TO: VLBA data acquisition group

FROM: A. E. E. Rogers

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SUBJECT: VLBA Baseband converter bandpass

a)   Low pass filters

   Filter type: 8-pole Butterworth with 3 db point at 90% of
                    standard bandwidths (the theoretical response
                    and group delay at 4MHz bandwidths are shown
                    in the attached figure).

   Standard bandwidths: 16, 8, 4, 2, 1, 0.5, 0.25, 0.125,
                          0.0625 MHz

   Bandpass response: 1)   >10 db down at bandedge x 1.08
                        2)   <0.5 db ripple across lower 80%
                        3)   <1   db between   units across upper
                             20% of band
                        4)   <5 deg phase ripple between units
                             across lower 80% of band
                        5)   <10 deg between units across upper
                             20% of band
                        6)   <0.1 deg/deg C temperature
                             coefficient of phase over 80% of
                             band
                        7)   <0.1 dB/deg C temperature
                             coefficient of amplitude over 80%
                             of band
                             (The above should ensure that
                             closure errors are <0.1 degrees)

b)   All-pass network pole-zero pairs used to separate sidebands.

   A   all pass   4.7, 66,   628,   6145 KHz
   B   all pass   20.8, 204, 1936, 27040 KHz

   these produce a theoretical phase difference of 90± 3 deg
   from 8 KHz to 16 MHz. The actual performance specification
   is 26 dB image rejection from 10 KHz to 16 MHz.

c)   High pass filter

   The low frequency response is limited by the coupling
   capacitors equivalent to a high pass pole at 3 KHz.

See also VLBA data acquisition memos 47, 48, 50, 51, 69, 74

REJECTION IN DB —

8 POLE BUTTERWORTH
(VLBA)

7 POLE BUTTERWORTH
(MK III)

VLBA STANDARD BANPASSES:

16,8,4,2,1,0.5,0.25,0.125,0.0625 MHZ

POWER

9 DB

6 DB

3 DB

0 DB

0   80 90 100   120

FREQUENCY IN PERCENT OF BANDPASS

GROUP DELAY OF 4 MHZ BANDPASS

FILTER PLUS ALL PASS NETWORK

8 POLE BUTTERWORTH FILTER

800

600

400

200

0

GROUP DELAY IN NANOSECONDS

0   1.0   3.6 4.0

FREQUENCY IN MHZ