COMM.SYS.450

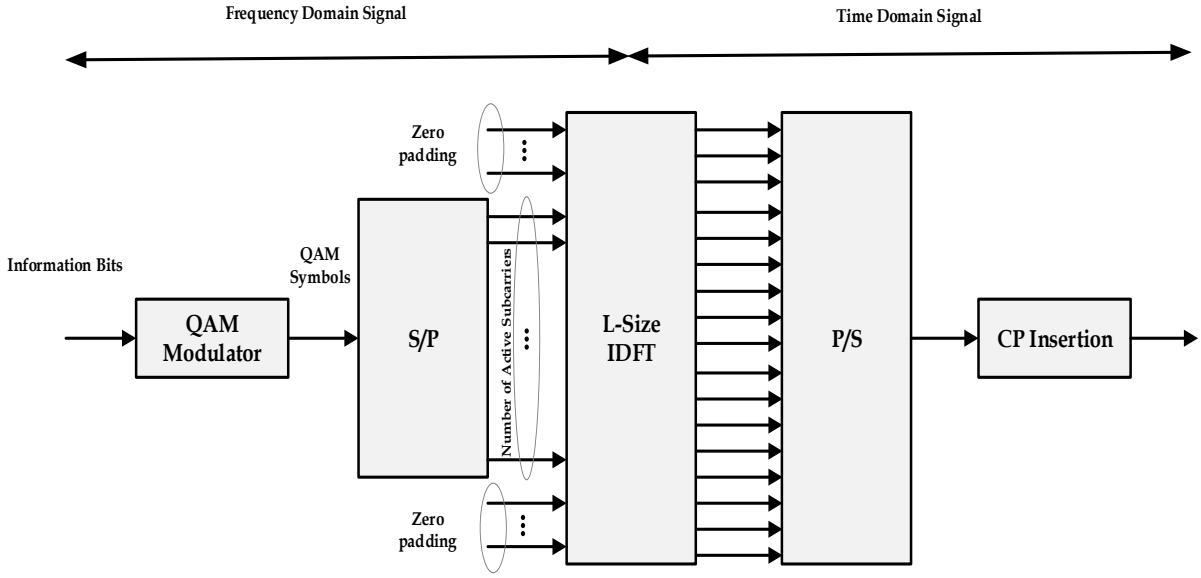
Multicarrier and Multiantenna Techniques

Exercises 1

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** before the following Tuesday. A model solution will be available on Moodle once the submission is closed.

The first exercise task is to implement an OFDM transmitter with **300 active subcarriers** and **16-QAM** symbols as subcarrier modulation. After generating the OFDM symbol, you need to include a **CP of ¼ times the OFDM symbol duration**.

The different steps that you will need to implement are described in the figure below.



First, you will need to generate a random sequence of information bits that will be the input to a 16-QAM modulator, which will map those bits onto their respective QAM symbols. Since we have 300 subcarriers available, you will need to generate the number of QAM symbols and choose the size of the IDFT accordingly. Since the number of active subcarriers and the size of the IDFT are different, you will have to add a zero padding. Physically, the zero padding is added on both sides of the OFDM spectrum as it is illustrated in the figure. This zero padding will act as guardband allowing to reduce the interference power leakage to the adjacent channel. At the output of the IDFT block, we will have our time domain OFDM symbol to which you will need to add the CP. Note that the S/P and P/S blocks are intended for

illustration purposes, since they just transform row vectors into column vectors and vice versa, respectively.

Use the Matlab template Ex1.m that is provided on Moodle 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.**