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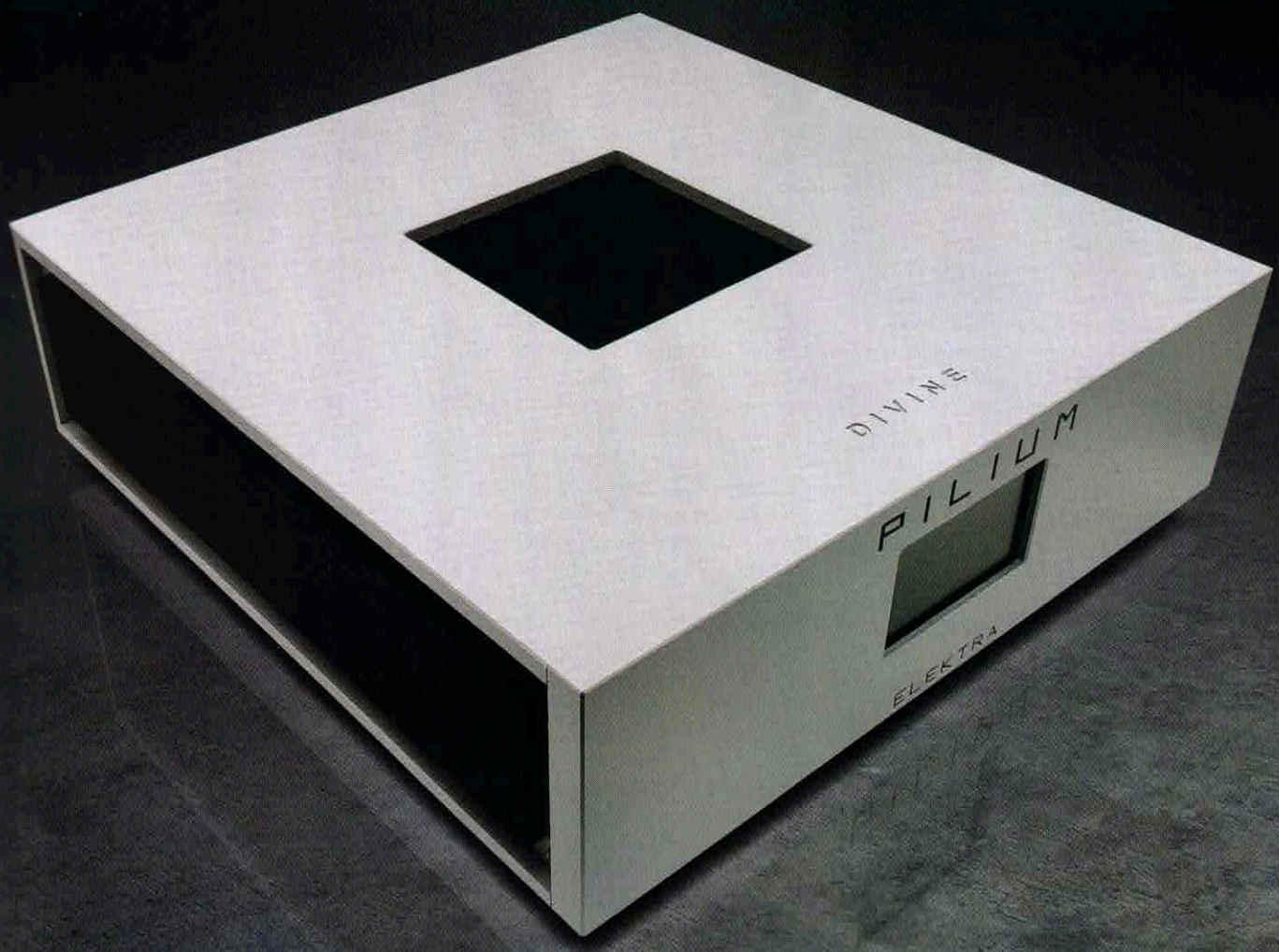
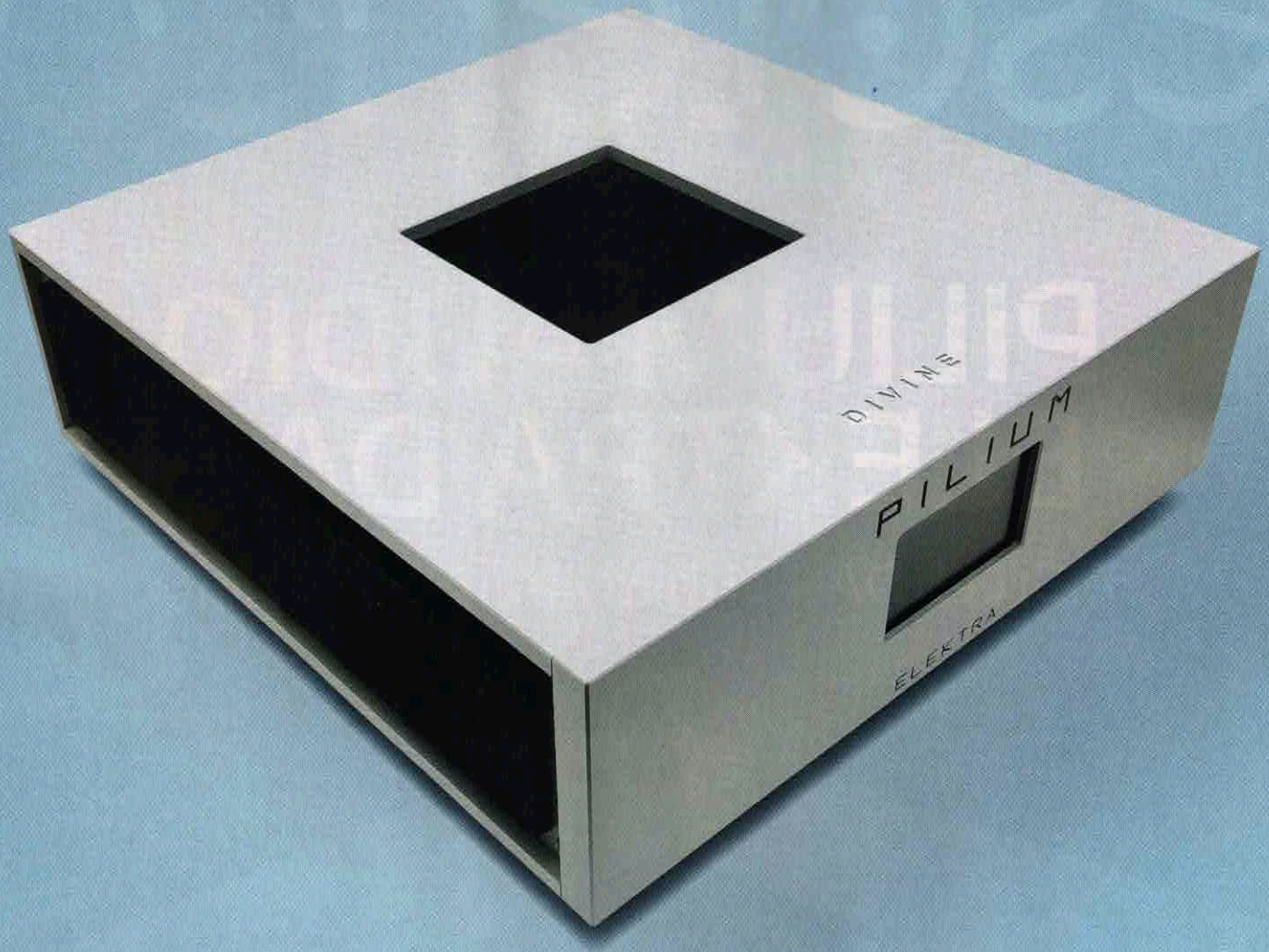
PILIUM AUDIO ELEKTRA DAC

A Greek DAC with mysterious origins!





PILIUM
ELEKTRA DAC – DIVINE LINE

A fascinating story. If you look at the rear of the Pilium Elektra DAC – Divine Line, you'll find a label that says 'Made in Greece' and the founder and owner of Pilium Audio, Konstantinos Pilios, is certainly as Greek as Greek can be. But Pilios lists his company's address as Tsar Boris III No 6, Petrich, 2850, Blagoevgrad, Bulgaria.

This I found a fascinating fact, because Greece and Bulgaria may share a border, but they're two different countries. Very different countries!

It turns out that when Pilios established Pilium Audio he had the bad luck to do it in 2012, which was the time of the huge economic crisis in Greece, during which many countries were trying to get Greece kicked out of the European Union.

Pilios wanted to have the financial stability of the EU to ensure the future of his business, so he decided to register Pilium Audio in Bulgaria, an EU country that was in no danger of getting kicked out it, even though he had no intention of moving there or of building his products there.

So despite its Bulgarian address, all Pilium Audio's products are — and always have been — designed and manufactured in Greece, in Pilium Audio's own factory — and mostly by hand, as we shall discover further on in this review. Pilium's DAC's name also has a fascinating history. It's named after Elektra, the main character in two of the most famous Greek tragedies, one written by Sophocles and the other by Euripides, both of which are named Elektra. In Greek mythology, Elektra was the daughter of King Agamemnon and Queen Clytemnestra and the sister of Iphigenia and Chrysothemis.

With her siblings, she planned the murder of their mother and her lover Aegisthus to revenge the murder of their father. In modern psychology, the phrase 'Elektra Complex' is now used to describe a psycho-sexual conflict between a mother and her daughter (the male version of this conflict is rather better known... an Oedipus complex).

A rather more modern take on this tragedy was written by American playwright Eugene O'Neill, titled Mourning Becomes Elektra. It's essentially an updating of Aeschylus' play Oresteia. I saw a fabulous staging of it put on by the Sydney Theatre Company at the Wharf Theatre in 1998, but you can now buy the film version (with Rosalind Russell playing Elektra) from Film Classics (www.filmclassics.com.au). (Trivia fans might be interested to know that Eugene O'Neill's daughter, Oona, was the fourth — and last — wife of the English actor and filmmaker Charlie Chaplin.)

Pilios says that when he decided to build a DAC (the company previously having built only hi-fi amplifiers), the decision was made to 'do things the hard way' and design everything from scratch. "We have designed and implemented on board our own special USB receiver — no OEMs here", he said, "and we have used our own special re-clocking technique, with only one software programmable femtoclock for extreme accuracy. We also use ten ultra-low-noise, fully discrete power supplies with extremely low output resistance in order to achieve the lowest possible noise floor that is commendably free from significant power-supply-related spuriae."

There are three custom toroidal transformers inside the Elektra, each one larger than I have ever seen in any other DAC

Digital-to-analogue conversion inside the Pilium Audio Elektra DAC is managed by no fewer than eight AKM AK4493EQ DACs used in dual-mono configuration (four DACs per channel). The AK4493EQ is a new DAC architecture from Japan's Asahi Kasei Microdevices Corporation.

It's a 32-bit two-channel DAC that has a switched capacitor filter 'OSR Doubler' that has low out-of-band noise. It also incorporates AKM's proprietary 'Velvet Sound' technology, which AKM claims delivers "the lowest distortion and widest dynamic range of any 32-bit DAC." As for that USB receiver, it's certainly programmed by Pilium, but it's a U30871C10 integrated circuit designed and built by XMOS, a fabless semiconductor company headquartered in the United Kingdom that develops multicore microcontrollers capable of concurrently executing real-time tasks. It's intended for use in DSP, edge AI processing and USB audio interfaces.

Cambridge Audio, FiiO Electronics and Meridian also use XMOS devices to implement their USB interfaces, so Pilium is in good company. Still, it's quite an achievement, of which Pilios is understandably proud, saying: "Our XMOS-based USB-receiver was a project by itself! Our team spent almost more than a year to develop it and the goal was to create a USB receiver onboard (not OEM externally placed like many manufacturers use) with a goal to achieve perfect signal transfer. After a lot of tests and comparisons with all available market solutions we came up with a design that could outperform all other solutions."

Pilios also says the Elektra uses a proprietary clocking scheme developed by his team that requires a large number of available clock frequencies. "Achieving this with conventional oscillators would require us to make compromises in board layout and signal integrity. We were not willing to make these compromises," he said. "Thus we made the choice of using a single high-end femtosecond programmable clock, powered by a dedicated fully-isolated and filtered ultra-low-noise power supply. This way the clock's signal path is optimal and thus signal integrity is guaranteed to perfection."

As you have probably gathered if you have peeked at the manufacturer's specifications, 31.3kg is pretty heavy for a DAC! That weight is partially from the number of components inside — more high-voltage capacitors than I have ever seen in any DAC, for example. But the weight is also because there's not just one, but THREE toroidal transformers inside the Elektra, each one larger than I have ever seen in any other DAC, and all custom-made for Pilium by Norwegian transformer specialist Noratel.

But the weight of 31.3kg is mostly because of the way the chassis has been constructed. It's built using a method that is very common for electronic products that are produced in small numbers, indeed most specialist scientific instruments are built in a similar fashion. You should be able to see the method from the photograph accompanying this review that shows the inside of the Elektra DAC. Essentially, the chassis is comprised of six powder-coated solid aluminium plates, with all these plates bolted together via butt joins using 15mm square aluminium bars and hex-headed bolts.

The difference between the Elektra and all other products I have seen that use this assembly method is that whereas most other manufacturers use thin aluminium plates, the aluminium plates used in the Elektra are all 10mm thick except for the front panel, which is made from 20mm-thick aluminium plate. This construction method means that the top panel of the Elektra weighs 6.1kg, the side panels each weigh 1.5kg, the rear panel weighs a bit more than that, the bottom panel weighs around 6.0kg and the front panel tips the scales at 3.0kg. All told, these alone add up to a weight of around 20kg!

Surprising though it may seem, this is still a more cost-effective way to build a chassis than to have one made conventionally because there are essentially no tooling costs. It's also a lot more cost-effective than CNC milling the chassis from a solid billet of aluminium. However, there is yet another reason for the weight of the chassis, which is that down each side of the DAC Pilium has bolted on thick anodised aluminium plates that are 430mm long, 90mm high and 9mm thick and each one of which adds a bit over another kilogram to the overall weight of the chassis. There's no mention of the reason for these plates on Pilium Audio's website, but I guess there must be a reason, otherwise the company is just increasing build costs — and shipping costs — by so doing. But it certainly improves the appearance of the chassis. But I guess I should have been thankful that I was reviewing one of Pilium's DACs and not one of its amplifiers.

Pilium's Achilles stereo power amplifier (which is rated at 300-watts per channel into 8Ω, 600-watts into 4Ω, 1,200-watts into 2Ω and said to be stable into 1Ω loads) weighs close to 120kg!

Pilium's website states that all its products are "entirely hand crafted" though in fact this is not strictly true, since those military-spec printed circuit boards you can see in the photograph of the inside of the Elektra have surface-mount (SMT) components that are very obviously not hand-placed or manually soldered. Although this would technically be possible, it would not be practical, and when we asked Pilium's Konstantinos Pilios about this he confirmed to us that: "As for our PCBs it would be impossible to be hand-soldered and completely unproductive even if it was possible. All the SMT components that are placed in Elektra's PCBs are assembled by a very specialised SMT (Pick & Place) factory in Poland."

Was I happy with it? I was ecstatic! The Pilium Elektra is a truly wonderful-sounding DAC.

It also transpired that the aluminium plates are cut and anodised in Germany.

You may be a little disappointed by the appearance of the rear panel of the Elektra DAC depending on the colour of the chassis you choose, because the XLR and RCA output terminals are on black metal fixings that are screwed to the rear of the panel using bright steel screws, and the XLR and S/PDIF inputs use the same screw-on fixings. These fittings are less visible on the black chassis than they are on the silver chassis, but the lack of colour matching and the method of mounting are rather unsettling to find on a product that retails for more than $50,000. Personally, I would have rear-mounted these fittings so you couldn't see the mounting hardware and/or used black steel bolts instead.

PERFORMANCE

Because the only way to switch the Elektra DAC on (or off) is via the mains power switch on the rear panel, you need to install it so that you have easy access to this switch, but that's the only issue you might have with installation — other than making sure the shelf of your equipment rack is capable of supporting its 31.3kg dead weight, of course!

Once powered up, all operation is managed via a monochrome (black and white) touch-sensitive 108×65mm display that is the sole feature of the front panel. I must confess that I was rather expecting to see one of those flashy full-colour super-OLED numbers, but the Pilium Elektra's bland two-tone display does the job... albeit rather mutedly.

I was also expecting a dedicated remote control or at least an app to allow me to control the Elektra from my phone, but neither a remote nor an app is available.

Touch-screens can sometimes be a bit cantankerous by refusing to respond to the touch of a finger — particularly the touch of the finger of an older person, due to the lack of skin-oils — but I had absolutely no issues with the Elektra's touchscreen. It worked perfectly every time. Or, rather, I did have one issue, which is that the display stays 'On' all the time. Some type of Standby mode would have been nice.

Not that the Elektra draws enough power to require a standby mode; I measured power consumption as being between about 18 and 22-watts, depending on screen brightness and operating mode. You can alter the screen's brightness—through ten different levels—but even at its minimum screen intensity, the display is still quite obvious.

In 'Standby' mode, the display has a white rectangle at its centre with the word 'Power' at its centre. At top left is the word 'Pilium' and at top right the word 'Elektra'. Under both words, stretching the full width of the display, there is a thick white underline. A thinner line would have been a better design choice (IMO).

Press that central 'Power' button gently and the Elektra switches to its home screen which maintains the same branding at the top of the screen, but then dominating the display is a large square at the left that shows the frequency of the digital input signal

alongside an identically-sized square at the right that shows the active input. Arrayed across the bottom of the display are five 'soft' buttons labelled, from left to right: Power, Filter, Settings, Input and Output.

The 'Power' description is a bit of a misnomer though, because it doesn't actually switch the power on or off at all, whereas the 'Filter' button does allow you to cycle through the six different digital filters that can be selected thanks to their being available on the AKM DAC: Sharp Roll-Off, Slow Roll-Off, Short Delay Sharp Roll-Off, Short Delay Slow Roll-Off, Super Slow and Low Dispersion Short Delay.

The 'Settings' button takes you through to another menu which is the one that allows you to adjust screen brightness, but also lets you switch 'SPDIF ASRC Operation' between 'ByPass' and 'Enabled'. SPDIF (the correct abbreviation is actually S/PDIF) stands for Sony Philips Digital Interconnect Format. ASRC stands for Asynchronous Sampling Rate Converter which in the Elektra upsamples incoming S/PDIF signals. According to Konstantinos Pilios it was decided to make this feature switchable because, he says: "Keeping it enabled provides audio that is measured to be of extremely high quality. But bypassing it produces subjectively better sound quality. Thus it was decided to leave the decision of either enabling it or disabling it to the end-user."

'Input' switches between the XLR, RCA, BNC, Toslink and USB inputs and if you have looked very closely at the photo of the rear panel of the Elektra — or examined at the specifications — you may well be wondering how you select the HDMI input. The answer is that you can't... it is not selectable. According to Pilios, the presence of the HDMI terminal is "to enable future upgrade connectivity with our upcoming streamer."

As for that 'Output' button, this is used to select the analogue output you want to be active: XLR (balanced) or RCA (unbalanced). As the switchable selection would suggest, you can use only the one output or the other: you cannot use both simultaneously.

LISTENING

I started listening via the USB input which, because I use a Mac, is a simple 'plug 'n play' affair. If you use Windows, you will have to ask for a suitable driver from either Absolute HiEnd or Pilium itself, because the necessary Windows USB driver is not supplied nor was it (at least at the time of writing) available for download from Pilium's website. (Actually, the Elektra was so new that I didn't get an Owners' Manual either. Neither, for that matter, was packaging available: my review loaner was delivered in an expensive custom-fitted aluminium flight case.)

I have to say at the outset that I was impressed right from the outset with the sound quality I heard from the Elektra. It was immediately obvious that it was a cut above the average, but before I started listening in earnest, I first explored all the filter selections and, as I usually find, I did not really have a 'favourite' filter, because my filter preference changed depending on the type of music I was listening to, the quality of the recording, and the bit-rate of the digital stream.

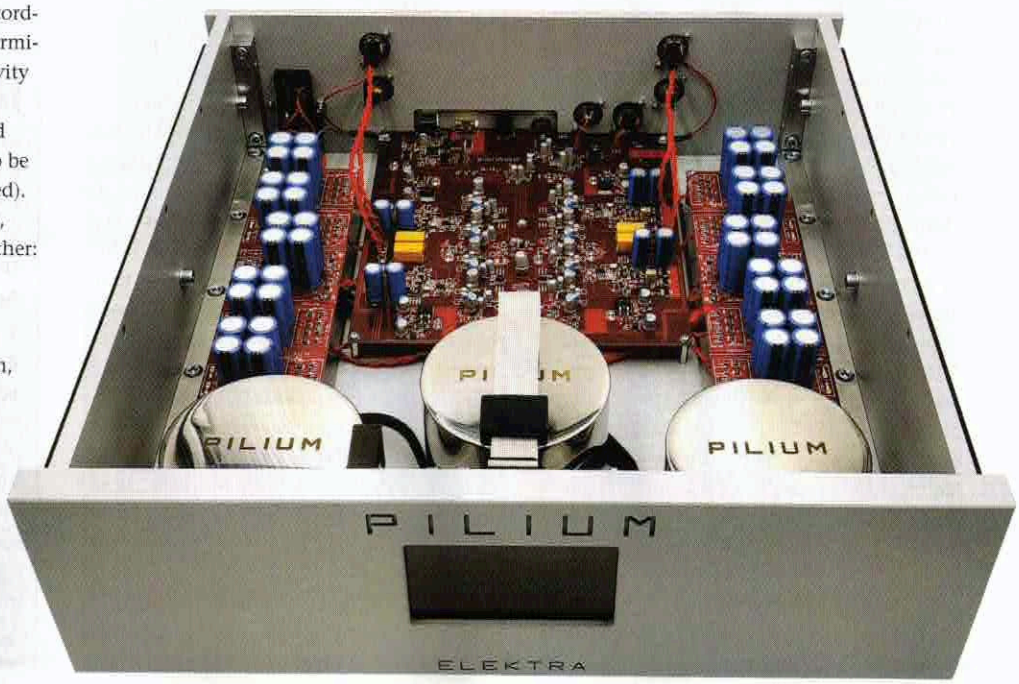
Because of all these variables, it would have been handy to have a remote control to allow filter switching from the listening position, because this would enable easy A–B comparisons to be made (I suppose I could have moved the Elektra up alongside my chair, but this would have meant using very long signal cables).

As it was, I simply enlisted the aid of family members to switch the filters while I listened, but the amount of switching I did during the course of this review rapidly turned me into 'Mr Unpopular', so I ended up with what I thought was the best all-round compromise filter, which was Sharp Roll-Off. For the record, Konstantinos Pilios' personal favourite of all the filters on offer is the Short Delay–Slow Roll Off. "This 32-bit filter has minimal echo and produces original sound as AKM claims," he says.

When using the S/PDIF input, which is actually my preferred digital input for listening to music, I tried switching between 'Standard' and 'ASRC' and found that again, I really would have preferred a remote control to evaluate these two modes because by this time I had exhausted the patience of all my family members to act as human remotes and the differences I was hearing between the two modes were so subtle that I'd really want to A–B them from my listening chair without moving my head at all in order to determine which one I preferred. So, sorry to leave this one hanging, but I am going to have to let you pick a winner between these two different settings.

Because of this, I simply followed Pilios' advice and went for the default option, plain vanilla S/PDIF, with no oversampling. Was I happy with it? I was ecstatic! The Pilium Elektra is a truly wonderful-sounding DAC. It has a pure, clean, delivery at all playback levels and when there's no music playing, it's as silent as a still evening in the Simpson desert. The sound quality is, to my ears, sweetly melodious and totally extended, reaching to the depths of the bass, and certainly far below the lowest note that could be played on any instrument.

At the opposite end of the audio spectrum the Elektra performs in a similar manner, though this time it reaches for the stars. And whereas some DACs begin to sound a little harsh in the highest treble regions, particularly at the lowest recorded levels, the high-frequency delivery of the Elektra remained totally pure and totally uncoloured at these levels, and that was true no matter whether we're talking fundamentals or harmonics of fundamentals.



I checked out the depth of the bass with Mala's *New Life Baby Paris*, a track I now play regularly when reviewing components. It was recommended to me by a friend in the UK. Mala (Mark Lawrence) plays electronic music in the dub-step style, where it's all about percussion, rhythm and bass. This particular track is just a bit too chilled to suit my musical preference, but for checking bass depth and rhythm control on hi-fi components it's fabulous. Scattered drum sounds with complex rhythms are interspersed with high-volume sub-bass 'hits' that seem to come out of nowhere. But don't start with this track on high volume lest your bass driver cones be ejected from your speaker cabinets!

The Pilium Elektra delivered the sonics with incredible precision, never blurring the transients and letting me hear the ambience even when Mala fills the foreground soundscape entirely.

Following up with Rage Against the Machine's *Bullet in the Head* revealed the Pilium can deliver rock like you were at one of their concerts. The sound of all the drums in Brad Wilk's kit are delivered with authority and you can hear the skin sound and sonorities, while the pacing of the Elektra is no better demonstrated than by the machine-gun-like drum attack that wraps up the track.

Tim Commerford's bass guitar is beautifully recorded, and the Elektra revealed the artful precision of his playing like no other DAC I have heard, as well as the glorious tone of the Music Man StingRay bass guitar he used back then. Weirdly, he ditched the StingRay first for a Fender Jazz, then a Lackland, before returning to the StingRay. Tom Morello's guitar antics on this track are absolutely insane, and the Pilium delivered all the insanity exactly as he intended.

A DAC has to get the midrange right, and the Elektra revealed to me that it had managed this the moment I span up Fleet Foxes' fantastic composition *Fool's Errand*.

Pitchfork's Matthew Strauss once wrote of Fleet Foxes: *"In many of their songs, desire is consistently hindered by reality, yet their grand sound renders simple moments triumphant."*

His sentence describes this track to a 'T'. The richness of the track's sound was rendered to perfection and the crystal clarity of the echoed vocal harmonies was triumphantly delivered by the Elektra.

The *a capella* section that transitions the guitars and drums to the solitary slightly detuned piano that re-introduces the main theme sounds miraculous through the Elektra, as does the sound of the piano itself. You can't truly evaluate midrange sound without listening to a fabulous female vocalist, so I listened to Billie Eilish first singing *No Time To Die* and then *When the Party's Over*, after which I just had to listen to the whole album ('When We All Fall Asleep, Where Do We Go?') as well as those tracks again, because that's what happens when you're auditioning a superb piece of audio equipment... you get so carried away you want to listen to everything anew.

Eilish's *All The Good Girls Go To Hell* reminded me that I hadn't listened to Lisa Bassenge's version of it for a while, so I loaded her album 'Mothers' and started from the top (*Joanne*). Bassenge not only has a great voice, she also has great taste in the musicians she chooses to accompany her (so much so that she married one of them). If you like a sweetly syncopated funky smokey-sounding jazz style, she's a musician to follow. Again the Pilium Elektra DAC revealed the two totally different vocal styles brilliantly: Eilish's close-miked, breathy waif-like technique vs. Lisa's clear and mature projection. Mothers has an incredible version of Janis Ian's *At Seventeen* by the way, plus the recording quality of the album is superb.

If you want to test the upper reaches of your own hearing as well as the upper reaches of the Elektra's high-frequency response, you could do no better than listen to Kamasi Washington's epic album (appropriately titled 'The Epic') which is a sonic smorgasbord. Listening to the way the Elektra DAC so clearly revealed the different sounds of the different cymbals that are used throughout the album, the signature sound of the Hammond organ, and the sweetness of the soprano voices solo and in unison in the choir was a revelation.

But perhaps the most revealing aspect of the music on this album is if you can clearly hear all the myriad sounds without them being melded together, and the Pilium Elektra passed this test with flying colours.

CONCLUSION

My time spent listening to Pilium Audio's Elektra DAC reminded me of one of the most famous quotes from Euripides' play, Elektra: "To spend life's fleeting days mid joy that never meets an evil hour is to be blessed beyond compare." Listen to your music using a Pilium Audio Elektra DAC and you will be similarly blessed! *Alan Leith*

CONTACT DETAILS

Brand: Pilium
Model: Elektra DAC – Divine Line
Price: $57,500 (RRP)
Warranty: Two Years
Distributor: Absolute Hi End
Address: PO Box 370, Ormond, VIC 3204
T: (04) 8877 7999
E: info@absolutehiend.com
W: www.absolutehiend.com

- Unbelievable build quality
- Super-silent backgrounds
- Amazing sound

- Remote/app control
- Stand-by mode
- Ethernet input/streaming

Readers interested in a full technical appraisal of the performance of the Pilium Elektra DAC should continue on and read the LABORATORY REPORT published on the following pages. Please note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.

LABORATORY TEST REPORT

Newport Test Labs measured the output of the Pilium Elektra at a shade higher than 3.7-volts RMS via the XLR outputs for a 0dBFS digital test signal. This is fairly standard. The output at the RCA terminals (not measured) would be half this, or around 1.8-volts RMS. You can see from the tabulated results that the voltage was slightly different for the left and right channels, but the difference (i.e., channel balance) of 0.55dB, although somewhat higher than I might have expected, is not audibly significant.

Separation between the left and right channels was outstandingly good at all three frequencies tested, with a best result of 141dB at 16Hz. The 100dB of separation measured by Newport Test Labs at 20kHz was exemplary: there are few DACs that are able to deliver a three digit result at this high frequency.

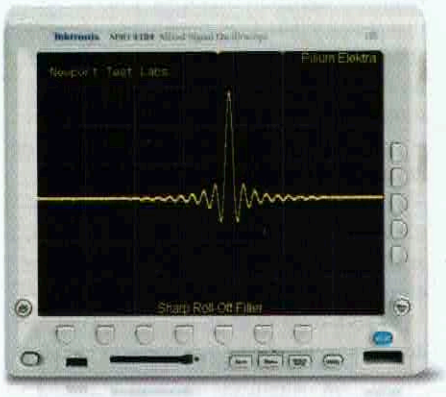
Inter-channel phase error was extremely low at low frequencies and although it gradually increased with frequency, was still only 0.94° at 20kHz. All the errors are so minuscule that they would not be audible and could be corrected, if required, by moving one speaker a few millimetres closer to the listening position. Group delay was typical for a standard delta-sigma DAC.

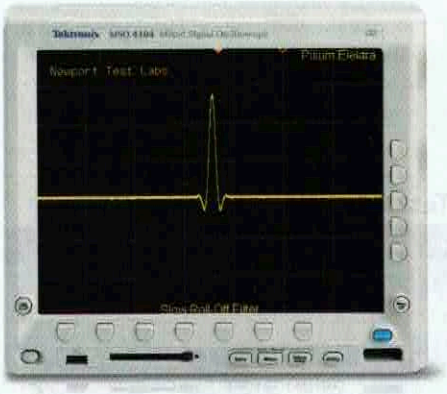
Overall THD+N was very low, as you can see from the result of 0.001% listed in the tabulated figures. Distortion was, however, related to level. You can see on Graph 1, which shows output at 0dBFS, that there is a second harmonic at –68dB (0.03981%), and a third at –80dB (0.01%), both of which would seem to be related to the output stage, rather than to the conversion process itself. Of the other distortion components visible on this graph, four are more than 100dB down (0.001%) and the other three more than 120dB down (0.0001%). Note that a 0dBFS signal is not one you'll find in any recorded music.

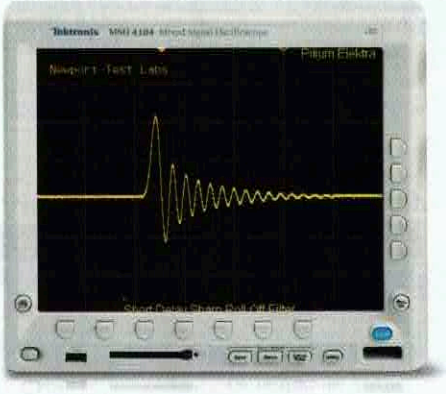
When the Pilium is reproducing a more representative signal level of –10dBFS (Graph 1), a second harmonic component is present at –90dB (0.00316%), a third at –98dB (0.00125%) with a fourth and fifth at –120dB (0.0001%). It's worth noting the exceedingly low noise floor of the Pilium Elektra, which is down at –140dB. It is rare to see such low noise in a DAC, particularly at the low frequencies, which you can see at the extreme left of this graph. Graph 3 shows distortion spectra for a 1kHz test signal at –20dBFS and you can see distortion has all but disappeared completely, with only a second harmonic at –117dB (0.00014%) and a third at –116dB (0.00015%). This is particularly good performance which again will be aided by the lack of noise introduced by the DAC itself.

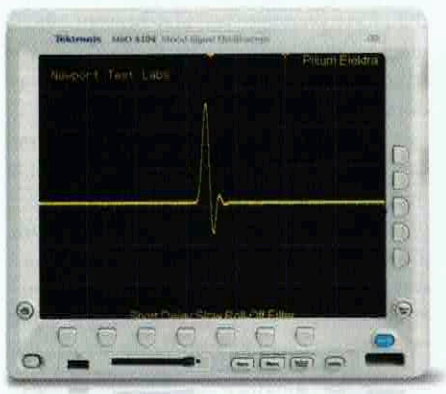
The Pilium's performance at –60dBFS shows some converter non-linearities (the 'grass' at the bottom of the graph), but these are well-distributed and very low in level, all being more than 120dB down (0.0001%). You can also see that the noise floor itself has dropped to below –140dB except at the very lowest frequencies. The non-linearities are due to the test signal not being dithered (see next paragraph).

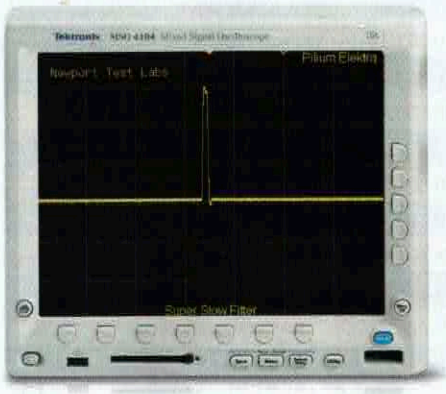
The effect of dithering the test signal is shown in Graphs 5 & 6 on the following page, where Graph 5 shows the Pilium's performance with a dithered signal and Graph 6 its performance with almost exactly the same test signal, except that it hasn't been dithered. You can see that dithering enables the converter to be better-behaved, so that it removes all the harmonic distortion components (even though all are more than 100dB down in any case) with the only trade-off being an increase in the noise floor, though since the noise floor ends up at –130dB, this is not an issue.

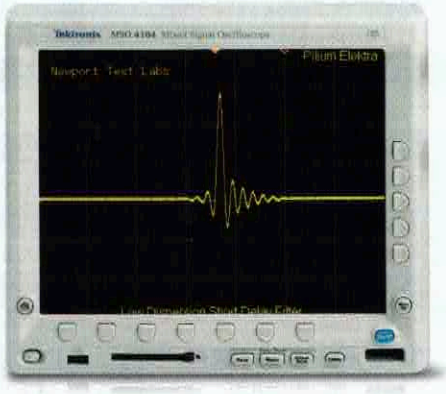


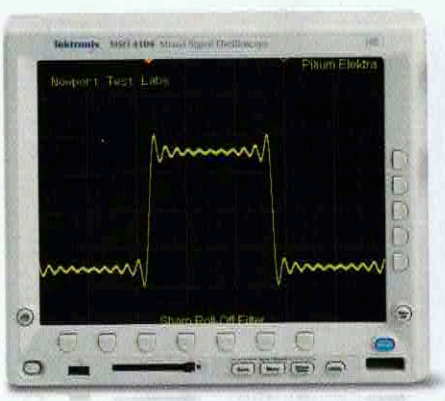


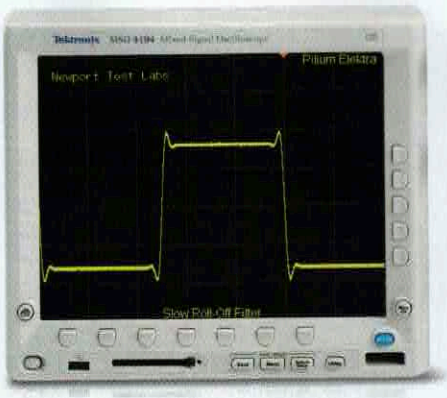


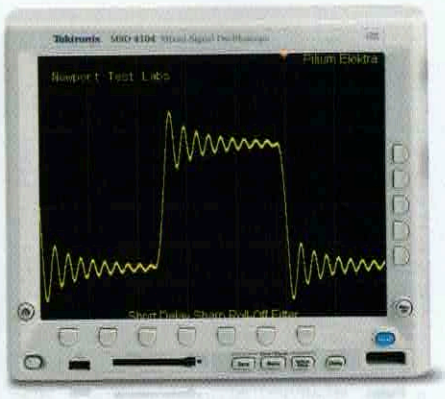


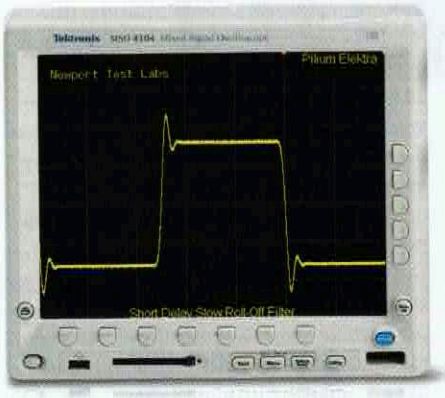


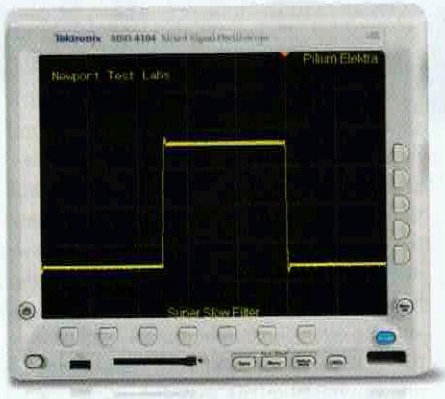


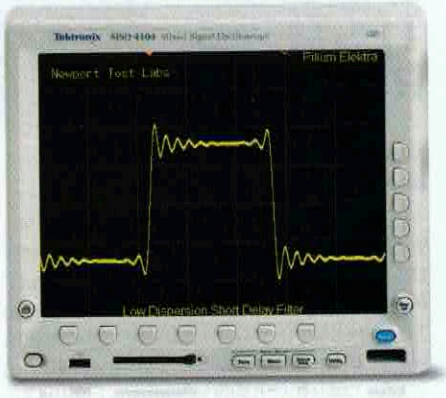












Graph 7 shows CCIF-IMD at 0dBFS. The two test signals result in the two nearest sidebands at 18kHz and 21kHz at more than 90dB down, and two more at 17kHz and 22kHz that are sitting down at around –110dB (0.00031%). The level of the unwanted signal regenerated at 1kHz is down at around –108dB (0.00039%). There are some sampling-related artefacts up around 44.1kHz which would not be audible.

Graphs 9, 10 and 11 show the effect on the Pilium Elektra's high-frequency response when using three of the different filters available. You can see when using the Sharp Roll-Off filter (Graph 9), frequencies above 20kHz are rolled off very steeply so at 24kHz signal level is 100dB down, while frequencies within the audio band are completely unaffected (at least in terms of level) by the filter.

Graph 10 shows the effect of the Pilium Elektra's Slow Roll-Off filter on the high-frequency response. As you can see, there's none of the sharp cut-off visible in Graph 9, with the high-frequencies slowly rolling off to be around 100dB down at around 35kHz. However, the slower roll-off means that the very highest frequencies in the audio band are slightly attenuated.

Using the Pilium's Super-Slow filter (Graph 11) there's no cut-off until up around 50kHz and an even-greater effect on the level of the frequencies below 20kHz.

The effect of the three filters on audio band signals is depicted in the frequency responses shown in Graph 12. You can see that the Sharp Roll-Off filter (green trace) is almost completely flat out to 20kHz, where it's only 0.2dB down. The Super-Slow filter starts having an effect on audio frequencies at 1kHz, so it's 0.5dB down at 11kHz and 1dB down at 10kHz. The Slow filter's response is flat out to 3kHz, then rises slightly before it starts its roll-off at 8kHz, to be 1dB down at 15kHz. It's arguable whether any of these differences would be audible.

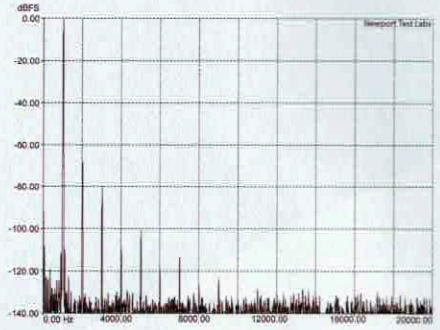
As with most modern DACs, the Pilium does not have a de-emphasis circuit enabled, which means that if you use it to play some CDs (or digital files) that were recorded more than forty years ago, you may hear slightly different high-frequency levels than the original producer intended. These differences may or may not be audible.

Linearity errors were very, very low, as you can see from the tabulated results, though interestingly the best (0.01dB) and 'worst' (0.05dB) results were measured at –60dB and –70dB respectively... and not that I put the word 'worst' in inverted commas because an error of only 0.05dB in level down at –70dB is evidently an excellent result!

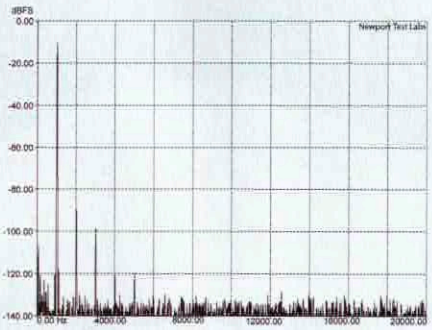
Also excellent were the signal-to-noise ra-

Pilium Elektra DAC – Laboratory Test Results

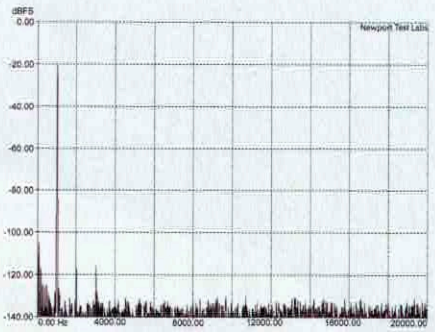
Analogue Section	Result	Units/Comment
Output Voltage (XLR)	3.7424 / 3.7871	volts (Left Ch/ Right Ch)
Frequency Response	See Graphs	dB (20Hz – 20kHz)
Channel Separation	141 / 124 / 100	dB at 16Hz / 1kHz / 20kHz
THD+N	0.001	@ 1kHz @ 0dBFS
Channel Balance	0.55	@ 1kHz @ 0dBFS
Channel Phase	0.01 / 0.06 / 0.94	degrees at 16Hz / 1kHz / 20kHz
Group Delay	180 / 14.44	degrees (1–20kHz / 20–1kHz)
Signal-to-Noise Ratio (No Pre-emph)	113dB / 121dB	dB (unweighted/weighted)
De-Emphasis Error	0.35 / 3.5 / 8.95	at 1kHz / 4kHz / 16kHz
Linearity Error @ –60.00dB / –70.00dB	0.01 / 0.05	dB (Test Signal Not Dithered)
Linearity Error @ –80.59dB / –85.24dB	0.03 / 0.01	dB (Test Signal Not Dithered)
Linearity Error @ –89.46dB / –91.24dB	0.04 / 0.03	dB (Test Signal Not Dithered)
Linearity Error @ –80.70dB / –90.31dB	0.03 / 0.04	dB (Test Signal Dithered)
Power Consumption	18.94 / 22.12	watts (Standby / On)
Mains Voltage During Testing	235 – 246	(Minimum – Maximum)



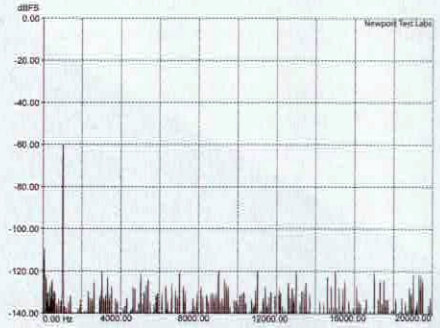
Graph 1: THD @ 1kHz @ 0dBFS.



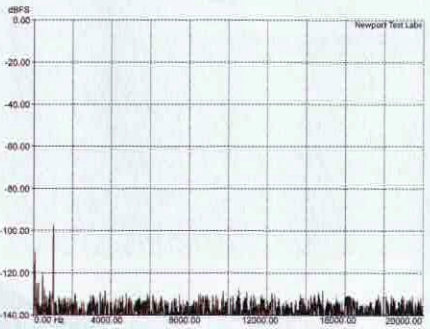
Graph 2: THD @ 1kHz @ -10dBFS.



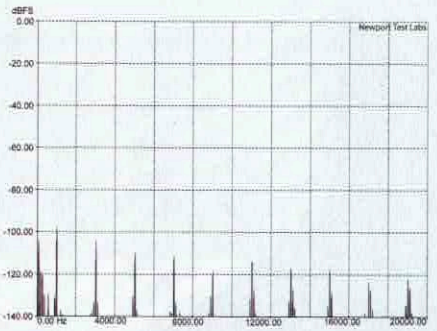
Graph 3: THD @ 1kHz @ -20dBFS.



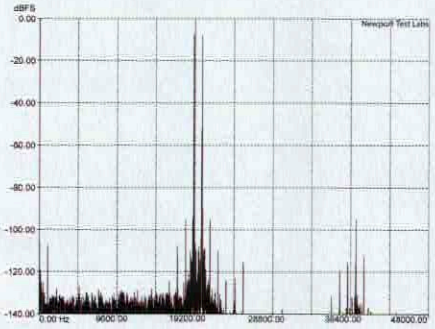
Graph 4: THD @ 1kHz @ -60dBFS.



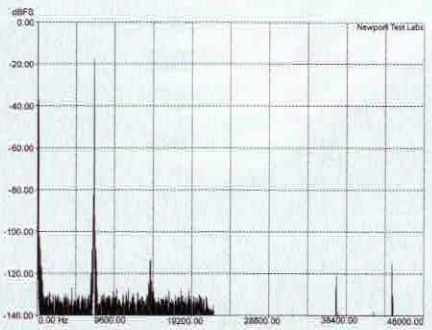
Graph 5: THD @ 1kHz @ -90.31dBFS with dithered test signal.



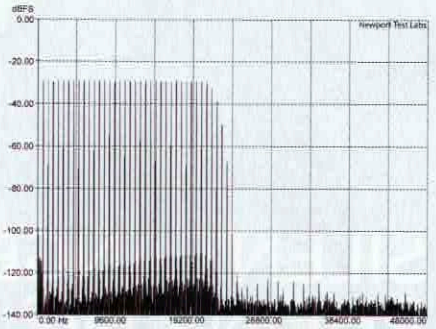
Graph 6: THD @ 1kHz @ -91.24dBFS with undithered test signal.



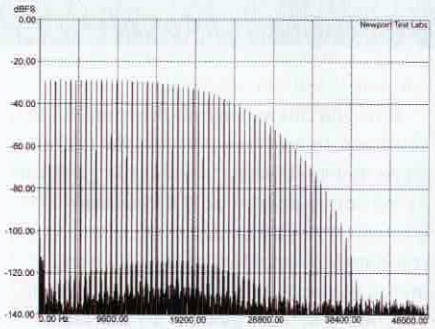
Graph 7: CCIF IMD 19kHz + 20kHz (1:1) at 0dBFS.



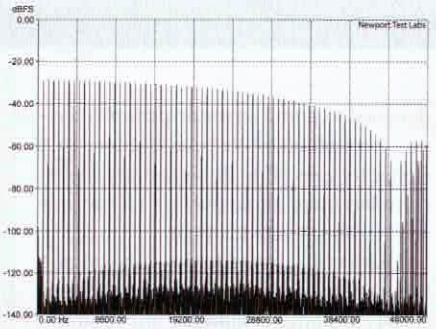
Graph 8: SMTE IMD 60Hz + 7kHz (4:1) @ 0dBFS.



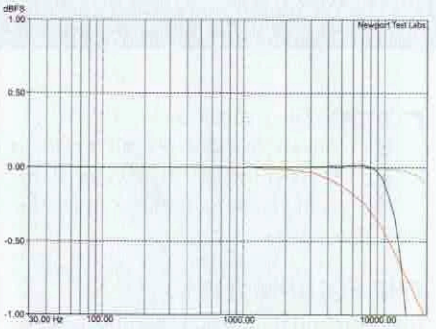
Graph 9: Frequency spectrum using 630 single sample pulses per second and Sharp Roll-Off Filter.



Graph 10: Frequency spectrum using 630 single sample pulses per second and Slow Roll-Off Filter.



Graph 11: Frequency spectrum using 630 single sample pulses per second and Super-Slow Roll-Off Filter.



Graph 12: Freq. response showing Super-Slow (red trace), Slow (black trace) and Sharp (green trace) filters.

tios measured by Newport Test Labs, with the Pilium Elektra returning wideband results of 113dB unweighted, and 121dB IHF-A weighted. This will make it the least-noisy link in your system, interconnects excepted.

The effect of the six different filters on a single impulse is shown in the oscillograms. You can see the primary differences concern the presence and the level of pre-ringing (unwanted signal prior to the pulse) as well as the extent and level of ringing after the pulse. Also that the Super-Slow filter appears to distort the pulse itself, which the other filters leave untouched.

Newport Test Labs also measured the effect of the six different filters on a 1kHz square wave, with the results shown in the twelve accompanying oscillograms. Contradictingly enough, the square wave that most resembles an analogue square wave was produced by using the Super-Slow filter.

The performance of the Pilium Elektra DAC, as measured by Newport Test Labs, was excellent. It's clearly a very superior DAC, particularly with regard to noise, having the lowest levels of it I can recall seeing on any DAC. ***Steve Holding***