**Design Problem 2**

**Due Date:** In class, Friday, July 25, 2003

**Description:**

You are to select one of the references on integrated circuit frequency synthesizers from the attached list. You should carefully read the reference and write a report on this paper as described below.

**Tasks:**

1.) Inform your instructor via e-mail of your choice of reference by suggesting several numbers in order of preference from the list at the end of this assignment. Your instructor will then approve your reference and you may continue this problem.

2.) Carefully read the reference.

3.) Write a short report (no more than five pages including figures) that addresses the following questions?

   a.) What is the type of frequency synthesizer architecture used?

   b.) What is/are the unique feature/features of this frequency synthesizer (i.e. what makes it different from other frequency synthesizers? Why was the paper published?)

   c.) Describe the blocks used in the frequency synthesizer.

   d.) Are any external components required to make the synthesizer work? If so what are they?

   e.) Summarize the experimental performance in the following table. (This table will be incorporated into a master table by your instructor so please do not adjust the column widths.) You will have to figure out how to convert the data in the paper to the table requirements. If this is not possible, explain why not and provide alternate data.

<table>
<thead>
<tr>
<th>Ref. No.†</th>
<th>$V_{DD}$ (V)</th>
<th>Technology* (min. L)</th>
<th>Output Freq. Range (GHz)</th>
<th>Ref. Freq. (MHz)</th>
<th>Phase Noise (dBC/Hz) @ 1MHz</th>
<th>Spurious Tones (dBc/Hz)</th>
<th>Settling Time (nsec.)</th>
<th>Power (mW)</th>
<th>Die Area (X mm x Y mm)**</th>
</tr>
</thead>
</table>

† This is the reference number of the paper assigned to you by your instructor.

* If not CMOS then also include the technology, i.e. BiCMOS, BJT, or GaAs

** Give the area as the sides of a square, for example 1.4mm x 2mm.

**Grading**

The report will be graded as follows with equal weighting to each category:

1.) Suitability of the paper you picked. Does it represent the general subject of frequency synthesizers? Is the paper trivial or complex?

2.) The use of concepts learned in ECE 6440 to understand and interpret the paper. Did you use any of the concepts and tools learned in the class in writing your report?
3.) The general understanding of the paper. Do you truly know how the frequency synthesizer works and do you understand the unique features and their significance? (The answers to these questions are always found in the ability to clearly and succinctly explain the material to others not familiar with it.)

4.) The quality and organization of the report. The report should follow the general guidelines of an engineering report. This category includes timeliness. You are encouraged to submit your report electronically.


17.) Nicola Da Dalt, Sven Derksen, Patrizia Greco, Christoph Sandner, Harald Schmid, Klaus Strohmayer; A fully integrated 2.4-GHz LC-VCO frequency synthesizer with 3-ps jitter in 0.18-?m standard digital CMOS copper technology, IEEE Journal of Solid-State Circuits, vol. 37, pp. 959 - 962, July 2002.


42.) Christopher Lam, Behzad Razavi; A 2.6-GHz/5.2-GHz frequency synthesizer in 0.4-μm CMOS technology, IEEE Journal of Solid-State Circuits, vol. 35, pp. 788 - 794, May 2000.


