

Aufgabe der Abschlussarbeit im ISE Bachelorstudiengang

für: Herrn Muhammad Kashif Aqil

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Thema: **RF Level Adjustment for 7-Tesla MRT Vector Modulator**

Thesis Task:

Our research project "7-Tesla MRT Ganzkörperspule" aims at the development of an array of coils (antennas) which can be electronically steered in phase and amplitude in order to compensate inhomogeneous field distributions inside the patient body. One work package requires the development of an 8-channel Vector Modulator for the small-signal radio frequency (RF) signals at 300 MHz which excite eight high-power amplifier stages. The input level of the Vector Modulator has to be adjusted in order to keep the active electronic circuit out of the saturation regime and the output signal has to be attenuated in order to compensate the gain (amplification) of the electronic circuit. The required attenuation range is 0 dB to 10 dB which shall be realized in dual steps (bits) of an analogue RF-circuit. The realization technology is to be RF-printed circuit technology using passive attenuator ICs which are voltage controlled by electronic potentiometer circuits (ICs) with digital interface as used at the department for other applications.

The thesis task is to design a printed circuit for the attenuator circuit, using commercial ICs and other surface-mount technology (SMD) components and using microstrip line on a dielectric laminate as the printed circuit technology.

In particular the task is to

- perform a search of the literature to find other relevant concepts and circuits for electronic attenuators
- get familiar with the voltage-controlled attenuator concept for passive electronic attenuators
- get familiar with the electronic potentiometer circuits and digital control interface developed at the department for other applications
- select capacitors and inductors for the bias circuit and dc-blocking
- layout the transmission lines and the electronic circuits and prepare the data files for production of printed circuit boards using EAGLE software
- assemble and test the circuits (match, insertion loss, insertion phase) using the network analyzer
- optimize the circuits for correct attenuation steps between the switch states and minimum phase variation with attenuation settings

After completion of thesis work a public presentation of results is to be given at the department.