

S-38.115 Signaling Protocols, Exercise 1

Deadline: Wed. 28.1.2004 at 13:45. All late answers will be disregarded. Please, adhere to the deadline.

Return: via mail s38115@netlab.hut.fi or to the box with the course code (s-38.115 Signaling Protocols). The subject of the message should be "Exercise 1". Remember to include your name and your student number *in the beginning of the message or the document*.

Instructions: Give the calculation steps. Language of the exercise is English.

Task 1

Following the Nyquist sampling theorem, what is the sampling rate of the following systems:

- a) a 4-kHz voice channel,
- b) a 7,5-kHz program channel,
- c) a 4,2-MHz video channel.

Task 2

- a) What is the quantization error (in volts) for a single sample in a PCM-system with 8 bit A/D linear converter with a step size of 0.38V.
- b) A 1V peak signal (peak values at +1 and -1 volts) with 0V dc offset is to be sampled. Assuming a 4 bit codeword, size the A/D linear converter, compute the step size and quantization error. Remember, you need a sign bit to represent the negative (and positive) signal values.

Task 3

Which voltage levels are the following A law PCM Coded numbers respecting,

1 000 0011
1 001 0011
1 110 0101
1 111 0011
0 000 0011
0 110 0101
0 001 0011
0 111 0011

Task 4

In the case of A law PCM, how big is the companding improvement in the case of small signal levels?