UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

H F T

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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Aufgabe der Abschlussarbeit im ISE Bachelorstudiengang

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Thema: **Evaluation of Multilayer Printed Circuit Board Technology to Design a Compact 1-to-N Microwave Power Divider**

Beschreibung:

The technology department of University Duisburg-Essen is currently establishing Multilayer Printed Circuit Board fabrication processes for Rogers RO4350/RO4003 laminates [1]. These substrate materials have low loss and are therefore suitable for microwave applications where losses might be critical. The fabrication process together with the specific Rogers laminate combination is to be evaluated to establish a reliable prototyping process for frequencies between 20 GHz and 30 GHz. The acquired knowledge is be used to develop a compact 1-to-N microwave power divider.

The thesis task is divided into two parts.

The first part covers technological aspects of multilayer fabrication technology using Rogers RO4350 or RO4003 PCB laminates. Test structures (e.g. ring resonators, line resonators or electrically long transmission lines) are to be developed for material characterization to determine the permittivity and loss tangent at 24 GHz. These structures have to be fabricated at the University's in-house technological department or they can be fabricated at an external PCB company for verification. The candidate must get familiar with network measurement techniques to assess the quality of the test structures. Different calibration techniques Short Open Load Thru (SOLT) and Transmission Reflect Line (TRL) can be applied, where the latter is particularly suitable in a microstrip or stripline environment.

The second part of the task is to design a 1-to-N power divider in stripline technology taking into account fabrication limitations, tolerances and material parameters, which are developed in the first part. This power divider is to be based on a composite right/left-handed transmission line (CRLH-TL) [2] in symmetric stripline technology to avoid radiation. The CRLH-TL is operated as an open-ended zeroth-order resonator, so to excite the individual shunt resonators, where each shunt resonator is tapped to form an output port. The design requirements are: operation frequency 24 GHz, uniform power division and phase distribution, low loss and compact size. The final prototype is to be compared to a standard divider tree of Wilkinson power dividers. Trade-offs: Bandwidth, loss and size comparing the new and the standard concept can be addressed to provide practical guidance.

A final presentation of the results has to be given in the department of Hochfrequenztechnik (HFT).