

Digital Television Techniques

Exercise 4, 7-May-2012

This exercise is submitted electronically on <https://xprog28.cs.abo.fi/ro.nsf>. Deadline is May 18.

1. Create a SNR / Error rate graph for a QPSK modulated signal, when no error correcting is used. For this, use either MATLAB or Octave (www.octave.org). Both are installed on 'tuxedo' computer at AAU, but Octave is open-source and can be freely used, e.g. at home. The syntax of MATLAB and Octave is almost identical, even if the functions available might vary. Here, information for Octave is used. The following steps should be done
 - (a) Create a constellation diagram, $c = [-1 - 1i, -1 + 1i, 1 + 1i, 1 - 1i]$;
 - (b) Create random integers, $b = \text{randint}(1, 1e5, 4)$;
 - (c) Modulate using the constellation diagram, $y = \text{genqammod}(b, c)$;
 - (d) Add noise to the signal, $z = \text{awgn}(y, \text{SNR})$, where SNR is a variable
 - (e) Demodulate the signal, using $q = \text{genqamdemod}(z, c)$
 - (f) Compare the original signal b to the demodulated signal q , and count the errors (error rate), e.g using functions $\text{size}(\text{find}(q - b))$

Now, collect SNR, error rate pairs, and draw it in a diagram.

2. A DVB-H network is being build in Turku area. The following mode is suggested, DVB-T: 8K, GI=1/4, QPSK, 1/2 code, DVB-H: FEC 3/4, 1024 rows. a) If each service is allocated bandwidth of 384 kbit/s, how many services can we provide? b) Which will be the burst duration of one burst in the time slicing (we assume one MPE-FEC frame is sent per burst)? c) Which will be the average service selection time? Assume receiver synchronization takes 200 ms.
3. Make a "C/N / efficiency" graph for the theoretical "efficiency" of the COFDM / ATSC coding schemes, for the 8VSB and the COFDM modulations (the Finnish: 8k, 2/3, 64QAM, 1/8 Guard Interval; UK: 2k, 64QAM, 2/3 Code, Guard 1/32). If we assume that in order to reach BER 10^{-12} , we need additional C/N of 8 dB compared to the teoretical minimum, which will the required C/N be for the different systems?