



Phillips SA8016DH 2.5 GHz Synthesizer SEE Testing

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To be presented by Marty Carts at the 2008 Single Event Effects Symposium, Long Beach, CA, 15 April 2008

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Outline



- **Introduction**
 - SA8016 Frequency Synthesizer
 - Prior SEE Test Results
 - GLAST Mission
- **Measures of Performance**
 - SET
 - SEU
 - SEFI
- **Data Analysis**
- **Discussion and Summary**

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Introduction

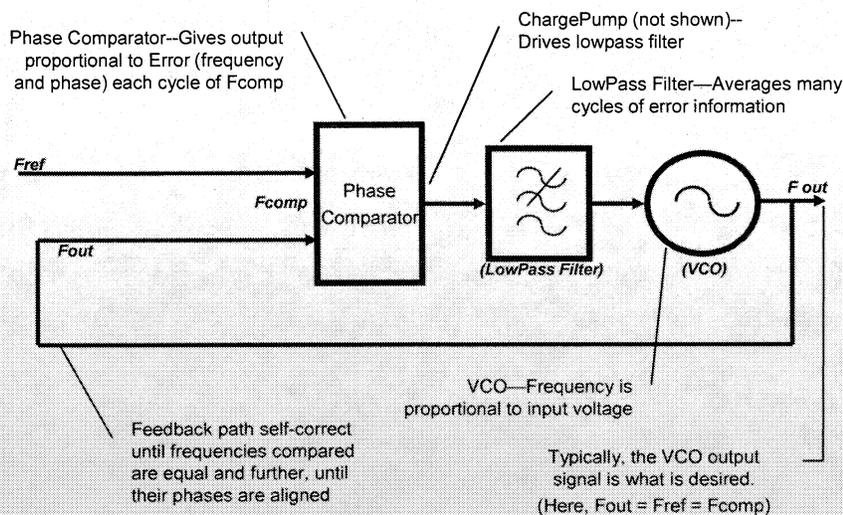
- **SA8016 Contains All Major Components of a Phase-Locked Loop (PLL) Except the VCO and Loop Filter (Capacitor)**
- **Built in Phillips QUBiC II BiCMOS Process**
- **Chosen by GLAST Program for Frequency Generation in both Tx and Rx**
- **Preliminary Testing Indicated Possible Problem**
- **GSFC Followup Testing Aimed at Duplicating Test (Hardware, Methods) and establishing adequate statistical knowledge of any problems.**

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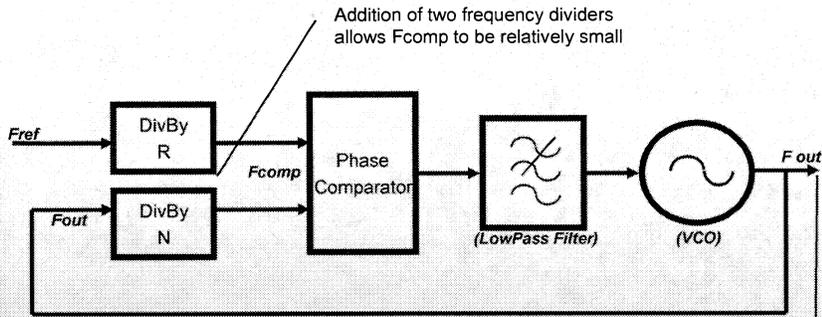
The Phase-Locked Loop



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The Phase-Locked Loop



$$F_{out}/N = F_{comp} = F_{ref}/R$$

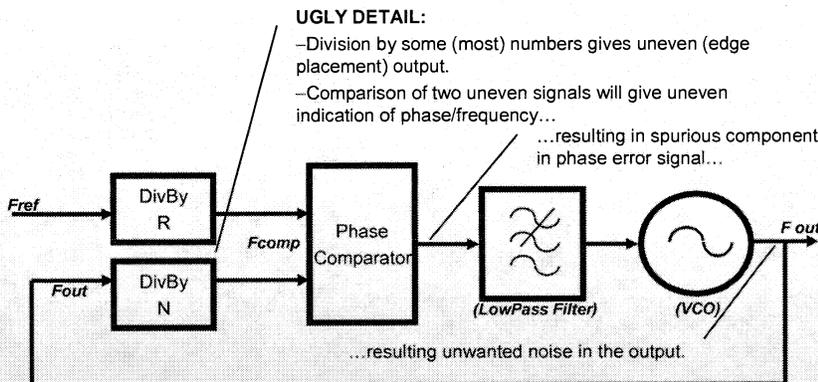
or

$$F_{out} = N/R * F_{ref}$$

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The Phase-Locked Loop

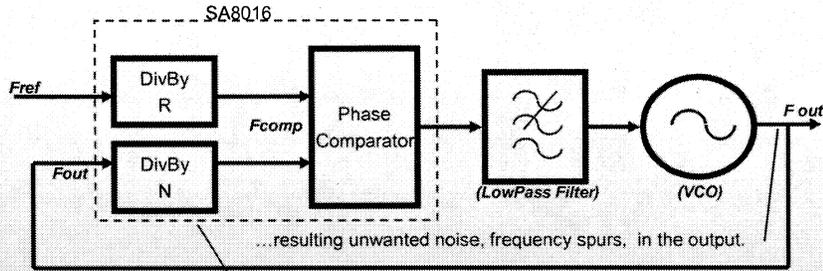


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The Phase-Locked Loop



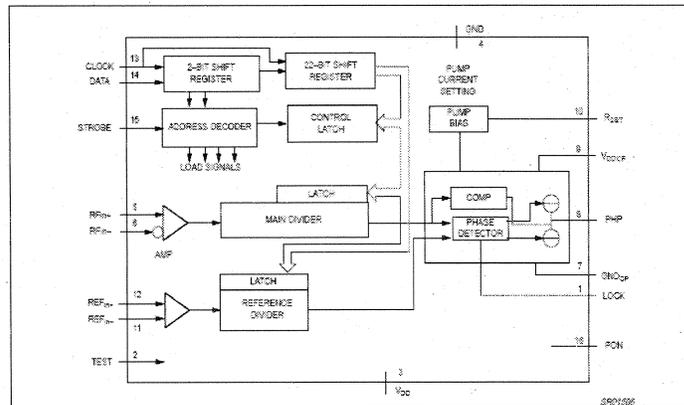
- The SA8016 allows for reduction of these spurs by (a cumbersome) process called "Fractional-N Compensation"
- The SA8016 contains most PLL components, lacking only the VCO and simple RC lowpass filter components

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2.5GHz Low Voltage Functional-N Synthesizer

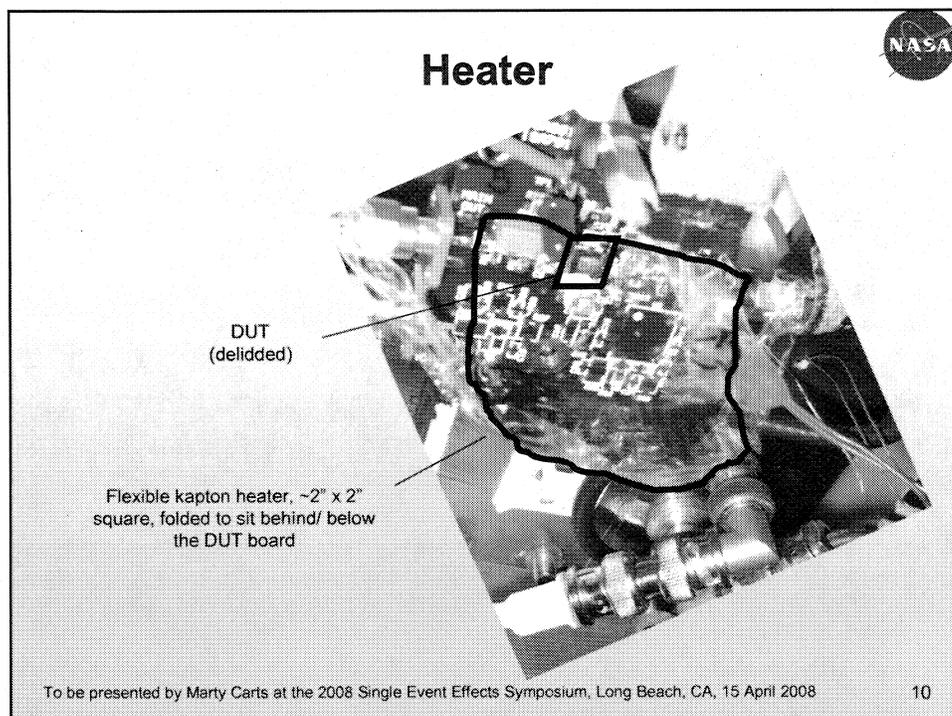
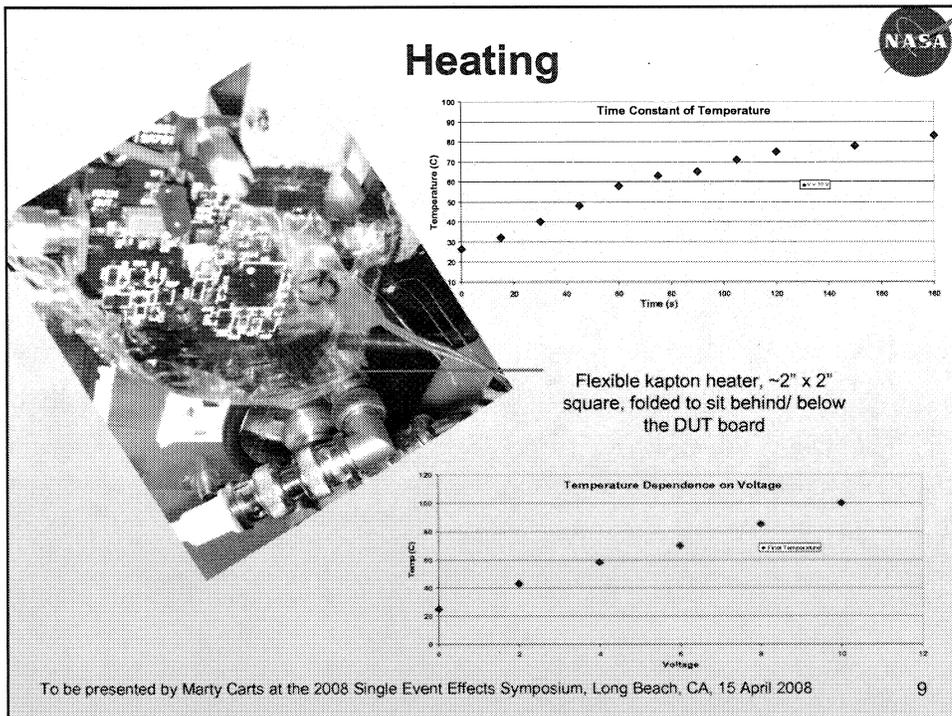


The Phillips Datasheet Block Diagram shows the PLL functions and the serial programming interface

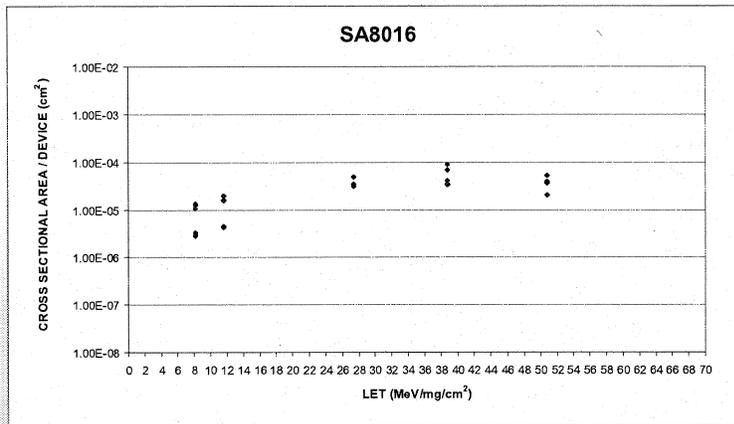
We suspect the RF inputs and (part of?) the dividers are bipolar; the rest should be CMOS.

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SA8016 Combined Event Type Cross Section



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Discussion and Summary



- **This device experiences these SEE:**
 - Many transient phase excursions expected to obliterate short (< 1 ms) data;
 - Some temporary frequency offsets and major phase excursions expected to obliterate longer (< 10 sec) data;
 - SEFI which will obliterate data until reconfiguration reestablishes the correct frequency;
 - No destructive types of events;
 - SEFI which require power cycle/reconfig. In applications which cannot powercycle this is effectively a destructive event.
- **The judgement as to whether to use or not use this device will depend on the ability to powercycle or tolerate a destructive condition rate calculated for that part.**

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