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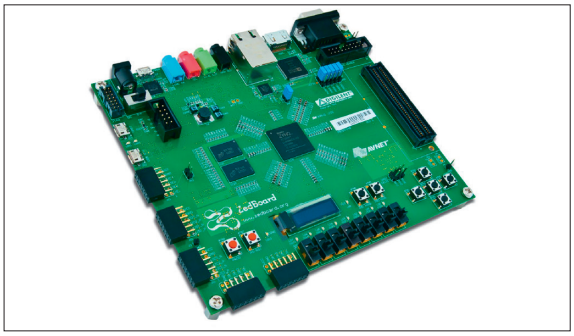
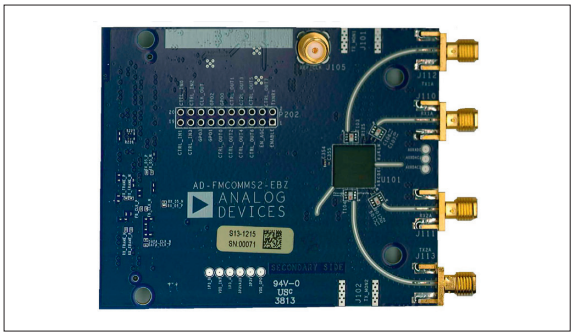
Subject Area	Mobilkommunikation

Channel simulator with an FPGA

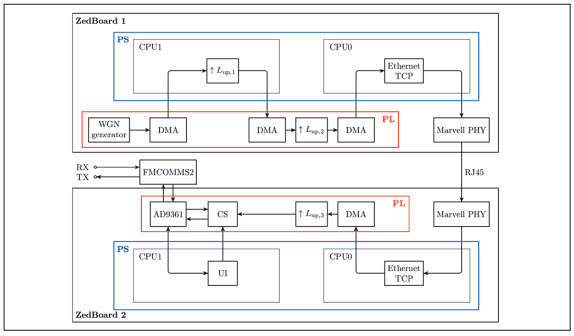
Channel simulator with a maximum bandwidth of 56 MHz in the Bluetooth low energy band of 2,400 to 2,484 MHz



The ZedBoard is the development board of the Xilinx Zynq SoC



The FMCOMMS2 is the transceiver board of the radio signals



Block scheme of the whole channel simulator system

Introduction: Roman Gassman's master's thesis showed that it is advantageous to have a channel simulator while developing a radio frequency system. This allows the modelling of different physical influences in a mobile communication channel. These effects are mostly not easy to simulate. It is also diffcult and expensive to test a prototype in different environments. With a channel simulator this should be achievable with less effort. The previous work showed that it is possible to build such a channel simulator. However, it became apparent that the chosen hardware was not an appropriate instrument for developing such a channel simulator. The programming language used for the hardware works with graphical blocks. Some details were not adjustable, unknown or not documented. The complexity level of the task was above the possibilities of that tool. As a conclusion to his work, Gassmann proposed switching to a text-based programming language to describe the hardware.

Proceeding: In conclusion, it is preferable to develop a channel simulator. In a first step, Matlab simulations should be carried out to learn how such a device can be built on hardware. The next step is to get to know the hardware and to implement the channel simulator. The system should be fully configurable.

Solution: The ZedBoard is an evaluation board for the Zynq from Xilinx. This Zynq is a so-called system on a chip and has an FPGA and a processor in one package. The different parts of the channel simulator were implemented in this device. Because the design used too many resources, the simulator was implemented in two ZedBoards. This worked because the complexity level of such a device is fairly high. Therefore, the communication between these two boards was investigated and implemented. Communication over the TCP protocol was implemented. As the part that converts the radio frequency signal to digital signals, the FMCOMMS2 board was evaluated and examined. The communication between the ZedBoard and this card could be successfully implemented. The subsystems mentioned above were first simulated with Matlab and Simulink to find out how the channel simulator could be implemented effciently. Afterwards, they were all implemented and could be tested successfully. However, in the end, merging these could not be realised because of time reasons.