UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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Aufgabe der Abschlussarbeit im Masterstudiengang (ERASMUS)

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Thema: **Magnetic Field Probe for Nearfield Measuremets of Antennas for 7-Tesla Magnetic Resonance Tomograph (MRT)**

Description:

Our research project “7-Tesla MRT Ganzkörperspule” has developed coils (antennas) for transmission and reception of signals at 300 MHz frequency. The important properties of the coils are related to the magnetic near field (close to the coil). Therefore, optimization of coils deals with current distributions on the coil which create homogeneous and strong fields – which have to be measured in realized coils constructions.
Magnetic fields can be measured based on the Faraday’ law (induction) using a small balanced loop made from a coaxial cable. The loop will convert the alternating magnetic field into an induced voltage which excites a wave into the coaxial cable. Using a network analyzer with the antenna as one port and the loop as the second port, we can make measurements of the transmission scattering parameter which can be related to the magnetic field strength at the position of the loop above the antenna once the wave magnitude (power) incident to the antenna is known.
The task of the thesis is to build a number of small loops and characterize the loops as magnetic field probes. This includes the determination of the equivalent circuit and the calibration (conversion factor and frequency variation) of the loops using measurements and calculation. In addition, the pick-up of electric field is to be checked and a compensation scheme using oppositely directed small dipole wires across the shield slit is to be tested.

The task in particular is to:

- Search the literature for information on design and function of the loops.
- Build a few loops of different diameter and using different coaxial cable.
- Measure the impedance of the loops and establish the equivalent circuit and the corner frequencies.
- Take measurements of the transmission scattering parameter on the loops over a suitable air-dielectric microstrip transmission line at frequencies up to 1 GHz and check for deviations from the theoretical pattern due to the standing waves.
- Derive the approximate electric and magnetic field strengths under the TEM-cell for a given input power.
- Take measurements of the transmission scattering parameter on the loops inside a TEM-Cell in order to derive the calibration factor and to verify the E-field compensation scheme.
- Derive the probe calibration constants from the calculated magnetic fields under the TEM-cell and the measured scattering parameters as a function of loop diameter and frequency.

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