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To: VLBA Data Acquisition Group

From: Alan E.E. Rogers and Durga Bagri

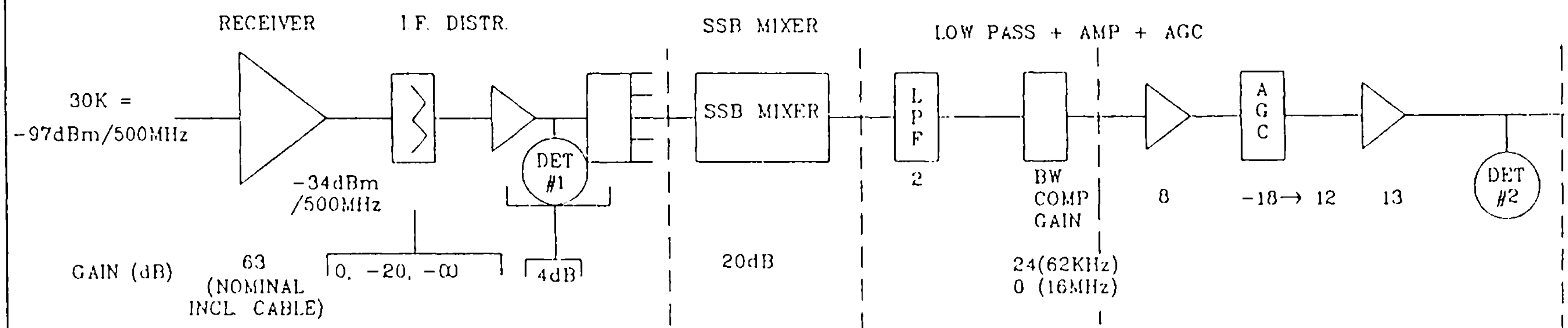
Subject: Revisions to Signal Levels in VLBA Receiving System

In order to extend the AGC range in the baseband converter to allow for as much as 10 dB loss of gain in the front-end the I.F. input levels to the DAR have been increased. The original reference level of -40 dBm has been increased to -34 dBm. While the front-end gain is not likely to drop by as much as 10 dB the new level allows plenty of margin to account for ripple in the front-end, imperfect cable attenuation compensation and any slow gain drifts that may occur with time. (The front-end gain can be manually adjusted but there is front-end gain control available via the MCB.)

In the original design the I.F. distributor had attenuation settings of 0, 15, 30, and 45 dB. In the interest of economy the 15 dB was taken out leaving 0 and 30 dB. Now we have changed the 30 dB to 20 dB to reduce the range over which the baseband converter has to operate. Also 20 dB attenuation is a better choice for solar observations (20 dB being the value used in the VLA).

The new signal levels are shown in Drawing 54120K007, Rev A. It should be noted that the AGC range can be extended, when observing strong spectral lines at bandwidths less than 16 MHz, by using non-standard values for the bandwidth compensation gain. One penalty for increasing the I.F. level is that the susceptibility to interference has been degraded. The worst case is a signal which falls at an I.F. frequency which is within 100 MHz of the baseband converter L.O. frequency but is outside the bandwidth selected. In this case a signal level of -71 dBm into the front end could cause 1 dB gain compression. This susceptibility level could be improved by moving some gain from the SSB mixer to somewhere after the low pass filters. This would increase the baseband converter noise contribution to its old value and possibly require the addition of extra filter stages to limit the wideband noise the amplication following the low pass filters. This needs to be investigated further. It should be pointed out however that operation in a very high interference situation may be to switch in the 20 dB attenuation in the I.F. distributor and increase the bandwidth compensation gain to compensate. In this case the 1 dB compression would be -61 dBm in the worst case.

Attachment (1)



	SSB mixer	LPF	Low pass + amp + AGC		Output
NORMAL POWER LEVELS (30°K INPUT-0dB ATTEN SETTING) (3,000 K -20dB ATTEN SETTING)	-30dBm/500MHz	-20dBm/50MHz	-23dBm	AGC = 2dB	0dBm
3,000 K LINE IN 62.5KHz CHANNEL [1]	-30dBm/500MHz	-20dBm	-3dBm	AGC= -18 dB	0dBm
1dB GAIN COMPRESSION LEVELS	6dBm	16dBm			+13dBm
INTERNAL NOISE LEVELS	-62dBm/500MHz (100,000K INCLUDING MIXER)				

DERIVED FROM ABOVE:
BASEBAND SNR BETTER THAN 32dB
WORST CASE SENSITIVITY INTERFERENCE WITHIN I.F. - BUT OUTSIDE BASEBAND CHANNEL -71dBm AT FRONT - END INPUT.
DETECTOR #1 READS 1 VOLT AT -34dBm INPUT LEVEL FROM RECEIVER
DETECTOR #2 READS 1 VOLT AT 0dBm BASEBAND OUTPUT
(-10 dBm ON FRONT PANEL BNC MONITOR OUTPUT)

NOTES

1. FOR STRONGER LINES THE BW COMP. GAIN CAN BE DECREASED TO AVOID RUNNING AGC BELOW -18dB

MATERIAL

FINISH AND/OR HEAT TREATMENT

SHOP NOTES, UNLESS OTHERWISE SPECIFIED

DRAWN FOR A.E. ROGERS 1-87
DRAWN BY A. PHILBROOK 1-87

NORTHEAST RADIO OBSERVATORY CORPORATION
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS

SIGNAL LEVELS IN VLBA RECEIVING SYSTEM

AER\SIGREC | DWG SIZE C | DWG NO 54120K007 | REV. A

C - 54120K007 A