

Up the dCS Staircase

MARK STANDBRIDGE (FOCAL UK) EXAMINES THE COMPLEX HIERARCHY OF dCS COMPONENTS AND EXPLAINS WHY HE HAD TO BUY INTO IT

MARK STANDBRIDGE

Paganini: the name alone evokes unrivalled complexity and virtuosity, and this particular *Paganini*, the mid-range digital player from dCS, is aptly named. (Mid-range here has the context of a £10,799 entry-level *Puccini*, and the £44,000 four-box *Scarlatti* flagship.) With three boxes, three power cords, two clock cables and a firewire cable, our review combo is a far from simple system – and that’s just to play a CD! However, the *raison d’être* behind this seemingly unnecessary separation of functions is to elevate performance to a level beyond that which is possible from a single box. And this it does. How, why, and to what degree I will try to explain.

dCS has been at the bleeding edge of digital audio for much of the last fifteen years or so, developing the first 24-bit, 24/96, 24/192, DSD and 24/384 DXD converters. Pro-audio components led to high-end consumer gear, and pioneering with the *Elgar* upsampling DAC along the way. Incidentally, the discovery of the upsampling effect was a happy accident, stumbled across when a distributor was playing with a 972 DDC and an *Elgar*. The *Elgar* also brought to widespread attention the discrete ‘Ring-DAC’, a refined and developed version of which is an integral part of the latest ranges.

No surprise then that, unlike some CD players, the dCS is not a technological dead-end. Both the DAC and the clock (in my case the third box is not the *Paganini Master Clock*, but the *Puccini U-clock*) allow digital inputs. In the case of the DAC, two S/PDIF and two AES/EBU inputs give up to 24-bit/192kHz capability, but probably of more interest to most, a USB input on the U-clock allows high resolution 24/96 files to be enjoyed with such ease that it becomes impossible to resist computer audio any longer. It now takes longer to download a hi-res track than it does to set up your system to play it. Optimisation may be a matter for another article, but trust me, dipping a toe in the hi-res water is an exciting and rewarding move.

But before I go too far into the undoubted future of recorded audio, I should return to the prime function of the *Paganini* – playing CDs. Like many who have read this far, I’ve collected enough of these silver beer mats not to want to spend weeks or months feeding them into a computer drive for the somewhat dubious pleasure of accessing my music with a mouse. When you have a player as lovely as a *Paganini* it’s nice to be able to interact with (*ie fondle*) it directly.

The dCS drawer opens and closes swiftly, and disc reading – whether redbook or SACD – takes just a few seconds. Earlier dCS players were prone to taking a frustrating length of time to reach a state of play, and the improvement here is most welcome. And once those few seconds have elapsed, the music – and the magic – starts.

Time for a little backstory. The *Paganini* wasn’t my first experience of the latest dCS generation players. A colleague rang me one day and said he had a *Puccini* one-box player on the backseat of his car, and how’s about he swing by for a listen? It would have been impolite to refuse, and in short order the *Puccini*’s beautifully milled front panel was on top of my equipment rack. I honestly can’t remember what the first track played was, but I can surely remember the impression it made.

Wow!

The same happened with the next disc, and the next, and so on. My friend and I didn’t need to exchange many words; raised eyebrows and knowing expressions made it clear that this standard of reproduction was far higher than I’d ever previously heard from my system. In fact, it was only when the first dozen or so demo favourites had been aired and lauded that the really interesting abilities of the dCS made themselves known.

Pulling rarely played and increasingly ‘awkward’ recordings from the collection proved that a truly great player will get good results with almost any material. Sure, the *sound* of these discs might not have been as perfect as one might wish, but the *music*

The USB option

USB, perhaps justifiably, has until only recently been seen as a third-rate connection option for audio, its reputation tarnished by high-jitter ‘adaptive mode’ implementation in a number of low cost DACs. Used asynchronously (the DAC becomes the critical master clock, radically lowering jitter), its potential as a viable high-end option looks to have been vindicated by dCS – and the company is not alone.

Recent USB DACs from Wavelength Audio and Ayre feature the work of Gordon Rankin, and reportedly also sidestep the usual USB pitfalls. There are most likely similarities between the dCS and Wavelength/Ayre solutions, both featuring asynchronous operation, but seemingly patentable differences as well – dCS preferred not to elaborate on the finer detail.

A USB input is also featured on both the forthcoming *Paganini* upsampler and the current *Scarlatti* upsampler, which allows the upsampling of external sources to 24-bit/192kHz or even DSD. dCS hopes in the near future to upgrade the current 24/96 USB input limit to 24/192 – the USB2.0 protocol in use may allow this with only a software update.

itself stood proud, almost separate from the embrace of the recording. Even if the recording hailed from the digital dark ages, or suffered from the hand of a deaf and/or sadistic mix engineer, the critical musical performance emerged intact. In my experience, not many audio components can pull this trick off. The *Puccini* does it, and so of course do the *Paganini* and *Scarlatti*. How? Maybe like this...

Let's grossly oversimplify the situation, and say there are two types of hi-fi system (and audiophile). One favours truth, the other beauty. In pursuit of beauty, it is fair – and probably necessary – to hide the 'nasties' and build a system to provide the colour the owner desires. Truth, I think, is actually a much harder trick to pull off. It's not made any easier because the truth can be so difficult to define.

In the dCS version, it very much comes down to an 'add nothing, take nothing away' philosophy. It's as much about what the player doesn't do as what it does. Neutrality and detail – often thought of as barriers to getting pleasurable sound from bad recordings – can actually work for rather than against. With the dCS players, instead of rough and painful, you get raw and vital. This is an essential distinction, and with many studio recordings it is possible to imagine oneself listening to the final mix in the studio itself. The sense of direct connection to the artists and the intent of the production seems stronger when the system has such a high level of true transparency. Which brings us back round to the sound – and that aforementioned magic.

Condensing my impressions of the single-box *Puccini*, I have to say that it ticks all of the requisite boxes. Detail, transparency, speed, timing, imaging – all these characteristics and more besides are simply top notch. And actually, on their own, irrelevant. The previous generation of dCS did all these things superlatively too, but never made the leap to 'must own' status for me. What lifts this generation above its peers, and justifies its existence in a world populated by many very good and more moderately priced players, is the holistic whole of the performance.

Despite great discrimination – every recording has a different tonal colour, feel, acoustic – the sound almost immediately becomes unimportant next to the music itself. There is a total coherence, an almost instant sense of rightness: all the technical nuts and bolts of the sonic picture merge to become a credible reality. They do in my case anyway: I'm easy, I *want* to believe.

Detail retrieval is huge, but without drawing attention to anything in particular. The timing of syncopated beats and complex rhythms is consummately handled. Simple, potentially dull

pieces reveal a previously unnoticed direction and purpose. Imaging may not seem important to all, but for me the portrayal of three dimensional space, with tangible images in realistic perspectives, separate but not divorced from each other, can only help the illusion. I've heard these dCS players described as analogue sounding. If the meaning is smooth and liquid, with a density to tones and textures that is quite uncommon in digital sources, I agree wholeheartedly.

In truth, all the latest dCS players, with their various possible combinations of transports, DACs and clocks have such a commonality of sonic attributes that it is in many ways easiest to talk about them as if they were cut from one cloth. As you climb the (gold-plated, marble-stepped) dCS staircase, the sense of foundation, dimension, palpability and simple you-are-there-ness increases. Three boxes are demonstrably better than one. The *Paganini* series stands above the *Puccini*, and the *Scarlatti* takes a further stride again. Yet I'm sure that a *Scarlatti* owner forced to downgrade to the *Puccini* could do so without too many tears, and I'm also pretty certain that no other player could provide such a satisfactory substitution.

Actually, the three ranges use the same main boards and similar software modules. DCS says it has deliberately NOT 'spoiled' the cheaper models, merely found ways to offer them at a lower price. The differences are in the separation of functions, the solidity and damping of the casework, the DAC power supply, the CD mechanism, features and remote handset. (Note that the *U-Clock* is completely different.)

I've set up base camp at a point on the *Paganini* staircase that, to me, makes a lot of sense. The *U-clock* instead of the *Paganini* clock saves £1500 and gives USB functionality, at the cost of a minimal loss on CD/SACD.

In fact, the whole clocking situation is something dCS says it takes "very seriously". In the consumer audio world possibly only Esoteric has similar focus. Theoretically, clocking should be a non-issue: a players' phase-locked-loop (PLL) should ensure even rudimentary internal clocks cannot stop the 1s and 0s arriving at the right place in the right time. DCS has already gone beyond the norm here, shunning integrated circuits and developing a proprietary discrete PLL which locks in three stages (wide, narrow, ultrafine), to all but eliminate jitter. We can, I think, safely assume that the dCS DAC clocks are beyond rudimentary, but despite this, on connecting the *U-clock* it was absolutely and immediately obvious that this third box brought notable improvements in focus, detail, soundstage

dimensionality and dynamics. The music became more compelling still.

The reason for the improvement has less to do with the absolute accuracy of the external clock and is more due to the separation of power supplies, a quieter electrical environment, and a more stable, oven-controlled crystal oscillator. An option is provided to 'dither' the clock. This apparently 'exercises' the PLL, and keeps it out of the insensitive part of its characteristic. Sonic effects? Dither gives perhaps a hair finer focus and slightly greater 'depth of field', most noticeable as extra clarity at the far back of the soundstage.

Step 1, swap cables; step two, listen. This simple experiment proved that the clock cables that came in the box deserved to stay there. I found that Blue Jeans 1695A Belden digital cables had a very positive effect, simply enhancing all the gains made by the introduction of the clock.

Paganini or *Scarlatti* components without a separate clock are definitely not reaching their full potential. More surprisingly perhaps is that a clock also benefits the *Puccini* in a similar way, although not quite to the same degree. I've heard similar effects with a Teac Esoteric source (the *G-0* clock and the single-box *X-01* player), so this behaviour is not exclusive to dCS.

What may be unique is the number of means available to tune the sound, through both designed-in options and external influences. With Red Book CD, the transport can output either native PCM 16-bit/44.1kHz data, or upsample to DSD. SACD is output in its native DSD format (or downsampled to CD format if required). The DSD output is where dCS made their reputation, and easily betters the rather coarse 'old skool digital' PCM.

The transport connects via a Firewire link to the DAC, and of course, this cable can – and does – make a difference. Fortunately, even a £10 Belkin or Van Damme Firewire cable betters the free item, but further gains are likely from more expensive cables by the likes of Acrolink and Siltech. Some suggest cables shouldn't affect digital data, a view with which I have some sympathy, but my ears say otherwise. And it's sometimes forgotten that *digital* data still represents an *analogue* signal...

Optional replay filter settings provide some tuning options, and may also specifically help system matching (see Box).

External – but vital – influences are power cables and supports. Both matter, support surprisingly so; a dCS on its own feet is a bird with a broken wing. Using aftermarket supports to bypass the standard feet – I've had success with Stillpoints, Black Ravioli and the acrylic Music Works *Revo* stand – is an



essential step in revealing the system's true ability.

But maybe I should stop before the tweak-agnostics discard this issue in despair. The intended message is not that the dCS is difficult, but simply that it rewards some, not necessarily expensive, care in set up. A prima donna? Maybe, but what a voice!

To conclude, it's easy to resort to cliché here, so why not? The dCS *Paganini* components present the clearest window onto the music that I've ever experienced (with the single and honourable exception of the *Scarlatti*). Having lived with it on loan, only one course of action was open to me. After a little hand-wringing, and mental fabrication of myriad arguments supporting the 'essential' acquisition of this three-box stairway to heaven, I finally dared approach my better half to tell of the impending purchase.

Her single word reply – "Good" – reminded me why I'm a happy man.

Prices

Puccini player	£10799
U-clock	£2999
Paganini Transport	£8999
DAC	£9599
Master Clock	£4499
Upsampler	£6099
(available Aug '09)	
Scarlatti Transport	£17999
DAC	£12999
Master Clock	£5599
Upsampler	£7299

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Filters, outputs and amplifiers...

Four filter options are accessible via the remote handset and a button on the player/DAC itself. In PCM mode, filter 1 is a classic brick-wall filter; dead flat in the audio band with a steep roll off. Filters 2, 3 and 4 offer progressively gentler roll-offs, trading better phase response against a small top octave droop and lesser Nyquist image rejection.

DSD mode works differently. Filters 1 to 4 progressively reduce out-of-band noise and limit bandwidth. Filter 1 has the highest bandwidth (around 70kHz) and the gentlest roll-off. DSD has an inherent high level of out-of-band noise; some amplifiers may have a sensitivity to the remaining high frequency post-filter content and may benefit from filters 2 or 3. Filter 4 is basically a narrow bandwidth test setting – if this one sounds best, you either need a different amplifier or should forego the DSD upsampling – and one of the main dCS virtues.

The analogue output is switchable for 2V or 6V level (6V being slightly cleaner and more dynamic), and there are separate and parallel single-ended and balanced outputs, neither suffering from being derived from the other. Single-ended exits via fine LT1028 and AD797 op-amps; the balanced path has an op-amp followed by a discrete transconductance stage. My listening comments are based purely on single-ended operation. Preferences may ultimately depend on the rest of the user's system.

dCS Second Opinion

THE dCS COMPONENTS RECEIVE MARTIN COLLOMS' LAB AND LISTENING ANALYSIS

MARTIN COLLOMS



dCS has a reputation for being the one of the – or even the – best silver disc replay providers in the business. When I reviewed the original dCS *Elgar* player for Hi-Fi News, it took the honours for the best domestic digital replay yet – though only when fed 24-bit/96kHz digital master tapes. These tests also confirmed that high resolution audio did hold out promise for better than Red Book sound quality in the home. (It was a pretty good Red Book DAC as well.)

This technical background and partnering test of the new *Paganini* combo turned out to be quite arduous, since this sophisticated and intrinsically complex device has a great many different options and operating modes. To save time these will not be discussed here; rather, look out for them in the many listening results. We were supplied with the *Paganini Transport*, *Paganini DAC* and the accessory, visually complementary *Puccini U-Clock*, a precision time reference which also adds a USB input for further music source connectivity.

Numerous replay filter options are present on the DAC with a complexity confounded by the availability of different filters in different modes. For example the 'non-pre-echo' filters (numbers 5, 6) are only available when the DAC is presented with either 176.4 or 192kHz files. (However the soon-to-be launched *Paganini Upsampler* will allow data to be up-sampled to either 24/176.4, 24/192 or DSD and thus use these filters.)

Replay filters 1-4 have a different identity depending whether the data arriving is Red Book PCM, up-sampled Red Book to DSD, or SACD. In fact we preferred the No 2 filter setting for all these formats, save for the direct connection of SACD replay to the power amplifier, which sounded

clearer and sweeter with filter 3's stronger ultrasonic filtering.

Sound Quality

Plain PCM Mode

Here we have CD's 16-bit/44.1kHz is automatically re-sampled to 24/192 for the DAC, with S/PDIF cable connections for *Transport-to-DAC*, and no *U-Clock*. This mode scored 50 for overall sound quality, which is a generally good CD result, but below a Naim *CDS3*, for example. Some mild grain suggested the presence of jitter in this mode, and disconnecting the power to an adjacent phono pre-amp and our second CD player significantly lifted the score to 73 marks (filter 1) showing that one shouldn't take mains quality for granted with this refined creature. However, on this result the player isn't particularly competitive.

At this stage we thought filter 2 sounder richer and more open, reducing some digital 'glare'. Then we added the recommended BNC-terminated cable clock sync connection between *DAC* and *Transport*. For CD mode our best shot at the various settings was with the DAC set to 'Master' and the transport to 'sync'. The score now peaked at 83, most promising, but still with some characteristic Red Book brightness and 'glare'. While this dCS combo excelled on detail, crispness, specificity, it sounded a tad muted on rhythm and dynamic expression.

With the above, the *U-Clock* was now connected, providing central synchronisation for both transport and DAC. In theory there should be still less jitter from this ultra low noise clock, but on PCM mode – straight CD if you like (though it's not) – we felt that this super accurate 1ppm clock made the sound more 'uptight' and contrived: still more detailed, but less real, more 'processed'. Here we judged the sound quality a bit lower but still a very good 75 points.

Now we switched over to the recommended DSD up-sampled mode, where CD is recalculated to a 1-bit/2.823MHz (BitStream/SACD standard) signal. First we deliberately left out all clocking connections. We again favoured the filter 2 setting (which is not equivalent to the '2' PCM setting). Then, going against received wisdom, we felt that the addition of *U-Clock* did not help this CD replay mode. However, when selecting the 'Master Clock' setting on the DAC (no *U-Clock*) we got the best results yet, 93 marks auditioned *via* a pre-amp and a rather special 120 marks when connected directly to a power amp, despite the latter requiring expected attenuation *via* the inbuilt board digital volume control. Clearly it's a very good digital volume control. This unique 'DSD' processed CD replay

was actually more like a genuine SACD. While a bit 'processed' and not perhaps quite faithful to the 'original', conversely it was imbued with more depth, detail and focus, and a sweeter and less fatiguing upper midrange which we thought was very, very plausible. A touch more dynamic expression and tighter rhythm would have iced the cake nicely.

The Digital Volume Control

Set up most carefully and using the original SACD feed, the control was assessed at 'full', and at -0.5dB (replay re-calibrated), enough to invoke re-quantisation and its potential sound quality losses. We estimated the loss in quality at 10%, which in context is very small. While you can hear those signal 'bits' being re-crunched with slightly less air, grace, space and focus, but this deterioration was much less than any known pre-amp, associated cabling, and power supply effects. Thus the volume control and direct power amp connection is eminently practical, and used this way the performance rises still further. Used with an analogue pre-amp the DAC should always be set to 'full' for best possible resolution.

SACD Replay

While our finding was to prefer CD material with the DAC set at 'Master' (here the *U-clock* seemed to increase sweetness and precision at the expense of reduced space and air), the converse was true for SACD. While CD replay was felt to be close to the world's best on 'Master' clock mode, interestingly for SACD this setting rendered it strangely brittle, larger than life, restless, even a bit fatiguing, though admittedly very detailed. This score stuck at a relatively disappointing 75.

Now that *U-Clock* came into its own, and when used with SACD discs it gave an open, clear highly natural and spacious sound, grain-free, well focused, in fact just how one hoped domestic high definition audio would sound, particularly when connected direct to a fine power amp (filter 3 proved optimal with this Conrad Johnson S350SA). A HIFICRITIC record of 150 points was awarded in this mode, which beat known references (as it probably should with an SACD source), including the extraordinarily good Meridian 808.2i (the latter using Red Book CD sources and its non 'pre echo' replay filter; note that the 808.2i can also accept hi-res music server sources, which we were not able to check out). A more representative Paganini separates score for the optimum SACD mode, now operating via a pre-amp, was 135 marks, which is still first rate. We found the Paganini SACD replay quality revelatory, and regret that so few players have been able to show this potential over the years.

Comments

For Red Book CD replay only, the *U-Clock* is hardly needed, unless the additional server/computer USB input is considered important. We tried the USB input with a Sony Vaio laptop, and its quality was above average, but delivered nothing like the scores recorded above, and the USB mode lab spectrum was not special either. However, for SACD replay the *U-Clock* is invaluable.

Throughout these user selectable variations, fascinating for extended listening experiments, there is an undeniable underlying power and strength to the dCS reproduction. Deep, focused bass, generally even timbres and perspectives, cool analytical and precise detailing – no wonder so many like the dCS sound. Further improvement and variation is possible with customer choices of mains, digital, and audio cables.

Lab Report

To some degree dynamic range is associated with noise floor and for SACD we got representative figures for this medium of 106, 100 and 109 dB respectively for unweighted, CCIR (1kHz), and A weighted, figures similar to a good pre-amp. The PCM figures were essentially the same. The distortion spectrum for a -10dB SACD, 1kHz signal (Fig1) is persuasive, with harmonics better than 115dB below signal level and 125 dB below 0dB, and was much the same on all modes except USB and unlocked PCM Red Book. For what it is worth, distortion towards full level is around 0.0002% midband; SACD has a little more distortion at full level: -108dB or 0.0005%! For the Vaio USB input (16-bit PCM), noise signals averaged -95dB up to our test range of 88kHz, not a great issue. The frequency response was +0dB, -0.05dB, 10Hz to greater than 20kHz, the latter depending on the sample rate and filter choice.

The transport gap error protection was first class; it will play troublesome discs and had excellent gap





Review System

Avalon *Eidolon Diamonds*, Conrad Johnson *350SA*, Audio Research Reference 3, CD5, XTC *PRE-2*, Naim *CDS3*, Marantz *CD-7* players. Cables by Cardas and Transparent. The Paganini/Puccini set was split into three parts, each accorded its own isolating shelf on the Finite Elemente *Pagode* audio rack)

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error concealment with stable tracking at 2.4mm of missing data.

Not uncommon with SACD, as the signal level reduces, idle tones unrelated to the input may appear, for example at -60dB modulation these appeared at about 70dB below, *ie* better than -125 for full level (Fig2). At still lower signal levels the higher frequency stuff fell back into noise, but an idle tone turned up at about 650Hz at -120dB, which is unlikely to be directly audible.

This system majors on low jitter signal purity, and a simple means of showing this is a high resolution spectrum analysis of 0-2kHz for a 1kHz full level pure tone. With substantial data averaging, the noise floor settles at a deep -140dB, despite the presence of that full level fundamental. The second harmonic and all the noise and jitter sidebands are visible too. Usually the cleaner this zoomed analysis looks, the better the sound.

Chasing noise and jitter, we tried every operating mode, clock locked and unlocked, with interesting

variations but little to pin down relative to absolute sound quality. Fig4 is representative and is not from the lab generators but from the transport itself playing an SACD lab disc. Second harmonic is -115dB, there are couple of inoffensive tiny spikes at main frequencies, and that's absolutely it – no spreading skirts to the central fundamental (random noise jitter), no noise at all down at the inherent, mainly analogue noise floor at -136dB! We know that this sounded good, and the poorer result for unlocked straight Red Book replay correlates with the increased noise and jitter seen in fig5. But moving on to the PCM mode where it sounded different between the 'Master' clock and *U-Clock* synchronisation, there was actually no measurable difference between either.

Showing how bad things can get, see fig6 for our 'zoom' representation for the USB mode sourced from the noisy *Vaio*. Here hi-tech clocking does not solve the overall noise problem, that is as poor as -70dB for the first sidebands, which incidentally have a 33.33Hz repetition rate, not explained at this point. Finally, fig7 shows the effect of filters 1, 2, 3, 4 for SACD mode (the marker is 1kHz at -80dB) and where the steeper rolloffs (if you can call them that) show progressively decreasing ultrasonic noise power above the audible range.

Summarising the lab results, at its best the dCS performs superbly on our zoom noise and jitter graphs. Oddly, some modes of preferred sound quality were not necessarily those with the lowest apparent jitter; perhaps other factors, such as the extra power supplies, chassis ground noise, even the choice of digital cables could play their part. (Transparent *Reference* was used for the S/PDIF connections.) The digital volume control worked very well and is eminently usable. The variety of low pass filters adds flexibility and provides choice.

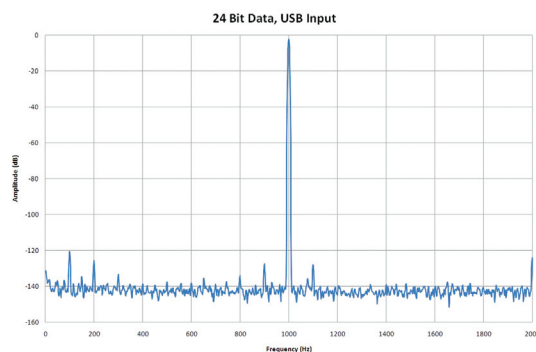
Editors Note

Andy McHarg developed at DCS the USB interface used in the Puccini U-Clock and supplied the following back up measurement to confirm the inherent spectral and jitter purity of their USB input mode for their the lab Paganini DAC and Puccini U-Clock, which should be identical to those we measured. Their setup was:

Samsung P200 Laptop, running off the mains via it's switch-mode charger, USB->Puccini U-Clock ->Paganini DAC via SPDIF, Puccini U-Clock->Paganini DAC Wordclock via Wordclock cable. Paganini DAC set to 6V out, max volume, Filter1, Sync to WCLK, Paganini DAC analogue output feeding dCS lab test equipment.

Generated two test waveform files using Nero WaveEditor, both 1kHz 0dB, one at 16/44.1 and one at 24/44.1: Played back using Foobar2000. Captured the data with a 32k FFT, H6 window, averaged 5, and graphed to approximate matching scale.

DCS clearly can test to a lower noise floor with their specialist in house resources, but fundamental is the very low noise and jitter result shown here for USB which usefully shows that HIFICRITIC needs to troubleshoot its test interface for USB audio.



Data kindly supplied by DCS to illustrate the inherent low jitter and noise performance of the U-Clock USB interface partnering the Puccini DAC.

Fig 1: Paganini - 10dB distortion SACD source

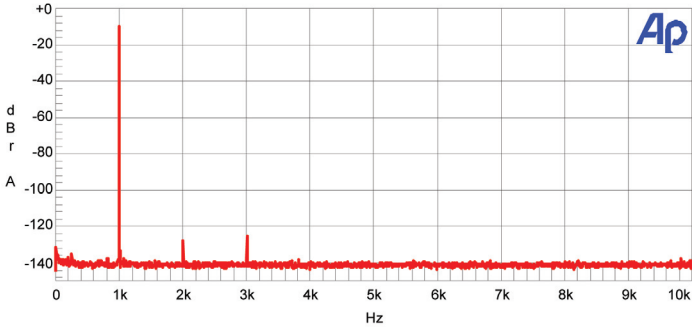


Fig 2: Paganini - 60dB distortion SACD source

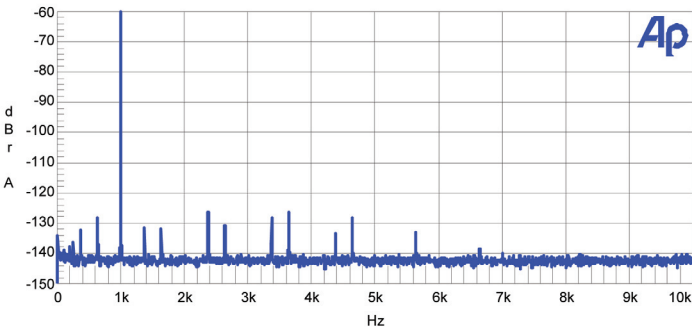


Fig 3: Paganini - 90dB distortion SACD source (note sub 1kHz idle tone)

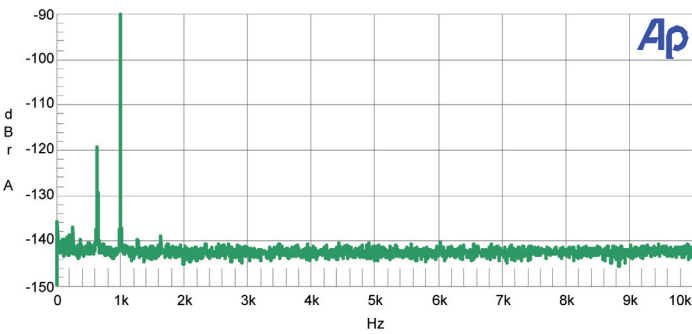


Fig 4: Paganini Transport/DAC SACD Jitter and sideband noise (using DAC Master clock) Adding Puccini U Clock results in no visible change

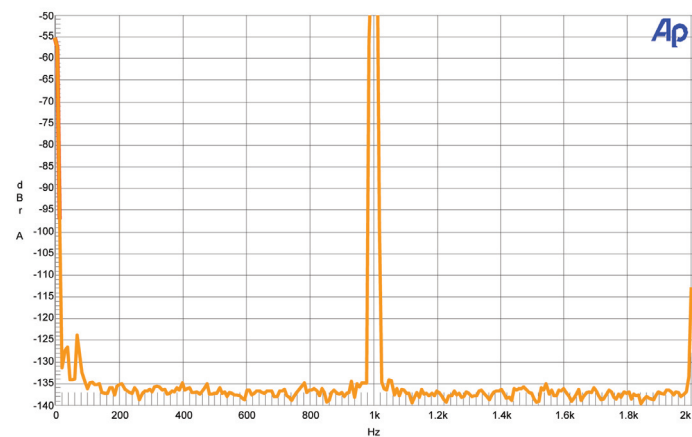


Fig 5: Paganini Transport/DAC, CD input no clocks noise spectrum, (No change visible when Master clocked)

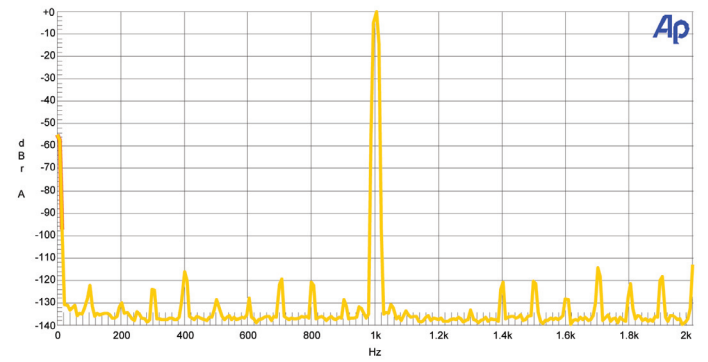


Fig 6: Paganini USB Jitter 0dB 1k U Clocked, from Sony Viao laptop

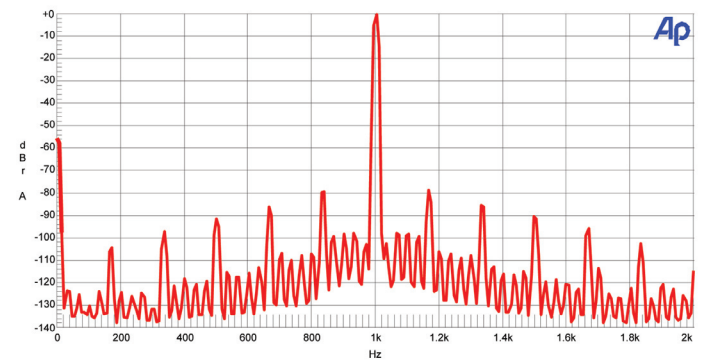


Fig 7: Paganini -80dB 1k SACD replay filters 1 red, 2 green, 3 blue, 4 cyan

