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Aufgabe der Abschlussarbeit im EIT Bachelorstudiengang

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Thema: **Experimental validation of a novel broadband design for frequency-scanning periodic leaky wave antennas**

Beschreibung:

Recently, a novel broadband design concept, for series fed patch array antennas has been investigated [Chen]. Based on this concept, a family of series-fed patch (SFP) antenna arrays has been designed and optimized for 24 GHz [Zhou]. This family of antennas and auxiliary circuitry consists of TRL calibration standards, single antenna columns, power dividers and several multicolumn array antennas. Furthermore, a hardware design from our group, a Composite Right/Left-Handed (CRLH) antenna [Caloz] for 24 GHz, is currently fabricated. The task of this Bachelor thesis is to comprehensively examine these SFP and CRLH antennas so to support the broadband design concept by measurement validation.
For the SFP and CRLH antennas under test (AUT), the transition frequency, where the antennas scan through broadside, is very critical. Here, generally a strong frequency dependency of the Bloch impedance and the attenuation constant is observed as well as a degradation of the antenna gain in broadside direction. The broadband optimization in [Chen] presents a methodology to achieve constant Bloch impedance and a frequency independent attenuation to overcome the aforementioned broadside radiation problem at the transition frequency.

In this thesis the chosen measurement scenarios and the presentation of the results should solve the question whether and to what extend the antennas under test show that optimum behavior based on their broadband design. Therefore, some relevant effects at 24 GHz, as there are measurement errors, fabrication tolerances (etching, component placement, multi-layer misalignment) and material parameter variations of the dielectric substrate (permittivity, losses, potential anisotropy) must be addressed and related to the raised question.

The following subtasks ought to be solved

- get familiar with the previous work [Chen] and [Zhou]
- apply the Thru Reflect Line (TRL) calibration method for accurate parameter extraction
- perform cylindrical near-field measurements to calculate gain and efficiency
- perform far-field measurements to determine the gain
- compare the measured results with existing simulation results, assess the agreement and refine simulation models if needed
- give an detailed summary of your results and assess the broadband design procedure

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

[Chen], Chen, Z. (2009), *Analysis and Synthesis of Series-Fed Patch Array Antennas using Bloch-Floquet Boundaries, Bachelor thesis*, University Duisburg-Essen, Germany
[Zhou], Zhou, B. (2010), *Broadband Series-Fed Patch Array Antenna Design and Optimization for 24 GHz, Bachelor thesis*, University Duisburg-Essen, Germany
[Caloz], Caloz, C. & Itoh, T. (2005), *Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications*, Wiley-IEEE Press.
[Pozar], Pozar, D. M. (2004), *Microwave Engineering*, J.Wiley & Sons, New York, 3nd ed.