

Summary

With the progress in research, the increasingly complex challenges of modern communication requirement can be overcome. As a breakthrough technology for the future, 6G goes beyond the limits of today's wireless communication and enables innovative applications in areas ranging from medical technology and radar to expanded possibilities in artificial intelligence. These technologies rely on use in high frequency ranges, which entails specific requirements. The choice of the right semiconductor for these frequencies is therefore crucial. Advanced transistor technologies such as the heterojunction bipolar transistor (HBT) and the double heterojunction bipolar transistor (DHBT) are used for this purpose. Preferred semiconductor materials for these technologies are SiGe and InP.

In this work, a low-noise amplifier with SiGe-transistors and InP-transistors was developed for use in the frequency range of 110 – 170 GHz. The requirements for the circuit are that it has a low noise level so that the circuit has a high signal-to-noise ratio (SNR) and thus enables a high data rate. Stable and linear behavior is also required. Stability is determined using the k - and μ - factors and a transient simulation. The linearity is evaluated by the OIP3 value.

The amplifier circuit consists of a cascode and is biased by current mirror. The advantage of the cascode is the high amplification and the large bandwidth. The input and output of the circuit are matched to 50 Ω using suitable matching networks.

This circuit was analyzed once with SiGe transistors and once with InP-transistors for its characteristic parameters such as S-parameters, maximum gain and noise. This resulted in a maximum gain of 10 dB at 140 GHz and noise factors between 4 and 6 dB for both amplifiers. The circuits differed only in their bandwidth. The circuit with SiGe-transistors has a bandwidth of 32 GHz and the circuit with InP transistors has a bandwidth of 15 GHz.

In summary, it can be said that both semiconductor materials are suitable for use in a low-noise amplifier.