

how it works

THE LAST ISSUE OF *EDN* DISSECTED THE PDAUDIO-CF SOUND CARD, WHICH TACKLES DIGITAL-DOMAIN CONVERSIONS. THIS CONCLUDING WRITE-UP DISCUSSES THE OTHER HALF OF THE PDAUDIO-HARDWARE CHAIN, MIC2496, ALONG WITH THE SYSTEM SOFTWARE THAT COMPLETES THE SYMPHONY.

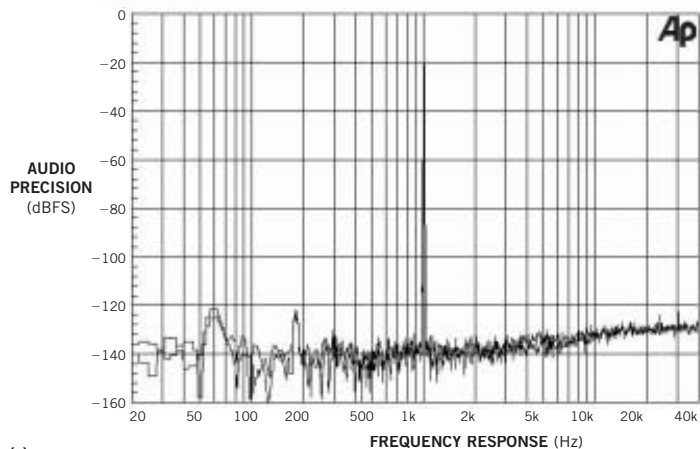
Sound savings: Portable audio recorder takes on tape, part 2

By Brian Dipert, Technical Editor

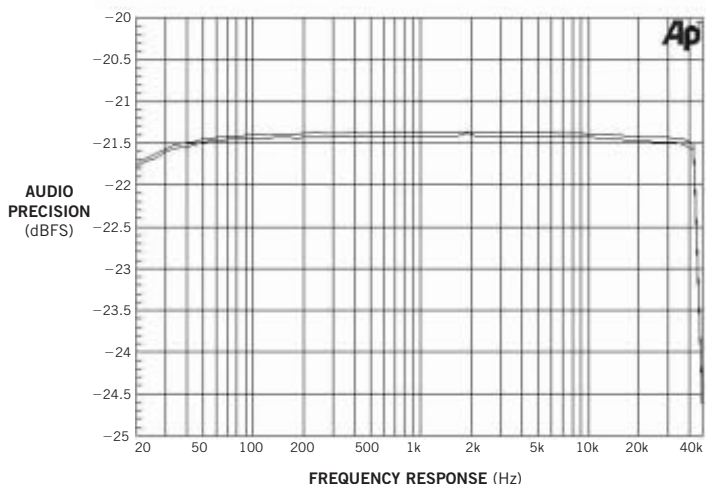
FOR USERS WHO DON'T OWN the necessary analog-centric and analog-to-digital-conversion gear necessary to transform the signals coming out of their microphones or who want to upgrade

their setup to capture high-resolution audio, Core Sound has developed the less-than-\$500, dual-channel Mic2496. Powered by a single 9V battery, Mic2496 generates 48V phantom power for the microphones (if required) and boosts the microphones' outputs through an ultra-low-noise preamp (Figure 1a). Level-adjustment controls combine with LED-"clipping" indicators, and the A/D converters deliver sampling rates as high as 96 kHz and output their data over both coaxial and optical-S/PDIF connections (Figure 1b). Footprint-compatible, 192-kHz ADCs, which only recently became available, will enable Core Sound to develop a higher end unit if demand warrants such a move.

Len Moskowitz, the owner of Core Sound, which has long catered to the audio-recording community, estimates that Mic2496 will run for approximately six hours on a fully charged battery if the microphones are self-powered. Phantom-power draw can reach 10 mA per channel and may notably reduce the battery-powered operating life. Mic2496 includes both a low-battery LED indication and provision for powering via an external ac adapter or battery pack. In designing Mic2496,



(a)



(b)

Figure 1

Mic2496's noise (a) and frequency response (b) curves speak highly of its capabilities (courtesy Core Sound).



Figure 2 Recording software from Gidluck Mastering (a), Pocco Software (b), PocketREC (c) and X-Art (d) lead PDAudio's charge into Pocket PC territory.

Recording software from Gidluck Mastering (a), Pocco Software (b), PocketREC (c) and X-Art (d) lead PDAudio's charge into Pocket PC territory.

Moskowitz faced the decision of whether to employ linear voltage regulators, which have low noise but exhibit 40 to 50% efficiency loss, or switching regulators, which have high efficiency but also higher noise than linear alternatives. Core Sound chose a partitioned design that employs both linear and switching-regulator-powered subsystems; the linear portion is for low-draw, high-gain circuits that require a clean power source, and the switching portion is for higher current but more noise-tolerant parts of the design.

Moskowitz's technical background both as a staff engineer and as an engineering manager aided him in determining what portions of the PDAudio project he could tackle himself (the architecture definition) and which areas were best left to others (the specifics of the hardware and software design). Un-

willing to hire and directly manage a design team, he submitted a request for proposal to several companies and accepted a quote from Elan Digital Systems, which developed both PDAudio-CF and its WDM (Windows Driver Model) and Pocket PC drivers. The WDM drivers are compatible with a diverse list of Windows 98SE, ME, 2000, and XP audio applications (see sidebar "Taking a test-drive").

A GLOBAL EFFORT

The developers writing Pocket PC-audio applications are Pocco Software from Canada, X-Art in Australia, and US-based PocketREC and Gidluck Mastering, whose Live2496 program I've written about (Figure 2 and Reference 1). For Linux, programmers from SuSE in Czechoslovakia are doing the driver development, targeting the ALSA (Ad-

TAKING A TEST-DRIVE

An audio-recording aficionado, I began my hobby with a Sony TCD-D8 portable DAT (digital-audio-tape) deck and a set of binaural "stealth" microphones, but my equipment suite has since expanded. My microphone collection now includes a dual-channel cardioid Audio-Technica AT825 and a set of Oktava MC012s with matched cardioid, hypercardioid, and omnidirectional capsule sets. A Denecke PS-2 portable phantom-power supply powers the microphones, and one of four units amplifies and sometimes also digitizes their signals. These units are a Denecke AD-20, Griffin Technology iMic, Sony SBM-1, and Sound Professionals SP Preamp. The list of options for capturing the audio has also grown from its TCD-D8 foundation (Figure A). I now own a Sony

PCM-R300 full-size DAT recorder, along with a Sharp MD-MT15 MiniDisc recorder. My Creative Labs Nomad Jukebox 3 is seeing increasing use, including at last fall's Austin City Limits music festival in Austin, TX, and at an EDN editorial meeting in San Francisco during this spring's Embedded Systems Conference. When I don't need an ultracompact platform, though, I increasingly turn to a notebook computer, such as my NEC Versa UltraLite, coupled with a Digigram VxPocket sound card and software, such as Sonic Foundry's Sound Forge or Syntrium's Cool Edit Pro.

As such, I bring some expertise to bear on a hands-on evaluation of Core Sound's PDAudio components, which Core Sound owner Len Moskowitz is putting the final polish on before production.

PDAudio-CF, which I will couple with my Denecke and Sony-combination microphone preamp and A/D-converter units, will come first. When Mic2496 arrives, I'll do some high-resolution recordings. Regularly visit this sidebar on the Web version of this article at www.edn.com for updates and samples of my results. I'll test the PDAudio system with my notebook PCs, running Windows 2000 and Windows XP Professional, and with my Pocket PC 2002-based iPaq 3835. For the Pocket PC, I've purchased the iPaq dual-slot PC Card-expansion pack, which embeds two 950-mAhr supplemental batteries and will allow me to simultaneously use PDAudio-CF and a high-density PCMCIA or CompactFlash storage device.



Figure A

I've got a plethora of recording options at my disposal.

vanced Linux sound architecture). PDAudio-CF driver source code and a user guide will be freely available to third-party audio-software developers, and Core Sound also plans to open-source the Linux-based PDAudio Recorder application (Figure 3).

PDAudio-CF will transfer incoming S/PDIF information at any supported sample rate and size to the system for subsequent processing. It's left to application software to be aware of the system capabilities and limitations and to appropriately handle audio that falls outside those boundaries. Possible actions, dependent on available processing horsepower and also bounded by system-battery-life goals, include rate- and -size-reducing the audio samples or simply displaying an error message that indicates that the user should adjust the operating parameters of the A/D converter before reattempting recording.

How much storage space will you need to use the PDAudio system? Dual-channel, 16-bit, 48-kHz recordings require slightly less than 700 Mbytes of storage per hour. Triple that figure for 24-bit, 96-kHz audio capture, and double it again for 192-kHz-sampled sound. These figures might at first glance seem extravagant, but consider that 512-Mbyte Secure Digital, 1-Gbyte CompactFlash, and 5-Gbyte PCMCIA cards are widely available, and higher density offerings are due to appear by year-end. Manufacturers are also now shipping 60-Gbyte, 2.5-in. hard-disk drives, enhancing the appeal of notebook PCs as high-resolution audio-capture and -editing devices.

Moskowitz extols the virtues of Internet-based research, low-cost programmable-intellectual-property cores and de-

velopment tools, and the open-source-software community; all have been a significant help during the definition and development stages of PDAudio. In addition to the organizations previously mentioned, other Internet resources that he and I find particularly helpful include discussion groups, such as DAT-Heads (www.solorb.com/dathheads/), Etree (www. etree.org/); Laptop-Tapers (<http://groups.yahoo.com/groups/laptop-tapers>), and the Oade Brothers forums (www.oade.com/Tapers_Section/); newsgroups such as alt.audio.minidisc and the rec.audio.* family; and Web sites such as Ecasound (www.wakkanet.fi/~kaiv/ecasound/), Handhelds.org (www.handhelds.org/), the Linux Audio Users Guide (www.djcj.org/LAU/guide/index.php), and Sound and MIDI Software for Linux (<http://sound.condorow.net/>). □

REFERENCE

1. Dipert, Brian, "Software tackles tough times with 'sound' savings," *EDN*, Sept 5, 2002, pg 20.

AUTHOR'S BIOGRAPHY

Technical Editor Brian Dipert is looking forward to toting his gear to concerts such as the High Sierra Music Festival and the Seattle Bumbershoot Festival. Contact him at 1-916-454-5242, fax 1-617-558-4470, bdipert@edn.com, and www.bdipert.com.



Figure 3

Core Sound's plans extend to the Linux environment, too.

FOR MORE INFORMATION...

For more information on products such as those discussed in this article, go to www.edn.com and click on the Reader Service link under the Tools & Services section. When you contact any of the following manufacturers directly, please let them know you read about their products in *EDN*.

Core Sound

1-201-801-0812
www.core-sound.com
Enter No. 316

OTHER COMPANIES MENTIONED IN THIS ARTICLE

Audio-Technica

www.audio-technica.com

Creative Labs

www.creative.com

Denecke

www.denecke.com

Digigram

www.digigram.com

Elan Digital Systems

www.elandigitalsystems.com

Gidluck Mastering

www.shoptheozarks.com/
GGM

Griffin Technology

www.griffintechnology.com

NEC

www.nec.com

Kludge Audio

www.techwood.org/kludge

Oade Brothers

www.oade.com

Oktava

<http://oktava.tula.net>

Pocco Software

www.poccosoftware.com

PocketREC

www.pocketrec.com

Sharp

www.sharp-world.com

Sonic Foundry

www.sonicfoundry.com

Sony

www.sony.com

Sound Professionals

www.soundprofessionals.com

SuSE

www.suse.com

Syntrillium Software

www.syntrillium.com

X-Art

www.x-art.at

SUPER INFO NUMBER

For more information on the products available from all of the vendors listed in this box, enter no. 317 at www.edn.com/info.