Down-sampler module

Description of Module Functionality
The down-sampling module is used to reduce the sampling frequency of the input. According to our team's scenario, we were given bandwidth constraint to be equal to 4kHz, so, using Nyquist's theorem, we decided to keep our sampling frequency to be twice as equal to the bandwidth constraint, i.e., 8kHz. Since the maximum frequency input was 48kHz, we decided to take the down-sampling factor to be equal to 6, so that the down-sampler module takes in every 6th sample, thereby, reducing the sampling frequency to fit well within the range, from 48kHz to 8kHz.
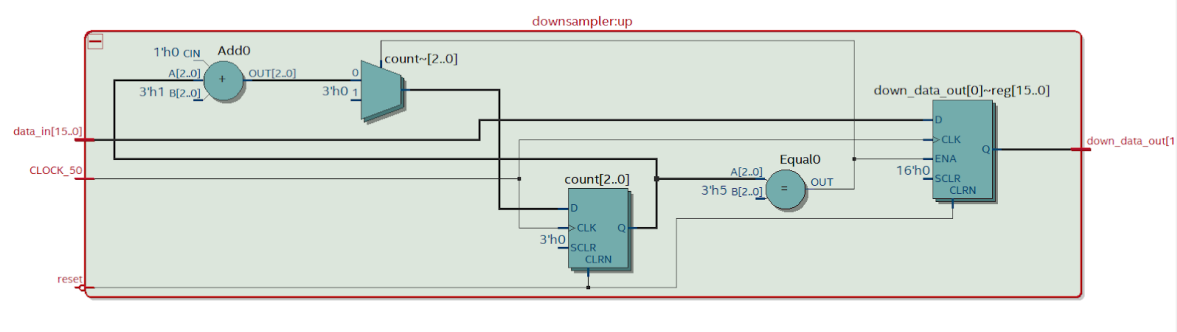
Block Diagram

Fig. 1: RTL diagram generated from Quartus

Testing Strategy:
For testing the down-sampler module, we made a brief testbench and plugged-in decimal values from 100 to 2000, with an increment of 100 each. We had made the design in such a way that the output would always take the 6th sample as the input, thereby taking only 600, 1200 and 1800 as the inputs as shown in the below section.
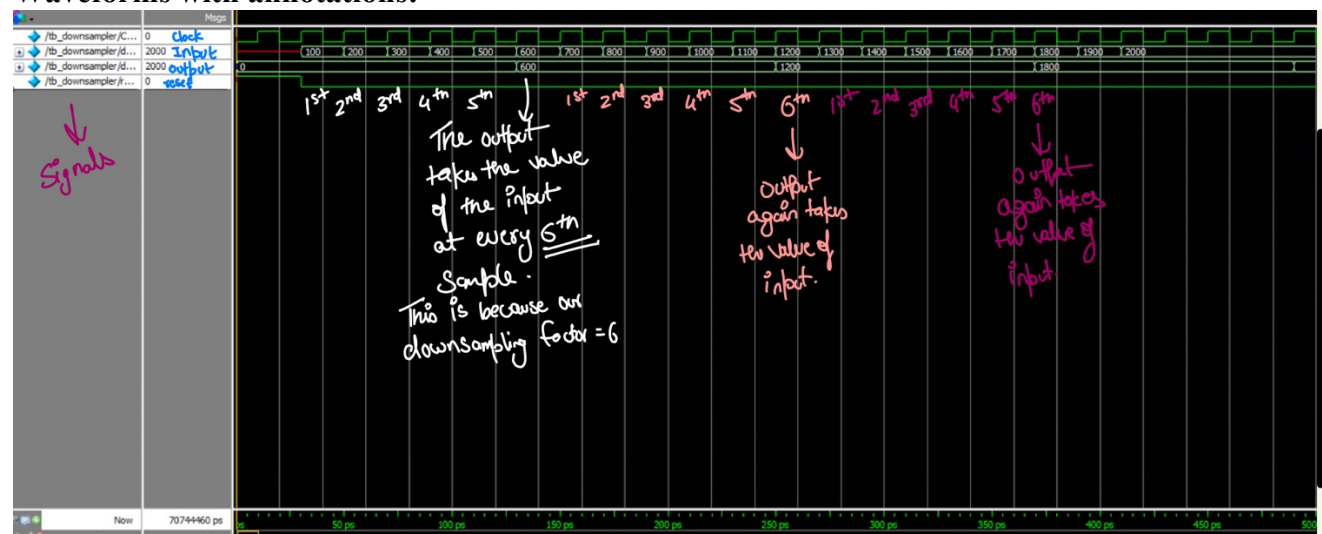
Waveforms with annotations:

Fig. 2: ModelSim waveform of the downsampler module, simulated using its testbench (with annotations)