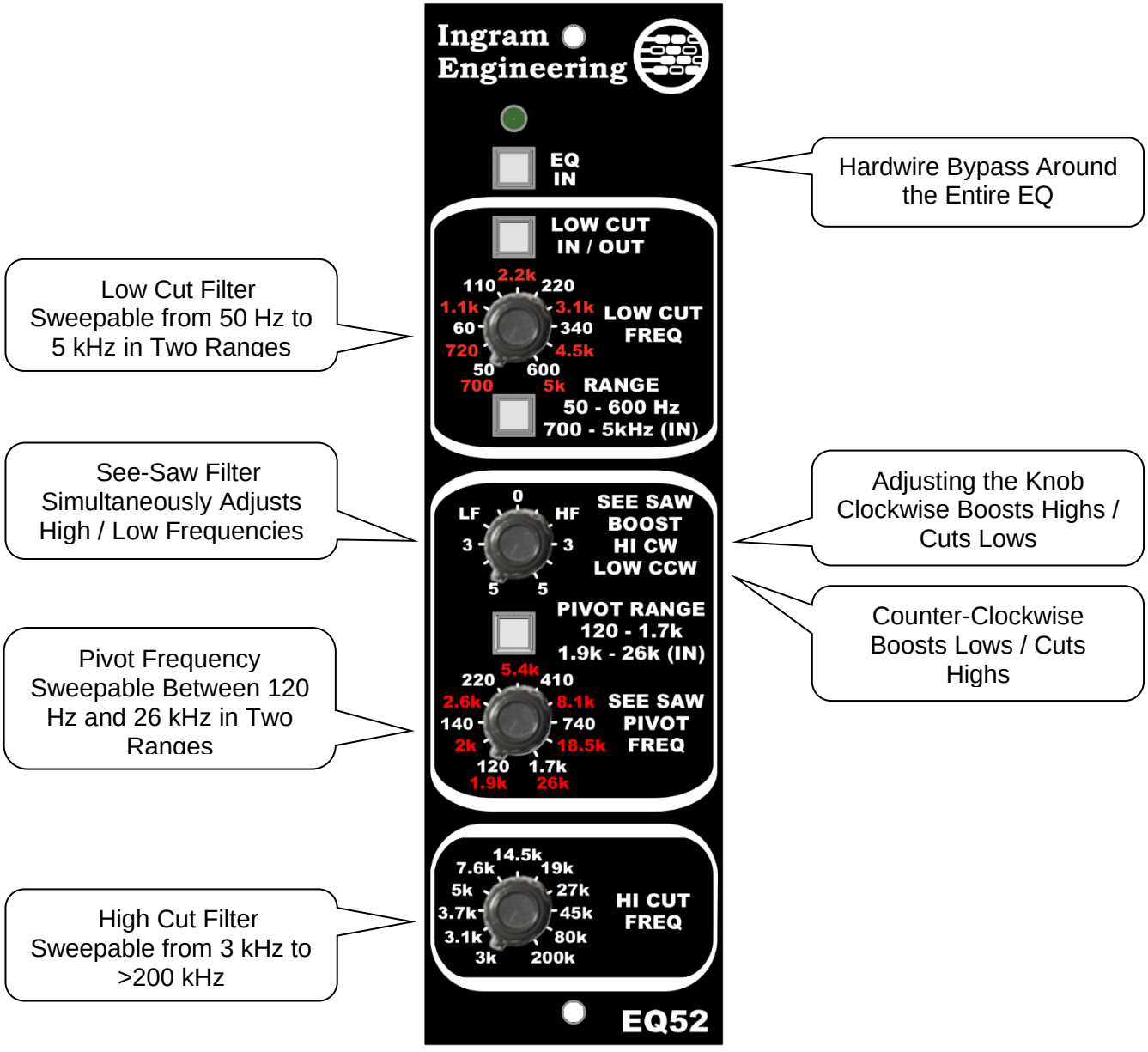
Overview of the EQ52 Filter Functions

The Ingram Engineering EQ52 is a 500-series equalizer module that contains extremely versatile and musical sounding Low Cut, High Cut and See-Saw filters. The unique See-Saw filter contains a combined bass and treble control that allows broad frequency response adjustments with a single control knob. This equalizer features low phase shift filters with extremely wide Low Cut and High Cut adjustment ranges and broad and gentle roll offs that enable transparent control of audio timbre without artifacts. The equalizer controls are highlighted in the figure below.



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1. See-Saw Filter

The See-Saw Filter provides simultaneous cut, or attenuation, of one frequency band while boosting another frequency band. When the adjustment knob is turned fully clockwise, treble is boosted and bass is attenuated. When the adjustment knob is turned fully counter-clockwise, bass is boosted and treble is attenuated. The filter has linear slope over the entire audio band. The See-Saw filter has a pivot frequency that may be set at any frequency between 120 Hz and 26k Hz.

The plot below shows sweeps of the See-Saw filter with the amplitude adjusted to the extremes of its ranges, with the pivot frequency set to 1 kHz.

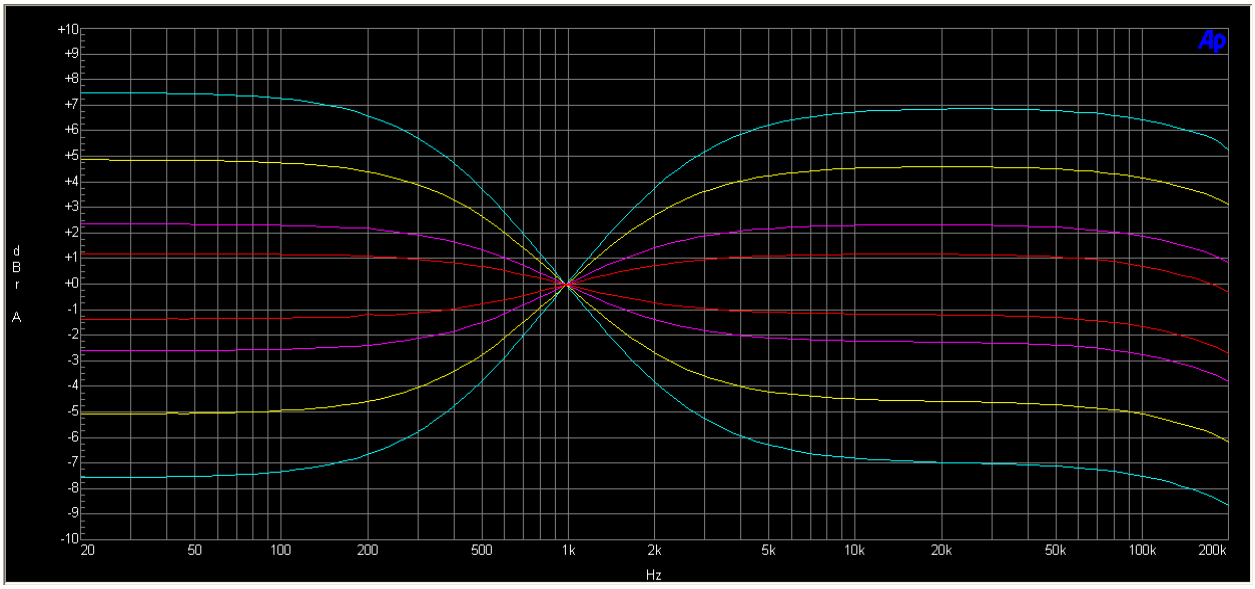

Figure 1: See-Saw Filter Responses, 1 kHz Pivot Frequency

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The See-Saw filter pivot frequency can be adjusted in two ranges. The plot below shows the first sweep range, 120 Hz to 1.7k Hz. Maximum boost/cut is shown for each pivot frequency.

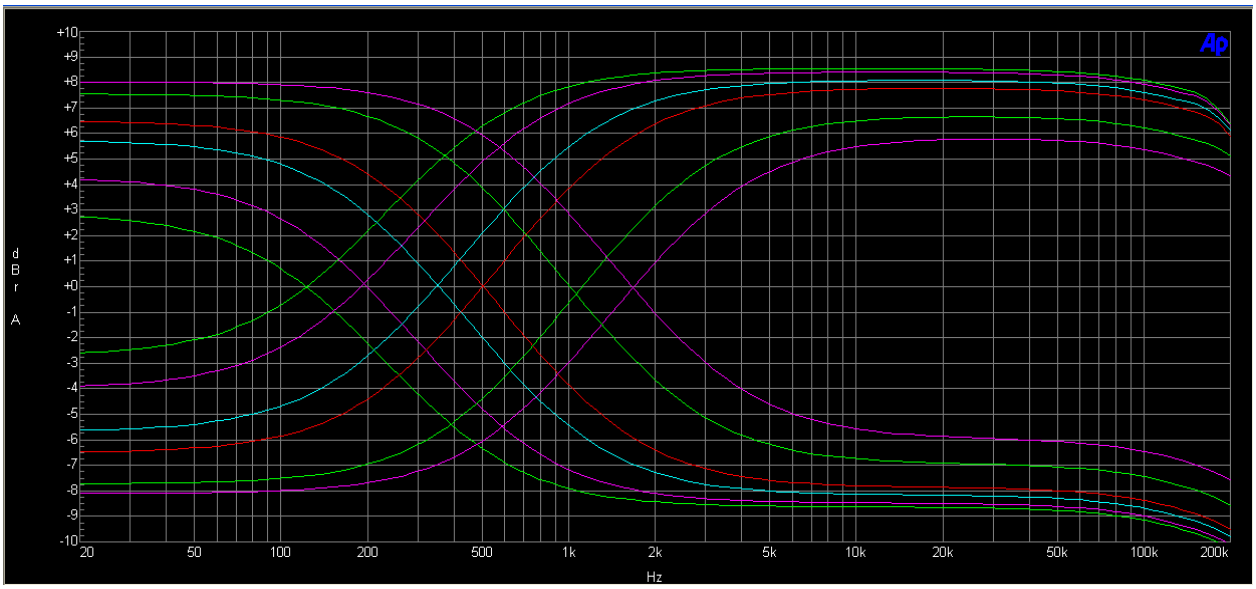

Figure 2: See-Saw Filter Responses, Range 1 Pivot Frequencies

The next plot shows the second sweep range, 1.9k Hz to 26k Hz. Maximum boost/cut is shown for each pivot frequency.

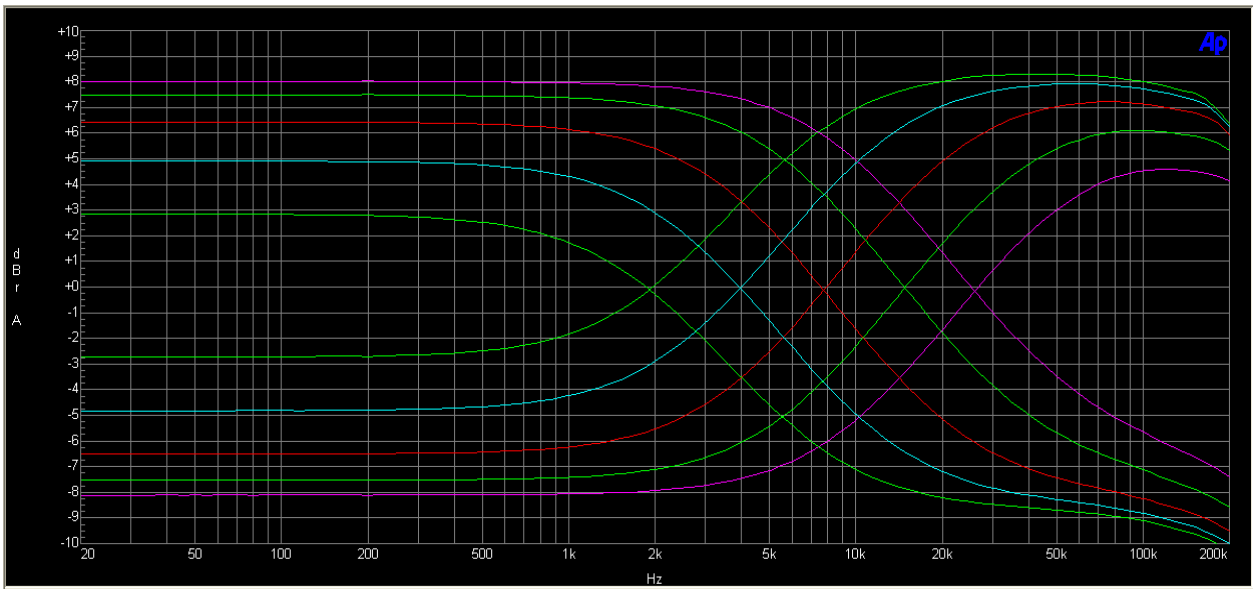

Figure 3: See-Saw Filter Responses, Range 2 Pivot Frequencies

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2. Low Cut Filter

The passive Low Cut Filter provides minimal phase shift -6dB / octave cut with frequency adjustment range of 50 Hz to 5 kHz, in two ranges. The plot below shows the full range of Low Cut filter responses with several intermediate adjustment positions.

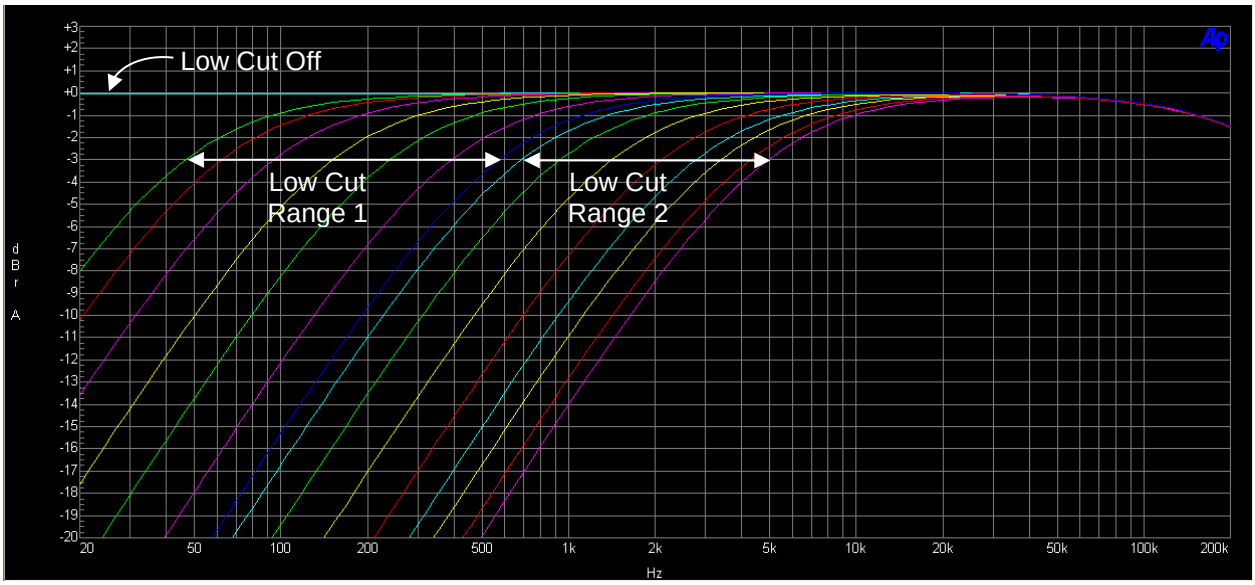

Figure 4: Low Cut Filter Example Responses

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3. High Cut Filter

The passive High Cut Filter provides minimal phase shift -6dB / octave cut with frequency adjustment range of 5 kHz to 200 kHz. The plot below shows the full range of High Cut filter responses with several intermediate adjustment positions.

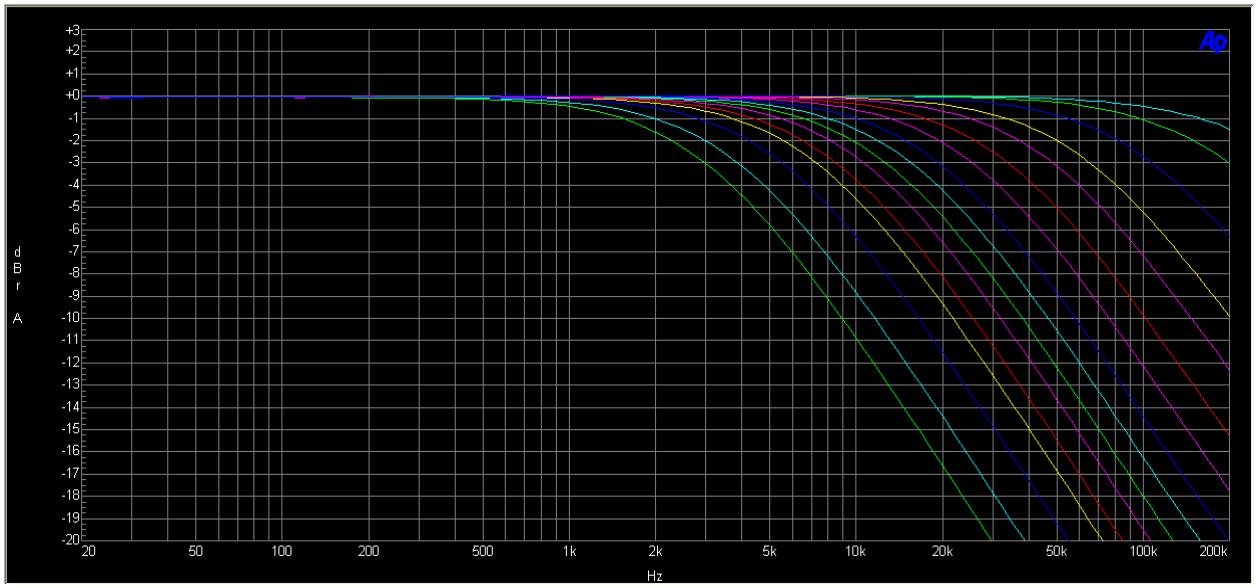

Figure 5: High Cut Filter Example Responses

Many equalizers with High Cut filters are designed such that they add phase and amplitude artifacts, even when the filter is set for widest bandwidth. The EQ52 High Cut filter was designed so that it can add dramatic effect without artifacts, and is a superb tool for cleaning up tracks. The following plots show how the EQ52 can clean up signals with overshoot and ringing artifacts that are created by other components in the signal chain. These artifacts are created by any equipment that has improperly tuned amplitude and phase response or even by cabling with excessive inductance or capacitance. Depending on the severity of the artifacts, the subjective purity of the signal is degraded, and an unwanted grainy or harsh element is added to the music. An excellent way to show how the EQ52 cleans up overshoot and ringing is by passing a square wave through the EQ, since a square wave gives a good representation of fast transients generated by piano, drums, percussion, synthesizers, etc.

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The next plot shows a 1 kHz square wave source with overshoot and ringing:

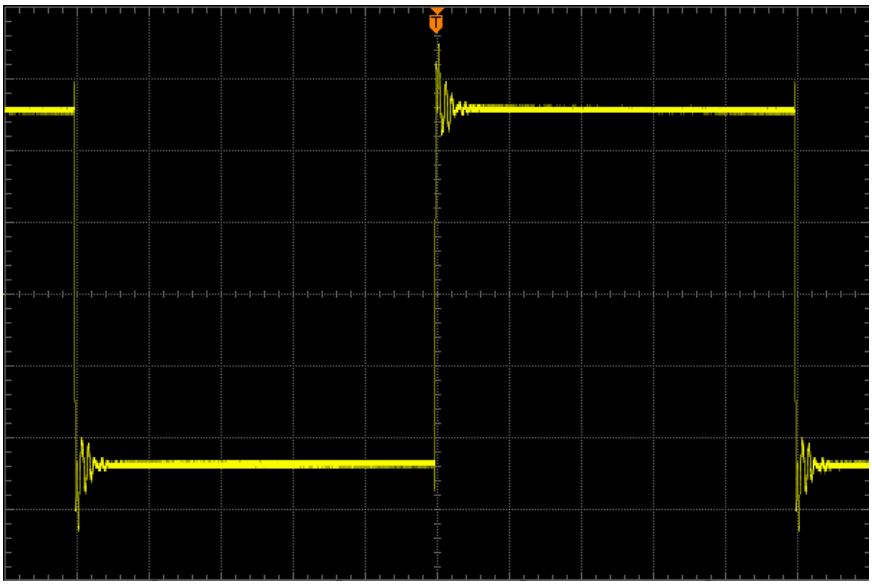

Figure 6: Source Signal with Ringing and Overshoot

The twentieth harmonic of this 1 kHz square wave is near the top end of our ability to hear, and harmonics this high are significantly and naturally lower in amplitude than the fundamental at 1 kHz. Nonetheless, attenuation or phase changes to frequencies much higher than 20 kHz can affect the quality of the 1 kHz square wave. Using the EQ52 High Cut filter cleans up the ringing and overshoot, even when the filter cutoff is outside the 20 Hz to 20 kHz band.

The next plot shows the same square wave with the High Cut filter set to 50 kHz. Note that the high frequency ringing is significantly reduced, despite the fact that the 50 kHz filter cutoff is far outside the range of human hearing.

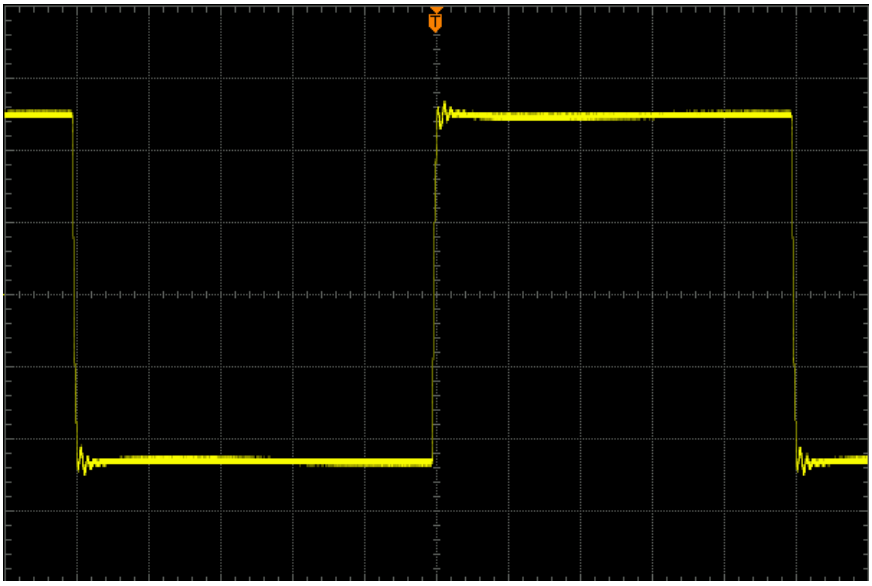

Figure 7: Ringing and Overshoot Reduction with EQ52 High Cut Set to 50 kHz

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The next plot shows the same square wave with High Cut set to 20 kHz. The ringing and overshoot have been eliminated by the EQ52.

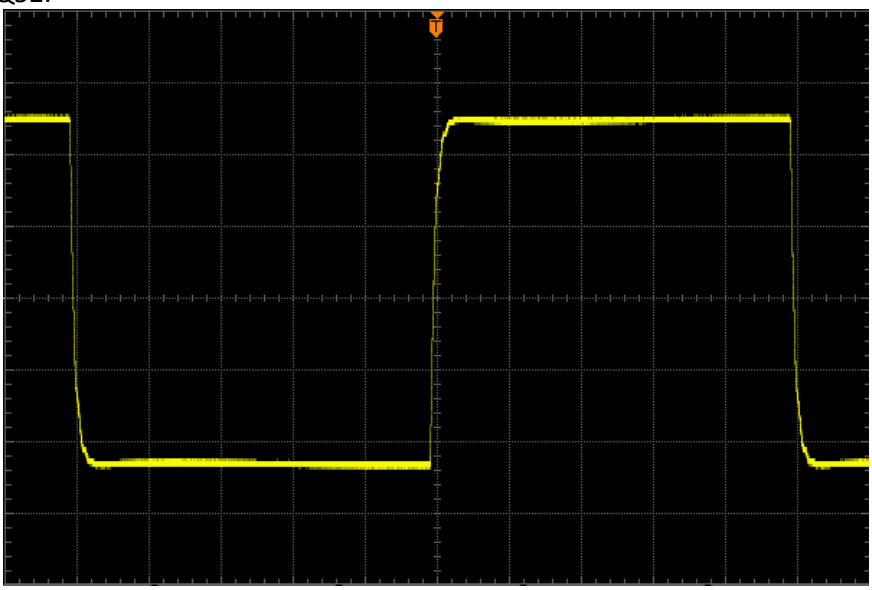

Figure 8: Ringing and Overshoot is Eliminated with EQ52 High Cut Set to 20 kHz

To further show the benefit and high quality of the High Cut filter, a clean 1 kHz square wave is passed through the EQ52, and no artifacts are added.

The next plot shows the clean square wave source:

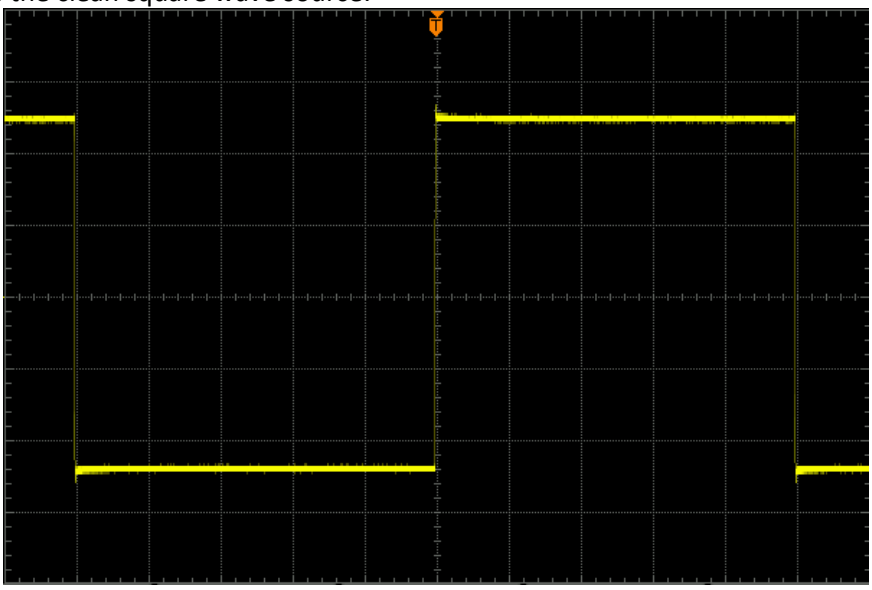

Figure 9: Good Quality Square Wave Source

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The following plot shows that, with the EQ52 High Cut filter set to 15 kHz, the transitions are slowed, and no phase or amplitude artifacts are added.

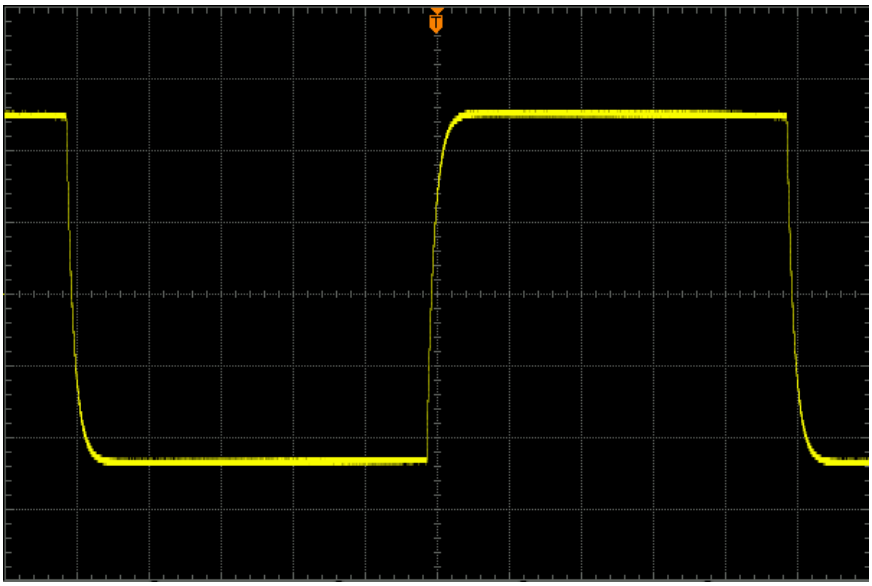

Figure 10: Good Quality Input Square Wave with EQ52 High Cut Set to 15 kHz

4. Using Filters in Combination

The following plots show examples applications of the three filters, used in combination. Settings are noted for each.

Smooth a stereo mix during mastering: Low Cut frequency = 35 Hz, See-Saw = -2.0, High Cut frequency = 35 kHz. See-Saw pivot frequency = 400 Hz

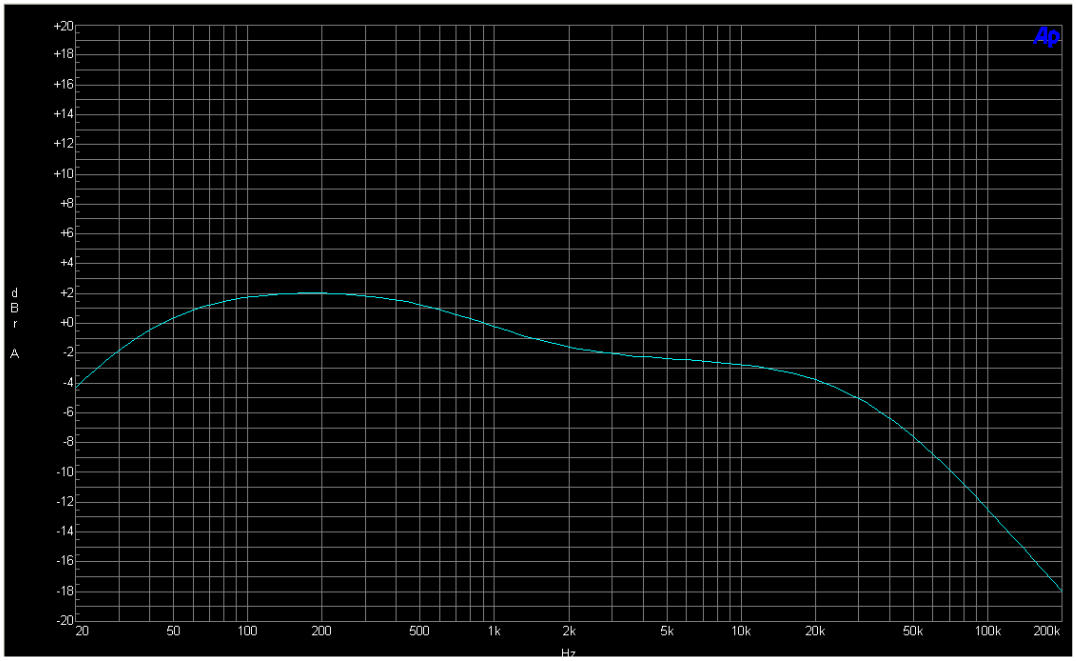

Figure 11: Filter Plot, Settings for Smoothing a Stereo Mix

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Subtle high frequency restoration: Low Cut frequency = 20 Hz, See-Saw = +1.0, High Cut frequency = 70 kHz. See-Saw pivot frequency = 1 kHz

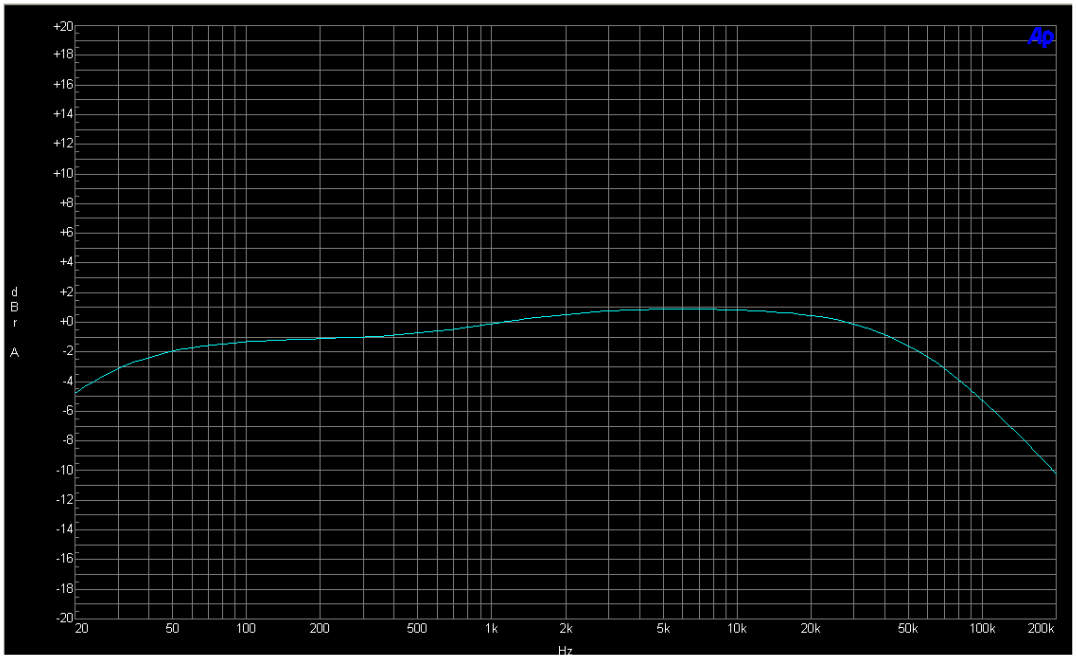

Figure 12: Filter Plot with Subtle High Frequency Restoration Settings

Compressor sidechain filter, triggering on mid-lows: Low Cut frequency = 100 Hz, See-Saw = -4, High Cut frequency = 15 kHz. See-Saw pivot frequency = 1 kHz

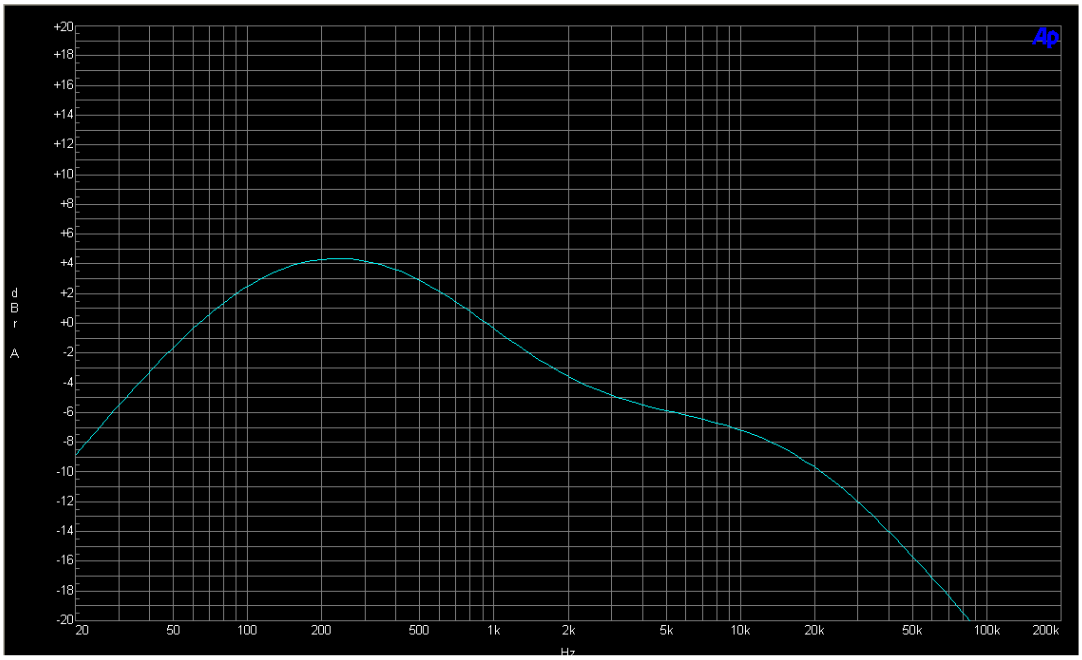

Figure 13: Filter Plot with Compressor Sidechain Filter Settings, Mid-Low Trigger Frequency

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Compressor sidechain filter, triggering on high frequencies: Low Cut frequency = 1 kHz, See-Saw = +2, High Cut frequency = 45 kHz. See-Saw pivot frequency = 400 Hz

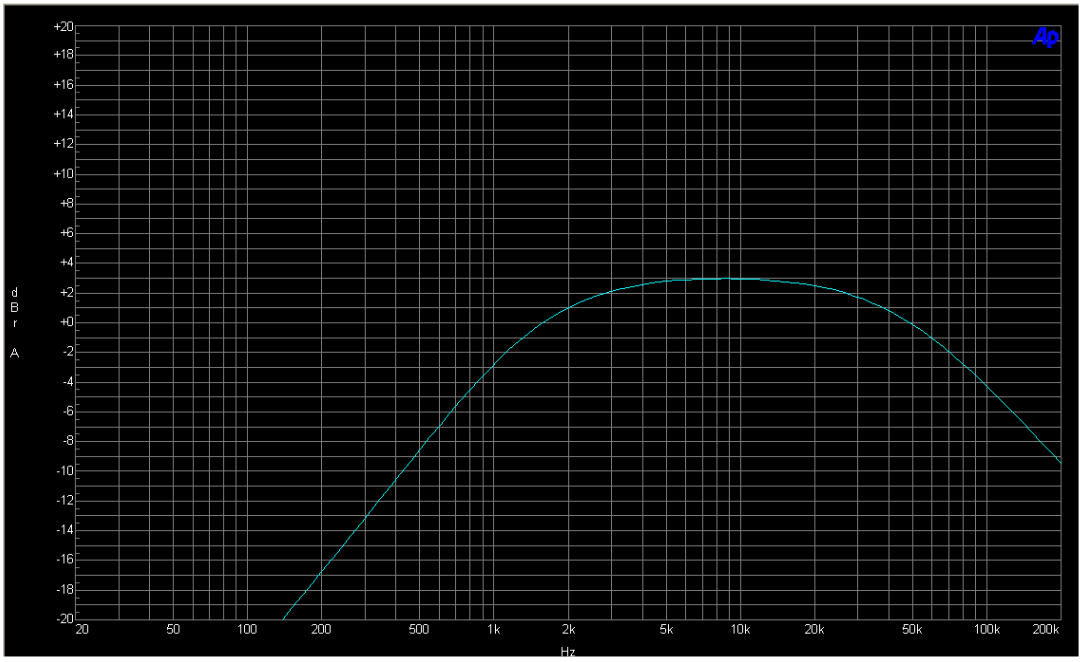

Figure 14: Filter Plot with Compressor Sidechain Filter Settings, High Trigger Frequency

Presence boost: Low Cut frequency = 35 Hz, See-Saw = +1.5, High Cut frequency = 35 kHz. See-Saw pivot frequency = 1 kHz

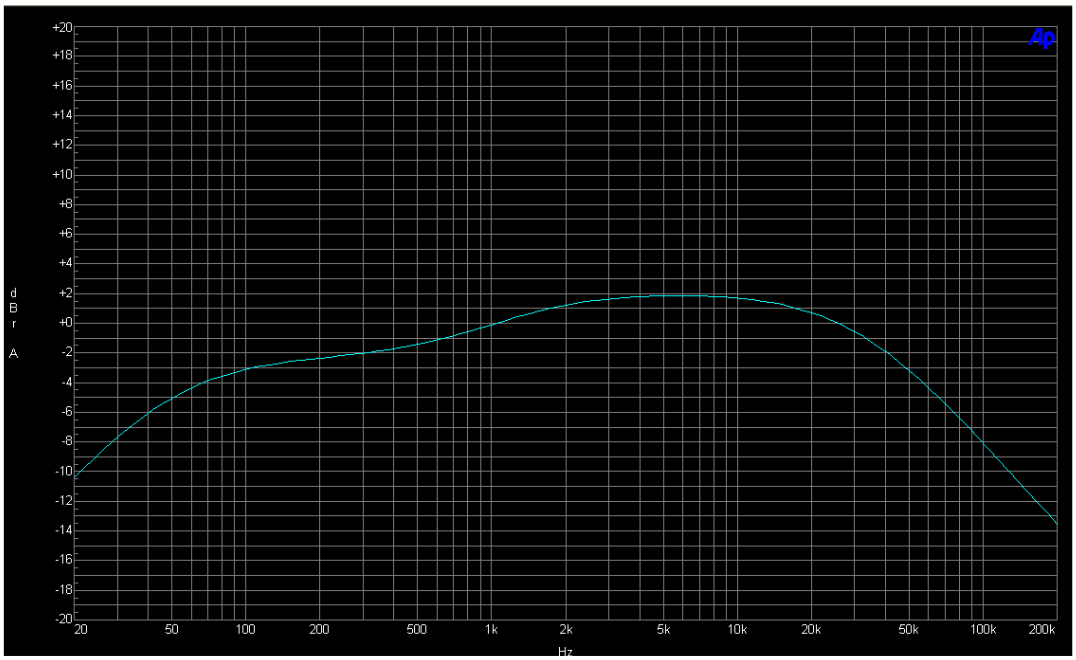

Figure 15: Filter Plot with Presence Boost Settings

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