SHUNYATA RESEARCH

Power Cord Misconceptions

There are many power cord misconceptions in the market. Here, we will address these issues and how Shunyata Research relates.

How can an aftermarket power cord, which represents the last 6 feet or so of many miles of cheap in-wall and underground wiring, make any difference at all to sound or video?

There are many misconceptions about the basics of power transmission and power quality that make it difficult for people to understand why any aftermarket power cord can impact the performance of a home A/V or professional recording and film system. The fact of the matter is that Shunyata Research power cords have made dramatic differences in all manner of consumer and professional recording, sound and film systems. Many skeptics question even the possibility of an aftermarket power cord making a difference in electronics performance. Shunyata Research is pleased to provide answers.

The first and most obvious question is — can power cords make any difference at all? There is no sense in talking about theories of operation if we ca't agree that there can be an obvious visual and audible effect when applying a competently designed aftermarket power cord to electronics. Most of the thousands of professionals and consumers that use Shunyata Research power cords started out as skeptics and have answered that question for themselves through their own experience.

The only cases where a high quality power cord may not have a significant effect is when it is coupled with a poor quality power conditioner that creates a high impedance to instantaneous current flow problem. The most common misconceptions about power transmission and their simple technical truths follow:

MISCONCEPTION #1: AC power is like water coming from a large power tank, flowing through several 10s of feet of power hose into a component. This implies that the component is at the end of this system.

Answer: Actually, the component sits between two power conductors: the hot and the neutral. AC power oscillates (alternates) back and forth at a 50-60hz rate. So power does not pour into the component at all. The component's power supply is within a complex network of wires and connectors. Due to their obvious proximity, ALL of the wire and connectors can and do affect the performance of the component'power supply.

MISCONCEPTION #2: AC power can be contaminated just like water in a hose. This implies that once the water is contaminated at some point up stream, that is must be cleansed before it arrives at the audio component.

Answer: As stated in #1, the component is not a the end of the power hose. It is between two power hoses and the current is oscillating back and forth. Further, current is not like water at all. Electrons cannot be contaminated. There are two aspects to power transmission: the EM wave and the current flow. The current itself cannot be contaminated but the EM wave can be modulated with other frequencies. We usually call these other frequencies noise or EMI. Within the various parts of a power circuit there may be EMI in certain parts that are not present in others. EM energy can be transformed or redirected to lessen their effects.

Some power cords for example, use capacitors, inductors, or ferrites in an attempt to control the EM fields around the audio component. The success of such an approach is completely dependent upon the specific power supply design and its reaction to the added reactive capacitance of the power cord.

MISCONCEPTION #3: There is up to a hundred feet of wire in the walls, so the last 6 feet of power cord can't possibly make any difference.

Answer: The PC is NOT the last 6 feet as stated in #1 and the local current and EM effects directly affect the sonic performance of the component. The power cord is not the last 6 feet, it is the first 6 feet from the perspective of the component. The further a noise source is from a component, the less of an impact it will have on the components power supply. The high-frequency noise sources that have the greatest impact on audio and video performance are the system components themselves — which are usually all in close proximity of one another and all emit radiated fields of high-frequency noise. A well designed power cord can act as a noise-isolated extension of the primary winding of a component's power supply and will help isolate the power supply from the fields of radiated RF and EM noise energy that is ever present in all electronics systems.

MISCONCEPTION #4: There is a tremendous amount of electrical interference and EMI coming from outside the home that we need to protect our equipment from. This implies that we need some sort of power conditioner or filter to protect the equipment.

Answer: Most of the EMI that affects the audio quality of a system is generated by the audio components themselves. EM waves that travel through space dissipate in power as the square of the distance from the source and very high frequencies that propagate through the power circuit do not survive for long. Power lines present a high impedance to Mhz and Ghz signals due to the relatively high inductance of power lines.

A primary source of audible sonic degradation is caused by the power supplies. Most components use FWBR (full wave bridge rectifier) power supplies that generate an incredible amount of transient noise when the rectifiers switch on and off. The design of a power cord can significantly affect the reactance of these signals within the power supply. Because the power cord is part of the primary winding of the power transformer, the transition between the various metals used in a PC can cause EM reflections and diode-like rectification of the noise impulses as they propagate away from the power supply. If the PC presents a high impedance to these signals they will be reflected back into the power supply where they will intermodulate increasing the high frequency noise levels of the component. Most power supply filters are ineffective at blocking very high frequency noise components and much of it is passed

through to the DC rails. The sonic effects of this include: high background noise levels, blurred or slurred transients and a general lack of clarity and purity of the sound or visual image.

MISCONCEPTION #5: There is some conspiracy among audio designers that keeps them from producing a "proper" power supply that is not affected by the quality and design of a power cord. This concept is like saying that if a speaker were properly designed, you wouldn't need to use a good quality speaker cable.

Answer: Shunyata Research power cords have been tested with modest beginner and mid-fi equipment as well as the most exotic and sensitive recording devices and electronics. We have yet to find a component that cannot be improved by replacing the power cord with a high-quality design. As long as power supply design is based upon FWBRs or switching supplies, the power cord will always be significant.

MISCONCEPTION #6: High-end power cords just increase the circuit capacitance acting as a high-frequency shunt. There are some power cords that ARE designed this way. Some even insert capacitors within the cable to further increase capacitance. This approach has some positives and many negatives, including the reactive interference with the way many power supplies are designed.

Answer: Capacitance alone cannot account for the differences in a power cord's performance. There are some very effective aftermarket power cords that have virtually unmeasurable levels of capacitance. These power cables are usually designed around hollow tubes with the conductors inside. The conductors are several inches apart and cannot significantly affect the capacitance of the power circuit.

MISCONCEPTION #7: Power cords are just like speaker cables; the shorter the cable the better.

Answer: A speaker cable conducts an audio signal from the power amplifier to the speaker. The distance is quite small, on the order of a couple of feet to several feet. The quality of a speaker cable is determined by how well it can transmit the signal from the amplifier to the speaker without alteration or signal degradation. A power cable on the other hand is not transmitting an analog signal. It is conducting A.C. power and its sonic superiority will be determined by its ability to deliver current (steady-state and instantaneous) and its ability to deal with the EMI effects of the components to which it is attached. Since a power cord is composed of a hot and neutral wire that the component sits between, a change in the length of the cord will increase the size of the "buffer" around the component. In the specific case of Shunyata Research — we use patented noise-isolating geometries, shielding and a patented compound that absorbs EMI in some power cord models. Increasing the length of the cable, increases the noise isolation, or coupling effect to the ZrCa-2000 compounds, therefore increasing the performance of the cable. In general, Shunyata Research does not recommend a power cord that is shorter than 3 feet or 1 meter in length for performance ease of use and, or resale reasons. Of course, subtle degrees of audio performance are not the only consideration when putting together an audio system. Aesthetics are also important especially when the system is located in a beautiful home. I just point out the performance differences so that people can make an informed decision when determining the optimum length for their cables.