

VLB ARRAY MEMO No. 407

VLB ARRAY MEMO No. \_\_\_\_\_

NATIONAL RADIO ASTRONOMY OBSERVATORY

Socorro, NM

RFI SURVEY FOR THE VLBA

PIE TOWN, NM SITE

June 19 to October 19, 1984

Jim Oty



The RFI survey for the proposed VLBA site at Pie Town, NM was completed on October 19, 1984. This survey was started on June 19, 1984 but as this was the first attempt at a complete survey, several factors delayed completion. The computer software had to be revised, hardware modified, and procedures defined. The R.F. amplifiers for the frequencies above 4.0 GHz. were not delivered until August 13, 1984 so the higher bands were completed after the Los Alamos, NM survey (VLBA Memo # 401).

This survey was actually conducted at a location about one mile from the proposed VLBA site as no electrical power was available there. The RFI trailer was parked on private property on the east edge of Pie Town. Some local interference was experienced in the 75 MHz. and 327 MHz. bands that seemed to be coming from a telephone company microwave station about 100 yards from the trailer. To confirm this, some short term tests were run from a second location, very near the proposed VLBA site, using a portable generator for power. Data from this location was clear of this interference.

The equipment set up for this survey was much the same as for the Los Alamos survey. Directional antennas connected to wide band amplifiers driving a spectrum analyzer. Data was collected, stored and plotted by a computer. As no strong out of band signals were present, such as TV or FM stations, no filters were required.

As usual, many plots were produced at each band. Representative plots for each band are included with this report and are listed in Table I. These plots were all made at the location in Pie Town. Table II lists the plots made at the second location near the actual VLBA site. Table III lists the threshold level of harmful interference for each band as given in VLBA Memo 81 and the measurement threshold of this survey.

**Conclusions:**

1. Pie Town is a relatively quiet location. This location is not plagued by the high power commercial stations of a metropolitan area.
2. Some local interference in the 75 MHz. and 327 MHz. Bands was present in Pie town. A telephone microwave station seemed to be the major culprit. Moving a mile away, to the actual VLBA site, eliminated this problem.

(2)

3. Commercial power is a problem. During the summer months of July and August, daily power outages occurred. Some just a glitch and some complete outages. These seemed to be associated with the late afternoon electrical storms. However, during the four days of operation in October, no power problems occurred.

4. The plot of the 5.9 GHz. to 6.4 GHz. band (plot 11) shows several signals. These are common carrier microwave signals from either M.C.I. or A.T.T. Figure 1 is a map of the Pie Town area showing the paths of these transmissions and the location of the closest towers. The 6 GHz. interference is spillover from the A.T.T. microwave link from Cat Mountain to the A.T.T. tower west of Datil, NM. These interfering signals should not compromise observations of the OH Masers at 6.016 GHz., 6.030 GHz. and 6.035 GHz. The local telephone companies microwave link that originates on Mangus Mountain and terminates in Pie Town does not show up in any of the VLBA bands.

(3)  
 TABLE I  
 PIE TOWN, NM

Plot #	Frequency	Filter Fc/BW	Comments
1	50 - 100 MHz	None	North
2	50 - 100 MHz	None	South. Antenna pointed at telephone microwave building.
3	300 - 350 MHz	None	High level signals are air/ground comm. Some low level computer type interference. Antenna pointed at microwave building.
4	560 - 660 MHz.	None	Clean band all directions.
5	1350 - 1550 MHz	None	Omni antenna.
6	1550 - 1750 MHz	None	Intermittent signals around 1680 Mhz. coming from east. Radiosonde assigned frequency.
7	2150 - 2350 MHz	None	Signals all below 2190 MHz. Rest of bands clean.
8	4.6 - 4.8 GHz	None	No signals found from 4.6 to 5.2 GHz. This is a typical plot.
9	4.8 - 5.0 GHz	None	
10	5.0 - 5.2 GHz	None	
11	5.9 - 6.4 GHz	None	Signals coming from the east.
12	7.9 - 8.4 GHz.	None	
13	8.4 - 8.9 GHz	None	
14	10.2 - 10.7 GHz	None	Typical plot of 10.2 to 11.2GHz. No signals.
15	10.7 - 11.2 GHz	None	

(4)  
TABLE II

Plot #	Frequency	Filter Fc/BW	Comments
16	50 - 150 MHz	None	From location near VLBA site.
17	70 - 80 MHz	None	Same as above.
18	300 - 350 MHz	None	Same as above.

TABLE III  
HARMFUL INTERFERENCE LEVELS

VLBA TUNNING RANGE	HARMFUL INTERFERENCE LEVELS (Note 1)	RFI MEASURED THRESHOLD (Note 2 and 3)
50 - 100 MHz.	*	-155 dBW/m <sup>2</sup>
310 - 340 MHz.	-151 dBW/m <sup>2</sup>	-155 dBW/m <sup>2</sup>
580 - 640 MHz.	-146 dBW/m <sup>2</sup>	-155 dBW/m <sup>2</sup>
1.35 - 1.75 GHz.	-135 dBW/m <sup>2</sup>	-132 dBW/m <sup>2</sup>
2.175 - 2.425 GHz.	*	-126 dBW/m <sup>2</sup>
4.6 - 5.1 GHz.	-120 dBW/m <sup>2</sup>	-130 dBW/m <sup>2</sup>
4.99 - 5.0 GHz. (Sub-band)	-127 dBW/m <sup>2</sup>	-130 dBW/m <sup>2</sup>
5.9 - 6.4 GHz.	-120 dBW/m <sup>2</sup>	-118 dBW/m <sup>2</sup>
8.0 - 8.8 GHz.	*	-114 dBW/m <sup>2</sup>
10.2 - 11.2 GHz.	-110 dBW/m <sup>2</sup>	-108 dBW/m <sup>2</sup>

Note 1: These levels, from VLB Array Memo No. 81, are increased by 10 dB since ground based RFI is likely to enter the antenna through 0 dBI sidelobes rather than the +10 dBI sidelobes assumed in Memo 81.

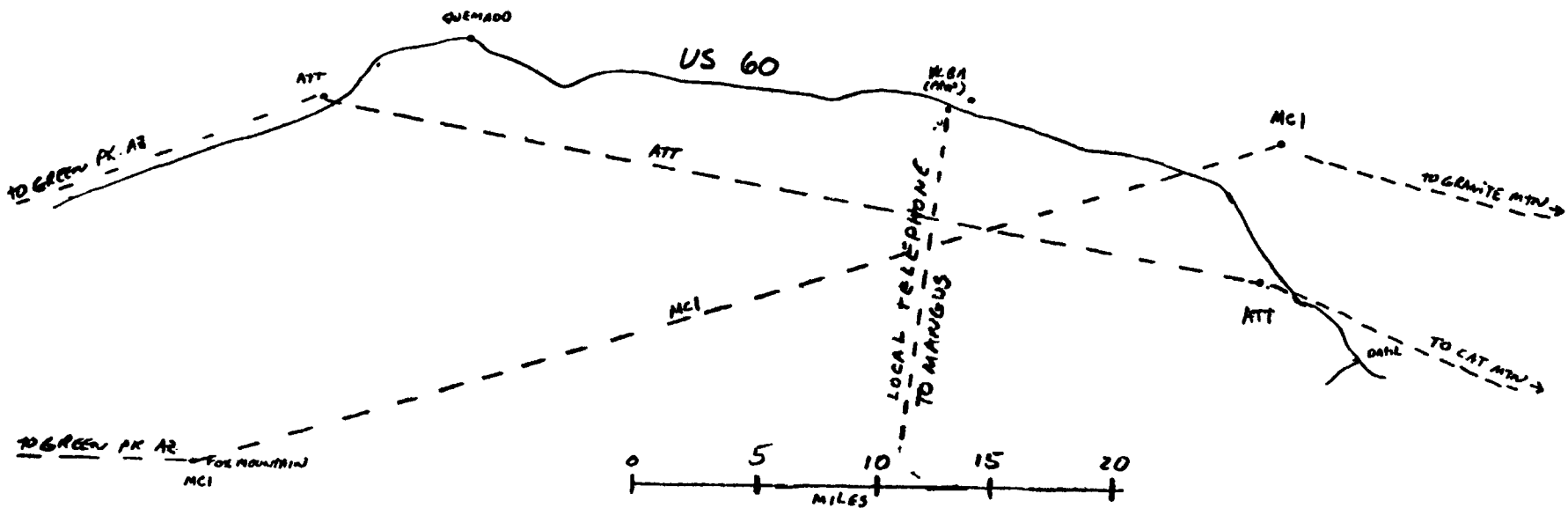
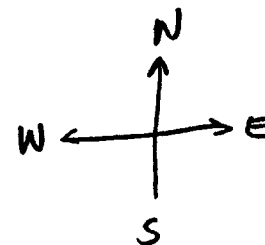
Note 2: These levels are threshold levels from Table I plots.

Note 3: These values may vary slightly from survey to survey because of minor equipment changes.

\* These frequency bands not included in memo 81.

FIG. 1

MICROWAVE TRANSMISSION PATHS



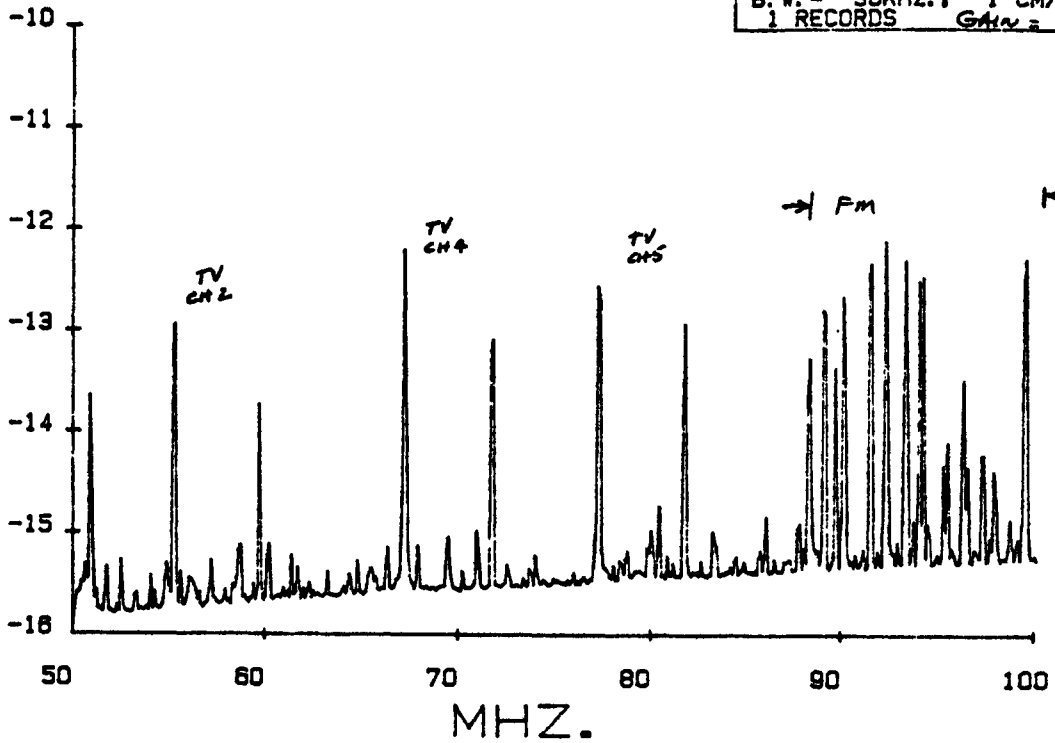
OTY  
10/29/84



FLUX (LOG W/SQ. M)

PLOT #1

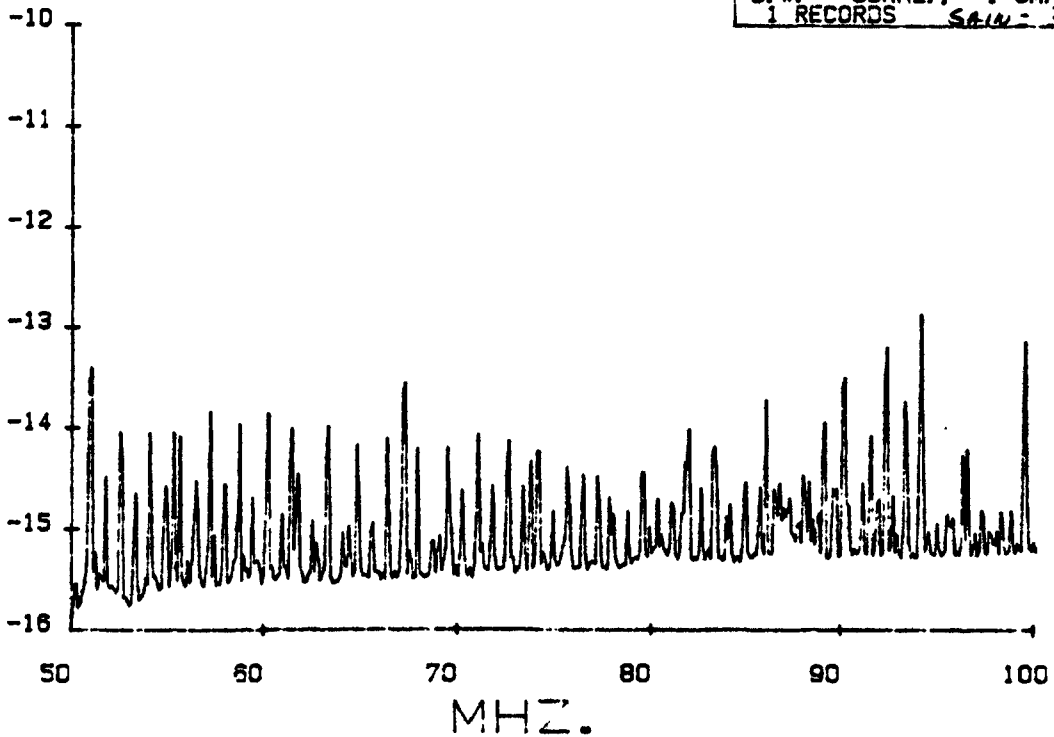
VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	11:45:41 07-18-1984
STOP:	11:47:17 07-18-1984
SO TO	100 MHZ. 360 DEG AZ.
B.W.	= 30KHZ.; 1 CM/SEC.
1 RECORDS	GAIN = 32.08



FLUX (LOG W/SQ. M)

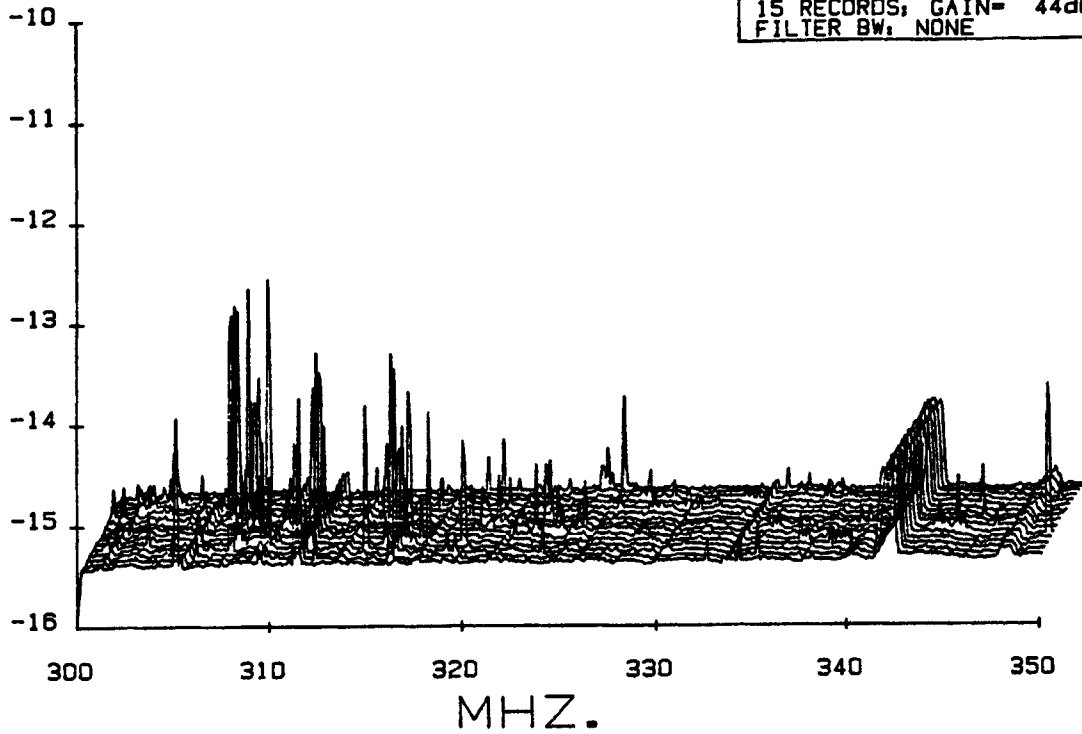
PLOT #2

VLBA RFI SURVEY	
LOCATION: PIE TOWN	
STAR:	11:57:38 07-18-1984
STOP:	11:59:18 07-18-1984
SO TO	100 MHZ. 180 DEG AZ.
B.W.	= 30KHZ.; 1 CM/SEC.
1 RECORDS	GAIN = 32.08



FLUX (LOG W/SQ. M)

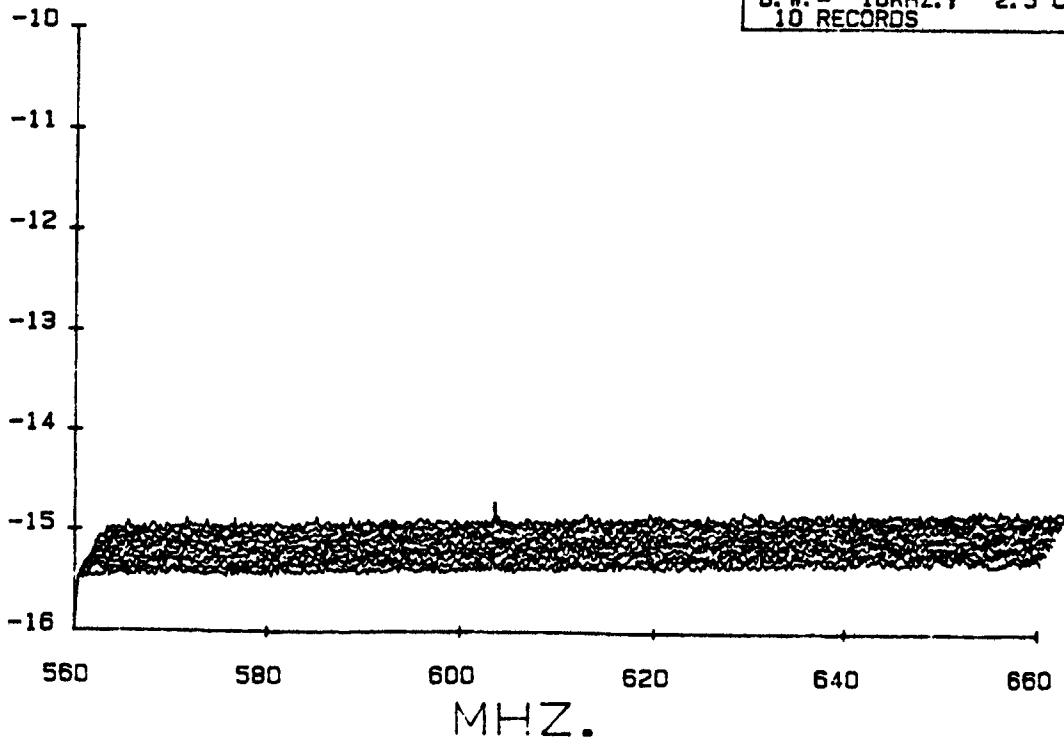
PLOT #3



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	11:48:17 07-17-1984
STOP:	12:45:29 07-17-1984
300 TO 350 MHZ. 180 DEG AZ.	
B.W. =	30KHZ.; 1 SEC/CM.
15 RECORDS; GAIN= 44dB	
FILTER BW: NONE	

FLUX (LOG W/SQ. M)

PLOT #4

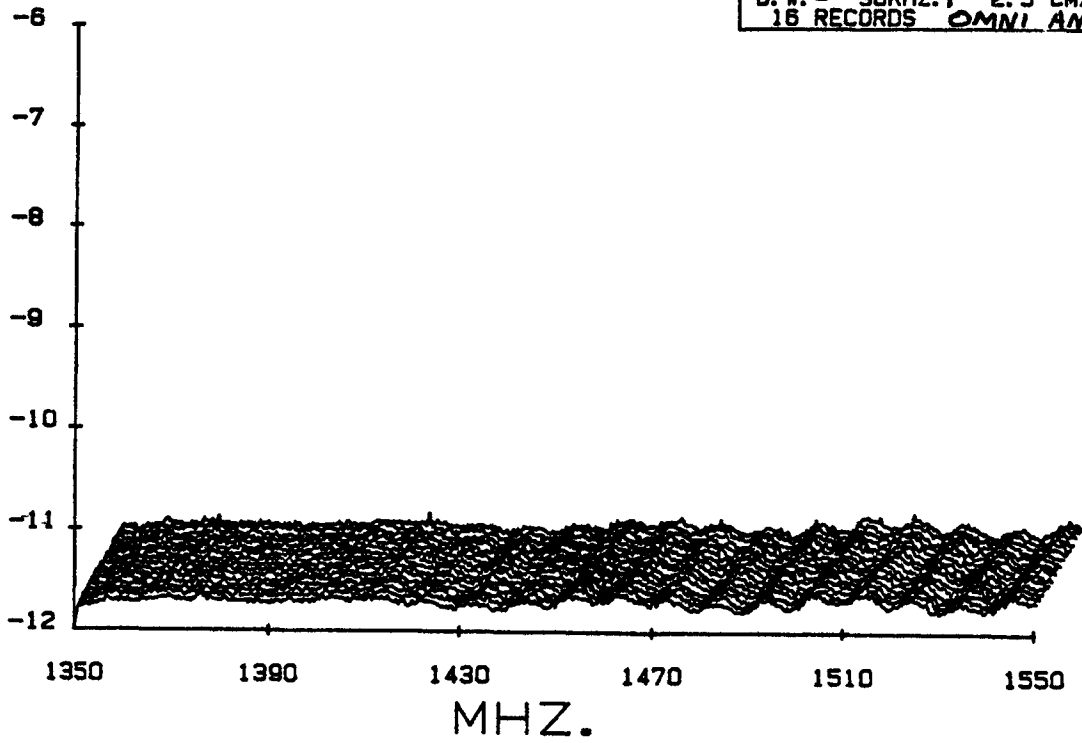


VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	12:54:16 07-12-1984
STOP:	13:14:57 07-12-1984
560 TO 660 MHZ. 360 DEG AZ.	
B.W. =	10KHZ.; 2.5 CM/SEC.
10 RECORDS	

VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	09:56:17 07-03-1984
STOP:	14:00:07 07-03-1984
1350 TO 1550 MHZ. 0 DEG AZ.	
B.W. =	30KHZ.; 2.5 CM/SEC.
16 RECORDS OMNI ANT.	

FLUX (LOG W/SQ. M)

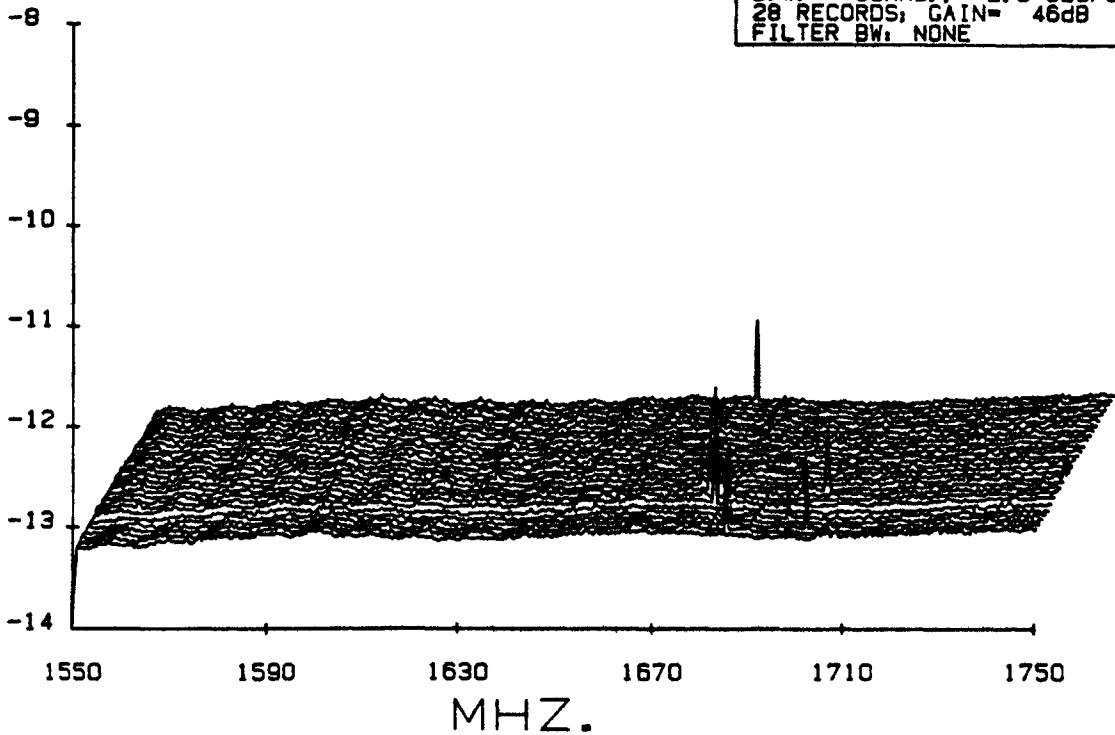
PLOT # 5



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	14:08:31 07-09-1984
STOP:	04:08:45 07-10-1984
1550 TO 1750 MHZ. 90 DEG AZ.	
B.W. =	30KHZ.; 2.5 SEC/CM.
28 RECORDS; GAIN= 46dB	
FILTER BW: NONE	

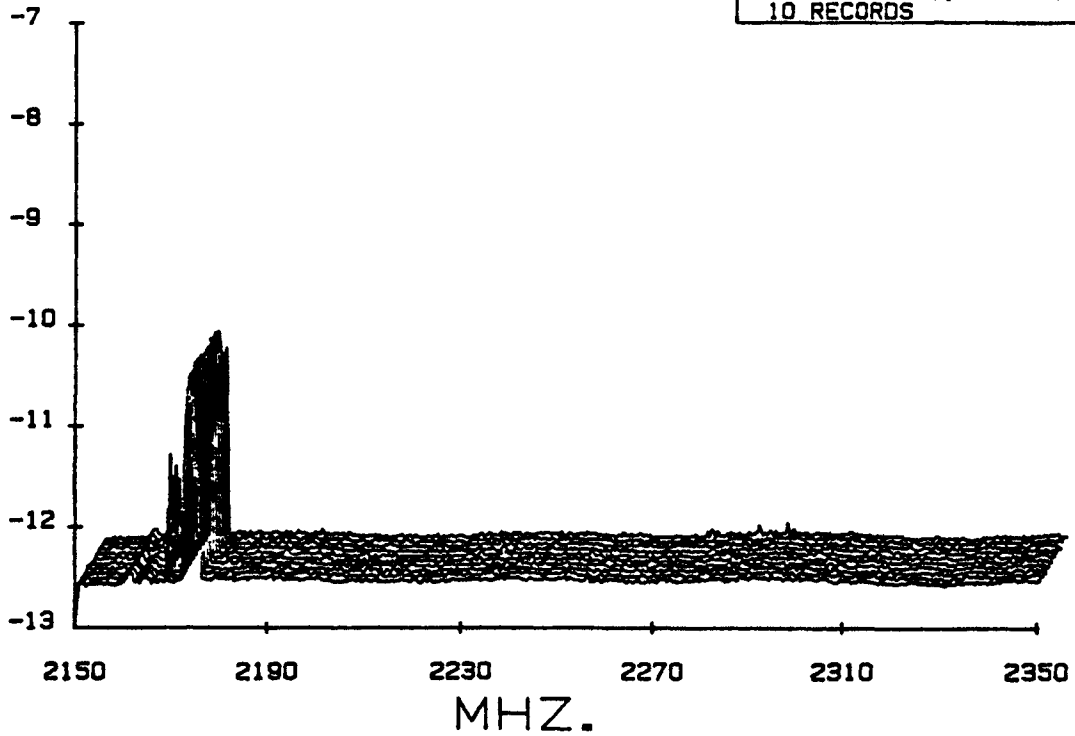
FLUX (LOG W/SQ. M)

PLOT # 6



FLUX (LOG W/SQ. M)

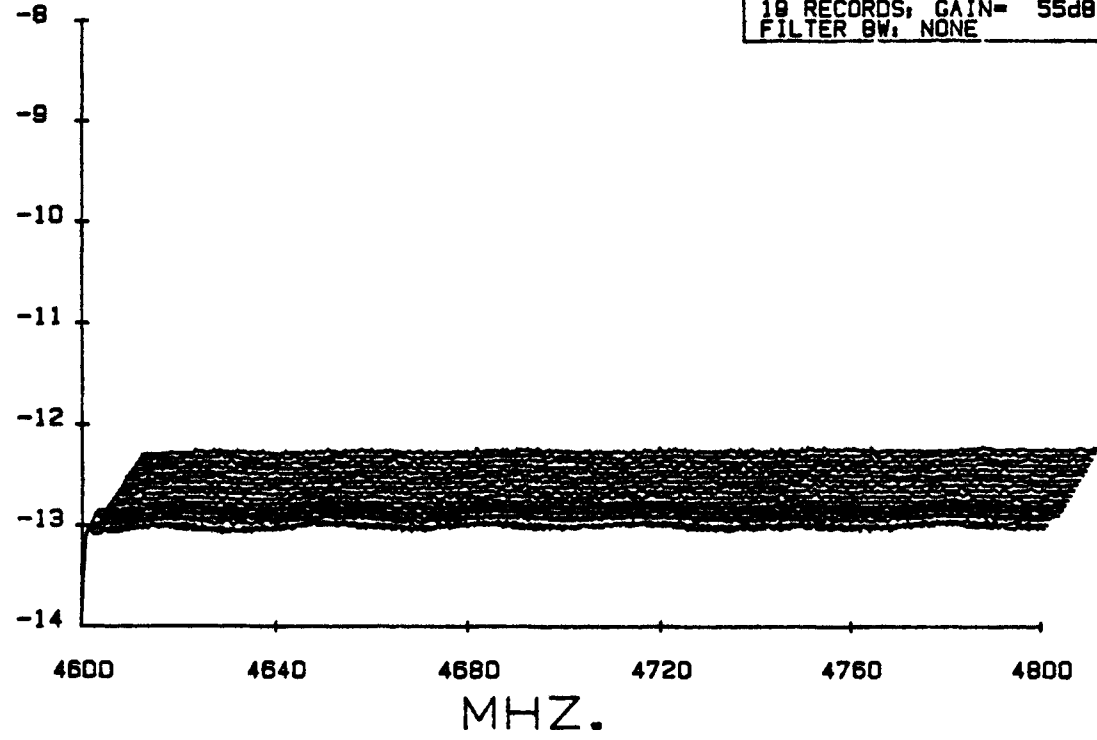
PLOT # 7



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	12:35:39 07-06-1984
STOP:	13:07:02 07-06-1984
2150 TO 2350 MHZ. 180 DEG AZ.	
B.W. =	30KHZ.; 2.5 CM/SEC.
10 RECORDS	

FLUX (LOG W/SQ. M)

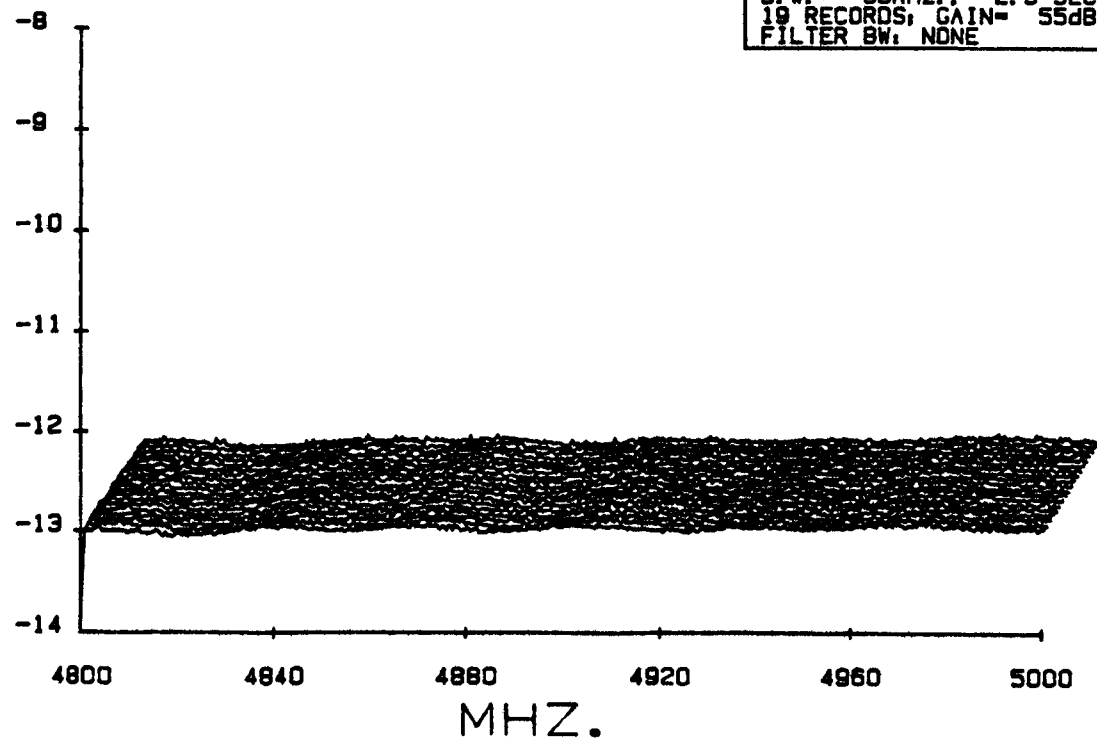
PLOT #8



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	15:21:33 10-16-1984
STOP:	02:53:09 10-17-1984
4600 TO 4800 MHZ. 90 DEC AZ.	
B.W.:	30KHZ.; 2.5 SEC/CM.
19 RECORDS; GAIN= 55dB	
FILTER BW: NONE	

FLUX (LOG W/SQ. M)

PLOT #9

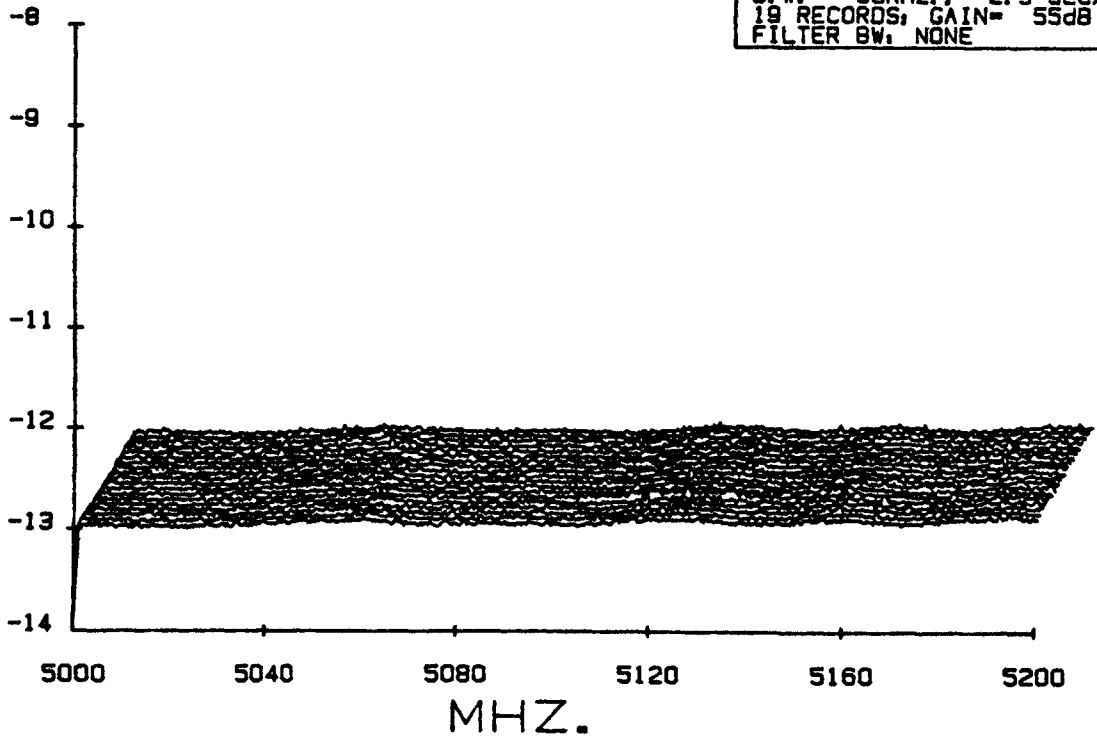


VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	09:43:50 10-17-1984
STOP:	11:52:26 10-17-1984
4800 TO 5000 MHZ. 90 DEC AZ.	
B.W.:	30KHZ.; 2.5 SEC/CM.
19 RECORDS; GAIN= 55dB	
FILTER BW: NONE	

PLOT# 10

VLBA RFI SURVEY
LOCATION: PIE TOWN
START: 12:04:55 10-17-1984
STOP : 14:11:26 10-17-1984
5000 TO 5200 MHZ. 90 DEG AZ.
B.W. = 30KHZ.; 2.5 SEC/CM.
19 RECORDS; GAIN= 55dB
FILTER BW: NONE

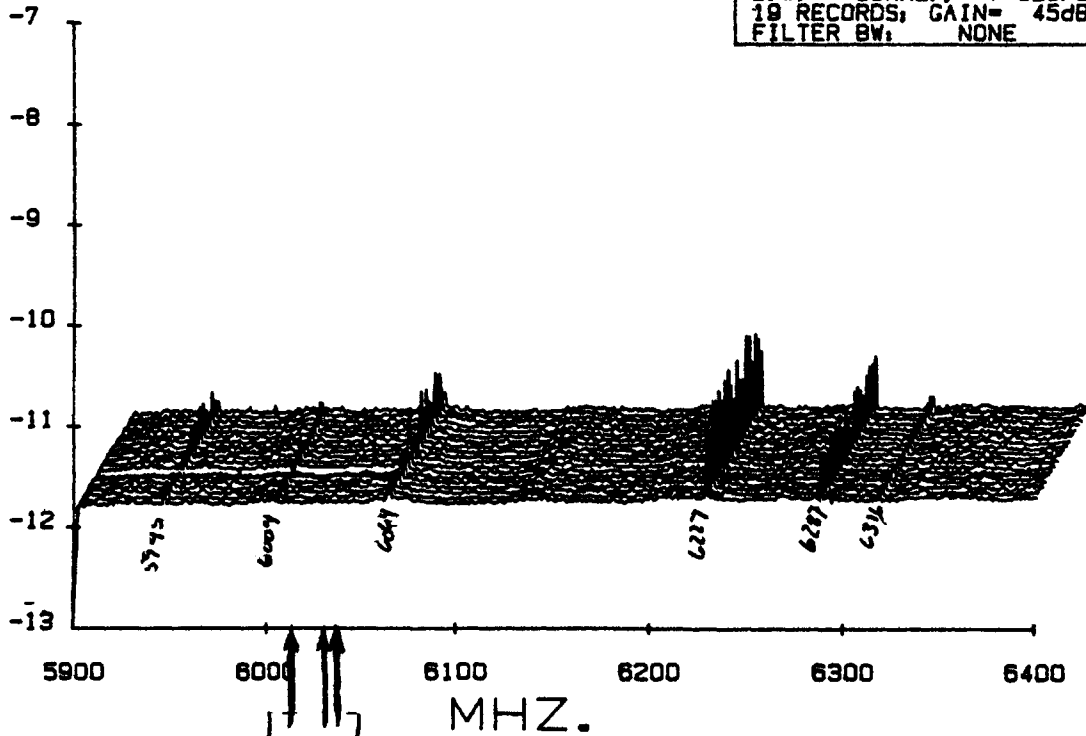
FLUX (LOG W/SQ. M)



FLUX (LOG W/SQ. M)

PLOT # 11

VLBA RFI SURVEY
LOCATION: PIE TOWN
START: 14:33:00 10-17-1984
STOP : 16:00:46 10-17-1984
5900 TO 6400 MHZ, 90 DEG AZ.
B. W. = 30KHZ.; 7 SEC/CM.
19 RECORDS; GAIN= 45dB
FILTER BW: NONE



OH Masers

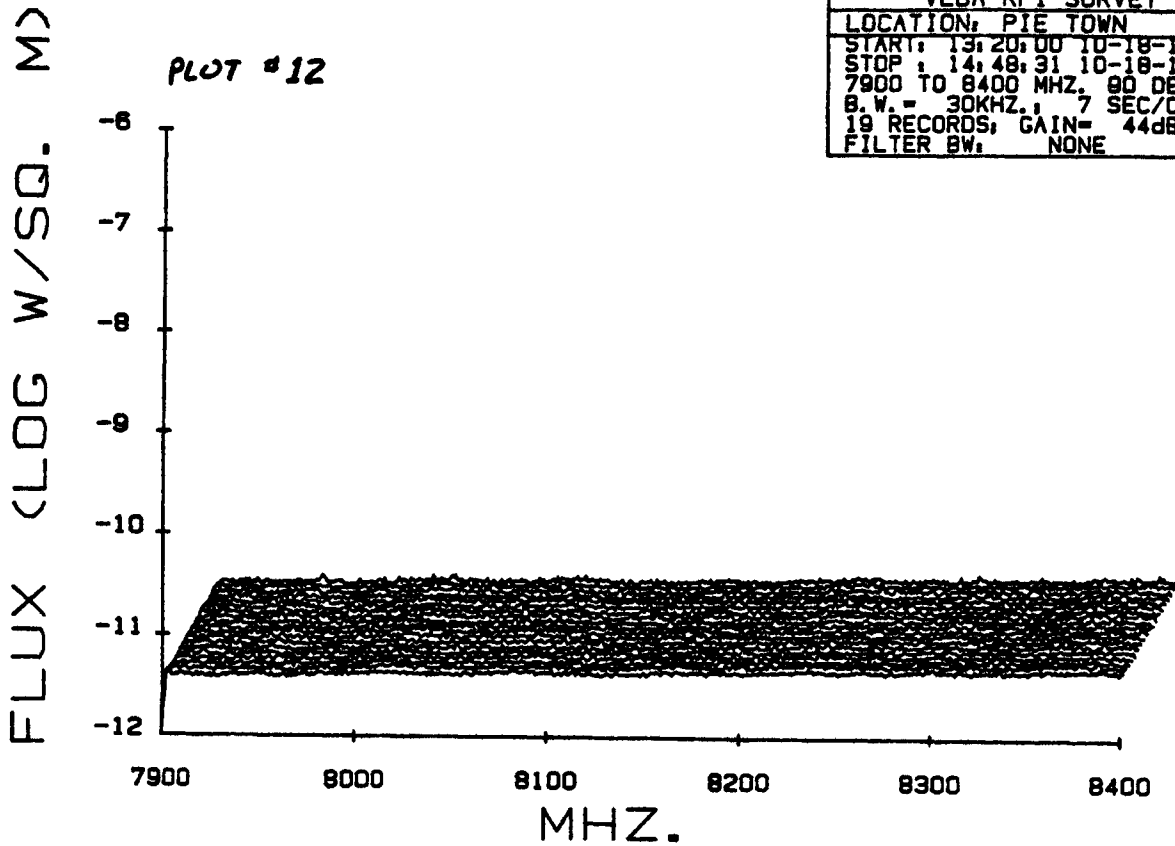
6016

6030

6035

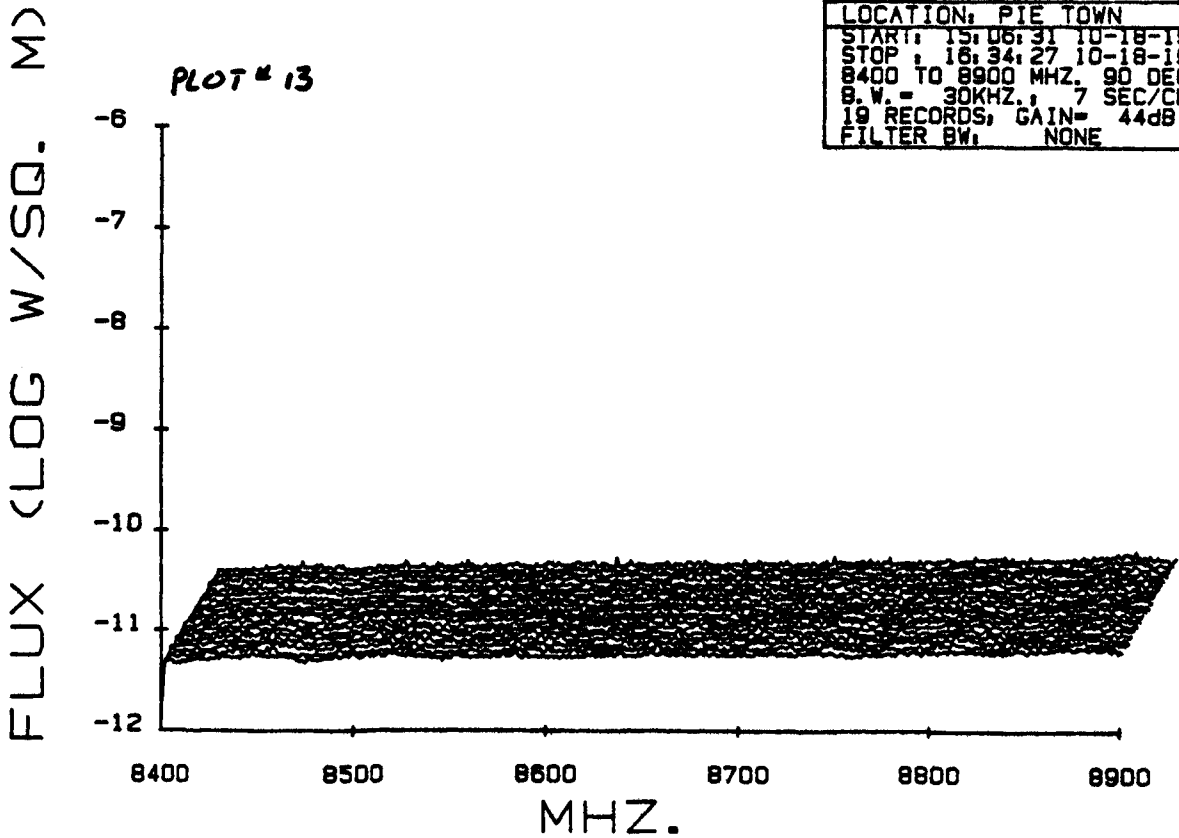
VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START: 13:20:00 10-18-1984	
STOP : 14:48:31 10-18-1984	
7900 TO 8400 MHZ, 90 DEG AZ.	
B.W. = 30KHZ, 7 SEC/CM.	
19 RECORDS, GAIN= 44dB	
FILTER BW: NONE	

PLOT #12



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START: 15:06:31 10-18-1984	
STOP : 16:34:27 10-18-1984	
8400 TO 8900 MHZ, 90 DEG AZ.	
B.W. = 30KHZ, 7 SEC/CM.	
19 RECORDS, GAIN= 44dB	
FILTER BW: NONE	

PLOT #13

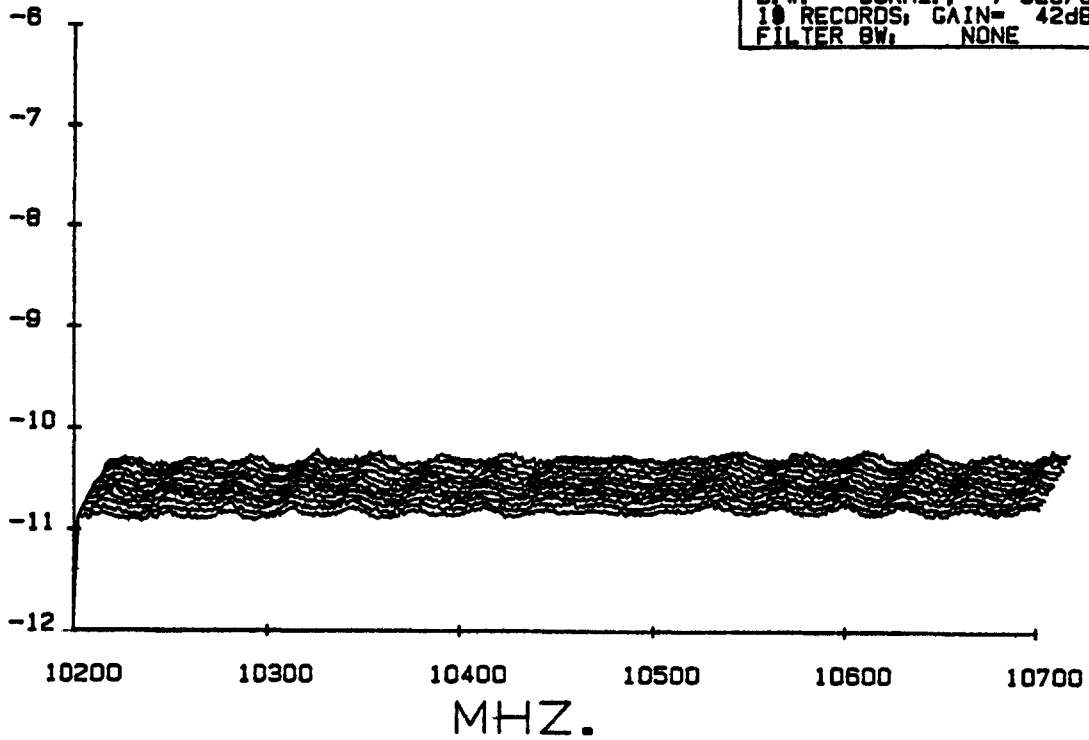




VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	15:06:31 10-18-1984
STOP:	09:53:27 10-19-1984
10200 TO 10700 MHZ. 90 DEG AZ	
B.W.:	30KHZ.; 7 SEC/CM.
19 RECORDS;	GAIN= 42dB
FILTER BW:	NONE

FLUX (LOG W/SQ. M)

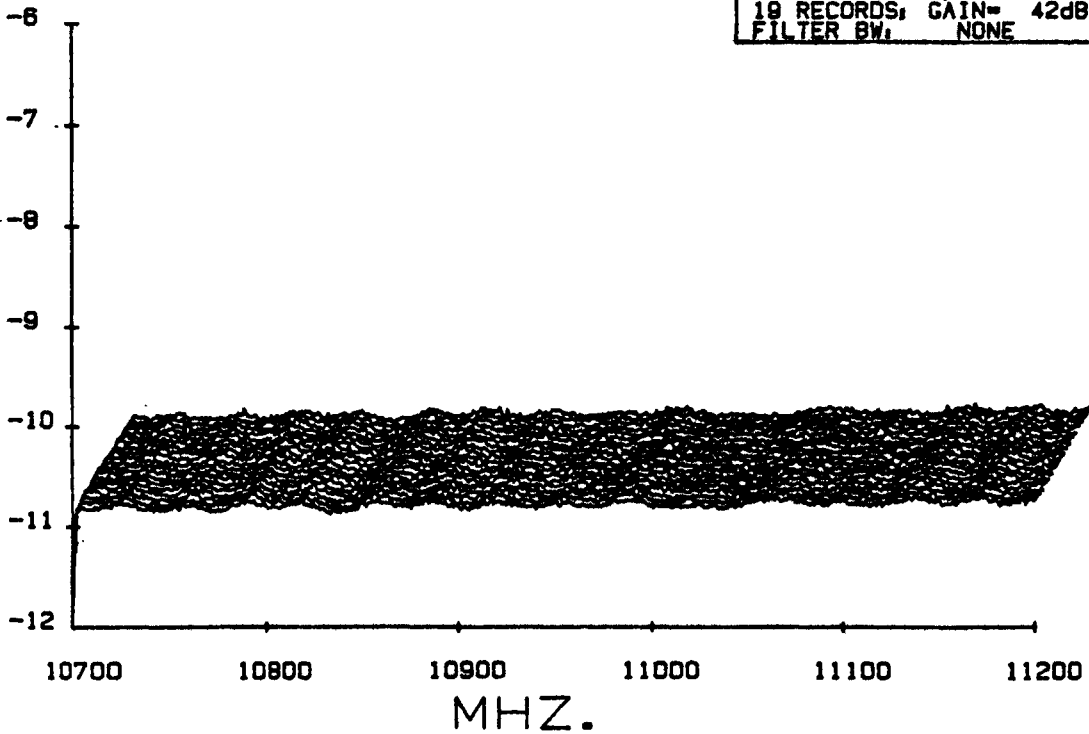
PLOT # 14



VLBA RFI SURVEY	
LOCATION: PIE TOWN	
START:	09:56:04 10-19-1984
STOP:	11:25:30 10-19-1984
10700 TO 11200 MHZ. 90 DEG AZ	
B.W.:	30KHZ.; 7 SEC/CM.
19 RECORDS;	GAIN= 42dB
FILTER BW:	NONE

FLUX (LOG W/SQ. M)

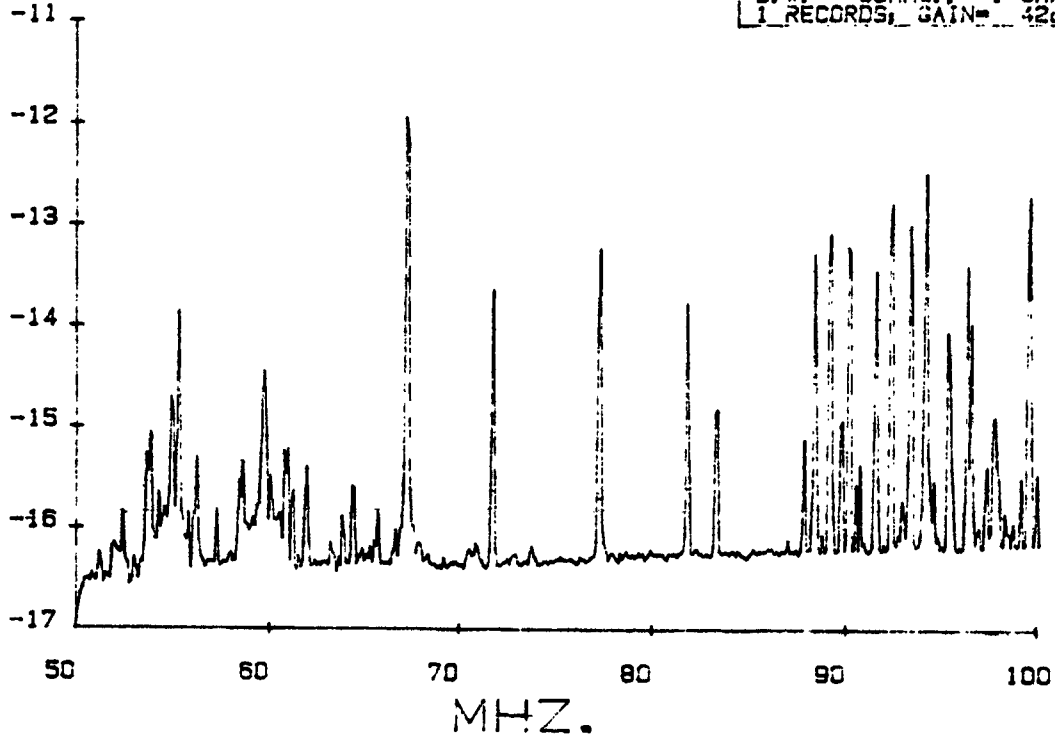
PLOT # 15



FLUX (LOG W/SQ. M)

PLOT #16

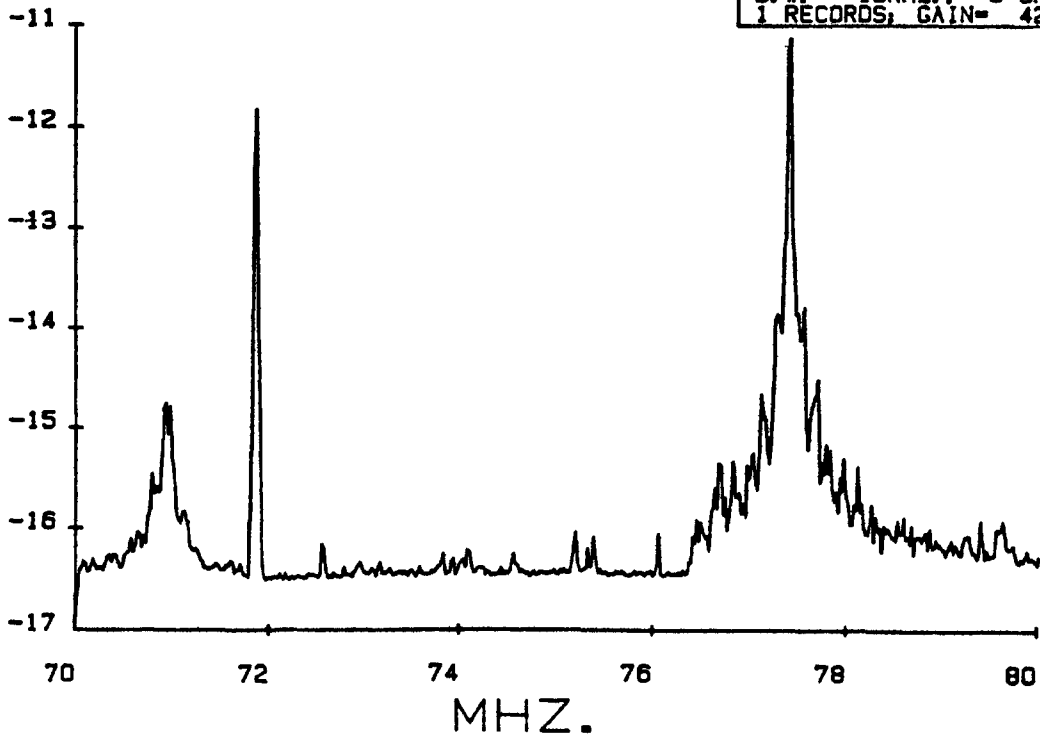
VLBA RFI SURVEY	
LOCATION: PIE REMOTE	
START: 13:09:33	07-31-1984
STOP: 13:11:33	07-31-1984
50 TO 100 MHZ. 190 DEG AZ.	
B.W. = 30KHZ. 1 CM/SEC.	
1 RECORDS, GAIN= 42dB	



FLUX (LOG W/SQ. M)

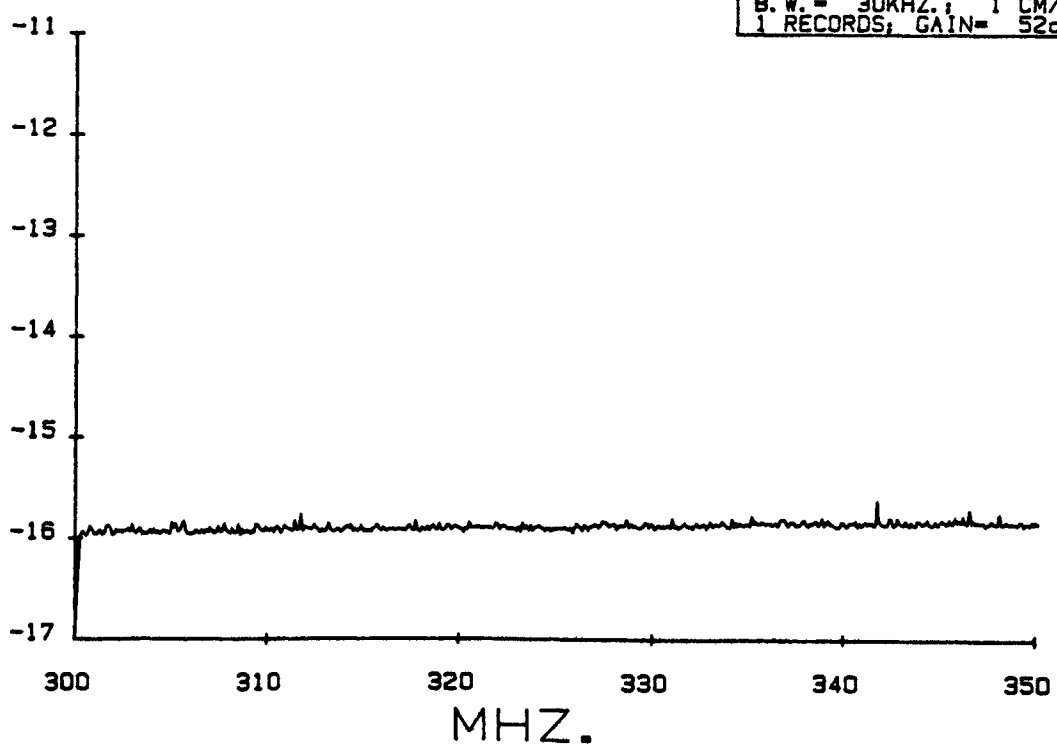
PLOT #17

VLBA RFI SURVEY	
LOCATION: PIE REMOTE	
START: 14:25:17	07-31-1984
STOP: 14:27:01	07-31-1984
70 TO 80 MHZ. 360 DEG AZ.	
B.W. = 10KHZ. 3 CM/SEC.	
1 RECORDS, GAIN= 42dB	



FLUX (LOG W/SQ. M)

PLOT # 18



VLBA RFI SURVEY
LOCATION: PIE REMOTE
START: 13:34:57 07-31-1984
STOP: 13:36:38 07-31-1984
300 TO 350 MHZ. 270 DEG AZ.
B. W. = 30KHZ.; 1 CM/SEC.
1 RECORDS; GAIN= 52dB