Investigation of Possible Leakage from the X-band Waveguide Joints Project TBASEDSB030206, 06 February 2003

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Introduction

Spectral baseline structure exists in standard position switched data taken towards strong continuum sources for many of the Gregorian receivers. This structure is especially prominent when using wide bandwidths (800 MHz) and appears to be upstream of the first mixer and not related to the telescope optics. One theory is that small variations in the impedance match exists between the LNAs, feed, and OMT components.

The spectral baselines are particularly poor for the X-band receiver and seemed to get worse (if anything) when the new InP LNAs were installed. It was thought that leakage could result at the waveguide joints which might contribute to at least some of this baseline structure. Therefore, copper tape was placed around a couple of waveguide joints near the feed throat of the X-band receiver. Here we make some typical on-off measurements and compare with previous results.

The spectrometer was configured in single bank mode with a bandwidth of 800 MHz and 2048 channels, resulting in a frequency resolution of 0.391 MHz (1W2-001-800). The receiver to spectrometer connection matrix is shown in Table 1. The integration time was 30 seconds. All scans were taken at a sky frequency of 9000 MHz.

Continuum Source Spectra

Figures 1 and 2 compare the system temperature and antenna temperature before and after copper tape was placed on the waveguide joints. About 3 weeks

Table 1: Receiver to Spectrometer Connection Matrix

Pol	ODM	CM	SF	AC Sampler
LCP	6	9	1	0
RCP	8	13	5	1

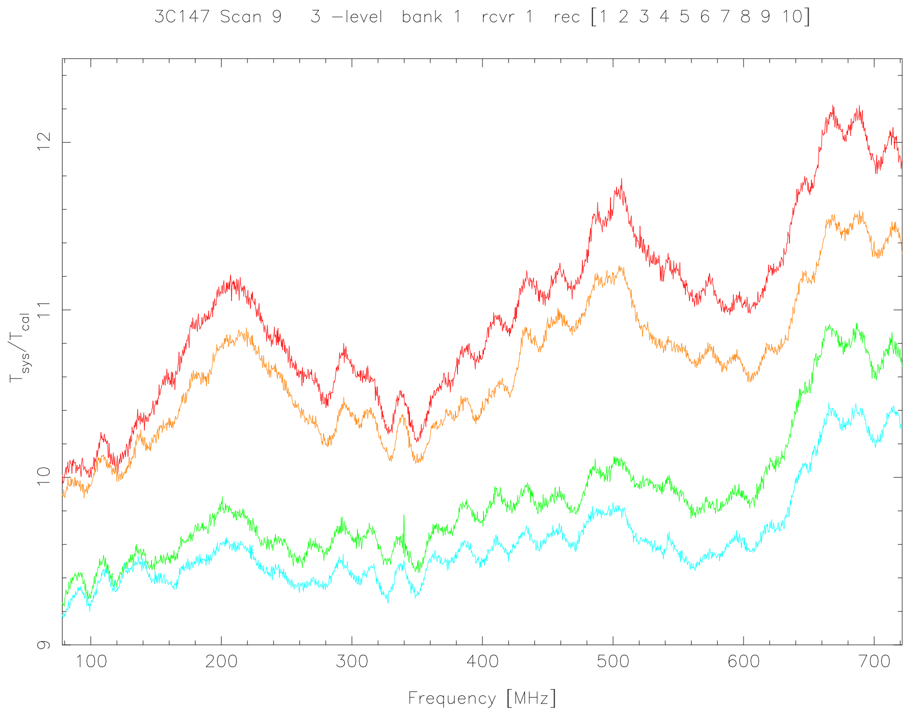

Figure 1: The system temperature (in units of the CAL) towards cold sky after 5 minutes of integration. The red and green curves correspond to LPC and RCP for project TBASEDSB030206 (scan 9) while the orange and green/blue curves correspond to LCP and RCP for project TBASEDSB030117 (scan 13). The data from TBASEDSB030117 have been offset by 1.1 and 0.8 for LCP and RCP, respectively.

separate the different observing sessions. Figure 1 plots the system temperature on cold sky in units of the CAL. The overall shape and detail are very similar. Figure 2 plots the antenna temperature towards 3C147 and 3C48 based on a single 5 minute, on-off pair. Even though the data were taken three weeks apart and the source continuum intensity is different, the overall baseline structure is very similar. It does not appear that the copper tape had any significant effect.

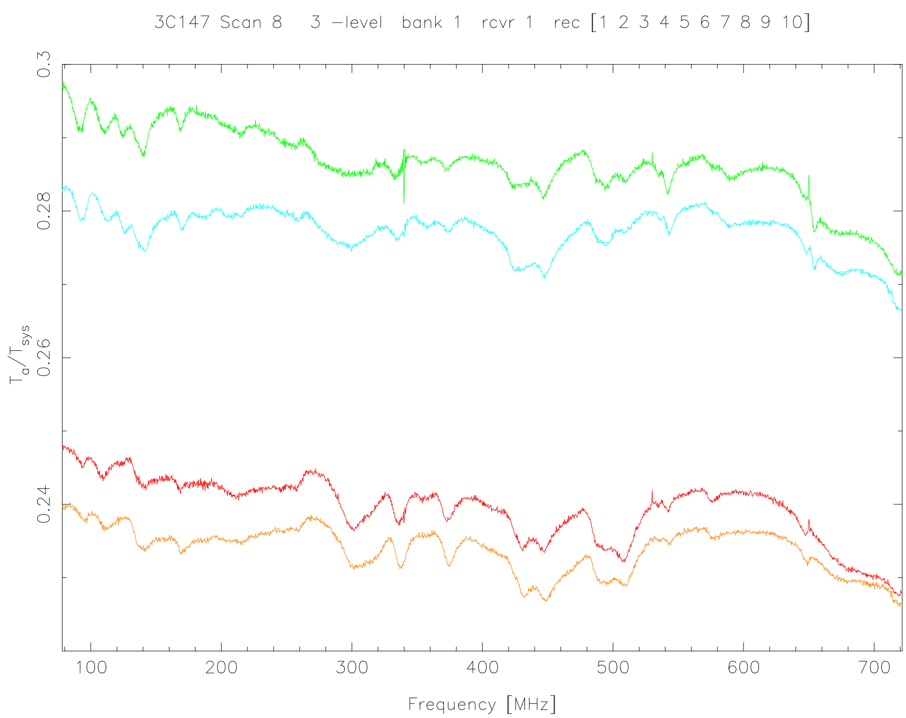

Figure 2: The antenna temperature (in units of the system temperature) for a 5 minute on-off measurement. The red and green curves correspond to LPC and RCP for project TBASEDSB030206 (scans 8,9; 3C147) while the orange and green/blue curves correspond to LCP and RCP for project TBASEDSB030117 (scans 5,6; 3C48). The data from TBASEDSB030117 have been offset by 0.05 and 0.065 for LCP and RCP, respectively.