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VLA ELECTRONICS MEMO. 230

ONE GHz BANDWIDTH FOR VLA USING THE EXISTING WAVEGUIDE-MODEM SYSTEM

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From the discussions in the recent VLA Upgrade meeting (98June29-30) it appears that for the present any upgrade will have to be in incremental steps. Also it is clear that the present correlator is a major limitation on many experiments using the VLA. Further the current plans for the MMA correlator fit the VLA upgrade requirements and it seems that there is a reasonable possibility of getting at least a quadrant of the MMA type correlator for the VLA if we can feed it appropriate signals. Therefore in this memo we propose a scheme to (1) bring signals of 500 MHz bandwidth per polarization from each antenna to the central electronics room (CER) using the existing waveguide-modem system, (2) convert these to 500 MHz baseband signals, and (3) provide the signals to the new correlator.

The VLA waveguide-modems have channel spacing of 2.4 GHz and the waveguide diplexers (channel filters located below the D-racks) have a bandwidth of almost 2 GHz per channel. Also a bandwidth of 500 MHz per polarization is available at the antennas at IF at the outputs of F4s and before filters in F7s. Therefore it should be possible to tap signals at this point and bring IF signals of 500 MHz bandwidth per polarization (total of 1 GHz bandwidth) from each antenna to CER.

This will need additional IF-LO electronics at the antennas and in the backends. Also to maintain the signal to noise ratio for the increased IF bandwidth, without increasing the antenna modem mixer power level during transmit (modem mixers already operate near 1 dB compression), we will have to add amplifiers between the antenna modem outputs and CER modem mixers and switch the amplifiers ON and OFF in synchronism with the waveguide cycle. This should not be hard and can be accomplished by turning ON and OFF switches in series of the amplifiers and DC power to the amplifiers. Further if a bandwidth of 28-50 GHz can be achieved from a single amplifier and two switches then putting only one pair of amplifiers per arm of the array (say in 20 mm waveguide in the control building) may suffice.

A possible block diagram of the additional electronics required to add this capability is shown in Fig.1. These additions should not affect the current operations. The frequencies of the additional LO and IF signals are given below.

F4 INPUT FREQ = 4490-4990 MHz. L6 LO FREQ = 3540 MHz.
F4 OUTPUT at J6 = (4490 to 4990) - 3540 = 950 to 1450 MHz (IF)

	IF@F4 OUT (@ J6)	NEW F8 LO	NEW T2 IF	NEW T3 LO	NEW BASEBAND
RCP	950-1450	2700	1750-1250	1800-50 =1750	0-500 MHz
LCP	950-1450	2100	1150-650	1200-50 =1150	0-500 MHz

A VERY ROUGH estimate of the cost of materials is :
(1) Antenna IF-LO Additions = $5k
(2) MODEM SNR Improvements/Filter & Amplifier Mods etc. = $5k
(3) CER Additions + Two 1 GSPS Samplers (6/8 bit quantization) = $8k
TOTAL/Ant= $18k
X 30 System = $540k (Labor additional)

One quadrant of the MMA correlator can be supported by this system though that will still not fully utilize the 2 GHz bandwidth of the correlator. Also if we use say 8 bit quantization for the new samplers and use digital filters at the input of the correlator then that may allow us to get practical experience of observing in the presence of RFI and determine utility of these filters for the RFI excision etc.

Modifying one antenna would establish viability of the scheme and cost but three antennas will allow interferometeric tests with the correlator being built during the MMA development phase.

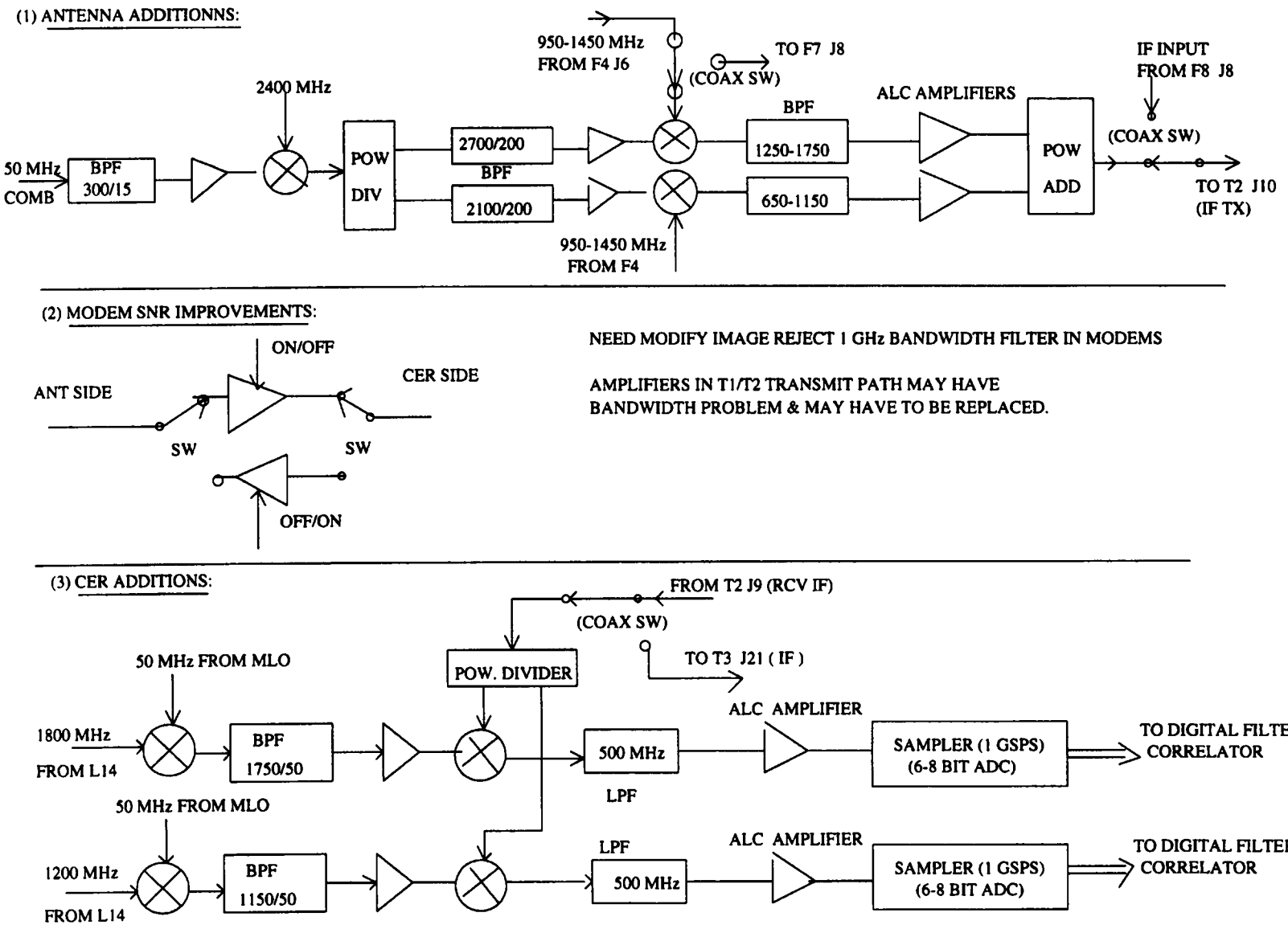

FIG. 1 ADDITIONAL ELECTRONICS NEEDED FOR TWO 500 MHz IF SIGNALS FROM ANTENNA TO CER & TO A NEW CORRELATOR