EE614 – 2019 Solid State Microwave Devices and Applications

Course Project

Power Amplifier Design

1. Amplifier IC: AFIC901N (RF LDMOS Wideband Integrated Power Amplifier)

   The AFIC901N is a 2-stage, high gain amplifier. The device is unmatched even at the interstage, allowing performance to be optimized for any frequency in the 1.8 to 1000 MHz range.

2. Problem Statement

   Design a power amplifier using AFIC901N for a gain of at least 20 dB at 520 MHz. The design is to be fabricated on FR-4 substrate with $\varepsilon_r = 4.4$, h = 1.6 mm, $\tan\delta = 0.02$. Design appropriate matching networks and bias-tee for the given amplifier IC. The amplifier should have S_{11} and S_{12} values less than -10 dB and -60 dB respectively.

3. Methodology

   Following are the recommended design steps.

   a. Datasheet
      Go through the datasheet of AFIC901N in detail to understand the RF performance and bias conditions.
   b. Simulation in ADS
      You will be provided with the S-parameter files (.s2p) of the 2 stages of the given amplifier IC. You can check the performance of the amplifier using these .s2p files, without any matching circuit. (Note: Stage 1 is termed as 'driver' while stage 2 as 'final'.)
   c. Matching Circuit Design
      Based on the simulation results in step *b* above, appropriate matching circuits are to be designed for input, output and the interstage connection.
   d. Bias-Tee Design
      The given S-parameters are for a specific bias condition (mentioned in the files). Appropriate bias-tees have to be designed for both the stages to isolate RF and DC signals.
   e. PCB Layout Design
      For the circuit finalized at the end of step *d*, a PCB layout has to be designed for the given substrate (FR-4).
   f. Fabrication and Testing
      The finalized layout should be fabricated using standard PCB technique and tested for gain performance.