Test Summary

The purpose of the 10-Gigabit Ethernet fiber tests conducted were to explore the length of 50/125 µm GIGAlite-10 cable and the number of Ortronics connector pairs possible using an 850 nm, 10GBASE-SR transceiver. A series of lengths of cable were tested with an increasing number of mated connector-pairs. An important aspect of the test was the utilization of both field and factory-installed connectors. 10GBASE-SR traffic was transmitted over the various cable and connector configurations to demonstrate the capability to operate at extended distances.

Background

The primary focus of this evaluation was the Berk-Tek GIGAlite-10, 50/125 µm multimode fiber cable. Specified optical reach of the 850-nm transceivers used in the experiment over the fiber cable is detailed in Table 1.

Table 1: Specified Optical Reach

Nexans Cable	Core Diameter (µm)	Cladding Diameter (µm)	Max Attenuation	Nexans Optical Reach
GIGAlite-10	50 ± 3.0	125.0 ± 2.0	3.5	300 m
GIGAlite	50 ± 3.0	125.0 ± 2.0	3.5	90m

In order to extend the distance of MMF in 10-Gigabit Ethernet applications, Nexans, as well as its competitors, have developed an enhanced MMF. The following tests were designed with this in mind.

Test Setup

Ortronics passive SC optical connectivity was used with the Berk-Tek GIGAlite-10 cable. A combination of factory installed and field terminated connectors was used in the evaluation.

The experiment was conducted using an IXIA chassis with two separate 850-nm 10GBASE-SR cards capable of wire-rate, full duplex operation at 10 Gb/s. Ethernet traffic was generated using maximum frame length of 1518 bytes with the minimum allowable inter-frame gap. Frame errors are usually seen in the FCS (CRC) error count, however they also can appear as frame fragments, undersized, oversized or dropped frames.

Table 2 describes the channel arrangement used in the trials.

Table 2: Cable and Connector Configurations Tested

Test Set	Fiber Cable Type	Total Length (meters)	Segments (meters)	Total Connector Pairs	Connector Termination
1	GIGAlite-10	300	300	4	4 Field
2		650	300, 350	6	4 Field 2 Factory
3		900	250, 300, 350	6	4 Field 2 Factory
4	Standard GIGAlite	150	150	N/A	Field Spliced

*NOTE: In Test Set 4, the GIGAlite 50/125um (LB) fiber optic cable was evaluated. Due to the characteristics of this cable, the length selected was 150 meters. The connectivity method used was to splice the cable. This trial completed without any errors.

Test Results

Results are shown in Table 3.

Table 3: Test Results of Each Configuration

Test Set	Channel	Frames Sent	Frames Received	FCS Errors	Fragments	Undersize	Oversize
1	Uplink	83,679,704,155	83,679,704,155	0	0	0	0
	Downlink	83,752,874,891	83,752,874,891	0	0	0	0
2	Uplink	812,231,497,412	81,223,149,7412	0	0	0	0
	Downlink	812,231,327,856	812,231,327,856	0	0	0	0
3	Uplink	68,861,042,224	68,861,042,224	0	0	0	0
	Downlink	68,860,713,049	68,860,713,019	29	0	0	0
4	Loopback	43,132,276,265	43,132,276,265	0	0	0	0

Conclusions

Under 10GBASE-SR (serial-850-nm) operation and at a 900-meter link length employing 6 mated connector pairs, the GIGAlite-10 fiber optic cable performed with a packet error rate (PER) in excess of 10^{-10}. This distance greatly exceeds the GIGAlite-10 specified limit of 300 meters. In addition, there were six mated connector pairs in the 900-meter length, which exceeds the IEEE specification that defines three connections with an average insertion loss of 0.5 dB each. This cable demonstrated characteristics beyond those currently available in the market.

The GIGAlite fiber optic cable performed without errors at 150-meters. This distance is greater than the Nexans specified length for 10-Gigabit Ethernet over GIGAlite, which is 90-m as well as the IEEE 802.3ae requirement of 82 meters for this type of MMF.

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.