

TSEK38 Radio Frequency Transceiver Design

Course overview 2019

1. GENERAL

Course Code: TSEK38, Radio Frequency Transceiver Design (Konstruktion av radiotransceivers), 6 HP (6 ECTS).

Recommended background: TSEK02 Radio Electronics, integrated circuits, wireless communication theory.

Supplementary courses:

TSEK02 Radio Electronics
TSEK03 Radio Frequency Integrated Circuits
Advanced courses in RF CMOS design

Goal: The course should give students a practical knowledge on RF transceiver system design for wireless communications. The course provides systematic design methods of receivers and transmitters used in communication systems, like GSM, WLAN or Bluetooth. System-level perspective will be presented, assumed RF circuits be well understood. The particular objective of the course is that the student will learn design principles of RF systems in terms of the modern radio standards and the existing physical limitations.

After the course the student should be able to:

- analyze an RF system in its physical layer given specifications defined by standards,
- transform the system specification into the requirements for the RF front-end blocks for various architectures,
- design an RF front-end for the required performance using professional software tools.

Course book: Qizheng Gu, "RF System Design of Transceivers for Wireless Communications", Springer, ISBN 0-387-24161-2, 2005.

The course uses Lisam Course Room, where you can find all course material and assigned project tasks in different folders. Uploading of project work reports and feedback will be made with *Submissions* function in the Course Room.

2. LECTURES OVERVIEW

Lecture 1: Introduction (Ch 1)
Lecture 2: Fundamentals of RF system modeling (Ch 2)
Lecture 3: Superheterodyne TRX design (Ch 3.1)
Lecture 4: Homodyne TRX design (Ch 3.2)
Lecture 5: Low-IF TRX design (Ch 3.3)
Lecture 6 + 7: Systematic synthesis (calc) of RX (Ch 5)
Lecture 8 + 9: Systematic synthesis (calc) of TX (Ch 6)

3. STAFF

Teacher (Lectures, labs, seminar/project work supervision, examiner):
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4. LABORATORY EXERCISES

There is one laboratory exercises in this course, 4x4h, no signup is required. The objective is that the student learn how to use ADS for RF design. ADS will also be used in the second part of the project work.

The PDF lab manual will be downloadable from the Lisam Course page, folder *Course documents*.

5. DESIGN PROJECTS

Individual project work on a mobile RF transceiver design:
Part 1. Mathematical model-based TRx synthesis (hand-calculations).
Part 2. Simulation model setup and performance verification in ADS.

Simulation software: Keysight ADS. Supporting software: Matlab and Excel.

Each part of the project will be summarized by a report approved by the Examiner, see the project descriptions for details.

6. EXAMINATION

PRA1 Completed final project report by the project deadline: 4 HP
LAB1 Laboratory assignments: 2 HP