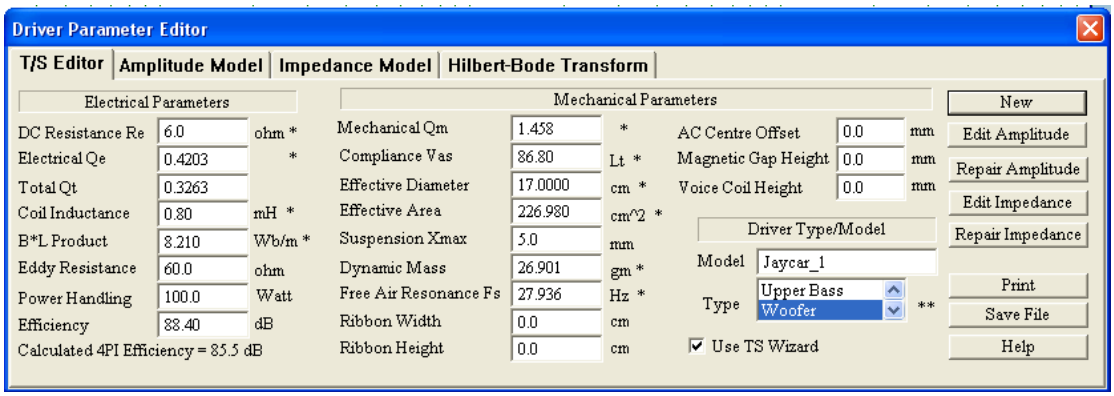
Rear Loudspeaker

Rear channels in 5.1 HT system carry mostly auxiliary sound information. Still, the design goal followed broadly the 5.1 system recommendations (Ref 1) and was to obtain maximum frequency response extension, say 45Hz-20000Hz from a relatively small box. Aesthetically, I was able to accept a box with internal volume of about 20Lt.

Conceptually, rear loudspeaker is a 2-way, vented system with 8”/90Wrms woofer and 1”/50Wrms titanium tweeter, shown below, and making it quite a robust, small loudspeaker.

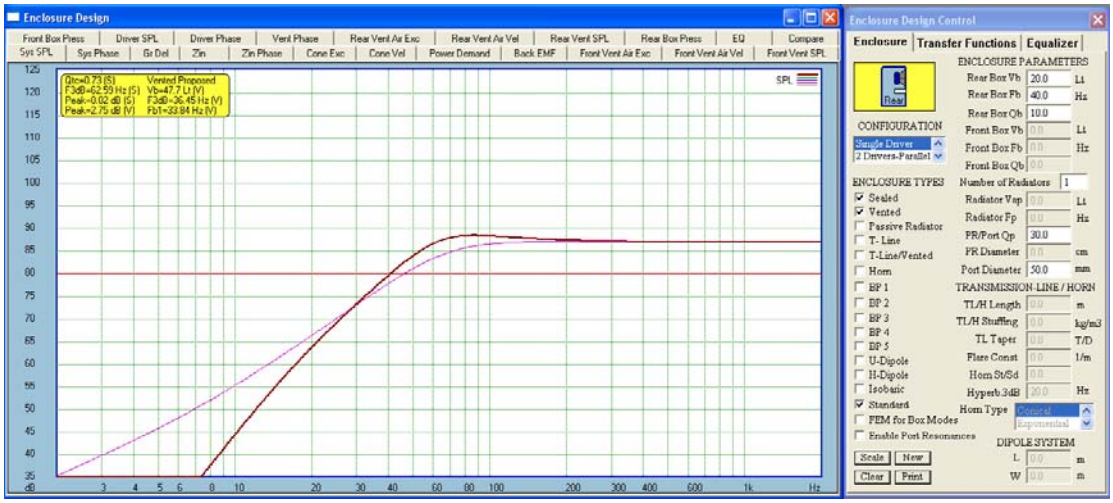
Enclosure design was carried out using SoundEasy V18. Based on TS parameters, I calculated all enclosure data, necessary to assemble the box and the measure drivers’ SPL/phase performance.

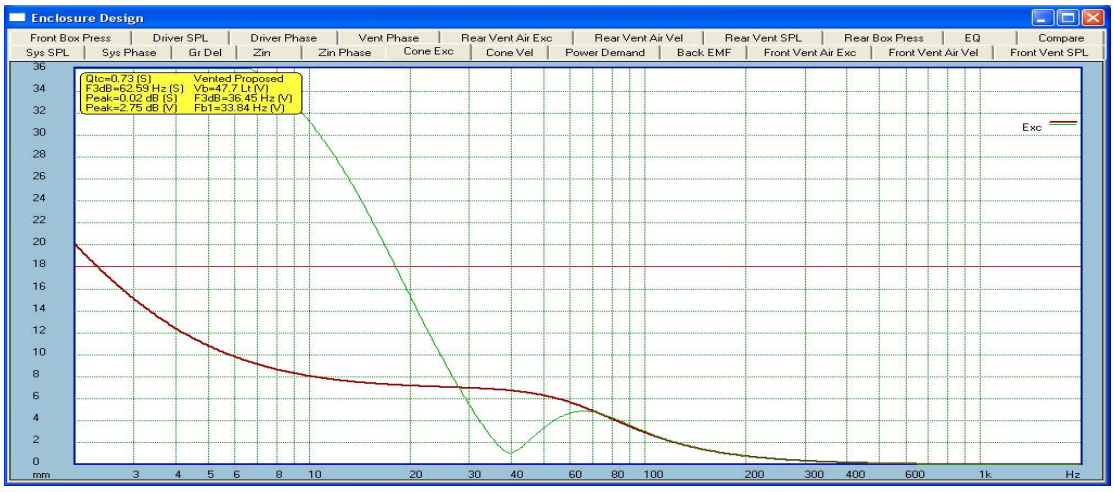
Woofer's T/S Parameters



Enclosure Design

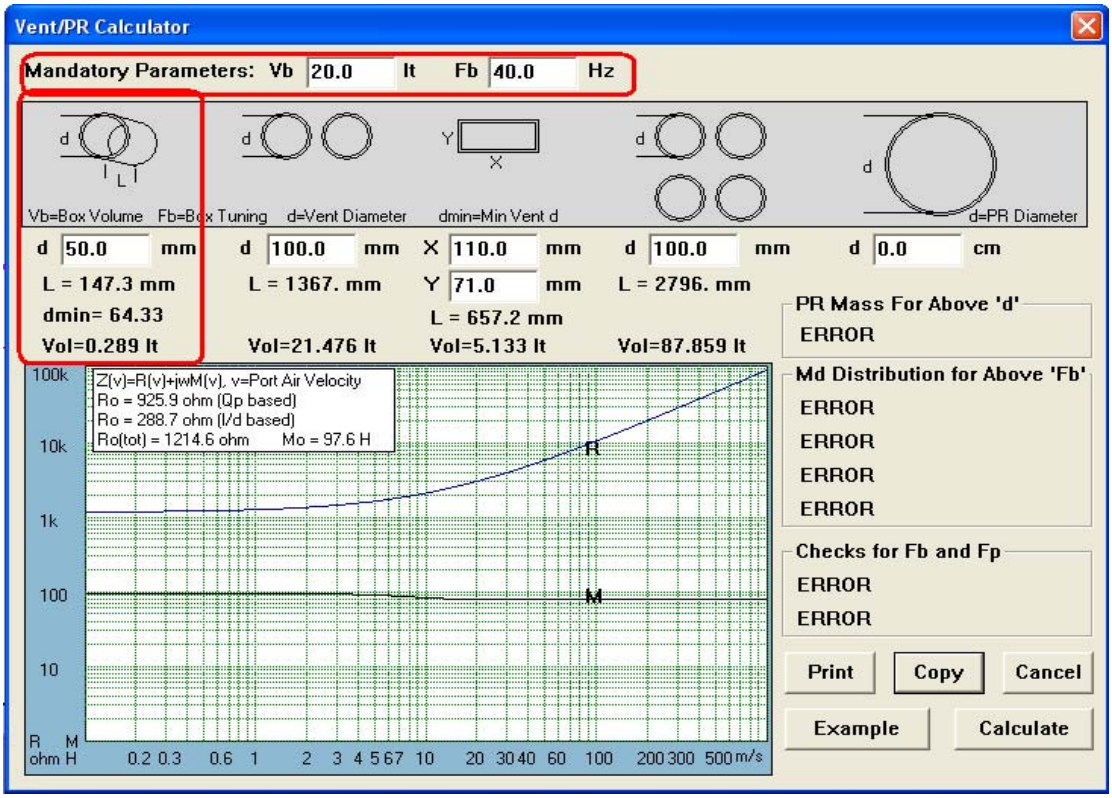
There are basically two options for the rear enclosure. I opted for vented system, because with around 3dB of available equalization, I will be able to obtain -3dB cut-off frequency of 45Hz, with satisfactory cone excursions. This is quite reasonable output from such small enclosure. The same equalization for sealed enclosure would result in the -3dB cut-off frequency of around 60Hz. The box is lightly padded with enclosure filling material, resulting in estimated Qb of 10.





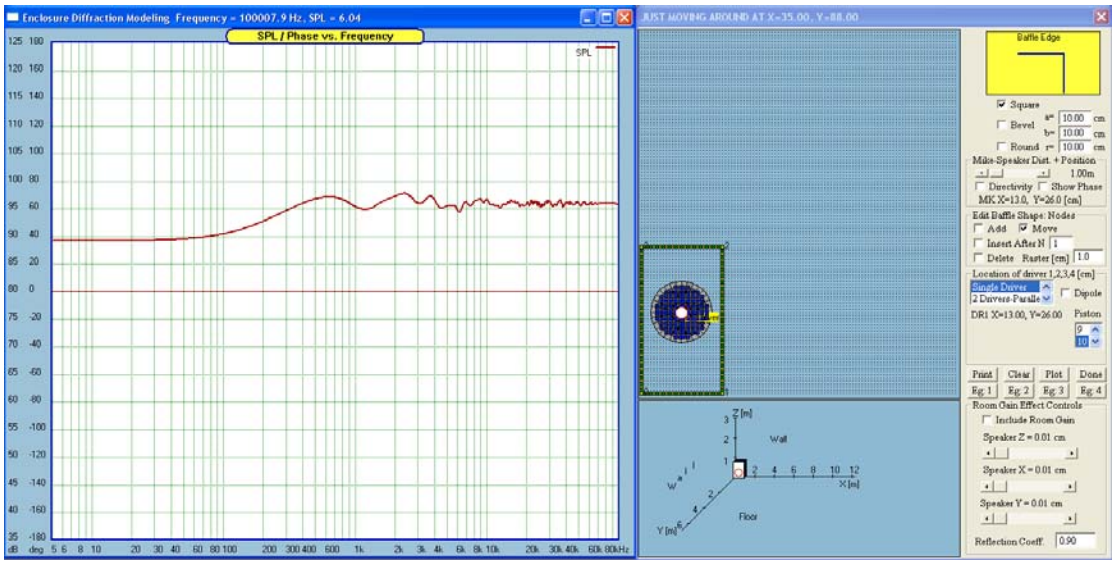
Vent Design

For the 20Lt enclosure, tuned to 40Hz, the vent must be rather small in diameter, otherwise, it's length is excessive and will not fit comfortably into the enclosure depth of 25cm. For the 50mm diameter vent, the expected length is 147mm.



Diffraction

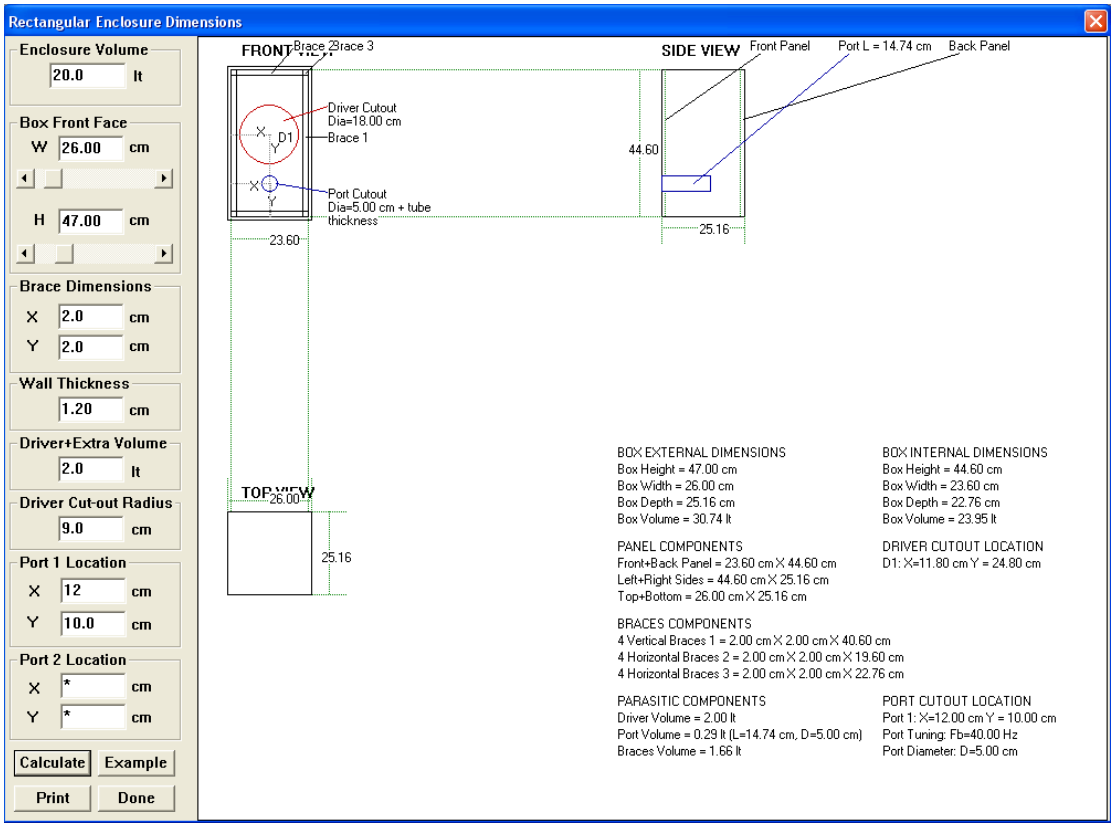
Diffraction curve for square edge type of enclosure is fairly typical. Starts rising from around 100Hz. Diffraction curve will be completely equalized using inverse HBT process.



Rectangular Box

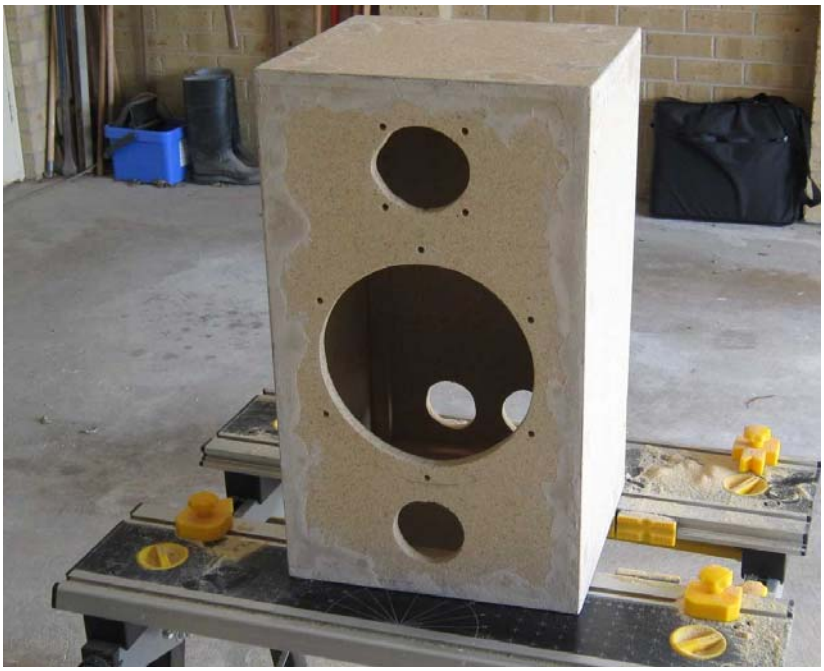
Finally, I proceeded to visualize the actual box design, even though it does not show tweeter cut out. Enclosure bracing is 20mm x 20mm in cross-section.

For the construction, I used 12mm particle-board. Joints are glued and all panels are screwed to the braces using suitable wood screws. Finish is very simple. Exterior is smoothed, primed and spray-painted white, to match the rest of the loudspeakers and room décor.



At the back of the box, there are two push connector terminals, one for the woofer and one for the tweeter. The 50mm diameter front port, is shown to the right.

After assembly, all surface irregularities (screw holes, chipboard edges) are patched with wood-filler, and left to dry for 4 hours. Then the whole exterior of the box is smoothed using two grades of sandpaper.



Finally, the exterior is primed and spray-painted with 4 layers of water-based enamel paint. Total construction time was about 10 hours. Fully assembled rear loudspeaker is shown below (picture looks better than the real thing).

As you can see, construction effort was kept to the minimum. The techniques used were simple, bordering on primitive. I did not expect the finish to rival a commercial product, as I do not have woodworking skills to ever accomplish that, but it all worked OK for me.

Since there is no crossover inside the box, it was very important to mark the rear connectors, to indicate which one connects to the woofer and which one connects to the tweeter.

References

1. The Recording Academy's Producers & Engineers Wing Recommendations For Surround Sound Production.

http://www2.grammy.com/PDFs/Recording_Academy/Producers_And_Engineers/5_1_Rec.pdf