EITP30 Modern Wireless Systems - 5G and Beyond

Exercise Set 01

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Exercises:

1. a) Estimate the number of sub-carriers in 3GPP LTE in case of a 10 MHz transmission bandwidth. Also determine the total number of coded bits carried by one OFDM signal if all sub-carriers are modulated with 64-QAM.

   b) In LTE, a transmitted OFDM signal duration typically is approximately equal to $71.7\ \mu s$, and the sub-carrier spacing is $15\ kHz$. Does this mean that the different sub-carriers are orthogonal over the entire OFDM symbol interval?

2. How many coded bits per second can be transmitted from an antenna within an LTE resource-block pair if we assume that 16-QAM is used in all sub-carriers?
   Is the obtained value reasonable for the uplink for a Category 3 terminal?

3. How many coded bits per second can be sent in LTE within a 20 MHz bandwidth if we assume that 64-QAM is used in all sub-carriers, and that eight transmitting and receiving antennas are used. Assume also normal cyclic prefix.

4. What is the required bandwidth to provide the peak rate of UE Category 9 devices?