



## Telematics – Exercises No. 3

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*Winter Term 2012/13, November 2<sup>nd</sup>, 2012*

### **Exercise 1, Signal to Noise Ratio:**

A binary signal is sent via a 4 kHz wide channel with a signal to noise ratio of 25 dB. Calculate the maximum data rate.

### **Exercise 2, Maximum Data Rate:**

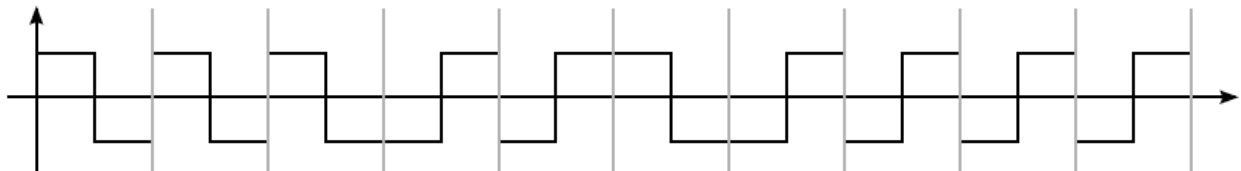
A quaternary signal is sent via a 15 MHz wide channel. The medium experiences interference. We measure a signal to noise ratio of 32 dB. Calculate the maximum data rate that can be achieved over this channel.

### **Exercise 3, Noiseless channel:**

Specify the maximum data rate that can be achieved over a noiseless 5 kHz wide channel.

### **Exercise 4, (Differential) Manchester:**

Consider you have measured the following signal.



The vertical lines represent the end of a bit. Specify the bit sequence that is encoded in the signal considering that it was encoded with:

1. Manchester baseband encoding (also called biphas-level)
2. Differential Manchester

Can the bit sequences be specified unambiguously?

### **Exercise 5, Data Encoding:**

The following bit sequence shall be encoded: 0101110010

Represent the sequence in a time-voltage-diagram using the following encoding schemes:

1. Non-Return-to-Zero (NRZ)
2. Return-to-Zero (RZ)
3. Differential-Non-Return-to-Zero
4. Manchester
5. Differential-Manchester

### **Exercise 6, Manchester Encoding & Bandwidth:**

Explain the disadvantage of the Manchester encoding scheme. Propose an improvement!

### **Exercise 7, Analog to Digital:**

Consider a scenario where an analog voice sample has to be transmitted via a digital network.

1. Explain how this can be achieved and which steps are necessary.
2. Discuss the errors that can occur.
3. Discuss the sampling theorem in this context.

### **Exercise 8, Base- and Broadband:**

Explain the term baseband and broadband. Why do we need broadband communication? Explain how broadband communication of baseband signals is achieved. Give example application scenarios.