

TACD (Taiko Audio CPU Direct)

Pre-Announcement of two new Taiko Audio Products that are closely related to each other.

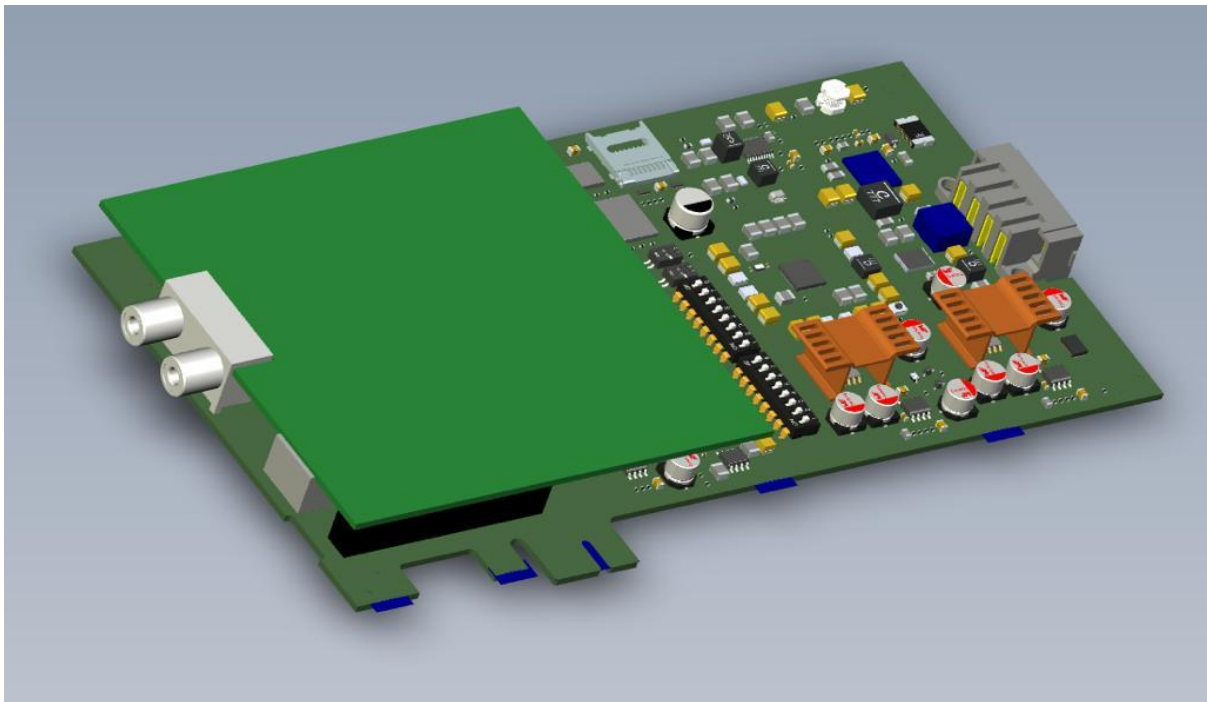
TACD PCIe Interface with modular daughter board

The Taiko-designed TACD PCIe Output Board will feature a modular build to support a range of outputs using either a D/A or D/D daughterboard, providing a single output type per module.

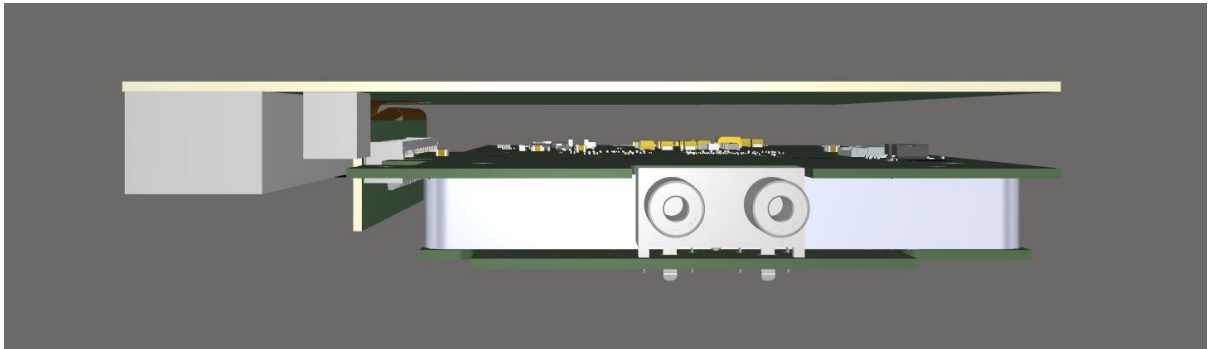
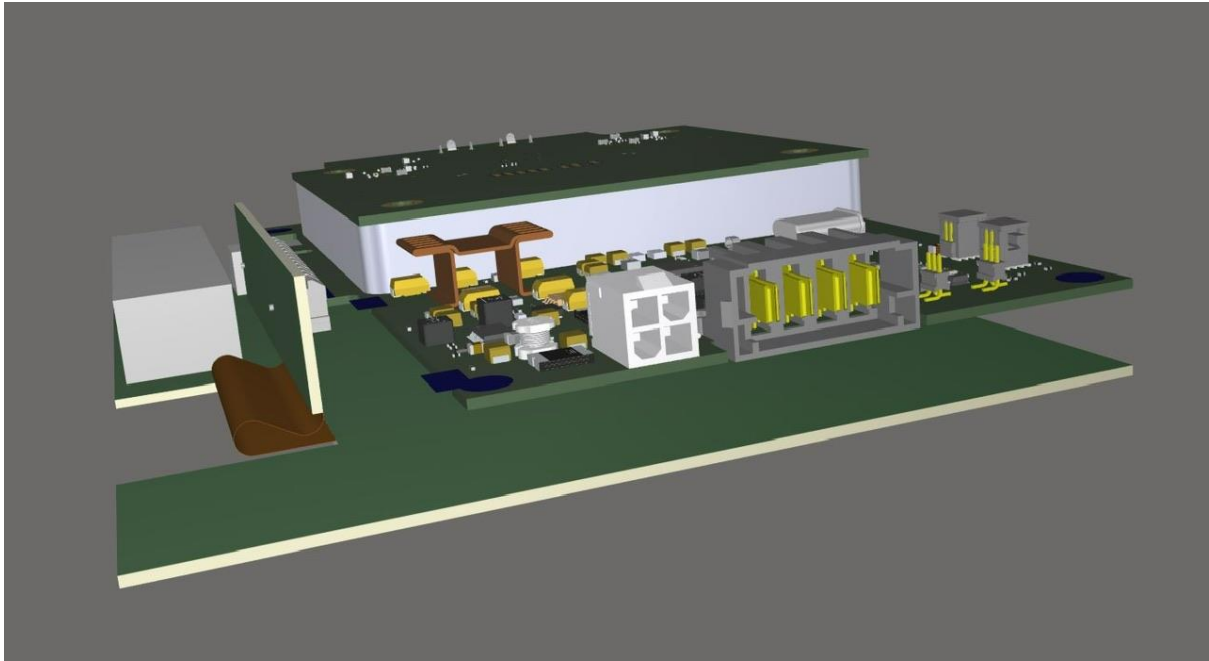
Transport and Interconnect system

Besides the PCIe interface, we also designed a new proprietary transport/interconnect/interface system for transferring the music signal from the PCIe interface mounted in the Extreme Music Server to an external DAC.

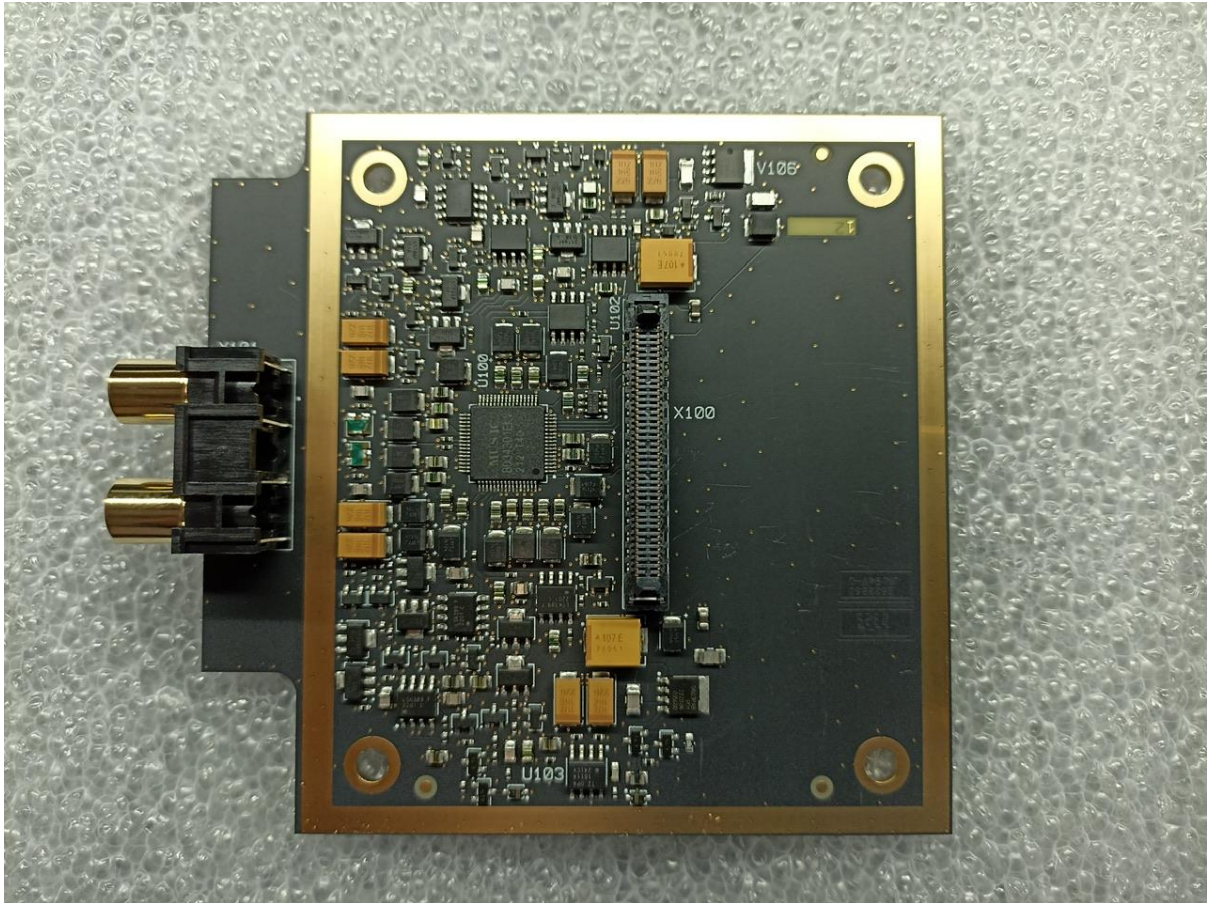
This transport/interconnect system is designed to be unhindered by the limitations of either the USB or AES/SPDIF/I2S interface. It will require a daughterboard to be mounted inside the external DAC to work. We have yet to come up with a final name for it but internally we refer to it as TACD for Taiko Audio CPU Direct.



Shown above is the modular PCIe main board with the daughter board on top, in this case the version containing a DAC and two analog outputs on RCA.



The “white block” is a solid machined piece of copper which contains and shields the optional output modules which in turn plug into the interface carrier board. In this render it contains the analog output module.



TACDA DAC + Analog output stage on daughterboard

Performance

The performance of TACD depends for a large part on the software, drivers, and firmware. Therefore, it will most likely produce superior results when used with the optimal interface for the DAC of choice.

We are talking with various manufacturers of High-End DACs, among which Lukasz "Lampizator" Fikus, Jonathan Gullman of MSB, Vincent Brient of Totaldac, and Stavros of Aries Cerat.

As it stands, it looks pretty certain that we will be offering the following configurations:

- PRO ISL for MSB
- Single AES/EBU for Totaldac
- Dual AES/EBU for dCS

The Dual AES/EBU outputs can also be used as single outputs.

Note that AES/EBU does not support native DSD128 which is implemented as DSD over PCM (24/176KHz over each wire).

For MSB, we can mount a PRO ISL daughterboard on the interface main board, so you can ditch the MSB Pro USB module and go PRO ISL directly from Extreme to DAC.

The optimal interface for Aries Cerat is yet to be determined.

For Lampizator, we'd likely make this either a "drop in" replacement for the jlsounds USB board or use I2S of which the Horizon has 2 inputs fitted as a factory default.

All the software enhancements we have developed to improve USB performance will now be available for these methods of connection. This also includes some XDMS technology that improves general streaming/file playback. More formats may follow.

Update 17-08-2023 with respect to TOTALDAC

After a brief discussion, it appears there's little benefit to be gained over just using AES/EBU as the Totaldac uses that "internally" already.

TACD PCIe Interface with on-board DAC and analog output features:

- Rohm BD34301EKV DAC chip
- Accepts up to 32/768 files with native playback
- Analog output on 2x RCA
- Operates on a 5V and 12V DC supply (can be powered internally from the Extreme power supply)

Modular Approach

We have decided on a modular build for the TACD PCIe card to be able to accommodate a wide range of interface options at a reasonable price level. Going modular protects the value of the investment into the interface/controller technology which is by far the costliest part of the design.

The interface section occupies 75% of the current card where the DAC / Analog section occupies the remaining 25%. A different card for each option would make it very inefficient and costly.

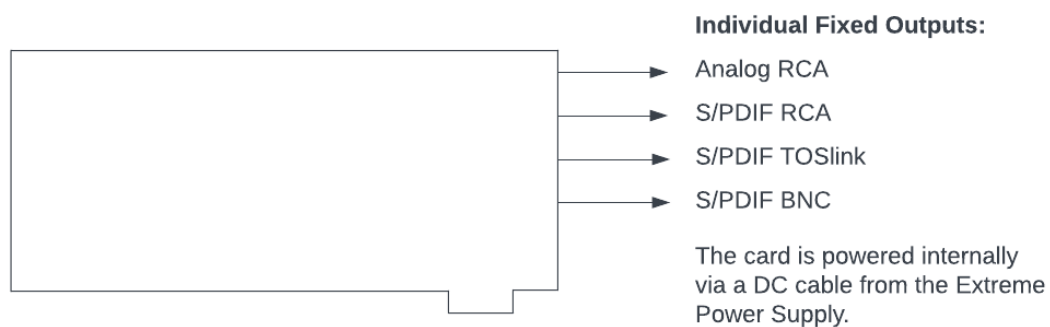
The Modular Daughter Board will mount on top of the main TACDA PCIe board and can then provide one specific function from an array of options such as:

1. A DAC with Analog output
2. Generic S/PDIF, AES/EBU, I2s, or other digital formats
3. Custom output like MSB Pro ISL
4. New Taiko proprietary interface

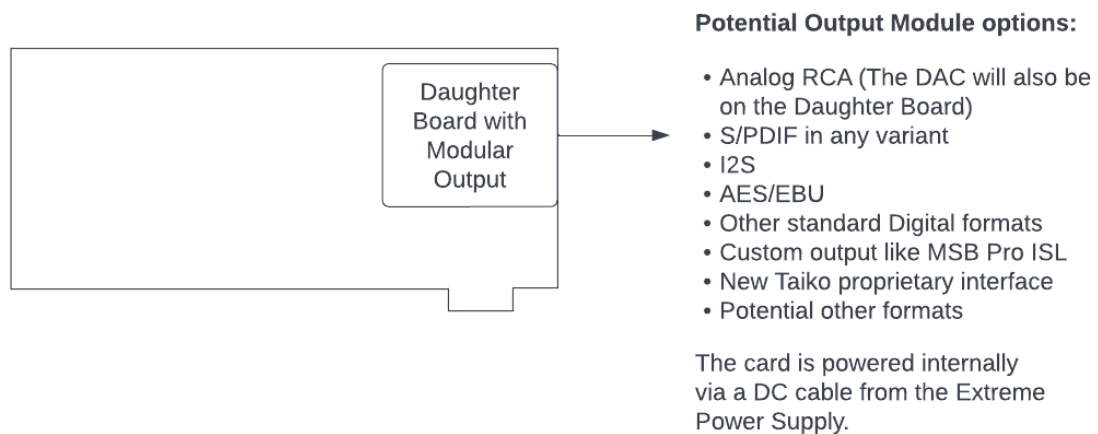
USB will not be added, and as such, these new cards will not substitute the Taiko Enhanced USB card.

The daughter board clicks in place on the main PCIe board and is Plug & Play, meaning that, if desired, it can be user-swapped.

TACDA Model as originally intended
With individual fixed outputs



Revised TACDA Model for actual release
With Modular output



Expected Availability

The redesigned modular version may launch in July/August.

Initially, the TACD technology will be made available only for existing Extreme owners. At a later stage, it will be made available to the wider public.

Pricing

TBC.

Back Story

For some time, the question on many people's collective minds was: "When will Taiko bring some form of DAC to market?"

As you all know we have been advocating the use of the USB interface to connect to your DAC while most other server vendors advocate the use of SPDIF/AES/I2S, and in a few rare cases, Ethernet. The reasons for this are pretty straightforward.

One aspires to meet or exceed CD transport playback performance for 16/44.1 files at a competitive retail price level. This first issue you will run into is a quite obvious one, you need a very significantly larger amount of PCB real estate, functionality, and processing power which require much more filtering to have competitive electronics noise levels. One could argue that a CD transport comes with additional expense for rotational stability and vibration control (jitter) but then one would be disregarding the streamer hardware possibly being equally sensitive to this, although it does have the luxury of the absence of a motor. Then you need an interface to the DAC. Very low-noise SPDIF/AES/I2S solutions have been around for decades with not much, if any, mystery surrounding their sound quality performance. And obviously, using the same interface as a CD transport, it becomes easier to approach a CD transport sound signature. However, this comes with a limitation of a 24/192 data rate over a single line, and due to how the interface works, increased noise levels at higher sample rates. Typically, this interface will not sound better for higher sample rate files than 16/44.1 (note that the source master quality tends to exceed any of these differences at all time), and worse than 16/44.1 with DSD/DXD files due to the need of significant conversion processing. Now, you have managed CD transport quality playback, for all sampling rates... To us this has been an unacceptable approach from day 1, which is why we went all in on USB. USB data packet rate is fixed and does not change with sampling rate, the interface is universal, the interface sound signature does not change with sampling rate, and it's the same for all receivers, or at least, that was the design goal... Today we know and have proven this is not true. Sure, we have developed an USB card with noise levels at or below those of an AES/SPDIF/I2S interface without the jitter/timing sensitivities of those interfaces. But still there were deviations and discrepancies from expected performance. It took designing our own USB driver, querying all DACs our customers support, and designing our driver to be adjustable to different implementations of USB receivers in DACs. This was quite an elaborate project, but as you have all witnessed the performance delta can be dramatic. However, as you also all know by now is that the playback software has its signature too, and Roon's signature has changed over time. Roon currently sounds more expansive than the average CD transport, but also softer and less clear, and some prefer this over CD, some don't. We now have XDMS (currently in Alpha state) to level the playing field once more. For 16/44.1 (local file playback), XDMS on the Extreme sounds like a mix of CEC TLO 3.0 timing, Kalista color shading, and the bass of a Mark Levinson 31.5. We like to think that what we have today is competitive

performance at 16/44.1 to top flight CD transports, and we deliver on the promise of better performance at higher sample rates (again assuming corresponding master quality).

Where to go next?

During our journey, exploring the USB interface, driving it to its absolute limits, coding drivers, and coding playback software, the idea came to bear there's room for improvement, considerably so, as further improvements in code are not possible due to USB interface hardware limitations. We conceptually have an even better USB interface design, but still, this will have the same limitations. This kind of improvement would be similar to the improvement that results from overengineering linear power supplies for a bigger multi box model Extreme without actually solving the "problem", without real progress or innovation.

So, we took it upon us to embark on a very ambitious project of designing an entire new interface not hindered by the limitations of either the USB or AES/SPDIF/I2S interfaces. This project involves coding a whole new driver stack with corresponding software from scratch and an entirely new hardware interface. We have not thought of a name for it yet but internally we refer to it as: TACD for Taiko Audio CPU Direct.

Q&A

What happened to the earlier announced non-modular PCIe card with fixed outputs?

The earlier announced non-modular version with fixed analog RCA digital S/PDIF RCA, BNC, and Toslink outputs will no longer be released. The Modular version that we will release instead will remove the fixed analog and S/PDIF outputs and substitute a new module. The PCIe card will have the controller/interface technology and power circuitry, with a connector to which you can connect a daughter board, which represents the Modular Option.

Why interface to another DAC if there is already a DAC chip on board?

To improve performance. 😊 We're not DAC designers, the innovation is in the superior interface, we've incorporated a Rohm BD34301EKV DAC chip because we thought it sounded best of the available "off the shelf" DAC chips (more "analog" than for instance ESS Sabre) and added a JFET class A output stage, but that's about all we could fit on a PCIe card sized PCB. It may compete with some 10-20K DACs, but to directly compete with a top-level DAC such as a Lampizator Horizon, MSB Select 2, or Totaldac D1-12 is a bit much to ask for! 😊

Why did we choose Rohm?

There aren't actually that many options to choose from anymore: AKM, Rohm and ESS. The Rohm "sounds" the most natural to us. We did not try the new revision AKM flagship though as it wasn't available yet. But I should add that the influence of the DAC chip itself is actually not that large, if I had to put numbers on it, it would look something like this:

-Interface 40%, DAC chip 10%, analogue stage 50%.

The Rohm current segments do allow for a more “elegant” analog output stage design which might be what placed it ahead. This might perhaps give it a larger share in the 10/50 figures quoted above, like maybe 20/40.

How would I connect DAC XXX to the new TACDA?

Coaxially either via S/PDIF RCA or via BNC. In an ideal world all DAC manufacturers would follow suit and incorporate our interface. 😊

For those DAC manufacturers who decide not to support the new Taiko digital protocol to transmit digital data from Extreme to DAC, would it be feasible for Taiko to develop an interface box, similar to MSB's Pro ISL box, to receive the Taiko protocol over the Taiko cable and convert it back to something the DAC would accept so that a very short cable would connect between box and DAC input?

Transporting I2S over a distance is generally problematic which for example MSB has addressed in their Pro ISL interconnect. So, you could have a potential benefit from going this way for an "old fashioned" direct I2S transport by shortening the distance, but it's hard to predict how it will all work out. We could run an experiment and see what happens, it would not be hard to do. But for AES/EBU or S/PDIF, there would be no benefit.

Would there be any benefit over USB from Extreme to DAC by going Taiko protocol from TACDD (in Extreme) to a Taiko box incorporating the "other half" of the Taiko protocol, which then outputs some connector/cable format the DAC accepts? Particularly, for dCS?

For dCS, that would then equate to dual AES/EBU. I don't expect AES/EBU to suffer badly from cable lengths. A box with direct AES/EBU plugs as outputs without any cabling is not impossible to design but surely challenging.

In addition to dual AES/EBU, it would be ideal if the dCS clock signal could also be sent back to the Extreme. In a dCS stack with clock, the clock cables also have a large influence on the sound.

That would actually also be doable, and we do have a fairly large amount of DCS owners amongst our customer base. We have added this feature request to the list.

What is more ideal, S/PDIF (BNC) S/PDIF (RCA)?

The outputs should have the same specification but it's too soon to tell.

Will the TACDA have any Digital Input(s) to take advantage of its capabilities?

Currently, no.

Will TACDA have multiple BNC outputs for higher sample rates?

1 BNC output means a 192 kHz 24-bit max limit. That is perfect for all the TotalDAC users but only until Lampizator, MSB, and TotalDAC add TACDD receivers into their DACs. That will surpass the performance of current formats such as S/PDIF, AES/EBU, and USB. That said, we are looking to release various versions of the daughterboard.

What type of cable will carry this new interface?

At the moment this is undisclosed.

If one is fine with 24/192 and has no need for DSD/DXD, would S/PDIF on the next gen card provide a sonic upgrade versus USB XMOS?

We're not sure, the thing is, the more time we spend with it, the more improvements we find, parameters affecting sound quality, some expected, some unexpected, even just the driver code has an incredibly large effect on the resulting sound, what we are used to listening to is severely compromised with regards to transients, dynamics and timing but also texture, spatial information, decay. Bottom line, we're just getting started here, it's brand new technology.

If you are using the TACDA card with the analog/RCA output, can one play any format PCM/DSD files, and any resolution?

Per the DAC chip specs:

Sampling Frequency 32 kHz to 768 kHz (PCM mode)

DSD 2.8 MHz, 5.6 MHz, 11.2 MHz, 22.4 MHz Available

Will this PCIe card be available for non-Extreme owners?

Yes, we actually most likely will make it available for the wider public. In this case we'd be looking for a degree of market adaptation. This has been a very expensive project meaning it would probably end up retailing at the same 10-20K if the card was only purchased by say just 20% of Extreme owners currently owning a DAC in that price range.

Does the TACDA replace the USB card?

The new technology interface card is CPU / PCIe direct to DAC - Analogue out AND CPU / PCIe direct to SPDIF (with RCA, BNC, and Toslink connectors). The DAC card is not meant to replace USB with SPDIF.

Does the Taiko Enhanced USB card have the Direct PCI technology to the CPU?

The USB card does not have this technology as using USB means it has to go through a PCI to USB conversion process and subsequently through a USB to I2S conversion process. Further to this, we have maxed out our software on some USB transfer limits.

What exactly is the full value offered to an Extreme user by the PCIe DAC card?

The value is:

- A start with addressing one of the largest SQ limiting issues in high-res digital playback
- Being able to offer a much-requested feature (one box solution)
- Significantly upgrade our SPDIF output option
- A potential direct upgrade for about 20% of our customers
- Expanding to a medium timeframe upgrade for about 60% of our customers (2023)
- Over a longer timeframe possibly providing an upgrade to 90% of our customers (into 2024)

PCI slot availability - If one has the USB card as well as the new ethernet card installed in the Extreme already, there seems to be no spare PCIe socket for the coming Extreme TACDA & TACDD interface card? Does the USB card have to be removed to make room for the new interface card?

You could either replace the USB card for which we could look into doing a trade-in deal or you can move the Optane OS drive, and there's room to relocate the storage cards. Also, you could opt to remove the VGA card which is hardly ever used. It's just a bracket with a flatcable connecting to the motherboard.

Is there a sq advantage to only having the dac card installed without the usb on the mb?

The difference is hardly noticeable.

Any future plans to reverse the allotment of space and offer an enhanced DAC card without having to devote so much space to interface options?

We can surely spend years cooking up all sorts of iterations & improvements, hence the decision to go modular now. This would also protect the value of the investment into the interface/controller technology which is by far the costliest part of the design.

We can surely look into expanding options to provide an enhanced DAC if it proves to be popular. We could even make a multi PCIe card setup. As far as we are aware, Slot 4 is not in use in any Extreme for example, slot 5 is used by the USB card, slot 6 by the VGA connector which is almost never actually used and as good as redundant, so we could even make a triple card setup, and each of these cards could have daughter boards, and then we could make external add-on boxes, but then we'd have become actual DAC manufacturers which we want to stay away from. We prefer to spend our R&D resources on improving source and interface, where there still are strange new worlds to explore, where we can seek out new life, to boldly go where no man has gone before.

Will this card work with Apple Mac?

The current implementation is Windows only and it is not likely that we will develop an Apple Mac version.

Will the TACDA PCI card be compatible with AMD Zen 3 hardware and/or with Linux OS?

Yes, that should work fine. Linux driver support is not hard to add.

Why no XLR Balanced Outputs?

Space is limited. The narrow PCI bracket and limited clearance of the slots on the Extreme's rear end prohibit the implementation of XLR connectors. We could theoretically add XLR connectors to the larger Option panel and connect them to the TACDA board with a short cable. But we'd need to pretty much double the components of the TACDA daughter board and we'd have to deal with double heat dissipation from an actual class A Jfet output stage.

That said, it *could* potentially be done.

Will there be an XLR balanced analog output?

No XLR outputs scheduled just yet, there's actually a limit to what we can handle at the same time ;) Technically not difficult as it's more or less just a doubled-up output stage. But the double components would introduce extra noise that we'd need to deal with, we'd have to resort to a break-out connection, perhaps the square Option panel, and we'd have to deal with double heat dissipation from an actual class A Jfet output stage.

So, for the people a preference for XLR, the way to go is to get a TACDD supported DAC so you get the benefits of the new interface?

Indeed, with a BPS-powered DAC you're in somewhat of a different situation as individual component self-generated noise and even additional PCB tracing becomes audible. Doubling up components and increasing PCB traces therefore increases this particular type of noise. Hence, a balanced version needs some more in-depth investigation to reach at least equal performance levels. That is not to say we won't do it, but it will require more effort than simply doubling up the output stage.

Market Adaptation - What's the likelihood of the collaboration with other D-A converter DAC manufacturers for the new card output?

The aforementioned manufacturers have expressed their willingness. Naturally, we're going to need market adaptation. These are not cheap developments, it's either going to be a long-haul investment project taking years to break even, like XDMS for example, or it's going to take off like a rocket and be widely used inside of 1-2 years. The pace will be largely decided by how well the products we launch that utilize this standard sell.

We would like to request from our readers to not contact your DAC manufacturer to request adoption. We understand the enthusiasm surrounding this project but this can be counterproductive to the process. We have a very clear view of the DACs used by our customers and we'll contact the manufacturers ourselves in a timeframe that works for us.

TACDD interface - please can you shed some light on the TACDD interface between Extreme and external DAC?

This is still to be designed and launched later.

Can we listen to Extreme with this TACDA output at the upcoming HE Munich in May?

We're fairly sure that it will be used somewhere! 😊

Will there be licensing costs for adapting TACDD for DAC manufacturers or will Taiko support DAC manufacturers to get market penetration?

We have not given that any thought yet.

What output voltage will the RCA outputs of the DAC card have?

It will be another month or so before we will disclose any more details on that.

Within a voltage range, what is the best voltage?

The largest variation in that would be caused by a linear Power Supply. For a LPS, a higher voltage might be better as most are noisier at higher currents (and lower voltages).

Is it possible for Lampizator or MSB to develop an interface for TACDD that could obviate the need for a new DAC or even having to ship back current DAC like the Horizon or Select 2 to the manufacturer for retrofit (like a home install/upgrade)?

For MSB, it can be relatively "easy" to implement. There are several parts in play here.

- The controller, for USB, the vast majority uses an XMOS controller, this controller is USB in and I2S out.

- The transport between devices, this can be:
 - Using a USB cable where the XMOS controller is located inside the DAC, like Lampizator and most other DACs really, the I2S signal is then generated inside the DAC.
 - Using a separate external box, in which the XMOS controller is located with an USB input and AES output (Totaldac reclocker), or an USB input and I2S output, like the MSB Pro/ISL module, though that's a proprietary implementation of an I2S transport, if you're interested in the specifics read up on the MSB website.
 - Placing the XMOS controller inside the server, convert USB to I2S internally, and then transport over a different link to the DAC, like Wadax for example.

What we're doing is replacing that XMOS controller to rid ourselves of USB entirely.

For MSB we could provide direct PRO ISL out from the server, that is the easiest way. MSB would then supply the actual MSB PRO ISL daughter board.

For other DACS we could provide direct I2S out but transporting I2S over a distance is very problematic. That is why MSB went through the trouble of designing PRO ISL in the first place. So it would be better to take it further and add a new interconnect design, which we are aiming to have ready in May 2023. This would require placing a small module inside the DAC, in a Lampizator DAC it could replace the JLSounds USB module for example and it would not need a high level of expertise to mount, we could probably find local people to do that about everywhere.

Update 17-08-2023 with respect to TOTALDAC

After a brief discussion, it appears there's little benefit to be gained over just using AES/EBU as the Totaldac uses that "internally" already.

Can you share details on how the clock signal is handled?

We would go for a link that is not sensitive to clocking, at least not in hardware, but that's about everything we can share about it at this stage.

Is there a digital interface that is essentially Immune to Jitter/reclocking artifacts? Or might there be one in the near future?

Not as far as we know.

Will the original non-modular TACDA board be discontinued when the modular one is released or do both run parallel?

We will not release the earlier model but split it into a modular design. That actually has a minimal impact as we need to change a few other things anyway. The final design won't have dip switches and other testing fixtures.

Will the Switch have the same grounding terminal as the Extreme?

Yes.

Totaldac response regarding TACDD implementation

I talked with Emile, we think that because AES-EBU has no limit in the Totaldac design there is no point integrating a Taiko board in the Totaldac DACs or reclocker. It is just equivalent to when this board is mounted in the Taiko server.

So, for the best sound from a Taiko + Totaldac system, a Taiko server should be equipped with the future Taiko AES-EBU output (based on one of the new TACDA board) and the link from the Taiko server to a Totaldac DAC or Totaldac reclocker would be AES-EBU.

The best result should be found when using a d1-digital-sublime reclocker, which is the reclocker developed for the new d1-sublime DAC.

You can find some talk about this DAC and reclocker here:

<https://www.whatsbestforum.com/threads/totaldac-new-dacs.36082/page-4>

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After a brief discussion, it appears there's little benefit to be gained over just using AES/EBU as the Totaldac uses that "internally" already.

Will sending the signal from Extreme to TotalDac with AES be as good as using a new Taiko Digital format?

Totaldac: A good AES-EBU source has almost no limit with a Totaldac DAC. Note that Totaldac doesn't use the clock transported by the AES-EBU link at all, it uses exclusively the data. The clock signal is built completely in the Totaldac DAC or reclocker. Normally, AES-EBU is a synchronous interface with the clock in the source governing what happens downstream. But Totaldac does not use it that way. It does not work like bi-directional asynchronous USB either. I am not aware of any server providing a similar or better AES/EBU signal, so if a new card + software would allow to provide a truly good AES/EBU signal it would be a revolution.

I wonder if with the Taiko DAC when it is available can one go directly into one's amplifier. Will the Taiko server + DAC have a volume control?

There will be no volume control.

Will there be an option to connect to a Chord scaler via USB?

No then we'd be back to USB, which we already have. This new interface replaced USB. We'll have output options for spdif/aes/bnc/i2s but the benefits then become limited to the internal part inside of the server. Which can still be considerable btw.

Will there be a dual BNC interface for Chord DAVE?

Not decided yet

When will TACDD be available?

We're expecting the first batch of modular redesigns to arrive mid-August. This will accept a MSB Pro ISL module, I'm sure there will be some adjusting and tuning involved in getting this all working properly, October/November would be nice.

Is the ISL module a dev effort by MSB which then piggy-backs onto the new Taiko parent board? Or do we use the existing fiber input into MSB devices, with Taiko outputting ISL signal from the Taiko daughter board?

As it looks now MSB would provide the PRO ISL module which plugs into our interface "carrier" board. But they have that design part ready, we mainly expect some additional design efforts surrounding the software drivers.

Have there been any recent discussions with Lukasz about the Lampizator?

Yes, the main question is how big the improvement is to warrant mounting a daughter board inside the Lampizator DAC over using its I2S input. The interface basically consists of 2 parts:

- 1) an entirely new way of converting data from CPU/Memory subsystems to I2S
- 2) a new interconnect which transports this same datastream to inside the DAC and converts it to I2S there

The new interconnect is completely insensitive to things like jitter, timing and data integrity which is an additional benefit but even just using part 1) is a substantial improvement over what's currently available to the market.

Does this mean that the new Taiko interface can be used with Lampi i2s input?

It does indeed.

Will the sonic benefit going via i2s be as good as using a connection such as that used by MSB?

We feel that MSB has an advantage as PRO ISL is a superior method of transporting I2S with a rather clever approach to clocking. I2S is not great for traversing lengths of wire. Which is the main reason of the existence of the ancient SPDIF - AES/EBU interfaces. These are also more or less obsolete due to their bandwidth limitations.

USB does have an advantage here as I2S is actually generated inside the DAC by the USB receiver/processor. The same goes for using Ethernet as an interface, but that requires a complete "mini streamer/server" to be placed inside the DAC running an Operating System and endpoint software like Roon RAAT.

However, neither USB or Ethernet are designed with Audio Fidelity in mind and a lot of design efforts of both server as DAC manufacturers are about developing Band-Aids to reduce the negative aspects of these interfaces as much as possible.

I recall with TAS that those whose DAC used Amanero but could not derive full benefit of TAS and switched to JL Audio. Do we not need a new daughter board in the Lampi this time around?

TAS led to the discovery that USB interfaces and there accompanying drivers are not always optimally utilized. Where this was considered to be generic, USB=USB, we discovered scope for improvement by controlling the way these drivers operated in an optimal form for the way the DAC side USB interface was configured. However, we could not control the Amanero driver, nor drive it in "low latency mode".

The next step in our evolution was to develop our own USB driver, moving these optimizations to the driver so they could be used by both TAS and Roon. This is what the USB profiles are for as outlined here: https://taikoaudio.com/taiko-2020/w.../Supported-DACs-and-USB-Profile-Guide_v23.pdf which allows you to drive each supported DAC optimally. An additional benefit to this was that Windows requires a unique driver to be installed for each DAC, supplied by its manufacturer. Today we have added around 80 DAC models to our driver, so you don't need to install the individual DAC manufacturer supplied driver anymore for these. BTW there is a generic USB audio driver which does support every USB DAC, for both windows as Linux. However, this generic driver is just not optimal.

Our new interface has been designed from scratch, specifically to perform optimally for servers, to convert streamed data to I2S as direct as possible with the absolute bare minimum necessary processing. It does not use off the shelf intermediates like USB controllers which are not designed for audio purposes. It eliminates multiple data / format conversions. The improvement in clarity, transient speed and the reduction of distortion, grain and grunge is remarkable in our humble opinion.

Have you been in contact with other DAC manufacturers? For instance, Soudation Audio?

I2S is pretty simple, once we have the framework running well it should be relatively easy to add various I2S output options.

The ultimate solution would eventually be for the second part of the design, the "lossless" interconnect option, to be adopted by manufacturers, but this does require an interface board to be mounted inside the DAC. For example, replacing either an Ethernet or USB input board.

The optimal pathway would be: Optimal would be:

processor - Tx module - interconnect - Rx module - processor board to generate I2S as close as possible to the DAC I2S input

So, there is no i2s being generated inside extreme and transmitted over the interconnecting cable, but it is going to be generated inside the DAC by Taiko i2s add-on module. This is very clever idea as i2s is very sensitive if transmitted over long distance. Also is it going to be the new format that is transmitted over the interconnect?

Yes, but USB does this as well so it's not unique in that way. We are "merely" eliminating USB as the interface as we are now running into limitations of that interface. So, it's more like an evolution of USB audio.

In its ideal implementation, this is what currently happens (simplified):

CPU / memory data -> is translated into USB data blocks -> sent out by a USB transmitter -> transported over a USB cable -> received by a USB receiver -> converted to I2S by a USB audio processor inside the DAC

What changes is this:

CPU / memory data -> is transported unaltered over our interconnect -> converted to I2S by our audio processor inside the DAC

The limitations we're running into with USB audio are that USB sends data packets at a 125-microsecond interval, corresponding to an 8KHz data packet transmission rate.

In the Extreme, with all its processing power and our custom USB driver, this has become a limitation. We're capable of sending data at much smaller intervals, like somewhere between 500-1000 times smaller. Why does this matter? Each data packet creates noise when it is processed, so we have noise spikes at 125 microsecond intervals (at 8KHz) and you can actually clearly hear this if you run an unshielded USB cable close to (unshielded) tubes. If you make that interval much smaller, create a continuous data stream at a very high frequency, way out of the audio range, it basically transforms into a continuous low-level noise at very high frequencies which can easily be filtered out. And we eliminate 2 relatively noisy USB controllers. The biggest audible advantages are a much better flow in the music reproduction, much blacker backgrounds with all its accompanying

advantages, a much smoother and less "choppy" sound, especially noticeable in the upper midrange and high frequencies.

Do any of these new developments regarding USB/IS2 etcetera help me when my DAC only has a SPDIF input and no USB?

Yes, they do!

Doesn't the Pink Faun I2S Bridge do the same?

This card uses an ancient off the shelf chip subject to the same limitations as SPDIF & AES/EBU.

Output via dual AES/EBU to dCS DAC or via single AES to dCS Vivaldi Upsampler?

The dual output AES/EBU card will also be able to use only a single AES/EBU output and thus feed a single AES input. Whether feeding the Upsampler or the DAC directly is better will be something that is entirely up to the user. For the purpose of the TACDD, it will not matter. This is just a personal preference.

What type cable is used to connect the Extreme to the DAC?

QFSP28 or QFSP-DD. QFSP28 is 112Gb, QFSP-DD is 400Gb. Not fully decided which of the 2 we'll end up using, both are serious overkill obviously, but overkill works.

These cables allow I2S to be generated in a remote device (DAC) instead of inside the Extreme without any bandwidth limitations and it's also insensitive to things like (audio-domain-) jitter which plagues interfaces like I2S, AES/EBU, SPDIF. IOW it uses today's state of the art in data transfer technologies instead of decades old technology which is the current standard in high-end audio.

These cables you can get from us but you can also purchase them elsewhere as they're an industry standard (like the SFP DAC cables which can be used with the switch/router).

What makes the Taiko DAC special?

Most of the innovations of the Taiko "DAC" lie in other areas than the D/A section, making it sound distinctly different from what you're used to hearing from external DACs driven by either CD transports or music servers. The things standing out most right now are an intriguing removal of what appears to be a collection of several types of distortion (when powered by a BPS), limitless sound staging (when used with the router), a beautiful kind of purity (again when used with the bps), and flow, dynamics, and timing are really good too.

When is it expected to be released?

We're in the last stages of bug squashing, we should have it shipping this year.

Can the Taiko DAC be retrofitted to the Extreme?

It's an extension to the Extreme which can indeed be retrofitted.