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Design and Development of Two-stage Low-noise Amplifier (LNA) using E-pHEMT Technology for C-band Application

Abstract

The low-noise amplifier (LNA) is a vital part of the radio frequency (RF) transceiver system. It amplifies weak signals with minimal distortion. The LNA performance is mainly determined by its noise figure (NF), gain, and power consumption. In this paper, the design of a 6 GHz low-noise amplifier (LNA) using enhancement-mode pseudomorphic high-electron-mobility transistor (E-pHEMT) technology is presented. In order to attain high gain with low S-parameters losses, a two-stage LNA configuration with single-stub matching is devised. The same bias conditions are applied to both of the LNA stages, V DS = 2.7 V and I DS = 10 mA. The LNA design is simulated and optimised by using electromagnetic (EM) software. To further improve the overall LNA performances, high impedance inductors and series resonators are implemented into the circuit. Simulated results of the designed LNA indicate a power gain, S 21 of 25.2 dB and NF of 2.4 dB at 6 GHz with 27 mW dissipation per stage. The circuit layout is fulfilled with an E-pHEMT technology (ATF-55143) on the FR4 substrate. The LNA is powered by a 3 V DC power supply.