#smartconnection

TECHNICAL PAPER

Extended Distance Cabling

Validating EXTP Performance Beyond 100 Meters

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Background

The evolution of intelligent buildings, industrial automation, and large-scale public infrastructure has fundamentally altered the physical requirements of structured cabling. While industry standards for copper-based Ethernet – principally **ISO/IEC 11801** and **TIA-568** – establish a 100-meter channel as the baseline for guaranteed performance, real-world deployments increasingly exceed this boundary.

Simultaneously, the proliferation of high-power Power over Ethernet (PoE) applications – including 4K PTZ surveillance cameras, Wi-Fi 7 access points and other IoT devices – has introduced a second, often overlooked, challenge: thermal behavior under sustained DC load. The delivery of remote powering (60W–90W) over extended distances exacerbates conductor heating, particularly in bundled cable runs. Elevated temperatures degrade signal-to-noise margins, thereby shortening the effective reach of conventional Category 6 or 6A cables below their nominal 100-metre rating when power and data are simultaneously transmitted.

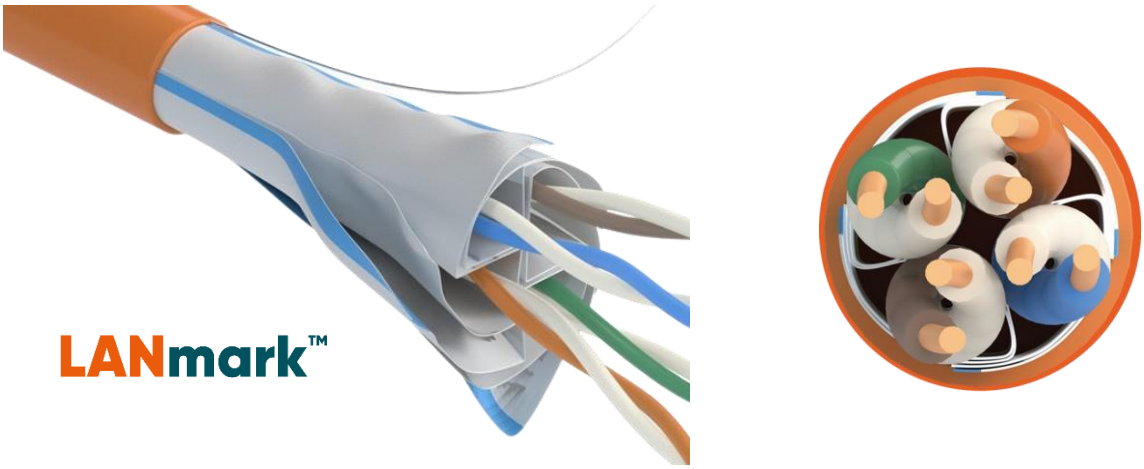

Figure 1: *Structural cutaway and cross-sectional details of the Aginode LANmark-6A ULTIM EXTP cable.*

Key Considerations for Extended-Reach PoE Deployments

- **High-power PoE demand –** Endpoints such as pan-tilt-zoom cameras with integrated heaters, high-density Wi-Fi access points, and industrial IO modules require 60–90 W continuous power, drawing higher current that increases both voltage drop and self-heating in the copper conductor.
- **Thermal derating effect –** In elevated ambient temperatures (e.g., 45–60 °C common in industrial zones, rooftop enclosures, or unairconditioned ceiling voids), the combined effect of Ohmic heating from PoE and external heat reduces the cable's maximum achievable reach for a given bit error rate, as insertion loss rises and alien crosstalk margins narrow.
- **Bundle heating and installation density –** Cables installed in tight bundles, ladder racks, or metallic conduits exhibit reduced heat dissipation; under sustained PoE++ load, the

internal temperature rise can accelerate insulation aging and increase DC loop resistance, further eroding the usable distance for 2.5G/5G and 10G transmission.

- **Need for validated extended-reach data –** Without manufacturer-provided characterization beyond 100 m, installers have no guaranteed performance basis for power-plus-data links, leading to conservative over-engineering (additional telecom rooms) or speculative, unverified installations that risk intermittent failures and shortened equipment lifespan.

Test Methodology

This test was conducted in the Aginode Test Lab. This test setup is designed to evaluate extended-length channel configurations, focusing on verifying their compliance with **IEEE 802.3** standards for 1000BASE-T and 2.5GBASE-T data transmission with **IEEE 802.3** Type 4, Class 8 Power over Ethernet (PoE) delivery. Based on the experimental results, users can draw a firm conclusion regarding the Extended Distance channel composed of Aginode's EXTP cables and ULTIM connectors.

LANmark™

Figure 2: *Aginode LANmark-6A ULTIM Snap-In Connector.*

The test model is based on 2 channel configurations: a 2-connection channel and a 3-connection channel. Tests on both configurations are conducted at 25 °C and temperature cycle from 30 °C to 60 °C. All tests are conducted in a minimum 8-hour period with 2 temperature cycles from 30 °C – 60 °C to evaluate the performance impact. An ethernet transmission tester measures actual packet loss for network interconnect devices under PoE Type 4 operating conditions.

Table 1: *Temperature cycle profile applied during the 8-hour validation period.*

Temperature	Duration
30 °C	1 h
40 °C	1 h
50 °C	1 h
60 °C	1 h
30 °C	2 h
40 °C	1 h
50 °C	1 h
60 °C	1 h

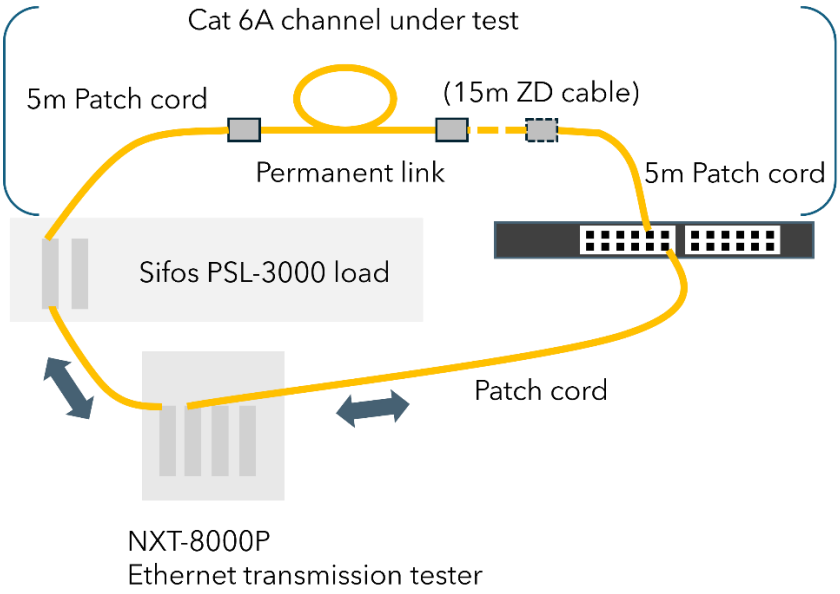

Figure 3: *Test set-up schematic for validating extended-distance channel performance.*

To avoid the influence of network device differences on the experimental results, this test covered four switch models from three different brands, all of which support remote power feeding performance of 60W or 90W.

Thanks to the conclusions and test model guidelines from **ISO/IEC TR 11801-9904**, **ISO/IEC 14763-2**, and **ISO/IEC TS 29125**, our tests also reflect whether remote power in high-temperature bundled-cable environments – a concern for users – would adversely affect **IEEE 802.3** network applications.

Results

By running real life 1000Base-T and 2.5GBase-T applications, we are proud to find that Aginode 22AWG Category 6A EXTP cables, terminated with Aginode ULTIM 6A connectors, can support all switch equipment in both 60W and 90W application types, with no packet loss or power drop detected throughout the entire process. The shortest channel length in the test was 160m.

Furthermore, based on the actual performance data from 1000Base-T, we have established a set of test limit values tailored for ultra-long-distance applications. These values are intended for use with handheld field testers, serving as practical on-site reference criteria. They also offer meaningful guidance for the field installation of screened extended distance channels. As suggested by **ISO/IEC TR 11801-9904**, Alien crosstalk imposes significant constraints on 2.5GBase-T and 5GBase-T applications. This constraint will further be exacerbated at channels exceeding 100m. The screened design of EXTP cables effectively mitigates this issue, preventing further signal attenuation at extreme distances from compounding the effects of external interference.

Figure 4: Aginode EXTP cable bundle.

Aginode has recently introduced a new warranty module for extended distances, supporting emerging applications with reach over 100 meters. For the EXTP Cable, please refer to the Category 6A AWG 22 column, See below:

Application drive distance (m)		LANmark Channel					
		Unscreened*	Screened				
		Cat 6	Cat 6	Cat 6A AWG 23	Cat 6A AWG 22	Cat 7A AWG 23	Cat 7A AWG 22
10BASE-T Ethernet	without PoE	177	177	177	177	177	177
	with PoE	130	130	145	160	165	177
100BASE-T Fast Ethernet	without PoE	140	140	145	160	145	160
	with PoE	130	130	145	160	145	160
1000BASE-T Gigabit Ethernet	without PoE	100	115	145	160	145	160
	with PoE	100	115	145	160	145	160
2.5GBASE-T 2.5 Gigabit Ethernet	without PoE	100	100	125	135	125	135
	with PoE	100	100	125	135	125	135
5GBASE-T 5 Gigabit Ethernet	without PoE	100	100	125	135	125	135
	with PoE	100	100	125	135	125	135
10GBASE-T 10 Gigabit Ethernet	without PoE	N/A	N/A	105	125	105	125
	with PoE	N/A	N/A	100	100	100	100

Table 2: LANmark Warranty application drive distances for extended distance structured cabling.

Conclusion on Extended Distance

In summary, the Extended Distance channel composed of Aginode's EXTP 6A cables and ULTIM connectors has proven to be a robust, high-performance solution for long-reach

applications. Lab tests for **IEEE 802.3** 1000Base-T and 2.5GBase-T with remote powering up to 90 W over distances at least 160 meters under demanding thermal conditions, the test results support Aginode recently released Warranty module for extended distance. This solution also reliably meets the needs of emerging smart building and campus IoT and other applications. The combination of screened construction, high-quality 22AWG conductors, and compatible connector interfaces not only ensures signal integrity but also effectively addresses Alien crosstalk challenges, making it a dependable choice for designers seeking extended distance channels without compromising transmission quality or power stability.

Note: Below standards are referenced during creation of the content:

ISO/IEC TR 11801-9904:2017 – Information technology – Generic cabling systems for customer premises, Part 9904: Guidelines for the use of installed cabling to support 2.5GBASE-T and 5GBASE-T applications

ISO/IEC 14763-2:2019 – Information technology – Implementation and operation of customer premises cabling, Part 2: Planning and installation

ISO/IEC TS 29125:2017 – Information technology – Telecommunications cabling requirements for remote powering of terminal equipment

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