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The dCS Vivaldi System

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dCS Vivaldi

DIGITAL PLAYBACK SYSTEM

More than a decade ago, Data Conversion Systems, aka dCS, released the Elgar Plus DAC, Purcell upsampler, and Verdi SACD/CD transport, for a total price of $34,000. In 2009 came the Scarlatti—a stack of four components for $80,000, also available individually (see my August 2009 review at http://tinyurl.com/mljelle). The latest variation on the English company's theme are the four Vivaldi components, launched at the end of 2012 for a total price of $108,496.

The Scarlattis improved on the Elgar Pluses in cosmetics and, more important, technical and sonic performance that, in the opinion of many, put it at the top of the digital audio heap. It will be obvious to those familiar with the Scarlatti stack that the Vivaldis take visual appearance and fit'n'finish

SPECIFICATIONS

dCS Vivaldi Upsampling SACD/CD transport Drawer-loading, dual-laser SACD/CD transport with remote control, PCM outputs, and encrypted DSD or DXD datastream output via dual AES/EBU (XLR). Digital outputs: 3 AES/EBU (XLR), 1 BNC, 1 RCA coaxial S/PDIF; SDIF2, BNC. Word clock In/Out, SUC multipin connector for RS-232 control. Includes BNC and AES/EBU cables. **Dimensions** 17.5" (444mm) W by 7.8" (198mm) H by 17.2" (437mm) D. Weight: 51.1 lbs (23.2kg).
Serial Number of Unit Reviewed VTT0S21C11D1S079650 (listening), VTT0S21B21D1S019174 (measuring).
Price $39,999.
dCS Vivaldi DAC D/A processor with 5-bit, 2.822 or 3.07MS/s oversampled, dCS-patented Ring DAC topology, switchable reconstruction filters, remote control, integral digital volume and balance controls. Inputs: 4 AES/EBU XLR, 2 RCA, 1 BNC, 1 TosLink, SDIF-2 on BNC, USB-B, 3 word clock on BNC . Digital output: word-clock BNC. Analog outputs: XLR balanced, RCA single-ended. Sample rates: 32, 44.1, 48, 88.2, 96, 176.4, 192kHz on single-wire interfaces and SDIF-2/word-clock input, auto-selected; 88.2, 96, 176.4, 192kHz, DSD, DXD, LPCM at 258.2 and 384kHz on dual AES interface, auto-selected. Frequency responses (filter 1): Fs=32kHz, 10Hz-15kHz, +0.1/–0.5dB; Fs=44.1 or 48kHz, 10Hz–20kHz, ±0.1dB; Fs=88.2 or 96kHz, 10Hz–20kHz, ±0.1dB; Fs=176.4 or 192kHz, 10Hz–20kHz, ±0.1dB; DSD, 10Hz–20kHz, ±0.1dB. **Dimensions** 17.5" (444mm) W by 6" (152mm) H by 17.2" (437mm) D. Weight: 35.65 lbs (16.2kg).
Serial Number of Unit Reviewed VDC0S21C1C11D1S109659 (listening), VDC0S21B11D1S019202 (measuring).
Price $34,999.
dCS Vivaldi Master Clock Class 1, temperature-compensated master clock with dual VCXO. Clock frequencies: 44.1, 48, 88.2, 96, 176.4, 192kHz. Clock accuracy: better than ±1ppm when shipped (guaranteed for 12 months from shipping date), typically ±0.1ppm when shipped and stabilized. Word-clock outputs: 8 in two groups of 4, independently buffered, on 75 ohm BNC connectors. Reference input: external reference input on one 75 ohm BNC connector. Accepts word-clock or AC-coupled signals at 32, 44.1, 48, 88.2, or 96kHz; or 1, 5, or 10MHz. Lock range: ±300ppm. Start-up time: typically 1 minute to rated accuracy. **Dimensions** 17.5" (444mm) W by 5" (127mm) H by 17.2" (437mm) D. Weight: 29.9 lbs (13.6kg).
Serial Number of Unit Reviewed VCK0S21B21D1S019183 (listening), VCK0S21B21D1019119 (measuring).
Price $13,499.
dCS Vivaldi Upsampler Digital-to-digital processor with switchable upsampling filters (4), upsamples input data to high-sample-rate PCM (up to 384kHz), DSD (1-bit data at 2.822MHz). Inputs: asynchronous USB1, USB2.0, S/PDIF RCA (x2), S/PDIF BNC, S/PDIF TosLink optical, AES3/EBU, word-clock In/Out, SDIF-2 BNC. Outputs: AES/EBU (x2) configurable as single or dual link, S/PDIF RCA, S/PDIF BNC, SDIF-2 BNC. **Dimensions** 17.5" (444mm) W by 5" (127mm) H by 17.2" (437mm) D. Weight: 31.3 lbs (14.2kg).
Serial Number of Unit Reviewed Not found (listening), VUP0S21B31D1019124 (measuring).
Price $19,999.
All Four Finishes Silver or Black.
System Price $108,496. Approximate number of dealers: 14. Warranty: 3 years, parts & labor, from date originally shipped from dCS, to original owner only.
Manufacturer dCS (Data Conversion Systems), Ltd., Unit 1, Buckingway Business Park, Anderson Road, Swavesey, Cambridge CB24 4AE, England, UK. US distributor: dCS America, PO Box 544, 3057 Nutley Street, Fairfax, VA 22031. Tel: (617) 314-9296. www.dcsltd.co.uk.

ERIC SWANSON

to new heights. These sculpted boxes in a silver matte finish, each with a unique, flowing wave pattern machined into its front panel, are pleasing to the eye and silky-smooth to the touch. Who said engineering geeks aren't sensual?

The four components are: the Vivaldi DAC ($34,999, slightly more than the original Elgar-Purcell-Verdi combo), which can decode *every* digital resolution, from MP3 to DSD to DXD (a 24-bit/358.8kHz PCM format used primarily for editing DSD files) and everything in between; the Vivaldi Upsampler ($19,999), which can upconvert the lowest-resolution MP3 data to 24/384, DSD, and DXD or any format in between; the Vivaldi Master Clock ($13,499), containing two groups of four clock outputs, which can be independently set; and the Vivaldi Transport ($39,999), a smooth, quiet, quick-booting SACD/CD drive based on TEAC's Esoteric VRDS Neo disc mechanism, considered by many to be the world's finest.[1] This is controlled by dCS-designed signal-processing electronics, and can also upsample CDs to DSD or DXD.

The total price is an astronomical $108,496, though of course you could start with just the DAC and save $73,497. Considering the cost of some preamplifiers, audiophiles with only a single source component can drive their power amplifier directly with the Vivaldi DAC, which has a digital-domain volume control, and save the cost of a standalone preamp.

Most audiophiles prepared to drop $35k on a DAC will head straight for the full stack, I feel, especially those who want to add a music server, since the Upsampler includes an Ethernet connection for network streaming via UPnP. (dCS makes available a free iPad app to work with UPnP-based servers.) While both the DAC and the Upsampler have an asynchronous USB-B port, to allow them to accept audio data from a computer, the Upsampler also has a USB-A port, for use with USB flash drives or i-Devices. The USB-B ports can operate in Type 1 mode, with data sampled up to 96kHz, or in Type 2 mode, which allows DSD and PCM up to 192kHz to be streamed to the Vivaldis. Type 1 operation doesn't require a driver program for Windows PCs or Macs; Type 2 operation doesn't need a driver with Mac OS10.6.3 or later; dCS supplies a driver program for Type2 operation with Windows XP and Windows 7. (They say that it will work with Windows 8 in Windows 7 compatibility mode.) The dCS driver is not compatible with ASIO-type drivers, which will need to be uninstalled.

While continuing to offer a transport option for those with large collections of CDs and SACDs, dCS has configured the Vivaldi for the discless future.

In other words, while continuing to offer a transport option for those with large collections of CDs and SACDs, dCS has configured the Vivaldi for the discless future—already the present

1 Why should a disc drive be so expensive? dCS claims that they pay about $5000 for each raw TEAC transport; if you do the usual fivefold "parts cost to retail" math, that's $25,000—then you have to add the chassis, the electronics, and the rest.

MEASUREMENTS

For logistical reasons, I measured different samples of the four Vivaldi components—transport, upsampler, master clock, D/A processor—from those auditioned by Michael Fremer. (The serial numbers can be found in the "Specifications" sidebar.) I examined the dCS Vivaldi system's electrical performance with *Stereophile*'s loan sample of the top-of-the-line Audio Precision SYS2722 system (see www.ap.com and the January 2008 "As We See It," http://tinyurl.com/4ffpve4). Both the Vivaldi DAC's and the Vivaldi Upsampler's performance via their USB ports was tested using my 2012-vintage Apple MacBook Pro.

Looking first at the Vivaldi SACD/CD transport, this offered almost the best error correction/concealment I have encountered. (The best is the Parasound Halo CD 1, which I reviewed in the December 2013 issue.) The Vivaldi played every track on the Pierre Verany *Digital Test* CD without glitches or muting until it reached track 38, which has 4mm gaps in the data spiral. The Transport recognized the pre-emphasis flag both on pressed CDs and on the CD-R with which the Parasound Halo CD 1 player had problems.

Turning to the Vivaldi DAC, Apple's USB Prober utility identified it as having the Product String "dCS Vivaldi DAC USB Audio 2" from "Data Conversion Systems Ltd"; the Vivaldi Upsampler was identified as "dCS Vivaldi UPS Audio Out." USB Prober confirmed that both products' USB inputs operated in the optimal isochronous asynchronous mode. The AES/EBU input locked successfully to data having sample rates up to 192kHz, with the dual-AES/EBU input handling DSD data and PCM data with sample rates up to 384kHz.

The maximum level at 1kHz from both balanced and single-ended outputs was 2.035V with the level set to "2V," 6.013V with it set to "6V." Both sets of outputs preserved absolute polarity (*ie*, were non-inverting), with the musical-note icon on the Settings screen right-side up. (The XLRs are wired with pin 2 hot.) The balanced output impedance was very low, at 2.3 ohms from 20Hz to 20kHz, including the series resistance of 6' of cable. The single-ended outputs had a higher source impedance, at a uniform 51 ohms, which is still low in absolute terms.

The Vivaldi DAC offers a choice of six reconstruction filters for data

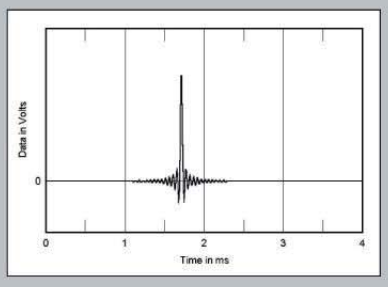

Fig.1 dCS Vivaldi DAC, Filter 1, 44.1kHz impulse response (4ms time window).

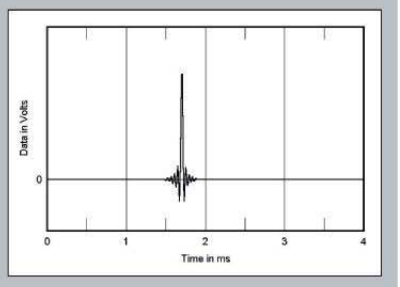

Fig.2 dCS Vivaldi DAC, Filter 4, 44.1kHz impulse response (4ms time window).

for some, particularly those who never got into SACDs—though it will still be some time before downloadable DSD content catches up with what's already available on disc.

Major Changes Inside

Compared with the older products, the structural rigidity of the Vivaldi components' cases has been upgraded, including top plates of thick aluminum into which are machined asymmetrical cavities that contain damping pads. The combination is said to reduce vibrational modes. But the Vivaldi DAC's insides have been given far more than a cosmetic makeover.

While dCS's products have all been based on the company's proprietary Ring DAC technology, the Vivaldi is based on a complete revision of the Ring DAC concept. The earlier Ring DAC used quad latches (a circuit element that can be instantaneously "flipped" between two stable states) to select current sources based on metal-film resistors. The new Ring DAC design still includes high-speed latches and metal-film resistors, but instead uses individual latch chips said to eliminate between-latch, on-chip crosstalk resulting in lower jitter. The total number of latches has been increased to make better use of the Ring DAC's available dynamic range. A pair of high-speed, software-updatable field-programmable gate arrays (FPGAs) replaces the Scarlatti's mapping ROM chips, which allows individual errors in the DAC's current sources to be randomized, reducing the level of distortion and spuriae by 3dB.

The Vivaldi DAC's and Upsampler's digital-processing platform, which runs dCS-developed and -maintained code that forms the core of the entire operating system, has been completely upgraded, including use of a single FPGA chip with more than twice the capacity of the previous two chips combined. These FPGAs are programmed from flash memory each time the DAC powers up, so that performance improvements, or new Ring DAC operating modes, can be added with a firmware update.

The Ring DAC's array of latches can be seen in the center of the bottom board, with the two large FPGA chips to their left.

The Vivaldi DAC's analog circuitry has been redesigned for reduced DC offset, lower noise, and less crosstalk. The completely dual-mono architecture is claimed to improve left/

measurements, continued

with sample rates of 44.1, 48, 176.4, and 192kHz, but only four for data sampled at 88.2 and 96kHz. Fig.1 shows the impulse response of Filter 1 with 44.1kHz data. The symmetrical ringing either side of the pulse maps the filter coefficients and reveals this filter to be a conventional linear-phase type. Filters 2–4 have increasingly shorter linear-phase impulse responses (fig.2 show Filter 4's impulse response), while Filter 5 (fig.3) is a minimum-phase type, with all the ringing following the pulse. Filter 6 (not shown) has similar time-domain behavior to Filter 1.

Fig.4 shows a wideband spectral analysis of the Vivaldi DAC's output with it set to Filter 1 and decoding 44.1kHz data representing a 19.1kHz tone at 0dBFS (cyan and blue traces) and white noise at –4dBFS (magenta and red).[1] The noise signal reveals that the filter rapidly rolls off the output above the audioband, reaching the noise floor at the Nyquist frequency, or half the sample rate. There is no trace of the image of the 19.1kHz tone at 25kHz (44.1–19.1kHz) above the 16-bit noise floor, and the second and third harmonics of the 19.1kHz tone lie at almost –110dBFS (0.0003%). Filters 2–4 offer increasingly slower rolloffs above the audioband, with Filter 4 (fig.5) allowing the 25kHz image to lie just 10dB below the level of the 19.1kHz tone and filling the audioband with spurious tones. It should be noted, however, that despite this slow rolloff, Filter 4 still doesn't offer the time-domain–optimized behavior of, for example, the famed Wadia Digimaster filter. Although it is a minimum-phase type, the Vivaldi DAC's Filter 5 (fig.6) offers identical image suppression to

1 My thanks to Jürgen Reis of MBL for suggesting this means of displaying the performance of a DAC's reconstruction filter.

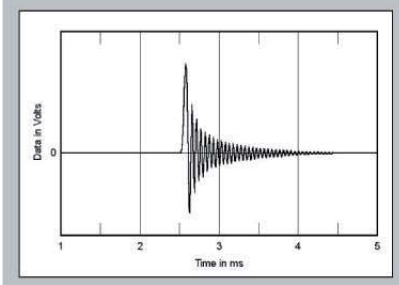

Fig.3 dCS Vivaldi DAC, Filter 5, 44.1kHz impulse response (4ms time window).

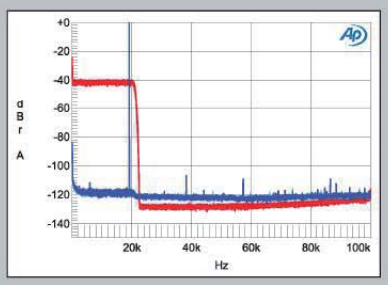

Fig.4 dCS Vivaldi DAC, Filter 1, wideband spectrum of white noise at –4dBFS (left channel magenta, right red) and 19.1kHz tone at 0dBFS (left cyan, right blue), with data sampled at 44.1kHz (10dB/vertical div.).

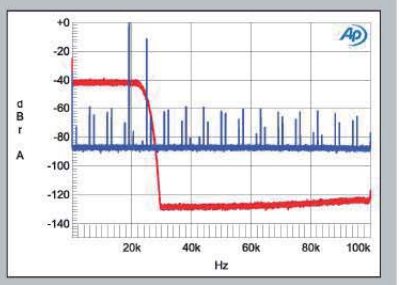

Fig.5 dCS Vivaldi DAC, Filter 4, wideband spectrum of white noise at –4dBFS (left channel magenta, right red) and 19.1kHz tone at 0dBFS (left cyan, right blue), with data sampled at 44.1kHz (10dB/vertical div.).

The Vivaldi Transport's rear panel adds SPDIF-2 BNC jacks to its three AES/EBU outputs, as well as Word Clock I/O.

right crosstalk by 15dB at 20kHz. New, higher-output mains transformers in all of the Vivaldi components run cooler than in earlier dCS products, and are mounted on specially damped subchassis to eliminate vibrations. Even the transport has been given a serious mechanical upgrade, which is claimed to reduce the level of acoustic noise by a significant 10dB.

The Vivaldi stack's exterior elegance sacrifices some user-friendliness: the small buttons and their even smaller labels aren't backlit, so if you like doing your digital business in the dark, or even in moderate light, keep a flashlight handy.

The non-backlit remote control suffers a similar problem. While it's a heavy, nicely made piece of aluminum finished pleasingly for the hand, its brushed-aluminum surface makes it difficult to read the labels just below the unmarked buttons unless it's angled just so to reflect any available light. But when you do that, the reflected glare makes the buttons that *are* marked hard to read.

Setup and Use

Setting up the Vivaldi system can be complicated, but when you spend almost $110,000 on a digital playback system, you can expect plenty of dealer help. The multi-cable system, featuring five AES/EBU cables—two each to connect the Transport and Upsampler to the DAC and a fifth to connect the Transport to the Upsampler—five word-clock connections, and four AC cords, is a cable manufacturer's dream.

But once everything has been set up for you, and the routing for each input and the many screen icons have been explained, you're on your own. Believe me, until you figure it all out and memorize the icons' meanings, you'll feel *lonely*.

Your options are then seemingly endless. For example, you can route the transport directly to the DAC via the dual AES/EBU connections, which will send DSD signals in their native format and, should you choose, upsample CDs to DSD or DXD—or you can send CD signals to the DAC via S/PDIF or AES/EBU and play them in their native resolution—or send CD data to the Upsampler via the single AES/EBU connection and, by selecting the Upsampler's AES input, play them back at 24/44.1 (the Upsampler automatically outputs at 24 bits)—*or* you can upsample the CD data *there* to high-resolution PCM or DSD.

The Vivaldi DAC has six filter options for PCM, with four more for DSD playback. dCS says that with PCM data, the first four filters give different tradeoffs between ultrasonic image rejection and impulse response. Filter 1 gives the most rejection, Filters 2–4 offer progressively relaxed image rejection and better time-domain performance. For data with sample rates from 176.4kHz to 384kHz, two extra filters are available, one with a Gaussian character, the other asymmetrical with almost no pre-

measurements, continued

that of the linear-phase Filter 1, as does Filter 6.

Fig.7 shows the frequency response of Filter 1, with sample rates of 44.1, 96, and 192kHz. With each rate, the output is flat to just below the Nyquist frequency, with then a rapid rolloff. Filters 2–4 offer increasingly slower rolloffs with each sample rate (not shown), while Filter 5 offers a restricted bandwidth with 192kHz data, reaching –6dB at 40kHz (fig.8, blue and red traces). Filter 6 extends the bandwidth with 192kHz data, the –6dB point now lying at 55kHz (not shown).

When the Vivaldi Upsampler is used to transcode 24-bit PCM data to DSD or the Vivaldi Transport feeds encrypted DSD data to it, the Vivaldi DAC offers a choice of four low-pass filters. Fig.9 reveals that the effect of these filters is to roll off the ultrasonic noise that results from the DSD format's noise shaping, with Filter 1 offering minimal rolloff (blue and red traces) and Filter 4, which dCS doesn't recommend for music playback, offering the most rolloff (green and gray). The traces in this graph were taken with original 44.1kHz data. Interestingly, when I used the Upsampler to transcode 24-bit/88.2kHz PCM data with the Vivaldi DAC set to DSD Filter 1, the traces were identical to the blue and red traces in fig.9. This suggests that while DSD encoding preserves the audioband resolution of 24-bit PCM, it actually has less resolution at ultrasonic frequencies.

The Vivaldi DAC's channel separation was superb, at >125dB in both directions below 1kHz (not shown), and still 118dB at 20kHz. The very low noise floor with 24-bit data can be seen in fig.10, with

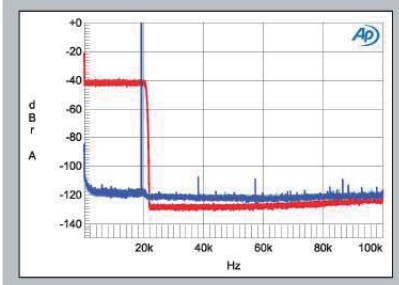

Fig.6 dCS Vivaldi DAC, Filter 5, wideband spectrum of white noise at –4dBFS (left channel magenta, right red) and 19.1kHz tone at 0dBFS (left cyan, right blue), with data sampled at 44.1kHz (10dB/vertical div.).

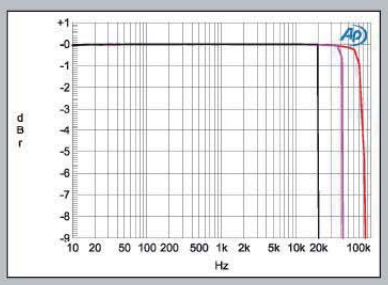

Fig.7 dCS Vivaldi DAC, Filter 1, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red) (0.5dB/vertical div.).

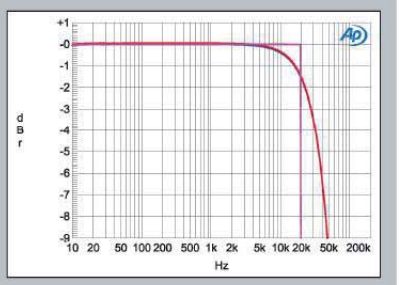

Fig.8 dCS Vivaldi DAC, Filter 5, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel cyan, right magenta), 192kHz (left blue, right red) (0.5dB/vertical div.).

ringing. With CD data, Filter 5 is also an asymmetrical type, Filter 6 a very sharp linear-phase type with pre-ringing. The DSD filters progressively roll off the format's ultrasonic noise, in case there are system synergy issues.

dCS recommends Filter 5 for CD playback, Filter 2 for 48, 88.2, and 96kHz-sampled data, Filter 6 for 176.4kHz data and above, and Filter 1 for DSD data. For this review, I stuck with Filter 1, which had been recommended by dCS distributor John Quick.

The Vivaldi DAC's rear panel offers every digital input other than Ethernet.

When the Vivaldi Upsampler and DAC are fed audio data via USB or the Upsampler via Ethernet, the incoming sample rate can be anything from 44.1kHz to 192kHz or even DSD. As the Vivaldi Master Clock has two independent groups of word-clock outputs, you can set one to 44.1 and the other to 48kHz; that way, you're less likely to get silence instead of music because the clock frequency isn't a multiple of the incoming bitstream's frequency. When they are connected by the dual-AES/EBU link, both the Vivaldi Upsampler and DAC correctly switch between the clocks for 44.1kHz and its multiples (including DSD) and 48kHz and *its* multiples.

For use with a UPnP server and control point, you'll need to set the Upsampler to its Network input. However, it turned out that my Meridian Digital Music Server was incompatible with the Vivaldi Upsampler, and could only be connected to the Vivaldi DAC via S/PDIF. John Quick therefore provided a "pre-filled" server running dCS's proprietary UPnP software.

I now had at my disposal my collection of SACDs, more than 3000 CDs, and 24/96 downloads on the Meridian, and a large collection of DSD files on a hard drive (also provided by Quick) that connected to my MacBook Air, in turn connected via USB to the Vivaldi Upsampler and the iPad-controlled server. I had the digital power!

The Digital Promise Finally Fulfilled?

Before doing any listening, I wondered how the Vivaldis' reproduction of PCM recordings would compare with that of MSB's Signature DAC IV with Diamond power supply ($43,325), which I'd borrowed along with their Platinum Data CD IV transport. (See Jon Iverson's review at http://tinyurl.com/dyctoth.) The MSB combo had produced the best digital sound I'd heard. It was clearly a leap forward from the dCS Scarlattis' playback of CD and hi-rez PCM recordings, particularly in terms of overall openness and three-dimensional, widescreen sound, minus the usual associated brightness and brittle transients.

With the MSB and Scarlatti systems no longer in my system, I couldn't perform direct comparisons. However, based on my

measurements, continued

all power-supply–related spuriae at or below –135dB and the random noise components mainly stemming from the analyzer's A/D converter. Astonishing! With a dithered 1kHz tone at –90dBFS, increasing the bit depth from 16 (fig.11, cyan and magenta traces) to 24 (blue and red) dropped the noise floor by 24dB, indicating that the Vivaldi DAC has at least 20-bit resolution, which is the state of the art. Linearity error with 24-bit data was nonexistent down to below –120dBFS, which, in conjunction with the low noise, allows it to perfectly reproduce an undithered 16-bit tone at exactly –90.31dBFS (fig.12). The waveform is perfectly symmetrical, the three DC voltage levels described by the data are perfectly resolved, and the time-symmetrical ringing from the linear-phase Filter 1 is clearly evident at the LSB transitions, even at this very low signal level. With Filter 5, the ringing clearly changes to the expected non–time-symmetrical type (not shown), and with 24-bit undithered data, the result is a superbly well-defined sinewave (not shown).

As good as the Vivaldi DAC's measured performance is in the digital domain, it is equally good in the analog domain. Fig.13 shows the output spectrum as the DAC drives a full-scale 50Hz tone at 6V into 600 ohms. The only distortion harmonics visible are the third, at –130dB (0.00003%) in both channels, and the second, at –126dB (0.00005%) in the left channel (blue trace). Intermodulation distortion was also vanish-

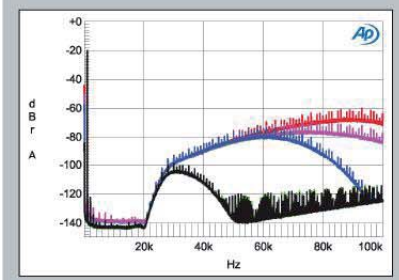

Fig.9 dCS Vivaldi DAC, spectrum of DSD-encoded 1kHz sinewave, DC–100kHz, at –20dBFS into 100k ohms with DSD Filter 1 (left channel blue, right red), DSD Filter2 (left cyan, right magenta), DSD Filter 3 (left cyan, right blue), DSD Filter 4 (left green, right gray) (linear frequency scale).

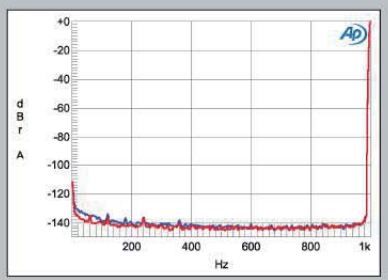

Fig.10 dCS Vivaldi DAC, spectrum of 1kHz sinewave, DC–1kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

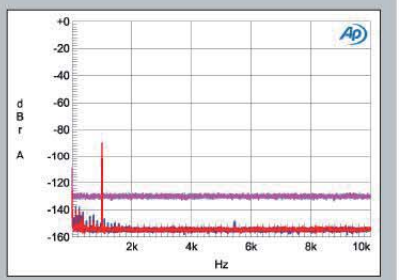

Fig.11 dCS Vivaldi DAC, spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red) (20dB/vertical div.).

aural memory, the Vivaldis immediately sounded more open and less reserved than the Scarlattis, which, while free of obvious digital artifacts, seemed to achieve that by hiding them in the folds of its warmish sound. Yet while sounding more open, transparent, and spacious, the Vivaldis still retained the Scarlattis' warmth and transient delicacy, minus their tendency to softness. The Vivaldis' overall sound was as nondigital, transparent, and—especially—as three-dimensional and spacious as I've experienced with digital. They also produced the most convincing musical textures I've yet heard from digital, 100% free of cardboardy or metallic artifacts.

No single overarching, obvious sonic character permeated every disc's or every source's sound: no bright overlay or etchy transient fingerprint that, once heard (usually quickly) in lesser gear, just can't be ignored.

Which is *not* to say, "Come back, Compact Disc—all is forgiven!" With hi-rez recordings at my fingertips, including some for which I also had the CDs, two things were clear: 1) While the best-engineered and -produced CDs can sound pretty good, CD sound pales next to SACD or hi-rez PCM; and 2) Those who trumpet CD's transparency and claim that higher resolution is inaudible are being guided by mathematical "proof"—not their ears, which for some reason they fail to trust.

The Vivaldi Upsampler's rear panel includes an Ethernet jack for use with uPnP-based servers.

I like to first evaluate a DAC using poor recordings. I'm not sure why, but I find that the more poorly recorded and/or mastered the recording, the more it spotlights a DAC's sonic character. Soft-sounding, poorly resolving DACs cover up recording flaws; harder, etchier, more analytical DACs make flawed recordings the audio equivalents of turning up a video display's Sharpness control.

The Band's *Live at the Academy of Music 1971: The Rock of Ages Concerts* (3 CDs, 1 DVD, Capitol UME 6 02537375271) features a new Bob Clearmountain mix of the original multitrack tapes, said to have been supervised by Robbie Robertson. It sounds nothing like either Mobile Fidelity Sound Lab's SACD or vinyl reissues, sourced from the original mix. Both the SACD and LPs sound relatively warm, with plenty of hall sound, along with the inevitable leakage from the stage monitors. They also emphasize bass and kick drums, at the expense of percussion and guitar transients and treble detail. You can comfortably turn up either the SACD or the LP to live performance levels.

The remix offers far more detail, particularly in the upper octaves. It's all about the guitars and cymbals, and it's *bright*, hard, and flat, with little sense of depth. It's threadbare in the bass—you can barely hear the kick drum, let alone feel it. The sonic balance reminds me of one of those thin, wiry, 1980s-era, coke-influenced mixes that for about half a decade ruined the sound of recorded music.

This new edition doesn't sound terrible at low levels, but if you try to play it at live SPLs, your ears will demand that you

measurements, continued

ingly low, although, as expected from the white noise/19.1kHz spectra discussed earlier, the rejection of the ultrasonic images resulting from an equal mix of 19 and 20kHz tones sampled at 44.1kHz depended on the reconstruction filter used. Filter 1 (fig.14) gave almost total suppression, Filter 4 the least suppression (fig.15), with again a lot of spuriae dumped back into the audioband.

It came as no surprise that the Vivaldi DAC, fed directly or via the Upsampler, offered superb suppression of jitter. With a 16-bit version of the Miller-Dunn J-Test data fed to the DAC's AES/EBU input, all that could be seen were the odd-order harmonics of the LSB-level tone, all at the correct level (not shown). With 24-bit J-Test data, a single pair of signal-related sidebands at ±229Hz is visible at –142dB (fig.16), though low-level sideband pairs of unknown origin can also be seen at ±71 and ±142Hz. With 24-bit data fed to the Upsampler and transcoded to DSD before being sent to the Vivaldi DAC, the central spectral peak that represents the 11.025kHz tone in fig.16 widened very slightly at its base and reduced the level of the sidebands at ±229Hz (not shown). With 24-bit data fed to the DAC via USB from my MacBook Pro (fig.17), there was a little less spectral spreading of the 11.025kHz tone than with AES/EBU, and the signal-related sidebands have dropped even further. The sidebands at ±142Hz are still evident, however. Again, connecting the MacBook's USB output to the Upsampler and transcoding to DSD before feeding the data to the DAC completely eliminated the sidebands at ±229Hz and broadened the central spike a little, but reintroduced the low-level sideband pair at ±71Hz (not shown).

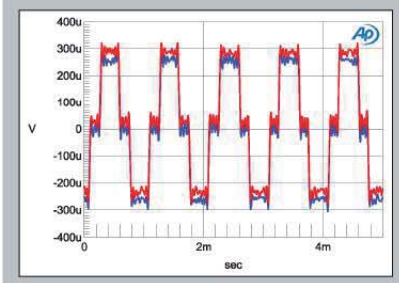

Fig.12 dCS Vivaldi DAC, Filter 1, waveform of undithered 1kHz sinewave at –90.31dBFS, 16-bit data (left channel blue, right red).

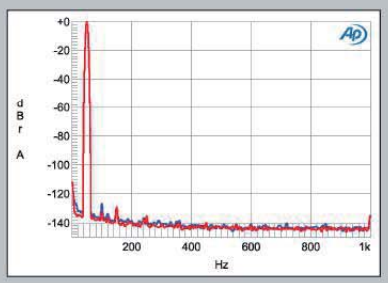

Fig.13 dCS Vivaldi DAC, 6V output setting, spectrum of 50Hz sinewave, DC–1kHz, at 0dBFS into 600 ohms (left channel blue, right red; linear frequency scale).

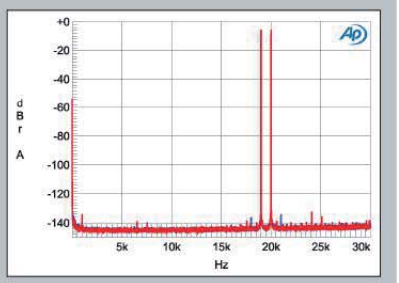

Fig.14 dCS Vivaldi DAC, Filter 1, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

turn it down. Through the Vivaldis it sounded ultraclean, fast, and appropriately sharp, with not a hint of DAC-infused grain, glare, or sheen. The Vivaldis' transient speed and resolve were impressive, even with a thin, bright CD—which lesser DACs coarsen, adding their own hash and glare.

Pop in the MoFi SACD and you get a warmth and a delicacy that make it hard to believe it's the same DAC, never mind the same recording. Unfortunately, the instant juxtaposition makes the MoFi sound smothered under a pillow, and the new version coming from an iPhone speaker. Not the Vivaldis' fault, of course, but to their credit as a neutral decoder.

Feel free to turn the volume up—way up—with good SACDs, and don't worry that you'll be assaulted by etchy digital artifacts. I'm not a huge Billy Joel fan, but "Say Goodbye to Hollywood," from his *Turnstiles*, recorded at Ultrasonic Studios in Hempstead, Long Island (SACD/CD, Columbia/Mobile Fidelity Sound Lab UDSACD 2063), sounded remarkably analog-like, producing a generous sense of studio space and deep bass on the Phil Spector–patented kick-drum rhythm and percussive transients, which were cleanly and sharply drawn, without unnatural etch. Joel's voice sounds naturally smooth, round, and solidly three-dimensional. The Vivaldis' bass performance was the best I've heard from a DAC: deep, rich, and particularly well textured.

I could play the Vivaldis at whisper-low levels. Unlike many digital front-ends, which fall apart and get murky at low SPLs, and get hard and etchy at high ones, the Vivaldis maintained their graceful, delicate, yet solid sound at volumes high *and* low.

The Zombies' *Greatest Hits* has always been one of my SACD benchmarks (Audio Fidelity AFZ 001). Rod Argent

The Vivaldi Master Clock offers eight Word Clock outputs arranged in two independent groups of four.

on electric piano, lead singer Colin Blunstone, and the rest created a uniquely sophisticated, melodic pop sound with tight three-part harmonies propelled by a rolling, flowing rhythm section. "Tell Her No," "She's Not There," "You Make Me Feel So Good," and, of course, "Time of the Season" are the highlights, but many of the lesser-known tracks are also worthwhile. Originally released on UK Decca vinyl, the recording has a suave, delicate, almost buttery quality, with everything equally bathed in generous reverb that softens and blunts percussive transients and rounds the vocal images. Like the tuneful music, the sound never offends, but can draw you in and produce a state of hypnotic suspension. Despite the heavy amounts of reverb overall, the guitars and some of the background vocals are closely miked and presented relatively dry. With those instruments and voices, the effect produces a startling jump-from-the-speaker immediacy and in-the-room three-dimensionality.

I know these recordings very well; for some lame reason, I long ago tried to analyze what made this record so unique-

measurements, continued

I repeated the USB-input jitter tests, clocking both the Upsampler and the DAC from the Vivaldi Clock. Whether it was the DAC fed 44.1kHz J-Test data via USB or fed 44.1kHz data upsampled to DSD by the Upsampler, I didn't find any significant measured differences from the DAC and Upsampler's internal clocks. But from my auditioning, I did find the Vivaldi Clock to add a small but noticeable improvement in sound quality, as I had done in my March 2005 review of the dCS Verona Clock.

Overall, the dCS Vivaldi measured superbly well. When I measured the company's earlier four-box system, the Scarlatti, in 2009 (http://tinyurl.com/4j8t9fw), I concluded that it offered "state-of-the-art measured performance." The Vivaldi improves on the Scarlatti's performance in almost every way. Wow!

Then I took a listen to the complete Vivaldi system. (See my Pass Labs review elsewhere in this issue for a list of the ancillary components used.) Again wow! Without any doubt, this was the best digital playback I have experienced. While there are digital processors that offer measured performance almost as good as the Vivaldi—the Electrocompaniet ECD-2, for example, and MSB's Diamond DAC IV or even NAD's M51—there was an increased sense of ease to the Vivaldi's sound quality, particularly when the Upsampler transcoded the data to DSD, that proved addictive. In this respect, it was even better than the MSB it replaced in my system. For a third time: Wow!—**John Atkinson**

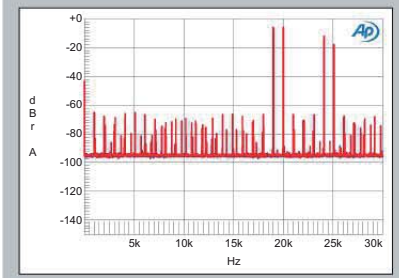

Fig.15 dCS Vivaldi DAC, Filter 4, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

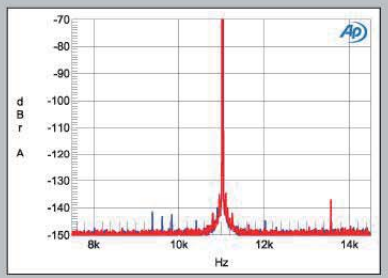

Fig.16 dCS Vivaldi DAC, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 24-bit data via AES/EBU from AP SYS2722 (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, 43.5kHz.

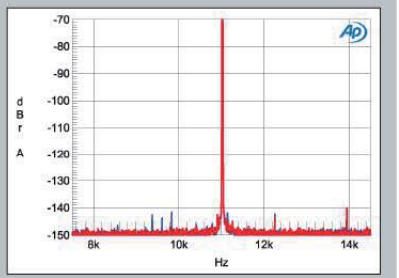

Fig.17 dCS Vivaldi DAC, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 24-bit data via USB from MacBook Pro (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, 43.5kHz.

ly attractive to my ear, so capable of producing a feeling of easy-flowing serenity. I've played the SACD/CD on every SACD and CD player I've reviewed and/or owned. What set apart the dCS Vivaldis' rendering of it? The speed, resolution, size, and timing of the vocal sibilants, for one thing; and, for another, how clearly I could hear the processing as a separate event that didn't etch and exaggerate the size or length of the actual sibilants. The Zombies' familiar tunes were presented with a depth-of-field three-dimensionality, delicacy of attack, generosity of sustain, precision of decay, and transparency I never thought I'd hear from digital. The launch of the reverb around Blunstone's voice had never before been so cleanly resolved, or timed so effectively.

On to the sonic spectaculars: I played the 24/176.4 files from the *HRx Sampler 2011* (DVD-R, Reference Recordings HR-2011 HRx) on a Mac laptop running Pure Music and the signal sent to the Vivaldi DAC's USB port. This produced the deepest, most robust, most controlled bass; the widest dynamic swings; and the most enormous sense of space I've yet experienced with the darTZeel NHB 458 monoblocks driving the Wilson Audio Specialties XLF speakers. Erik Satie's *Gymnopedie* 1, with Eiji Oue conducting the Minnesota Orchestra, produced a wide, deep, spacious sound, yet despite all the space, the instrumental focus was precisely and delicately drawn. In the *Finale* of Walton's *Crown Imperial*, played at ridiculous SPLs, the rumbling organ's textural suppleness and bass weight, and the overall sound, would have had even the most fanatical vinyl die-hards reveling in every aspect of the music.

The Vivaldis presented the 24/96 file of Neil Young's *Live at Massey Hall 1971* with abundant transparency, spaciousness, and organic wholesomeness, but when I switched to the AAA vinyl (two LPs, Reprise/Classic 43328-1), the LP added life to what was, in all other ways, a truly superb, pristine sound.

On the other hand, Doug MacLeod's superb *There's a Time* (DVD-R, Reference HR-130 HRx), originally recorded on the Skywalker Ranch Soundstage at 24/176.4 by Keith O. Johnson, sounded very similar from both digital and LP, the digital original getting the nod through the Vivaldi for its somewhat more robust bass and wider macrodynamics—but with a good analog front end, the differences were fewer than those who think we like vinyl for its euphonic colorations would care to admit. The vinyl can't sound *better* than the original 24/176.4 file it was mastered from, unless the vinyl mastering engineer's DAC betters what you have at home.

The dCS Vivaldi components comprise the best non-digital-sounding digital system I've heard.

dCS Server iPad software

Using the iPad UPnP app I'd downloaded from dCS with a router and the AVA Media Zara Premium server connected to the dCS Vivaldi Upsampler via Ethernet, you can have instant access, with touchscreen convenience, to an entire music library, with files of resolutions up to 24/192. The software also lets you switch the Upsampler to its USB-A port to access and play files from thumb drives.

The iPad app's user interface is neither as elegant nor as intuitive as the Meridian Digital Music Server's, but it does allow playback of files with higher resolution. Some nasty digital noise occasionally marred playback from thumb drives, but for the most part the iPad interface worked well. A server adds more value to the Vivaldi stack, though whether or not a $110,000 digital playback system can be called a "value" in the first place is arguable, to say the least.

Getz/Gilberto (24/96, Verve/HDtracks) sounded as delicate, liquid, highly resolved, and analog-like as digital has ever sounded in my room, rivaling in many ways the 45rpm reissue (2 LPs, Verve/Analogue Productions AVRJ 8432-45). The 24/176.4 files of the Rolling Stones' *12 x 5* (ABKCO/HDtracks) sounded spectacular in the true stereo mix, but the SACD produced greater transparency and liquidity.

Compared to the Vivaldis, the other digital systems I've had here, the MSB excepted, all sounded spatially constricted, two-dimensional, texturally dry, and mechanically processed. Even the MSB sounded *somewhat* dry and "techno" in comparison. With other digital systems, I couldn't wait to return to vinyl playback. By contrast, I ran the Vivaldis directly into my darTZeel amplifiers for the last week of the review auditioning, and though I couldn't play any vinyl that week, I didn't miss it.

Conclusions

The dCS Vivaldi components produced a texturally supple, delicate, musically involving sound filled with color and life. Their soundstaging and imaging capabilities surpass what I thought was possible from digital.

Some may find the Vivaldis' complexity daunting—but if you're willing to put in some time, you'll be able to operate it comfortably. Depending on your needs, you might be able to get away with just the DAC or the DAC-and-clock combo, which, directly driving my amplifiers, produced high-resolution digital sound that I found easy to warm up to.

The Vivaldis comprise the best non–digital-sounding digital system I've heard. ■

ASSOCIATED EQUIPMENT

Analog Sources Continuum Audio Labs Caliburn turntable, Cobra tonearm, Castellon stand; Kuzma 4Point tonearm; Lyra Atlas, Miyajima Labs Zero mono, Ortofon Anna cartridges.
Digital Sources BPT-modified Alesis Masterlink hard-disk recorder; Meridian Digital Media System, AVA Media Zara Premium music servers; Pure Music software.
Preamplification Ypsilon MC-10 & MC-16 step-up transformers; Ypsilon VPS-100 phono preamplifier; darTZeel NHB-18ns preamplifier.
Power Amplifiers darTZeel NHB 458 monoblocks.
Loudspeakers Wilson Audio Specialties Alexandria XLF.
Cables Digital: AudioQuest CAT 700 Carbon & Diamond RJ/E Ethernet; Fono Acustica USB; Snake River S/PDIF; Wireworld Eclipse Gold Starlight AES/EBU, clock, S/PDIF. Interconnect: EnKlein Aeros, Stealth Sakra & Indra, TARA Labs Zero Gold, Teresonic Clarison Gold, Wireworld Platinum Eclipse 7, ZenSati Seraphim. Speaker: EnKlein Aeros, TARA Labs Omega Gold , Teresonic Clarison Gold. AC: Shunyata Research ZiTron Anaconda & ZiTron Alpha Digital.
Accessories Shunyata Research Hydra Triton & Hydra Typhon power conditioners (2 sets); Oyaide AC wall box & receptacles; ASC Tube Traps; RPG BAD, Skyline, Abffusor panels; Symposium Rollerblocks & Ultra platform; HRS Signature SXR, Finite Elemente Pagode stands; Audiodharma Cable Cooker; Furutech & Stein Audio DeMagnetizers, Furutech deStat; Loricraft PRC4 Deluxe, Audio Desk record-cleaning machines.—**Michael Fremer**