Task of the Master's thesis in the Embedded Systems Engineering (ISE) program

Topic: Design of an Low Noise Amplifier in the regime of 130- 150 GHz based on InP-HBTs for 6G applications

Task:

In the study of communication systems, amplifiers play an important role. The Low noise amplifier (LNA) is one of the basic building blocks of these communication systems, which exists in the front end of a high frequency receiver (RX). The role of the LNA is to amplify very weak signals received by an antenna. These signals are typically just a little stronger than the noise floor, so the LNA needs to add as little additional noise to the signal as possible. The LNA design involves many tradeoffs between noise figure (NF), gain, bandwidth, linearity, impedance matching, and power dissipation. Generally, the main goal of LNA design is to achieve simultaneous noise and input matching (SNIM) at any given amount of power dissipation. An LNA is used to reduce noise in all later stages. Consequently, it is necessary for an LNA to boost the desired signal power while adding as little noise and distortion as possible to allow signal extraction in the later stages of the system. Thus, the LNA is a critical circuit in these systems since it is the first block in the receiver chain.

This work focuses on the design of LNA to achieve low noise figure (NF), high gain, high bandwidth, high linearity (IIP3), high stability and optimized input matching (S11) in the D- band frequency range based on the InP-HBTs technology of the Ferdinand Braun Institute (FBH). A schematic layout of the circuit is first to be developed in circuit design software (Advanced Design Systems ADS) for 130-150 GHz frequency range by utilizing a design kit by FBH. After that, based on the results of the circuit design, a physical layout shall be designed and simulated in state-of-the-art 3D EM software (ADS or CST Microwave Studio) to verify the results. It is planned that the designed circuit will be fabricated by FBH and utilized in system studies.