Subject: Re: 3pi, smaller cab possible?
Posted by Wayne Parham on Fri, 28 Dec 2012 01:14:42 GMT
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Changing the size of the baffle will alter the speaker's directivity at low to midrange frequencies. At low frequencies, the speaker radiates omnidirectionally but as frequency rises, the baffle begins to limit the radiation pattern to the forward-facing hemisphere. This directivity shift modifies both on-axis and off-axis response. Some call the modification to the on-axis response the "baffle step".

However, a small change in the dimensions won't make much difference. Making it smaller will shift the transition frequency upwards, and larger will shift the transition frequency downwards. As long as the changes are small, it won't matter much, especially if the baffle is large anyway. If the transition region is below the Schroeder frequency, room modes play a much bigger part than baffle directivity shifts. Self-interference anomalies from nearest boundaries are also in play.

The loudspeaker baffle is sort of like a 180° waveguide, with the baffle dimensions being like the mouth dimensions of a horn. Actually, it isn't merely like a 180° waveguide - that's precisely what it is, a conical waveguide having 180° wall angle and "mouth" dimensions equal to the height and width of the baffle.

Just like a horn loses directivity control based on its mouth size, so does a baffle. It will lose pattern control at a different frequency in the horizontal than it does in the vertical if the baffle has a different height than width. If it is taller than wide, it will maintain a 180° pattern in the vertical to a lower frequency than it can in the horizontal, widening at low frequencies. But also, just like a horn suffers waistbanding in the transition region where it is losing directivity control, so does a baffle in the frequency range where it transitions between 180° beamwidth and omnidirectional radiation.

As frequency drops, beamwidth narrows briefly before it widens. This directivity ripple creates a slight on-axis response ripple, although power response remains flat. Since power response remains flat, and since the transition region is near the Schroeder frequency on large baffles, I do not recommend any sort of electrical EQ (aka baffle step filters) to modify on-axis response. Baffle StepAll that to say, as long as the baffle size is large enough, small changes don't matter much. What anomalies occur are in the modal region and so should be mitigated in the same way as self-interference from nearest boundaries and room modes, using multisubs and flanking subs.

On the other hand, if the dimension changes are large enough, then the directivity changes will become apparent. Narrow baffles cause directivity shifts above the modal range, up in a range where directivity shifts are probably more offensive. Perhaps even more importantly, if the cabinet is modified enough, its internal standing waves line up differently and without measurements, you can't really know what you've got. That's why I sometimes caution people against making modifications unless they have measurement equipment to validate their changes. Tower speakers are really cool looking and convenient to place, but they take a little extra care because they are particularly vulnerable to pipe modes in the lower midrange and upper midbass, where internal stuffing is unable to damp effectively. You definitely don't want a pressure node to line up with the driver or port, because it can create prominant response ripple.