Subject: Midrange horn answers
Posted by Adrian Mack on Sun, 22 Feb 2004 06:02:53 GMT
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Cool, I can see what was happening now from those response curves and inputs you sent me. I threw Fs, Qts and Vas into a box modelling program using a closed box volume of the size you entered in Hornresp, which was 3L. It shows an underdamped response and peaks 3.8db at about 165Hz. As it turns out, this is one of the reasons you were getting more frequency response extension on the low end than you would get normally. A box volume of 19L for this driver gives a Qtc of 0.707 for the rear chamber so it doesn't peak at cutoff. Without changing any other horn parameters, compare the response in Hornresp with 3L rear chamber to a 19L rear chamber on your horn model. Efficiency between 100-300Hz is less, its 4db down at 150Hz compared to 400Hz (for anyone else viewing the thread, response was dead flat with the 3L chamber from 150Hz-500Hz and up to 1KHz as well, just a bit more wobbly). The 4db peaking is part of the reason for the LF boost. Also notice that the rolloff seems a lot shallower and to a lower frequency than before as well, because Fb of the rear volume of 19L is lower than Fb when its 3L, and both are a lot lower than horn Fc. The extra 12db/oct rolloff below Fb doesn't begin until a lower frequency. Excursion at low frequencies is also less now. While the horn now rolls off below 500Hz (about the 1/4wl frequency of its length) its not rolling off very fast at all, a meagure 3db/oct. Reason for this is efficiency. Remember that a horn cannot effectively reach maximum efficiency until its length is 1/2wl of frequency to be used (nor can it reach zero acoustic phase for that matter) although the horn will work when length is 1/4wl of lowest frequency. Notice that despite being on a horn, the 1w/1m sensitivity of it is only 90db 1w/1m, which really is nothing more than what the driver does in a simple acoustic suspension or reflex box. Horn length is very small at 7", actually it was 6.69" in the model you sent me (hence its rolling off below 500Hz and not 480Hz being my previous assumption). Since hornresp works in centimeters, lets use these terms instead. Length that you had entered was 17cm, increase this to say 30cm and have it calculate SPL curve. Notice that efficiency above 300Hz is now 4-5db greater than when it was 17cm long, and now frequencies below 300Hz are attenuated a lot more because of this. The "real" low end limit shifts to 300Hz from 500Hz now because 30cm is 1/4wl of 300Hz. The longer length is also increasing efficiency. Its now falling off more rapidly from Fc to Fb, where it is direct radiator below Fc. Compare efficiency at 300Hz now to 150Hz, its attenuated almost 9db now. To add to that as I mentioned before, passband efficiency is now 94/95db 1w/1m with 30cm length and not 90db 1w/1m when it was 17cm length. If it were a different driver with a smaller and lighter diaphragm designed to work above 500Hz, say a 3" or 4" driver, even some 2" compression drivers can work this low, then 7" would be the correct length to maximize efficiency. The driver that your using though with its 43Hz Fs etc is "meant" to be used lower than this and it doesn't work right when length is this short. To comment on the rest of the inputs, change front volume to ~118cc from the 250cc that you had. Although different 6" drivers vary their volume under the cone because of different cone shapes, the volume of air under the Eminence Alpha 6" driver cone that I measured was 118cc, so we can assume your 6" has a volume "around" this amount. Any differences between different makes of 6" will be minimal anyway. Since the cone is shape which is just that, there isn't a fixed or single cross section area, so its hard to put a value into Hornresp. It cannot be bigger than Sd though, so change it to around ~80cm^2 for a 6" driver. It's got nothing to do with the LF cutoff which is the main purpose of this thread, but rather the HF cutoff, I thought I would mention it anyway. I'd make the throat perhaps a little smaller, say 55cm^2 to maximize HF efficiency. Hornresp does not predict this accurately though, but it's likely to be better when you measure the response if you actually build a horn for it. If you have calculated the SPL curve again after these changes you'll notice efficiency changes again. Changing throat and front chamber sizes/volumes will effect passband efficiency along with other things. If the throat is made smaller the horn will load to a higher frequency up to a certain point, then it becomes attenuated again by out of phase reflections between the cone and mounting plate. You can see that the volume between cone and mounting plate forms a resonant chamber acting like an acoustic lowpass filter for the high frequencies. Then there is other things to consider as well such as distortion from throat resistance, too small a throat will choke the low end and it all becomes non linear. There is a specific range of values to maximize efficiency, bandwidth and distortion products. Don't trust what Hornresp predicts on the top end though, it's model isn't accurate enough for this. To me this doesn't seem like the best driver for a horn. It's Fs is too low so efficiency is compromized a lot. 94db 1w/1m from a driver/horn is low considering many horns boast at least 100db 1w/1m. If you make length much longer than 30cm, the response curve starts to generate a lot of ripple. If you make it 57cm long or 1/4wl of 150Hz, it makes horrible ripple with the tallest peak being 8db. You need to look for ones with a higher Fs (hence lower moving mass) which will also have higher efficiency, motor strength governs this too. This is why I choose the Alpha 6 driver for my midrange horn. Remember that the horn lowers the Fs of the driver so you can get more low end out of a low qts/high fs/high eff driver in a horn than you could in a closed or reflex box, which for a driver with these specs would have a very high f3 by comparison. Adrian

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