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Grounding For High Frequency Interference

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When is the safety or green wire ground not enough? When HFI (High Frequency Interference) or excessive ground loop currents are present in your data center. High frequency interference or commonly known in layman's terms as ground loop noise can have a detrimental effect on computer equipment and sensitive electronic equipment. This may be especially apparent with interconnected systems and SCSI interfaced equipment. Erratic equipment performance, intermittent failures and unexplained system resets are generally the first indication that environmental issues such as HFI may be the likely cause.

High Frequency Interference or ground loop activity is a potentially detrimental loop formed when two or more points in an electrical system that are nominally at ground potential are connected by a conducting path such that either or both points are not at the same ground potential. This noise is generated within the facility and can come from a verity of sources such as electronic ballast's, HVAC, construction activity, miswired electrical distribution or equipment, and even communication cable placement can contribute to HFI. Because of the increased speed of computer equipment and the lowering of logic voltages to compensate for the increased speed, HFI becomes a serious threat to data and system reliability.

The resolution to this HFI is simple and relatively inexpensive; install an SRG (Signal Reference Ground Grid) under the raised floor and use it as an equipotential ground reference for all equipment in the data center. The raised floor metal structure if properly grounded can provide a path for dissipation for high frequency noise to safely travel to ground. By attaching all equipment in the room to the ground grid eliminates any differences in potential between equipment or server racks.

"My equipment is grounded with a green-wire safety ground and that should be enough". This is a common statement by facilities managers and electricians but illustrates an incorrect understanding of safety ground verses grounding for high frequency or ground loop noise. The green wire safety ground is obviously important and must be present to provide a ground for power supplies, limit touch potential and a path to ground should a fault occur. The reference ground on the other hand provides protection from noise with frequencies that far exceeds those of a normal safety ground. IEEE defines an SRG as "A system of conductive paths among interconnected equipment that reduces noise-induced voltages to levels that minimize improper operation. Common configurations include grids and planes". Signal Reference grounding (SRG) is the most efficient way of dissipating the HFI so that is no longer a threat to our computer systems. Hundreds of data centers around the world are utilizing the benefits of SRG grounding and installing Signal Reference Grids under their raised floor structure.

A properly installed grid should be comprised of flat copper braided conductor criss-crossing under the raised floor creating grid squares of 2, 4 or 6 feet. The use of braided conductor is imperative due to the high frequencies involved. Noise above 100 KHz does not travel through the center of the conductor but travels on the outside, or skin, of the wire. This phenomenon is known as skin effect. The use of multi-stranded braided cable provides hundreds of wires or skins for this noise to effectively travel. If the installed raised floor structure is bolted or screwed together, it may already be a low impedance path and therefore adding a 1 inch flat copper braided conductor around the perimeter of the room may be all that is needed to create the grid structure. Once the grid is constructed, it is then connected to the ground bus in each and every power panel in the data center. If isolation transformers are present in the data center, a strap of braided cable must be connected from the grid to the transformer ground. This also applies to UPS equipment if it is located in the data center.

Once the grid is constructed, every system, server cabinet, or piece of Telco equipment must be bonded to the grid. It is important that everything in the room shares the same ground reference and therefore must be attached to the grid. A 1 inch flat copper braided conductor should be used to attach equipment to the grid and these pieces of braided strap must be in lengths as short as possible. The recommended length of these straps is 18 inches or less. Paint must be removed at the area where the strap is attached and a good mechanical clamp must be used to attach the cabinet strap to the grid or support post.

If the computer world used nothing but fiber optic cables then interference problems would be reduced dramatically. However, copper still rules and where copper prevails interference will remain an issue.