**Digital Television Techniques / 2010**

**Exercise 2, DVB-T2 Performance Evaluation**

This exercise shall be returned to the lecturer (Jerker Björkqvist) electronically at https://xprog28.cs.abo.fi/ro.nsf

Deadline May 4th, 2010.

Download the file T2sim.tar from www.abo.fi/~knybom/T2 and extract the contents. The tar file contains a pre-compiled program *bicm* for running DVB-T2 simulations and a test data file Tx\_3\_16Q\_12.dat, along with two folders with parameters (BCH code polynomials and LDPC parity-check matrices) for the DVB-T2 simulator.

In a DVB-T2 receiver, the received signal strength is measured to 0.5 pW. With the same receiver the signal level on an empty channel is estimated to 0.158 pW. With the DVB-T2 configuration 16-QAM modulation, 16200 bits LDPC code with code rate 1/2, and assuming an Additive White Gaussian Noise (AWGN) channel, the receiver cannot achieve bit error rates (BER) below 10-4 at this signal-to-noise ratio.

Run simulations with bicm until a BER of 10-4 or lower is achieved. Plot the uncoded BER (displayed as LLR\_BER in the program), the LDPC BER and BCH BER versus SNR in one figure. Keep in mind the performance of LDPC codes, i.e., increase the SNR with small steps to obtain the waterfall BER curve. How much higher should the signal strength be in order to achieve a BER below 10-4? What is the coding gain at BER level 10-4 for using the LDPC code?

To run bicm, use the following command:

./bicm –u AWGN –f Tx\_3\_16Q\_12.dat –x {SNR}

where SNR is the signal-to-noise ratio for the simulation run. Simply running bicm without command line arguments displays all options.

Hints:

The signal-to-noise ratio is calculated as

$$SNR=10log\_{10}\left(\frac{signal level}{noise level}\right)$$

The coding gain is calculated as

$$coding gain=SNR\_{uncoded}-SNR\_{coded}$$

where the SNRs are those that achieve the BER 10-4.