VLB ARRAY MEMO No. 495

VLB ARRAY MEMO No._____

NATIONAL RADIO ASTRONOMY OBSERVATORY

Socorro, NM

RFI SURVEY FOR THE VLBA

OWENS VALLEY RADIO OBSERVATORY

Bishop, California

August 1985

Jim Oty

After completing the RFI Survey in Washington the equipment trailer was taken to the next proposed VLBA site at the Owens Valley Radio Observatory near Bishop, California. The RFI Survey for this location was started on August 5 and completed on August 15. Only one location was surveyed.

The Owens River Valley is a broad valley that generally runs north and south and is flanked on both sides by mountain ranges. This provides a natural path not only for travel but also radio communications. It was evident from driving through the valley that most of the commercial microwave paths were routed along the floor of the valley. Each town in the valley had one or two local links for telephone service and the usual Government agencies. Added to this usual array of microwave signals were TV signals that apparently were microwaved up the valley from the Los Angeles area and used by the local TV cable companies and low power translator installations.

One other fact that should not be overlooked is the military installations at the southern end of the valley. China Lake Naval Weapons Center and Edwards AFB could pose a problem particularly in the 330 MHz. band.

Only one location in the Owens Valley was surveyed as no decision for the final location of this VLBA site has yet been made. From the overall view of this valley, it is unlikley that there will be much change in the RF environment from a change in location of a few miles.

The elevation of the horizon to the east and west is dominated by mountains and is as high as 13 degrees at one point. A plot of this horizon is included as figure 1. A map of the general area is included as figure 2.

These are my comments:

73 MHz. to 75 MHz. No local low band VHF TV staions. Only a few local FM stations.

300 MHz. to 350 MHz. Strong signals are military air/ground activity in this area. Closest military base is China Lake Naval Weapons Center. Long term plot of this band shows lots of activity and possibly some ECM activity.

550 MHz. to 650 MHz. No local UHF TV in this band. Signal at 600 MHz. is a harmonic of the 200 MHz. L.O. signal used by the Solar Interferometer.

500 MHz. to 1 GHz. Quick look at VLBA IF band. A few TV translators seen.

1.35 GHz. to 1.75 GHz. Low half of the band fairly clean. Upper half of the band shows numerous signals from the north. Some of these appear to be TV signals probably used by local cable companies.

2.15 GHz. to 2.35 GHz. The usual commercial micro wave signals.

4.6 GHz. to 5.2 GHz. No signals.

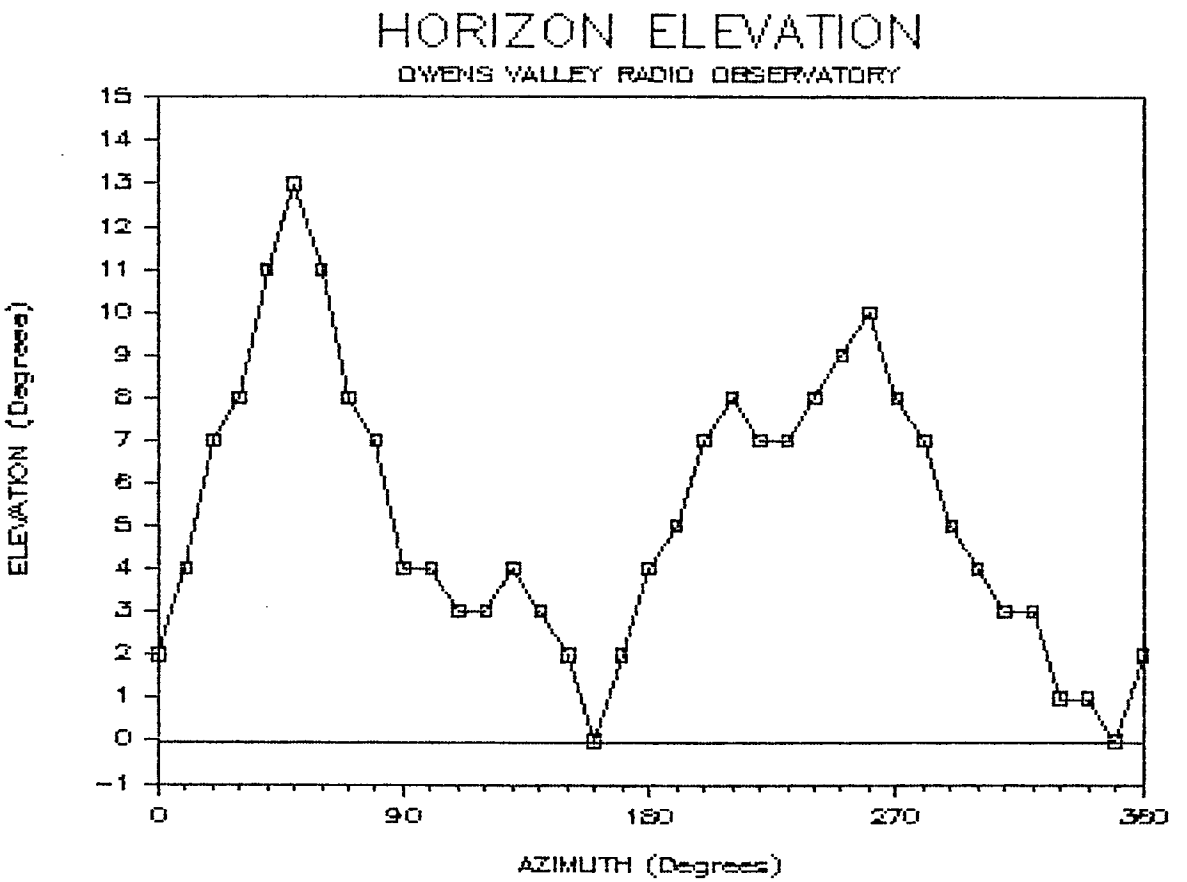
5.9 GHz. to 6.4 GHz. Several commercial signals. Strongest at about 6.095 GHz. from the direction of Bishop.

7.9 GHz. to 11.2 GHz. No signals.

Table I lists the plots included with this report. These are typical plots intended to show items of interest. Many other plots were generated and are on file.

Table II has been expanded to include data from VLBA Electronics Memo 39, Table I. This data gives flux density required by an interfering signal that would result in a 1% comression in amplifiers.

FIGURE 1


HORIZON ELEVATION
OWENS VALLEY RADIO OBSERVATORY
ELEVATION (Degrees)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
0
90
180
270
360
AZIMUTH (Degrees)

(4)

FIGURE 2

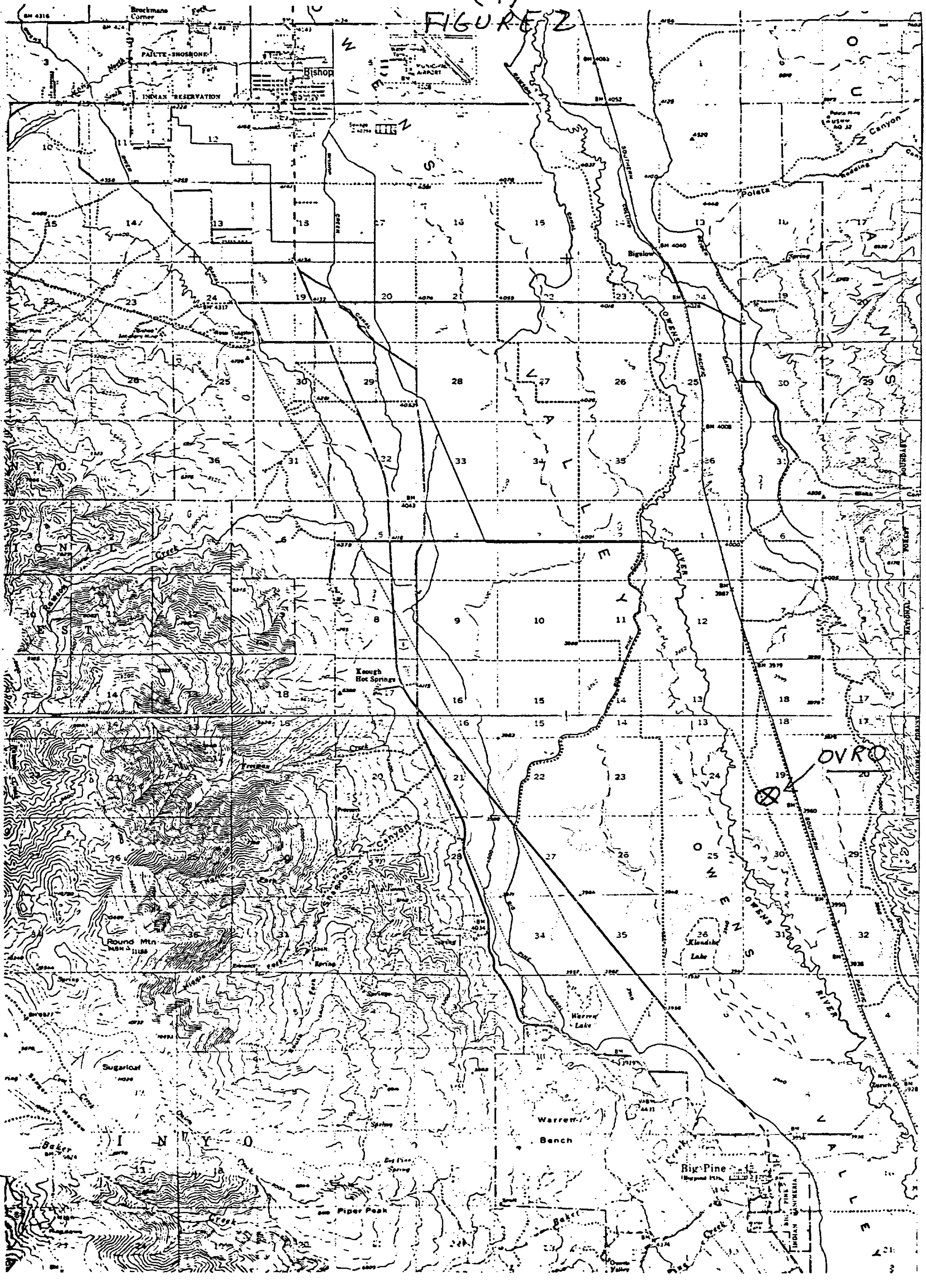

Brockmans Corner
PAIUTE-SHOSHONE
INDIAN RESERVATION
Bishop
AIRPORT
Poleta
Canyon
Bigelow
SOUTHERN PACIFIC
OWENS
RIVER
Keough Hot Springs
Creek
Canyon
OVRO
Round Mtn
Klondike Lake
Warren Lake
Sugarloaf
Warren Bench
I N Y O
Big Pine
Piper Peak
O W E N S
V A L L E Y

TABLE I
OWENS VALLEY RADIO OBSERVATORY
Bishop, California

Plot #	Frequency	Filter Fc/BW	Comments
1	50 - 100 MHz	None	North. Typical plot.
2	50 - 100 MHz	None	South. Typical plot.
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	North. Shows typical air/ground communications.
6	300 - 350 MHz	325/50	West. Same as plot 5.
7	300 - 350 MHz	325/50	South. Long term plot showing air/ground activity. Short duration, wide band signal probably airborne ECM activity.
8	550 - 650 MHz	600/100	North. 600 MHz. signal is harmonic of 200 MHz. L.O. from solar interferometer.
9	550 - 650 MHz	600/100	South. Same as above.
10	500 - 1000 MHz	None	North. Quick look for signals in the VLBA IF band.
11	500 - 1000 MHz.	None	West. Same as plot 10.
12	1350 - 1550 MHz.	1500/1000	North.
13	1350 - 1550 MHz.	1500/1000	South.
14	1550 - 1750 MHz.	1500/1000	North. Many signals from the north. Some are TV.
15	1550 - 1750 MHz.	1500/1000	East. Several intermitent signals. Origin unknown.
16	1559 - 1750 MHz	1500/1000	South. More of the same.

Table I (Cont.)

17	1300 - 1800 MHz.	1500/1000	South. Long term plot.
18	1300 - 1800 MHz	1500/1000	Omni. Another long term plot. Sveral signals seem time variable.
19	2150 - 2350 MHz	HP2000	North. Usual commercial signals.
20	2150 - 2350 MHz	None.	South. Strongest from the south.
21	4.6 - 4.8 GHz	HP4000	Typical plot.
22	4.8 - 5.0 GHz	HP4000	Typical plot.
23	5.0 - 5.2 GHz.	HP4000	Typical plot.
24	5.9 - 6.4 GHz	HP4000	South. Several commercial micro-wave siganls.
25	5.9 - 6.4 GHz.	HP4000	West. Strongest signal coming from about 300 deg. (Bishop).
26	7.9 - 8.4 GHz.	HP6000	Typical plot.
27	8.4 - 8.9 GHz	HP6000	Typical plot.
28	10.2 -10.7 GHz	HP6000	Typical plot. Signal is birdie.
29	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 & 3)	FLUX DENSITY FOR 1% COMP. (Note 4)
50 - 100 MHz.	*	-142 dBW/m^2	#
310 - 340 MHz.	-151 dBW/m^2	-149 dBW/m^2	-72 dBW/m^2
580 - 640 MHz.	-146 dBW/m^2	-143 dBW/m^2	-67 dBW/m^2
1.35 - 1.75 GHz.	-135 dBW/m^2	-140 dBW/m^2	-59 dBW/m^2
2.175 - 2.425 GHz.	*	-138 dBW/m^2	-55 dDW/m^2
4.6 - 5.1 GHz.	-120 dBW/m^2	-128 dBW/m^2	-49 dBW/m^2
4.99 - 5.0 GHz. (Sub-band)	-127 dBW/m^2	-128 dBW/m^2	-49 dBW/m^2
5.9 - 6.4 GHz.	-120 dBW/m^2	-126 dBW/m^2	-47 dBW/m^2
8.0 - 8.8 GHz.	*	-119 dBW/m^2	-44 dBW/m^2
10.2 - 11.2 GHz.	-110 dBW/m^2	-115 dBW/m^2	-42 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.

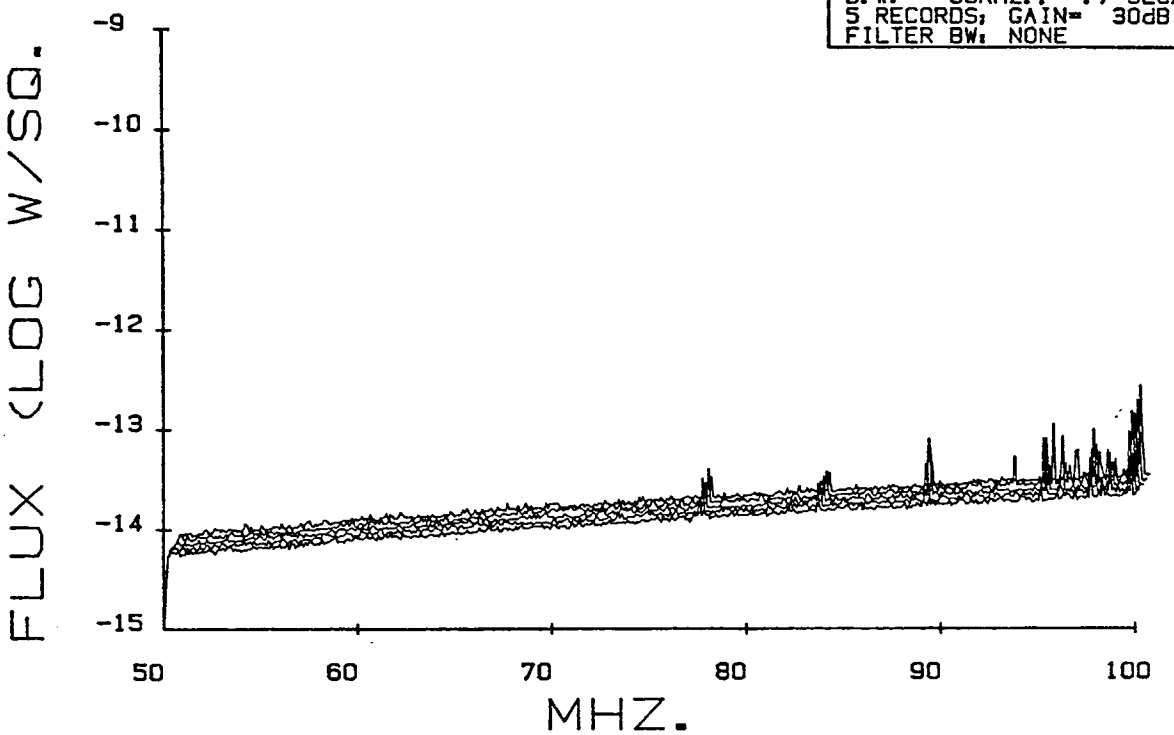
Note 2: These levels are threshold levels from Table I plots.

Note 3: These values may vary slightly from survey to survey because of minor equipment changes.
Note 4: These levels are from VLBA Electronics Memo No. 39.

* These frequency bands not included in memo 81.
# These frequency bands not included in memo 39.

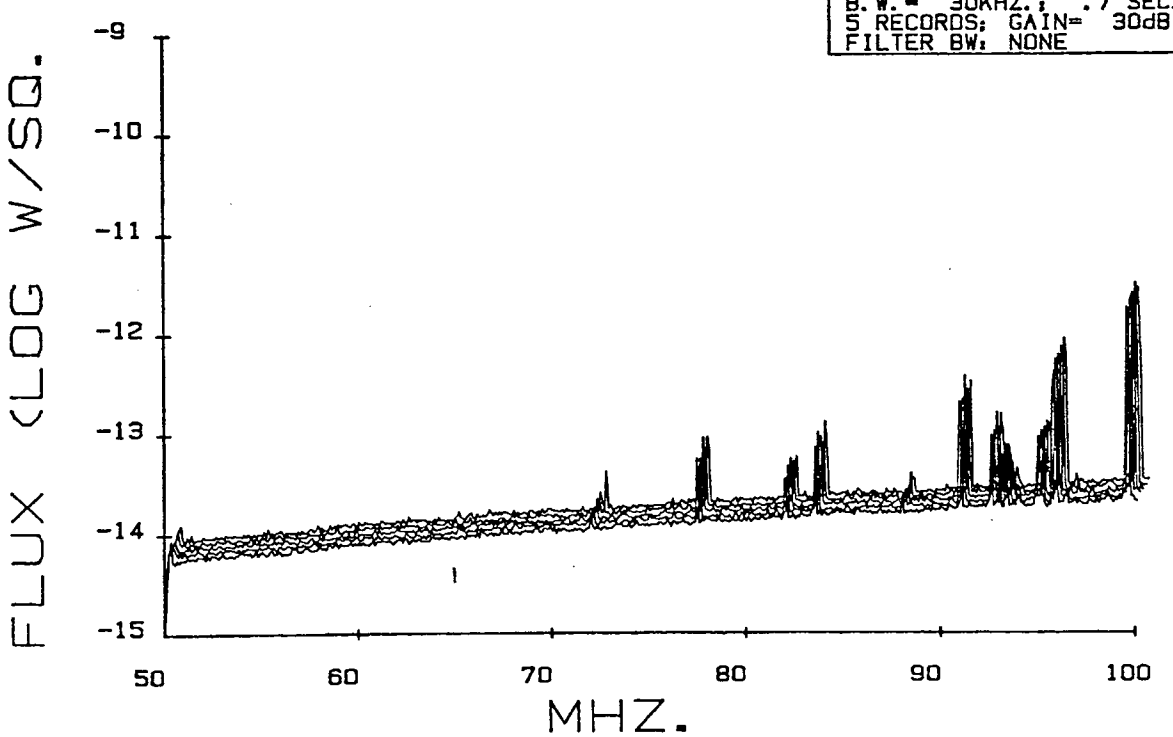
PLOT # 1

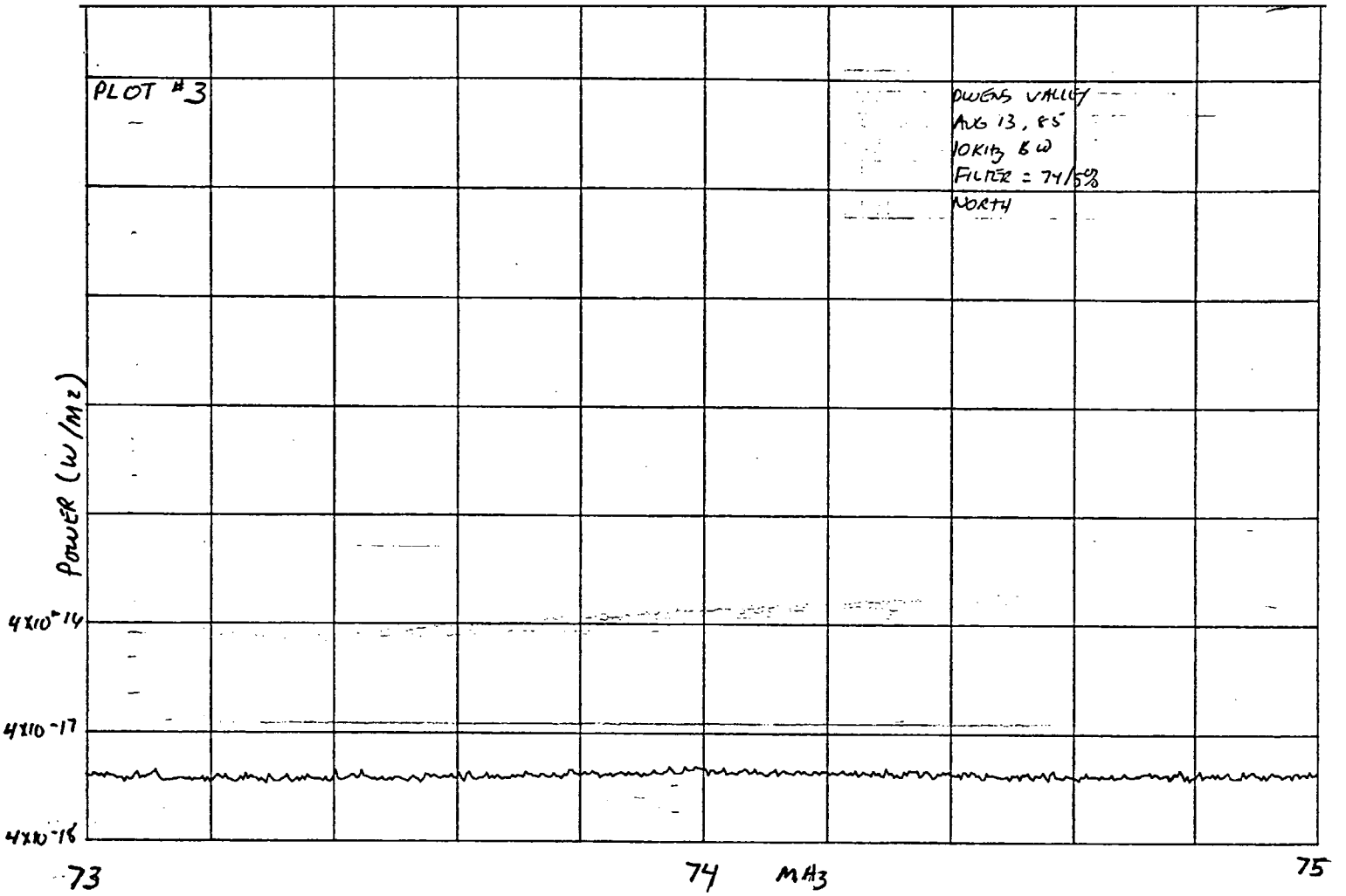
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 10:43 08-13-1985
STOP : 10:54 08-13-1985
50 TO 100 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; .7 SEC/CM.
5 RECORDS; GAIN= 30dB
FILTER BW: NONE

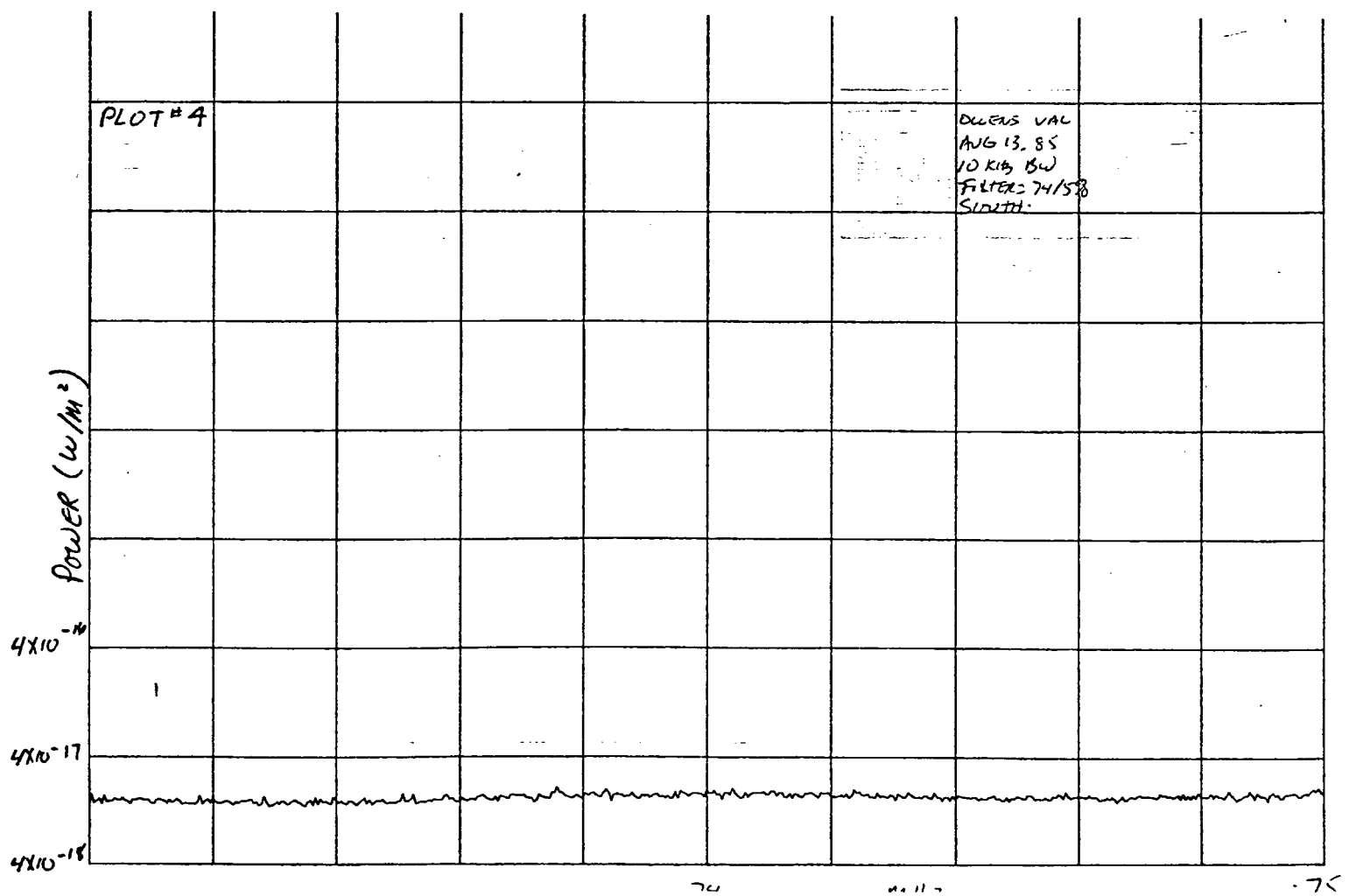


PLOT # 2.

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 11:06 08-13-1985
STOP : 11:17 08-13-1985
50 TO 100 MHZ. 180 DEG AZ.
B.W.= 30KHZ.; .7 SEC/CM.
5 RECORDS; GAIN= 30dB
FILTER BW: NONE

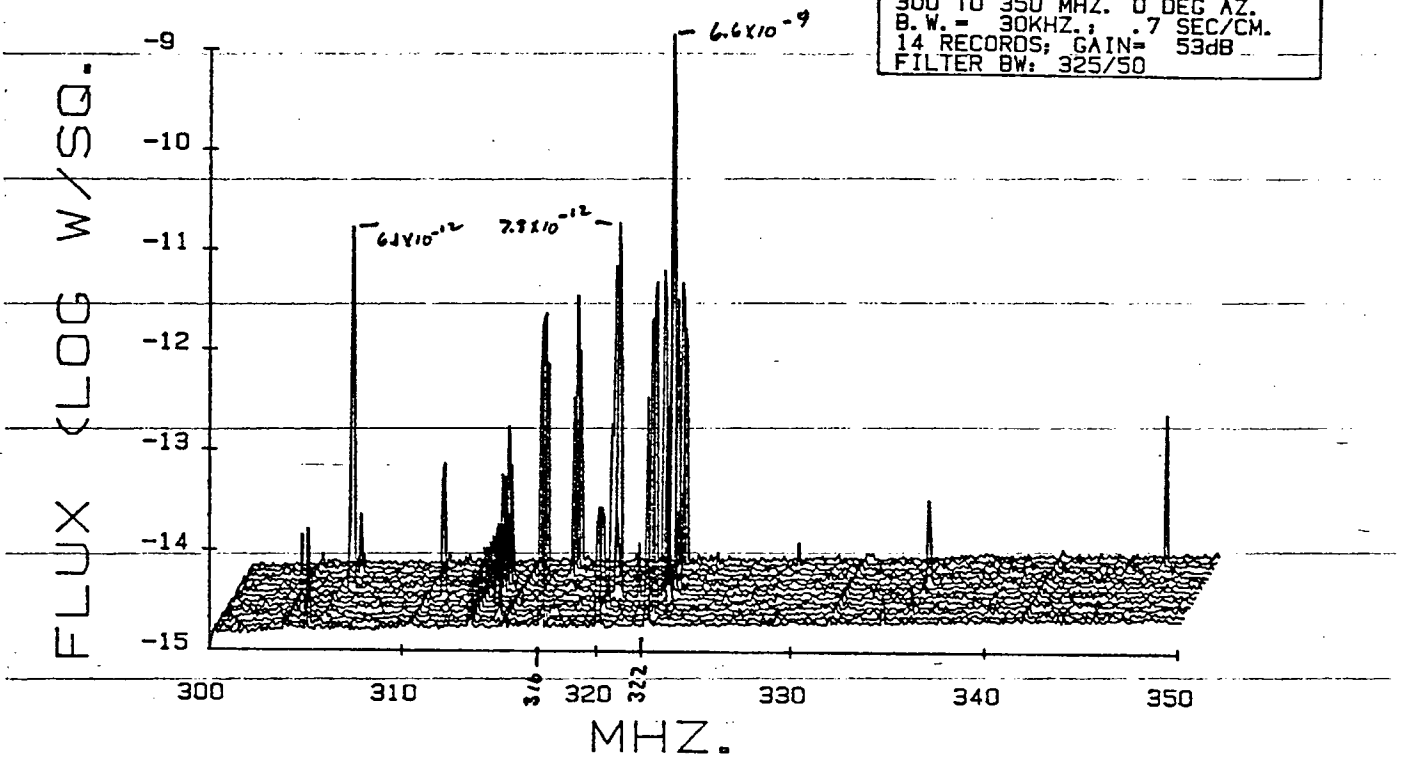



PLOT #3
OWENS VALLEY
AUG 13, 85
10 KHz BW
FILTER = 74/5%
NORTH
POWER (W/M²)
4X10⁻¹⁴
4X10⁻¹⁷
4X10⁻¹⁶
73
74
MHz
75


PLOT #4
OWENS VAL
AUG 13, 85
10 KHz BW
FILTER: 74/5%
SOUTH.
POWER (W/M²)
4X10⁻¹⁴
4X10⁻¹⁷
4X10⁻¹⁸

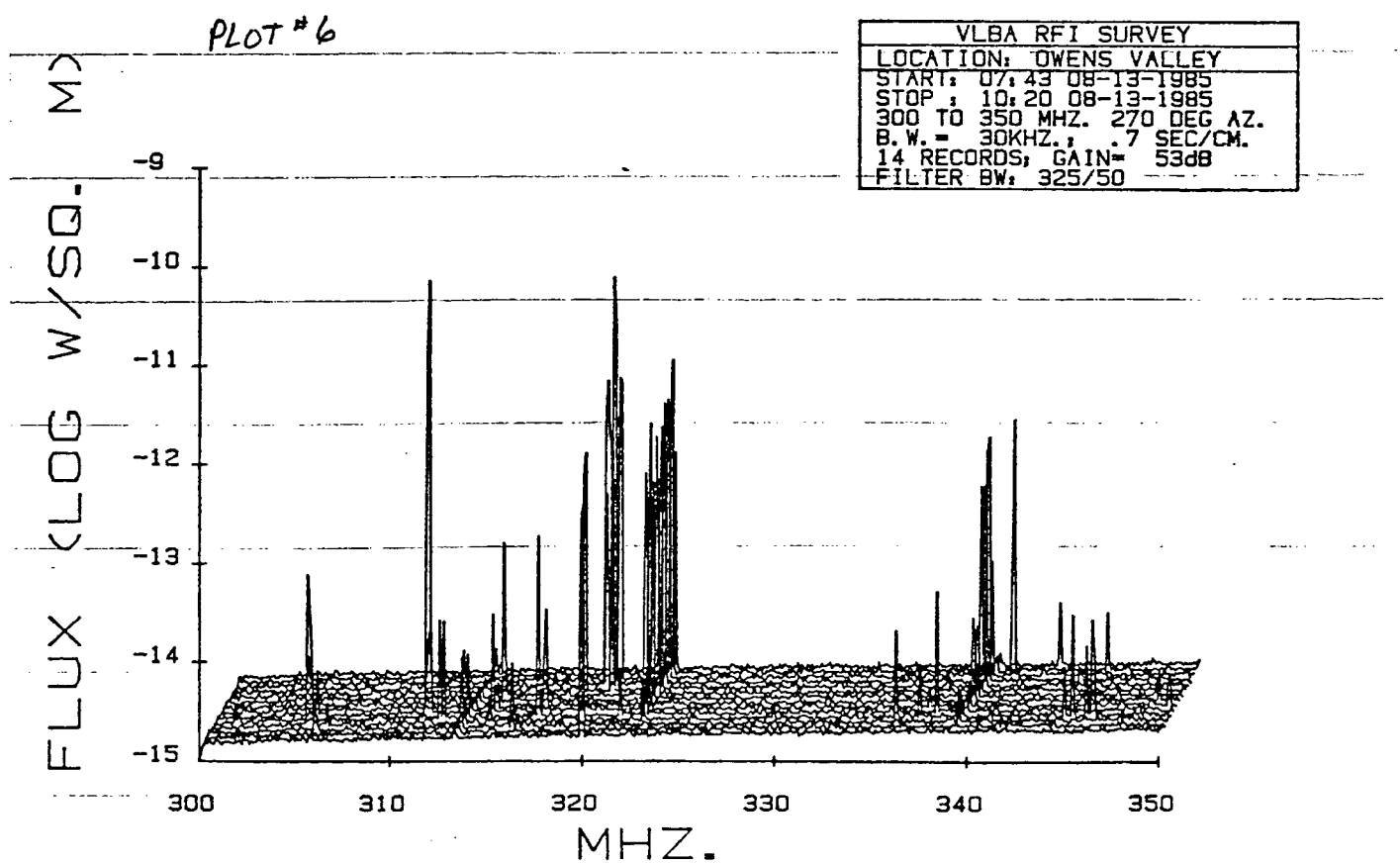
PLOT #5

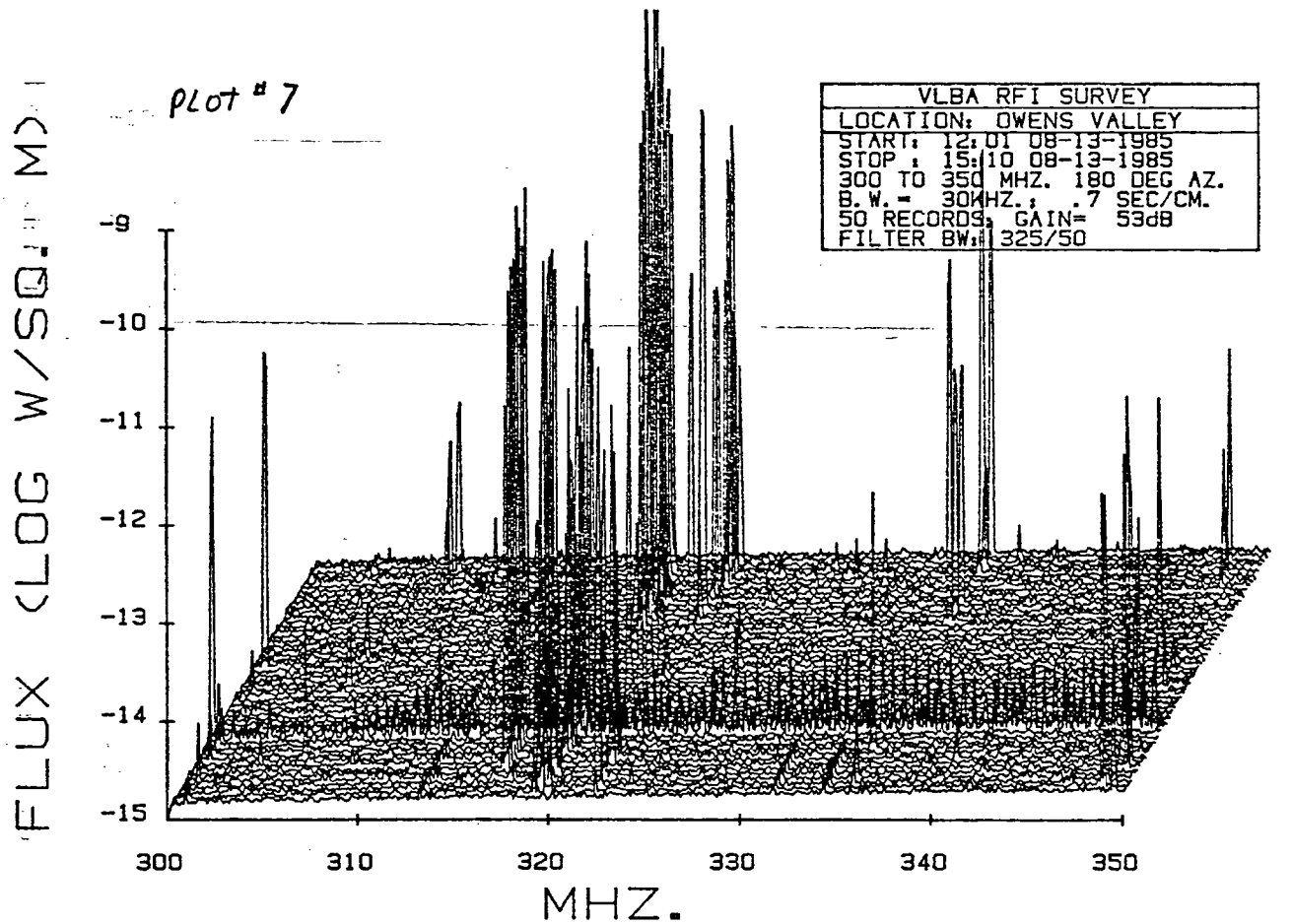
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 13:38 08-12-1985
STOP : 16:42 08-12-1985
300 TO 350 MHZ. 0 DEG AZ.
B.W. = 30KHZ.; .7 SEC/CM.
14 RECORDS; GAIN= 53dB
FILTER BW: 325/50



PLOT #6

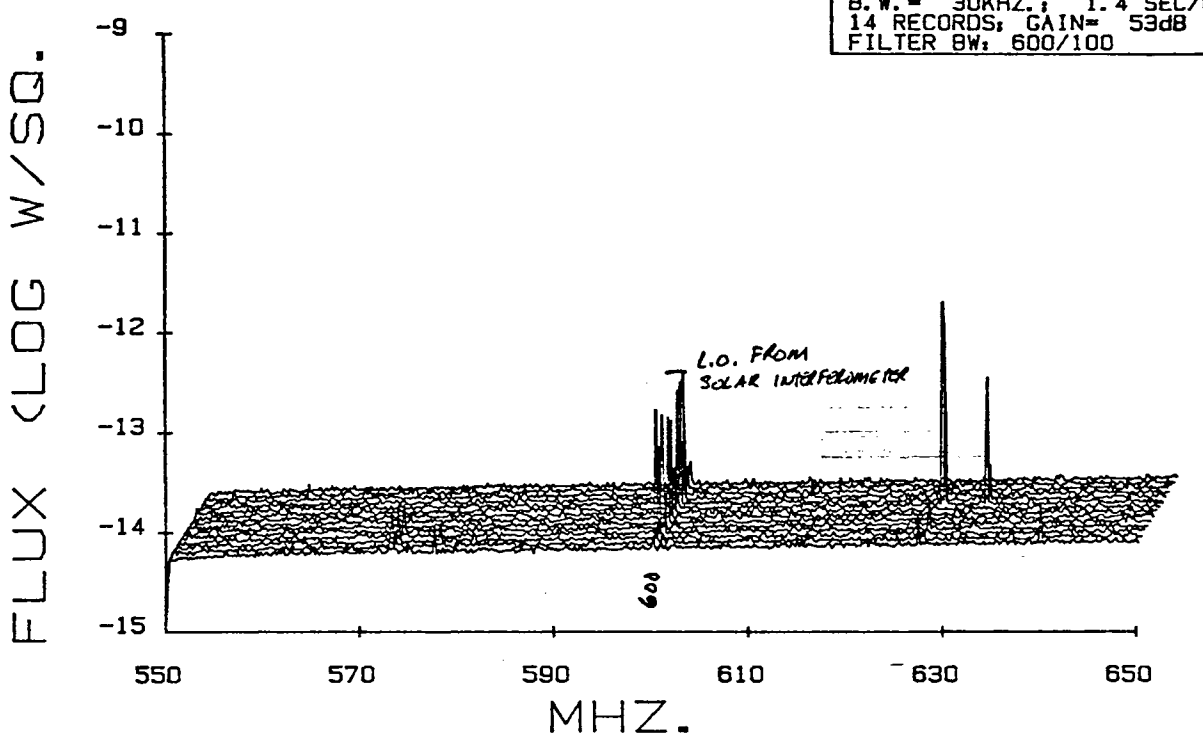
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 07:43 08-13-1985
STOP : 10:20 08-13-1985
300 TO 350 MHZ. 270 DEG AZ.
B.W. = 30KHZ.; .7 SEC/CM.
14 RECORDS; GAIN= 53dB
FILTER BW: 325/50




plot # 7
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 12:01 08-13-1985
STOP : 15:10 08-13-1985
300 TO 350 MHZ. 180 DEG AZ.
B.W.= 30MHZ.; .7 SEC/CM.
50 RECORDS, GAIN= 53dB
FILTER BW: 325/50
FLUX (LOG W/SQ.
-9
-10
-11
-12
-13
-14
-15
300
310
320
330
340
350
MHZ.

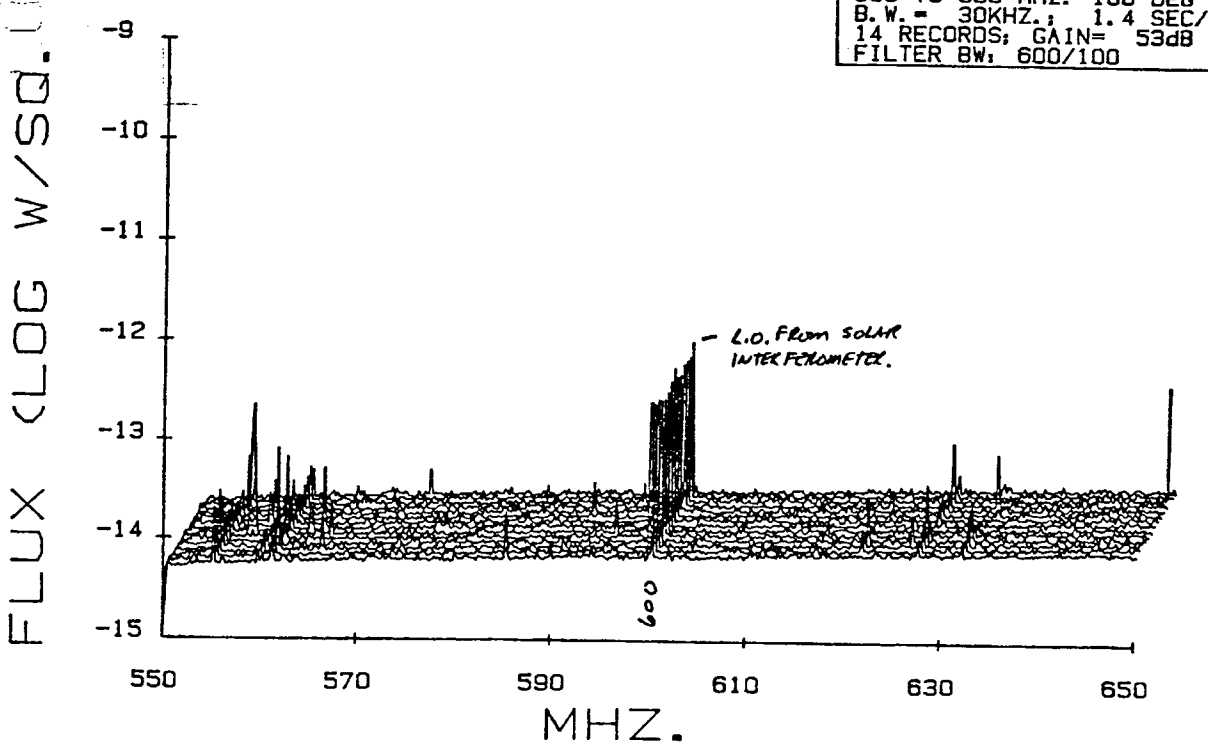
PLOT # 8

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 20:45 08-11-1985
STOP : 05:17 08-12-1985
550 TO 650 MHZ. 0 DEG AZ.
B.W. = 30KHZ.; 1.4 SEC/CM.
14 RECORDS; GAIN= 53dB
FILTER BW: 600/100

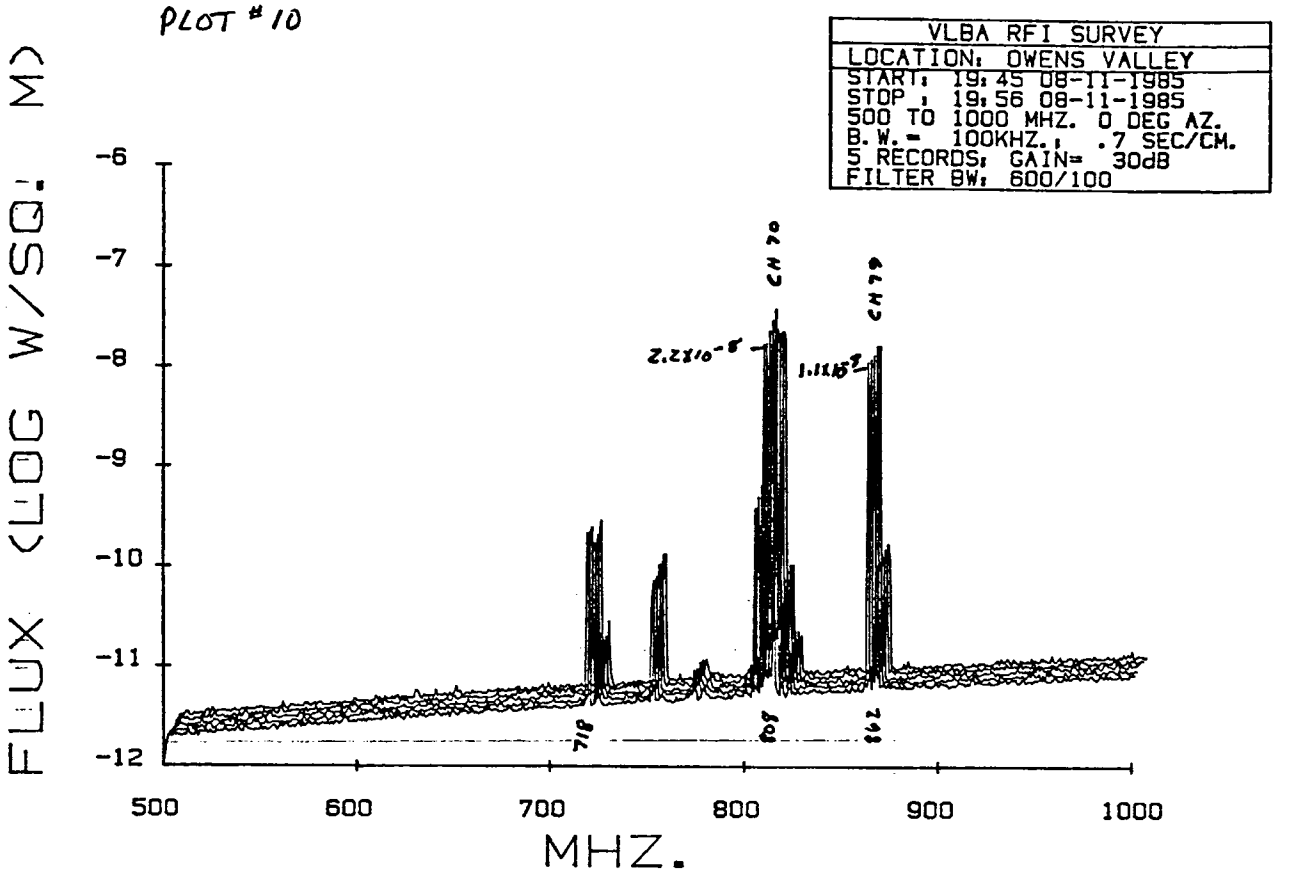


PLOT # 9

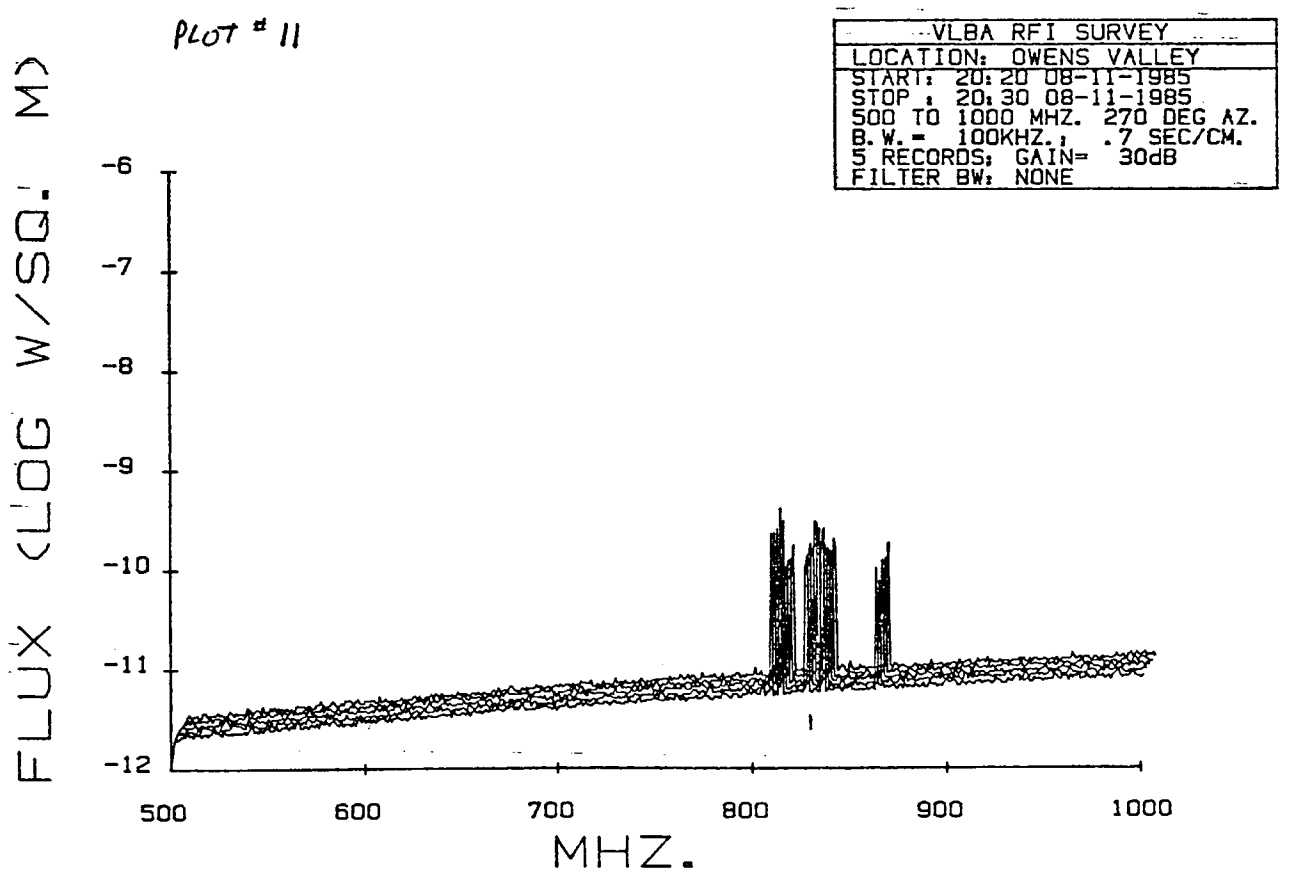
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 09:08 08-12-1985
STOP : 11:17 08-12-1985
550 TO 650 MHZ. 180 DEG AZ.
B.W. = 30KHZ.; 1.4 SEC/CM.
14 RECORDS; GAIN= 53dB
FILTER BW: 600/100



PLOT # 10

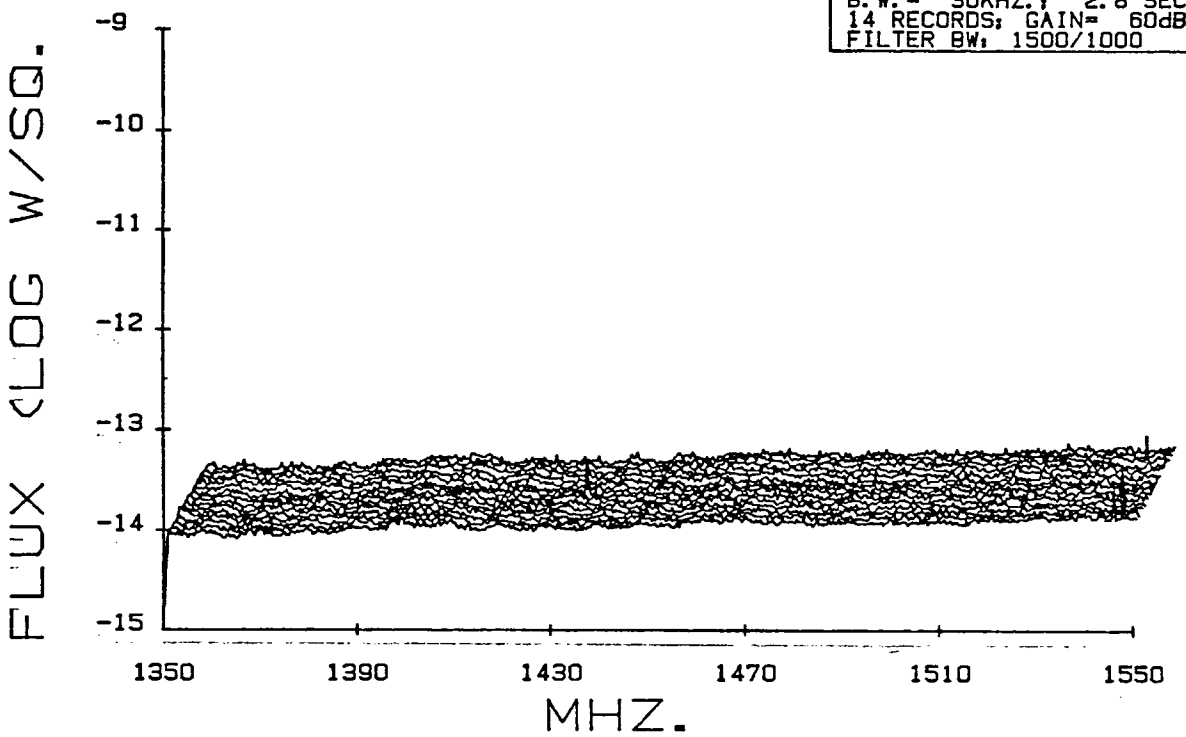


PLOT # 11



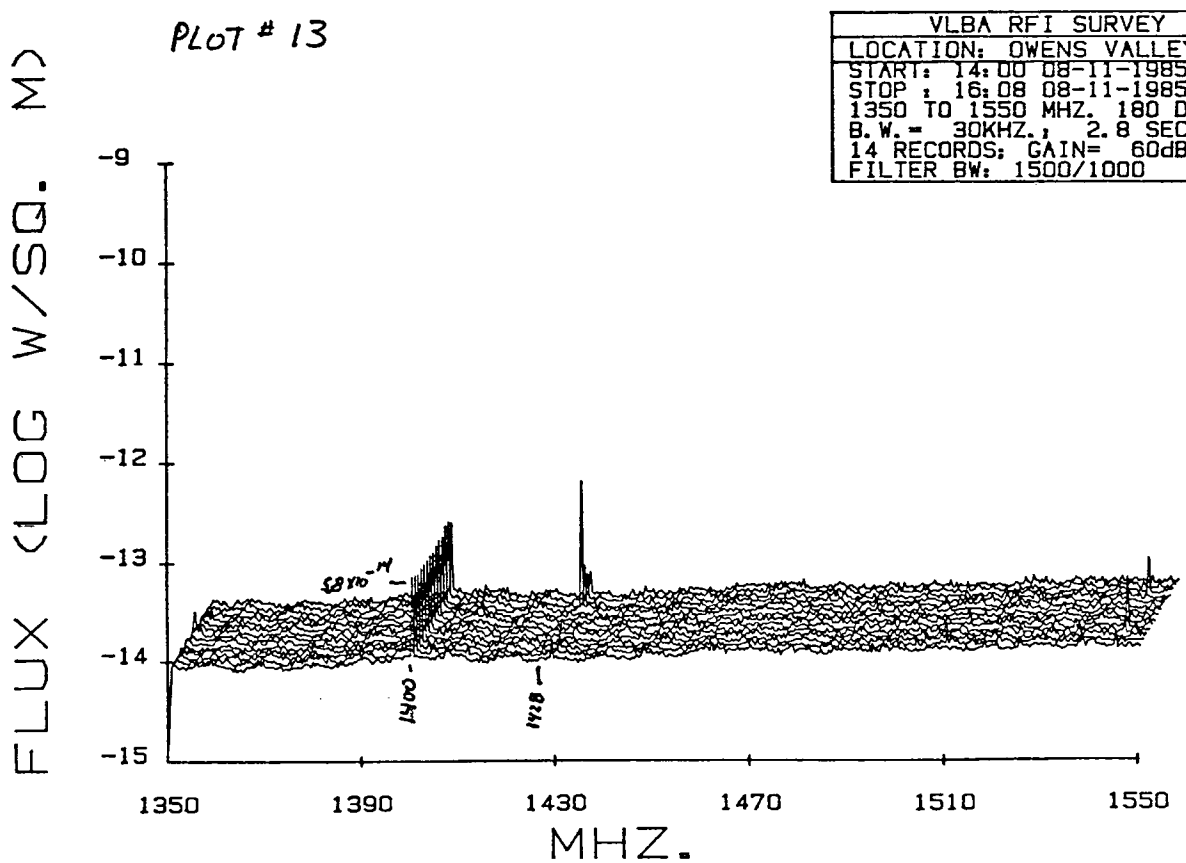
PLOT # 12

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 09:38 08-11-1985
STOP : 11:43 08-11-1985
1350 TO 1550 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000



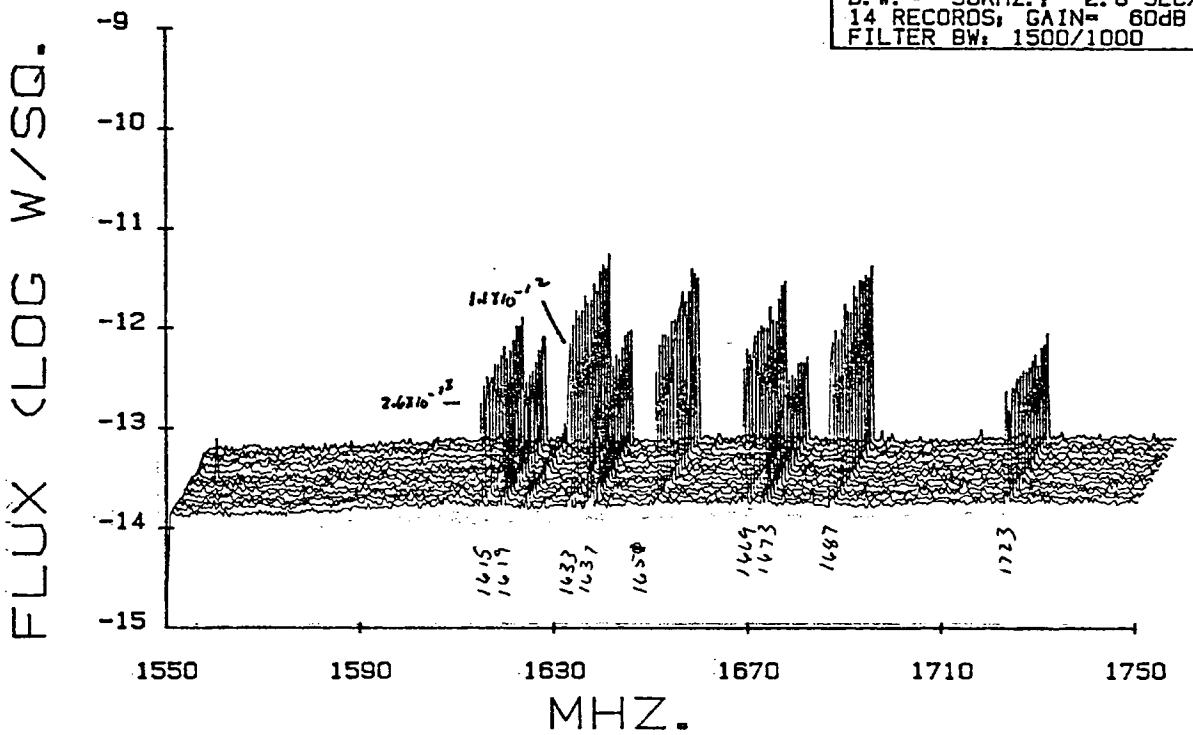
PLOT # 13

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 14:00 08-11-1985
STOP : 16:08 08-11-1985
1350 TO 1550 MHZ. 180 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000



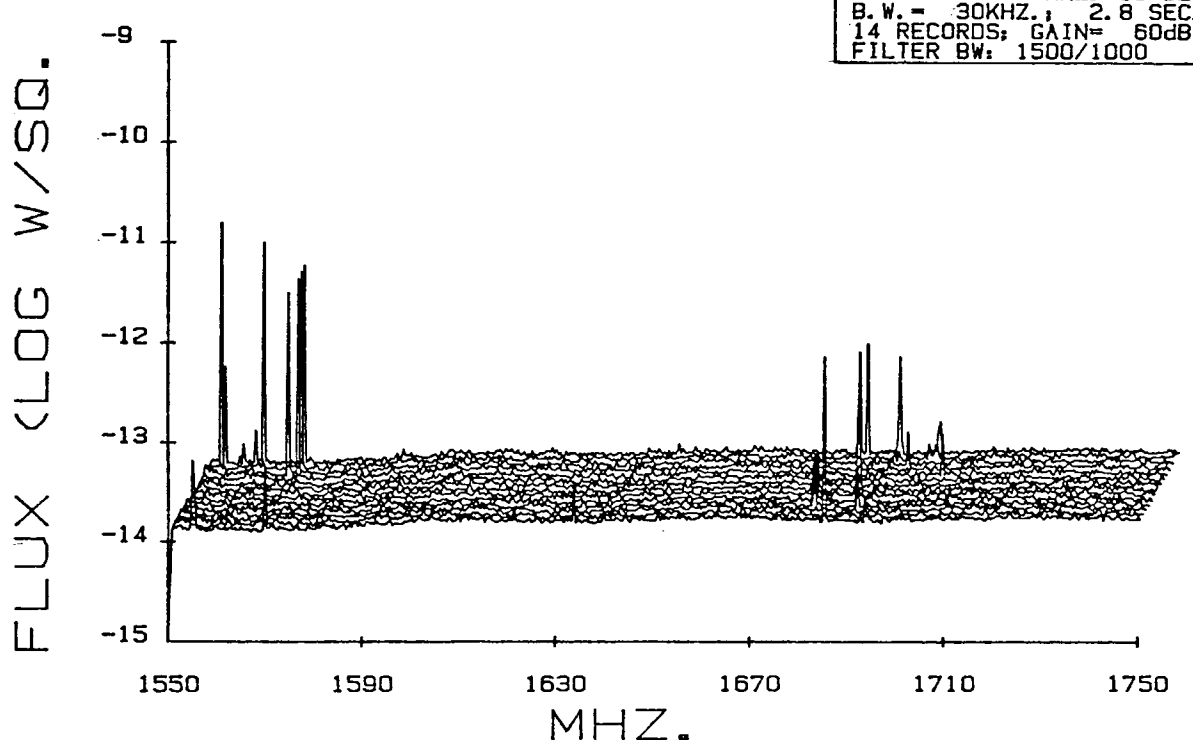
Plot #14

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 09:17 08-13-1985
STOP : 11:22 08-13-1985
1550 TO 1750 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000

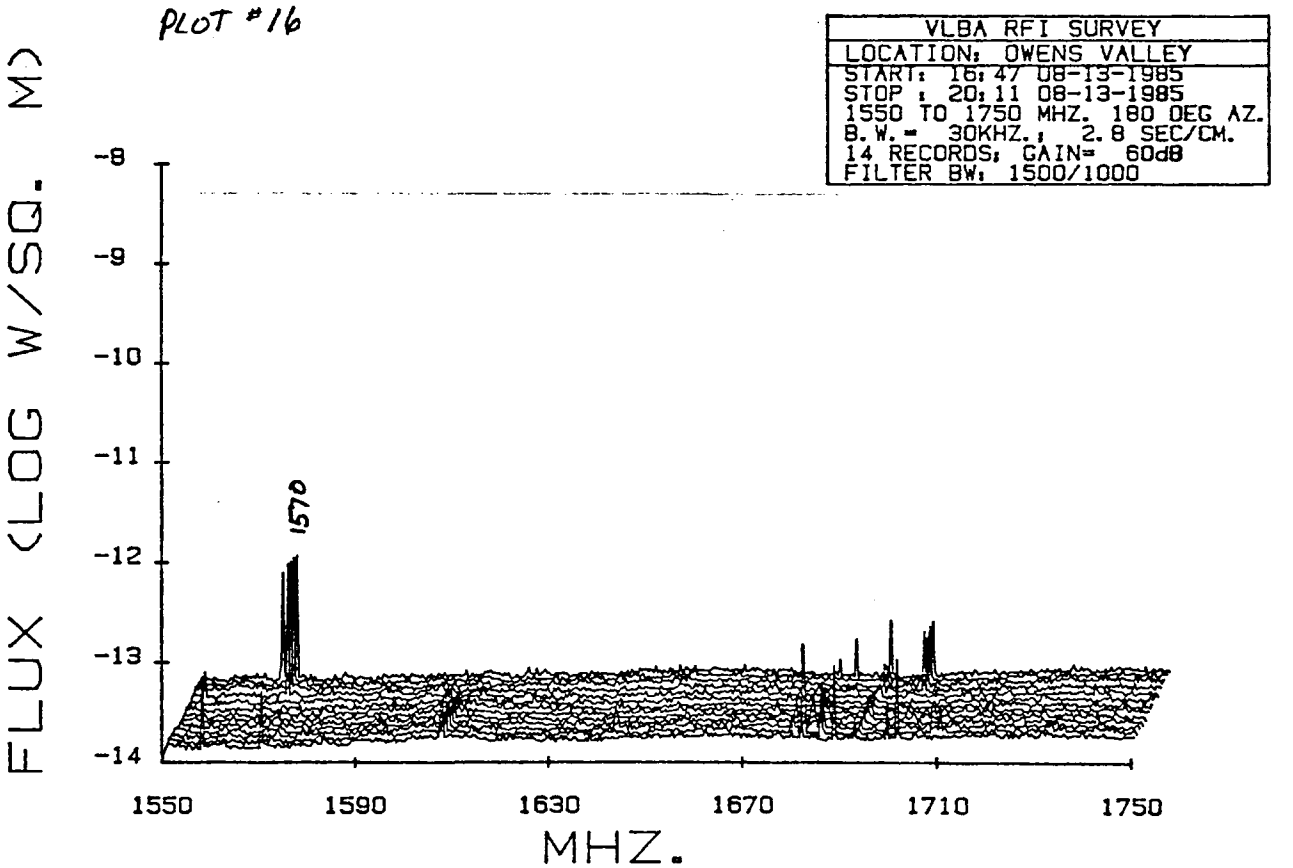


Plot # 15

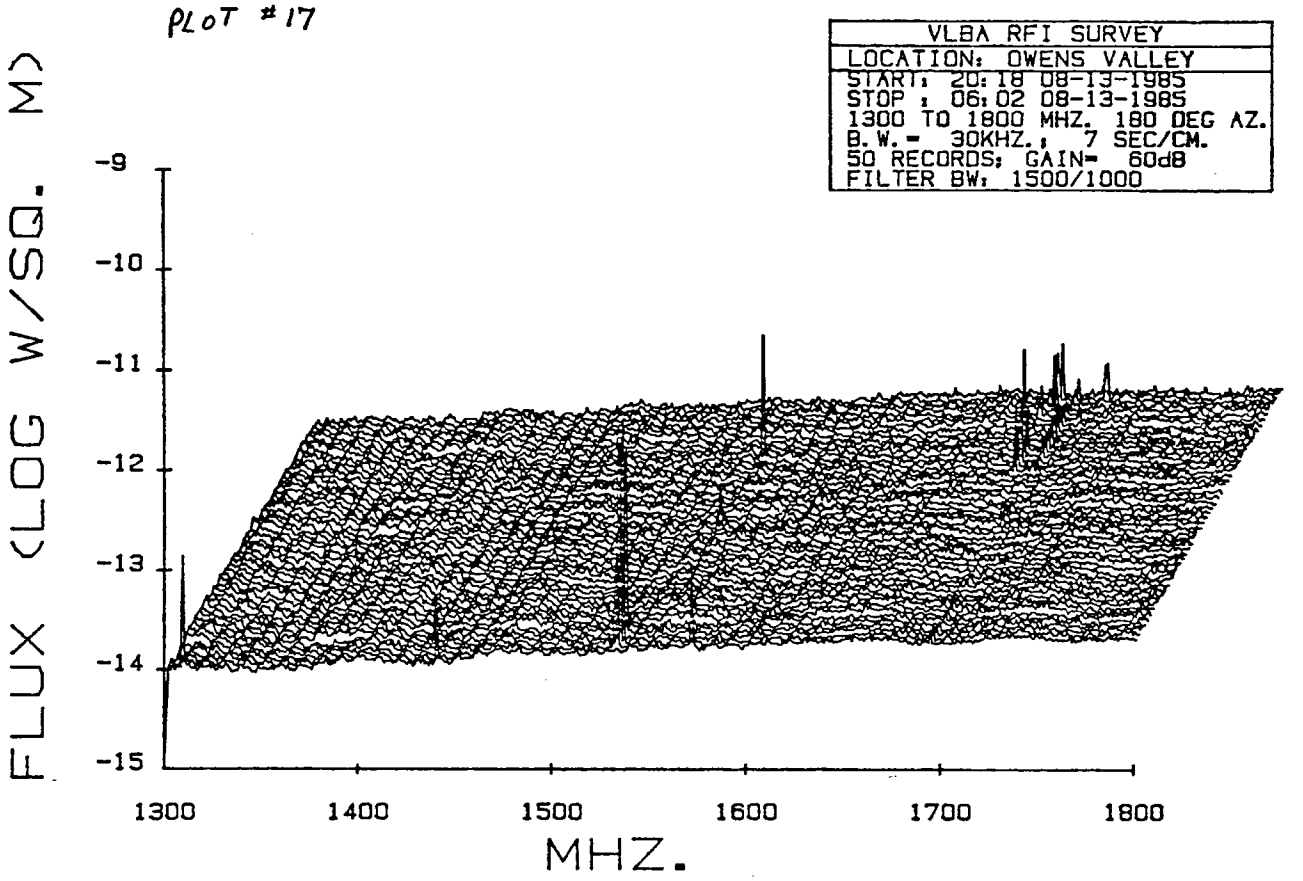
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 16:26 08-10-1985
STOP : 19:38 08-10-1985
1550 TO 1750 MHZ. 90 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000



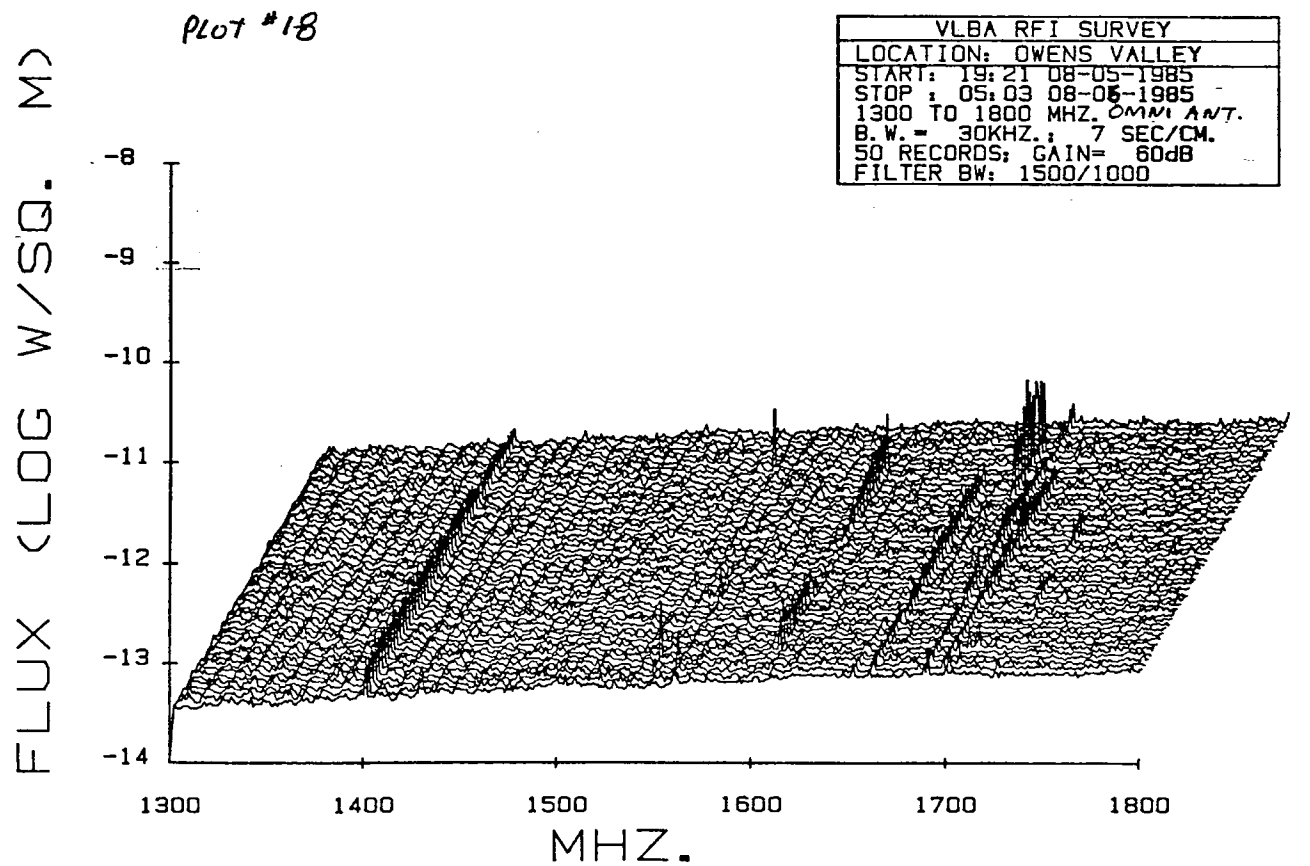
PLOT #16


VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 16:47 08-13-1985
STOP : 20:11 08-13-1985
1550 TO 1750 MHZ. 180 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: 1500/1000
FLUX (LOG W/SQ. M)
-8
-9
-10
-11
-12
-13
-14
1570
1550
1590
1630
1670
1710
1750
MHZ.

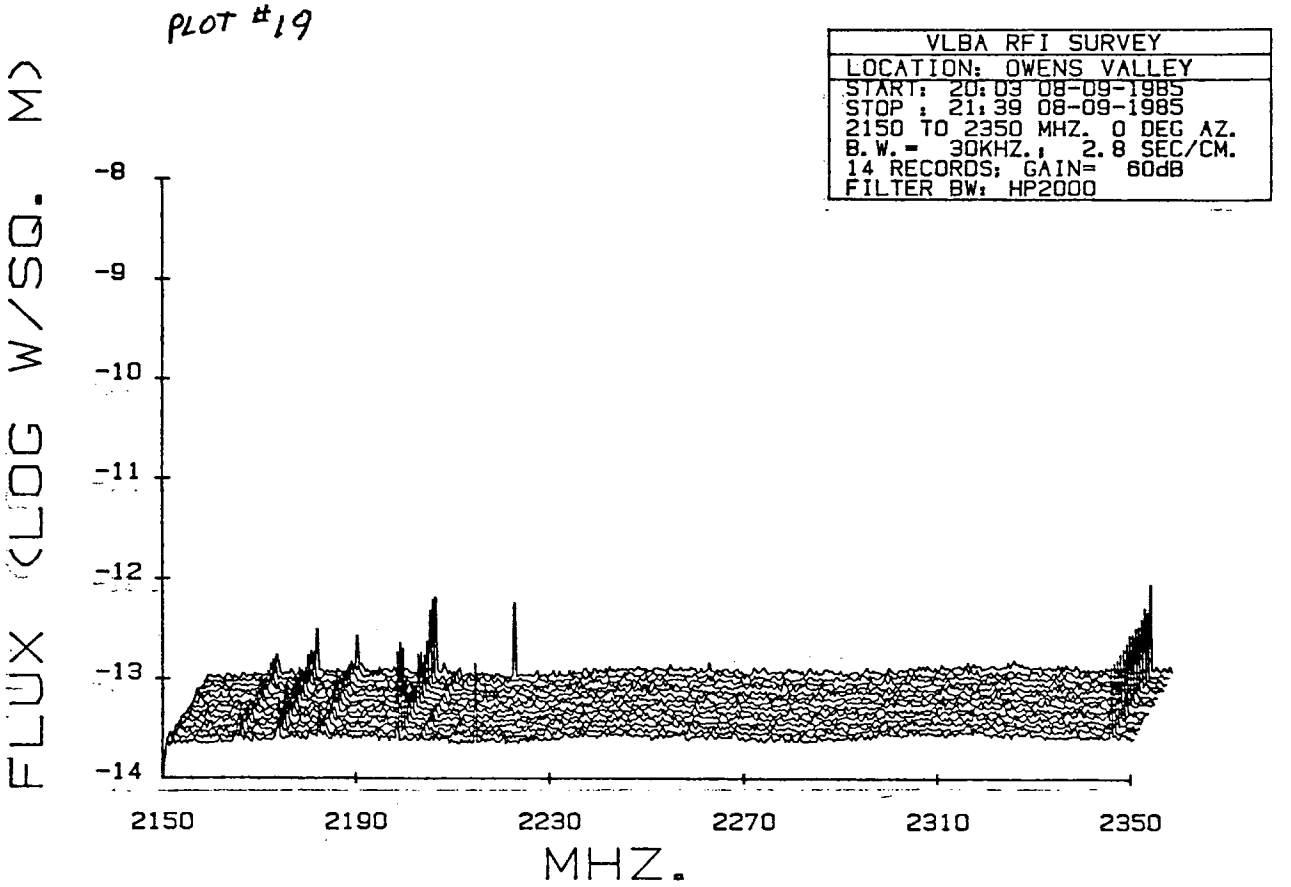
PLOT #17



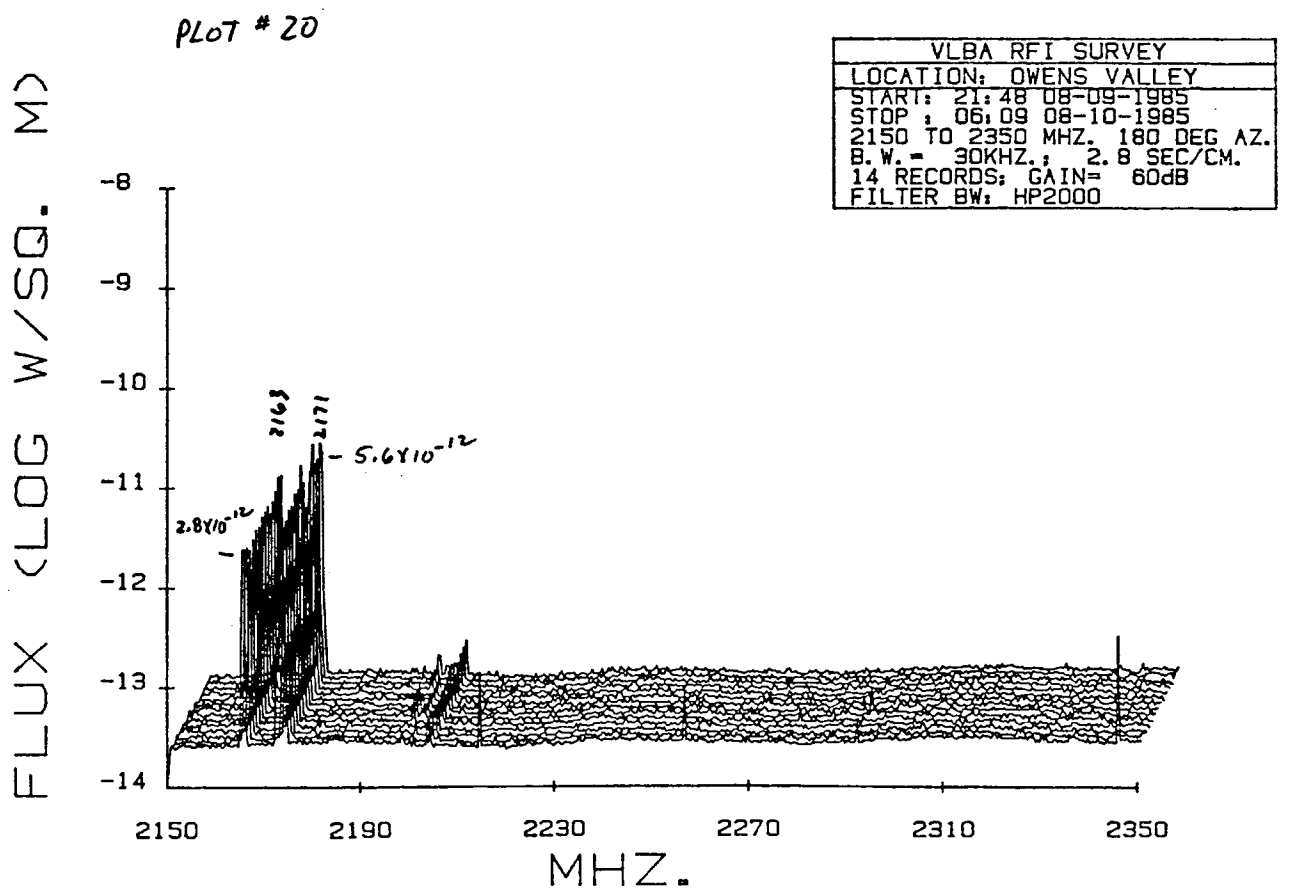
PLOT #18



PLOT #19

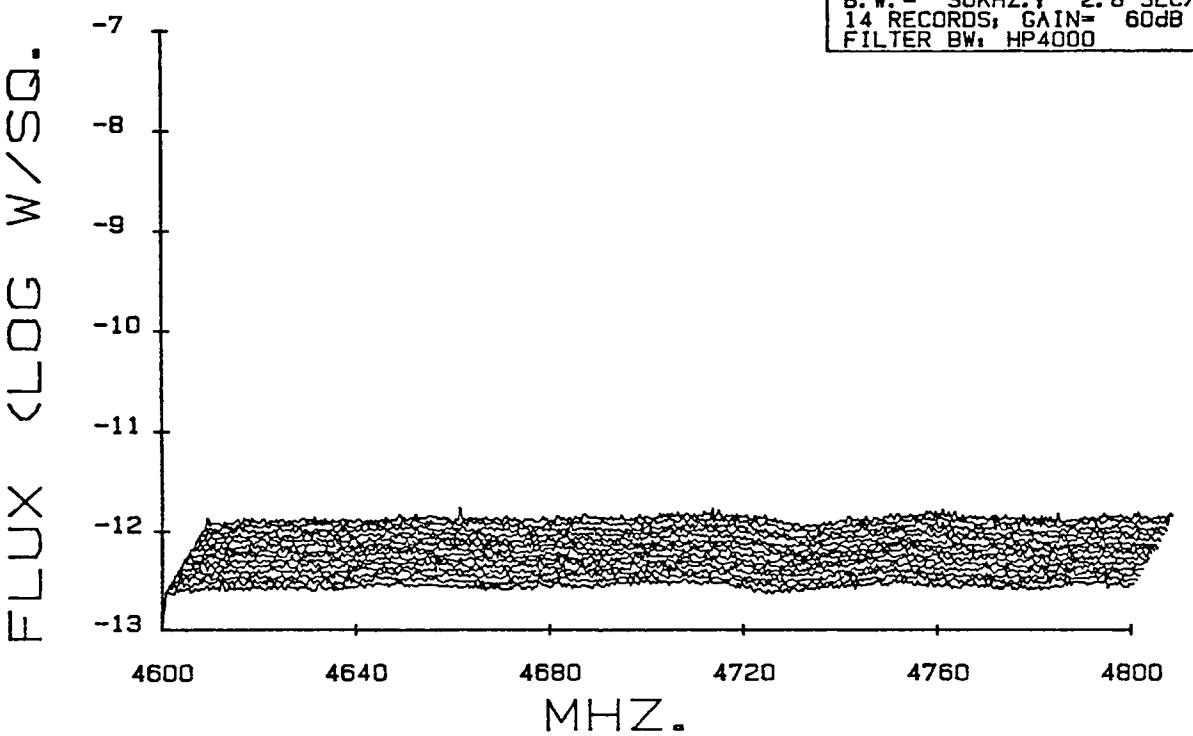


PLOT # 20



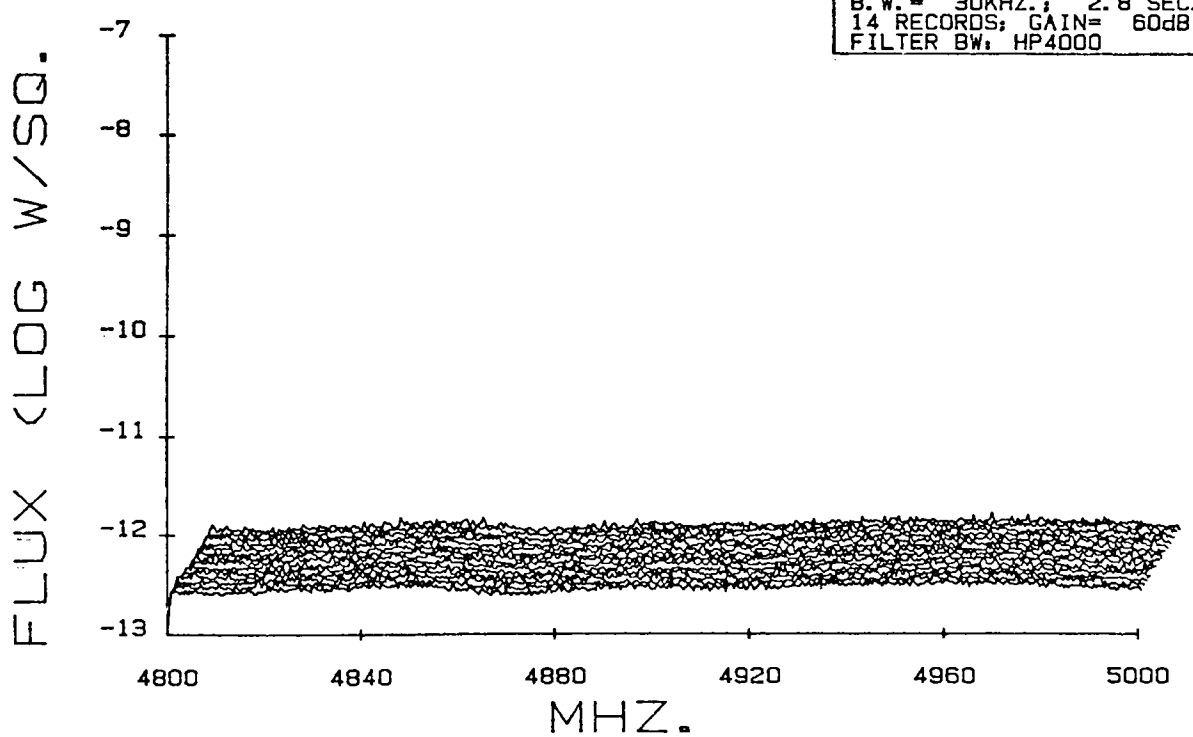
PLOT # 21

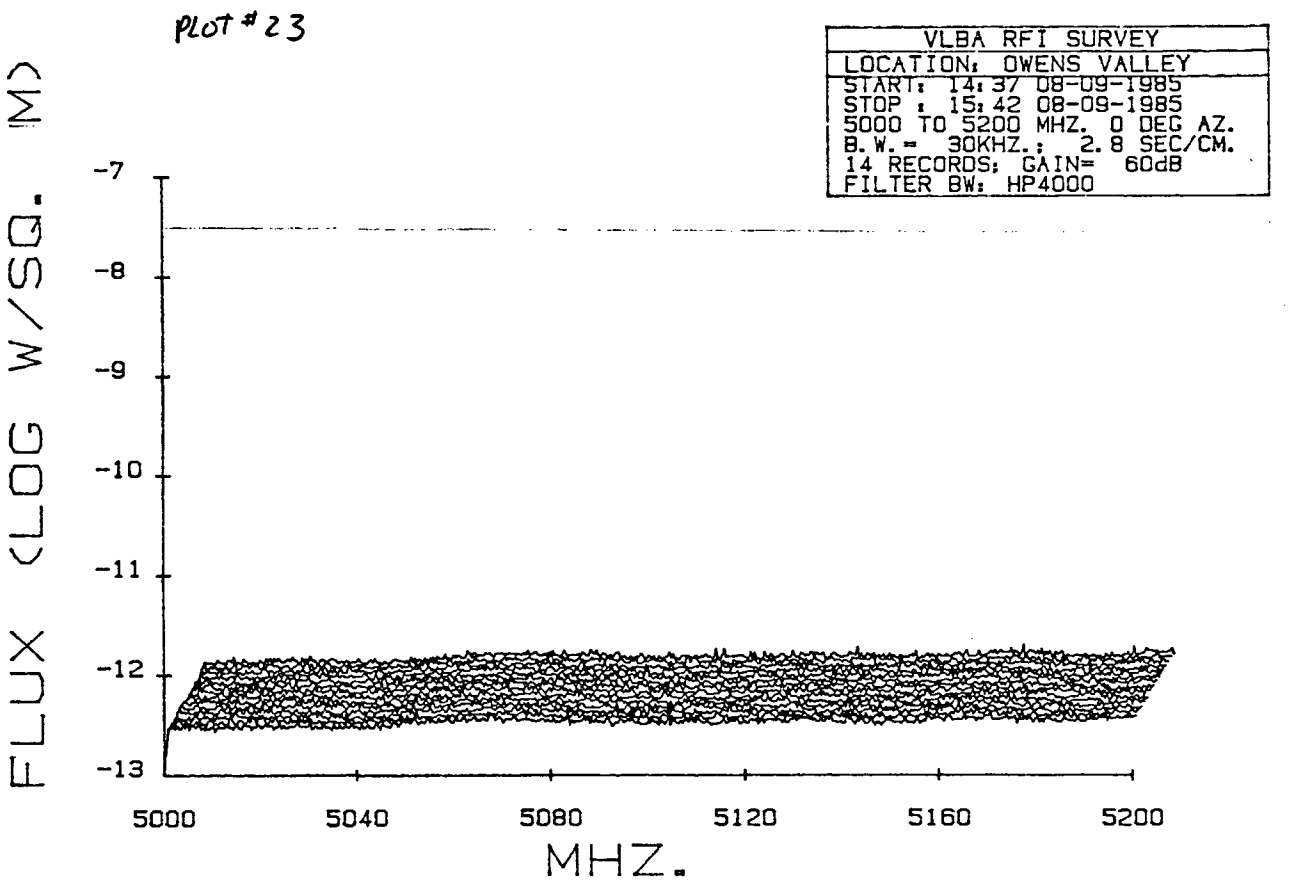
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 18:47 08-08-1985
STOP : 20:55 08-08-1985
4600 TO 4800 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: HP4000



PLOT # 22

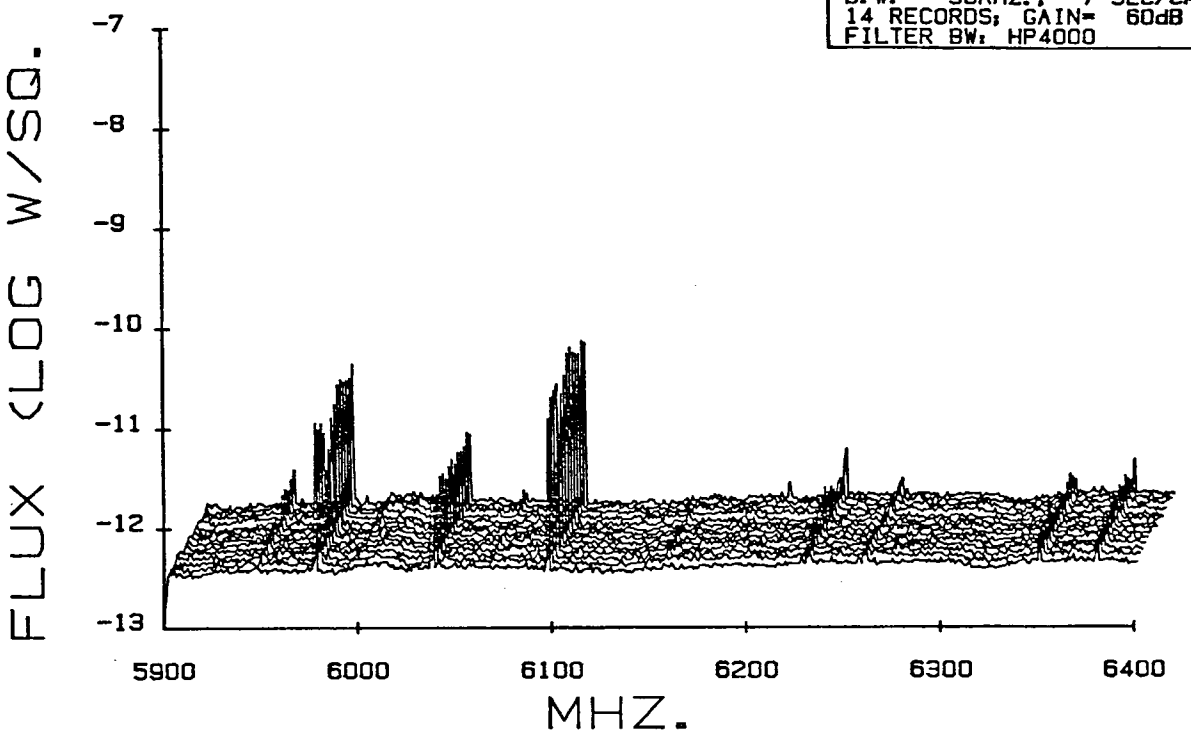
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 09:48 08-09-1985
STOP : 10:51 08-09-1985
4800 TO 5000 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: HP4000




PLOT # 23
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 14:37 08-09-1985
STOP : 15:42 08-09-1985
5000 TO 5200 MHZ. 0 DEG AZ.
B.W.= 30KHZ.; 2.8 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: HP4000
FLUX (LOG W/SQ. M)
-7
-8
-9
-10
-11
-12
-13
5000
5040
5080
5120
5160
5200
MHZ.

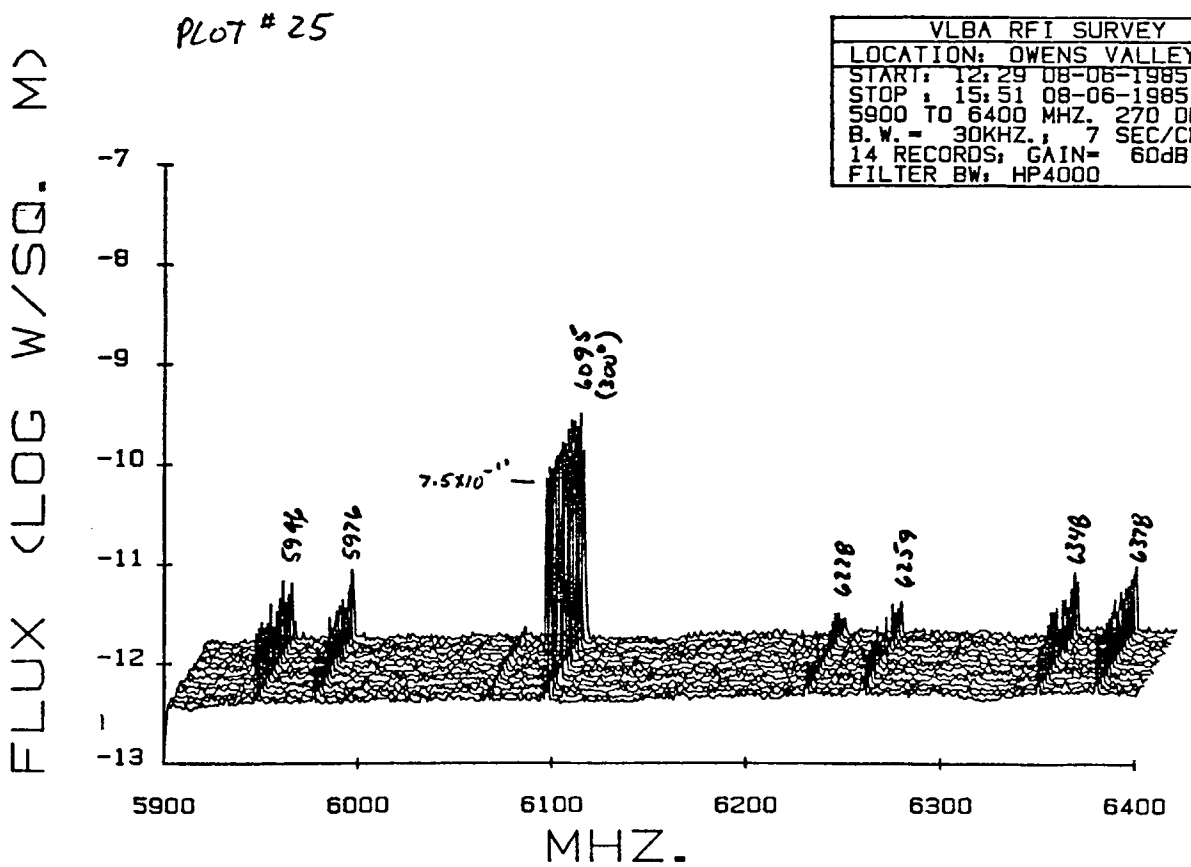
PLOT # 24

VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 10:13 08-06-1985
STOP : 12:26 08-06-1985
5900 TO 6400 MHZ. 180 DEG AZ.
B.W. = 30KHZ.; 7 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: HP4000

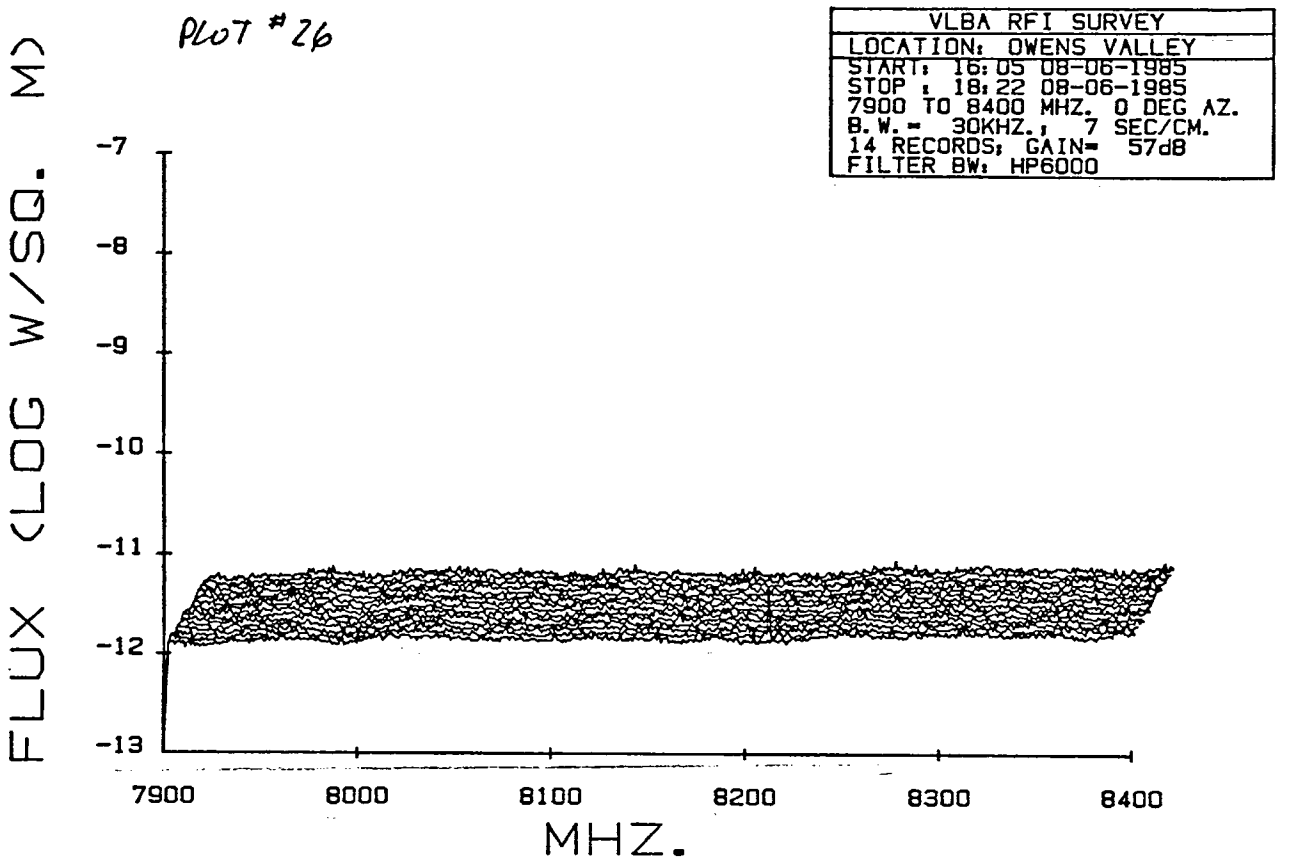


PLOT # 25

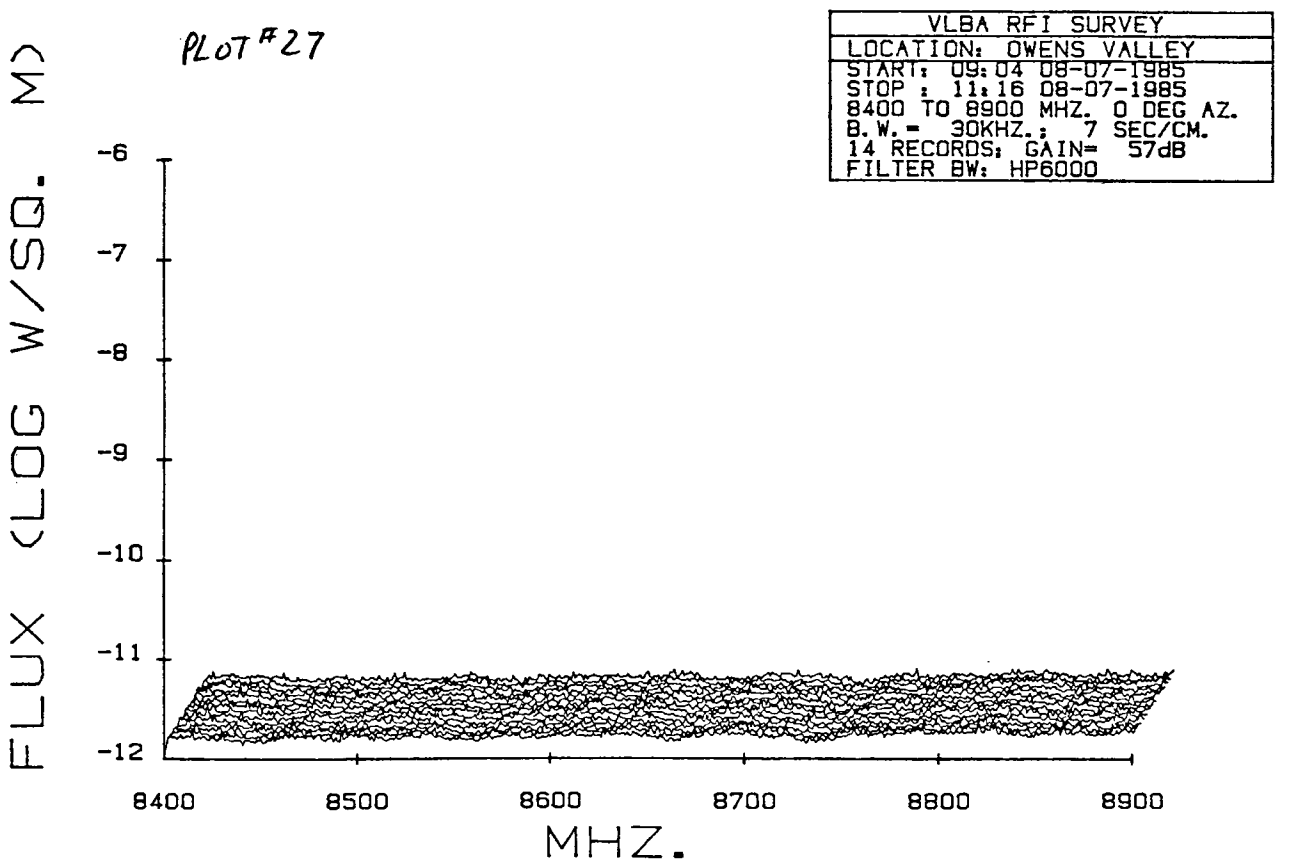
VLBA RFI SURVEY
LOCATION: OWENS VALLEY
START: 12:29 08-06-1985
STOP : 15:51 08-06-1985
5900 TO 6400 MHZ. 270 DEG AZ.
B.W. = 30KHZ.; 7 SEC/CM.
14 RECORDS; GAIN= 60dB
FILTER BW: HP4000



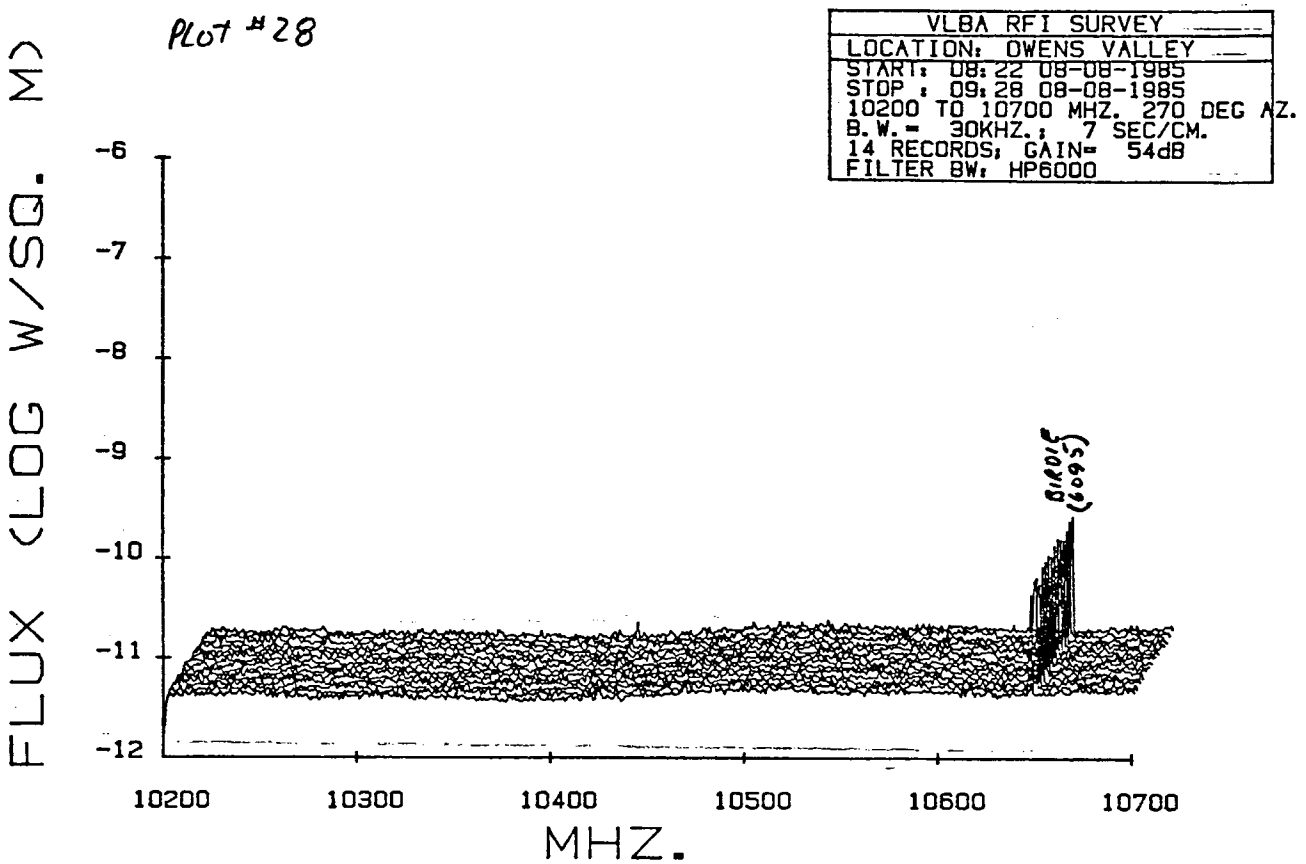
PLOT #26



PLOT #27



Plot #28



Plot #29