WAVELET-BASED DENOISING OF ECG SIGNAL

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Goal: Detrending and Denoising of an ECG signal for complex identification.

Project Abstract:

ECG (Electro cardiogram) signal consists of PR Segment, QRS Complex, ST Segment. During recording process, noise effect the signal heavily. Noise include baseline wandering, EMG noise, motion artifact, power line interference and electrode pop or contact noise. Our main goal is to denoise the ECG signal using wavelet denoising technique and make QRS complex more distinct and identify peaks and valleys of ECG denoised signal.

Theory:

- Wavelet transform decomposes signal into low pass sub-band (Approximation level) and high pass sub-band (Detail level).
- The approximation sub-band can further be decomposed to different levels for fine scale analysis.
- Then we decide on the thresholding technique and process the coefficients according to threshold and reconstruct the signal.
- Soft thresholding technique is used. This threshold technique reduces the detail coefficients below the threshold to zero and above the threshold to a value lesser by threshold value.
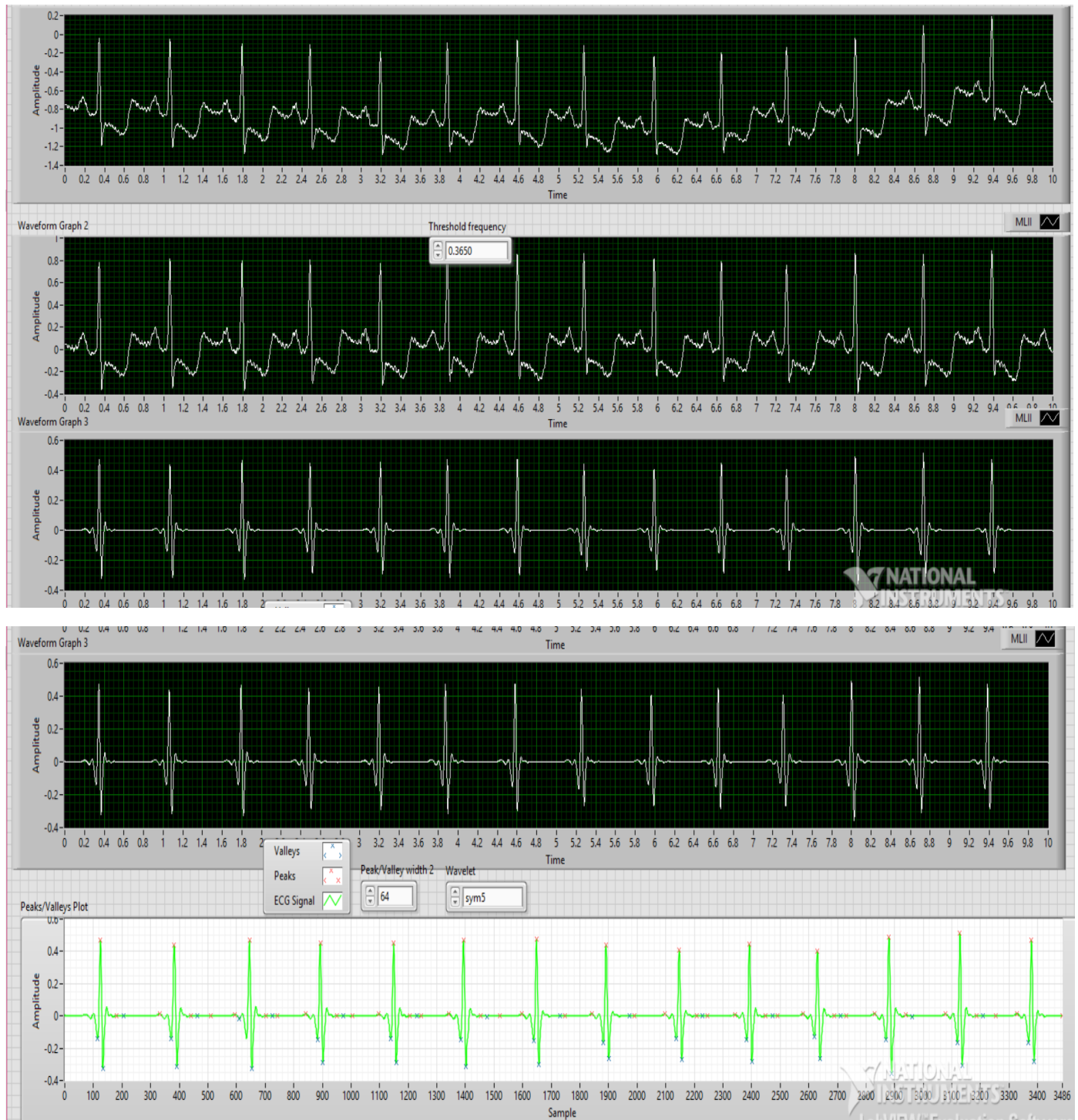
Working: –
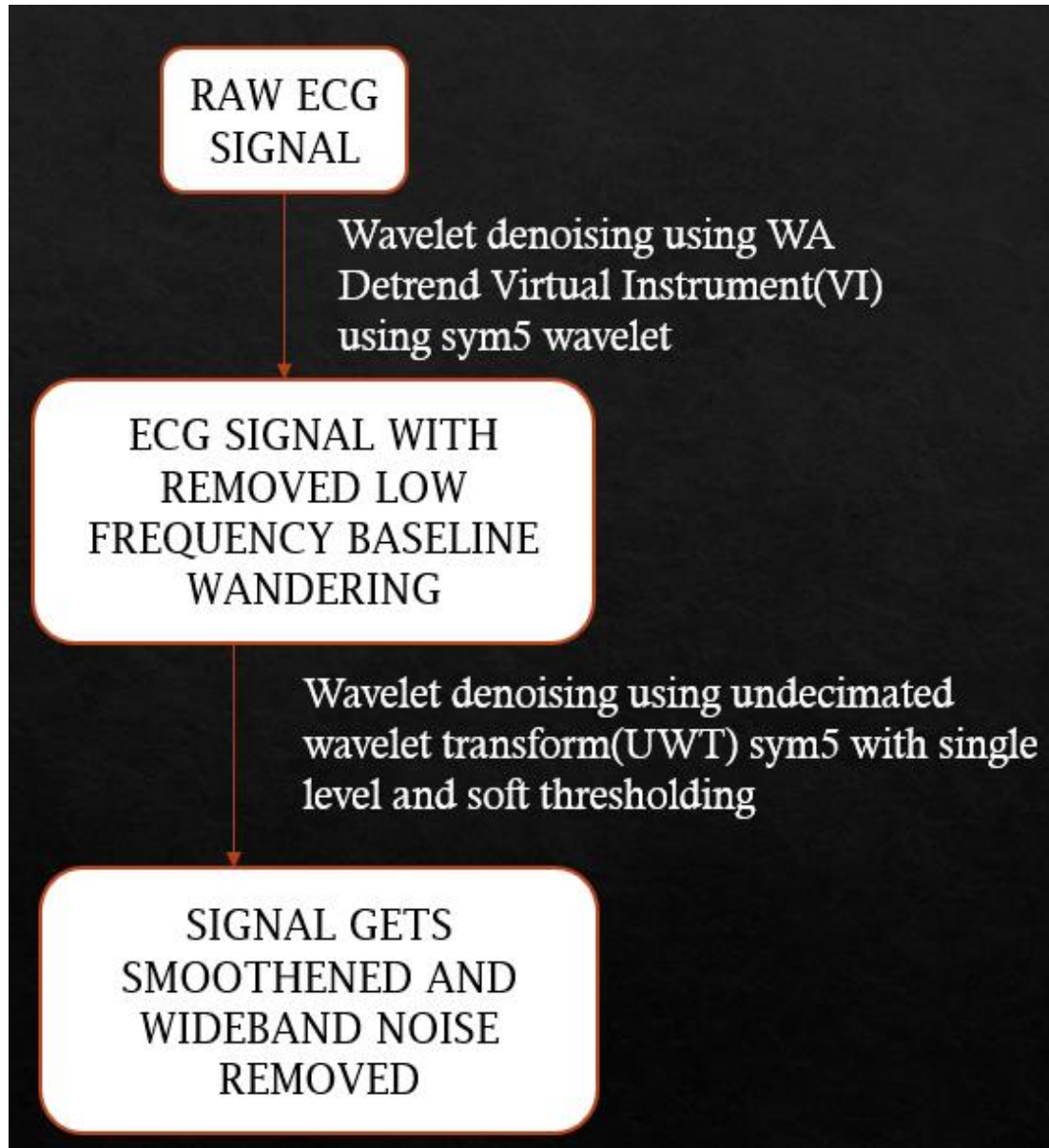
Threshold for detrending = $\log_2 2t \ / \log_2 N$, where "t" is the duration of the signal and N is the number of samples

Simulation and Results:

The simulation is done using LABVIEW tool.
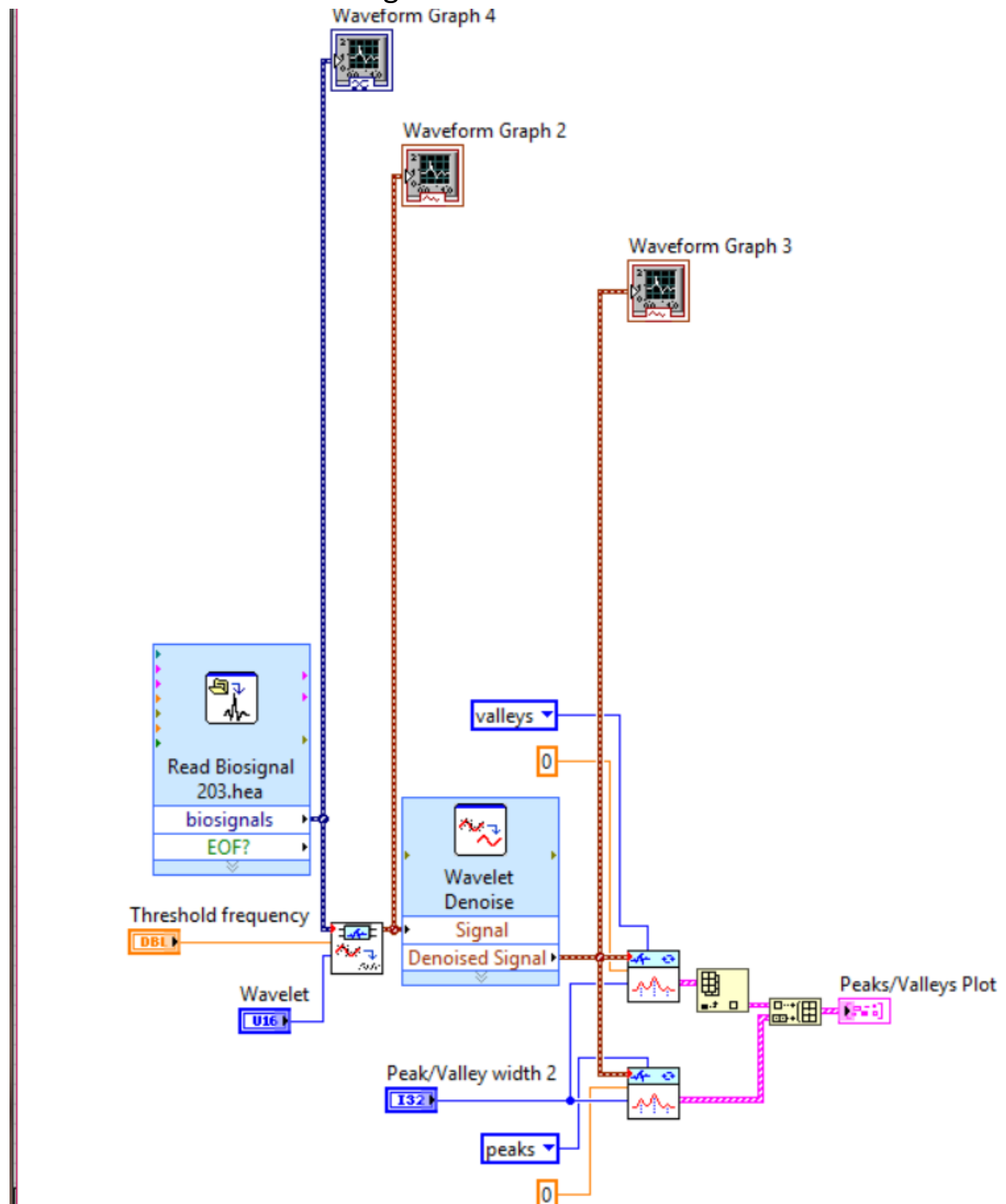
Waveform with ECG signal-1 and its outputs

Waveform graph -2 is the signal after removing baseline wandering and waveform graph-3 signal is after removing wide band noise and smoothening the signal. Sampling time=10s and No. of samples=3600. Peaks/Valleys plot shows the locations of peaks and valleys.

Waveform with ECG signal-2 and its outputs
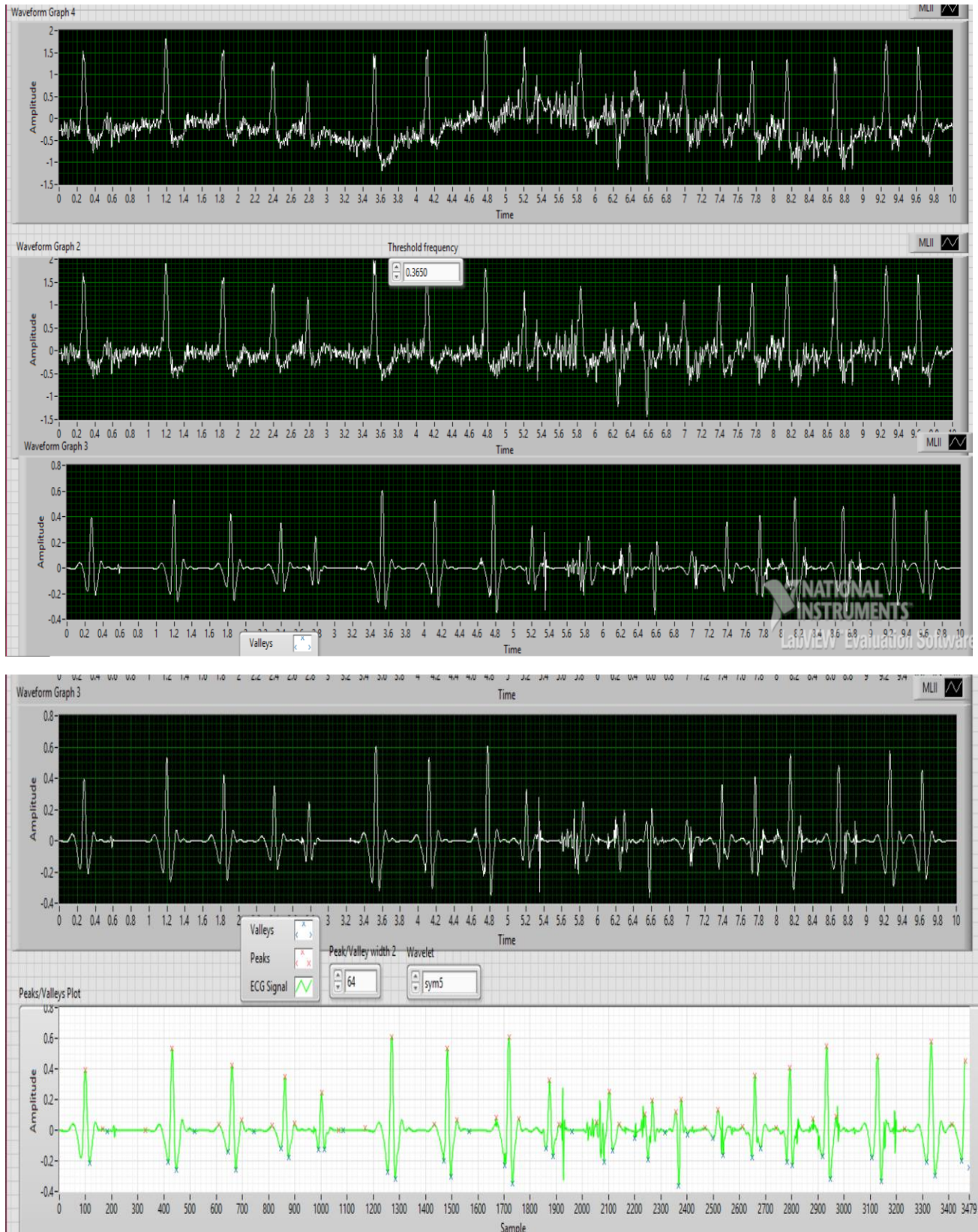
Waveform with ECG signal-3 and its outputs