

# COMM.SYS.450

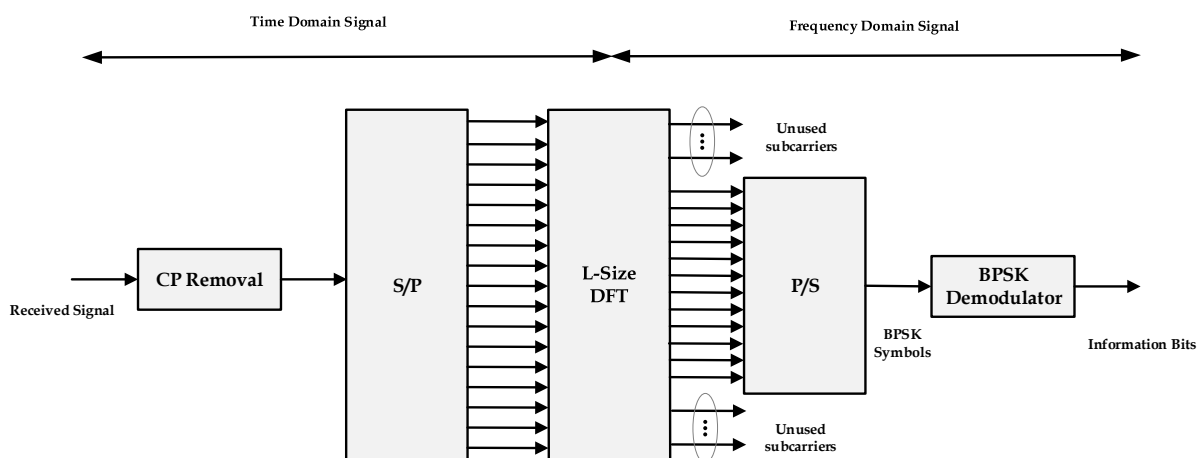
## Multicarrier and Multiantenna Techniques

### Exercises 2

Familiarizing with the task before attending the session is strongly recommended, and some work to finalize the code may be needed afterwards. For the exercise bonus, it is required to return the solution script to **Moodle** by the following Tuesday at 16:00. A model solution will be available on Moodle once the submission is closed. For any inquiries regarding the grading of the exercise returns please contact Karel Pärin ([karel.parlin@tuni.fi](mailto:karel.parlin@tuni.fi)).

The second exercise task is to implement an OFDM transmitter with 300 active subcarriers, 15 KHz subcarrier spacing and BPSK symbols as subcarrier modulation. Add a CP with a duration of  $1.6667 \cdot 10^{-5}$  seconds. In addition, you will need to implement the corresponding OFDM receiver to be able to recover the BPSK symbols. For this second exercise, we will assume that the transmission is carried-out over an ideal channel with impulse response  $\delta(t)$ .

The different receiver blocks that you will need to implement are described in the figure below, note that it follows the same principle as that of the transmitter but in the other way around.



First of all, you have to implement the OFDM transmitter, you can use your previous work or the model solution and change the system parameters accordingly. Then, you will have to pass the signal through the ideal channel. Once you have the signal at the channel output it is time to implement the OFDM receiver.

For the receiver implementation, you will need to remove the cyclic prefix from your received signal first. After that, you will have to perform the OFDM demodulation, this is done by means of the DFT operator (it basically undoes the effect of the IDFT). **Note that for the DFT to be able to undo the effect of the IDFT, that is, to be able to demodulate the OFDM waveform, it must have its same size, otherwise, it will just compute the discrete Fourier transform of the signal.** Once you have demodulated the OFDM signal, you just have to select the DFT bins (outputs) that are carrying the actual information symbols. Demodulate the BPSK symbols and check if it corresponds to the sequence that you generated at the transmitter.

Use the Matlab template Ex2.m that is provided on POP to write your code. More detailed explanations about how to do the coding are given there.

What to submit: a zip file containing the following

- 1) Matlab script with the solution.
- 2) PDF with a short explanation of the main concepts reviewed in the exercise and figures returned by the script, if any