Subject: Re: An amazing listening session with the H290C
Posted by Wayne Parham on Tue, 23 Apr 2013 18:28:10 GMT
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Ash R wrote on Tue, 23 April 2013 12:21Sorry for the tangent but somewhat related, IMO:

On another web site, there's a lot of scuttle about a short waveguide. No need to mention it by name.

Some measurements show what you're talking about, a lot of ripple in the response, but other measurements don't show it as bad. Any idea why that might be?
Could be a lot of things:

1. Different compression drivers. The rear chamber can be sized to provide reactance annulling, which will smooth response down low. It sort of fills in the first hole, right above cutoff. But in truth, this is probably not going to be effective on a 90° waveguide, because most 1" compression drivers are tuned too low.

2. Different environment and boundary conditions. If a waveguide is measured on a baffle and also in free space, the free space measurement will probably show more ripple. Polars are different too. This is less the case for very large devices and more apparent on smaller ones.

3. Drive circuits. Current sources expose impedance peaks as response peaks. Output impedance forms a voltage divider with the load impedance, and this is manifested in the response curve. Resistance in the circuit will exacerbate any peaks caused by standing waves or other internal reflections, since they create a corresponding impedance peak.

4. Drive signal. Different drive signals excite the device under test differently. In a hypothetical perfect device, this would not matter but in the real world, it does. See Keith Larson's discussion about measurement signal types. Also note that clipping can somtimes make a response chart unusually flat. Square waves generate several frequencies, so dips at specific frequencies will be missed because other frequencies are also present. This is not an issue if the measurement system uses bandpass/bandstop filters to reject noise.

5. Measurement method. Some systems measure amplitude response directly, usually with a stepped sine. Other systems measure time response directly, usually with a noise-like signal, such as a pseudo-random maximum-length sequence. The measurement system can translate frequency response to time response and vice-versa, but this is another hypothetical "perfect device" scenario.

In practice, I find some subtle differences in measurements made using various methods. Each method usually provides a lot of detail in some modes, and less in others. For example, swept/stepped sines usually provide very detailed response charts, provided the number of samples is high enough. And with bandpass/bandstop filters, they are pretty good at noise rejection too. But they are slow, and sometimes aren't as useful in the design phase, where time domain information is more helpful. On the other hand, broadband signals like MLS are great for design work because they are fast, and they're usually more accurate in the time domain. They obtain all information from a single quick burst, so are sometimes called real-time measurements.

But they sometimes have limited resolution, so you can't see as much detail.

You can kind of lump 4 & 5 together, and just say "measurement system."

I have two different systems, one that I use for design work and another that I use for final test and verification. My development platform is WTPro, which includes a crossover design module that is extremely useful for me. I can design a circuit in Spice, and the system will simulate the transfer function. It's sort of like having an active DSP crossover that I can configure with a Spice model. I use it in the real-time mode, so it is very fast and quite accurate. But in this mode, the resolution isn't real high so I cannot see sharp notches. It's sort of like a natural smoothing mechanism, but it's really from resolution. The other platform I use is LMS, and it uses a stepped sine. I can set it up to give me as high resolution as I want, and I tend to set it for 100 points per octave. That is more than enough detail to see anything and everything.

When I start using a new device, I sweep it with LMS at high resolution to examine it closely in great detail. I am specifically looking for things like breakup in a cone driver or internal reflections in a horn. Those show up as spikes and notches. If I find too much of that, I abandon the device as being unacceptable. But if it measures well, then I move to the WTPro system to design and refine. After I am satisfied that the crossover is right, using a technique described in the "crossover optimization" thread, then I measure the completed system using LMS. If it is not perfect, I sometimes go back to WTPro and make changes, validating again later with another set of sweeps on LMS.

I have seen a lot of DIYers in the last few years using measurement systems that don't have a lot of resolution. That's fine, a big step up from having no measurement capability at all. Twenty years ago, all DIYers were blind, so even medium resolution systems are a huge step forward compared to that. Some even argue that the detail found in a high resolution chart is excessive, that the tiny details are inaudible. I've heard it said more than once that 1/6th octave resolution is plenty, because any detail finer than that is inaudible. I generally agree, but still prefer to reach a higher standard than that.

It's not just a matter of being a perfectionist. Sometimes lower-resolution charts miss detail that is audible. A sharp notch is probably inaudible, but a half-octave wide peak or dip is not. And I've seen a lot of these low and medium resolution systems resolve a device that has 3dB half-octave peaks and dips down to nearly a flat line. You probably can't hear a 10dB notch that's only 1/25th octave wide, but you definitely can hear a 3dB dip that's 1/2 octave wide. Peaks too, if it's more than about 3dB and more than about a quarter octave, you'll hear it. So if the measurement system misses that, you're blind. But I've seen a lot of measurement systems that miss even that level of detail.

That's why I use two different measurement systems and look at a device-under-test with several signal types. I put it through a suite of measurements on two different platforms using a variety of signal types. That gives me the best visibility and gives me a high degree of confidence that I do not miss any details. I realize most hobbyists cannot go to this level of detail, but that's what I feel I need to do in order to provide the highest quality products.