

Lab 3 report - Pulse shaping and matched filtering

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Task 1

See Matlab code in file *ex3-3-1_demodpulse.m*.

We add AWGN with the given SNR (assuming the given signal is normalized and has a power of 1).

```
1 wx = 1/sqrt(SNRlin*2) * (randn(length(signal), 1) + randn(length(signal), 1)*1i);
2 rx_signal = signal + wx;
```

The coefficients of the matched filter are generated with the *rrc.m* function because the RRC is its own matched filter, as explained in the assignment.

We can apply the filter by using the MATLAB *conv* command. To prevent a change of length (heads and tails), the argument 'same' is added to the function.

```
1 fir_rrc = rrc(os_factor, 0.22, rx_filterlen);
2 filtered_rx_signal = conv(rx_signal, fir_rrc, 'same');
```

Task 2

See Matlab code in file *ex3-3-2.m*.

The output and

The file output gives us:

```
1 FILTER TAPS: 3, FILTER LENGTH: 1, BER: 0.017169
2 FILTER TAPS: 5, FILTER LENGTH: 2, BER: 0.009831
3 FILTER TAPS: 7, FILTER LENGTH: 3, BER: 0.012487
4 FILTER TAPS: 9, FILTER LENGTH: 4, BER: 0.011004
5 FILTER TAPS: 11, FILTER LENGTH: 5, BER: 0.007615
6 FILTER TAPS: 13, FILTER LENGTH: 6, BER: 0.006925
7 FILTER TAPS: 15, FILTER LENGTH: 7, BER: 0.007293
8 FILTER TAPS: 17, FILTER LENGTH: 8, BER: 0.006824
9 FILTER TAPS: 19, FILTER LENGTH: 9, BER: 0.00635
10 FILTER TAPS: 21, FILTER LENGTH: 10, BER: 0.006313
11 FILTER TAPS: 23, FILTER LENGTH: 11, BER: 0.006371
12 FILTER TAPS: 25, FILTER LENGTH: 12, BER: 0.00622
13 FILTER TAPS: 27, FILTER LENGTH: 13, BER: 0.006103
14 FILTER TAPS: 29, FILTER LENGTH: 14, BER: 0.006103
15 FILTER TAPS: 31, FILTER LENGTH: 15, BER: 0.0061
```

A BER lower than 7×10^{-3} is achieved at a one-sided filter length of at least 6. (so 13 filter taps).