Weiss Engineering

POW-R Dither by Bob Katz

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I was skeptical when I received the new Weiss redithering box for review. I've been doing shootouts of redithering algorithms for about eight years and every system I've tried has been unable to recover ambience as well as my venerable Meridian model 518 does. When I heard the Weiss, however, I couldn't believe my ears – this box brings 16-bit audio closer to the 24-bit source than I thought possible. I had thought every dither was a compromise – some sacrificed ultimate depth and space for a pleasant tonality or vice versa. The POW-R dither has broken a barrier – removing the compromise of tonality vs. depth. POW-R is short for Psychoacoustically Optimized Wordlength Reduction. POW-R dither is owned and licensed by the POW-R consortium LLC, a group formed by four independent audio companies Millennia Media, Lake DSP, Weiss and Z-Systems. The goal was to produce the most sonically transparent dithering algorithm possible. The process the consortium came up with is not just dither with noiseshaping, but a patent-pending approach shrouded in secrecy.

At a Glance

Applications: Dither processor for mastering studios
Key Features: Multiple digital inputs and outputs; accepts 44.1 kHz and 48 kHz sampled audio signals on any standard digital interface
Price: $3,500
Contact: G-Prime at 212-765-3415; or circle Reader Service 127.

POW-R is similar to other wordlength reduction schemes in its use of a random noise signal as part of the signal/quantization error decorrelation process. How this noise signal is generated and what its spectral characteristics and statistical properties are, differentiates POW-R. POW-R dither comes in three flavors intended to fit different kinds of music. The POW-R consortium will license the algorithm noncompetitively to its own members and to additional licensees, including notable DAW, processor and converter manufacturers.

Features

The Weiss box ($3,500) is the first implementation of the algorithm in a standalone hardware product. It accepts four input formats: S/PDIF (RCA), AES-EBU (XLR), SDIF-2 (BNC) and SDIF-l (9- pin). Any selected input simultaneously feeds all outputs, so the box also functions as a distribution amplifier and format converter, since the bypass mode is bit-transparent. The algorithm can be switched between 16-, 18- and 20-bit output, with an option to blank the output to digital black (mute) if the source has been black for a certain number of samples. A bypass switch, which also selects the type of algorithm, completes the simple complement of controls. I only tested the box with the S/PDIF interface, as my entire digital system has been converted to 75 ohms, mostly on BNC connectors. Noise-shaping is a method of improving the signal-to-noise ratio of dither, resulting in an SNR more like the longer wordlength source. It can't be perfectly done – if we could fit 24 pounds into a 16-pound bag we

wouldn't need the bigger bag. Noise-shaping curves are tailored to the limits of human hearing. For 16-bit output, the object is to keep the total power of the curve at 16 bits, but to lower the noise in the areas where the human ear is most sensitive. In critical bands it is possible to lower the noise to 20-bit levels.

In Figure l, a Spectrafoo FFT illustrates the dilemma at three ninth-order curves: Meridian's shape D (blue curve), POW-R dither type 3 (yellow) and Waves Ultra dither type l (green), an improved Waves dither from its new L2 Ultramaximizer limiter. Notice how each manufacturer follows the same general shape, but each one chooses fine variations on that shape. Noise masks signal in the same frequency band. Thus, in the frequency ranges where the dither noise is reduced, more of the source music and ambience is revealed (unmasked).

In use

That's the theory. Now to hook up the box and listen. Based on my experience with other dithering boxes, I thought the Weiss should perform better in some areas and worse in others, but I was wrong. My skepticism turned to wonder – my first reaction when I hooked up the POW-R box was "is this thing on?" I thought I was listening to the source! I rechecked my connections, inspected my bitscope and switched around until I was sure there was no wrong connection. Apparently the POW-R dither avoids major soundstage shrinkage and tonality changes associated with other dithers. Next I familiarized myself with the box's operation. There are three types of POW-R dither. Previous experience has shown me that rock'n'roll music frequently benefits from a gentle noise curve or a UV-22 approach; I think these curves cover up some of the evils in the source and tend to be less edgy sounding on brashy material. Classical music tends to benefit from the ninth-order curves, like Meridian shape D, which has greater depth and width yet has a bit of a sheen to it that makes it unsuitable for bright music. Because each dither affects the tonality of the sound, I integrate it into the mastering process. Ideally, a dither should be tonally neutral, with the 16-bit final sounding like the 24-bit master. In the FFT of Figure 2, note that POW-R type 1 (blue) is a near-Nyquist dither second-order curve, which resembles UV-22 in its shape. Type 2 (green) is a slightly steeper fifth-order curve, which resemhles Meridian type E. And type 3 (red) is the severe ninth-order curve, like Meridian shape D or the new Waves Ultra curve. As a serious dither connoisseur, I expected to hear meaningful differences between the POW-R curves. But again, I was wrong. Using a delicate 24-bit classical piano solo recording, I could not reliably distinguish the three 16-bit curves from each other or from the 24-bit source! This has never happened before. I usually notice some degradation and a meaningful difference between any box's curve shapes. I tried an excellent recording of a country rock group, which has a lot more high-frequency information than the classical piano. This recording came in on 1/2" 30 IPS analog tape and I had previously mastered it using various digital processors and Meridian D dither. Starting with POW-R type 3 (the sharpest curve), I was amazed at the clarity, depth and lack of congestion in the music. With this music, I was finally able to hear the smallest difference between the 24- bit source and the 16-bit dithered version; it's hard to describe, the 16-bit being a bit more closed in but a respectable facsimile of the original in all respects. I then tried POW-R type 1 and heard a bit more degradation compared to type

3, but nothing to write home about. I certainly can't use POW-R for tone control; it may soften the sound, but more subtly than its predecessors. Basically, after a few tests, I decided that the way to use POW-R dither is to stick with the best-sounding curve (type 3). This is not the box to use if you need to cover up some evils in your source, So keep those other boxes around, just in case. POW-R neither disguises nor enhances any part of the spectrum. We can also conclude that the effect is music-dependent; complex stereophonic music appears to expose dither problems more than simple. As a control, I compared the POW-R against my reference dither, Meridian's shape D. I had originally chosen shape D over other dithers because it revealed more of the source and added a little bite, which was desirable with this music. So I was concerned that POW-R's tonal neutrality might produce a more recessed sound. I found that POW-R reveals so much more of the source that I no longer needed the Meridian's artificial edge – I was obviously using the edge to make up for the its lack of resolution. Instead, the transparency of the original source carried the day.

I really started noticing the congestion of the Meridian algorithm, yet the Meridian's resolution is slightly better than other dithers. It's all a matter of degree, but it didn't take long for me to conclude that the POW-R dither is better than anything else out there. Negligibly different from the source, it's an incredible achievement.

Summary

Putting this in perspective, many people are insensitive to the virtues of the different dithering systems. What order of magnitude of differences are we talking about? If you are inclined to music that has depth, space, clarity and purity of tone, you will recognize the qualities provided by a superior dither. A high-resolution monitor system is useful to distinguish the sound of subtly different dithers from each other and from the source. I have no reservations about this box except for the price, which does cover the cost of the multiple professional interfaces. I guess it's time to remortgage the house. It would be nice if Weiss produce a lower-cost version with just AES or S/PDIF.

Bob Katz, president and mastering engineer of Digital Domain in Orlando, Fla, i.s a contributor to Pro Audio Review.

Product Points

Weiss POW-R

Plus
Virtually indistinguishable from the 24-bit source
Wordlength reduction delivered with little or no sonic congestion

Minus
Expensive

The Score
If you want to make the best sounding 16-bit product in the world, this box is the top contender.