Don't Correct the Room, Build It Right

<BY NICK COLLERAN AND JOHN GARDNER>

The use of sophisticated (and expensive) equalization to attempt room correction made the rounds of sound reinforcement companies and recording studios in the 1960s and 70s. Now, this bad habit is back (times five or more) in home theater rooms. While equalization can make a good system sound even better in a good room, it does not re-write the laws of physics.

The room is an active environment. It will fight back in what we'll call an acoustic "zero sum" game. Simply put, increasing the power of an absent frequency also increases the level of the out-of-phase room reflection, perpetuating the "null" in the room. It may even be possibly broadening it. Remember, if the sum of the +3dB SPL original and –3 dB SPL reflection equals zero, so too will adding 3 dB for a + 6 dB original SPL and – 6 dB reflection SPL sum to zero.

This can be demonstrated effectively with a simple experiment. Using a single driver loudspeaker, a single frequency oscillator, and an amplifier, feed a 1000 Hz tone to the speaker through the amplifier to achieve a comfortable listening level. Reposition the speaker to face a hard, flat surface approximately six inches away. The sound will all but disappear. This is due to the distance being one half wavelength of 1000 Hz. The reflected energy is 180 degrees out-of-phase with the source. This is most easily shown graphically.

Sound travels at approximately 1,130 feet per second in air. The wavelength of 1000 Hz is 1,130 feet divided by 1,000 Hz, or 1.13 feet. Half wavelength equals 6.78 inches, which is 1.13 feet, divided by two times 12 inches per foot. This calculation will vary slightly for temperature, pressure (altitude) and humidity conditions.

As you can see from the diagram, increasing the source signal level will always cause a corresponding increase in the reflected signal level. In practice, the reflected signal is going to be slightly less, and some sound heard as signal strength will diminish over distance and absorption.

HAVEN'T WE PASSED THIS WAY BEFORE?

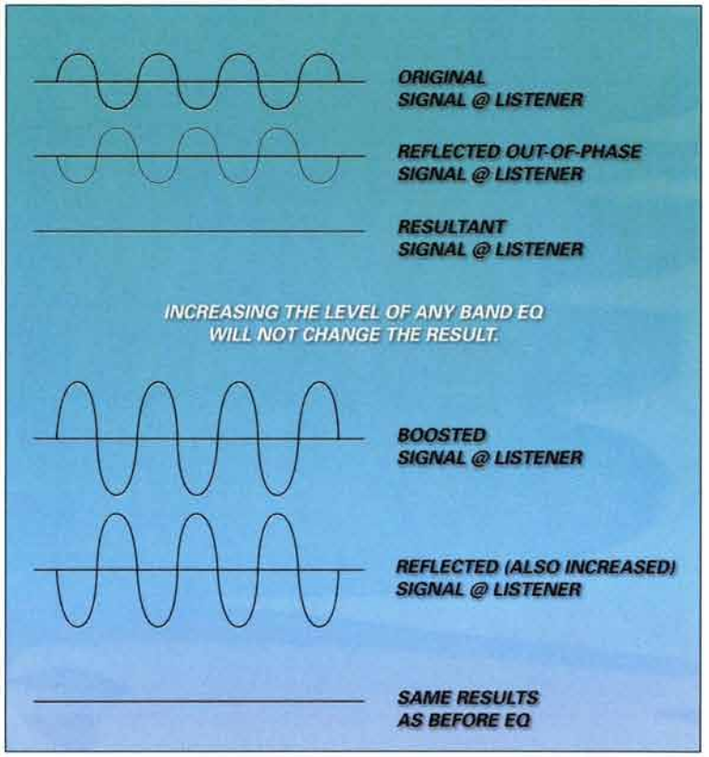
During the days of increasing playback channels (mono, stereo, quad) and increasing recording tracks (mono, two track, three track, four track, eight track, 12 track, 16 track, 24 track), there was also an increasing awareness of acoustics. Why did the mix sound different at home or in the car, not to mention in the next studio? We have seen rooms vary 12 dB within the same facility, with mixes being all bass or no bass, depending upon the room in which they started.

When these rooms were corrected with equalization, it typically covered only the mixing engineer's position or sweet spot. Some complained of having to wear a neck brace for fear of falling out of the sweet spot. Of course, the producer, needing to hear the same mix, would literally be in the engineer's lap, and, if the artist and musicians came in to listen, not only would they not hear the real mix, they changed the acoustics of the room by simply being there.

Adding or subtracting by equalizing induces phase shift and ringing due to deteriorating quality. The equalization curve is bell-shaped. Increasing EQ broadens the effect to the nearby frequencies, as well as the offending one, creating a situation requiring further correction. A narrow high Q equalizer may overcome this, but it can introduce its own problems, such as phase shift. An equalized boost or cut doesn't change the resonance of the room; it can only correct an idealized sweet spot.

With the new range of sophisticated digital equalizers averaging around $10,000, the serious audiophile is wise to consider as little as one-third of that amount to acoustically treat the room. A two-inch panel of seven pound per cubic foot fiberglass will effectively eliminate reflections above 500 Hz and also reduce the problems by 45 to 75 percent in the two octaves below that point. It will allow an upscale equalizer to do its job (or possibly eliminate the need for it). The sweet spot will be widened.

It is unfair to judge any piece of audio gear in a room that fights back. Fixing a room with an equalizer is only one of many audio myths. Correct the acoustics first and all of the equipment, including the equalizer, will have a chance to live up to its published potential. **CR**



As this diagram shows, equalization is not a panacea for room-based sonic anomalies.

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