



LUNDS UNIVERSITET  
Lunds Tekniska Högskola

*Course syllabus*

## Högfrekvensförstärkare RF Amplifier Design

**ETIN50, 7,5 credits, A (Second Cycle)**

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED E

Date of Decision: 2023-04-11

### General Information

Elective for: E4-fh, F4, F4-fel, MSOC1, MWIR1, N4-hn

Language of instruction: The course will be given in English

### Aim

The course is intended to give a basic and wide knowledge in analysis and design of radio frequency (RF) amplifiers, based on lumped and distributed components, but also to provide engineering skills in measurement techniques that are necessary for verification of the result. The RF amplifier is an essential part in wireless applications such as cellular phones, multimedia terminals, computer networks, and short range communications between wireless devices.

There is a great demand for this knowledge as this technology area rapidly advances, primarily connected to implementation of systems for 5G and millimetre wave radar.

### Learning outcomes

#### *Knowledge and understanding*

For a passing grade the student must

- be able to analyse and design circuits with reactive components and transmission lines and use the Smith chart for analysis and synthesis of radio frequency circuits
- be able to analyse an amplifier stage with two-port models

#### *Competences and skills*

For a passing grade the student must

- be able to identify the S-parameters of a transistor experimentally, and use these with

- theoretical models in order to design a stable RF amplifier that meets a performance specification
- be able to verify the implemented design with spectrum and network analysers.

### *Judgement and approach*

For a passing grade the student must

- be able to express in writing a solution to a radio frequency problem for colleagues.

## **Contents**

The main focus is analysis and synthesis of high-frequency amplifiers. Systematic methods for the design of amplifiers with regard to optimum gain, stability, noise and output power are described. Circuits implemented with transmission lines and transistors in the frequency range MHz to THz are presented. Signal propagation on transmission lines is a natural topic since the wavelength of the signals often is comparable to the size of the circuit elements. Measurement techniques based on advanced high frequency instruments such as spectrum and network analysers are important practical elements.

The theory presented in lectures is elaborated and practised in exercise seminars. The course comprises mandatory laboratory exercises where advanced measurement techniques are used to compare theoretical models with the behaviour of real components. The course also includes mandatory hand-in assignments.

## **Examination details**

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** Written examination. Hand-in assignments. Laboratory work, with preparation exercises.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

### **Parts**

**Code:** 0121. **Name:** Written Examination.

**Credits:** 5. **Grading scale:** TH. **Assessment:** Passed Examination **Contents:** Written Examination

**Code:** 0221. **Name:** Laboratory Work.

**Credits:** 1. **Grading scale:** UG. **Assessment:** Approved Laboratory Work **Contents:** Laboratory Work

**Code:** 0321. **Name:** Hand-in Assignments.

**Credits:** 1,5. **Grading scale:** UG. **Assessment:** Approved Hand-in Assignments **Contents:** Hand-in Assignments

## **Admission**

**Assumed prior knowledge:** ETIF05 Basic Wireless Communication Technique or EITF50 An Introduction to Wireless Systems

**The number of participants is limited to:** No

**The course overlaps following course/s:** ETI032

## **Reading list**

- G. Ghione, M. Pirola: Microwave Electronics. Cambridge University Press, 2018, ISBN: 978-1-107-17027-8.

- L. Sundström, G. Jönsson, H. Börjeson: Radio Electronics. Tryckeriet i E-huset, 2015.  
Pdf document of previous course literature.

## **Contact and other information**

**Course coordinator:** Navya Sri Garigapati, [navya\\_sri.garigapati@eit.lth.se](mailto:navya_sri.garigapati@eit.lth.se)

**Course homepage:** <https://www.eit.lth.se/course/etin50>

**Further information:** With less than 16 participants, the course may be given with reduced teaching and more self studies.