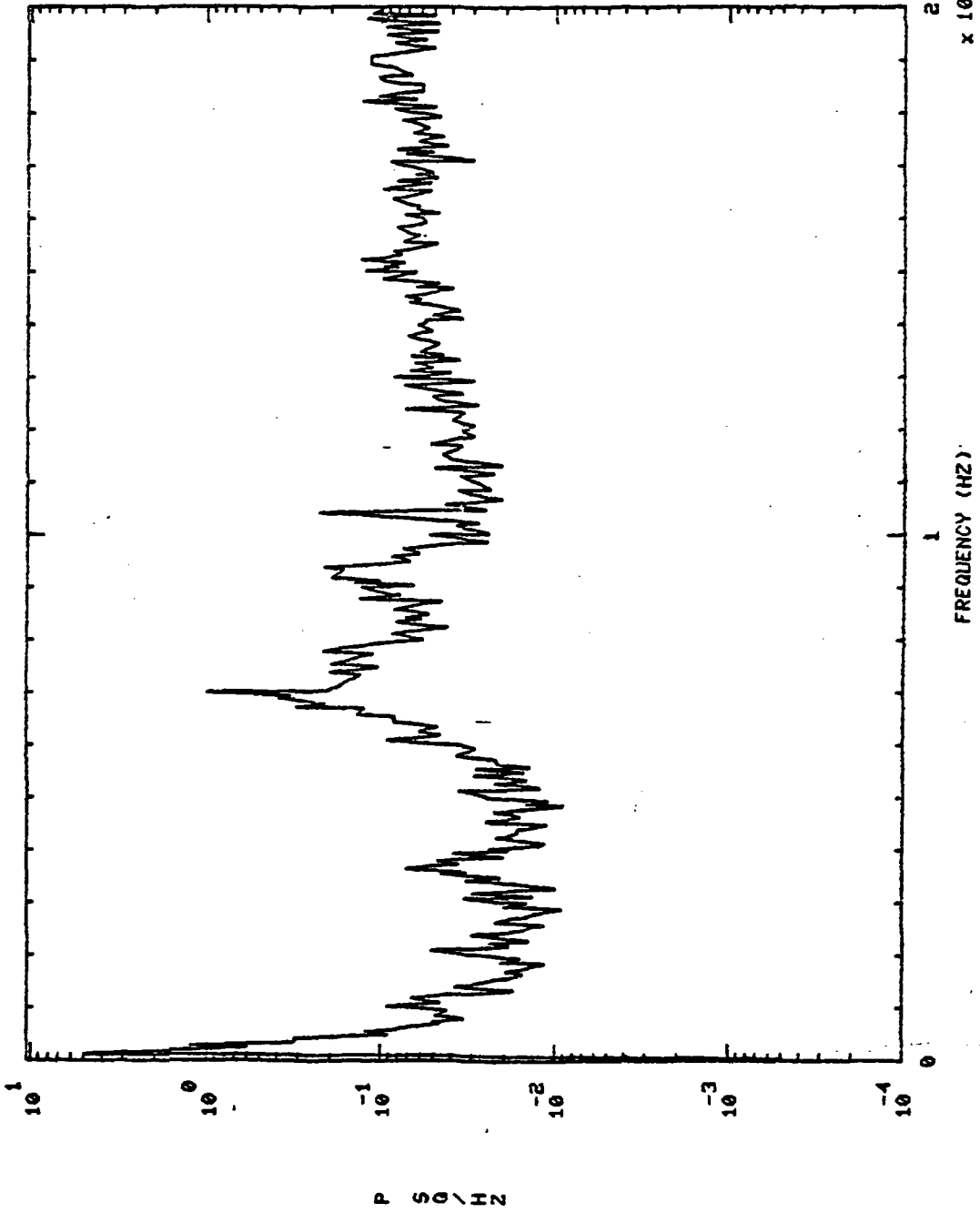


S+ 280.01H0,'S

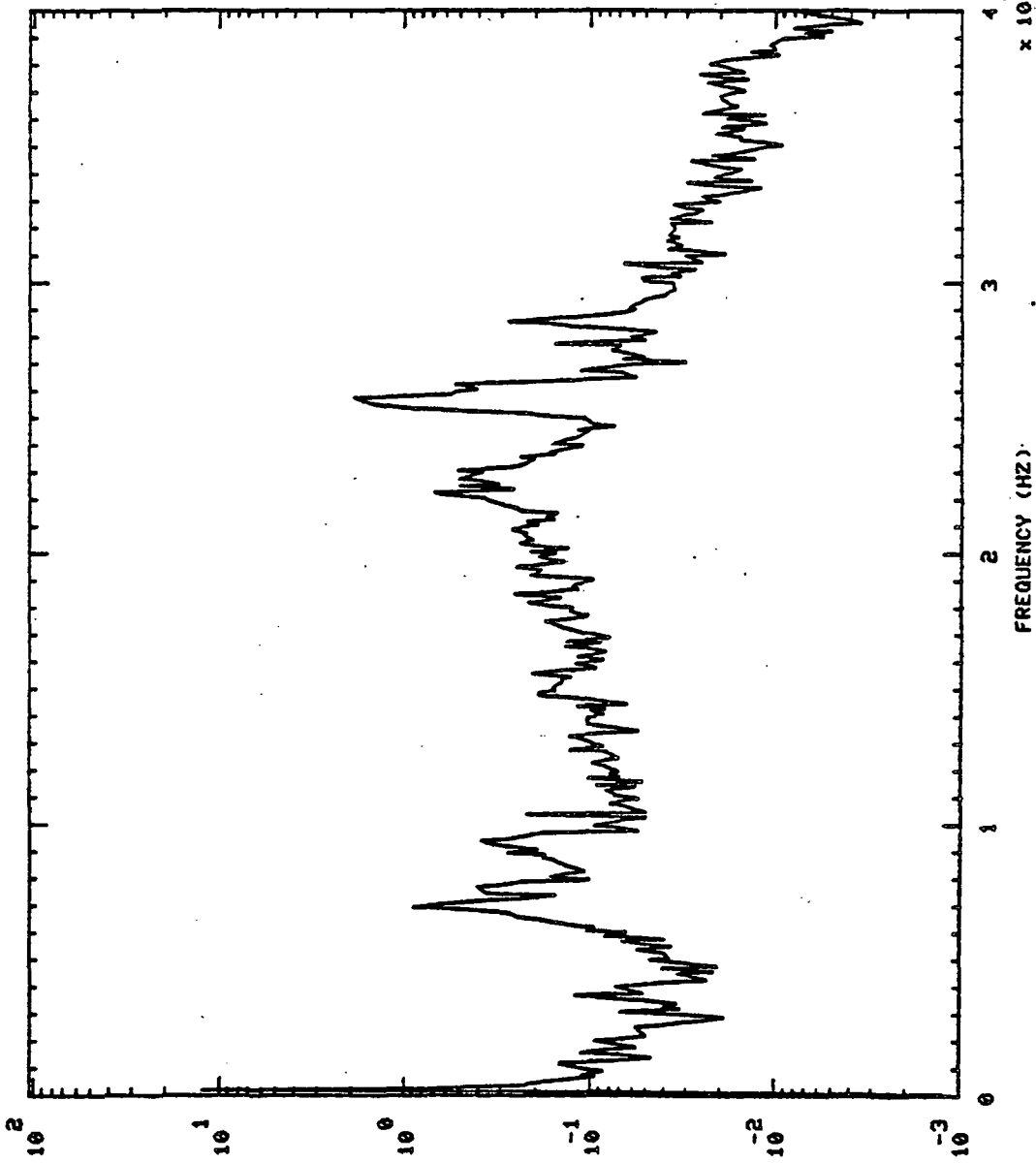
750116 HPOP DS PR



750116 MCC HOT GAS IN PR S+ 30.01H0,'S



750116 MCC HOT GAS IN PR S+ 30.01H0, 'S

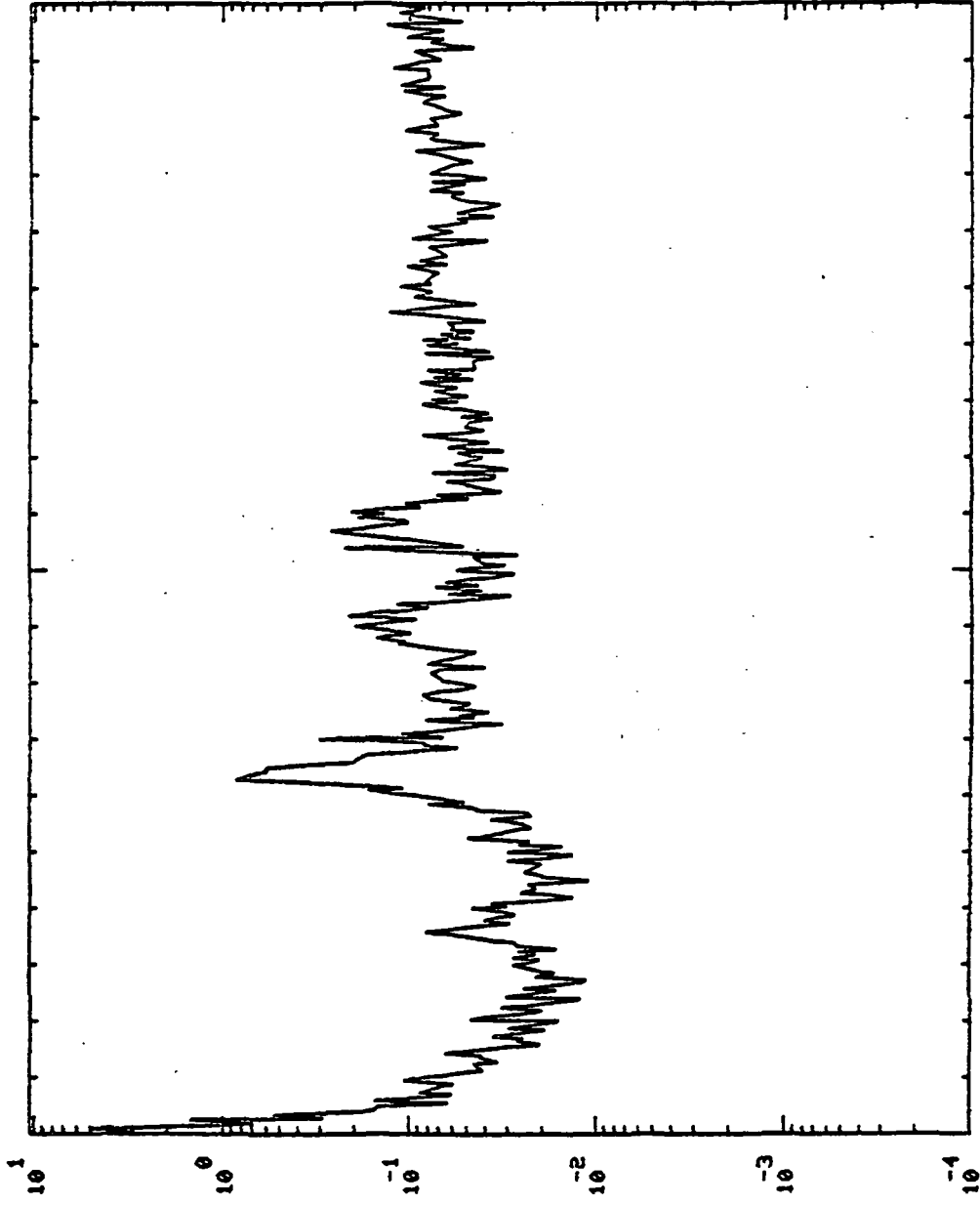


P SO/H2

750116 MCC HOT GAS IN PR S+ 150.01H0,'S

750116 MCC HOT GAS IN PR

750116

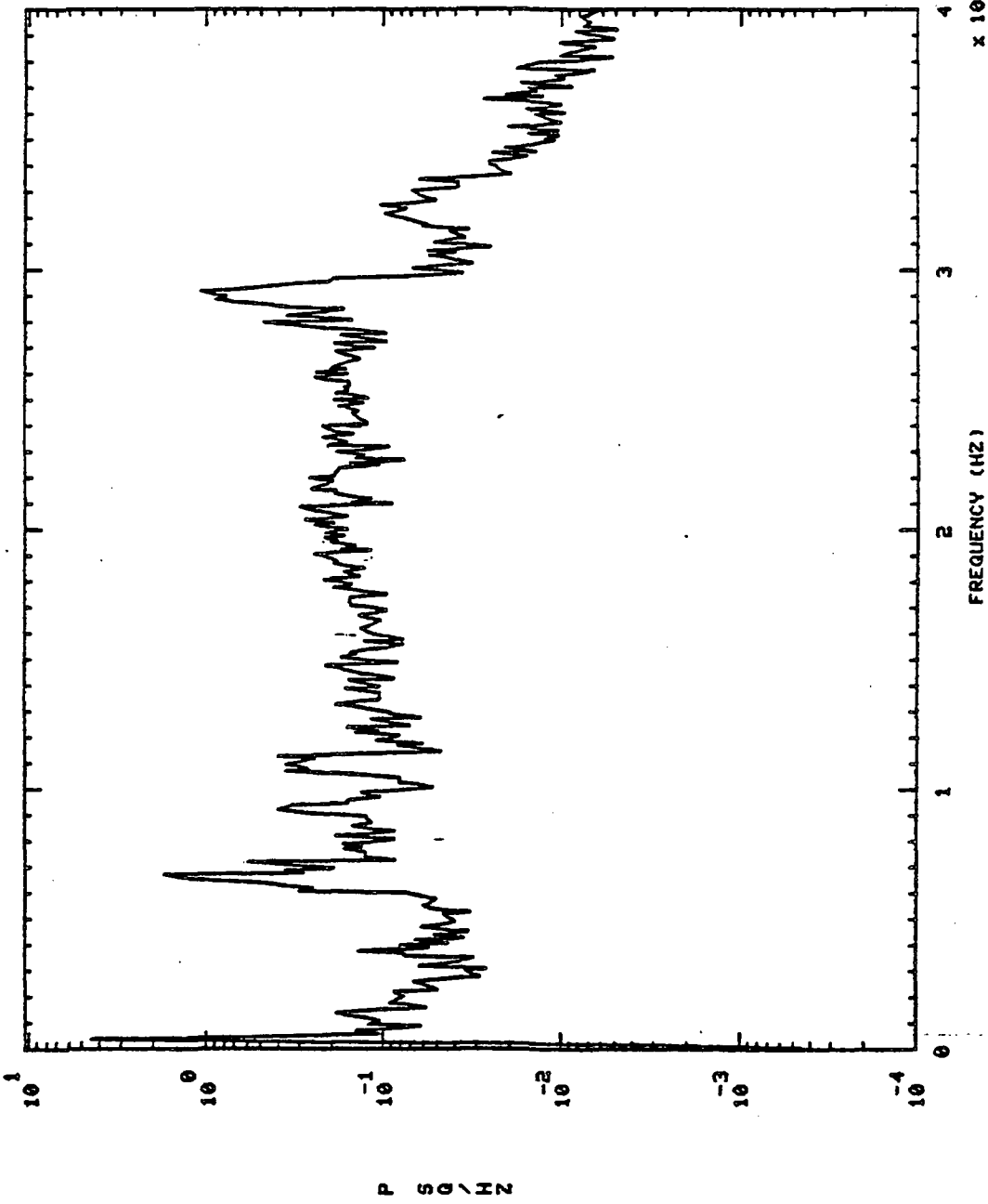


P SQ / HZ

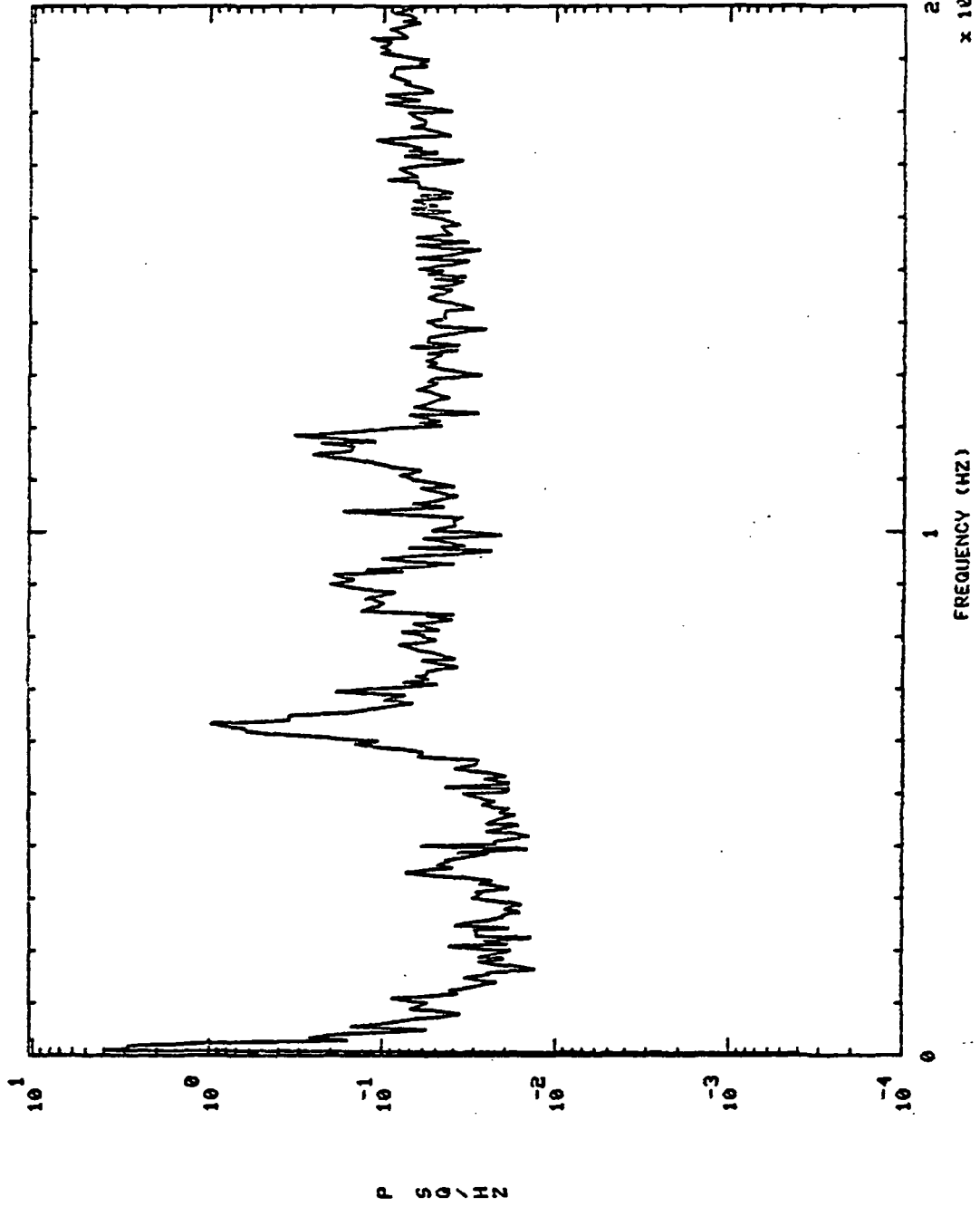
FREQUENCY (HZ)

x 10⁴

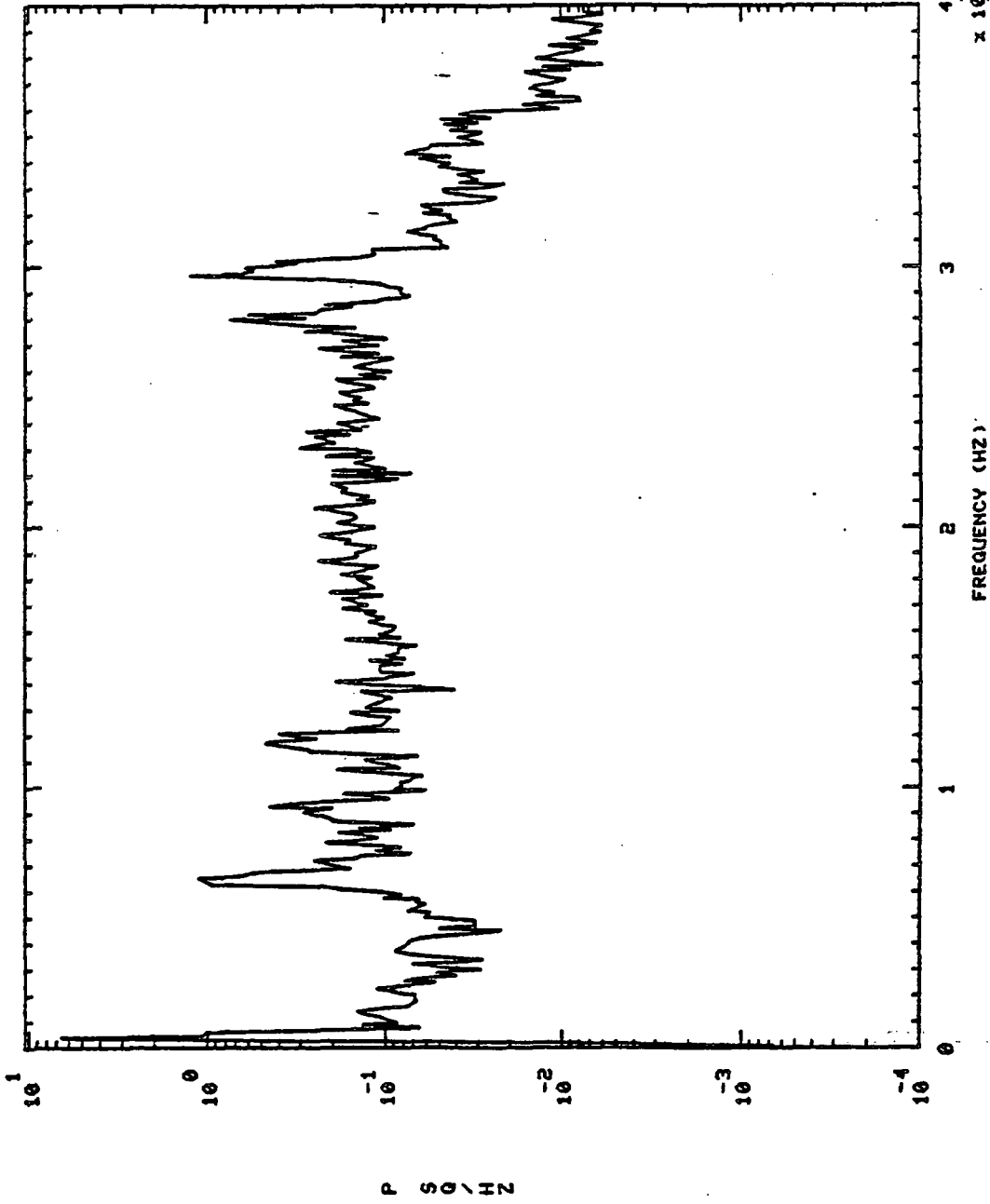
750116 MCC HOT GAS IN PR S+ 150.01H0.'S



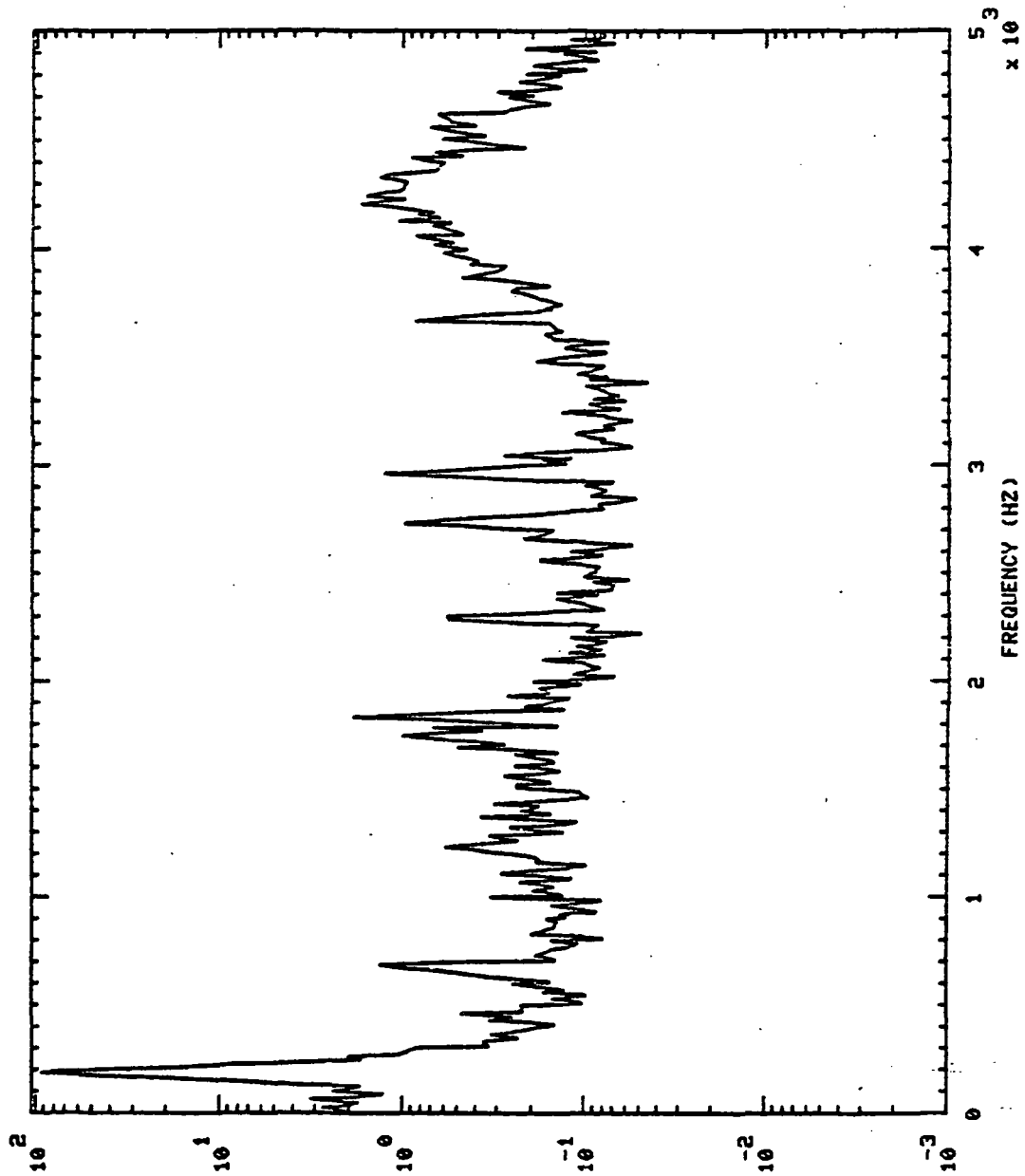
750116 MCC HOT GAS IN PR S+ 250.0140,'S



750116 MCC HOT GAS IN PR S+ 280.0140,'S



750116 PBP DS PR S+ 30.0140,'S

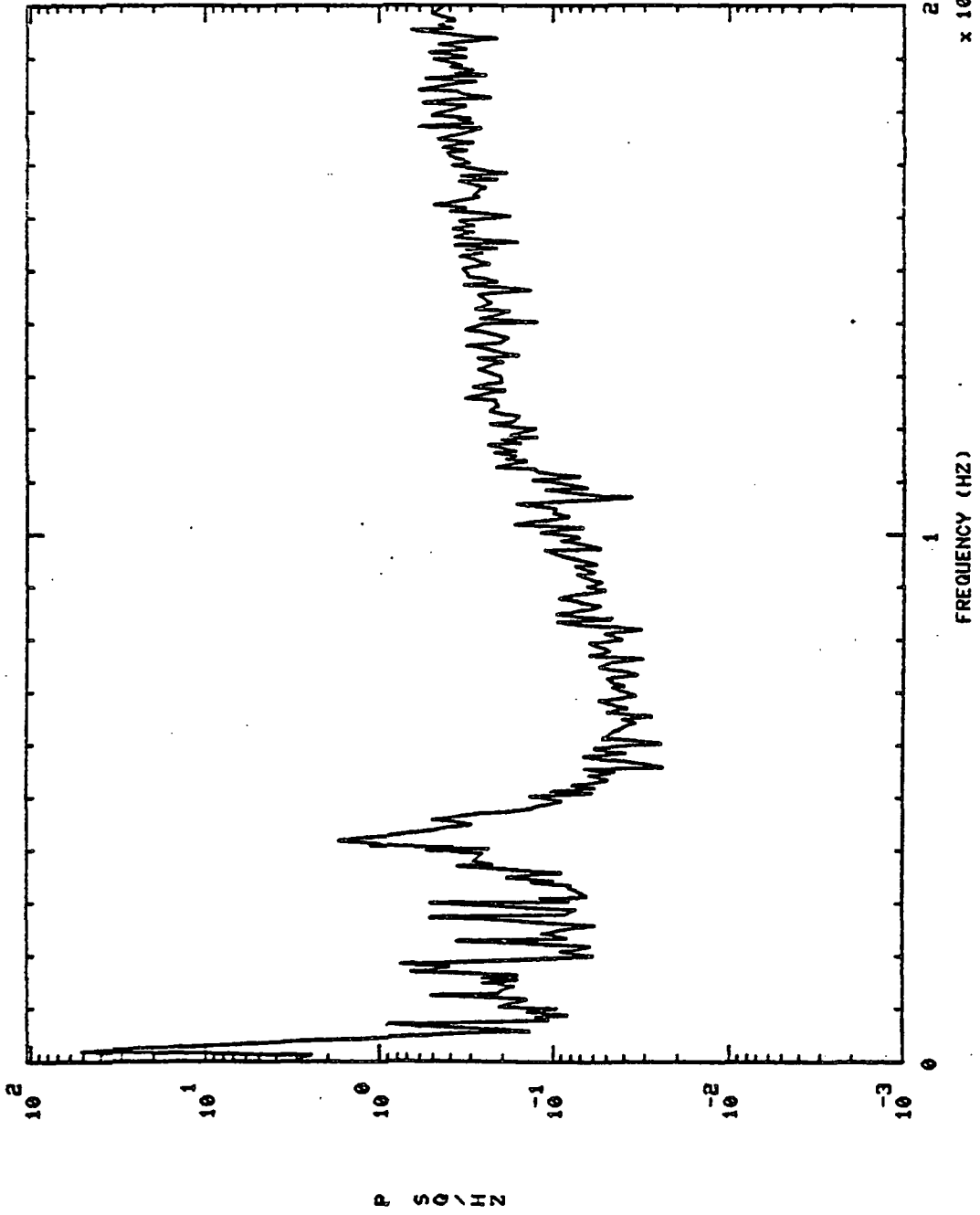


P S Q / H Z

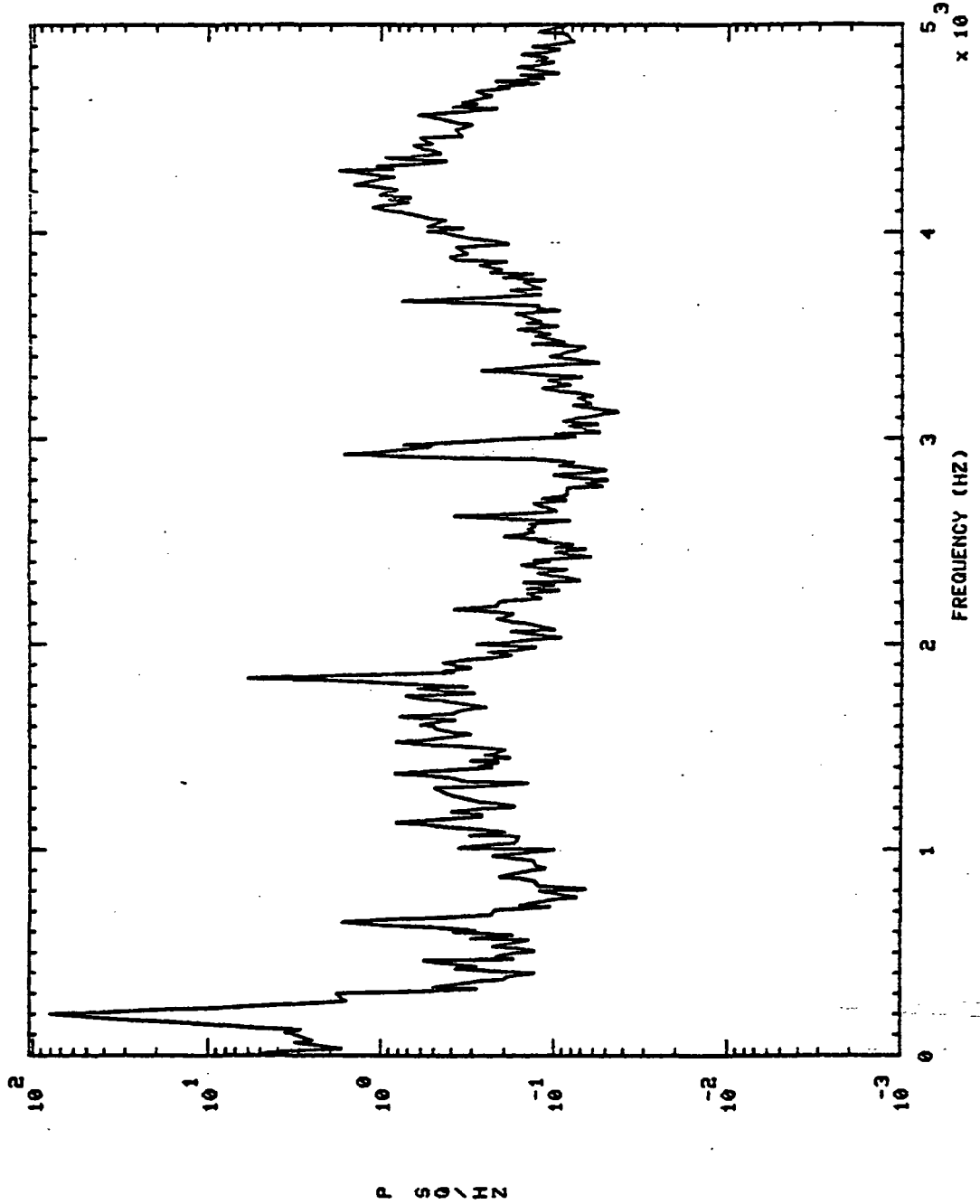
S+ 30.01H0,'S

PBP DS PR

750116

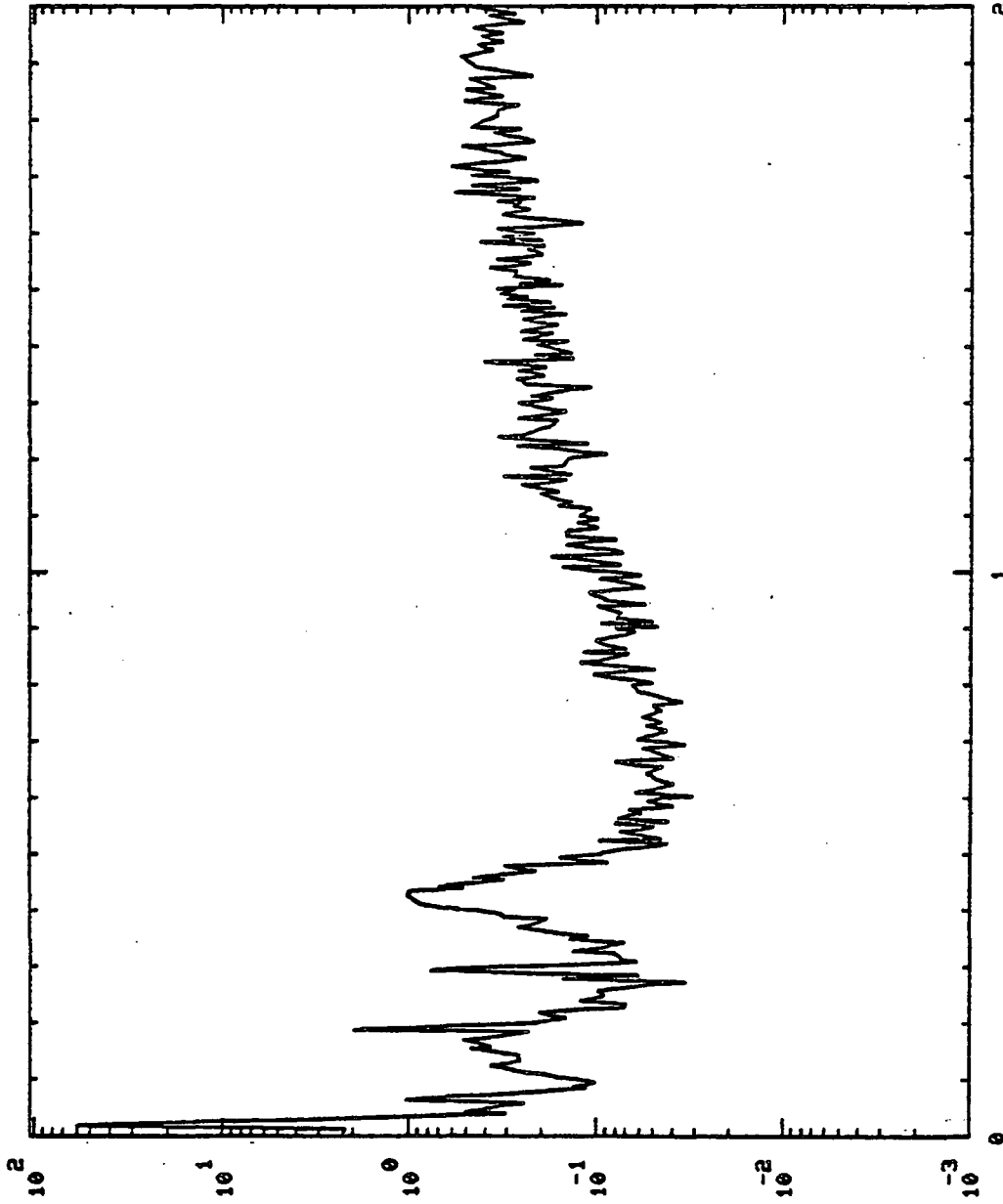


750116 PBP DS PR S+ 150.01M0,'S



S+ 150.01H0,'S

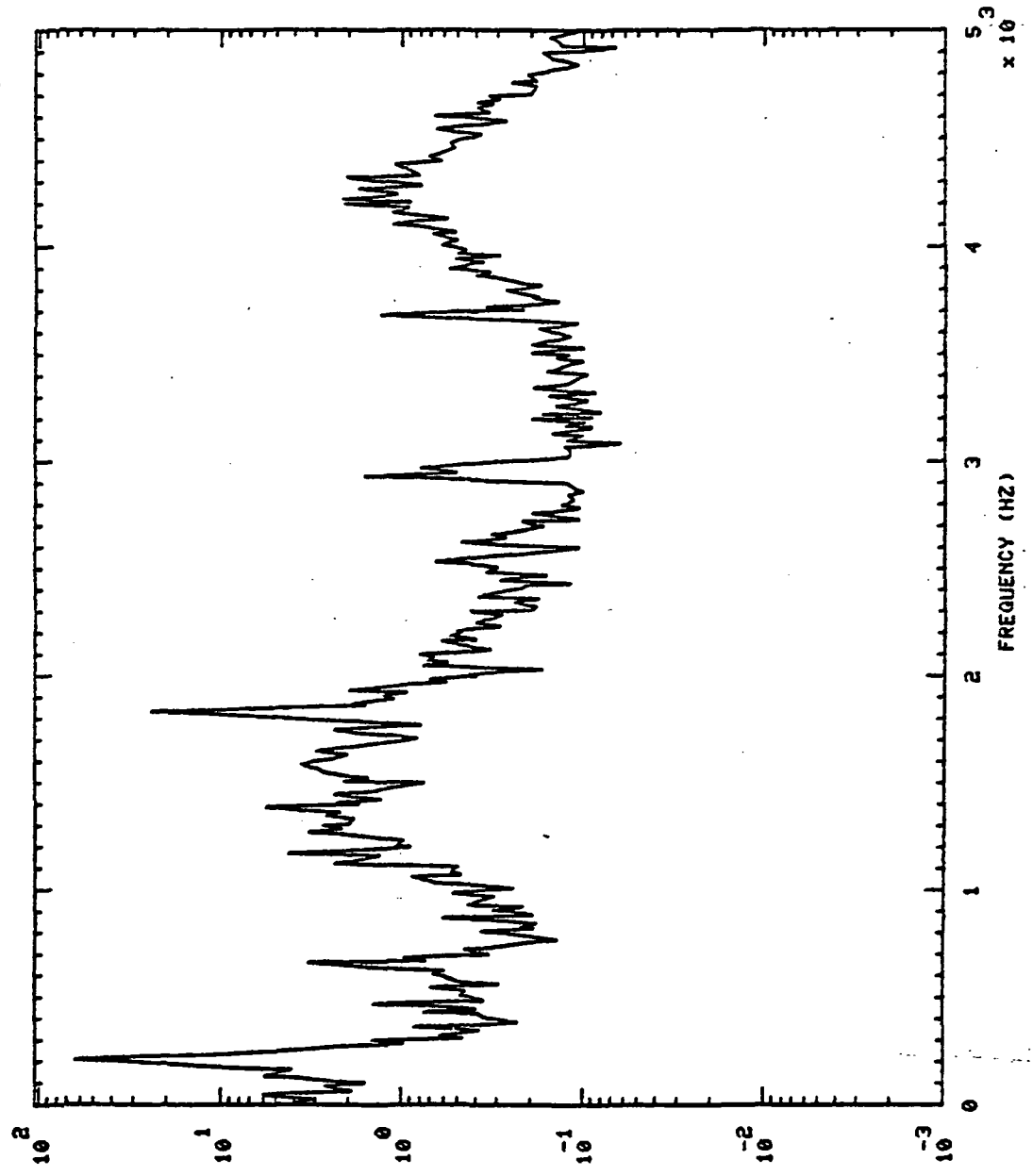
750116 PBP DS PR



2 4
x 10

FREQUENCY (HZ)

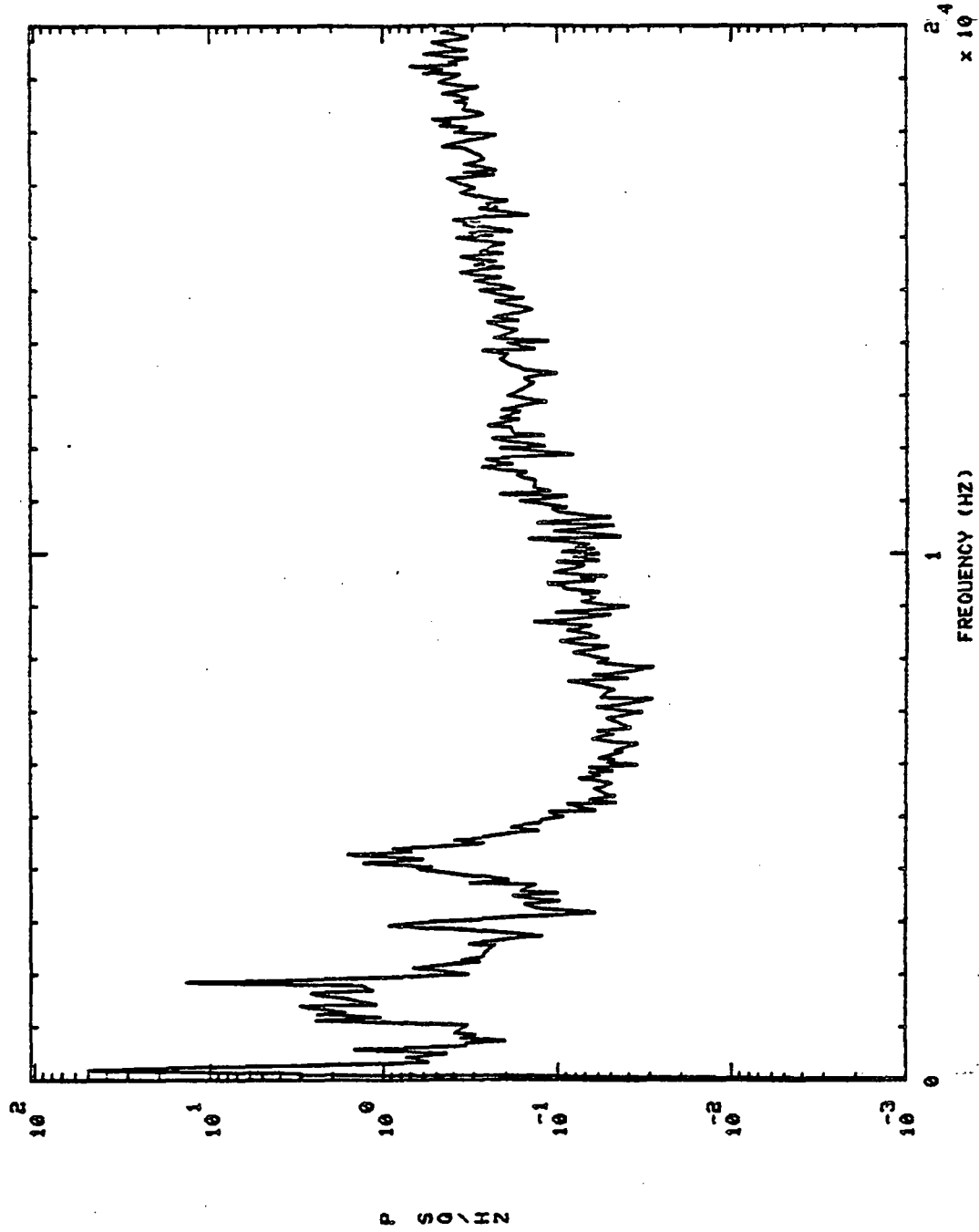
750116 PDP DS PR S+ 280.01H0.'S



P S O / HZ

S+ 280.01H0,'S

750116 PBP DS PR

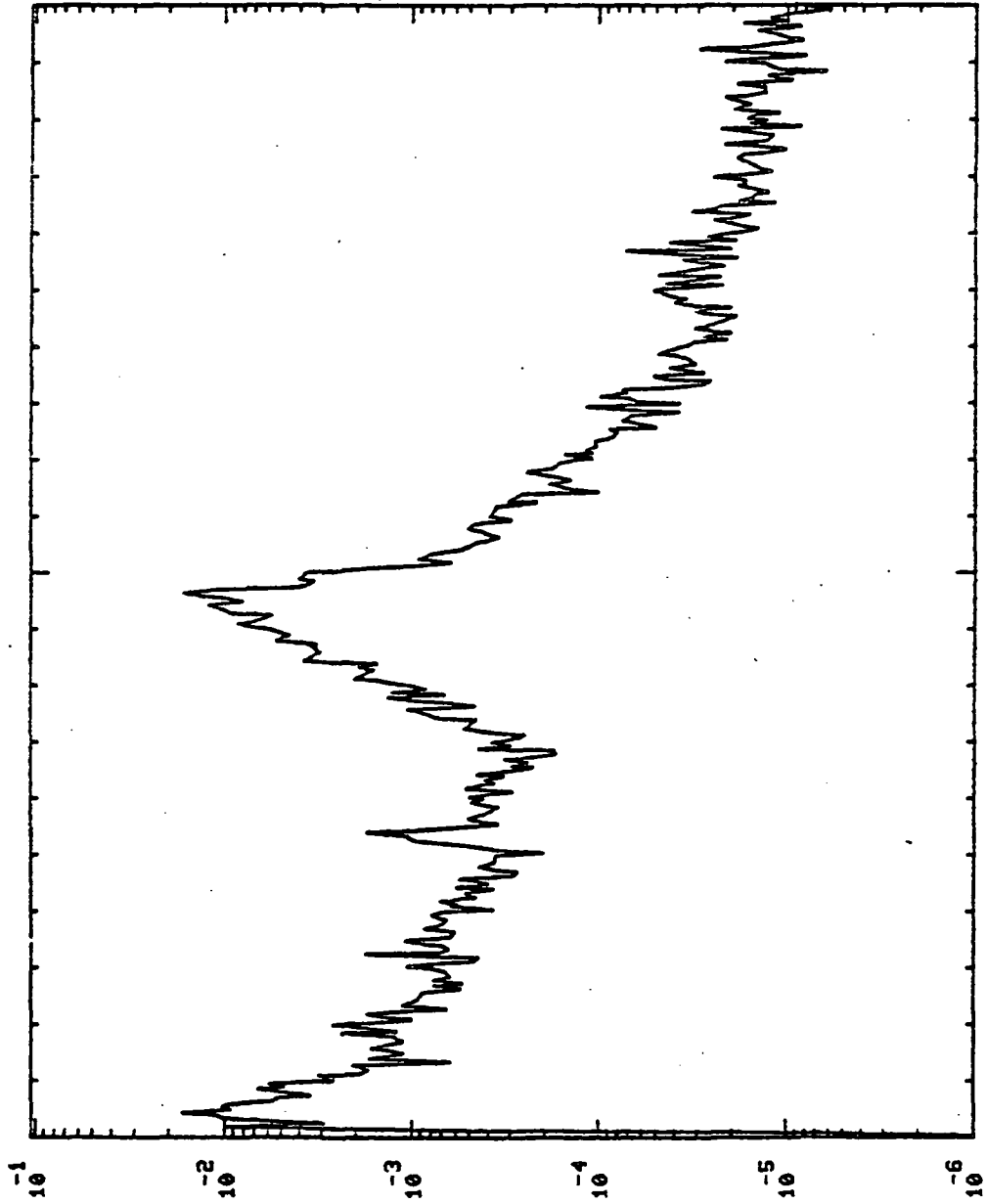


10^4
 $\times 10^4$

1
FREQUENCY (HZ)

750116 LPFP DS PR S+ 30.01H0,'S

750116 LPFP DS PR



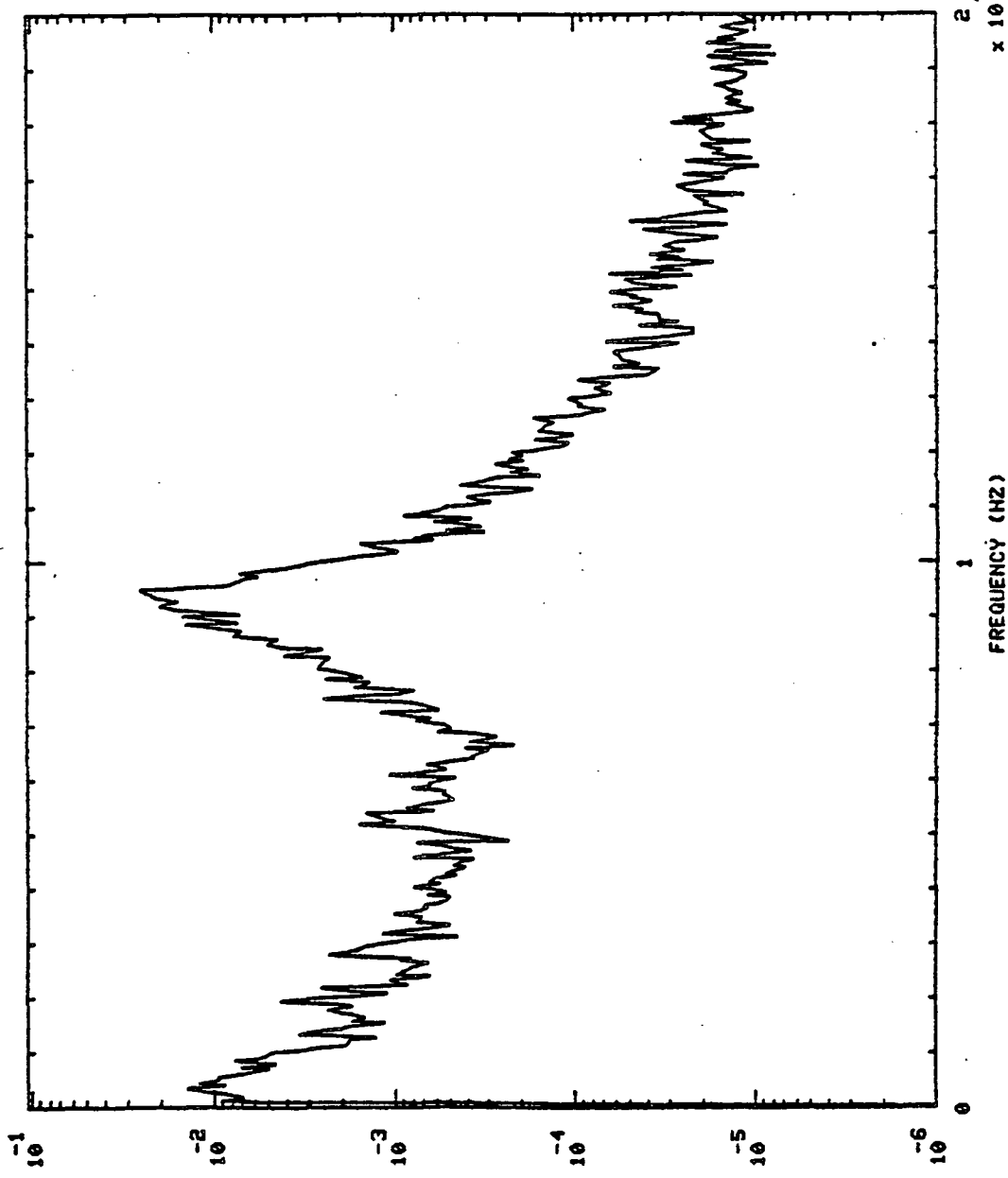
P S Q / H Z

2.4×10^4

FREQUENCY (HZ)

S+ 150.01H0.'S

750116 LPFP DS PR



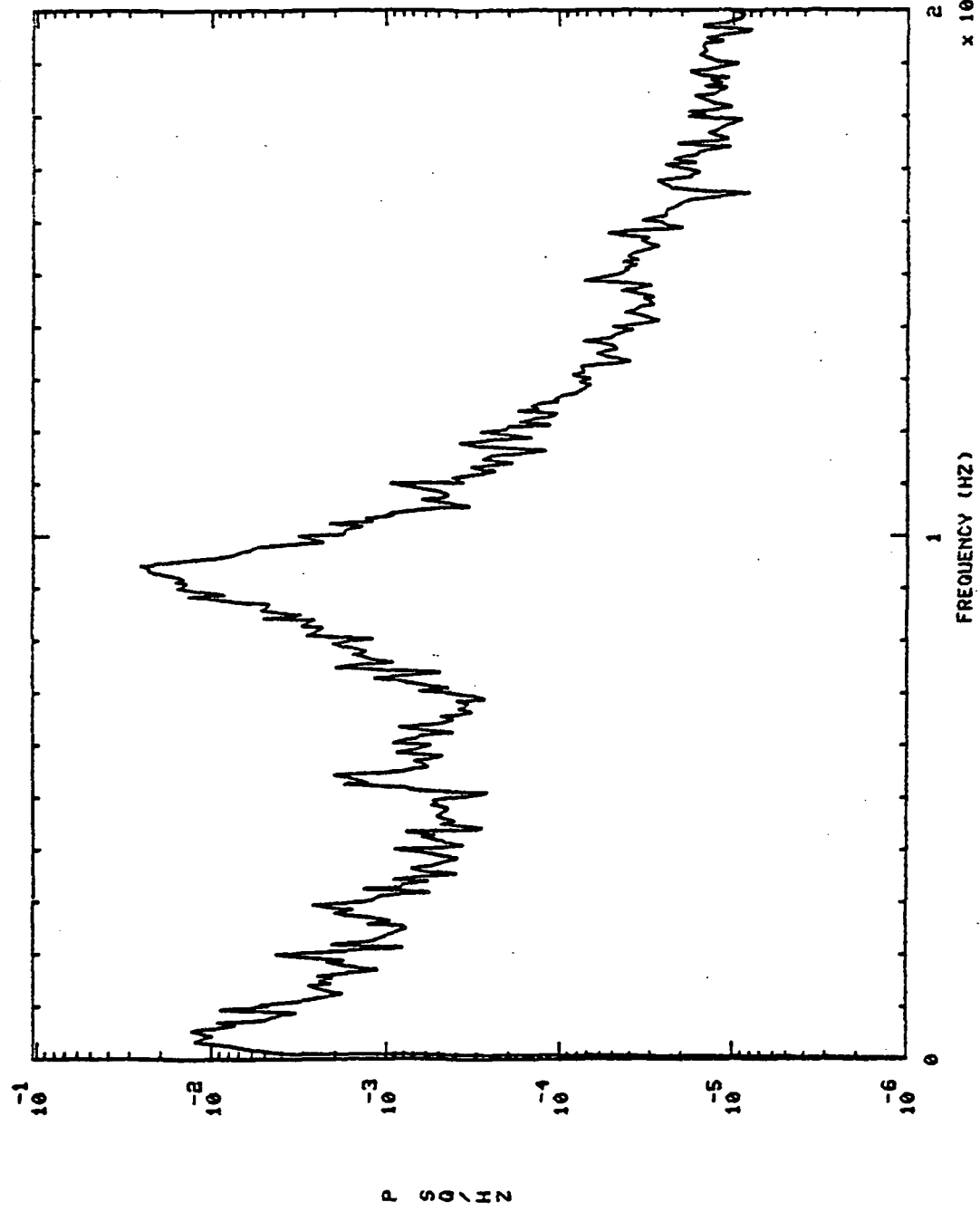
P S D / H Z

FREQUENCY (HZ)

2.4×10^4

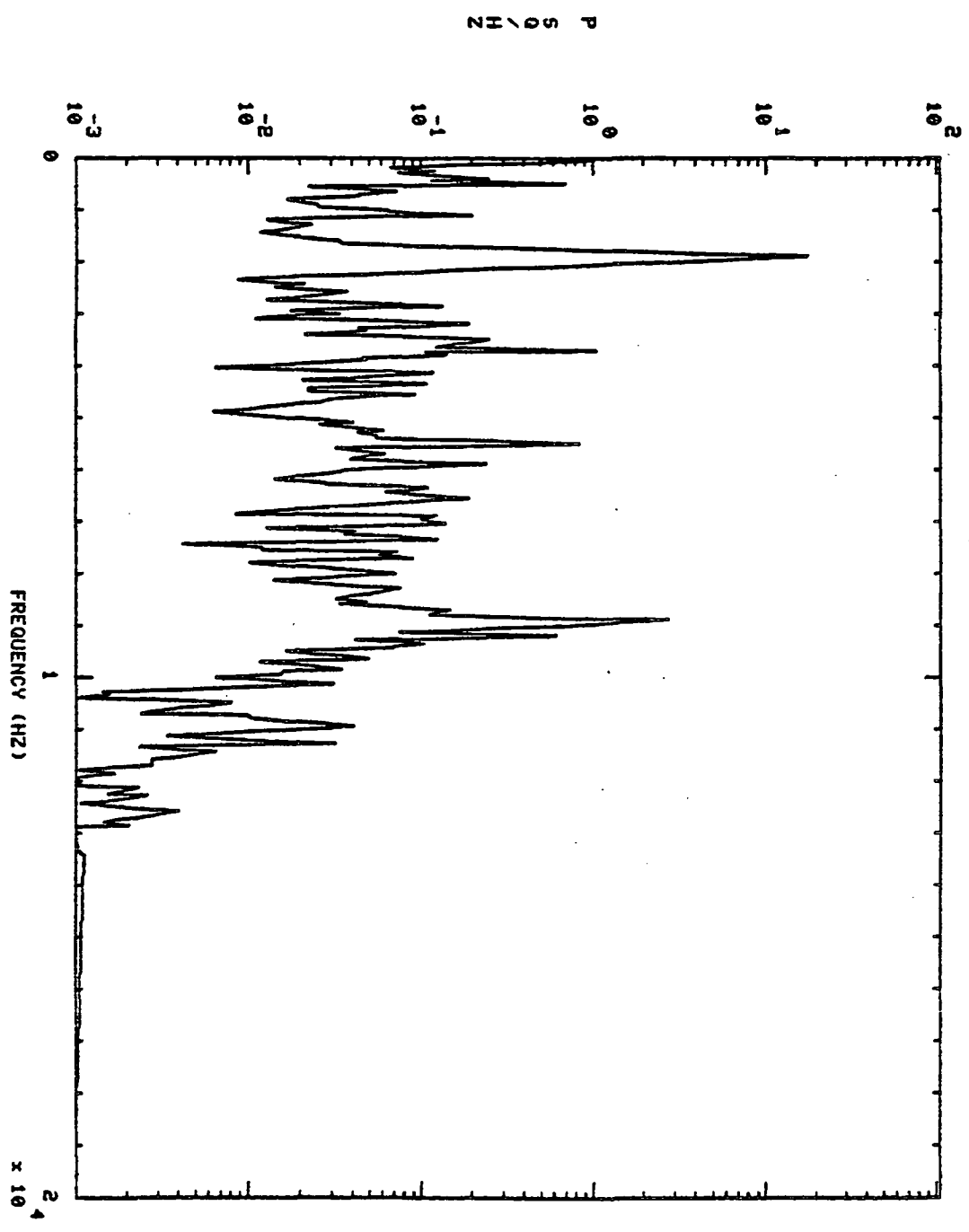
750116 LPFP DS FR

S1 280.0140,'S



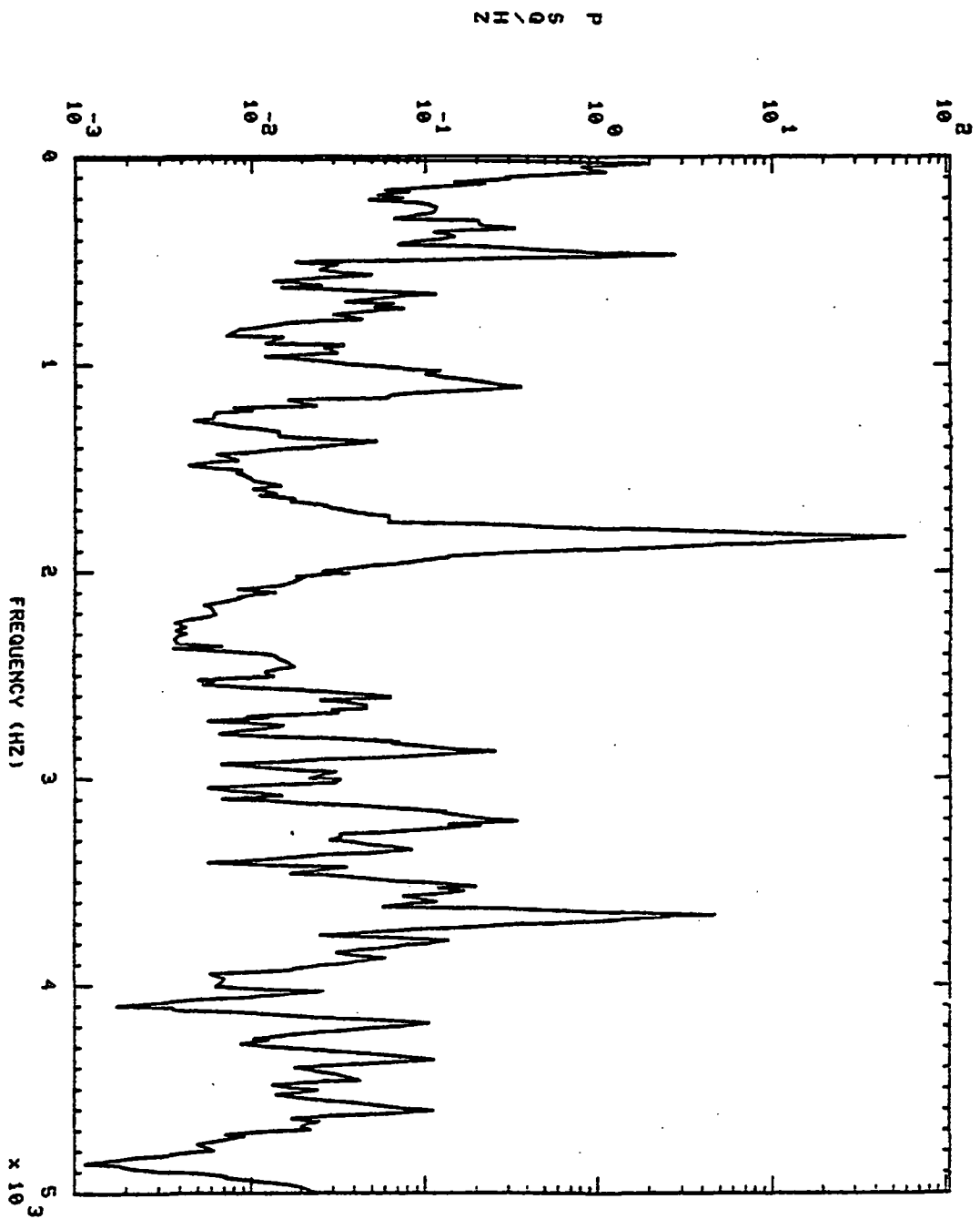
750116 LPOT TURB DR PR

S+ 150.01H0,'S



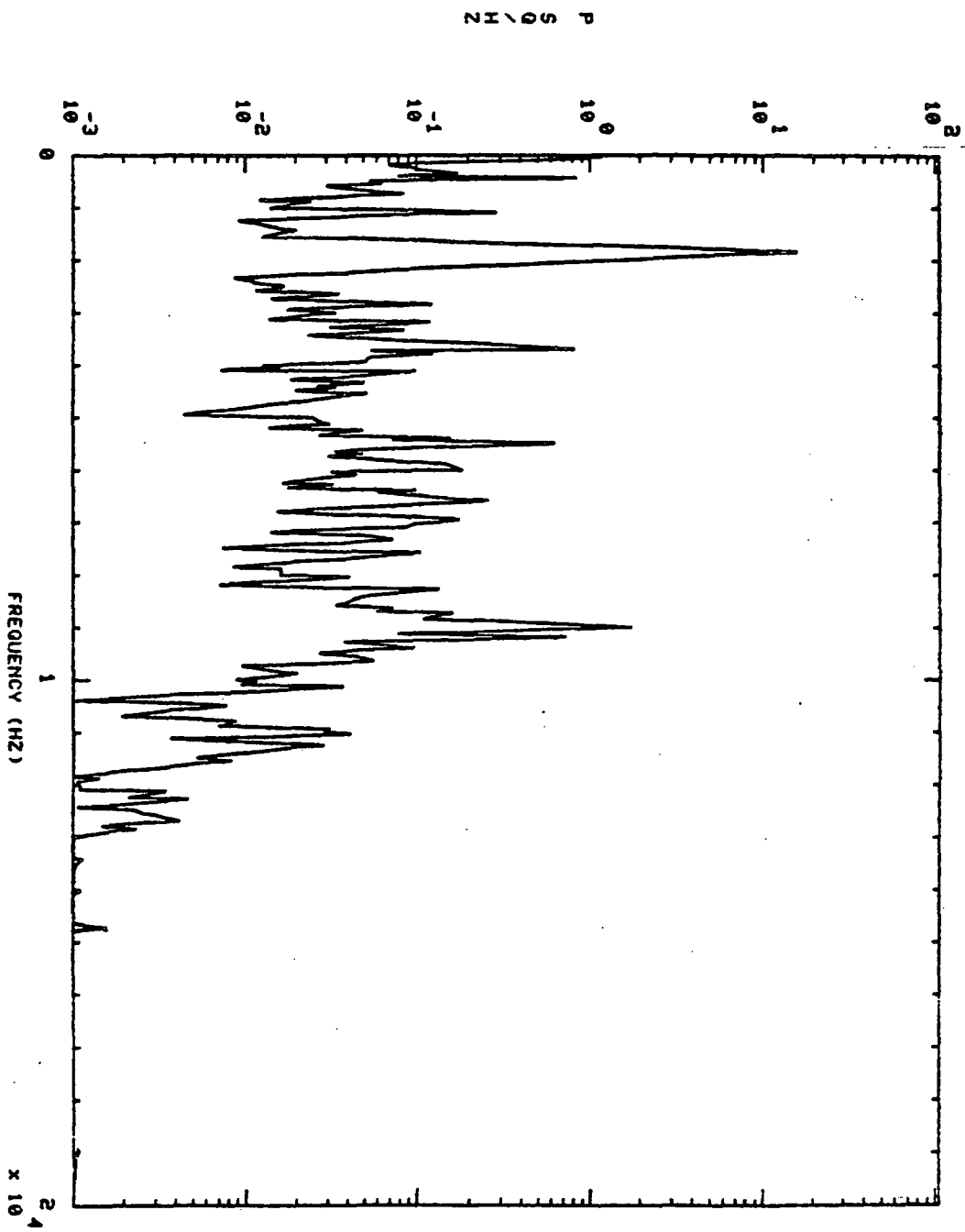
750116 LPOT TURB DR PR

S+ 150.01H0,'S

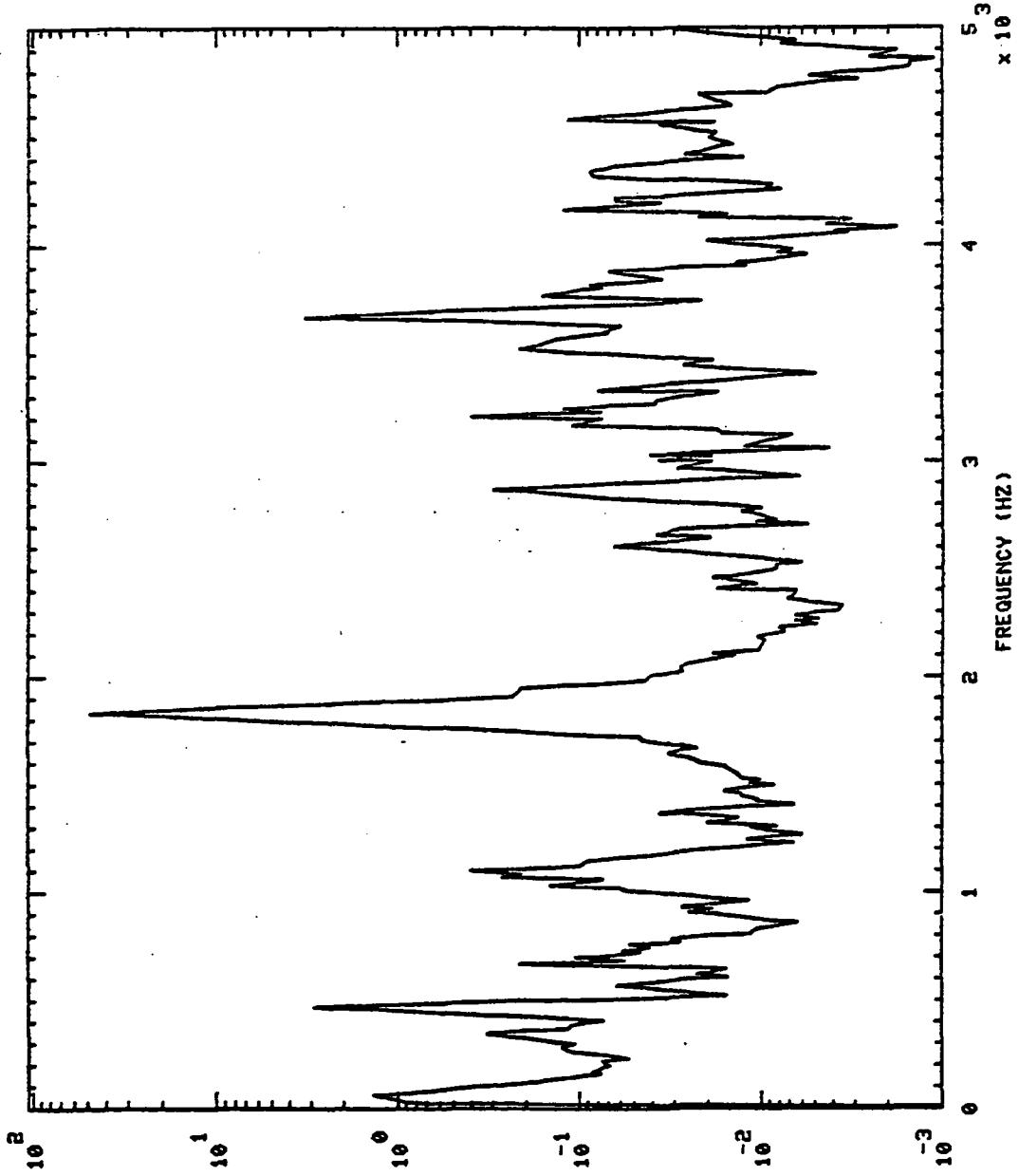


750116 LPOT TURB DR PR

S+ 30.01H0,'S

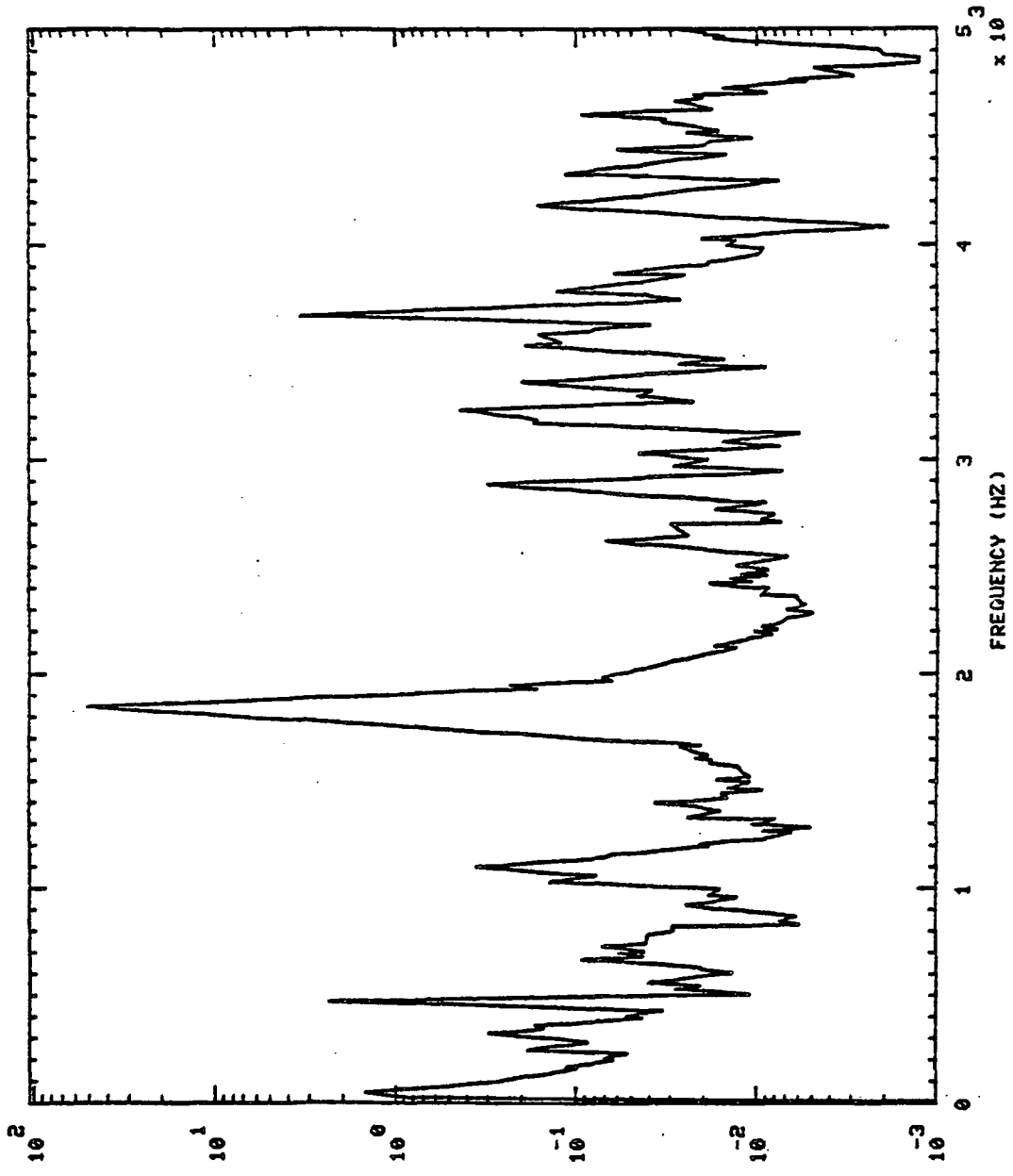


750116 LPOT TURB DR PR S+ 30.01H0,'S



P S G / H Z

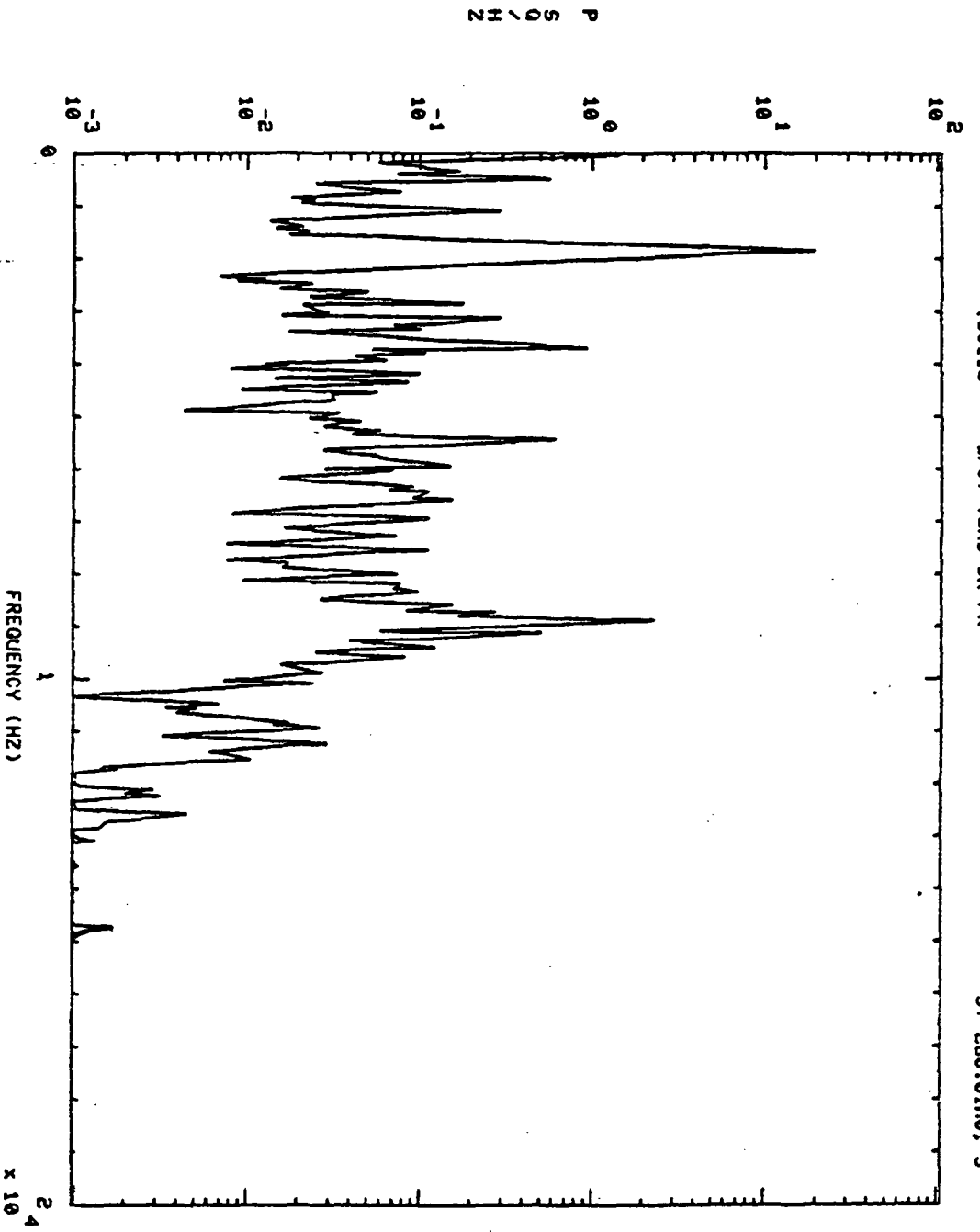
750116 LPOT TURB DR PR S+ 280.01H0.'S



P SQ/M2

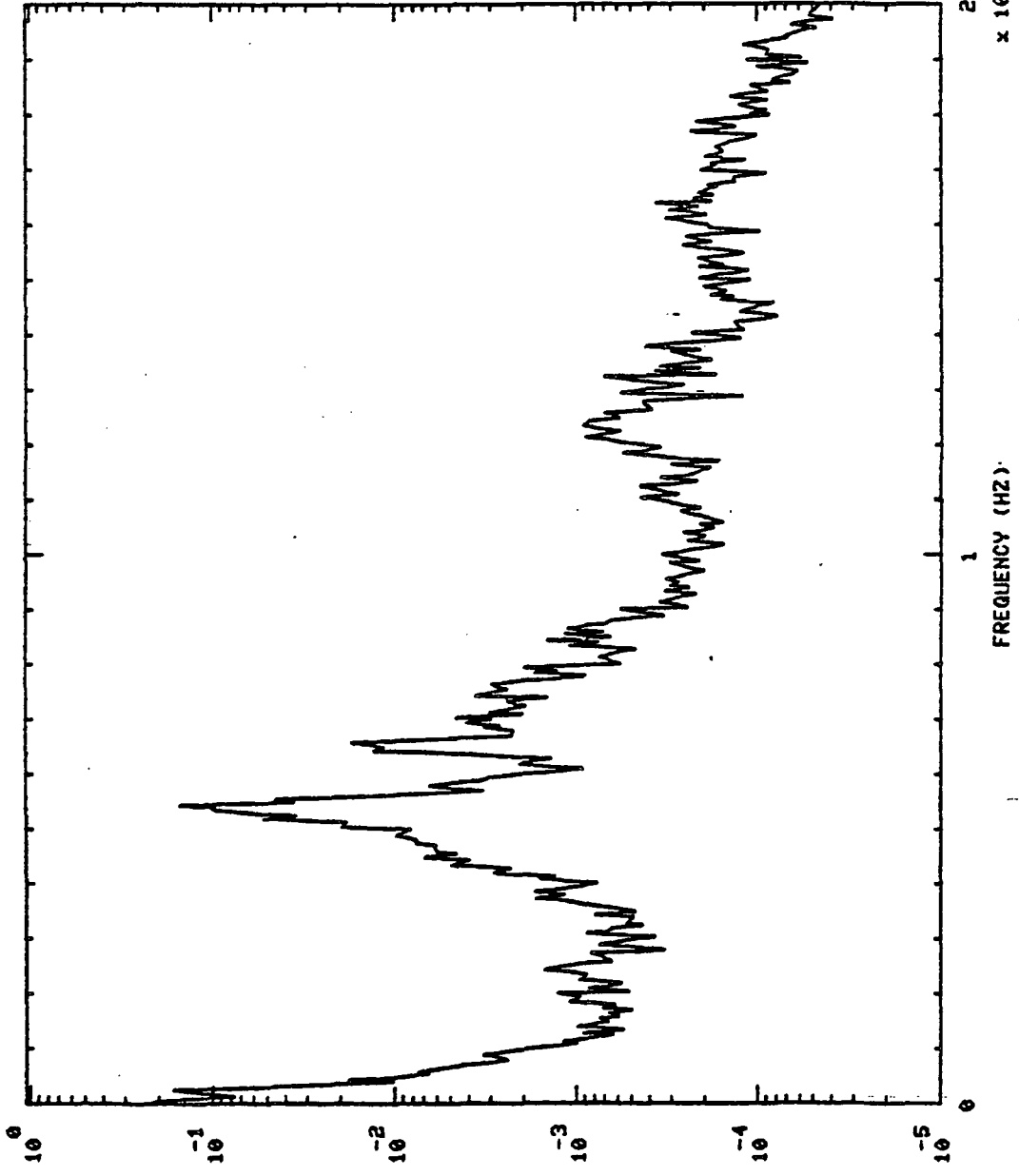
750116 LPOT TURB DR PR

S + 280.0110, 'S



S+ 30.01H0,'S

750116 OPB PC PR



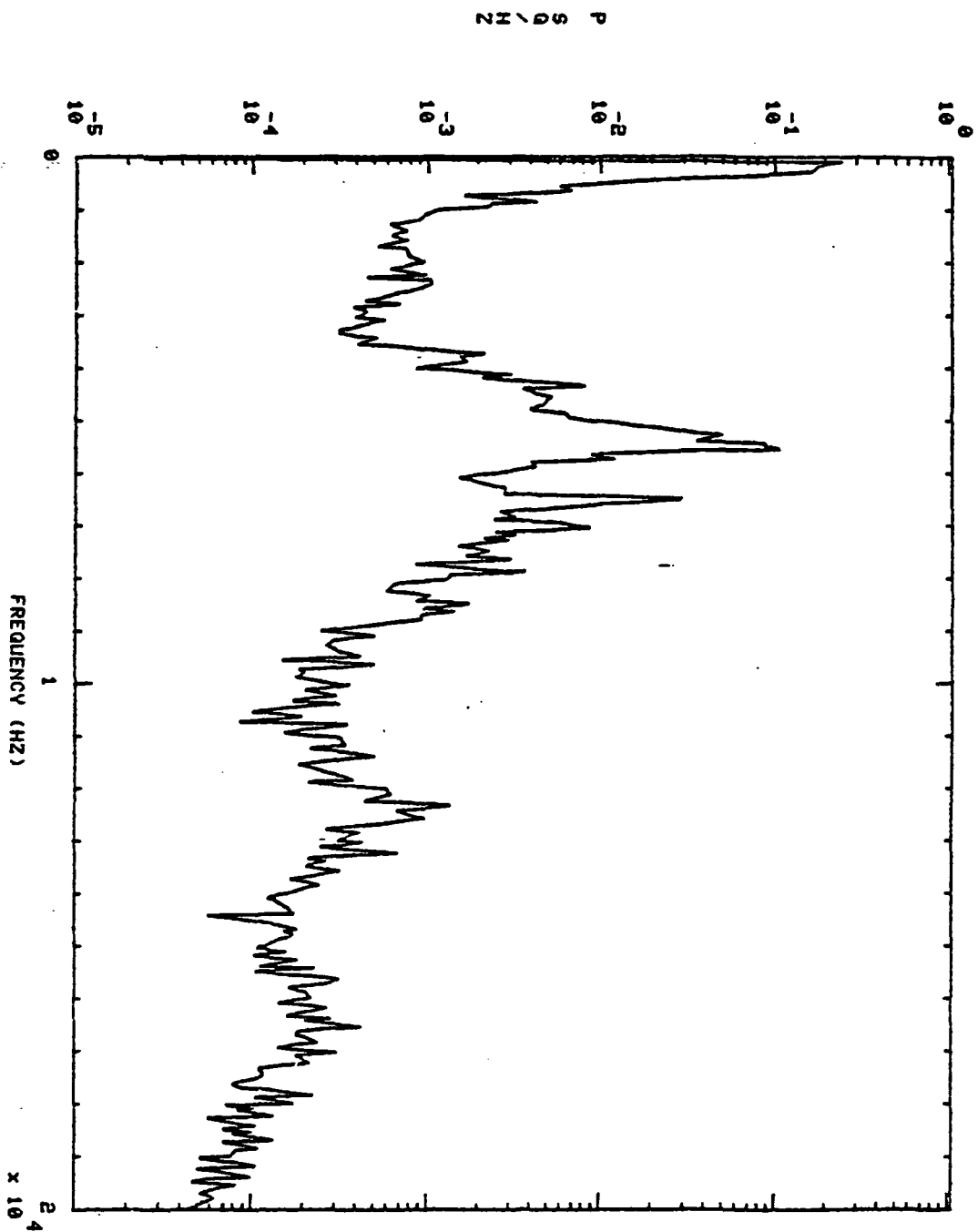
P S D \ HZ

FREQUENCY (HZ)

$10^{2.4}$
 $\times 10^0$

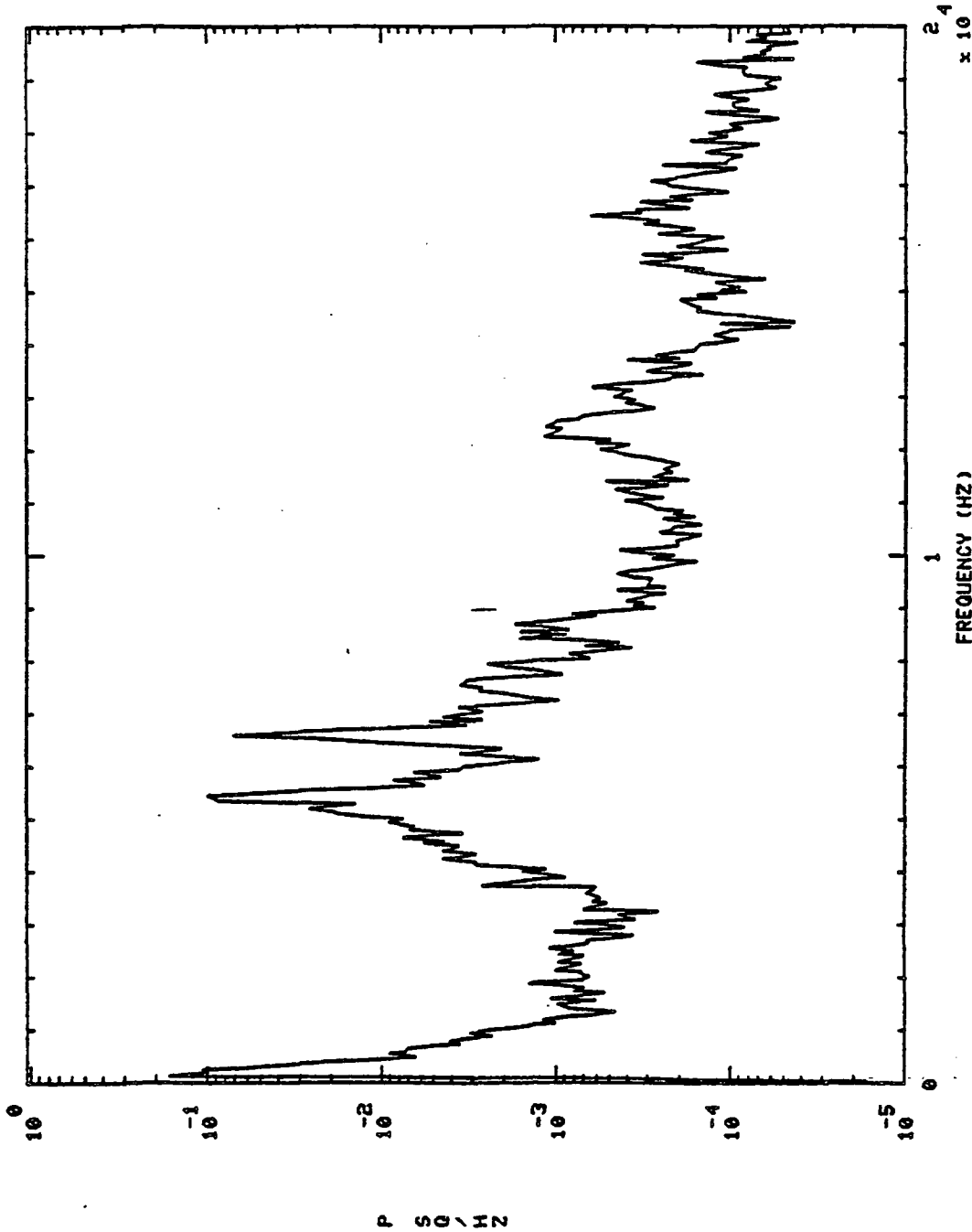
750116 OPB PC PR

S+ 150.0110, 'S



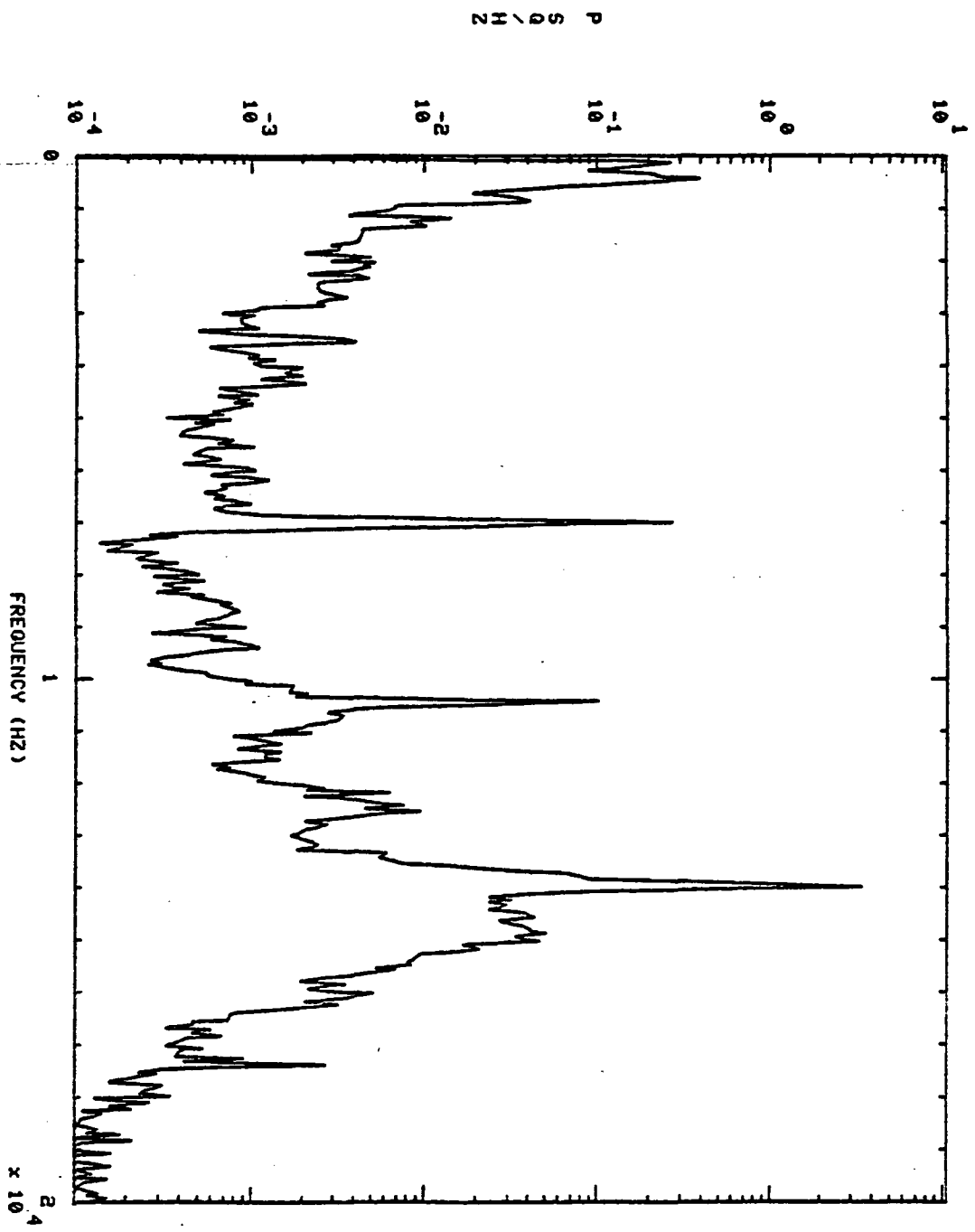
S + 280.01H0, 'S

750116 OPB PC PR



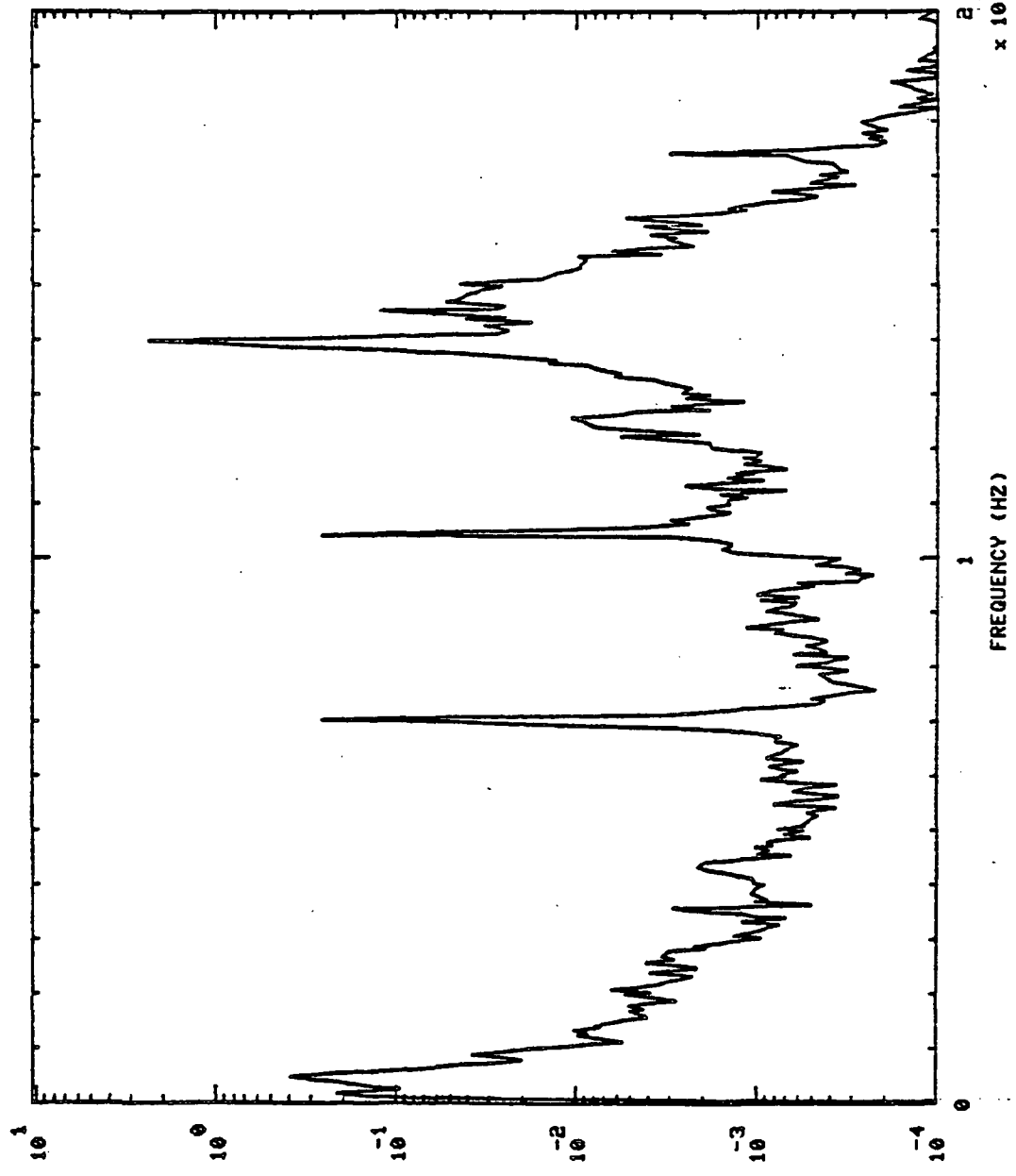
750116 HPFP DS PR

S+ 30.01H0,'S



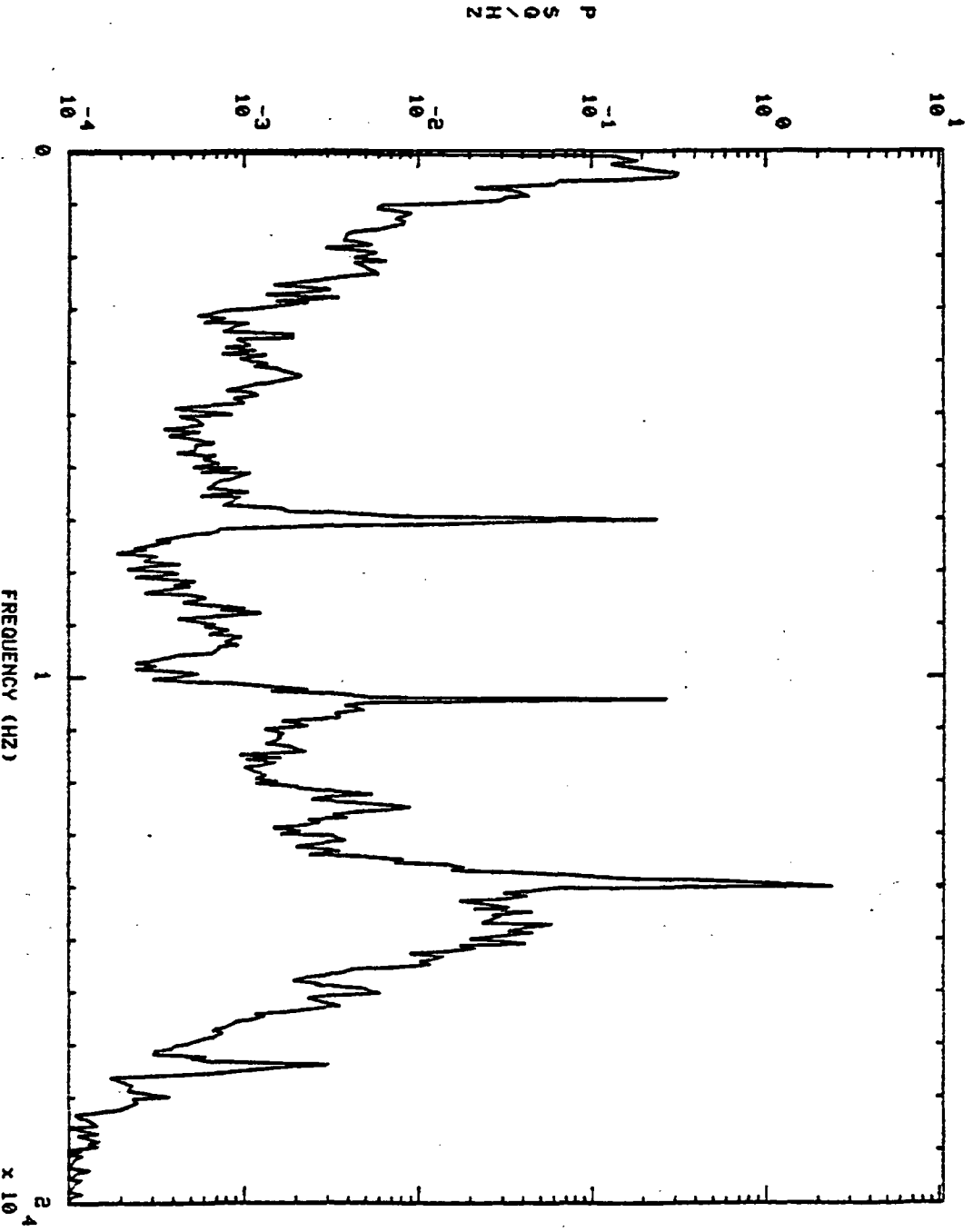
S+ 150.01H0.'S

750116 HPFP DS PR

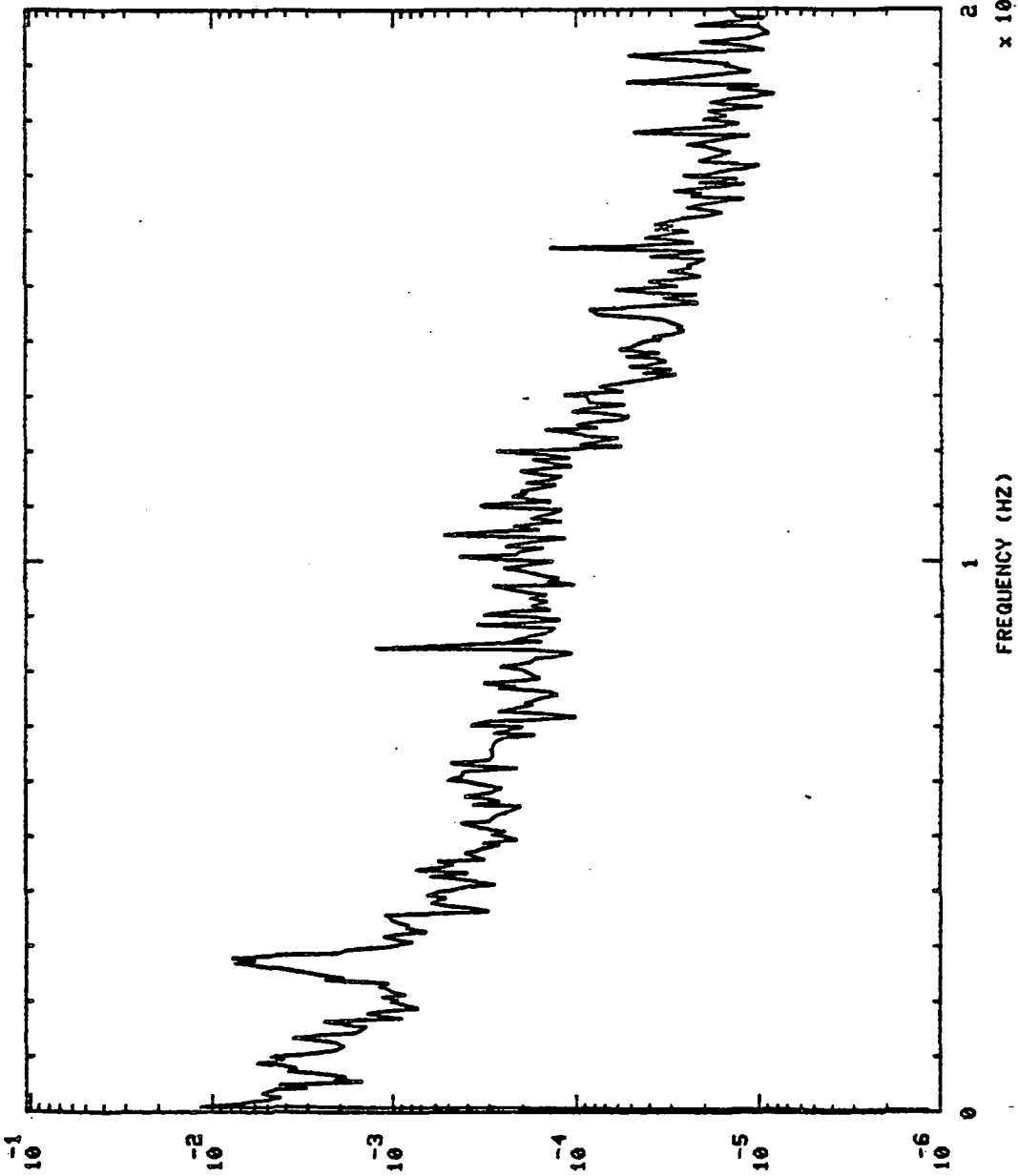


750116 HPFP DS PR

S + 230.01H0,'S



750116 HOT GAS MAN PR3 S+ 30.01H0,'S



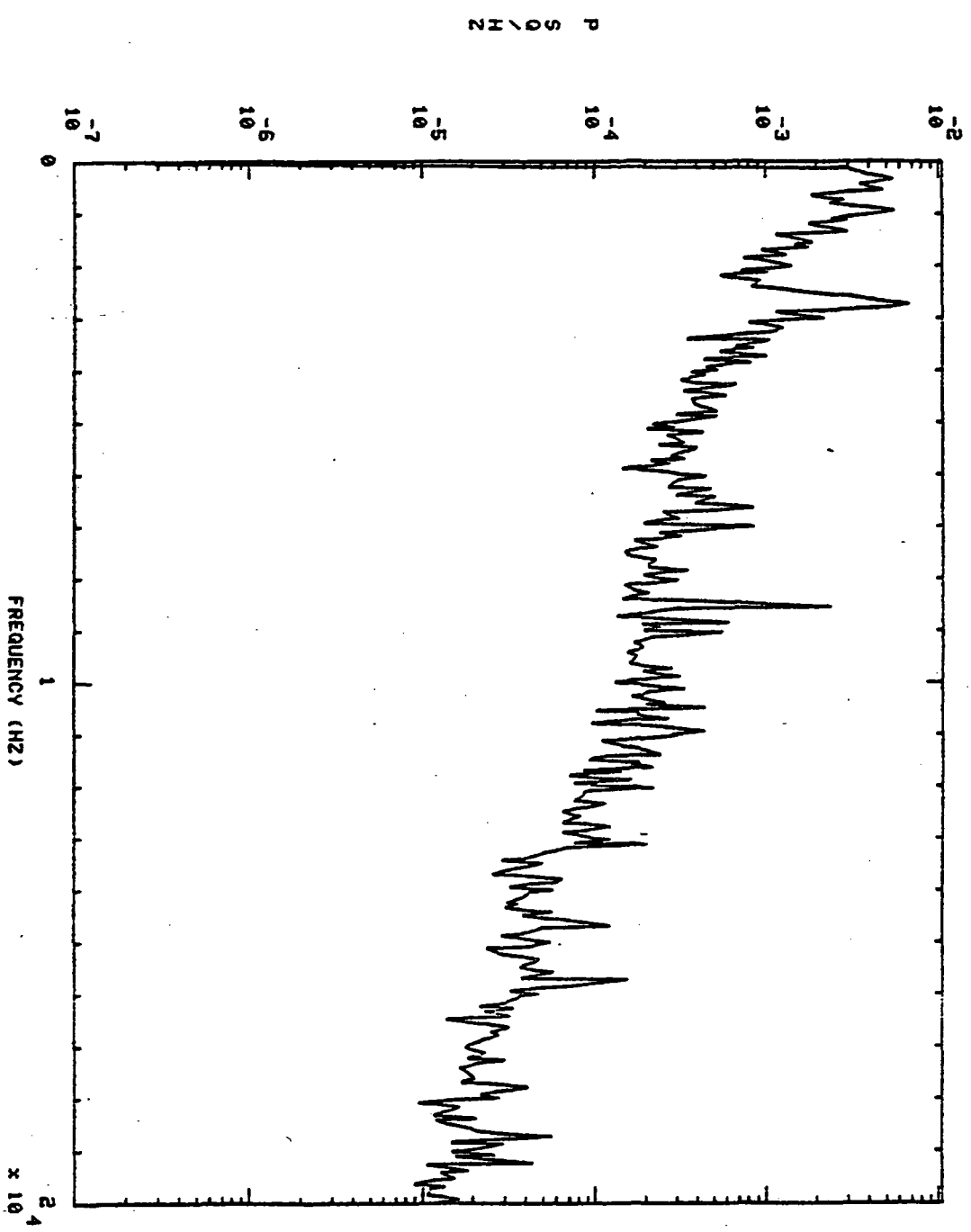
P SQ/IN

FREQUENCY (HZ)

2.4×10^4

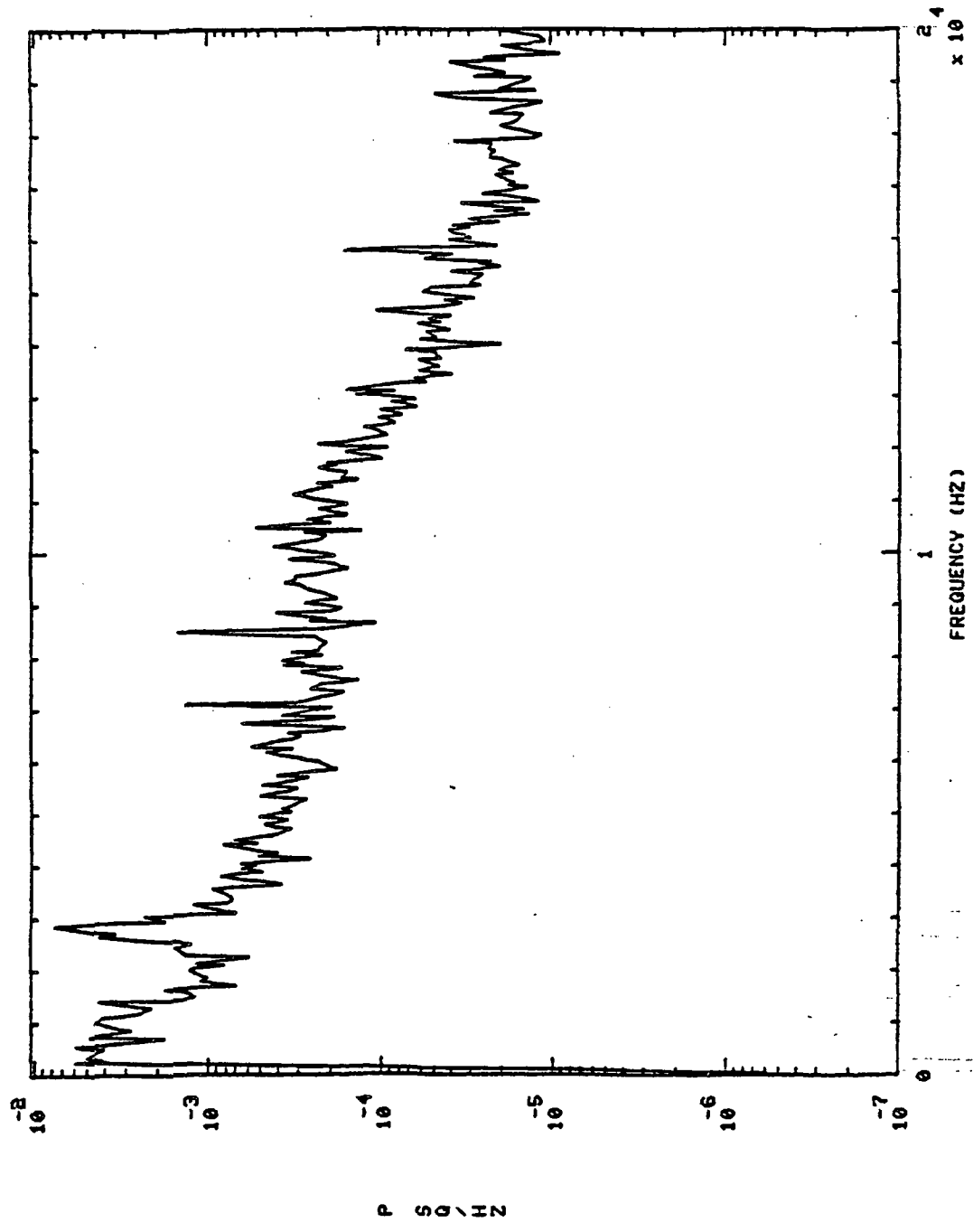
750116 HOT GAS MAN PR3

S+ 150.01H0,'S



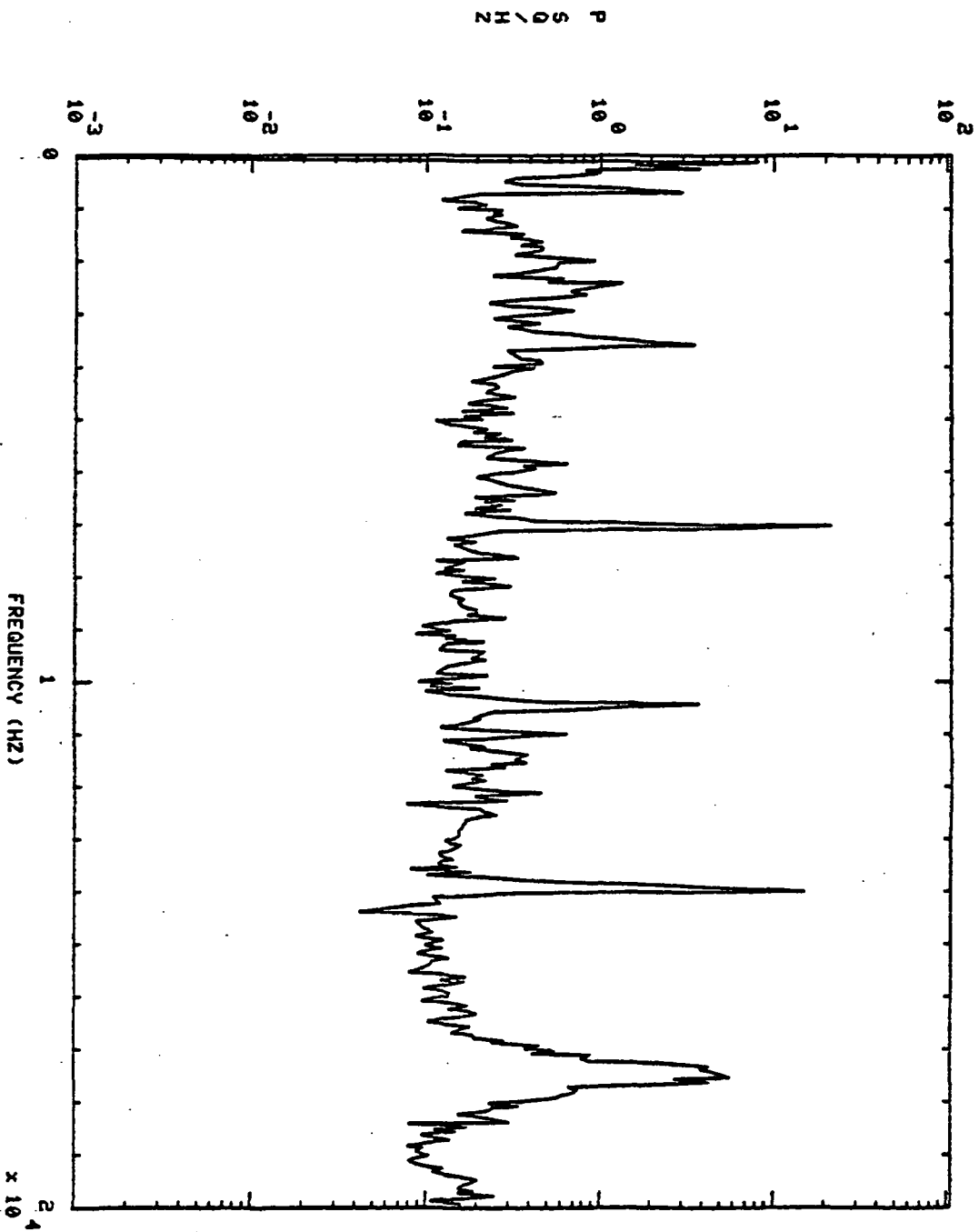
S+ 280.01H0,'S

750116 HOT GAS MAN PR3

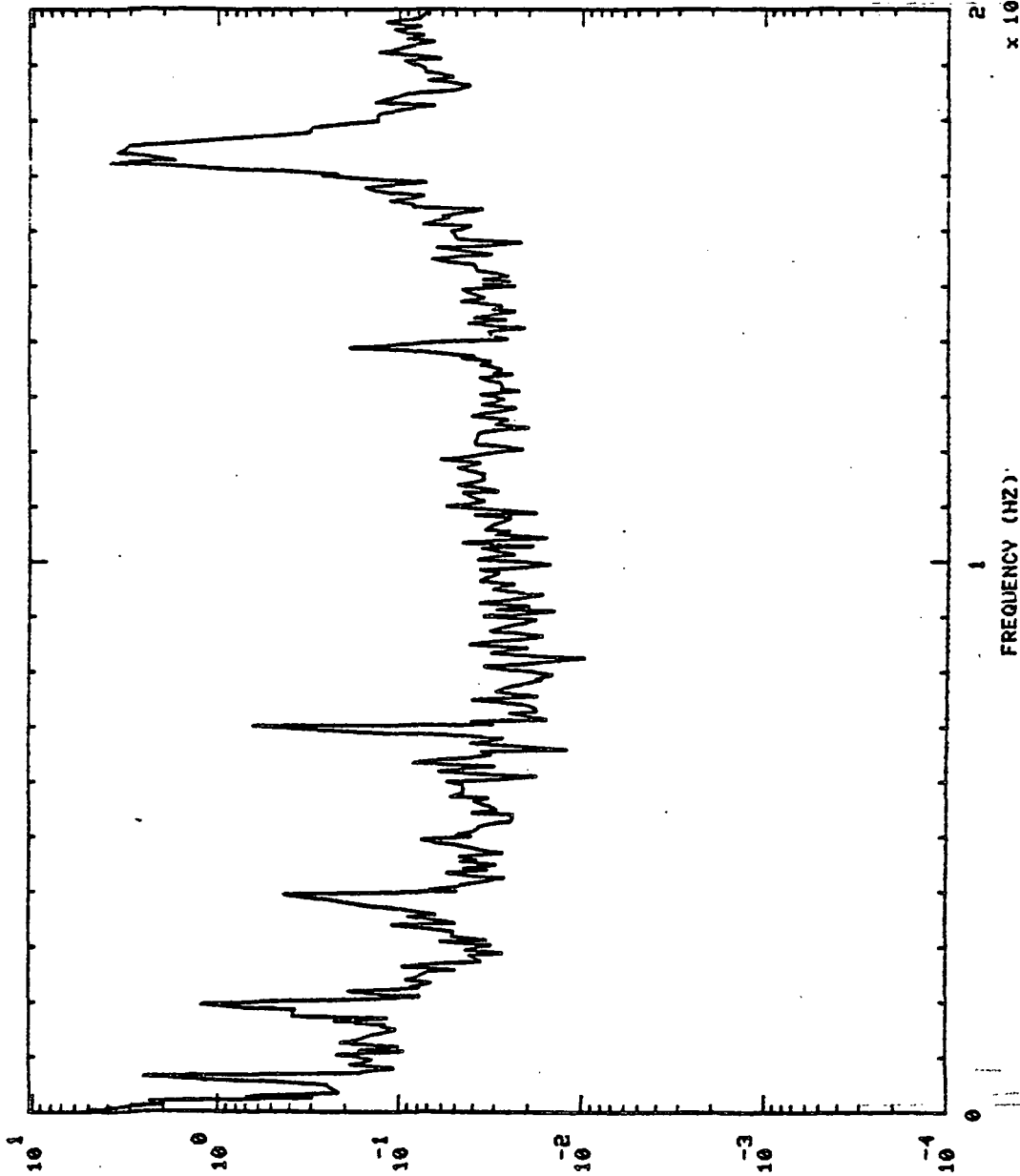


750116 HPFP BAL CAU PR

S+ 30.0110,'5



750116 HPFP BAL CAU PR S+ 150.01H0,'S



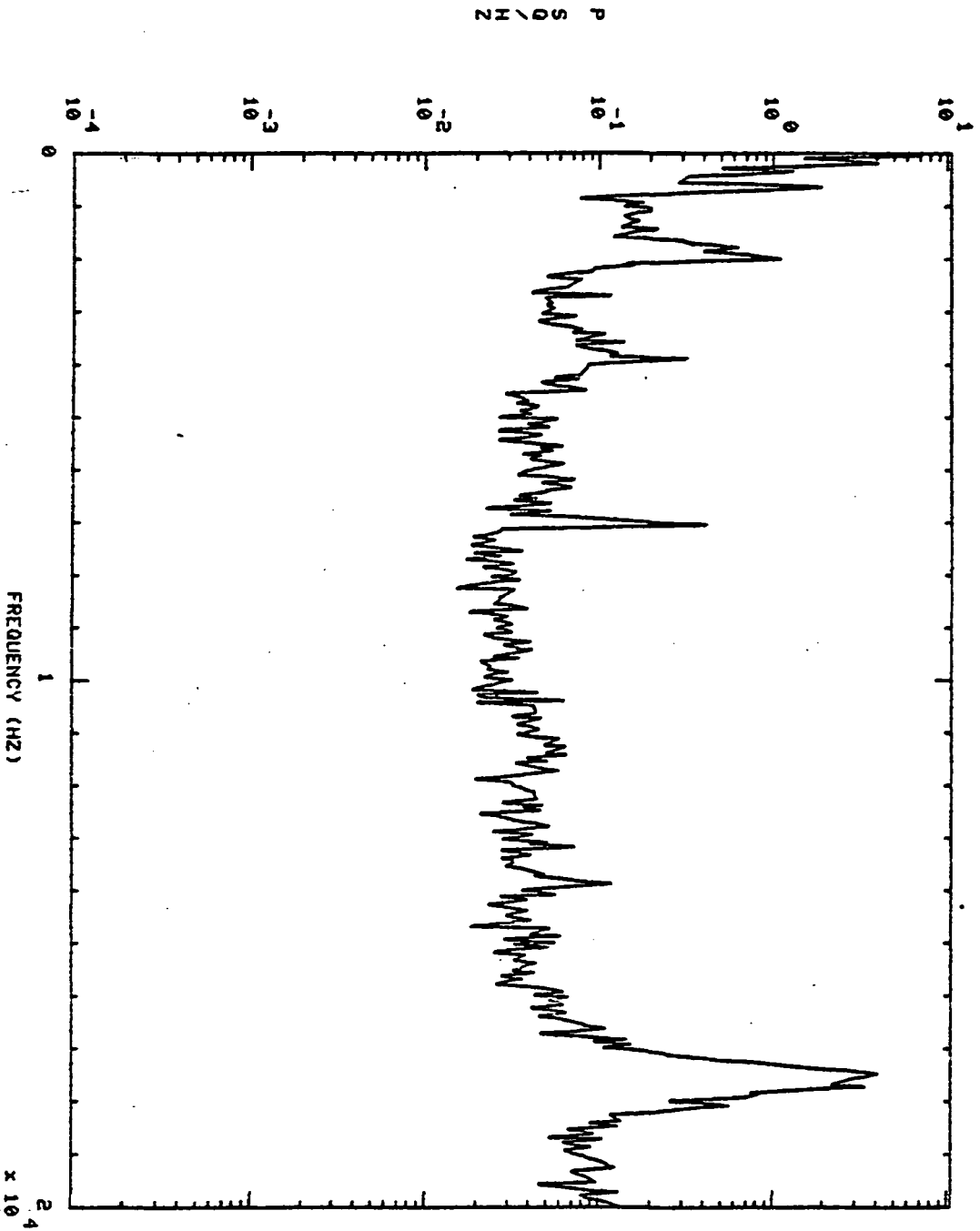
P S D / H Z

10^2
 $\times 10^4$

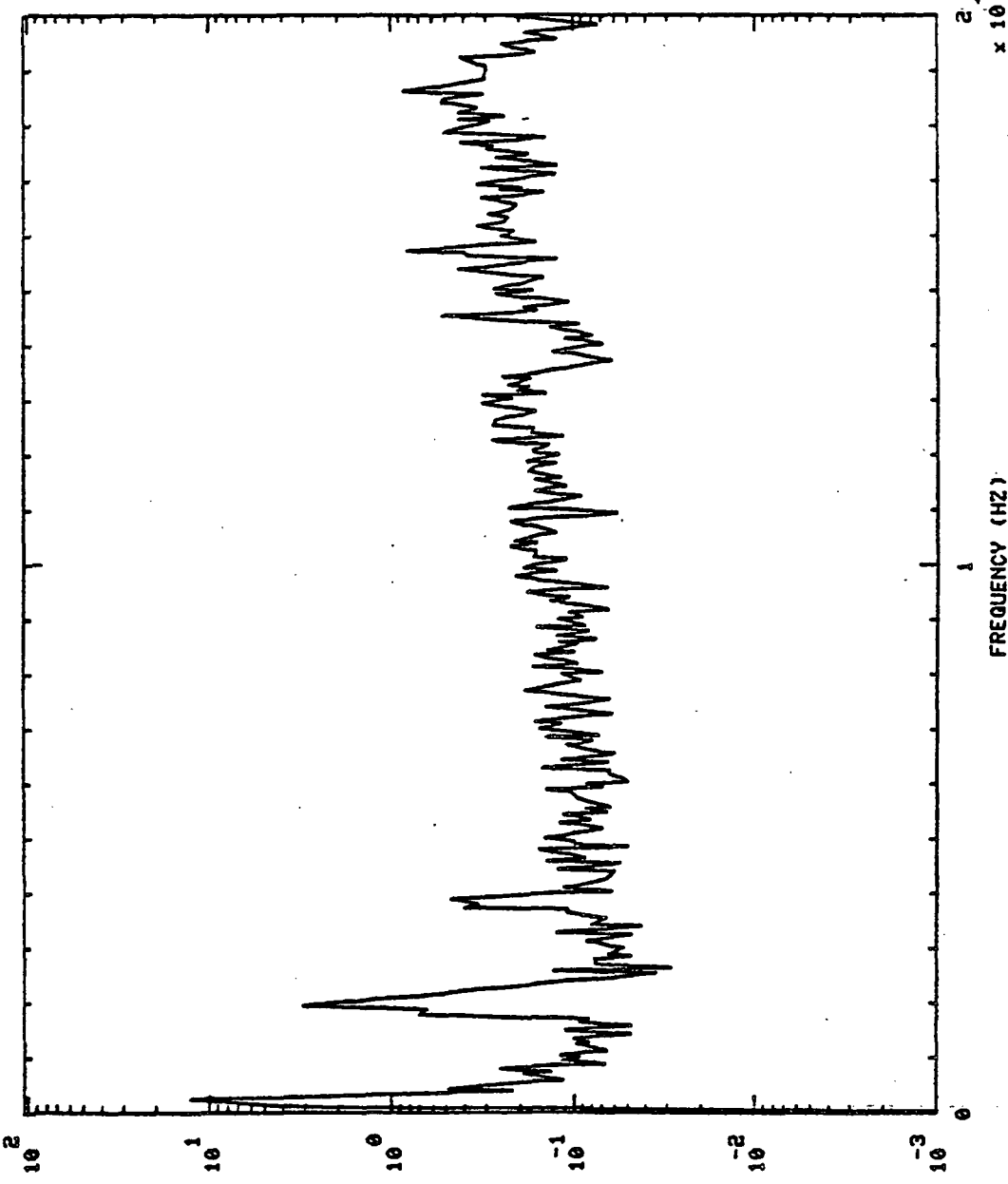
FREQUENCY (HZ)

750116 HPFP BAL CAU PR

S+ 280.01H0,'S

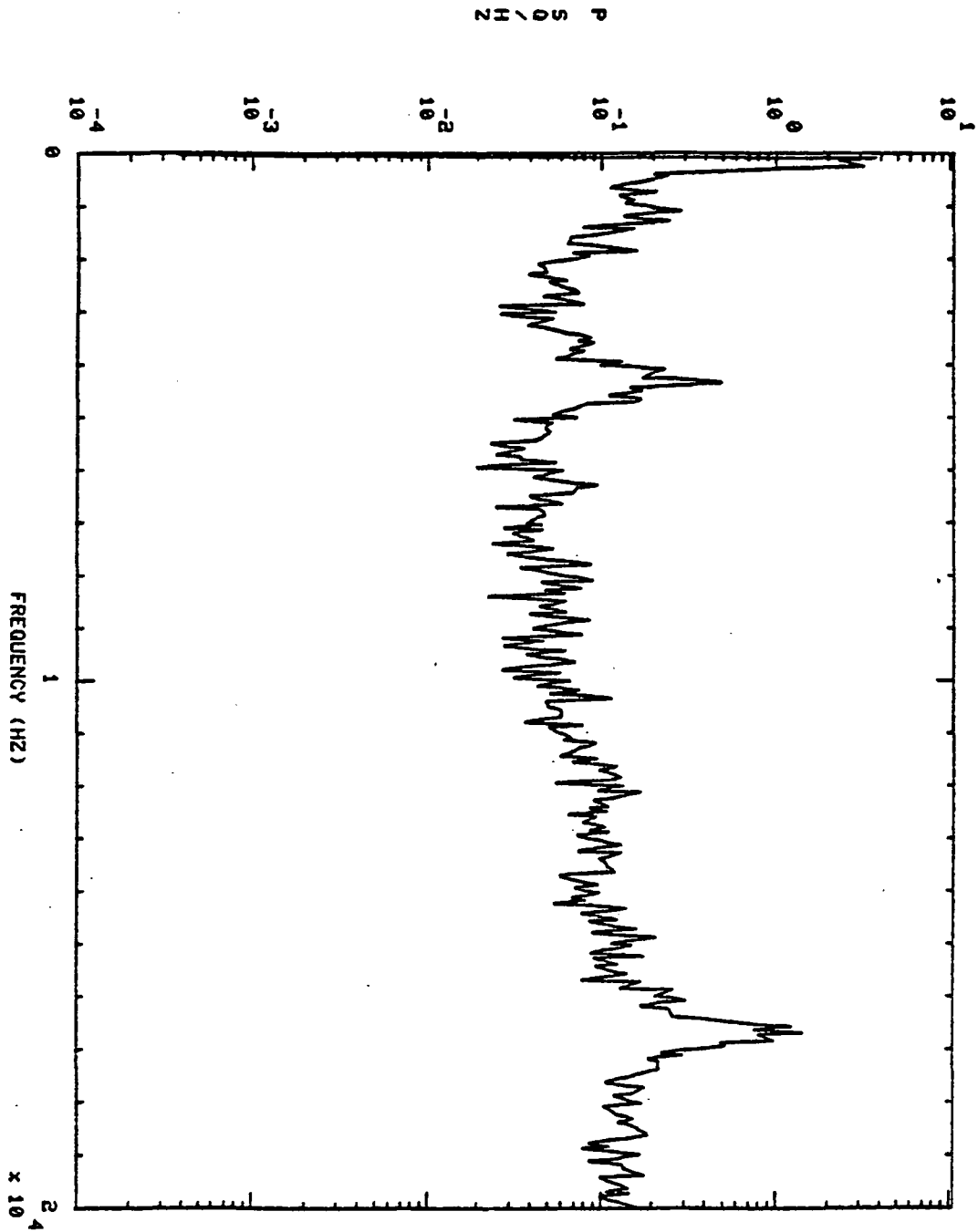


750116 OPB PC PR DC S+ 4.01H0.'S



750116 OP8 PC PR DC

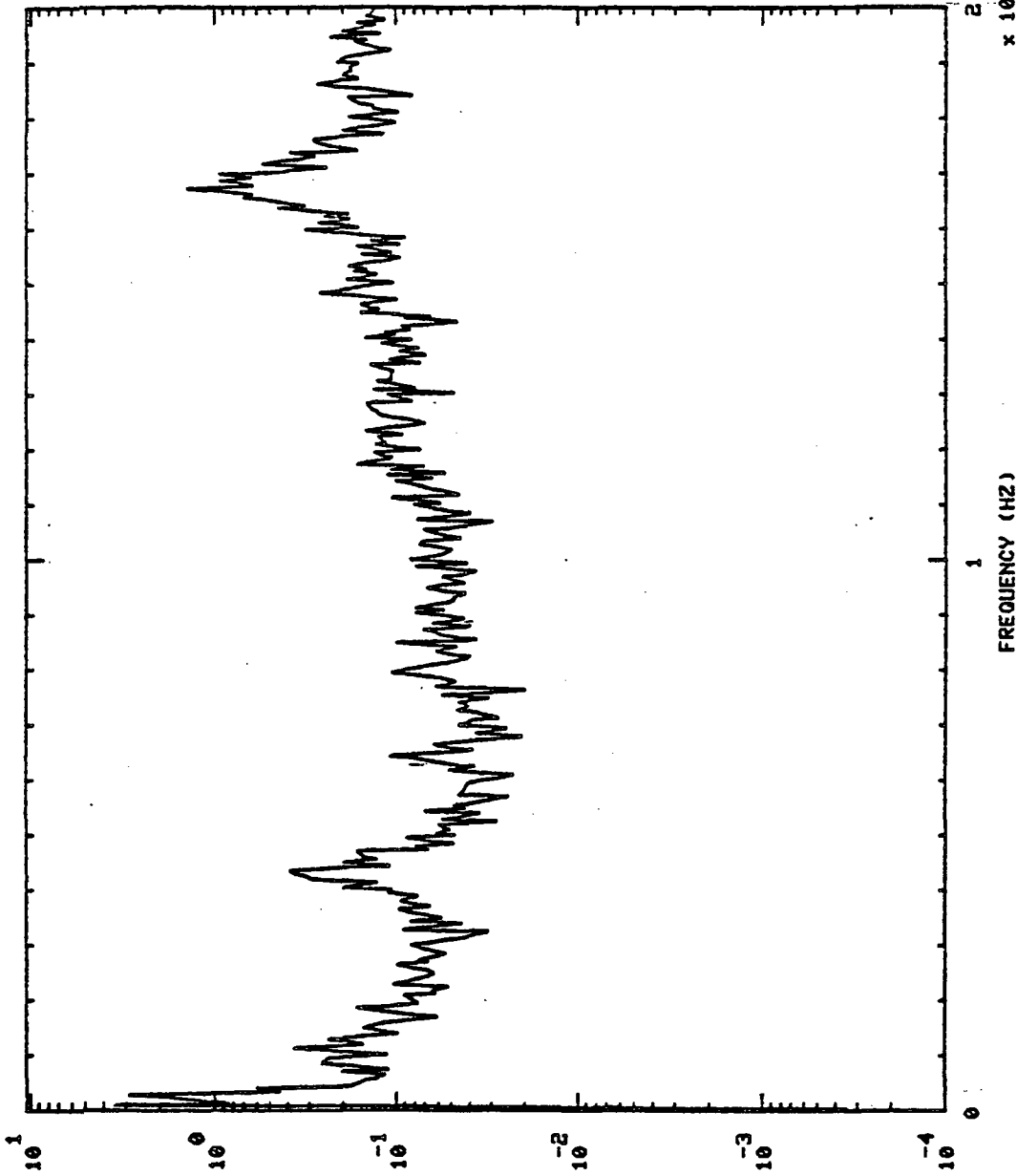
S+ 30.0110.'S



S+ 150.01H0,'S

OPB PC PR DC

750116

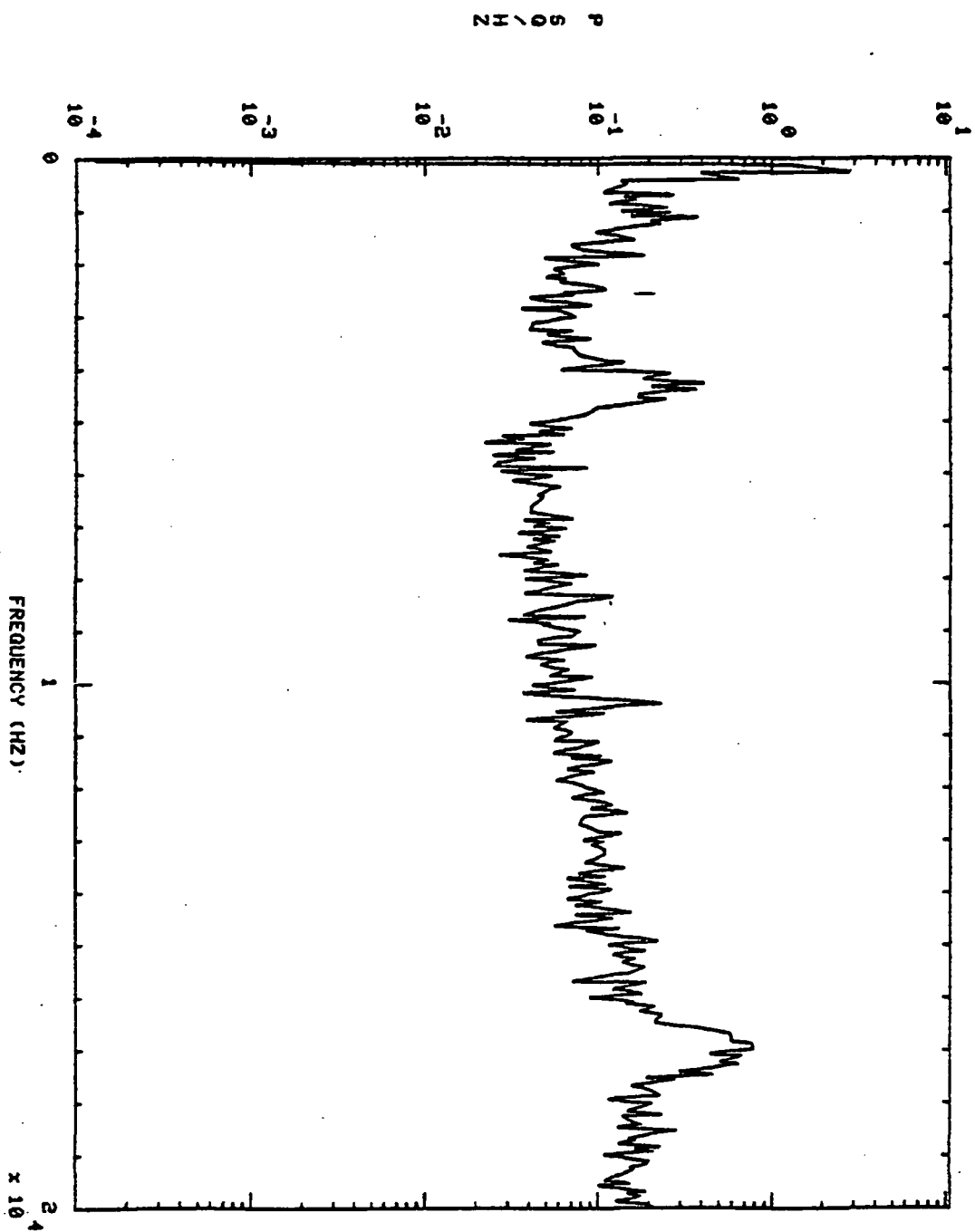


2.4×10^4

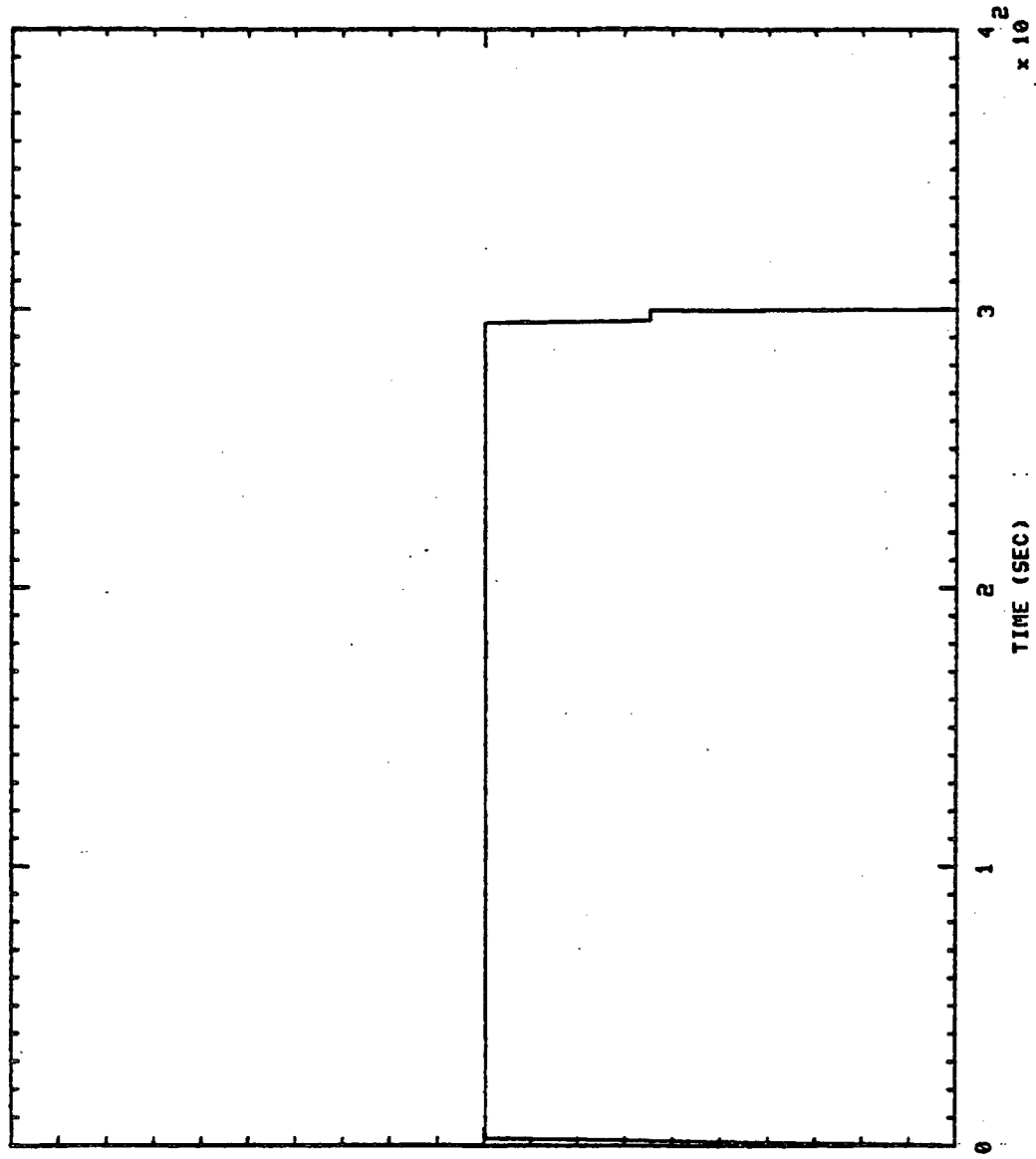
FREQUENCY (HZ)

750116 OP8 PC PR DC

S + 280.01H0,'S

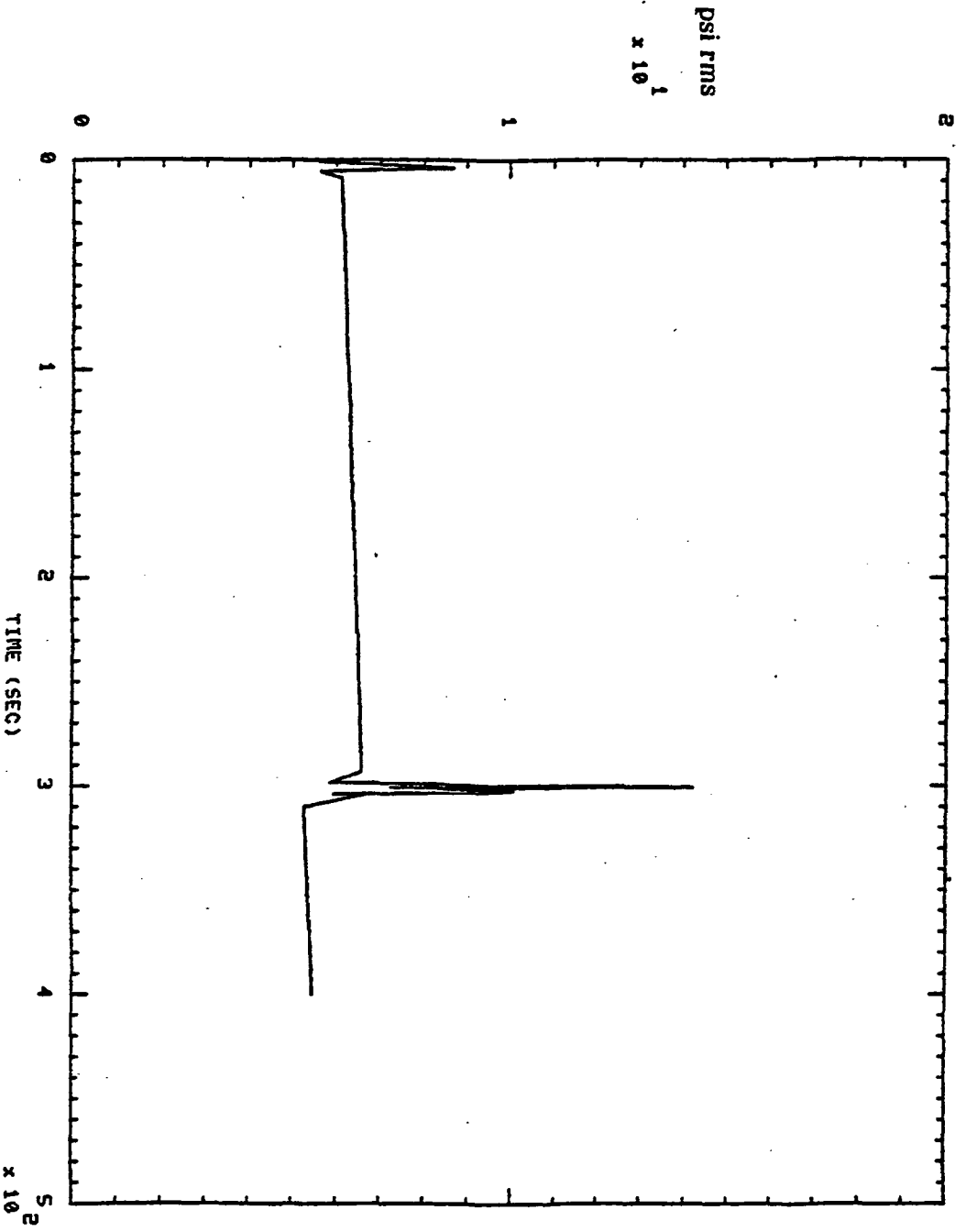


750117 THRUST (UNFILTERED)



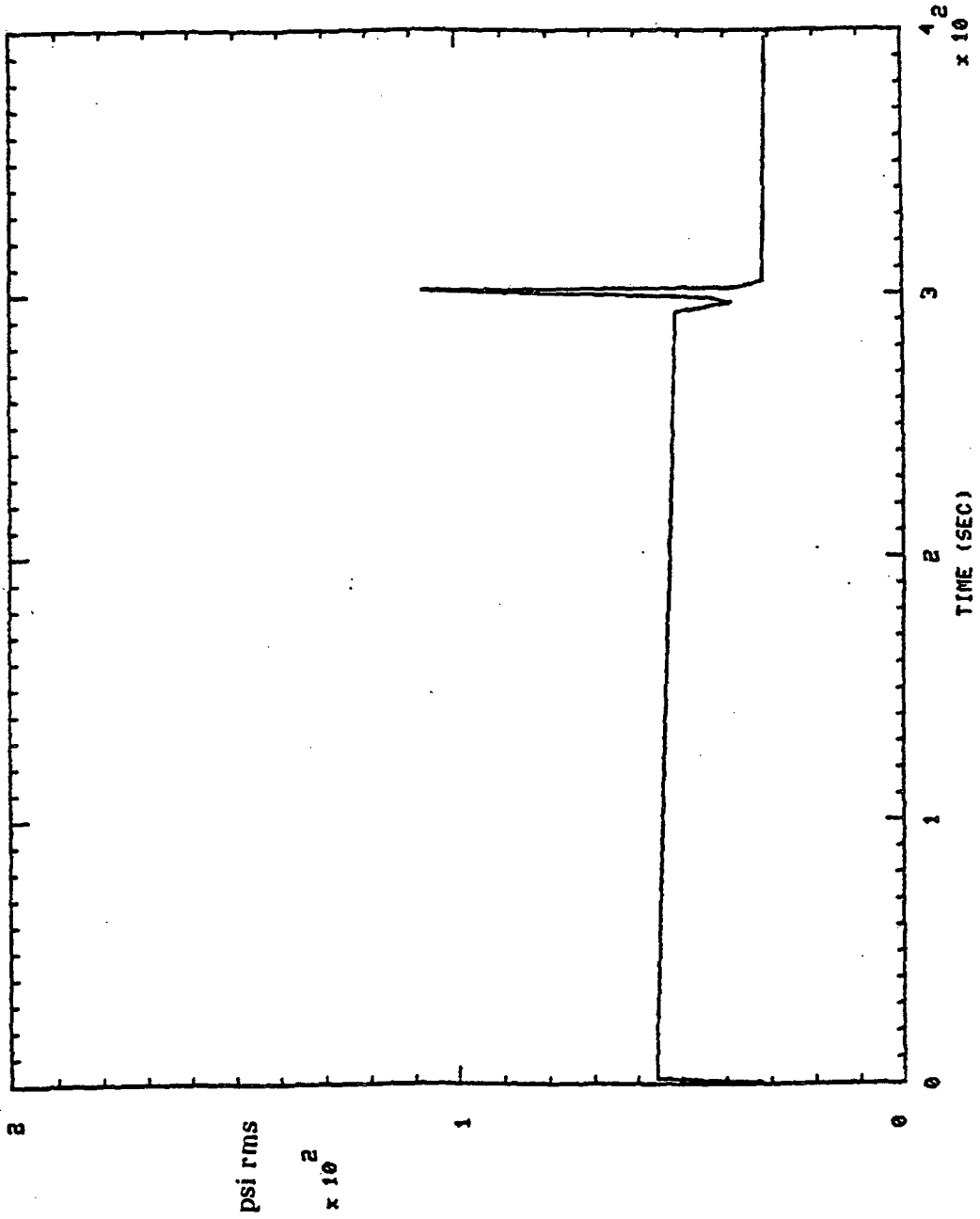
750117 LPOP DS PR

(1 - 20K HZ)

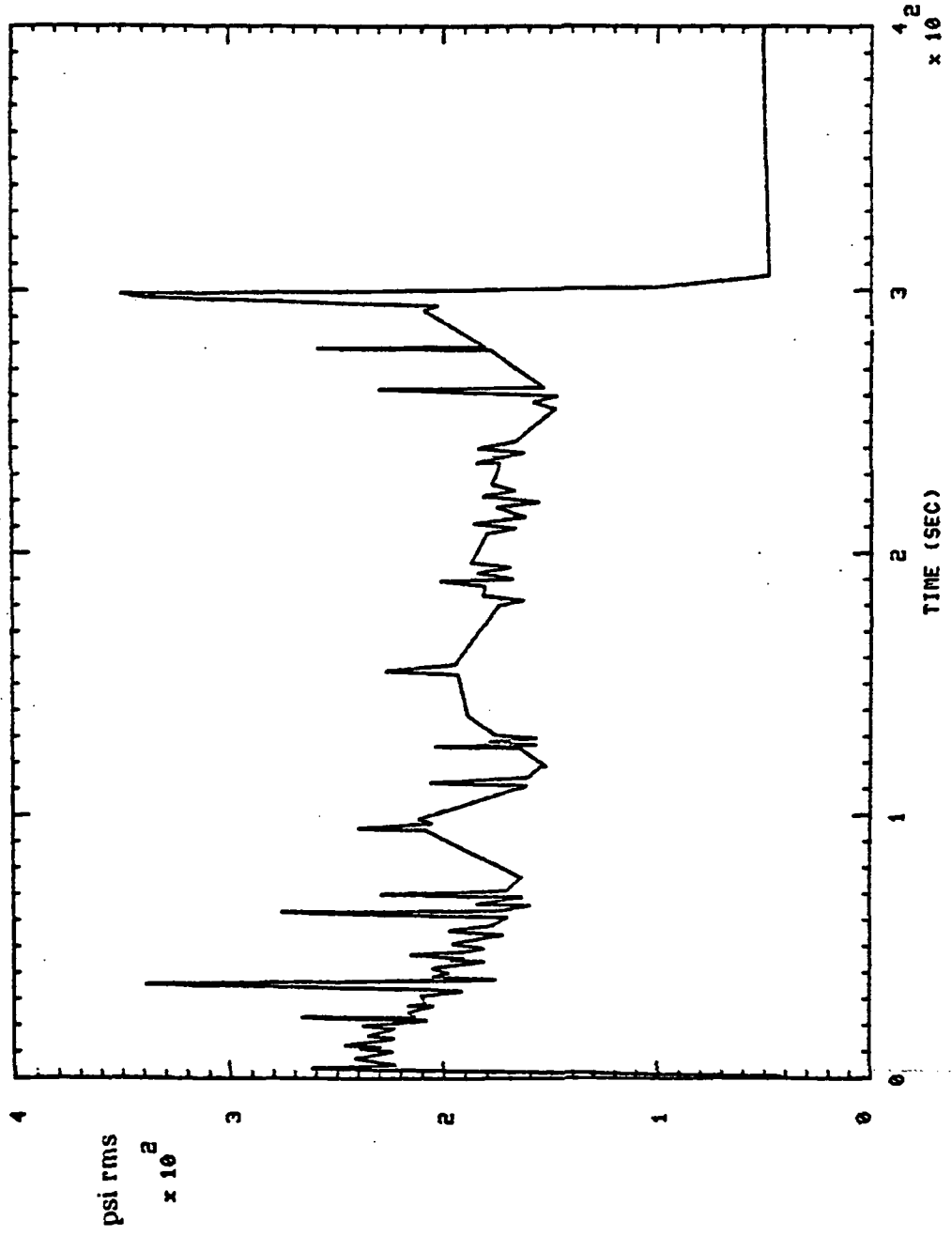


(1 - 20K HZ)

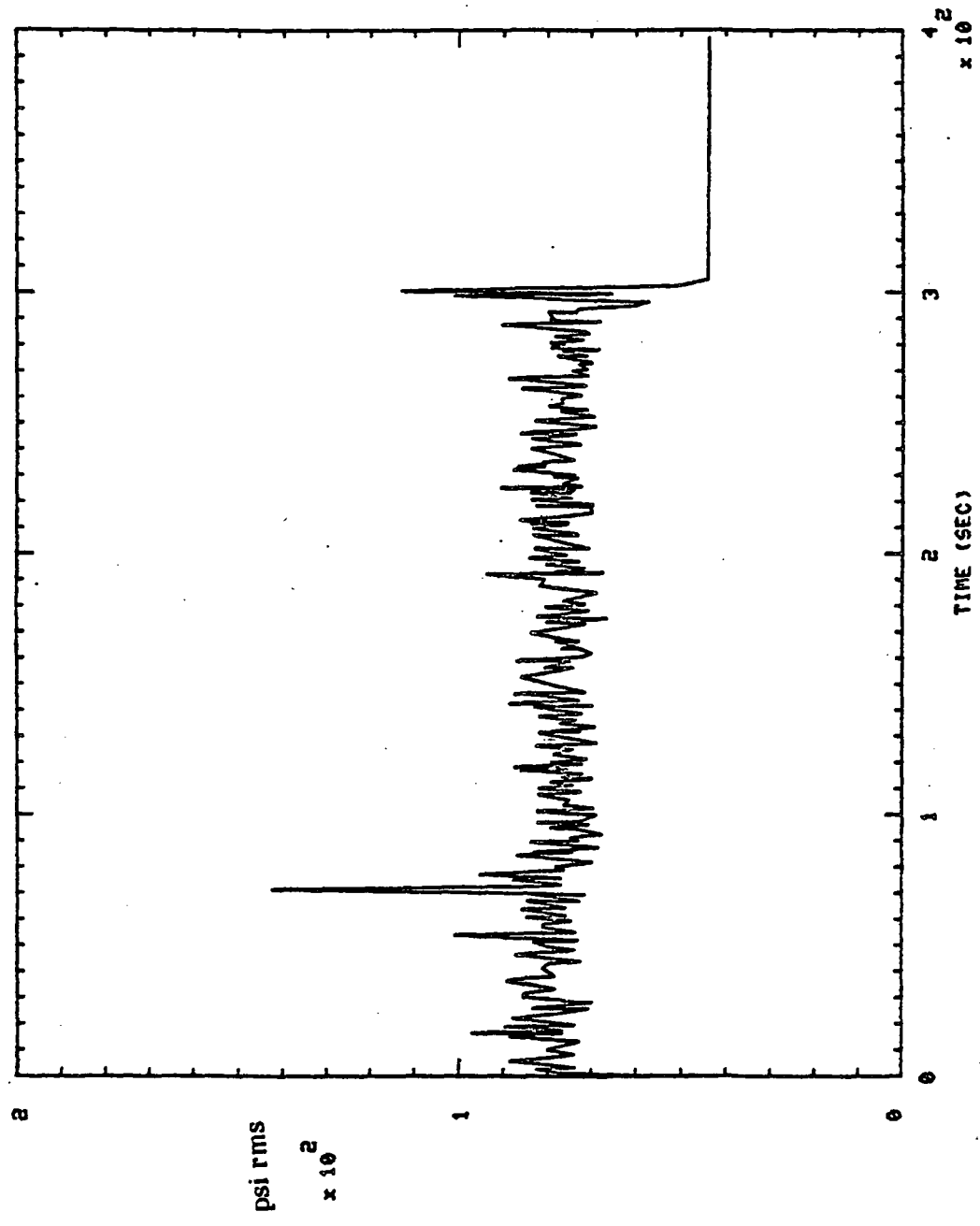
750117 HP0P DS PR



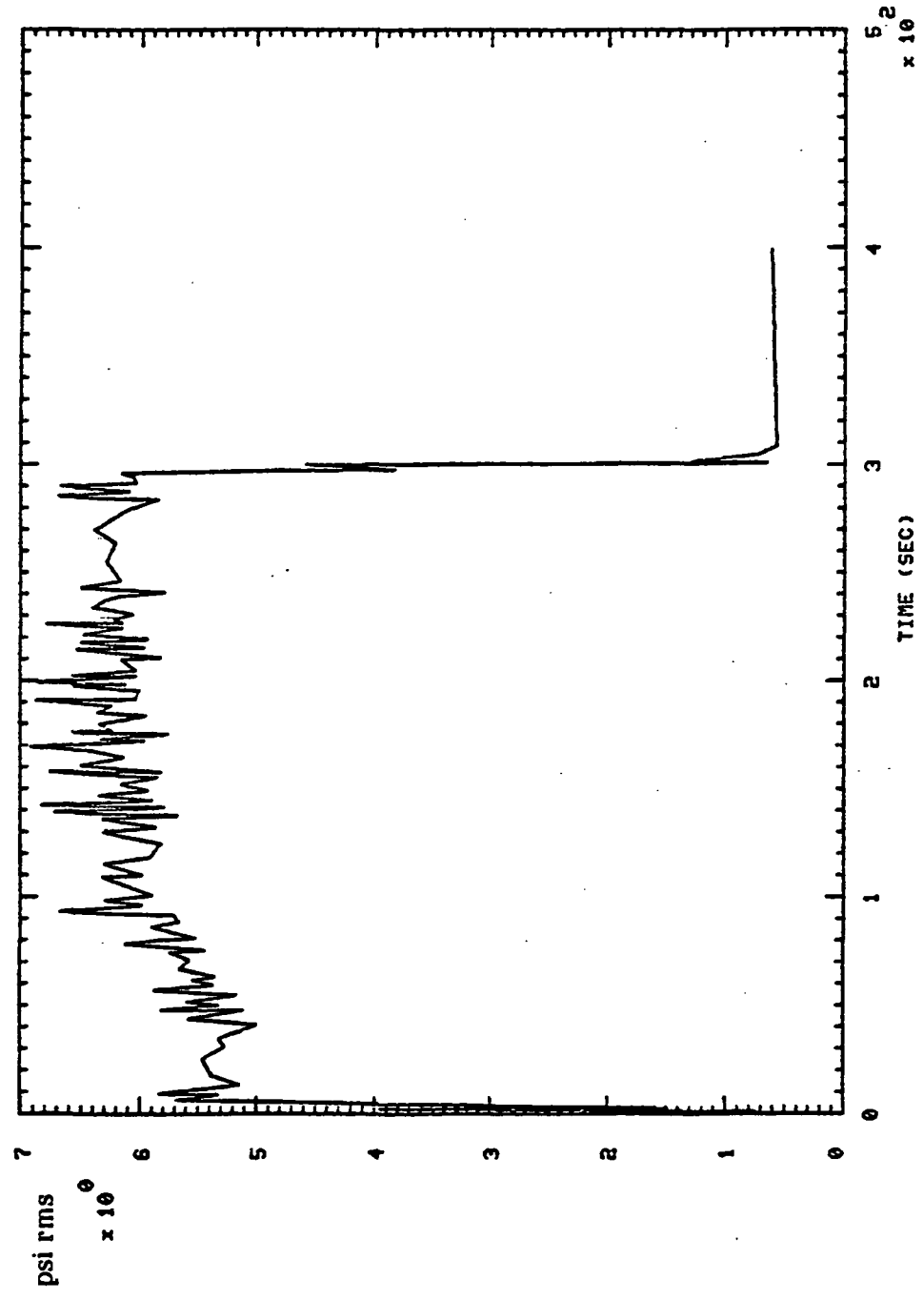
750117 MCC HOT GAS IN PR (1 - 20K HZ)



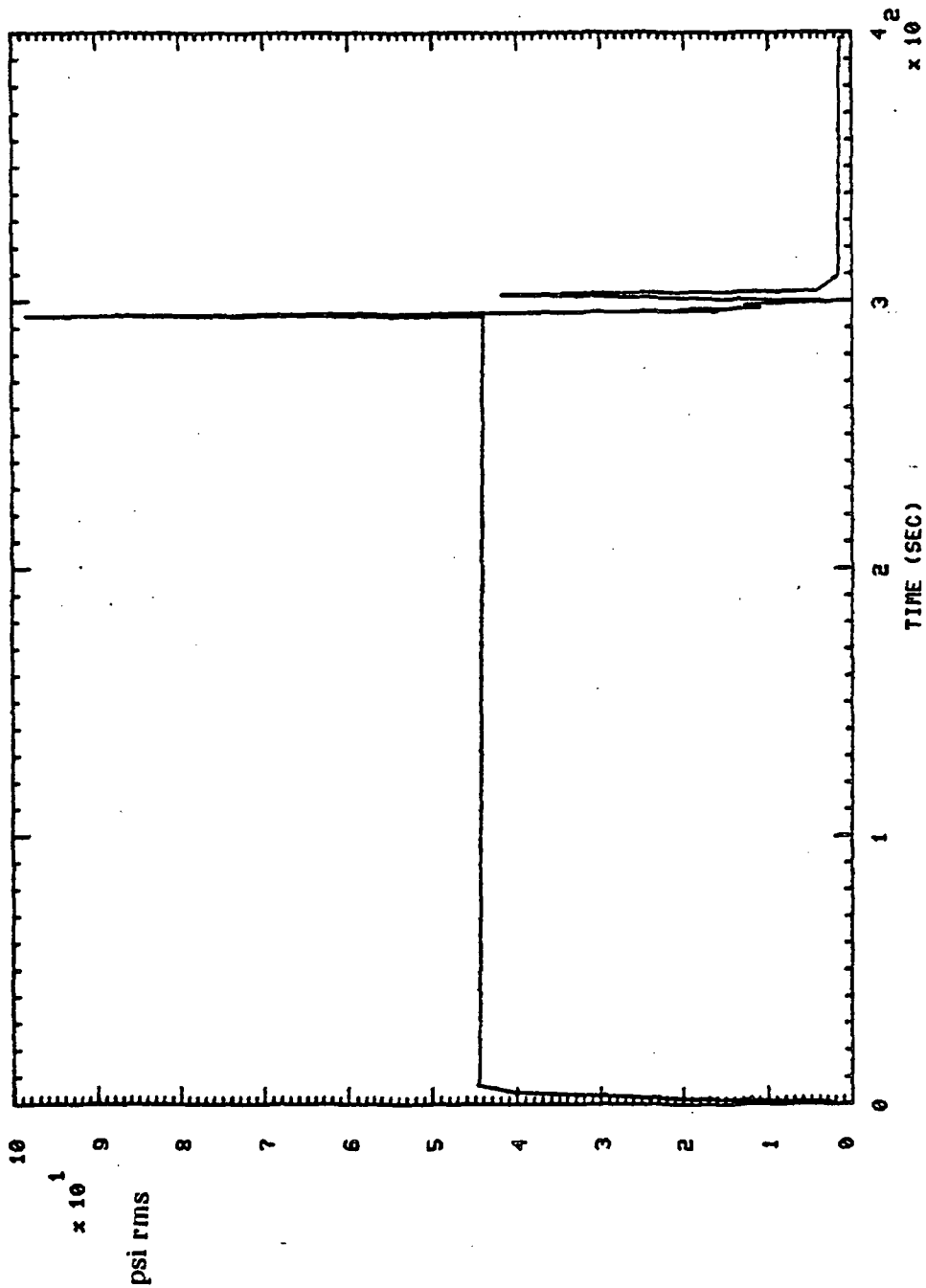
750117 FBP DS PR (1 - 20K HZ)



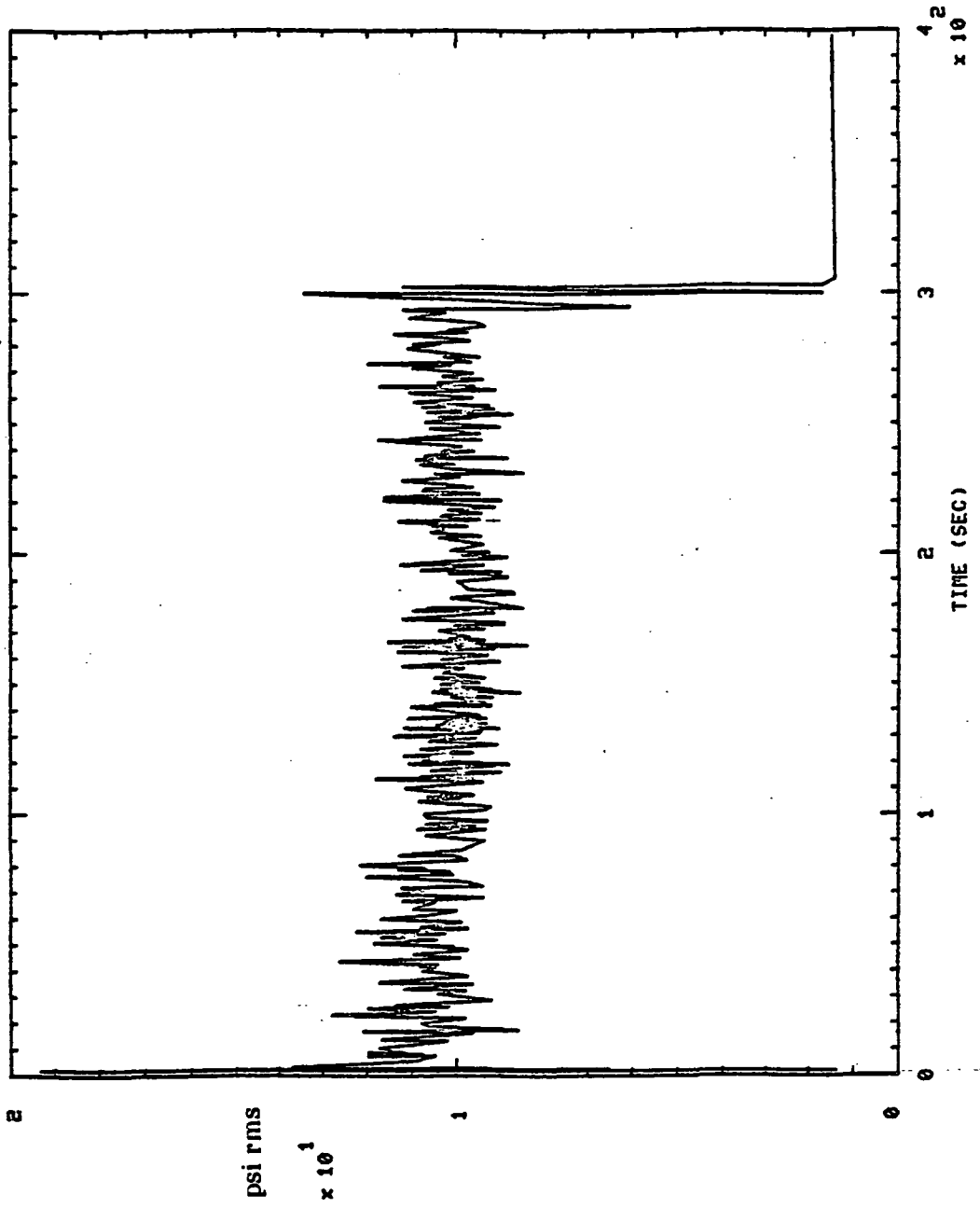
750117 LPFP DS PR (1 - 20K HZ)



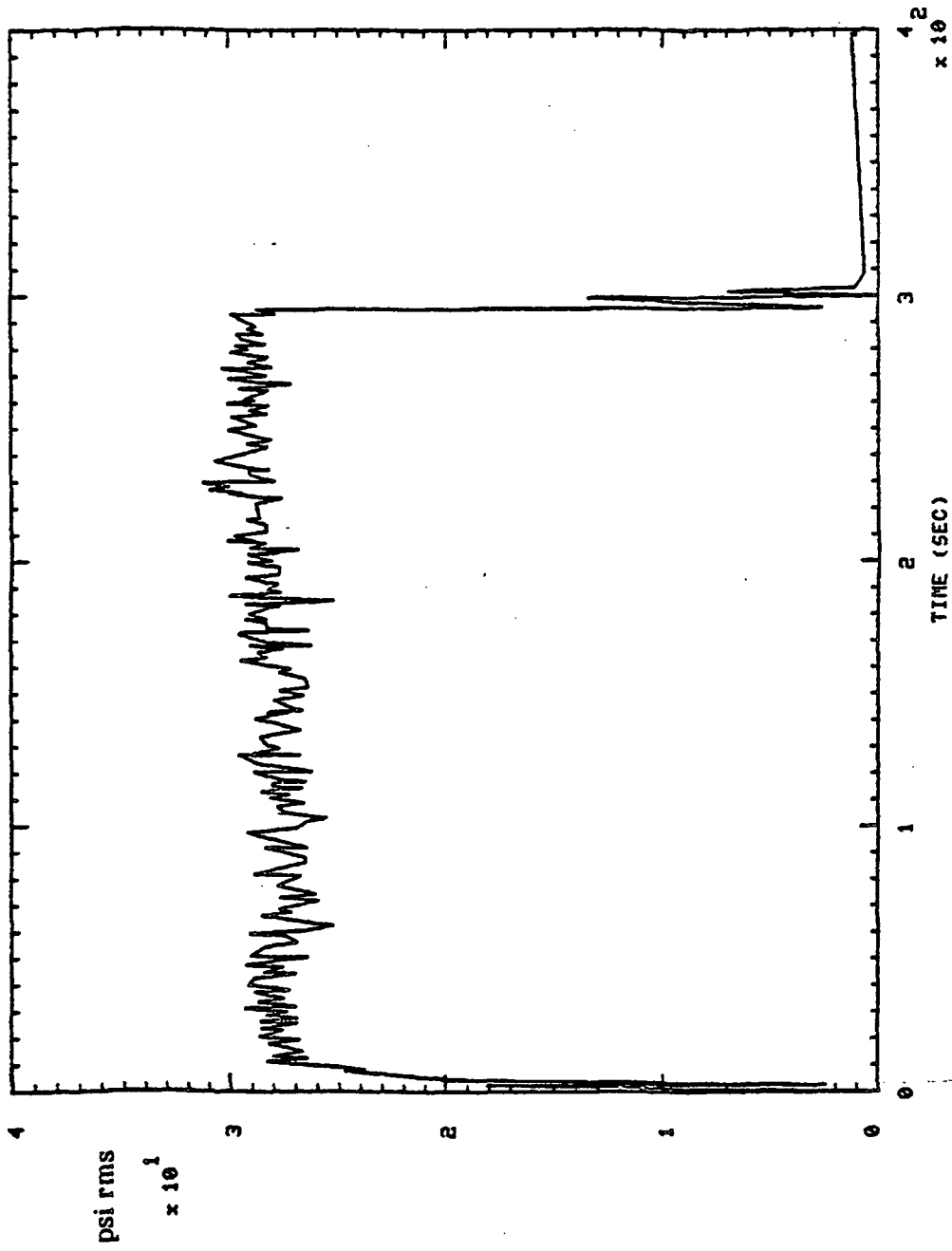
750117 LPOT TURB DR PR (1 - 20K HZ)



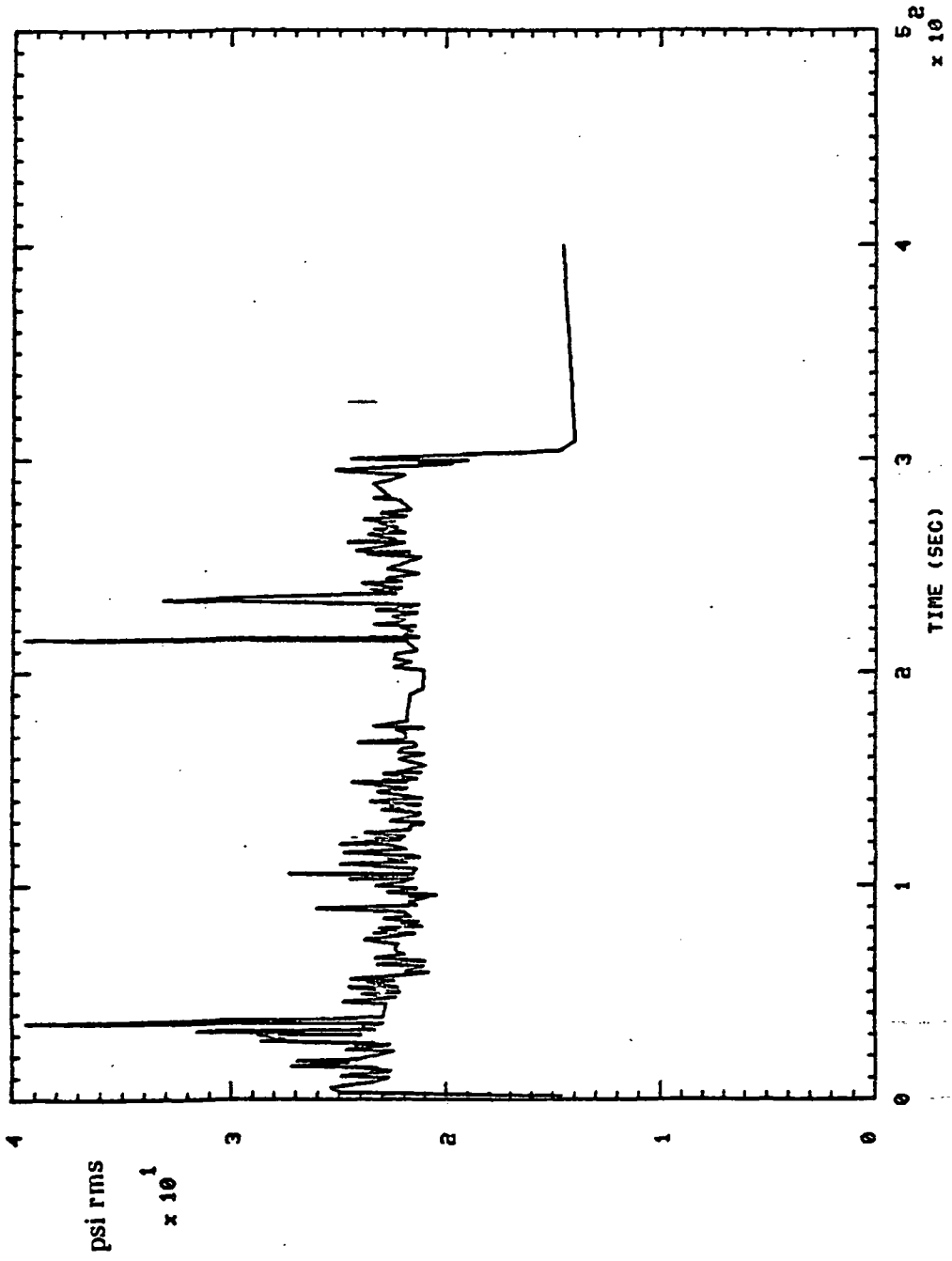
750117 OPB PC PR (1 - 20K HZ)



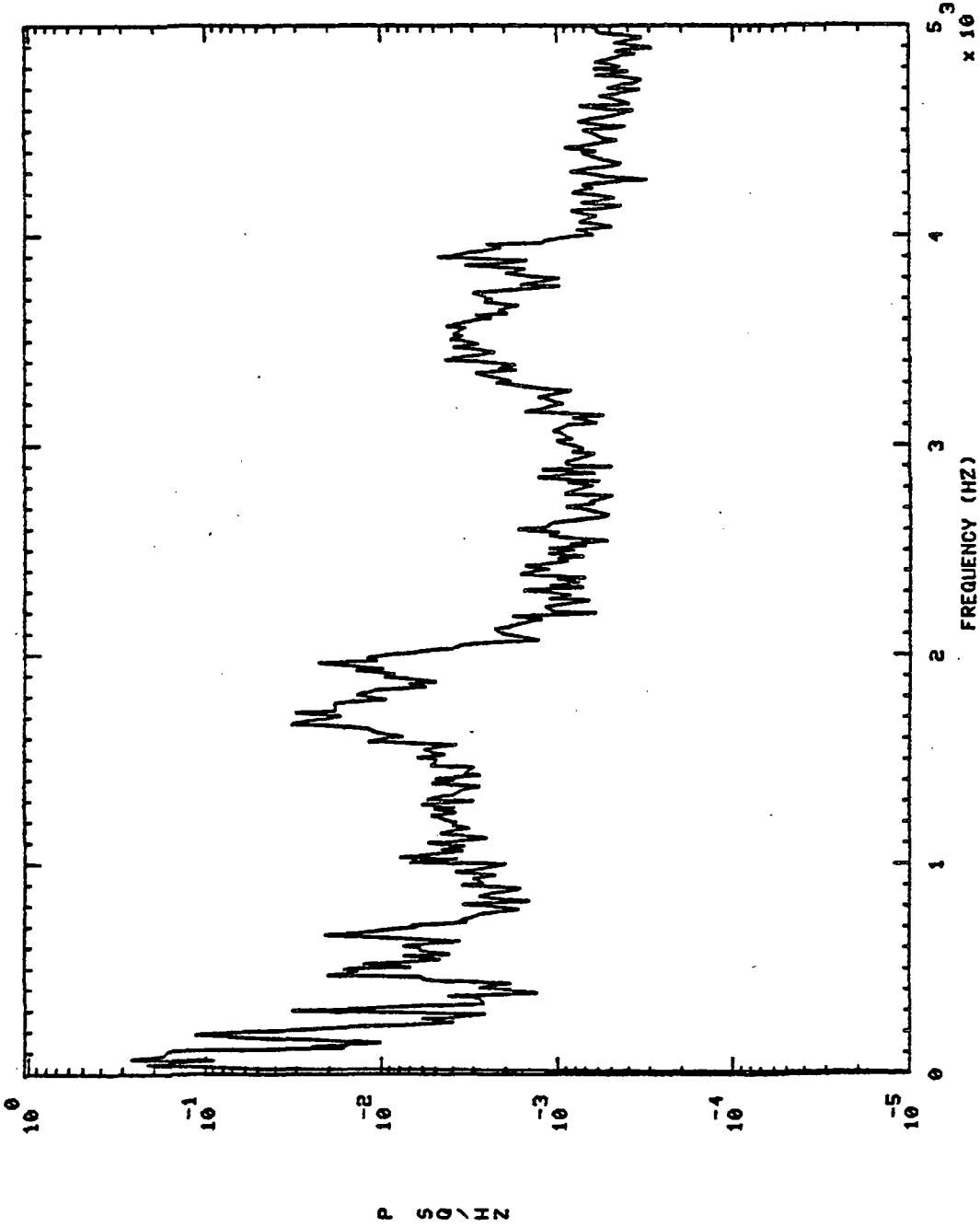
750117 HPFP D5 PR (1 - 20K HZ)



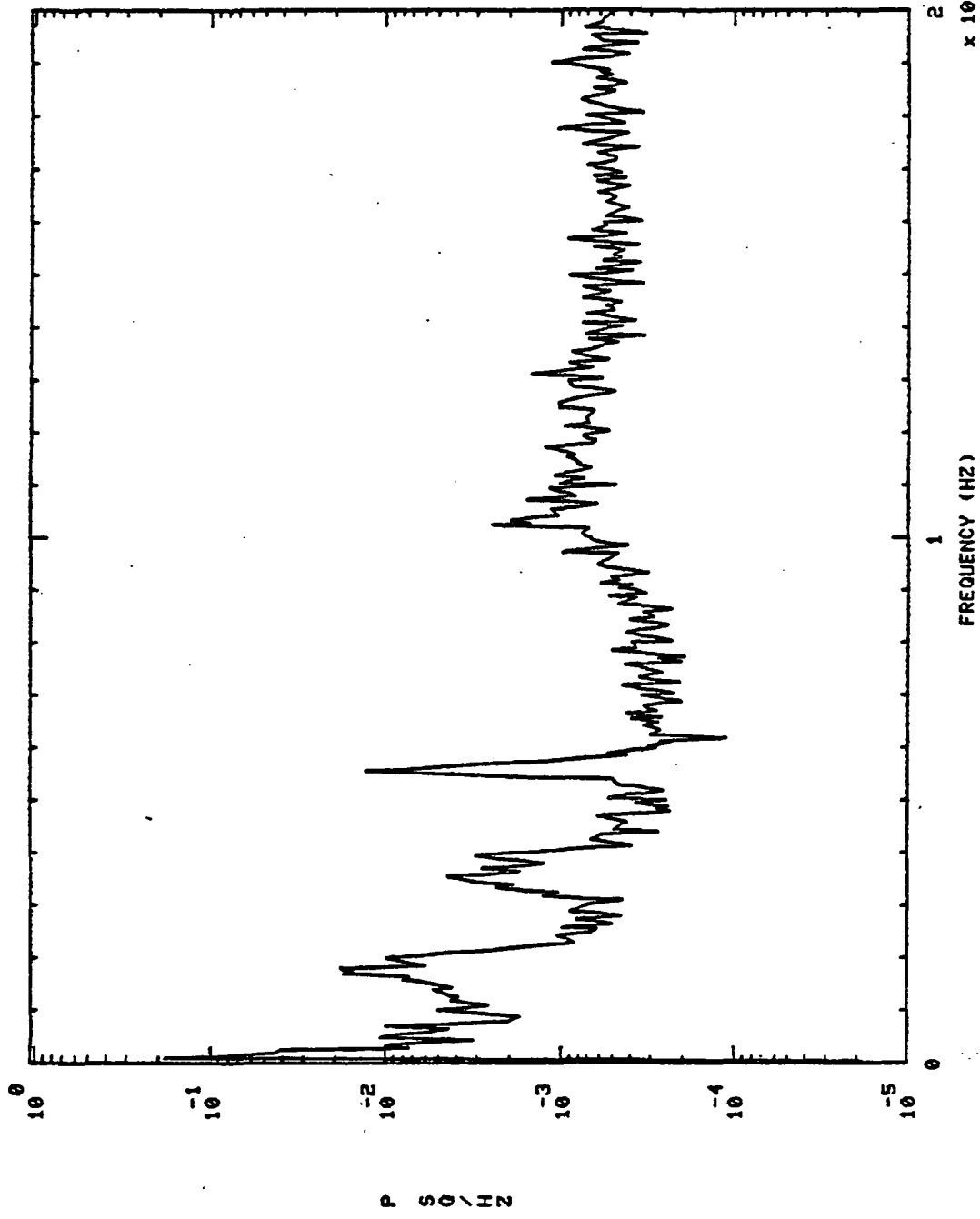
750117 HPFP BAL CAU PR (1 - 20K HZ)



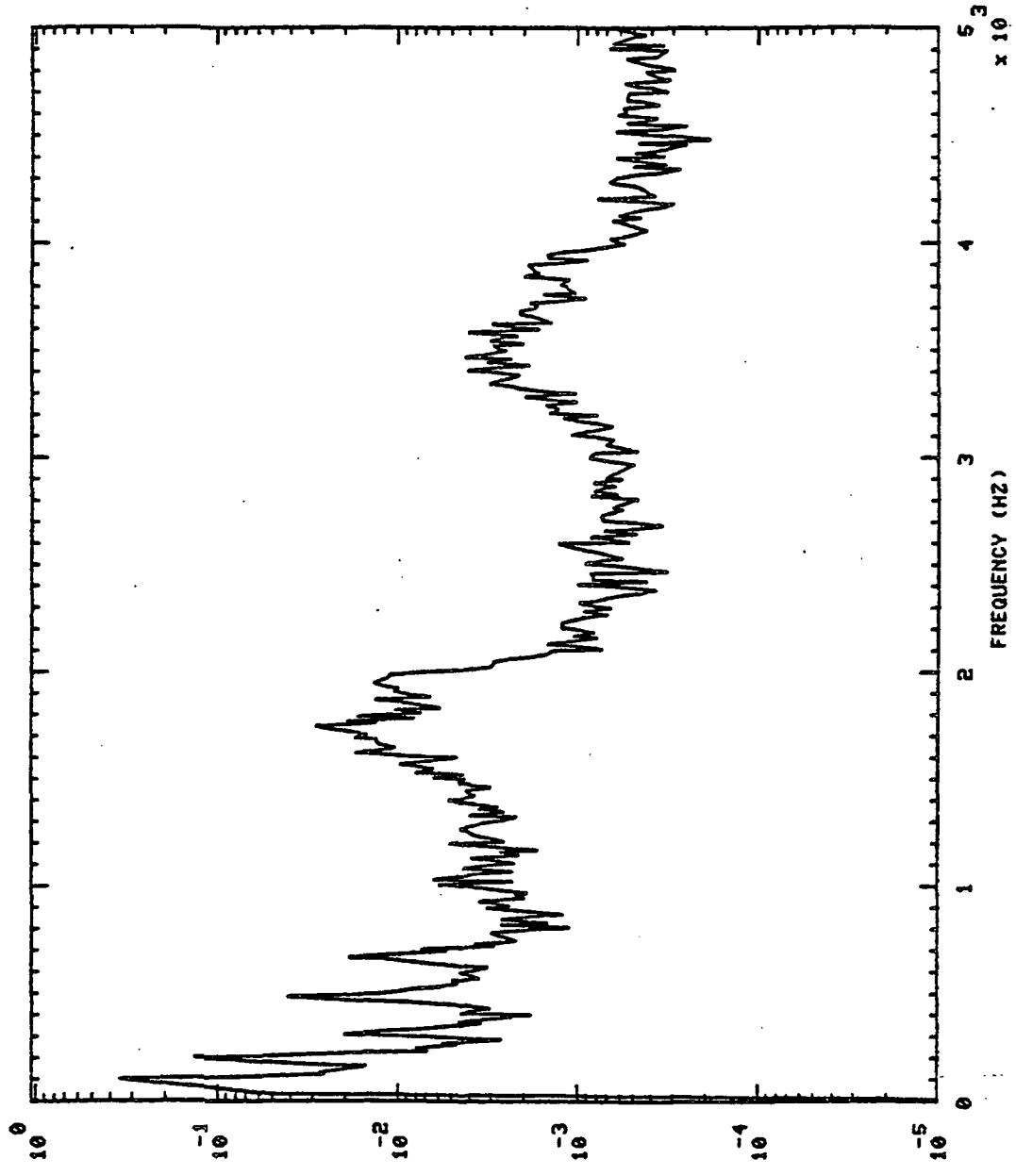
750117 LPOP DS PR S+ 30.01H0,'S



750117 LPOP DS PR S+ 30.01H0.'S

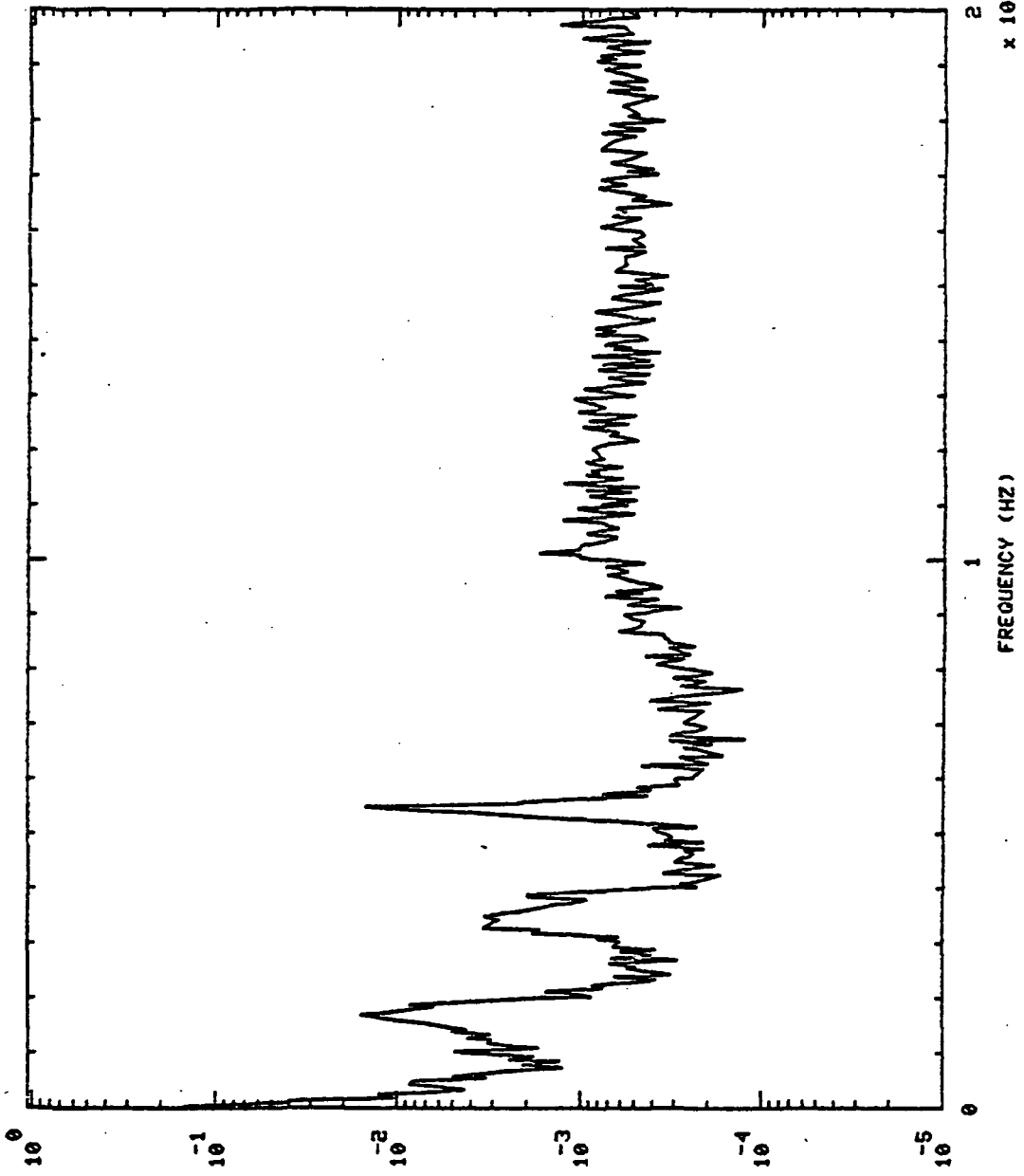


750117 LPOP DS PR S+ 150.01H0,'S



P SQ/HZ

750117 LPOP DS PR S+ 150.01H0,'S



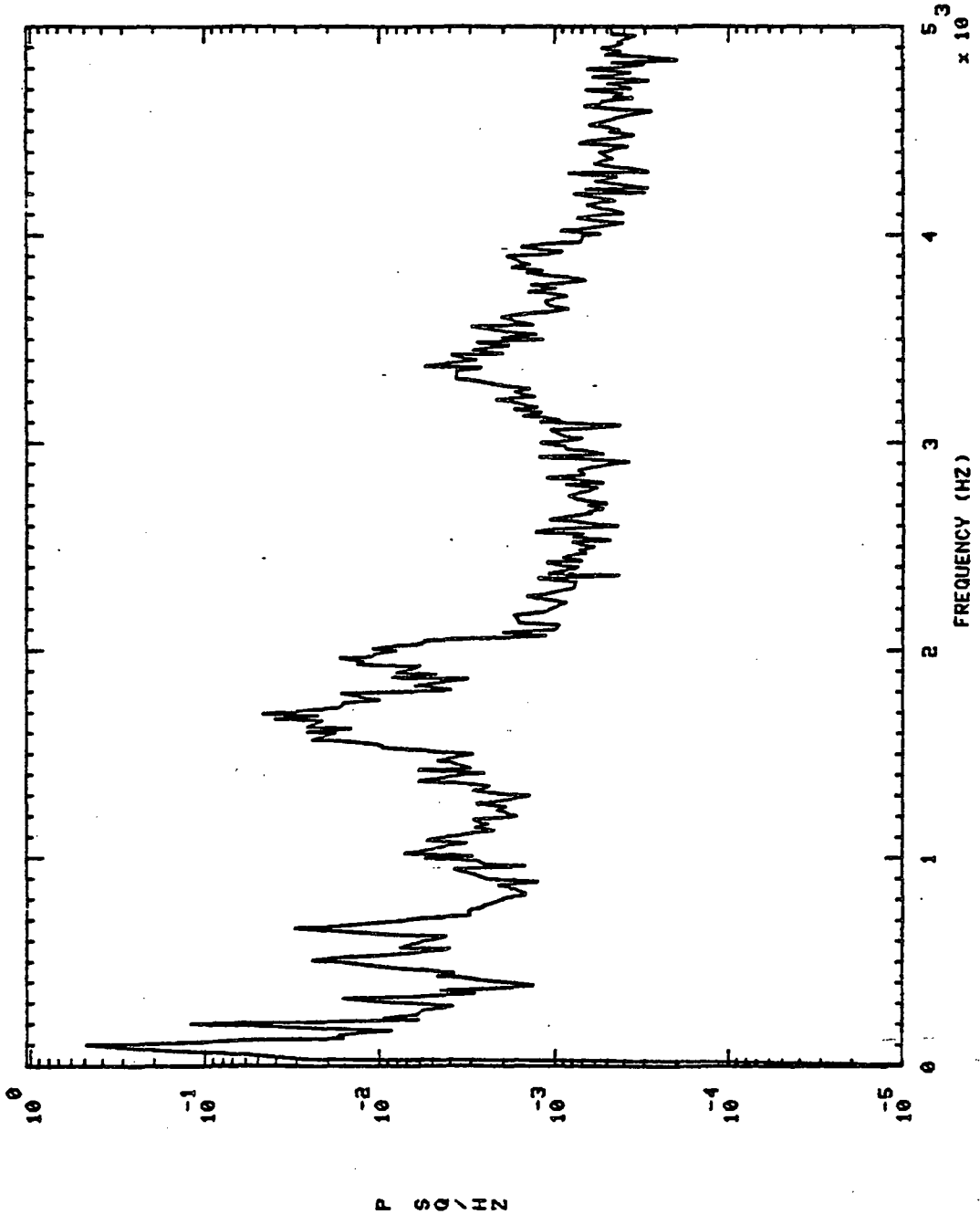
P SQ \ HZ

FREQUENCY (HZ)

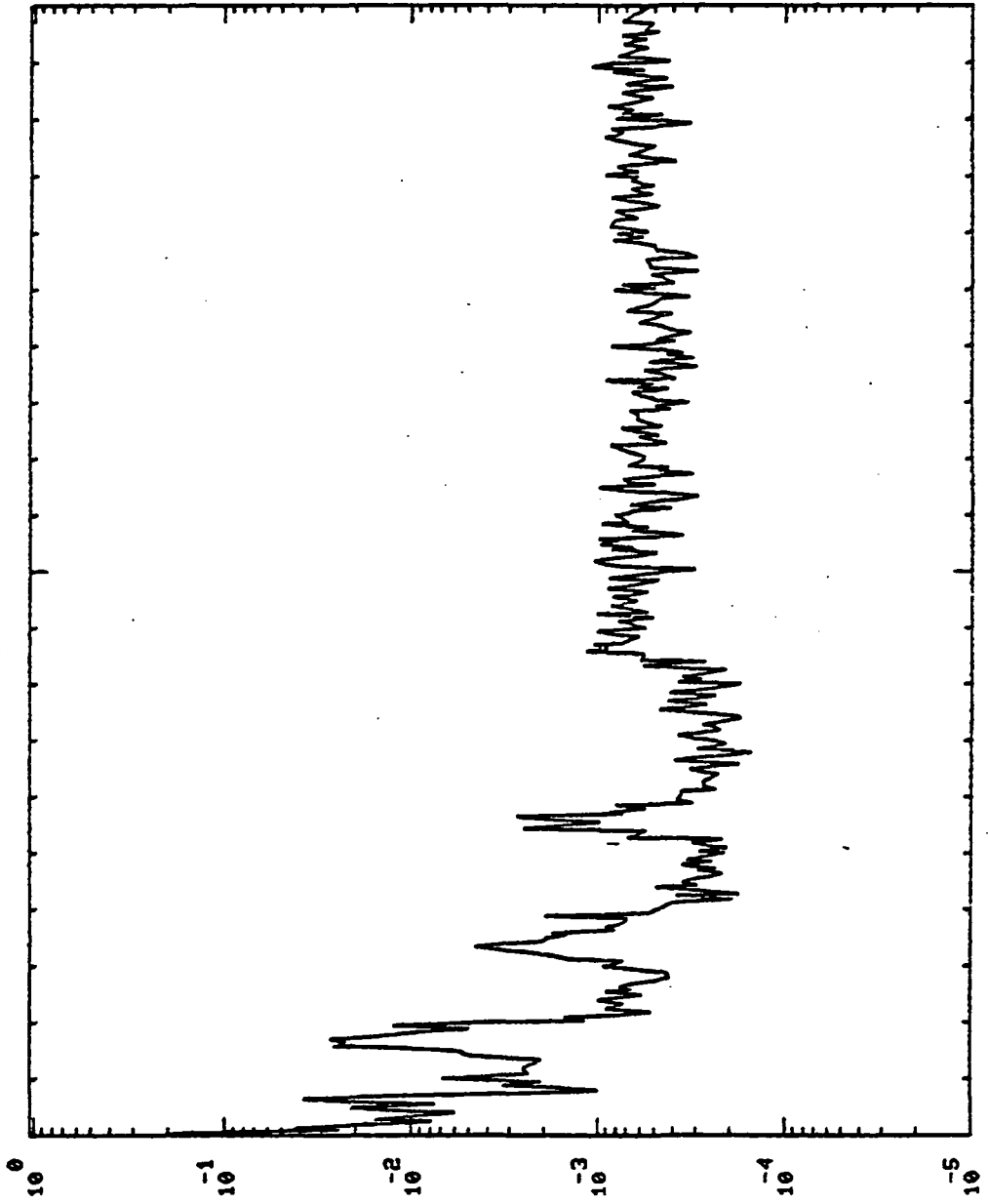
$\times 10^4$

S+ 297.01H0.'S

750117 LPOP D5 PR



750117 LPOP DS PR S+ 297.01H0,'S



P S D / HZ

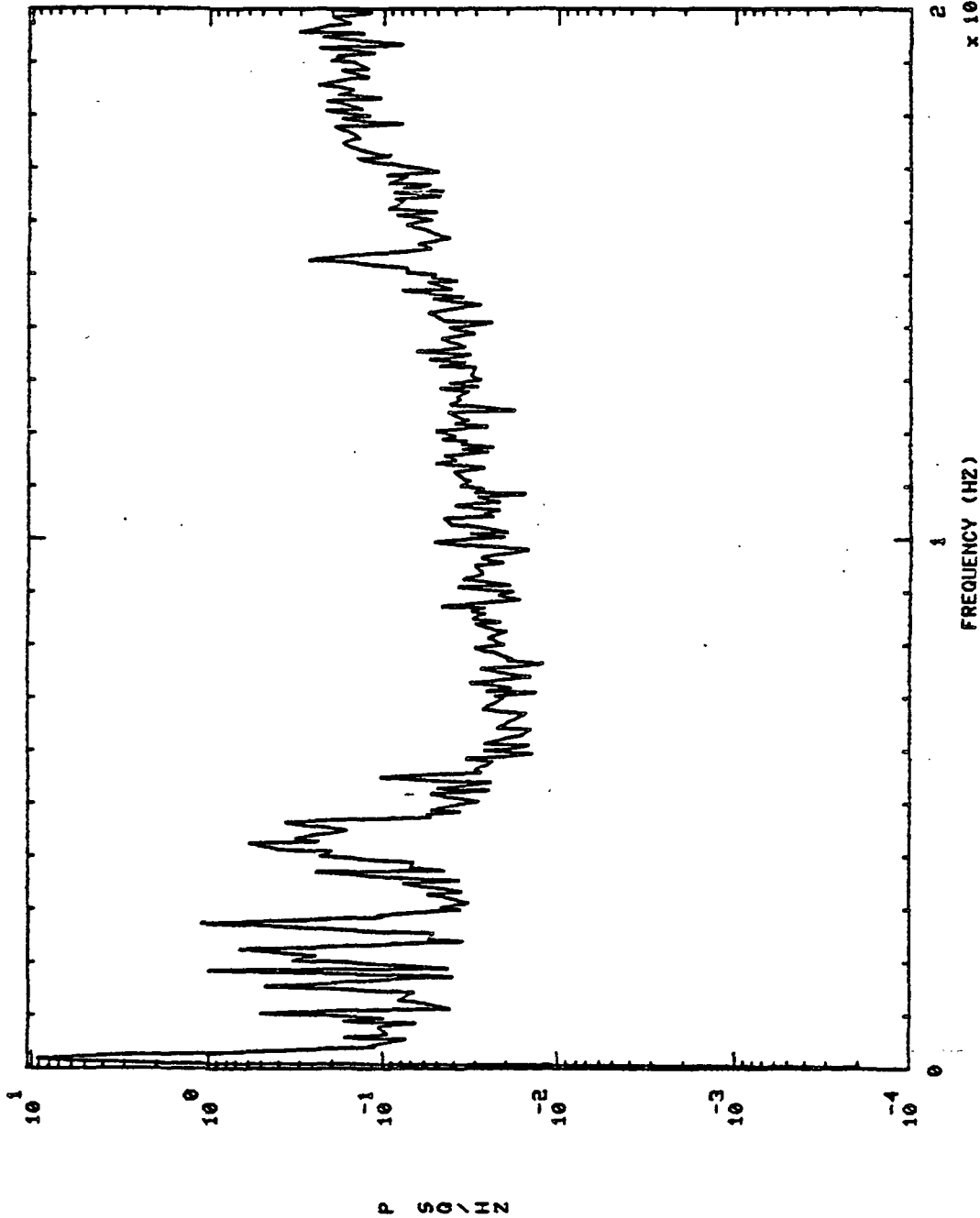
2.4
x 10⁴

1
FREQUENCY (HZ)

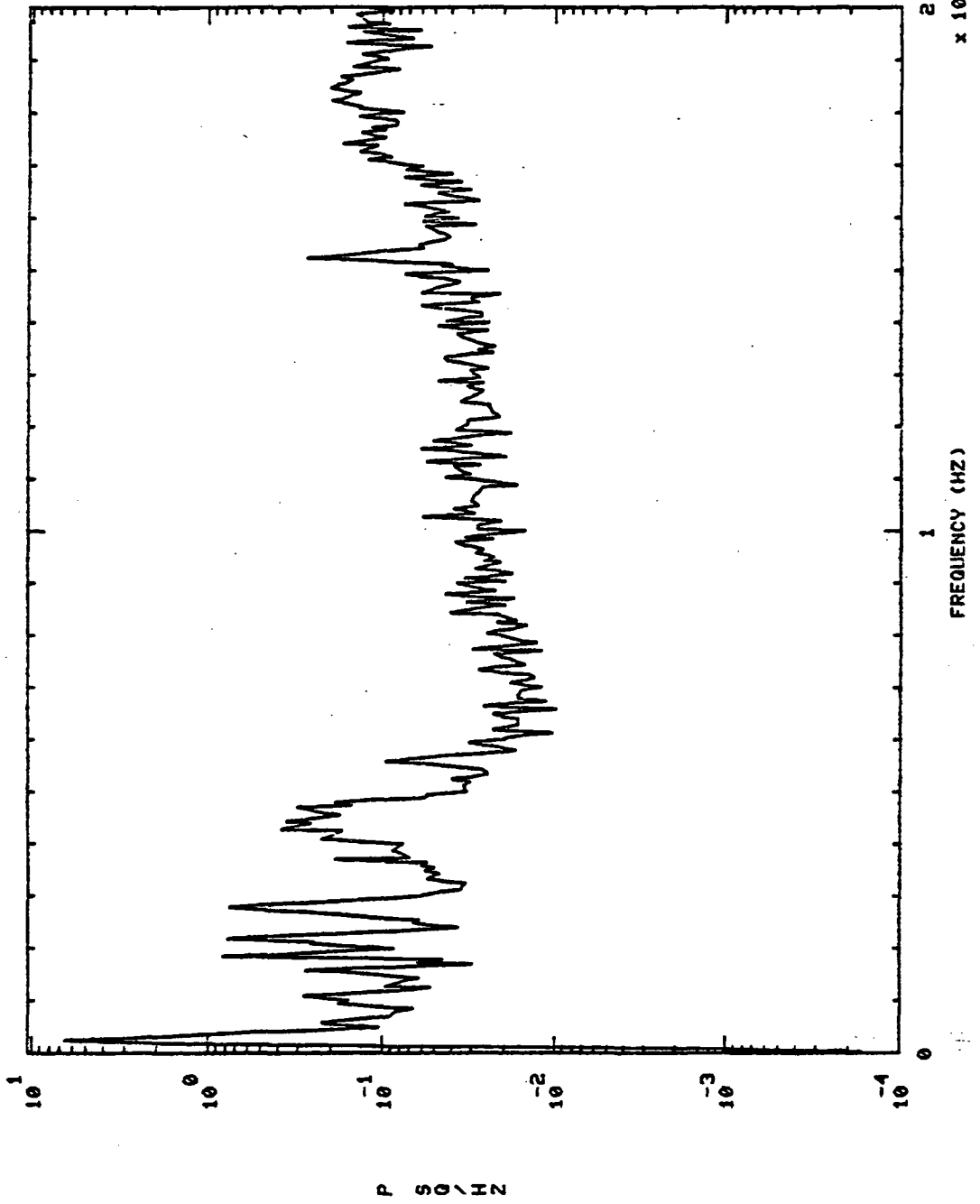
S+ 30.01H0,'S

HPOP DS PR

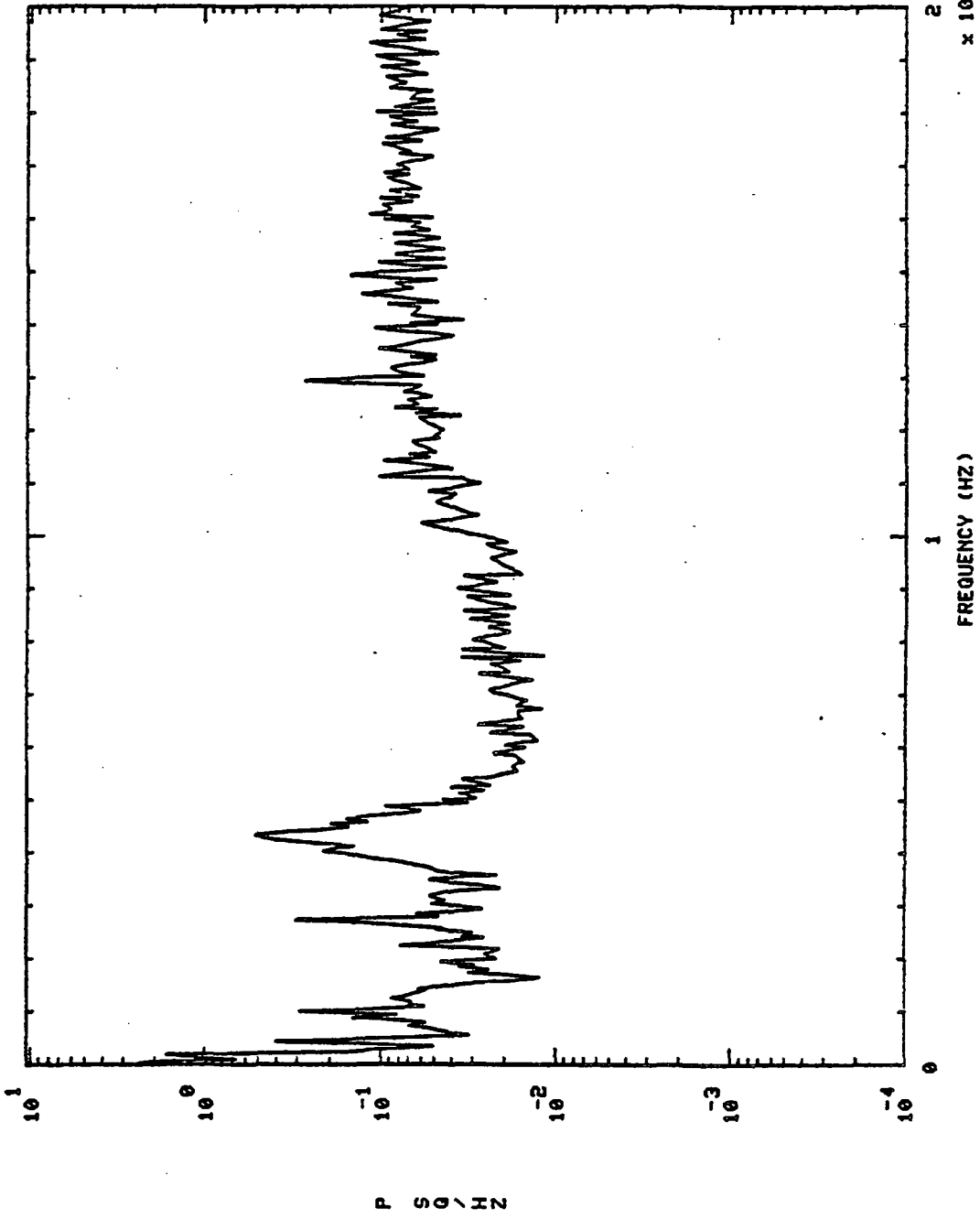
750117



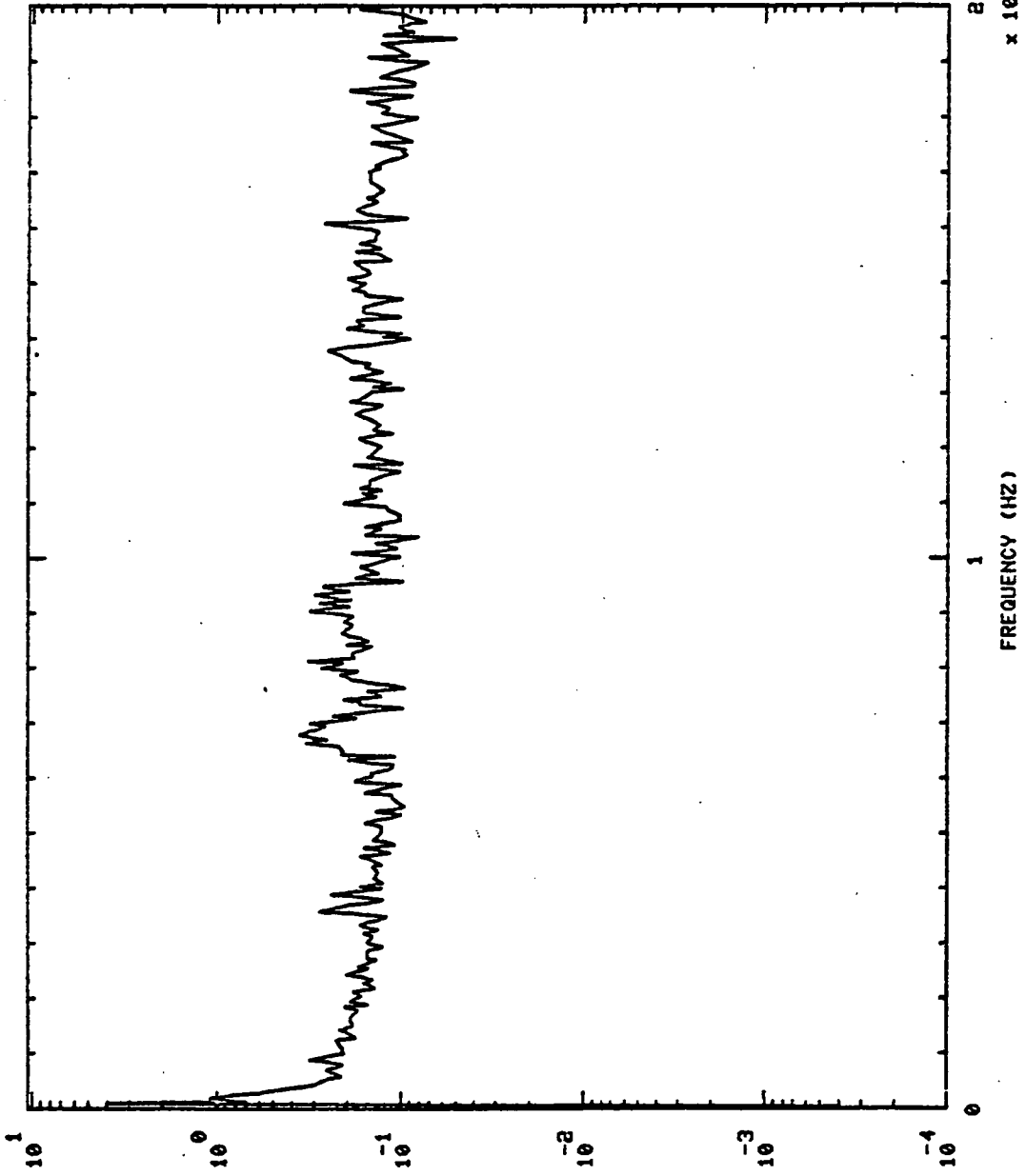
750117 HPOP DS PR S+ 150.01H0,'S



750117 HPOP DS PR S+ 297.01H0,'S

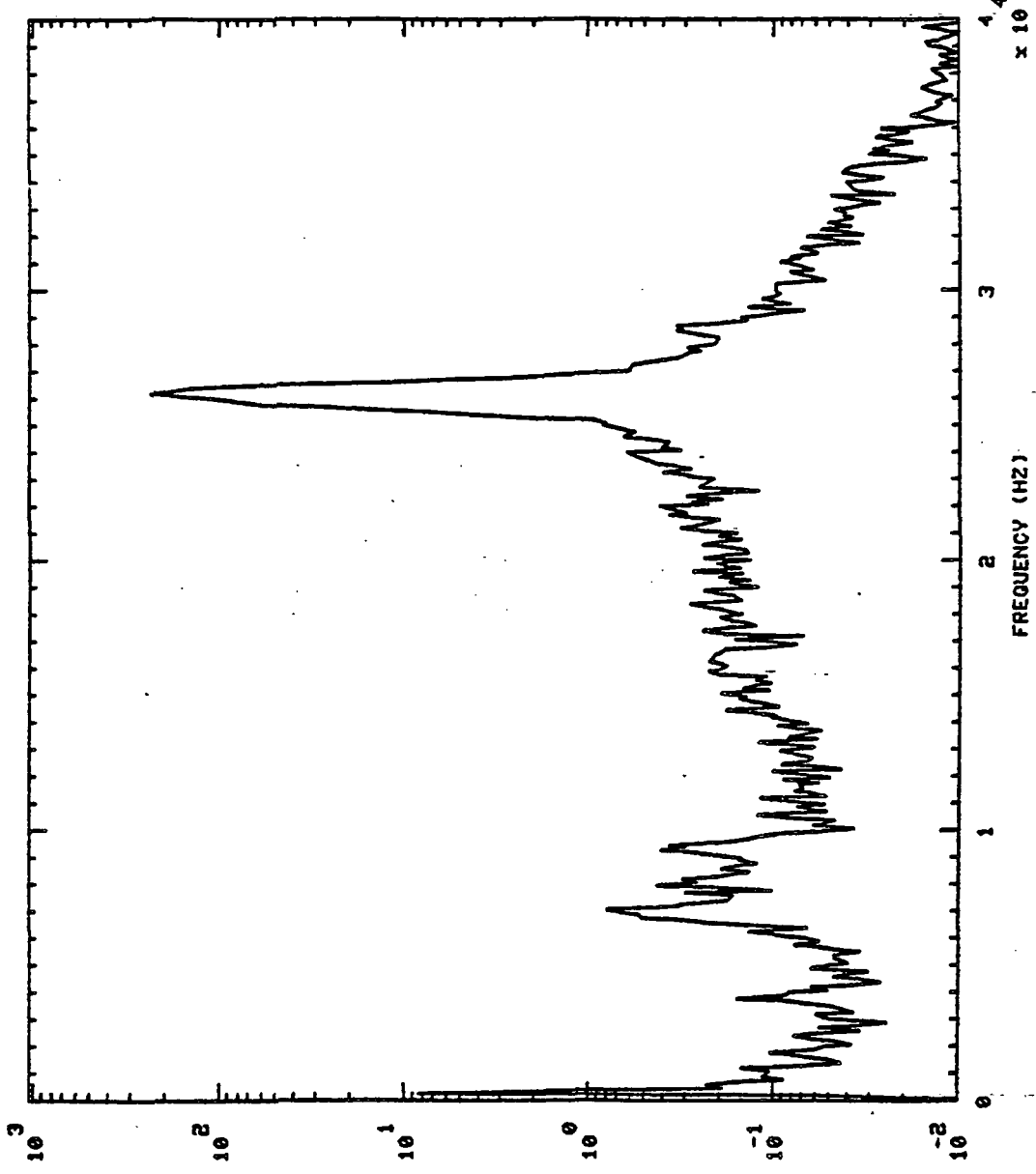


750117 MCC HOT GAS IN PR S+ 30.0110,'S



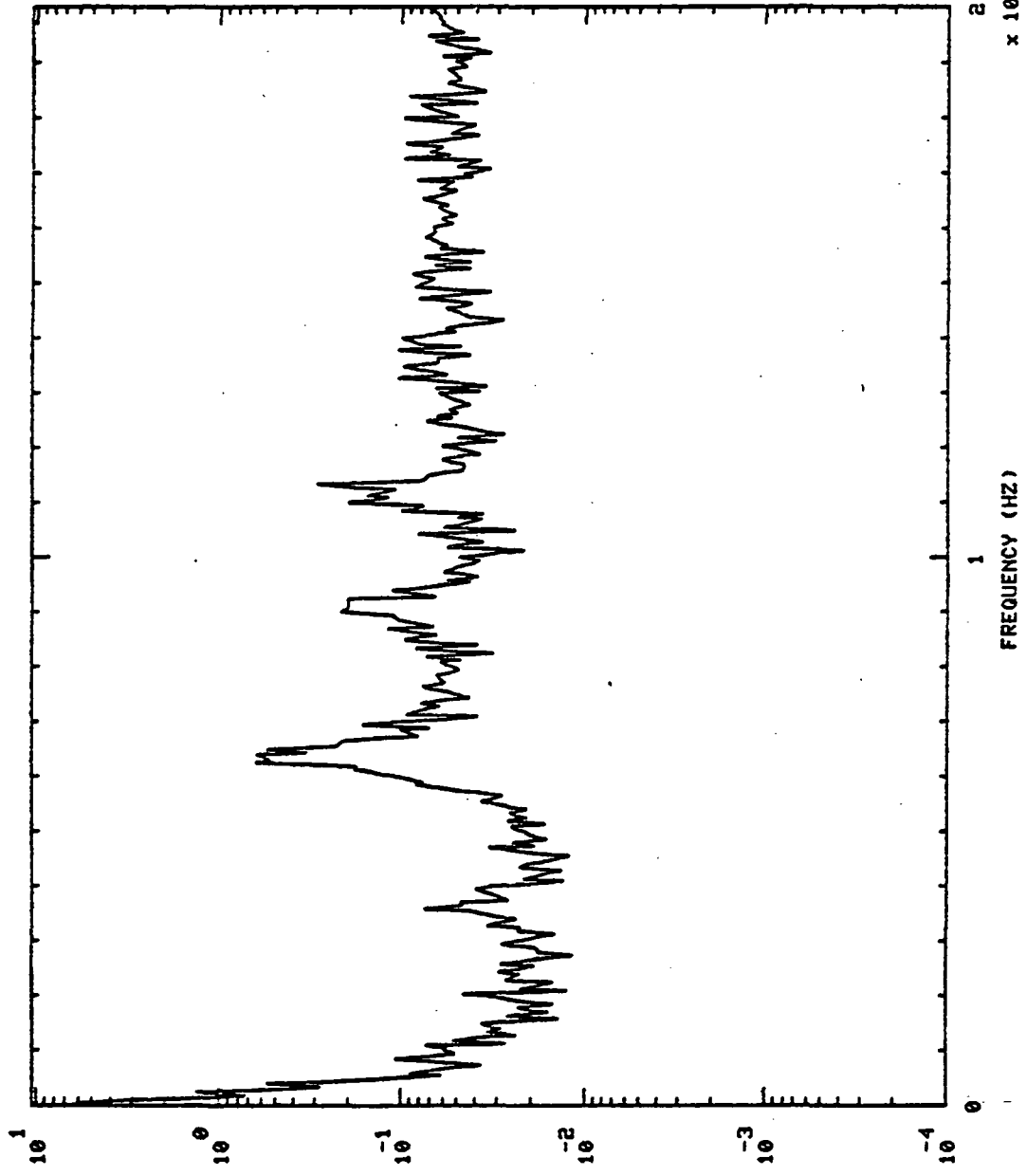
P S D / H Z

750117 MCC HOT GAS IN PR ST 30.01H0.'S



P S D / H Z

750117 MCC HOT GAS IN PR S+ 150.01H0,'S

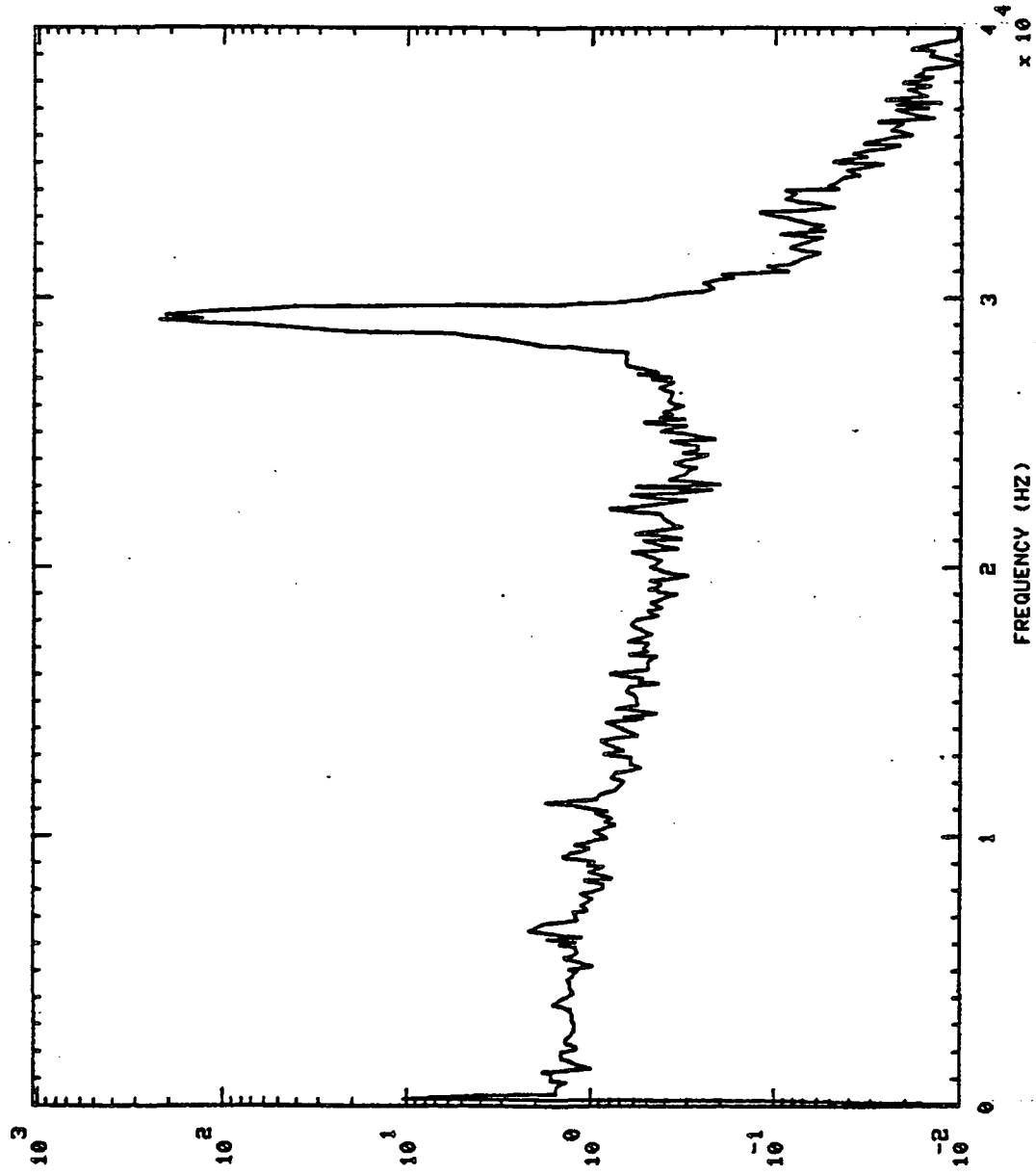


P S D / H Z

S+ 150.01H0, 'S

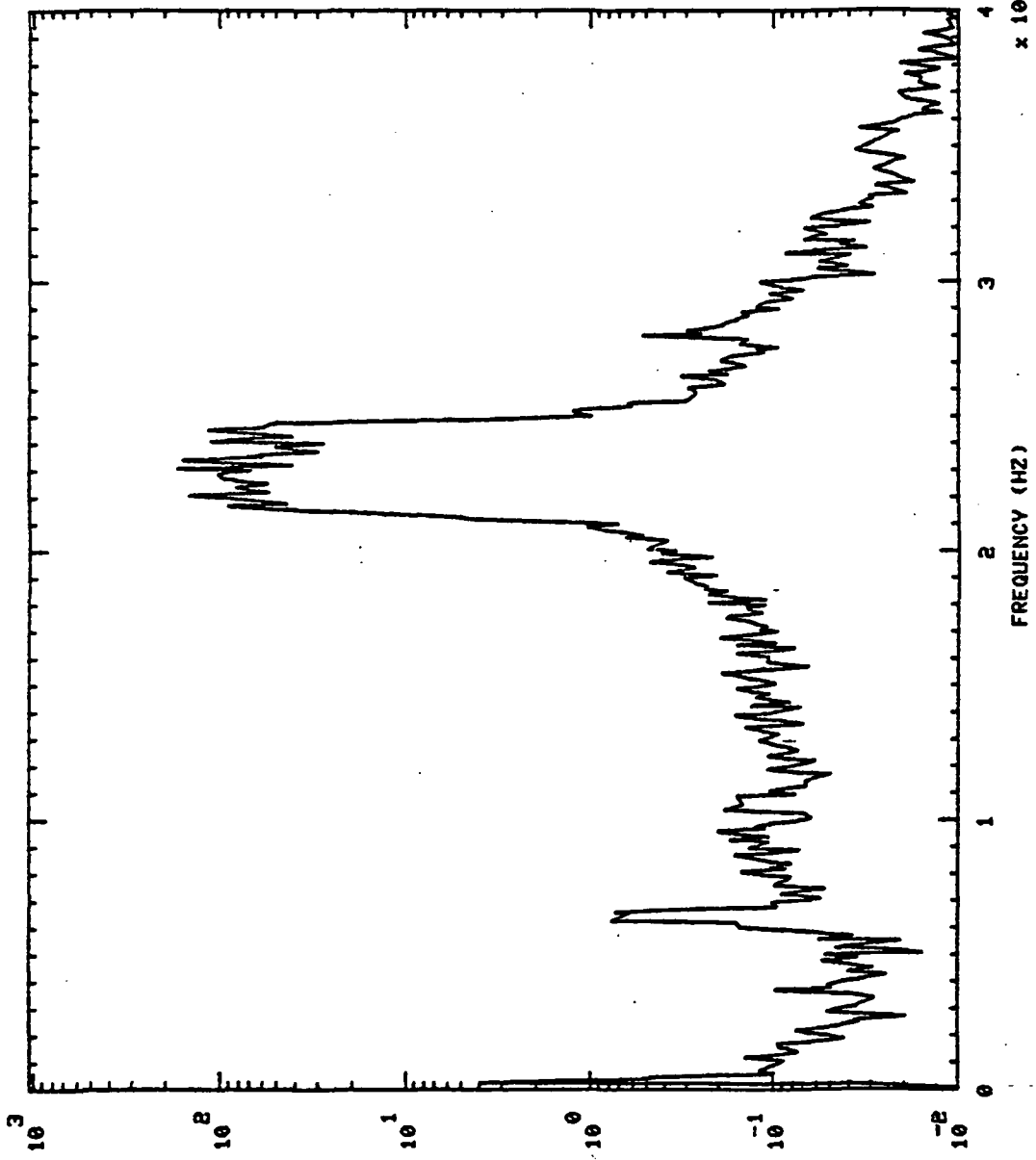
MCC HOT GAS IN PR

750117

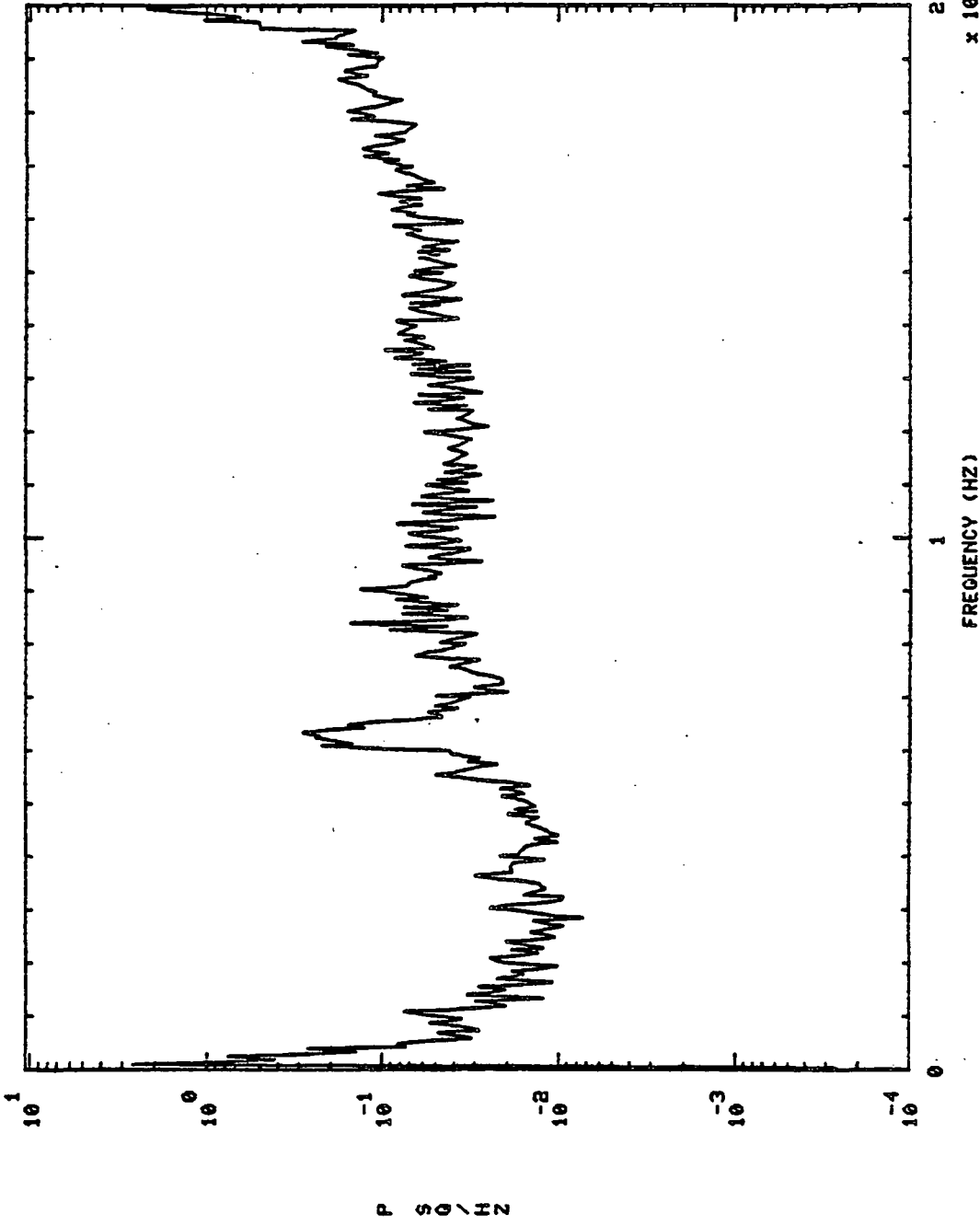


14 15 16

750117 MCC HOT GAS IN PR S+ 280.01H0,'S



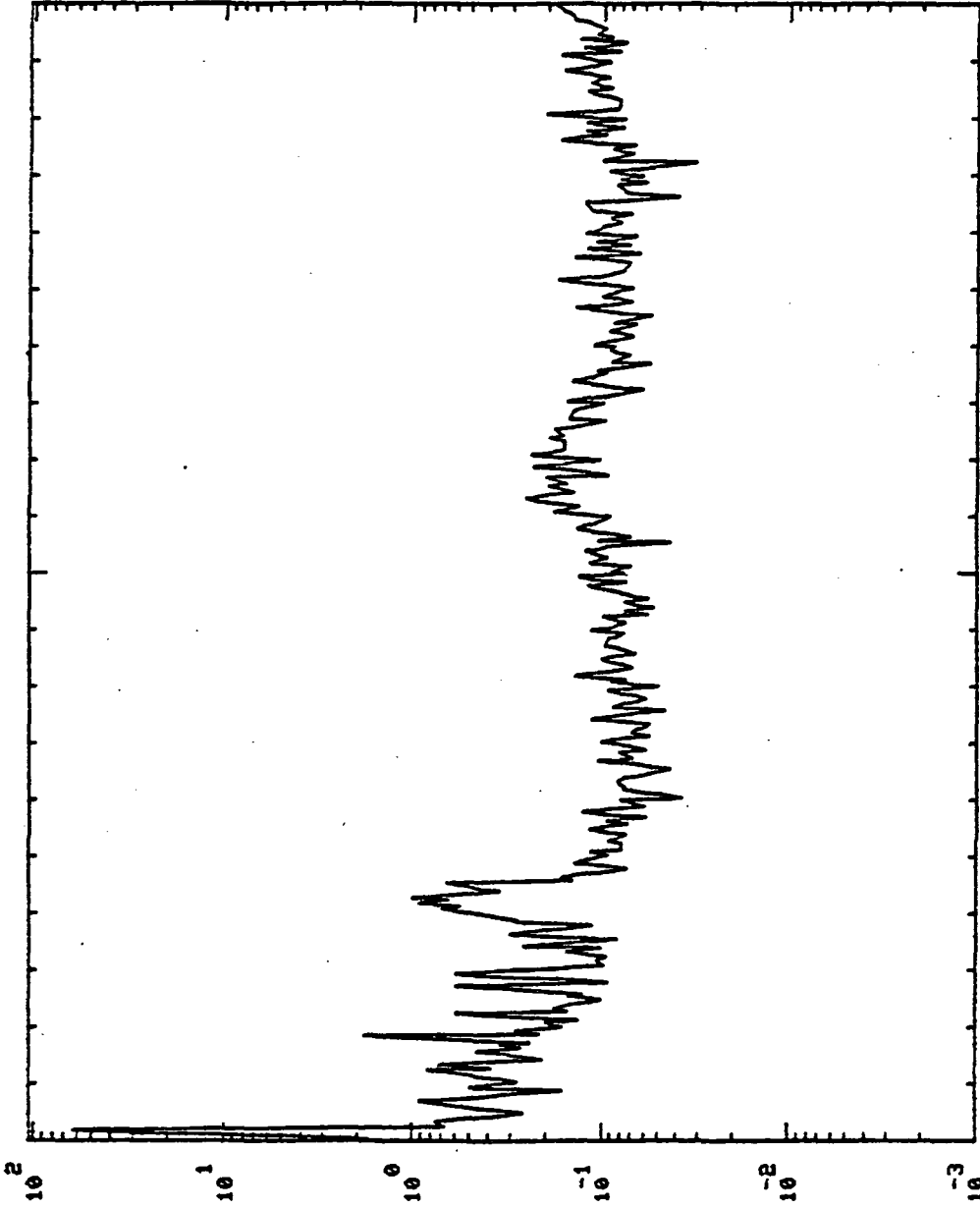
750117 MCC HOT GAS IN PR S+ 297.01H0,'S



750117 PBP DS PR S+ 30.01H0.'S

750117 PBP DS PR

750117

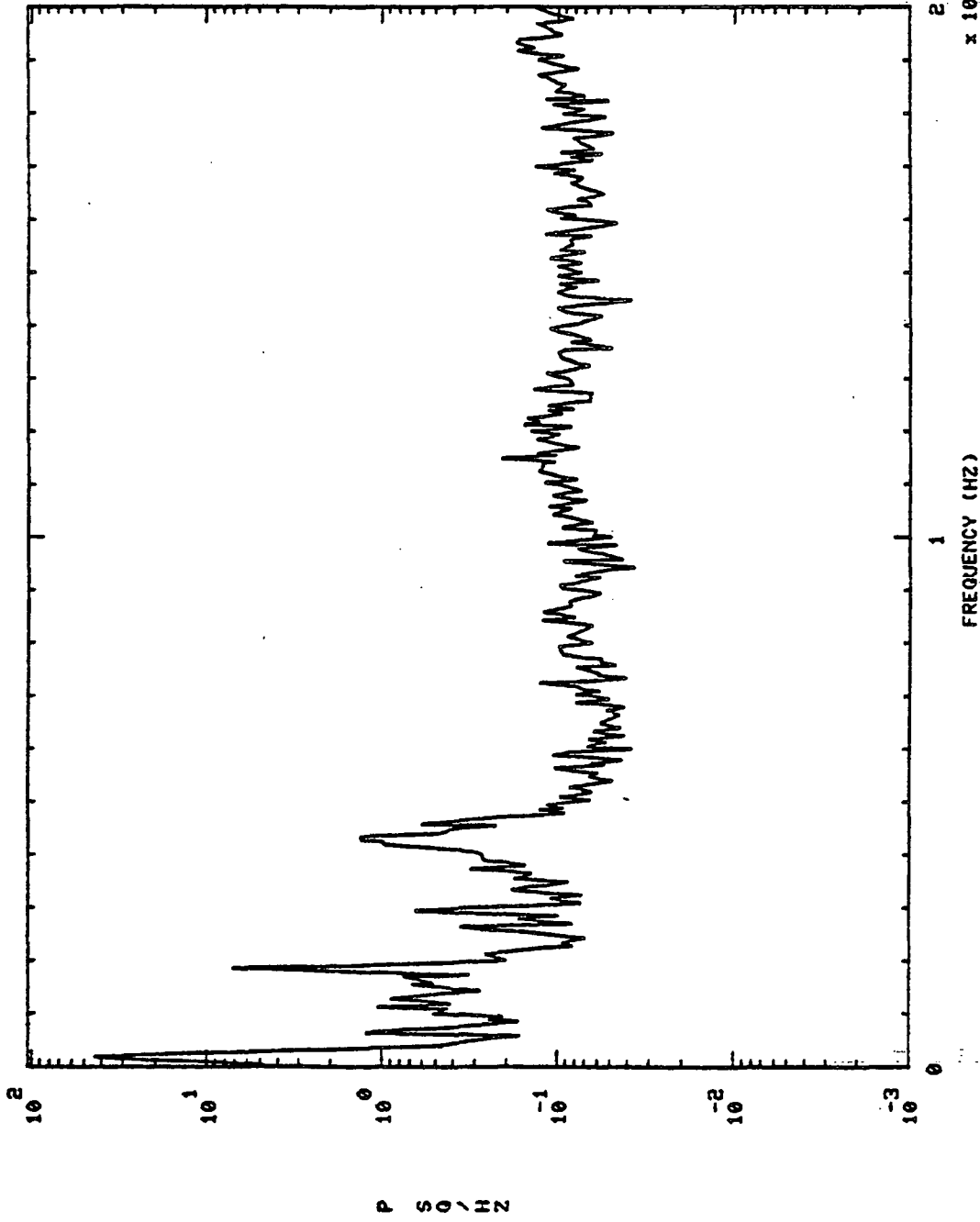


P S D (HZ)

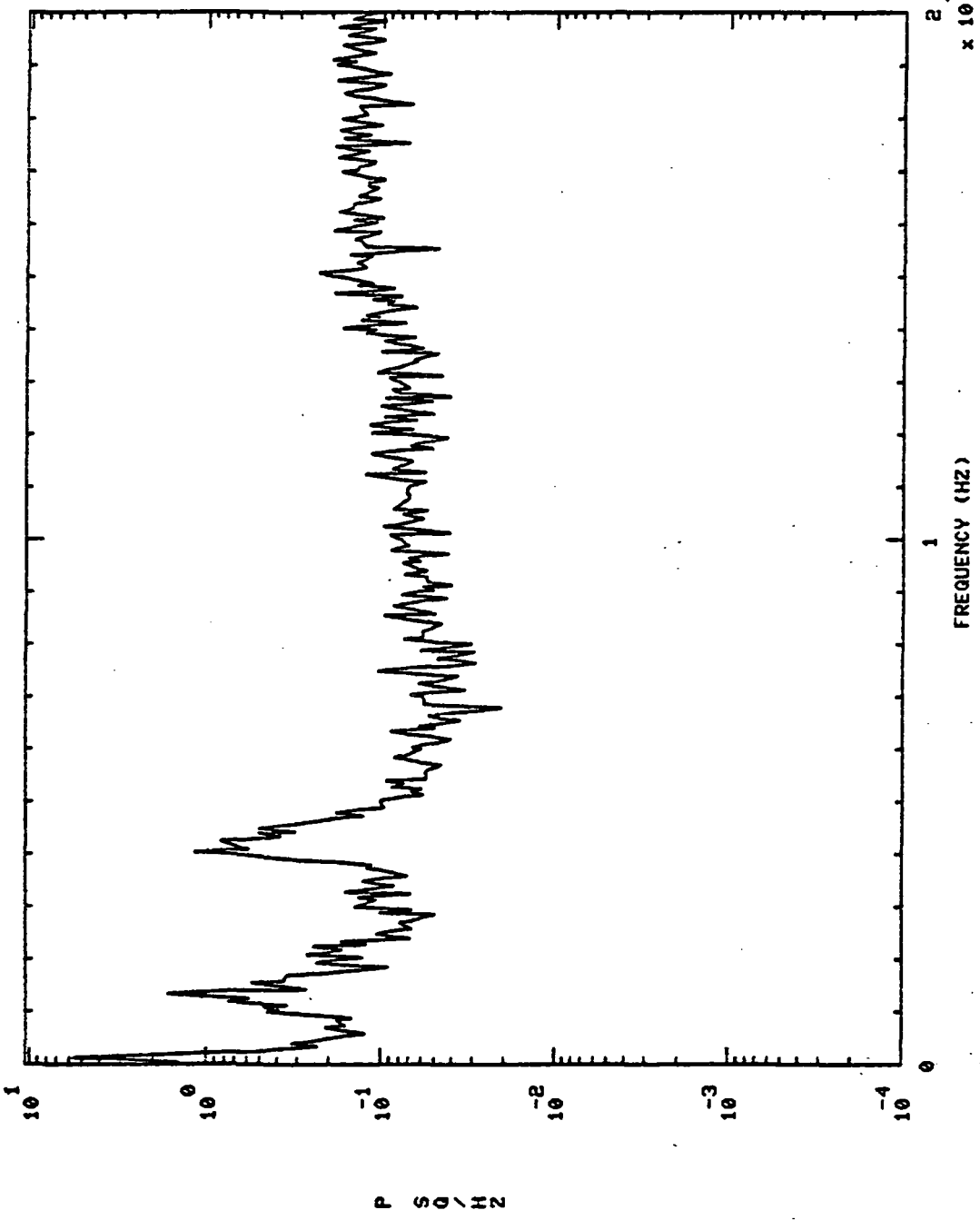
FREQUENCY (HZ)

2.4
x 10⁴

750117 PBP DS PR S+ 150.01H0,'S



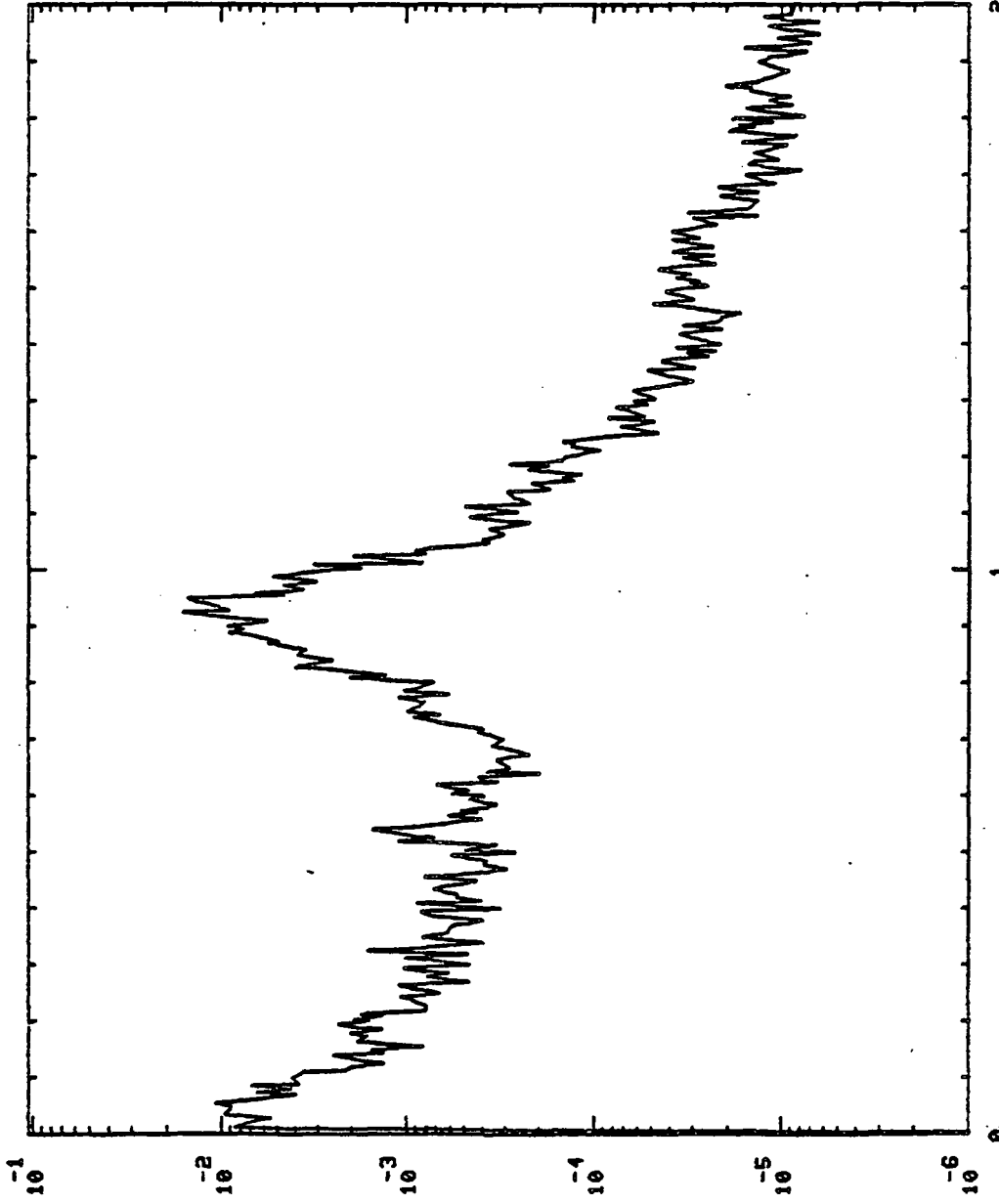
750117 PBP DS PR S+ 297.0140,'S



St 30.01H0,'S

LFPF DS PR

750117



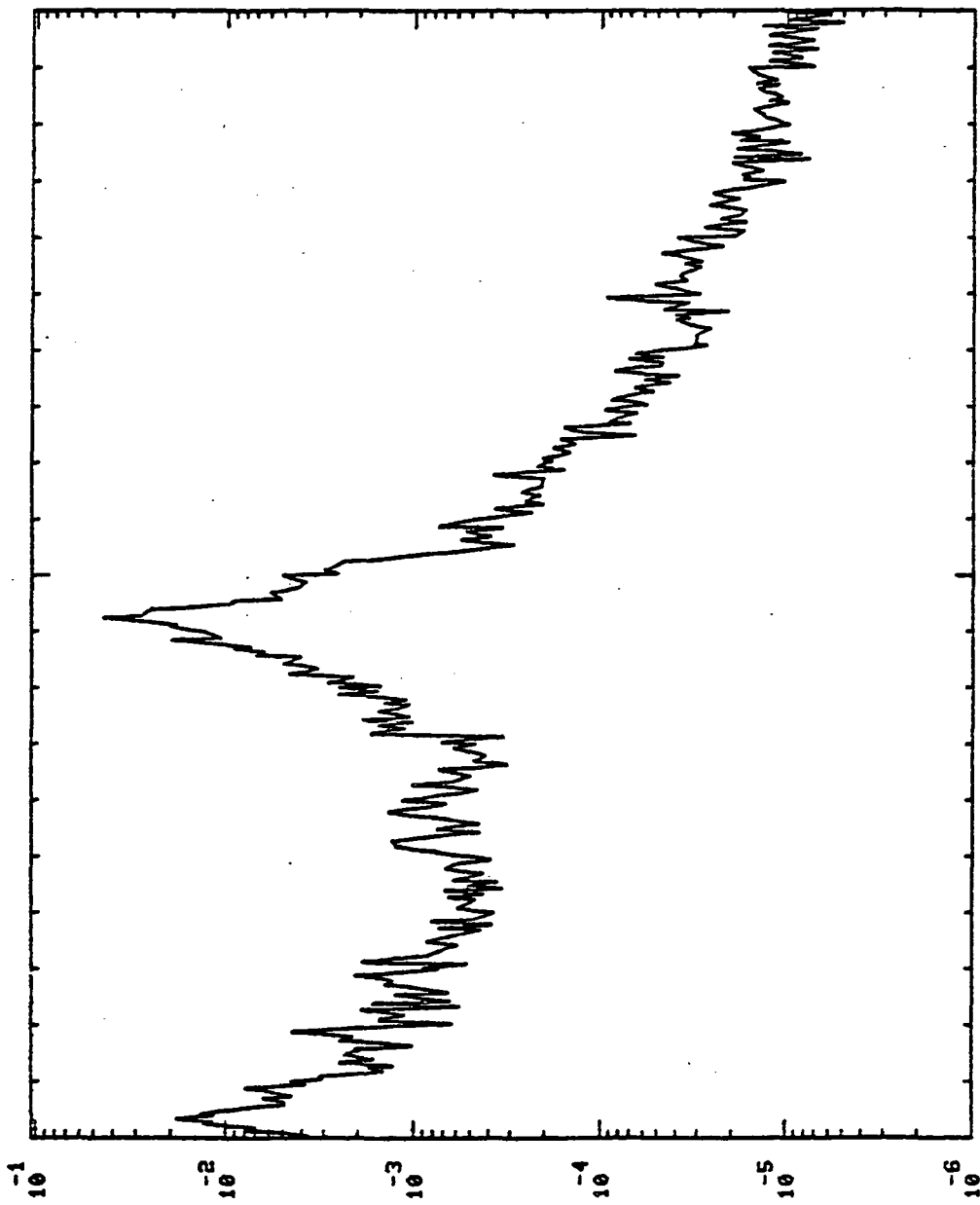
2.4×10^4

FREQUENCY (HZ)

0

P S O \ H Z

750117 LPFP DS PR S+ 150.01H0,'S

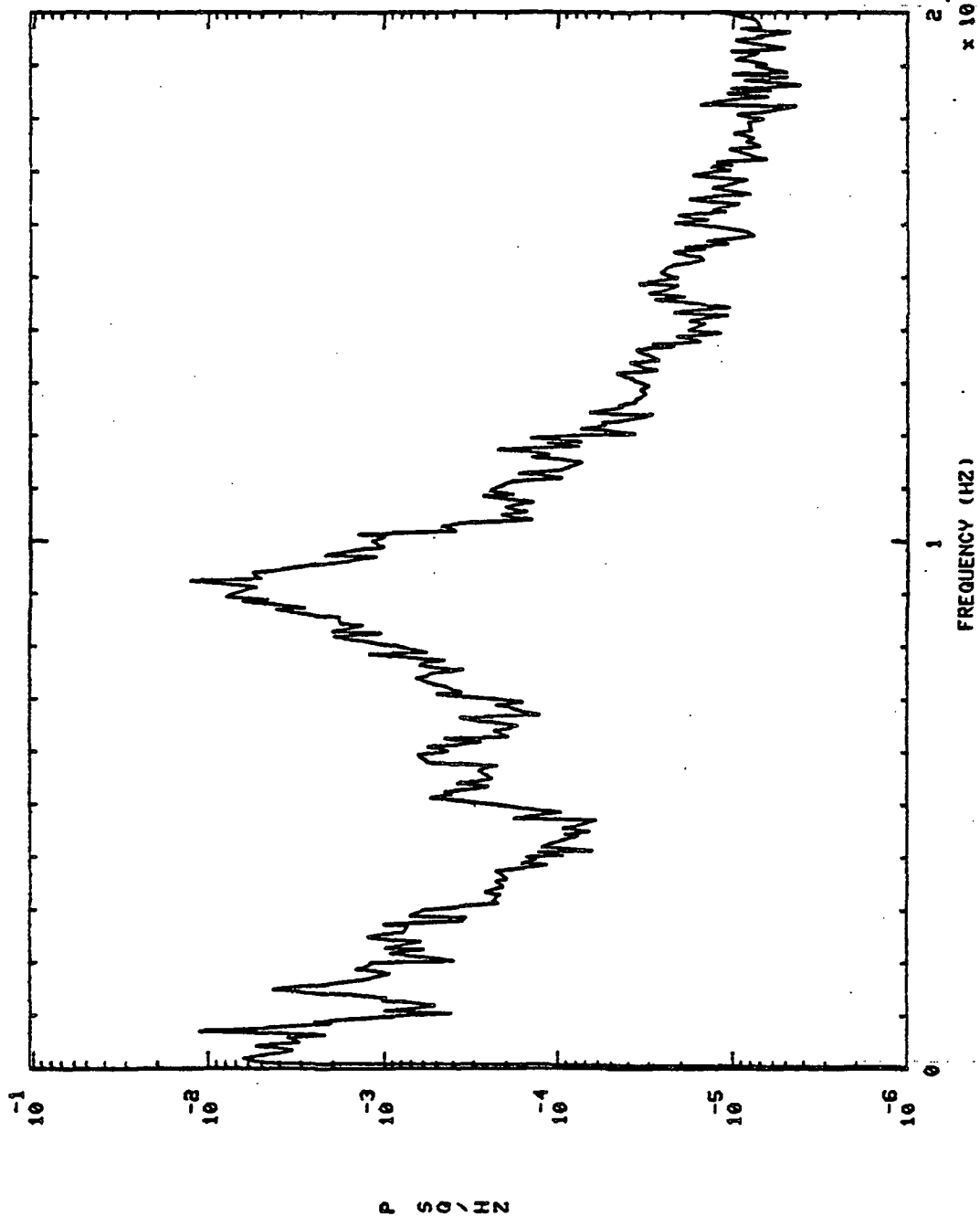


P S G / H Z

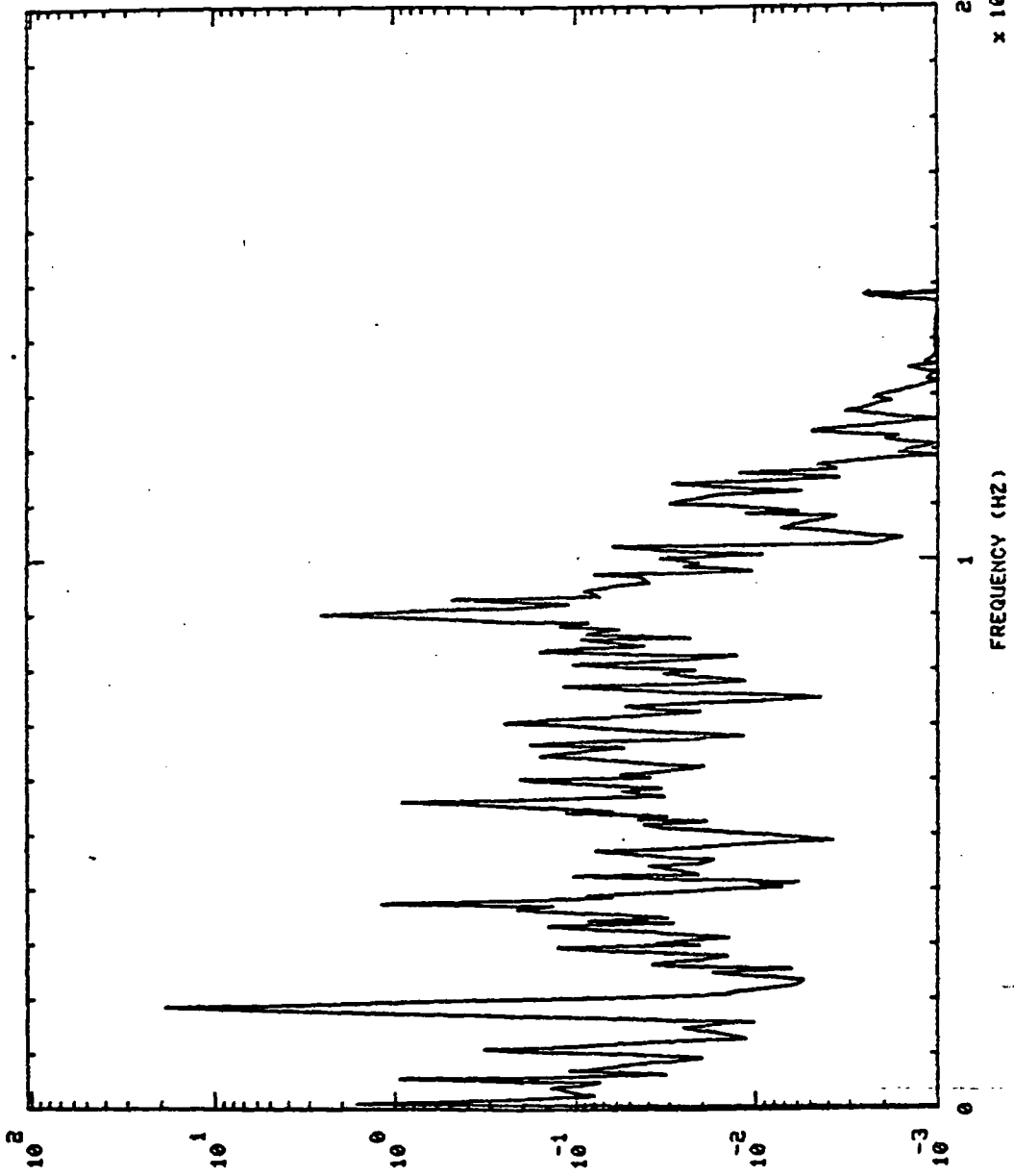
FREQUENCY (HZ)

2.4×10^4

750117 LPFP DS PR S+ 297.01H0,'S

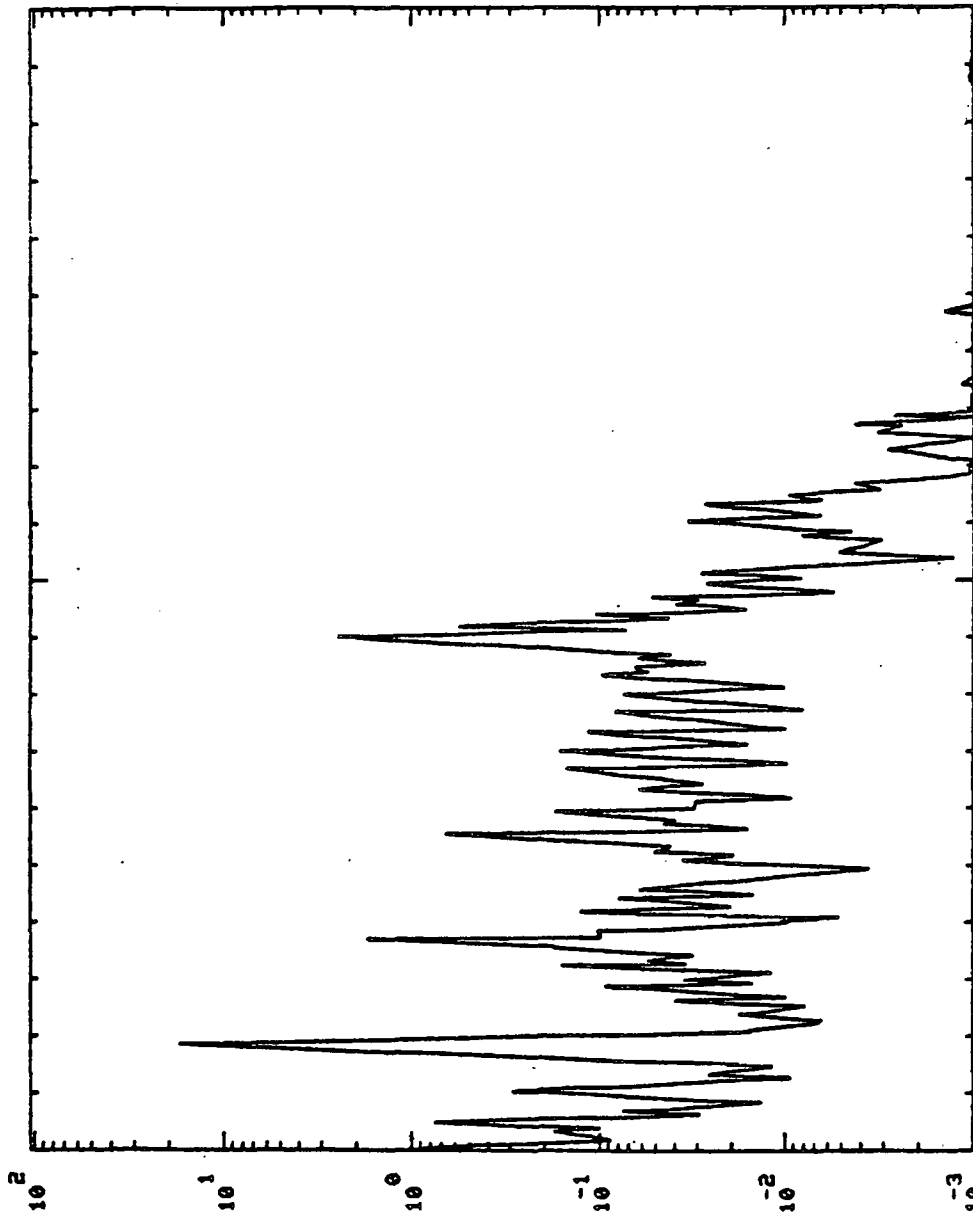


750117 LPOT TURB DR PR S+ 30.01H0.'S



P S D IN

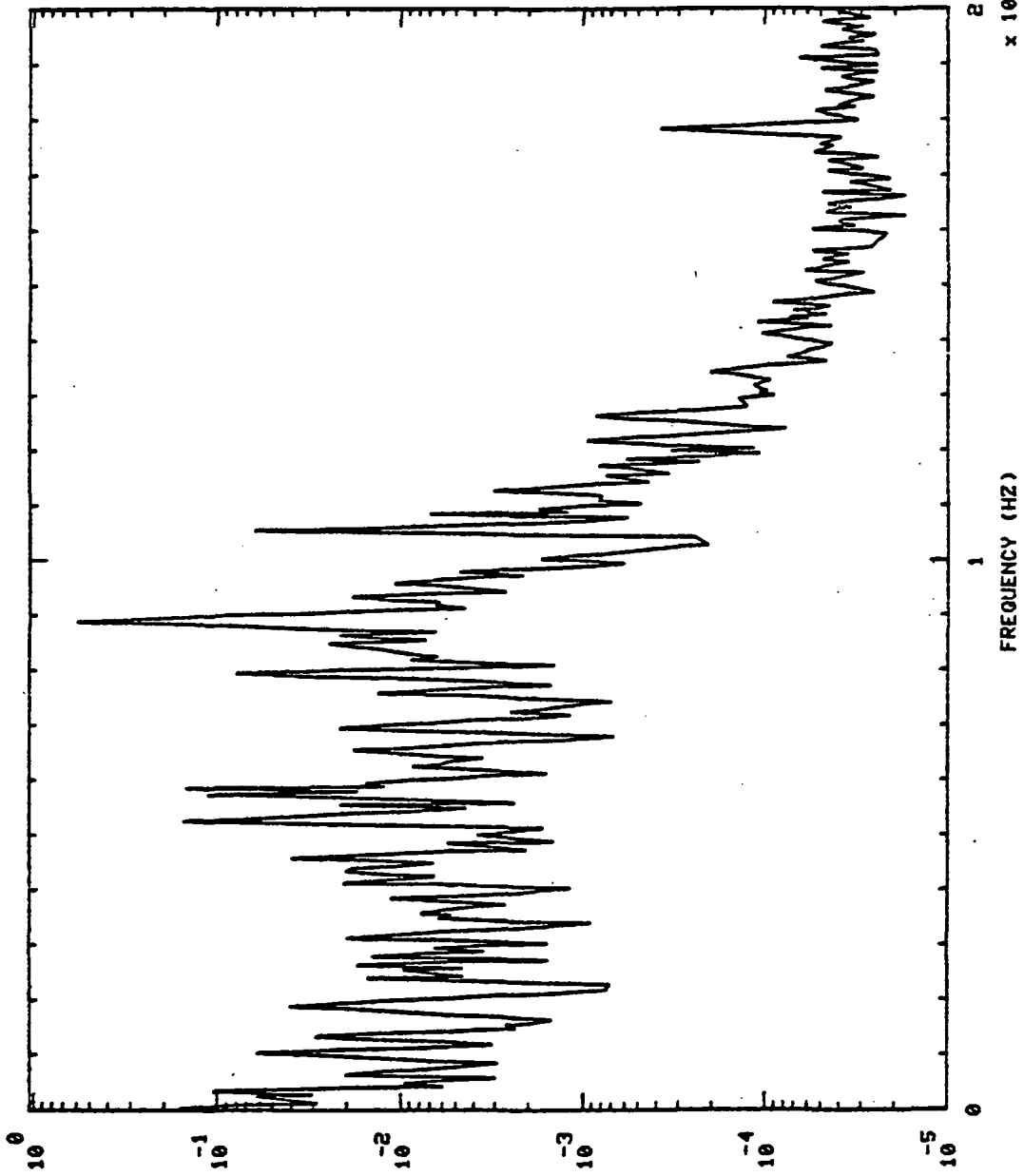
750117 LPOT TURB DR PR S+ 150.01H0,'S



PSD / HZ

FREQUENCY (HZ) x 10⁴

750117 LPOT TURB DR PR S+ 297.01H0,'S



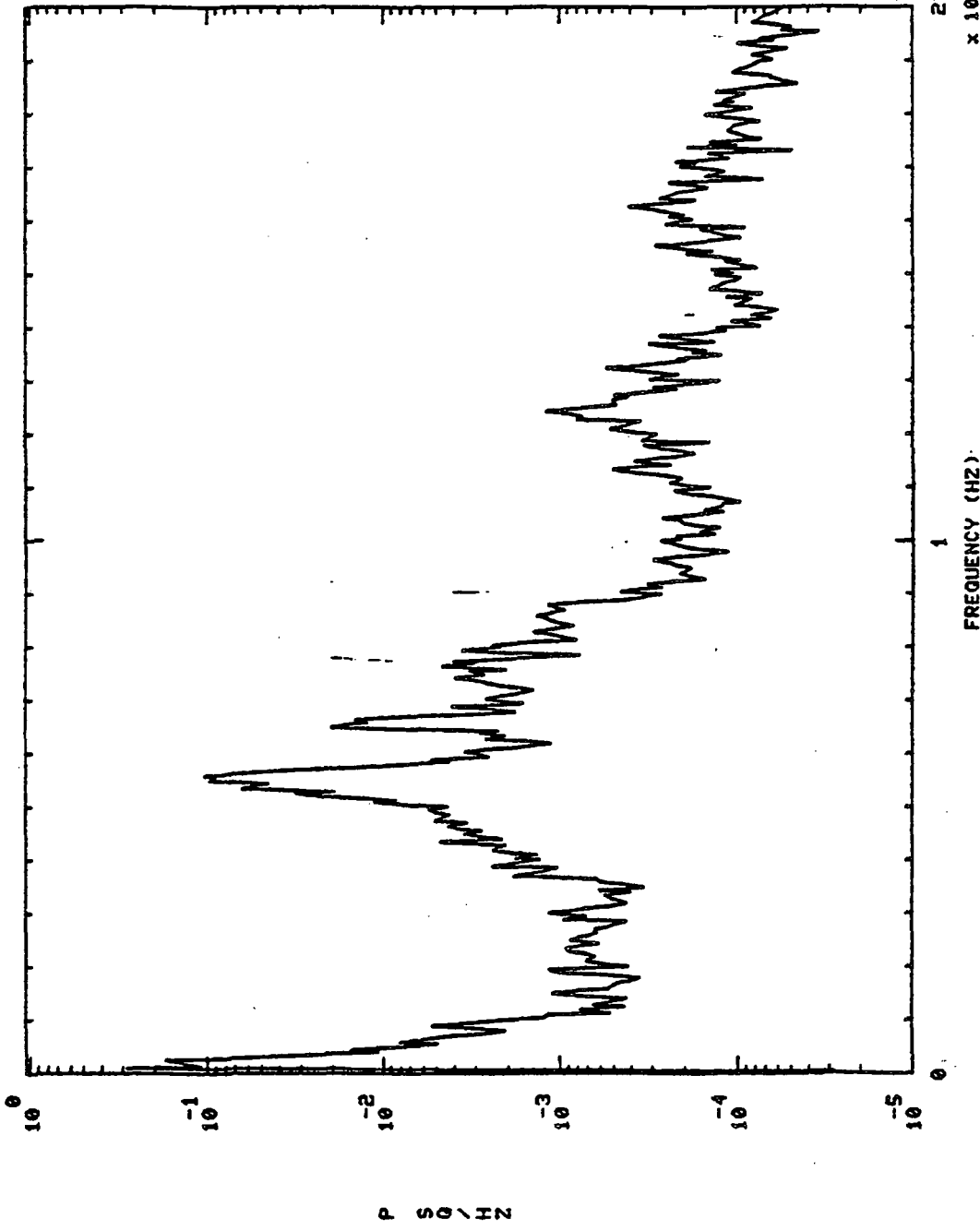
P S G / H Z

FREQUENCY (HZ)

2.4×10^4

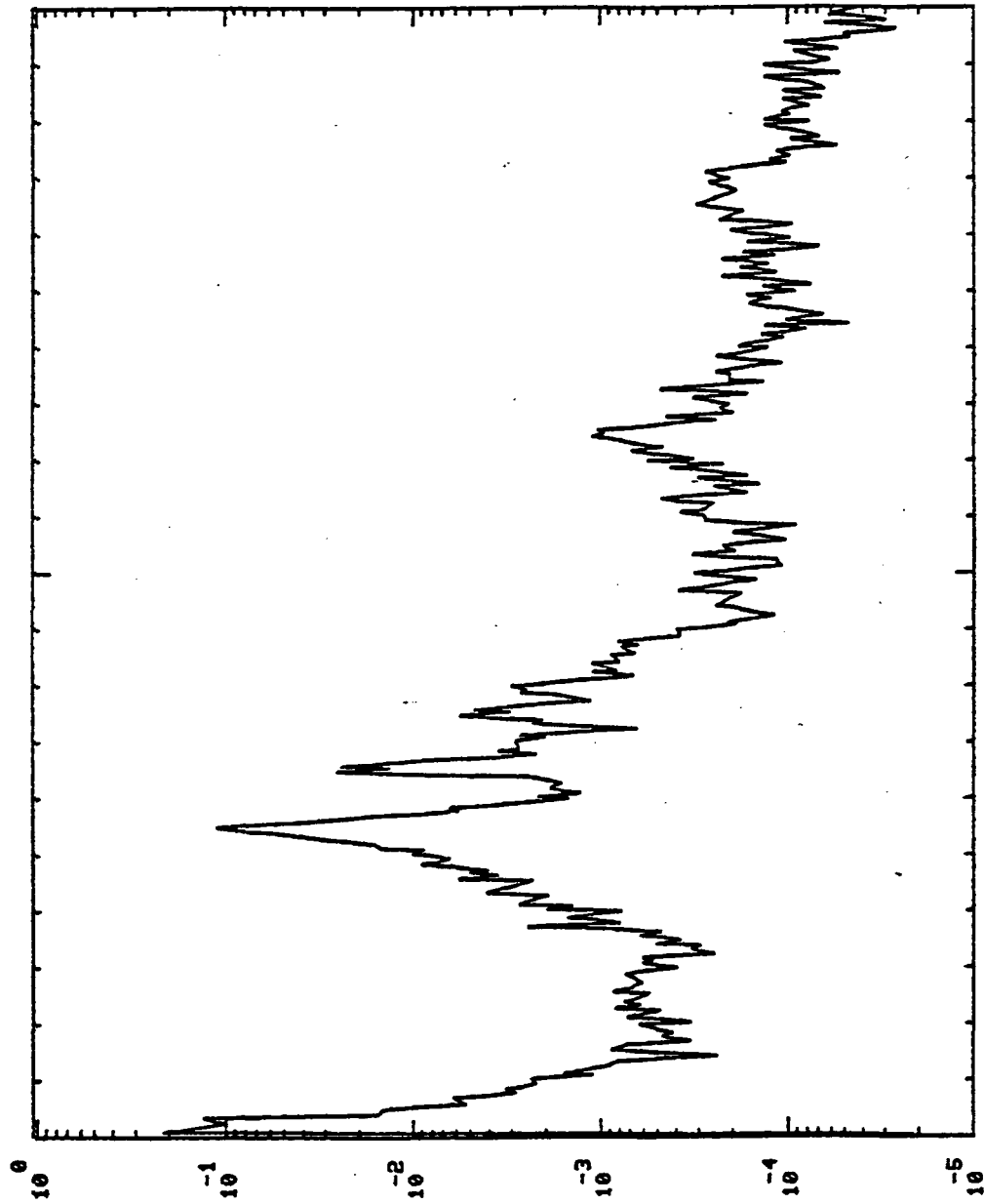
S+ 30.01H0,'S

750117 OPB PC PR



S+ 150.01H0.'S

750117 OPB PC PR

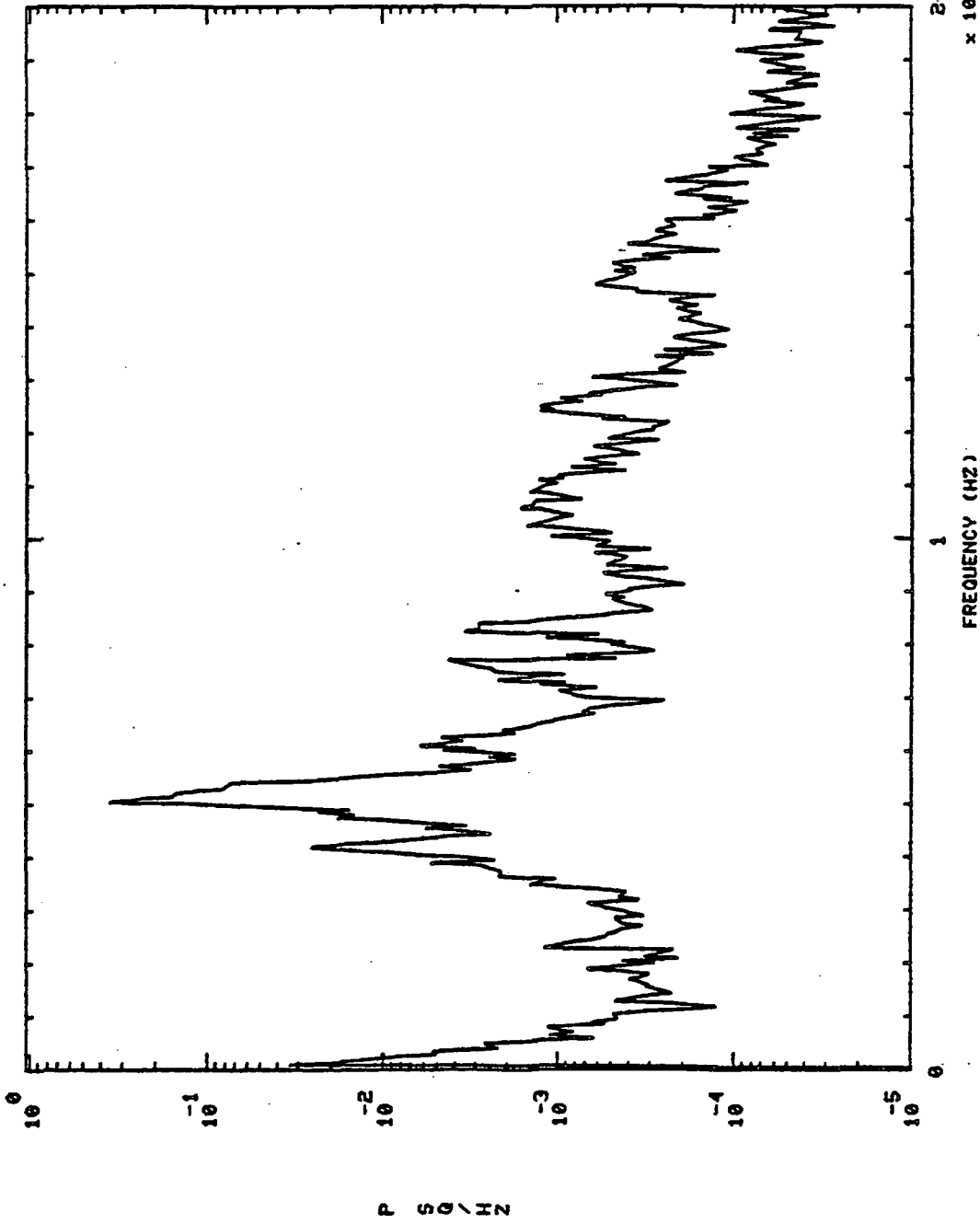


P S / HZ

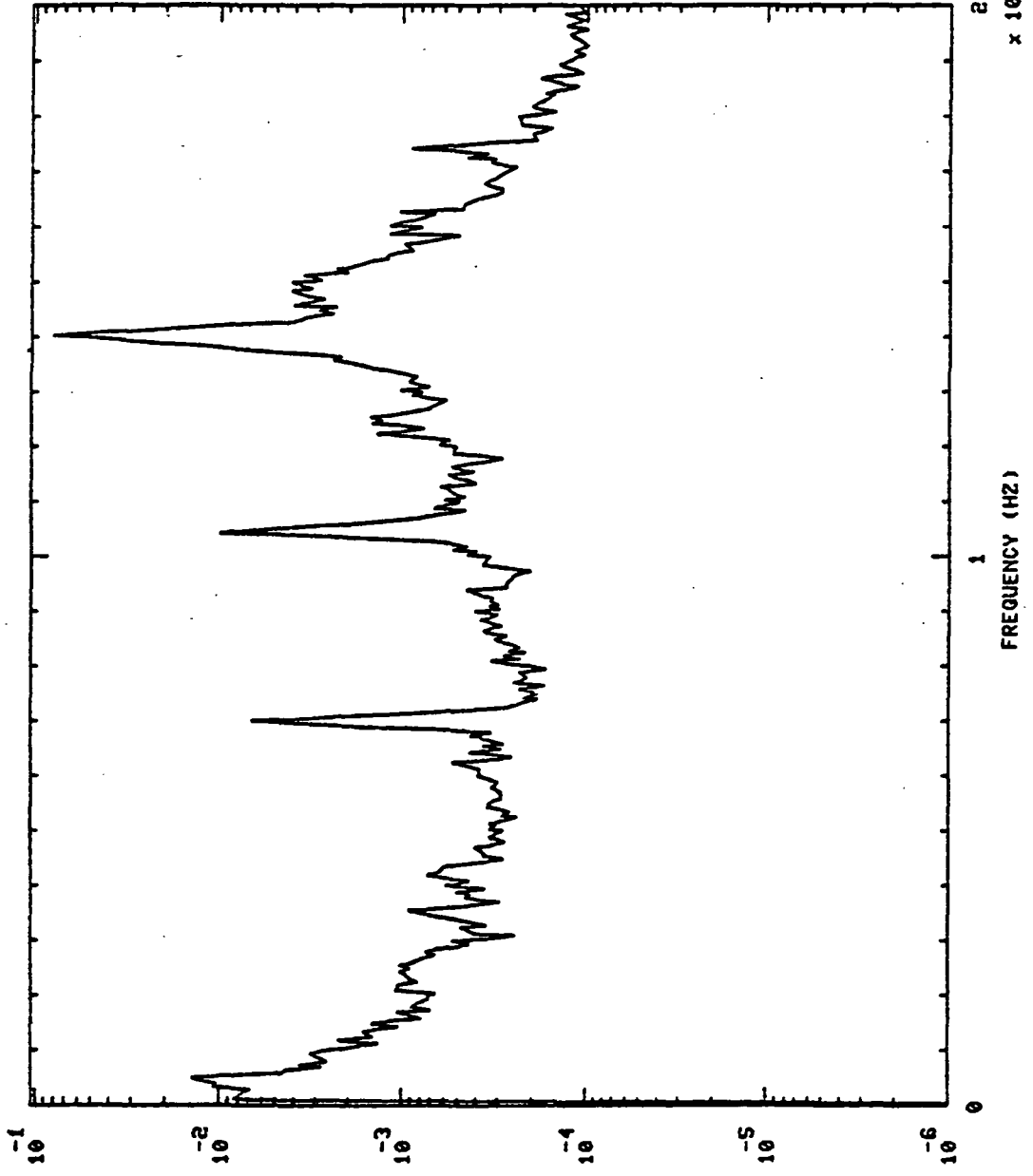
FREQUENCY (HZ) $\times 10^4$

S+ 297.01H0,'S

750117 OPB PC PR



750117 HPFP DS PR S+ 30.01H0,'S



P S D \ H Z

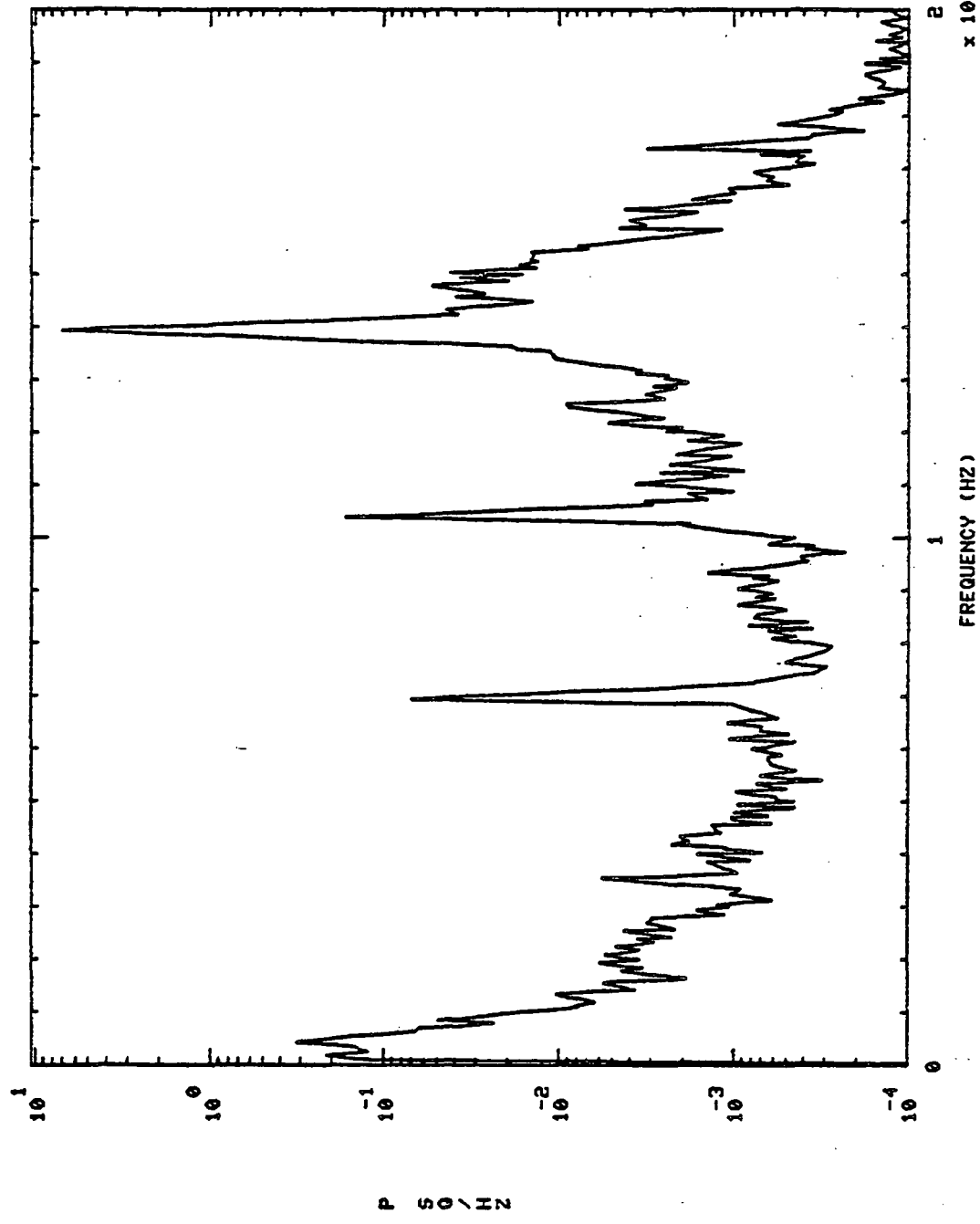
FREQUENCY (HZ)

10^4
 $\times 10$

S+ 150.01H0.'S

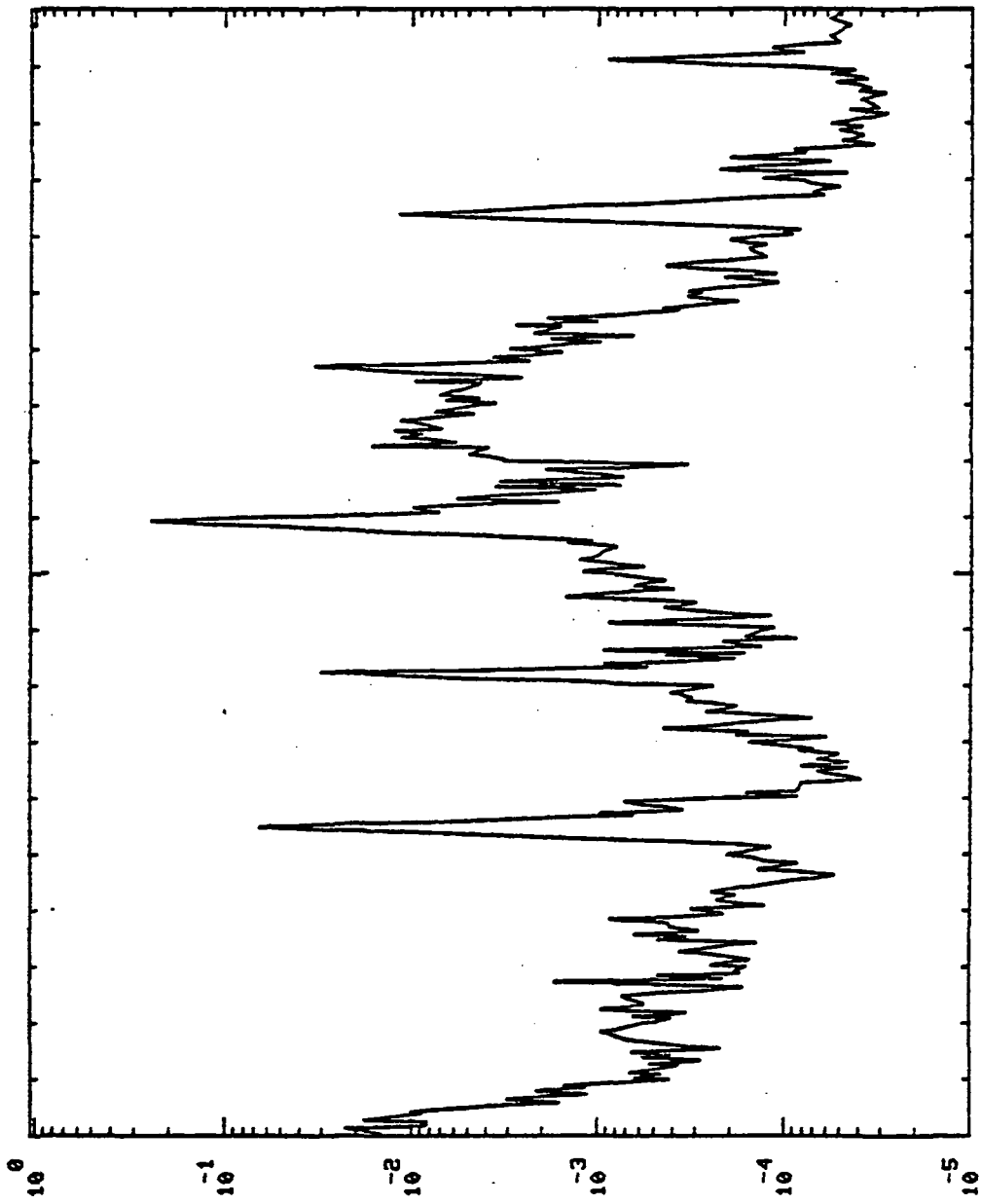
HPFP DS PR

750117



S+ 297.01H0,'S

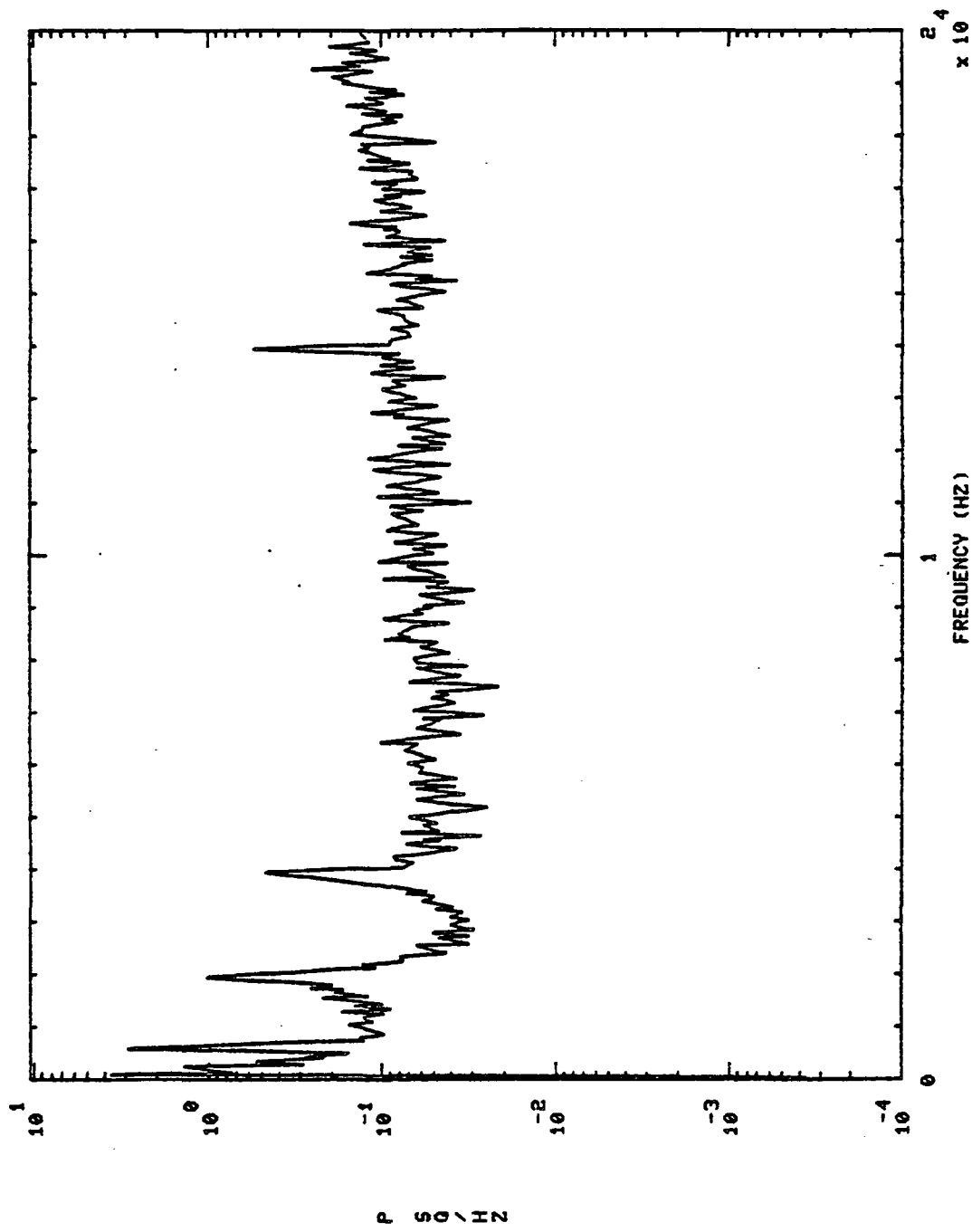
750117 HPFP DS PR



1
FREQUENCY (HZ)
 $\times 10^{2.4}$

P SQ/HZ

750117 HPFP BAL CAU PR S+ 150.01H0,'S

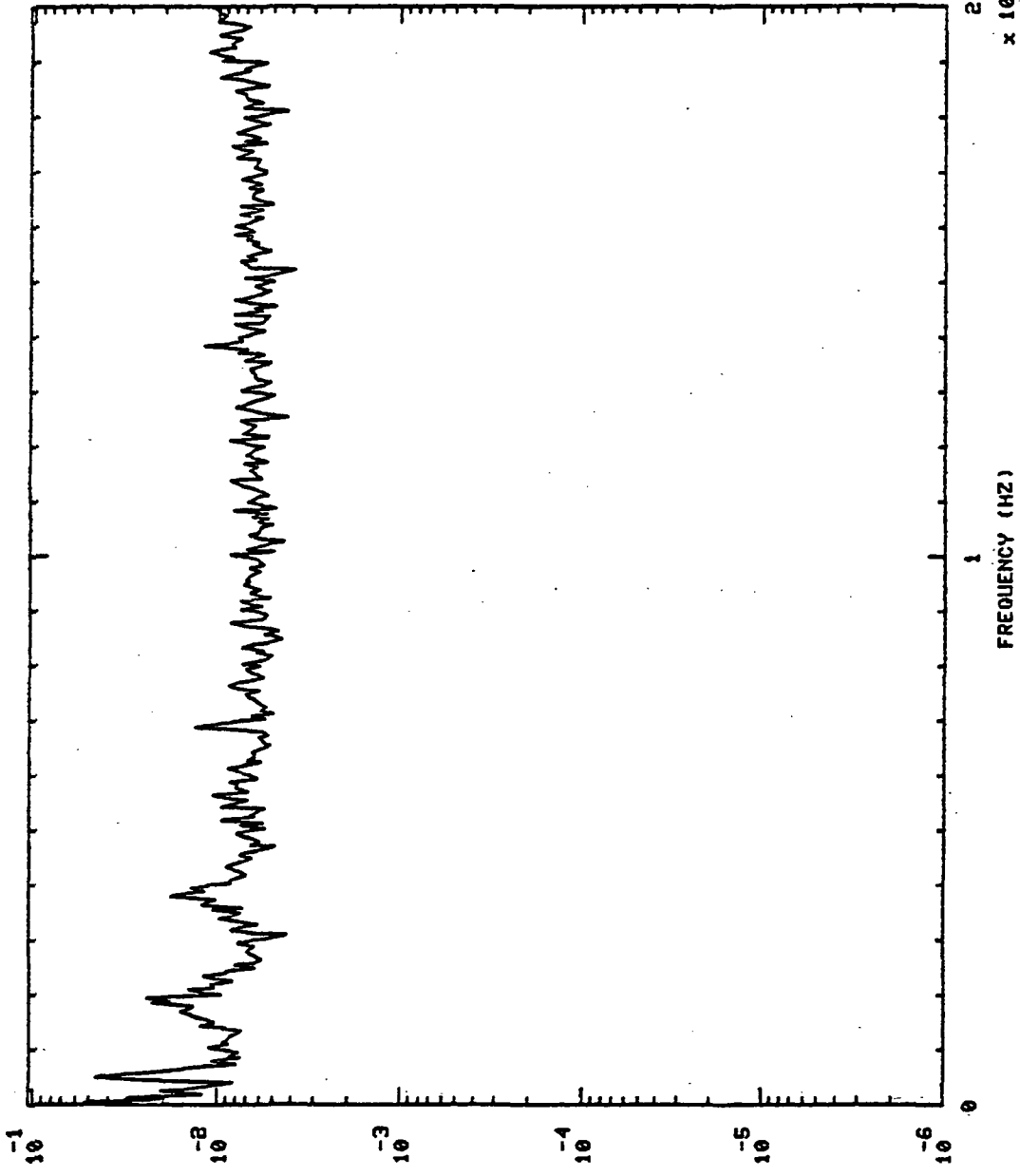


PSD / HZ

FREQUENCY (HZ)

2.4×10^4

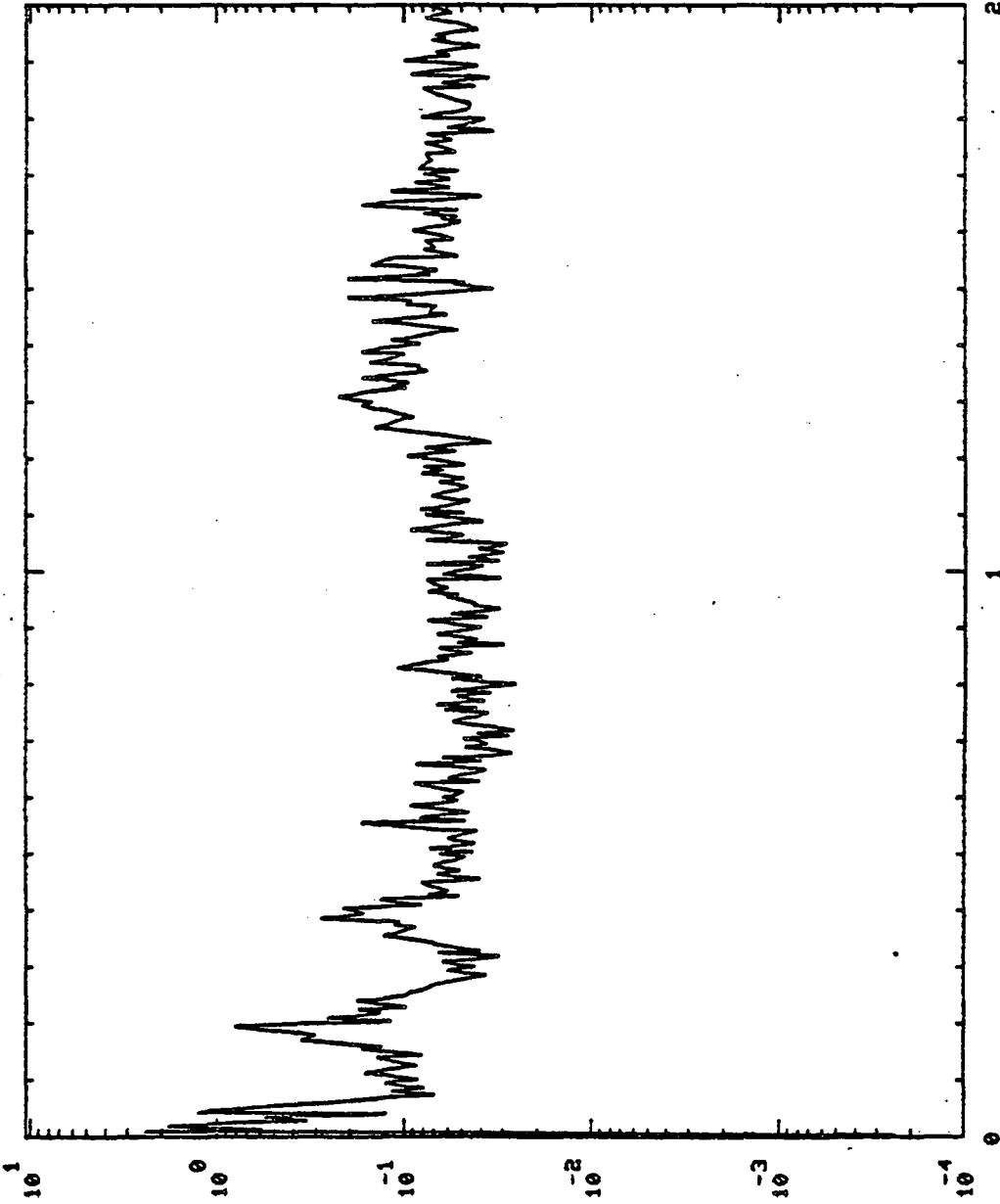
750117 HPFP BAL CAU PR S+ 30.01H0,'S



P S O \ H Z

FREQUENCY (HZ) x 10⁴

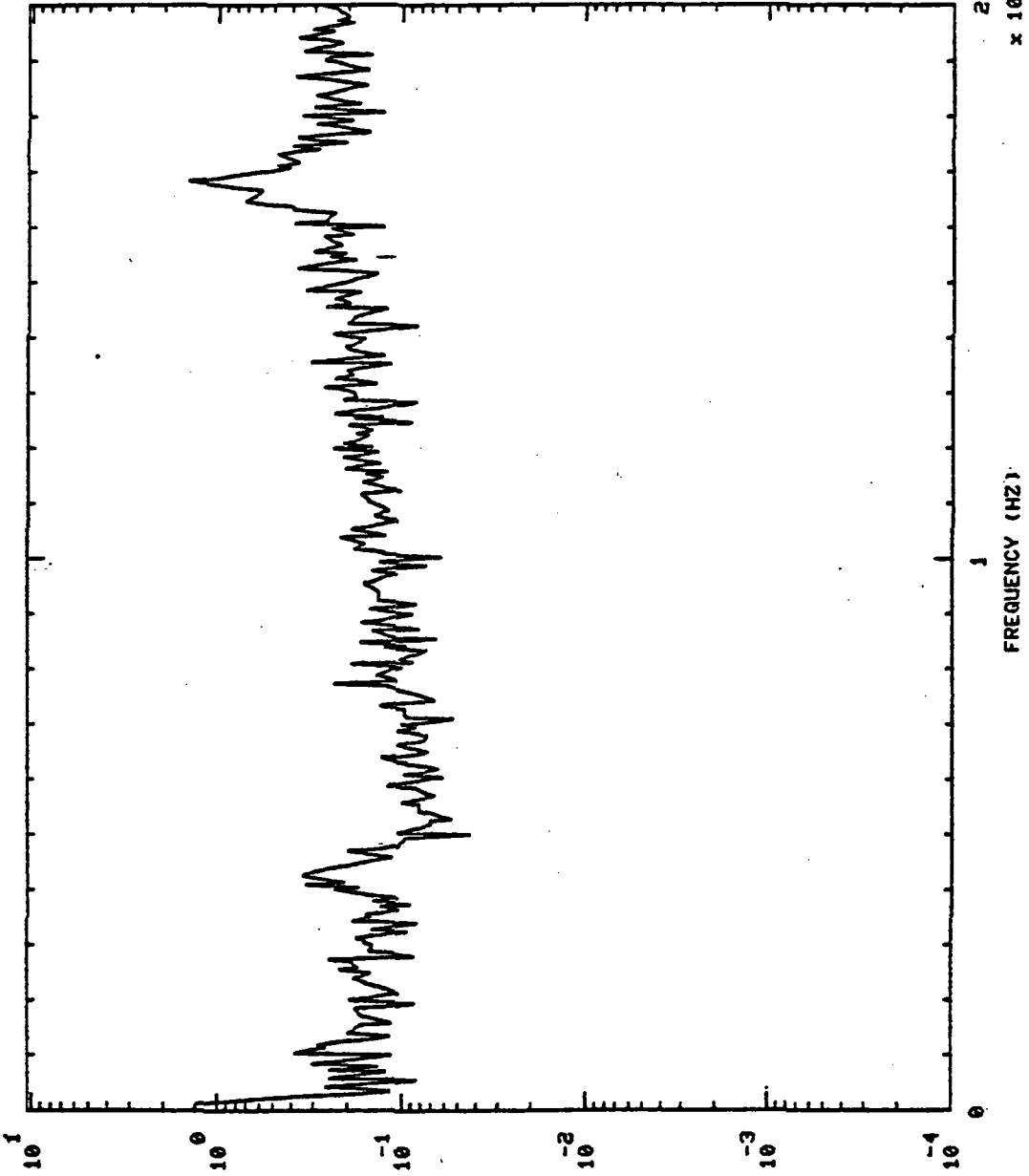
750117 HPFP BAL CAU PR S+ 297.01H0,'S



FREQUENCY (HZ)

2.4×10^4

759117 OPB PC PR DC S+ 30.01H0.'S



P S D \ H Z

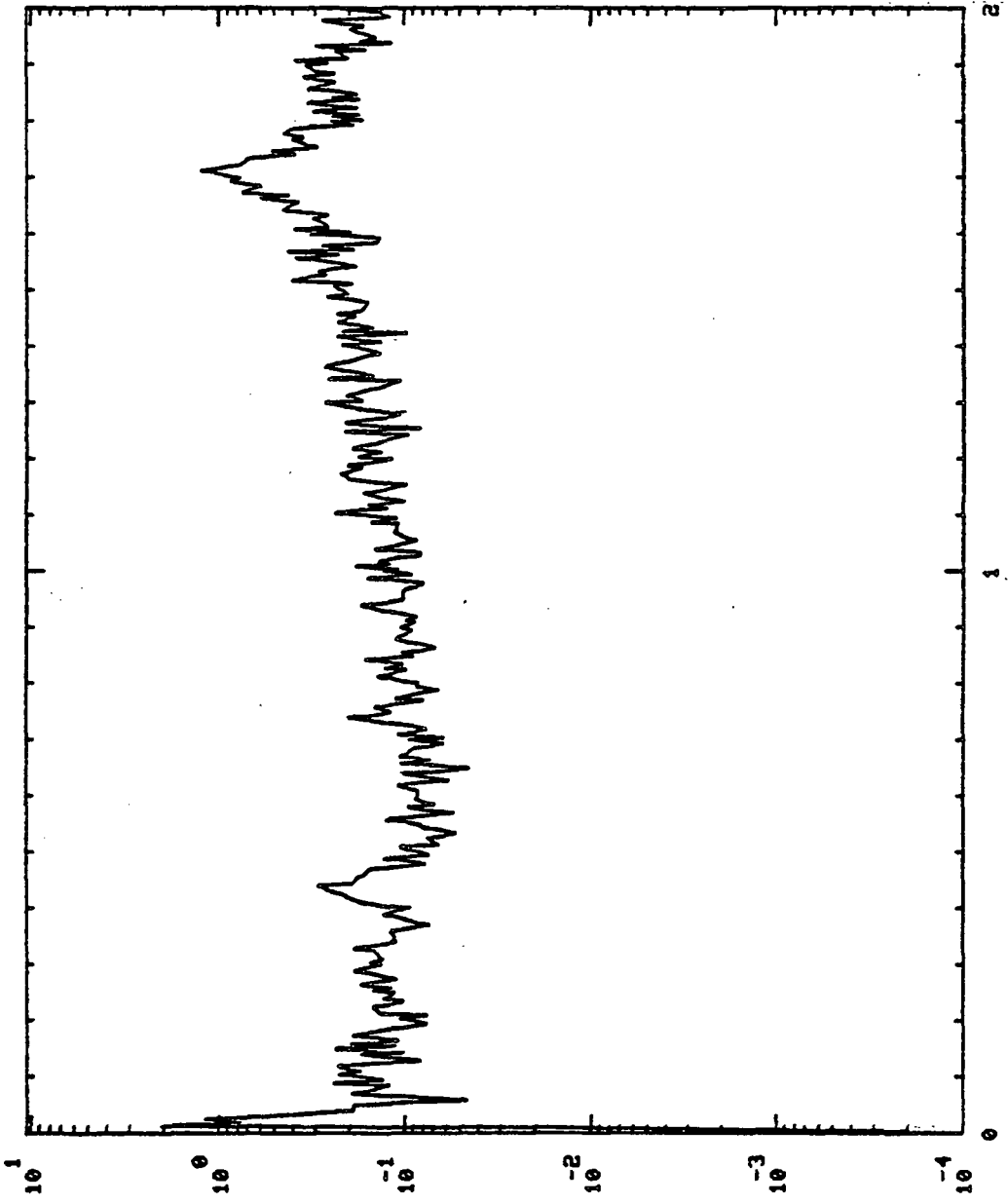
24
x 10^4

FREQUENCY (HZ)

S+ 150.01H0,'S

OPB PC PR DC

750117

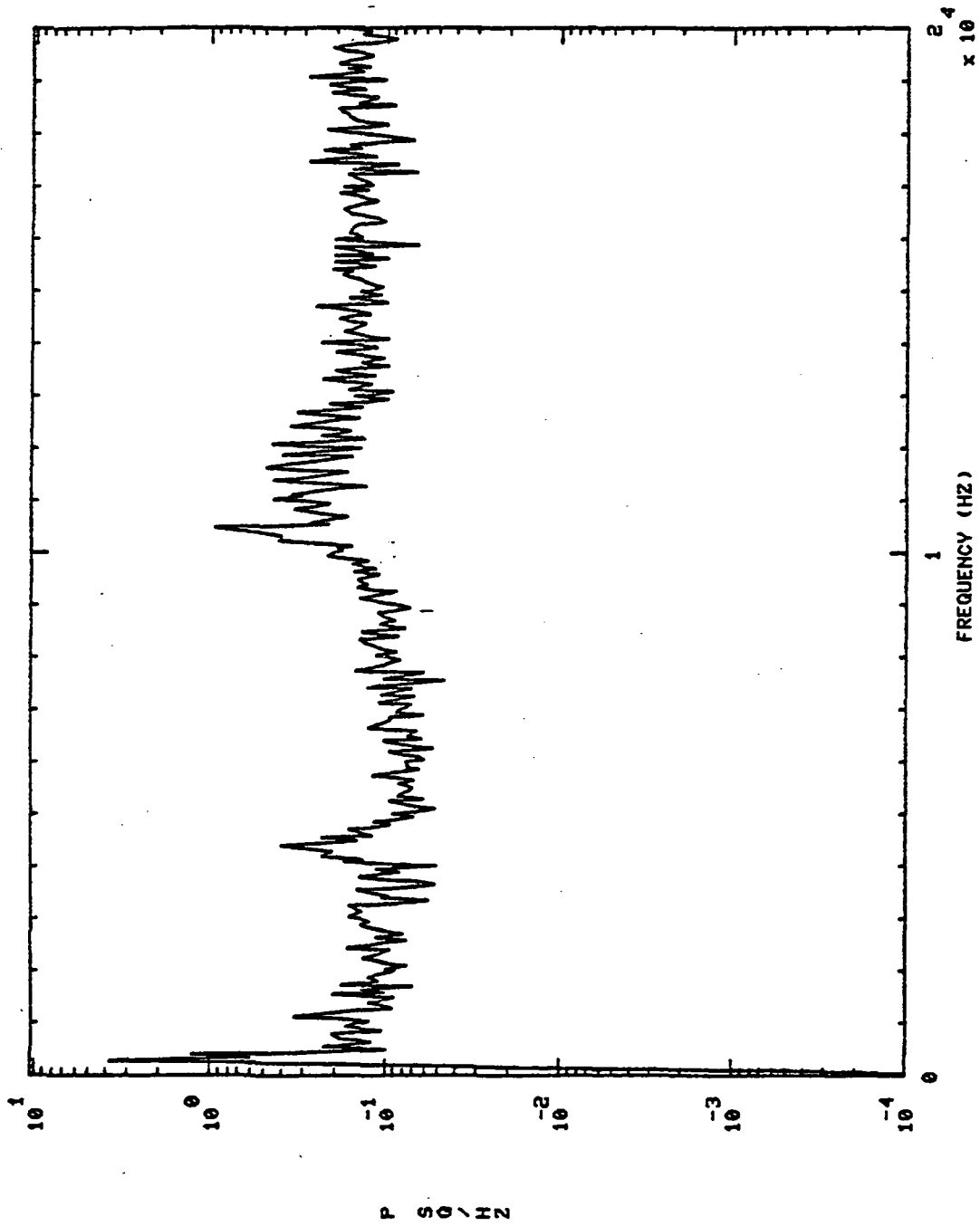


P S O \ HZ

FREQUENCY (HZ)

x 10⁴

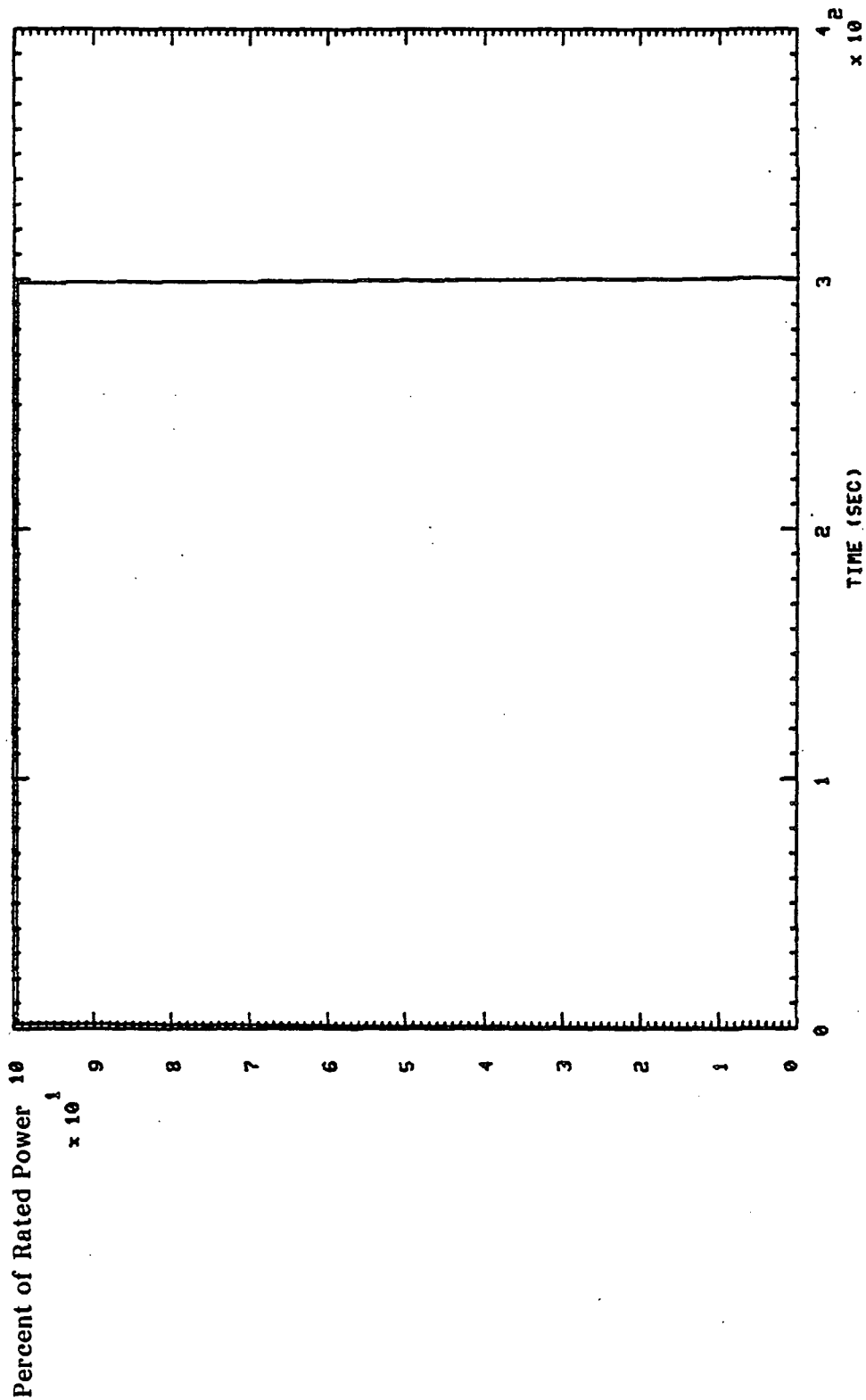
750117 OPB PC PR DC S+ 297.01H0,'S



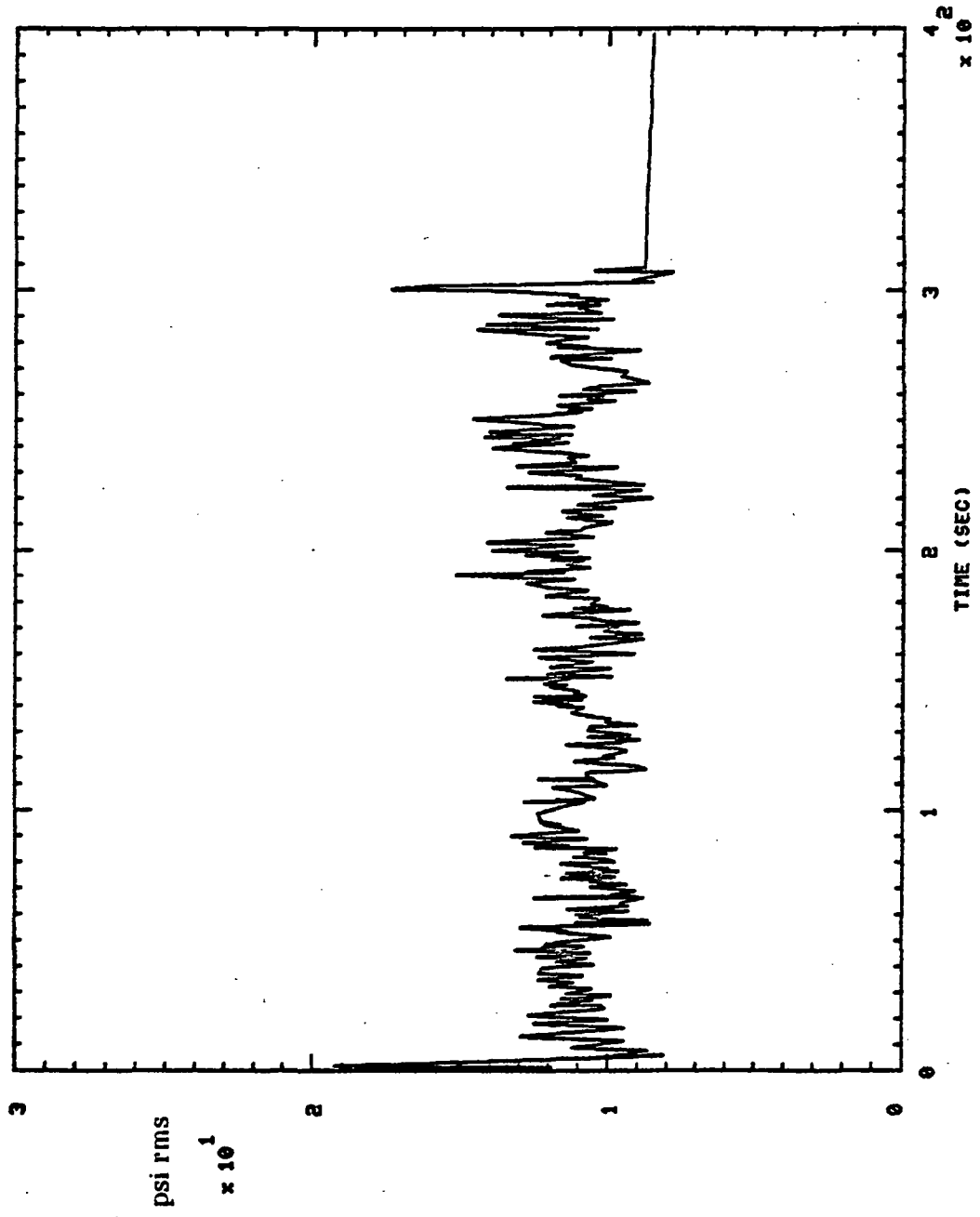
750118

THRUST

(UNFILTERED)

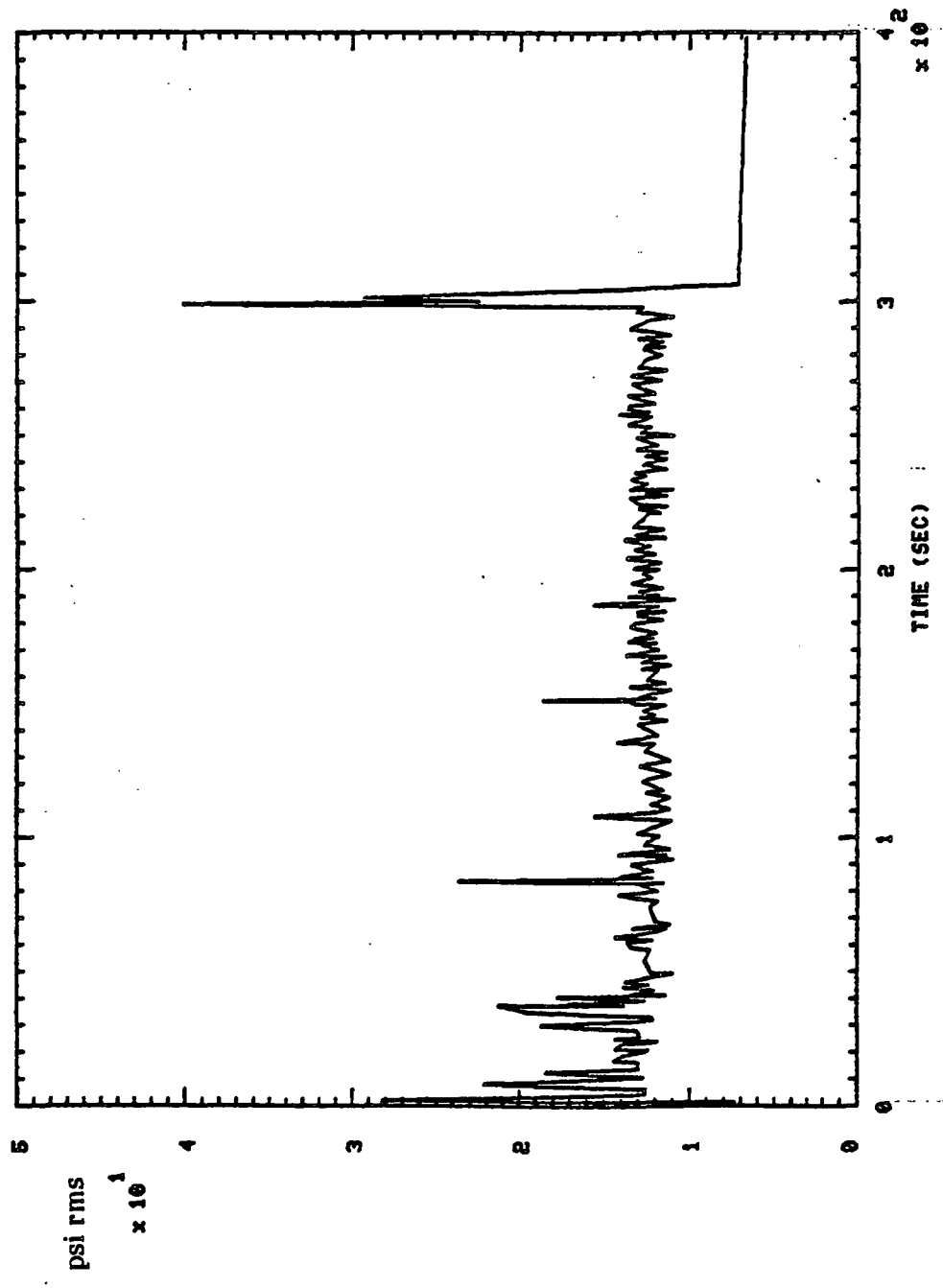


750118 LPOP DS PR (1 - 20K HZ) 204



750118 HPOP BAL CAU PRI

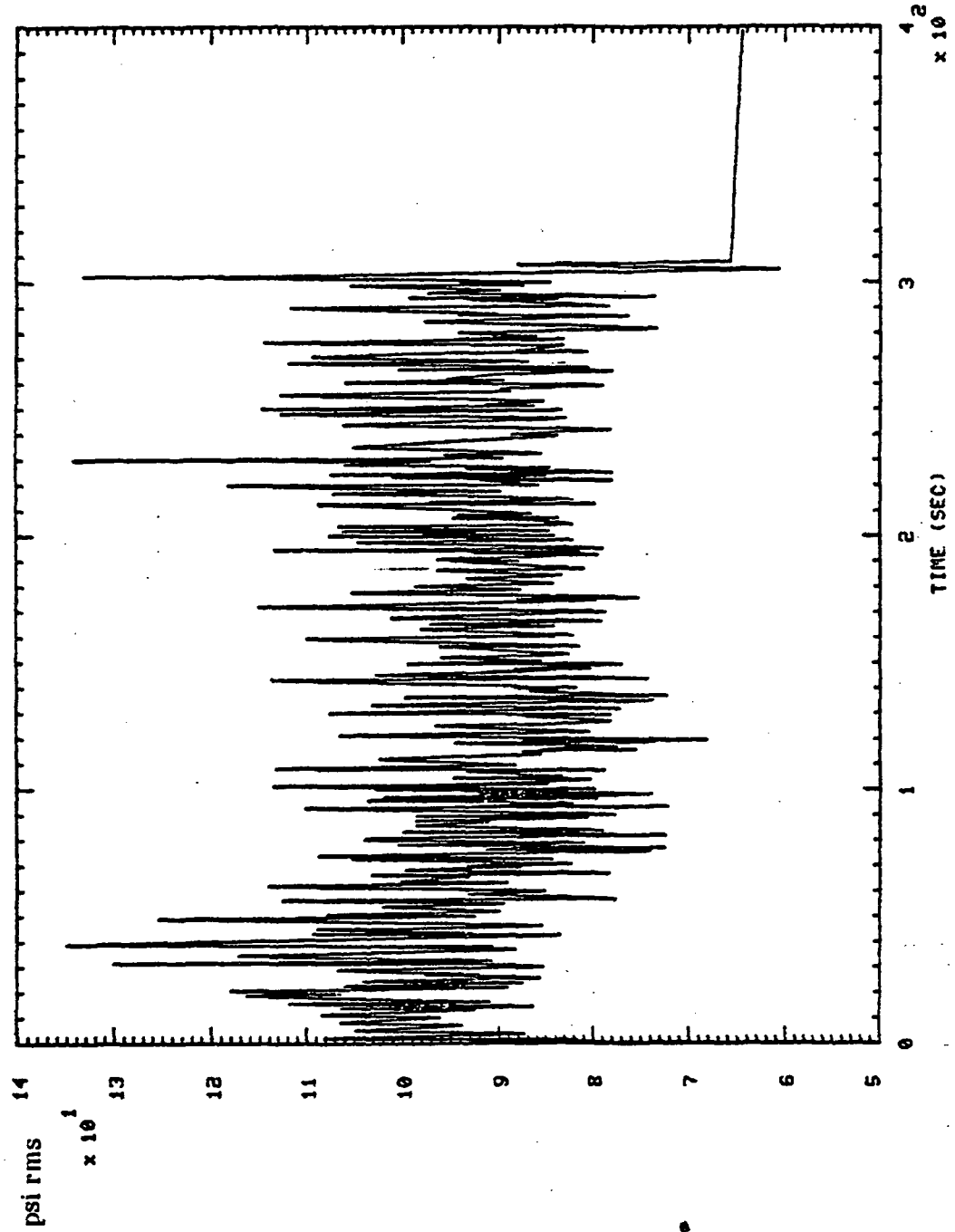
(1 - 20X HZ) 204



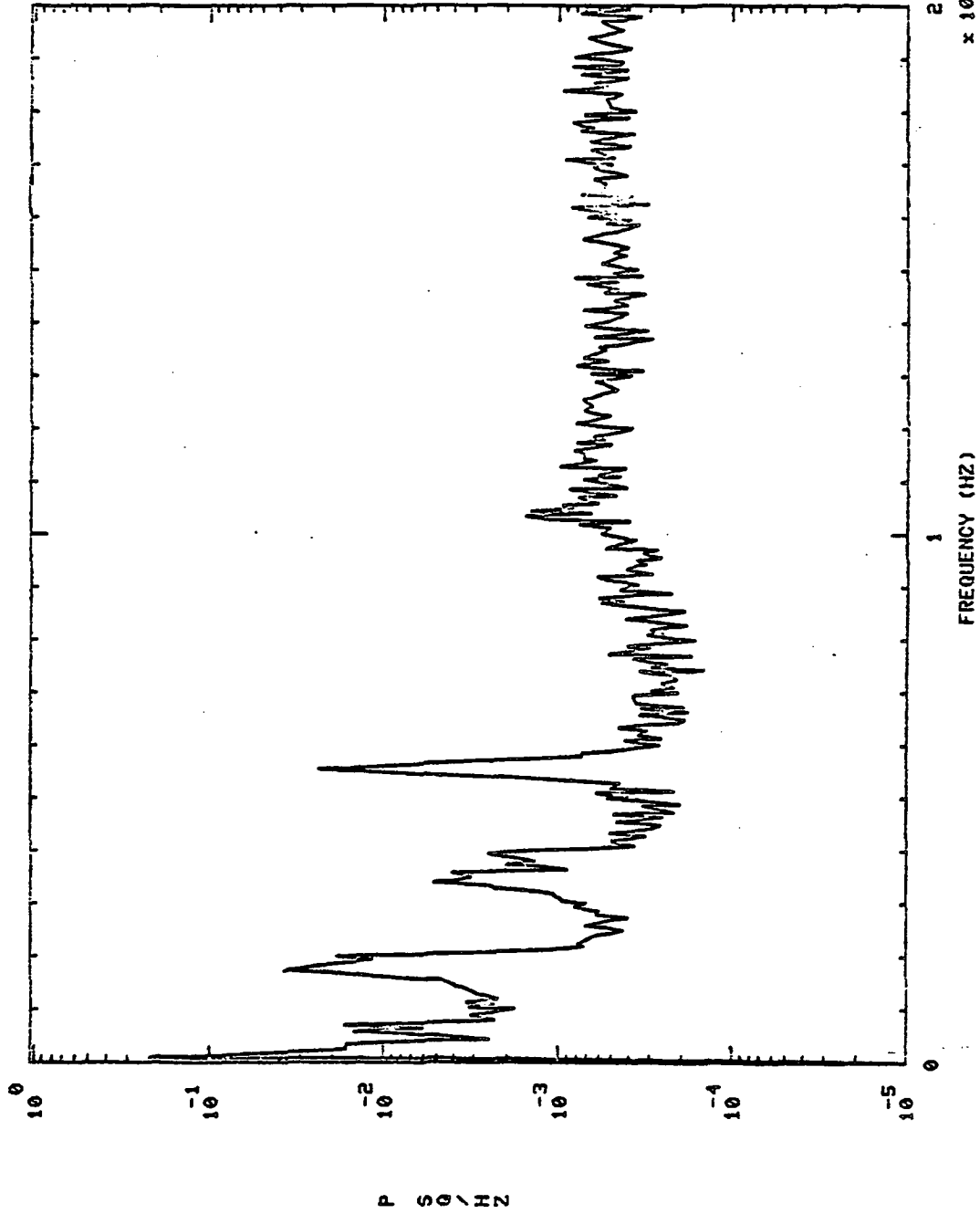
C-4

(1 - 20K HZ)

750118 P8P DS PR

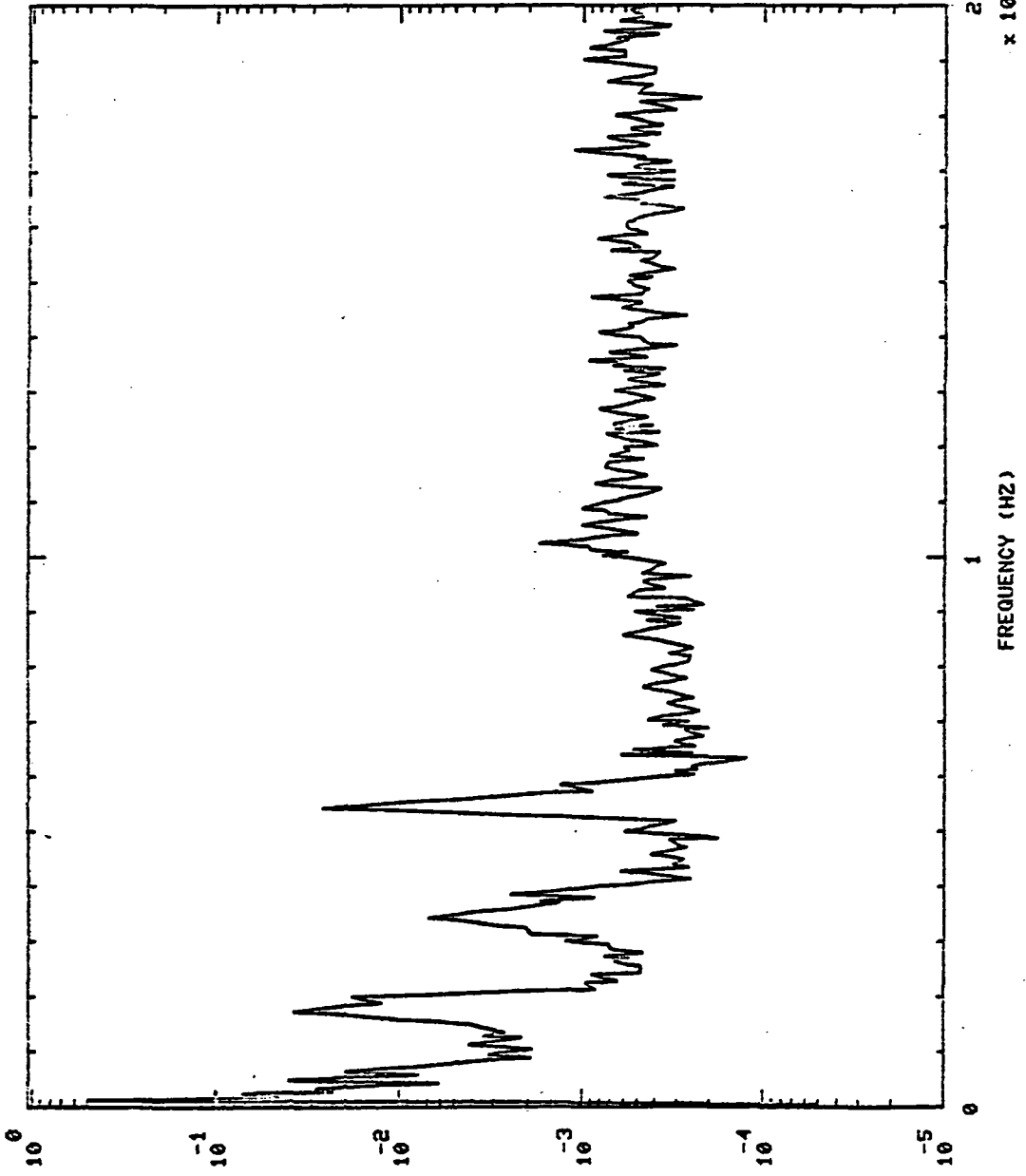


750118 LPOP DS PR 51 30.01H0,'S

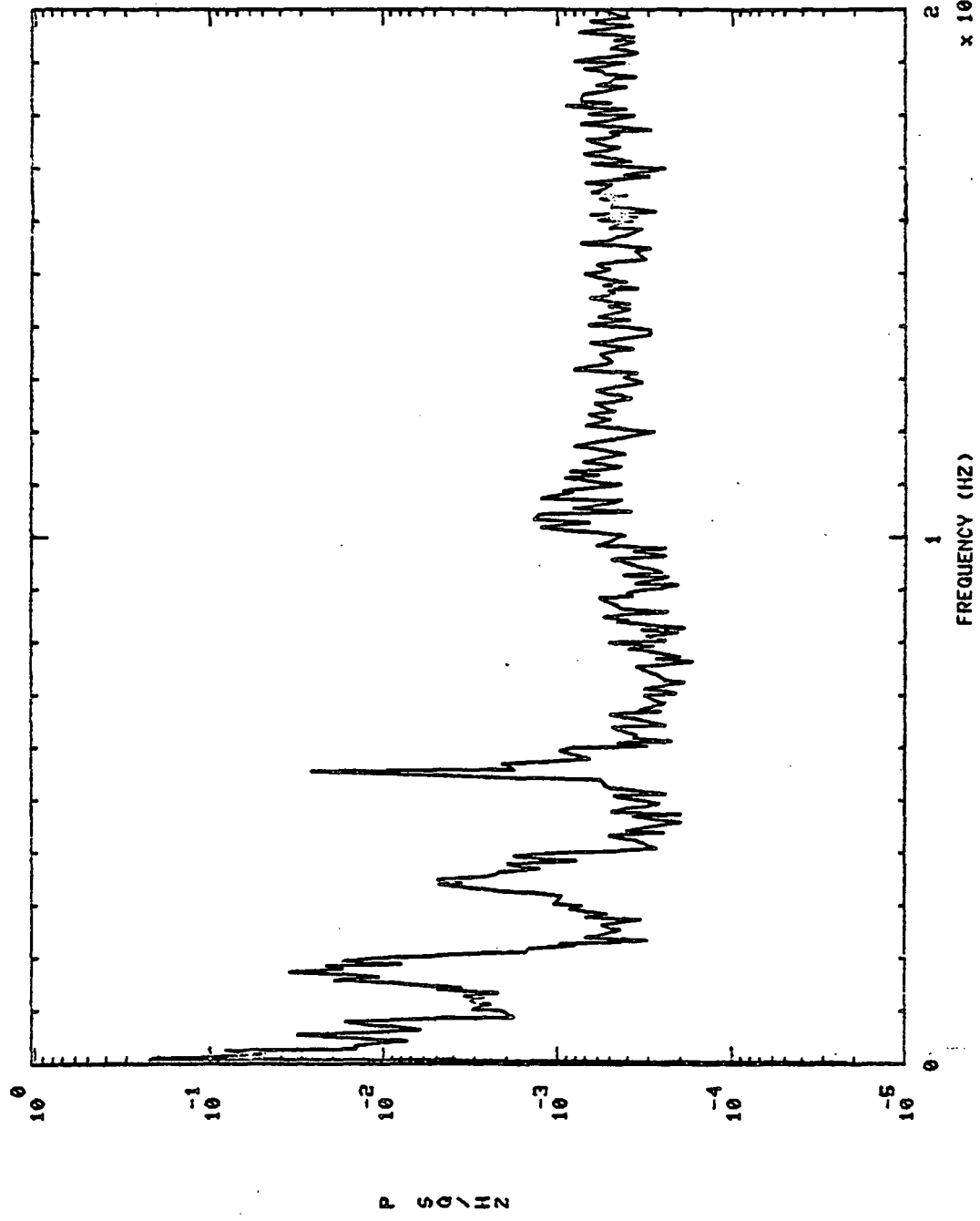


750118 LPOP DS PR S+ 150.01H0,'S

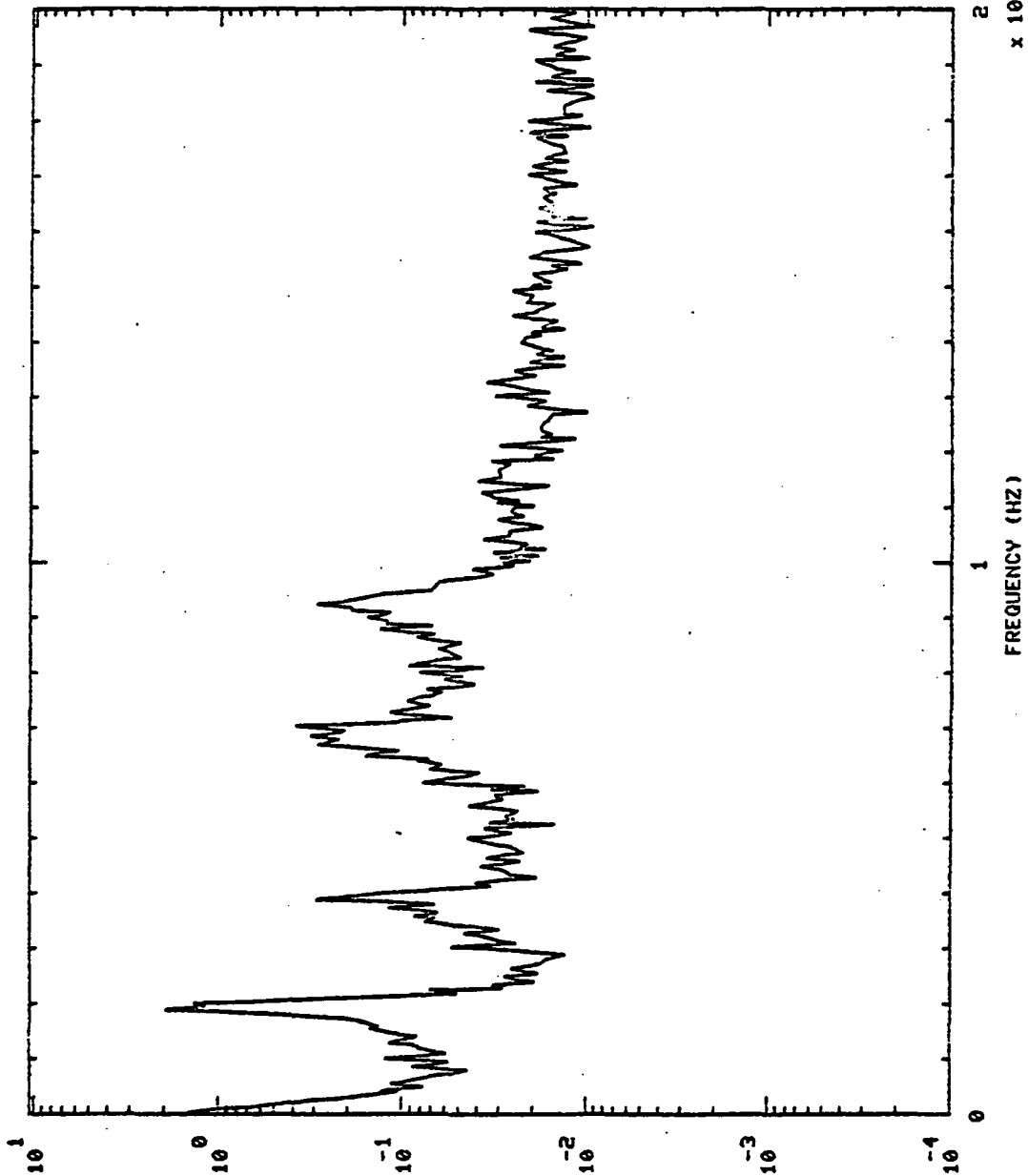
750118 LPOP DS PR



750118 LPOF DS PR S+ 200.01H0.'S



750118 MCC HOT GAS IN PR ST 30.01H0,'S

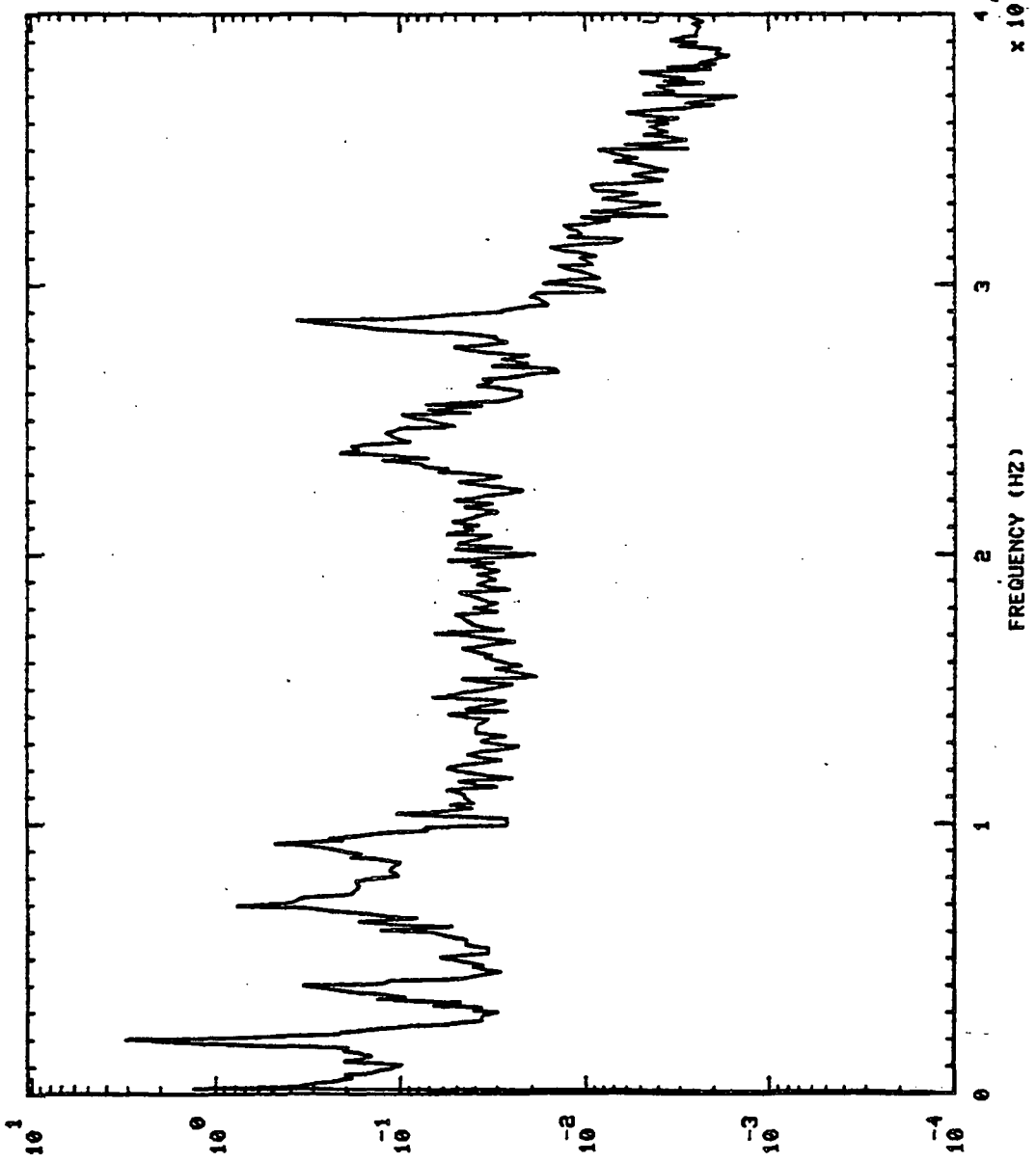


P SQ/HZ

S+ 30.01H0,'S

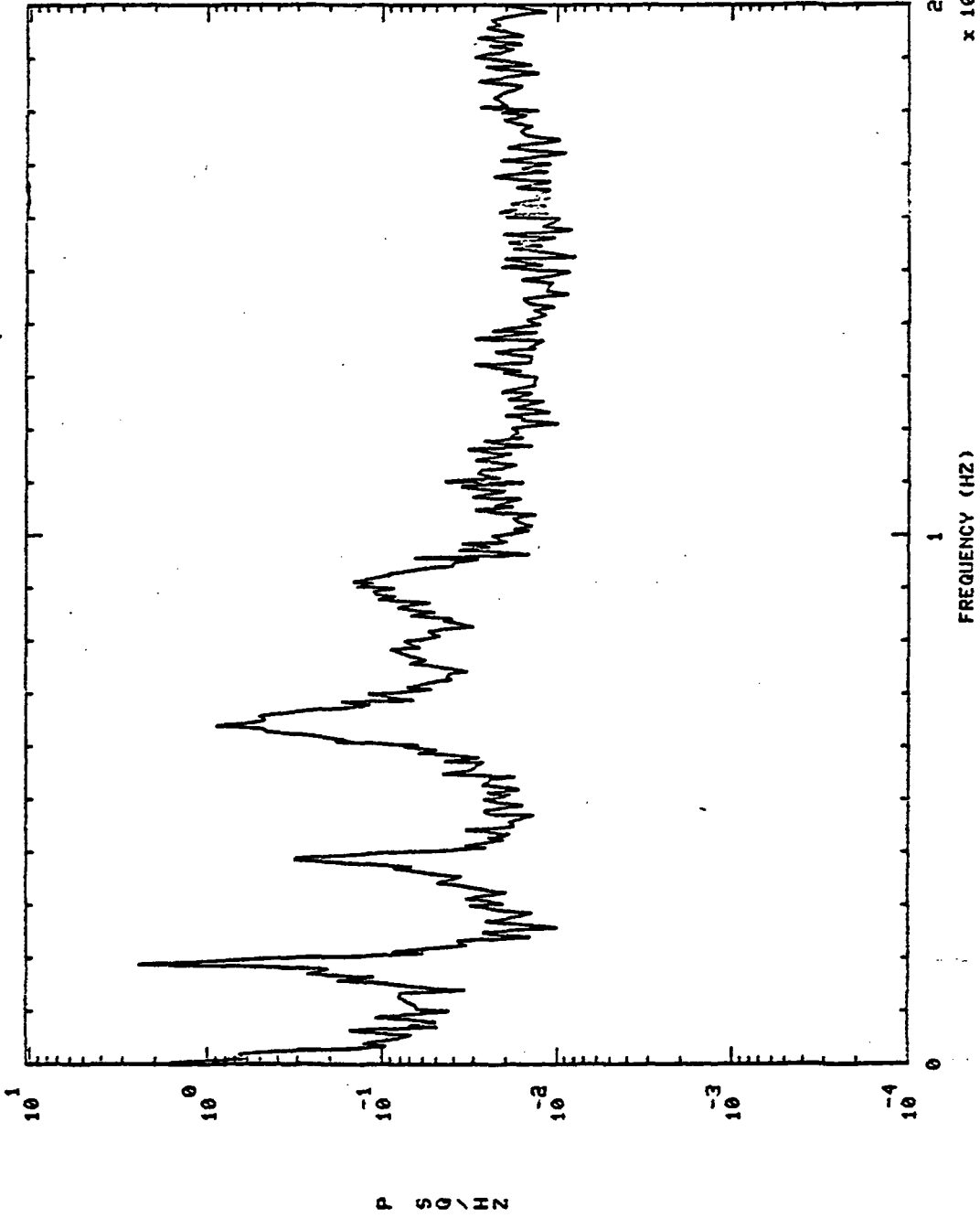
MCC HOT GAS IN PR

750118

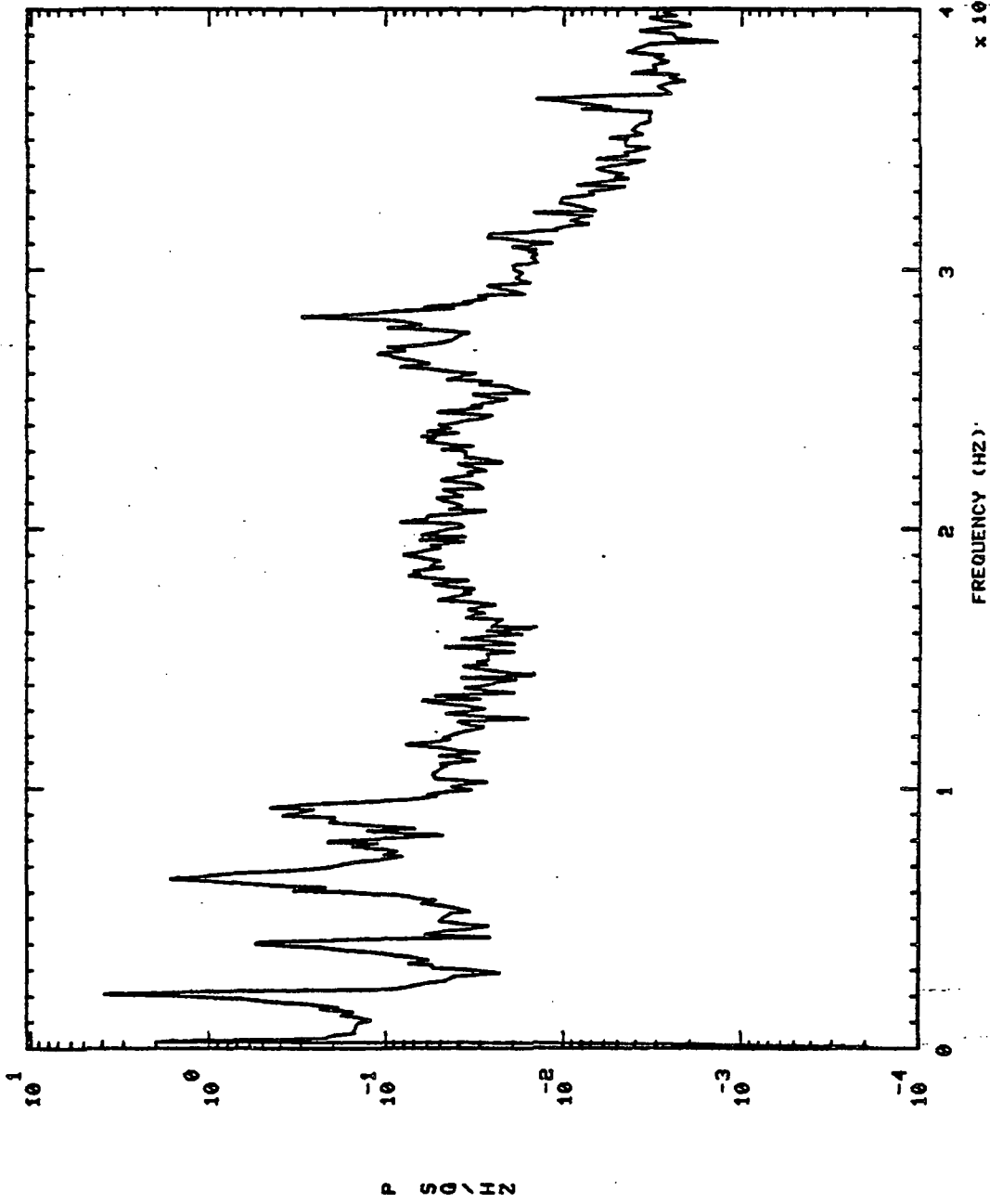


P SQ / HZ

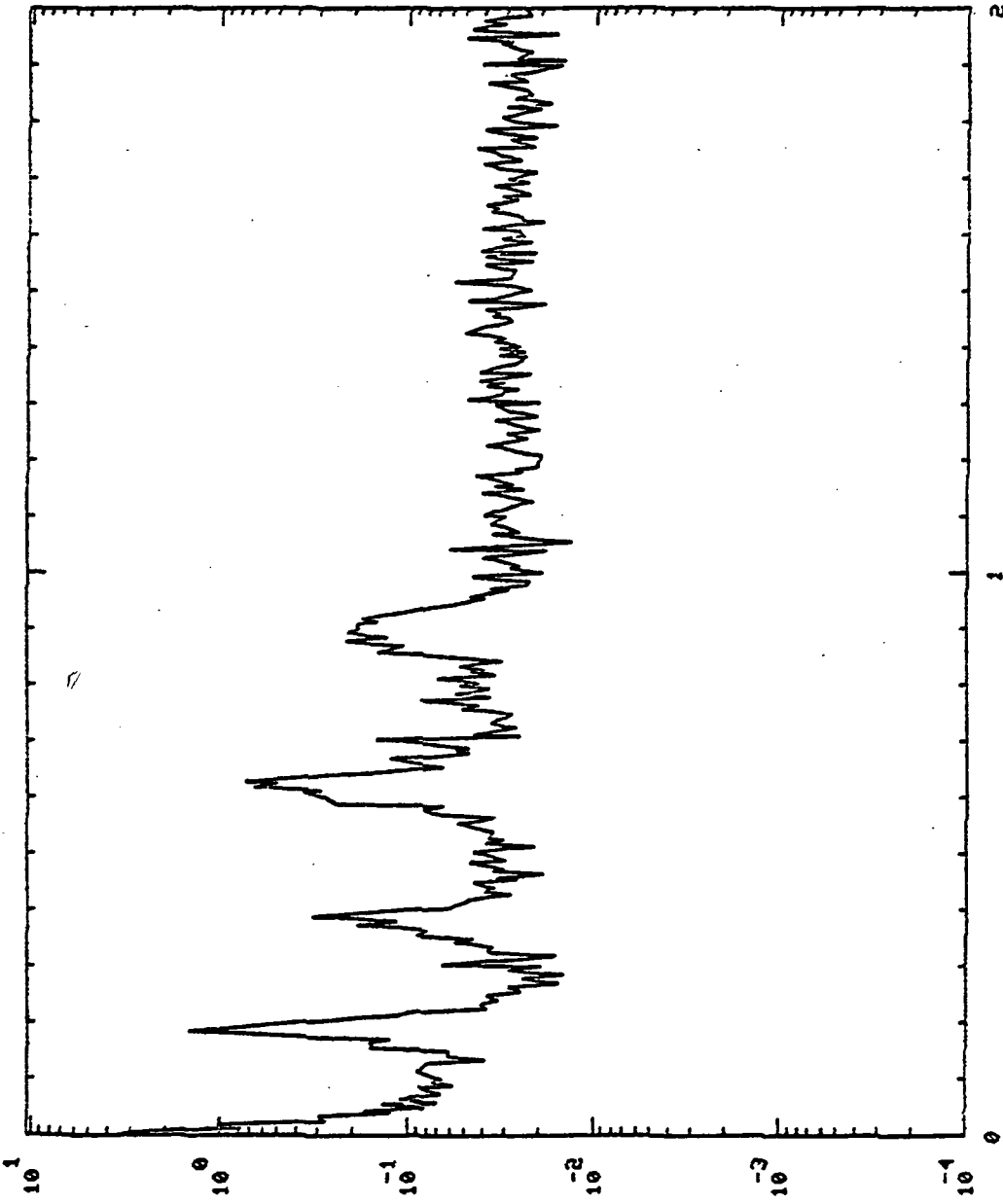
750118 MCC HOT GAS IN PR S+ 150.0140, 'S



750118 MCC HOT GAS IN PR S+ 150.01H0,'S



750118 MCC HOT GAS IN PR S+ 280.01H0.'S

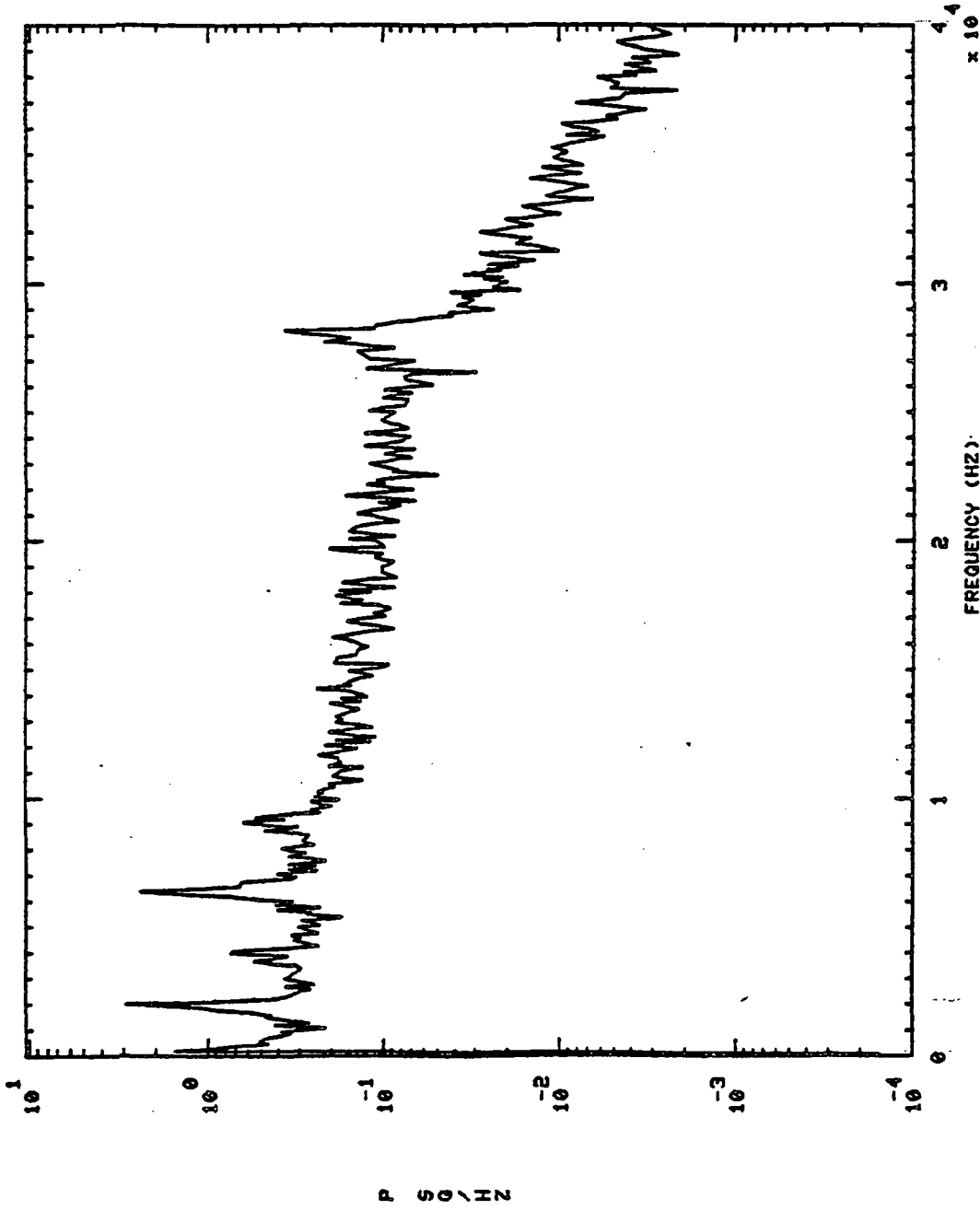


P S D / H Z

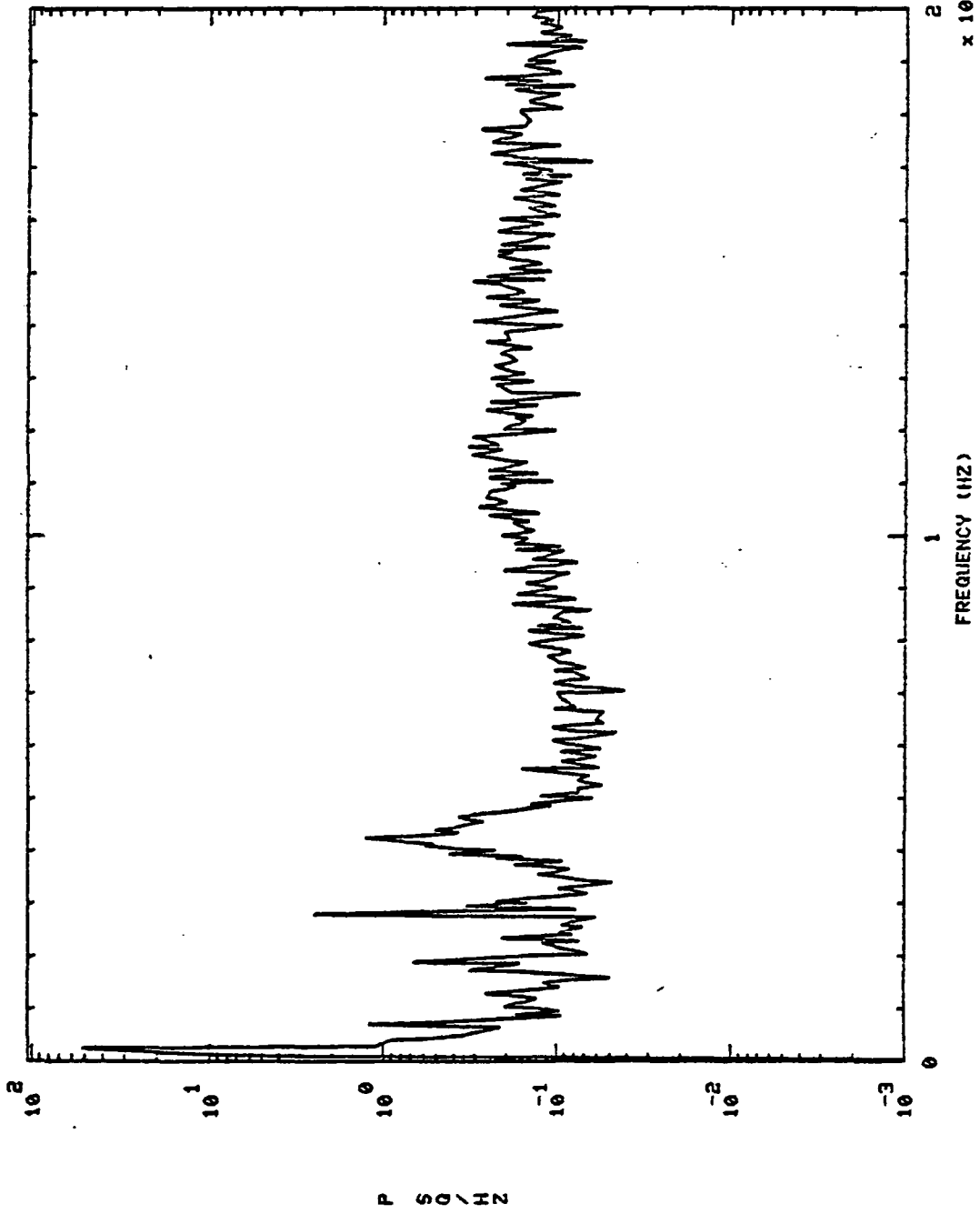
FREQUENCY (HZ)

2.4
x 10⁴

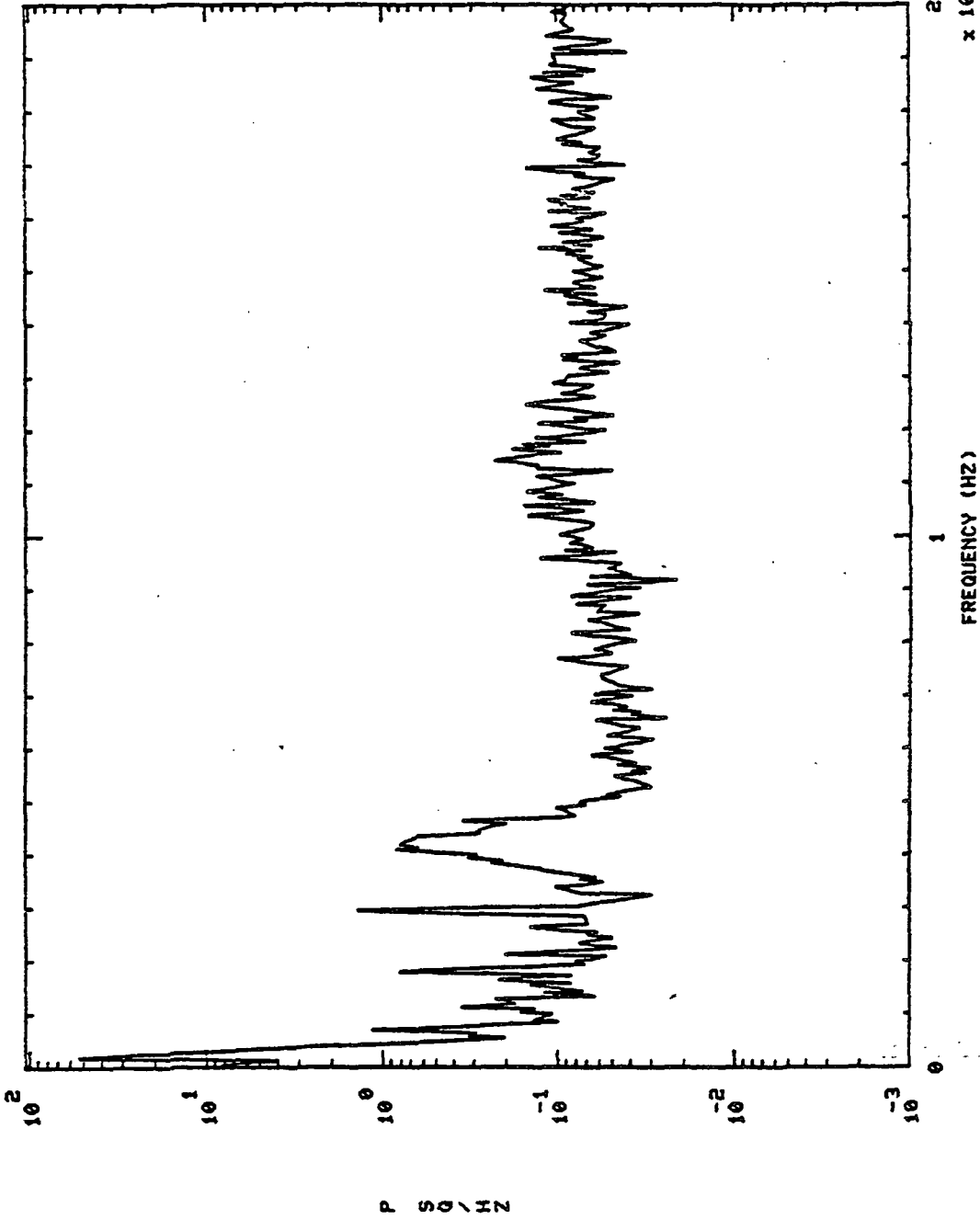
750118 MCC HOT GAS IN PR S+ 280.01H0,'S



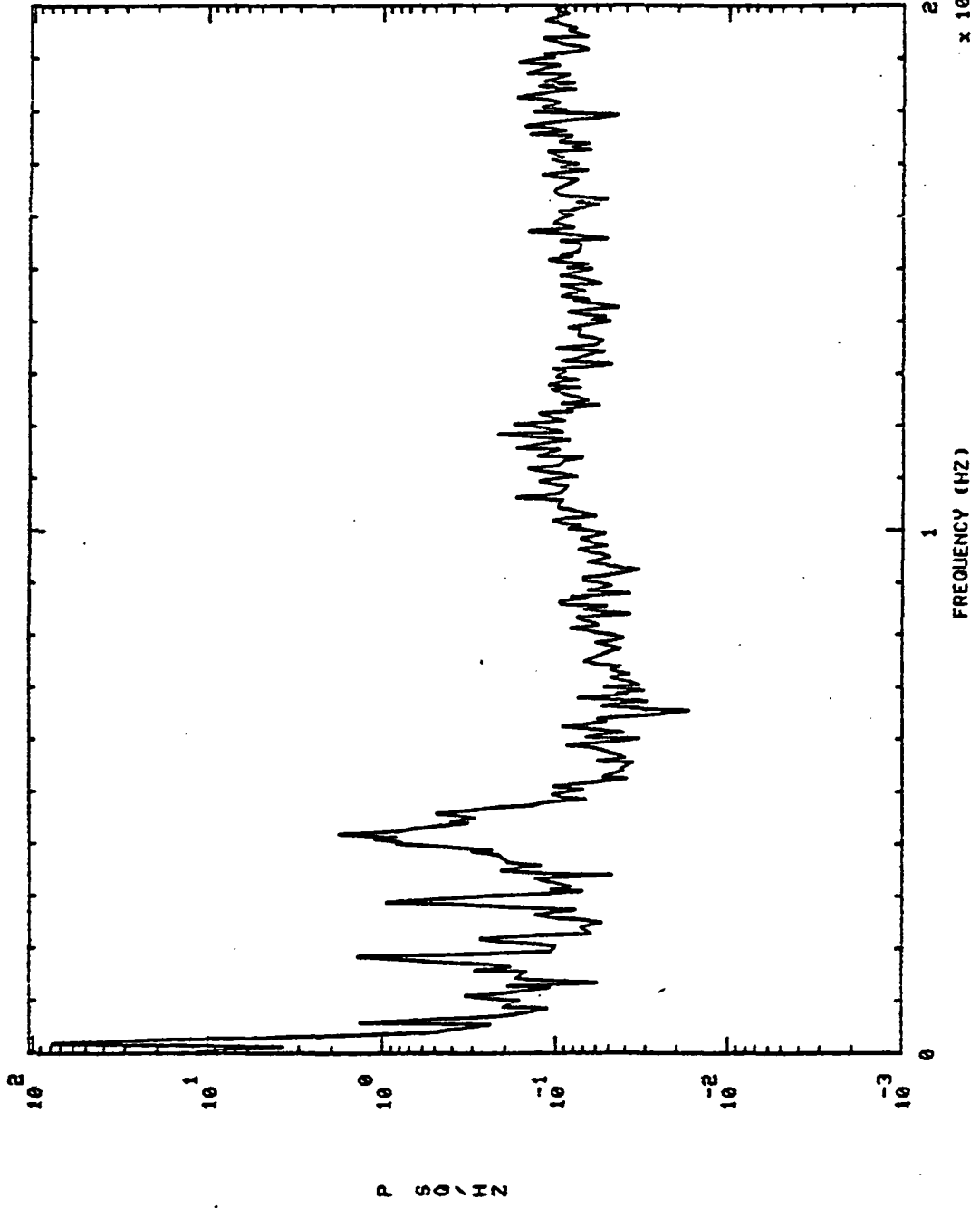
750118 PBP DS PR ST 30.0140,'S



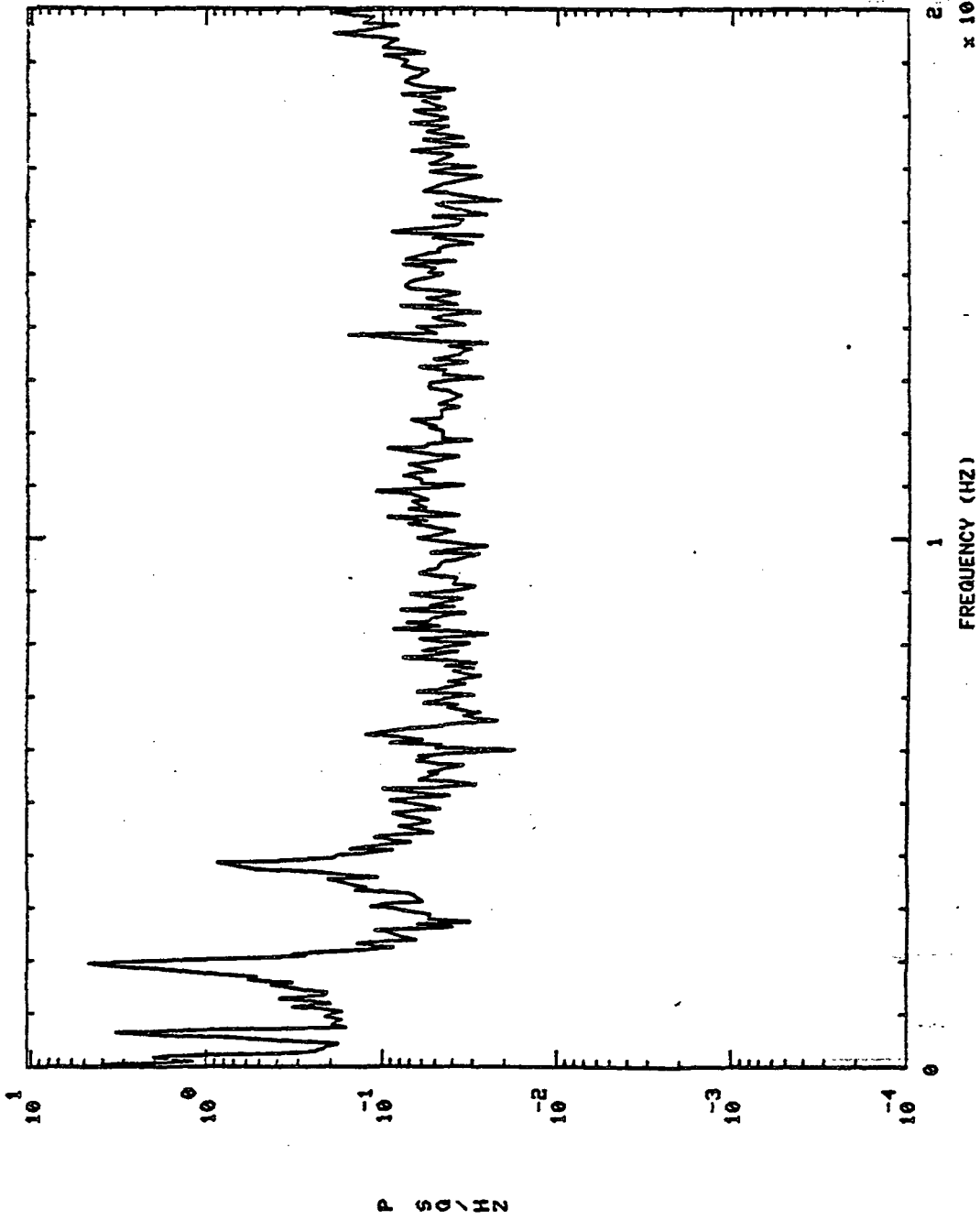
750118 PBP DS PR S+ 150.01H0,'S



750118 PBP DS PR S+ 280.01H0.'S

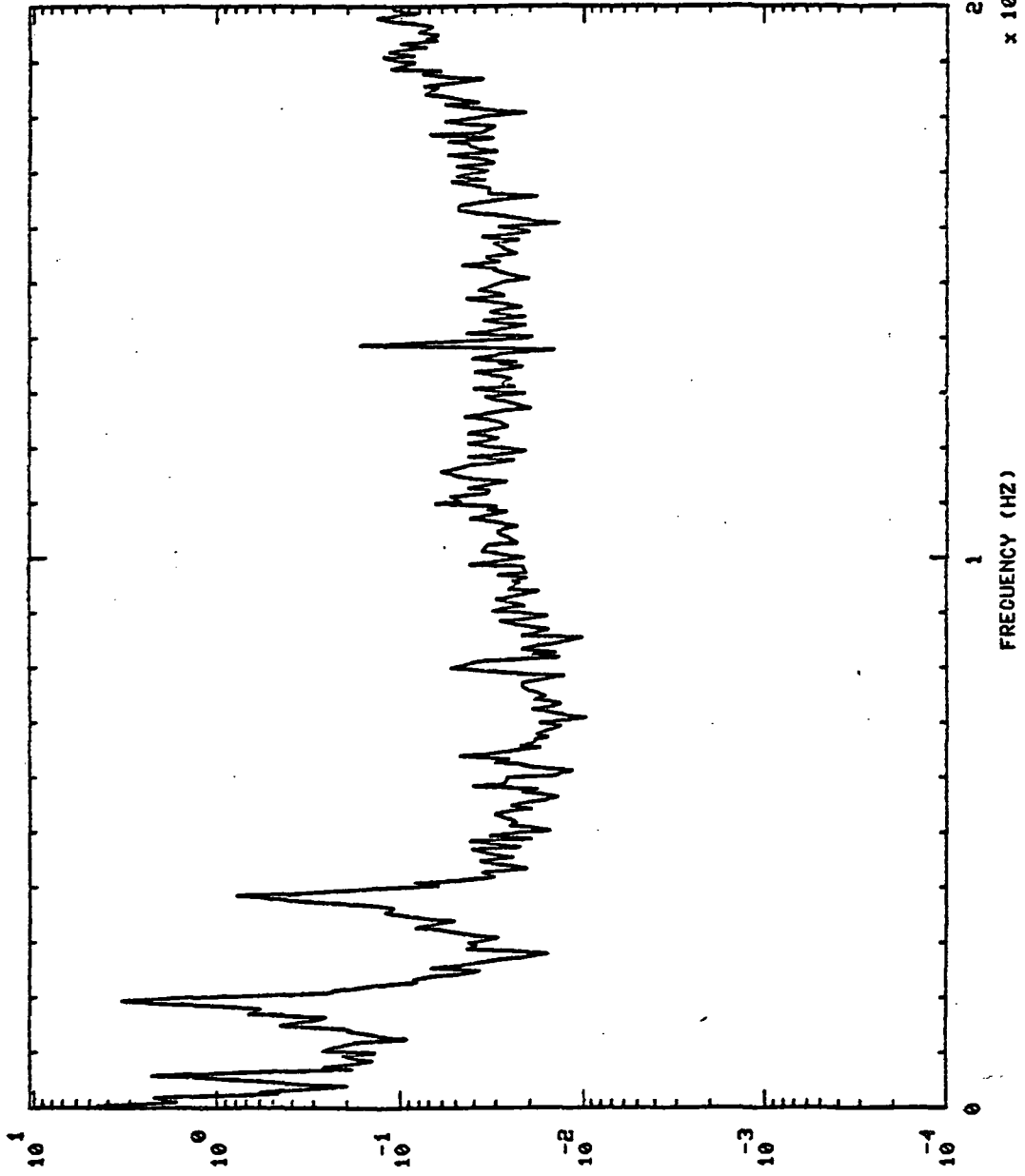


750118 HPFF BAL CAU PR S+ 30.01H0,'S



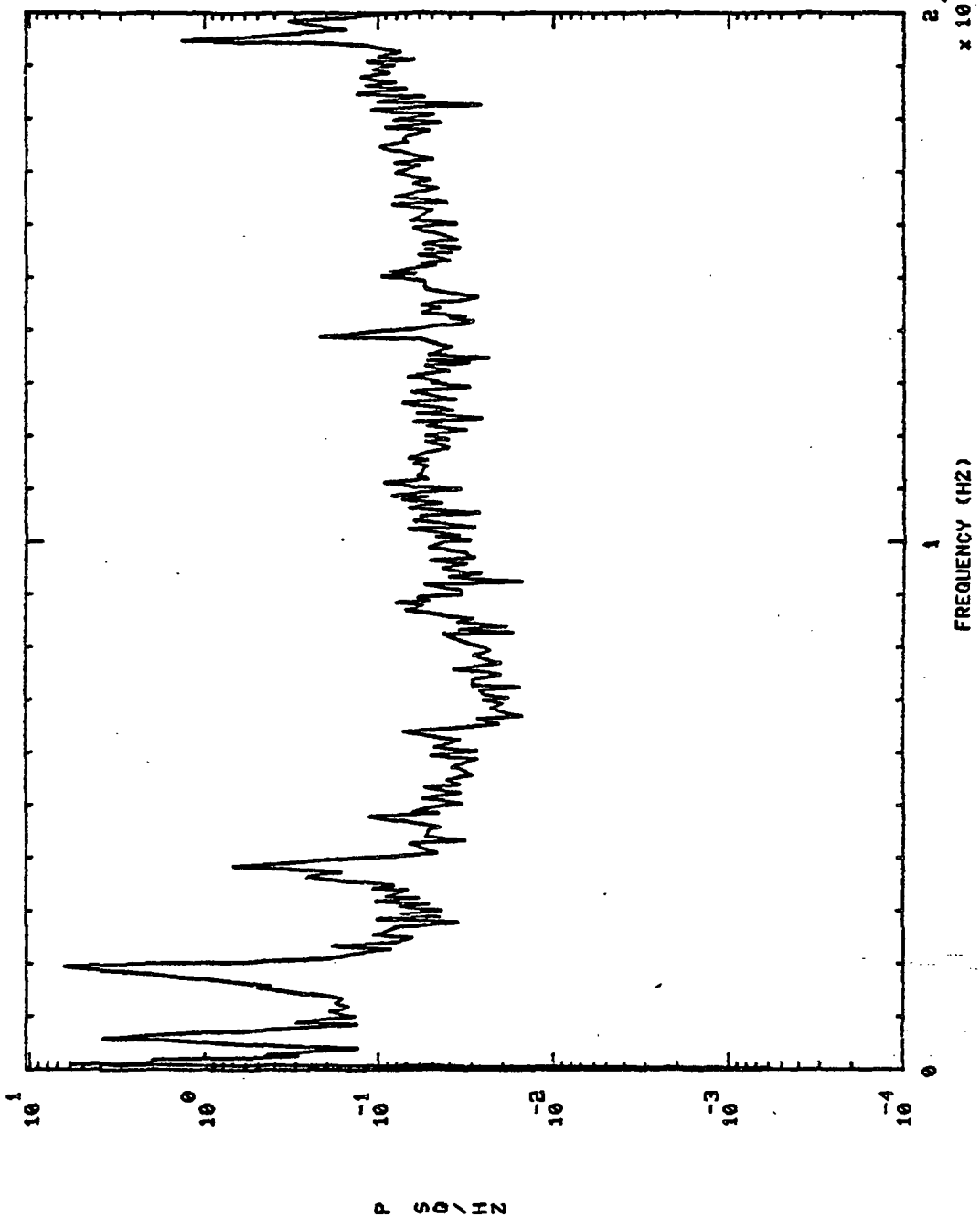
S+ 150.01H0,'S

750118 HFFP BAL CAU PR

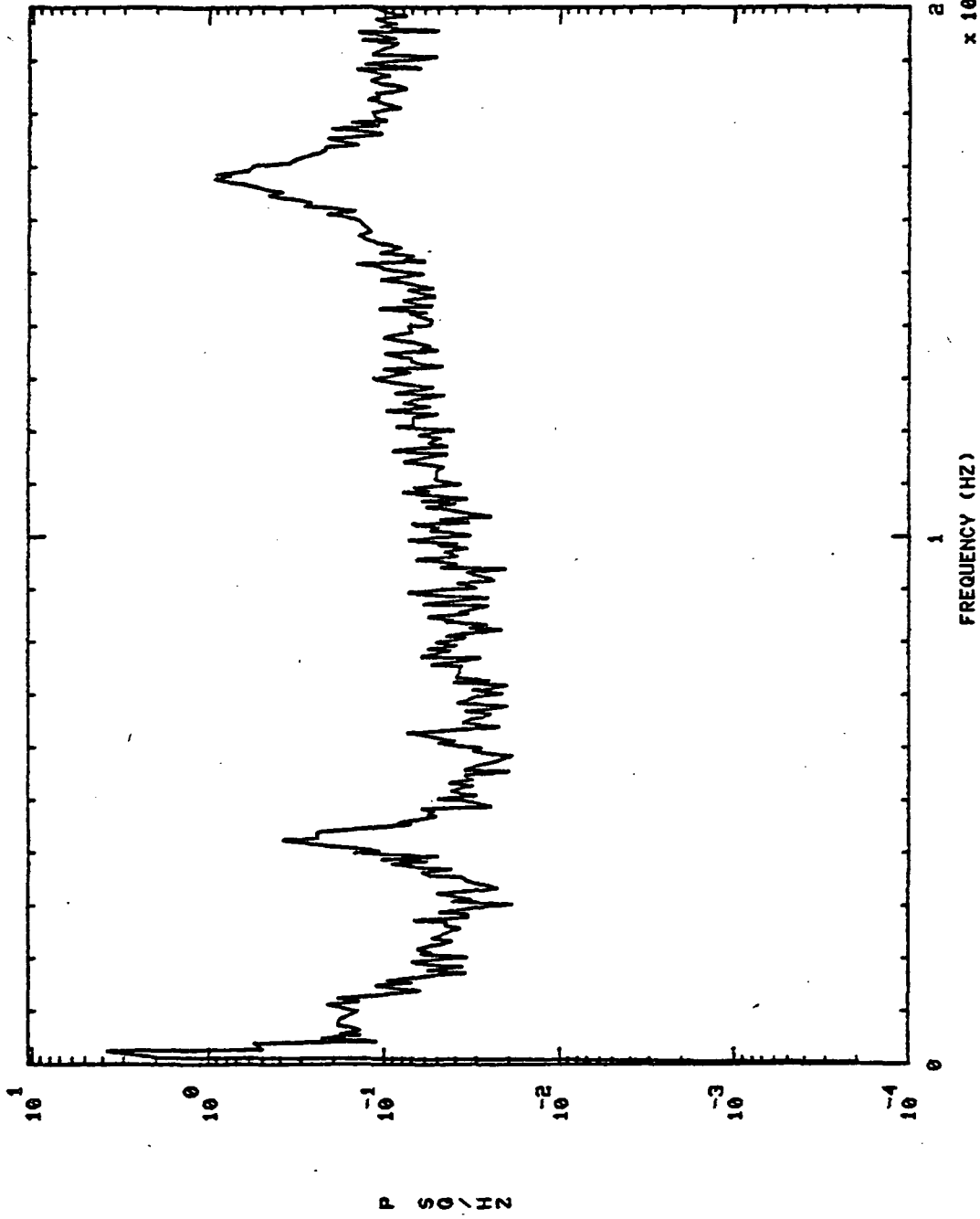


P 50 / HZ

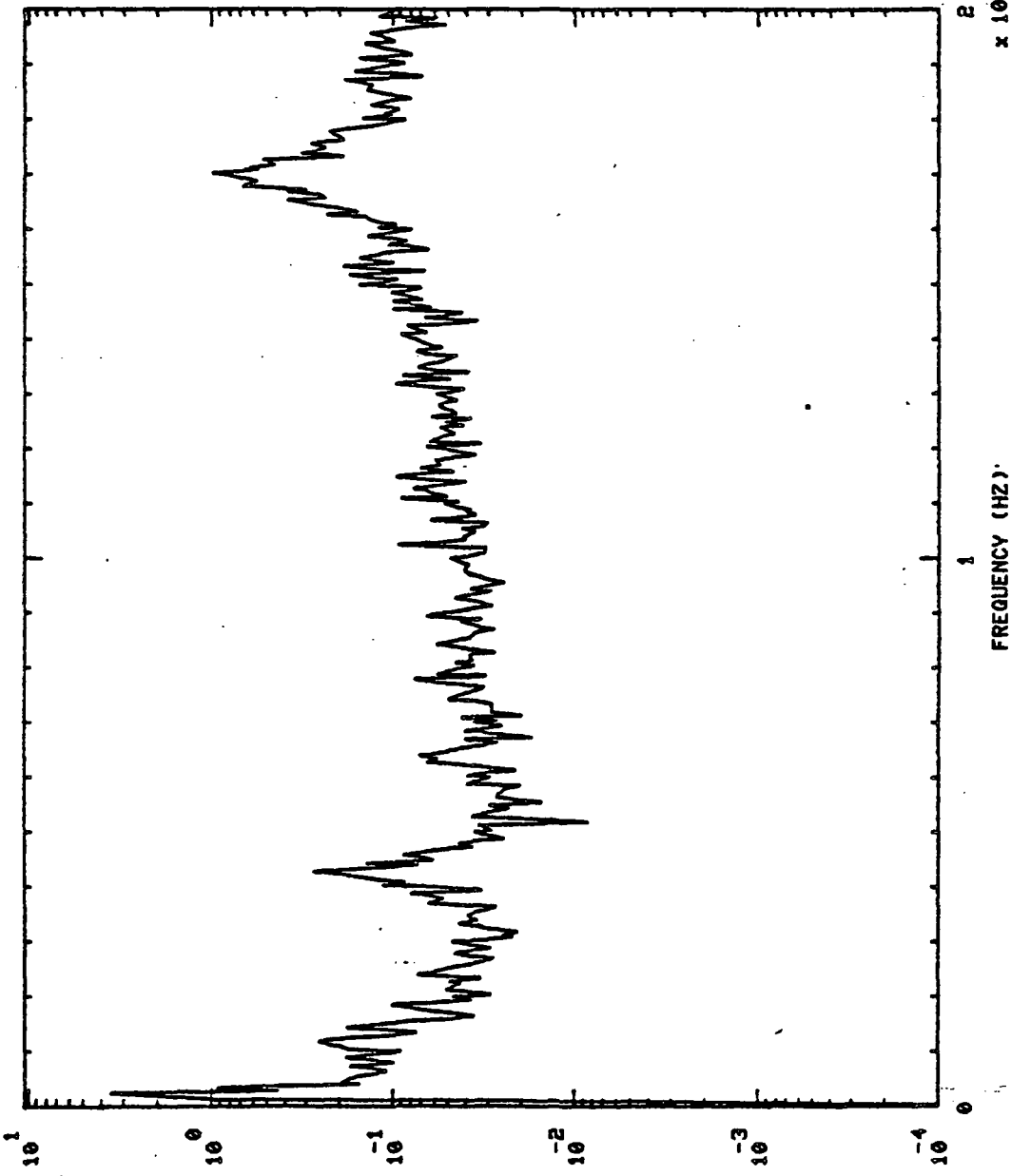
750118 HPFP BAL CAU PR S+ 280.01H0, 'S



750118 OPB PC PR DC S+ 30.01H0,'S



75011B OPB PC PR DC S+ 150.01H0.'8



P SQ / HZ

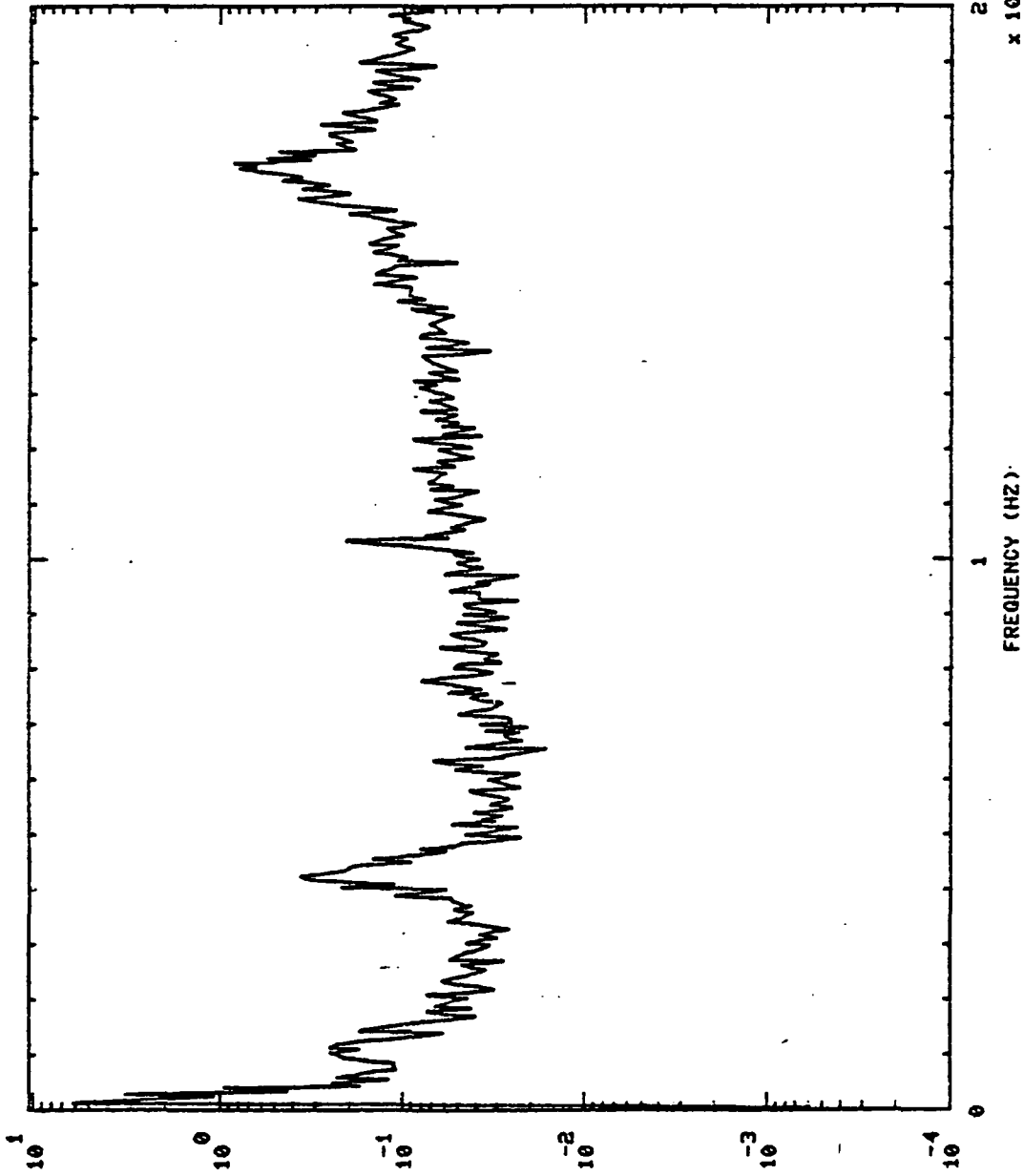
2.4 x 10^4

FREQUENCY (HZ)

S+ 280.0140,'S

OPB PC PR DC

750118



PSD / HZ

FREQUENCY (HZ)

$\times 10^4$