

Report of Ad Hoc Committee on Sampling and Channels

Members: A. Rogers (convenor), M. Ewing, B. Clark (reporting)

Meetings: February 28, March 4 1983

1. Sampling.

A. Rogers points out that sampling errors in multilevel samplers can produce spurious responses to a nearly sinusoidal signal. This may have grave consequences in detecting weak emission colocated with a strong maser line, or very weak emission nearby. For this reason, and in order not to preclude efficiently playing Mk III format data into the VLBA processor, two level sampling must be supported. For weak line problems (eg absorption measurements or extragalactic masers) the improvement in signal-to-noise ratio of multibit sampling is substantial. For this reason, three- or four-level sampling must be supported.

Samplers will be designed with three comparators. The reference voltage for the two magnitude comparators will be adjustable from 0.6 sigma (optimum for three level sampling) to 0.8 sigma (optimum for four level sampling).

It is hoped that the correlator may be designed for processing full four level sampling. If, due to exigencies of design time or chip size, this cannot be accomodated, either three-level or four-level-with-reduced-number-of-channels will be implemented. The latter may be implemented at the system level, as a four-level correlator may be synthesized from a two-level correlator and two three-level correlators which handle the cases in which the magnitude bits are the same. The possibility is not yet precluded that both of these might be supported, by setting sampler comparator thresholds at an intermediate level.

2. Coding.

Data will be encoded for the binary recording system as either one bit per sample or as two bits per sample. It is recognized that this results in substantial waste of tape and recorder bandwidth for a three level mode, but this is not construed to be of importance in the practical cases.

Filter widths, sample rates, and sampling will be under independent control of the observer, so that a wide range of choices of multi-level and over sampling is available.

The system of sample packets, and of the interfaces to the recording system, is to be designed to permit a wide range of choices of number of channels and sample rates per channel. These should be constrained only by the recording system capacity: 200 Mbits/second maximum, 100 Mbits/second for normal 24 hour unattended operation. The recording system should be designed so that if substantially less than 100 Mbits/second is required, a saving in tape usage results. A maximum flexibility in this regard is worthwhile, with steps as consonant as

convenient with the sample rates given below, and a capability of reducing tape usage by up to perhaps an order of magnitude.

### 3. Channels.

The recommendations of Memo 164 are accepted that the full system comprise 16 I. F. to video converters, 32 samplers. The following baseband filter widths are recommended:

32 MHz	24 MHz
16 MHz	12 MHz
8 MHz	
4 MHz	
2 MHz	
1 MHz	
500 kHz	
250 kHz	
125 kHz	

The following sample rates will be supported:

- 64 MHz \*
- 48 MHz
- 32 MHz
- 24 MHz
- 16 MHz
- 8 MHz
- 4 MHz
- 2 MHz
- 1 MHz
- 500 kHz
- 250 kHz

\* multi-level sampling will not be supported at this rate.

### 4. Implementation.

For practical or financial reasons it may be desired to curtail implementation of the full system at some or all stations. The system should be designed and modularized to make this practical. Specifically, it should be possible to implement less than the full set of I. F. to video converters (but at least four at each station should be initially implemented). Alternatively, if the full set of converters and samplers is provided, the full set of baseband filters need not be provided on more than the first four samplers.

The design goal of the correlator is the support of a full four level capability at a sample rate of 32M per second, with two level processing at 64M per second. If necessary to meet design or construction schedules, a reduced capability with three level processing or a smaller number of channels at four levels (as mentioned above) will be implemented; however, some form of multilevel processing will be implemented in the correlator from the beginning.