

## Tip #29 Spread it Around

No, we're not talking about spreading peanut butter on a muffin. We're talking about speakers spreading out sound. This is what engineers call "dispersion." Dispersion can be "wide," "directional," or "controlled." These attributes can be good, bad, intentional, or unintentional. It all depends on what you're trying to accomplish.

### The Basics of Speaker Design

First, let's talk about the nature of sound. Sound travels through the air in waves, just like waves travel through water in the ocean. The distance from the top of the wave to the top of the next wave is called the wavelength, because that's how long the wave is. Got that?

Bass frequencies are long (a 50 Hz tone's wavelength is 22 feet), while the highest treble tones are short (an 18 kHz tone is  $\frac{3}{4}$ "). Here's the secret formula for figuring this out: Take 13560 and divide by the frequency in Hz and you'll get the wavelength in inches. That's it.

Because of the way physics works here on Earth, a speaker will exhibit narrow dispersion when it tries to reproduce a tone whose wavelength is smaller than the driver itself. For instance, say you have an 8" 2-way speaker with a crossover of 5000 Hz. A 5000 Hz tone is 2.71" long (13560 divided by 5000). That's a lot smaller than the 8" woofer that's playing it, right?

Here's what happens: as the frequency increases to the point where it's smaller than the 8" woofer (anything above about 1700 Hz or so), the woofer starts to beam its sound straight ahead, like a flashlight beams its light. That's what we mean by narrow dispersion.

In contrast, if that 8" driver is asked to play a 400 Hz tone, it exhibits very wide dispersion (sometimes

called "omni-directional") at that frequency, because a 400 Hz tone is significantly longer (over 34 inches!) than the 8" driver. (See Figure 1)

### The Speaker Designer's Dilemma: "Decisions, decisions..."

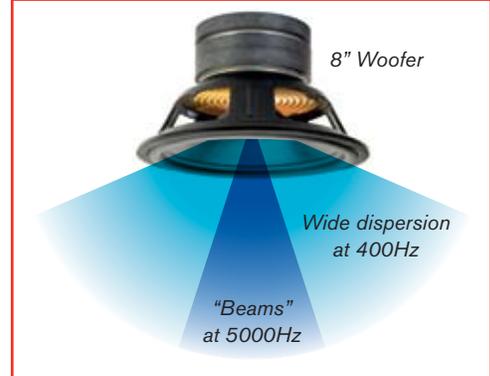
Good speaker designers know these things and they pay attention to the frequencies at which drivers become directional.

But... is there ever a circumstance where the speaker designer might actually want the speaker to be beamy and directional? Yes Mildred, perhaps there is. Here's one situation: The front channels of a home theater. As the listener, you want the sound (dialogue, on-screen effects) to be clearly intelligible. It stands to reason, therefore, that a speaker that disperses its sound uncontrollably in all directions might not be the best thing. Too much of the speaker's sound reflects off the floor and ceiling, creating audible "ghosting," thereby smearing the direct sound from the speaker. So you'll want to limit the vertical dispersion to reduce floor-ceiling reflections, yet maintain wide horizontal dispersion so listeners seated all around the room can still hear clearly.

Atlantic pays close attention to these things. Atlantic knows how to position its drivers to optimize their dispersion. We don't break the laws of physics, but we know how to make them work in our favor.

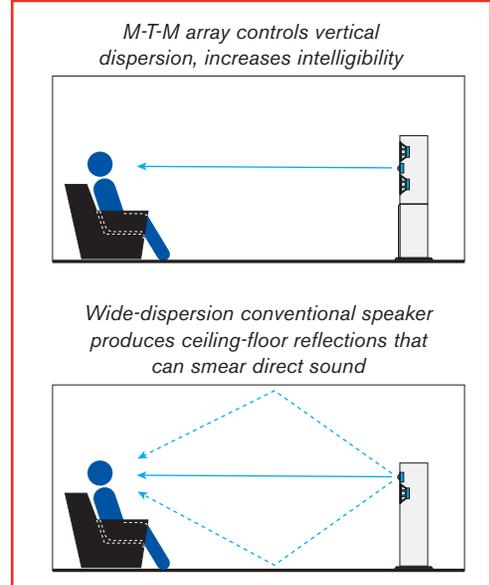
Dispersion is just one aspect of speaker design. Now that you've had a little glimpse into the complicated world of a speaker engineer, you have a sense of the dozens of considerations that they juggle back and forth in order to come up with the best speaker for a given task.

Figure 1



8-inch woofer has wide dispersion at 400Hz, but "beams" at 5000 Hz

Figure 2



Designer must understand dispersion in order to optimize speaker design

### Other Tech Tips:

Tip 25: Do it 'till it Hertz

Tip 26: Creating Good Room Acoustics

Tip 27: IWTS-8 vs. IWTS-8e

Tip 28: Setting your Receiver's Sub X-Over