VLBA Acquisition Memo # 67

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To: VLBA Data Acquisition Group

From: Alan E.E. Rogers and Kevin Ball

Subject: Stability Tests of VLBA Data Acquisition Electronics

A thermal enclosure was used to cycle the temperature of the electronics over a range of approximately 30 to 60 degrees C. Performance parameters were measured as a function of temperature and a linear fit made to the data. The results are summarized below:

1] SUBMODULE TESTS

a] Square Law Detector

Temperature coefficient of frequency out at constant R.F. input Power:

0.09 ± 0.01 % per deg C (0.004dB/deg C)

b] SSB Mixer

Temperature coefficient of phase delay at baseband frequency of 1 MHz:

0.1 ± 0.01 deg/deg C (0.5 ps/deg C)

Temperature coefficient of group delay over baseband frequency range of 1 to 5 MHz:

5 ± 5 ps/deg C.

2] MODULE TESTS

a] 5 MHz Distributor

Temperature coefficient of delay: 3.3 ± 0.3 ps/deg C.

b] Baseband Converter

Temperature coefficient of gain: -0.2 ± 0.1 %/deg C (0.01 dB/deg C)

Temperature coefficient of group delay: (measured at 5 MHz)

0.07 ± 0.02 ns/deg C at 16 MHz BW

0.18 ± 0.02 ns/deg C at 8 MHz BW

Temperaure coefficient of phase delay: (Measured at L.O. = 500 MHz, baseband = 5 MHz)

0.4 ± .05 deg/deg C at 500 MHz and 16 MHz BW

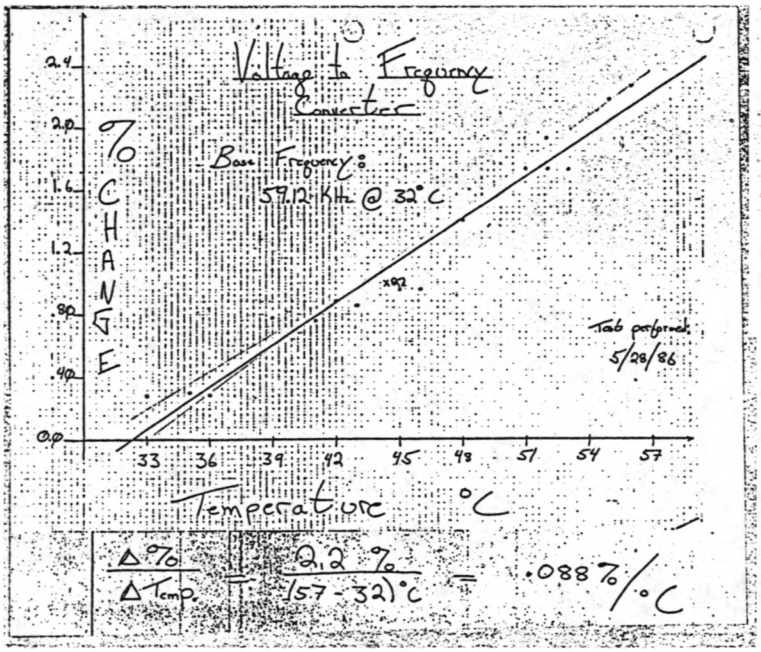
(0.8 deg/degC/GHz)

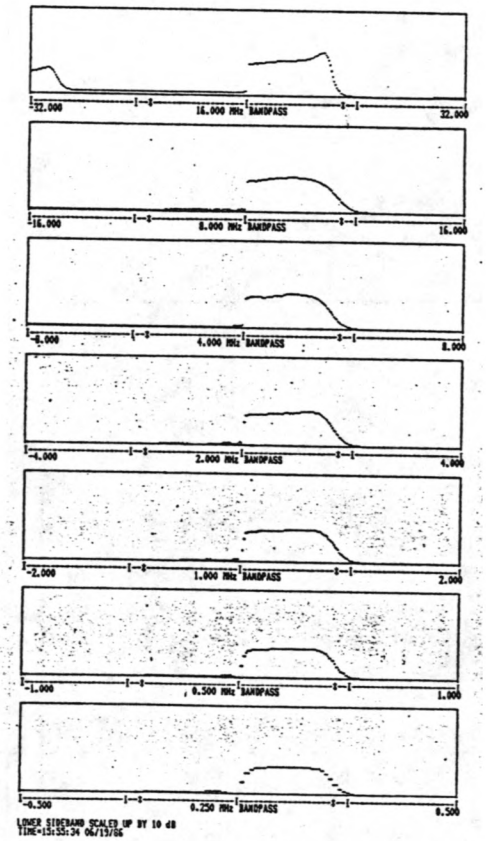
(2.2 ps/deg C)

Comments:

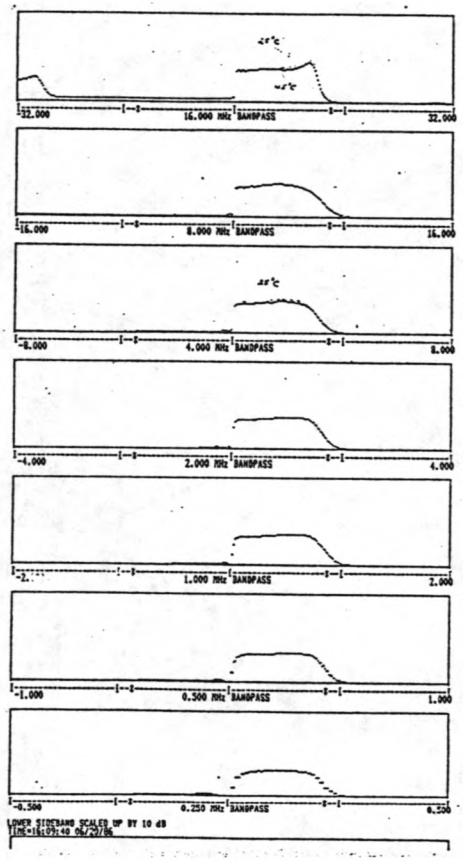
The temperature coefficient of group delay is expected to increase at lower bandwidths while the phase delay measured in time units variations should be virtually independent of L.O. and baseband frequency. The measured temperature sensitivities are all within the specification limits given in the Project Book. See Acquisition Memos 61 and 64 for earlier measurements of baseband converter performance.

Attachments (3)





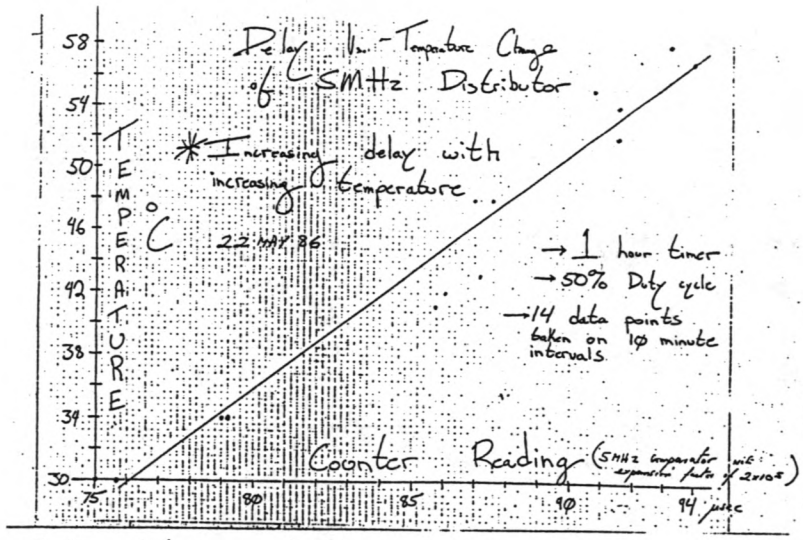
77°F = 25C



113°F = 45 C

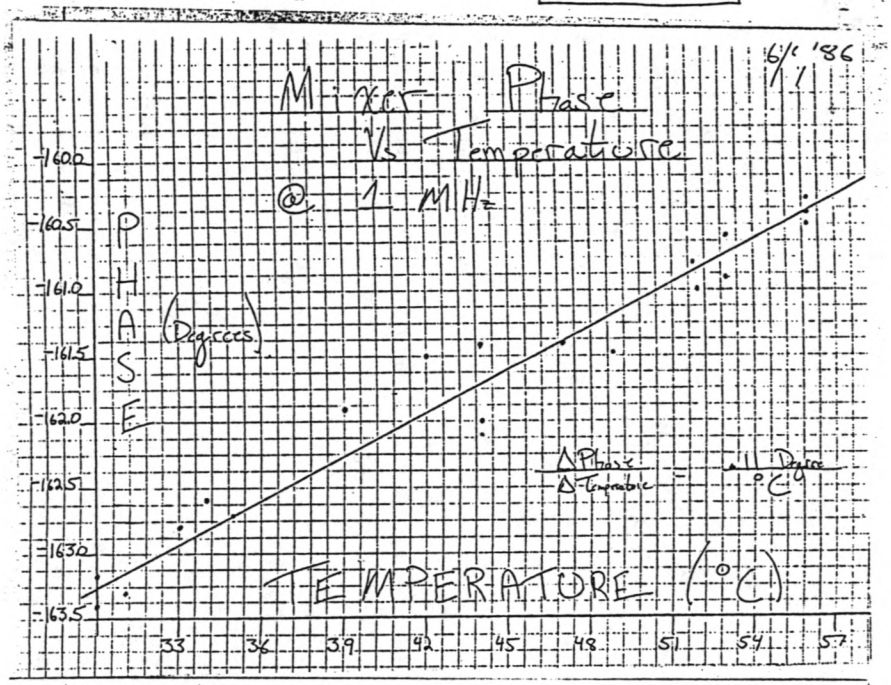
Temperature coefficient:
+ - 0.2 ± 0.1 % per deg C
- - 0.007 db/deg C

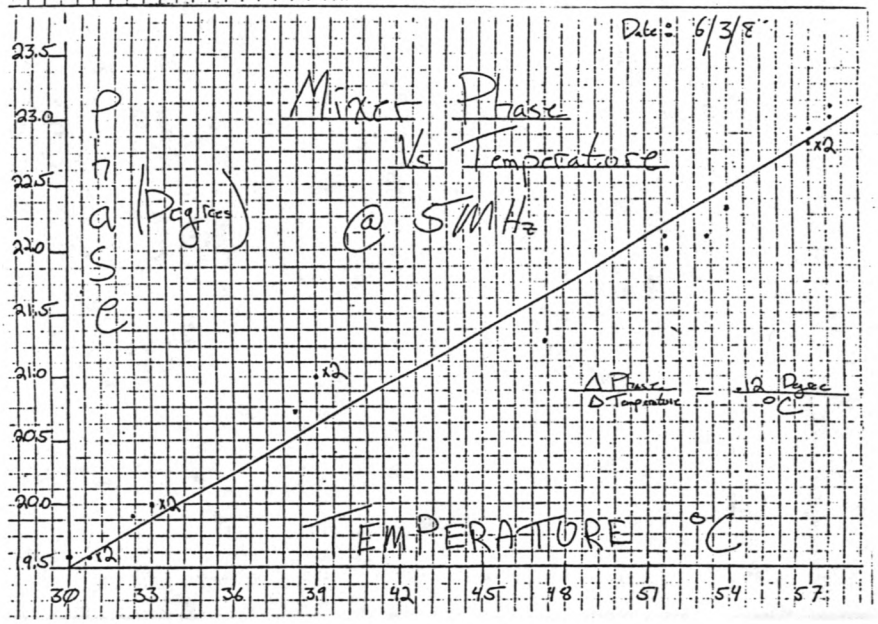
Attachment 1



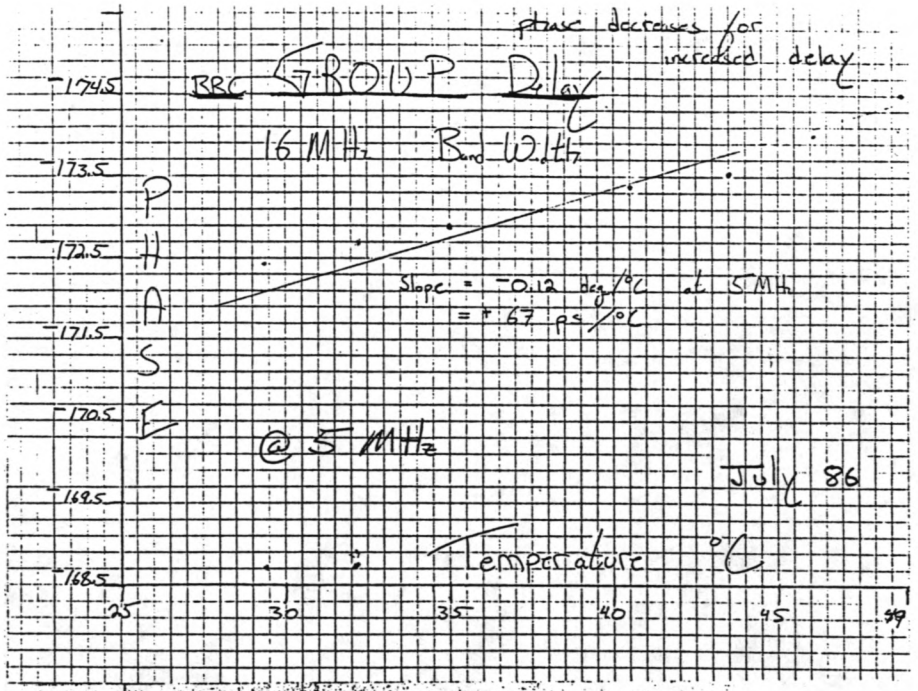
From 'best fit' line $\frac{\Delta \text{time}}{\Delta \text{temp}} = \frac{5 \cdot \Delta \text{Counter}}{\Delta \text{temp}}$

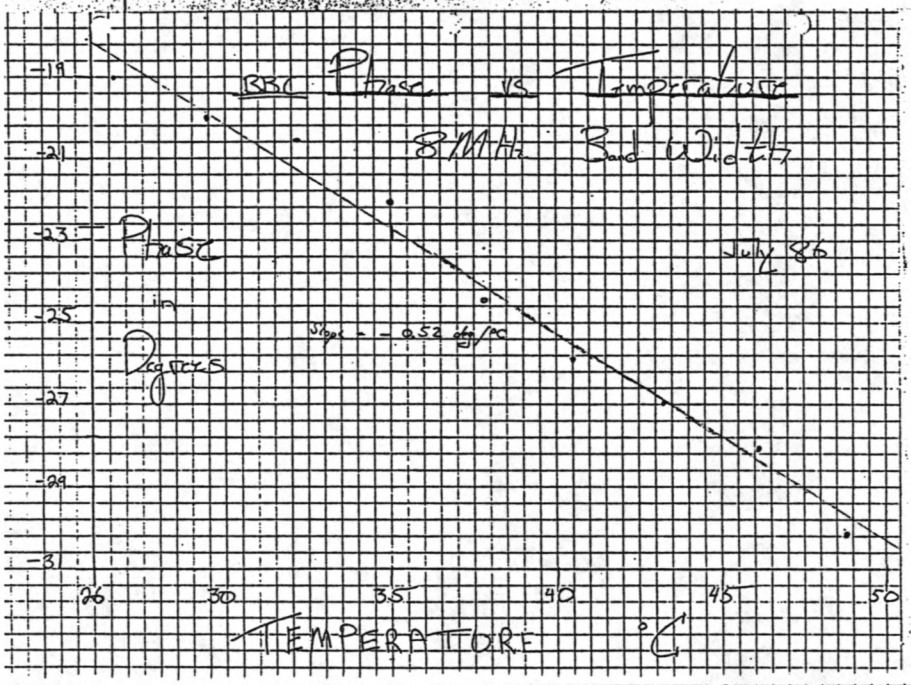
$\therefore \frac{\Delta \text{time}}{\Delta \text{temp}} = \frac{5[94-76]}{[57-30]} \doteq \boxed{3\tfrac{1}{3} \frac{\text{pSecond}}{^\circ C}}$ Increase

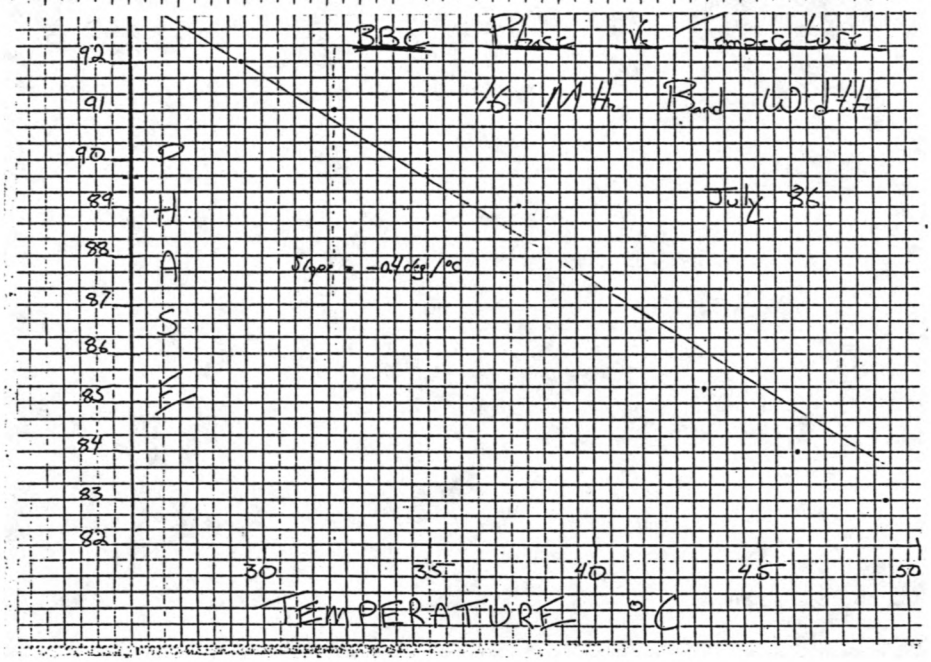




Attachment 2







Attachment 3