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NUSC Technical Report 4635

Long-Range Propagation Loss Measurements of Project TRANSLANT I in the Atlantic Ocean East of Bermuda

[Unclassified Title]

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NAVAL UNDERWATER SYSTEMS CENTER
New London Laboratory

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PREFACE

This work was performed under NUSC Project A-650-15, "Long-Range Acoustic Transmission Experiments for Surveillance System Development" (U), Principal Investigator, R. W. Hasse, Code TA; and Subproject and Task No. R2408, Program Manager, Dr. R. D. Gaul, Code 102-OS, Office of Naval Research.

The Technical Reviewer for this report was Dr. F. R. DiNapoli, Code TA113.

REVIEWED AND APPROVED: 12 June 1974

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Associate Director for Sonar Research

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Long-range (1400 nmi) underwater acoustic propagation measurements were made from 26 September to 14 October 1971, during TRANSLANT I. Three-pound explosive charges detonated at 60 and 500 ft were used as sound sources, and the signals were received on hydrophones at different locations and depths near Bermuda. The purpose of the exercise was to measure propagation loss and signal-to-noise ratios as dependent upon range, frequency, source depth, receiver depth,

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and topographic features, such as seamounts and the Mid-Atlantic Ridge. Besides providing a data base against which to check acoustic models for the subject area and climatic conditions, the data were to be compared with similar data taken in January and February 1971.

Considering all ranges and frequencies up to 200 Hz, propagation losses from 60-ft sources averaged about 6 dB greater than for 500-ft sources for hydrophones at depths of 10,900 and 4,650 ft. A similar difference between propagation losses for shallow as opposed to deep sources was found at 25 Hz for receivers at depths of 14,000 and 14,706 ft. For 50, 100, and 200 Hz, losses from both shallow and deep sources were about the same to the deep receivers. For sources detonated at the Mid-Atlantic Ridge (about 1300 nmi), the lowest loss was for the hydrophone suspended in the deep sound channel at 4,650 ft. Reduced propagation losses were also evident for sources detonated in the vicinity of Rockaway Seamount. The two deep hydrophones located at 14,000 and 14,708 ft indicated strong convergence gains for some frequencies for ranges as great as 900 nmi with losses somewhat greater for the deeper hydrophones.

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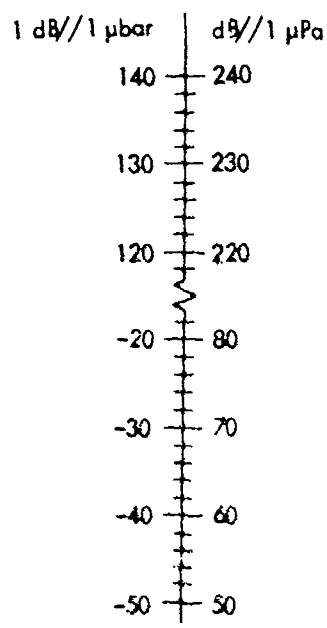
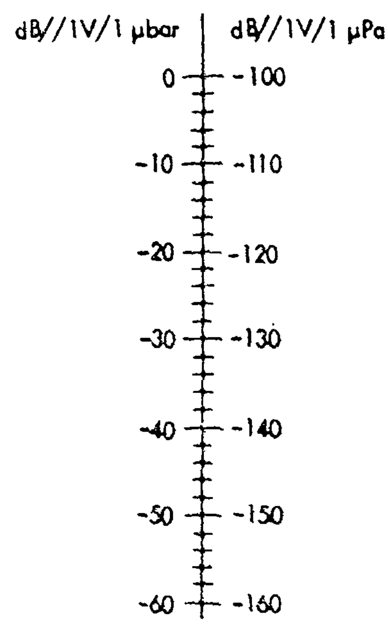
TECHNICAL NOTE

The micropascal (μPa), one micronewton per square meter (1μN/m^2), has replaced the microbar (μbar), one dyne per square centimeter (1 dyne/cm^2), as the standard reference pressure used to express acoustic levels. One μPa is equal to 10^{-5} μbar. The effect of this change in reference is a translation of 100 dB. For sonar parameters expressed in terms of dB//1 μbar (e.g., source level* and background noise), the level increases by 100 dB when expressed in dB//1 μPa, as shown by scale a. For sonar parameters expressed only in dB, which represent a difference of two acoustic levels (e.g., target strength and propagation loss), the value remains unchanged. The receiving sensitivity, which is expressed in dB//1V/1μbar, decreases by 100 dB when expressed in dB//1V/1 μPa, as shown in scale b.†



a. dB//1 μPa = dB//1 μbar + 100 dB



b. dB//1V/1 μPa = dB//1V/1 μbar - 100 dB

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*In this report, source level is expressed in terms of dB//(1 μPa)^2 · sec at 1 yd. Note that the source level will be 0.8 of a decibel lower for a reference of 1 m.

†Receiving sensitivity is a voltage reading at some specified location in the system which results when a standard pressure level is present at the transducer face. This standard reference pressure has been 0 dB//1 μbar at the transducer face. The new reference, 0 dB//1 μPa, respresents a unit pressure level that has been decreased by a factor of 10^5 or 100 dB. Consequently, this 100-dB reduction in pressure level results in a 100-dB drop in the receiving sensitivity value.

LONG-RANGE PROPAGATION LOSS MEASUREMENTS OF PROJECT TRANSLANT I IN THE ATLANTIC OCEAN EAST OF BERMUDA

INTRODUCTION

(U) During 26 September to 14 October 1971, long-range underwater acoustic propagation loss measurements were made between Bermuda and the Mid-Atlantic Ridge. These measurements were part of project WESTLANT, which has been redesignated TRANSLANT I. Explosives detonated at 60 and 500 ft were used as sound sources. The signals were received at five widely separated hydrophones in the Bermuda area and recorded on magnetic tape at the Naval Underwater Systems Center's Tudor Hill Laboratory, Bermuda. The measurements were intended to (1) study the dependence of propagation loss and signal-to-noise ratios (SNR) on range, frequency, source depth, and receiver depth, (2) show the effects of seamounts and the Mid-Atlantic Ridge on propagation loss, (3) provide comparisons with similar experiments on a seasonal basis, and (4) provide measurements for the development and validation of acoustic models for this type of acoustic environment.

(U) Environmental information along the several tracks was obtained by USNS SANDS (T-AGOR-6), the source ship, in the form of sound velocity profiles, expendable bathythermograms (XBT's), and water depth recordings, as well as standard meteorological data.

DESCRIPTION OF THE EXPERIMENT

(U) Figure 1 gives the location of the Broadband (BB), Trident Vertical (TVA-1), and Coherence (C6) receivers used in this experiment. Two additional hydrophones — Easy 1 (E1) and Easy 40 (E40) of the Easy II Array were also used. The source ship SANDS traversed the track as shown in figure 2 starting within 2 nmi of the Broadband Array and proceeding on an easterly great circle route toward the Mid-Atlantic Ridge. At point "B" about 612 nmi from the start, a northerly diversion from the great circle course was made. This course change (designated in the track plot as BCDE) was made so that the source ship would traverse the area of the Rockaway Seamount. At point "E," SANDS again continued on the original great circle route to the Mid-Atlantic Ridge about 1400 nmi from the start of the track. Excursions were then made back and forth over the ridge as shown in figure 2.

(U) SANDS proceeded on the track at 10 knots and detonated explosive sound sources on the following schedule: Starting on the hour and every 7 min thereafter to 49 min, a 3-lb TNT block was detonated at 500 ft; 2 min after each 500-ft shot, a 3-lb TNT block was detonated at 60 ft. In addition, thermal observations of the water column in the form of 2500-ft XBT's were taken every 8 hr. Deep sound velocity profiles (3600 m) were scheduled daily and were taken when weather and schedule permitted. Primary navigation was provided by the satellite navigation system.

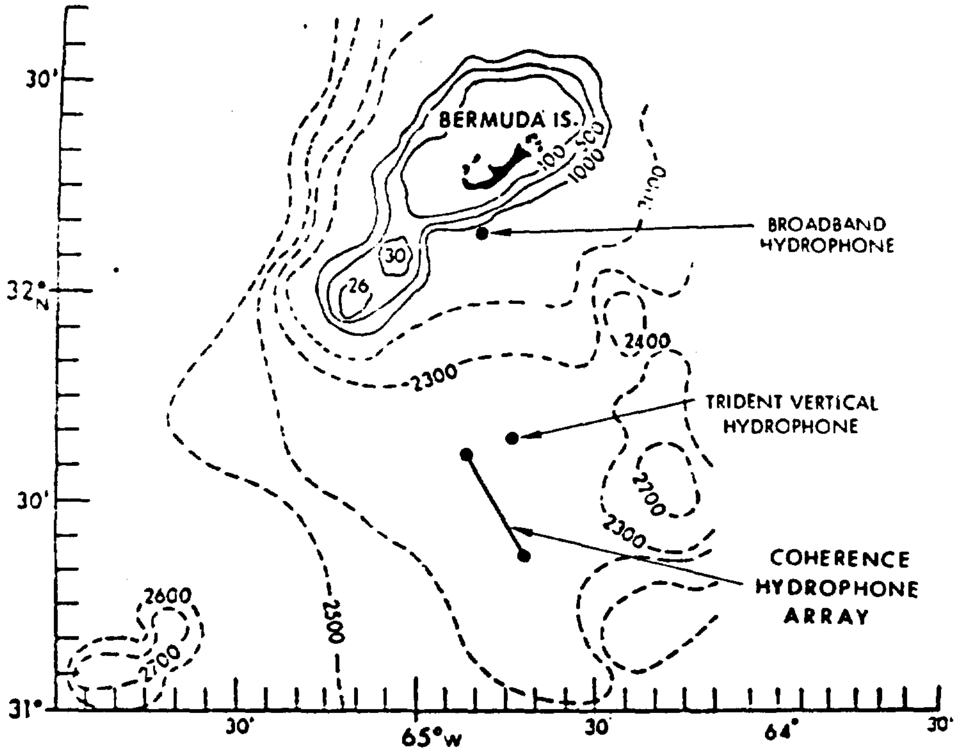


Figure 1. (U) Location of Hydrophones for TRANSLANT I (U)

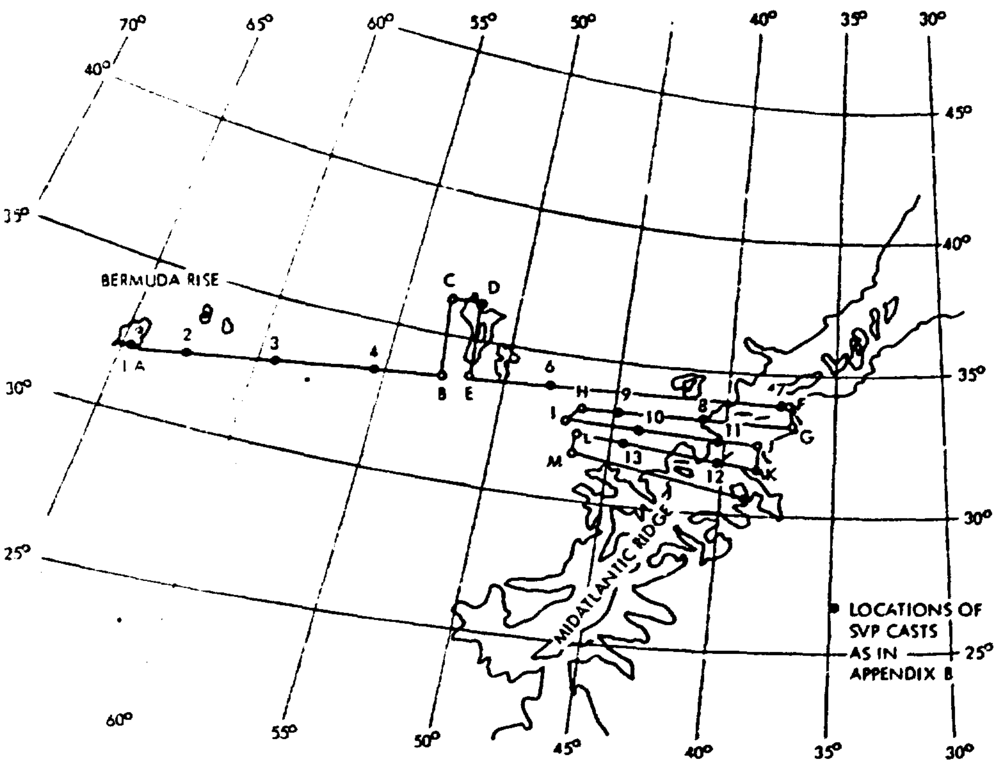


Figure 2. (U) Track for TRANSLANT I Measurements (U)

DATA ACQUISITION AND REDUCTION

(C) The explosive acoustic signals were received on hydrophones E1 and E40 at 10,900 ft, BB at 4650 ft, TVA-1 at 14,000 ft, and C6 at 14,708 ft; E1, E40 and C6 are on the sea floor, whereas TVA-1 and BB are suspended at 300 and 2500 ft, respectively, above the bottom. The acoustic signals received at the hydrophones were recorded on 14-channel magnetic tape with each of the 5 hydrophones assigned a high and low gain channel. IRIG-B time code signals and voice were also recorded.

SOURCE LEVELS

(U) Table 1 lists the 1/3-octave-band source levels (energy) of the explosive detonation at the geometric mean frequencies (GMF) of 25, 50, 100, 200, and 400 Hz for the depths of 60 and 500 ft. They are from an unpublished memorandum.[1]

Table 1. (C) Effective 1/3-Octave-Band Source Levels for TRANSLANT I (U)

GMF (Hz)	3-lb TNT at 60 ft	3-lb TNT at 500 ft
25	213.5	219.3
50	214.5	219.7
100	215.5	217.1
200	216.5	219.2
400	217.5	219.4
Source Level (dB//(1 μPa)^2 · sec at 1 yd.		

SYSTEM CALIBRATIONS

(U) Calibration curves relating voltage output to a reference sound pressure of 1 μPa* versus frequency were available for each hydrophone. Sine wave electrical signals at 1/3-octave GMF were periodically injected at the hydrophone terminals to calibrate the receiving amplifiers and tape recorder.

(U) *See Technical Note on page v.

DATA PROCESSING SYSTEM

(U) A combination analog digital system was used to process the data. The magnetically recorded wideband signals for each hydrophone were reproduced and fed to the 1/3-octave-band analog filters with GMF of 25, 50, 100, 200, and 400 Hz. The filter outputs were envelope detected, serial sampled, multiplexed, and converted from analog to 12-bit digital words. The digital samples were then used as input to a Univac 1230 computer, where a program provided for the calculation of the received signal levels, background noise levels, SNR, and propagation losses (source level-received level). Automatic timing was included in the program to sense for the arrival of the acoustic signal in order to initiate the start of sampling. This feature is subject to manual override if false triggering occurs. A graphic recorder is used to display the received analog signal and the computer generated "window" in order to ensure proper time alinement. The computer program used to calculate the propagation loss and ambient noise values has been described previously.[2]

RANGE DETERMINATION

(U) A computer program was used to determine the great circle distances between the sources and the hydrophones for all the usable satellite navigational fixes, and the range for each detonation was then determined by interpolation using the associated detonation times.

FORMAT AND PRESENTATION OF THE DATA

ENVIRONMENTAL DATA

(U) Bathymetry along the track traversed by SANDS is shown in appendix A. The data are plotted to the same range scale as the propagation loss curves presented in the following sections of this report. Bathymetry from the BB hydrophone is that from the actual depth sounding records taken by SANDS, whereas bathymetry from the other hydrophones was determined with the aid of hydrographic charts for the area. For the latter in the range to about 250 nmi, the topography is that best estimated from the charts, since for the geometry of the measurement track with respect to these hydrophones, the source-receiver signal path continually changes with each detonation. Thus, the topography is not an extension of that to the previous detonation, and therefore, a topography plot for each detonation would be required. Over 250 nmi, the topography presented is that obtained from the soundings taken by SANDS. Sound velocity versus depth profiles (SVP) taken by SANDS along the track as indicated in figure 2 are shown in appendix B. A summary of the daily sea state and weather conditions from the SANDS' log is presented in table 2.

Table 2. (U) Surface Conditions From Log of USNS SANDS (T-AGOR-6) (U)

Date	Sea		Wind		Swell		Barometer (in. of Hg — Average)	Range (nmi) at Start of Day (From Point A)
	Height (ft)	Direction (deg)	Speed (knots)	Direction (deg)	Height (ft)	Direction (deg)		
9/26	3-2	130-155	15-10-15	130-155	6	210	30.00 →	0
9/27	2	180-190	18-10	180-190	6-7	210-230	30.00 →	138
9/28	2	210-360-340	12-10	210-360-340	4-6	220-340	30.07 ↑	333
9/29	2-4	020-060	8-16-12	020-060	4-12-3	020-060	30.16 ↑	534
9/30	1	180-230	8-14	190-230	4	000-010	30.16 ↓	628
10/1	3	240-310	16-22	240-310	3-4	240-310	29.66 ↓	663
10/2	5-6	280-330-310	24-26-12	280-330-310	8-12-8	310-330-210	29.90 →	824
10/3	3-5	300-220	12-22	300-220	4-12	310-350	29.90 →	848
10/4	3-8	220-240-210	20-25-20	220-240-210	8-20-12	350-310	29.90 →	1055
10/5	6-2	210-330	20-12	210-330	12-6-15	300	29.98 ↑	1295
10/6	2-6	330-080	14-16	330-080	8-15-6	310-350	30.17 ↑	1333
10/7	2-1	080-050-090	15-8-15	080-050-090	5	350-360	30.23 →	1142
10/8	3-1	090-050	15-10	090-050	4-2-6	360-050	30.26 →	956
10/9	2-4	050-010	12-14	050-010	6	060-070	30.22 ↓	1121
10/10	3	030-040-020	12	030-040-020	6	070-050	30.18 →	1321
10/11	1-2	030-320-000	10-6-12	030-320-000	6-3-6	050-310-070	30.21 →	1179
10/12	1-4	030-040	8-18	030-040	4-8	070-050	30.22 →	972
10/13	3-6	030	14-24	030	8-15	050	30.13 ↓	1078
10/14	7-6	030-010	20-24	030-010	15-6	050-045	30.03 →	1289

PROPAGATION LOSS

(U) Point sets representing propagation loss as a function of range or shot number are contained in appendix C. They are arranged in order according to hydrophone, source depth, ship track, and frequency. These plots have been edited to eliminate data that were invalid because of overloading, noise contamination, incomplete detonation of the source, or low SNR on an energy basis, i.e., when the estimated signal energy is equal to or less than the estimated noise energy for an equivalent time interval. Propagation loss was obtained to both the E1 and E40 hydrophones, which are horizontally separated by 1800 ft. Only E1 data are presented inasmuch as there was essentially no discernible difference between the results for the two units.

(U) For the purpose of exhibiting propagation loss and SNR results, the ship track is divided into several segments, namely ABEF, HG, IJ, LK, and MN. For the portion of the track labeled BCDE, there was only a slight change in the ranges to Bermuda receivers, and thus plotting propagation loss and SNR versus shot number proved to be the most convenient way of indexing measured results to topography.

(U) For each hydrophone/track segment/source depth combination, two figures are used to present the results for all five frequencies. The first figure includes results for 25, 50, and 100 Hz; the second gives results for 200 and 400 Hz. In these and later figures, the enclosed numbers with signs following the frequency labeling indicate the adjustment necessary for each curve to give the proper ordinate value.

AMBIENT NOISE SPECTRUM LEVELS

(U) A noise sample is taken just before each signal arrival and the average noise spectrum level is computed for the GMF of each 1/3-octave-band filter by applying a 10-log bandwidth correction to the calculated band level. These levels are presented in appendix D as points in a format compatible with the propagation loss plots and thus give the ambient noise levels at the time the source ship is at a given range from the receivers. For track BCDE, the points are plotted versus shot numbers. Much of the initial background noise was that of the measuring system when low gain or large signal attenuation was used. In order to obtain a true representative level of the ambient sea noise, the gain was increased periodically during the experiment for each hydrophone with the exception of E1. The levels obtained are plotted as connected triangles on the noise spectrum plots, which were first edited to remove points representing system noise.

SIGNAL-TO-NOISE RATIOS

(U) The SNR using the received signal band levels and the band noise levels are shown in appendix E. The format used in the propagation loss plots was also used for the SNR plots.

DISCUSSION OF EXPERIMENTAL RESULTS

GENERAL COMMENTS ON ENVIRONMENT

(U) Referring to figure 3, except for areas at 273 and 680 nmi from the start of the track (locations of velocity profiles 3 and 5), a surface duct having a depth variable from 40 to 80 m is indicated by the velocity profiles. Thus, it is likely that for most of the run, the 60-ft sources were in the surface duct. Below the surface duct, a subsurface channel forms between the origin of the track and 107 nmi (the range to velocity profile 2). This channel extends to between 680 and 847 nmi, as evidenced by velocity profiles 5 and 6. Since the upper (lower) boundary of this channel ranged between 80 and 105 m (400 and 550 m), it always contained the 500-ft sources. The dotted line in figure 3 indicates that the deep sound channel axis lies between 1175 and 1275 m. Critical depths are marked with x's in figure 3. Note that only over the interval from 400 to 800 nmi was there any appreciable depth excess and this stretch was interrupted by high ground at 600 nmi. Over the remainder of the track, the deep sound channel is essentially bottom limited.

AMBIENT NOISE SPECTRUM LEVELS

(U) Referring to appendix C note that a low wind speed condition is evident from the low ambient noise spectrum levels at TVA-1 at 400 Hz for the period during which the ship was at ranges between 650 and 700 nmi.[3] The TVA-1 and C6 hydrophone ambient noise spectrum levels at this period agree reasonably well (within 2 to 3 dB) with the average values presented by Perrone for 2400 and 2500 fm and a wind speed of 0 knots.[4] There is no direct comparison available for the BB noise spectrum levels, but if they are compared with Perrone's values for 1100 fm, the major difference is at 400 Hz where the value here is about 8 to 10 dB lower.

(U) The noise spectrum levels for the different hydrophones are compared in figures 4 and 5 for the ship range EF. In the range AB, system noise associated with some of the hydrophones prevents a similar comparison. Neglecting peaks resulting from local shipping, note that for the frequencies where the noise levels are independent of wind speed (25 and 50 Hz), the spectrum levels for TVA-1 are higher than those for E1 by almost 10 dB. At 25 Hz, C6 and BB noise values range from 5 to 10 dB less than those of TVA-1 with the C6 values higher than those for the BB. At 50 Hz, C6 and BB are within 5 dB of TVA-1 and are within about 3 dB of each other. At 100 and 200 Hz, the general tendency is for the noise levels of TVA-1 to be highest, but the overall spread is reduced to about 5 dB. At 400 Hz, the background noise was that of system noise for E1, and thus no comparison is included. SNR for a given propagation loss could be expected to be lowest at TVA-1 and highest at E1 with a maximum difference of about 10 dB at 25 and 50 Hz.

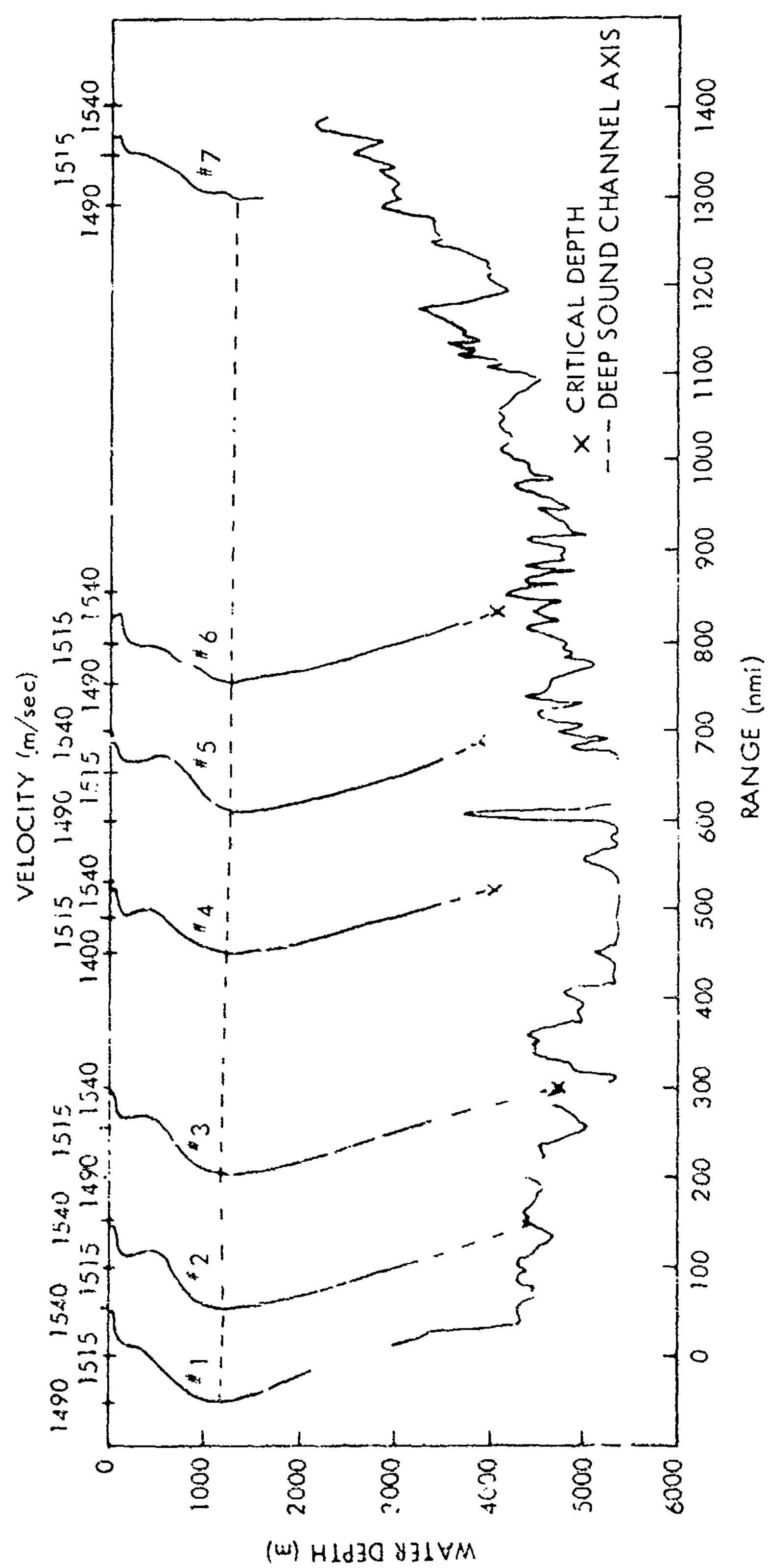


Figure 3. (U) Deep Sound Channel Axis and Critical Depth for TRANSLANT I Measurements (U)

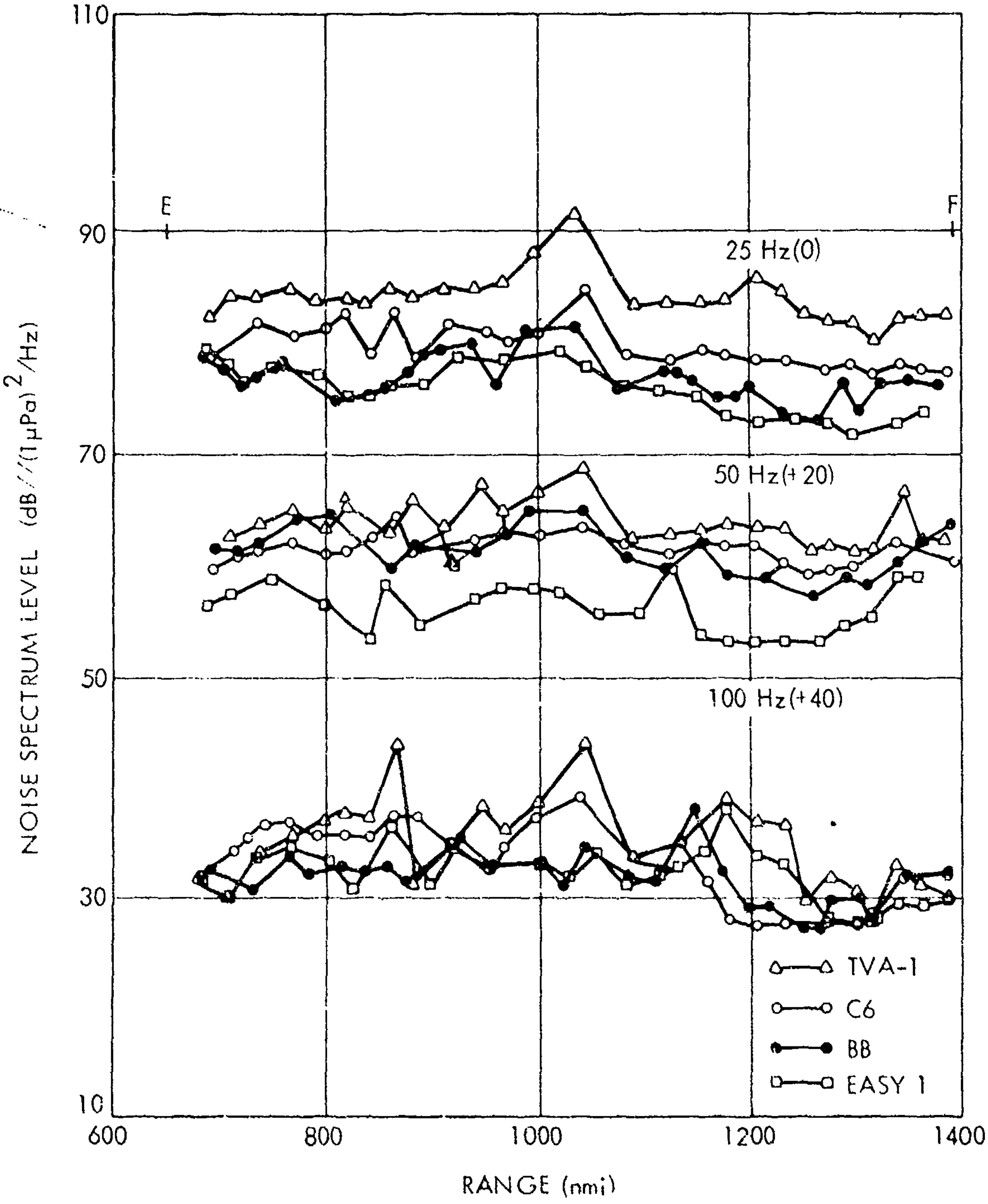


Figure 4. (U) Comparison of Noise Spectrum Levels at TRANSLANT I Hydrophones (25, 50, 100 Hz) (U)

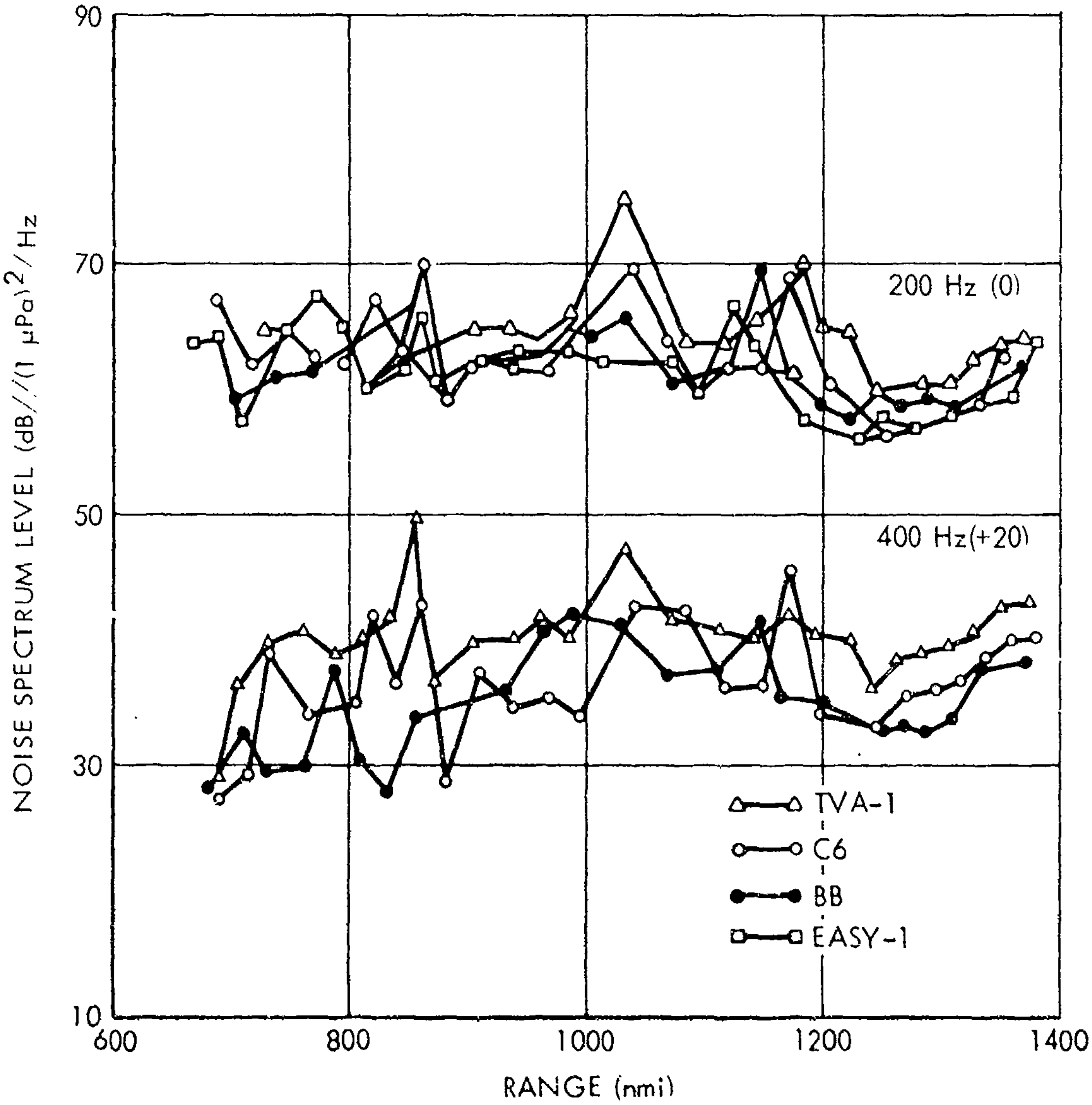


Figure 5. (U) Comparison of Noise Spectrum Levels at TRANSLANT I Hydrophones (200, 400 Hz) (U)

PROPAGATION LOSS AND SIGNAL-TO-NOISE RATIOS FOR 500-ft SOURCES

(U) For each frequency (25, 50, 100, 200, and 400 Hz), figure 6 contains a plot for the ABEF track, which exhibits (1) average propagation loss to all four hydrophones from the 60-ft sources, (2) average propagation for the 500-ft sources, and (3) a bottom profile, all of which are plotted as a function of range. The average values were obtained by drawing lines of best fit through the appropriate scatter diagrams of appendix C. Since the use of average values hides the scatter in the data and obscures the effects of zonal propagation, figure 6 is presented only as a continuing guide for use while reading the following sections. For details, the reader is directed to the figures in appendix C that actually contain the point sets.

(C) From the long-range propagation loss curves for track ABEF, it is seen that the loss curves for TVA-1 and C6 (figure 6) are very similar in shape. Convergence zone gains are quite evident in the point set plots shown in appendix C. The average propagation loss for TVA-1 is 2 to 5 dB less than that for C6 for frequencies up to 100 Hz. At 200 and 400 Hz, large convergence gains (20 dB or more) at TVA-1 overshadow similar gains for C6. However, from the previous discussion, as a result of higher ambient sea noise at TVA-1 for 25, 50, and 100 Hz, the received SNR would be about the same as C6. At 200 and 400 Hz, the SNR at TVA-1 would be higher as a result of the higher convergence gain and lower loss. This is reasonably confirmed by comparing the SNR for the two hydrophones in appendix E.

(C) The propagation loss curves at 25, 50, and 100 Hz extend to approximately 900 to 1100 nmi for both hydrophones. Subsequent tracks of HG, IJ, LK, and MN give values compatible with the ABEF track for the same range, and any effect at ranges over 1100 nmi due to topographical features is not evident.

(C) Losses are greater to BB than to E1 for 25 through 200 Hz out to about 200 nmi. The sudden decrease of losses for BB that appears for all frequencies just beyond 200 nmi has been checked and rechecked to determine if a processing error existed. However, this does not seem to be the case, and beyond this range BB losses approach those of E1 and are in general agreement from approximately 250 to about 1100 nmi. The loss values at 400 Hz for E1 were limited as a result of high system noise and are essentially not usable beyond 150 nmi. Loss values to BB for this frequency are available out to a range of about 800 nmi. Convergence type gains are evident for both hydrophones at lower frequencies but are slightly more noticeable for E1. Considering 25- through 200-Hz results, note that curves for both BB and E1 show a marked increase in loss at about 1200 nmi. This is at the range where an approximate 100-nmi-wide trench exists in the Mid-Atlantic Ridge, as indicated in the bottom topography. Beyond this range, the loss to E1 gradually increases out to a maximum at 1300 nmi. On the other hand, for BB the losses beyond the trench decrease again to near their earlier values. For still greater ranges (over 1280 nmi), there is a diminution of propagation loss to BB, especially at 25 and 50 Hz followed by complete cutoff of the signal corresponding to the ship's actual traverse of the ridge.

(C) At approximately 1300 nmi, which is the most distant range for which losses could be measured to E1, loss values to E1 are about 10 dB greater than are the losses to BB. Here, the energy from the sources, which normally follows paths to E1, is reflected from the upper slopes of the ridge toward the channel axis thus favoring propagation to BB.

(C) For the excursions (GH, IJ, LK, and MN) back and forth across the ridge, it is seen from the bathymetry (appendix A) and track plot (figure 2) that the peak of the Mid-Atlantic Ridge decreases in range with subsequent crossovers. Again, there is up to 10 dB lower propagation losses to BB than to E1 in the vicinity of the ridge. Just as for the ABEF track, propagation losses to BB increase rapidly as the ship crosses the ridge.

(U) The SNR curves (appendix E) reflect the different propagation loss values to BB and E1 in the vicinity of the Mid-Atlantic Ridge. Thus, around the 1300-nmi range where the loss to BB becomes lower than that to E1, the SNR is greater for BB by about 5 to 10 dB at 25 Hz and somewhat less at other frequencies.

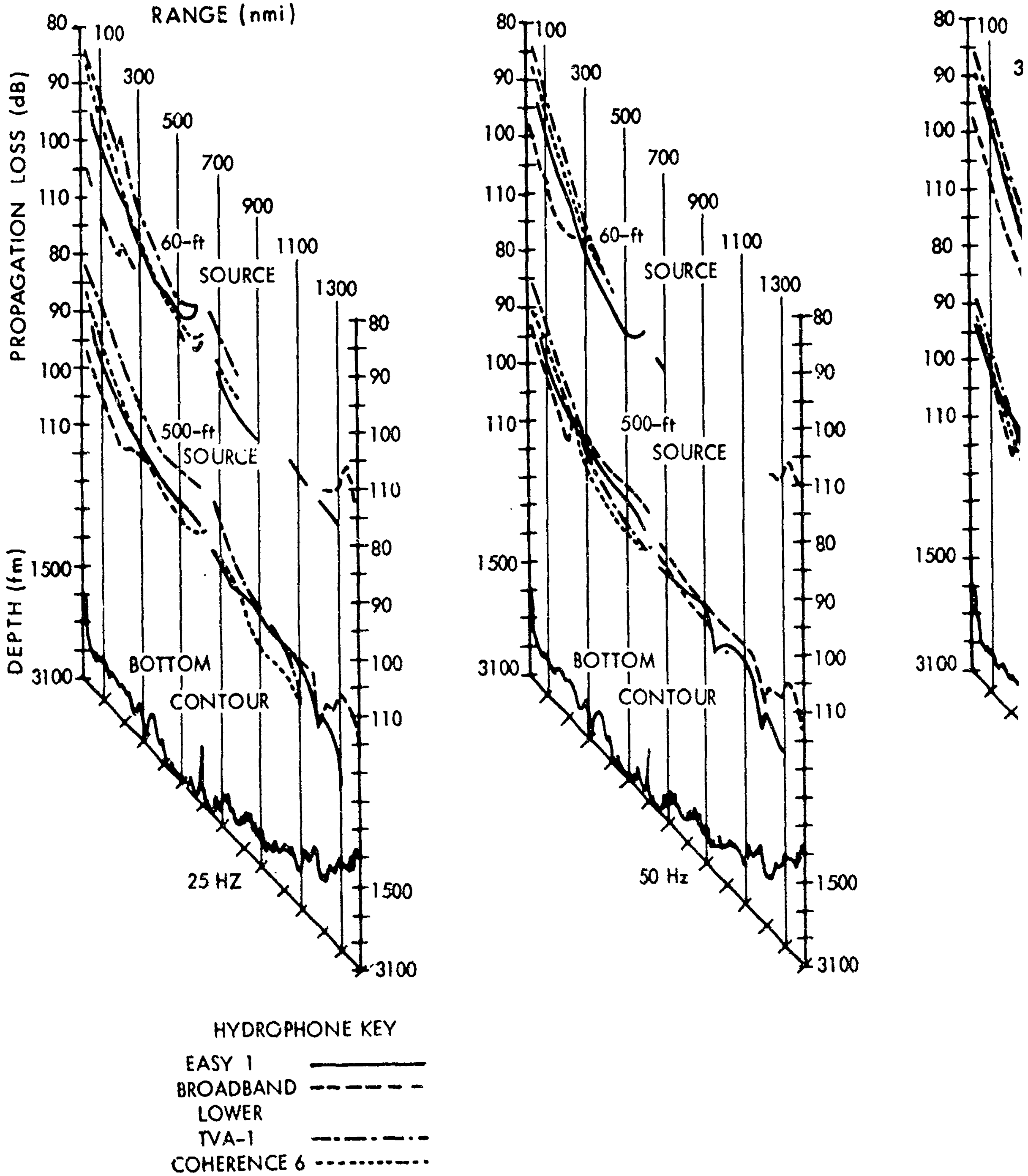
(C) The average propagation loss to TVA-1 at 25 Hz is less than that to E1 and BB out to about 800 nmi. For frequencies of 50 Hz and above, the crossover range lowers to about 250 nmi or less, and for ranges beyond the crossover, the average loss is greater to TVA-1. The average loss above 250 nmi at 400 Hz is about the same to TVA-1 and BB. For E1 there are no corresponding loss values as a result of a high 400-Hz system noise.

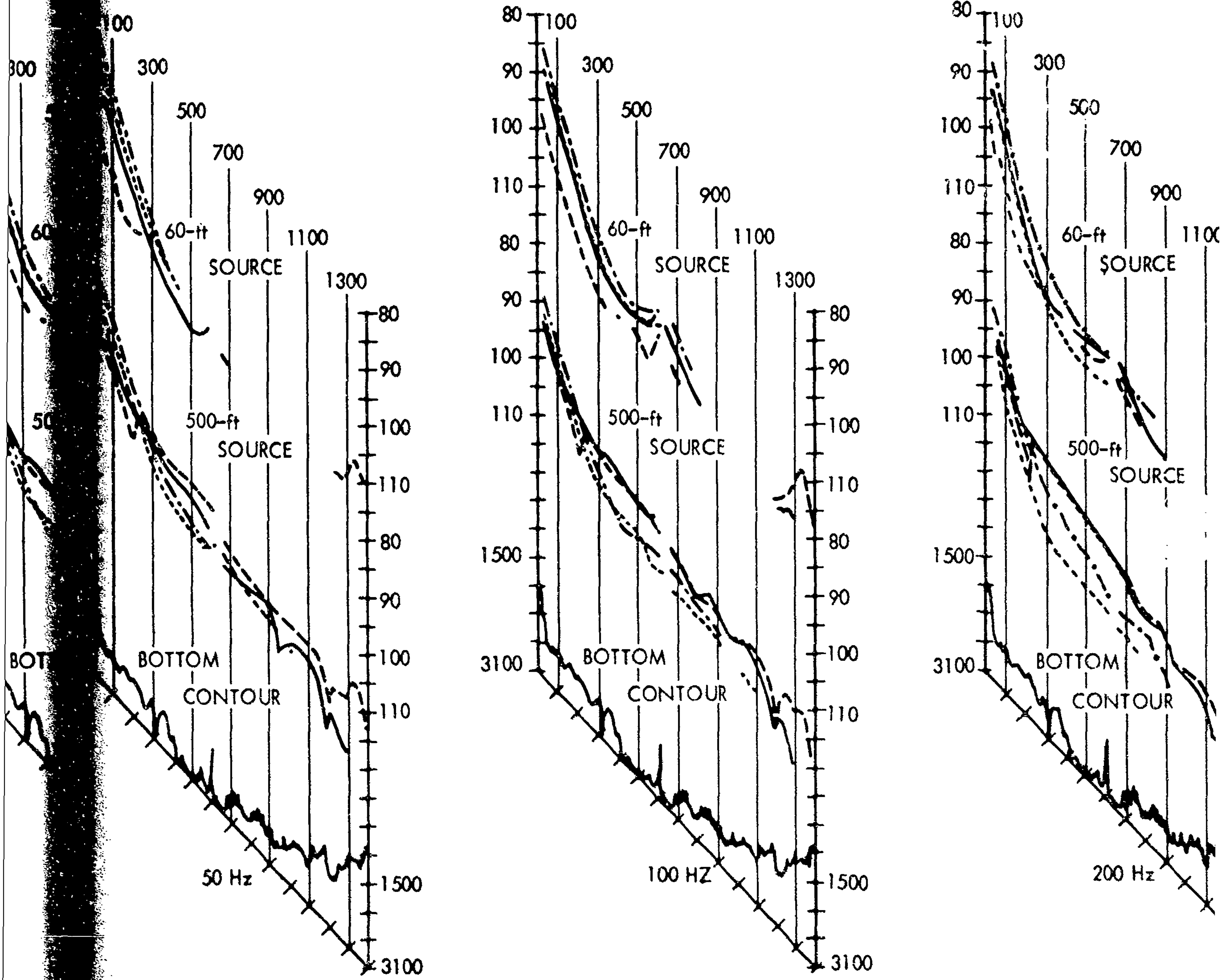
(C) In figure 6, the southern part of the high ground of the Rockaway Seamount appears at a range of 600 nmi. This high ground is reflected in the lower propagation losses and higher SNR at 25 and 50 Hz to the deep hydrophones C6 and TVA-1.

PROPAGATION LOSS AND SIGNAL-TO-NOISE RATIOS FOR 60-ft SOURCES

(C) The propagation loss from the 60-ft sources to TVA-1 for all frequencies and ranges is similar to but lower than that to C6 (figure 6). At 25, 50, and 100 Hz, the lower loss at TVA-1 is equalized by higher ambient noise so that the SNR is about the same as C6 (appendix E). Higher convergence gains at TVA-1 at 200 and 400 Hz result in a higher SNR than for C6. The results are similar to those obtained for the 500-ft sources.

(C) Out to the range where they can be compared (approximately 600 to 800 nmi), the average propagation loss to TVA-1 generally is lower than that to E1 at all the frequencies. Here again, as in the case of the 500-ft sources, the lower loss to TVA-1 for 25, 50, and 100 Hz is somewhat offset by higher ambient noise so that one may expect the SNR to be about the same as for E1. TVA-1 indicates a slight advantage in SNR at 200 Hz in the 200- to 400-nmi range as a result of convergence gains. For 25, 50, 100, and 200 Hz beyond 800 nmi where essentially there are no propagation loss values for TVA-1 because of low SNR, some values are still available at E1 to a range of about 1200 nmi.


RANGE (nmi)
PROPAGATION LOSS (dB)
DEPTH (fm)
100
300
500
700
900
1100
1300
60-ft
SOURCE
500-ft
SOURCE
BOTTOM
CONTOUR
25 HZ
50 Hz
HYDROPHONE KEY
EASY 1
BROADBAND
LOWER
TVA-1
COHERENCE 6


60-ft
SOURCE
500-ft
SOURCE
BOTTOM
CONTOUR
50 Hz
100 HZ
200 Hz
100
300
500
700
900
1100
1300
1500
3100
80
90
100
110

Fig

2

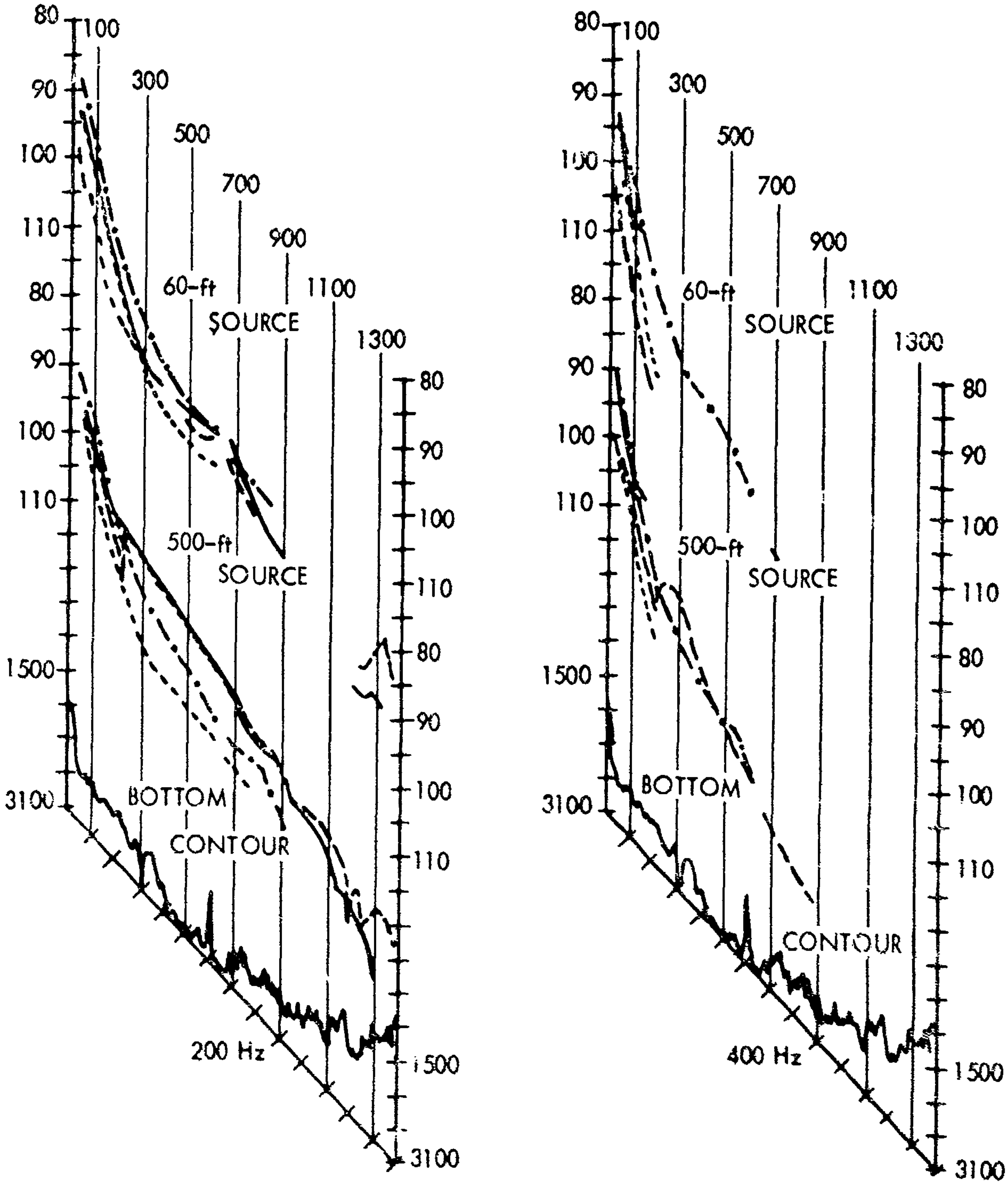


Figure 6. (C) TRANSLANT I Propagation Loss Composite (U)

(C) Out to 1200 nmi and for the frequencies measured, the propagation loss is greater and the SNR generally lower at BB than for any of the other hydrophones. At 25 and 50 Hz, the loss is about 10 to 20 dB greater than for TVA-1 for ranges out to about 200 nmi. In the range from near 600 to almost 1200 nmi, only a relatively few received signals exceeded the background noise at the hydrophones. Above 1200 nmi, however, there is a substantial increase in signal level and corresponding lower propagation loss at BB to about 1375 nmi, after which the loss increases rapidly. This diminution of propagation loss is even more pronounced than for the case of 500-ft sources. The propagation loss for BB and E1 in this region is compared in figure 7 for 25, 50, and 100 Hz. In the vicinity of 1300 nmi where E1 curves terminate, the propagation loss to BB is from 5 to about 15 dB lower. For the 60-ft sources the effect of the seamount at about 630 nmi reduces the propagation loss at all hydrophones and is more noticeable than for the 500-ft sources.

(C) The effect of the Atlantic Ridge on the propagation loss for 60-ft sources for tracks HG, IJ, LK, and MN is similar to that noted for the 500-ft sources. The propagation loss decreases to BB as the source approaches the ridge and increases rapidly after passing over the peak. Increases in loss to BB are also noted at the ranges where troughs or depressions exist in the ridge. In track HG where the forward wall of the trench or depression is very steep and about 950 fm deep, the propagation loss values cut off sharply. At track IJ where the depression is only about 600 fm deep and the forward wall not very steep, the propagation loss is seen to increase but at a slower rate with increasing range.

COMPARISON OF 60- AND 500-ft
PROPAGATION LOSS RESULTS

(C) With the exception of some increased zonal enhancement at 25 Hz for the 500-ft sources, the propagation loss to TVA-1 is about the same for both the 500- and the 60-ft sources. This is also true for C6. Furthermore, for most ranges and frequencies, losses to the deeper receiver, C6, are typically 3 or 4 dB greater than are losses to TVA-1.

(C) Although scarcely measurable in the first 200 nmi, the loss to E1 at all frequencies is progressively less with increasing range for the 500-ft sources than for the 60-ft sources. The propagation loss to BB is clearly source-depth dependent out to near the Atlantic Ridge, with that for the 500-ft source having less loss. This source-depth dependency is consistent with the view that a large part of the signal at the hydrophone is due to totally refracted paths and the deeper source involves a proportionally greater number of the more nearly axial rays. At the Atlantic Ridge, energy from sources at both depths is reflected into refraction paths near the channel axis, and thus the propagation loss is lower to BB than to any other hydrophone. However, this reflective mechanism appears slightly more efficient in the case of 60-ft sources as indicated by the slightly lower losses to BB in the 1300- to 1400-nmi region for the shallow charges.

(U) It should also be noted that there was a greater increase in signal level to all hydrophones due to the Rockaway Seamount for 60-ft sources than for 500-ft sources.

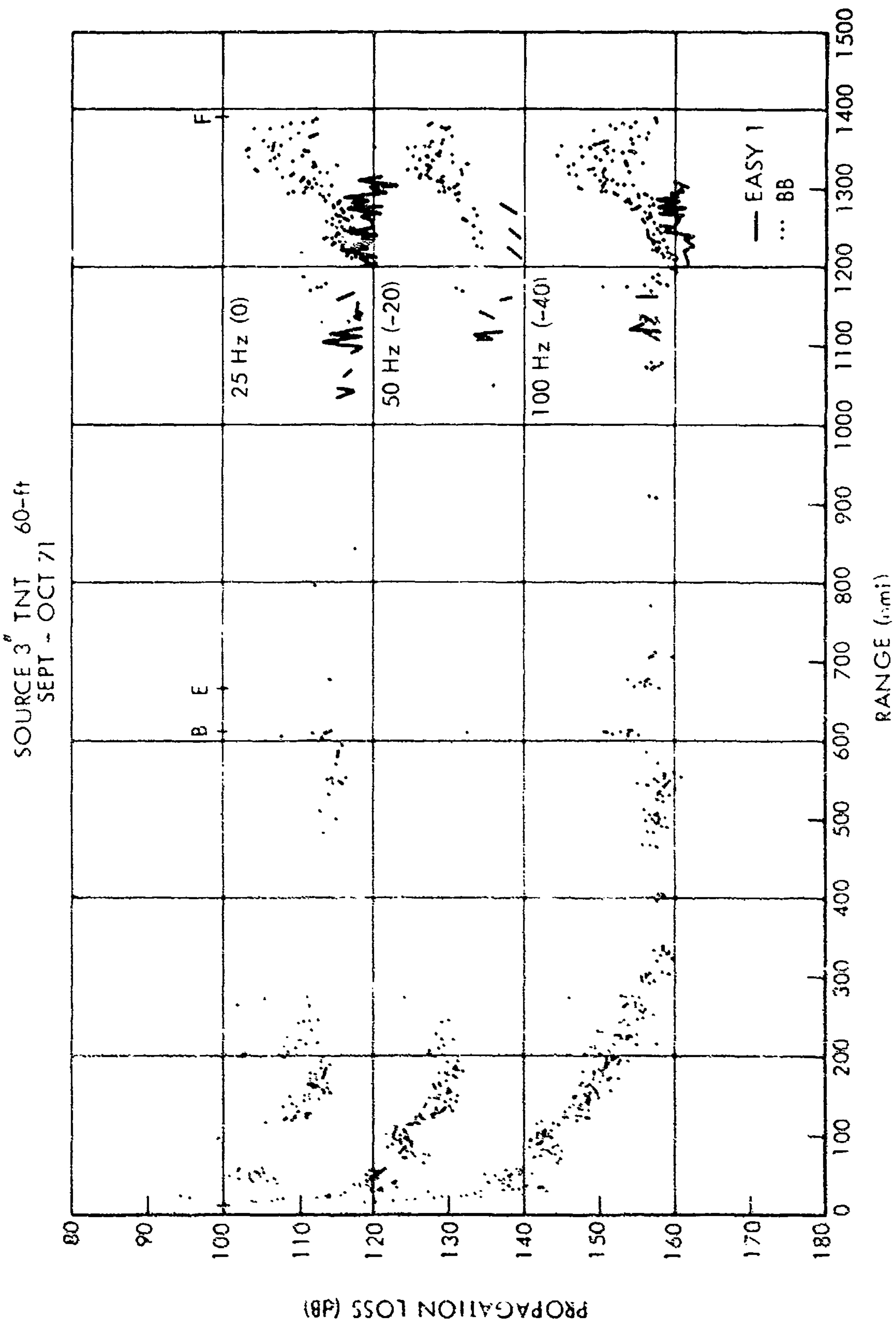


Figure 7. (C) Propagation Loss Comparison at 3B and E1 Hydrophones (25, 50, 100 Hz) (U)

PROPAGATION LOSS FOR TRACK BCDE

(U) The propagation loss values versus shot number for the track BCDE are presented in appendix C for the various frequencies, hydrophones, and source depths. The bottom contour along this track is shown in appendix A. The most pronounced feature of the contour is the double peak in the Rockaway Seamount area extending upwards to almost 400 fm from the surface for the highest peak and to about 1200 fm for the lower peak The peaks are in the DE section of the track near shot 1500. Two minor peaks to 2400 and 2600 fm are near shots 1100 and 1700, respectively.

(C) For the 500-ft source, the propagation loss values for E1 and BB agree closely in shape and level. At about shot 1200 or shortly after passing the first minor peak in the topography plot, the losses increase until near the first large peak at about shot 1500, and then decrease rapidly. The effect of the high peaks on the propagation loss is more evident in the plots for the 60-ft source, since the propagation loss is greater and there are fewer values. Decreases in propagation loss amounting to 10 dB or more occur in the region of the highest peak. For TVA-1 and C6, the spread and variability of the propagation loss data do not lend themselves to an easy interpretation of the effects of the seamount. However, both TVA-1 and C6 show a gap in the data for the shot numbers covering the regions between the two major peaks.

COMPARISON OF TRANSLANT I AND PROJECT ATOE/NA MEASUREMENTS

(U) A long-range propagation measurement from Bermuda to the Mid-Atlantic Ridge was made in the winter months of January and February 1971, under Project ATOE/NA[5] (Acoustic Transmission and Oceanographic Experiment, North Atlantic). Source depths were 60, 500, 2000, and 4000 ft, and the receiving hydrophones were the same as those used in the TRANSLANT I measurement. The track followed the great circle route that intersected and passed over the Rockaway Seamount. At this point the course went due south to where the seamount was not in the transmission path and then proceeded along approximately the same great circle route as that for TRANSLANT I to the Mid-Atlantic Ridge where the measurements ceased. The sound velocity profiles indicated a surface channel of about 150-m depth for the first 900 nmi. During the final 500 nmi, the vertical extent of the layer decreased and was quite variable but always contained the 60-ft source. Over the entire test track the velocity minimum or deep sound channel axis was between 3100 and 4400 ft.

(C) Reduced propagation loss near the seamount was evident at BB with a substantial reduction in received signal when the track went behind the mount. When the course was changed to avoid having the seamount in the transmission path, the signals were again received. Disregarding seamount effects at BB, the lowest propagation loss for 50 through 200 Hz for the 60- and 500-ft sources are to BB and E1 (designated Easy II in ATOE/NA) followed by increasing loss to TVA-1 and C6, respectively. At 25 Hz, the propagation loss was slightly lower to TVA-1 than to E1 for both source depths and also slightly lower than that to BB for the 500-ft depth. For 25 Hz, the loss is greatest to BB for the 60-ft source.

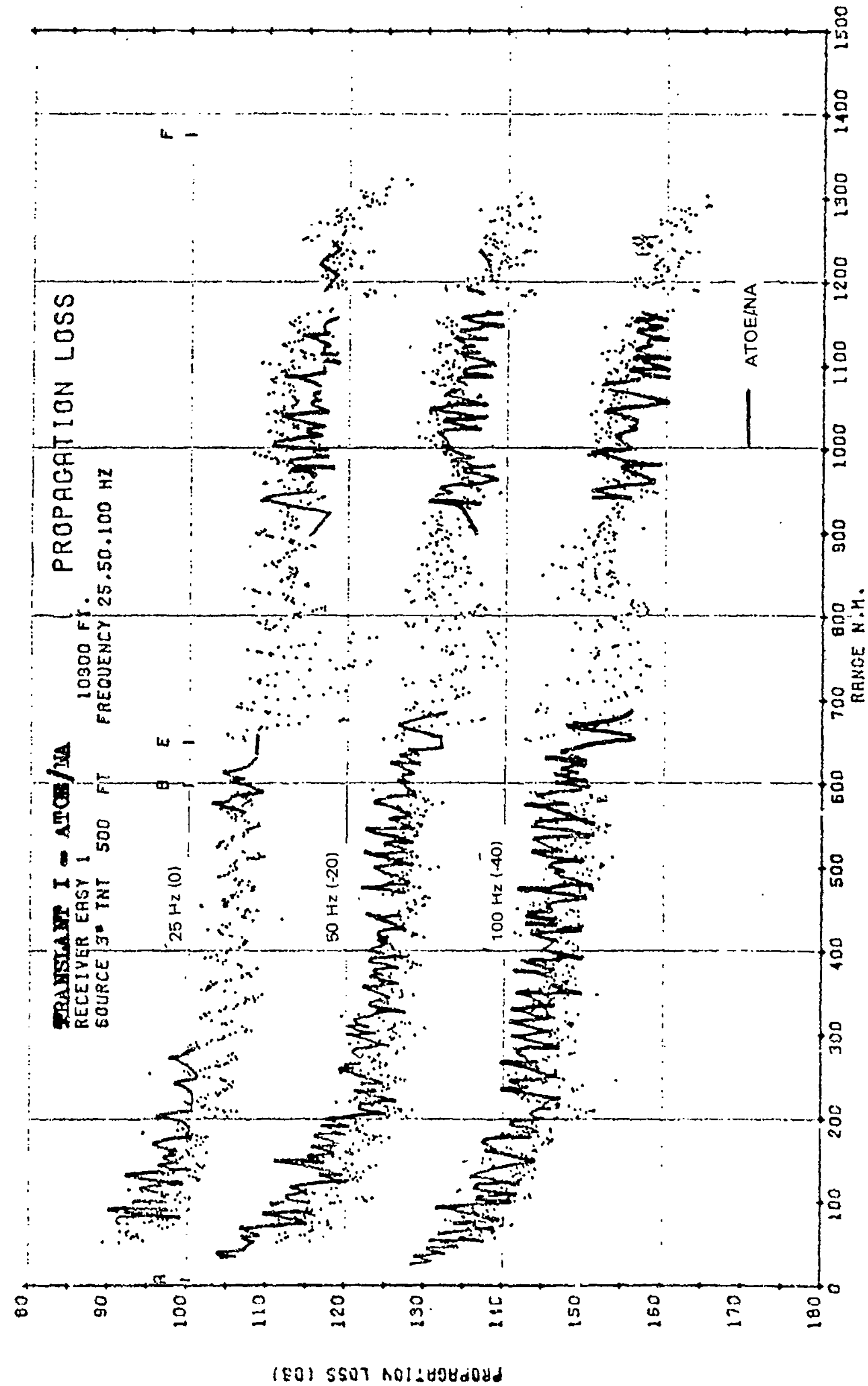


Figure 8. (C) Propagation Loss at E1 Hydrophone (25, 50, 100 Hz) for a Source Depth of 500 ft (U)

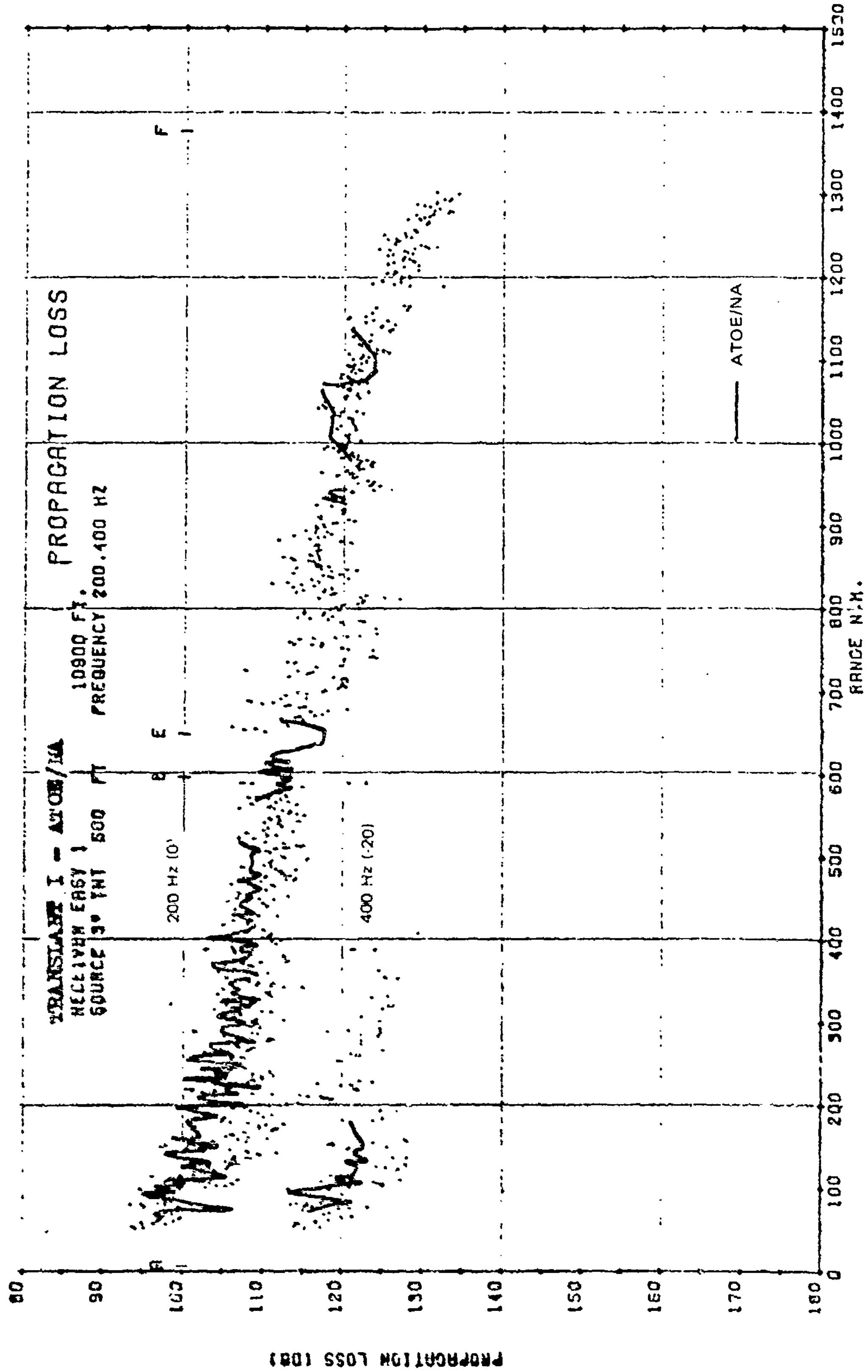


Figure 9. (C) Propagation Loss at E1 Hydrophone (200, 400 Hz) for a Source Depth of 500 ft (U)

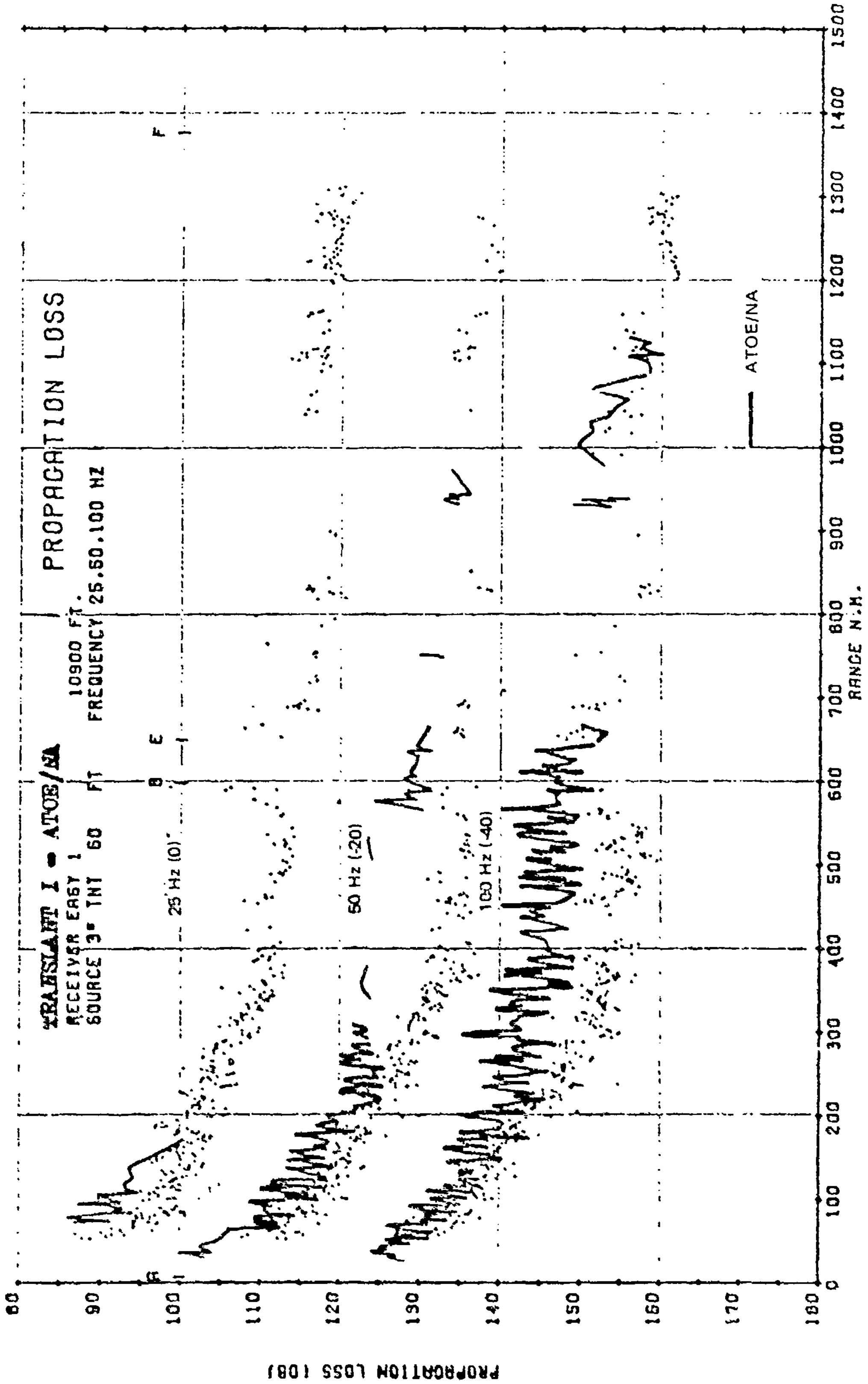


Figure 10. (C) Propagation Loss at E1 Hydrophone (25, 50, 100 Hz) for a Source Depth of 60 ft (U)

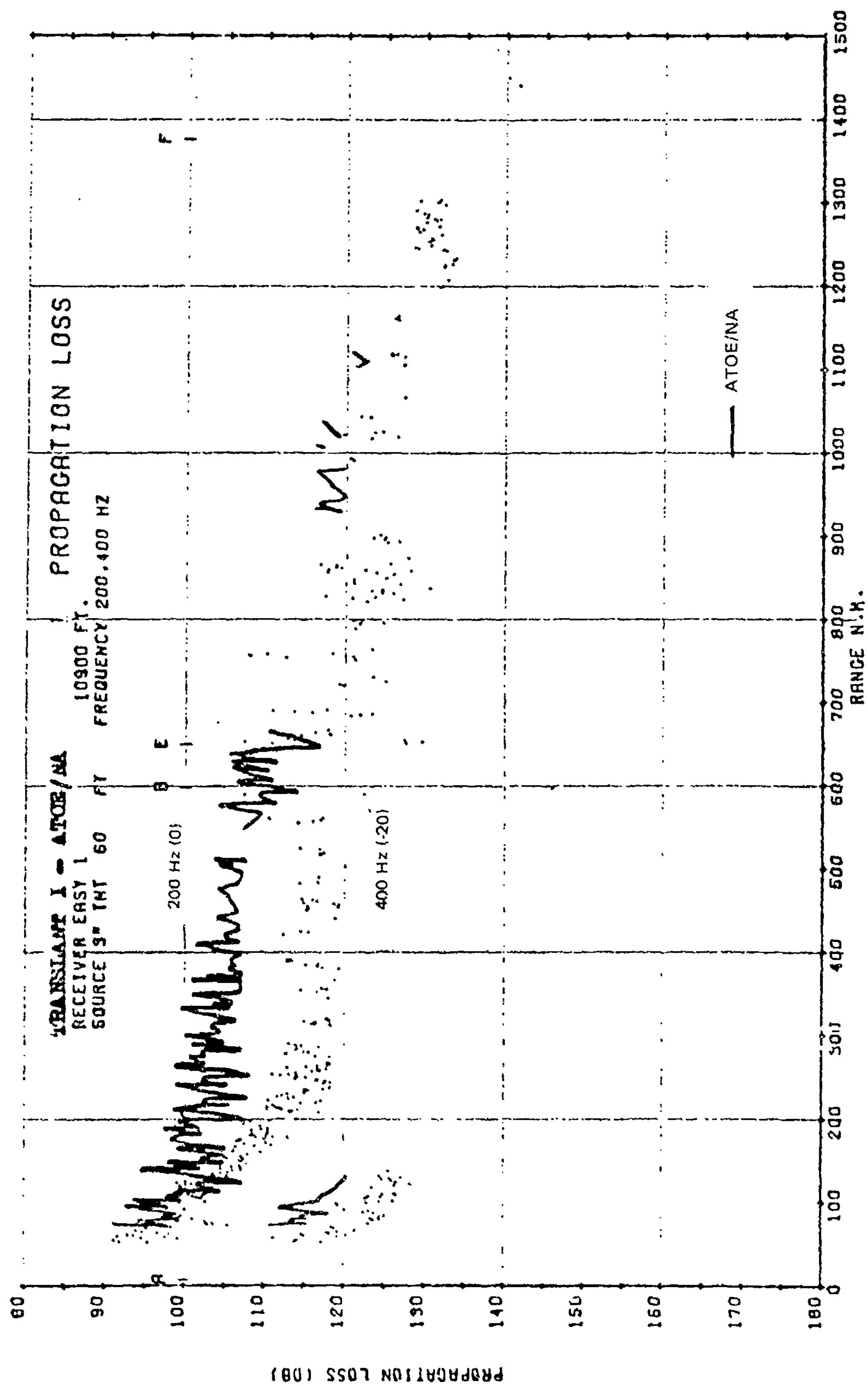


Figure 11. (C) Propagation Loss at E1 Hydrophone (200, 400 Hz) for a Source Depth of 60 ft (U)

(C) Values of propagation loss versus range for TRANSLANT I and ATOE/NA are compared for the E1 receiver for 500-ft sources in figures 8 and 9. The solid lines representing the ATOE/NA data are eye sketched from the individual values of the measurements. For ranges out to 700 nmi and for frequencies up to 200 Hz, propagation loss averages about 2 dB more for TRANSLANT I than for ATOE/NA. Figures 10 and 11 present a similar comparison except that here the source depth is 60 ft. Again, for ranges out to about 700 nmi and for frequencies up to 200 Hz, the available data indicate that the ATOE/NA losses averaged about 6.5 dB less than the TRANSLANT I propagation loss values. Comparisons of propagation loss values versus range for the two exercises for the remaining hydrophones are contained in appendix F. Neglecting the effects of the Atlantic Ridge, the major difference for the 500-ft source at BB is for frequencies at and below 100 Hz where the TRANSLANT I losses are 5 to 10 dB greater than ATOE/NA losses. For the 60-ft sources, the losses were 5 dB or greater for all frequencies above 25 Hz for the TRANSLANT I measurements for all ranges where data were available for comparison. For the 500- and 60-ft sources the average loss to TVA-1 and C6 for frequencies above 25 Hz are alike for both of the measurements. At 25 Hz the loss is 4 or 5 dB lower for the TRANSLANT I measurements at both hydrophones.

(C) In summary, neglecting the effects of the Atlantic Ridge and seamounts, there is no single hydrophone that indicates the lowest average propagation loss at all frequencies and ranges for both source depths for both the ATOE/NA and TRANSLANT I measurements. Both measurements indicate that the lowest average loss at 25 Hz is to TVA-1 for ranges where they can be compared for both sources. For the 500-ft source and the frequencies 50, 100, 200, and 400 Hz the lowest average loss for the ATOE/NA measurements is to BB except for the range to 125 nmi at 400 Hz where that to E1 is slightly lower. For TRANSLANT I and for the same source depths and frequencies, the average loss to TVA-1 is equal to or lower than that to the other hydrophones to about 250 nmi. Above this range, BB and E1 are about equally low. The noise spectrum levels of TRANSLANT I indicate that the advantage of lower loss at TVA-1 is somewhat nullified so that from a detection standpoint E1 may be equal to or have a slight advantage over TVA-1. TRANSLANT I gives the lowest loss for the 60-ft source for all frequencies to TVA-1; however, again considering the background noise, E1 and C6 would be suitable from a detection standpoint. From ATOE/NA for the 60-ft source, the lowest average loss at 50, 100, and 200 Hz is most consistent to BB. At 400 Hz over the first 100 nmi, E1 indicates slightly lower loss than BB. There is no comparison of ambient noise at the various hydrophones in the ATOE/NA report, because of the large amount of local ship interference. However, occasional comparisons of ambient noise that were possible appear to indicate that the advantage in detection resulting from lower loss at TVA-1 at 25 Hz is reduced by the higher ambient noise so that detection is similar to that at BB. A similar ambient noise increase for BB at 200-Hz would result in a better advantage in detection at E1.

CONCLUSIONS

(C) From the TRANSLANT I measurements, considering both propagation losses and ambient background noise, the best reception of acoustic signals from both the 60- and 500-ft sources and for frequencies of 25, 50, 100, and 200 Hz is the bottom mounted hydrophone E1 for ranges up to but not exceeding the Mid-Atlantic Ridge (about 1300 nmi). Near and at the peak of the ridge, energy is received only at the BB hydrophone with the propagation loss values lowest for the 60-ft source. The loss at this range (about 1400 nmi) for the 60-ft source is approximately equal to that at about 100 nmi and the SNR reaches almost 20 dB. The transmission path is effectively blocked by the ridge for both source depths for ranges past the ridge.

(U) The propagation loss for the 60-ft source only is lowest to TVA-1. However, the lower propagation loss is offset by higher ambient sea noise, and thus from a detection standpoint, E1 and TVA-1 are alike. For this source depth, the poorest results (except as noted above at the Ridge) are at BB because of its large propagation loss.

(U) For the 500-ft sources only, the lowest propagation loss is to E1 with that at BB being about the same. The greatest propagation loss and lowest SNR are at C6.

(U) The propagation loss is lower at any hydrophone for the 500-ft source than for 60-ft sources. In addition to the decrease in propagation loss to BB resulting from the ridge, propagation loss is also influenced by other topographical features, such as seamounts and the trench in the ridge. In the latter case, the propagation loss increases to BB and E1 for the 500-ft source.

REFERENCES

1. L. C. Maples, unpublished memorandum.

2. R. W. Hasse and R. L. Martin, "PARKA I — Acoustic Processing and Results," NUSL Technical Memorandum 2210-015-69, 28 July 1969 (CONFIDENTIAL).

3. A. J. Perrone, "Deep-Ocean Ambient Noise Spectra in the Northwest Atlantic," Journal of the Acoustical Society of America, vol. 46, no. 3, September 1969, pp. 762-770.

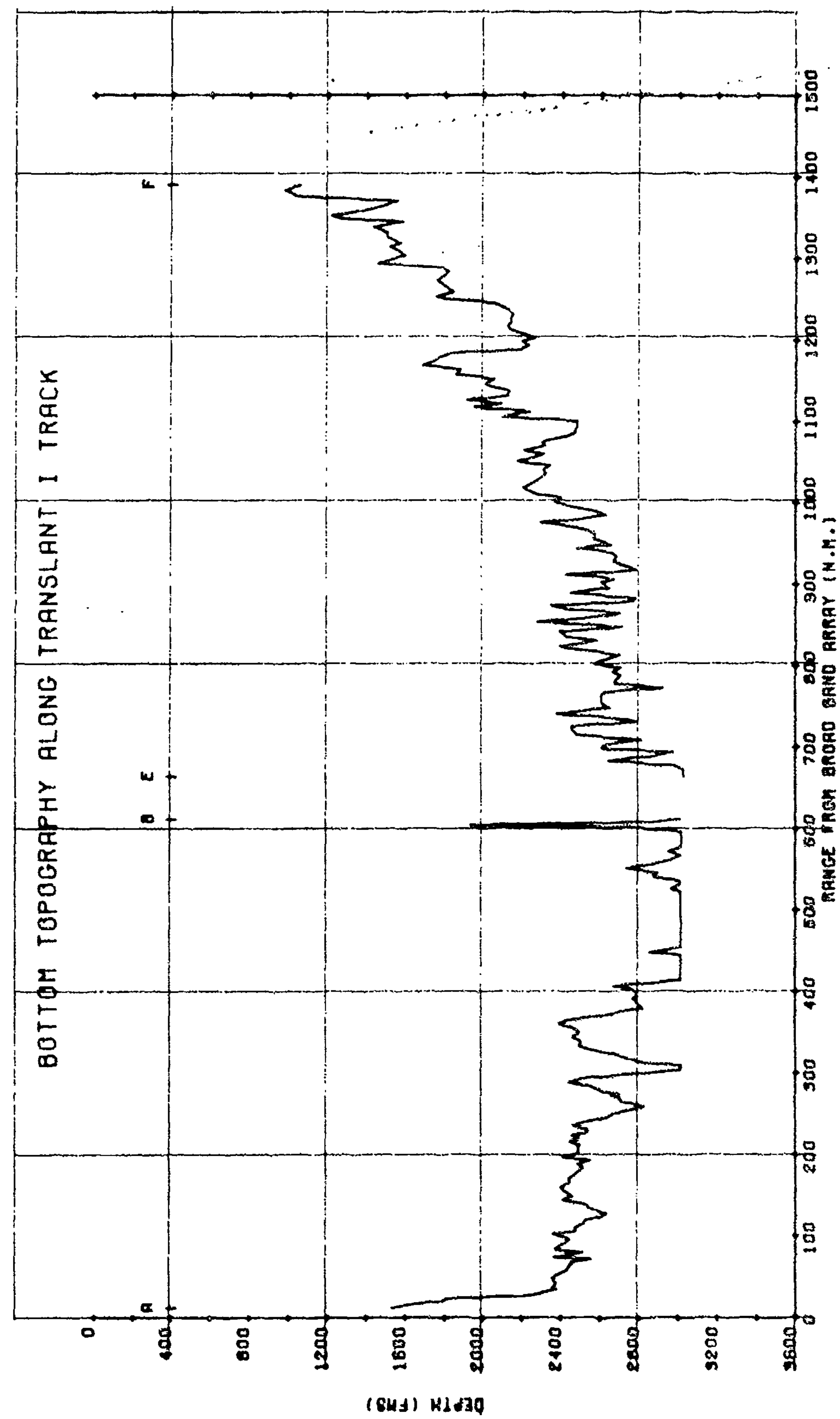
4. A. J. Perrone, "Ambient Noise Level as a Function of Water Depth," Journal of the Acoustical Society of America, vol. 48, no. 1, July 1970, pp. 362-370.

5. R. F. LaPlante, F. C. Friedel, W. H. Thorp, and P. D. Koenigs, Low-Frequency Propagation Loss Measurements of the Acoustic Transmission and Oceanographic Experiment (ATOE) in the Atlantic Ocean East of Bermuda (U), NUSC Technical Report 4473, 14 June 1973 (CONFIDENTIAL).

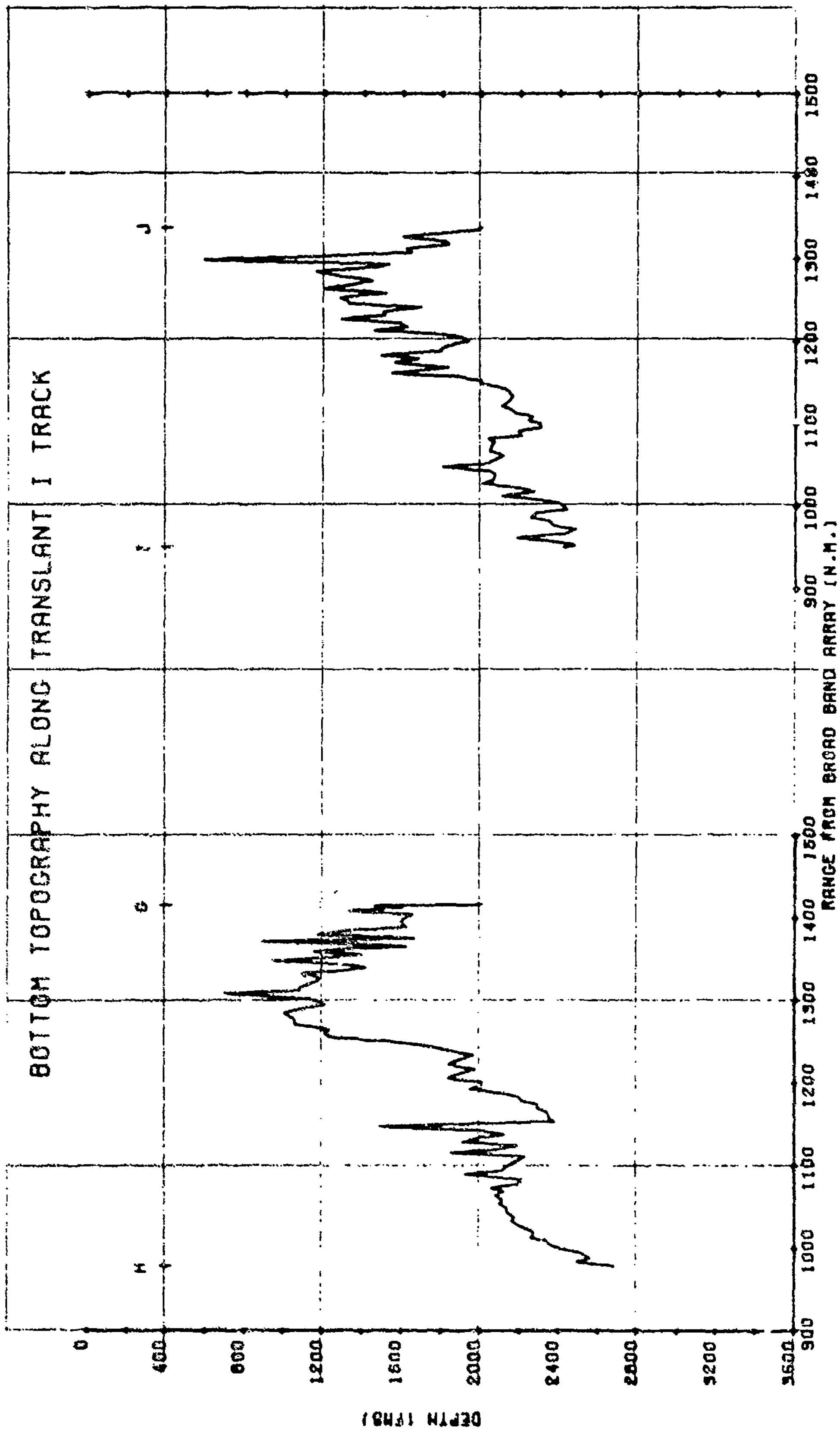
Appendix A

TRANSLANT I BOTTOM TOPOGRAPHY PLOTS

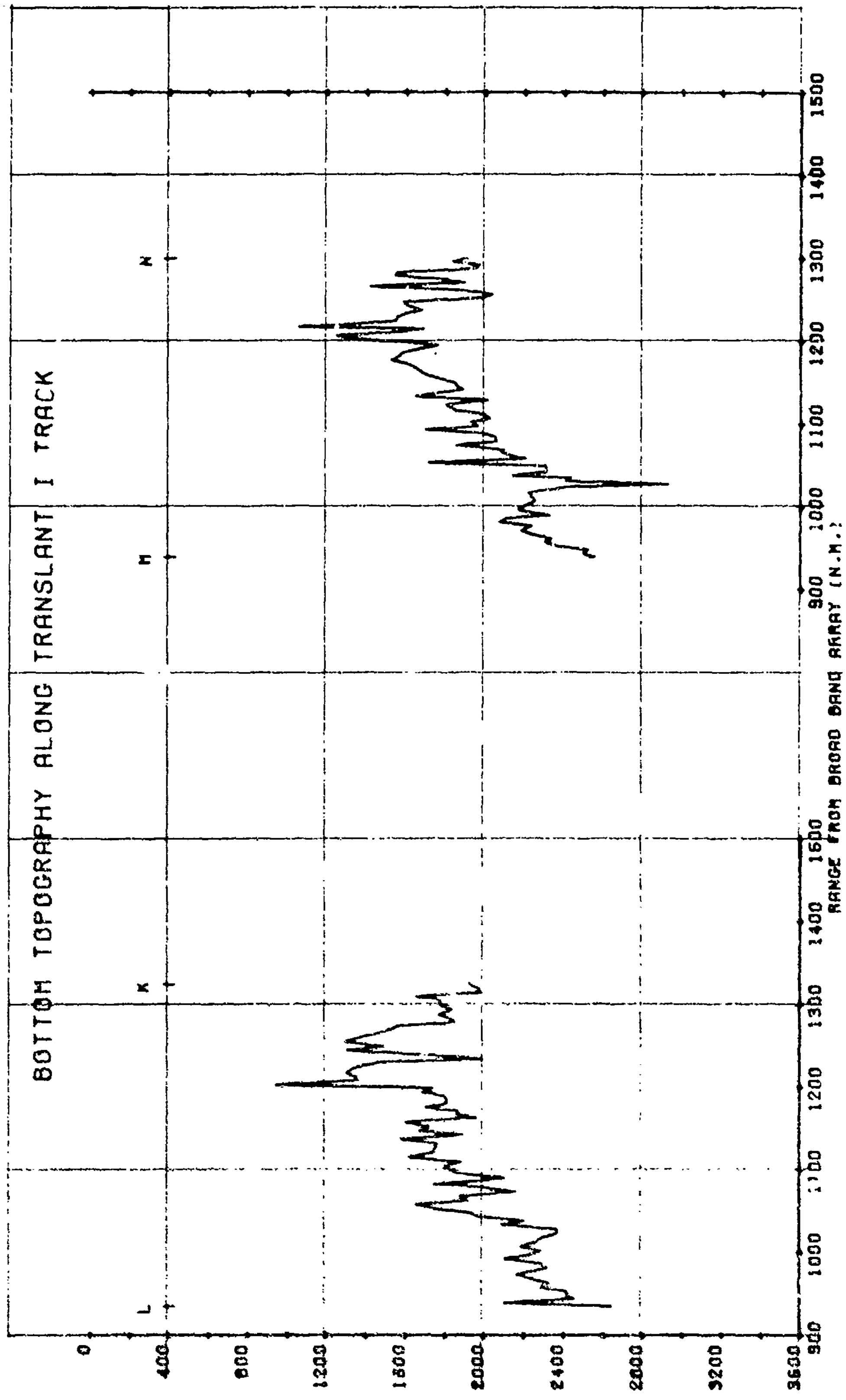
Bottom topography plots along the TRANSLANT I track are presented on the following pages.


BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
RANGE FROM BROAD BAND ARRAY (N.M.)
DEPTH (FMS)
A
B
E
F

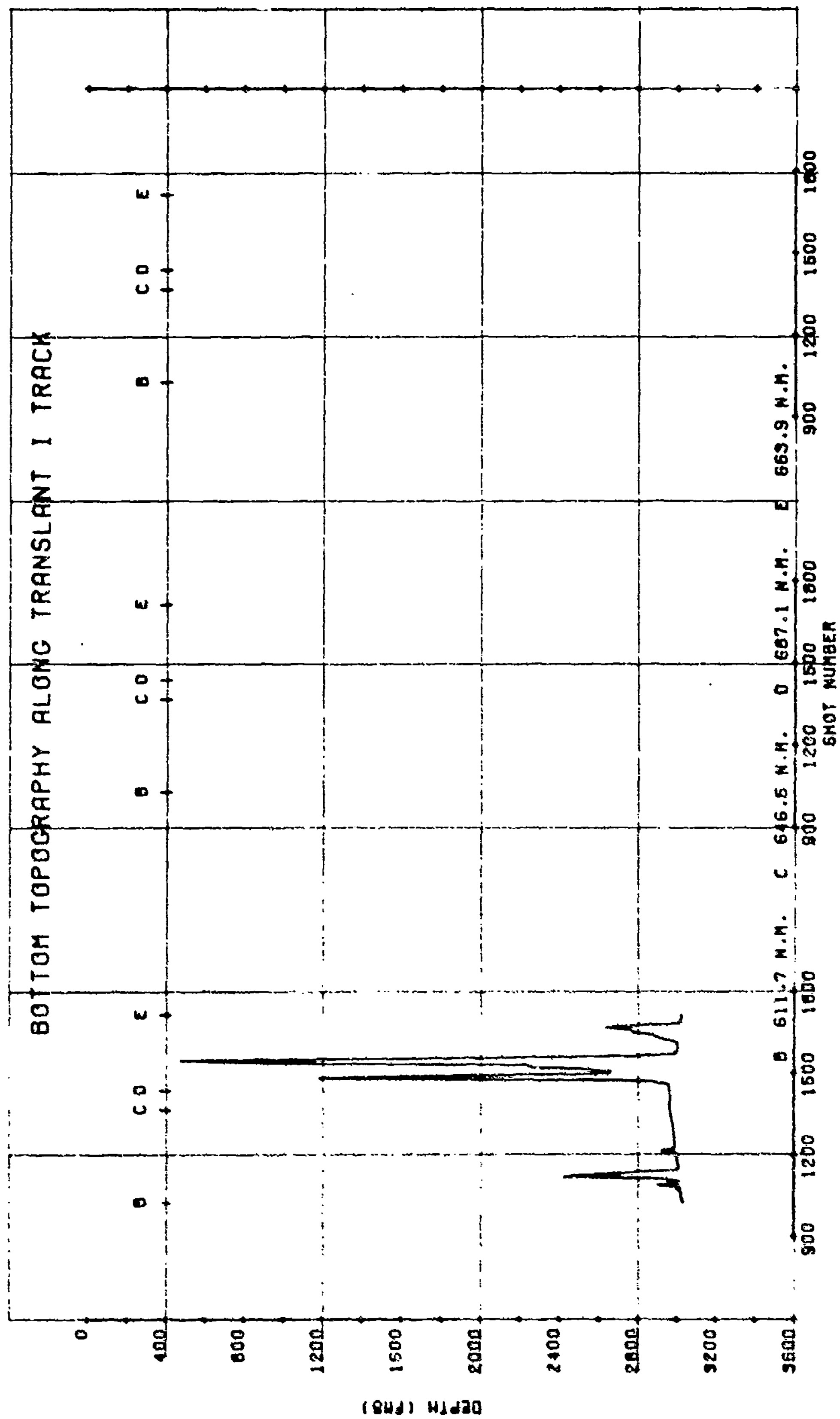
A-1


BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
RANGE FROM BROAD BAND ARRAY (N.M.)
DEPTH (FMS)
0
400
800
1200
1600
2000
2400
2800
3200
3600
900
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
H
G
I
J

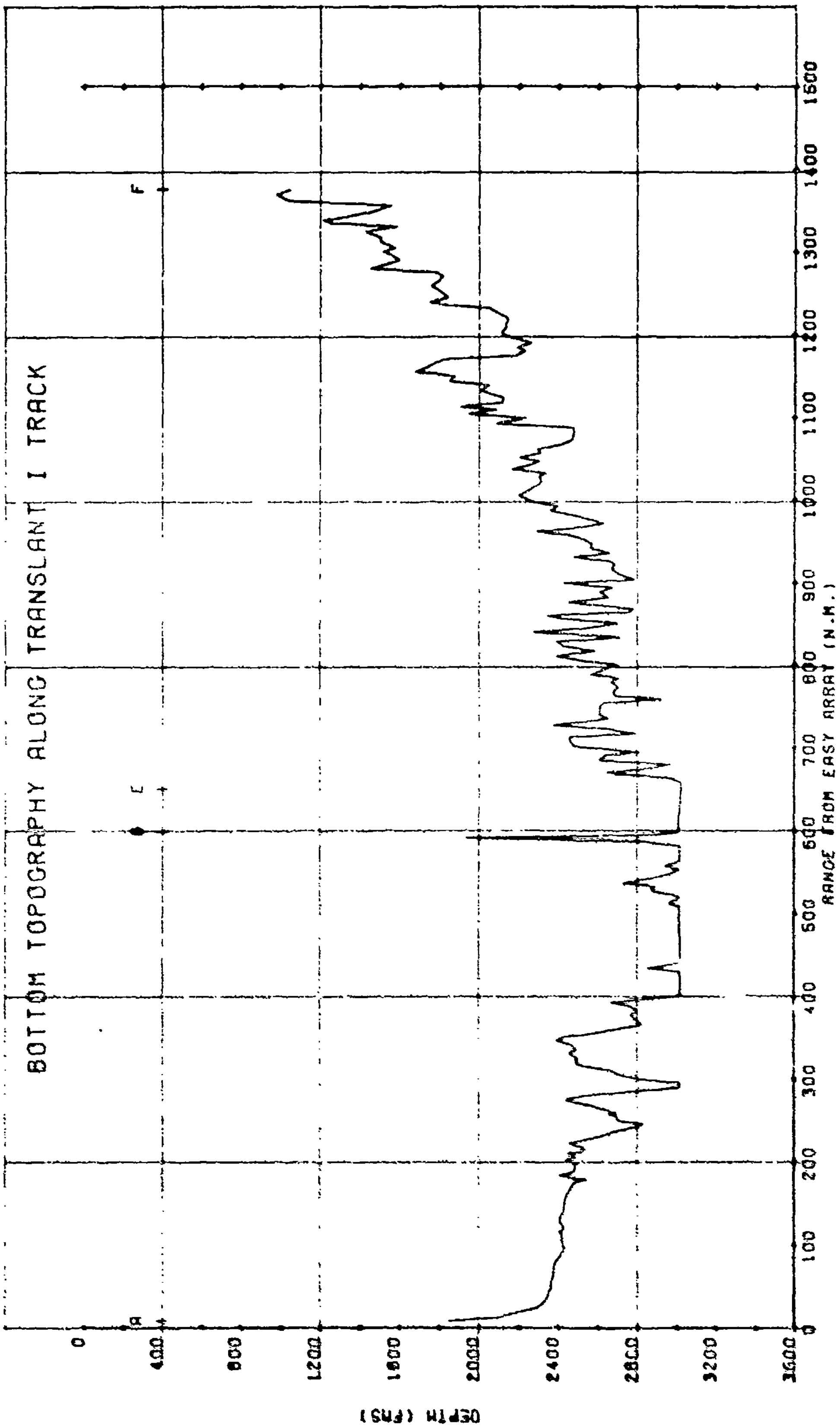
A-2


BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
RANGE FROM BROAD BAND ARRAY (N.M.)
DEPTH (FMS)
L
K
M
N

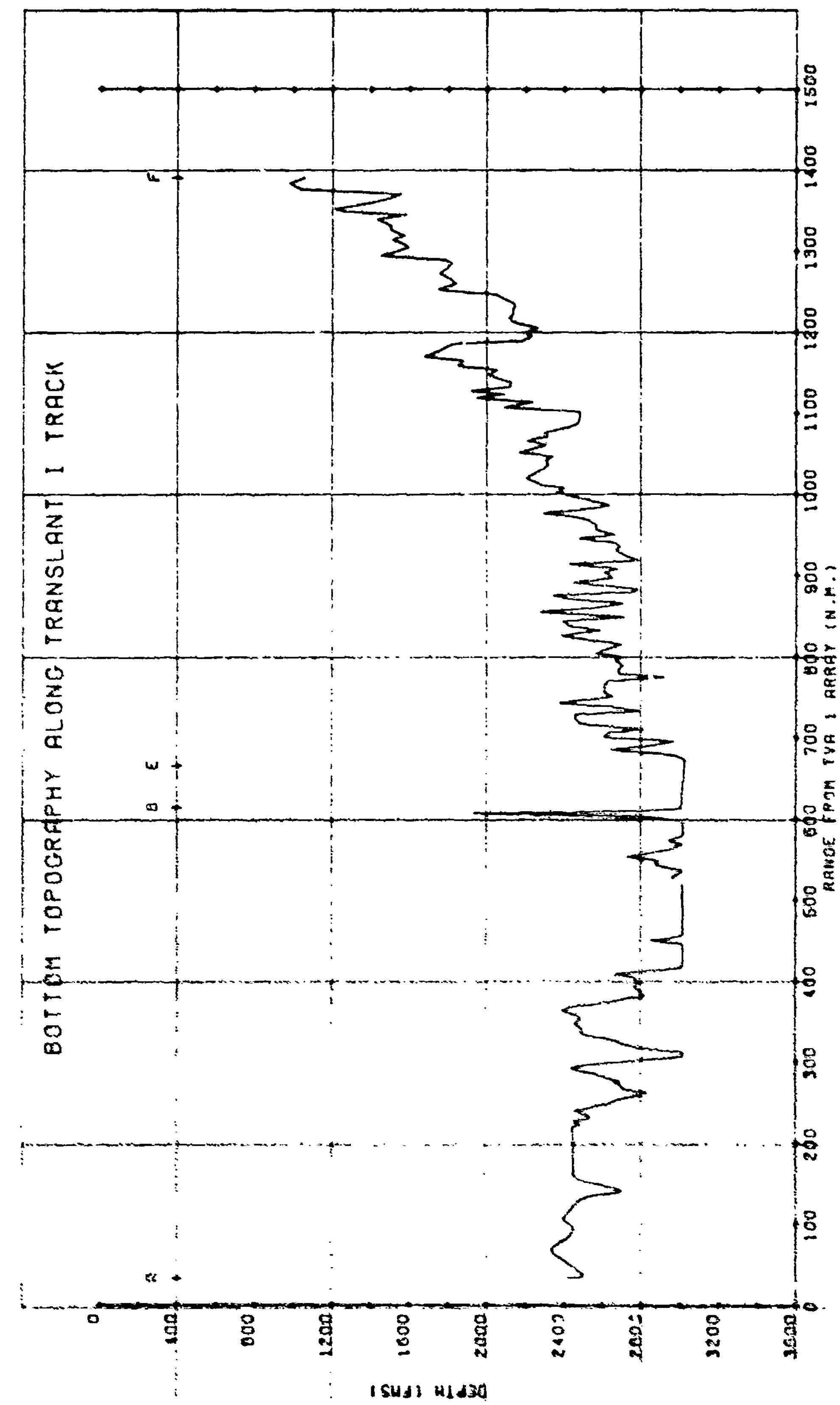
A-3

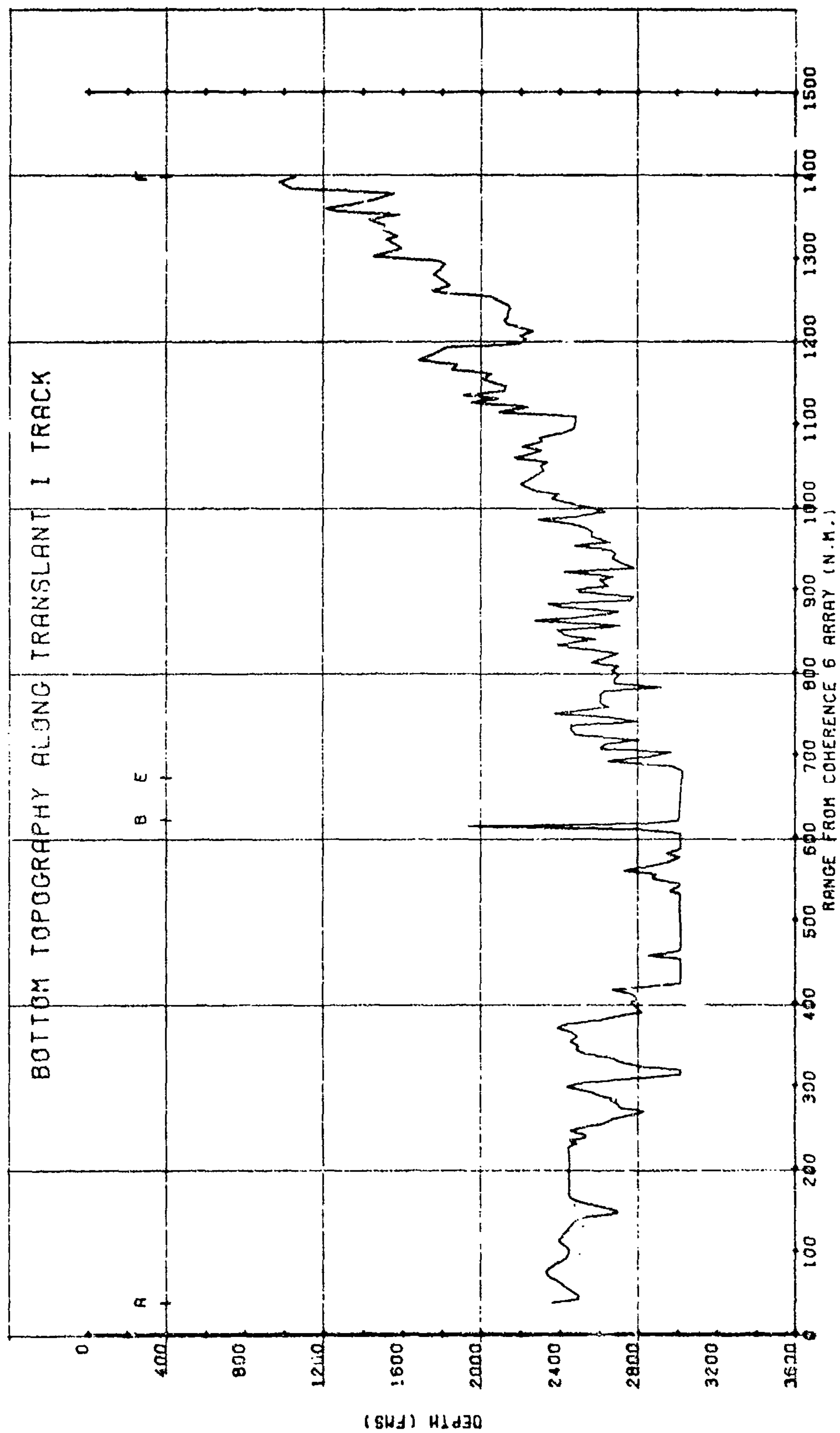

BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
DEPTH (FMS)
0
400
800
1200
1600
2000
2400
2800
3200
3600
SHOT NUMBER
900
1200
1500
1800
611.7 N.M.
646.5 N.M.
687.1 N.M.
663.9 N.M.
B
C
D
E

A-4


BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
RANGE FROM EASY ARRAY (N.M.)
DEPTH (FMS)
0
400
800
1200
1600
2000
2400
2800
3200
3600
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
A
E
F

A-5


BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
RANGE FROM TVA 1 ARRAY (N.M.)
DEPTH (FMS)
0
400
800
1200
1600
2000
2400
2800
3200
3600
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
A
B
E
F
A-6

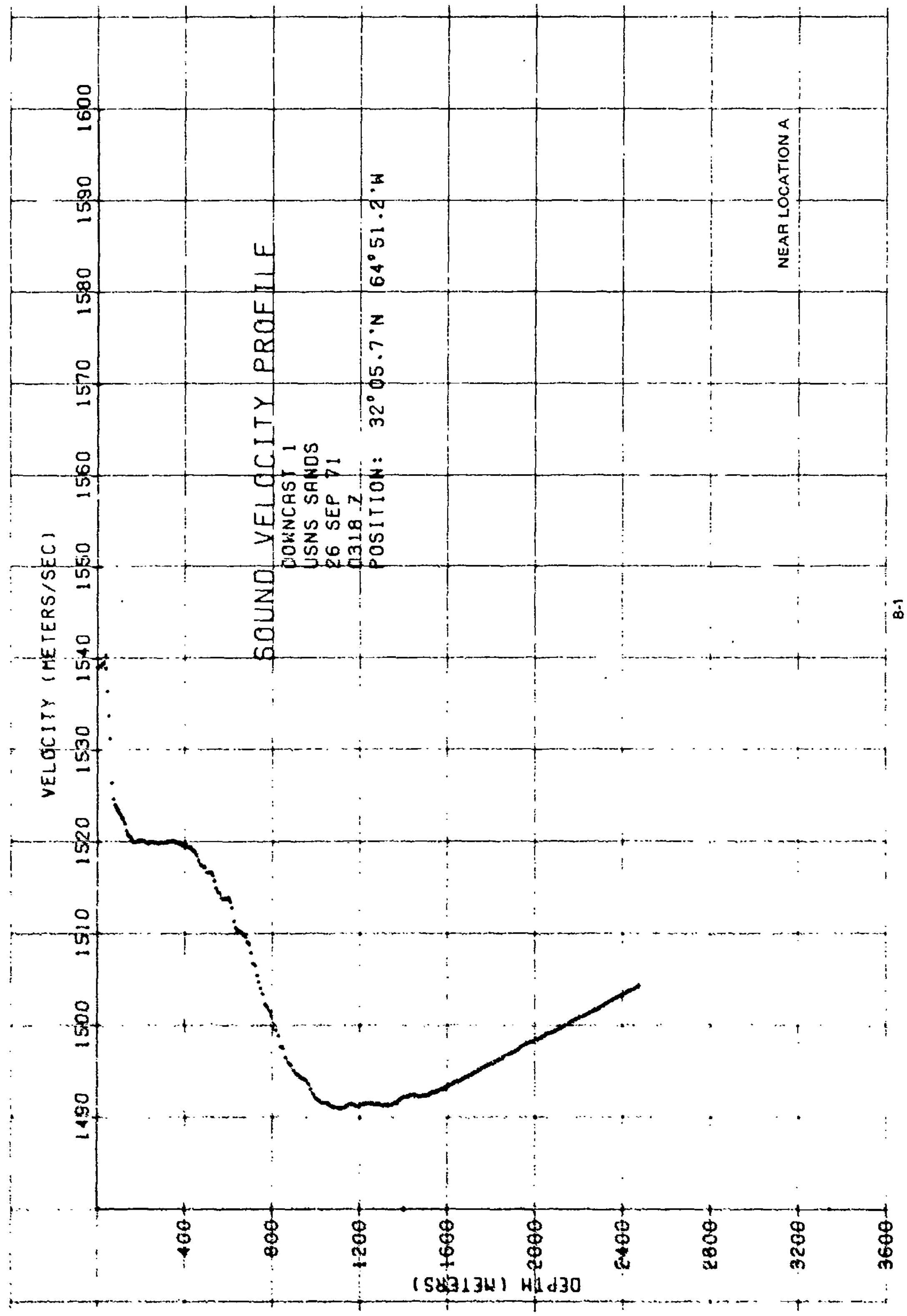

BOTTOM TOPOGRAPHY ALONG TRANSLANT I TRACK
A
B
E
RANGE FROM COHERENCE 6 ARRAY (N.M.)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
DEPTH (FMS)
0
400
800
1200
1600
2000
2400
2800
3200
3600

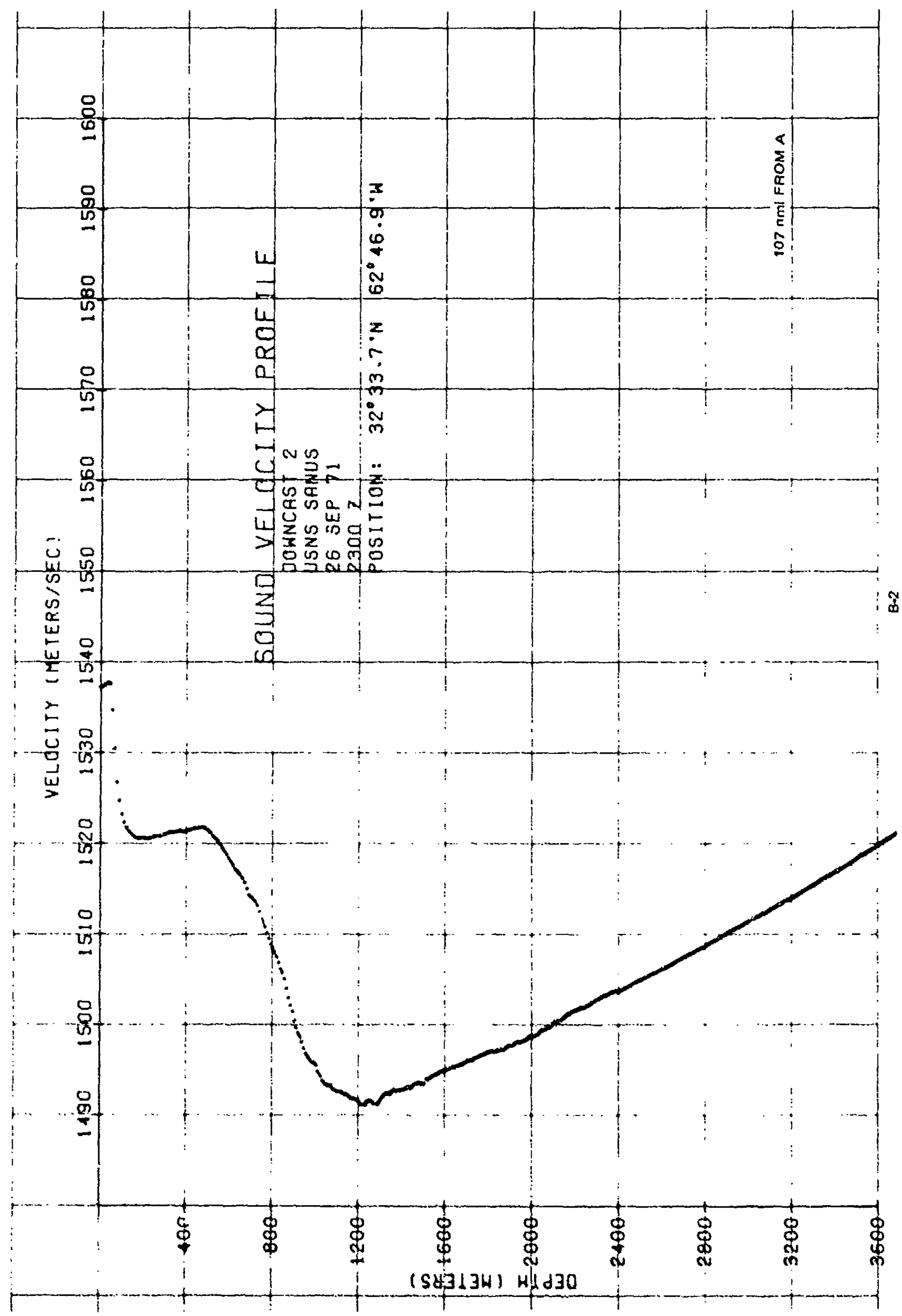
A-7

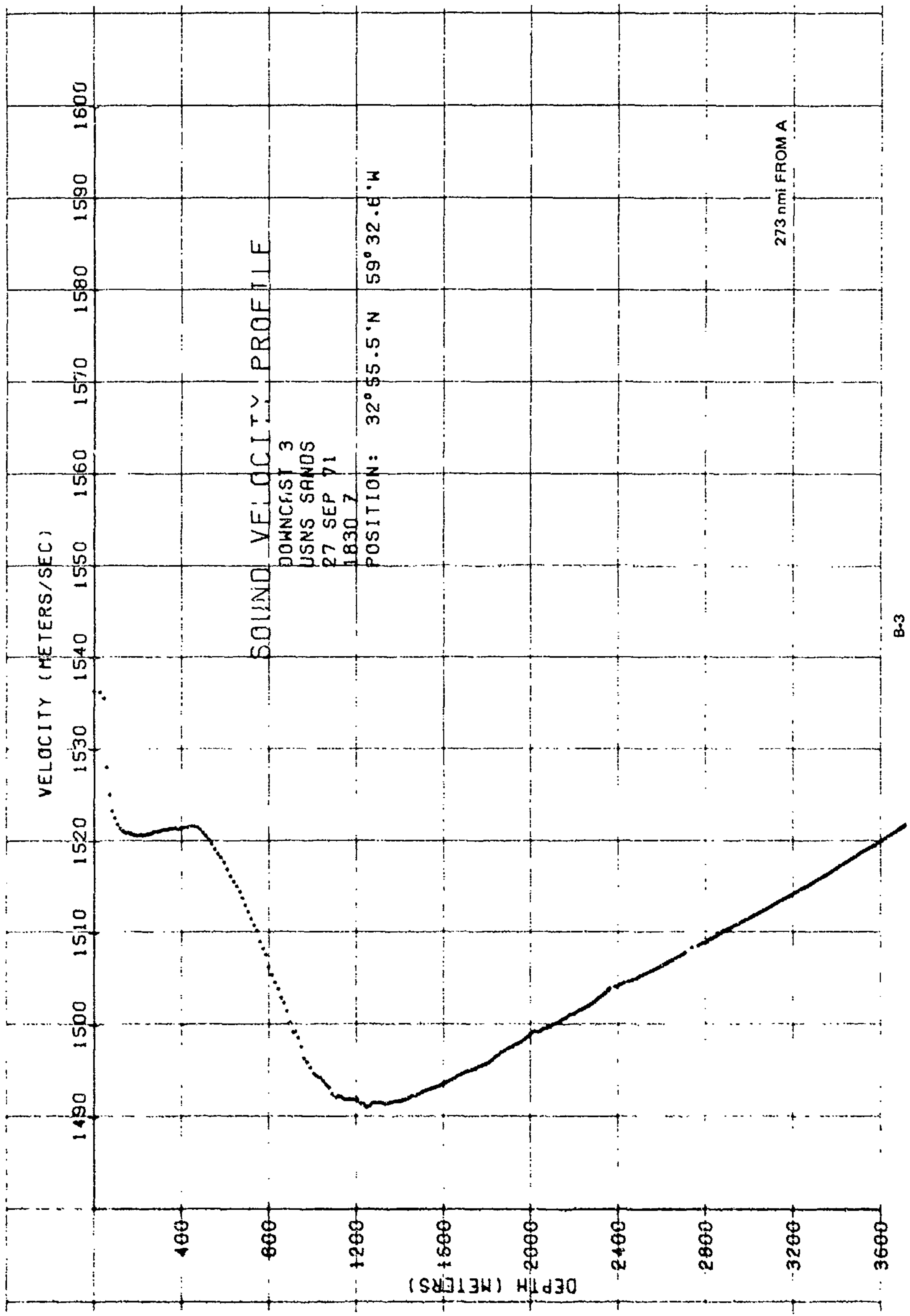
Appendix B

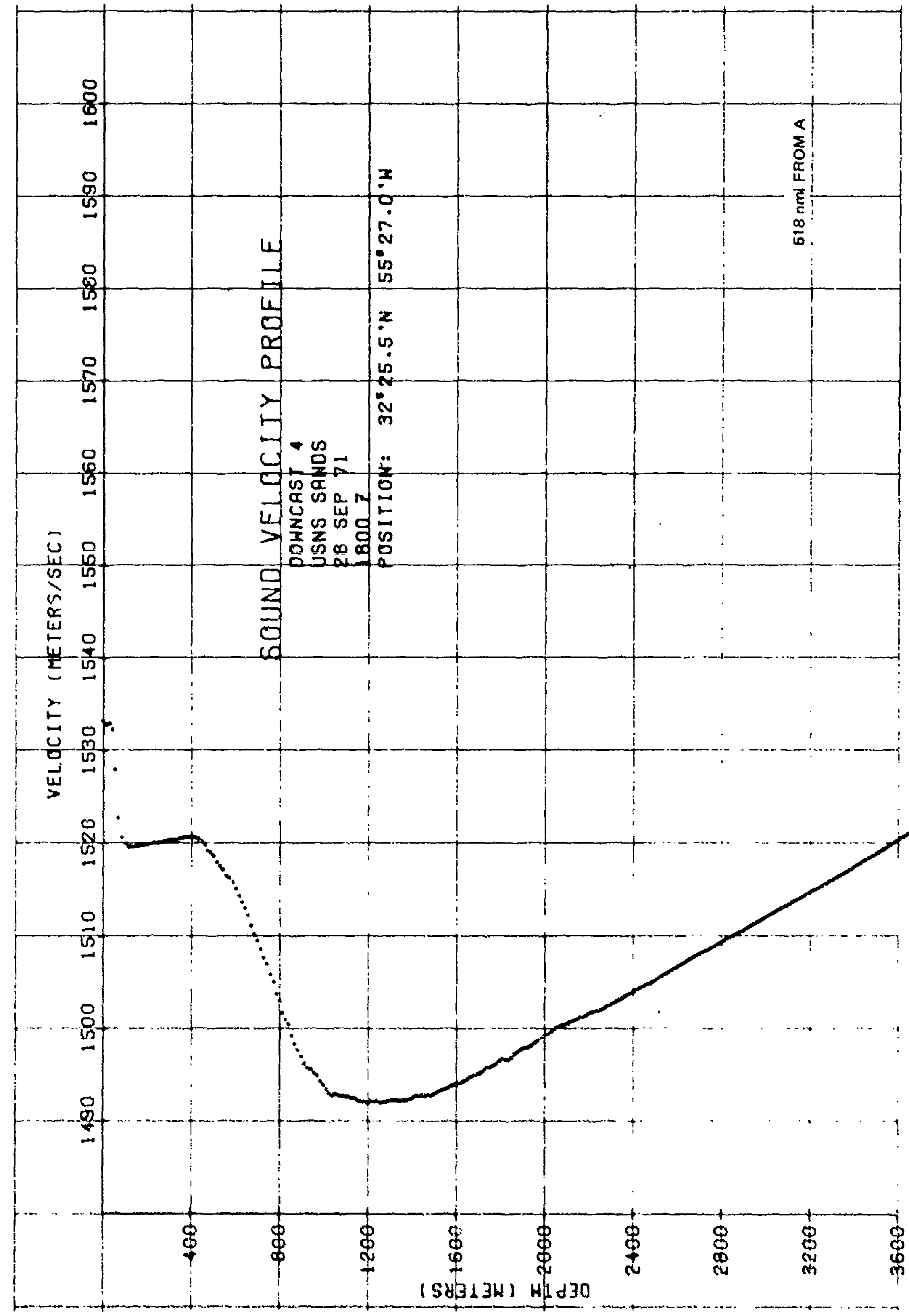
TRANSLANT I SOUND VELOCITY PROFILES

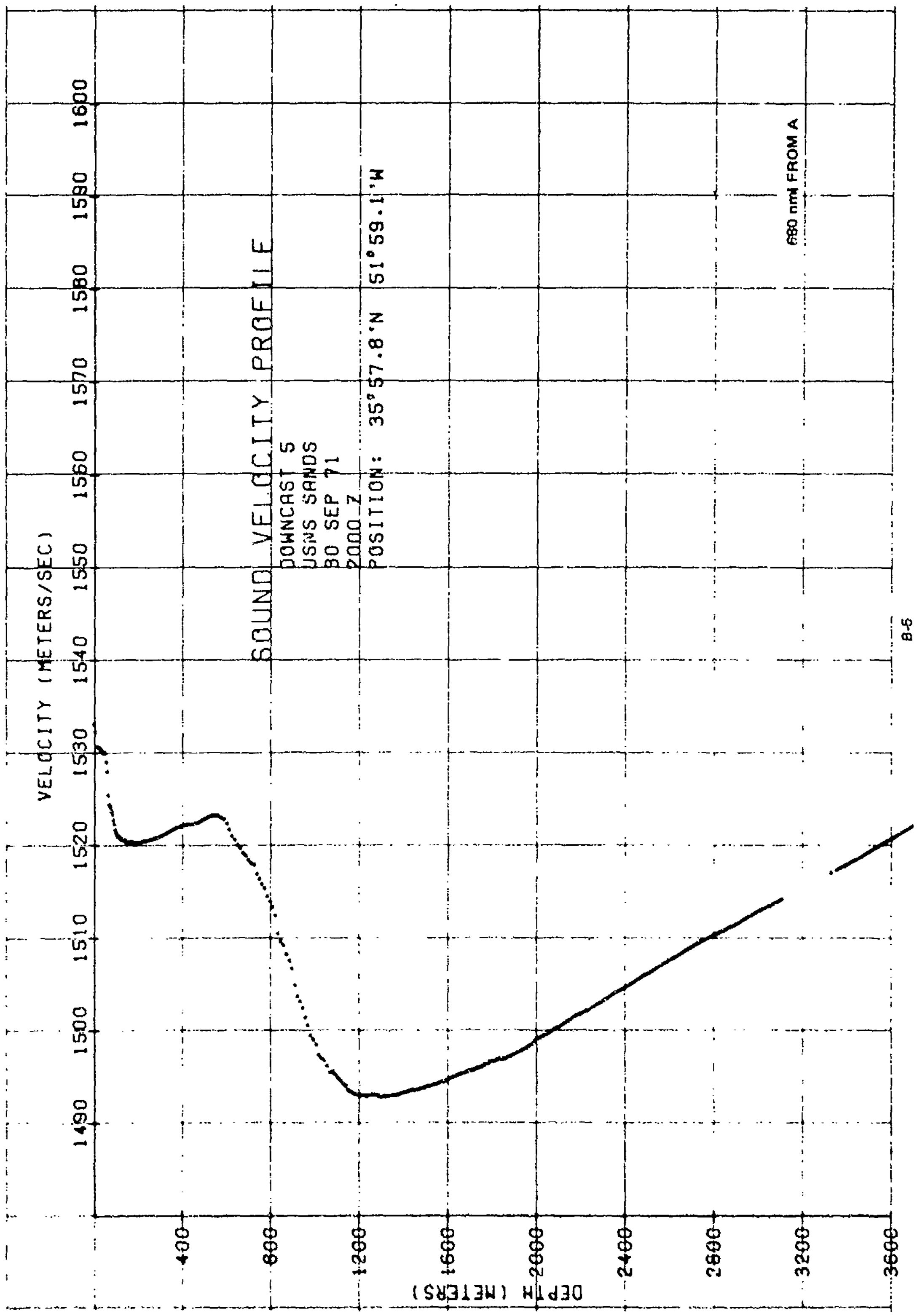
Sound velocity profiles along the TRANSLANT I track are presented on the following pages.

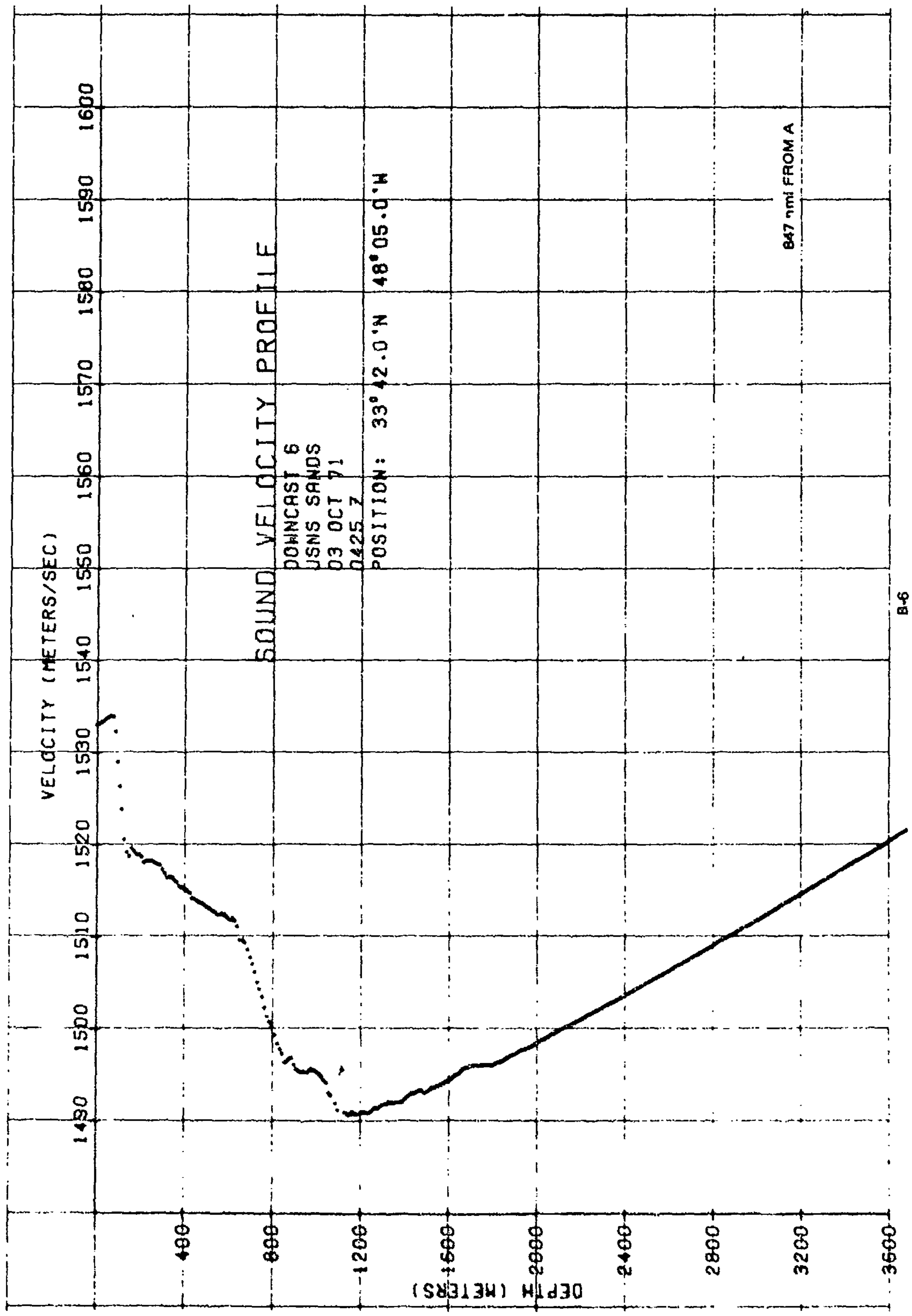

SOUND VELOCITY PROFILE
DOWNCAST 1
USNS SANDS
26 SEP 71
0318 Z
POSITION: 32°05.7'N 64°51.2'W
NEAR LOCATION A
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
B-1

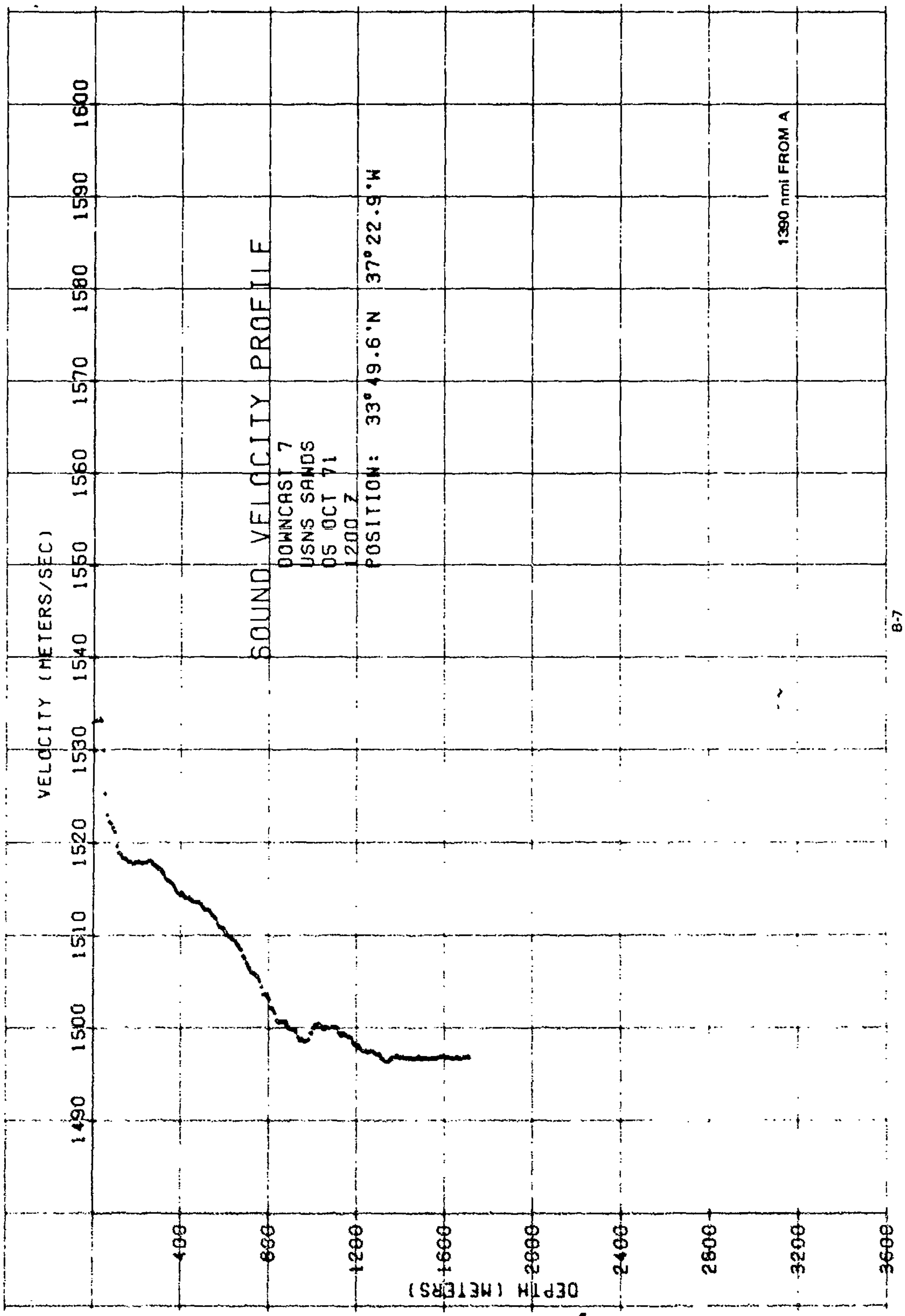

SOUND VELOCITY PROFILE
DOWNCAST 2
USNS SANDS
26 SEP 71
2300 Z
POSITION: 32°33.7'N 62°46.9'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
107 nmi FROM A
B-2

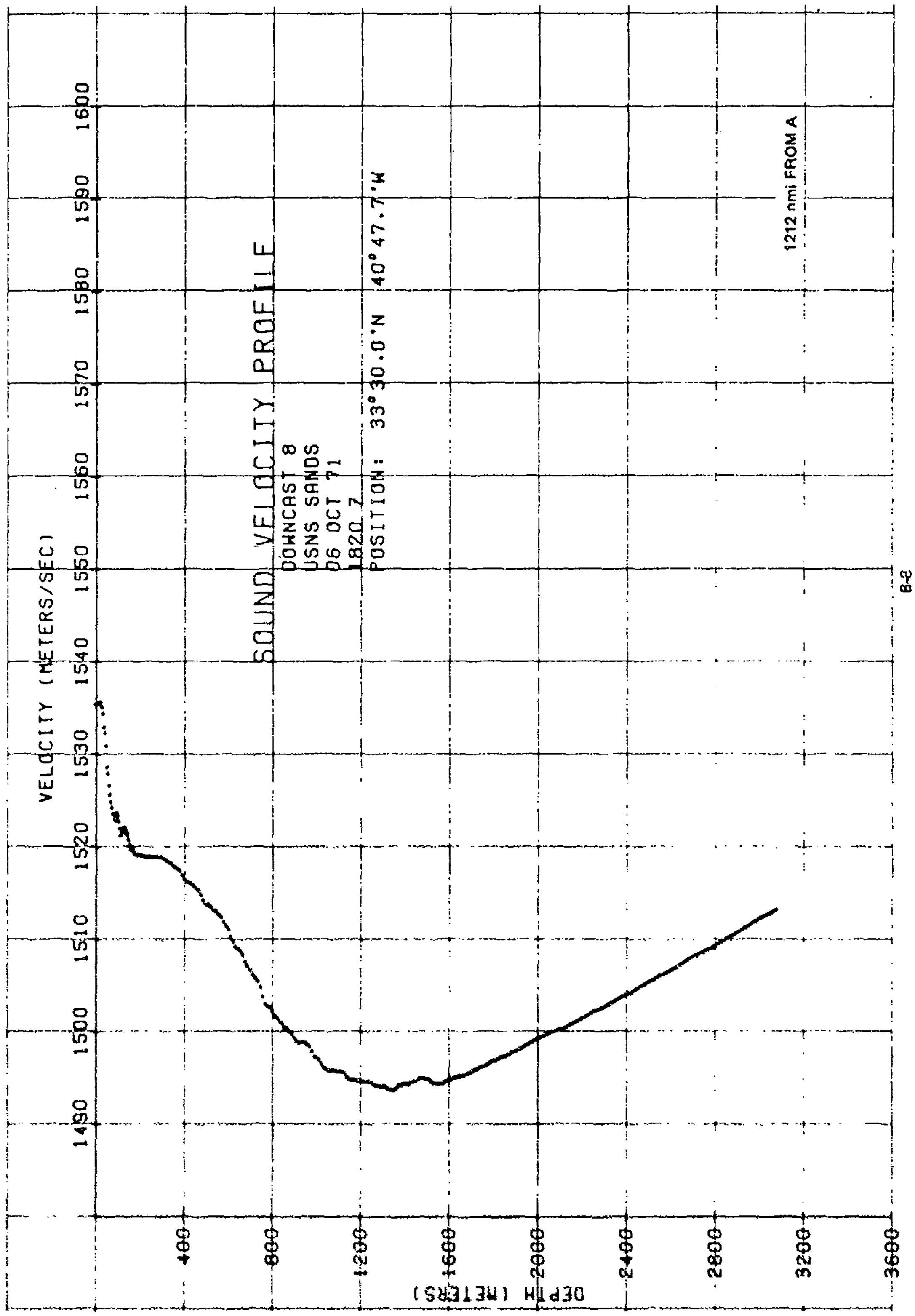

SOUND VELOCITY PROFILE
DOWNCAST 3
USNS SANDS
27 SEP 71
1830 Z
POSITION: 32°55.5'N 59°32.6'W
273 nmi FROM A
VELOCITY (METERS/SEC)
1490 1500 1510 1520 1530 1540 1550 1560 1570 1580 1590 1600
DEPTH (METERS)
400 800 1200 1600 2000 2400 2800 3200 3600
B-3

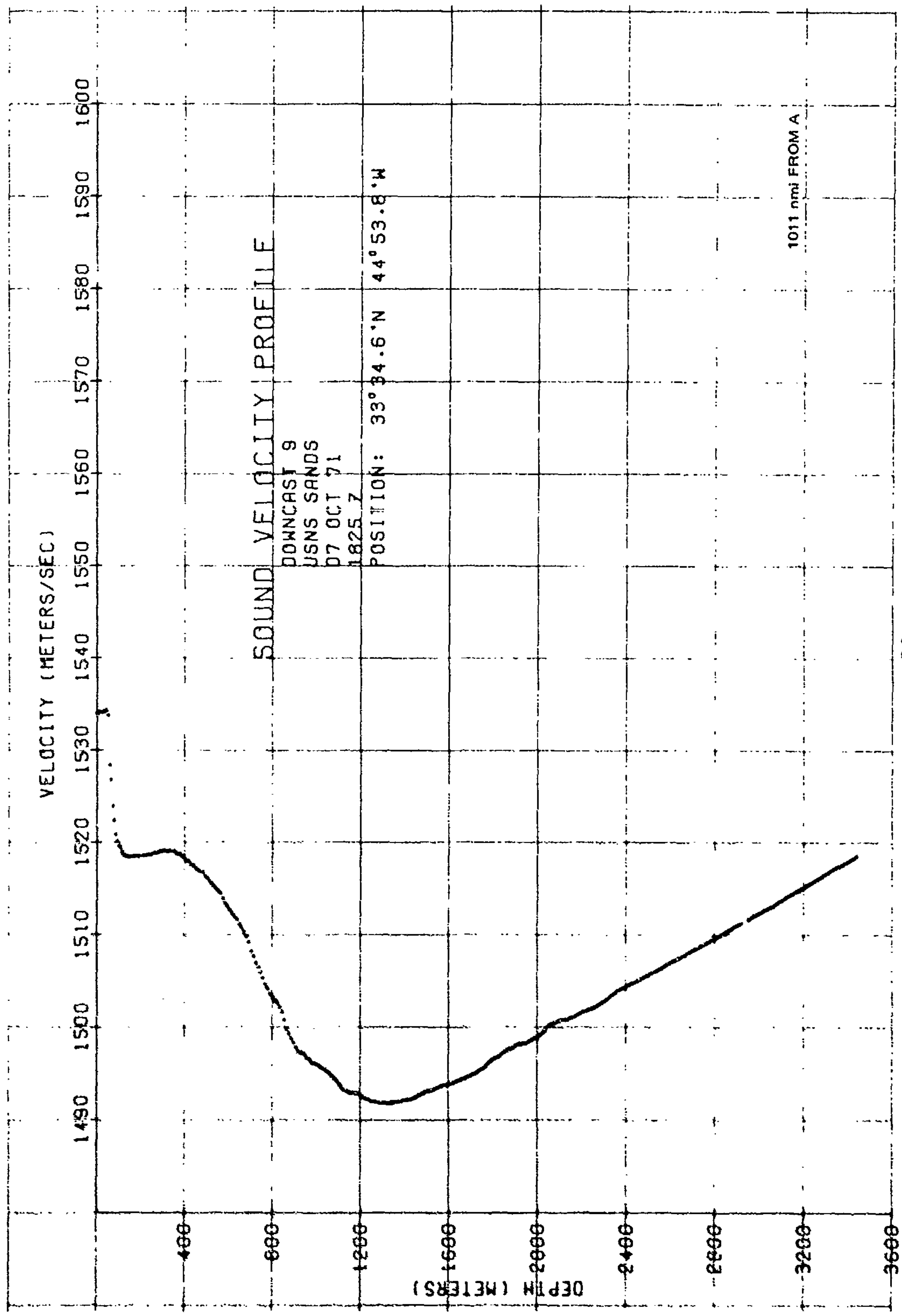

SOUND VELOCITY PROFILE
DOWNCAST 4
USNS SANDS
28 SEP 71
1800 Z
POSITION: 32°25.5'N 55°27.0'W
518 nmi FROM A
B-4
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600

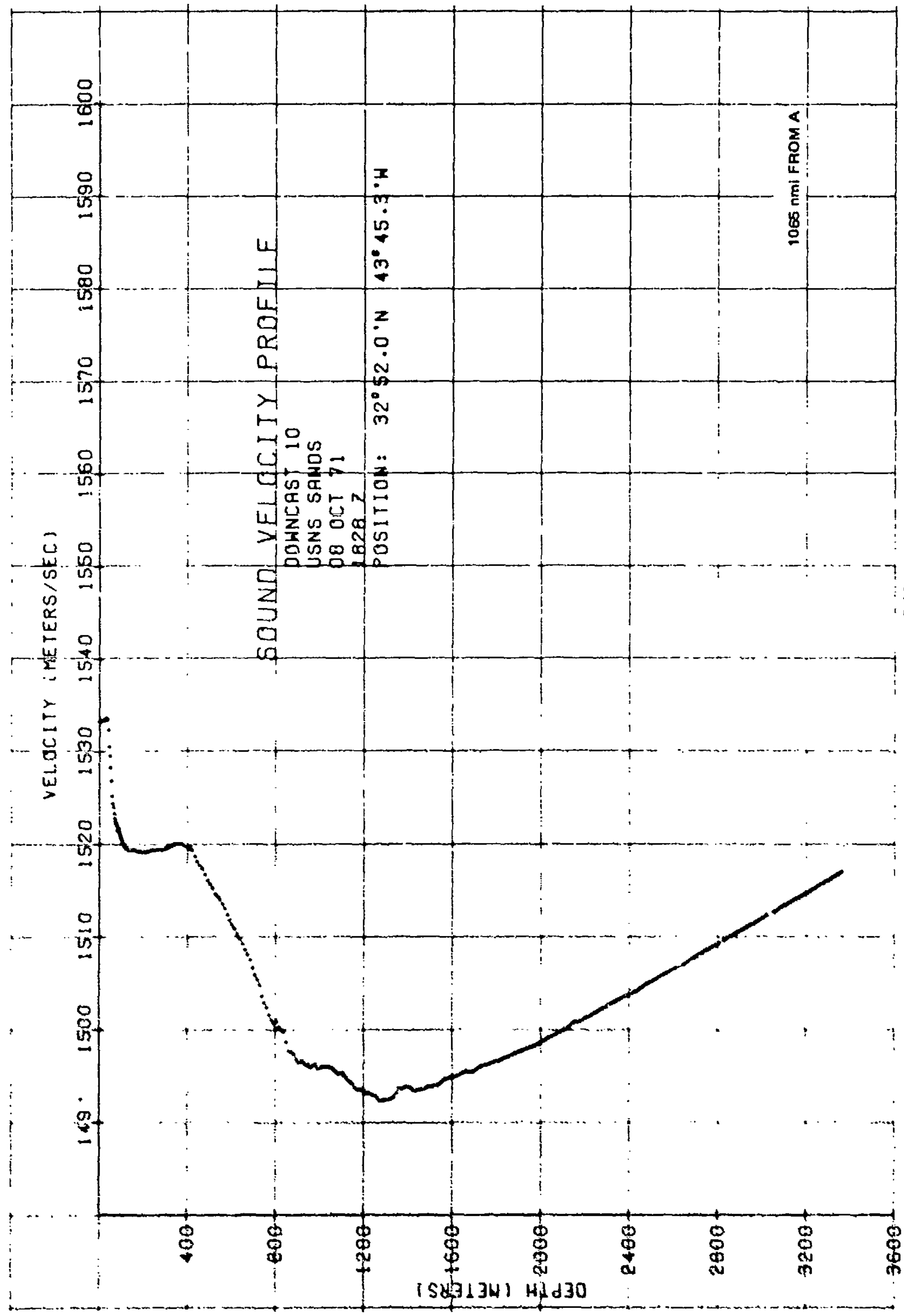

SOUND VELOCITY PROFILE
DOWNCAST 5
USNS SANDS
30 SEP 71
2000 Z
POSITION: 35°57.8'N 51°59.1'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
680 nmi FROM A
B-5

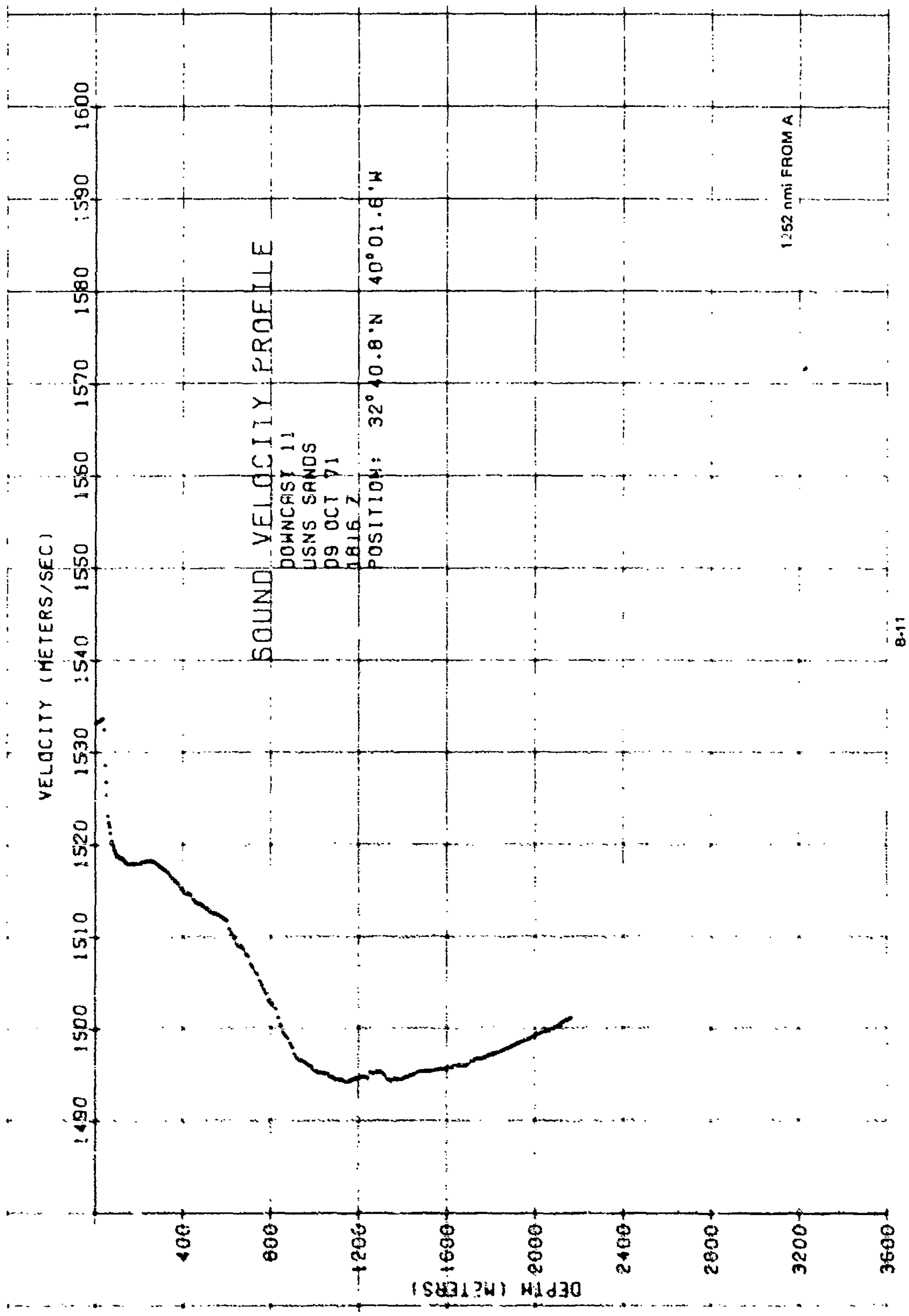

SOUND VELOCITY PROFILE
DOWNCAST 6
USNS SANDS
03 OCT 71
0425 Z
POSITION: 33°42.0'N 48°05.0'W
847 nmi FROM A
B-6
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600

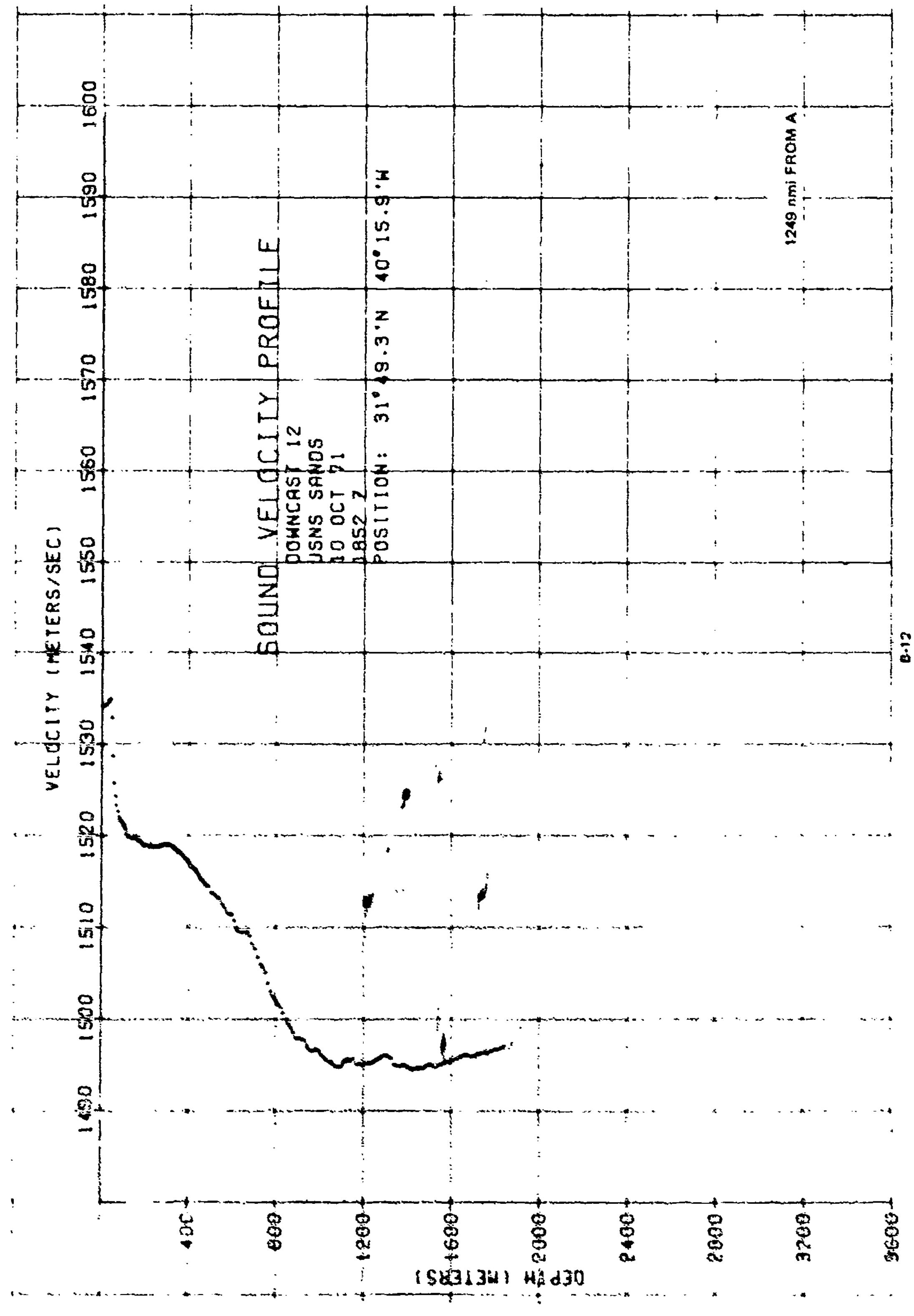

SOUND VELOCITY PROFILE
DOWNCAST 7
USNS SANDS
05 OCT 71
1200 Z
POSITION: 33°49.6'N 37°22.9'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
1390 nmi FROM A
B-7

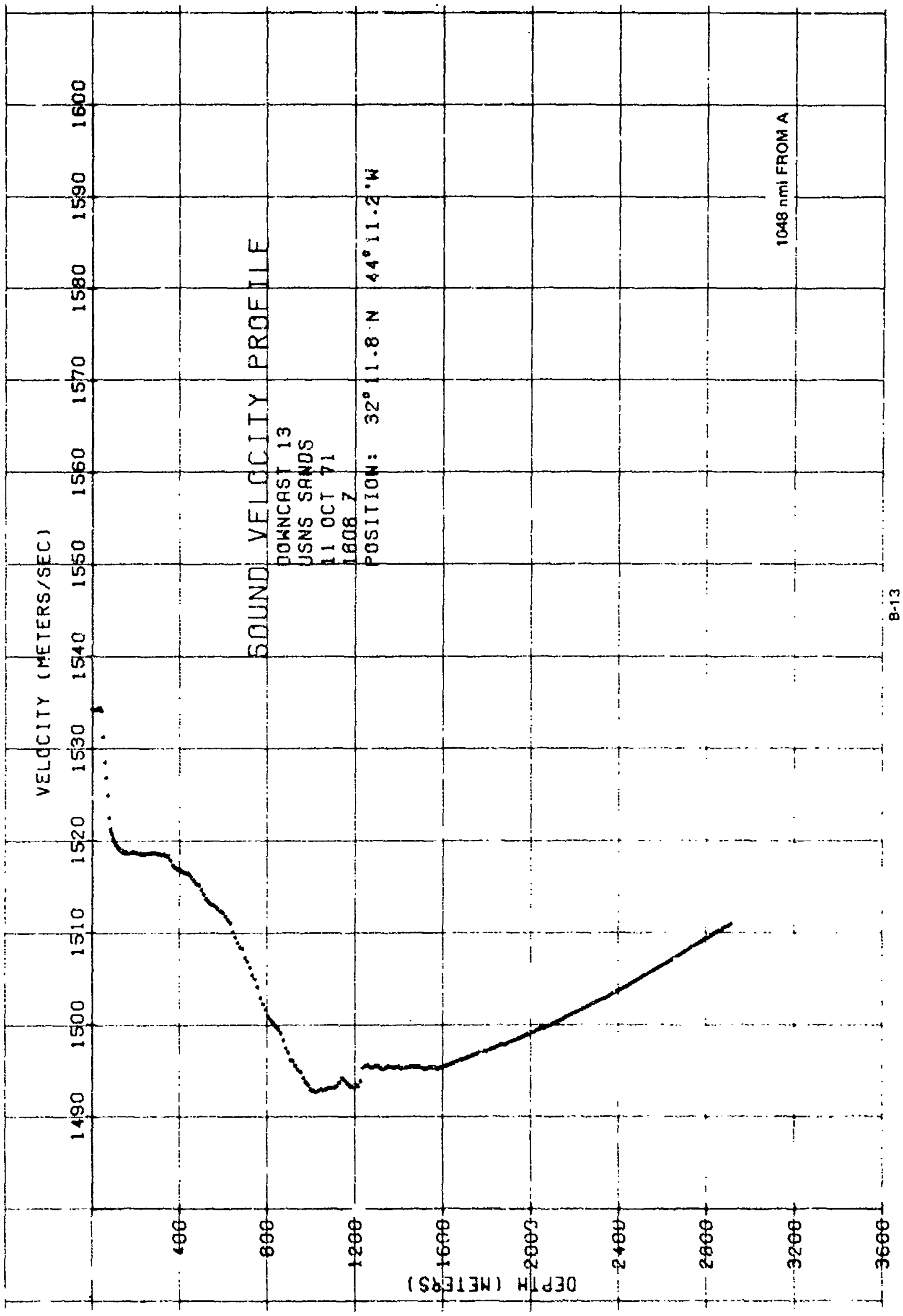

SOUND VELOCITY PROFILE
DOWNCAST 8
USNS SANDS
06 OCT 71
1820 Z
POSITION: 33°30.0'N 40°47.7'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
1212 nmi FROM A


SOUND VELOCITY PROFILE
DOWNCAST 9
USNS SANDS
07 OCT 71
1825 Z
POSITION: 33° 34.6'N 44° 53.8'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
1011 nmi FROM A
B-9


SOUND VELOCITY PROFILE
DOWNCAST 10
USNS SANDS
08 OCT 71
1828 Z
POSITION: 32°52.0'N 43°45.3'W
VELOCITY (METERS/SEC)
DEPTH (METERS)
1066 nmi FROM A
B-10


SOUND VELOCITY PROFILE
DOWNCAST 11
USNS SANDS
09 OCT 71
1816 Z
POSITION: 32°40.8'N 40°01.6'W
1:52 nmi FROM A
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
B-11

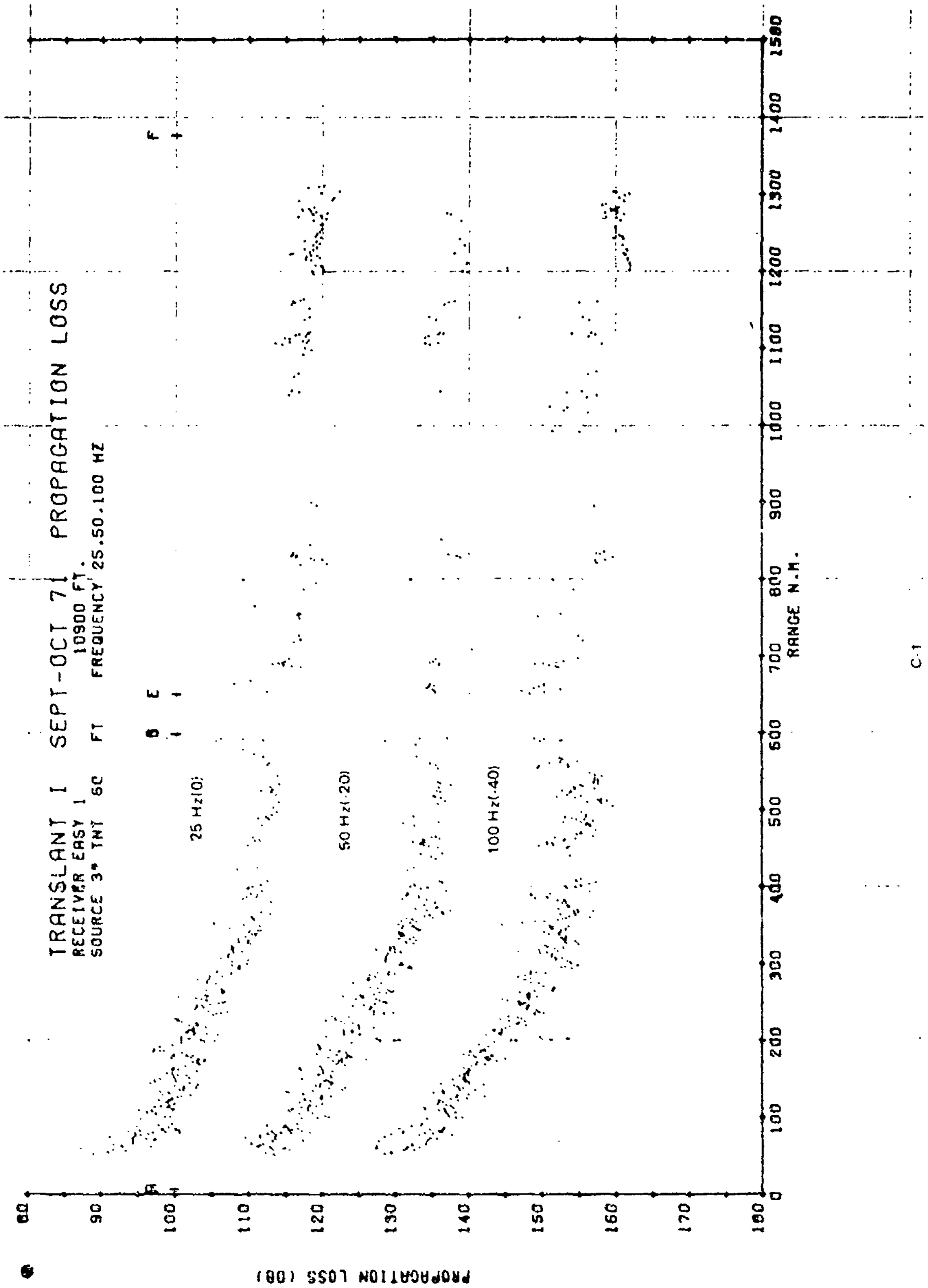

SOUND VELOCITY PROFILE
DOWNCAST 12
USNS SANDS
10 OCT 71
1852 Z
POSITION: 31°49.3'N 40°15.9'W
VELOCITY (METERS/SEC)
1490
1500
1510
1520
1530
1540
1550
1560
1570
1580
1590
1600
DEPTH (METERS)
400
800
1200
1600
2000
2400
2800
3200
3600
1249 nmi FROM A
B-12


SOUND VELOCITY PROFILE
DOWNCAST 13
USNS SANDS
11 OCT 71
1808 Z
POSITION: 32° 11.8 N 44° 11.2'W
VELOCITY (METERS/SEC)
1490 1500 1510 1520 1530 1540 1550 1560 1570 1580 1590 1600
DEPTH (METERS)
400 800 1200 1600 2000 2400 2800 3200 3600
1048 nmi FROM A
B-13

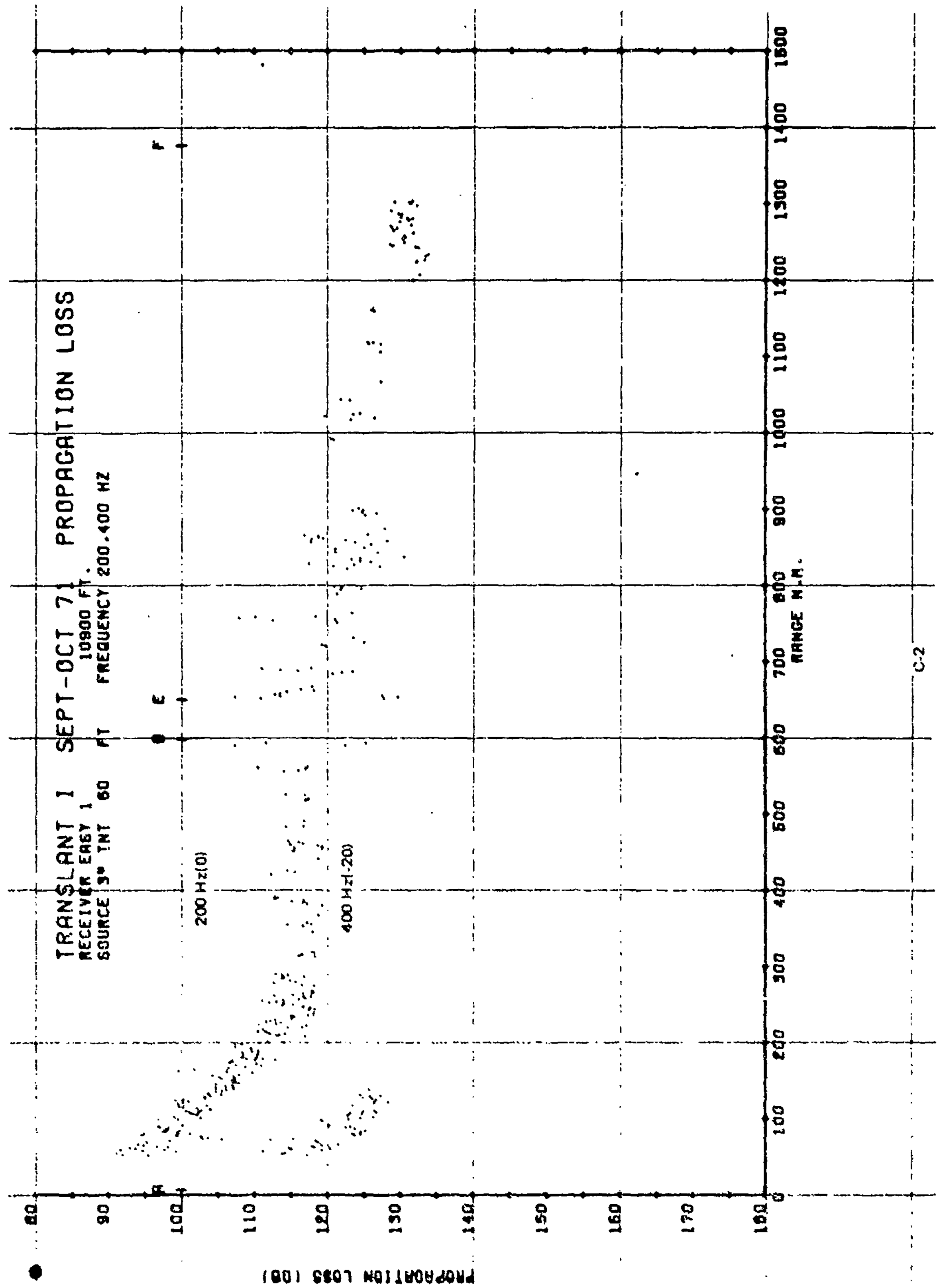
Appendix C

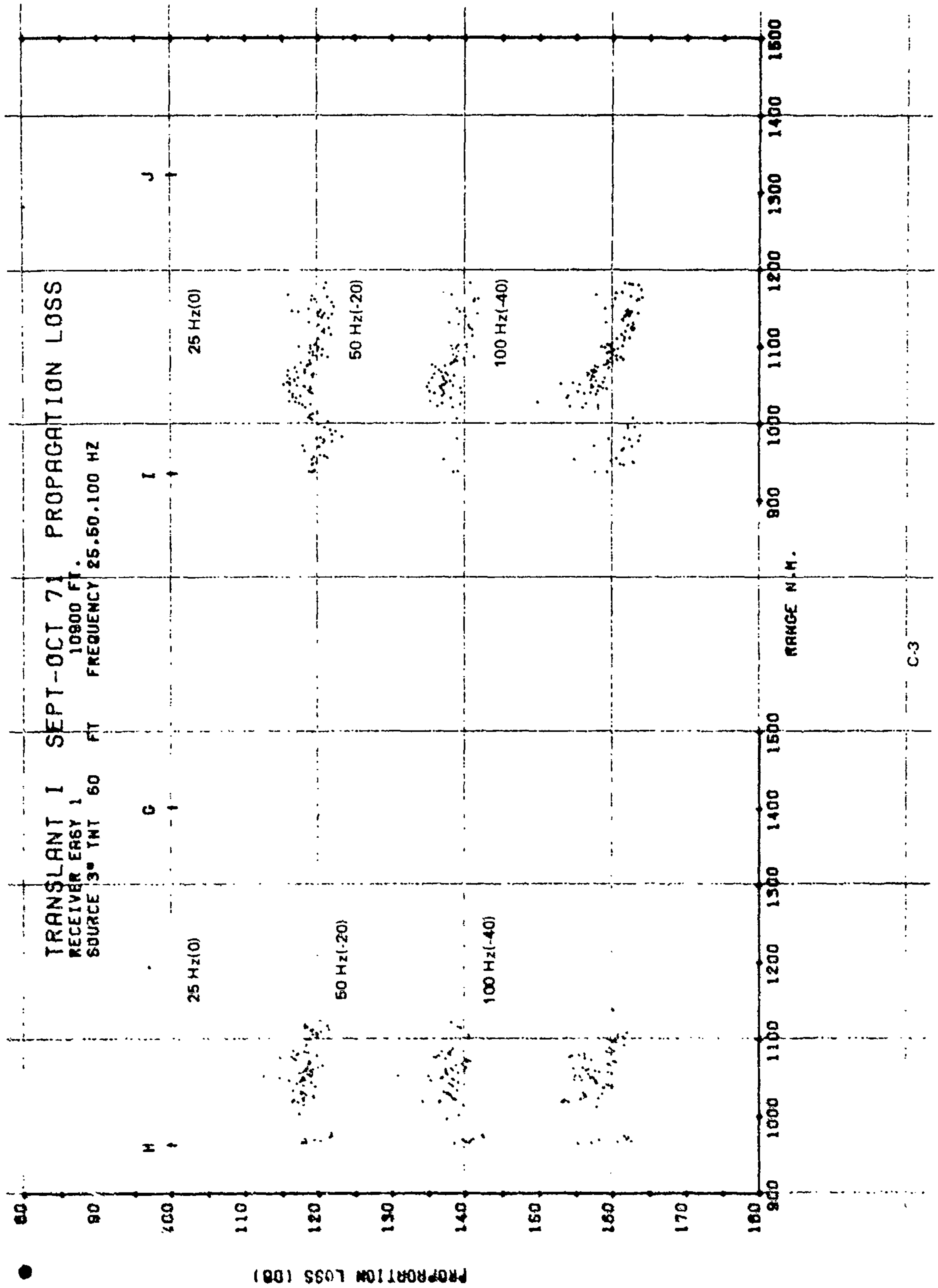
TRANSLANT I PROPAGATION LOSS

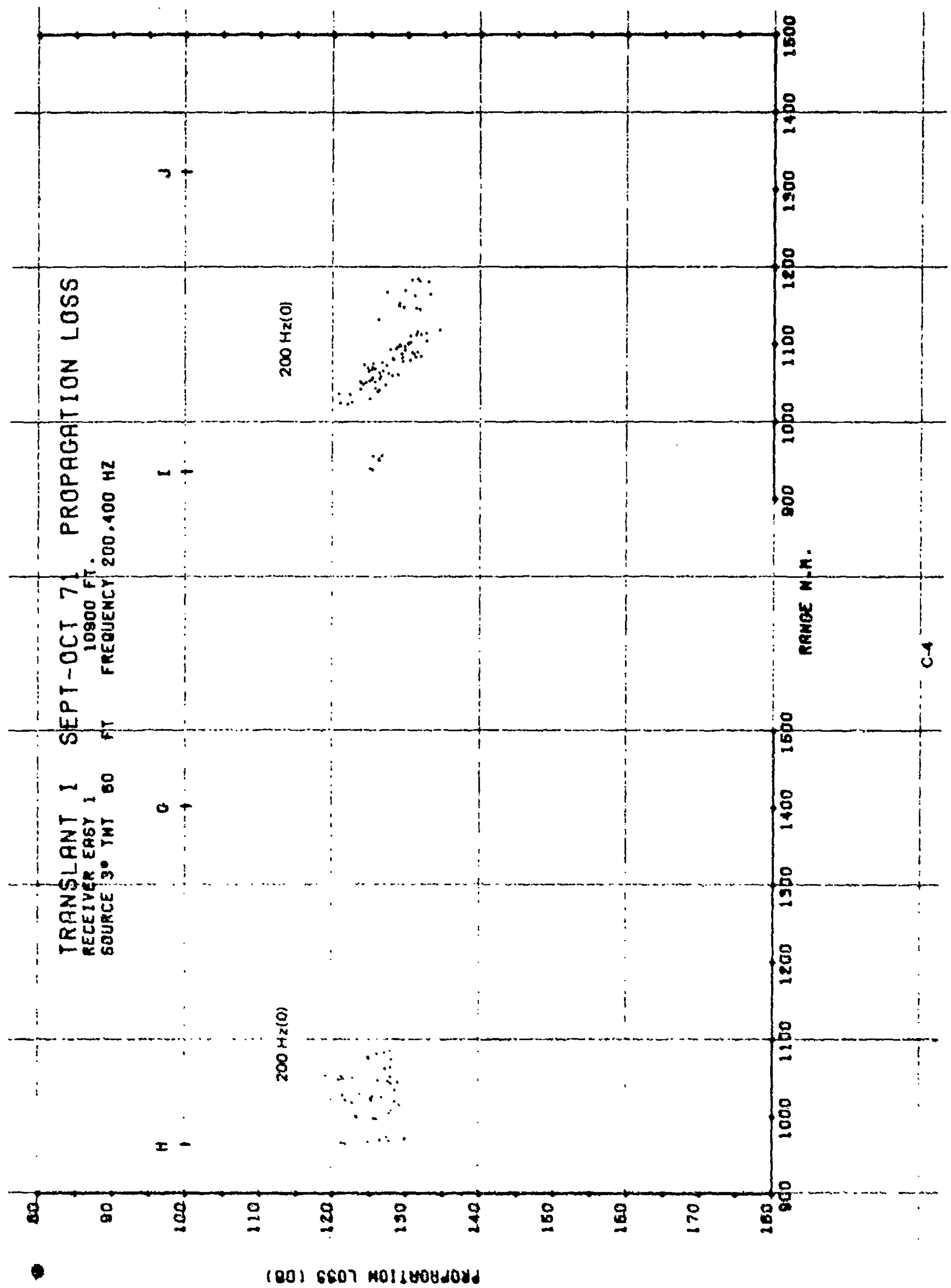
(U) The measured propagation loss for the TRANSLANT I experiment as a function of range and frequency are presented on the following pages.

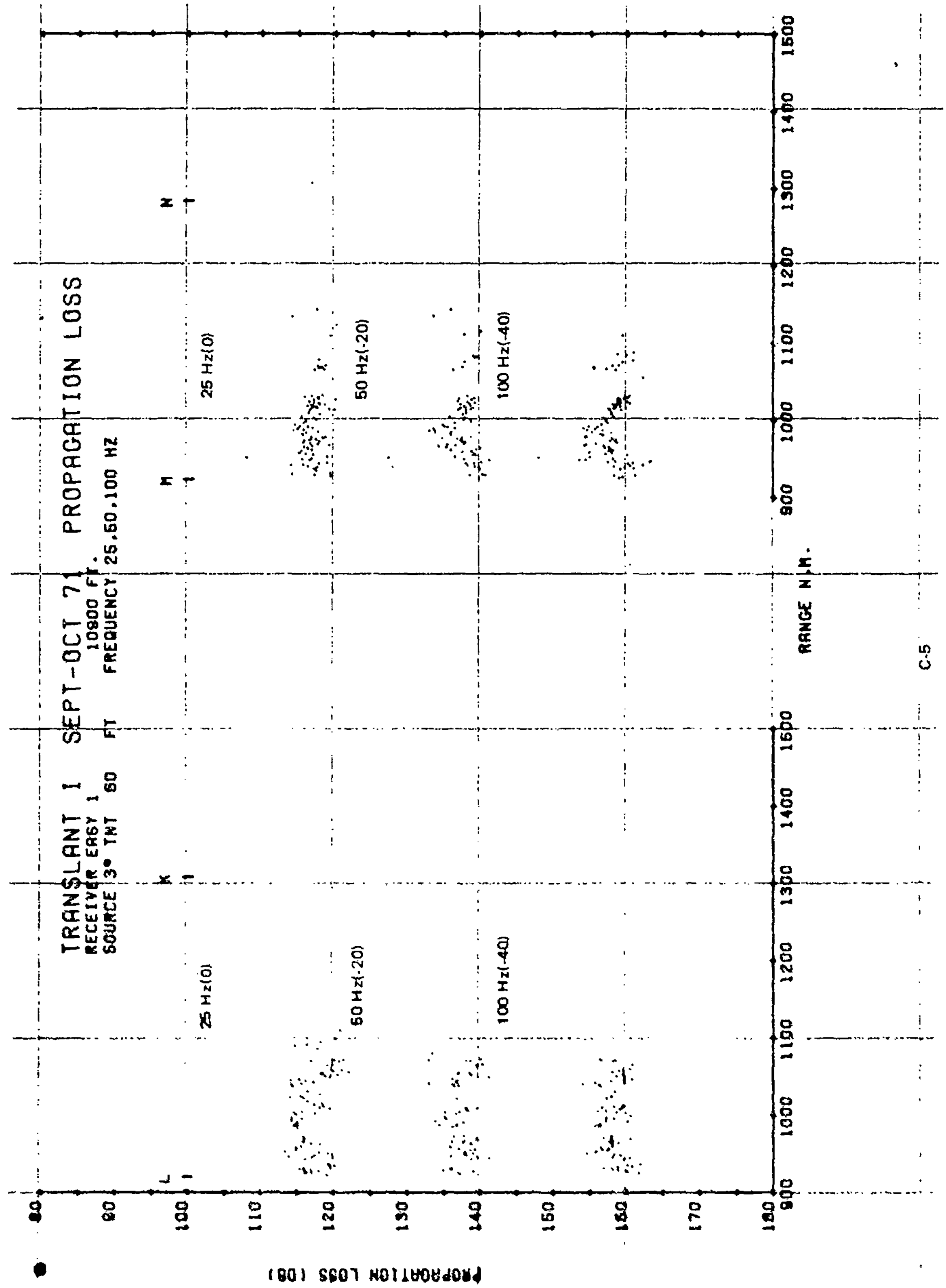


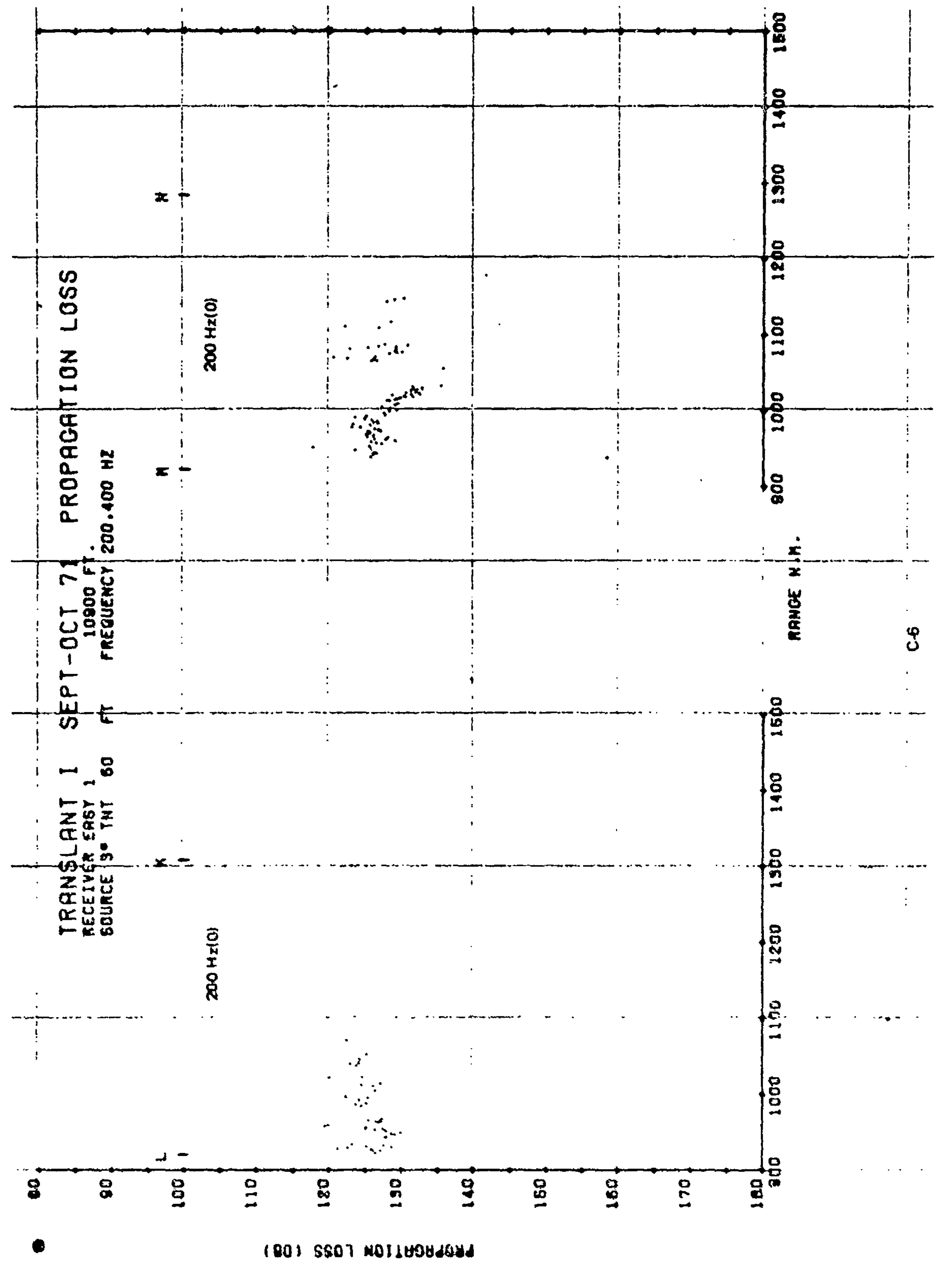
TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-1

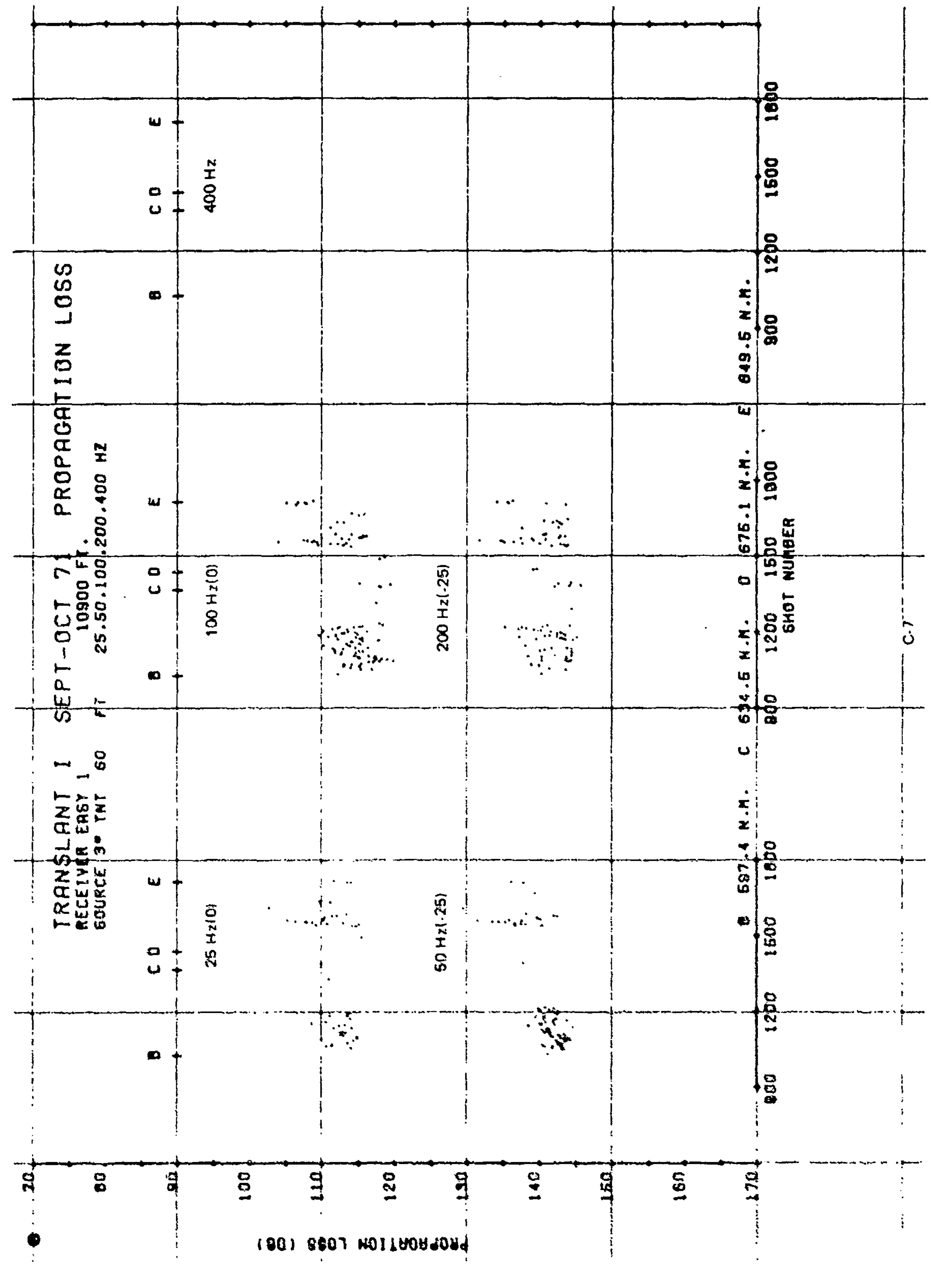

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200.400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
PROPAGATION LOSS (DB)
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
80 90 100 110 120 130 140 150 160 170 180
C-2

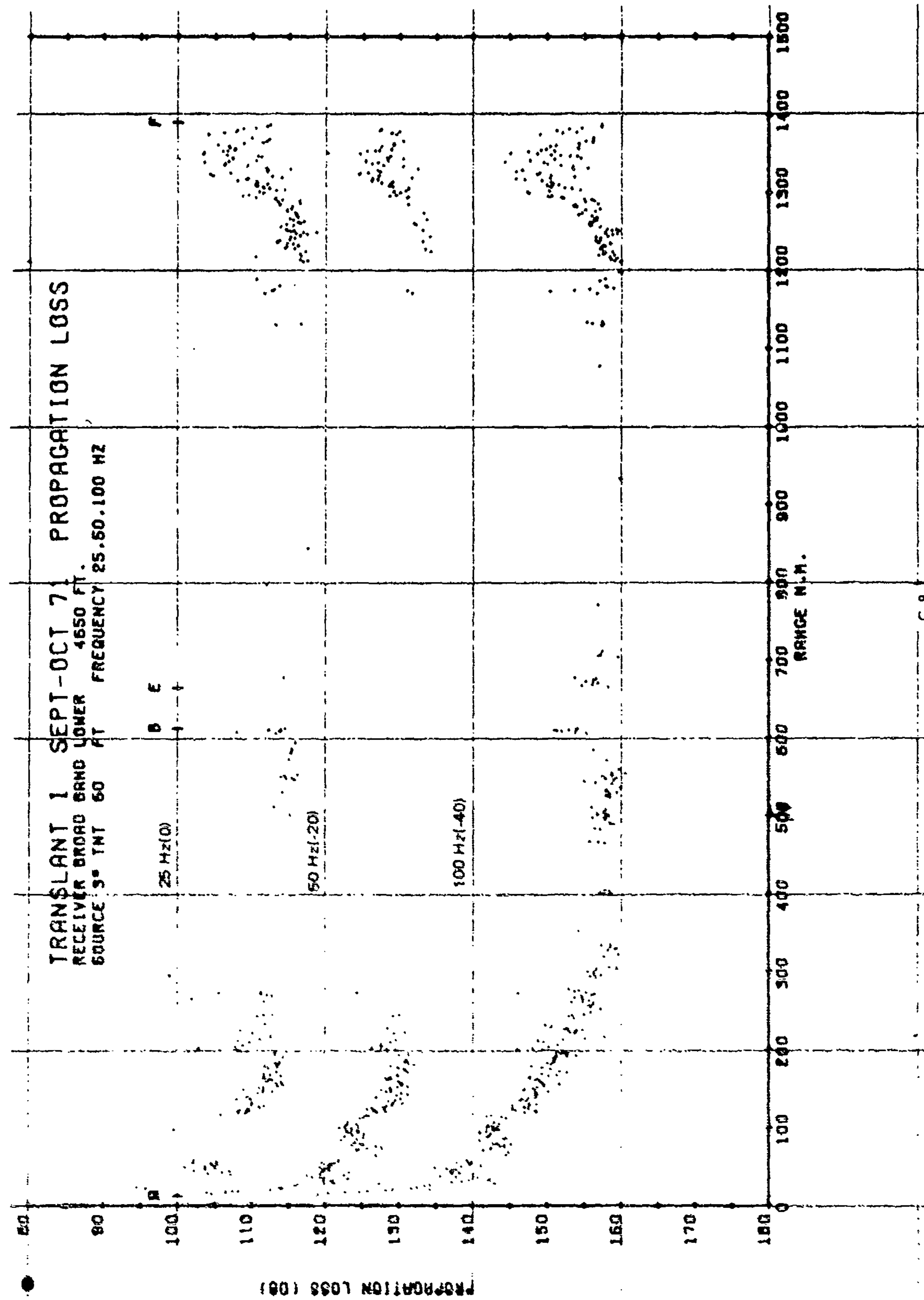

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
H
G
I
J
PROPORTION LOSS (DB)
RANGE N.M.
C-3

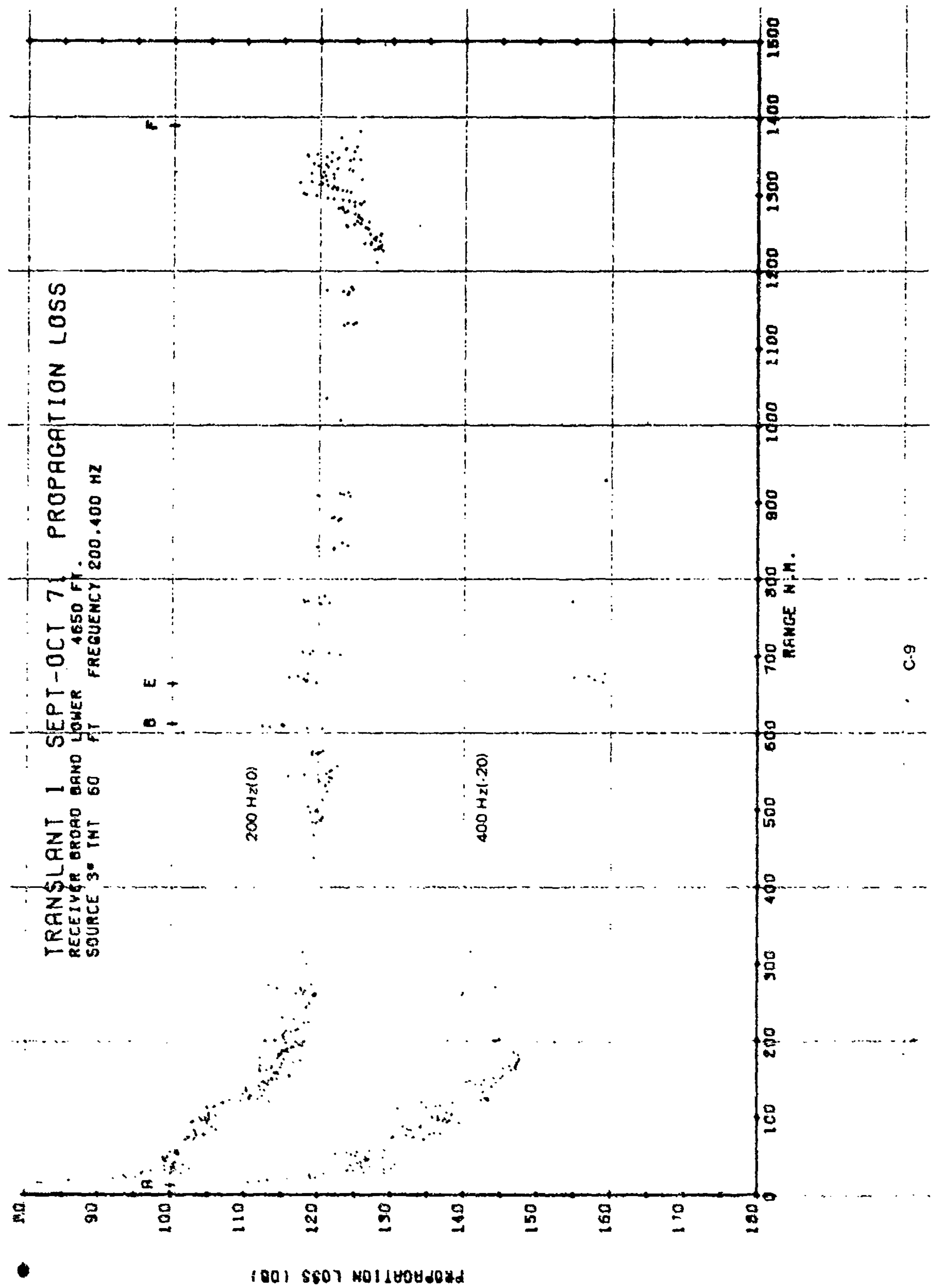

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3° TNT 60 FT FREQUENCY 200,400 HZ
200 Hz(0)
200 Hz(0)
H
G
I
J
C-4
RANGE N.M.
PROPAGATION LOSS (DB)

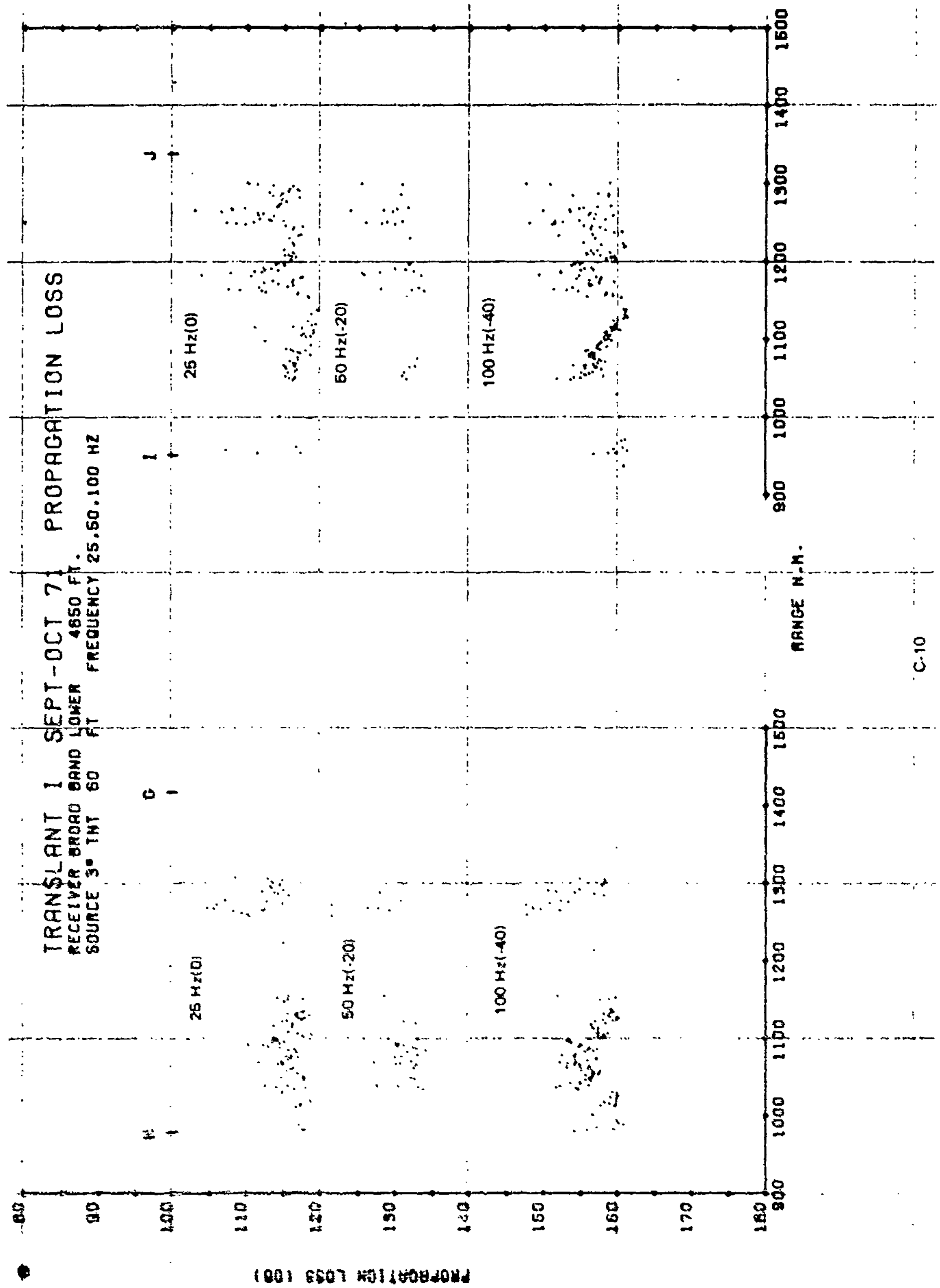

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER ERGY 1 10800 FT.
SOURCE 3* TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-5

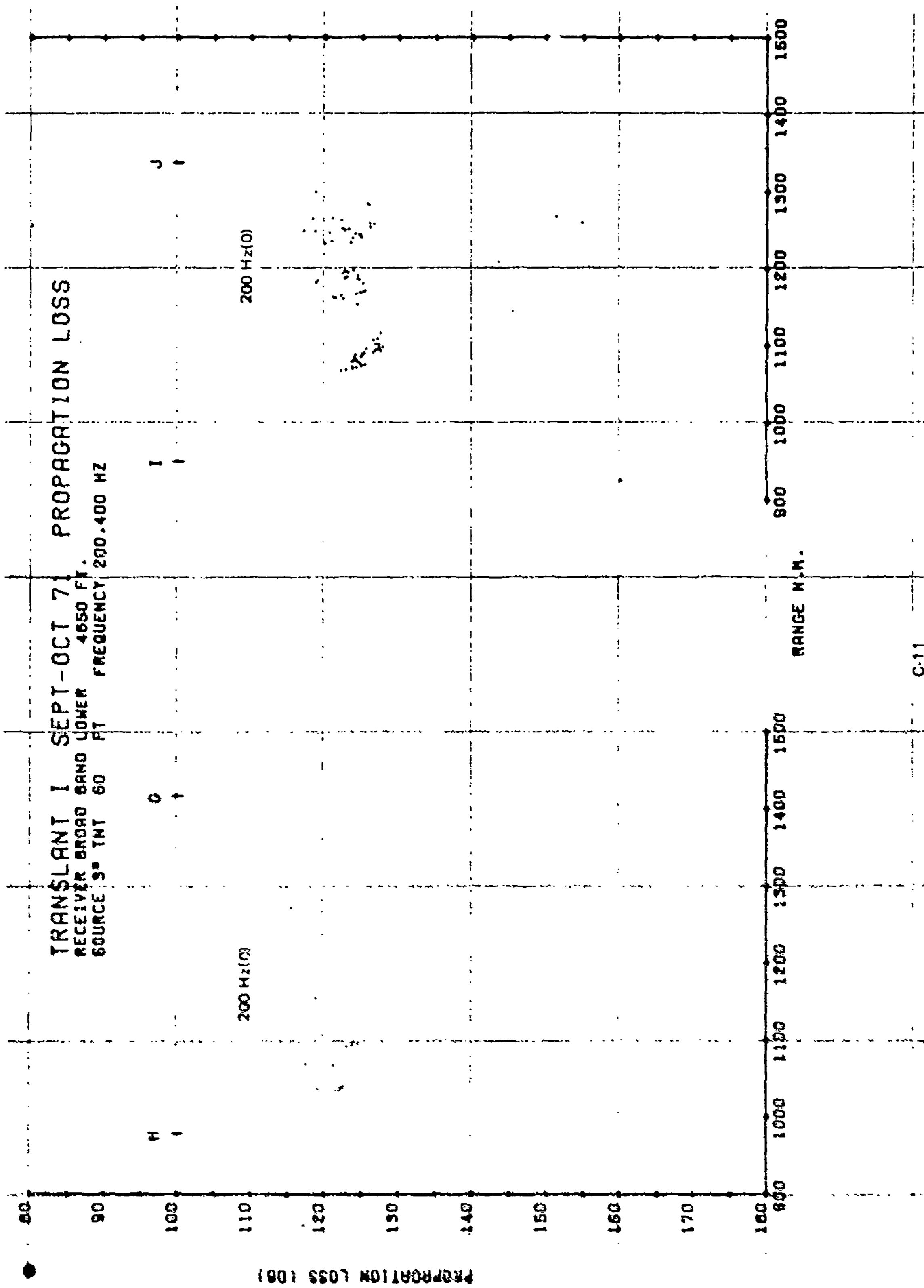

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200.400 HZ
200 Hz(O)
200 Hz(O)
RANGE N.M.
C-6
PROPAGATION LOSS (DB)

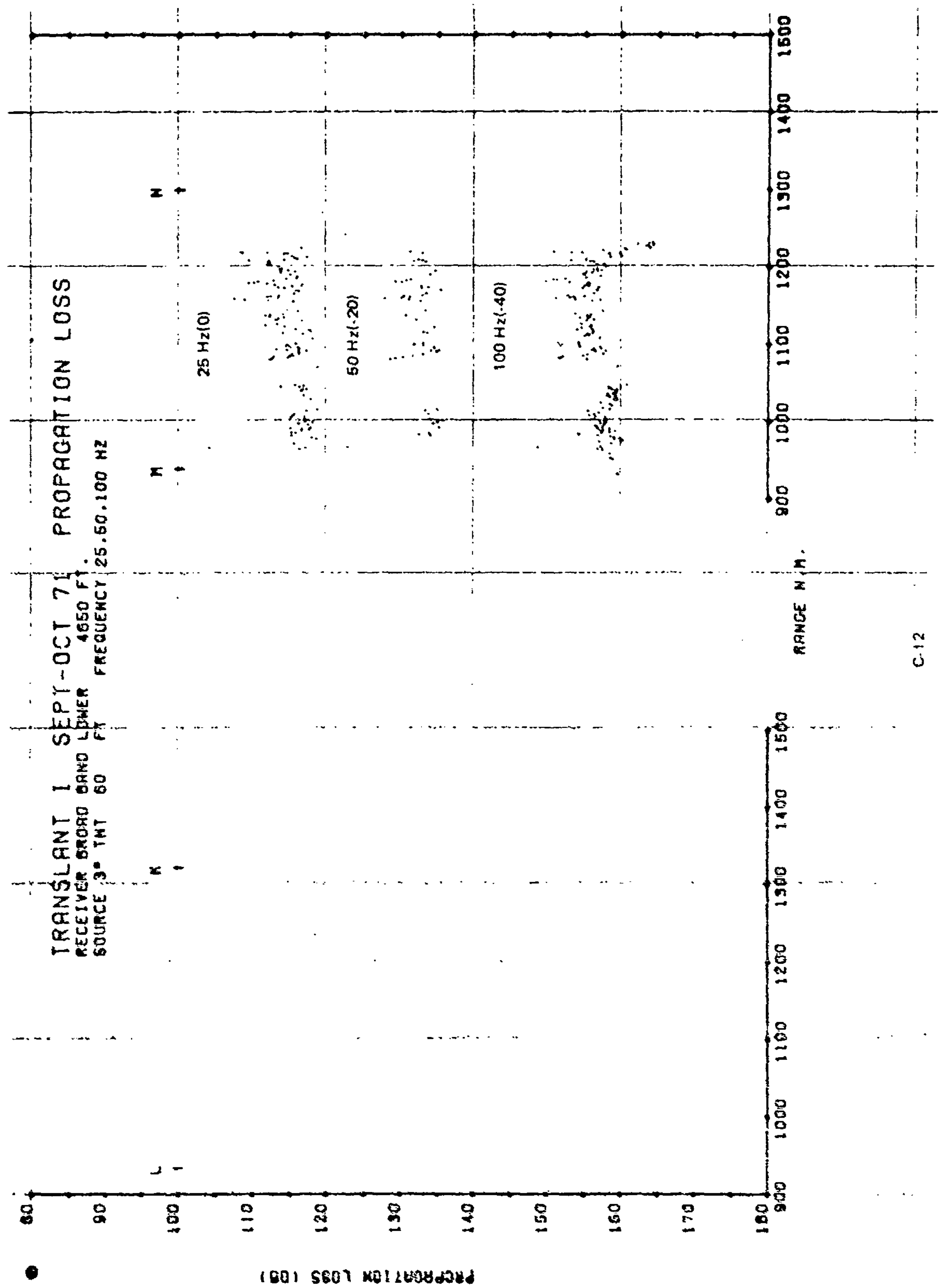

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT 25.50.100.200.400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz
B C D E
597.4 N.M.
634.5 N.M.
676.1 N.M.
849.5 N.M.
SHOT NUMBER
PROPAGATION LOSS (DB)
80 90 100 110 120 130 140 150 160 170
800 1200 1500 1800
C-7


TRANSLANT 1 SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-8

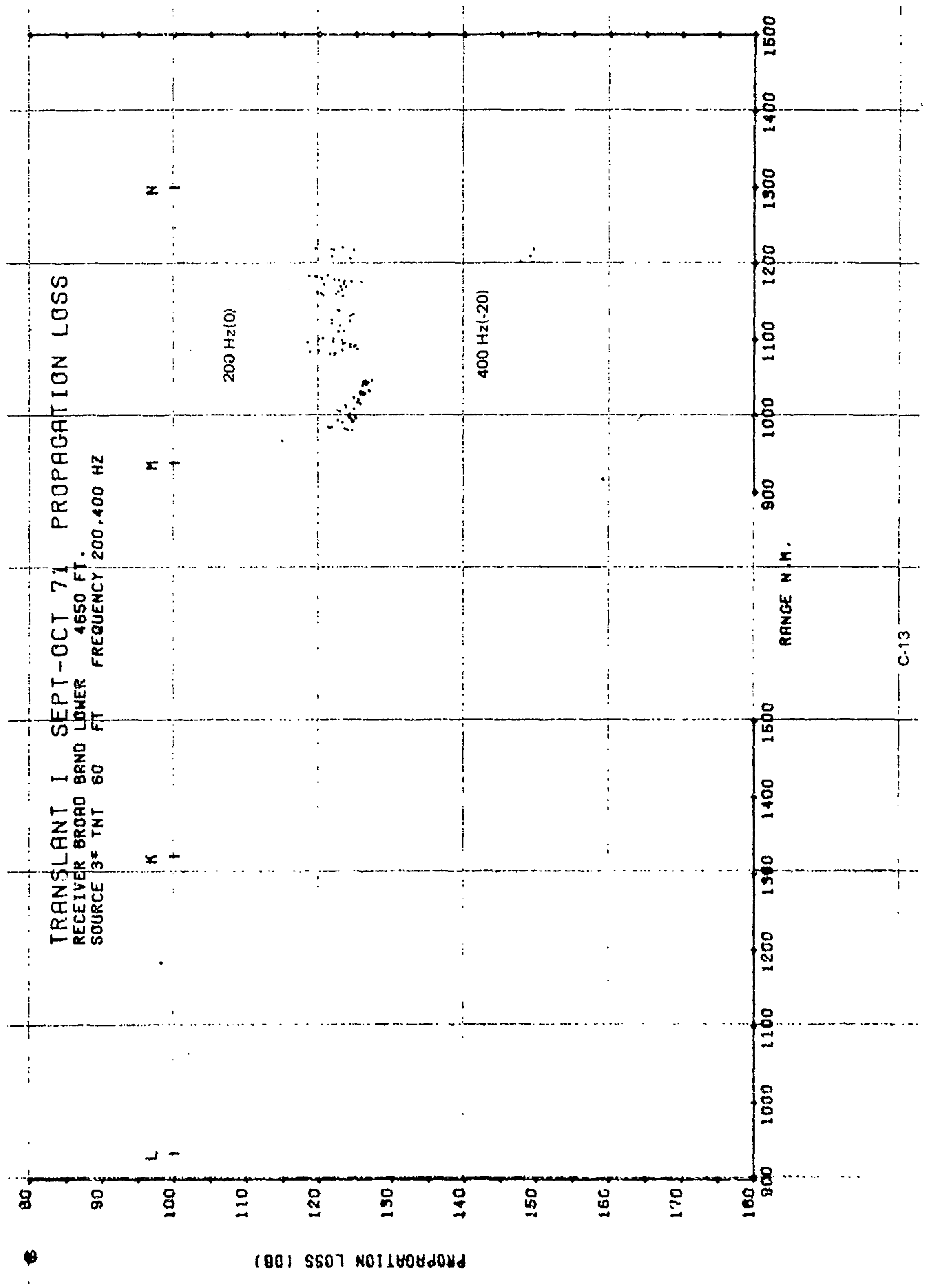

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200.400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
PROPAGATION LOSS (DB)
C-9

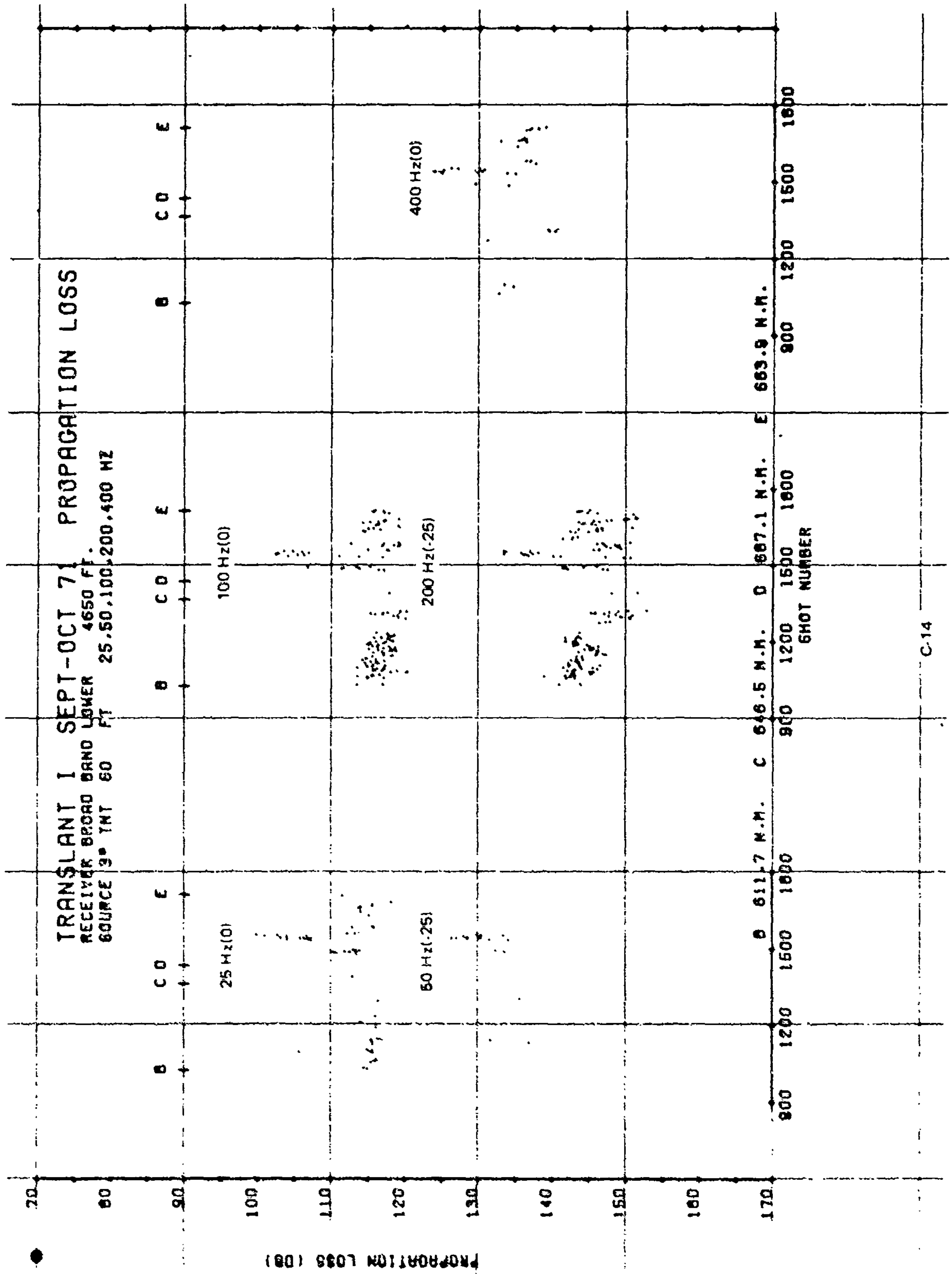

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3* TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
H
I
J
G
RANGE N.M.
PROPAGATION LOSS (DB)
C-10

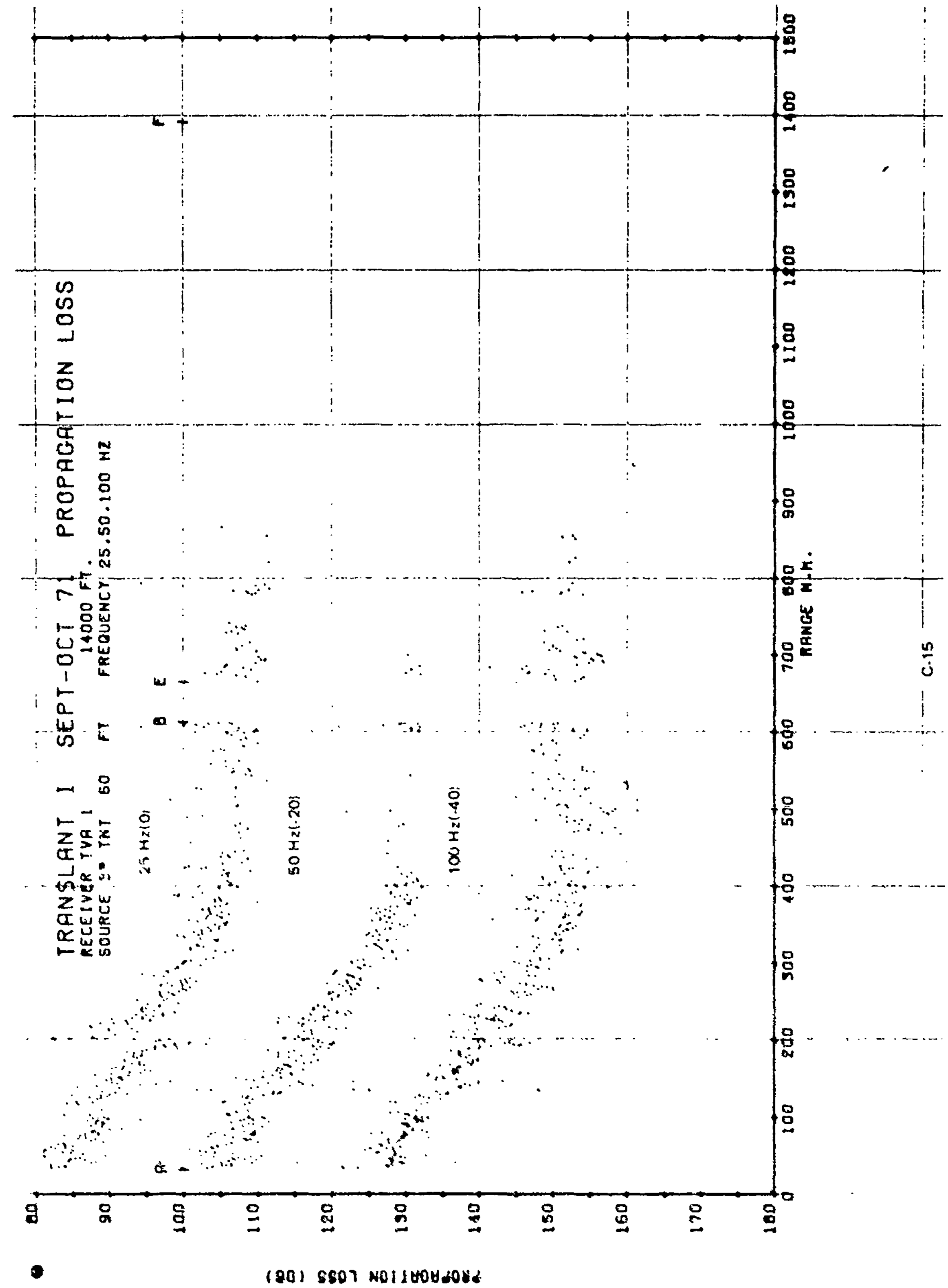

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200.400 HZ
200 Hz(O)
200 Hz(O)
H
G
I
J
PROPAGATION LOSS (DB)
80 90 100 110 120 130 140 150 160 170 180
900 1000 1100 1200 1300 1400 1500
900 1000 1100 1200 1300 1400 1500
RANGE N.M.
C-11

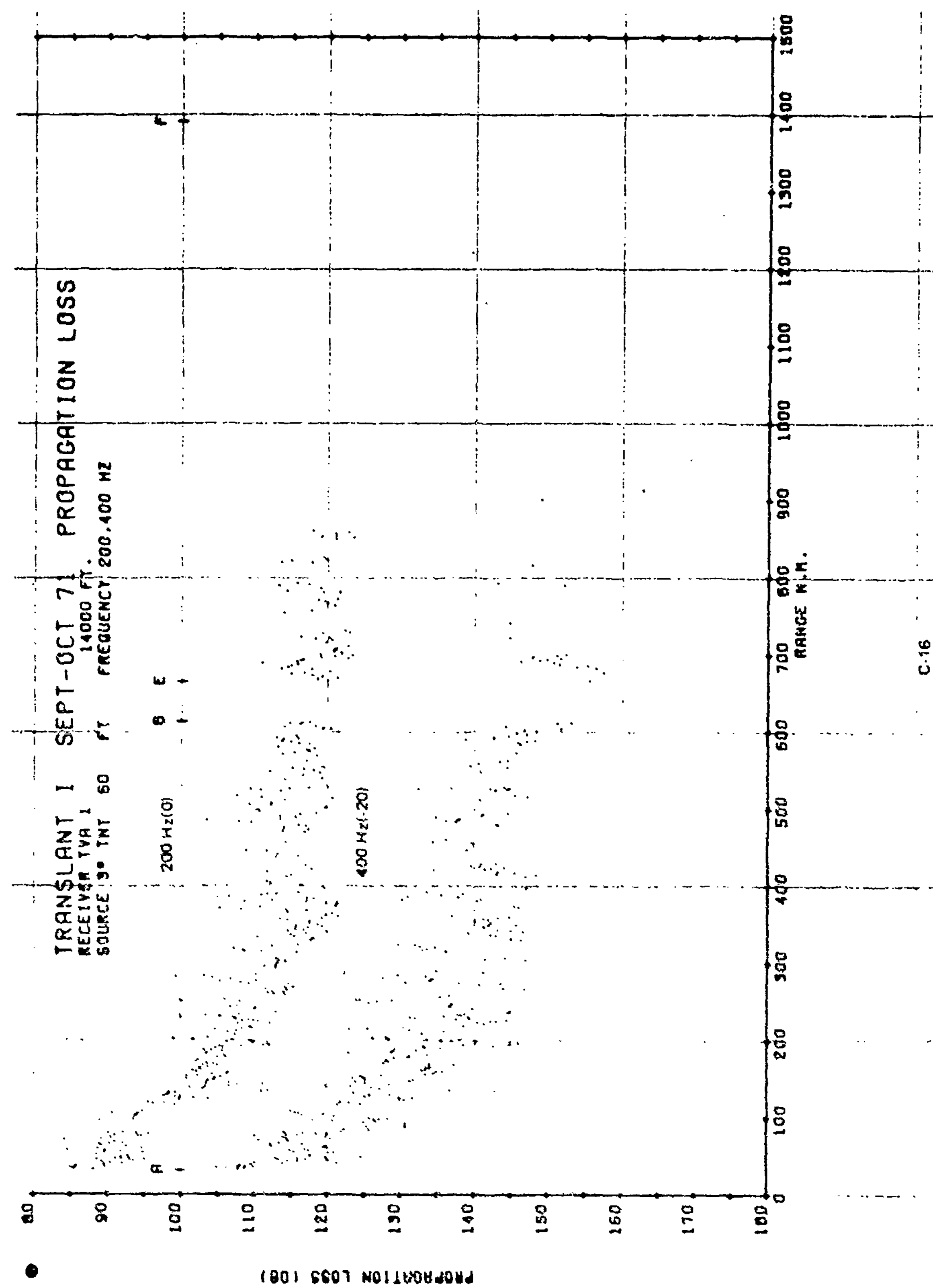

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3* TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
80
90
100
110
120
130
140
150
160
170
180
900
1000
1100
1200
1300
1400
1500

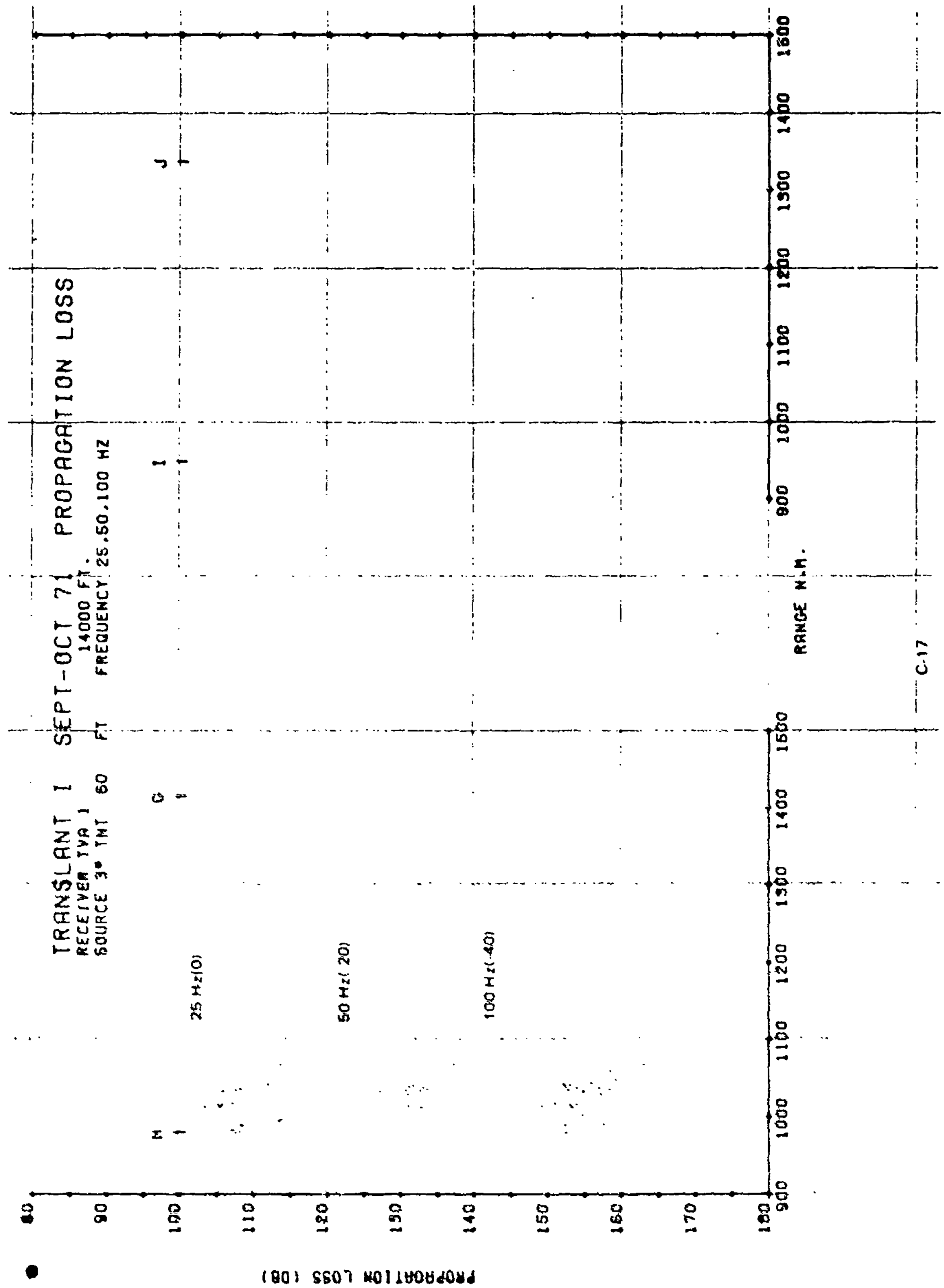
C-12

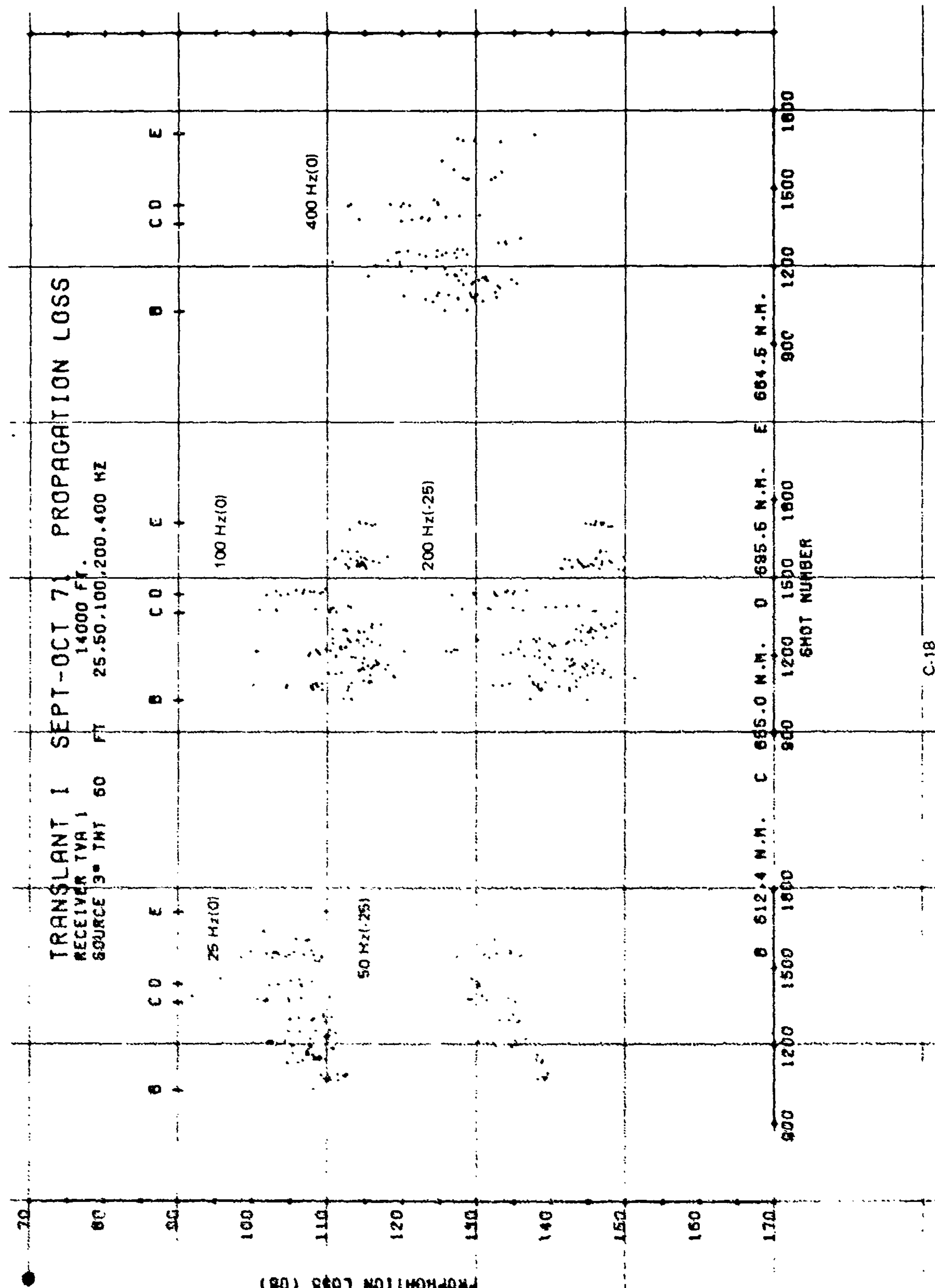

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
PROPAGATION LOSS (DB)
80 90 100 110 120 130 140 150 160 170 180
900 1000 1100 1200 1300 1400 1500
900 1000 1100 1200 1300 1400 1500
C-13

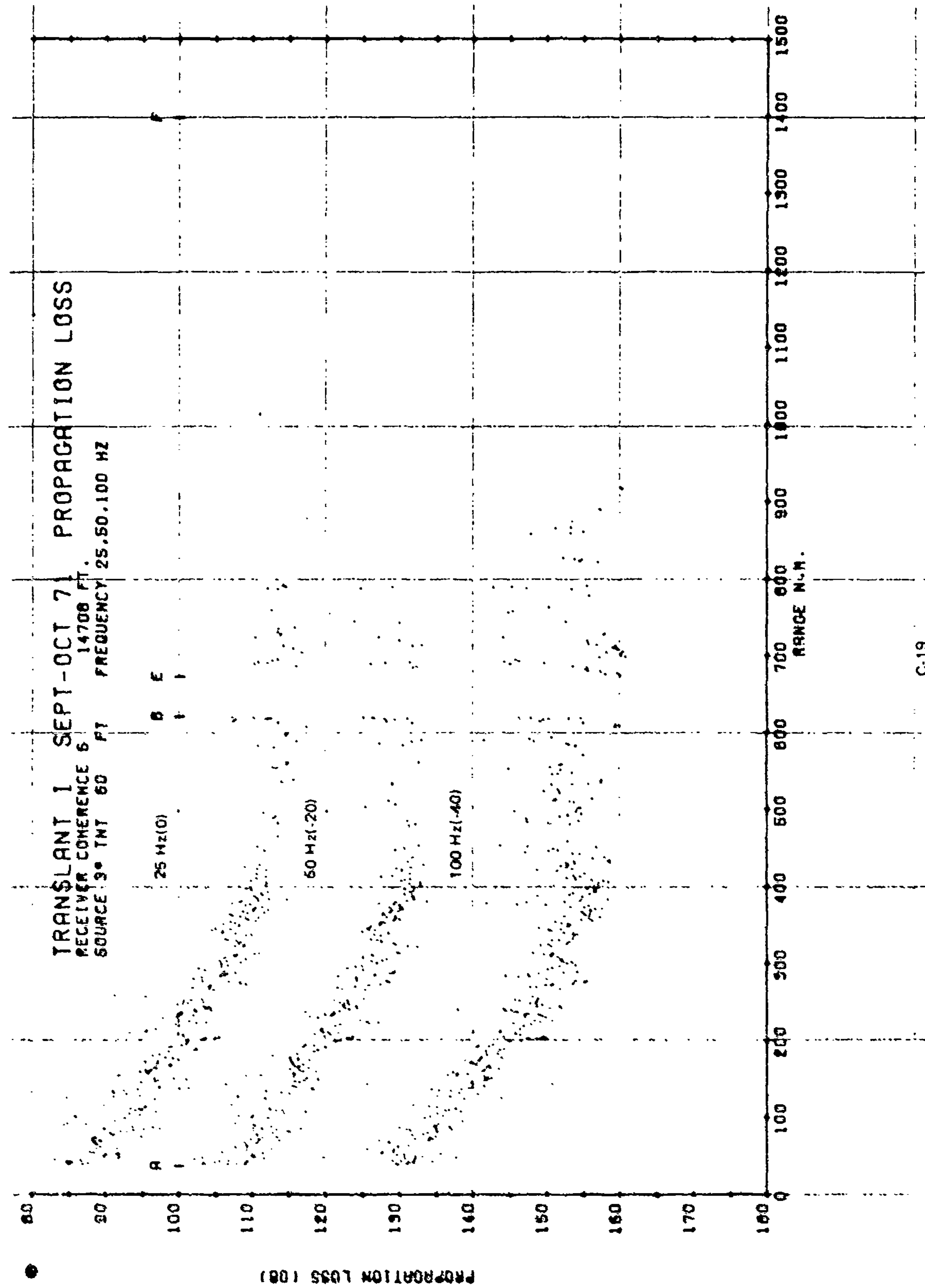

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT 25,50,100,200,400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz(0)
B
C
D
E
611.7 N.M.
646.5 N.M.
667.1 N.M.
663.9 N.M.
900
1200
1500
1800
SHOT NUMBER
70
80
90
100
110
120
130
140
150
160
170
PROPAGATION LOSS (DB)
C-14

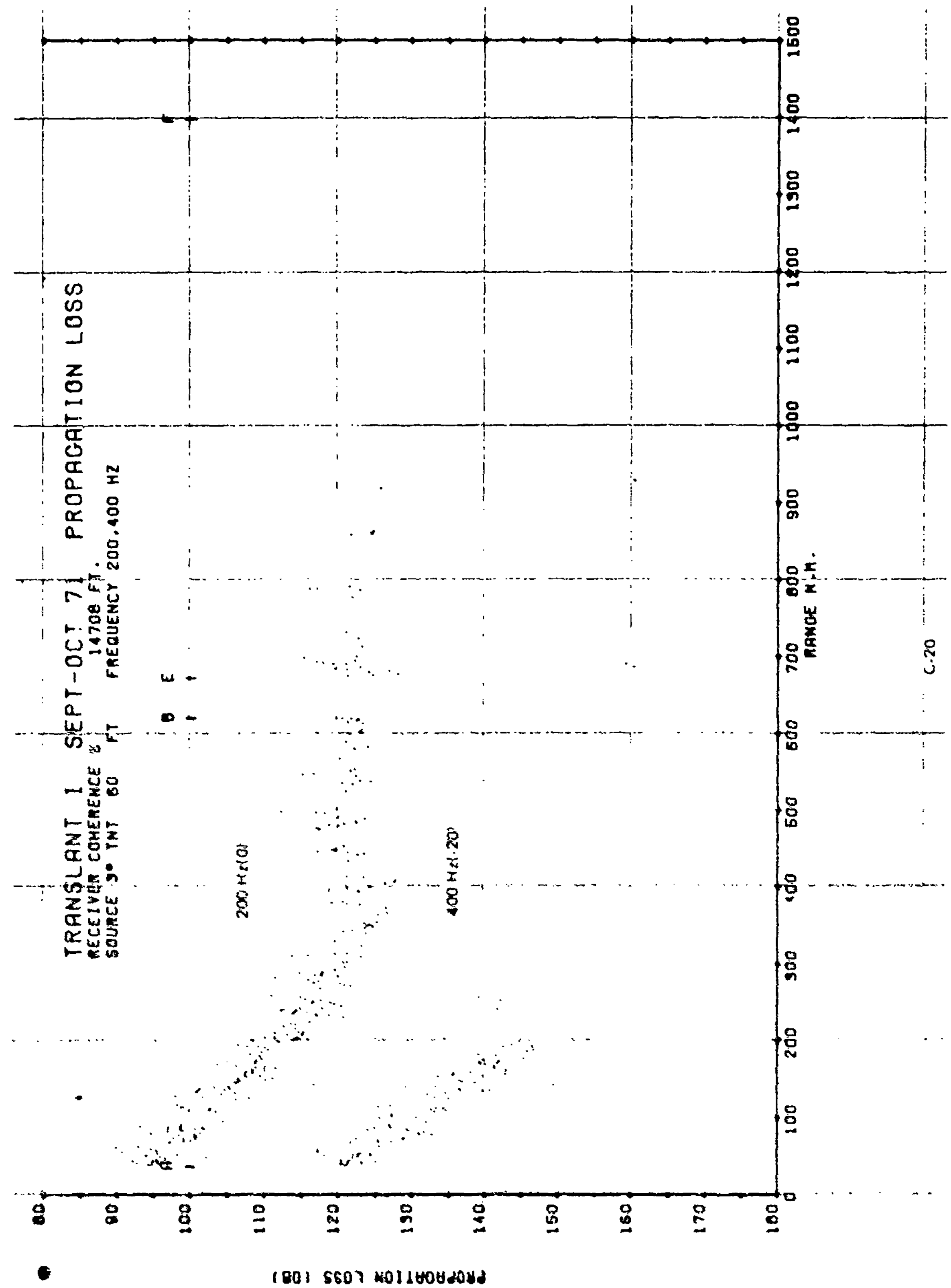

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA I 14000 FT.
SOURCE 2* TKT 60 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-15

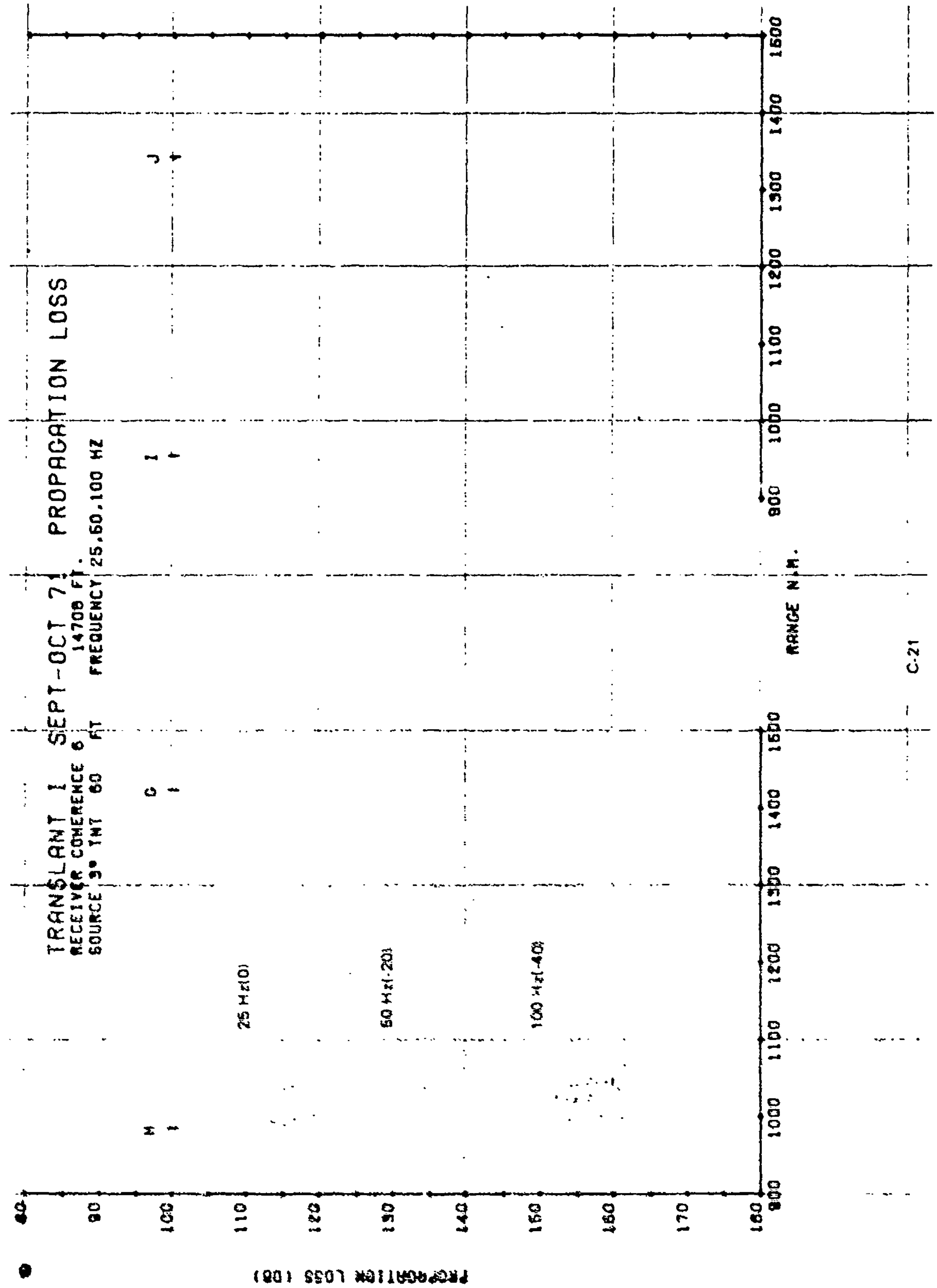

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA 1 14000 FT.
FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
PROPAGATION LOSS (DB)
C-16

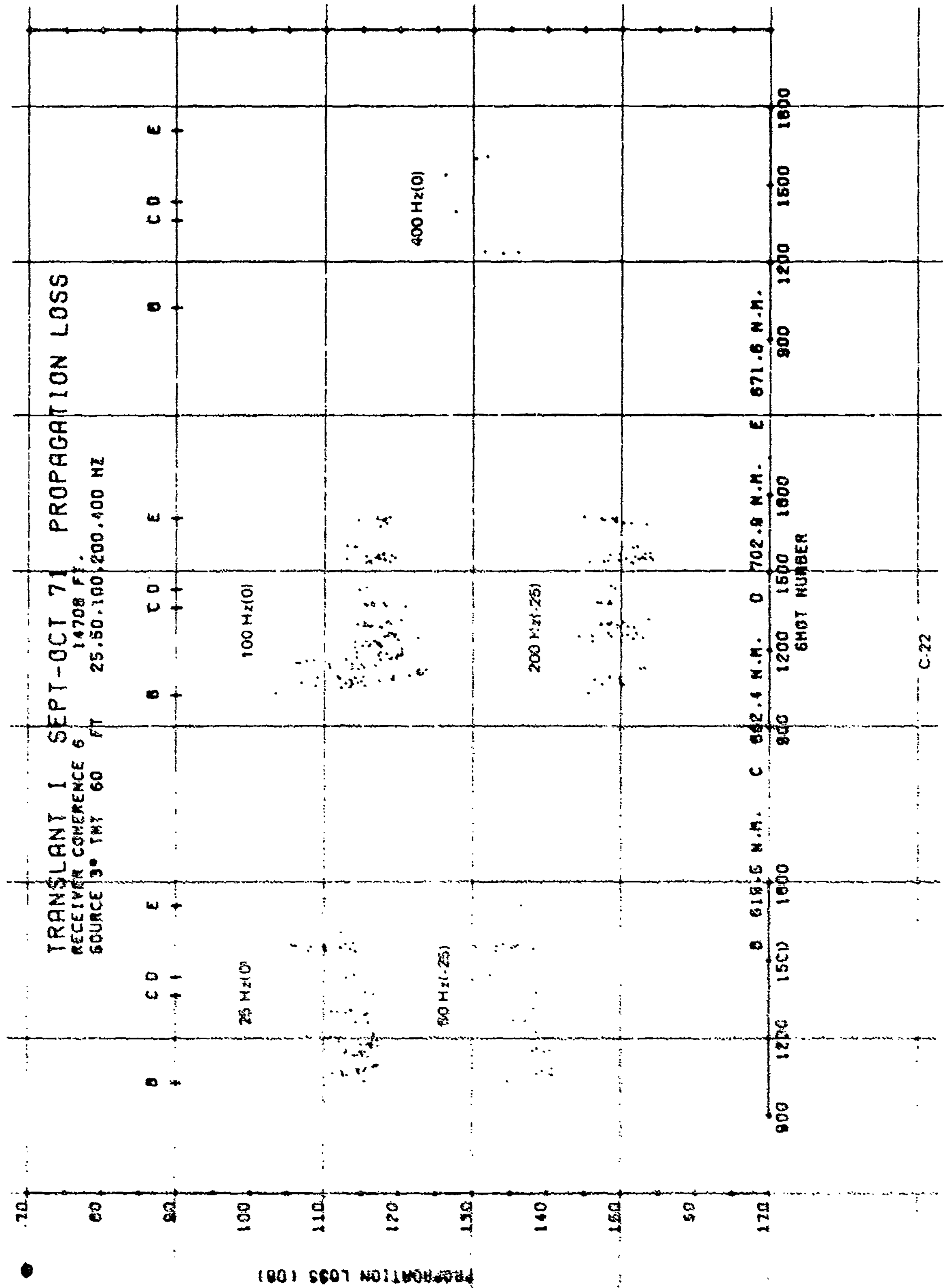

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(20)
100 Hz(-40)
G
I
J
H
RANGE N.M.
PROPAGATION LOSS (DB)
80
90
100
110
120
130
140
150
160
170
180
900
1000
1100
1200
1300
1400
1500
1600
C-17

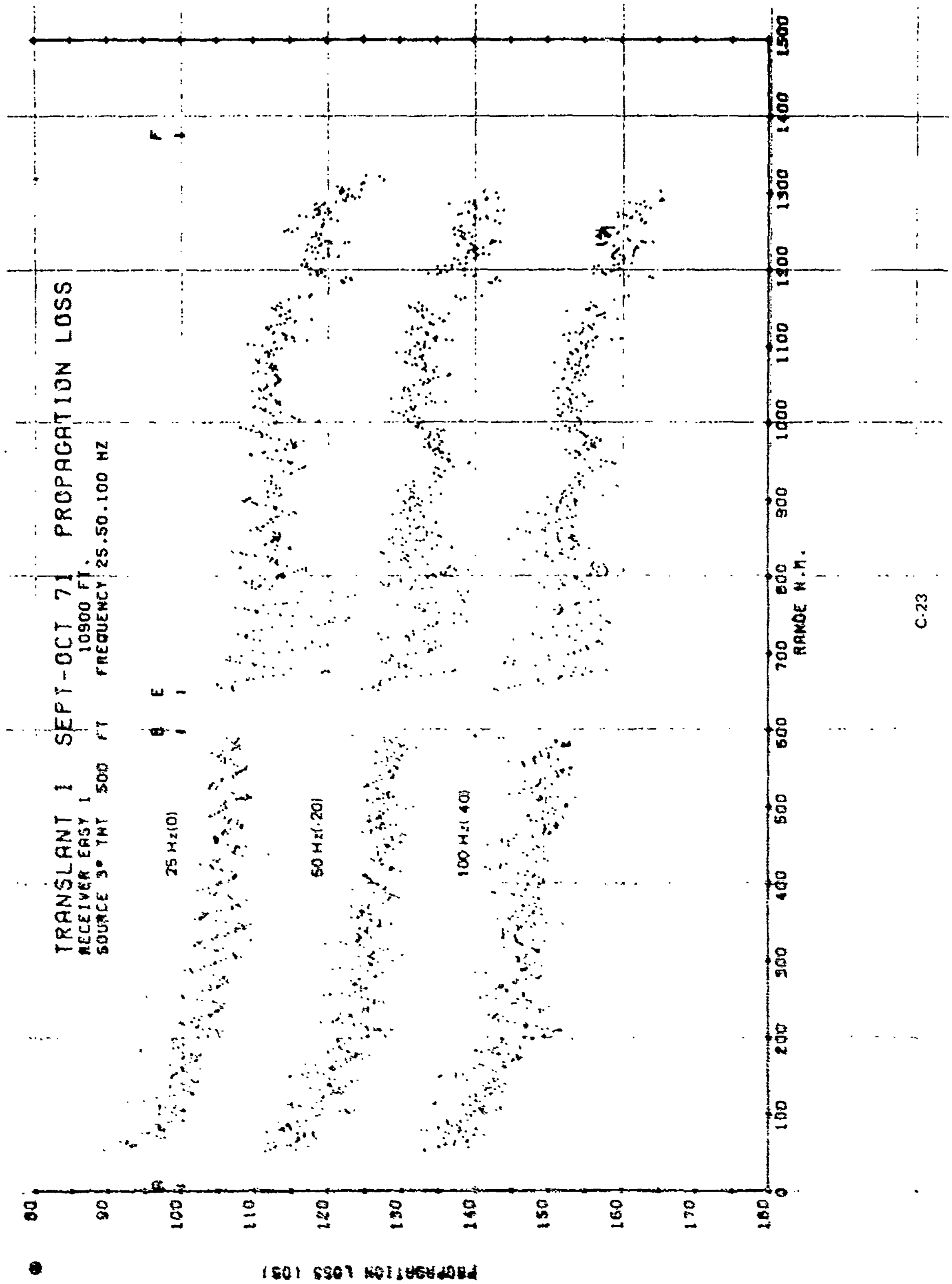

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 60 FT 25.50.100.200.400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz(0)
B
C D
E
612.4 N.M.
635.0 N.M.
685.6 N.M.
684.5 N.M.
900
1200
1500
1800
SHOT NUMBER
70
80
90
100
110
120
130
140
150
160
170
PROPAGATION LOSS (DB)
C.18

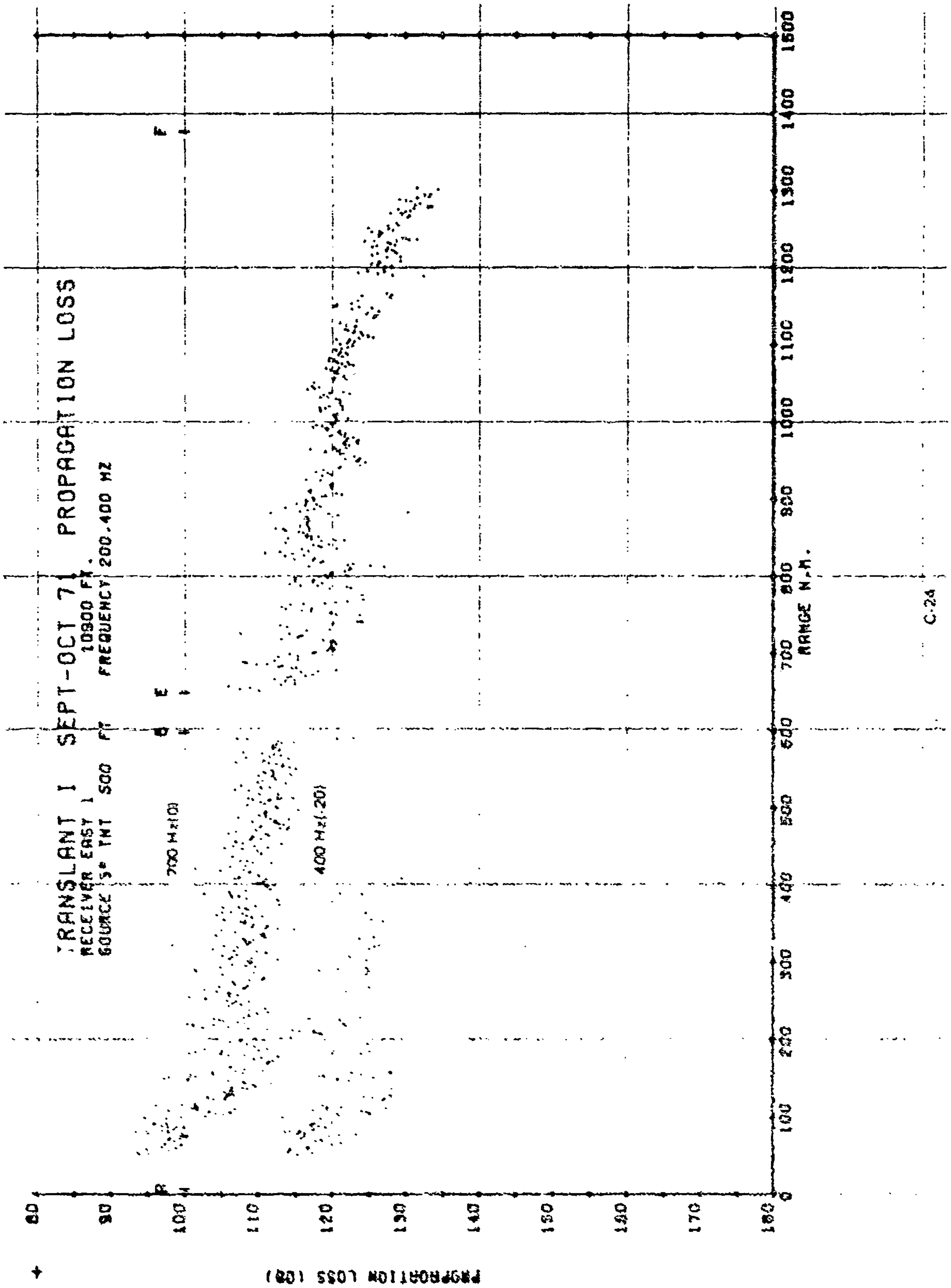

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
80 90 100 110 120 130 140 150 160 170 180
C-19

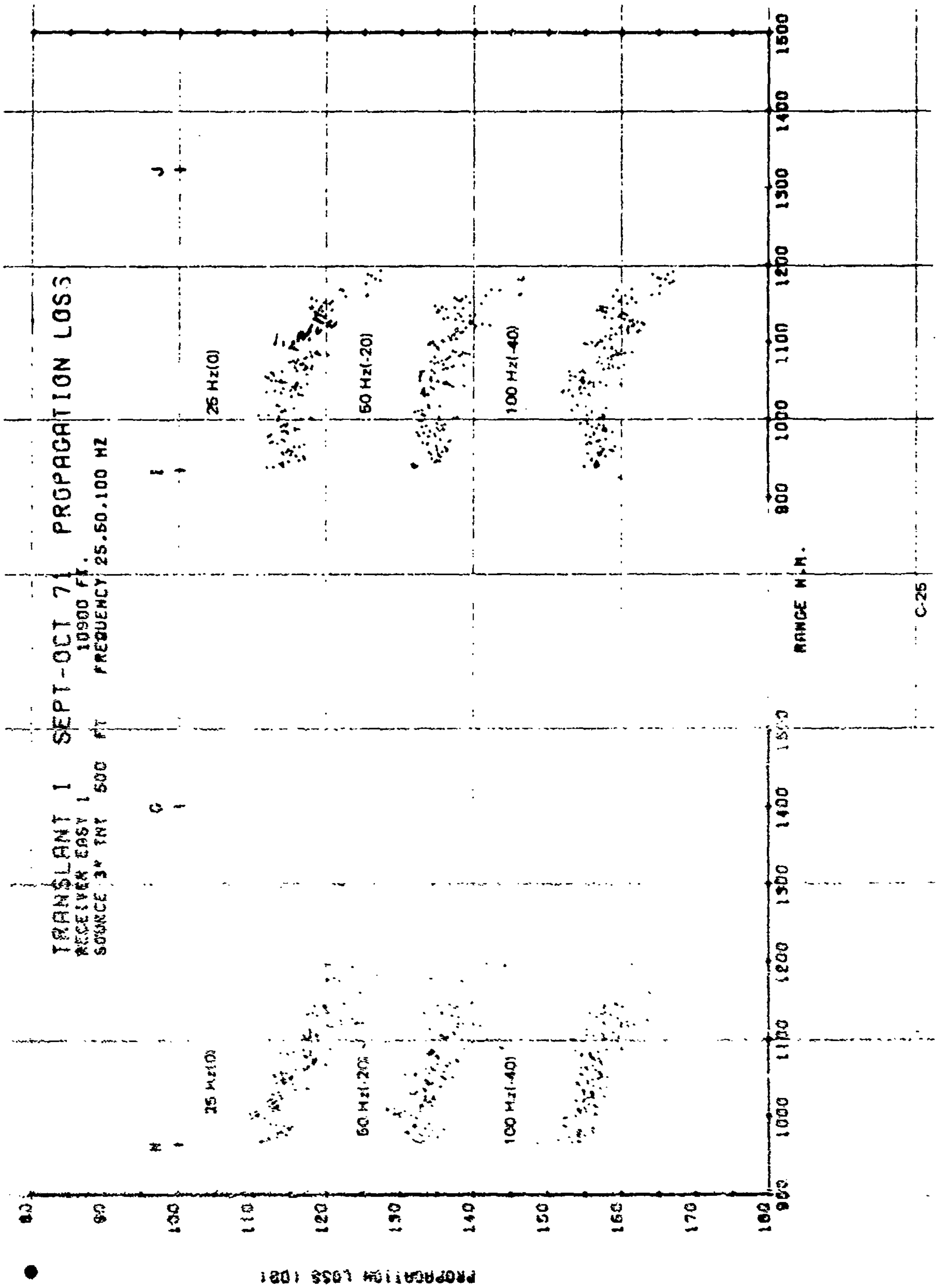

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 2 14708 FT.
SOURCE 3* TNT 60 FT FREQUENCY 200,400 HZ
200 Hz(10)
400 Hz(.20)
RANGE N.M.
PROPAGATION LOSS (DB)
C.20

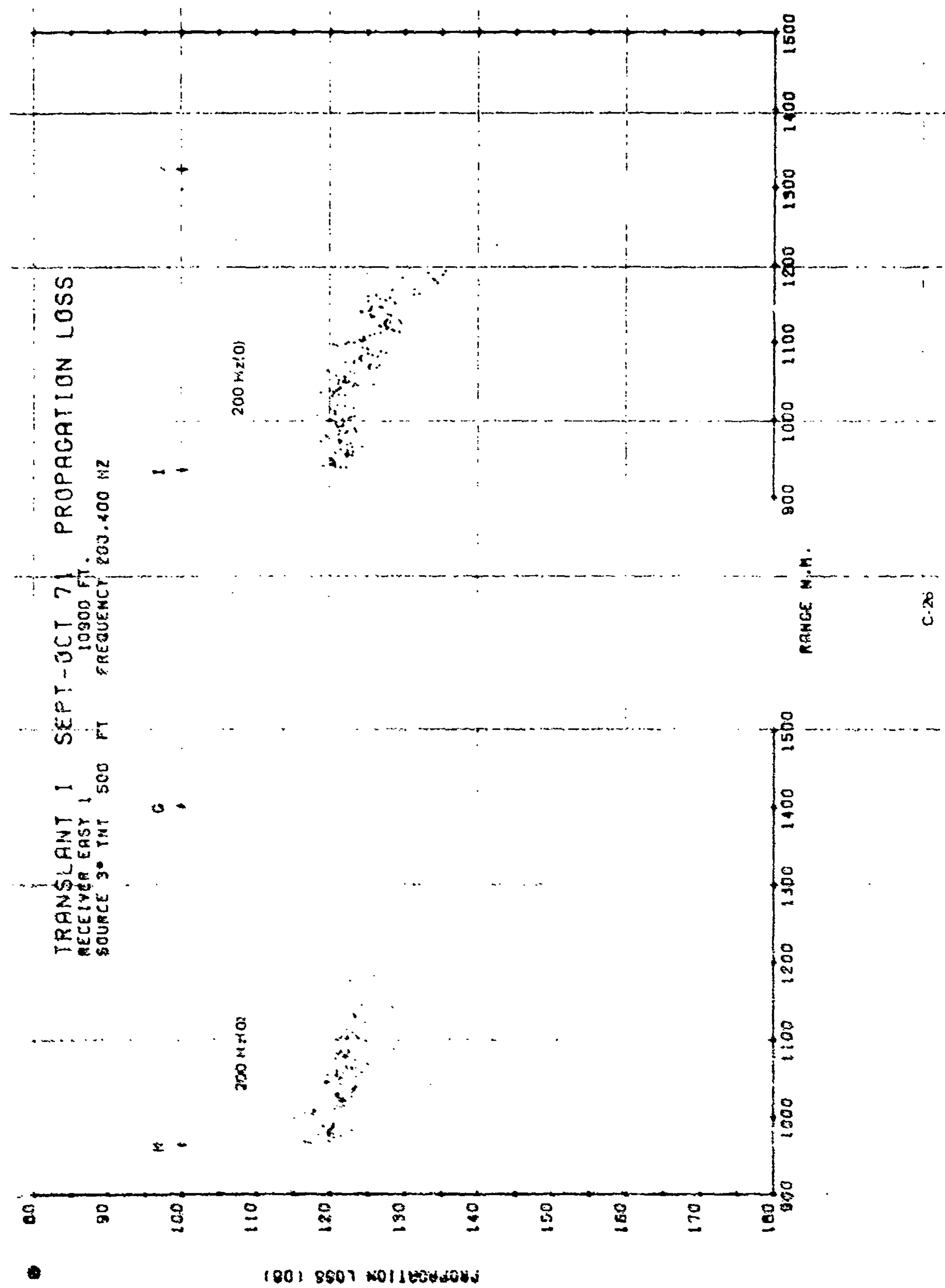

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-21

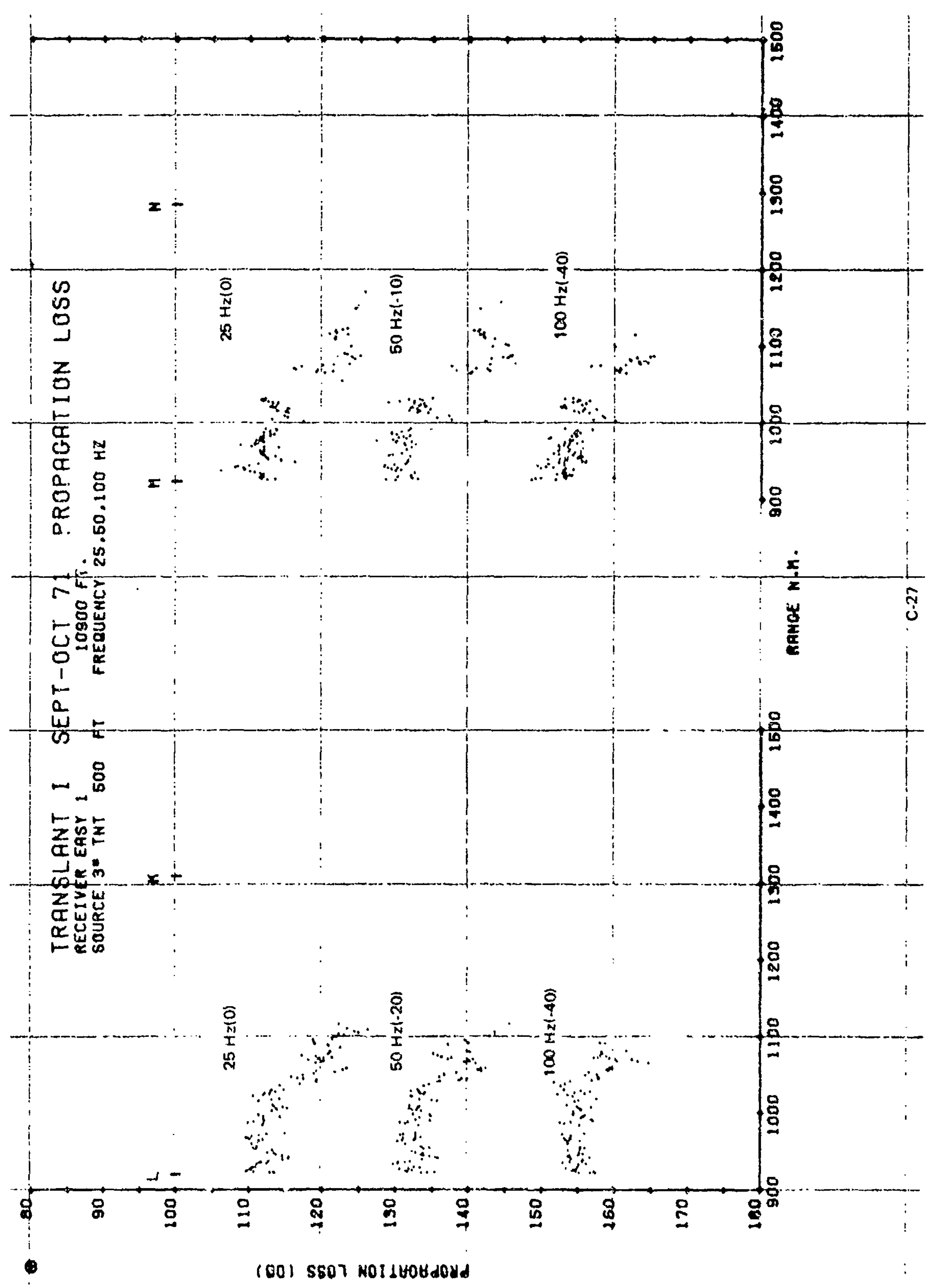

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3° TNT 60 FT 25,50,100,200,400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz(0)
PROPAGATION LOSS (DB)
SHOT NUMBER
B C D E
618.5 N.M.
652.4 N.M.
702.9 N.M.
671.6 N.M.
70 80 90 100 110 120 130 140 150 160 170
900 1200 1500 1800
C-22

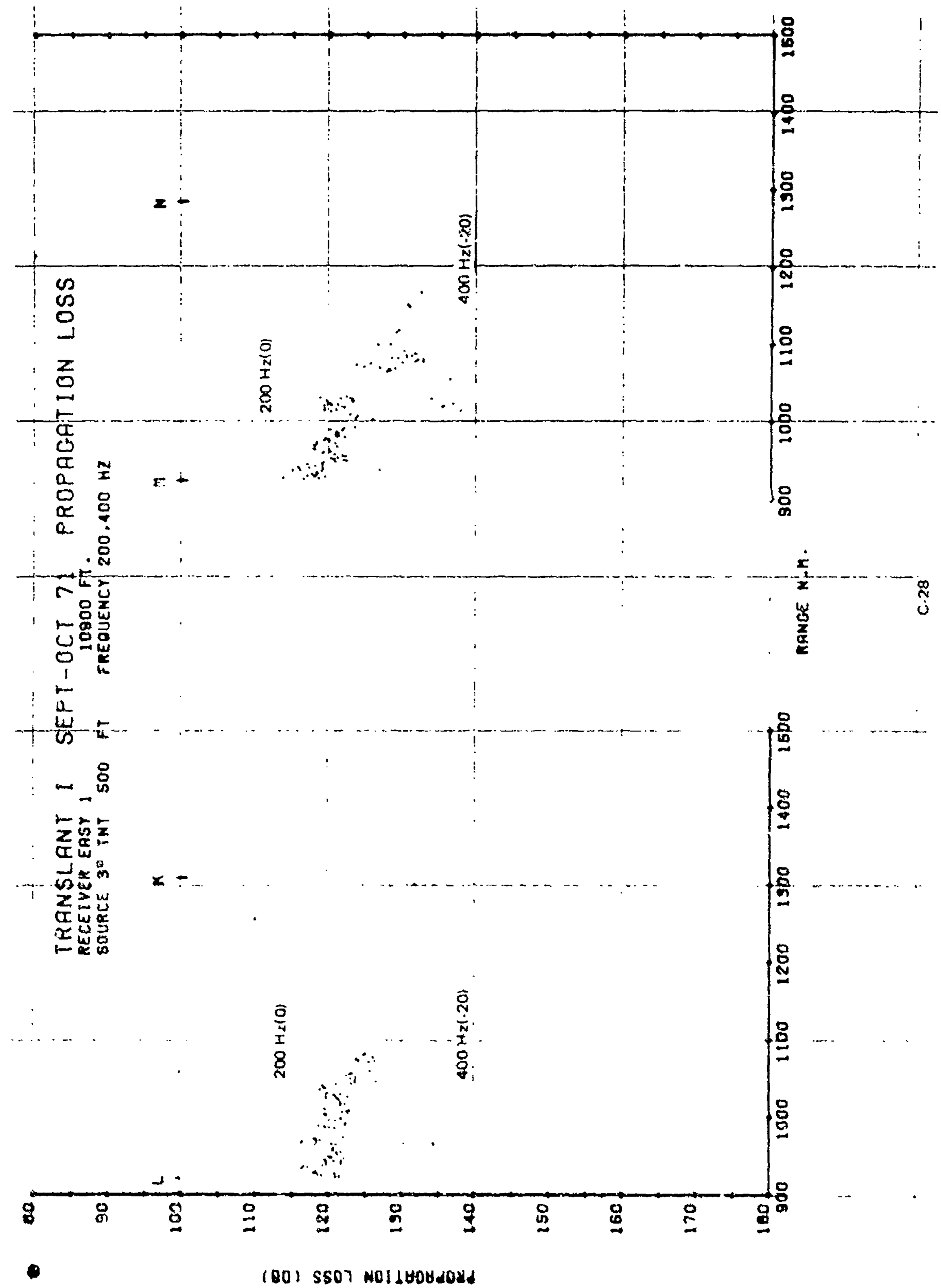

TRANSLANT 1 SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-23

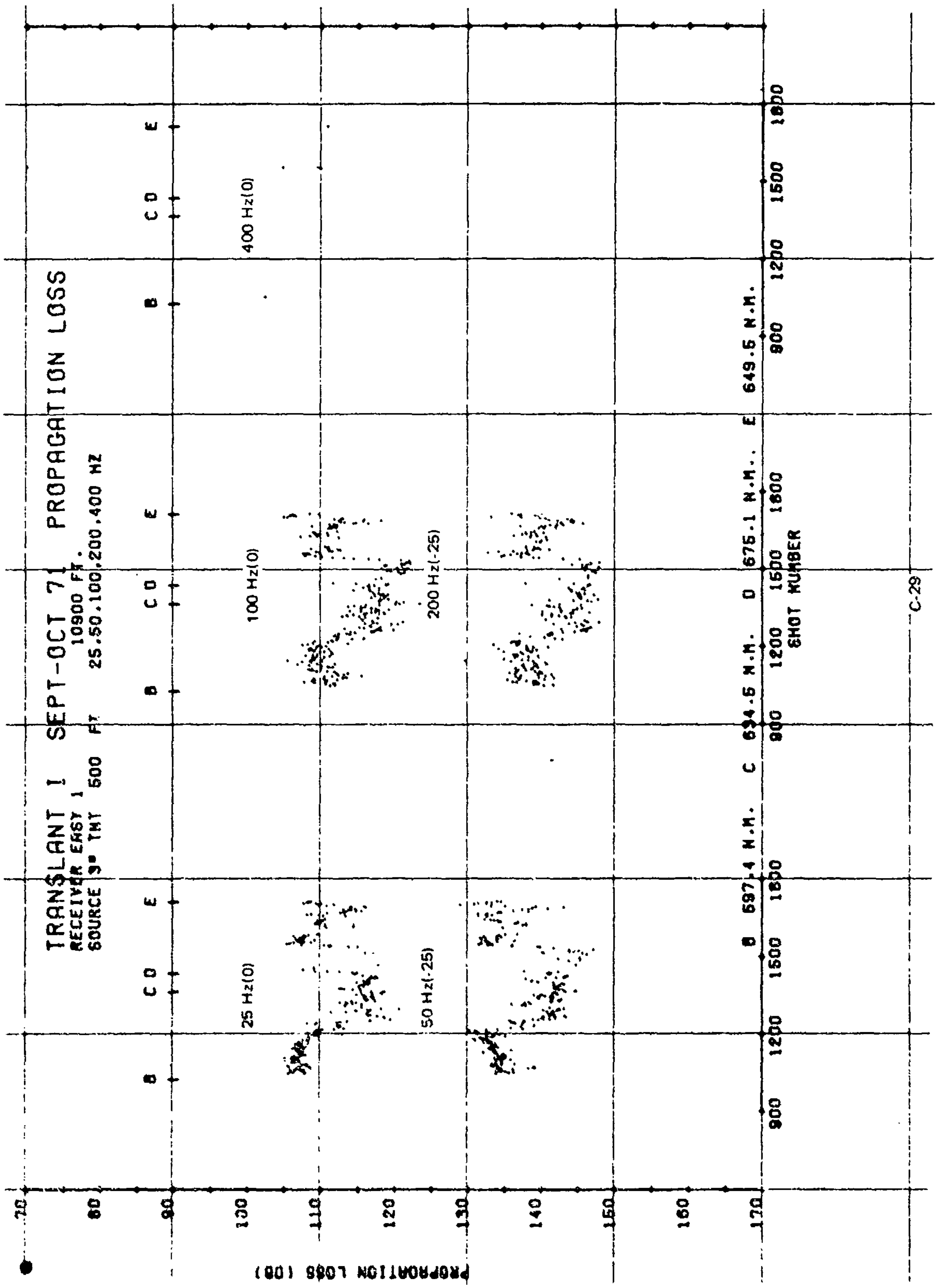

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EAST 1 10900 FT.
SOURCE 5# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
PROPAGATION LOSS (DB)
C-24

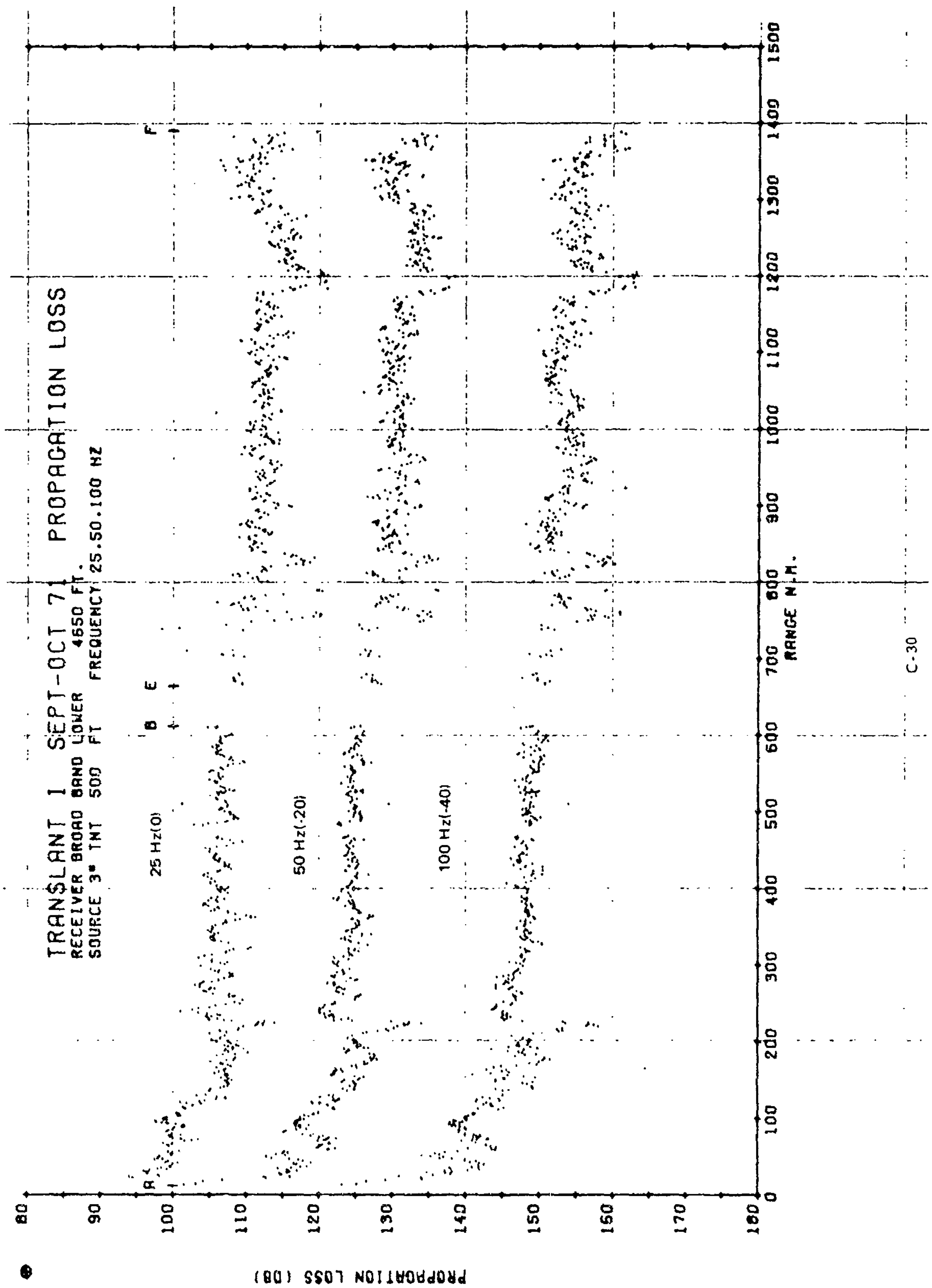

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY I 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-25

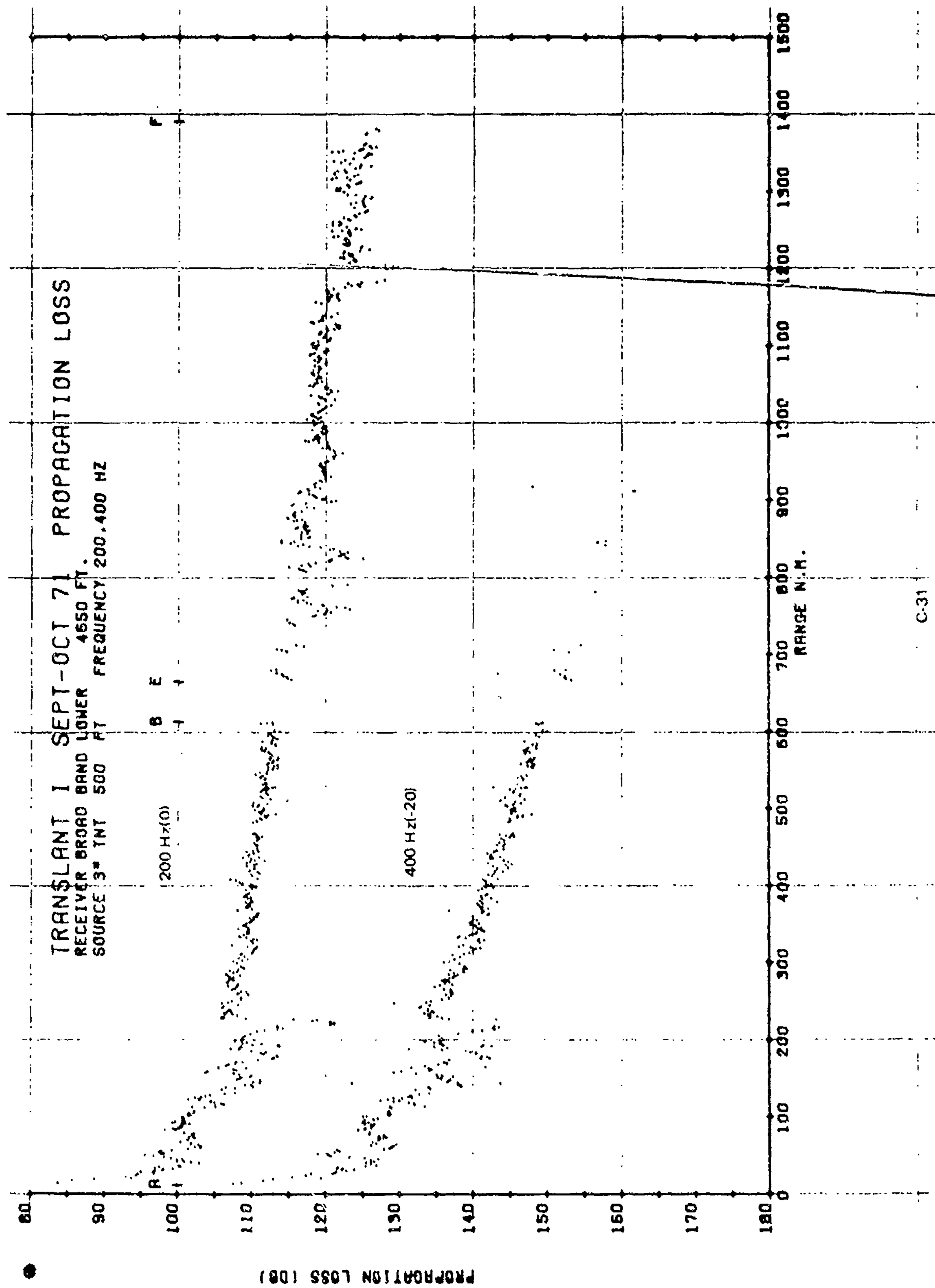

TRANSLANT 1 SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3* TNT 500 FT FREQUENCY 203.400 HZ
200 Hz(0)
200 Hz(0)
PROPAGATION LOSS (DB)
RANGE N.M.
80
90
100
110
120
130
140
150
160
170
180
900
1000
1100
1200
1300
1400
1500
C-26

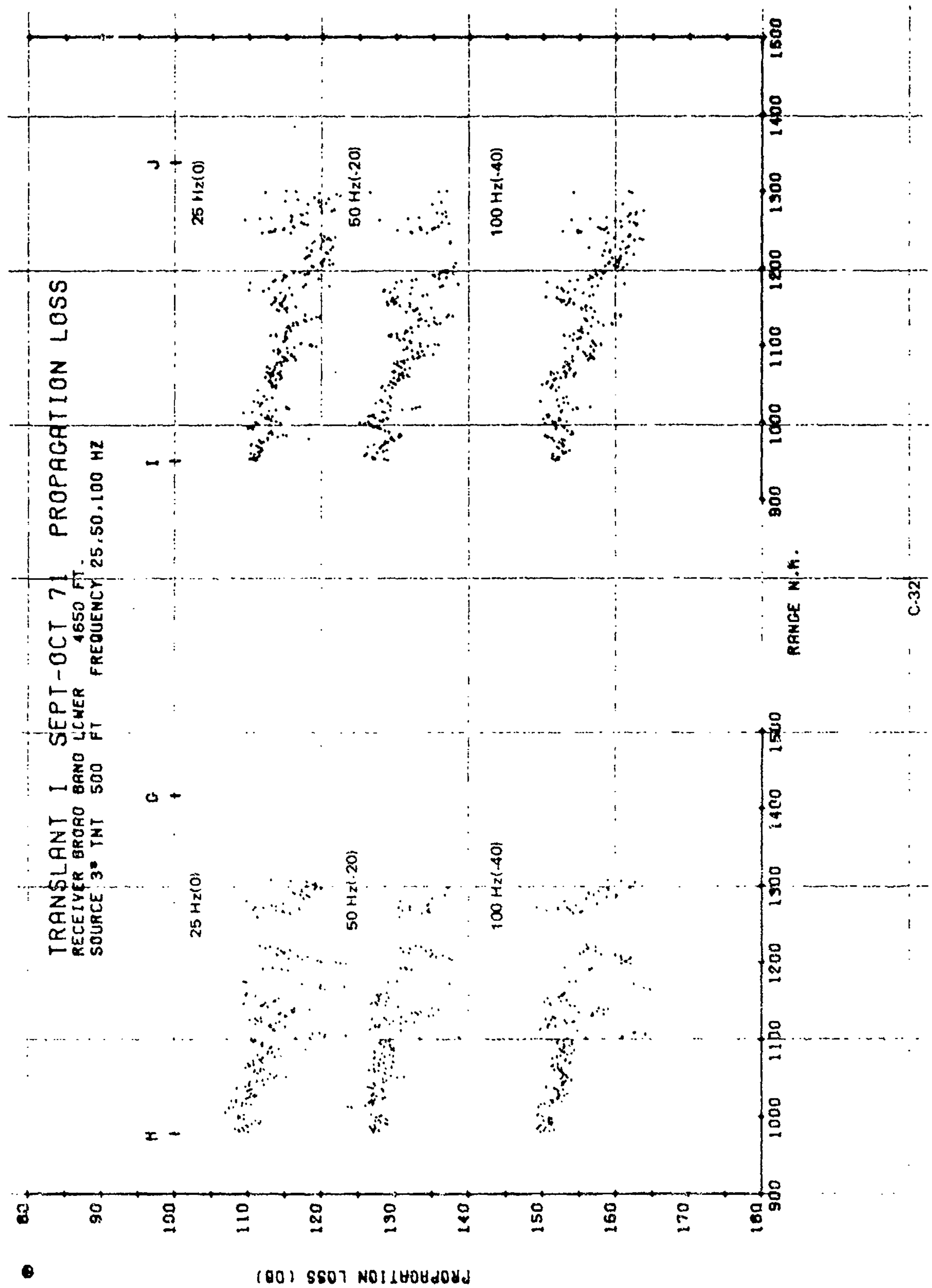

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
25 Hz(0)
50 Hz(-10)
100 Hz(-40)
L
K
M
N
RANGE N.M.
PROPAGATION LOSS (DB)
80 90 100 110 120 130 140 150 160 170 180
900 1000 1100 1200 1300 1400 1500
900 1000 1100 1200 1300 1400 1500
C-27

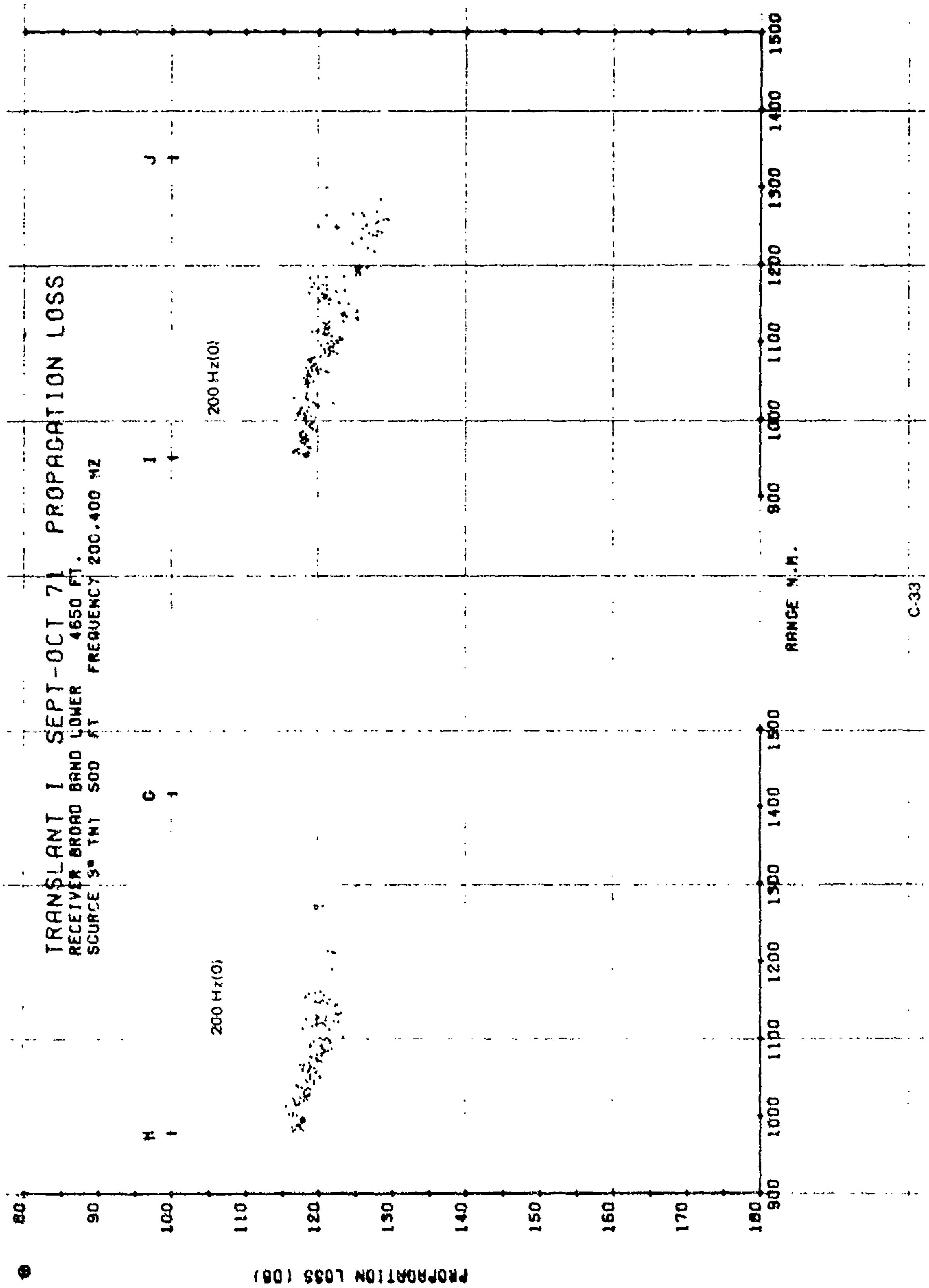

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3° INT 500 FT FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
200 Hz(0)
400 Hz(-20)
PROPAGATION LOSS (DB)
80
90
100
110
120
130
140
150
160
170
180
RANGE N.M.
900
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
C-28

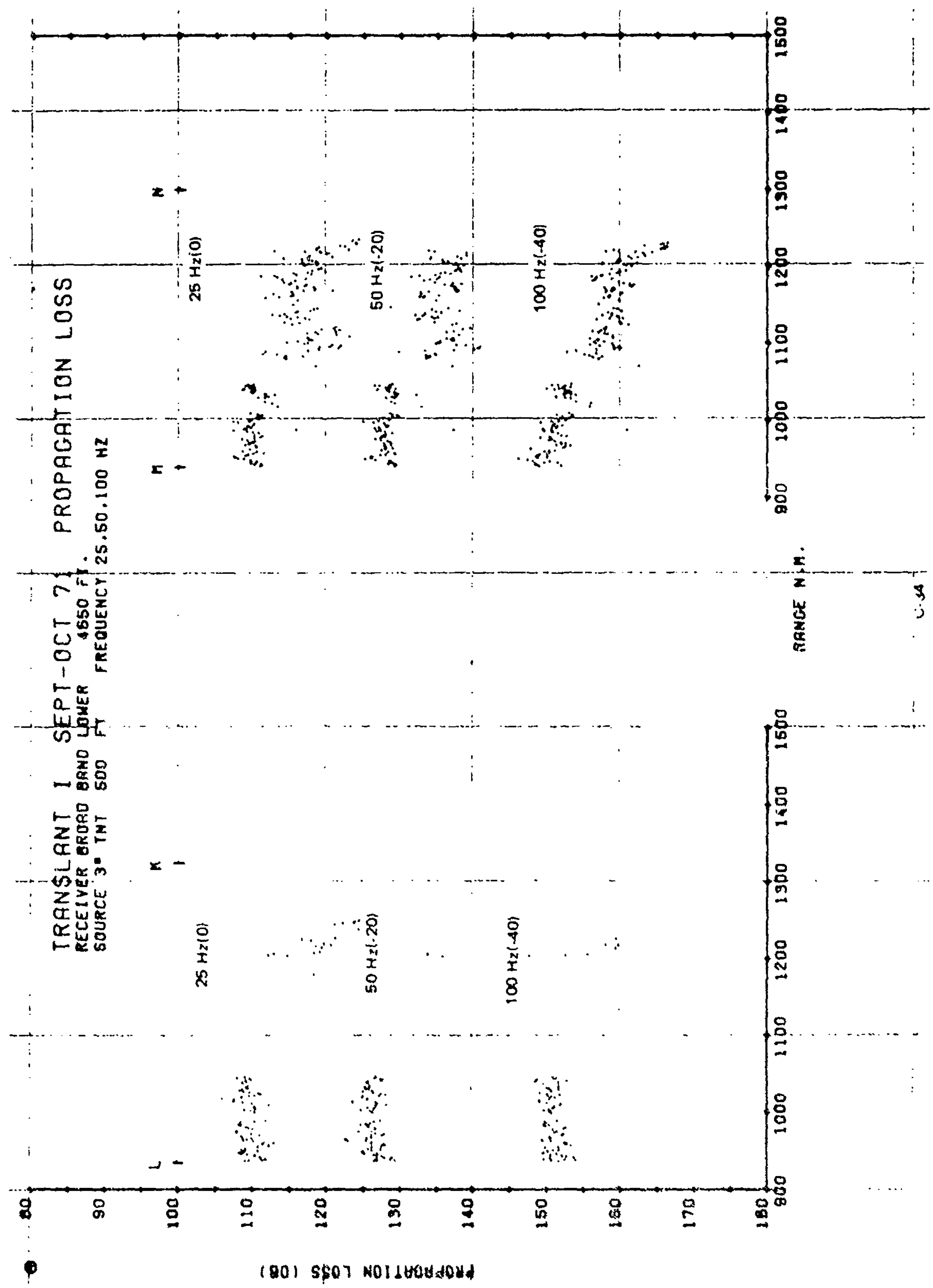

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT 25.50.100.200.400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz(0)
697.4 N.M.
634.5 N.M.
675.1 N.M.
649.5 N.M.
SHOT NUMBER
PROPAGATION LOSS (DB)
C-29

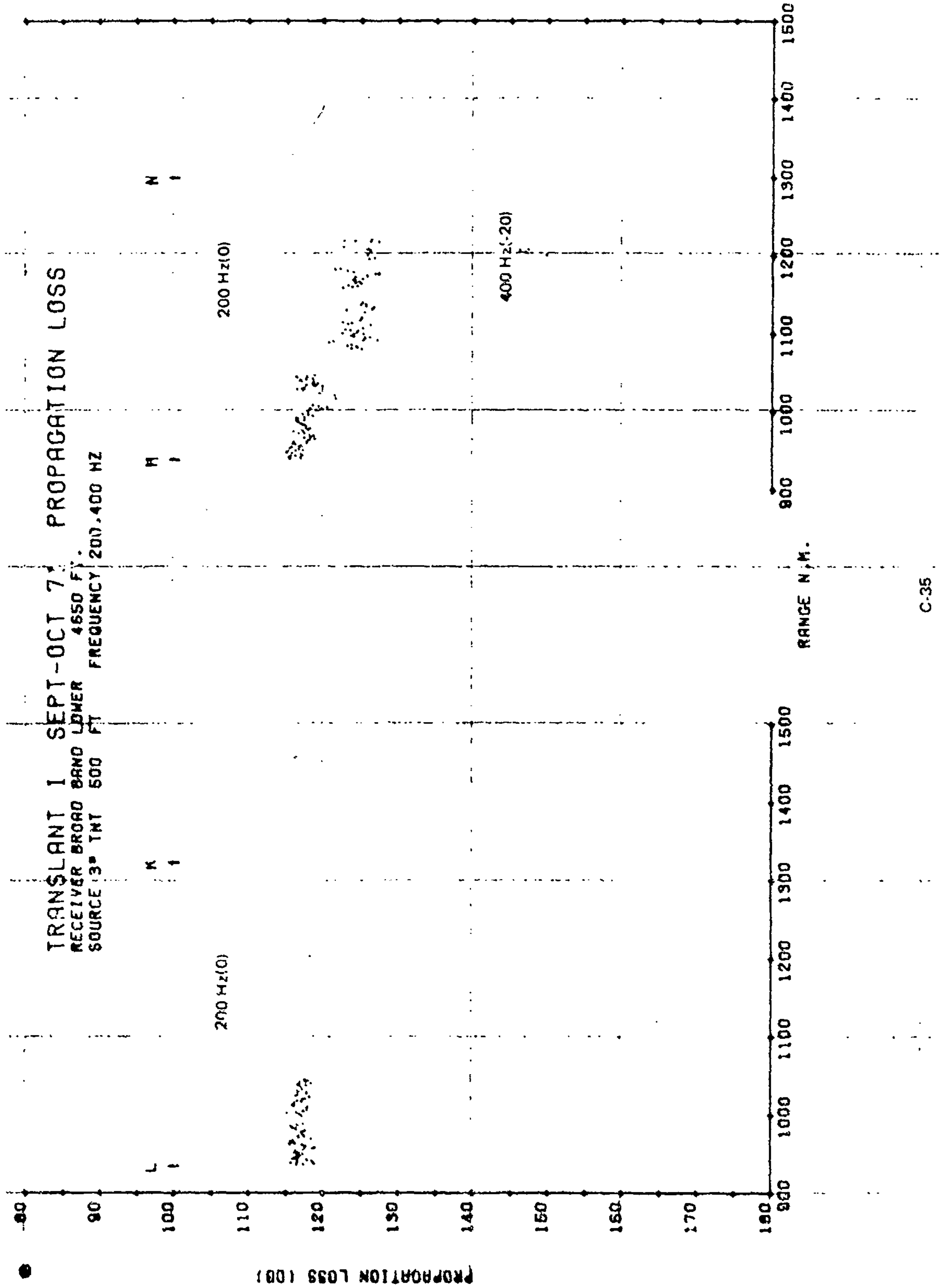

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-30

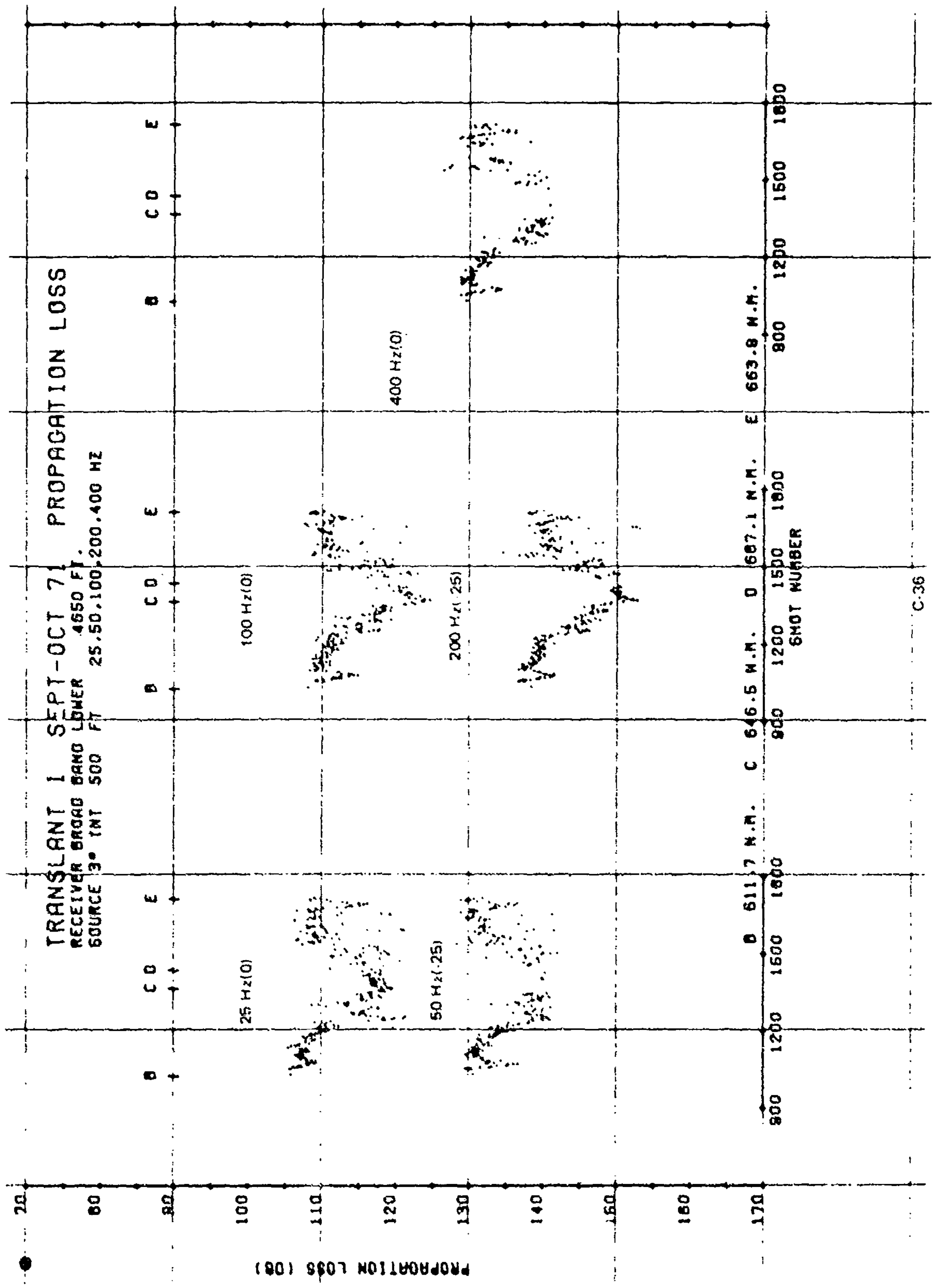

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200.400 HZ
200 Hz(0)
400 Hz(-20)
RANGE N.M.
C-31

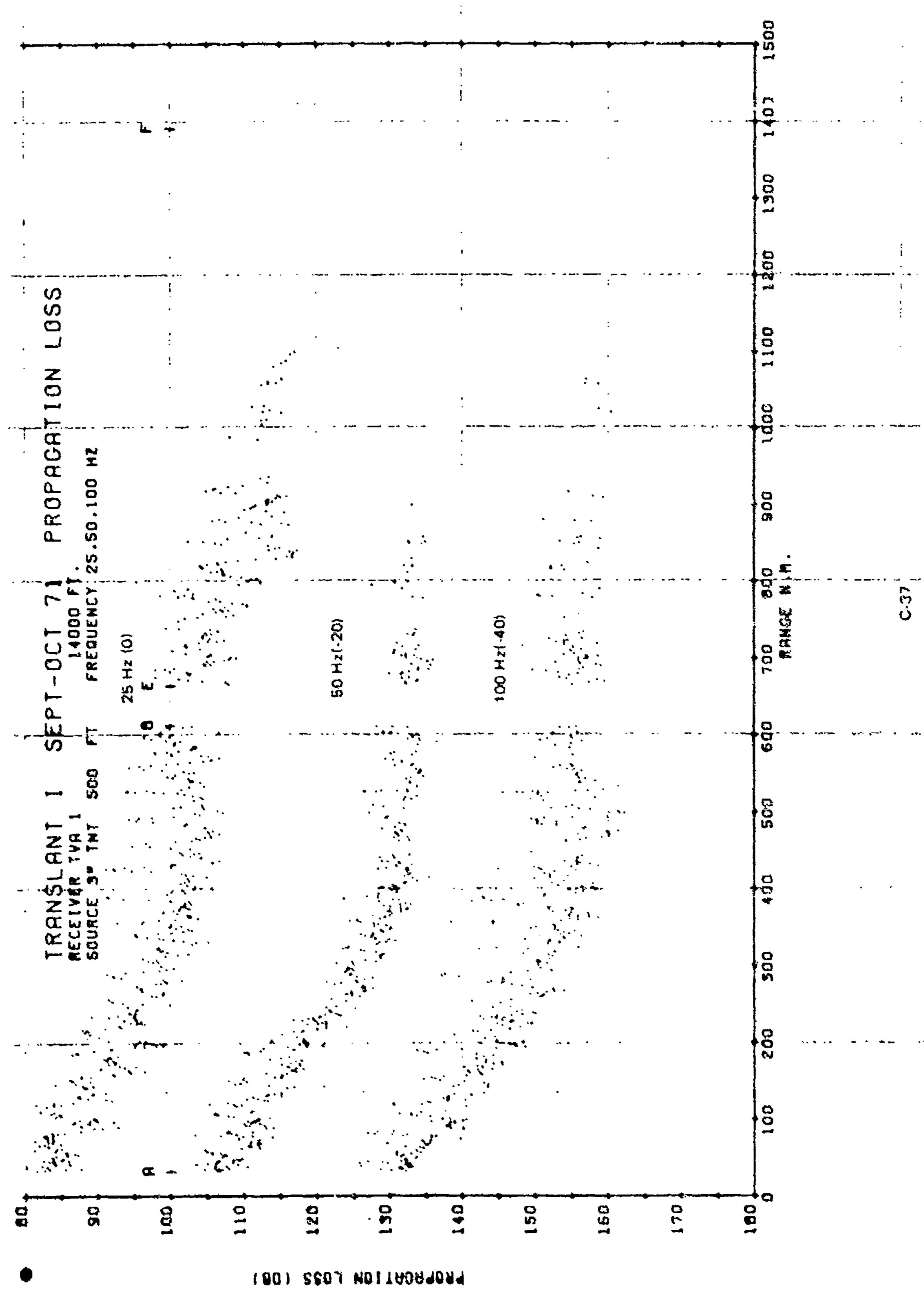

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
H
G
I
J
PROPAGATION LOSS (DB)
RANGE N.M.
C-32

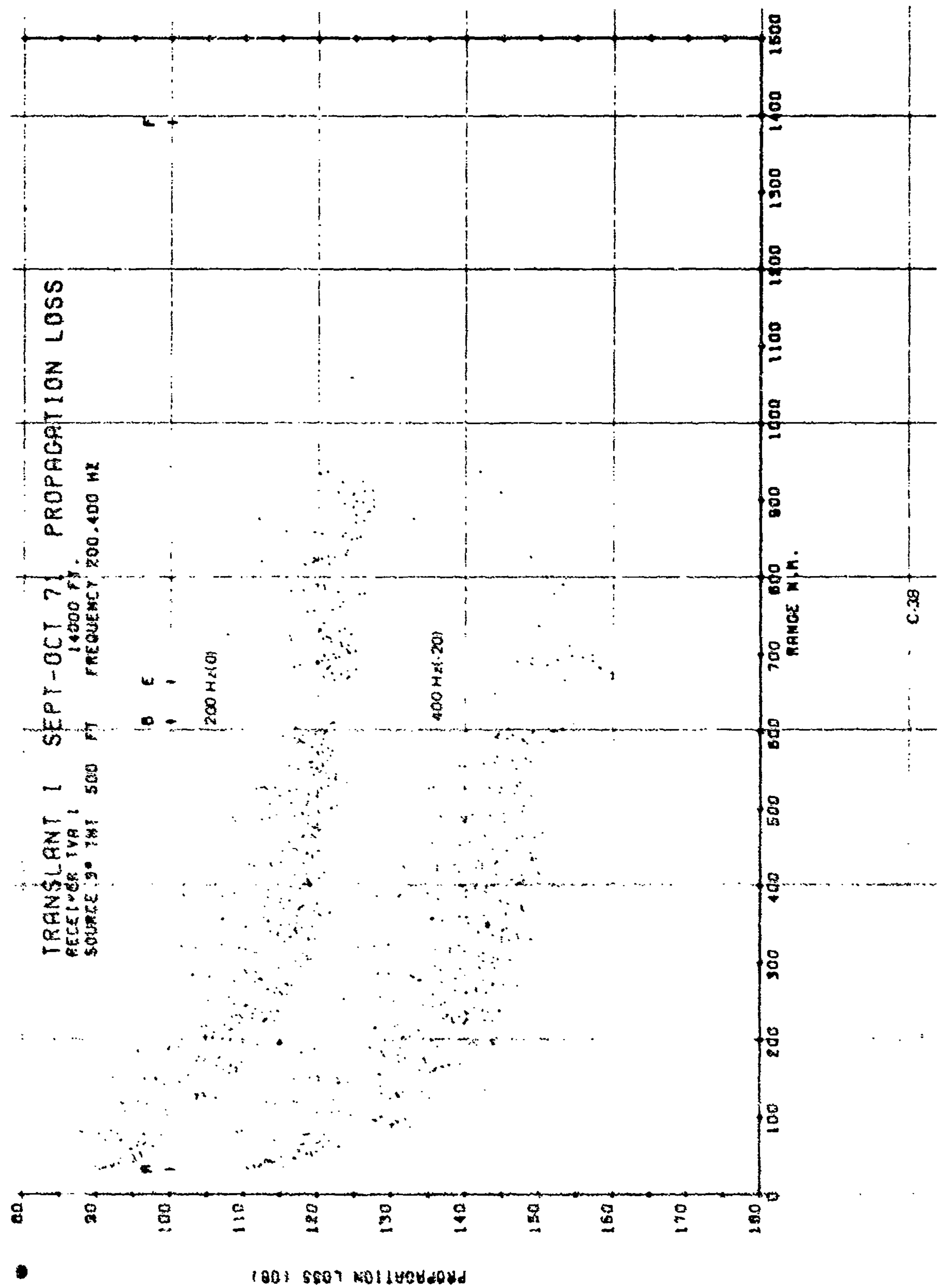

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 5# TNT 500 FT FREQUENCY 200.400 HZ
200 Hz(0)
200 Hz(0)
H
G
I
J
RANGE N.M.
PROPAGATION LOSS (DB)
C-33

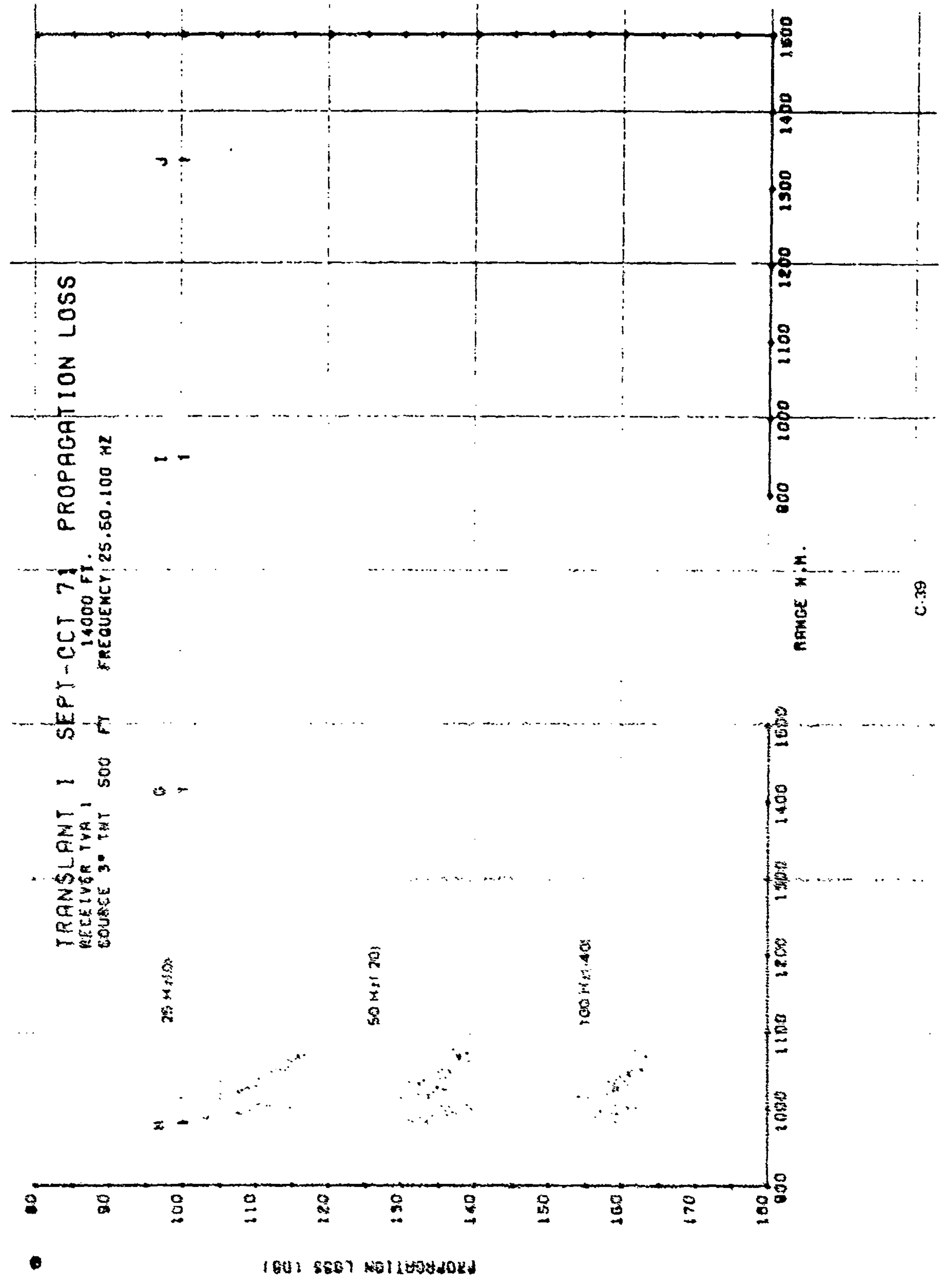

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)

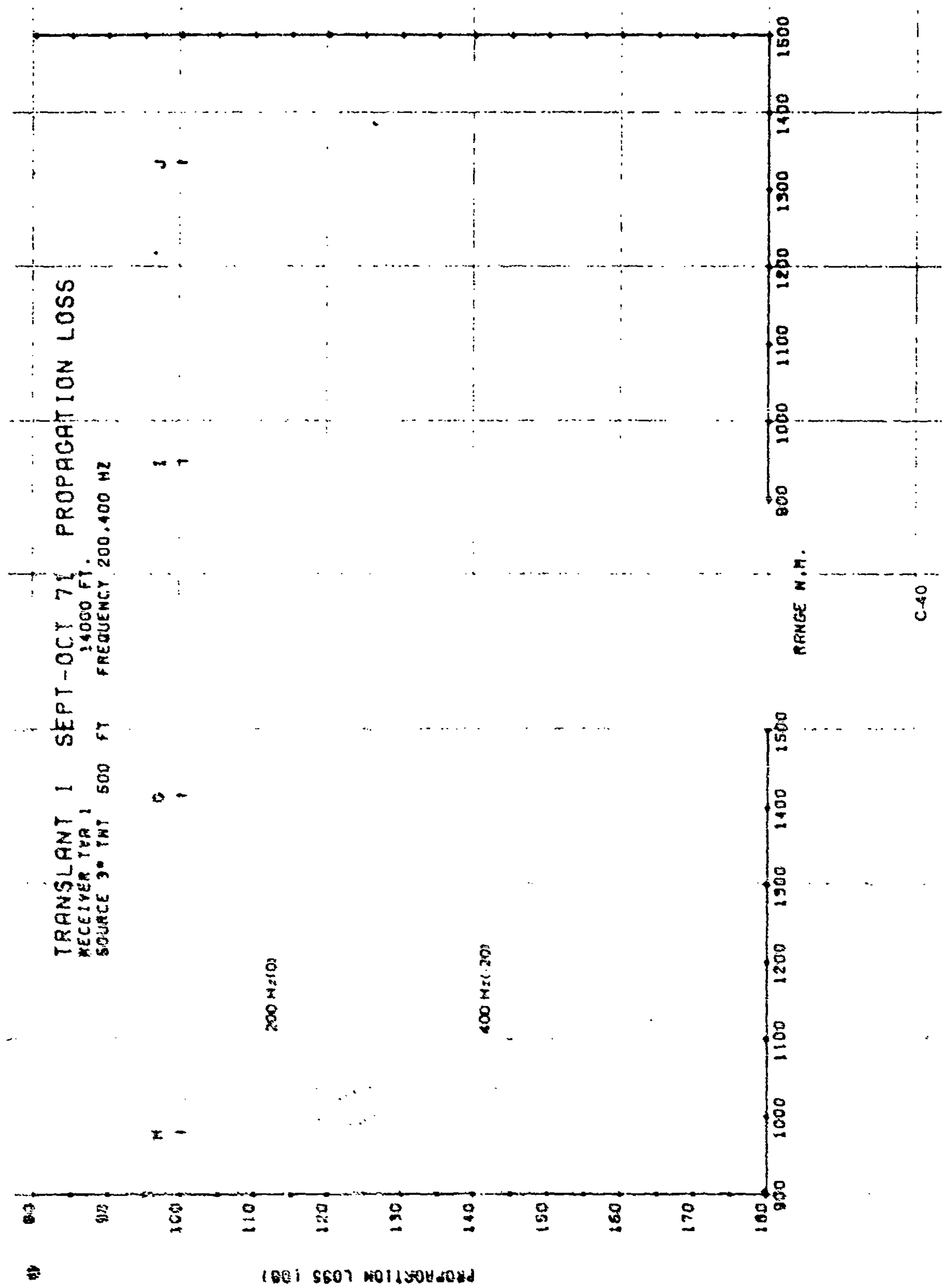

TRANSLANT I SEPT-OCT 7? PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
200 Hz(0)
PROPAGATION LOSS (DB)
80
90
100
110
120
130
140
150
160
170
180
RANGE N.M.
900
1000
1100
1200
1300
1400
1500
C-35


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT 25,50,100,200,400 HZ
25 Hz(0)
50 Hz(.25)
100 Hz(0)
200 Hz(.25)
400 Hz(0)
PROPAGATION LOSS (DB)
SHOT NUMBER
C-36


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-37

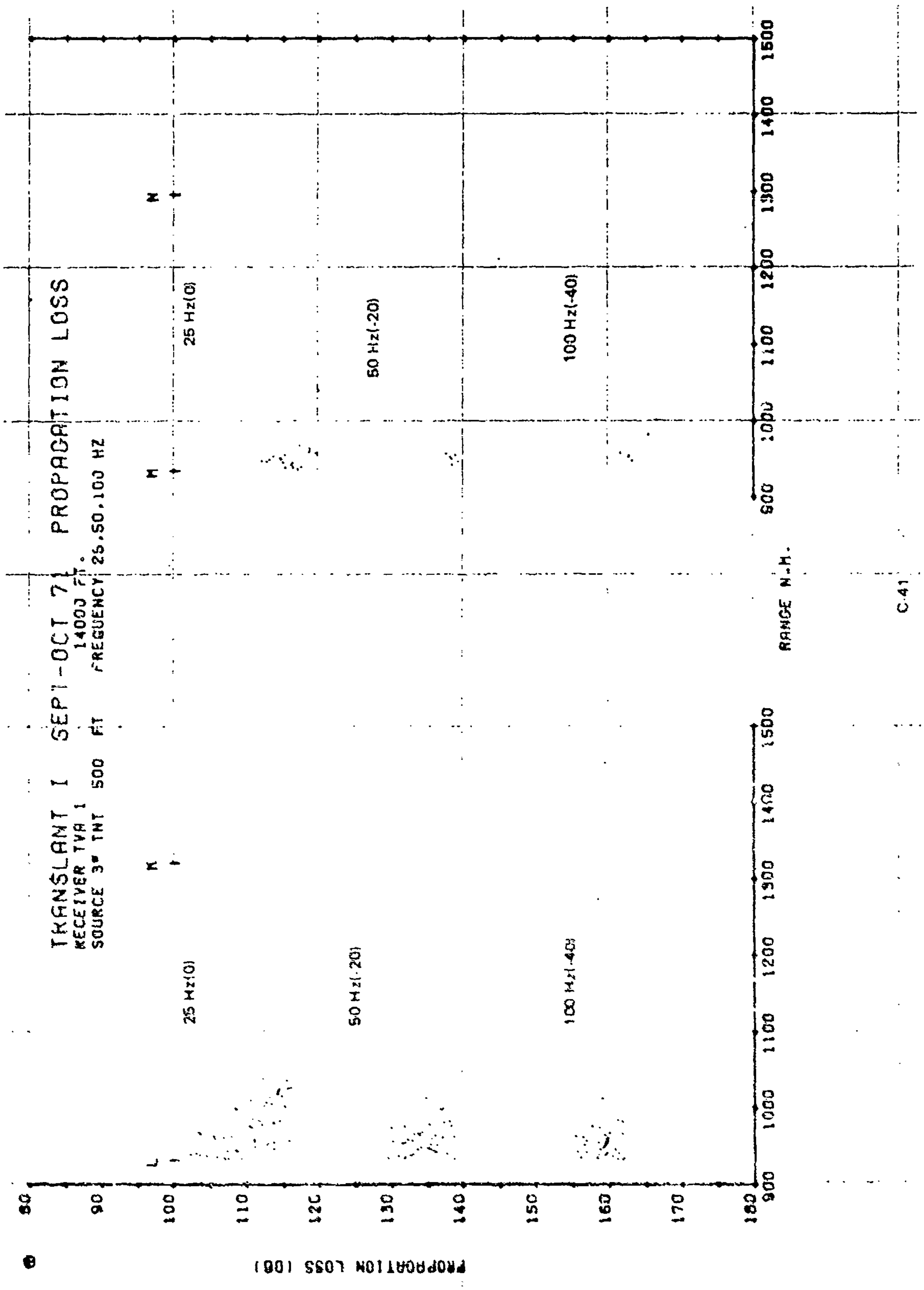

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA I 14000 FT.
SOURCE 3* TNT 500 FT FREQUENCY 200,400 HZ
200 Hz (0)
400 Hz (-20)
RANGE N.M.
PROPAGATION LOSS (DB)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
80
90
100
110
120
130
140
150
160
170
180
C-38


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVA I 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY: 25.50.100 HZ
25 Hz (10)
50 Hz (20)
100 Hz (40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-39

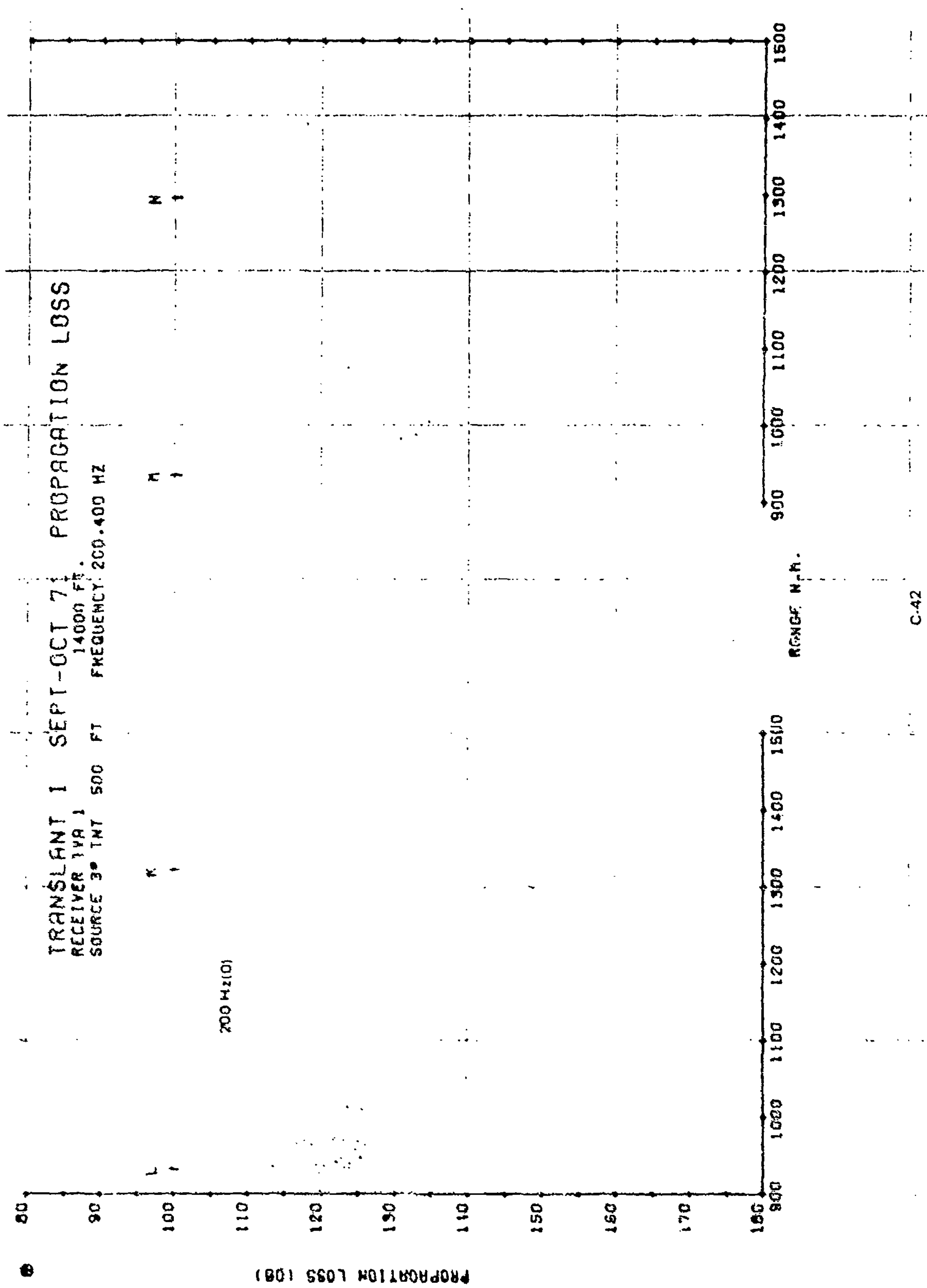


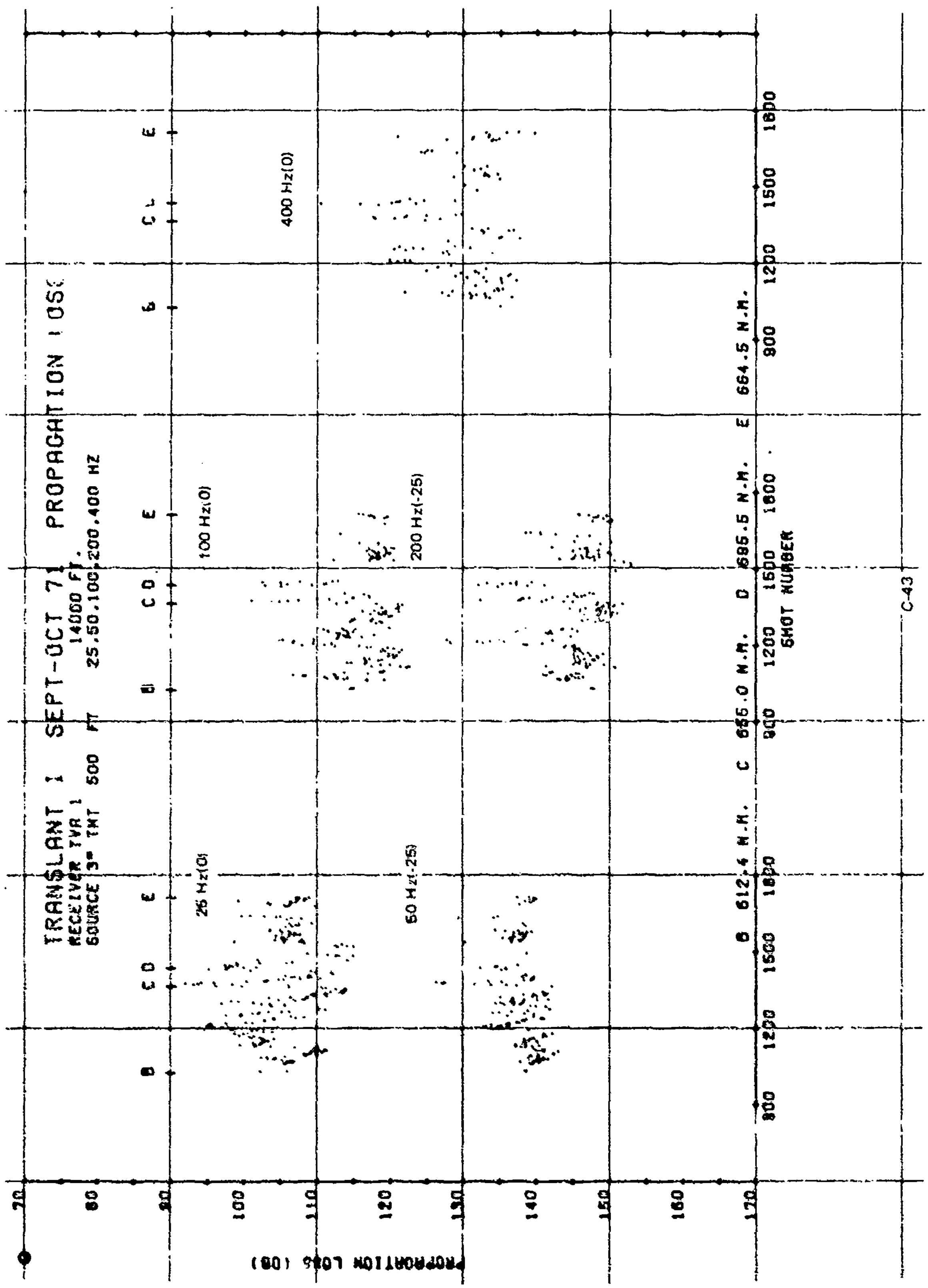
TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TYR 1 14000 FT.
SOURCE 3* TNT 500 FT FREQUENCY 200,400 HZ
200 Hz(O)
RANGE N.M.
PROPAGATION LOSS (DB)
C-40

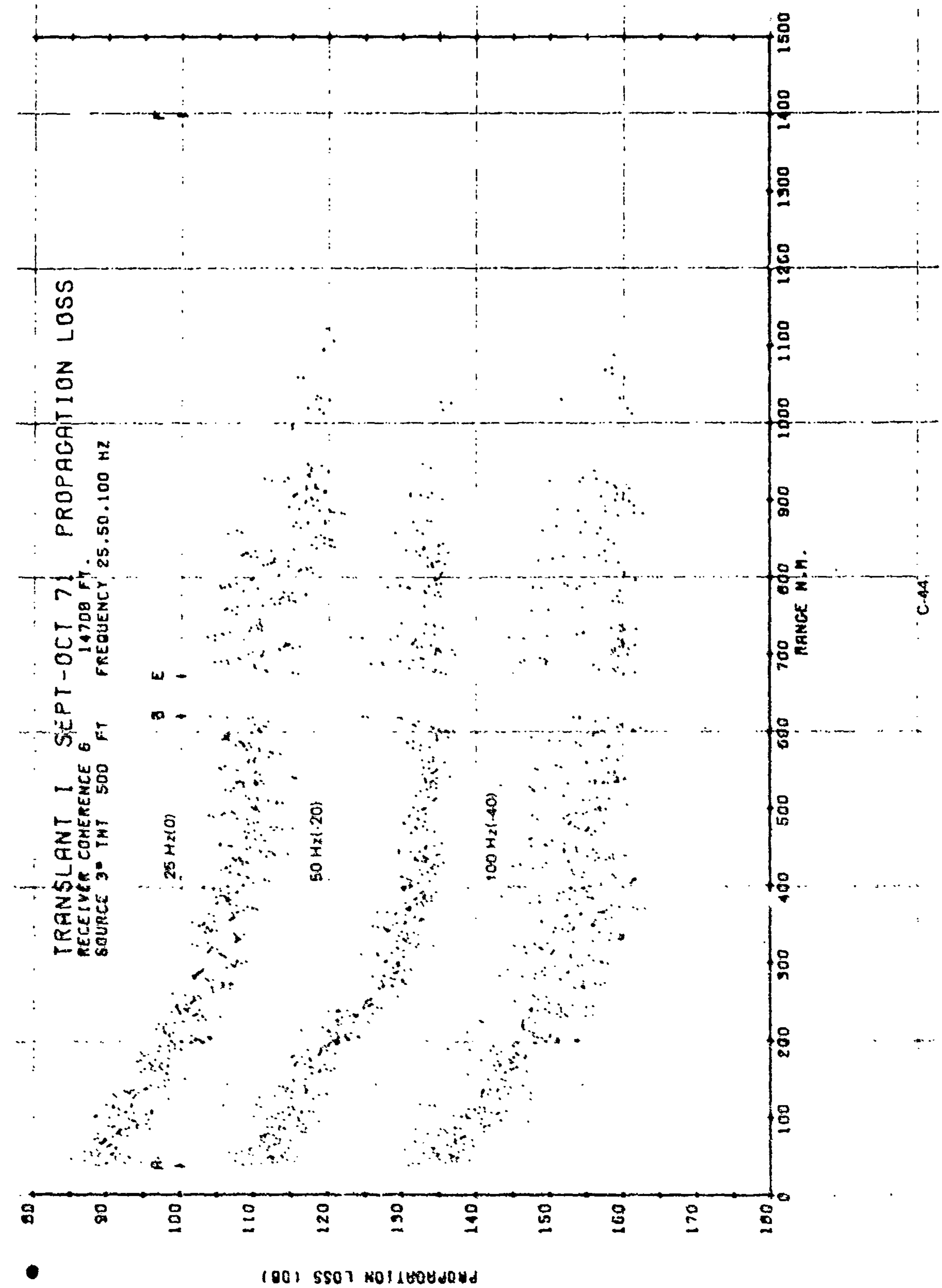
CONFIDENTIAL

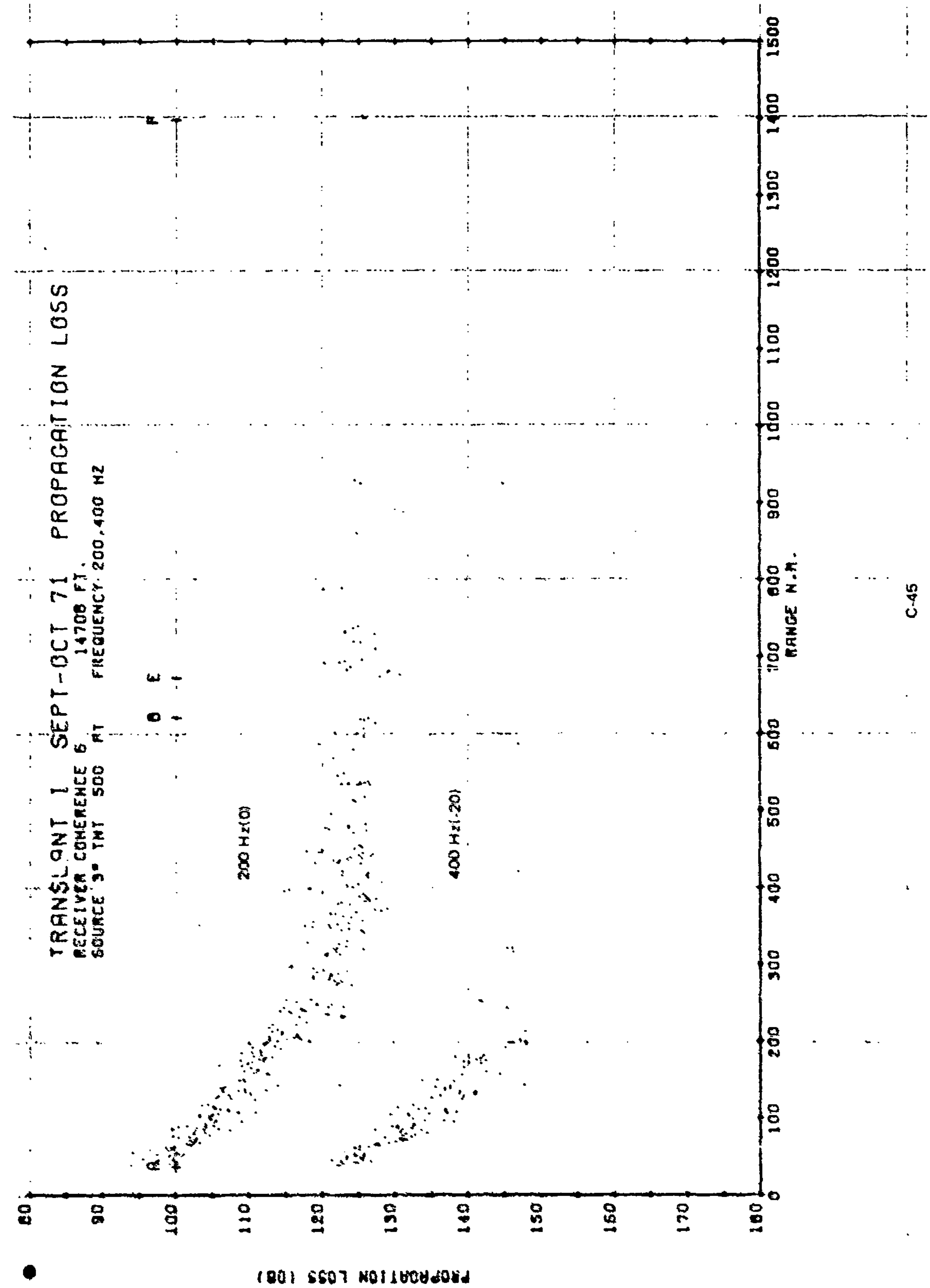


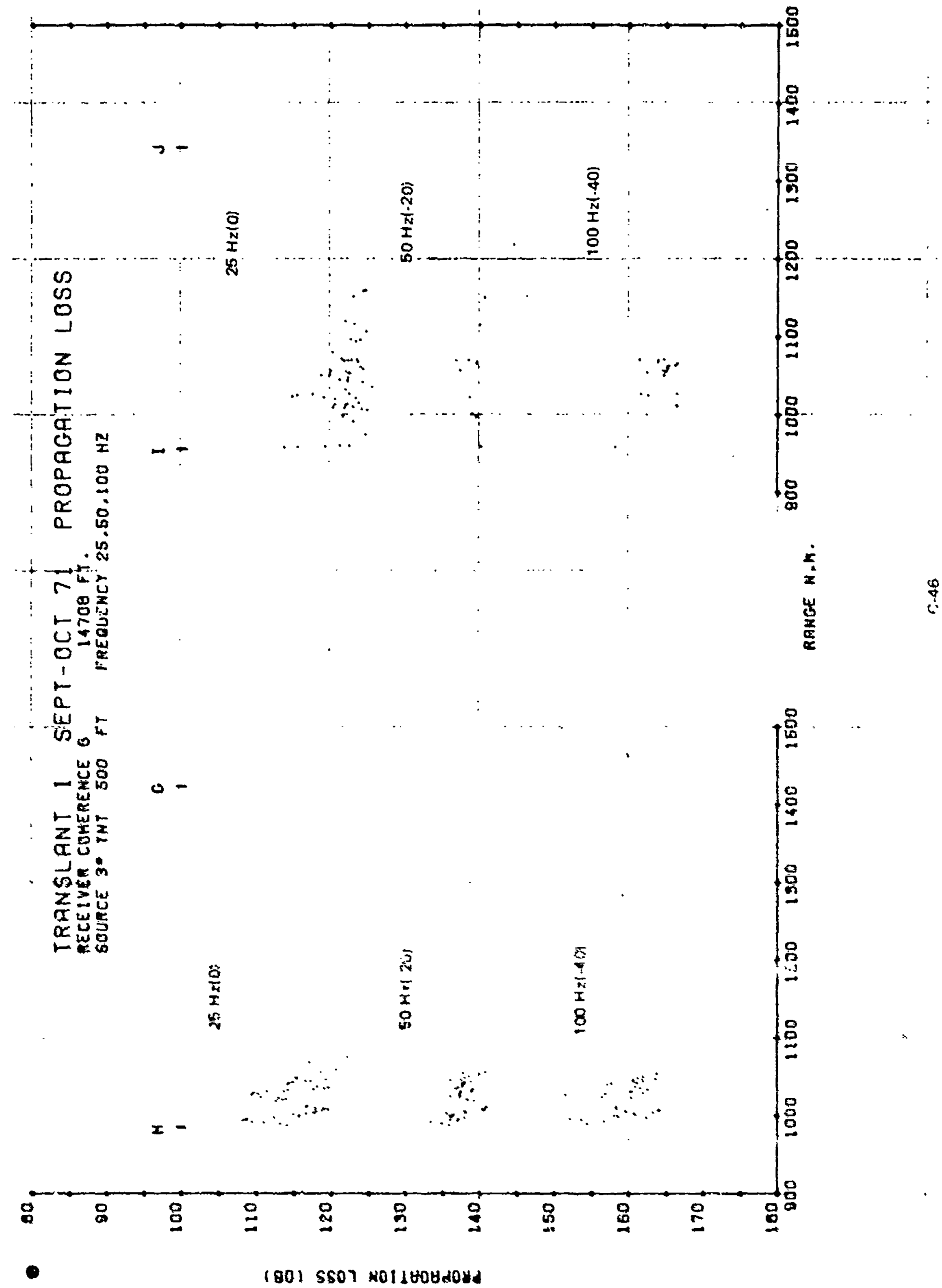
CONFIDENTIAL

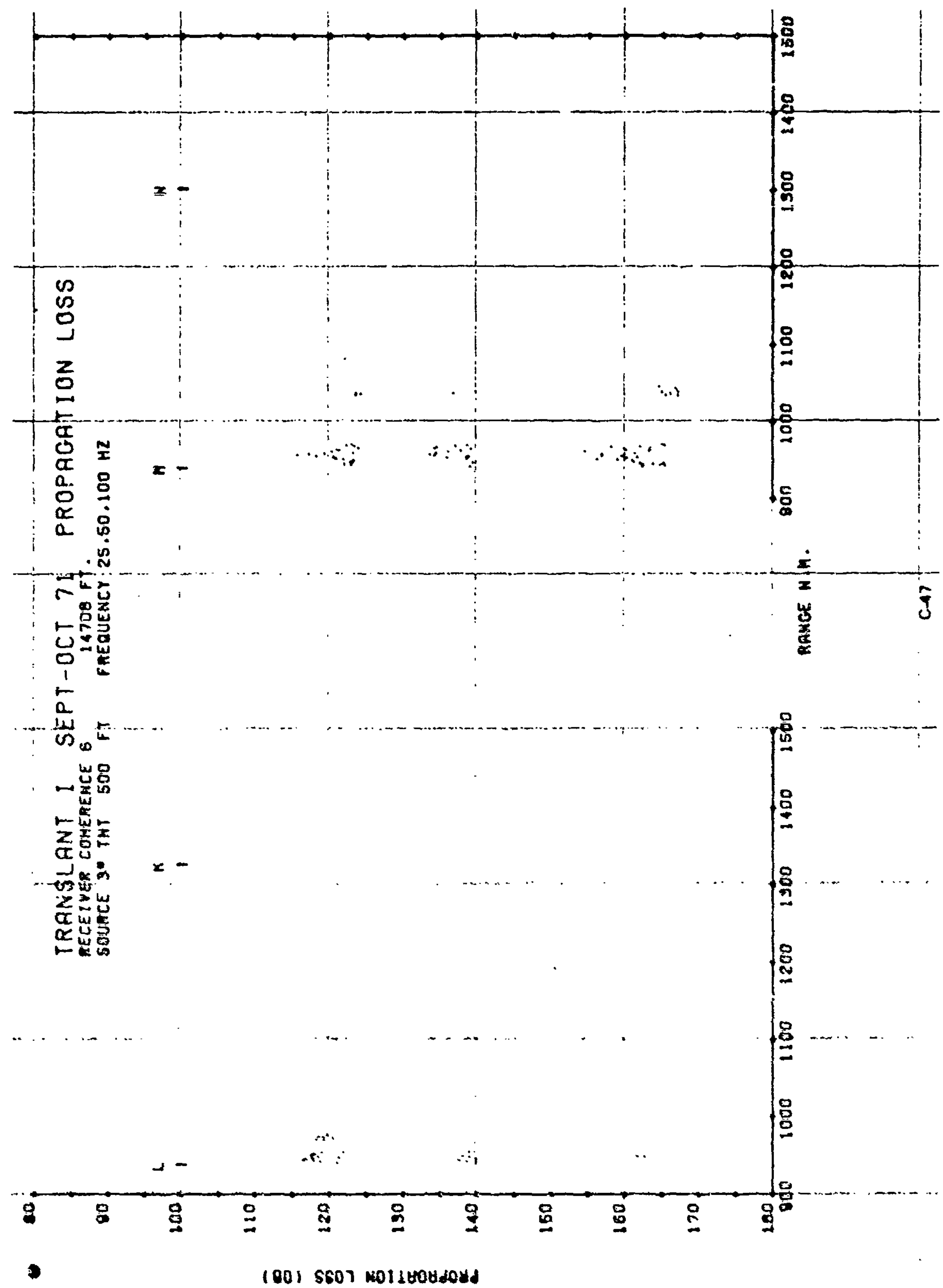

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER 1YA 1 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200.400 HZ
200 HZ(O)
PROPAGATION LOSS (DB)
RANGE N.M.
C-42

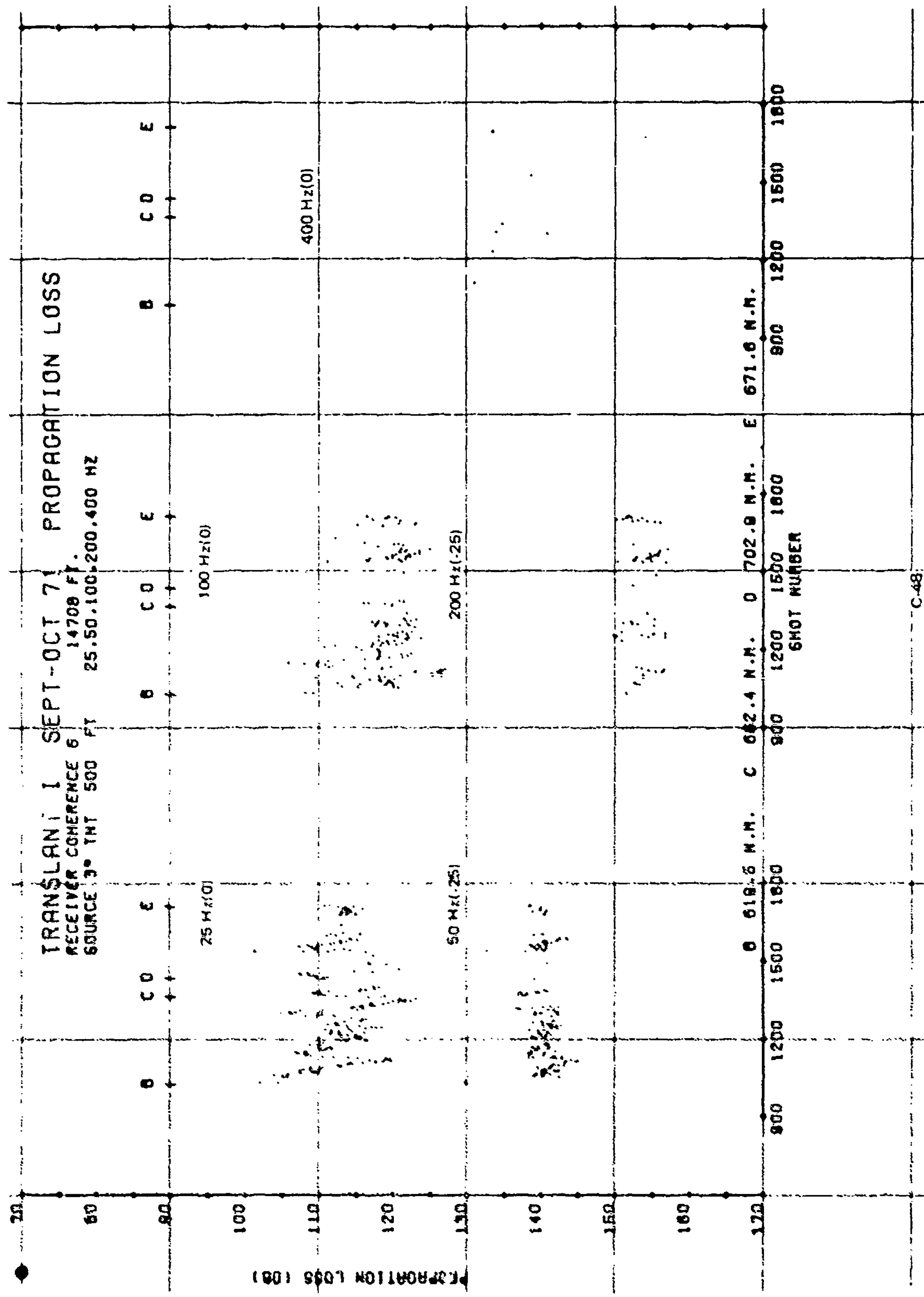

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER TVR 1 14000 FT.
SOURCE 3" TNT 500 FT 25.50.100.200.400 HZ
25 Hz(0)
50 Hz(-25)
100 Hz(0)
200 Hz(-25)
400 Hz(0)
B 612.4 N.M. C 655.0 N.M. D 695.5 N.M. E 664.5 N.M.
SHOT NUMBER
PROPAGATION LOSS (DB)
C-43


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
RANGE N.M.
PROPAGATION LOSS (DB)
C-44


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz(0)
400 Hz(-20)
PROPAGATION LOSS (DB)
80
90
100
110
120
130
140
150
160
170
180
RANGE N.M.
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
C-45


TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14700 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz(0)
50 Hz(-20)
100 Hz(-40)
H
G
I
J
RANGE N.M.
PROPAGATION LOSS (DB)
C-46

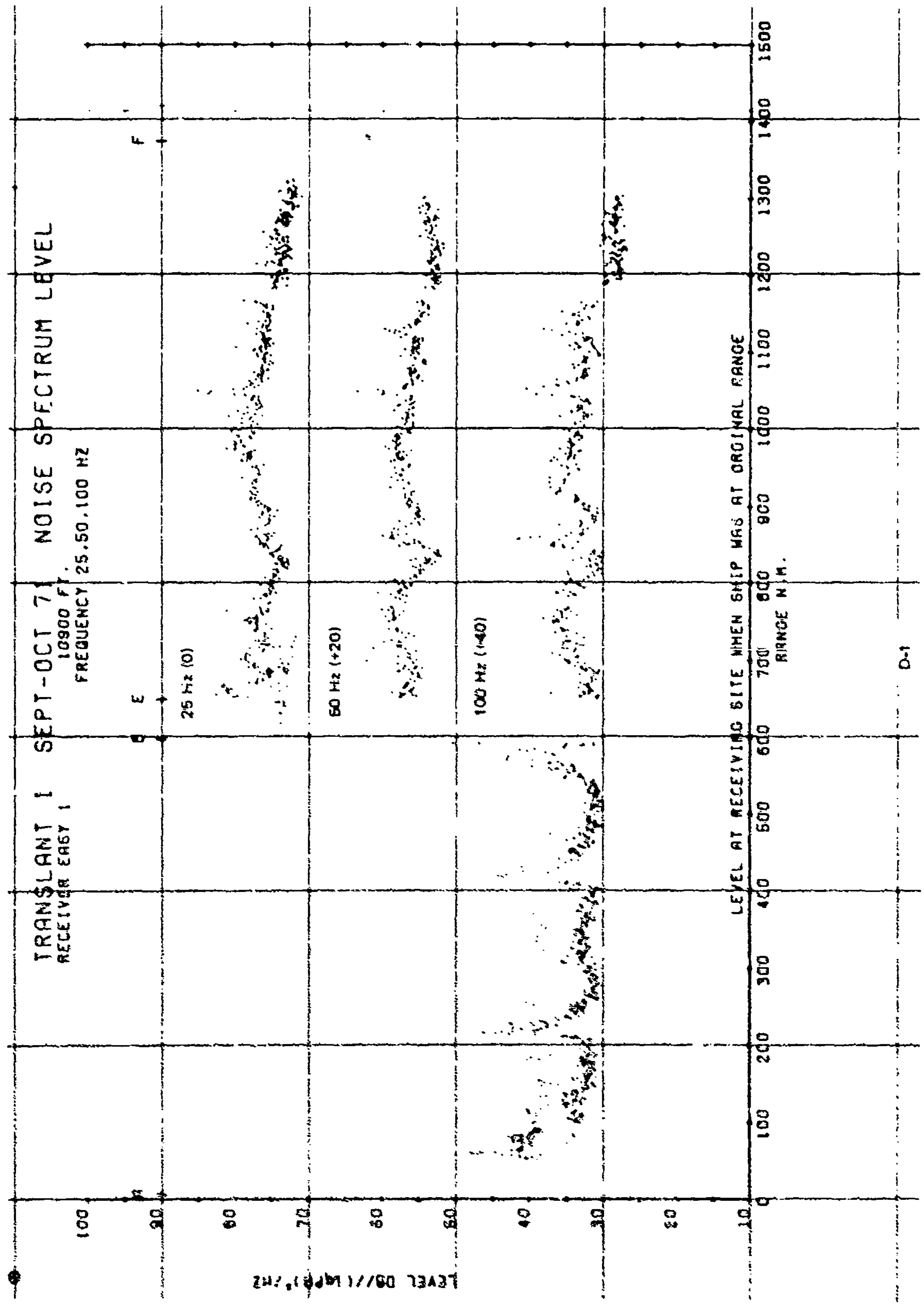

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
RANGE N.M.
PROPAGATION LOSS (DB)
C-47

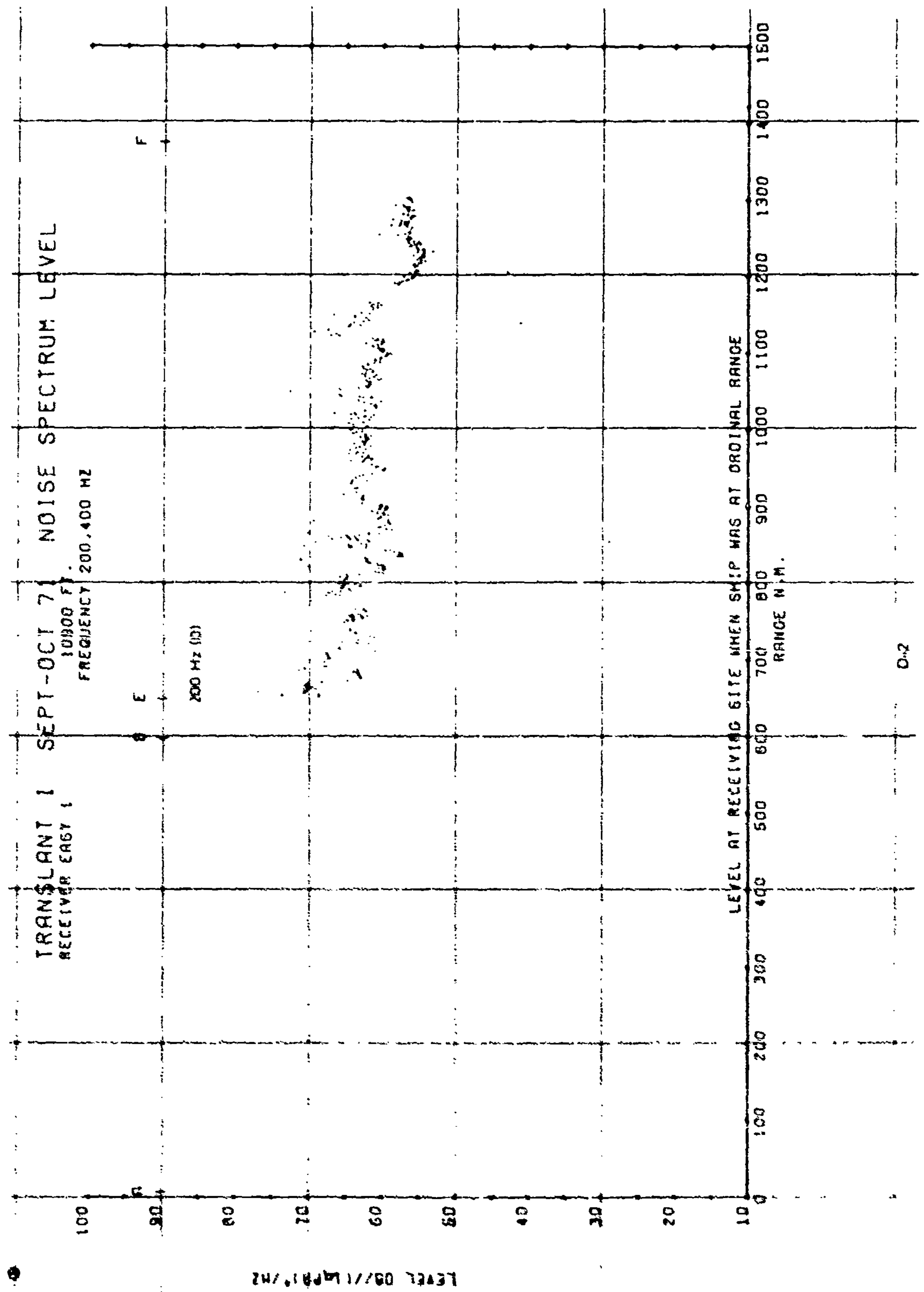

TRANSLANT I SEPT-OCT 71 PROPAGATION LOSS
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT 25.50.100.200.400 HZ
25 Hz(0)
50 Hz(.25)
100 Hz(0)
200 Hz(.25)
400 Hz(0)
B C D E
619.6 N.M.
662.4 N.M.
702.9 N.M.
671.6 N.M.
900 1200 1500 1800
SHOT NUMBER
70 80 90 100 110 120 130 140 150 160 170
PROPAGATION LOSS (DB)
C-48

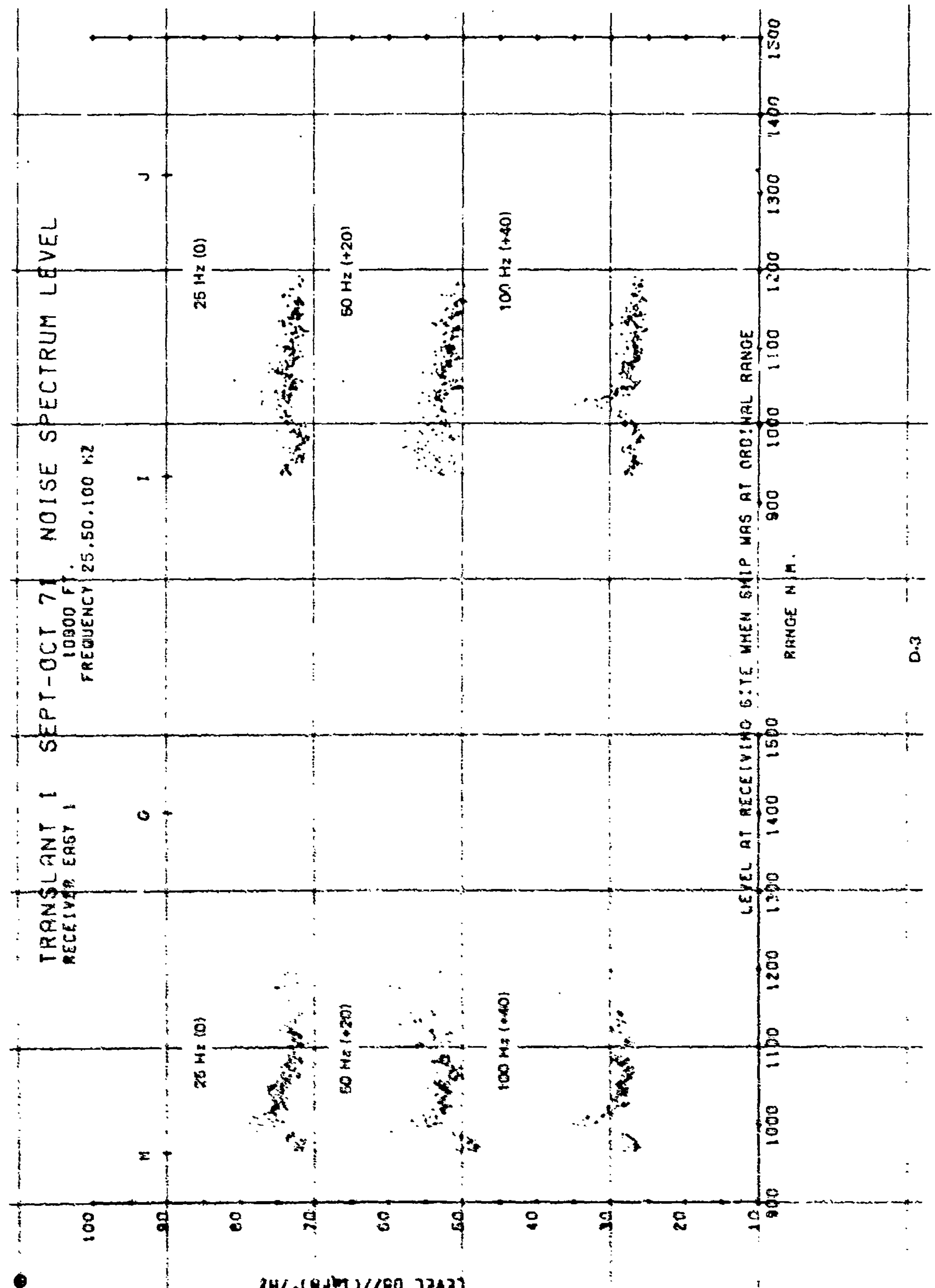
Appendix D

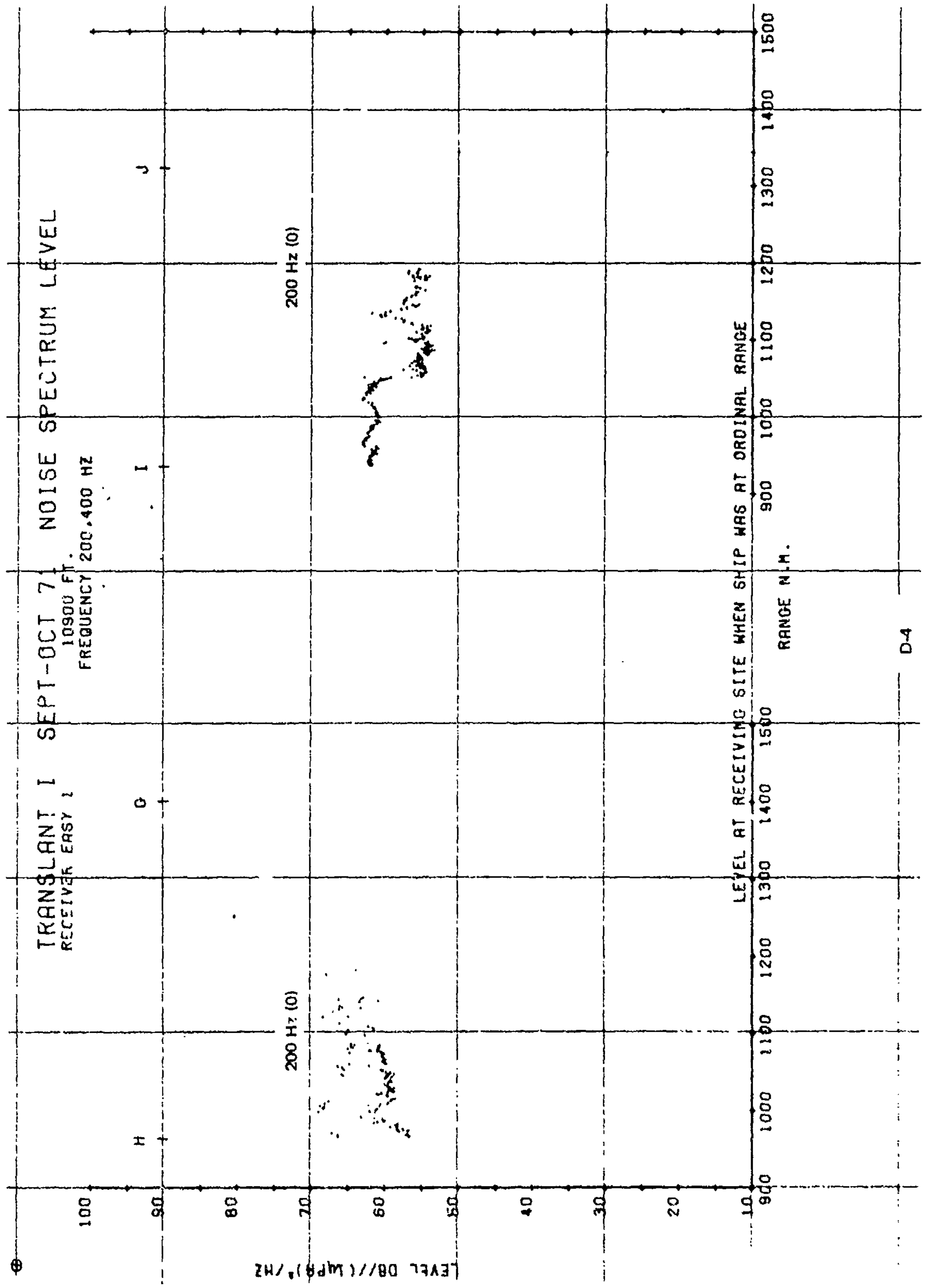
TRANSLANT I BACKGROUND NOISE SPECTRUM LEVELS

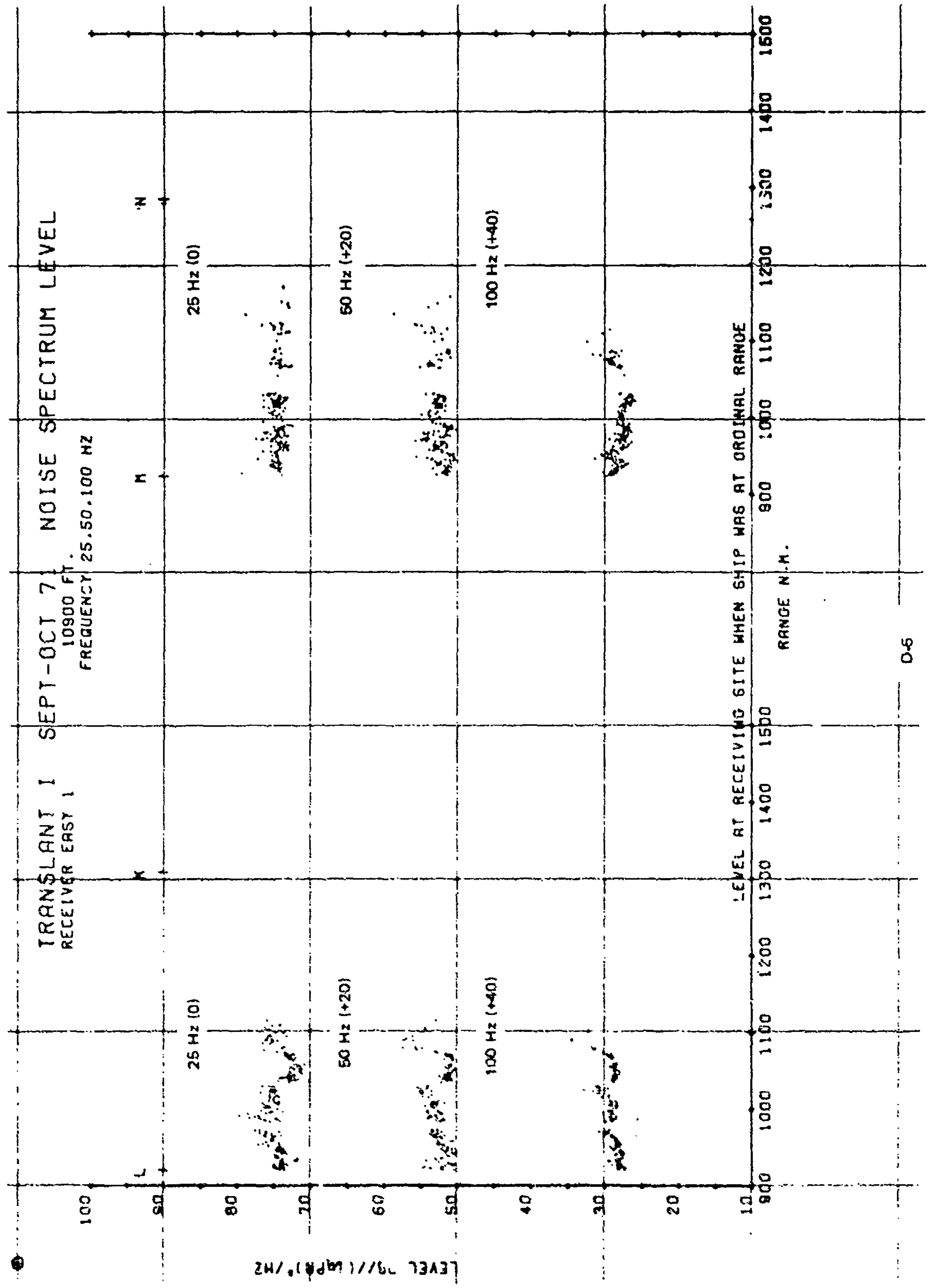
The background noise spectrum levels as a function of time, frequency, and hydrophone are presented on the following pages.

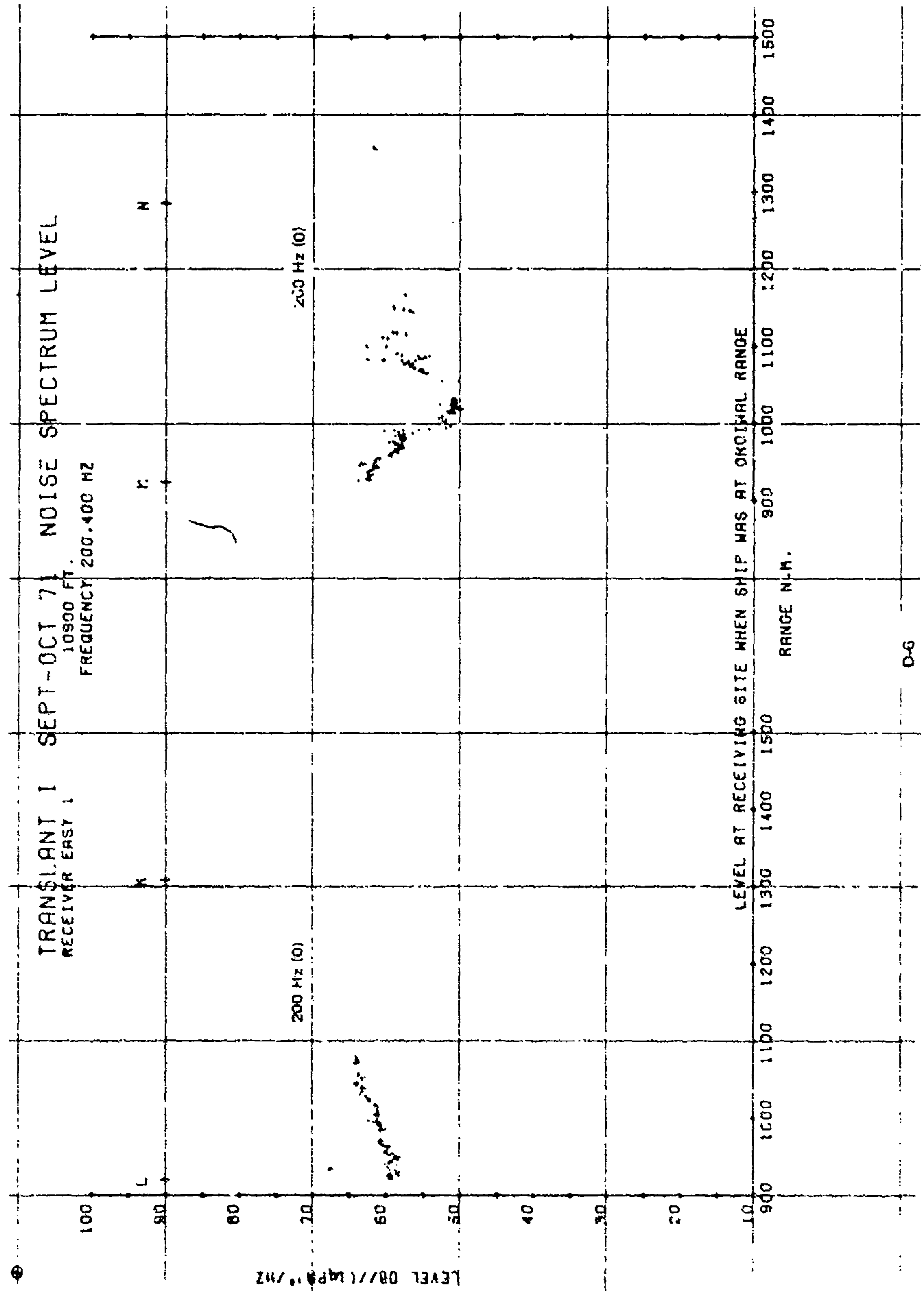

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY I
10900 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORIGINAL RANGE
RANGE N.M.
D-1

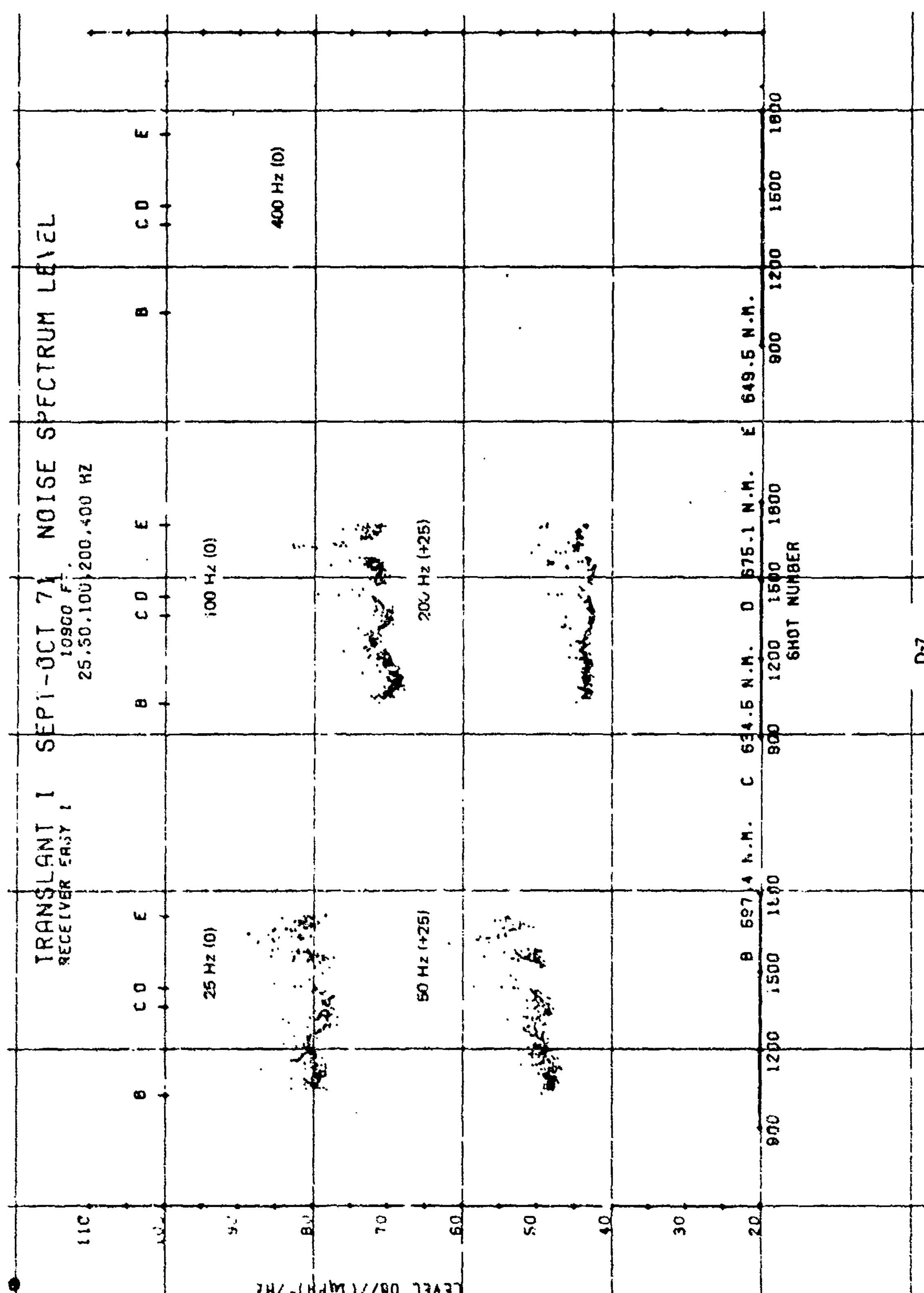

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY 1
10,800 FT.
FREQUENCY 200,400 HZ
200 Hz (D)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
100
90
80
70
60
50
40
30
20
10
D
E
F
D-2

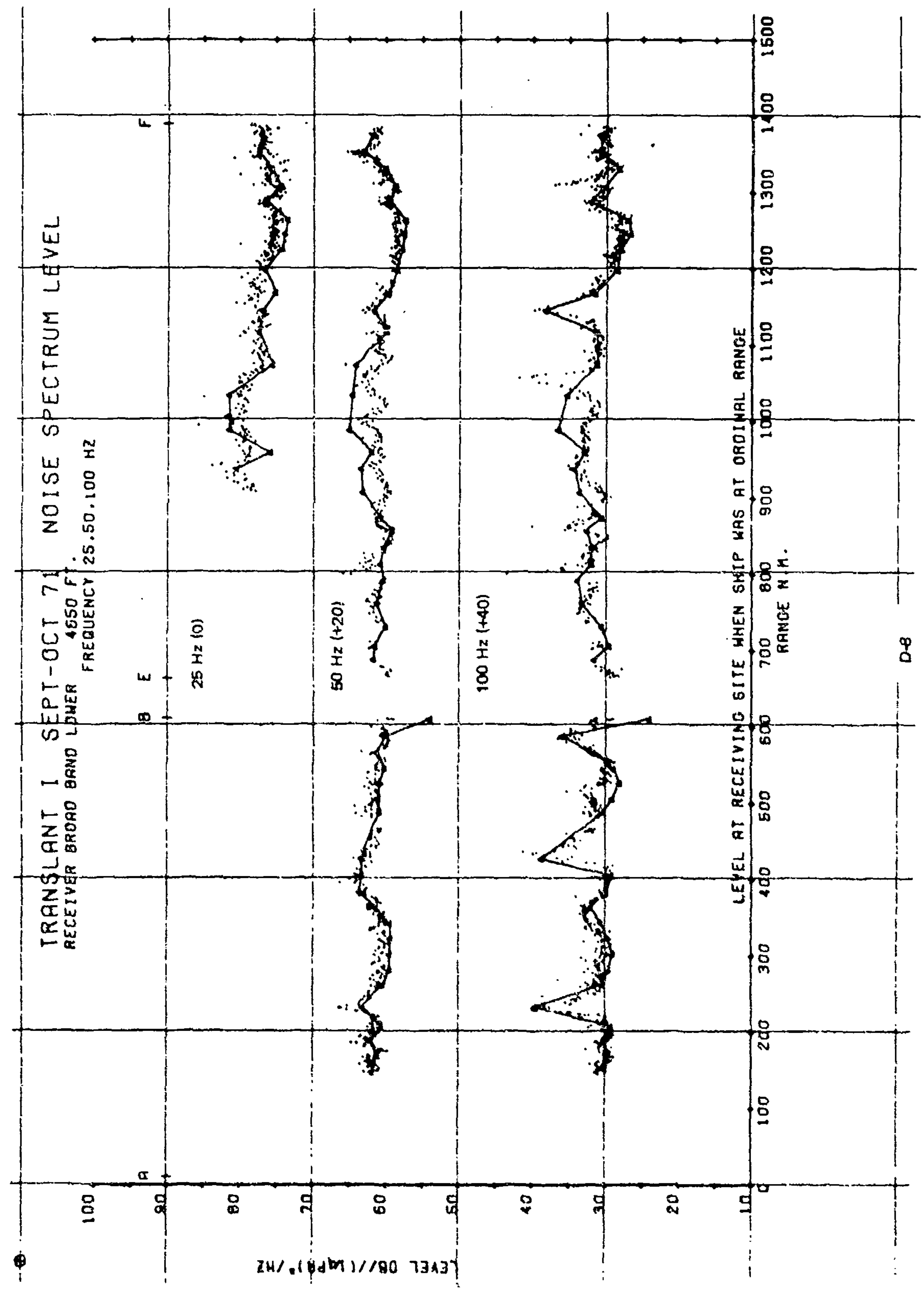

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY I
10900 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
H
G
I
J
LEVEL DB//(1 μPa)²/HZ
100
90
80
70
60
50
40
30
20
10
900
1000
1100
1200
1300
1400
1500
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-3

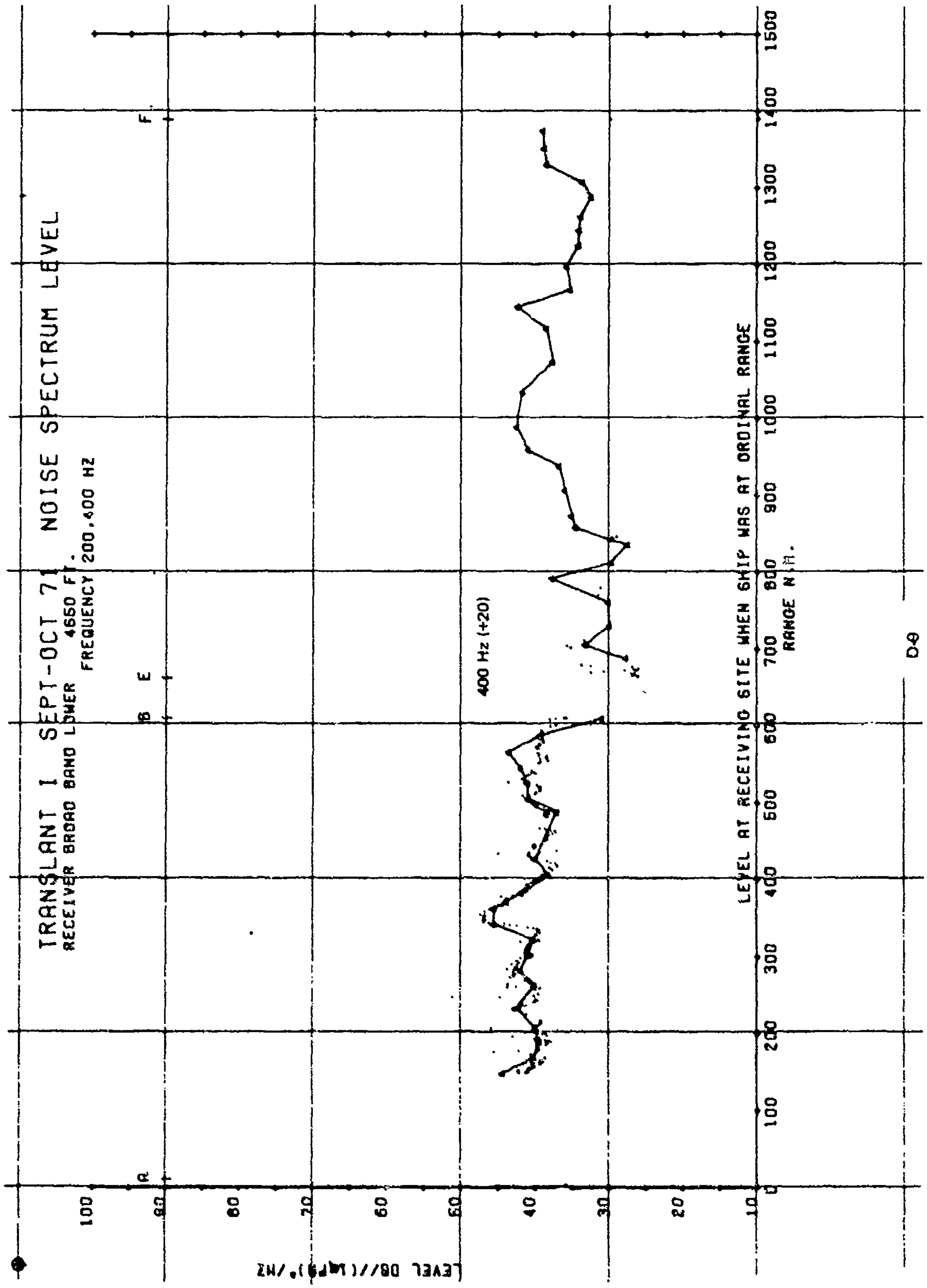

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY 1
10900 FT.
FREQUENCY 200,400 HZ
200 Hz (0)
200 Hz (0)
H
G
I
J
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(uPa)²/HZ
D-4


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY 1
10900 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
900 1000 1100 1200 1300 1400 1500 900 1000 1100 1200 1300 1400 1500 1600
100 90 80 70 60 50 40 30 20 10
D-5


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EAST 1
10900 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
200 Hz (0)
RANGE N.M.
D-6

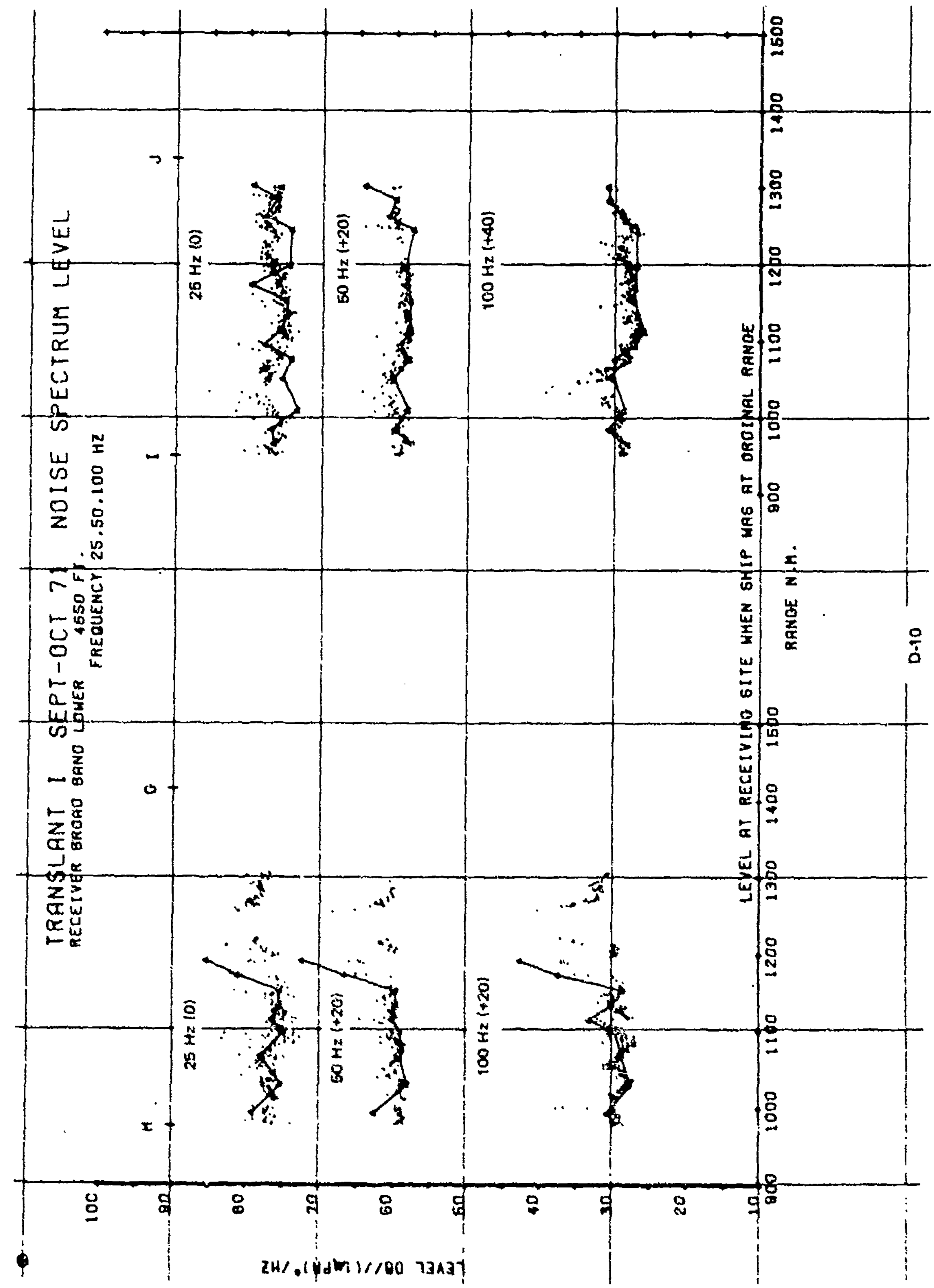

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER EASY I
10900 FT
25,50,100,200,400 HZ
25 Hz (0)
50 Hz (+25)
100 Hz (0)
200 Hz (+25)
400 Hz (0)
SHOT NUMBER
D-7

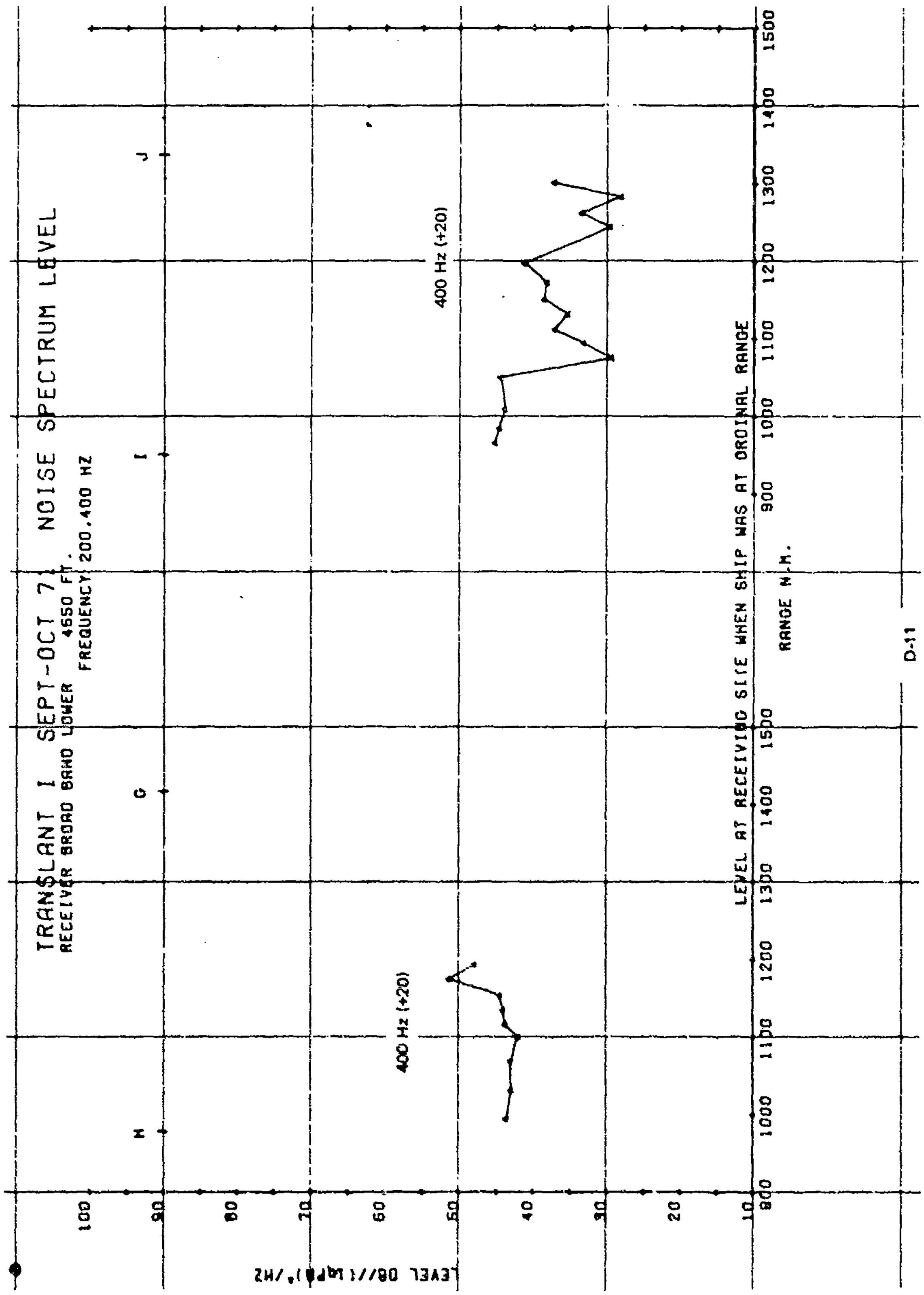

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
LEVEL DB//(1μPa)²/HZ
100 90 80 70 60 50 40 30 20 10
A
B
E
F
D-8

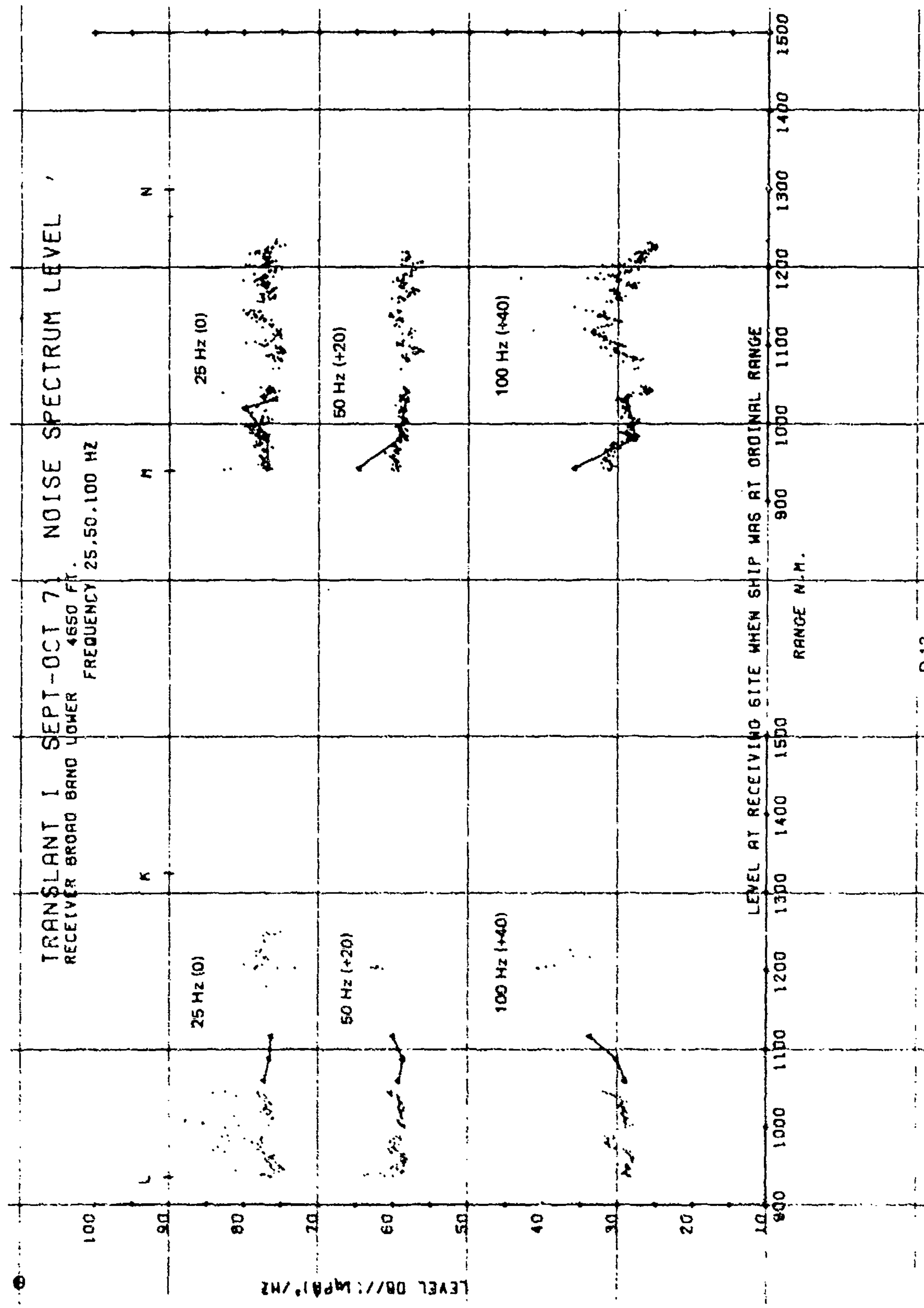


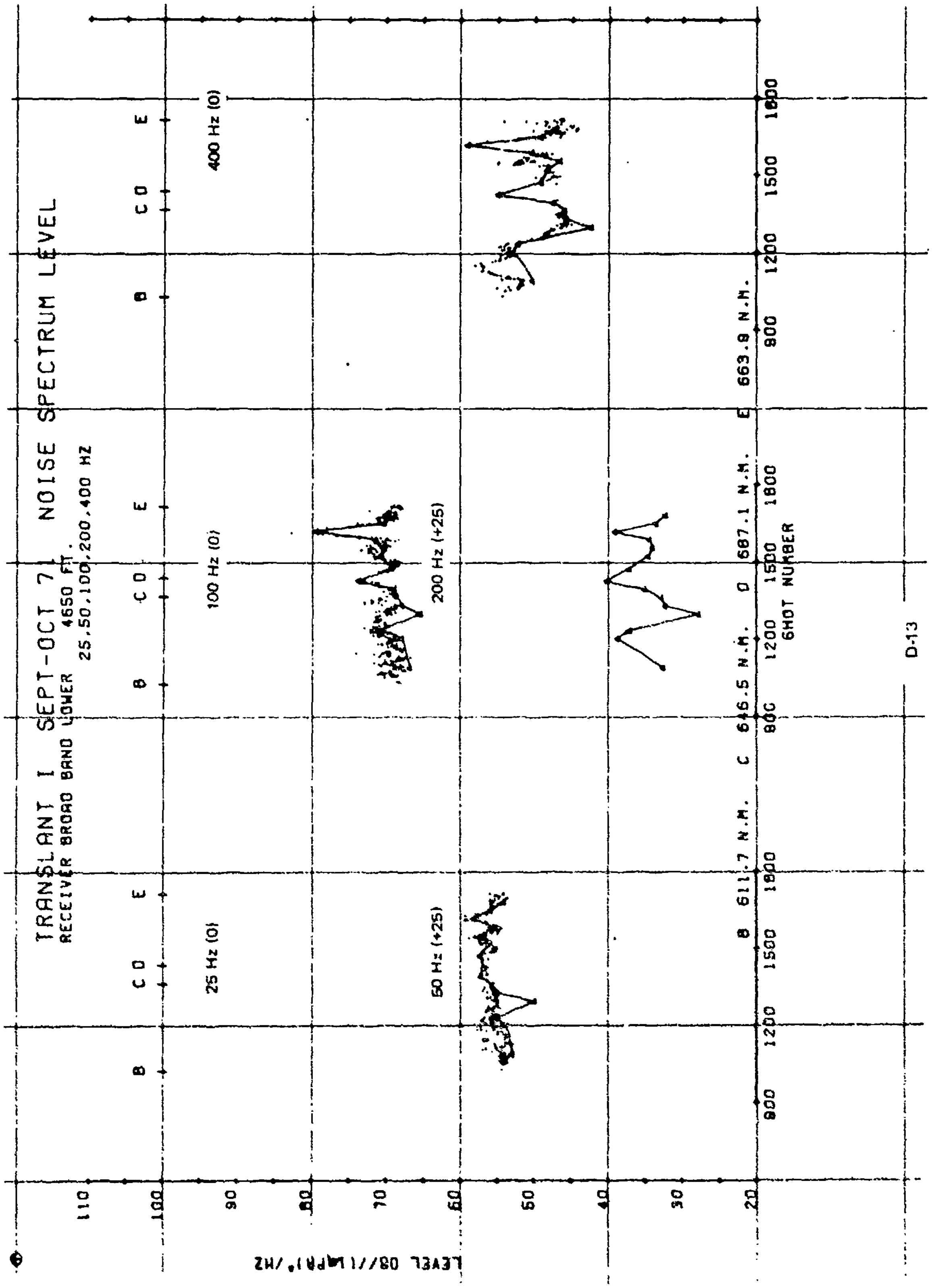
TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
FREQUENCY 200,400 HZ
400 Hz (+20)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
10 20 30 40 50 60 70 80 90 100
A B E F

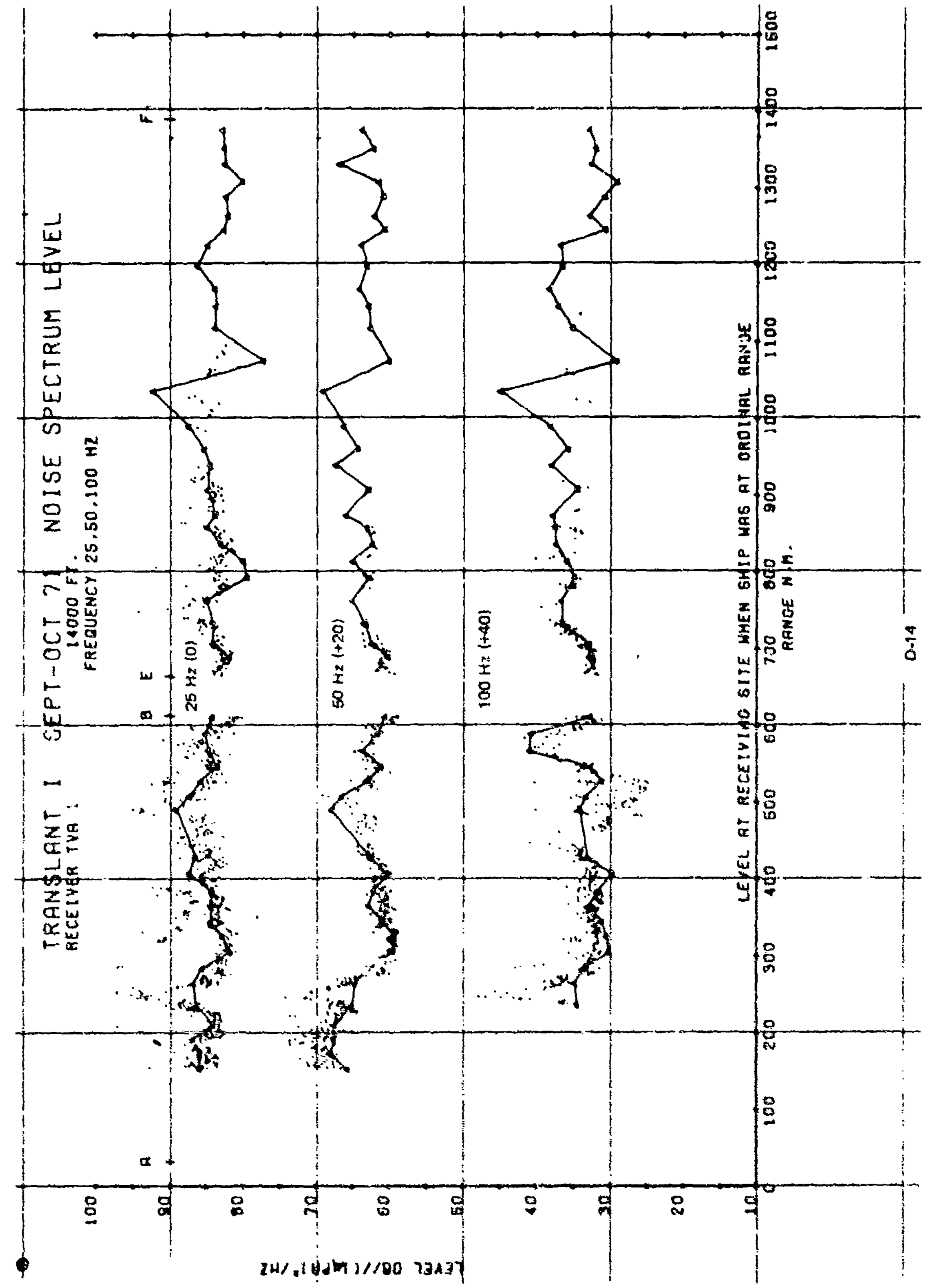
D-9

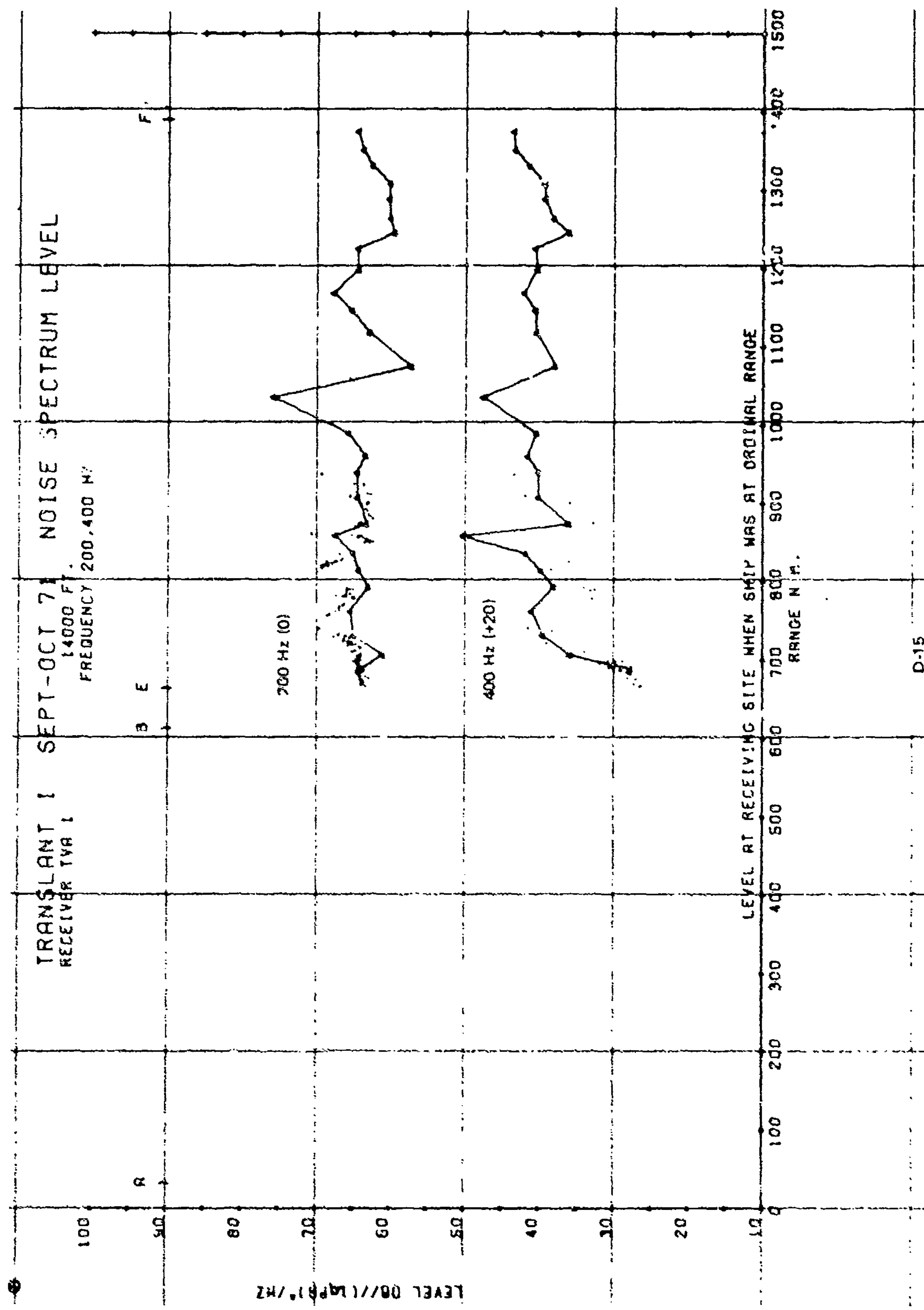

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
25 Hz (0)
50 Hz (+20)
100 Hz (+20)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(1μPA)²/HZ
D-10

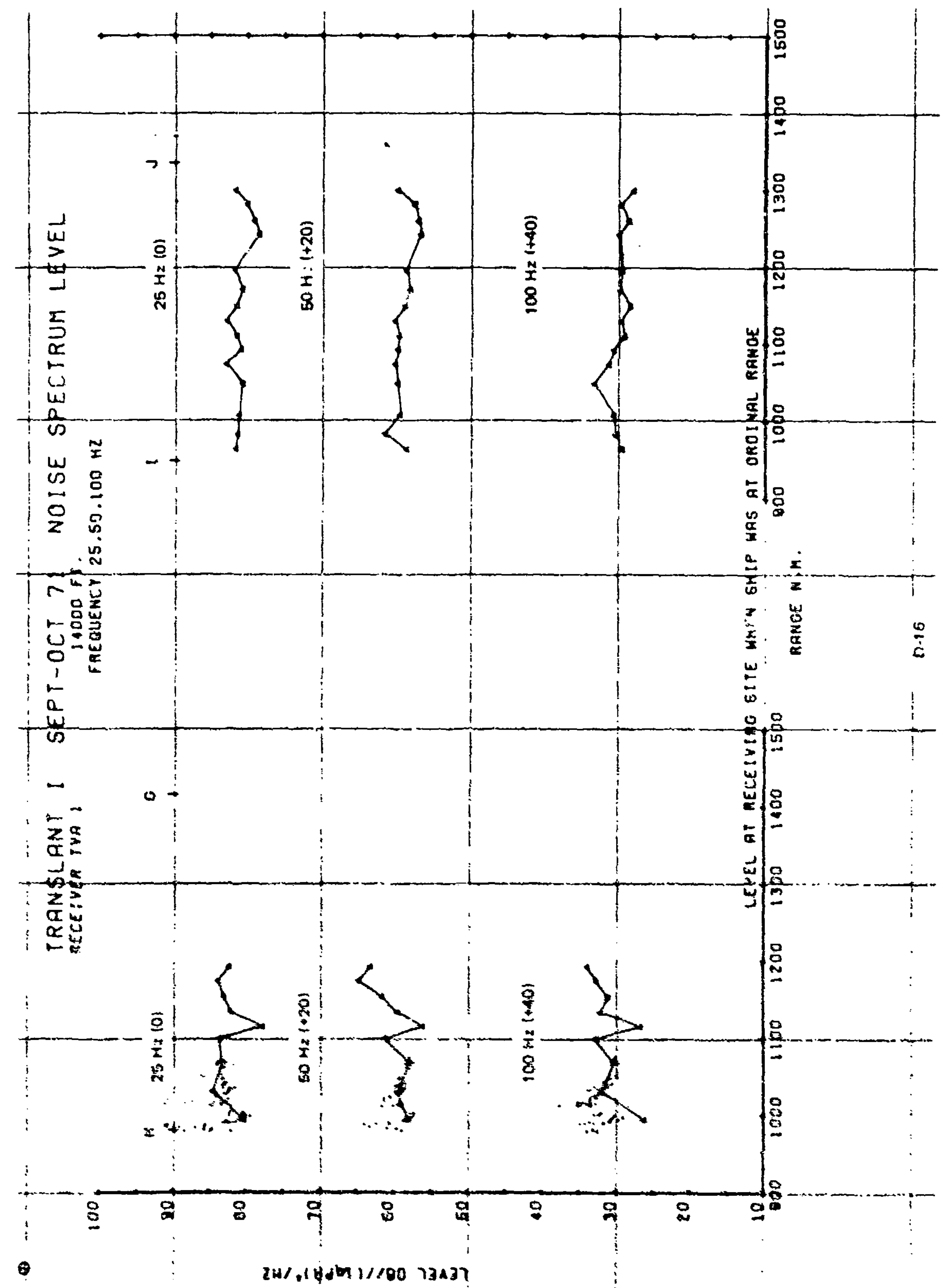

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
FREQUENCY 200,400 HZ
400 Hz (+20)
400 Hz (+20)
H
G
I
J
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(1μPa)²/HZ
D-11

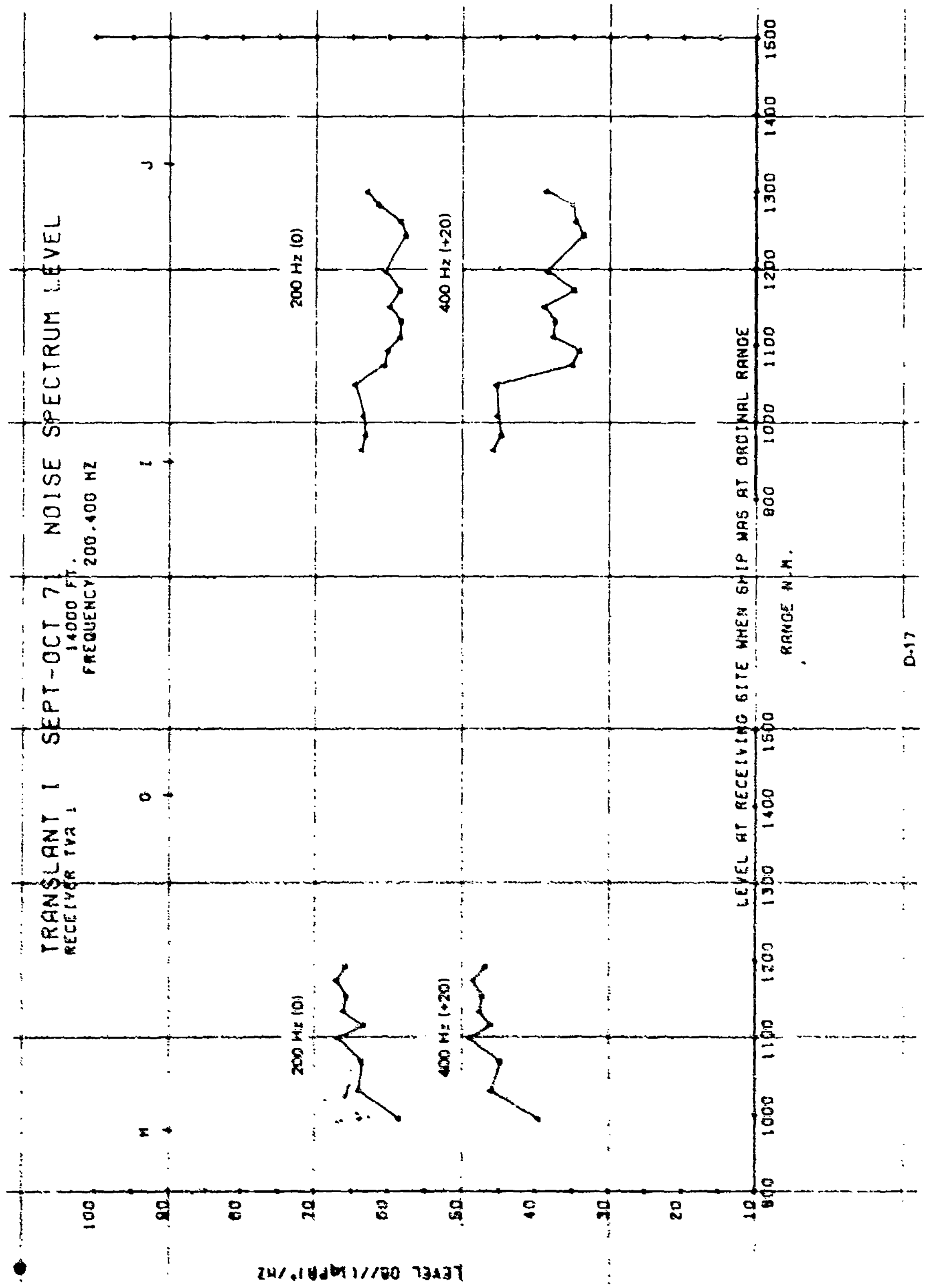

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//: 1μPa)²/HZ
D-12

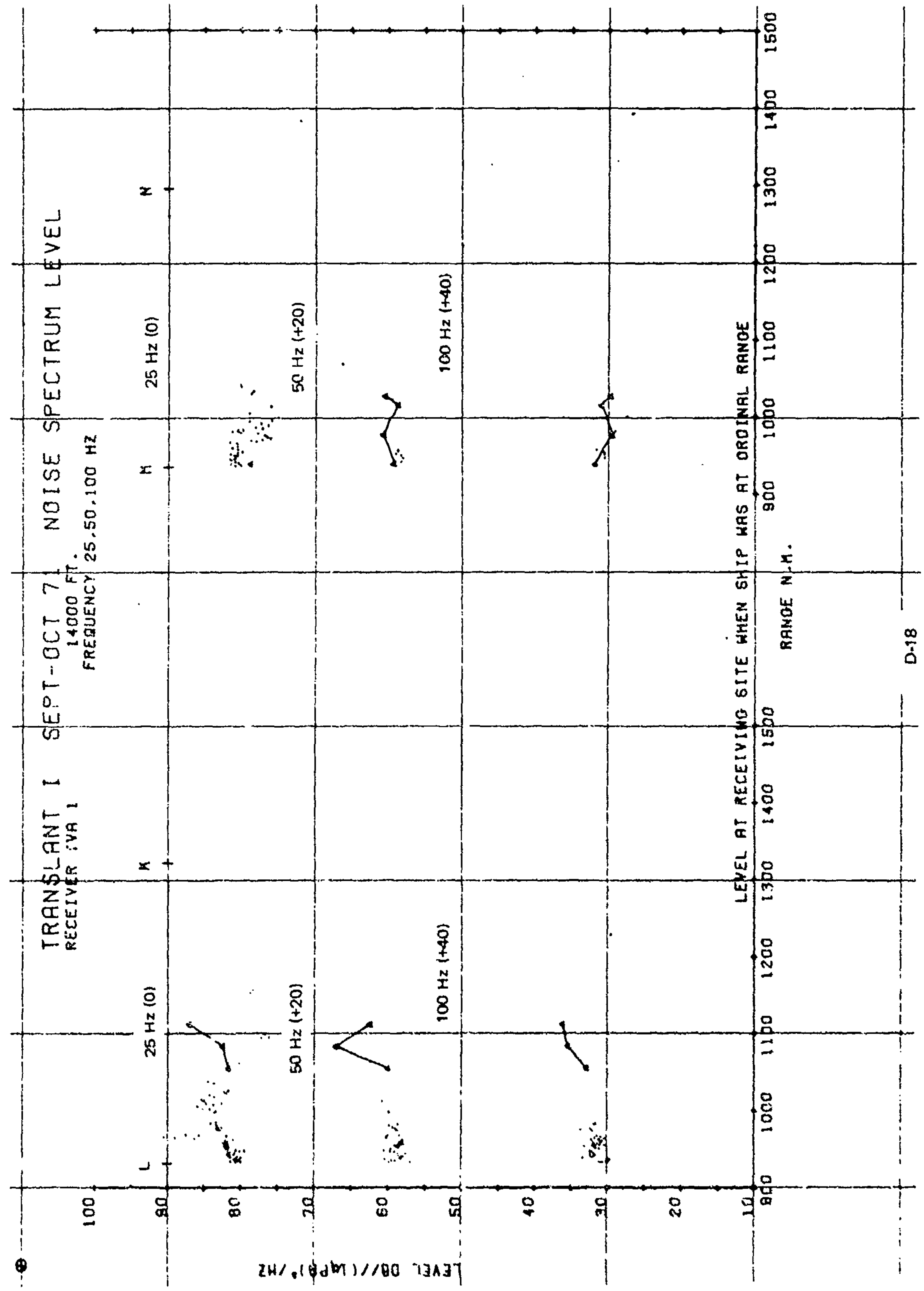

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER BROAD BAND LOWER 4650 FT.
25,50,100,200,400 HZ
25 Hz (0)
50 Hz (+25)
100 Hz (0)
200 Hz (+25)
400 Hz (0)
B C D E
611.7 N.M.
646.5 N.M.
687.1 N.M.
663.9 N.M.
SHOT NUMBER
900 1200 1500 1800
LEVEL DB//(1 μPA)²/HZ
20 30 40 50 60 70 80 90 100 110
D-13

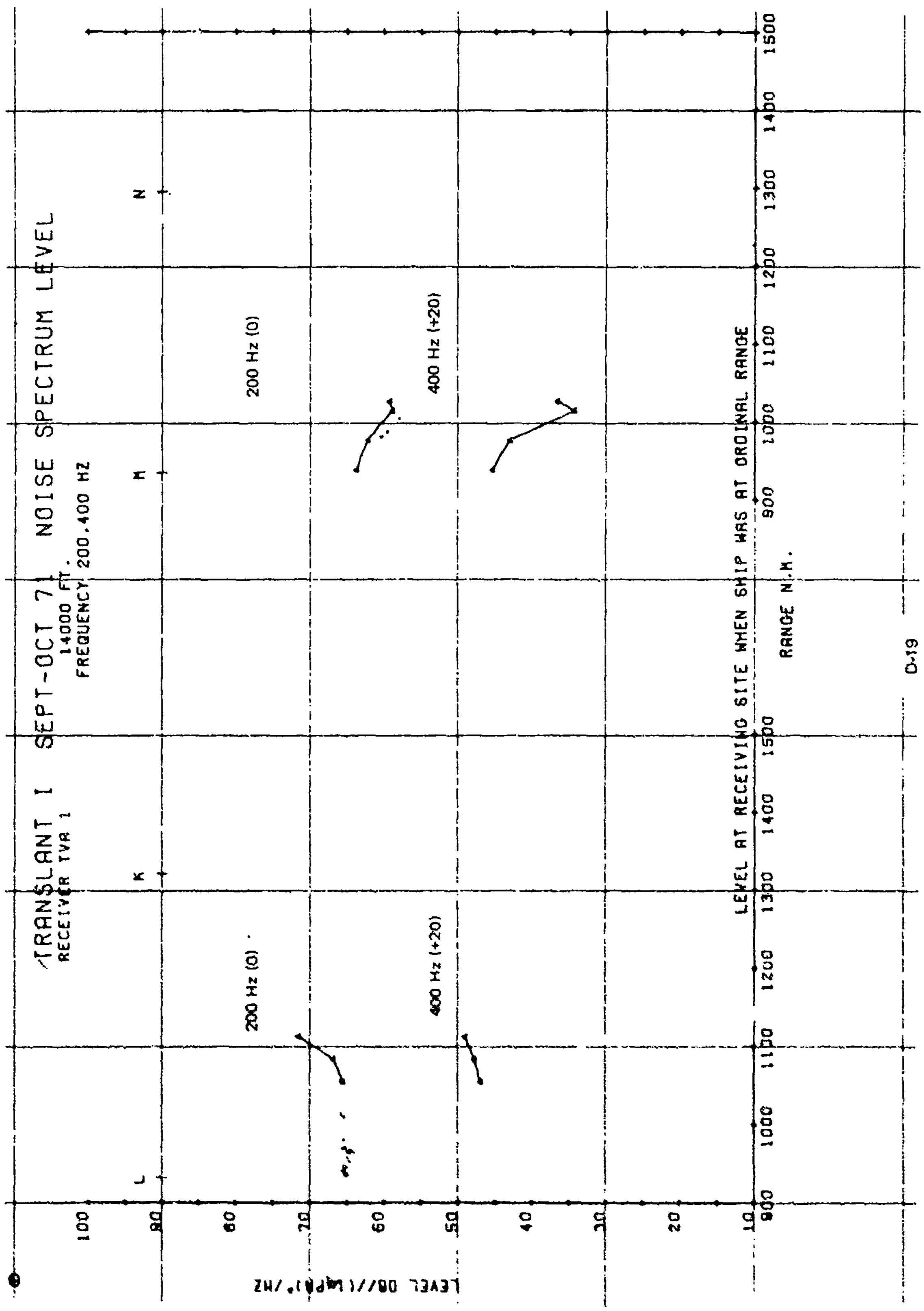

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVA
14000 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
A
B
E
F
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(uPa)²/HZ
D-14

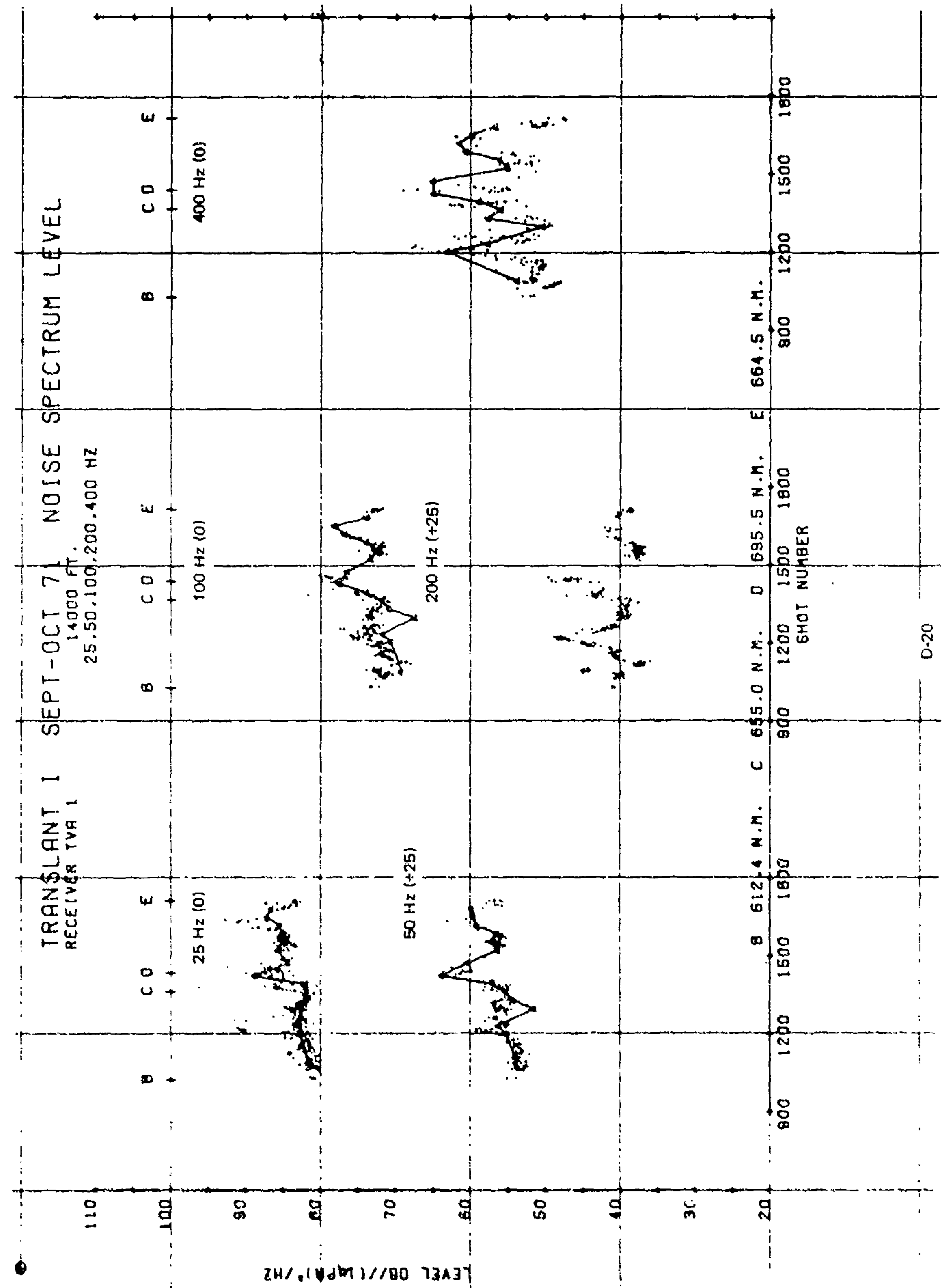

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVA I
14000 FT.
FREQUENCY 200,400 HZ
200 Hz (0)
400 Hz (+20)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
100 90 80 70 60 50 40 30 20 10
A B E F
D-15

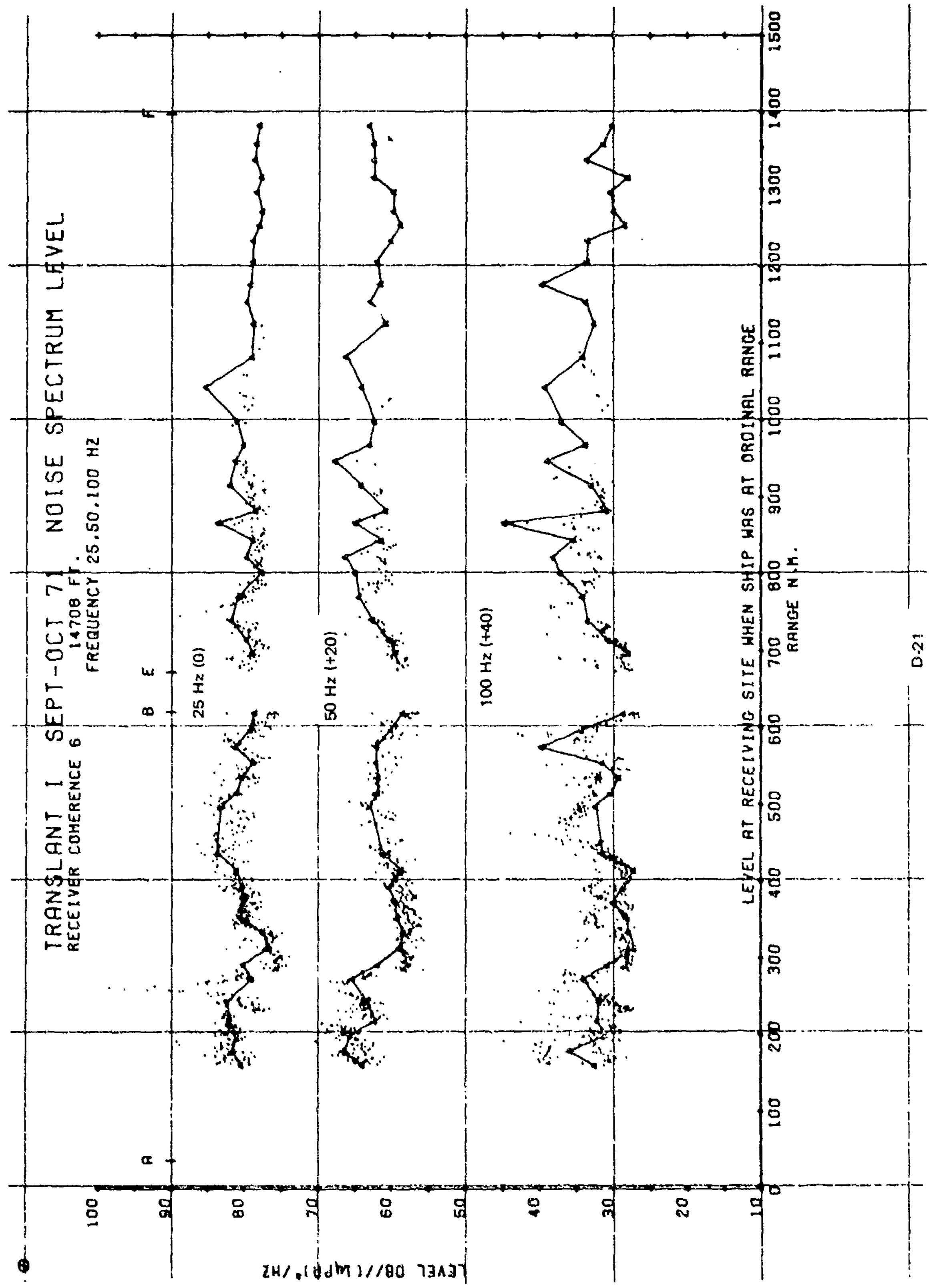

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVA 1
14000 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(μPa)²/HZ
D-16

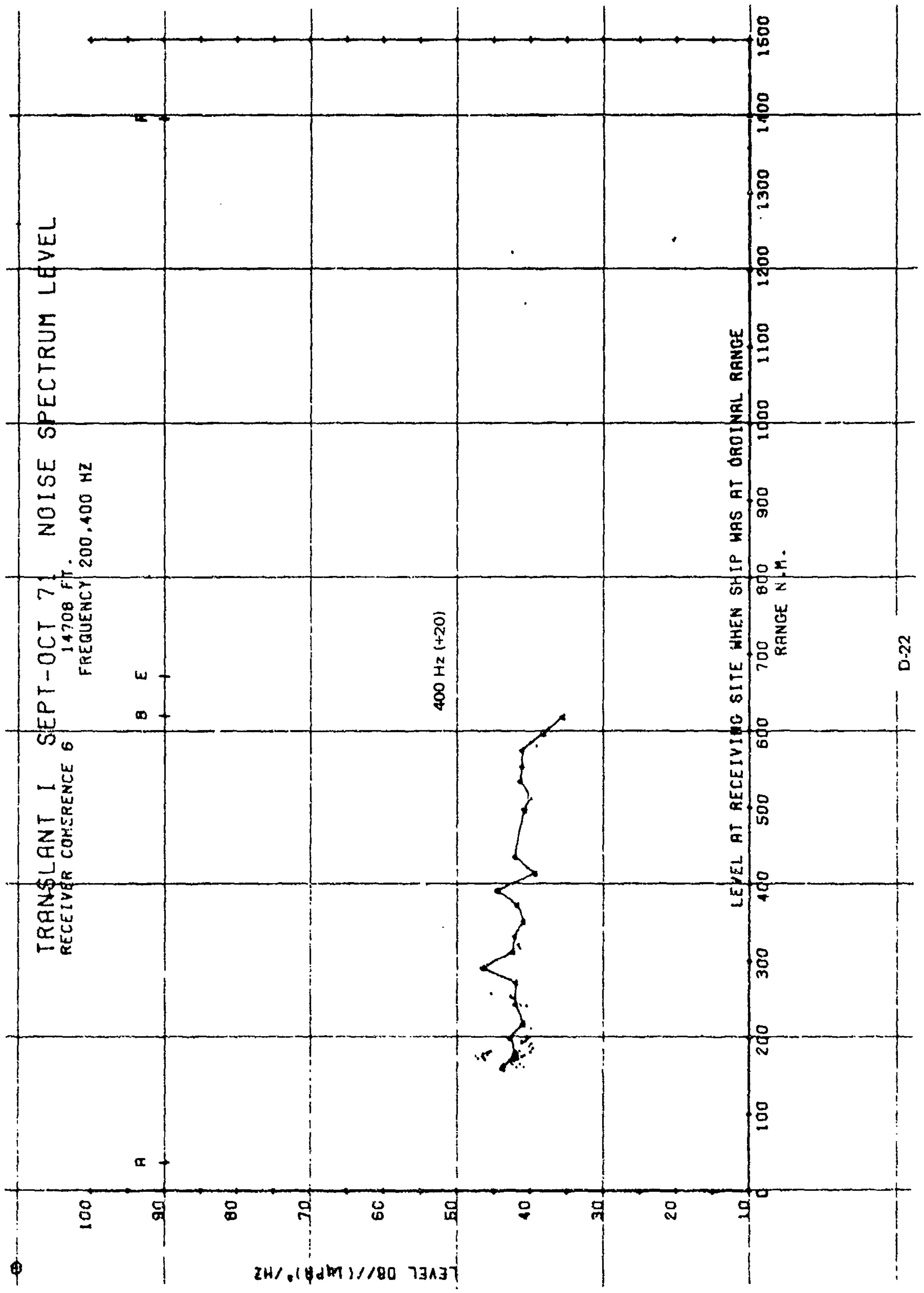

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVR 1
14000 FT.
FREQUENCY 200,400 HZ
200 Hz (0)
400 Hz (+20)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-17

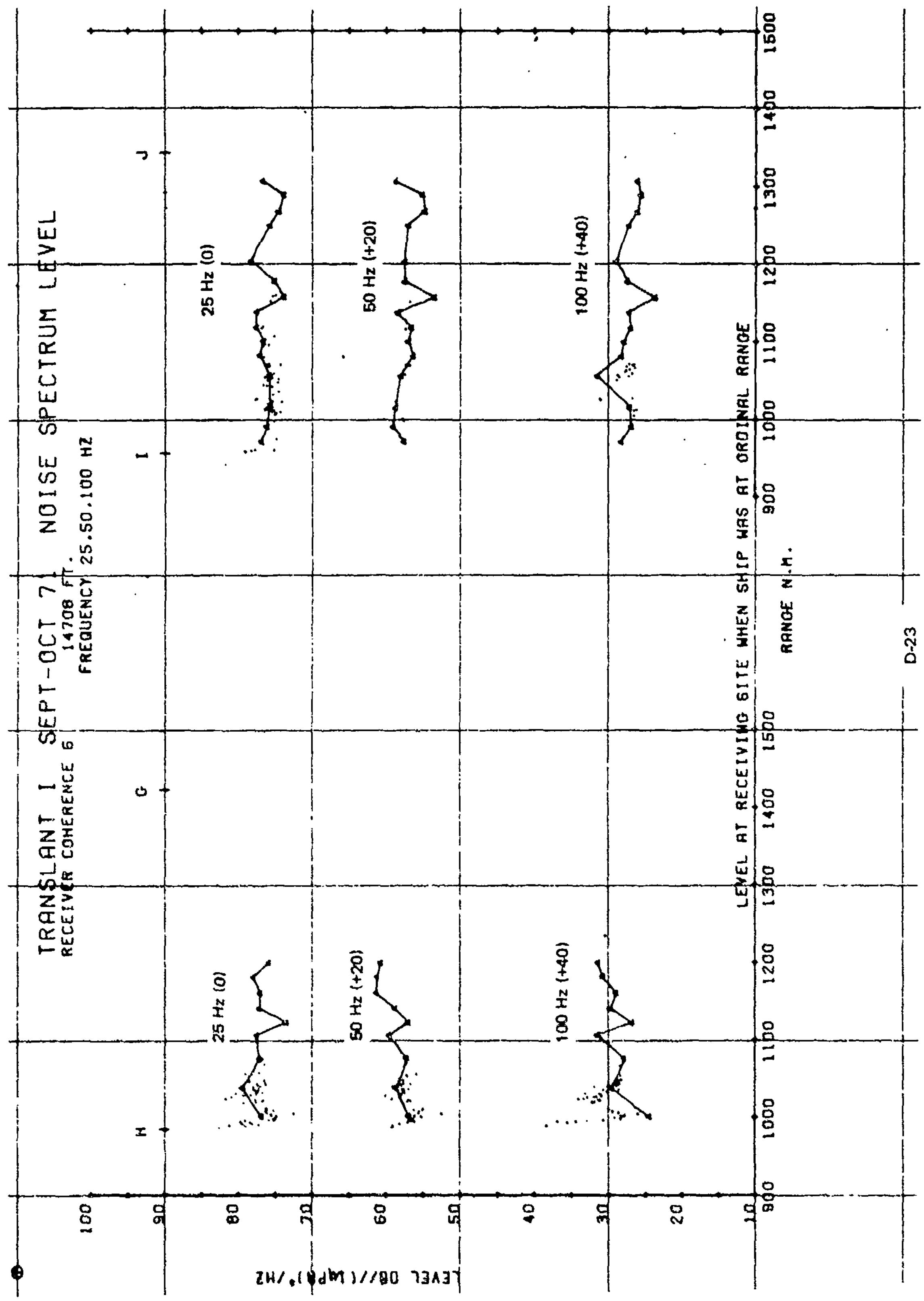

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER IVA 1 14000 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
L
K
M
N
LEVEL DB//(1µPa)²/HZ
100
90
80
70
60
50
40
30
20
10
900
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-18

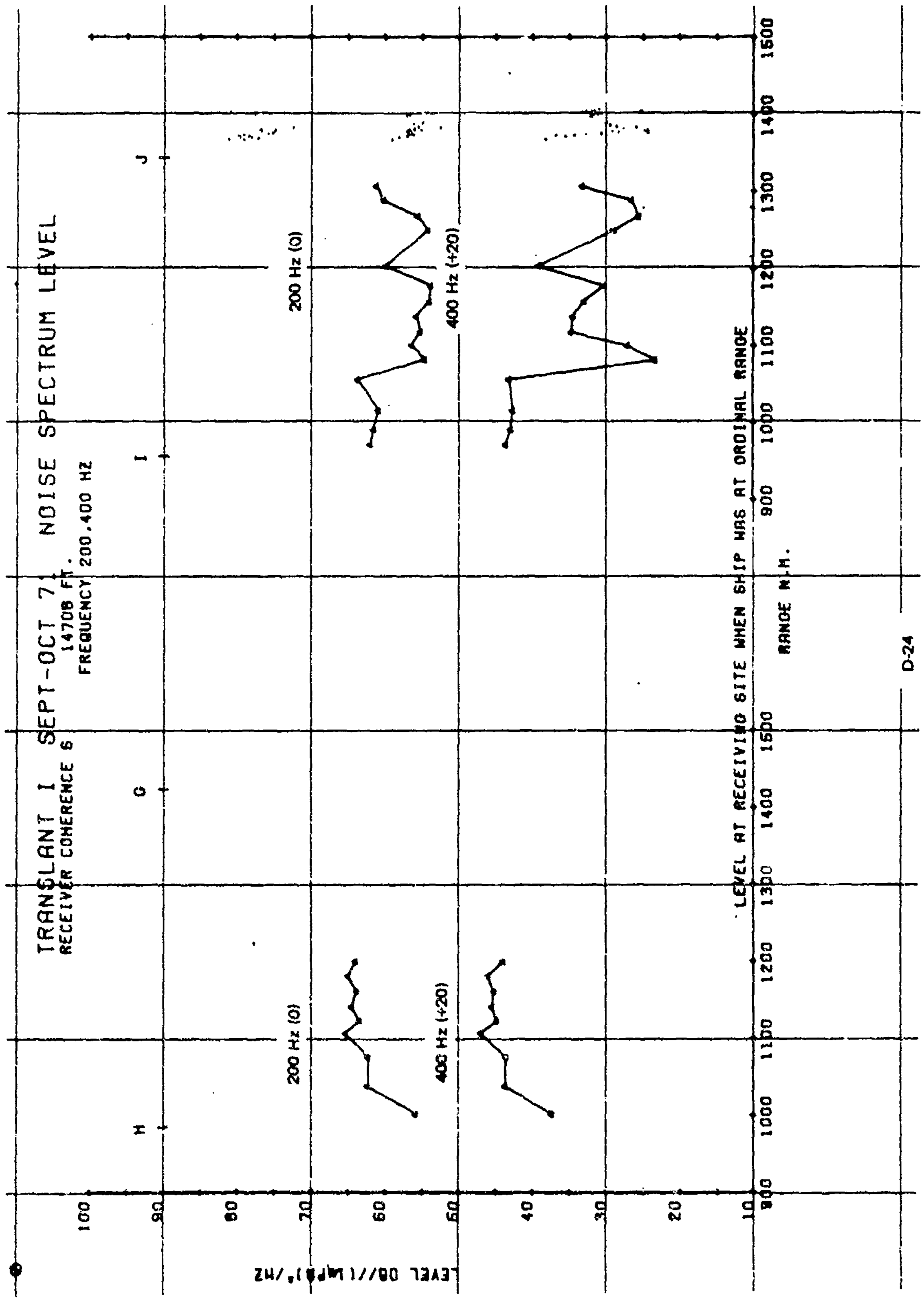

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVR 1
14000 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
400 Hz (+20)
200 Hz (0)
400 Hz (+20)
L
K
M
N
LEVEL DB//(uPa)²/HZ
100
80
60
70
60
50
40
30
20
10
900
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-19

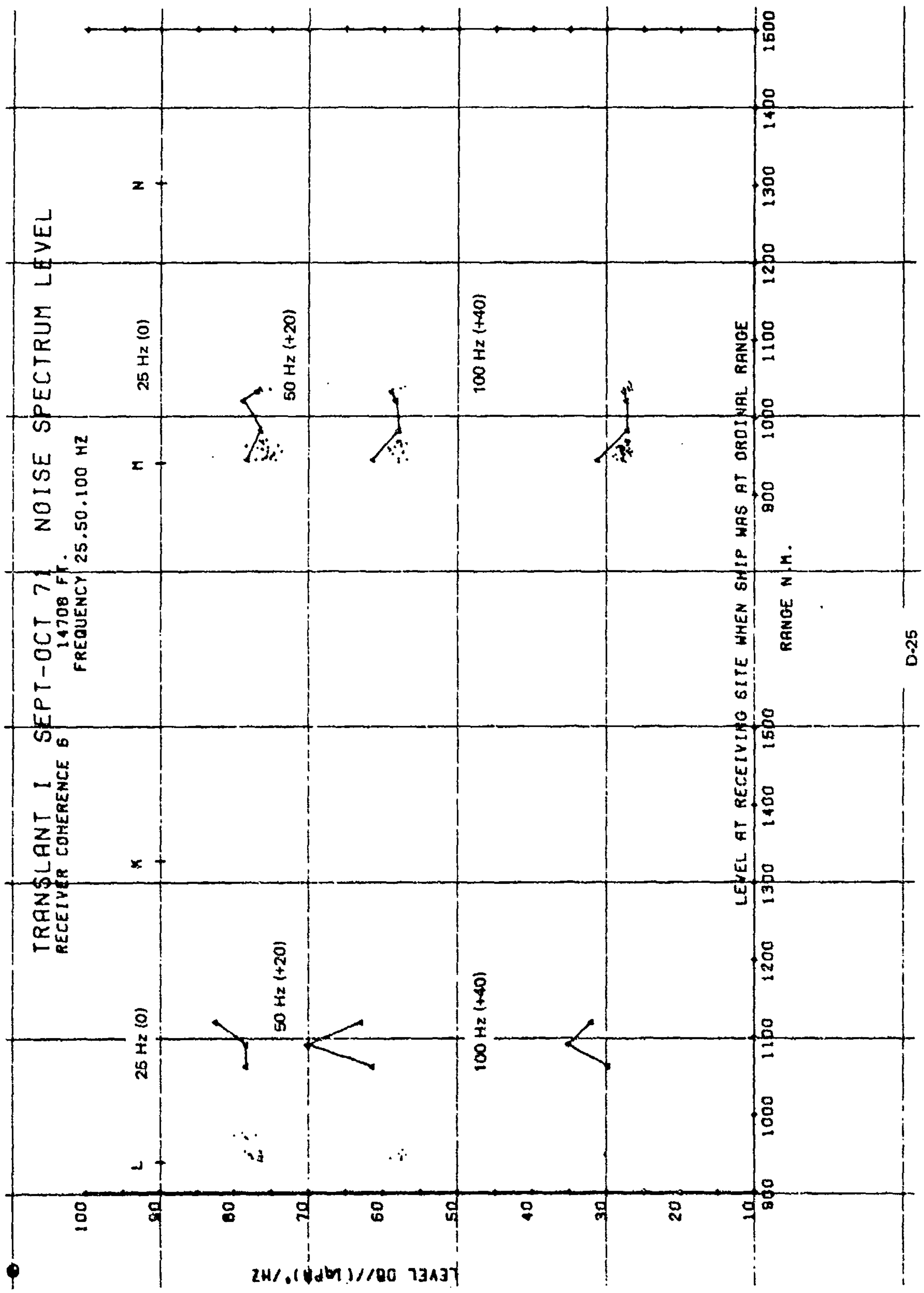

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER TVA 1
14000 FT.
25,50,100,200,400 HZ
25 Hz (0)
50 Hz (+25)
100 Hz (0)
200 Hz (+25)
400 Hz (0)
B
C D
E
B 612.4 N.M.
C 655.0 N.M.
D 695.5 N.M.
E 664.5 N.M.
900
1200
1500
1800
SHOT NUMBER
110
100
90
80
70
60
50
40
30
20
LEVEL DB//(1μPA)²/HZ
D-20

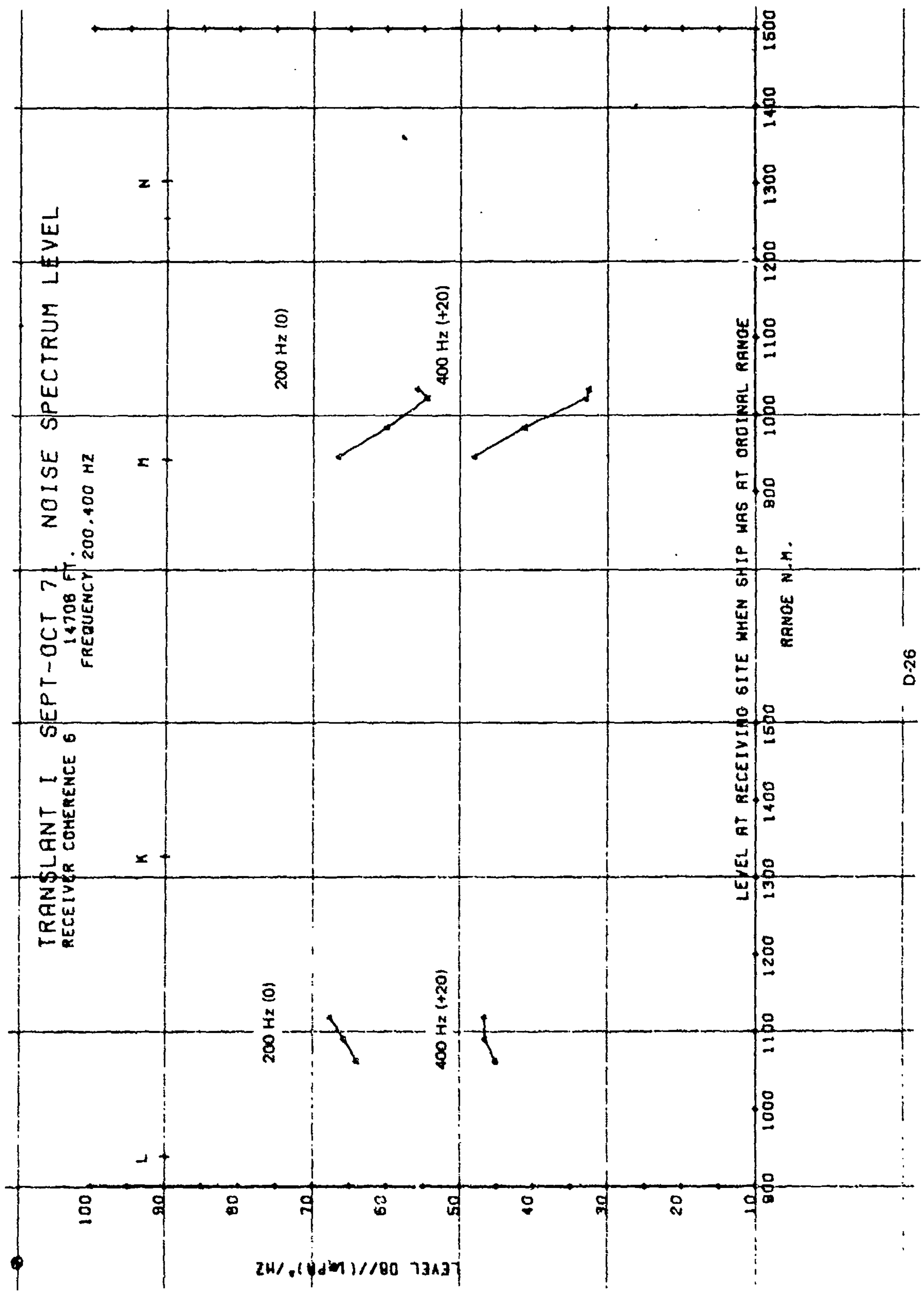

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
A
B
E
F
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(μPa)²/HZ
D-21


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 200,400 HZ
400 Hz (+20)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(UPA)²/HZ
D-22

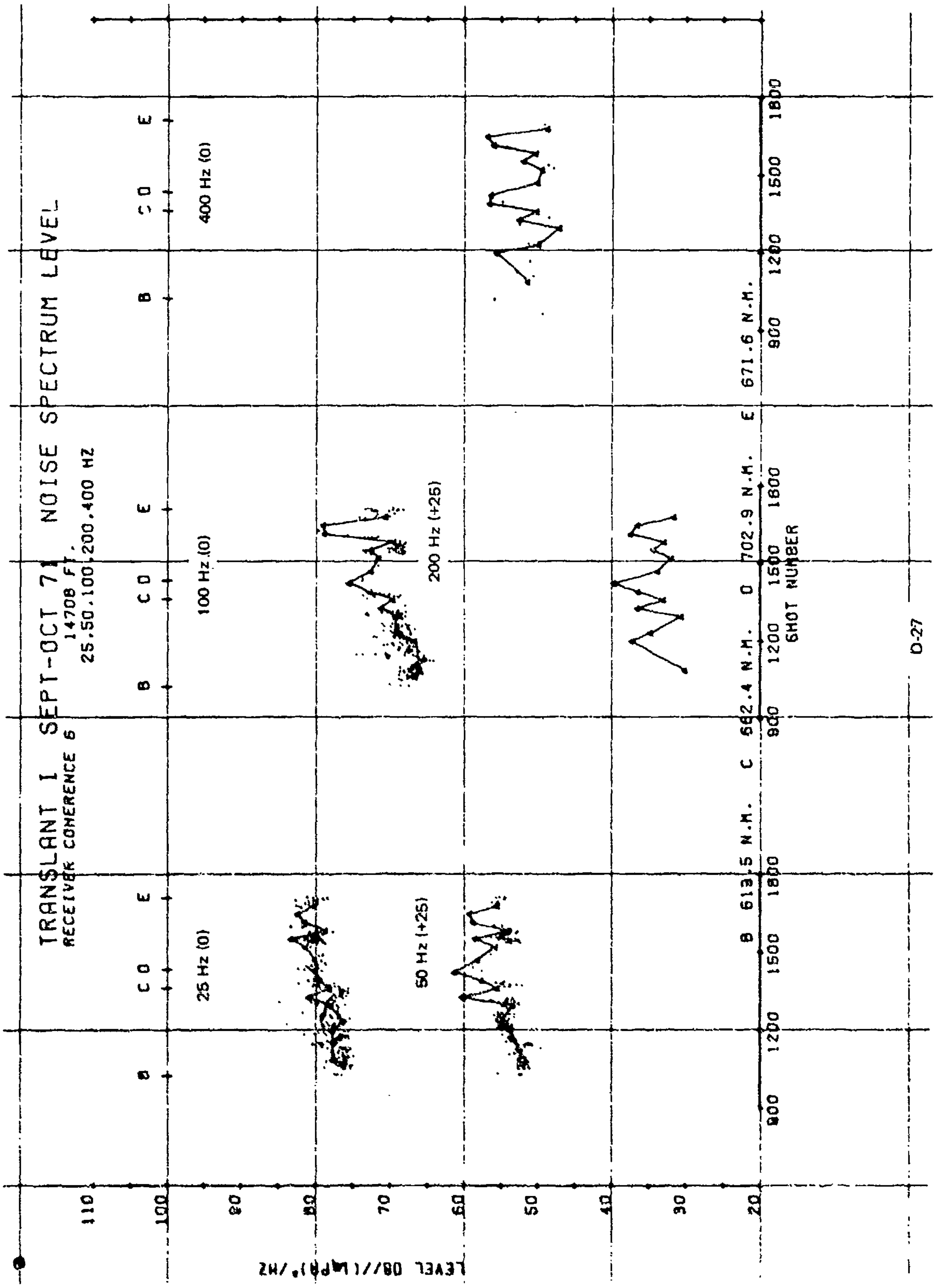

TRANSLANT I SEPT-OCT 7 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
H
G
I
J
LEVEL DB//(1 µPA)²/HZ
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-23


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
400 Hz (+20)
200 Hz (0)
400 Hz (+20)
H
G
I
J
LEVEL DB//(1 μPa)²/HZ
100
90
80
70
60
50
40
30
20
10
900
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
D-24


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (+20)
100 Hz (+40)
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.
LEVEL DB//(1μPA)²/HZ
L
K
M
N
D-25


TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
400 Hz (+20)
200 Hz (0)
400 Hz (+20)
L
K
M
N
LEVEL DB//(1μPA)²/HZ
100
90
80
70
60
50
40
30
20
10
900
1000
1100
1200
1300
1400
1500
800
900
1000
1100
1200
1300
1400
1500
LEVEL AT RECEIVING SITE WHEN SHIP WAS AT ORDINAL RANGE
RANGE N.M.

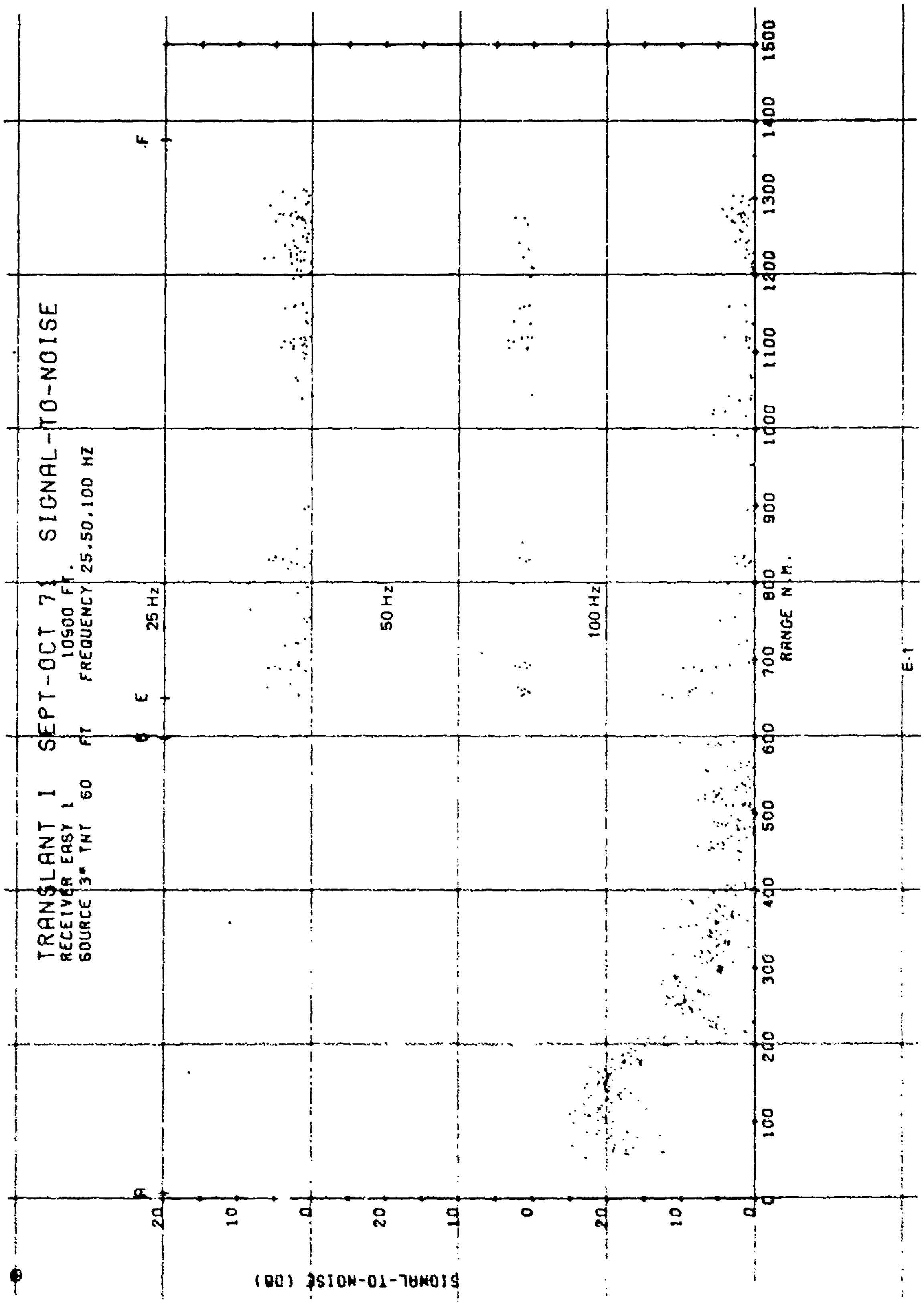
D-26

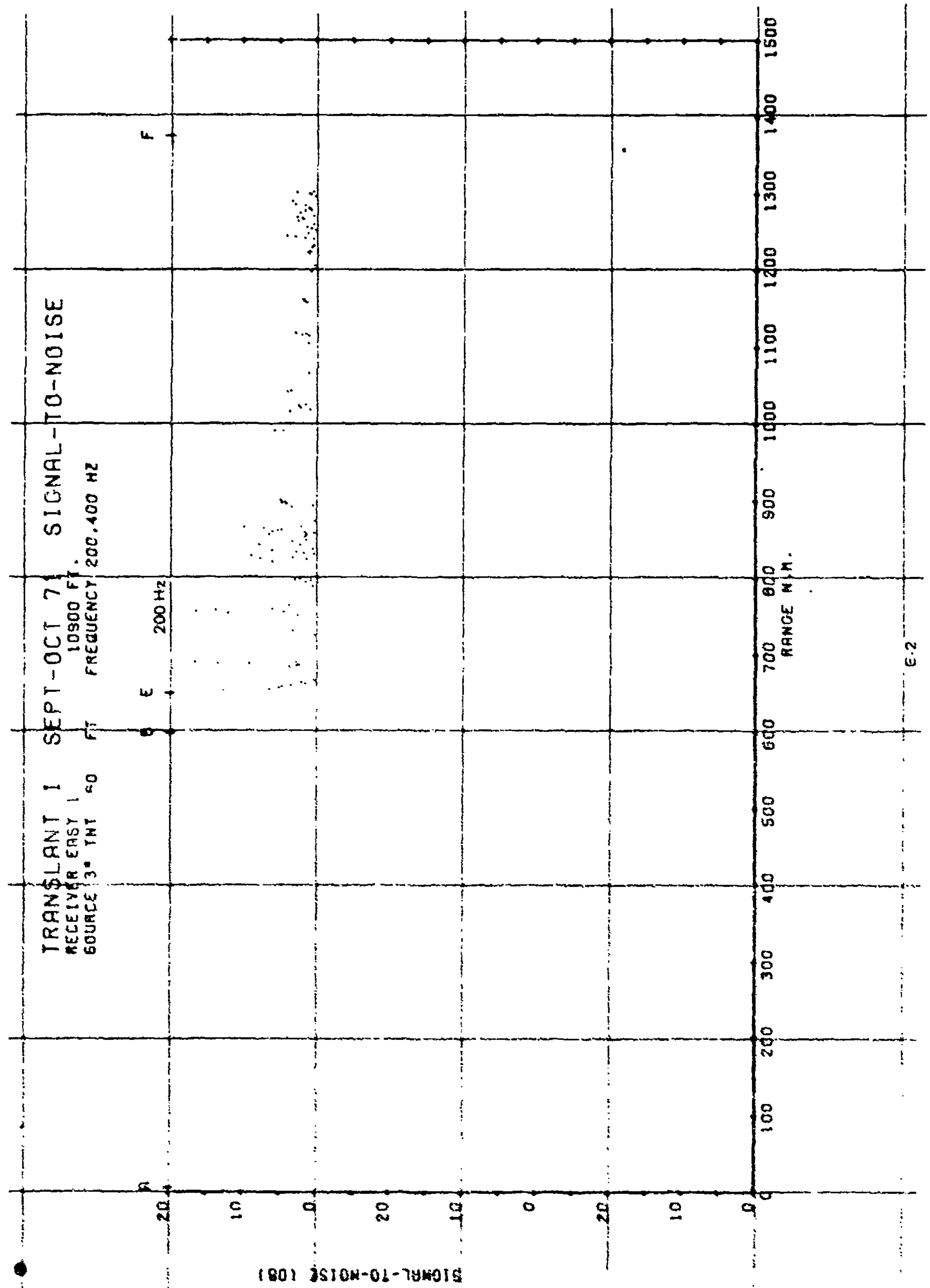

TRANSLANT I SEPT-OCT 71 NOISE SPECTRUM LEVEL
RECEIVER COHERENCE 6
14708 FT.
25.50.100.200.400 HZ
25 Hz (0)
50 Hz (+25)
100 Hz (0)
200 Hz (+25)
400 Hz (0)
B 613.5 N.M.
C 662.4 N.M.
D 702.9 N.M.
E 671.6 N.M.
SHOT NUMBER
D-27

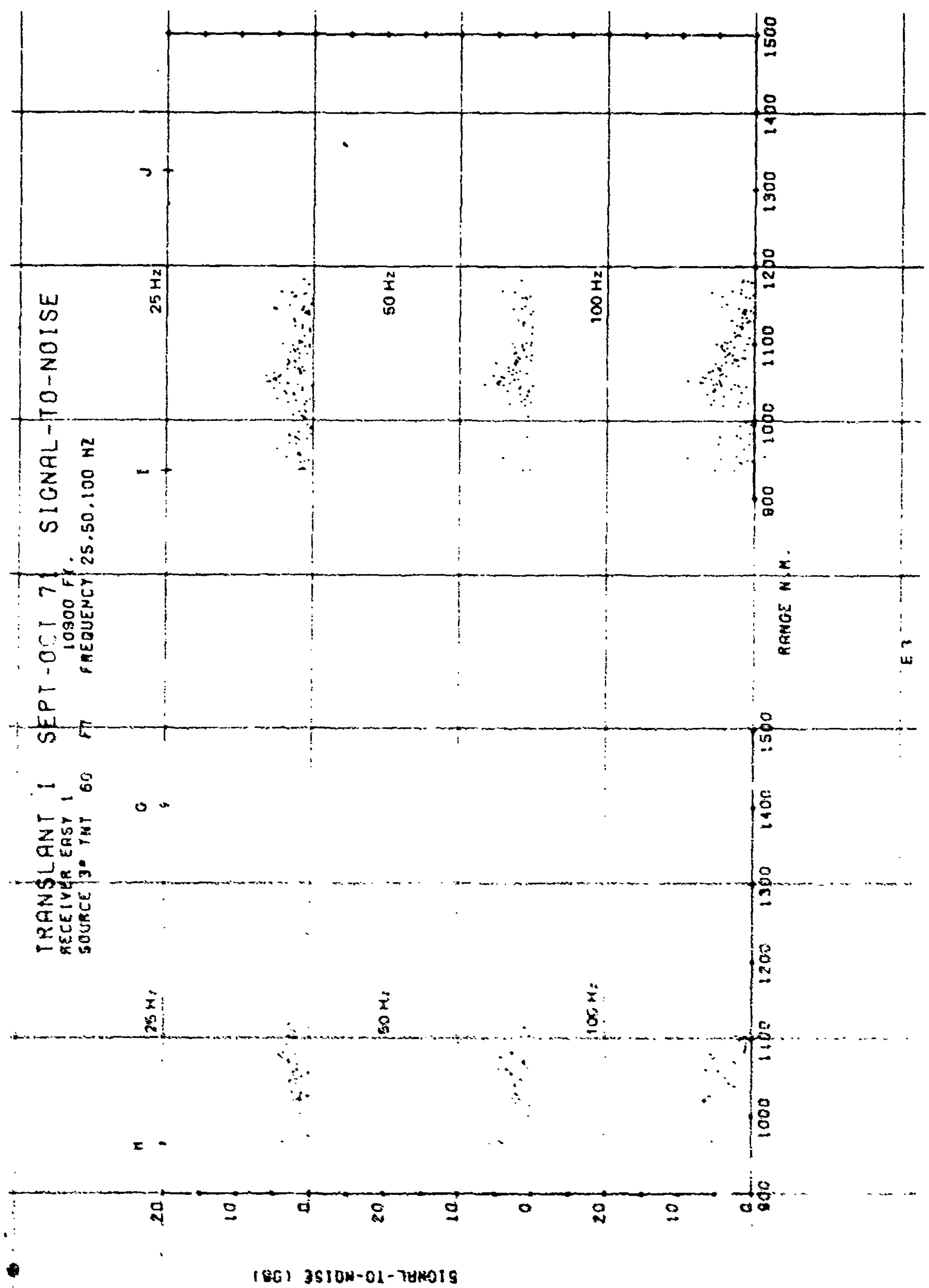
Appendix E

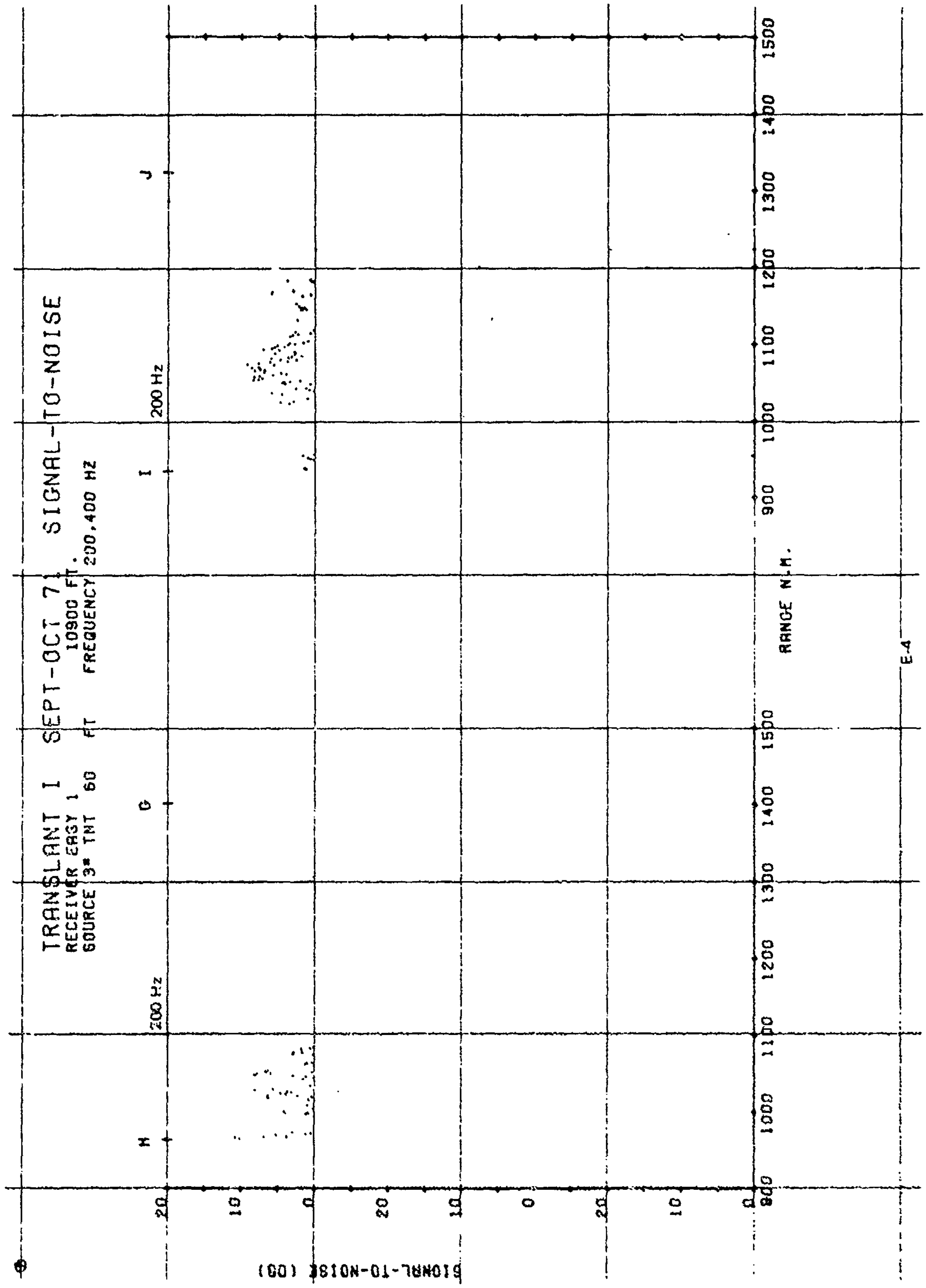
TRANSLANT I SIGNAL-TO-NOISE LEVELS

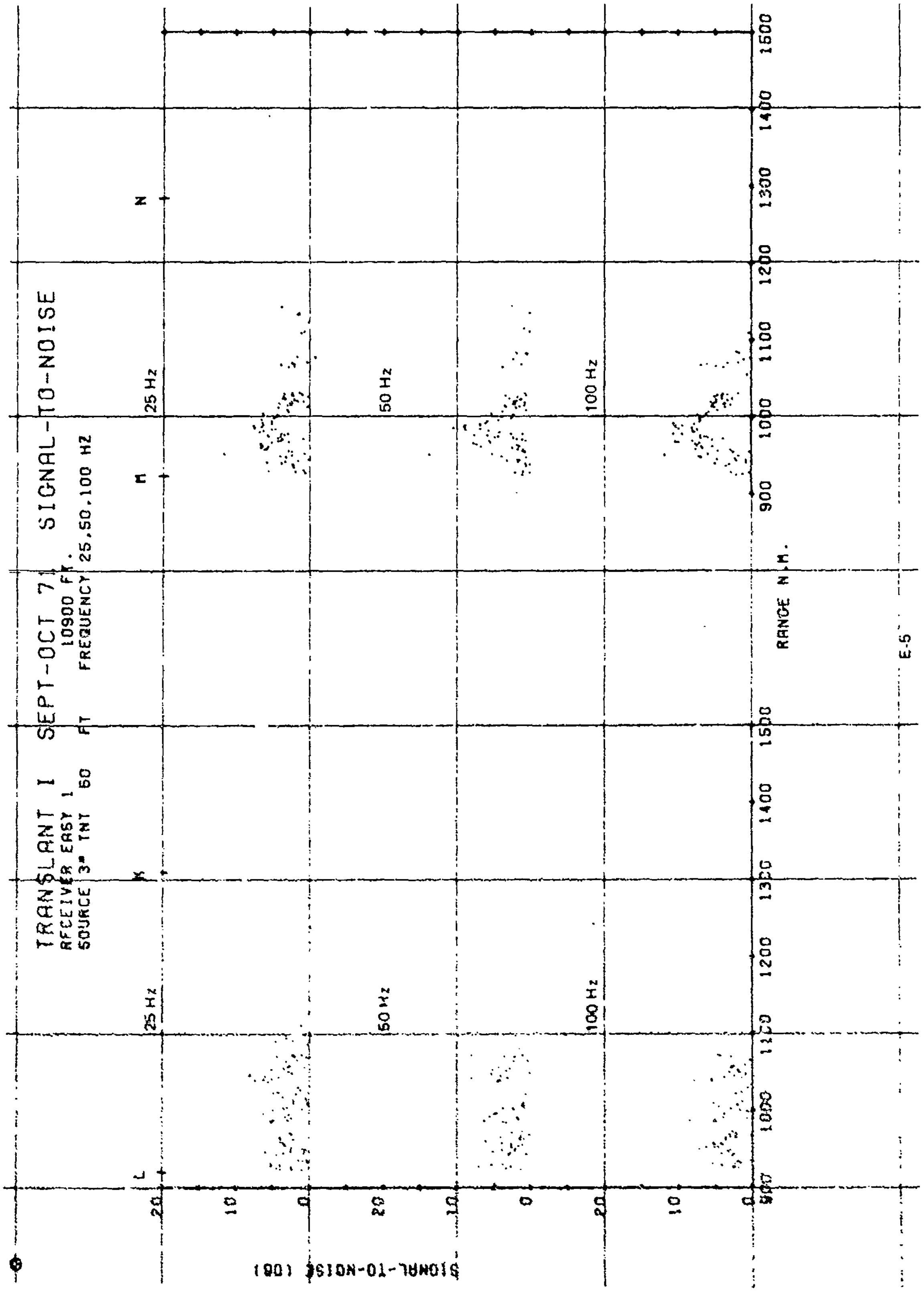
The signal-to-noise ratios for the TRANSLANT I measurements are shown on the following pages.

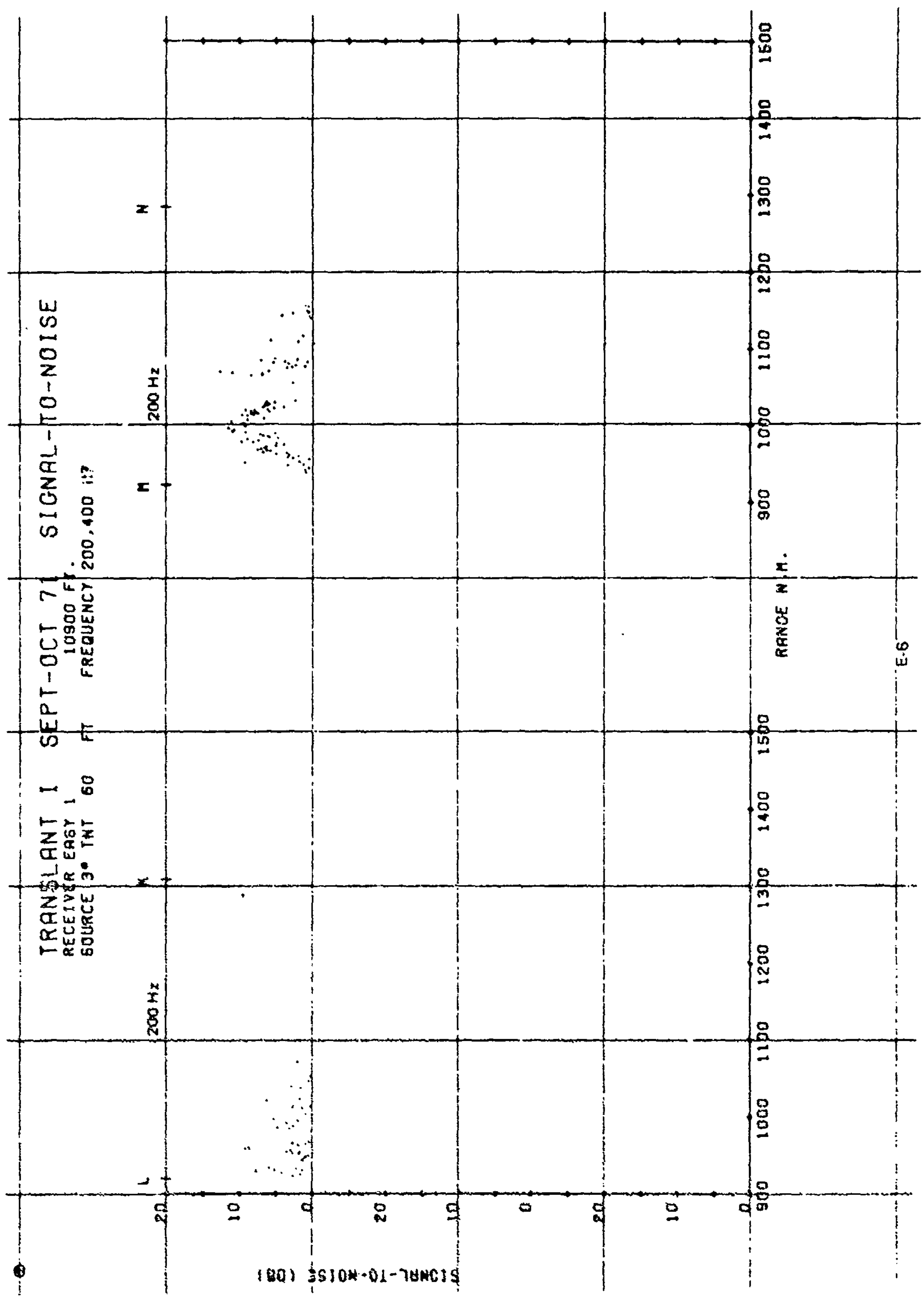

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10500 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
A
E
F
SIGNAL-TO-NOISE (DB)
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
20 10 0 20 10 0 20 10 0
E-1

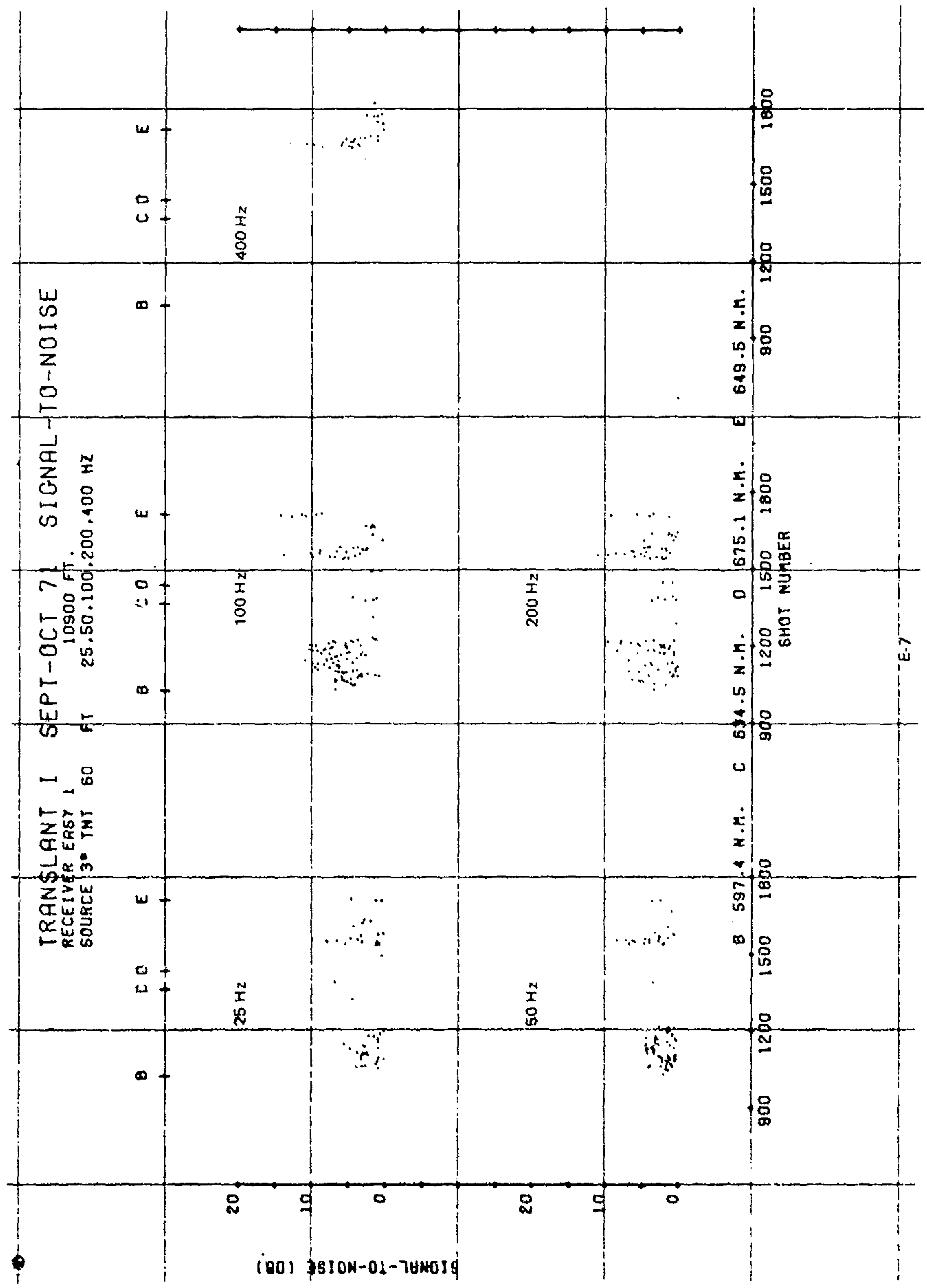

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200,400 HZ
200 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-2

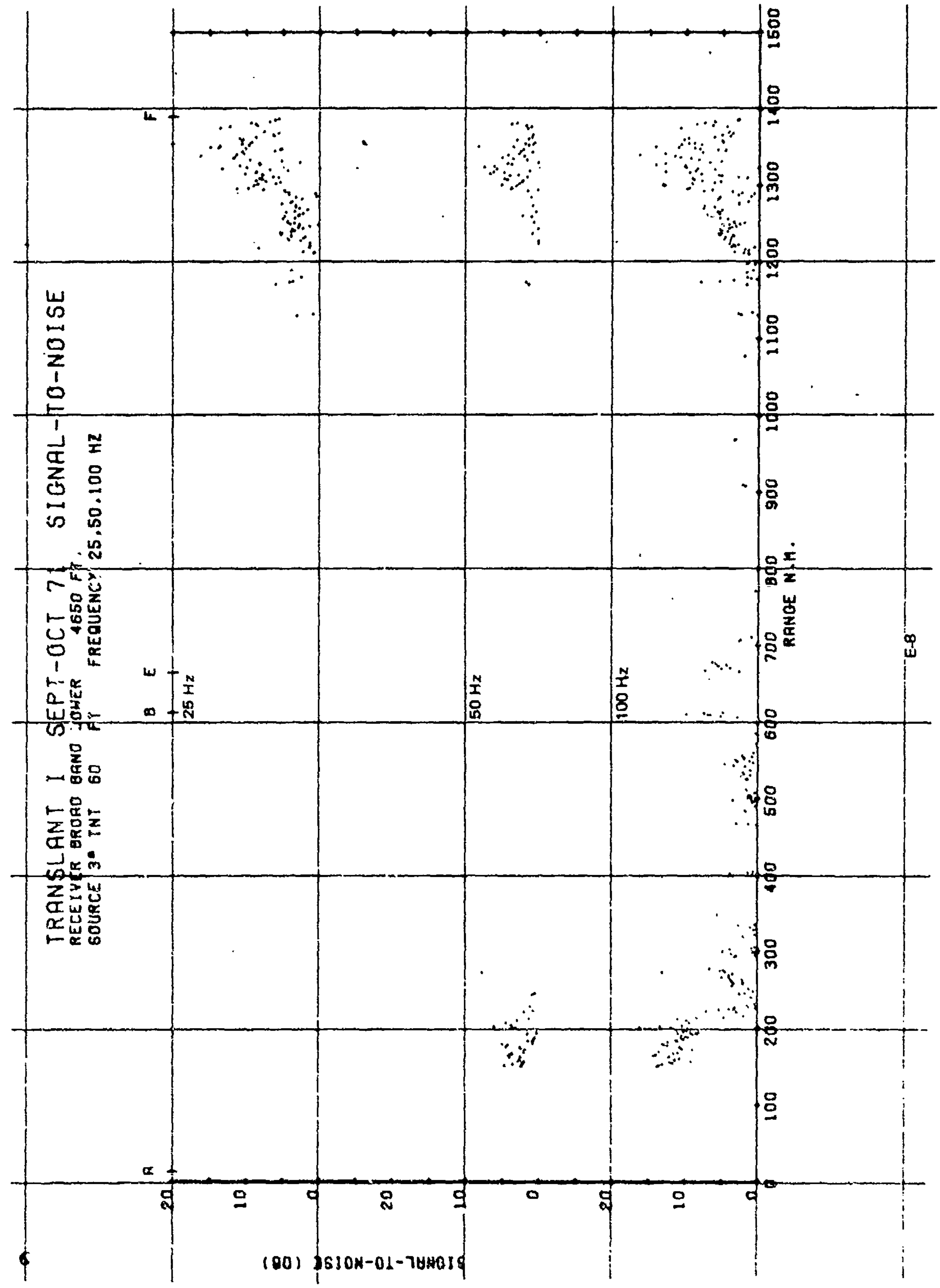

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)

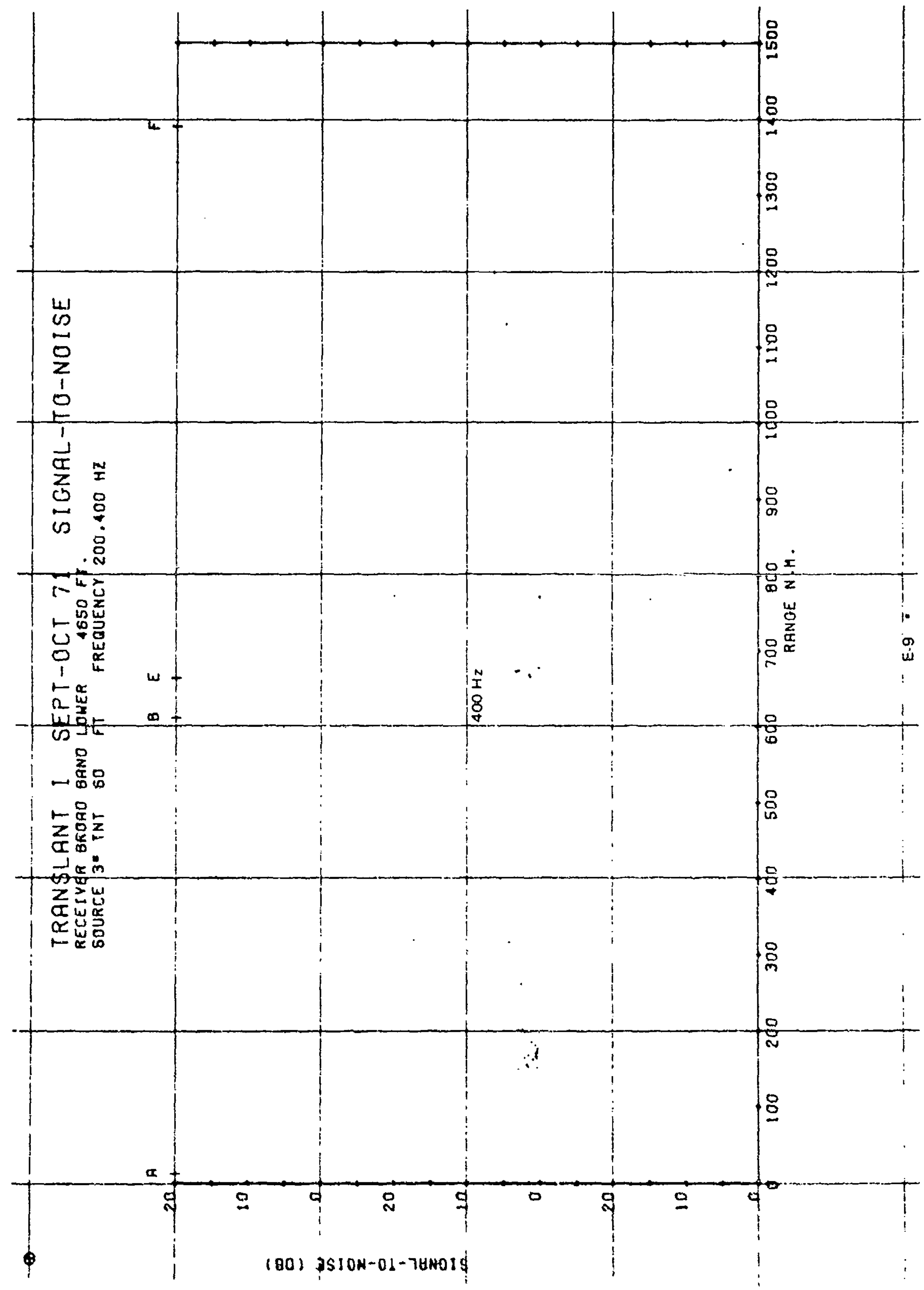

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200,400 HZ
200 Hz
200 Hz
H
G
I
J
20
10
0
20
10
0
20
10
0
800
1000
1100
1200
1300
1400
1500
900
1000
1100
1200
1300
1400
1500
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-4

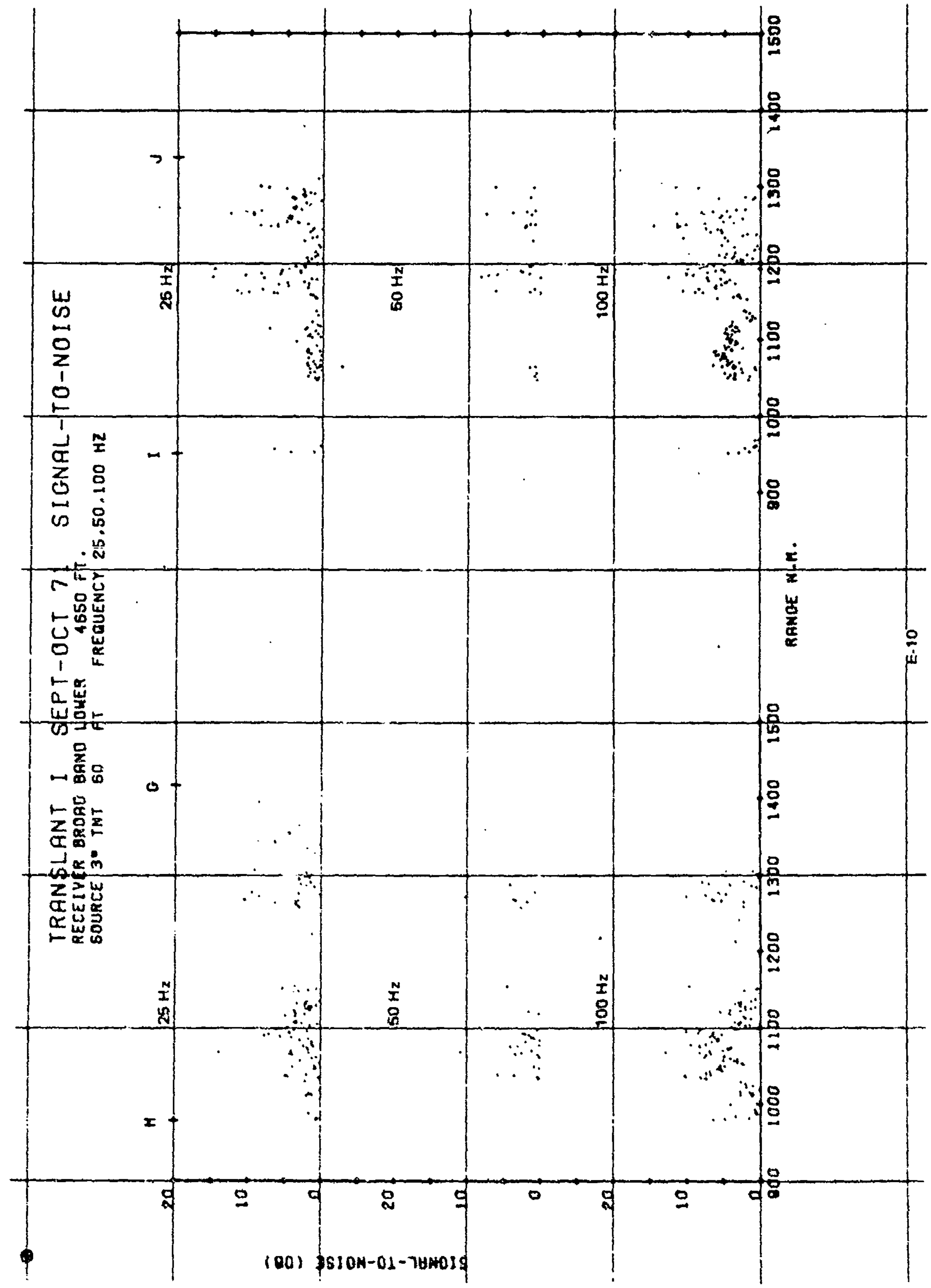

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
N
M
K
L
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-5

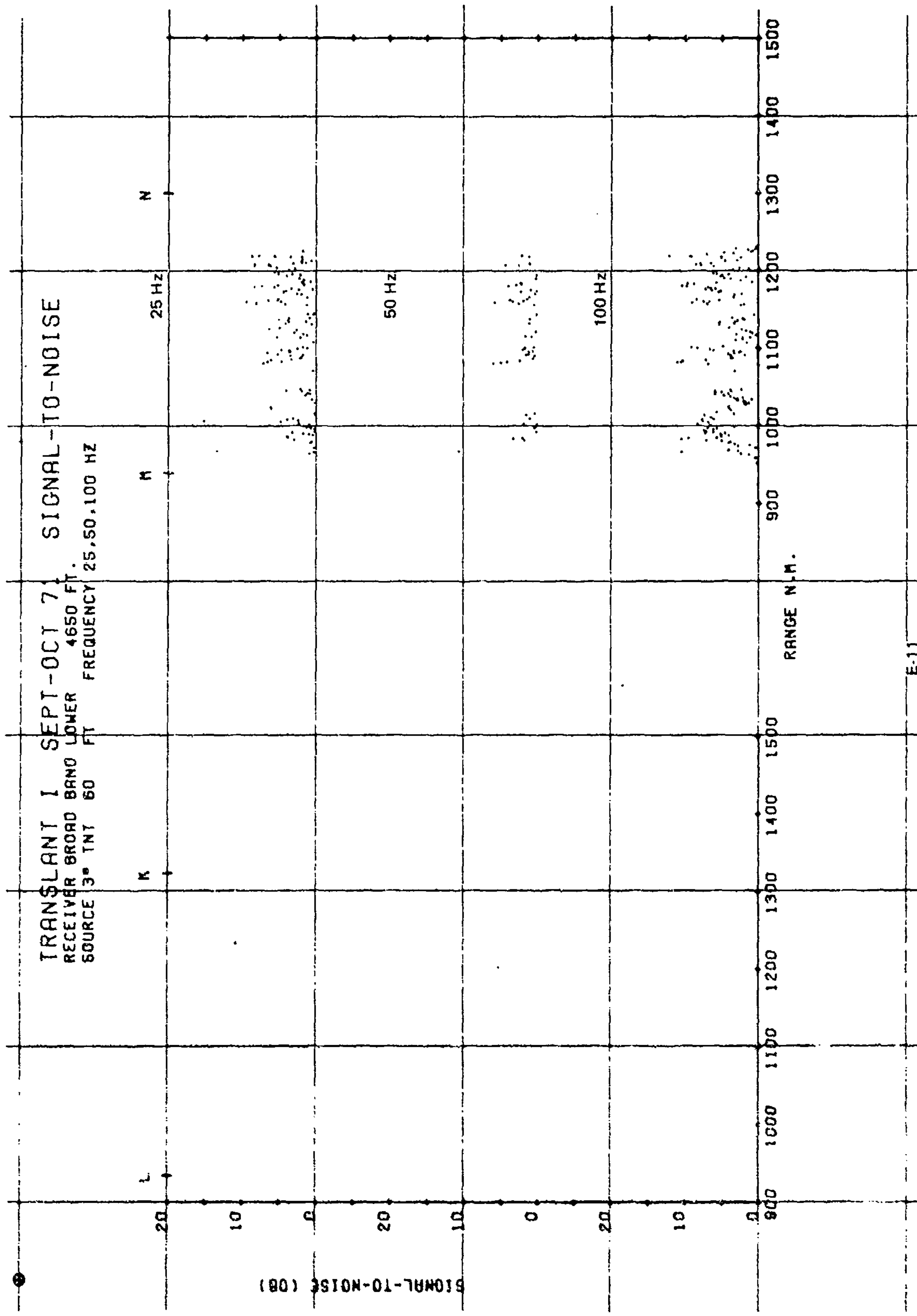

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200,400 HZ
200 Hz
200 Hz
L
K
M
N
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-6

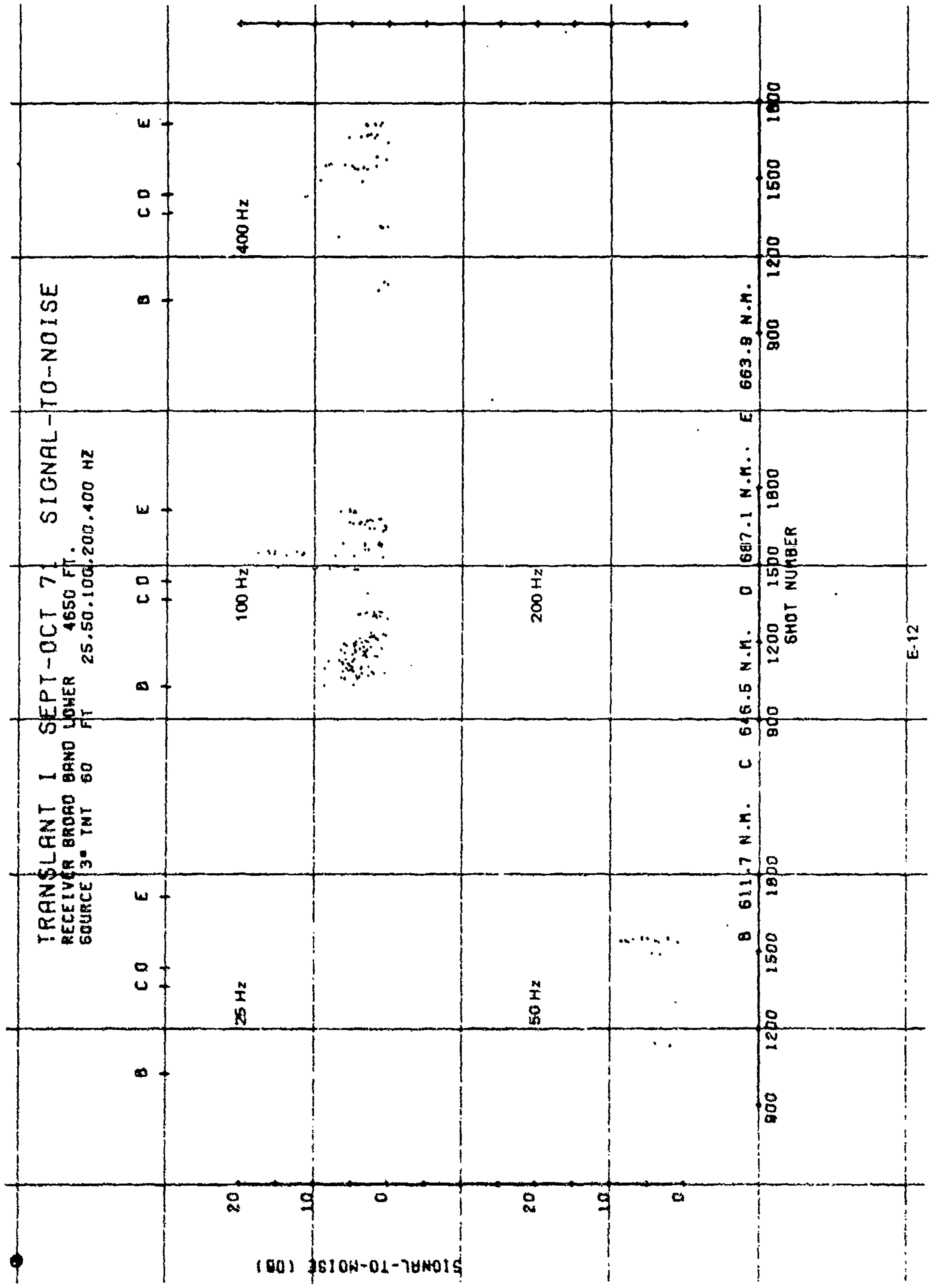

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER ERSY 1 10900 FT.
SOURCE 3# TNT 60 FT 25.50.100.200.400 HZ
400 Hz
100 Hz
200 Hz
25 Hz
50 Hz
B 597.4 N.M. C 634.5 N.M. D 675.1 N.M. E 649.5 N.M.
SHOT NUMBER
SIGNAL-TO-NOISE (DB)
E-7

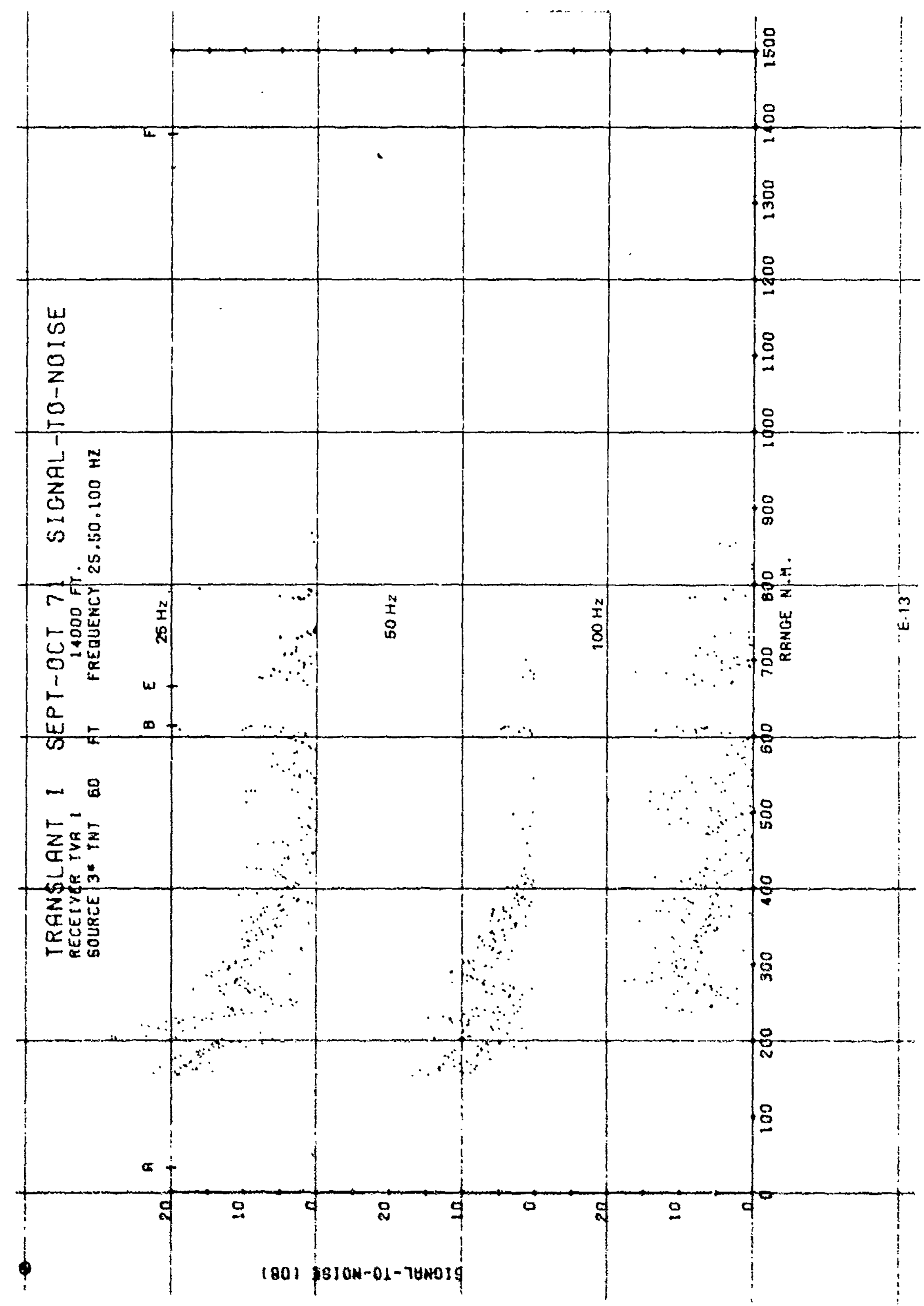

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-8

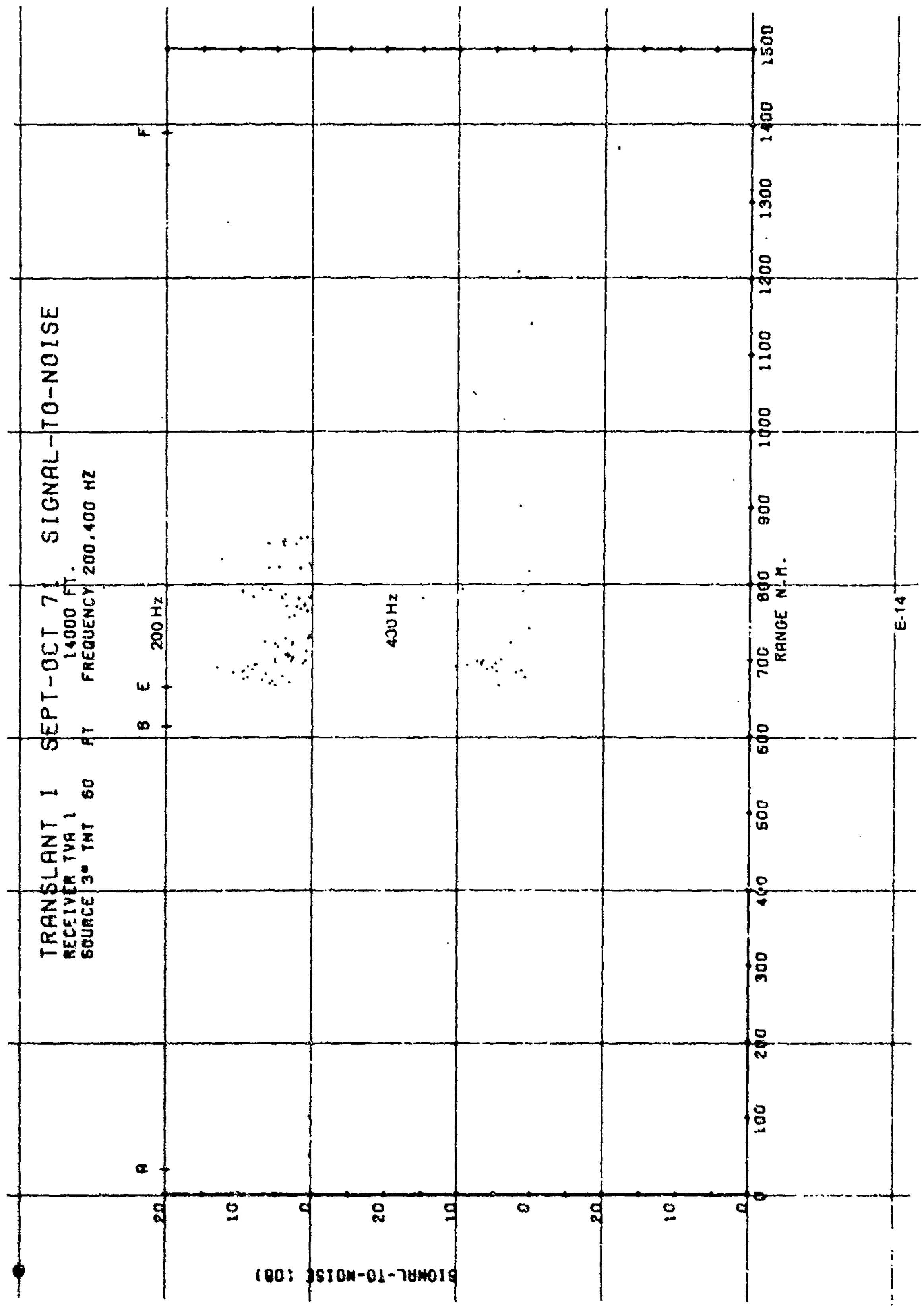

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 200.400 HZ
RANGE N.M.
SIGNAL-TO-NOISE (DB)
400 Hz
A
B
E
F
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
20 10 0 20 10 0 20 10 0
E-9

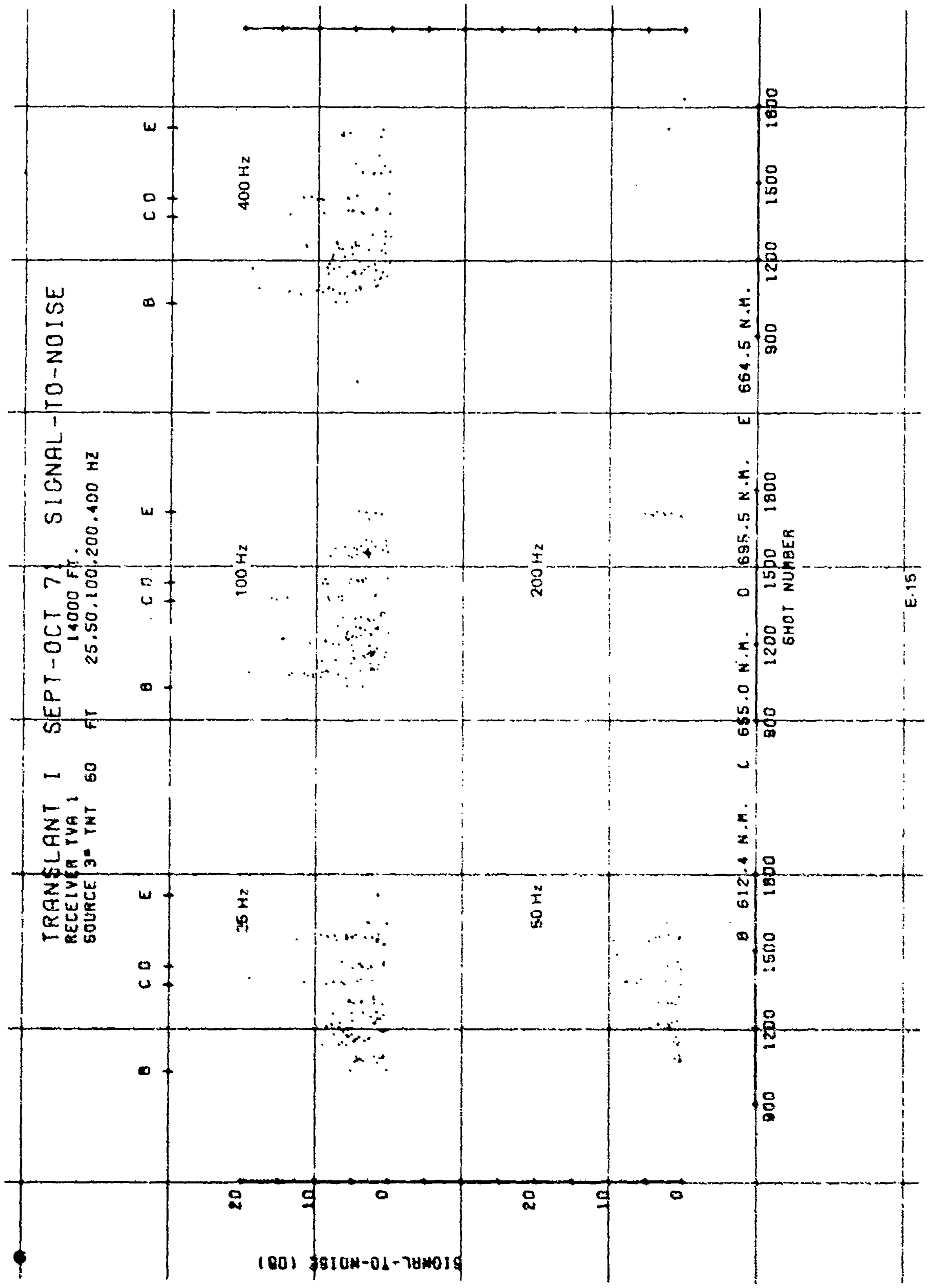

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
H
G
I
J
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-10

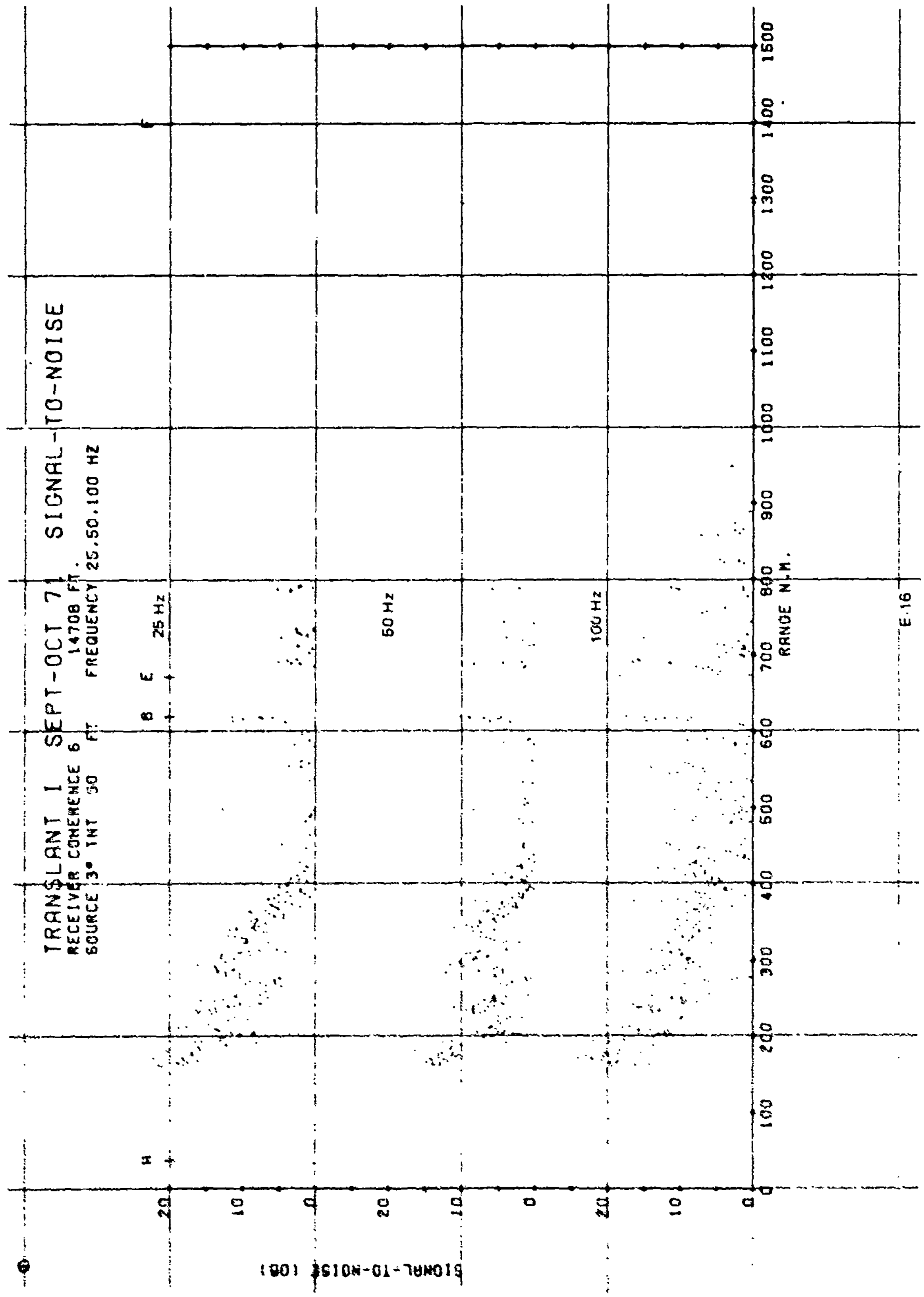

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
L
K
M
N
SIGNAL-TO-NOISE (DB)
RANGE N.M.
E-11

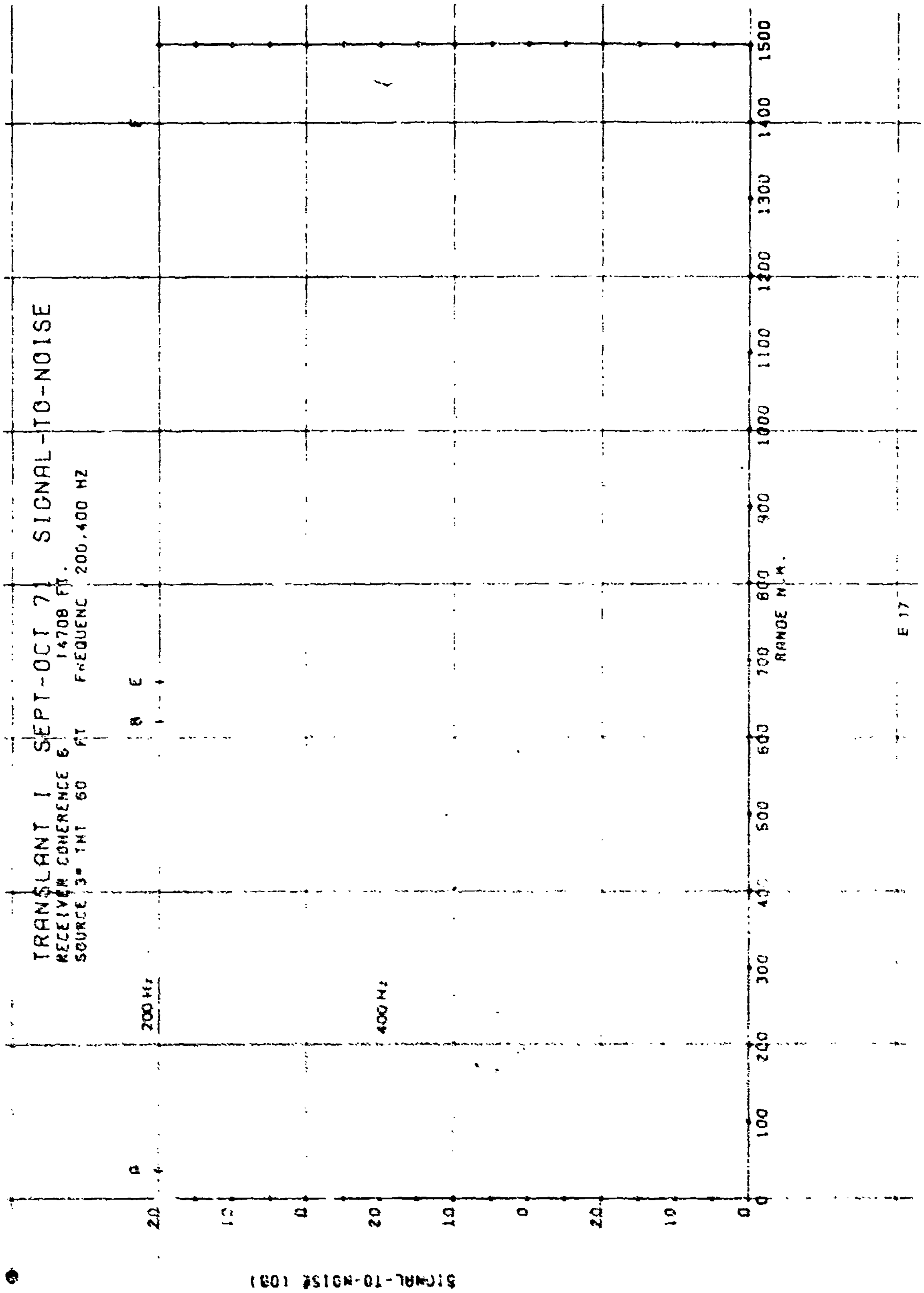

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT 25.50.100.200.400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
B 611.7 N.M. C
646.5 N.M. D
687.1 N.M. E
663.9 N.M.
SHOT NUMBER
SIGNAL-TO-NOISE (DB)
E-12

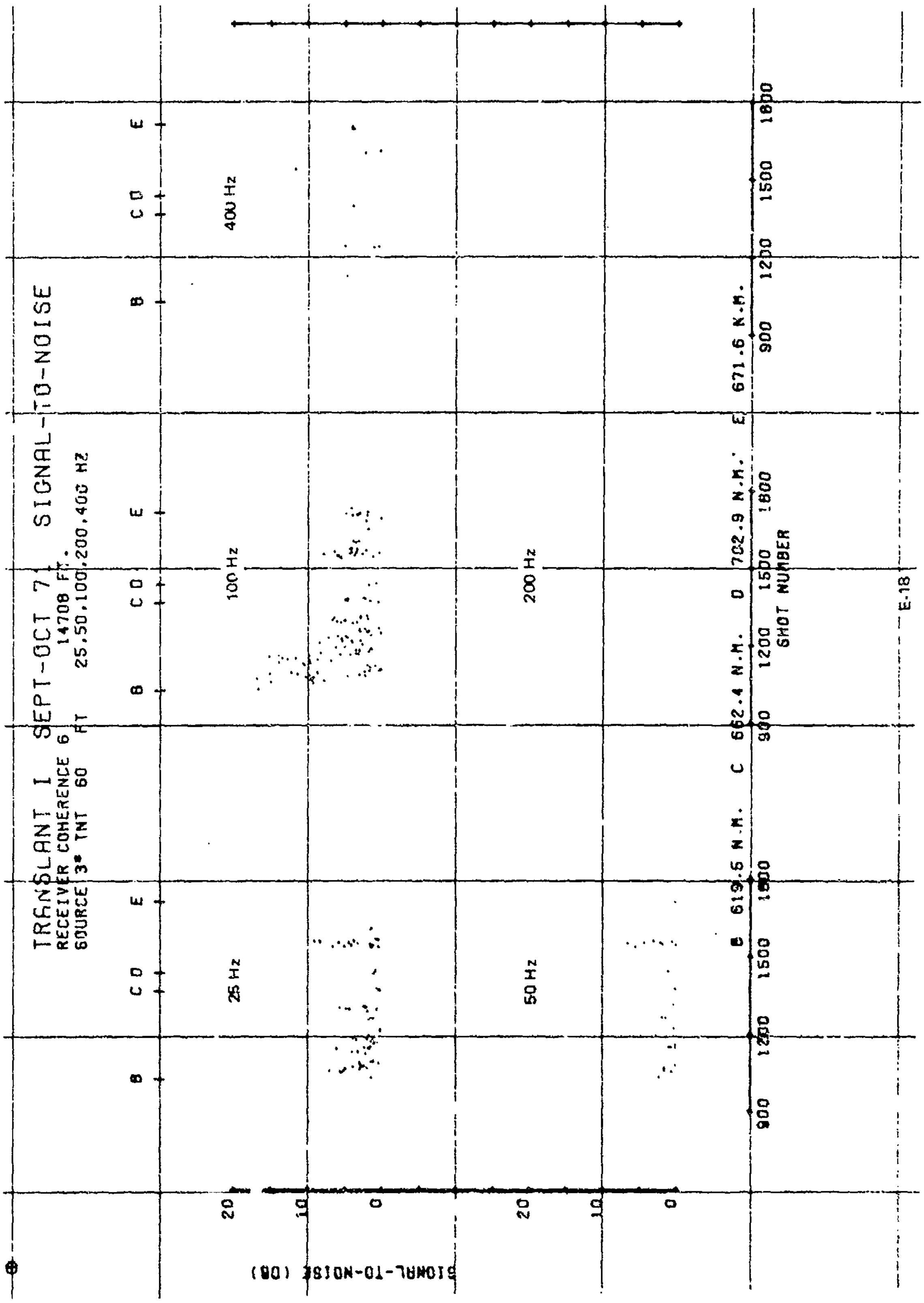

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA I 14000 FT.
SOURCE 3* TNT 60 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
A
B
E
F
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
RANGE N.M.
20
10
0
SIGNAL-TO-NOISE (DB)
E-13

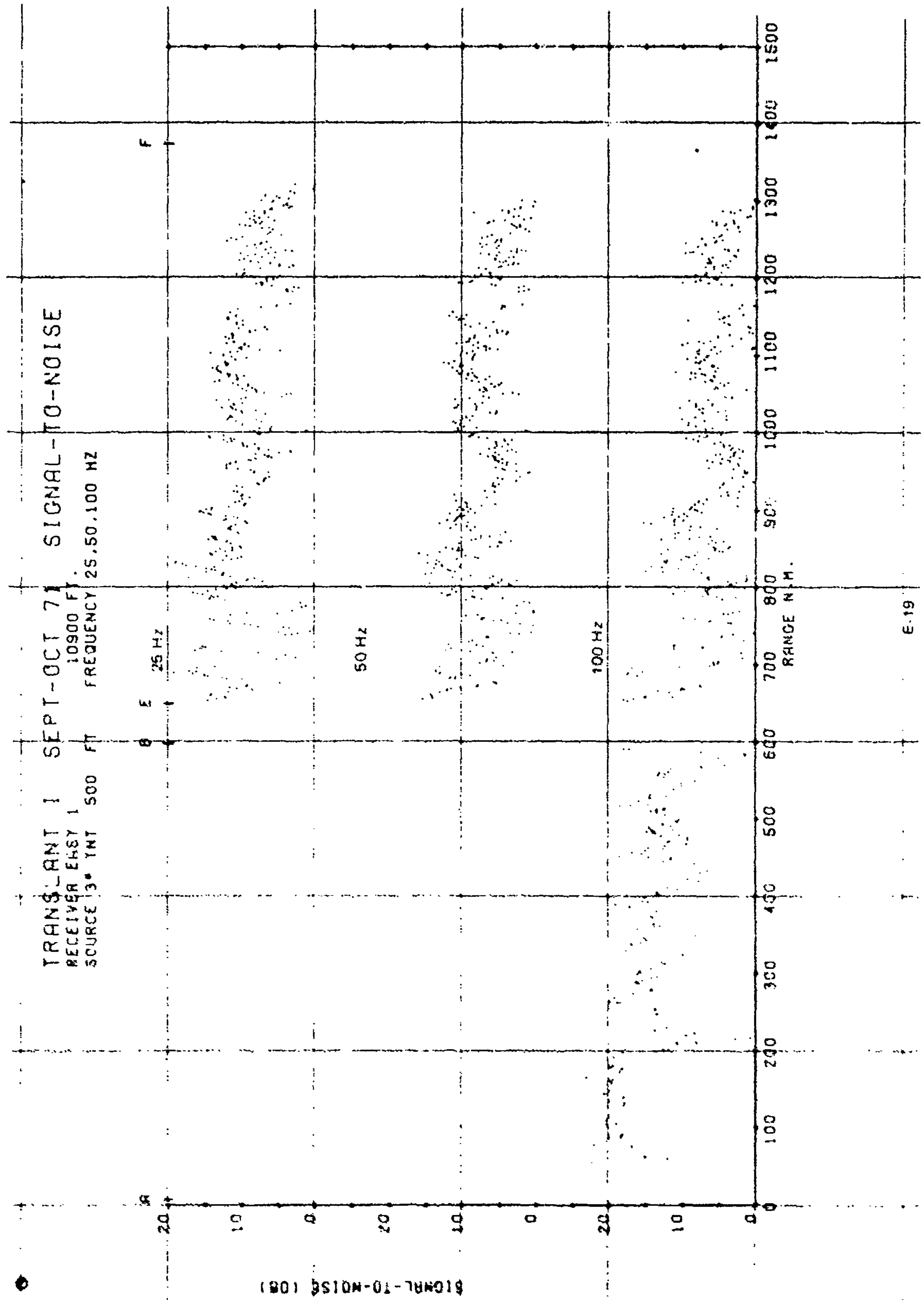

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3" TNT 60 FT FREQUENCY 200,400 HZ
200 Hz
400 Hz
A
B
E
F
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
SIGNAL-TO-NOISE (DB)
20 10 0 20 10 0 20 10 0
E-14

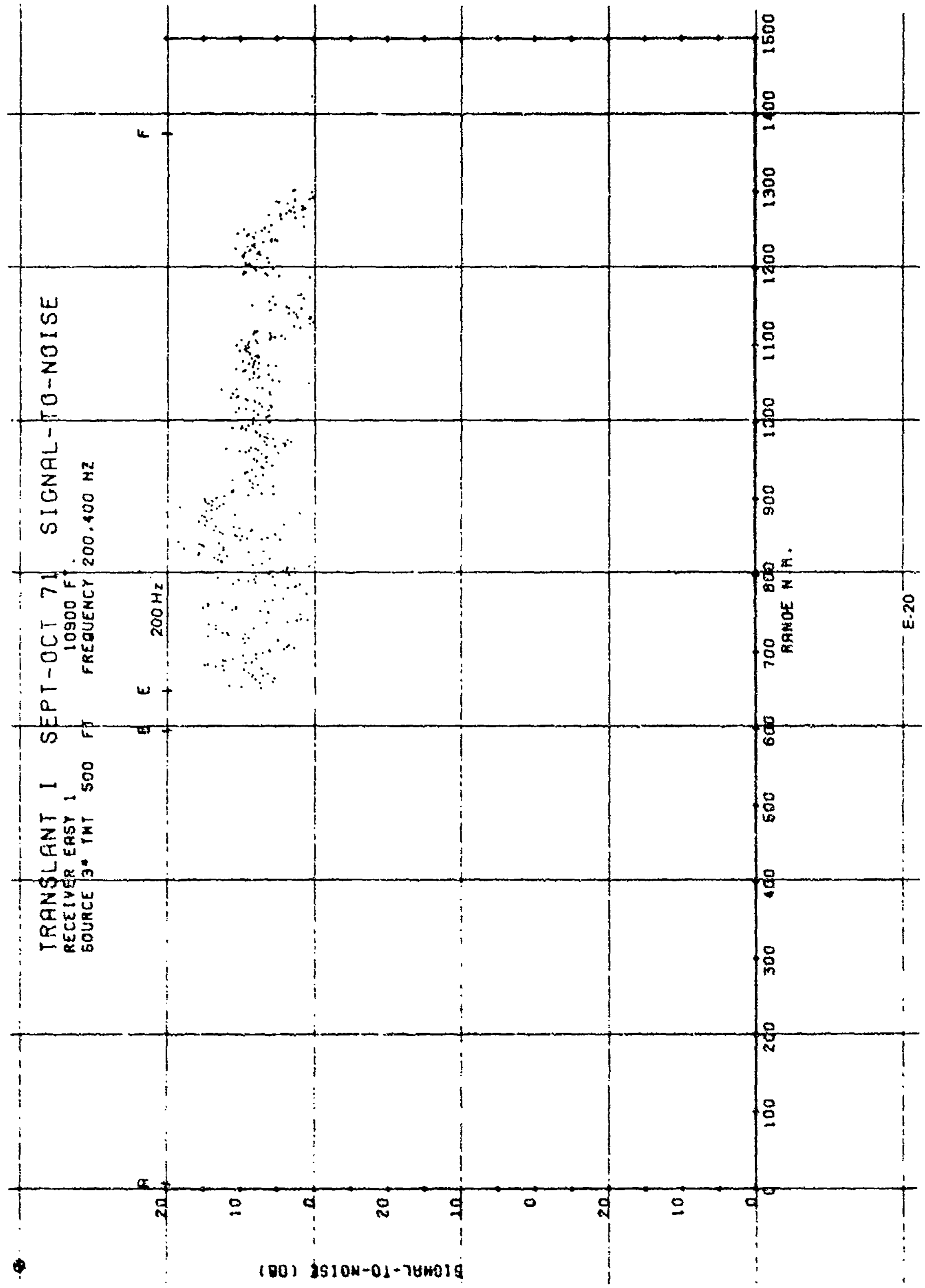

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 60 FT 25,50,100,200,400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
B
C D
E
612.4 N.M.
655.0 N.M.
695.5 N.M.
664.5 N.M.
900
1200
1500
1800
SHOT NUMBER
20
10
0
SIGNAL-TO-NOISE (DB)
E-15

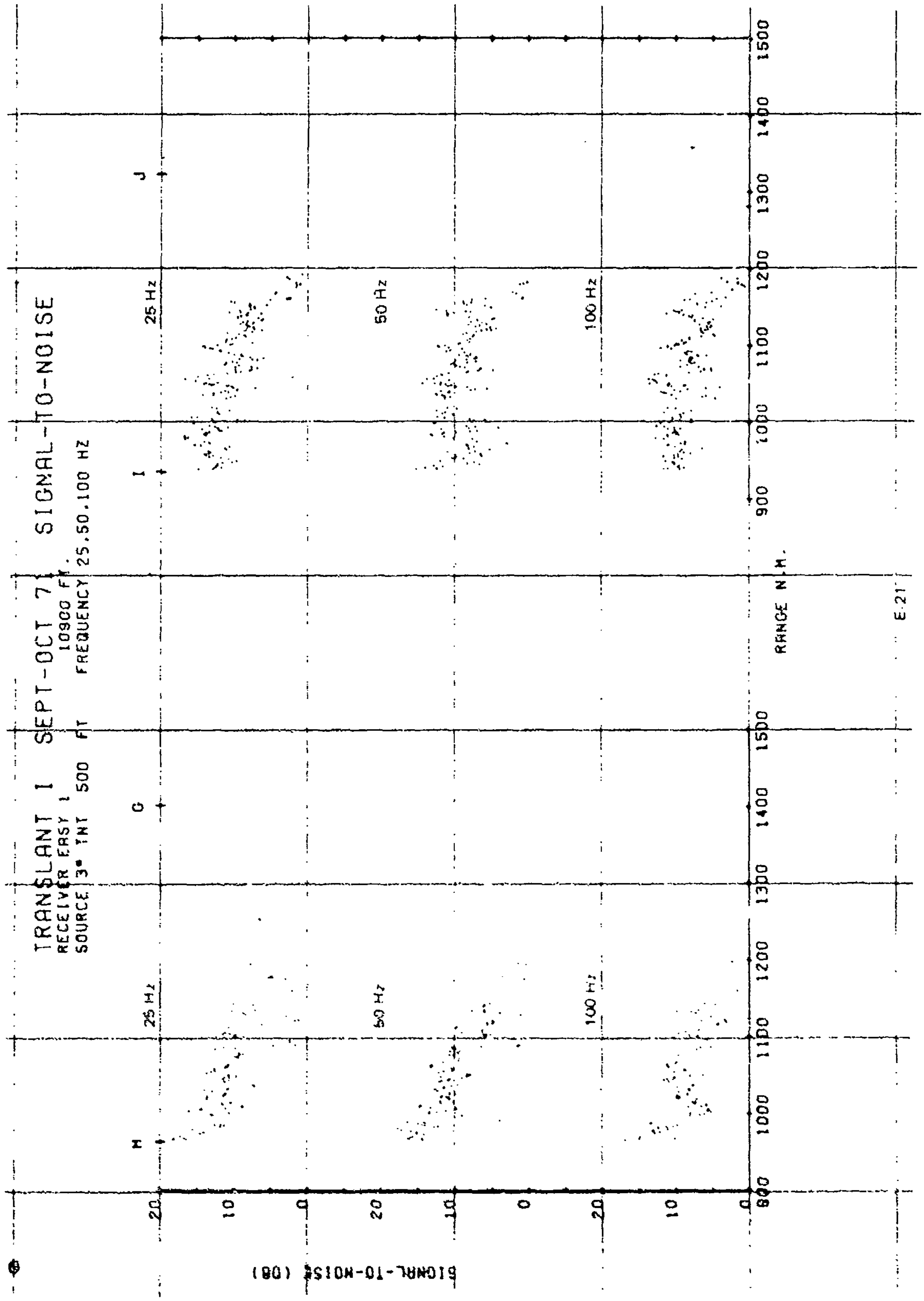

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3° INT 30 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
B E
H
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
SIGNAL-TO-NOISE (DB)
20 10 0 20 10 0 20 10 0
E.16

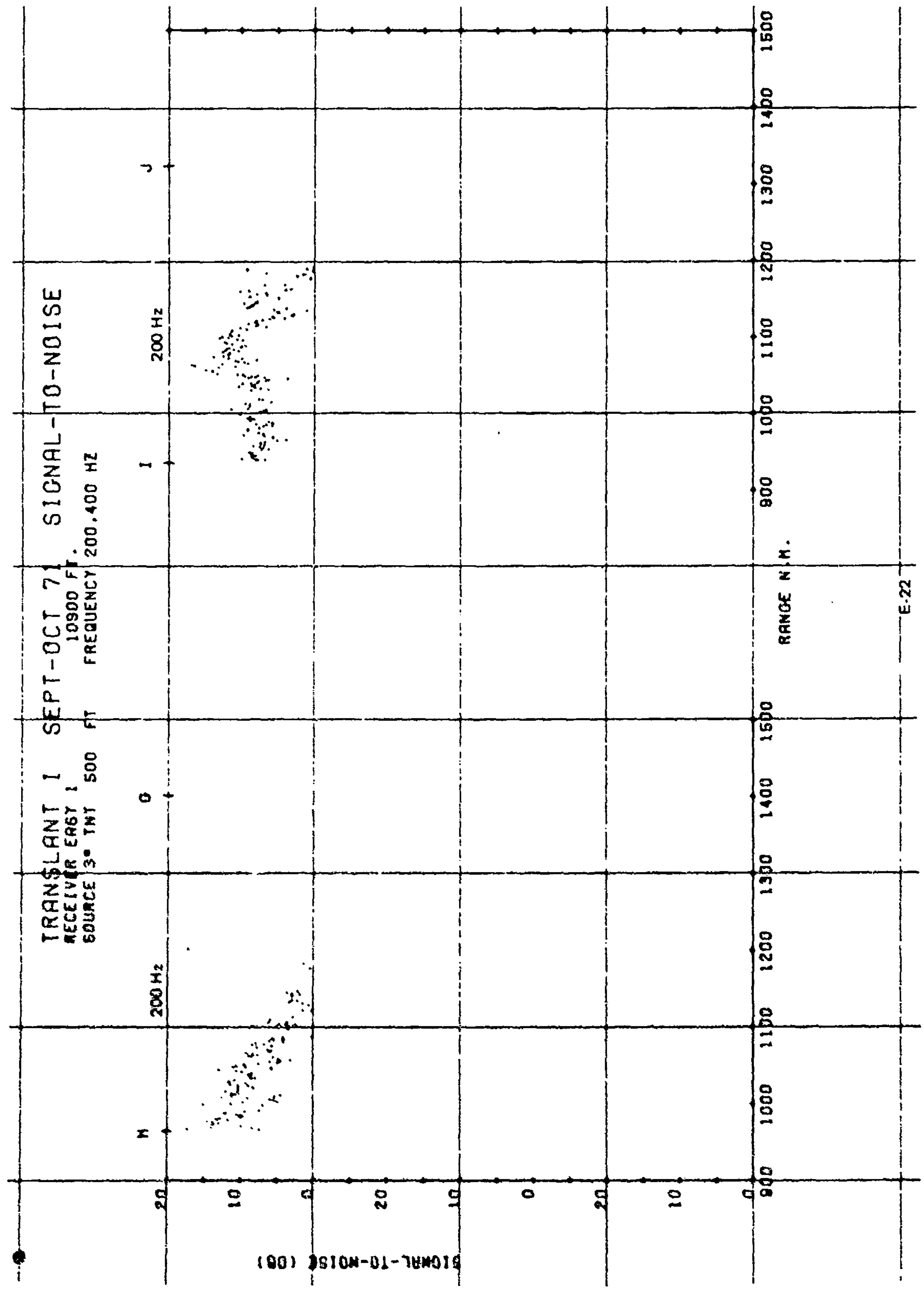

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3* TNT 60 FT FREQUENC 200,400 HZ
200 Hz
400 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E 17

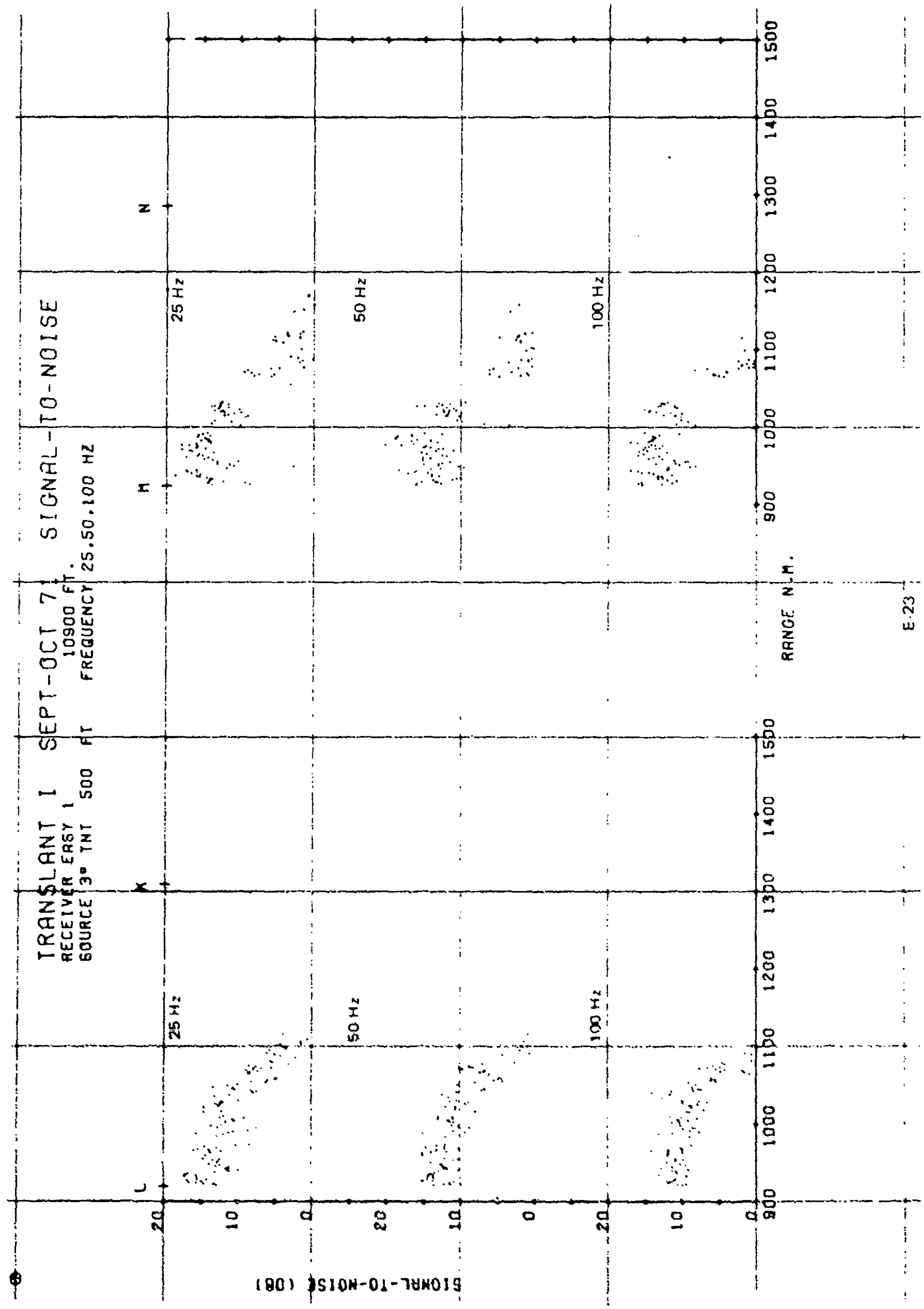

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 60 FT 25,50,100,200,400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
619.5 N.M.
662.4 N.M.
702.9 N.M.
671.6 K.M.
SHOT NUMBER
SIGNAL-TO-NOISE (DB)
E-18

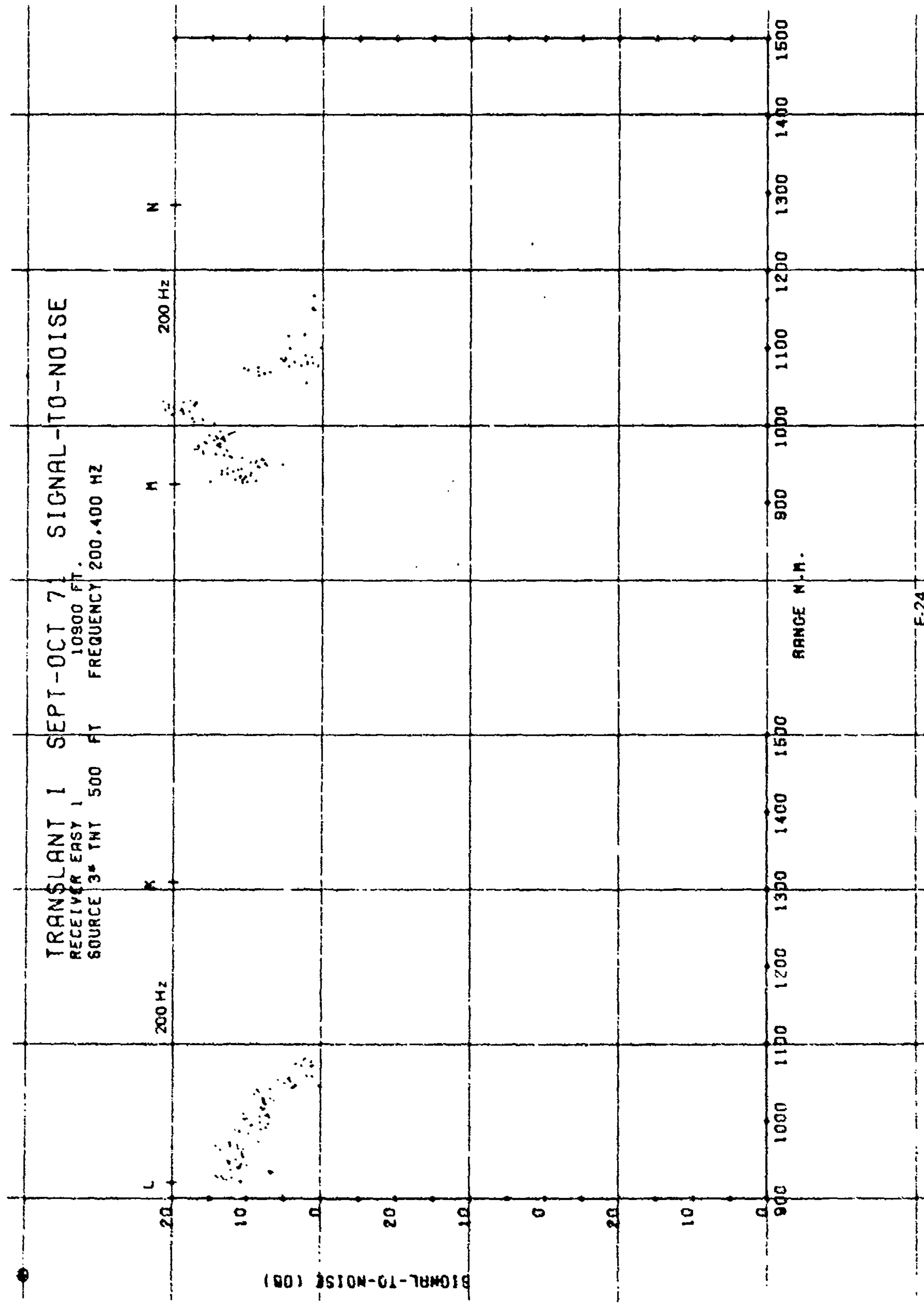

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
SIGNAL-TO-NOISE (DB)
RANGE N.M.
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
20 10 0 20 10 0 20 10 0
E-19

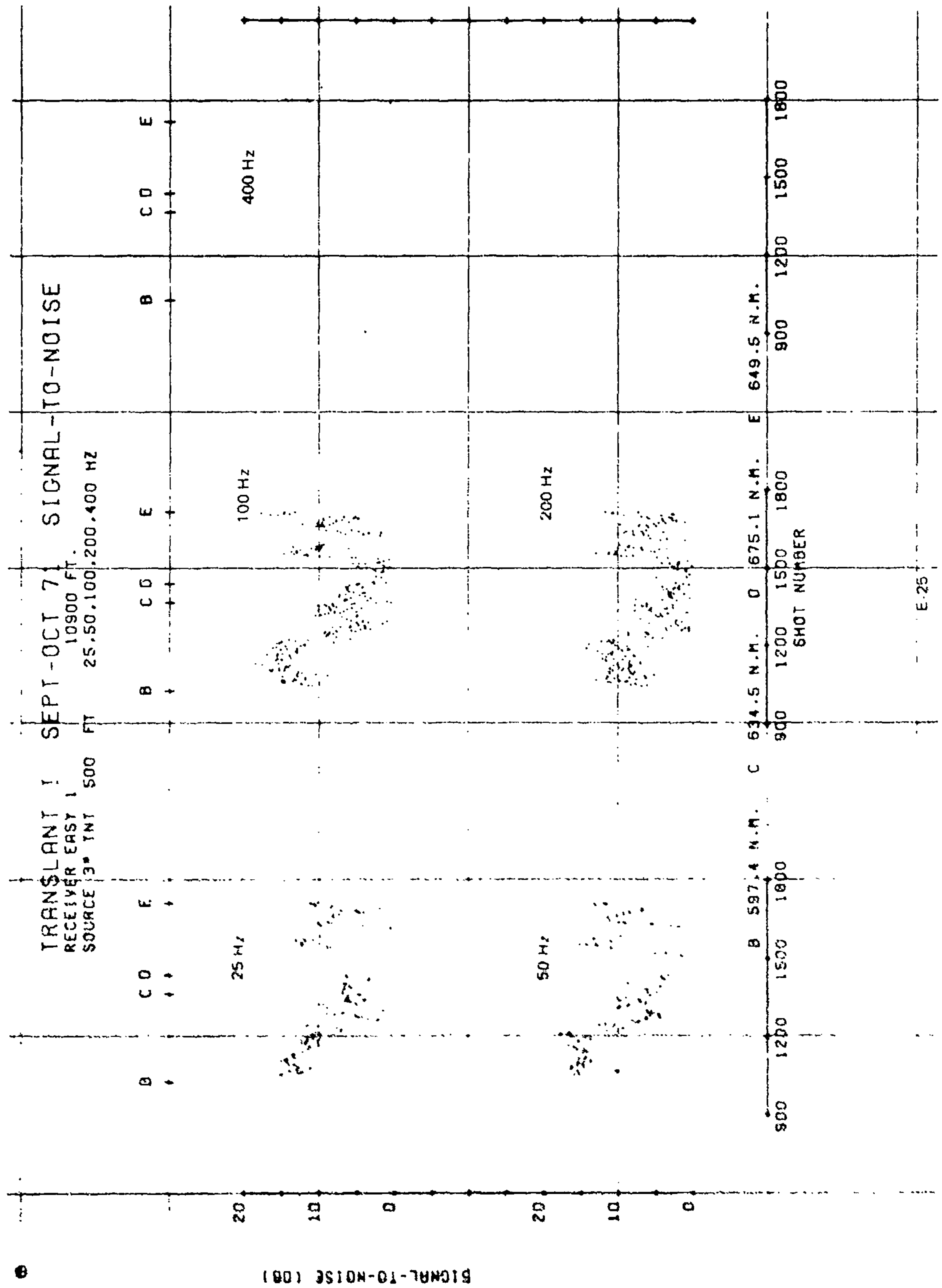

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz
A
B
E
F
RANGE N M.
SIGNAL-TO-NOISE (DB)
E-20

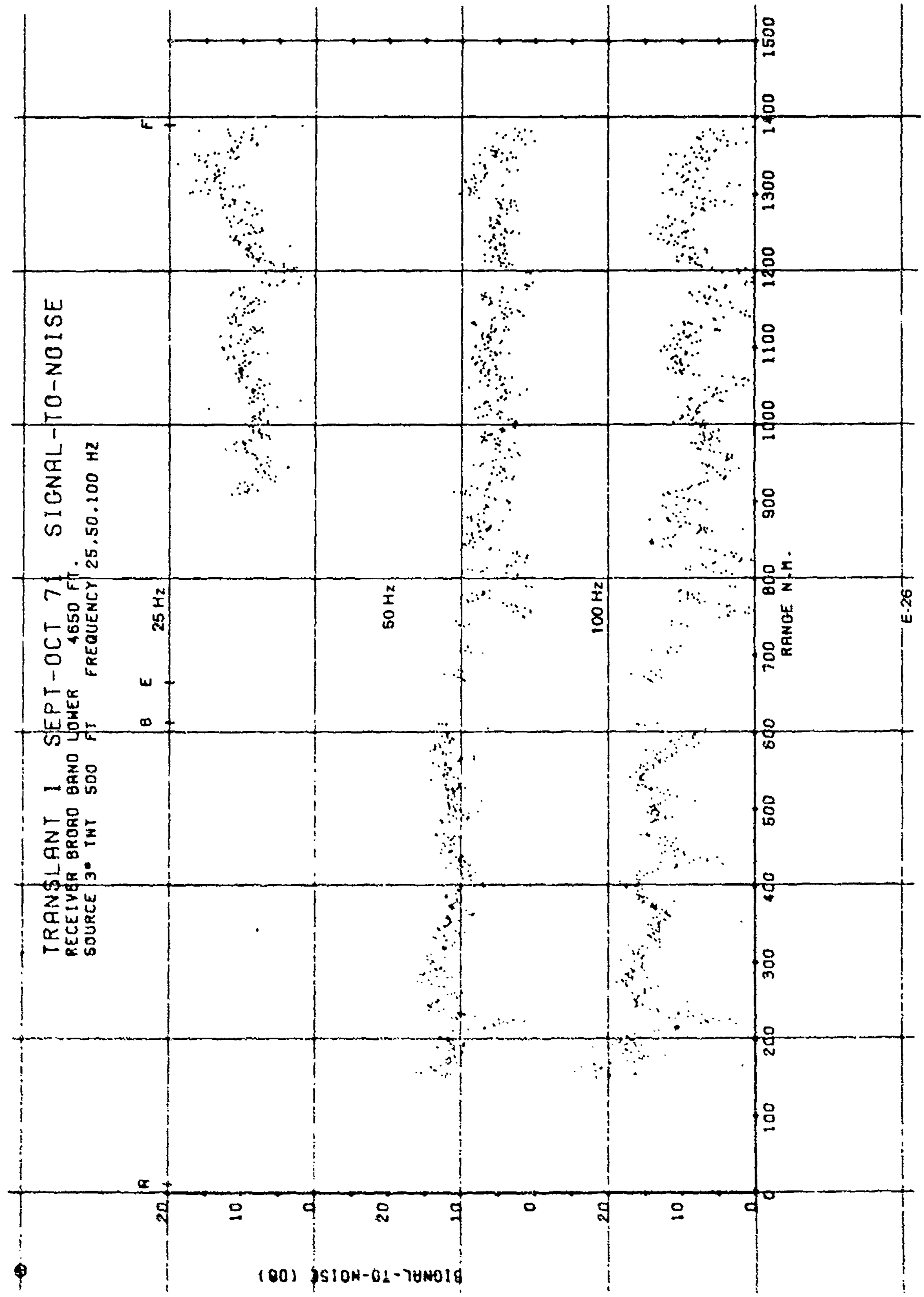

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz
50 Hz
100 Hz
G
H
I
J
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E.21

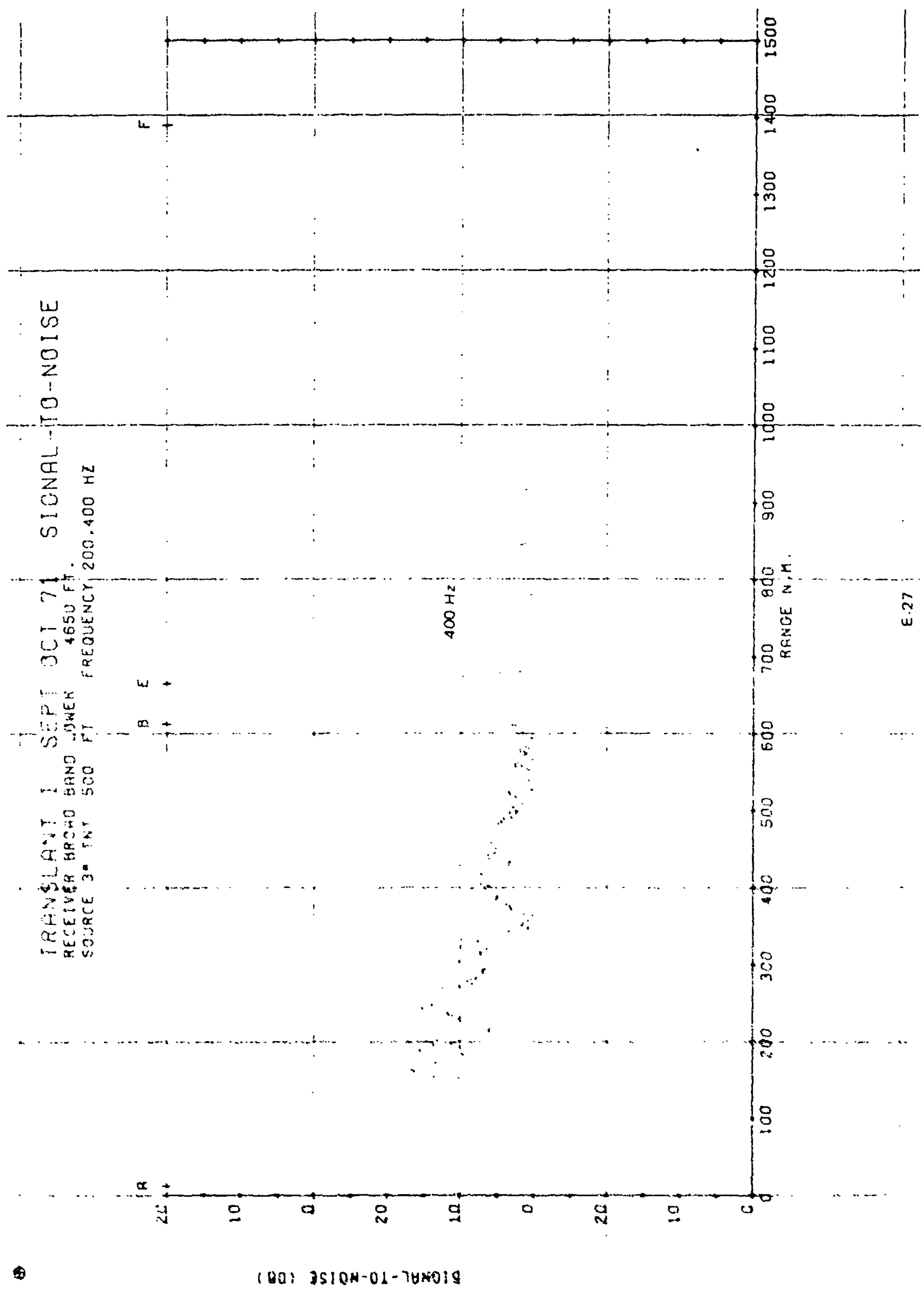

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER ERGY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
SIGNAL-TO-NOISE (DB)
RANGE N.M.
200 Hz
200 Hz
H
G
I
J
900
1000
1100
1200
1300
1400
1500
20
10
0
E-22

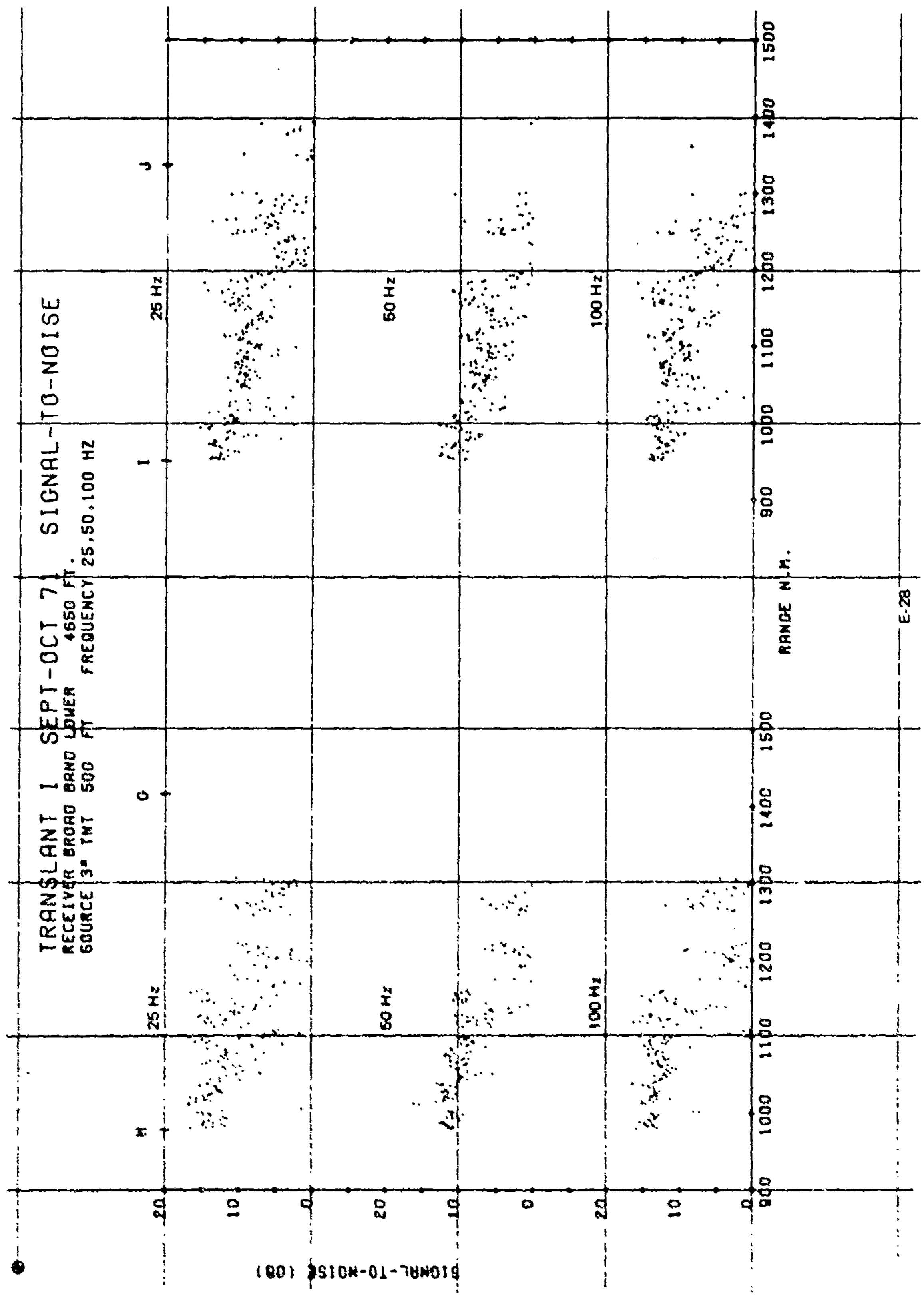

TRANSLANT I SEPT-OCT 7 SIGNAL-TO-NOISE
RECEIVER ERGY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz
50 Hz
100 Hz
SIGNAL-TO-NOISE (DB)
RANGE N.M.
E-23

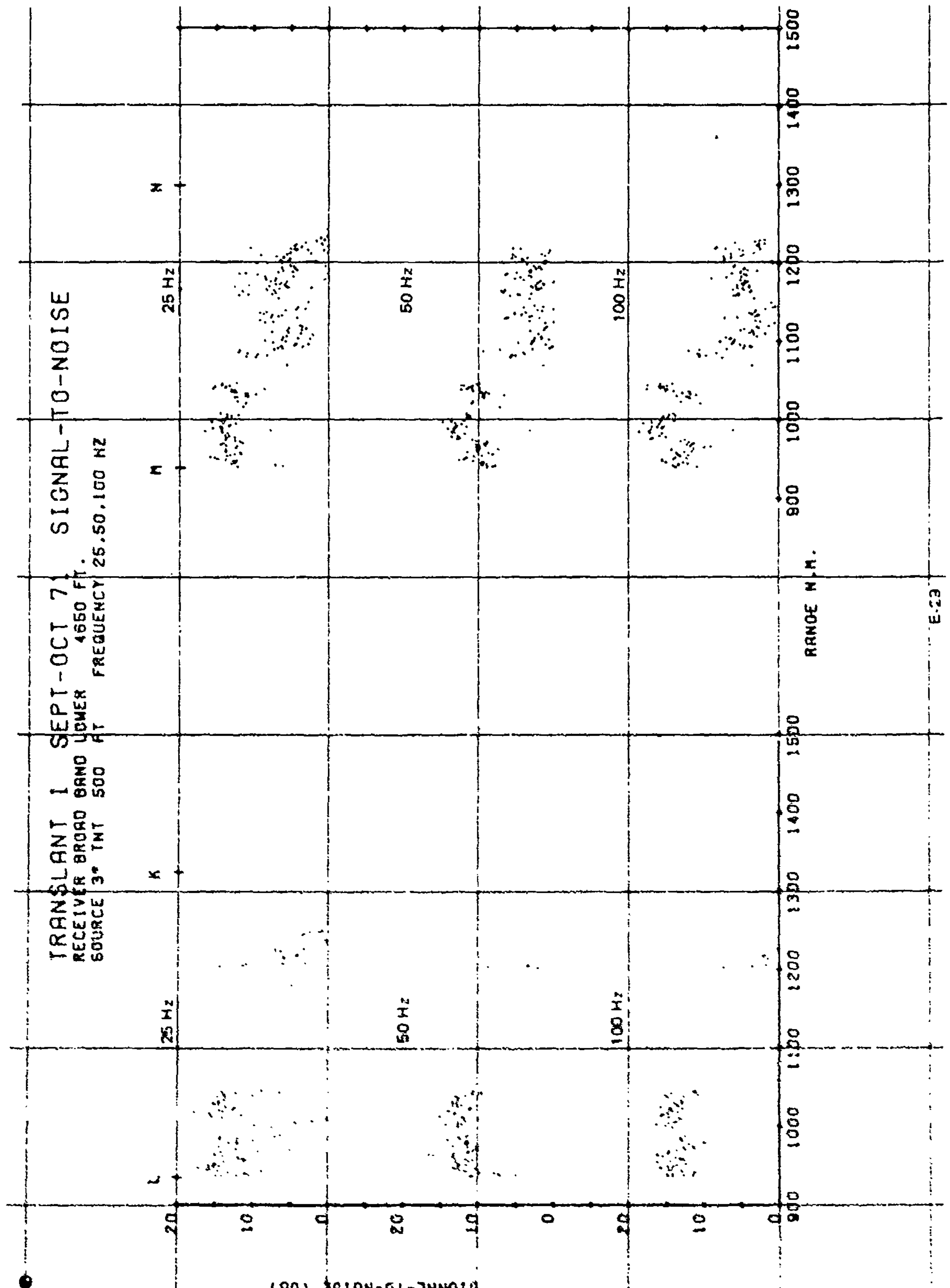

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200.400 HZ
200 Hz
200 Hz
L
K
M
N
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-24

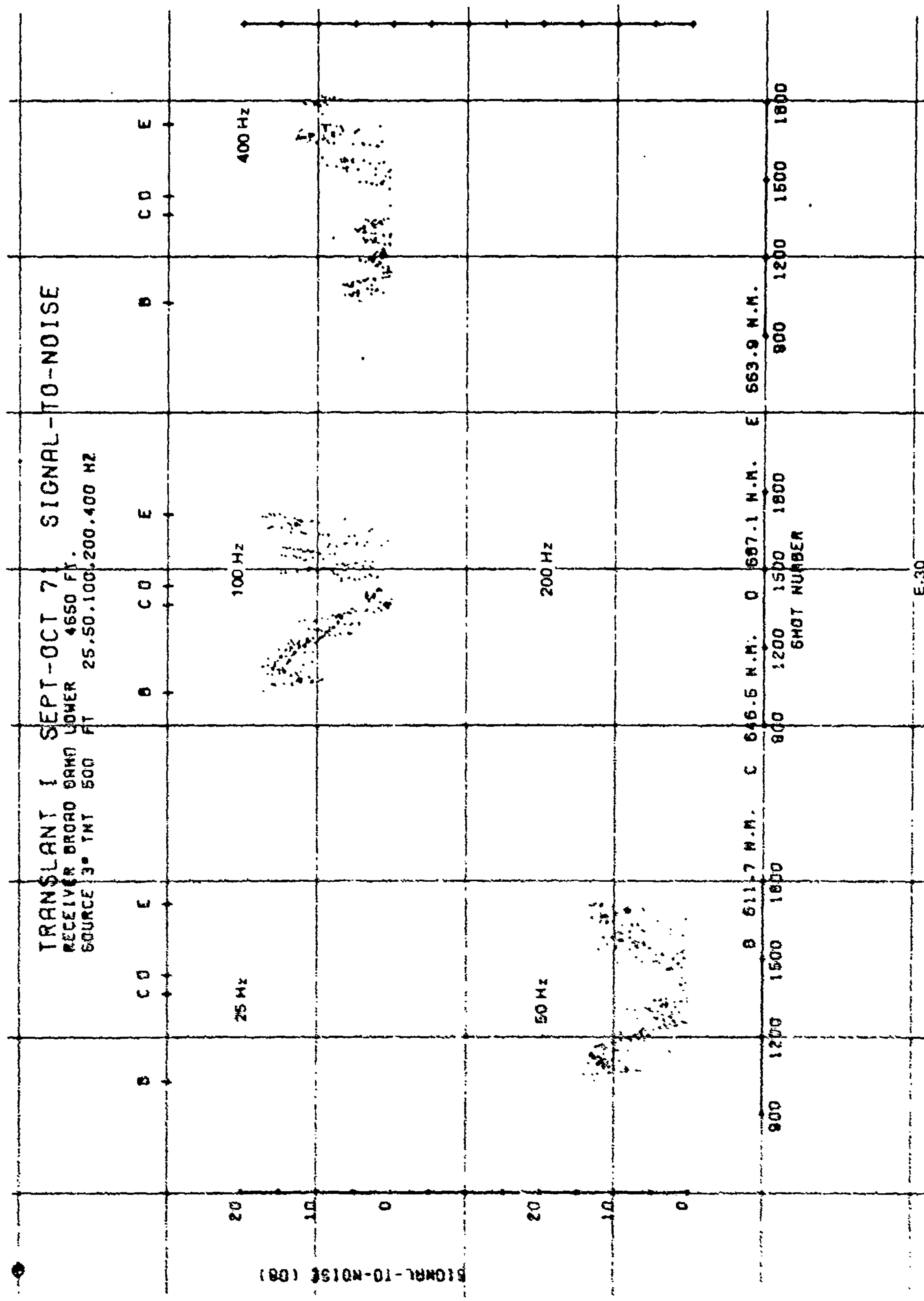

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER EASY 1 10900 FT.
SOURCE 3# TNT 500 FT 25,50,100,200,400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
B C D E
597.4 N.M.
634.5 N.M.
675.1 N.M.
649.5 N.M.
900 1200 1500 1800
SHOT NUMBER
20 10 0
SIGNAL-TO-NOISE (DB)
E-25

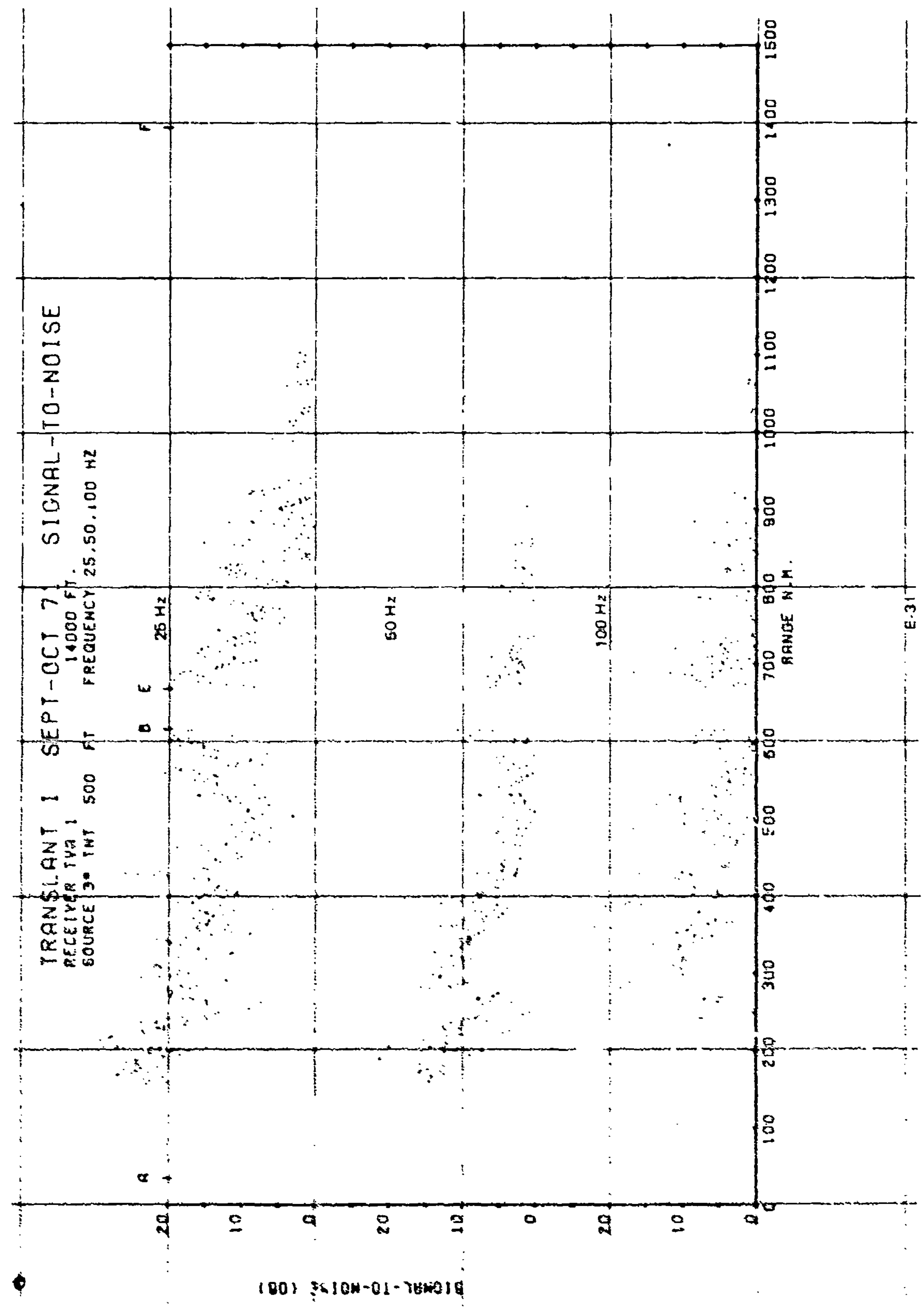

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
SIGNAL-TO-NOISE (DB)
RANGE N.M.
E-26

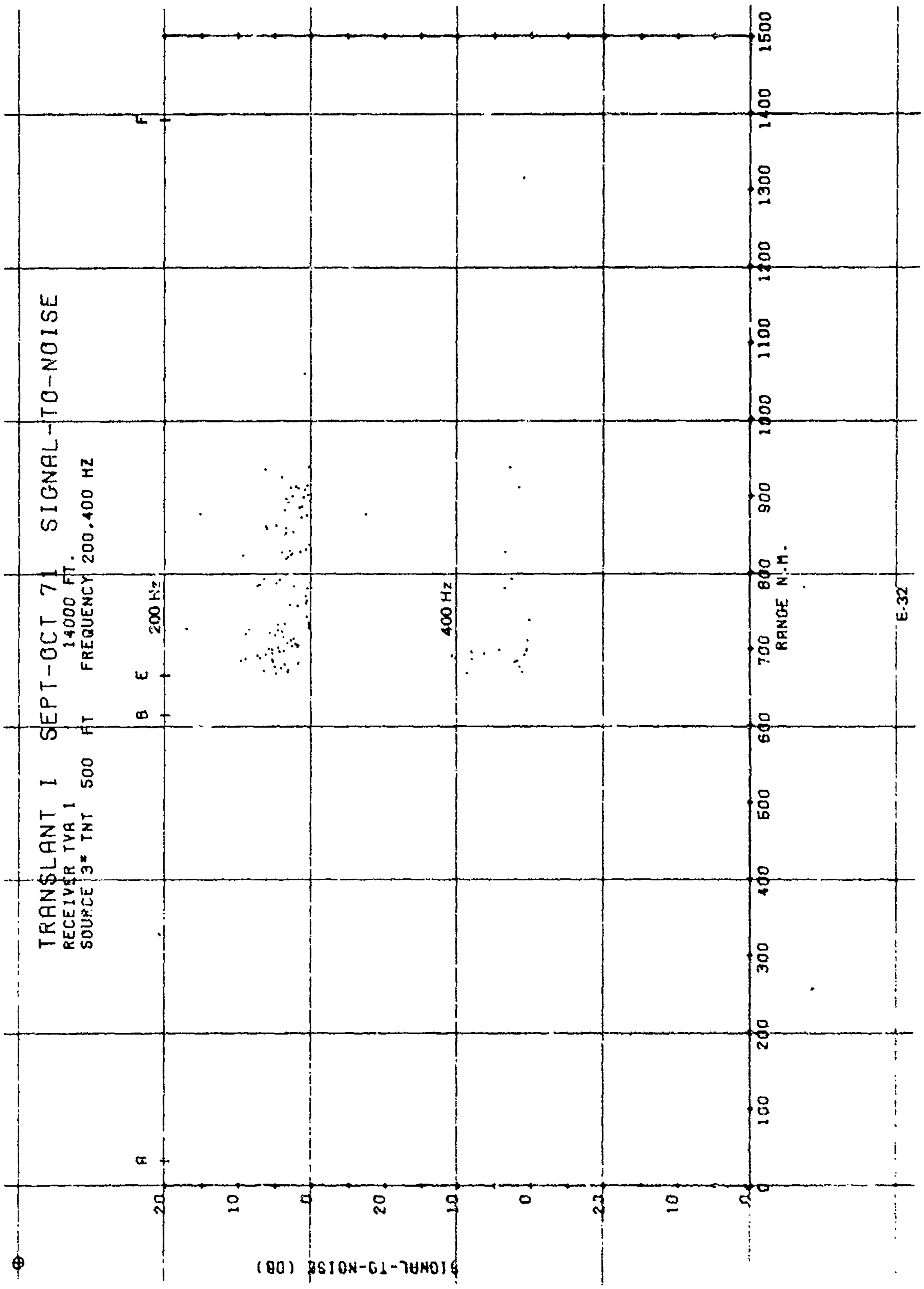

TRANSLANT I SEPT OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
400 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E.27

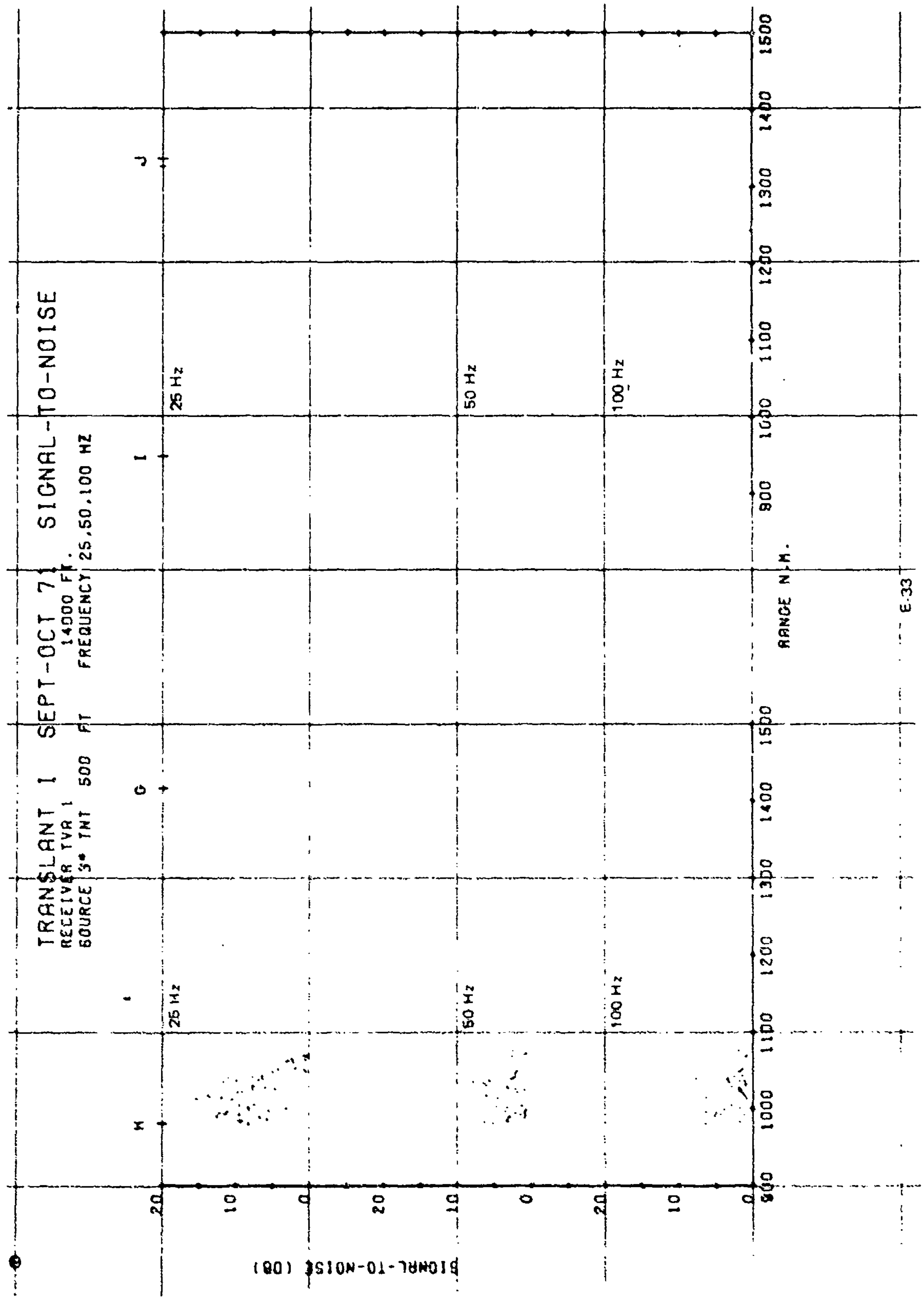

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
M
G
I
J
SIGNAL-TO-NOISE (DB)
RANGE N.M.
E-28

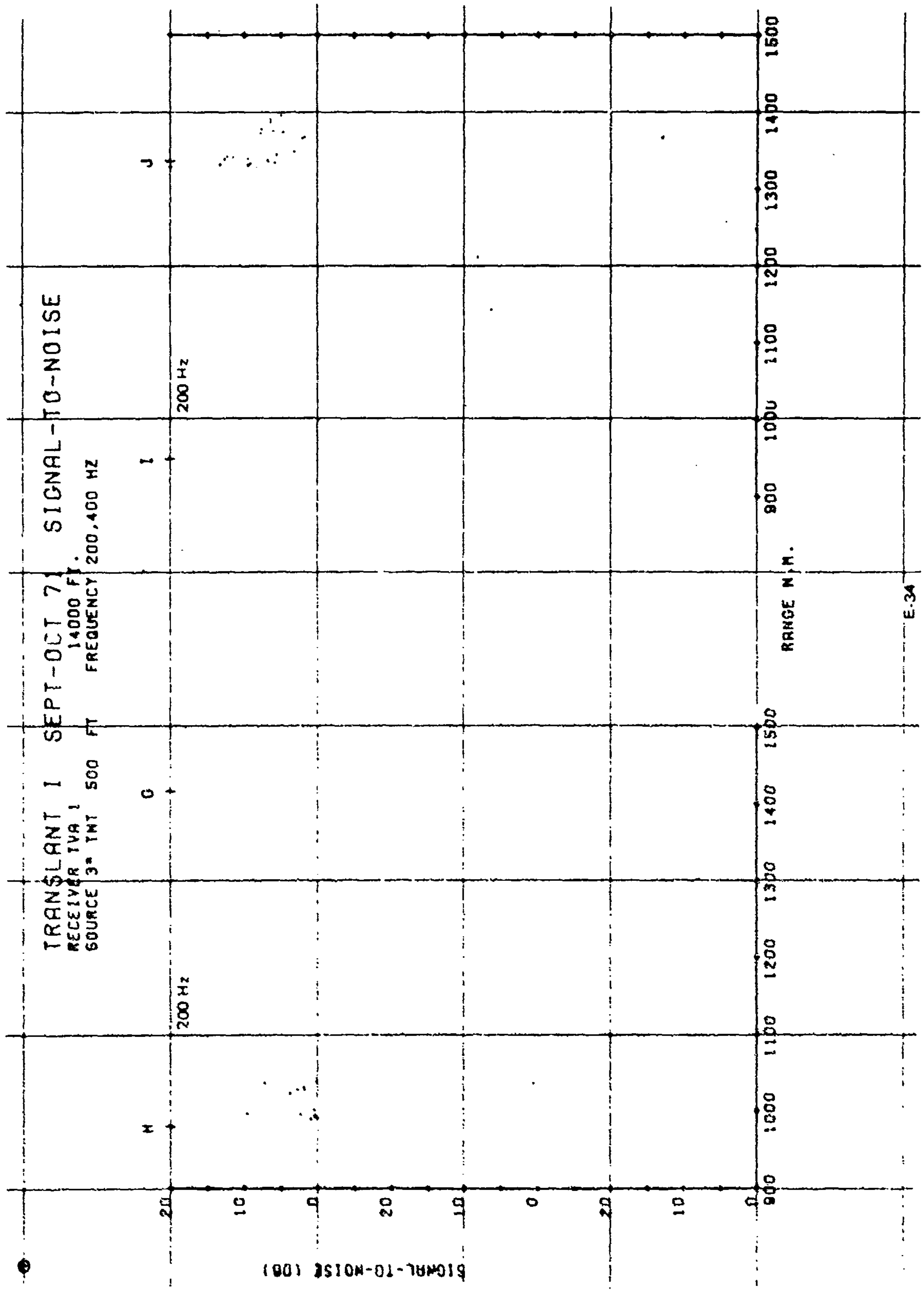

TRANSLANT 1 SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
L
K
M
N
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E.23

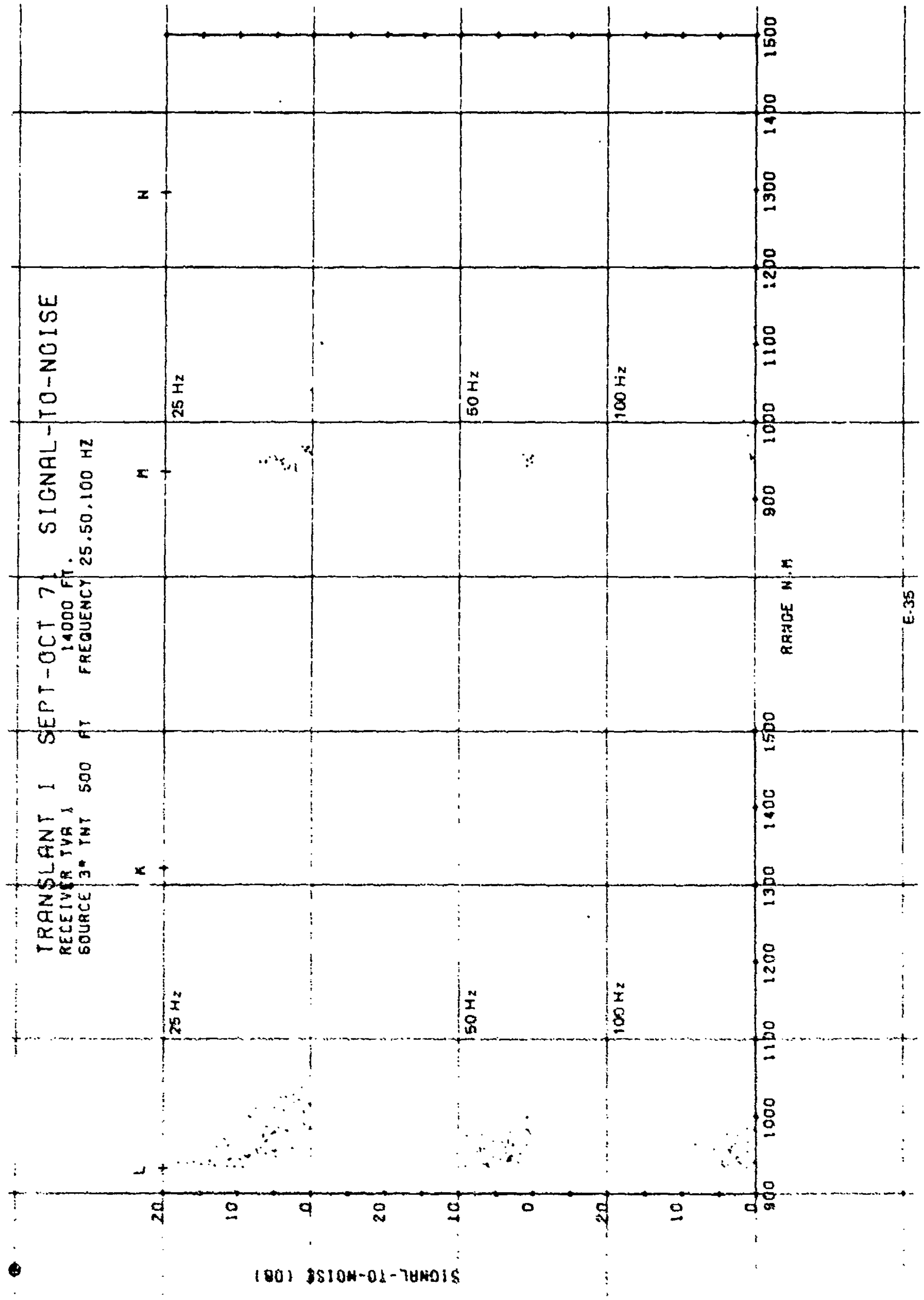

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT 25.50.100.200.400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
SIGNAL-TO-NOISE (DB)
SHOT NUMBER
511.7 N.M.
546.5 N.M.
587.1 N.M.
563.9 N.M.
E-30

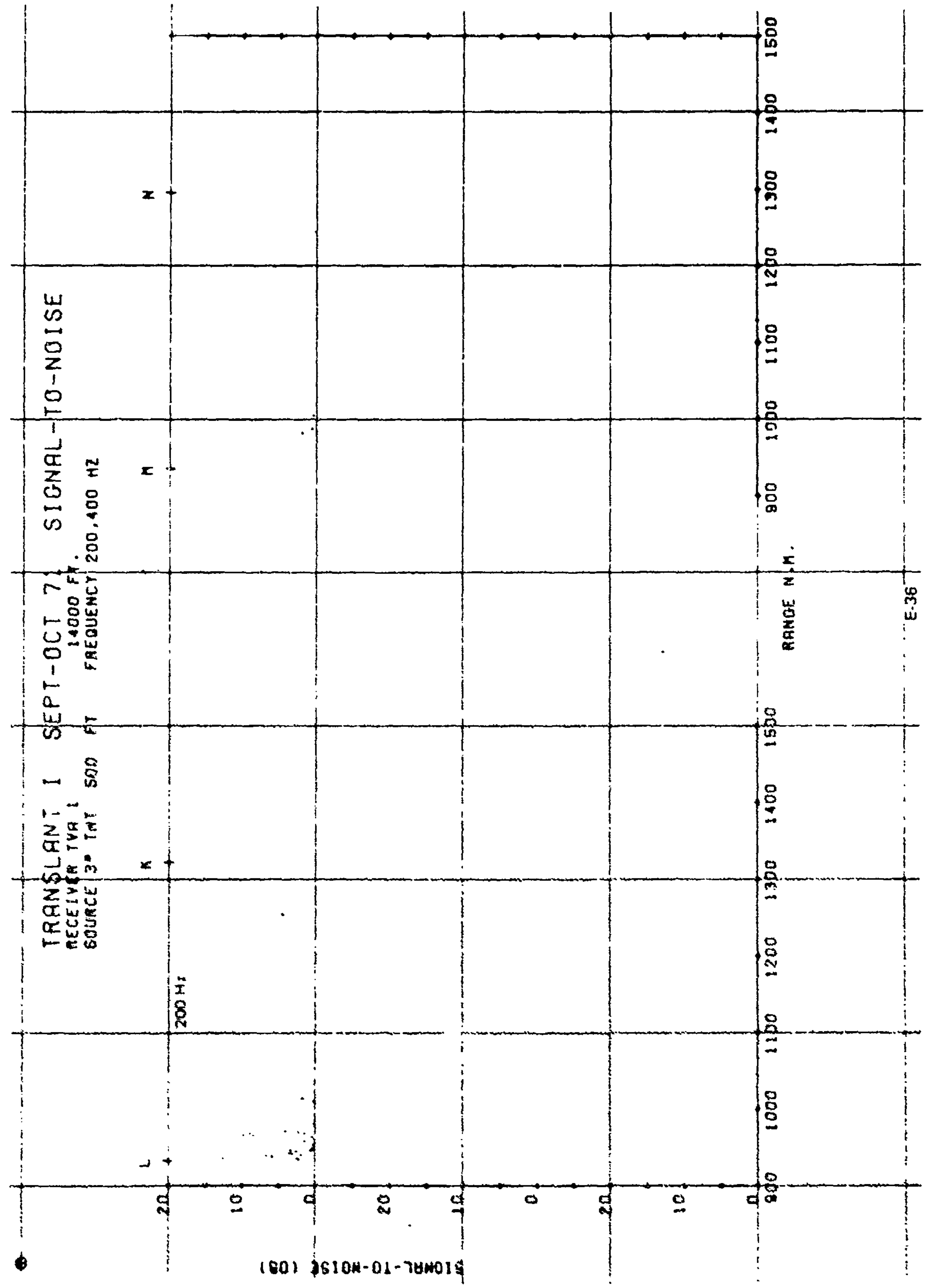

TRANSLANT 1 SEPT-OCT 7 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT
SOURCE 3* TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
20 10 0 20 10 0 20 10 0
A B E F
E-31

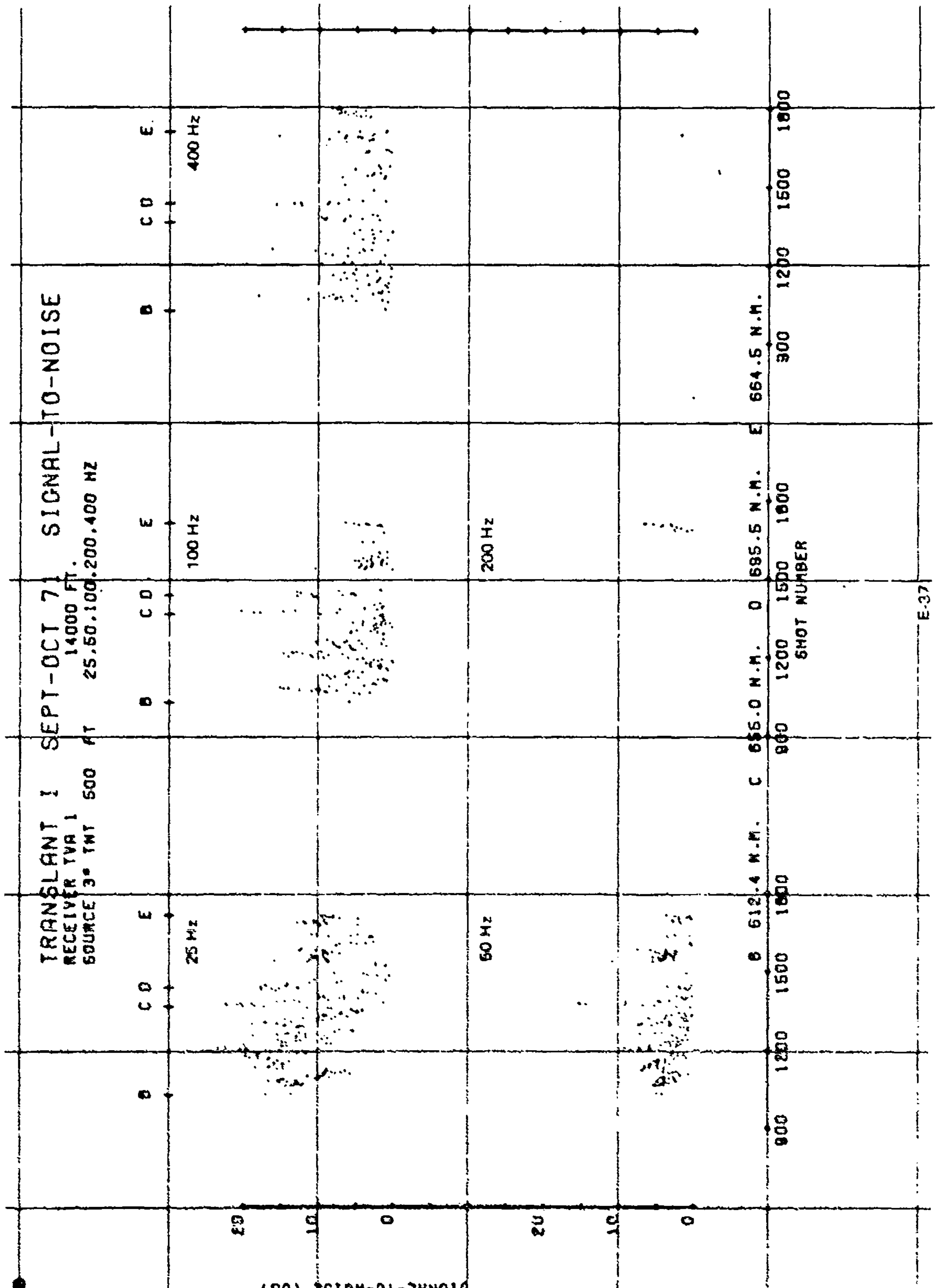

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz
400 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-32

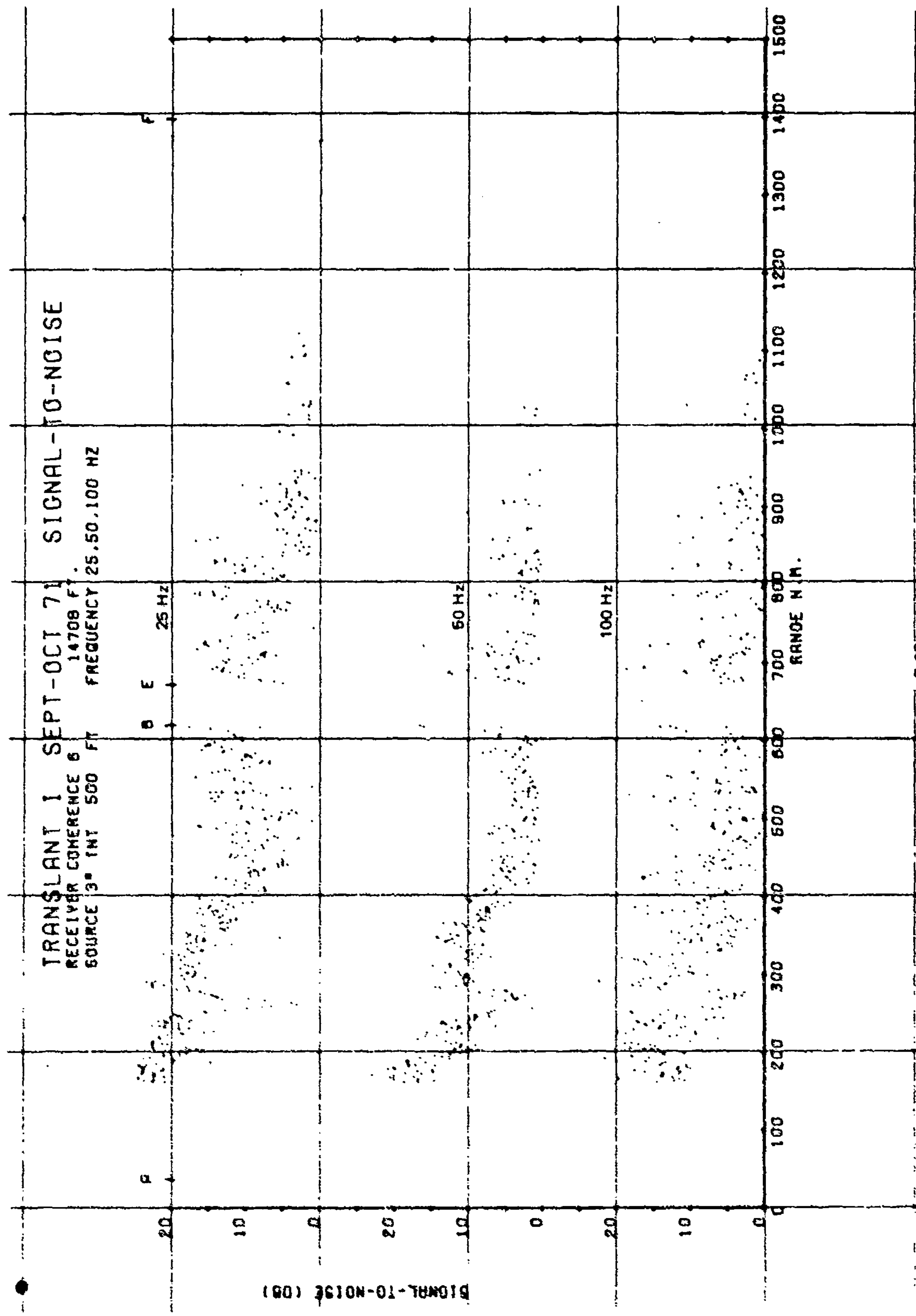

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVR 1 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-33

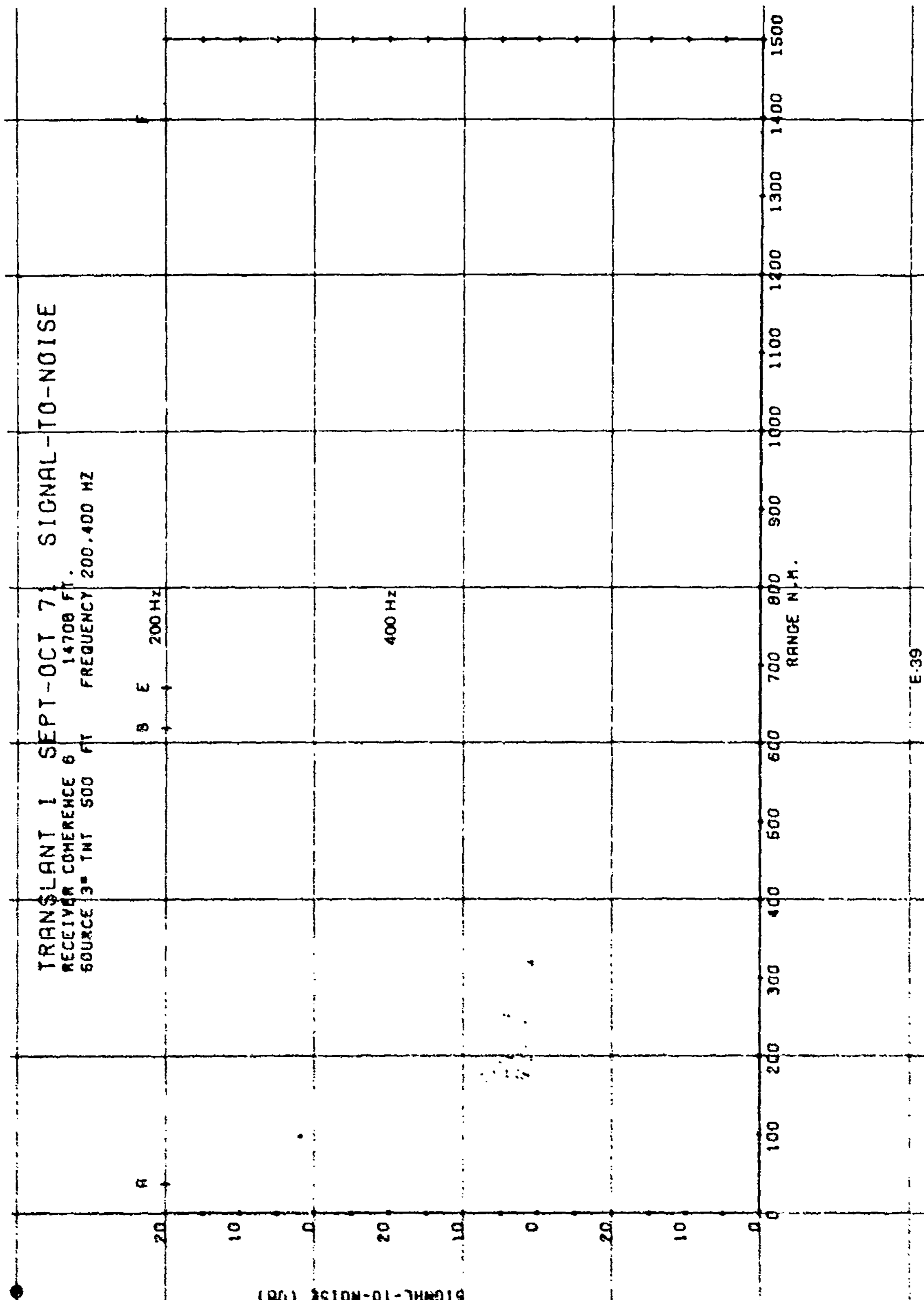

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200,400 HZ
200 Hz
200 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-34

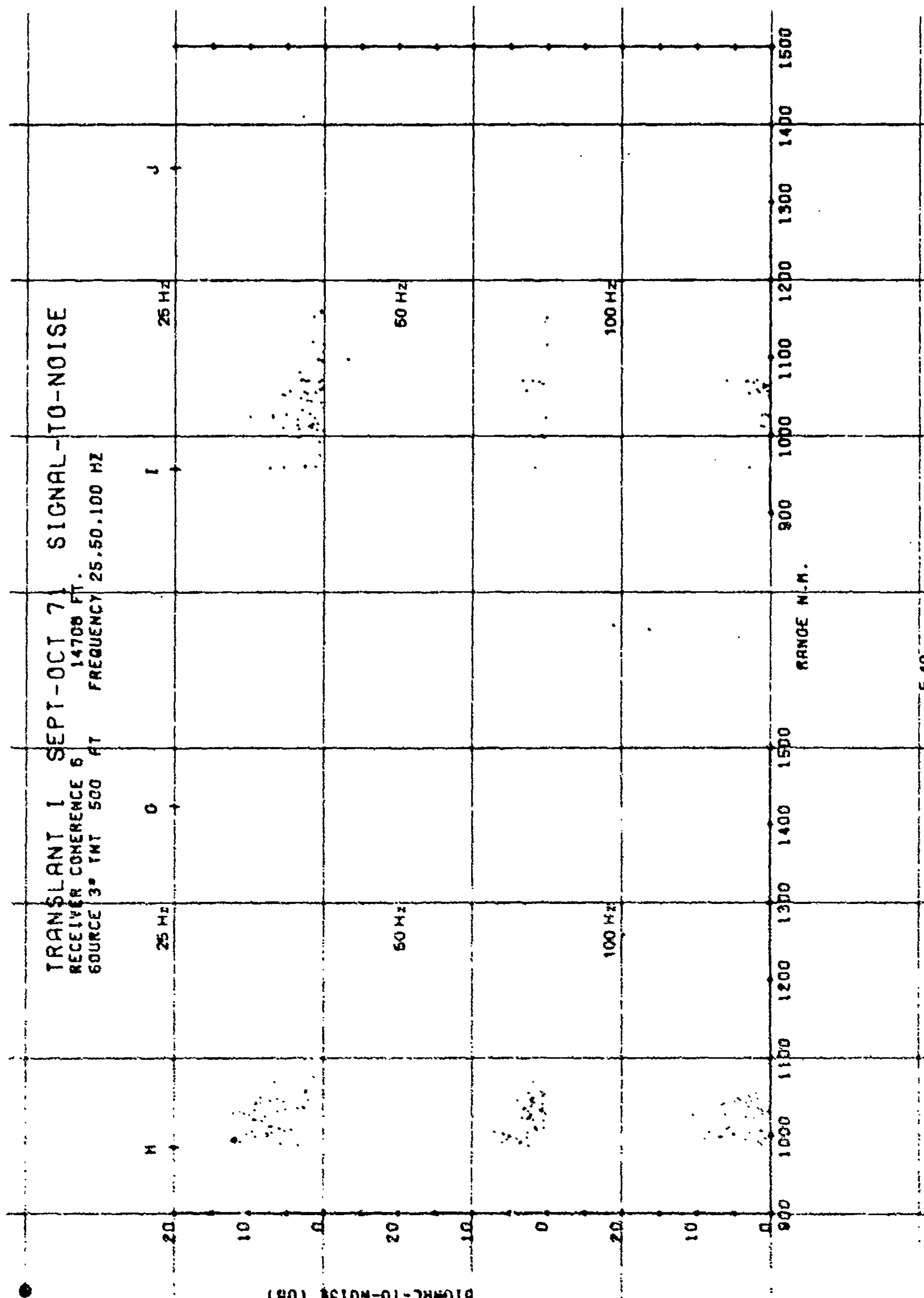

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TYR 1 500 FT 14000 FT.
SOURCE 3# TNT FREQUENCY 25.50.100 HZ
25 Hz
50 Hz
100 Hz
L
K
M
N
SIGNAL-TO-NOISE (DB)
RANGE N.M
900
1000
1100
1200
1300
1400
1500
20
10
0
E-35

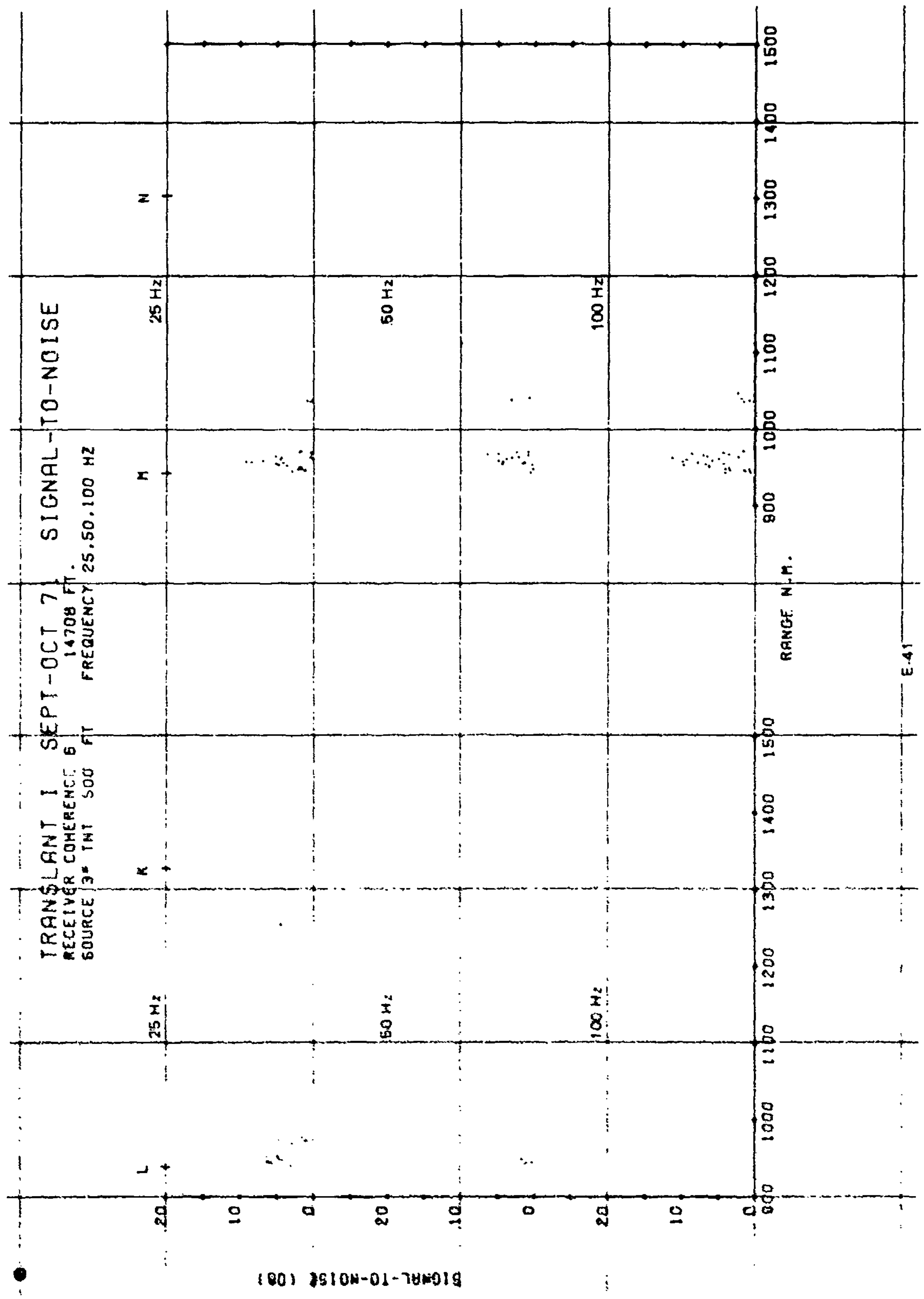

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3* TNT 500 FT FREQUENCY 200,400 HZ
200 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-36

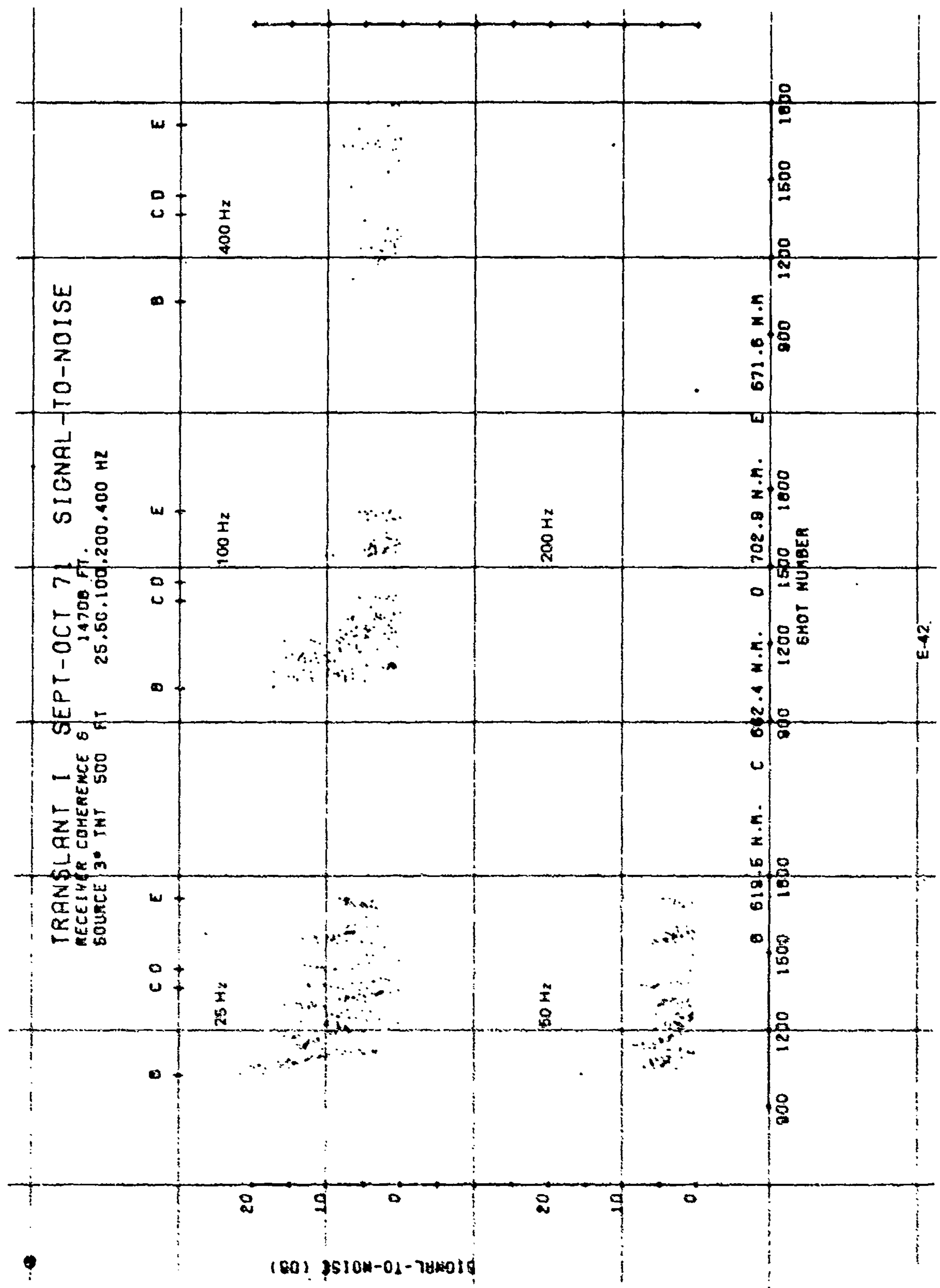

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER TVA 1 14000 FT.
SOURCE 3# TNT 500 FT 25,50,100,200,400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
B 612.4 N.M.
C 655.0 N.M.
D 695.5 N.M.
E 664.5 N.M.
SHOT NUMBER
SIGNAL-TO-NOISE (DB)
E-37


TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3° INT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
20 10 0 20 10 0 20 10 0
A
B
E
F
E-38


TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14700 FT.
SOURCE 3* TNT 500 FT FREQUENCY 200,400 HZ
200 Hz
400 Hz
RANGE N.M.
SIGNAL-TO-NOISE (DB)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
20
10
0
E-39


TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
H
O
I
J
RANGE N.M.
SIGNAL-TO-NOISE (DB)
F-40

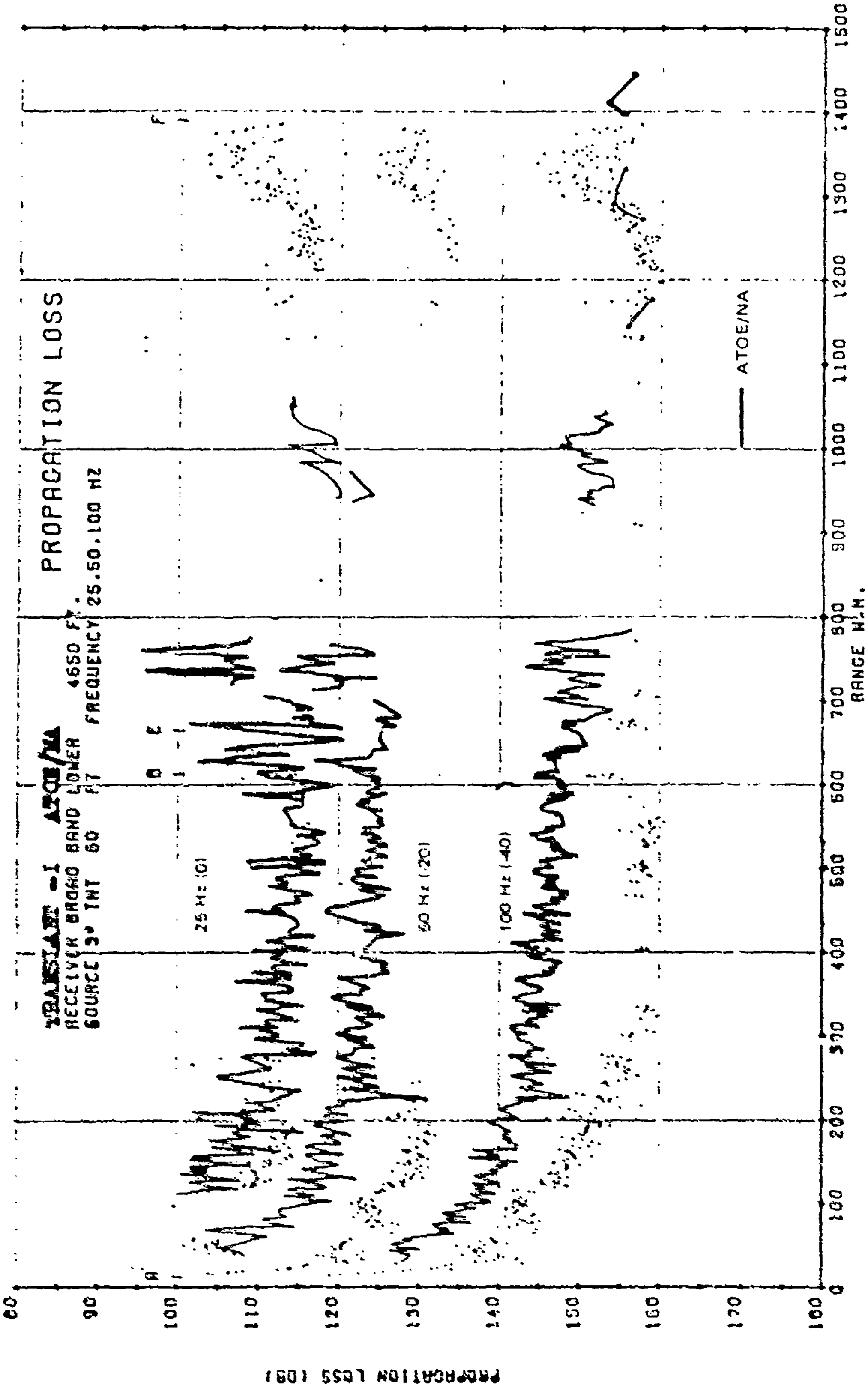

TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14708 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25,50,100 HZ
25 Hz
50 Hz
100 Hz
L
K
M
N
RANGE N.M.
SIGNAL-TO-NOISE (DB)
E-41


TRANSLANT I SEPT-OCT 71 SIGNAL-TO-NOISE
RECEIVER COHERENCE 6 14700 FT.
SOURCE 3# TNT 500 FT 25.50.100.200.400 HZ
25 Hz
50 Hz
100 Hz
200 Hz
400 Hz
SHOT NUMBER
SIGNAL-TO-NOISE (DB)
E-42

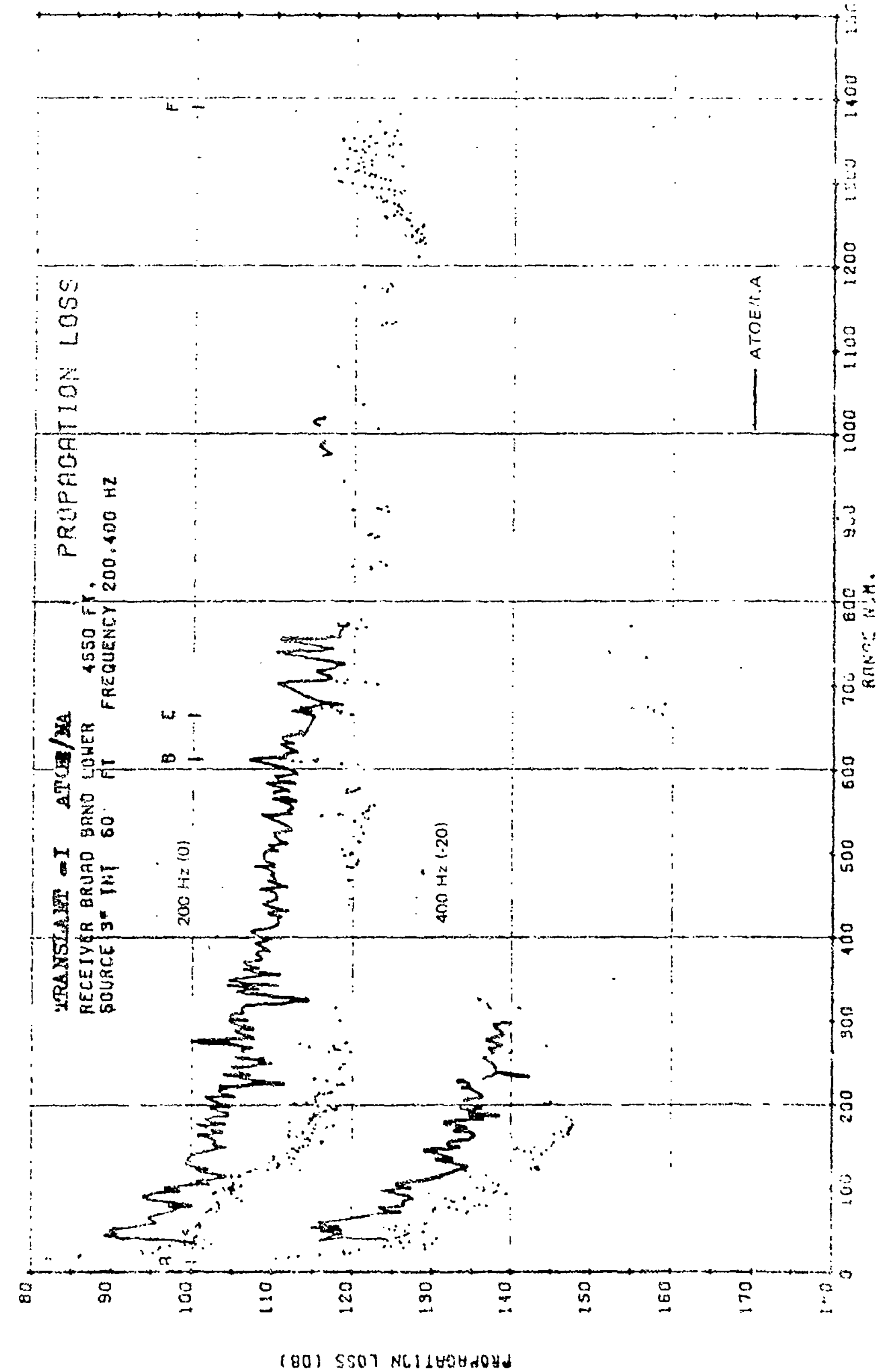
Appendix F

TRANSLANT I AND ATOE PROPAGATION LOSS COMPARISON

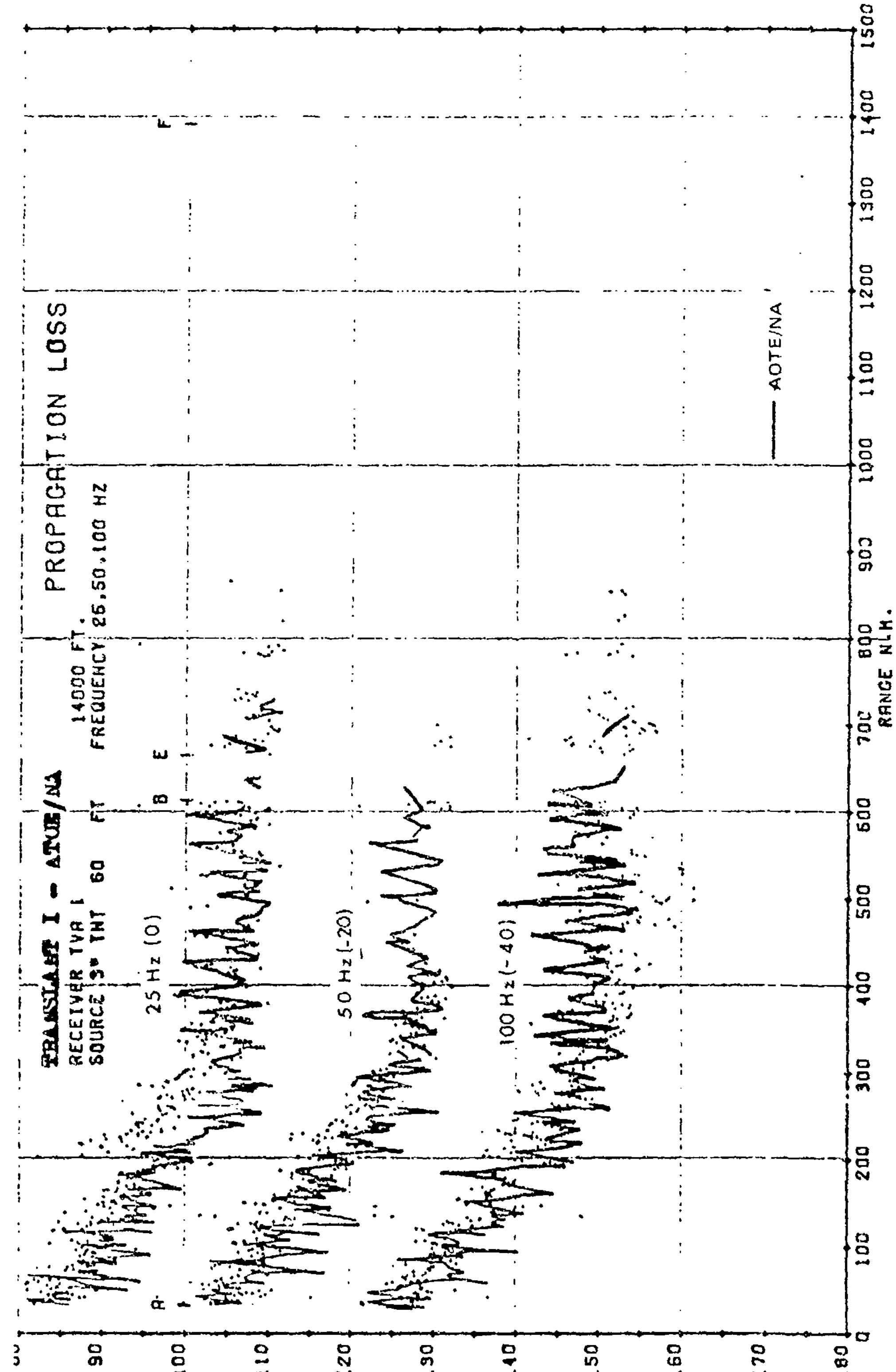
(U) Plots comparing the propagation loss for the TRANSLANT I and ATOE measurements as a function of range, frequency, and hydrophone are shown on the following pages.


PROPAGATION LOSS
ATOE/NA
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 60 FT
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

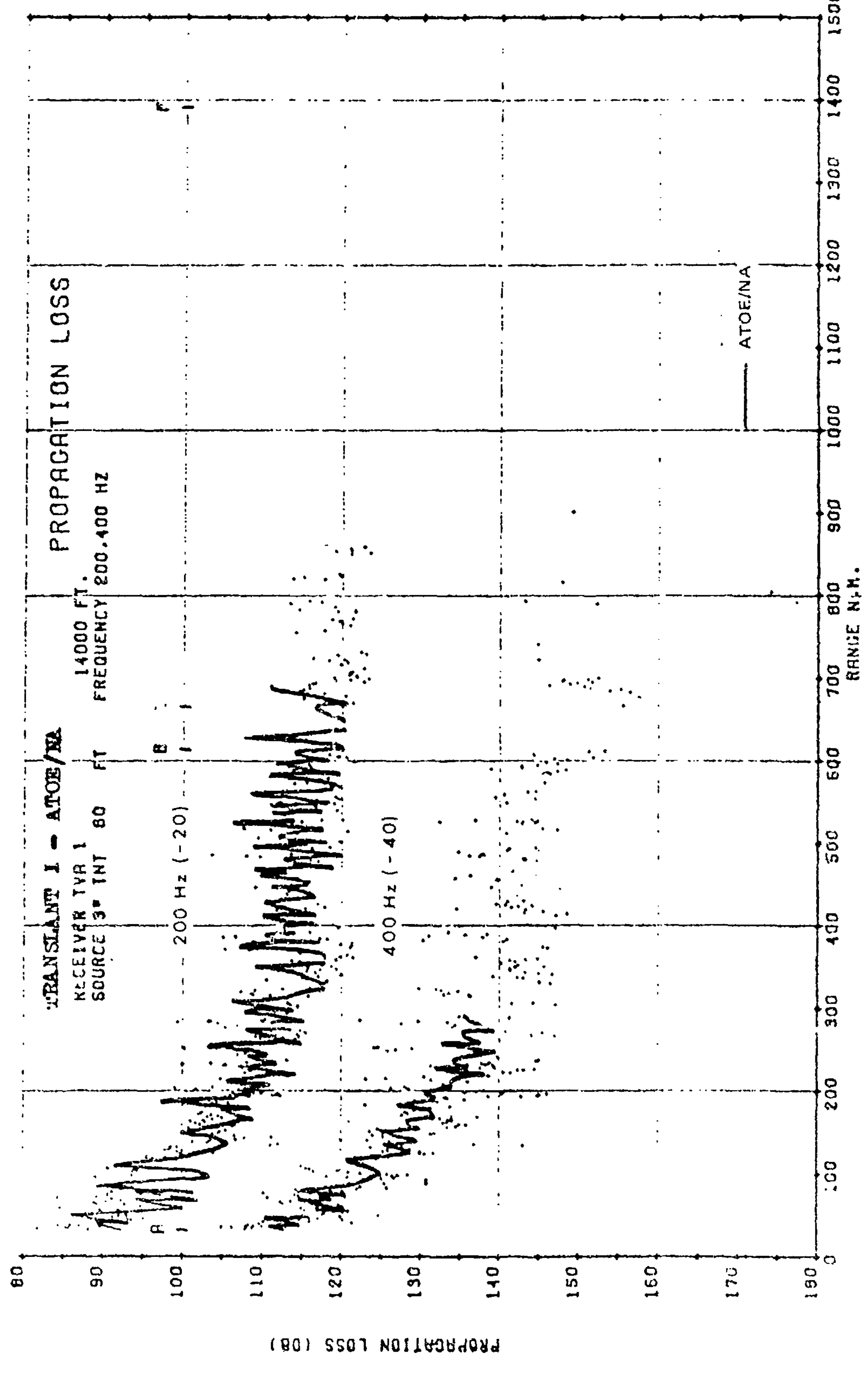
F.1


TRANSLANT -I ATOE/MA
RECEIVER BROAD BAND LOWER 4550 FT.
SOURCE 3" INT 60 FT FREQUENCY 200,400 HZ
PROPAGATION LOSS
200 Hz (0)
400 Hz (-20)
B
E
F
ATOE/MA
RANGE N.M.
PROPAGATION LOSS (DB)

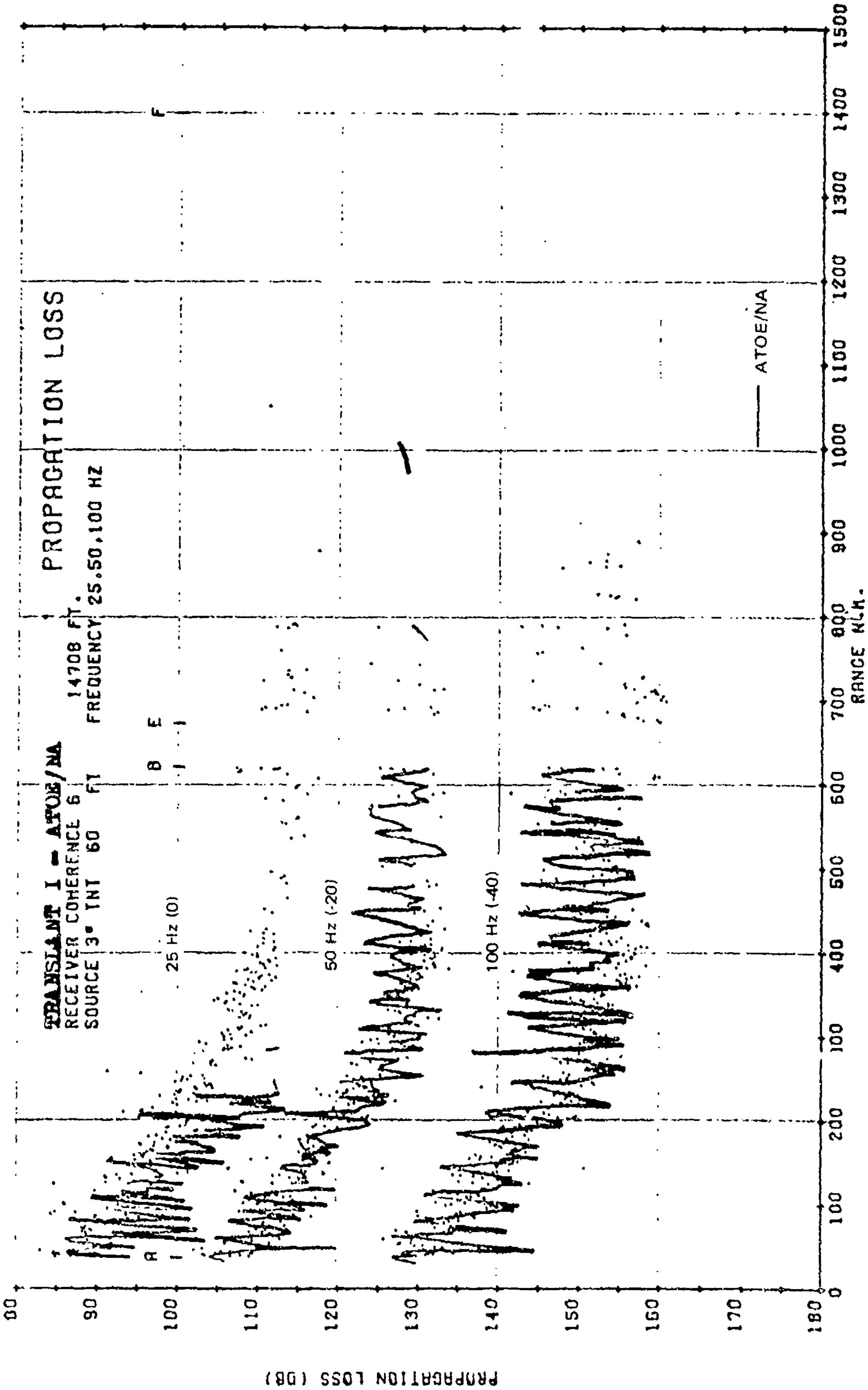
F-2


PROPAGATION LOSS
TRANSLANT I - AOTE/NA
RECEIVER TVR I
SOURCE 3" TNT 60 FT
14000 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
AOTE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

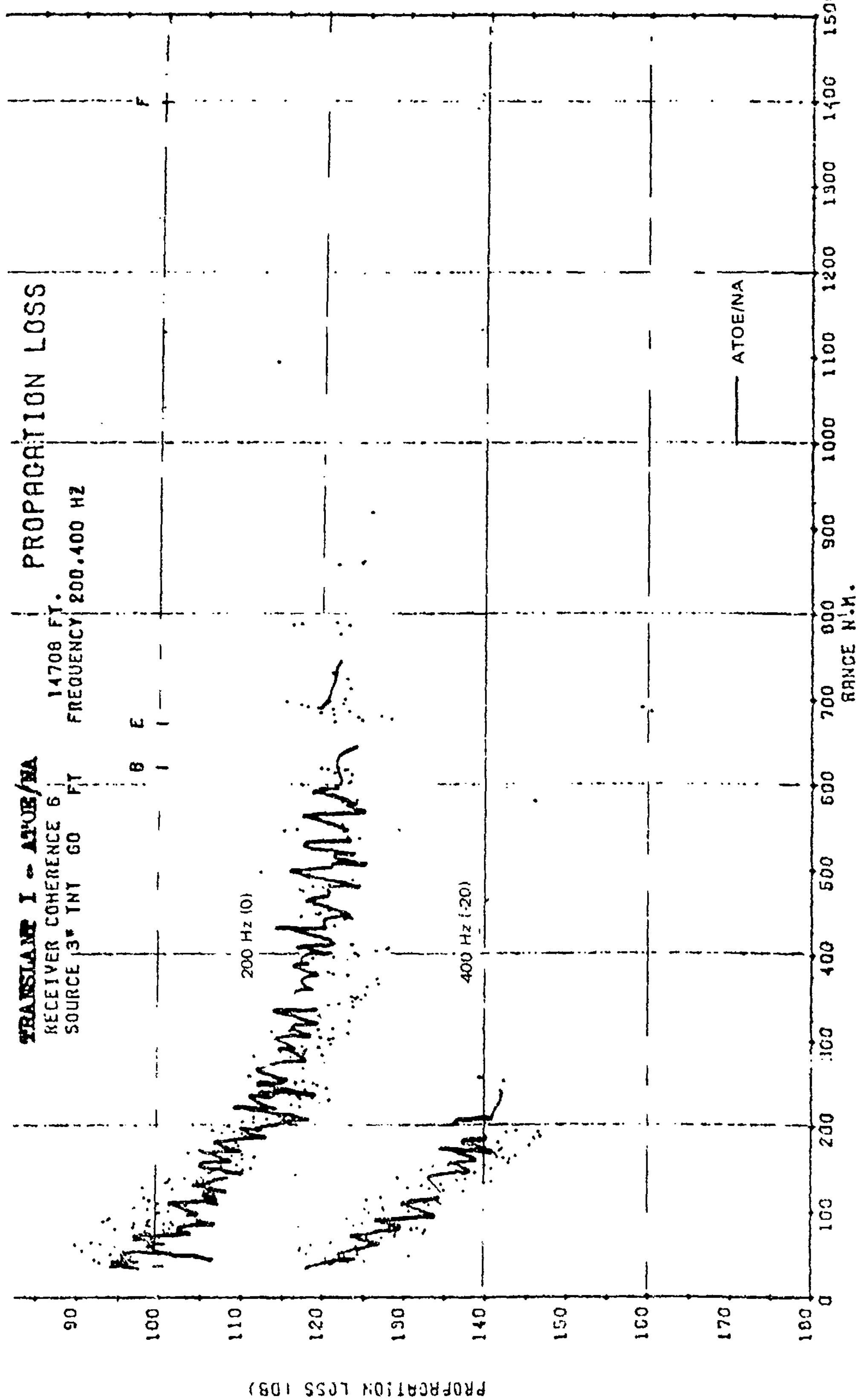
F-3


PROPAGATION LOSS
TRANSLANT I - ATOE/NA
RECEIVER TYR 1
SOURCE 3" INT 80 FT
14000 FT.
FREQUENCY 200.400 HZ
200 Hz (-20)
400 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

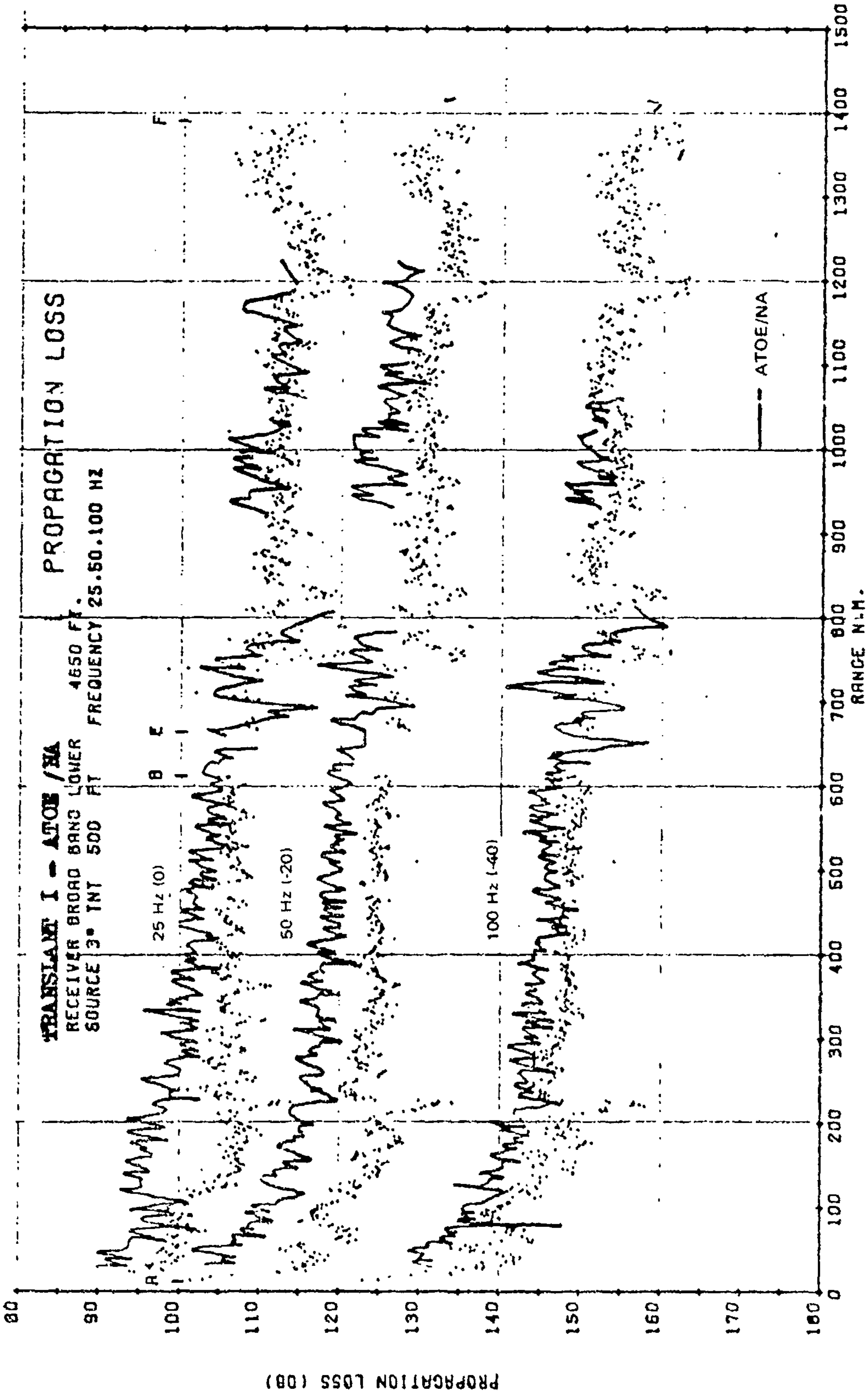
F-4


PROPAGATION LOSS
TRANSLANT I - ATOE/NA
RECEIVER COHERENCE 6
SOURCE 3° INT 60 FT
14708 FT.
FREQUENCY 25,50,100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

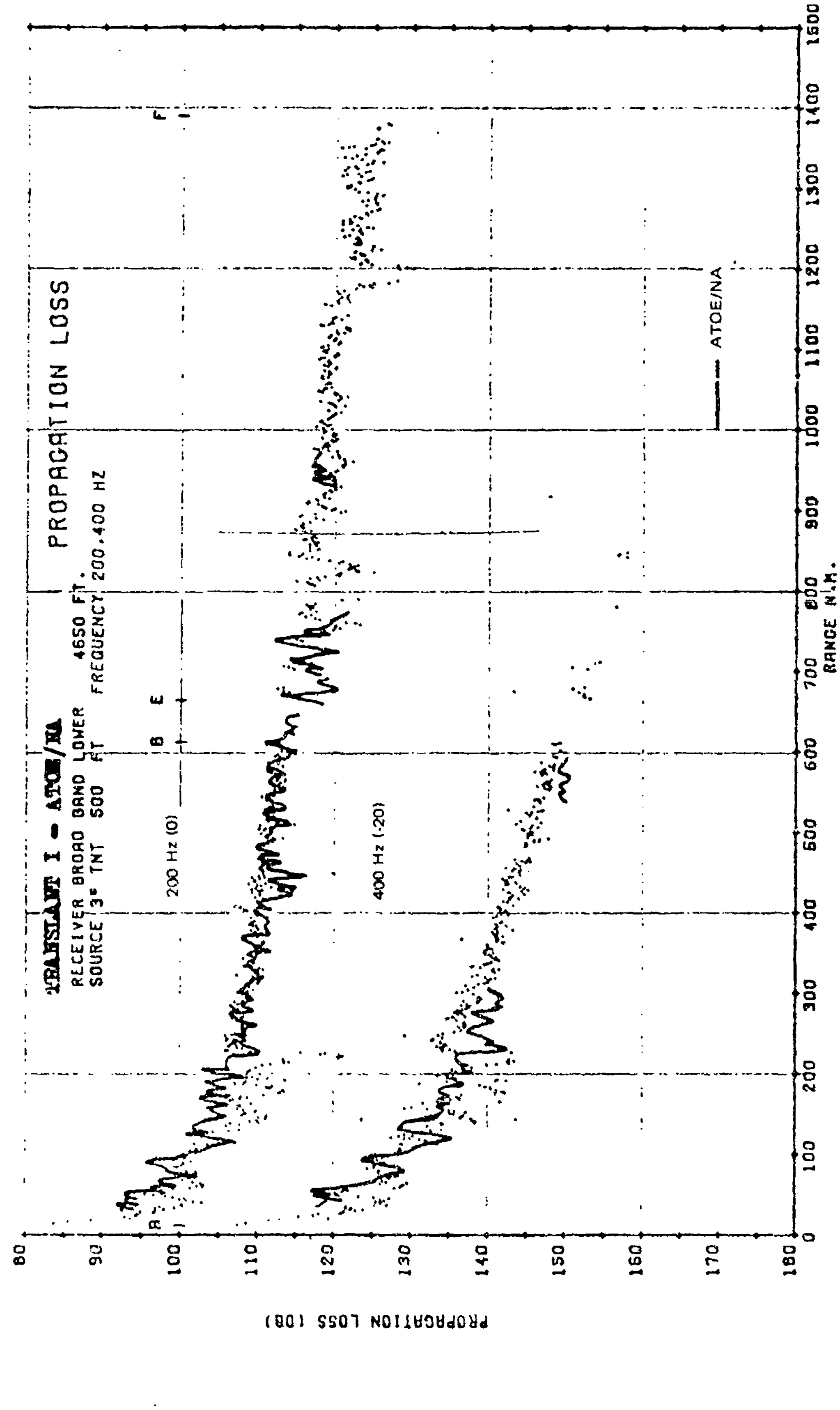
F-5


PROPAGATION LOSS
TRANSLANT I - ATOE/NA
RECEIVER COHERENCE 6
SOURCE 3" TNT 60 FT
14708 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
400 Hz (-20)
ATOE/NA
B
E
F
RANGE N.M.
PROPAGATION LOSS (DB)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
90
100
110
120
130
140
150
160
170
180

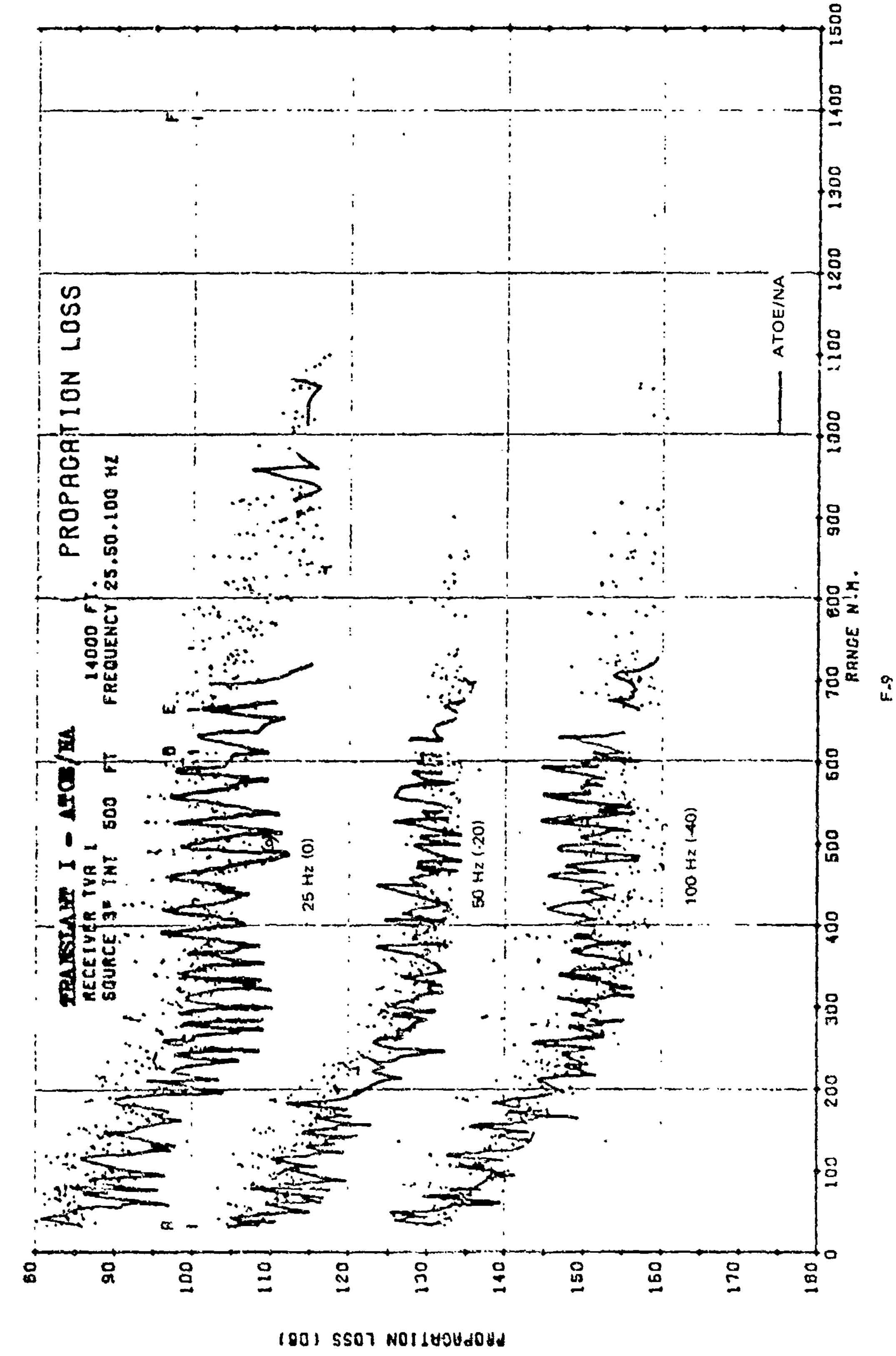
F-6

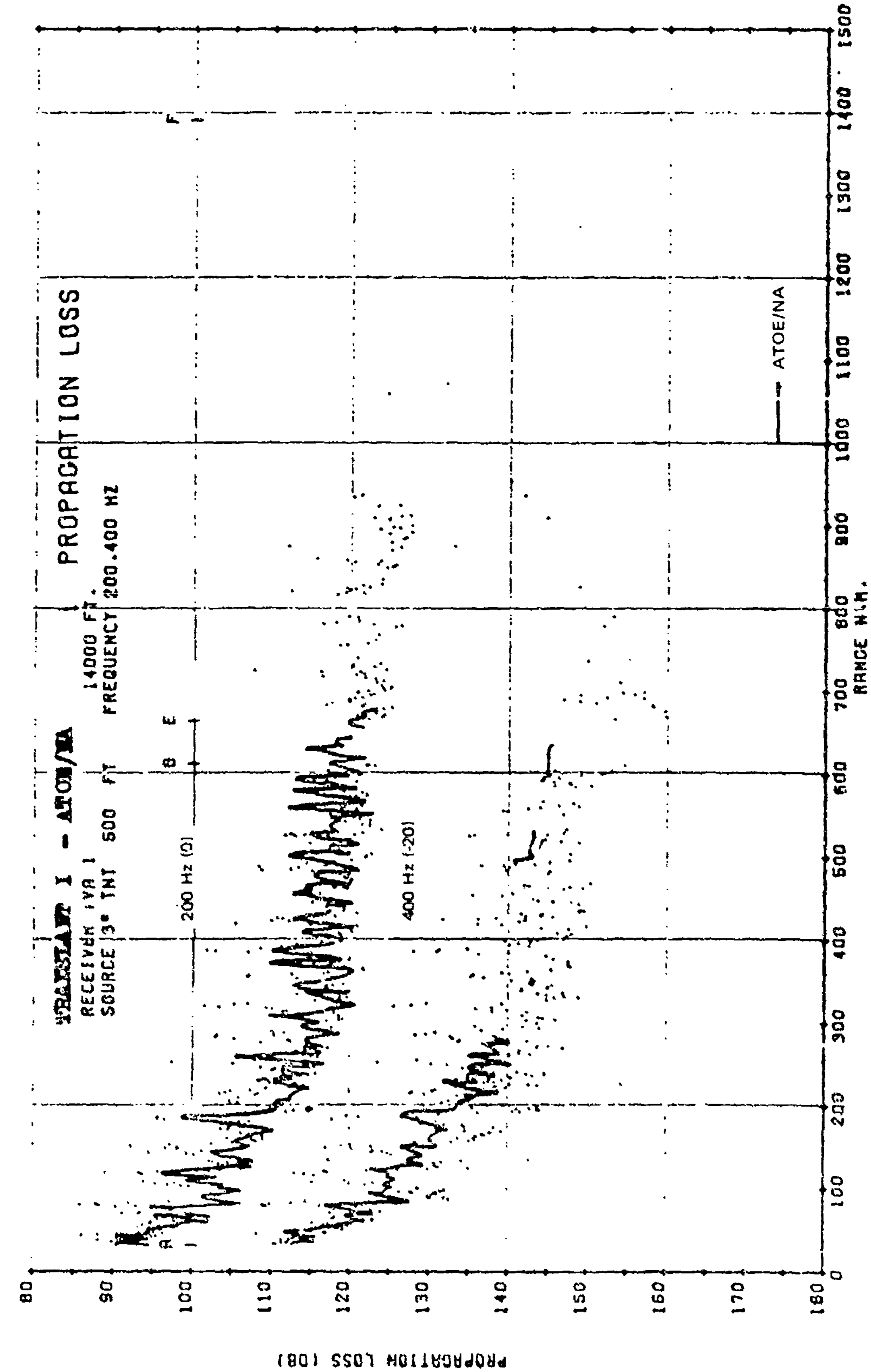

PROPAGATION LOSS
TRANSLANT I - ATOE /NA
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

F-7

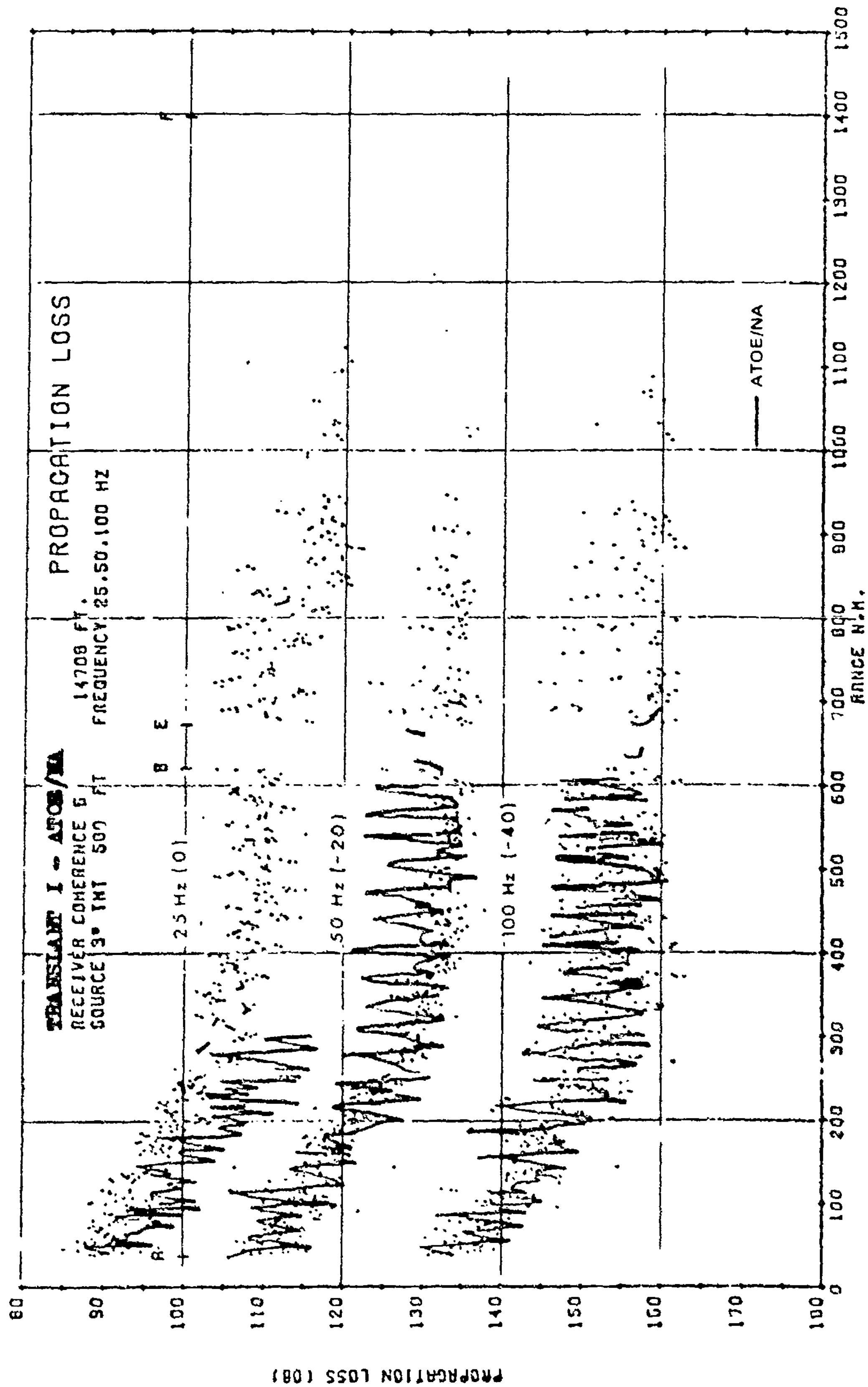

PROPAGATION LOSS
TRANSLANT I - ATOE/NA
RECEIVER BROAD BAND LOWER 4650 FT.
SOURCE 3# TNT 500 FT FREQUENCY 200.400 HZ
B E F
200 Hz (0)
400 Hz (-20)
ATOE/NA
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
RANGE N.M.
80 90 100 110 120 130 140 150 160 170 180
PROPAGATION LOSS (DB)

F-8

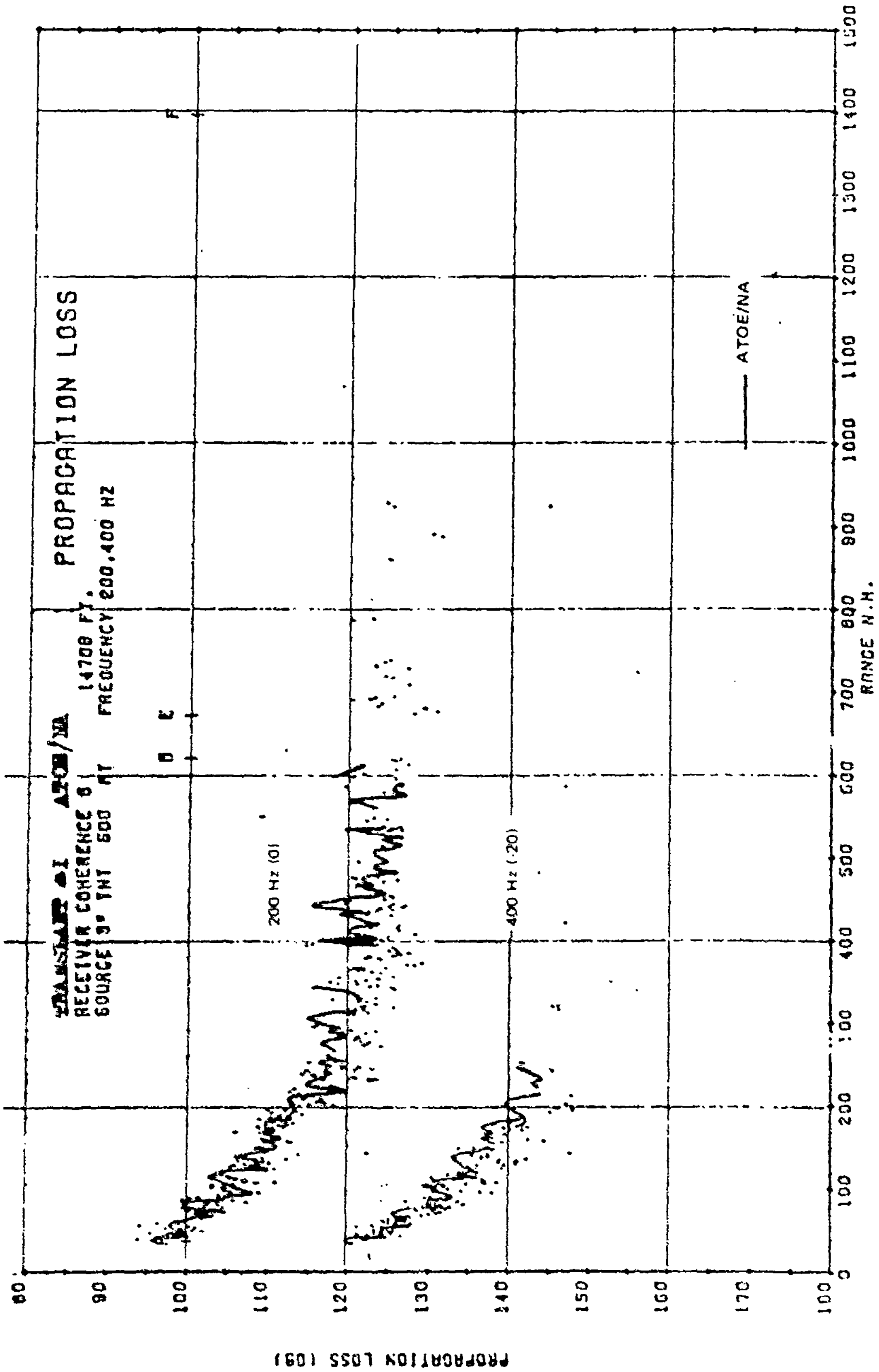

PROPAGATION LOSS
RECEIVER TVR I 500 FT
14000 FT
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)
F-9


PROPAGATION LOSS
500 FT
14000 FT.
FREQUENCY 200.400 HZ
200 Hz (0)
400 Hz (-20)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
80
90
100
110
120
130
140
150
160
170
180

F-10


PROPAGATION LOSS
TRANSLANT I - ATOE/NA
RECEIVER COHERENCE G
SOURCE 3° TMT 500 FT
14700 FT.
FREQUENCY 25.50.100 HZ
25 Hz (0)
50 Hz (-20)
100 Hz (-40)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

F-11


PROPAGATION LOSS
RECEIVER COHERENCE 0
SOURCE 9° TNT 600 FT
14708 FT.
FREQUENCY 200,400 HZ
200 Hz (0)
400 Hz (-20)
ATOE/NA
RANGE N.M.
PROPAGATION LOSS (DB)

F-12

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Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
Unavailable	Beam, J. P., et al.	LONG-RANGE ACOUSTIC PROPAGATION LOSS MEASUREMENTS OF PROJECT TRANSLANT I IN THE ATLANTIC OCEAN EAST OF BERMUDA	Naval Underwater Systems Center	740612	ADC001521	U
Unavailable	Cornyn, J. J., et al.	AMBIENT-NOISE PREDICTION. VOLUME 2. MODEL EVALUATION WITH IOMEDEX DATA	Naval Research Laboratory	740701	AD0530983	U
Unavailable	Unavailable	COHERENCE OF HARMONICALLY RELATED CW SIGNALS	Naval Underwater Systems Center	740722	ADB181912	U
Unavailable	Banchero, L. A., et al.	IOMEDEX SOUND VELOCITY ANALYSIS AND ENVIRONMENTAL DATA SUMMARY	Naval Oceanographic Office	740801	ADC000419	U
3810	Unavailable	CONSTRUCTION AND CALIBRATION OF USRD TYPE F58 VIBROSEIS MONITORING HYDROPHONES SERIALS 1 THROUGH 7	Naval Research Laboratory	741002	ND	U
ARL-TM-73-11; ARL-TM-73-12	Ellis, G. E., et al.	ARL PRELIMINARY DATA ANALYSIS FROM ACODAC SYSTEM; ANALYSIS OF THE BLAKE TEST ACODAC DATA	University of Texas, Applied Research Laboratories	741015	ADA001738; ND	U
Unavailable	Mitchell, S. K., et al.	QUALITY CONTROL ANALYSIS OF SUS PROCESSING FROM ACODAC DATA	University of Texas, Applied Research Laboratories	741015	ADB000283	U
Unavailable	Unavailable	MEDEX PROCESSING SYSTEM. VOLUME II. SOFTWARE	Bunker-Ramo Corp. Electronic Systems Division	741021	ADB000363	U
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