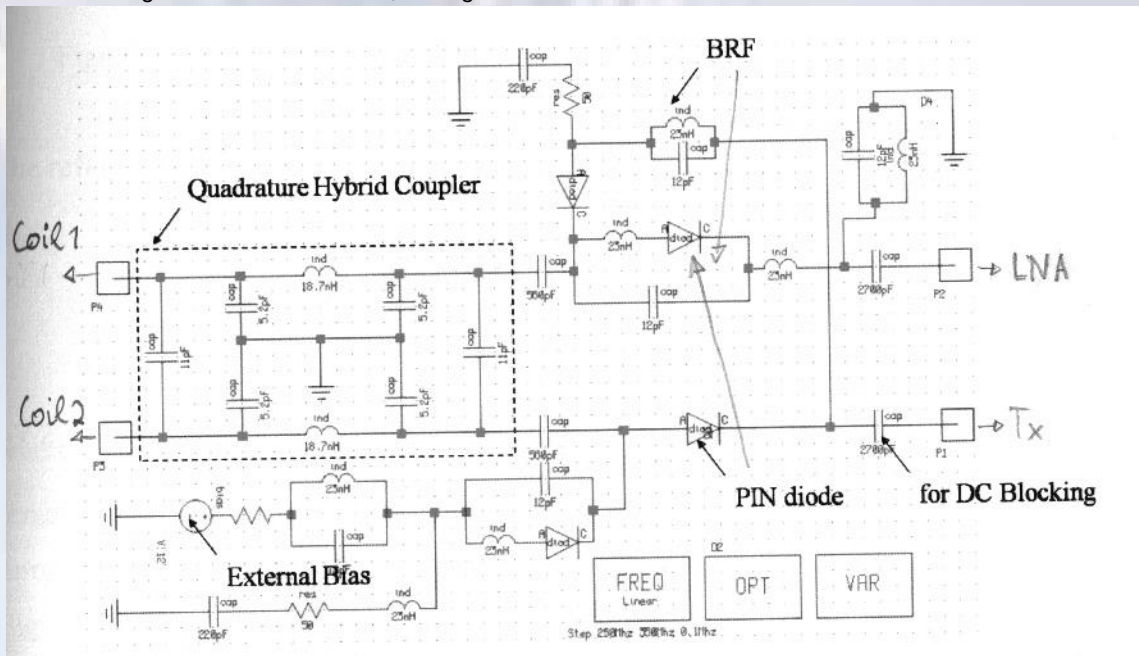


Projektarbeit

Task: Transmit/Receive Switch for Quadrature Coils in a 7-Tesla Magnetic Resonance Imaging System (MRI)

Our research project "7-Tesla MRT Ganzkörperspule" has provided an array of transmit coils (antennas) which can be electronically steered in phase and amplitude in order to compensate inhomogeneous field distributions inside the patient body. In order to allow the use of the coils also in receive, a suitable transmit/receive switch has to be inserted between the high-power transmitter and the receiver low-noise amplifier. A recent doctoral thesis has presented a detailed design of such a T/R switch, see figure below.

Project Task

The task of the project is to examine this design by simulation and to build the circuit for testing in our 7 Tesla MRI at the Erwin L. Hahn Institute (Essen).

In particular the task is to

- Set-up an RF-simulation of the quadrature coupler and of the complete circuit in Advanced Design System (ADS, a microwave circuit analysis tool) and verify the function of the switch
- Select suitable and available component values for the critical low-loss capacitors in the LC resonant circuits and in the quadrature hybrid coupler
- lay-out a microstrip (or grounded coplanar) circuit realization on Rogers RO4003 laminate
- prepare the data files for production of the printed circuit board for production of the board at our in-house PCB workshop
- after production of the PCB, assemble and test the circuit (impedance/reflection coefficients, insertion loss, insertion phase) using a vector network analyzer
- tune the circuit for correct quadrature performance of the coupler and for the correct resonance frequencies of the LC resonant circuits by modifications in the wire wound inductors

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