ATNF ATUC Memorandum

To: ATUC
From: John Reynolds
Date: 29 November 2004
Subject **Parkes 50cm RFI**

Summary
The Parkes 10/50cm receiver system installed in October 2003 continues to function well. The main limitation at present is Radio Frequency Interference (RFI) caused by Television transmissions in the 50cm band, both within and outside the nominal observing band (648-712MHz). The RFI, if unmitigated, threatens to make useful observing in this band very difficult.

The "in-band" interference can be mitigated to a large extent with specialised cancellation hardware. Mitigating the "out-of-band" interference without seriously degrading the sensitivity of the receiver remains a problem with no obvious solution at present. Shifting the observing band (upwards) remains a live option, but will have limited value until the "out-of-band" RFI problem is controlled.

Background
Historically 50cm observations at Parkes have exploited a gap in TV channel allocations in the area, however observations with the new receiver have struck two problems;

> The gap in channel allocations is closing rapidly as new Digital TV broadcast transmitters open up in and adjacent to the observing band,
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> The new receiver has a wider bandwidth than the old 50cm receiver and is also much more sensitive. However the new LNAs are also more susceptible to Intermodulation Distortion (IMD) and compression from out-of-band transmissions originating from Mt Canobolas, 100km distant.

The "in-band" TV transmissions originate from Mt Ulandra, 200km distant. Two transmitters have started within the last year – another three are due to start within the next 2 years. While strong enough to render observing very difficult if unmitigated, tests have shown that the effects of the RFI can be almost eliminated by the use of cancellation techniques. A 3m parabolic antenna at the Observatory now receives the interfering signals with high sensitivity and provides a template signal for the cancellation. Tests so far have furnished impressive results in cancelling the RFI from the astronomy signals, but specific hardware is required to perform the cancellation in real time. This hardware is currently in the design stage.

Eliminating the "out-of-band" RFI poses perhaps a more difficult technical problem at present. It is proving difficult to source LNAs with better IMD and compression properties without compromising the excellent sensitivity provided by the existing units. Placing filters ahead of the LNAs also degrades the system sensitivity unless these filters can be cooled, or unless they have very low insertion loss. Work is proceeding in attempting to identify the best overall solution. Meanwhile the only solution available to observers is to avoid observing at those telescope angles which are most susceptible to the out-of-band Mt Canobolas transmissions. A new software tool has been developed to assist observers in this.