

## NATIONAL RADIO ASTRONOMY OBSERVATORY

MEMORANDUM

March 26, 1984

To: Distribution  
 From: C. Brockway  
 Subj: 140-ft K-Band Maser Noise Temperature

I have been asked by S. Weinreb to set down the measured noise performance of the K-band maser system on the 140-ft telescope.

There have been two different K-band receiving systems used at the 140-ft. The first was a single band, single channel receiver using a four-stage maser with 33 dB net gain and about 200 MHz instantaneous bandwidth. It was used with a VLA type smooth wall, rectangular feed that was coupled by waveguide to the maser input circulator with no in-line components except for a waveguide window and noise coupler. This receiver has been replaced with a four-band system with about 30 dB net gain and 400 MHz bandwidth and a Rick Fisher designed corrugated wall feed. The K-band receiver noise temperature is about 10 degrees higher for the four-band system.

The first receiver type is more like a potential VLBA K-band maser due to the direct coupling between feed and maser. The noise performance of the receiver at 22235 MHz is:

$$T'_R = 16 \text{ K}$$

$$T_R = 32 \text{ K}$$

where  $T'_R$  is the receiver noise at the dewar input flange measured using hot-cold (ambient - LN<sub>2</sub>) absorber loads over a test feed and  $T_R$  is the receiver noise measured at the system feed aperture using the same absorber loads.

Figure 1 is a typical tipping scan; this one showing a zenith optical depth of 0.10. The noise at zenith due to atmosphere is calculated as 27 K meaning the sum of spillover, scatter and background is about 7 K. The system noise is given by:

$$T_{\text{sys}} = 39 \text{ K} + T_{\text{atm}}$$

Figure 2 shows the noise distribution.

There is information available on two other K-band systems using similar masers:

1. OVRO - Richard Moore memo of June 24, 1982

$$T_{\text{sys}} = 35 \text{ K} + T_{\text{atm}}$$

2. CSIRO - R. X. McGee memo of July 17, 1981

$$T_{\text{sys}} = 44 \text{ K} + T_{\text{spillover}} + T_{\text{sky}}$$

I think the CSIRO system used a ferrite beam switch in front of the maser.

CJB/cjd

Enclosures

22.235 GHz TIPPING SCAN

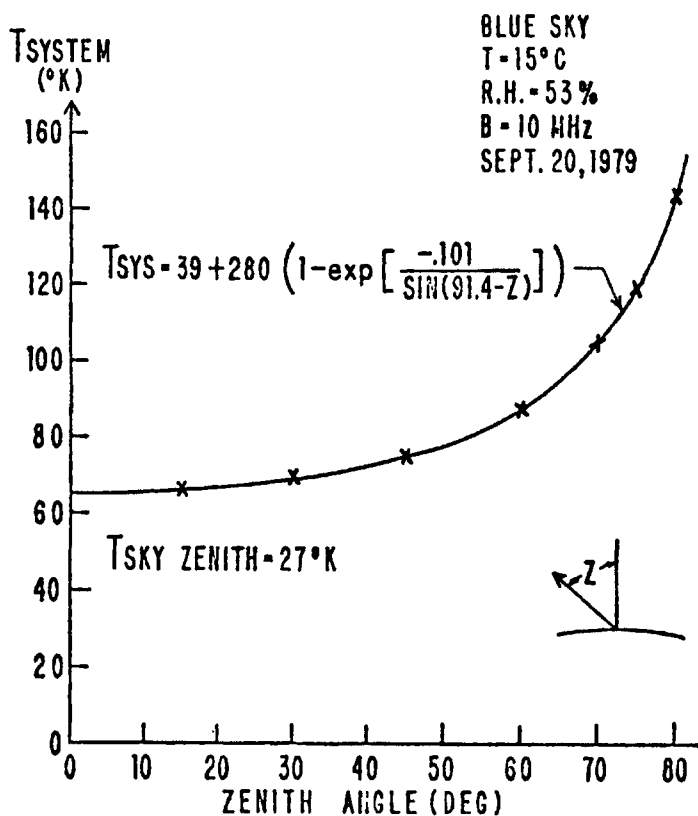


FIGURE 1

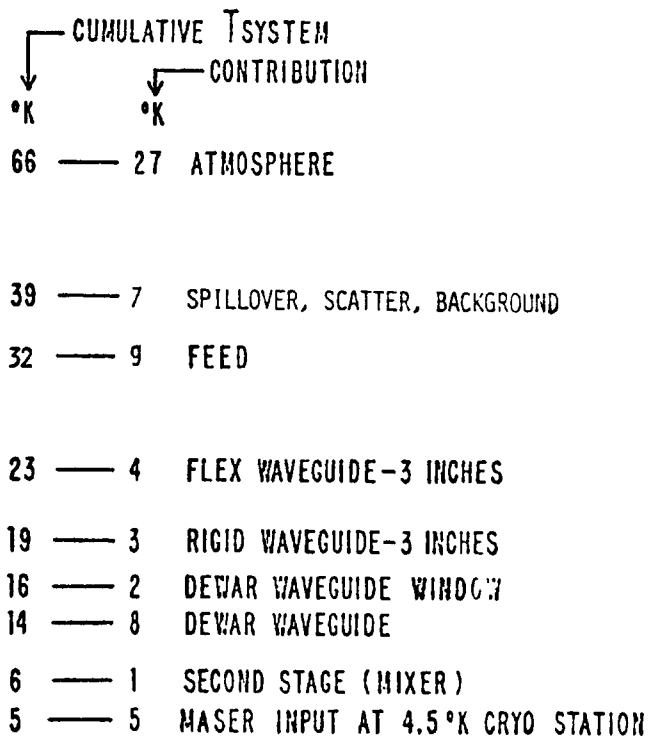


FIGURE 2

MASER RECEIVER NOISE CONTRIBUTIONS  
22 GHz