UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geophysical Surveys in the Vicinity of the Pinson and Getchell mines, Humboldt County, Nevada

By

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INTRODUCTION

During August 1985, the U.S. Geological Survey conducted geophysical studies on the east flank of the Osgood mountains in the vicinity of the Pinson and Getchell disseminated gold deposits in Humboldt County, Nevada (figure 1). These geophysical investigations were done as part of an integrated study under the Development of Assessment Techniques (DAT) program. The general objectives of this study are to characterize the in-situ petrophysical properties of disseminated gold deposits. Several geophysical techniques were employed in this survey, including total field magnetics, very low frequency electromagnetics, and high precision gravity. The data are presented with no interpretation in order to effect timely public release. These data supplement telluric data described by Hoover and others (1986) and other geophysical surveys in the vicinity described by Heran and Smith (1984) and Hoover and others (1984).

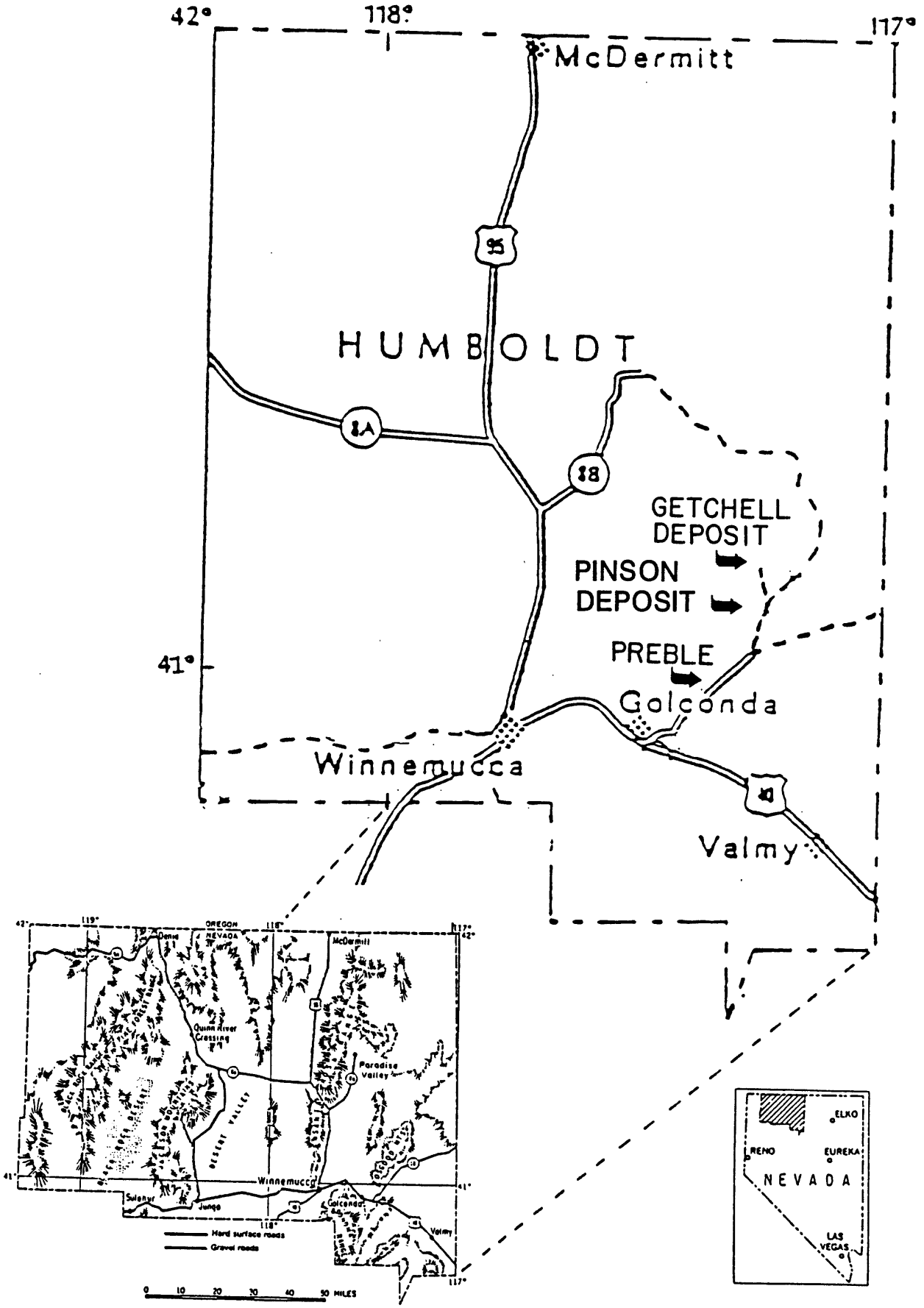

Figure 1. Map showing the location of Humboldt County and the approximate locations of the Getchell, Pinson and Preble dissemenated gold deposits.

General Geology

The geology of the Osgood Mountains has been described by Hotz and Willden (1964), the geology of the Getchell mine by Joralemon (1951) and Berger (1975), and the geology of the Pinson and Preble Gold Deposits by Kretschmer (1984).

The following summary is based on these studies. The Osgood Range trends north-northeast and is bounded on the east by normal faults. The oldest rocks in the area are the Osgood Mountain Quartzites of lower Cambrian age, exposed in the southern half of the Osgood Mountains. The northern part of the range is composed of younger Paleozoic sediments that have been complexly folded and thrust-faulted.

The Osgood Mountain Quartzite is mainly a pure cross-bedded quartzite with a few thin shaley partings and is overlain in sedimentary and some places structural contact by the middle to upper Cambrian Preble Formation. The Preble Formation is predominantly shale with a total thickness of approximately 12,000 feet, and can be broken down into three distinct units. The lower member consists of sandy shale, quartzitic sandstone and phyllitic shale. The middle unit is composed of a sequence of limestone, carbonaceous shale and calcareous shale with phyllitic shale and quartzitic sandstone. The upper member consists of phyllitic shale with some sandy shale and carbonaceous beds. The Preble Formation is overlain by the upper Cambrian to middle Ordovician (Kretschmer, 1984) Comus Formation. This formation consists of thin-bedded carbonate and shale units with interbedded dolomite siltstone and some chert. The sediments strike northerly and dip to the east along the southern limb of a dominant fold whose axis plunges 45° northeast. To the north they are isoclinically folded and dip northeast (Joralemon, 1951).

A dumbell shaped granodiorite stock of Cretaceous age (Silberman and others, 1974) intrudes the Preble Formation. It is an homogenous, coarse, inequigranular stock with associated dikes. The stock is symmetrical and dips outward 45^{o}-60^{o} on the east and west flanks. The stock has metamorphosed the shaley rocks to phyllite, slate, hornfels and biotite-andalusite-cordierite schists, and the limestones to marble and tactite.

The Getchell fault system bounds the eastern margin of the range and can be traced for about 24 km (Berger, 1975). The fault zone strikes generally north, parallel to the strike of the sedimentary rocks, but it bends westward around the northern part of the stock. The Getchell Fault system is the main control for gold mineralization in the area of the Osgood range. At the Getchell and Pinson deposits, the fault zone consists of a 50 to 100 ft wide zone with persistent footwall and hangingwall strands (Berger, 1980). Disseminated gold mineralization occurs where the fault zone cuts calcareous rocks of the Preble and Comus Formations.

The Pinson and Getchell gold deposits occur as sheet-like mineralized zones along the Getchell fault zone hosted mostly within carbonaceous shales and silty limestones of the middle member of the Cambrian Preble Formation and the Ordovician Comus Formation (Berger, 1980), (Kretschmer, 1984). Gold occurs in the native state as submicron to micron sized particles in association with carbonaceous material, within sulfide minerals, and as particles within and between quartz and clay grains (Berger, 1975). Other associated minerals include realgar, orpiment, aresenopyrite, chalcopyrite, cinnabar, sphalerite and stibnite. Hydrothermal alteration consists mainly of decarbonatization accompanied by silicification.

Methods Used

Three geophysical methods were employed in this survey: total field magnetics, very low frequency (VLF) electromagnetics, and high precision gravity measurements. The reader is referred to Telford and others (1983) for a detailed description of these methods.

The instrumentation[1] used to obtain these data were:

A. Magnetic Method

Protron Magnetometer - Scintrex MP-3

B. Electromagnetic Method

VLF - Scintrex VLF-4 Electromagnetic Receiver

C. Gravity Method

LaCoste Romberg Gravity Meter (G-551)

Data Collection

Geophysical data were collected in the areas of both the Getchell and the Pinson deposits (figure 2 and 3). Traverse locations are shown in figures 2 and 3 for all lines in the area, including those conducted by Hoover and others, (1984). The data in the present survey was collected along line PIN-1 (figure 2) and part of line G-4 (Reily) (figure 3). The station numbers on figures 2 and 3 represent distance in 100's of meters, so that station 20 on the figure corresponds to station 2000 on the profiles.

The survey in the Pinson mine area (figure 2) consisted of one northwest trending profile (PIN-1), 3.5 km in length, just south of the Pinson pit at Hoghead Canyon. Magnetic, VLF, and gravity measurements were made along this profile using a station spacing of 50 meters. Elevation measurements along the line were made using a Hewlett-Packard Total Station Infrared Distance

[1] Use of specific brand names does not directly or indirectly constitute endorsement by the USGS, but are used for descriptive purposes only.

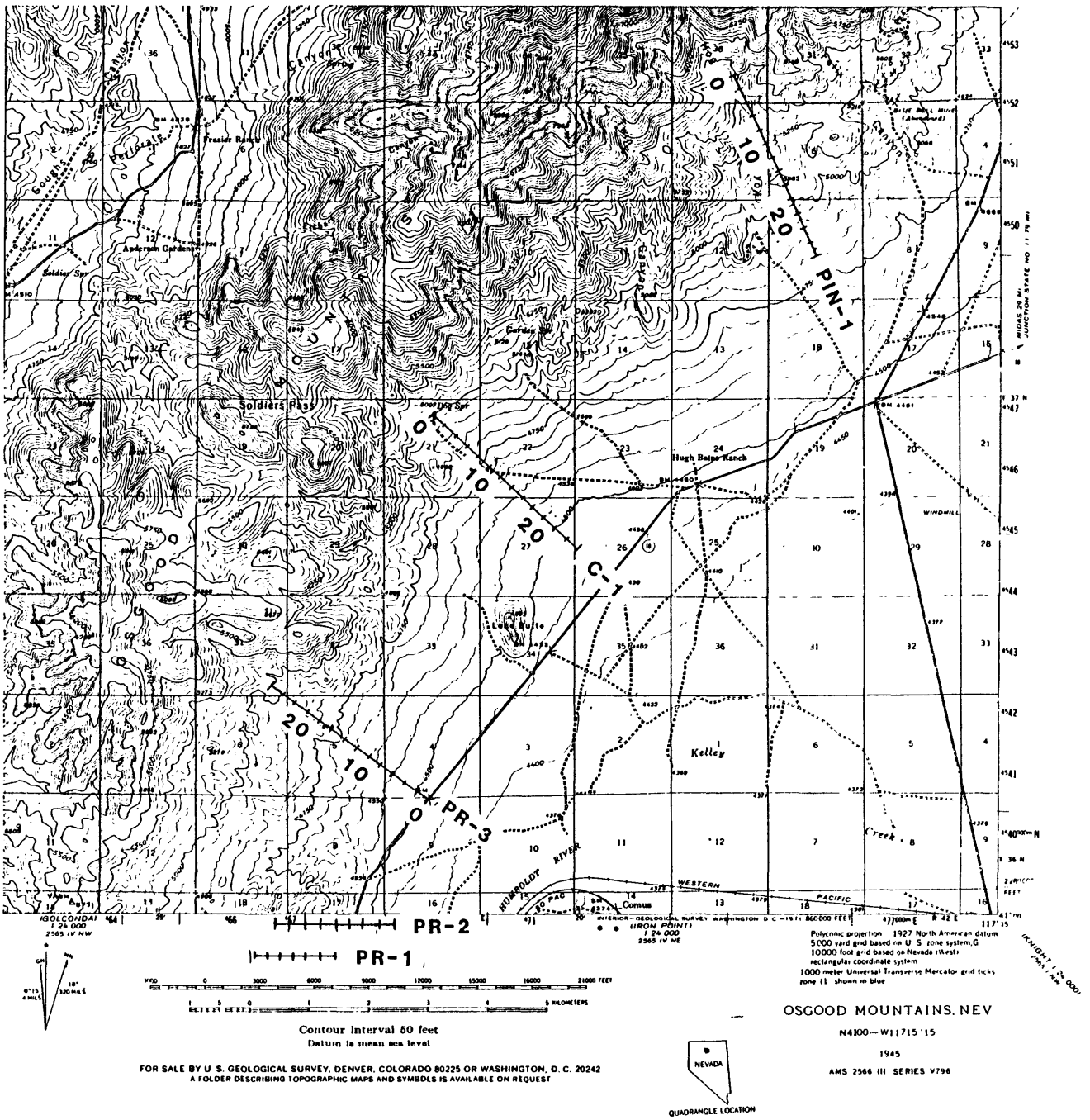

Figure 2. Map showing the locations of geophysical lines in the Pinson mine area. (This survey - PIN-1). Numbers represent distance in 100's of meters.

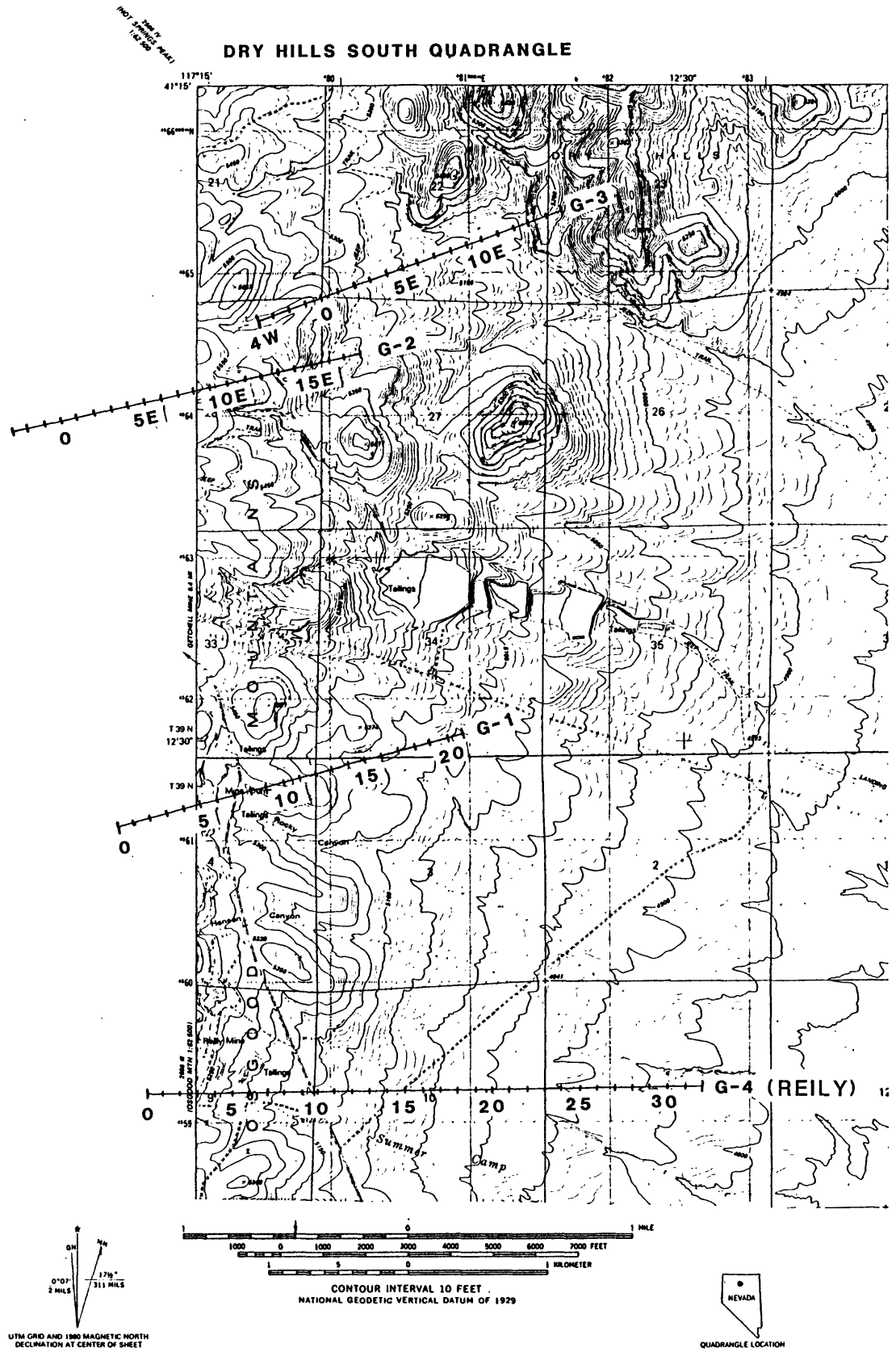

Figure 3. Map showing the locations of geophysical lines in the Getchell mine area. (This survey - G-4 Reily). Numbers represent distance in 100's of meters.

Measuring System. Horizontal distance and slope distance between stations were measured along the line totalling 3450 meters. The horizontal distance between stations was measured with an accuracy of 0.001 meters at 50 meter intervals obtaining a total of 72 stations. The relative change in elevation was computed with an accuracy of 0.001 feet giving an overall relief on the profile of 956.6 feet. The absolute elevation was obtained by tieing to a U.S.G.S. bench mark (elev. 4461 ft) located at the road junction southeast of the profile. Gravity observations were made at each station along the line with an accuracy of 0.1 milligals (mGal). The gravity stations were referenced to a field base station that was referenced to a U.S. Department of Defense (DOD) base at the Winnemucca Airport, which is part of the International Gravity Standardization Net. Measurements were started and closed daily by making repeat observations at the DOD base and field base. The magnetic measurements were made with a 1 gammas resolution using a protron magnetometer. A magnetic base station was set out approximately 100 meters north of the lines to monitor and correct for the magnetic time variations. The sample rate set on the magnetic base station was 60 seconds with a base field reference value of 52000 gammas. Three different frequencies were used in the VLF measurements, 24.8 KHz (Seattle, Washington), 23.4 KHz (Hawaii), and 21.4 KHz (Annapolis, Maryland). The 24.8 KHz frequency was used on the entire PIN-1 line. The 23.4 KHz frequency was used from 0-2100 meters and the 21.4 KHz frequency was used from 2150 to 3450 meters on the PIN-1 line. The 24.8 KHz and 23.4 KHz frequencies were used on the Reily G-4 line.

The survey in the Getchell area consisted of one east-west trending profile (G-4 Reily), 1,000 meters in length, at the Reily mine. This line was surveyed in using tape and compass. Magnetic and VLF measurements were obtained along this line with a station spacing of 25 meters. Figure 3 shows

the total surveyed length of G-4 but data was only obtained to station 10 (1000 meters) in this survey.

Data Reduction

The magnetic and VLF data reduction and plotting was done on a Hewlett Packard 85 computer system using unpublished U.S.G.S. programs. In some cases the plotting programs plot highs or lows that may not be supported by actual data points. The magnetic data is automatically corrected for diurnal variations by internal software in the MP-3 unit. The VLF data has not been corrected for topographic effects. The gravity data was reduced using unpublished U.S.G.S. programs existing on the U.S.G.S. Digital Equipment Corp. VAX 11-750 computer system. The terrain and Bouguer corrections (IAG, 1971; Morelli, 1974; Hammer, 1939) were made using a standard reduction density of 2.67 gm/cm^3. The Nettleton method (Nettleton, 1971) was used to check this reduction density. The reduction density was varied from 2.2 gm/cm^3 to 3.0 gm/cm^3 along the entire profile. The topography along the profile was plotted and compared with the Bouguer anomaly values. Values near 2.67 gm/cm^3 gave least correlation with topography showing that the near surface densities are close to the assumed standard reduction density of 2.67 gm/cm^3 and that the gravity values are reflecting local variations in lithology along the profile.

Data Presentation

The data are presented as profiles and as numerical tables in appendices A and B. Appendix A contains data from the Pinson mine area and appendix B contains data from the Getchell mine area. The order of presentation in each appendix is 1) total field magnetic data, 2) very low frequency (VLF) electromagnetic data, and 3) high precision gravity data.

The magnetic data are plotted as total field (gammas) versus the station location. The very low frequency (VLF) electromagnetic data are plotted as

apparent resistivity versus station location and as phase angle in degrees, by which E leads H, versus station location. Also plotted versus station location is tilt angle or the vertical in-phase component of the polarization ellipsoid, and the quadrature or the vertical out-of-phase component of the polarization ellipsoid. The three frequencies of 24.8 KHz (Seattle, Washington), 23.4 KHz (Hawaii) and 21.4 (Annapolis, Maryland) are plotted separately. The gravity data are plotted as station location versus the Bouguer anomaly in milligals.

Acknowledgements

The authors and the Geophysics Branch of the U.S. Geological Survey would like to thank the Pinson Mining Company and FRM Minerals, Inc., for permission to conduct this research on their property, and for their help and cooperation.

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APPENDIX A

Geophysical data from the PINSON mine area

PROFILE - TABULAR

NW

PINSON LN PIN-1 MAGNETICS

SE

AZ

PINSON MAG
Line: 1
85/08/14
NUMBER OF STATIONS = 70

STATION	MAG	TIME
+0	54056.9	12: 0
+50	54067.8	12:11
+100	54093.7	12:20
+150	54082.3	12:28
+200	54068.9	12:35
+250	54067.0	12:42
+300	54056.5	12:47
+350	54063.2	12:52
+400	54046.8	12:59
+450	54051.2	13:30
+500	54063.0	13:39
+550	53894.6	13:45
+600	54044.0	13:50
+650	54043.6	13:54
+700	54046.1	13:59
+750	54052.8	14: 4
+800	54047.1	14:10
+850	54018.8	14:15
+900	54028.3	14:20
+950	54026.2	14:25
+1000	54016.0	14:30
+1050	54016.8	14:35
+1100	54001.1	14:43
+1150	53995.2	14:50
+1200	54006.4	14:55
+1250	54003.0	15: 0
+1300	54003.5	15: 8
+1350	54001.3	15:13
+1400	53998.9	15:18
+1450	53991.7	15:22
+1500	53999.5	15:27
+1550	53987.3	15:31
+1600	53969.3	15:36
+1650	53983.2	15:43
+1700	53979.1	15:48
+1750	53983.0	15:53
+1800	53974.3	15:58
+1850	54097.0	10:12
+1900	54024.0	10:19
+1950	54011.5	10:31
+2000	53773.3	10:38
+2050	54022.5	10:45
+2100	54013.3	10:54
+2150	53976.8	12:20
+2200	53979.7	12:42
+2250	53974.4	12:46
+2300	53969.7	12:49
+2350	53990.8	12:52
+2400	53984.9	12:54
+2450	53973.7	12:57
+2500	53973.8	13: 2
+2550	53962.3	13: 6
+2600	53973.2	13:11
+2650	53965.0	13:18
+2700	53955.3	13:21
+2750	53970.3	13:25
+2800	53965.5	13:33
+2850	53959.2	13:39
+2900	53958.7	13:44
+2950	53955.7	13:48
+3000	53959.9	13:52
+3050	53961.2	13:56
+3100	53965.5	14: 0
+3150	53926.5	14: 5
+3200	53942.6	14:12
+3250	53937.6	14:16
+3300	53943.8	14:19
+3350	53949.0	14:22
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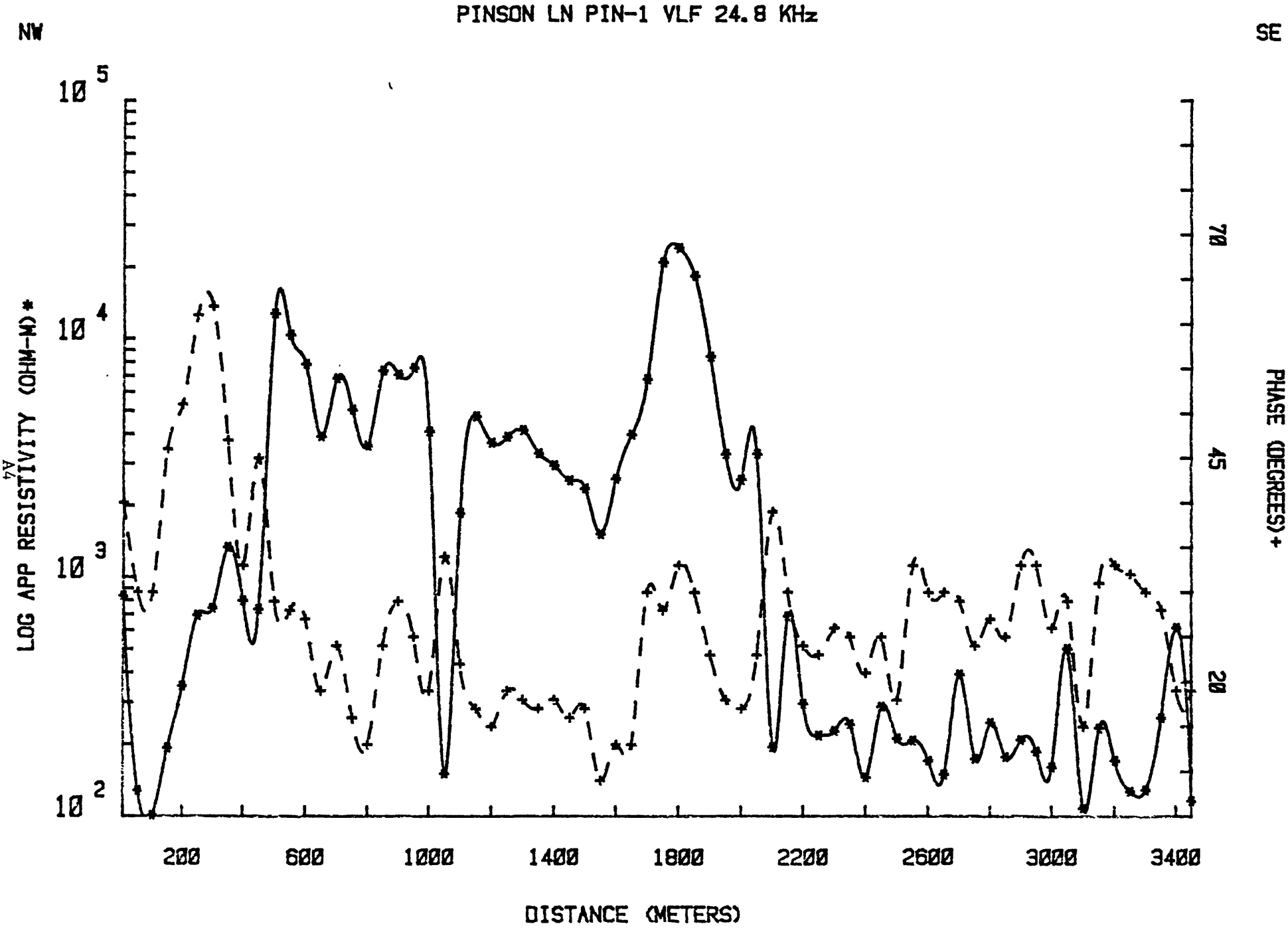
+3450	53947.9	14:29


PINSON LN PIN-1 VLF 24.8 KHz
NW
SE
LOG APP RESISTIVITY (OHM-M)*
PHASE (DEGREES)+
10 5
10 4
10 3
10 2
70
45
20
200
600
1000
1400
1800
2200
2600
3000
3400
DISTANCE (METERS)

PINSON
Line: 1
85/08/14
24.8KHz

NUMBER OF STATIONS = 70

STATION	RES	PHASE	Hy
+0	+832	+40	+21.0
+50	+128	+30	+27.7
+100	+101	+30	+30.5
+150	+193	+46	+25.9
+200	+351	+51	+23.2
+250	+695	+61	+21.0
+300	+744	+62	+20.7
+350	+1340	+47	+21.9
+400	+800	+33	+20.3
+450	+738	+45	+20.8
+500	+12800	+29	+20.9
+550	+10400	+28	+21.5
+600	+7820	+27	+21.7
+650	+3890	+19	+24.5
+700	+6830	+24	+24.3
+750	+5040	+16	+25.7
+800	+3570	+13	+25.9
+850	+7350	+24	+22.8
+900	+7090	+29	+23.0
+950	+7570	+25	+23.7
+1000	+4090	+19	+22.5
+1050	+151	+34	+24.1
+1100	+1870	+22	+24.4
+1150	+4750	+17	+23.6
+1200	+3680	+15	+23.9
+1250	+3900	+19	+25.2
+1300	+4140	+18	+23.4
+1350	+3310	+17	+23.3
+1400	+2950	+18	+23.2
+1450	+2550	+16	+25.0
+1500	+2360	+17	+25.7
+1550	+1520	+9	+22.5
+1600	+2590	+13	+25.4
+1650	+3980	+13	+22.5
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+1750	+21000	+28	+20.3
+1800	+24100	+33	+20.6
+1850	+18400	+30	+19.7
+1900	+8440	+23	+19.7
+1950	+3290	+18	+21.3
+2000	+2570	+17	+21.6
+2050	+3300	+23	+21.0
+2100	+195	+39	+22.1
+2150	+688	+30	+23.9
+2200	+296	+24	+25.1
+2250	+218	+23	+22.4
+2300	+228	+26	+19.4
+2350	+243	+25	+24.5
+2400	+146	+21	+23.9
+2450	+288	+25	+22.1
+2500	+212	+18	+22.5
+2550	+208	+33	+21.8
+2600	+171	+30	+20.8
+2650	+150	+30	+22.5
+2700	+392	+29	+21.8
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+2800	+246	+27	+23.4
+2850	+177	+25	+22.9
+2900	+209	+33	+23.7
+2950	+187	+33	+23.2
+3000	+161	+26	+23.9
+3050	+503	+29	+23.7
+3100	+108	+15	+25.0
+3150	+234	+31	+23.5
+3200	+171	+33	+24.7
+3250	+127	+32	+23.8
+3300	+129	+30	+23.2
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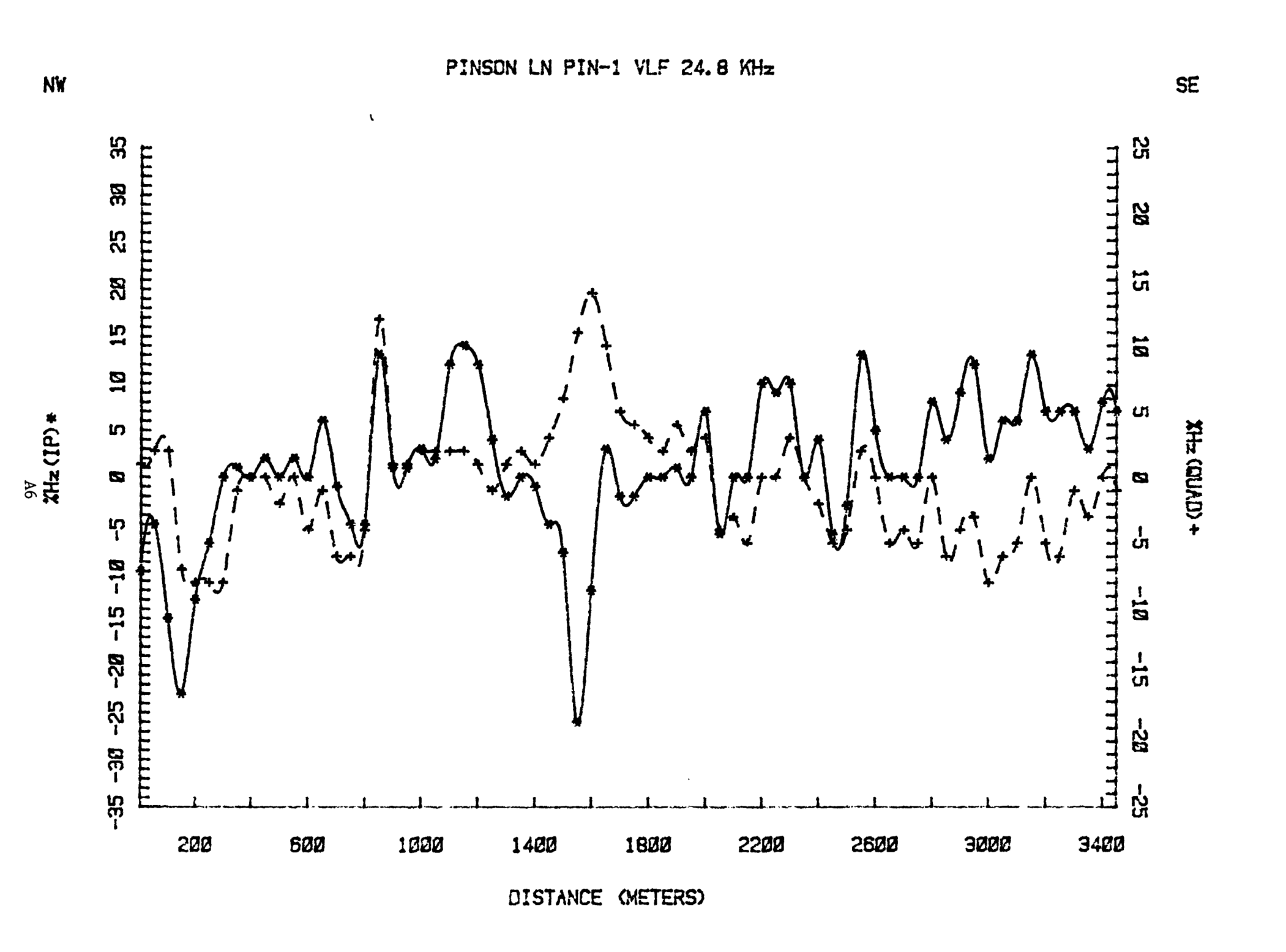
PINSON LN PIN-1 VLF 24.8 KHz
NW
SE
%Hz (IP)*
%Hz (QUAD) +
-35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35
25 20 15 10 5 0 -5 -10 -15 -20 -25
200 600 1000 1400 1800 2200 2600 3000 3400
DISTANCE (METERS)

PINSON
Line: 1
85/08/14
24.8KHz

NUMBER OF STATIONS = 70

STATION	Hz(IP)	Hz(Q)	Hy
+0	-10	+1	+23.2
+50	-5	+2	+27.7
+100	-15	+2	+30.1
+150	-23	-7	+25.6
+200	-13	-8	+23.2
+250	-7	-8	+20.9
+300	+0	-8	+20.4
+350	+1	-1	+21.6
+400	+0	+0	+20.6
+450	+2	+0	+20.6
+500	+0	-2	+19.5
+550	+2	+0	+21.5
+600	+0	-4	+21.8
+650	+6	-1	+24.5
+700	-1	-6	+24.1
+750	-5	-6	+25.5
+800	-5	-4	+25.6
+850	+13	+12	+23.2
+900	+1	+1	+22.7
+950	+1	+1	+23.7
+1000	+3	+2	+22.7
+1050	+2	+2	+24.2
+1100	+12	+2	+23.8
+1150	+14	+2	+23.4
+1200	+12	+1	+24.0
+1250	+4	-1	+24.9
+1300	-2	+1	+23.0
+1350	+0	+2	+23.6
+1400	-1	+1	+23.3
+1450	-5	+3	+23.8
+1500	-8	+6	+26.2
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+1600	-12	+14	+24.5
+1650	+3	+10	+22.7
+1700	-2	+5	+20.6
+1750	-2	+4	+20.0
+1800	+0	+3	+20.1
+1850	+0	+2	+19.3
+1900	+1	+4	+18.4
+1950	+0	+2	+21.1
+2000	+7	+3	+21.4
+2050	-6	-4	+20.5
+2100	+0	-3	+21.7
+2150	+0	-5	+22.9
+2200	+10	+0	+25.4
+2250	+9	+0	+23.1
+2300	+10	+3	+20.4
+2350	+0	+0	+24.1
+2400	+4	-2	+23.3
+2450	-6	-5	+21.9
+2500	-3	-4	+22.4
+2550	+13	+2	+21.9
+2600	+5	+0	+20.7
+2650	+0	-5	+22.4
+2700	+0	-4	+21.8
+2750	+0	-5	+23.4
+2800	+8	+0	+23.3
+2850	+4	-6	+21.7
+2900	+9	-4	+22.9
+2950	+12	-3	+22.4
+3000	+2	-8	+23.3
+3050	+6	-6	+23.6
+3100	+6	-5	+24.9
+3150	+13	+0	+23.3
+3200	+7	-5	+24.6
+3250	+7	-6	+23.2
+3300	+7	-1	+23.2
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+3400	+8	+0	+24.0
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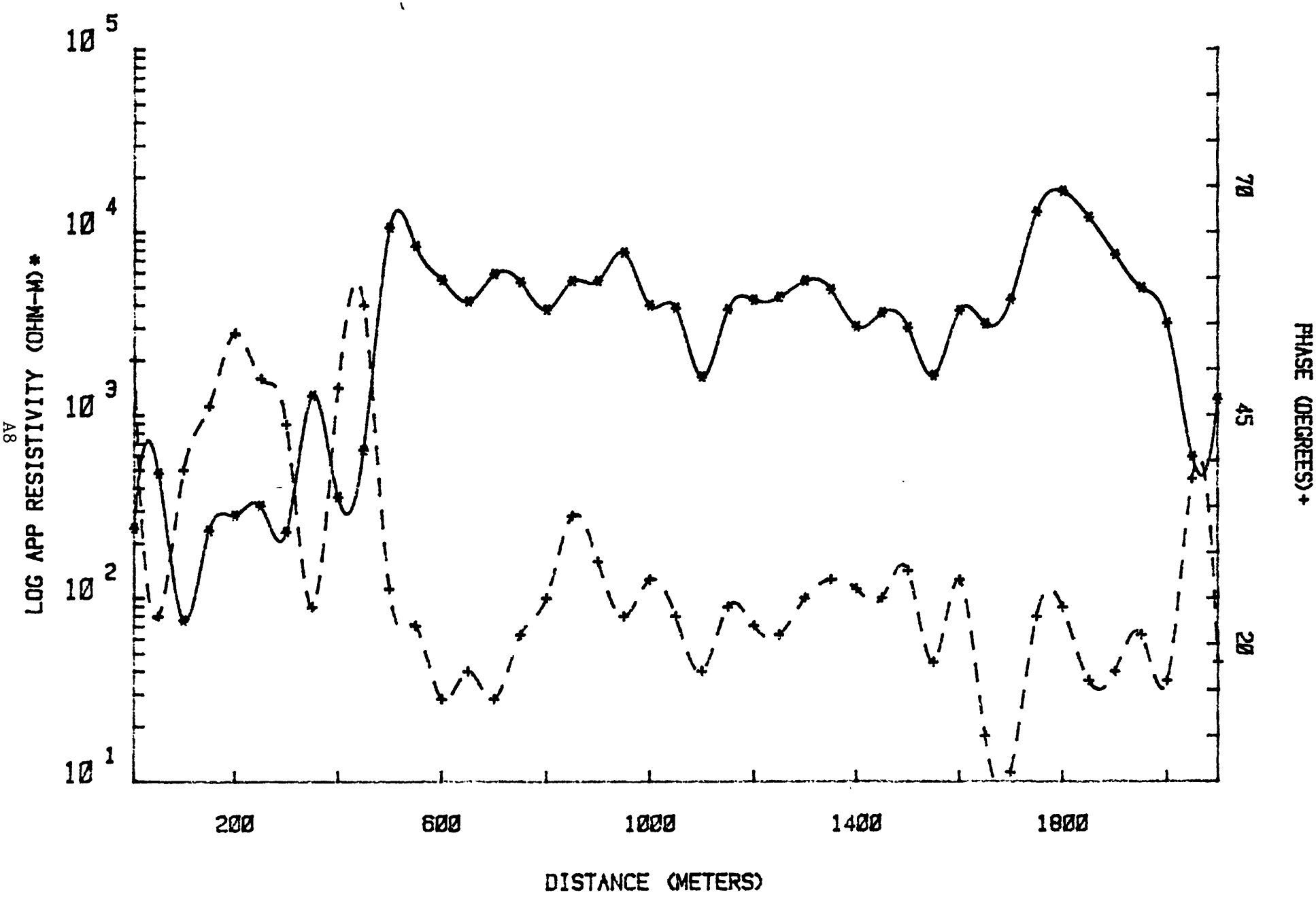
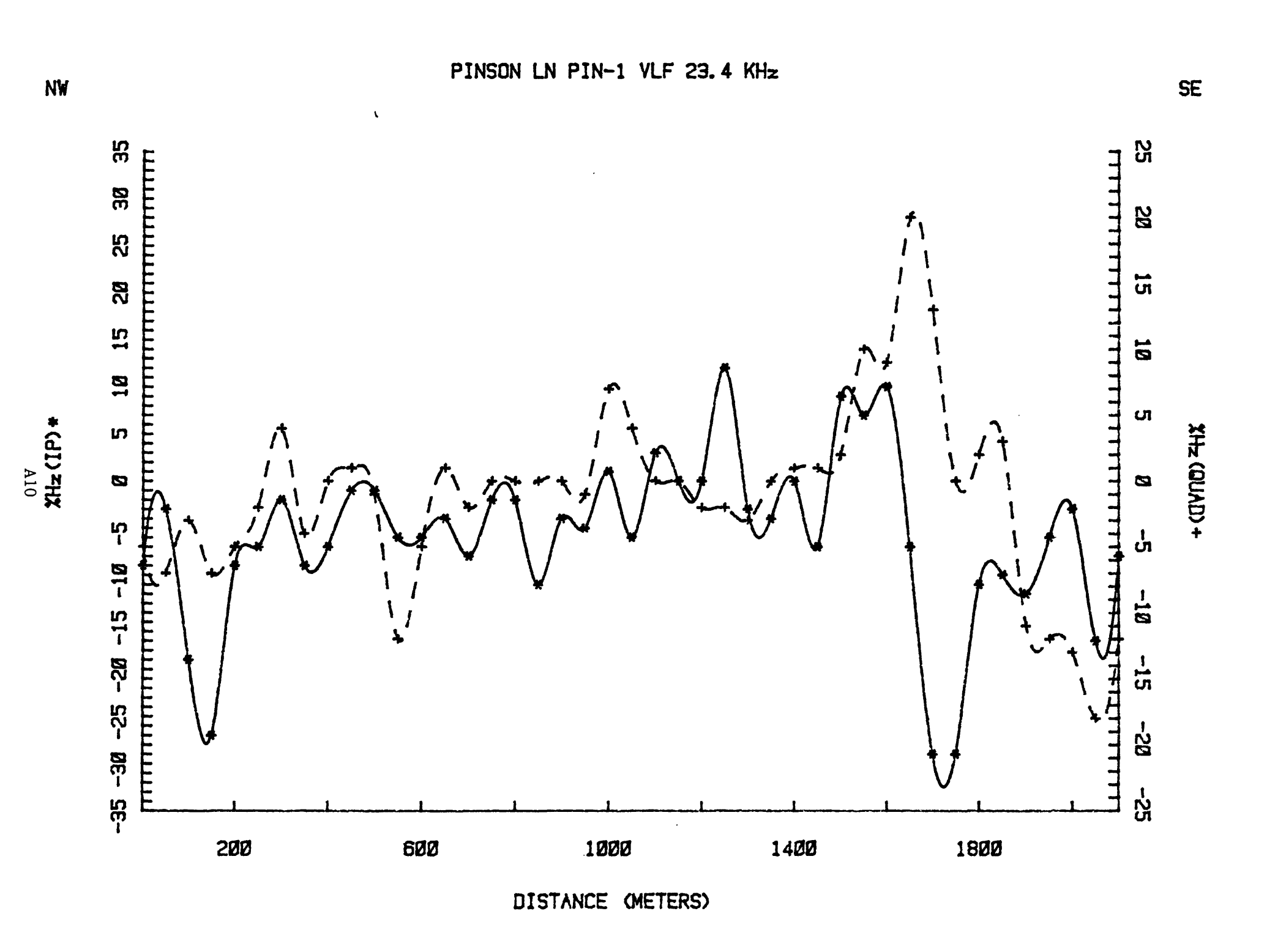

PINSON LN PIN-1 VLF 23.4 KHz
NW
SE
LOG APP RESISTIVITY (OHM-M)*
PHASE (DEGREES)+
10 5
10 4
10 3
10 2
10 1
70
45
20
200
600
1000
1400
1800
DISTANCE (METERS)

FILE = PNEH

PINSON
Line: 1
85/08/09
23.4KHz

NUMBER OF STATIONS = 43

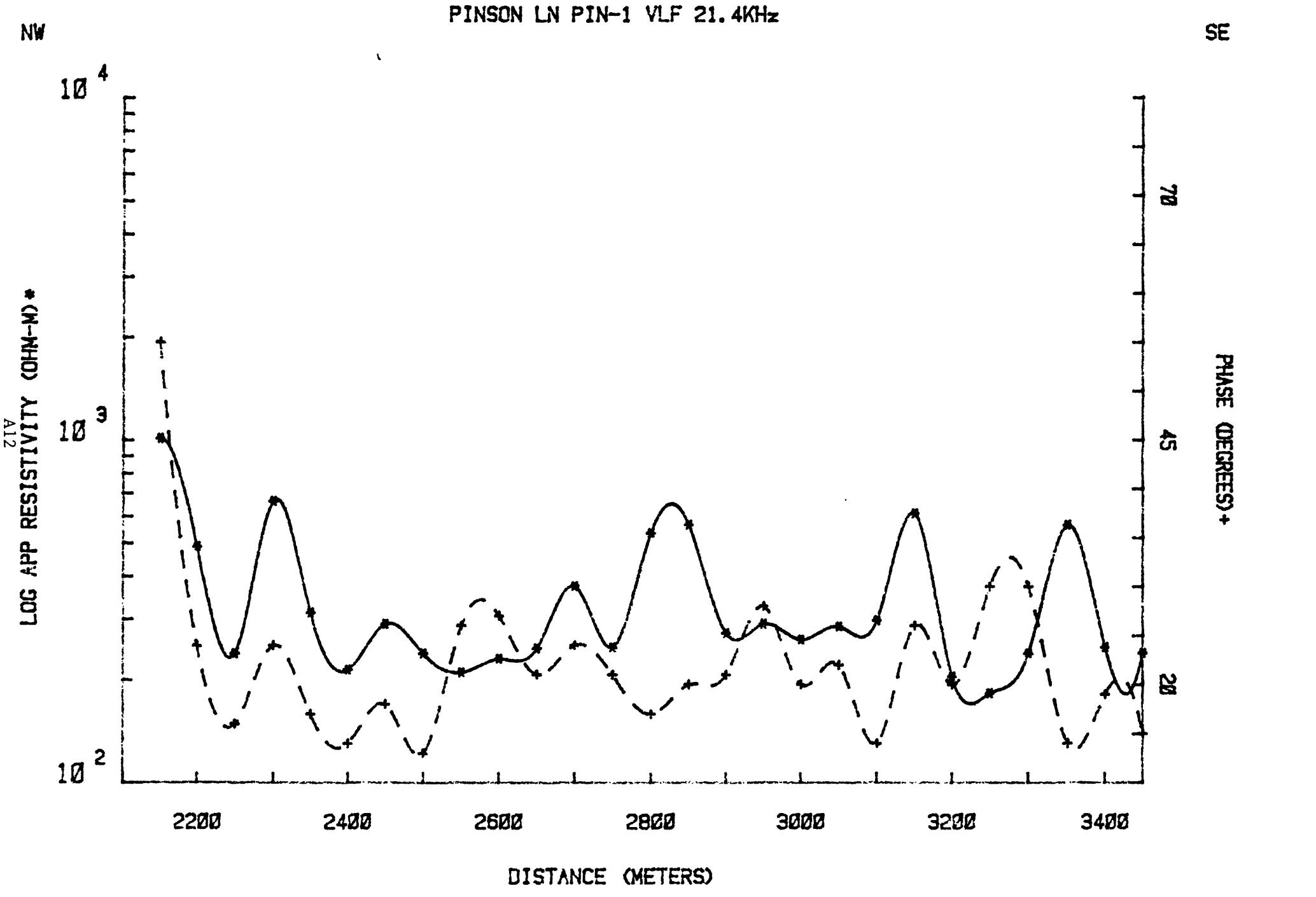
STATION	RES	PHASE	Hy
+0	+242	+51	+9.0
+50	+482	+23	+9.8
+100	+76	+39	+10.4
+150	+235	+46	+8.8
+200	+284	+54	+9.0
+250	+320	+49	+9.7
+300	+231	+44	+9.6
+350	+1280	+24	+10.4
+400	+357	+48	+9.4
+450	+647	+57	+10.4
+500	+10600	+26	+9.6
+550	+8400	+22	+10.7
+600	+5480	+14	+9.6
+650	+4190	+17	+10.5
+700	+5910	+14	+9.8
+750	+5320	+21	+18.3
+800	+3790	+25	+18.3
+850	+5420	+34	+17.9
+900	+5440	+29	+17.4
+950	+7750	+23	+16.0
+1000	+3990	+27	+16.5
+1050	+3860	+23	+15.0
+1100	+1620	+17	+17.6
+1150	+3790	+24	+17.3
+1200	+4270	+22	+17.5
+1250	+4420	+21	+18.4
+1300	+5440	+25	+18.0
+1350	+4860	+27	+17.7
+1400	+3050	+26	+17.0
+1450	+3630	+25	+16.3
+1500	+3020	+28	+17.3
+1550	+1650	+18	+15.5
+1600	+3740	+27	+18.6
+1650	+3160	+10	+20.7
+1700	+4290	+6	+22.4
+1750	+12900	+23	+14.9
+1800	+16700	+24	+14.8
+1850	+12000	+16	+15.6
+1900	+7530	+17	+9.5
+1950	+4920	+21	+9.2
+2000	+3170	+16	+10.2
+2050	+592	+38	+9.0
+2100	+1220	+18	+11.2


PINSON LN PIN-1 VLF 23.4 KHz
NW
SE
%Hz(IP)*
%Hz(QUAD)+
-35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35
25 20 15 10 5 0 -5 -10 -15 -20 -25
200
600
1000
1400
1800
DISTANCE (METERS)

PINSON
Line: 1
85/08/09
23.4KHz

NUMBER OF STATIONS = 43

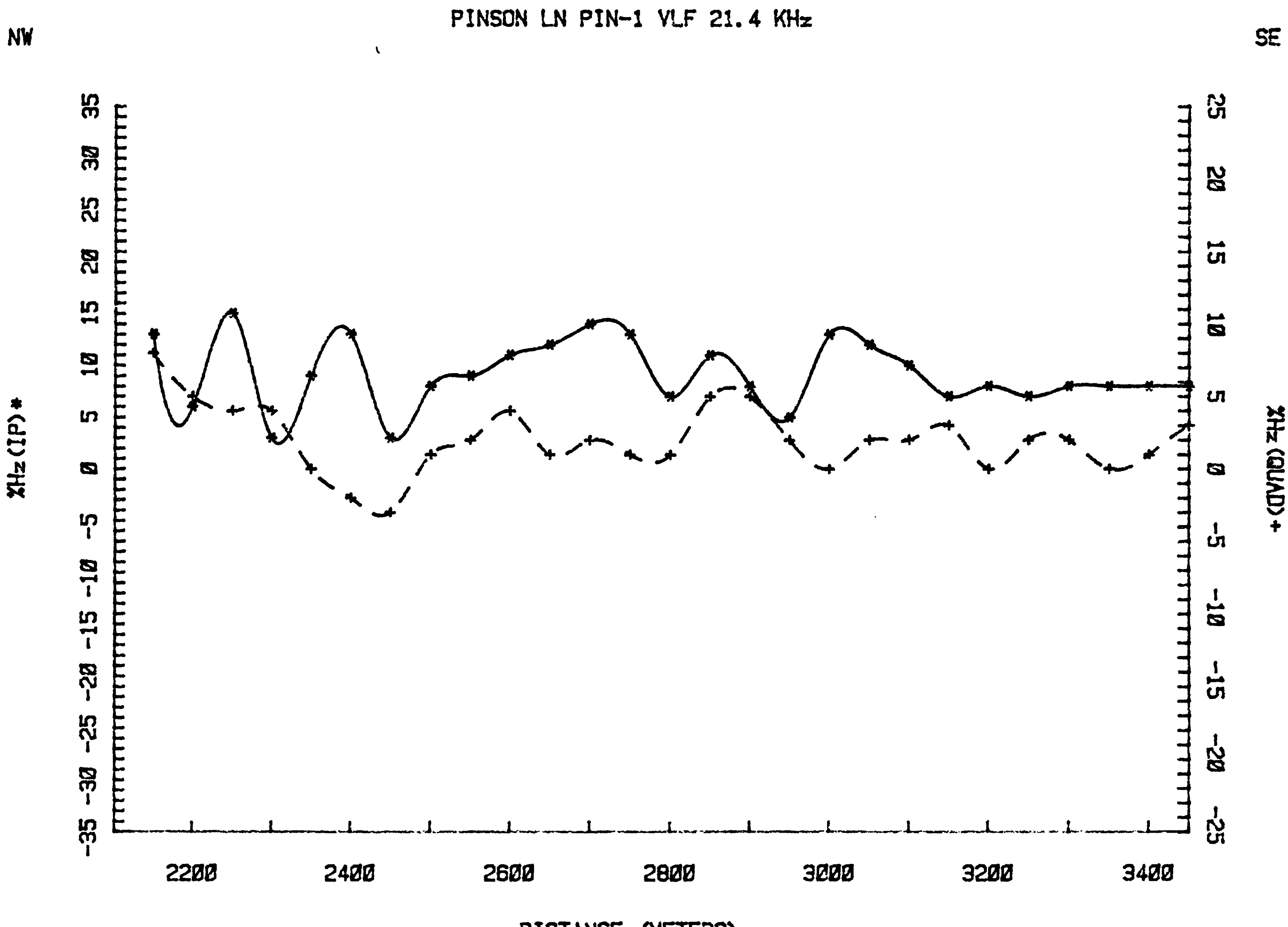
STATION	Hz(IP)	Hz(Q)	Hy
+0	-9	-5	+8.7
+50	-3	-7	+9.8
+100	-19	-3	+10.2
+150	-27	-7	+8.6
+200	-9	-5	+9.1
+250	-7	-2	+9.3
+300	-2	+4	+9.9
+350	-9	-4	+10.7
+400	-7	+0	+9.3
+450	-1	+1	+10.4
+500	-1	-1	+9.1
+550	-6	-12	+10.4
+600	-6	-5	+9.1
+650	-4	+1	+10.4
+700	-8	-2	+9.4
+750	-2	+0	+18.1
+800	-2	+0	+18.0
+850	-11	+0	+17.5
+900	-4	+0	+17.2
+950	-5	-1	+15.9
+1000	+1	+7	+16.2
+1050	-6	+4	+14.5
+1100	+3	+0	+17.3
+1150	+0	+0	+17.1
+1200	+0	-2	+17.2
+1250	+12	-2	+18.1
+1300	-3	-3	+17.7
+1350	-4	+0	+17.4
+1400	+0	+1	+16.5
+1450	-7	+1	+15.7
+1500	+9	+2	+17.0
+1550	+7	+10	+15.3
+1600	+10	+9	+18.8
+1650	-7	+20	+20.9
+1700	-29	+13	+21.9
+1750	-29	+0	+14.7
+1800	-11	+2	+14.4
+1850	-10	+3	+7.6
+1900	-12	-11	+9.4
+1950	-6	-12	+8.8
+2000	-3	-13	+10.1
+2050	-17	-18	+9.0
+2100	-8	-12	+11.2


PINSON LN PIN-1 VLF 21.4KHz
NW
SE
LOG APP RESISTIVITY (OHM-M)*
PHASE (DEGREES)+
DISTANCE (METERS)
10 4
10 3
10 2
70
45
20
2200
2400
2600
2800
3000
3200
3400

PINSON
Line: 1
85/08/14
21.4KHz

NUMBER OF STATIONS = 27

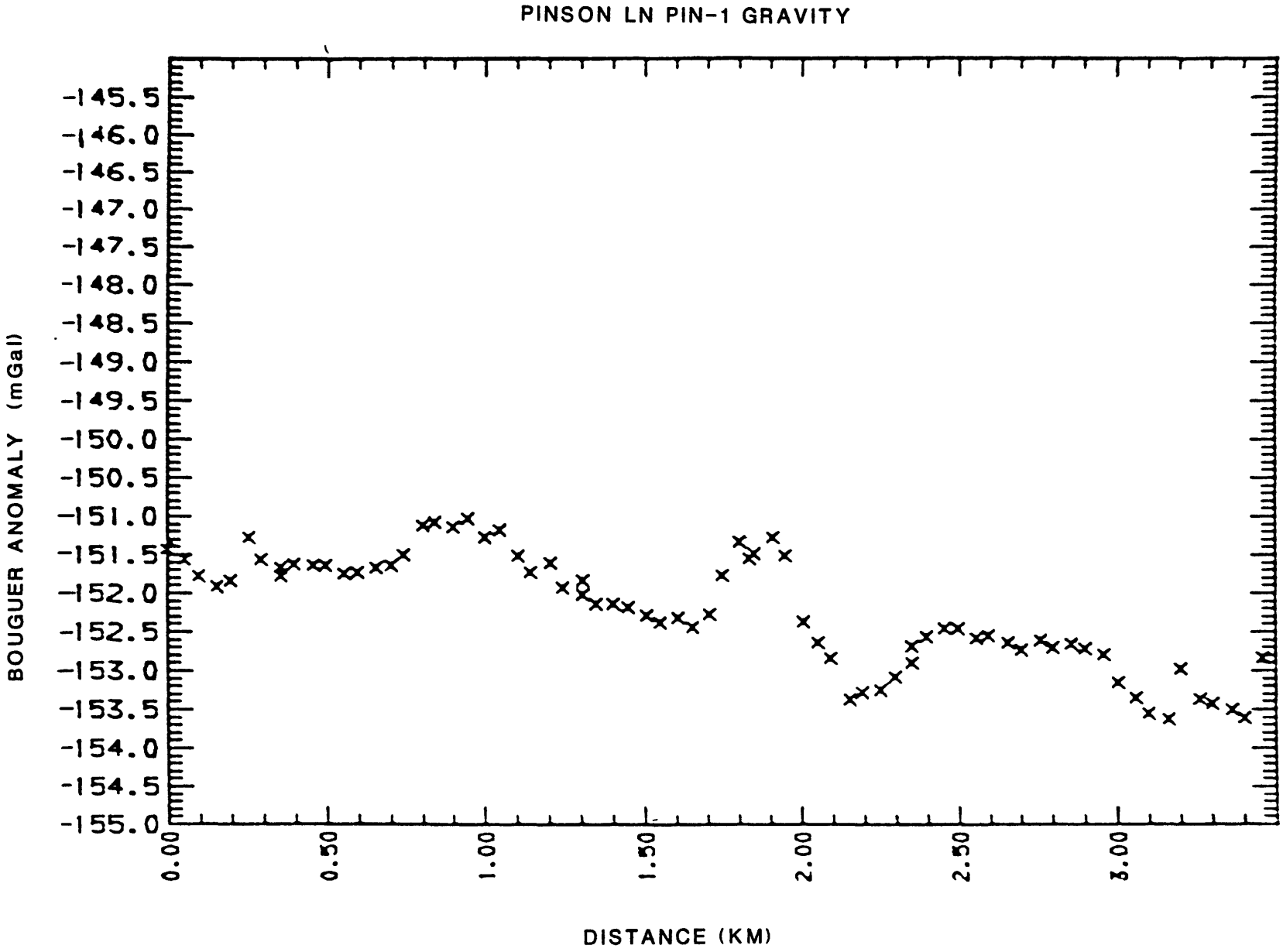
STATION	RES	PHASE	Hy
+2150	+1010	+55	+8.2
+2200	+488	+24	+8.4
+2250	+238	+16	+8.9
+2300	+662	+24	+7.8
+2350	+313	+17	+9.2
+2400	+213	+14	+8.9
+2450	+290	+18	+8.4
+2500	+238	+13	+8.7
+2550	+209	+26	+8.5
+2600	+229	+27	+8.5
+2650	+246	+21	+8.8
+2700	+374	+24	+8.9
+2750	+248	+21	+8.9
+2800	+535	+17	+6.7
+2850	+566	+20	+7.9
+2900	+273	+21	+8.3
+2950	+290	+28	+8.6
+3000	+261	+20	+8.5
+3050	+285	+22	+8.6
+3100	+297	+14	+9.4
+3150	+610	+26	+7.5
+3200	+204	+20	+7.8
+3250	+182	+30	+8.1
+3300	+238	+30	+8.4
+3350	+564	+14	+7.6
+3400	+248	+19	+8.8
+3450	+239	+15	+8.4

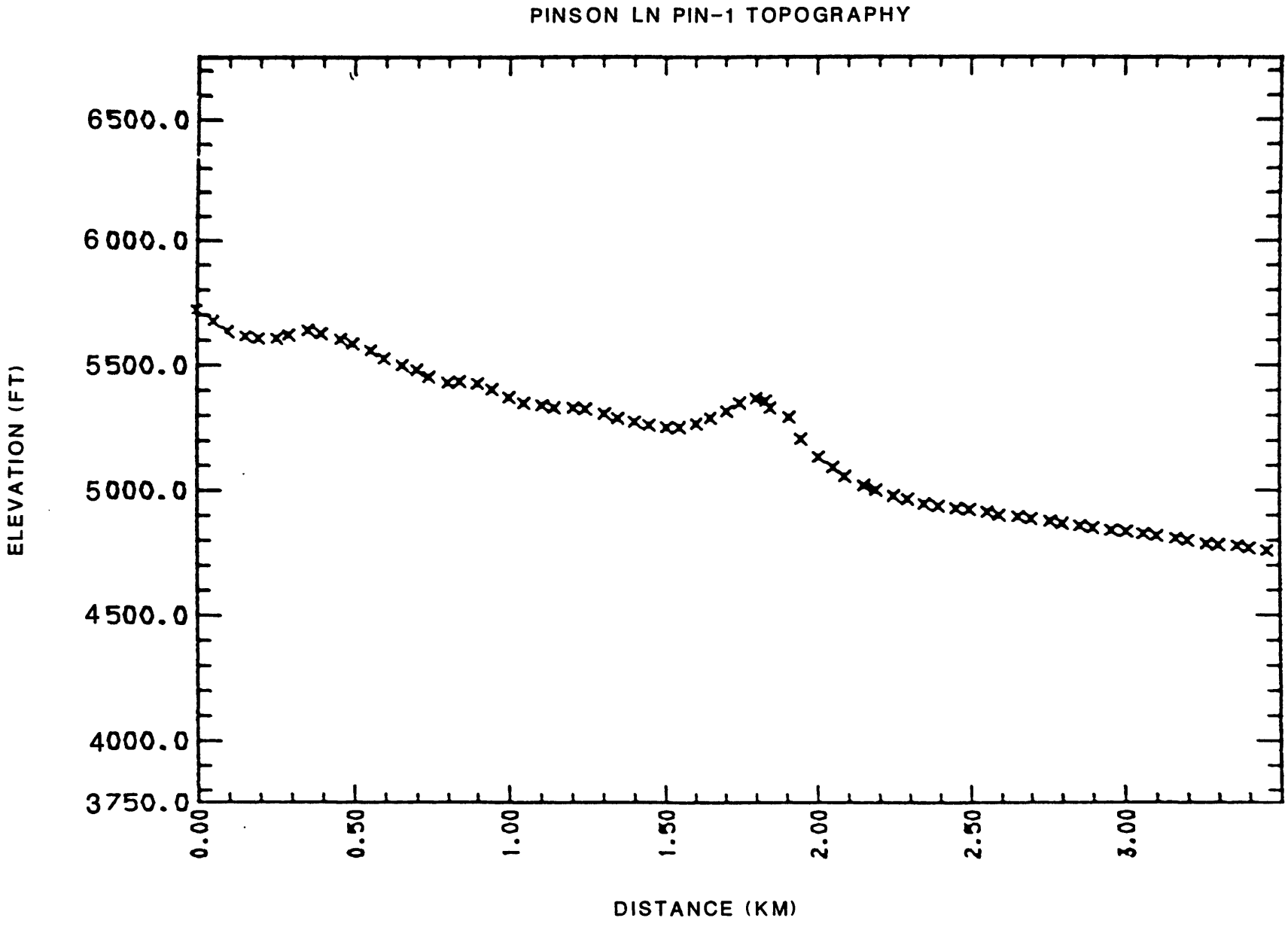

PINSON LN PIN-1 VLF 21.4 KHz
NW
SE
%Hz (IP) *
%Hz (QUAD) +
35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35
25 20 15 10 5 0 -5 -10 -15 -20 -25
2200 2400 2600 2800 3000 3200 3400
DISTANCE (METERS)

PINSON
Line: 1
85/08/14
21.4KHz

NUMBER OF STATIONS = 27

STATION	Hz(IP)	Hz(Q)	Hy
+2150	+13	+8	+8.4
+2200	+6	+5	+8.1
+2250	+15	+4	+8.6
+2300	+3	+4	+7.9
+2350	+9	+0	+9.4
+2400	+13	-2	+9.0
+2450	+3	-3	+8.2
+2500	+8	+1	+8.3
+2550	+9	+2	+8.2
+2600	+11	+4	+8.4
+2650	+12	+1	+8.6
+2700	+14	+2	+8.9
+2750	+13	+1	+8.6
+2800	+7	+1	+6.9
+2850	+11	+5	+8.0
+2900	+8	+5	+8.4
+2950	+5	+2	+8.5
+3000	+13	+0	+7.7
+3050	+12	+2	+8.5
+3100	+10	+2	+8.9
+3150	+7	+3	+8.1
+3200	+8	+0	+8.4
+3250	+7	+2	+8.1
+3300	+8	+2	+8.6
+3350	+8	+0	+7.9
+3400	+8	+1	+8.6
+3450	+8	+3	+8.2


PINSON LN PIN-1 GRAVITY
BOUGUER ANOMALY (mGal)
-145.5
-146.0
-146.5
-147.0
-147.5
-148.0
-148.5
-149.0
-149.5
-150.0
-150.5
-151.0
-151.5
-152.0
-152.5
-153.0
-153.5
-154.0
-154.5
-155.0
0.00
0.50
1.00
1.50
2.00
2.50
3.00
DISTANCE (KM)


PINSON LN PIN-1 TOPOGRAPHY
ELEVATION (FT)
6500.0
6000.0
5500.0
5000.0
4500.0
4000.0
3750.0
0.00
0.50
1.00
1.50
2.00
2.50
3.00
DISTANCE (KM)

PINSON LINE PIN-1 GRAVITY PROFILE ELEV-FT DENSITY-2.67

STA-ID	DIST		FREE AIR	BOUG ANOM	ELEV	ITC	OTC	OBS GRAV
pin-2	0.1006	0.0000	38.10	-151.78	5632.50	1.61	2.09	-222.211
pin-1	0.0553	0.0000	39.62	-151.56	5672.90	1.66	2.13	-224.461
pin-0	0.0000	0.0000	40.97	-151.43	5716.40	1.85	2.20	-227.156
pin-4	0.2016	0.0000	37.12	-151.83	5603.40	1.56	2.07	-220.531
pin-5	0.2587	0.0000	37.70	-151.27	5604.10	1.57	2.07	-220.070
pin-6	0.2987	0.0000	37.71	-151.56	5616.50	1.68	2.08	-221.242
pin-7	0.3602	0.0000	38.02	-151.66	5636.80	1.97	2.08	-222.891
pin-8	0.3993	0.0000	37.54	-151.62	5621.50	1.96	2.08	-221.961
pin-9	0.4617	0.0000	36.89	-151.63	5600.90	1.92	2.06	-220.727
pin-10	0.5012	0.0000	36.32	-151.64	5579.90	1.78	2.04	-219.344
pin-11	0.5578	0.0000	35.49	-151.75	5553.40	1.62	2.01	-217.727
pin-12	0.6031	0.0000	34.67	-151.73	5522.80	1.45	1.98	-215.711
pin-13	0.6597	0.0000	33.81	-151.66	5493.20	1.39	1.95	-213.828
pin-14	0.7037	0.0000	33.23	-151.63	5475.20	1.41	1.93	-212.750
pin-15	0.7437	0.0000	32.49	-151.50	5449.90	1.43	1.91	-211.133
pin-16	0.8061	0.0000	31.91	-151.12	5428.50	1.69	1.88	-209.750
pin-17	0.8457	0.0000	32.01	-151.07	5431.10	1.75	1.87	-209.930
pin-18	0.9018	0.0000	31.64	-151.13	5421.80	1.74	1.86	-209.469
pin-19	0.9472	0.0000	31.07	-151.03	5399.50	1.68	1.83	-207.977
pin-20	1.0038	0.0000	29.98	-151.27	5369.90	1.55	1.81	-206.328
pin-21	1.0487	0.0000	29.31	-151.18	5345.60	1.50	1.78	-204.742
pin-22	1.1048	0.0000	28.99	-151.51	5334.60	1.15	1.75	-204.078
pin-23	1.1452	0.0000	28.63	-151.73	5326.70	1.04	1.73	-203.727
pin-24	1.2068	0.0000	28.70	-151.61	5325.50	1.06	1.71	-203.578
pin-25	1.2458	0.0000	28.24	-151.92	5320.60	1.07	1.69	-203.609
pin-26	1.3082	0.0000	27.57	-152.02	5304.30	1.10	1.67	-202.797
pin-27	1.3482	0.0000	26.95	-152.13	5286.90	1.03	1.65	-201.813
pin-29	1.4493	0.0000	26.05	-152.18	5257.70	0.94	1.60	-200.039
pin-30	1.5059	0.0000	25.63	-152.29	5248.00	0.93	1.58	-199.594
pin-28	1.4044	0.0000	26.49	-152.14	5271.50	0.98	1.62	-200.867
pin-31	1.5508	0.0000	25.55	-152.38	5250.10	1.01	1.56	-199.898
pin-32	1.6074	0.0000	25.85	-152.32	5262.60	1.21	1.55	-200.820
pin-33	1.6523	0.0000	26.20	-152.44	5285.60	1.54	1.54	-202.656
pin-34	1.7089	0.0000	26.84	-152.27	5315.30	2.08	1.54	-204.852
pin-35	1.7484	0.0000	27.75	-151.77	5344.90	2.68	1.55	-206.758
pin-36	1.8045	0.0000	28.09	-151.34	5364.70	3.45	1.55	-208.328
pin-36b	1.8333	0.0000	27.67	-151.54	5352.70	3.27	1.53	-207.633
pin-37	1.8508	0.0000	27.18	-151.49	5328.70	3.01	1.51	-205.883
pin-38	1.9119	0.0000	26.10	-151.28	5288.90	2.99	1.46	-203.258
pin-39	1.9514	0.0000	23.69	-151.51	5205.50	2.38	1.40	-197.867
pin-40	2.0084	0.0000	21.47	-152.37	5130.90	1.21	1.37	-193.117
pin-41	2.0538	0.0000	20.24	-152.64	5091.90	0.86	1.35	-190.719
pin-42	2.0929	0.0000	19.02	-152.84	5054.60	0.62	1.33	-188.453
pin-43	2.1544	0.0000	17.41	-153.36	5019.10	0.52	1.31	-186.773
pin-44	2.1944	0.0000	16.86	-153.27	4998.80	0.48	1.30	-185.453
pin-45	2.2510	0.0000	16.20	-153.24	4978.10	0.48	1.28	-184.211
pin-46	2.2959	0.0000	15.72	-153.07	4961.40	0.56	1.27	-183.148
pin-70	3.4586	0.0000	9.72	-152.84	4759.80	0.27	0.89	-171.070
pin-69	3.4016	0.0000	9.14	-153.61	4766.30	0.29	0.91	-172.219
pin-68	3.3621	0.0000	9.52	-153.50	4775.20	0.32	0.91	-172.641
pin-67	3.3010	0.0000	9.74	-153.43	4779.90	0.31	0.93	-172.813
pin-66	3.2610	0.0000	10.08	-153.36	4786.50	0.25	0.95	-173.063
pin-65	3.1990	0.0000	10.92	-152.97	4800.20	0.26	0.96	-173.477
pin-64	3.1595	0.0000	10.53	-153.62	4808.10	0.26	0.97	-174.578
pin-63	3.0980	0.0000	10.97	-153.54	4819.80	0.28	0.99	-175.188
pin-62	3.0580	0.0000	11.37	-153.35	4826.70	0.29	1.01	-175.406
pin-61	3.0010	0.0000	11.78	-153.15	4834.50	0.32	1.03	-175.688
pin-60	2.9565	0.0000	12.37	-152.79	4841.80	0.33	1.04	-175.750
pin-59	2.8990	0.0000	12.74	-152.71	4851.10	0.34	1.06	-176.211
pin-57	2.8546	0.0000	13.02	-152.65	4858.50	0.35	1.08	-176.594
pin-56	2.7980	0.0000	13.30	-152.69	4867.90	0.34	1.09	-177.148
pin-55	2.7589	0.0000	13.74	-152.60	4878.10	0.34	1.10	-177.648
pin-54	2.6965	0.0000	13.89	-152.72	4887.00	0.34	1.12	-178.281
pin-53	2.6574	0.0000	14.19	-152.63	4893.80	0.35	1.14	-178.594
pin-52	2.5954	0.0000	14.50	-152.54	4900.90	0.36	1.16	-178.906
pin-51	2.5559	0.0000	14.79	-152.57	4911.50	0.39	1.17	-179.578
pin-50	2.4988	0.0000	15.16	-152.45	4920.80	0.43	1.19	-180.039
pin-49	2.4540	0.0000	15.36	-152.45	4927.70	0.46	1.20	-180.461
pin-48	2.3973	0.0000	15.45	-152.56	4935.20	0.50	1.22	-181.031
pin-47a	2.3520	0.0000	15.67	-152.68	4947.40	0.54	1.25	-181.922

APPENDIX B

Geophysical data from the Getchell Mine area

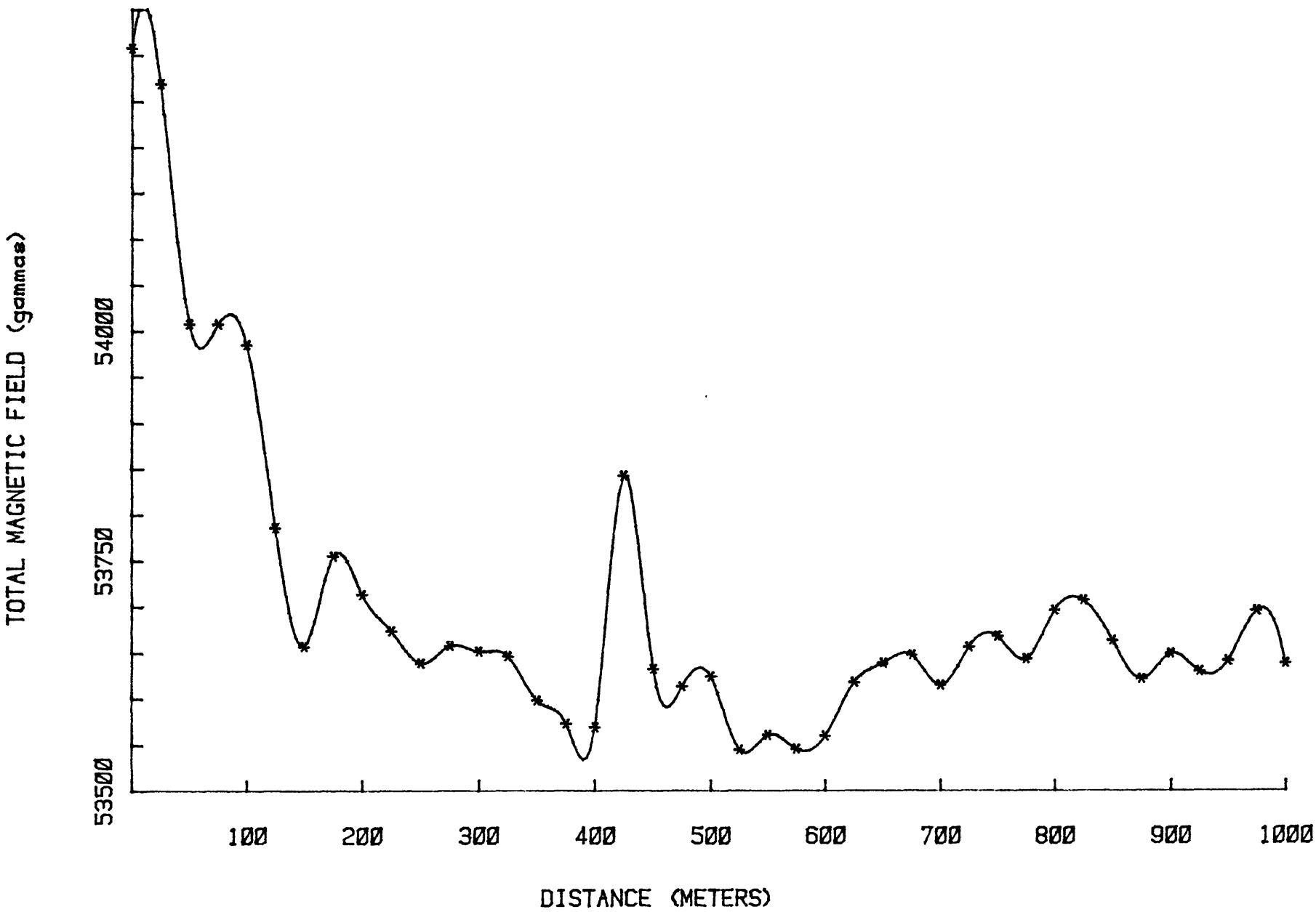
PROFILE - TABLUAR

Page	Data Type	Line	Description
B2	Magnetic data	G-4 (Reily) (0-1000 meters)	Total field
B4	VLF data	G-4 (Reily) (0-1000 meters)	Apparent resistivity, phase angle: 24.8 KHz, Seattle, Wash.
B6	VLF data	G-4 (Reily) (0-1000 meters)	Tilt angle (DIP), % quadrature: 34.8 KHz, Seattle, Wash.
B8	VLF data	G-4 Reily (0-1000 meters)	Apparent resistivity, phase angle: 23.4 KHz, Hawaii
B10	VLF data	G-4 Reily (0-1000 meters)	Tilt angle (DIP), % quadrature: 23.4 KHz, Hawaii

W

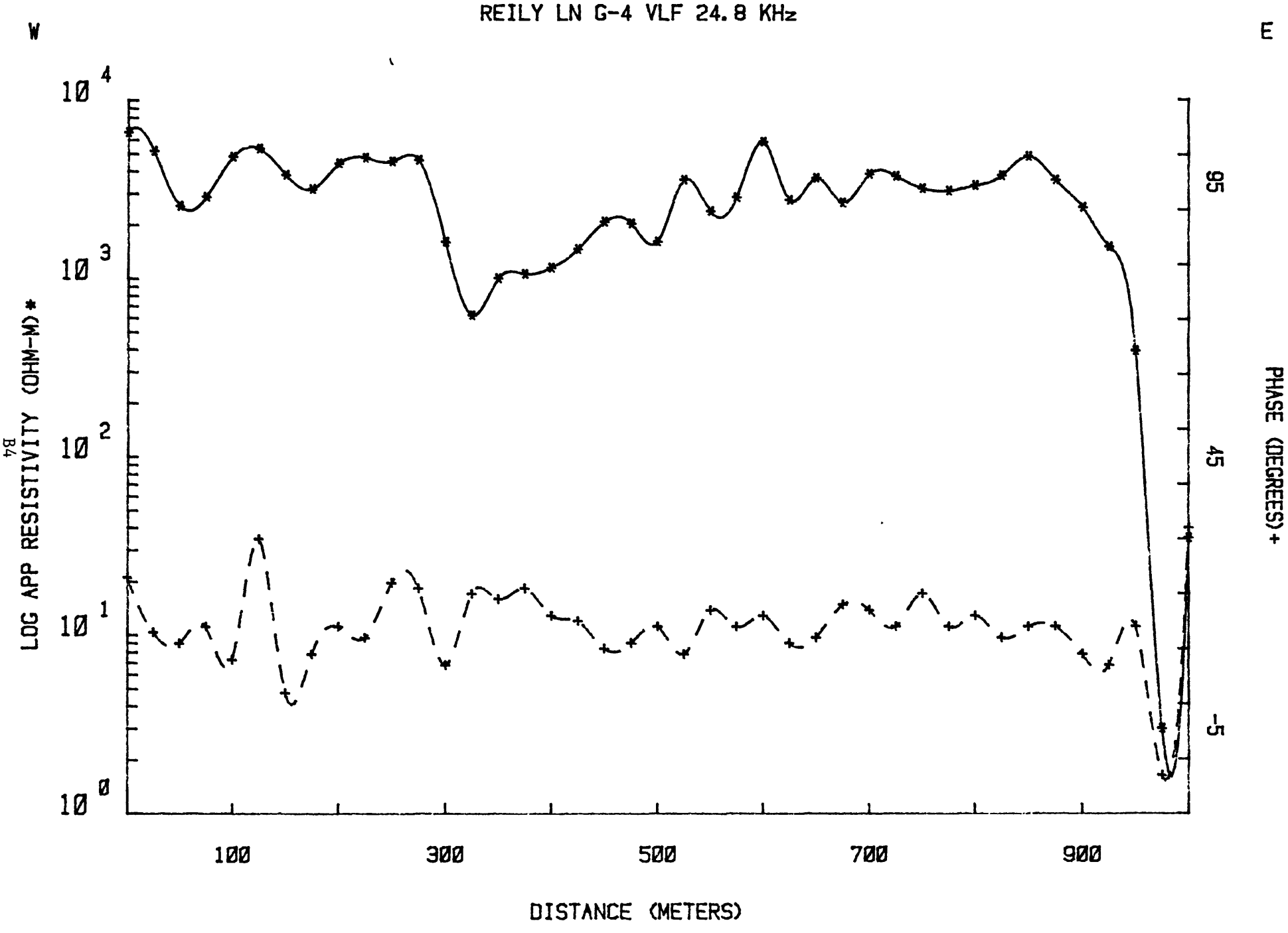
REILY LN G-4 MAGNETICS

E



REILY LINE MAGNETICS
Line: 1
85/08/12
NUMBER OF STATIONS = 41

STATION	MAG	TIME
+0	54307.7	2:10
+25	54268.7	2:14
+50	54007.7	2:20
+75	54007.4	2:24
+100	53984.9	2:29
+125	53785.5	2:34
+150	53656.8	2:38
+175	53754.6	2:42
+200	53713.0	2:47
+225	53673.4	2:54
+250	53638.6	2:59
+275	53657.5	3: 3
+300	53651.4	3: 8
+325	53646.2	3:12
+350	53598.1	3:17
+375	53572.9	3:28
+400	53569.2	3:37
+425	53842.3	3:42
+450	53632.6	3:47
+475	53613.3	3:52
+500	53624.1	3:56
+525	53544.6	3:59
+550	53560.6	4: 4
+575	53545.5	4: 8
+600	53559.8	4:12
+625	53617.7	4:17
+650	53639.0	4:22
+675	53647.3	4:28
+700	53614.8	4:31
+725	53656.0	4:36
+750	53667.9	4:41
+775	53643.1	4:45
+800	53695.6	4:50
+825	53706.7	4:55
+850	53663.2	4:59
+875	53621.1	5: 4
+900	53649.0	5: 9
+925	53629.5	5:13
+950	53641.4	5:18
+975	53695.4	5:23
+1000	53638.5	5:28

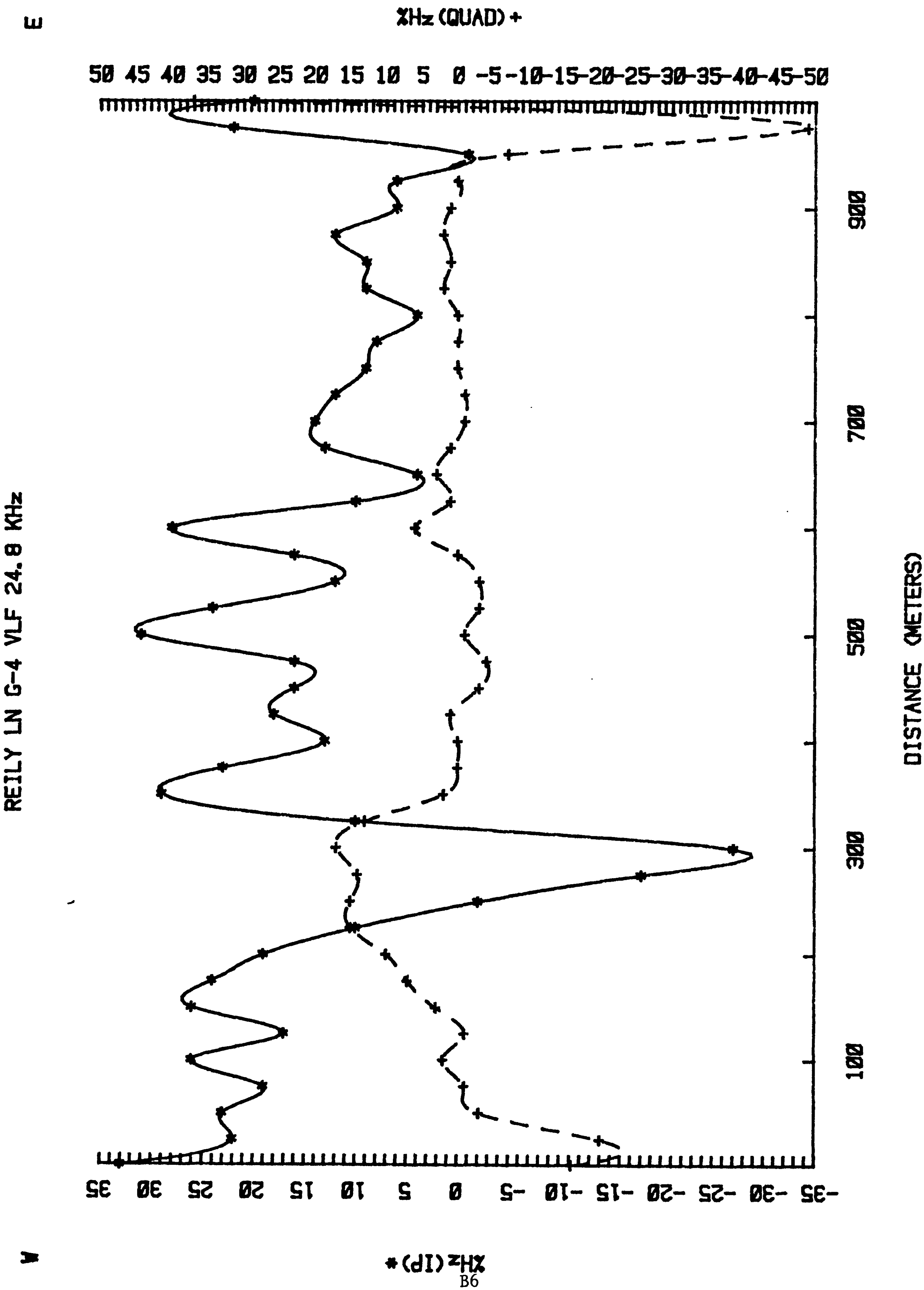

REILY LN G-4 VLF 24.8 KHz
W
E
LOG APP RESISTIVITY (OHM-M)*
10 4
10 3
10 2
10 1
10 0
PHASE (DEGREES)+
95
45
-5
100
300
500
700
900
DISTANCE (METERS)

FILE = RIES*

REILY
Line: 1
85/08/12
24.8KHz

NUMBER OF STATIONS = 41

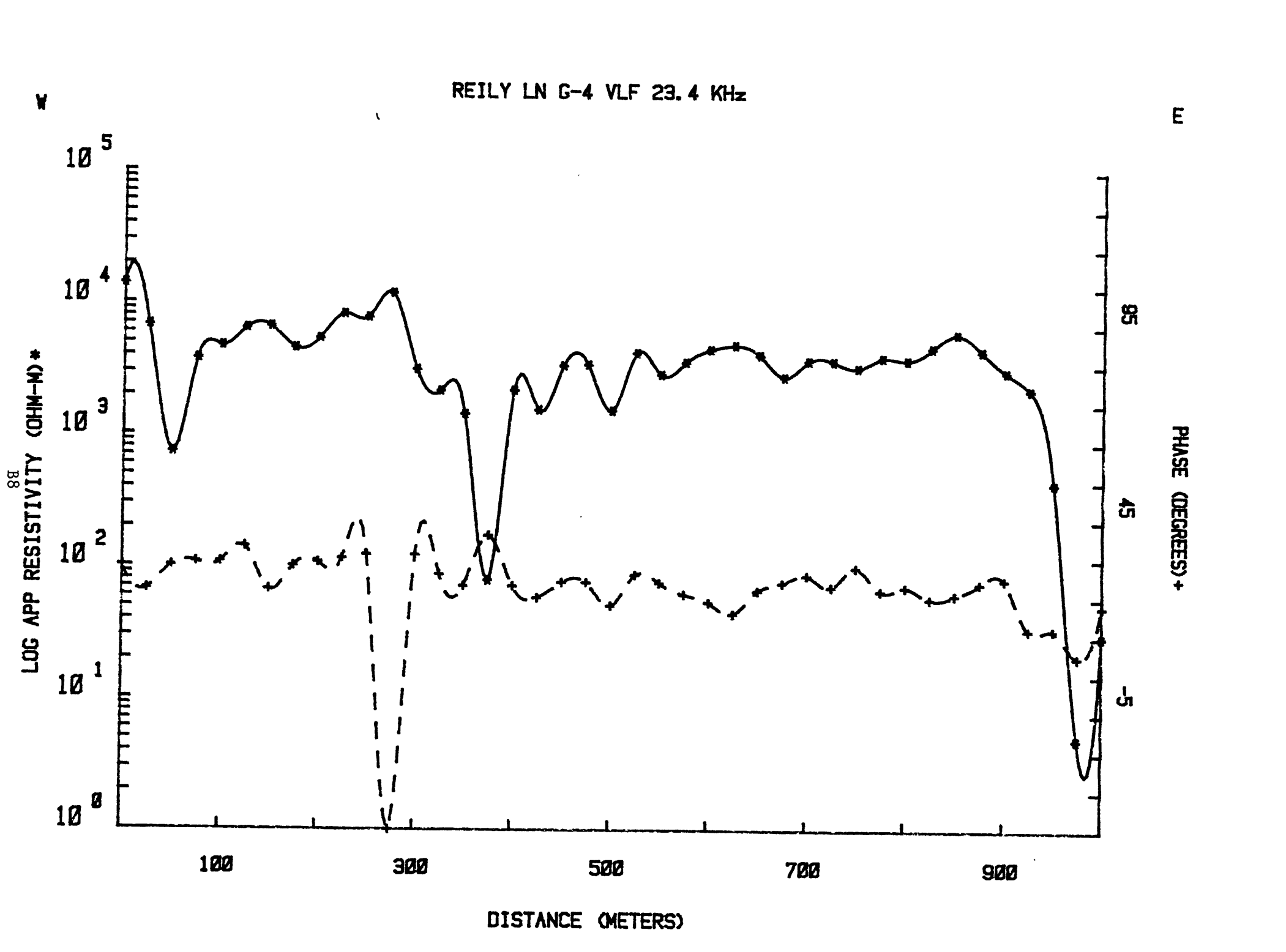
STATION	RES	PHASE	Hy
+0	+6610	+23	+17.0
+25	+5200	+13	+17.5
+50	+2550	+11	+19.7
+75	+2870	+14	+21.4
+100	+4820	+8	+20.5
+125	+5330	+30	+18.0
+150	+3800	+2	+18.7
+175	+3170	+9	+18.3
+200	+4410	+14	+18.7
+225	+4750	+12	+16.5
+250	+4540	+22	+17.7
+275	+4610	+21	+18.9
+300	+1600	+7	+24.8
+325	+621	+20	+29.8
+350	+1000	+19	+23.3
+375	+1060	+21	+20.8
+400	+1150	+16	+20.6
+425	+1460	+15	+21.2
+450	+2080	+10	+20.4
+475	+2030	+11	+20.9
+500	+1610	+14	+19.0
+525	+3570	+9	+16.4
+550	+2380	+17	+18.5
+575	+2850	+14	+18.7
+600	+5830	+16	+16.7
+625	+2750	+11	+16.3
+650	+3640	+12	+16.2
+675	+2660	+18	+16.7
+700	+3840	+17	+16.8
+725	+3730	+14	+16.2
+750	+3190	+20	+16.1
+775	+3090	+14	+16.3
+800	+3310	+16	+15.3
+825	+3770	+12	+15.6
+850	+4830	+14	+15.6
+875	+3550	+14	+15.5
+900	+2490	+9	+14.4
+925	+1500	+7	+14.2
+950	+392	+14	+13.9
+975	+3	-13	+16.6
+1000	+35	+32	+14.4


REILY LN G-4 VLF 24.8 KHz
%Hz (QUAD) +
50 45 40 35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50
%Hz (IP) *
35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35
DISTANCE (METERS)
100
300
500
700
900
E
W

REILY
Line: 1
85/08/12
24.8KHz

NUMBER OF STATIONS = 41

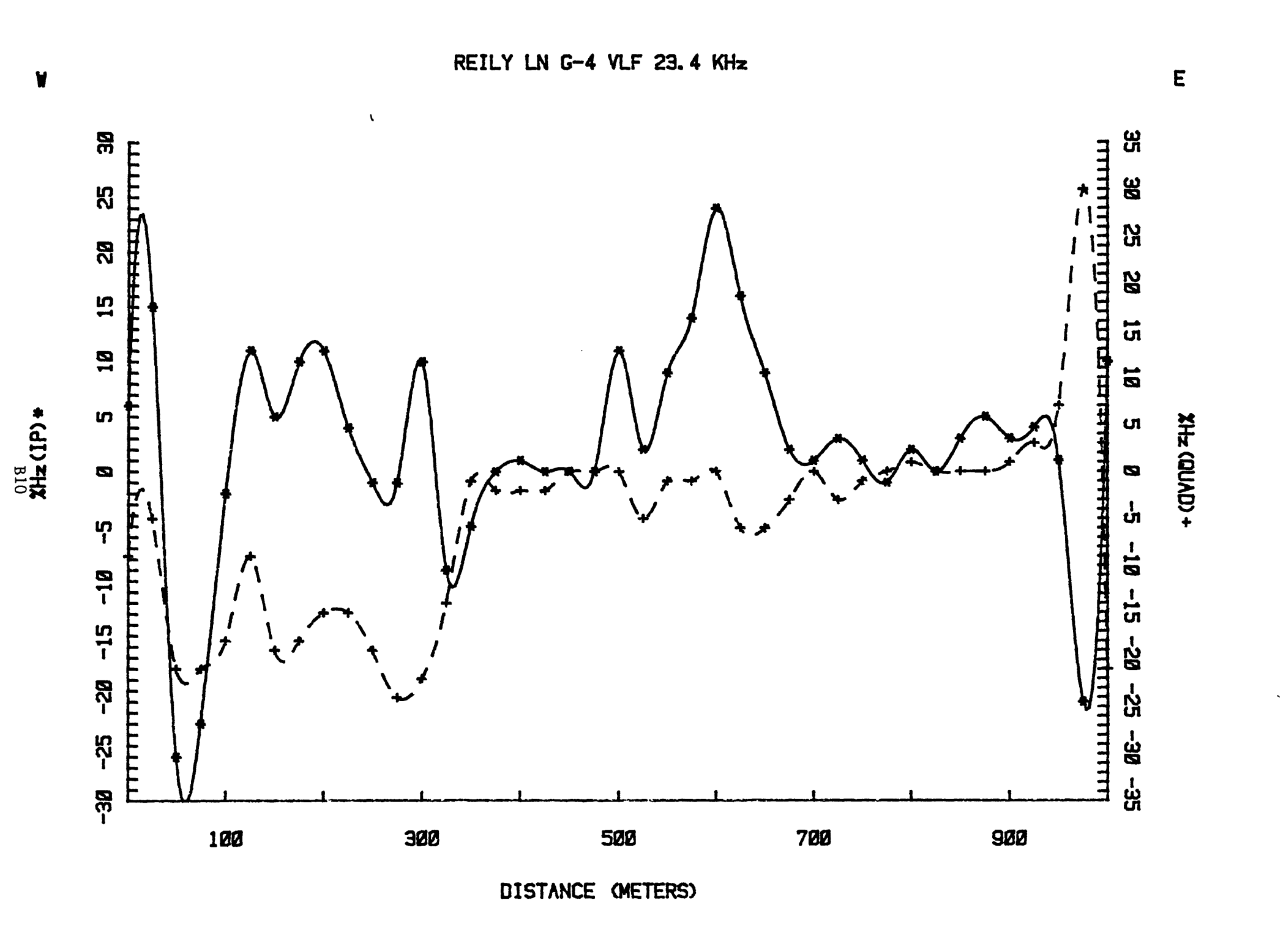
STATION	Hz(IP)	Hz(Q)	Hy
+0	+33	-16	+16.4
+25	+22	-20	+16.6
+50	+23	-3	+18.8
+75	+19	-1	+21.7
+100	+26	+2	+20.8
+125	+17	-1	+17.2
+150	+26	+3	+18.4
+175	+24	+7	+17.5
+200	+19	+10	+17.4
+225	+10	+15	+16.1
+250	-2	+15	+17.5
+275	-18	+14	+18.7
+300	-27	+17	+24.6
+325	+10	+13	+29.1
+350	+29	+2	+23.2
+375	+23	+0	+20.6
+400	+13	+0	+20.1
+425	+18	+1	+20.9
+450	+16	-3	+19.9
+475	+16	-4	+20.6
+500	+31	-1	+17.7
+525	+24	-3	+16.4
+550	+12	-3	+18.0
+575	+16	+0	+18.3
+600	+28	+6	+16.3
+625	+10	+1	+16.3
+650	+4	+3	+15.8
+675	+13	+1	+16.4
+700	+14	-1	+16.5
+725	+12	-1	+16.0
+750	+9	+0	+16.1
+775	+8	+0	+16.0
+800	+4	+0	+14.6
+825	+9	+2	+15.5
+850	+9	+1	+15.4
+875	+12	+2	+15.5
+900	+6	+1	+14.4
+925	+6	+0	+14.7
+950	-1	-7	+13.6
+975	+22	-49	+16.5
+1000	+20	+37	+14.2


REILY LN G-4 VLF 23.4 KHz
W
E
LOG APP RESISTIVITY (OHM-M)*
PHASE (DEGREES)+
10 5
10 4
10 3
10 2
10 1
10 0
95
45
-5
100
300
500
700
900
DISTANCE (METERS)

REILY
Line: 1
85/08/12
23.4KHz

NUMBER OF STATIONS = 41

STATION	RES	PHASE	Hy
+0	+13800	+28	+16.4
+25	+6700	+22	+20.7
+50	+730	+28	+17.8
+75	+3740	+29	+15.4
+100	+4680	+29	+13.5
+125	+6380	+33	+13.8
+150	+6570	+22	+13.8
+175	+4530	+28	+14.2
+200	+5360	+29	+14.7
+225	+8200	+30	+15.7
+250	+7780	+31	+15.6
+275	+11800	-40	+14.1
+300	+3140	+31	+15.7
+325	+2170	+26	+16.6
+350	+1450	+23	+15.9
+375	+79	+36	+16.3
+400	+2190	+23	+16.4
+425	+1560	+20	+17.0
+450	+3390	+24	+17.3
+475	+3450	+24	+17.2
+500	+1550	+18	+17.5
+525	+4240	+26	+16.0
+550	+2920	+24	+15.9
+575	+3630	+21	+16.5
+600	+4540	+19	+15.9
+625	+4880	+16	+16.2
+650	+4130	+22	+17.0
+675	+2810	+24	+17.0
+700	+3740	+26	+16.0
+725	+3710	+23	+16.4
+750	+3310	+28	+15.7
+775	+3960	+22	+15.9
+800	+3800	+23	+16.0
+825	+4700	+20	+15.7
+850	+5970	+21	+15.4
+875	+4460	+24	+15.7
+900	+3090	+25	+15.5
+925	+2260	+12	+15.6
+950	+437	+12	+15.1
+975	+5	+5	+15.2
+1000	+30	+18	+15.1


REILY LN G-4 VLF 23.4 KHz
W
E
%Hz (IP)*
%Hz (QUAD)+
-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30
35 30 25 20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35
100
300
500
700
900
DISTANCE (METERS)

FILE = RIMH*

REILY
Line: 1
85/08/12
23.4KHz

NUMBER OF STATIONS = 41

STATION	Hz(IP)	Hz(Q)	Hy
+0	+6	-9	+15.6
+25	+15	-5	+20.5
+50	-26	-21	+17.9
+75	-23	-21	+15.1
+100	-2	-18	+13.4
+125	+11	-9	+13.8
+150	+5	-19	+13.9
+175	+10	-18	+14.1
+200	+11	-15	+14.7
+225	+4	-15	+15.3
+250	-1	-19	+15.4
+275	-1	-24	+13.9
+300	+10	-22	+15.4
+325	-9	-14	+16.3
+350	-5	-1	+15.8
+375	+0	-2	+16.3
+400	+1	-2	+16.4
+425	+0	-2	+16.4
+450	+0	+0	+16.6
+475	+0	+0	+16.9
+500	+11	+0	+17.3
+525	+2	-5	+15.7
+550	+9	-1	+15.8
+575	+14	-1	+16.1
+600	+24	+0	+15.7
+625	+16	-6	+16.5
+650	+9	-6	+16.3
+675	+2	-3	+16.5
+700	+1	+0	+16.1
+725	+3	-3	+15.8
+750	+1	-1	+15.5
+775	-1	+0	+16.0
+800	+2	+1	+15.6
+825	+0	+0	+15.5
+850	+3	+0	+15.1
+875	+5	+0	+15.6
+900	+3	+1	+15.5
+925	+4	+3	+15.0
+950	+1	+7	+14.6
+975	-21	+30	+15.0
+1000	+10	-21	+15.0