The Napoleons

Small Speakers that punch above their weight

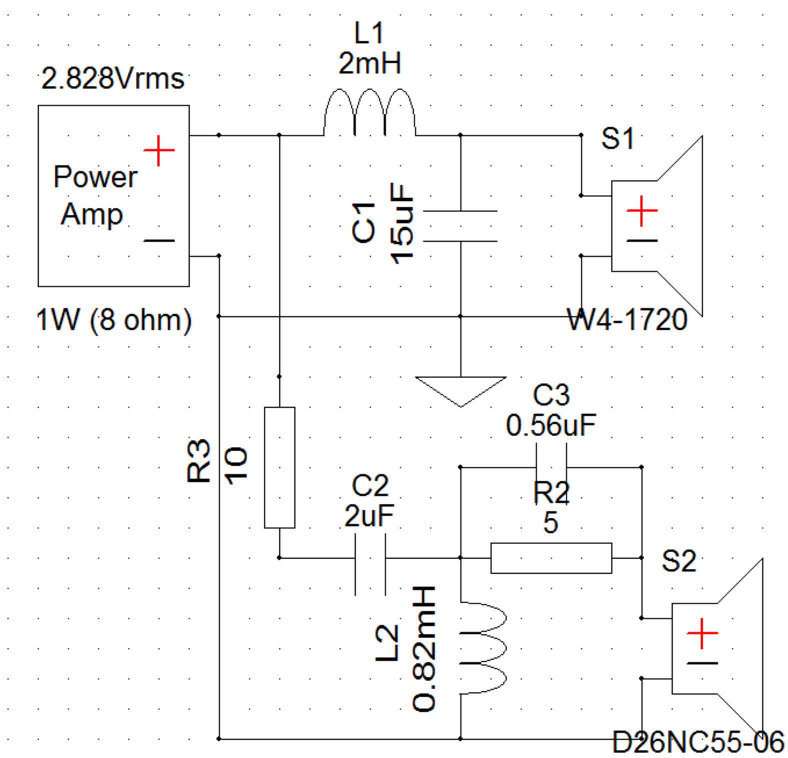
<u>Appendix III: Third Iteration</u>

An update was published adding more baffle diffraction compensation with a bit more bass energy around 100Hz, and resulted in a much more open mid-range. It also adds 5 dB more rejection of woofer break up, which is believed to also contribute to the more open sound.

The crossover is a 7 element second order electrical, in phase driver connection. Special attention was placed on smooth on and off axis response, and a smooth response when standing while listening.

<u>Low pass</u>
L1: 2 mH inductor, 1.0 ohms dc resistance (e.g. Solen 20 gauge air core).
C1: 15 uF cap (not electrolytic)

<u>High Pass</u>
C2: 2 uF cap (not electrolytic)
L2: 0.82 mH inductor, 0.43 ohms dc resistance (e.g. Solen 18 gauge air core; 20 gauge (0.63 ohm) could be used to as well with no real difference)
R3: 10 ohm resistor, high power (25W or greater)
R2: 5 ohm resistor, high power (25W or greater)
[There is no R1, but due to a bug in Xsim, resistors were not relabelled by the program]
C3: 0.56 uF. This provides a bit of high frequency lift, benefitting off axis

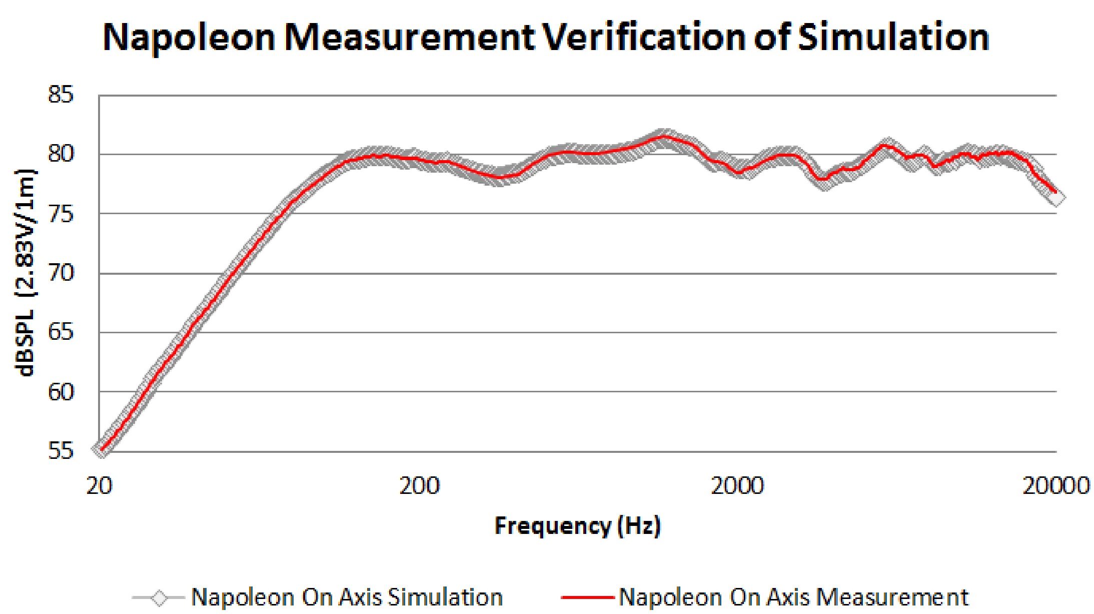


No special treatment for low inductance resistors is necessary. For example, the inductance of a Vishay RH-25 was found to reduce 10 kHz by only 0.03 dB.

Low cost air cores were chosen for their small size without iron core's potential for saturation induced distortion.

The system reflection-free frequency responses in the graphs following were created by measuring the unfiltered individual driver frequency responses in box at each observation position, and then simulating the crossover via Xsim (using measured driver impedances, in box).

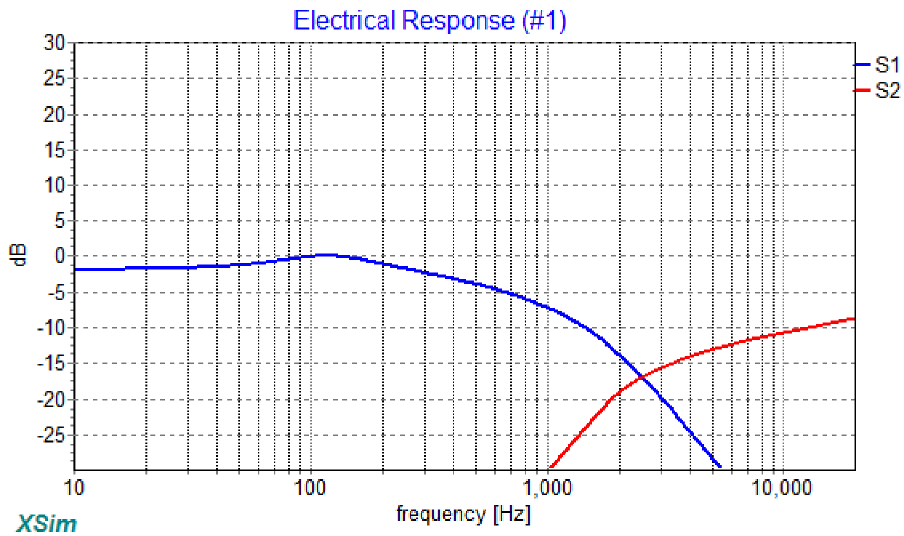
To verify the simulation accuracy, an on-axis measurement of the completed system (Appendix I crossover) was taken and compared to simulation. As shown following, the simulations are effectively dead-on accurate, validating the design approach.



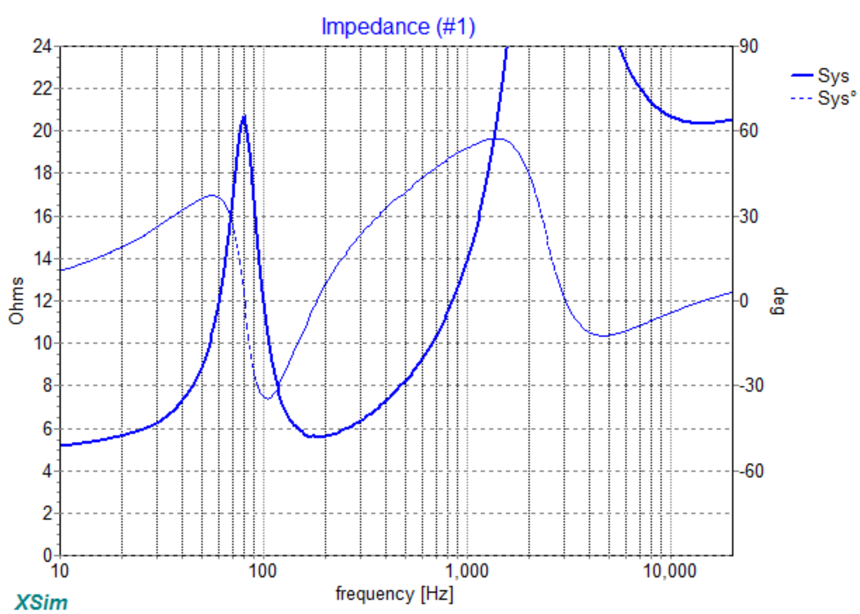
These can be considered highly accurate reflection-free responses. All sensitivities following are at 1 meter, 2.83V.

Filter Electrical Response loaded by the drivers and the System Impedance

Filter shapes were chosen for as high a crossover point as possible while maintaining a good off axis response, acceptable rejection of woofer break up, a good tonal balance standing up, and minimizing off axis tweeter contribution around crossover.

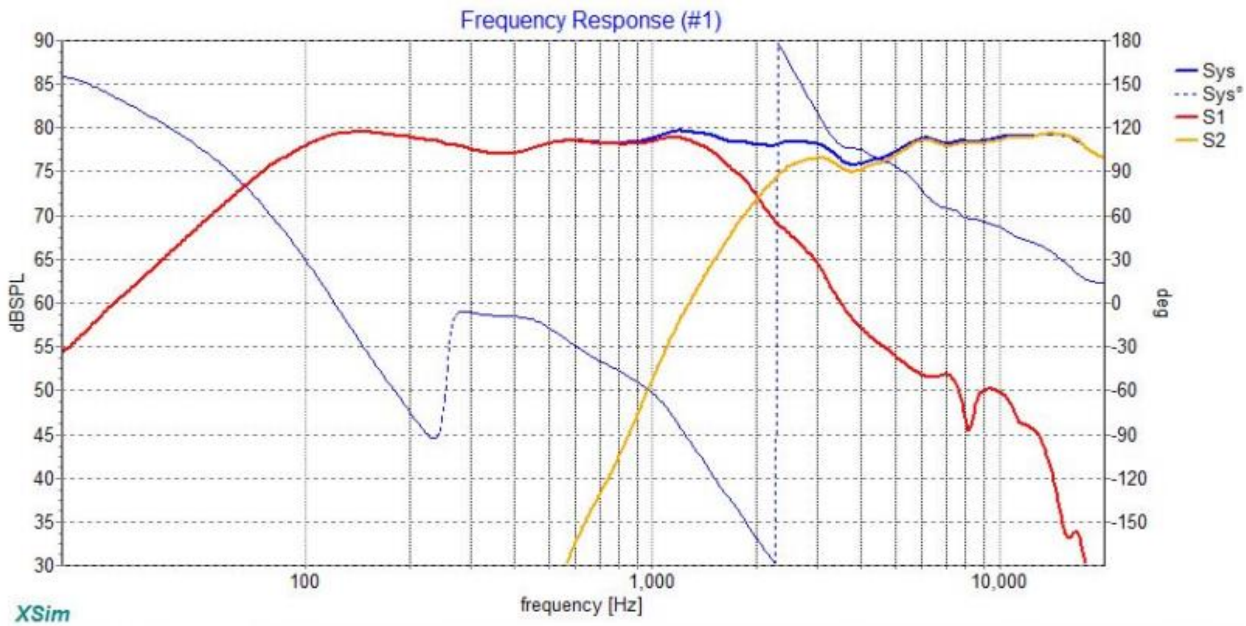


Electrical System Impedance is an easy drive even for chip amps as it never dips below 5 ohms, and never gets too capacitive.

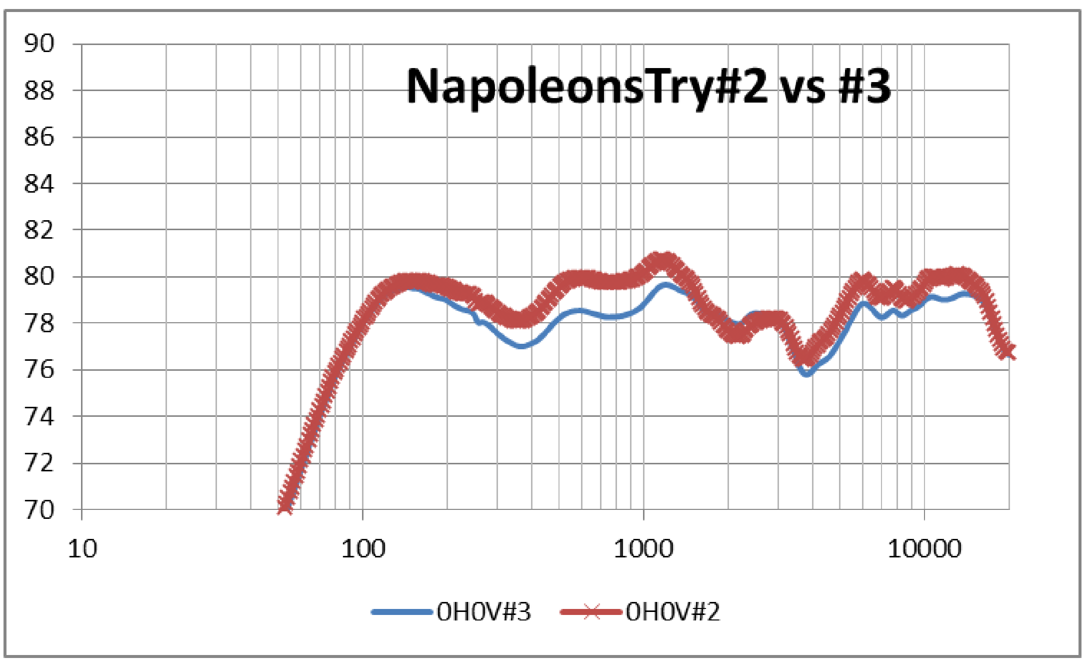


On-Axis

On axis may be a small bit too “hot” for some in near field listening, but works very well in large or damped rooms.

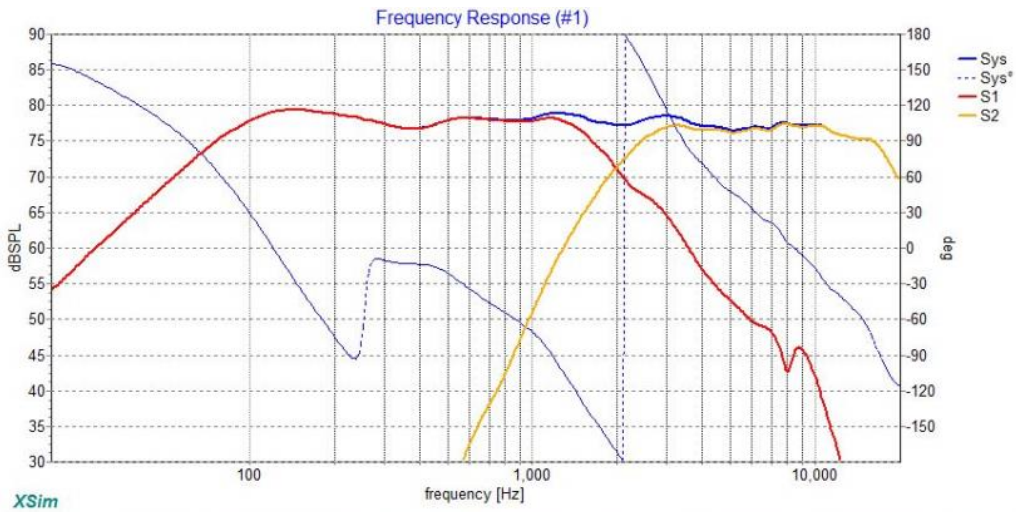


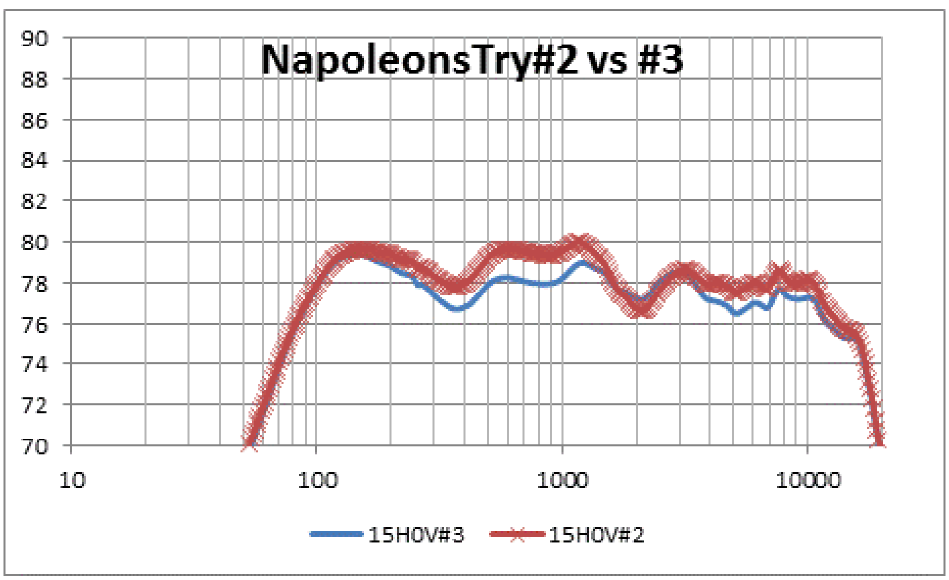
The following illustrates the differences on axis between this crossover and the previous iteration as found in Appendix II. “#2” is previous iteration, “#3” is this crossover.



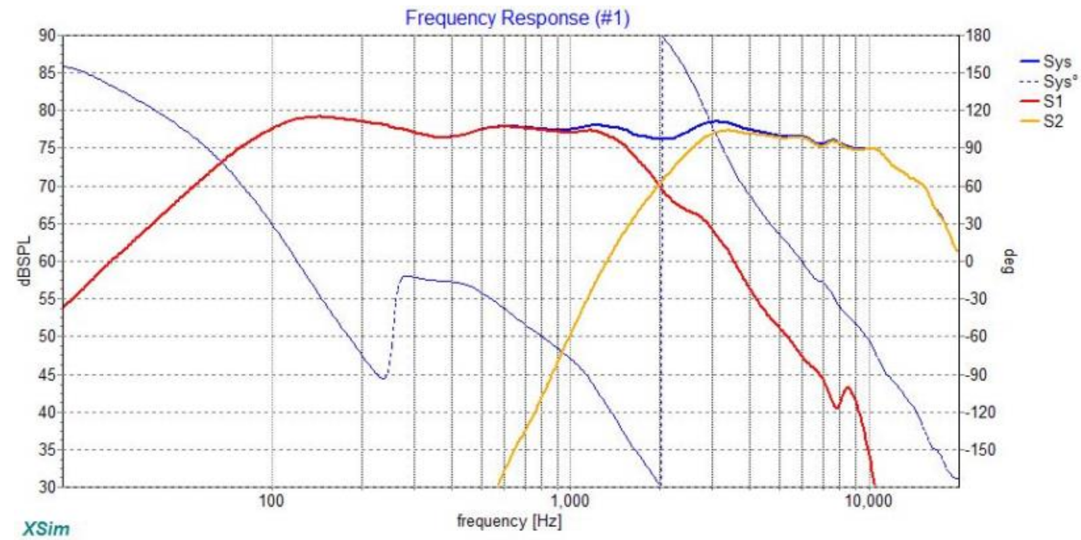
<u>15 Degrees Horizontal</u>

It's recommended that the speaker be toed in, pointing in front of the listener, so to be listening off axis at 10 to 15 degrees. The response is optimized for this angle. In a small reflective room, this toe in also stabilizes the central image and reduces tonal anomalies from side wall reflections.

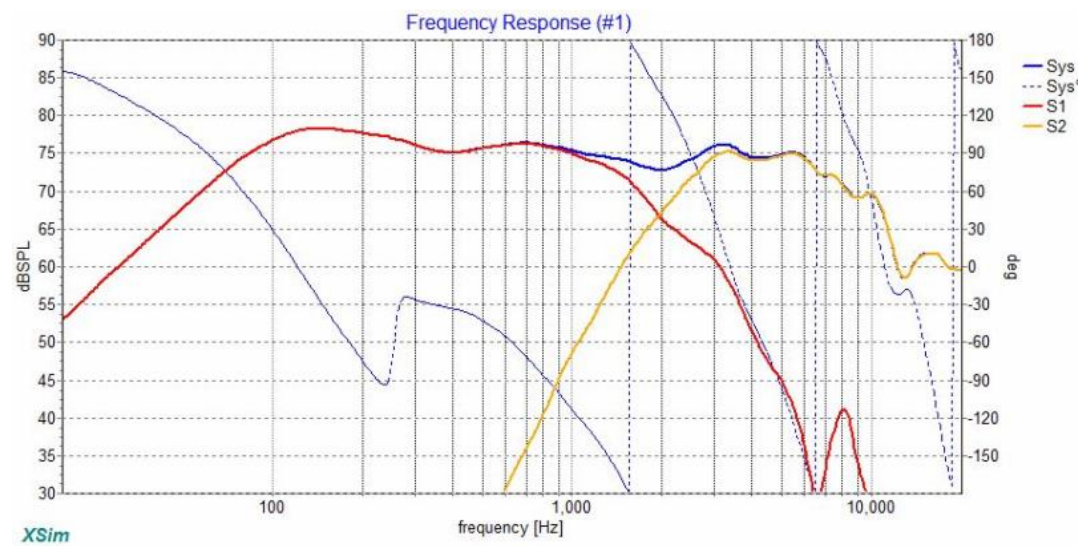




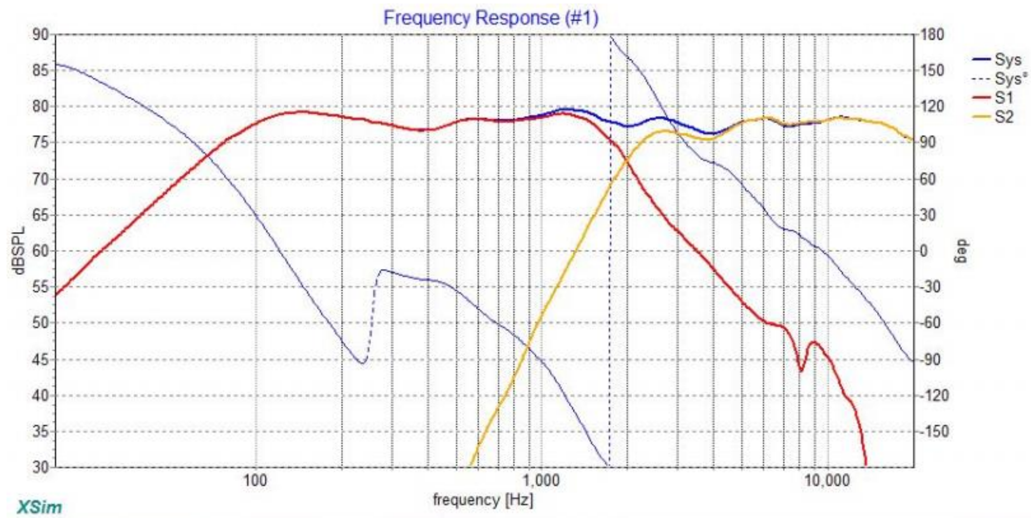
30 degrees Horizontal



60 Degrees Horizontal



+15 Degrees Vertical (represents "listener standing")



On Axis Reverse Null