INTERFERENCE SURVEY III

RESUME

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 interfering signal strengths over periods ranging from 30 minutes, 6 hours to 3 days.

SECTION A

Outline of results obtained

The accompanying figures A-1 to A-5 indicate the interfering 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 terrestrial 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 emanate 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.

610/660 MHz and 643 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>
<thead>
<tr>
<th>TABLE B-11 HARMFUL LEVEL CONVERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.T. PARAMETERS</td>
</tr>
<tr>
<td>FREQ (MHz)</td>
</tr>
<tr>
<td>327</td>
</tr>
<tr>
<td>408</td>
</tr>
<tr>
<td>610</td>
</tr>
<tr>
<td>843</td>
</tr>
</tbody>
</table>

KEY

AST-B/W Astronomical (protected) bandwidth
OUCH1 Estimated harmful system temperature increase in 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 at 500K
PWR10 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 occurred 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 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 MHz and 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
CIRCULAR POLARISATION: DIRECTION 0

CULGOORA 28/2/84
CIRCULAR POLARISATION: DIRECTION 90

CULGOORA 28/2/84
CIRCULAR POLARISATION: DIRECTION 180

CULGOORA 28/2/84
CIRCULAR POLARISATION: DIRECTION 270

FIGURE A-4

HL: Harmful Level

A: Astronomical Band
<table>
<thead>
<tr>
<th>Site</th>
<th>Reported</th>
<th>Nearest Frequency</th>
<th>Xmitter</th>
<th>Receiver</th>
<th>Bearing</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S-Spring</td>
<td>350.5</td>
<td>30,000</td>
<td>MT. Glorious Aircraft</td>
<td>NE</td>
<td>100w</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>355.9</td>
<td>350.30</td>
<td>KINGS TABLE</td>
<td>SSW</td>
<td>100w</td>
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<tr>
<td>4</td>
<td></td>
<td>413.9</td>
<td>413.750</td>
<td>Mt GemCoath Coona</td>
<td>S</td>
<td>SW, Grain Handling</td>
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<tr>
<td>5</td>
<td></td>
<td>460.9</td>
<td>460.700</td>
<td>Mt GemCoath Dubbo</td>
<td>H</td>
<td>1w Health Commission</td>
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<tr>
<td>6</td>
<td></td>
<td>461.3</td>
<td>461.10</td>
<td>WeeWaa Mobile</td>
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<td>?</td>
</tr>
<tr>
<td>7</td>
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<td></td>
<td>461.275</td>
<td>Sugarloaf Wickham</td>
<td>E</td>
<td>50w Mayne Nichless</td>
</tr>
<tr>
<td>8</td>
<td>Colacora</td>
<td>413.5</td>
<td>413.500</td>
<td>Mt Dune WeeWaa</td>
<td>WNW</td>
<td>10w Telecom</td>
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<tr>
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<td>WNW</td>
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<tr>
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<td></td>
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<td>460.600</td>
<td>Mt Helen Quinidi</td>
<td>SW</td>
<td>5w R. Hall &amp; Son</td>
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<tr>
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<td>462.7</td>
<td>462.500</td>
<td>Grannedah Paylaway</td>
<td>SE</td>
<td>80w Telecom</td>
</tr>
<tr>
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<td></td>
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<td>465.00</td>
<td>Mt Oxley Bourke</td>
<td>W</td>
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