



# bel canto

## **Optimal DSD Playback for Bel Canto Design DACs.**

DSD is a very hot topic right now in digital. We are aware of the format and all the titles soon to be released. Our goal is to make sure you get the most satisfaction from all of your digital source material, especially DSD, now that it's back in the news.

There are optimal ways to listen to DSD that insure the best sonic performance, and all of our current DAC products provide the performance you desire from any of your digital source files, DSD, 16/44.1 PCM and high bit rate PCM.

It's important to remember DSD format occurred in early days of digital reproduction. As you'll see in the examples at the end of this paper PCM is much quieter, with a larger dynamic range. So it captures all of the performance of the original DSD signal. By following our conversion recommendations the result will be superior playback of DSD material without compromising any digital format.

With a bel canto DAC you will always be on the forefront of digital because high dynamic range performance is designed in from the beginning.

*John Stronczner  
Bel Canto Chief Designer*



# bel canto

## Optimal DSD Playback for Bel Canto Design DACs.

**All Bel Canto DACs can be used to play DSD files perfectly by using JRiver, Pure Music or other software.** This is accomplished using the computer for conversion from DSD to a 24/176.4 PCM file and streaming this through the USB interface. We prefer this method for optimum playback of DSD for the following reasons:

- 1) All State-of-the-Art DACs are either multi-bit sigma-delta, 24 bit PCM or a combination. These modern DACs can provide very high dynamic range, low noise and distortion with performance approaching 126-128dB. Either PCM or DSD source files will be converted to whatever specific modulation method the DAC uses for final conversion to analog.

**What this means is that there is NO 'pure' DSD playback method using a modern high performance DAC.**

- 2) **DSD has very high noise levels above 20 kHz because of the noise-shaping algorithm** used to achieve reasonable noise levels in the lower audio frequencies. This noise needs to be reduced by the addition of either an analog filter stage if playback remains DSD or an FIR filter if playback uses a conversion to PCM. **Any additional analog filters add noise and distortion,** the PCM FIR filter avoids the need for any additional analog circuitry. **This is the primary reason we prefer DSD playback using conversion to 24/176.4 PCM.**

**There is no additional analog circuitry needed that would compromise the final output.**

- 3) **The PCM conversion process that JRiver and Pure Music provide uses 64 bit math and is transparent,** adding no additional noise or distortion products, indeed the noise shaping characteristic of the DSD file is retained as shown in figures 1 and 2. **Any sound characteristics that this noise floor offers will be retained and heard through the final analog output.**

# bel canto

## Optimal DSD Playback for Bel Canto Design DACs.

- 4) 24/176.4 PCM is inherently a lower noise, wider dynamic range process than DSD so playback of the DSD file within the PCM process will not add any distortion or noise to the original DSD signal.

The beauty of the conversion to 24/176.4 PCM is that all of the characteristics of the original DSD file are retained and you can get the sound characteristics of DSD without compromise to playback of any PCM files, either CD or at higher bit rates of 24/88.2 and above.

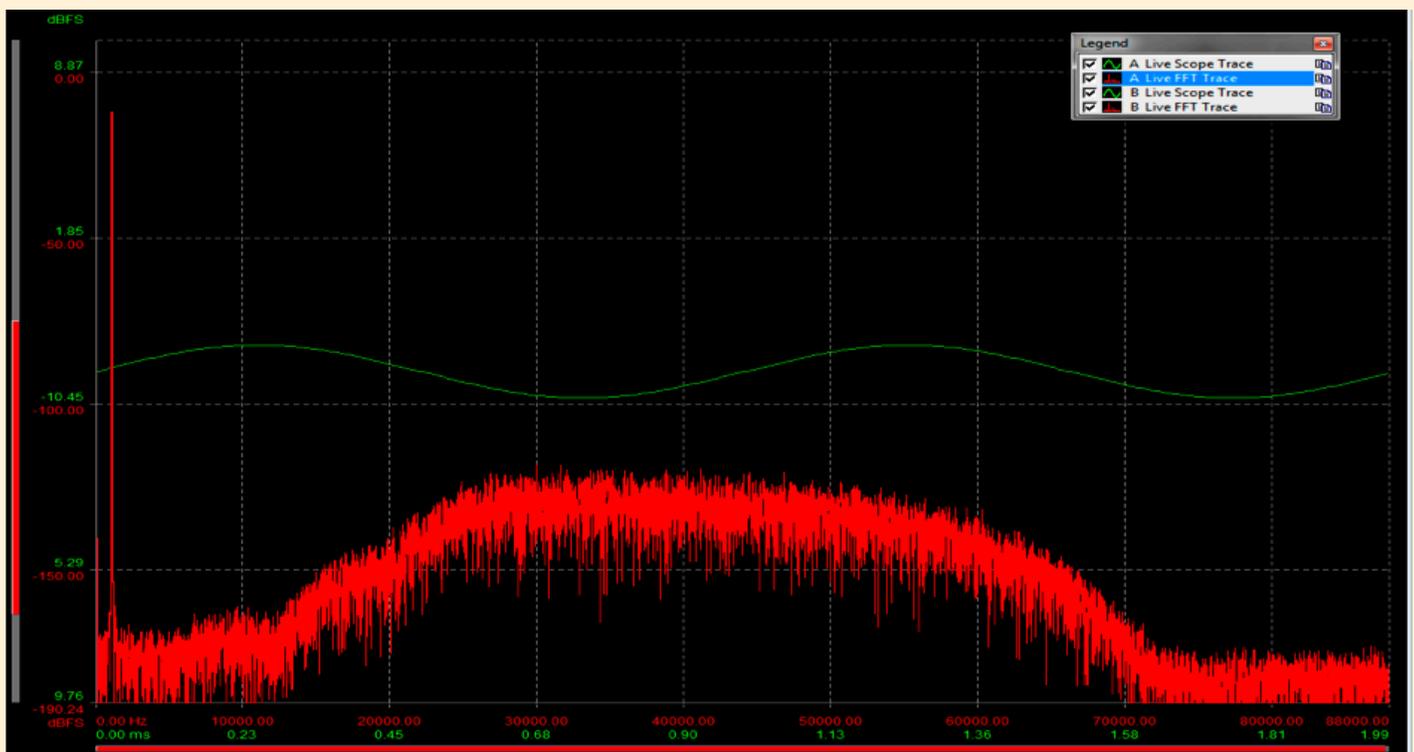


Figure 1. DSD to 24/176.4 PCM 1kHz test tone with 24kHz 48dB/octave FIR

Figure 1 is using the default JRiver FIR filter at 24kHz 48dB/octave done in software. To do this after the DAC it would take more analog stages than in any of our DAC products. This would be a very aggressive analog filter that could compromise a high performance DAC. Note the inherent rise in noise above 20kHz due to the DSD processing. This is corrected by the FIR filter without needing to add any additional analog circuitry.

# bel canto

## Optimal DSD Playback for Bel Canto Design DACs.

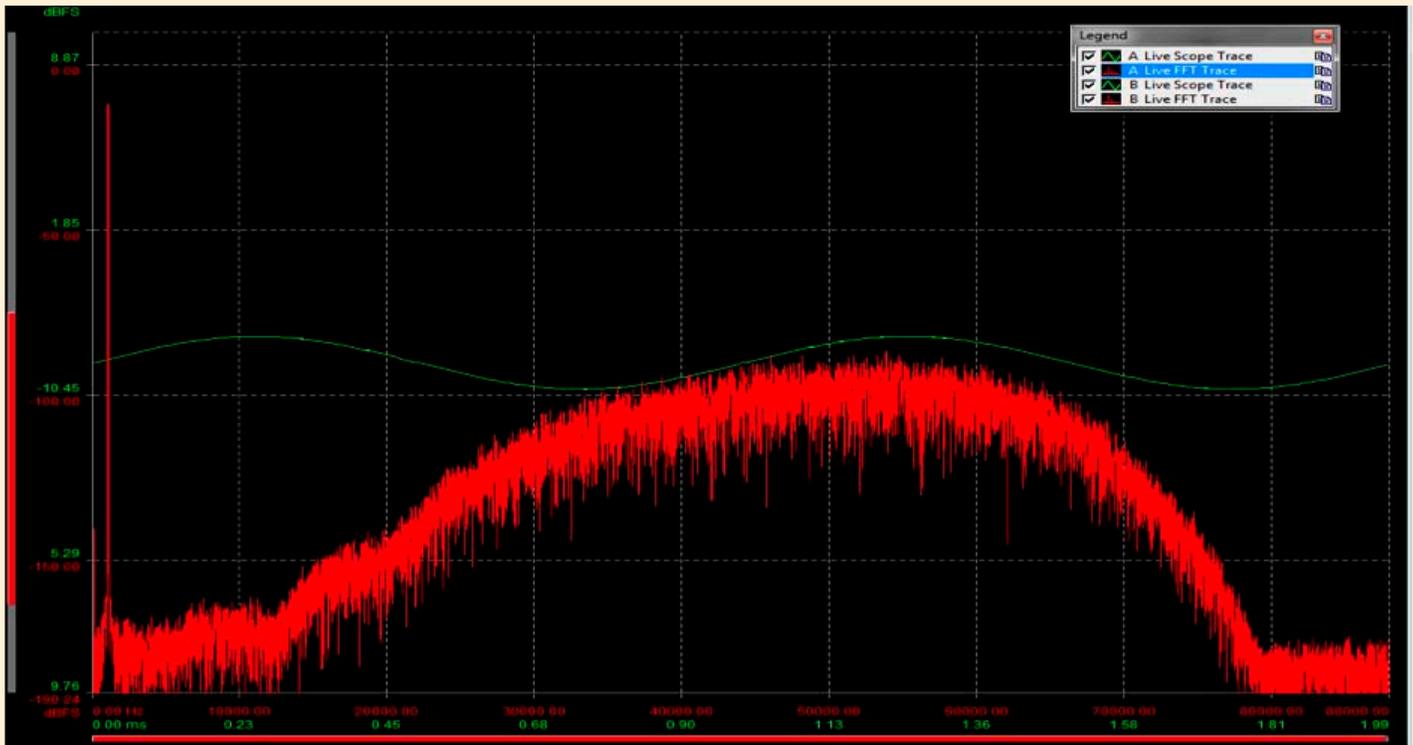


Figure 2. JRiver DSD to 24/176.4 PCM 1kHz test tone with 30kHz 24dB/octave FIR

Figure 2 shows a less aggressive 30kHz JRiver software filter option at 24dB/octave, you can see the HF noise increase by the bump in the noise (30dB higher). With the click of a mouse you can choose the filter that works best with in your system. Note that the noise floor below 10Khz is around -175dB and that there is no distortion or tones, i.e. it is totally transparent.

# bel canto

## Optimal DSD Playback for Bel Canto Design DACs.

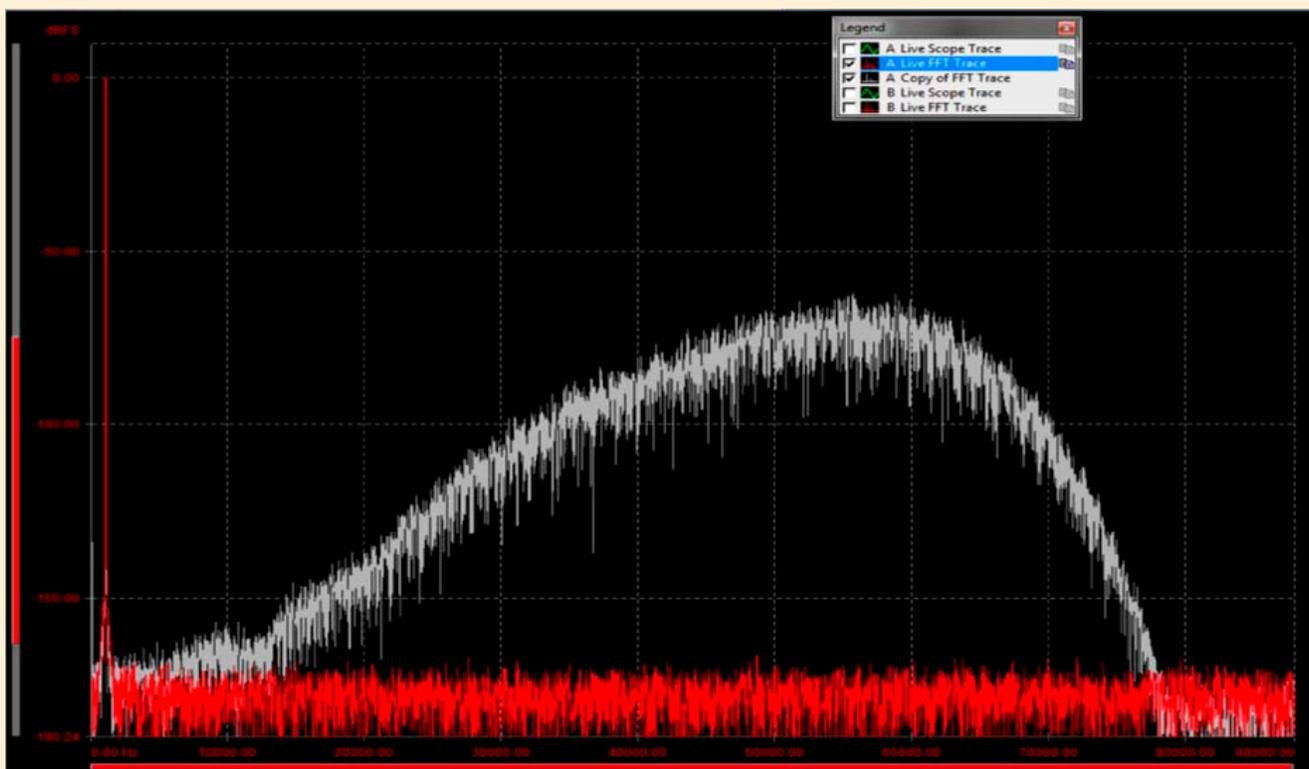


Figure 3. Dynamic Range of DSD and 96/176 PCM

Figure 3 demonstrates that the 24/176 PCM noise floor (Red trace) is lower than DSD (White trace) by a considerable amount below 20KHz and much lower above 20KHz.

*John Stronczer  
Bel Canto Chief Designer*

©2013 bel canto design  
221 North 1st Street  
Minneapolis MN 55401  
USA