Subject: c-t-c formula and tweeter placement
Posted by taylor on Wed, 01 Sep 2004 20:56:52 GMT
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Hi,Ive just purchased 32 PE 4inches and 70 Onkyo tweeters to build an array. Ive always wondered how they sound and these will be an intro. I currently listen to horns and Maggies (I love the strengths of each) and think an array will give me the wonderful presentation the Maggies have but with the dynamics and efficiency the horns possess (minus the size).My question is to the ctc spacing. I dont have a clue as to the calculation. I read Jim Griffins paper but still missed the formula. I gather from others, that 3700hz is ideal xo point but how high can I go without really detremental effects? Im using the 2" square tweeters and 5k is about as low as I should cross them. Also, Im going to mount the tweeters on a separate baffle so if they sound horrid, I can swap in something else so how far away from the mid drivers can I mount them? Also, what does using a 3th/4th order xo do in terms of sound quality? Thanks, taylor

Subject: Re: c-t-c formula and tweeter placement
Posted by Jim Griffin on Thu, 02 Sep 2004 02:38:32 GMT
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Taylor,The c-t-c calculation relates the frequency (F) in Hz wherein the c-t-c spacing (D) in inches becomes a wavelength. The formula is F = 13500 / D where 13500 is the velocity of sound in inches per second. Thus if you have a 4 inches c-t-c spacing (4 inch diameter drivers with flanges touching) you get a frequency of 3375 Hz. As I explain in my white paper this is the recommended crossover frequency between the woofer and tweeter lines. What happens if you crossover above 3375 Hz in the example above is that you will run the risk of comb lines in the vertical axis (the comb lines will be most severe at twice 3375 Hz or 6750 Hz. Thus I would suggest that you avoid crossing over much beyond 4000 Hz to prevent those comb lines. Parts Express has a frequency response on their web site (click on the sample response tab) for their 4 inch drivers which shows serious peaks in the response of the 4 inch 27-570 drivers at around 7000 Hz so for sure you need to crossover well below that frequency. But more important than the comb line issue I just raised, you start to lose array directivity above 3375 Hz. That means the array gain of the woofer line would start to decline as the wavefronts from each individual woofer are no longer additive. Thus the sensitivity improvement that you had below 3375 Hz will start to suffer if you operate beyond that point. While you can compensate for this effect if you use an equalizer to adjust for the decrease in sensitivity, you can not avoid the comb line issue. Bottom line is that 3375 Hz (or below) is the prefered cross point for the 269-570 (same as 269-568) units. You could try a higher cross but with tradeoffs such as a higher low pass filter slope (say 3rd or 4th order) or response flatness performance will start to suffer. I recall reviewing the specs and response on the Onkyo autosound driver. That tweeter could be crossed a little lower if you remove the plastic grid over the dome if I recall. It may blend OK with the 4 inch driver in the 4000-5000 Hz area. You may be a candidate for Bill Fitzmaurice's line array which he offers a tease in his coverage in several threads below. While his detailed article will not appear for a while, his design uses some of the same drivers that you have purchased. As you might guess from my comments to Bill on his design, his design does have issues related to driver spacing (his

design features a greater than 4 inches c-t-c for these drivers) and his choice of crossover frequency is 6000 Hz. I guess we will have to await his design article to understand how he deals with the above issues. Jim

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Subject: Re: c-t-c formula and tweeter placement
Posted by taylor on Thu, 02 Sep 2004 05:08:55 GMT
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Jim,Thanks for the info. Im pretty excited about building these since this is about the only speaker design Ive not had any experience with. I tested the tweeters and they seem to sound reasonable down to about 4k. As far as clipping off the phase shields of 64 tweeters, I think I'll pass. Im going to do a fairly quick build just to get a feel for the sound and then look at a high performance design. I picked the tweeters simply because they were cheap, easy to mount, and have pre-soldered wires on the terminals.If the Pioneers do a good job then maybe I will invest in some Dayton Pt2s as others have. BTW, I looked at the Selah Audio site and couldnt find any reference to the Linus2 kits. Are they still available there?taylor

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Subject: Combing
Posted by Bill Fitzmaurice on Thu, 02 Sep 2004 11:33:59 GMT
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If you do space further apart than what is considered by some to be ideal you will get a combed vertical radiation pattern close to the drivers, where their individual radiation patterns don't allow them to integrate into a single coherent wavefront at the radiating plane. But as long as the actual spacing between the individual radiating planes is kept to a wavelength or less those individual radiation patterns will integrate into a single wavefront within a wavelength of the baffle plane.Even when that 1 wavelength distance is exceeded at the highest frequencies passed by the tweeters the individual patterns will still integrate eventually. If they don't do so until even 6 wavelengths out that still will occur five inches or so from the baffle plane at 15kHz. Simply put, vertical combing at six inches from the array is an almost moot point; it's what the soundfield looks like six feet or more out where you're actually listening to it that counts.Don't alter the tweets; cross them over at 5 to 6kHz, and make the crossover at least 3rd order to adequately protect the tweets, minimize the driver overlap zone and quell the response bump of the woofers at 7kHz. Space all the drivers as tight as you can get them with your construction techniques, but don't sweat what the radiation pattern will look like six inches out at 5kHz, or 15kHz for that matter, unless you plan on sitting that close to your lines.

Subject: Re: Combing

Posted by Jim Griffin on Thu, 02 Sep 2004 11:47:36 GMT
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Bill,The on axis vertical response of line array will always show a peak but go off axis and you see problems. This is true regardless of c-t-c spacing. Perhaps you are ignoring the off axis performance. Furthermore, you don't say what you do to accommodate the loss in sensitivity (less array gain) that occurs when you space greater than a wavelength apart. If you take frequency response measurements, you'll see both the impact of combing and the loss in array gain. Jim