EE6240 Design Project 2: Mixer Design – due Friday 25/10/2013

In this project, you are asked to design a fully-differential double-balanced Gilbert-cell mixer to be used in a direct-conversion receiver, that meets or exceeds the specifications given below. Use the IBM 90nm CMOS BSIM4 process parameters supplied to you. Use the scalable inductor model supplied to you in the LNA project to model any inductors in your circuit. There are two sections in this project:

(a) In this portion of the project, design the mixer for the following specs:

- $f_{RF} = f_{LO}$ = 2.3-2.6GHz; BW of desired signal = 20MHz
- V_{DD} = 1.2V
- Mixer conversion gain > 15dB
- SSB NF ≤ 13dB
- $IIP_2 \geq$ 45dBm; use two tones at 2.405Ghz and 2.406GHz and apply a mismatch of 1% between all devices (active or passive) in the differential paths
- $IIP_3 \geq$ 5dBm; use two tones at 2.405Ghz and 2.406GHz
- Minimise power consumption (P_{diss})

(b) Now, combine the mixer from (a) above with the LNA you designed in Project 1. Determine the overall Gain, NF and IIP_3 and compare your results to hand calculations.

Notes:

1. It is expected that the IM2 and IM3 curves be well-behaved with normal linear behaviour at low power levels and gain compression at high powers. Some gain-expansion is ok (say 2-3dB), but too much is not good. Make sure your IM2 and IM3 curves do not have any unexpected non-linearities at lower power levels. Choose the extrapolation point carefully.
2. Include and discuss the expected characteristics of the LO waveform in your report.