Going to Ground

REDUCING RFI, RADIO OR HIGH-FREQUENCY INTERFERENCE, IN AUDIO SYSTEMS SHOULD IMPROVE SOUND QUALITY – BUT DOES IT, AND HOW EASY IS IT TO DO? KEVIN FISKE EXPERIMENTS AND INVESTIGATES.

In electrical terms, when thinking of conducting possible interference away, an important distinction is made between earth and ground. Earthing is an electrical safety strategy. If we touch a piece of audio kit or any other electrical device that has developed a fault, earthing leads unwanted energy away, literally to earth, so that we don't risk getting an unpleasant or even life-threatening shock. Grounding on the other hand seeks the zero voltage reference point in an item of audio hardware from which the wanted signal is processed. It has nothing to do with safety.

One reason this matters is because audio circuits feed unwanted electrical noise to signal ground. In the context of an audio system with multiple components each connected to the other, that's where, via the ground return on the interconnects, unwanted electrical noise circulates between equipment where it can exert a profoundly negative influence on sound quality.

The noise can be wideband, comprising 50Hz hum and still lower frequency components, and also extend right up to 50MHz, low VHF or greater. It is often generically labelled RFI and exists on the audio signal ground lines because of conduction via the mains feed, and radiation that enters the system courtesy of the antenna effect of interconnects and metal equipment cases. It is also present within equipment and thus may be conducted to the next unit in the chain or indeed the previous item.

RFI can be mitigated by connecting an audio system to the huge lossy capacitance that is planet Earth via a low-impedance path, a wire. There, the unwanted noise can largely dissipate without damaging sound quality. This is called grounding, for obvious reasons.

Grounding expert Ben Duncan blames 'shoddy' power supply design for much interference

As electronic engineer Ben Duncan, who wrote for HIFICRITIC about mains electricity in 2007, points out, grounding is not a new discovery, but one that was well understood a generation ago when it was employed to improve antenna gain for quieter AM and FM radio reception, and also by film and music recording studios to help achieve the best possible sonic quality by reducing the noise floor.

We might reflect on the irony that now, when numerous RFI-producing devices including mobile phones are so omnipresent in the home, that good grounding practice is no longer so well appreciated or deployed.

We don't need costly measurement technology to prove that RFI is a thief of audio quality. Most readers will be familiar with the 'after midnight' phenomenon when their system sounds more natural; relaxed and yet dynamic at the same time, and tonally richer. Many will be equally familiar with the frustration of listening at other times when the sound might be gritty, hard and disappointing. Same system, different times of day, different results.

Duncan notes that some of the variation we hear is the result of voltage fluctuations. The boiler-plate on the mains supply from the District Network Operator in the UK may be a nominal 235V, but audio equipment is optimised for peak value, not an averaged RMS. Under- and over-voltages can therefore cause changes in sound quality even while the 'RMS value' remains within statutory limits.

But Duncan reserves his greatest ire for the shoddy design of power supplies in televisions and many other devices that spew harmonic distortion into the mains supply of a neighbourhood. Our sensitive audio systems are designed to modulate the incoming audio signal voltage to give us music via current in a loudspeaker. If a system gets those volts plus a dose of noise…then that's what it amplifies, and that's why sound quality tends to be