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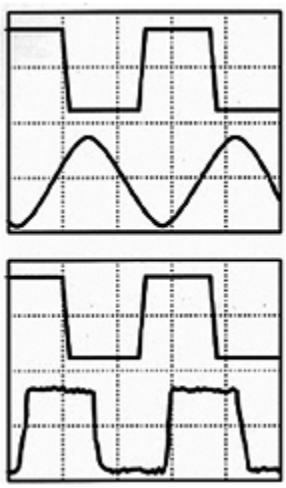
The Future of Sound: SACD

By EDWARD JAY EPSTEIN

Mark Levinson, the arch guru of ultra hi-fi musical reproduction, has stopped recording music on conventional CDs. He no longer even listens to them. And, while his name still is burnished on some of the world's most expensive CD players -- the Mark Levinson Reference CD Player, for example -- by a company which bought his brand, and name, years ago, he discourages clients at his own company, Red Rose Music, from buying conventional CD gear. Instead, he records all his music in the new Super Audio CD format (SACD) and recommends to his customers that, if they want digital music, they buy SACD players.



The top graph shows digital input (top line) and sound output in PCM; the bottom graph, in SACD.

SACD, which was recently launched in America by Sony and Philips, the same partnership that, a quarter century earlier, developed and patented the CD, is identical to the CD in its dimensions and appearance but has a different and far superior way of encoding and decoding digital sound.

Mr. Levinson explains that this change is crucial to the future of digital sound. "SACD addresses what has become an international epidemic: PCM." PCM, which stands for Pulse Code Modulation, is the operating system used for all digital sound -- CDs, movies, television, DVDs, computers, etc. -- with the exception of SACDs. Mr. Levinson's concern about PCM goes beyond the quality of the music it reproduces. He believes that PCM induces toxic stress in listeners.

The Sony executives responsible for marketing this new format do not share Mr. Levinson's view about the toxicity of PCM. But they acknowledged that there were sonic problems with PCM, which had resulted in reports of "listening fatigue," as David Kawakami, who directs the Super Audio project for Sony, put it to me. All agreed that SACD was vastly superior. So why had PCM become the standard for digital sound?

Mr. Kawakami explained that PCM had come about as an engineering solution to "a bit-management problem." In the early 1980s, Sony stipulated two requisites for developing digital sound. First, the container itself, which was the CD disk, could not be more than 4.75 inches in diameter -- a dimension that would allow CD players to meet the European standard for an audio player on an automobile's dashboard. This meant, given the state-of-the-art technology then, that the CD could not hold more than 650 million bits of data. Second, it had to be capable of playing at least 70 minutes of music -- the length of a typical symphony -- which required more than 2.5 billion bits of digital data.

To meet these seemingly contradictory requirements, part of the signal had to be eliminated, but without degrading the sound so much that it became unacceptable to the public. Enter PCM. This ingenious electronic fiddle truncated the original bandwidth from 100,000 to 20,000 hertz, since humans cannot normally hear frequencies above 15,000 hertz, and "sampled," or took a digital snapshot, of the remaining information 44,000 times a second. This doctored data was repackaged into 16-bit packets capable of playing back a symphony in 74 minutes or less.

Of course, the acoustical engineers who invented PCM knew that the condensed 16-word product would be inferior to the original: For one thing, filters, on both the encoding and decoding ends, cause audible "errors." For another, chopping out all the information between 20,000 and 100,000 Hertz reduced the harmonic depth of the music itself.

Still, PCM did provide a highly convenient means of getting sound, or its approximation, to the masses. Sony, with its partner Philips, gradually managed to convince enough people that the PCM CD offered superior sound to LPs and that its aural replication of music was . . . perfect. They and their licensees have so far sold roughly one billion CD players and 20 billion CDs.

Some diehard audiophiles refused to settle for the Procrustean world of PCM. They spent as much as $10,000 and more for digital-to-analog converters designed to ameliorate the filtering errors in PCM. But even the most expensive outboard digital gear could not restore the missing bandwidth. By the mid-1990s, however, digital sound technology had taken a giant step forward, enabling Sony to exorcise the PCM demon.

The answer was already for sale in every consumer electronics store in the world: the DVD. Originally developed to store digital video, the DVD player had a laser which could read marks packed much closer together than those on an audio CD. As a result, a DVD could store about eight times as much data as the CD. Indeed, there was more than enough room on a DVD to directly stream in single bits of a digital record of the sound of a 74-minute symphony, sampled 2.8 million times every second. The difference is evident when one listens in the Sony studio through earphones to the actual digital bitstream. With PCM, all that is heard is a hash of hisses. With SACD, so closely did this digital stream approximate the original that one can actually hear the music. And since this streaming did not need to be repackaged into 16-bit words or truncated at all, no digital filtering was used. It conveyed the entire bandwidth, audible or inaudible, up to 100,000 hertz.

Aside from being closer to the music (see accompanying graphs), it was simpler than jerry-rigged PCM and, therefore, cheaper to implement. The Super Audio project, under Mr. Kawakami's direction, was quickly green-lighted.

By this fall, Sony, once again partners with Philips, plans to sell SACD players for under $300. They will also be backwardly compatible with conventional CDs so that consumers can play the CDs they already own. Some 200 SACDs have already been issued.

Being an early adopter, I bought an SACD player as soon as it was available. But then I discovered my very expensive ($10,000) pre-amp redigitalized the SACDs into PCM. Aside from this sophisticated circuitry, there was the problem of the volume control. Like that of many other pre-amps, mine filtered out all bandwidth over 20,000 hertz. That is because, before the introduction of SACD, sonic information over 20,000 hertz would be heard as unintended noise. So I still was not getting the full benefit of SACD.

Surfing the Internet with key words like "audiophile" and "volume control," I then found in Boise, Idaho, something called a passive volume attenuator, made by Placette Audio and sold for $1,400. By using several dozen precision resistors, costing about 300 times as much as a conventional volume control, the Placette was capable of controlling the volume from the SACD without filtering out any of its bandwidth.

Once I had hooked up my Placette, I was finally able to listen to unadulterated PCM-free music. I listened on available SACDs, selling for about $25 -- everything from jazz and church choirs on the DMP sampler I bought to classical Bach on an acoustical guitar and a Rupert Brooke poem, read by "Sex and the City" actress Kim Cattrall (who is Mark Levinson's wife) on Red Rose Music's sampler.

After two weeks of listening, and comparing CD and SACD tracks of the same original recording, I can say unequivocally that I have heard the future, and it is SACD.