Subject: Re: H290C Horn/Waveguide
Posted by Wayne Parham on Thu, 12 Jul 2012 13:08:35 GMT
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Measurements

all measurements taken using DE250 driver
mounted on infinite baffle, i.e. half-space
drive signal 8.4v
microphone distance 3M

Impedance

also see it in the response curve below.

dimensions of the H290C place that peak just below the passband, which I find an attractive configuration.

Its pure oblate spheroidal flare profile sets its length and mouth size based on its tangential wall angle and throat size. These are fixed dimenisions, set by its geometry, as discussed earlier in this thread. A conical or OS flare has to be at least as long as half its width to achieve the right mouth size to support a 90° pattern. You can't create a right triangle with any other dimensions.

On-axis response

Devices like this have a peak at cutoff, followed by reduced output through the first octave. That's because they don't really provide good acoustic loading down low. They start becoming most

region, as well as for setting the top-octave compensation for mass-rolloff. The values chosen for

virtue of attenuator bypass capacitor and/or shunt resistor and the rising impedance of the voice coil). So this very versatile crossover configuration is perfect for waveguides.

Horizontal Response Curves, every 10° through a 180° arc

Horizontal off-axis response is excellent, very uniform through the coverage pattern, and well-behaved outside the pattern too.

Horizontal Contour Chart (Directivity Sonogram)

Viewing the horizontal beamwidth using a sonogram, you can see that energy distribution is very uniform. However, you may also notice that at low frequencies, the beamwidth doesn't widen as you might expect, it actually becomes more narrow. This is called waistbanding, a narrowing of the beam before the pattern widens at low frequencies below 1kHz.

The H290C waveguide is optimized to reduce internal reflections through the passband, and to do this requires the oblate spheroidal flare profile remain pure, without much of a secondary flare widening at the mouth. This approach trades a slight amount of waistbanding for reduced internal reflections, smoother response and improved overall sound quality.

This is a useful tradeoff because waveguide beamwidth narrows in the crossover overlap region where it blends with the other sound source. The two sources contribute to the overall summed response in all axes, and this provides the loudspeaker designer an easy solution path for uniform directivity.

The chart above shows the energy produced at all horizontal angles without normalization. Being denormalized, you see the actual energy distribution at various angles, not the directivity as referenced to the on-axis level. If we want to see that, we must normalize the curves to the on-axis chart, as shown below:

Horizontal Contour Chart (Normalized to the on-axis curve)

This shows directivity is constant through the passband. The definition of beamwidth is angles where the SPL is -6dB from the on-axis level, which can be seen to be constant at 90° (+/-45°).

It is easier to see the -6dB points if we stratify the contour gradient at 6dB rather than every 1dB. This shows the beamwidth angles very clearly:

Horizontal Contour Chart (Stratified at 6dB increments)

Now to the verticals.

Vertical Response Curves, every 10° through a 180° arc

Naturally, the output at large off-axis angles is reduced considerably in the vertical. This is exactly what we want. It cannot maintain directivity control all the way down to 1kHz like it does in the horizontal axis - the horn is too small in the vertical dimension. But it is able to start gaining directivity control around 2kHz, which is excellent for a horn of this size. It also manages to collapse directivity gracefully, largely due to the mouth roundover and baffle mounting.

As you can see, directivity smoothly collapses as it begins to get control around 2kHz. By 3kHz, it is around 50°, and it remains pretty constant above that point.

Vertical Contour Chart (Directivity Sonogram)

Again, we are viewing the energy produced at all vertical angles without normalization. Being denormalized, you see the actual energy distribution at various angles, not the directivity as referenced to the on-axis level. If we want to see that, we must normalize the curves to the on-axis chart:

Vertical Contour Chart (Normalized to the on-axis curve)

This shows vertical beamwidth is constant from 3kHz upwards through the passband. Again, the definition of beamwidth is angles where the SPL is -6dB from the on-axis level, which can be seen to be constant around 50° (+/-25°).

It is easier to see the -6dB points if we stratify the contour gradient at 6dB rather than every 1dB. This shows the beamwidth angles very clearly:

Vertical Contour Chart (Stratified at 6dB increments)