VLBA Electronics Memo No. 93

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NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia
August 6, 1987

To: VLBA Electronics Group

From: A. R. Thompson

Subject: VLBA Electronics Group Meeting, Aug 4, 1987

Attendees: Bagri, Balister, Bradley, Brundage, Campbell, Lilie, Morris, Napier, Norrod, Oty, Schlecht, Stetten

Progress of 1987 construction was reviewed. Front ends through serial no. 3 have been completed for 1.5 and 4.8 GHz, so that at Green Bank the remaining VLBA construction for front ends in 1987 consists of two more for each of these two bands, and one for the 2.3 GHz band. For the 1.5 and 4.8 GHz units, machine shop work is the pacing factor. For the 2.3 GHz front end, tests of cooldown of the Dewar (without amplifiers) will be made this week, and a prototype amplifier will shortly be tested in the lab. Tests of the completed front end are unlikely to occur before October. For 8.4 GHz, the front end to be installed on the Pie Town antenna is under test at the VLA site. For 23 GHz, one front end is almost complete in the lab at Charlottesville, and the goal is to complete three more by the end of the year. Several minor problems have slowed down the progress on the first 23 GHz front end. New quartz cooling fins have had to be ordered for the cold load, to replace ones that were damaged. Also, delivery of the mixers to be used to convert the signal to the 8.4 GHz band has been delayed by over six weeks. It is expected that the first 23 GHz front end should be completed by the end of September.

In the area of racks and modules, four more 2-16 GHz synthesizers will be needed by the end of the year, and six such units are now in construction at Green Bank. Two each of racks A, B, and C with associated power supplies, LO modules, converter modules, etc. are also required, and will be constructed in Charlottesville. Some further manpower may be necessary to assist in construction of modules which contain large amounts of internal wiring.

During 1988 it is expected that the VLBA electronics division in Charlottesville will take responsibility for construction of Data Acquisition racks, beginning with serial no. 5. Construction of some of the modules, in particular the Baseband Converter, may continue to be done at Haystack.

There was some discussion of the best way to ensure that emission from the Sowrball radar, to be installed near Kitt Peak, cannot damage the VLBA L-band front end. Damage could occur only when the beams of the radar and VLBA antennas are pointing directly at one another, in which case the peak power received would be about 400 mW. To avoid any problem, power at the L-band input should never be allowed to exceed a level 10 dB below this figure. Possible schemes to preclude damage include a filter at the L-band front-end input, a shutter in the input waveguide opened under computer control only after the antenna pointing has been checked, or a software or hardware limit on the antenna elevation.

Serious interference is possible at the Mauna Loa site in Hawaii, from a 100 kW FM station to be constructed about two miles distant from the VLBA antenna site under consideration. At the two-mile distance the field strength of the transmitter would be about 0.5 vm^{-1}, which could be expected to infiltrate shielded cables at the level of a few hundred microvolts. It was concluded this would present a very difficult environment in which to operate a VLBA antenna.

The Electronics Group meetings for the months of May through July have been brief, and have not been summarized in individual memoranda. Some of the more important points that were discussed are as follows. After a few early problems, the model 22 refrigerators on 8.4 GHz front ends on the VLA have shown an encouraging degree of reliability. A total of 22 front ends with model 22 refrigerators are running cold at the VLA site. Half of these are on antennas and half on a lab test setup. All have had the original carbon bushings replaced by Envex or Vespel bushings, and three have the modified Scotch yoke. So far there have been no failures associated with the new bushings or yoke design. It has been decided to include a coaxial transfer switch in the converter modules for most of the receiving bands. This switch would interchange the signals for the two opposite polarizations from the front end, with the purpose of helping to locate failures in the RF or IF signal paths. These 'diagnostic transfer switches' will be controlled through the General Interface Module. Extensive testing of the relative phase stability of systems serial no. 1 and serial no. 2 has been performed by Durga Bagri at the VLA site. System no. 2 was set up inside the shielded room in the VLA electronics lab, and system no. 1 in the lab outside the shielded room. Front ends were not included in these tests. Signals were fed into the 1.5 GHz and 4.8 GHz converter modules, and the change in relative phase of the corresponding IF or baseband signals measured as the temperature in the shielded room was varied by about 20 deg F. Changes in the relative phases of the local oscillator signals were also measured. Overall temperature coefficients of phase are in the range of 1 to 2 degrees GHz^{-1} K^{-1}. These results are considered to be satisfactory.