Q&A on LessLoss Skin-filtering and the Idea of Power Cable Performance

By Louis Motek
LessLoss Audio

(For more information on the technical aspects about undesirable high frequency noise as it pertains to audio reproduction, please see *Why Radio is so Important*. Without getting too technical, I will here take some Frequently Asked Questions about power cable design and its significance to high performance audio.)

Q: *Most manufacturers say that their own power cords are the best. When I get into your web site (www.LessLoss.com) I just get more confused reading all the technical info. People say your cable is definitely different than others, but how exactly is it different, and why should this difference make a real difference in sound? (I listen to computer audio.)*

The main points explained on our website are that high frequencies (the ones we do not want in our audio gear) are induced all long the power line, but it is the last several feet of wire (this represents the power cable itself) which is potentially most detrimental to sound quality, because the high frequencies induced there will not diminish in intensity before entering the gear. This is because there is no distance for the high frequency noise to travel (the gear is right there, very close), such that little attenuation of this noise occurs. (Attenuation just means a falling off, a falling down, a lessening of.)

The design principle of our power cables is based on our own developed Skin-filtering technology. It is already known through physical laws that the higher the frequency, the closer to the outer surface of the conductor the signal will be located. Knowing this, we can concentrate all of our efforts on the very skin of the metal and create there, along the entire length of the cable, an extended filter which disables the cable from acting as an antenna, which would normally conduct high frequencies. Ours is an extremely effective method of dealing with noise, which you can tell by the now over 300 reviews and public feedback garnered throughout the years.

I am not going to tell you "ours is the best". Such a statement would be purely subjective. Your question is objective, simply a desire to gather information, and I believe there is nothing to hide in our art. After all, to make a decision, you have to have real information to go on.

Our power cables are not marketed as "the best", and we rely completely on the expression of people's honest opinions in forums, magazines, and by simply trying them out by borrowing them from a friend.

We have worked extremely hard on the new DFPC Reference power cable, which is on a performance level we are very proud of, and which took years of concentrated effort to reach.

Q: *I'm an audiophile. By day I'm a professional installer of sensitive industrial equipment (costing close to a million dollars). Consulting with the manufacturer in Germany, they told me to use a plain old 10 AWG oxygen free copper power cable. Now, if in the industrial world where equipment costs are huge and operation is backed by insurance policies the thickness of a Bible, how can you tell me that changing a power cord on something like a Devialet or Wadia Intuition DAC/amp combo is going to make a difference?*

The difficulties that our audiophile equipment deals with are different than those that most industrial sensitive equipment deals with (though sometimes related). All of our quality issues have only to do with real-time signals (data streams for simultaneous perception and evaluation), whereas much equipment in the world (even when extremely sensitive) deals with processing information in a non-real-time environment. This means that any and all errors that might occur can be corrected through maths and re-calculation, whereas the audiophile type of errors we deal with, namely, the four types of distortion mentioned in my article, and especially Jitter (see *Why Radio is so Important*) have no chance of being corrected, because the incurrence of the distortion is simultaneous (for all practical purposes) with the radiation of the critically evaluated sound from the speakers. This means that real-time electronic events are brought to a much more demanding prerequisite in terms of precision. I am describing here in general terms the entire battlefield that any electroacoustic arts engineer needs to first comprehend before striving towards better sound quality: audio is a real-time process, and, hence, all bottlenecks to audio quality are also real-time processes.

For power cable design, the main implication of this difference between real-time processes (even if they are digital) and environments where error correction still has time to occur (even if they are analogue), is mainly that of the difference between industrial reliability in the case of the latter and comprehensive real-time performance of the former. Hence, the expressed recommendation of 10 AWG oxygen free copper from your German colleagues. It needs only to be reliable and safe in a utilitarian sense over a long period of time, for that application to function well.

In our audiophile realm, there are many more influential aspects to the build and functionality of a power cable, only because the real-time nature of their influence is readily perceived. Every single aspect of the build of a power cable will influence the sound quality to some degree. Even power regenerators are not really complete buffers, because they are in principle nothing more than 50 or 60 Hz sine wave generators with accompanying amplifiers, and all generation and amplification operates under the same power that one wants to separate from one's gear. So even if there is some buffering, noise and other sonic influences do get through, which is why every user of DFPC Skin-filtering power cables reports hearing its positive influence even when used to power a power re-generator or filter.

Real time does not mean fast, it means real time.

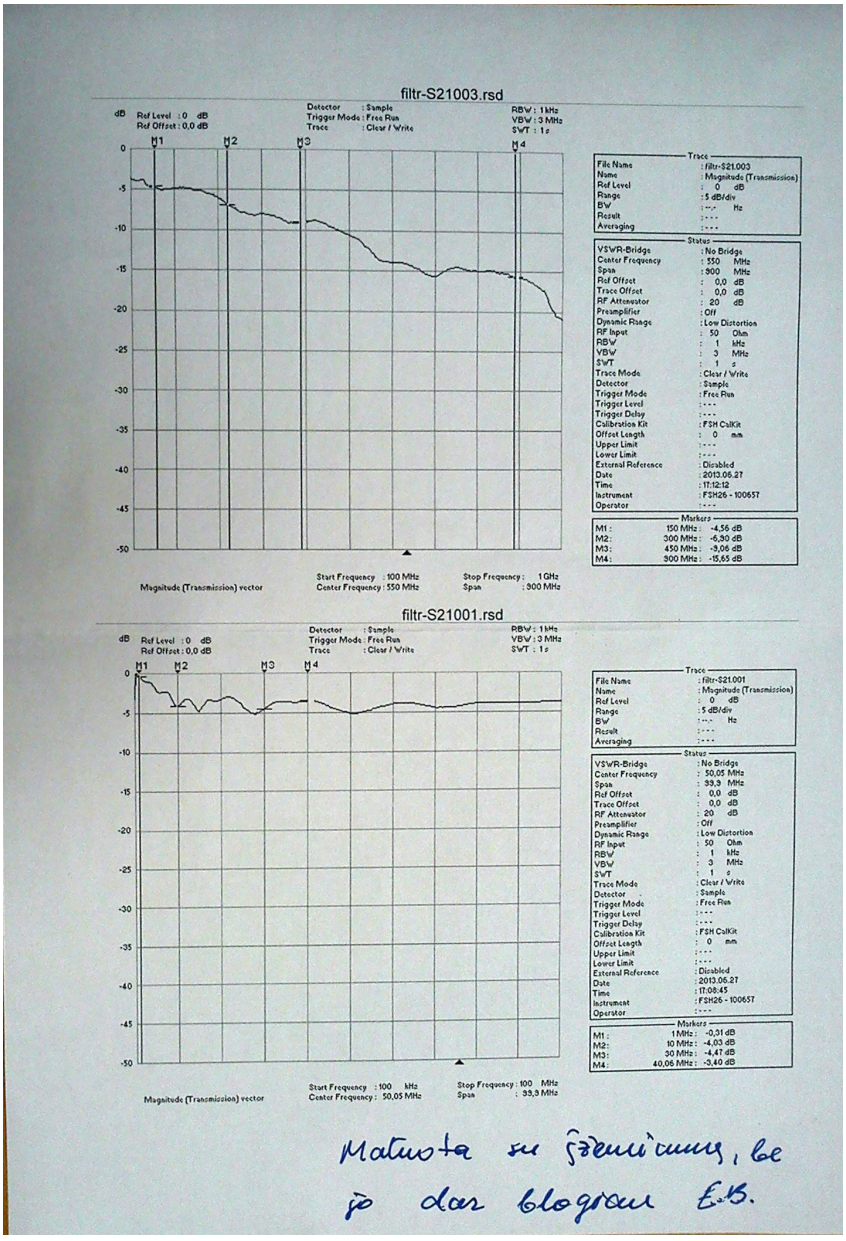
In our solution, with Skin-filtering along the entire power cable length, we address noise in real time. This is key to understand. The real-time nature of the noise reduction is something that standard caps and coils methods of filtration, based on resonance and the storage and release of energy, are unable to keep up with.

Difficulties in obtaining repeatable measurement

A power cable has no known and no stable impedance at high frequencies. It changes from place to place, from length to length, and from frequency to frequency. Therefore, it is impossible to measure high frequency noise reduction very accurately using standard lab equipment and protocol. Even the connectors are not suited to high frequency measurement. They will show additional resonance aberrations of their own. This means that in a lab, one will be able to interpret the data in too many ways to achieve reliable, informative results. In practice, simply bending a cable or moving a finger around it will produce wild HF artifacts on the analyzer's scope. In fact, there is no established certification or standards protocol for measuring power cable performance. The only accepted parameters are resistance (expressed by the gauge) and physical reliability (resistance to moisture,

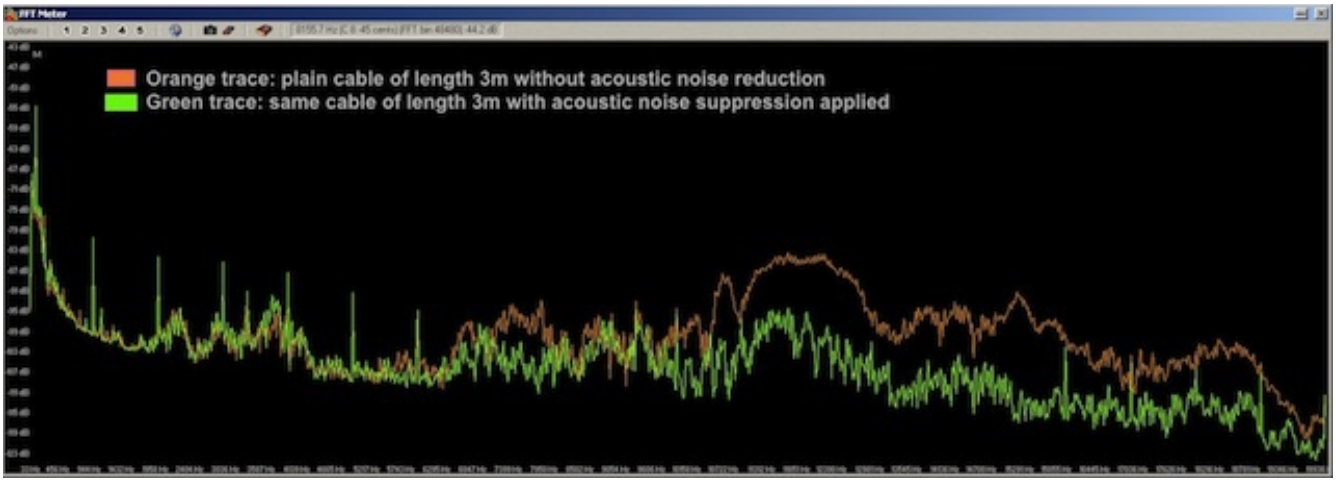
longevity of use), as well as some lifecycle bending and abrasion tests, and fireproof tests based on how long it takes an open flame on the burning cable to self-extinguish.

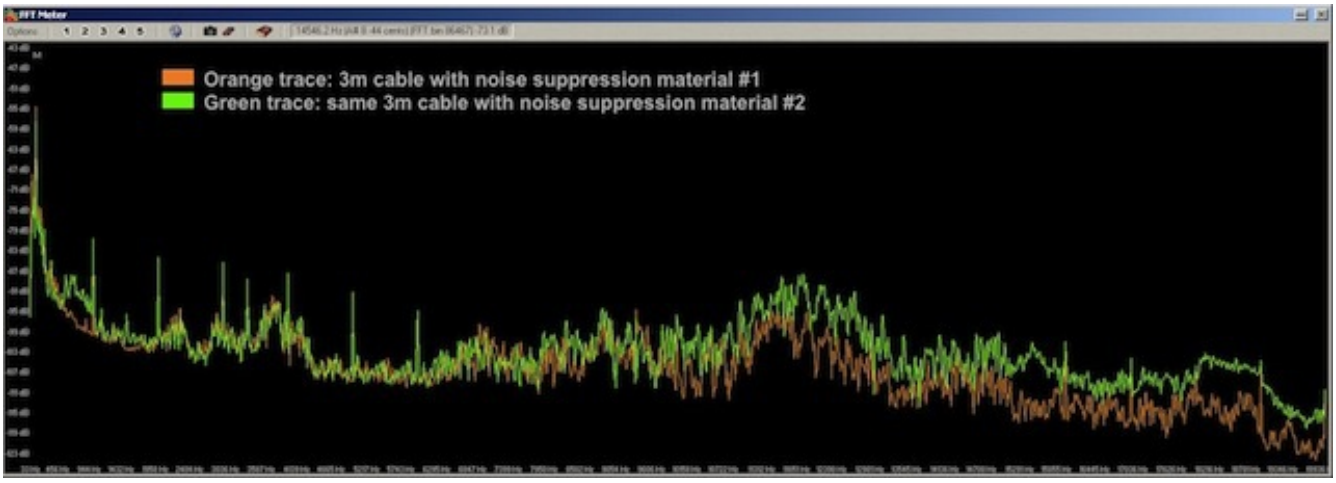
Specific to the functionality of the Skin-filtering technology is that it has no dips and peaks as standard filters do, which are based on resonance. Please see the attached image of a lab measurement taken of a 20 cm length of Skin-filtering wire with attached 50 Ohm high frequency BNC connectors. This is not a measurement of an actual power cable we sell, but is a measurement of a prepared piece of short wire treated with an early iteration of Skin-filtering just to show the principle of operation. As one can see, the higher the frequency introduced, the more radically this frequency is attenuated, in a smooth and even fashion, without resonance peaks or valleys. This type of characteristic is important for natural sound quality.



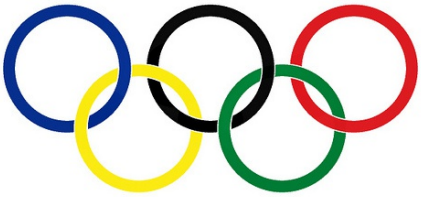
But there's more to it than that.

When dealing with sound quality, this power cable performance factor, though highly influential, is not adequate to completely explain the many other aspects which influence sound quality. For example, the acoustic behavior is also influential, because a cable passing moving charges will vibrate. The acoustic self-resonation characteristic of a cable can be measured and plotted by exciting it physically on one end with a vibration actuator and running FFT analysis on the result as picked up with an isolated contact microphone on the other end. Please see a few acoustics measurements attached here. One can plainly see different results from the application of different absorption materials to the same subject cable. And these results do correlate to the audible outcome when using the power cables thus treated on audio equipment.





The limiting thing here is that the available measurement methods each show only one particular aspect of design performance. The profound difficulty is that one aspect's performance, while good, also influences another aspect's performance, often degrading the latter. For example, when lead (the metal), is used as a thick shielding material, it's own EM spectrum of absorption and emission causes its own sonic fingerprint to be imprinted onto the resulting sound quality, as well as its effect on the acoustic resonance of the cable. So even though lead shields against very high energy EM waves, it is not perfect in terms of neutral sound quality attained because of at least two other factors influencing other aspects of performance.



Let the games begin!

A good image or symbol for how these influences interrelate is the logo used for the olympics with the interconnected rings. Each ring could represent some build aspect of the cable: conductor size, material, pureness, hardness, dielectric permittivity, color spectrum, resonance, geometry, thickness, etc. Adding them all up, one has a real-time mosaic of influence of these overlapping rings, each also simultaneously influencing at least one or two other effect caused by the others. Therefore, to change just one thing in the design can easily throw an earlier masterfully achieved balance of some other aspects completely out of line again.

Q: *Is the filtration material inside the jacket on the wire?*

The filter is along the entire length of the conductor, and represents the outer skin of the conductor itself. Resistors are made of carbon or very fine wires. Now envisage a copper core wire which has a conductive resistive coating, representing a resistor on its outer shell. We have thus split the conductor into two parts: a well-conducting part at the core for low frequencies, and a highly resistive part on the outer skin for the high frequency noise. Thus, we achieve noise reduction simply because nature dictates that the noise resides at the skin of the conductor. The high frequency noise does not seek the path of least resistance in this 3D scenario when looking at a conductor from cross-sectional vantage point. It adheres to the physical laws which require it to reside at the skin of the conductor. After all, the skin is conductive. It just happens to be purposefully less conductive in our design.

Q: *The manufacturer of my digital DAC and amp combo says that power cables don't make a difference worth mentioning on my equipment. What's your take on that?*

If you are using the Wadia Intuition or a Devialet as an amp and DAC together, then this is big news regarding the influence of the power cable on the resulting sound quality. The more functionality is built into a single piece of audio gear, the more the influence of the power cable's performance is heard, because there is simply so much inter-dependent signal processing going on in this single piece of gear.

Take for example the Devialet amplifiers from France. They have all sorts of digital and analogue processing in them, with digital inputs, DACs, digital volume control and power amplifier. There have been many LessLoss customers using the Devialet DAC/amplifiers who are very happy with the results using our DFPC power cables on them. I myself have witnessed the improvement in sound quality with the Devialet. It is a large leap forward in terms of clarity along the entire frequency spectrum, with reduced background noise, and, hence, a more profound and natural expression of musicality.