AT/15.5/022

CSIRO DIVISION OF RADIOPHYSICS

INTERFERENCE SURVEY III

RESUMÉ

INTRODUCTION

Further interference tests were performed at Culgoora between 28/2/84 and 1/3/84. The two frequencies which suffered from significant interference during the last survey ,327 MHz and 408 MHz, were re-examined partially as a verification but mostly to gain further statistics on their characteristics. Two additional frequency bands were included (i) 575-675 MHz specifically to cover centre frequencies 610 MHz and 650 MHz and (ii) 818-868 MHz around centre frequency 843 MHz. The relatively interference free frequencies of 1420 MHz and 2295 MHz were not re-examined given specific time constraints.

Particular emphasis in this survey was to examine the variation in the interferring signal strengths over periods ranging from 30 minutes, 6 hours to 3 days.

SECTION A

Outline on results obtained

The accompanying figures A-1 to A-5 indicate the interferring signals present at the four frequencies. They show a summary of the results obtained, giving the spectrum for the compass directions (rather than every 30 degrees). Indicated on these to aid comprehension are the estimated harmful levels using a relatively simple criterion given in section B. A more complete analysis of the harmful levels and the various criteria that are available will be given a fuller report. Also shown are the actual assigned astronomical bands.

As indicated in the previous survey the major source of interference is from fixed frequency terrestial transmitters rather than broadband noise or satellites etc.

327 MHz Survey

There seemed two puzzling sources of interference at this frequency (in the astronomical band). The first was accounted for by the front end oscillation of the Culgoora Heliograph antennas. The results on the 28/2/84 (figure A-1) clearly show this effect where the critical band is totally corrupted. Powering down the Heliograph gave the clearer spectrum as on the 29/2/84 (figure A-2) leaving the residue of the second as yet unidentified source of interference. This signal is also apparent on the previous day's record hence seems to be permanent. The interference survey II also

gave a hint of its presence and as it is inside the radio observing band exact identification would be desirable. Efforts in this direction were made and the following comments apply.

(i) Intermodulation was rejected after extensive tests
(ii) The signal seemed present in all directions
(iii) The signal did not emminate from the CSIRO building(s)
(iv) The signal was evenly spaced throughout the spectrum
(v) The strength of this signal seemed to vary (~hrs)
(vi) The signal definitely came in through the antenna
(vii) The signal was not generated in the measuring equipment

408 MHz Survey

Examination of the figure A-3 given show that there are strong transmitters quite adjacent to the astronomical band, which only the 3.9 MHz between 406.1 MHz and 410.0 MHz is protected. It is clear from the indicated threshold that if these were included in the observing band potential adverse effects are highly likely. The survey over the three days indicated that typically these transmitters had little temporal variation hence seem permanent fixtures in the local Culgoora radio spectrum.

610/650 MHz and 843 MHz

These two new (higher) frequencies show little interference from such sources particularly in the intended observing band (see figures A-4 and A-5).

SECTION B

Harmful Interference Criterion

Here we take our threshold of what is estimated to cause adverse effects to a synthesis system, during an astronomical observation, as being a system temperature increase of 1% (ref VLBA Memo 81).

Since the plots given in this report are calibrated in terms of the power input to the spectrum analyser it is necessary to compensate for the antenna gain, amplifier gain and bandwidths so that the A.T. 1% figure relates to the interference measuring equipment (I.M.E.) system. To this effect the following table B-1 has been set up indicating the parameter values for the different frequencies.

TABLE B-1: HARMFUL LEVEL CONVERSION .

A.T. PARAMETERS				I.M.E. PARAMETERS						
FREQ (MHz)	AST-B/W (MHz)	SYS-T (K)	OUCH1 (K)	G (dB)	ANT-T (K)	INT-FTR -((kHz))	INT-T (K)	SYS-T (K)	POW1O (dBm)	OUCH2 dBm)
327	6.6	100	1	14	25	66(100)	1650	2140		-85
408	3.9	100	1	14	25	40(100)	1000	1490		-85
610	6.0	100	1	11	12	20(300)	240	610		-85
843	10.0	100	1	11	12	100(100)	1200	1625		-86

Key

AST-B/W Astronomical (protected) bandwidth
OUCH1 Estimated harmful system temperature increase AT
ANT-T Equivalent non-integrated harmful temperature
INT-FTR Dimensionless Ratio of AST-B/W to S.A. Resolution B/W (Figure in brackets is the S.A. Resolution B/W)
INT-T Equivalent integrated harmful temperature
SYS-T Harmful interference level + system contribution ~500K
POW1O Measured level of a 10000K step (Antenna Temp)
OUCH2 Corresponding (to OUCH1) level in I.M.E.

The final column levels are marked onto the frequency plots.

The analysis assumes implicitly that the interference comes in through the sidelobes where the gain is ~0dB.

SECTION C

Preliminary Time Scans

Briefly presented also in graphical form (figures C-1 to C-3) are investigations into the temporal variations of transmitters over time intervals of 30 minutes (samples every 90 seconds) to 6 hours (samples every 1-hour). The relevant parameters are recorded on the plots.

All observations were done in the same direction and polarisation. It is apparent that no significant changes in the spectrum occured over the intervals of observation. However the differences in the individual plots implies there is some power fluctuation at least between when the samples were taken.

This section was ore concerned with indicating what is achievable in future surveys rather than being a complete analysis of the temporal statistics of transmitters at 327 MHz. It is also possible to take the difference spectrum and plot this against time.

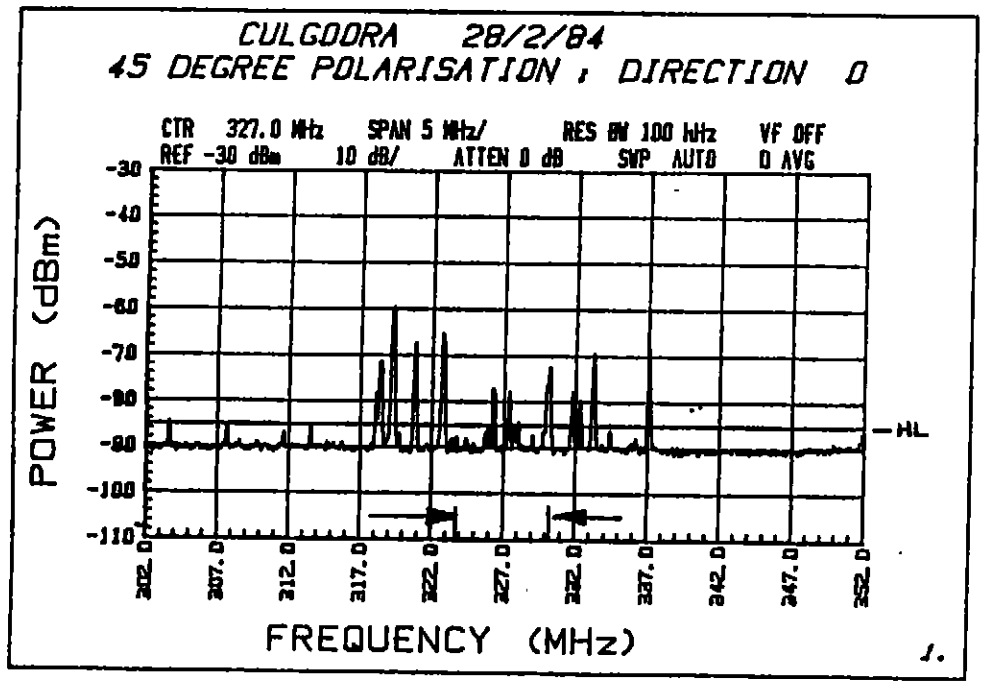
CONCLUSIONS

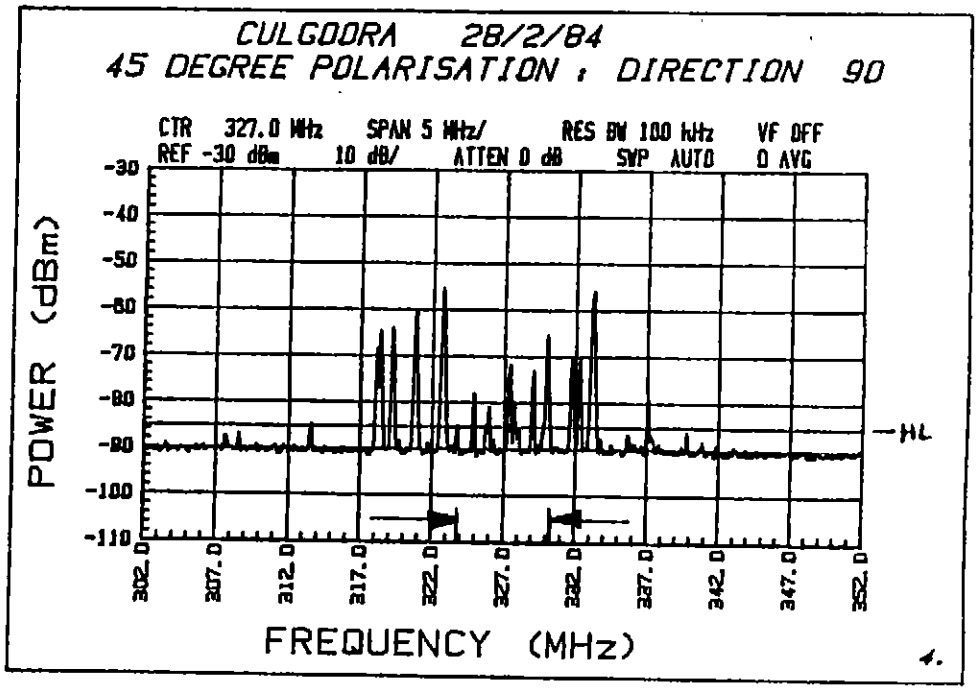
The two higher frequencies (610/650 MHzand 843 MHz) seem devoid of potentially harmful interference.

At 408 MHz strong interference adjacent to the band will constrain bandwidths wider than 3.9 MHz unless extensive filtering is undertaken.

At 327 MHz there exists one puzzling source of interference which future surveys will be required to identify.

R.A.KENNEDY
J.W.BROOKS
19/3/84


CULGOORA 28/2/84
45 DEGREE POLARISATION ; DIRECTION 0
CTR 327.0 MHz SPAN 5 MHz/ RES BW 100 kHz VF OFF
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO 0 AVG
POWER (dBm)
-30
-40
-50
-60
-70
-80
-90
-100
-110
HL
302.0
307.0
312.0
317.0
322.0
327.0
332.0
337.0
342.0
347.0
352.0
FREQUENCY (MHz)
1.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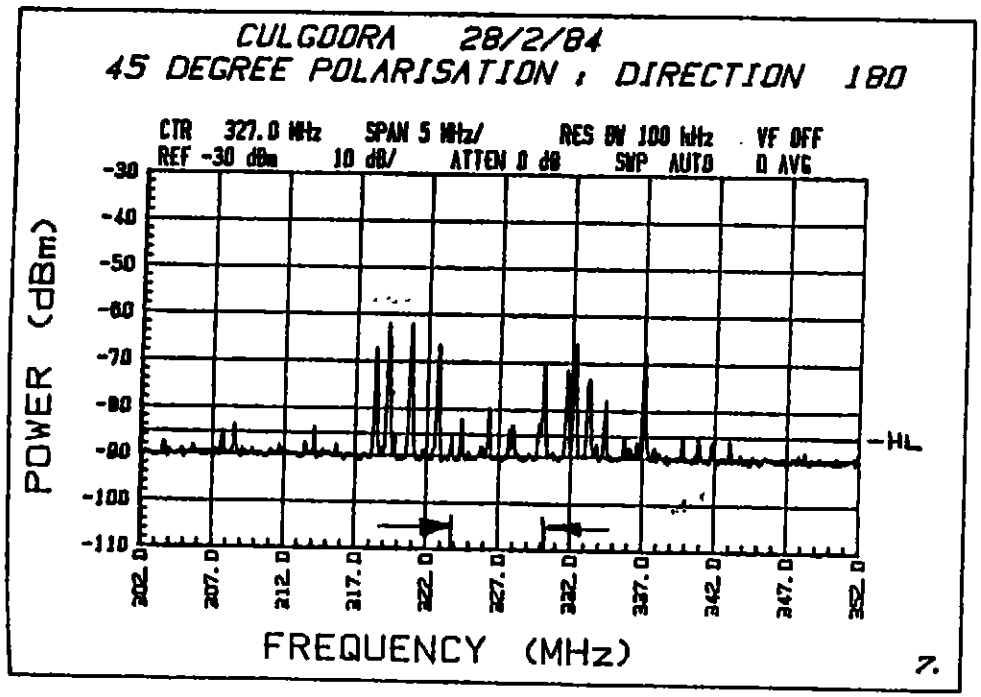
45 DEGREE POLARISATION ; DIRECTION 90
CTR 327.0 MHz SPAN 5 MHz/ RES BW 100 kHz VF OFF
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO 0 AVG
POWER (dBm)
-30
-40
-50
-60
-70
-80
-90
-100
-110
HL
302.0
307.0
312.0
317.0
322.0
327.0
332.0
337.0
342.0
347.0
352.0
FREQUENCY (MHz)
4.


CULGOORA 28/2/84
45 DEGREE POLARISATION ; DIRECTION 180
CTR 327.0 MHz SPAN 5 MHz/ RES BW 100 kHz VF OFF
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO 0 AVG
POWER (dBm)
-30
-40
-50
-60
-70
-80
-90
-100
-110
HL
302.0
307.0
312.0
317.0
322.0
327.0
332.0
337.0
342.0
347.0
352.0
FREQUENCY (MHz)
7.

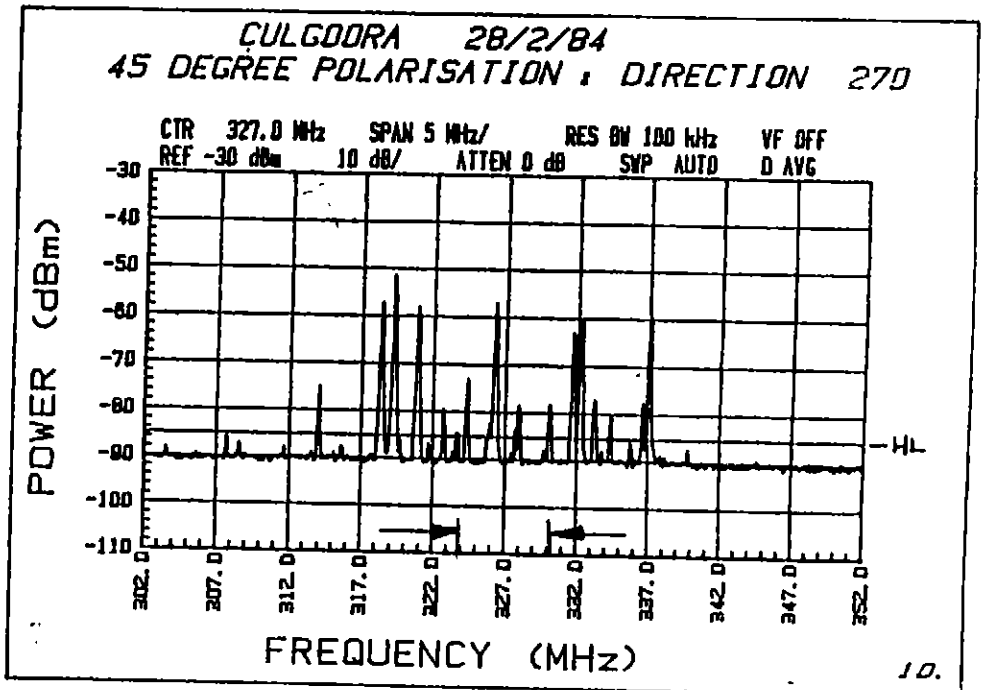
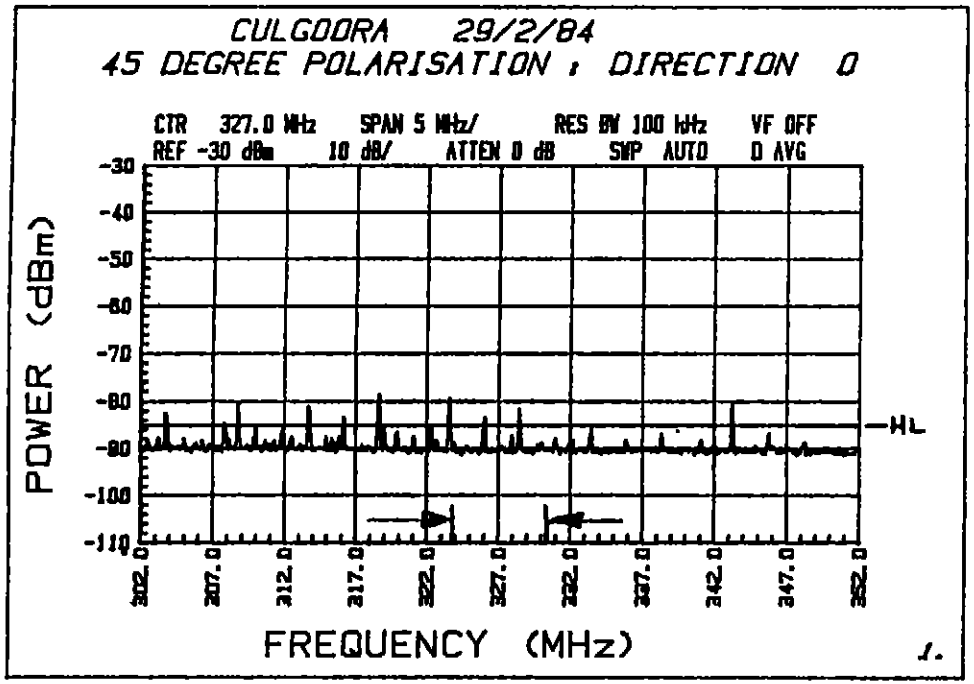
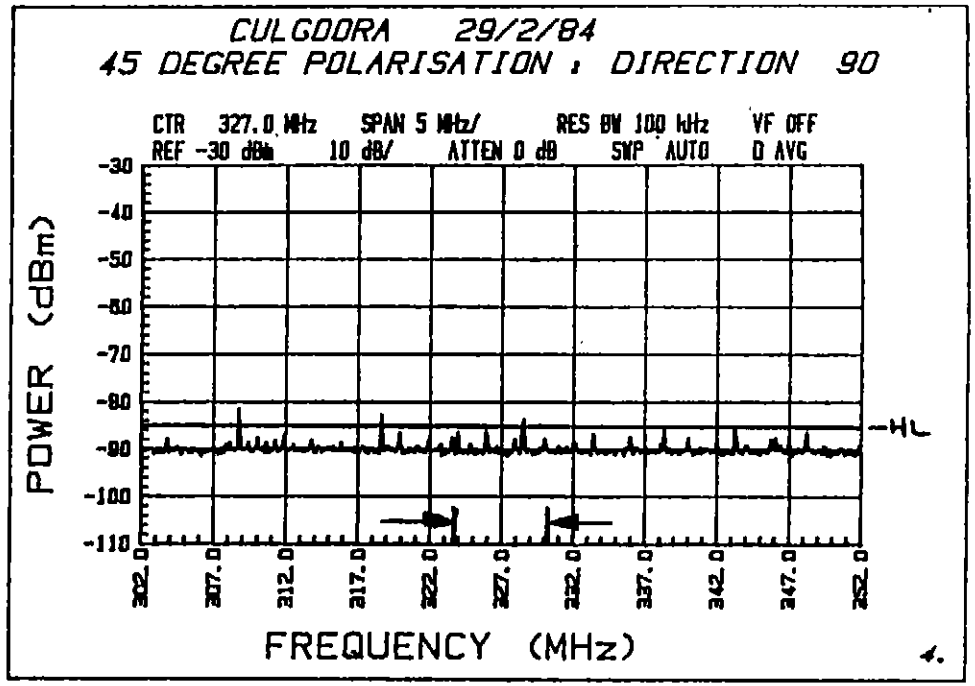
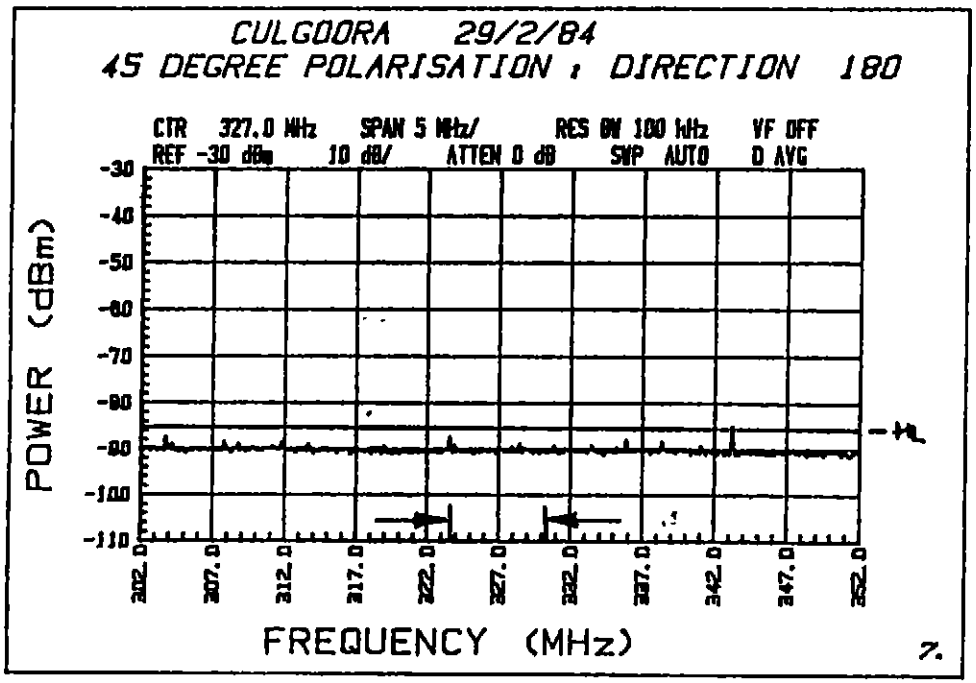

CULGOORA 28/2/84
45 DEGREE POLARISATION ; DIRECTION 270
CTR 327.0 MHz SPAN 5 MHz/ RES BW 100 kHz VF OFF
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO 0 AVG
POWER (dBm)
-30
-40
-50
-60
-70
-80
-90
-100
-110
HL
302.0
307.0
312.0
317.0
322.0
327.0
332.0
337.0
342.0
347.0
352.0
FREQUENCY (MHz)
10.

FIGURE A-1







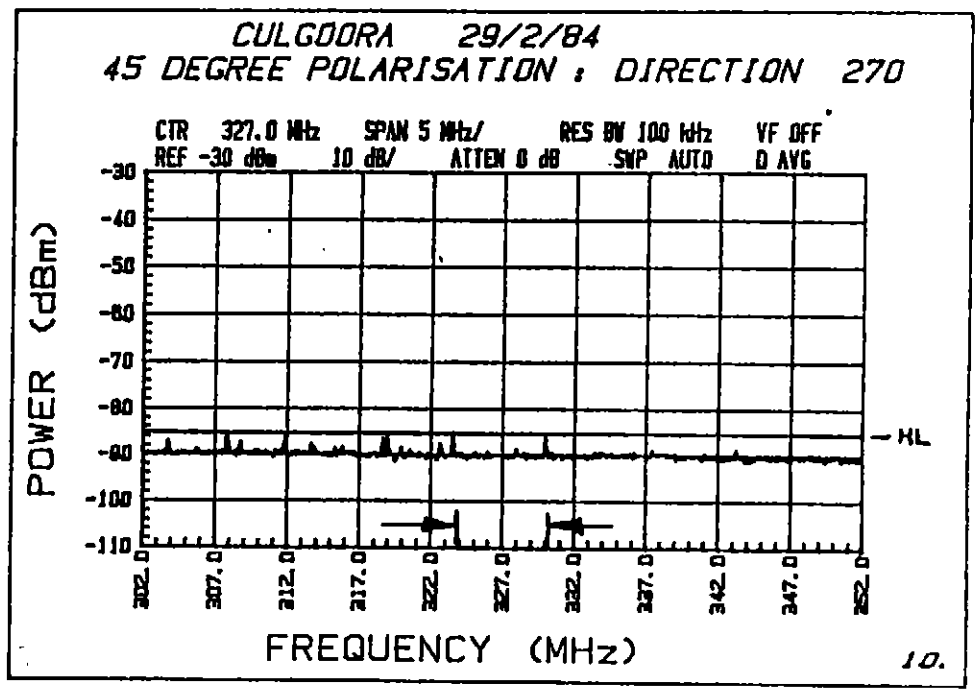
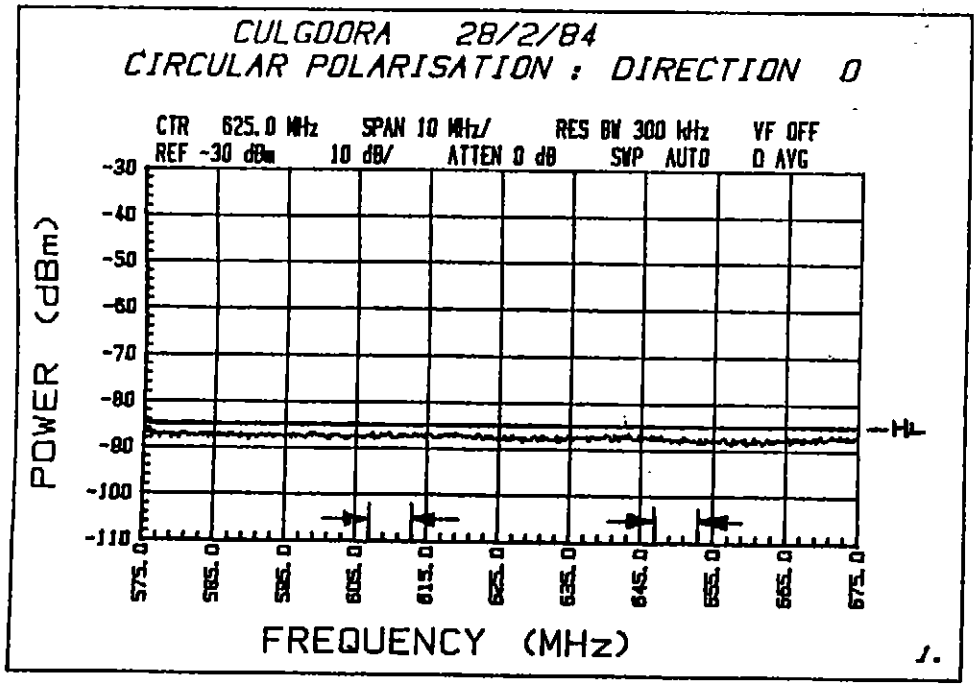
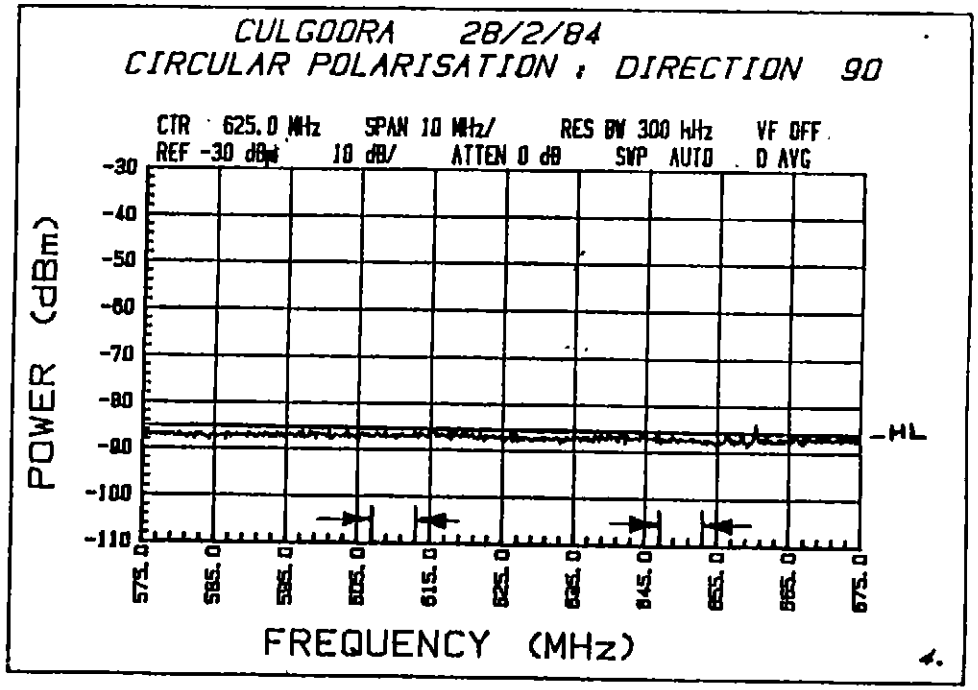
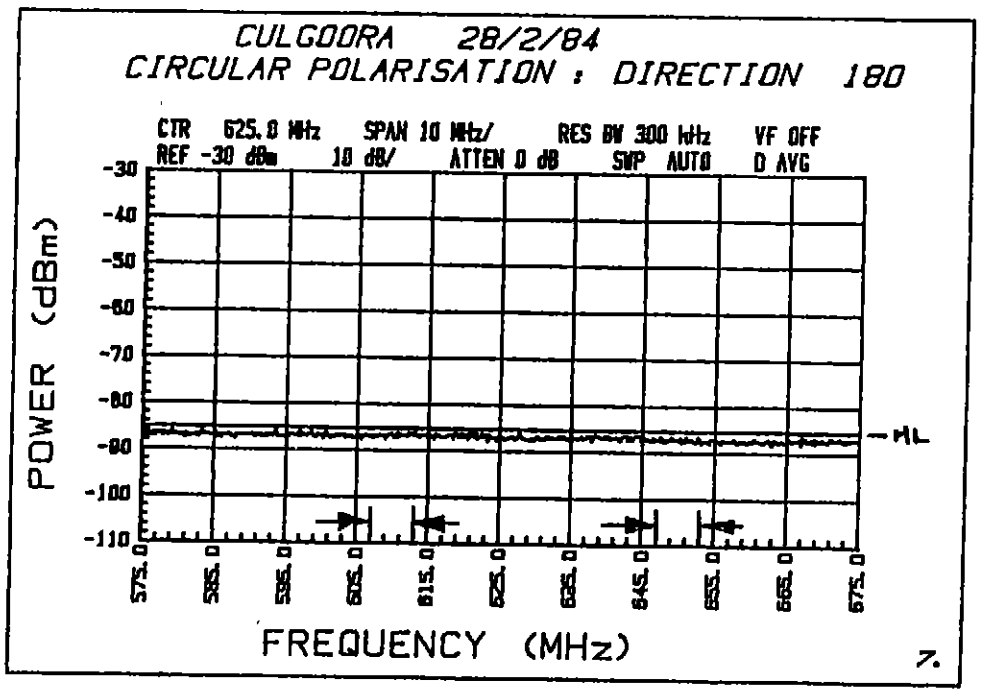


FIGURE A-2

HL: Harmful Level
→| |←: Astronomical Band







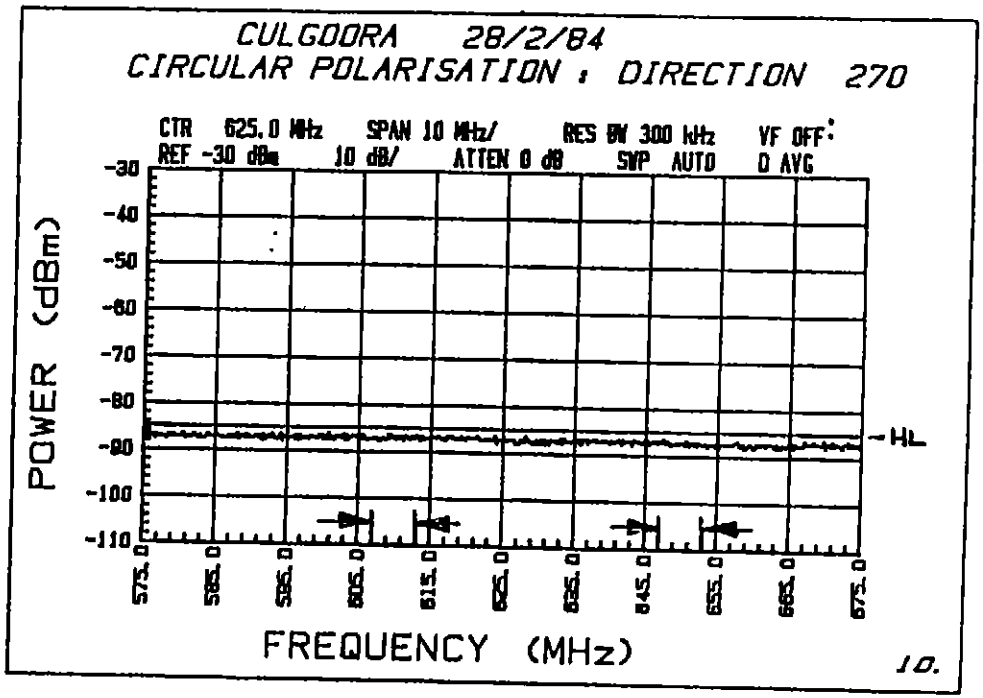
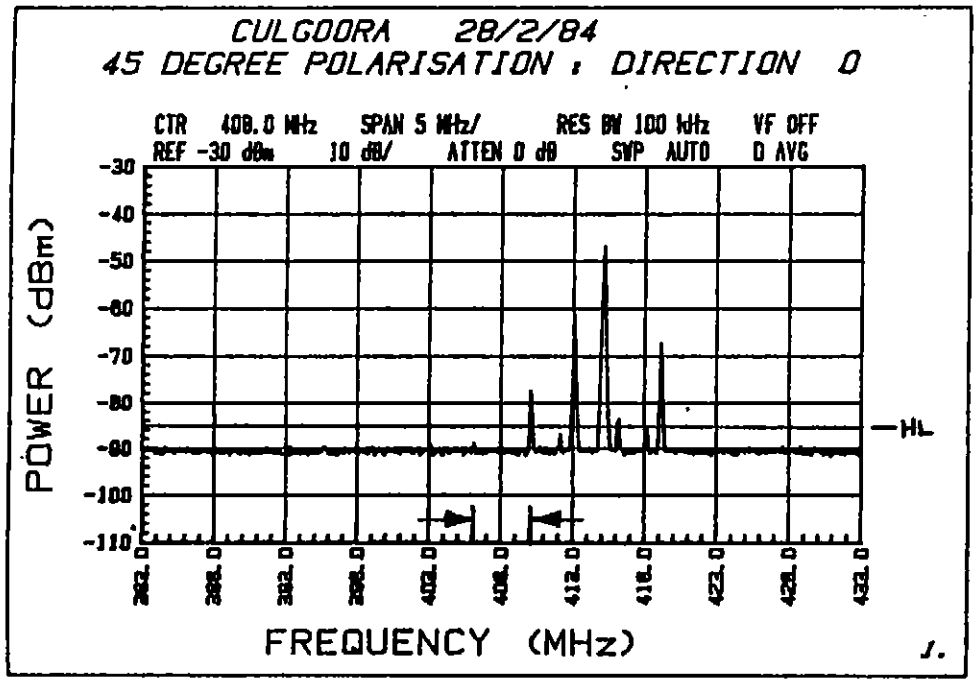
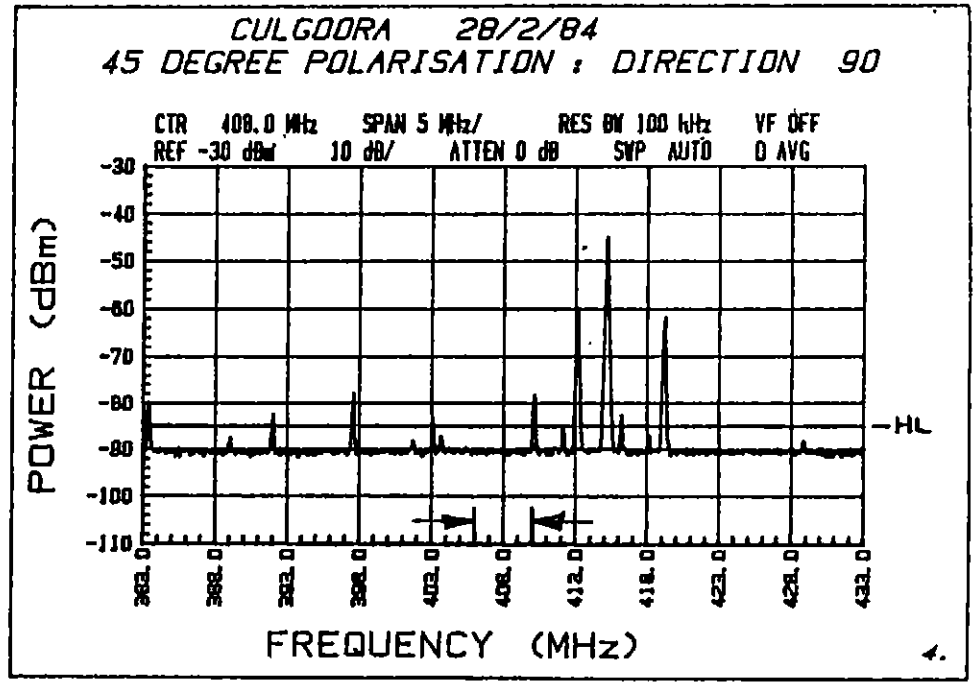


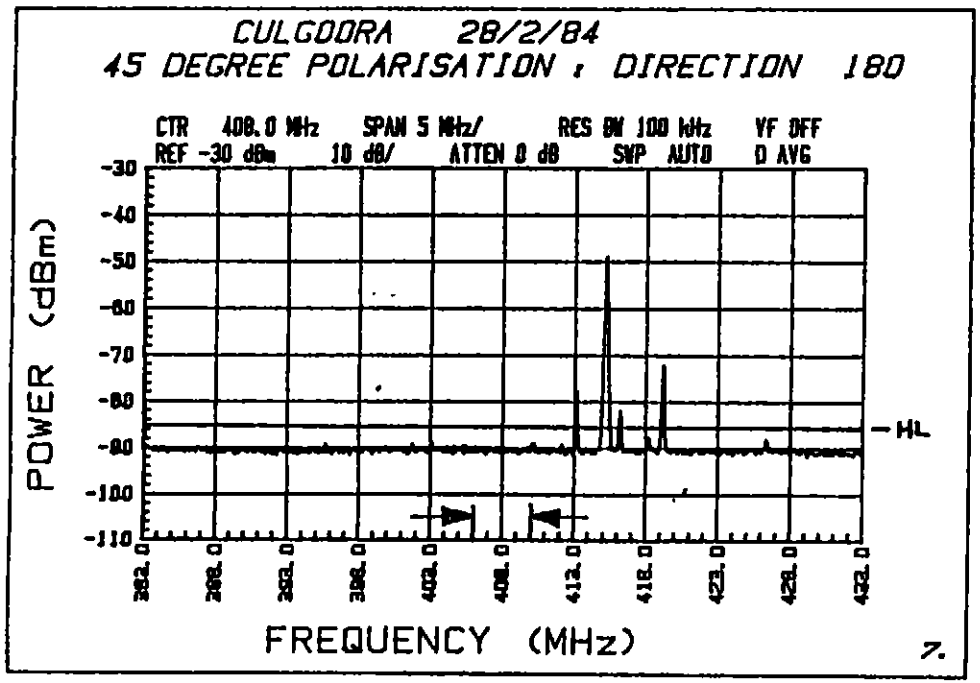
FIGURE A-4

HL : Harmful Level

→| |← : Astronomical Band







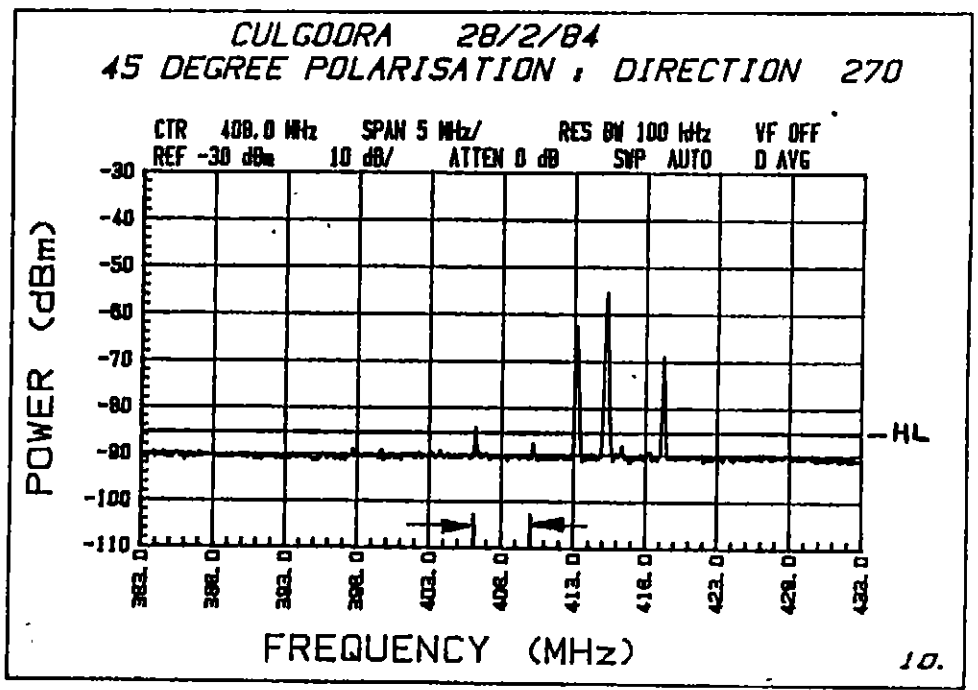
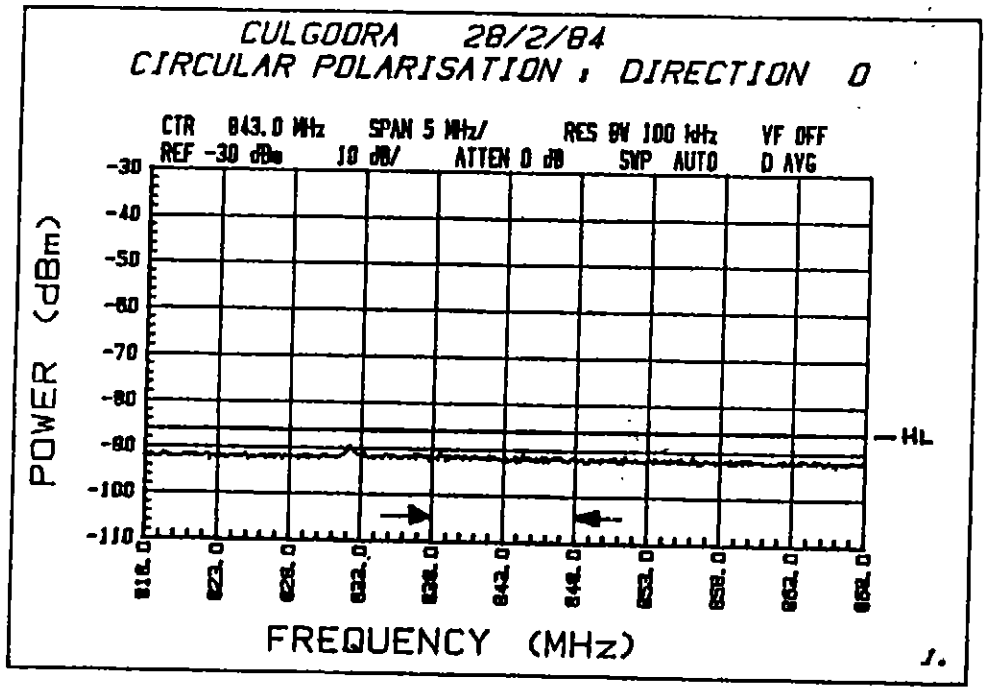
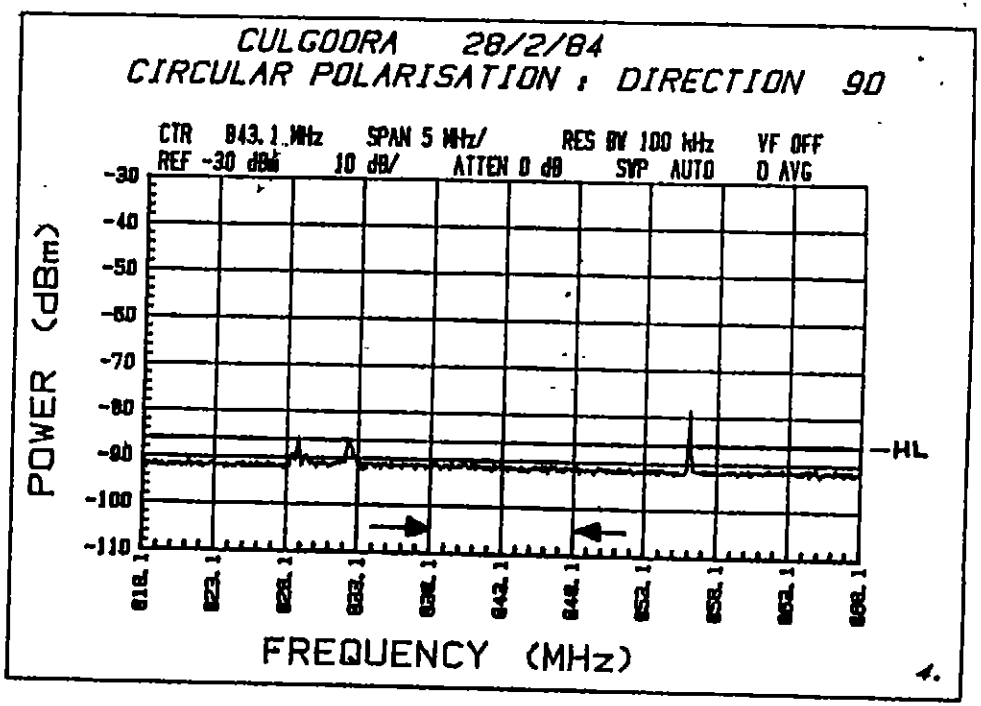
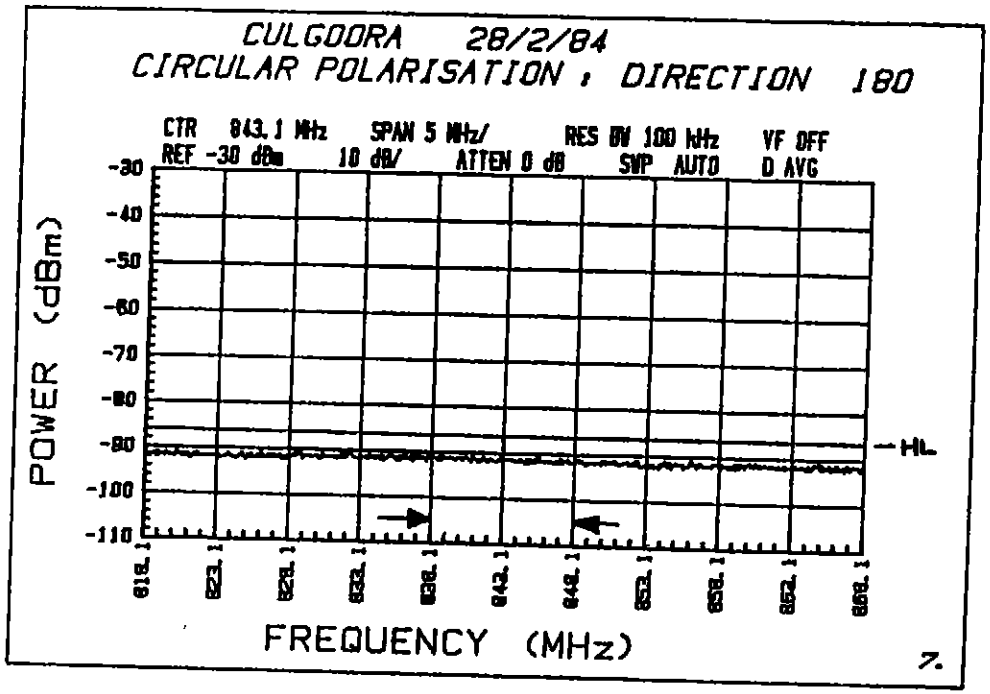


FIGURE A-3

HL: HARMFUL LEVEL
: ASTRONOMICAL BAND







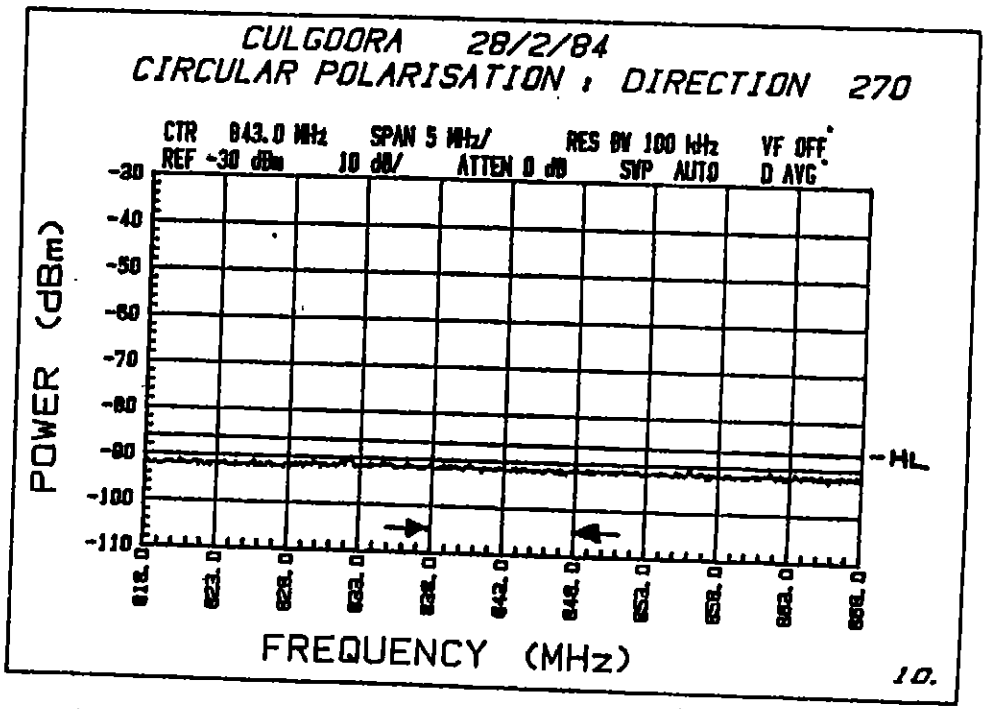


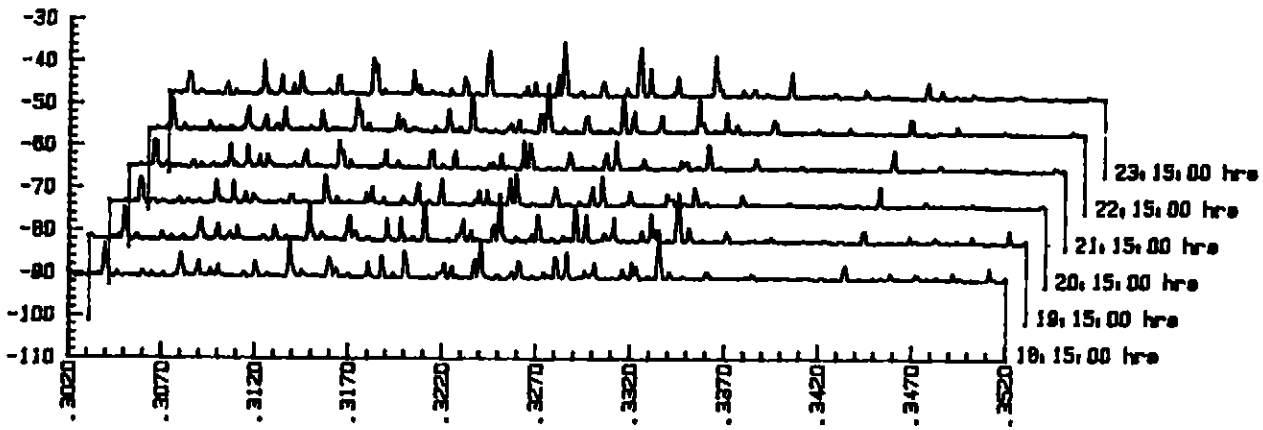
FIGURE A-5

HL: Harmful Level
→| |← : Astronomical Band

CULGOORA TIME SCAN AT 327 MHz
29/2/84

CTR 327.0 MHz SPAN 5 MHz/ RES BW 100 kHz VF .03
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO 0 AVG

POWER (dBm)



TIME

FREQUENCY (GHz)

FIGURE C-1

CULGOORA INTERFERENCE SCAN
1/3/84 DIRECTION NW

CTR 326.8 MHz SPAN 5 MHz/ RES BW 100 kHz VF .03
REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO D AVG

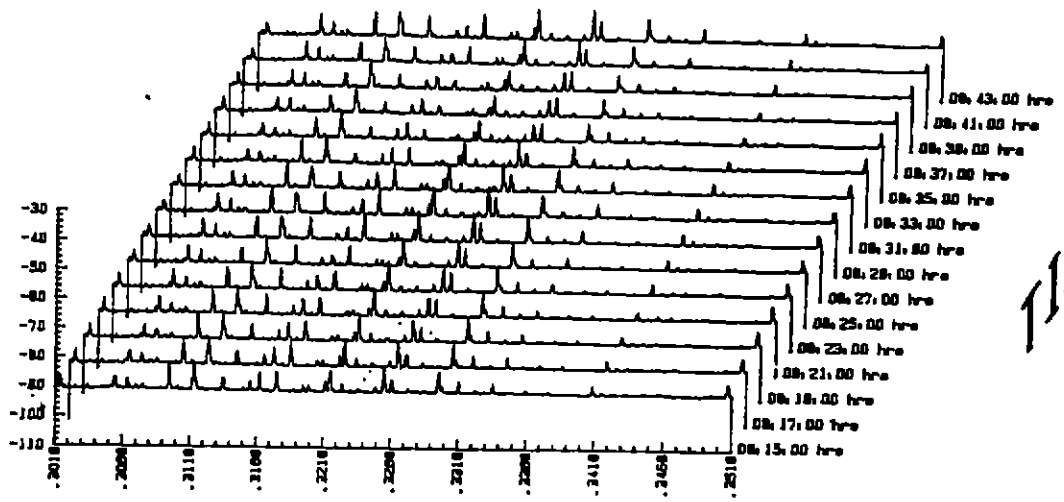


FIGURE C-2

CULGOORA SCAN #3
1/3/84 DIRECTION NW

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REF -30 dBm 10 dB/ ATTEN 0 dB SWP AUTO D AVG

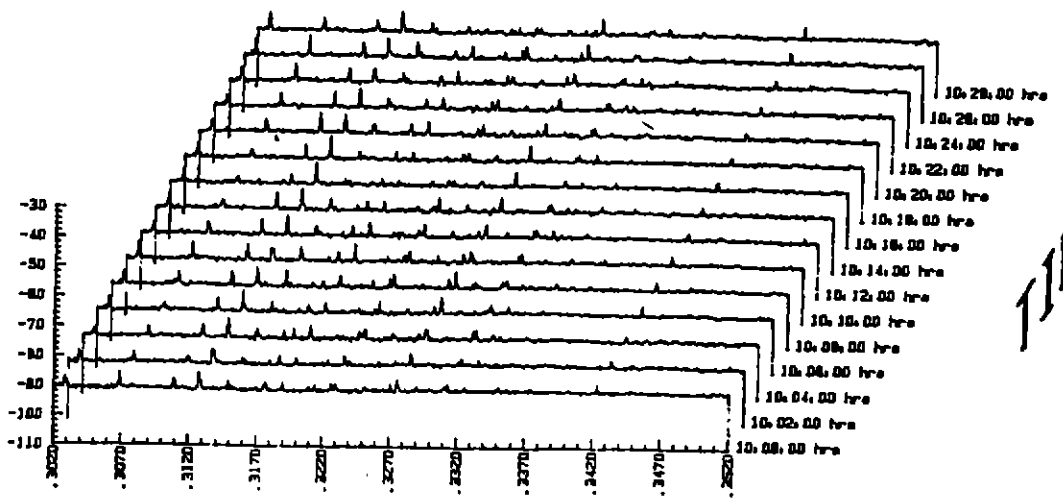

FIGURE C-3

POSSIBLE IDENTIFICATION OF STRONG INTERFERENCE

	SITE	REPORTED FREQ.	REPORTED DIRN	REPORTED POLN	REPORTED SYST TEMP	NEAREST FREQUENCY	XMITTER	RECEIVER	BEARING	POLN	POWER	
1	S-SPRING	350·5	0°	V	30,000	350·20	MT. GLORIOUS	Aircraft	NE	?	100W	Civil Aviation
2						350·30	KINGS TABLE	"	SSW	?	100W	" "
3	"	355·9	0°	V	6,000	—	No Allocations between 350·3 and 360·6 MHz					
4	"	413·9	60°	H	950	413·750	Mt Cem Creagh	Coona	S	V	5W	Grain Handling
5	"	460·9	300°	H	6,000	460·700	Mt Cem Creagh	Dubbo	S	H	1W	Health Commsn
6	"	461·3	30°	V	2,400	461·10	Wee Waa	Mobile	N	?	?	Douglas Hall
7						461·275	Sugarloaf	Wickham	E	V	50W	Mayne Nickless
8	Culgoora	413·5	300°	V	60,000	413·500	Mt Dowe	Wee Waa	WNW	H	10W	Telecom
9	"	415·5	90°	V	1,000,000	415·50	Mt Dowe	Burren Jn	WNW	V	10W	Telecom
10	"	460·6	270°	—	75,000	460·600	Mt Helen	Quirindi	SW	V	5W	R. Hall & Son
11	"	462·7	270	—	?10,000	462·500	Gunnedah	Piallaway	SE	?	80W	Telecom
12	"	464·8	270	—	380,000	465·00	Mt Oxley	Bourke	W	V	10W	Telecom

SOUTH-EAST AUST