

Department of Electrical and Information Engineering

**Master Thesis  
Ajay Bhardwaj**

## **INVESTIGATION OF WIRELESS CHANNEL MODELS FOR INDUSTRIAL APPLICATIONS**

### **Abstract**

Real-time performance evaluations of wireless communication networks (e.g. Bluetooth) is an extremely challenging topic. The major challenge of the real-time performance analysis in actual network installation is the lack of repeatability due to uncontrollable interference and propagation complexities. They are generally caused by multipath propagation and time varying effects. This underscores the need of a simulation model for a particular wireless system that predicts the behavior of the developed system under different harsh environments.

In this thesis, a Bluetooth based system is investigated, which was developed at the department of Electrical and Information Engineering, designed to act as a sensor actuator interface (SAI). It transmits periodic information to a central computer or to the other Bluetooth system. This system is investigated in different environments and their specific results are discussed and suitable pathloss model are derived.

To predict the behavior of the SAI in a new environment, a true prototype Simulink model of the system is developed. Channel coding mechanisms such as forward error correction (FEC), cyclic redundancy check (CRC) and automatic repeat request (ARQ) are implemented. The simulation is performed by considering all possible different channels (Rician, Rayleigh and AWGN channels) with an emulation of related parameters such as bit error rate (BER), packet error rate (PER) at the application layer and at the baseband layer.

A statistical 2-state Gilbert Elliot Markov Model is suggested for the future implementation into the developed Bluetooth Simulink model with the impression that the most reliable and secure data should be transmitted when the state is good else it should wait for a good state.

**1<sup>st</sup> Supervisor      Prof. Dr.-Ing. Uwe Meier**

**2<sup>nd</sup> Supervisor      Prof. Dr.-Ing. Stefan Witte**