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## Diplomarbeit / Masterarbeit

Aufgabe der Abschlussarbeit im

ISE Bachelor/Masterstudiengang

**für:** Herrn Luis Ernesto **Quineche Orellana**  
**gestellt von:** Prof. Dr.-Ing. K. Solbach  
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**Thema:** **Investigation of Board-Mounted Omni-Directional Antennas for WLAN-Applications**

### Description of Problem:

In wireless LAN systems, antennas of omni-directional radiation characteristic are important in achieving 360° coverage by one single antenna. Presently, such antennas are available as integrated antennas on the printed circuit board (PCB) or as off-board unit, both using designs based on the simple monopole antenna. The integrated antenna types are compromise solutions due to the placement of monopole structures at the edge of the PCB which does not allow real omni-directional characteristic when the PCB is oriented horizontally. The Off-board antenna units can be oriented vertically so that the natural radiation pattern of a monopole over ground can be exploited with good azimuthal coverage over 360°.

Recently, antenna array systems have been proposed which utilize a number of antenna elements to form an antenna array with a narrow beam which can be electronically switched or scanned in direction. Two thesis projects in the department presently are aimed at the design of 4-element arrays with four discrete beams in azimuth which can be utilized at the same time, so-called multi-beam arrays. In one of the projects the radiator-elements to be employed in the designs are monopole antennas which are mounted on the circuit board and fed by a microstrip transmission line; this type of radiators is basically uncovered in the literature, although it is a close relative to the classical dipole- and monopole antenna covered in any textbook on antennas.

### Thesis Task:

The thesis task is an investigation of various types of monopole antennas which are mounted on a circuit board and fed by a microstrip line. In particular, the task is to investigate as far as time allows all four types of antennas:

- monopoles of quarter-wave length
- shorted monopoles with top-loading and microstrip matching circuit
- folded shorted monopoles with top loading
- monopoles of half-wavelength with microstrip matching circuit

The investigation is to cover the design, simulation and fabrication of radiators and the test of the feed-point impedance / reflection coefficient, efficiency and radiation pattern. The antennas are to be realized on boards of standard FR4 material and microwave substrate-material. The effect of limited size of the PCB on the radiation pattern is to be noted and a comparison is to be made of the radiator variants w.r.t. volume, height, bandwidth and efficiency. With respect to array applications of the antenna elements it is also interesting to measure the mutual coupling scattering parameter of a pair of antennas as a function of frequency and distance and find the most robust antenna type from a comparison of results.

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