

NATIONAL RADIO ASTRONOMY OBSERVATORY

Technical Data Sheet
February 1987

No. 17
Page 1 of 2

140-ft Cassegrain Receiving System

Geometry

An offset configuration is used in which an asymmetric hyperboloidal subreflector rotates about the telescope axis and illuminates one of three possible locations on a feed circle. The feed circle defines a focal plane orthogonal to the telescope axis and located several feet above the paraboloid vertex. Feeds over twin receivers are located on opposite sides of the feed circle and a polarization sensitive passive beam splitter is on the circle midway between. For dual receiver operation, the subreflector is focused on the splitter which then reflects orthogonal linear polarized signals to ellipsoidal reflectors positioned over each feed. For single receiver operation, the feed reflector moves out of the way to permit a direct path between feed and subreflector. The beam splitting system can be used over the frequency range of 7.6-25 GHz; any frequency combination in this range is possible. Beam splitting is not available for frequencies below 7.6 GHz. Performance tests on the beam splitter are on-going and potential users should check with the receiver engineer.

Receivers

The low-noise amplifier is an 18-25 GHz reflected wave ruby maser with a gain of 33 dB and a mid-band instantaneous bandwidth of 380 MHz. Frequencies extending down to 4.7 GHz are translated to the maser frequency range using one of three varactor upconverters. Maser and upconverters are cooled to 4.5 K in a three-staged closed-cycle helium cryocooler. Frequency coverage and noise temperatures are given in the NRAO Front-End Box Status Sheet (Technical Data Sheet No. 12).

Feeds

There is a separate feed for each of the four frequency bands. All are corrugated conical horns and one at a time is mounted over the receiver. The time needed for a band change, including feed replacement, is about four hours.

Subreflector Corrections

There is a controlled shaping of the subreflector surface as a function of telescope elevation to compensate for astigmatism distortion of the paraboloid. The subreflector focus is also controlled to track the paraboloid best fit focus which moves laterally due to other surface deformations. The combination substantially improves beam shape and aperture efficiency particularly at low elevations.

Beam Switching

The subreflector is periodically tilted (nutated) for beam switching. Maximum beam throw on the sky is 18 arc minutes and is fixed in direction. The beam can be offset up to plus and minus 12 arc minutes. The nutation rate is adjustable up to 4 Hz with a transition time of 50 milliseconds. Nutation can be synchronized to the continuum backend system or to the autocorrelation receiver.

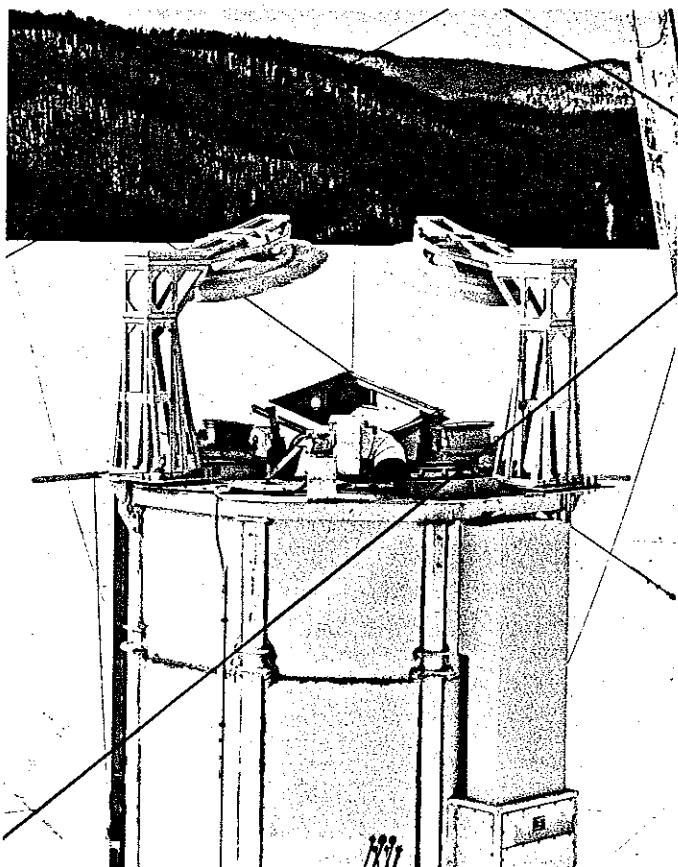
Options

For front-end frequency switching, steps up to 1 GHz are possible with a switching time of less than 8 milliseconds. Noise adding is available at all frequencies on a requested basis, and can be synchronized with the nutating subreflector in addition to total power observing. An IF polarimeter is used together with the beam splitting system for polarization measurements in the 7.6-25 GHz range. Circular polarization can be provided in the 4.7-7.2 GHz range on a requested basis.

Further Information

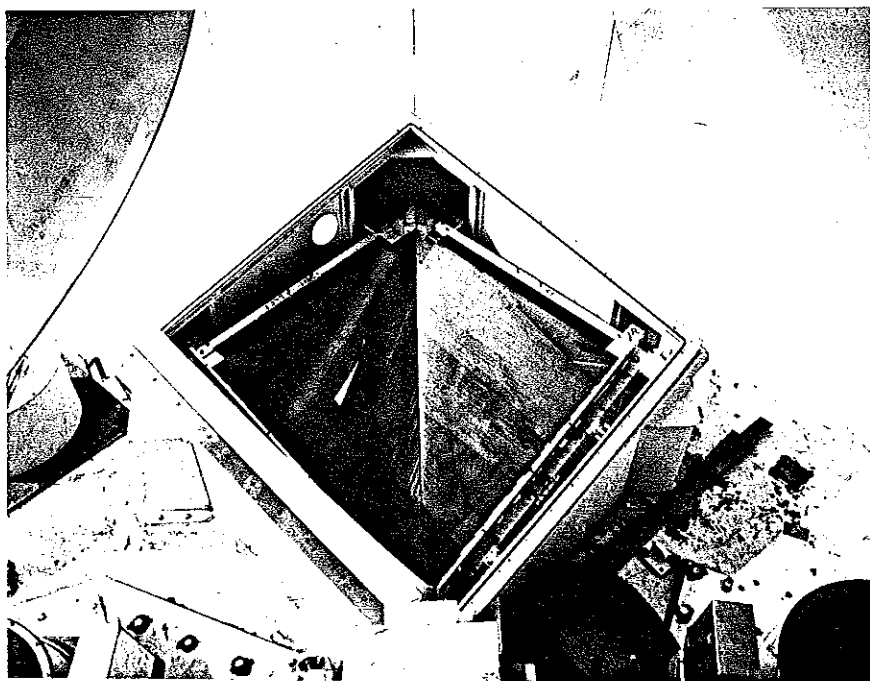
Electronics Division Technical Note No. 106 provides information about the calibration of the receiver and can be obtained from the Electronics Division secretary in Green Bank. Chuck Brockway is the receiver engineer and users are encouraged to discuss their plans and needs with him in advance of their observing runs.

140 FT. BEAM SPLITTING SYSTEM

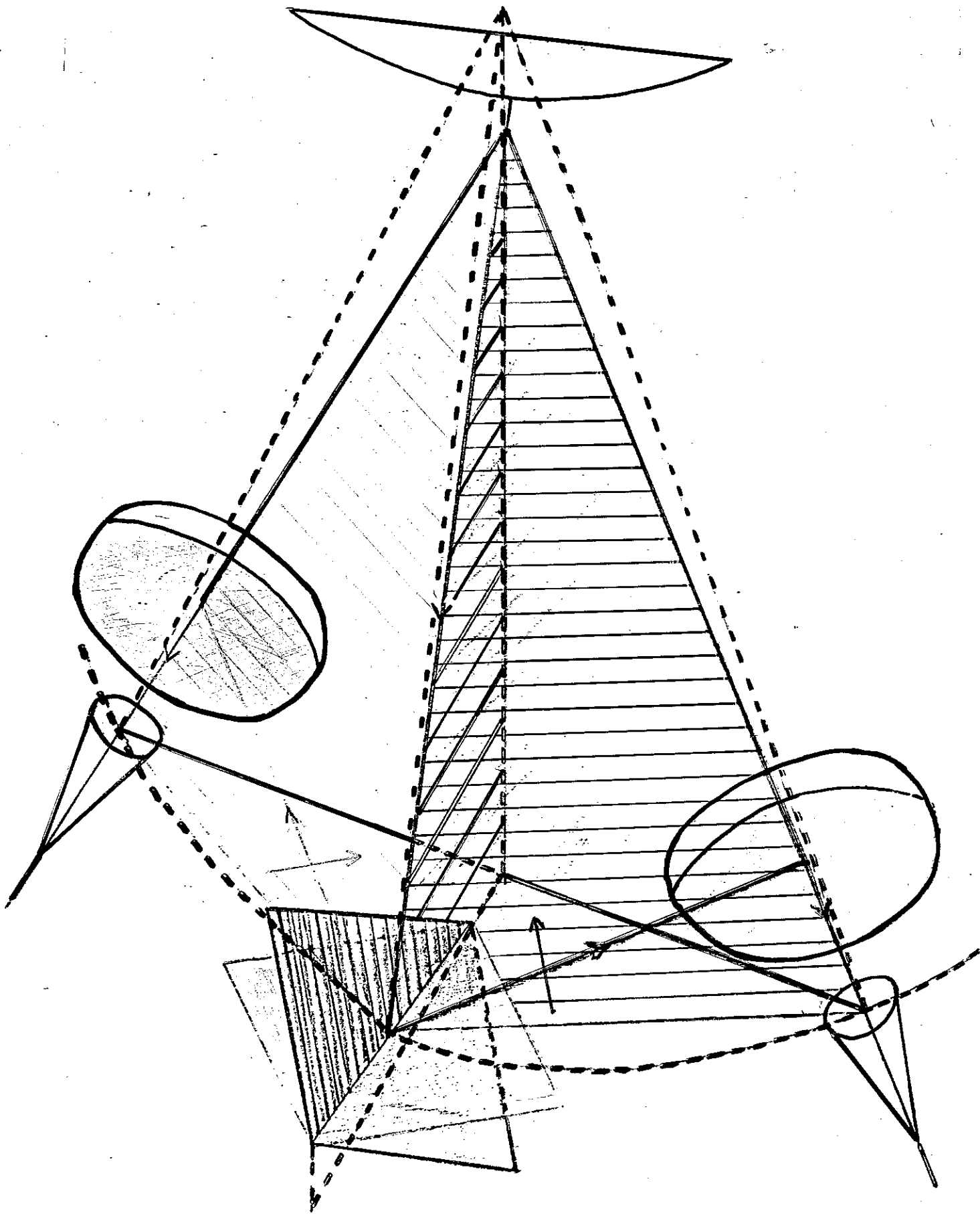


2.5-25 GHz SPLITTER AND
FEED REFLECTORS.

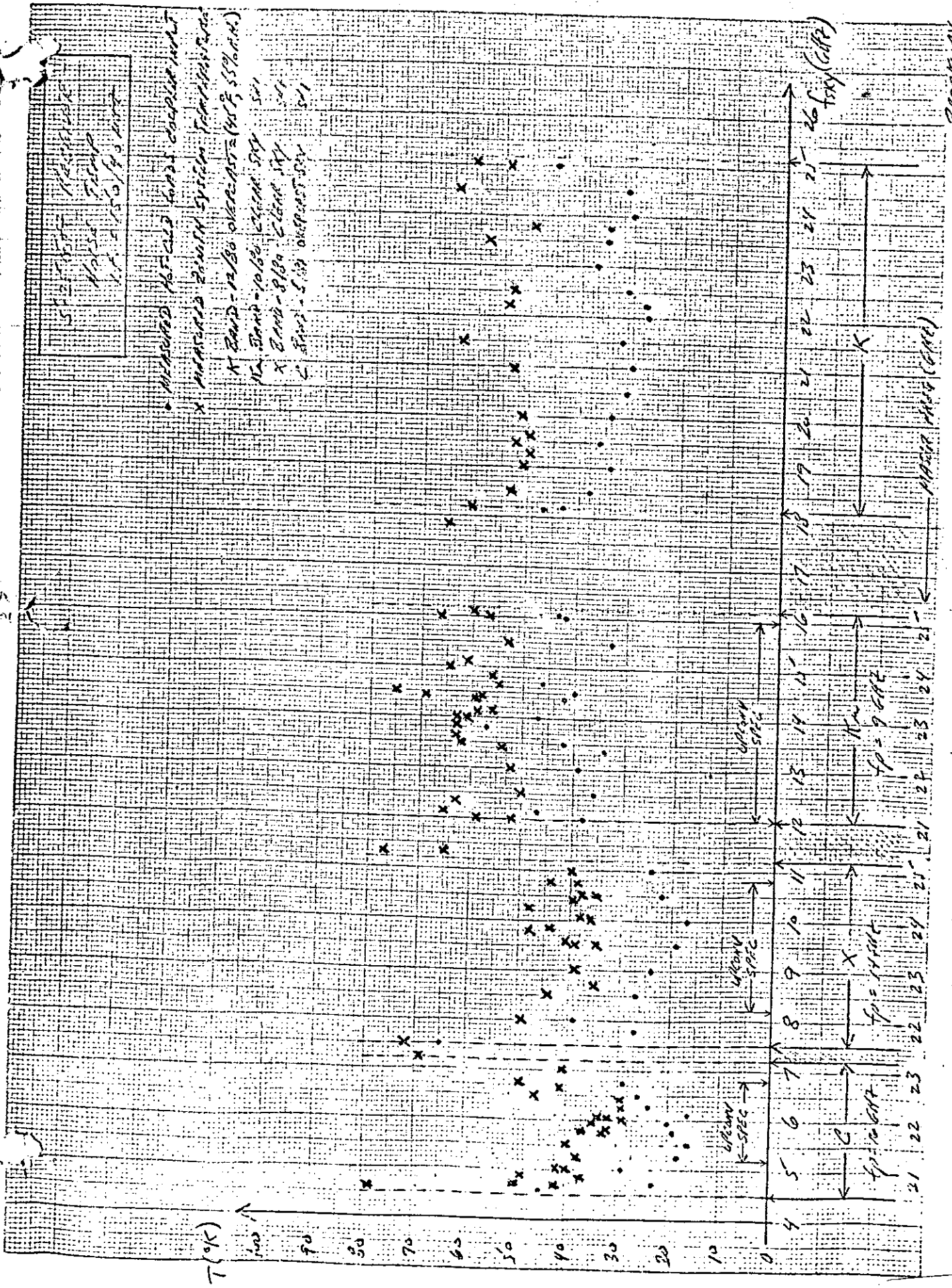
18-25 GHz FEEDS INSTALLED



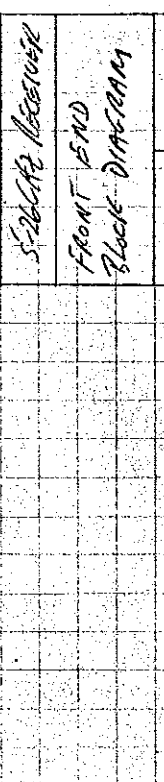
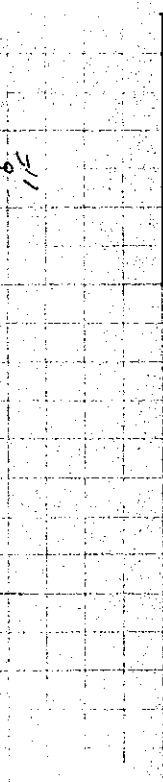
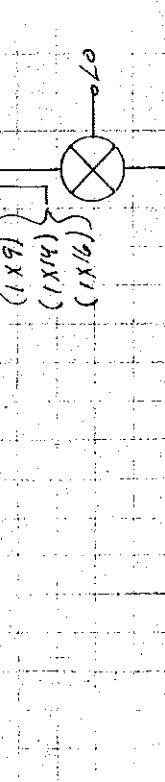
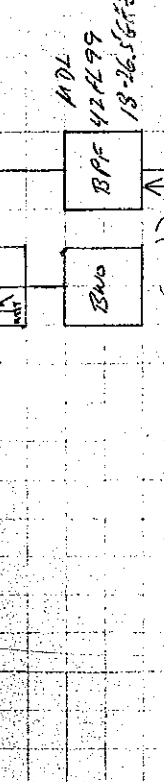
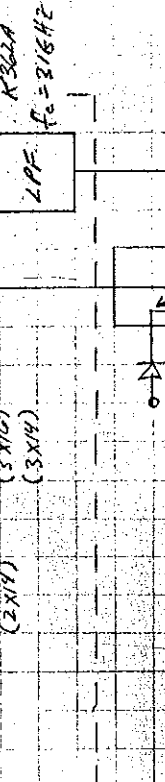
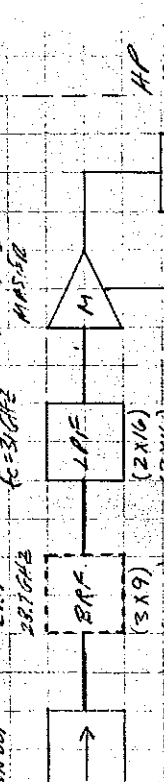
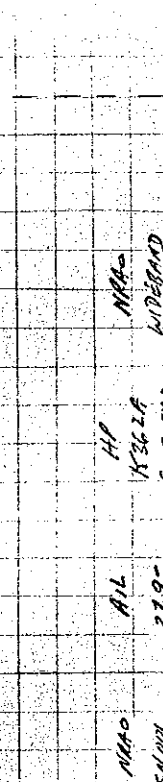
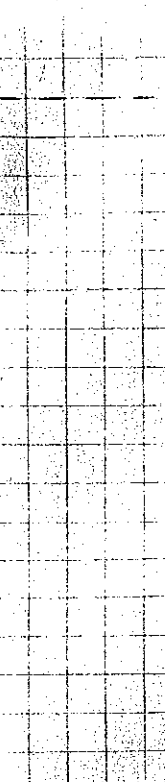
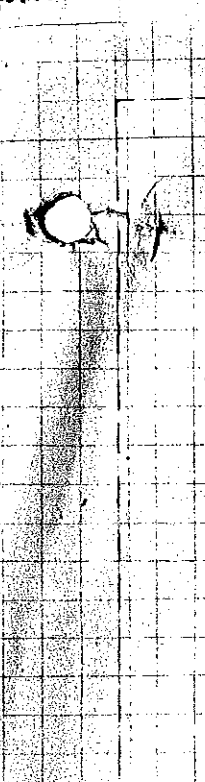
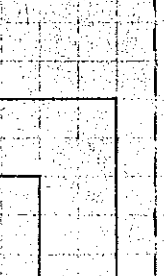
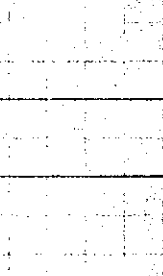
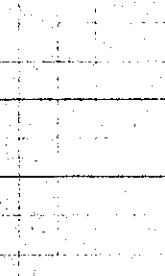
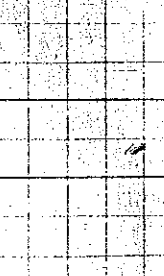
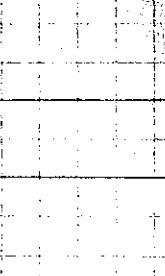
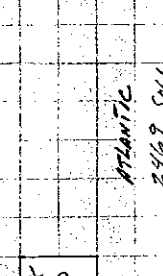
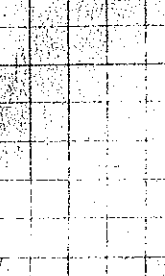
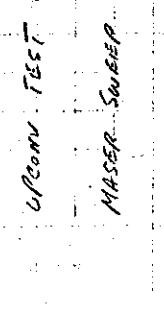
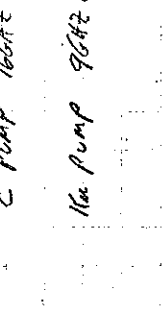
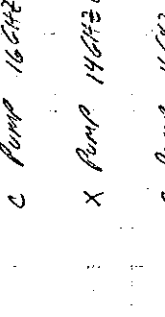
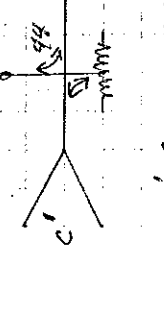
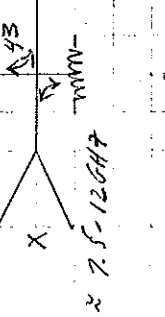
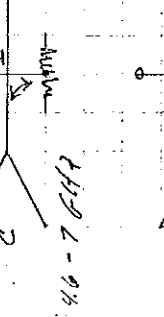
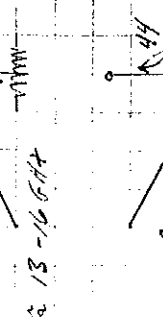
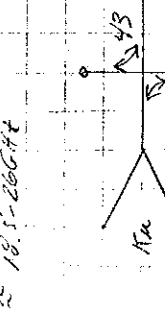
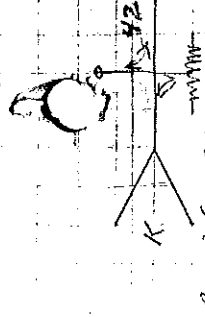
BEAM SPLITTER



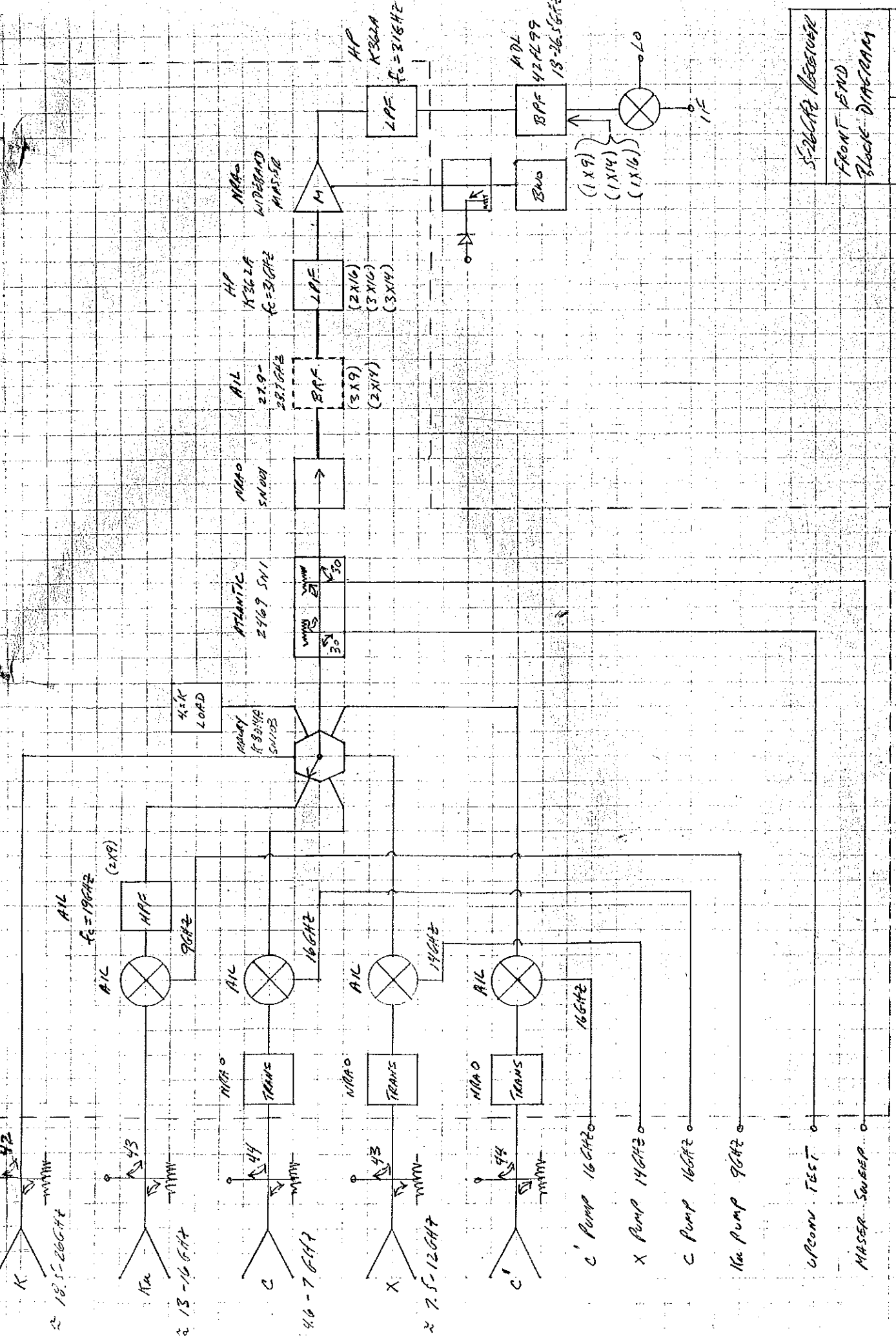
140 FT CASSEGRAIN BEAM SPLITTING



Beckman



DEAMP



5-26GHz RECEIVER
FRONT END
BLOCK DIAGRAM
1168
CSB