UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik
Institut für Nachrichten- und Kommunikationstechnik

Prof. Dr.-Ing. K. Solbach
Prof. Dr.-Ing. A. Beyer

Studienarbeit / Bachelorarbeit

Aufgabe der Studienarbeit

im Hauptstudium II

für: Herrn Liangjun **Wu**

gestellt von: Herrn Prof. Dr.-Ing. K. Solbach
Fakultät für Ingenieurwissenschaften - Hochfrequenztechnik

Thema: **Planar Multi-Beam Antenna for W-LAN**

Description of Problem:

Wireless Local Area Networks in dense traffic situations may use base station antennas with directional selectivity in order to divide the traffic in angular sectors. While in mobile communications this concept is implemented using individual sector antennas placed around a base station mast, in W-LAN applications we need smaller, more simple and inexpensive solutions. If we require beams only in a limited angular sector (non omni-directional), e.g. in a hemisphere, one way is to employ a planar array of radiators which are fed by a network in order to create a number of beams in the azimuth plane.

The Task:

The task in this project is to design and evaluate such an antenna for a 2.4 GHz system. The antenna array employs four radiators and is fed by a network made of four directional coupler (90° phase shift) - power dividers, called a *Butler Matrix*. In an earlier Bachelor thesis, a patch antenna element was designed, which can be incorporated into this thesis work. A special requirement of the antenna system is a coverage of a full 180° angular range in azimuth (hemisphere) which we may realize by reducing the element spacing and by suitable bending of the planar substrate carrying the radiator elements.

In particular the task incorporates

- Search for applicable publications and patents
- Simulation of beam patterns and optimization of element spacing
- Layout and test of a planar patch radiator element
- Design of the matrix circuit topology based on commercially available surface mount power dividers and production of layout; alternatively network based on microstrip branch guide coupler
- Production and measurement of S-parameters of the matrix network
- Production and pattern test of the complete antenna in an anechoic chamber
- Extension of pattern coverage by bending the planar substrate

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If time allows, the following additional tasks may be covered

- Simulation or measurement of element patterns and of the mutual coupling matrix of the four radiators
- Full network simulation of the antenna system using the Advanced Design System tool
- Simulation of the radiation pattern based on the element pattern and on the radiator current distribution as calculated from the network simulation and comparison with array pattern measurements

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