Experience report
G13

Sara Akbari
Haitham Babbili
Waleed Abu Laban
Eltjon Qefalija

18 October 2021

1 Project Organization

The organization and work distribution in the group went well. First, we divided the work into two parts, each part is assigned for two members in the group, one for the transmitter and the other one for the receiver which makes addressing the problems easier during the work process.
The organization for the meetings was good since every group member was committed by time and the plan that was in the proposal. Moreover, delivering reports and room booking was distributed between the group members that help us to be in time.
No conflict happened between the group members that is because every one knows his/her mission and did it correct.

2 Planning Process

According to the project plan, the project work was supposed to be divided between two groups of two members each, one working on the transmitter and the other on the receiver, but since the group came up on that, the receiver required much more working than the transmitter, so instead the members agreed on working together on the remaining part of the receiver after the finishing of the transmitter.
Initially, the plan was to use 240 Hz for bandwidth, but after testing it was found that 120 Hz is enough for data transmission with size 432 bits. In addition, the roll off factor was intended to be half, but in practice 0.4 was used to provide more bandwidth for transmission. Moreover, the carrier frequencies were planned to be 1 KHz and 6 KHz however the project uses 4 KHz and 5 KHz which was found better using the given headphones. Furthermore, the round trip time was suggested to be 4.5 sec while in practice it was around 3 sec because the group adjusted the filter in a better setting.

3 Cooperation and motivation

The group members followed the rules which were agreed in the common values very well during this project. The group meetings were held regularly twice a week in person and that changed to almost everyday in last two weeks with the members' agreement. Everyone would contribute to the

project's development with his own ideas and that was the case especially the last 2 weeks, since we tried many ideas in order to fix our final problems.
Each of us wanted to finish this project so that we get the highest profit obviously, and to learn more about the problems that we encountered, because these problems are the ones that we might encounter later in other projects. Also every engineer when finishes a project, views the process as an achievement.
Finally, not only every project contributes to our society in its own way, but it helps addressing new problems and solve past problems.

4 Profitability

Our initial estimation for working hours in this Project was 250 hours, but the project took more than 310 hours. The group spent more time on the project implementation, testing and modification to make the program more robust for the costumer. The group decided not to charge the costumer more than what was in the proposal, since the additional time was helping the group to understand the project and the course in a better way.
However, the group will ask the costumer to promote the work in business society as a startup tech-company.

5 Learning during the project

The hardships that we faced during the project gave us a lot to learn. Firstly, we faced a problem with practicality where new problems on real hardware arises that never existed in theory like choosing parameters that fit the quality of the headphones.
Also, we learned to measure the output at each step to build the future work on solid base, so we plotted a lot of time-domain signals, frequency-domain signals and constellations.
Further more, each time we faced an idea that did not work we gained a lot of ways that we should avoid, and by progressing the road of project completion became clearer, for example we tried to send a pilot signal for continuous time phase fix but after a lot of problems we faced we learned that this idea does not fit into the project specifications.
And at the end, since in last two weeks, while we were about to be done with the project, we faced a case which made us work on it everyday, so we learned to never trust 100% the pre-set schedule.

6 Suggestions for improvements

We suggest to add solutions to solve the problem of phase miss detection in full duplex systems when transmission for both systems is not timed perfectly.
One idea is to add a pilot at different frequency that keeps track for the phase changes with the message, assuming that the system is has no frequency selective fading.
Another idea is to send multiple preambles at different time slots to increase the accuracy of phase detection through the whole time of transmission.
One more final improvement idea is related to how much we can push the system parameters further, since we used a combination of theory and trial and error to reach our final parameter choice, so there might be a better parameters that fits this exact hardware in a better way.