

NATIONAL RADIO ASTRONOMY OBSERVATORY
SOCORRO, NEW MEXICO
VERY LARGE ARRAY PROJECT

VLA ELECTRONICS MEMORANDUM NO. 144

MEMORANDUM

August 15, 1974

To: S. Weinreb
From: M. Balister
Subj: Cooled Mixers and Spurious Signals

Both the cooled mixers in the VLA prototype receiver produce spurious signals in the 4.5-5.0 IF frequency range. They are produced by the mixing of the paramp pump and harmonics with the mixer LO signal and harmonics. The most serious spurious signal is produced by the K-band mixer and results from the mixing of pump and the 2nd harmonic of the LO.

$$\begin{aligned} 2 \times \text{LO (GHz)} - \text{Pump (GHz)} &= \text{IF (GHz)} \\ 36.335 - 31.835 &= 4.5 \\ 36.835 - 31.835 &= 5.0 \end{aligned}$$

This occurs for an LO frequency range 18.1675 - 18.4175 GHz which corresponds to a 22.917-23.167 signal frequency.

The Ku band mixer has a spurious signal output resulting from the mixing of the second harmonic of the pump and third harmonic of the mixer LO.

$$\begin{aligned} 2 \times \text{Pump (GHz)} - 3 \times \text{LO (GHz)} &= \text{IF (GHz)} \\ 63.67 - 59.17 &= 4.5 \\ 63.67 - 58.67 &= 5.0 \end{aligned}$$

This occurs for an LO frequency range 19.552-19.723 GHz which corresponds to a 14.807-14.973 GHz signal frequency.

These are the worst spurious signals. There are more lower level ones which have not been identified yet.

The pump signals get into the mixer via three routes:

- 1) The IF connection. A radial line choke tuned to 31.835 GHz has been incorporated in the K-band mixer; it gives at least 30 dB rejection. The same choke could be incorporated into the Ku band mixer.
- 2) The bias connection. The bias line was at one time picking up the pump radiated by the paramp housing and paramp bias lines. This has been reduced to a negligible level by using a coax line (stainless inner and outer) on the bias connection and terminating it on the 70°K station at an OSM RFI feed-through (OSM 238).

- 3) The signal input. The Ku mixer has a low pass input filter; however, its rejection at 31.835 GHz has not been measured. The gapped junctions are presumably letting the pump into the signal port. An extra choke ring outside the signal frequency choke may be a good idea here.

These signals do not appear to be serious, provided care is taken when observations are made close to the frequencies mentioned. However, since the possibility exists that they may be in the future troublesome, I would suggest taking some of the steps mentioned to further reduce their level.

MB/cjd

Copies to:

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