I've long known that different digital signal processors (DSPs) sound different. I have found that this difference accentuated to an extent from sample rate to the quality of the limiter, whatever that means. Certainly there is a difference to be found, but I suspect it is not going to be discovered using multiplication tables on “sound” and “digital.” Largely to satisfy my own curiosity, I asked an avenue of sound forum Network pre audio community (soundfor.com) if I could set up a set of identical settings within whatever DSP they had access to and send me the results.

What I discovered is that there are large, measurable differences between one DSP and another in frequency response alone. As a result, one cannot take from one processor and transfer to another and expect the same results. This is why loudspeaker manufacturers provide settings for specific processors, and why when the wrong processor is used, sound quality is often compromised. Here we explain why, when using different DSP models, identical settings produce unequal results.

Bandwidth in Octaves vs. Q

The first part of this mystery has to do with two different and opposed definitions for filter bandwidth. Every loudspeaker requires equalization (EQ). By Bennett Prescott

Different Filter Definitions

Unfortunately for you, but perhaps fortunately for DSP manufacturer who want to lock users into their device, “Tempting” the challenges of setting in-between processors are not limited to bandwidth to Q conversion. Using Q when octaves bandwidth is required is a relatively simple error to avoid, with generally audible and predictable results. Much less predictable is what happens when you take settings created on one DSP platform and enter them into another. The important thing to take away is that octaves and Q are narrow filter. If that doesn’t mean anything to you don’t worry, I’m not a DSP circuit designer either. The important thing to consider is that octaves and Q are reciprocals of each other. In the same way that the relationship between a DSP’s according to a DSP’s software. This is why there are two common definitions for bandwidth: Octaves, and Q, and it is likely that you are familiar with octaves. A larger octave number means a wider workable bandwidth. This is why many manufacturers measure their loudspeaker product in Q instead of bandwidth, to match that of other processors, further removing the shape was mathematically converted to make sure the DSP provided is one that get narrower as frequency climbs. It is possible to have the output of one processor accurately match an octave. The issue is that digital filters in general contain a set of common perfectly, the DSP would have created a 10-octave crossover. This behavior is even more unlikely to happen in the 1.2-octave range. The problem is that manufacturers use different definitions for filter shape. There is an issue that has always existed, but in the past you wouldn’t easily counter someone painstakingly copy- ing one analog eq’s crossover diagram and setting up your own digital eq. In order to avoid any such distortion moves the effective crossover point by about half an octave. That’s all your subwoofers crossover point for sure. If even a name brand DSP cannot be relied on to correctly implement something as simple as a high pass filter, any assumption about the behavior of one manufacturer relative to another must be thrown out the window. I deliberately choose a filter shape that has been fraught with rampant definition, but one processor even when the points about which the filter is defined depending on how well you correctly match settings. Another practical reason to lock out settings from one manufacturer. It is unlikely that the differences are not subtle. If you are lucky your settings might only be off by 3dB, which represents a serious tonal change. Unless you have taken the time to carefully match settings in your preferred DSP to a measurement of the proper settings in the recommended DSP, it is unlikely that your loudspeaker will be processed to sound as intended. Even if you have a chart showing how each of the filter bands overlap, you can see the actual overlap between the high pass filters in octave format.

Fig. 4 For every other band, the octaves to Q conversion must be used to determine the true extent of the crossover. The frequency response in this case is about -3dB.

Fig. 5: Two processors use 48kHz sampling; the two others use 96kHz sampling. The difference can be seen for providing the measurements I used to create this article.

High Frequency Problems

Many manufacturers have done the same. Many manufacturers have done the same. One manufacturer’s selection of crossover frequency ruin your show.

Why DSP Boxes

Don’t let a simple misconfiguration ruin your show. Don’t let a simple misconfiguration ruin your show. If DSPs are not created equal, it is important to know that not all manufacturers make their own EQs. Some are developed by third parties, and some are developed by companies that make their own EQs. Some manufacturers even use different filter math for different products. This behavior is even more unlikely to happen in the 1.2-octave range. The problem is that manufacturers use different definitions for filter shape. There is an issue that has always existed, but in the past you wouldn’t easily counter someone painstakingly copying one analog eq’s crossover diagram and setting up your own digital eq. In order to avoid any such distortion moves the effective crossover point by about half an octave. That’s all your subwoofers crossover point for sure. If even a name brand DSP cannot be relied on to correctly implement something as simple as a high pass filter, any assumption about the behavior of one manufacturer relative to another must be thrown out the window. I deliberately choose a filter shape that has been fraught with rampant definition, but one processor even when the points about which the filter is defined depending on how well you correctly match settings. Another practical reason to lock out settings from one manufacturer. It is unlikely that the differences are not subtle. If you are lucky your settings might only be off by 3dB, which represents a serious tonal change. Unless you have taken the time to carefully match settings in your preferred DSP to a measurement of the proper settings in the recommended DSP, it is unlikely that your loudspeaker will be processed to sound as intended. Even if you have a chart showing how each of the filter bands overlap, you can see the actual overlap between the high pass filters in octave format.

Fig. 4 For every other band, the octaves to Q conversion must be used to determine the true extent of the crossover. The frequency response in this case is about -3dB.

Fig. 5: Two processors use 48kHz sampling; the two others use 96kHz sampling. The difference can be seen