System Tuning Report

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Crosstown K-Series

FA 4740
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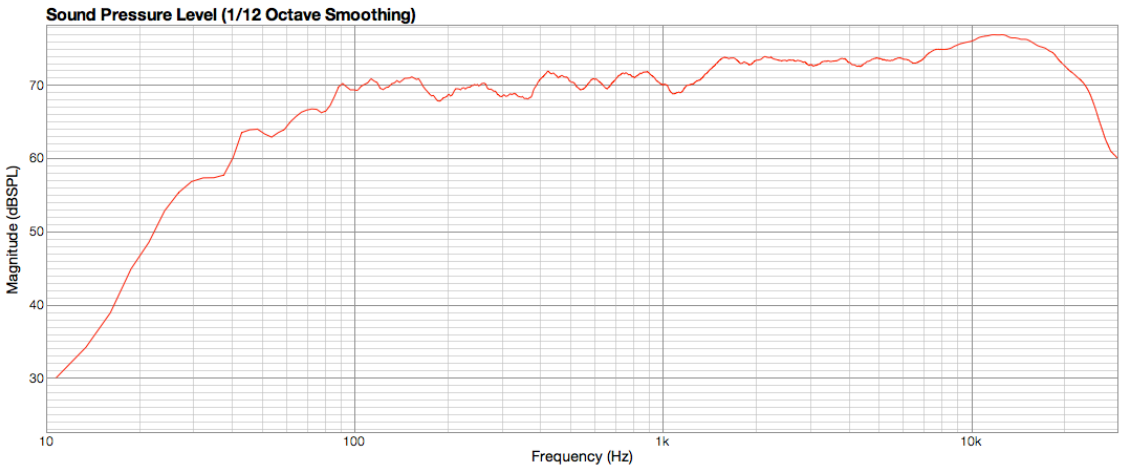
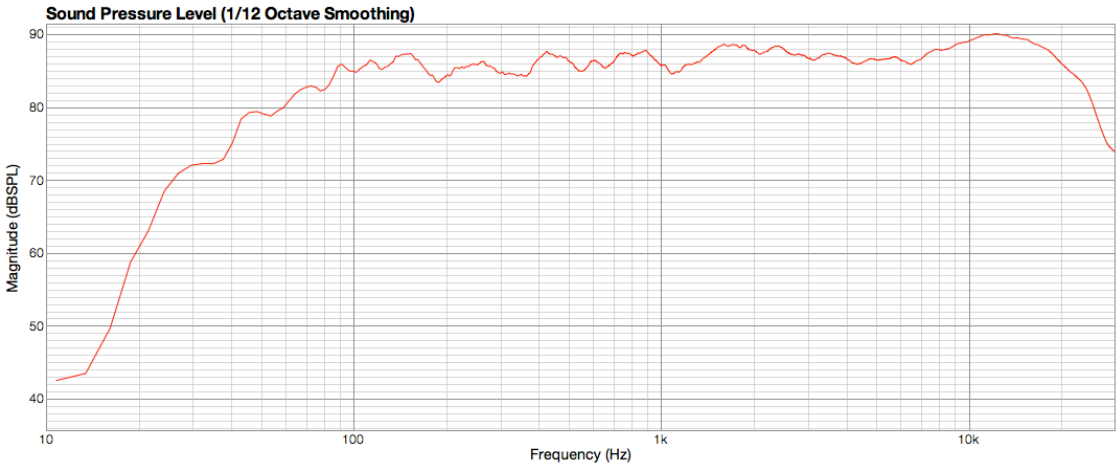
The process behind optimizing my system was crucial to the overall quality of the finished product. I mostly worked with tuning the crossover circuit tuning, enclosure design changes, port tuning, and acoustic treatment.

My initial tests were actually somewhat promising. I was pleased with the low-end response of the CA18RLY woofer given its relatively small size. The 27TDFC sounded pretty bright and clear as well, but almost too bright. Below is my initial frequency response with the original crossover schematic.

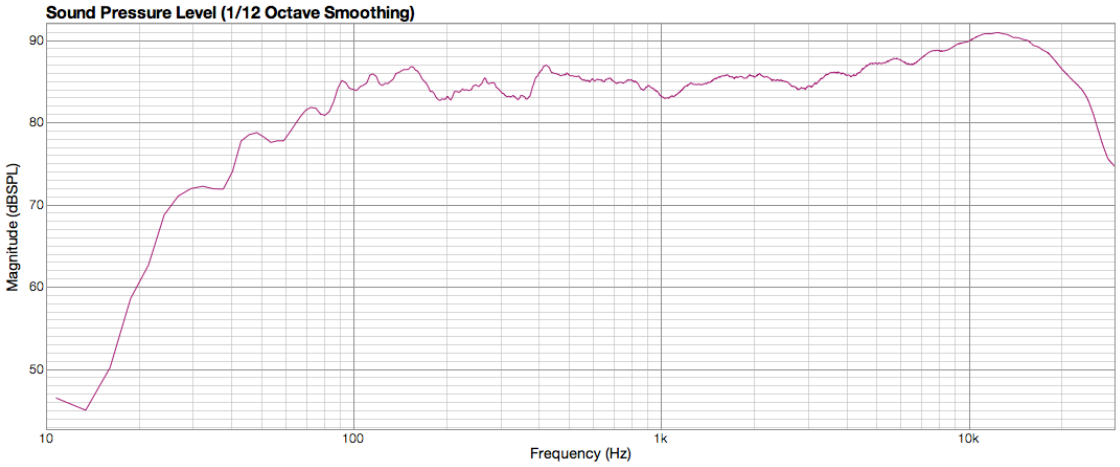


The 27TDFC, even with baffle-step compensation, is overall about 3-5 dB louder than the woofer. I decided to implement a parallel L-Pad on the tweeter to hopefully reduce the overall SPL. This involved a 1.5-Ohm resister in parallel with a

14-Ohm resistor creating a -3 dB attenuation. Below is the result of the L-Pad:

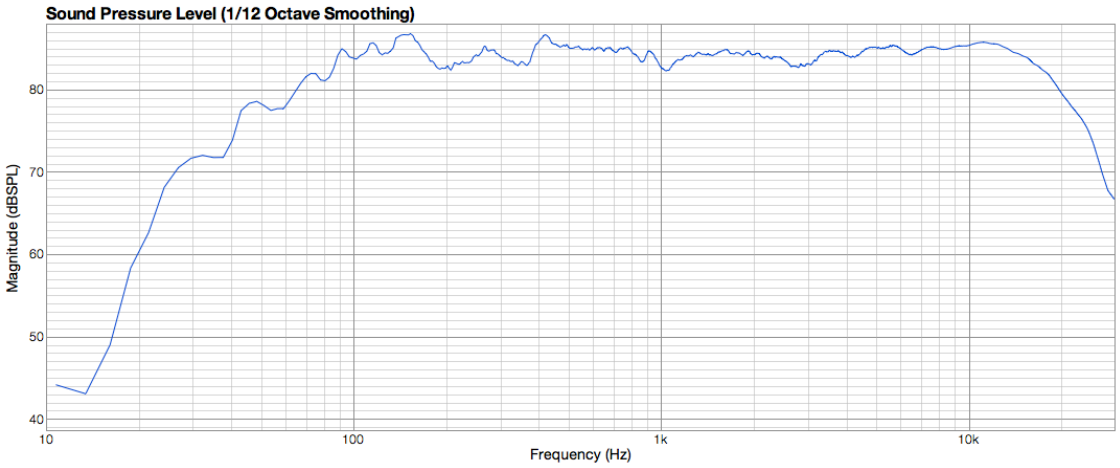


The L-Pad helped bring down the tweeter level pretty nicely making the crossover point a bit more comprehensible. At this point, the crossover is at 2 kHz and I only notice a little dip at 2 kHz of about 1 dB. This isn't too much of an issue, but I wanted to try to flatten out the region from 2 kHz – 5kHz a bit more. I moved the crossover on the woofer down to 1.2 kHz in hopes that the summation would even out. Below is the result of the changed crossover:

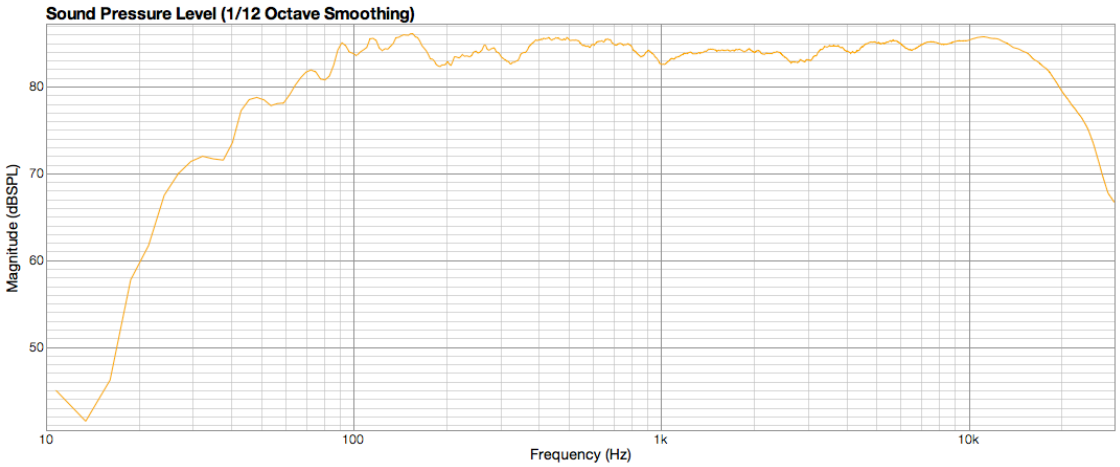


The transfer from the woofer to the tweeter evened out a bit as a result of moving the crossover point down. However, the rising response on the tweeter from

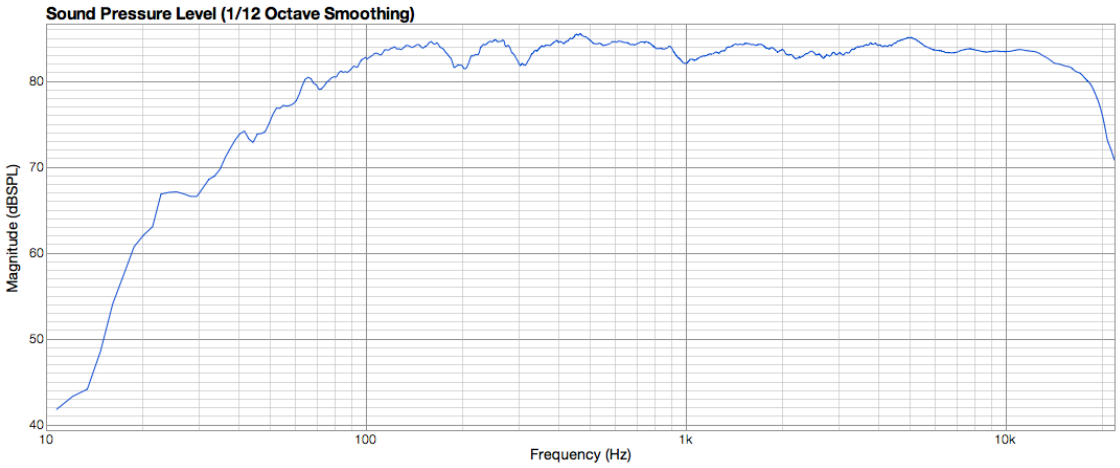
about 8 kHz up to 20 kHz needed to be tamed. I implemented a 1st order Butterworth at about 10000 Hz with a .1 mH inductor in series with the tweeter. Below is the result of the roll-off:



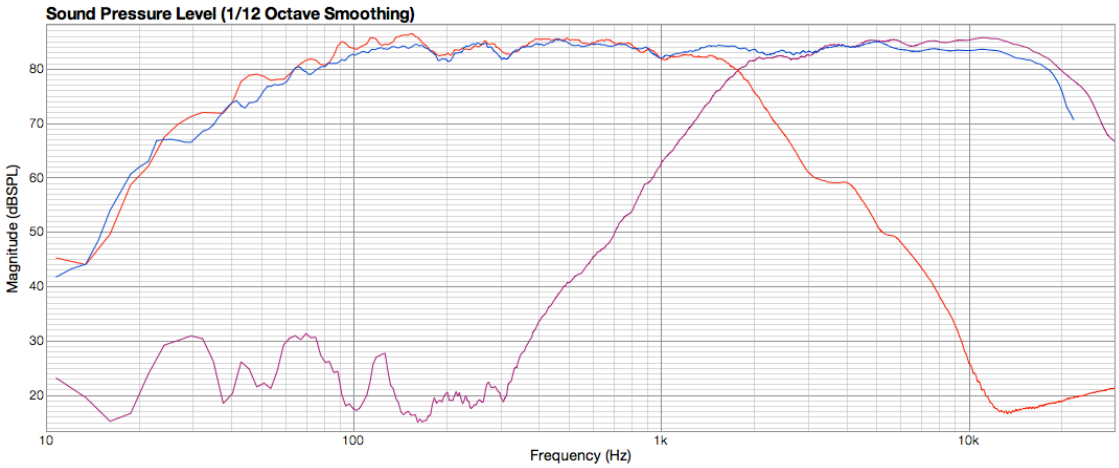
The roll-off at 10 kHz did the trick. It was able to bring the tweeter response down about 3 dB giving a pretty decently flat response for the tweeter. There's still an issue with the 200 Hz- 400 Hz range, however. At first, I thought the issue was cancellations of waves due to reflections in the box. I put a rigid piece of fiberglass at the back panel of the cabinet in hopes of diffusing the reflective waves.



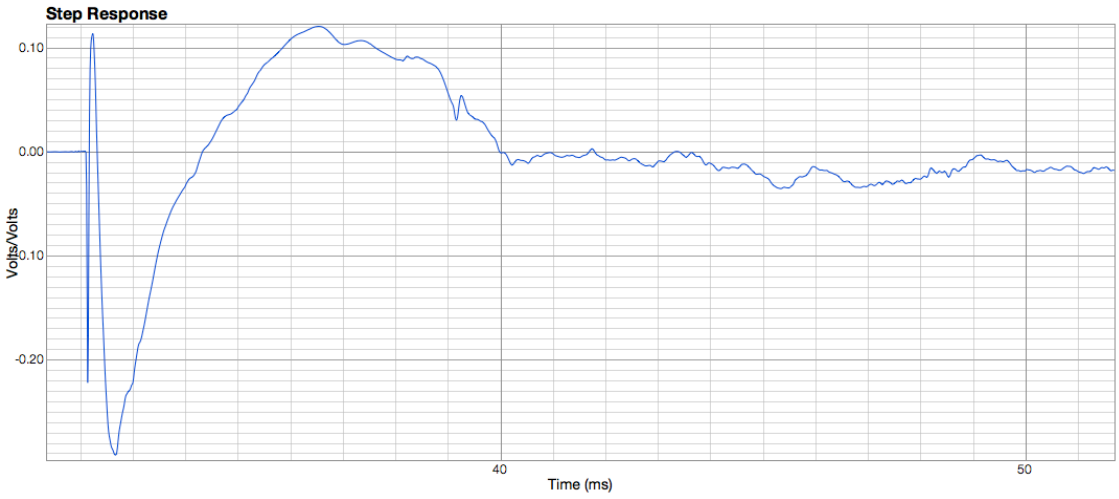
This helped smooth out the region from 400 Hz – 900 Hz, but the region from 200Hz – 400 Hz didn't change as a result of the absorptive material. I tried adding more fiberglass to the top and bottom of the cabinet to see if the cancellations were caused from reflections from other parts of the enclosure. Again, there was really no change. I realized then that the back of the enclosure, which is removable, was not really secured to the rest of the cabinet. After securing the back, the response around the problem region was quite a bit more tolerable.



The 4 dB drop at 180 Hz shrank down and the overall response smoothed out a bit more. At this point, I felt as if the crossover tweaking was done. There wasn't too much else I could change in the frequency response by crossover filtering. Below is what the overall frequency response and crossover summation looks like:

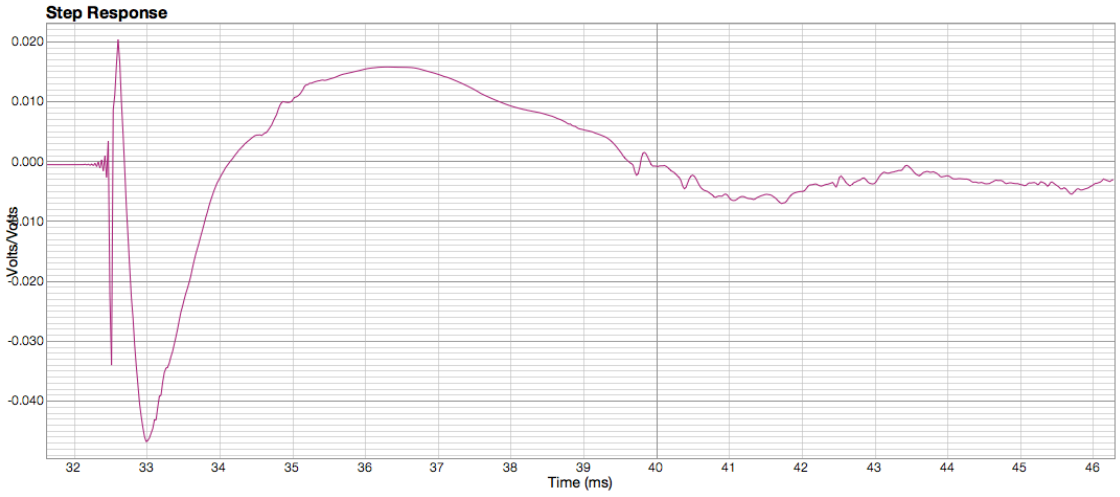


With frequency response somewhat settled, I started concentrating more on absorptive material amount. Below is the impulse response with no absorptive material:

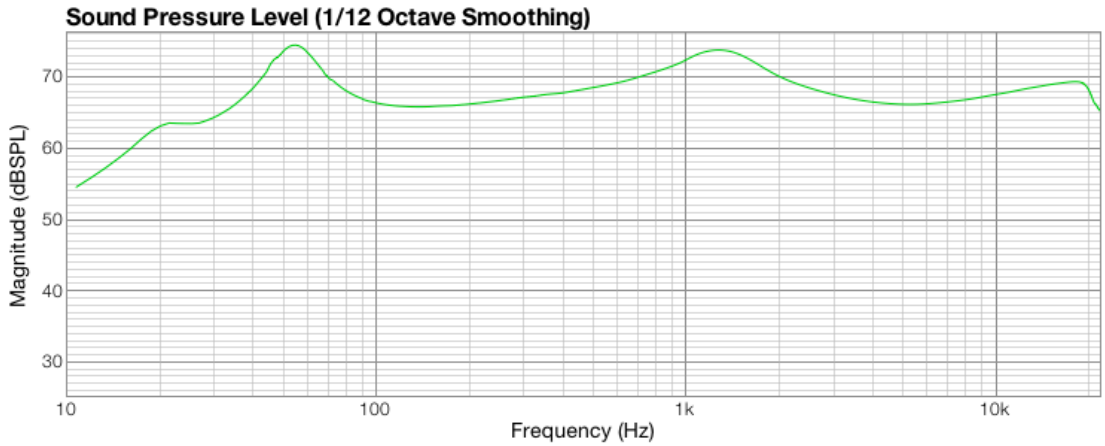


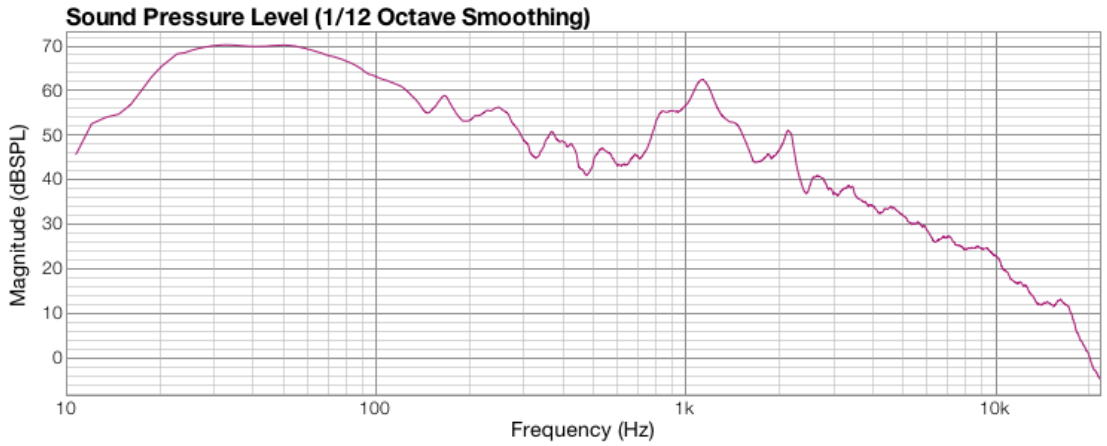
Not terrible, but could use some smoothing out. I added a rigid shelf of fiberglass on the top and bottom of the cabinet trying to rid of excess enclosure reverberation. After listening, I determined that the sound really had no life to it I replaced the rigid fiberglass on the top and bottom with thinner loose fiberglass.

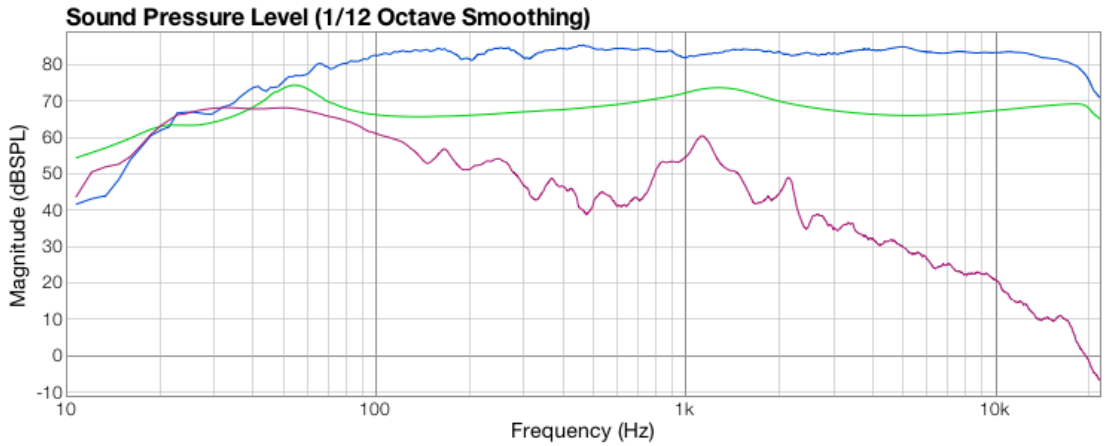
After listening, I felt the sound was appropriate. Below is the impulse response of the enclosure at this point:



The resulting response is a lot smoother and continuous than before. After tuning the crossover and enclosure acoustics, I worked on tuning the port. Below is the original impedance response of the system and the response of the port:







I decided the tuning frequency needed to be a bit higher to match up to the bass roll-off of the system and extend the overall response. The final port length ended up being 1 ½" with a 2" diameter.