



Tech note

## ***PowerStation***

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### **Active Mains Purification**

Poor mains power has an impact on audio. The quality of our mains power is further eroded by the abundance of cheap switch-mode power supplies in typical household appliances and the sea of RFI/EMI in which we are constantly bathed

The iFi PowerStation is the solution. It forms part of our range of products that reduce 'noise' (distortion) in incoming electrical power - both directly from the mains or via USB ports. The PowerStation is the first to offer our proprietary Active Noise Cancellation in a whole-system, six/eight-outlet mains solution.

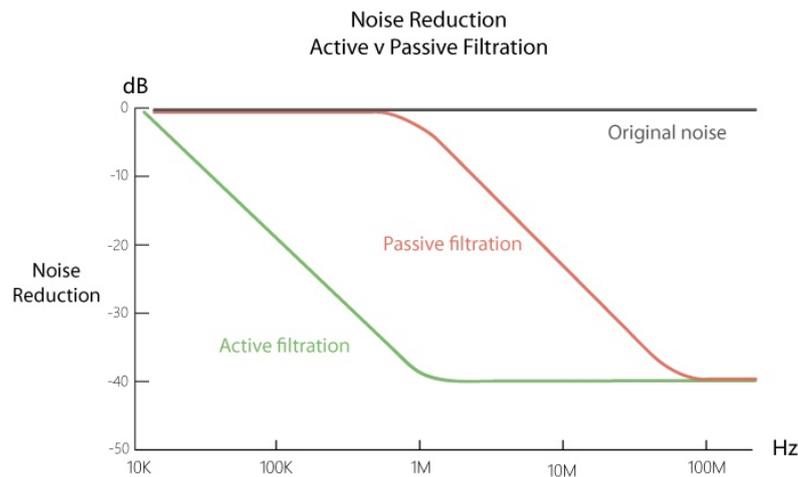
#### **Part 1: Actively goes where no power block has gone before**

The PowerStation's core performance-enhancing technology is Active Noise Cancellation II. It is an **ACTIVE** not a passive product. This enables it to achieve a far more comprehensive termination of noise across the frequency spectrum.

Most power 'conditioning' products engage passive noise reduction through a selection of filters and regulators. Whilst this can be effective, it has inherent disadvantages compared to our active system, which uses inverse noise current to cancel out the noise in the mains signal. The way this works is not unlike the technology in noise-cancelling headphones.

Noise in the mains supply occurs at different frequencies, depending on the cause. Passive noise reduction systems are effective at the top end of the frequency spectrum but tend to be less so at lower frequencies. In addition, passive systems need large capacitors to be truly effective, which make the best such products bulky and expensive.

This chart compares the (green line) which is ACTIVE to generic mains filters (red line) which are typically passive.



The effective noise reduction difference can easily be seen.

- i. MUCH better at -40dB
- ii. Effective across the WHOLE frequency range

Our Active Noise Cancellation II is effective in reducing noise consistently across the entire frequency spectrum, by approximately -40dB. This is coupled to additional passive filtering on each outlet to eradicate noise at the very highest frequencies – typically caused by wireless transmission systems. The result is a mains block that delivers highly effective reduction of both differential mode noise (caused by conventional switch-mode power supplies, for example) and common mode noise (including interference caused by Wi-Fi and Bluetooth).

### **Where can the PowerStation be used?**

The PowerStation is designed for use with ANY mains powered audio system. It is very effective when used with modern audio systems that have an abundance of digital and analogue components.

Typically, these systems are powered by a plethora of mains plugs. All of these ‘wall warts’ can add their own unwanted noise issues and pollute the local mains supply. The noise busting capabilities of the PowerStation can be taken one step further by adding our AC iPurifier to separate digital and analogue components and reduce cross contamination.

How to use additional AC iPurifiers along with the iFi Power Station.



It can also be used with your home devices such as televisions and computers – anything that would benefit from cleaner power.

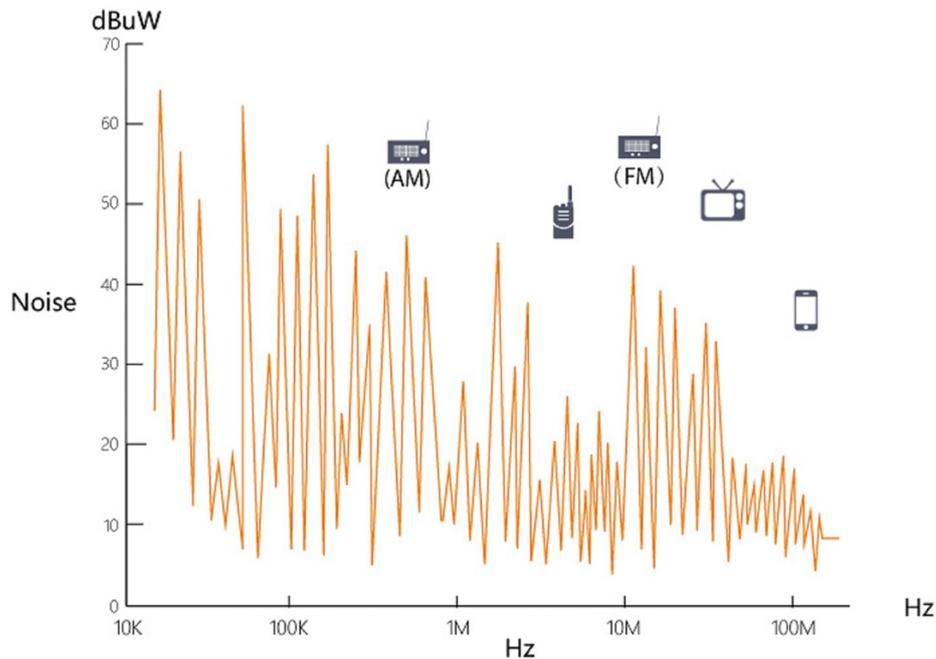
Sonic improvements delivered by the PowerStation include greater clarity and definition, plus enhanced dynamic and spatial qualities, avoiding the apparent softening of leading edges, timing and dynamics that can occur with lesser mains filtering products.

Read more about mains noise to Part 2.

## Part 2: Mains noise. A real bane.

Power supply noise is the bane of every audio system. There are always multiple sources of noise and they come from two main sources – inside and outside.

### External noise is all around



This chart shows that noise is anywhere and everywhere and some of it inevitably ends up in the mains that supplies the audio system. We can do little about most of these as they come from sources found in everyday life such as radios or mobile phones.

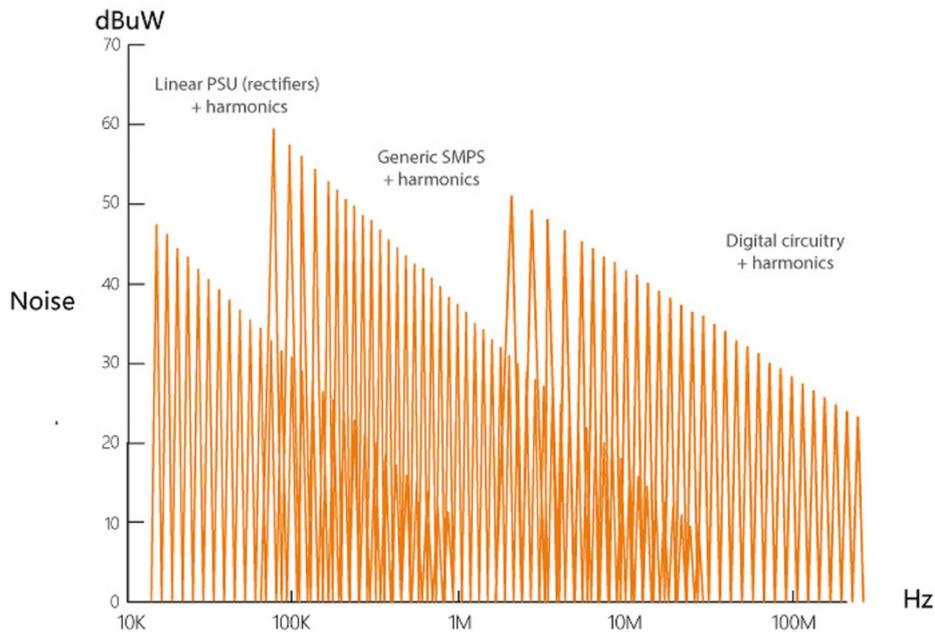
As these are wireless in nature, they are very difficult to deal with at the source, so we need to address the symptom.

The next chart shows the 'local' noise sources found in and around an audio system.

### Local noise comes from hi-fi components

These sources of noise are found in hi-fi systems and come from three main sources:

- i. AC mains power supplies
- ii. Switch-Mode Power Supplies
- iii. Digital circuitry.



From left to right:

The first set of noise sources (10k > 10MHz) relate to AC supply rectifiers and their harmonics caused by Linear Power Supplies (LPS). Yes, they make a noise!

The second set of noise sources (67k > 200 MHz) is caused by Switch-Mode Power Supplies (SMPS). By comparison, these harmonics run in the higher frequencies.

The third set of noise sources (8 MHz > 500 MHz) is caused by digital circuitry, clocks and their harmonics. And this type of noise exists in the most upper frequencies.

You can see from the chart that the concentration of noise is from 30kHz upwards (the lower the dB, the less influential is the noise).

## LPS vs SMPS

It is worth noting that, as much as LPS designs get a good reputation and SMPS designs get a bad reputation, the reality is somewhere in between. And the situation is dynamic.

LPS designs are on the whole good and, on average, are quieter than poorly designed SMPS power supplies (which tend to be more for charging mobile phones and are not optimised for noise). This is why LPS is often perceived as superior to SMPS.

Hybrid and electric cars used to be shunned, yet they are now all the rage. We believe the same is happening for SMPS. These are now more environmentally-friendly and consume far less power. Whereas all SMPS used to be 'noisy', we are one of the few companies who have broken down the SMPS into its constituent parts and fundamentally re-designed it for audiophile use ie super low-noise. The iPower is the 'Model 3' of SMPS power supplies.



Nevertheless, not everyone has an iPower at their disposal. It is therefore important to be able to effectively deal with normal SMPS noise which can be quite severe.

The next section explains which aspects of the PowerStation target the different groups of noise and how this compares with the common approach.

Part 3 shows how active beats passive everytime.

### Part 3: Active beats Passive

Passive filtration is the most common approach seen in aftermarket power supply accessories.

However, it is not without its limitations:

- i. It filters only in the very high frequencies in the high MHz region.
- ii. To be effective, the capacitors must be large, and this means bulky and costly.

Given these drawbacks, the PowerStation had to be different, more thorough and more comprehensive.

The solution for the PowerStation is active + passive sections for the most complete purification over the frequency range.

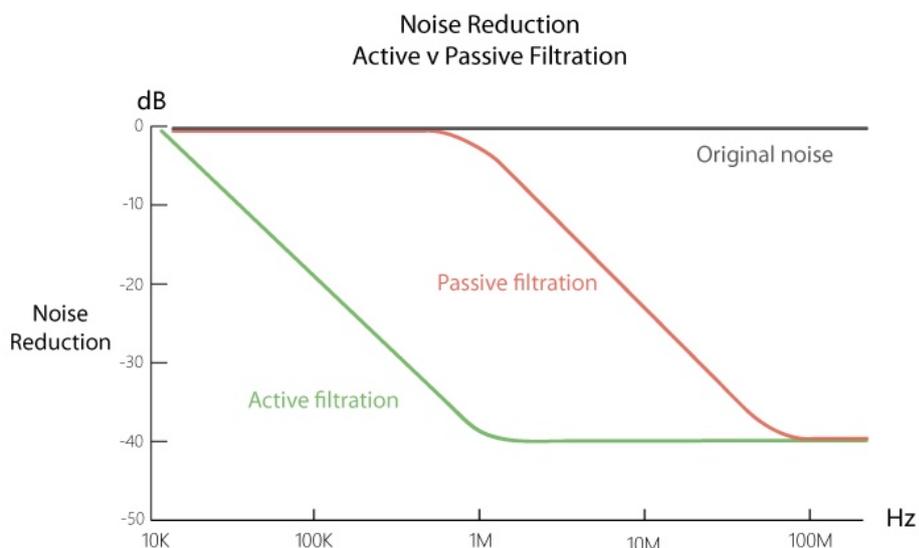
1. Wireless Purification System – covers the high MHz range
2. Active Noise Cancellation - covers high KHz and low MHz ranges
3. Intelligent Earth – connects to SMPS power supplies to drain mains noise

The chart below illustrates the impact upon noise.

The black line represents normal noise found in a system with no remedy for it. It runs across the frequency range at 0dB as it is not reduced.

The red line represents typical mains accessories that have passive circuitry – these typically start to work at 2 MHz.

The green line represents the PowerStation impact by starting at 10k and then reducing noise by -35dB and more all the way up to 100 MHz. By comparison passive filtration starts much higher in the frequency range at 30 MHz so misses out on filtering two-thirds of the noise.



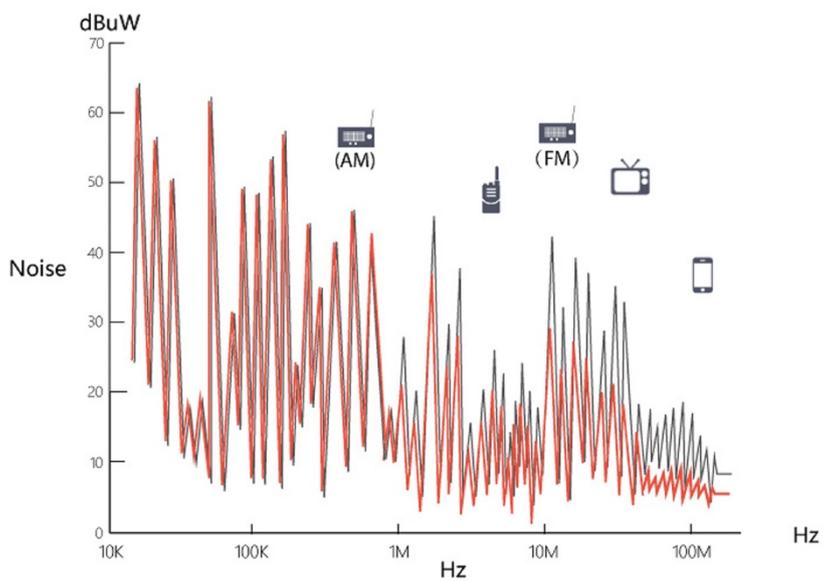
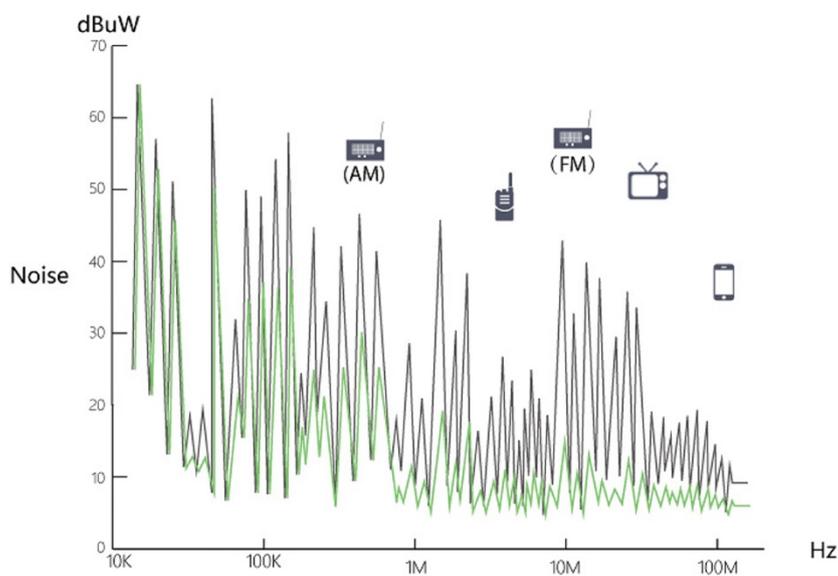
## The PowerStation against generic passive filters

As explained earlier, external sources of noise, from radios to TVs to mobile phones, are not concentrated in just one area as they contribute to noise across the frequency range.

The graph below shows how the PowerStation nullifies external noise sources across the frequency spectrum.

By comparison, the generic passive filter does not deal with certain radios and walkie-talkie type products.

The first graph shows RF noise reduction with the Power Station whereas the second shows RF noise reduction using a passive filter.

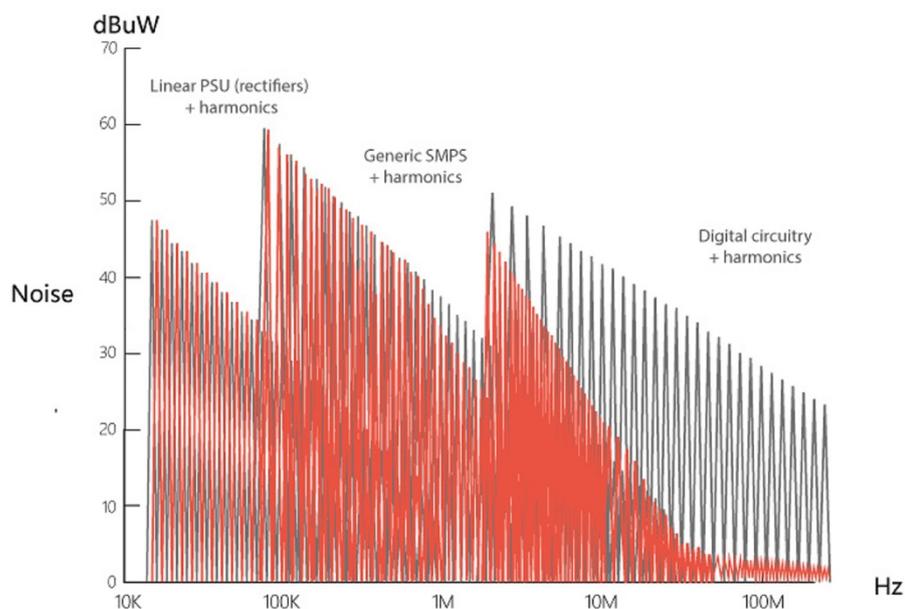
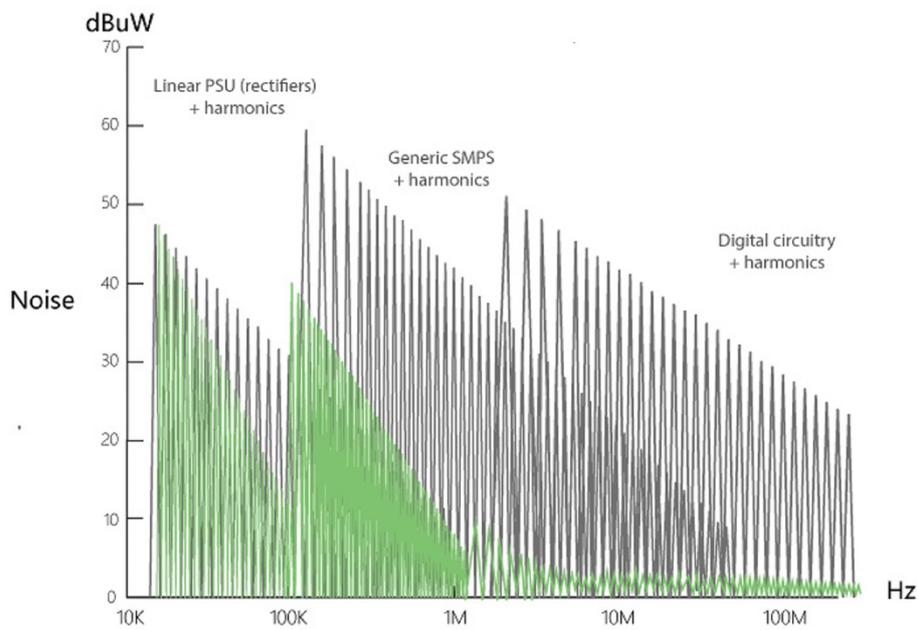


With local sources of noise, these range from linear power supplies (yes, they make noise!) to switch-mode power supplies to digital circuitry and all the related harmonics.

It should be no surprise that, with the PowerStation actively covering the frequency range, far more noise is reduced – by an impressive -45dB or so.

By comparison, with a generic passive filter, noise from linear power supplies and switched-mode power supplies remain with only some digital circuitry being attended to.

Again, the first graph show equipment generated noise reduction with the PowerStation and the second with a passive filter.



High-resolution photos & official logos: <https://media.ifi-audio.com/portfolio/power-station/>

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iFi is the sister-brand of Abingdon Music Research (AMR) and is headquartered in Southport, UK. The two brands respectively design and manufacture portable, desktop and lifestyle audio products and high-end hi-fi components. Combined in-house hardware and software development teams and a 'music first' approach enable iFi and AMR to create advanced audio products that deliver new levels of design, functionality and performance at their respective price points. Since iFi's formation in 2012, its products have earned many awards around the world, helping it to become one of the fastest-growing brands in its field.

