UNIVERSITÄT DUISBURG ESSEN

# Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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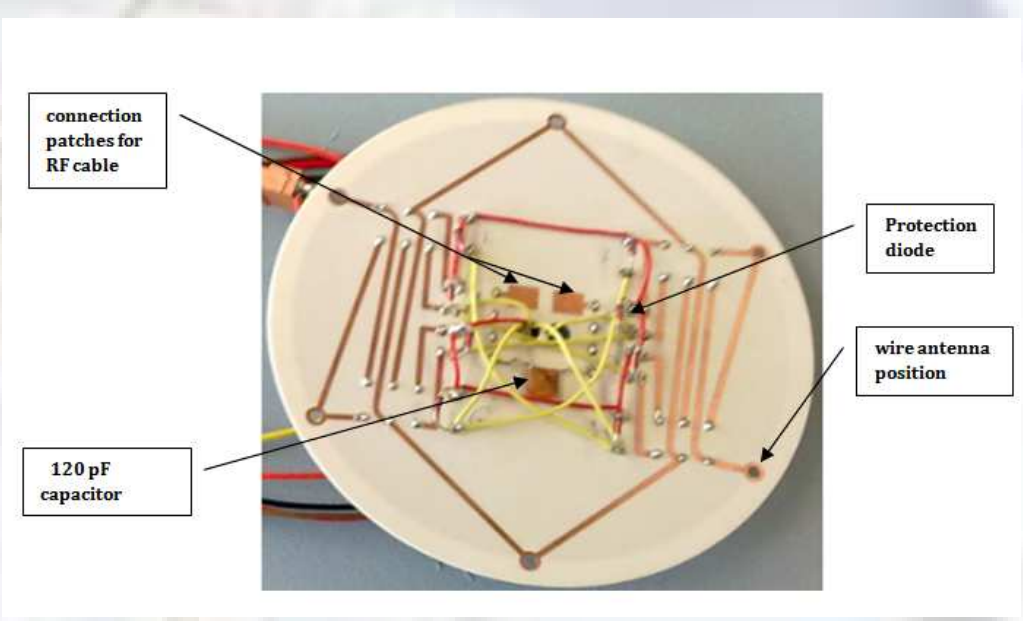
## Projektarbeit

### Task: Relay Board for a novel Switched Beam Antenna for HF communications

Description:
Many communication systems require antennas with omni-directional coverage and high gain. A single antenna element (e.g., a dipole) cannot provide both at the same time. Present solutions use either an antenna array with electronic scan (phased array) or use a mechanical rotation of an antenna array. A novel “switched beam” solution has been realized in an earlier Master Thesis* by Ashraf Ahmad, where six quarter-wave conductors (wires) are arranged around a carrier pole and are interconnected by electro-mechanical switches (relays) to create two V-shaped dipoles which act as a two-element array antenna. Using different settings of the switches, six different array antennas can be realized with six overlapping main beams covering the full 360° in azimuth with some gain relative to a single dipole.




The task:
The task of the thesis is to design, build and test new relay boards for an improved version of the switched beam antenna for 14 MHz. In particular, the boards are to be designed to allow the six antenna conductors to be switched individually to function as driven element, as parasitic element or in a common mode. The relays and the connecting lines (conductors) are to be placed on a multi-layer PCB where also a part of the impedance matching network is to be realized. The task entails the following steps:

- Measure the capacitance between the open relay contacts using a Vector Network Analyzer
- Design one relay board for three relays per antenna conductor and one for four relays using the EAGLE software
- Include an impedance matching element and a load for the parasitic element
- Assemble the relay boards and measure the impedance between the six antenna terminals for all switching states and compare results to predictions based on the relays’ capacitances

This task requires some background in RF technology (lecture on “MRFT”, Bachelor course) and requires the ability to design a printed circuit board.

*See presentation of 16.08.2010 in http://hft.uni-duisburg-essen.de/arbeiten/arbeiten.shtml