

Master's Thesis

LTE over optical wireless channel

To satisfy the exponentially increasing demand for mobile data communications radical new solutions are needed. One promising idea is to off-load some of the data traffic from the radio frequency (RF) domain to the optical domain by using so-called Visible Light Communications (VLC). With the wide spread use of light emitting diodes (LEDs) in smart devices, flashlight, street and traffic lights, vehicles, trains, planes, etc. there is the opportunity to set-up VLC links for a range of applications in both indoor and outdoor environments. However, VLC is very sensitive to signal blockage due to the high directionality of the optical channel. But there are also major advantages of VLC like the excellent spectrum reuse as the risk of co-channel interference is small as compared to radio frequency (RF). Hence, VLC has gained substantial attention from both industry and the research community which require large-scale deployments of low-cost VLC solutions indoors as well as outdoors. The goal of this thesis is to study whether the standard 3GPP LTE protocol stack designed for operation in RF bands can be reused for communication over optical wireless channel (OWC) Such an approach would be very promising as LTE operators could upgrade their infrastructure (BSs) with little effort in order to start off-loading mobile traffic to the optical channel.

■ Goals of the Thesis

The goal of this thesis is to experimentally analyze the performance of LTE over an OWC. Starting with a simple configuration of an LTE link with downlink operation only, a bi-directional LTE communication where OWC is used for DL and radio frequency (RF) for uplink (UL), towards a full OWC-setup where both DL and UL use OWC or a configuration where RF and OWC are simultaneously used in DL by means of carrier aggregation techniques available in LTE. The performance of the system is to be evaluated in different scenarios (e.g. link distance) while considering different metrics provided by the srsLTE software toolbox. Possible milestones are as follows:

- Study the relevant literature on LTE
- Learn the srsLTE toolbox and perform first tests in testbed using Software-defined Radio technology
- Identify literature on OWC
- Setup the LTE-over-OWC testbed for the different use-cases
- Perform experiments and collect relevant performance metrics
- Analyze the results and discuss the differences to LTE over RF

■ Keywords

LTE, SDR, optical wireless channel

Contact:

Dr. Zubow: <zubow@tkn.tu-berlin.de>

Website:

www.tkn.tu-berlin.de