IEEE 802.3 Cable Discharge Adhoc

Chair's Summary Report

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The IEEE formed an adhoc study group in January of 2001 due to concerns stated within the LAN industry of device/product failure rates that were attributed to a phenomena known as “Cable Discharge Events” hence the acronym “CDE” was adopted to title this adhoc.

Initially, there was much speculation about the phenomena, its cause, methods of testing for immunity at both the device and product level, and methods of protection.

Empirical field data indicated failure rates on some products as high as 1-2% due to this issue alone and had been much more prevalent in CAT5E and CAT6 cable installations than in CAT3 or CAT5 installations. Certain devices were found to exhibit higher levels of sensitivity to the problem and vendors were seeking a better understanding so they could design their devices to withstand whatever condition might exist on installed wiring.

The adhoc met three times over this period and a number of valuable presentations were made. A liason letter was drafted to the TIA to request experts in the cabling industry to assist us by helping to understand the range of any potential energy and voltage that can be found on the cabling, the circumstances under which this could occur, and a model that would be useful to develop testing.

Presentations were made to show that relative humidity was more relevant to charge storage on cables than the media type (CAT 3,4,5,6) that was being used. In fact, those presentations led the chair to believe that cable charge capacity alone was not the issue at hand. Other presentations showed that the discharge characteristics of Unshielded Twisted Pair (UTP) cables is much different than the Human Body Model which has been standardized for testing silicon devices. Unlike the HBM which is a very high impedance and low capacitance model, UTP cables discharge a very large amount of charge with a low impedance. This means much more energy is absorbed by the device than with a HBM. Typical device protection structures in silicon that are designed to withstand HBM discharges can be destroyed when hit with the larger amounts of energy due to CDE.

At the Portland meeting, an interesting point was made that ultimately never has been thoroughly investigated. Could the problem be due to triboelectric material differences in the cables? For example, drawing a PVC-clad cable through a PVC conduit is unlikely to cause a charge transfer because the triboelectric materials are common. However, drawing a Teflon-clad cable through a PVC conduit might just result in a transfer of charge from the conduit onto the cable. At the molecular level, differences in materials can result in charge transfer when those materials are mechanically drawn against each other. The most noteable case of this is a classic glass/fur experiment used in schools to explain charge transfer to children.

The adhoc never completed an investigation into this question. Due to overall challenges within the industry to tighten belts during an economic downturn, and prioritization of projects, this question has not been resolved to completion.

This is an important point to consider because it could potentially explain why some cables have empirically been observed to be more likely to result in CDE events than others despite presented evidence of equivalent charge storage behavior. I believe that any study, experimentation, or data that is relevant to this question would be gladly accepted by the IEEE 802.3 working group or the TIA TR-42 if someone wishes to pursue it.

As a final action for this adhoc, I intend to publish a test methodology for silicon devices and products that I believe will be sufficient to meet the objectives of the adhoc group. The objective of that test methodology will be practicality, repeatability, and consistency with observed failure mechanisms. My intended schedule is to complete and publish this report before the end of 2002. I will submit it to the IEEE 802.3 and rely upon that committee to share it with TIA or any other relevant committees via laison efforts.

Regards,

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Chair, IEEE 802.3 CDE Adhoc Committee