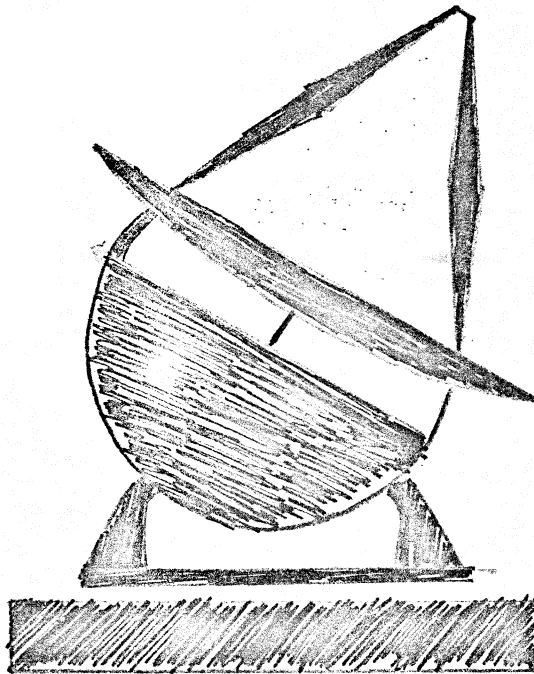


NATIONAL RADIO ASTRONOMY OBSERVATORY  
GREEN BANK, WEST VIRGINIA

THE REBER DISH FOR RECEIVING  
432 MHz AMATEUR EME SIGNALS



EDWARD TEYSSIER  
WA6LCZ

SEPTEMBER 10, 1975

## THE REBER DISH FOR RECEIVING 432 MHz AMATEUR EME SIGNALS

Edward Teyssier

### Introduction:

These brief notes explain the method I used to hear 432 MHz EME (Earth-Moon-Earth) signals from amateur radio operators. While writing these notes I am also packing my things to return to California. Therefore, I must be brief, and small errors and omissions may be present. I hope these will be overlooked. In spite of what may be missing, it is hoped that sufficient information may be found here to enable others who are interested in moonbounce to attempt a similar set up. K2UYH was clearly heard on September 1, 1975, demonstrating that good results are possible using this set up. (See also C. Dunkle's file on the Reber Dish.)

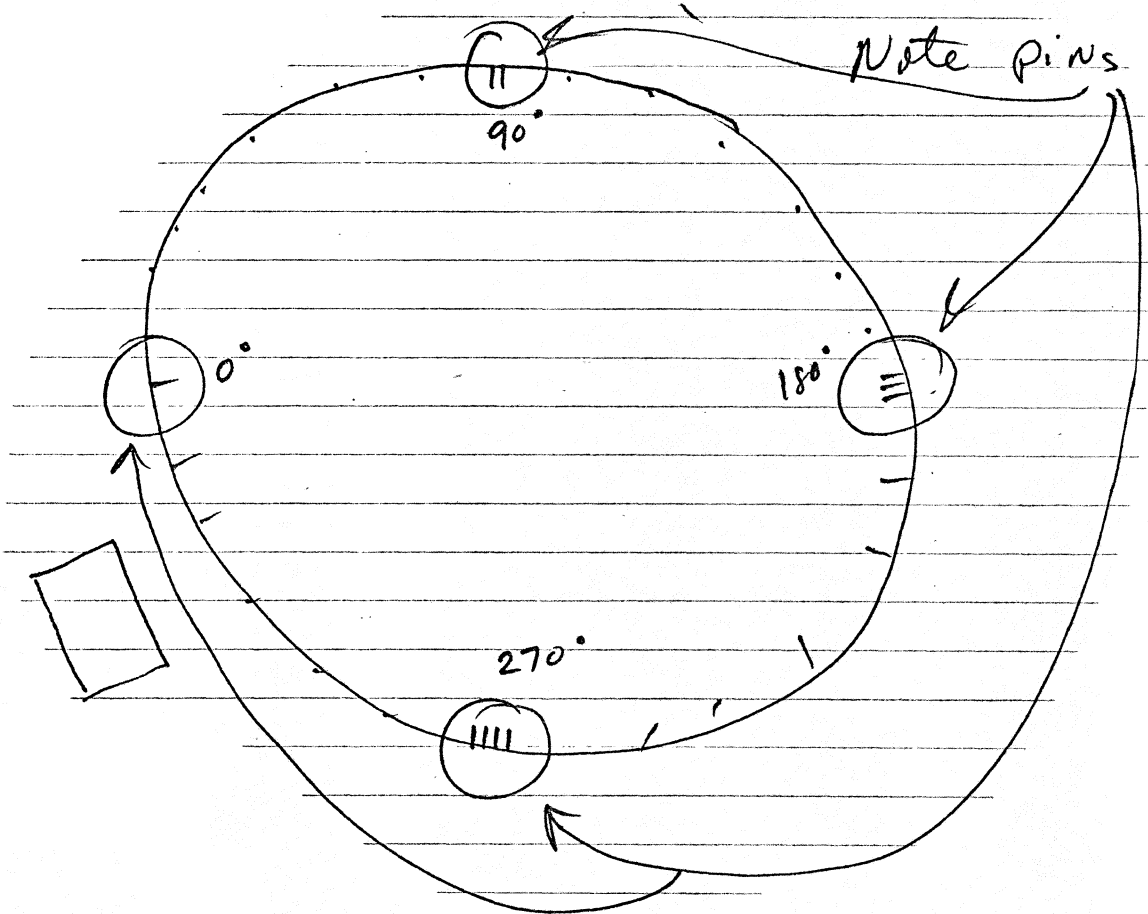
### Problems:

There are several problems that must be overcome. I shall explain the problems and then provide the solutions that I used.

1. A low-noise front-end. The total receiver noise figure must be under  $\sim$  2 dB. This is a number usually found in the ham literature and is based on a typical station that has  $\sim$  500 watts at the antenna output on transmitter and an antenna that has about 25 dBi of gain. In other words, a ham who already has a station with these specifications could easily hear echos with a 2 dB noise figure receiver. The receiver preamps should be mounted at the feed.
2. An antenna. One that rotates in elevation and azimuth and is trackable.
3. A feed. A 10 dB edge taper would be optimum.
4. Method to calculate position of moon. For overcast nights.

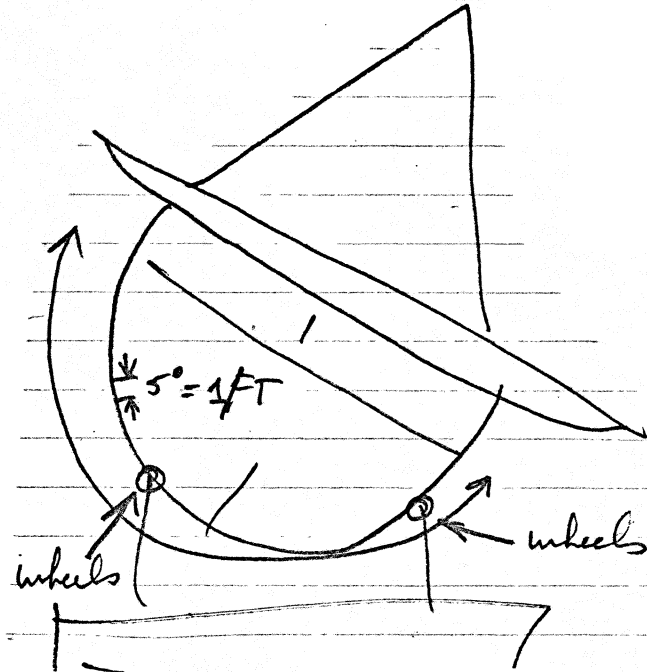
Solutions:

1. I already had 2 preamps, each with N.E.C. 2N5651 transistors, so this problem was easy. These 2 preamps and converter produced a total system noise figure of 1.8 dB.
2. The Reber dish was used.



Azimuth tracking: There is a switch under one of the wheels that at one time was used to hit a pin, or pins, every 10°. When the switch hit one of these pins a bell would go off. This bell system no longer works, but the pins are still there and by noting where the switch is, and which pin it will hit next gives azimuth tracking.

Elevation:



Around the circumference of the supporting hub that is used to carry the weight of the dish on trolley wheels, 1 foot of hub circumference is equal to  $4.98^\circ$  or approximately  $5.0^\circ$ .

There is a pointer on the rotating table that points at this circumference. By painting a spot every 1 foot on the hub, elevation can be read.

Feed:

I used the NRAO crossed dipole for 250-500 MHz that is associated with the antenna test range. I mounted that on a  $27 \frac{3}{4}$ " square front-end front plate and put a cavity around it. Pattern plots are included in this report.

Circular polarization was used with the  $90^\circ$  hybrid coupler that comes with the dipole. Use the input port on the coupler. A 50 ohm load was placed on the isolation port. Final SWR was:  $\sim 1.1/1$ . Edge for this F/D is at  $\sim 4.4^\circ$ , so feed is not optimum.

This assembly was then mounted as close the apex of the feed support arms as possible. Wire was used to tie everything in place.

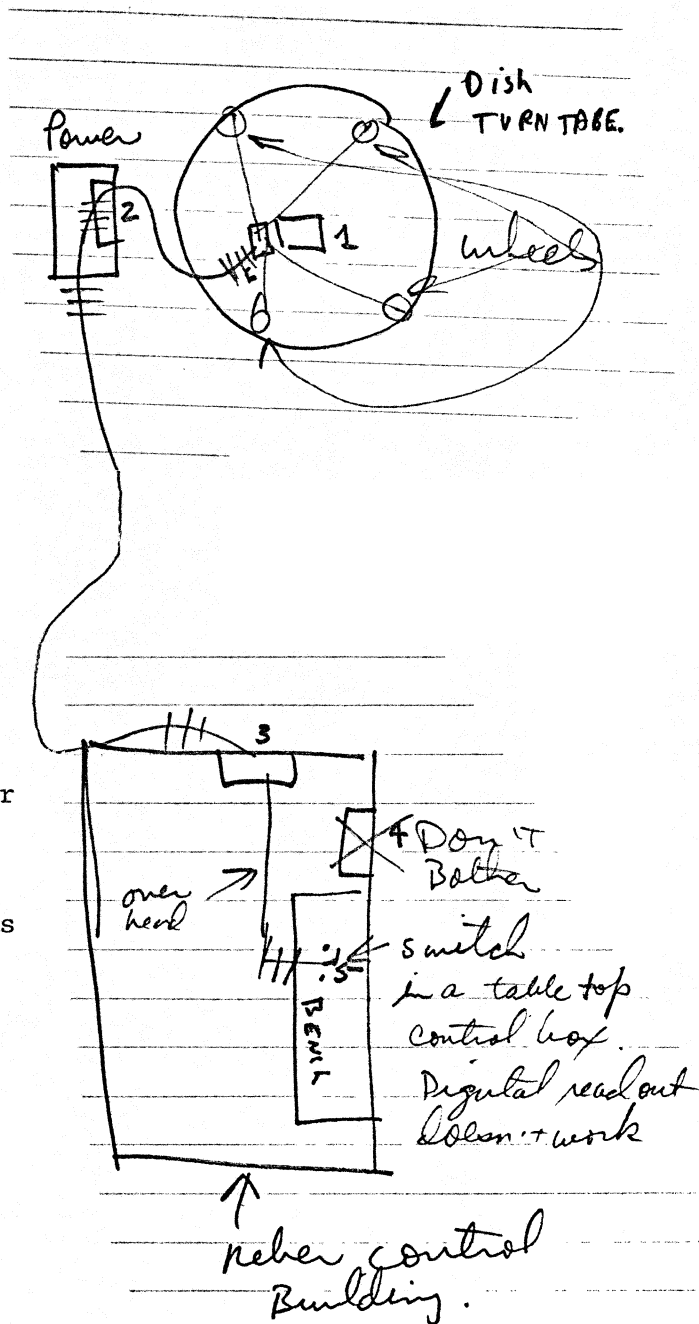
Feed line was RG-9/U to the big box under the dish. From there a connection was made to a cable that went to the Reber control room. Power for the preamps was in a piece of stranded, insulated, #18 gauge wire that also made a connection to a wire in the box under the dish.

To get to the focus: Use scaffolding found in the machinists' yard. The feed is easy to reach from the top of the 3rd layer (18') when the dish is tilted way over.

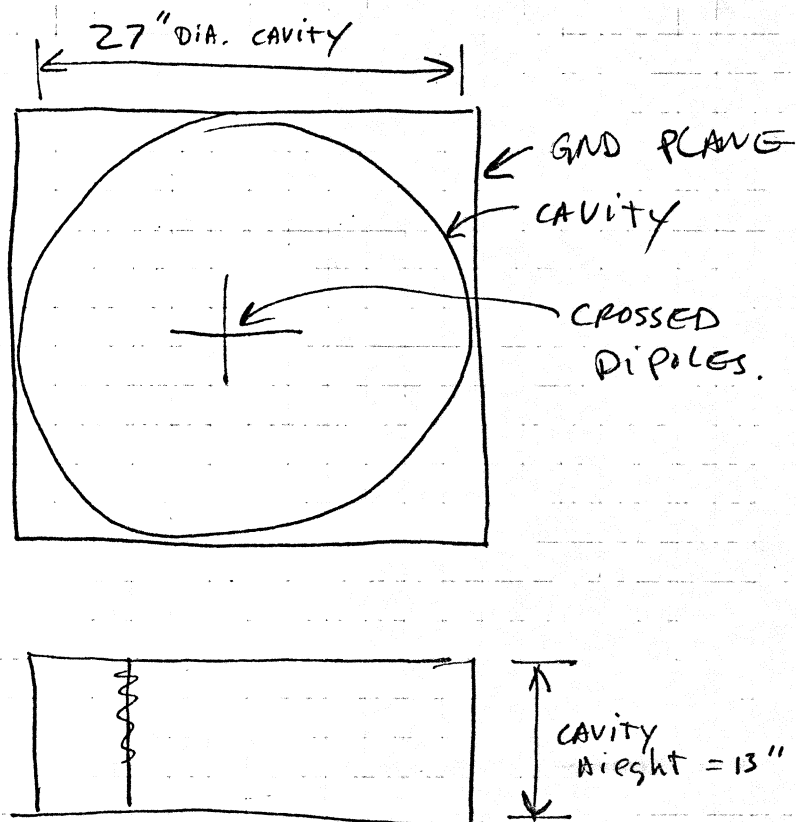
How to turn the dish:

1. Turn on power in box 2.
2. Be sure that unit in lower left hand side of box 2 is getting power. This unit is switched remotely by cables (3) from the Reber control room.
3. Go to Reber control room. The 3 wires that terminate there can control azimuth. Black-white is one direction. Black-green is the other direction.

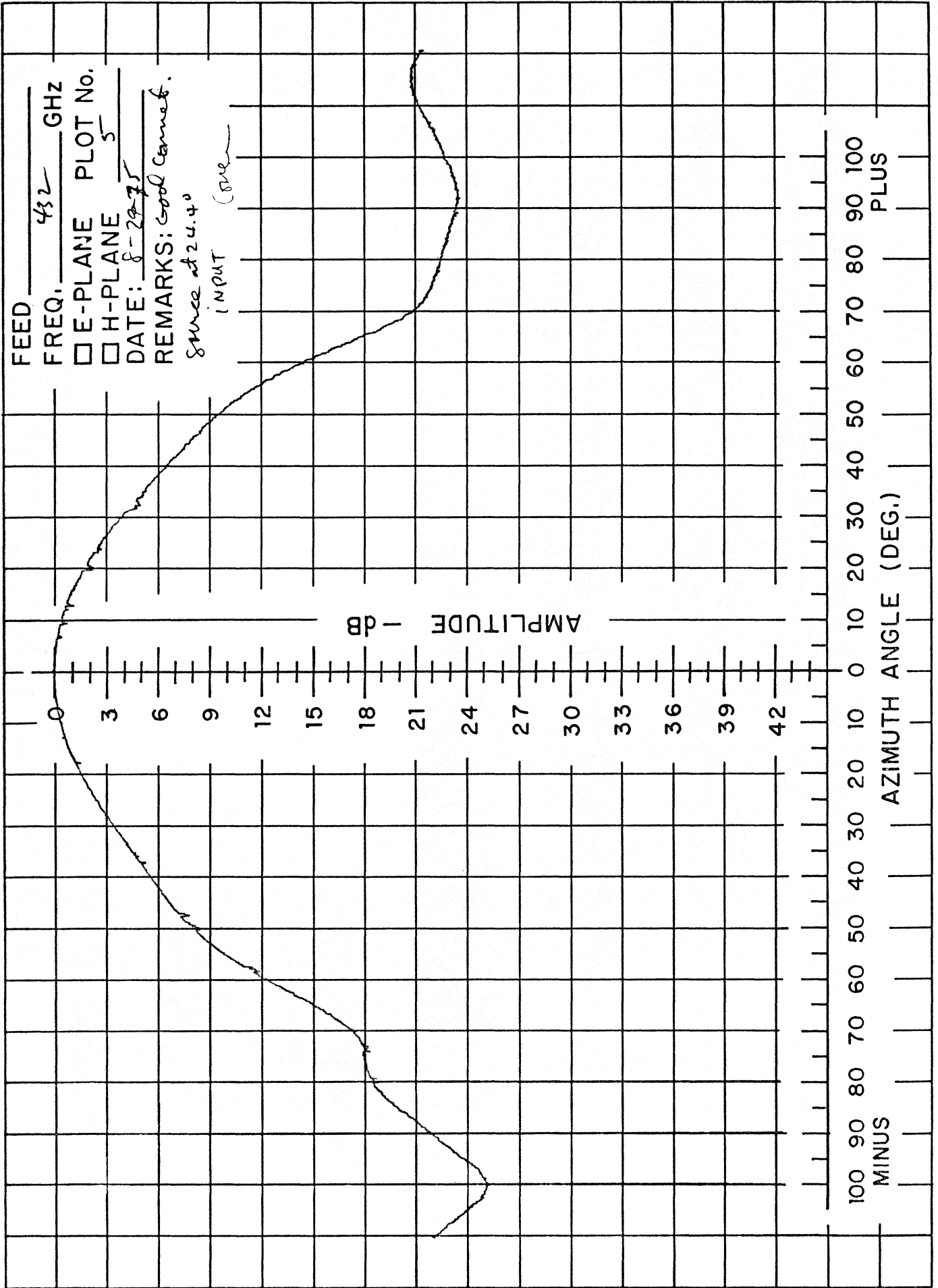
Note: Be sure dish is secured whenever leaving it for a long period of time. The dish blew over in winter of 1972 (?) and was very expensive to repair.

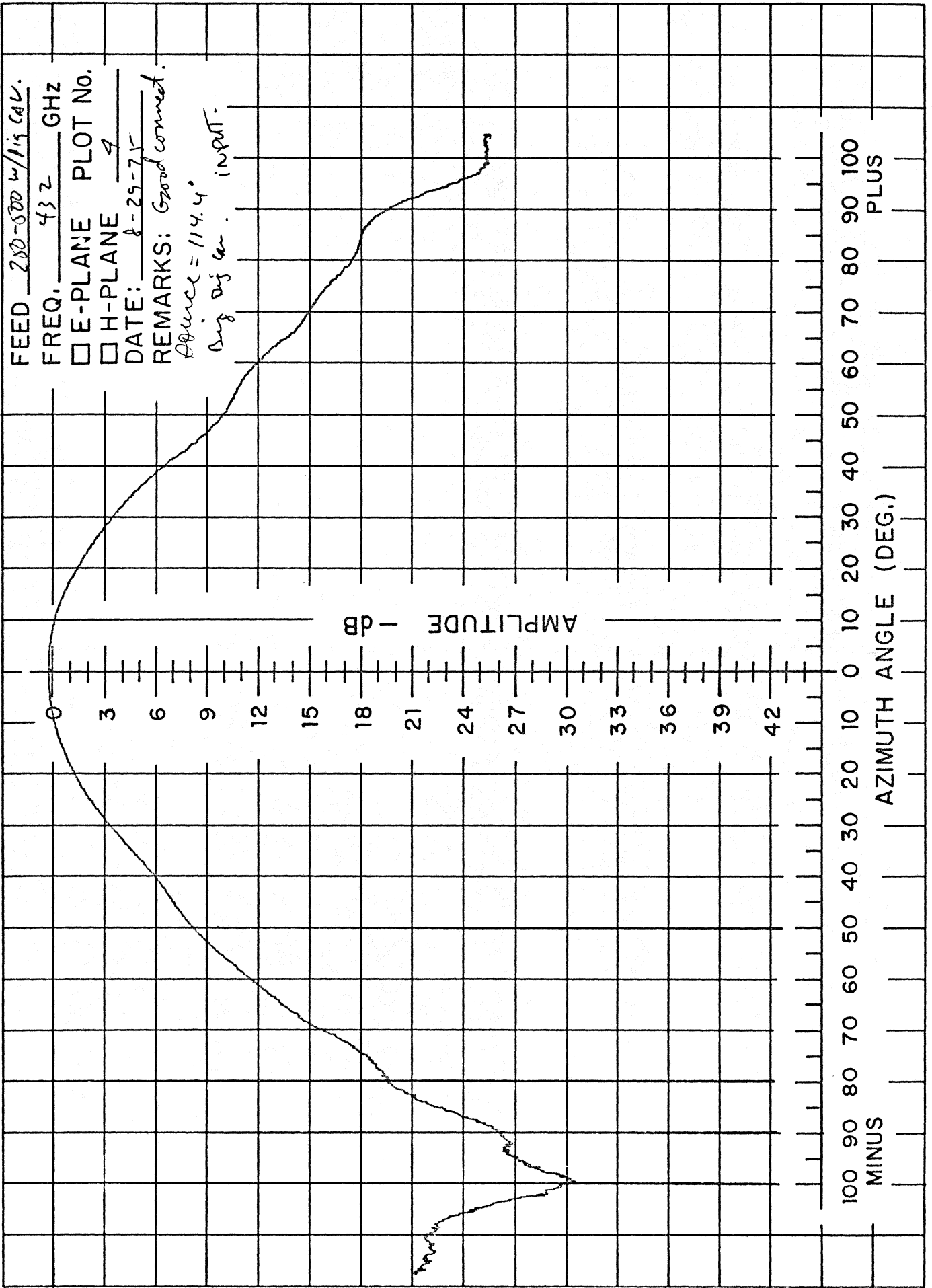


Feed dimensions were as follows:



A better edge taper would probably be accomplished by a deeper cavity.



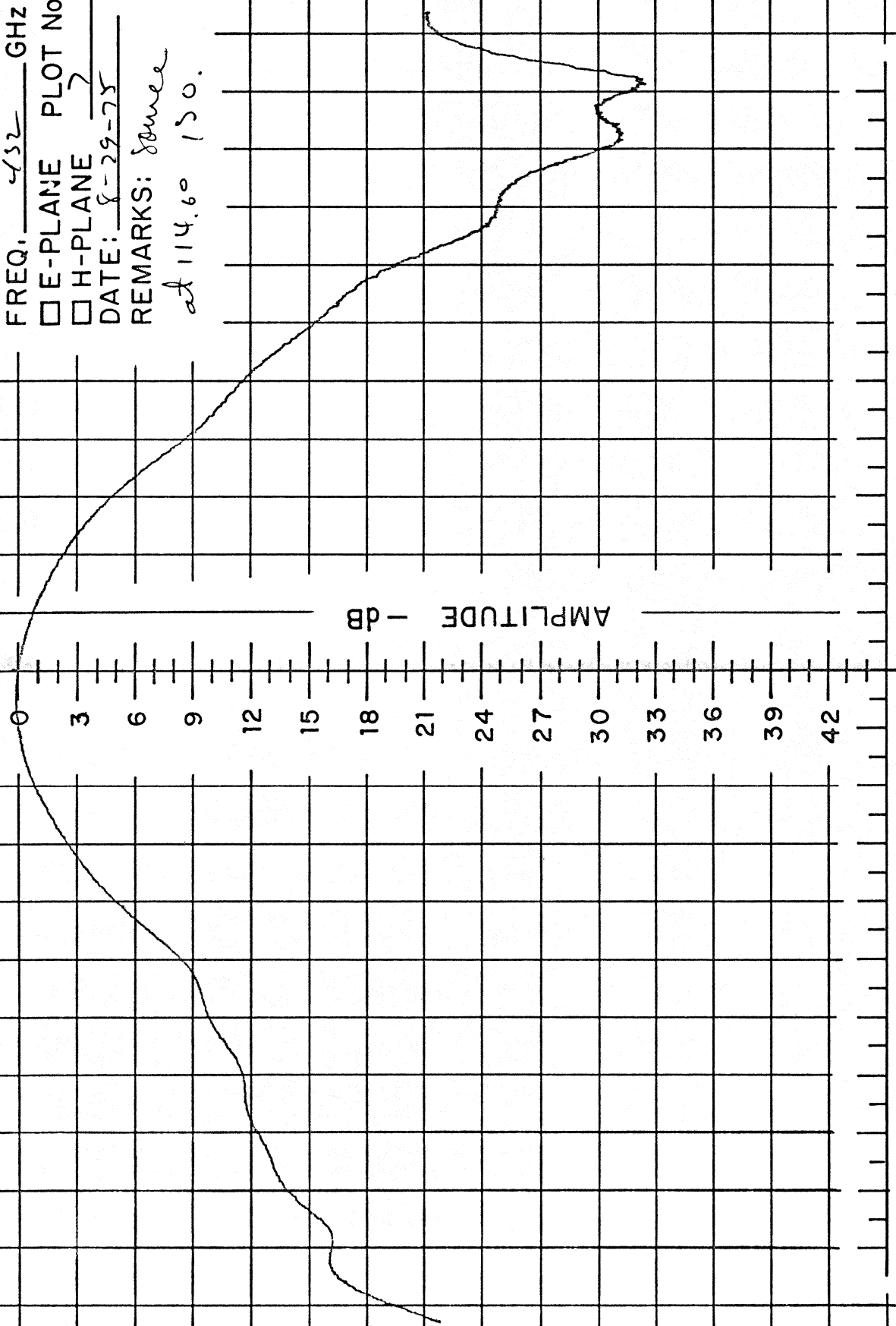


FEED \_\_\_\_\_  
 FREQ: 4.52 GHz  
 E-PLANE PLOT No.  
 H-PLANE 7  
 DATE: 8-29-75  
 REMARKS: same  
at 114.60 150.

AMPLITUDE - dB

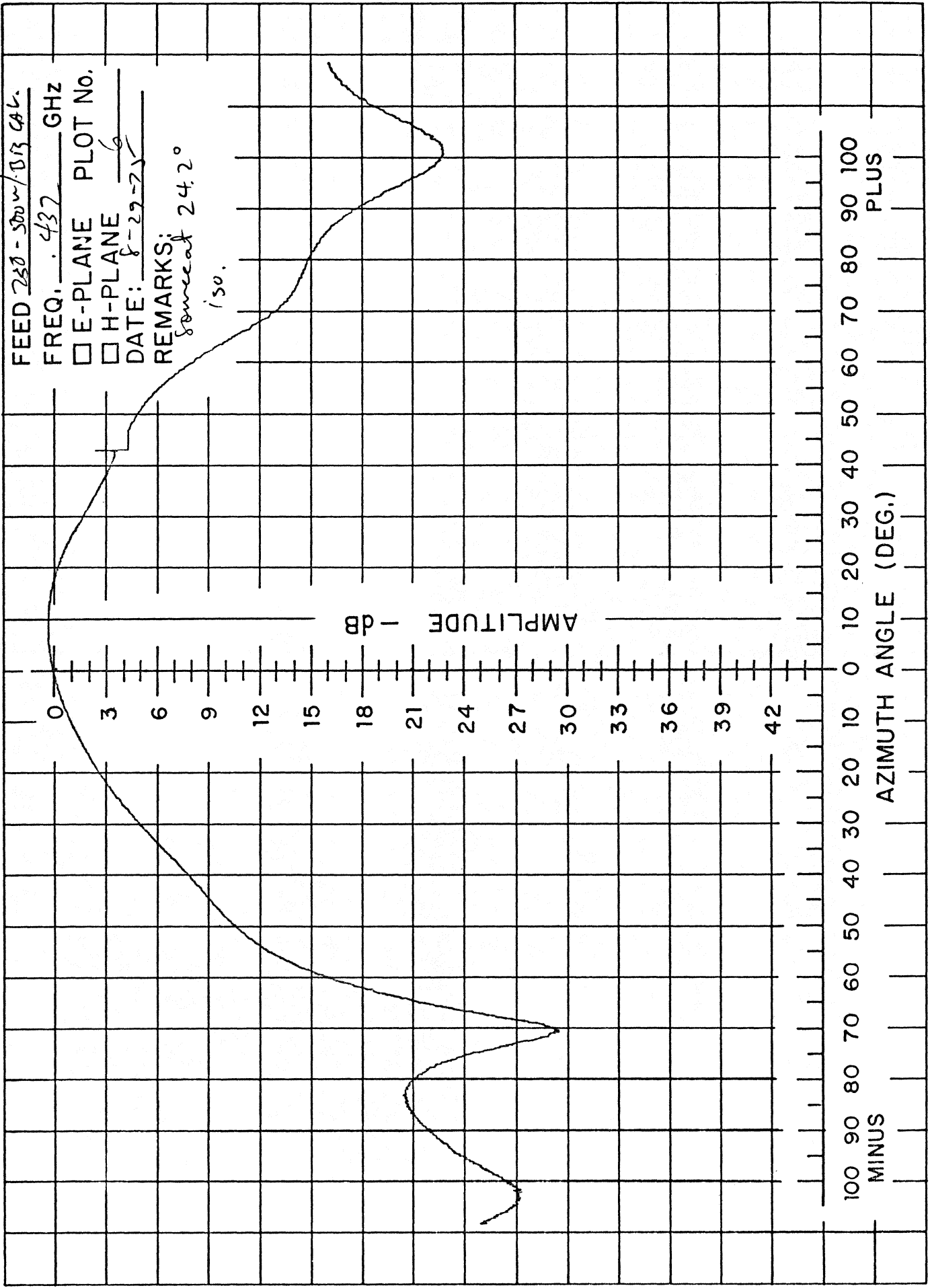
0 3 6 9 12 15 18 21 24 27 30 33 36 39 42

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100  
 MINUS AZIMUTH ANGLE (DEG.) PLUS



FEED 250 - 500 W / D13 CAL.  
FREQ. 437 GHZ  
 E-PLANE PLOT No.  
 H-PLANE 6  
DATE: 8-29-75

REMARKS:  
Source at 24.2°  
150.



AMPLITUDE - dB

AZIMUTH ANGLE (DEG.)

MINUS

PLUS















930	50.3	20.7	116.4	59.1
940	52.7	20.7	119.4	60.7
950	55.1	20.7	122.7	62.4
1000	57.6	20.7	126.3	63.9
1010	60.0	20.7	130.3	65.4
1020	62.4	20.7	134.7	66.8
1030	64.8	20.7	139.6	68.1
1040	67.2	20.8	144.9	69.3
1050	69.7	20.8	150.8	70.3
1100	72.1	20.8	157.1	71.2
1110	74.5	20.8	164.0	71.8
1120	76.9	20.8	171.2	72.2
1130	79.3	20.8	178.6	72.4
1140	81.8	20.8	186.0	72.3
1150	84.2	20.8	193.4	72.0
1200	86.6	20.8	200.4	71.4
1210	89.0	20.8	206.9	70.7
1220	91.4	20.8	213.0	69.8
1230	93.8	20.8	218.5	68.7
1240	96.2	20.8	223.5	67.4
1250	98.6	20.8	228.1	66.1
1300	101.0	20.9	232.2	64.6
1310	103.5	20.8	236.0	63.1
1320	105.9	20.8	239.4	61.5
1330	108.3	20.8	242.5	59.8
1340	110.7	20.8	245.4	58.2
1350	113.1	20.8	248.1	56.4
1400	115.5	20.8	250.5	54.7
1410	117.9	20.8	252.8	52.9
1420	120.3	20.8	255.0	51.1
1430	122.7	20.8	257.1	49.2
1440	125.1	20.8	259.0	47.4
1450	127.5	20.8	260.8	45.5
1500	129.9	20.8	262.6	43.7
1510	132.4	20.9	264.3	41.8
1520	134.8	20.9	265.9	39.9
1530	137.2	20.9	267.5	38.0
1540	139.6	20.9	269.1	36.1
1550	142.0	20.9	270.6	34.3
1600	144.4	20.9	272.0	32.4
1610	146.8	20.9	273.5	30.5
1620	149.2	20.9	274.9	28.6
1630	151.6	20.9	276.3	26.7
1640	154.0	20.9	277.7	24.9
1650	156.4	20.9	279.1	23.0
1700	158.8	20.9	280.4	21.1
1710	161.3	20.9	281.8	19.3
1720	163.7	20.9	283.2	17.4
1730	166.1	20.9	284.5	15.6
1740	168.5	20.9	285.9	13.8
1750	170.9	20.9	287.3	12.0
1800	173.3	20.9	288.7	10.2
1810	175.7	20.9	290.1	8.4
1820	178.1	20.9	291.5	6.6
1830	180.5	20.9	292.9	4.9
1840	182.9	20.9	294.3	3.2
1850	185.4	20.9	295.8	1.4

AZ-EL DATA FOR WA6LCZ/8  
LONG 79.8 LAT 38.4

08/31/75

GMT	GHA	DEC	AZ	EL
500	332.3	20.9	63.0	0.1
510	334.8	20.9	64.5	1.8
520	337.2	20.9	66.0	3.5
530	339.6	20.9	67.4	5.3

540	342.0	20.9	68.8	7.0
550	344.4	20.9	70.2	8.8
600	346.8	20.9	71.6	10.6
610	349.2	20.9	73.0	12.4
620	351.6	20.9	74.4	14.2
630	354.0	20.9	75.7	16.0
640	356.4	20.9	77.1	17.8
650	358.8	20.9	78.5	19.7
700	1.2	20.9	79.8	21.5
710	3.7	20.9	81.2	23.4
720	6.1	20.9	82.6	25.2
730	8.5	20.9	84.0	27.1
740	10.9	20.9	85.4	29.0
750	13.3	20.9	86.8	30.9
800	15.7	20.9	88.3	32.8
810	18.1	20.9	89.7	34.6
820	20.5	20.9	91.2	36.5
830	22.9	20.9	92.8	38.4
840	25.3	20.9	94.4	40.3
850	27.7	20.9	96.0	42.2
900	30.1	20.9	97.7	44.0
910	32.6	20.8	99.5	45.9
920	35.0	20.8	101.4	47.8
930	37.4	20.8	103.4	49.6
940	39.8	20.8	105.4	51.4
950	42.2	20.8	107.6	53.2
1000	44.6	20.8	110.0	55.0
1010	47.0	20.8	112.5	56.8
1020	49.4	20.8	115.2	58.5
1030	51.8	20.8	118.1	60.2
1040	54.2	20.8	121.3	61.8
1050	56.6	20.8	124.8	63.4
1100	59.0	20.8	128.6	64.9
1110	61.5	20.8	132.8	66.4
1120	63.9	20.8	137.5	67.7
1130	66.3	20.8	142.6	68.9
1140	68.7	20.8	148.3	70.0
1150	71.1	20.8	154.4	70.9
1200	73.5	20.8	161.1	71.6
1210	75.9	20.8	168.1	72.1
1220	78.3	20.8	175.4	72.3
1230	80.7	20.8	182.9	72.4
1240	83.1	20.8	190.2	72.1
1250	85.5	20.8	197.3	71.7
1300	87.9	20.8	204.0	71.0
1310	90.4	20.8	210.3	70.1
1320	92.8	20.8	216.0	69.1
1330	95.2	20.7	221.3	67.9
1340	97.6	20.7	226.0	66.6
1350	100.0	20.7	230.3	65.2
1400	102.4	20.7	234.2	63.7
1410	104.8	20.7	237.8	62.1
1420	107.2	20.7	241.0	60.5
1430	109.6	20.7	244.0	58.8
1440	112.0	20.7	246.8	57.1
1450	114.4	20.7	249.3	55.4
1500	116.8	20.7	251.7	53.6
1510	119.3	20.7	253.9	51.8
1520	121.7	20.7	256.0	49.9
1530	124.1	20.7	258.0	48.1
1540	126.5	20.7	259.8	46.2
1550	128.9	20.7	261.6	44.4
1600	131.3	20.7	263.4	42.5
1610	133.7	20.7	265.0	40.6
1620	136.1	20.7	266.6	38.7
1630	138.5	20.6	268.2	36.9

1640	140.9	20.6	269.7	35.0
1650	143.3	20.6	271.2	33.1
1700	145.7	20.6	272.6	31.2
1710	148.2	20.6	274.1	29.3
1720	150.6	20.6	275.5	27.4
1730	153.0	20.6	276.9	25.5
1740	155.4	20.6	278.2	23.7
1750	157.8	20.6	279.6	21.8
1800	160.2	20.6	281.0	19.9
1810	162.6	20.6	282.3	18.1
1820	165.0	20.6	283.7	16.2
1830	167.4	20.6	285.0	14.4
1840	169.8	20.6	286.4	12.6
1850	172.2	20.6	287.8	10.8
1900	174.6	20.5	289.2	9.0
1910	177.0	20.5	290.6	7.2
1920	179.4	20.5	292.0	5.4
1930	181.8	20.5	293.4	3.7
1940	184.3	20.5	294.8	2.0
1950	186.7	20.5	296.3	0.3