Subject: Re: Six Pi Review
Posted by Wayne Parham on Mon, 24 Sep 2012 19:06:03 GMT
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As an aside, measurements made in a trihedral corner outdoors naturally do not show room modes, the response down low is ruler-flat. But indoors, room modes take over and make hot spots and dead spots, causing ripples in response. I'm sure in your case, the room modes clean up considerably when the subs and other speakers are added in. Do you have any response charts with subs running?

On the other hand, the pair of mains-only charts at 1M and 3M (3 feet and 10 feet) are excellent for illustrating the benefits of the constant directivity cornerhorn, because they show movement of the anomalies, which proves the absense of self-interference from the nearest boundaries, the walls adjacent to the corners. The fact that the anomalies move in frequency proves them to be caused by room modes and not by self-interference.

Looking at the measured response charts, you can clearly see the room modes below about 200Hz. This is always present, and is the reason for multisubs. What is also clear, is the absense of self-interference notches from the nearest walls, the ones behind and beside the speaker.   This is significant, because it shows how effective the constant directivity cornerhorn configuration is.

In most cases, you can't really tell which ripples are caused by modes and which are caused by self-interference from a nearest boundary. They're similar in that they are caused by reflections from the walls, floor and ceiling. The only difference is that modes are standing waves, whereas self-interference notches from a boundary occur without standing waves. They're just a cancellation effect between the direct sound and a reflection.

But there is one special case where you can tell the difference. The reflection from the wall behind the speakers is delayed by the same amount no matter what distance the microphone is placed from the speaker. So in this case, the self-interference ripple doesn't change frequency even when the microphone is moved. As long as the angle of reflection remains constant, the frequency of the anomaly remains constant too.

This helps identify self-interference notches. When you move around in the room, the microphone passes through modal regions. This changes response due to room modes. Some frequencies will peak and others will dip, and the ripple will move as you change positions. If you change the angle of incidence to the nearest boundary, its self-interference notch will change frequency too. But if you do not change the angle of incidence - just the distance - then the frequency of the response anomaly will remain the same.

So to learn the effects of a particular boundary reflection, measure the response while moving the microphone away, perpendicular to the boundary. The self-interference notch from that boundary will remain at the same frequency. This will tell you the amplitude of the anomaly caused by a particular boundary. If you do not see a notch that stays put, then there is no delayed reflection, as is the case with constant directivity cornerhorns.

A self-interference notch from the wall behind the speakers will remain at the same frequency even as the microphone distance is varied. The floor bounce notch will move because the angle of reflection changes. Room modes will change because they are standing waves that form fixed "pockets" of sound, like a checkerboard pattern that the microphone moves through. But the self-interference from the back wall remains constant.

When you move the measurement microphone through the room, in most cases you see a mixture of modal and self-interference anomalies. Some move as the microphone is moved, but others remain fixed. The largest one remains fixed, actually, the one that comes from behind the speakers. But in the case of the constant directivity cornerhorn, it doesn't even exist. A constant directivity cornerhorn has no self-interference from the walls behind the speaker. The only thing that remains to be solved are room modes, and they are best mitigated using multisubs.

If the most offensive anomalies are at low frequency, as is often the case with constant directivity cornerhorns, then subs can be placed fairly distant from the main speakers for best results. But if they are higher in frequency, I would prefer a pair be placed closer, much like flanking subs. They aren't needed to smooth self-interference notches, so it isn't the same thing. They don't need to be placed between the mains and the nearest boundaries, nor could they be. But they do need to be symmetrically placed and somewhat close to the mains, so they can be used up into the lower midrange without localization problems, similar to the flanking sub approach.

I think your subwoofer placement as shown in the photo probably works pretty well for this, since the second and third axial modes between your relatively narrow side walls are probably at least partly responsible for the anomalies at the upper end of the modal region. Sometimes having the subs on risers helps too, since the upper frequency modes are often vertical axial modes. The lower frequency modes are the primary modes, lowest being from the longest dimension. Those can be smoothed using subs placed further from the mains, run only at very low frequency.
Room modes, multisubs and flanking subs
