Can You Ace Outdoor ACOUSTICS 101?

PHOTO COURTESY NEAR

As exterior audio setups are requested for more than a simple patio design, loudspeaker placement and use of subwoofers and amplification require more sophistication.

BY WILLIAM KIELTYKA

EVERY INTEGRATOR has experienced the trials and tribulations of dealing with indoor acoustical problems caused by room dimensions and the acoustic properties of wall and ceiling materials. The most common indoor acoustical problem is that of "standing waves" that can cause large bass sound pressure dips and peaks at various locations in the room.

It's a real challenge to deal with indoor room acoustics issues, but that's not what we're going to cover here. Let's move the conversation outdoors.

What happens when there are no walls and ceilings? Should you expect fewer acoustical problems or more? The issues will be different, but not necessarily fewer.

In this article we'll focus on how the typical outdoor acoustical environment, amplifier power and speaker placement influence sound. We'll explore how to get better tonal balance and clarity as well as great bass impact.

CAN YOU HEAR ME NOW?

With no room surfaces to contain the sound and with the high ambient noise typically found outdoors (birds, traffic, kids and other annoyances), the first issue you face outdoors is the amount of sound.

First, let's establish how much sound is enough. Outdoor background noise is usually in the 55dB to 60dB (A-weighted) range. A "background" music level where the listener is aware of the music but conversation is possible is typically 60dB – 65dB, just over the ambient noise level. "Foreground" music listening is in the range of 66dB to 75dB; at this level music starts to interfere with conversation. "Party" loud is 80dB and up. For reference, a live rock concert is typically 90dB to 95dB.

Sound outdoors follows the Inverse Square Law, where each doubling of distance drops the output by 6dB (that's a lot). If a speaker is playing at let's say 70dB at 1 meter (roughly 3 feet), at 2 meters (roughly 6 feet) the sound pressure will be 64dB, and so on.

It is not uncommon for listeners to be 8 meters (about 25 feet) away from

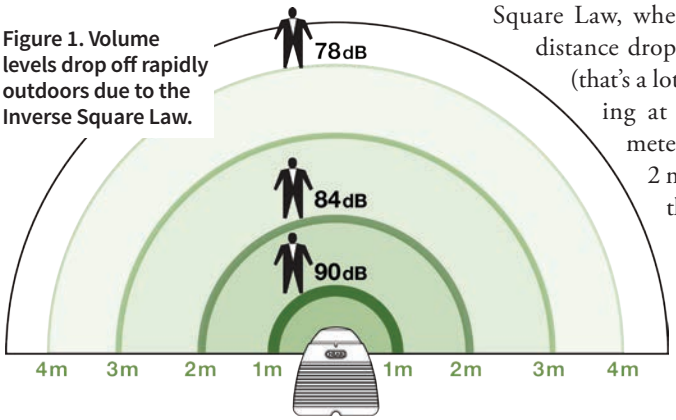

Figure 1. Volume levels drop off rapidly outdoors due to the Inverse Square Law.

the speakers; in that scenario the sound pressure level would be only 52 dB, not loud enough to overcome typical outdoor ambient noise of 55dB to 60dB. Yes, you could turn up the volume so that the listeners at 8 meters can hear the music, but the listeners at 2 meters will be blasted with too-loud sound.

If you're just doing a simple residential backyard deck and dual-speaker setup where the listeners are always going to be situated near the speakers, the Inverse Square Law isn't much of a problem. But for larger multi-area scenarios you've got to keep it in mind. Using multiple strategically placed speakers will go a long way to solving the problem.

POWER TO THE PEOPLE

Another important consideration is amplifier power. You can never have too much power. Overcoming the rapid drop in sound pressure level (SPL) due to the Inverse Square Rule takes a lot of power. Amp power has to double for every 3dB of additional SPL. To make up for the 6dB SPL loss with a doubling of the distance from speaker to listener, the amplifier needs to put out quadruple the power.

We've seen installations where integrators use the Zone 2 outputs from an A/V receiver to drive outdoor speakers. That may be OK for a "deck plus two" system but it's wholly inadequate for large area installations. It is always better to have a beefy amplifier dedicated only to the outdoor speakers. Having reserve power well beyond the anticipated average levels is necessary to prevent amp clipping and speaker damage.

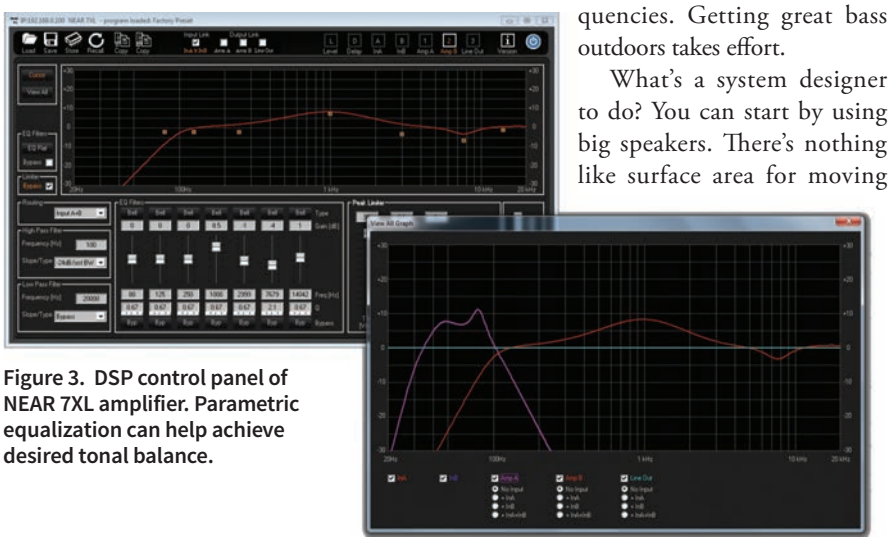

Figure 3. DSP control panel of NEAR 7XL amplifier. Parametric equalization can help achieve desired tonal balance.

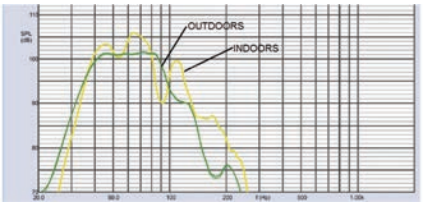

Figure 2. NEAR LB12 subwoofer bass response indoors and outdoors. "Room gain" yields louder bass indoors but the absence of walls outdoors promotes flatter, more accurate response.

ALL ABOUT THE BASS

Who doesn't like bass? Nobody — it really rounds out the sound of quality audio, and it's apparent when low frequency is lacking. But achieving high impact bass outdoors can be a challenge.

In one respect bass is better outdoors than indoors; the lack of walls means you're not going to have standing wave problems — low frequency response will be "flat" with no acoustically-induced peaks and dips (**Figure 2**). On the not-so-good side the lack of walls means you'll lose the "room gain" or "boundary effect" — an acoustic phenomenon that boosts bass output by several dB. Also working against you is the fact that human hearing is less sensitive at low frequencies than at mid and high frequencies. Getting great bass outdoors takes effort.

What's a system designer to do? You can start by using big speakers. There's nothing like surface area for moving air. An 8-inch woofer has a surface area of 50 square inches, while a 6.5-inch woofer sports just 33 square inches and a 5.25-inch model only 22. Size does matter. Positioning the speakers near large surfaces such as under eaves helps, but many homeowners don't like having speakers hanging on their homes. The ground is a huge surface and provides a couple of dB of bass gain.

Another option is to add one or more subwoofers to the system. Again, large driver size is the integrator's friend, as is in-ground mounting. You have to be careful with subwoofer placement. If the subs and mid/high speakers are not equidistant to the listening area the differing arrival times of the bass and mid/highs will lessen bass impact, smear detail and color the sound.

Solving this problem may be as simple as moving the subwoofer (if you haven't already buried it) to more closely align the sound of subs and satellites, or by delaying the signal to the speakers electronically. Several modern amplifiers such as models from Crown, Lexicon and NEAR feature built-in digital signal processing (DSP) that provides the means to apply time delay to the nearer speakers. Just a few microseconds of delay can work wonders in achieving better bass impact and overall better sound.

Last but not least is the value of equalization. DSP-equipped amplifiers also provide some sort of frequency equalization, usually a sophisticated parametric equalizer that provides tremendous control to shape the frequency response of the system to overcome environmental acoustic issues (**Figure 3**).

In most outdoor settings you probably won't need to or want to fool around with the mids and highs (unless the fundamental design of the speaker is flawed), but a gentle application of bass boost in the 35Hz to 100Hz range will provide improved tonal balance and impact. But be gentle. An EQ boost of 3dB will double the power drain on the amplifier; a 6dB boost quadruples the power requirement. CE Pro

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