

MB 003E

10GBASE-T Testing of Belden IBDN® System 10GX®

The transmission of 10GBASE-T over copper UTP cables comes through with flying colors in third party testing of the Belden IBDN System 10GX.



Error-Free Performance During This First-ever 10G Transmission Over 100 Meter Cat. 6A UTP Test, Proves Belden IBDN System 10GX is the High Value Solution for 10 Gigabit Transmission

10GBASE-T, formally known as the IEEE 802.3an-2006 Standard, is a technology for transmitting 10 Gigabit (10G) Ethernet up to 100 meters over a four-pair, four-connector structured cabling system. In transmitting 10G over copper, two major challenges must be overcome: the first challenge is to eliminate Alien Crosstalk, and the second one is to have controlled internal performance up to 500 MHz. There has been some debate within the industry as to whether or not this is possible using augmented Category 6 UTP (unshielded twisted pair) cabling. Belden is pleased to announce that the debate is over.

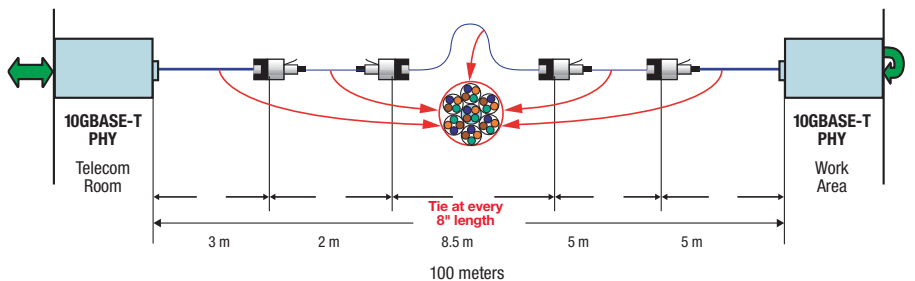
In a live demonstration involving third party testing at 100 meters, using the worst-case channel configuration scenario specified by the TIA, the Belden IBDN System 10GX UTP Cabling Solution performed error-free and with margin to spare. Belden's System 10GX was the first such system to be tested, and the published test results offer definitive proof that UTP systems

designed with Alien Crosstalk reduction and superior internal performance are the best and most cost-effective cabling choice to support 10GBASE-T transmission.

Testing Methodology and Results

The validation trials performed on the Belden System 10GX were conducted in September 2006 by Solarflare™ Communications Inc. in Irvine, California, using Solarflare's newly developed 10Xpress™ 10GBASE-T PHY (physical layer) evaluation boards. The testing was done on a 100-meter Belden IBDN System 10GX channel in a worst-case, 4-connector channel configuration (as specified in the TIA augmented Category 6 draft standard, currently under development in the TIA TR 42.7 subcommittee). A 7-cable (six-around-one) configuration was used, with the Belden 10GX cables bundled every eight inches. Such a configuration is a very severe test and most real life installations will not be as demanding.

10GX System Live Test Set-up



No errors were detected in Solarflare's live test demonstration – even though the test lasted over several hours.

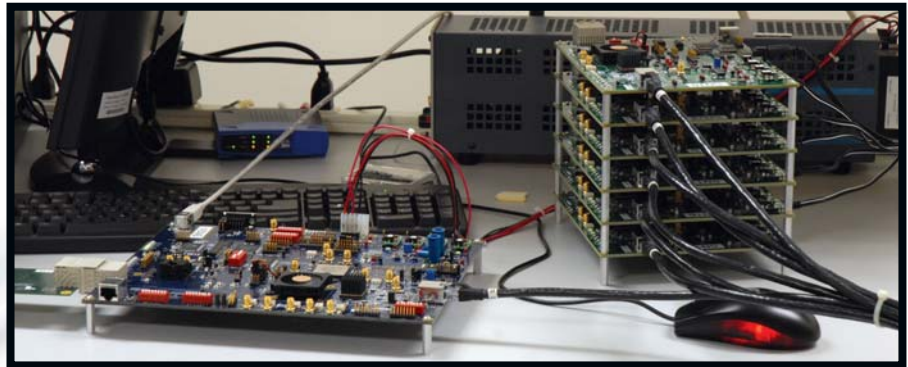
The 10 Gb/s Ethernet signals were generated using a traffic generator at the XAUI interface to the PHY evaluation boards. The signal was looped back at the far-end transceiver and the received frames compared to the sending frames. Live 10GBASE-T traffic was transmitted simultaneously on all six neighboring channels, simulating a worst-case Alien Crosstalk environment. There were no errors detected for the duration of the testing, which lasted over several hours. The Signal-to-Noise ratio monitored during the testing was in excess of 25 dB, providing additional margin of about 3 dB over the standard.

This marked the first real-life test to demonstrate the performance capability of 10GBASE-T, using

Solarflare's 10GBASE-T evaluation product over Belden's 10GX Category 6A cabling. A real-life example of what this means would be the difference between transmitting high resolution images (1200 dpi) at 20 per minute at 1 Gb/s, versus 200 per minute at 10 Gb/s.

Solarflare Communications is a leading silicon vendor delivering Ethernet products that enable rapid adoption of 10 Gigabit for data center and enterprise networks. Belden has worked with Solarflare on 10G cabling performance parameters right from the start. And, now that the 10GBASE-T for copper media has been proven as a viable solution, 10GBASE-T switches and NIC products will soon be forthcoming.

Testing 10GX In a Real Life, Worst-case, Alien Crosstalk Environment



Seven channel test configuration using Solarflare's 10Xpress evaluation board

SNR and BER Results

Test	100 m (6x1) w/Alien Crosstalk Master		100 m (6x1) w/Alien Crosstalk Slave	
	SNR	CRC err	SNR	CRC err
1	26.4	0	26.5	0
2	26.3	0	26.7	0
3	26.4	0	26.8	0
4	26.3	0	26.5	0
5	26.8	0	26.4	0
6	26.3	0	26.9	0

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What Do the Test Results Mean?

For structured cabling system contractors, installers and end users who recommend, specify and purchase cabling solutions for 10G Ethernet transmission, these test results are highly significant from a performance, safety and financial point of view. These results are the first "proof in the pudding" that 4-pair copper-based systems can perfectly transmit 10GBASE-T over 100 meters with four connectors.

These tests also put to rest one of the debates in the industry regarding the ability of UTP to support 10GBASE-T transmission: In the course of the recent Alien Crosstalk debate, some manufacturers of shielded twisted pair (ScTP) cabling put forth the idea that ScTP systems are more immune to Alien Crosstalk performance issues than UTP systems, and would therefore be a better choice for 10GBASE-T installations. As the real-ife test results clearly demonstrate, that perception is unfounded. The fact is, a well designed UTP system is clearly positioned to deliver higher performance and better value for the investment than an ScTP system can. Moreover, UTP solutions have a better value proposition in terms of purchase and installation costs, and are not susceptible to grounding issues.

In short, the results obtained during these joint tests with Belden and Solarflare prove that UTP systems are fully capable of delivering flawless 10 Gb/s Ethernet transmission, while offering ease of installation and providing a high-performing, low-cost option when compared with ScTP systems.

Belden IBDN® System 10GX® Sets the Standard

The Belden IBDN System 10GX is not simply an improved or boosted Category 6 system, but a revolutionary new solution designed and engineered around a series of dynamic enabling technologies to ensure the highest level of Alien Crosstalk isolation and the best electrical performance during high frequency operation.

The key to the Belden System 10GX Solution's superior channel performance is that all of the network system components – modules, patch cords, cables and connectivity devices – are completely in tune with each other. Some of its unique design and engineering features include:

- **10GX Cable Design:** An innovative cable design consisting of a unique, internal cross-web design. This feature both increases and randomizes the distance between the pairs within one cable and its neighboring cables, resulting in greatly improved Alien Crosstalk coupling and Return Loss channel characteristics.
- **MatriX IDC Technology:** A patent-pending IDC design and patch panel circuit layout which positions each IDC at 90 degrees to its neighbor – effectively canceling out the Alien Crosstalk between modules by 15 dB as compared with traditional technology.

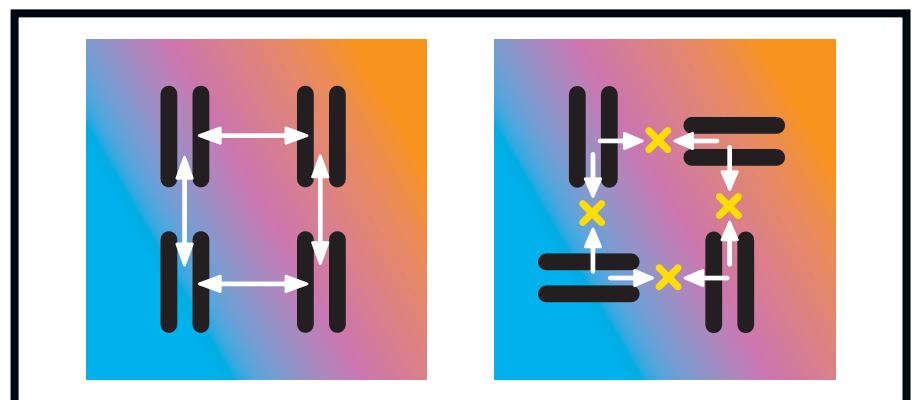
• X-Bar Installation Device:

A control device that affixes to the module to enable the accurate positioning of each UTP pair for termination on the 10GX Module's IDC pins. This X-Bar design enables installers to maintain the proper conductor twist lays during installation to prevent un-twisting. This assures Installable Performance®, the after-installation assurance that no termination errors have been committed.



• FleXPoint PCB Technology:

A patent-pending technology in which a flexible printed circuit board within the module allows the compensation circuitry to be located directly at the point of plug contact. This reduces the delay between the source of the crosstalk in the plug and the crosstalk cancellation circuitry on the PCB, resulting in a dramatic reduction in crosstalk at frequencies up to 625 MHz.



Traditional Technology vs. MatriX IDC Technology

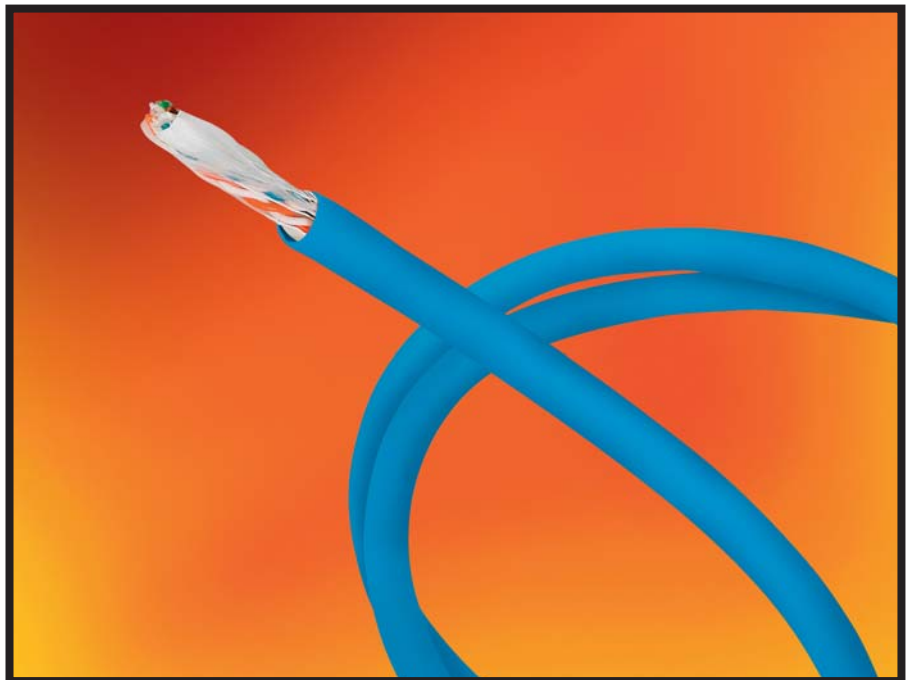
Make the Right Choice: The Tested and Proven Choice

Clearly, greater bandwidth in 10G Ethernet service will be increasingly required as voice, data and video networks converge. Today, demand is growing for even more data-intensive applications – such as uncompressed high resolution digital video, medical imaging, digital animation, CAD/CAM, high-speed data storage, cluster computing, advanced multimedia, security systems, and Voice over IP (VoIP).

With the Solarflare test results in mind, you can now be assured that the Belden IBDN System 10GX delivers the superior performance and

reliability required to support these high-bandwidth applications – at the most affordable price. Our solution was tested under the absolute worst-case scenario, with the cables bundled together every 8 inches, conditions under which your system will never have to perform.

So make the right choice, the only tested and proven choice. Call your Belden sales representative today for more information about the Belden IBDN System 10GX.



10GX Cable

Solarflare and 10Xpress are registered trademarks of Solarflare Communications.
For more information on Solarflare's 10Xpress 10GBASE-T PHY evaluation boards, go to www.solarflare.com.

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