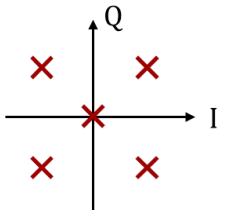
Spectral Efficiency Analysis of Complex-Valuex On-Off Keying with Faster-Than-Nyquist Signaling

Studienarbeit/Diplomarbeit/Project Work

Problem Statement



Impulse radio is a strong contender for energy-efficient wireless communications when the requirements on the spectral efficiency are low. However, possibilities to increase the spectral efficiency of impulse radio play a big role in enabling energy-efficient communications for a wider range of applications. Latest results show that encoding information in the sign of real-valued on-off keying reduces the required energy per communicated bit significantly. Therefore, the achievable rate is of interest when going one step further and using complex QPSK symbols when a pulse is transmitted. As this means that the real and imaginary part are linked, the achievable rate for real-valued symbols cannot be simply doubled but a new evaluation is required which is the objective of this work. To further increase the achievable rate, faster-than-Nyquist signaling in combination with runlength-limited sequences shall be used as done in previous works.

Tasks

- Familiarization with
  - Faster-than-Nyquist signaling and runlength-limited sequences
  - The simulation-based evaluation of the mutual information
- Implementation of the spectral efficiency evaluation for complex-valued on-off keying
- Analysis of the obtained results

Expected Skills

- Basic knowledge of information theory
- Experience with python or MATLAB

Contact Person

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  Please include a recent transcript of your grades when getting in contact

Recommended References

- F. Roth et al., “Why to Use the Phase in Time-Encoding Modulation and Its Effect on the Spectral Efficiency,” in Proceedings of IEEE International Symposium On Personal, Indoor And Mobile Radio Communications (PIMRC 2024), Valencia, Spain, Sep. 2024.
- D. M. Arnold et al. , “Simulation-Based Computation of Information Rates for Channels With Memory,” *IEEE Trans. Inf. Theory*, vol. 52, no. 8, Aug. 2006, doi: 10.1109/TIT.2006.878110.