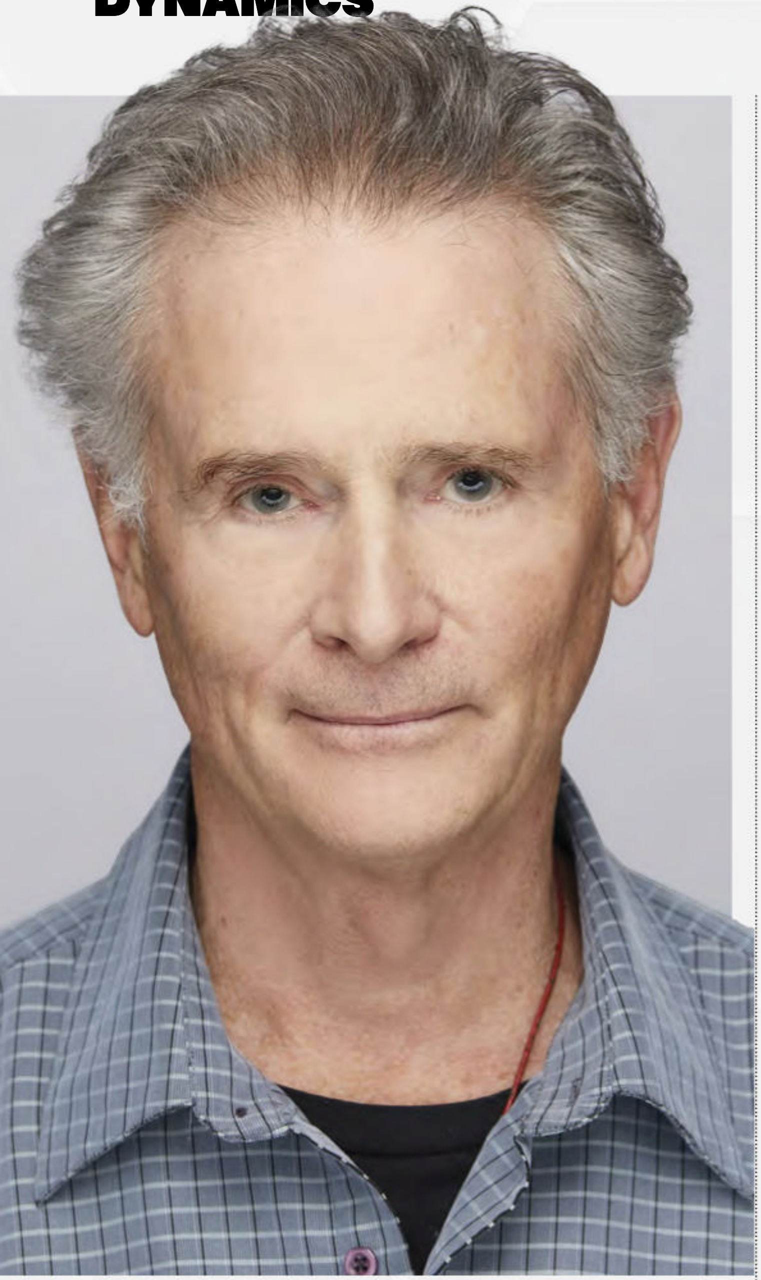
BY ROBERT HARLEY



Musical Dynamics and Noise Reduction

Caelin Gabriel, Founder, CEO, and Chief Designer, Shunyata Research

RH: Your design efforts have been directed toward developing products that widen a system's dynamic range by better transfer of AC current to amplifiers, as well as lowering the noise floor through grounding systems. Why are these such important design goals?

CG: For professional recording and sound reproduction systems we invest our most significant material and measurement resources into optimizing peak-current transfer, which we term DTCD (Dynamic Transient Current Delivery). Through measurement and hundreds of field tests, we've found that prioritizing this design element affects every area of sound reproduction, including perceived noise reduction. To illustrate, I'll use the example of our patented QR/BB circuit. This technology is deployed in our upper-tier power distributors and power cords. The QR/BB circuit acts as a reservoir for peak-current energy. This technology hastens the in-rush of peak energy to component power supplies more efficiently than from the wall circuit, making it easier for components to receive the (micro-second) impulse current they need to seamlessly reproduce a complex audio waveform.

Results after deploying this technology include notably increased scale and dynamic headroom. Music comes across with greater impact and three-dimensional presence as if more force were being applied behind the signal. To use a car analogy, designing a power system using all our DTCD design principles delivers a result similar to upgrading a 4-cylinder engine to an 8-cylinder. Sound is delivered with greater unforced weight and authority. Other related design elements include our proprietary solid-copper outlets, solid-copper AC terminals, and numerous metal refinements that reduce in-series resistance to DTCD. We've found this material template to improve the realistic performance of both recording and playback systems. Not only does this approach reduce perceived noise, but it also adds a more visceral, interactive element to the listening experience. Prioritizing DTCD acts as a force-multiplier for the many forms of noise reduction we implement thereafter.

Regarding measurable noise reduction, we've spent the past 28 years researching and developing multiple patented technologies that eliminate many forms of power-line, RFI, and EMI noise. We've seen firsthand that unaddressed high-frequency noise will blunt the resolution of both audio and visual signals in significant ways. For industries that rely on optimized signal fidelity, eliminating these forms of noise has both observable and measurable results. Our work in electrophysiology, as well as with well-known professionals in the recording industry, offers data points that reflect the importance of reducing power-line and component-generated noise. The fact that we've been able to work in two industries that use measurement and observable metrics to calibrate their systems gives us an advantage when advancing the technologies we develop.

In electrophysiology, if there is significant noise present when a low-amplitude heart signal appears on a monitor, the noise appears *as part of the heart signal*. This visible noise will obscure changes in a patient's heart rhythm, making the procedure more complicated. Removing the noise renders clean, easy-to-read variations in a patient's heart rhythm, improving the likelihood of a successful surgical outcome. Our experience developing products for a clinical discipline that uses objective measurement and imaging results have informed the work we do in audio and the recording industries.

Using this evidentiary template, we've been able to draw a parallel result for professional recording and music-playback systems. The same power-line noise that distorts the heart signal will also obscure the delicate timing and detail balance in a low-amplitude audio signal. By subtracting high-frequency RFI, EMI, and component-generated noise, recorded sound becomes immediately more dimensional and interactive, revealing layers of harmonic content that were previously obscured. We use multiple patented technologies including TAPc (Transverse Axial Polarizer), NIC (Noise Isolation Chambers) and others to reduce high-frequency interference and remove the patina of noise that distorts signals in the audio band. We currently work with a number of partners in the recording industry that have used null testing and measurement to confirm dramatic drops in noise across the frequency spectrum after applying our products.

Among Shunyata Research's 12 patents, more than half are devoted to removing power-line, EMI, RFI, and noise generated by the electronics system. All Shunyata Research's patented technologies have the *subjective effect* of reducing perceived background noise, but what people are really hearing is a more linear, more fully realized audio signal. Even when a system is pushed to a higher volume level, Shunyata Research-powered systems render a clear perception of reduced compression, hardness, or the edginess a listener might attribute to shortcomings within the electronics or speakers. In reality, these and other distortions are caused by unaddressed power-line and component-power-supply-generated noise. Our design template starts at the component and works outward, rather than the more traditional brickwall approach to power conditioning that focuses more on noise being generated far outside the reproduction chain.

MUSIC COMES ACROSS WITH GREATER IMPACT AND THREE-DIMENSIONAL PRESENCE AS IF MORE FORCE WERE BEING APPLIED BEHIND THE SIGNAL.

What are the audible benefits of a lower noise floor?

The easiest-to-hear improvement should be an immediate increase in the clear definition of instruments and voices framed by the recorded space that surrounds them. Even on the most complex program material, sound should come across as unconstrained and pure, free of highlighted elements that draw attention away from the performance. The *attack* of a note, or what some engineers term the first-order harmonic, should sound effortless as it seamlessly transitions into the color, texture, and tone of instruments and voice. Characteristic instrumental signatures and the small changes in amplitude within recordings should become more fully developed, less truncated or blurry. This newfound detail should become clearly audible once the noise-related distortion that blurs this content is removed. The newfound absence of noise should include a clean rendering of soundstage width and depth as notes and voices fall into the silence of the recorded venue. The separation of each character in a recording should be framed as distinct and apart from other instruments or voices. There should be a sensory impression that the resolution of the program material has been expanded,more easily enveloping the listener in sound. Finally, music and sound should come across as fluid, unforced and with greater dynamic headroom. Nuances within quiet passages should appear and fade as if recently added to a familiar recording.There will be a noted reduction of perceived compression, hardness, or artificial edge on recordings that can distract from the experience, even if sound levels are pushed beyond their previous limits.

Most audiophiles have a mistaken view of noise, thinking of it as a separate component that rides beneath the music when, in fact, the noise is superimposed on the audio signal. How do you think of the noise component of an audio signal?

We've found that proximally generated noise, due to its nearfield intensity and complexity, will distort and blur information embedded in the audio or visual signal. Even experienced recording engineers might blame their sources, amplification, or monitors as being in need of an upgrade rather than suspecting power-line or component-to-component interference, which we abbreviate as CCI. Many professionals don't realize the resolution their system is capable of until these forms of noise are removed. Once this noise is dealt with, many have chronicled to us dramatic improvements in the program material they are recording or producing. At Woodland Studio in Nashville, for example, David Rawlings found that adding our Everest-X eliminated the higher-frequency noise peaks they had measured when using their analog tape machine, so they now use Everest-X to power their analog deck and the lathe's cutting amps. Rick Rubin's Shangri-la studio, David Gilmour's Astoria, and others have commented on consistent, dramatic results over many years, giving us confidence that we are on the right path in terms of our design approach.

There are, of course, audible forms of noise that can be heard as separate from reproduced sound, but proximal noise is more insidious because its effects are not easily identified until it is removed. This is why the signal-altering effects of nearfield noise can be misdiagnosed as a problem elsewhere in the system.

We've had the good fortune to work within different industries that have access to cost-no-object measurement tools and arguably some of the best critical listeners in the pro ranks. We've been able to see and hear the effect noise has on a low-level signal. These partnerships have sharpened our skill set. We'll continue to develop technologies that elevate systems where the resolution of images, data, and sound is *the* critical mission. tas

Caelin Gabriel is a former US military research scientist with a background in the design of ultra-sensitive data-acquisition systems. These systems were designed to detect extremely low-level signals otherwise obscured by random noise. Gabriel has devoted decades of intensive research into the sources and effects of signal and power-line noise interference.Gabriel's subsequent work experience included work for DARPA. Caelin Gabriel has been granted more than 12 patents with others pending, protecting the unique sciencebehind Shunyata Research products.