Single Carrier

Thomas Verelst - Pieter Van Damme

November 2016

Task 1

See Matlab code in file *audiotrans.m*.

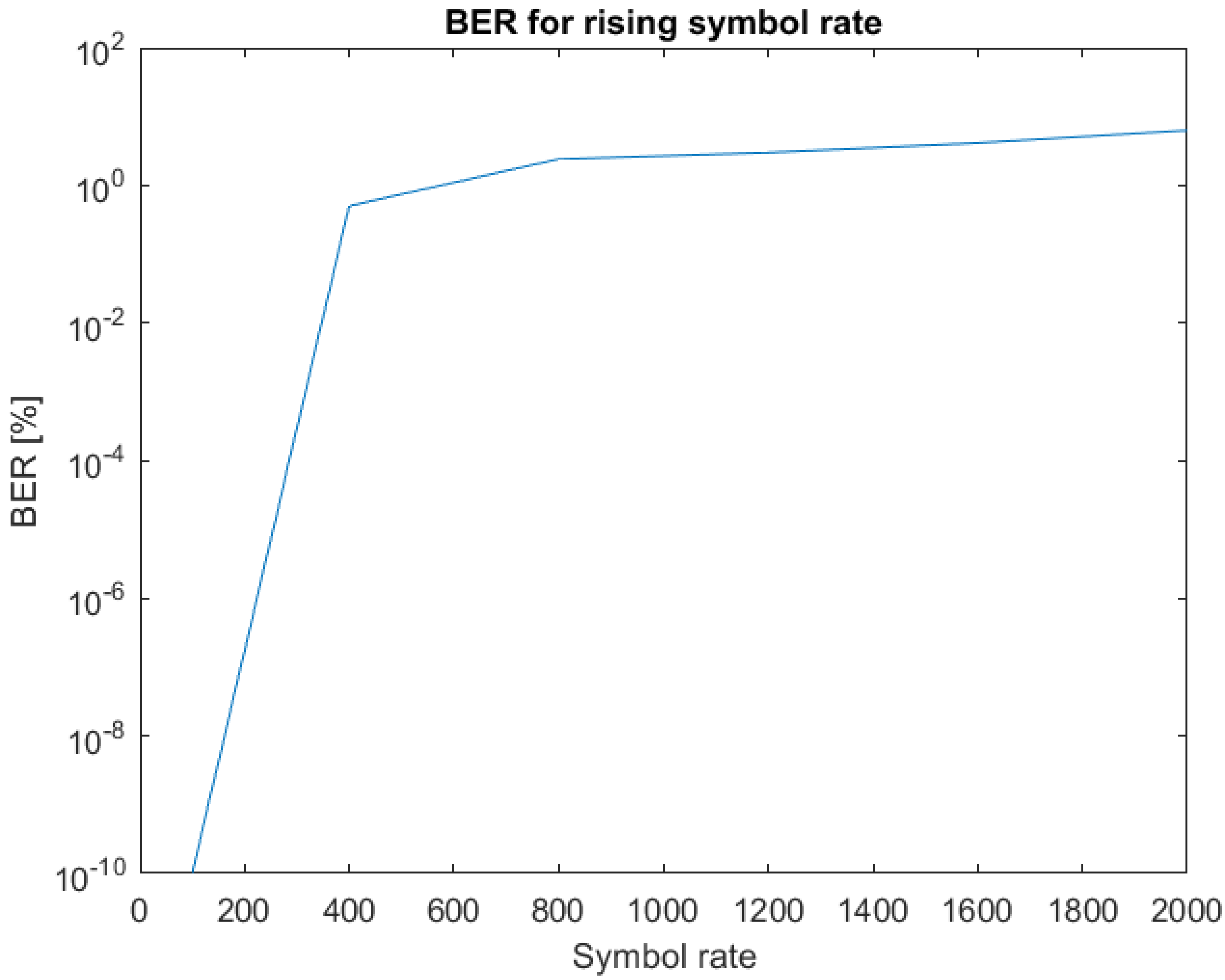
You can clearly hear the sine wave when you implement a baseband signal that generates an unmodulated carrier wave.

Task 2

In our transmission system we use a fixed sample frequency of 48kHz. We tested our system using 4kHz, but multiple carrier frequencies are possible. The oversampling factor depends on the ratio of the sampling frequency and the used symbol rate. In our system we implemented a frame synchronizer by using a preamble of length 100 genarated with a LFSR. The duration of the transmission depends on the used symbol rate. If we double the symbol rate the duration is cut by half for the same amount of bits. We did not implement time synchronization, because we already implemented frame synchronization and we use a very high sampling rate. We implemented a phase estimator.

Task 3

Every time the symbol rate is doubled, the length of the rrc pulses is cut by half. This is because the oversampling factor becomes smaller and therefore the symbol period becomes shorter. In the BER plot we can see that the BER becomes higher when the symbol rate rises.



Task 4

When we introduce a frequency offset we sample the incoming data at the wrong moment in time. This time offset varies for every incoming sample. So even if the frequency offset is low, this will result in a rather large sampling offset for long transmission times. This is shown in the following plot. It is clear that this will result in a worse BER plot. When the offset becomes to big we will also not be able to detect the preamble.

Our system is able to detect the preamble when the offset is situated somewhere between 0.5Hz and 1Hz. To solve this problem we should implement a timing estimator. The approximated sampling result can than be recovered by using interpolation.