Subject: Re: Super Tweeters
Posted by Wayne Parham on Wed, 02 Nov 2011 16:01:53 GMT
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First, a technical answer then a more actionable one:

At high frequencies, pretty much everything indoors acts like multiple subs. This is called dense interference. The reverberent field is charged with an infinite number of tightly spaced phase relationships between wavefronts going every which way. This is because of the small wavelengths involved. The room is large compared to wavelength, so interactions become very diverse. Since the interactions are so complex, the sound field becomes an average of all sources and reflections. You can't detect a difference between the sound level when moving from one position to another, other than the falloff from moving away.

At low frequencies, this isn't the case. The interactions are widely spaced, so much that you can literally stand in one position where there is positive reinforcement between standing wave nodes, and then move a few feet over and walk into another position where there is negative reinforcement between standing wave nodes. This is called course interference. It makes the SPL noticeably different in one position than the other. Multiple subs smooth this out by creating more interactions, moving towards dense interference.

Outdoors, you have another case, one where there is no reflections (other than from the ground). In this case, the sound can truly be a point source in an anechoic (reflection free) environment, where there is no interference at all.

You can visualize these three states as ripples on a pond. The reflection free state is a single pebble thrown into a very large pond, one where the banks are so far away no ripples return. The wavefront is pure in this case. Next is course interference. This would be the case where two pebbles are thrown into the pond. As the ripples expand from each point of entry, peaks and valleys form very clearly defined interference patterns where the wavefronts collide. Next is dense interference. This would be the case where raindrops pepper the surface of the pond. It becomes an averaged surface, one where no clear peaks and valleys cen be detected.

Put a boat on the surface of the pond, and you can really see the difference between each of these states. In the first case, the boat simply moves up and down as the wavefront passes. The amount of up/down movement is constant, no matter where the boat is placed. The only thing that makes a difference is the distance from the point of impact. In the third case, the ripples on the pond, up/down movement is also constant. Pretty much no matter where you put the boat, it just kind of jiggles in place, moving the same amount no matter where it is. But the second case - the one with dense interference - the movement is largely dependent on where the boat is placed. In some positions, where wavefronts combine in an additive fashion, the up/down movement is large. In other positions, where wavefronts cancel, the boat is relatively still. So this second case is the one that is most easily noticed when moving along the surface.

So all that to say you don't really need (or want) multiple sound sources at HF. It doesn't give you any benefit, and while it doesn't change the reverberent field, it does modify the direct sound (and the polars). I personally prefer not to use super-tweeters. Back in the days of the JBL 2410,

compression drivers didn't go north of 10kHz. You could really hear the lack of highs. But now days, you can find any number of compression drivers that reach well above that. A good 1" exit compression driver will run smoothly to over 18kHz, and some (beryllium diaphragm) drivers reach above 20kHz. Even the cheapos will hit 16kHz, and ironically, many of them peak in this region.

My suggestion is rather simplistic, just maybe give it a bit more juice. If you have a treble control, give it a couple decibels more up top. If not, swap the R1/R2 values to move the tweeter up 2dB or 4dB. See how you like that. As a reminder, here is the chart of R1/R2 values for various decibel levels:
Compensation component valuesWhen the speaker is corner loaded, it increases output in the bass and midrange. If you look at the constant directivity cornerhorn schematics, the tweeter is always run a little hotter than the two-ways. This is because of that fact. The tweeter isn't benefiting from corner loading, because it is acoustically distant. The tweeter horn is what sets the pattern, and the walls don't do much of anything. But down low, in the bass and midrange, the walls actually become a sort of horn, a directivity device. They force the sound into a 90° pattern. As a result, the sound gets louder. It isn't being spread around as far, it is slightly more "focused". So the increased output should be matched with a little more tweeter drive.