Siglent 2.5G/5G/10G Ethernet Compliance Testing Solution

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1 Overview

With the deep integration of digital economy and age of intelligence, 10 Gigabit Ethernet (2.5G/5G/10GBASE-T) has become the core communication technology in data center, intelligent automobile, industrial automation and other fields because of its high bandwidth, low latency and strong compatibility. However, with the iterative upgrade of IEEE 802.3 and other standards, equipment manufacturers are faced with multiple test challenges such as physical layer signal integrity, protocol compliance and multi-scenario compatibility. As the world's leading provider of electronic test and measurement solutions, SIGLENT, relying on its profound technical accumulation in the field of high-speed signal testing, has released a 10Gigabit Ethernet (2.5G/5G/10GBASE-T) compliance test solution, which provides the technical support for the industry from standard interpretation, test tools to automation processes, and helps customers accelerate product development and market access.

2 Basic knowledge

2.1 Technical definition and innovation breakthrough

10 Gigabit Ethernet (2.5G/5G/10GBASE-T) is a high-speed wired communication technology based on IEEE 802.3 standard, which realizes high-speed (2.5G/5G/10G) transmission through twisted pair:
2.5Gbase-T: 4 twisted pairs, 625Mbps each, with a total speed of 2.5Gbps, supporting Cat5e/Cat6 cables.
5Gbase-T: 4 twisted pairs, 1.25Gbps each, with a total speed of 5Gbps, compatible with Cat6 cables.
10Gbase-T: 4 twisted pairs, 2.5Gbps each, with a total speed of 10Gbps, requiring Cat6a/Cat7 cables.
Its core technology architecture embodies the double breakthrough of high-frequency signal processing and protocol compatibility:
Physical layer: Using PAM4 technology (four-level pulse amplitude-modulated),2 bits of data is transmitted in each symbol period, which improves the information carrying capacity of a single symbol and significantly reduces the transmission loss of high-frequency signals. For example, 10GBASE-T achieves a transmission distance of 100 meters on Cat6a cable through PAM4 technology, while traditional NRZ modulation requires a higher baud rate, which leads to increased signal attenuation; Supports 64B/66B coding (coding efficiency is 97%), improves the precision of signal clock recovery, and combines dynamic equalization technology (DFE/FFE) to compensate the high-frequency attenuation of Cat6a/Cat7 cable.
Data link layer: Using RS-FEC forward error correction technology, 16 bytes of cyclic redundant check are added to every 255 bytes of data, which greatly reduces the bit error ratio and compensates the signal-to-noise ratio loss in high-frequency signal transmission; Consistent with the frame structure of traditional Ethernet and be compatible with existing network devices.
Protocol layer: supports IEEE 802.3bz(2.5G/5GBASE-T) and 802.3by(10GBASE-T) standards, and realizes functions such as auto-negotiation and clock recovery.

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