

**Aufgabe der Abschlussarbeit im
EIT Bachelorstudiengang****für:** Frau Jennifer **Dutiné****gestellt von:** Prof. Dr.-Ing. Klaus Solbach
Fakultät für Ingenieurwissenschaft - Hochfrequenztechnik**Thema:** **Control Board for a novel Switched Beam Antenna for HF communications****Beschreibung:**

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 Abuelhaija, 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 a new control circuit for the relay board. The control circuit comprises a table-top unit with a mechanical rotary switch with six positions and an encoder circuit, and a remote switch board which is integrated with the relay board on the antenna mast and which is connected to the table-top unit via a eight-wire control cable. The relay switch board uses a decoder circuit to turn-on the relays as required for the antenna settings. Apart from the six antenna beam directions as controlled by the rotary switch, additional relay settings and the control of additional relays lead to a maximum of 16 different settings which can be encoded in a 4-bit word and transmitted over four wires of the control cable. The table-top unit is housed in a box large enough to provide space for a world map with LEDs to indicate the antenna beam heading direction.

The task entails the following steps:

- Determine the truth table for the relay actuation based on the requirements of the intended antenna beam steering with four relays per antenna conductors
- Design a 4-bit encoder circuit and a decoder circuit with relay transistor driver stages
- Design a PCB for each board using EAGLE software
- Assemble and test the individual fabricated boards
- Test the complete circuit
- Assemble the relay boards and measure the impedance between the six antenna terminals for all switching states and compare results to the specifications of the relay board

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