



Magnetotelluric Data, Mid Valley, Nevada Test Site, Nevada

By Jackie M. Williams, Erin L. Wallin, Brian D. Rodriguez, Charles R. Lindsay, and Jay A. Sampson

Open-File Report 2007–1123

**U.S. Department of the Interior
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Prepared in cooperation with the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office, Office of Environmental Management under Interagency Agreement DE-AI52-07NV28100.

Suggested citation:
Williams, J.M., Wallin, E.L., Rodriguez, B.D., Lindsey, C.R., and Sampson, J.A., 2007, Magnetotelluric Data, Mid Valley, Nevada Test Site, Nevada: U.S. Geological Survey Open-File Report 2007-1123, 137 p.

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Introduction

The United States Department of Energy (DOE) and the National Nuclear Security Administration (NNSA) at their Nevada Site Office (NSO) are addressing ground-water contamination resulting from historical underground nuclear testing through the Environmental Management (EM) program and, in particular, the Underground Test Area (UGTA) project.

One issue of concern is the nature of the somewhat poorly constrained pre-Tertiary geology and its effects on ground-water flow. Ground-water modelers would like to know more about the hydrostratigraphy and geologic structure to support a hydrostratigraphic framework model that is under development for the Rainier Mesa/Shoshone Mountain Corrective Action Unit (CAU) (Bechtel Nevada, 2006).

During 2003, the U.S. Geological Survey (USGS), in cooperation with the DOE and NNSA-NSO, collected and processed data at the Nevada Test Site in and near Yucca Flat (YF) to help define the character, thickness, and lateral extent of the pre-tertiary confining units. We collected 51 magnetotelluric (MT) and audio-magnetotelluric (AMT), stations for that research (Williams and others, 2005a, 2005b, 2005c, 2005d, 2005e, 2005f). In early 2005 we extended that research with 26 additional MT data stations (Williams and others, 2006), located on and near Rainier Mesa and Shoshone Mountain (RM-SM). The new stations extended the area of the hydrogeologic study previously conducted in Yucca Flat. This work was done to help refine what is known about the character, thickness, and lateral extent of pre-Tertiary confining units. In particular, a major goal was to define the upper clastic confining unit (UCCU). The UCCU is comprised of late Devonian to Mississippian siliciclastic rocks assigned to the Eleana Formation and Chainman Shale. The UCCU underlies the Yucca Flat area and extends westward towards Shoshone Mountain, southward to Buckboard Mesa, and northward to Rainier Mesa. Late in 2005 we collected another 14 MT stations in Mid Valley and in northern Yucca Flat basin. That work was done to better determine the extent and thickness of the UCCU near the southeastern RM-SM CAU boundary with the southwestern YF CAU, and also in the northern YF CAU. The purpose of this report is to release the MT data at those 14 stations shown in [figure 1](#). No interpretation of the data is included here.

Electrical Rock Properties

Electromagnetic geophysical methods detect variations in the electrical properties of rocks-in-particular, electrical resistivity, or its inverse, electrical conductivity. Electrical resistivity can be correlated with geologic units on the surface and at depth using lithologic logs to provide a three-dimensional (3-D) picture of subsurface geology. In the upper crust the resistivity of geologic units is largely dependent upon their fluid content, pore-volume porosity, interconnected fracture porosity, and conductive mineral content (Keller, 1989). Although there is not a one-to-one relationship between lithology and resistivity, there are general correlations that can be made using typical resistivity values, even though values vary from one location to another (Palacky, 1987). Fluids within the pore spaces and fracture openings, especially if saline, can reduce resistivities in what would otherwise be a resistive rock matrix. Resistivities can also be lowered by the presence of electrically conductive clay minerals, graphitic carbon, and metallic mineralization. It is common, for example, for altered volcanic rocks to contain replacement minerals that have resistivities ten times lower than those of the surrounding rocks (Nelson and Anderson, 1992). Fine-grained sediments, such as clay-rich alluvium, marine shales, and other mudstones, are normally conductive from a few ohm-meters (ohm-m) to a few tens of ohm-m (Keller, 1987; Palacky, 1987). Metamorphic rocks (non-graphitic) and unaltered, unfractured igneous rocks are normally moderately to highly resistive (a few hundreds to thousands of ohm-m). Carbonate rocks can have similarly high resistivities depending on their fluid content, porosity, and impurities

(Keller, 1987; Palacky, 1987). Fault zones may be moderately conductive (tens of ohm-m) when comprised of rocks fractured enough to have hosted fluid transport and consequent mineralogical alteration (Eberhart-Phillips and others, 1995). Higher subsurface temperatures cause higher ionic mobility that reduces rock resistivities (Keller, 1987; Palacky, 1987). Tables of electrical resistivities for a variety of rocks, minerals, and geological environments may be found in Keller (1987) and Palacky (1987).

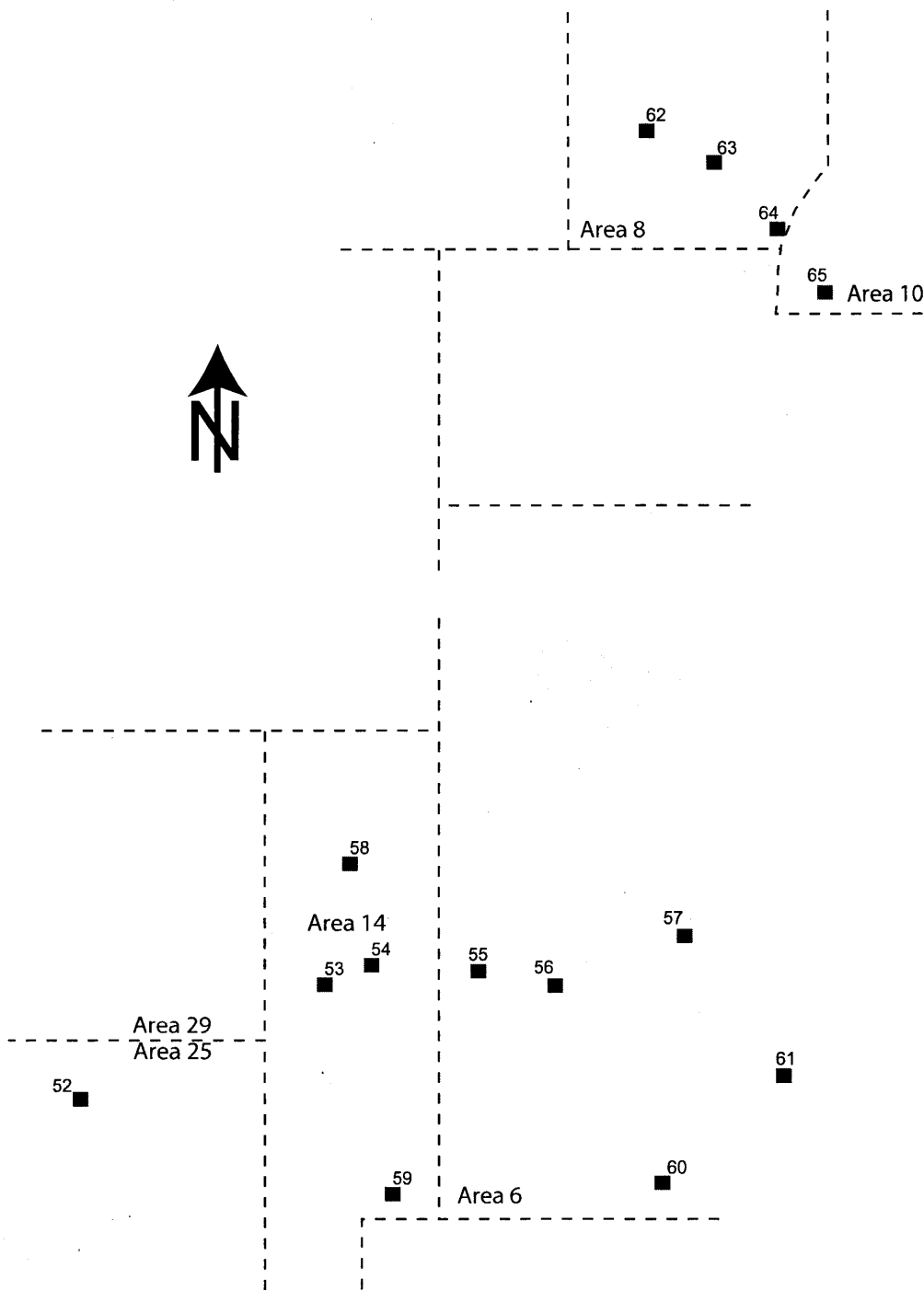


Figure 1. Index image showing magnetotelluric stations in the Mid Valley Area.

Magnetotelluric Method

The MT method is a passive-surface electromagnetic geophysical technique that measures variations in the Earth's natural electromagnetic fields to investigate the electrical resistivity structure of the subsurface from depths of tens of meters to tens of kilometers (Vozoff, 1991). Worldwide lightning activity at frequencies of 10,000 to 1 Hertz (Hz) and geomagnetic micro-pulsations at frequencies of 1 to 0.001 Hz provide the majority of natural signal used by the MT method. The natural electromagnetic wave propagates vertically into the Earth due to the large resistivity contrast between the air and the Earth, causing a vertical refraction of the electromagnetic wave transmitted into the Earth (Vozoff, 1972).

The natural fields are recorded in the xyz direction for the magnetic field and the xy direction for the electric field at the Earth's surface. The resulting time-series signals are used to derive tensor apparent-resistivities and phases by first converting them to complex cross-spectra using Fourier-transform techniques. Least squares, cross-spectral analysis (Bendat and Piersol, 1971) are used to solve for a tensor transfer function. Prior to conversion to apparent resistivity and phase, the tensor is normally rotated into principal directions that usually correspond to the direction of maximum and minimum apparent resistivity. For a two-dimensional (2-D) Earth, in which Earth's resistivity structure varies with depth and in one lateral direction, the MT fields can be decoupled into transverse-electric (TE) and transverse-magnetic (TM) modes; 2-D resistivity modeling is generally computed to fit both modes. When the geology satisfies the 2-D assumption, the MT data for the TE mode represents electric fields that are oriented parallel to geologic strike, and the data for the TM mode represents electric fields oriented perpendicular to strike. The MT method is well suited for studying complicated geological environments because the electric and magnetic fields are sensitive to vertical and horizontal variations in resistivity. The method is capable of establishing whether the electromagnetic fields are responding to subsurface rock bodies of effectively 1, 2, or 3 dimensions. An introduction to the MT method and references for a more advanced understanding are contained in Dobrin and Savit (1988) and Vozoff (1991).

Magnetotelluric Survey

In October of 2005 we collected 14 MT stations around Rainier Mesa and Shoshone Mountain and in northern Yucca Flat ([fig. 1](#)). The station locations were chosen to constrain the geologic/hydrostratigraphic interpretation, for proximity to roads, and to avoid, where possible, electrical noise from power lines and vehicles. The MT data were collected with an Electromagnetic Instruments, Inc., (EMI) MT-1 system (EMI, 1996). Horizontal electric fields were measured using three copper/copper sulfate porous-pot electrodes placed in an L-shaped array with dipole lengths of 30 meters (m). The orthogonal, horizontal magnetic fields in the direction of the electric-field measurement array were sensed using EMI's high-magnetic-permeability, mu-metal-cored induction coils. The MT data were recorded as non-remote referenced single stations.

The following table lists the 14 MT station locations as recorded using a GPS during field acquisition. Coordinates are referenced to the 1866 Clarke spheroid and North American 1927 Western United States datum. Longitude and latitude format is degrees, minutes, seconds. Universal Transverse Mercator (UTM) Zone 11 North and East units are in meters. Station elevation is given in meters. The accuracy of the x , y component is ± 5 m. The accuracy of the z component is ± 10 m. Ex direction is given in degrees and is the direction of the measured magnetic (H_x) and electric (E_x) fields.

Table 1. Station Locations

Station	Latitude (d,m,s)	Longitude (d,m,s)	Elevation (m)	Northing (m)	Easting (m)	Ex dir
52	36,54'21.2	116,14'50.5	1596	4084493	567053	180
53	36,55'43.0	116,10'59.3	1460	4087063	572750	0
54	36,55'57.4	116,10'14.3	1400	4097522	573860	0
55	36,55'50.9	116,08'40.3	1321	4087336	576187	180
56	36,55'49.7	116,07'17.8	1381	4087314	578229	0
57	36,56'29.0	116,05'16.8	1436	4088553	581213	180
58	36,57'12.9	116,10'31.7	1415	4089848	573490	0
59	36,52'56.8	116,09'59.3	1416	4081955	574354	0
60	36,52'08.6	116,05'37.0	1186	4082376	580776	180
61	36,54'30.8	116,03'43.7	1221	4084935	583550	0
62	37,11'32.4	116,05'55.0	1458	4116384	580001	0
63	37,11'09.1	116,04'50.0	1394	4115683	581613	0
64	37,10'12.6	116,03'42.9	1317	4113957	583282	0
65	37,09'21.4	116,02'53.7	1291	4112395	584511	0

Magnetotelluric Data

The recorded time-series data were transformed to the frequency domain and processed to determine the impedance tensor, which is used to derive apparent resistivities and phases at each site. Rotation of the impedance tensor allows for decoupling into the TE and TM modes. The data provided here have not been rotated from the original north-south, east-west acquisition orientation. During the analysis and interpretation process, each station will be rotated to a fixed angle determined by the given nominal profile orientation. Cross-power files were sorted to select optimal signal-to-noise time-series data sets (see [Appendix 1](#)).

The effects of near-surface resistivity anomalies can cause what are known as “static shifts” in the data (Sternberg and others, 1988). Cultural features also can affect the measured magnetotelluric responses. These features include fences, pipelines, communication lines, railways, and other manmade conductors.

The figures in [appendix 1](#) represent the field-processed MT data for each station, after the time-series data were converted to the frequency domain and the tensor-transfer function was developed. For each station, nine separate plots are given:

- Apparent Resistivity (x and o symbols are xy and yx components)
- Impedance Phase (x and o symbols are xy and yx components)
- Rotation Angle
- Impedance Skew
- Multiple Coherency (x and o symbols are xy and yx components)
- Impedance Polar Plots
- Tipper Magnitude
- Tipper Strike
- HzHx (x symbol) and HzHy (o symbol) Coherency

Error bars (|,|) on the Apparent Resistivity, Impedance Phase, Skew, Tipper Magnitude, and Tipper Strike plots represent probable errors within one standard deviation of the sample variance (Gamble and others, 1979).

Apparent resistivity is the approximate ratio of the electric-field strength to the magnetic-field strength at a given frequency. The impedance phase is proportional to the slope of the apparent resistivity curve on a log-log plot, but from baselines at ± 45 degrees (Vozoff, 1991). A measure of the dimensionality for MT data is provided by the impedance skew of the impedance tensor (Vozoff, 1972). If the effective measured resistivity response to the geology beneath a MT station truly is one or two dimensional, then the skew will be zero. Instrumental and environmental sources of electrical noise can cause non-zero skew values. Skew values typically are small (about 0.1) for relatively low-noise recordings. Higher skews (above 0.2) are an indication of either the resistivity response to 3-D geology or higher levels of noise. Manmade electrical noise, such as power lines, power generators, and moving vehicles and trains, can have a negative effect on MT data quality. All of these local disturbances can produce incoherent noise that mainly affects frequencies above 1 Hz. Other manmade electrical noise, such as direct-current electric trains and active cathodic protection of pipelines, produces coherent electromagnetic signals that mainly affect frequencies below 1 Hz.

In the survey area, noise from a number of small power lines and small moving vehicles was negligible at distances greater than 0.4 km from the noise source. Power-line signal levels were measured at each site and typically were less than 20 percent of the maximum recordable signals. Noise from larger power lines, power generators, pipelines, and trains was negligible at distances greater than 5 km. Local lightning, wind, and rainstorms may also degrade data quality. Burying the magnetic induction coils and the electric dipole wires minimized wind noise.

Predicted values of the electric field can be computed from the measured values of the magnetic field (Vozoff, 1991). The coherence of the predicted electric field with the measured electric field is a measure of the signal-to-noise ratio provided in the multiple coherency plots. Values are normalized between 0 and 1; values at 0.5 signify signal levels equal to noise levels. For this data set, coherencies generally were at an acceptable level, except at times in the frequency ranges of about 0.1 to 5 Hz (traditionally referred to as the “dead band”).

The field-processed MT data include some scatter and poor signal-to-noise ratios. Spectral results were inspected visually for noisy data, and the best signal-to-noise field data were combined into the final plots.

The magnetotelluric impedance polar plots provide a measure of MT data dimensionality (Reddy and others, 1977). For 1-D resistivity structures, the principal impedance polar diagram (dashed line) is a circle. For 2-D or 3-D resistivity structures, the principal impedance polar diagram (dashed line)

elongates either parallel or perpendicular to strike direction. Over resistors, the principal impedance polar diagram elongates perpendicular to strike direction, and over conductors, it elongates parallel to strike direction. For 2-D resistivity structures, the additional impedance polar diagram (solid line) attains the shape of a symmetric clover leaf. For 3-D resistivity structures, the additional impedance polar diagram (solid line) elongates in one direction, and its amplitude is comparable to that of the principal impedance polar diagram (dashed line).

The magnetotelluric “tipper” is calculated from the vertical component of the magnetic field. The tipper magnitude is a measure of the “tipping” of the magnetic field out of the horizontal plane (Vozoff, 1991). It will equal zero for the 1-D case. It typically increases to values between 0.1 to 0.5 and seldom approaches 1, as it responds primarily to vertical and subvertical structures. The tipper strike is used to help resolve the 90-degree ambiguity in the impedance rotation angle. The HzHx and HzHy coherency is a measure of the signal-to-noise ratio of the vertical magnetic field with respect to each of the orthogonal, horizontal magnetic-field directions. Values are normalized between 0 and 1; values at 0.5 signify signal levels equal to noise levels. These three-component magnetic-field coherencies provide a check on the signal-to-noise ratio of the measured values in the tipper magnitude and tipper strike plots.

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Appendix 1. Magnetotelluric Data Plots

There are nine separate plots for each station:

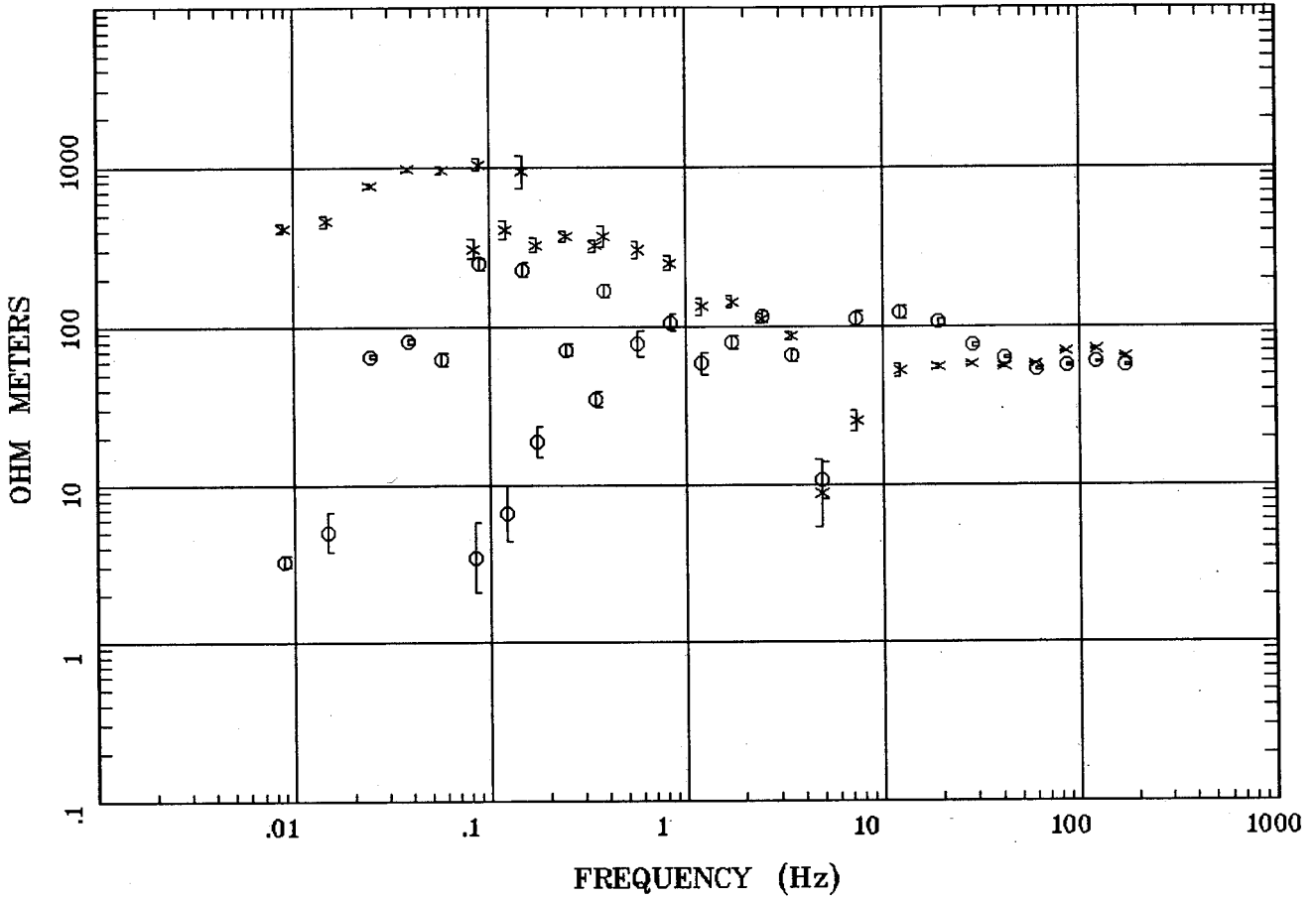
1. Apparent Resistivity for the x-y direction (x symbol) and y-x direction (o symbol) modes
2. Impedance Phase for the rotated maximum (x symbol) and minimum (o symbol) modes
3. Rotation Angle for the impedance tensor (corresponds to the x-y direction)
4. Impedance Skew for the impedance tensor
5. Multiple Coherency for the x-y direction (x symbol) and y-x direction (o symbol) modes of the electric field
6. Impedance Polar Plots (at 12 selected frequencies)
7. Tipper Magnitude for the vertical magnetic field
8. Tipper Strike for the vertical magnetic field
9. HzHx (x symbol) and HzHy (o symbol) Coherency

Refer to the “**Magnetotelluric Data**” section in this report for an explanation of these plots. The priorities listed on the plots were determined prior to data acquisition. During post-processing the priority ranking was changed.

Station 52

APPARENT RESISTIVITY

Shoshone Peak

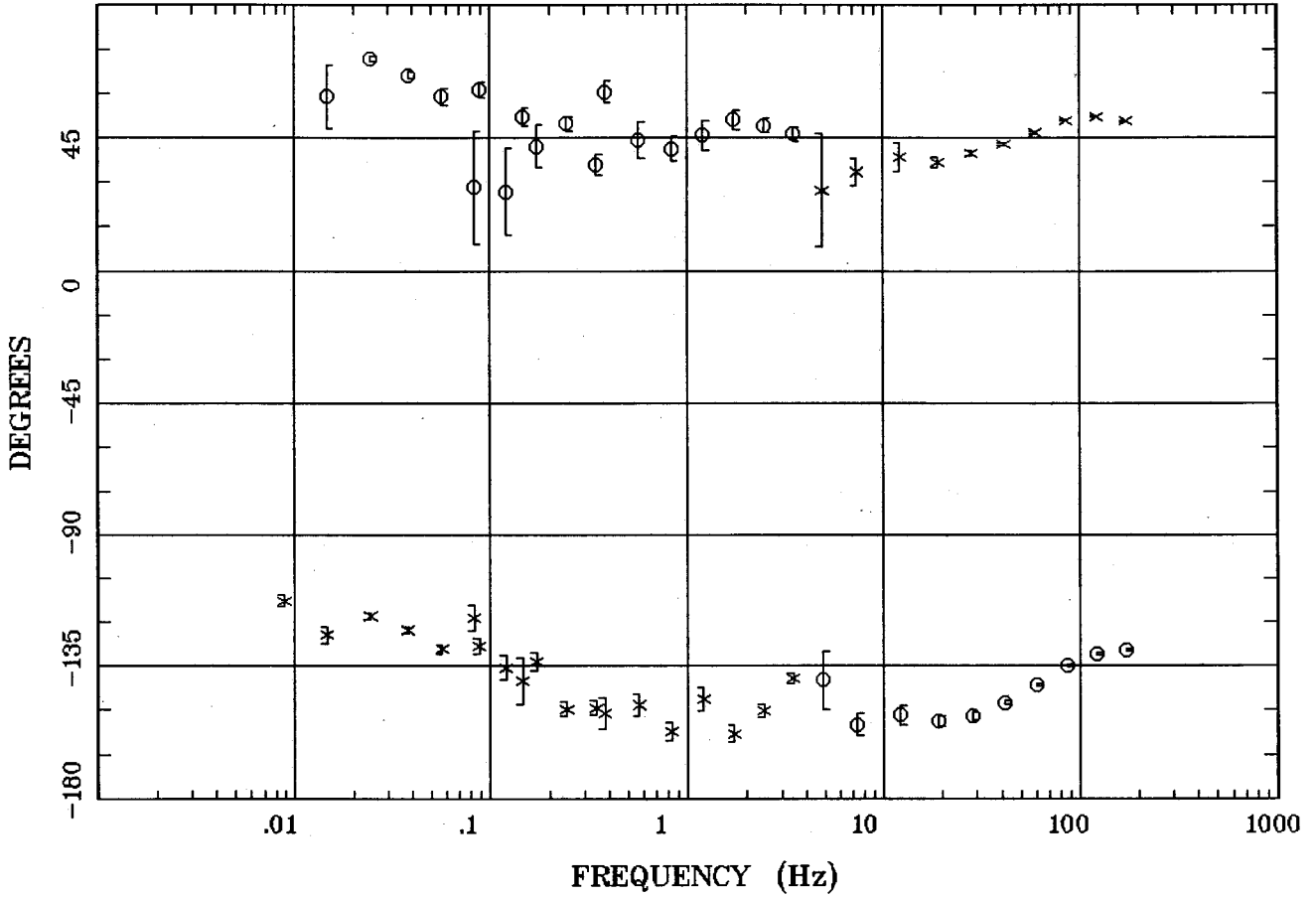


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IMPEDANCE PHASE

Shoshone Peak



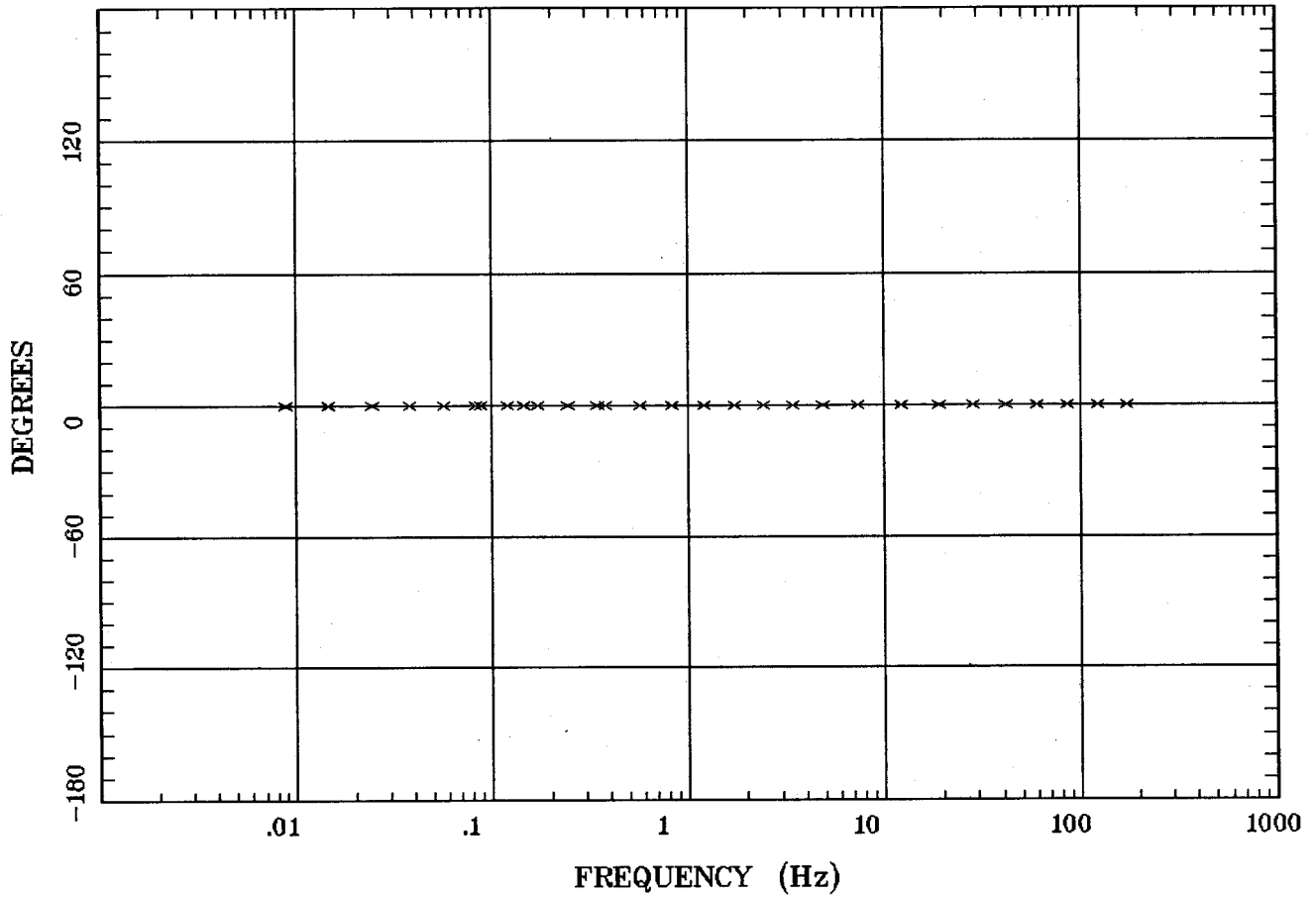
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Plotted: 15:09 Feb 08, 2006
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Station 52

ROTATION ANGLE

Shoshone Peak

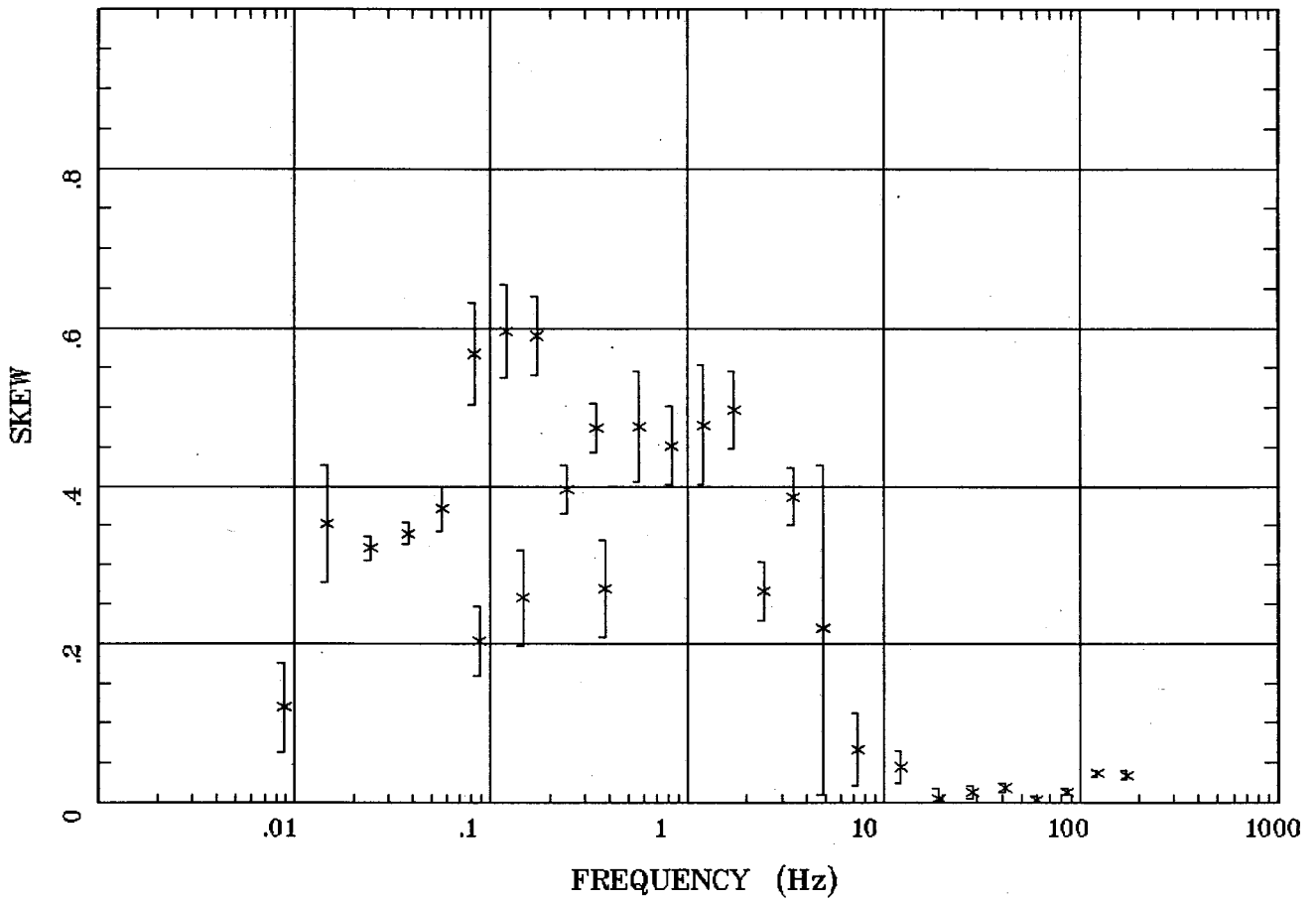


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IMPEDANCE SKEW

Shoshone Peak

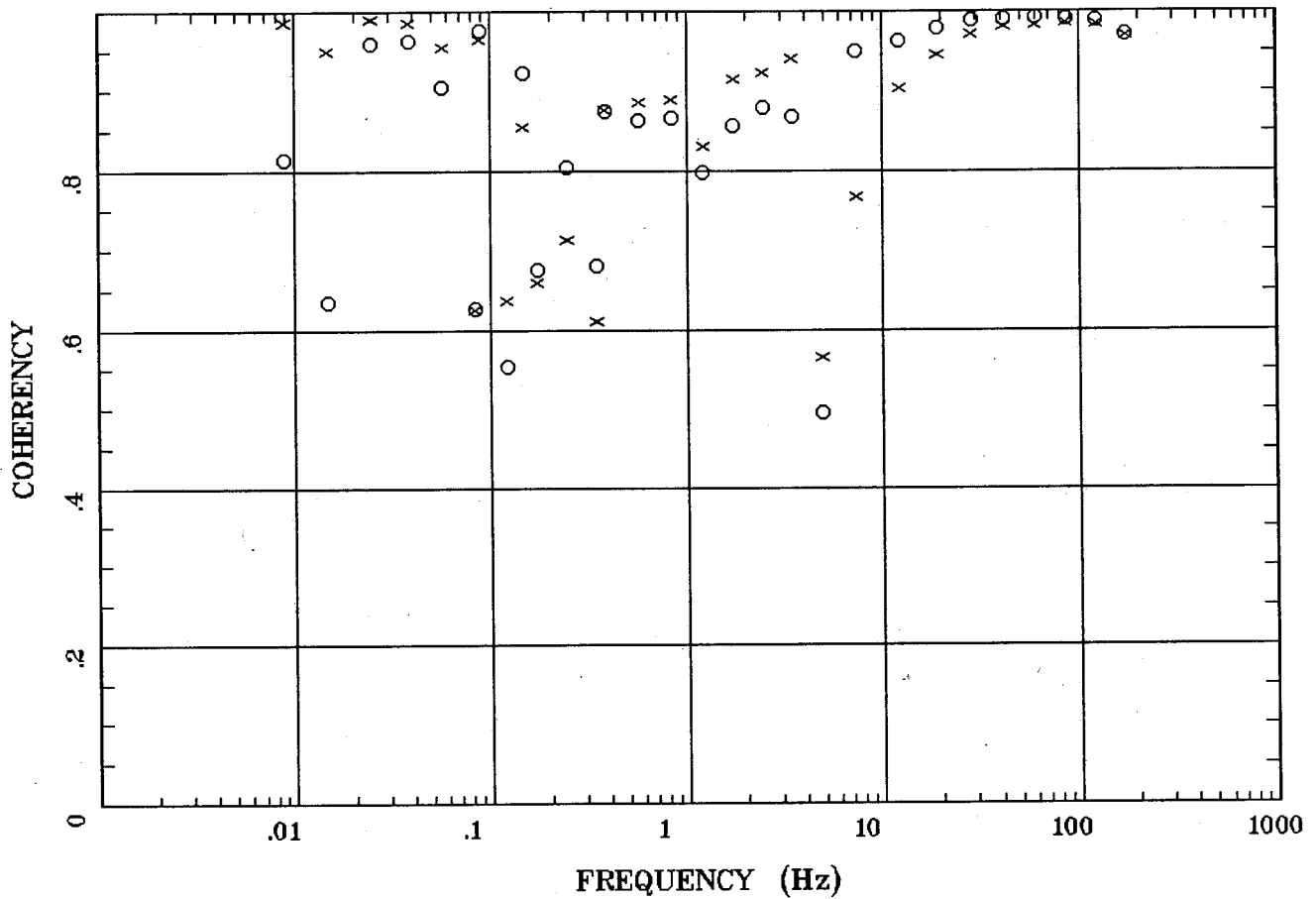


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E MULT Coh.

Shoshone Peak



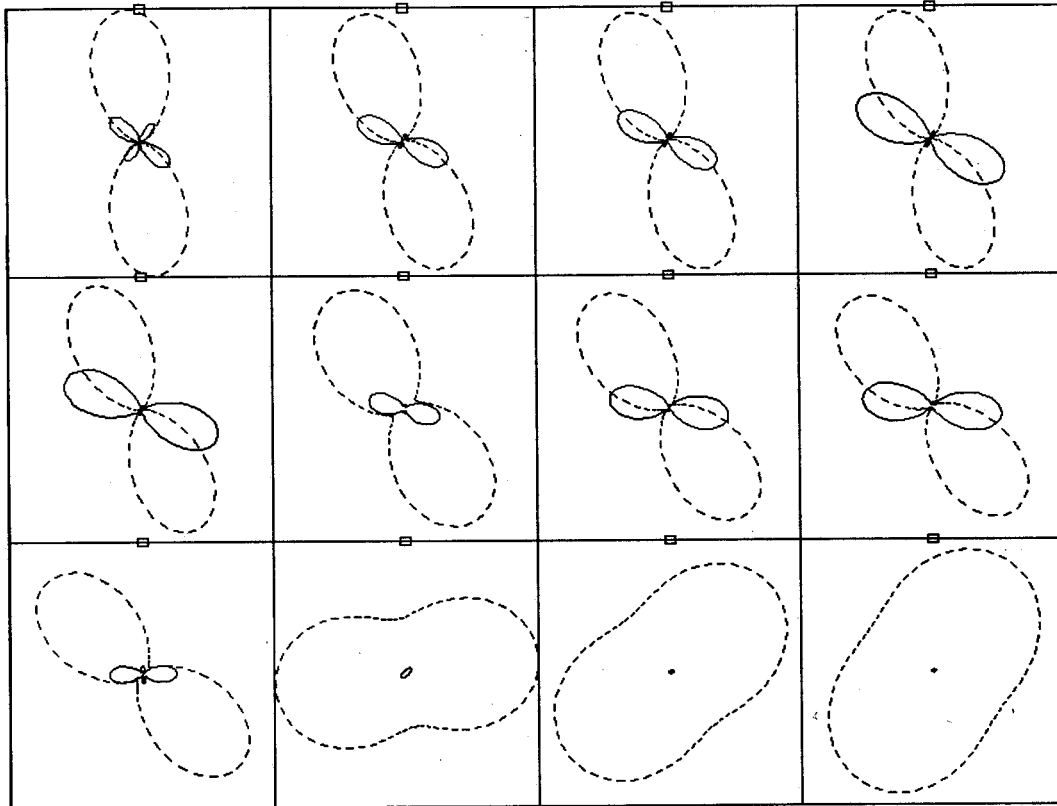
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Rotation:
Filename: nt52m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:09 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 52

POLAR PLOTS

Shoshone Peak



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

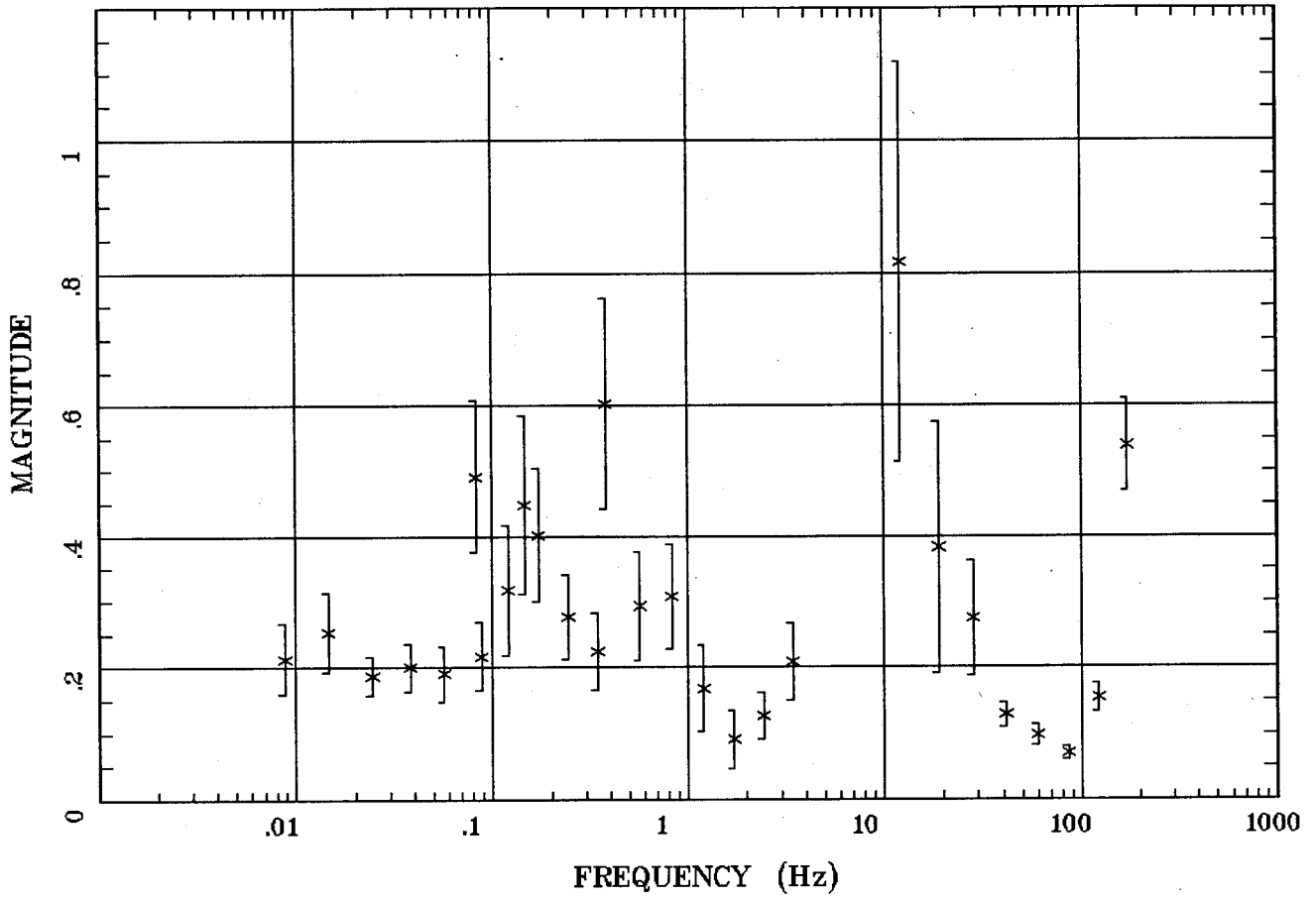
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Survey Co: US Geological Survey

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Plotted: 15:10 Feb 08, 2006
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TIPPER MAGNITUDE

Shoshone Peak

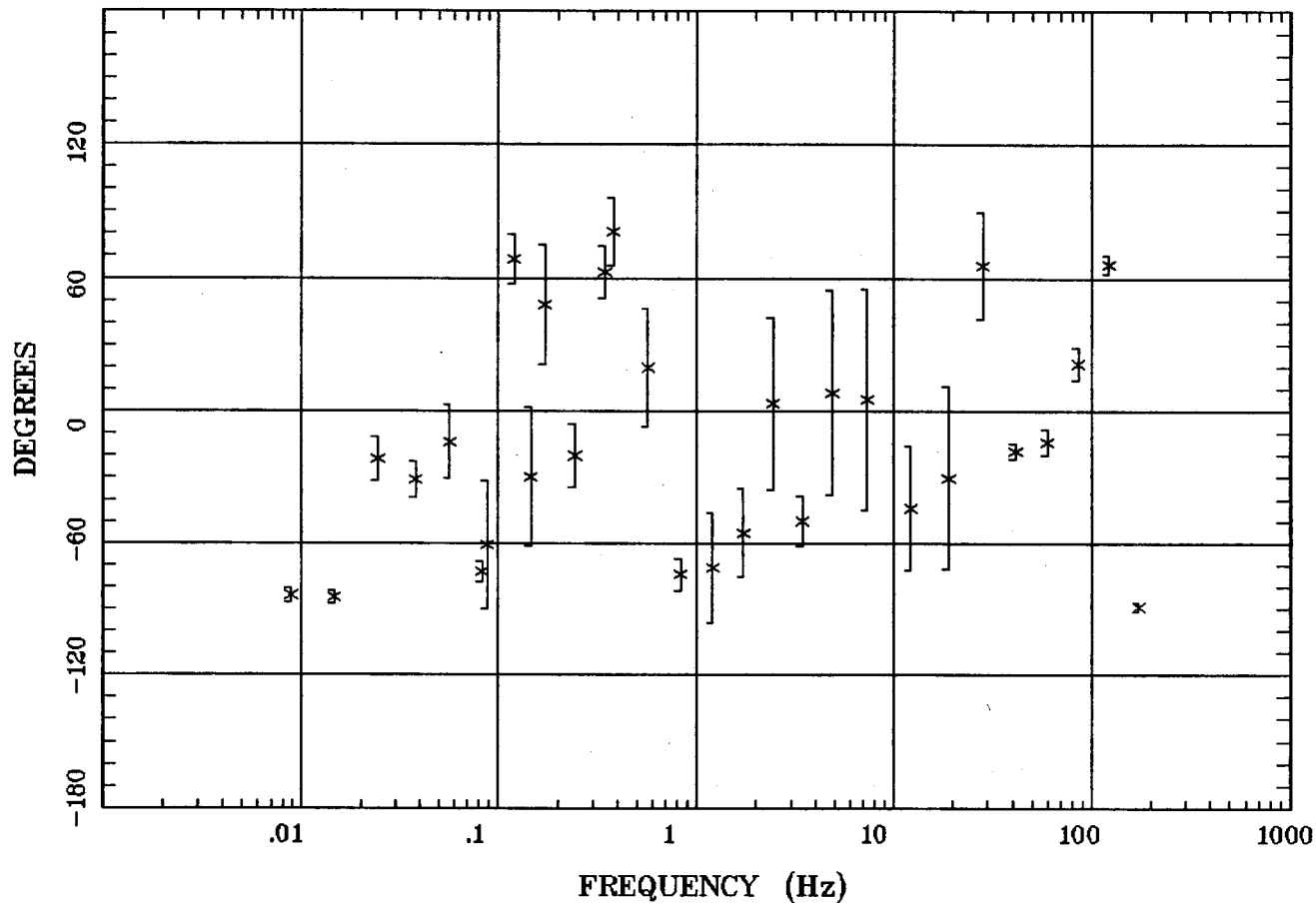


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TIPPER STRIKE

Shoshone Peak

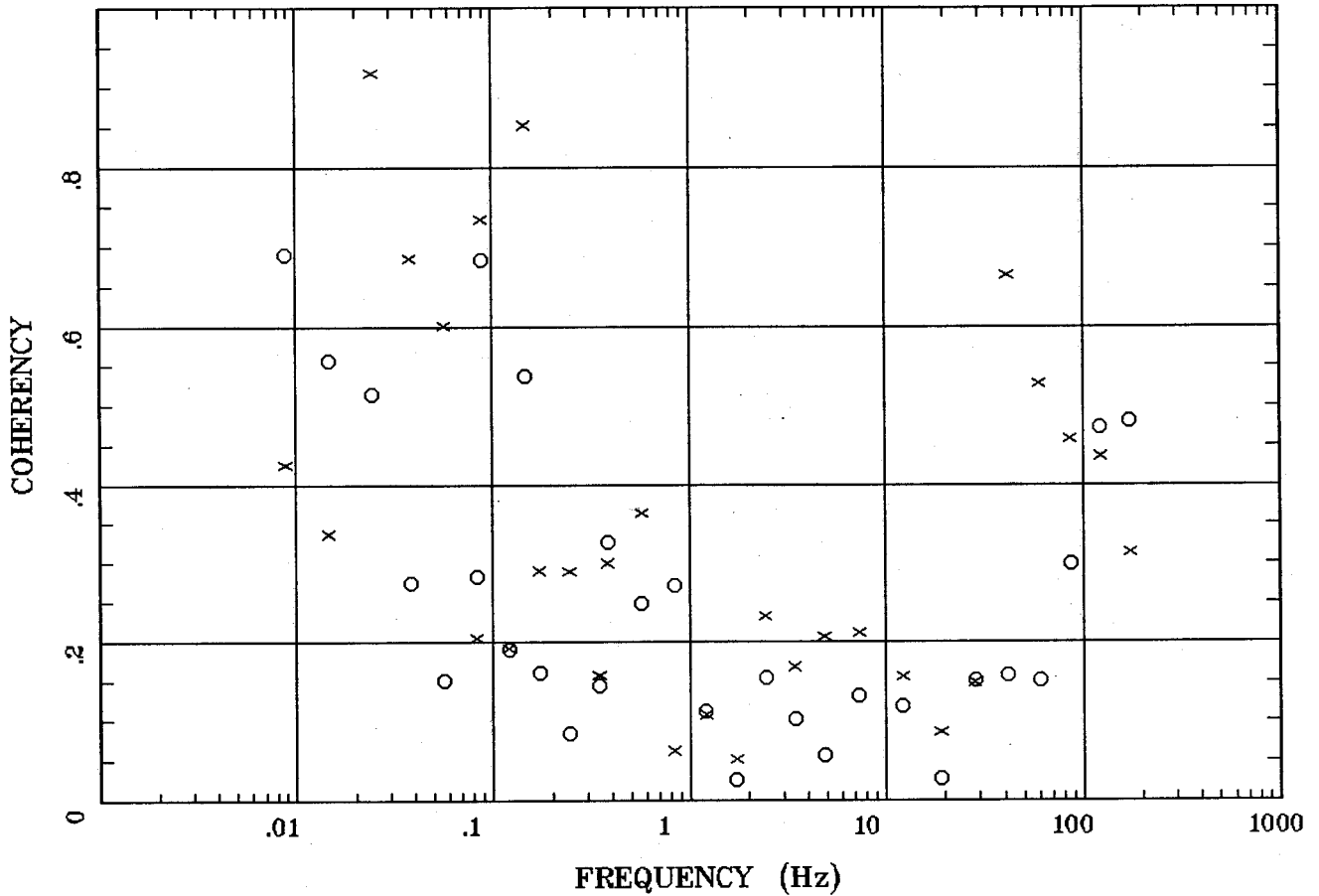


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HzHx.x Coh HzHy.o

Shoshone Peak



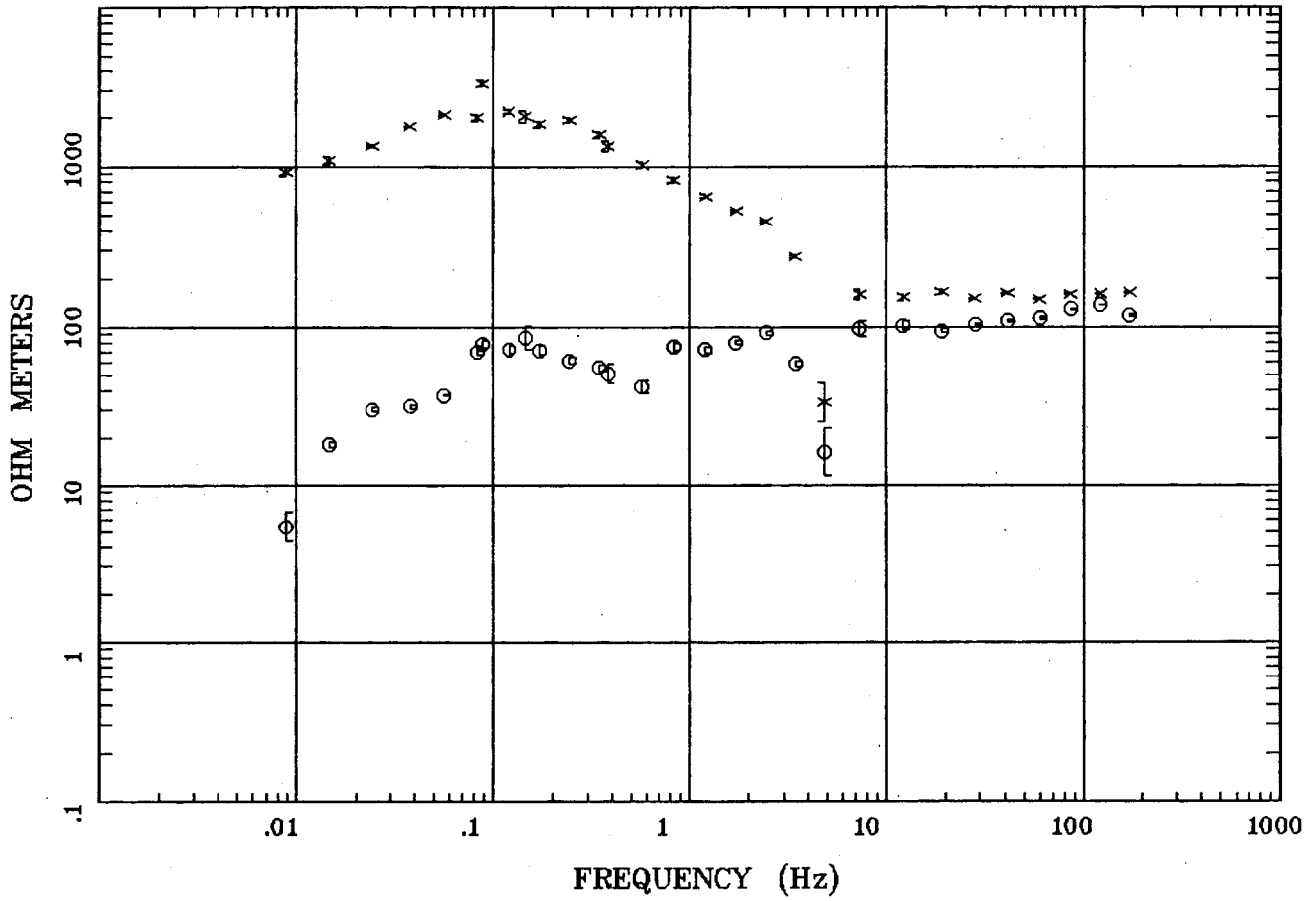
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Plotted: 15:10 Feb 08, 2006
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Station 53

APPARENT RESISTIVITY

Southwest of DAF

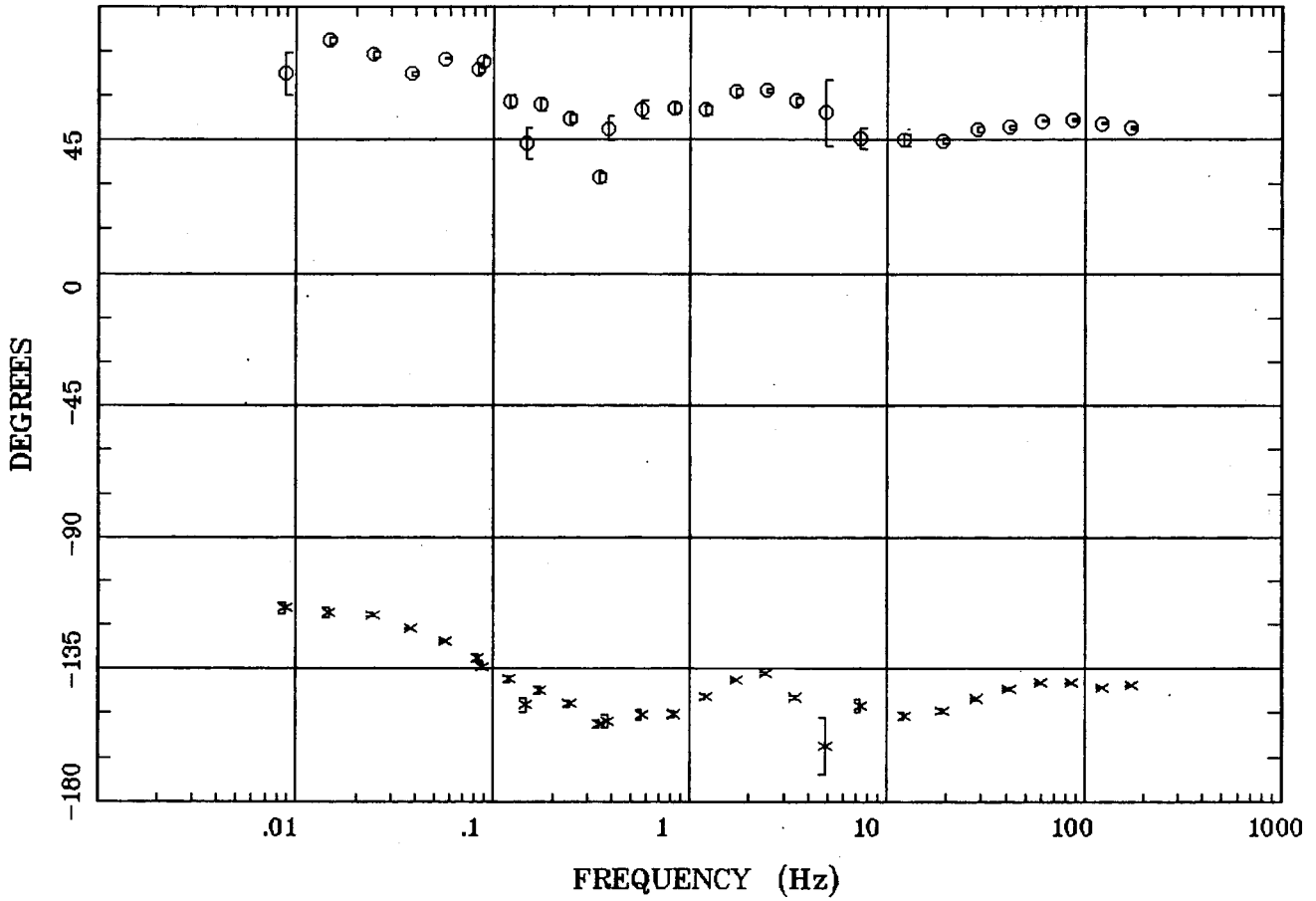


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Survey Co: US Geological Survey

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IMPEDANCE PHASE

Southwest of DAF

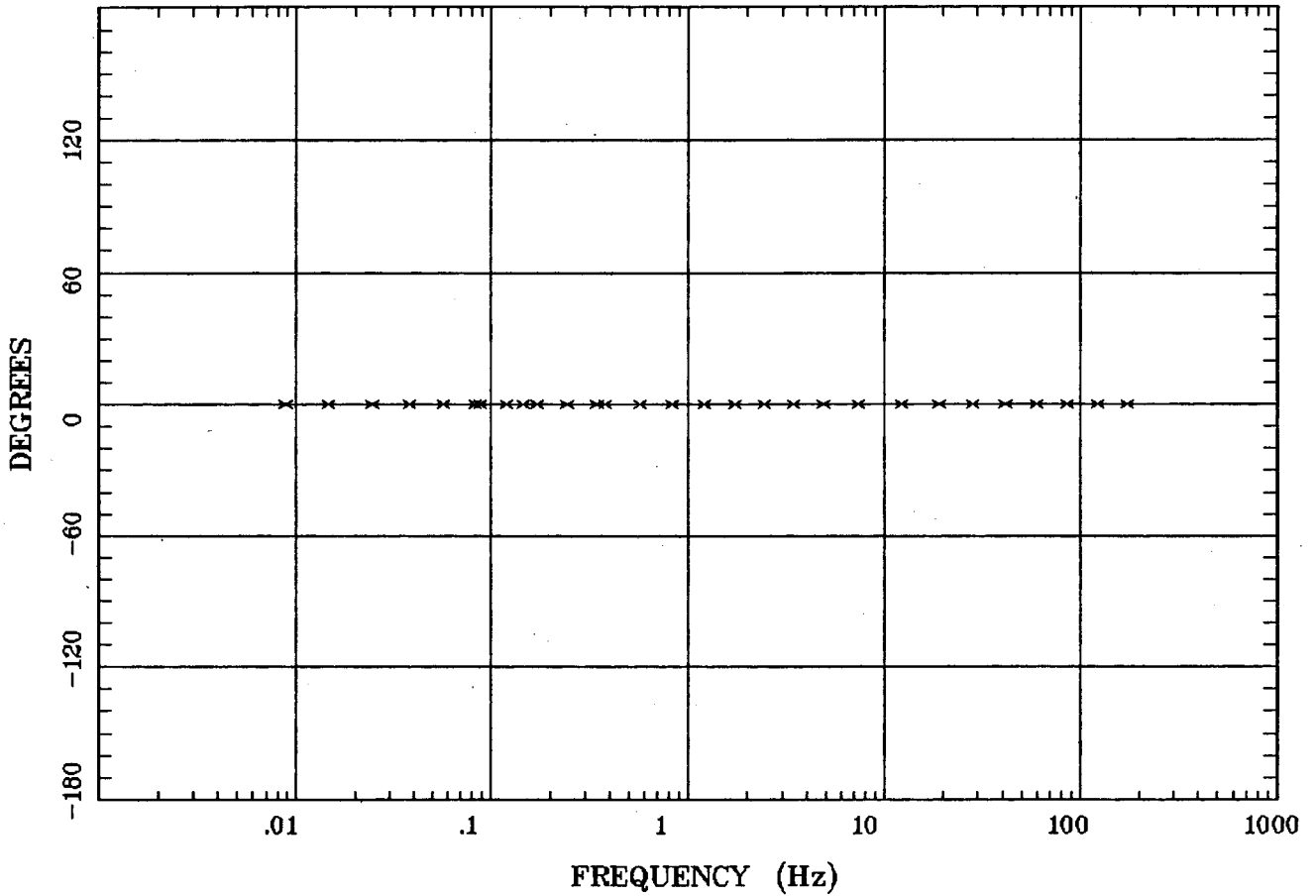


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ROTATION ANGLE

Southwest of DAF

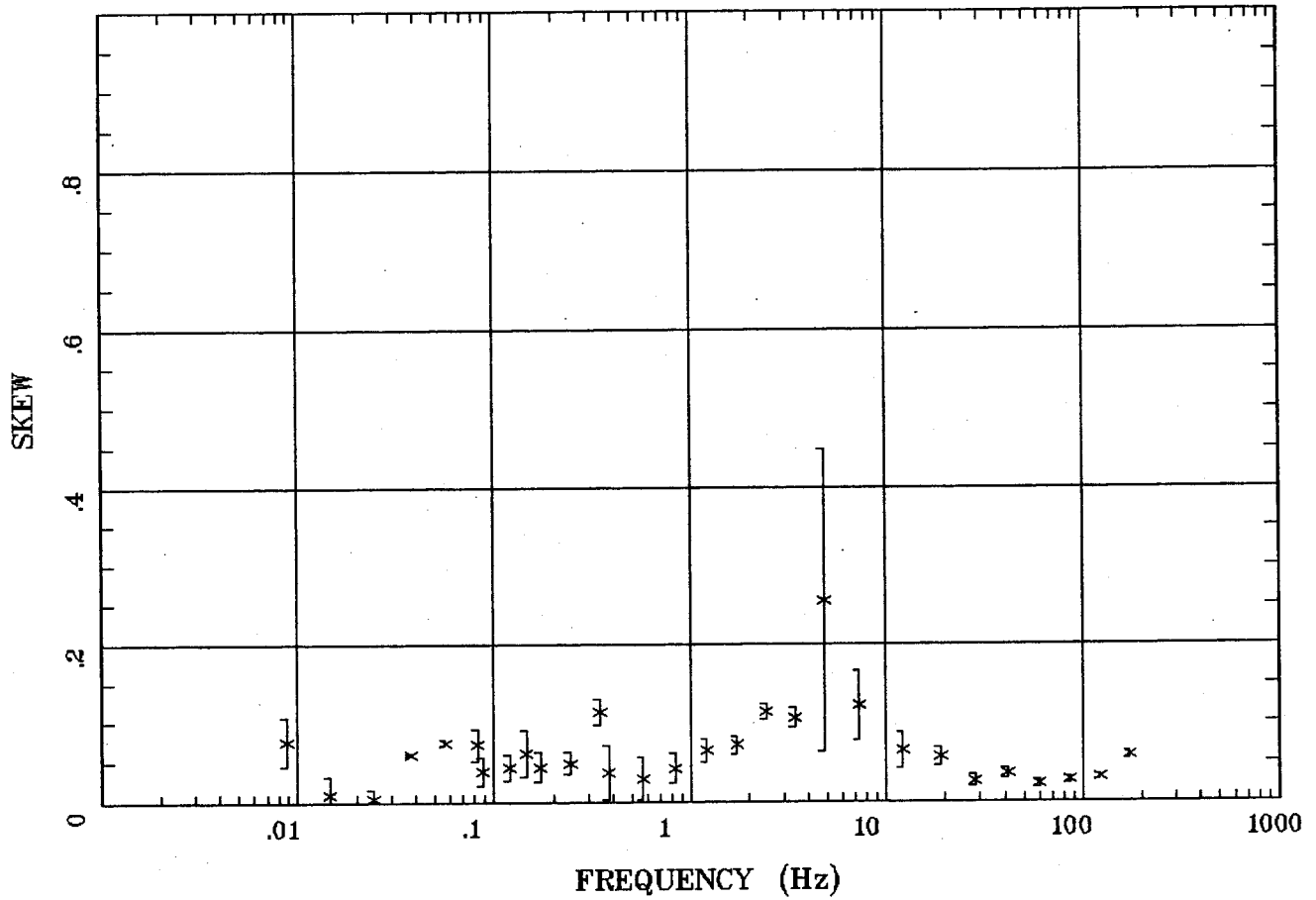


Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

Southwest of DAF



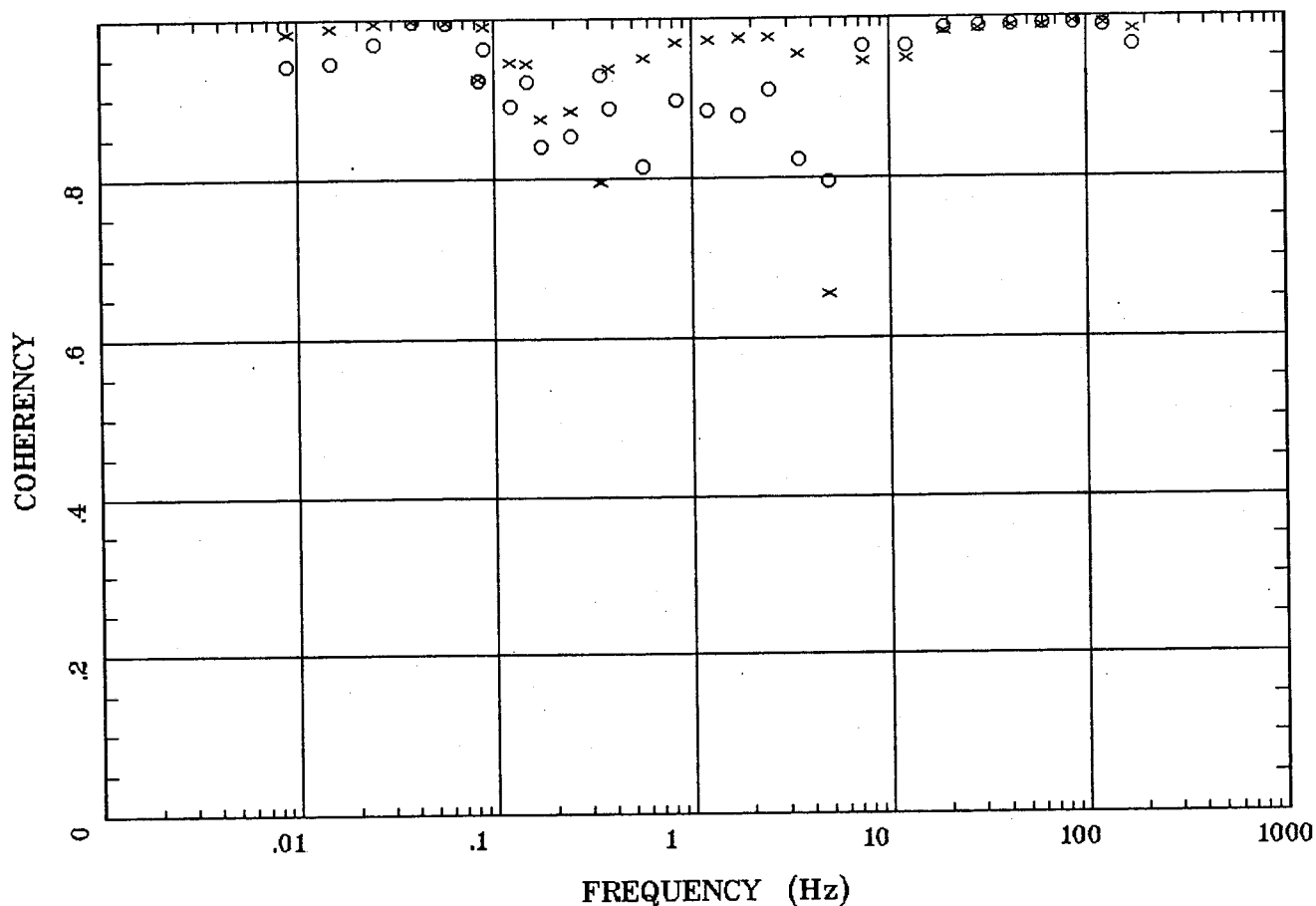
Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Southwest of DAF

Station 53



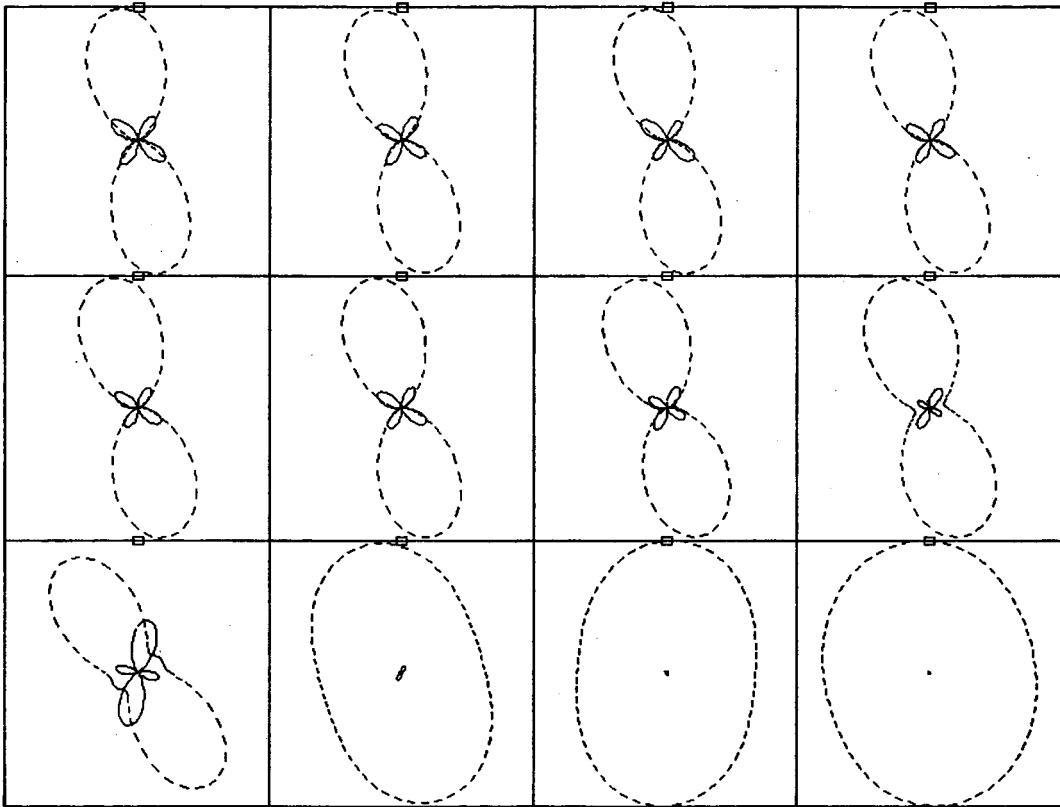
Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Southwest of DAF

Station 53



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

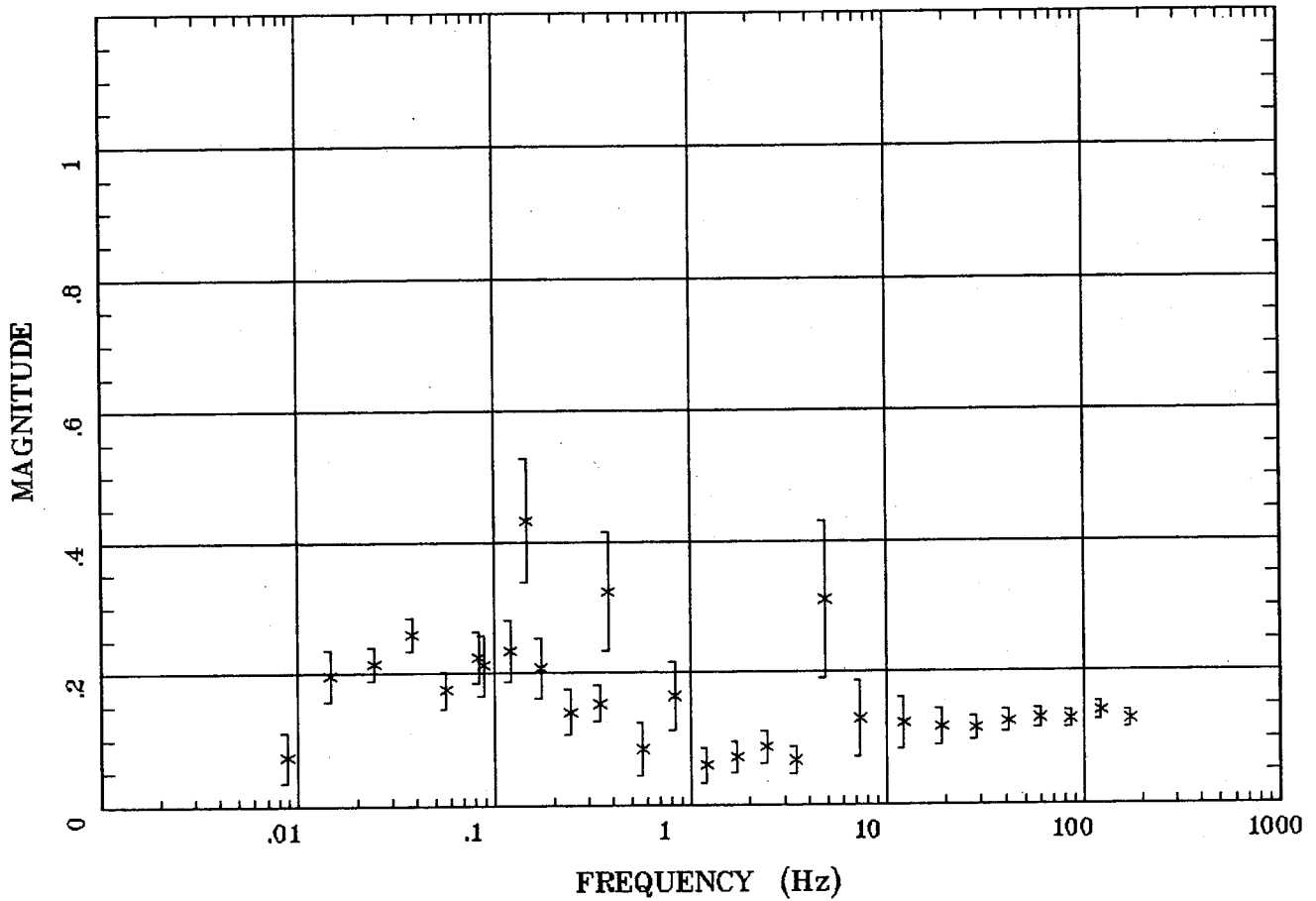
Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

Southwest of DAF

Station 53

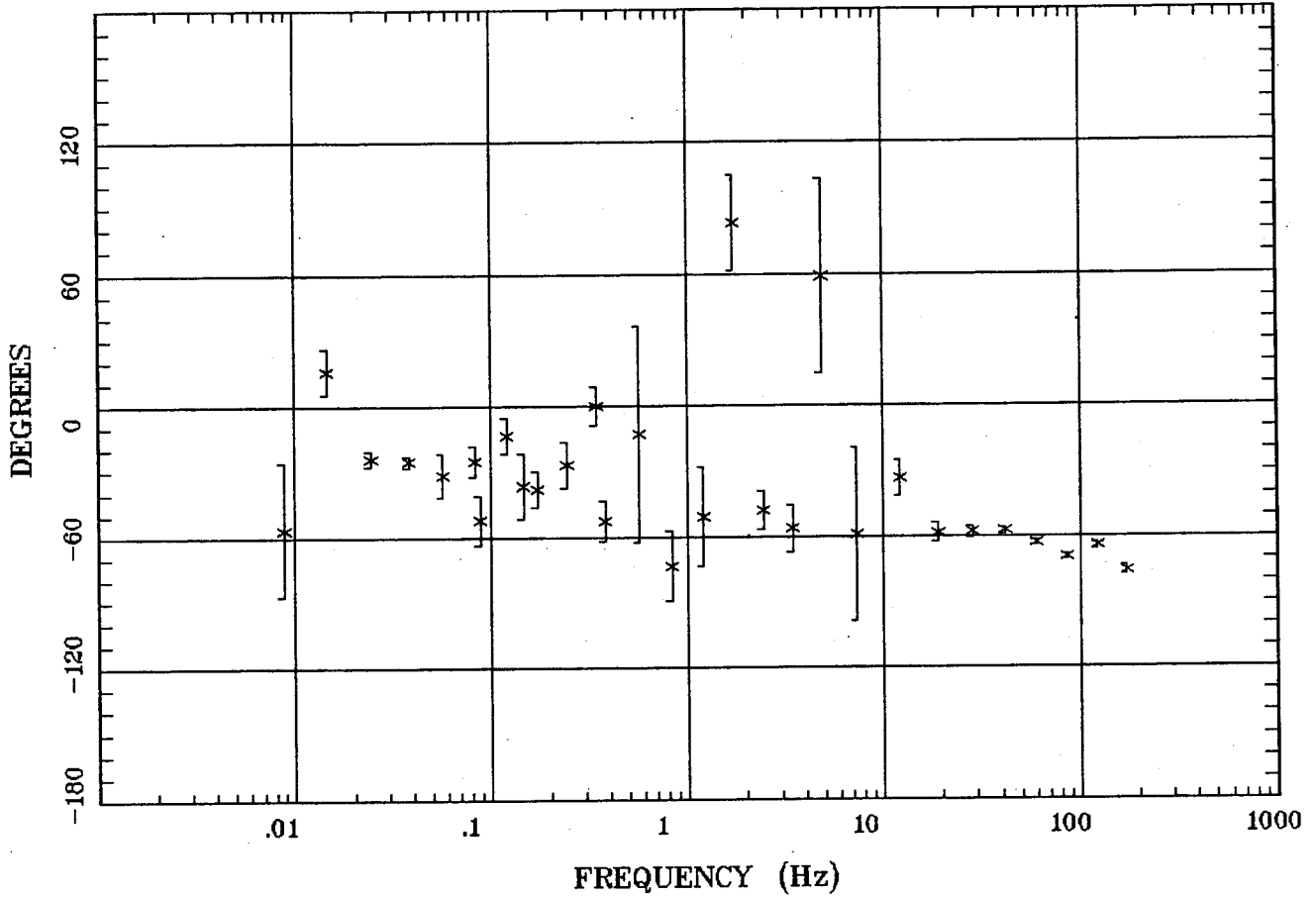


Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Southwest of DAF

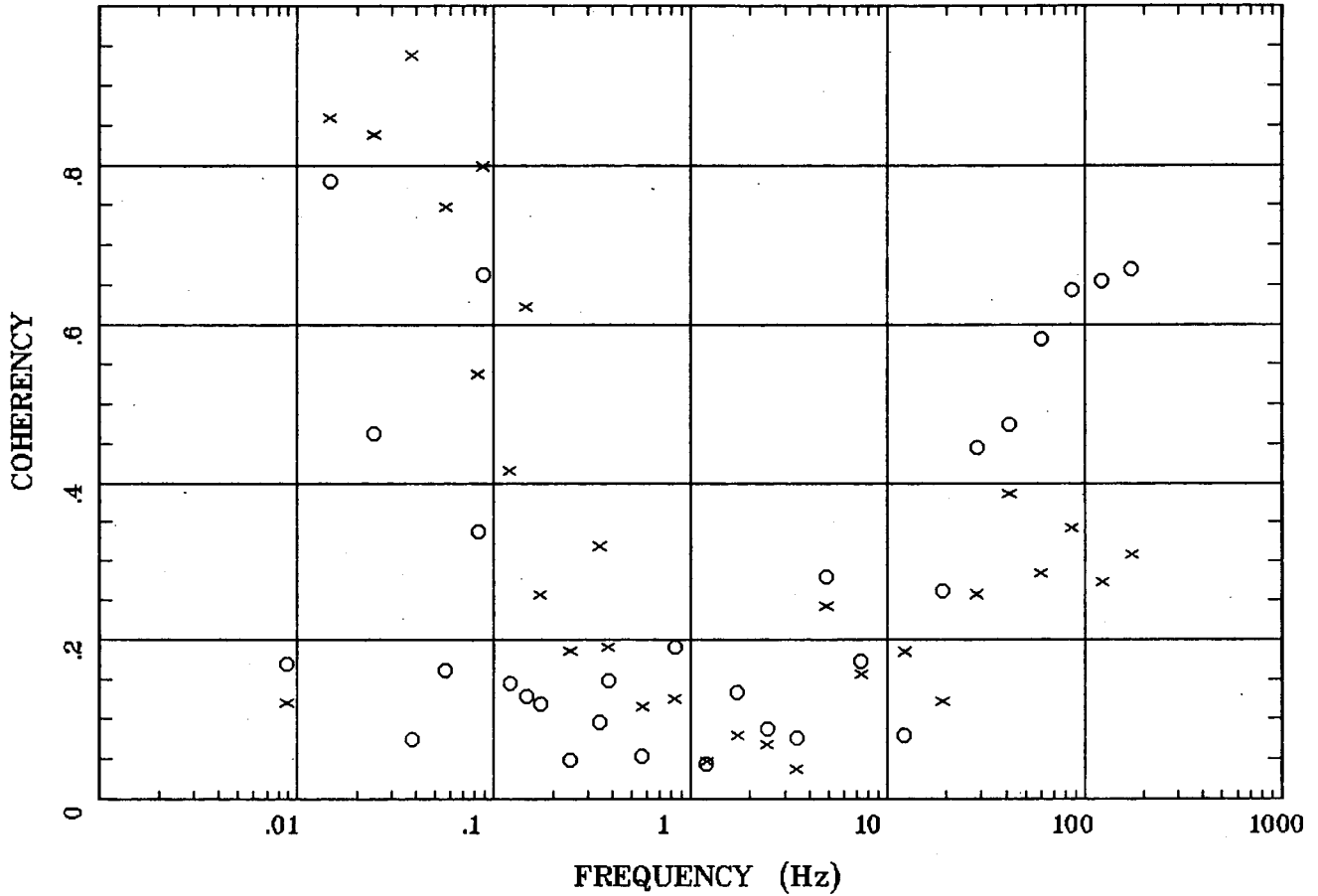


Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

Southwest of DAF

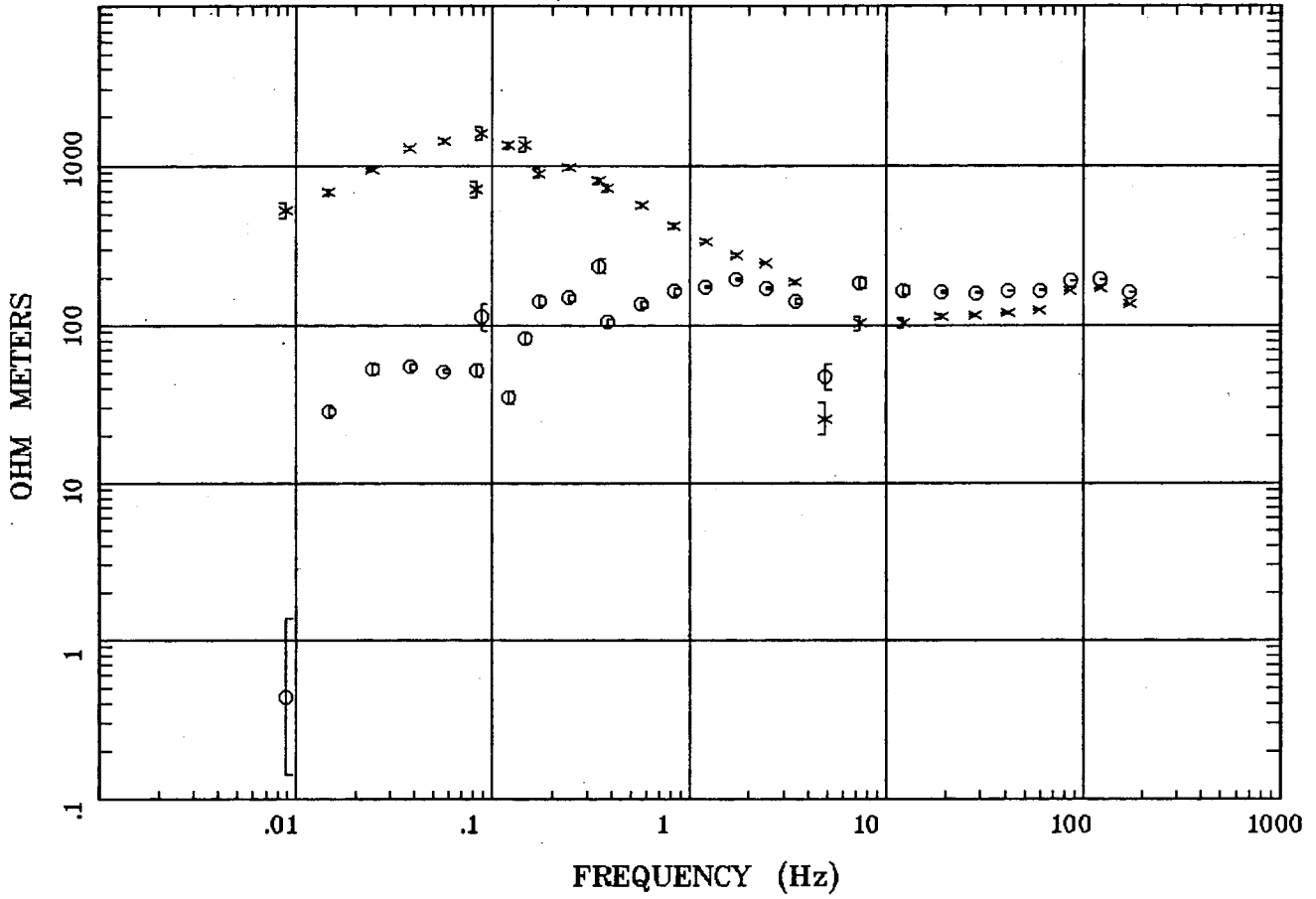


Client: Water Resources & DOD
Remote: none
Acquired: 06:1 Oct 11, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt53n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:26 Feb 02, 2006
< EMI - ElectroMagnetic Instruments. >

APPARENT RESISTIVITY

Mid Valley RD



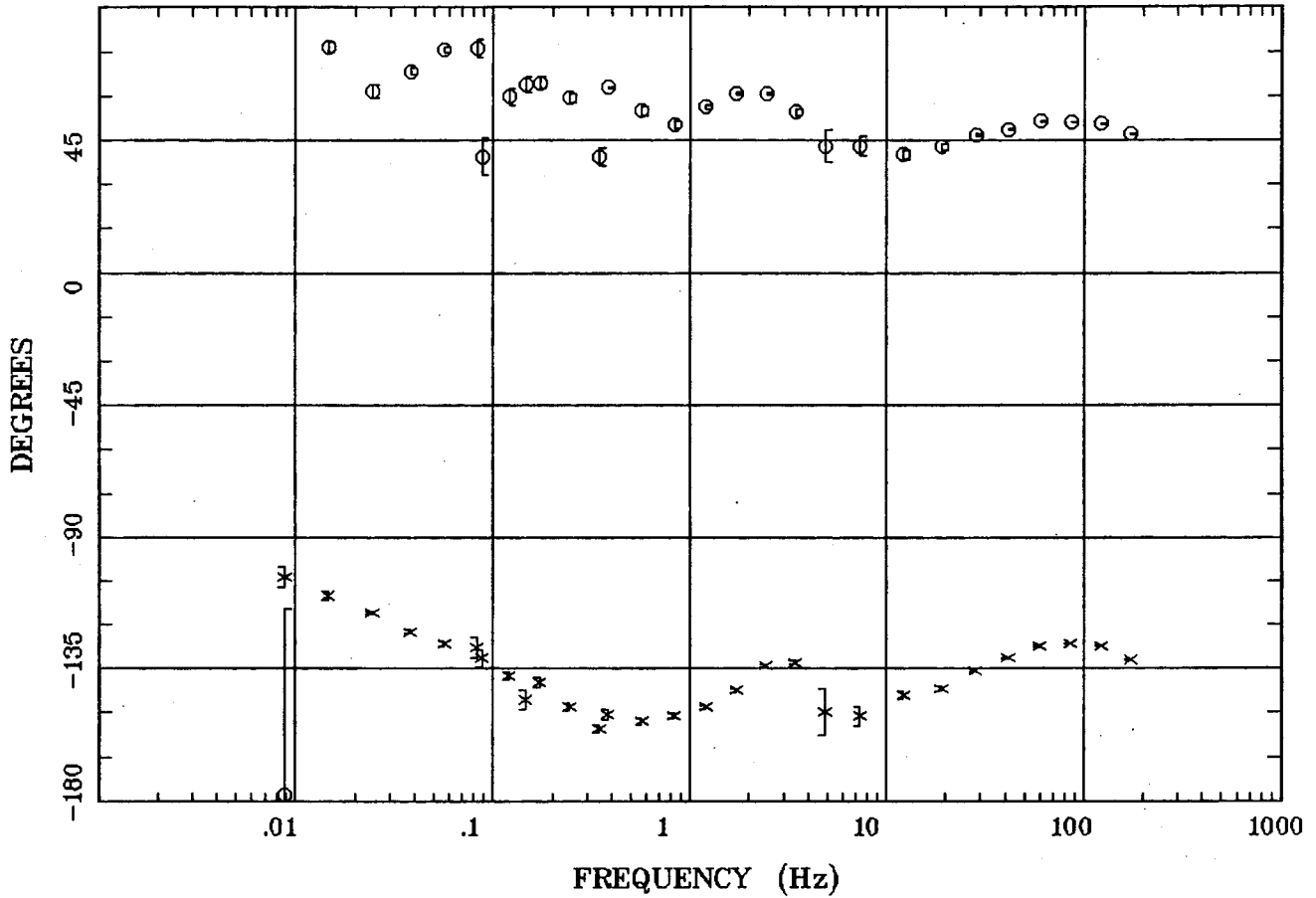
Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

Mid Valley RD

Station 54

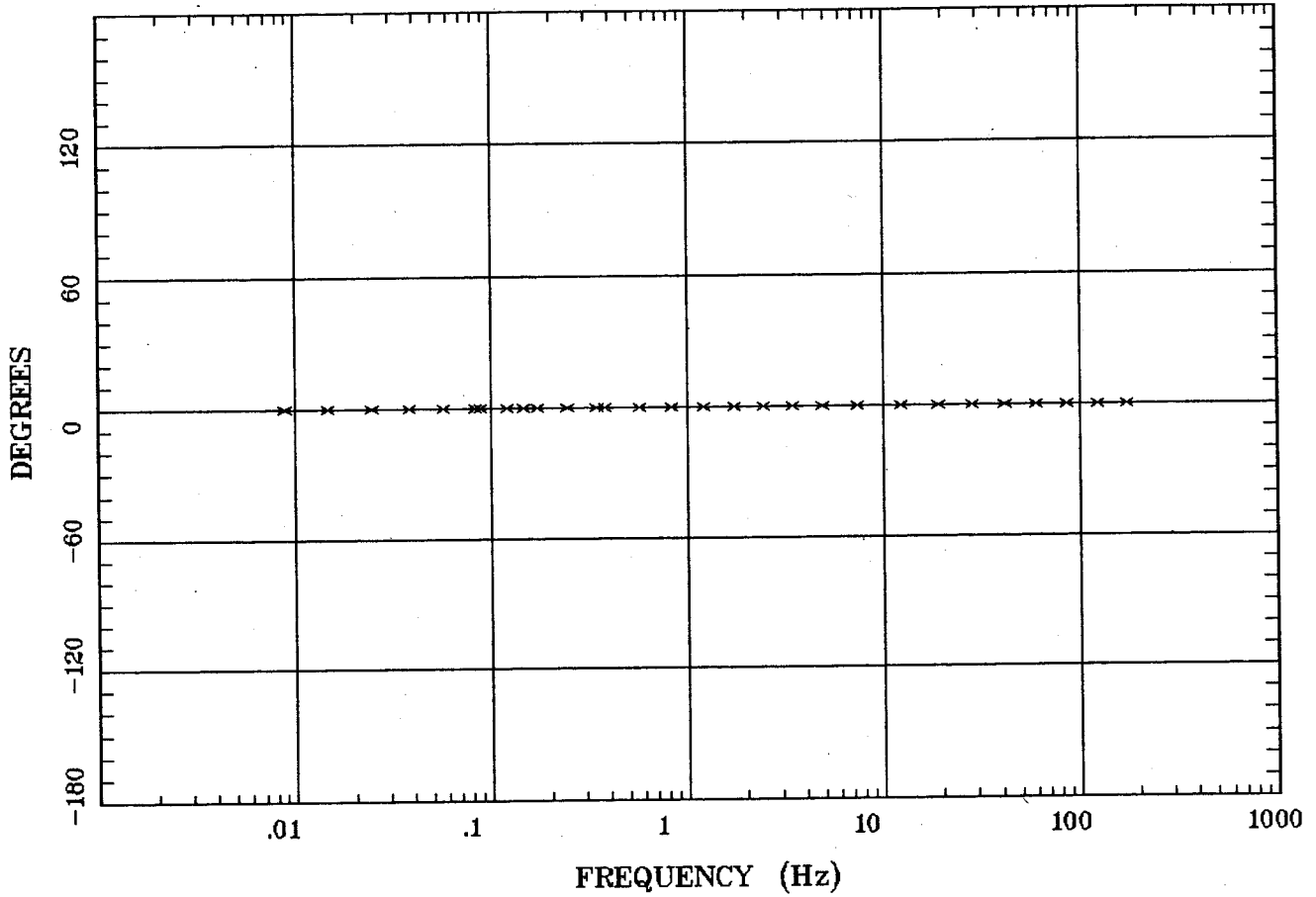


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

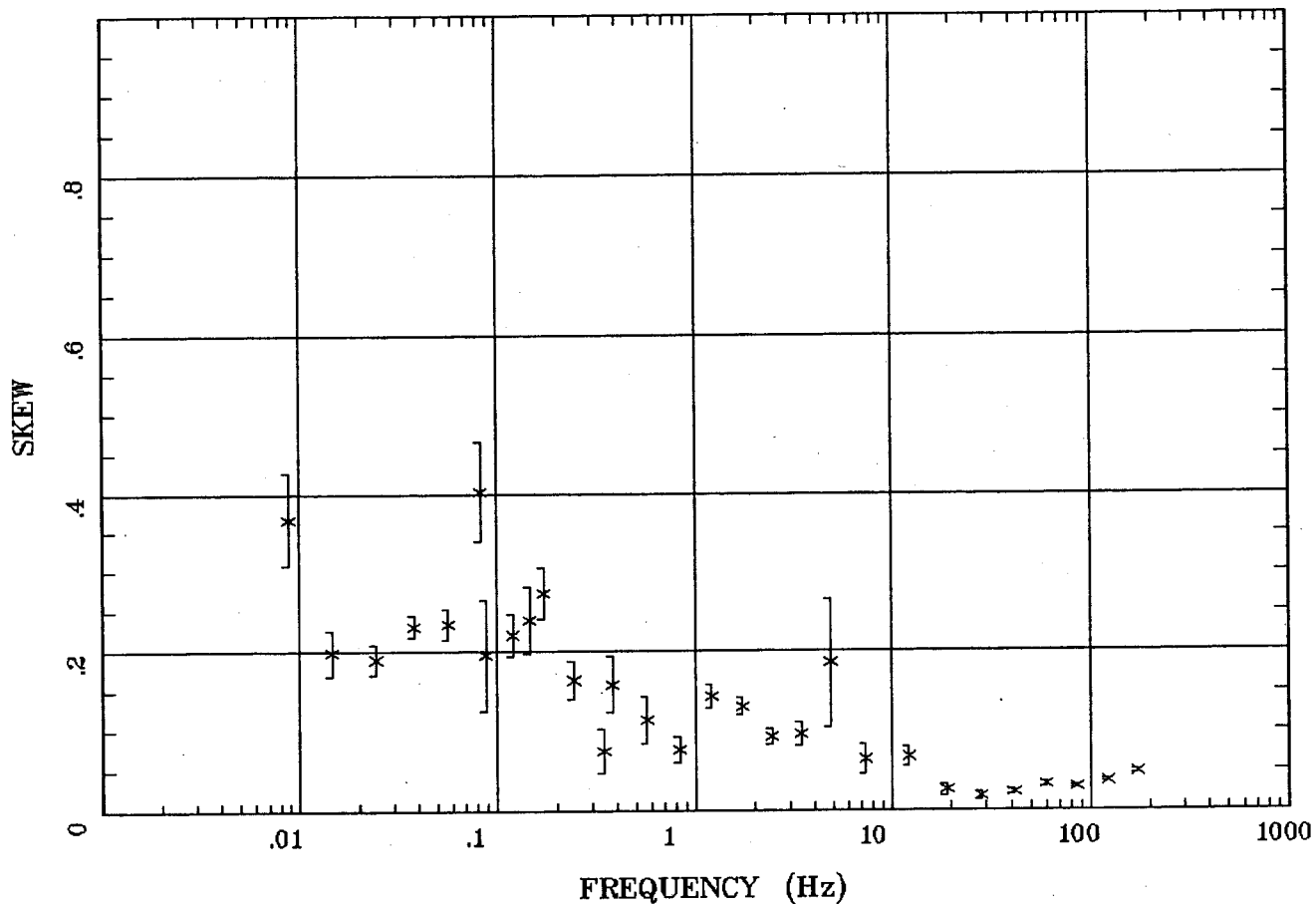
ROTATION ANGLE

Mid Valley RD



Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

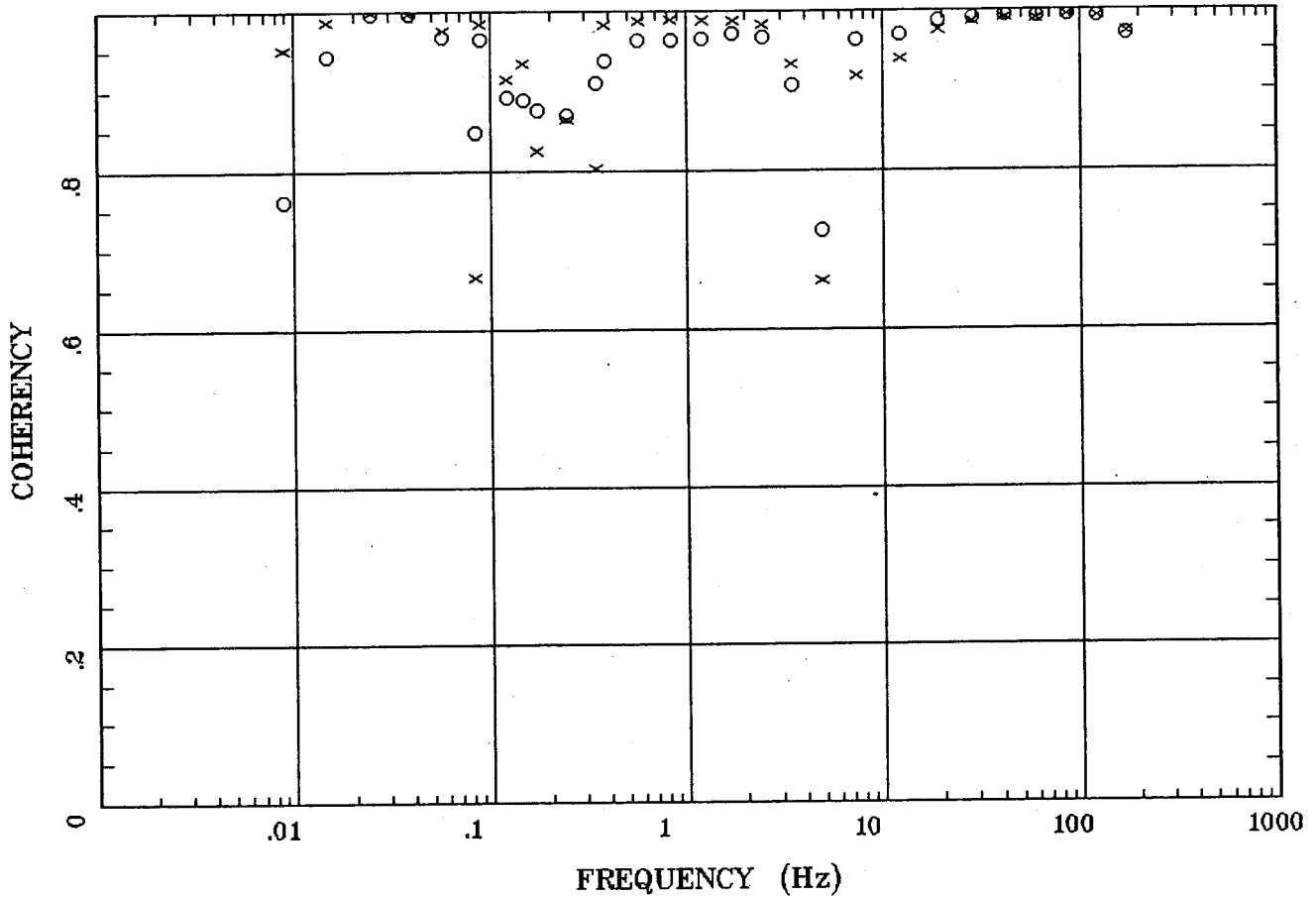


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Mid Valley RD

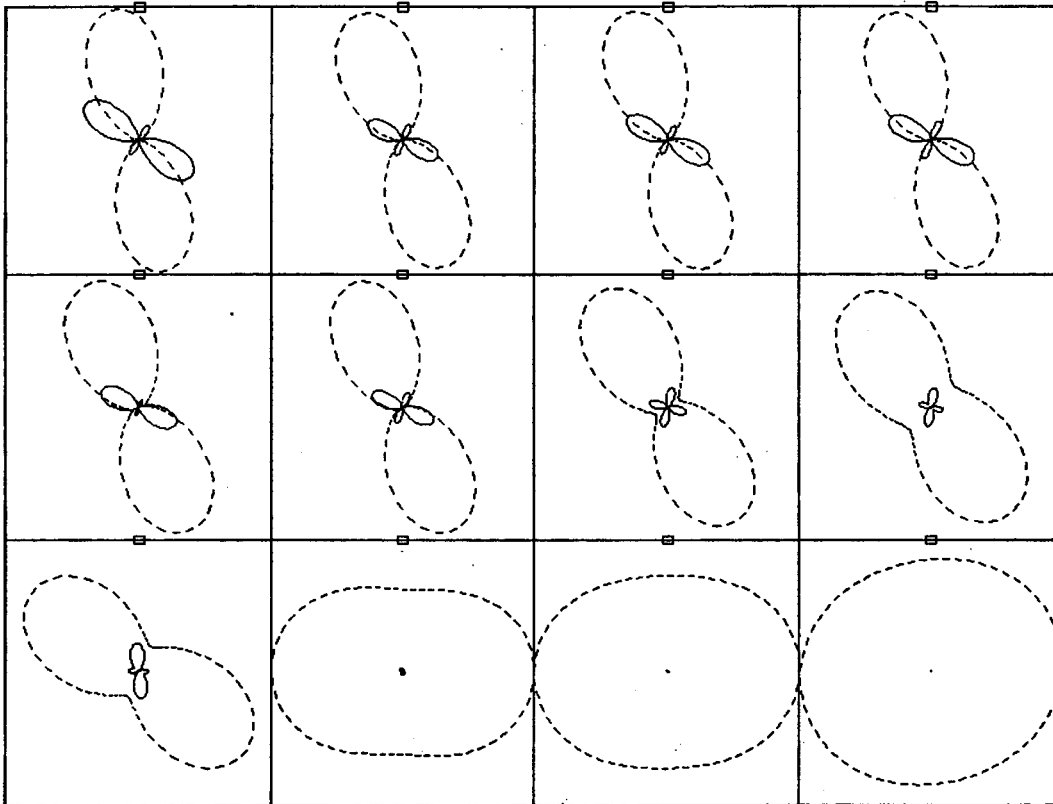


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Mid Valley RD

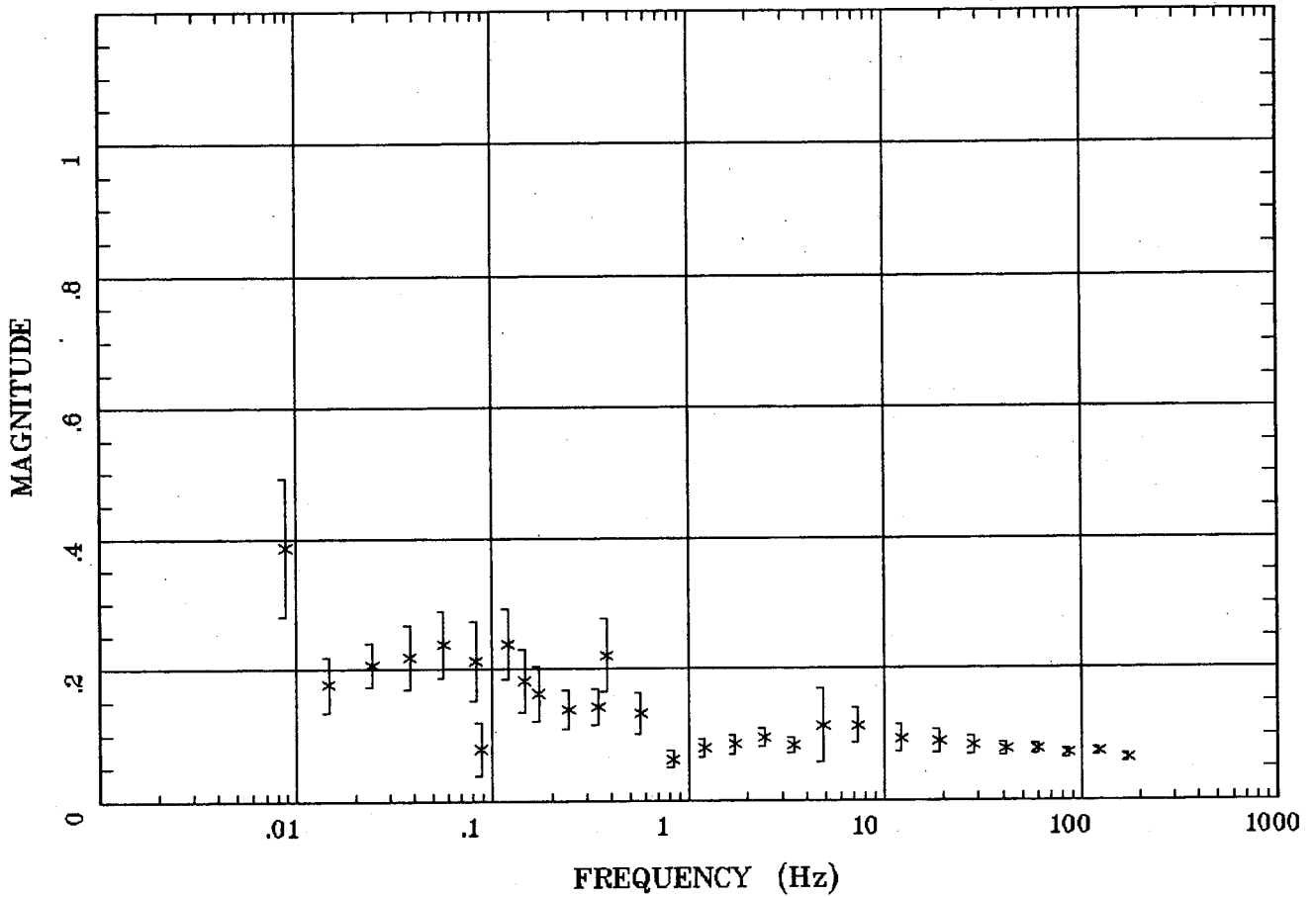


.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

Rotation:

Client: Water Resources & DOD
 Remote: none
 Acquired: 04:5 Oct 12, 2005
 Survey Co: US Geological Survey

Filename: nt54n.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 09:56 Feb 02, 2006
 < EMI - ElectroMagnetic Instruments >



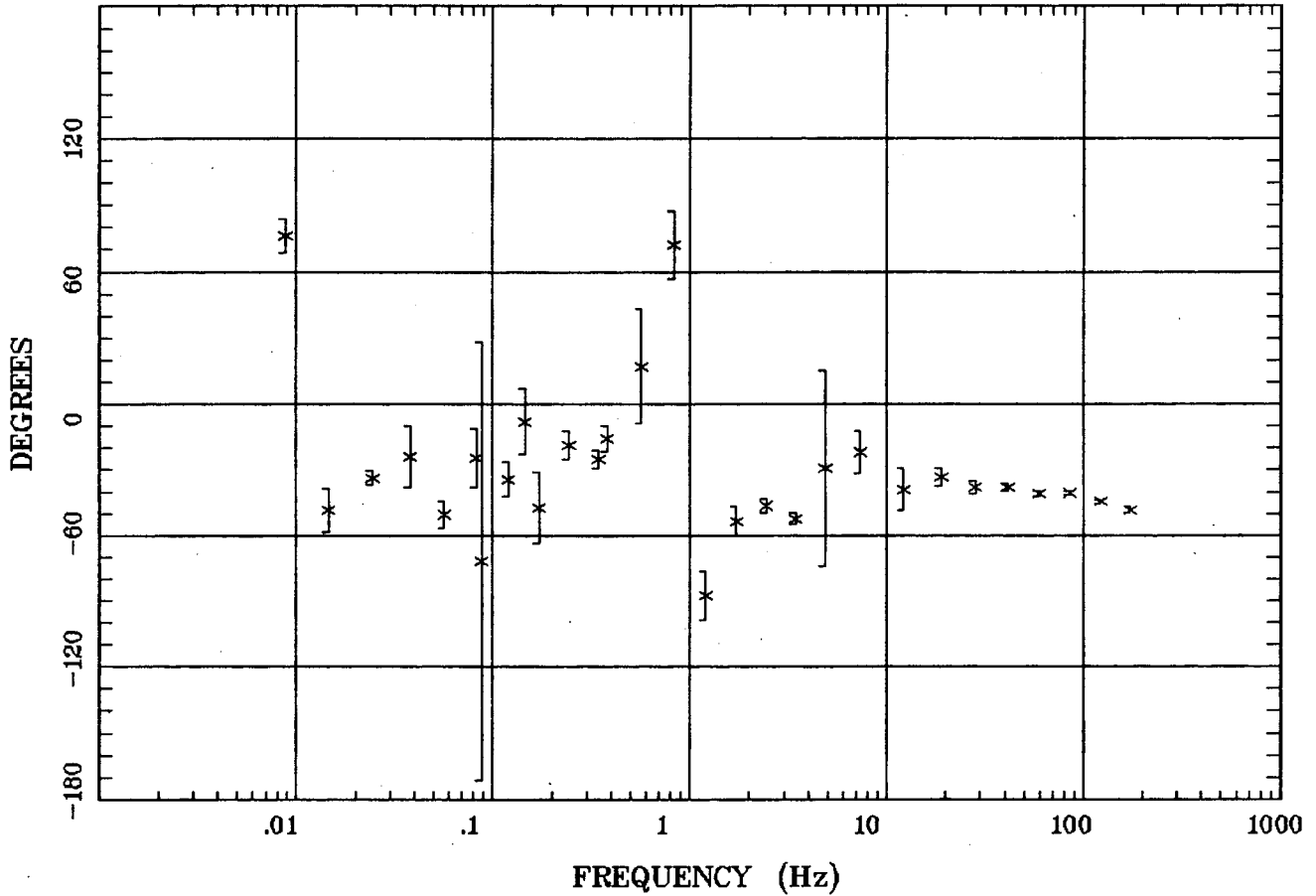
Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Mid Valley RD

Station 54



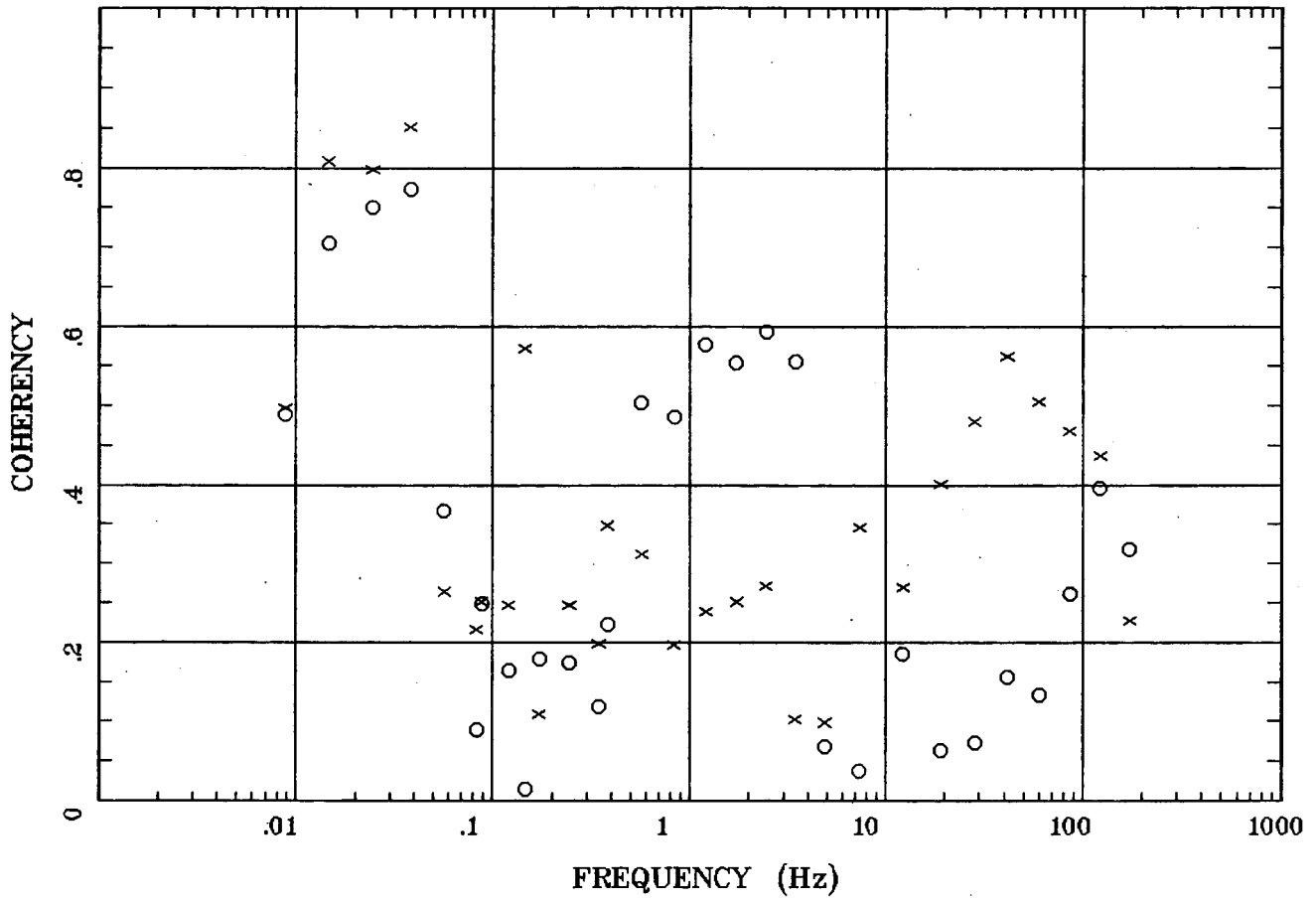
Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

Mid Valley RD

Station 54

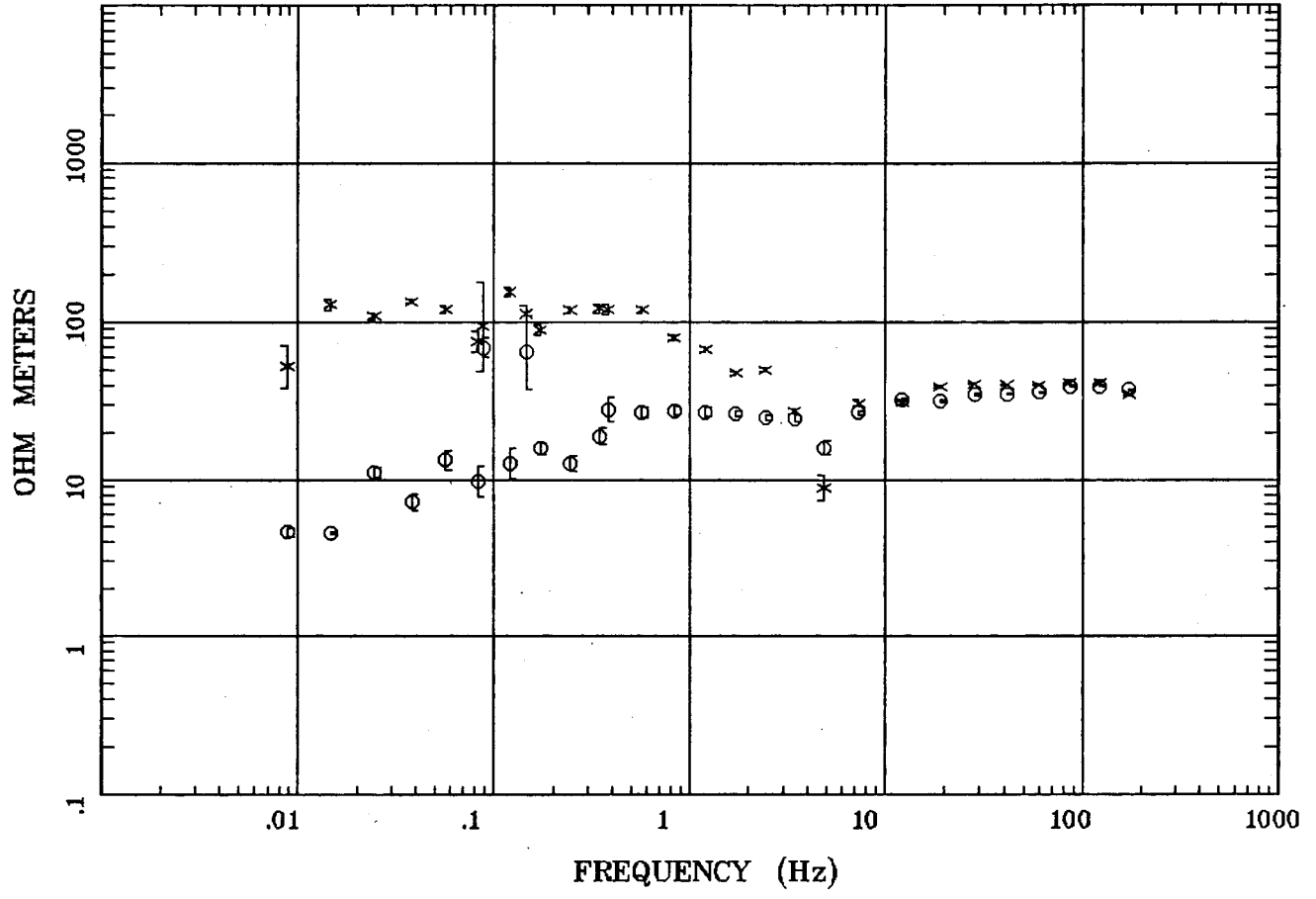


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 12, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt54n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:56 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

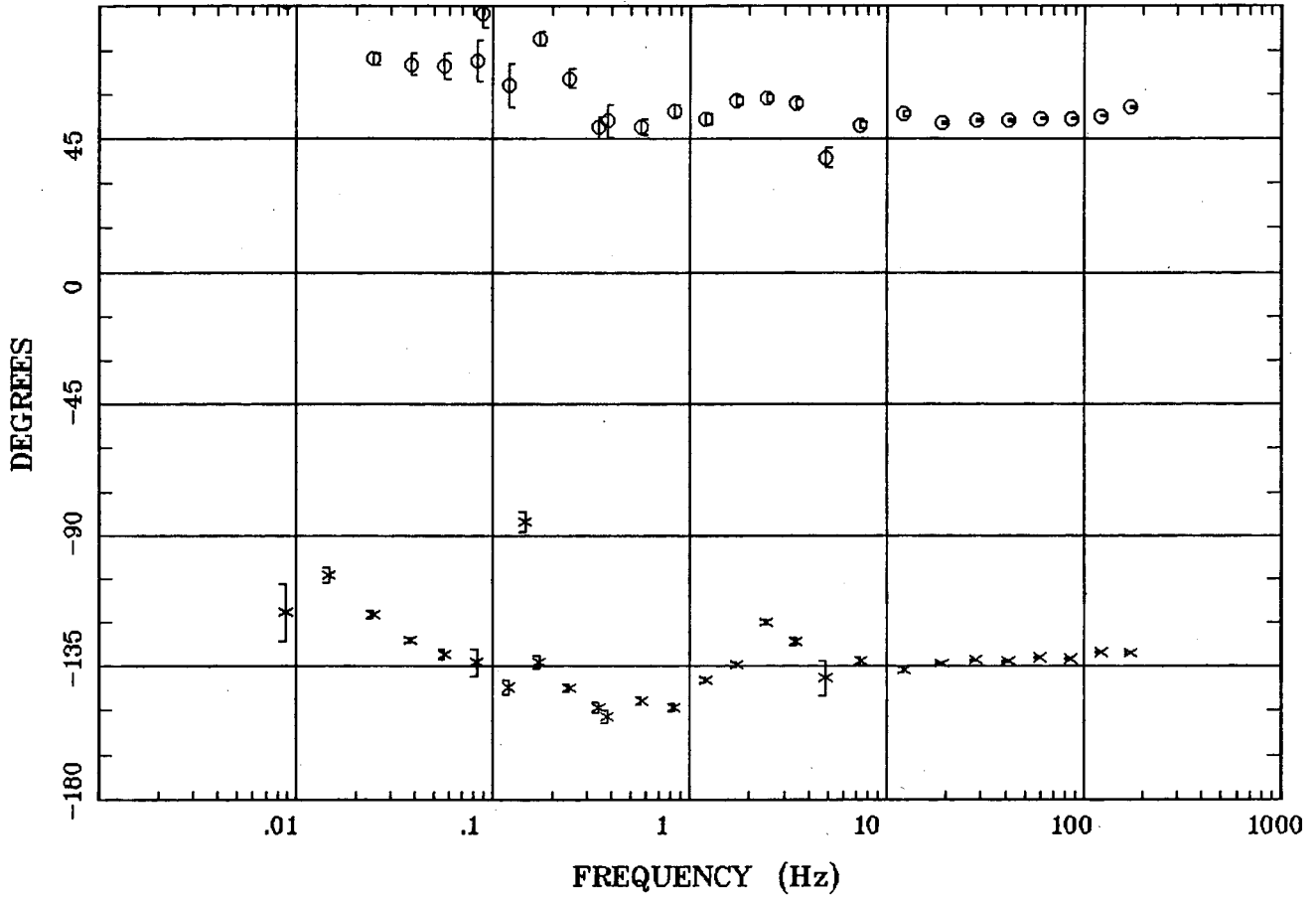
APPARENT RESISTIVITY

Mid Valley RD



Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >



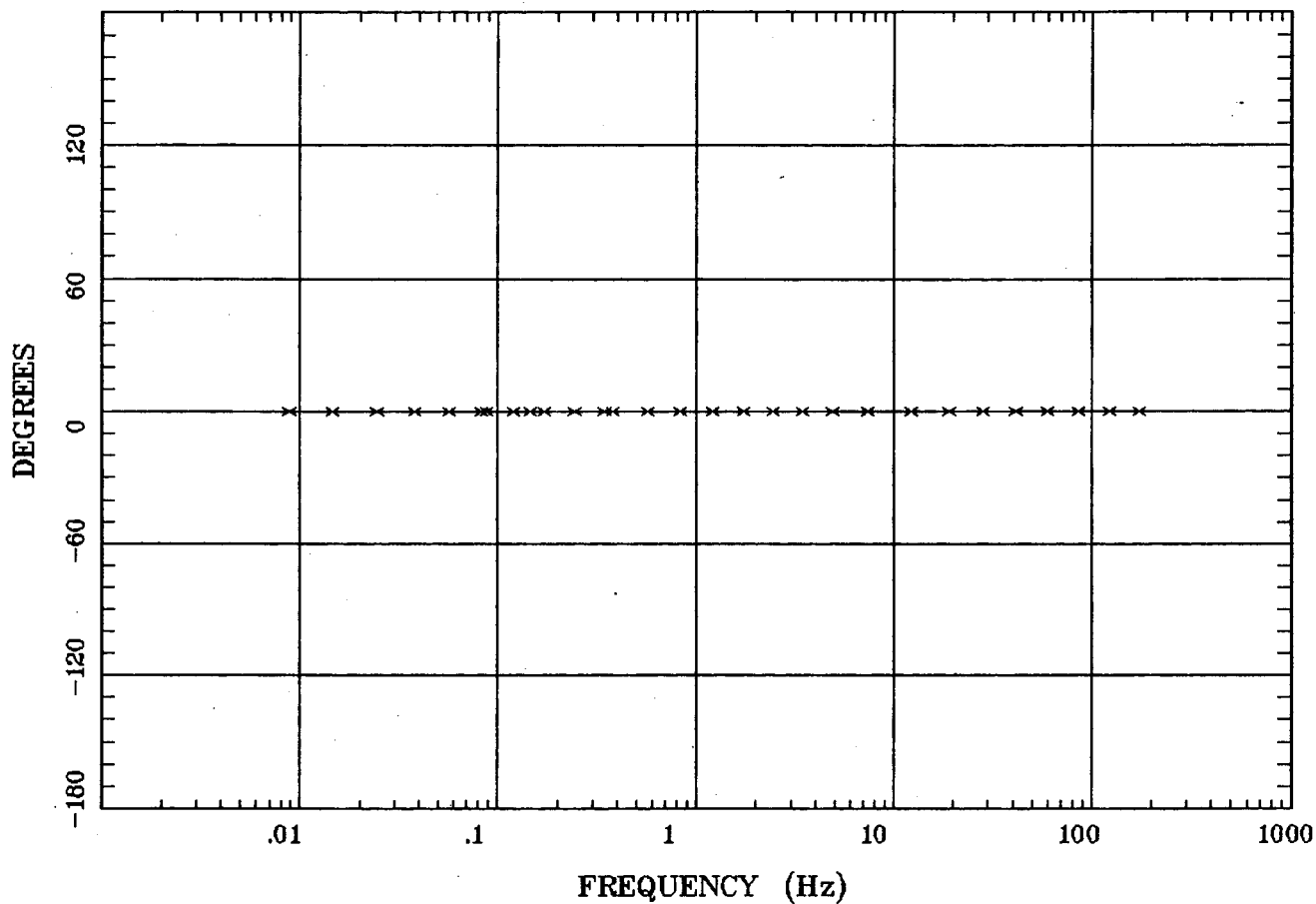
Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

ROTATION ANGLE

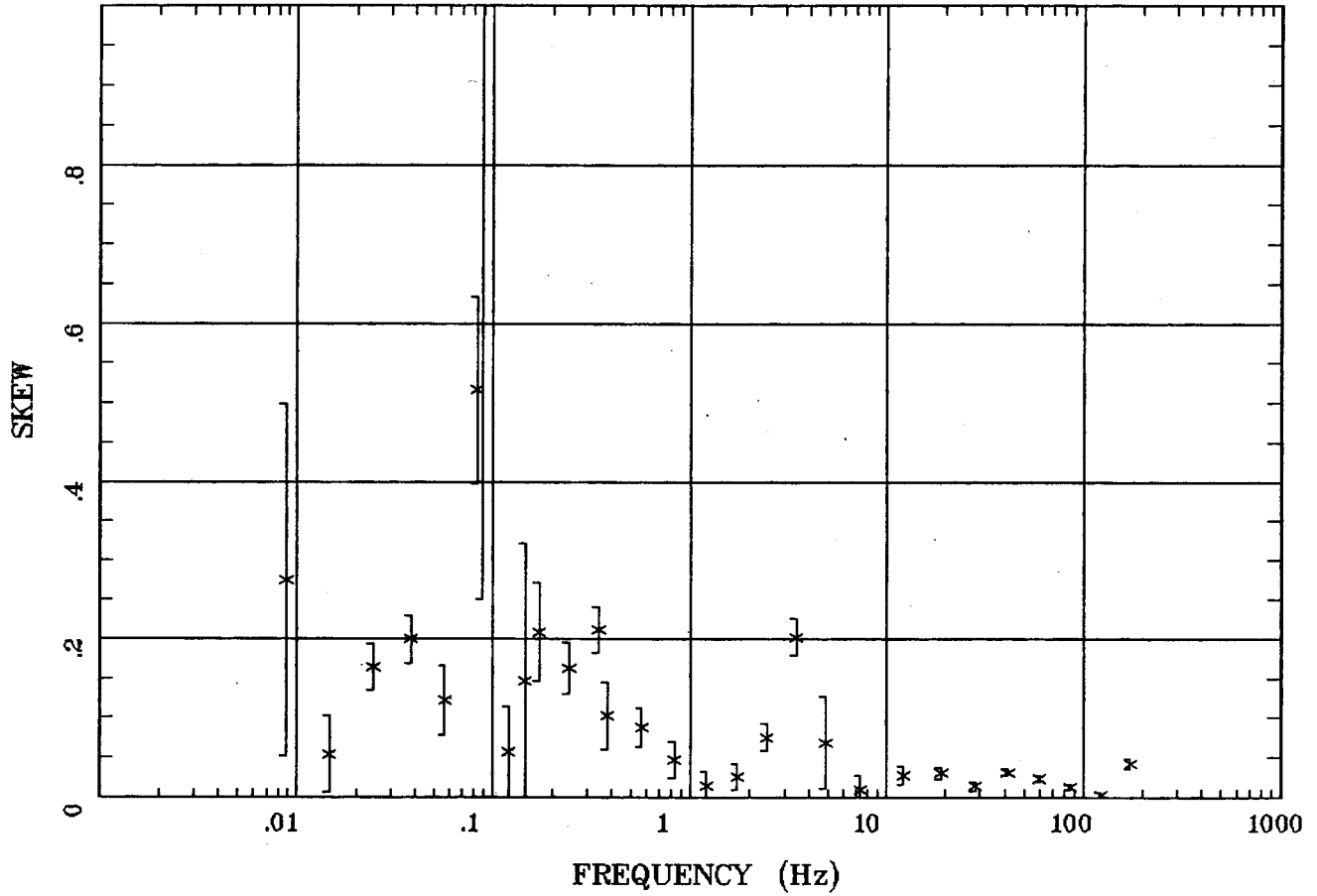
Mid Valley RD

Station 55



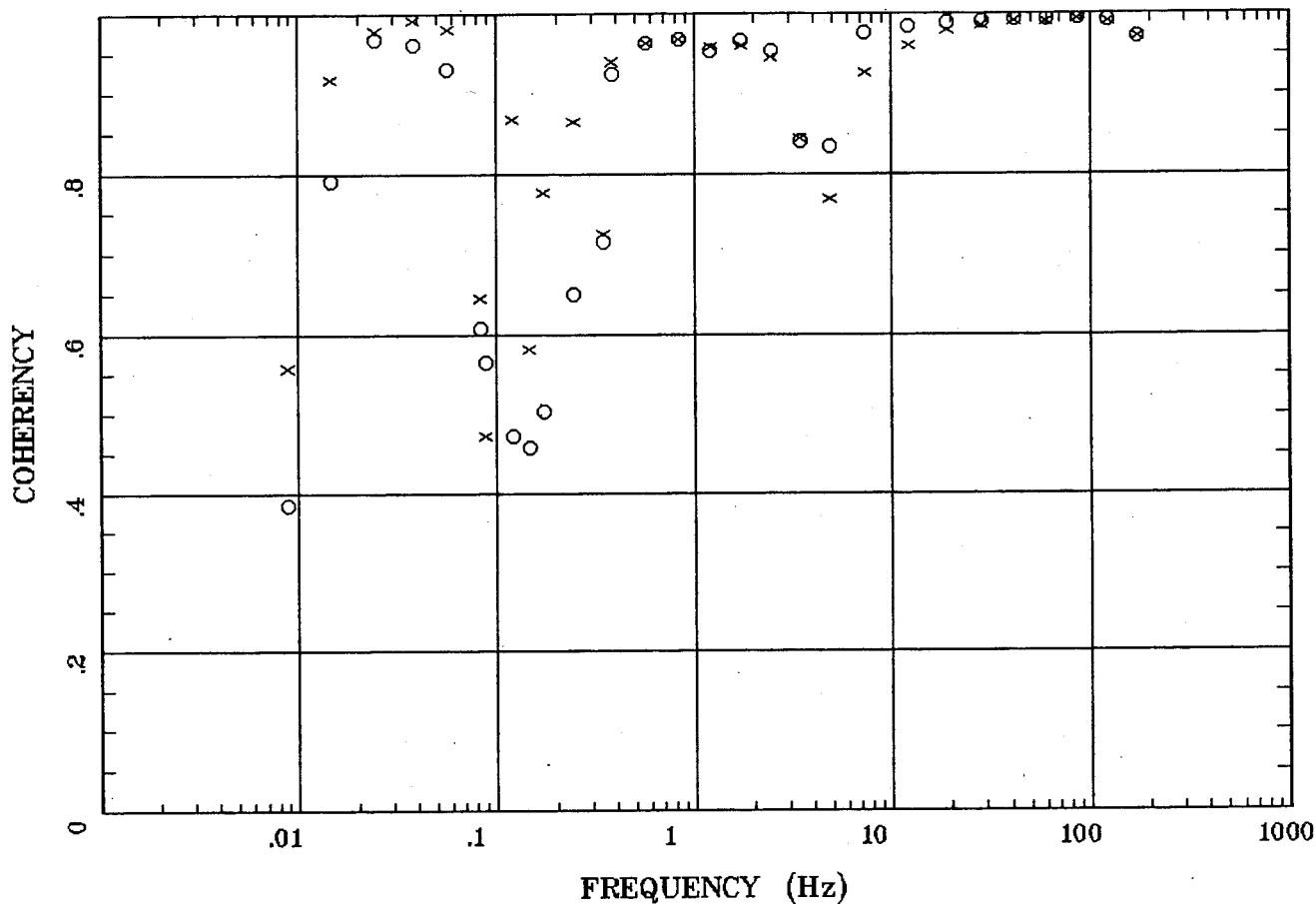
Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >



Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

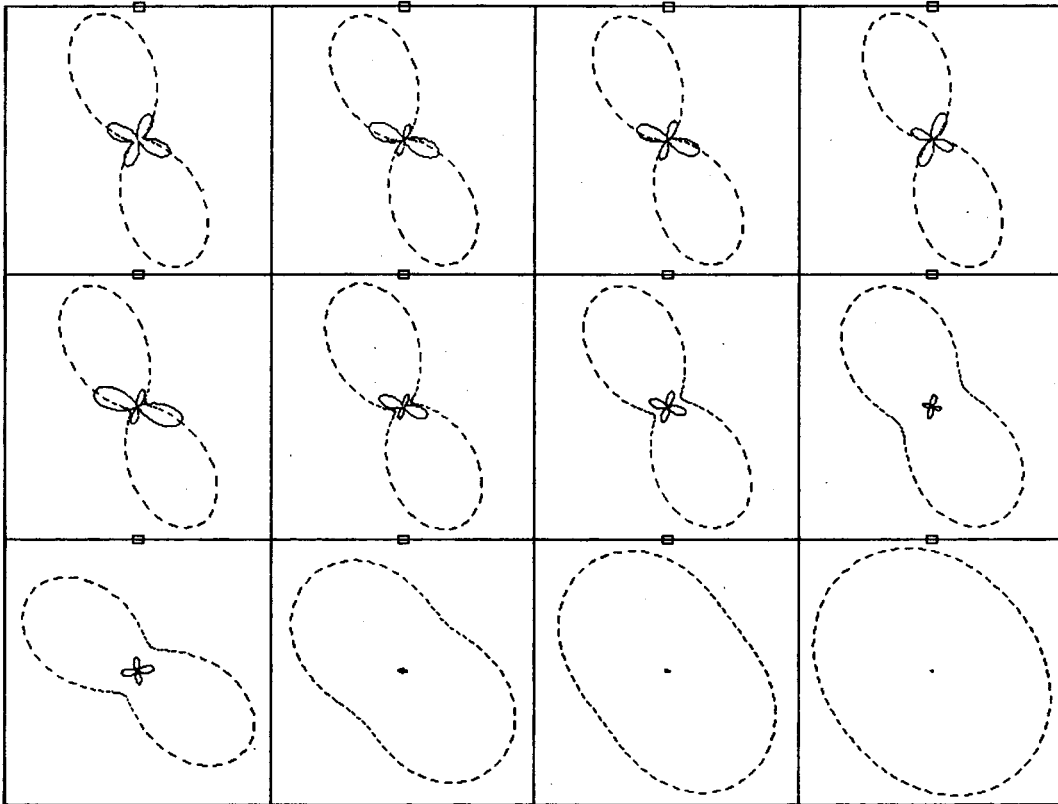


Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Mid Valley RD



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

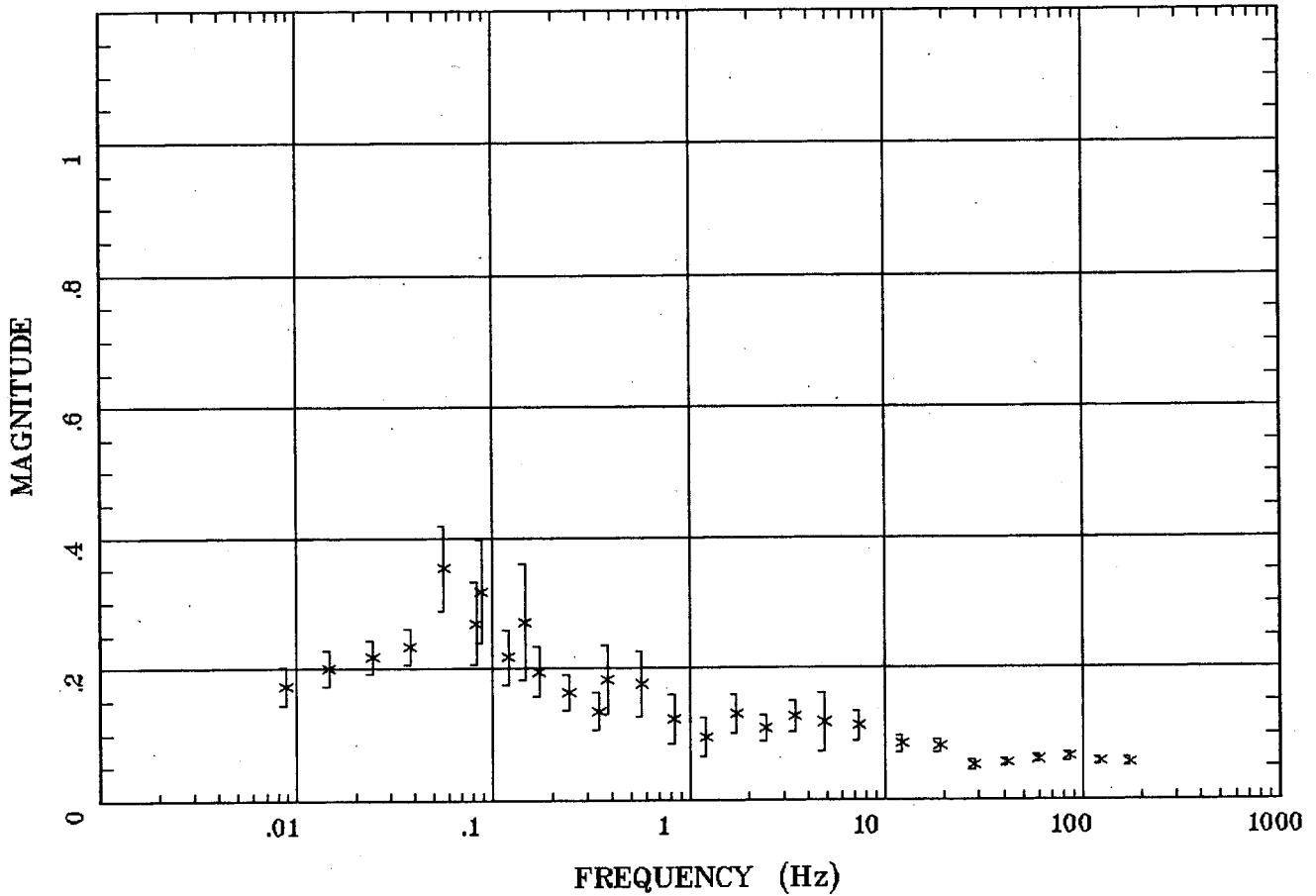
Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

Mid Valley RD

Station 55

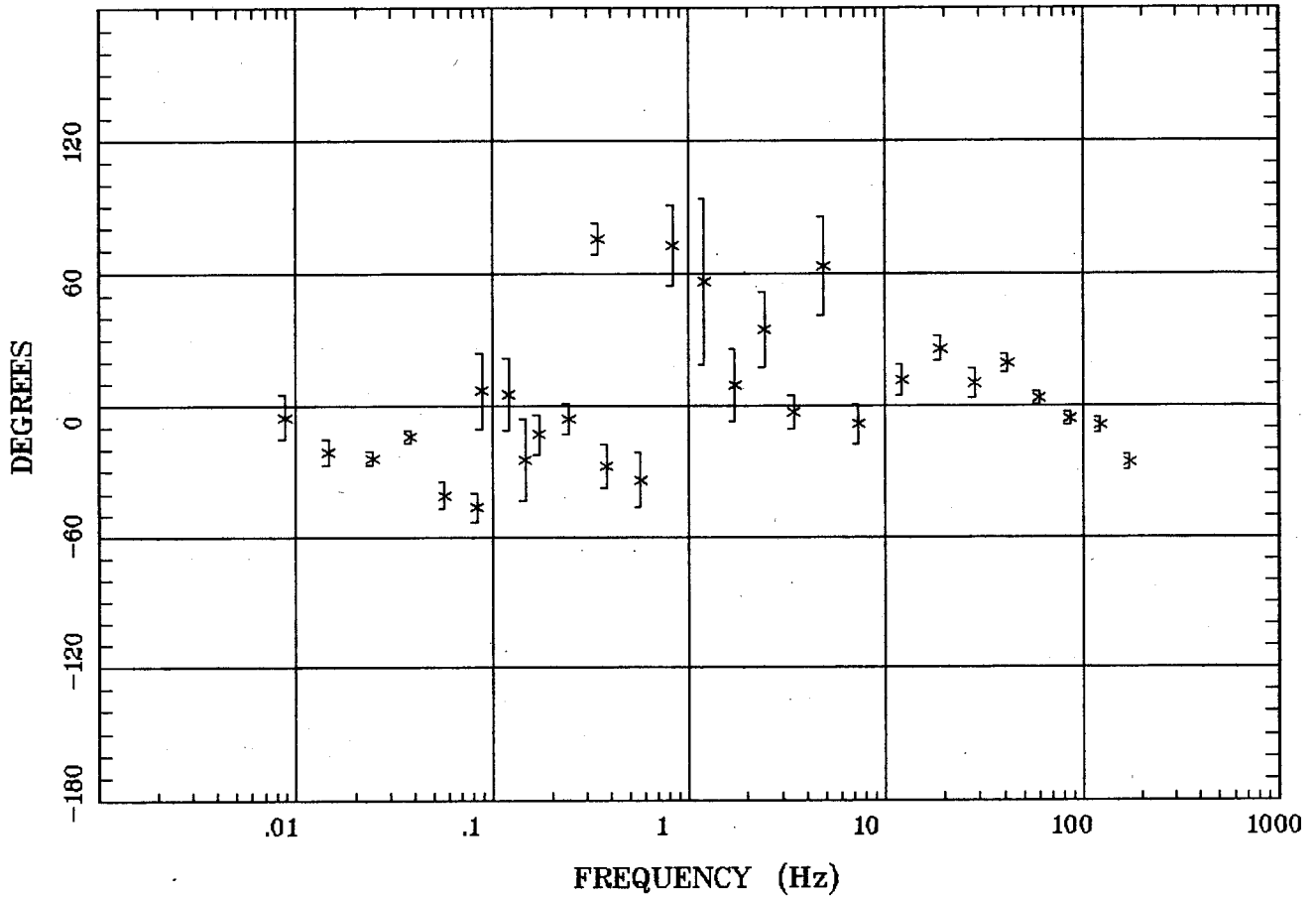


Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Mid Valley RD

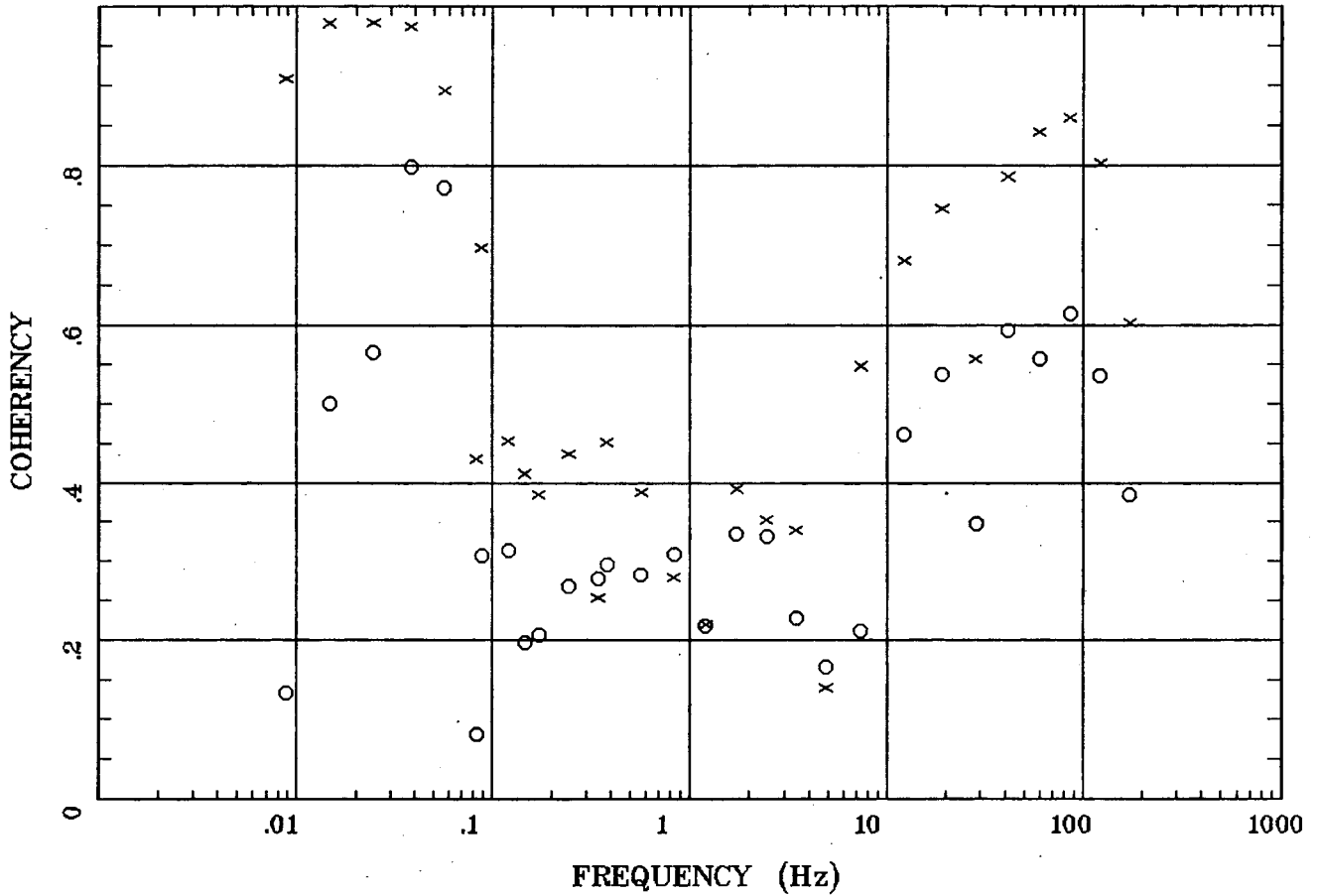


Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

Mid Valley RD

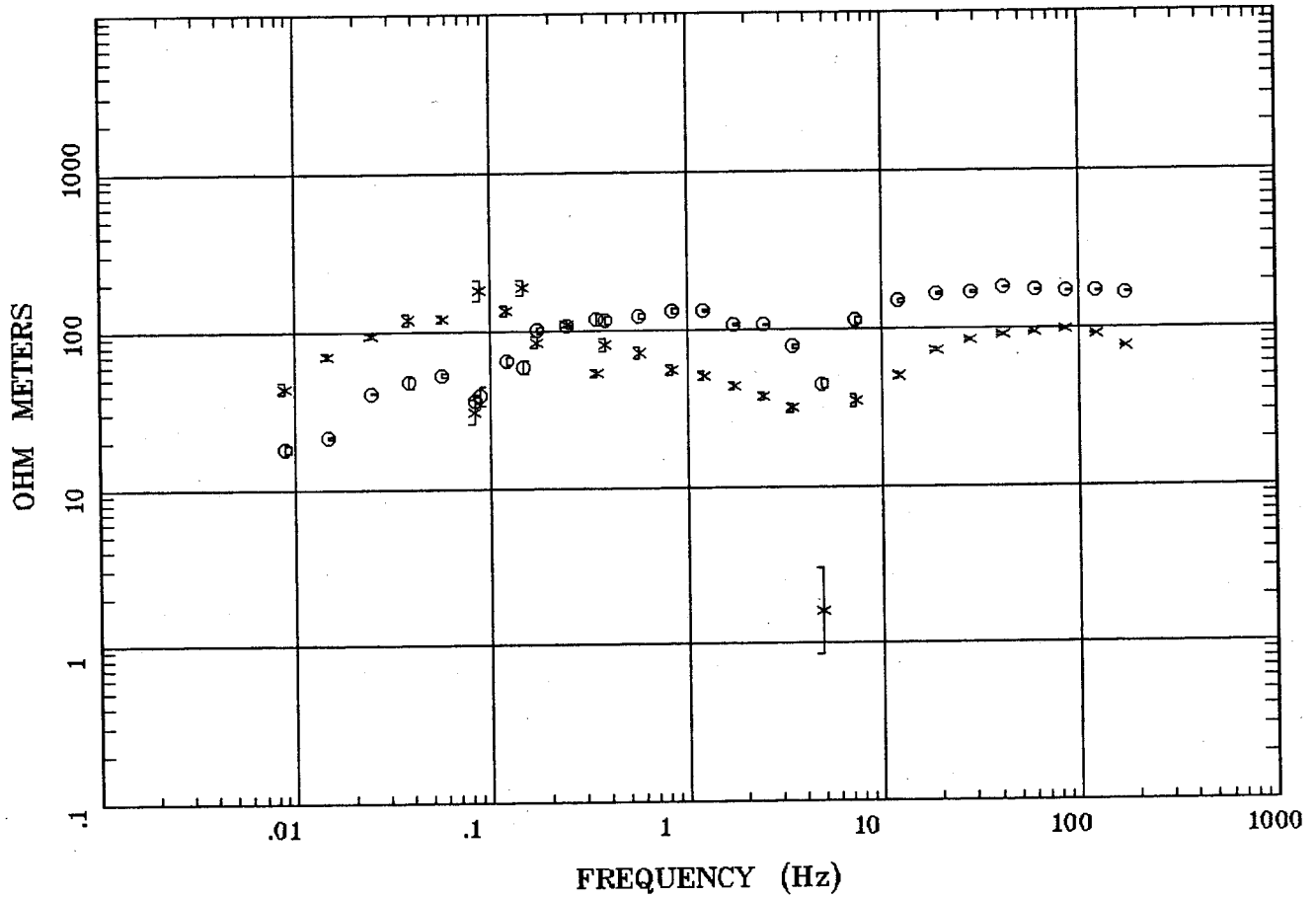


Client: Water Resources & DOD
Remote: none
Acquired: 06:3 Oct 13, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt55n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:57 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

Mid Valley RD seismic **Station 56**
line

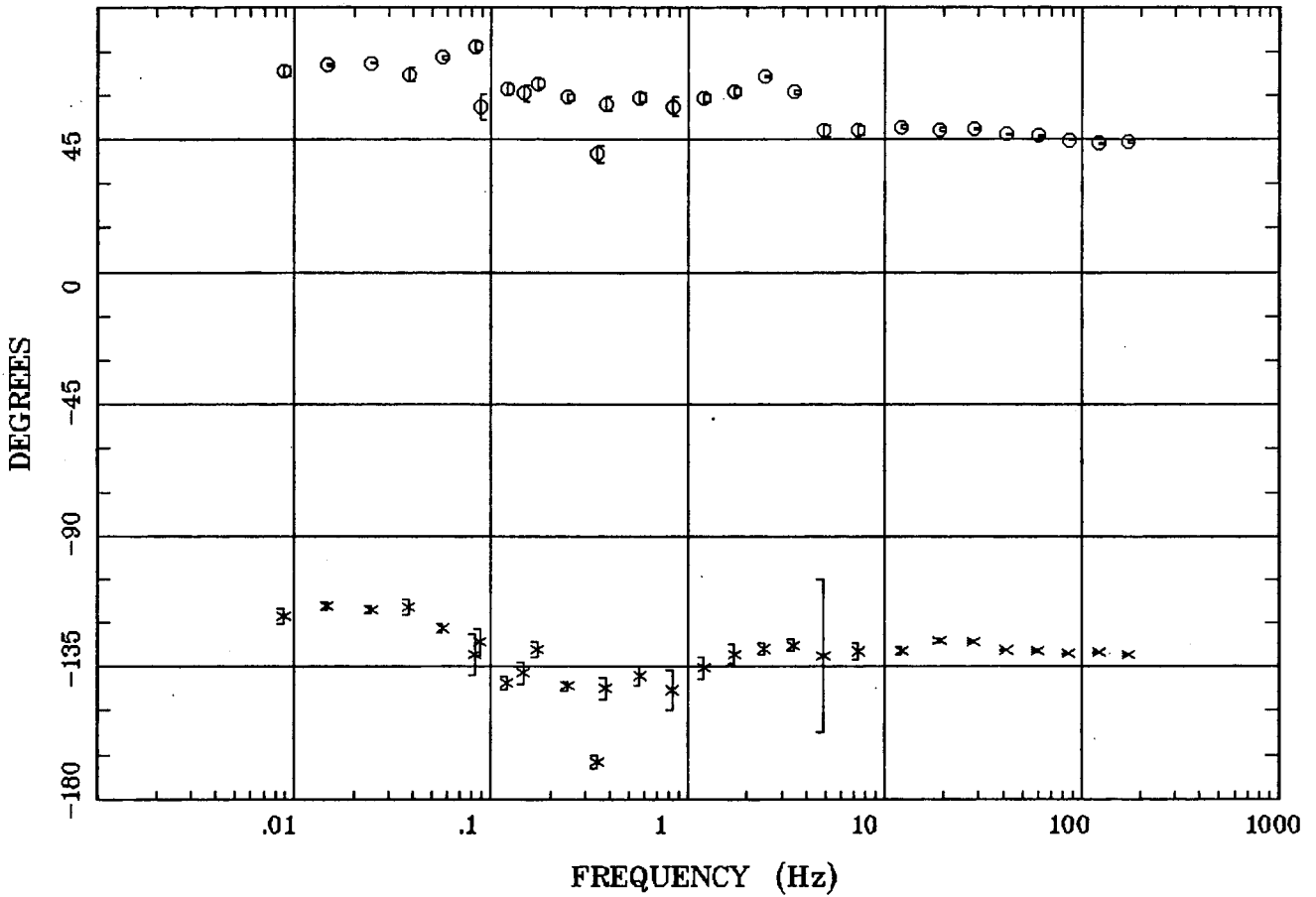


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

Mid Valley RD seismic line

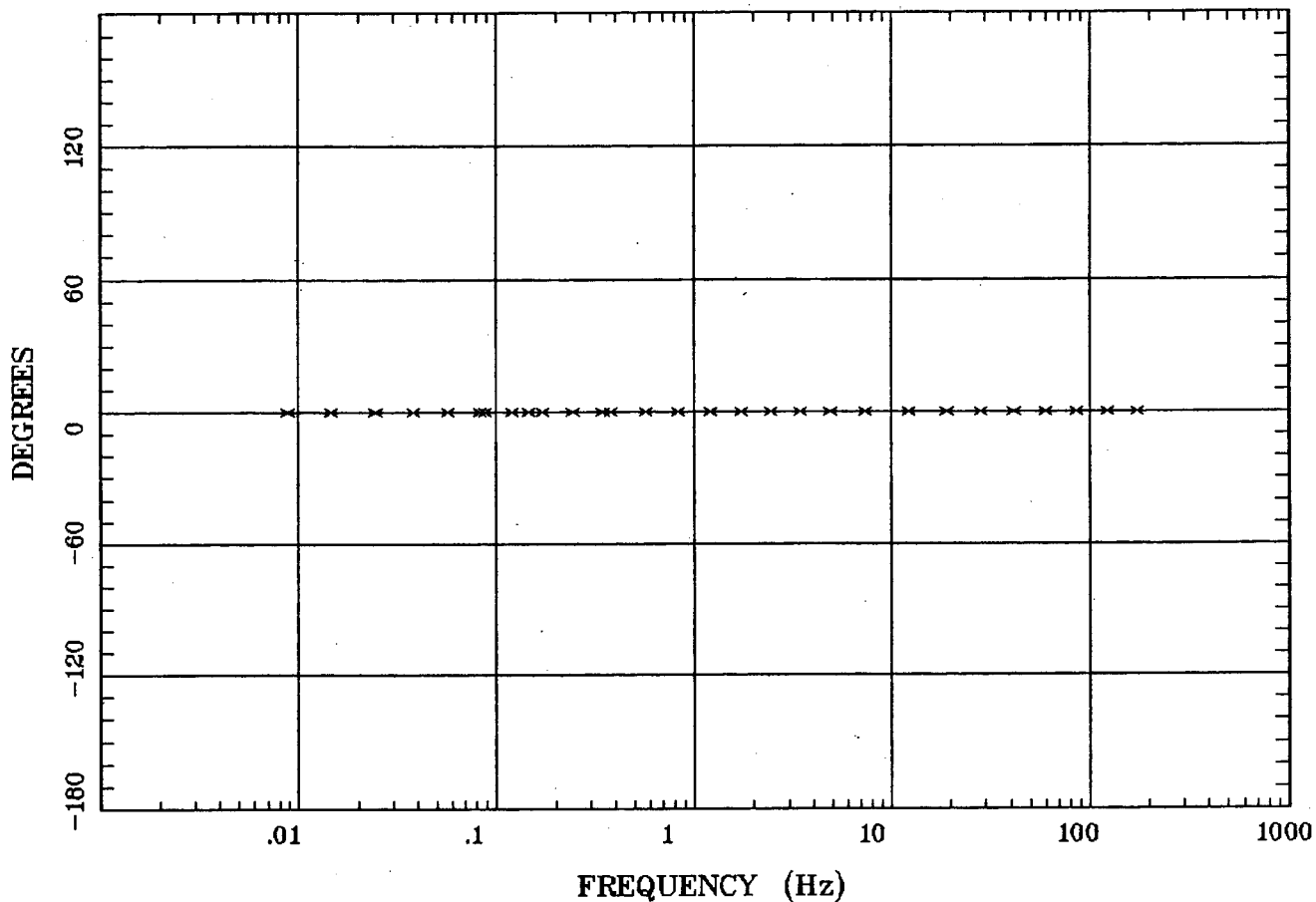


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

ROTATION ANGLE

Station 56
Mid Valley RD seismic line

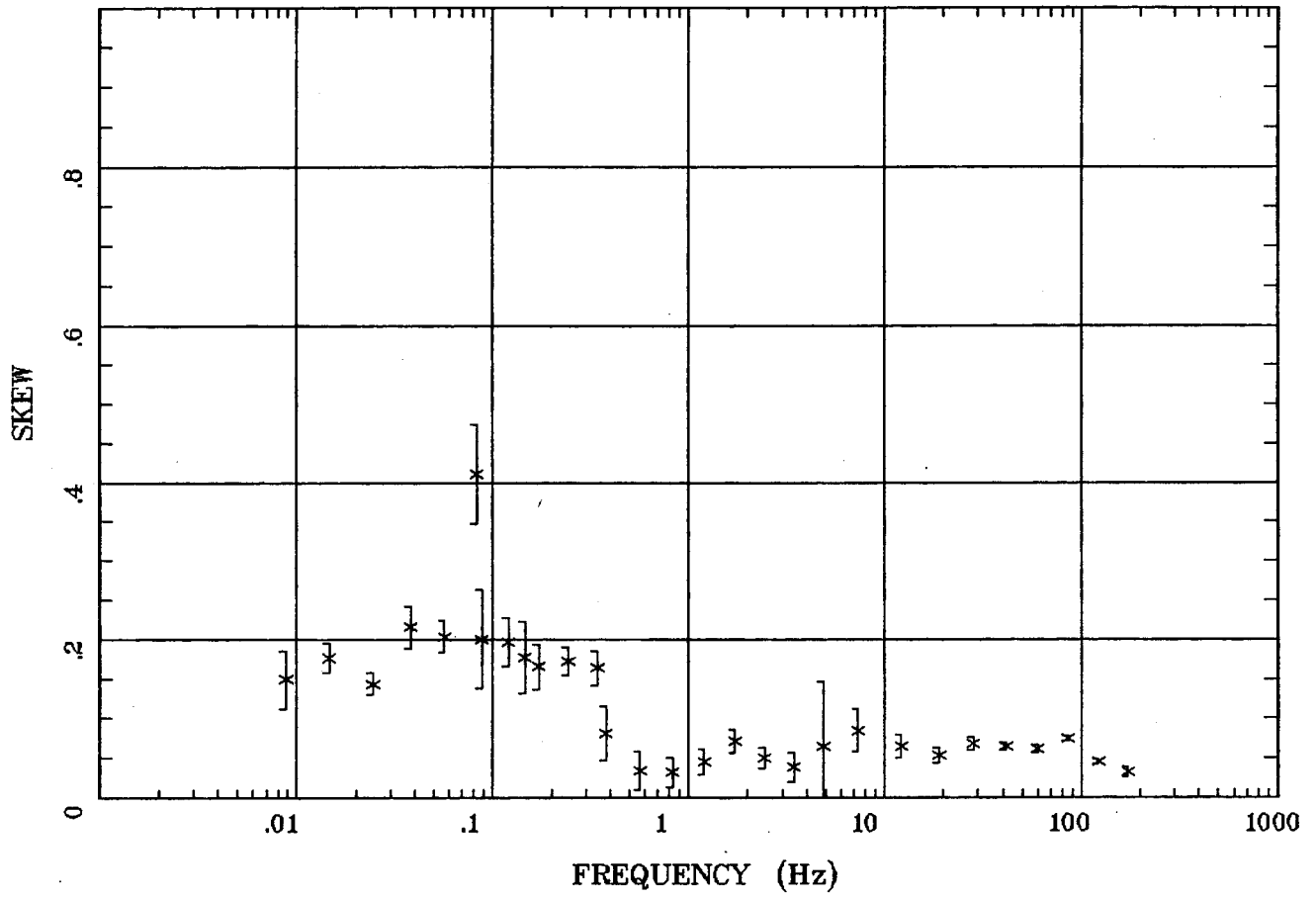


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

Mid Valley RD seismic line **Station 56**

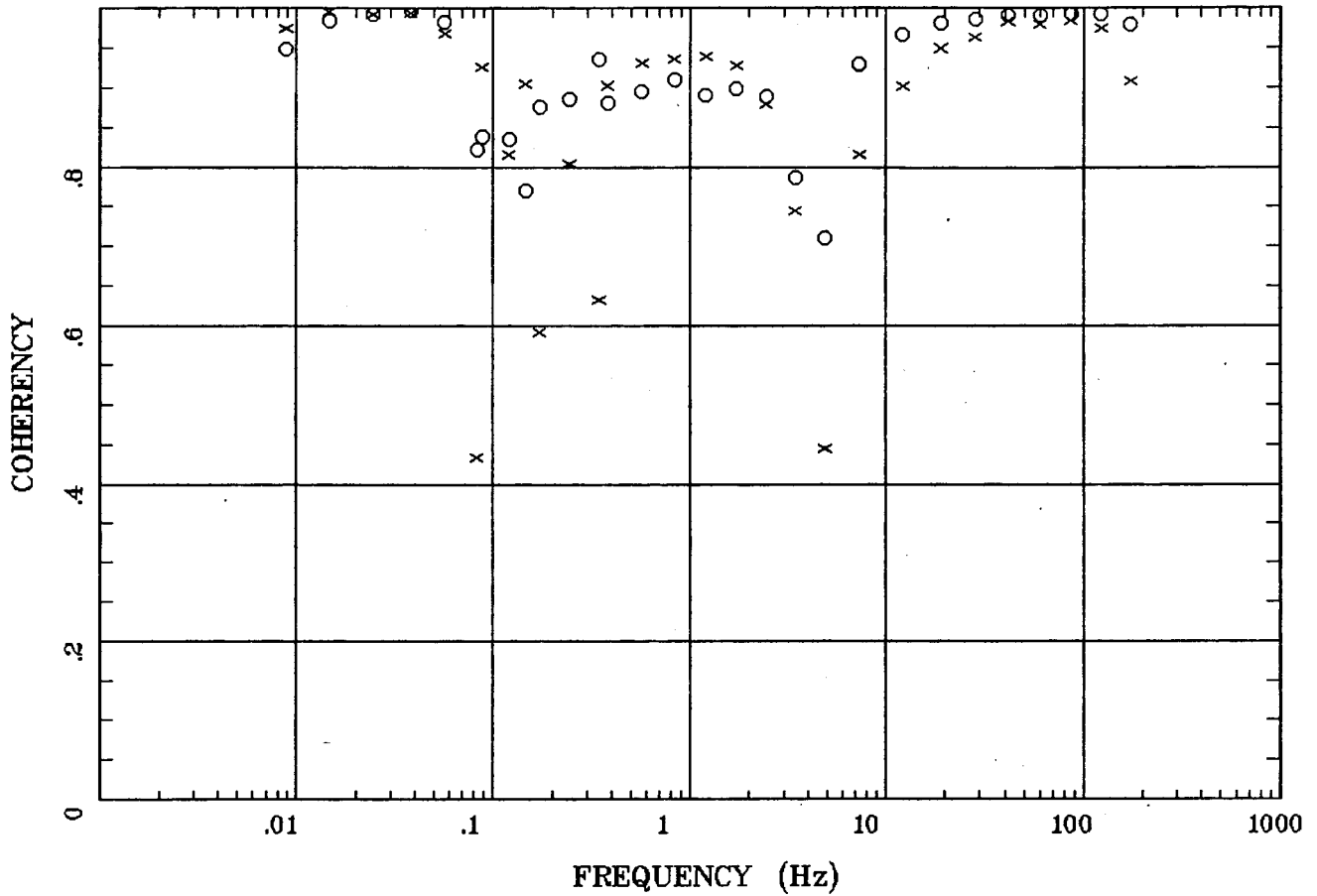


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Mid Valley RD seismic line **Station 56**

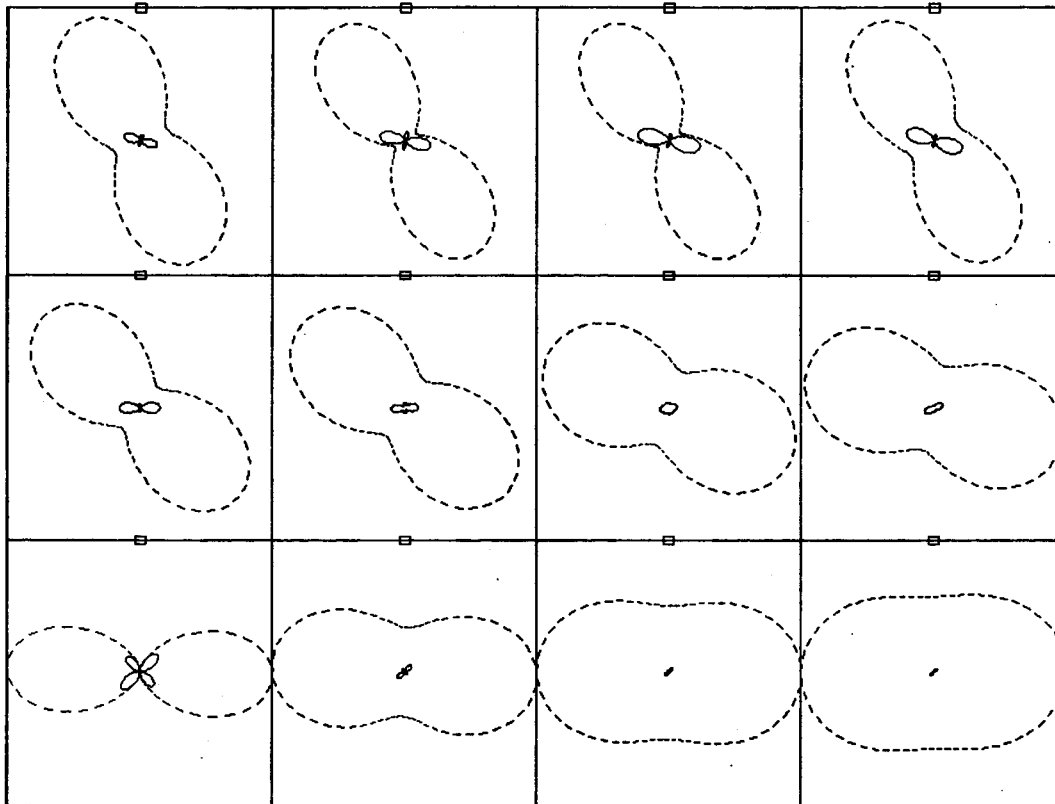


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Mid Valley RD seismic line



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

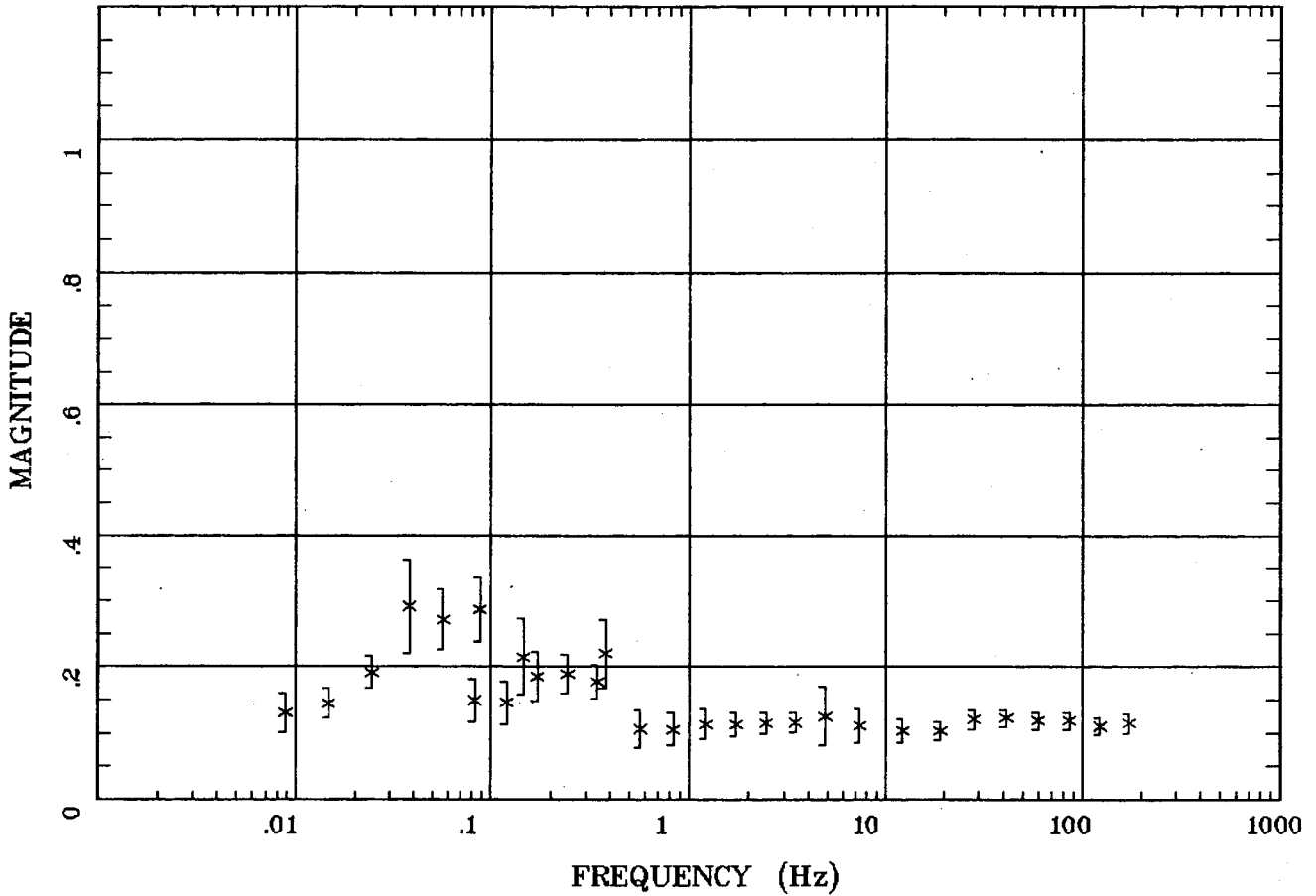
Rotation:

Client: Water Resources & DOD
 Remote: none
 Acquired: 04:4 Oct 14, 2005
 Survey Co:US Geological Survey

Filename: nt56n.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 09:58 Feb 02, 2006
 < EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

Mid Valley RD seismic line **Station 56**

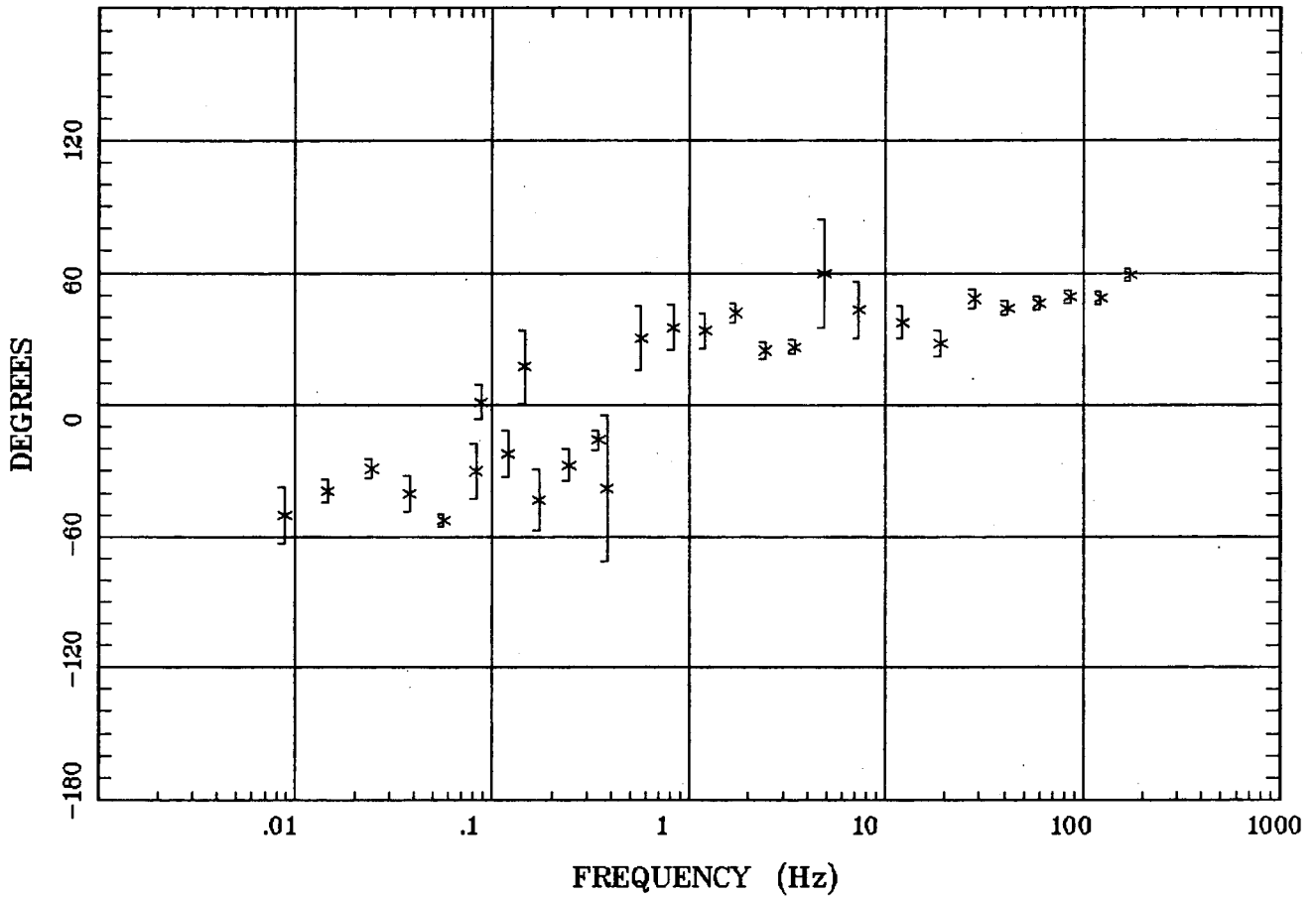


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Mid Valley RD seismic line **Station 56**

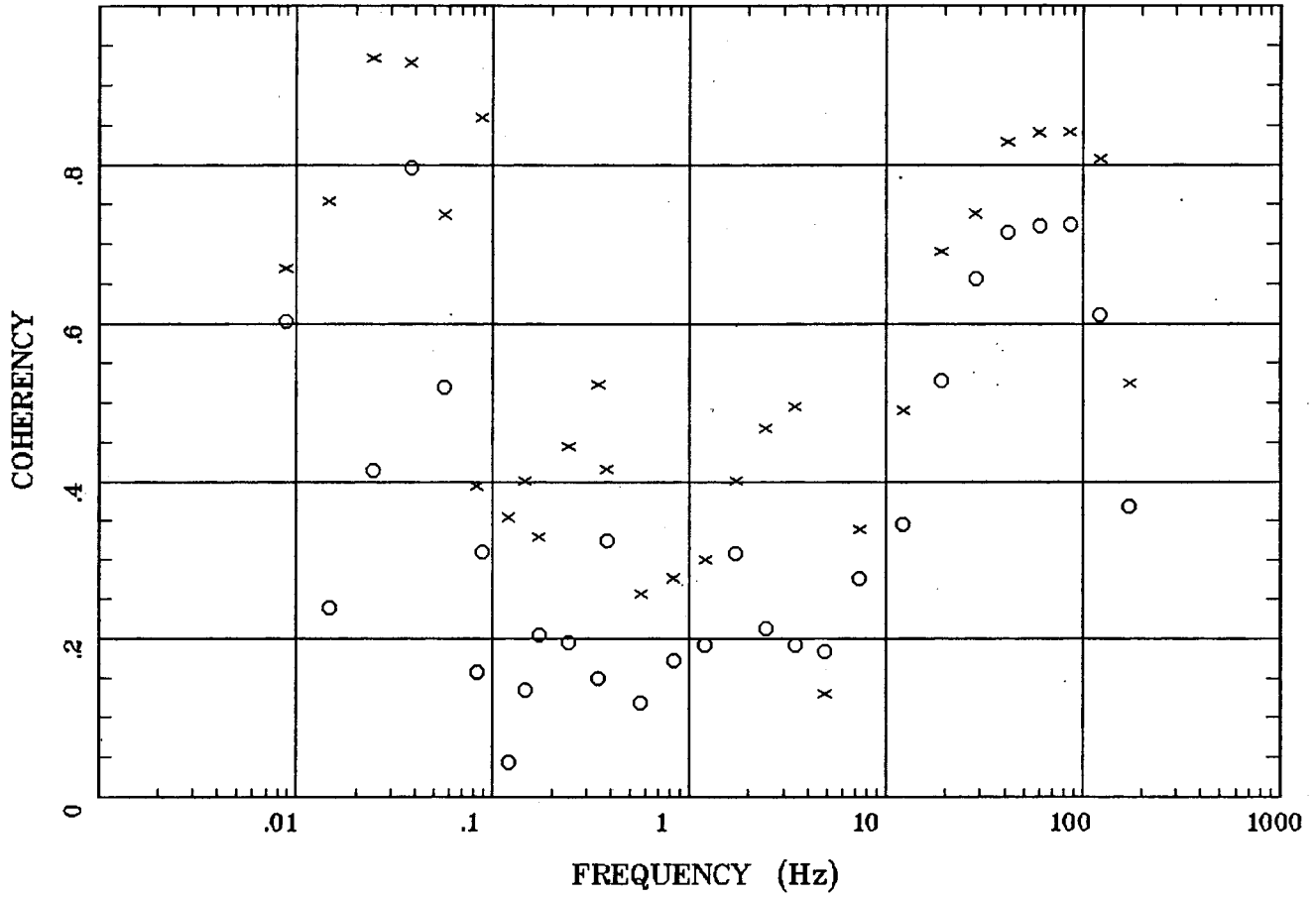


Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

Mid Valley RD seismic line **Station 56**



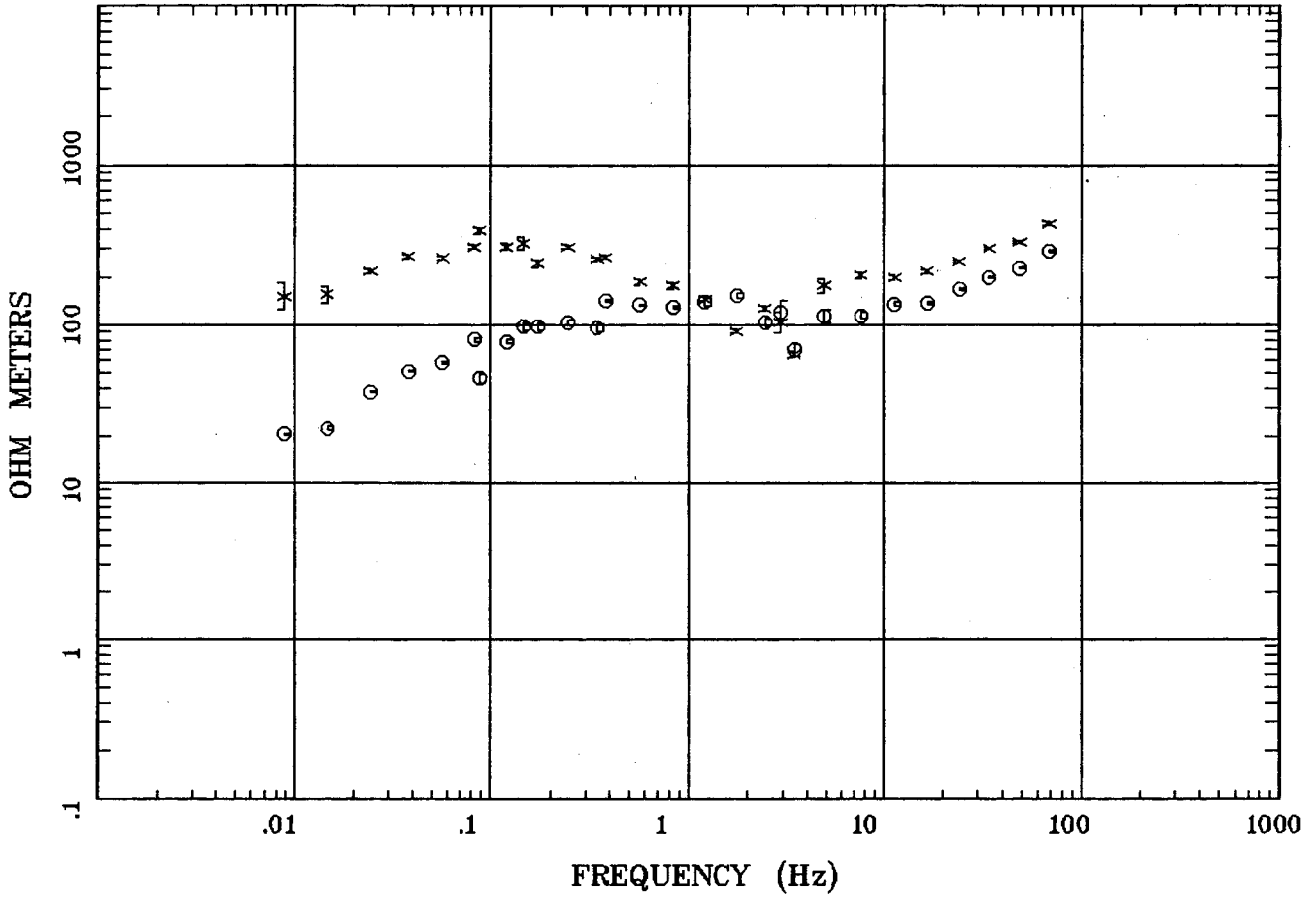
Client: Water Resources & DOD
Remote: none
Acquired: 04:4 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt56n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:58 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

Station 57

APPARENT RESISTIVITY

End of 6-04 Rd



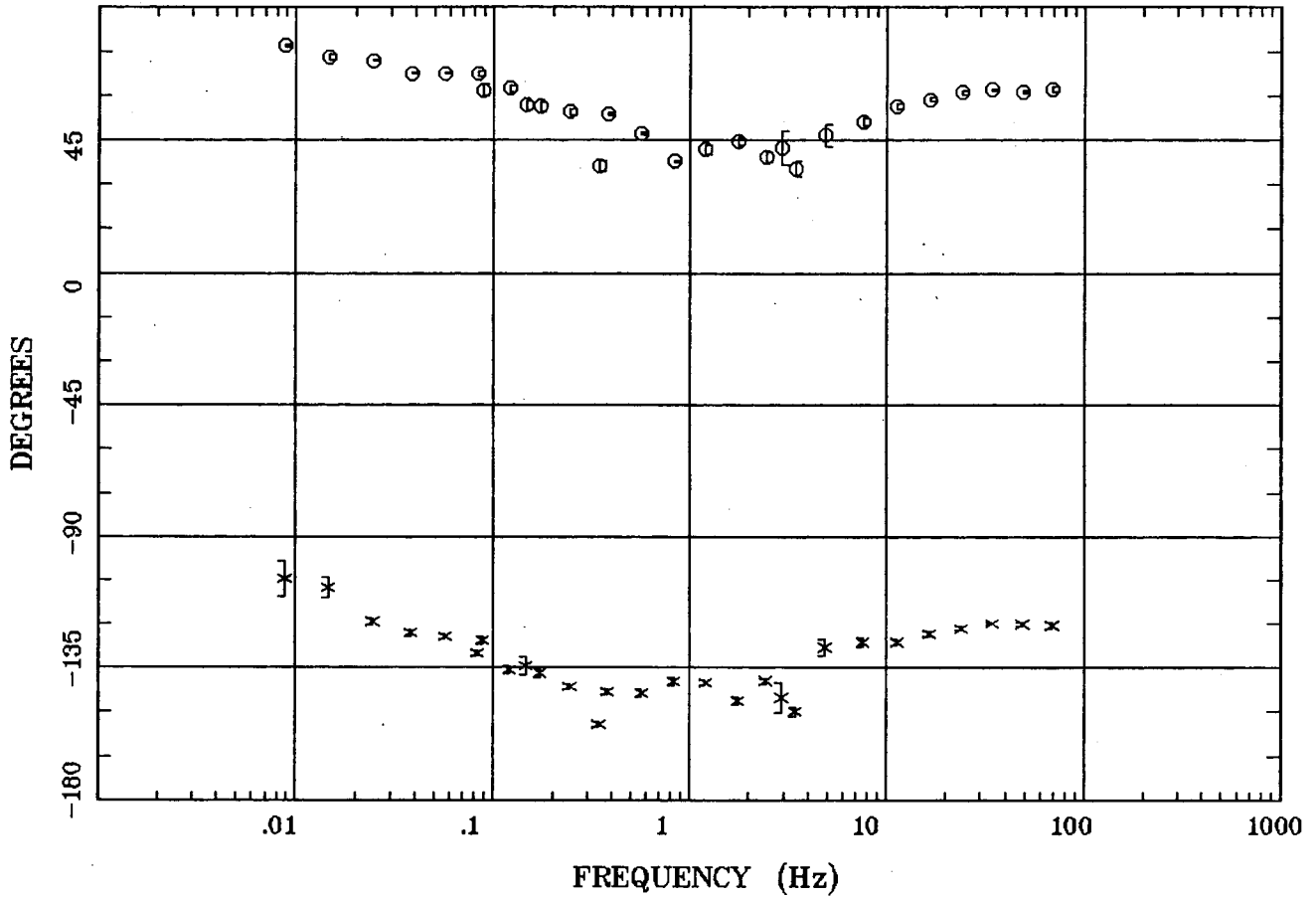
Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

End of 6-04 Rd

Station 57



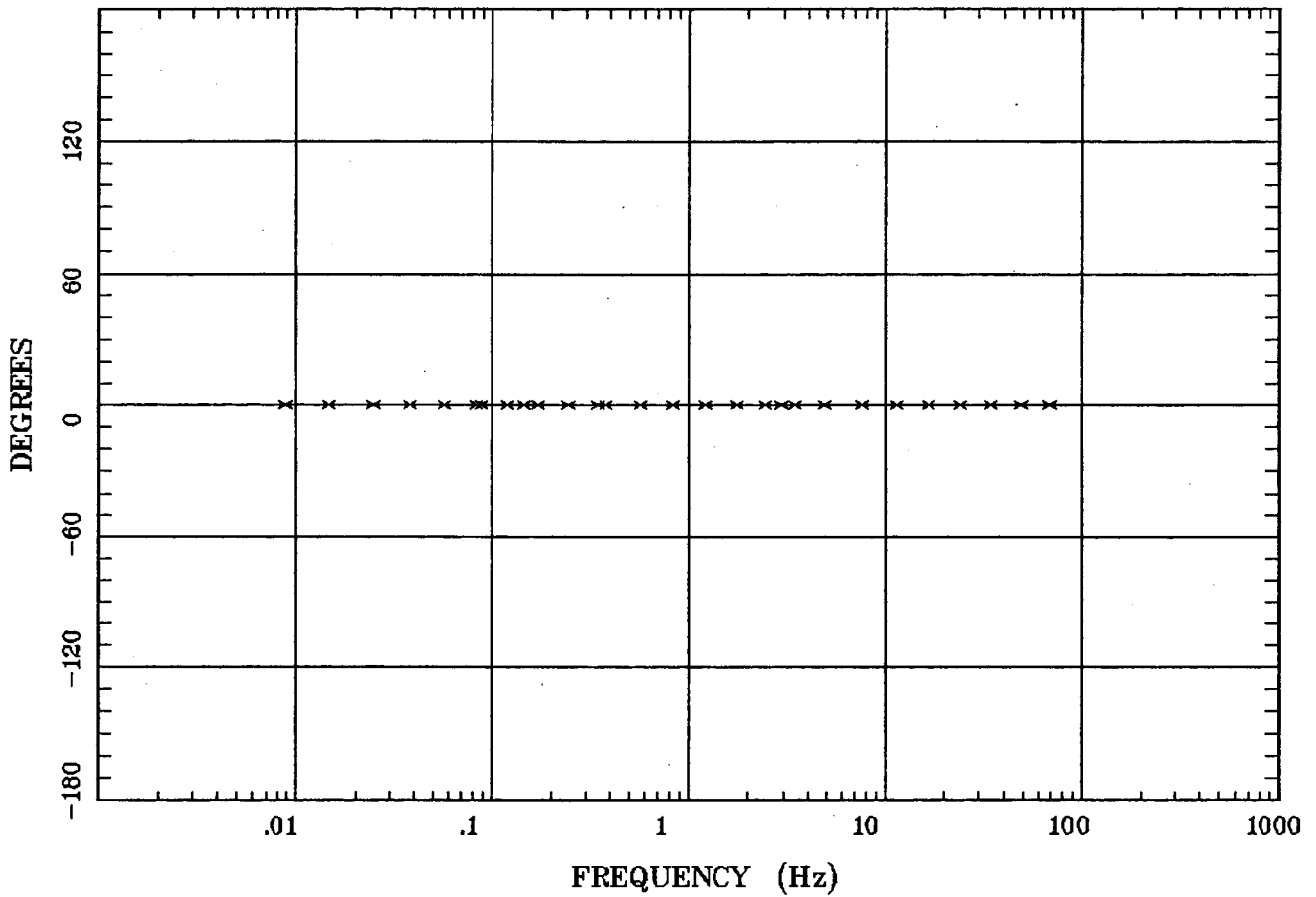
Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

ROTATION ANGLE

End of 6-04 Rd

Station 57



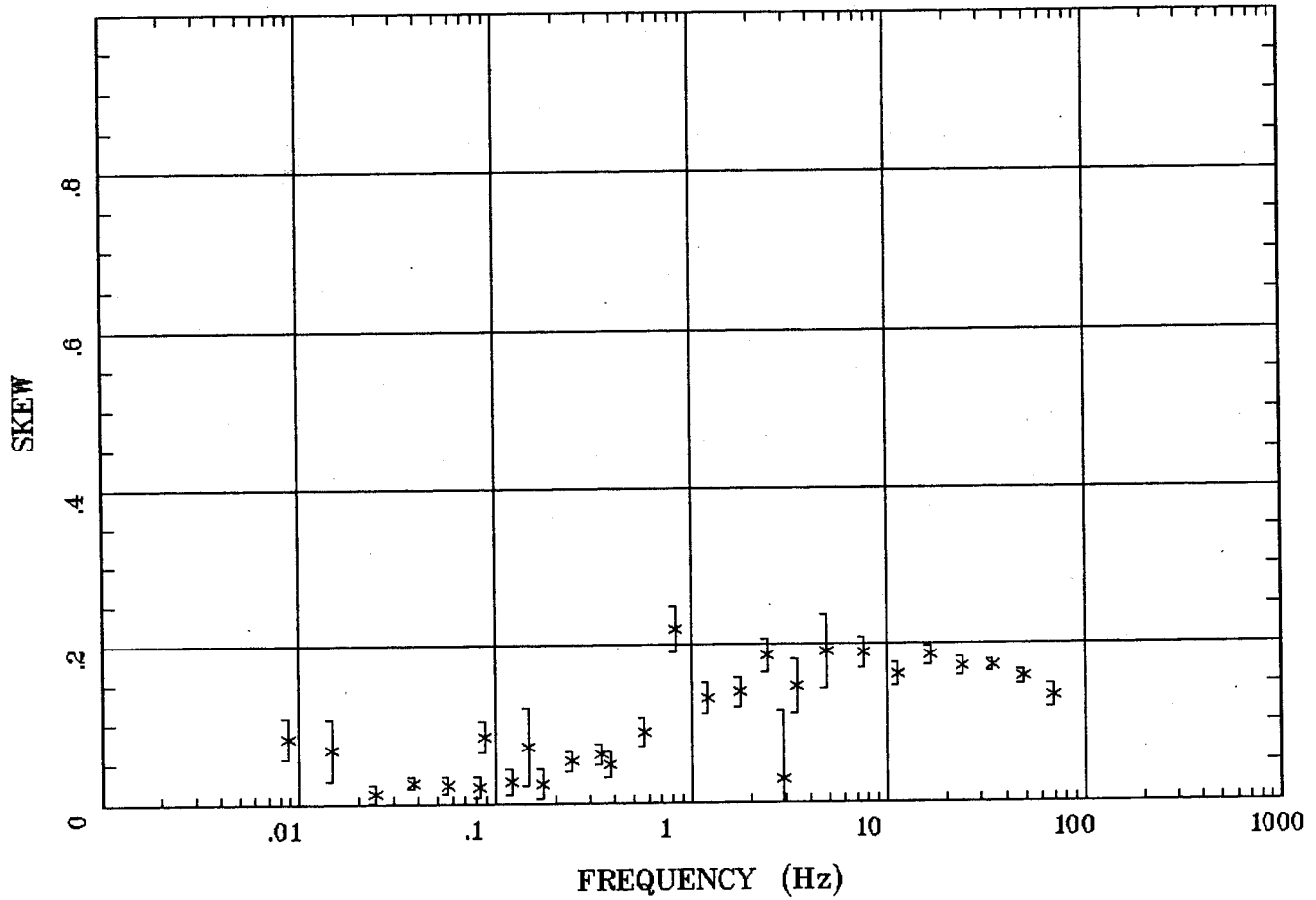
Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

End of 6-04 Rd

Station 57

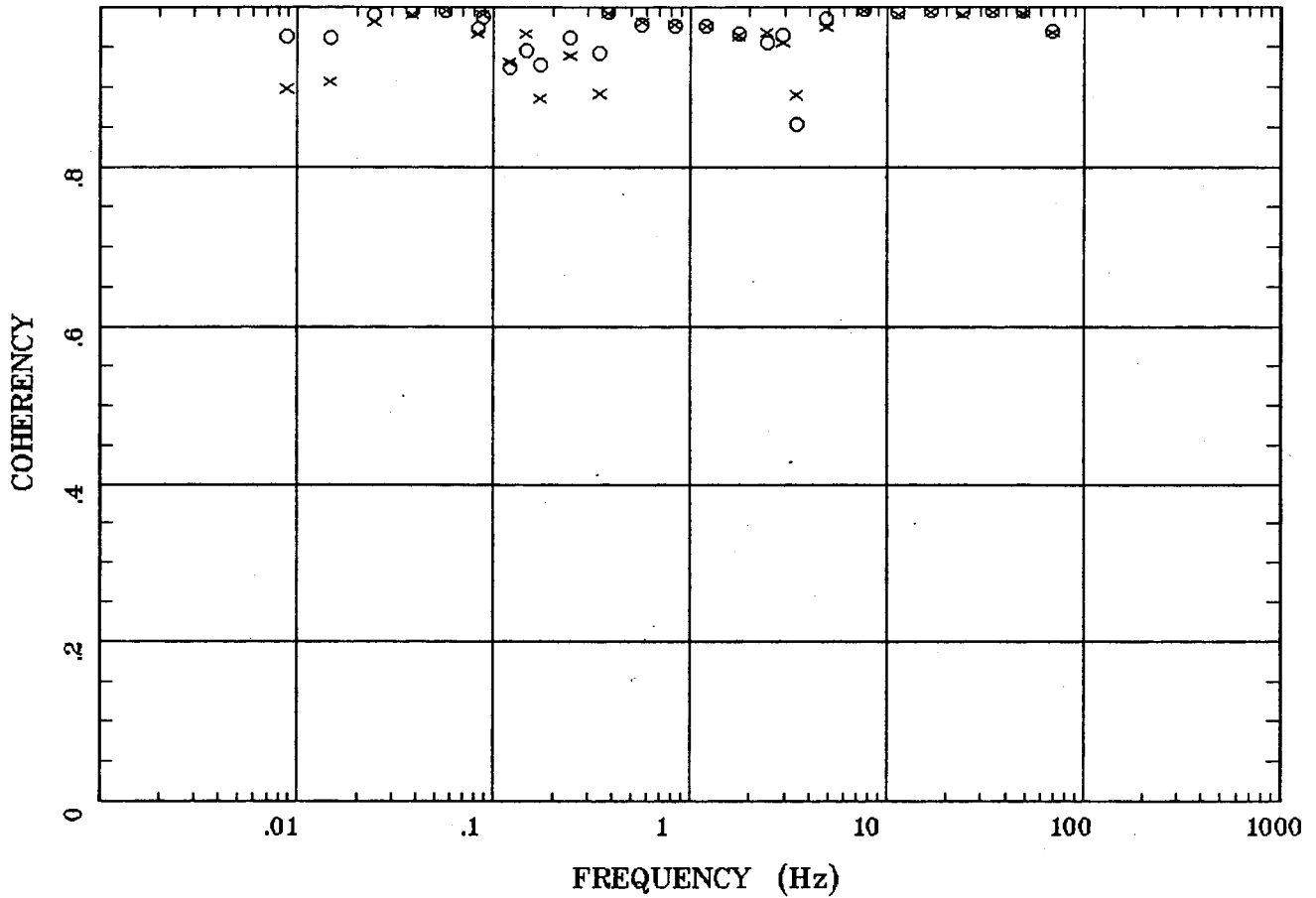


Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

End of 6-04 Rd



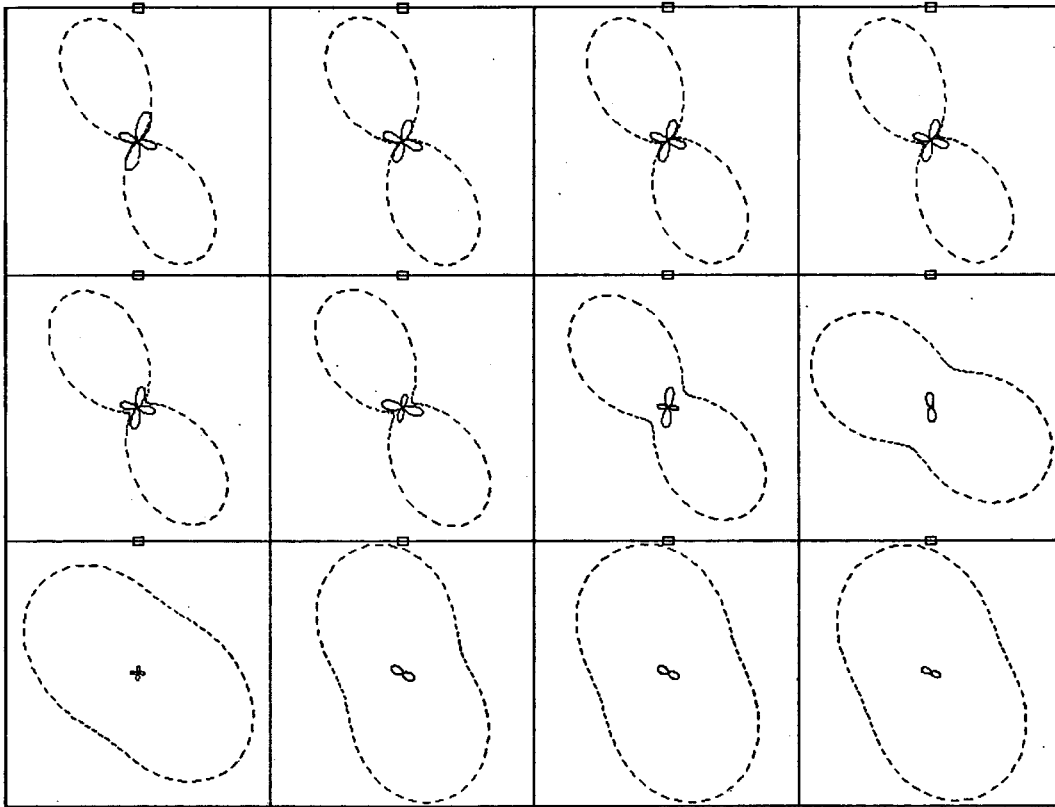
Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

End of 6-04 Rd

Station 57



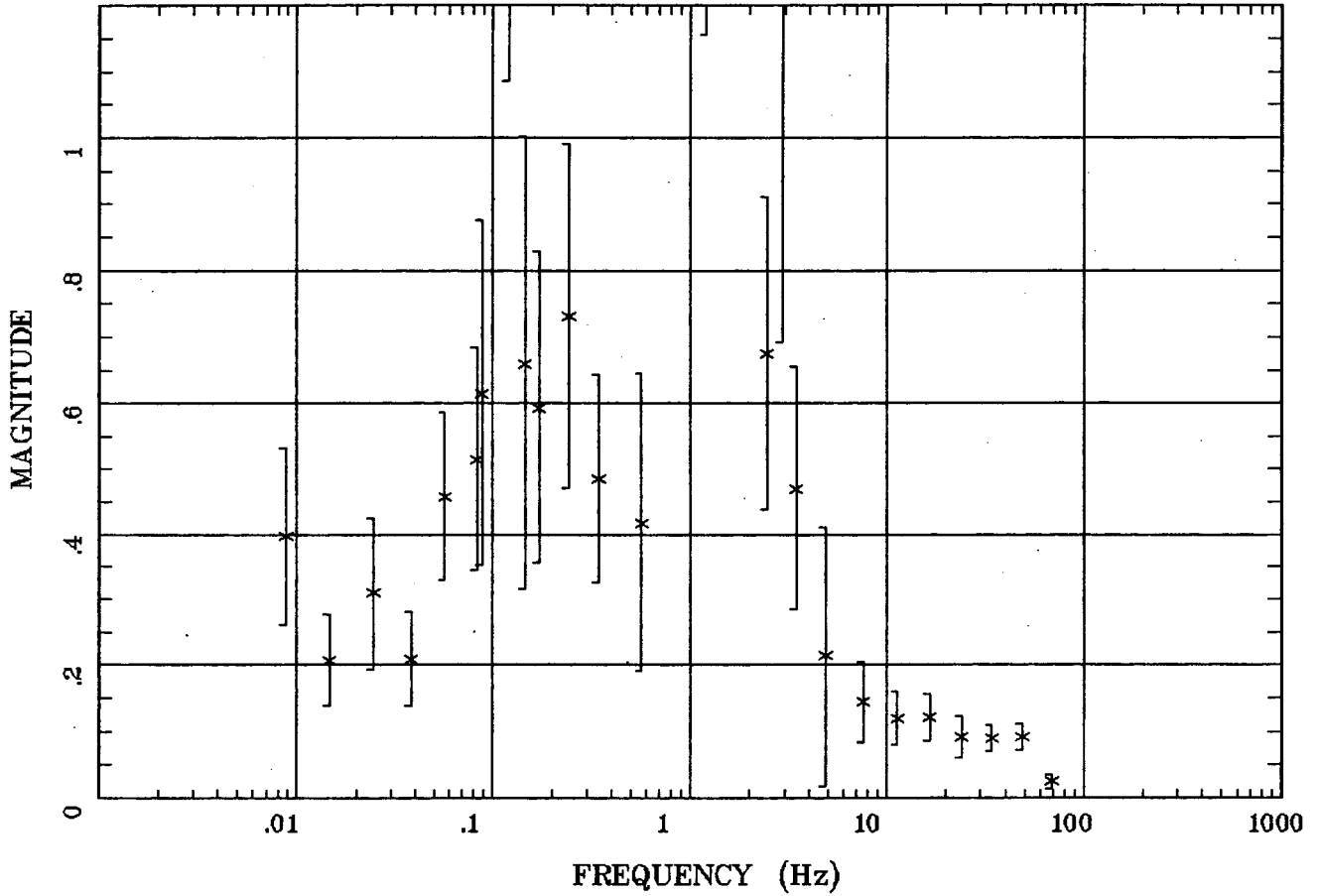
.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.345 Hz	.566 Hz	1.758 Hz
2.930 Hz	7.617 Hz	16.602 Hz	34.375 Hz

Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

End of 6-04 Rd



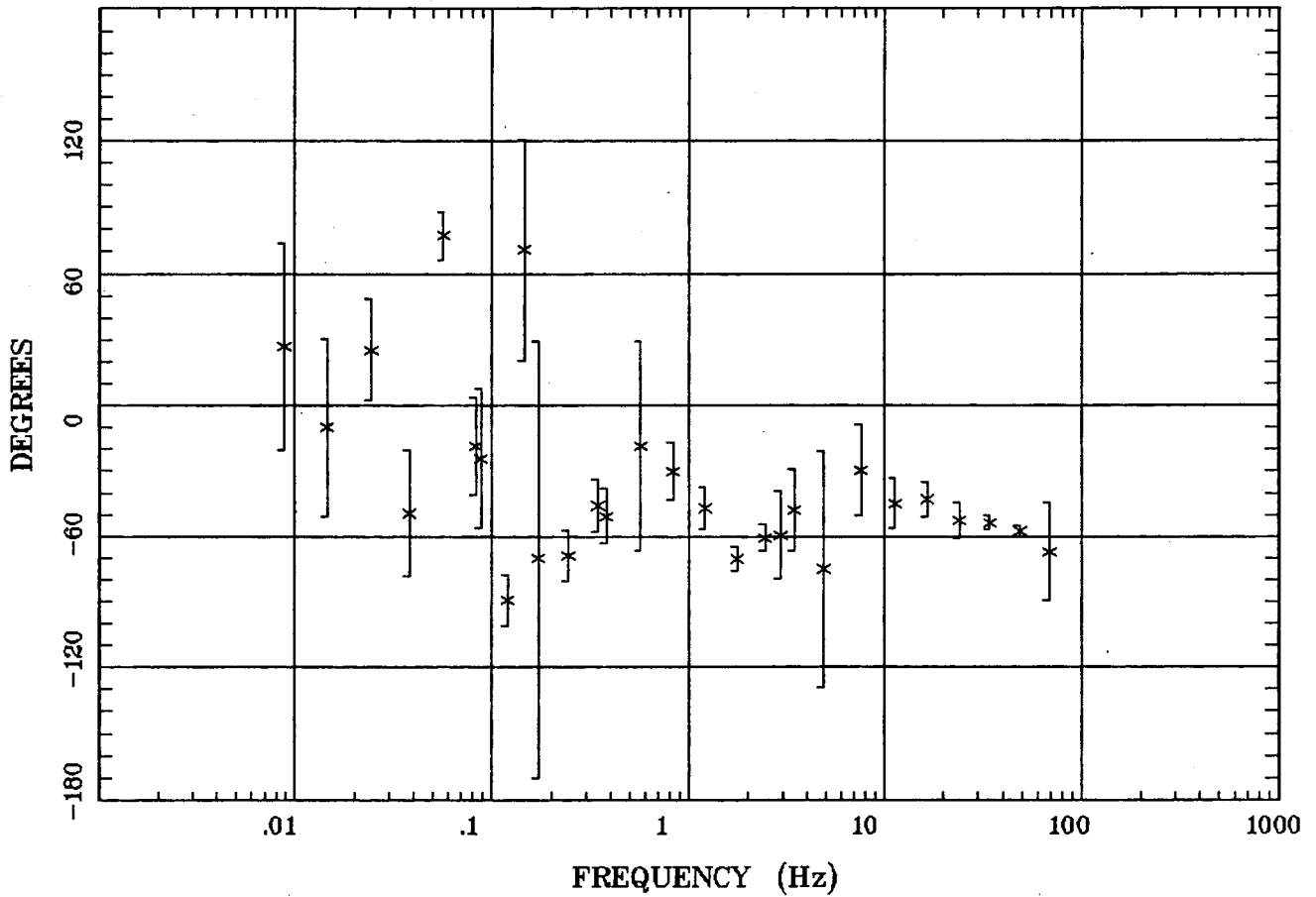
Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

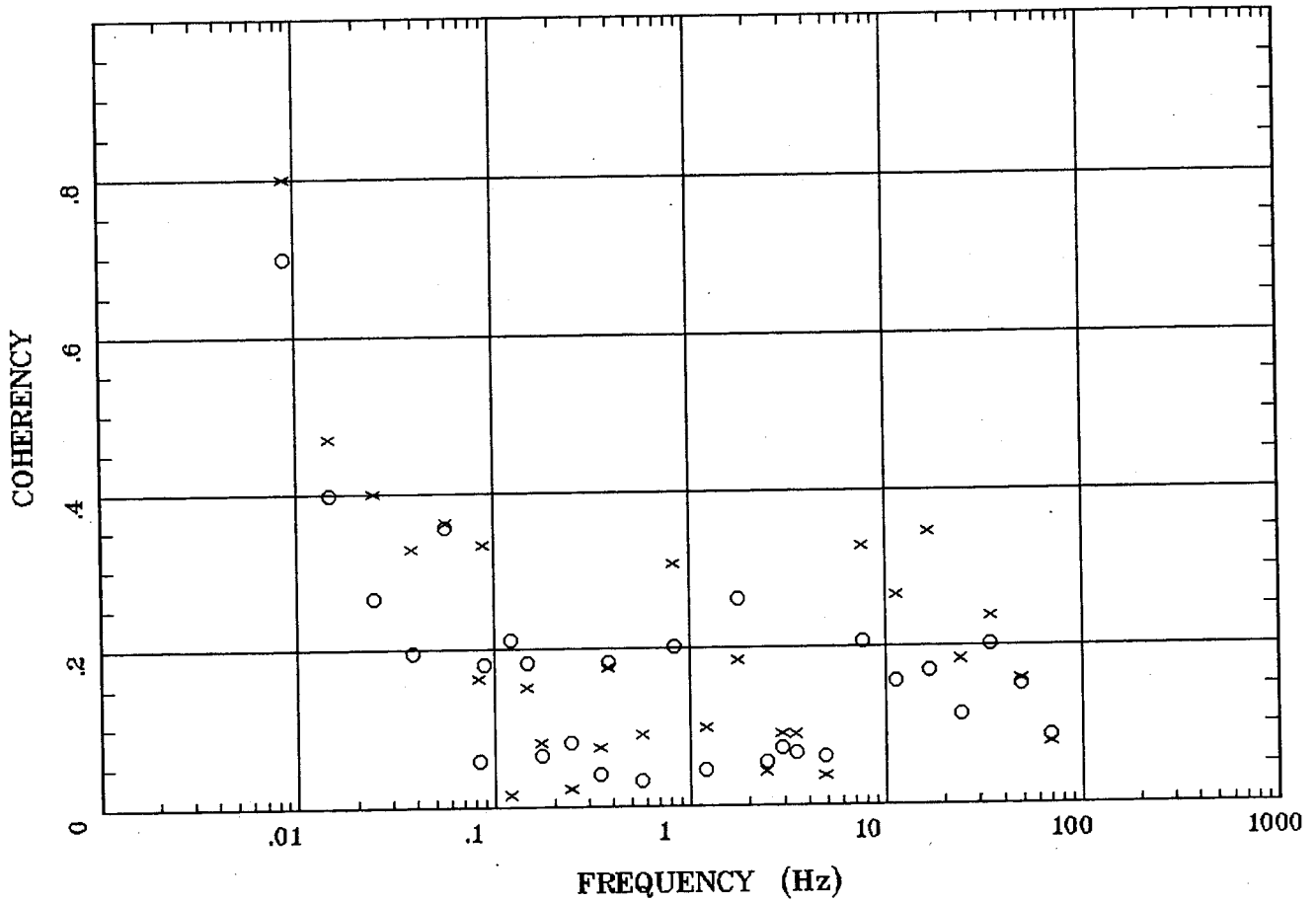
End of 6-04 Rd

Station 57



Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

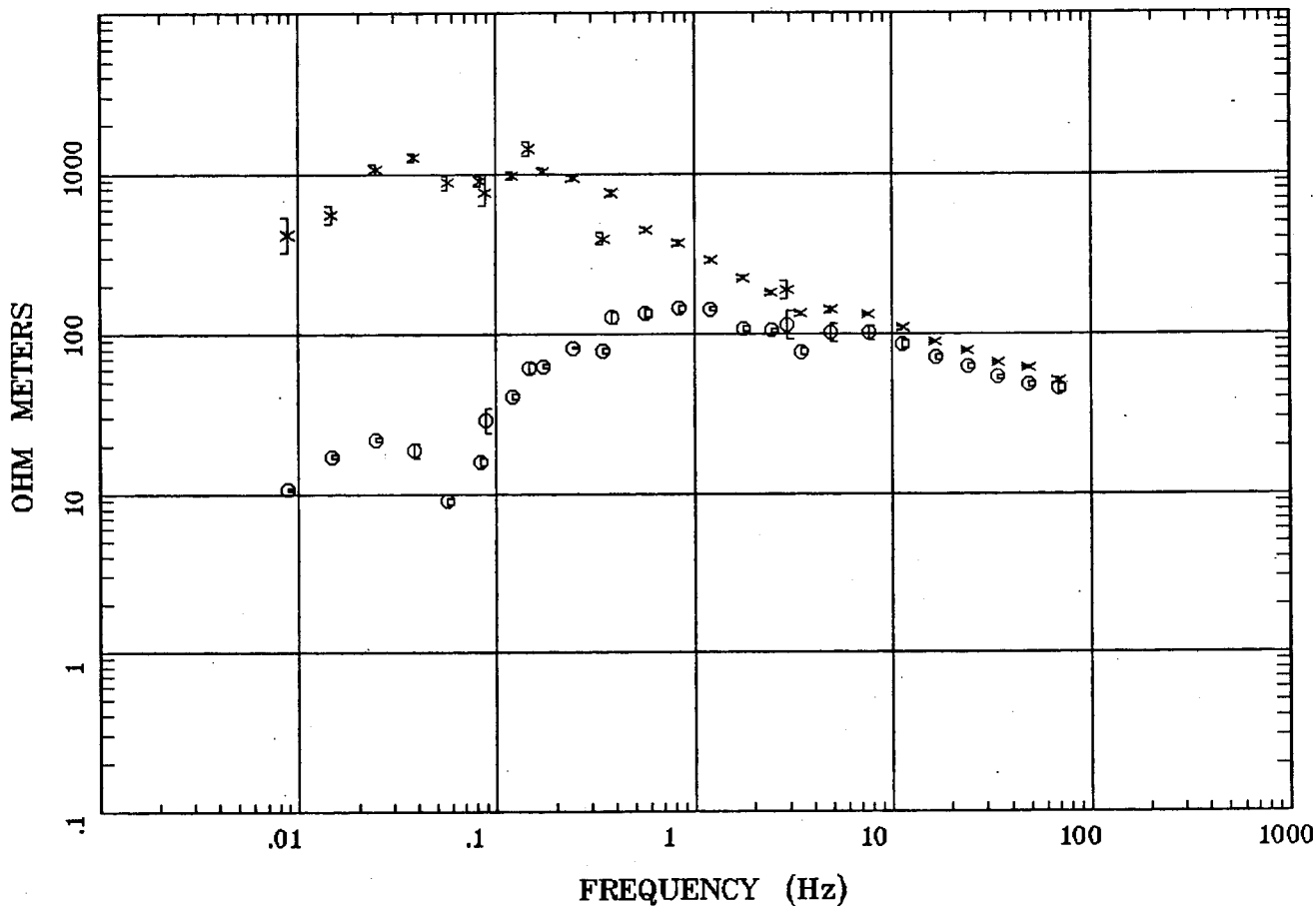


Client: Water Resources & DOD
Remote: none
Acquired: 08:5 Oct 16, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt57n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:42 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

Station 58
Saddle Mtn rd near Mid Valley

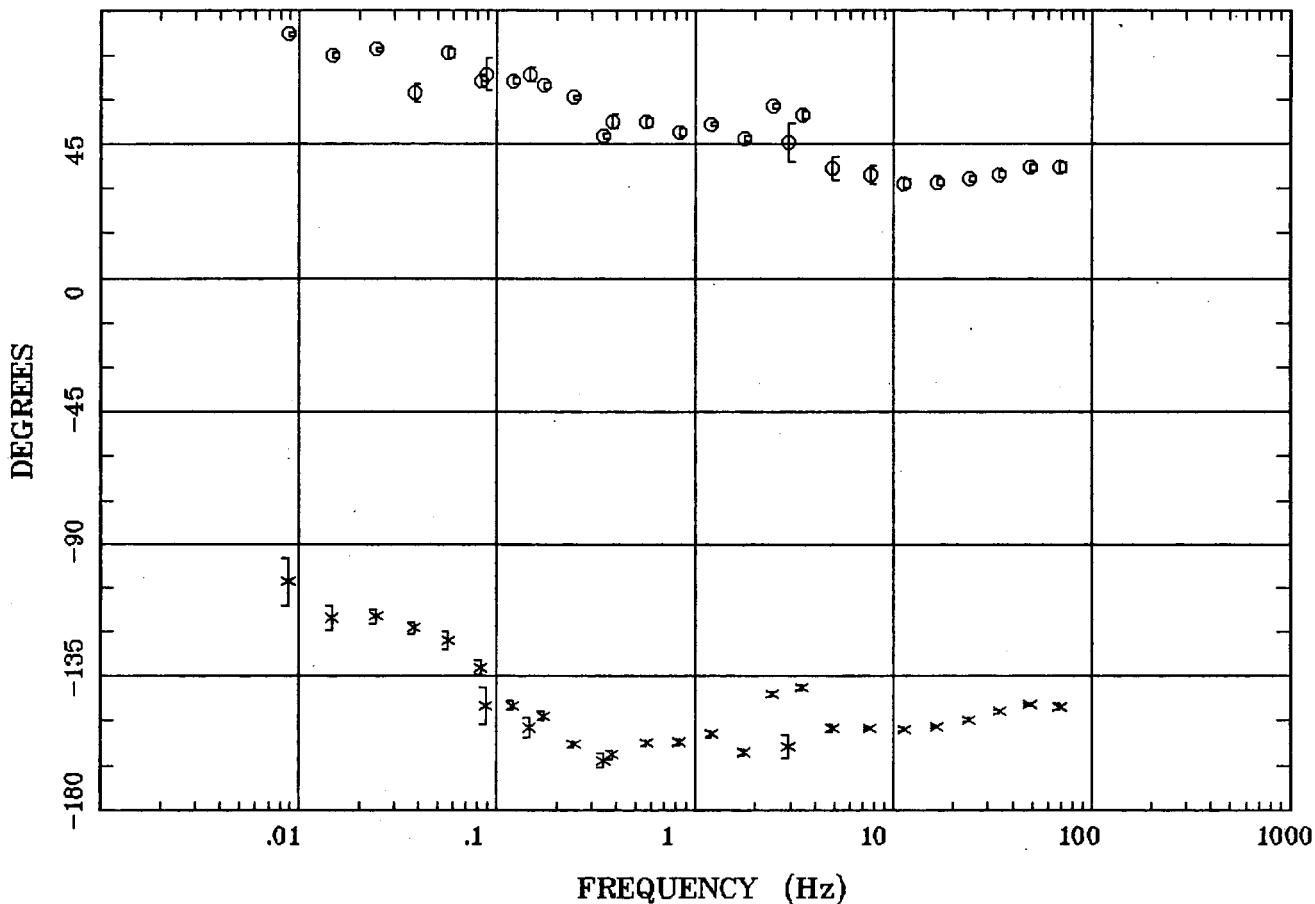


Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

Saddle Mtn rd near Mid Valley **Station 58**



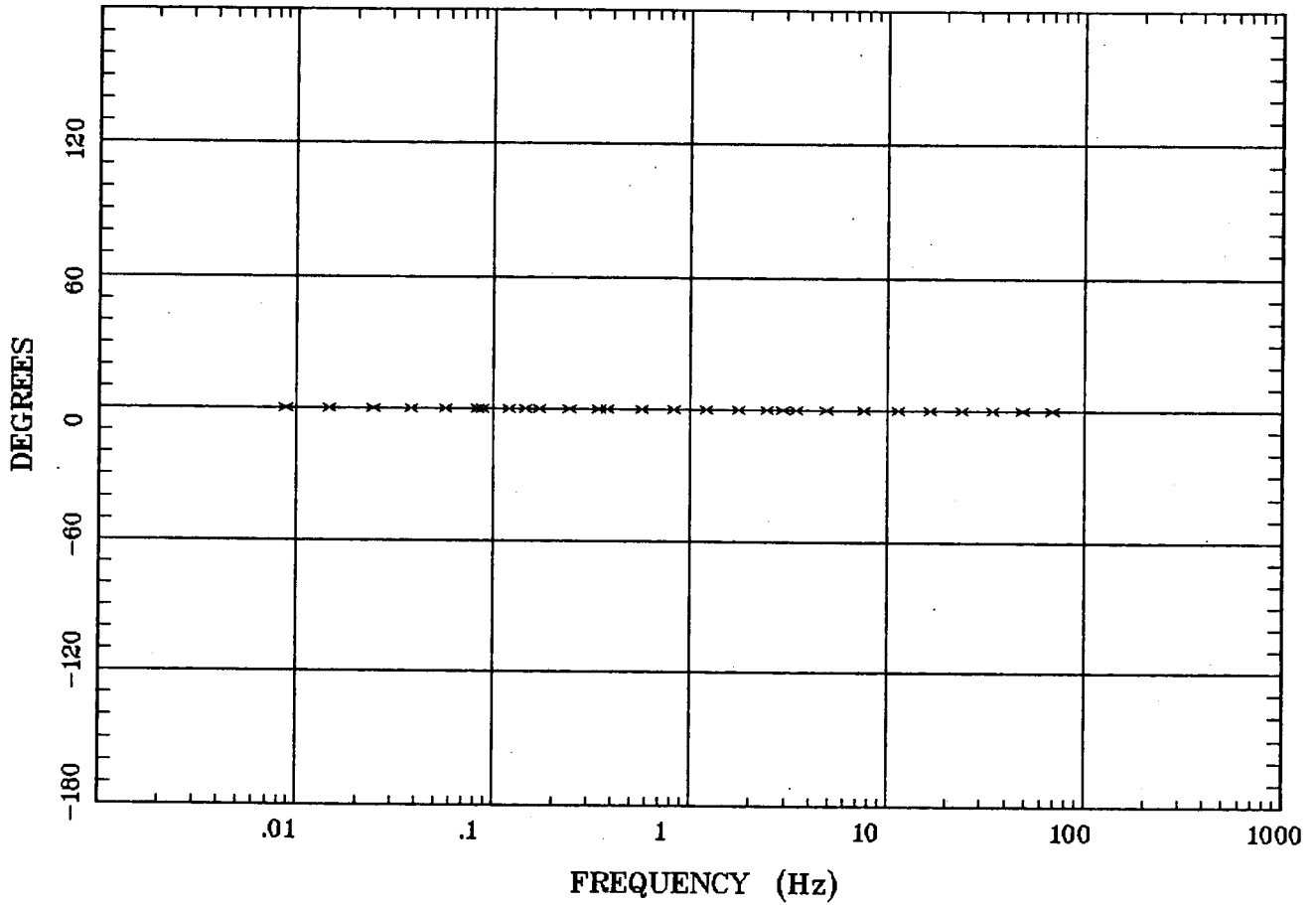
Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

Station 58

ROTATION ANGLE

Saddle Mtn rd near Mid Valley



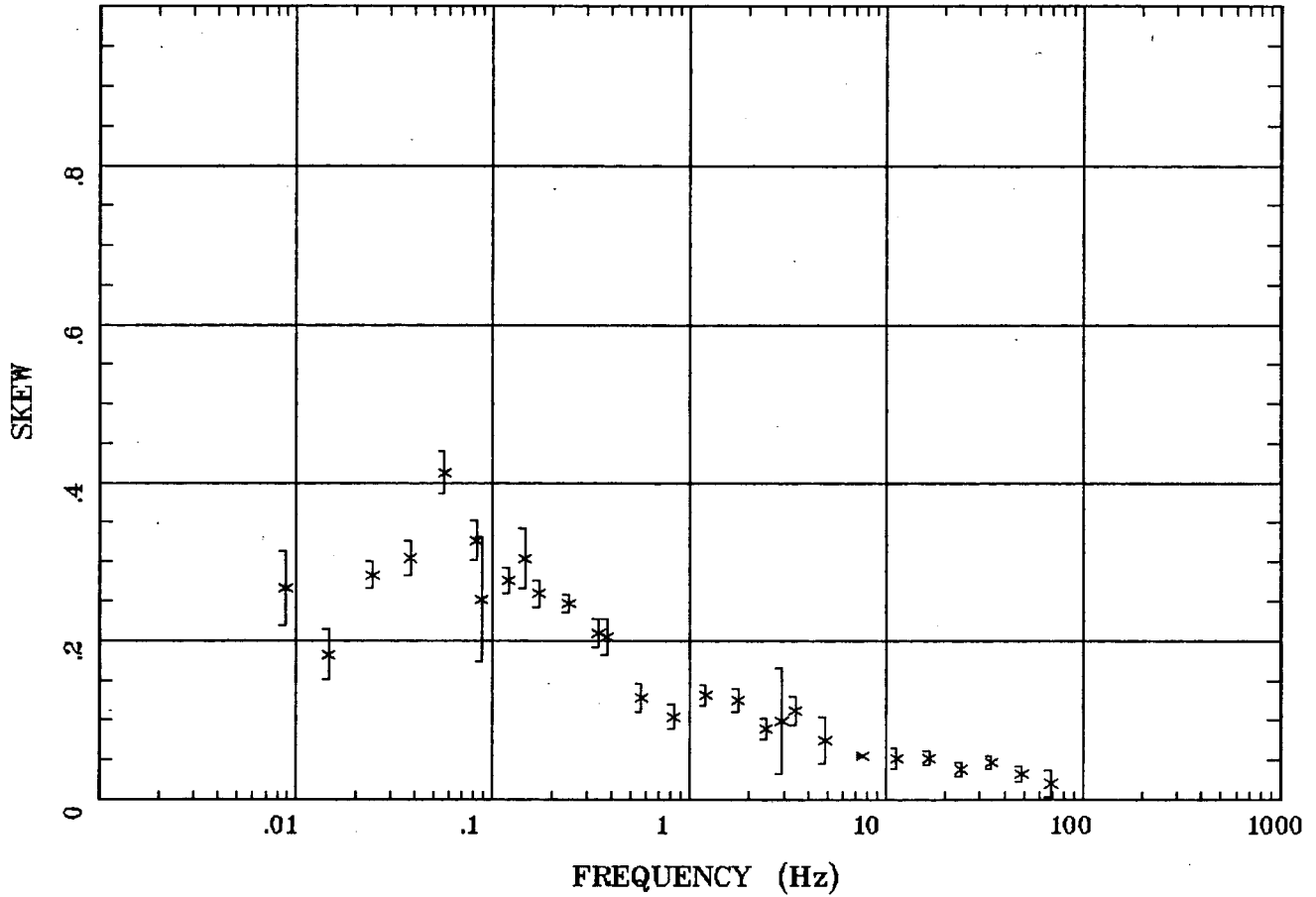
Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

Station 58

IMPEDANCE SKEW

Saddle Mtn rd near Mid Valley

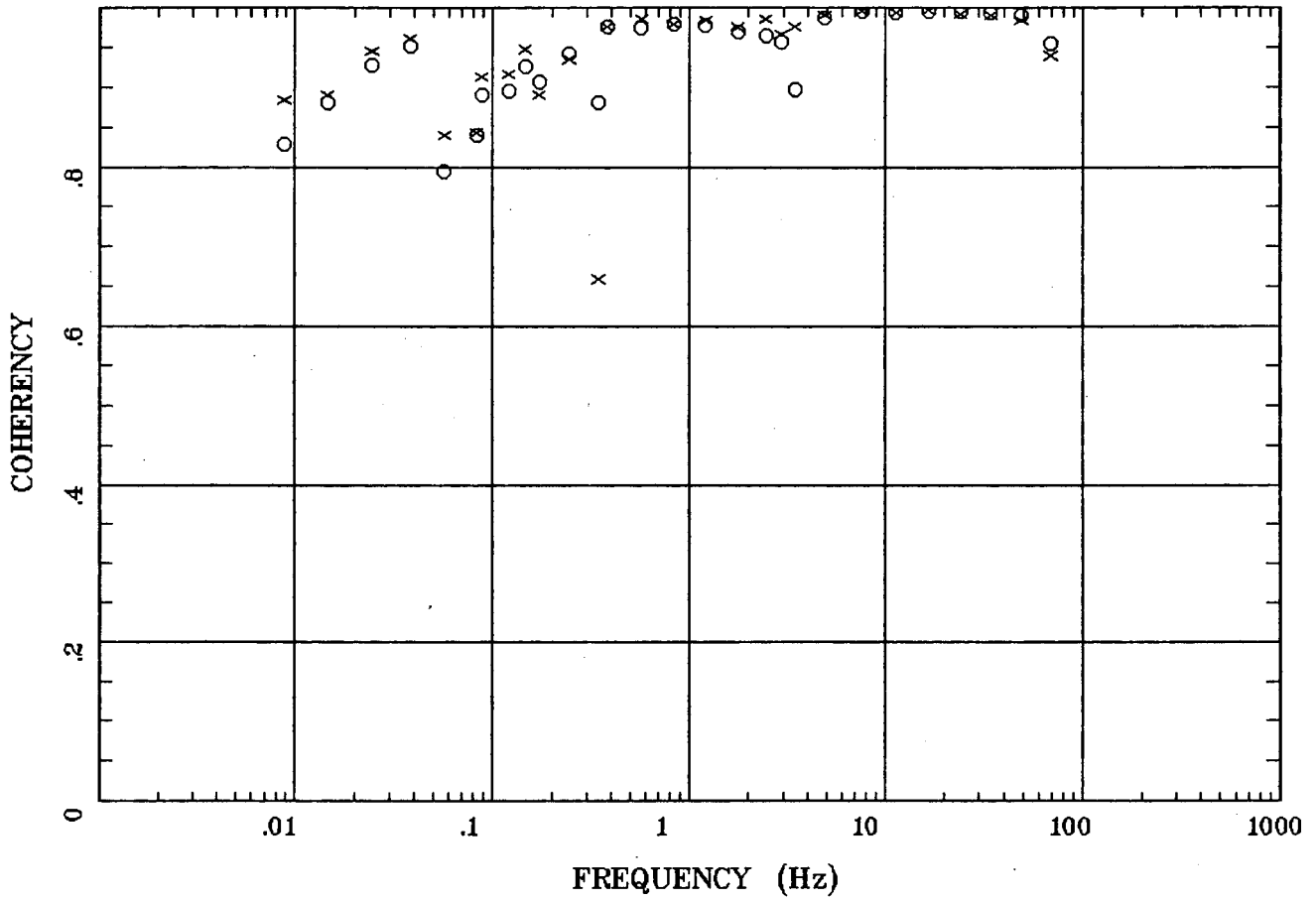


Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Station 58
Saddle Mtn rd near Mid Valley

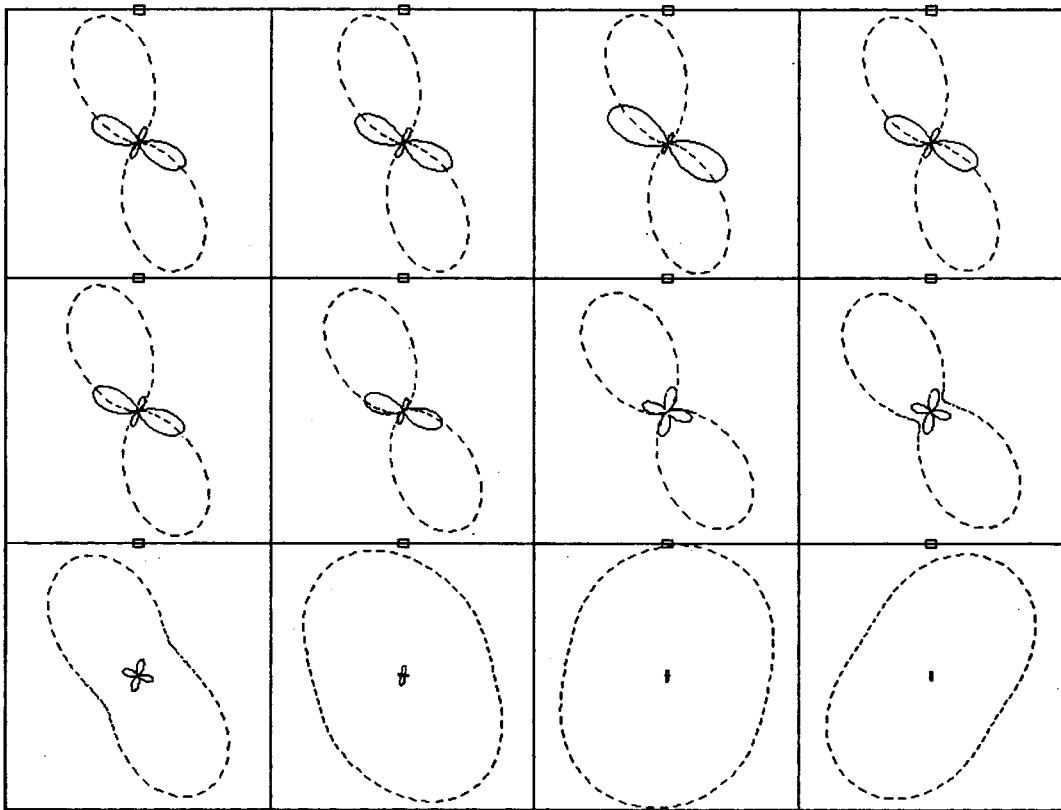


Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Saddle Mtn rd near Mid Valley **Station 58**



.0088 Hz
.172 Hz
2.930 Hz

.0244 Hz
.345 Hz
7.617 Hz

.0566 Hz
.566 Hz
16.602 Hz

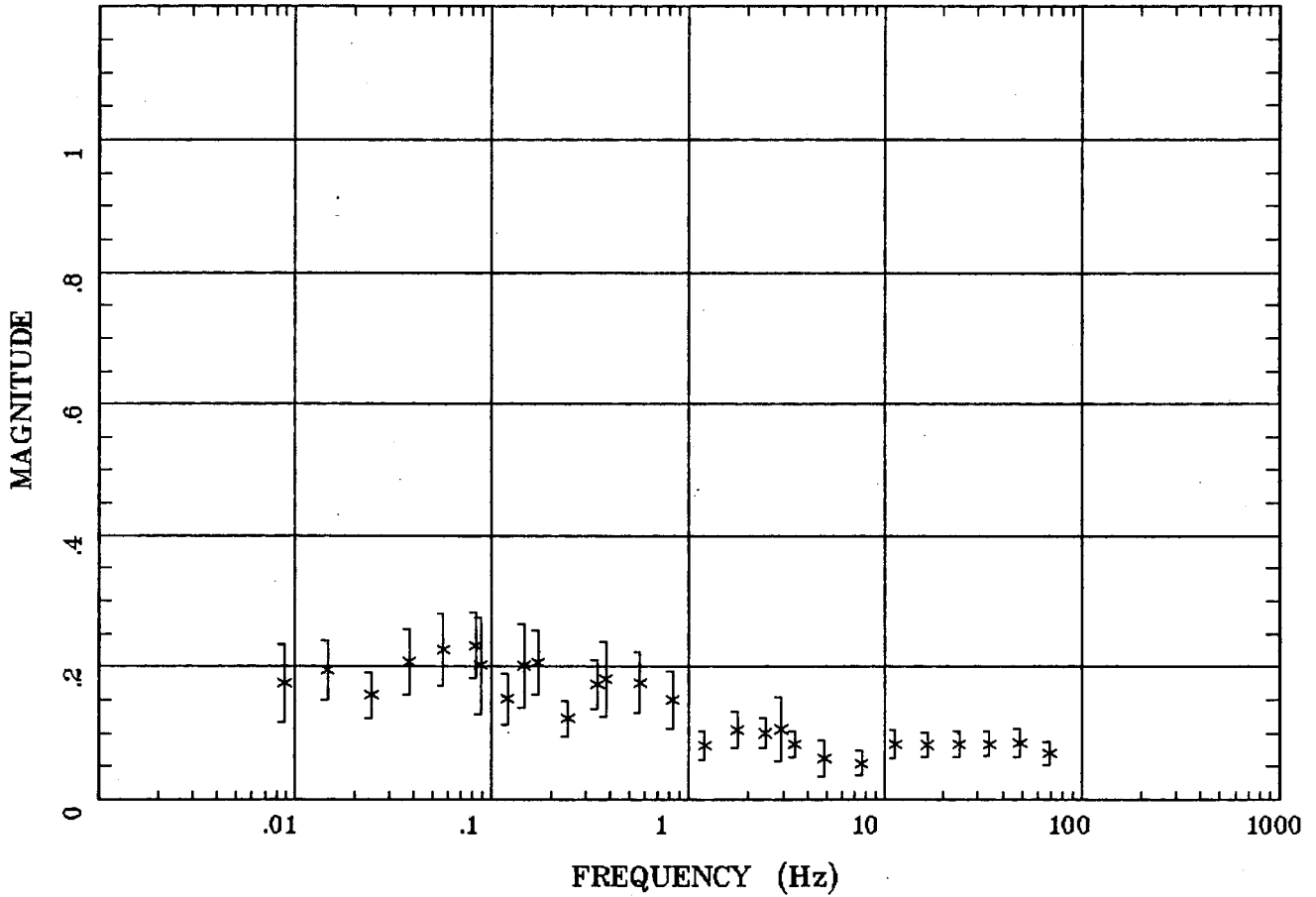
.120 Hz
1.758 Hz
34.375 Hz

Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

Saddle Mtn rd near Mid Valley **Station 58**



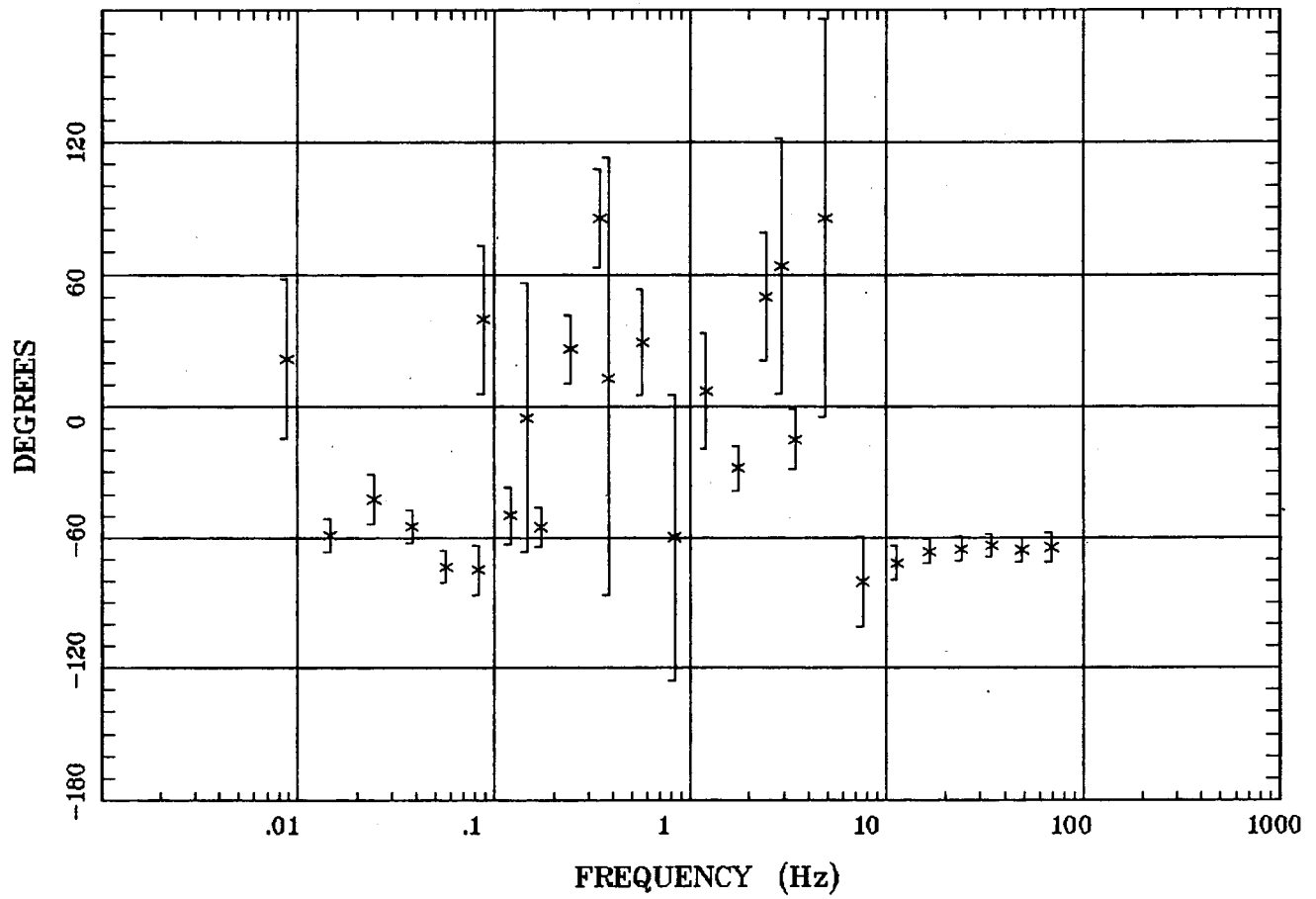
Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

Station 58

TIPPER STRIKE

Saddle Mtn rd. near Mid Valley



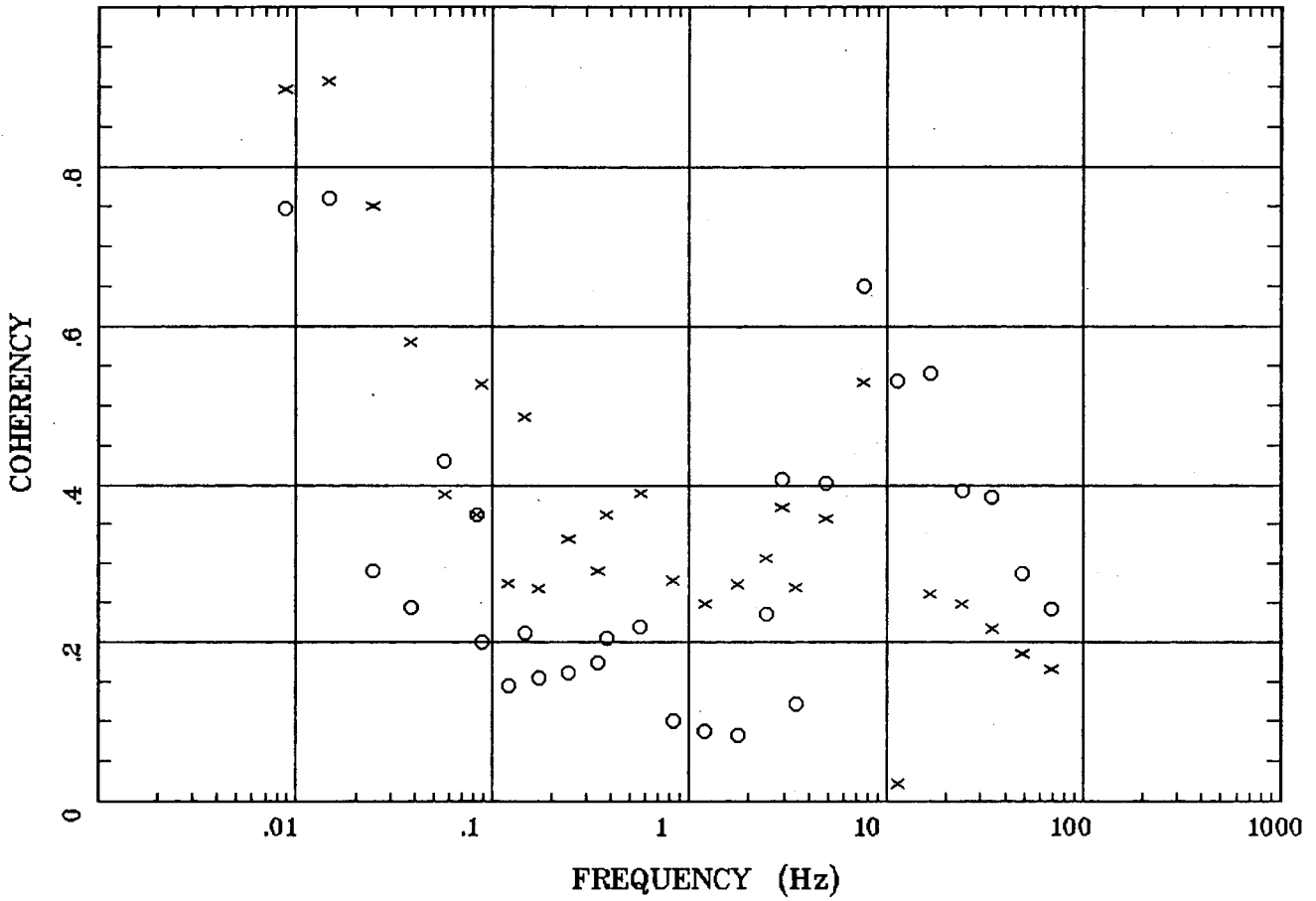
Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

Station 58

HzHx.x Coh HzHy.o

Saddle Mtn rd near Mid Valley

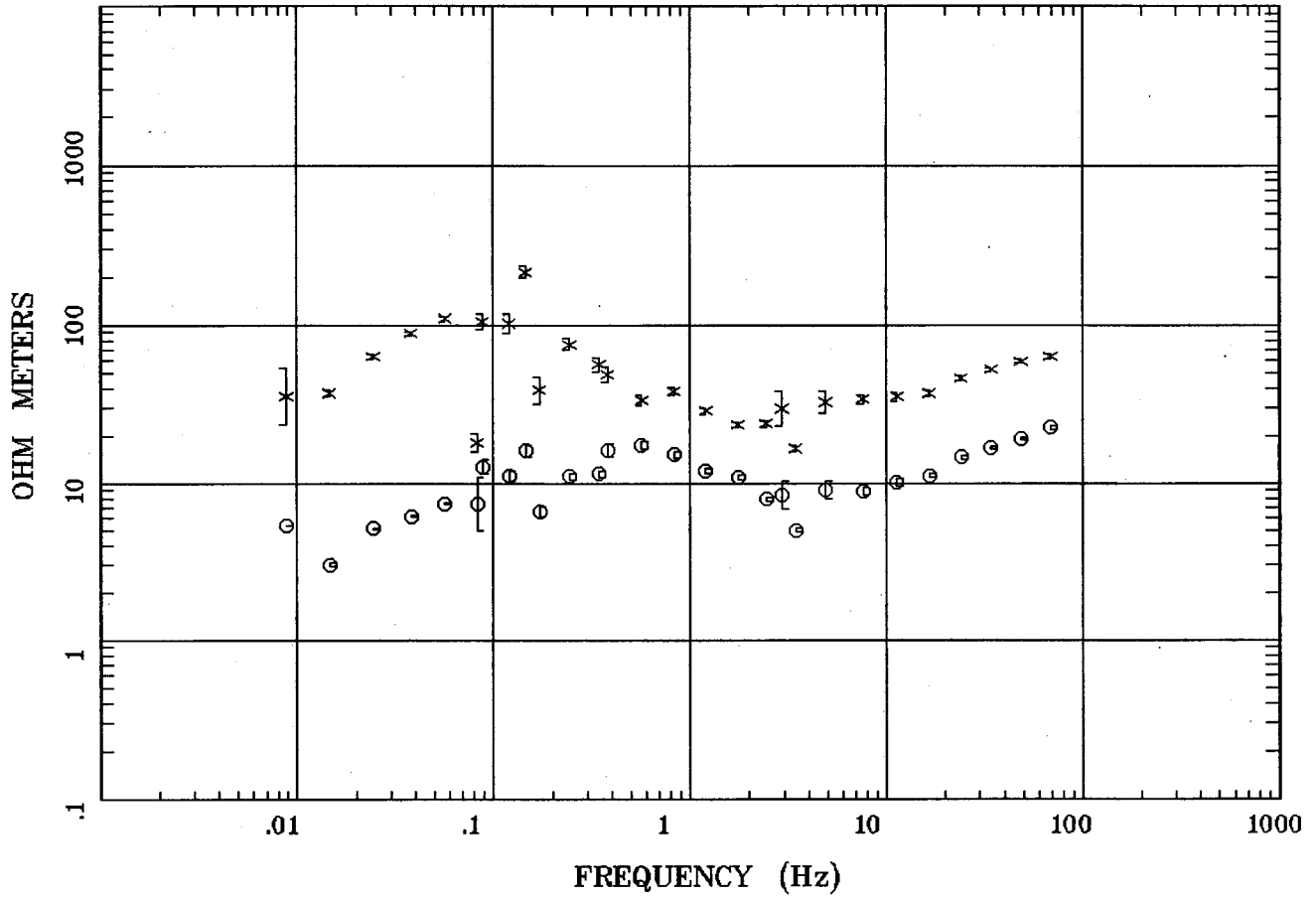


Client: Water Resources & DOD
Remote: none
Acquired: 10:3 Oct 14, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt58m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 09:43 Jan 30, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

Mid Valley RD seismic line

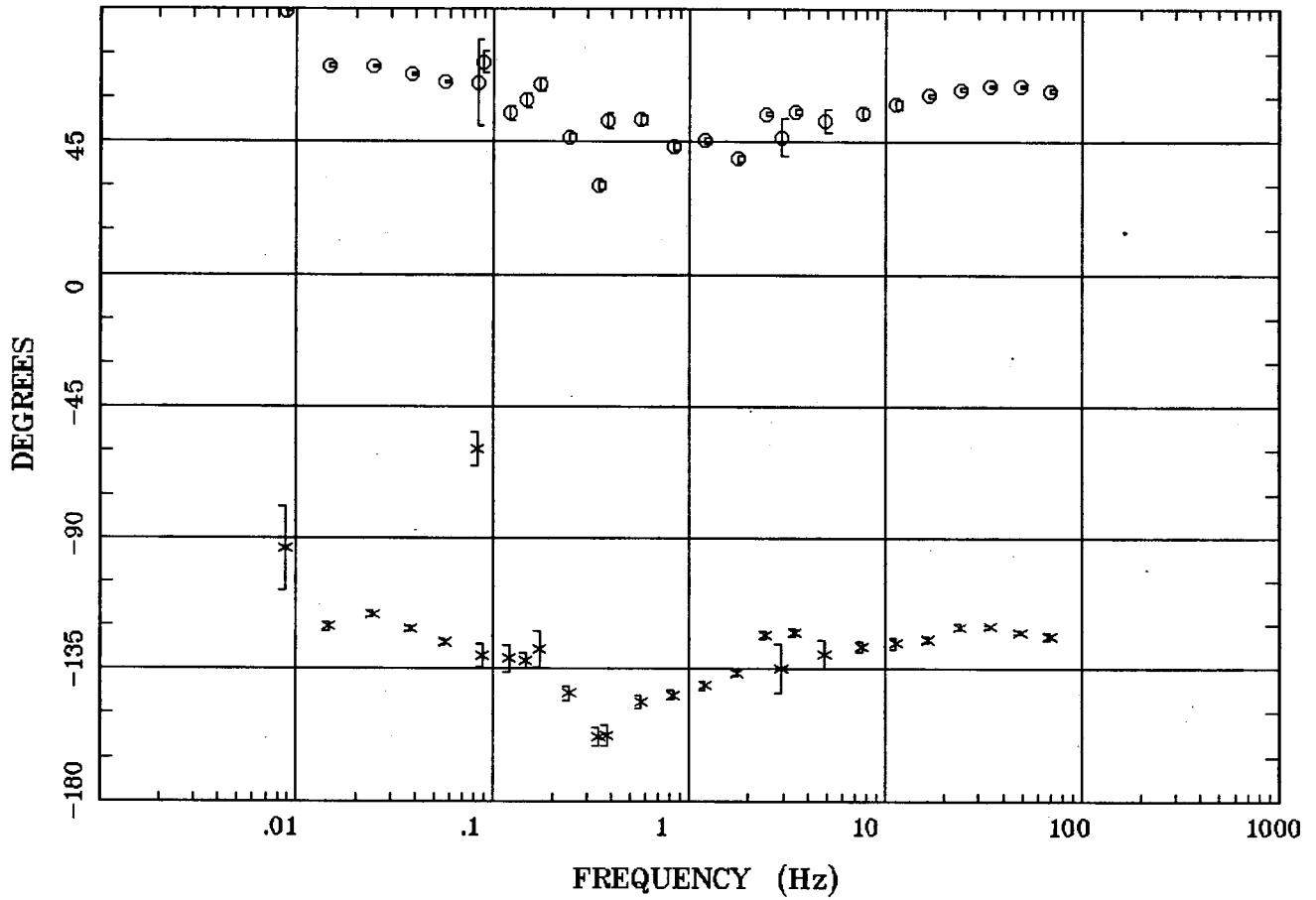


Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

Station 59
Mid Valley RD seismic line



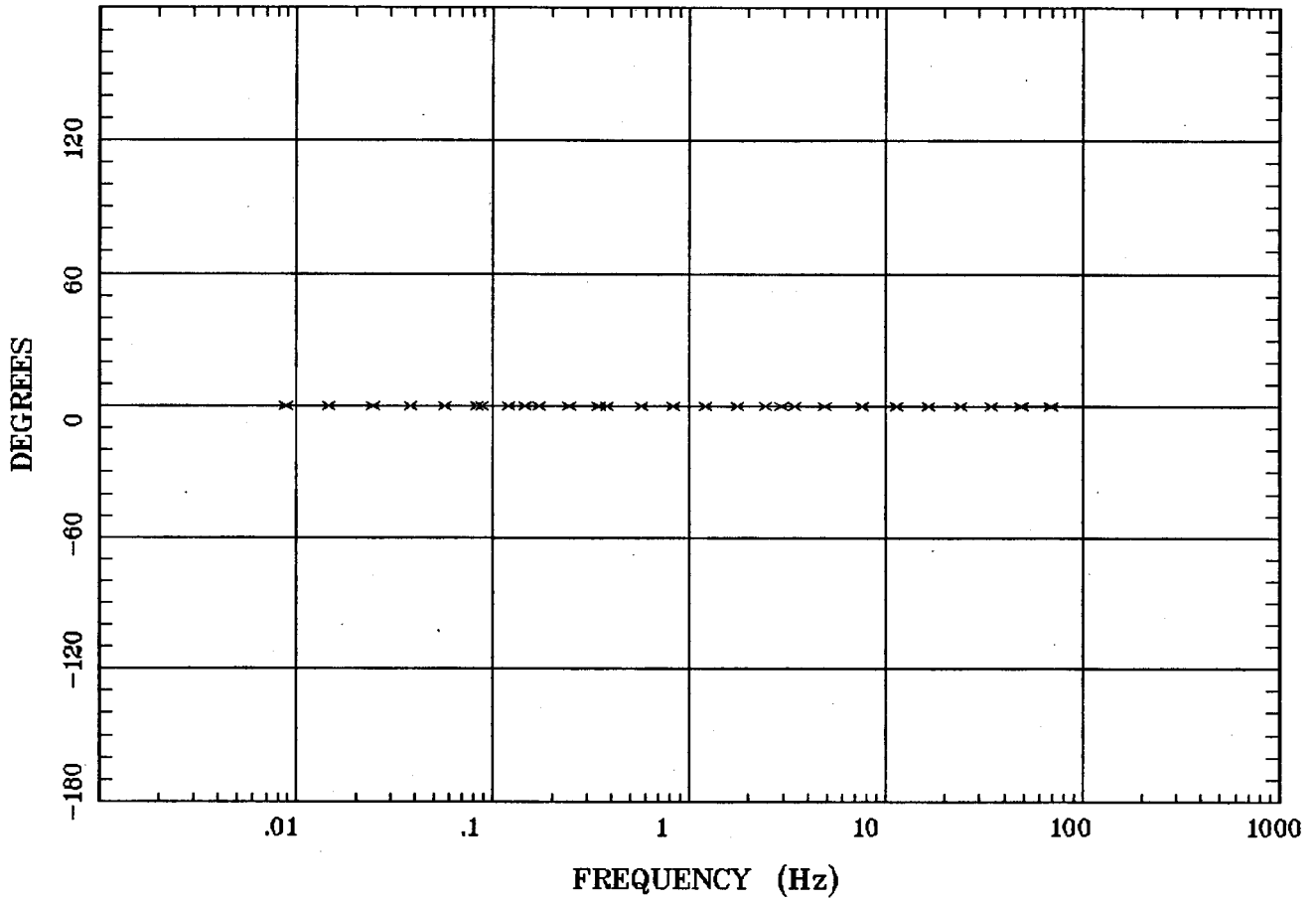
Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 59

ROTATION ANGLE

Mid Valley RD seismic line

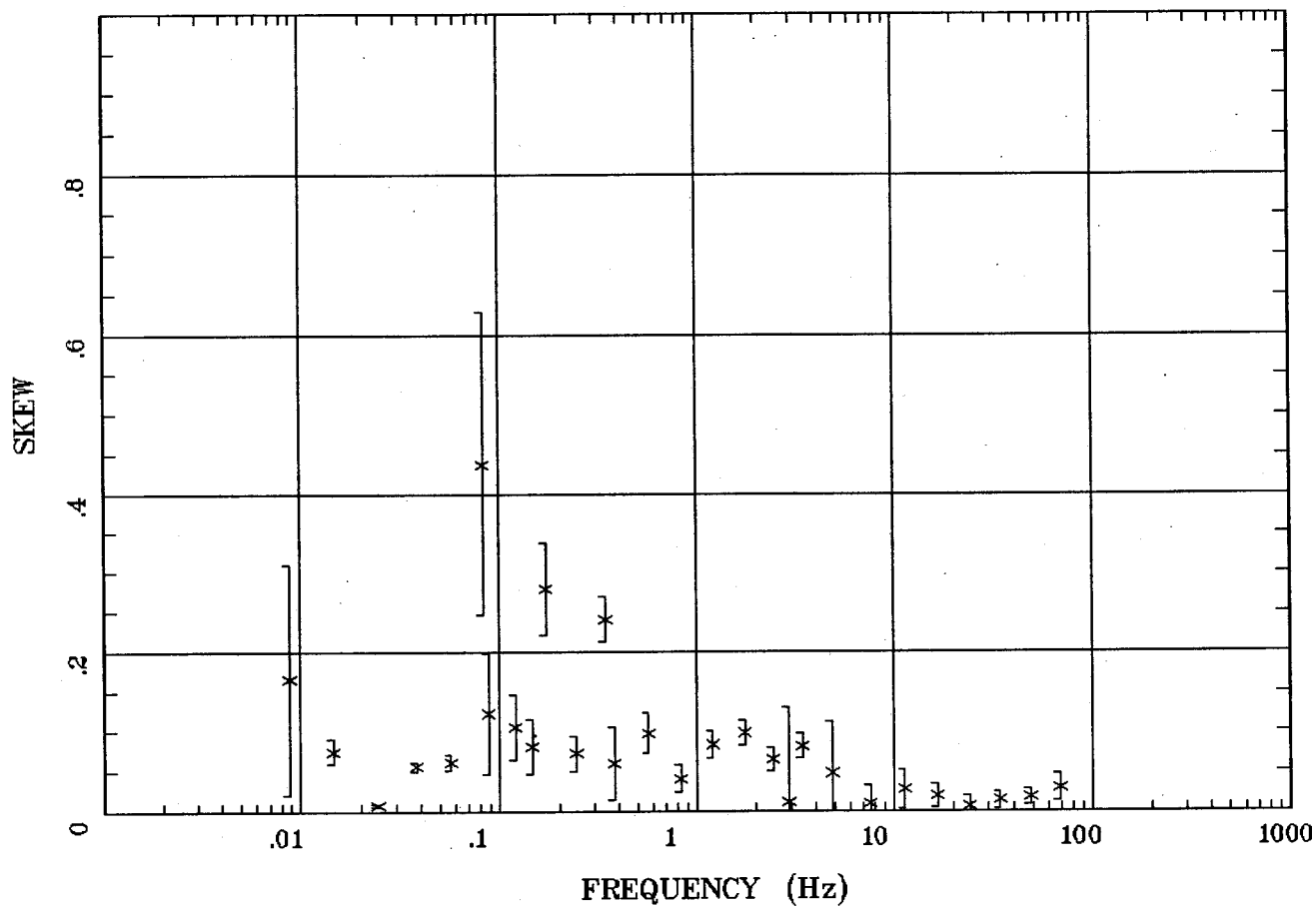


Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

Station 59
Mid Valley RD seismic line

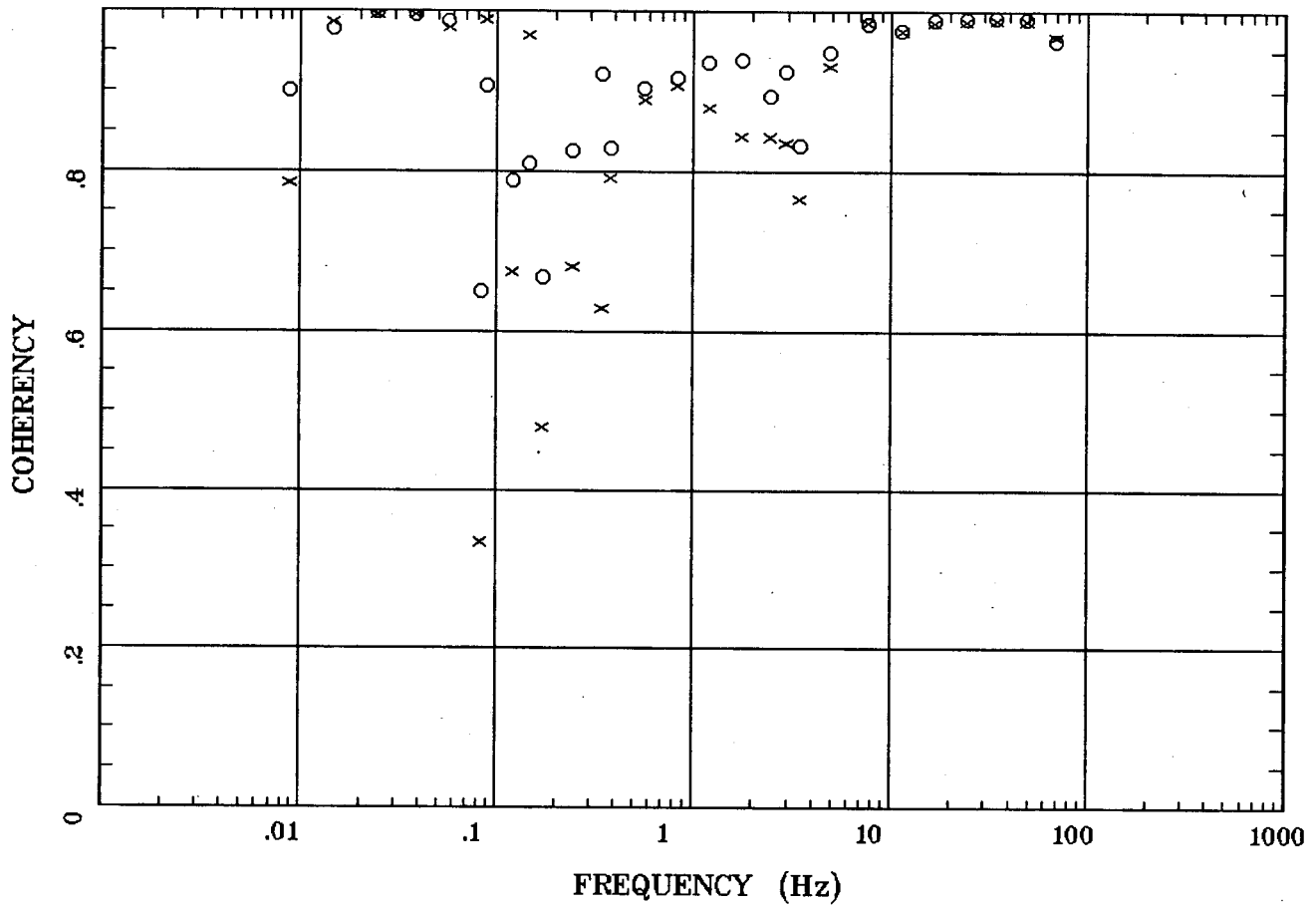


Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Mid Valley RD seismic line

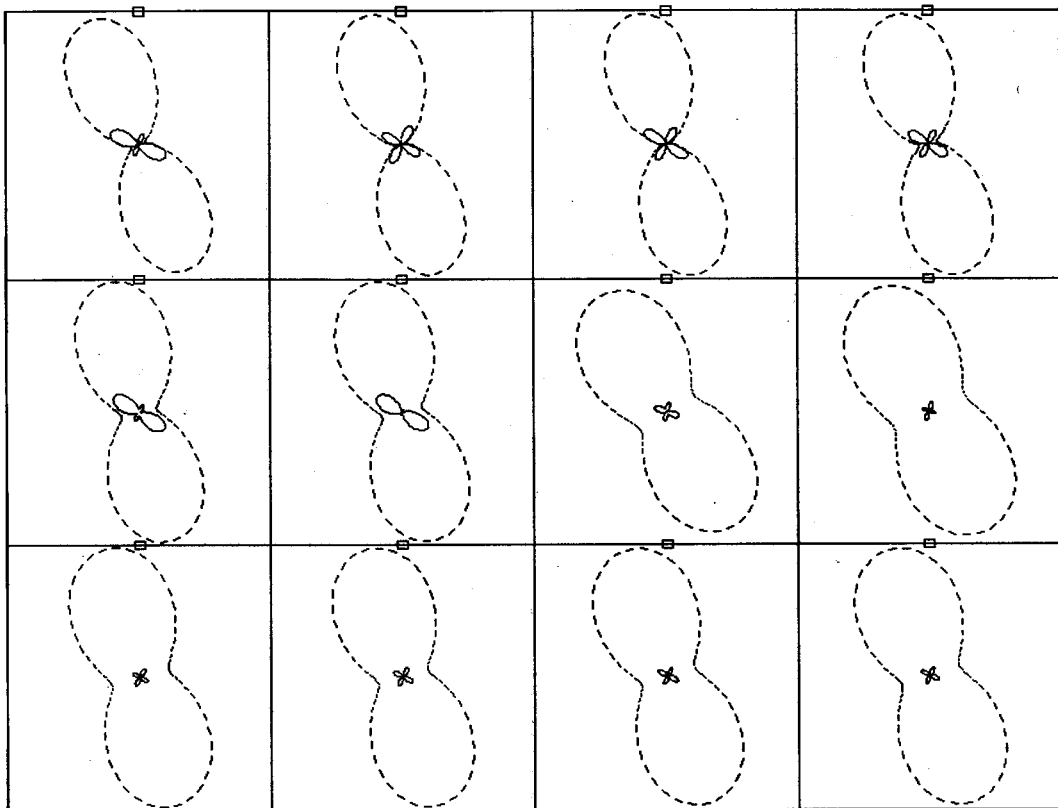


Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Mid Valley RD seismic line



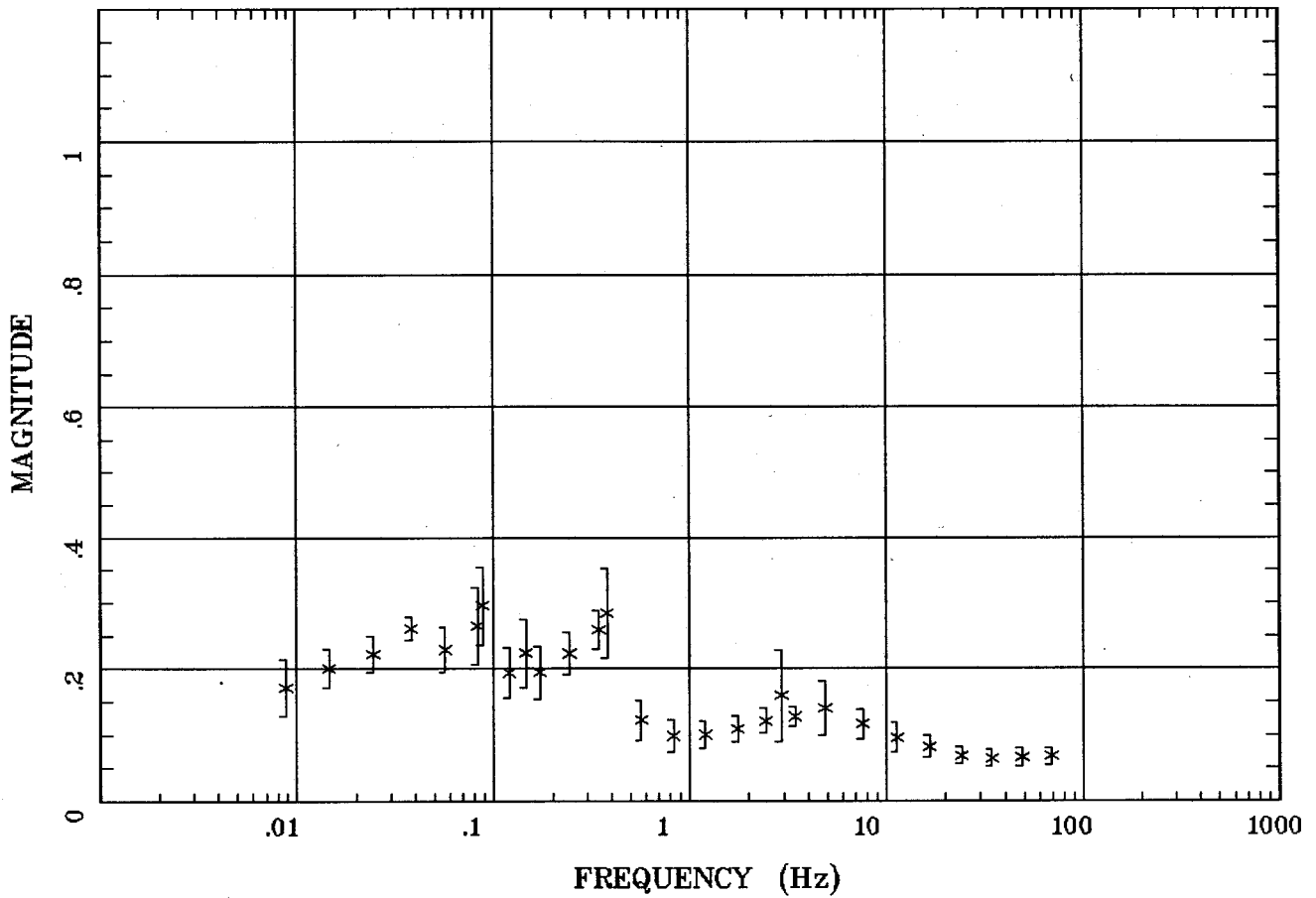
.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.345 Hz	.566 Hz	1.758 Hz
2.930 Hz	7.617 Hz	16.602 Hz	34.375 Hz

Client: Water Resources & DOD
 Remote: none
 Acquired: 04:3 Oct 15, 2005
 Survey Co:US Geological Survey

Rotation:
 Filename: nt59m.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 14:58 Feb 08, 2006
 < EMI - ElectroMagnetic Instruments >

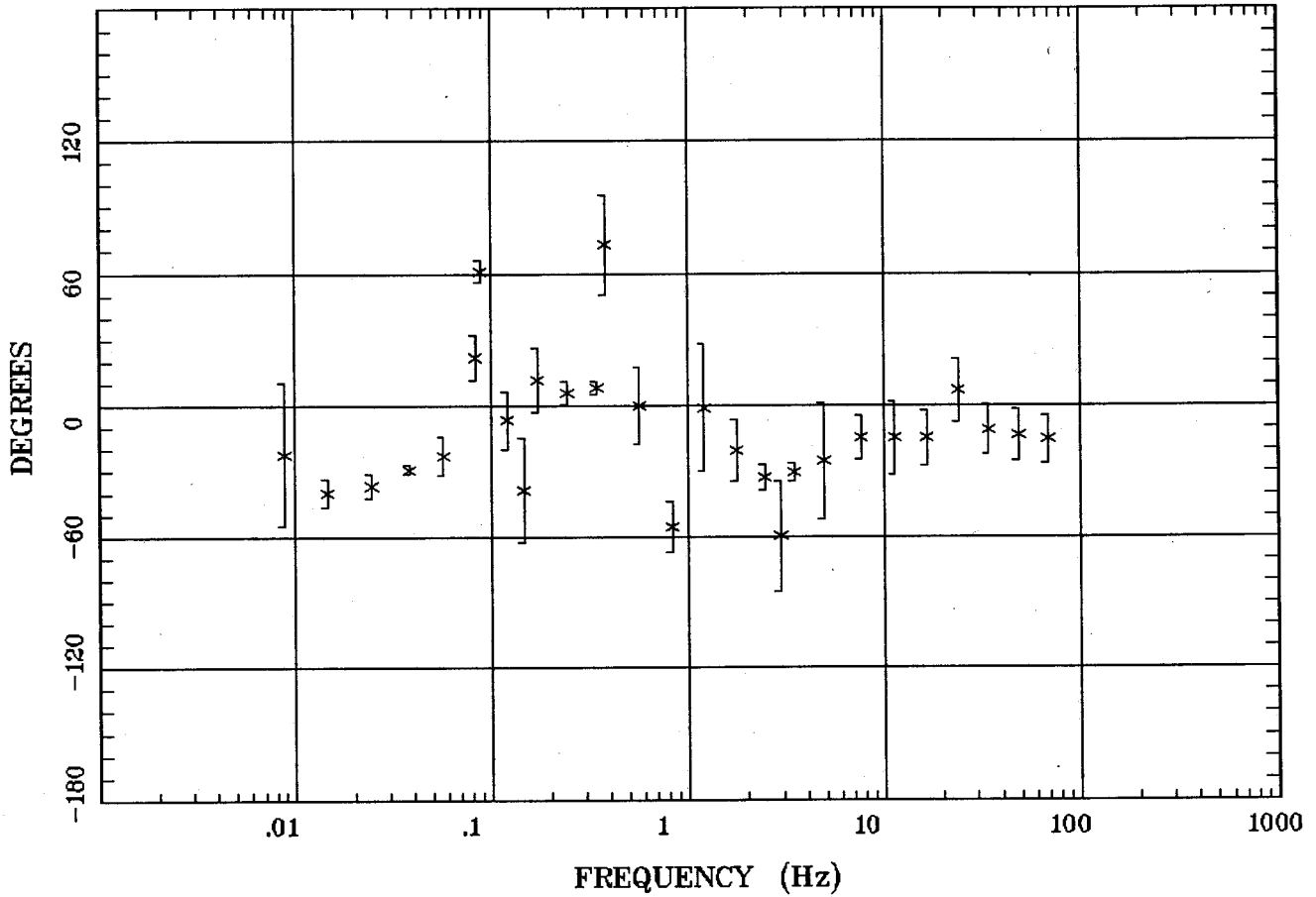
TIPPER MAGNITUDE

Mid Valley RD seismic line



Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >



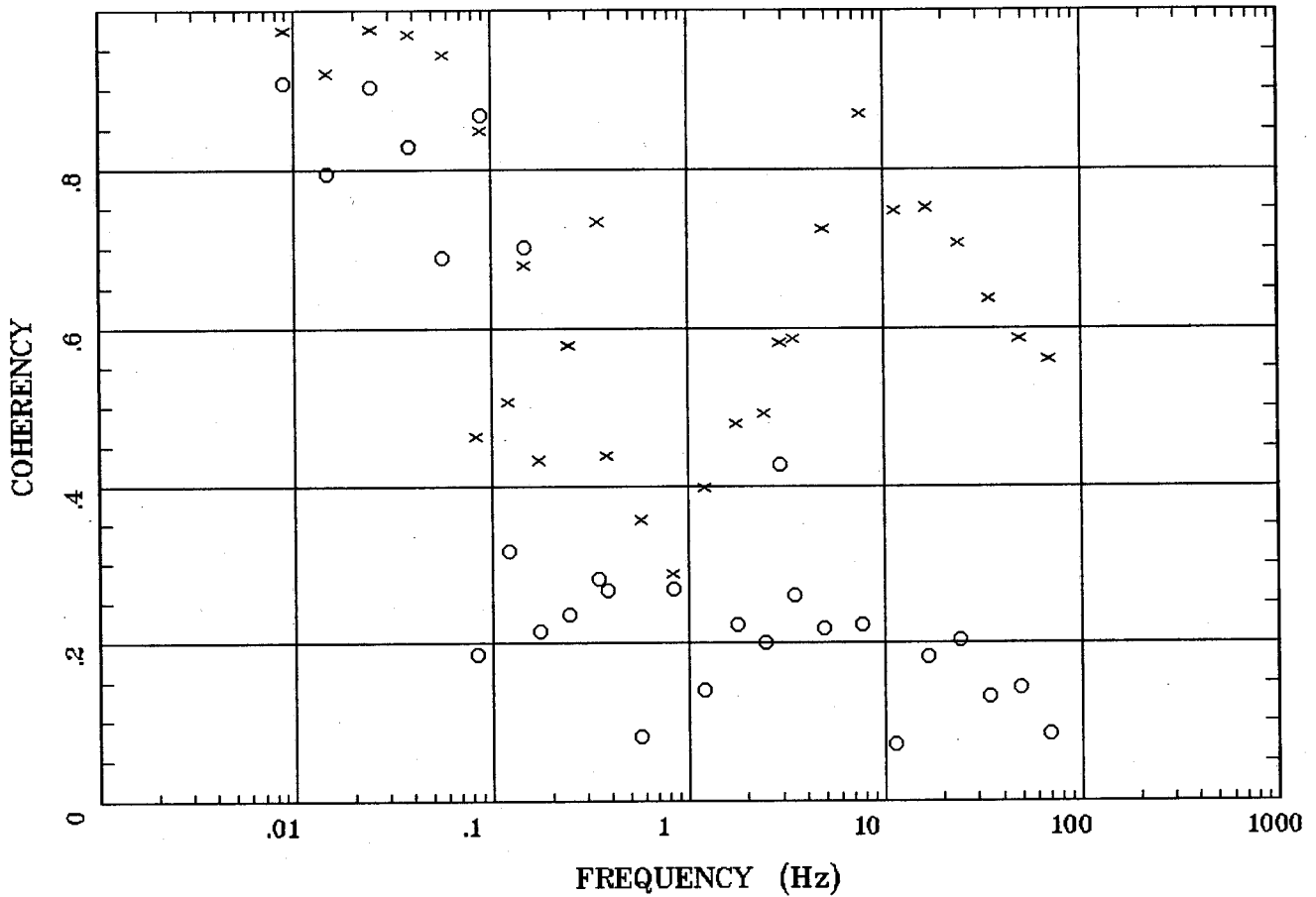
Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 59

HzHx.x Coh HzHy.o

Mid Valley RD seismic line

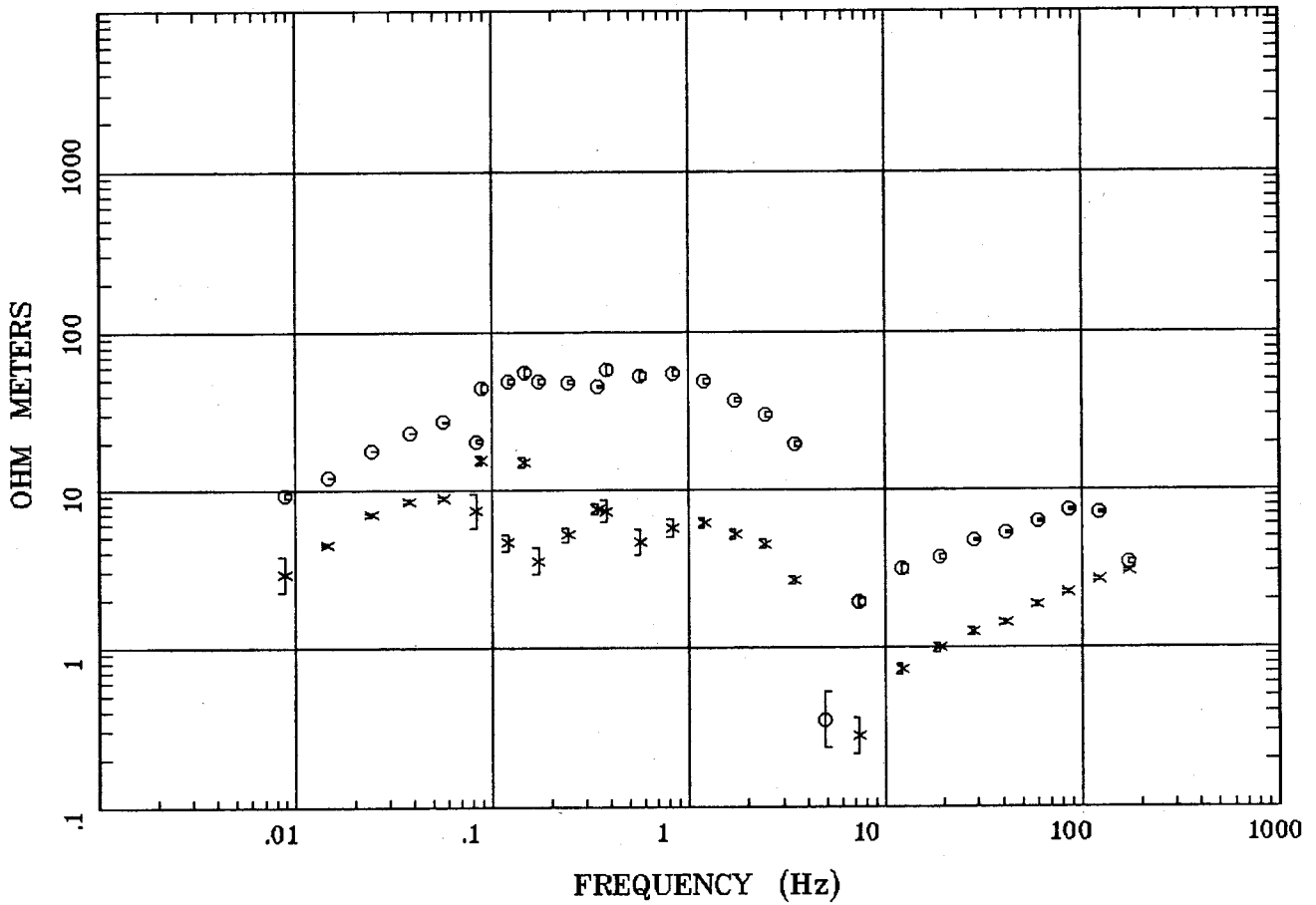


Client: Water Resources & DOD
Remote: none
Acquired: 04:3 Oct 15, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt59m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:58 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

Southwest of DAF

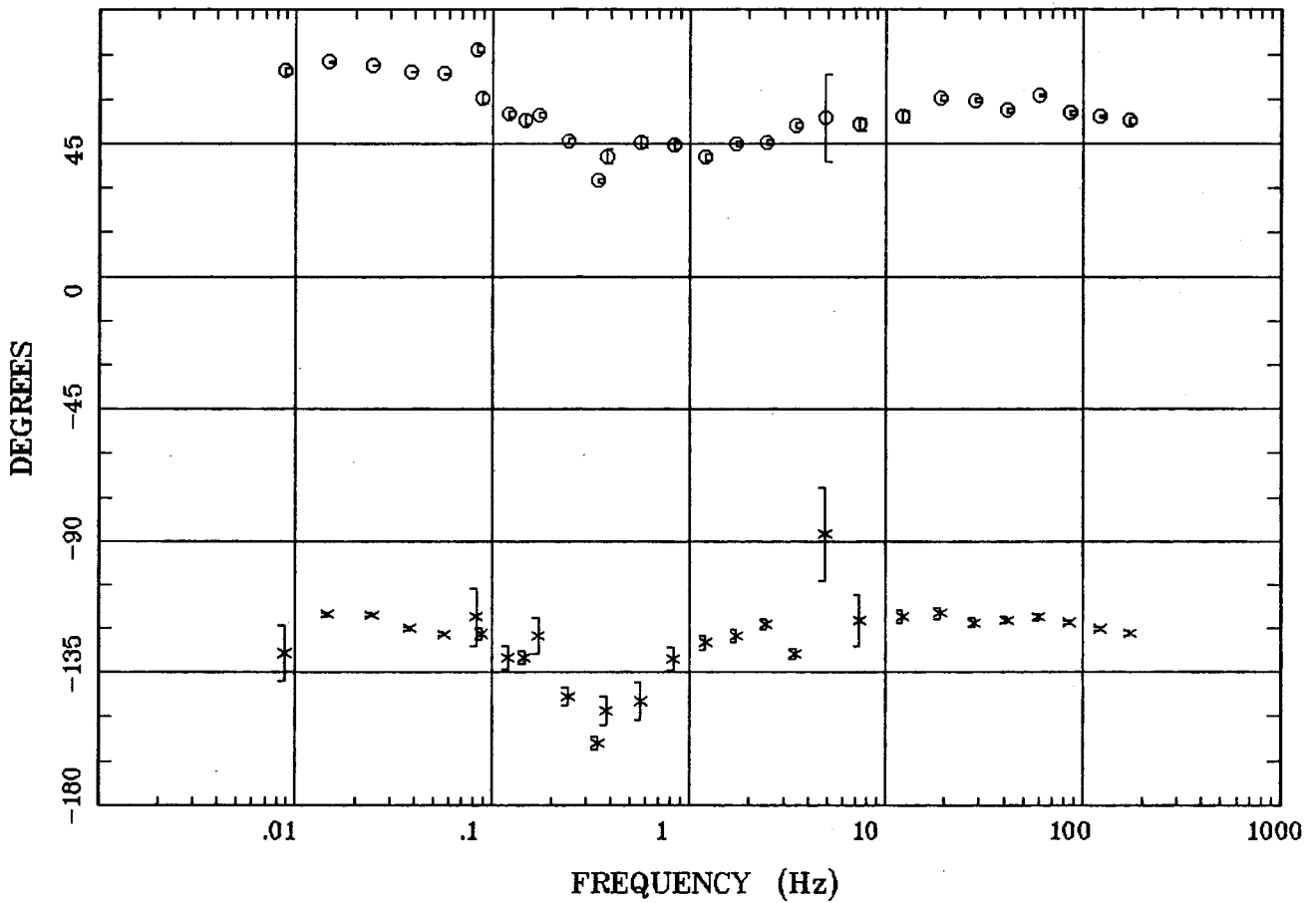


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

Southwest of DAF



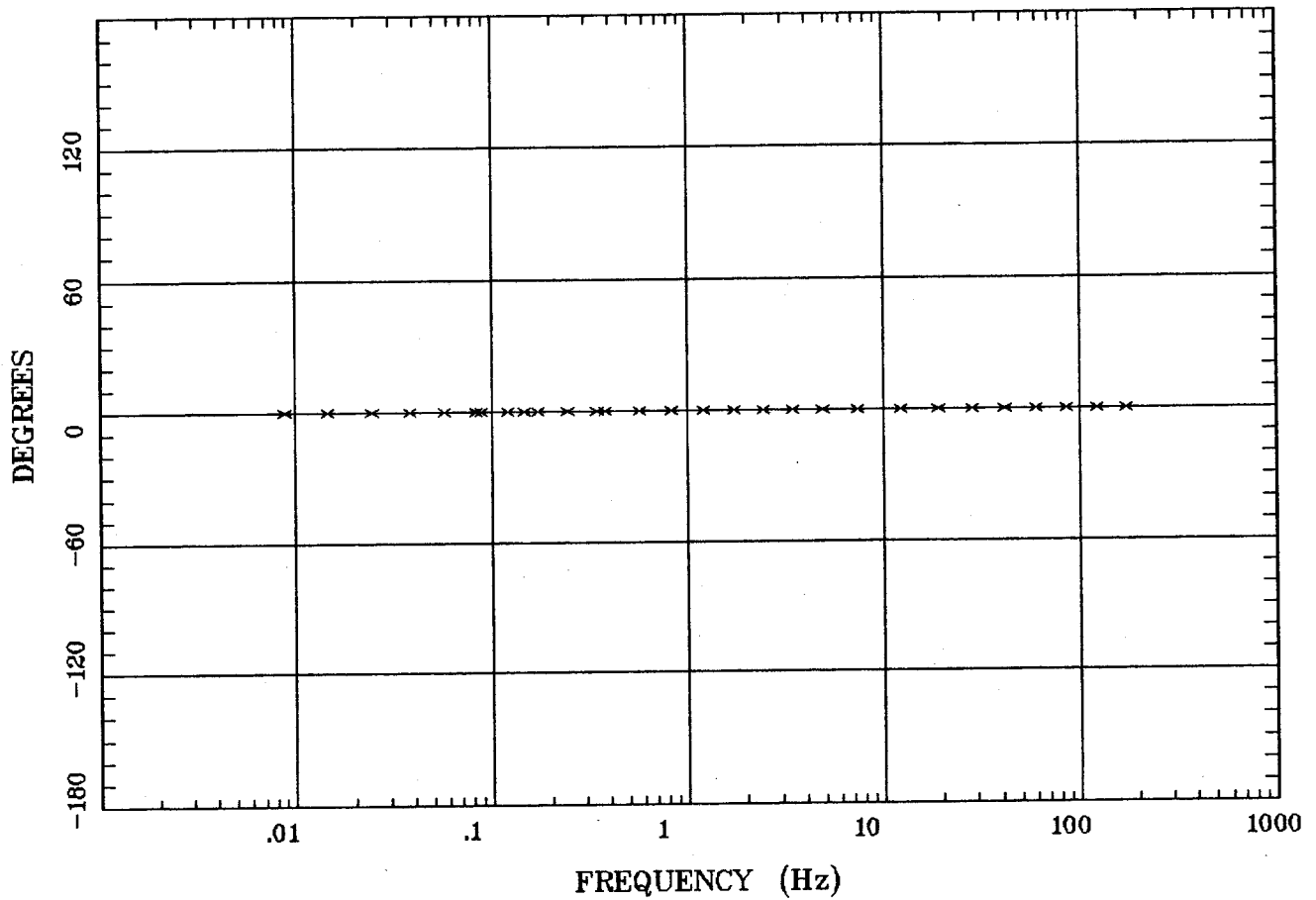
Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

Station 60

ROTATION ANGLE

Southwest of DAF

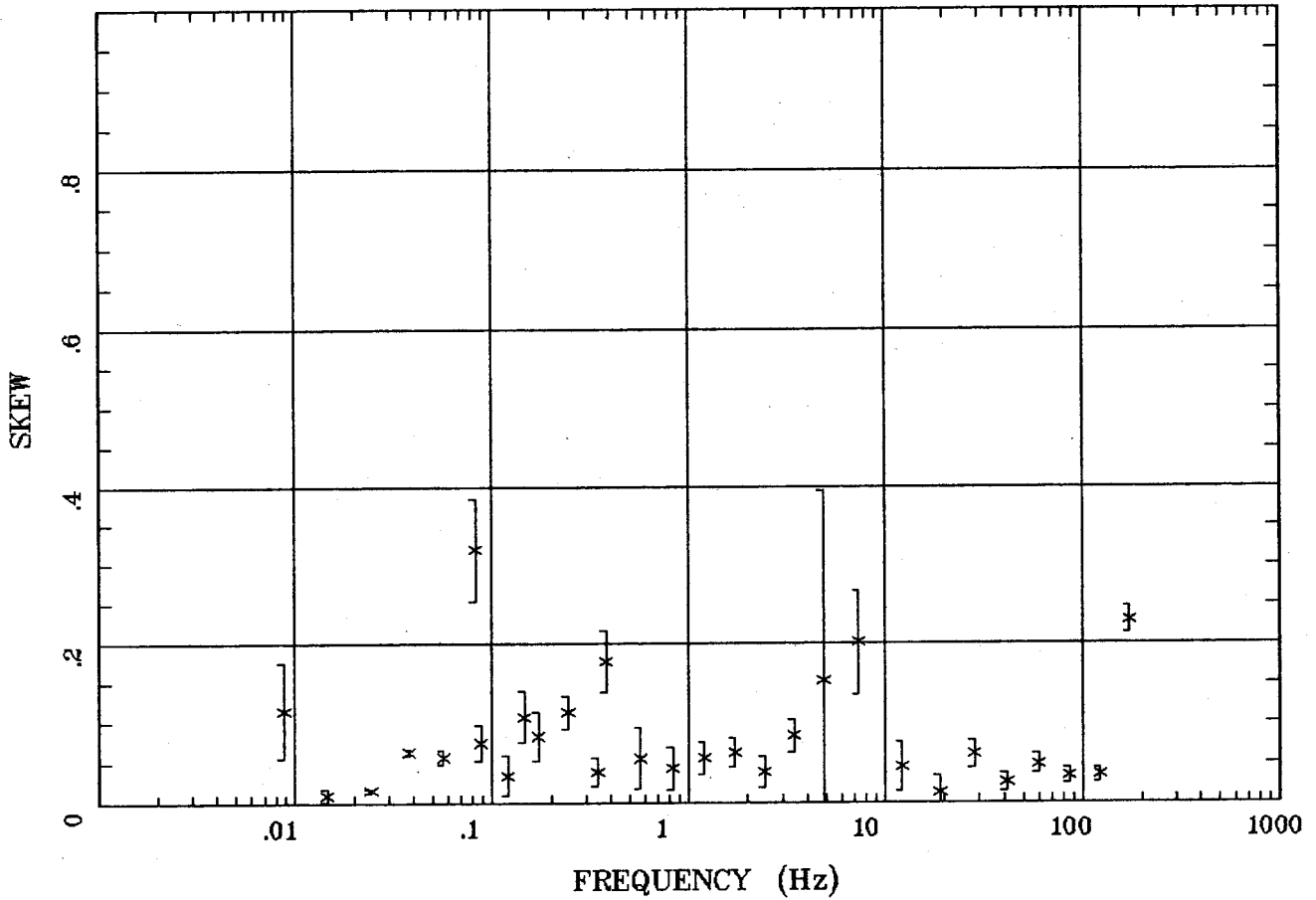


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

Southwest of DAF

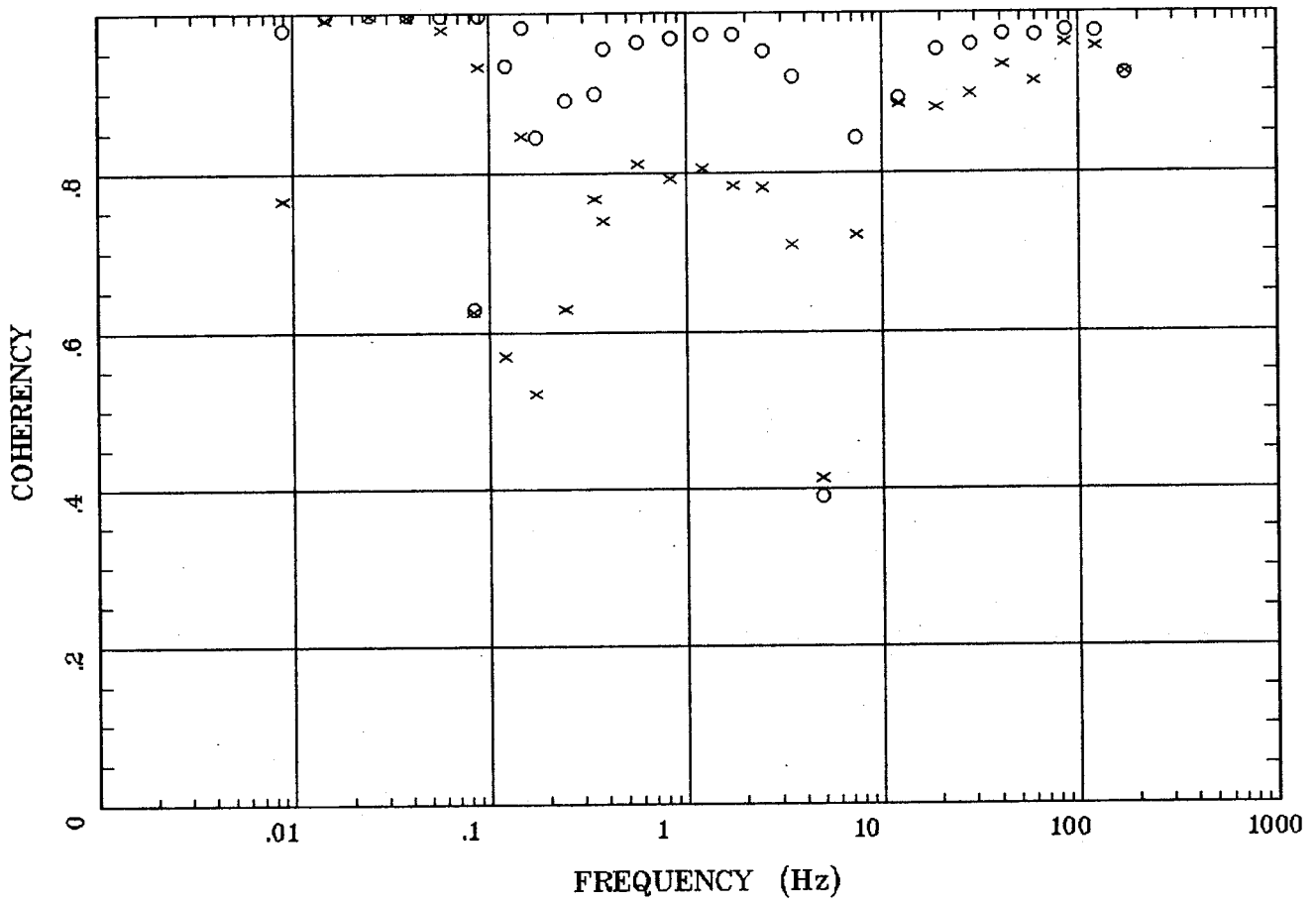


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

Southwest of DAF

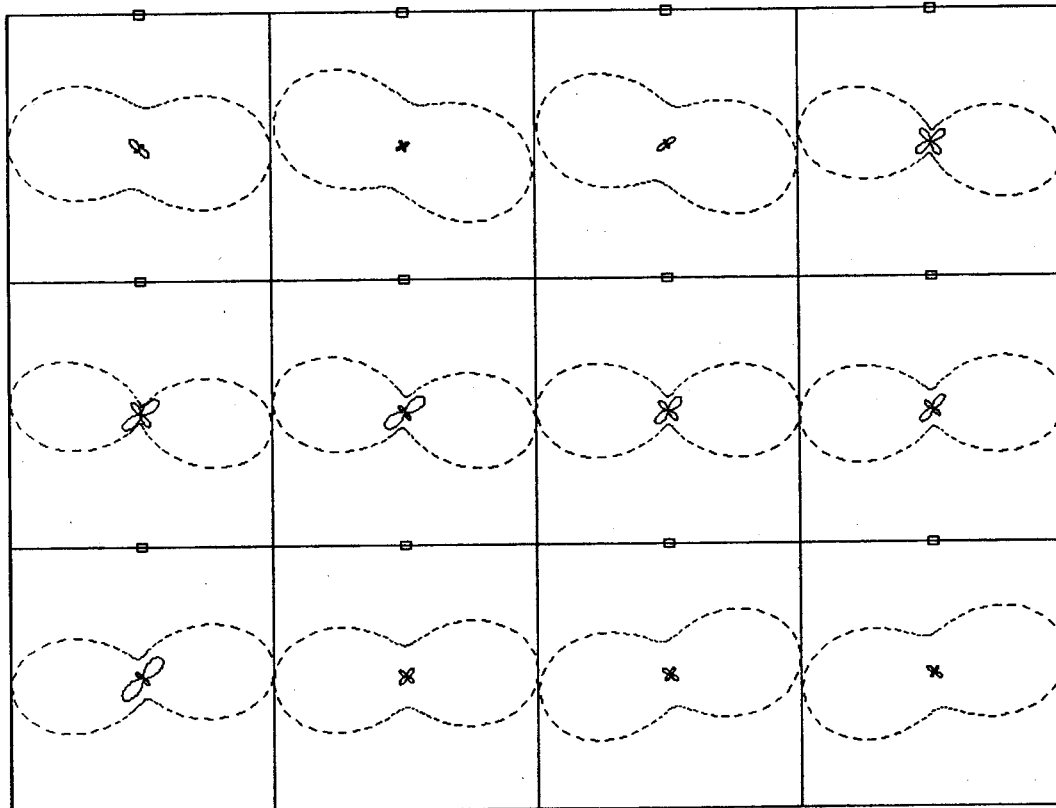


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

Southwest of DAF



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.381 Hz	.830 Hz	1.719 Hz
4.883 Hz	12.207 Hz	41.504 Hz	85.938 Hz

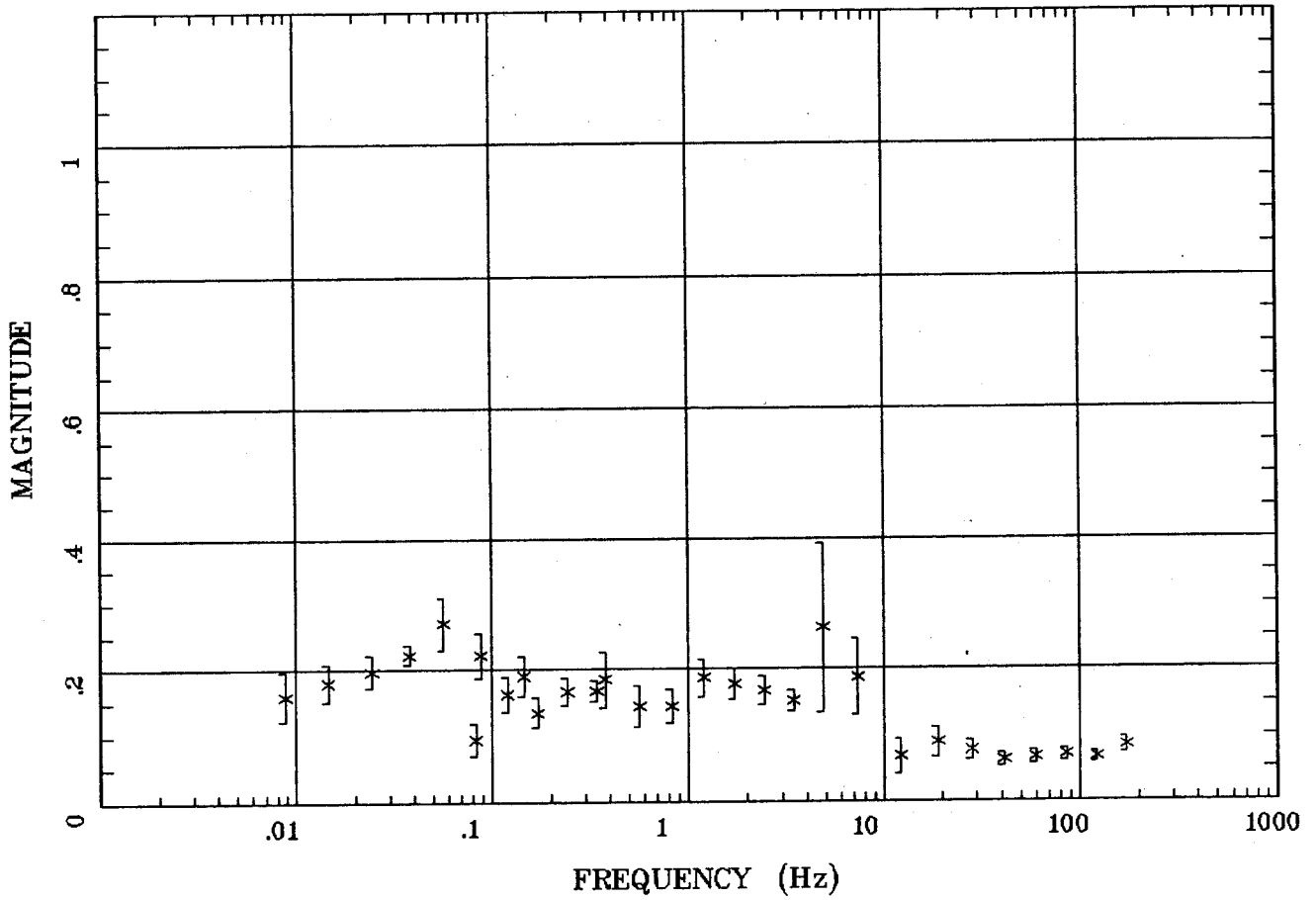
Rotation:

Client: Water Resources & DOD
 Remote: none
 Acquired: 11:5 Feb 02, 2006
 Survey Co: US Geological Survey

Filename: mt60n.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 12:00 Feb 02, 2006
 < EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

Southwest of DAF

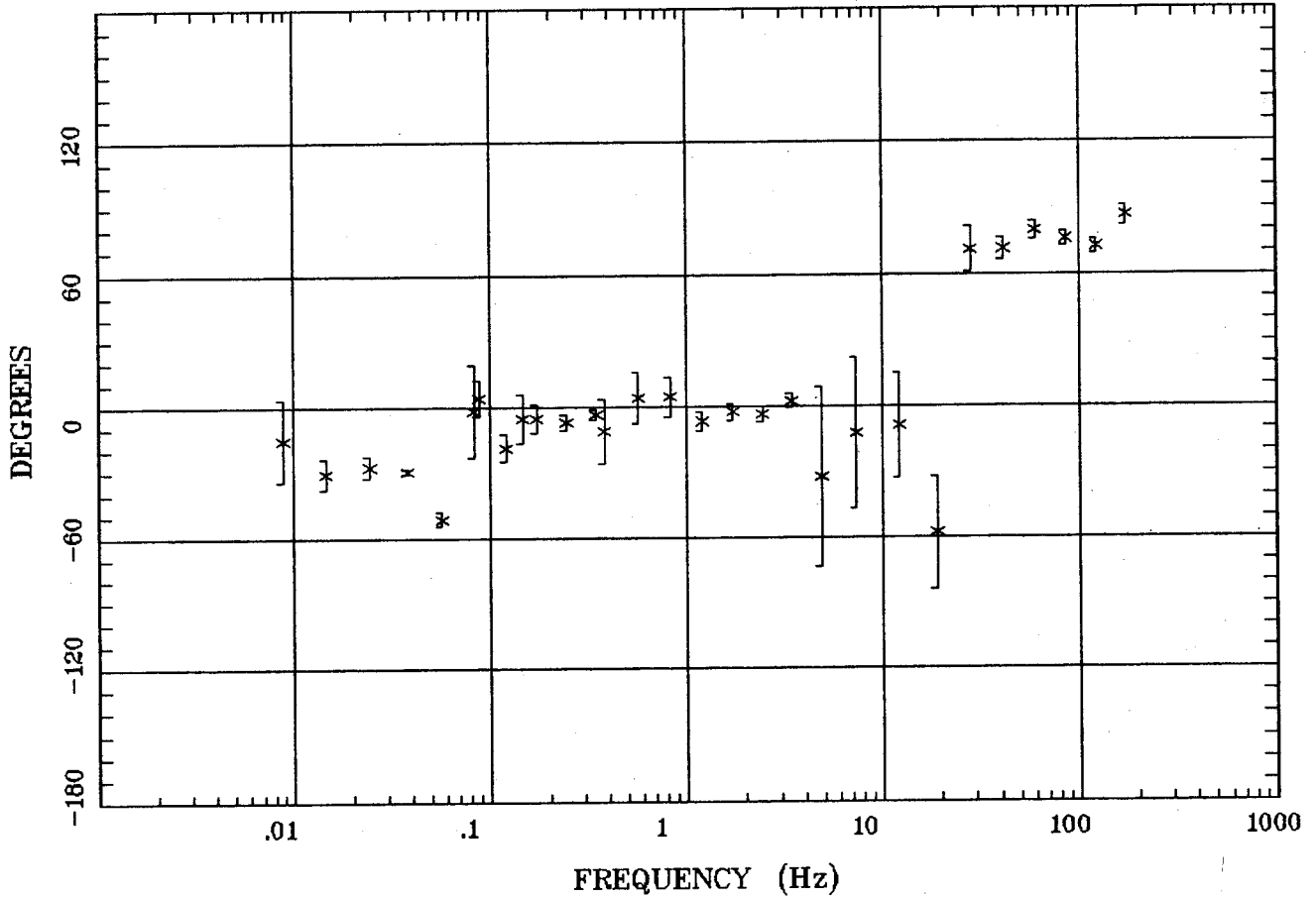


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Southwest of DAF



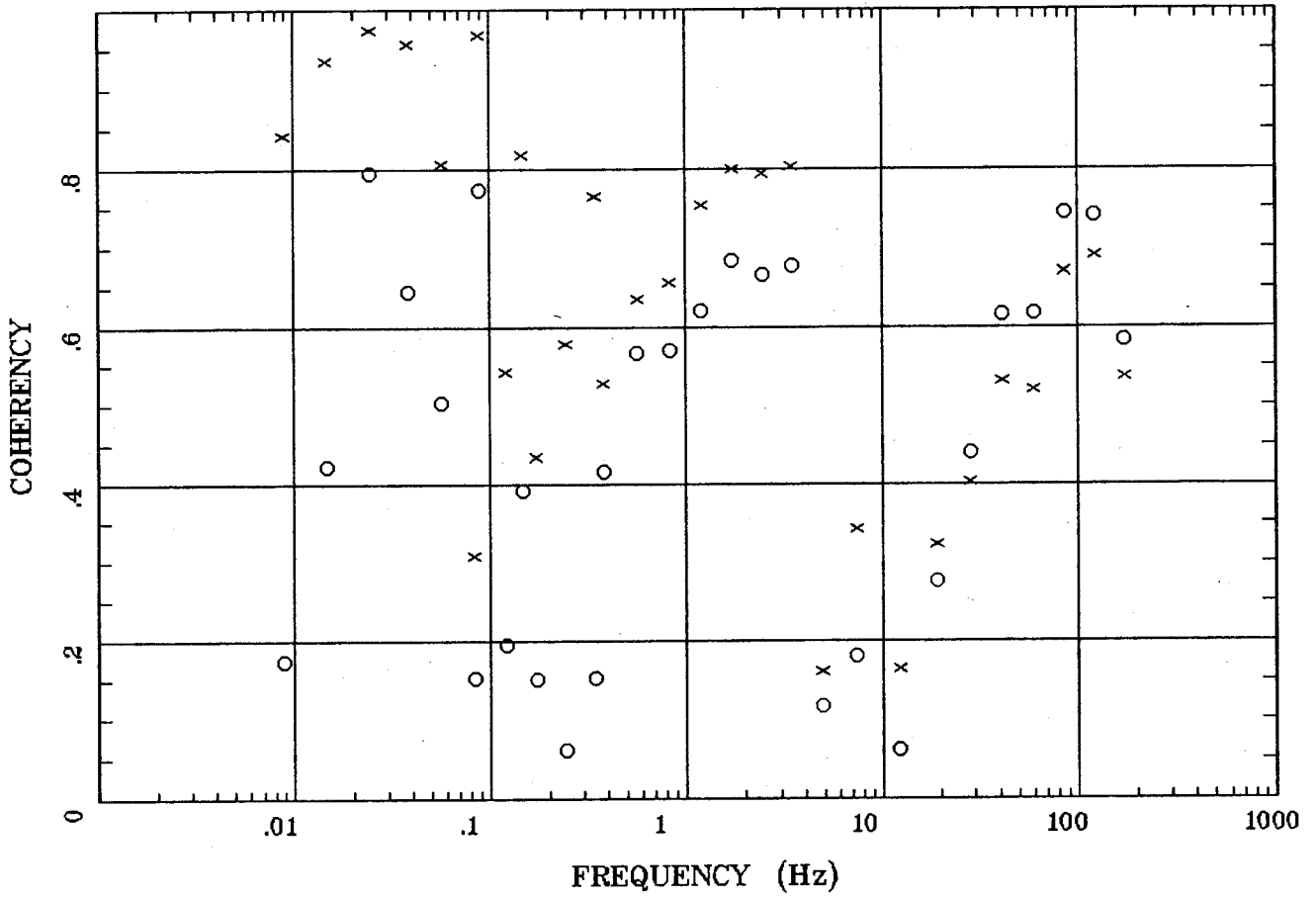
Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co:US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

Station 60

HzHx.x Coh HzHy.o

Southwest of DAF

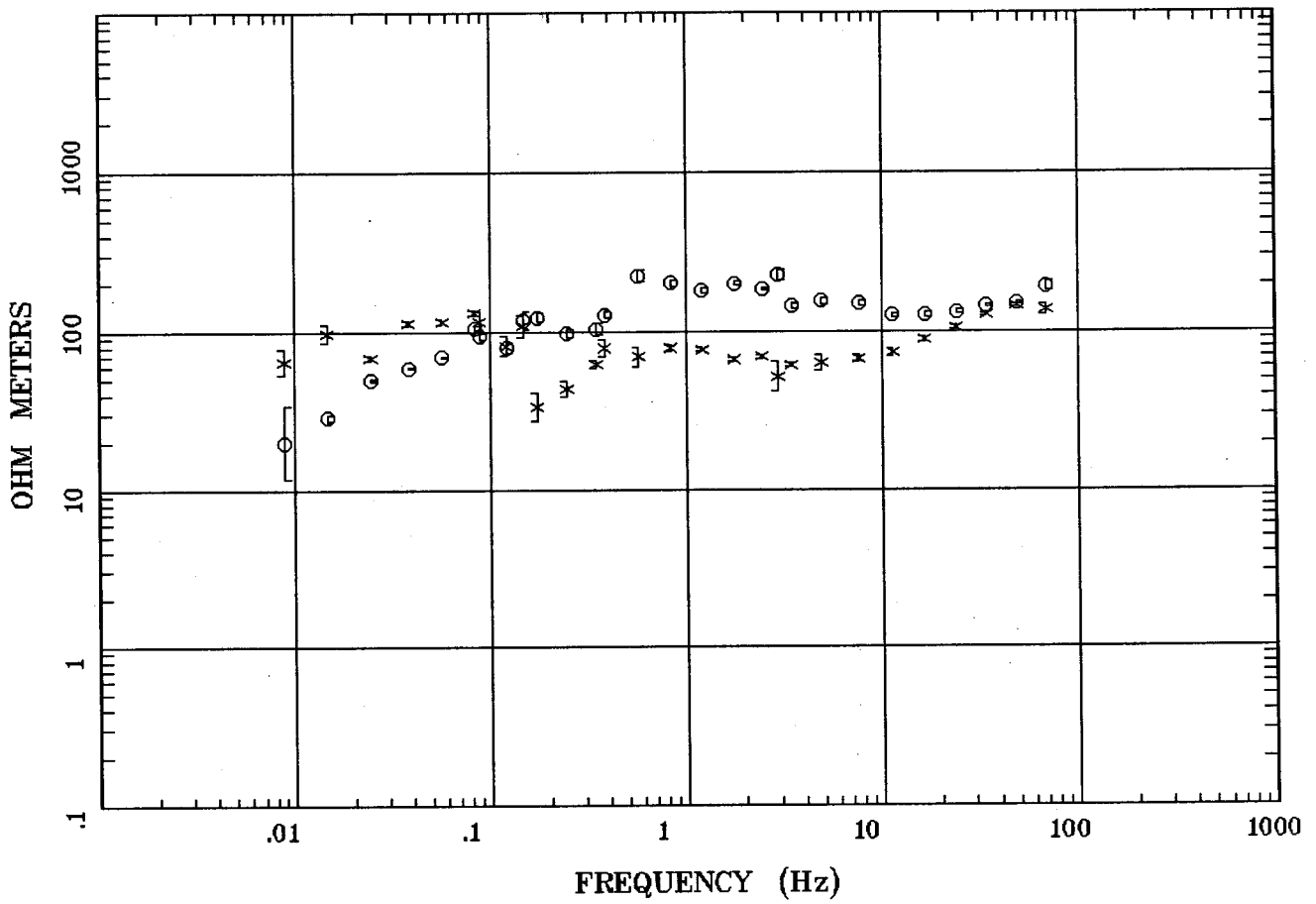


Client: Water Resources & DOD
Remote: none
Acquired: 11:5 Feb 02, 2006
Survey Co: US Geological Survey

Rotation:
Filename: mt60n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 12:00 Feb 02, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

NE of DAF

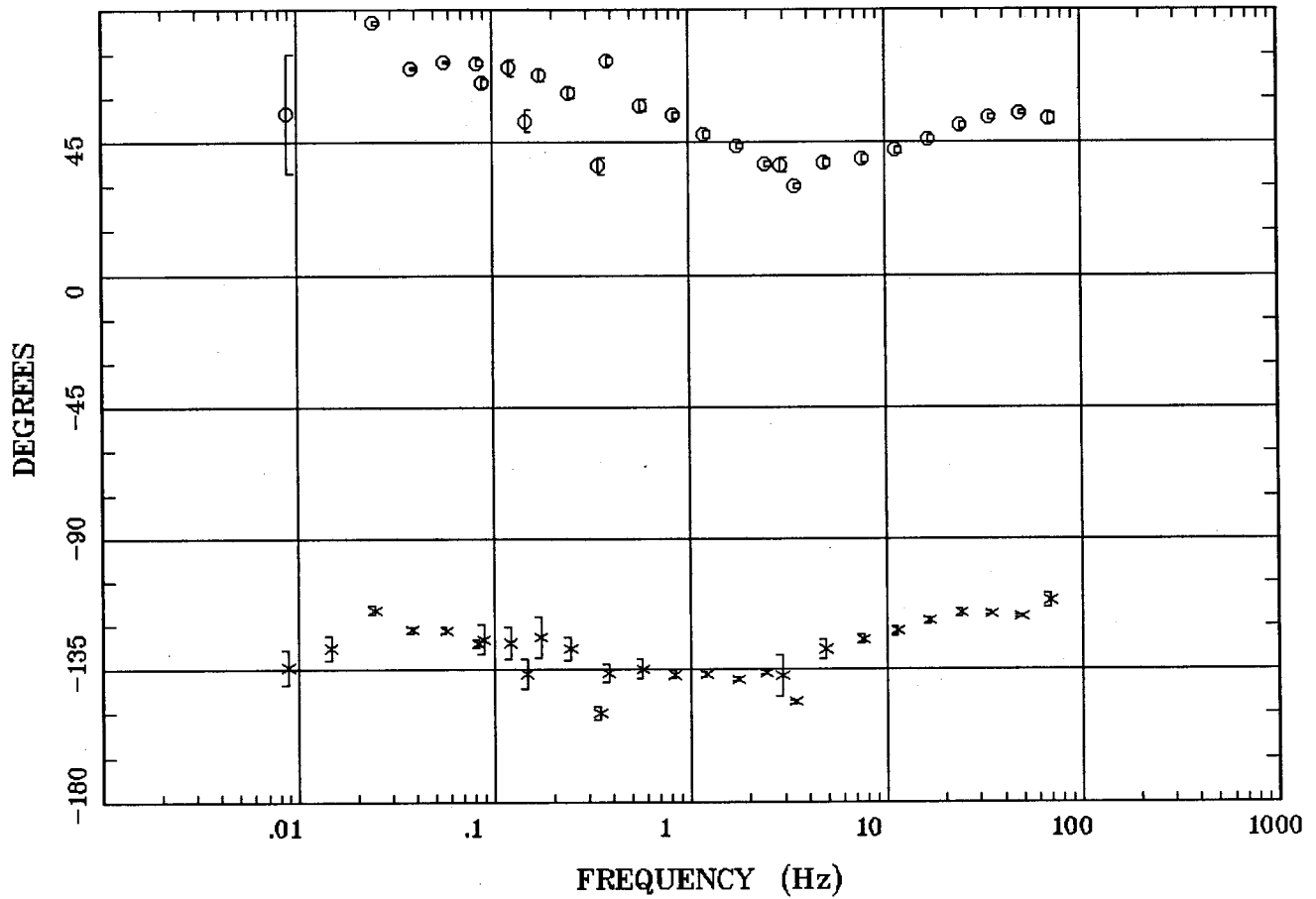


Client: Water Resources & DOD
 Remote: none
 Acquired: 04:5 Oct 20, 2005
 Survey Co: US Geological Survey

Rotation:
 Filename: nt61m.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 14:59 Feb 08, 2006
 < EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

NE of DAF



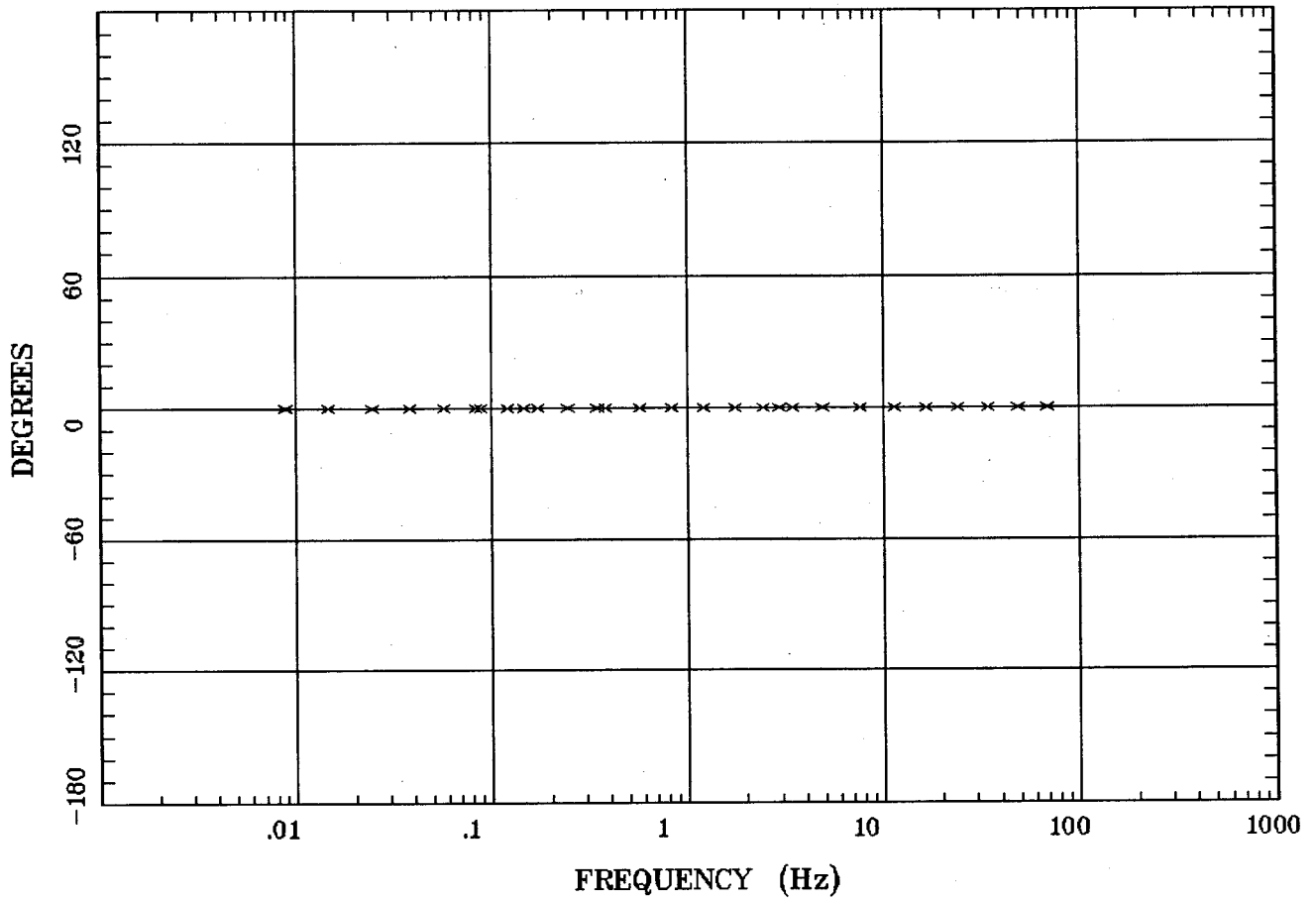
Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 61

ROTATION ANGLE

NE of DAF

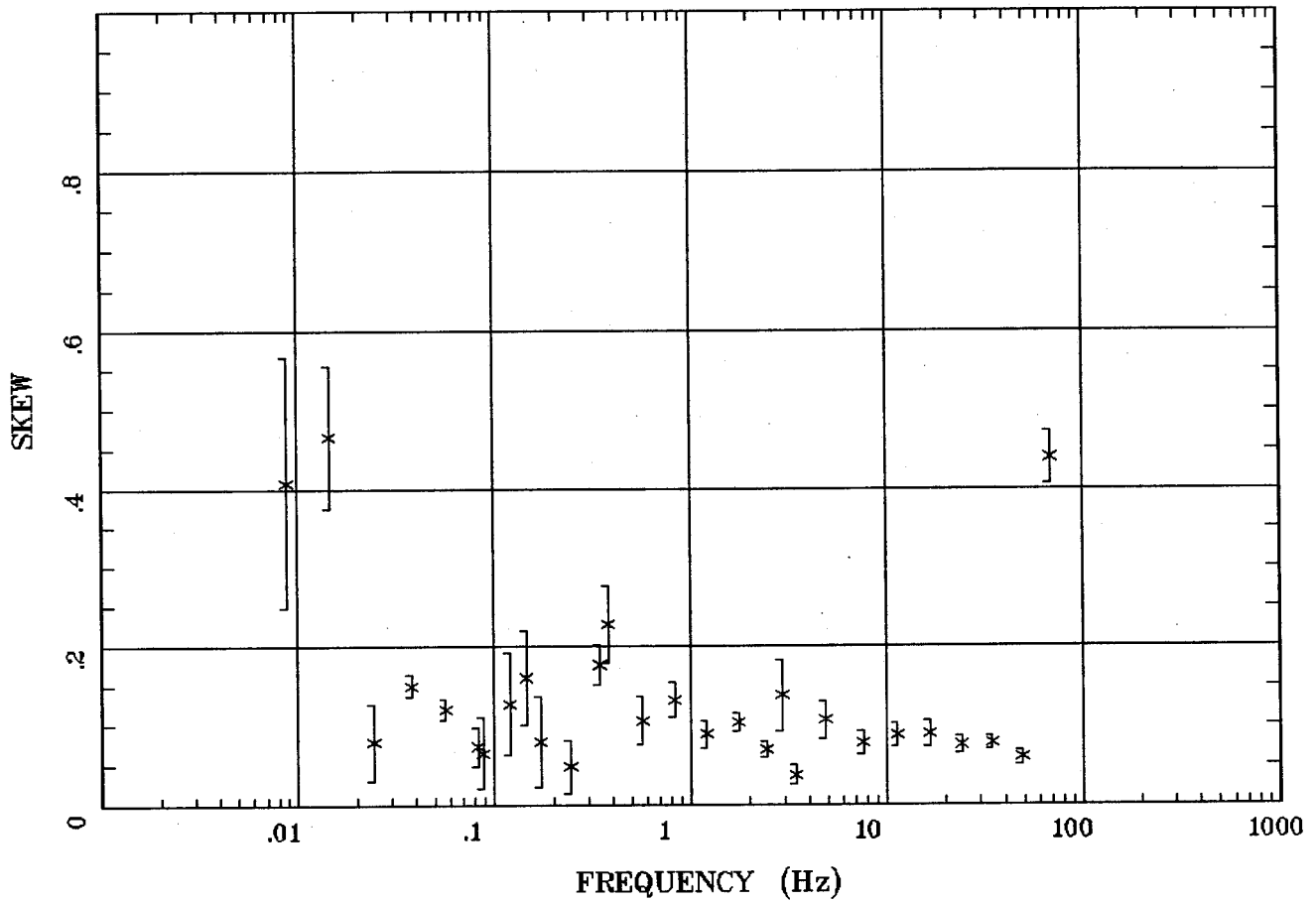


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

NE of DAF

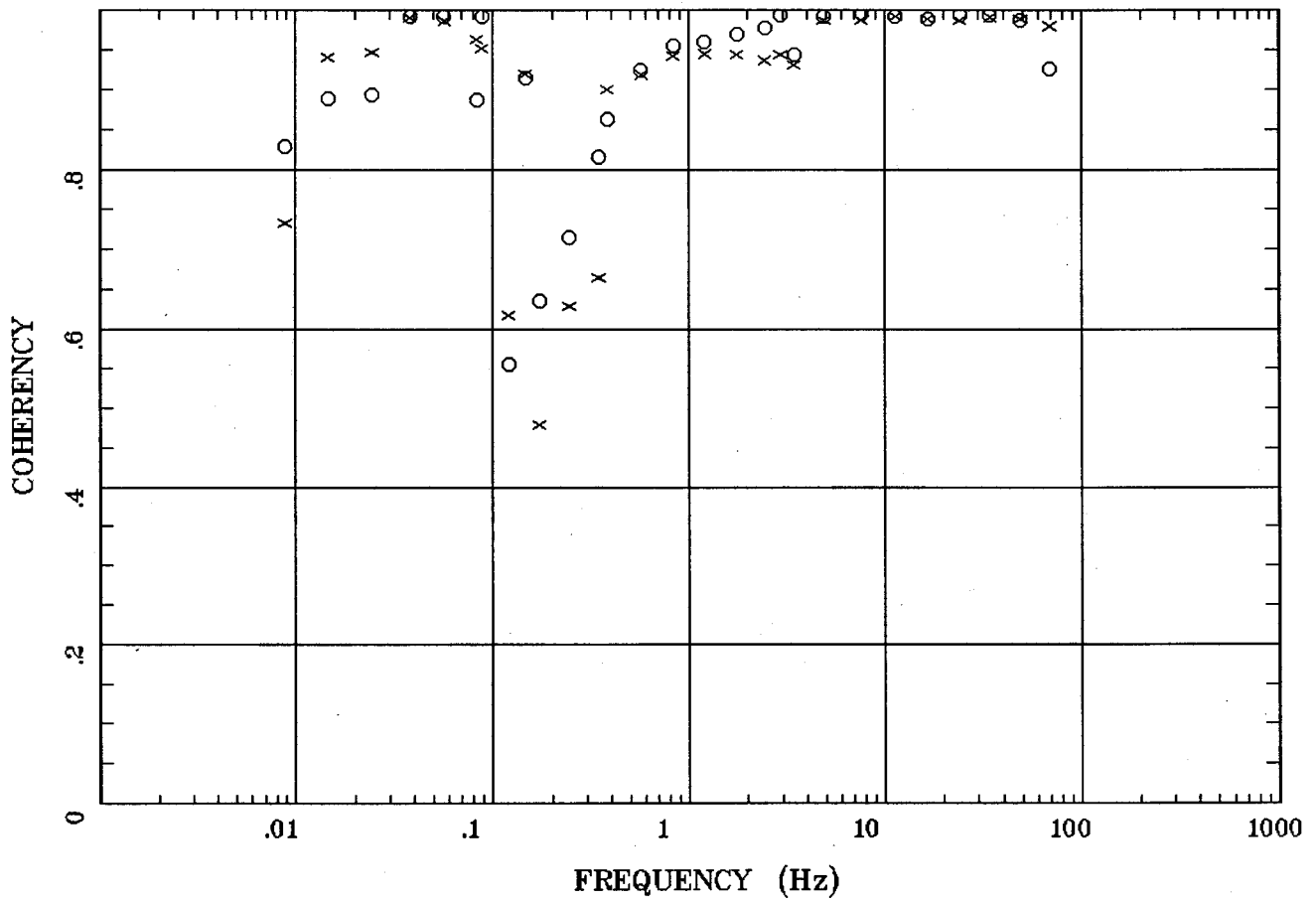


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

E MULT Coh.

NE of DAF

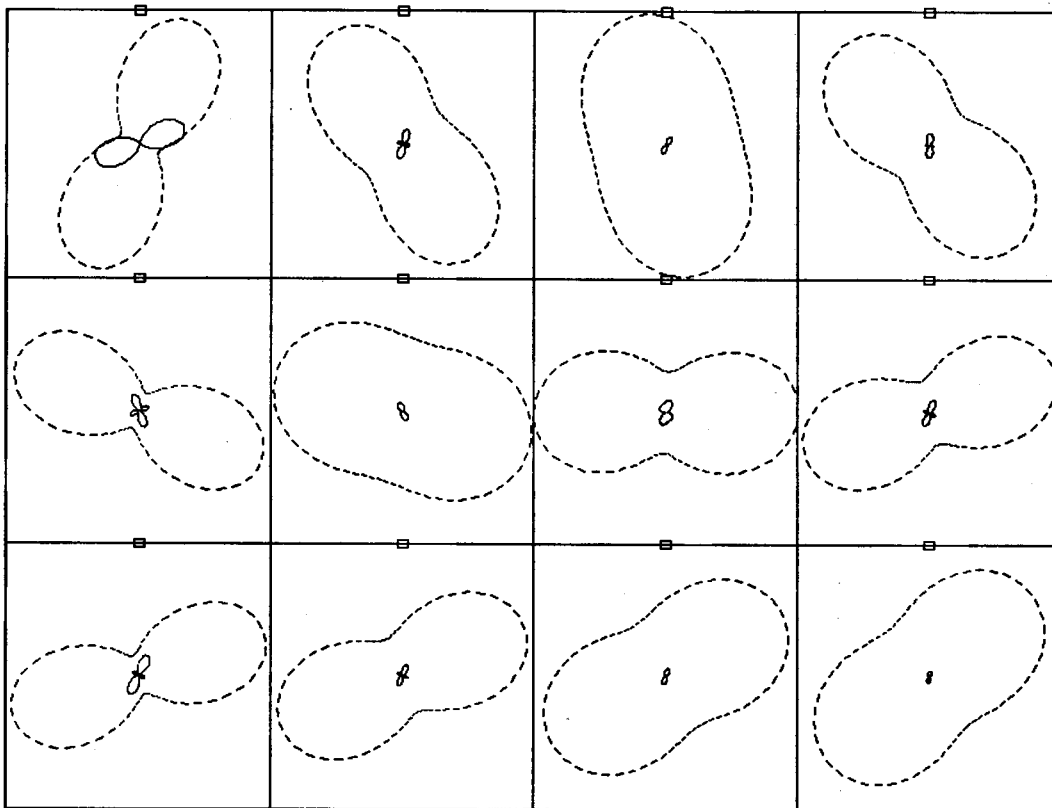


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

NE of DAF



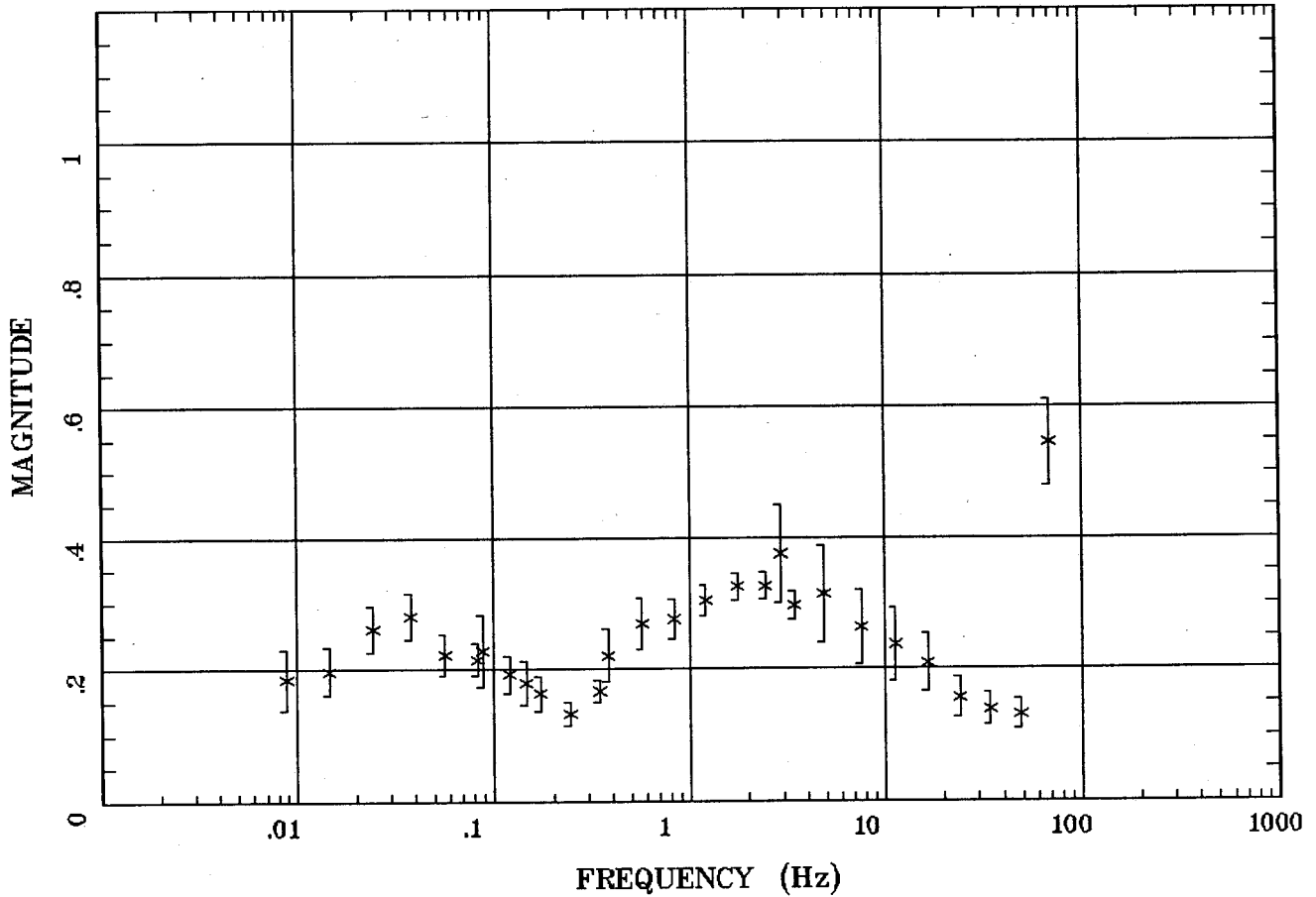
.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.345 Hz	.566 Hz	1.758 Hz
2.930 Hz	7.617 Hz	16.602 Hz	34.375 Hz

Client: Water Resources & DOD
 Remote: none
 Acquired: 04:5 Oct 20, 2005
 Survey Co: US Geological Survey

Rotation:
 Filename: nt61m.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 14:59 Feb 08, 2006
 < EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

NE of DAF

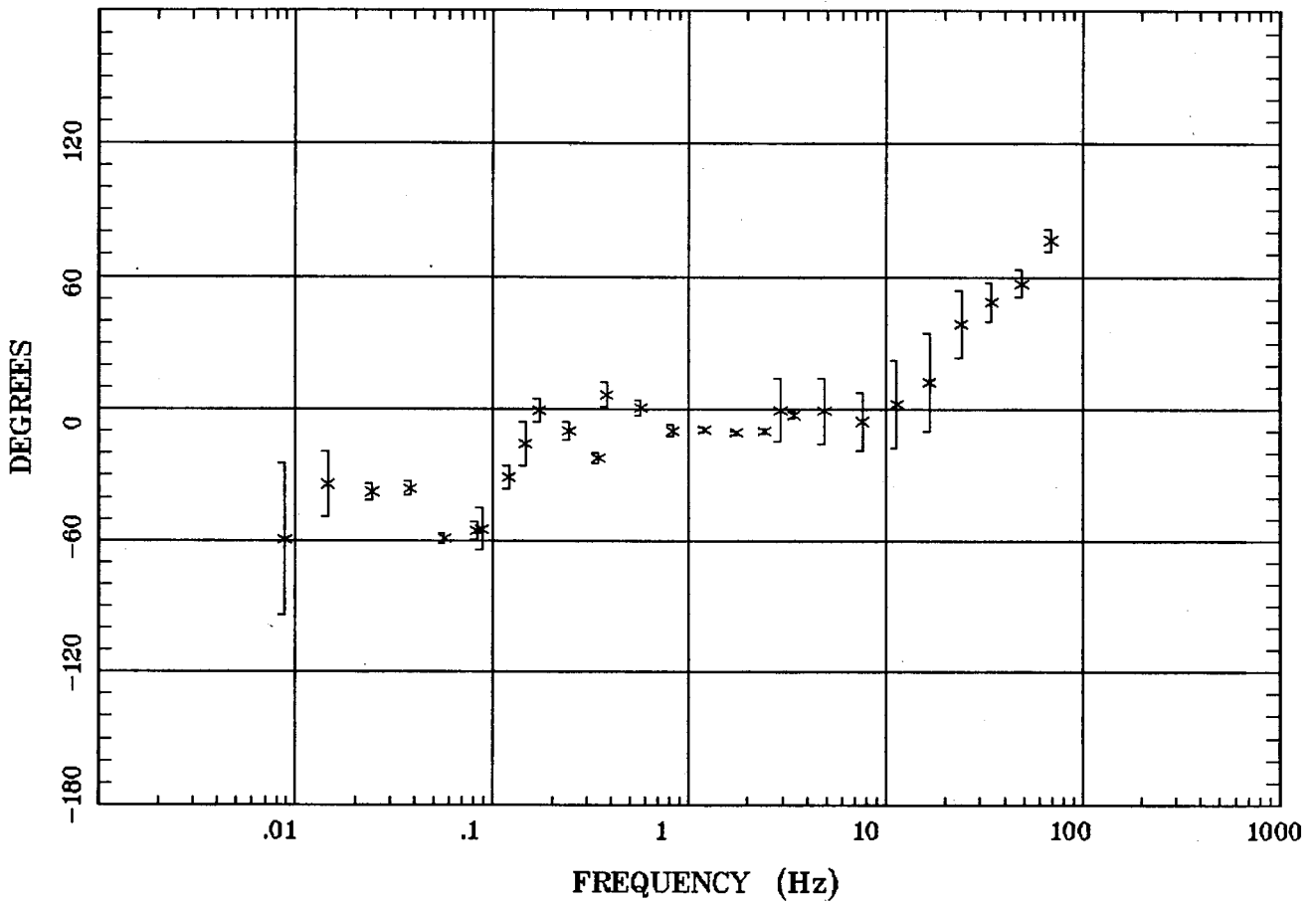


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

NE of DAF

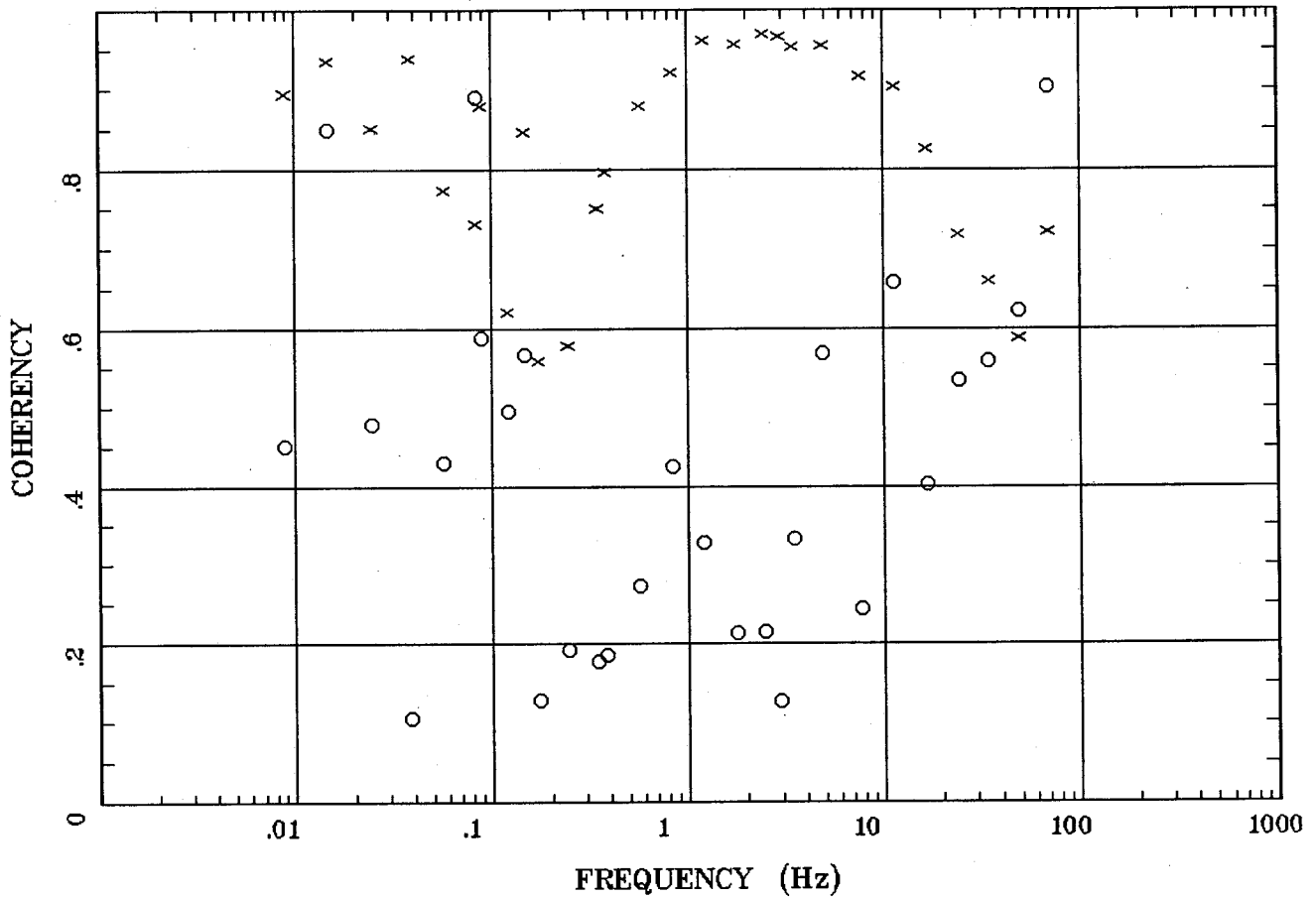


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

NE of DAF

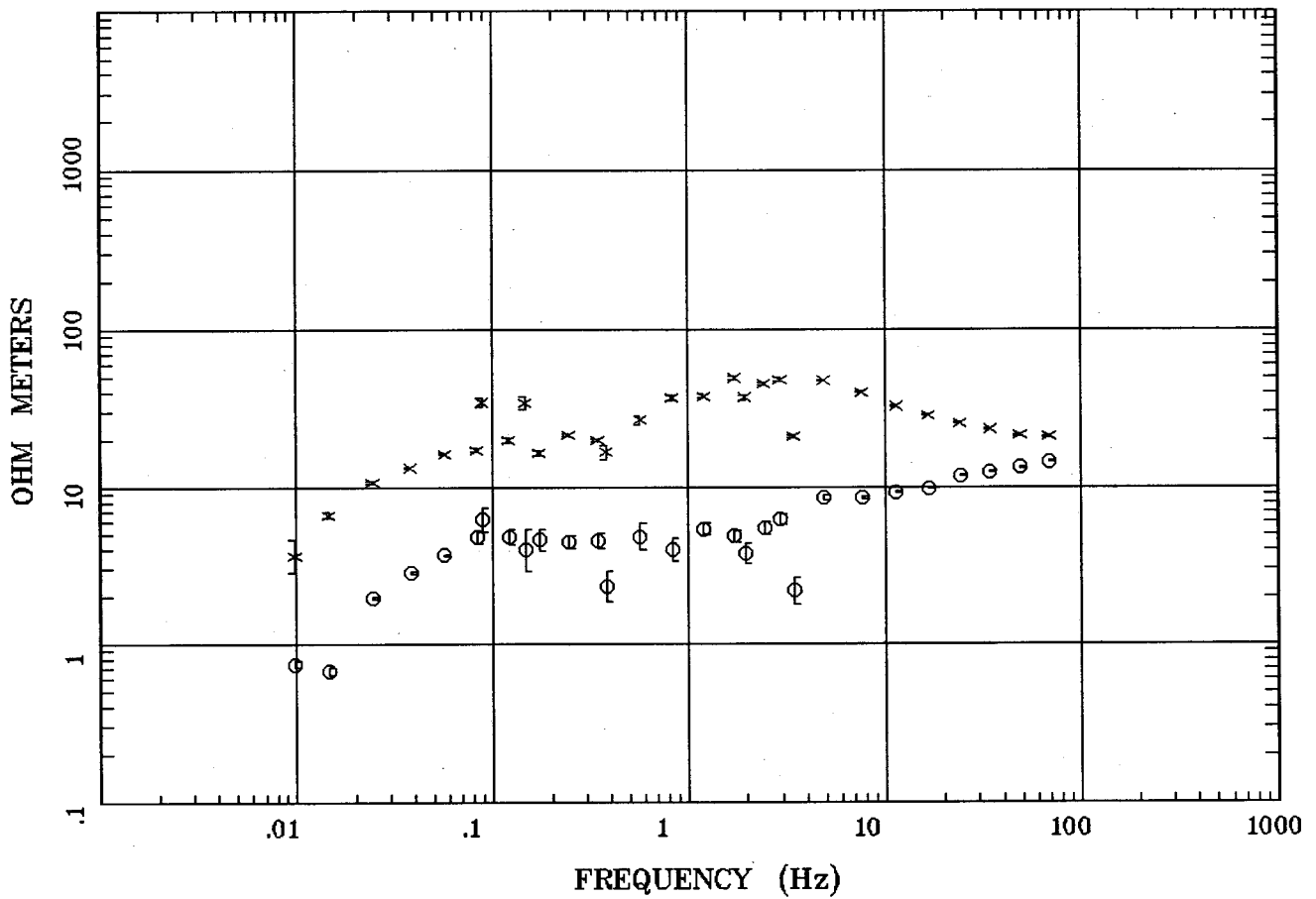


Client: Water Resources & DOD
Remote: none
Acquired: 04:5 Oct 20, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt61m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 14:59 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

North of Raineer Mesa 8-01rd

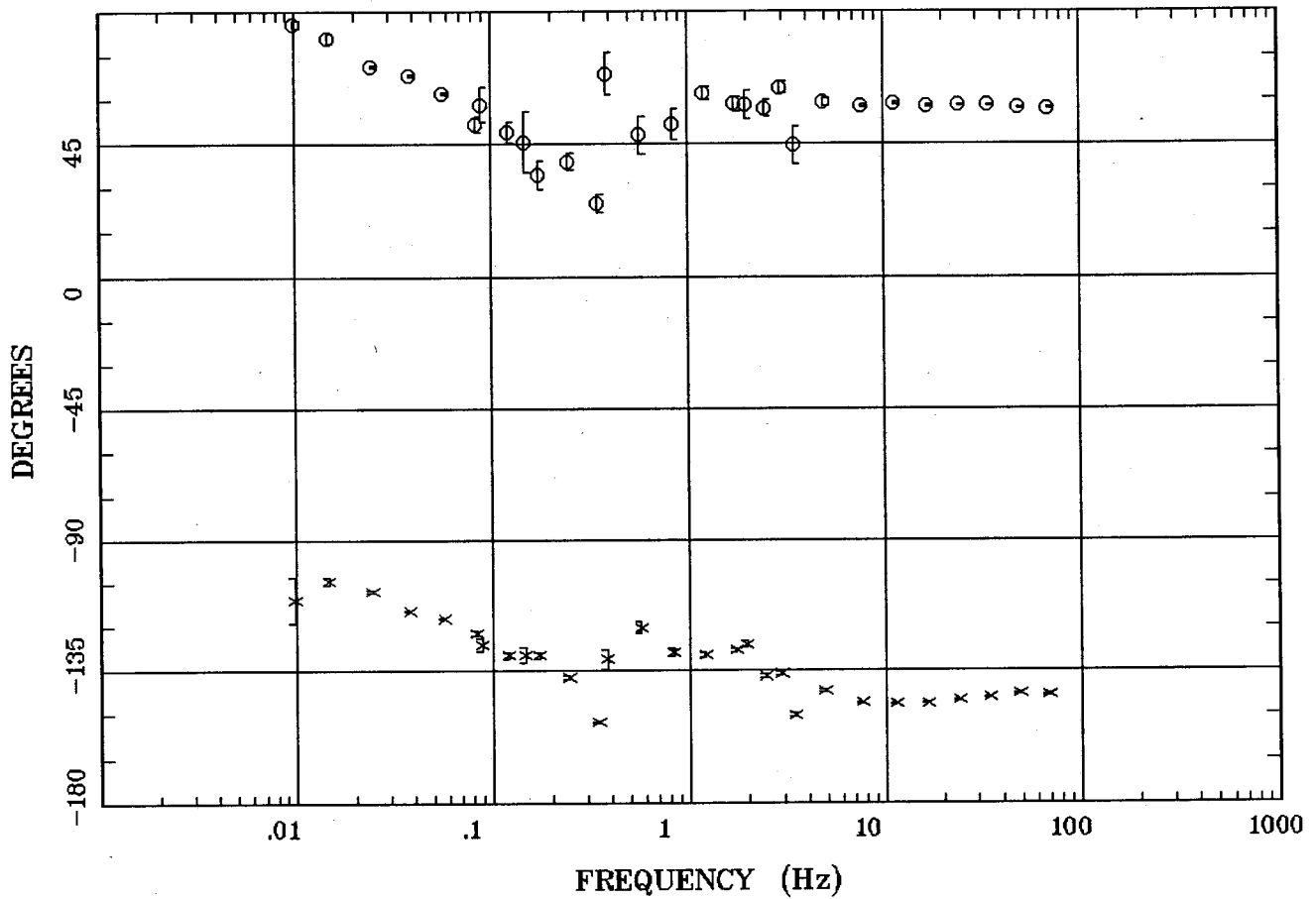


Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

North of Raineer Mesa 8-01rd



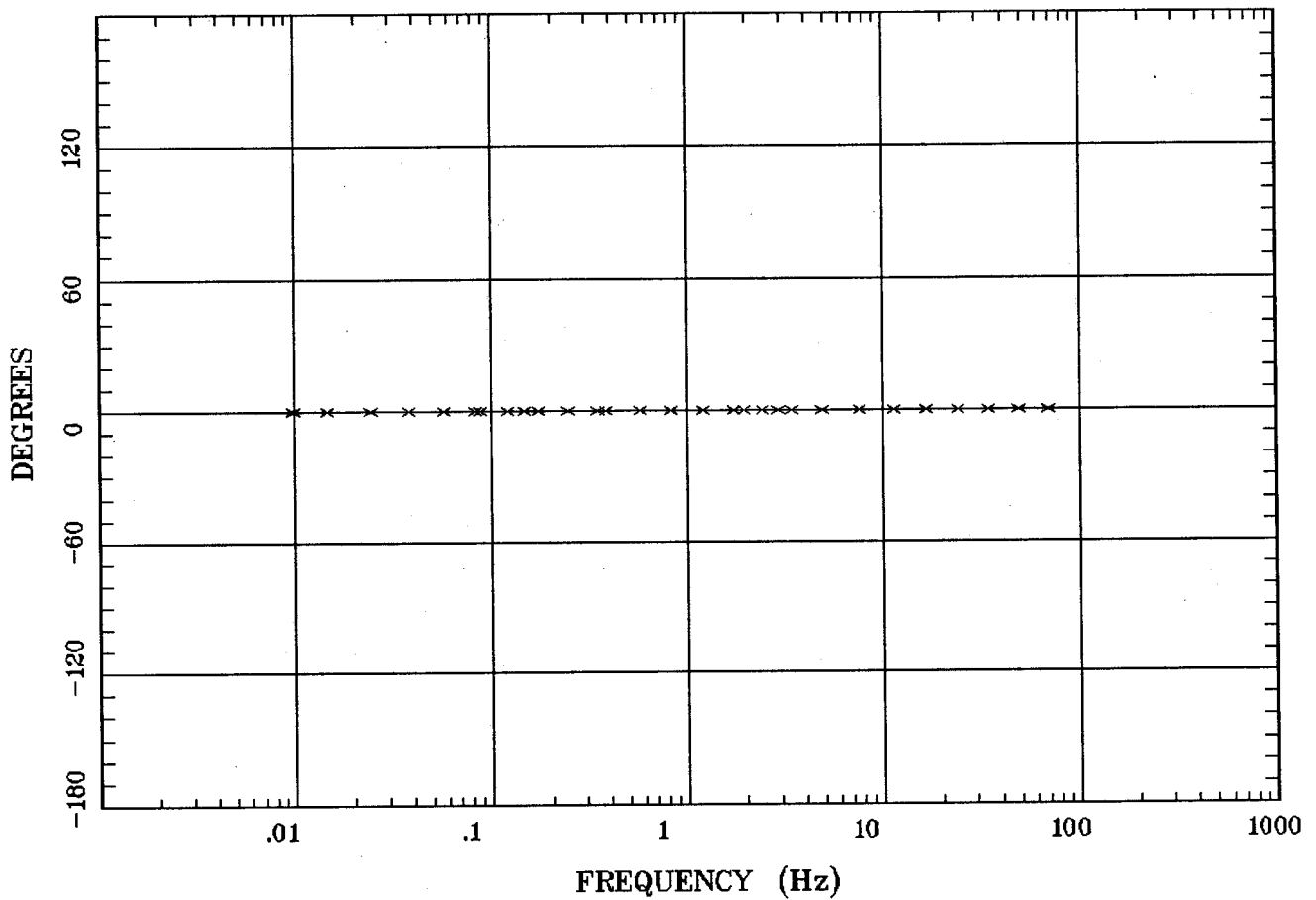
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 62

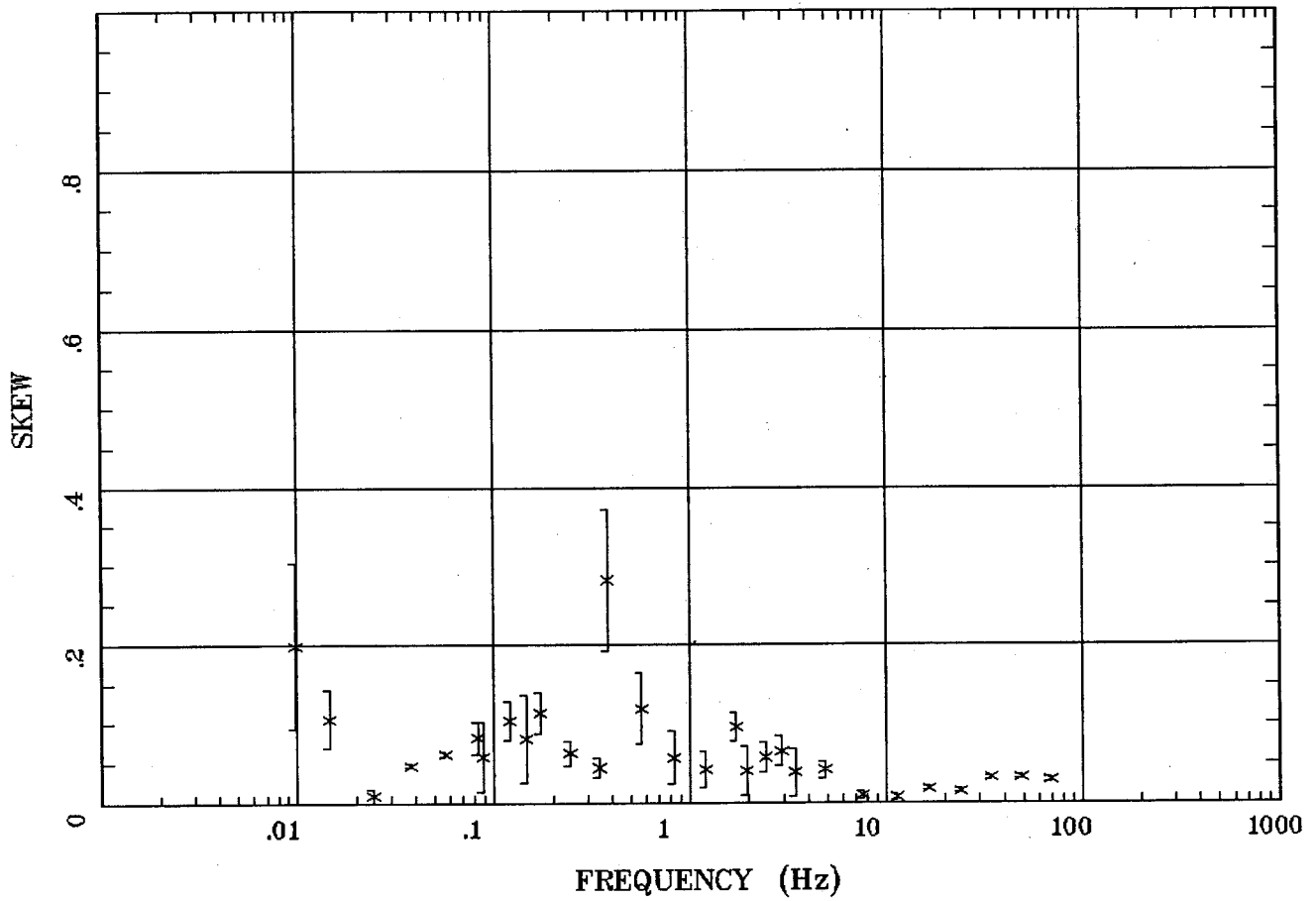
ROTATION ANGLE

North of Raineer Mesa 8-01rd



Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >



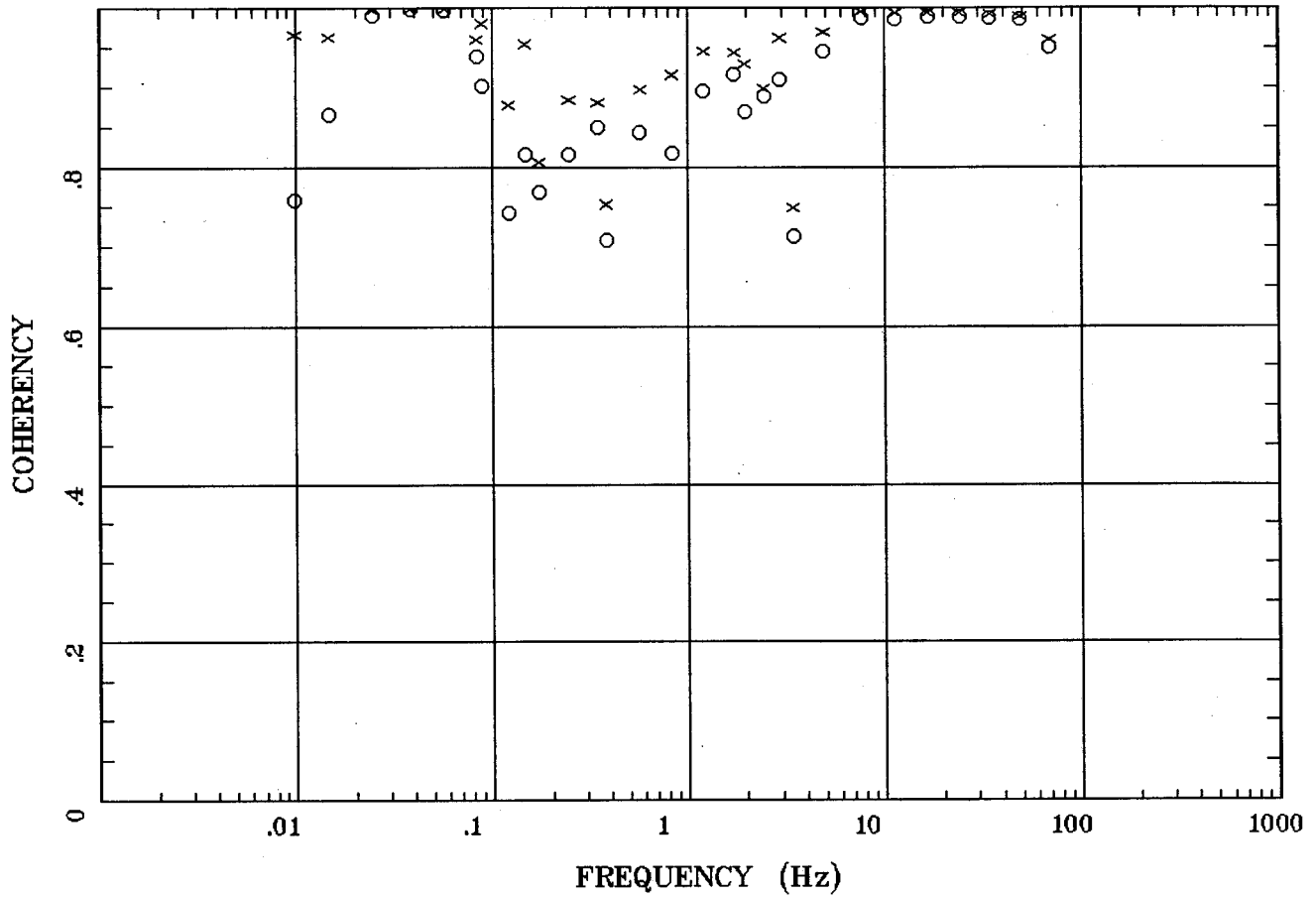
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 62

E MULT Coh.

North of Rainier Mesa 8-01rd



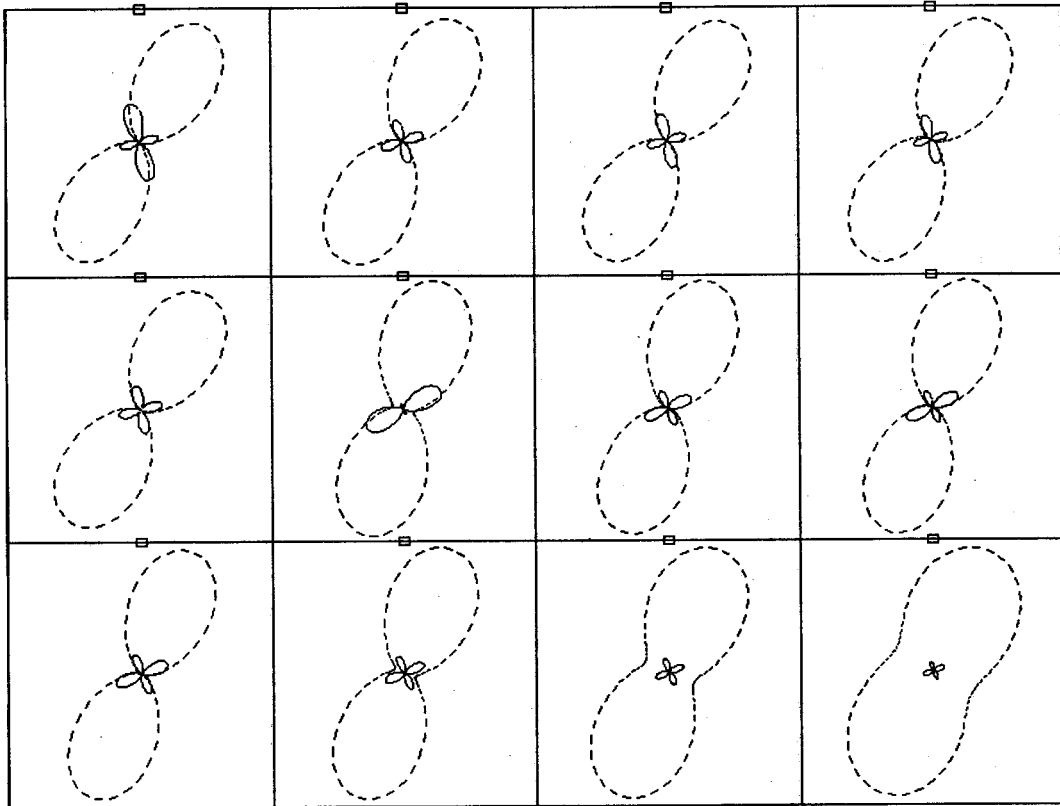
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 62

POLAR PLOTS

North of Rainier Mesa 8-01rd



.0098 Hz
.172 Hz
2.930 Hz

.0244 Hz
.381 Hz
4.883 Hz

.0566 Hz
.830 Hz
16.602 Hz

.120 Hz
1.719 Hz
34.375 Hz

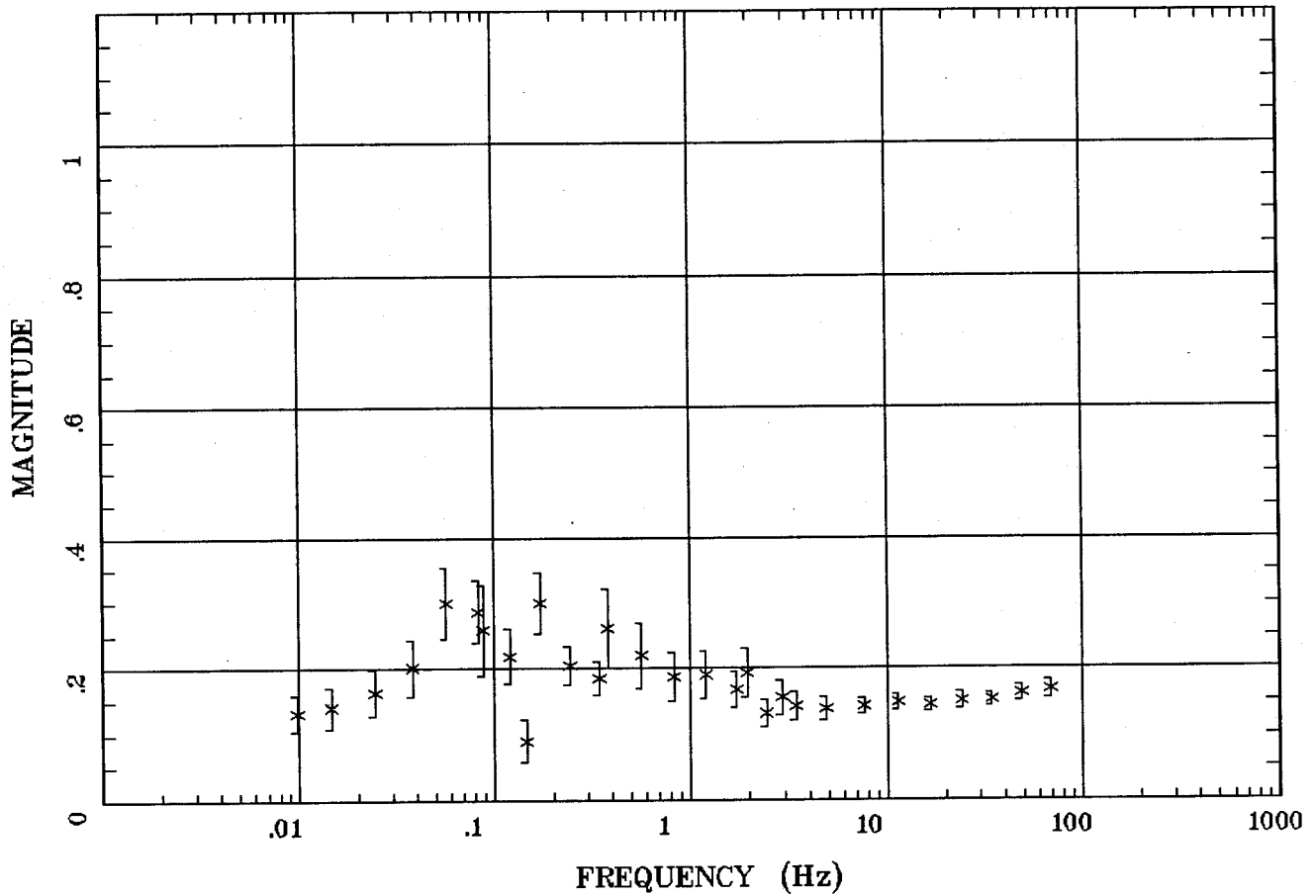
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:18 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 62

TIPPER MAGNITUDE

North of Raineer Mesa 8-01rd



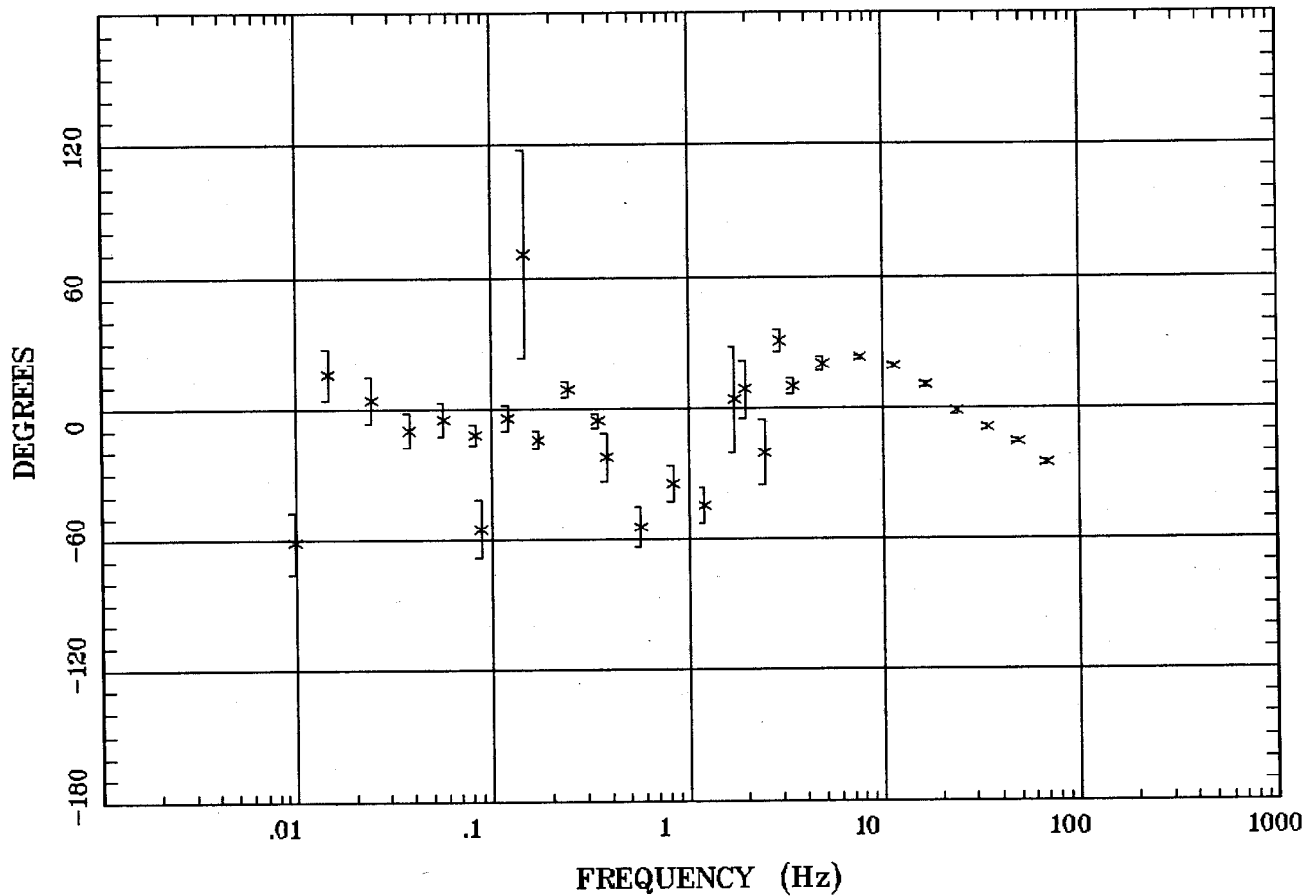
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:19 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 62

TIPPER STRIKE

North of Raineer Mesa 8-01rd

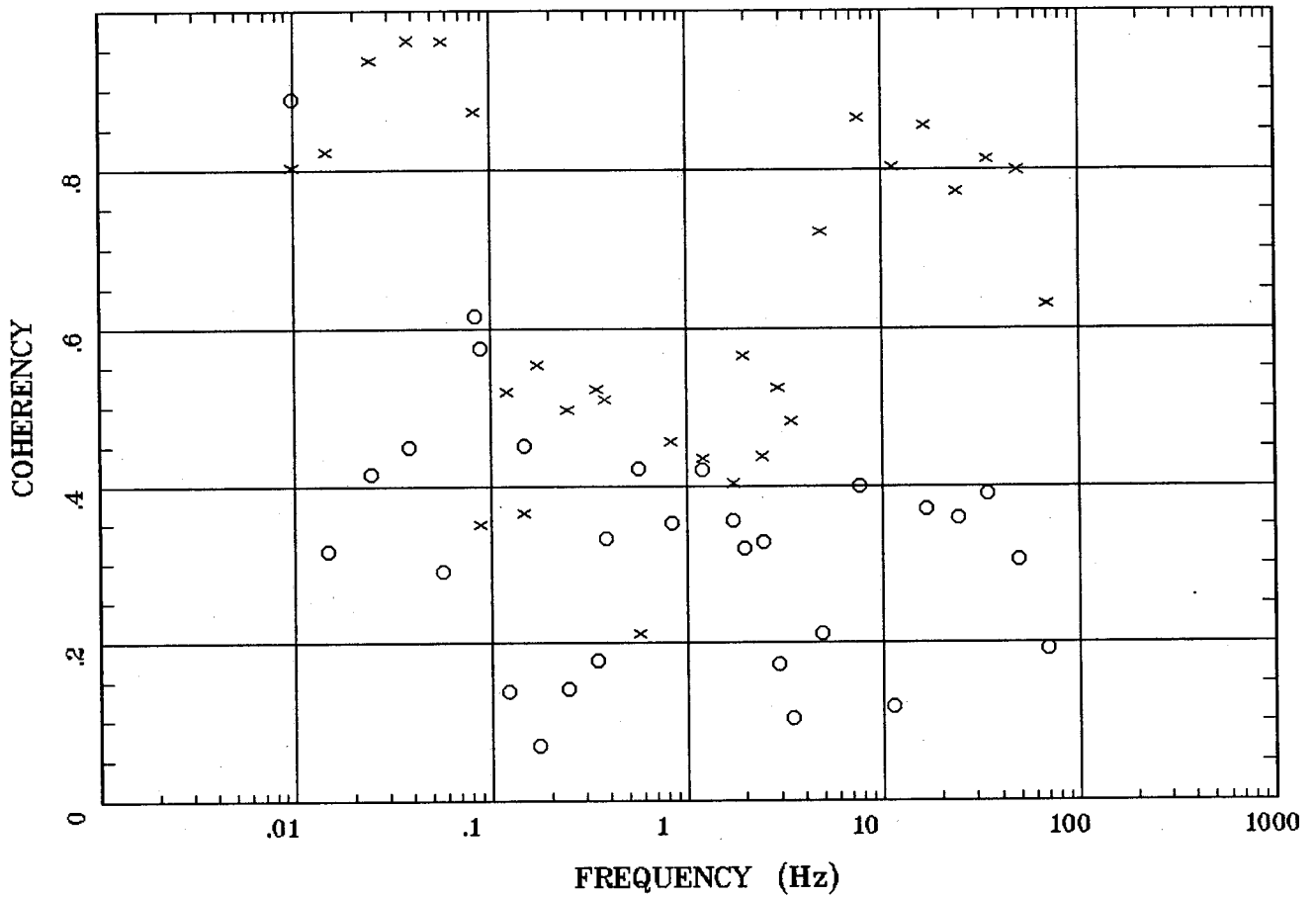


Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:19 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

HzHx.x Coh HzHy.o

North of Raineer Mesa 8-01rd



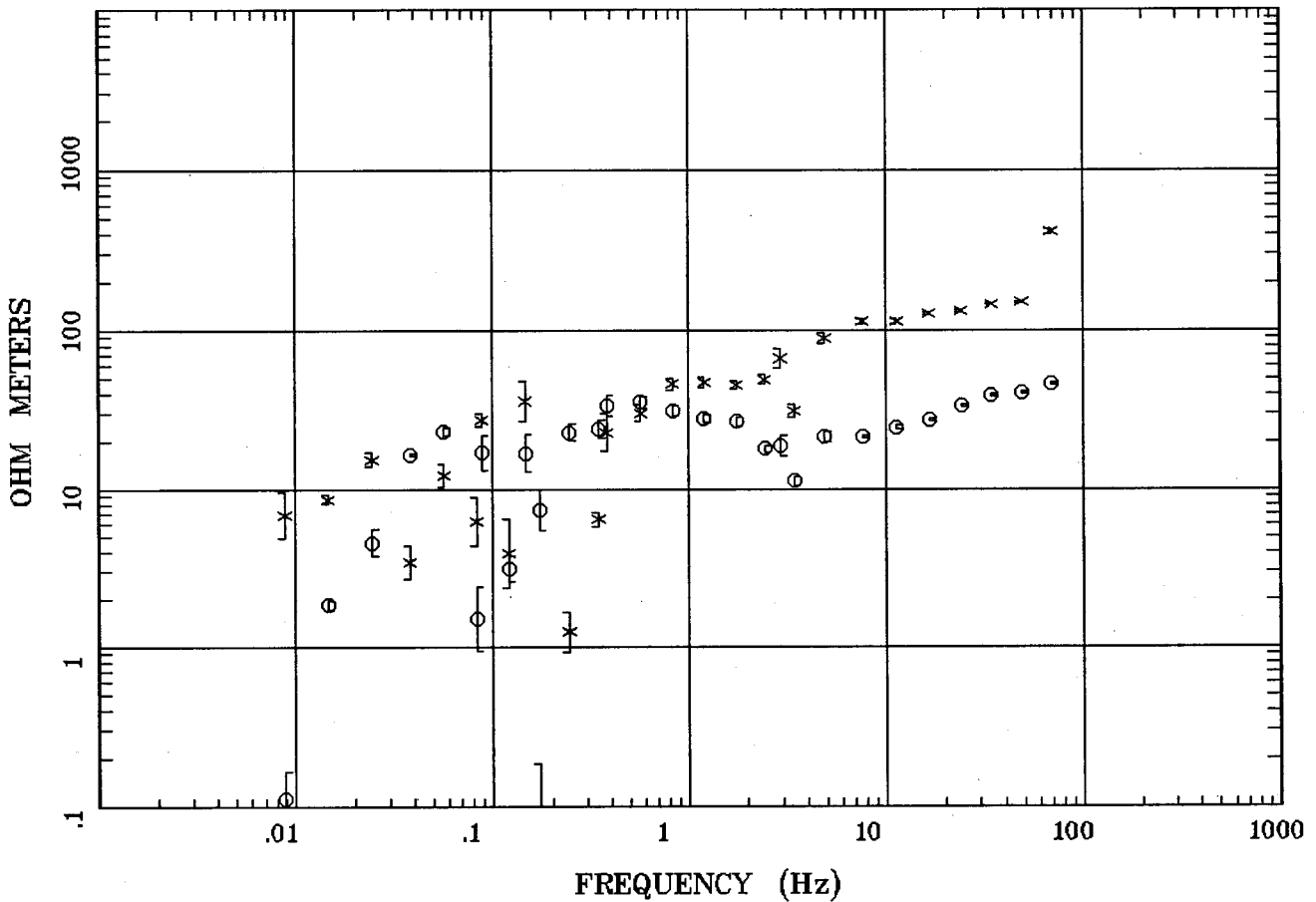
Client: Water Resources & DOD
Remote: none
Acquired: 13:5 Feb 01, 2006
Survey Co:US Geological Survey

Rotation:
Filename: nt62n.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 15:19 Feb 08, 2006
< EMI - ElectroMagnetic Instruments >

Station 63

APPARENT RESISTIVITY

North of Raineer Mesa Road

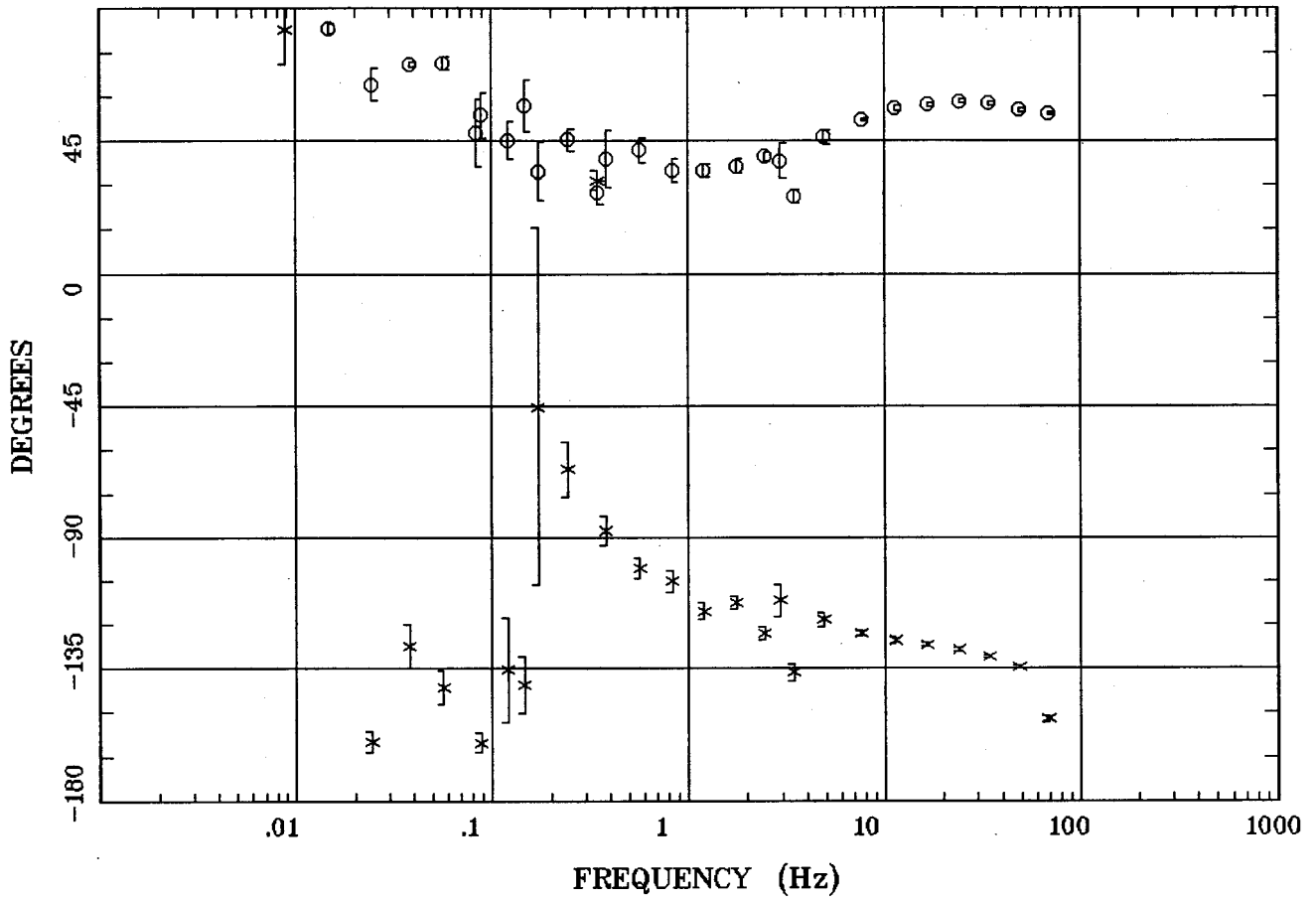


Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE PHASE

North of Raineer Mesa Road



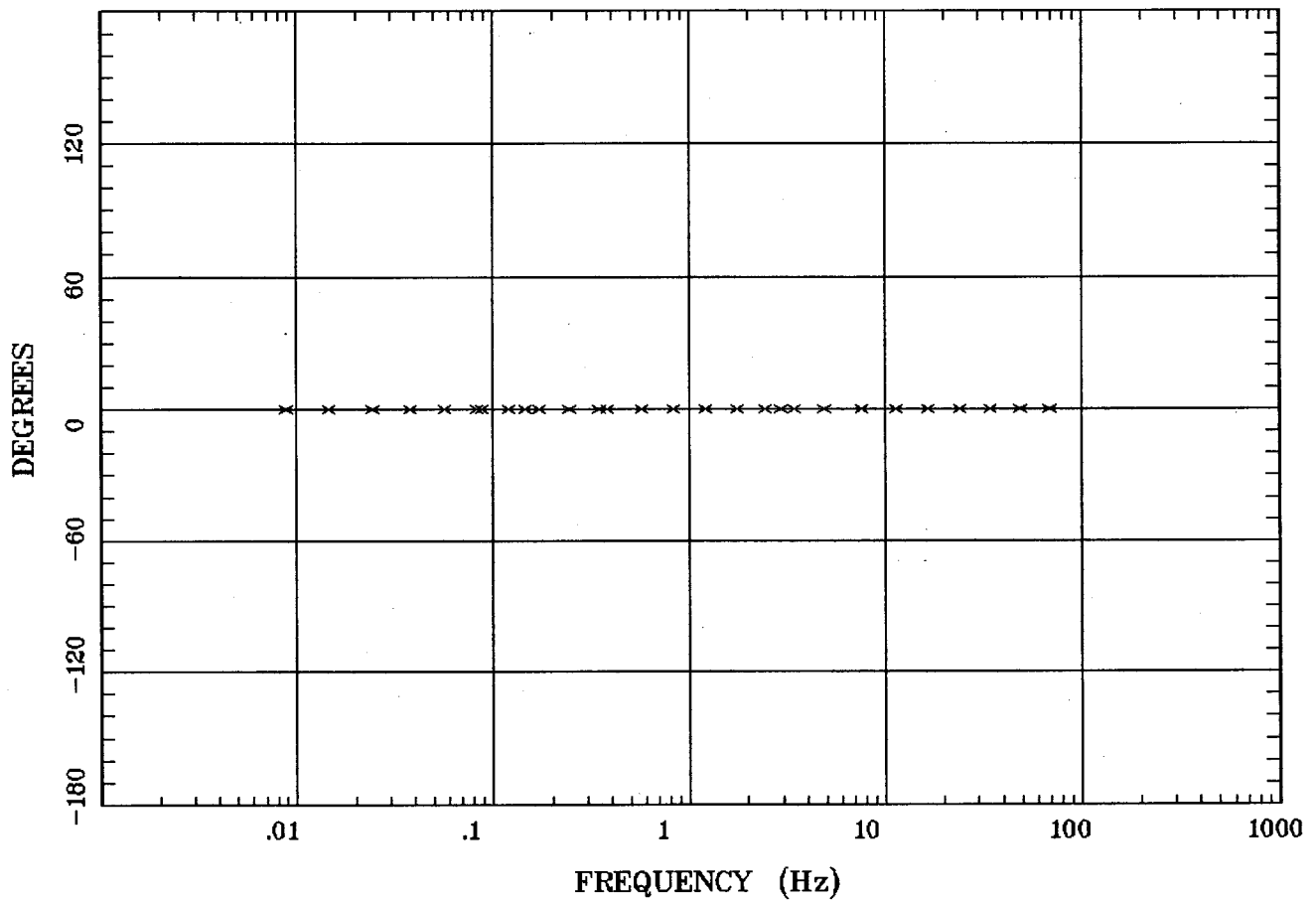
Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 63

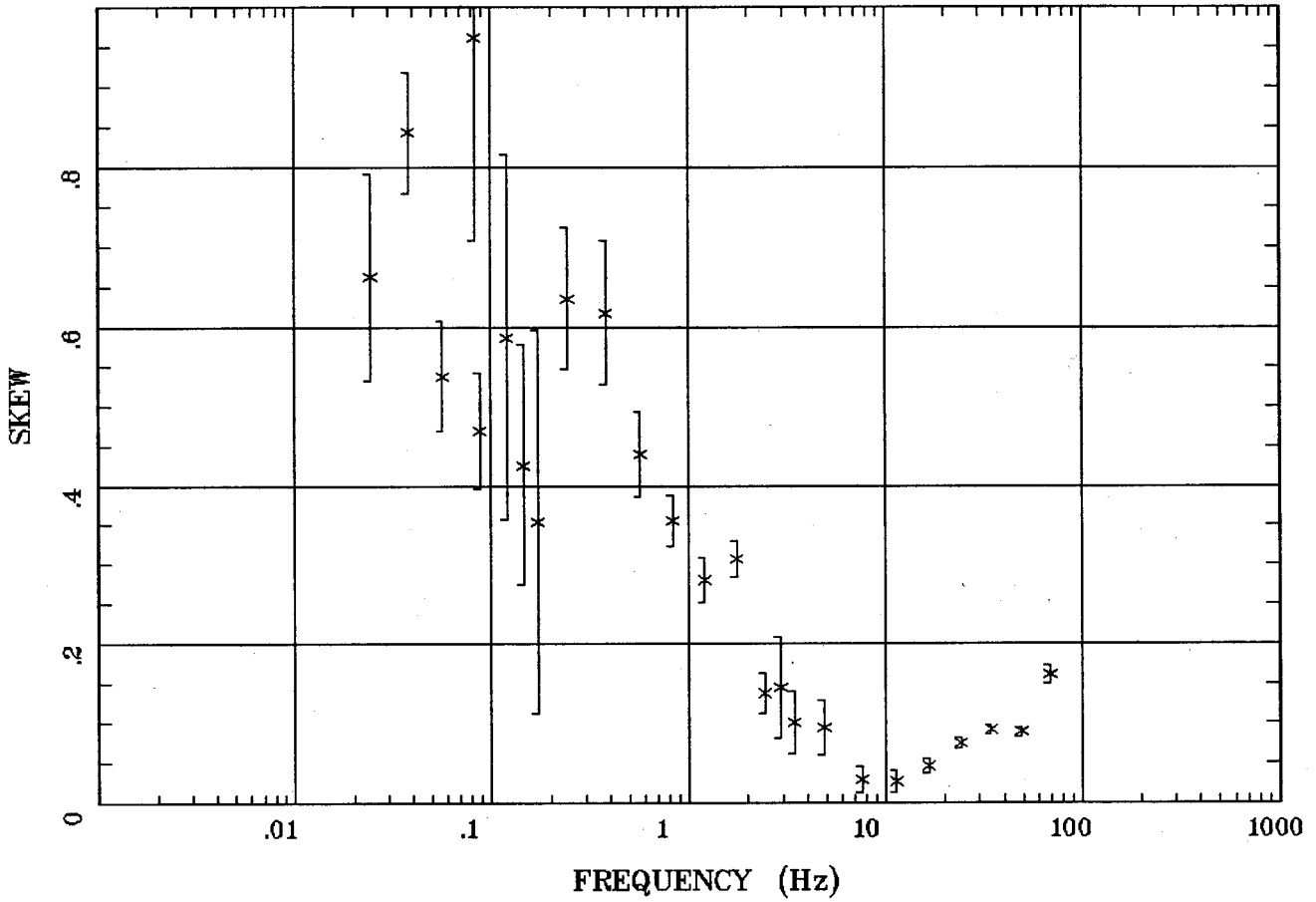
ROTATION ANGLE

North of Raineer Mesa Road



Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >



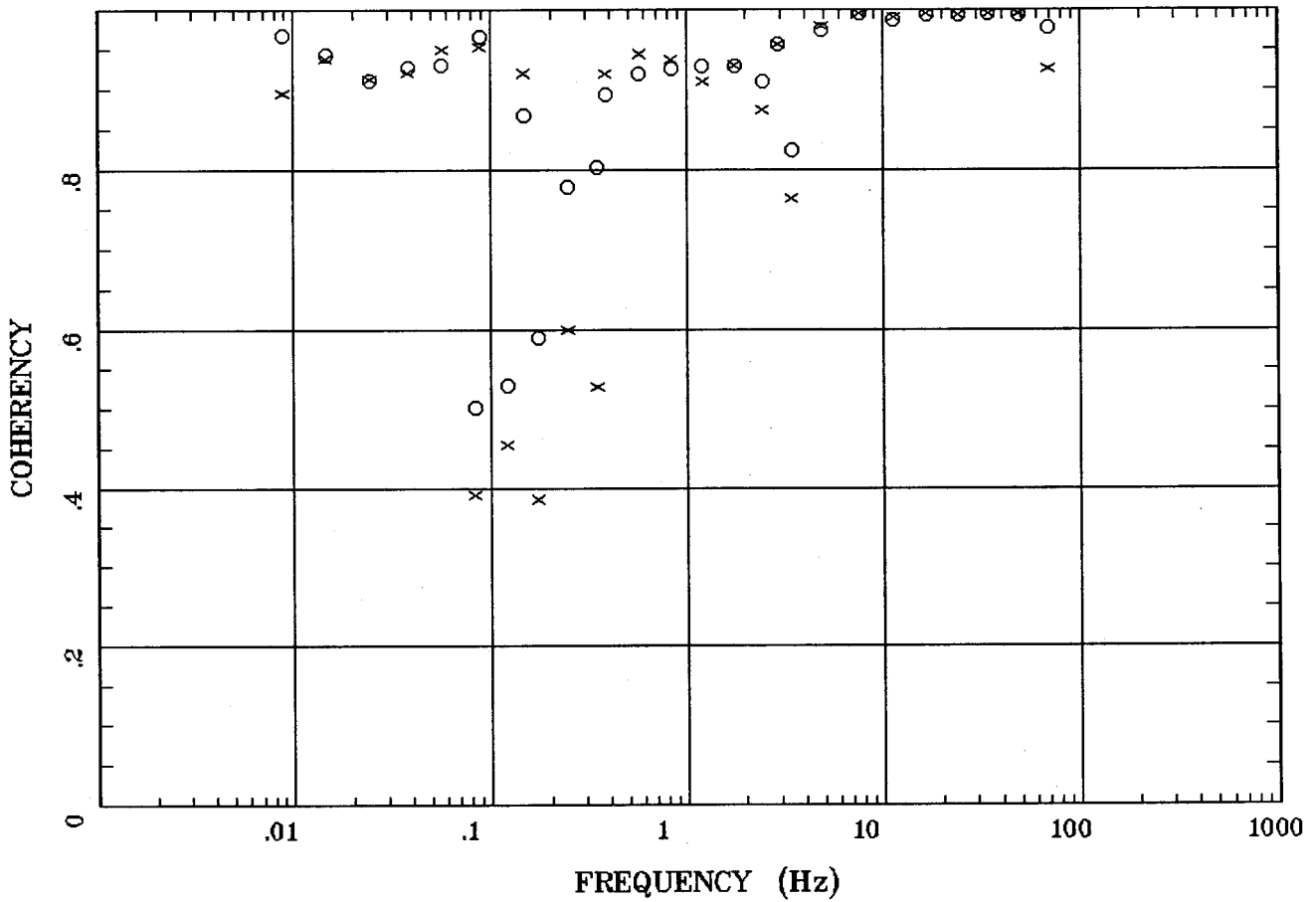
Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 63

E MULT Coh.

North of Raineer Mesa Road

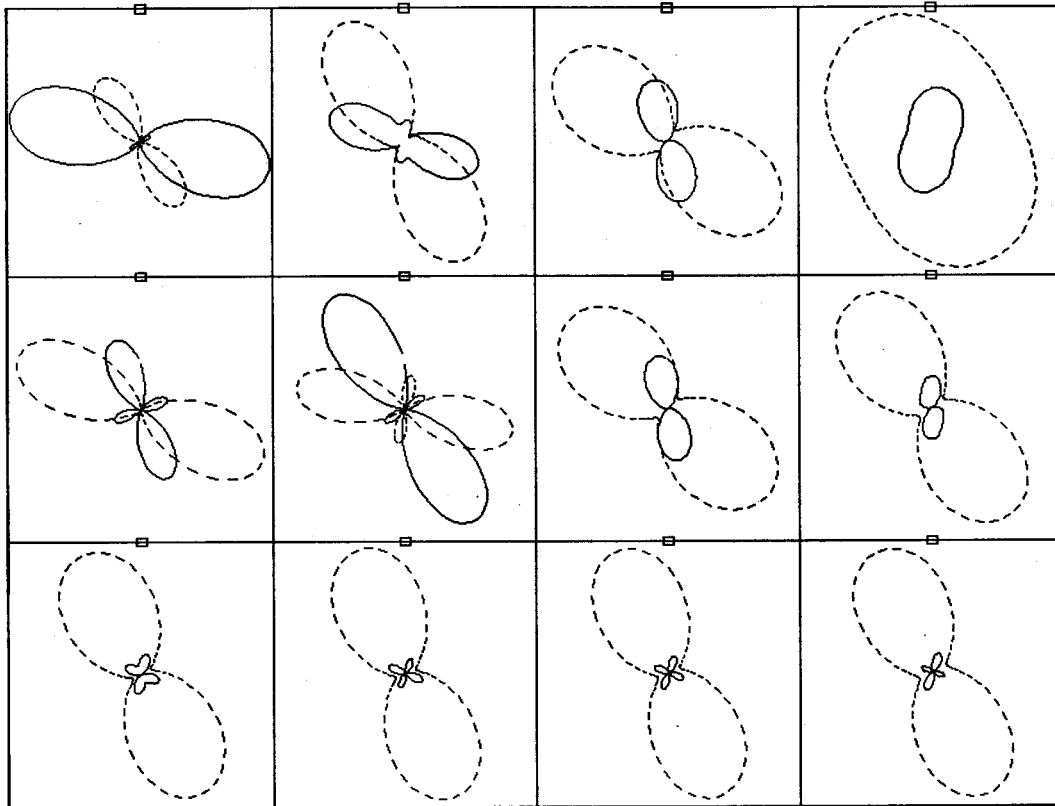


Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

North of Raineer Mesa Road



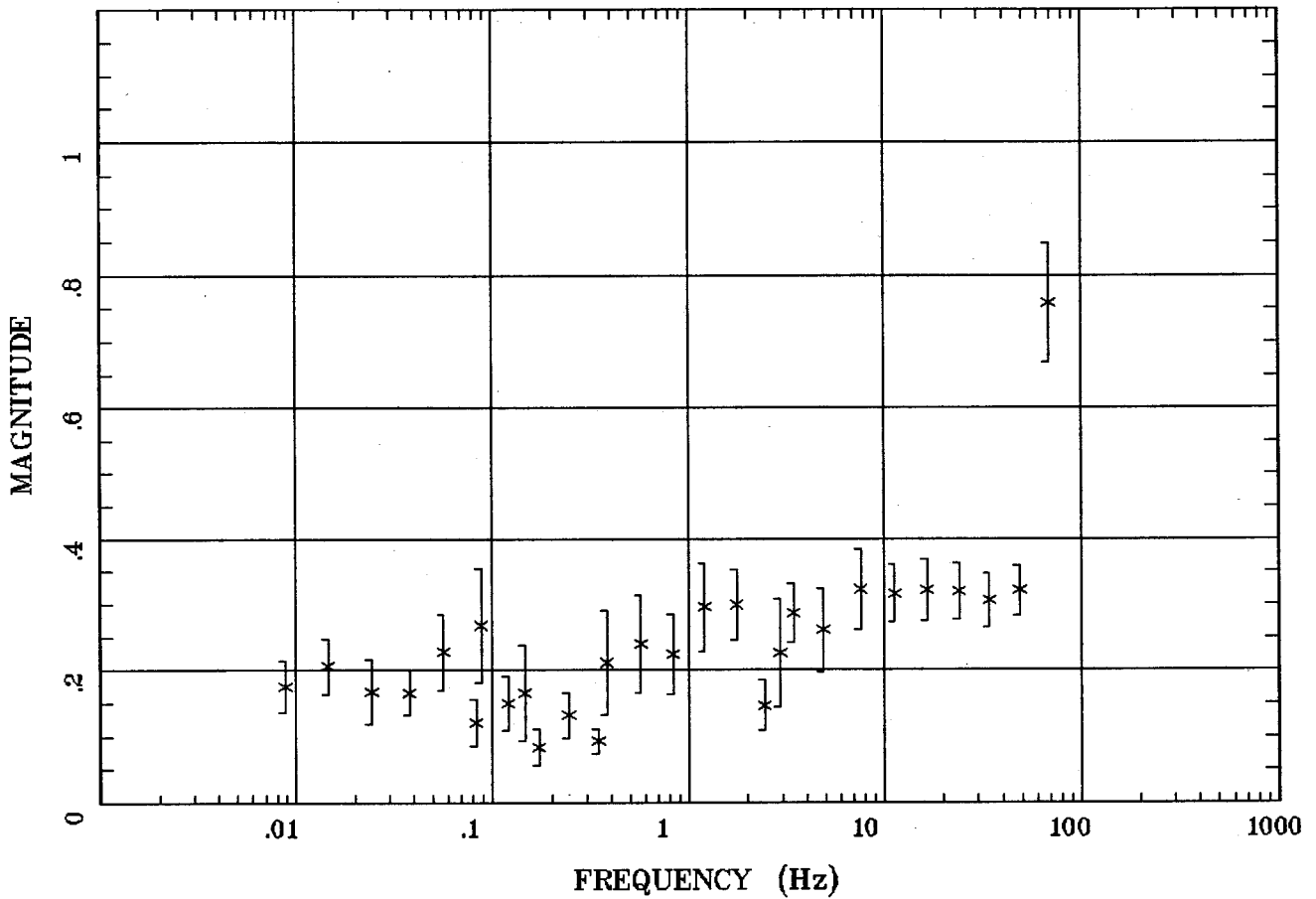
.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.345 Hz	.566 Hz	1.758 Hz
2.930 Hz	7.617 Hz	16.602 Hz	34.375 Hz

Client: Water Resources & DOD
 Remote: none
 Acquired: 05:3 Oct 17, 2005
 Survey Co:US Geological Survey

Rotation:
 Filename: nt63m.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 08:10 Feb 09, 2006
 < EMI - ElectroMagnetic Instruments >

TIPPER MAGNITUDE

North of Raineer Mesa Road

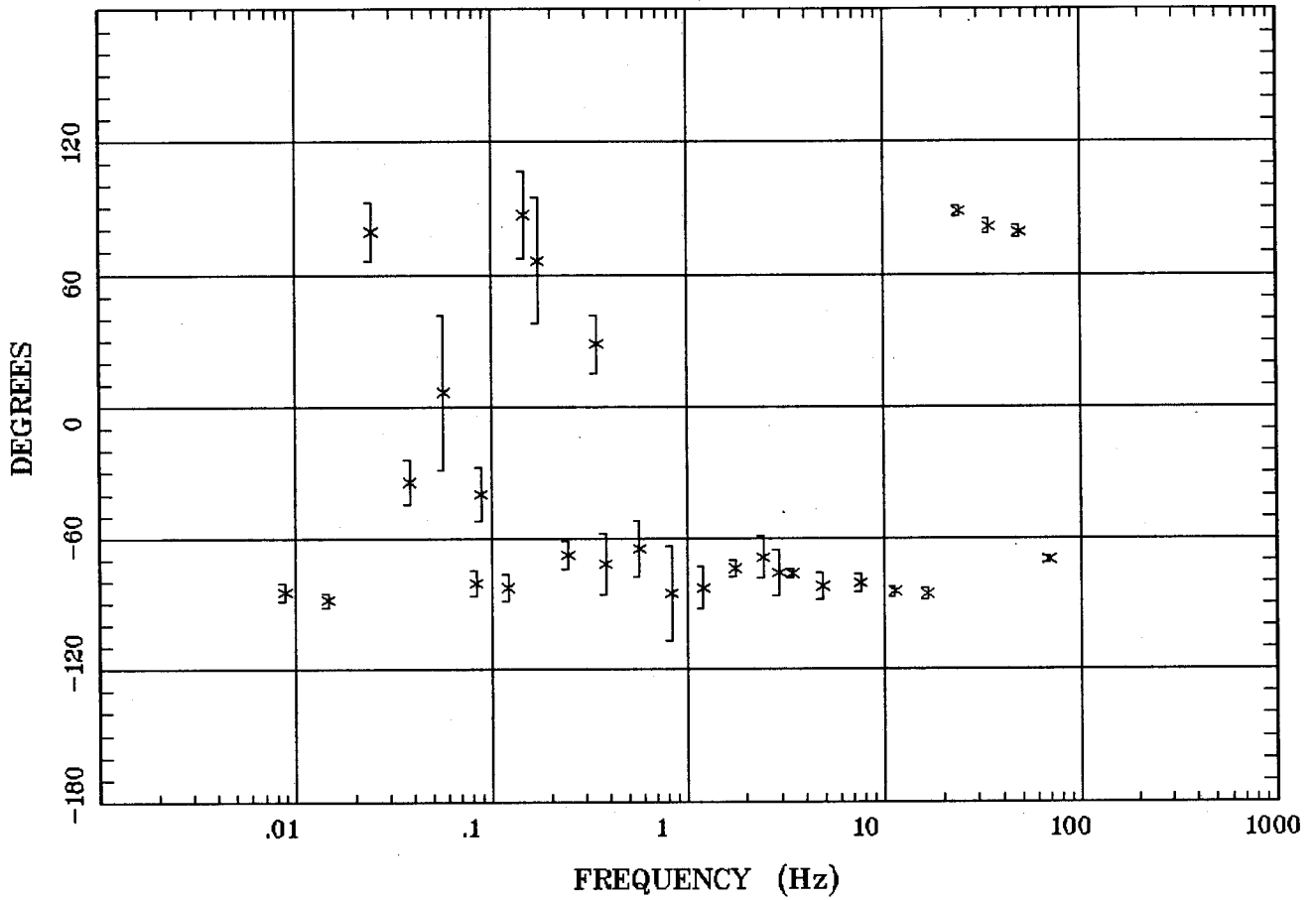


Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

North of Raineer Mesa Road



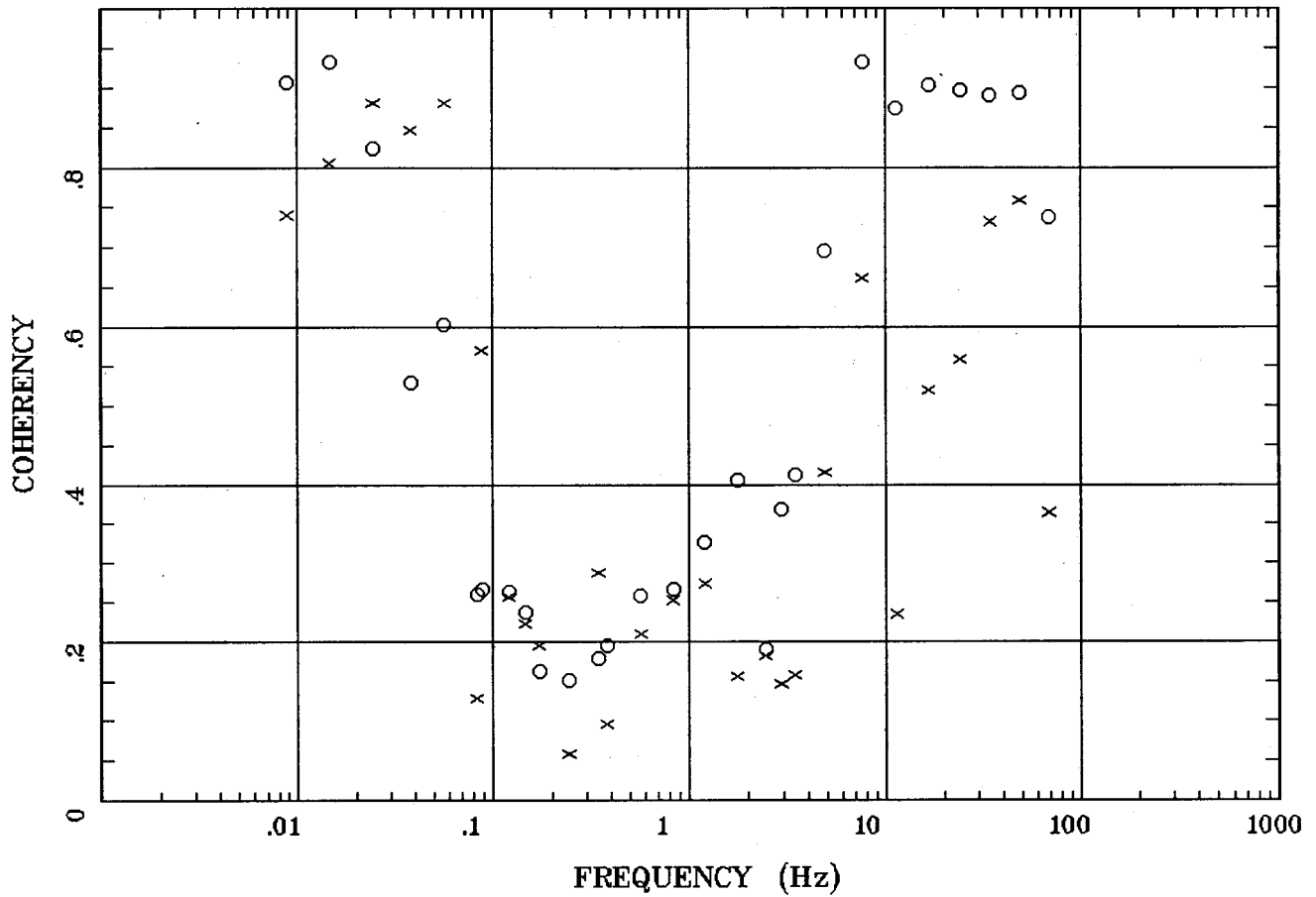
Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 63

HzHx.x Coh HzHy.o

North of Raineer Mesa Road

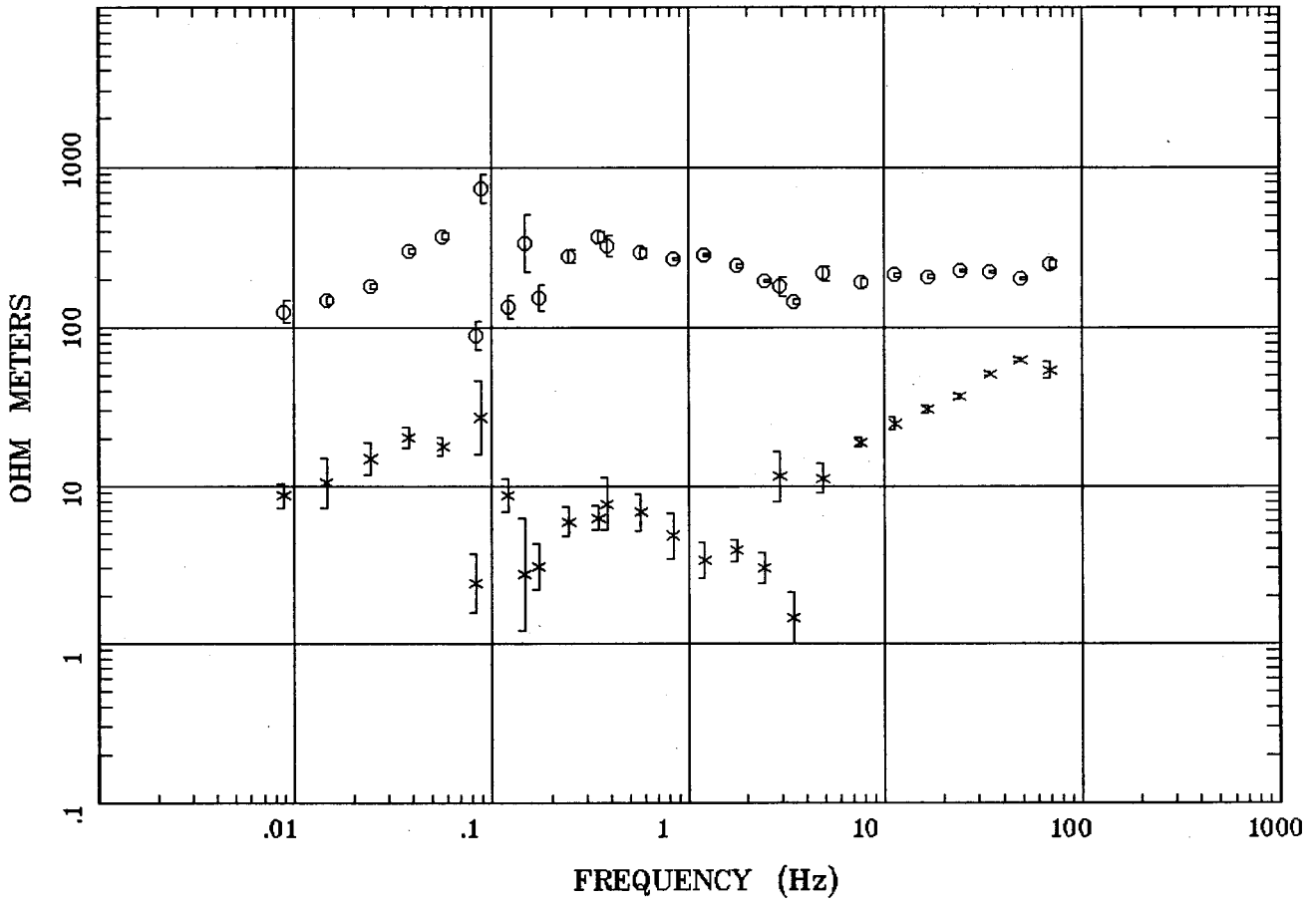


Client: Water Resources & DOD
Remote: none
Acquired: 05:3 Oct 17, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt63m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 08:10 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

APPARENT RESISTIVITY

Station 64
North of Rainer Mesa Road



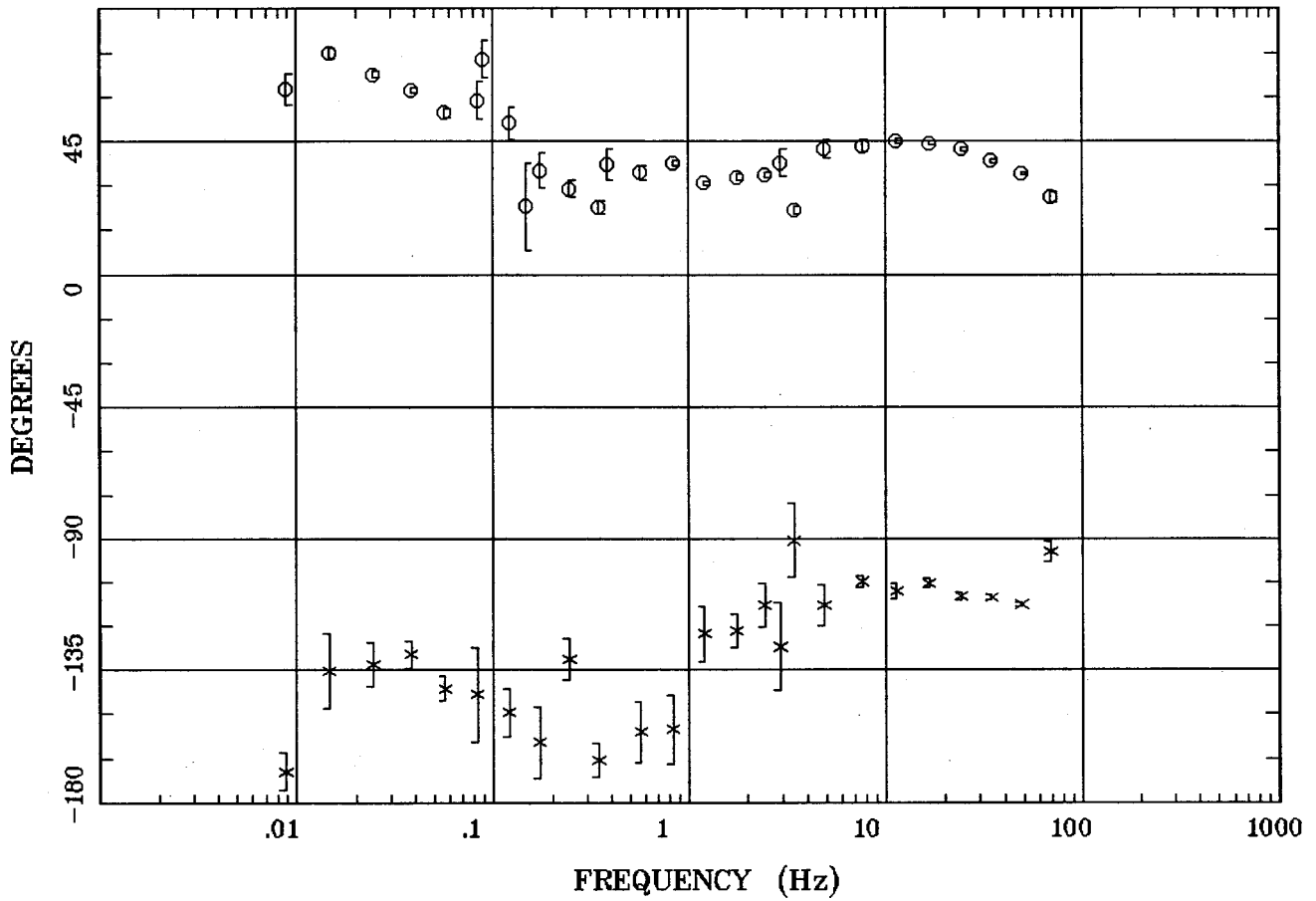
Client: Water Resources & DOD
 Remote: none
 Acquired: 10:4 Oct 18, 2005
 Survey Co:US Geological Survey

Rotation:
 Filename: nt64m.avg
 Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
 Plotted: 10:19 Feb 09, 2006
 < EMI - ElectroMagnetic Instruments >

Station 64

IMPEDANCE PHASE

North of Raineer Mesa Road



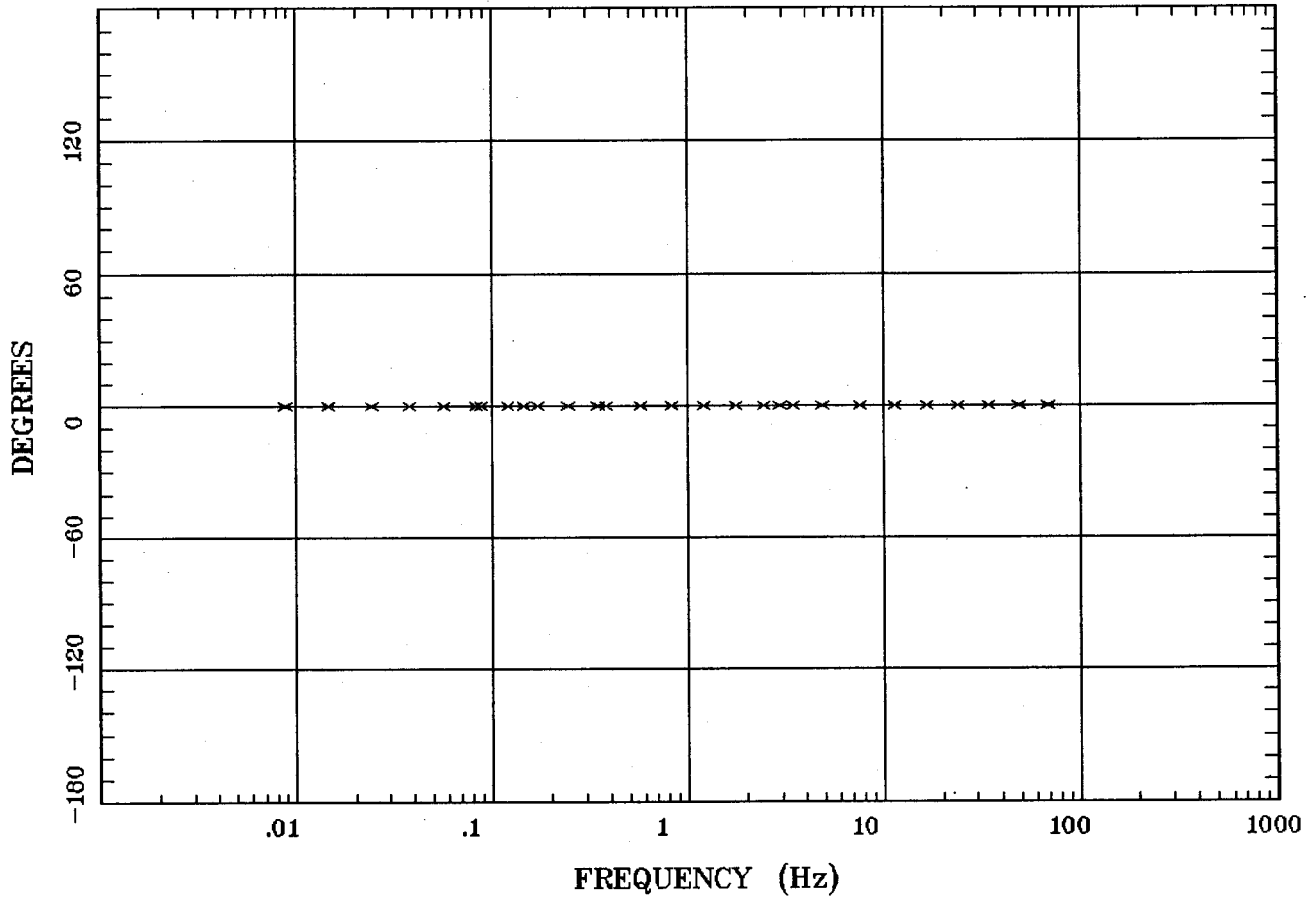
Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 64

ROTATION ANGLE

North of Raineer Mesa Road

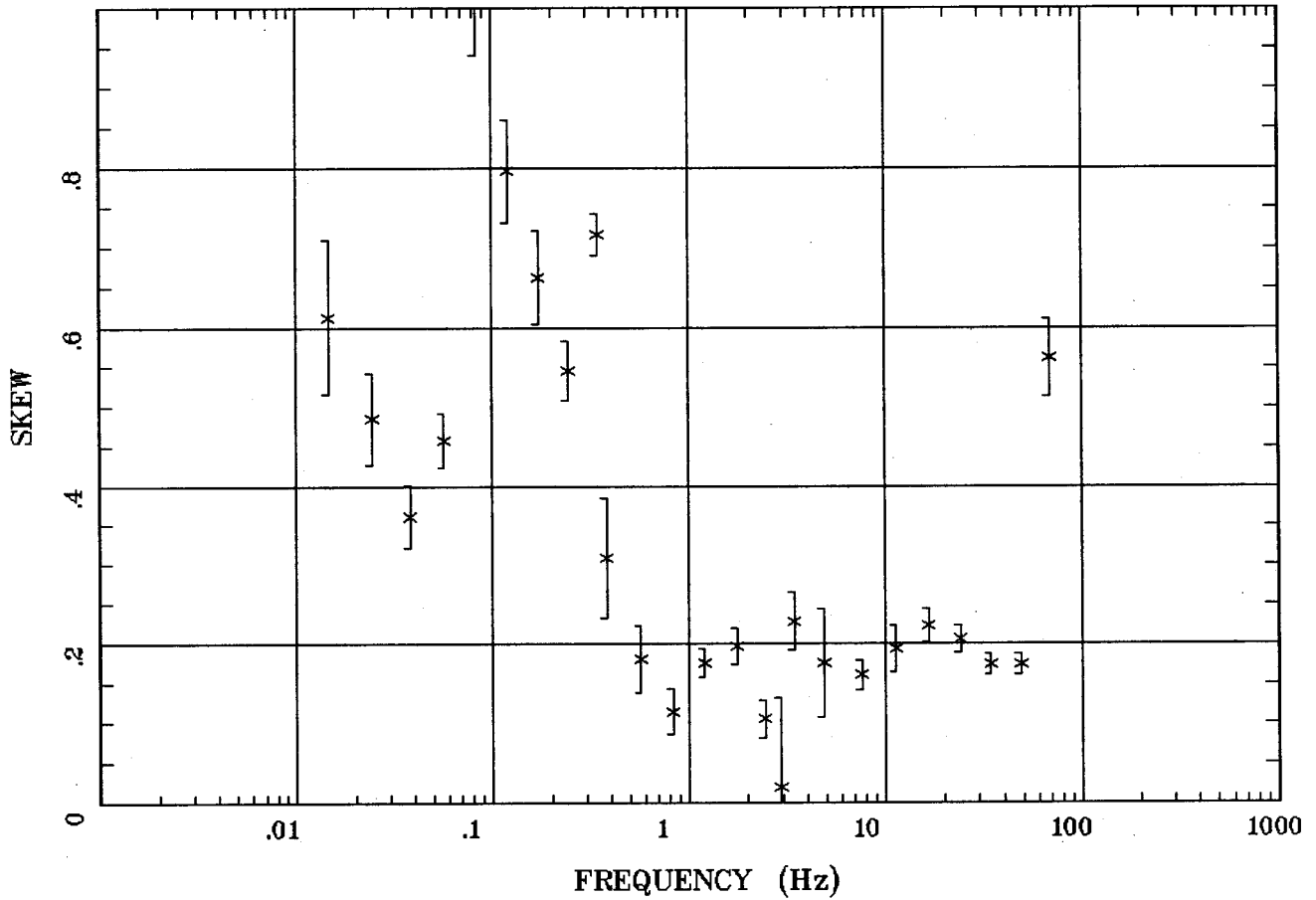


Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

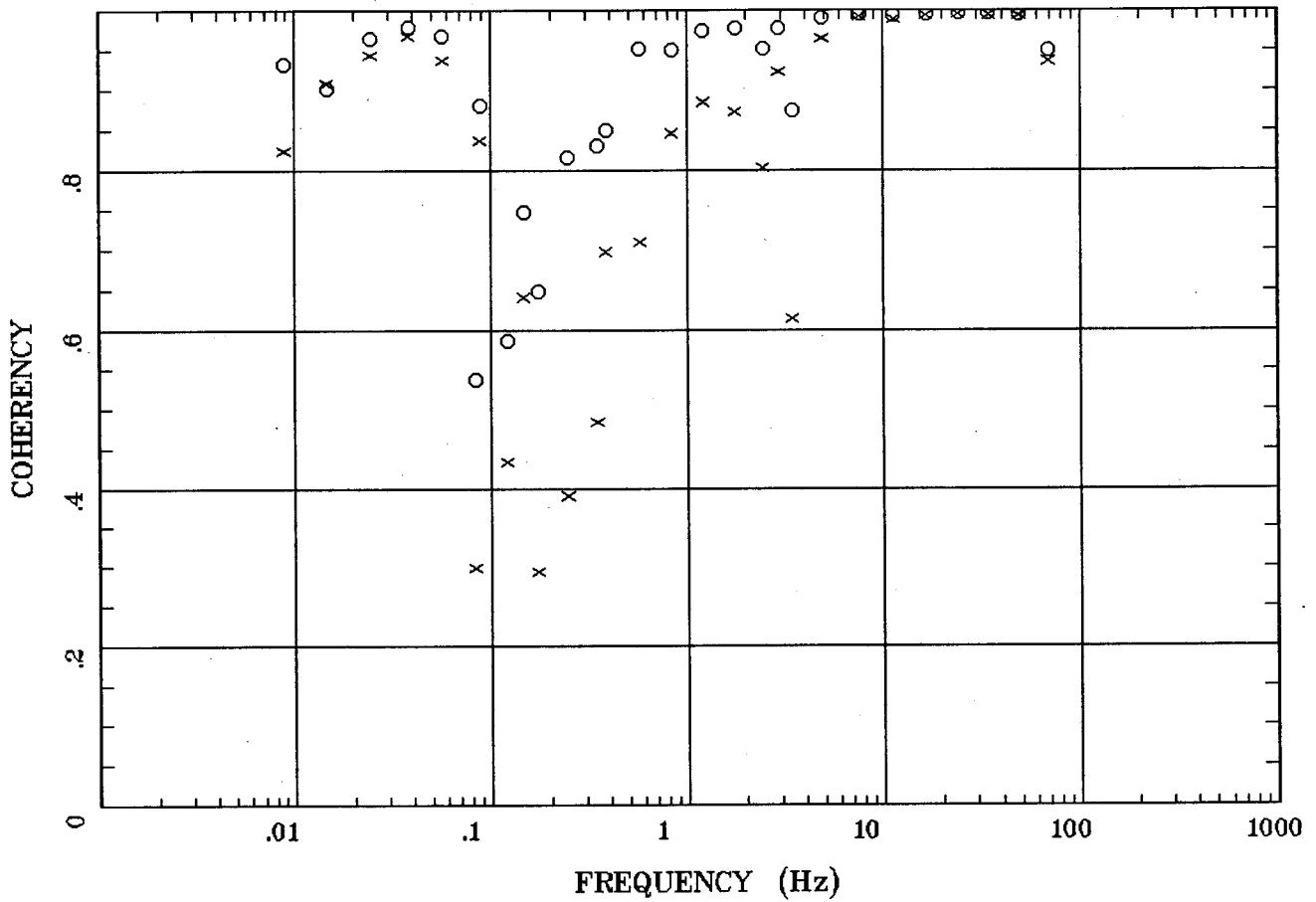
IMPEDANCE SKEW

North of Raineer Mesa Road



Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

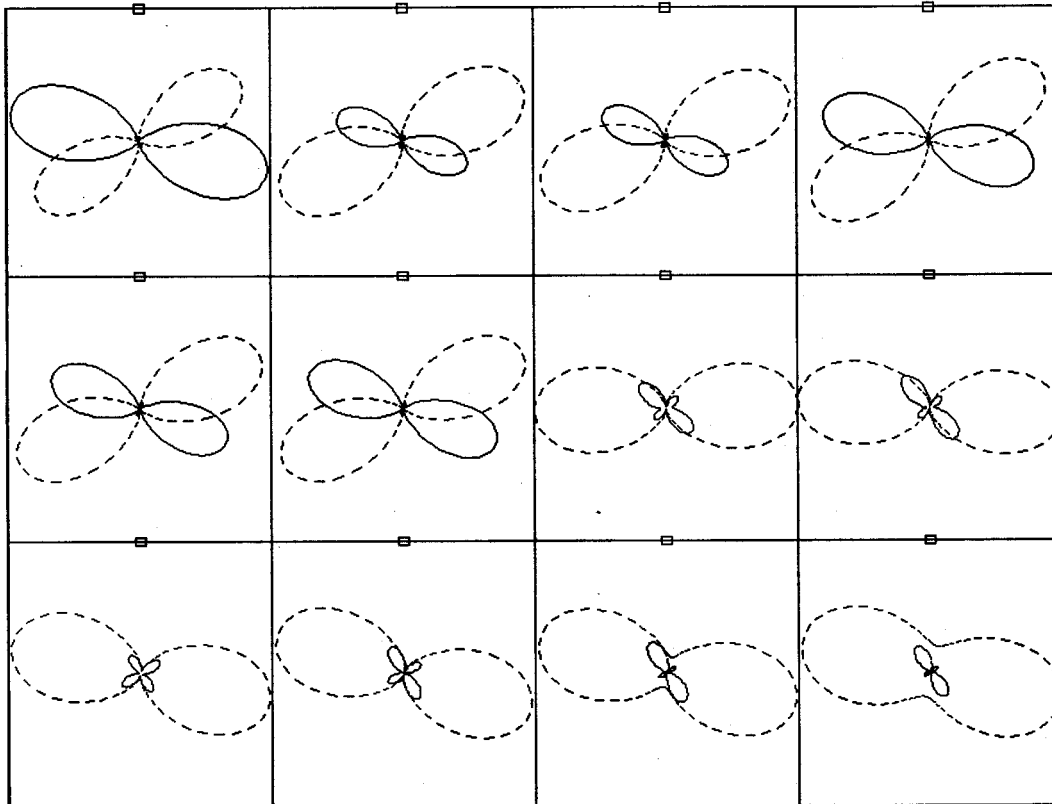


Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

North of Raineer Mesa Road



.0088 Hz	.0244 Hz	.0566 Hz	.120 Hz
.172 Hz	.345 Hz	.566 Hz	1.758 Hz
2.930 Hz	7.617 Hz	16.602 Hz	34.375 Hz

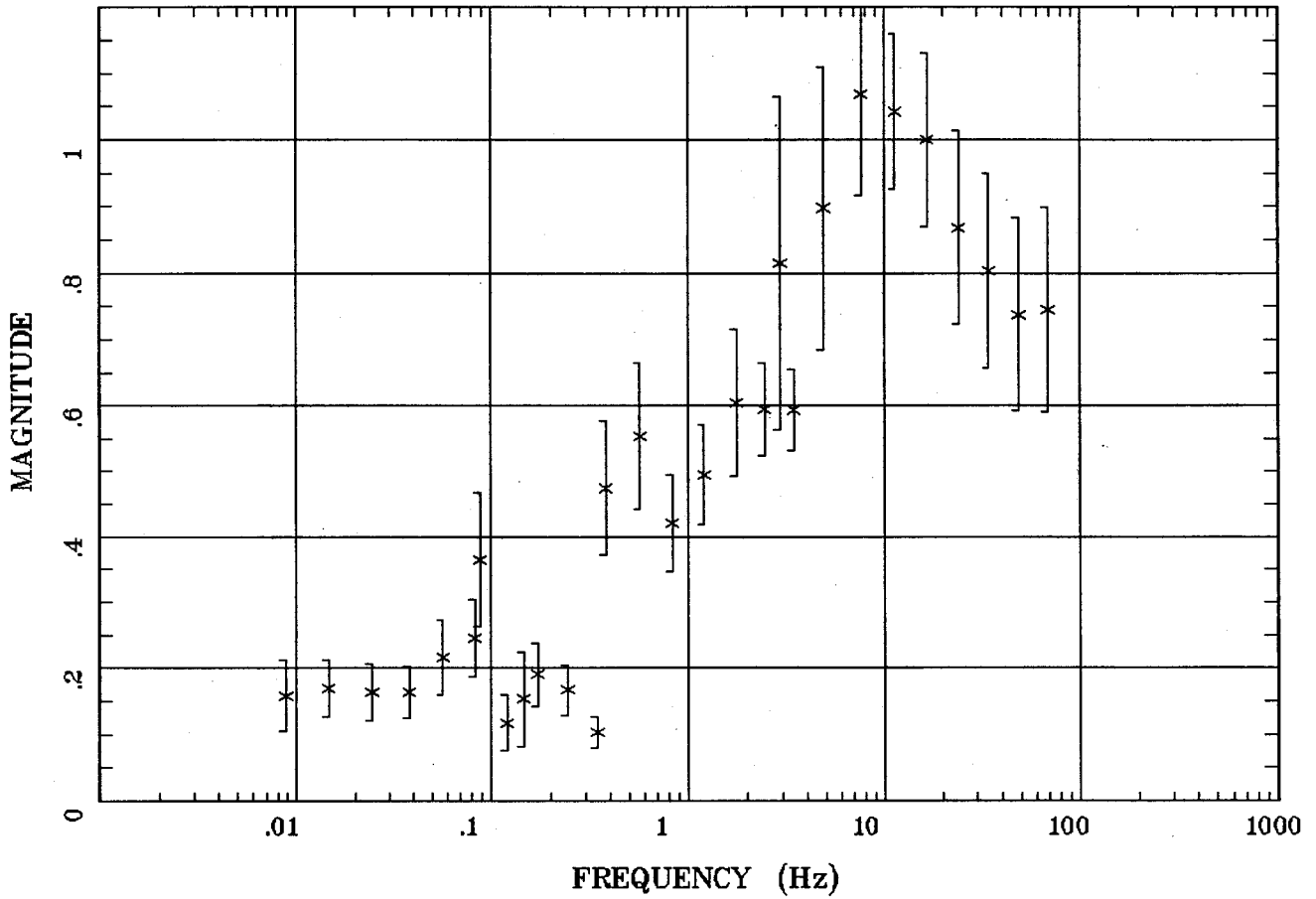
Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 64

TIPPER MAGNITUDE

North of Raineer Mesa Road

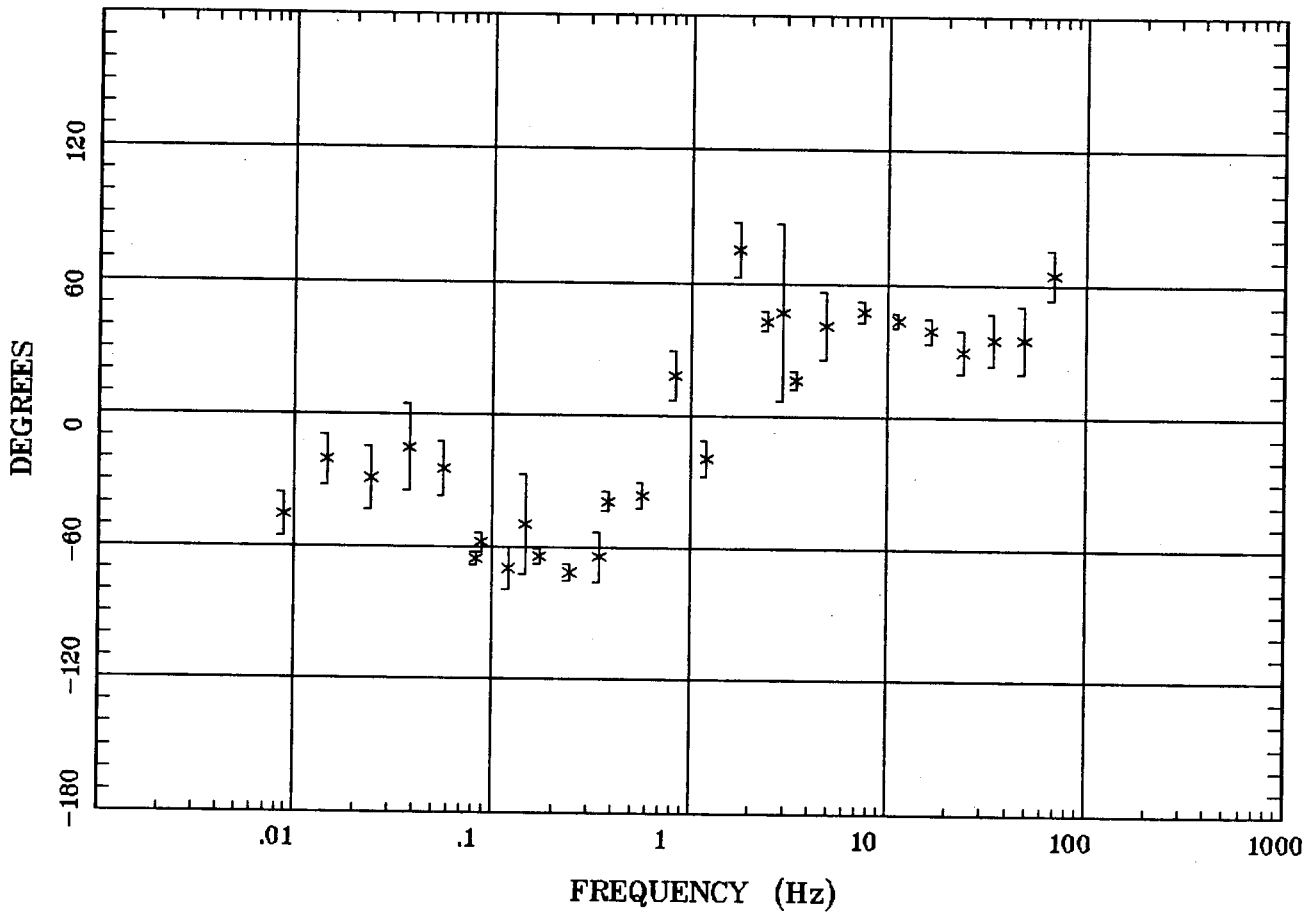


Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Station 64
North of Raineer Mesa Road



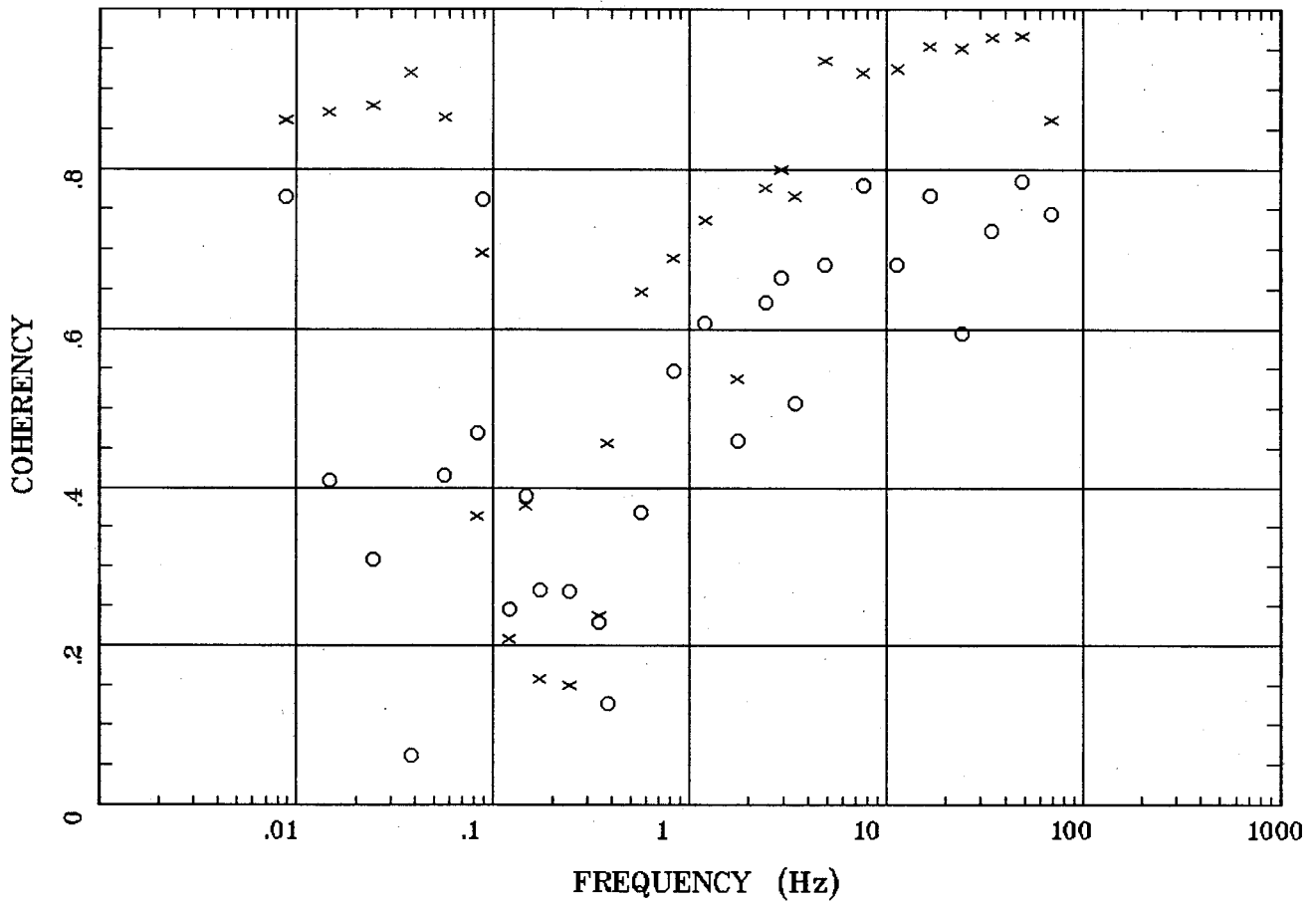
Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 64

HzHx.x Coh HzHy.o

North of Raineer Mesa Road



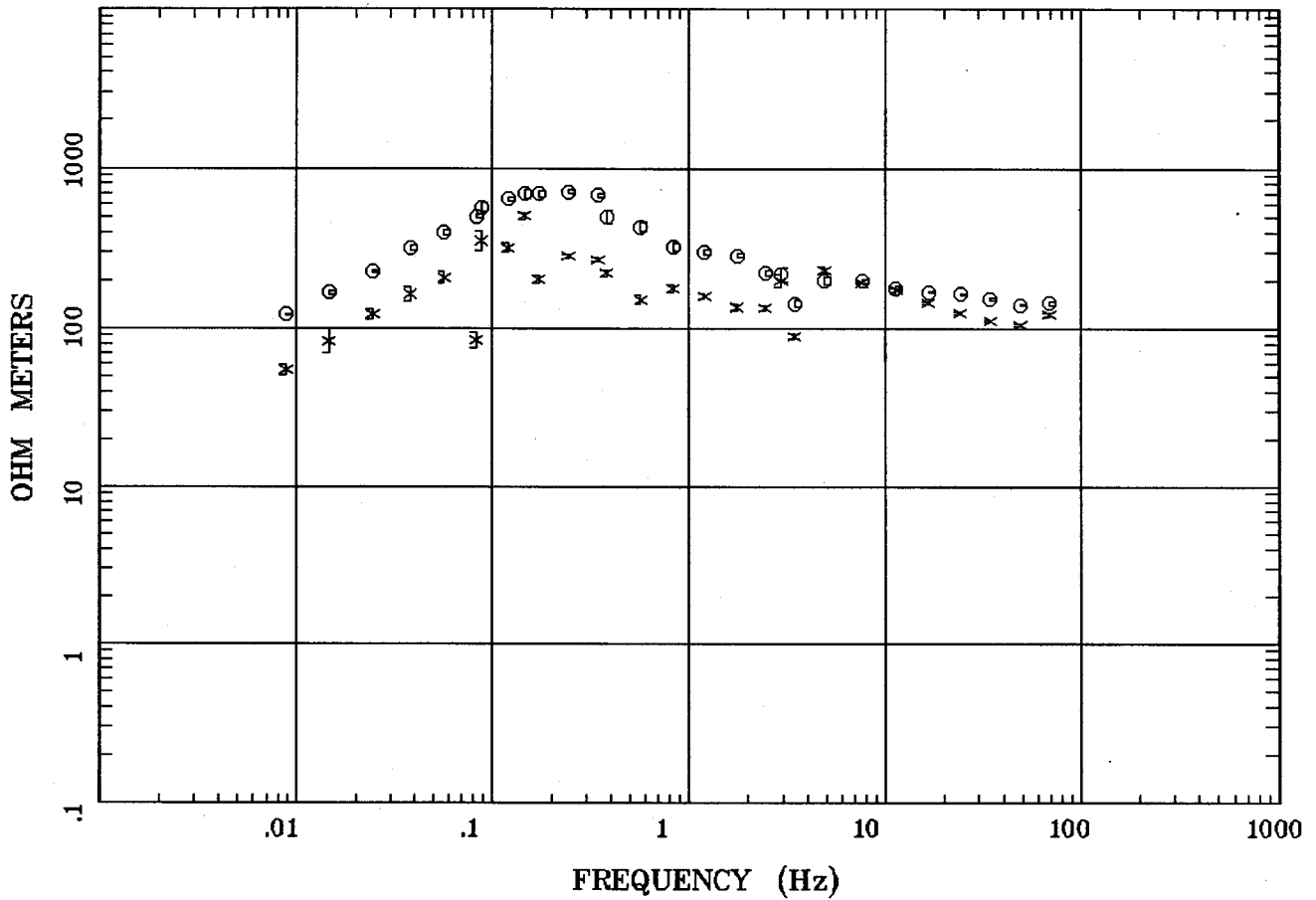
Client: Water Resources & DOD
Remote: none
Acquired: 10:4 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt64m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 10:19 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 65

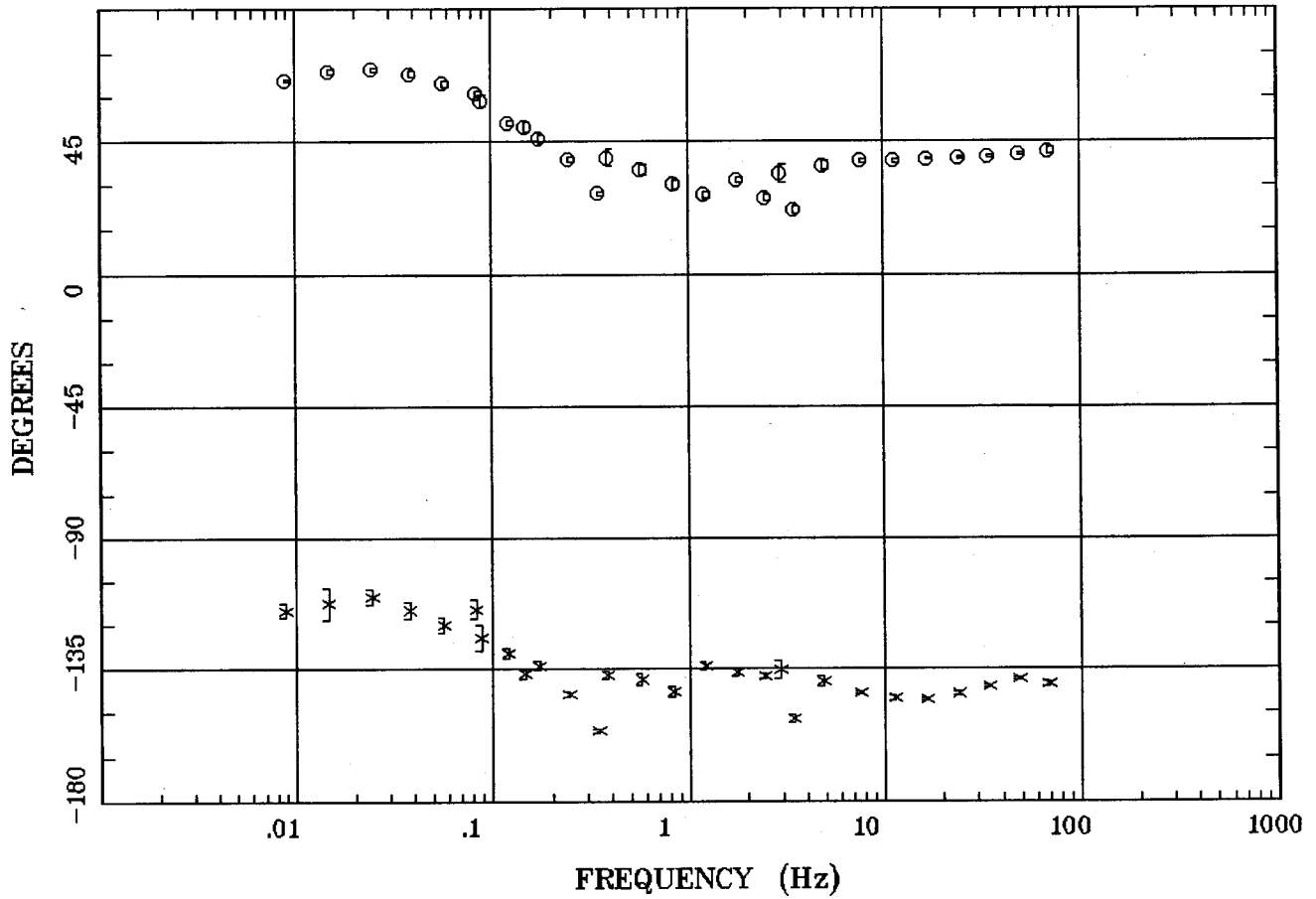
APPARENT RESISTIVITY

North of Raineer Mesa Road



Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >



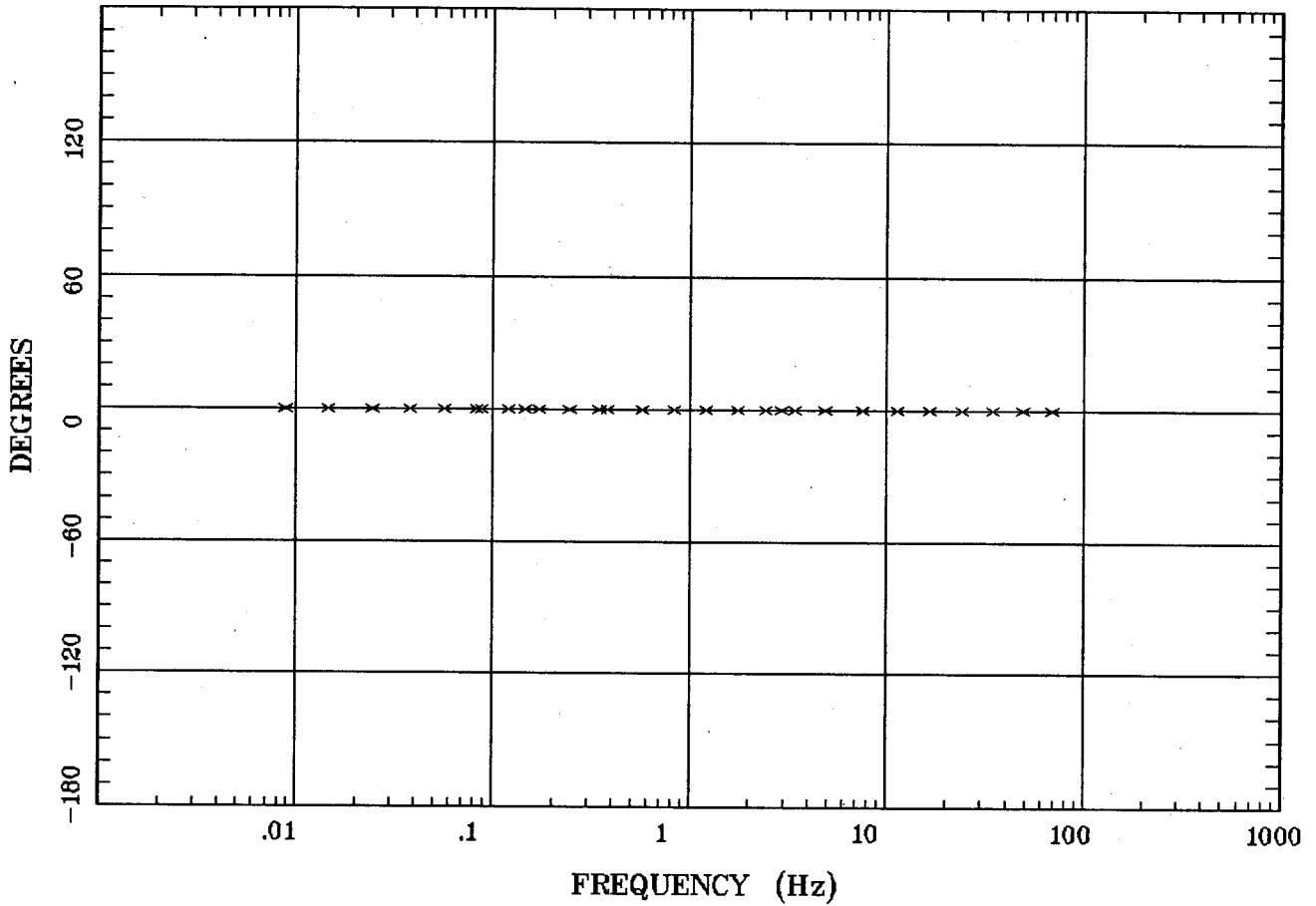
Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 65

ROTATION ANGLE

North of Raineer Mesa Road

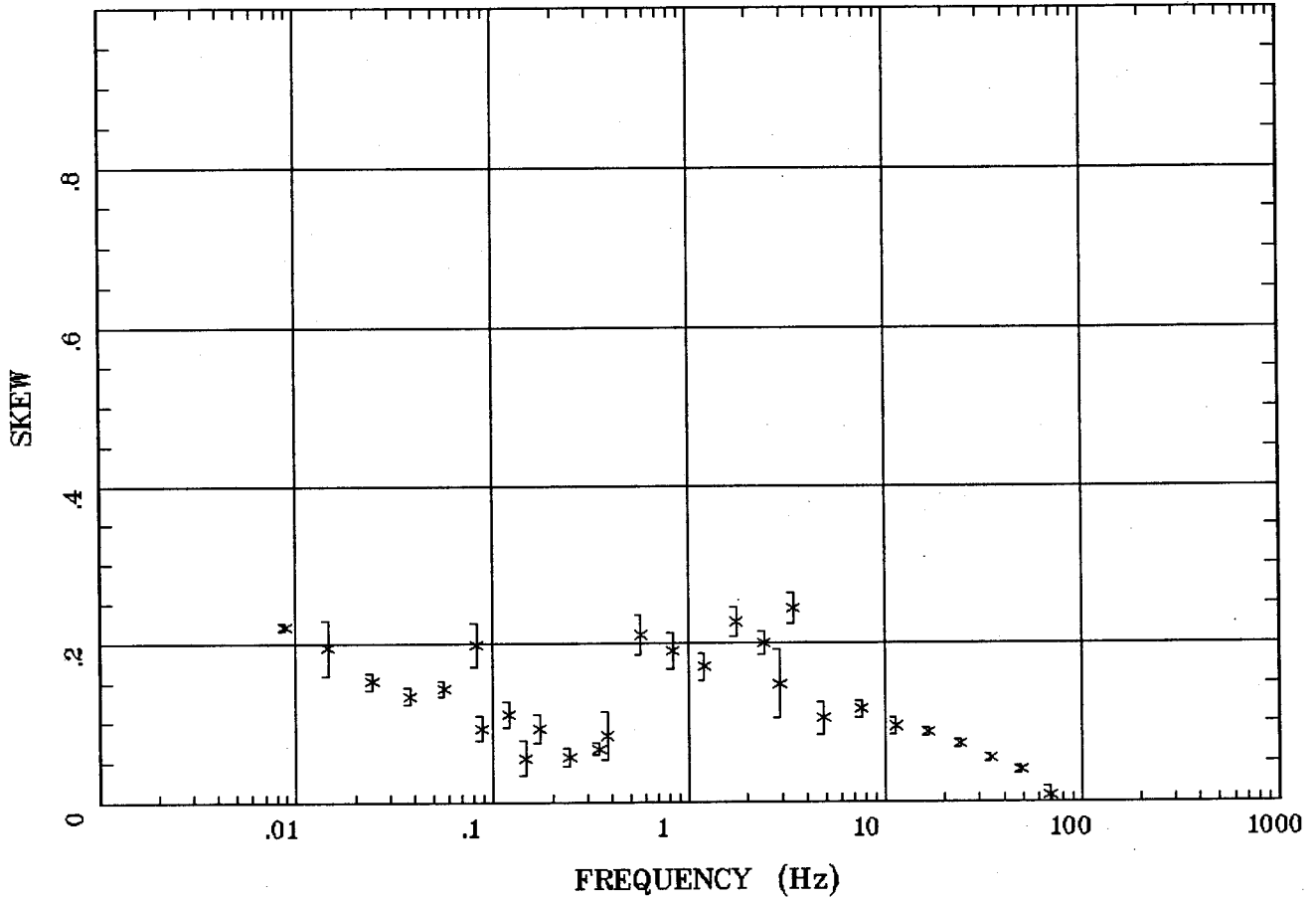


Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

IMPEDANCE SKEW

Station 65
North of Raineer Mesa Road



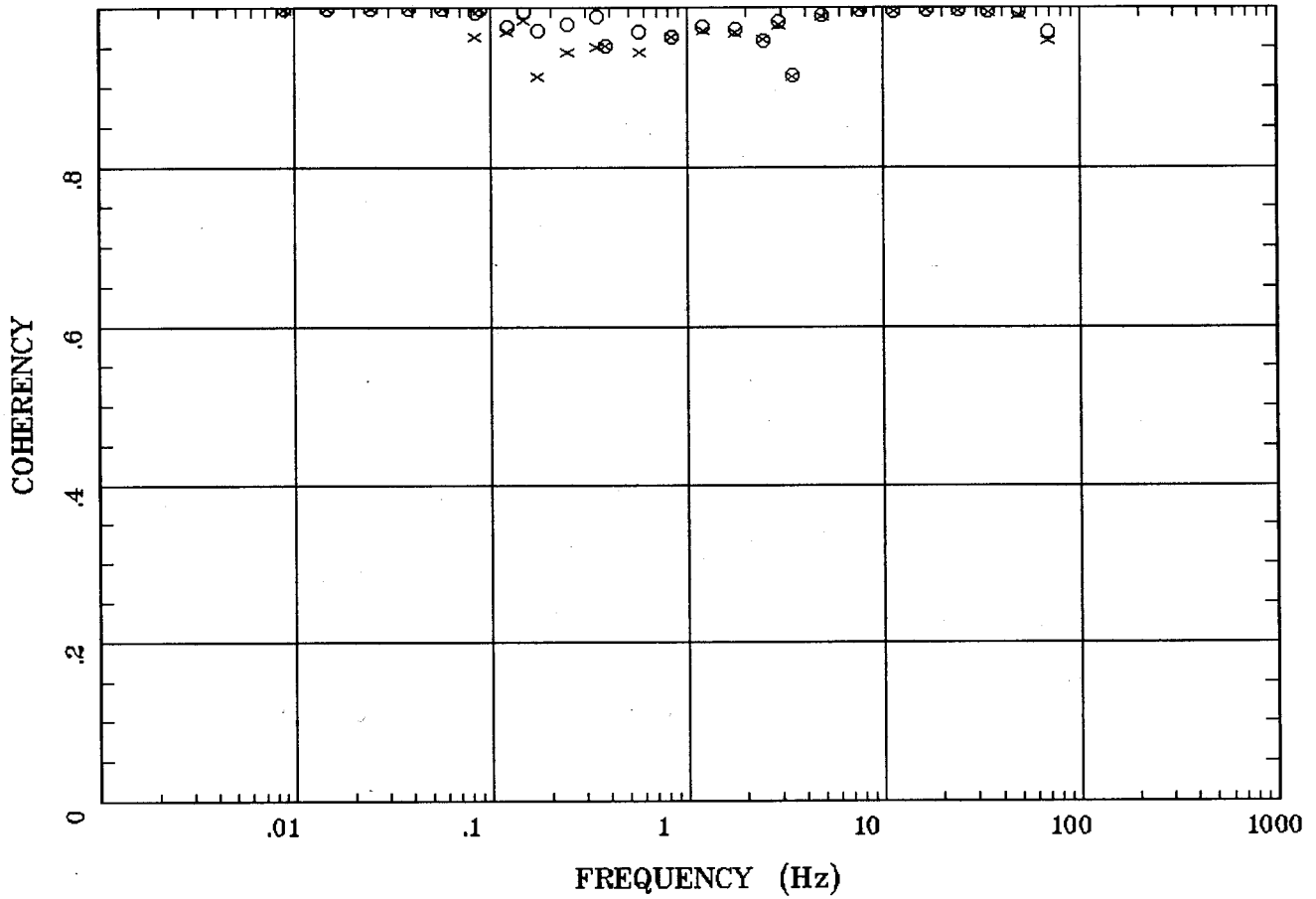
Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 65

E MULT Coh.

North of Raineer Mesa Road

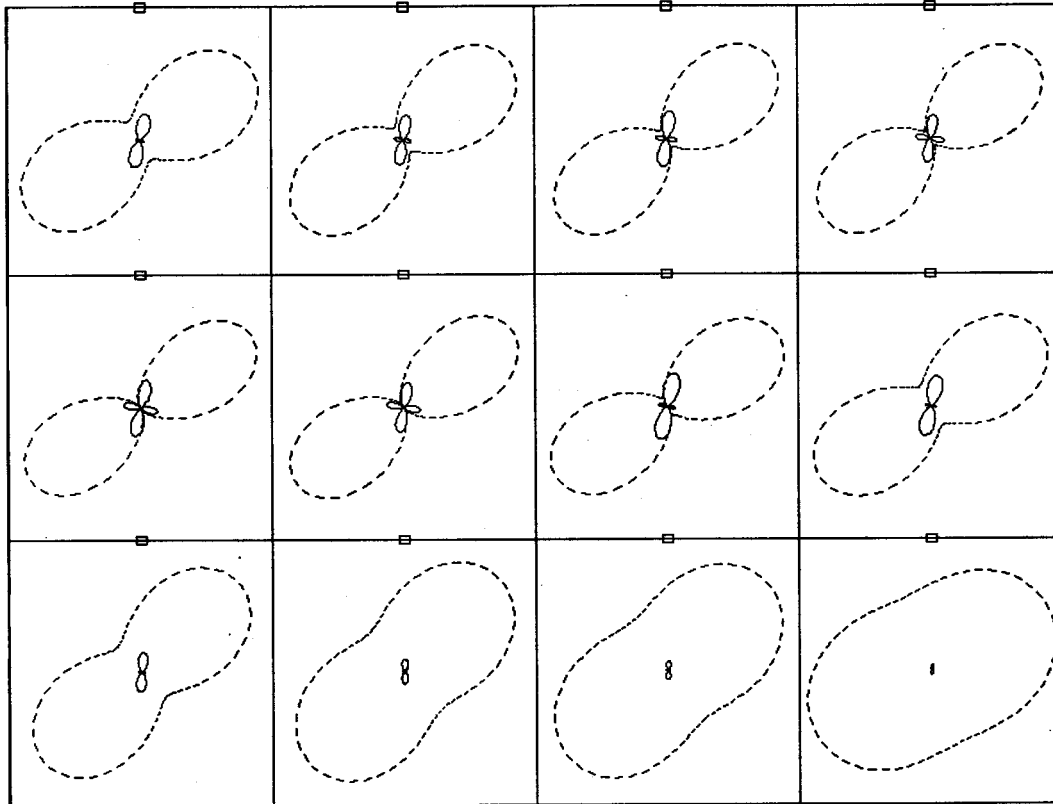


Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

POLAR PLOTS

North of Raineer Mesa Road



.0088 Hz
.172 Hz
2.930 Hz

.0244 Hz
.345 Hz
7.617 Hz

.0566 Hz
.566 Hz
16.602 Hz

.120 Hz
1.758 Hz
34.375 Hz

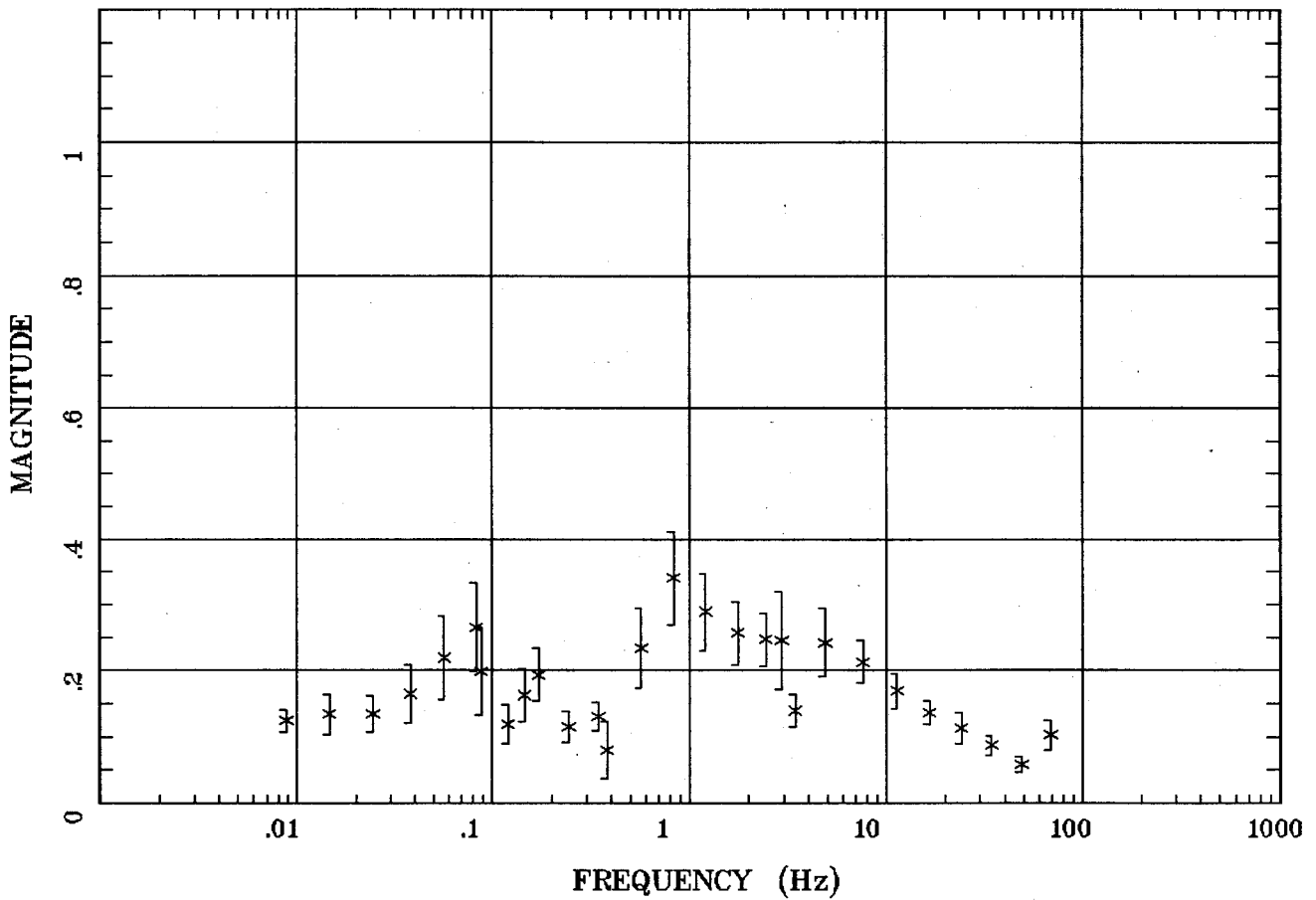
Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 65

TIPPER MAGNITUDE

North of Raineer Mesa Road

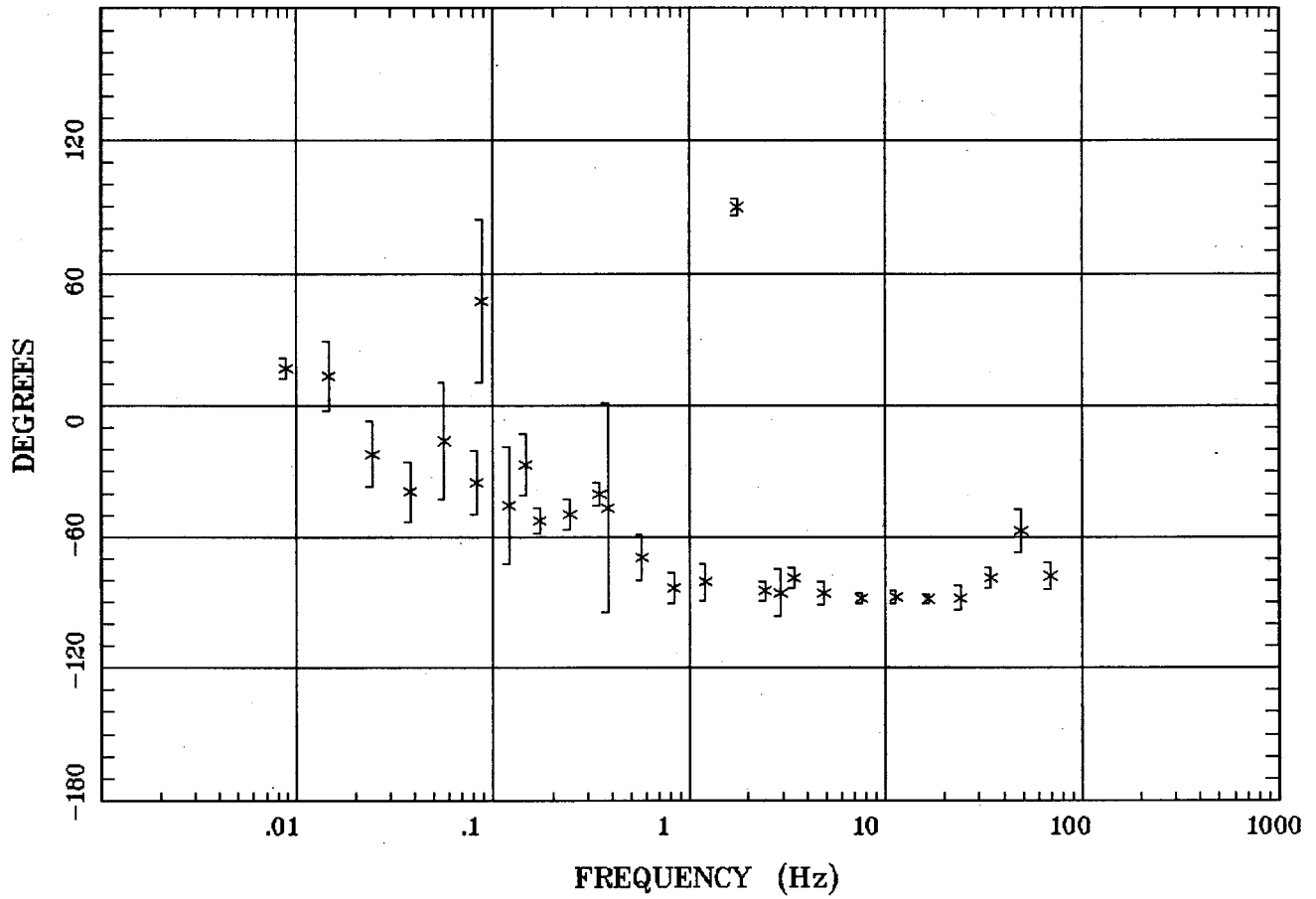


Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co:US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

TIPPER STRIKE

Station 65
North of Rainier Mesa Road



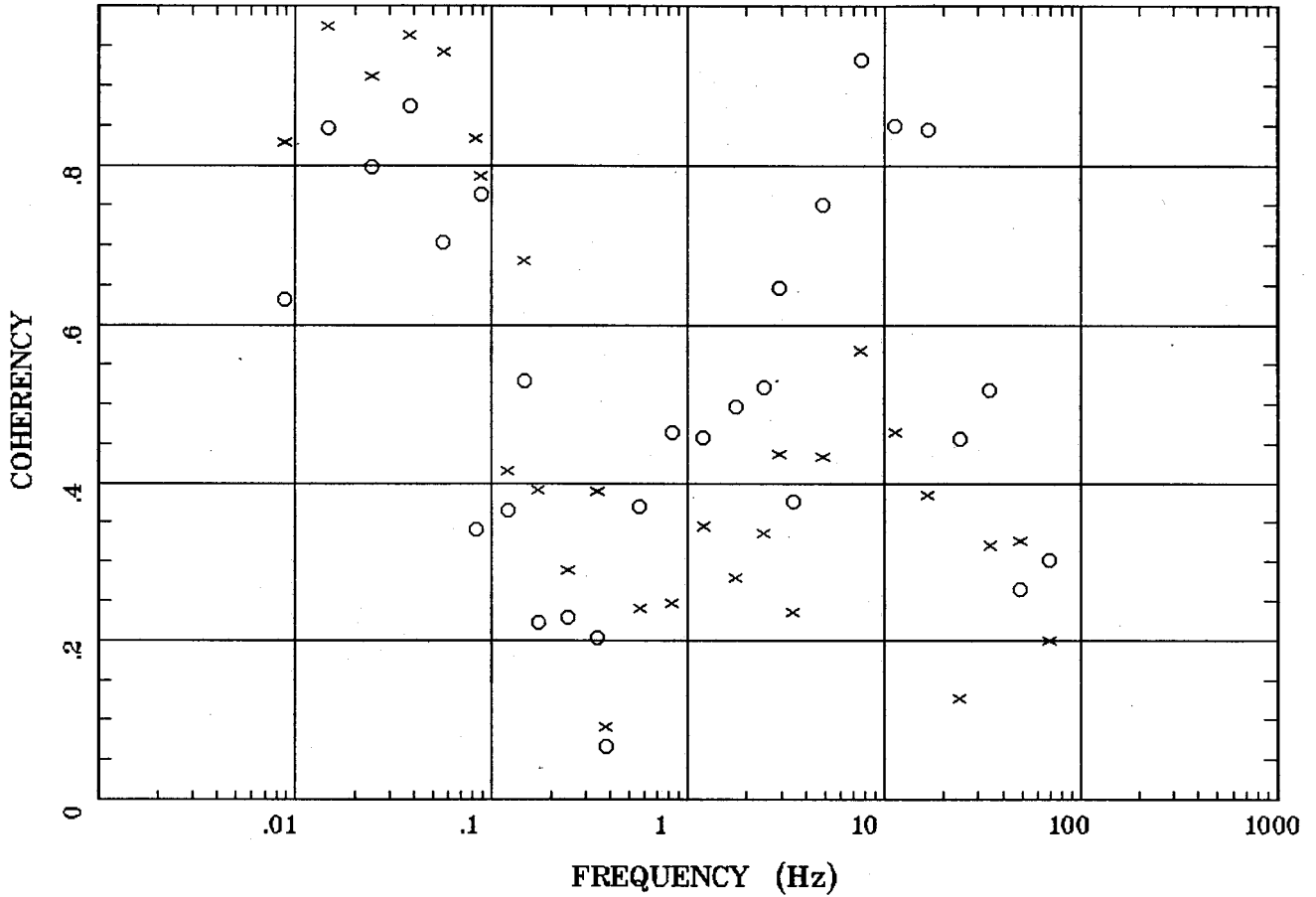
Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >

Station 65

HzHx.x Coh HzHy.o

North of Rainier Mesa Road



Client: Water Resources & DOD
Remote: none
Acquired: 04:2 Oct 18, 2005
Survey Co: US Geological Survey

Rotation:
Filename: nt65m.avg
Channels: Ch1 Ch2 Ch3 Ch4 Ch5 Ch3 Ch4
Plotted: 11:12 Feb 09, 2006
< EMI - ElectroMagnetic Instruments >