NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

December 7, 1984

To: VLBA Electronics Group

From: Dick Thompson

Subject: VLBA Electronics Meeting, December 6, 1984

Attendees: Balister, Bradley, Brundage, Campbell, D'Addario, Dill, Henderson, Kellermann, Lillie, Mauzy, Moffet, Napier, Norrod, Schlecht, Sebring, Thompson, Walker.

Cryogenics

H. Dill reported on his visit to CTI on November 26. We now have four model 22 units back for rework. Two of them had some original bolt holes drilled out by NRAO for mounting. CTI will fit thread inserts and we will modify our mounting arrangement. It appears that CTI does not contemplate any design modification of the model 22, but expects to achieve 10,000 hours MTBF by improving tolerances and inspection of parts. For further details see VLBA Electronics Memo No. 31. Harry also reported that the radio astronomy group at Berkeley has been achieving 16,000 hours MTBF with their model 21 units.

On the cryogenics test setup at Green Bank, R. Norrod reported that four model 22 units are running, one of which is approaching 3,000 hours and one 2,500. The first of these has been run without any interruption, and is showing an increase in temperature from approximately 14 K to 20 K. We will continue to run it until maintenance becomes necessary.

Front Ends

R. Norrod gave details of the performance of the L-band front end. The system temperature averages 12.5 K over the 13.5 to 17.5 GHz range, with variation of ± 2 K. This is within about 2-3 K of the best Green Bank system in which the polarizer is cooled to 15 K. Thus the receiver performance is very good. In cooldown the second stages reaches 13-14 K in 18-24 hours and the orthomode transition stabilizes at about 70 K after 30 hours. Although tests indicate that, when cold, the system still has some reserve capacity, Roger felt that the long cooldown time suggests further cooling capacity is desirable, and recommended

that the design be modified to accommodate a model 350 refrigerator. This would increase the cooling capacity by a factor of 2 to 3, and the total weight of the front end by 10 to 20 pounds. The present unit weighs 87 pounds This idea met with general approval and no serious objections. It was therefore decided to construct the next 1.5 GHz front end using a model 350 refrigerator, and that if no unforeseen problems arise, this will become the standard design for this band. There was some discussion of whether operational considerations place a limit on the accetpable cooldown time, but it was generally felt that this is not the case. The long cooldown is simply undesirable because it indicates too little margin in cooling power. From this viewpoint we do not have any hard figure for acceptable performance, but 20-30 hours seems too long, 10-12 hours is probably alright.

The results of a meeting on Dec 3, which concerned plans for the 23 and 43 GHz front ends, were briefly discussed. It was decided at that meeting that a HEMT amplifier for 15 K operation would be developed for 23 GHz, and an SIS mixer system for 43 GHz. For further details see VLBA Electronics Memo No. 32.

P. J. Napier reported that the 8.4 GHz prototype front end at the VLA has been installed on an antenna, and the system temperature has been estimated as 42-43 K on one channel and 43 K on the other, which is highly satisfactory. These figures are based on the calibration of the built-in noise source as measured in Charlottesville.

Feeds

Peter Napier also discussed the performance of the 4.8 GHz feed. The proposed design is the conventional one (as distinct from the broadband design). The feed will be optimized for the 4.6-5.0 GHz band, and at 6.1 GHz the subreflector is then slightly under-illuminated. However, the resulting efficiency at 6.1 GHz is only about 5% less than that for an optimized design for that frequency.

Local Oscillator

R. Mauzy reported good progress with the synthesizer bread-board. He has measured the phase stability of the comb generator that will drive the harmonic mixer, and found it to be 0.25 deg per deg C per GHz for temperature variation, and 0.2 deg per dB for the 500 MHz drive-level variation. These values are the largest variations measured and are a preliminary indication of acceptable performance.