VLB ARRAY MEMO No. 584

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TESTING OF THE VLBA ELECTRONICS AT THE VLA SITE

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Electronics for the Pie Town antenna was shipped from Charlottesville to the VLA site and arrived there at the beginning of October. This equipment consisted of racks of type A, B, and C, and front ends for 330/610 MHz, 1.5 GHz, 4.8 GHz, 10.7 GHz and 15 GHz. The Data Acquisition rack, less the formatter unit, was shipped from Haystack Observatory and arrived at the VLA site towards the end of October. Tests of basic operation on all of these units had been performed before shipping, and more detailed tests of the integrated system have been started and are progressing at the VLA site. Trips to the VLA for these tests have to date been made by Dick Thompson (October 12-18 and November 9-15) and Erich Schlecht (October 27-November 1), and the testing program is being continued by Durga Bagri and Jim Oty. Some planned modifications resulting from these tests are given in VLBA Electronics Memorandum No. 83.

The following is a list of the tests which it is planned to perform, in as much detail as time and facilities allow, before the equipment is installed on the Pie Town antenna. This installation is expected to begin in March 1987.

1. Checking of power supply voltages, differences in ground potential between racks, etc., and levels of noise on power supply lines.

2. Checking of LO reference levels, correct operation of phase lock loops, locking of 2-16 GHz synthesizers at correct frequencies.

3. Checking of signal levels and passband shapes at various points along the RF, IF, and baseband paths.

4. Checking that units will operate over power supply voltage variation of, say, ± 5% from the nominal.

5. Computer interfacing through the M/C system: control of front ends, IF and LO switching, synthesizer tuning, etc., and readback of all monitor points.

6. Interconnection of 1 Hz timing pulses, and 5 MHz reference waveforms from rack C to the computer and the Data Acquisition and Recorder racks.

7. Measurement of receiver noise temperatures for available front ends and checking of operation of switched noise sources.

8. Search for spurious responses, with dual-band operation for suggested dichroic modes.

9. Checking of levels of image responses.

10. Connection of IF signals to the Data Acquisition rack, and checking of tuning of baseband LO (10 kHz steps), sideband separation level of baseband converters, and range of baseband ALC.

11. Checking for RFI from digital systems: computer, M/C interfaces, formatter (N.B. some of these will be in the shielded room of the station building and this location will affect levels that can be tolerated.) We can use 330/610 MHz front ends to detect the interference.

12. As a check of reliability, keep system powered up as much of time as possible.

13. Cross correlation signals from different baseband channels recorded on the same tape, using a common noise source to provide a correlated component. This method can be used to measure the following characteristics:

    a) differential instrumental delay between channels
    b) instrumental closure
    c) stability of differential phase delays
    d) cross coupling between channels and sidebands
    e) dynamic range (i.e. amplitude and phase of the correlated signal as a function of input level)
    f) spurious LO signals too close to the carrier to be seen on a spectrum analyzer, and low-level 500 MHz harmonics
    g) recorder error rates
    h) DC offsets in the samplers

14. Recording of data on 3C84 from four VLA antennas onto four tracks of a tape. This procedure would require converting the VLA baseband signals up to the VLBA IF range by adding, say, 600 MHz. It would test the Data Acquisition and Recorder racks.

15. Recording of data with four-level quantization in test 13 or 14 above. These data could be processed on the Haystack Mark III correlator using a multiple-pass procedure.

Since test no. 14 above does not involve racks A, B, and C or any front ends, it could be performed after the start of outfitting of these items at Pie Town. It would, however, require a station computer at the VLA to control the Data Acquisition and Recorder racks.

The signal and LO power levels at various points are determined by cable attenuations that can be estimated to within a few decibels only at this time. These will be established more accurately after installation on the antennas. Measurements of phase stability as a function of temperature, power supply levels, etc. can best be performed with at least two systems in the lab and will be performed on two later systems (2 and 3 or 3 and 4). Tests of the round trip phase measurement must await further work on the round trip phase modules, and should be possible before the end of the test period.