Taiko Audio Extreme DC Power Distributor – FAQ

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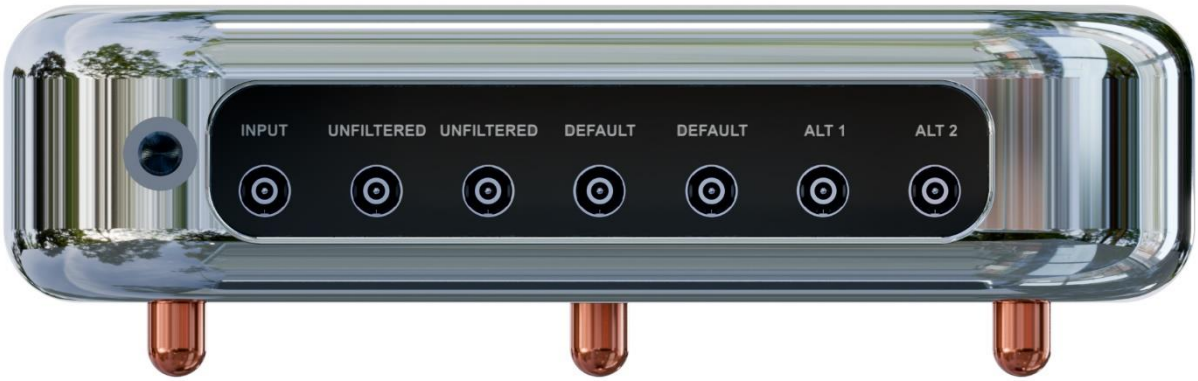
TAIKO AUDIO



Description

With the DC Power Distributor, we designed a “power splitter” with additional filtering allowing multiple devices to be powered from a single power supply while minimizing “cross contamination”.

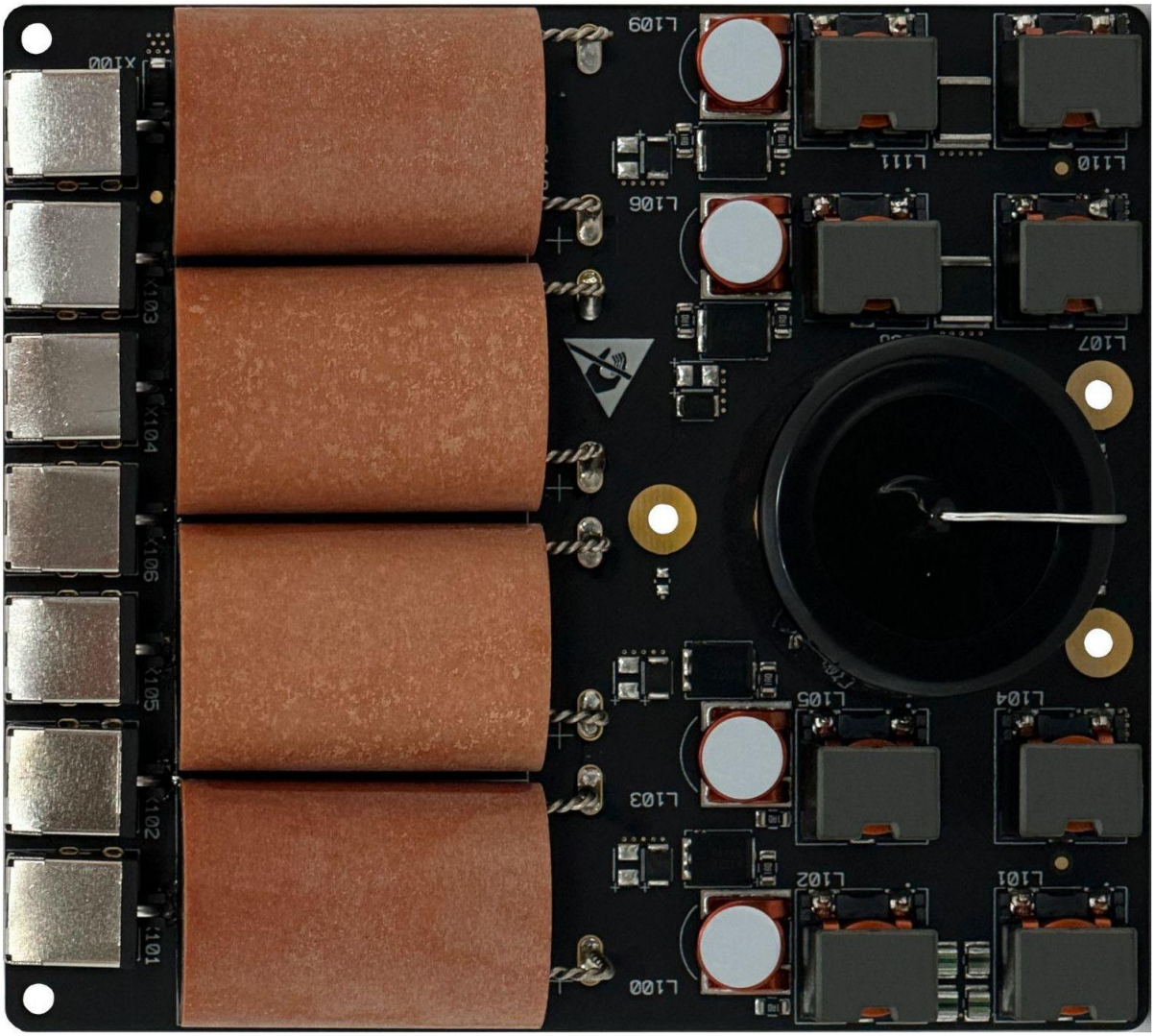
In our tests, having the Switch and Router running of a single LPS (Linear Power Supply) using the DC Power Distributor actually sounds significantly better than a separate LPS for Switch and Router!

The DC Power Distributor offers 4 different filter outputs, allowing the user to tune the sound towards getting a neutral balance even with varying power supplies and mains conditions. Alternatively, one can divert from neutral to taste.

The DC Power Distributor will use the same milled-from-solid-copper chassis as the Switch and Router, but reduced in size, 160mm x 160mm x 40mm, weighing 5.2 KG, and it will come in either chrome or black finish.

The DC Power Distributor is also available in black:

DC Power Distributor PCB:



Background

The DC Power Distributor is a very recent development resulting from discoveries while addressing noise issues associated with wifi access points. Although DC power supply filtering is something we have years of experience with, zooming in on specific aspects of noise, and the way they affect sound quality took an interesting turn when investigating noise generated by devices which are not designed with sound quality in mind. For example, the discovery that the degradation caused by wifi noise is in fact not dominated by the airborne / radio function but by its interaction with the supply that powers it and how that in turn affects the mains supply which powers our entire systems, gave us a different perspective to investigate.

We started analyzing these noise spectra and have designed filters to specifically target this type of noise, only to discover that this is a limited solution, as the supply powering the device is a big part of the equation. To make matters worse, different designs interact differently, with rather dramatically differing effects on sound quality as a result. Keep in mind this even applies to a wifi access point which is only connected to the mains, as the connection on the output side of the device is airborne.

While testing a variety of power supply designs and various filters, the switch and router in fact performed better being powered by a single power supply instead of dual power supplies, simply because a 2nd power supply, even a very low noise linear design, produces more (interacted) noise than the switch and router combined. Additionally, when you connect the switch and router with the lowest noise-producing option, being a DAC cable, there's a direct/common ground between the 2 devices, which is unfavorable if being "modulated" by 2 different power supplies. Simply put, one shared ground is better from a noise perspective, taking into account the very low current draw of both devices. Still, the switch drawing 100mA is an unavoidably lower noise device than the router which draws 500mA and which performs more processing. Hence there's a benefit "isolating" these 2 devices from each other while maintaining a common "ground" and reducing total setup noise by using one power supply.

Each of the filters provide over 80dB of additional noise filtering. The filter’s 64 parts have been selected by ear, some are exotic and costly, like Duelund capacitors, and each of these have a clearly audible effect at this level.

We started with two default filters which we consider to be neutral sounding. They don't change the sound, they just (significantly) improve upon what's there, improving communication and the sense of realism. The extent of their effectiveness was truly surprising as it is far from subtle, perhaps as much as a 20% improvement on the whole package.

When we speak of neutrality, one can ask: “in relation to what?” What we consider neutral is in reference to a Battery Power Supply. But the plot thickens when using different power supplies and when mains "quality" differs. For that reason, we included 2 alternative filters allowing you to tune the sound towards getting a neutral balance even with varying power supplies and mains conditions. Alternatively, the user can divert from neutral to taste. These alternative filters allow the user to "tune the sound" towards either a darker, fuller, warmer, and more expansive sound, or a tighter, brighter, more incisive, and subjectively more detailed sound.

We recommend starting with both the Switch and Router connected to the default filters. Then change your switch to alt1 and alt2. Alt1 yields a sound that is Relatively more “analytical” while Alt2 yields a sound that is Relatively more “natural”.

After establishing your preference, you can try swapping router and switch to see which way you prefer. If you preferred Roon over XDMS before the Router/DCD you will most likely have a preference for the “alt2” filter, if you preferred XDMS over Roon, chances are good you’ll prefer “alt1”. But this is nevertheless highly individual.

There’s really nothing “magical” about these different filters beyond having slightly different filtering points and slopes. The outcome of your preferred filter can be a combination of strength of particular offending frequency ranges, how those affect your gear, or perhaps even you. The filters are designed to specifically target typical frequency ranges transmitted by network appliances but also their interaction with AC-DC power supplies combined with noise generated by those themselves.

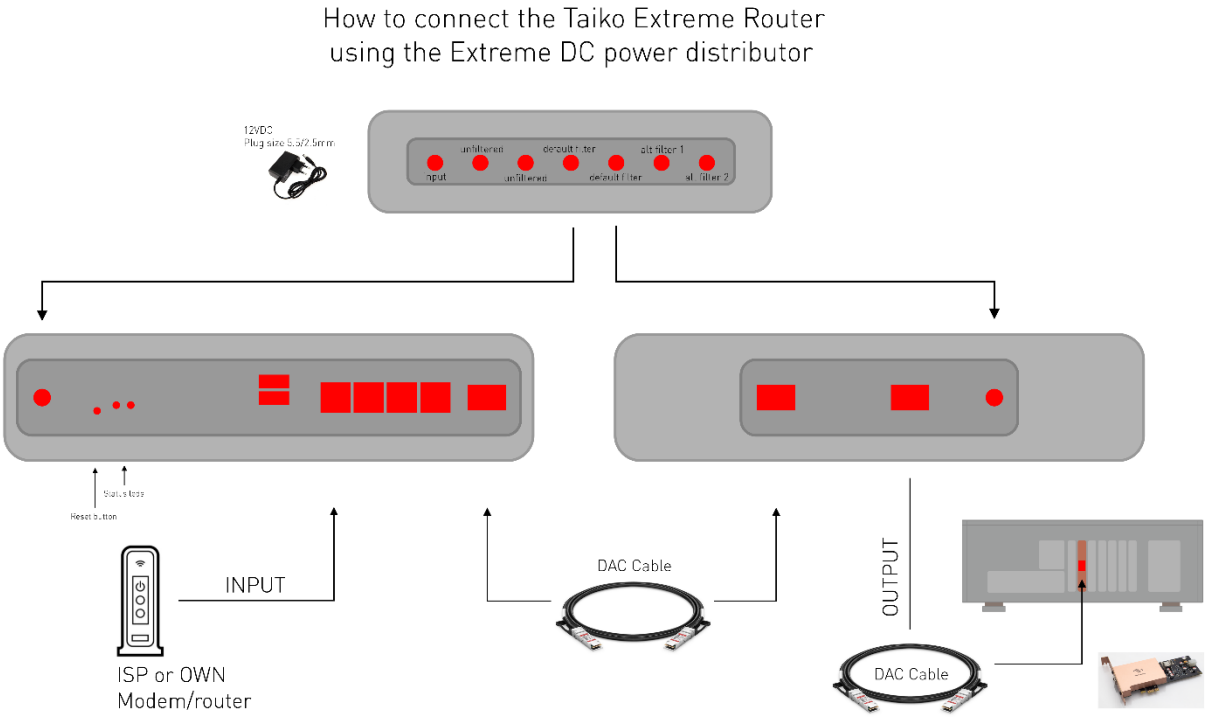
Burn In

The first 5 days is the most significant. After that, it keeps improving for about a month with a declining slope of audible improvements. There is no need to play music to burn in the unit. Burn in will happen as long as the unit is connected to power providing output power to a ballast (for example a Router or Switch).

Filter Burn In

Something to keep in mind when comparing filters is that each individual filter is prone to burn-in effects. They use the highest possible quality parts available like Duelund capacitors which take about 5 days or so to lose their initial “veil” after which clarity, sophistication, micro detailing, and dynamics are at a significantly higher level. You will probably not notice this veil initially as this is offset by the increased clarity of inserting the Router/DCD into the chain, but if you change filters after these 5 days, those which have had some burn-in may sound better to you just because of that.

How to use the DC Power Distributor



Specifications

- Chassis machined from a solid block of copper (the surface is treated such that it will not stain or otherwise decay)
- Grounding post
- Two 1-meter-long DC barrel to DC barrel cables are supplied (at least for the initial run of 200 pc)
- Size 160 x 160 x 40mm without feet, 160 x 160 x 50mm with feet.
- Weight 5.2 kg (11.5 lbs)
- 1 DC input, 6 DC outputs, 2 unfiltered (pass-through), 2 default filters, and 2 different alternative filters (one darker, fuller, warmer, and more expansive, the other tighter, brighter, more incisive, and subjectively more detailed)
- DC connectors: 2.5mm inner diameter, 5.5mm outer diameter, 11.3mm length (same as the switch and router)
- For making your own DC cables, make sure to use 11mm or 14mm long connectors. 8 mm is too short as you lose about 3mm due to the chassis and shielding.
- Maximum current capacity 10A, maximum input voltage 25V, voltage in = voltage out, so this would typically be used with a 12V LPS to power multiple 12V devices. 10A is just the max load for connected devices, actually mainly limited by the DC socket current limit, the circuitry could handle a bit more.

Photo showing the difference in size. Left: Extreme Switch; Right: Extreme DC Power Distributor

FAQ

Is the DC Power Distributor also available for, and usable by, non-Taiko users?

Yes, it will work with all equipment, over a wide voltage range. Maximum input voltage 25V, voltage in = voltage out.

Does this mean only one 12v LPS will be necessary if the Taiko Power Distributor is used?

Indeed, in fact this is far superior to using 2 power supplies.

Will it be better sounding if each device had its own separate power rail?

It depends, each power supply generates noise itself. More power supplies = more total noise. On the whole, there's the power supply + powered device(s) interaction. In general, a power supply becomes "noisier" when you increase the current draw.

If the user ultimately buys the BPS, will we still need the Taiko DC Power Distributor?

With our BPS, The DC distributor has no "filtering" effect as there's no noise to filter. In fact, they would slightly reduce performance. There's no advantage to these filters and they are even detrimental, when used with our BPS.

But they can be beneficial for "off the shelf" battery solutions as the BMSs (Battery Management Systems) used in those 3rd party manufacturers are pretty decent noise generators themselves. This is why we had to design one ourselves.

So, if you hookup a "regular" battery supply, then the DC distributor will work to filter the noise generated by the battery supply BMS (Battery Management System).

Also, you can still use the DC distributor to improve your sound by using it for your ISP modem or Router which gives you a similar effect as on our Switch/Router, or you return it as a trade in towards a BPS which we'll accommodate of course.

It took us quite some effort to design a BMS which does not contribute any noise to the battery cell noise which is mainly low frequency in nature and only measurable on a nanovolt scale (caused by the battery's chemical processes).

A BMS monitors all the individual battery cells, it balances them so all cells have an equal charge, and it protects the battery from being drained too far or from overcharging, both of which can damage the cells, and depending on the type of cells use, even cause them to leak or catch fire. It's therefore a mandatory addition to lithium battery cells, which you'll use as the other types of batteries are pretty useless for audio, high impedance, noisy etc.

You can filter noise to very low levels but besides the filtering itself and even the components used are audible to a degree, which is the reason for using exotic and expensive components like for example Duelund capacitors, you're still better off with even lower noise levels and no filters at all. It's surprising that even noise levels expressed in nanovolts can have considerable effects on our perception of sound quality.

Will an access point be part of the purchase package and where will it fit in the schematic?

Currently no, but we might offer it as an option should it turn out to provide an upgrade. This is still being tested. It would be a low-cost addition though.

If the switch + network card + router represent 100% without the power distributor, where would you put the combination -with- the power distributor?

Putting it into a percentage, we're inclined to say it adds another 20%. However, the actual difference really is more significant than that number might suggest. What the DC Distributor does is enhance the resolution and harmonic complexity while removing an unnatural sheen or veil and thus increasing naturalness and overall realism. It really brings a similar kind of difference as can exist between two different DACs.

It appears you can use your house wifi?

Indeed 😊

Did you test the distributor with a range of LPSs? I am wondering if it mitigates need for the most expensive LPSs. Additionally, curious how much the sound signature of the LPS and DC cable connecting it to the distributor still comes through.

Yes, and each and every supply "sounds" different, hence the inclusion of the alternative filters which can offset most of this.

The DC Power Distributor is currently listed as an option when ordering the Router. Will the DC Power Distributor be available to purchase separately in the future?

We are currently limited in the first batch size. We may consider offering it separately, but it will then need to be priced higher. We priced it as low as we possibly can as a router+switch "bundle" deal. It's actually a rather costly device to manufacture.

If the power distributor is better than two LPSes, what improvement could you expect from a single Paul Hynes SR7T two rail 12 volt?

Pretty much the same, the DC distributor will still provide an estimated 17-18% improvement instead of 20%.

From a practicality perspective, am wondering about stacking the switch, router, distributor on one shelf of my rack - how much of a bad idea is this?

The only problem would be sliding and scratching risks. Bare minimum shelf size to place everything horizontally would be 17 x 17".

Is there a possibility a DC distribution box could power the Extreme along with accoutrements in the future?

There is not.

When supplying the juice for Taiko switch and Taiko router, would you recommend running the non-Taiko dirty side router on the Taiko dc distributor as well?

No, we would not recommend this.

Just to make sure: it is also not recommended when the dirty router is in front of (upstream of) the Taiko side?

Yes, indeed!

Is a Ferrum Hypsos PS good enough for Taiko switch & Taiko router, or a mismatch?

We have no experience with the Ferrum Hypsos but it's an interesting design. In any case, it is much less critical with the DC Distributor, and you can adjust the balance using the ALT filters. Still, it will interact with your mains supply.

What about the Plixir power supply? This one came recommended very highly by a user with the taiko switch.

The Plixir is most definitely a good pick, with solid feedback.

Is there a reason why, if one gets the distributor, then the DAC cable is vastly preferred?

With DAC, the connections are direct, not via transformers. This way, a DAC cable directly interconnects the Switch and Router grounds.

What's better – use two independent power rails from the same power supply or two fully independent power supplies?

Two independent supplies, since two rails do not normally "isolate" quite as much as one might assume.

If one uses an LPS such as the Uptone JS-2 with 2 rails, would that also serve to connect the grounds of the Router and Switch (assuming a DAC cable connects the Router to the Switch?

Two "rails" is usually 2 regulators on the same single "rail" and therefore this can be considered as one single power supply.

Can you provide a list of some LPS units on which you found the distributor to work with particularly well?

We don't use commercially available brands but have a wide range of supplies of our own design.

Wasn't an inexpensive wireless access point to be included with the Taiko router initially?

After initial success with this method, we ultimately felt it to be a two-sided sword. We will continue investigating this avenue but for now, you can simply use your own router and access point.

Would network noise be more prevalent in congested areas such as apartment complexes, cities, developed areas? Or is network noise inherent no matter what? Is that same noise/pollution the same on all networks? I would imagine measuring network noise in Amsterdam might be different from some rural area…

It seems we've all been conditioned into believing in something which does in fact not exist. There's no such thing as "internet noise" traveling through your home router. There's noise caused BY activity due to the need to process more network packets, more processing means more noise in the device performing the processing. Naturally there's download speed, where it takes a longer or shorter time to receive the requested data, which translates into longer lower intensity processing, or shorter higher intensity processing, creating a different noise spectrum.

Basically, More Processing Means More Noise?

Adding the switch reduces processing in the Extreme, adding the router reduces processing in both the switch and the extreme.

Will the DC Power Distributor improve the sound for those who later purchase the Taiko BPS? Or is this an upgrade only for those who will not purchase the BPS?

It's currently a rather substantial upgrade, but with the BPS, things change. We will however take it back if it becomes redundant when you upgrade to the BPS.

With the introduction of the new power distributor, will the DC outlets be moved from the Extreme's back with the BPS to the power distributor, so that the latter becomes a necessary accessory for the BPS so that multiple devices can be added, or is this yet to be determined?

They will not. The BPS will retain multiple outputs. The DC distributor you may still want to keep to upgrade your home router/switch/wifi. But we will trade it back in if it becomes obsolete.

For a setup that includes both the switch, router and power distributor, I understand that one LPS is enough and actually preferred. Now my question is: For also upgrading my further upstream existing router: Should I use the same LPS? My feeling is probably not so to keep the audiophile network part clean. Once the BPS become available, I'd relocate that now free LPS to my existing non-audio router and am done with LPS. Is this sound reasoning?

You can indeed use one LPS for the distributor which then powers the switch + router. Don't share with the upstream "dirty" router. And indeed, if you go for the BPS, then moving the LPS + distributor upstream is a good idea.

Isn't a wall-wart power supply good enough for the Taiko Switch and Router?

It is only good enough to get you started. We strongly recommend using a LPS. 1 LPS powering switch and router, when using a DAC cable as the interconnect, "sounds" better then 2, even more so when using the DC distributor.

Will a second Taiko Router obviate the need for a good quality LPS?

Unfortunately, no.

Is there a clear preference between RJ45 or DAC cable to connect the Router to the Switch when the router and switch are on their own individually-isolated Shunyata Denali receptacle and all grounds are connected to the ALTAIRA? I won't be getting the DC Distributor.

In this particular use case, you may prefer RJ45. In that particular setup you may want to avoid directly connecting the switch and router grounds with a DAC cable, even though it's the superior method of connection. If you use 2 power supplies there will be a noise voltage "riding" on the ground connections between the connected devices. You can then try to reduce that by different "grounding" schemes to try to get closer to single point grounding, but as these devices are both externally powered you can simply achieve superior single point grounding by using 1 shared power supply.

Are there any observations on using 3 outputs and does adding a 3rd (e.g. for my sotm usb/aes/ebu reclocker) impact the sound?

This is no problem if your LPS is up to the task. The switch is 100mA, router 500mA, if you use fiber, each fiber module can add about another 100mA.

Can one independently choose which filter to use for the Switch and the Router(e.g. Default-Alt1, say), or must they always be of the same type (e.g. Default-Default, Alt1-Alt1, etc.)?

We recommend starting with the Default outputs and, if desired, experiment. You are free to use any combination of filter outputs.

What is the rationale in providing this particular set of outputs?

They provide a lot of tuning options, you'd likely use at least 1 default filter, the other would be unfiltered, default as well, or alt 1 or 2. Then there will be a difference when using a filter with a different device, almost too many options already. Adding multiples of each alternate filter would have required the implementation of entire additional filter sections with expensive parts which would have resulted in a larger device and much-elevated cost. We have contemplated this very thoroughly and ultimately decided on the current configuration. Normally, you'd likely use at least 1 default filter and the other would be unfiltered, default, or alt 1 or 2.

Can I order a different length DC cable?

Although we'd love to be able to accommodate that, alas, we can't.

Does the length of the DC cable matter?

The longer the length of the DC cable the more of its "sonic signature" it may impart and longer or shorter runs of the same cable may even sound somewhat different, but technically there is no problem with using different lengths. And you can choose a different filter combination to compensate.

A 4-meter length of AWG24 wire will waste about 70 mW of power on the switch and about 400mW on the router and if you go AWG18, that is about 18mW and 100mW. This slightly increases the power draw and perhaps noise of your DC power supply. Both the switch and router use our GaN based regulators as pre regulators which are pretty much immune to source power supply resistance as long as this remains somewhat reasonable. Importantly, the DC distributor does not care at all.

Which DC cable (brand) would you recommend between the switch and power distributor?

Are there any brands that you've tested that I should look at?

We did not test commercially available brands but we did test several types of wire. Capacitive and inductive influences are negligible; however, each type of wire has a "coloration". Metallurgy, sleeving, structure and geometry, all have a sonic signature.

Ultimately, we don't have any specific recommendations but we do recommend not going overboard on this, especially since the DC distributor will make it partially irrelevant.

Will the DCD be vital for the upcoming TACDD and TACDA card?

It will be ideal to move to a BPS solution for this.

From a technical perspective would it be fair to say Alt2 filters the most and Alt1 the least? Or do they start filtering at different frequencies? Do you filter the plus side only, or also ground? Can you elaborate on the precise nature of the filters?

Alt1 is a bit more effective high up while Alt2 is less effective there, but starts a bit lower. We filter both voltage and ground. Other than this, we prefer to not completely "spill our beans" online :)

Should I power the ISP Modem Router from the DCD or a BPS output?

The ISP would definitely benefit from its own DCD but we recommend against sharing a DCD with the Taiko Router and/or Switch. The same goes for the BPS.

Once you have BPS powering the Extreme Router and Extreme Switch, we recommend against using additional outputs to power other components (ISP Modem-Router, external Clocks, etc). However, if you have a BPS for the Router and Switch, you can use the DCD to power the devices upstream of the Extreme Router and Switch will improve the sound.

Which LPS would you recommend for the Switch, Router, DCD?

We're not up to speed on commercial LPS offerings but a few popular ones we know our customers frequently use to satisfaction are Plixir, Uptone, Sean Jacobs.

Since the DC cables do not pass information in the frequency spectrum typically associated within the audible bandwidth, is their effect is mediated by altering the spectrum that is important to conducting noise in the cable?

1) Is this noise spectrum in the KHz range, MHz range, or other?

2) Can you share any details (without revealing proprietary information) about how one modifies the noise spectrum to yield a sound that is "Relatively more "analytical" (Alt1) or "Relatively more "natural" (Alt 2)

The filters start in the KHz range but work up to MHz ranges. All filters are designed to address the same frequency ranges yet the filter response differs.

In general, filters are all the same in their basics and use 3 components:

1) resistors which have a fixed resistance

2) inductors which have a resistance (impedance) which rises with increasing frequency (doubles each octave)

3) capacitors which have a resistance (impedance) which falls with increasing frequency (halves each octave)

How you use these for DC filtering is largely the same as how you'd use them in loudspeaker crossovers. You use an inductor in series with a woofer to decrease high frequency energy from passing through the woofer. You use a capacitor in series with a tweeter to decrease low frequency energy which passes on to the tweeter.

This is then a 6dB / octave filter, if its impedance at 1 KHz equals the resistance of the voice coil of the loudspeaker driver you reduce power running through it by 50% at that frequency.

You can then create more effective filters with stronger attenuation by combining inductors and capacitors to create 12dB attenuation filters, or 18dB, or 24dB etc.

This works roughly the same for DC filtering, however at higher frequencies we start running into something called "parasitics". A capacitor also has a small amount of inductance, an inductor has a small amount of capacitance. This is something you can ignore with loudspeakers with a limited (low) frequency range to address, but not with high frequency DC filtering.

The inductor you use will have an increasing resistance up to a limit where its parasitic capacitance starts working against this and the impedance starts dropping again. So, it's actually more like a bandpass device with an impedance between 2 values, low and high frequency.

The same goes for a capacitor, where parasitic inductance will decrease its efficiency at conducting high frequencies.

PCB circuit traces start playing a significant role at some point as well.

So, with the DC distributor you have a variation in a combination of better or worse filter efficiencies with variations in frequency responses due to parasitics of the components and PCB layout.

Here are a few characteristics:

- ALT2 starts at a lower frequency but is less efficient at higher frequencies.
- Default filters similarly in KHz ranges, but is better at MHz ranges, extending further up with stronger attenuation at medium-high frequencies.
- ALT1 is the cleanest/strongest filter extending even into GHz ranges.

In other words:

- ALT2 is a better filter at KHz ranges.
- ALT1 is a better filter at MHz ranges.
- Default sits in the middle, a bit less good at KHz ranges than ALT2, but better than ALT2 at MHz ranges with ALT1 being superior at MHz ranges, extending quite a bit further upwards.

Ultimately, there's no such thing as a perfect filter!