With the ratification of the 10GBASE-T standards for 10Gb/s Ethernet over copper cabling, adoption of screened and shielded cabling has risen dramatically. While the increased usage has driven greater market familiarity and comfort with these cabling systems, there remain some points of confusion.

This Q&A, compiled by Siemon’s Valerie Rybinski, an expert in the design and implementation of screened and shielded cabling, addresses the most common questions posed by users planning on implementing a screened or shielded solution.

Q: What is the preferred way to terminate a cable shield? Clause 4.6 of ANSI/TIA-568-B.1 and Clause 11.3 of ISO/IEC 11801:2002 state that the cable shields shall be bonded to the telecommunications grounding busbar (TGB) in the telecommunications room and that grounding at the work area may be accomplished through the equipment power connection. This procedure is intended to support the optimum configuration of one ground connection to minimize the appearance of ground loops, but recognizes that multiple ground connections may be present along the cabling.

Q: Siemon requires that the screened/shielded patch panel be grounded to the TGB on the rack in the telecommunications room. What are the requirements for grounding at the work area? There are no special requirements for grounding at the work area.

Q: Is it okay to "daisy chain" patch panels to each other and then connect the bottom panel to the TGB? Or, must each panel be directly connected to the TGB? “Daisy chaining” is never a recommended cabling practice as it reduces system reliability. For example, a single failure point at one patch panel can result in multiple failures across an entire rack. Each patch panel should be directly connected to the TGB.
Q: Is it okay to connect the #6 AWG ground wire from the panel to the rack? Or, must it be connected directly to the TGB? If it is okay to ground it to the rack, then how is that accomplished? It is acceptable to connect the #6 AWG ground wire to the rack if (1) the hardware that is used effectively bonds the conductor to the rack metal (not the paint) and (2) the rack is properly grounded to the TGB (which in some cases may be via a metallic raceway). For example, Siemon supplies a ground lug with each rack that can be used for either bonding the rack to the TGB (or metallic raceway as noted) or bonding panels to the rack.

Q: Can a shield ever behave as an antenna? Both metallic shields and the copper balanced twisted-pairs in a UTP cable will behave as an antenna to some degree. Models and experiments, however, prove that UTP cables have 100 times more potential to radiate and receive signals (i.e. behave like an antenna) than F/UTP cables under correct termination conditions and 10 times more potential to radiate than F/UTP cables that have not been grounded. The reason for this is that, in UTP environments, the signal-to-ground path that induces disturbing noise currents is poorly controlled since it is dependent upon factors such as distance from metallic raceways, metallic structures surrounding the pairs, the use of non-metallic raceways, and termination location. Conversely, this signal-to-ground is smaller, better defined, and more controlled in screened/fully-shielded cabling environments.

Q: What happens if the shield is accidentally left ungrounded on both ends? Shield effectiveness is reduced by 20dB (a factor of 10) if the shield is left ungrounded on both ends. The noise immunity benefit of the shield is still apparent, though, as this level of performance is still 20 dB better than UTP cabling! UTP cables are still 10 times more likely to radiate and receive signals (i.e. behave like an antenna) than F/UTP cables under worst-case, ungrounded conditions.

Q: What is a ground loop? Ground loops develop when there is more than one ground connection and the difference in voltage potential at these ground connections introduces [generates] noise on the cabling. It is a misconception that common mode noise from ground loops can only appear on screens and shields; this noise regularly appears on the twisted-pairs, as well. One key point about the voltage generated by ground loops is that its waveform is directly related to the profile of the building AC power, which is typically 50 Hz or 60Hz. TIA and ISO standards identify the threshold when an excessive ground loop develops as when the difference in potential between the voltage measured at the shield at the work area end of the cabling and the voltage measured at ground wire of the electrical outlet used to supply power to the workstation exceeds 1.0 Vrms. This difference in potential should be measured and corrected in the field to ensure proper network equipment operation, but values in excess of 1.0 Vrms are very rarely found in countries, such as the US, that have carefully designed and specified building and grounding systems.

Q: Will grounding both ends of an F/UTP or S/FTP cabling channel potentially cause a “ground loop”? The chances are high that the cabling at the work area is already grounded by some means through the network equipment chassis. (It is important to remember that this possibility was considered when the grounding and bonding recommendations specified in ANSI-J-STD-607-A-2002 were developed). The fact is that, while grounding of the screen/shield in multiple locations can also result in common mode noise current induced on the screen/shield, these common mode noise currents do not affect data transmission because, regardless of their voltage magnitude, their waveform is always associated with the profile of the building AC power (typically 50 Hz or 60 Hz). Due to the excellent balance of the cabling at low frequencies, noise currents that may be coupled from a screen/shield (or induced onto the twisted-pair directly from equipment impedance differentials in the case of UTP cabling) are simply subtracted out by the transceiver as part of the twisted-pair transmission protocol. Although there is no reason to ground both ends of an F/UTP or S/FTP cabling channel, doing so will not adversely affect data transmission.
Q: What if I use an unshielded patch cord at one or both ends of an F/UTP or S/FTP channel?

Sometimes, a UTP patch cord is used at one end of an F/UTP or S/FTP channel with the mistaken belief that it will minimize the potential for noise currents induced by ground loops. This is not a necessary practice, however, as the balance of the cabling system is more than sufficient to ensure immunity against the low frequency currents (i.e. 50 Hz or 60 Hz) that result from ground loops. Using UTP patch cords at both ends of an F/UTP or S/FTP channel is not recommended as it can reduce the noise immunity performance of the cabling system by 20 dB. (This is not critical; as even this compromised noise immunity performance is still better than what can be realized with a UTP system!) For optimum alien crosstalk and noise immunity performance, the use of UTP patch cords in screened/shielded cabling systems should be avoided.

Q: Should steps be taken to avoid grounding the shield at the end user's PC or device chassis?

Since the possibility that grounding at the work area through the equipment may occur was considered when the grounding and bonding recommendations specified in ANSI-J-STD-607-A-2002 were developed and there is no inherent risk from interference from low frequency (i.e. 50 Hz or 60 Hz) noise currents induced by ground loops, there is no need to specifically avoid grounding the shield at the end user’s PC or device.

Q: Does a shielded system take significantly longer to terminate and cost significantly more than a UTP system?

Shielded outlets typically take approximately 2x longer to terminate than UTP outlets. However, the balance of the installation, such as cable pulling and basic field testing are equivalent. Factoring these considerations in with the costs of the materials, a shielded installation carries roughly a 25% premium over a UTP equivalent installation. However, this premium may be essentially nullified if field testing of alien crosstalk is required. Due to the higher susceptibility of alien crosstalk for UTP installations, some end users require field testing of this parameter which is a time consuming endeavor for installers.
For more in-depth information on the implementation of screened and shielded cabling, please refer to the Siemon whitepaper entitled “Screened and Shielded Cabling – Noise Immunity, Grounding and the Antenna Myths” by Valerie Rybinski. The complete version of this document may be downloaded or ordered in hardcopy at www.siemon.com.