



# Teranetics Turns to Tektronix to Validate First Dual-Port 10GBASE-T PHY

## Customer Solution Summary

February 2010

### Challenge

Bring first dual-port 10GBASE-T PHY to market and make testing of complete IEEE 802.3an specification faster and more affordable for partners.

### Solution

Tektronix XGbT software, Tektronix DSA70000B series oscilloscope, Tektronix XGbT test fixtures.

### Benefits

- Ability to use a single instrument for completing 10GBASE-T PHY compliance tests.
- Automated one-button testing can be completed in about an hour by a technician. In contrast, manual testing takes over a day and requires a senior engineer.
- The use of a single instrument reduces upfront costs by 50 percent in certain configurations.

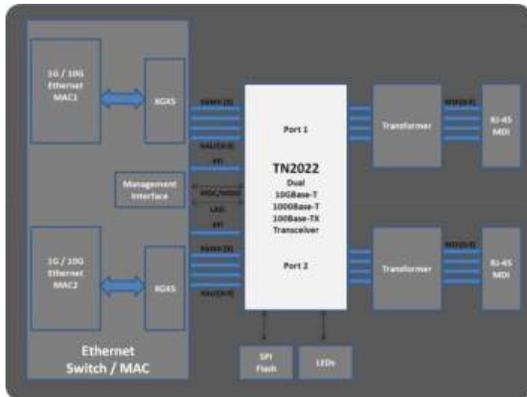


Figure 1  
The Teranetics TN2022 is the industry's first dual port 10GBASE-T PHY.



## First to Market

Teranetics, a Santa Clara, Calif.-based mixed-signal IC company that develops silicon products for advanced communication applications, has staked its claim to fame on the fast-emerging 10GBASE-T standard. For instance, the company was first to market with a dual-port 10GBASE-T PHY IC -- doubling the port density of switch and Network Interface Cards (NIC) compared to first generation 10GBASE-T PHYs.

10GBASE-T is IEEE standard 802.3an. Ratified in 2006, the IEEE 802.3an specification details the technology to run 10 Gbps Ethernet over standard structured twisted pair copper cabling. The use of standard cabling and RJ-45 connectors makes it easy for network managers to gradually migrate to 10 Gbps speeds and retain their investments in installed copper cabling infrastructure.

While 10GBASE-T is destined to be a big win for bandwidth-hungry network managers in applications like high-performance computing clusters and switch-to-switch connections, developing the technology to push 10 Gbps of data through 100m of UTP 6a cabling was no easy task. Top industry experts, including senior engineers from Teranetics, took four years to create the IEEE 802.3an-2006an specification.

The 10GBASE-T PHY employs full duplex baseband transmission over four pairs of balanced cabling. The aggregate data rate of 10 Gbps is achieved by transmitting 2500 Mb/s in each direction simultaneously on each wire. Despite numerous improvements in





Figure 2  
Power spectral density measurement.

able standards, every “trick in the book” of signal processing needed to be employed to achieve these data rates. Other PHY layer challenges include reducing crosstalk and finding ways to lower power requirements.

## Teranetics Delivers with TN2022

It’s no surprise that Teranetics — one of the drivers behind the 10GBASE-T standard — has stepped in with a range of 10GBASE-T PHYs. The company’s latest, the Teranetics dual port, single chip TN2022 (see Figure 1), enables switch manufacturers to design as many as 48 RJ-45 ports into a single rack unit while consuming just 6 watts per port for 50% better energy efficiency than 1st Generation PHY.

*“...the Tektronix XGbT solution provides significant time and cost savings for us going forward and for anyone developing 10GBASE-T products.”*

Dimitry Taich  
Director of Systems Engineering, Teranetics.

Given the increased complexity of the 10GBASE-T technology, a significant challenge facing Teranetics and its customers and partners revolved around how to quickly and efficiently conduct compliance testing. The IEEE 802.3 spec has six primary measurement clauses that reference PHY testing covering such areas as maximum output droop, transmitter timing jitter and transmit clock frequency.

“As a silicon designer and a contributor to the specification we have the expertise in-house to set up and conduct these tests ourselves, but the same isn’t necessarily true of networking equipment manufacturers,” said Dimitry Taich, Director of Systems Engineering, Teranetics.

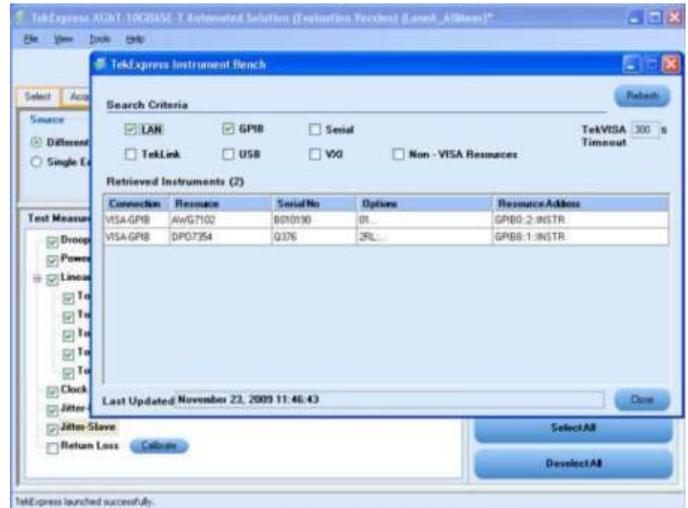


Figure 3  
XGbT GUI example showing instrument bench discovery.

“Also, it’s very time-consuming to set up the test configurations and complete the tests manually. To ensure broad adoption and interoperability, we needed a simpler, more automated way to conduct 10GBASE-T compliance testing.”

## One Instrument, One-Button Test

Based on experience with Tektronix test solutions, the Teranetics team felt comfortable turning to Tektronix for its test and measurement needs. Tektronix has long offered an integrated toolset for earlier Ethernet variants such as 100BaseT and 1000BaseT, including analog verification, automated compliance software and device characterization solutions.

While Teranetics was in the process of designing its 10GBASE-T PHY products, Tektronix was hard at work developing a comprehensive 10GBASE-T PHY test automation solution based on the TekExpress automation framework along with the appropriate test fixtures. With Tektronix supplying the test expertise and Teranetics the Ethernet insights, the two companies worked closely together to devise a test suite that could meet the growing industry’s need for a low-cost, reliable, fast and easy to operate 10GBASE-T PHY test automation solution.

“We knew going in that 10-GBASE-T PHY would present significant compliance test challenges simply by virtue of what we were trying to accomplish. It made sense to work with a test and measurement company with significant experience with Ethernet test,” says Taich. “Using an oscilloscope as the common platform to perform 10GBASE-T measurements such as power spectral density (see Figure 2), power level and linearity, the Tektronix XGbT solution provides significant time and cost savings for us going forward and for anyone developing 10GBASE-T products.”

Compared to competitive offerings which require the use of an oscilloscope, vector network analyzer (VNA) and spectrum analyzer, the Tektronix oscilloscope and XGbT software solution provides faster and easier test set-up. The use of a single instrument reduces upfront costs by nearly 50 percent in certain configurations and provides for a significantly improved user experience and more repeatable results. This is especially important in distributed engineering environments where

repeatable test methods are required across different groups using different test equipment.

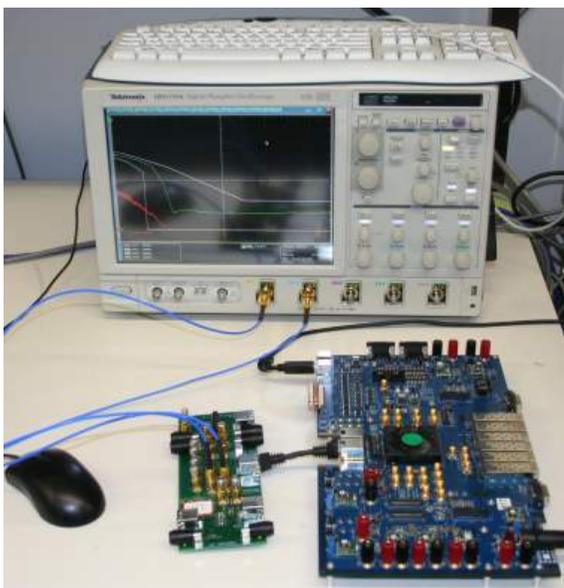
Many end-users of Ethernet compliance solutions are technicians who work on the production floor testing Ethernet equipment. In this environment, companies need automated testing to quickly validate performance and interoperability of production units coming off the line. Using the Tektronix XGbt solution, customers have one-button selection of multiple tests. As shown in Figure 3, the XGbt software provides a graphical user interface (GUI) and an intuitive workflow through setup and testing.

The solution allows customers to use all four channels of a DPO70000 or DSA70000 series oscilloscope to perform measurements for faster test times and additional cost savings. Customers can also use a Tektronix P7380 SMA differential probe and P6330 high input impedance probe with the XGbt test fixture to further reduce test time. For in-depth validation and debugging, the XGbt software includes a reporting module and results export capabilities and can capture test margins and statistical information.

## Poised for Rapid Growth

Although 10G Ethernet has been shipping since 2001, the adoption rates have historically been low – a few hundred thousand per year – hampered by the expense and other challenges of moving away from copper. By comparison, about 5 to 6 million 1 Gbps copper switch ports ship every month. The availability of 10GBASE-T switches and 10GBASE-T servers dramatically expand the opportunity for 10G Ethernet networking by supporting simpler, cheaper, twisted-pair copper cabling.

“We believe that all the pieces are in place – from an IEEE specification to cost-effective second generation silicon to fully automated compliance test solutions – for 10GBASE-T to see rapid adoption growth over the coming years,” Taich says. “All the major roadblocks have been overcome and we’re ready to move forward to broad industry adoption. We could not have done this without the help of Tektronix and others who have helped solve a number of difficult challenges.”



The setup showing the PSD test for Lane A.