Channel, End-to-End, and MPTL: Staying Current and Understanding Your Cable Test Setup

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Agenda

• Applications
  – Channel test
  – Permanent Link
  – MPTL (Modular Plug Terminated Link) formerly “direct attach connection”
  – End to End (E2E)

• Summary

• Questions
Permanent Link & Channel Link

Test Plane Ends Here

Permanent Link Adapter

Permanent Link Test Cord

90m max.

Permanent Link Adapter

Test Plane Ends Here

Permanent Link Adapter

Permanent Link Test Cord

100m max.

Channel Link Adapter

Patch Cords in the Channel

Channel Link Adapter
Field Tester Permanent Link
Why New Link Definitions?

• Permanent link and channel link have served us well
• You may be running into new topologies (MPTL) due to higher bandwidth requirements and the ease of installing RJ45 in the field
• E2E provides for multi segment capability & flexibility
Higher Bandwidths

What’s prompting the need for MPTL connectors?

• Design recommendation for WAP installations call for 2 Cat 6A to each location
• Additional IoT applications require the increased bandwidth provided by a Cat 6A dedicated link
• Lower costs than traditional wall plate surface block and patch cord
• Difficulty in crimping a traditional RJ45 onto a Cat 6A cable
• Component manufactures have responded with great new designs
Crimping History

- Cat 3: easy small O.D. few twists
- Cat 5e: smaller O.D. untwisting still easy
- Cat 6: harder, twist is tighter and O.D. larger
- Cat 6A: good luck
Just Better!

The industry often innovates to meet a need in the marketplace

Sample MPTL Connectors
Testing Requirements for MPTL Assemblies

Implications for field testers

- Classical Channel test setup CANNOT be used
- Channel tests hardware does NOT include the first and last connector

- **Failures** due to field termination (other than simple wiremap errors) may not be found using Channel configuration/limits!
For Certification – 3 Things Must Match

- Tester Interface Hardware
- Link Under Test
- Limit Chosen on Field Tester
Figure 1-A: Certification report from tier 1 Certifier on sample 45-foot Cat 6 assembly.

- One end connected to a patch panel
- Remote end terminated with MPTL RJ-45 connector
- MPTL test was performed
- Cable link gets overall pass
Figure 1-B: Cable link immediately re-tested with Patch Cord Adapter & PL Adapter.

- Cable Fails Return Loss test
How to test MPTL

The TIA 568-2-D states:

- Tester shall use a PL (Permanent Link) adapter on the patch panel side.
- Tester shall use a patch cord adapter on the field RJ45 side.
- Note: patch cord adapters are category specific, you will need to match the adapter to the type of assembly under test. TIA dictates the connecting hardware for MPTL testing.
How to set up MPTL

- The permanent link adapter will be installed on the local side.
- A terra to RJ45 TRC (test reference cord) will be used to plug into the patch panel.
- The proper category rated patch cord adapter will be installed on the remote side.
- The field installed MPTL will plug directly into the patch cord adapter.
Field Tester with MPTL adapters
Check Settings!

- From the home screen select Test Setting and then Test Options under Advanced.
- Advanced Test Option Screen, turn Direct Attach on.
Select your Test Limits

- Select the Test Limit drop down and choose TIA standards
- Select the appropriate Test Limit for the assembly you are testing
- Remember: Patch Cord Adapters are Category specific so be sure to install the proper adapter for the assembly under test
- Your now ready to hit Autotest and save the result and send to eXport software and produce certification reports

(Scroll down for Cat 6A MPTL)
Field Tester MPTL hardware config

- Local unit plugs into the patch panel (simulated with green connector)
- Remote unit male MPTL/RJ45 plugs directly into the female patch cord adapter
- Select autotest
Sample MPTL Report

- Save results in field tester
- Import results into the reporting software
- Both summary and detailed .pdf reports are available
- Results can also be saved in .csv format
MPTL Test Report

- Limit Type is CAT 6A MPTL
- Adapters are 6A Link (Permanent Link) and Cat 6A Patch Cord
End to End

- End-to-End or E2E is well-known in industrial applications.
- We are seeing growth in the US as industrial ethernet replaces proprietary networks.
- Industrial ethernet takes advantage of the reliability and efficiency of an End-to-End network topology, a number of point-to-point segments in a series.
- There are immediate applications in Healthcare, Building Automation Systems, Security, etc.
- End-to-End allows these additional points to be linked serially for signal efficiency and with patch cords (segments) for ease of installation.
- The segments can be linked by adapters, hubs, switches, and gateways.
- Increasingly, E2E links support widely varying requirements in bandwidth, PoE, and reliability.
E2E Applications

- **LED Lighting:**
  - Many of the new systems run on PoE and are segment-based topologies

- **Healthcare:**
  - Many of the nurse call and patient room applications are segment-based

- **Data Center**
  - Direct connection between devices
  - Example servers in the same row
    (Note: E2E not yet standardized for CAT6A / Class E_A)

- **Professional Entertainment:** Cabling “on the fly” for stage equipment
PoE and E2E

A Power over Ethernet installation reduces material and labor cost by using a single Cat5e/6 connection for power and communication. This plug-and-play, low-voltage cabling approach greatly simplifies the installation process, saving time, minimizing safety risk and helps to alleviate resourcing constraints for skilled labor.

From Hubbel’s website
What’s Different About E2E

- E2E is a segment-based topology
- You can have multiple segments between the connecting devices or end points
- Because of this, the number of RJ45 connectors, or jacks, will vary
- Both the number of segments & connectors will determine the specific link limits
E2E Segment Diagrams
Testing Requirements for E2E Assemblies

Implications for field testers
• Classical channel test setup CANNOT be used
• Channel hardware and limits do NOT include the first and last connector
E2E Practical Guidelines

- Make sure your tester supports E2E links? Software and hardware capable?
- Field tester will need to have relatively new software with E2E
- There are E2E optional testing accessories available
- Standards only define measurement up to CAT6 / Class $E_A$
- Max Ethernet supported speed is 1000MBit/s
  - If 10GBit/s performance is required, Softing recommends using hybrid cables and CAT6A / Class $E_A$ permanent link limits
- Hybrid cords can help to access tight or exposed locations
  - Make sure the device can handle measurement using hybrid cords
Cabling Requirements for IoT

E2E link configuration

- Up to 100m on solid wires, ~80m on stranded (depends on cable capabilities/quality)
- Permanent link – E2E has plugs at the end
- Directly connect equipment without using patch cables
- Plugs at the end need to be included in test because they can be terminated in the field
Testing E2E

Currently E2E is governed by the ISO 11801

- This Field Tester should be fitted with M12 (Industrial Ethernet) or End to End adapters.
- When testing RJ45’s on both ends, terra to female RJ45 TRC’s (test reference cords) will be used.
Category vs. Class D & E

- Class C: link/channel up to 16 MHz using Category 3 cable/connectors
- Class D: link/channel up to 100 MHz using Category 5 cable/connectors
- Class E: link/channel up to 250 MHz using Category 6 cable/connectors
- Class $E_A$: link/channel up to 500 MHz using Category 6$A$ cable/connectors

ISO/IEC 11801-1:2017
How to setup End to End

- Install M12 (Industrial Ethernet) adapters on both the local and remote units
- Adapters are hot-swappable With Terra connectors, the TRC (test reference cords) will be a Terra to female RJ45
Field Tester with E2E adapters
Select your Test Limits

- From the Test Limit drop down select ISO standards
- Select the appropriate Test Limit for the number of segments and connectors
- You’re now ready to hit Autotest and save the result and send to Xport software and produce certification reports
Field Tester E2E Set Up

- Terra to Female RJ45’s on both the Local and the Remote
- Yellow Cable simulating a 2 connector, 1 segment E2E link
- Saved result can now be exported to the reporting software
Sample E2E Test Results

Cable Label: E TO E 3 CON W/M12 CAT 6A

Date & Time: 7/11/2018 19:33:08 AM
Building: Unspecified Building
Limit Type: ISO - Three Connection Class D E2E Link
Floor: Unspecified-Floor
Cable Name: CAT 6A UTP
Room: Unspecified-Room
Connector Name: UTP Mod Jack 6A
Rack: Unspecified-Rack
Site: HOLE IN THE WALL TEST LAB
Panel: Unspecified-Panel
Operator Name: BUTCH

Local Ser. No.: px20300006
Remote Ser. No.: sw2003164
Local Adapter: M12
Remote Adapter: M12
Local Calibration Date: Mar 1 2018
Remote Calibration Date: Mar 1 2018
Device Software: 7.4
Reporting Software: Build_#972_7_4_2018-04-02_10-25-38

Overall Result: Pass

Insertion Loss: Pass
Return Loss: Pass
NEXT: Pass
ACR-F: Pass
ACR-N: Pass
PS-NEXT: Pass
PS-ACRF: Pass
PS-ACRN: Pass
Conclusions

• Using channel adapters as a one size fits all solutions is wrong
• Know your links and know how to avoid false Pass / false Fail tests
• With the TIA 568-2-D you can now certify MPTL Link assemblies to standards
• With the ISO 11801 you can now certify E2E assemblies to standards
• Test reports will show how you tested the link!
Valid Testing Scenarios

False Fail Scenario or False Pass Scenario

**Hardware**

**Limit**

- 6 MPTL
- 5E Patch Cord

- 6 A PL
- E2E and PL

**Link**

- 6 MPTL
- 5E Patch Cord

- 6 A PL

- 5E Patch Cord
Questions?
Thank You

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