	<b>Comparison of Cat. 5e to Cat. 6 Using EFT Pulse EMI</b>
Data Communications Competence Center	DCCC03040901 July 12, 2007

## **Test Summary**

This test report outlines the Frame Error Rate performance of Cat. 5e and Cat. 6 cables exposed to EMI due to EFT pulses in power cables.

## **Background**

In many office, school and business buildings, power cabling may be installed without separation from data cabling. Power spikes that occur on power cables in this environment may be as high as 500 volts.

To analyze performance of data cable exposed to power spikes, the Data Communications Competence Center conducted testing where Gigabit Ethernet signals were transmitted / received over the cabling systems with zero separation to power cables with EFT Pulses. Frame Error Rate (FER) was measured.

## **Test Equipment**

- 1, Spirent SmartBits® 2000 Multi Performance Analysis System with Model GX-1420B Gigabit Ethernet modules.
  - 1518 byte frames, 0.096 $\mu$ s interframe gap, Continuous packets full duplex
- Haefley Generator, Control Unit P90.1 with High Voltage Unit PHV 41.2
- 2 PCs with 3COM Gigabit Ethernet NIC cards running EtherPeak Traffic Generation and Evaluation Software
- 6 each-100 meter channel
  - 3 Balanced Cat. 5e channels
  - 1 Unbalanced Cat. 5e channel
  - 2 Balanced Cat. 6 channels

## Test Setup

### *Test Setup for EFT Pulse EMI*



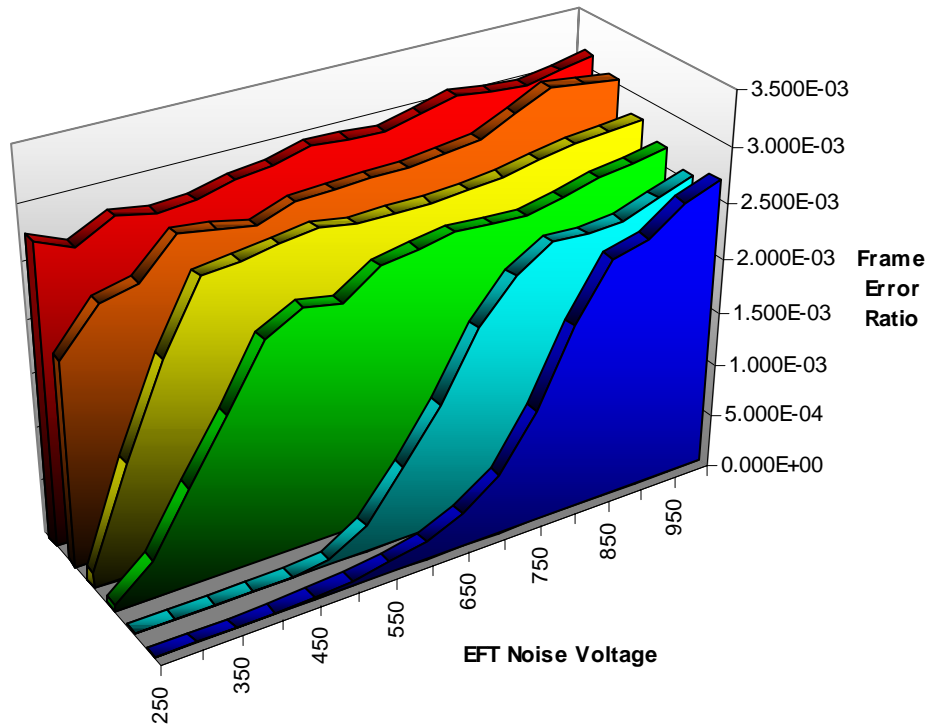
### *Description*

- 90 meters of test cable was installed in the raceway with two 5 meter patch chords to two PCs which ran Etherpeak.
- 90 meters of power cable was installed with zero separation from the data cable in the raceway. The Haefly Generator was connected to the data-receiving end of the raceway and a heater was connected as a sink to the other end.
- The Haefly Generator put a current onto the power cable with EFT pulses, starting with 250 volts pulses increasing to 1000 volts.

Etherpeak generated Gigabit Ethernet traffic on the data cables from one PC and received the data traffic into Etherpeak on the second PC. Etherpeak reported errors and missing packets.

**Test Results**

**Error Rates of Cables under EFT**



■ CAT6 Sample 1 ■ CAT6 Sample 2 ■ CAT5e Sample 3 ■ CAT5e Sample 1 ■ CAT5e Sample 2 ■ Unbalanced CAT5e

Figure 1: Error rates of Cable under EFT Pulse EMI.

Normalized Errors per EMI Pulse Voltage						
Volts	Unbalanced CAT5e	CAT5e Sample 1	CAT5e Sample 2	CAT5e Sample 3	CAT6 Sample 1	CAT6 Sample 2
250	279.00	14.47	190.53	5.93	0.00	0.00
300	263.80	104.73	231.33	34.20	0.00	0.00
350	280.93	188.80	239.00	89.27	0.00	0.00
400	274.60	250.27	271.67	144.00	0.80	0.00
450	276.33	254.07	266.60	201.47	2.60	1.00
500	285.53	258.80	259.33	219.20	5.00	4.40
550	288.47	263.93	271.47	212.60	9.40	25.00
600	298.20	258.07	273.13	236.20	16.00	67.80
650					30.60	115.20
700	293.00	257.93	275.20	246.67	56.60	176.00
750					105.40	213.60
800	308.93	263.33	281.93	242.13	173.80	234.00
850					224.80	231.40
900	301.80	276.20	313.00	258.40	232.80	234.20
950	0.00	0.00	0.00	0.00	256.00	245.60
1000	314.47	280.47	304.53	268.60	267.00	257.20

\*Note: The errors noted in this chart are the average errors per 100,000 frames of three trials.

## **Test Conclusions**

The Category 5e cables consistently showed data packet loss due to EFT pulse interference starting at 250 volts followed by a rapid increase in error rate. The Category 6 cables do not show interference until the 500 volt range followed by a more moderate increase in error rate. This test clearly demonstrates that Category 6 cables are more resistant to EMI due to EFT Pulses when compared to Category 5e cables.

**Table 1: Definitions of Acronyms**

<b>Abbreviation</b>	<b>Description</b>
CAT5e	Category 5 cable enhanced cable
CAT6	Category 6 cable
CAT6e	Category 6 enhanced cable
CRC	Cyclic Redundancy Check
EFT	Electrical Fast Transient
HVAC	Heat, Ventilation and Air Conditioning
IEEE	Institute of Electrical and Electronics Engineers
LAN	Local Area Network
NIC	Network Interface Card
FER	Frame Error Rate
UTP	Unshielded Twisted Pair

### ***Data Communications Competence Center***

Nexans' Data Communications Competence Center, located at the Berk-Tek Headquarters in New Holland, Pennsylvania, focuses on advanced product design, applications and materials development for networking and data communication cabling solutions. The Advanced Design and Applications team uses state-of-the-art, proprietary testing and modeling tools to translate emerging network requirements into new cabling solutions. The Advanced Materials Development and Advanced Manufacturing Processes teams utilize sophisticated analytical capabilities that facilitate the design of superior materials and processes. The Standardization and Technology group analyzes leading edge and emerging technologies and coordinates data communication standardization efforts to continuously refine Nexans' Technology Roadmap. An international team of experts in the fields of cable, connectors, materials, networking, standards, communications and testing supports the competence center. The competence center laboratories are a part of an extensive global R&D network that includes eight competence centers, four application centers and two research centers dedicated to advanced technologies and materials research.