

Dithering in SONAR

From the feedback we get from our SONAR customers, it would seem that recording and mixing in 16 Bit is a thing of the past. 24 Bit or higher seems to be norm nowadays and in a world of powerful computers with monster sized hard drives, the benefits of higher bit-rate recordings are easy for everyone to achieve. But to put your completed song on to a CD you still have to turn it into a 16 Bit file for compatibility and this bit-rate reduction of your project will degrade its sound unless you apply a process called Dithering.

What is Dithering?

Dithering is a form of low-level random noise (called “dither”) added to an audio file as it is being processed from a higher bit depth to lower one. There are different mathematical calculations used to generate dither, each with its own particular advantages and disadvantages depending on the musical style or the operation you intend its use for.

Some of the more often used dithering options are a result of mathematical calculations that were developed by a consortium of specialist companies who call themselves the POW-R Consortium. These guys set out in 1997 to create the most sonically transparent dithering algorithms possible. The same algorithms are still being used today by many leading DAW vendors including Cakewalk which is a marvelous testimony to their quality.

Why Dither?

Going from one bit depth to a lower one creates an undesirable distortion (called quantization noise) which can colour the sound of your project. Our ears are very sensitive to this kind of distortion which makes it undesirable. Our ears are a lot less sensitive to the random noise generated by the dithering process which reduces the effect this quantization noise. If you use the dithering tools at your disposal carefully then this process will be almost transparent to the average listener.

When do I Dither?

Assuming that you are now recording or editing at a 24 bit or higher bit resolution, you should only want to create a 16 bit mixed down version of your project to put on to an audio CD. This is usually done at the last stage of the project’s life-cycle when you have completed your mix.

Ensure all processes such as track bouncing or freezing when you are mixing or editing are done at the same bit-rate you have set for the whole project and switch all dithering options off for these processes. This is because it is not a good idea to dither the same piece of audio more than once as this can make the random noise artifact generated by the dithering process a lot more apparent to the listener which will ruin your final mix.

What are the options?

SONAR Producer offers five kinds of dithering. This is explained in SONAR’s Help section as follows:

Rectangular. Essentially white noise, no noise shaping.

- Advantages: least CPU-intensive, lowest signal-to-noise ratio, preferable to shaped dither when successive dithering can occur (e.g. bouncing, freezing).
- Disadvantages: suffers from intermodulation distortion, higher perceived loudness than Pow-r dither.

Triangular. Higher level than rectangular, no noise shaping.

- Advantages: low CPU-intensive dither, superior to Rectangular as it does not suffer from modulation noise effects. Preferable to shaped (Pow-r) dither when successive dithering can occur (e.g. bouncing, freezing).
- Disadvantages: higher perceived loudness than Pow-r dither.

Pow-r 1. Noise-shaped dither.

- Advantages: less CPU-intensive than Pow-r types 2 and 3, lower perceived loudness than Rectangular or Triangular.
- Disadvantages: less noise shaping than Pow-r types 2 and 3, not recommended for operations where dither will be applied successively (e.g. bounce and freeze).

Pow-r 2. Noise-shaped dither.

- Advantages: lowest perceived loudness, highest quality settings, recommended for audio export.
- Disadvantages: highest CPU-intensive settings, not recommended for operations where dither will be applied successively (e.g. bounce and freeze).

Pow-r 3. Same as Pow-r 2 except most CPU-intensive and transparent of all choices.

I have read that Pow-r-1 is best used for narrative audio; Pow-r-2 is best used for compressed rock styles of music and Pow-r 3 for music with a greater dynamic range such as classical. But then again, through my research, I also read that a lot of users tend to only use Pow-r 3 as it is the best. Remember, these algorithms were developed in 1997 where the typical speed of the average computer processor were just tipping 450 MHz (ie, quite slow by today's standards). So to some users, Pow-r 3 may not have been a viable option due to time constraints during the rendering process.

Now we have the luxury of blindingly fast computers so why not choose the most transparent and CPU intensive option. But it still might pay to compare the results of the different dithering options to see which one suits the sound of your mix.

