RF Note #44

April 11, 1979
R. Gress

LOW LEVEL STATUS

At this time it is appropriate to assess both the status and direction of the low level electronic project. Fig 1 illustrates the ten major stages of module evolution; also shown are suitable weights for each stage. Module requirements are listed in Table 1, and Table 2 indicates per module progress to date. Until recently it has been logical and necessary to utilize the parallel development technique for the modules. This technique is reasonably efficient up to about the 75% completion stage, however beyond this point it is appropriate to change to serial development for completion. As evident from Table 2, the mixer modules lag furthest behind. Consequently, present efforts are being focused on these circuits. Following is a brief statement about each module, and a skeleton schematic for each which has not been documented elsewhere.

Mixer Modules

As Fig 2a indicates, there will be six separate modules involved in the mixing scheme. Fig 2b shows how these are integrated with the low pass filters in the mixer NIM bin. The module containing only delay lines will not require etching. The 135-210 MHz amps and buffers are satisfactory. Interconnection of the modules will be via cableson the rear panels. Considerable drafting time is now required to produce a good schematic and board layout tape-up. These layouts are of the most critical nature due to the VHF frequencies involved. Additional parts still need to be ordered; some of which depend upon results of the layout. Next, five boards must be etched with about a 5-10 day turn-around. Assembly will be straight forward requiring approximately five days. Thus in view of all this, a completion date of around April 21 is anticipated.

Low Pass Filters

These units are all built and are described in RF Note #31. We will use these to get up and running. The cutoff frequency for these filters is 85 MHz, which means third harmonics of frequencies to to 28 MHz are passed. If these cause problems, it makes good engineering sense to rebuild the filters with a 35 MHz cutoff.

2MHz Mixers

One module (sufficient for tests) exists. These will be used for the phase detector 1F input. Before the remaining modules are built, these must be re-evaluated since tests done by D. Birkett (RF Note #35) showed some amplitude dependent phase shift. If these are not suitable, perhaps commercial units will be used.

Electric Motor Servos

All modules of this type are built and so far are satisfactory.

Amplitude Servos

Here again, all units necessary for operation are built, although a spare should be constructed. These will be satisfactory with perhaps slight modifications (See RF Note #42). A wide dynamic range detector design, for possible incorporation, is being being thoroughly tested by A. Laisne.

Buffer Amps

The final prototype for this module exists and tests to date prove it satisfactory. Modifications are being added to make the amps both short and open circuit proof. This module is described in RF Note #30.

Phase Detectors

A module of this type is also built and ready for final tests. Negatives for making filter boards for the rest of the modules will be sent out in a few days. By the time the filter boards return, we will have wound all necessary toroids for them. More on this module in RF Note #35.

Driver Amps

A few parts for the on-board reference signal regulators are still outstanding. Also some optimization of the regulators will need to be performed on the final prototype. The drivers are discussed in RF Note #30.

Phase Shifters

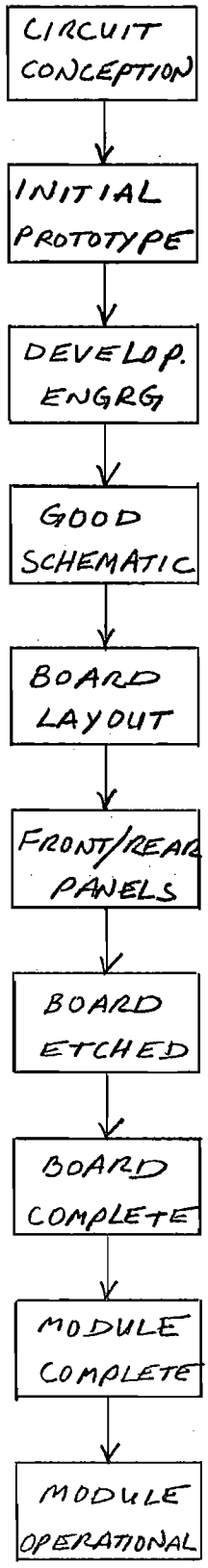
A. Laisne has evaluated two variations of the original circuit proposed by D. Birkett in RF Note #34. These improved versions require fewer transistors and seem to yield much better performance. The best all around circuit of the three will become the final prototype.

General

Except as noted, parts are on hand for all modules which have reached the 75% completion stages.

MODULE EVOLUTION FLOW CHART

FIG 1



	WEIGHT	COMPLETION
CIRCUIT CONCEPTION	10%	
INITIAL PROTOTYPE	10%	
DEVELOP. ENGRG	25%	45%
GOOD SCHEMATIC	10%	
BOARD LAYOUT	10%	
FRONT/REAR PANELS	5%	
BOARD ETCHED	5%	75%
BOARD COMPLETE	10%	
MODULE COMPLETE (FINAL PROTOTYPE)	10%	
MODULE OPERATIONAL (FINAL TEST)	5%	100%

TABLE 1

MODULES REQUIRED

FUNCTION	NUMBER REQ'D
OSC / MIX	6
L.P. FILTERS	1
DRIVER AMPS	3
BUFFERS	7
PHASE SHIFTERS	1
PHASE DET.	5
MIXER (2MHz)	8
EL. MOT. SERVOS	8
AMPL. SERVOS	4

TABLE 2

MODULE PROGRESS CHART

MODULE	CIRCUIT CONCEPTION	INITIAL PROTOTYPE	DEVELOPMENT ENGR'G	GOOD SCHEMATIC	BOARD LAYOUT	FRONT/REAR PANELS	BOARD ETCHED	BOARD COMPLETE	MODULE (FINAL) COMPLETED	MODULE (FINAL) OPERATIONAL TEST
OSC/MIX	X	X	X							
L.P. FILTS	X	X	X	X	X	X	X	X	X	X
DVR. AMPS.	X	X	X	X	X	X	X			
BUFFERS	X	X	X	X	X	X	X	X	X	
PHASE SHIFTERS	X	X	X	X	X	X	X			
PHASE DET	X	X	X	X	X	X	X	X	X	
MIXER (2MHz)	X	X	X	X	X	X	X	X	X	X
EL. MOT SERVOS	X	X	X	X	X	X	X	X	X	X
AMPL. SERVOS	X	X	X	X	X	X	X	X	X	X

10% 20% 45% 55% 65% 70% 75% 85% 95% 100% completion

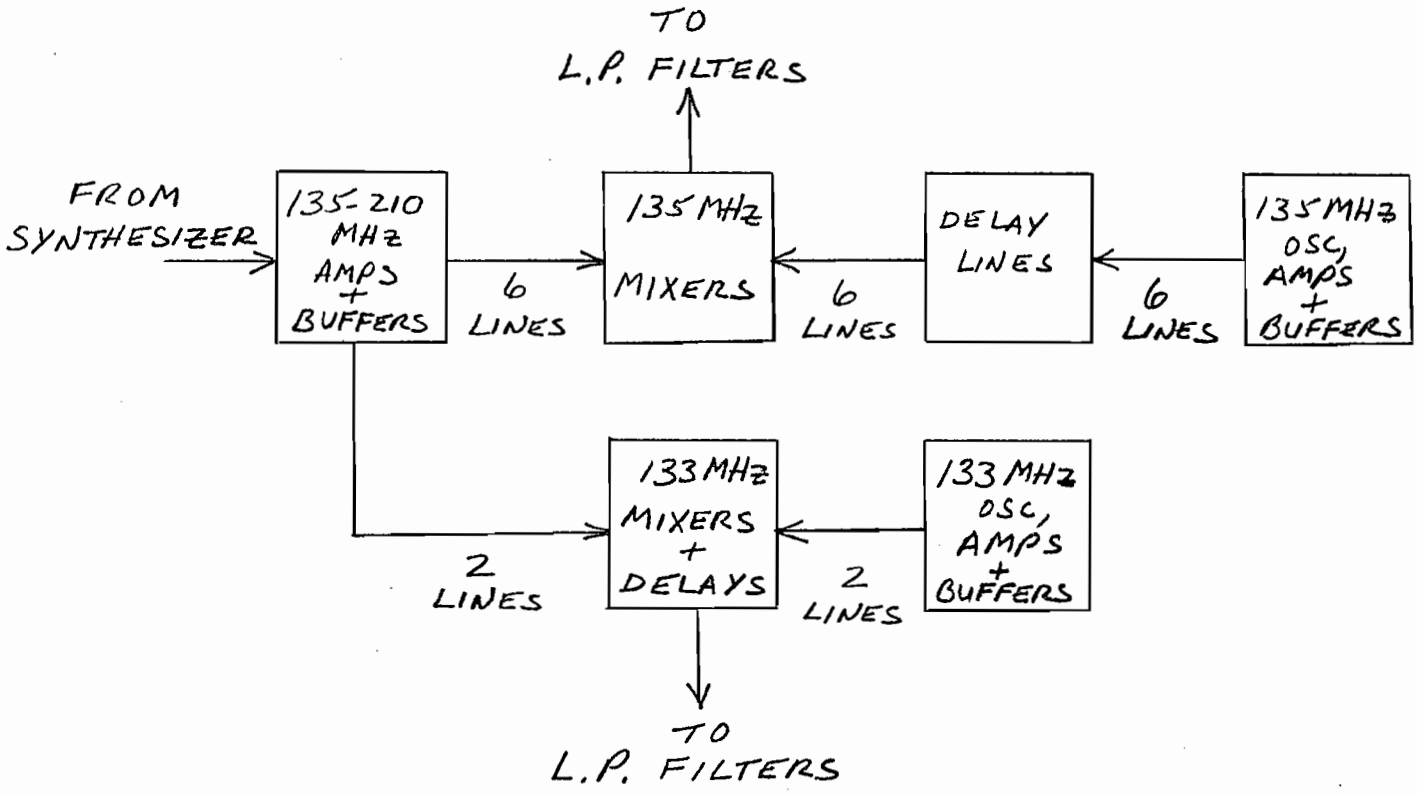


FIG 2a MIXER MODULE SCHEME

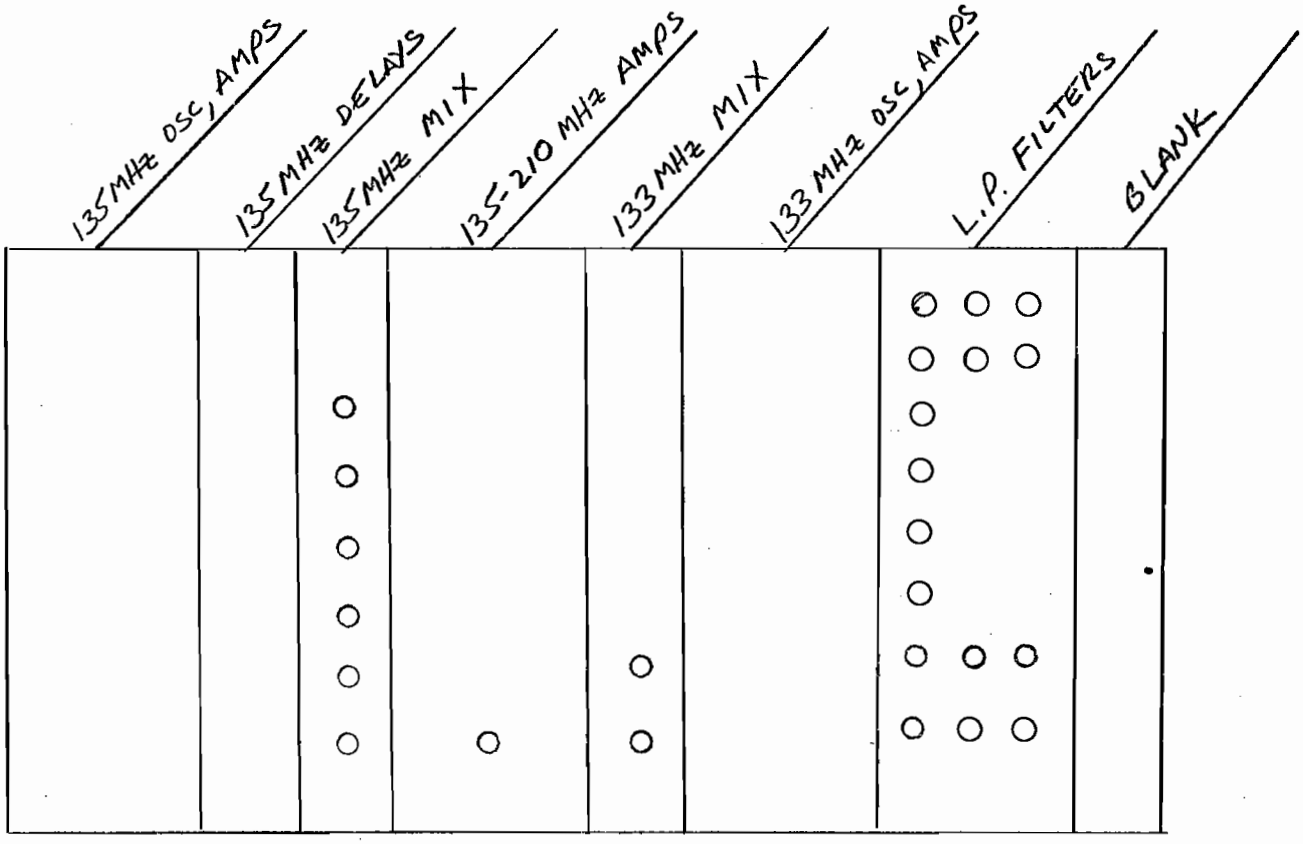
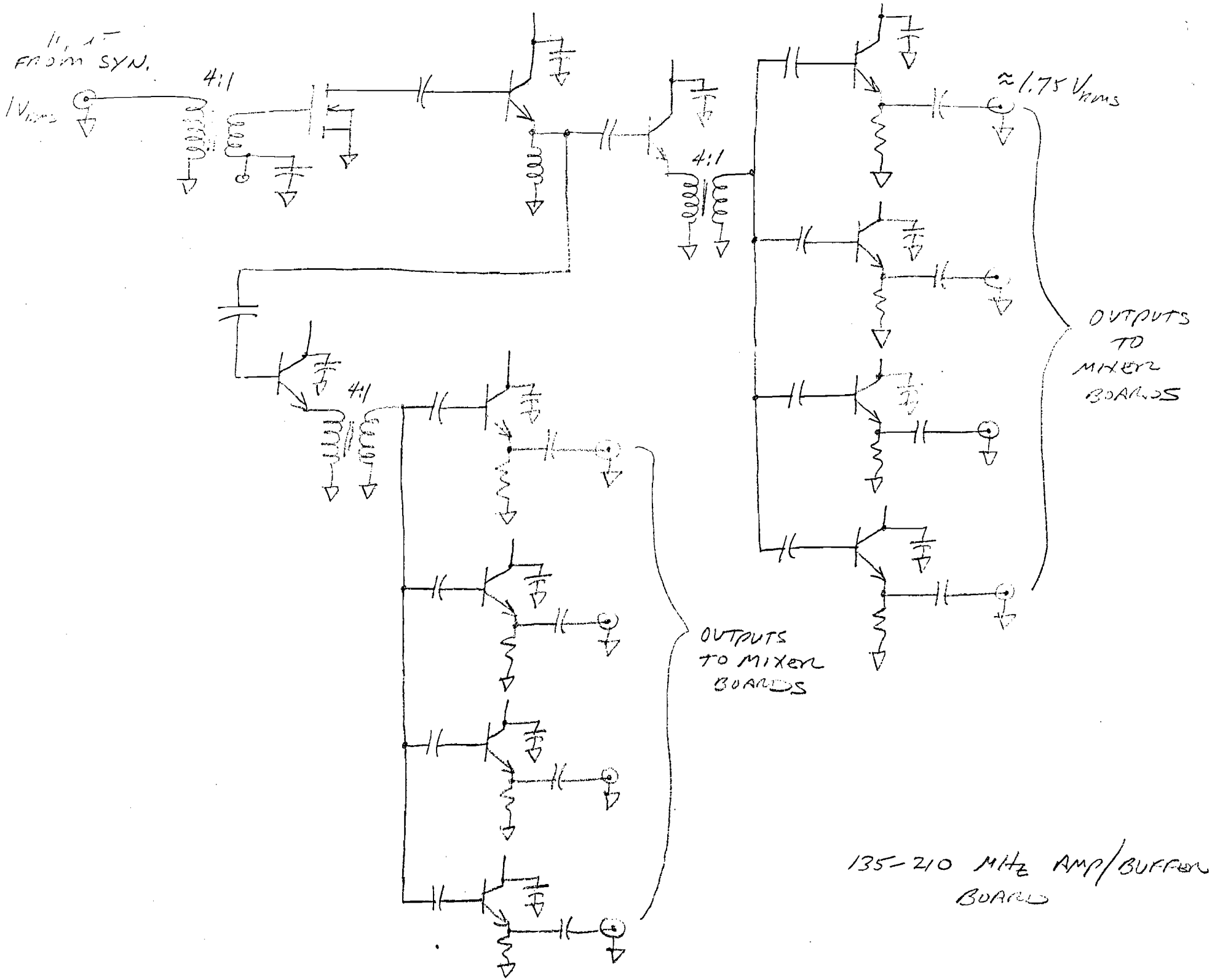
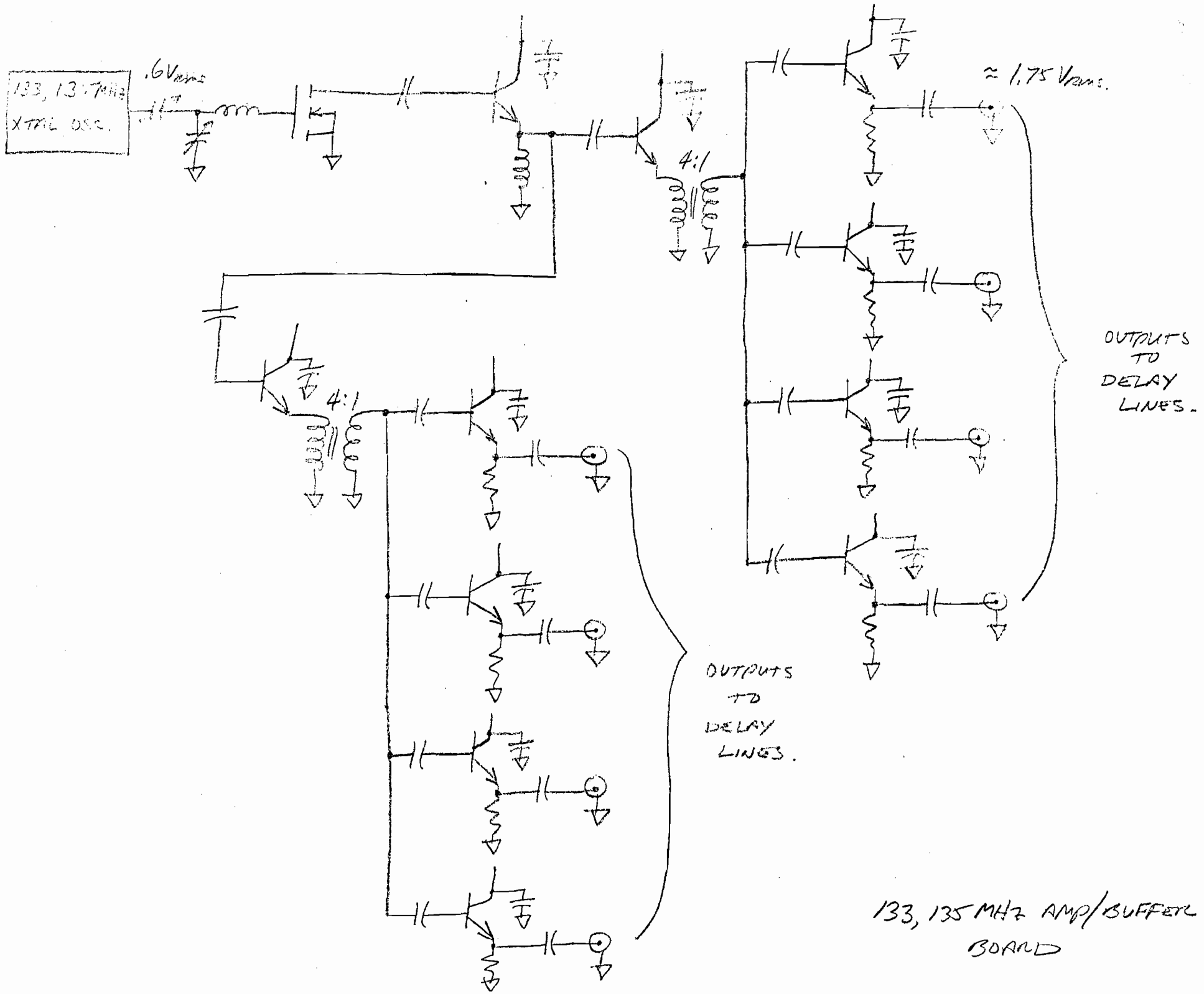


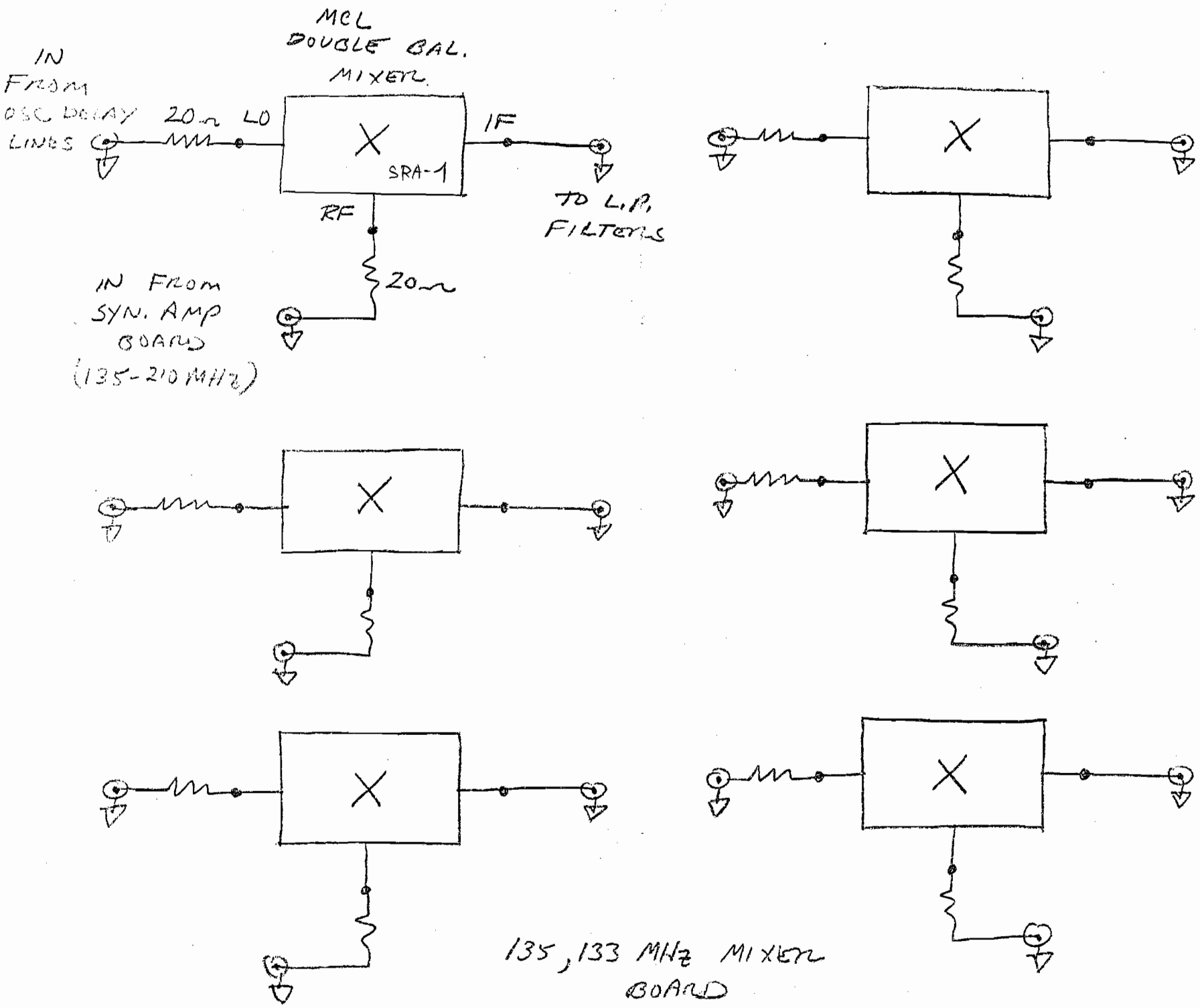
FIG 2b MIX NIM BIN



135–210 MHz AMP/BUFFER BOARD



133, 135 MHz AMP/BUFFER BOARD


MCL
DOUBLE BAL.
MIXER.
IN
FROM
OSC DELAY
LINES
20Ω
LO
IF
SRA-1
RF
20Ω
TO L.P.
FILTERS
IN FROM
SYN. AMP
BOARD
(135-210 MHz)
135, 133 MHz MIXER
BOARD