Subject: frequency vs. phase
Posted by Jerry Parker on Sun, 16 Jun 2002 22:14:12 GMT
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Hi Wayne. Another question for ya. I was playing around with a signal generator on my computer, along with computer software called winisd, which you input theile small parameters and can find the response curves of different types of enclosures. Anyways, I put in the parameters for my enclosure for my big subwoofer along with the thiele small parameters and came out with the dual impedence peaks at 17 and 42hz. The box is tuned approximatly to 28hz. Now it is rather curious that the loudest note of the box is infact 42hz. That would tend to make sense, the resonant frequency of the enclosure is 42hz isnt it? Also, why is there two peaks? I assume one is for the port and the other for the driver? Minimum driver excursion is at tuning, and I get almost no cone movement at 28hz. The most excursion seems to be below tuning and 10hz above tuning, and a drop off of excursion after that. Does this seem correct?Also, at the two resonant peaks of a vented box, why is the impedence so high? I know resonance is the frequency at which the driver radiates naturally, but if that is the case, shouldnt the impedence be very low at these frequencies? Thanks!

Subject: Behaviour of vented loudspeaker systems
Posted by Wayne Parham on Mon, 17 Jun 2002 02:25:48 GMT
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All bass-reflex systems have two impedance peaks, fl and fh. The Helmholtz frequency (fb) and the free-air resonance of the woofer (fs) interact and modify each other to create fl and fh. Minimum excursion is at fb and maximum is below fl, where excursion tends to rise rapidly as frequency goes down. The woofer is unloaded under fl and the woofer is for all practical purposes moving as it would in free air. There is another maximum at fh and this is the one you should concern yourself with the most. Excursion at fh should not exceed Xmax. You can high-pass the woofer to remove signals from being presented to it below fl in a high-power application because it will not be generating any useable output below fl anyway. But fh is in the passband, so this sets your excursion limit.

At frequencies below fl, the woofer and port are moving together, so that the woofer goes out when the port's air mass goes in. This causes complete cancellation, and the system is unloaded. But as frequency rises above fl - as frequency passes through fb - the two resonators are moving towards a condition where they push against one another and provide an in-phase signal. That's why diaphragm excursion is reduced at fb, the air mass in the port is moving opposite to the diaphragm. Between fb and fl, the system is still resonant but not as tightly coupled. Above fh, the system is no longer at resonance and the port is for all practical purposes acoustically invisible. At frequencies above fh, it is like it weren't even there at all.

As we rise much beyond fh, the port begins to act as though it weren't there. Pressure changes are too rapid for the area of the port to be of any significance, so above fh, the port does nothing at all. Of course, there is a possibility of wavelength-related phenomenon, but that is why we use acoustic insulation in the cabinet. We want to minimize wavelength related phenomenon and ensure that the significant mechanism be only that of the Helmholtz resonator and its interaction with the woofer. In this way, the fl-fb-fh resonance region mentioned above is all that is affected by the system.