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Setting the Record Straight on Room Acoustics

Calibrating an audio system may require a better understanding of acoustical products before you install them.

by Robert Archer

Integrators need to be well versed on the difference between diffusers and absorbers, and the limitations of room EQ systems.

FOR DECADES AUDIOPHILES HAVE searched for the Holy Grail of sound. During this time most of their efforts have focused on equipment changes. They swap out amplifiers, cables, turntables, CD players, loudspeakers and more — and many of them are still on their quest.

Kelly Donnelly, owner and engineer of Studio Plush, a recording studio in Austin, Texas, points out that room acoustics have a great effect on audio performance in the home, perhaps even more so than equipment choices.

“There are so many variables; the listening room and the quality of the components are the main [contributors],” Donnelly explains. “I’ve seen some friends spend a great deal of money on their systems, but the acoustics of their rooms are flawed to the point where no matter how much you spend on a system you’re not going to get there.”

UNDERSTANDING ACOUSTICAL PRODUCTS

Over the past couple of decades Tony Grimani, president and lead consultant at PMI, Ltd., as well as a principal at MSR Acoustics, has educated electronics dealers about pitfalls of home acoustics.

Foremost, Grimani says that when someone examines the solutions available in the residential acoustic product market, they should learn what they are buying. He cites, for example, that many bass traps don’t actually improve the performance of in-home, small-room acoustics.

“We have found that a lot of bass ‘traps’ are, in fact, nothing more than absorbers for mid-bass frequencies and they are often ineffective below 100Hz,” he says. “Most home theaters and listening rooms have standing wave resonance problems in the 40Hz to 80Hz region, therefore most of those bass absorbers aren’t going to cure low-frequency issues.”

He says homeowners (and installers) considering the addition of acoustical treatments in

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High-End Audio: Room Acoustics

their homes should seek out products that control room reflections down to 500Hz. This means that absorbers should be at least two inches, but preferably four to six inches, thick. He adds that manufacturers need to back up their claims with test results from reputable independent labs.

Also, only a quarter of a room's walls should be covered with absorbers, Grimani recommends, or the room will be overly damped. (And, by the way, Grimani bemoans the misuse of "dampening" as a term. He notes that dampening is defined as the act of putting water on something, whereas damping is the act of reducing a resonance.)

ABSORBERS VS. DIFFUSERS

One thing that would help consumers and pros better understand the category, Grimani theorizes, is a redefining of the products used in the field. "For bass traps, I'm going to go out on a limb and say the term means nothing at all, while it means everything too," he explains. "Most absorbers work through a process of friction of air molecules against fibrous materials. Frictional absorbers are basically a chunk of material that absorbs sound and in some cases the sound being absorbed is bass, but it is not being 'trapped'; it is being absorbed into the fibrous material."

There are products that work for low frequencies, but are not typically referred to as traps. "A device that really does 'trap' bass sound is actually a resonator device that uses a tympanic membrane or a ported resonator enclosure [often known as a Helmholtz]," says Grimani. "This trap uses resonating technologies to convert bass into heat."

Another common acoustical treatment product is a diffuser, which Grimani says he usually divides into two types of designs: 2D and 3D. "A 2D diffuser is one that turns an oncoming sound vector into a two-dimensional hemi-disc plane, and is best used toward the front half of a room's side walls," explains Grimani. "A 3D diffuser turns an oncoming sound vector into a three-dimensional hemisphere, which is good to use on the back half of the side walls and the back half of the ceiling."

TACKLING THE EQUALIZATION MYTH

Another recent development has been the advancement of room equalization (EQ) technologies designed to overcome the problems associated with reproducing sound within the home. They've become increasingly popular with A/V receiver manufacturers who are now embedding such solutions into their components.

Grimani says that while these EQ technologies have become quite sophisticated, they are not a fix-all solution. "To get great sound you need a room with the right proportions and the right amount of absorption, diffusion, bass absorption; you need to sit at the right location in the room, the speakers have to be placed correctly in the room, and you need equalization as the final touch to tie it all together," he emphasizes.

"Simply put, you must have an equalizer [because] all rooms are going to affect the voicing of a loudspeaker, and its response needs to be equalized for the room ... as for auto EQ, I guess that technology is fine for low- to- middle-end systems. Anything above that should be measured and adjusted manually and it should be listened to carefully for proper results."

Grimani says you can't rely strictly on the measurements of an analyzer because electronics don't hear like human ears, and EQ doesn't fix other elements that need to be addressed in the home.

"Equalization cannot get rid of sound echoes, so on that front, all bets are off," he says. "However, equalization can mitigate some of the audibility of bass standing waves and is therefore worth doing even if the homeowner cannot afford acoustical engineering or treatments."

Bad sound deprives someone of experiencing the full impact of their home theater system purchase, Grimani says. That's bad news for clients and bad business installers, whom they've entrusted to put together the best for their bucks. "I would say you're only getting half of your sound and picture quality if you don't design and tune the room correctly," Grimani says. "In other words, you could be wasting 50 percent of your investment." ■