EE 340: Communications Lab Course Outline

Autumn 2015

Instructor: Shalabh Gupta

Learning methodology and objectives

Lab experiments will involve the following

- GNU radio software for signal processing, IQ modulator board and RTL-SDR dongles for RF reception.
- Some breadboard based communication electronics experiments as well.

After completing the lab you will be able to

- understand modulation and demodulation concepts.
- become familiar with some practical issues in wireless and wired communication links.
- use GNU radio companion to implement communication system blocks.
- Understand how some communication system blocks are implemented in actual hardware.

Lab timings and venue

- The class is divided in two batches: Batch A and Batch B
- **Batch A (WED 2:00 pm to 5:00 pm) WEL1**
- **Batch B (THUR 2:00 pm to 5:00 pm) WEL1**

Please reach the lab by 1:45pm (if reach after 2pm, no marks will be allotted to you for the days lab)

Lab organization-1

Basics of communications and SDR

Lab1: Familiarization with GNU Radio and complex signals.

Lab2: Implementation of Amplitude and Frequency Modulation schemes in GNU Radio.

Lab3: Mixer-UP conversion and Down conversion.

IQ-Mod Board Based Experiments

Lab4: IQ Modulator Board and Practical Considerations.

Lab5: Use of pre-emphasis/de-emphasis for high-frequency noise reduction in FM.

Lab6: Non-linearity and its effects in communication systems.

Advanced Topics:

Lab7: Lock Synchronization for Data Recovery in Communication Links using Phase Locked Loops (PLLs).

Lab8: Familiarization with Digital Modulation and Detection

Lab9: Multipath Propagation and Equalization.

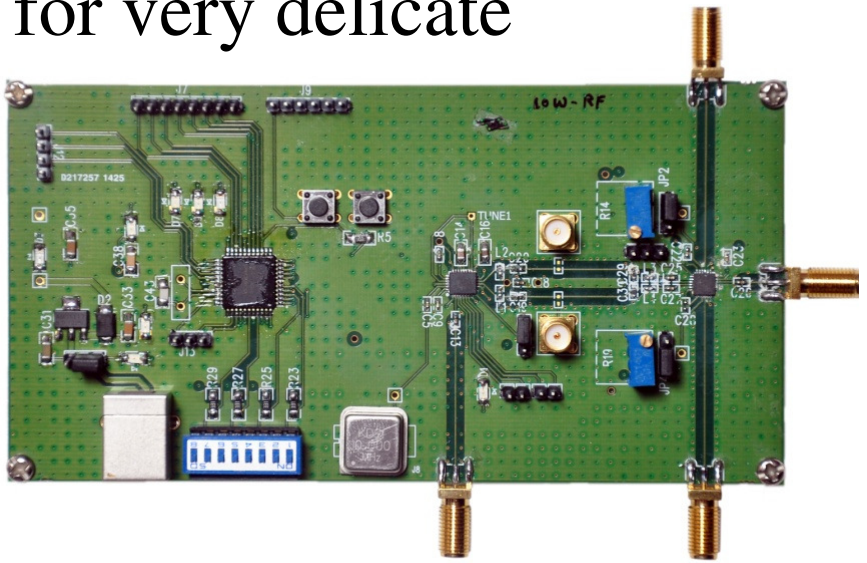
Lab10: Carrier Phase & Frequency Recovery and Compensation in Communication Links using Costas (Phase Locked) Loop.

SDR Dongle: Receiver

- Includes RTL2832U and R820T tuner ICs on the USB deviceRTL2832U
- Will work for both for software defined radio and DVB video capture (where available)
- Compatible with most SDR software, such as GNU Radio
- Provides an approximate tuning range of 25MHz-1700MHz for software defined radio (SDR)

I-Q modulator board: Transmitter

- This is a four layer PCB designed, and developed and fabricated in WEL!
- Thanks to WEL RAs Manu, Saurabh, Amal, Wilson, Nilesh and Onkar, Akshay and Priyanka who have developed all the lab resources for us!
- Thanks to Maheshwar for help in PCB design and also to Shekhar, Shahin and Sadanand for very delicate soldering!



Lab organization-2

Prelab work

- Prelab sheets will be available each week (a few days in advance).
- **Coming for lab session without prelab work is not allowed**
- At the beginning of each lab, there will be a small prelab quiz (5 marks).
- There will be 15 marks for in-the-lab experiments (i.e. a total of 20 marks per session).
- Attendance for each lab is **mandatory**.

Lab organization-3

Grading policy

In session marks:	**50%**
Mid-Sem:	**20%**
End-semester exam/ project:	**30%**