

Center Stage screen acoustical transparency versus speaker angle

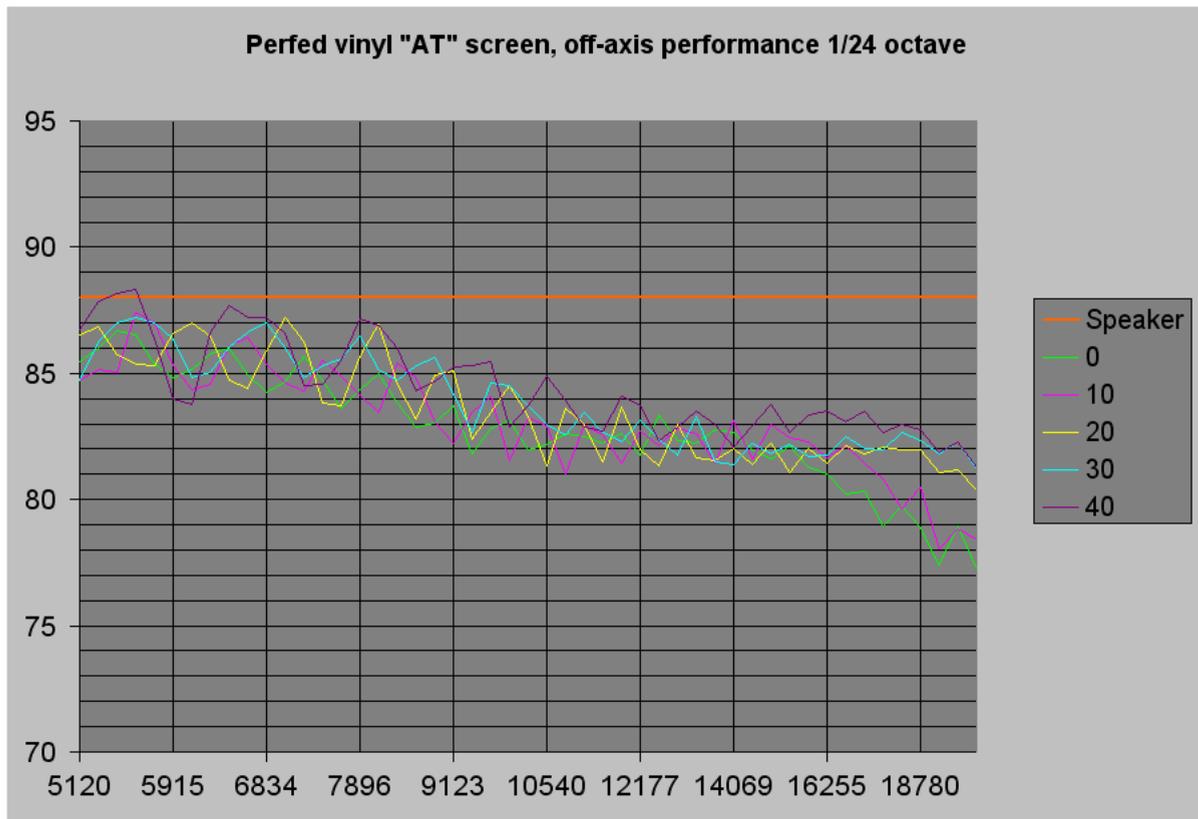
Test setup: A calibrated Behringer ECM8000 microphone was placed an inch from the test screen, which was located about 6" in front of the center speaker. I didn't rotate the speaker or the microphone, as this would cause its acoustical performance within the room to change. I don't want to measure the off-axis performance of my speaker, so I only rotated the fabric. I then subtracted the measured performance from my speaker's frequency response, so you're only looking at the change from adding and angling the screen. Here's a picture of the setup:



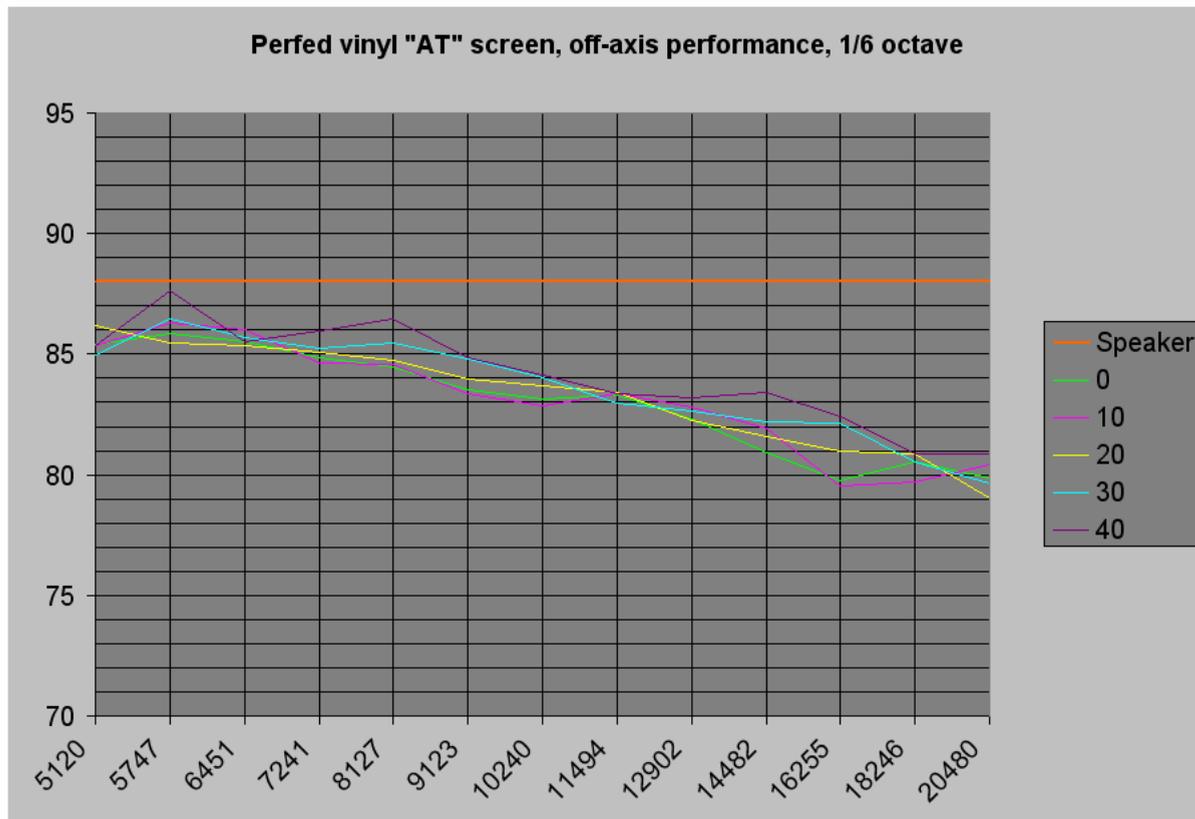
The general consensus is that people can only discern 1/3 octave frequency variations; that our hearing naturally smoothes out narrow bandwidth artifacts. I argue that this is a bit crude, so I'll show the 1/24 octave to see what the microphone can hear, and a 1/6 octave resolution to see what effects could be audible.

First up is a perforated vinyl AT screen like I have had prior experiences with in residential and commercial theater sound. I've known since the around 1991 (first stage sound job) that the sound of speakers firing through perforated vinyl screens changed depending on what angle they fired through the screen. The effect is admittedly minor compared to the typically-huge changes in speakers' natural off-axis performance, but is clearly audible. While this should teach me not to learn from prior experiences, it won't because that would be learning from a now-prior experience.

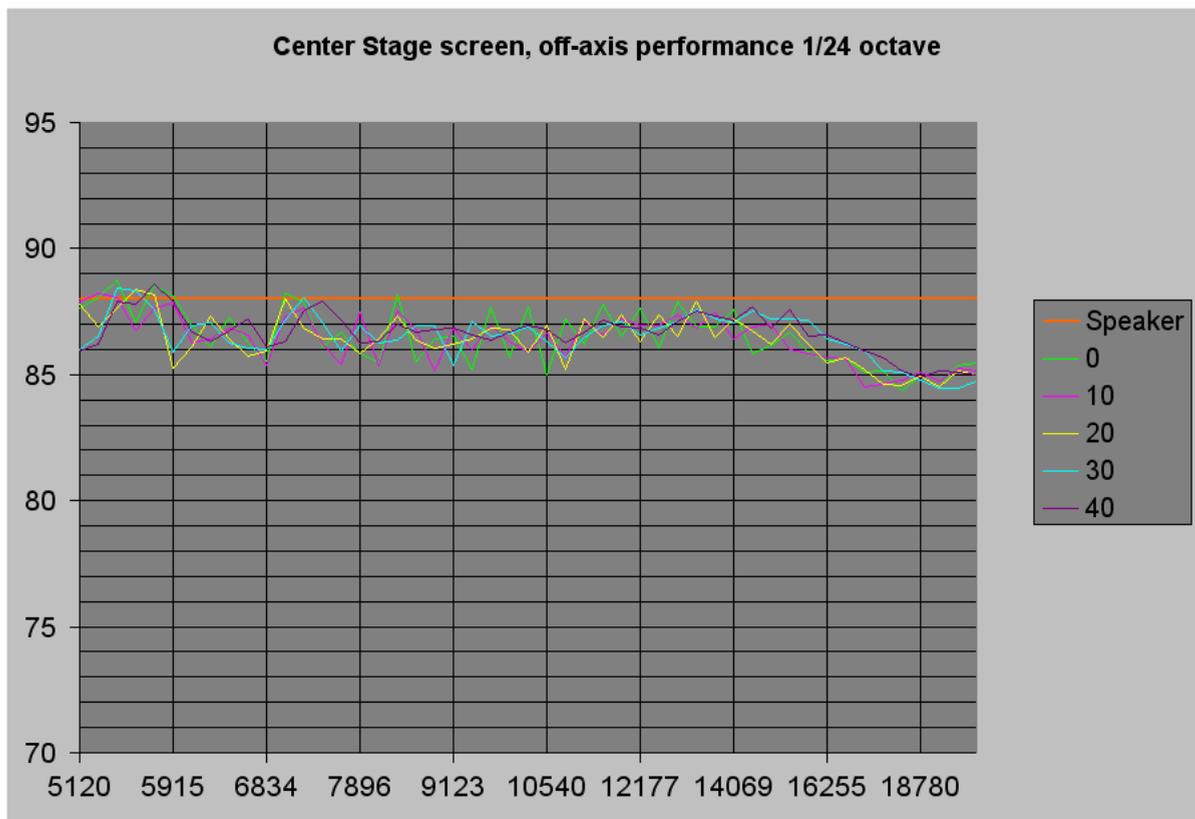
This first chart is a perforated vinyl AT screen, measured with 1/24 octave resolution. This chart shows a change in how the screen comb filters the sound passing through it at different angles. I don't get too much from this chart other than these screens give "acoustically transparent" a bad name. I'd be just slightly more likely to do this to my speakers than I would be to replace everything with a Wave radio and mp3s (now possible via the Aux jack – yea!)



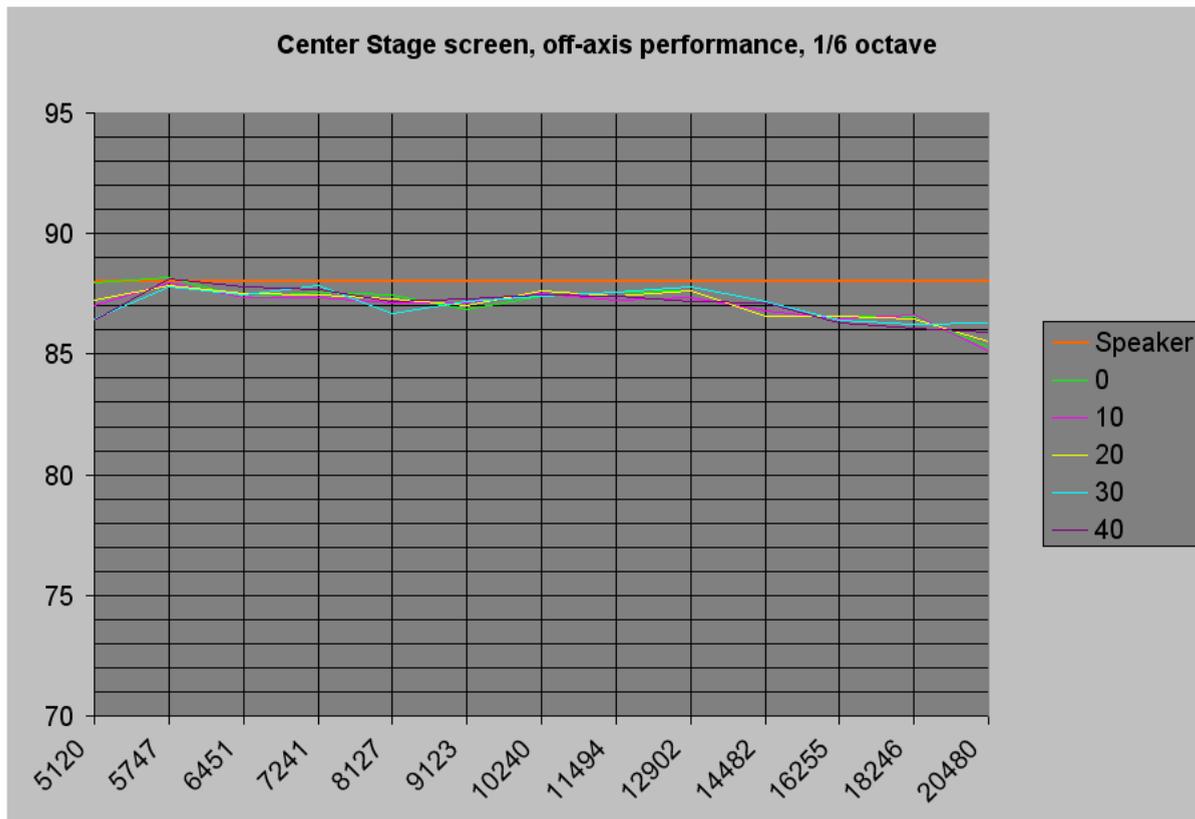
More importantly, the following is what you hear. At 1/6 octave resolution, the chart below shows that while the vinyl screen will easily sound *different* versus speaker angle, it doesn't necessarily sound *worse*. The speaker's frequency response is significantly different versus screen angle, but the variation in the screen's acoustical attenuation isn't significantly changing. I calculated the standard deviation in order to put a number on how much audible comb filtering the screen is doing versus angle, and it doesn't change much. That chart is at the end of the article.



Here is a 1/24 octave chart with the Center Stage screen material. There is measurable comb filtering (even many speaker grill fabrics will measure comb filtering), but the general takeaway is that the measured performance isn't significantly affected by speaker angle.



In the 1/6 octave chart below, we are better able to discern what would be the audible effects of changing the firing angle of the speaker through the screen fabric. From the +/- 40 degree angle sweep, the acoustical transparency of the screen is within 1dB, which is about what my test uncertainty is. Even at significant angles, the fabric is just not acoustically reflective enough to affect the sound much. With this, we say to angle your speakers however you think best for the room surfaces, speaker radiation pattern, seating angles, and overall preferences and not worry about any screen effects.



Judging the squiggly-ness of the lines quantitatively, I calculated the standard deviations of each angled measurement to map out audible changes in frequency variation versus angle. Below is the chart showing that various angles don't affect the audible comb filtering much for either AT screen type. While perforated vinyl screens are arguably acoustically transparent at all, their frequency response varies greatly no matter what angle the speaker is. Being highly variable, their response will audibly change versus angle, but their variability is not increased with angle.

Similarly, the Center Stage screen's degree of frequency variation is consistent versus speaker angle. The material is acoustically inert enough that the speaker angles have a minimal and also notably consistent effect. There may well be more good reasons for angling your speakers than there are against.

