Agilent Technologies Transforms Optoelectronic Component Development

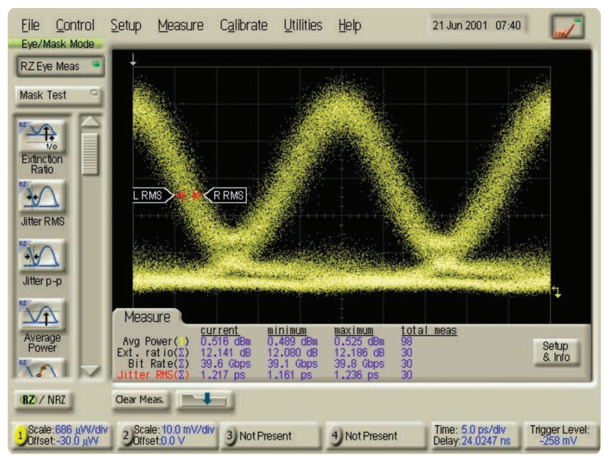
Optical sampling technology utilized in viewing optical communication signals

Agilent Labs around the world have collaborated to develop an optical sampling technique that allows more than 500 GHz of bandwidth. Optical experimentation utilizing nonlinear crystalline materials has yielded astonishing results.

In the last 20 years optical fiber transmission networks have progressed tremendously in terms of link distance and information handling capability. Major technological advances have made this possible. Transmitters that use semiconductor lasers can now be modulated with transition times on the order of 5 to 10 picoseconds to provide data rates up to 40 Gb/s. Receivers use photodetectors with bandwidths over 50 GHz and interconnects use fibers that allow low dispersion at high transmission rates. The outstanding performance of these components has generated considerable effort to improve the capabilities of test equipment. In order to characterize crucial optoelectronic devices and systems, state-of-the-art optical measurement techniques are required. One of these innovative techniques incorporates a time-domain architecture called optical sampling.

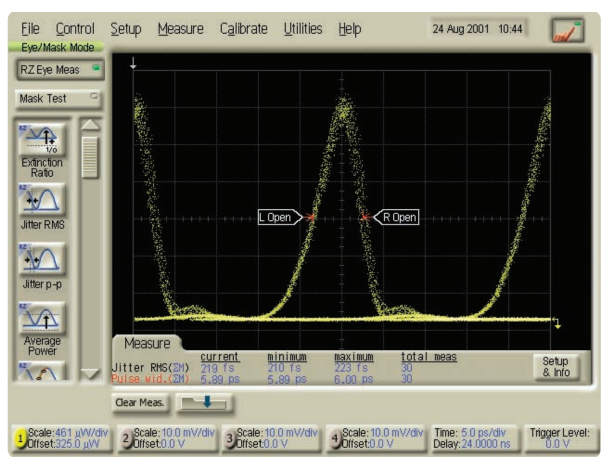
Today, the majority of optical transceiver testing consists of compliance measurements utilizing eye-diagram analysis on a digital communications analyzer (DCA). The DCA is an equivalent-time sampling oscilloscope with powerful software capable of performing these compliance tests automatically. The DCA selects the appropriate Sonet/SDH compliance mask and Bessel-Thompson filter based on the bit rate of the displayed eye diagram and performs the corresponding measurements. As bit rates increase to 40 Gb/s and beyond, it is common to utilize return-to-zero (RZ) modulation formats. As these new formats are implemented, the need for more bandwidth in the DCA becomes critical. Although the instrumentation technology is improving on a daily basis, current instruments carry significant uncertainties in measurements (such as risetime and pulsewidths.)

Is this what your 40 Gb/s signal looks like?



40Gb/s RZ signal using a conventional sampling architecture.

This is how it should look!



40Gb/s RZ signal using an optical sampling architecture.

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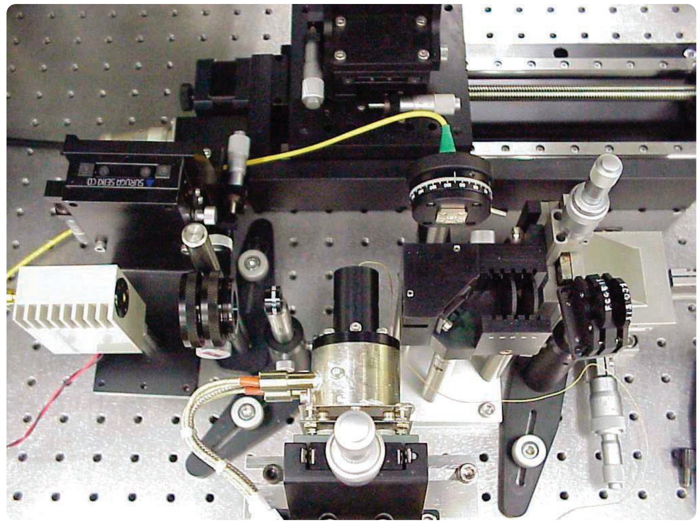
In order to achieve the ultimate test system for the optical networks of the future, it is necessary to obtain an order of magnitude increase in bandwidth. This goal is not easily achievable by conventional sampling circuits because they are limited by the semiconductor material switching properties. Consequently, a new sampling method must be utilized. This sampling method must withstand the rapid pace of component development and the ultra-high data rates that they produce. The technology of choice for this challenging application is optical sampling.

Agilent Labs around the world have collaborated to develop an optical sampling technique that allows more than 500 GHz of bandwidth. Optical experimentation utilizing nonlinear crystalline materials has yielded astonishing results. Eye diagrams as never observed before are now routinely analyzed on a laboratory bench in a very high throughput environment. Agilent divisions are exploring new product development concepts based on this new technology.



Experimental apparatus utilizing optical sampling technology.

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