UNIVERSITÄT DUISBURG ESSEN

Fachgebiet Hochfrequenztechnik

HFT

Fachbereich Ingenieurwissenschaften
Abteilung Elektrotechnik und Informationstechnik

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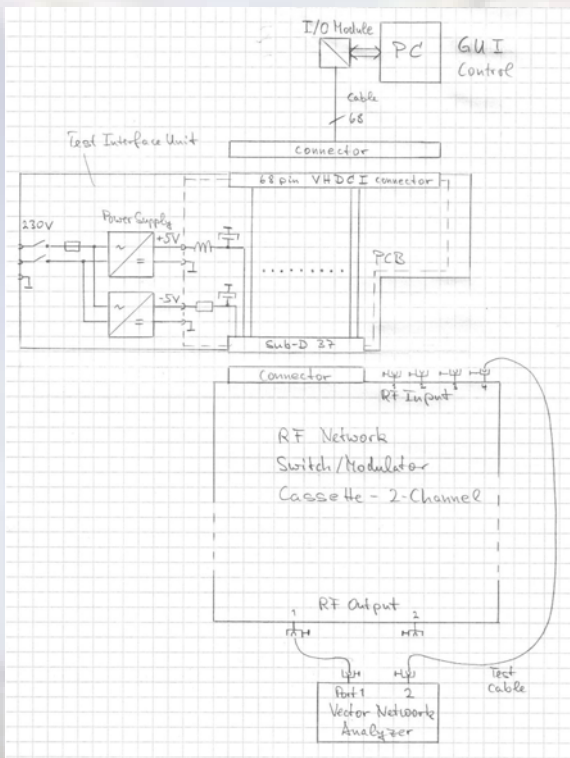Prof. Dr.-Ing. A. Beyer

Aufgabe der Abschlussarbeit im
ISE Bachelorstudiengang

für: Herr Chao **Xia**

gestellt von: Prof. Dr.-Ing. Klaus Solbach
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Thema: **Test Interface Unit for Switch/Modulator Cassette in 7 Tesla MRI System**

Beschreibung:

In our project *MRexcite* we develop a 32-channel RF transmit power amplifier array for a 7 Tesla MRI system. The amplifiers are driven by vector modulators to set phase and amplitude individually for each channel. For this purpose, the RF Network includes 16 cassettes containing switch/modulator circuits for two RF channels each. The switch/modulator circuits select one of four input signals for each channel and set amplitude and phase controlled via a parallel digital interface with 16 bits for address and data. In the final application system, sixteen cassettes are arranged in a 19-inch rack and digital control is provided by a 32-bit PC digital I/O module. Digital control signals as well as dc voltages are supplied to the cassettes via Sub-D connectors.

The thesis task is to design a Test Interface Unit for the test of the functionality of cassettes after fabrication and/or repair.
The task entails the following steps:
1. Familiarize with the function of the Switch/Modulator and its digital control interface based on the available documentation in project *MRexcite* and IC manufacturer data sheets.
2. Familiarize with the function and programming of the digital I/O module (to be acquired after start of thesis work) using the manufacturer documentation.
3. Familiarize with EAGLE, the CAD tool to be used for the design of the printed circuit board (PCB).
4. Design the circuit schematic for the Test Interface PCB which mainly combines the 68 pin VHDCI connector and the 37 pin Sub-D connector.
5. Transfer the circuit to the board layout in EAGLE and optimize positions of connectors to fit in a standard metal case.
6. Deliver the PCB data set to the in-house PCB workshop. Assemble the components to the fabricated PCB and combine with the power supplies to build up the Test Interface Unit.
7. Program a graphical user interface (GUI) in Matlab to control the data and address bits on the digital I/O module.
8. Test the functionality of the Test Interface Unit by
a. transmitting static settings of the Switch/Modulator cassette channels and checking the RF insertion phase and amplitude using a Vector Network Analyzer,
b. transmitting fast varying settings creating graphical figures (straight lines, circles, spirals, etc.) at the Vector Network Analyzer display.

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