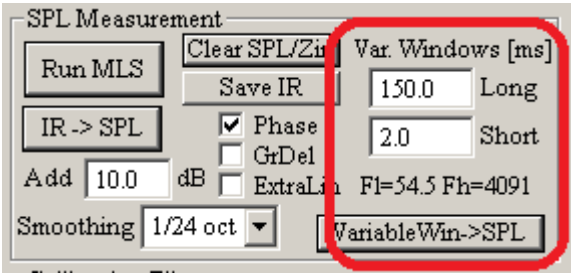
Adaptive Windowing

With the Adaptive Window feature the length of the time window applied to the measured room impulse response varies, smoothly and continuously, between two pre-defined lengths.



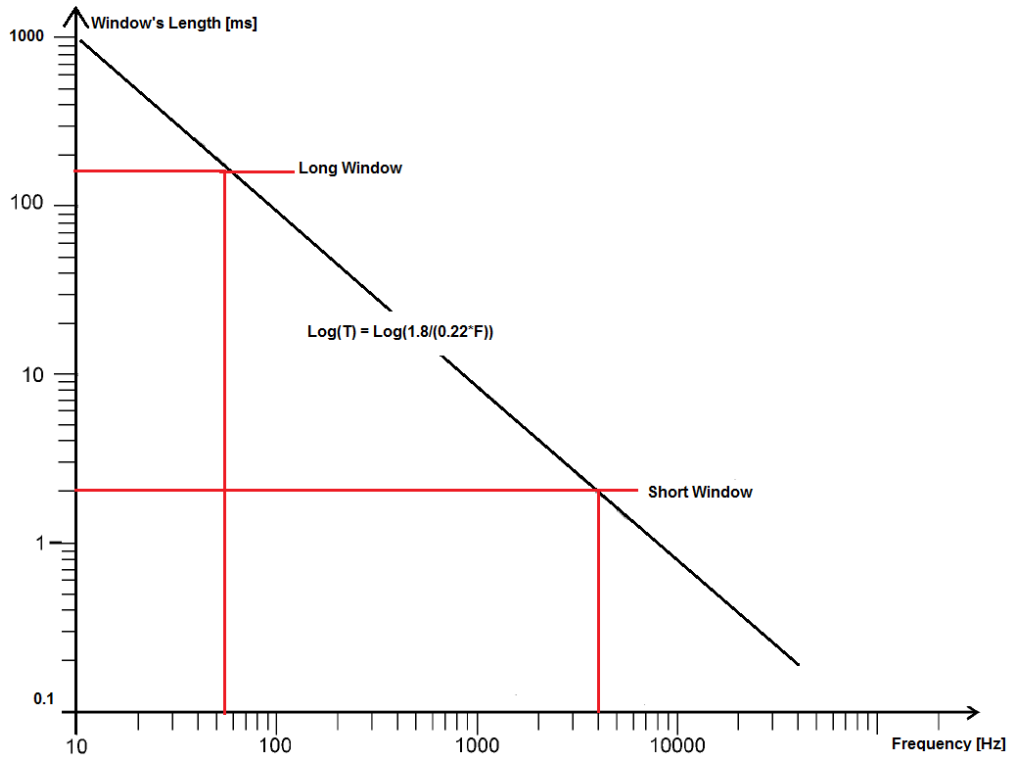


Figure 1. Defaults for Long Window and Short Window.

The lengths of both windows are set manually from the MLS dialogue box. The Short Window is set to exclude almost all reflections in the measurement location – the default value is set to 2ms. The long window (set to 150ms default) captures nearly all room reflections, including the late arrivals. The window starts at the same position as the short window but is more them 150ms long. In the frequency range between these two extremes,

the algorithm automatically varies the time window length to yield a frequency resolution of 1/3 octave, which approximately corresponds to the width of the ear's critical bands.

Literature suggests, that one should not include reflections later than roughly 500ms because the ear tends to perceive such very late reflections as reverberation or ambience.

Figure 2. SPL calculated with Adaptive Windows: 2ms (Short Window) and 150ms (Long Window).

The adaptively windowed room frequency response therefore excludes all but the earliest room reflections at high frequencies, gradually includes more reflections in the midrange and finally includes nearly all room reflections in the bass region. The Adaptive Window algorithm also preserves phase response – see Figure 3.

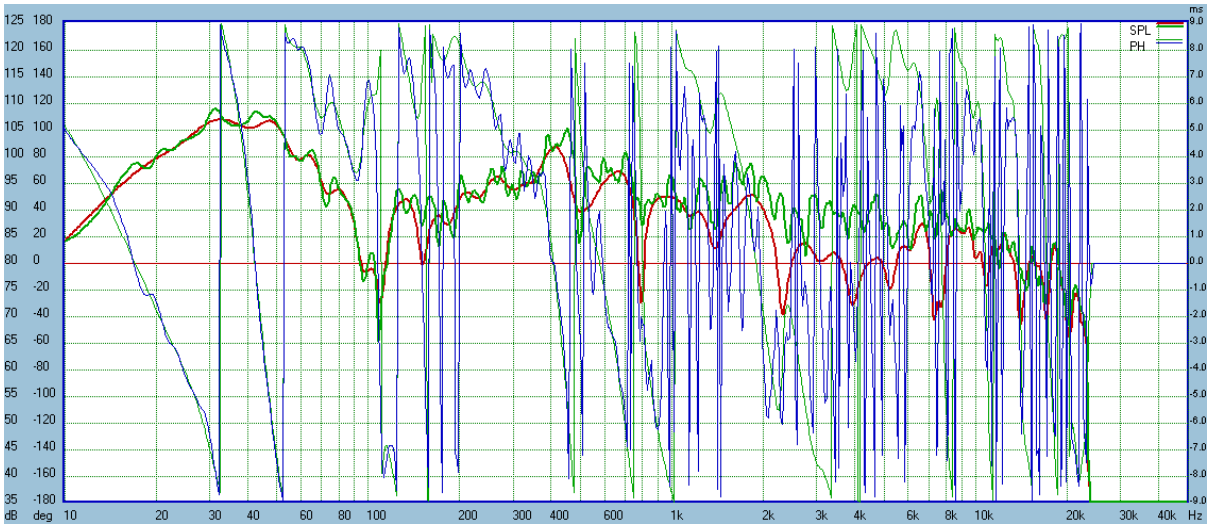


Figure 3. Adaptive Window algorithm preserves phase response.

Control Dialogue

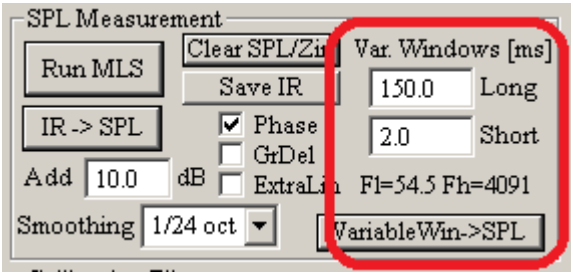


Figure 4. Controlling Adaptive Windowing algorithm.

The Adaptive Windowing algorithm can only be activated after the room impulse response has been measured. For more information, please consult appropriate sections of SoundEasy program manual.

Next, you would select the lengths of the Long Window and the Short Window from the MLS control dialogue box – see Figure 4.

Finally, you need to position the cursor marker on the Impulse Response window where you wish the windowing should start, and then press the "**VariableWin->SPL**" button to start the algorithm.

Now, for each of the 750 frequencies of the SPL curve, the algorithm selects different length of the FFT window – as per curve on Figure 1. The whole SPL is then re-calculated from the impulse response. This process can be quite lengthy. Particularly, when you select longer MLS sequences (and therefore FFTs) for the measurements. The current frequency and the intermediate results are shown on the SPL window, and will be cleared once the process is completed for all 750 frequency bins.

Comparison with standard measurements

Figure 5 shows comparison between SPL recovered via Adaptive Window SPL (red) with a standard 500ms "fixed window" (green).

It is observable, that at the very low-end and very high-end both SPL curves are very similar. However, they differ significantly everywhere else.

The differences are most pronounced in the midrange frequency range. Here, the SPL calculated via the Adaptive Windowing algorithm sits several dBs below the SPL measured with single, wide window.

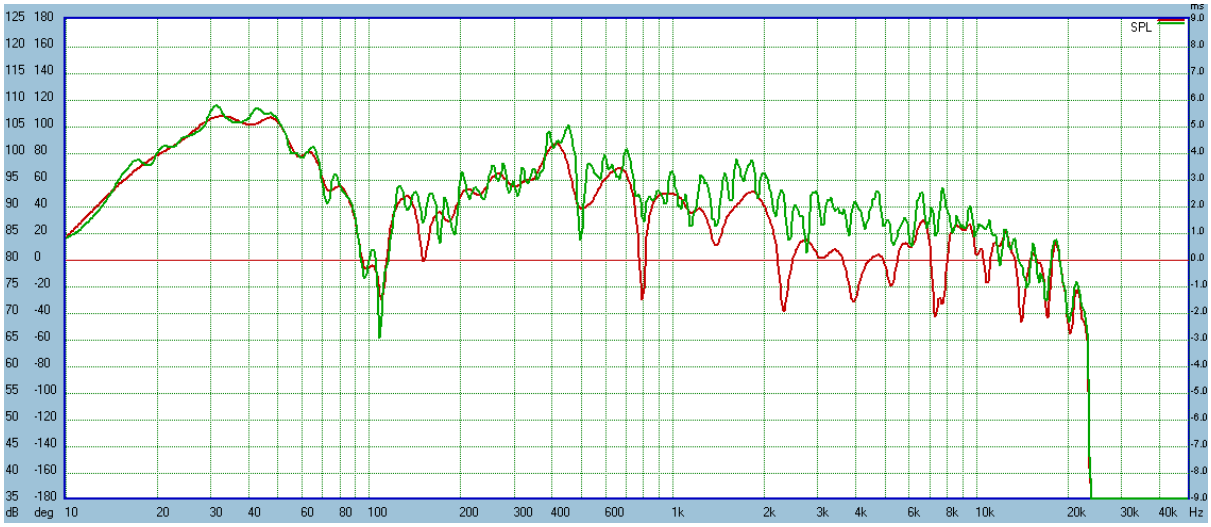


Figure 5. Comparison between Adaptive Window SPL (red) with a standard 500ms "fixed window" (green).

Similar conclusions can be drawn from MLSSA measurement system – see picture below.
http://www.mlssa.com/pdf/DRA-MLSSA-Manual-10WI-8.pdf

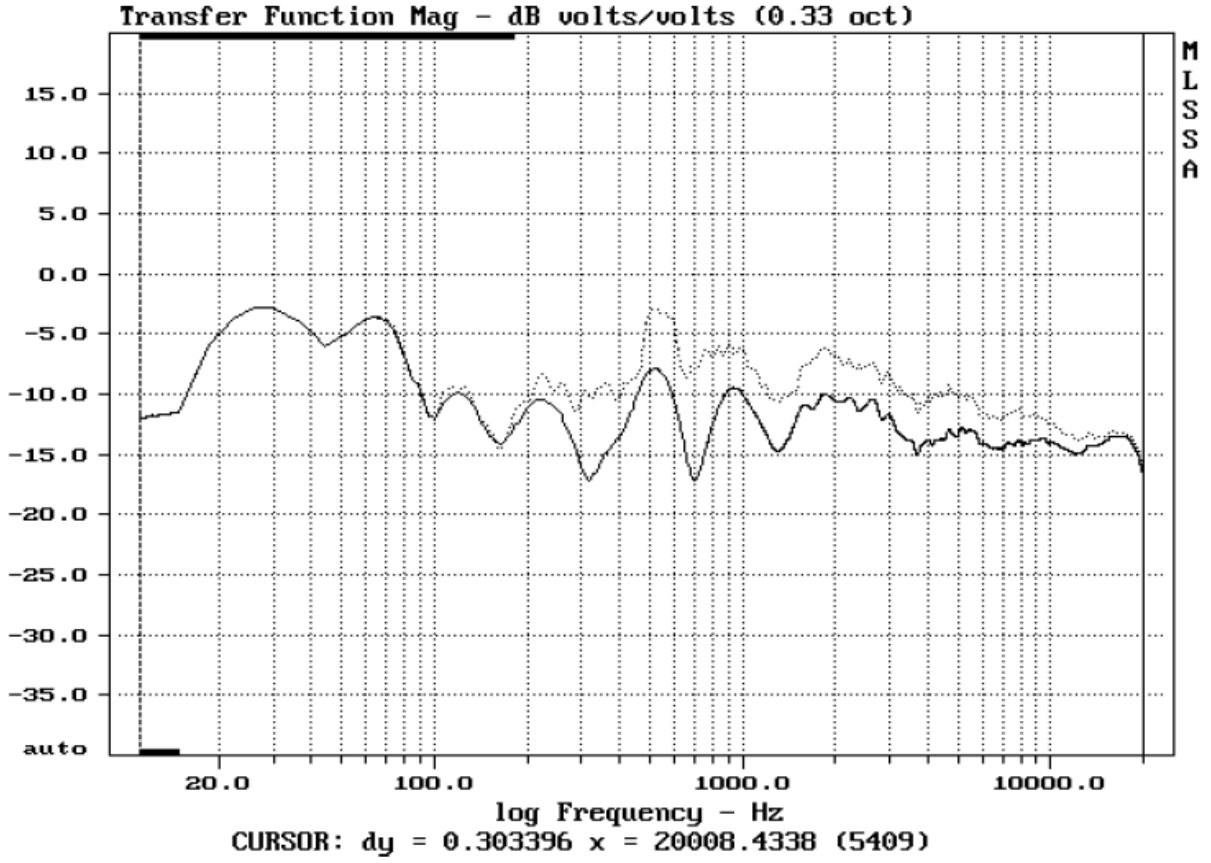


Figure 6. Example of Adaptive Windowed measurements vs. fixed window.

This offset creates an interesting dilemma for those, who would like to use the SPL calculated via the Adaptive Windowing algorithm as the input curve for calculating room correction filter as the minimum-phase inverse of the room response.

If the measured room response has a general, very broad dip in the midrange frequencies (as calculated by Adaptive Windowing algorithm), then the inverse correction filter will have a broad peak in the midrange frequencies. As a result, your equalized system may sound overly bright.

You can re-measured the equalized system, once again, using the Adaptive Windowing algorithm scheme, and it will show nice and flat room frequency response, but it may sound overly bright.