

VLB ARRAY MEMO No. 433

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NATIONAL RADIO ASTRONOMY OBSERVATORY

Socorro, NM

RFI SURVEY FOR THE VLBA

THREE POINTS, AZ SITE

(ROBLES JUNCTION)

January 1985

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(1)

After the completion of the RFI Survey at Kitt Peak, AZ (see VLB ARRAY Memo 423), a second survey was conducted at Three Points, AZ. This survey was a backup in case the Kitt Peak location proves unsatisfactory.

The RFI monitoring trailer was set up at the junction of State Route 86 (Ajo Way) and State Route 286. This location was centrally located in the Altar Valley about midway between Tucson and Kitt Peak and within a few miles of three abandoned Titan II missile sites. One of these abandoned missile sites could be an alternate VLBA location for Kitt Peak. Since time would not permit a RFI survey of all sites, the central location was chosen and the assumption made that the RF environment in the valley would not change significantly from site to site. A map of the area is included as Figure 1.

A complete survey was made at this location from January 7, 1985 to January 31, 1985. The survey included all VLBA frequencies from 75 MHz. to 11.2 GHz. Electrical power was very reliable and no equipment problems were encountered.

The significant contributors to the RF environment at this location seemed to be Tucson and Davis-Monthan AFB. The Tucson commercial stations in the TV and FM bands were very strong as it was line of sight to the Tucson transmitter site. Signals in the 6 GHz. band were numerous and were coming from the general direction of Tucson. Phoenix stations were not a problem because of the distance and the low elevation of the monitoring site. Davis-Monthan AFB created several problems, primarily in the 325 MHz. and 1.5 GHz. areas, with all of the air activity associated with their training exercises. The following comments are my observations.

300-350 MHz. Activity in this band varied with military aircraft activity. Plot 3 shows the worse case.

500-1000 MHz. This band segment was added as it is the proposed IF for the VLBA. Primary reason for monitoring was to identify any extremely strong signals that could bother this IF. Channel 40 TV was by far the strongest with a power measurement of $1.4 \times 10^{-7} \text{ W/M}^2$.

550-650 MHz. This band was dominated by TV channel 40 (626-632 MHz.). Other UHF tv signals were also present.

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1350-1750 MHz. The activity in this band also varied with the military aircraft activity. Extra time was spent monitoring during a military exercise (Cactus Arizona '85). Several types of aircraft were used including ECM aircraft. Several long term plots were generated showing some unusual activity. In most cases it was imposible to identify these signals, however, radar signals from a F4 type aircraft were plotted from about 1610 to 1650 MHz. The other signals were probably associated with the ECM activity during this exercise.

2.15-2.35 GHz. Usual signals at lower end of band. Probably from power company micro-wave links.

4.6-5.2 GHz. No detectable activity.

5.9-6.4 GHz. Unusual number of signals in this band coming from the general direction of Tucson.

7.9-11.2 GHz. No detectable signals.

The terrain around the Three Points location is fairly flat. The highest points on the horizon were Mt. Lemmon to the northeast and Kitt Peak to the southwest and both were about 3 degrees. No elevation plot is included in this report.

The enclosed plots are typical plots of each of the bands. Several extra plots are included to point out some significant detail. Many other plots were generated and are available for further study if needed. Table I lists those plots included with this report.

Table II is the usual interference level table that shows the harmful interference level and the threshold level of this survey.

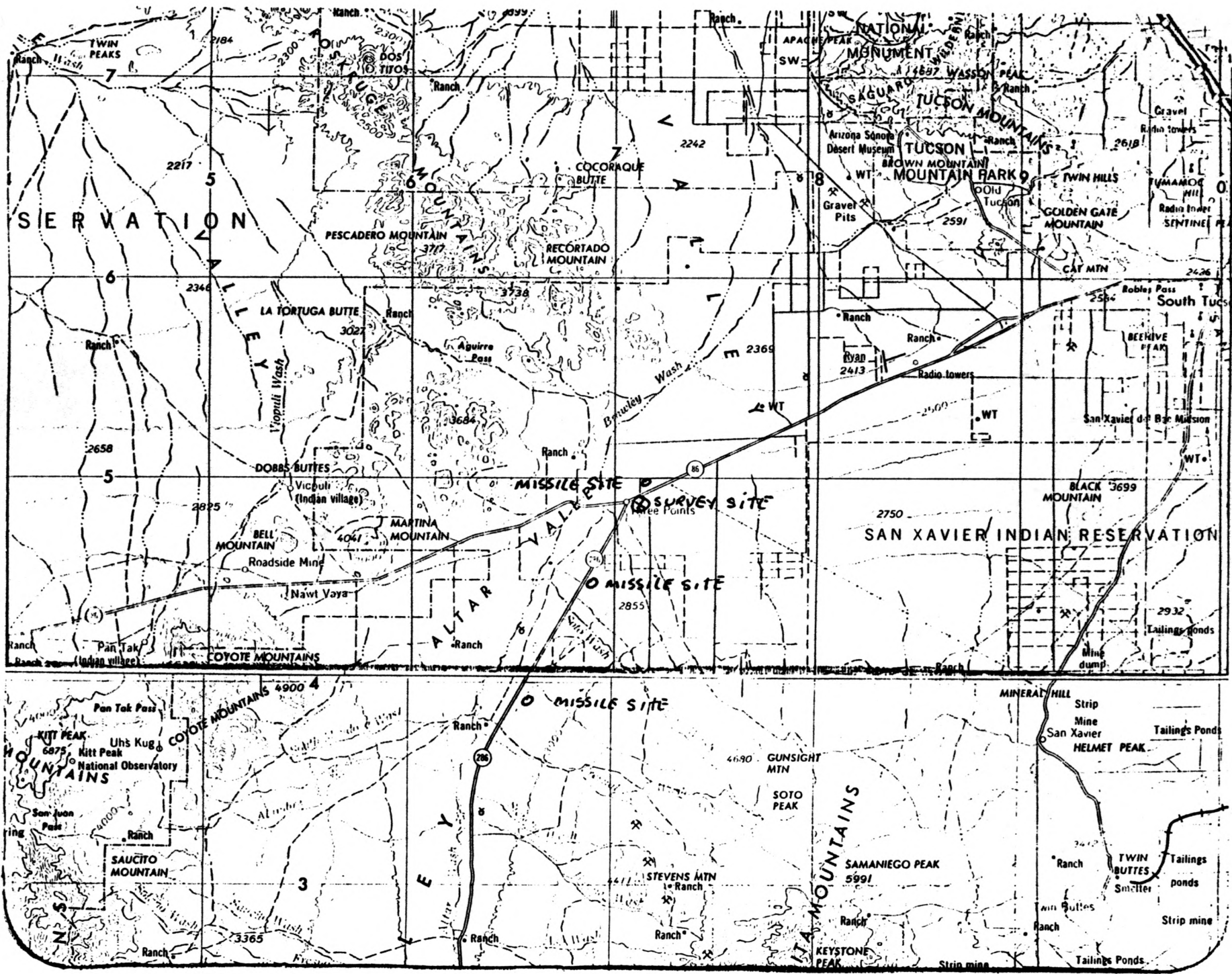


Figure 1 (3)

(4)
 TABLE I
 THREE POINTS, AZ

Plot #	Frequency	Filter Fc/BW	Comments
1	50 - 100 MHz	None	East.
2	50 - 100 MHz	None	West.
3	74 - 76 MHz	75/5%	North. Single plot showing noise floor.
4	74 - 76 MHz	75/5%	South. Single plot showing noise floor.
5	300 - 350 MHz	325/50	Worse case. High level signals are air/ground comm.
6	300 - 350 MHz	325/50	Best case.
7	550 - 650 MHz.	600/100	Channel 40 from Tucson. Channel 33 from Phoenix.
8	550 - 650 MHz	600/100	One record plot with lower gain to show power level from CH 40.
9	500 - 1000 MHz	None	Low gain plot to show high level signals.
10	1350 - 1550 MHz.	1500/1000	Best case. Very little military activity.
11	1550 - 1750 MHz.	1500/1000	Best case. Very little military activity.
12	1550 - 1750 MHz.	1500/1000	Typical signal from F4 type aircraft.
13	1300 - 1800 MHz.	1500/1000	Long term plot. Activity coincides with military aircraft activity.
14	1300 - 1800 MHz	1500/1000	One record extracted from Plot 13 showing strength of signal from F4 type aircraft.

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TABLE II (Cont.)

15	1300 - 1800 MHz	1500/1000	One record extracted from Plot 13 showing activity associated with military activity. ECM ??
16	2150 - 2350 MHz	HP2000	North.
17	2150 - 2350 MHz	HP2000	West.
18	4.6 - 4.8 GHz	HP4000	Typical plot.
19	4.8 - 5.0 GHz	HP4000	Typical plot.
20	5.0 - 5.2 GHz.	HP4000	Typical plot.
21	5.9 - 6.4 GHz	HP4000	East. From general direction of Tucson.
22	7.9 - 8.4 GHz.	HP6000	Typical plot.
23	8.4 - 8.9 GHz	HP6000	Typical plot.
24	10.2 -10.7 GHz	HP6000	Typical plot.
25	10.7 11.2 GHz	HP6000	Typical plot.

TABLE II
HARMFUL INTERFERENCE LEVELS

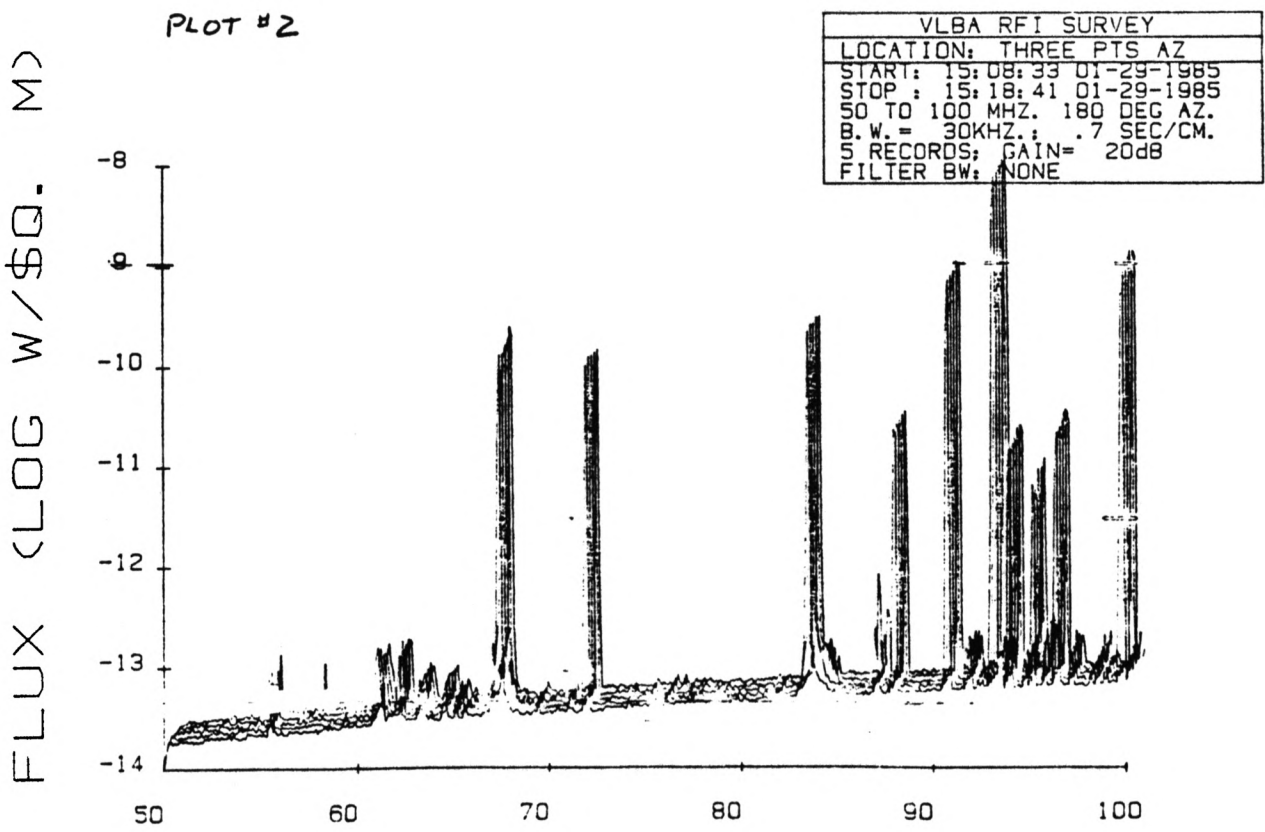
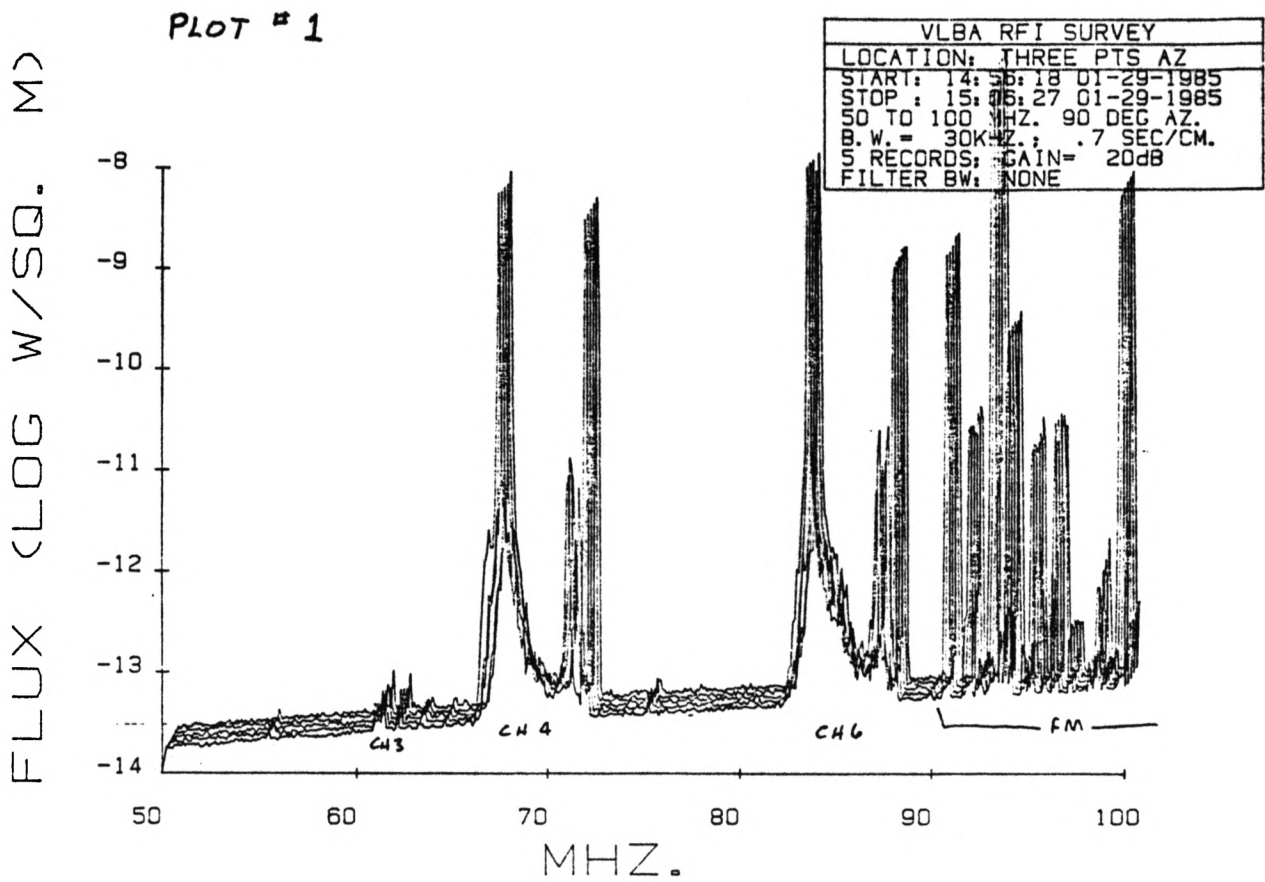
VLBA TUNNING RANGE	HARMFUL INTERFERENCE LEVELS (Note 1)	RFI MEASURED THRESHOLD (Note 2 and 3)
50 - 100 MHz.	*	-138 dBW/m ²
310 - 340 MHz.	-151 dBW/m ²	-152 dBW/m ²
580 - 640 MHz.	-146 dBW/m ²	-148 dBW/m ²
1.35 - 1.75 GHz.	-135 dBW/m ²	-135 dBW/m ²
2.175 - 2.425 GHz.	*	-133 dBW/m ²
4.6 - 5.1 GHz.	-120 dBW/m ²	-127 dBW/m ²
4.99 - 5.0 GHz. (Sub-band)	-127 dBW/m ²	-127 dBW/m ²
5.9 - 6.4 GHz.	-120 dBW/m ²	-125 dBW/m ²
8.0 - 8.8 GHz.	*	-122 dBW/m ²
10.2 - 11.2 GHz.	-110 dBW/m ²	-117 dBW/m ²

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.

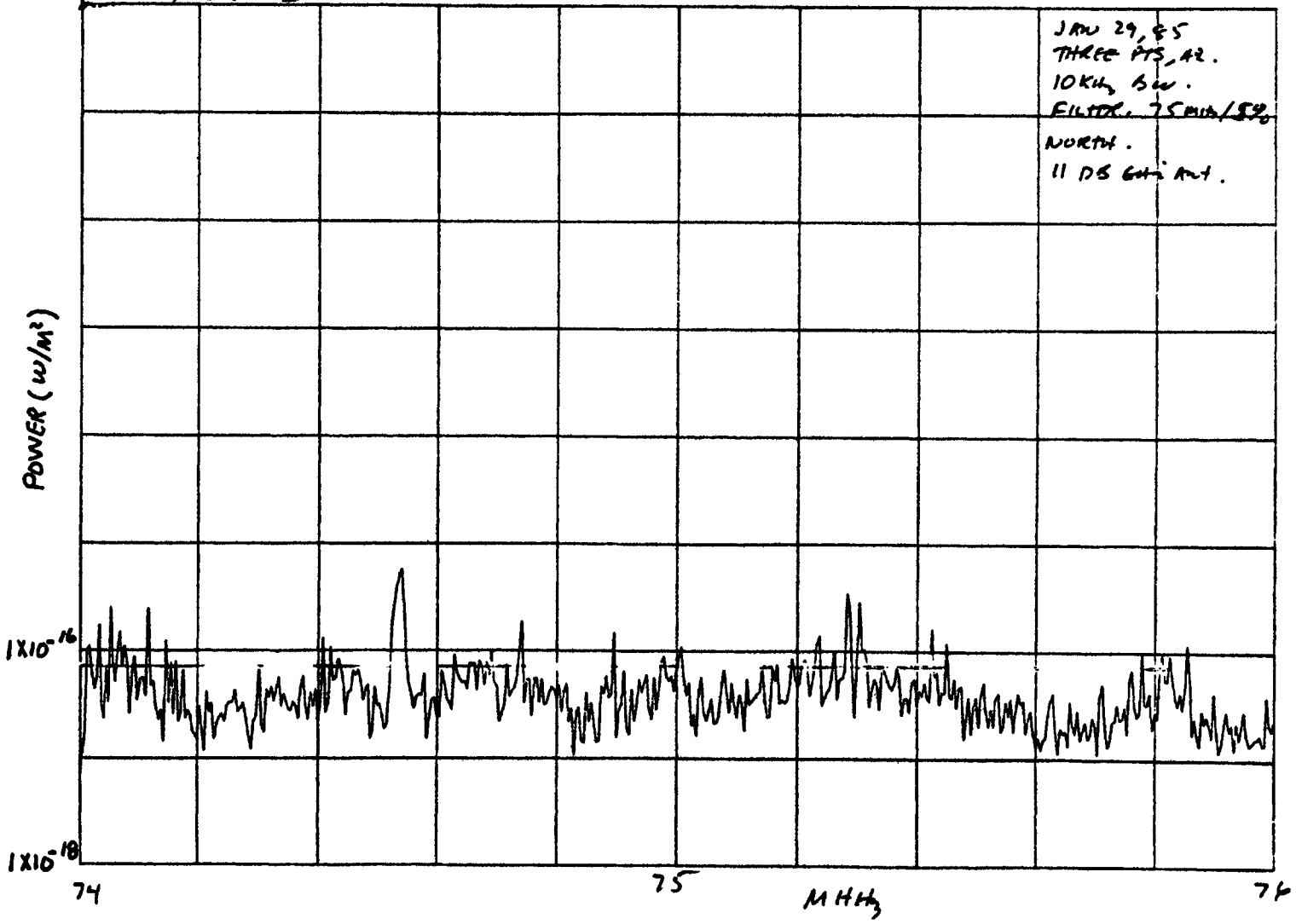
Note 3: These values may vary slightly from survey to survey because of minor equipment changes.

* These frequency bands not included in memo 81.



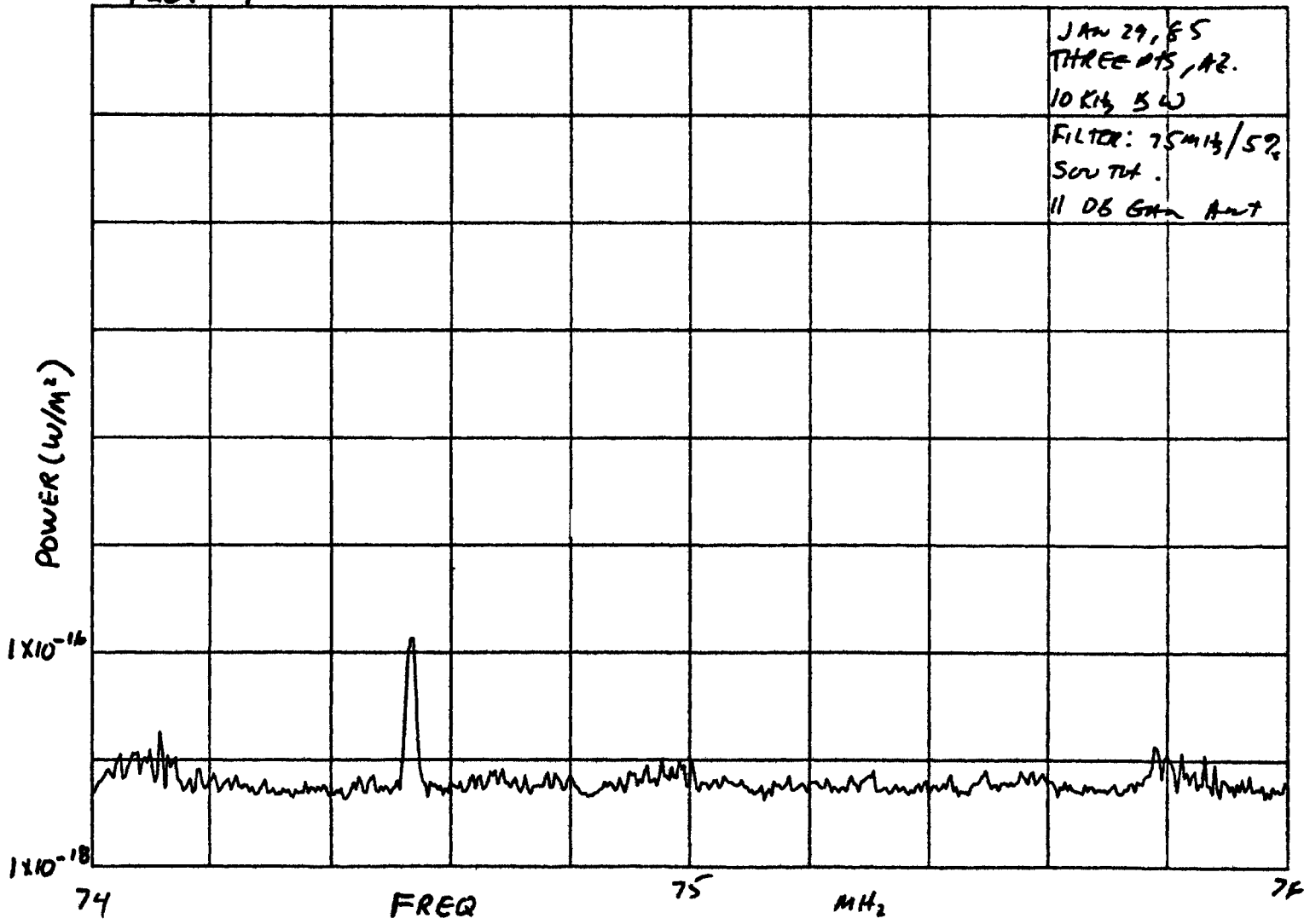
PLOT #3

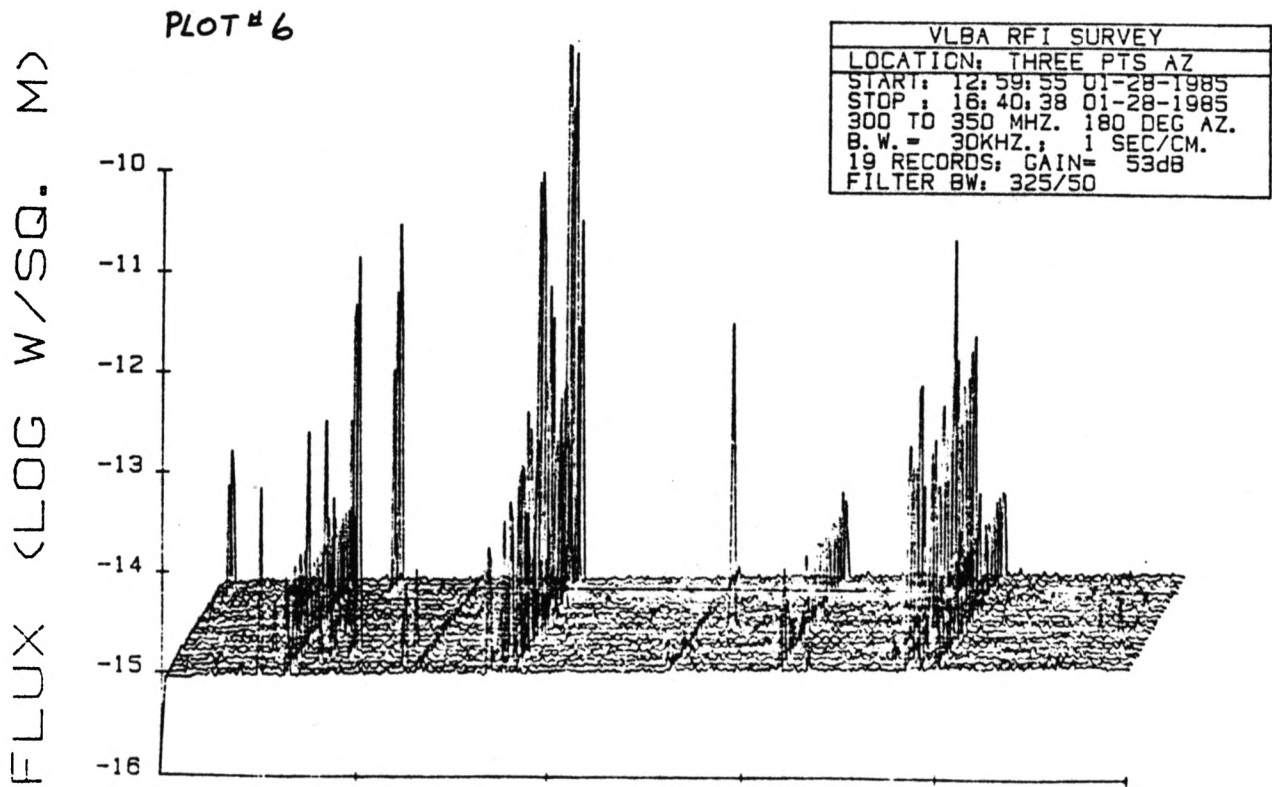
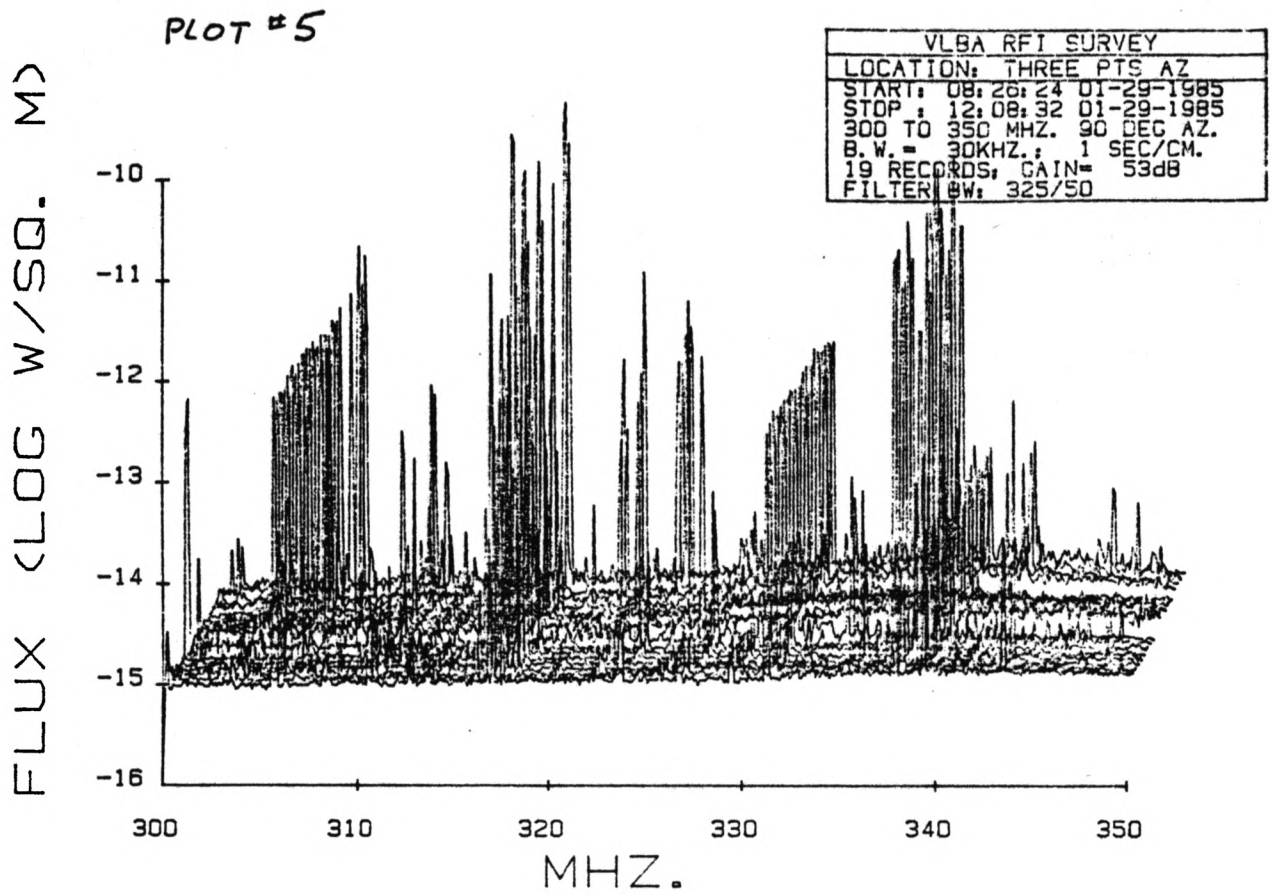
JAN 29, 65
THREE PTS, AR.
10 KM SW.
FILTER, 75 MHz / 5%
NORTH.
11 DB GAIN ANT.

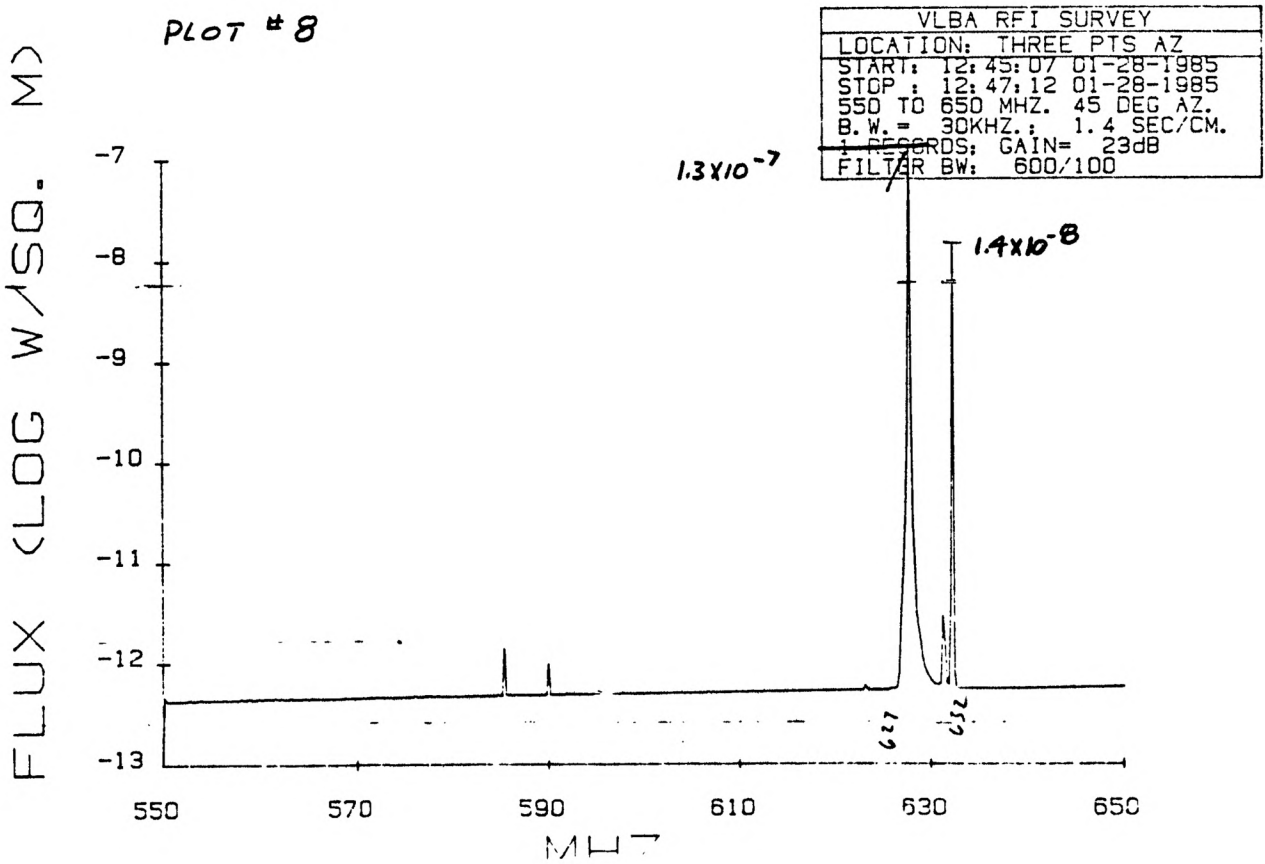
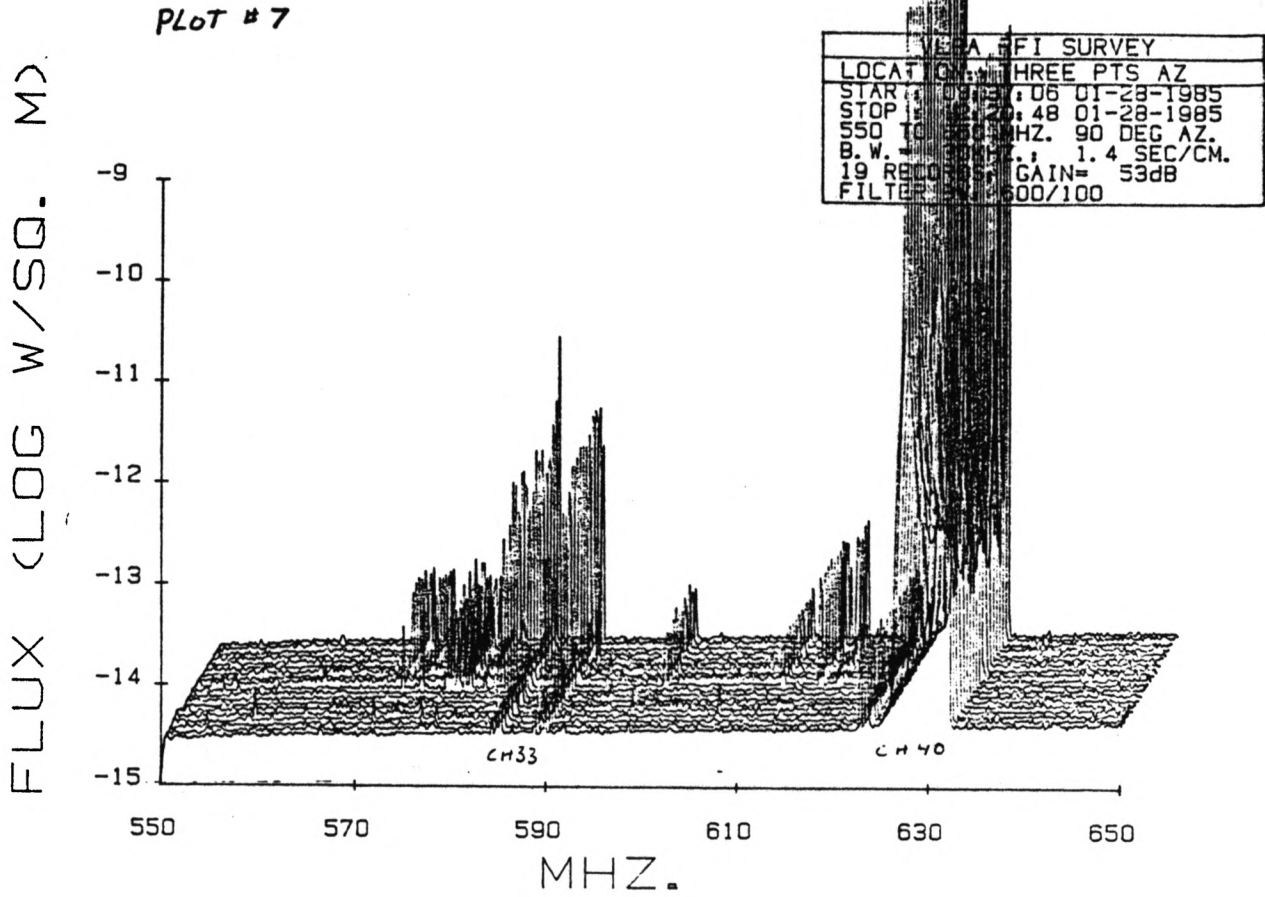


PLOT #4

JAN 29, 85
THREE PTS, A2.
10 KHz BW
FILTER: 75 MHz/5%
SQU TWT.
11 DB GAIN ANT

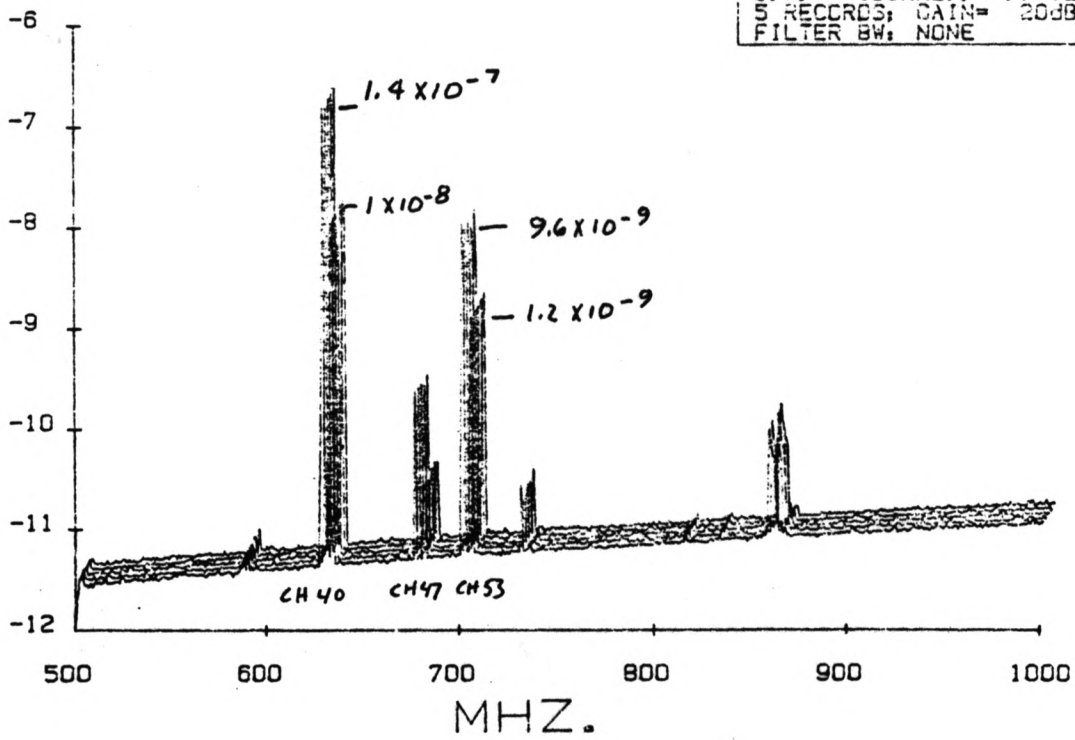




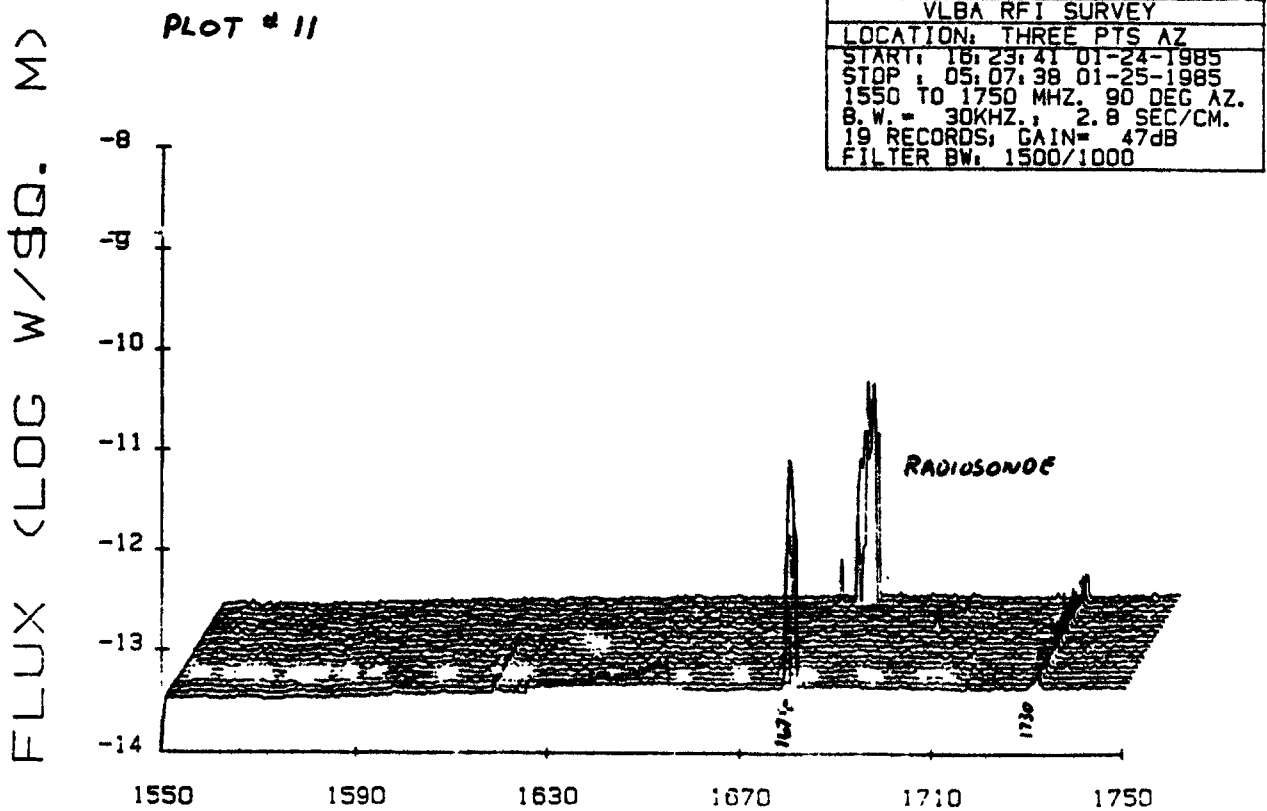
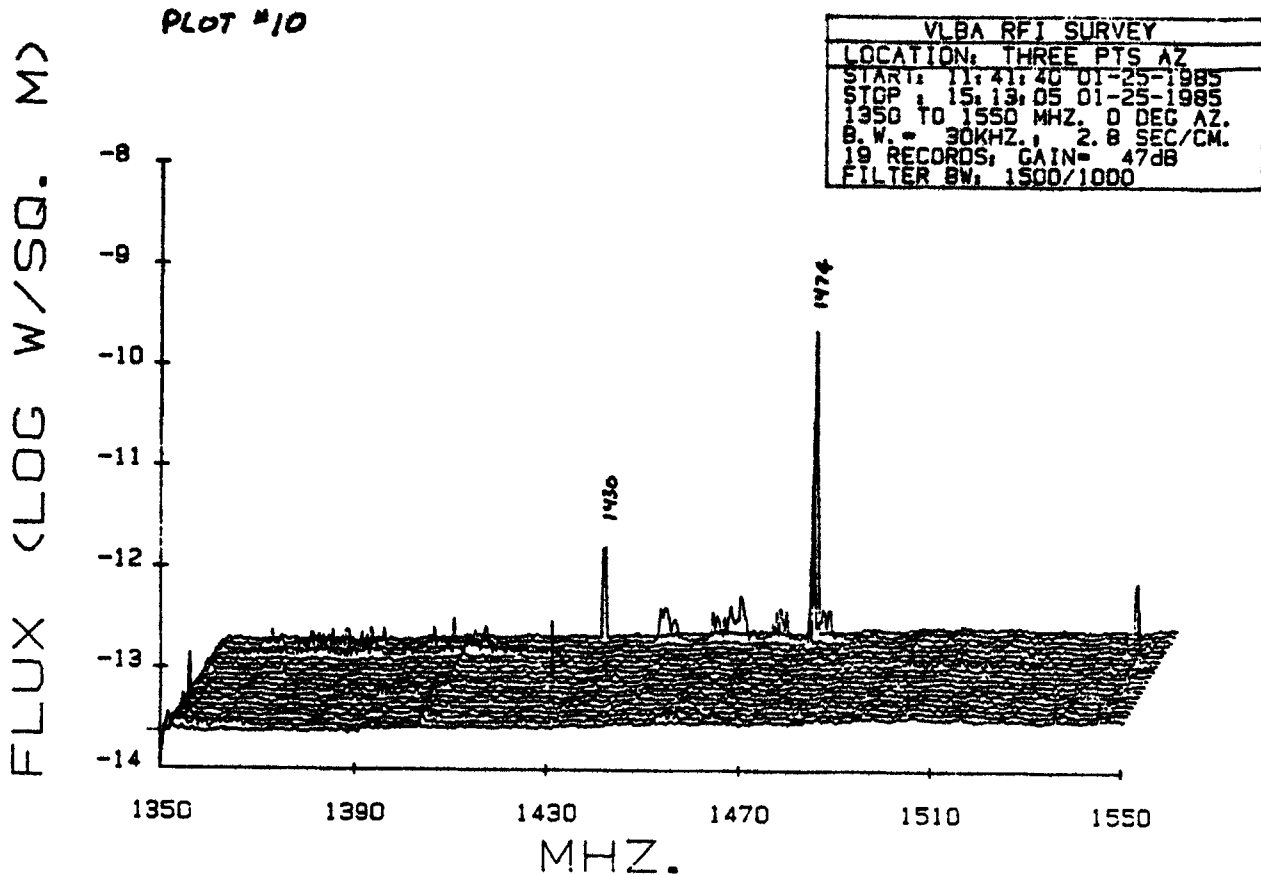


FLUX (LOG W/SQ. M)

PLOT #9



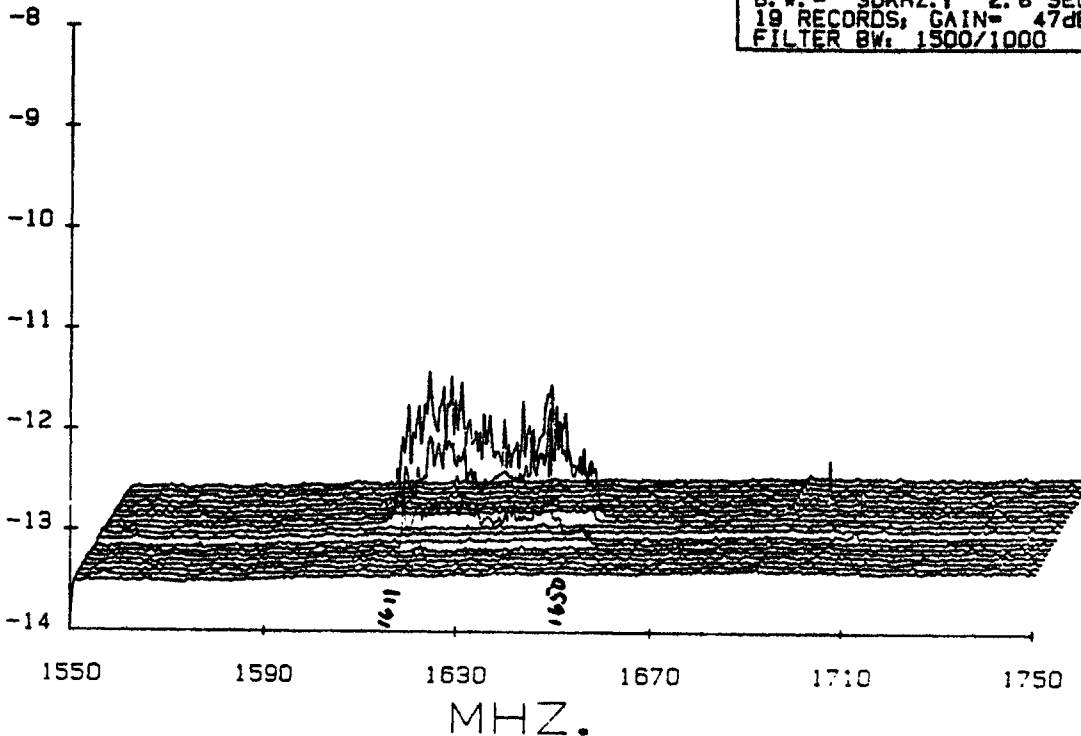
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START:	13:48:00 01-29-1985
STOP:	13:58:01 01-29-1985
500 TO 1000 MHZ. 90 DEG AZ.	
S.W.:	100KHZ. .7 SEC/CM.
S. RECCORDS:	CAIN= 2088
FILTER BW: NONE	



FLUX (LOG W/SQ. M)

PLOT #12

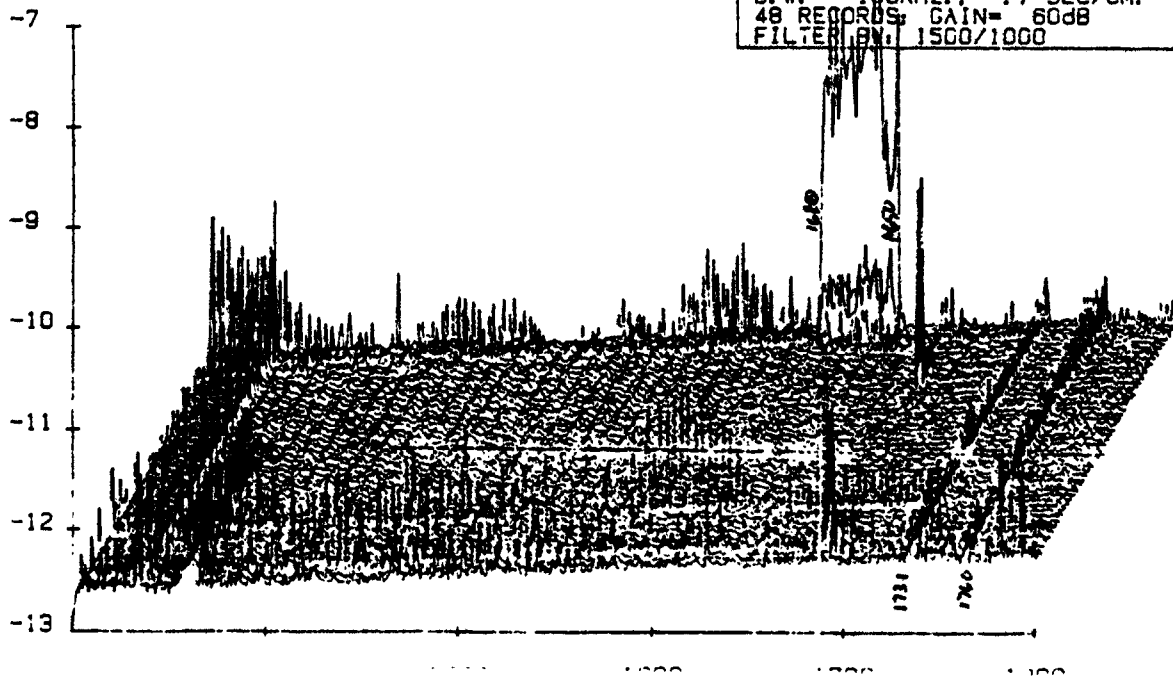
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START:	12:49:41 01-24-1985
STOP:	16:20:19 01-24-1985
1550 TO 1750 MHZ. 180 DEG AZ.	
B.W. =	30KHZ. 2.8 SEC/CM.
19 RECORDS; GAIN= 47dB	
FILTER BW: 1500/1000	



FLUX (LOG W/SQ. M)

PLOT #13

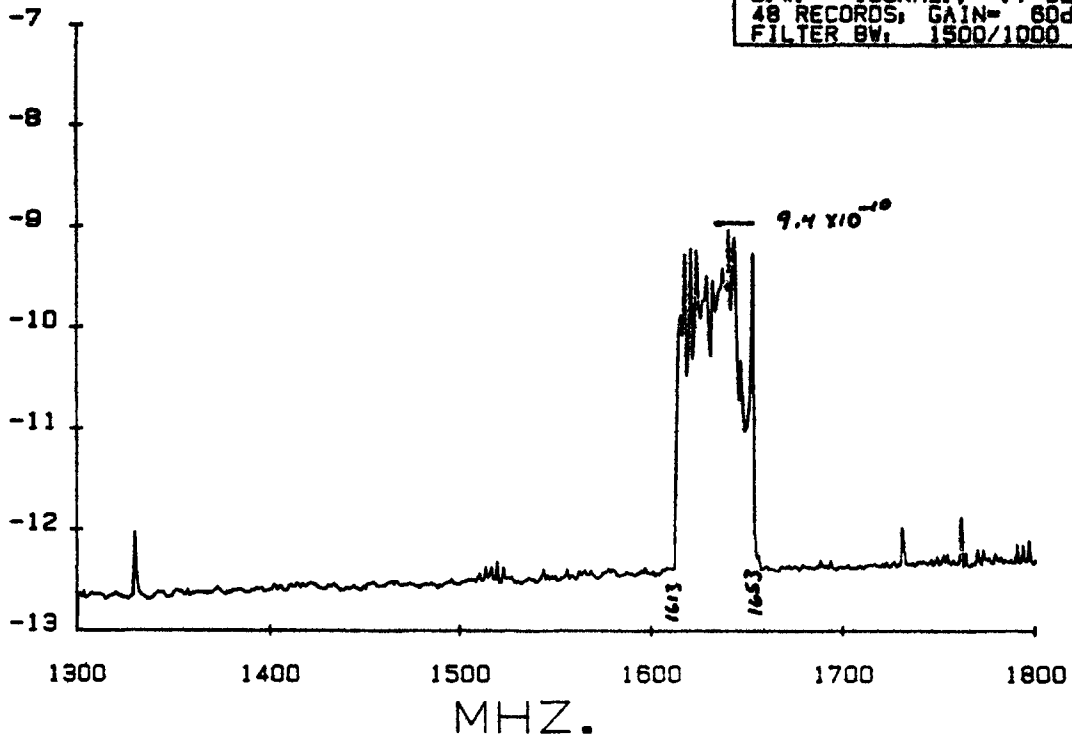
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START:	14:53:31 01-26-1985
STOP:	09:19:56 01-27-1985
1300 TO 1800 MHZ. CMNI ANT.	
B.W. =	100KHZ. .7 SEC/CM.
48 RECORDS; GAIN= 60dB	
FILTER BW: 1500/1000	



FLUX (LOG W/SQ. M)

PLOT #14

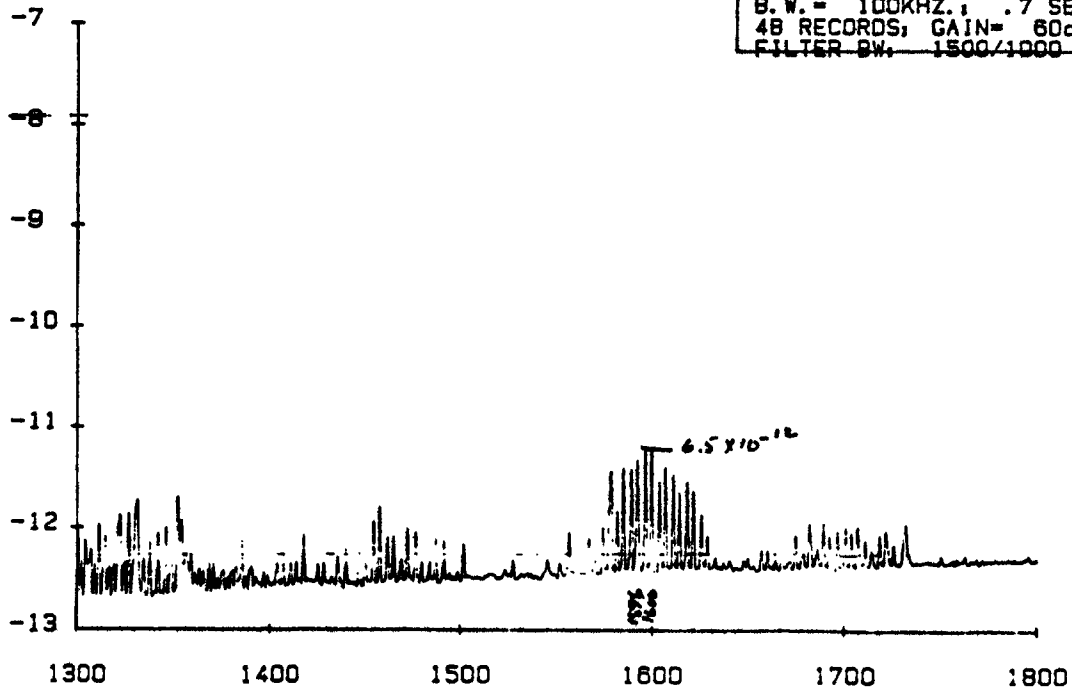
VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 14:53:31 01-26-1985
STOP : 09:19:56 01-27-1985
1300 TO 1800 MHZ. <i>GMV ANT.</i>
B.W. = 100KHZ.; .7 SEC/CM.
48 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000



FLUX (LOG W/SQ. M)

PLOT #15

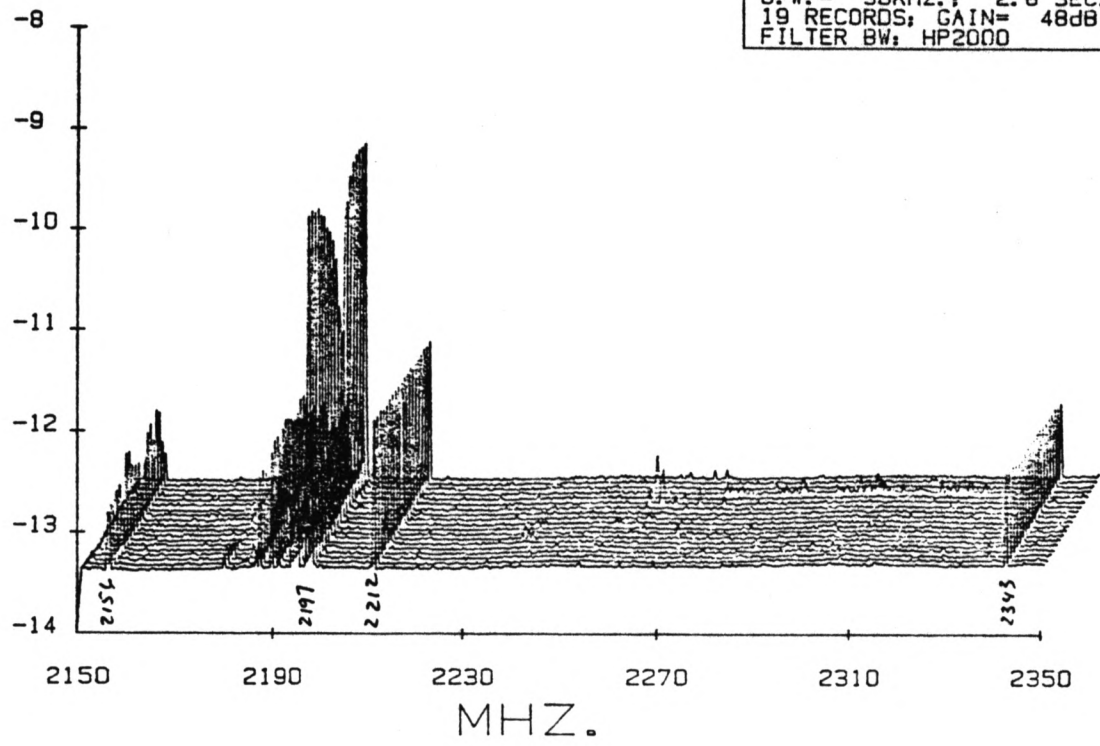
VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 14:53:31 01-26-1985
STOP : 09:19:56 01-27-1985
1300 TO 1800 MHZ. <i>GMV ANT.</i>
B.W. = 100KHZ.; .7 SEC/CM.
48 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000



FLUX (LOG W/SQ. M)

PLOT # 16

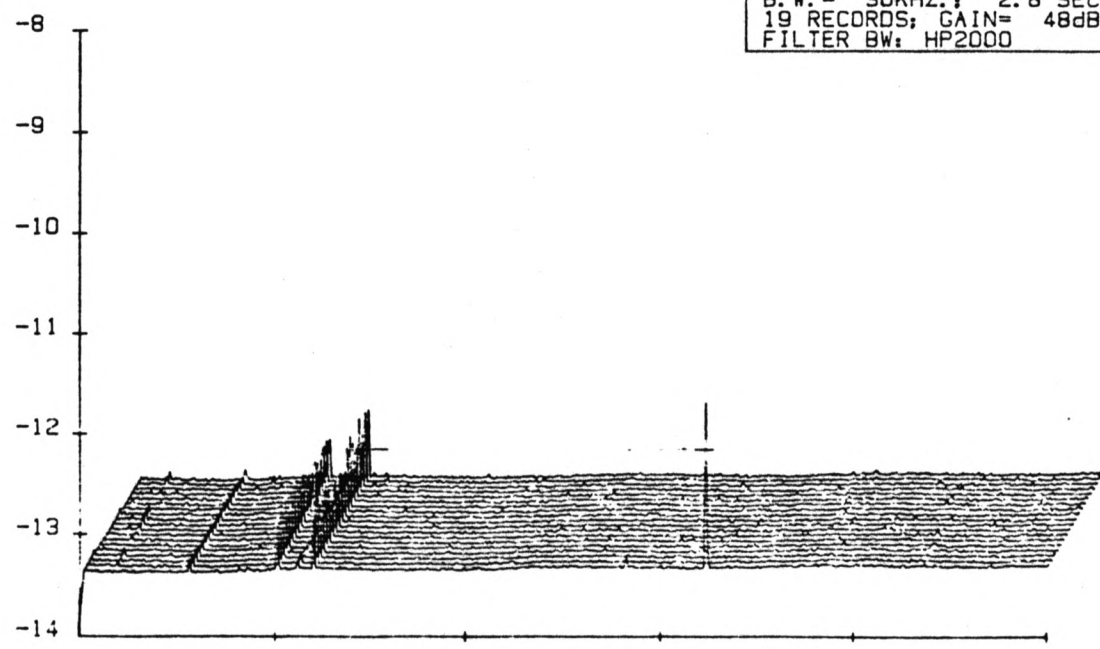
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START: 08:23:09 01-18-1985	
STOP : 10:35:11 01-18-1985	
2150 TO 2350 MHZ. 0 DEG AZ.	
B.W. = 30KHZ.; 2.8 SEC/CM.	
19 RECORDS; GAIN= 48dB	
FILTER BW: HP2000	



FLUX (LOG W/SQ. M)

PLOT # 17

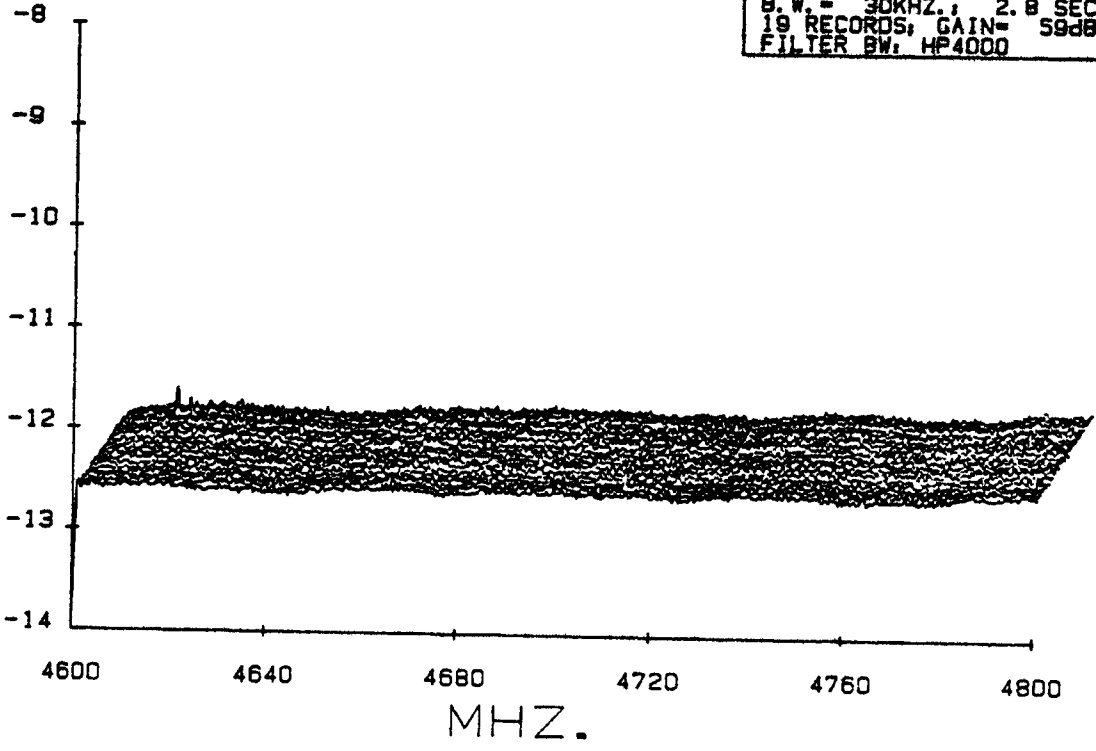
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START: 13:56:34 01-17-1985	
STOP : 16:44:31 01-17-1985	
2150 TO 2350 MHZ. 270 DEG AZ.	
B.W. = 30KHZ.; 2.8 SEC/CM.	
19 RECORDS; GAIN= 48dB	
FILTER BW: HP2000	



PLOT # 18

VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 08:11:03 01-16-1985
STOP : 10:16:36 01-16-1985
4600 TO 4800 MHZ. 180 DEG AZ.
B.W. = 30KHZ.; 2.8 SEC/CM.
19 RECORDS; GAIN= 59dB
FILTER BW: HP4000

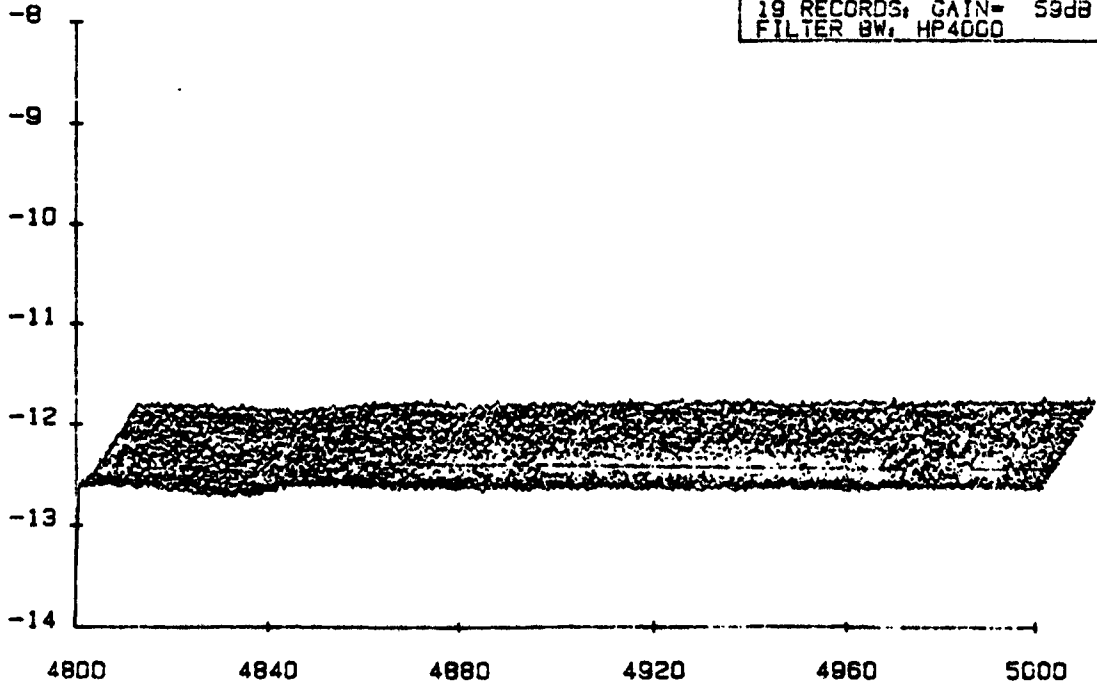
FLUX (LOG W/SQ. M)



PLOT # 19

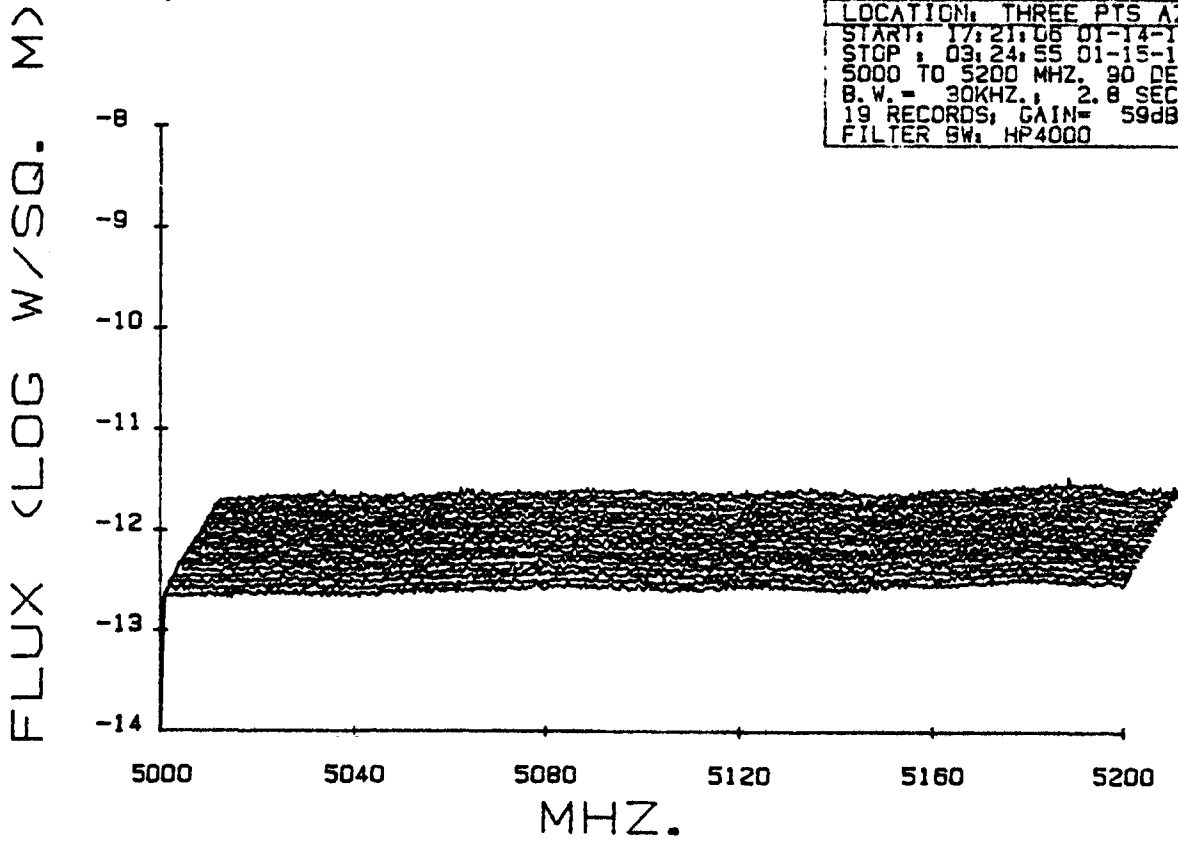
VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 08:15:31 01-16-1985
STOP : 12:19:45 01-16-1985
4800 TO 5000 MHZ. 270 DEG AZ.
B.W. = 30KHZ.; 2.8 SEC/CM.
19 RECORDS; GAIN= 59dB
FILTER BW: HP4000

FLUX (LOG W/SQ. M)



PLOT # 20

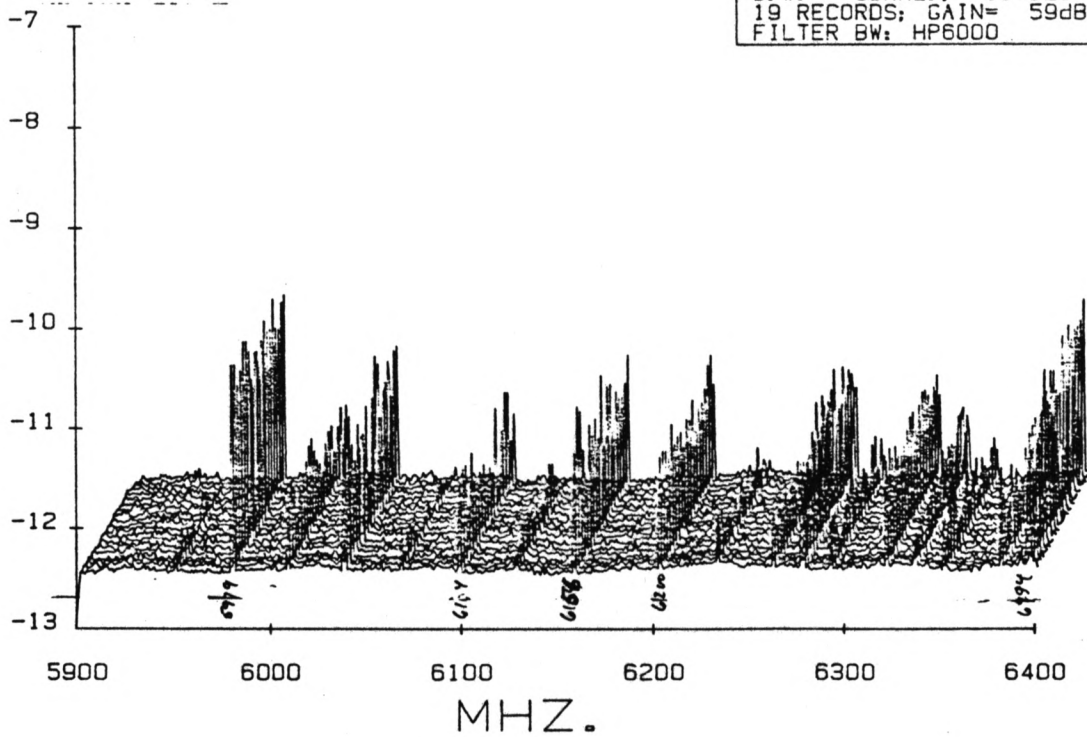
VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 17:21:06 01-14-1985
STOP : 03:24:55 01-15-1985
5000 TO 5200 MHZ. 90 DEG AZ.
B.W. = 30KHZ.; 2.8 SEC/CH.
19 RECORDS; GAIN= 59dB
FILTER SW: HP4000

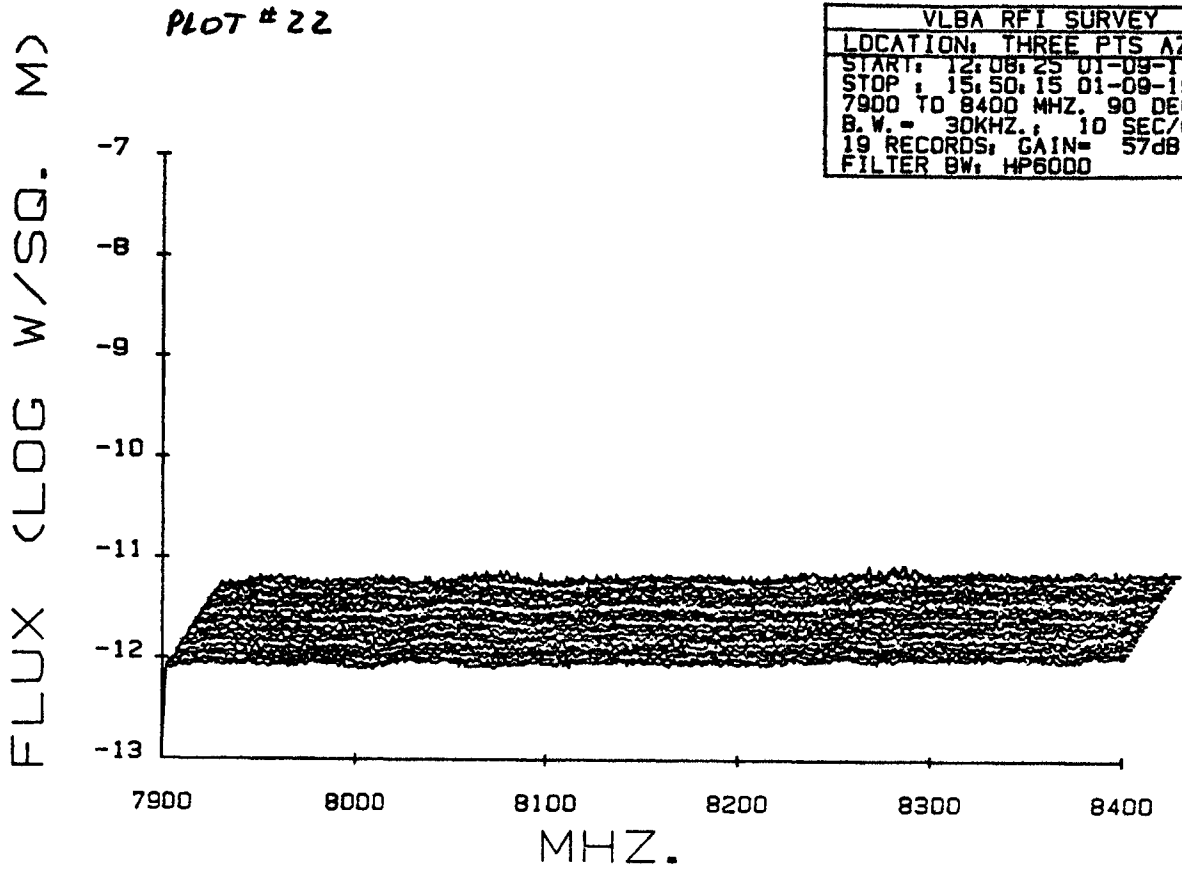


plot # 21

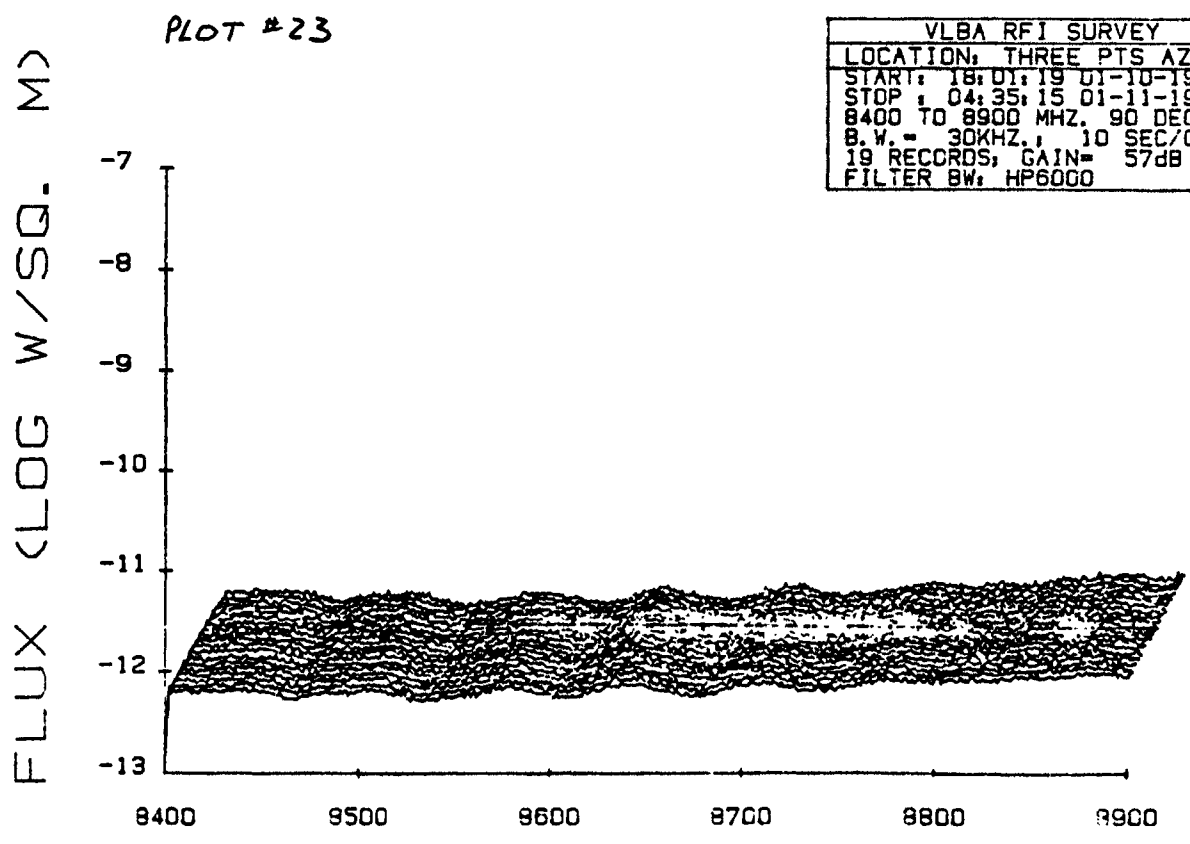
VLBA RFI SURVEY
LOCATION: THREE PTS AZ
START: 15:09:31 01-08-1985
STOP : 19:37:48 01-08-1985
5900 TO 6400 MHZ. 90 DEG AZ.
B.W. = 30KHZ.; 10 SEC/CM.
19 RECORDS; GAIN= 59dB
FILTER BW: HP6000

FLUX (LOG W/SQ. M)





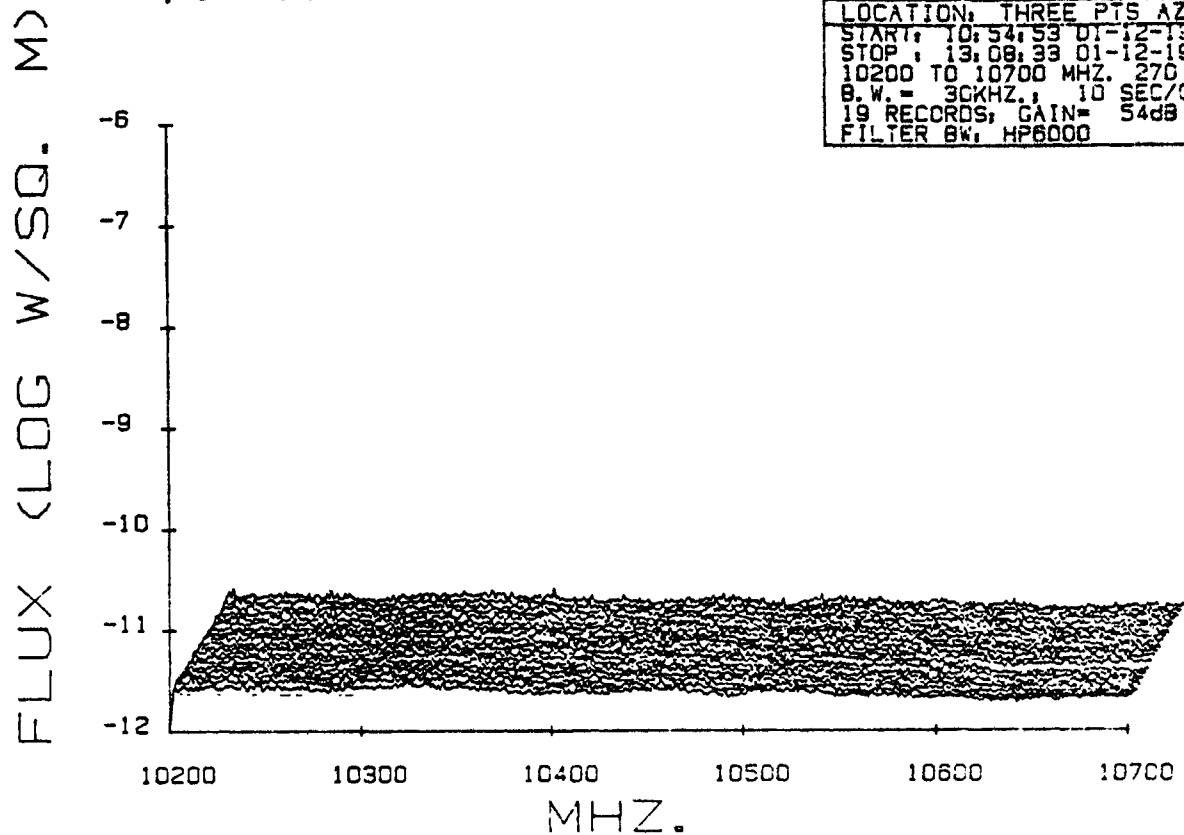
VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START: 12:08:25 01-09-1985	
STOP : 15:50:15 01-09-1985	
7900 TO 8400 MHZ. 90 DEG AZ.	
B.W. = 30KHZ.; 10 SEC/CM.	
19 RECORDS; GAIN= 57dB	
FILTER BW: HP6000	



VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START: 18:01:19 01-10-1985	
STOP : 04:35:15 01-11-1985	
8400 TO 8900 MHZ. 90 DEG AZ.	
B.W. = 30KHZ.; 10 SEC/CM.	
19 RECORDS; GAIN= 57dB	
FILTER BW: HP6000	

PLOT # 24

VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START:	10:54:59 01-12-1985
STOP:	13:08:39 01-12-1985
10200 TO 10700 MHZ. 270 DEG AZ.	
B.W.:	30KHZ.; 10 SEC/CM.
RECORDS:	19 RECORDS; GAIN= 54dB
FILTER BW:	HP6000



PLOT # 25

VLBA RFI SURVEY	
LOCATION: THREE PTS AZ	
START:	08:59:54 01-13-1985
STOP:	13:34:39 01-13-1985
10700 TO 11200 MHZ. 0 DEG AZ.	
B.W.:	30KHZ.; 10 SEC/CM.
RECORDS:	19 RECORDS; GAIN= 54dB
FILTER BW:	HP6000

