Department of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

HOCHSCHULE BREMEN
UNIVERSITY OF APPLIED SCIENCES

Master 2007

Berkin Fenli

Design and Implementation of a Channel Encoder/Decoder for Optical Free Space Transmission

ABSTRACT - Masterthesis

The principles of free-space optical transmission were worked out in the 60s after the development of the first laser diodes and other optical components. However, atmospheric turbulence can greatly degrade the performance of free-space optical links, particularly over ranges of the order of 1 km or longer.

Channel coding is a type of digital signal processing that improves data reliability by introducing a known structure into a data sequence prior to transmission or storage. This structure enables a receiving system to detect and possibly correct errors caused by corruption from the channel and the receiver.

Channel coding can be applied to improve the error performance an such channels. In optical free-space transmission, channel coding is not applied until now. However, it is expected that the performance of free-space transmission increases significantly with channel coding.

The goal of this thesis is to design and analyze a channel coding scheme suitable for highspeed optical free-space transmission. This thesis is done with the company Tesat-Spacecom. The channel coding scheme shall be matched to the frame structure and further technical constraints defined by Tesat-Spacecom. Towards that goal, a novel channel coding scheme called line product codes has been invented which is perfectly matched to the given constraints.

The useful channel encoder/decoder is designed and implemented in ANSI C Code and VHSIC Hardware Description Language (VHDL) code. The results of the new channel coding scheme will be seen by these programming languages. Also the results from both codes simulations will be compared. ANSI C Code will give information about the software part. VHDL Code will give information about the hardware design.