



Performance Media Industries, Ltd.

The Bottom Line
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by A. Grimani

One thing is for certain: bass sells! Nothing impresses people more than tight, clean, and dynamic low frequency. You could say that bass adds the “bottom line” to home theaters, but bass is in peril!

Now, why in the world would I say bass is in peril? There are an increasing number of opportunities to mangle it these days, and since Murphy is always at work, there’s a really good chance it *will* get mangled somewhere along the line!

Before I describe the perils of bass and the ways to deal with them, let me first outline what I consider good bass to be:

- Extended in-room response down to 20 Hz
- Consistent low frequency character for all channels
- Output level capability of at least 105dB SPL (preferably 110-115dB) for bass in any channel
- No audible distortion
- Smooth frequency response and “tight” time character
- No variations from seat-to-seat in a multi-seat listening room (theater or music application)
- No localization of bass sources
- Discreet overload character (since virtually nothing out there can play everything recording engineers “mix up” without overloading at some point)

These are the things that, to me, quantify what the average humanoid out there perceives as impressive bass. Now, for the perils that will mess with your bass:

- Room Acoustic Standing Waves (a.k.a. room modes or resonances). Standing waves are one of the biggest bass killers. Take a perfectly good subwoofer or full range speaker, put it in a room, and what do you get? Usually, you get a speaker that doesn’t sound so perfectly good! The bass becomes irregular, with emphasis

at some frequencies and loss at others. Also, the bass becomes muddy and resonant, hanging in the room way too long at the prime resonant frequencies. Dealing with standing waves takes a systematic and cautious five-step approach: (1) Room dimensions should be such that resonant frequencies don't multiply on the three axes. (2) Room construction should be such that the walls are flexible or absorptive at low frequencies. (3) The subwoofers should be placed so that they don't excite the resonances. (4) The seats should be located where the resonances are less audible. (5) The remaining response errors should be equalized to get rid of peaks in the response.

If you want to configure a home theater's bass reproduction for the best interaction with standing waves, you should employ bass management, which feeds all the bass from the main channels into subwoofers as a summed mono signal. You can then place the subs for limited interaction with standing waves, and the bass will be consistent from channel-to-channel. Typically, the best crossover frequency is around 80 Hz since that is where most of the nasty room resonances start. It is also a sufficiently low frequency that you won't be able to localize the subs.

- The DVD-Audio and SACD Connection Conundrum. Although digital links are becoming more prevalent, the typical connection scheme for a DVD-A or SACD player is still six analog interconnects run to an A/V controller. The problem is that, if you want to use bass management as advised above, you may be out of luck. Many players don't include bass management, and most controllers' 6-channel analog inputs don't either! So, you play a Dolby Digital or DTS signal fed digitally from the player, and everything is OK. Then, you switch to the 6-channel analog input, and there's no low bass - a raw deal! The bass from the main channels isn't finding its way to your subwoofers, so it is not reproduced by your system.

How do you know if you have this problem? Try reading through your DVD player or A/V controller's specifications, block diagrams, and owner's manuals for information on bass management parameters. If these documents don't help, you can try calling the product managers at the manufacturers' home offices to see if they can provide further info. Ultimately, you can test the signal flow yourself by putting a test disc into your player, running the signal through the 6-channel analog path into your controller, and measuring the response at the controller's outputs with a spectrum analyzer (or by ear if you have no test gear). The Chesky DVD-A test disc "*The Ultimate Surround Sampler & 5.1 Set-Up Disc*" (CHDVD221) is a good source for test signals. It features Dolby Digital 5.1 and PPCM 5.1 test signals as well as 96 kHz 2-channel stereo LPCM. There are also

bass management, speaker phase, frequency response, and delay alignment tests, plus eight music selections from the Chesky catalog.

- **A/V Controllers with Adjustable LFE Levels.** Some controllers allow you to set the ratio of the Low Frequency Effects (LFE) signal to the rest of the bass sent to the subwoofers. Why? I can't think of a good reason, since production standards call for the LFE level to be encoded +10dB compared to the main channels. (I'll bet adjustable LFE level is a feature manufacturers put in their products because of competition...) If a controller's LFE level is set improperly, the bass signals placed in the LFE channel by a sound designer or recording engineer may play back too low or too high, thereby completely messing with the delicate tonal balance of your system. To check that the LFE level is correct, just verify that the LFE level control is not set to attenuate the LFE channel signal being mixed into the subwoofer feed. Again, you can ensure correct levels by using one of the various test discs on the market.
- **A/V Controllers with Built-in Subwoofer Output Limiters.** Many controllers incorporate a built-in adjustable limiter function often referred to as a Bass Peak Level Limiter. This function is nice to have if you use passive subwoofers, or if the limiters built into your active subwoofers generate audible distortion side-effects. If you don't check your controller's limiter, it might be set too low, meaning that peak bass signals are never allowed out of your controller! That's a bad thing, right?! Remember to go into your controller's setup menu and either turn the limiter off or engage it at the level where your subwoofers start to misbehave.
- **A/V Controllers with Multiple Subwoofer Outputs.** Some newer controllers offer multiple subwoofer outputs. I don't consider this a useful feature since 99% of the time all you need is a subwoofer output that contains the sum of the LFE signal and the low frequency portions of all the main channels. Nevertheless, the market keeps pushing forward and demanding more features. Just make sure you have correctly configured all those subwoofer outputs, or else your bass may be leaking out the wrong port (and I'm not trying to be crass).
- **Subwoofers with Multiple Bass Inputs.** Like I just explained, the best way to manage your bass signals is to create a collection of LFE plus low frequencies from the main channels and then ship it to the subwoofers. This function should be performed by the A/V controller, with the signal being sent to the subwoofers on a single cable. Sure, things will sound different as you start adding more signal paths between the processor and the subwoofer, but different may be wrong and may result in inconsistent bass or just too much bass.

- **Production Uncertainties:** This is a really tough problem. It used to be that all film DVDs were recorded and mastered under standardized conditions. The bass in monitoring rooms was set at a predictable level, so all you had to do was create a listening environment calibrated to the same level. Well, it now seems that some folks in the production community have decided to master DVDs *their* way using mastering rooms with inconsistent bass levels. In some cases, mastering engineers are altering the bass balance of a soundtrack for a DVD release remix. It gets even worse in the world of multi-channel music mastering, where bass management is often misunderstood and improperly set in the monitoring room. As a result of all this confusion, you end up with wild variations in bass levels from disc to disc. Darn! I like not having to readjust the bottom end of my system for each disc, but these days may be numbered.

You can't do anything about production problems other than choosing your program material carefully and hoping for the best! Oh, I guess you could also write letters to the editors of relevant magazines and call the DVD companies to complain...

My intent here is to reassure you that you are not crazy. Those wild bass variations from system-to-system and from disc-to-disc really do exist and are not just a figment your imagination. Further psycho-analysis might reveal that you are, in fact, a bit crazy for reading a four page document about nothing but bass problems. I can't help you regain your sanity (mine is somewhere around here), but for the bass problem, I say to be vigilant and understand the theory and practice of bass standing waves, bass management, and low frequency production standards. Two Advil will also make you feel better...

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