Radio Electronics p3 2021 (preliminary version)

Welcome to the first lecture on Monday Jan 18, 15.15. Digital or pandemic allowing, in Electrum room 204.

Text book: RF Microelectronics, Behzad Razavi, Pearson 2nd edition (available via Kårbokhandeln on KTH campus)
Course material: Lecture slides, Lab PM and project handouts are available through Canvas.
Reference books:

- Madhow, U., "Fundamentals of Digital Communication", Cambridge Press
- Rappaport, T.S., "Wireless Communications: Principles and Practice", Prentice Hall
- R. Johnson, JR., W. A. Sethares, A. G.- Klein, "Software Receiver Design", Cambridge University Press 2011

Examination: 6 credits, Grades A-F based on combined results from two parts I and II.
Part I. Written exam on Chapters 1-4.
Part II. Individual short reports on chapters 5-12.
Lab 1, 2 1.5 credits. Grade P/F.

The first part of the course covers the textbook chapters 1-4 with two matching labs. The second part covers chapters 5-12 and individual reports are required.

The course provides an understanding of how modern radios are designed and function. A number of basic concepts are discussed that limit the radio performance such as noise and non-linearity leading to the radio dynamic range. Modulation techniques are discussed and architectures of receivers and transmitters and how to make design choices depending on desired performance. Wireless standards are discussed and transceiver examples are given. All concepts covered are in much industrial demand at the moment as we are transitioning to fifth generation mobile systems. The first lab contains rf-measurements of radio building blocks using spectrum analysis while the second contains building a radio transmitter and a receiver of those blocks including transmitting content from transmitter to receiver.
The textbook contains so much material it could fill two or more courses. To get an overview of several chapters with material central to designing a modern radio we will go through chapters 5-12 rather quickly without all detail. The student will write reports on each chapter that will be graded and added to the exam results. Key building blocks for radios covered here will be low noise amplifiers, mixers, oscillators, phase locked loops and power amplifiers.

Tentative schedule

L1	Historical background to Mobile communication Chapter 1 Introduction to rf and wireless technology
L2	Chapter 2 Basic concepts in rf design. Slides 4-24 (ISI in ch 3.3.1)
L3	Chapter 2 Basic concepts in rf design. Slides 4-24 (Not ch 2.6-2.8)
L4	Problems Chapter 2
L5	Chapter3 Communication concepts (selected parts of text book, use book as reference)
L6	Chapter 4 Transceiver Architectures Part I (selected parts of text book)
L7	Chapter 4 Transceiver architectures Part II Slides 8-15 (not ch. 4.2.5 and 4.4)
L8	Continued Ch 4 on Transmitters. Exercise Chapter 4
LAB 1	Basic concepts in rf design
LAB 2	Transceiver architectures

L9	Chapter 5 LNA Lecture/Introduction
L10	Chapter 6 Mixers Lecture/Introduction
L11	Chapter 8 Oscillators Lecture/Introduction
L12	Chapter 9 PLL Lecture/Introduction
L13	Chapter 12 PA Lecture/Introduction