Table 2

SOUND POWER LEVELS CALCULATED FOR TEST SPEAKER

Octave Band	Lw (dB)
250	87.50
500	92.99
1000	93.78
2000	95.72
4000	99.99
broadband	103.03

The Field Test. The source was then taken to each plant and positioned as shown in Figures 7 and 8. The speaker was placed on the floor of the plant facing the ceiling for both tests. With the source powered, measurements were taken at one-foot intervals on either side of the speaker in a single plane. Additional spot readings outside that plane were taken at several locations near the source to establish the level variation for the entire area surrounding the speaker (see Figures 7 and 8 for the location of all measurement points).

Figures 9 and 10 display the broadband levels observed in the measurement plane for each plant. It should be noted that an accident occurred during the Tip Top plant testing in which the speaker was sprayed with water prior to the measurements on the right hand side of the speaker. This appears to have reduced the response output of the speaker to some extent. Appendix C contains the results of octave band filtering of each of the measured values.

Since the measurement points intersected the directivity pattern of the speaker, the direct field levels were determined based on the following calculations:

$$Lp = Lp\theta - 20 \log \frac{r}{ro}$$

Where

- Lp = direct field sound pressure level for the measurement point
- $Lp\theta$ = sound pressure level obtained from the speaker directivity pattern for the angle corresponding to the measurement point.
- r = distance from speaker to measurement point (meters)

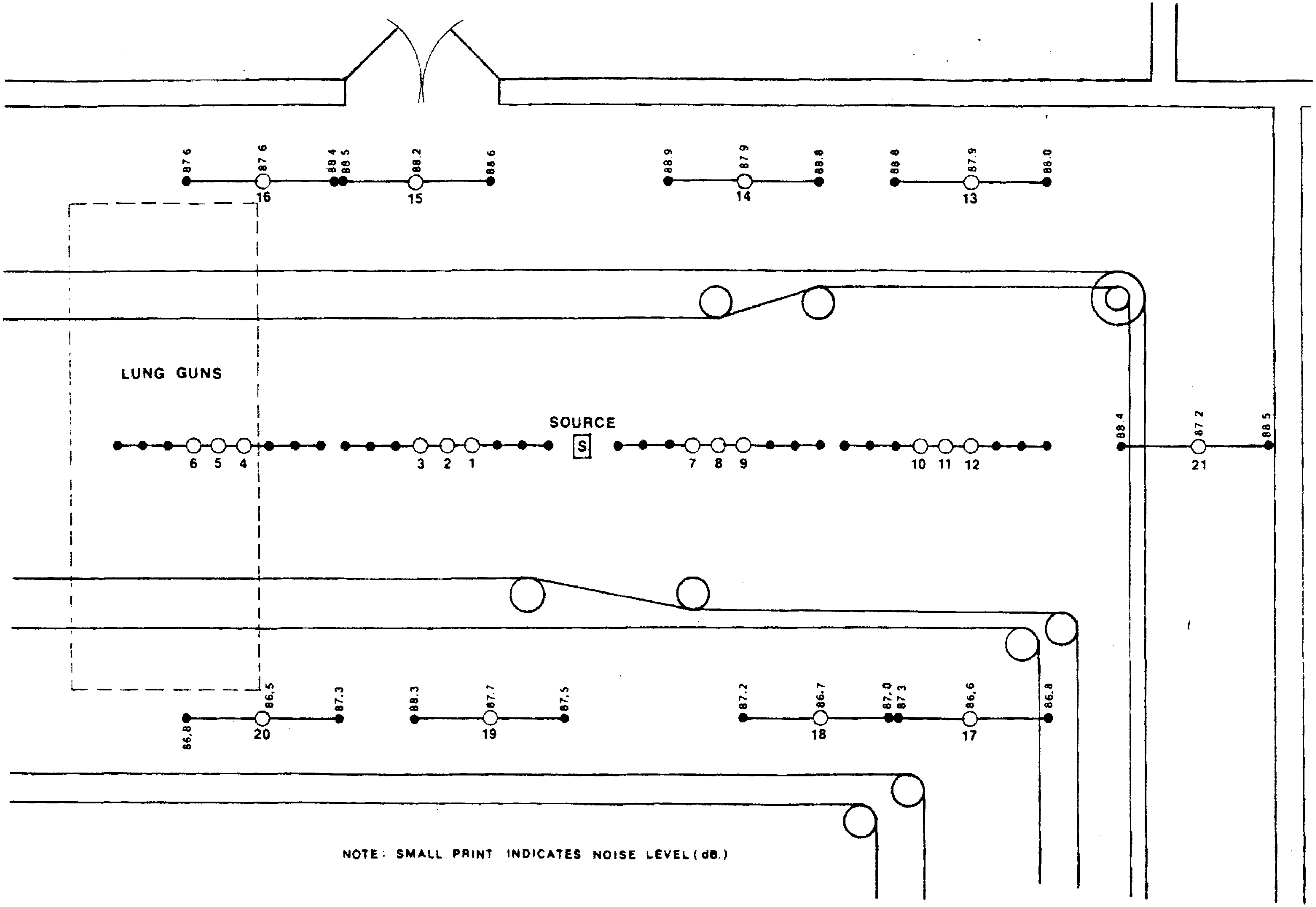


FIG. 7 LOCATION OF MEASUREMENT POINTS FOR
DIRECT-REVERBERANT TEST
CENTRAL SOYA PLANT

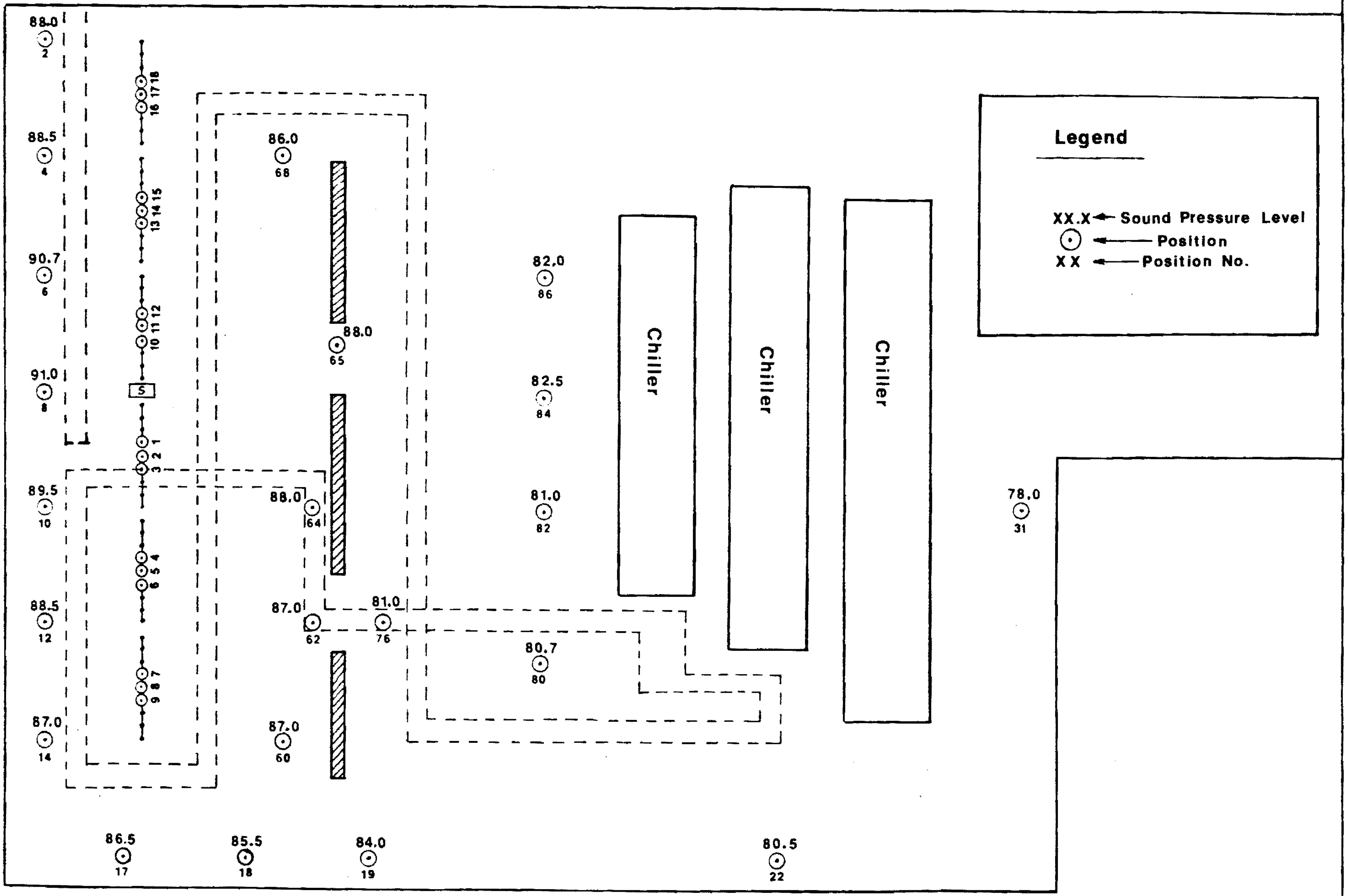


FIG. 8 LOCATION OF MEASUREMENT POINTS FOR DIRECT-REVERBERANT TEST TIP TOP PLANT

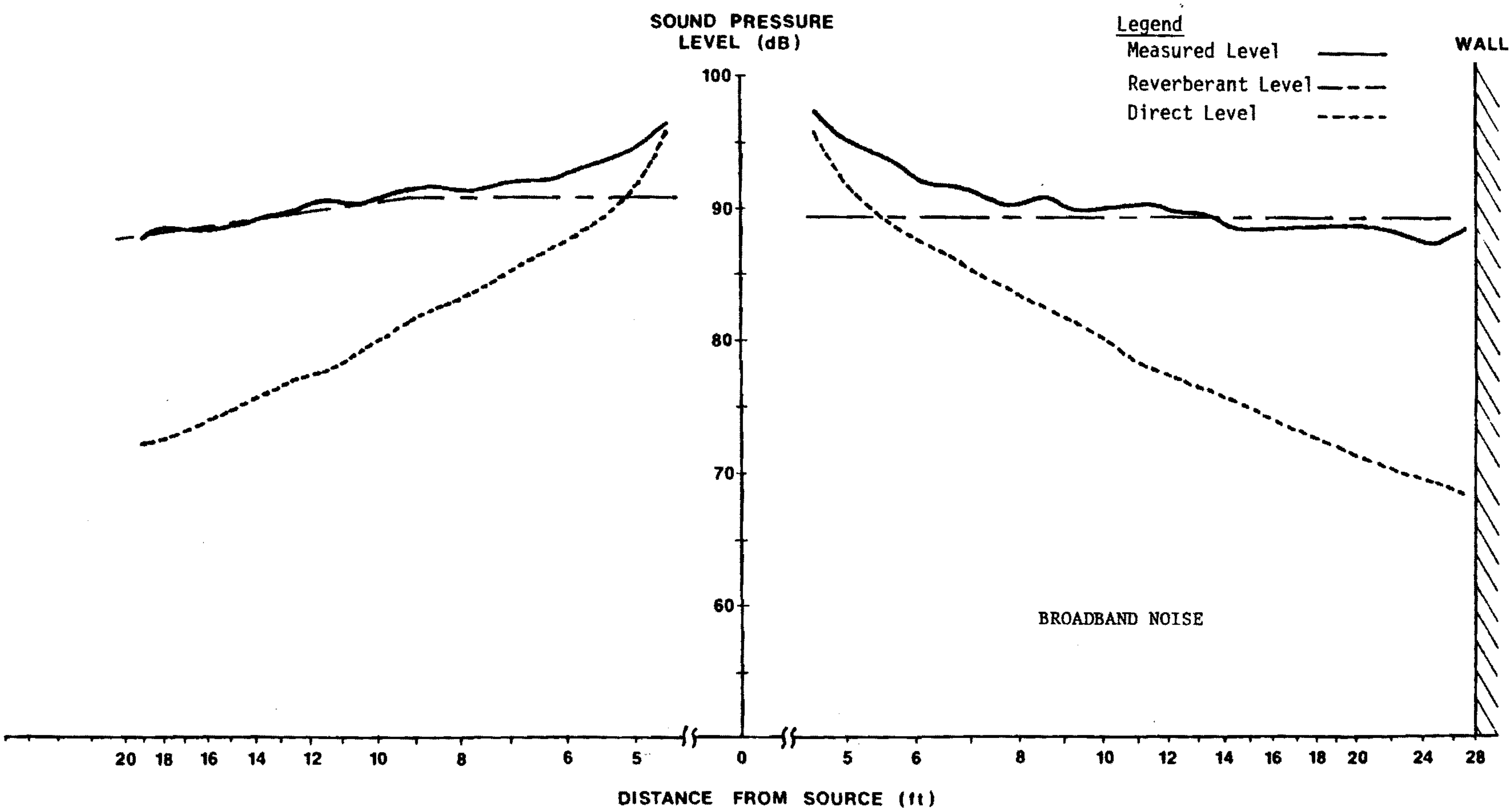


Fig. 9 Direct/Reverberant Noise Fields for Test Speaker

CENTRAL SOYA PLANT

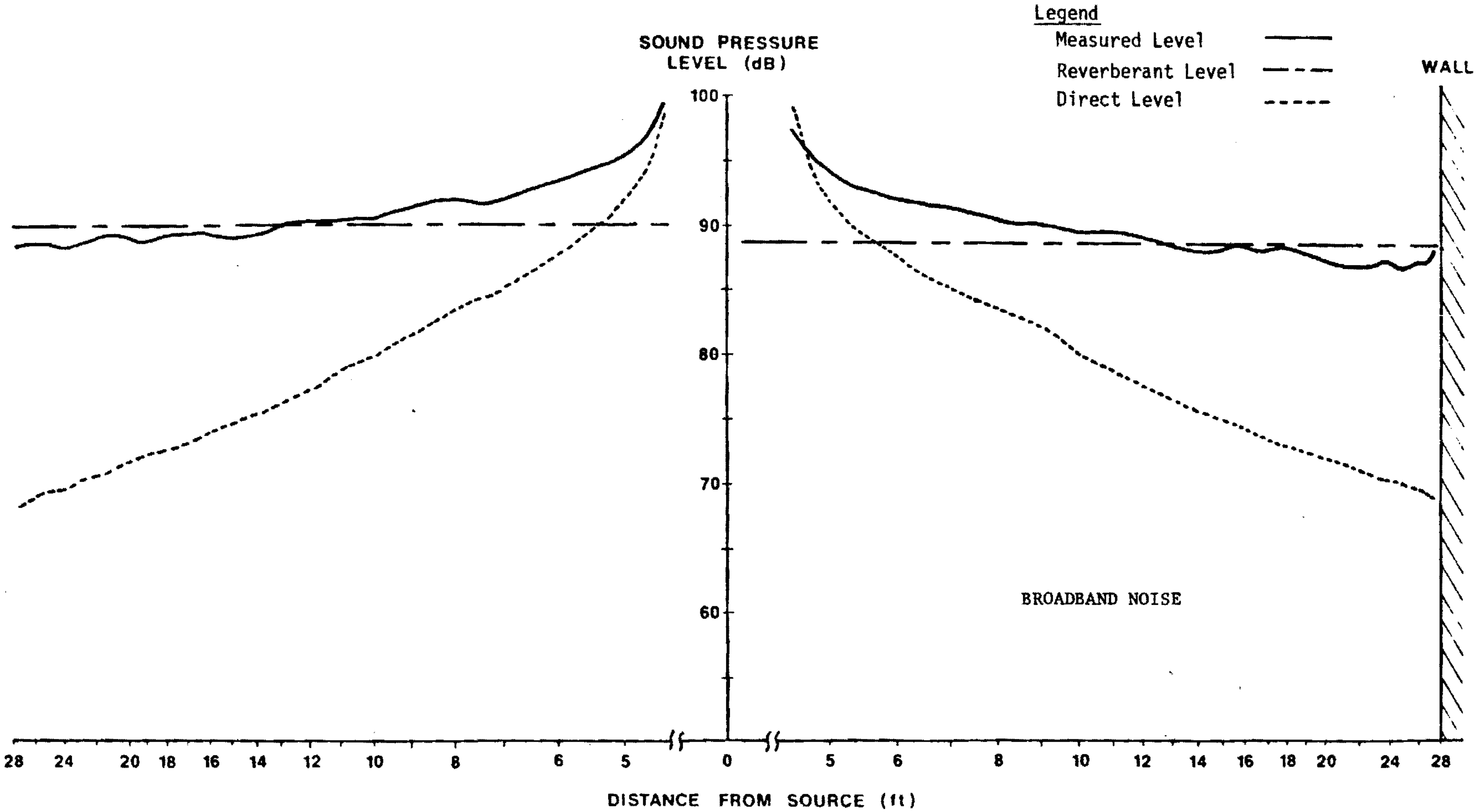


Fig. 10 Direct / Reverberant Noise Fields for Test Speaker
TIP TOP PLANT

r_o = distance from speaker at which $L_{p\theta}$ was measured (meters)

From these figures, it is apparent that the overall level observed at distances beyond a few feet from the source are substantially influenced by the reverberant noise field. However, the reverberant field in the Central Soya plant does not appear to be uniform in level to the left of the speaker, but rather decays at a rate of approximately 3dB/doubling of distance from the source. This phenomenon has been observed by others for rooms in which one dimension is more than five times that of another.* For the Central Soya plant, the room length of 51.2 meters is nearly ten times the ceiling height of 5.5 meters. This is not true of the Tip Top plant where the largest dimension is roughly four times that of the smallest.

Defining the Reverberant Environment

The information obtained from the direct/reverberant field test was used to calculate the average surface absorption coefficient for each plant, using the following equation:

$$\alpha SAB = \frac{4}{S}\left[\text{antilog}\frac{Lp-Lw}{10} - \frac{Q_\theta}{4\pi r}\right]^{**}$$

Where

αSAB = average sabine surface absorption coefficient

S = surface area of the room (meters^2)

Lp = measured sound pressure level (dB)

Lw = calculated source sound power level (dB)

Q_θ = directivity factor of the source

r = distance of measurement point from the source (meters)

In order to make this calculation, the sound pressure level measured at a distance of nine feet was used for the Tip Top plant. For the Central Soya plant, since the reverberant noise field was not uniform in level, the nine foot reading was attenuated at a rate of 3 dB/doubling of distance from the source to the picking room wall, and the resulting reverberant field levels were space averaged. The corresponding direct field contribution for the equation at this equivalent distance from the source was estimated to be small and was therefore neglected in the calculation for this plant. Table 3 presents the Lp values used in the calculation of surface absorption coefficient for each plant.

---

*Reference 1, page 4-13.

**Reference 2, page 228. Note that the factor of 4 was derived for diffuse conditions. Since non-diffuse conditions were observed in the Central Soya Plant, a factor of 2 was used for it.

Table 3

MEASURED SOUND PRESSURE LEVELS (dB)

Central Soya Plant[a/] Octave Band		Tip Top Plant[b/] Octave Band	
250 Hz	72.9	250 Hz	80.7
500 Hz	73.9	500 Hz	82.0
1000 Hz	76.9	1000 Hz	84.8
2000 Hz	77.9	2000 Hz	85.0
4000 Hz	76.9	4000 Hz	85.8
Broadband	83.9	Broadband	91.1

a/ Space averaged level for reverberant field.

b/ Measured at nine feet from the source.

Since the equation called for a measure of the directivity of the speaker to determine the direct field contribution, the following procedure was used to calculate this value. The sound pressure level at the measurement point which would be provided by a nondirectional source was calculated using the total sound power output of the source. This sound pressure level was then compared to the sound pressure level actually provided by the direct sound field at the measurement point. The ratio of the actual direct level to that level which would have been provided by a nondirectional source defined the directivity factor (Q_θ).* Table 4 presents calculated values for the Tip Top plant measurement point where the direct field entered into the calculation.

Table 4

SOURCE DIRECTIVITY FACTORS FOR TIP TOP MEASUREMENT POINT USED TO CALCULATE SURFACE ABSORPTION COEFFICIENTS

Octave Band	Q_θ
250 Hz	.879
500 Hz	.767
1000 Hz	.611
2000 Hz	.225
4000 Hz	.383
Broadband	.315

*Reference 2, page 159.

The final input to the calculation was the total surface area of the test room. For the Central Soya plant the test area was defined as the total evisceration area. However, for the Tip Top plant, the wall in the middle of the evisceration area provided an effective barrier for containing sound and, therefore, was used to define one wall of the test area. The total surface area of the Central Soya plant test area was calculated to be 1834 square meters and that for the Tip Top plant test area was calculated to be 627 square meters.

Using these inputs, the average surface absorption coefficient for each plant was calculated and is presented in Table 5.

Table 5

ESTIMATED SURFACE ABSORPTION COEFFICIENTS[a/]

Central Soya Plant		Tip Top Plant	
Octave Band	SAB	Octave Band	SAB
250 Hz	.031	250 Hz	.032
500 Hz	.088	500 Hz	.089
1000 Hz	.053	1000 Hz	.053
2000 Hz	.066	2000 Hz	.077
4000 Hz	.222	4000 Hz	.187
Broadband	.089	Broadband	.104

[a/] Values include any contribution from atmospheric absorption as well.

It should be noted that there were some energy losses during testing attributable to openings in some of the surface boundaries defining the test areas. Furthermore, no allowance was made in the calculations for nonsurface absorption such as by air, a factor which had approximately a 15% impact on the surface absorption coefficient calculated for the 4000 Hz octave band. However, it is believed that the coefficients in Table 5 reasonably approximate the absorptive qualities of the test rooms.

Reverberant Field Decay Test

The second test used to confirm the values obtained from the direct/reverberant test consisted of exciting each plant with noise, then terminating the source of the noise and measuring the time needed for the noise level in the room to decay 60 decibels.

This decay time provided yet another measure of the average absorption coefficient for surfaces in the test area, through the following equation:

$$\alpha SAB = \frac{161V}{TS} \ *$$

Where

αSAB = Average sabine absorption coefficient

S = Total room surface area (meters^2)

V = Total room volume (meters^3)

T = Reverberation decay time (seconds)

Each plant was excited with noise from a 22 caliber, blank pistol for the test. This source provided sufficient sound power to thoroughly excite the test area but unfortunately provided only broadband comparative values. It was positioned at the location of the speaker in Figures 7 and 8 and was pointed toward the ceiling. Measurements were taken nine feet from the source. Figures 11 and 12 show the time history of the measured decay rate of the sound field in each plant following the pistol shot. The full 60 dB reverberant decay time was determined from these figures, using straight line extrapolation. These values were then inserted into the above equation, using the room statistics for each test area given in Table 6.

Table 6

ROOM STATISTICS FOR REVERBERANT FIELD DECAY TEST

Central Soya Plant	Tip Top Plant
V = 3110 m^3	V = 847 m^3
S = 1834 m^2	S = 627 m^2

With these inputs, the average broadband suface absorption coefficient for each plant was calculated and is presented in Table 7.

Table 7

ESTIMATED BROADBAND SURFACE ABSORPTION COEFFICIENT USING PISTOL SHOT

Central Soya Plant	α SAB = .136
Tip Top Plant	α SAB = .093

*This calculation also produced values which include any contribution from atmosphere absorption. Source: Reference 2, page 238.

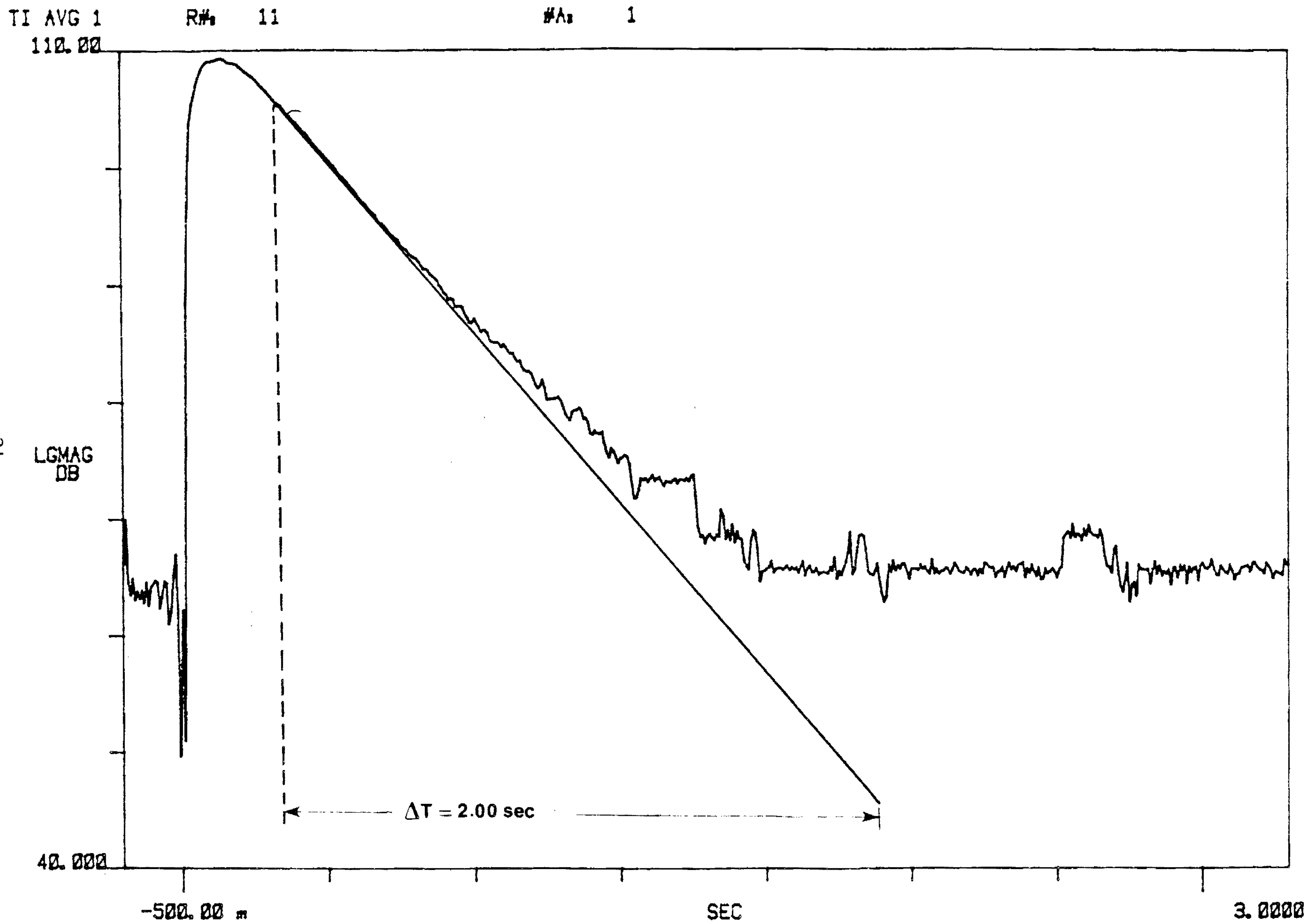
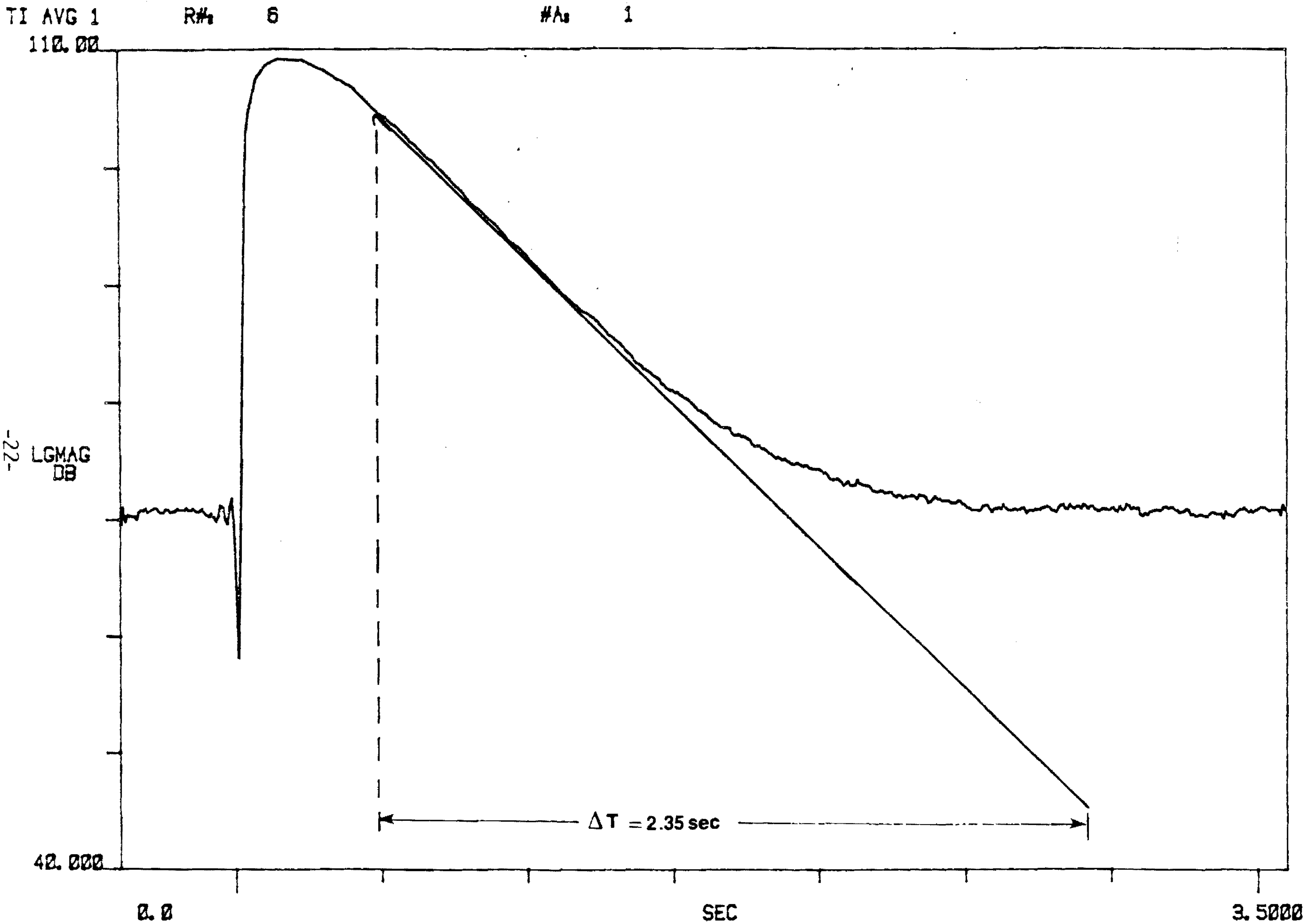


Fig. 11 Time History of Reverberant Noise Field Decay

CENTRAL SOYA PLANT



-22-

Fig. 12 Time History of Reverberant Noise Field Decay
TIP TOP PLANT

The values in Table 7 are reasonably close to the broadband values shown in Table 5, thereby confirming these values. Due to the non-diffuse conditions existing in the Central Soya Plant, the decay curve for it seems to exhibit some non-linearity which was not accounted for in the straight-line extrapolation. This may explain part of the difference between the abosorption coefficient determined for it by this method and that determined by the direct/reverberant field method.

SOURCE EVALUATION

Introduction

Observations made earlier of the general environment indicated only a few major sources were distinguishable above the general din. In order to complete an assessment of the poultry noise problem, a study of these noise sources was performed.

Sound Power Estimates

Using the information contained in the contours of Figures 4 and 5, an estimate was made of the A-weighted sound power output of all distinguishable noise sources. The technique used involved observing that contour line which was within 2 to 6 feet of the apparent acoustical center of the source, calculating the area encircled by the contour line, determining the radius of a circle with an equivalent area to that enclosed by the contour, and assuming a symmetrical hemispherical contour in the vertical plane. These inputs were then applied to the following equation:

$$Lw = \bar{L}pH + 20 \log r + 10 \log 2\pi^{*}$$

Where

Lw = estimated A weighted sound power output

$\bar{L}pH$ = A-weighted sound pressure level of the observed contour line

r = radius of circle with equivalent area to that encircled by the contour line.

The selection of 2 to 6 feet was made because contour lines closer than 2 feet typically will be in the near field of the source, while those farther than 6 feet typically will reflect significant reverberant noise field contributions. Unfortunately, certain contour lines within these distance limits were still unduly influenced by contributions from either the reverberant environment or another nearby source. Consequently, any source whose contour pattern appeared to be significantly influenced by activities other than from the direct noise field of that source was listed as having a sound power output which was not determinable from the contour data.

Applying the information contained in the contour plots, the values in Table 8 were developed.

---

*Reference 2, page 155.

Table 8

ESTIMATED SOUND POWER OUTPUTS OF MAJOR SOURCES

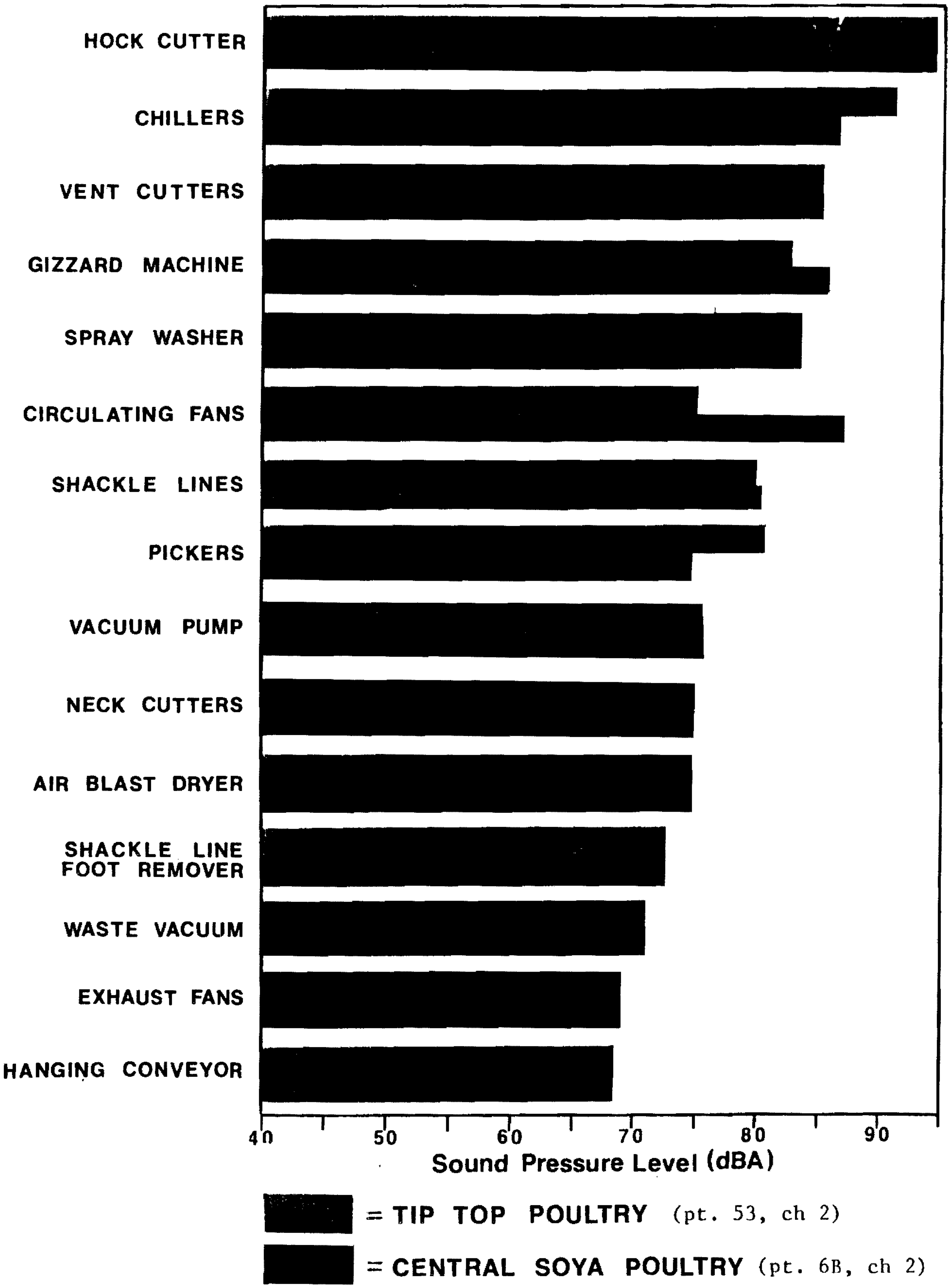
Central Soya Plant		Tip Top Plant	
Lung Guns	108.2dBA	Lung Guns	102.7dBA
Chillers	not determinable	Chillers	102.7dBA
Fan	94.7dBA	Exhaust Fan	not determinable
Hock Cutters	103.9dBA	Hock Cutters	100.2dBA
		Drying Air	94.7dBA
		Gizzard Peeler	not determinable
Total	109.7dBA	Total	107.05dBA

From these estimates, it appears that the top three noise sources in both plants are the lung guns, a chiller component, and hock cutters. The data in the Central Soya plant, however, need qualifying. The chiller component was positioned so that the lung guns masked much of its observable contribution. However, it is apparent in Figure 4 that a large contribution is coming from the chiller area as noted by the presence of a local increase in sound pressure level in the area immediately between the lung guns and the gizzard peelers. Since the gizzard peelers are apparently not producing that intense a signal, only an item on the chillers appears capable of being the second source. Also the hock cutters in the Central Soya plant were positioned in the picking room such that the combination of their outputs and the reverberant field associated with the pickers could have resulted in observed sound pressure levels more intense than those associated with the direct field of just the hock cutters. These two points are made so that the reader can apply caution when liberally interpreting the benefits of source sound power reduction in the Central Soya plant.

Source Contribution Assessment

As a means of evaluating the contribution of all sources to a locally observed sound pressure level in the noise contour of Figures 4 and 5, a microphone was located at point 6B, channel 2, in the Central Soya plant (see Figure 1) and point 53, channel 2, in the Tip Top plant (see Figure 2). With all sources turned off in each plant, individual sources were turned on and off one at a time. Figure 13 presents the A-weighted sound pressure levels observed for each source tested in each plant. Appendix D provides frequency contribution information about each source in addition to a comparison of the combined frequency spectra of all sources tested to that observed at

Fig. 13 Source Contribution A-Weighted Sound Pressure Level at a Single Point in Each Plant



that point in each plant under normal operating conditions. It should be noted at this time that a few major sources were not operated in each plant because of difficulties encountered at the time of testing.

These findings provide information which must be interpreted cautiously. For instance, the measurement point was close to some sources and far away from others implying care be taken in comparing source levels. Also, many of the sources were operated under conditions not typical to normal usage, such as the chillers, which were operated without ice or water, and the neck cutter, which lacked animal fat from the chickens to prevent an uncharacteristic whine.

This analysis, however, does provide some insight into the hurdles which can arise from keying reduction efforts on only one source, by displaying how the contributions of other sources can become significant even though they are currently masked during normal conditions.

THE PROBLEM IDENTIFIED

Using the data from the previous sections, an analysis was performed to determine if essentially all of the noise levels currently observed in each plant were directly and indirectly the result of only the few "major" sources identified. Since the direct effects were observable in the contour plot, only the indirect effects or the contribution of these sources to the reverberant field needed analysis. To perform the analysis, the following equation was used:

$$Lpr = Lw + 10 \log \left(\frac{4}{S \, \alpha SAB} \right)^{*}$$

Where

Lpr = sound pressure level of the reverberant field

Lw = sound power output of major noise sources

S = surface area of evisceration area

αSAB = average broadband surface absorption coefficient

In this calculation, the values of α SAB utilized were those for broadband noise from Table 5. Using the surface area values contained in Table 9, the calculations were performed.

Table 9

SURFACE AREAS ESTIMATED FOR TOTAL EVISCERATION AREA IN EACH PLANT

Central Soya Plant	Tip Top Plant
1834 m^2	1669 m^2

The calculations yielded the following results:

Central Soya Plant

Lpr = 90.6 dBA

Tip Top Plant

Lpr = 90.7dBA

These values were reasonably close to the A-weighted sound pressure levels observed in the reverberant field of each plant per Figures 4 and 5:

*Reference 2, page 228. Note that due to non-diffuse conditions, a factor of 2 rather than 4 was used (see page 17).

Central Soya Plant

Lpr = 90.4dBA (space averaged)

Tip Top Plant

Lpr = Between 90 and 91dBA

Therefore, it appears that the reverberant noise field in these plants is currently powered by only those few "major" noise sources identified in the contour plots.

As a result of these findings, it now becomes evident why there have been many failures in reducing overall plant noise levels. Since most efforts are focused on source quieting, only those efforts which are focused on a major source will be successful in significantly reducing noise levels, and even then the success will depend on the presence or absence of other intense noise sources. Clearly, therefore, a plant must know its major noise sources if source quieting is to be successful. On the other hand, increasing surface absorption in the plant will almost assuredly reduce noise levels in much of the plant through its impact on the reverberant noise field. But, even this solution will be limited in its overall effect by the nature of each plant's reverberant noise field and the distribution and total sound power output of sources throughout the plant.

POTENTIAL SOLUTIONS

In discussing potential solutions to the poultry processing noise problem, it should be stressed that each plant will have differing circumstances which impact their ability to effectively implement certain changes. Nonetheless, these solutions appear practical on the whole for the industry.

Source Solutions

There has been activity in the area of noise reductions at the source. Some actions have deliberately focused on noise reduction, others on productivity improvement. Here is an overview of possible solutions to reducing noise from sources in a poultry processing plant.

Lung gun noise is currently being alleviated in many plants with the use of drawing machines which also pull out lungs. Drawing machines are being widely used in broiler plants which process a relatively uniform bird size. Unfortunately, plants which process hens or a wide range of bird sizes cannot use the existing drawing machines. For these plants, there have also been studies* to baffle or shield noise from the body cavity during the lung gun operation. However, these baffled lung guns have not been used extensively because the baffles are difficult to keep clean and obstruct the view of the operator.

Efforts to quiet hock cutters have been restricted largely to isolating the machine from personnel. There are several designs of hock cutter available, but none are particularly quiet.

Chiller noise can typically be alleviated through vibration dampening. Impact noise from ice drop-off stations is often observable on ice slush chillers. This noise can be reduced through dampening of metallic surfaces in the ice delivery system, as well as by reducing the ice load through energy conservation efforts to jacket the chiller trough. Refrigerated chillers can further eliminate the need for ice altogether.

Lastly, the importance of regular and proper machinery maintenance cannot be overemphasized as a means of controlling source noise. Worn bearings, misaligned drive shafts, and improperly lubricated fittings can all turn a normally quiet machine into an unusually loud machine.

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*References 4 and 5.

Room Acoustic Solutions

There has also been activity in the area of increasing the absorptive qualities of a plant.

For the most part, panels made of absorbant material, such as fiberglass or foam, have been developed.* These panels have been covered with plastic films to meet USDA requirements for use in food plants. But difficulties have occurred in the plastic film withstanding the harsh elements of most plants. Perhaps the single biggest problem is shearing of the plastic cover which renders the panel unacceptable for continued use by USDA requirements.

If a design could be developed which utilized a screen to protect the plastic film while remaining transparent to noise or if a cover could be designed of a film tough enough to withstand cleaning and other routine operations, then absorbing panels would clearly help in reducing the transmission of sound in the reverberant noise field.

*References 4 and 5.

CONCLUSION

In general, the poultry processing noise problem is the result of loud sources and reflective surfaces. Within the evisceration area, where nearly 60% of all processing personnel are stationed, it can be concluded that only a few major sources (lung guns, a chiller component, and hock cutters) are responsible for essentially all direct and reverberant sound pressure levels currently observed during normal operations. Consequently, any efforts to reduce the noise problem must first address the sound power output of these sources and/or the absorptive qualities of the room.

Reducing the sound power of major sources can be accomplished either by redesign or source isolation. Studies of redesign have been performed on many items.* The lung guns in particular have had several redesigns proposed. The thrust of these designs has been to shield the sound originating in the body cavity from the suction process. However, these baffled lung guns have not been used extensively because the baffles are difficult to keep clean and obstruct the view of the operator.

Isolation of a source has also been performed on such items as pickers and in some instances hock cutters. However, as was shown in the Central Soya plant, not all isolation mediums have been totally effective.

For either source quieting or isolation to work, the technique will need to be simple and inexpensive and not substantially change the manner in which processing is currently done. Yet, for every decibel of total sound power reduction achieved, a corresponding decibel reduction in observed sound pressure level will be noticed, perhaps not uniformly, but on a space average throughout the plant. The key words here, however, are total sound power reduction. It must be remembered that other sources, which are currently unidentifiable, will begin to contribute significantly to total sound power as the levels of the current major sources are reduced. This implies that a compounding problem exists as lower and lower sound pressure levels are sought.

Increasing the absorptive qualities of the plant is also an area where some studies have been performed.** However, difficulties have arisen with both cost and durability. Still, there is optimism that a design exists which will meet all criteria. Treatment of only the ceiling areas of the two plants studied could help reduce overall sound pressure

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*Reference 3.

**Reference 4 and 5.

levels approximately 5dB on average. The ceiling of the Central Soya plant contains approximatley 35% of the total surface area and of the Tip Top plant contains approximately 30% of the total surface area.

However, room absorption is also limited in the total sound pressure level reduction achievable. This is because as reverberant levels decline, direct field levels from more obscure sources will begin to control local sound pressure levels. By reducing the intensity of the reverberant field, however, the potential for the current problem of the exposure by processing personnel being controlled by one or two noise sources will be reduced, which will provide both long-lasting and far-reaching benefits.

REFERENCES

1. Handbook of Noise Control, Cyril M. Harris, 2nd Edition, McGraw-Hill, 1979

2. Noise and Vibration Control, Leo Beranek, McGraw-Hill, 1971

3. Summary of Noise Investigations for the Poultry Industry, W. M. Idhe, Report to the Poultry Industry Advisory Committee on Safety and Health, 1973

4. Materials for Noise Reduction in Food Processing Environments, S. A. Waggoner, J. F. Shackelford, F. F. Robbins, Jr., and T. H. Burkhardt, APPLIED ACOUSTICS, Vol. 11, 1972

5. Clean and Quiet Baffles and Panels, Owens Corning Fiberglass, Publication 1-SD-9224, 1979

EQUIPMENT USED FOR DATA ACQUISTION & ANALYSIS

Microphones: B+K Precision condenser-type acoustic transducers were used for all sound pressure level measurements.

Channel	Cartridge Type	Serial No.	Preamp. Type	Serial No.
1	4165	775332	2619	748130
2	4165	750790	2619	748145
3	4165	708529	2619	748110
4	4165	732743	2619	748132

Power Supply to Pre-Amplifier: Two type 2807 B+K twin channel power supplies.
Tape Recorder: Hewlett-Packard type 3964A Instrumentation Tape Recorder.

Power Source for Field Use: All microphones and tape recorders were operated from a TRIPP-LITE 400-watt inverter that was powered from a 12-volt automobile battery. The use of the inverter was necessary to make the data-gathering equipment more portable and to reduce the problems encountered with voltage fluctuations and power line noise that were present in some of the plants where we acquired data.

Sound Source: The source for the reverberation time was a .22 caliber blank pistol.

The source for the direct field/reverberent field comparison was a B+K type 4205 white noise generator connected to a Bogen 30-watt power amplifier. The power amplifier drove a 12-inch paper loudspeaker that was mounted in an 18-inch square wooden box.

Analyzer: All time records and spectra were computed on a Hewlett-Packard type 5420A digital signal analyzer. The results were plotted with a Hewlett-Packard type 8972 four-color graphics plotter.

RMS Averages: All root-mean-square averages were determined with a fluke type 8010 digital multimeter.

A-Weighting: B+K Type 2203 Precision sound level meter was used to A-weight all readings. This meter was also used to take auxiliary readings in the plants.

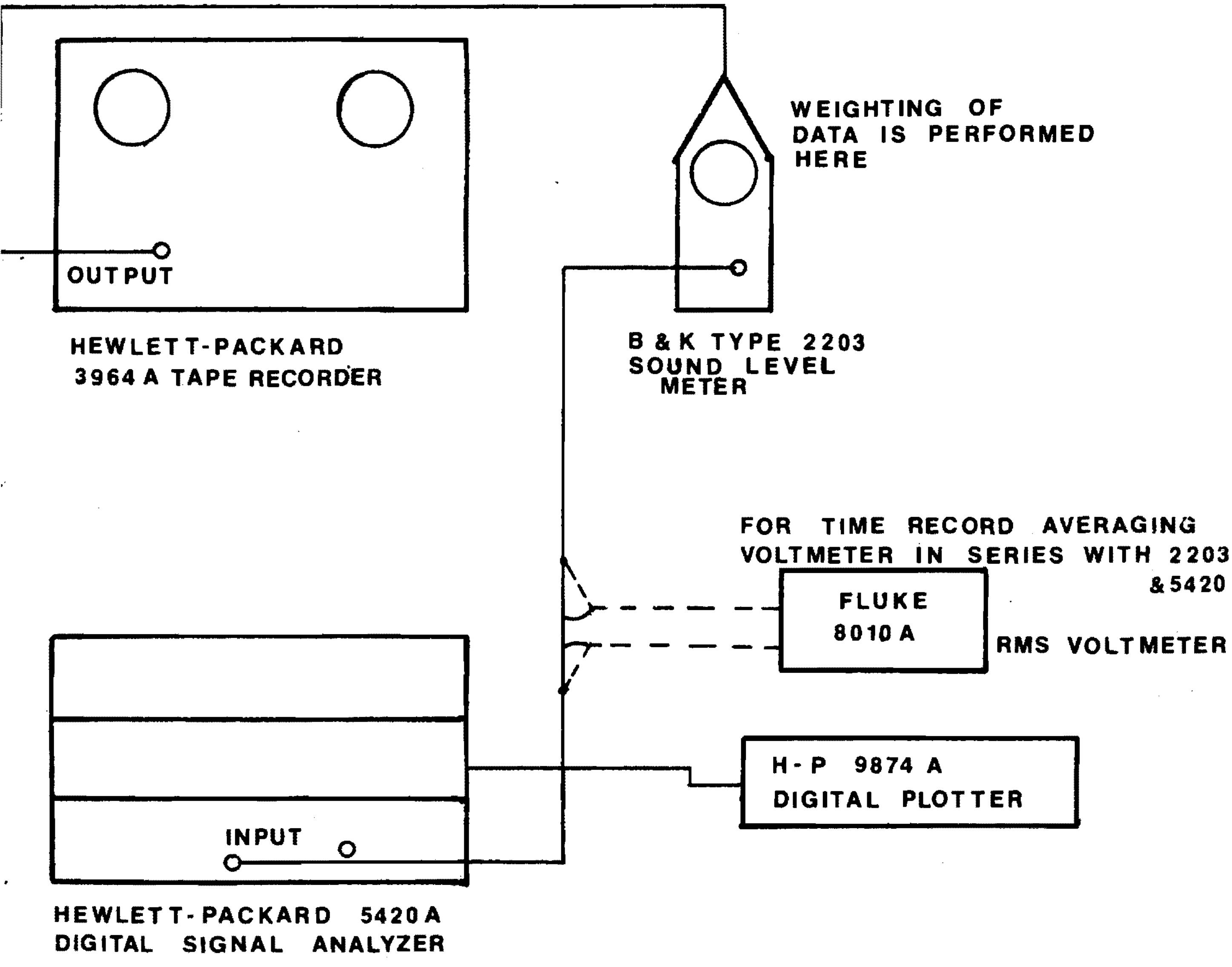


Figure 1A

DATA ANALYSIS CONFIGURATION

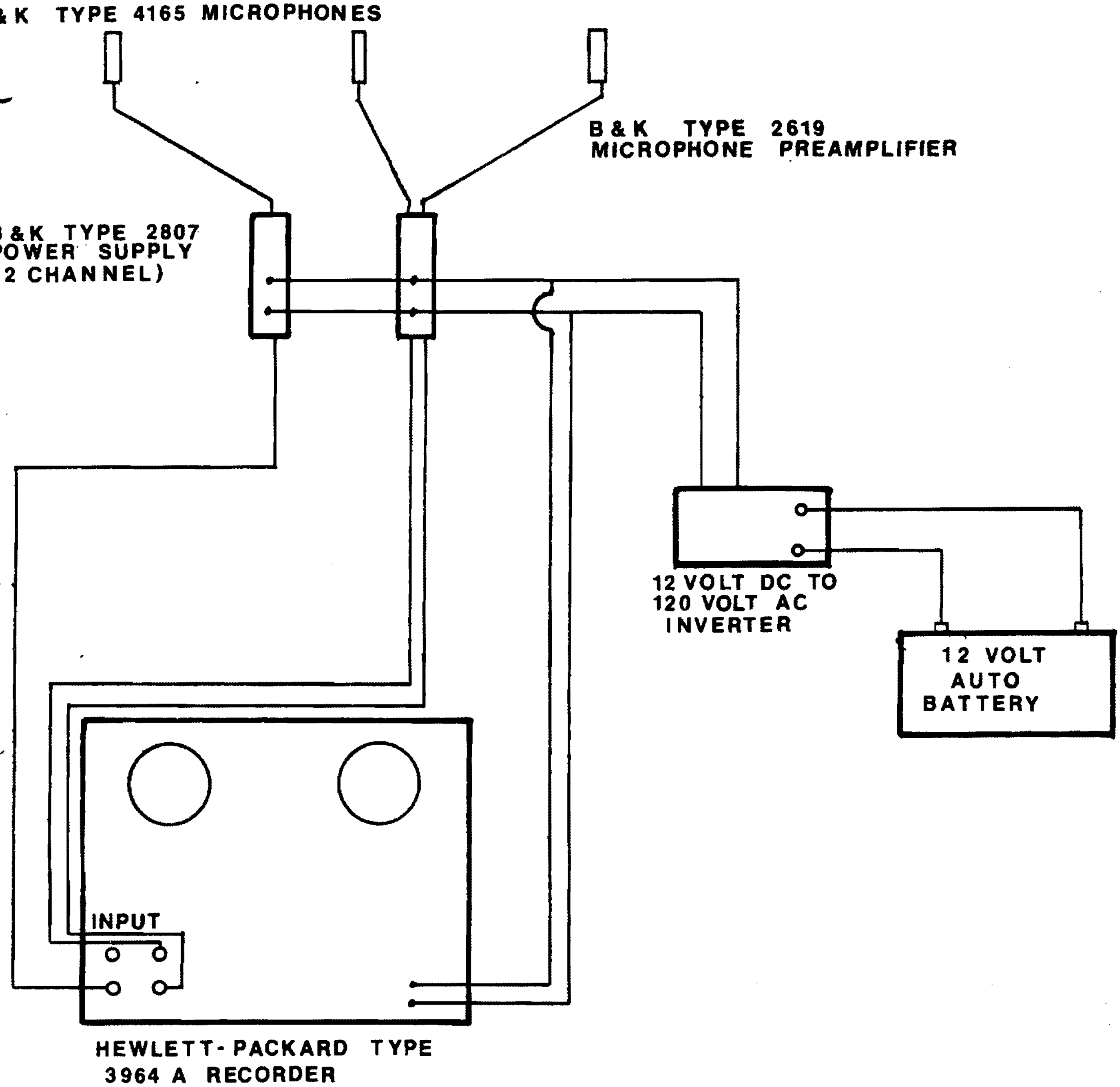


Figure 2A

DATA RECORDING CONFIGURATION

Appendix B

GENERAL PLANT ENVIRONMENT DATA

GENERAL PLANT ENVIRONMENT DATA

The figures in this appendix show frequency spectra and time histories of selected measurement points observed in both plants during normal operations. While not exhaustive, these points provide an example of the frequency characteristics observed throughout the noise field. The plant name and measurement position for each graph are noted in the upper right-hand corner. These values correspond to those coordinates listed in Figures 1-B and 2-B. Both Linear and A-weighted readings are presented for each point selected.

Warning: The frequency data are presented in both a linear and logarithmic fashion. Since the analyzer used was only capable of performing constant bandwidth analysis the logarithmic presentation is merely a distorted presentation of the constant bandwidth analysis. It is presented here only for those readers who are more familiar with viewing constant percentage bandwidth outputs.

Again, it must be stressed that the logarithmic presentations are not the result of constant percentage bandwidth analysis, but merely a distorted presentation of constant bandwidth analysis.

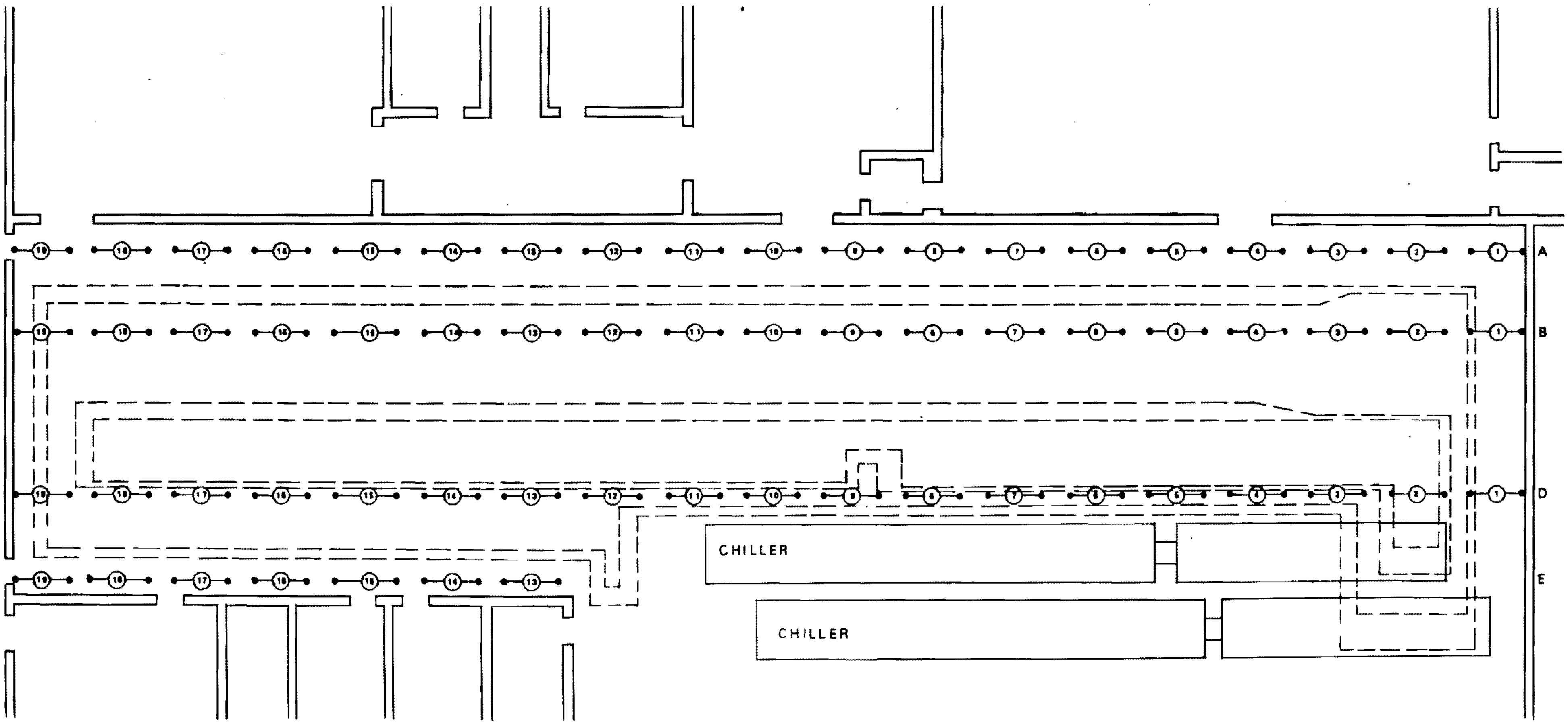


FIG. 1 B LOCATION OF MEASUREMENT POINTS IN CENTRAL SOYA

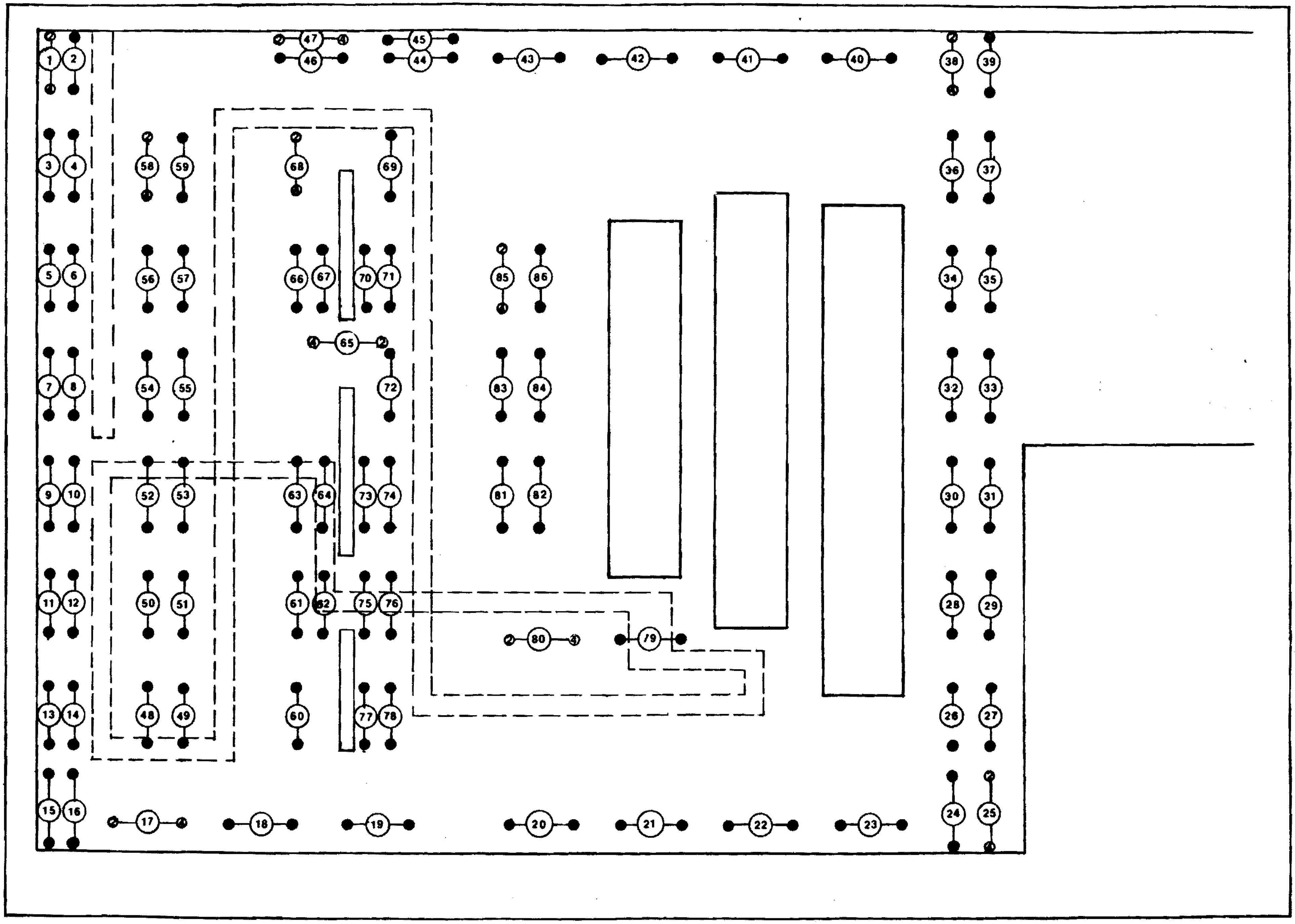


FIG. 2B LOCATION OF MEASUREMENT POINTS IN TIP TOP

Noise Contour

Data

FREQUENCY SPECTRA CENTRAL SOYA PLANT

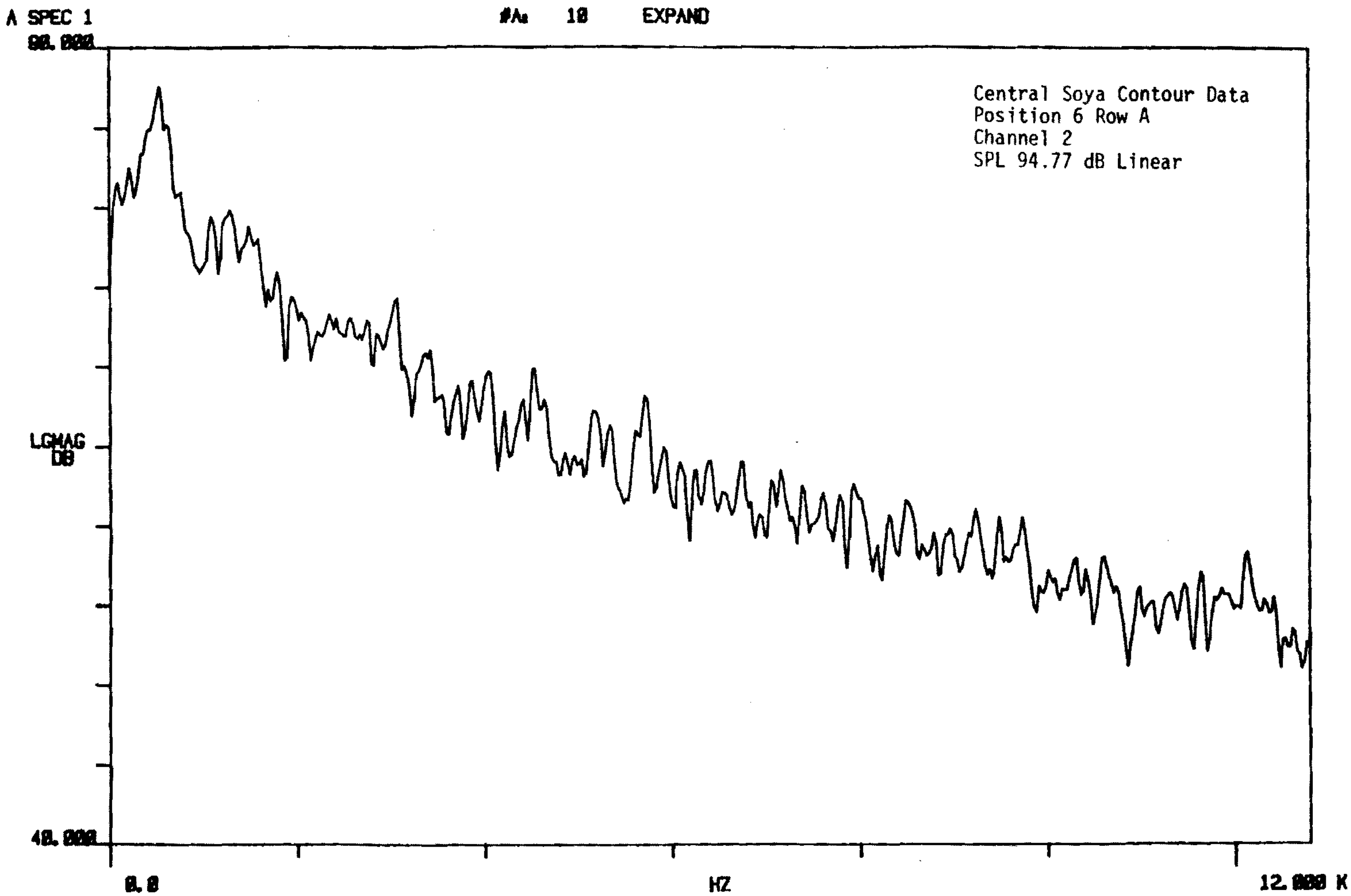

A SPEC 1
#A: 10
EXPAND
80.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 6 Row A
Channel 2
SPL 94.77 dB Linear

Figure 3B

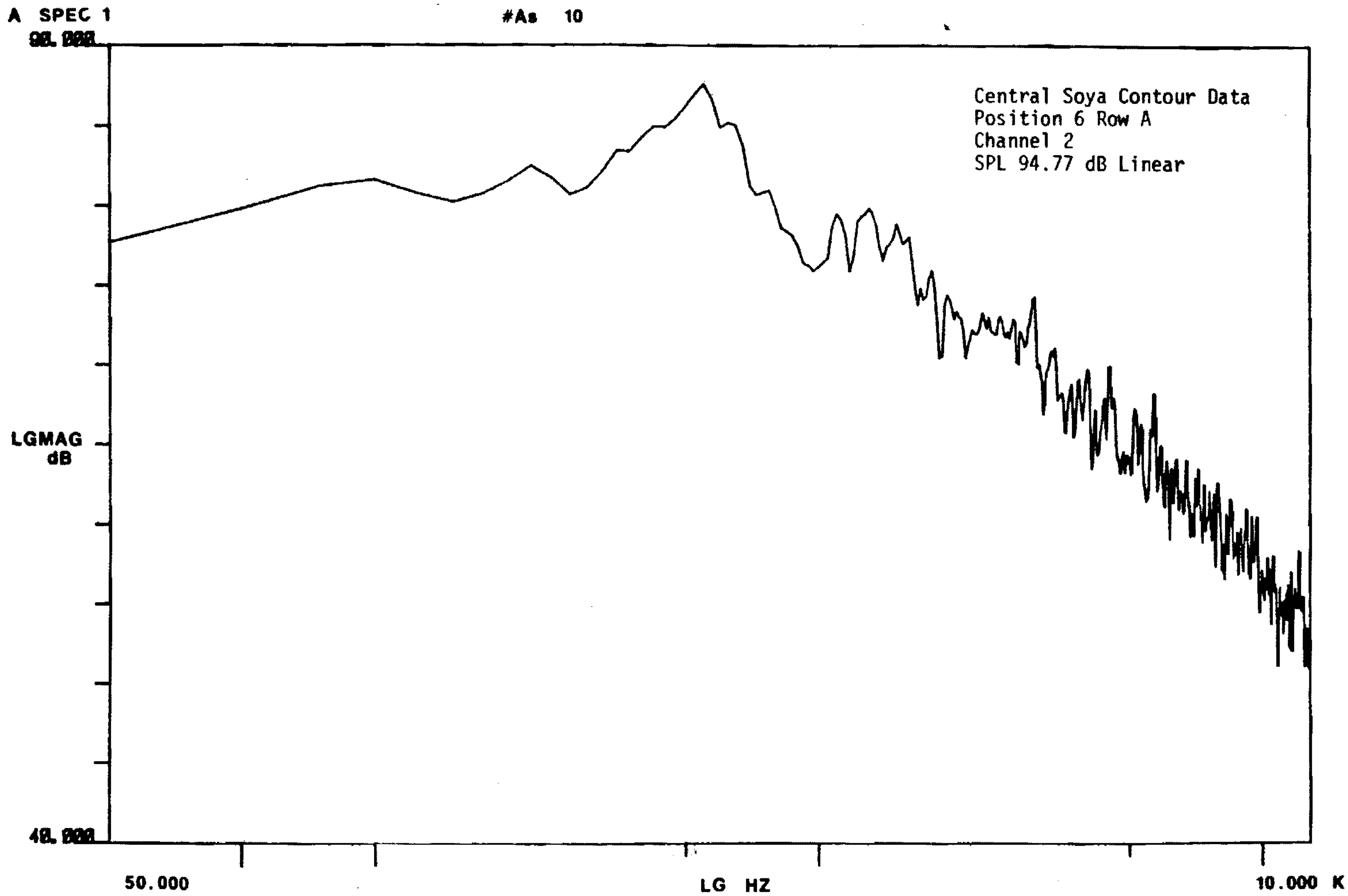
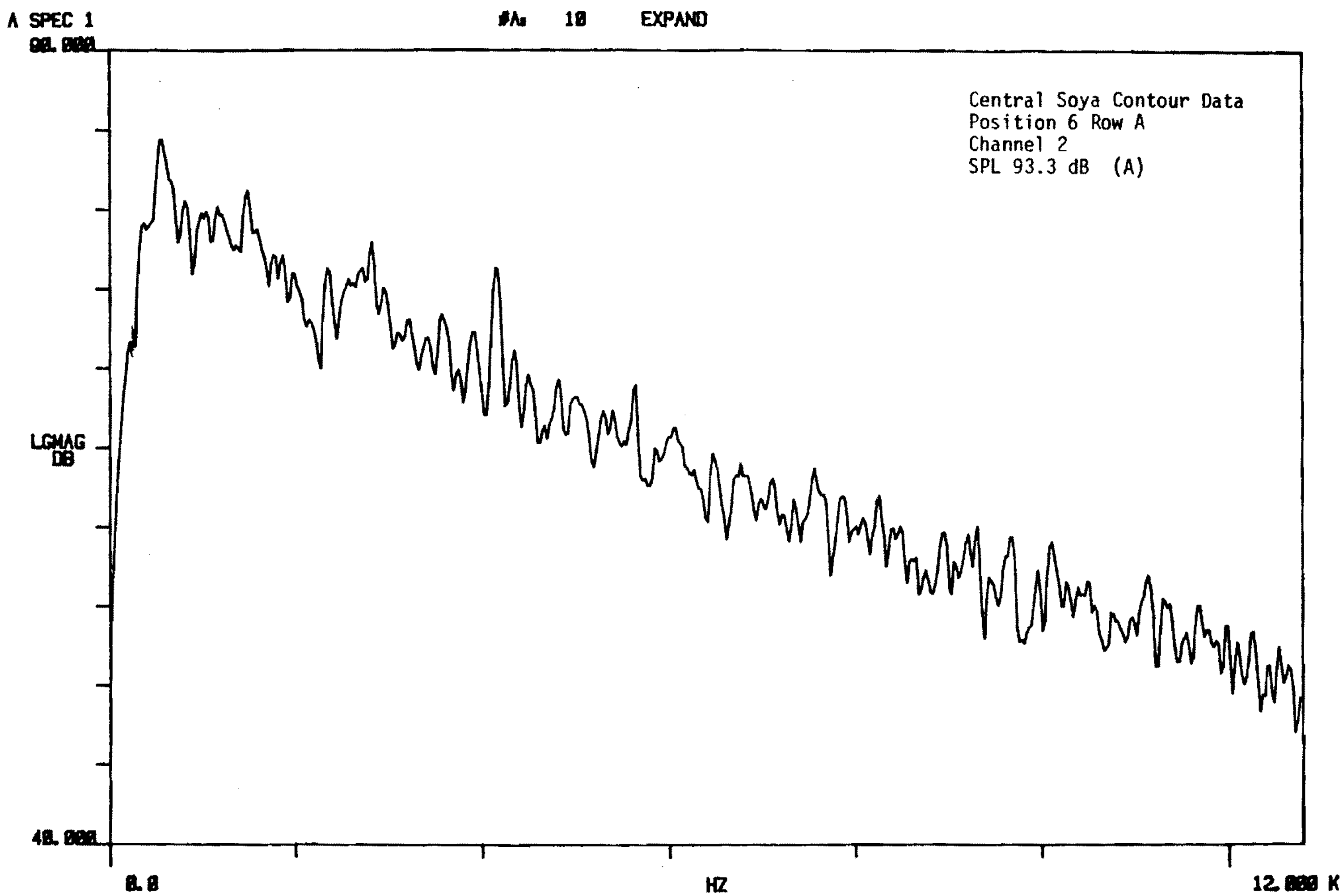

A SPEC 1
#As 10
90.000
LGMAG
dB
40.000
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 6 Row A
Channel 2
SPL 94.77 dB Linear

Figure 4B


A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
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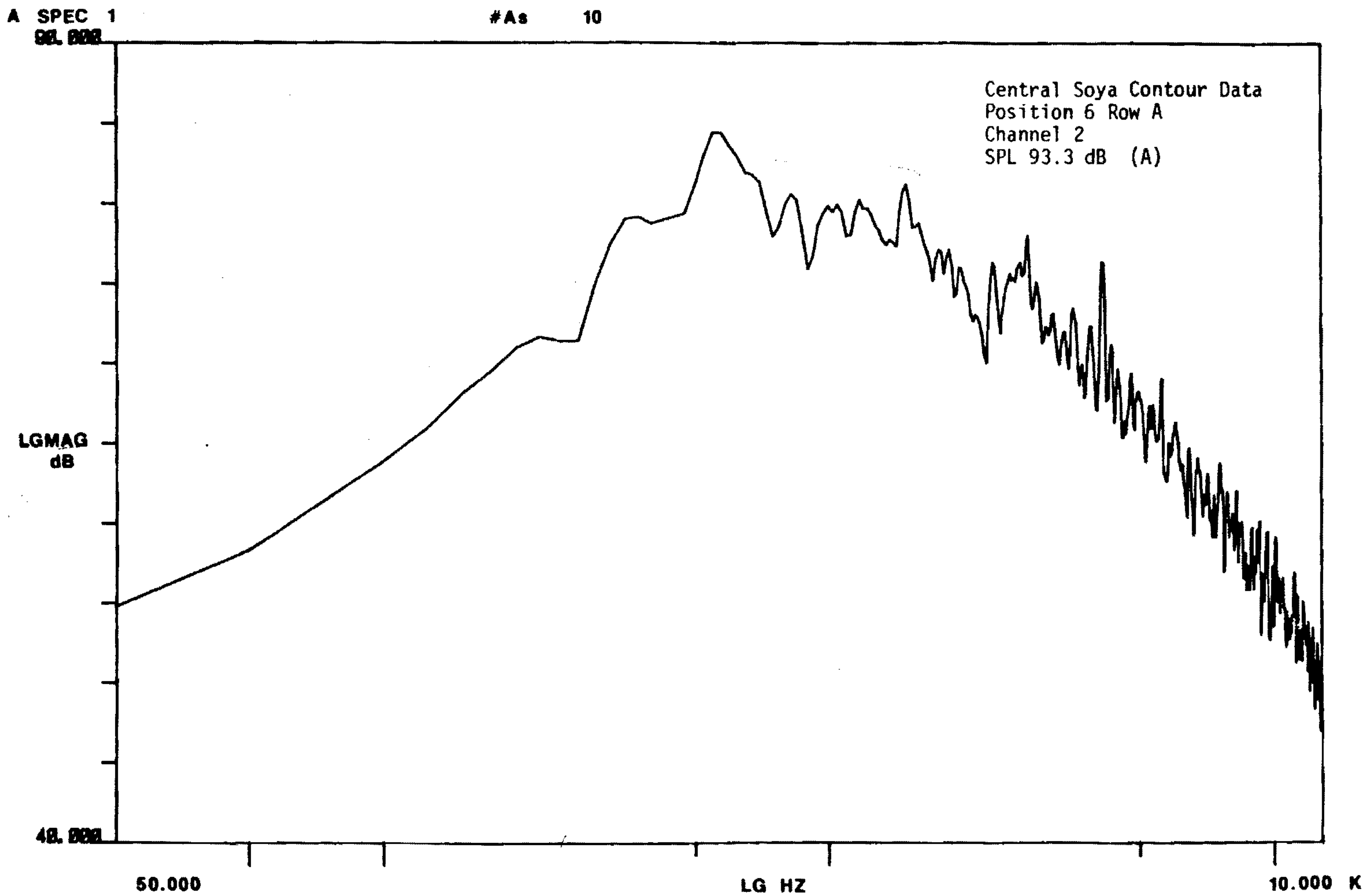
0.0
HZ
12.000 K
Central Soya Contour Data
Position 6 Row A
Channel 2
SPL 93.3 dB (A)

Figure 5B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90.000
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Position 6 Row A
Channel 2
SPL 93.3 dB (A)
LGMAG
dB
40.000
50.000
LG HZ
10.000 K

Figure 6B

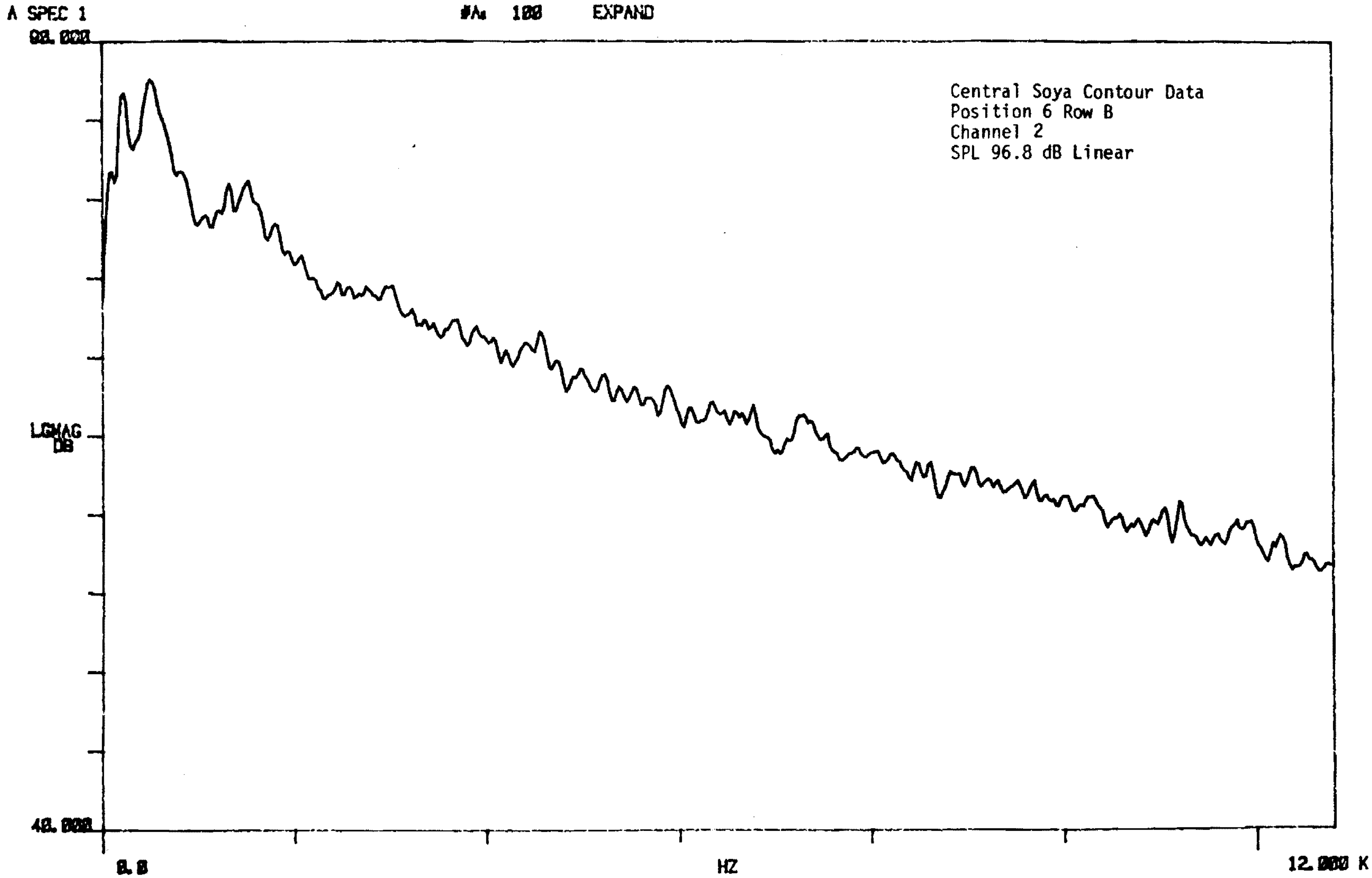
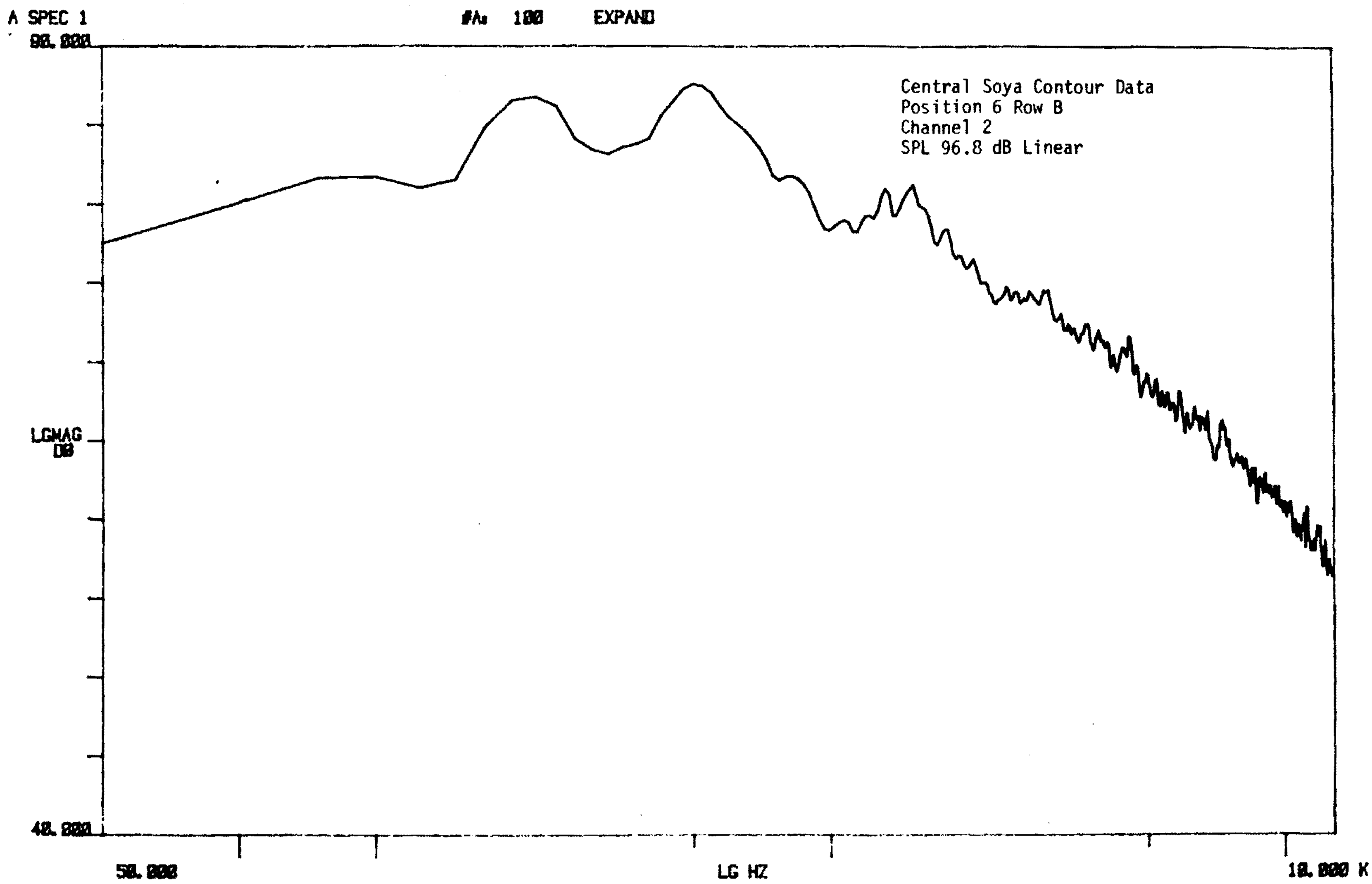

A SPEC 1
#A: 100 EXPAND
98.000
LGMAG DB
40.000
Central Soya Contour Data
Position 6 Row B
Channel 2
SPL 96.8 dB Linear
0.0
HZ
12.000 K

Figure 7B



A SPEC 1
#A: 100
EXPAND
90.000
LGMAG
DB
40.000
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 6 Row B
Channel 2
SPL 96.8 dB Linear

Figure 8B

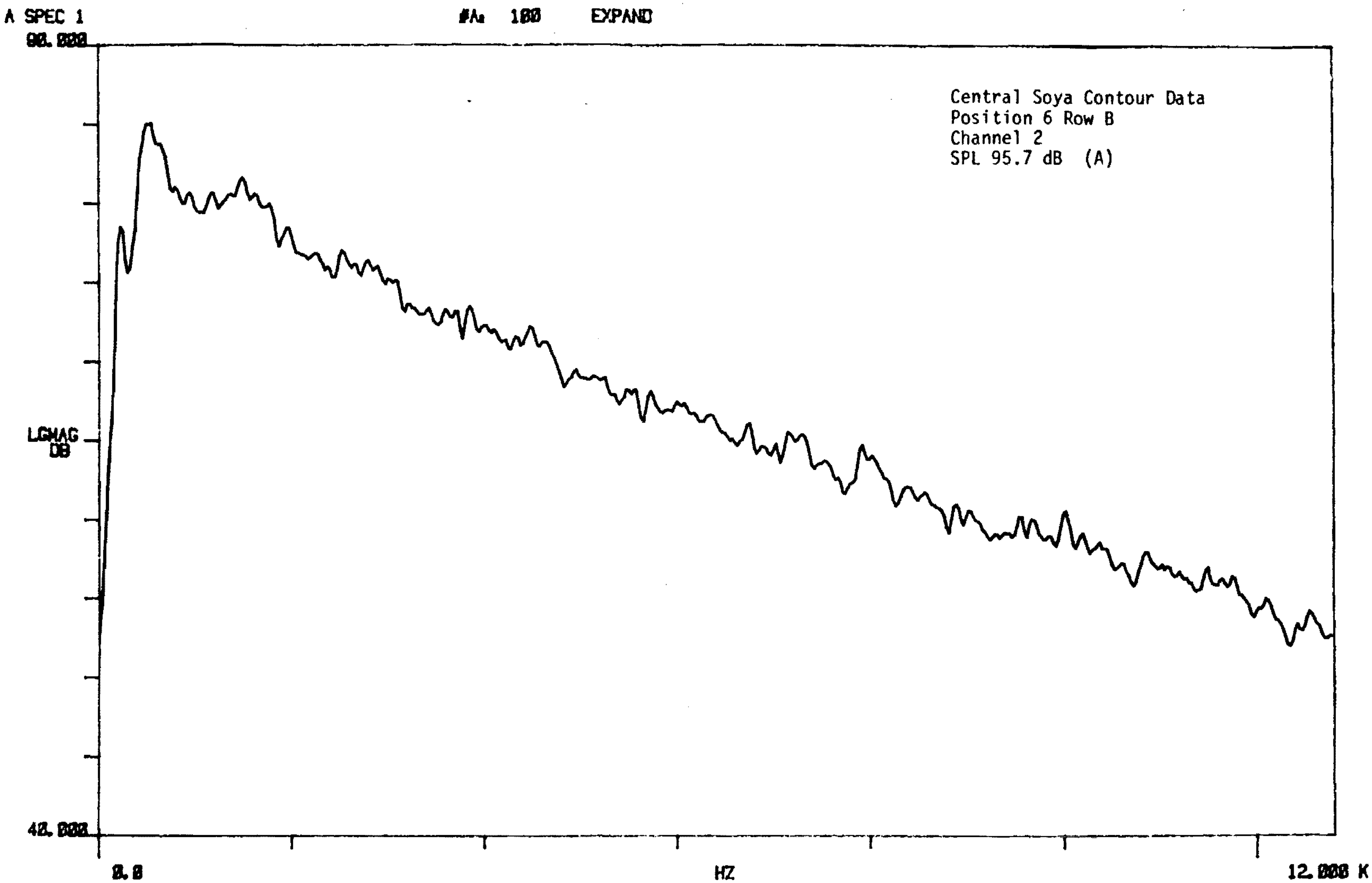

A SPEC 1
#A: 100
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 6 Row B
Channel 2
SPL 95.7 dB (A)

Figure 9B

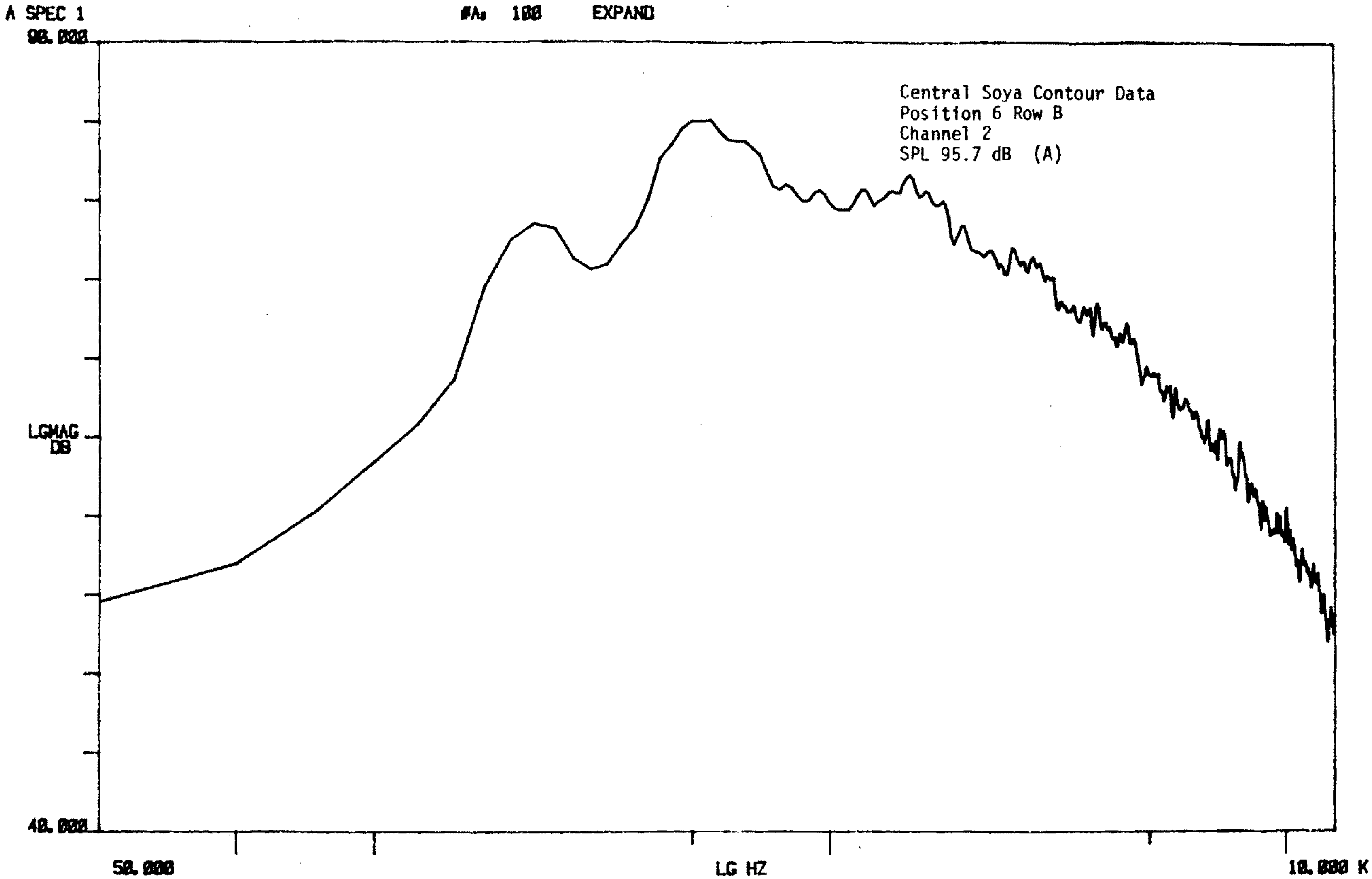

A SPEC 1
#A: 100
EXPAND
90.000
Central Soya Contour Data
Position 6 Row B
Channel 2
SPL 95.7 dB (A)
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 10B

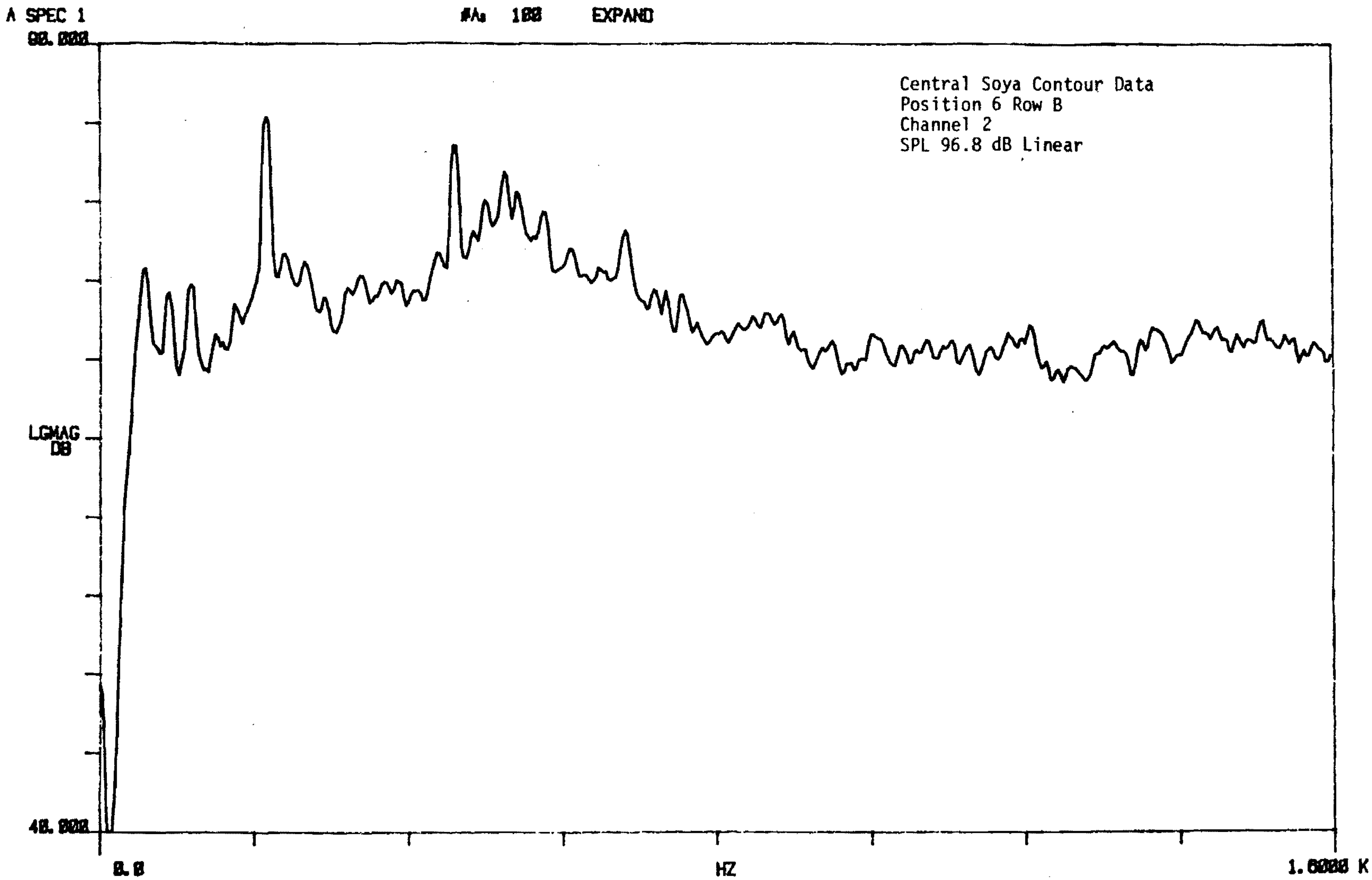

A SPEC 1
#A: 100 EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
1.0000 K
Central Soya Contour Data
Position 6 Row B
Channel 2
SPL 96.8 dB Linear

Figure 11B

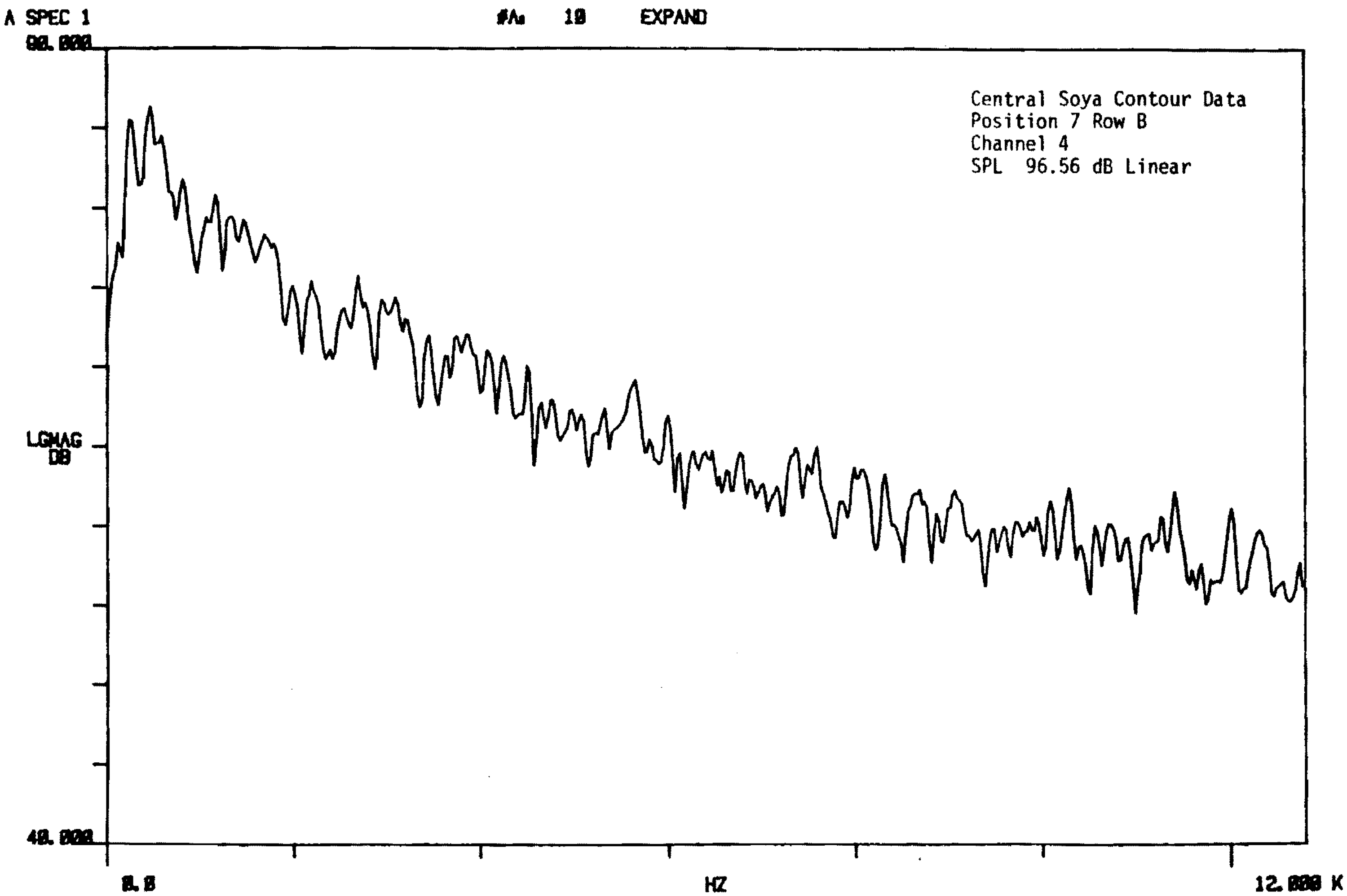

A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 7 Row B
Channel 4
SPL 96.56 dB Linear

Figure 12B

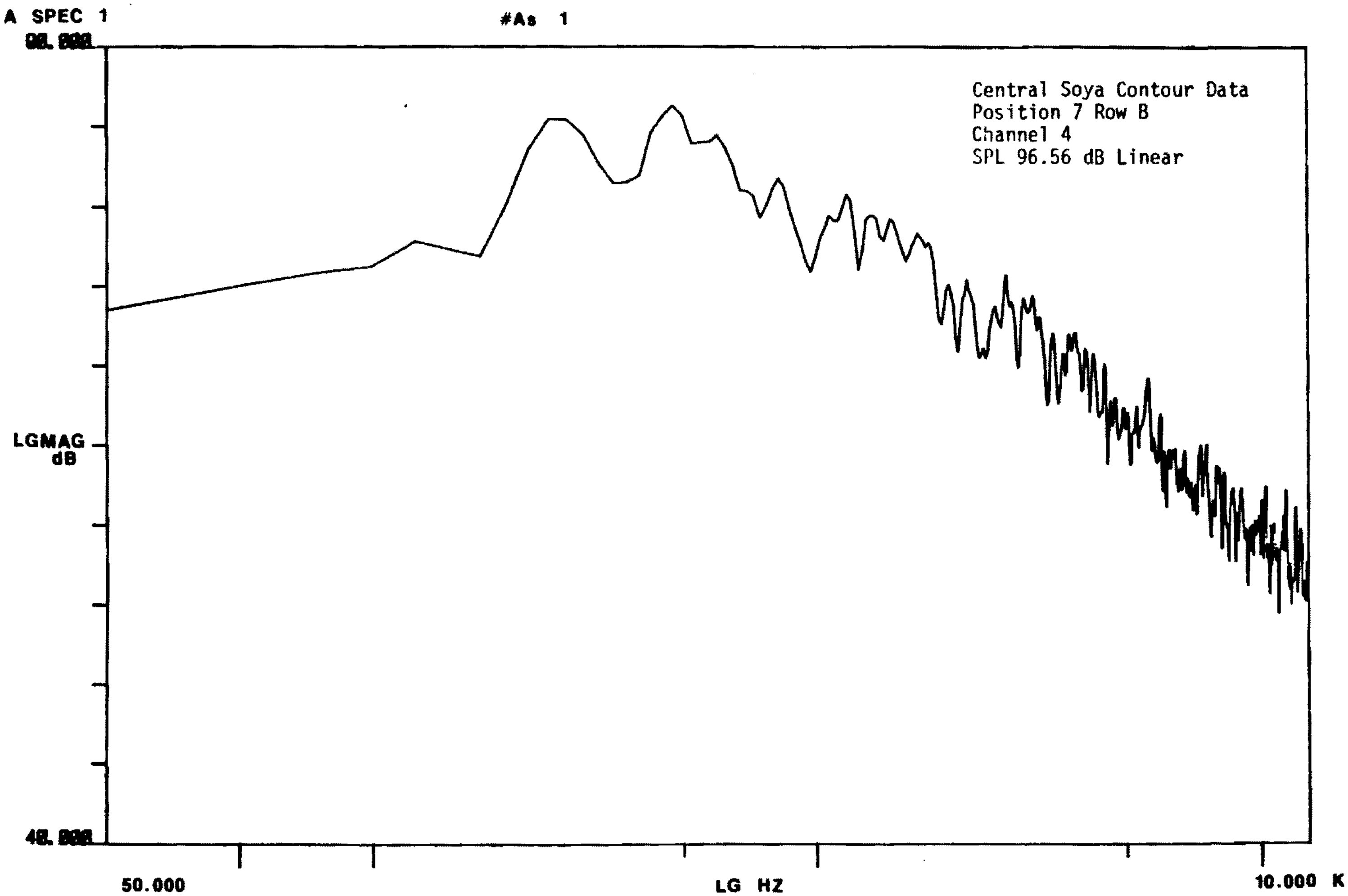
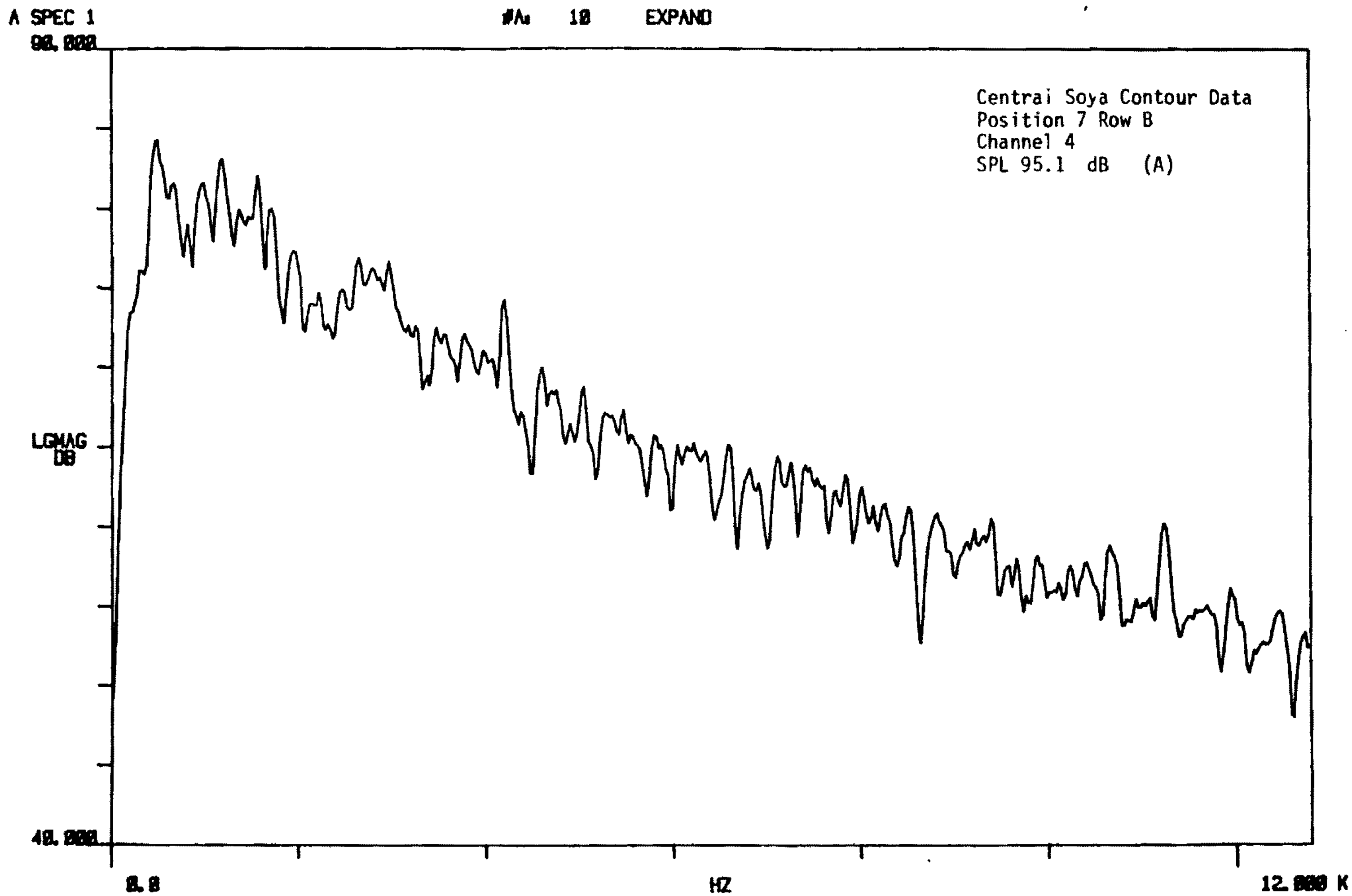

A SPEC 1
#As 1
Central Soya Contour Data
Position 7 Row B
Channel 4
SPL 96.56 dB Linear
LGMAG
dB
50.000
LG HZ
10.000 K

Figure 13B



A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Centrai Soya Contour Data
Position 7 Row B
Channel 4
SPL 95.1 dB (A)

Figure 14B

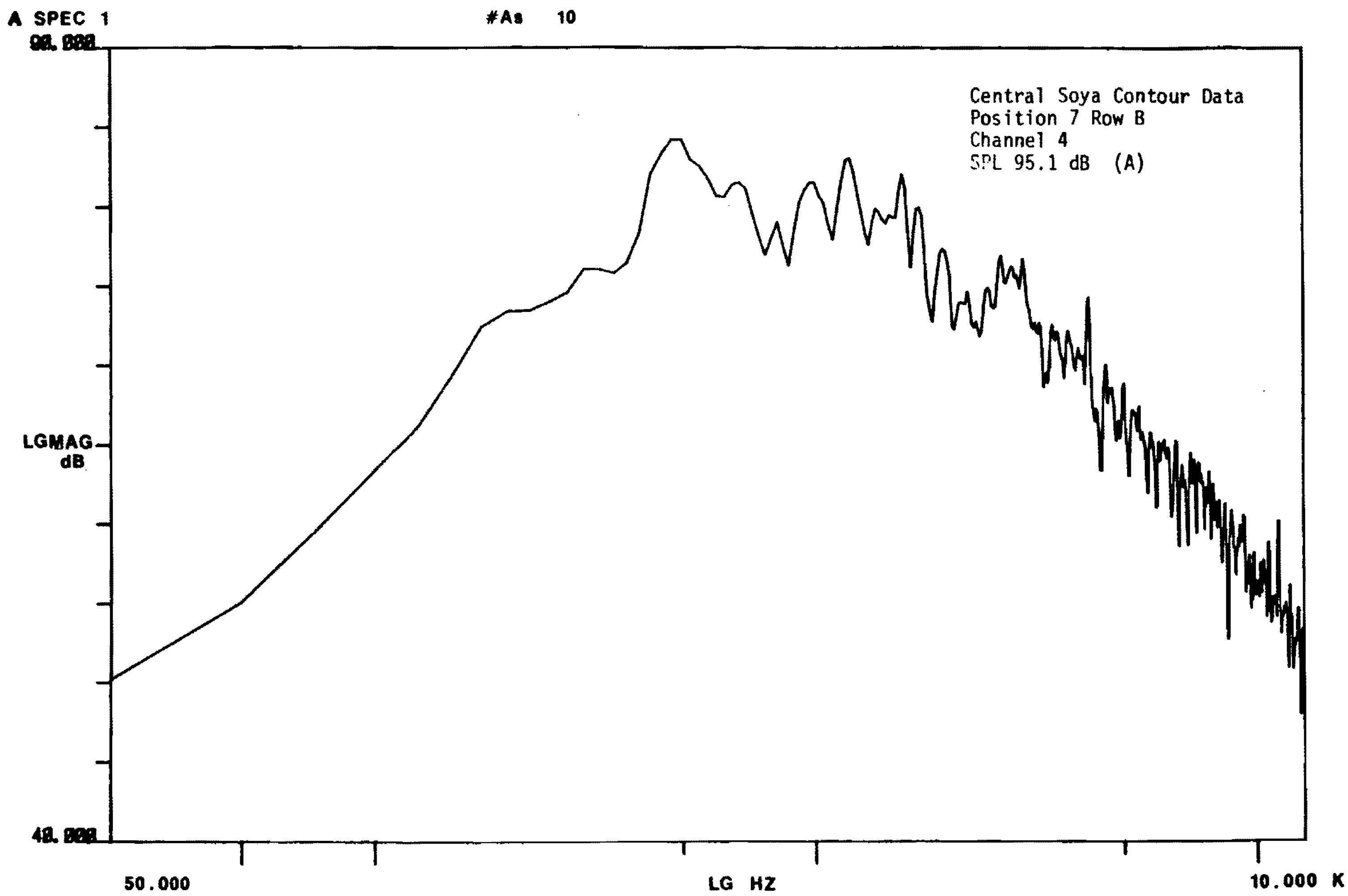

A SPEC 1
#As 10
LGMAG
dB
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 7 Row B
Channel 4
SPL 95.1 dB (A)

Figure 15B

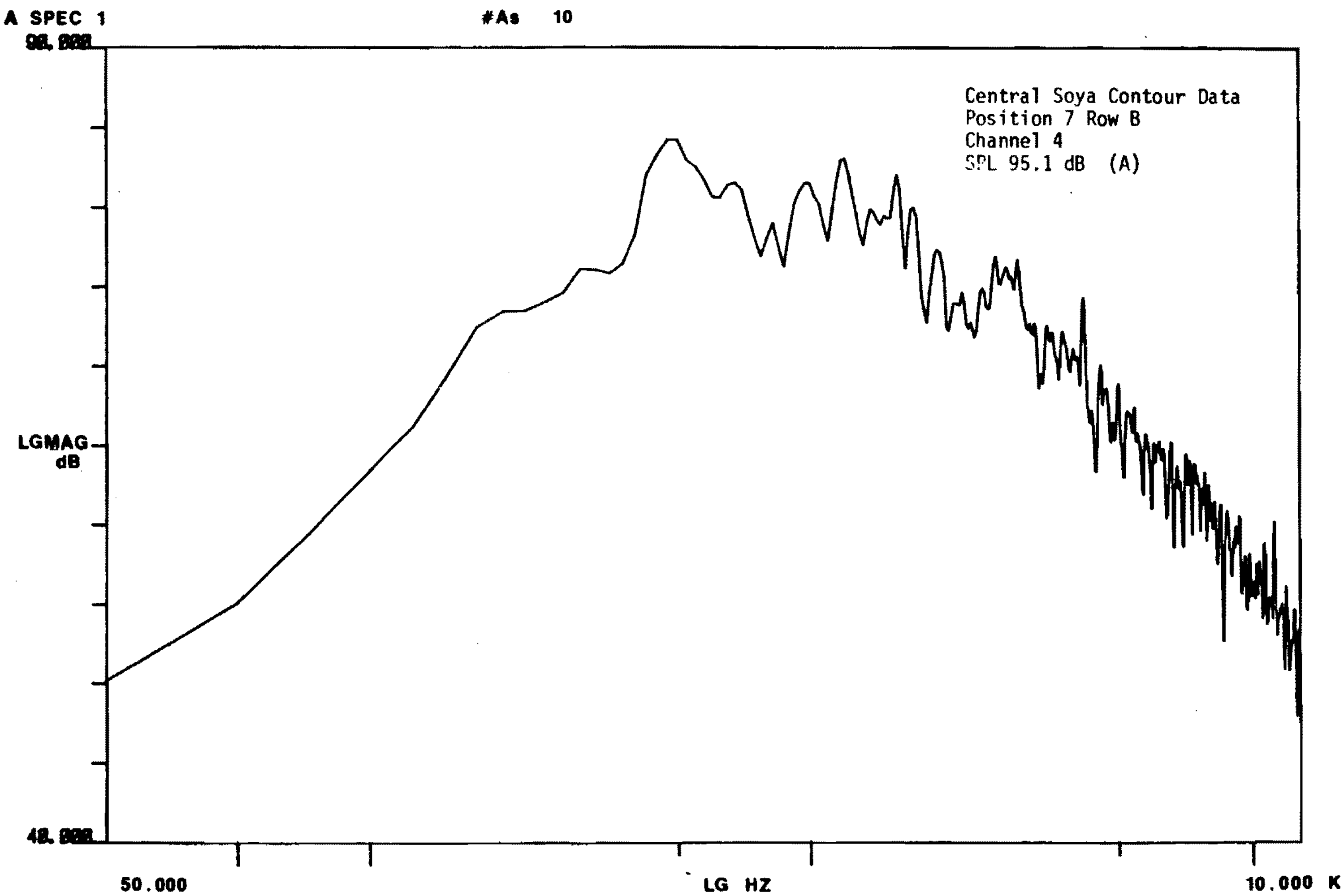
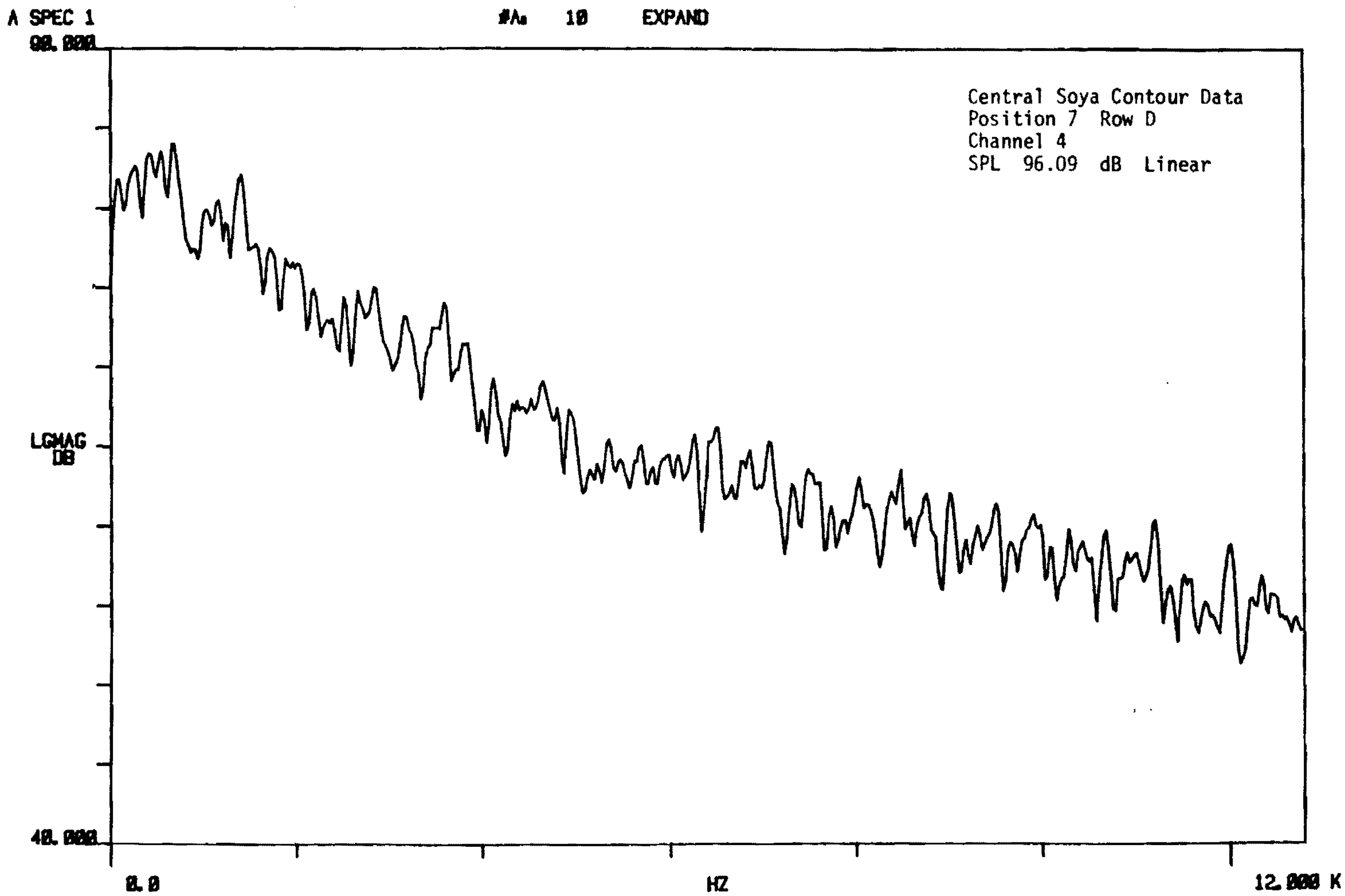

A SPEC 1
#As 10
LGMAG
dB
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 7 Row B
Channel 4
SPL 95.1 dB (A)

Figure 15B



A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 7 Row D
Channel 4
SPL 96.09 dB Linear

Figure 16B

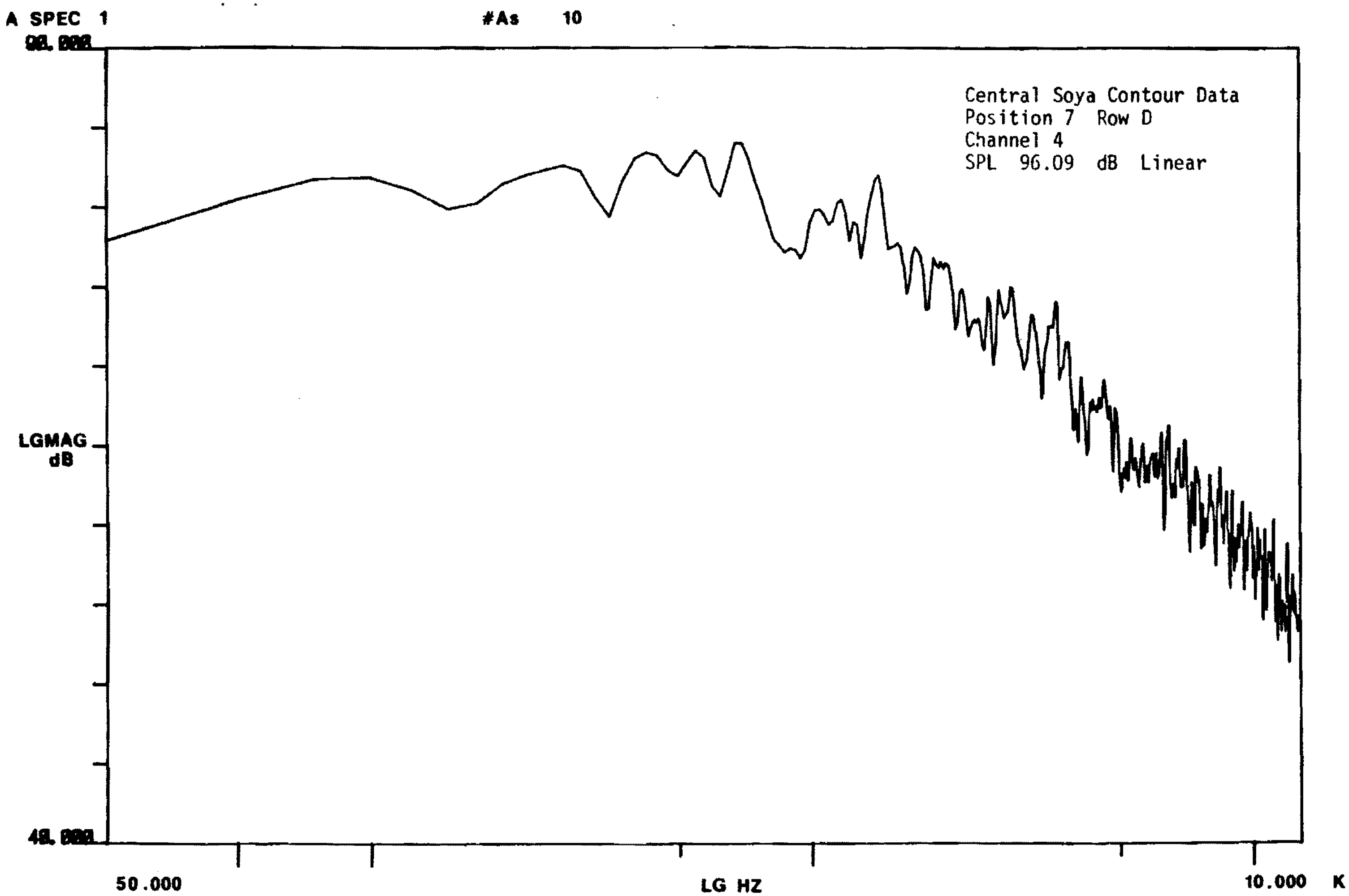

A SPEC 1
#As 10
90.000
Central Soya Contour Data
Position 7 Row D
Channel 4
SPL 96.09 dB Linear
LGMAG
dB
40.000
50.000
LG HZ
10.000 K

Figure 17B

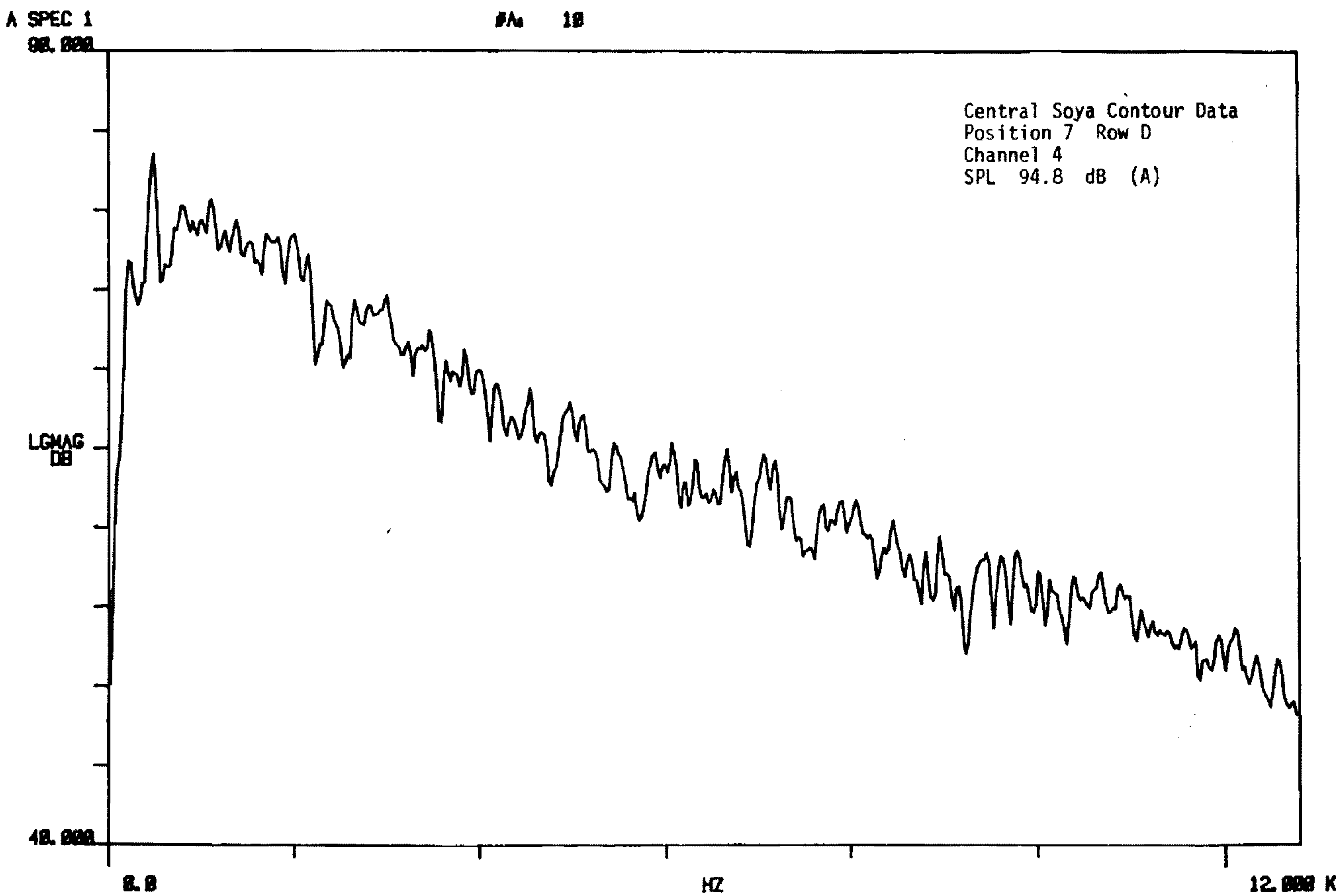

A SPEC 1
#A: 10
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 7 Row D
Channel 4
SPL 94.8 dB (A)

Figure 18B

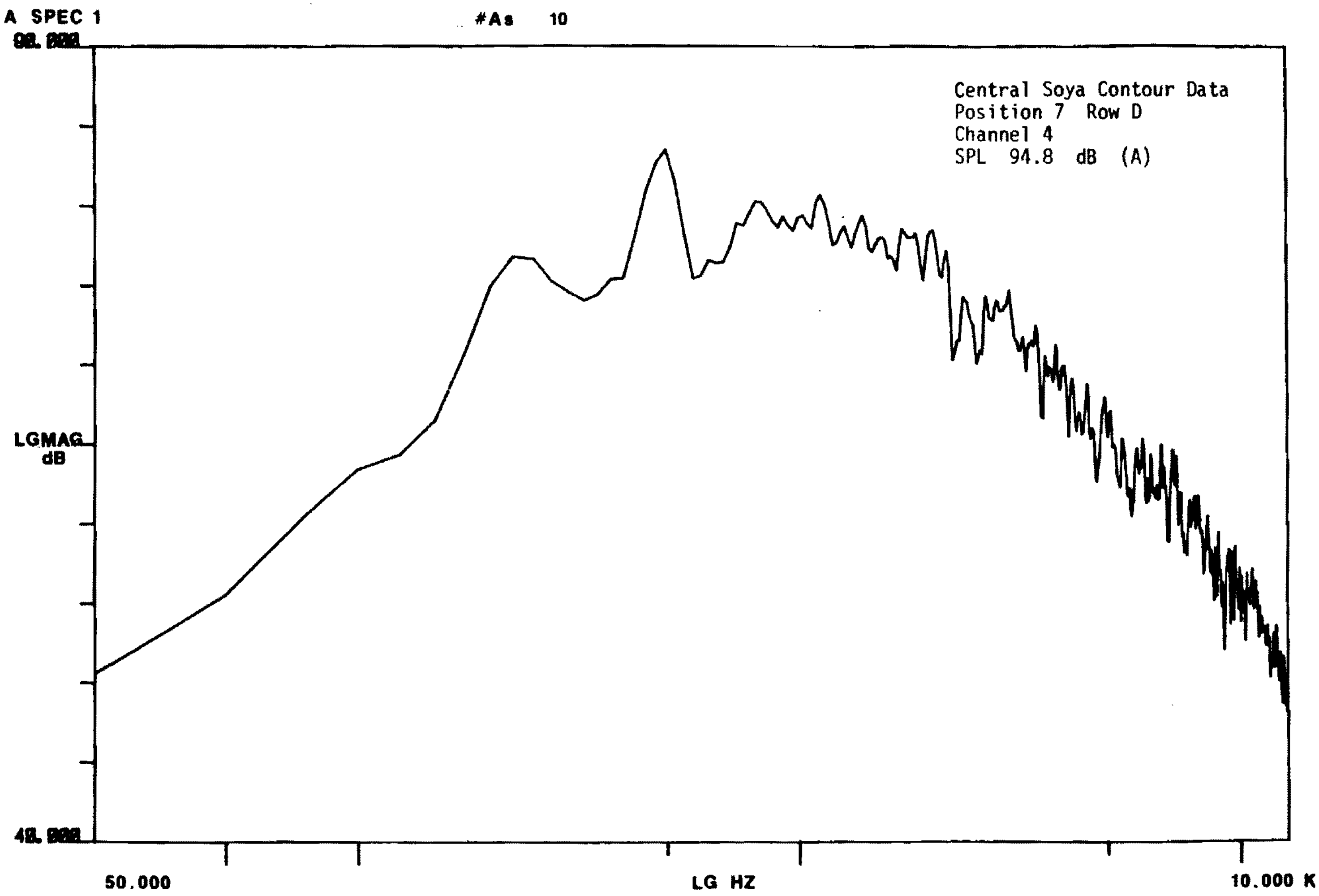

A SPEC 1
#As 10
90.000
LGMAG
dB
40.000
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 7 Row D
Channel 4
SPL 94.8 dB (A)

Figure 19B

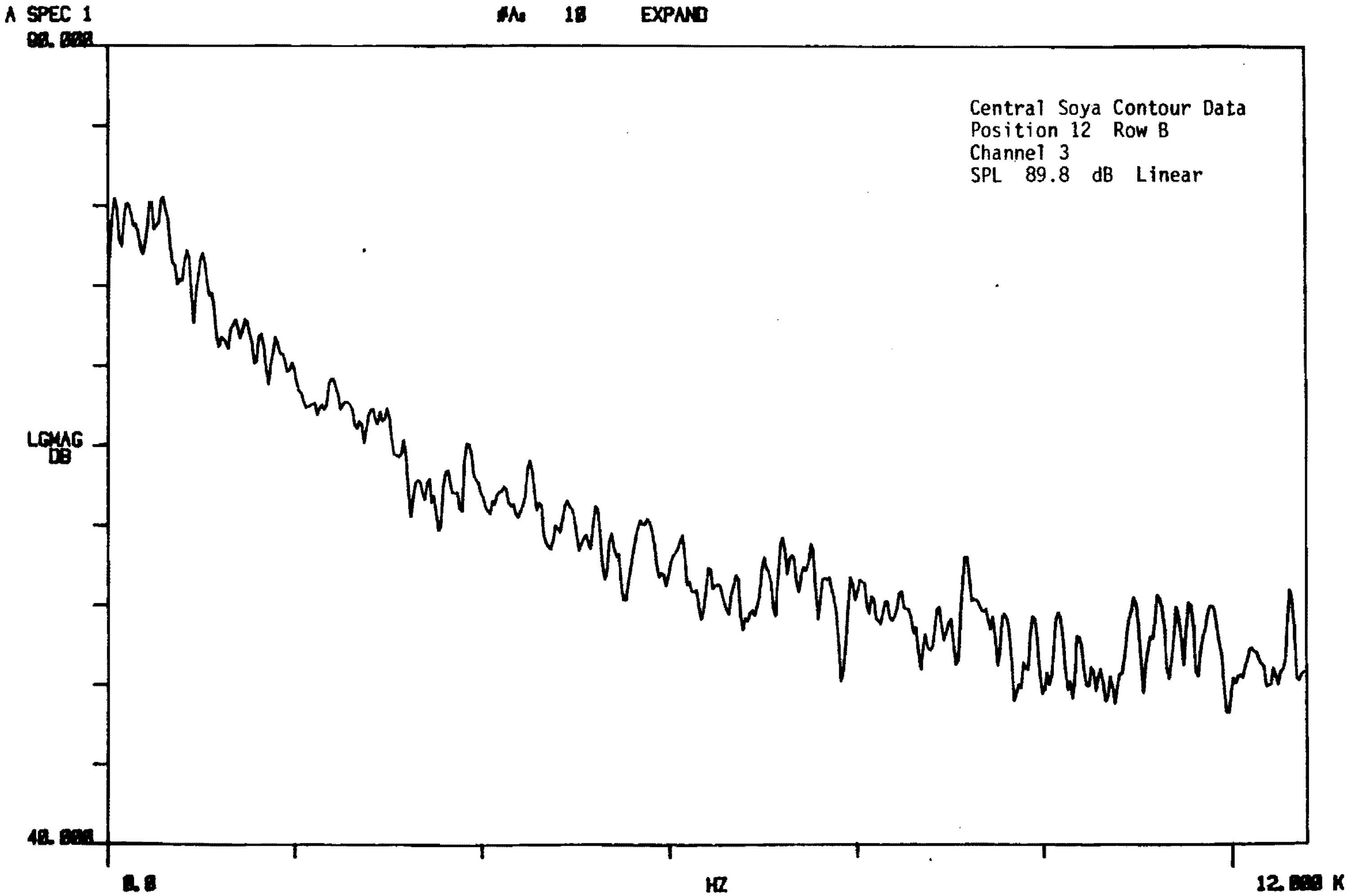

A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 12 Row B
Channel 3
SPL 89.8 dB Linear

Figure 20B

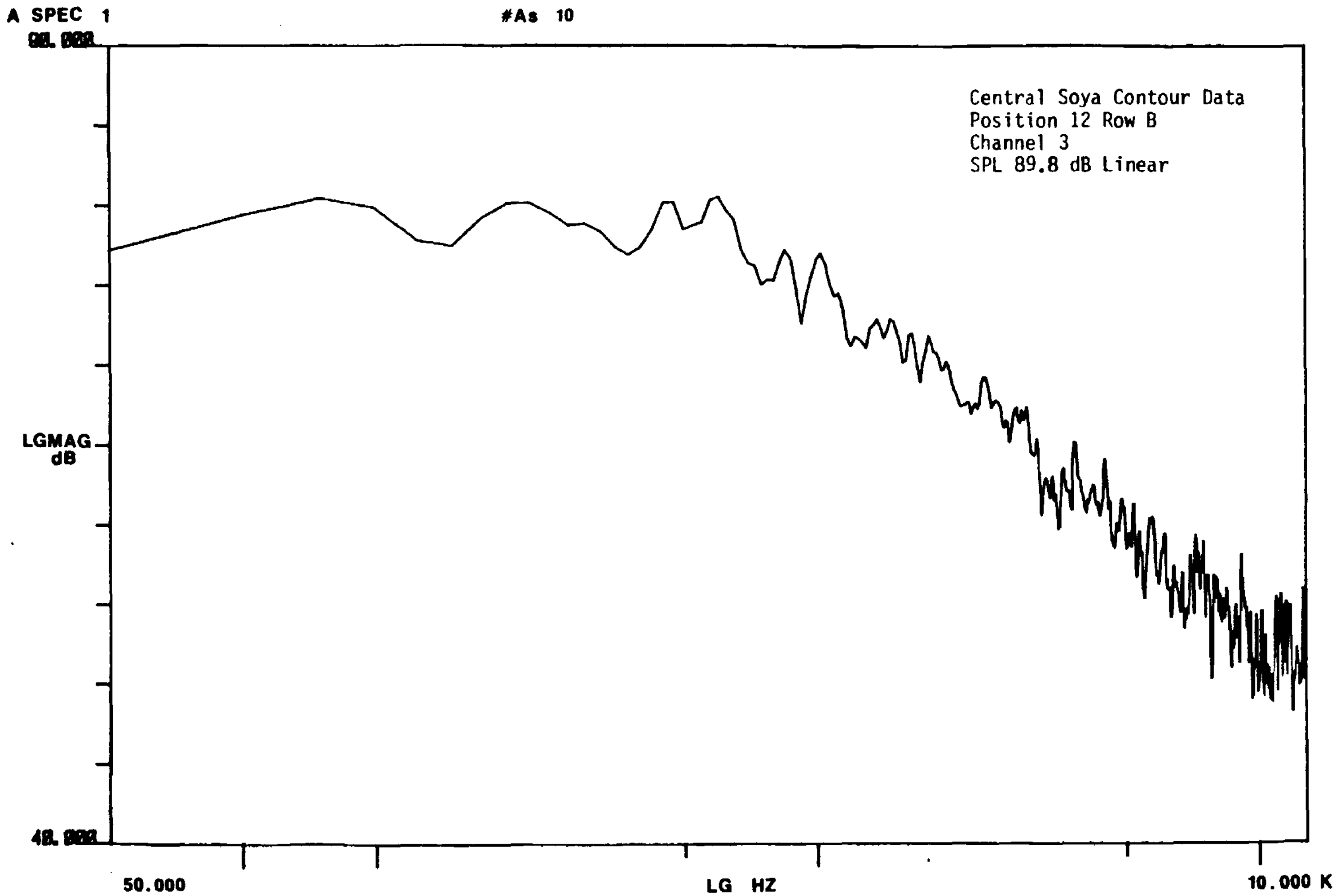

A SPEC 1
#As 10
Central Soya Contour Data
Position 12 Row B
Channel 3
SPL 89.8 dB Linear
LGMAG
dB
50.000
LG HZ
10.000 K

Figure 21B

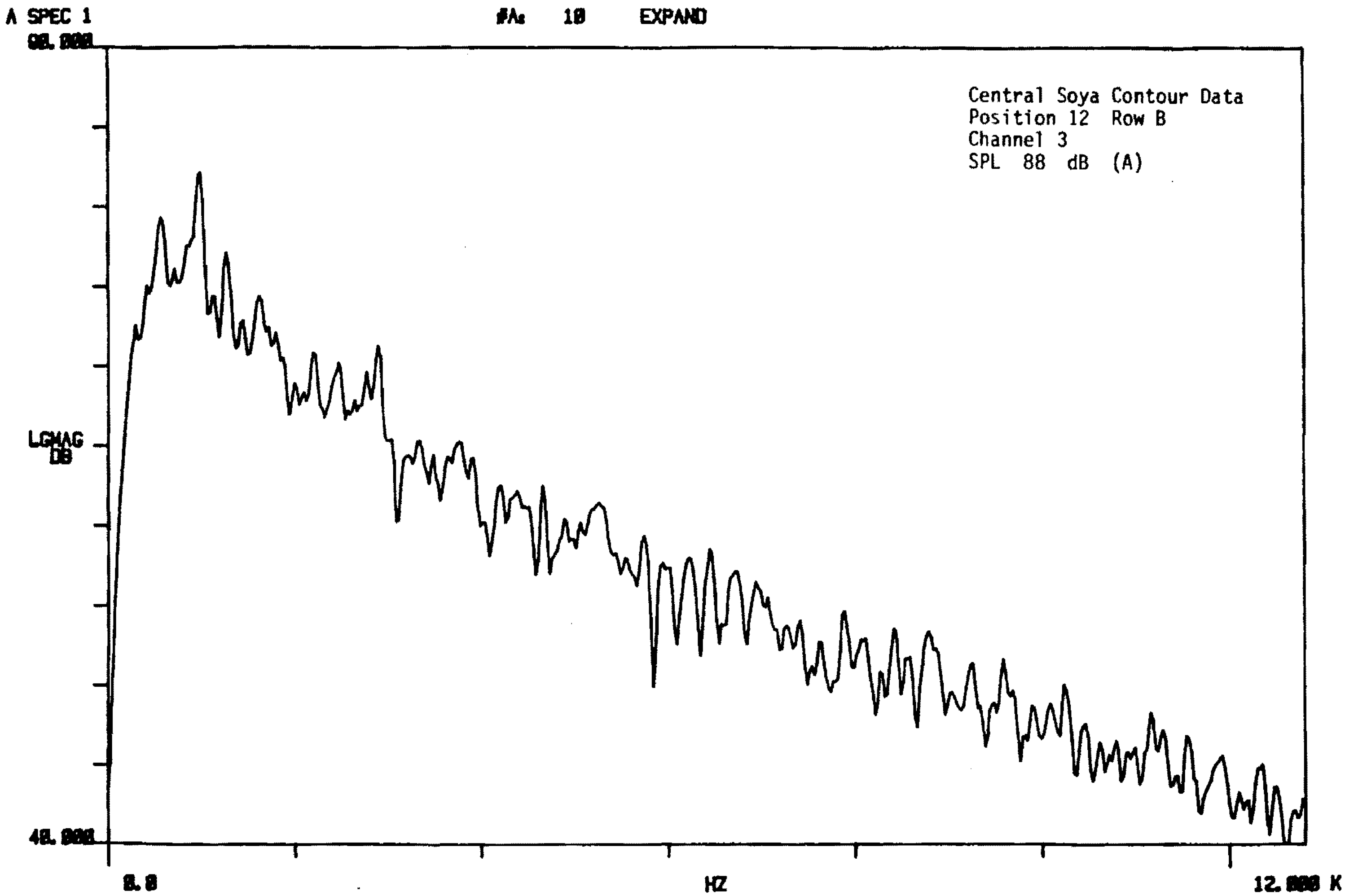

A SPEC 1
#As 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 12 Row B
Channel 3
SPL 88 dB (A)

Figure 22B

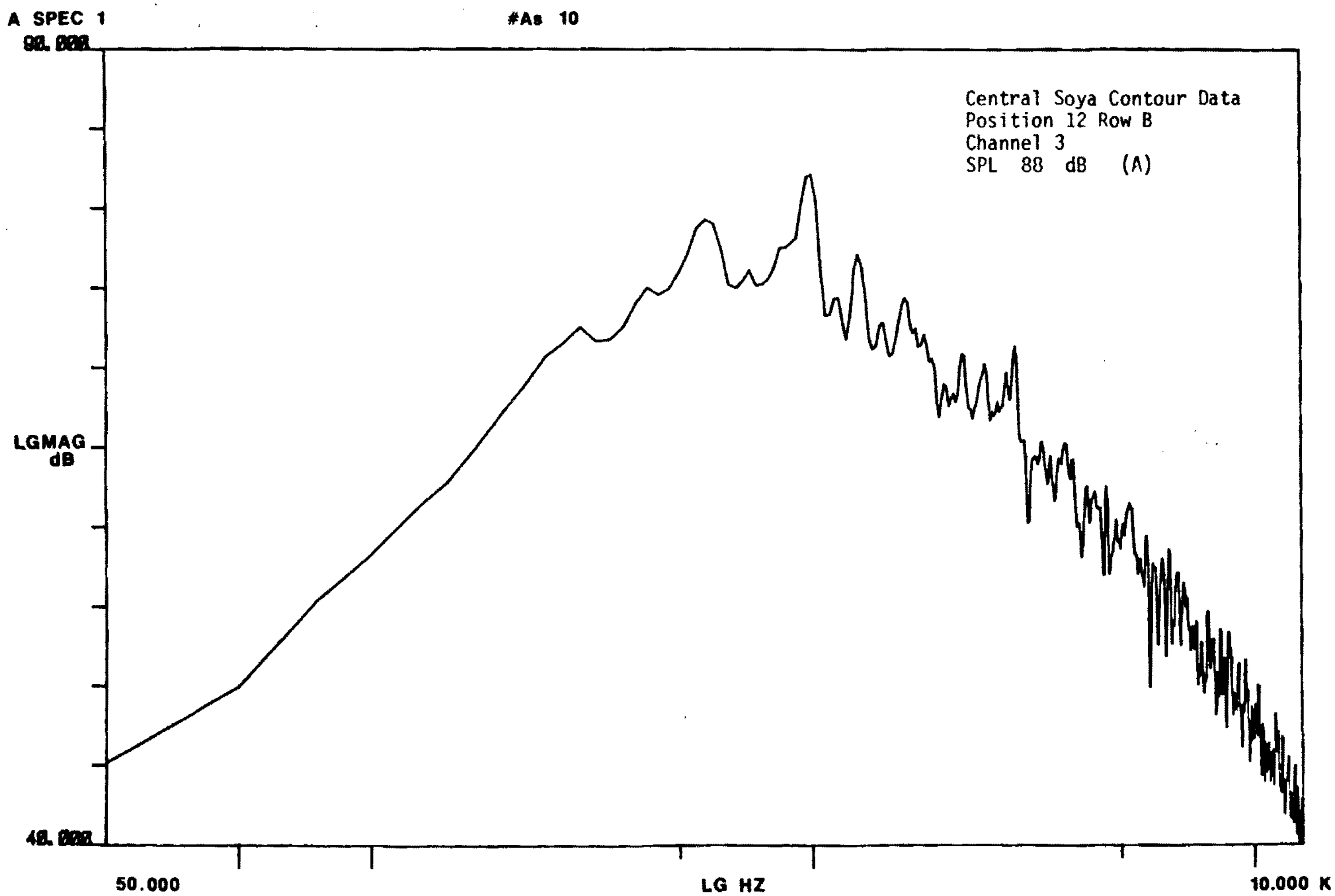

A SPEC 1
#As 10
90.000
Central Soya Contour Data
Position 12 Row B
Channel 3
SPL 88 dB (A)
LGMAG
dB
40.000
50.000
LG HZ
10.000 K

Figure 23B

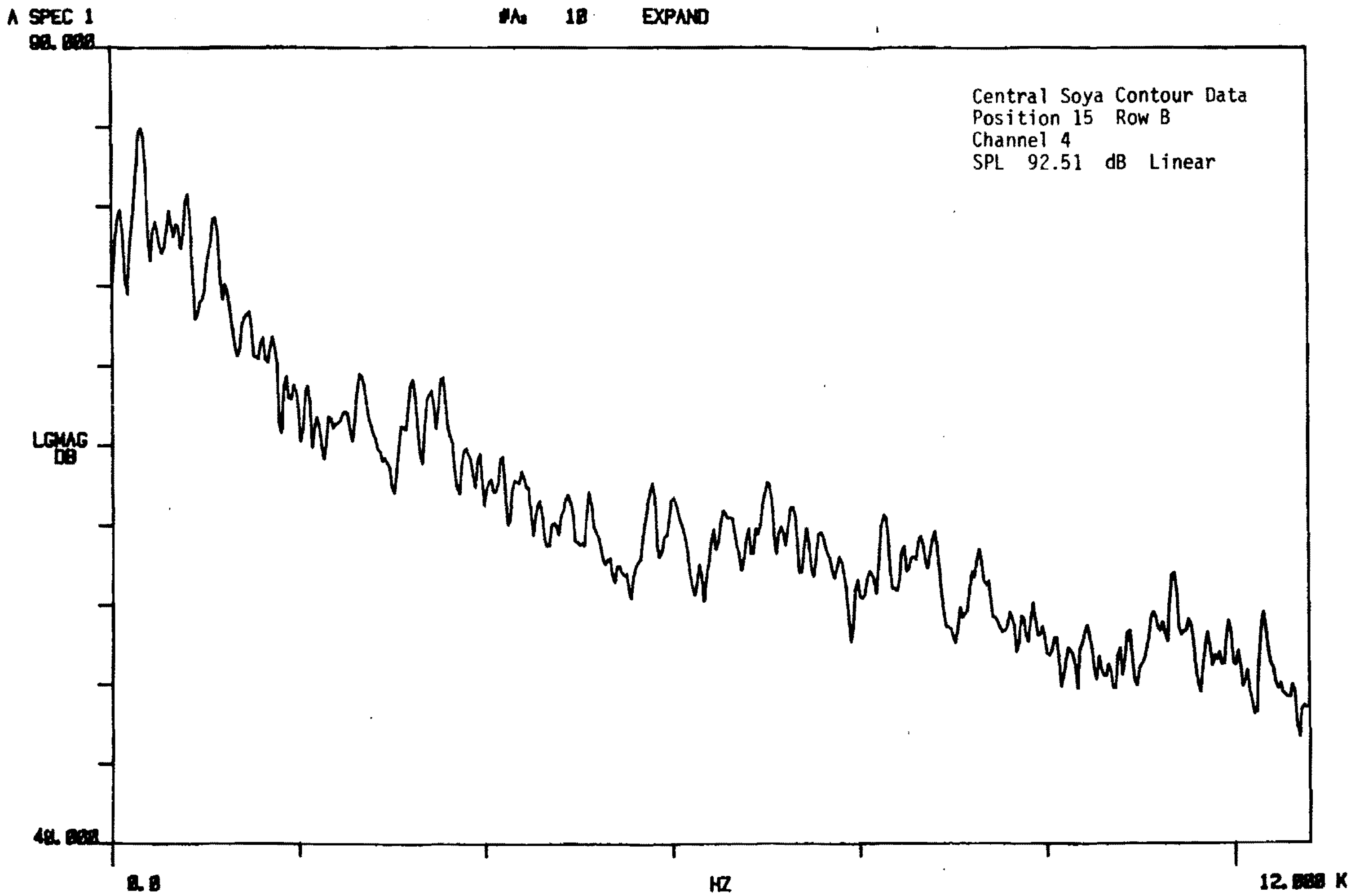

A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 15 Row B
Channel 4
SPL 92.51 dB Linear

Figure 24B

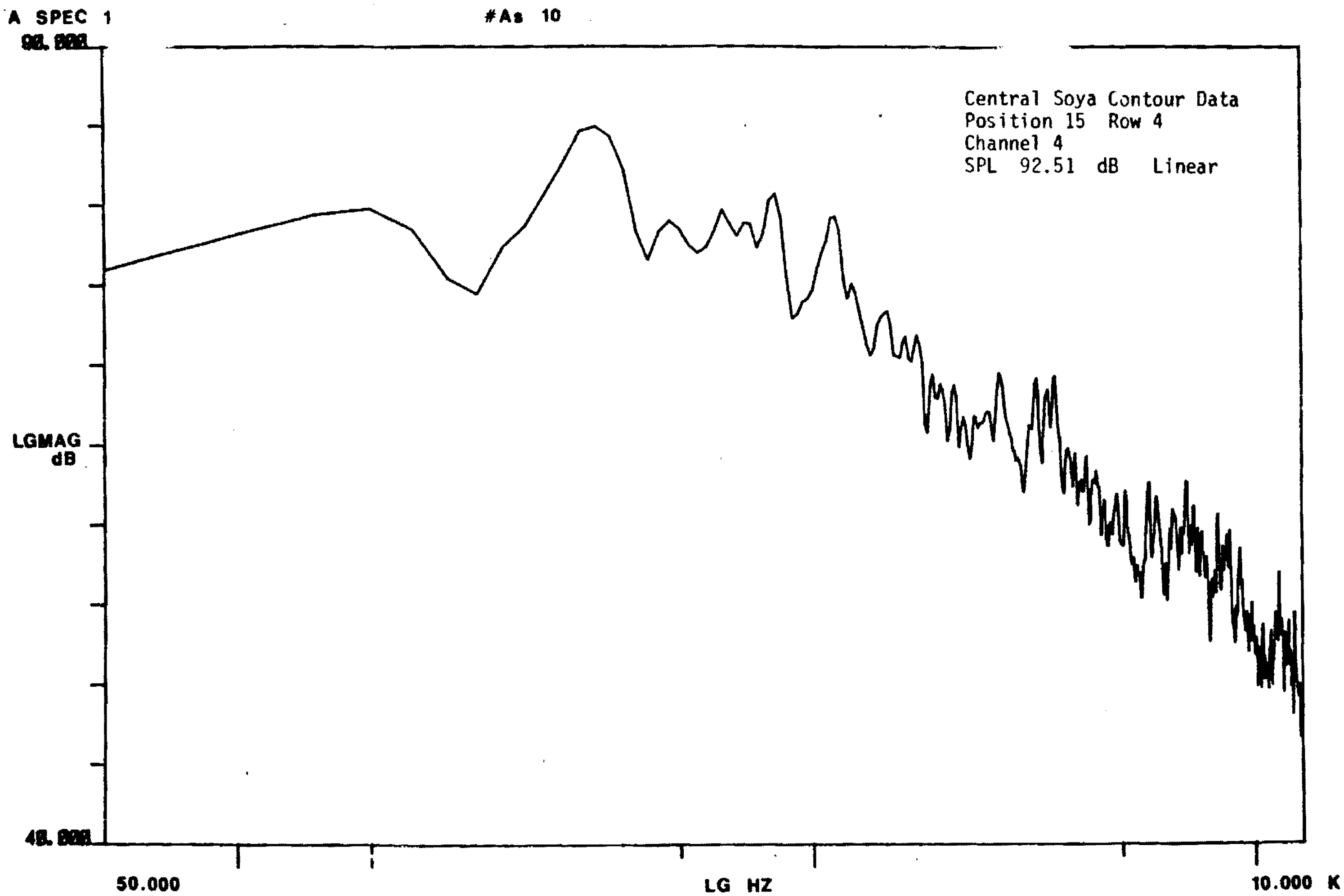

A SPEC 1
#As 10
Central Soya Contour Data
Position 15 Row 4
Channel 4
SPL 92.51 dB Linear
LGMAG
dB
50.000
LG HZ
10.000 K

Figure 25B

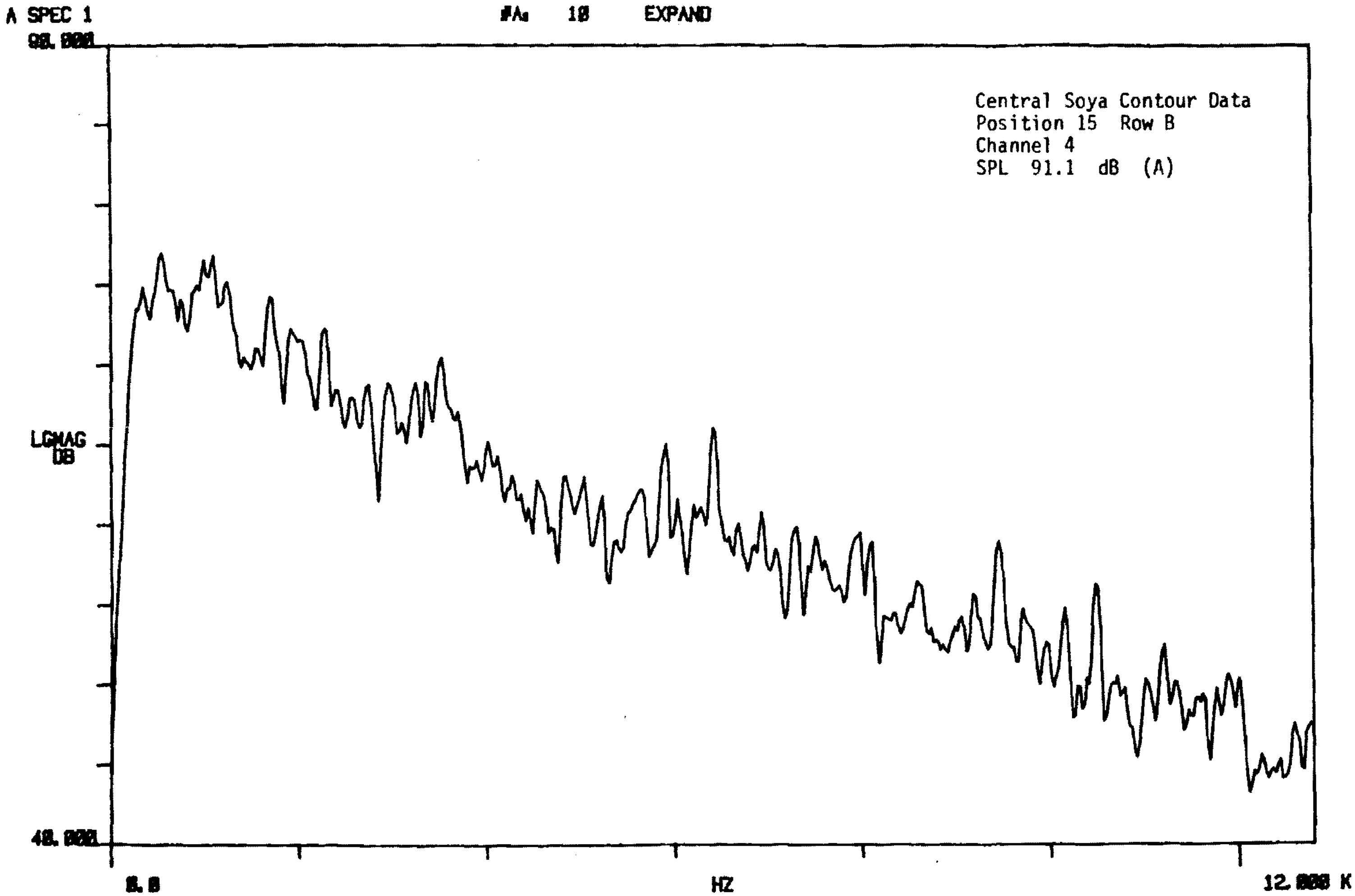

A SPEC 1
#A: 10
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
Central Soya Contour Data
Position 15 Row B
Channel 4
SPL 91.1 dB (A)

Figure 26B

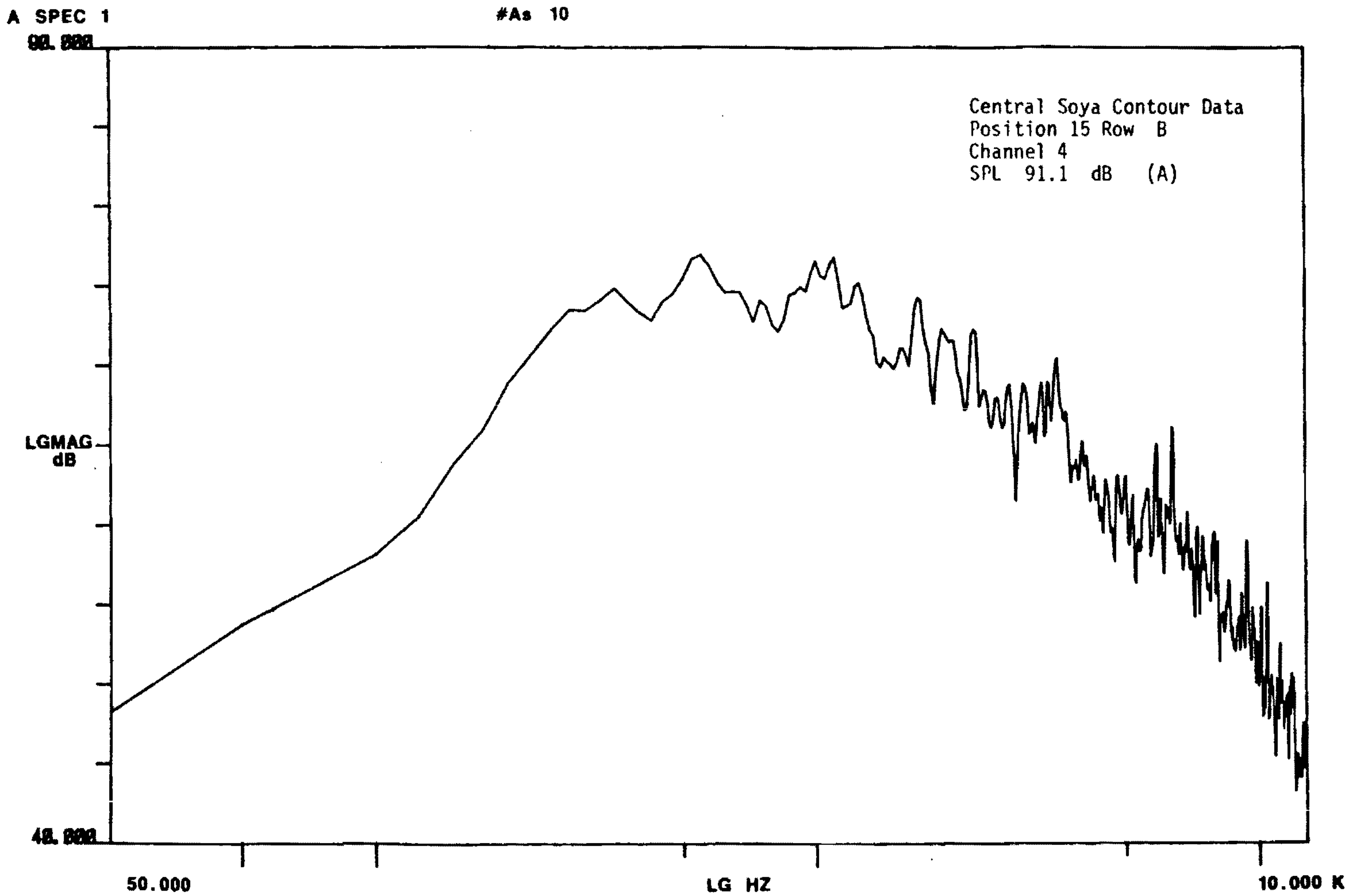

A SPEC 1
#As 10
LGMAG dB
Central Soya Contour Data
Position 15 Row B
Channel 4
SPL 91.1 dB (A)
50.000
LG HZ
10.000 K

Figure 27B

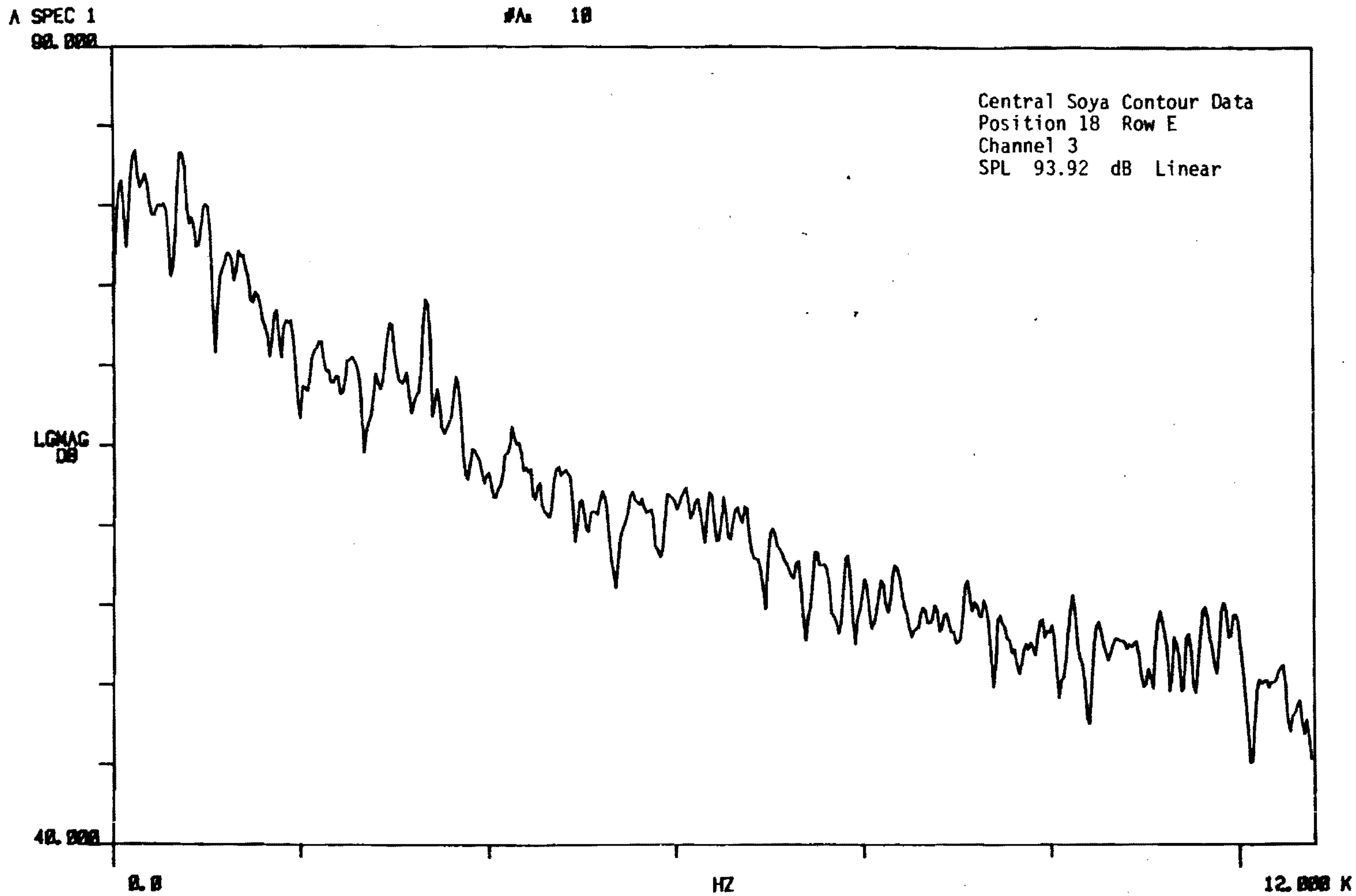

A SPEC 1
#A: 10
90.000
Central Soya Contour Data
Position 18 Row E
Channel 3
SPL 93.92 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 28B

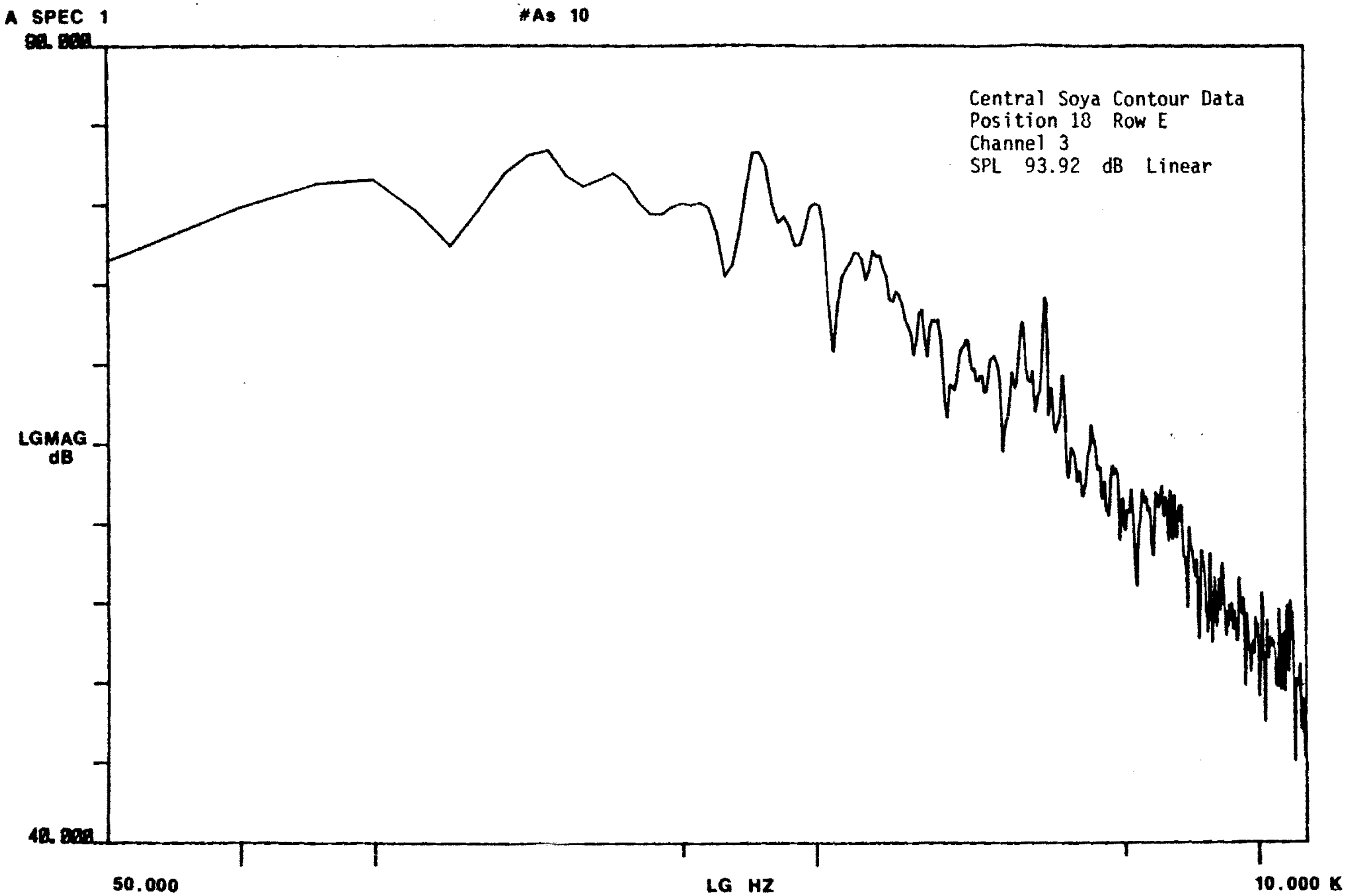

A SPEC 1
#As 10
90.000
LGMAG
dB
40.000
50.000
LG HZ
10.000 K
Central Soya Contour Data
Position 18 Row E
Channel 3
SPL 93.92 dB Linear

Figure 29B

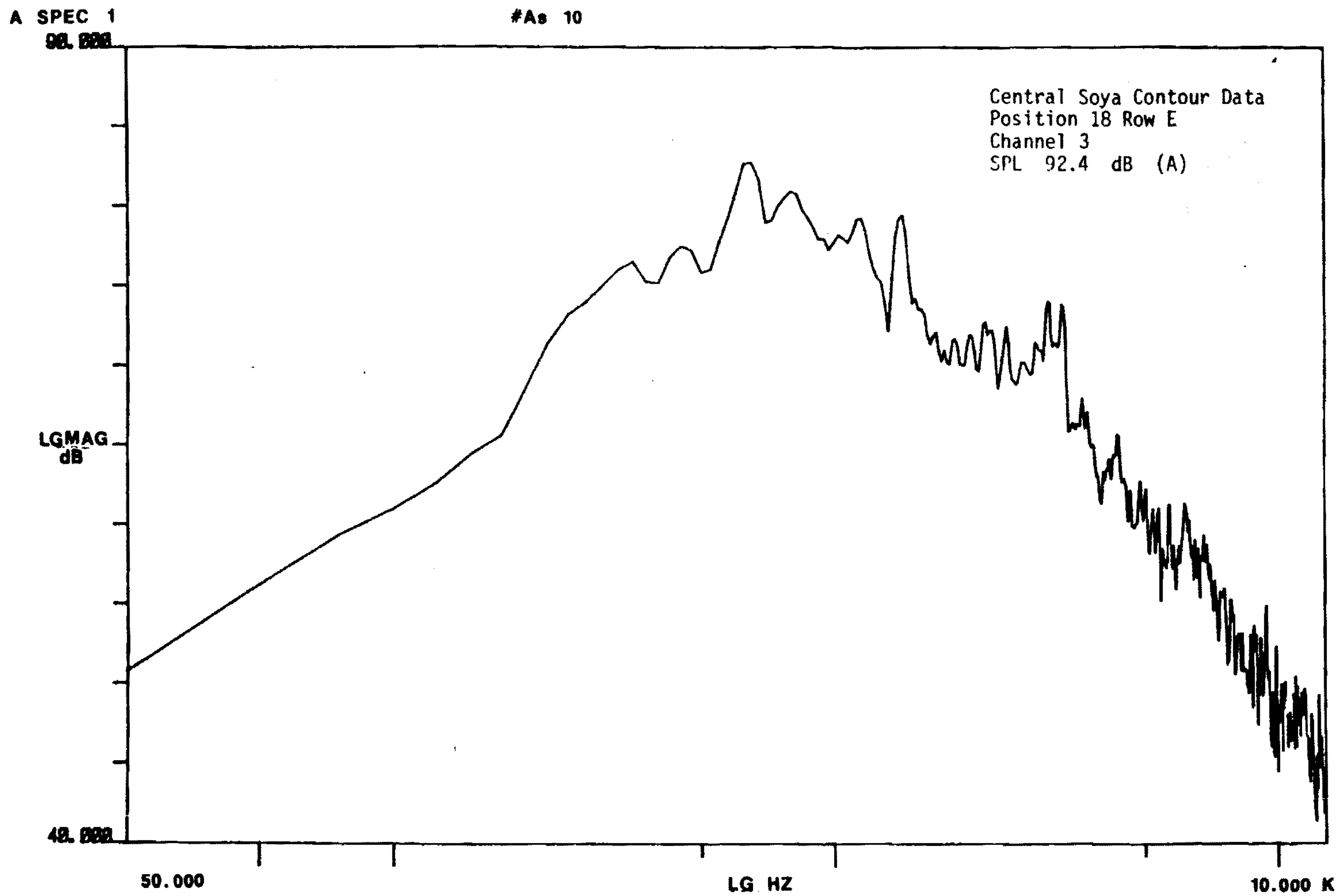

A SPEC 1
#As 10
90.000
Central Soya Contour Data
Position 18 Row E
Channel 3
SPL 92.4 dB (A)
LGMAG
dB
40.000
50.000
LG HZ
10.000 K

Figure 30B

Noise Contour

Data

TIME AVERAGES

CENTRAL SOYA PLANT

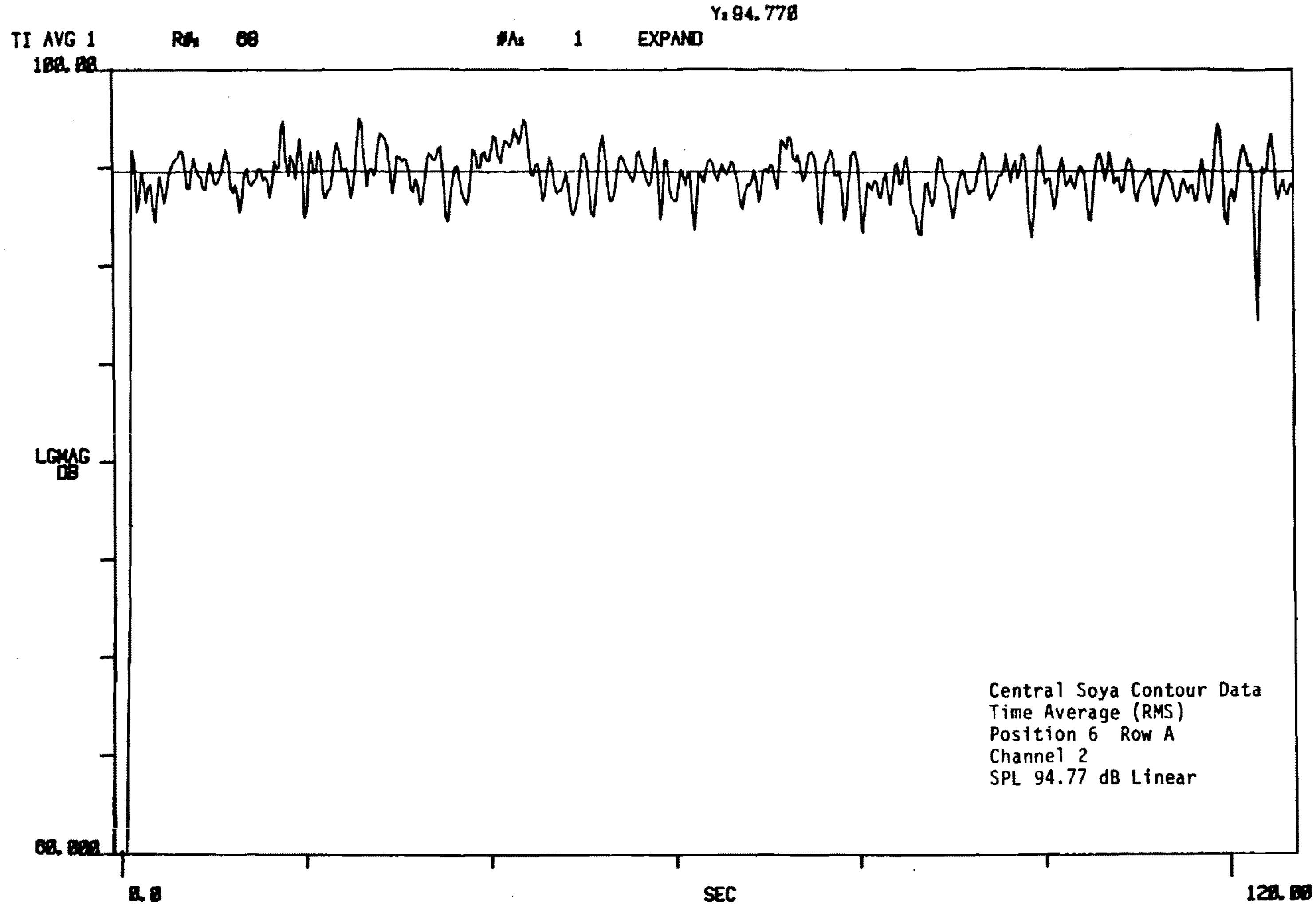
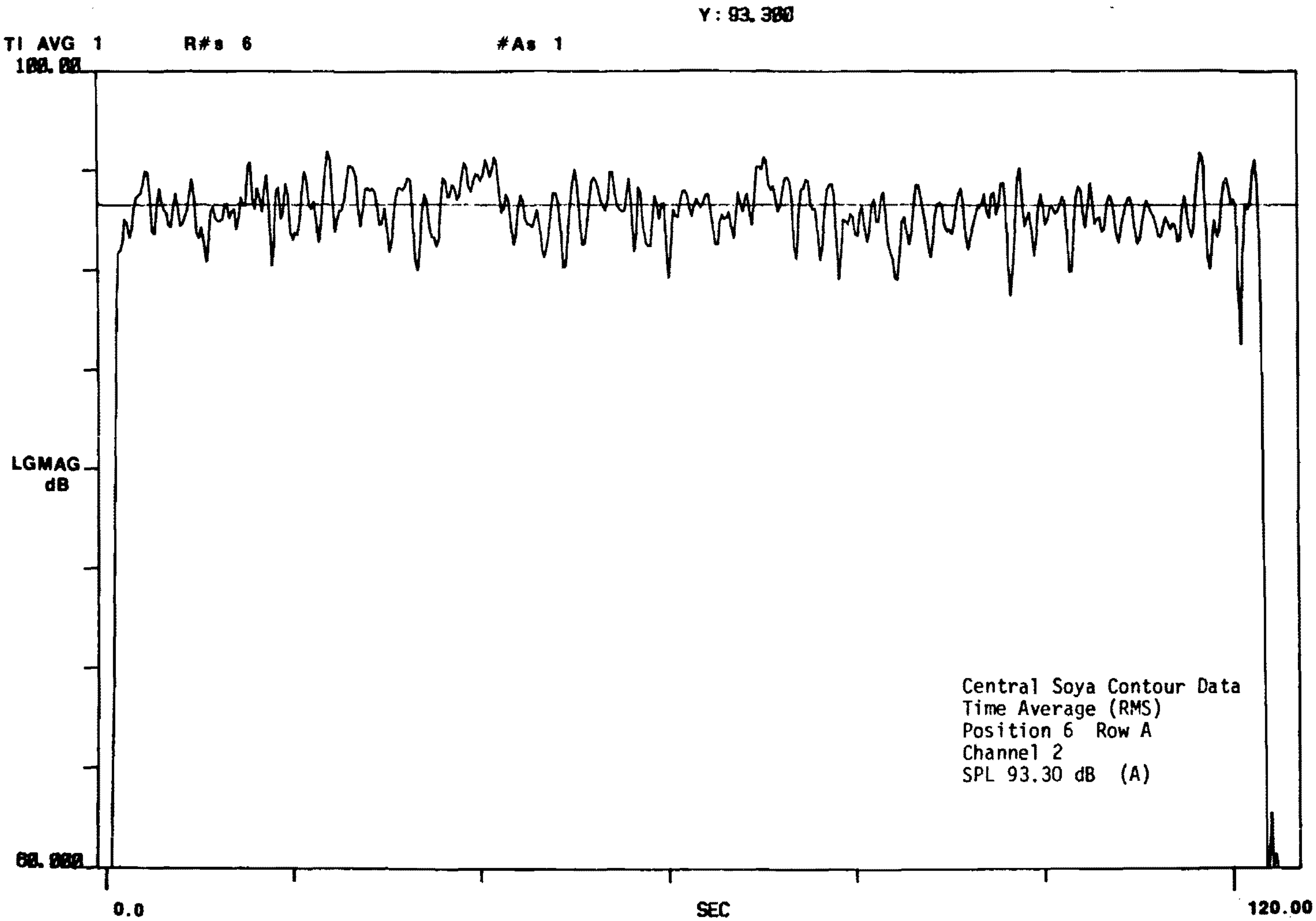

Y: 94.770
TI AVG 1
R#: 60
#A: 1
EXPAND
100.00
LGMAG
DB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 6 Row A
Channel 2
SPL 94.77 dB Linear

Figure 31B



Y: 93.300
TI AVG 1
R#s 6
#As 1
100.00
LGMAG
dB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 6 Row A
Channel 2
SPL 93.30 dB (A)

Figure 32B

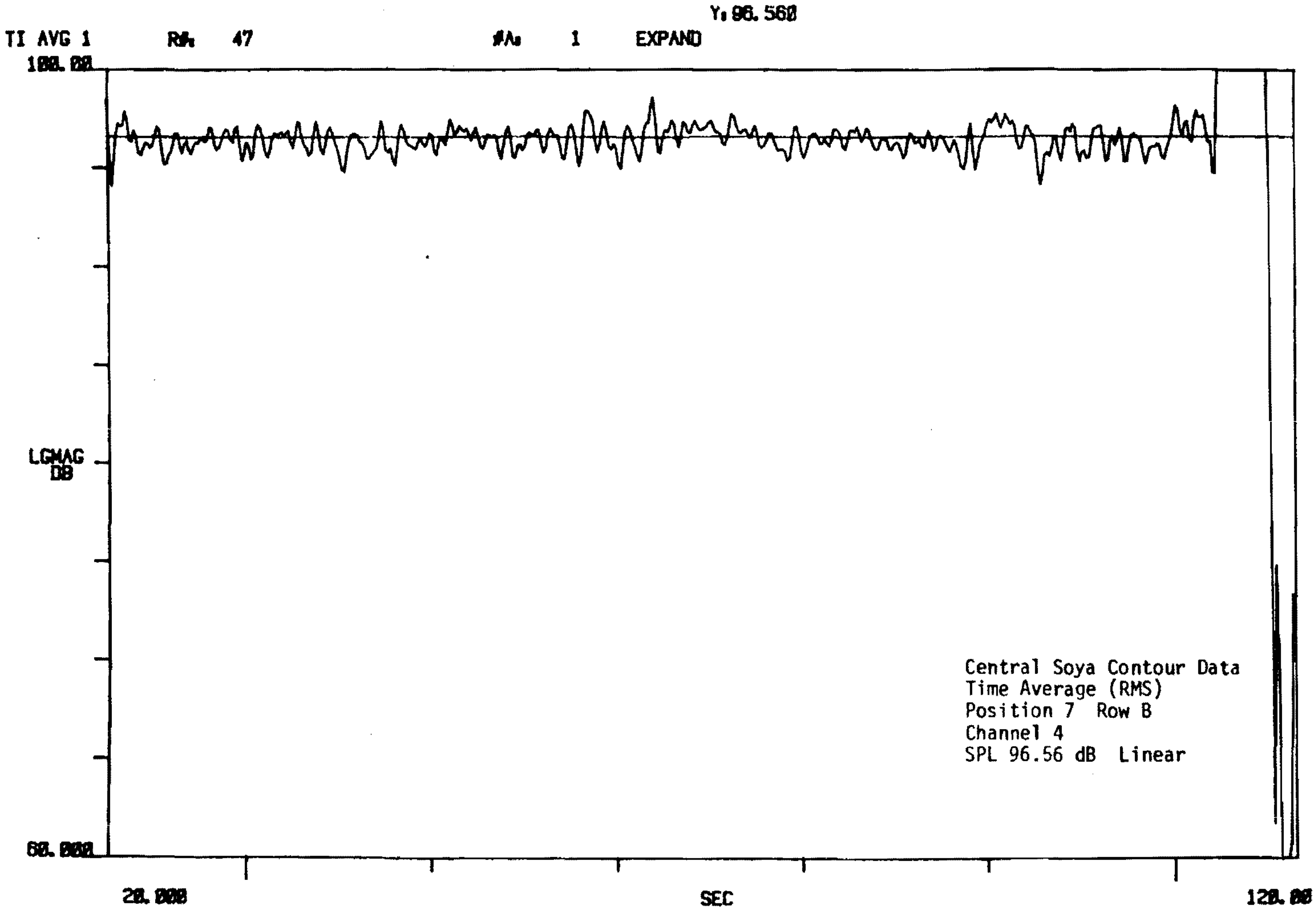

Y: 96.560
TI AVG 1
R#: 47
#A: 1
EXPAND
100.00
LGMAG
DB
60.000
20.000
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 7 Row B
Channel 4
SPL 96.56 dB Linear

Figure 33B

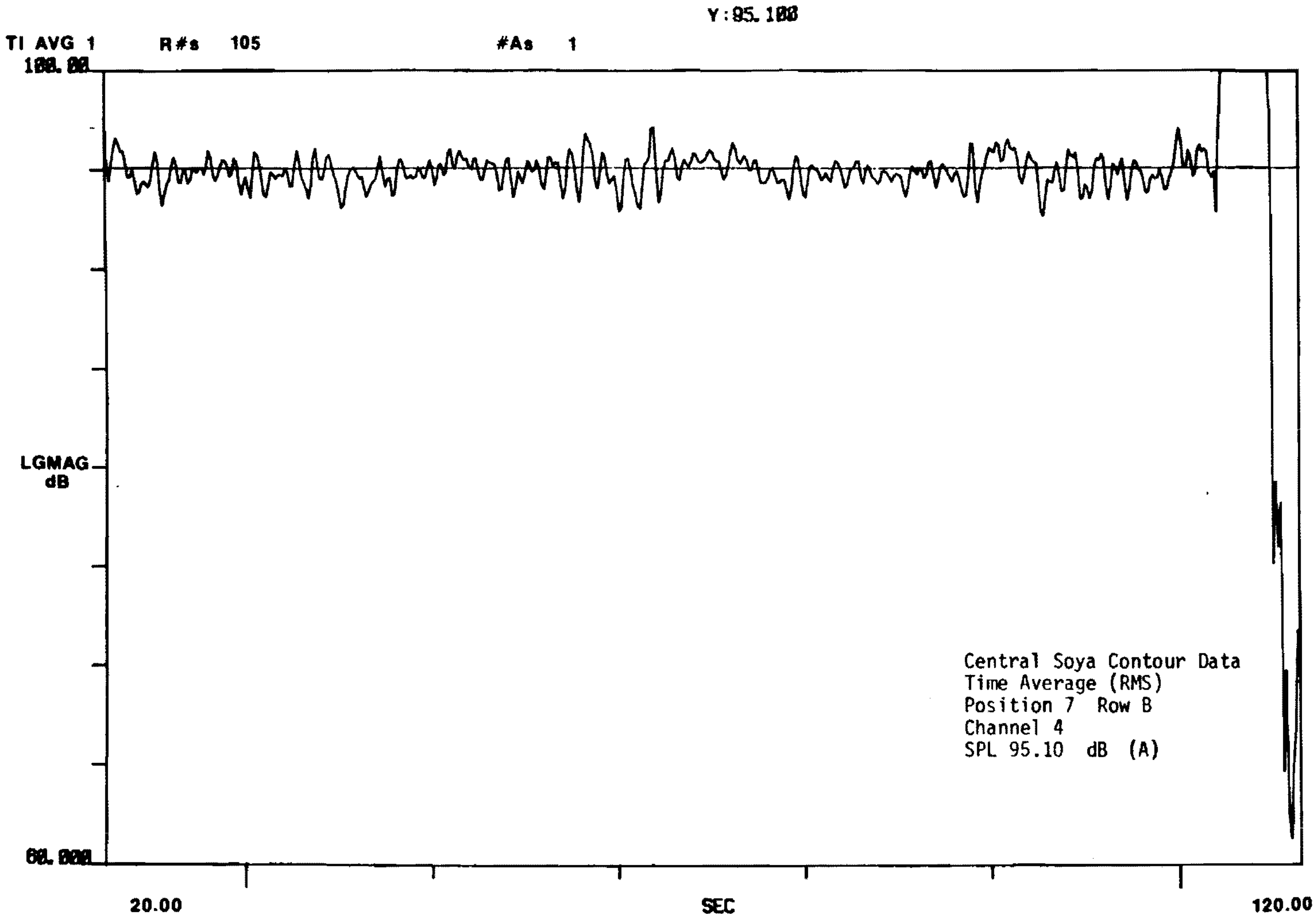
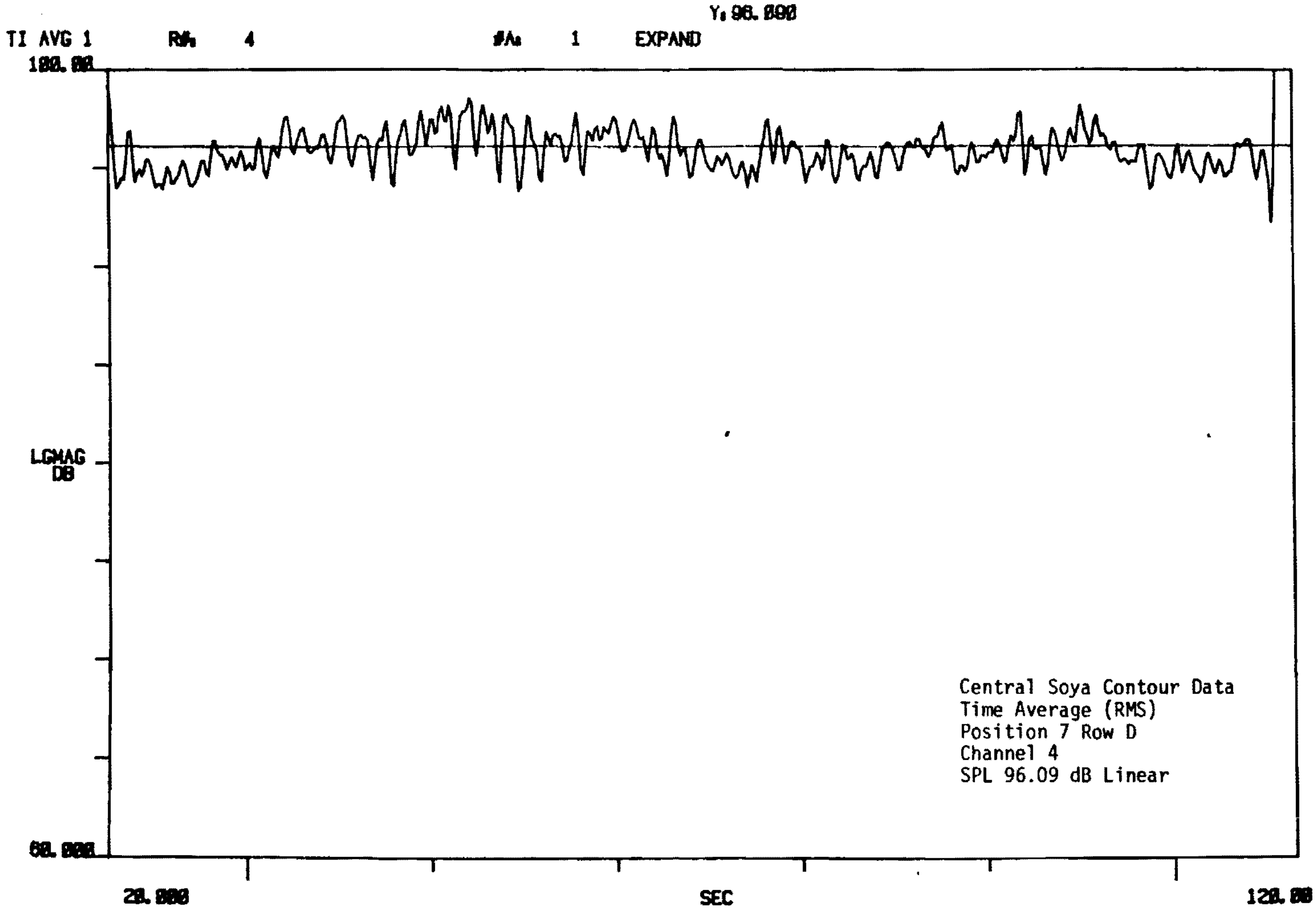
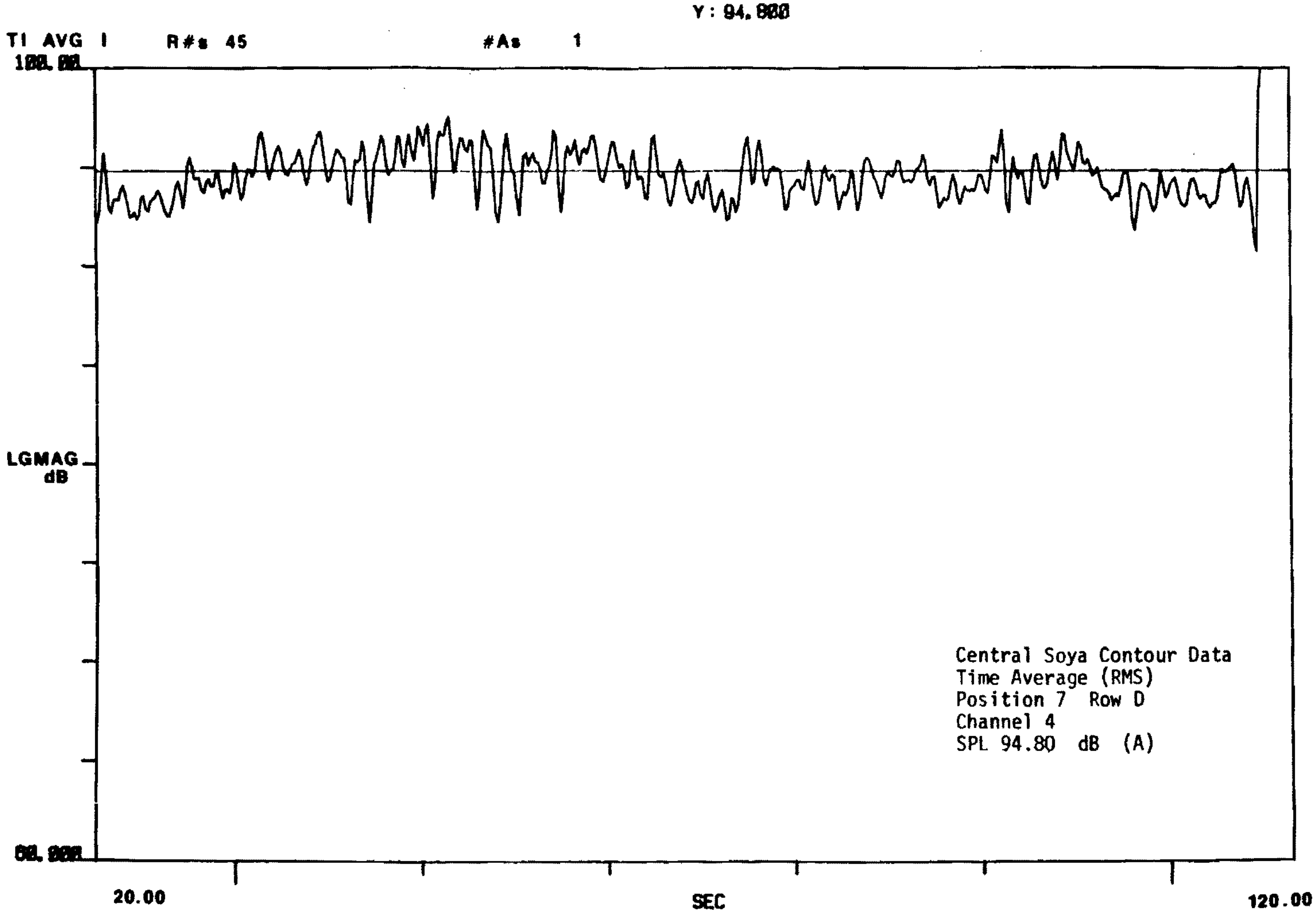

Y:95.100
TI AVG 1
R#s 105
#As 1
100.00
LGMAG dB
60.000
20.00
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 7 Row B
Channel 4
SPL 95.10 dB (A)

Figure 34B



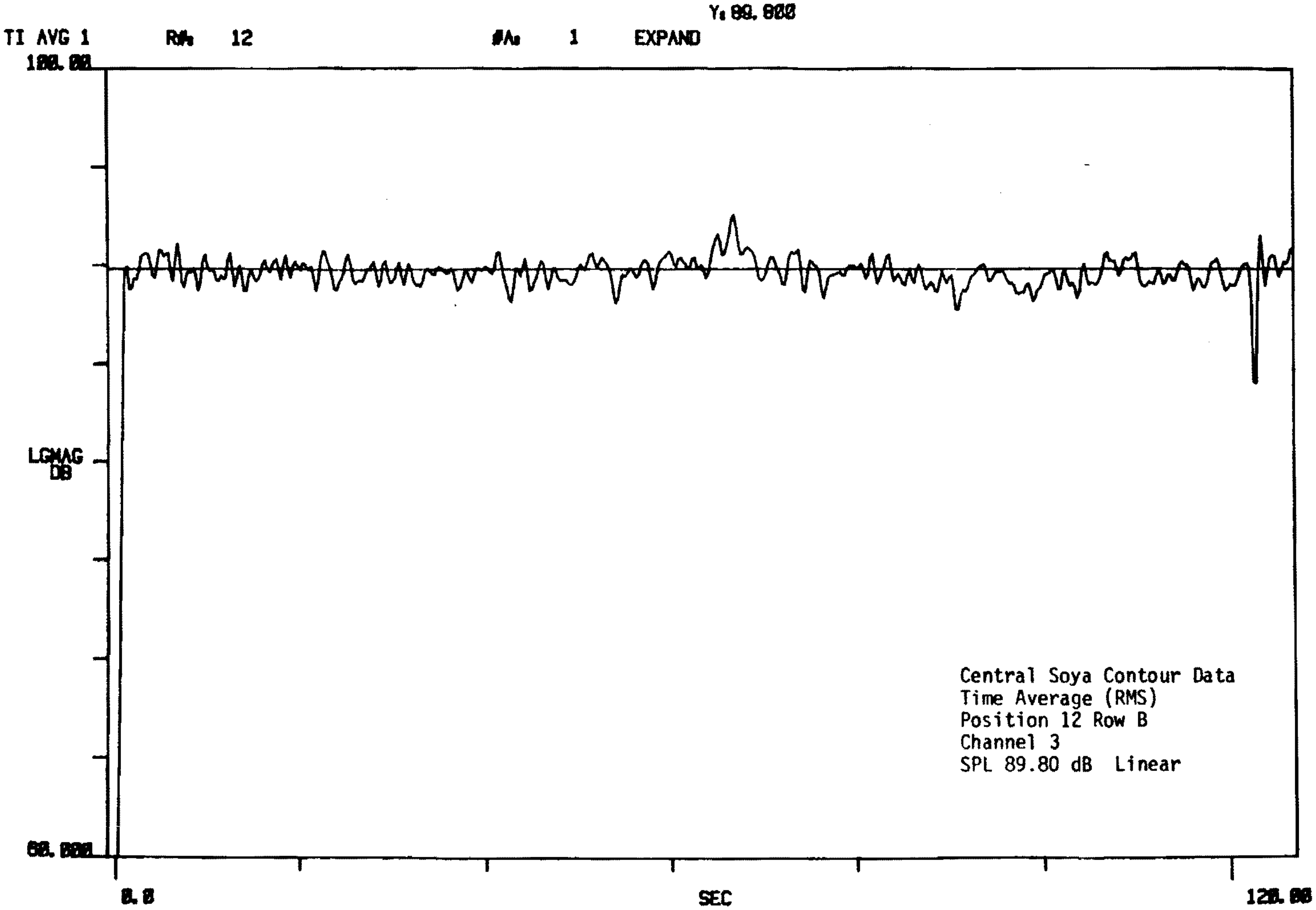
Y: 96.000
TI AVG 1
RM: 4
#A: 1
EXPAND
100.00
LGMAG
DB
60.000
20.000
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 7 Row D
Channel 4
SPL 96.09 dB Linear

Figure 35B



Y: 94.800
TI AVG I
R#s 45
#As 1
100.00
LGMAG
dB
60.000
20.00
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 7 Row D
Channel 4
SPL 94.80 dB (A)

Figure 36B



Y: 89.800
TI AVG 1
R#: 12
#A: 1
EXPAND
100.00
LGMAG
DB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 12 Row B
Channel 3
SPL 89.80 dB Linear

Figure 37B

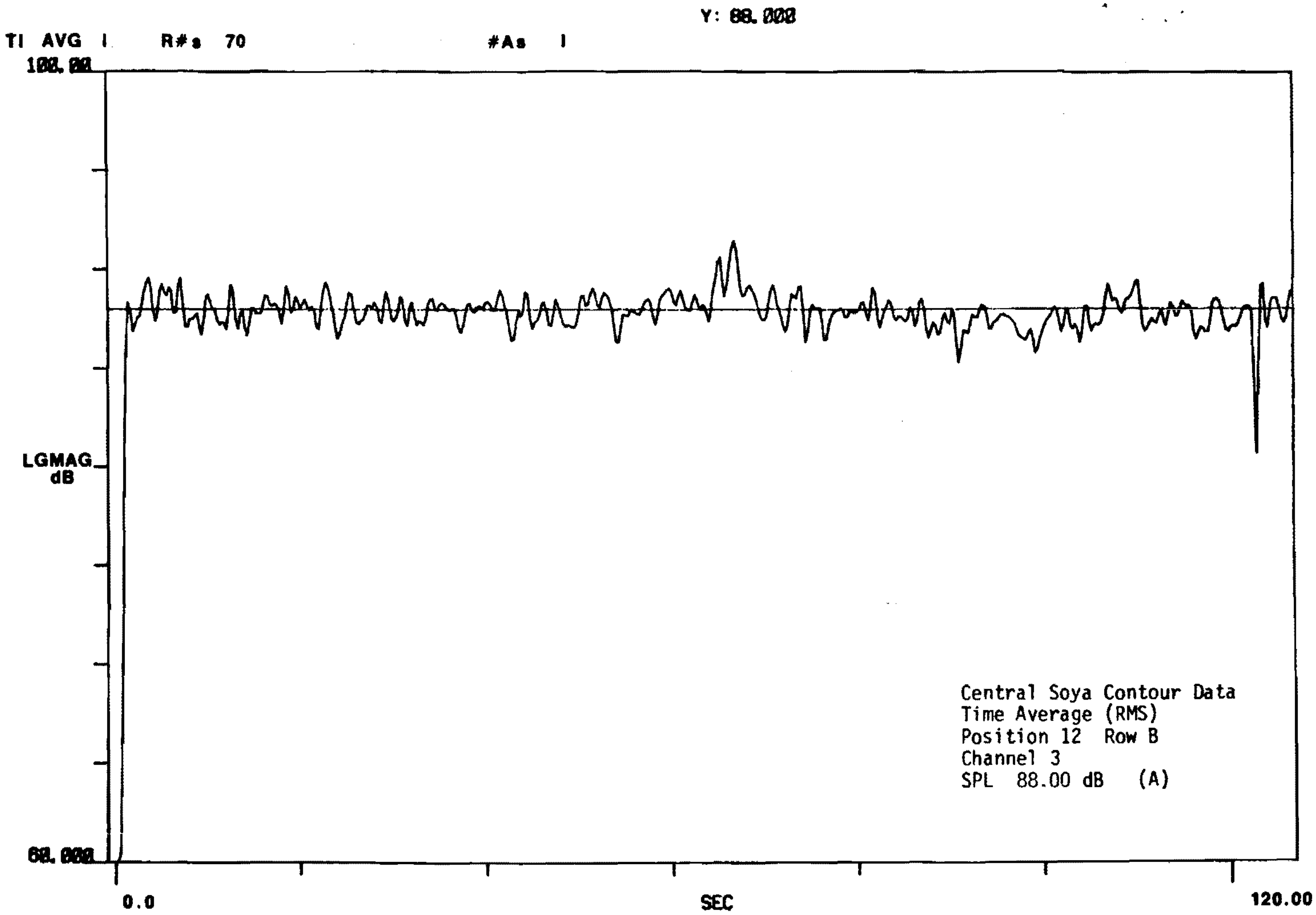
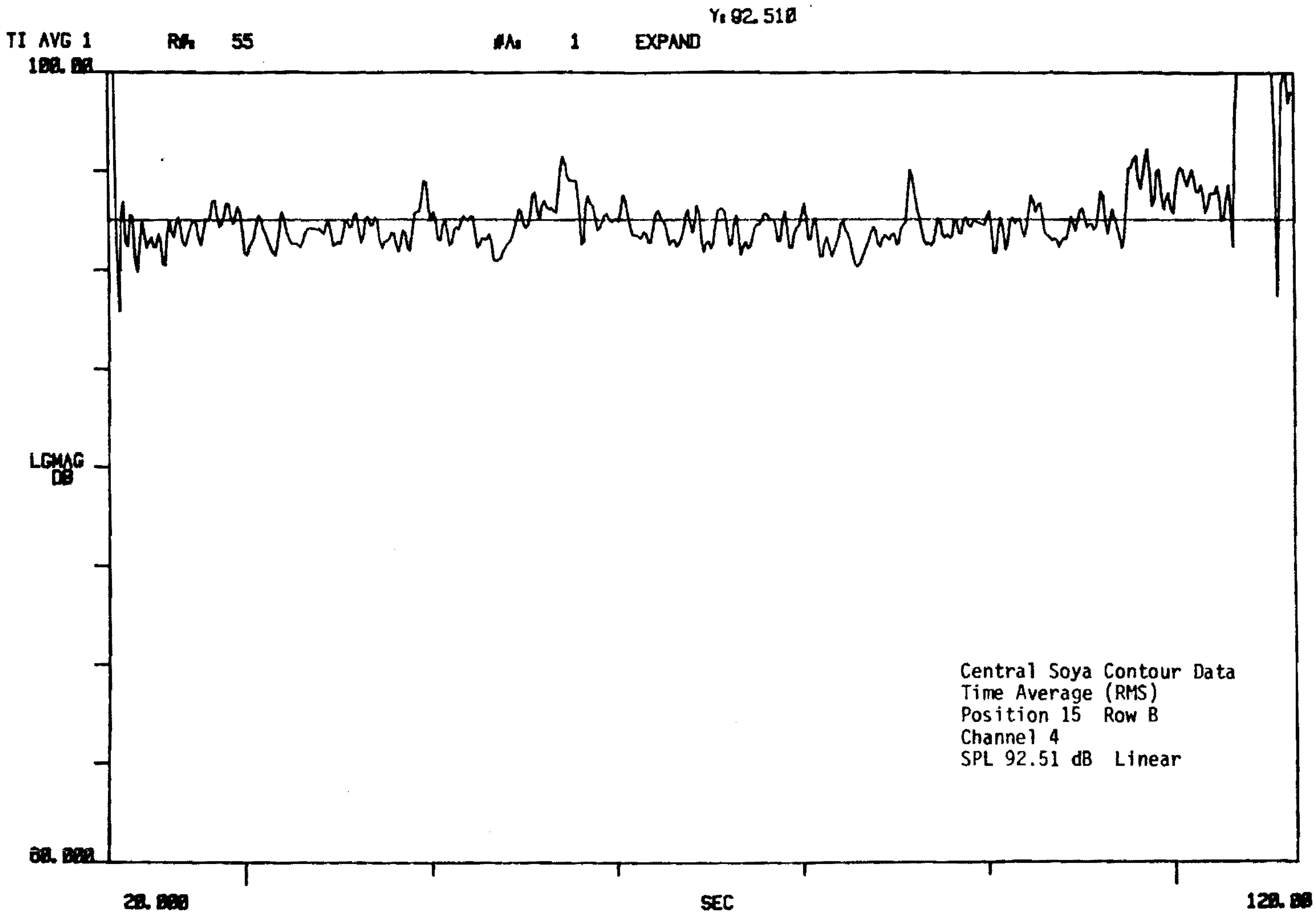

Y: 88.000
TI AVG I R#s 70 #As I
100.00
LGMAG dB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 12 Row B
Channel 3
SPL 88.00 dB (A)

Figure 38B



Y: 92.510
TI AVG 1
R#: 55
#A: 1
EXPAND
100.00
LGMAG
DB
80.000
20.000
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 15 Row B
Channel 4
SPL 92.51 dB Linear

Figure 39B

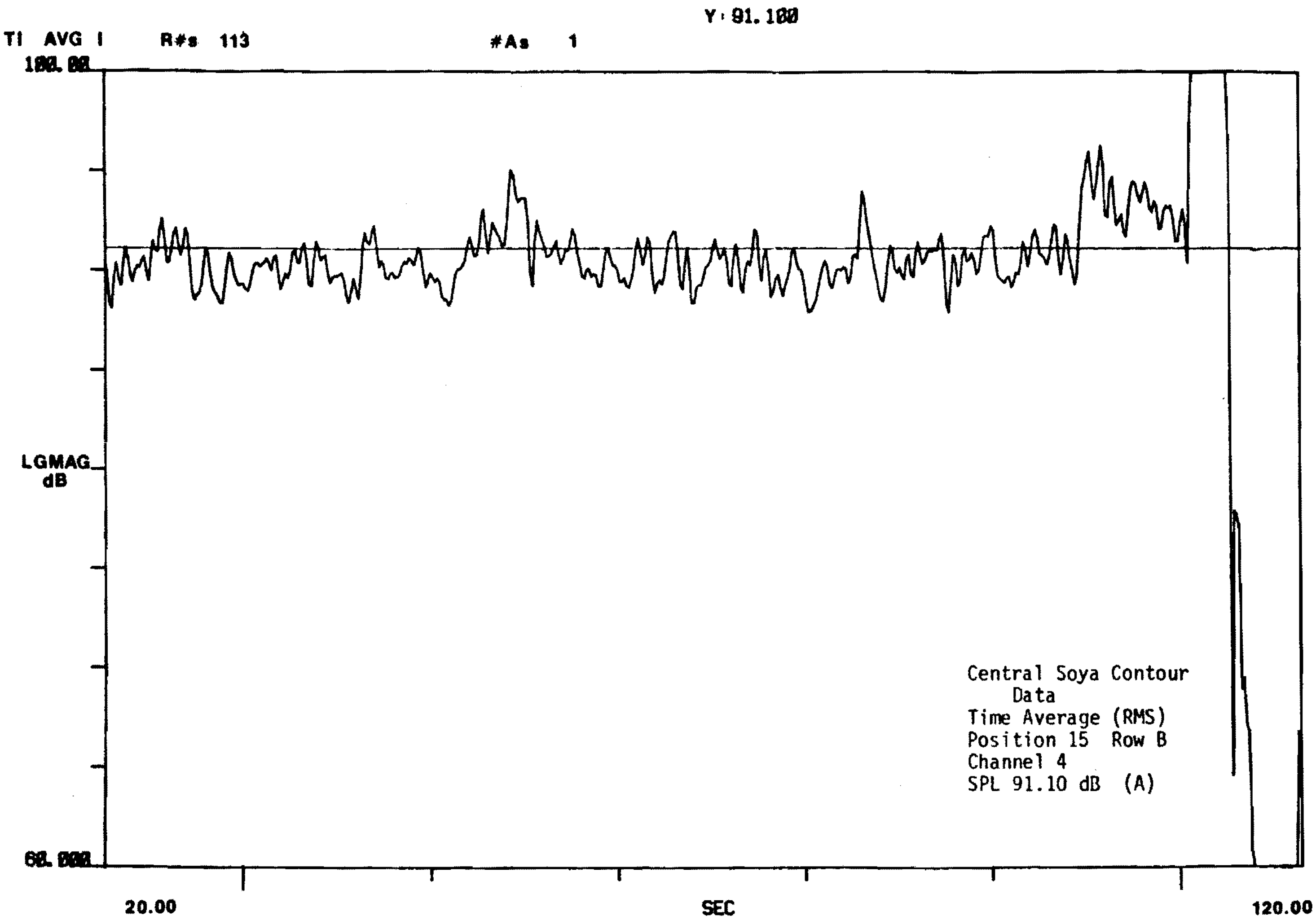

Y: 91.100
TI AVG I R#s 113 #As 1
100.00
LGMAG dB
60.000
20.00
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 15 Row B
Channel 4
SPL 91.10 dB (A)

Figure 40B

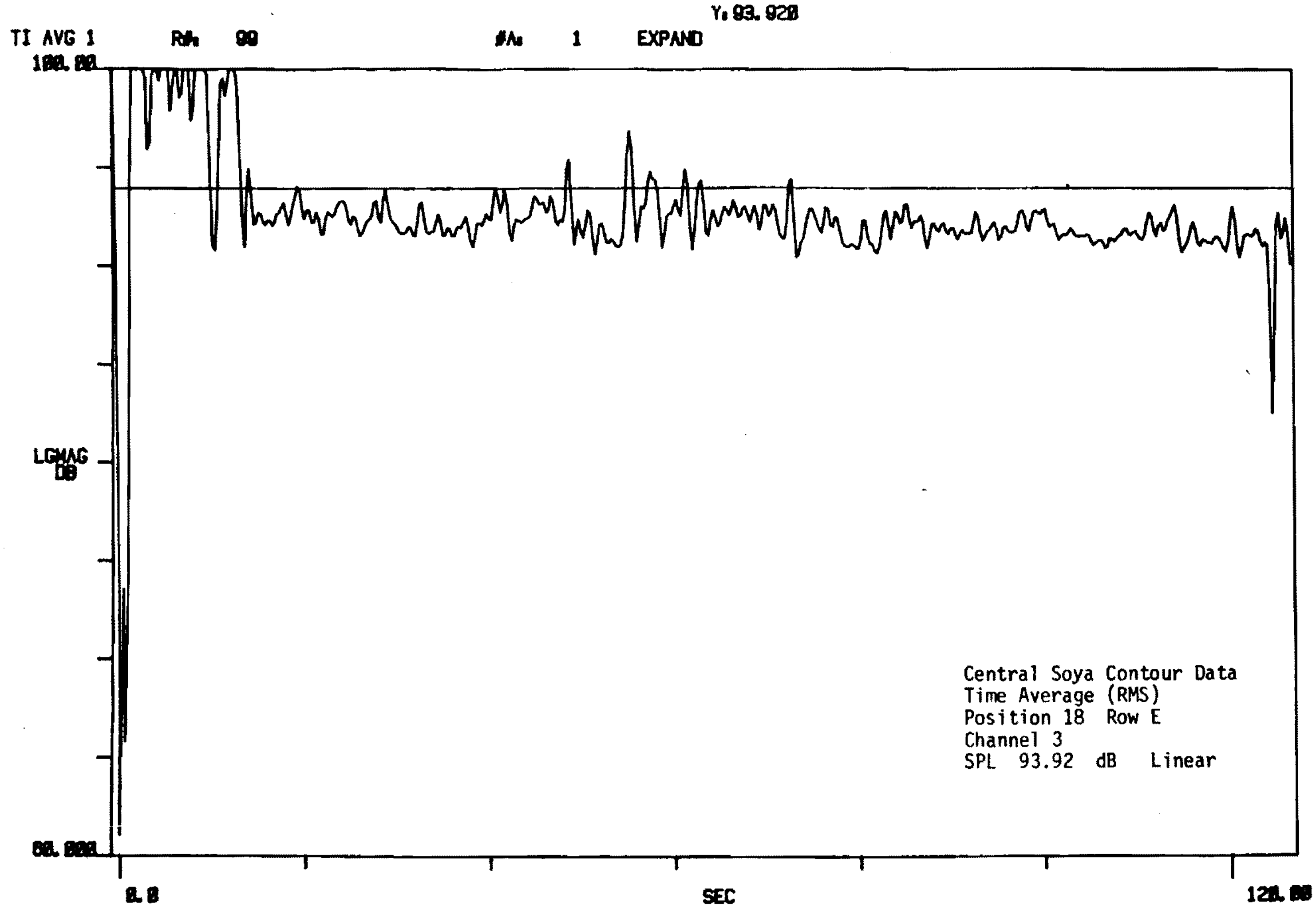

Y: 93.920
TI AVG 1
R#: 99
#A: 1
EXPAND
100.00
LGMAG
DB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 18 Row E
Channel 3
SPL 93.92 dB Linear

Figure 41B

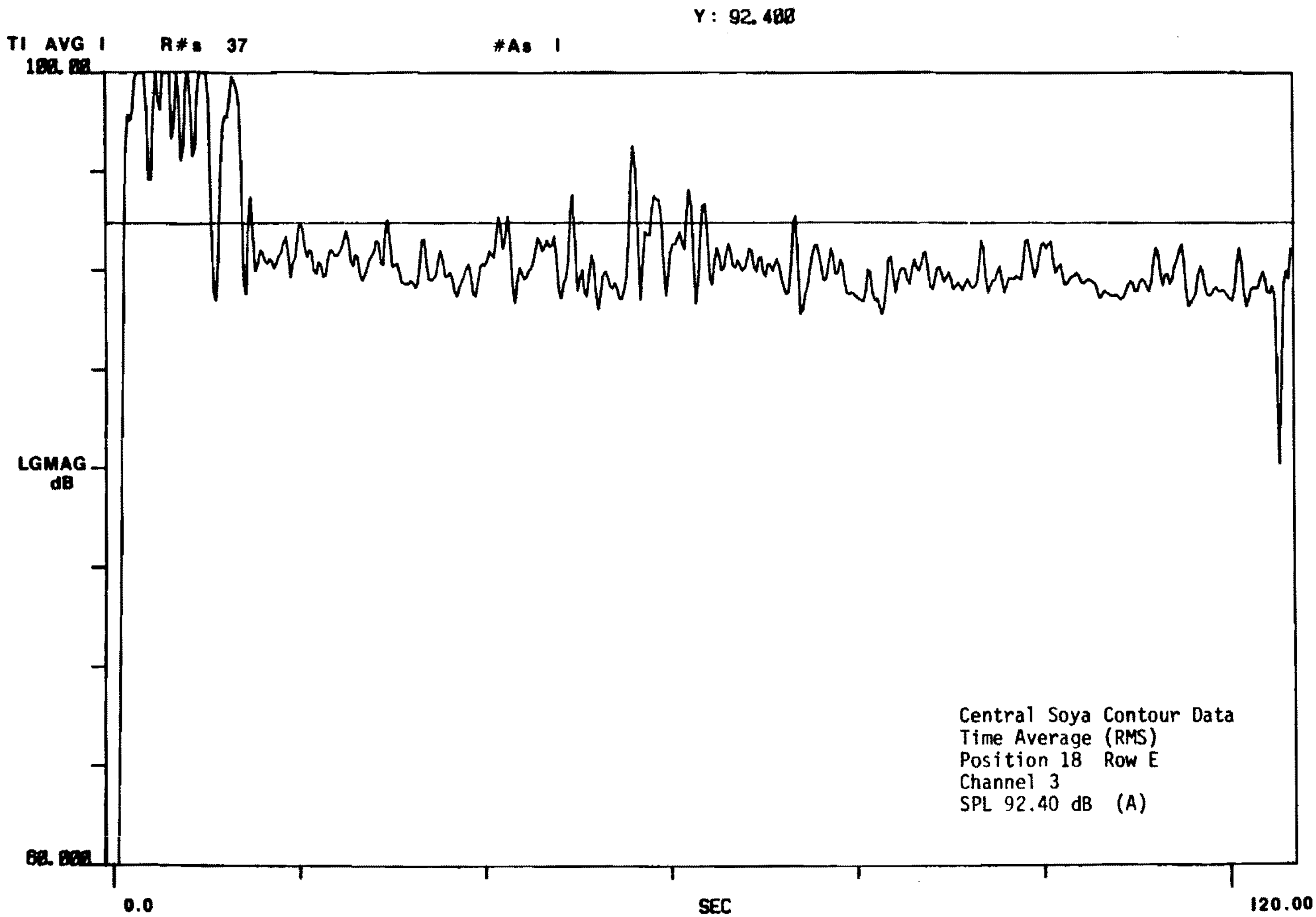

Y: 92.400
TI AVG I
R#s 37
#As I
100.00
LGMAG
dB
60.000
0.0
SEC
120.00
Central Soya Contour Data
Time Average (RMS)
Position 18 Row E
Channel 3
SPL 92.40 dB (A)

Figure 42B

Noise Contour

Data

FREQUENCY SPECTRA TIP TOP PLANT

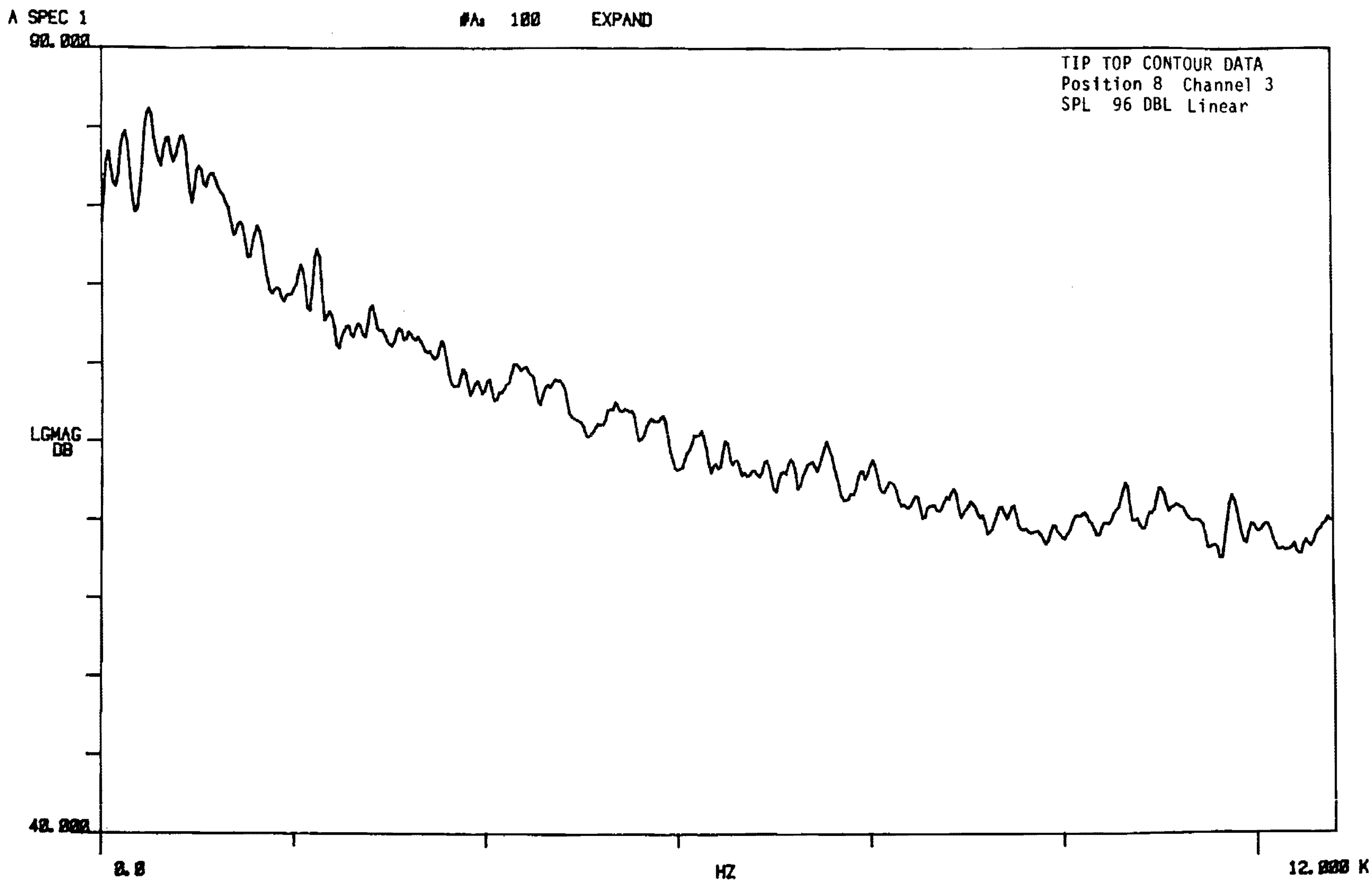

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 8 Channel 3
SPL 96 DBL Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 43B

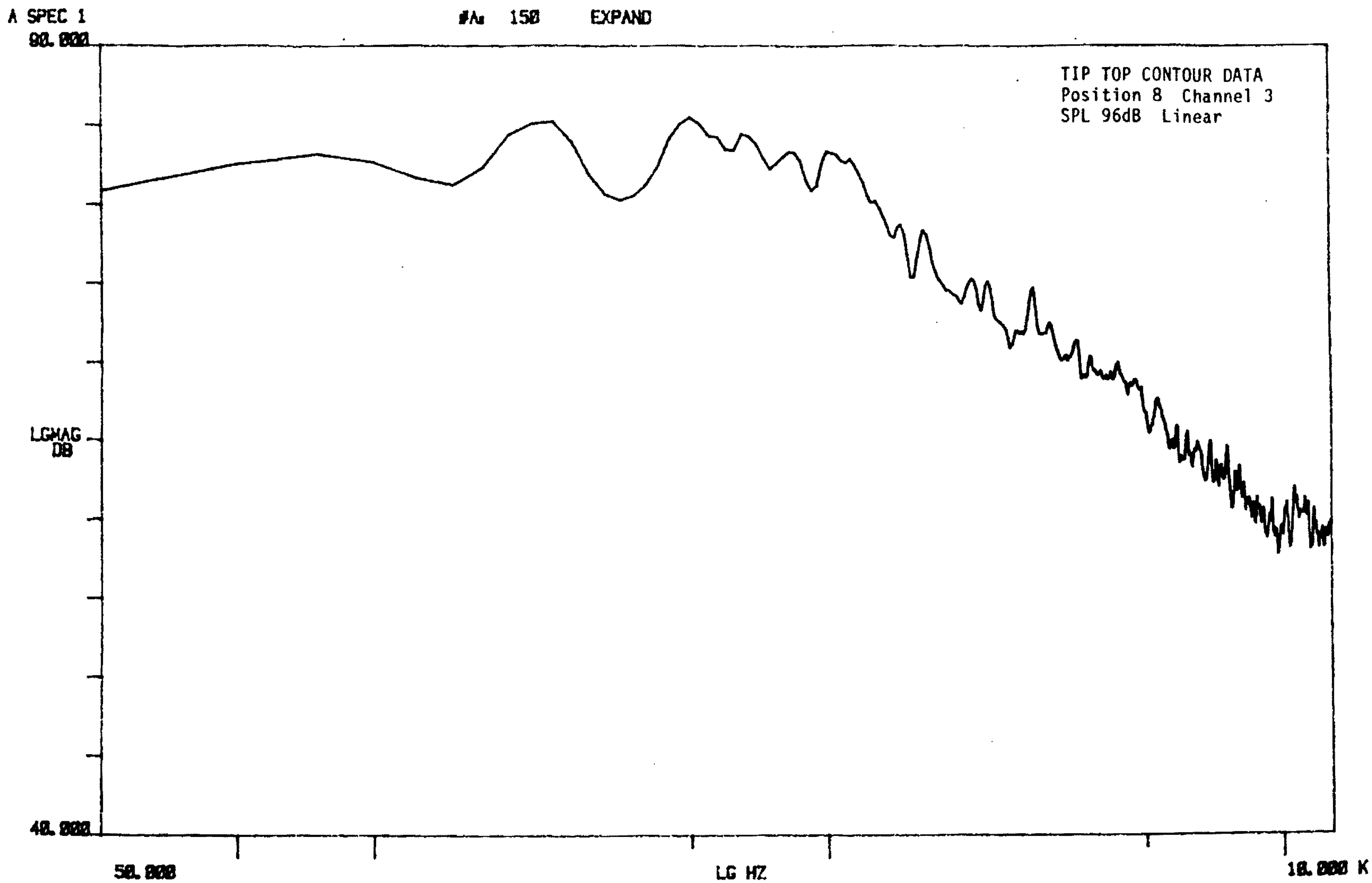

A SPEC 1
#A: 150 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 8 Channel 3
SPL 96dB Linear
LGMAG DB
40.000
50.000
LG HZ
10.000 K

Figure 44B

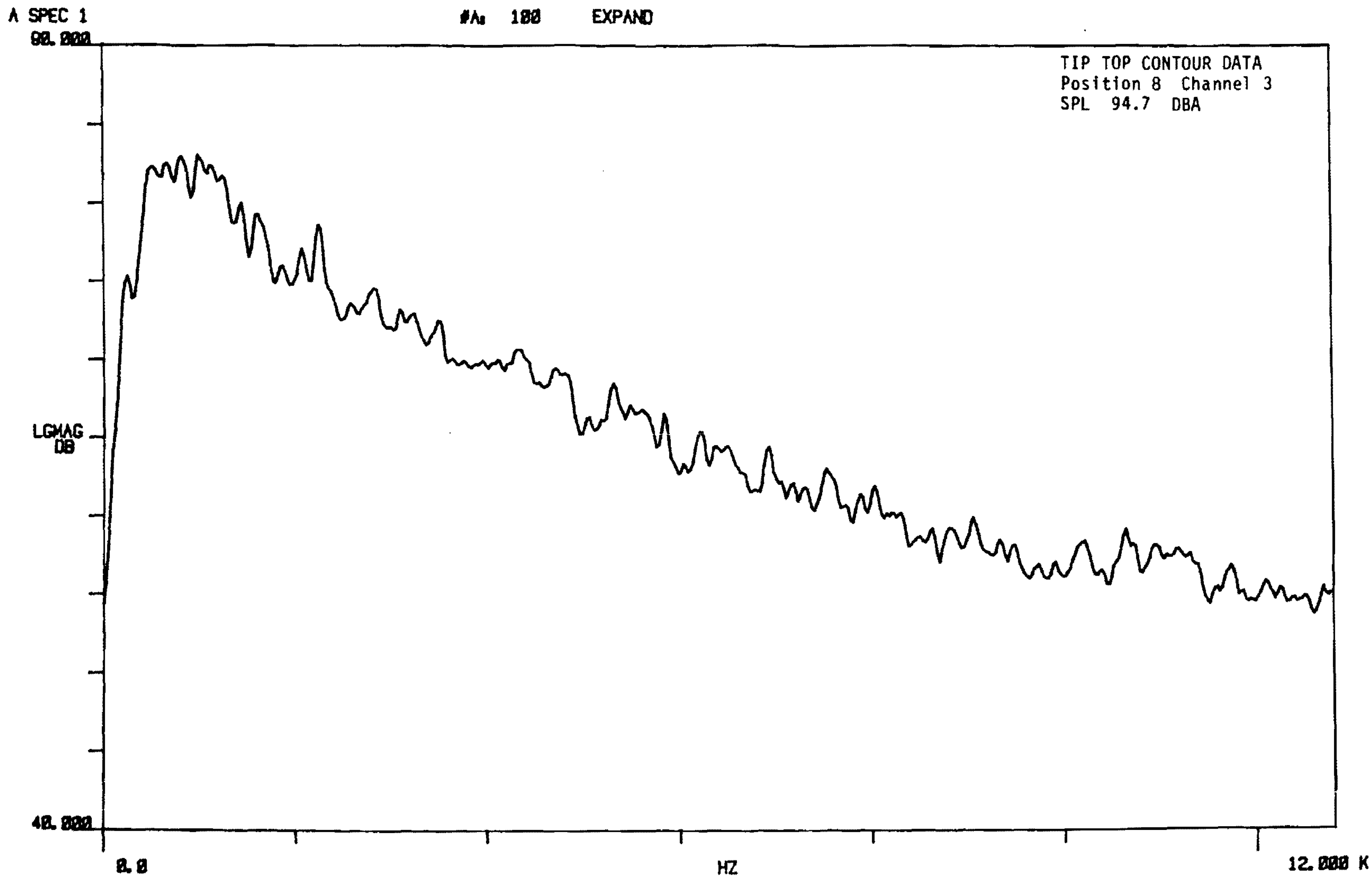
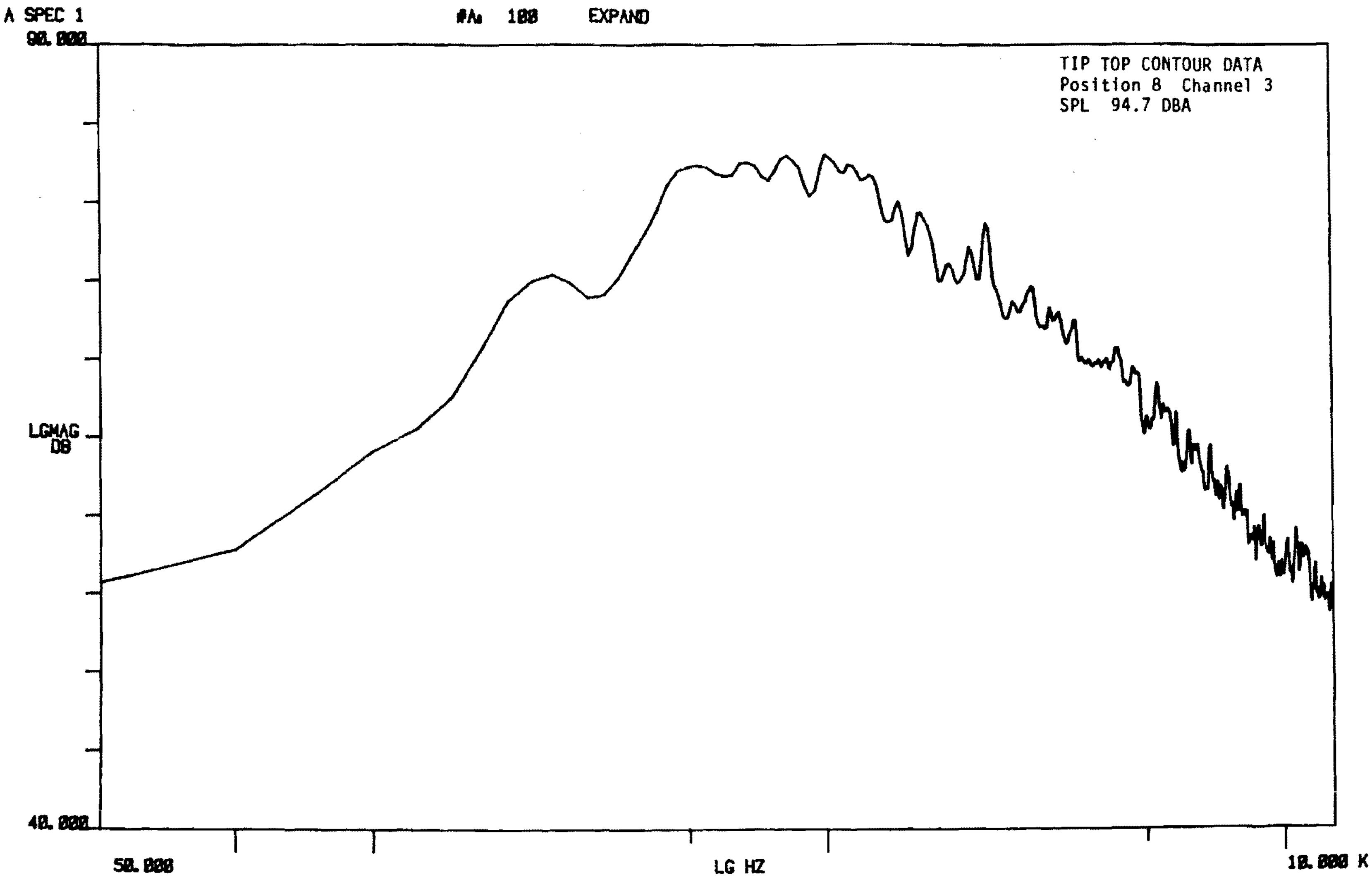

A SPEC 1
#A: 100 EXPAND
80.000
TIP TOP CONTOUR DATA
Position 8 Channel 3
SPL 94.7 DBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 45B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 8 Channel 3
SPL 94.7 DBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 46B

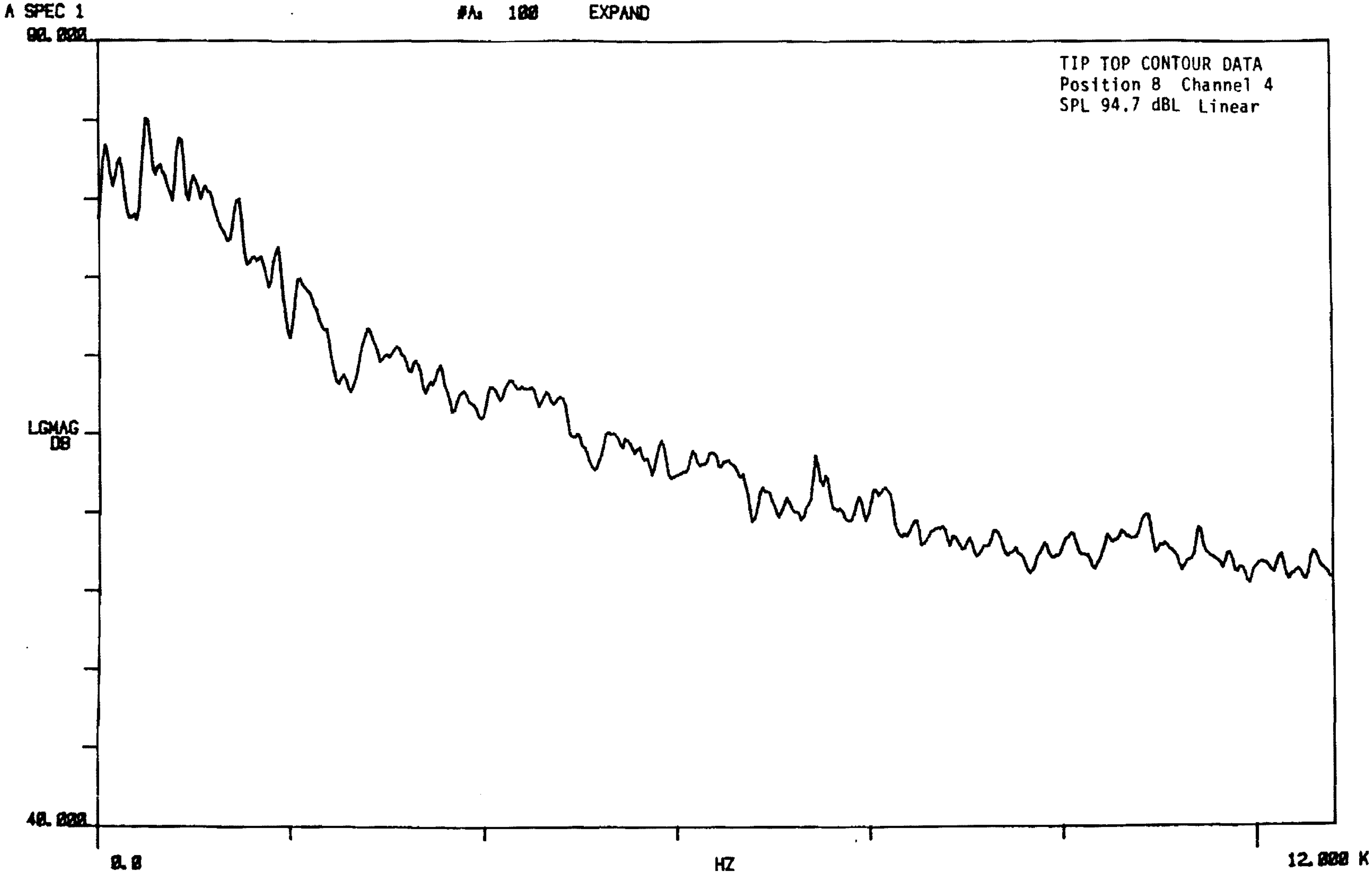

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 8 Channel 4
SPL 94.7 dBL Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 47B

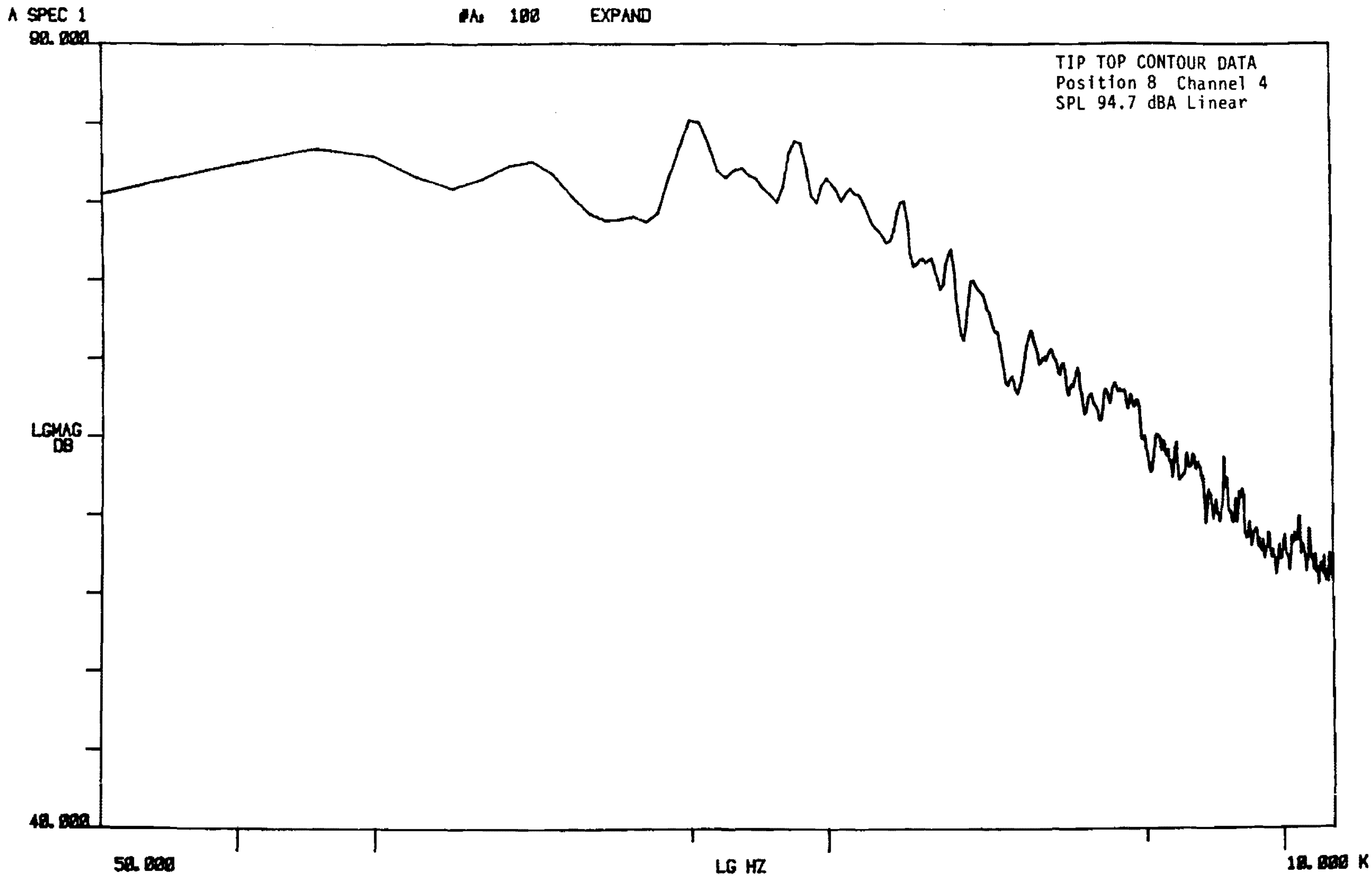
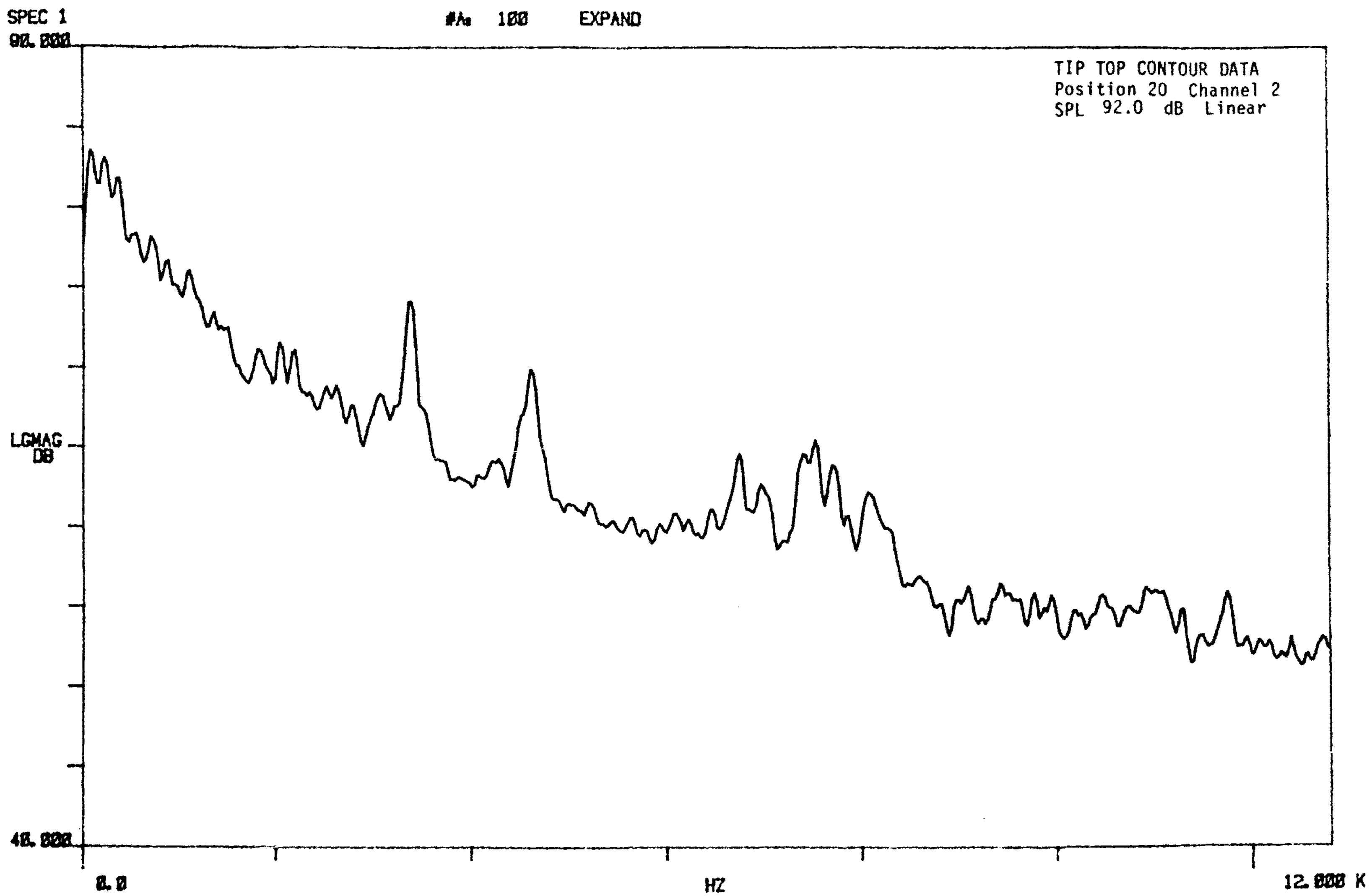

A SPEC 1
#A: 100
EXPAND
90.000
40.000
LGMAG DB
TIP TOP CONTOUR DATA
Position 8 Channel 4
SPL 94.7 dBA Linear
50.000
LG HZ
10.000 K

Figure 48B



SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 20 Channel 2
SPL 92.0 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 49B

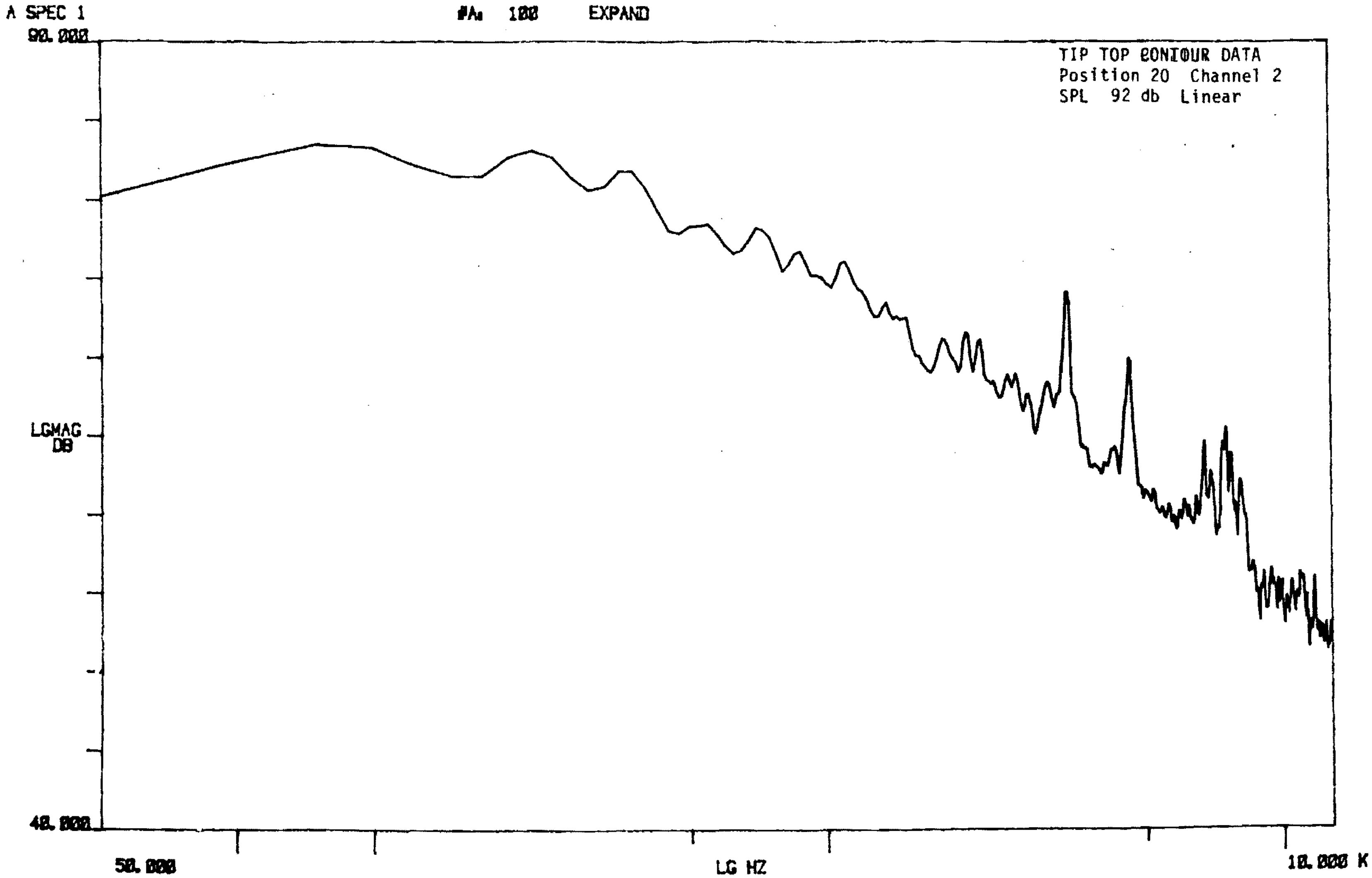

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 20 Channel 2
SPL 92 db Linear
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 50B

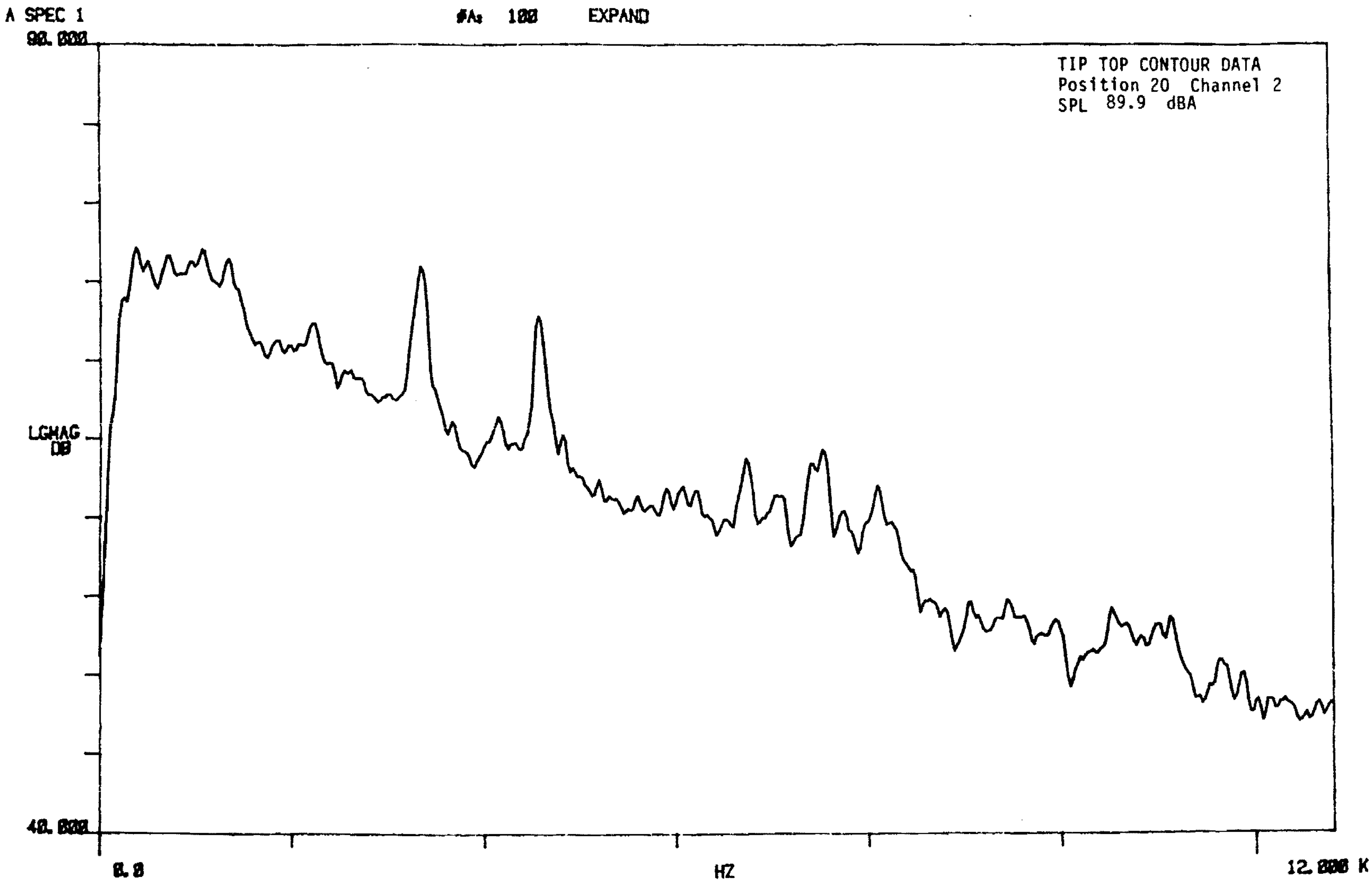
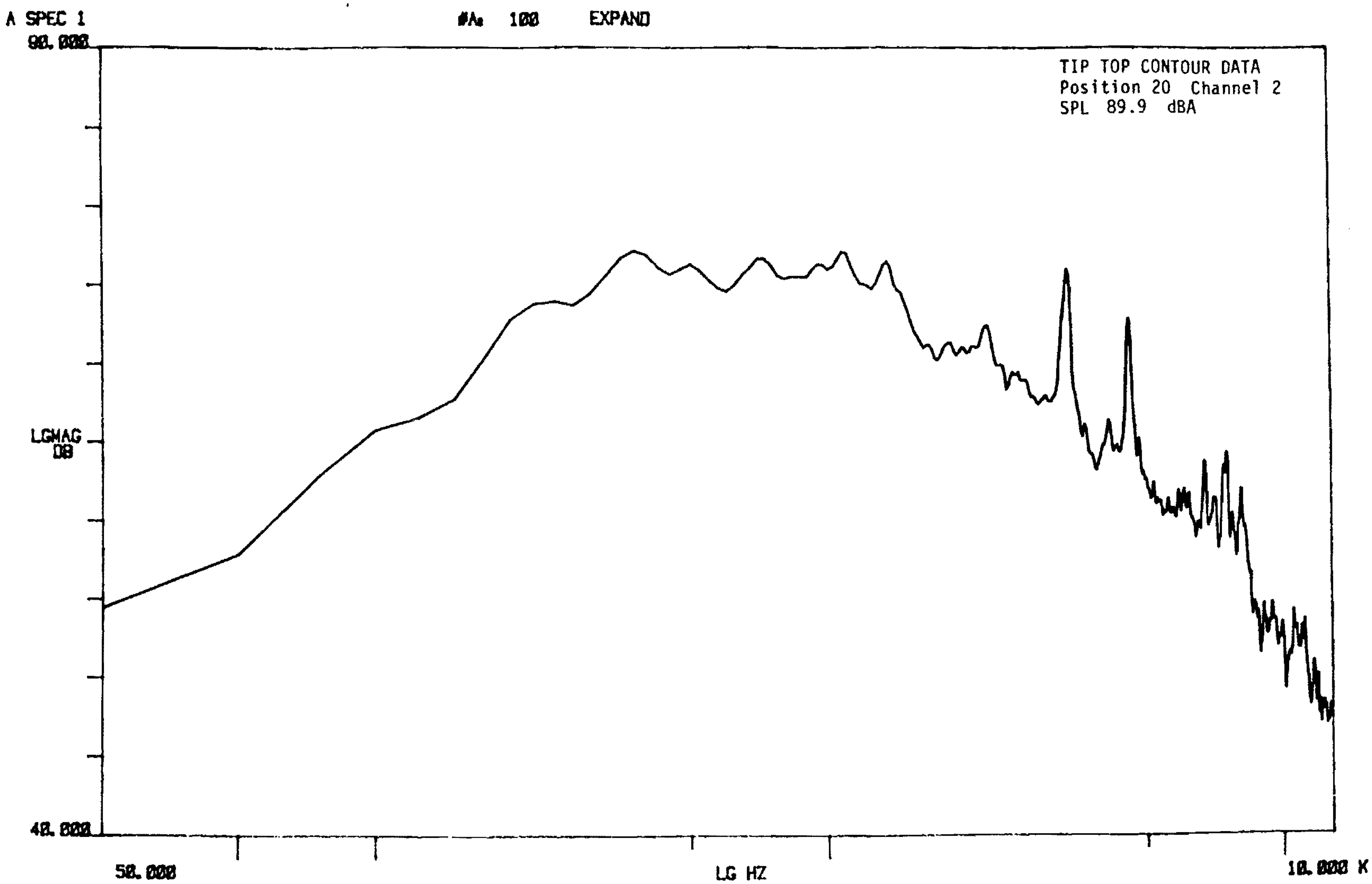

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 20 Channel 2
SPL 89.9 dBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 51B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 20 Channel 2
SPL 89.9 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 52B

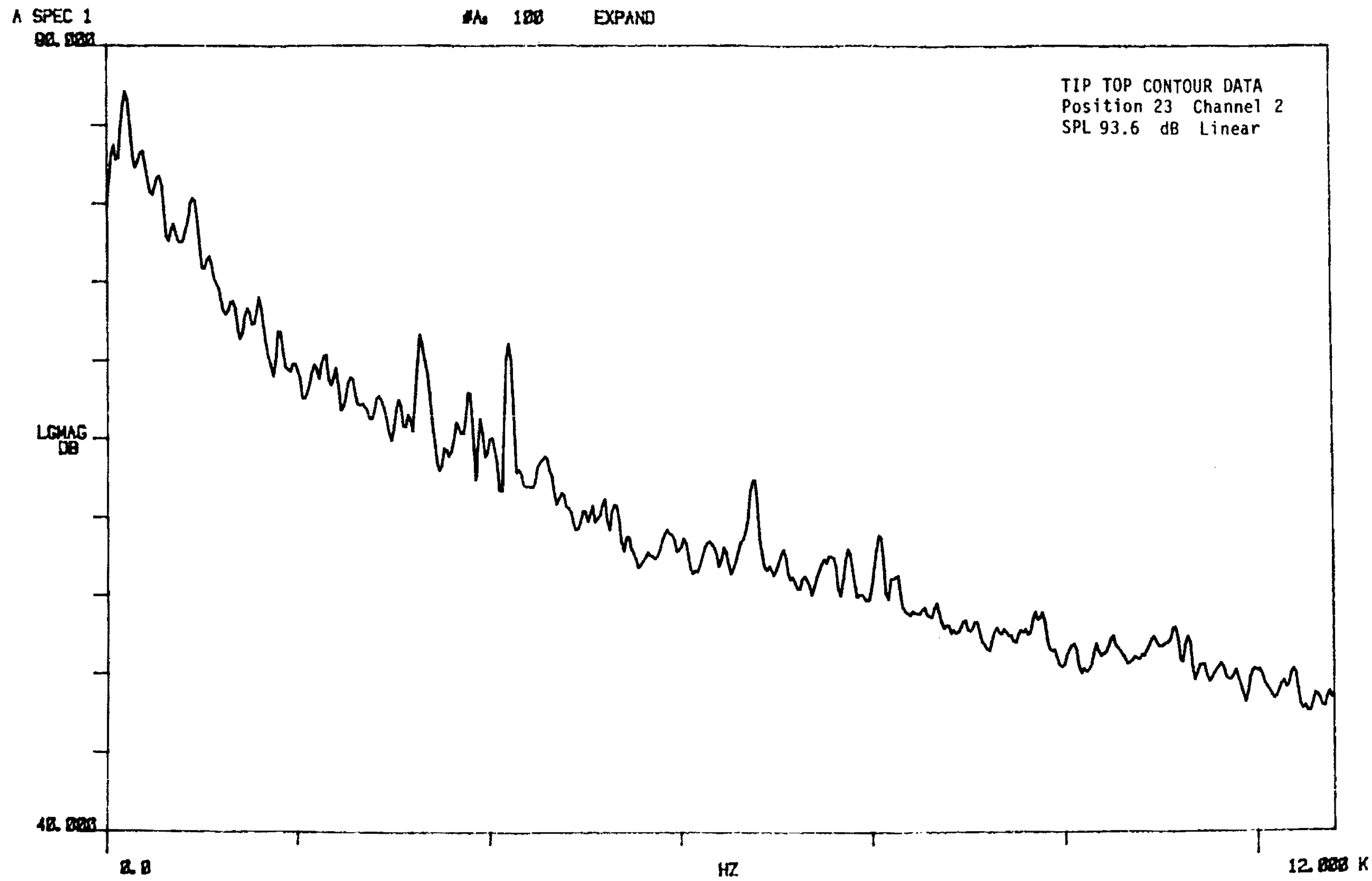

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 23 Channel 2
SPL 93.6 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 53B

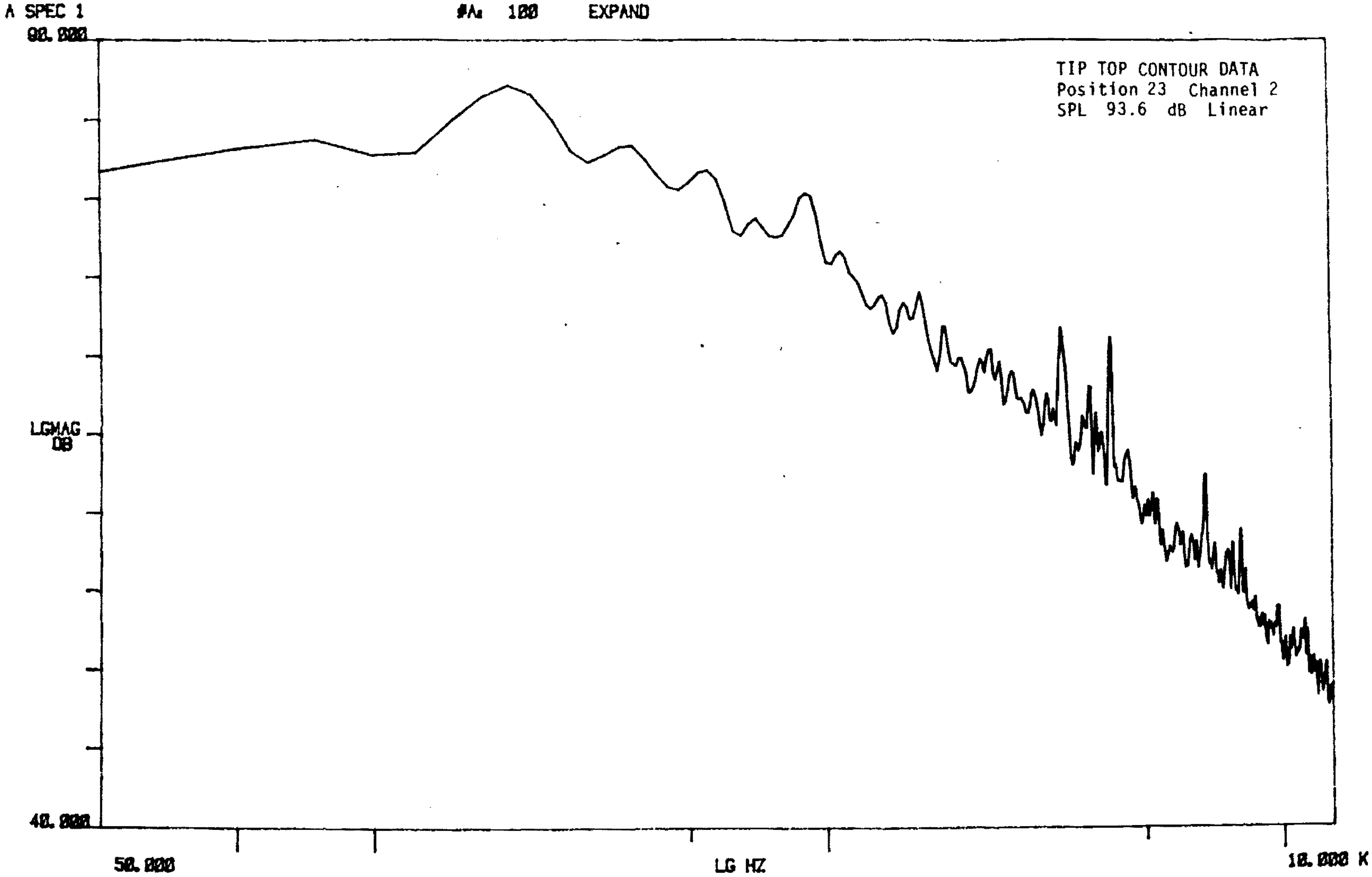

A SPEC 1
#A: 100
EXPAND
80.000
TIP TOP CONTOUR DATA
Position 23 Channel 2
SPL 93.6 dB Linear
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 54B

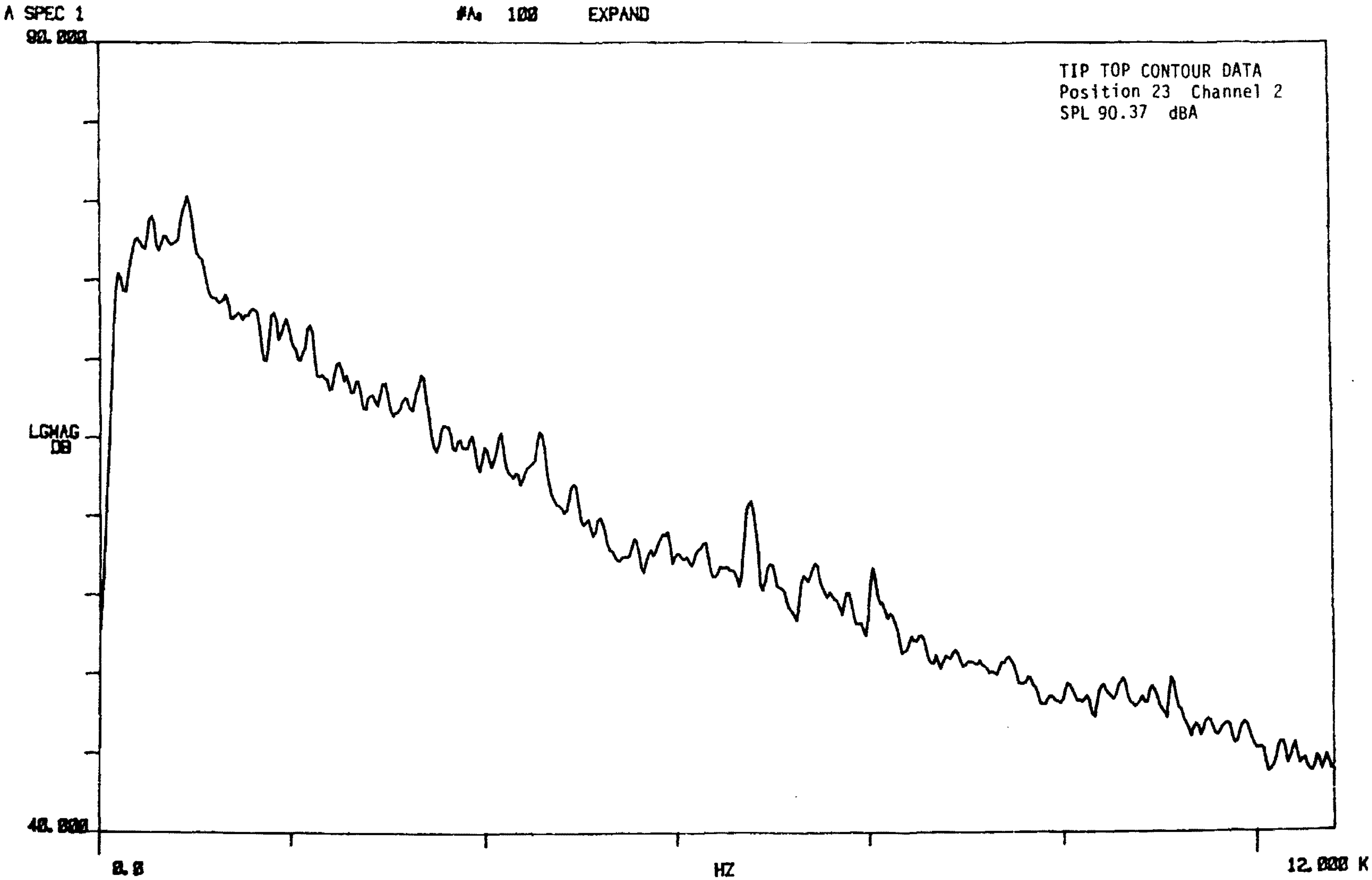
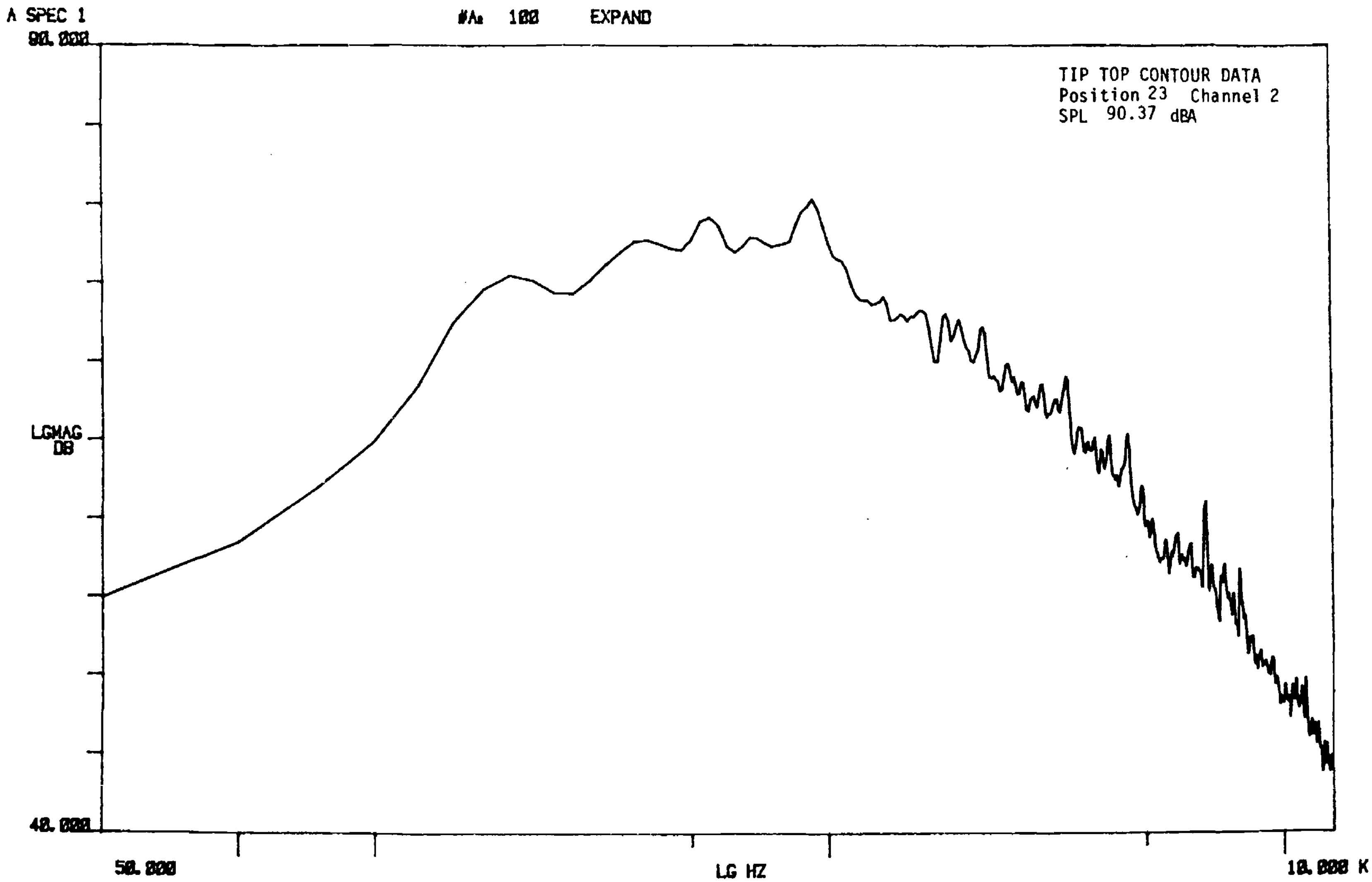

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 23 Channel 2
SPL 90.37 dBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 55B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 23 Channel 2
SPL 90.37 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 56B

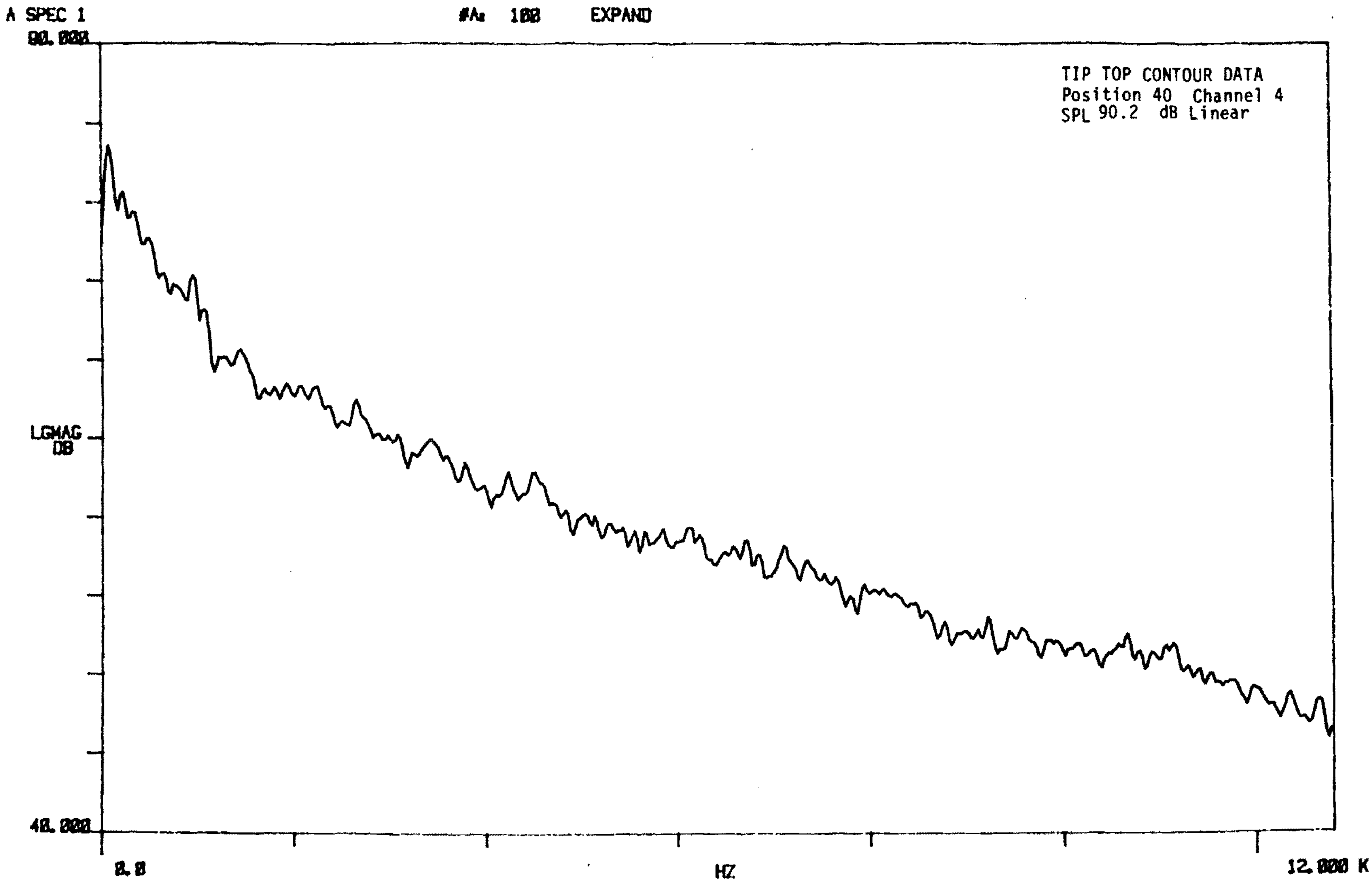

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 40 Channel 4
SPL 90.2 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 57B

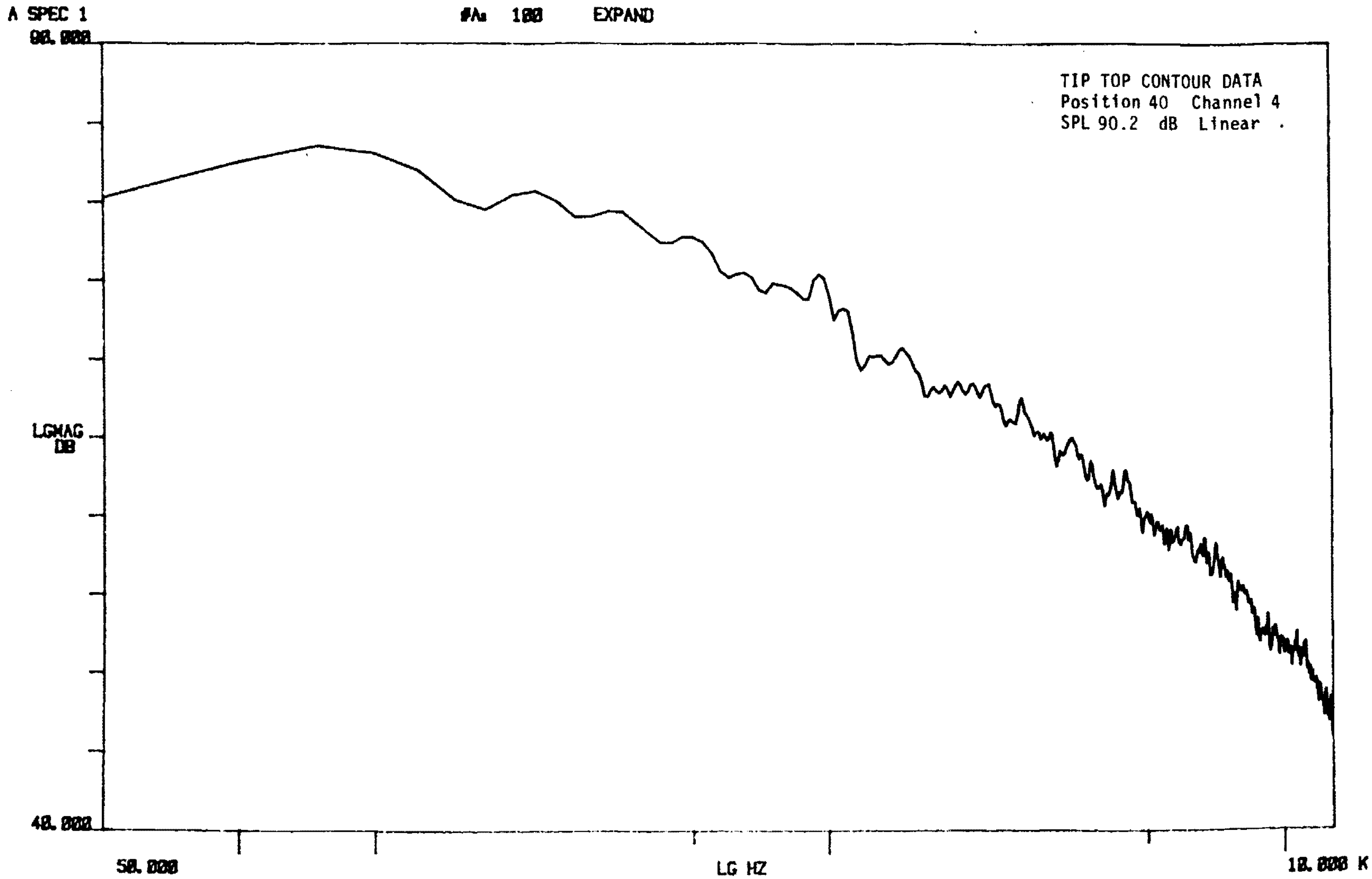

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 40 Channel 4
SPL 90.2 dB Linear
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 58B

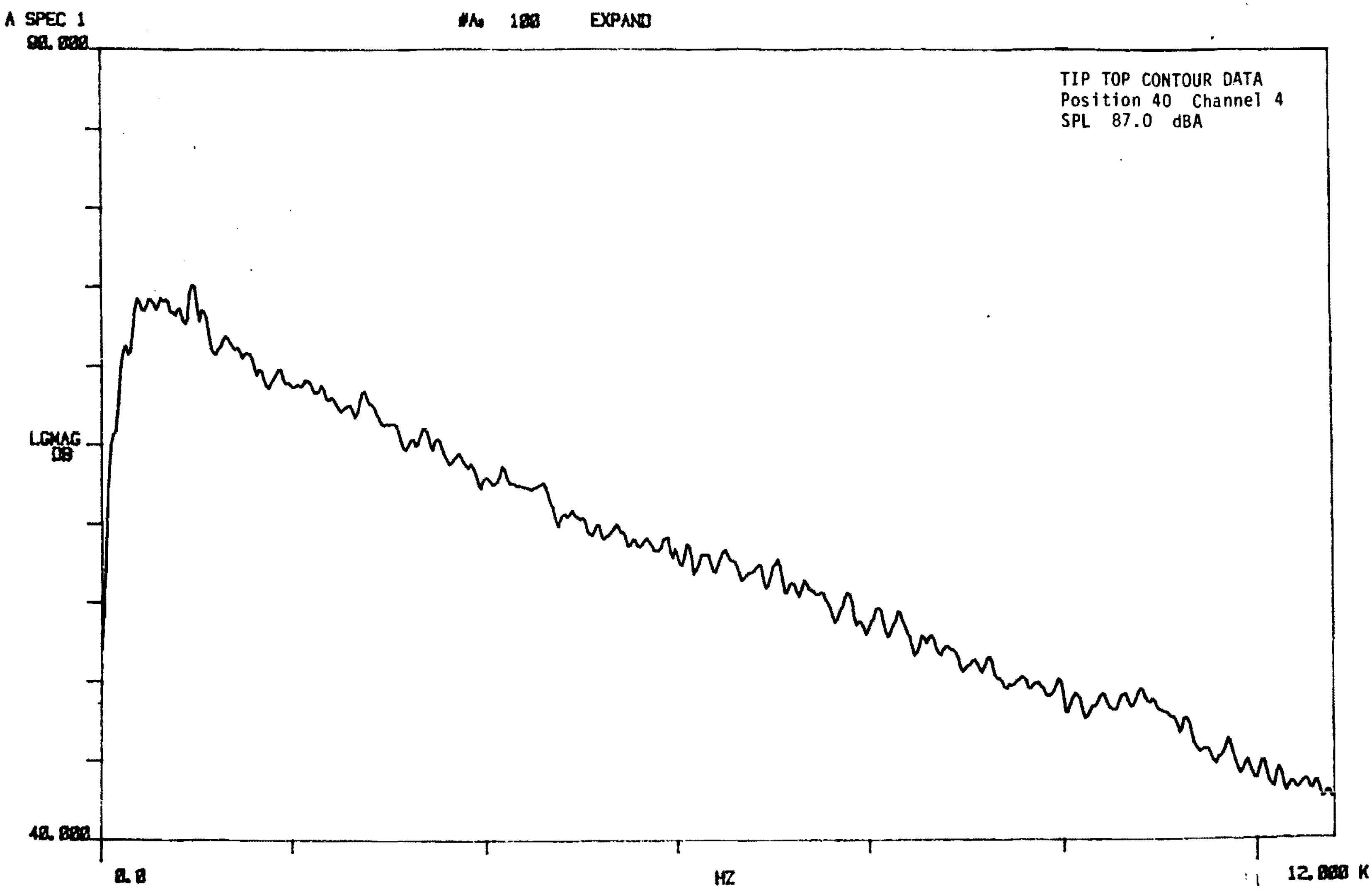
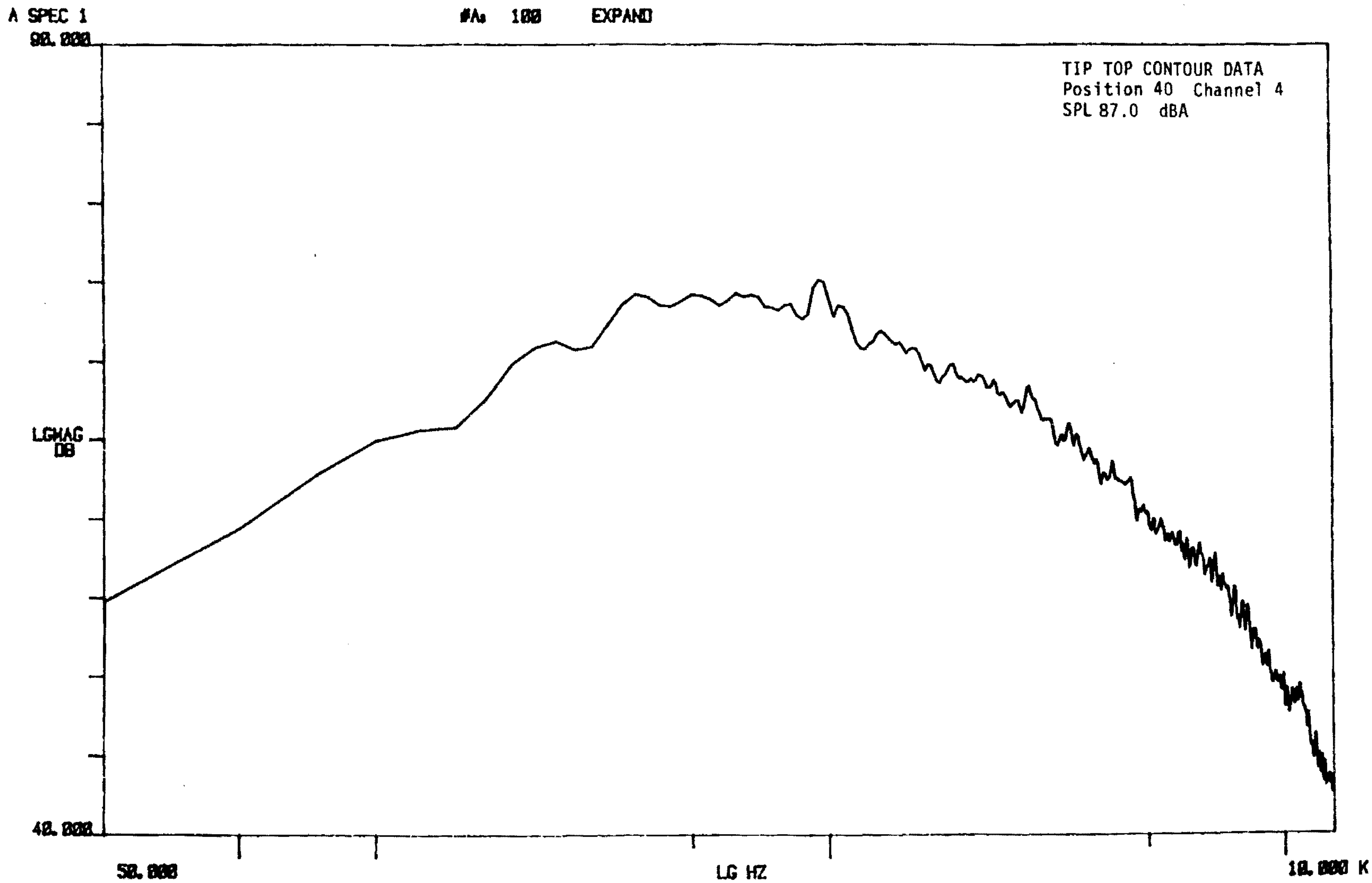

A SPEC 1
#A: 100 EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
TIP TOP CONTOUR DATA
Position 40 Channel 4
SPL 87.0 dBA

Figure 59B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 40 Channel 4
SPL 87.0 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 60B

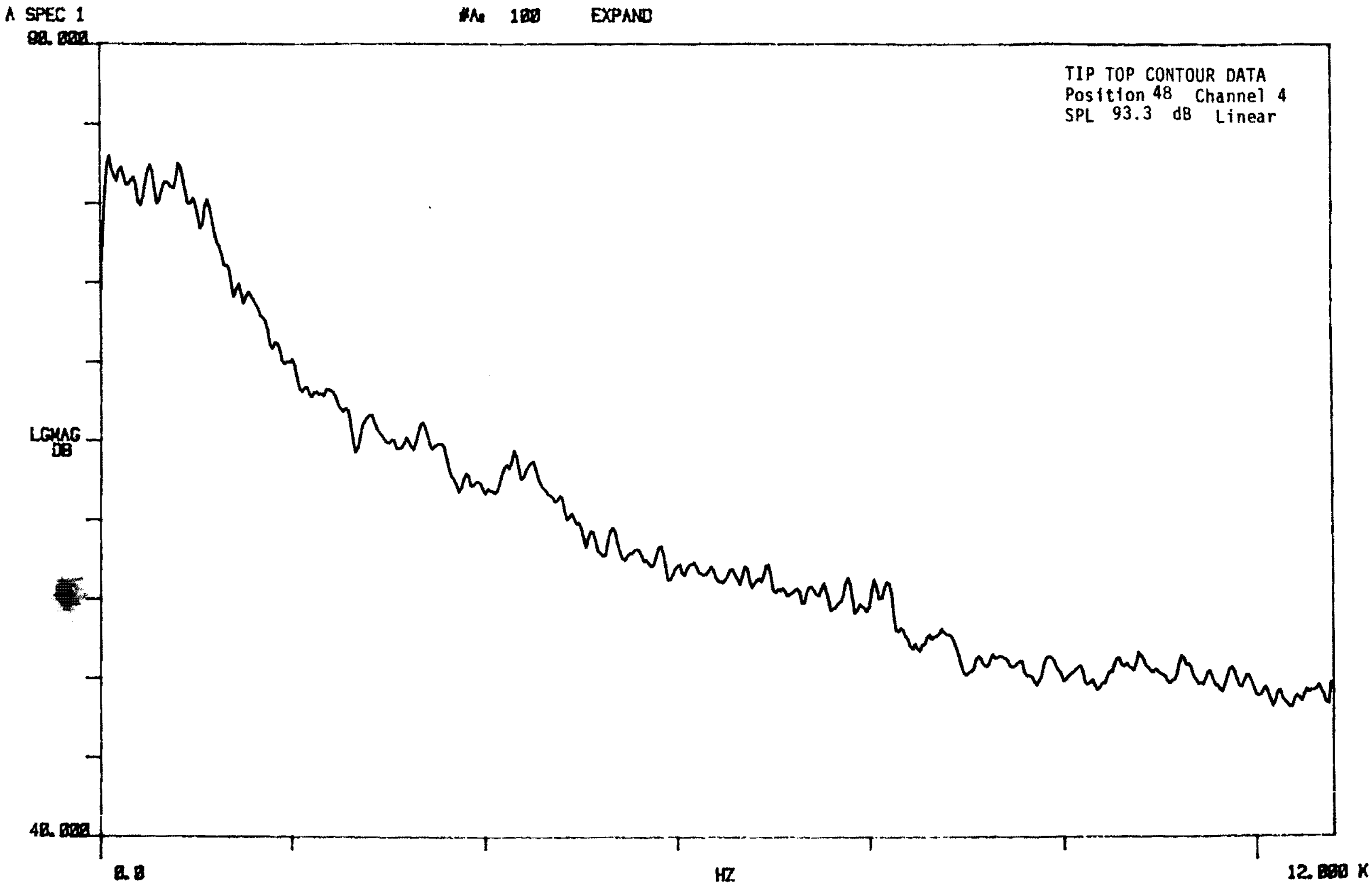

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 48 Channel 4
SPL 93.3 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 61B

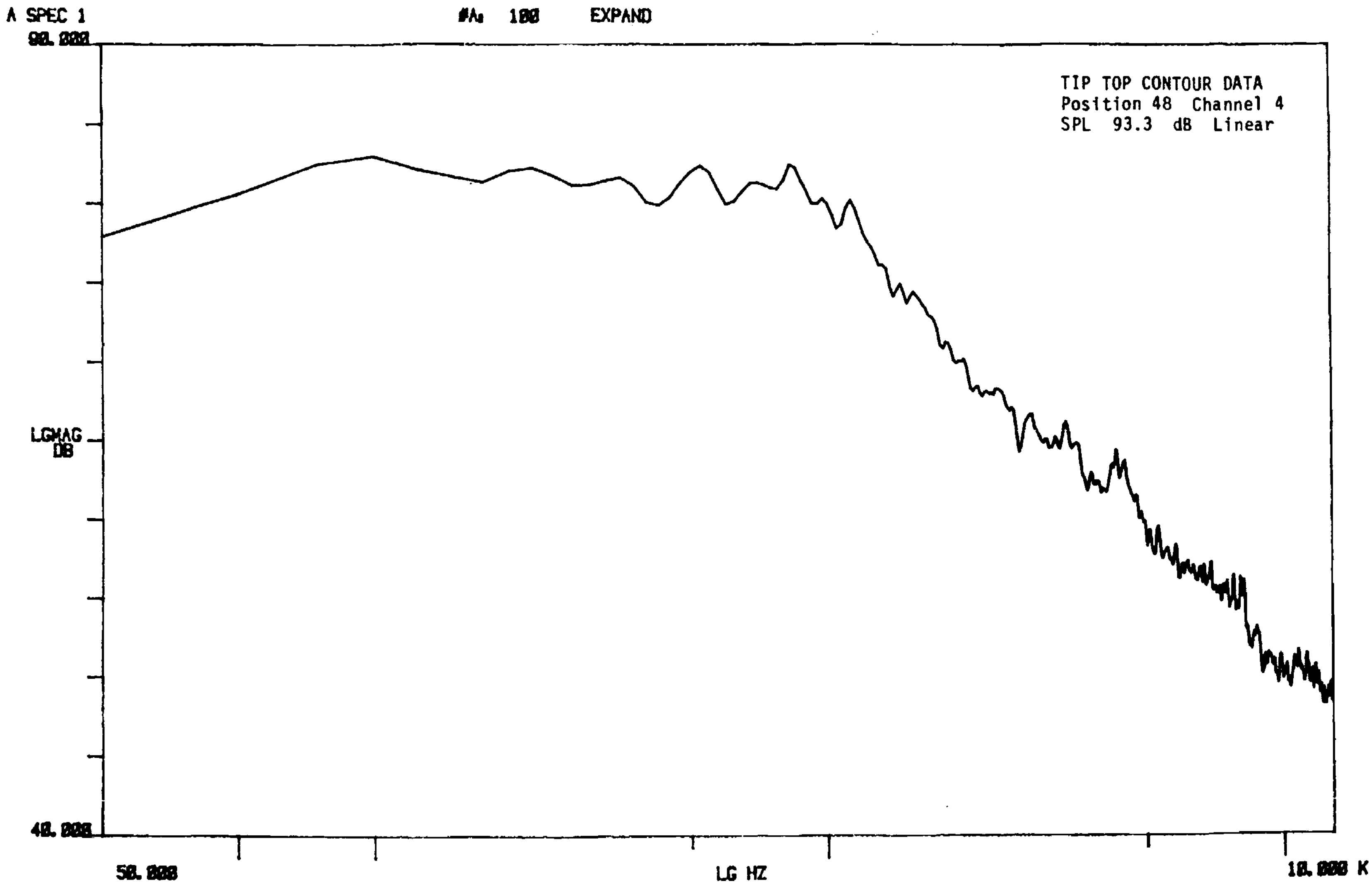

A SPEC 1
#A: 100
EXPAND
90.000
LGMAG
DB
40.000
50.000
LG HZ
10.000 K
TIP TOP CONTOUR DATA
Position 48 Channel 4
SPL 93.3 dB Linear

Figure 62B

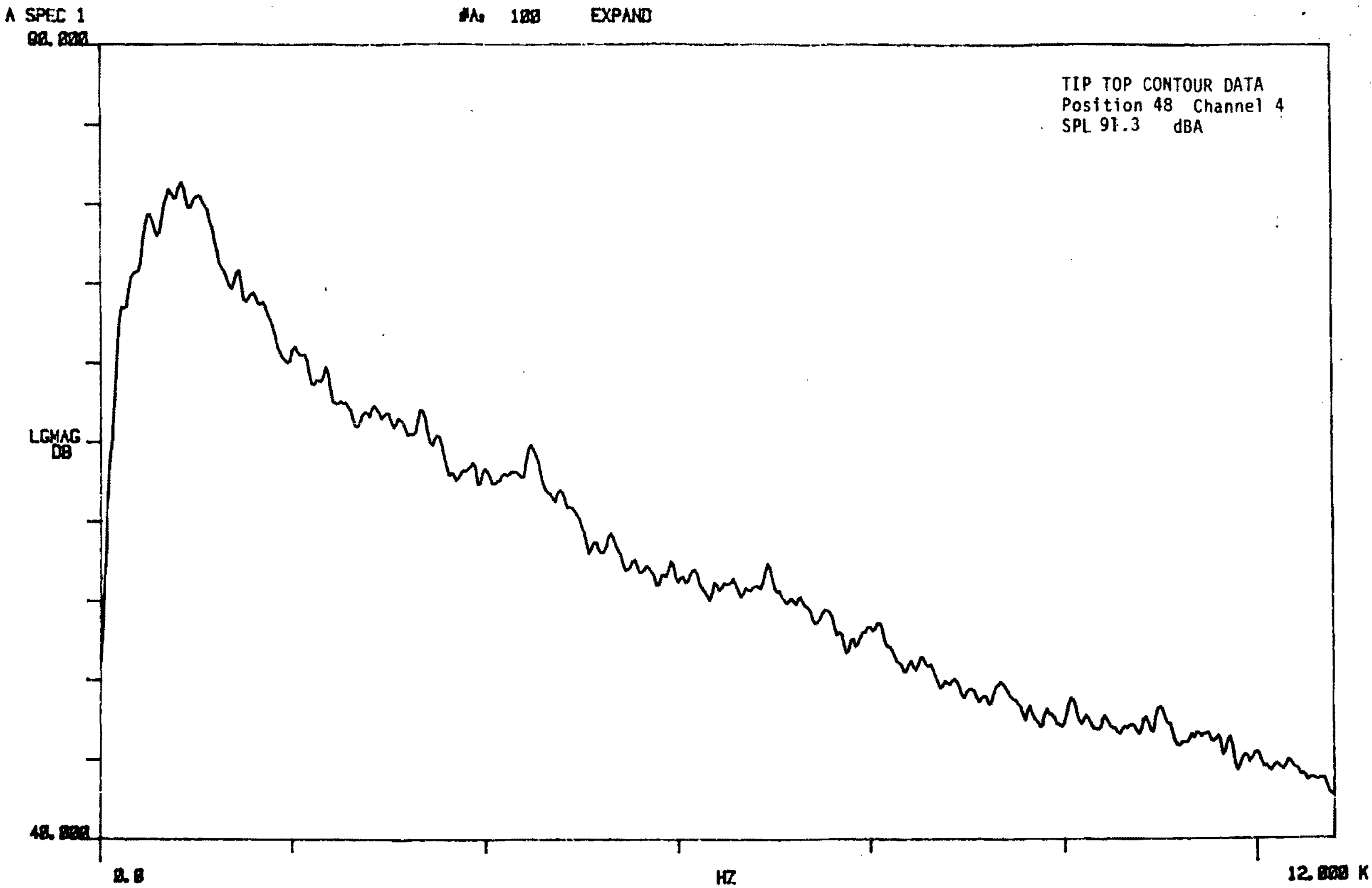

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 48 Channel 4
SPL 91.3 dBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 63B

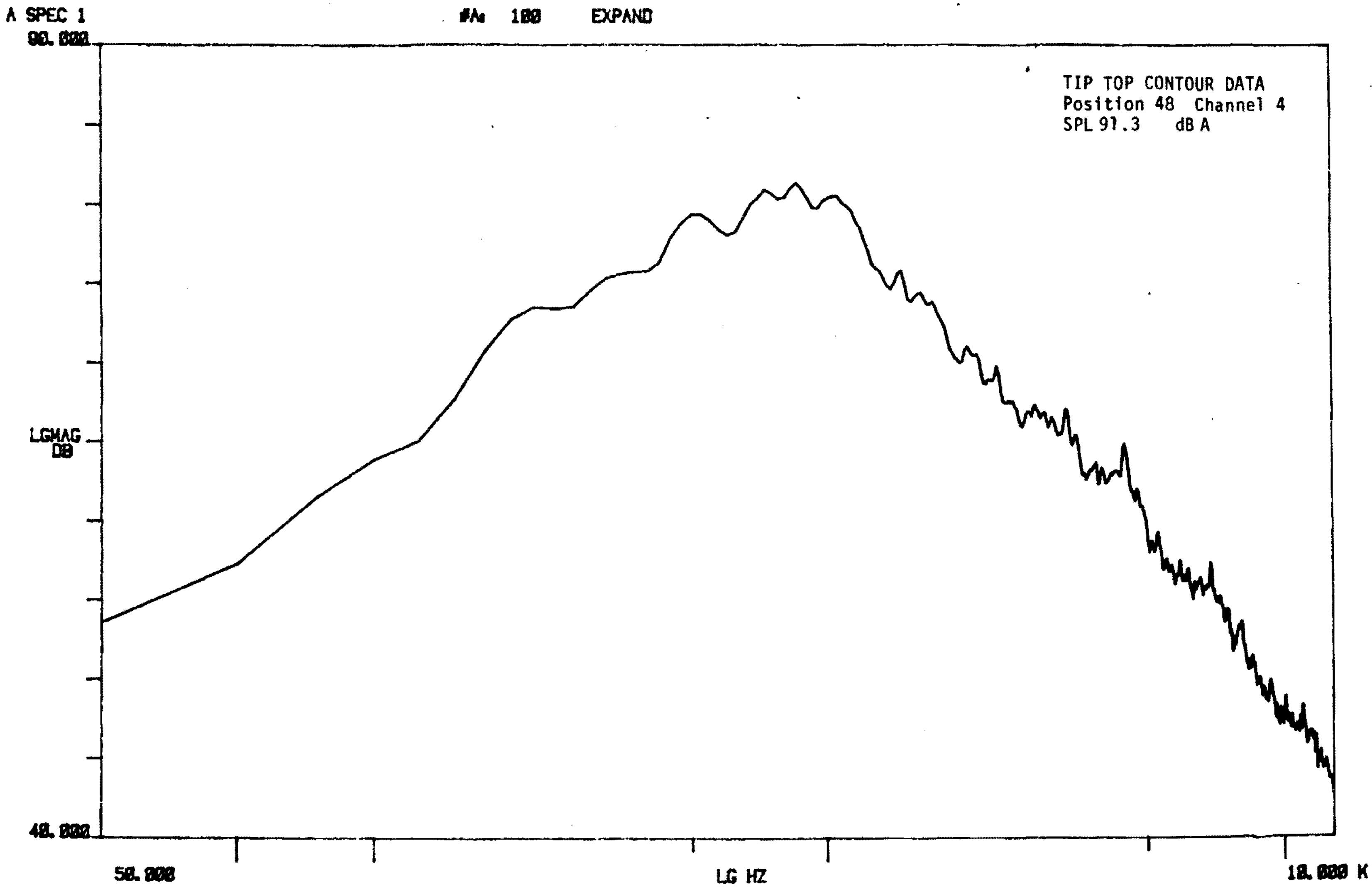
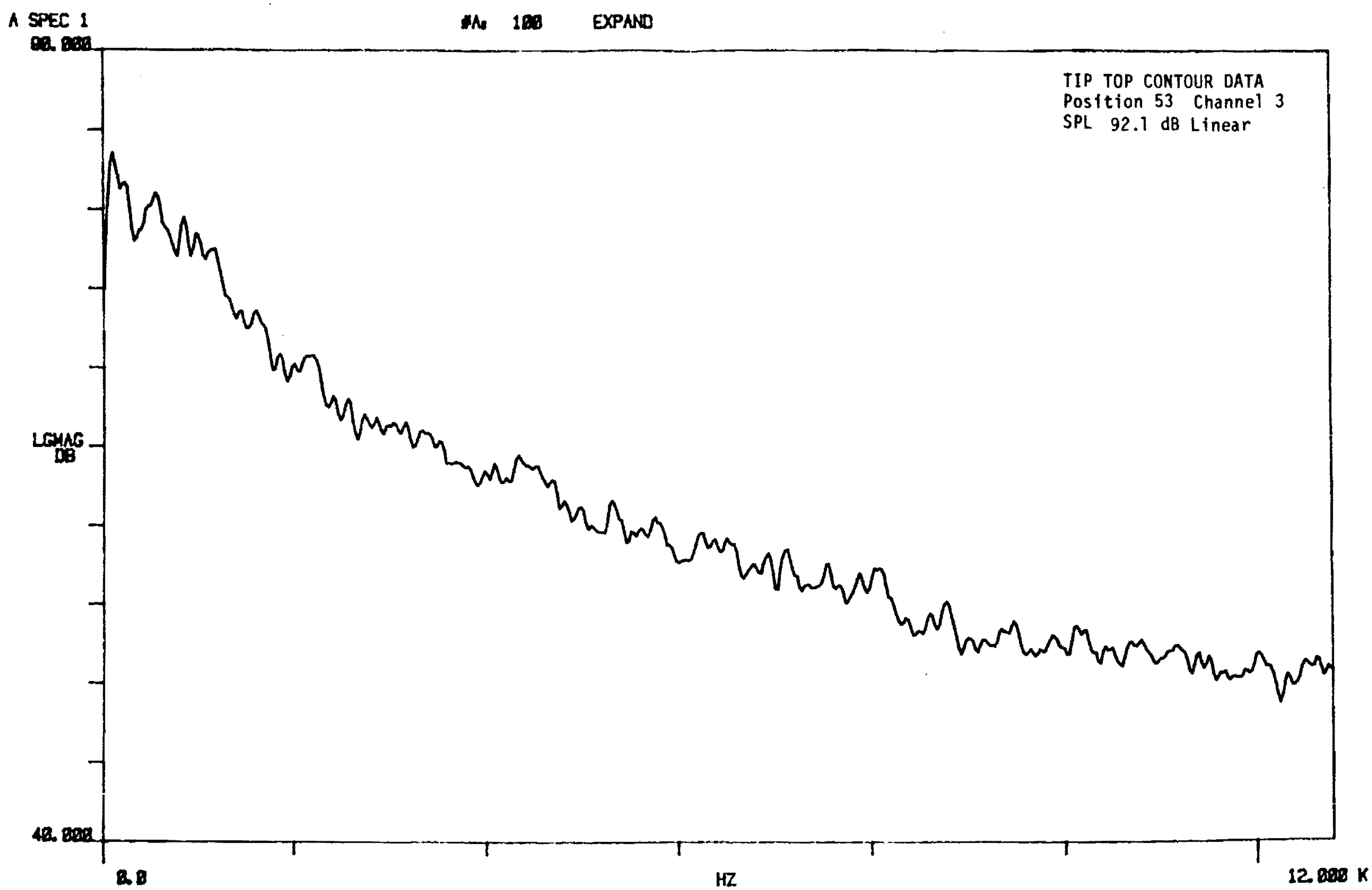

A SPEC 1
#A: 100 EXPAND
80.000
TIP TOP CONTOUR DATA
Position 48 Channel 4
SPL 91.3 dB A
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 64B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 53 Channel 3
SPL 92.1 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 65B

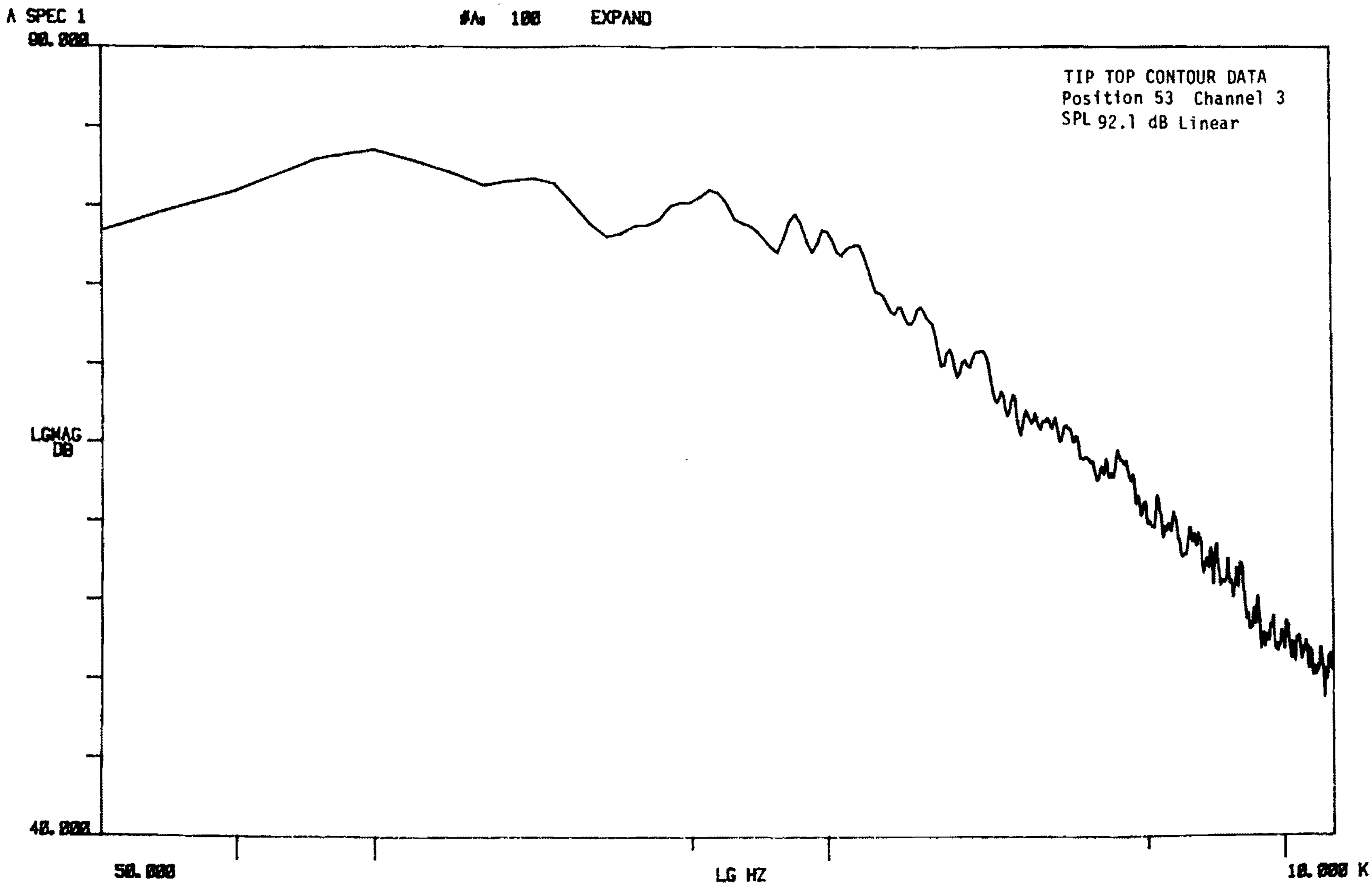

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 53 Channel 3
SPL 92.1 dB Linear
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 66B

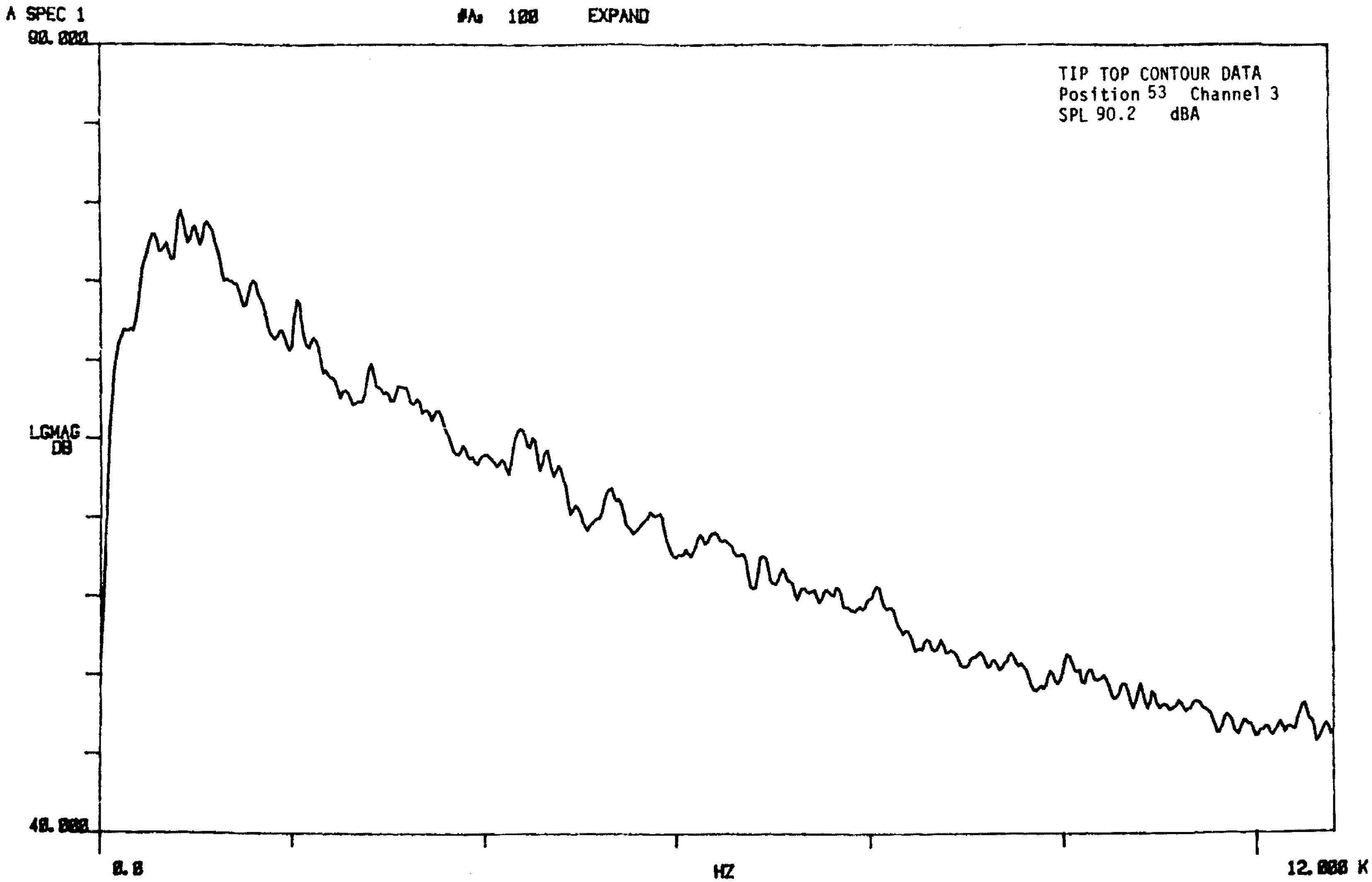

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 53 Channel 3
SPL 90.2 dBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 67B

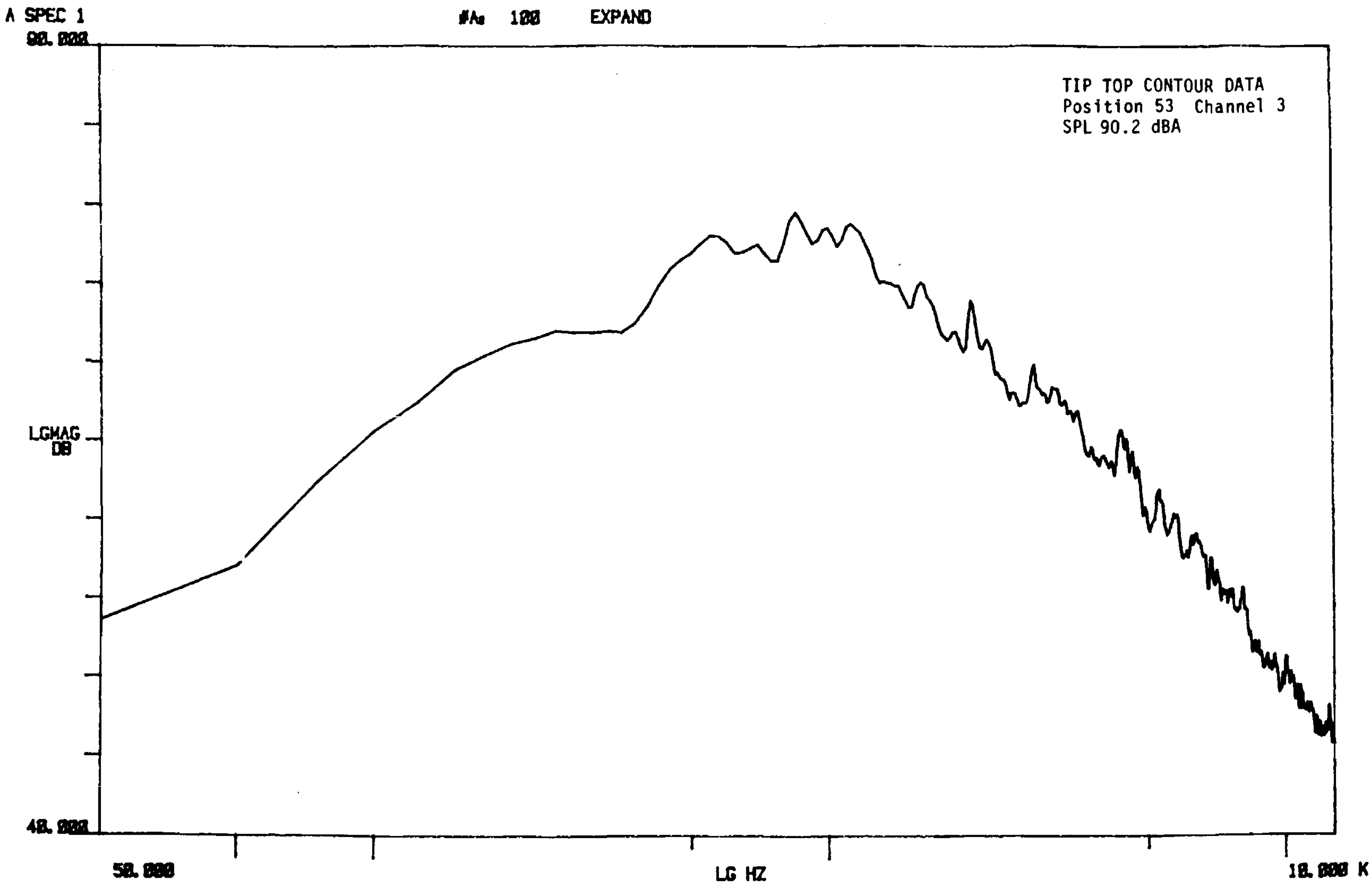

A SPEC 1
#As 100 EXPAND
80.000
TIP TOP CONTOUR DATA
Position 53 Channel 3
SPL 90.2 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 68B

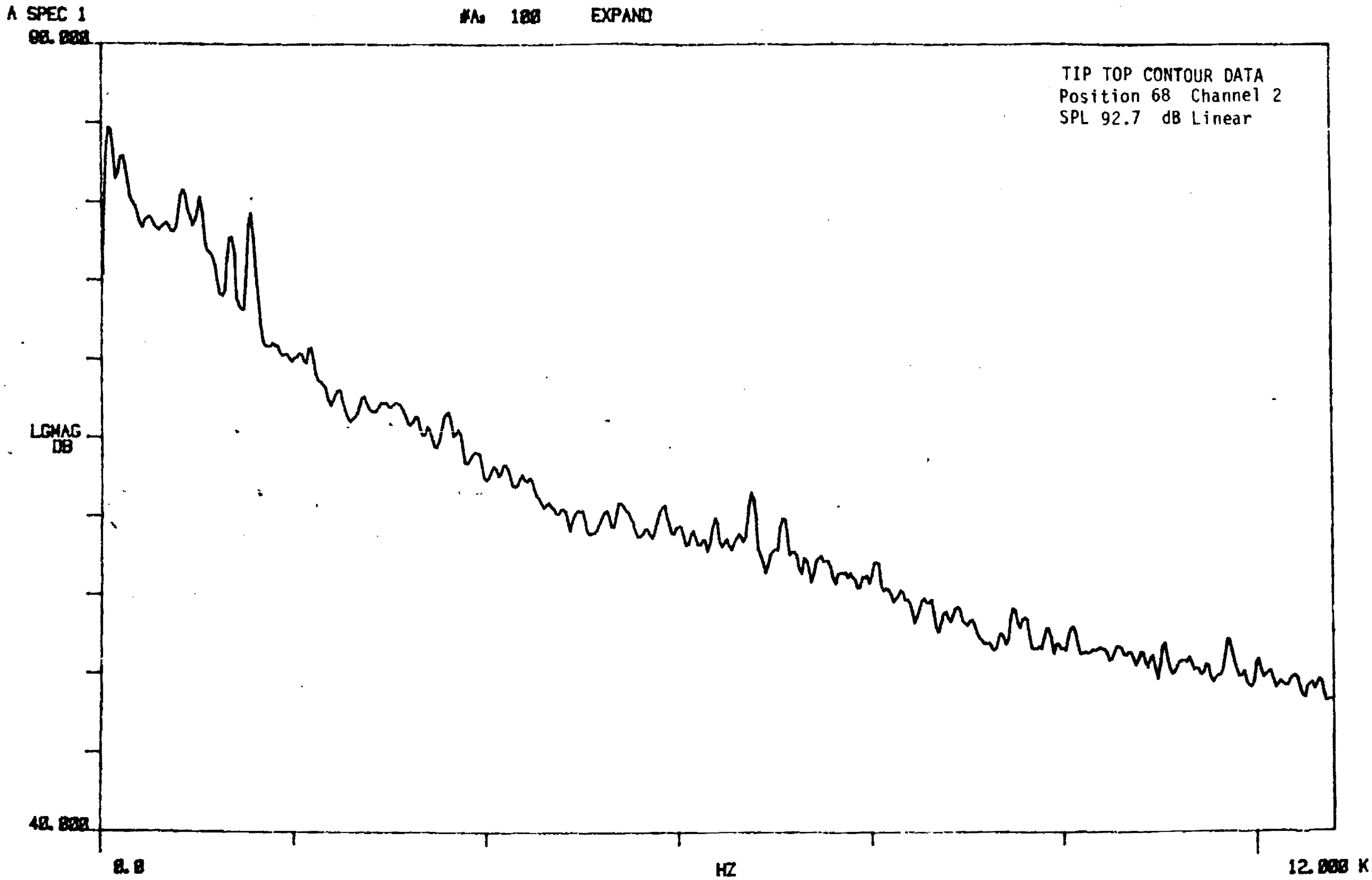
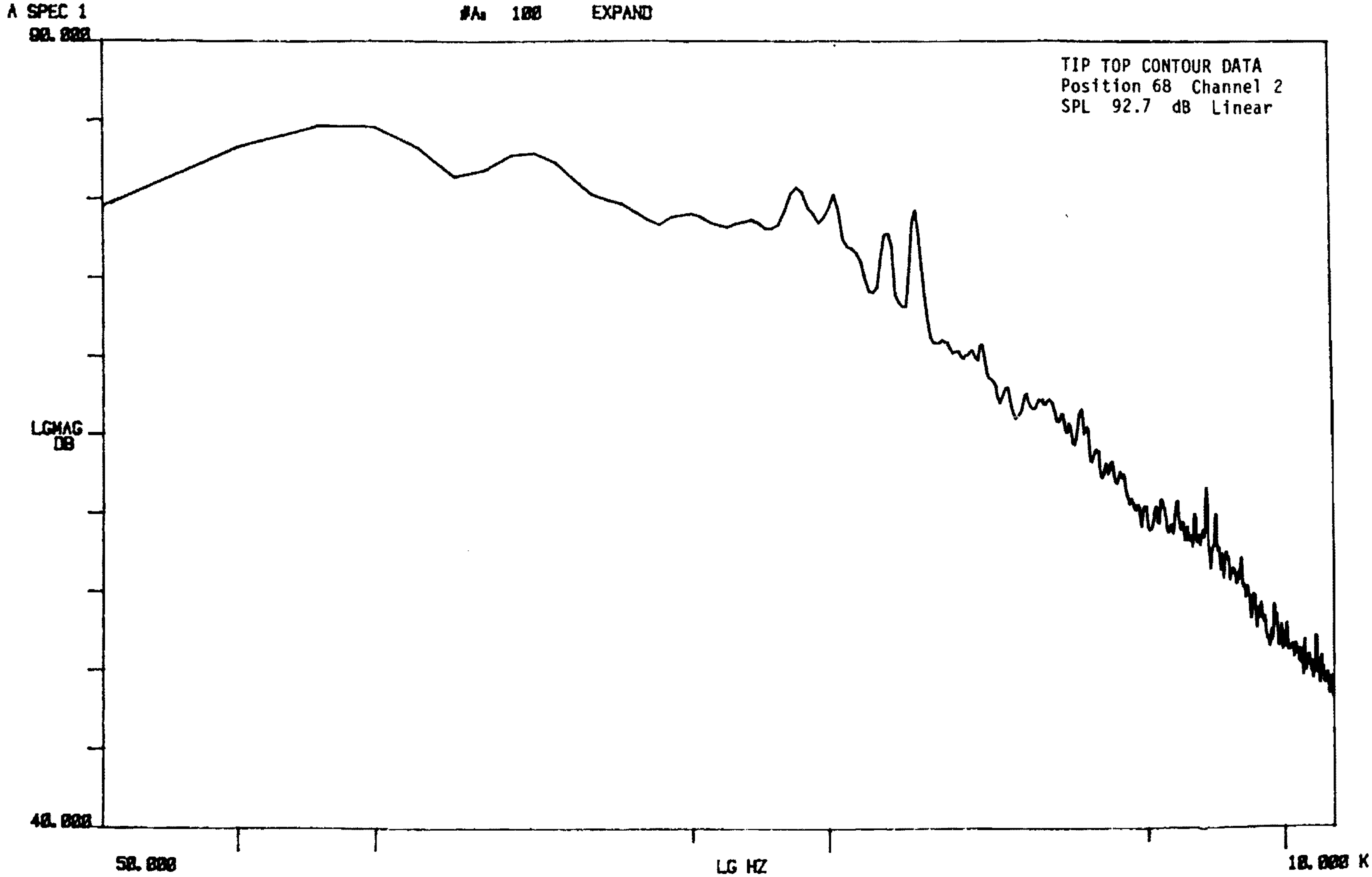

A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 68 Channel 2
SPL 92.7 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 69B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 68 Channel 2
SPL 92.7 dB Linear
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 70B

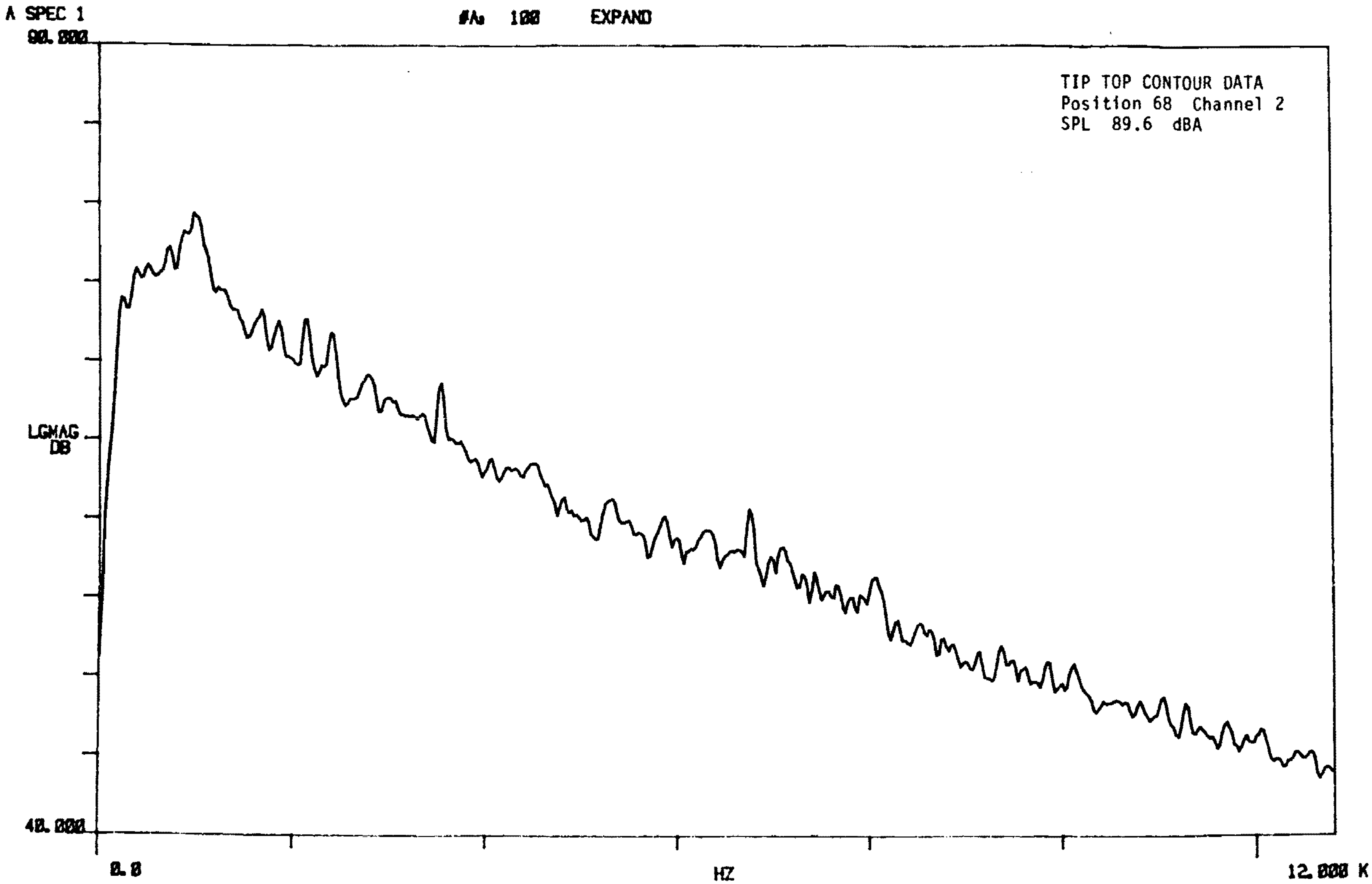

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 68 Channel 2
SPL 89.6 dBA
LGMAG DB
40.000
0.0
HZ
12.000 K

Figure 71B

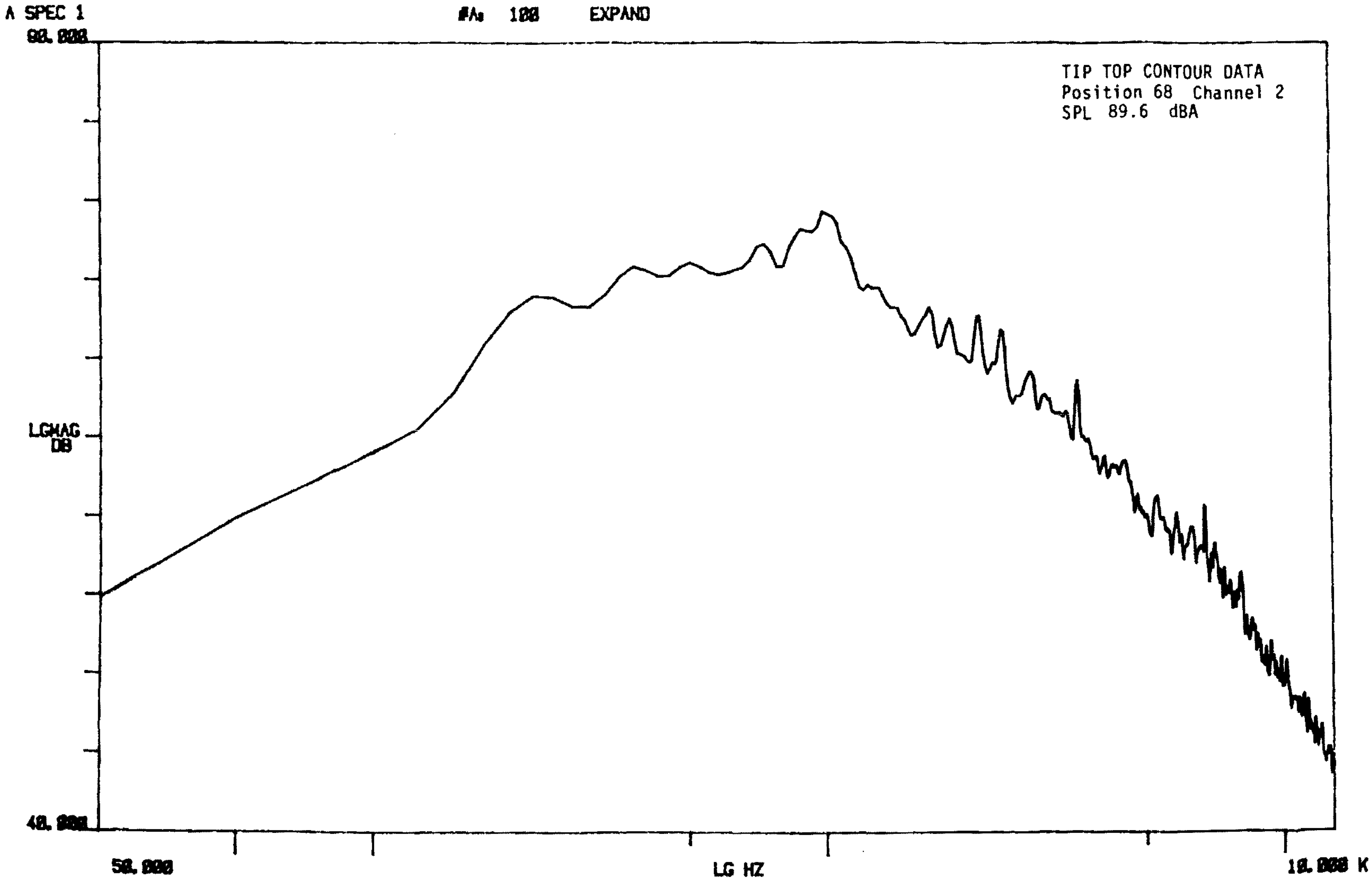

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 68 Channel 2
SPL 89.6 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 72B

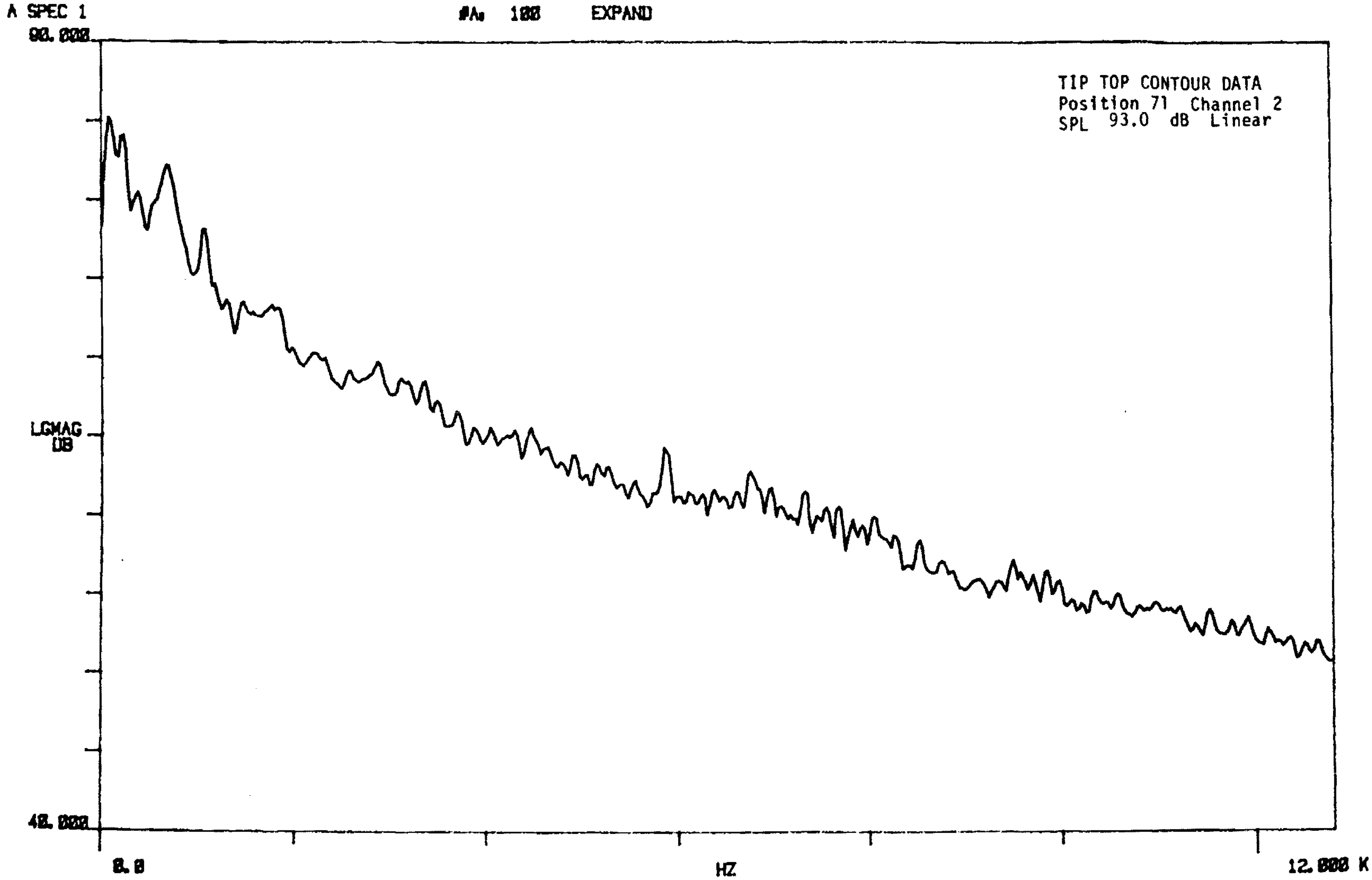

A SPEC 1
#A: 100
EXPAND
90.000
LGMAG
DB
40.000
0.0
HZ
12.000 K
TIP TOP CONTOUR DATA
Position 71 Channel 2
SPL 93.0 dB Linear

Figure 73B

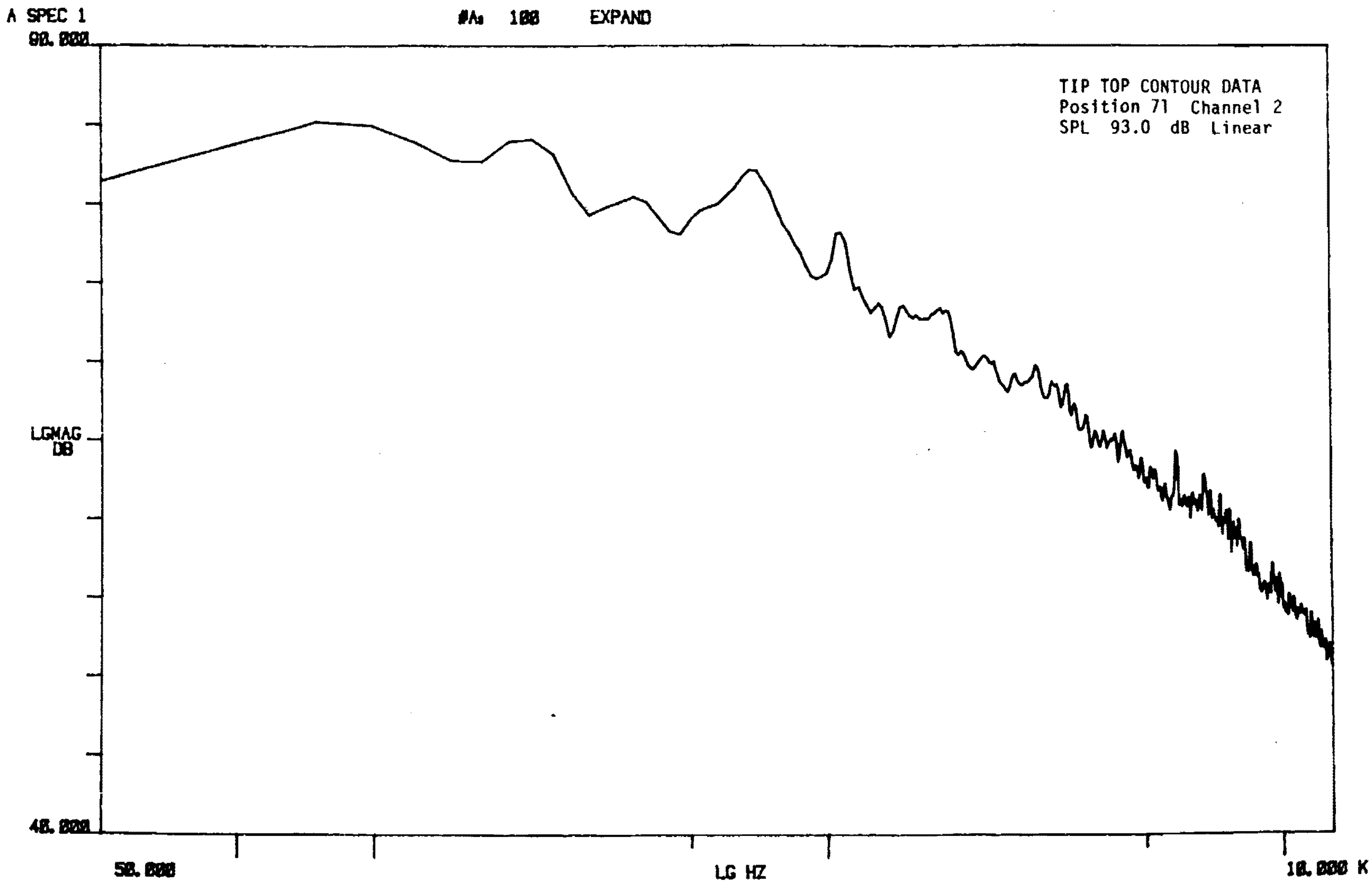

A SPEC 1
#A: 100
EXPAND
80.000
LGMAG
DB
40.000
TIP TOP CONTOUR DATA
Position 71 Channel 2
SPL 93.0 dB Linear
50.000
LG HZ
10.000 K

Figure 74B

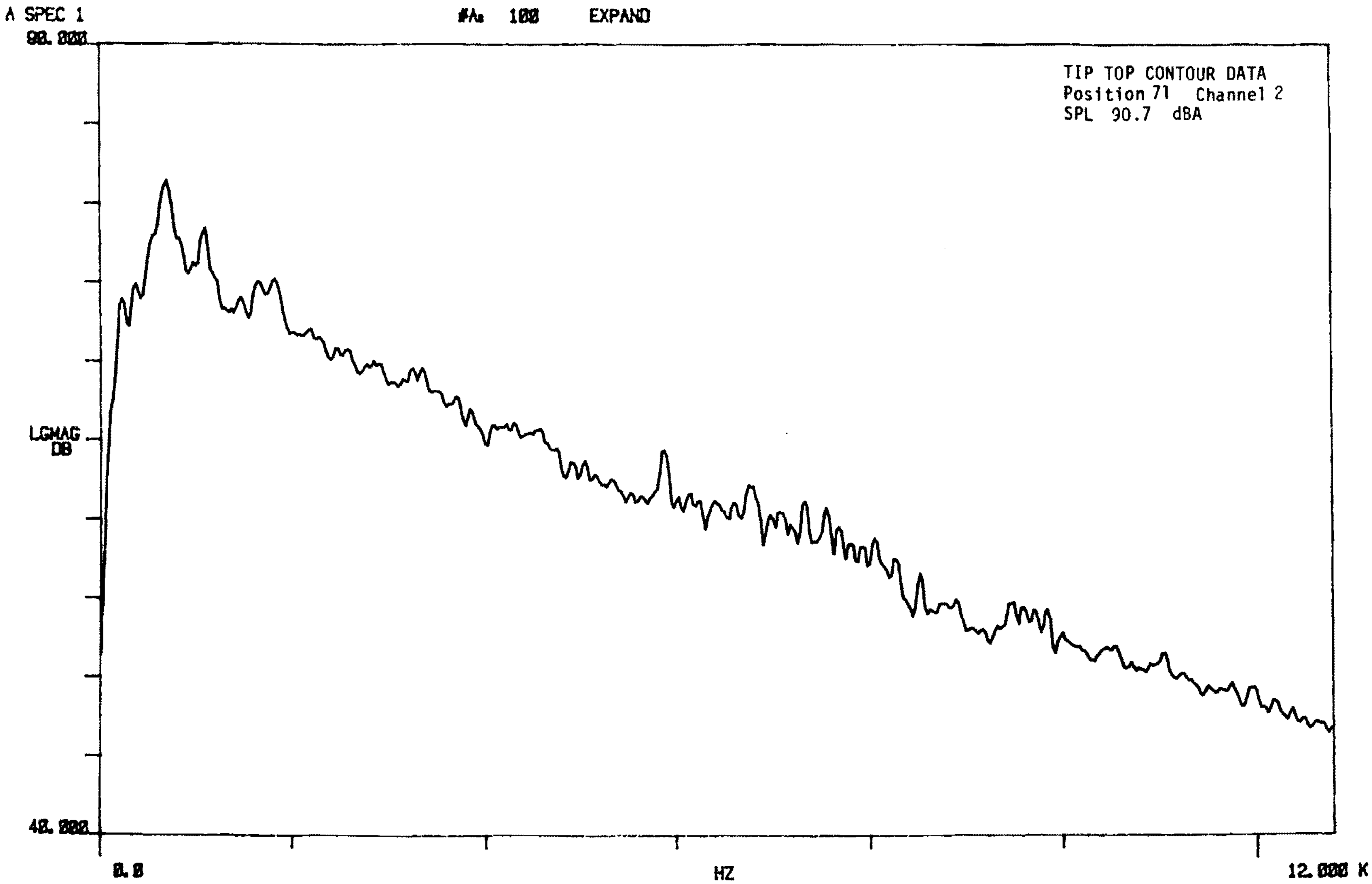
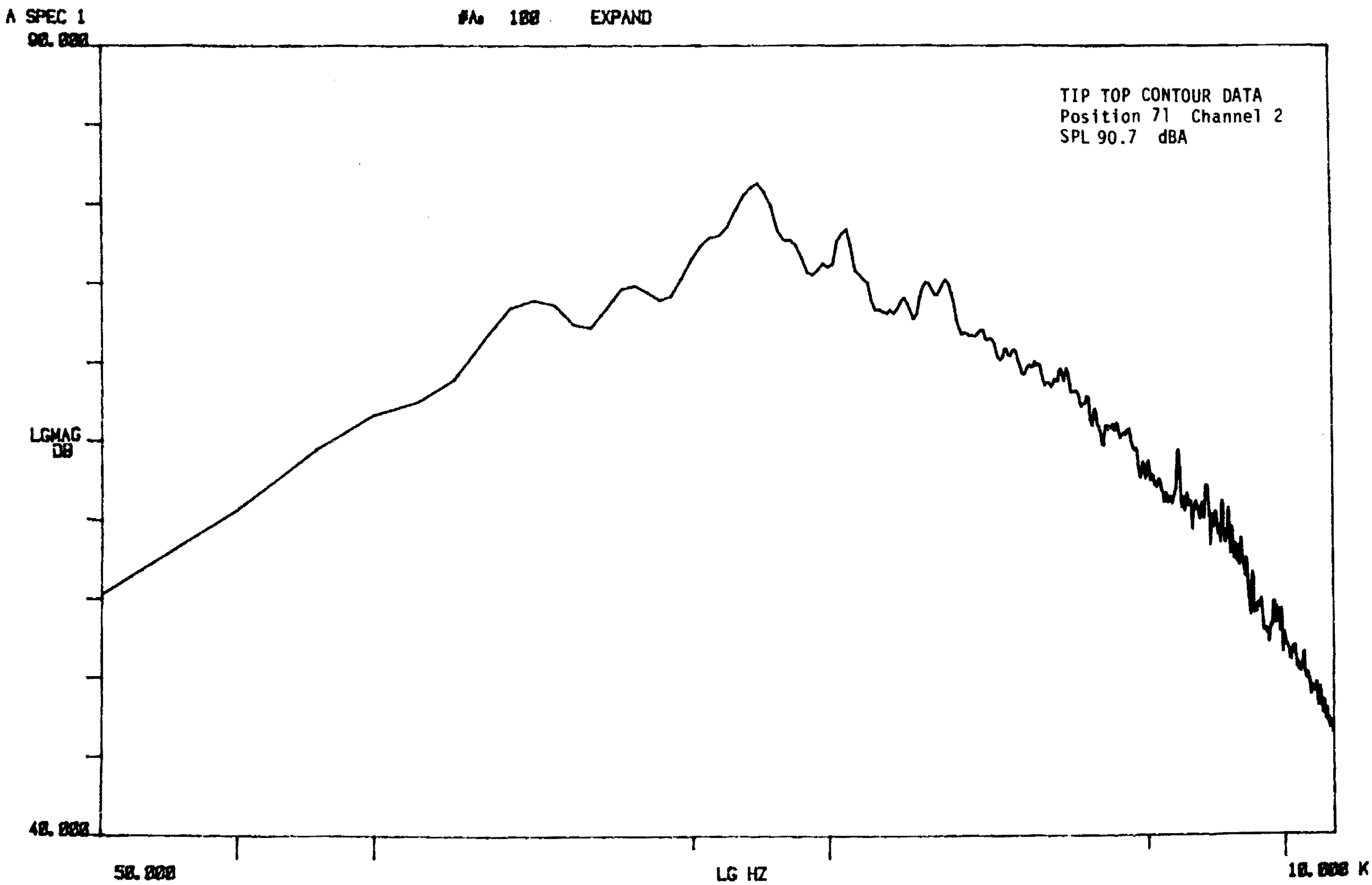
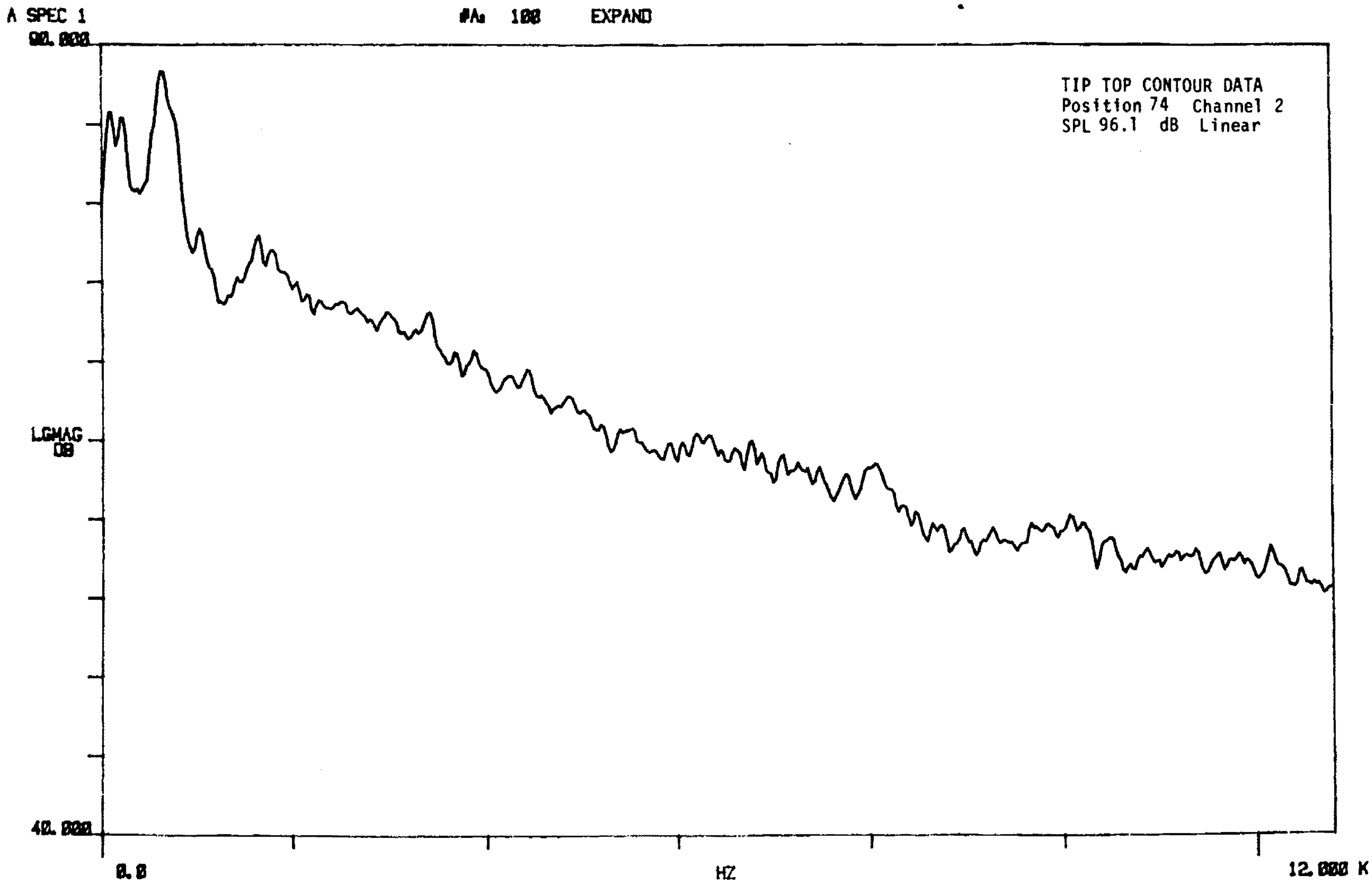

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 71 Channel 2
SPL 90.7 dBA
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 75B



A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 71 Channel 2
SPL 90.7 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 76B



A SPEC 1
#A: 100
EXPAND
90.000
TIP TOP CONTOUR DATA
Position 74 Channel 2
SPL 96.1 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 77B

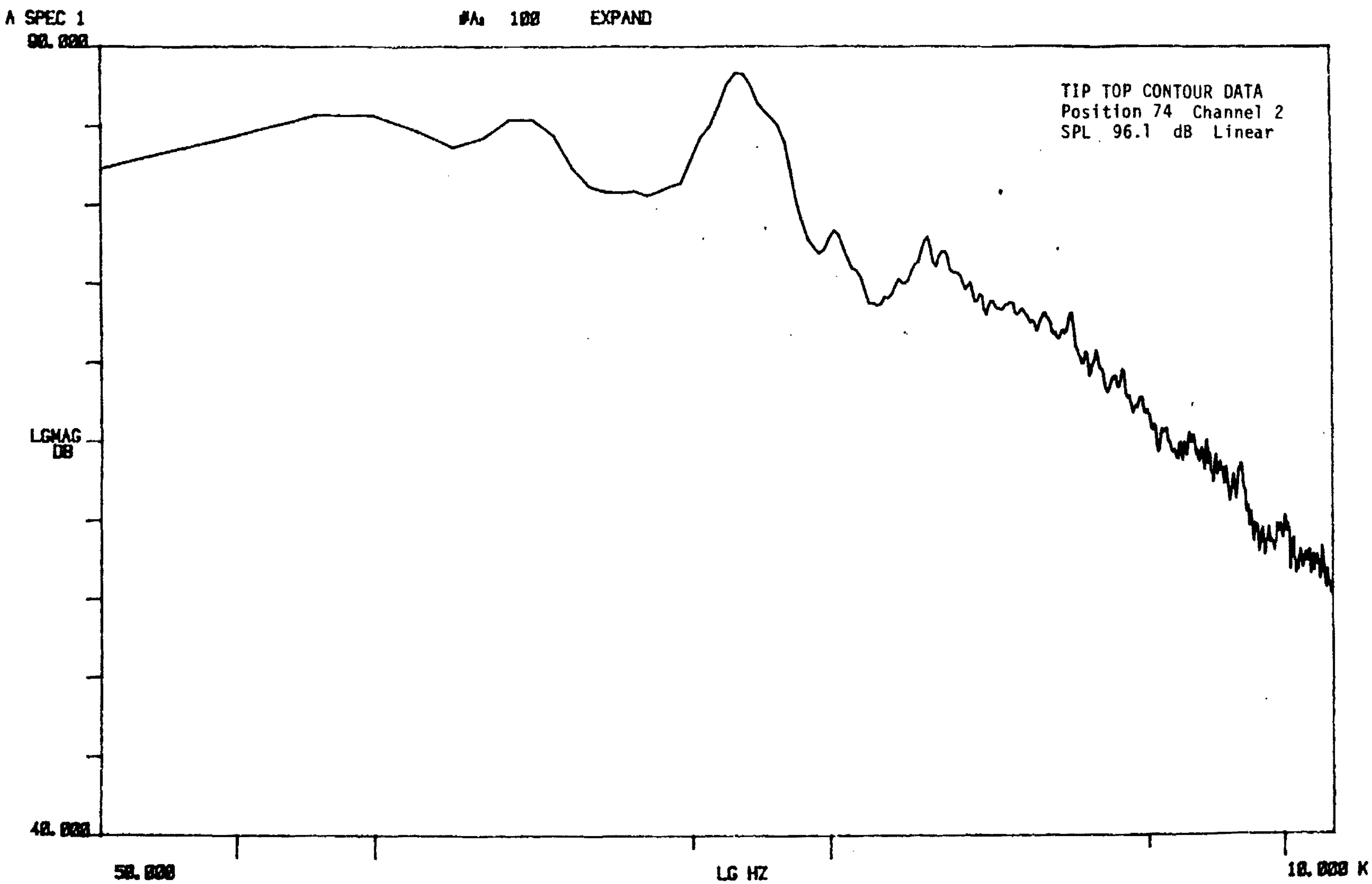

A SPEC 1
#A: 100 EXPAND
90.000
LGMAG
DB
40.000
50.000
LG HZ
10.000 K
TIP TOP CONTOUR DATA
Position 74 Channel 2
SPL 96.1 dB Linear

Figure 78B

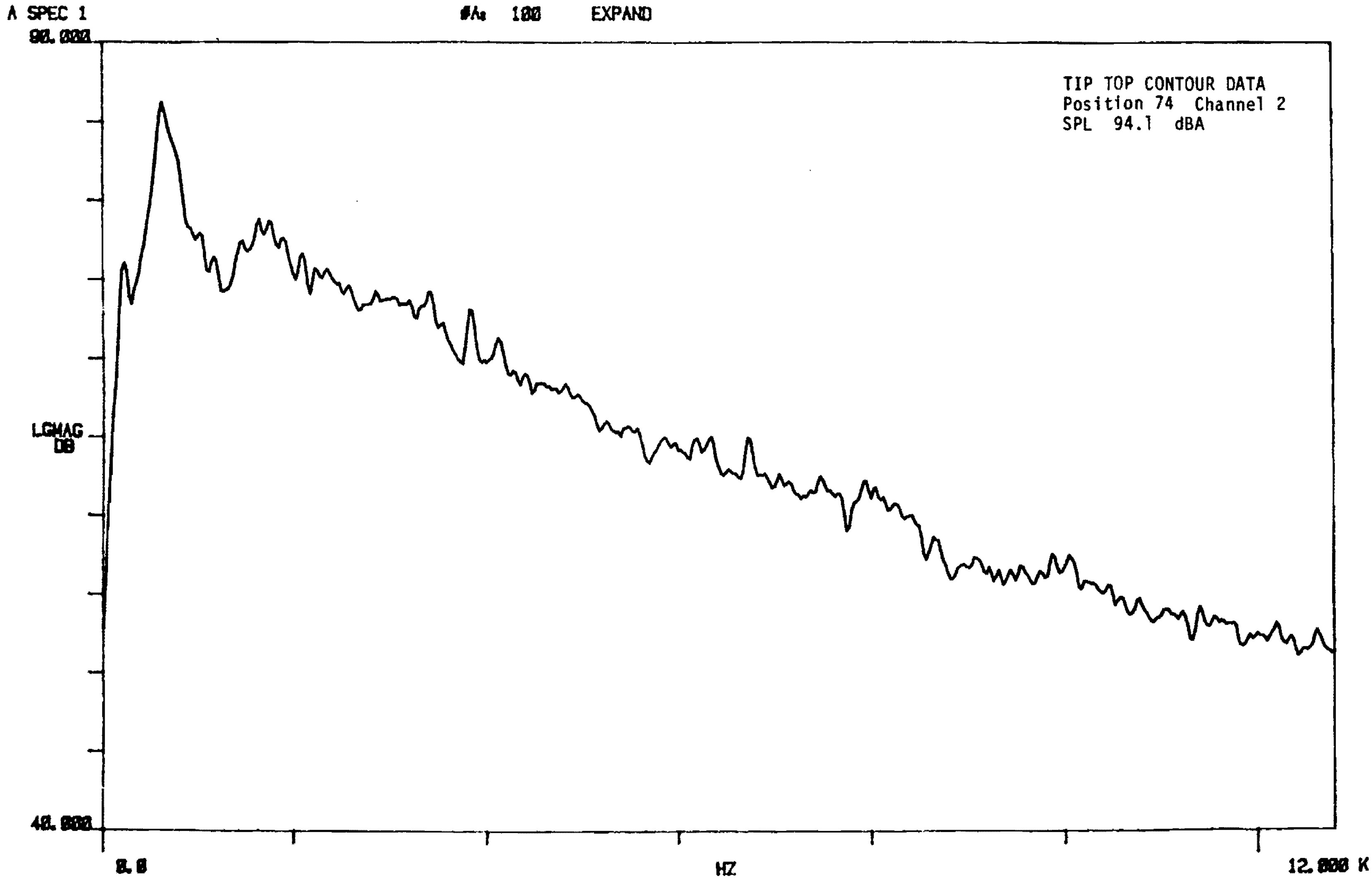

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 74 Channel 2
SPL 94.1 dBA
LGMAG DB
40.000
0.0
HZ
12.000 K

Figure 79B

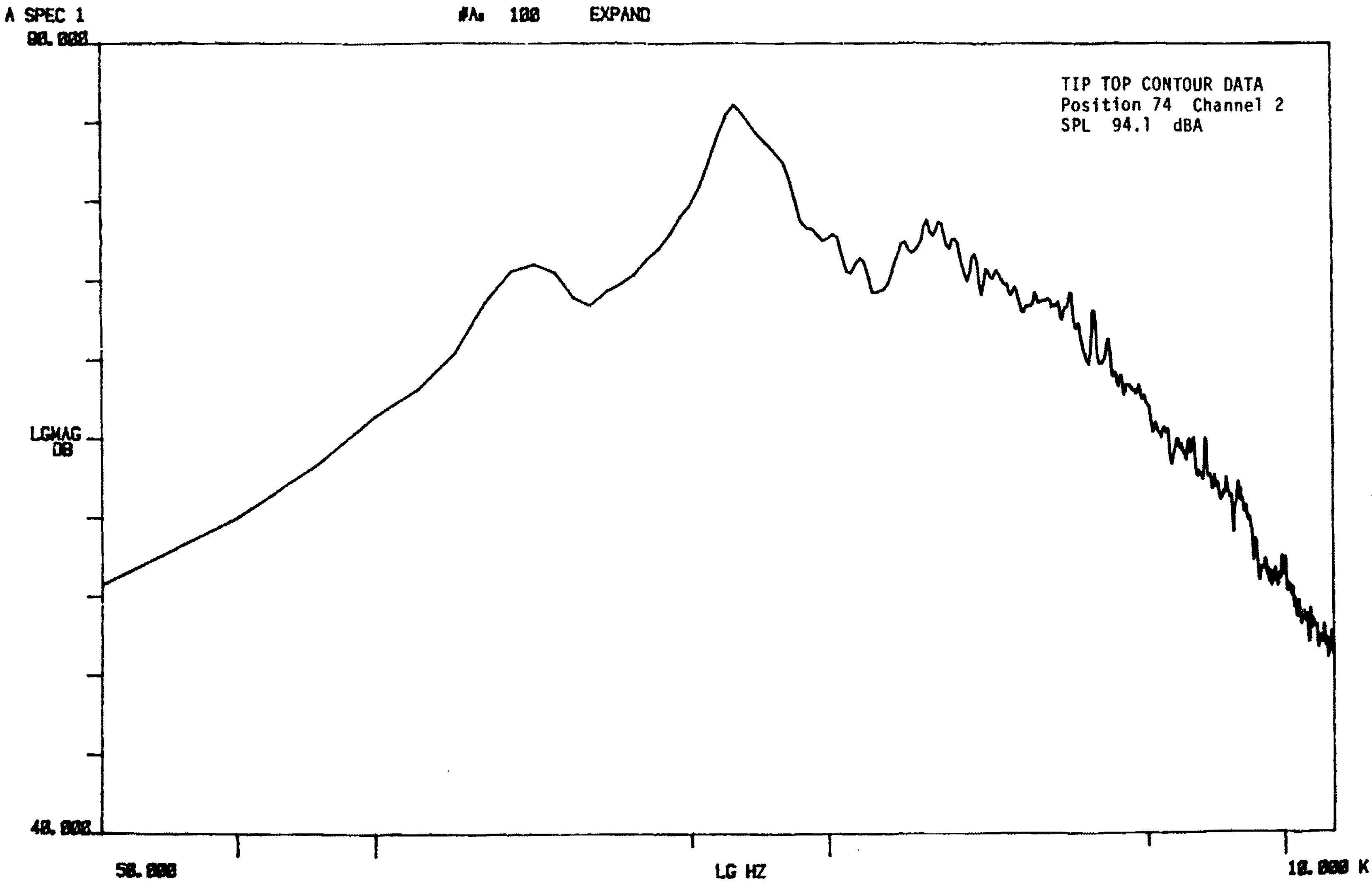

A SPEC 1
#A: 100
EXPAND
80.000
LGMAG
DB
40.000
TIP TOP CONTOUR DATA
Position 74 Channel 2
SPL 94.1 dBA
50.000
LG HZ
10.000 K

Figure 80B

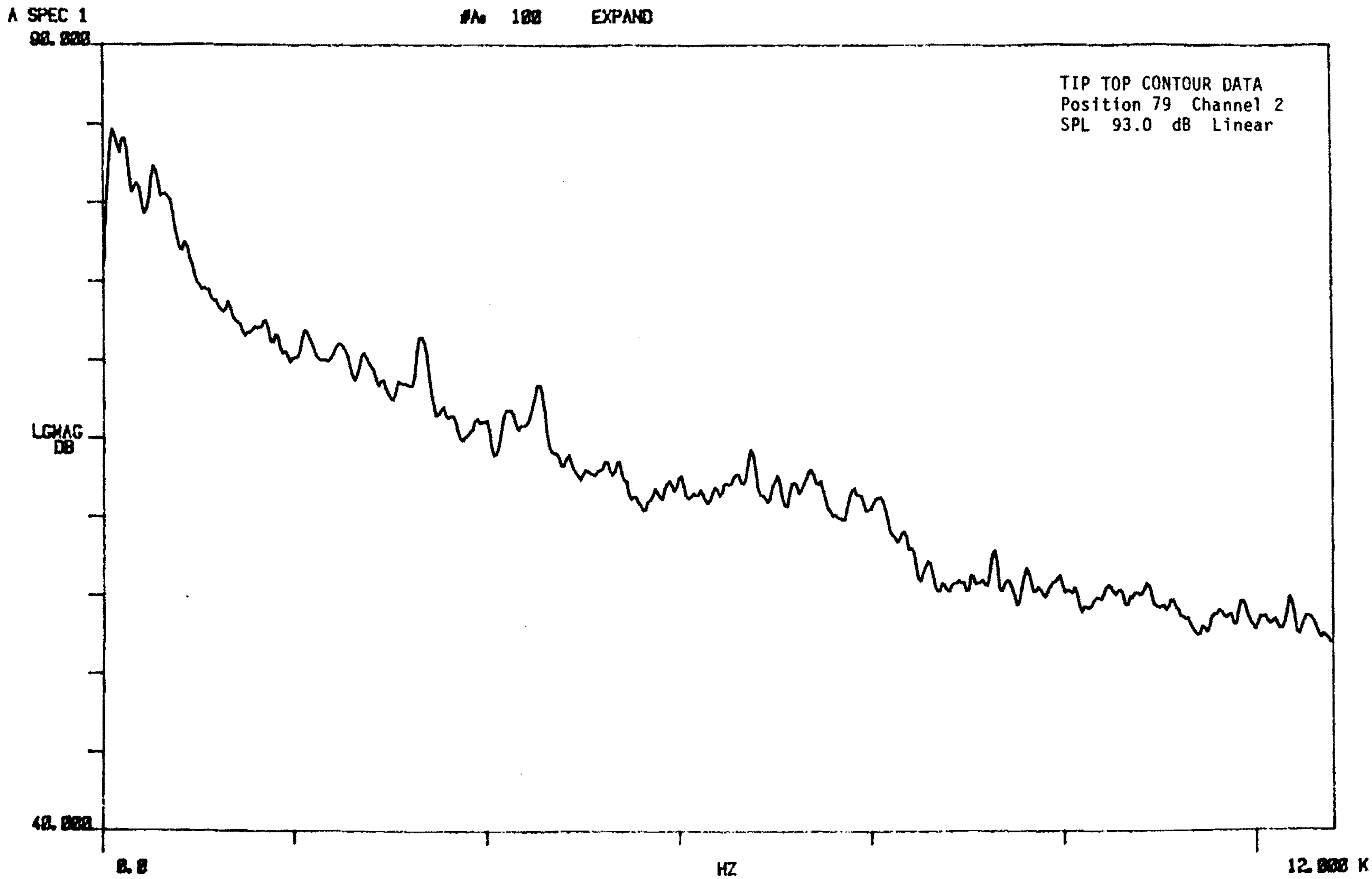
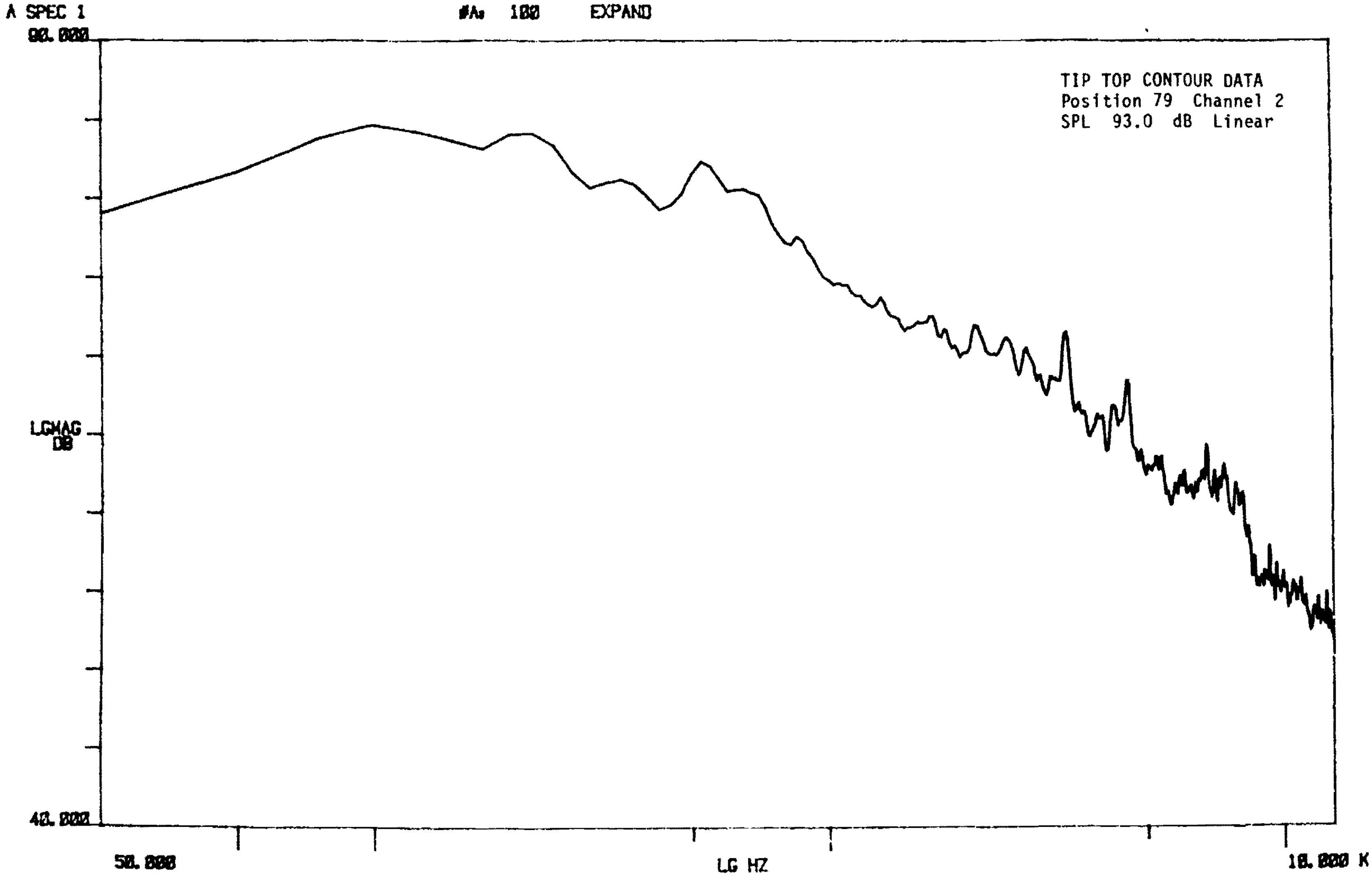

A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 79 Channel 2
SPL 93.0 dB Linear
LGMAG
DB
40.000
0.0
HZ
12.000 K

Figure 81B



A SPEC 1
#A: 100 EXPAND
90.000
TIP TOP CONTOUR DATA
Position 79 Channel 2
SPL 93.0 dB Linear
LGMAG DB
40.000
50.000
LG HZ
10.000 K

Figure 82B

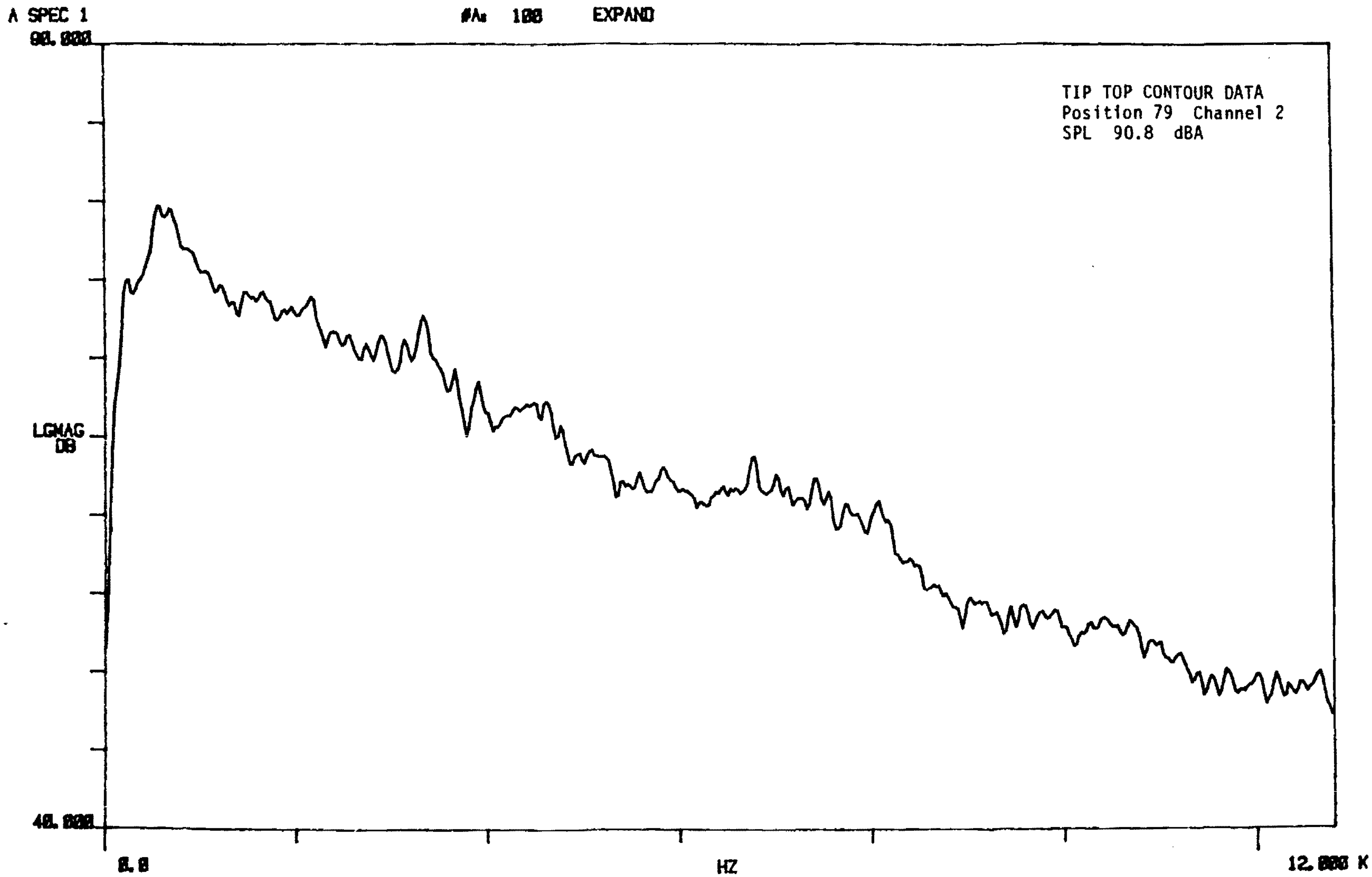

A SPEC 1
#A: 100
EXPAND
90.000
LGMAG DB
40.000
0.0
HZ
12.000 K
TIP TOP CONTOUR DATA
Position 79 Channel 2
SPL 90.8 dBA

Figure 83B

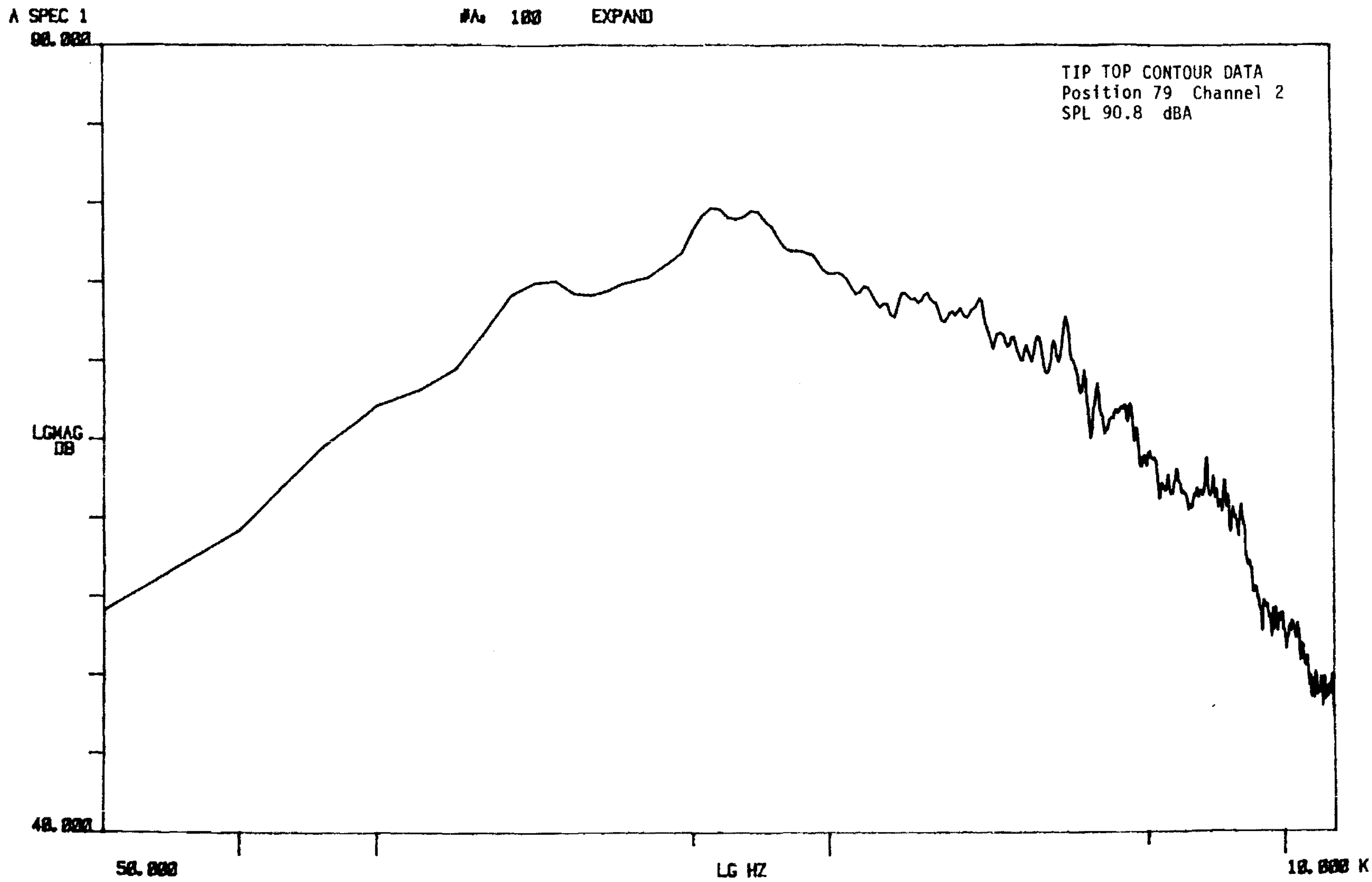

A SPEC 1
#A: 100
EXPAND
80.000
TIP TOP CONTOUR DATA
Position 79 Channel 2
SPL 90.8 dBA
LGMAG
DB
40.000
50.000
LG HZ
10.000 K

Figure 84B

Appendix C

OCTAVE BAND ANALYSIS OF DIRECT/REVERBERANT FIELD TEST

OCTAVE BAND ANALYSIS OF DIRECT/REVERBERANT FIELD TEST

The broadband test data gathered in each plant during the direct/reverberant noise field test were octave band analyzed to provide an assessment of the frequency characteristics of the direct and reverberant sound fields associated with the output of the test speaker. The findings are presented in this appendix. They indicate that the reverberant sound field becomes dominant at a distance of only a few feet from the source at all frequency intervals studied.

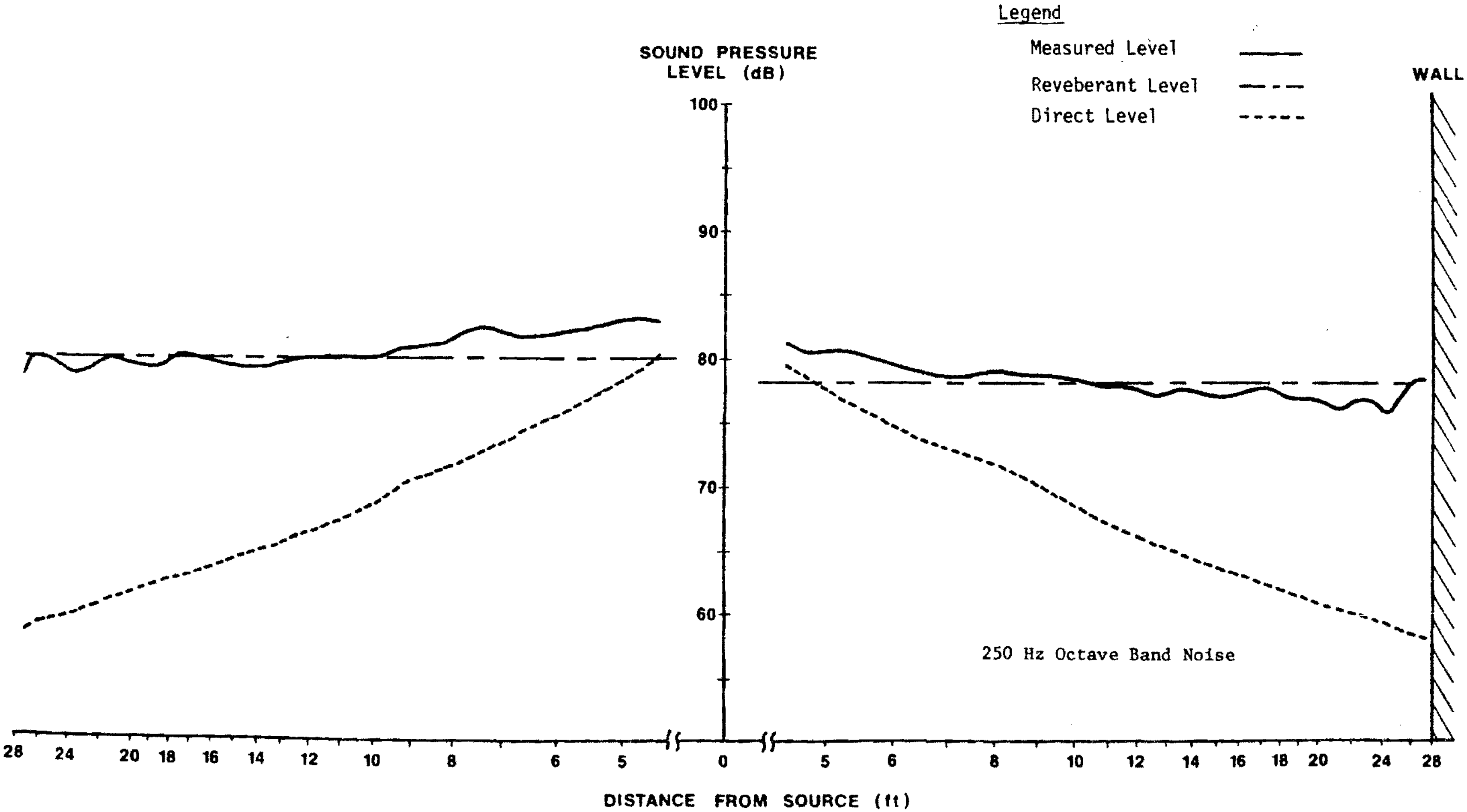


Fig. 1C Direct/Reverberant Noise Fields for Test Speaker
TIP TOP PLANT

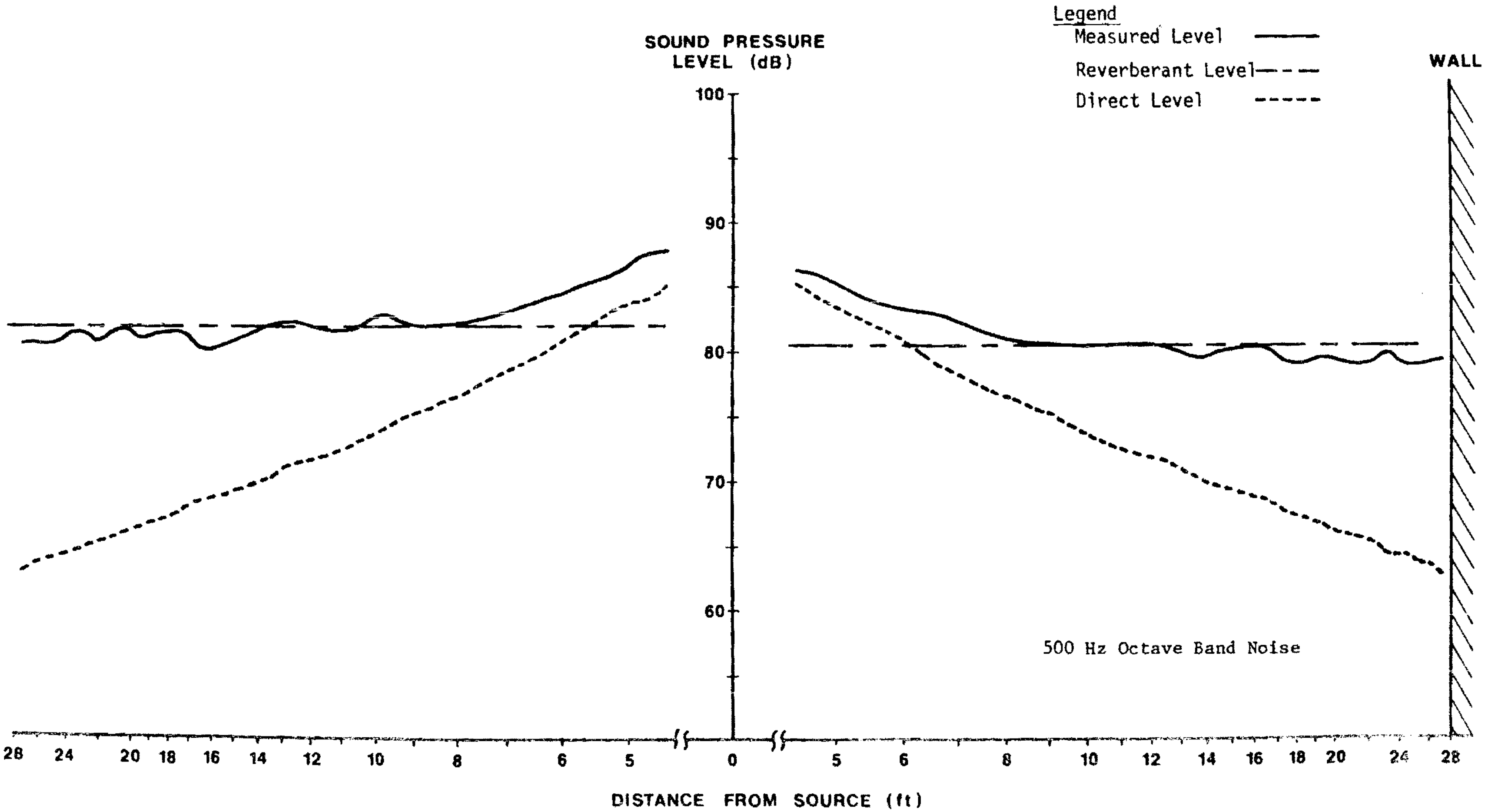


Fig. 2C Direct/Reverberant Noise Fields for Test Speaker

TIP TOP PLANT

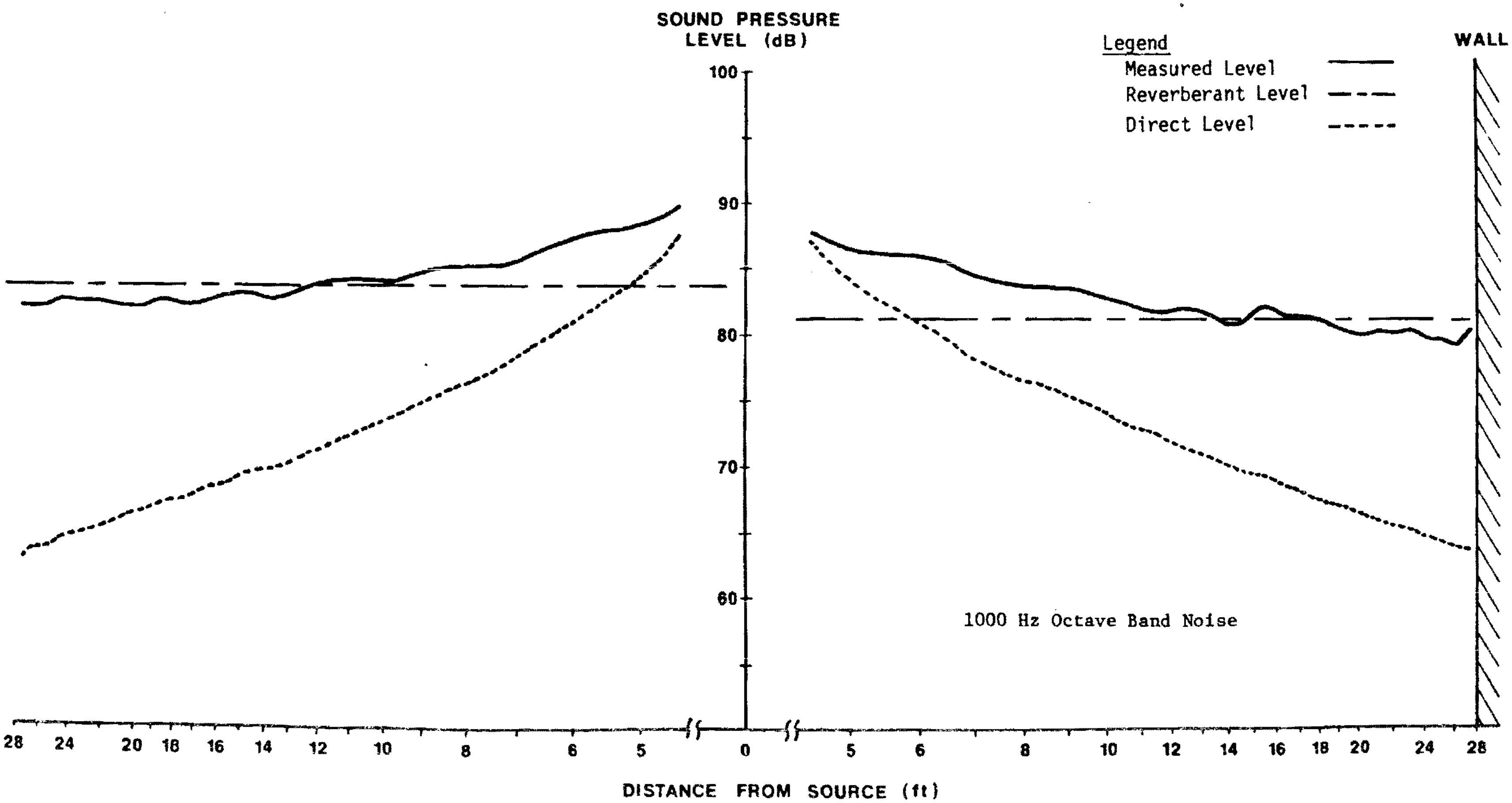


Fig. 3C Direct/Reverberant Noise Fields for Test Speaker
TIP TOP PLANT

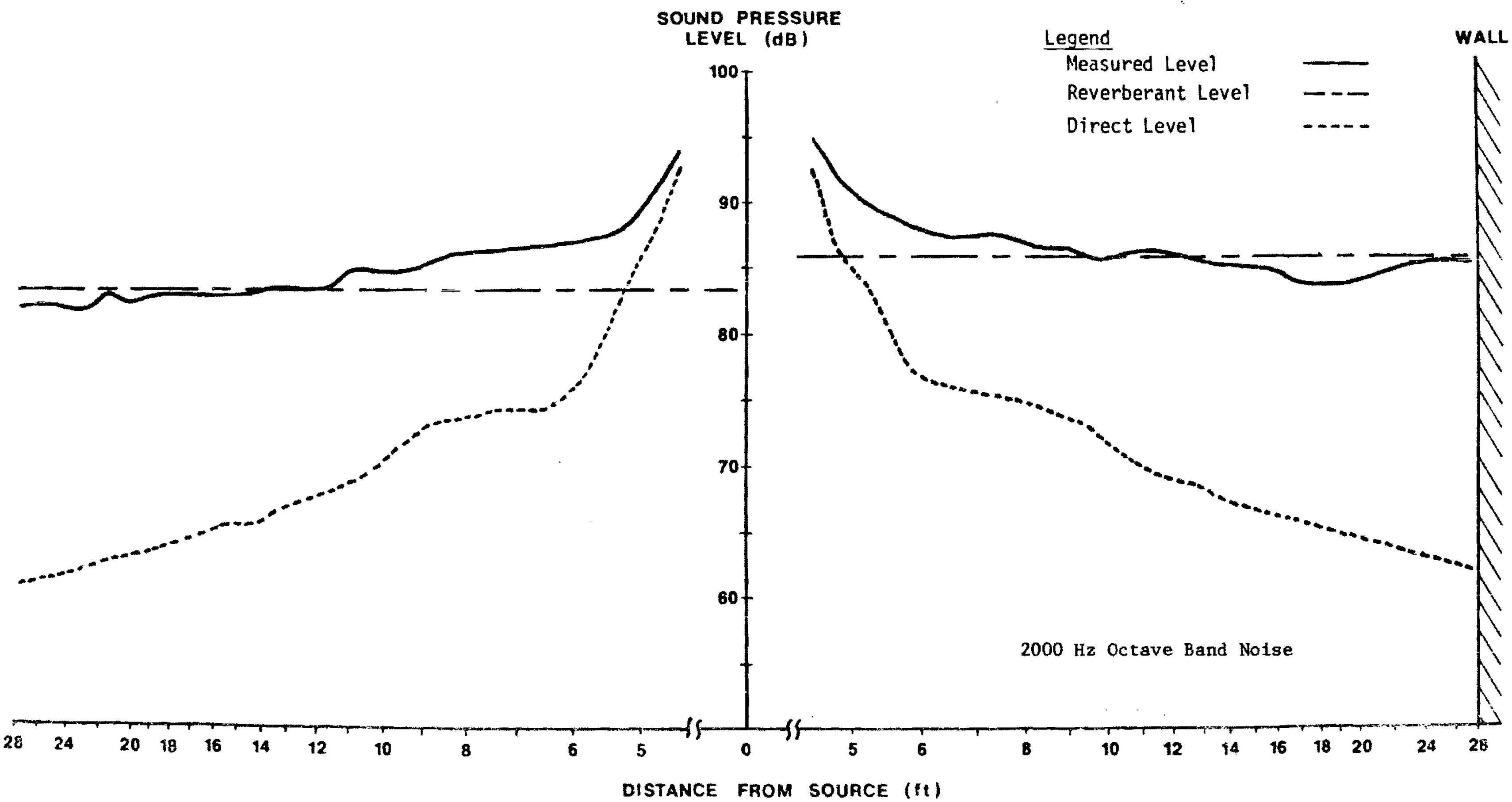


Fig. 4C Direct/Reverberant Noise Fields for Test Speaker

TIP TOP PLANT

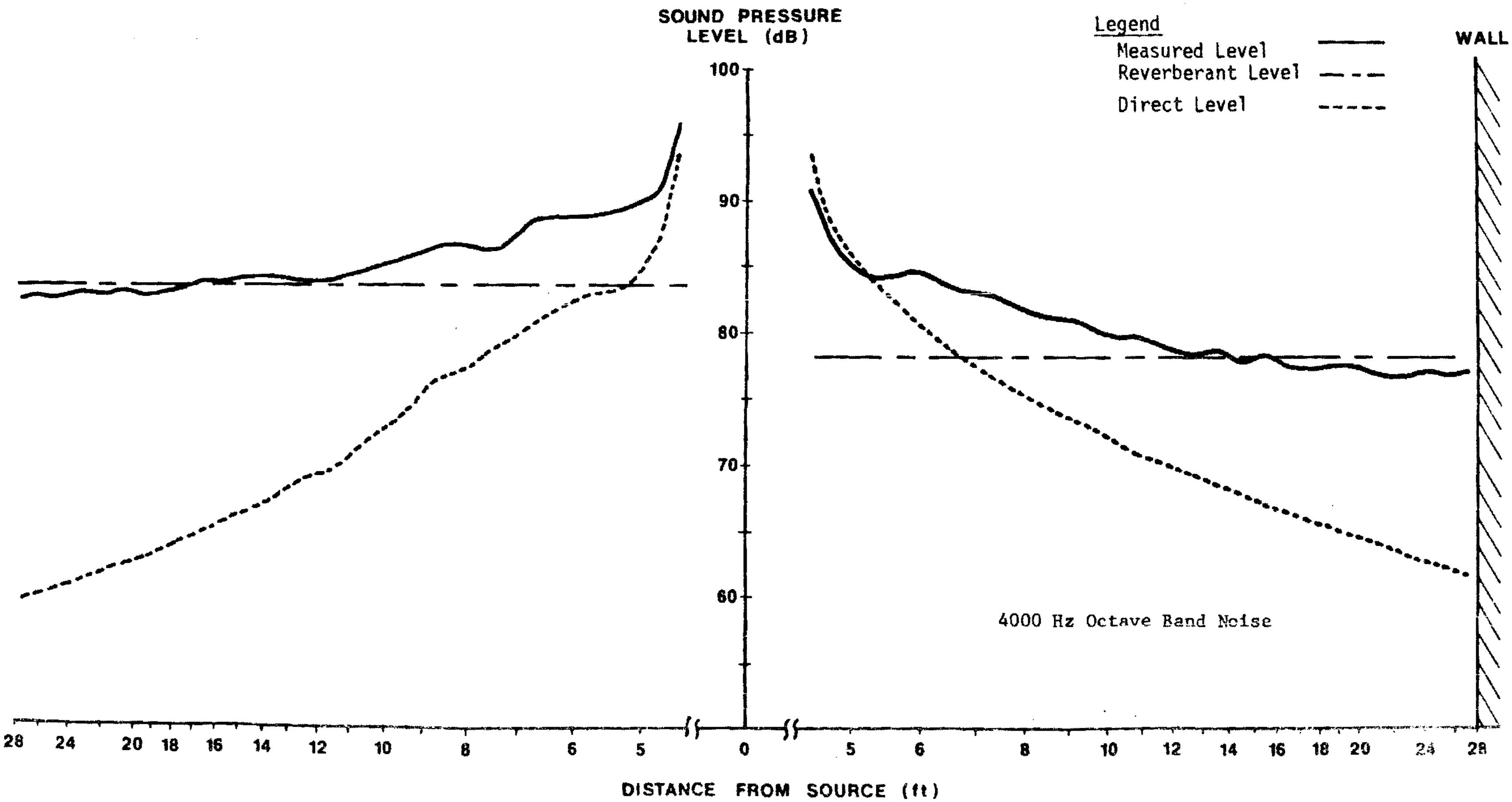


Fig. 5C Direct/Reverberant Noise Fields for Test Speaker

TIP TOP PLANT

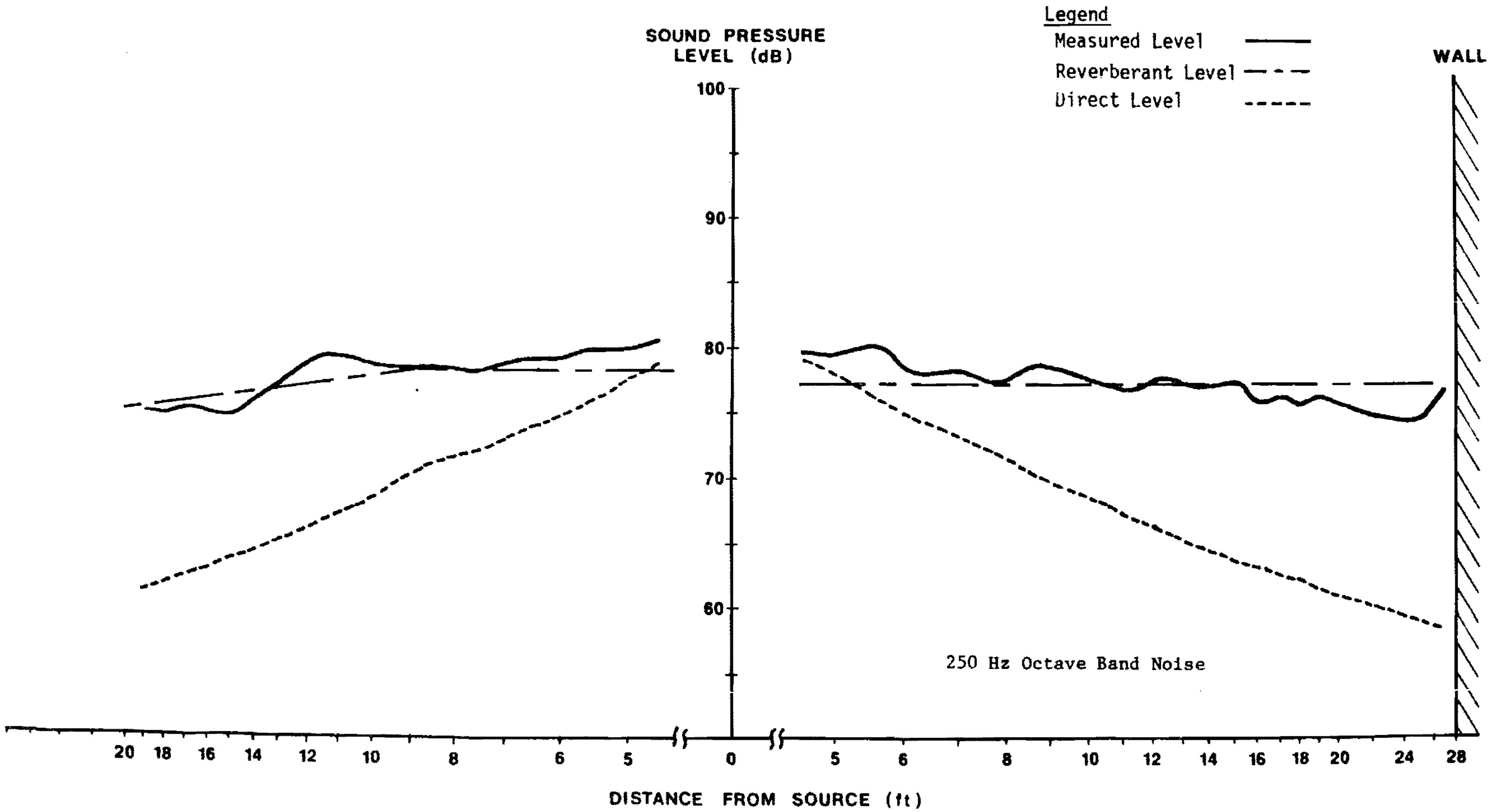


Fig. 6C Direct/Reverberant Noise Fields for Test Speaker
CENTRAL SOYA PLANT

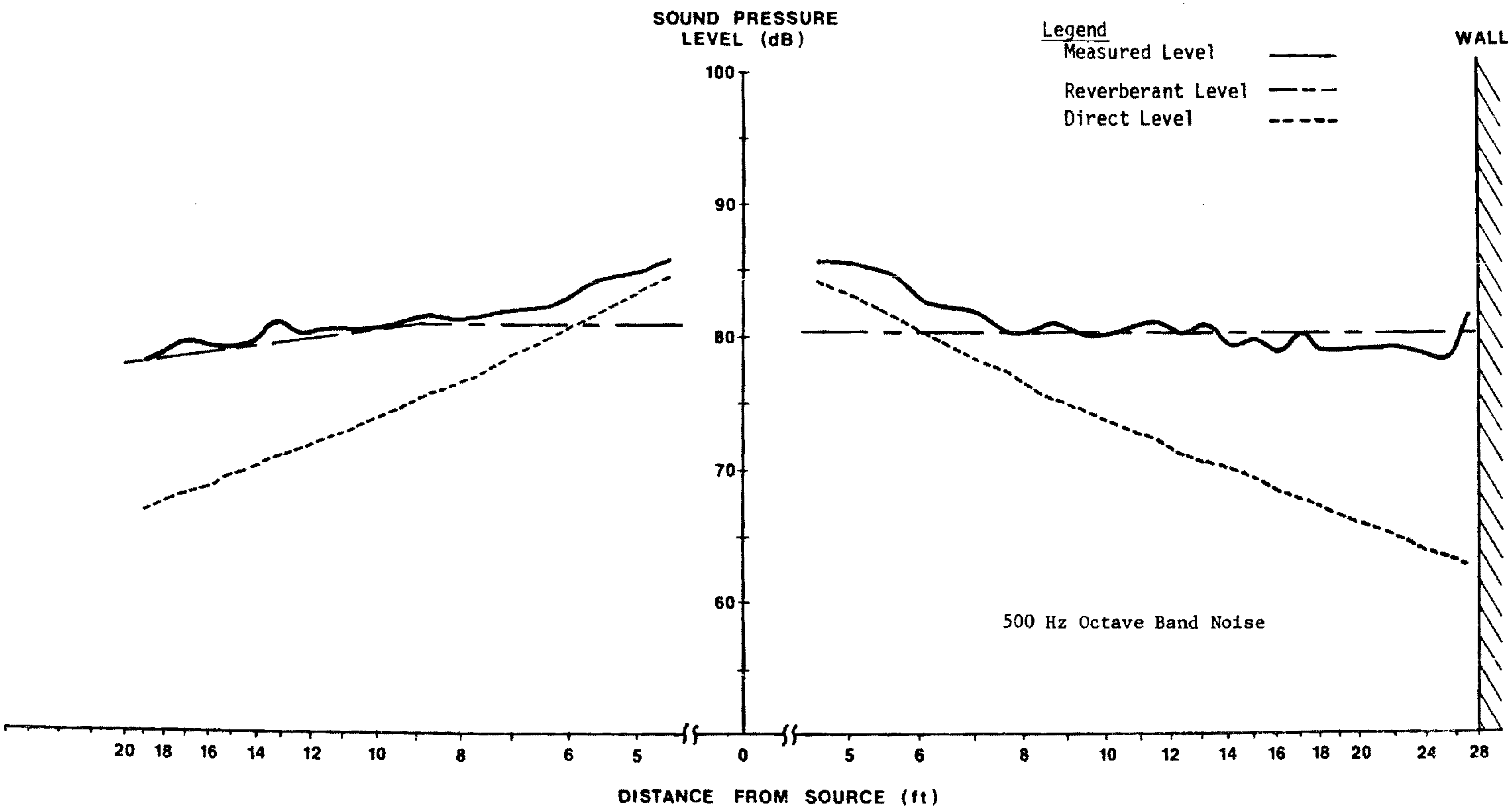


Fig. 7C Direct/Reverberant Noise Fields for Test Speaker
CENTRAL SOYA PLANT

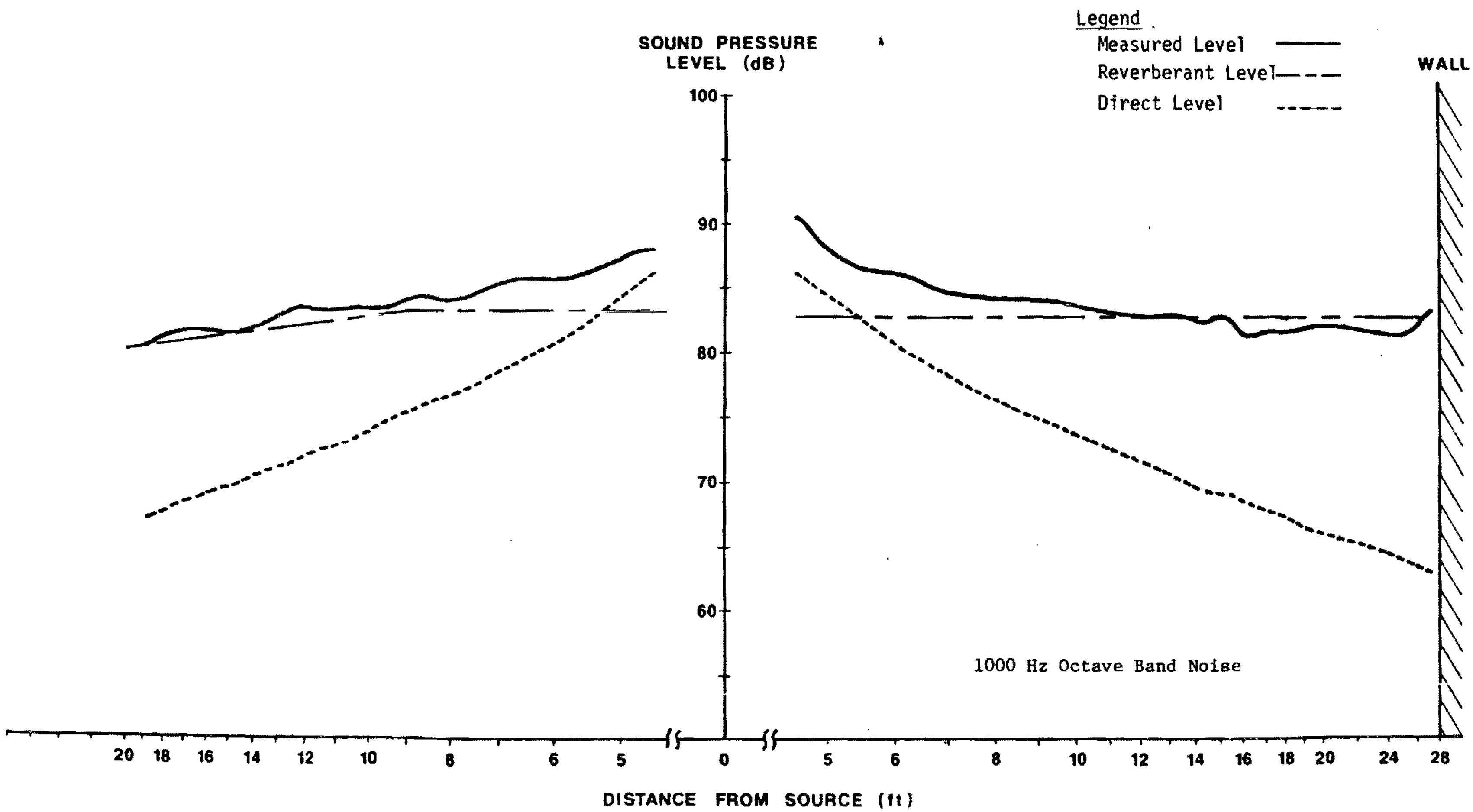


Fig. 8C Direct/Reverberant Noise Fields for Test Speaker

CENTRAL SOYA PLANT

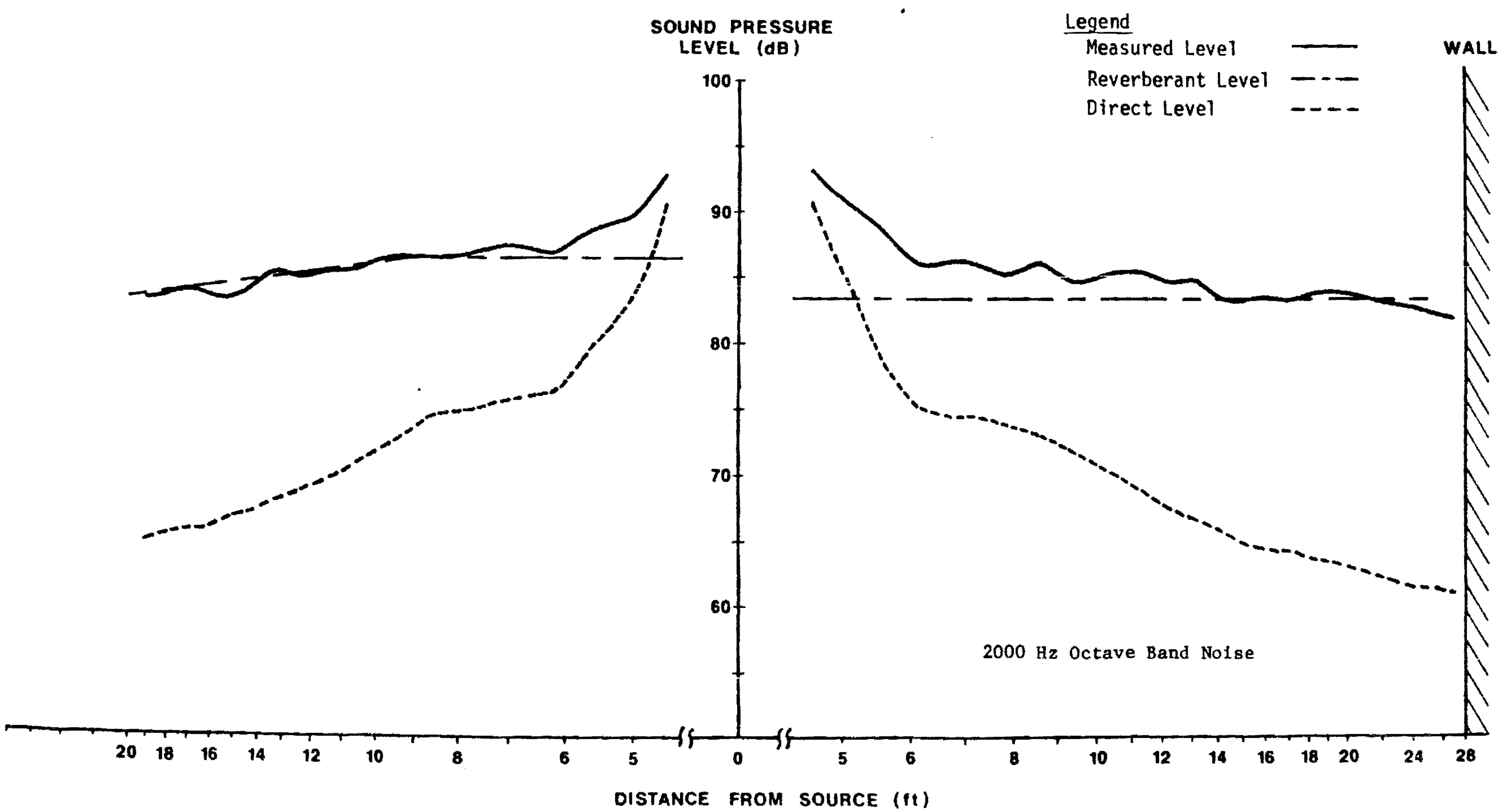


Fig. 9C Direct/Reverberant Noise Fields for Test Speaker
CENTRAL SOYA PLANT

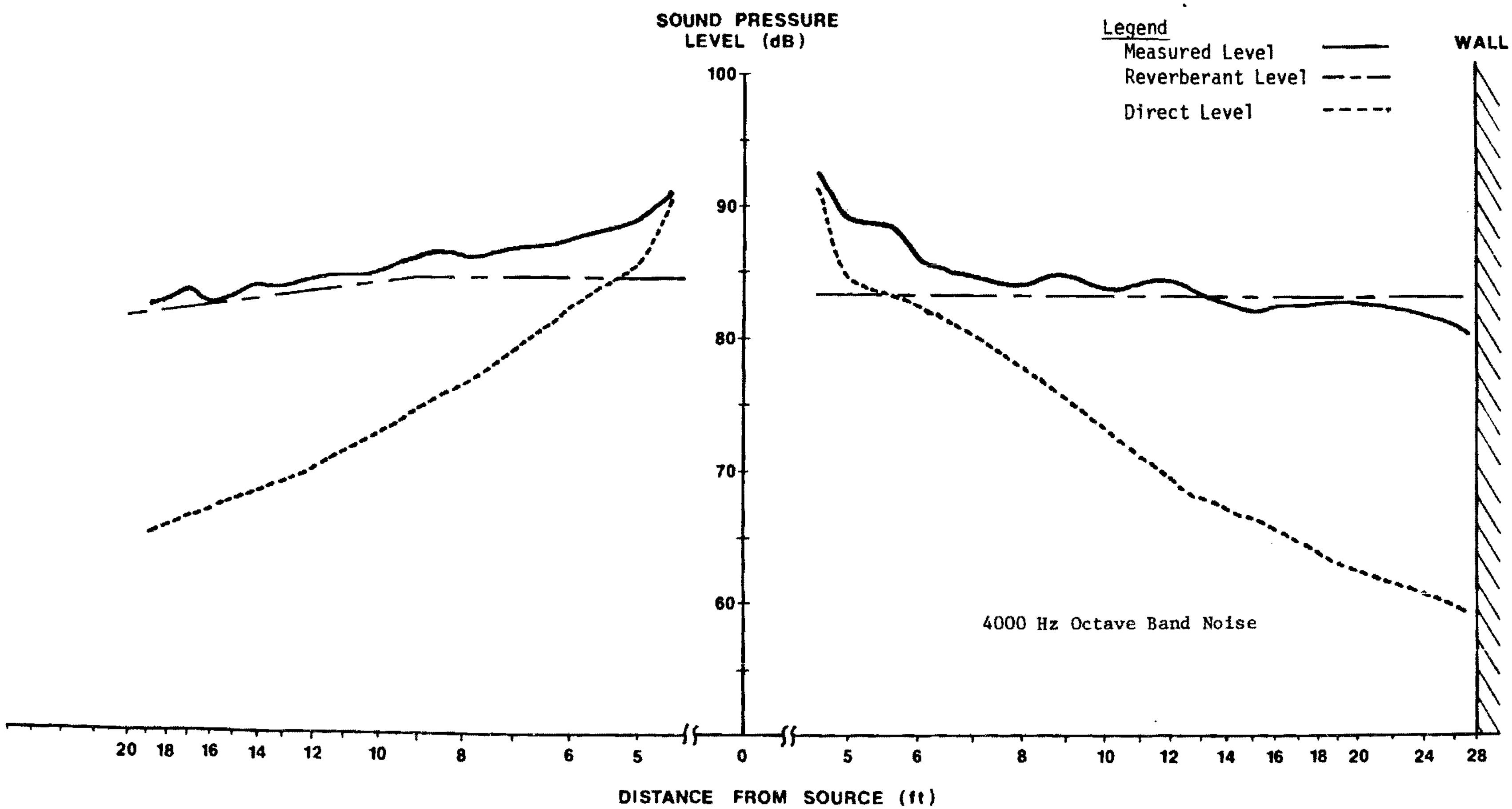


Fig. 10C Direct/Reverberant Noise Fields for Test Speaker
CENTRAL SOYA PLANT

Appendix D

AN ANALYSIS OF INDIVIDUAL SOURCE CONTRIBUTION CHARACTERISTICS

AN ANALYSIS OF SOURCE FREQUENCY CHARACTERISTICS

The data gathered to evaluate the contribution of various sources to the observed sound pressure level at a point in each plant were also analyzed for frequency content. This was done to distinguish qualities about the sources which might be useful in any subsequent source abatement efforts. Unfortunately, as mentioned in the text, the data must be reviewed very carefully since the measurements were taken with some of the sources operating under conditions which were other than typical.

Regarding the Central Soya plant sources, the circulating fans are very close to being a major source in this area of the plant. While they are not always operated, when they are they could still go essentially undetected under normal operations because of their nearness to the lung guns. The spray wash station, on the other hand, shows level peaks which reach significant proportions and appear to contribute significantly to a 350Hz peak in the operating data taken at this point. The detected source of these peaks is a series of restrictor valves in the water system, valves which are commonly used throughout the industry. The neck cutter plot is not believed to be characteristic of this device because the blade rubbed on a bare plastic shield without the typical presence of animal fat from the birds to lubricate this contact. And as mentioned in the text, the chillers lacked water and ice, of which the water is probably an attenuator and the ice (through the dump cycle) a source. Figure 11D shows a comparison of the observed levels of the combined sources versus the observed level during normal operations. With the exception of the peaks in the upper frequency range caused by the neck cutter, the two spectra are reasonably similar in shape. The frequency shift of the 350Hz peak on the red plot is believed to be attributable to a higher than normal water line pressure during the individual source testing.

Regarding the Tip Top plant sources, the fans, at least in this area of the plant, are very quiet. But both the hock cutter and the chillers are intense sources which unfortunately during this test are suspected of producing noise levels not typical of those observed under normal operating conditions. Figure 22D seems to bear this out. When a comparison is made between the observed level of the combined sources versus the observed level during normal operations, the former is higher. This is probably again because the chillers were operated without water or ice and because the hock cutter was operated without birds. In addition to level differences, the two spectra also exhibit substantial differences in shape at several points, which further raise questions regarding the representativeness of the source signatures observed from these two machines.

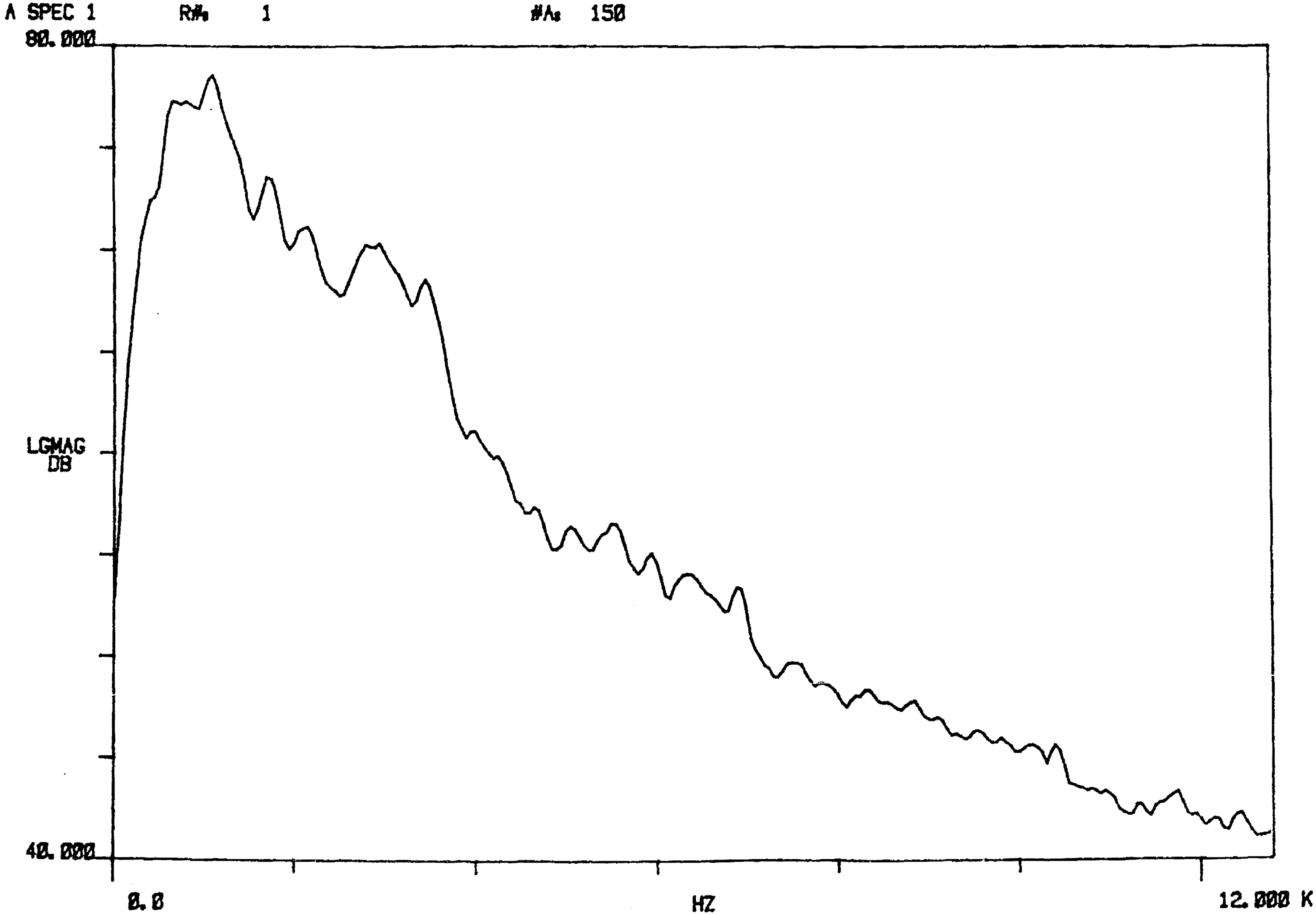


Fig. 1D - A-Weighted Source Contribution Analysis : Circulating Fans
CENTRAL SOYA PLANT (pt. 6B, ch.2)

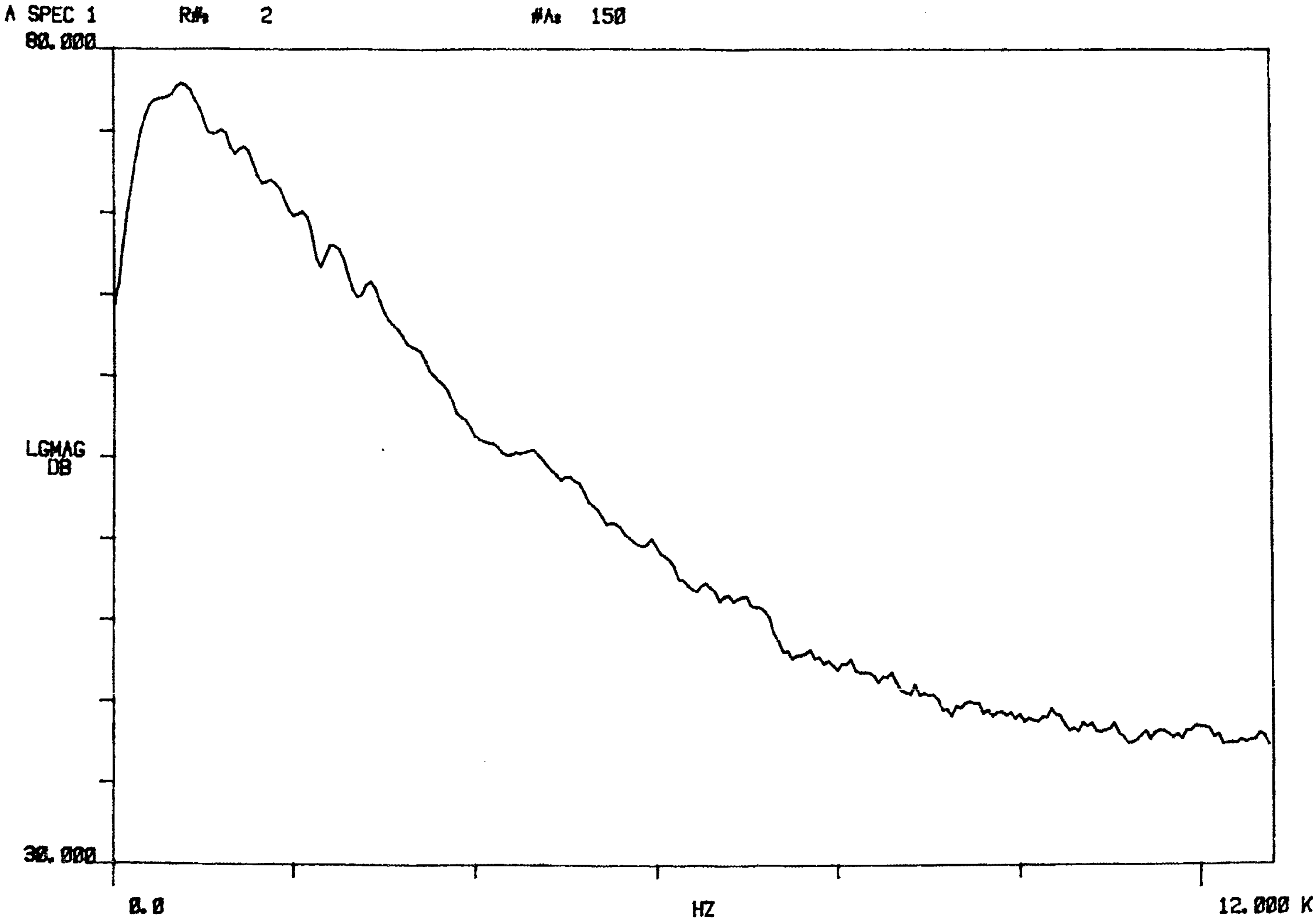


Fig. 2D - A-Weighted Source Contribution Analysis : Chillers
CENTRAL SOYA PLANT (pt. 6B, ch.2)

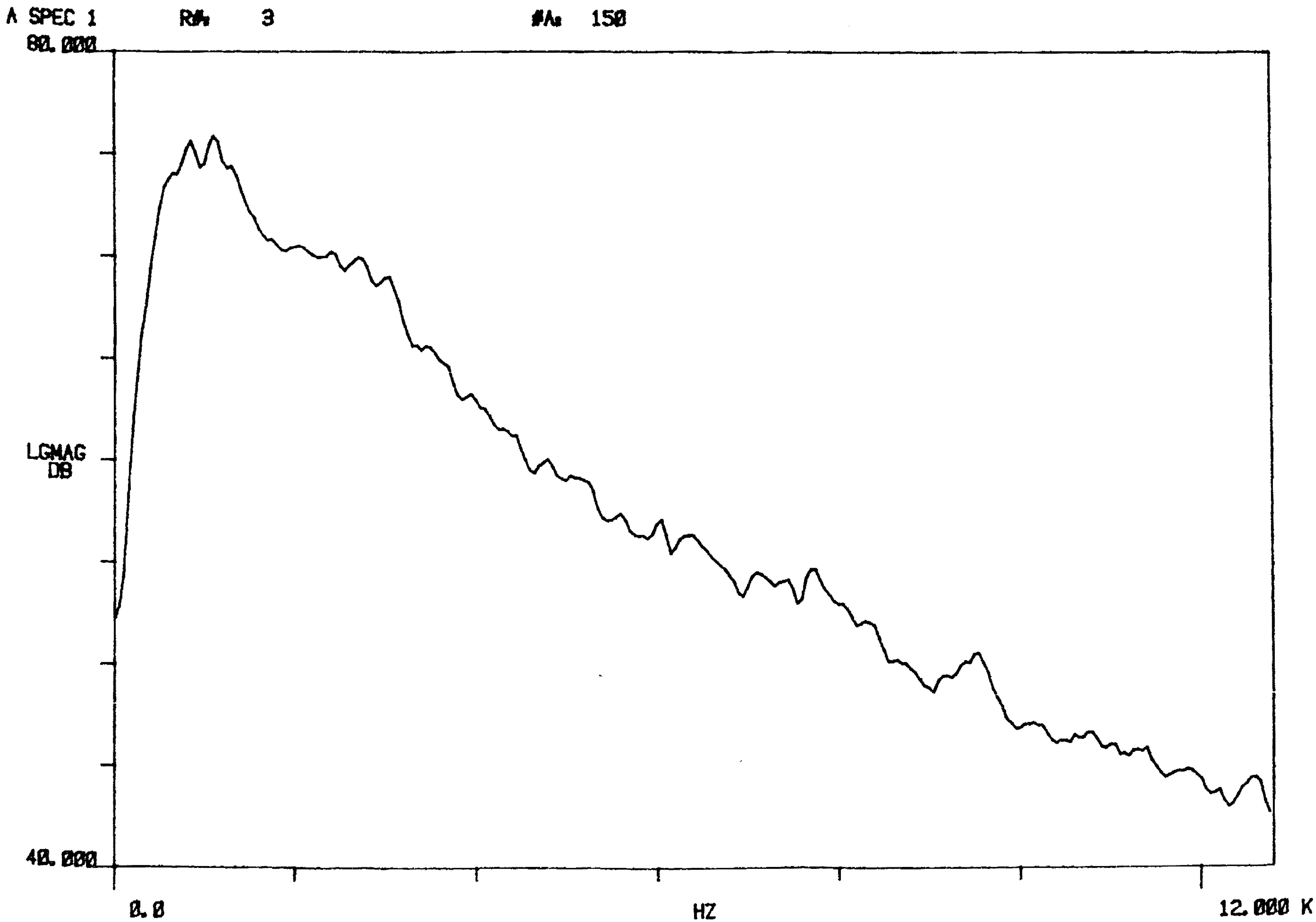


Fig. 3D - A-Weighted Source Contribution Analysis : Gizzard Machine
CENTRAL SOYA PLANT (pt. 6B, ch.2)

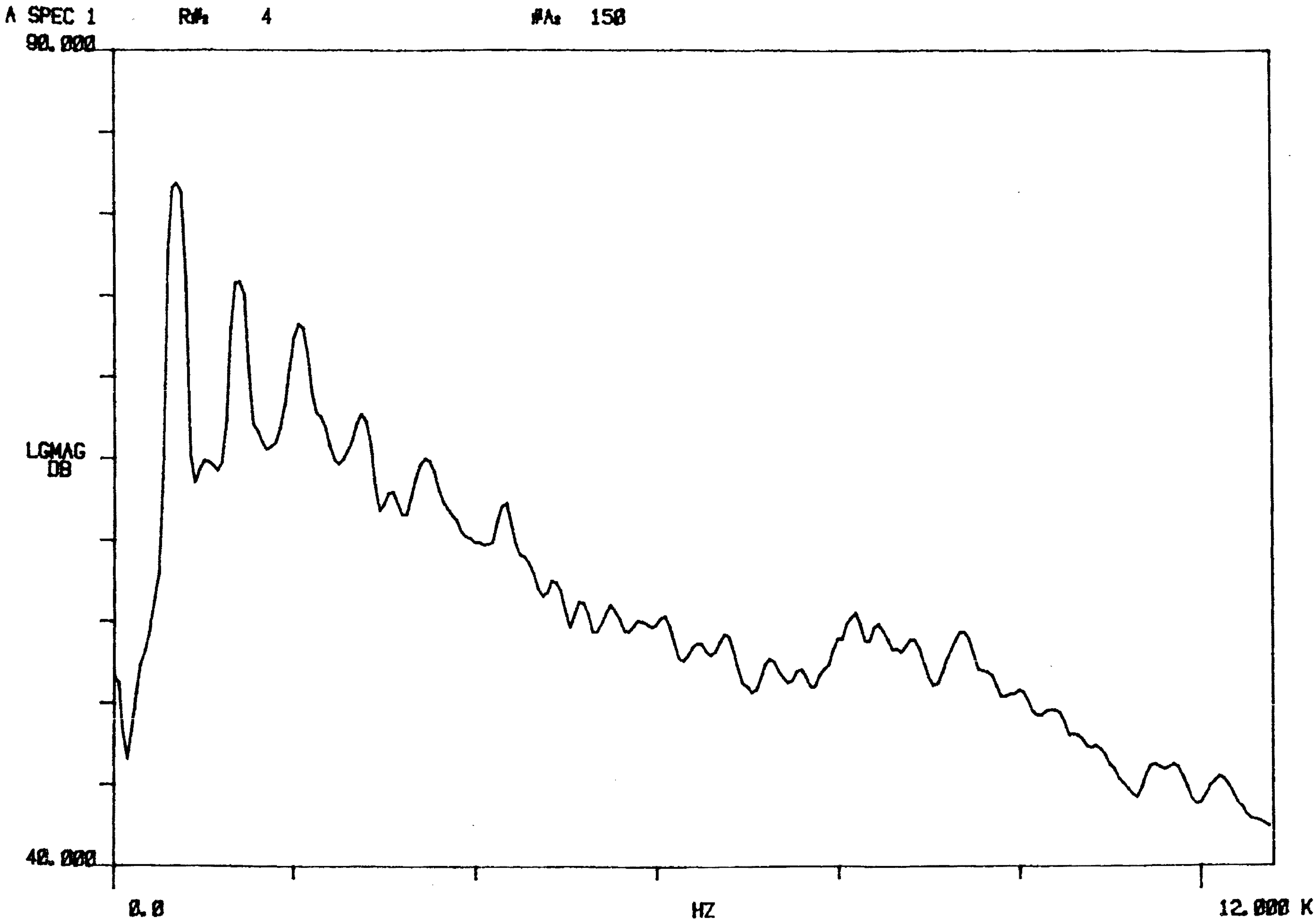


Fig. 4D - A-Weighted Source Contribution Analysis : Spray Washer
CENTRAL SOYA PLANT (pt. 6B, ch.2)

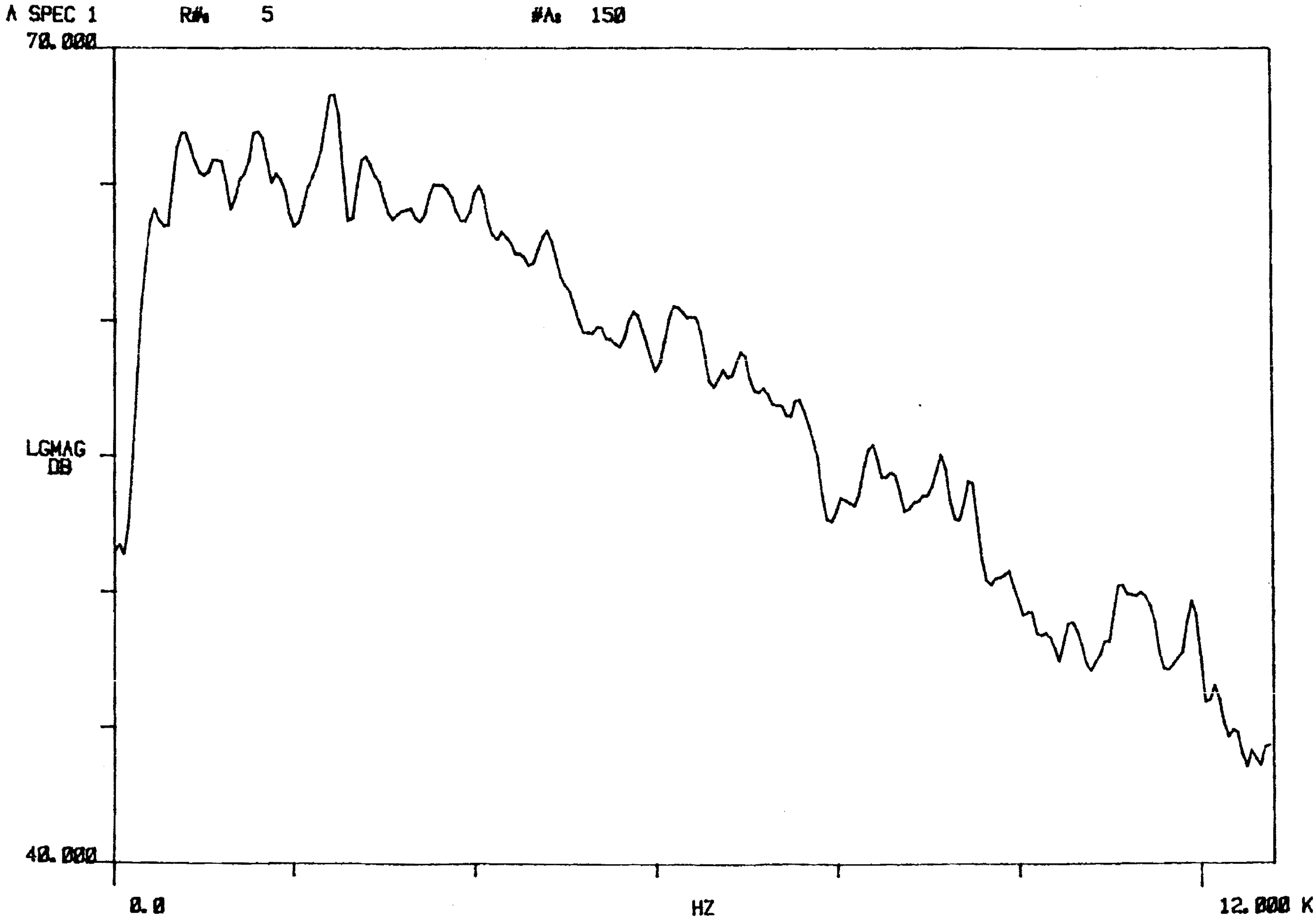


Fig. 5D - A-Weighted Source Contribution Analysis : Shackle Lines
CENTRAL SOYA PLANT (pt. 6B, ch.2)

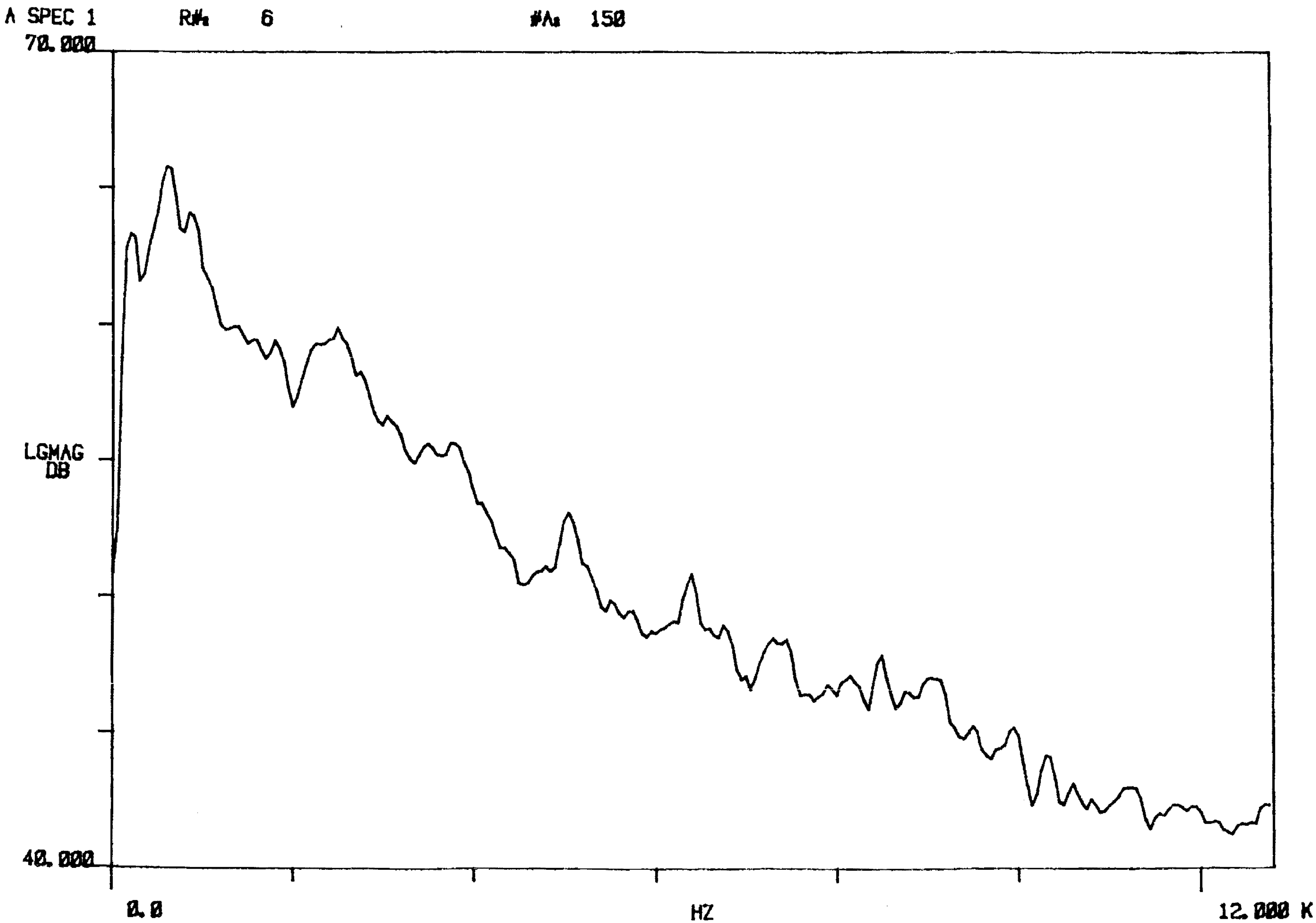


Fig 6D - A-Weighted Source Contribution Analysis : Vacuum Pump
CENTRAL SOYA PLANT (pt. 6B, ch.2)

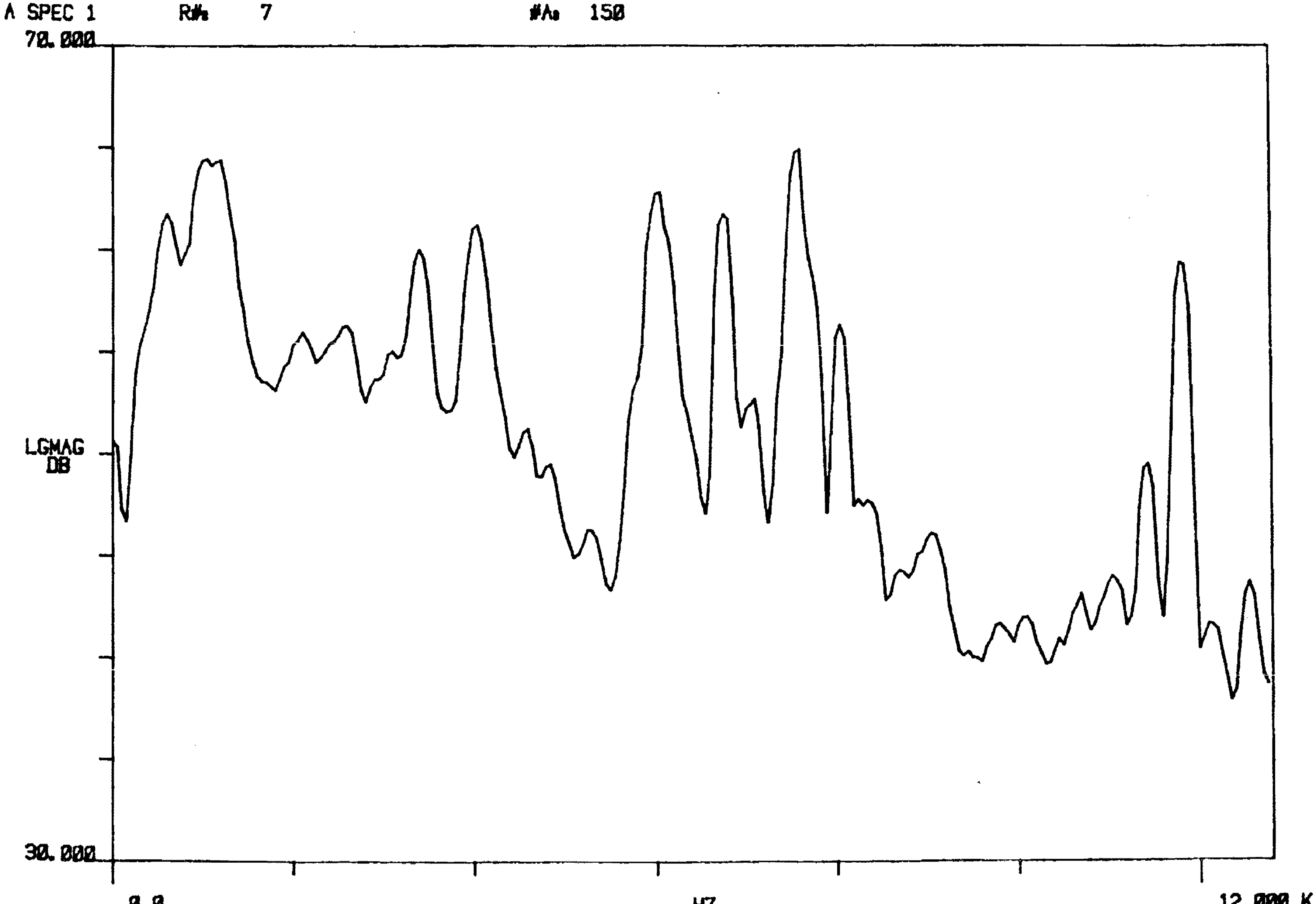


Fig. 7D - A-Weighted Source Contribution Analysis : Neck Cutters
CENTRAL SOYA PLANT (pt. 6B, ch.2)

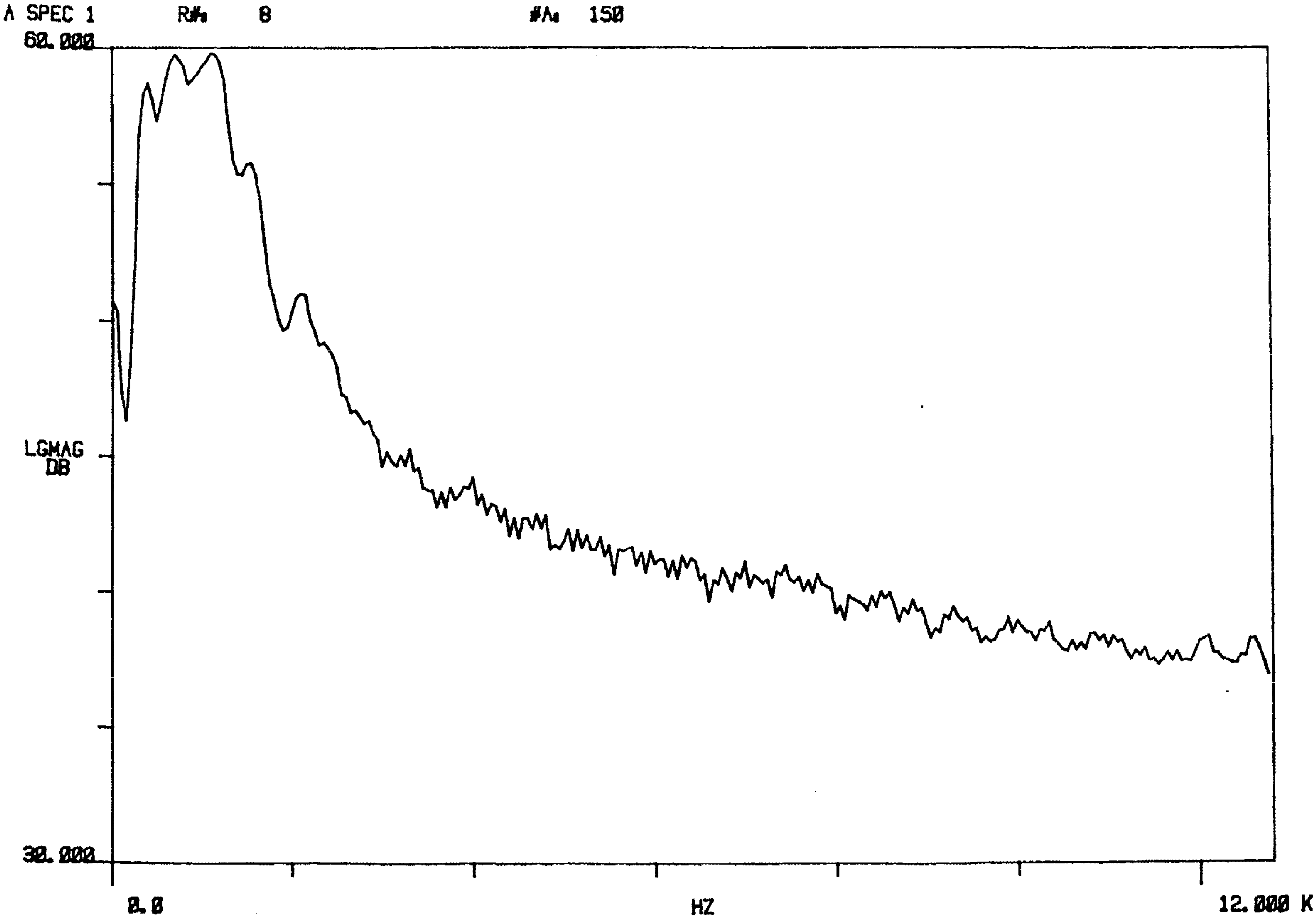


Fig. 8D - A-Weighted Source Contribution Analysis : Pickers
CENTRAL SOYA PLANT (pt. 6B, ch.2)

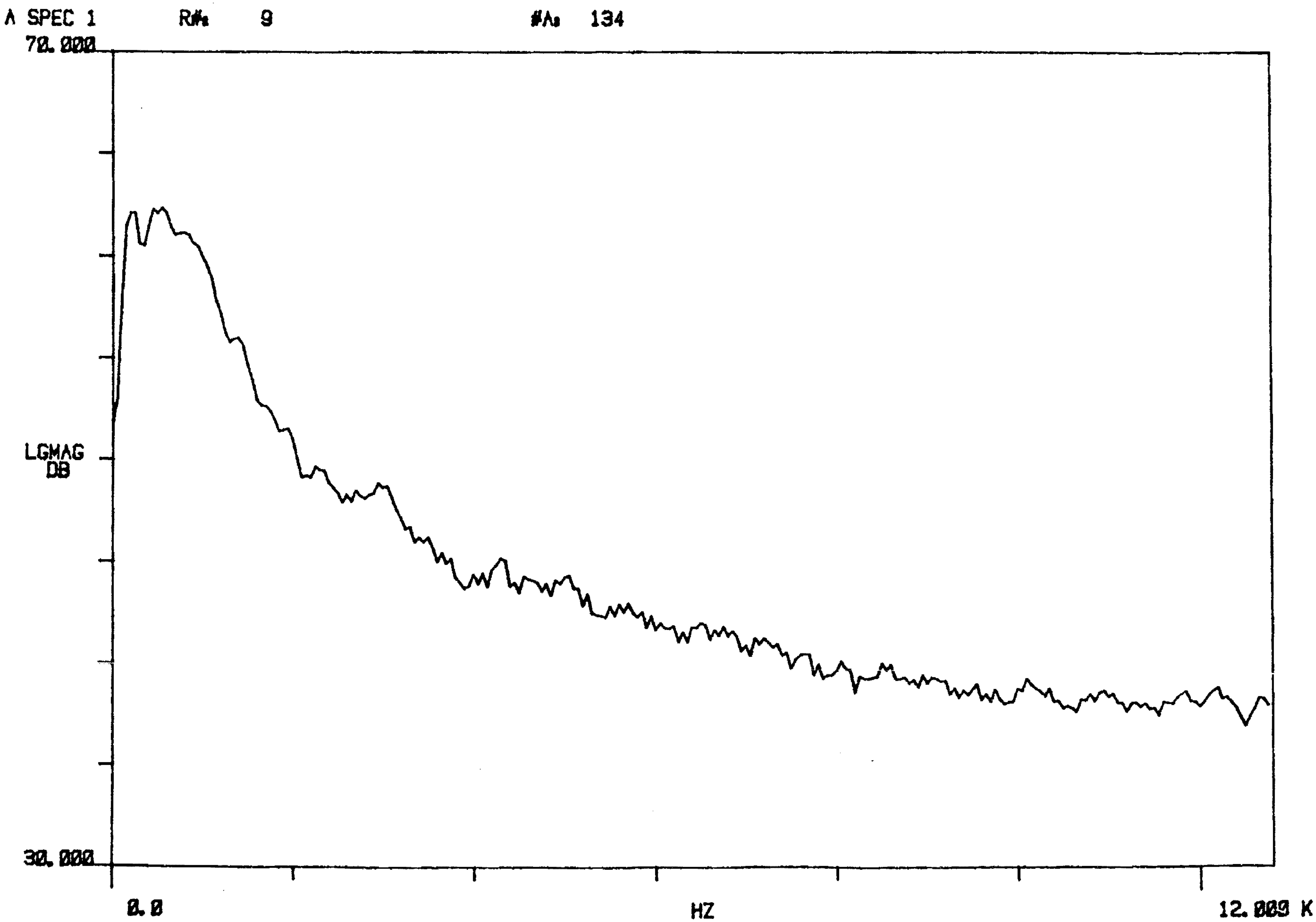


Fig. 9D - A-Weighted Source Contribution Analysis : Waste Vacuum
CENTRAL SOYA PLANT (pt. 6B, ch.2)

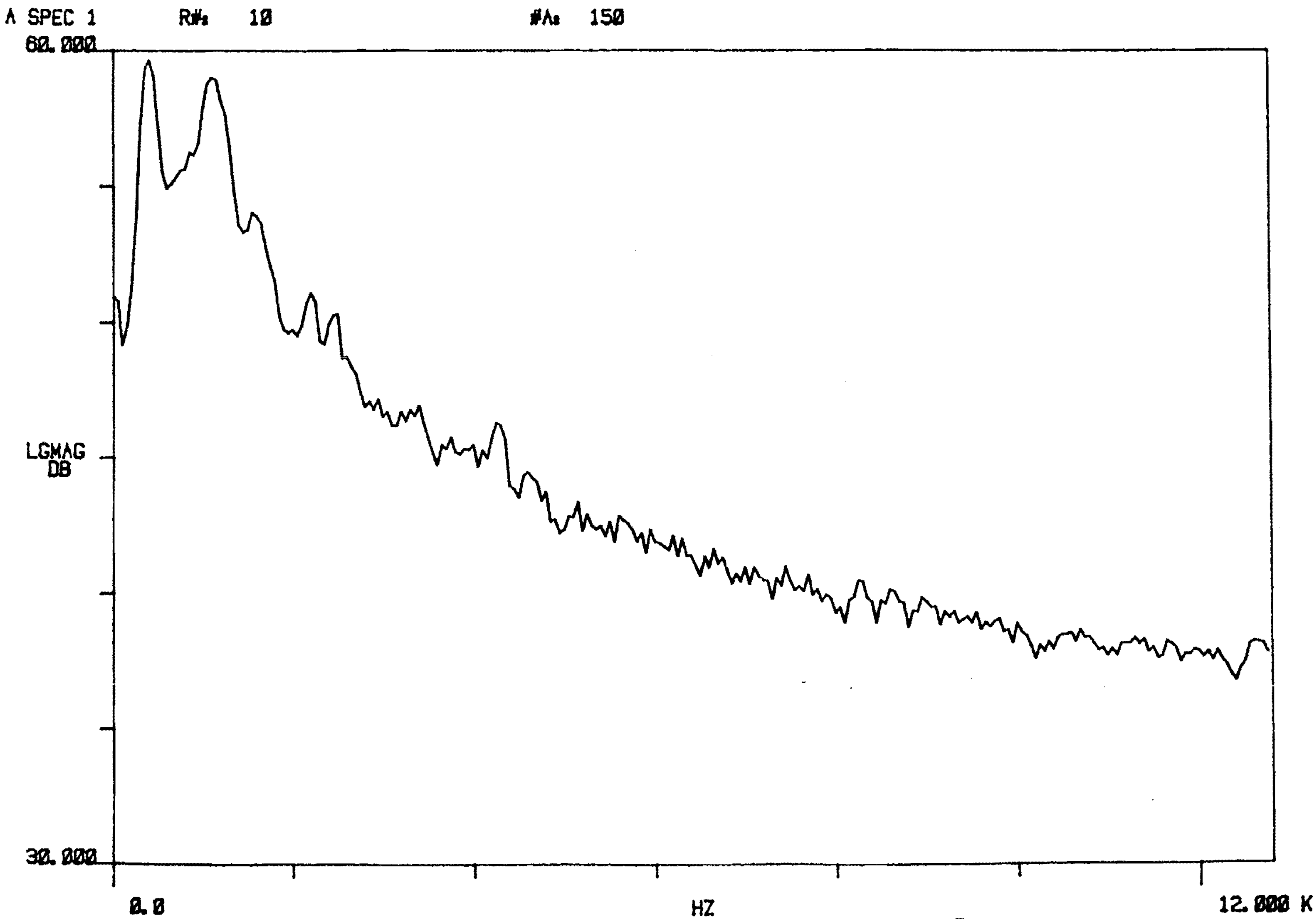


Fig. 10D - A-Weighted Source Contribution Analysis : Exhaust Fans
CENTRAL SOYA PLANT (pt. 6B, ch.2)

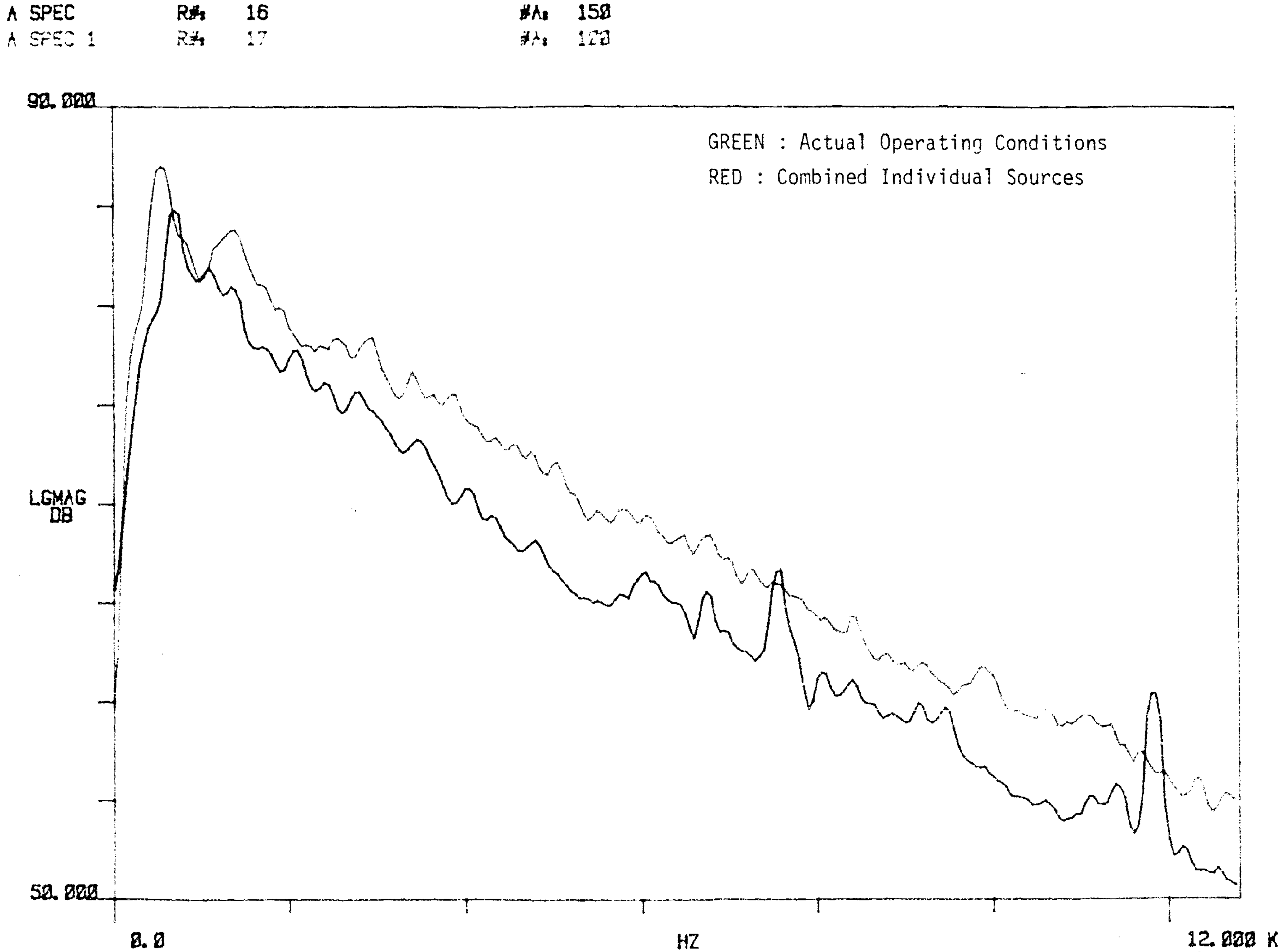


Fig. 11D - A-Weighted Comparison of Combined Individual Sources vs Actual Operating Conditions
CENTRAL SOYA PLANT (pt.6B, ch.2)

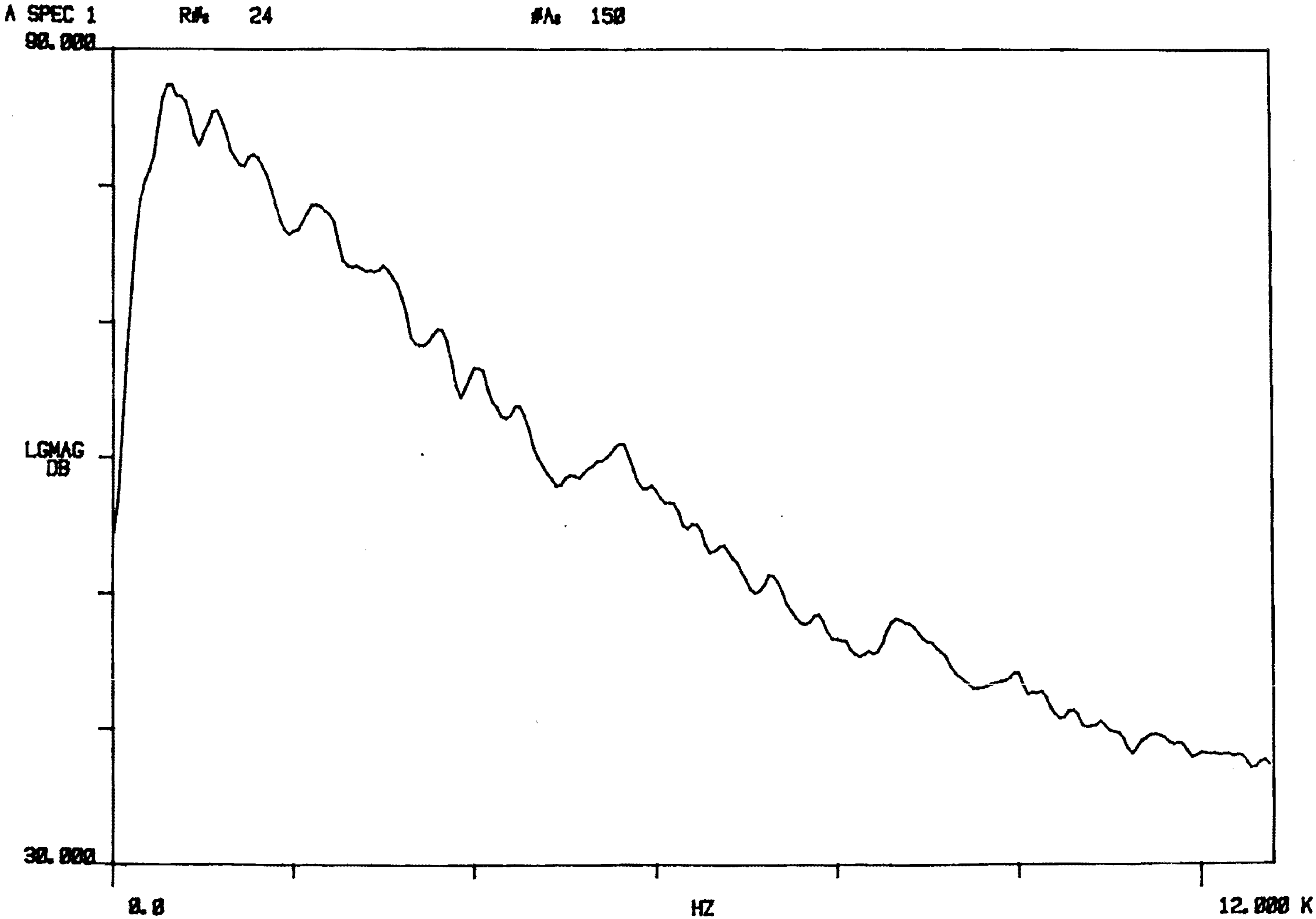


Fig. 12D - A-Weighted Source Contribution Analysis : Hock Cutter
TIP TOP PLANT (pt. 53, ch.2)

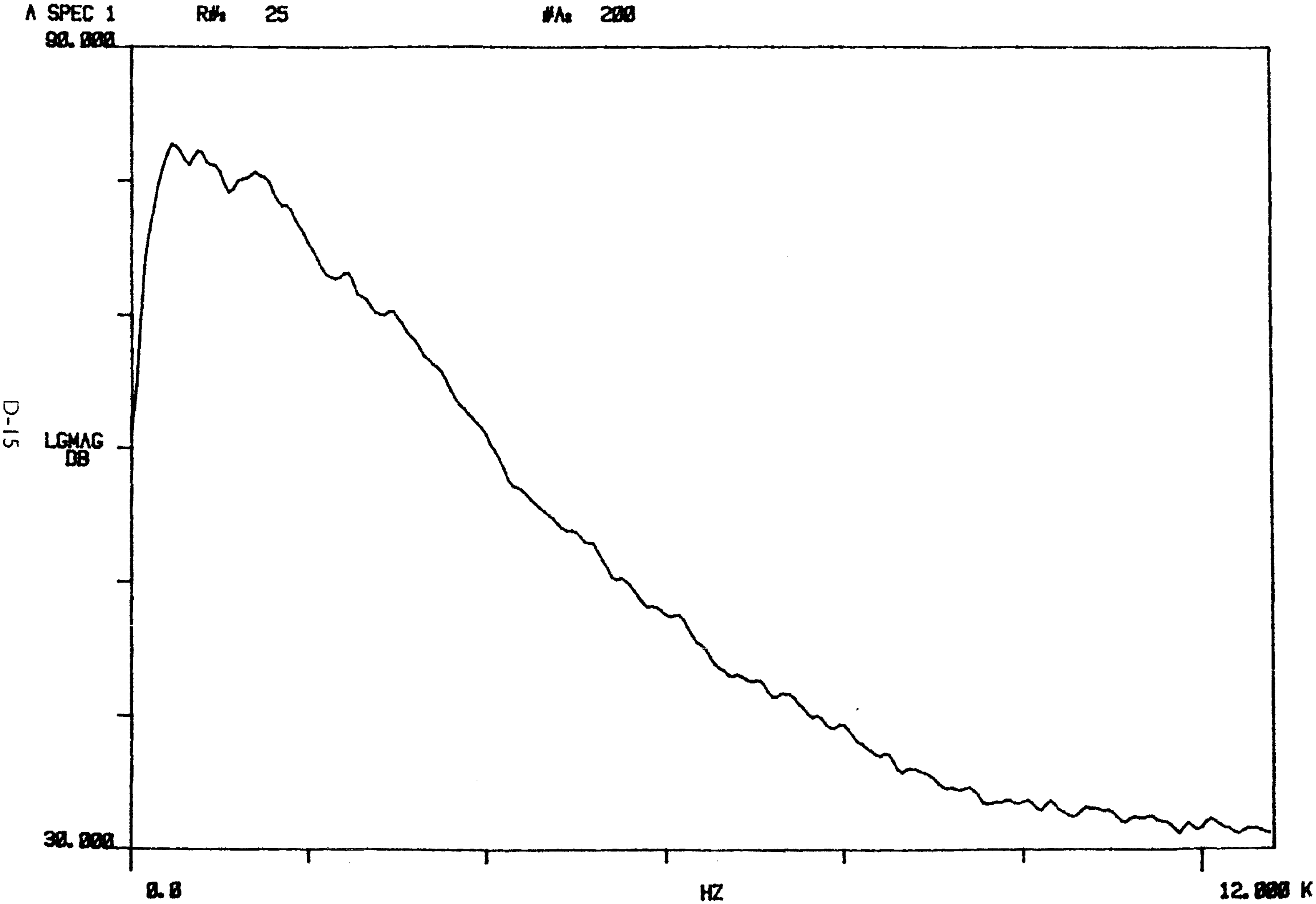


Fig. 13D - A-Weighted Source Contribution Analysis : Chillers
TIP TOP PLANT (pt. 53, ch.2)

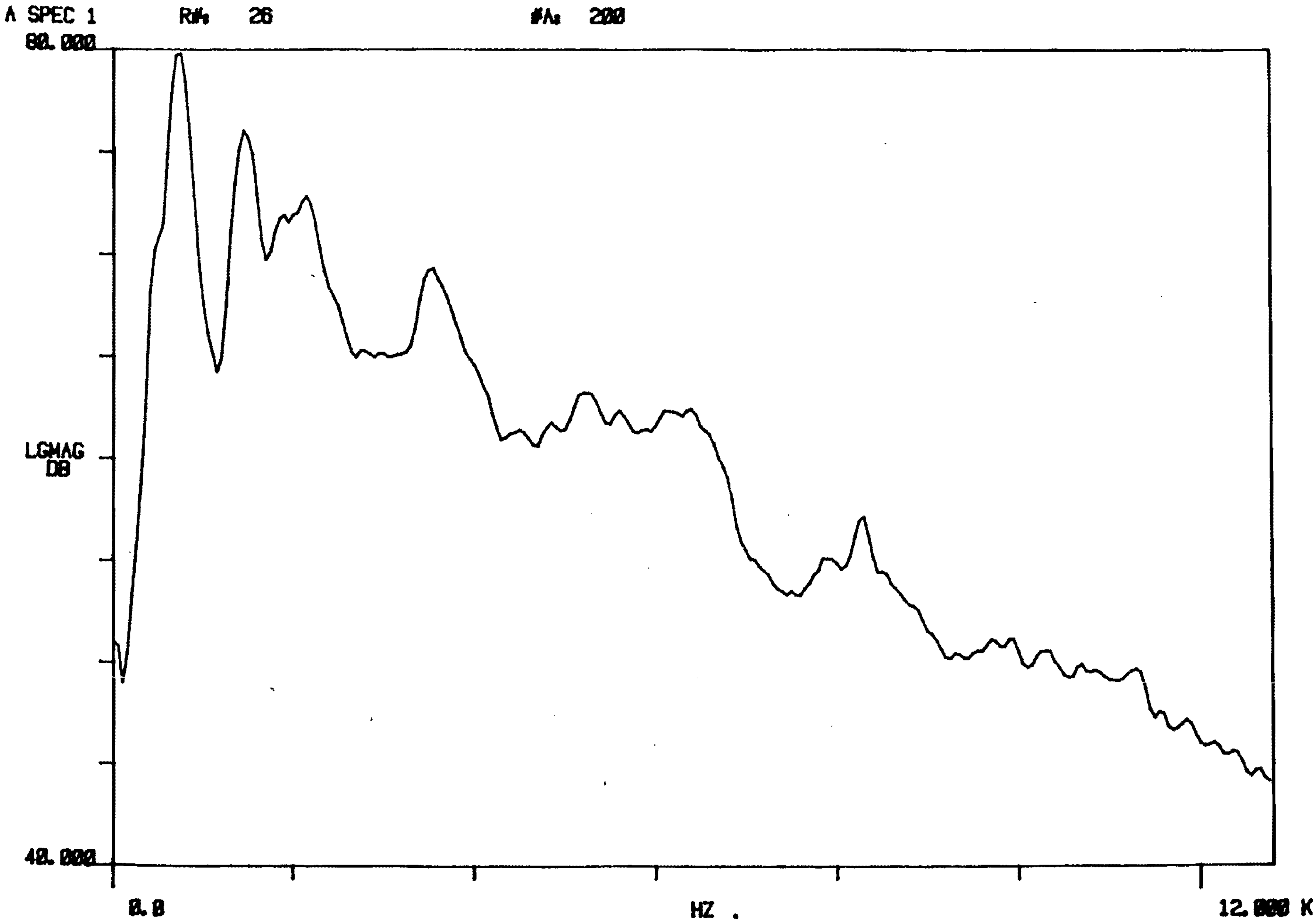


Fig. 14D - A-Weighted Source Contribution Analysis : Vent Cutters
TIP TOP PLANT (pt. 53, ch.2)

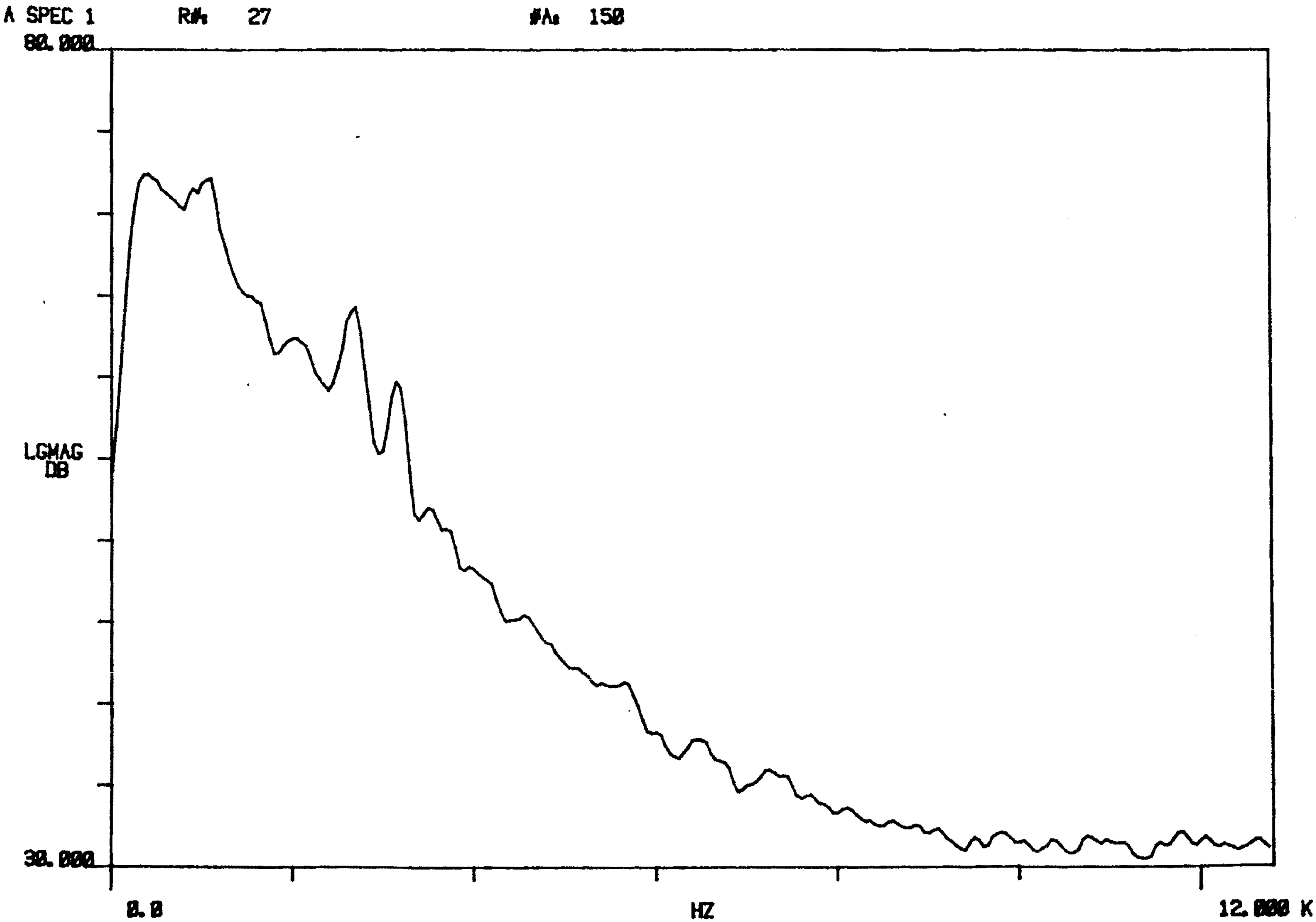


Fig. 15D - A-Weighted Source Contribution Analysis : Pickers
TIP TOP PLANT (pt. 53, ch.2)

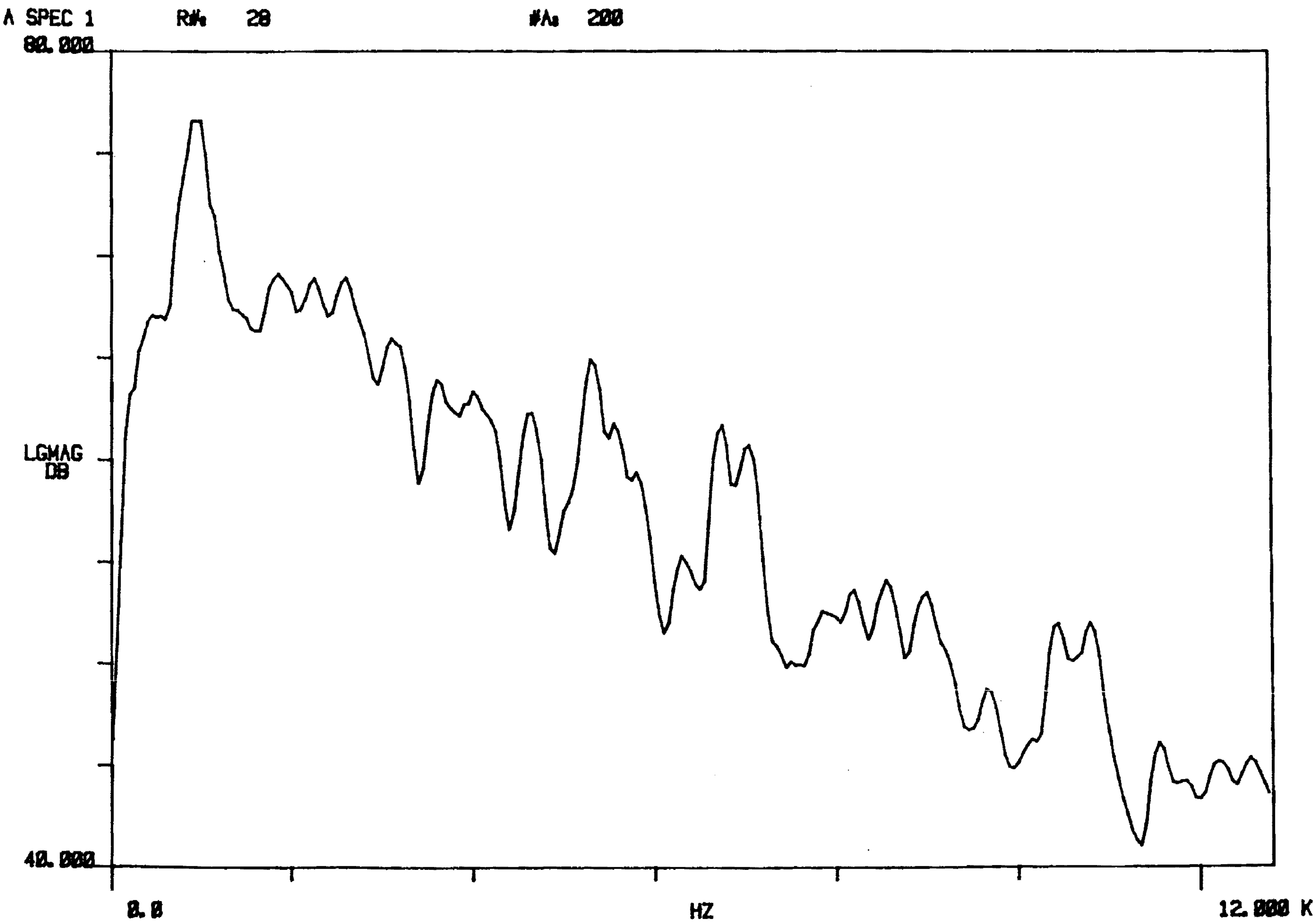


Fig. 16D - A-Weighted Source Contribution Analysis : Gizzard Machine
TIP TOP PLANT (pt. 53, ch.2)

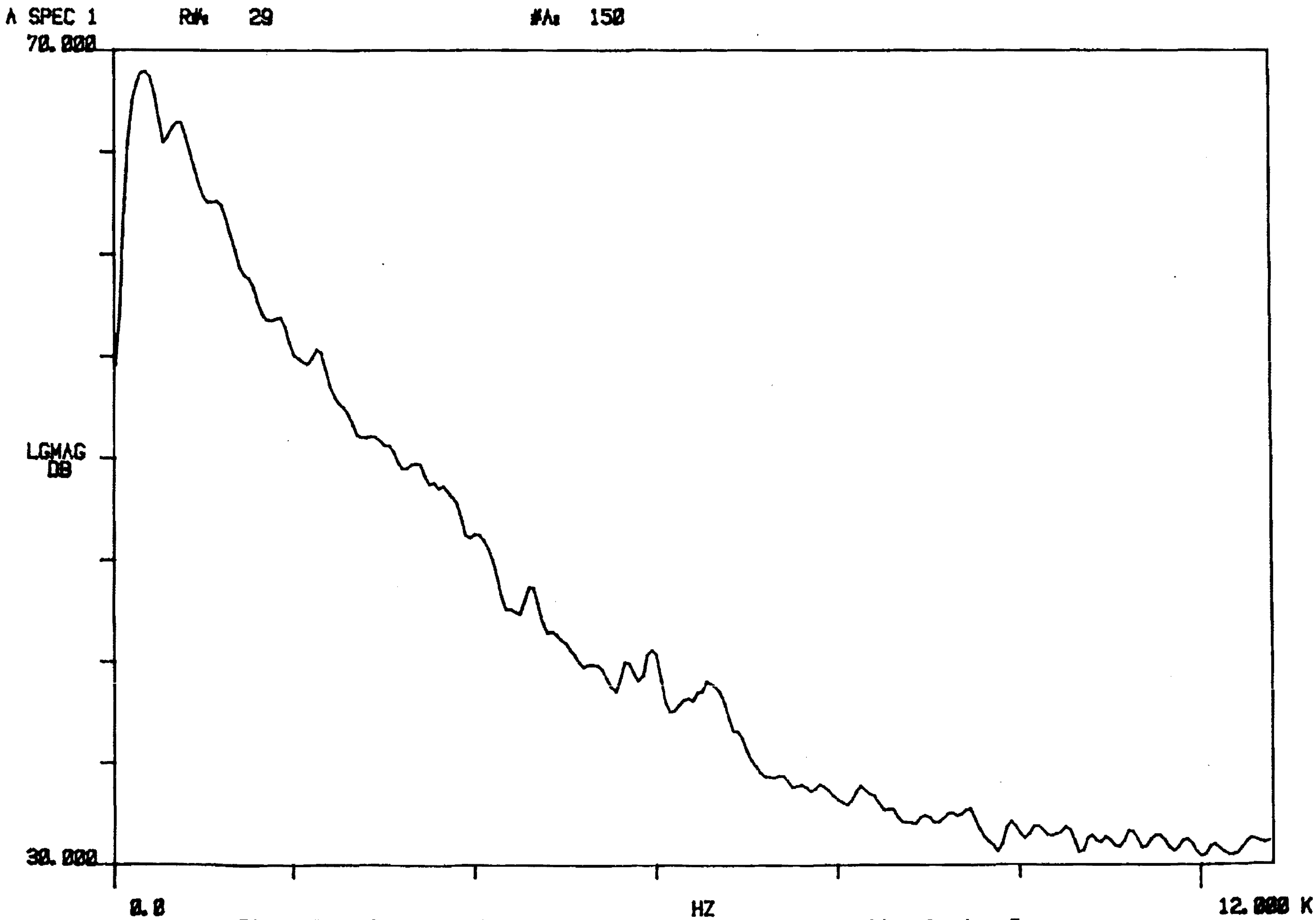


Fig. 17D - A-Weighted Source Contribution Analysis : Circulating Fans
TIP TOP PLANT (pt. 53, ch.2)

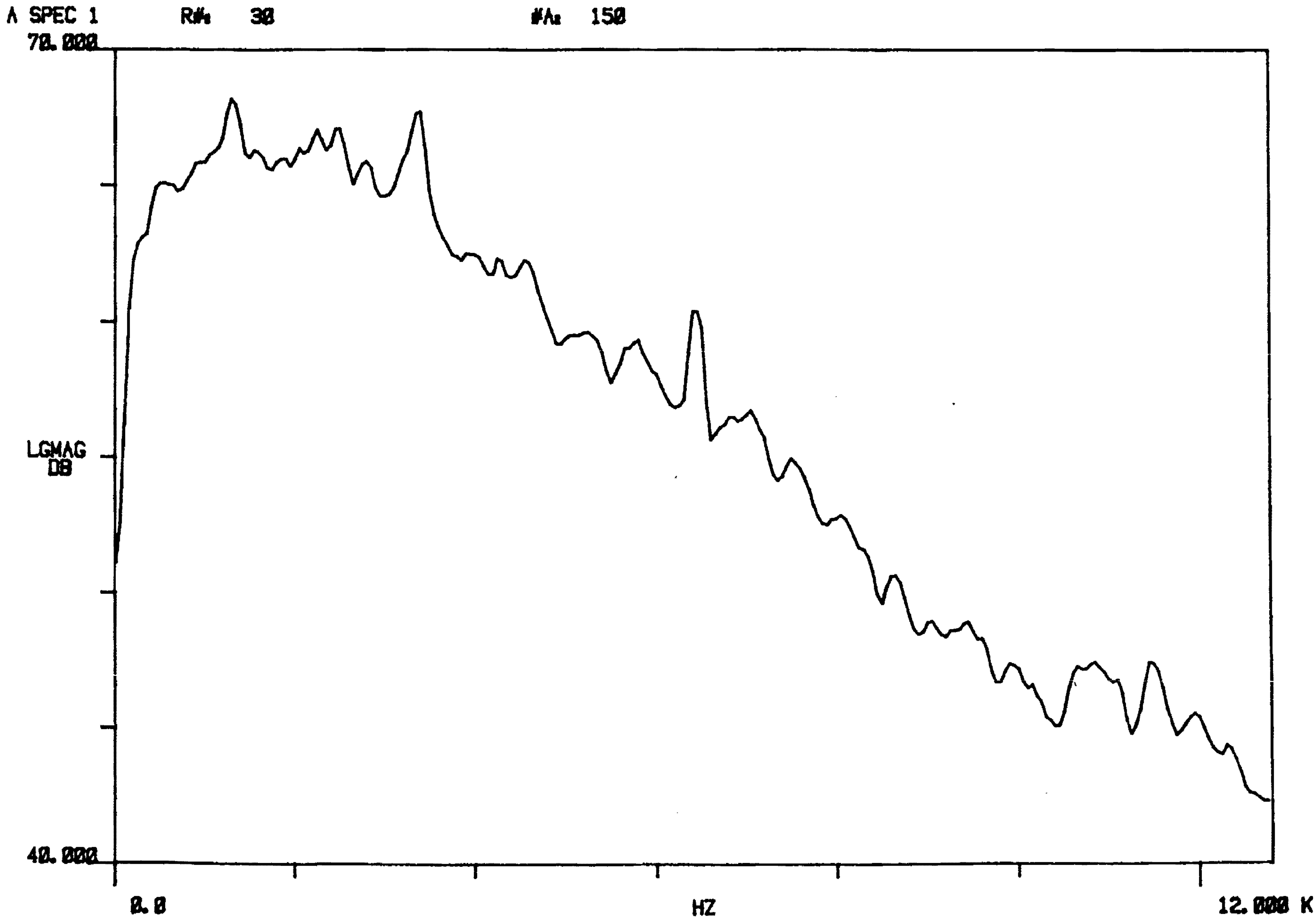


Fig. 18D - A-Weighted Source Contribution Analysis : Shackle Lines
TIP TOP PLANT (pt. 53, ch.2)

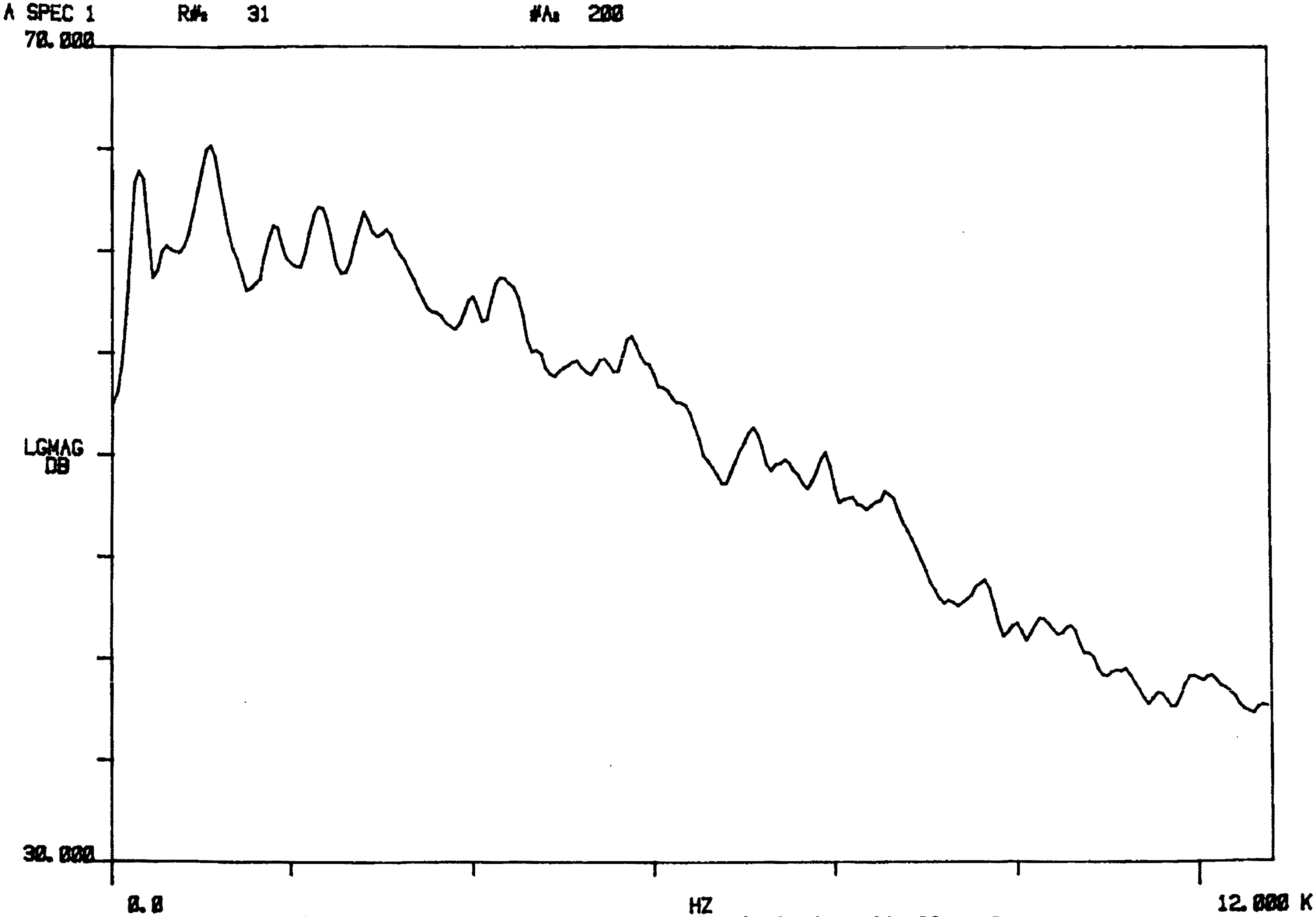


Fig. 19D - A-Weighted Source Contribution Analysis : Air Blast Dryer
TIP TOP PLANT (pt. 53, ch.2)

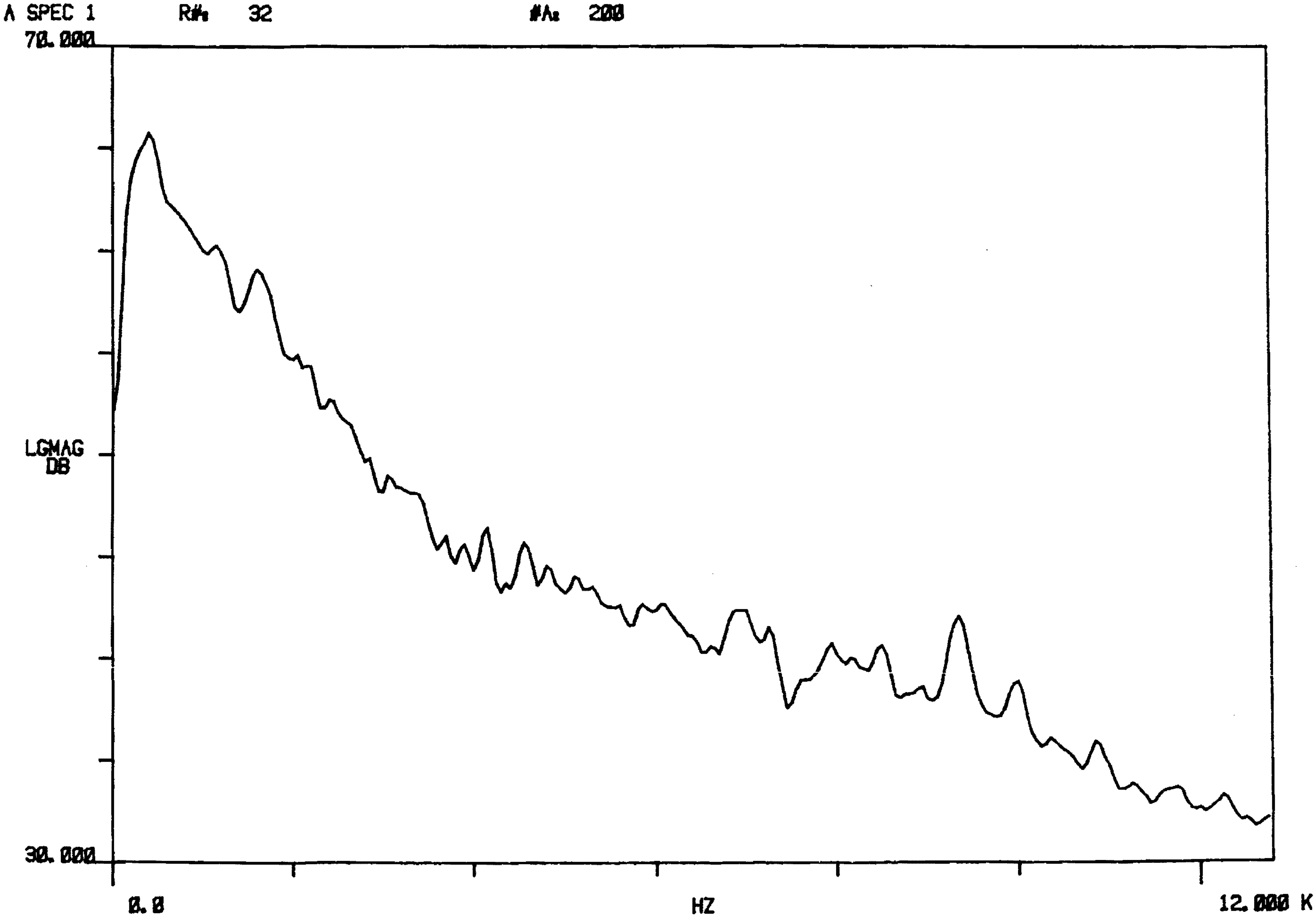


Fig. 20D - A-Weighted Source Contribution Analysis : Shackle Line Foot Remover
TIP TOP PLANT (pt. 53, ch.2)

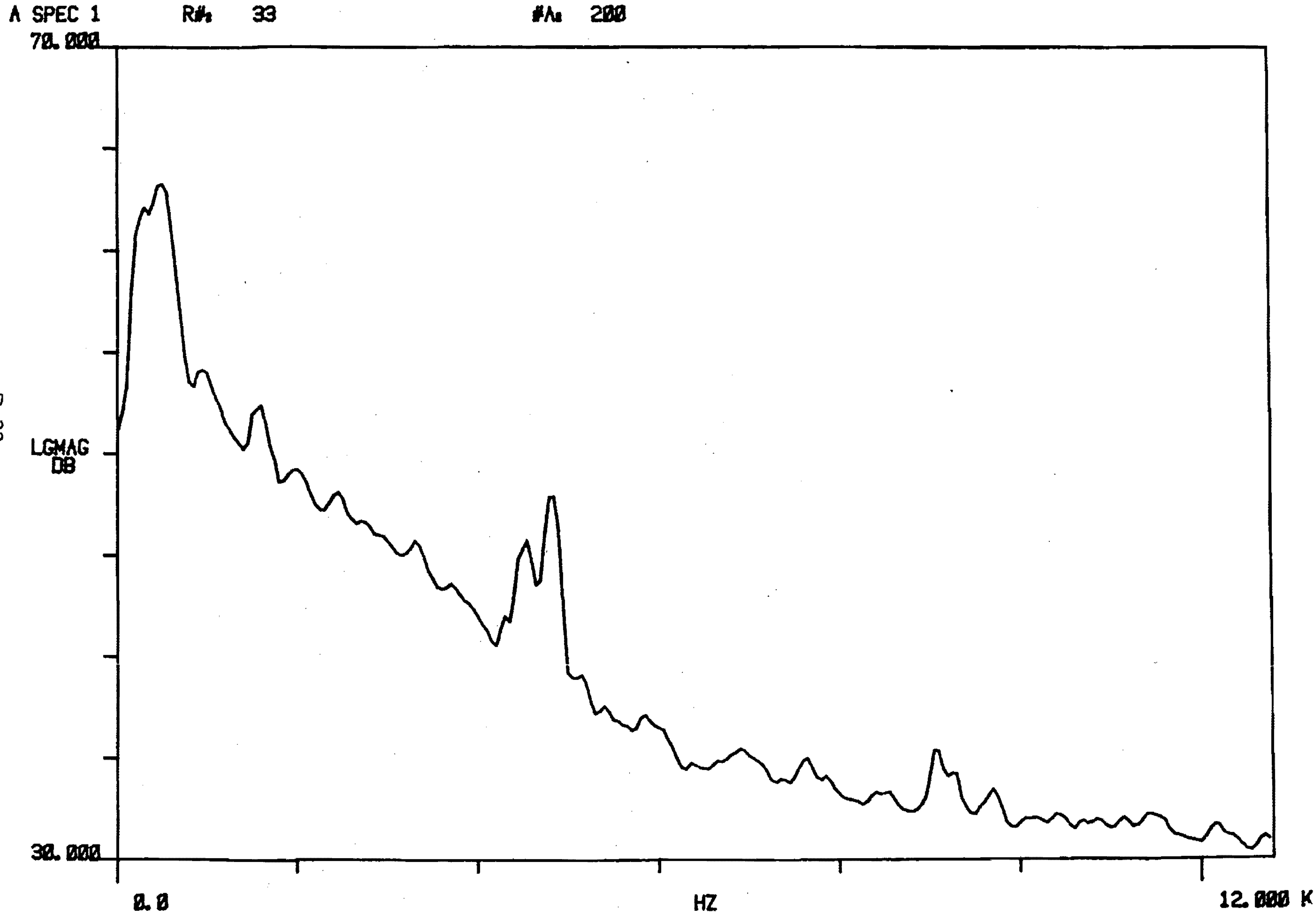


Fig. 21D - A-Weighted Source Contribution Analysis : Hanging Conveyor
TIP TOP PLANT (pt. 53, ch.2)

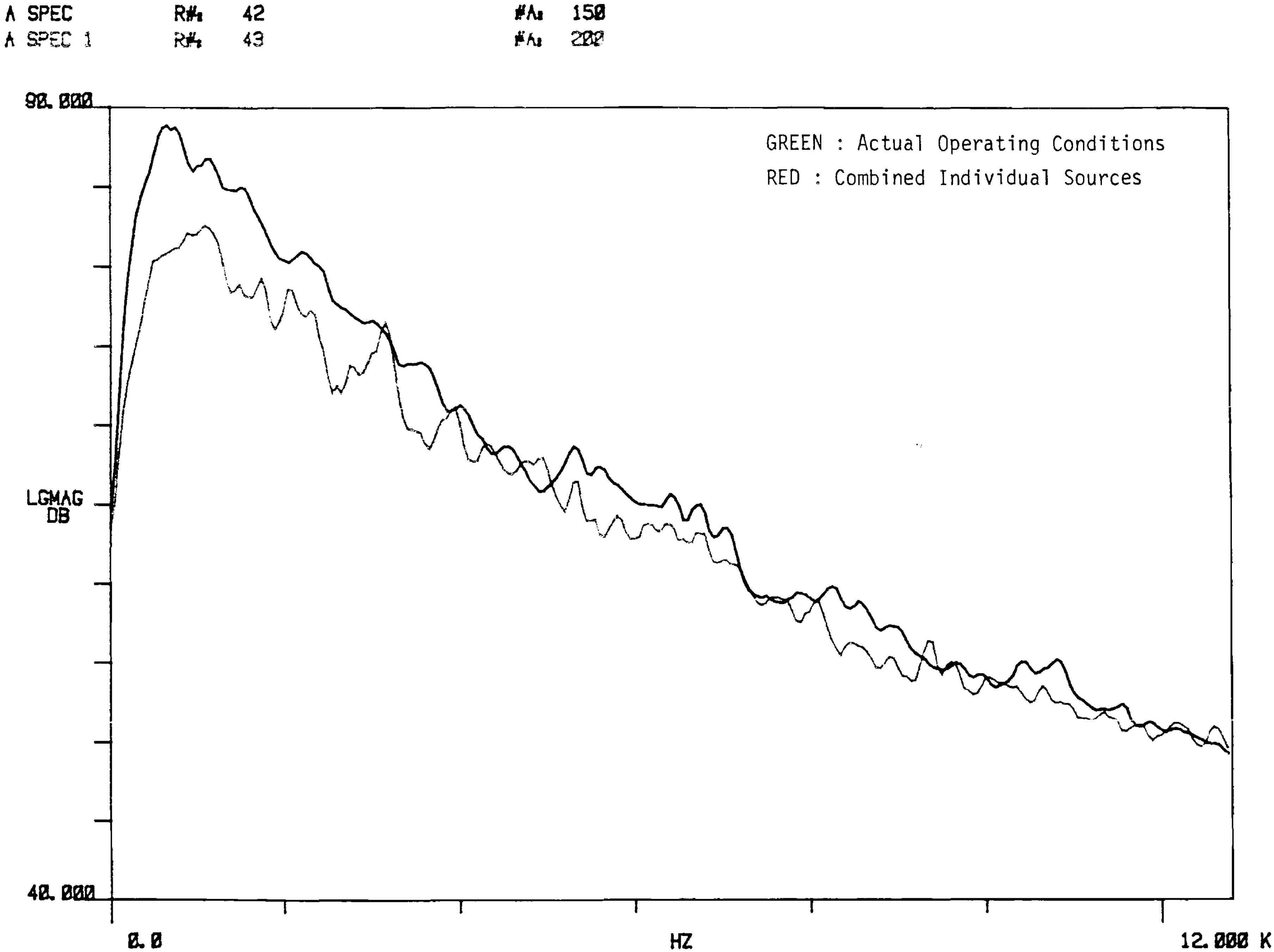


Fig. 22D - A-Weighted Comparison of Combined Individual Sources vs Actual Operating Conditions
TIP TOP PLANT (pt. 53, ch.2)