Subject: coverage angle
Posted by dwkurfma on Thu, 19 Dec 2002 21:02:49 GMT
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At the crossover frequency to the PSD-2002, does anybody know what the coverage angle (sorry, I'm not good with directivity factors) is for 12" driver and the 15" driver. As I recall this is 1.6k. Obviously response angle is narrowing substantially at this frequency using these drivers. Just wondering if the 15" is less than 90 and if so how much, and how close is the 12" to 90. JBL consistently crossed over at about 1000 to 1200 to make the DI of the low frequency match the DI of the hi frequency driver. If I recall correctly, this was something Eargle was big on. I keep going back and forth between the PI 4 and PI 3 plus sub. Just finished the basement. It is about 26 x 25, but the couch sits about 10 feet from the wall due to furniture placement, etc., and boy would 4 pi's look big.Dan

Subject: Re: coverage angle
Posted by Wayne Parham on Fri, 20 Dec 2002 03:32:26 GMT
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A direct radiating woofer is nearly omnidirectional at deep bass frequencies, but the pattern begins to form a cone shape as frequency goes up. By the point where wavelength is equal to the radiating diameter, the pattern has collapsed to approximately 90°. The radiating diameter is not the advertised diameter, by the way, but rather is measured across the cone from the center of the surround.

The vertical pattern is affected by the placement of the drivers. Interaction between sound sources cause nulls to form above and below the forward axis. It is therefore best to narrow the vertical pattern of the horn to roughly match the angle of the nulls. If these nulls are placed just outside the horn's pattern, they serve to punctuate pattern control in the crossover region.

When you crossover a direct radiator to a 90° CD horn, assuming they are in phase on the forward axis, summing is constructive on-axis as well as off-axis in the horizontal plane even at large angles. So the pattern narrows smoothly from being nearly omnidirectional at low frequencies down to approximately 90° at crossover, where it remains because of the horn.

In the vertical plane, nulls form above and below the speaker at an angle set by the distance between drivers and the frequency range of the overlap in the crossover region. This is usually somewhere between 40°-60°. At 20°-30° above the forward axis and at 20°-30° below the forward axis, nulls develop. These limit directivity to 40°-60°, no matter what the horn's directivity is at that frequency.

If the 90° horn is axisymmetric, then the pattern widens back up again above the crossover frequency. So the directivity of the horn is not matched to the null angle in the vertical plane, and there is some ripple through that region as a result.

A horn with narrow vertical pattern is useful for matching directivity with the angle of the nulls in the vertical plane. If a horn is used that has 40°-50° vertical pattern, then the pattern does not widen above the crossover region. In the crossover region, the pattern is set by the off-axis nulls, and above the crossover region, it is set by the horn.

Sometimes, a horn is used that is not large enough to provide pattern control at the lowest frequencies. In this case, the pattern widens up briefly above the null frequency, and then settles back down as the horn gains pattern control. But even in that case, I think having an asymmetrical horn provides more uniform spectral balance overall.

My conclusion is a horn with 90°x40° coverage is very useful for loudspeakers with vertically stacked drivers. The dimensions of the drivers (setting the spacing between them) and the crossover points needed all seem to come together using these angles.