Subject: The subwoofer volume and crossover
Posted by drake on Thu, 28 Sep 2017 18:26:09 GMT
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Apparently, buying and setting up a home theater system doesn't necessarily mean that everything's set and that's why I love letting professionals set up my system. In the absence of my informed friend that I always consult, how do I go about setting the receiver in such a way that it knows when to play sound on the subwoofer and when to switch to the main speakers?

Subject: Re: The subwoofer volume and crossover
Posted by Wayne Parham on Thu, 28 Sep 2017 19:27:15 GMT
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The answer to that can range from simple to complex. So let's start with simple, move towards more complex topics and then leave it to those interested to research further.

The simplest way to setup a subwoofer is the way most home theater systems are made to be used: Connect the subwoofer to the LFE channel and configure the system to use the sub. Mains should be set to "large" if they can handle low frequencies or to "small" if they can't.

The next step up is a primitive multi-sub setup, which essentially feeds two to four subs from the LFE channel. This is better than a single sub, but it may present localization problems. What I mean by that is the LFE channel might have enough midbass content that the subs draw attention to themselves. You don't want that - You don't want to even know the subs exist. They should blend seamlessly. All they should do is to create a foundation.

Next step up is flanking subs, one for each of the L/R mains and distributed multisubs placed further away. These require specialized low-passing for each of the subs: Flanking subs work best with 100Hz second-order low-pass and distributed subs work best with steeper slopes and lower cutoff, e.g. 50Hz fourth-order. Also, flanking subs require a low-passed version of the signal presented to the main speaker they are flanking, while distributed subs require an all-channel-summed signal like what's sent to the LFE channel.

Subject: Re: The subwoofer volume and crossover
Posted by moss24 on Tue, 03 Oct 2017 13:26:26 GMT
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I must admit that what Wayne just said sounds quite complex but I will ensure to closely examine my home theater and see if there any changes I can make. Getting a system to sound great isn't as easy as most people think.

Subject: Re: The subwoofer volume and crossover
Posted by bsolof on Mon, 06 Nov 2017 14:17:02 GMT
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Hi Wayne,

Curious about the flanking sub and distributed sub recommended crossover points.

You're suggesting that 100 hz is good for the flanking subs and 50 as the cutoff for the distributed subs. Didn't you recommend higher crossover points a few years ago? It seemed like 120 hz or so for the flanking units and somewhere around 80 for the others.

Mostly curious as there's an existing plate amp in the house that will crossover at 100 hz with a 2nd order slope. Easiest thing to do (in theory) is find another used one for stereo and call it a day. But it's crossover only goes to 100 hz.

There are inexpensive pro amps like the Crown xls 1502 that can crossover well above 100hz but it has a 24 db slope. What's your preference these days?

Many thanks,
Barry

Subject: Re: The subwoofer volume and crossover
Posted by Wayne Parham on Mon, 06 Nov 2017 16:51:07 GMT
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I was generalizing the concepts and using "round numbers" in my earlier post above.

Flanking subs are setup to blend generally in the 100-200Hz region, but in practice the blending region is shifted a little lower than that. Distributed multisubs are always used below 100Hz but usually below 80Hz and sometimes even lower, in the 50Hz to 60Hz range.

In many system setups, mains are blended with flanking subs deeper than 100Hz. They're often blended down to 60Hz to 80Hz or so, depending on the cutoff of the mains. Mains shouldn't be high-passed when running flanking subs, or if they are, it should just be for over-excursion protection. The mains should be run as low as they'll go. This pushes the bottom of the blending region downward in frequency, giving a wider blending band.

In practice, flanking sub blending rarely is accomplished above 150Hz because crossover frequency and slope usually prohibits it. If you tried to crossover higher, you'd create an unnatural sounding localization problem. The flanking sub would call attention to itself if crossed too high. But the most troublesome anomalies are usually around 120Hz, so blending there is most important.

To do this, I prefer a gentle second-order slope with low-pass "cutoff frequency" between 80Hz and 120Hz for the flanking subs. I put "cutoff frequency" in quotes because having a

second-order slope, there is still plenty of energy a half-octave above "cutoff" and that's what I'm counting on for blending. I've even used first-order with great success, but second-order seems to work best.

Some people use third-order, and it can be made to work with a higher cutoff frequency in the 120Hz to 150Hz range. But I don't find it as natural sounding as using a more gradual slope. Fourth-order slopes are too steep to allow for blending without setting the crossover too high.

The goal is to have each main speaker and its flanking sub blended in the 80Hz-120Hz region without having localization problems. You don't want to be able to detect the subs as being separate from the mains. You shouldn't be able to distinctly hear the flanking subs. They should be very subtle, and the only way you should be able to even tell that they're on is the bass extension is deeper. But the wider the blending band you can create seamlessly, the better.

As an aside, the reason for the anomaly that flanking subs correct is that people almost always place their speakers a few feet from the wall behind them, due to room layout and space constraints. This results in self-interference around 120Hz. Flanking subs smooth this out using multiple sound sources. Where one source has a self-interference notch, the other sound source doesn't because it's in a different position.

Distributed multisubs are easier to setup. What I'm calling "distributed multisubs" are just those placed more than a few feet from the mains. They can usually be run with the LFE channel driving all of them. All you really need for the distributed multisubs is an all-channel summed signal that's low-passed somewhere between 50Hz and 80Hz. Steep slopes are generally preferred, which is why so many plate amps have fourth-order filters built-in.

I generally setup distributed subs to simultaneously accomplish modal smoothing and extension. It's a bit of a balancing act, but it's usually pretty easy to do. Setting too low a crossover can create a hole in response, but setting too high can create a localization problem. In practice, setting the distributed sub crossover is usually almost trivially easy. Setting their low-pass roughly equal to the cutoff of the mains is generally a pretty good starting point.

The flanking subs' extension spans the range down to and past the distributed subs' crossover point. That makes it easy to set them up, and makes their crossover point almost arbitrarily low. You just want to make sure the distributed subs cover the lowest room modes, which are usually between 30Hz and 60Hz.

This is a common solution using two mains, two flanking subs and two distributed subs: Set the distributed subs for low-pass where the mains run out of steam. Say the mains run to 60Hz, then set the LFE crossover to 60Hz. By doing this, you have the same number of sound sources below 60Hz as you do above 60Hz. Two mains and two flanking subs above, and two flanking subs and two distributed subs below. What's really cool is when the flanking subs' upper cutoff coincides with the mains' baffle step, which is the case for large high-efficiency mains. It all comes together very nicely.

But in any case, the crossover frequency for distributed subs isn't terribly critical, provided they aren't run too high. Usually you won't be able to hear much difference between low-pass at 50Hz and low-pass at 80Hz, provided all other things are equal. Just don't go too high with them.

Just like flanking subs, you don't want to set crossover high enough that you can localize them. You don't want to be able to detect that the subs are playing. The impression should be that all sound comes from the mains. Actually, the deepest bass should sound like it's coming from all around you. It just shouldn't sound like it's coming from one of the subs. If it does, then the sub is either crossed-over too high or its volume level is too loud.

Subject: Re: The subwoofer volume and crossover
Posted by bsolof on Wed, 08 Nov 2017 15:31:24 GMT
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Hi Wayne,

Thanks for the detailed response.

I started doing the sub tricks with old gear lying around the house. First it was two flanking subs (in mono) placed in between the 2 Pi Towers. Then added a small sub near the couch as a distributed sub in spite of the fact it was only running one channel.

The shortcomings of this setup didn't get in the way of it sounding great. Bass was solid, midrange clarity was improved and the texture of things like guitar strings was amazing. Even doing it wrong took the system up a few notches.

From there a big mono sub replaced the small, stereo distributed sub near the couch and it was crossed in the 50's or low 60's. Nice improvement. You can't tell the sub is there but it's adding it's magic.

Finally, I borrowed a Crown amp to put the flanking subs in stereo. It's hard to say if stereo is that much better than the mono but something wasn't quite right. From what you've mentioned it's likely the 24 db/octave slope on the Crown is harder to blend. Shame, the Crown is far more flexible in terms of frequency cutoff and can be set much higher. But that's why I've asked the question - it doesn't seem to be as seamless as the Keiga and I didn't understand why. From what you're saying it isn't the right crossover for this setup.

Shame, it's a one box solution that fits nicely on the equipment rack.

It's been fun to play with the subs. Flanking subs added bass and nuance and adding the distributed sub took the textures up another notch. It's almost spooky. Been rummaging through some recordings that have been hidden away for a while and having a great time listening to all of them again.

Many thanks,
Barry

Subject: Re: The subwoofer volume and crossover
Posted by Wayne Parham on Wed, 08 Nov 2017 16:10:47 GMT
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I agree with all of your observations. And, based on lots of experience, I can add a confirmation about your guess on the 24dB/octave slope not being right for flanking subs. That slope works great for distributed subs but just isn't right for flanking subs. Second-order works best for flanking subs.