

PROJECT DESCRIPTION, EITN21, PART TWO, HT2, 2021

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Task 1: Your task is to implement an OFDM system over the audio channel via speakers and mics. The system should be capable of transferring a file (text, picture etc.) from one computer to another. Most system parameters are optional, but the system must include the following components:

- A minimum of 64 subcarriers.
- 4-QAM symbol constellation, or larger.
- A preamble with pilots only, then data together with 4 sub-channels with continuous pilot symbols.
- Your system must at least operate at 0.5 kb/s.
- Minimum separation between speaker and microphone is 1 meter.
- Minimum length of file: 20000 bits.

A convolutional code is optional, and can be used if there is need for it. As soon as you can, reliably, transmit and decode the signal, you have passed Task 1. Do not forget to look at (by plotting them) the signals that you are transmitting. If they have a large peak-to-average power ratio it might be good to consider the use of a scrambler.

Task 2: In Task 2, a full duplex system should be implemented. The system should be packet based, and each packet must consist of at most 1000 information bits. In addition, parity bits should be inserted at the transmitter for each packet via a CRC. All packets are next sent to the receiver, which decodes each packet, and verifies the parity bits. The system parameters are the same as for task 1. Note that the packet length is subject to optimization. If the packet length is long, there will be many re-transmissions. The receiver next acknowledges the correctly decoded packets, and asks for re-transmission of the incorrectly decoded packets. The transmitter now re-transmits the requested packets. This process is repeated until all packets have been correctly received at the receiver. A particular nice way to present this task is to let the file represent a picture. Then the receiver can plot the correctly decoded packets to the screen, while the incorrect packets show up as noise.

Form of presentation: This audio based part should be submitted no later than, Dec 3, 2021, at 12.00. There will be ONE chance to correct and resubmit the report directly after the presentation if necessary, further resubmissions are examined during the re-exam periods.

The written report should be 3-4 pages, and include a block diagram of the system, a plot of the results and with the full code as an appendix. As an engineer you of course compare your results to theoretical results where applicable, and show that you have reached the goal or met the requirements. The report should look nice, and be written using proper English. Graphs should be crisp and have labels and axis descriptions. Include a scatter plot so that you can analyze the received constellation diagram. Plot the signals you are transmitting to make sure that they look as you want them to look. Analyze also how the phase of the continuous pilots evolves over time and frequency. Include your code as an appendix at the end of the report.

Both members of the group will be examined individually! All details of the system must be known to both group members.