Industrial Communications [DT0725] & Industrial Internet of Things [DT0942] — 2025/03/28

Exercise 1

Consider a wireless networked control system operating at 2450 MHz with a 2 MHz bandwidth. The receiver (RX) of the actuator is affected by thermal noise (assume $T = 300$ K) and is placed at a distance of 50 m from the remote controller transmitter (TX). Antenna gains at the TX and RX are 3 dB and 0 dB, respectively. Assume a bit-error-ratio (BER) constraint of BER $\leq 10^{-3}$.

1) Consider QPSK, 8-PSK, and 16-PSK modulation schemes and plot the BER curves as a function of E_b/N_0. Determine the required transmit power for each modulation format to achieve the BER constraint.
2) Consider 4-QAM, 16-QAM, and 64-QAM modulation schemes and plot the BER curves as a function of E_b/N_0. Determine the required transmit power for each modulation format to achieve the BER constraint.
3) Produce a table to compare the considered modulation formats. The table should include the required E_b/N_0 for the assigned BER target, the determined transmit power and the served bit-rate.

Solve the exercise by using SIMULINK and MATLAB programmatically.

Useful links

- BER and SER for uncoded data over AWGN channels
- Creating and updating wait bar dialog box
- Physical constants in MATLAB (requires the Phased Array System Toolbox)
- Running and scripting programmatic simulations of Simulink models
- Programmatic Modeling Basics
- Programmatically Specifying Block Parameters and Properties
- Property Inspector
- Programmatic Model Editing
- Simulink Block Libraries
- Keyboard Shortcuts and Mouse Actions for Simulink Modeling