

Linkwitz Dipole Subwoofers

During shows and auditions, we met some interested audiophiles, that initially had reservations about dipole bass. Their assumption was that dipole bass was rather weak.

Of course, with dipoles, the laws of physics dictate a 6dB per octave diminishing SPL output at lower frequencies. A driver roll-off of 12dB per octave aggravates the problem even further.

What to do here? Quite a difficult situation for a passive crossover network! Since we are talking about active Linkwitz speakers, we can compensate for this 6db + 12db = 18dB per octave roll-off completely in the active crossover network. Problem solved.

But that also means pushing the drivers harder, i.e., 18db per octave boost for lower frequencies. Only very few drivers are capable of performing along these lines.

As SPL is a function of air volume displacement, drivers of a given size (e.g., 26cm/10') must show extreme linear excursion capabilities, while staying mechanically stable and reliable over time. Of course, such drivers wouldn't move much using a 5Watts tube amplifier.

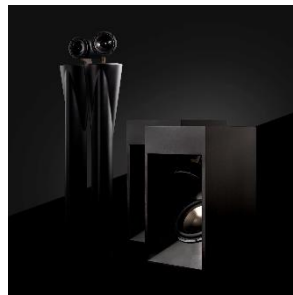
Luckily, the days of limited amplifier power are over, and we find power amplifiers that can deliver enormous amounts of performance and top-notch sound quality at reasonable cost. With these active loudspeakers, measures like porting a speaker cabinet for bass enhancement are no longer required. Ports are even detrimental when looking at the group delay issues involved.



In LX521 and in LXstudio, you see the LXsub4 at work.

Two 10' long stroke, aluminum cone drivers per side. No resonant sound box, no ported design.

Rather, the exact opposite.



After applying analog active compensation, the LXsub4 shows a linear frequency response from below 30Hz up to crossover to the lower midrange at 120Hz.

Now, what's the point?

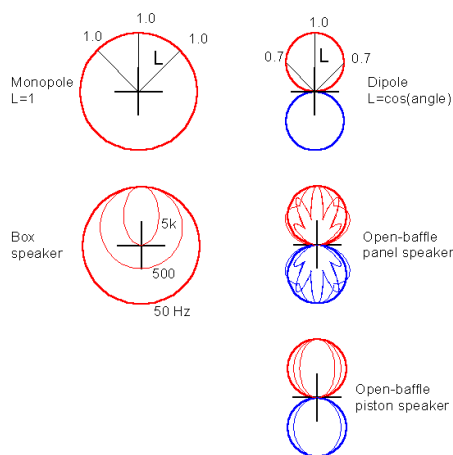
So far, we have a nice subwoofer, that is quite linear in frequency response and comes with good impulse behavior, no exciting box resonances nor port resonances. Because there is neither a box nor a port. This results in life-like dynamic and un-boomy bass.

Once an electrical signal reaches the subwoofer, it immediately translated into full energy towards the listener. No need to first load the sound box nor the air column of the port with energy.

Once this electrical signal stops, there is no sound box nor air column with stored energy, that continues transmitting, while the driver should rather be silent.

But the best is yet to come...

It's the dipole shaped radiation pattern of that dipole sub. Remember, conventional speakers act as monopoles (virtually same SPL in all directions) at low frequencies, though some more advanced designs may form a cardioid radiation pattern in bass.



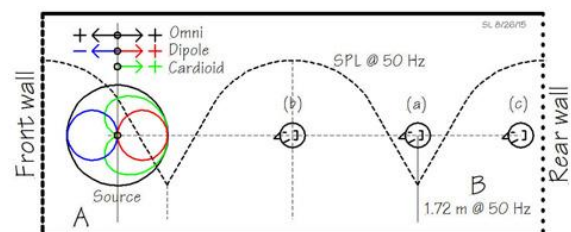
But the **dipole pattern** is unbeatable when it comes to **energy distribution** in the room.

At 90 degrees off axis (left and right), there is a dipole null, that's where front and back waves cancel each other: Minimal SPL on that left and right 90-degree axis.

With the same SPL at the listening position, a **dipole bass design loads the room with 4.8dB less energy** (due to less energy to the sides).

This is a fundamental advantage, as room nodes are excited to a much lesser degree.

The directionality of the dipole sub can help in preventing room nodes: You may toe-in or toe-out the dipole subs. So left and right dipole sub "see" different path lengths to the walls around them. That can average out some -otherwise accumulating- room nodes. And there is practically no room node excitation in the axis of the dipole nulls.



We tried this in one of our small hotel room show setups, and it worked. But, we then decided not to present a substantially toed-in right subwoofer to the audience. That would appear rather unconventional. The LX521 system is already a speaker system full of "unconventionalities". So, we didn't want to challenge the show audience with another obvious "unconventionality". Maybe we will go for it in one of our future shows....

When it comes the demo tracks, LXsub4 must prove the claims.

Reading is fine, but hearing is believing:

Play e.g., Yim Hok Man: "Poem of Chinese Drums" at full volume and feel the extremely powerful and deep drum strokes in your chest. Clear and precise and un-boomy.

One of the tracks, that put a big smile on the face of many dipole bass skeptics.

Try it out for yourself!

References

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