Posted by Wayne Parham on Mon, 22 Aug 2022 22:01:40 GMT
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Measured in-room, I think your response curves are pretty good. This is typical in-room response. Looks to me like all is working as designed.

In-room measurements show the room more than they do the speakers. But having a waveguide speaker really helps in that regard.

What isn't helped by the waveguide is the range you're talking about - the 30Hz to 150Hz region - which is entirely in the modal region. It's why we want to employ multisubs and flanking subs. The mains can't do much there by themselves, at least not without energizing room modes, which is generally counter-productive.

This gradual rolloff below 150Hz is caused by baffle step. Above 150Hz or so, the sound radiates mostly forward because of the size of the baffle. But below that frequency, the sound radiates omnidirectionally, so on-axis SPL is reduced. The sound energy is spread over a wider area at low frequencies, and that's what causes baffle step.

Some designers might "boost" the region below baffle-step, but they actually do it by attenuating the whole audio range above baffle-step. I prefer to go the other way, to use what I call "flanking subs" to provide extension and to bring up the energy below 150Hz. You can see it as a three-way speaker with the bass driver detached, in its own cabinet.

I mean, you could boost bass going to the mains. But then you have a single sound source - or two, if stereo - energizing the room in the modal region. This small number of sound sources creates well-defined room modes. The room has strong peaks and dips in the modal region.

Adding sound sources in the modal region helps to mitigate room modes. The room is energized in a variety of locations, which tends to smooth the modes.

You'll notice the big peaks and deep notches in the 60Hz to 120Hz range. Response is usually made smoother using flanking subs. That's the whole reason for having them. They reduce speaker boundary interference response (SBIR) anomalies, which are what usually causes the roller-coaster in that region. And they also provide baffle-step compensation, which is what makes the speakers droop below 200Hz or so.

The SBIR anomaly is really pronounced in the measurement you showed with the speaker lying on its back. I see this often - it's kind of a textbook case for why to use flanking subs - because many speakers are pushed back directly against the wall behind them, or maybe just a foot or two away from the wall. This is a common placement for speakers, because it is a convenient use of space. Most people don't have rooms large enough to pull their speakers several feet out into the room. So it results in that tell-tale SBIR roller-coaster between 80Hz and 120Hz. Pull 'em out a little further and the notches shift lower, but they're still there.

SBIR is not the same as room modes, but they are both caused by reflections. Modes are

standing waves whereas SBIR is self-interference between a direct wave and a reflected wave. The nasties in the 80Hz-120Hz region are primarily caused by SBIR in most cases. But higher-frequency room modes are there too.

So the point is you will really benefit by employing flanking subs and possibly one or two additional subs placed far away in a multisub arrangement. Flanking subs will mitigate baffle-step, SBIR and high-frequency room modes. Distant multisubs will mitigate lower frequency modes.
