Assignment of the Master's Thesis in the Program Electrical Engineering and Information Technology

Topic: Design of a D-Band Power Amplifier in InP DHBT MMIC Technology

Task:

The increasing networking and automation in all areas of industry continuously impose new requirements on the capacity of communication systems. Applications demand systems with ever-higher data rates, reaching up to terabits per second. To meet future demands, the next-generation radio standard, 6G, will utilize the large bandwidth of the terahertz spectrum. This high bandwidth also translates to increased requirements for the semiconductor technologies used to realize the circuits. A promising technology in this frequency range is based on double heterojunction bipolar transistors (DHBTs) in the indium phosphide material system, which is characterized by high cutoff frequencies f_{max} and f_T as well as high breakdown voltages, making it particularly suitable for power amplifiers.

The aim of this work is to design a power amplifier in the D-band with output power in the multi-milliwatt range based on the InP-DHBT MMIC process from the Ferdinand Braun Institute in Berlin. Initially, a suitable topology and amplifier stage number will be determined through an analysis of the available transistor variations. Following this, the schematic design of the circuit will be carried out and optimized concerning output power, efficiency, and bandwidth. Subsequently, a physical layout will be created, which will comply with the design rules of the MMIC process. The generated layout will then be verified using 3D FEM simulation software to estimate the performance of the actual layout and make adjustments if necessary.