

VLBA ACQUISITION MEMO #309

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To: VLBA Data Acquisition Group
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Subject: Possible replacements for the 10G070 dual modulus counter

1] Background

The 10G070 dual modulus counter used in the prescaler of the digital divider for the BBC synthesizer is no longer available. The entire GaAs logic process from Gigabit Logic was taken over by Triquint who have no plans to continue manufacturing this part.

2] Requirements for a replacement

- a) Compatibility with 10KH logic and power supply.
- b) Reasonable power consumption ($< 1W$).
- c) Small digital delay or at least a low temperature coefficient of delay.
- d) Operation to 1 GHz.

3] Replacement choices

I can find no direct replacement, so some pc board revisions will be required.

a) SP8782A - This IC from GEC Plessey is a possibility but has the following potential problems.

- 1] The modulus ratio is $+16/17$ which would require station software changes.
- 2] Relatively large delay $\sim 3ns$.
- 3] The future availability of this IC is uncertain.

b) Fujitsu high speed ECL

This ECL is capable of operating at a 4 GHz clock rate. The biggest problem however is power consumption. A dual modulus counter requires 4 D flip-flops and a few gates which would require at least 2 MB1811s, plus 1 M1801, for a consumption of about 2W.

c) MC10E131 + MC10E101

The use of Motorola ECL-PS logic looks like the most viable replacement. A +10/11 modulus counter using 4 D flip-flops (MC10E131) and 3 4-input (MC10E101) NOR gates looks like it should work to 1 GHz utilizing a circuit similar to that of the MC12013 dual modulus counter. (The D flip-flops will clock at 1.1 GHz minimum with propagation delay of 500 ps from clock to output. The typical NOR gate delay is 350 ps maximum and the typical flip-flop set-up time is 20 ps so that the feedback path delay is 870 ps. With worst case delays and set-up the counter would only reach 740 MHz - however, the clock to the first flip-flop can be delayed since the state of this flip-flop is not an input to the modulus control and even with worst case ECL-PS performance it should be possible (on paper) to operate at 1 GHz.) Power consumption for the two ICs would be about 500 mW.

d) Low power prescalers like MC12022 and Fujitsu MB1501

These devices have a large digital delay and are unlikely to have a low temperature coefficient but could be tested. The entire divider circuit, its control, and the software, would have to be changed to use this type of prescaler.