

Fading Illustration with Software Defined Radio

Semester Thesis for Sara Cinzia Halter and Naoki Pross
HS 2021

1 Introduction

In real-world wireless channels a variation of signal attenuation occurs for example due to multipath propagation, shadowing effects produced by obstacles, and movement of transmitter or receiver. Channels affected by this effects are usually referred to as fading channels. To be able to make the impact on the signal visible, Software Defined Radios (SDR) come in handy, because they give a high degree of freedom regarding the signal processing part of the transmitter and receiver. This gives the possibility of interchanging parameters in the signal processing chain in software very quickly without developing new transmitter and receiver architectures.

2 Task Definition

The goal of this thesis is to develop a SDR-based demonstrator, consisting of one transmitter and one receiver, to illustrate the impact of different fading effects on the signal. To get a brief understanding of the concept of fading channels, the project should be started with a literature research followed by simulation of different scenarios, which then can be reproduced by measurements. The following tasks should be carried out:

- Evaluate a suitable development environment for the SDR (GNURadio, Matlab or others).
- Develop the signal processing chain for the SDR transmitter and receiver.
- Allow the flexibility to change parameters such as for example modulation scheme.
- Elaborate scenarios which can be demonstrated (walking, car).

3 Project Schedule & Specifications

At the beginning of the thesis, a project schedule and a specification sheet must be prepared and submitted to the supervisor within the first two weeks:

- Plan a total of 240 working hours (8 ECTS \times 30 h/ECTS) per student.
- The project work should be divided appropriately within the group; the report must include a breakdown and comparison of the planned and the effectively implemented project plan.
- A typical specification sheet can be found in the Student's Guide and on the public server¹.

4 Lab Journal

Each student has to keep a handwritten and dated lab journal. The journal can be either in the form of a bound booklet or, if you have a laptop with a touchscreen, digitally but still handwritten. All activities concerning duration and results are to be recorded in it, along with the minutes of the weekly meetings. The lab journal has to be handed in at the end of the work and will be graded.

¹Path of the public server: \\hsr.ch\root\auw\sge\labors\Mk\pub_for_students\

5 Thesis Report

The thesis report must contain all considerations, clarifications, calculations as well as investigations in detail (in text and figures). Beyond that, the following points need to be considered:

- The text the report should not exceed 60 pages.
- The report must be written legibly and clearly structured. Guidelines on structure and other useful information can be found in the Student's Guide, which is available in printed form in the workspace folder and digitally on the student server.
- The report must include a signed non-plagiarism declaration, an example of this explanation can also be found on the public server.
- Two printed copies of the report must be submitted. A microSD card containing all data (incl. a PDF of the report, with a file size of ≤ 5 MB) has to be enclosed with each report.
- Writing in English is highly encouraged, and so is the use of \LaTeX .

Further details will be discussed and determined during the weekly meetings. Meanwhile, the project work should be carried out as independently as possible. The criteria for evaluation and grading are provided in the Student's Guide.

6 Important Dates

Project start:	September 20, 2021
Report submission:	December 24, 2021, 12:00
Presentation:	tbd

7 Administrative Information

Adviser:	Michel Nyffenegger, michel.nyffenegger@ost.ch
Lab assistant:	Marcel Kluser, 058 257 42 73, marcel.kluser@ost.ch
Place of work:	WsComm Lab, 2.106a
Meetings:	weekly, by arrangement, in the lab or via Teams
Examiner:	Prof. Dr. Heinz Mathis, heinz.mathis@ost.ch