EVLA Feed CDR:
Review Panel Report

Gary Anderson (NRAO), Germán Cortés (Cornell), Bruce Veidt (DRAO)

17 February 2005

1 Introduction

The EVLA Feed CDR Review Panel is impressed with the design solutions that have been developed for the EVLA feeds. The process from design and fabrication to installation is well thought out. The design team is to be commended on excellent horn designs which will greatly increase both the sensitivity and the frequency coverage of the VLA.

Although not within the scope of this CDR, the orthomode transducer design that was presented appeared to be an excellent solution to the problem of resonances and "suckouts" in the frequency response of such devices.

2 Recommendations

The Review Panel has the following recommendations.

1. We feel that understanding RFI containment is the most critical issued facing the feed upgrade. Preliminary tests have shown that there is electromagnetic coupling from the interior of the vertex room to the waveguide input of the L-band receivers. One possible leakage path is through the joints in the walls of the feed. However, production of the L-band feeds has commenced even though the coupling route has not been determined. Thus it is important to quickly establish whether modifications to the horn fabrication process are required. We recommend the following steps:

   (a) Determine whether the level of leakage is significant to astronomical observations.

   (b) If the leakage is found to be significant, then the coupling mechanism or path must be determined.

   (c) If the leakage path is found to be through the joints in the ring and band construction of the horn then methods to improve joint conductivity, such as welding, should be investigated.

2. We recommend that radiation pattern measurements be done to confirm that there is no significant interaction between the Q- and Ka-band horns and their respective mounting tubes.

3. We recommend to maintain a step-by-step description of horn fabrication processes in order to preserve "shop floor" knowledge and to ensure uniformity of the horns throughout a production run.

4. Concerning the outdoor antenna test range, we wonder if the foundation for the azimuth rotator is large enough for the over-turning moment of an L-band feed on top of the foam pillar.

5. A written test procedure needs to be developed for antenna pattern measurements to ensure uniformity.

6. Given the time and expense of measuring radiation patterns, it has been proposed that spot checks (around one out of five feeds) be made unless there is significant deviation in the return loss of a new feed in comparison to a prototype feed, in which case the radiation pattern of the new feed would be measured. We recommend that reducing the number of patterns measured be done with caution since there are scenarios where a horn with a satisfactory return-loss measurement may not have compliant radiation properties. For example, a slight ellipticity in the cross-section of a horn might not perturb the return loss significantly but may result in a serious degradation of polarization performance.

7. We suggest particular caution in the production of the laminated feeds because they are largely hand-made and thus more prone to error than CNC-machined feeds.

8. The C-band feed results displayed a taper anomaly at 7.2 GHz which deserves further attention. Is this due to an error in measurement or is it due to a resonance in the feed? Given that the frequency-sampling interval is rather coarse, is it possible that there are other anomalies hidden between sample points? If this is a real effect, how significant is it to astronomical observations?

3 Conclusions

The Charge to the Review Panel posed four questions. Those questions and our responses are:

1. *Are the detailed requirements for the subsystem complete and adequate?*
   Yes.

2. Will the design selected for implementation meet the requirements?
   Yes, if recommendations 1, 2, and 8 are acted upon.

3. *Are the interfaces to other subsystems defined adequately and completely?*
   Yes. The waveguide interface is trivial and the mechanical interface to the reflector antenna structure (through the feed cone) is strong, efficient, and simple to produce.

4. *Has adequate attention been given to the production and maintenance of the equipment?*
   Yes, if recommendations 3, 5, 6 and 7 are acted upon.