BRYSTON

NEWSLETTER

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Bryston 'Family Of Curves' - What ?

BRYSTON SPEAKER FAMILY OF CURVES

Many times I get asked about the design philosophy behind the Bryston loudspeakers and what design parameters we feel are the most salient. If I had to define our mandate in a single phrase it would be the:

'FAMILY OF CURVES'

I guess the first question is "What is the family of curves?" and what we're looking at is a whole bunch of curves (FIG 1) which are amplitude responses measured in a true anechoic chamber (not computer based gating systems). The speaker is measured at points all the way around (360 degrees) the cabinet horizontally and then all the way around the cabinet vertically.

The 'family of curves' is extremely important to the sound of a loudspeaker – it is about what you're actually going to hear in a real listening room and how we determine that. Typically the family of curses is not discussed much and I think there are two reasons. First there's nothing visual about it. You can't look at a speaker and say "Oh, this is going to have a particular family of curves" just by what the drivers look like, the cabinet looks like, or the components on a crossover look like.

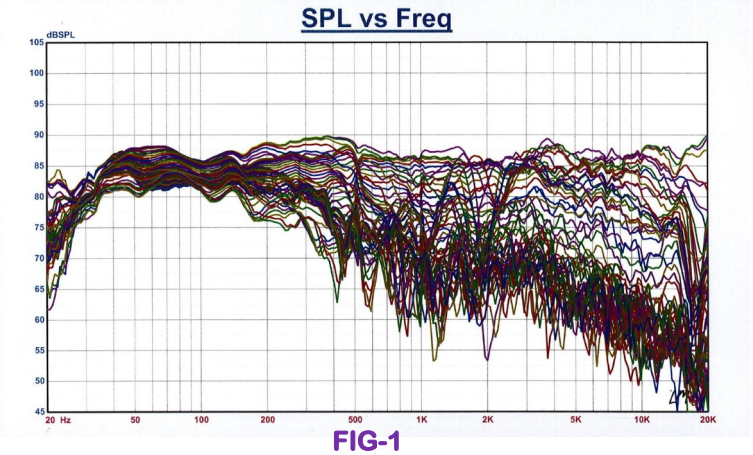

FIG-1

None of these things really tell you much of anything about the family of curves, so we tend to gravitate and talk about things that you can see. While that's sensible on one hand, it doesn't really get into the meat-and-potatoes about what makes a good-sounding loudspeaker vs a not-so-good sounding loudspeaker. Second the family of curves is not an easy thing to measure. There are a lot of curves involved, and you really have to have a large anechoic chamber in order to measure all of these curves accurately.

So it's not talked about in a lot of cases because it's not something that's measured by most other speaker manufacturers.

Even just looking at a simple loudspeaker – say a two-way bookshelf speaker – you're looking at over 150 curves in order to create the entire family of curves that you need to work with and manipulate in order to create what's going to be the end product.

Listening Window & Sound Power

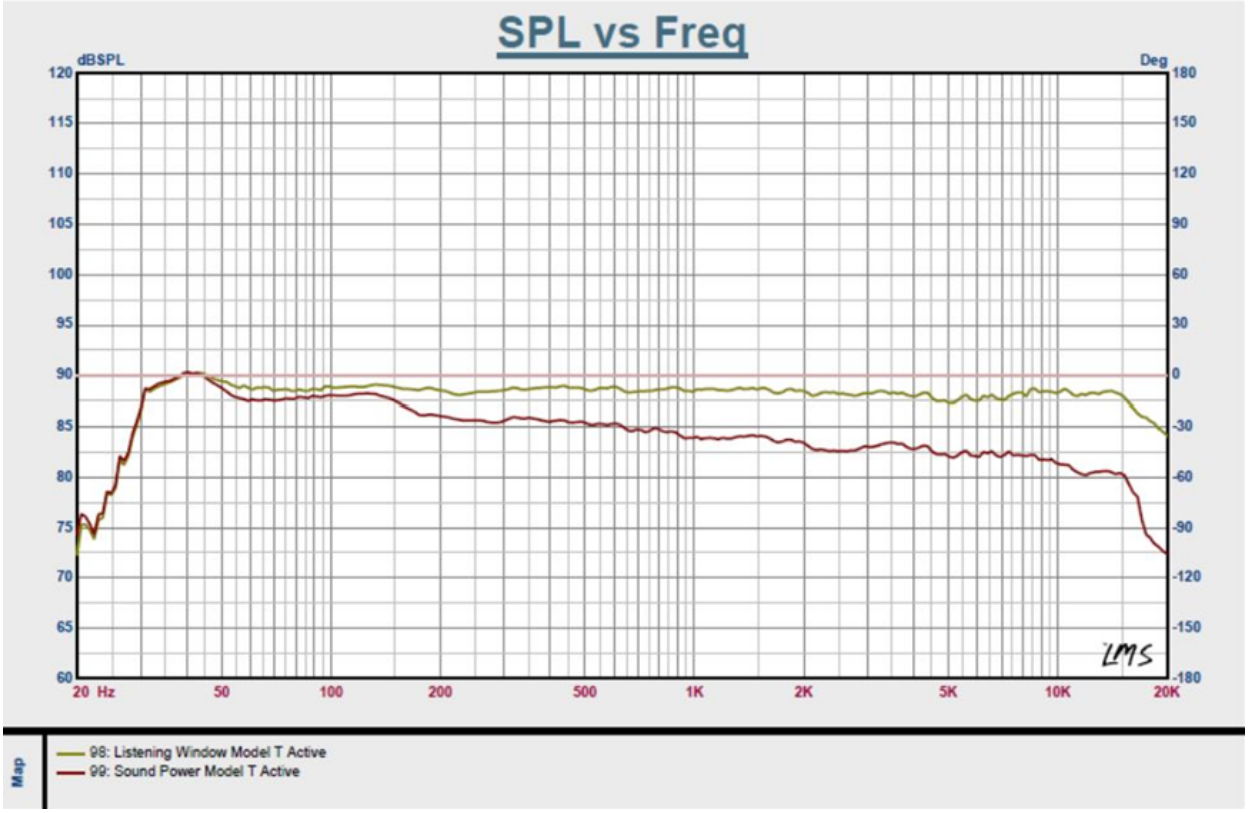

FIG-2

You've got the curves of all the individual drivers, and then you have the curves of the combined end product, and that's going to give you +150 curves. Realistically, in the process of the loudspeaker design, you're going to be doing those measurements over and over again. You can really end up in a design with over 1,000 curves before you're done.

And that's for a simple bookshelf speaker! If you get into a multi-driver tower, you can start multiplying that number by two, three – even four times. So it's not a particularly easy thing to do and you need the proper tools **(Anechoic Chamber)** to do it. Once it's all done, you still have to interpret what these curves mean. They don't have what you would call a 'normal' sort of visual. If you think about on-axis or a listening window curve {FIG 2}, we're used to just seeing something that's reasonably linear across the bandwidth, that represents a good frequency response. But there's quite a bit more to it.

One of the questions people often ask is, "Why do I care what's coming out of the bottom of the speaker or the back of the speaker when I can't hear that?"

There is a misconception that some people have that the sound comes out of the front of the speaker and that's all we're worried about. Well, that

Direct Sound vs Reflected Sound

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When you listen to a speaker in a room you are

NOT

listening to the

DIRECT SOUND

you are listening to the

SOUND POWER

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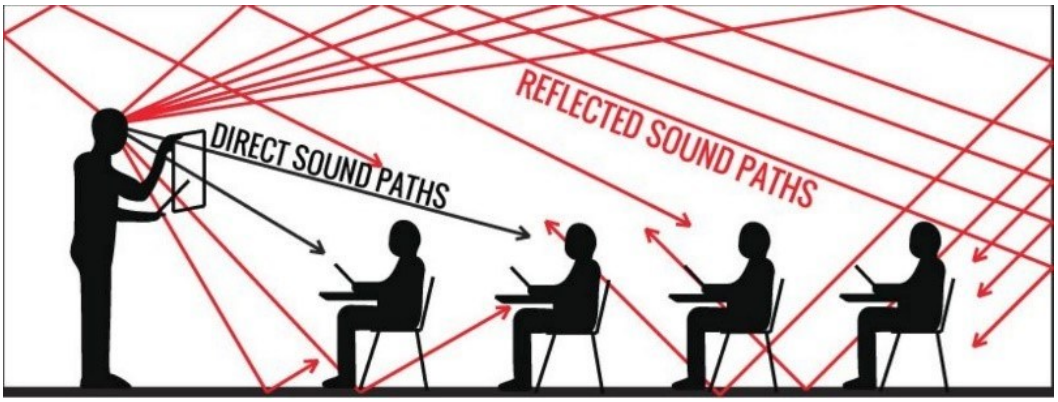
Typical Room Reflections



would be the case if we listened to speakers inside an anechoic chamber environment, where there are no reflections. But when you put the speaker in a normal room — and it doesn't matter how much damping, or padding, or furniture, or carpet, or whatever you have in the room — you get reflections.

'DIRECT VS REFLECTED'

Those reflections are not predominantly the direct signal from the speaker, it's all of these off-axis measurements, all these positions that cause reflections coming all the way around the speaker including behind it. Even though there's no drivers back there, the low frequencies will have an impact behind the cabinet, the cabinet itself can radiate some sound. So we have to measure, and have an idea what the speaker is going to do in the room. The best way to evaluate that is by looking at this 'family of curves'.

Now, the graph on page 1 looks like a total mess, and very difficult to interpret, if you just looked at it with all of these curves overlaid on one another and it doesn't tell you a heck of a lot. And if we looked at any of the individual curves, in isolation, it also doesn't tell you a lot. Many people think that you need the flat on -axis response. Well, that's nice to have, assuming that the family of curves looks smooth and even as well.

Now, how we interpret this mess of curves is by looking at two main curves that we call the 'listening window' and the 'sound power'. The listening window takes into account the direct signal from the speaker and what are known as the "first reflection points" off of the side walls, the floor, and the ceiling. And it averages those into this upper curve that you see in Figure 2 , Page 2.

'SOUND POWER'

The sound power is an average of all of those curves that were on the previous page and it's the interpretation of how you do the averaging that really is the magic of loudspeaker design. By interpreting these curves we can understand everything that the loudspeaker is doing and how it's going to interact with the room. Small changes that we bring to individual curves may or may not impact the listening window and the sound power.

FACT: You Are Listening To Sound Power

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We're always adjusting things to make these two curves look a certain way, and really, on and off axis smoothness is something that we're looking for. We don't want big discontinuities in either the listening window or the sound power, because that will suggest that there's an issue with the way the speaker has been designed.

It is an important point about listening tests as well in that really, about 80% of the listening tests that we do here, the double-blind listening tests, are about the family of curves. We will make small adjustments to the family of curves, and subject that to a listening test, to see if we can isolate measurements that can improve the sound quality.

I can not stress this point enough:

When you listen to a speaker in a room you are NOT listening to the 'Direct Sound'... you are listening to the 'Sound Power'

At the end of the day, all that really matters is that you have to consider all of these family of curves in trying to assess how the speaker is going to perform in the typical listening room, and that's why we place prime importance on this sophisticated family of measurements in developing our loudspeakers.

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