PIXELGEN THX INTERCONNECT

THX® Interconnect Performance Summary

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This paper will delve into the unique features of the THX® Interconnect design, shedding light on its overall benefits in conjunction with the mandatory Ultra High Speed (UHS) HDMI® Cable certification standard. It will underscore the distinct areas where THX testing stands out, emphasizing its position. Most importantly, it will underscore these standards' integration and significance in the all-new THX® Interconnect.

Ultra High Speed HDMI® Cable Certification
Compliance with the Ultra High Speed HDMI® (UHS HDMI) Cable certification is a requirement for 8K interconnect system infrastructure. It is also a crucial security measure. Without the assurance of HDMI as a technology, there is no guarantee of the cable's capacity to handle the top speeds necessary for 8K-10K delivery. The presence of the new Ultra High Speed HDMI Certification label on every (genuine) UHS HDMI cable, whether short, long, or in between, provides this much-needed security.

The UHS HDMI cable certification holographic sticker now features a standard scannable QR code, a useful addition by the HDMI organization. This code ensures the cable's authenticity, providing a sense of security for all end users. It is helpful for manufacturers, allowing them to communicate their strong affiliation with HDMI. For end users, it guarantees the cable's trustworthiness in a market filled with counterfeit cables, assuring consistent, sparkle-free 8K-10K signals at the highest 48Gbps speeds within the HDMI 2.1b specification. Let us next review several specifics.

First, UHS Certification testing focuses on high-level physical layer testing, assuring only HDMI-approved plug/receptacles are integrated and within mechanical HDMI limits. Secondly, HDMI tests the essential electrical parametric characteristics within the cable itself. Also, here are such signal characteristics tested in the HDMI ATC (Authorized Test Center) labs: Interpair skew (differential FRL pair-to-pair matching) and Intrapair skew (differential FRL inner-pair or +/- wire-to-wire matching), High-speed FRL Data Eye Diagram (Jitter) testing, Far End Crosstalk (ensuring that signals don't interact with one another at the end of cable transmission), Insertion loss (cable attenuation), differential impedance testing (how close are the differential pairs to the 100ohm tolerance which ultimately minimizes signal reflections and maintains tight signal coupling), DDC/CEC line capacitance and voltage (to avoid EDID and HDCP handshaking failures) and also DC testing, which includes testing the +5V power consumption and its overall power characteristics (critical to long-reach cables). These tests are crucial for a cable running four 12Gbps differential signals in tandem.

THX Interconnect cables standards, design, and testing.
The THX Interconnect family of cables provides that extra layer of confidence when dealing with long-reach interconnects. It focuses on exploiting real-world failure events like power sequencing, hot-plugging, and time-lapsed high-bandwidth burn-in testing, to name a few. Most importantly, THX superbly finds repeatable ways to –expose these historical real-life HDMI system failure points. Thus, THX Interconnect cables were tested to complement the HDMI ATC testing program to reassure the market of the interconnects' reliability and interoperability, especially critical in long-reach implementation.

The THX Interconnect family of cables assures 100% uncompressed high-speed signal delivery, enforces real-world live HDMI protocol feature-set validation, and provides the highest standard of in-system 8K-10K interoperability and reliability. Moreover, the THX badge guarantees 100% uncompressed signal transmission, ensuring only uncompressed signal delivery occurs—all bits in and out. Cable interconnect methods that use compression techniques cannot pass the same rigorous pre-release testing process of the THX Interconnect cables (Category cabling and IP-based solutions, for example). Although some end-users may not know about these implementations, the THX badge guarantees 100% (uncompressed) fidelity and full HDMI 2.1b protocol functionality.

This best-of-class line of cables has gone through this rigorous testing within HDMI ATC and within the THX labs. This will instill confidence in knowing that all cables have undergone an exhaustive sweep of testing at the THX laboratory built for long-term 8K-10K system reliability and adherence to the mandatory Ultra High Speed HDMI® Cable Certification Program. At its core, the THX name adds an essential extra layer of confidence. THX® Interconnect cables are built and validated to these high THX standards surpassing all others. Example THX Interconnect HDMI cables' validation standards:

UNCOMPRESSED HIGH-SPEED SIGNAL VALIDATION

- Specifically critical for long-reach HDMI extension methods, all THX Interconnects pass through an FRL5/40Gbps pixel error analysis test. Within this high-speed frame match comparative test, THX engineers are screening for invalid pixel values between the source and destination to ensure that only uncompressed signal delivery occurs—all bits in and out. As mentioned, HDMI interconnect methods that use compression techniques cannot pass this test.

LOW-SPEED COMMUNICATION PROTOCOL TESTING

- All THX Interconnects (passive & active) are tested through live low-speed HDMI protocol screening. Time-lapsed, low-speed communication protocol tests include eARC (Ensuring proper lossless 37Mbps upstream audio connectivity), CEC (Ensuring proper Consumer Electronics Control operation), and HDCP (Ensuring that all HDCP 1.4/2.2 & 2.3 content protection protocols operate as expected concurrently alongside high-speed signal delivery).

FITNESS-TO-APPLICATION TESTING

- THX Interconnect cables have passed through a stringent 'real-world environment' testing suite using 8K-10K HDMI Source, Display, and Repeater devices. THX executes lab-emulated in-field events such as multiple cable hot-plugging actions, intermittent power drops, power sequencing, and time-lapsed pixel error screening. All in-system HDMI operations must recover adequately following the abovementioned events, which are reflective of real-world scenarios in the field.

INTEROPERABILITY TESTING

- All THX Interconnect lengths are put through an exhaustive sweep of interoperability testing using a large matrix of 8K-enabled (and 4K legacy) AV equipment, ensuring maximized interoperability between multiple AV equipment vendors. Additionally, the interoperability tests ensure that the combined equipment's maximum AV format bandwidth capabilities are maintained within the cable to stay within the intended video standard being transmitted. The UHS HDMI link training mechanism is a process whereby transmitted AV formats may unknowingly drop down to lower FRL High-Speed rates. To ensure an AV connection and avoid blank screens. The intent of this built-in HDMI functionality is to ensure that valid data can always be recovered by the IC's equalizer stage within the display (or repeater) input. The THX validation test monitors and flags this inclusive HDMI link training event, assuring that this mechanism is never triggered at startup and maximizes overall system performance. All lengths and cable types (copper/optical) of the THX Interconnect have been designed and manufactured to ensure this built-in HDMI cable link training event will never occur.

Together with THX high fidelity testing and the affixed UHS HDMI badge, THX has established the most robust and dependable family of HDMI interconnects possible with the all-new THX® Interconnect family of cables. These key areas of differentiation above will help all levels within the HDMI supply chain and, most importantly, the end-user experience for a superior home theater or home listening room experience.

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