PROJECT 2: Synchronization

Department of Electronic Systems, NTNU

1. Goal

The purpose of this project is to experiment with linear modulations on a radio hardware simulation, in the context of detection in noise.

Additionally, the students should gain understanding of the behavior of received signal characteristics related to receiver synchronization methods.

2. Group work

- Groups of three, random population
- Joint report

Collaboration and discussion across groups recommended. Regular rules regarding citation of sources, as well as acknowledgement of help received apply.

3. Project 2

The students are provided a MATLAB livescript which serves as the main control hub for a Simulink baseband digital communication system. The livescript guides through the project with task descriptions and explanations. The following topics are covered:

- Channel and Hardware Effects
- Timing Synchronization
- Phase and Carrier Frequency Synchronization
- Phase-Locked Loops (PLL)
- Data-aided synchronization

3.1. Reporting

In addition to the completed Matlab livescript and other project files a report must be delivered. 2 page max. Keep to the deadlines, no extensions.

Important parts of reports are:

1. Problem statement: describe the general project set-up.

2. Address tasks from the livescript with solutions and conclusions. Include relevant theory. Introduce performance metrics and any validation or verification methods you will use (Spectrum plots, constellation plots, eye diagram).

3. Reflection: overall reflection, conclusions, lessons learned.

The report template is available in BlackBoard. Please do not deviate from the structure unless you strongly feel it will improve the report.

3.2. Grading criteria (0-15pts)

- General quality: clarity, readability, structure (2pts)
- Relevant Theory to predict measurement results identified and explained (2pts)
- Documentation of design at a level that enables justification for theory (why the theory applies to the design) (3pts)
- Test design (3pts)
  - Choose and/or design tests to evaluate system characteristics (e.g. performance) and verify against requirements
  - Documentation of the test method for the quantity of interest.
- Result analysis (5pts)
  - Comparison to theory
  - Identification of deviations and unexpected results (wrt theory), eventually further tests to explain the results

4. Project support

- Johan Suárez, (johan.suarez@ntnu.no)