UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

Prof. Dr.-Ing. K. Solbach
Prof. Dr.-Ing. A. Beyer

Aufgabe der Abschlussarbeit im EIT Bachelorstudiengang

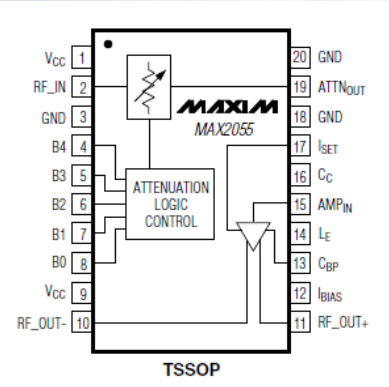
für: Herrn Khaled **Rebhi**

gestellt von: Prof. Dr.-Ing. Klaus Solbach
Fakultät für Ingenieurwissenschaft - Hochfrequenztechnik

Thema: **Driver Chain for 7-Tesla MRI Smart Power Amplifier**

Beschreibung:

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 chain 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 chain. The driver accepts an input signal at low power (a few milliwatt at maximum) 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 linear in its transfer characteristic and its gain has to be adjustable in order to allow a degree of adaptation of the over-all gain of the smart amplifier to input levels and to variations in the gain of the last stage.



TSSOP

Task:
The task of the thesis is to build a two-stage driver amplifier using available active and passive components, in particular using an integrated circuit MAX2055 as a first stage with digital gain control and the MRF6V2010 LDMOS transistor for the second stage delivering 10 W of RF pulse power at 300 MHz. For both stages, the manufacturers provide schematics and layout examples which have to be adapted to the requirements of a narrow-band amplifier by band-pass filter inter-stage coupling and tuned matching circuits.

In particular, the task entails the following steps:

- Design a circuit layout and assemble (after production of the PCB at our workshop) the first stage amplifier using the MAX2055 integrated circuit with a DIP switch bank for manual gain control and using a band-pass filter at the output.
- Test the circuit regarding gain, gain control range, output power and linearity.
- Design a circuit layout and assemble (after production of the PCB at our workshop) the second stage amplifier with input and output matched to 50 Ohm.
- Test the circuit regarding gain, output power, efficiency and linearity using continuous and pulsed input power.
- Design a circuit layout of a combined two-stage driver amplifier using the designs for both partial circuits and using as little as possible board area.
- Assemble (after production of the PCB at our workshop) the amplifier and test using continuous and pulsed input power. Measure gain, gain control range, output power, efficiency, linearity and test immunity against self-oscillations (stability), thermal stability and effects of supply voltage variations.

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