

NATIONAL RADIO ASTRONOMY OBSERVATORY

MEMORANDUM

October 19, 1983

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R. Fisher
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From: W. Brundage *WB*

Subj: IF Converter for the Spectral Processor

In the three attached diagrams I outline the revised IF Converter options as Lacasse, Mauzy, and I discussed earlier this week.

Eliminating the analog IF Polarimeter allows a "simplified" IF Converter as the function diagram shows.

Lacasse and Granlund are investigating a single-sideband baseband FFT pipeline as an alternative to the complex double-sideband baseband FFT pipeline which we have assumed up to now. Therefore, Mauzy will investigate the limitations and trade-offs of two mixer options, each having two sub-options. These options are:

1. Complex double-sideband (DSB) mixer.
 - a) Wideband.
 - b) Fixed second IF.
2. Real single-sideband (SSB) mixer.
 - a) Wideband.
 - b) Fixed second IF.

The complex DSB mixer has the advantage of relative simplicity, but the disadvantages of (a) stringent amplitude and phase match between the real (R) and imaginary (Q) baseband outputs and (b) the uncertainty of the effect of the zero frequency component.

The real SSB mixer has the advantage of no matching of R and Q baseband outputs, but the disadvantage of stringent unwanted sideband suppression.

The complex DSB mixer and the real SSB mixer require different data multiplexing and possibly different FFT pipeline clock rates.

The wideband mixer tuning option has the advantage of reduced birdies inherent in single frequency conversion, but the disadvantage of worse intermods, worse phase/amplitude match and worse sideband suppression over a multi-octave tuning range.

The fixed second IF sub-option has the advantage of better phase/amplitude match and better sideband suppression over a small percentage-bandwidth, but the disadvantages of worse birdies and complexities inherent in a second frequency conversion.

Mauzy's investigation will determine achievable performances and trade-offs for the options, such as:

1. Amplitude and phase difference between f_{2R} and f_{2Q} (DSB mixer).
2. Suppression of unwanted sideband (SSB mixers).
3. Dynamic range.
4. Intermod levels.
5. Birdie frequencies and levels.
6. Aliasing amplitude vs. frequency.

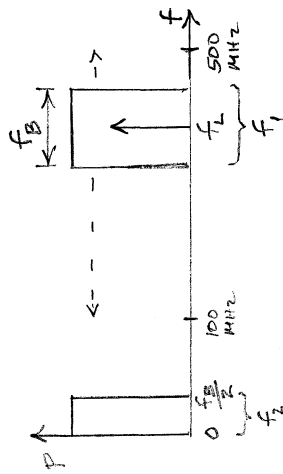
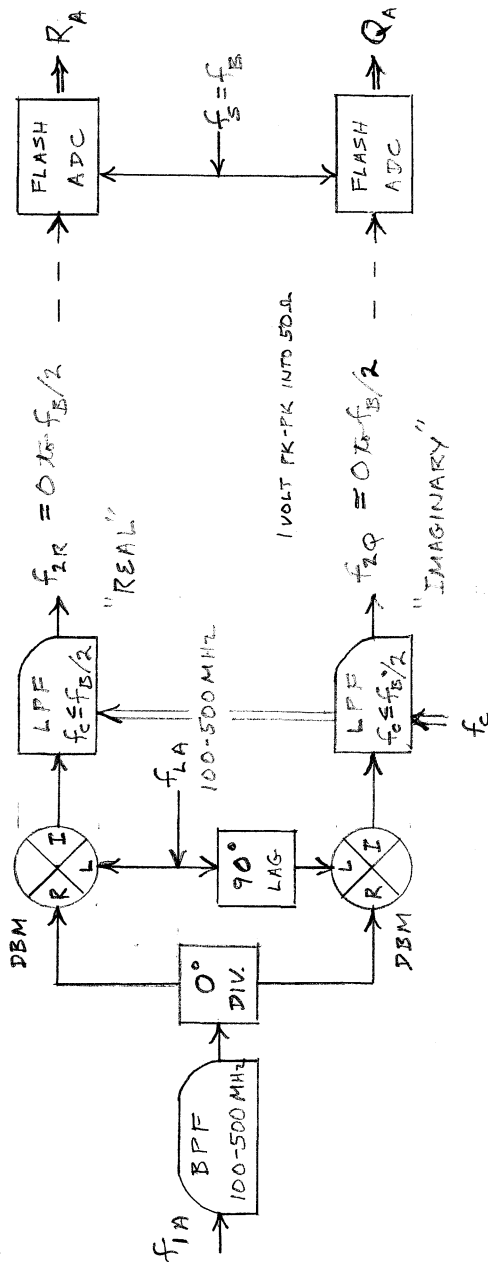
WDB/cjd

Enclosures

1. IF Converter: Function Diagram
2. IF Converter: Mixer: Complex DSB Option
3. IF Converter: Mixer: Real SSB Option

WIDEBAND SUB-OPTION

FRONT-END IF; 100-500 MHz



$f_B = 40 \text{ MHz}$

20

10

5

2.5

1.25

0.625

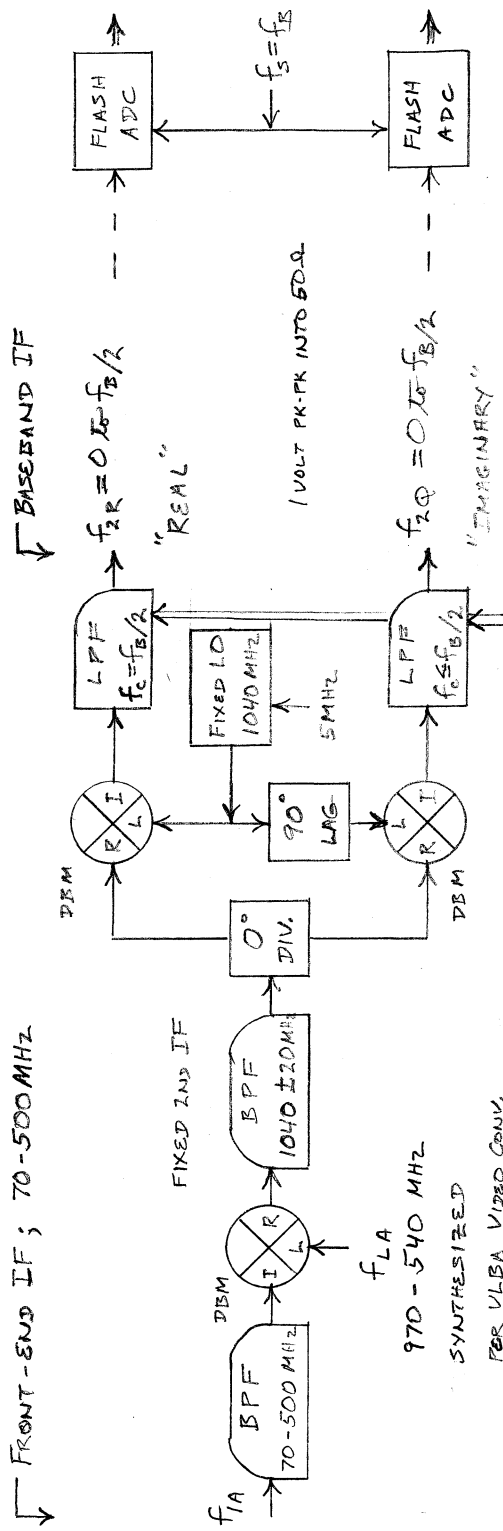
0.3125

0.15625

0.078125 MHz

FIXED 2-ND IF SUB-OPTION

FRONT-END IF; 70-500 MHz



SPECTRAL PROCESSOR
IF CONVERTER: MIXER;
COMPLEX DSB OPTION
2.265 WDB 10-83

FIND: 1) Amplitude + phase difference between f_{2R} and f_{2Q} .

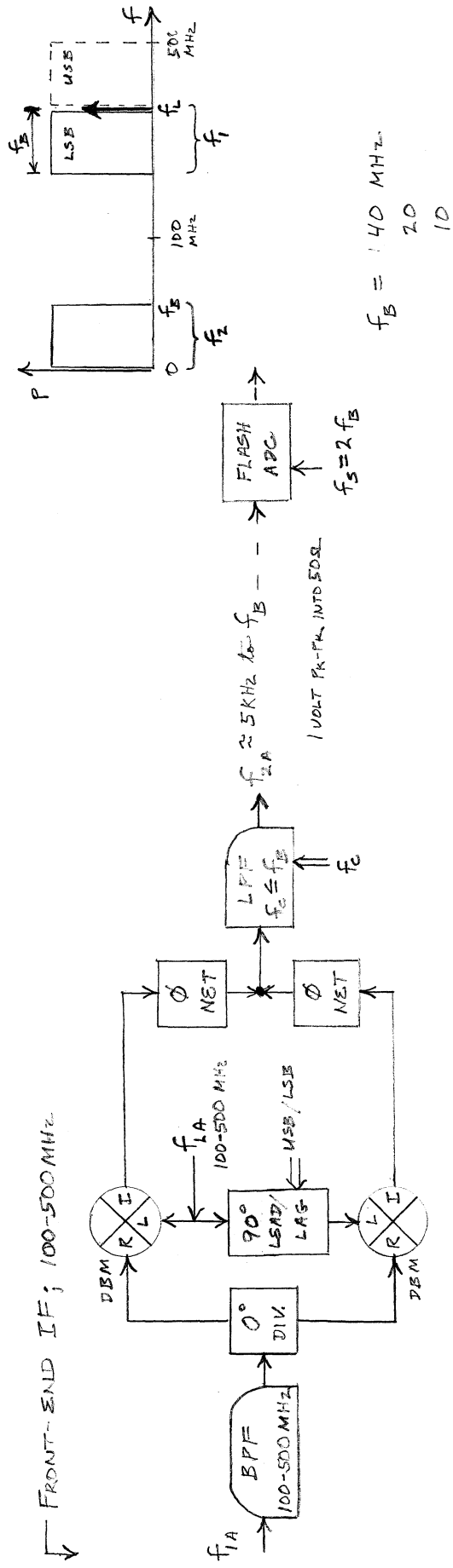
2) Dynamic range

3) Intermod levels

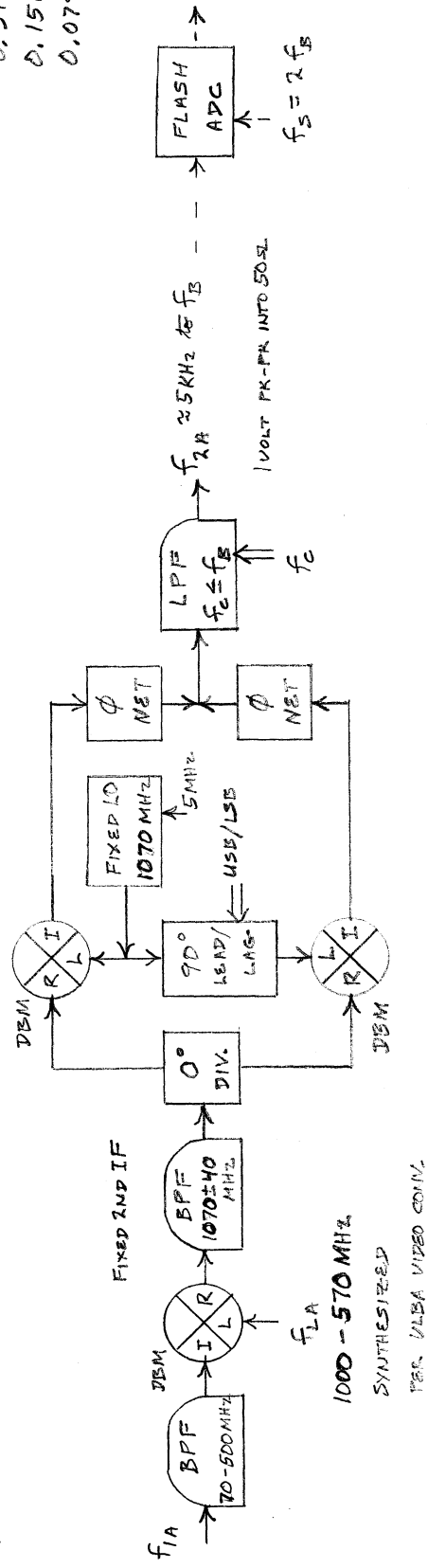
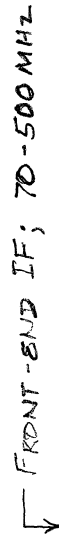
4) Birdie freq. + levels

5) Aliasing amplitude vs. freq.

WIDE BAND SUB-OPTION



FIXED 2ND IF SUB-OPTION

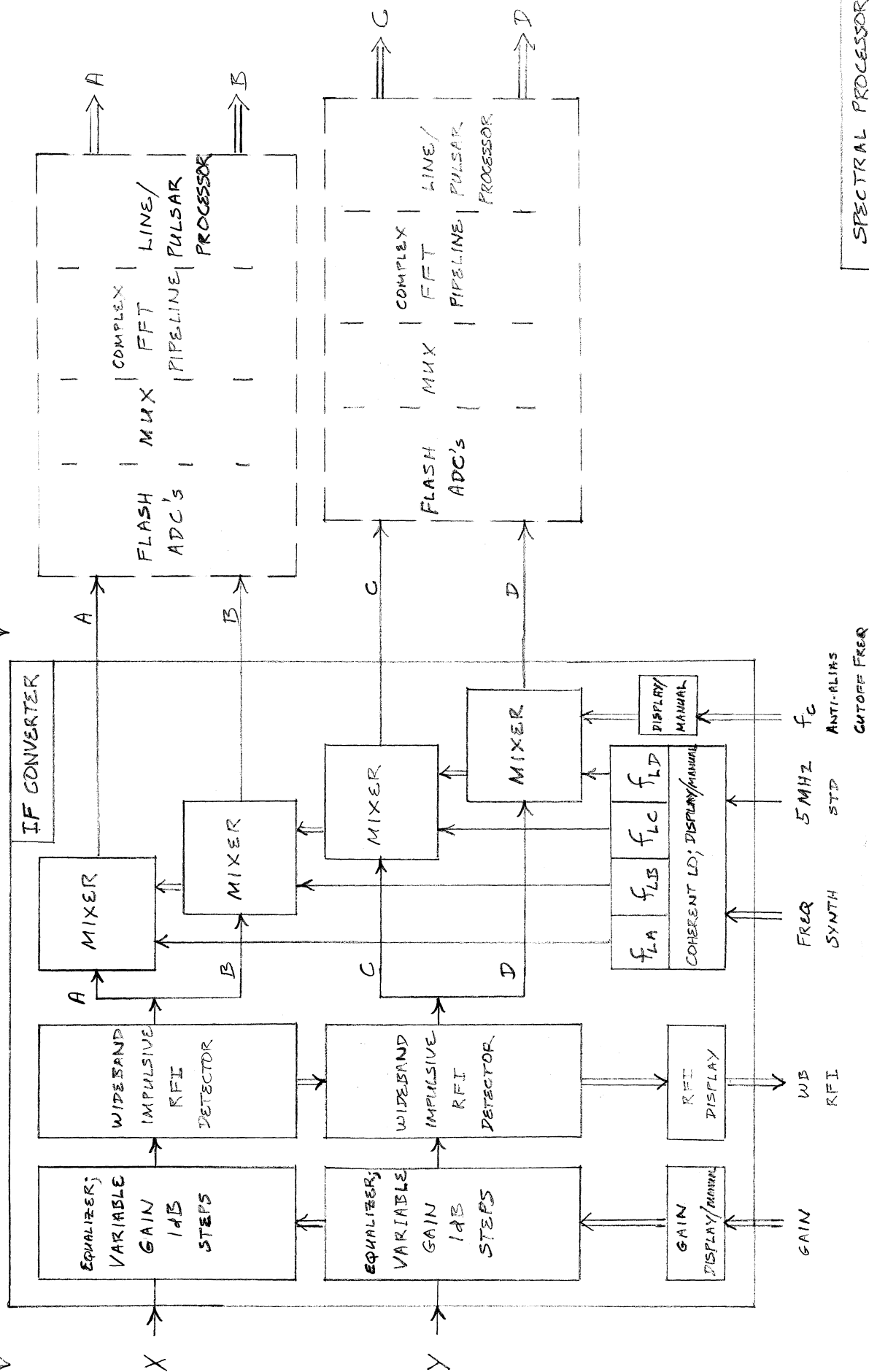


- FIND:
- 1) Unwanted sideband suppression
 - 2) Dynamic range
 - 3) Intermod. levels
 - 4) Birdie freqs and levels
 - 5) Aliasing amplitude vs. freq.

SPECTRAL PROCESSOR
IF CONVERTER: MIXER;
REAL 55B OPTION
2.265 W7B 10-83

FRONT-END IF; 70 to 100 to 500 MHz

BASEBAND IF



SPECTRAL PROCESSOR
IF CONVERTER :
FUNCTION DIAGRAM
2.265 WPB 10-83