UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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Aufgabe der Abschlussarbeit im ISE Bachelorstudiengang

für: Herr Kevin **Kolpatzeck**

gestellt von: Prof. Dr.-Ing. Klaus Solbach
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Thema: **Driver Amplifier for 7-Tesla MRI Smart Power Amplifier**

Beschreibung:

Description:

In a research project, the department develops a high pulse-power amplifier for a 7-Tesla Magnetic Resonance Imaging (MRI) system. The power amplifier employs a high pulse-power final stage with a driver amplifier and a Cartesian feedback loop to control amplitude and phase of the generated power signal. The feedback loop is based on the translation of the RF signal at 300 MHz to baseband (zero frequency) with in-phase and quadrature-phase components.
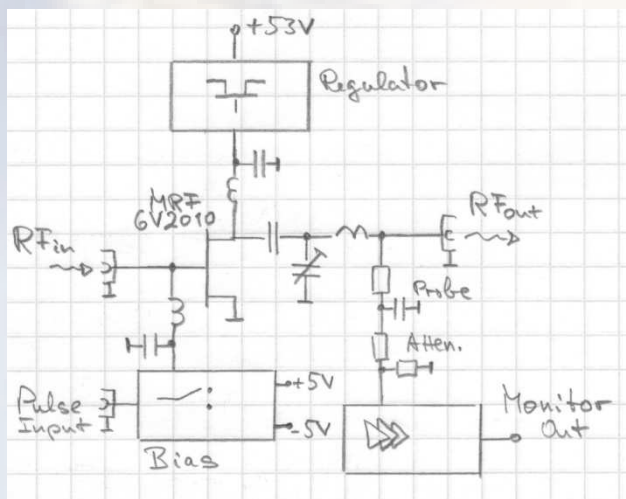
One component of the smart high pulse-power amplifier to be developed is the driver amplifier. The driver accepts an input signal at low power (100 mW) and boosts the power to a level that is required as the input power to the high-power amplifier stage (about 10 W). The driver stage has to be pulsed by switching the bias on and off and has to be flexible in its operating point to allow class A and class A/B operation. Further, the Drain voltage has to be stabilized against droop and the RF output voltage has to be monitored using an envelope detector.

The task of the thesis is to build a complete driver amplifier using the MRF 6V2010 RF power transistor with input and output matching circuits, pulse bias circuit and voltage regulator.

In particular, the task entails the following steps:

- Design input- and output L-C matching circuits for the RF amplifier based on available data from earlier designs and the manufacturer's data sheet.
- Design a microstrip circuit layout for the RF amplifier using the EAGLE tool for PCB production and using RO4003 of 0.8 mm thickness which is mounted on a brass groundplane.
- Design a PCB layout for the pulse bias circuit (Gate voltage) and for the voltage regulator (Drain voltage), both based on circuits developed at the department.
- Design a PCB layout for an RF voltage probe and a logarithmic envelope detector circuit using the AD8307 integrated circuit based on the data sheet of the manufacturer.
- Combine the layouts into one design, using as little as possible of board area, prepare the data files and submit to the PCB workshop.
- After production of the PCB, assemble the circuit and adjust the dc levels of the bias circuit.
- Test for DC current consumption and functionality of the bias circuit and the voltage regulator for different modes of operation and pulse width from 100 usec to 5 msec
- Measure and adjust the RF amplifier match at input and tune the output matching network for maximum output power.
- Test the gain and linearity of the amplifier and verify the correct operation of the monitor circuit.

At the end of the work, a public presentation of results is to be given.