Exercise 10

A signal is sampled with 176.4ksamp/sec. After sampling and A/D conversion the signal is band limited to 20 kHz in a FIR down sampling filter. The filter has 65 coefficients. After the band limiting the sampling rate is reduced to 44.1 kHz.

a) A sinusoidal with frequency 1 kHz is sent into the down sampler. How many samples are taken per period of the signal before and after the rate conversion?

b) Explain how we can reduce the computational workload in the FIR filter when we know that it is to be used in a four times down sampler.

c) How many samples per second must be read into the filter and how many multiplications per second must be performed in the efficient filter?

A DSP system works on a sampling rate of 44.1 kHz. Before the output signal is sent to the D/A converter, a four times up conversion to 176.4 kHz is performed. In connection with this up conversion a FIR filter with 65 coefficients is used.

d) Explain the process used to increase the sampling rate. Explain specifically the function of the FIR filter.

e) The FIR filter to be used in an up converter can be realized in a more efficient manner than a conventional FIR filter. Explain with a block diagram how this can be done.

f) How many samples per second must be read into and from such a FIR filter and how many multiplications per second must be performed in the FIR filter?