Transformer and Channel ad hoc

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Two ad hocs with an average attendance of 15 people since the last IEEE meeting.

Agenda

- **Approach taken**
- **Creating the IEEE 802.3 channel model**
- **Review task force recommendations**
- **Current unbalance**
- **Next step.**

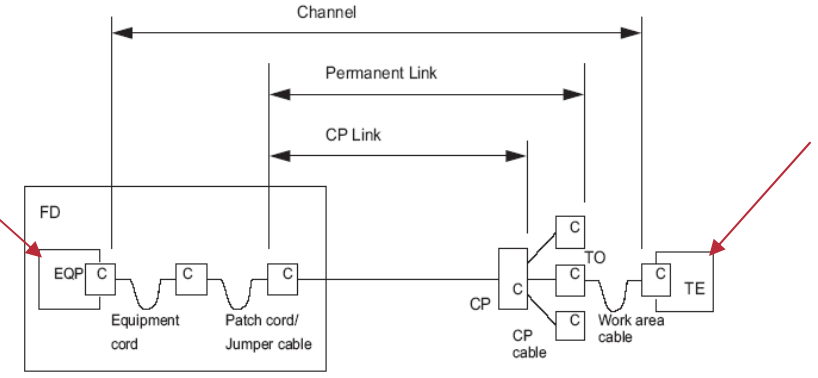
Approach Taken

- **Agree on a system model for current unbalance calculations.**
- **Use IEEE 802.3 requirements and legacy system data to refine the model used.**
- **Use the refined approach to model IEEE 802.3at current unbalance.**

Reference to IEEE channel

33.4.8 Midspan PSE device additional requirements

The cabling specifications for 100Ω balanced cabling are described in ISO/IEC 11801-2002. Some cable category specifications that only appear in earlier editions are also supported. The configuration of "channel" and "permanent link" is defined in Figure 33–18.



FD = floor distributor; EQP = equipment; C = connection (mated pair);
CP = consolidation point; TO = telecommunications outlet;
TE = terminal equipment

Figure 33–18—Floor distributor channel configuration

end point PSE

PD

Clause 33 only discusses midspan PSEs with reference to a channel.

It can be inferred that an end point PSE needs to connect to a channel.

This system has 6 connections when a PSE is connected to a PD.

Reference to IEEE channel continued

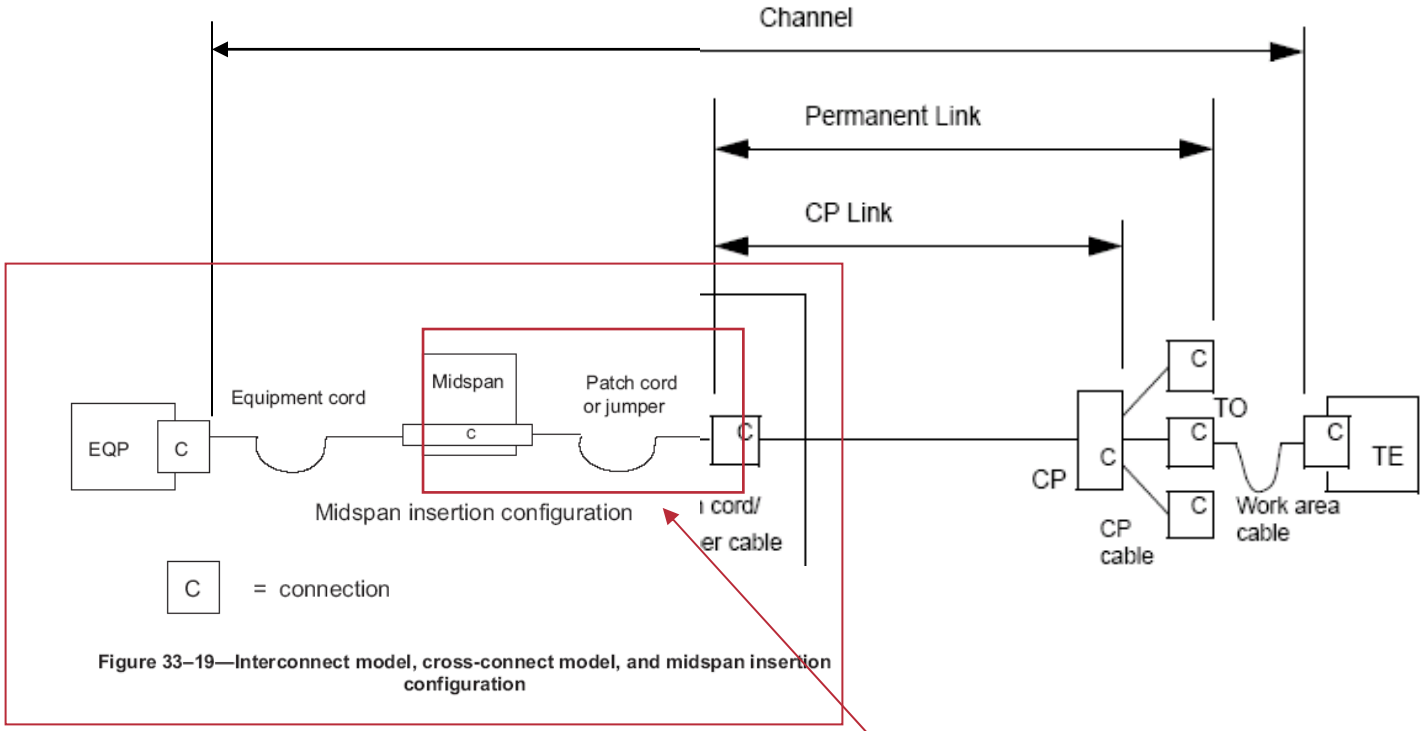


Figure 33–19—Interconnect model, cross-connect model, and midspan insertion configuration

Midspans have two connectors.

This system has 6 connections.

Should Figure 33-19 show a typical midspan that provides two connections?

Specifications Referenced

ISO/IEC 11801

4.2.4 Test Configurations.

The cabling configurations that are tested in the field are as follows:

- Channel. The channel test configuration is intended to be used by system designers and users of data communication systems to verify the performance of the overall channel. The channel as defined in ISO/IEC 11801 (or equivalent), includes up to 90 m of horizontal cable, a work area equipment cord, a telecommunications outlet/connector, an optional transition connection close to the work area and two cross-connect connections in the floor distributor. The total length of work area, patch cords and jumpers shall not exceed 10 m. The connections to the equipment at each end of the channel are not included in the channel definition. The end-user patch cord shall be used to test channel performance.
- Permanent link. The permanent link test configuration is intended to be used by installers and users of data communication systems to verify the performance of permanently installed cabling. The permanent link distributor as defined in ISO/IEC 11801 (or equivalent) consists of up to 90 m of horizontal cabling and one connection at each end. The permanent link excludes both the cable portion of the test cord of the test equipment and the connection to the test equipment, but may include the optional transition point.
- CP Link, The CP link test configuration is intended to be used by installers and users of data communication systems to verify the portion of a permanent link between the floor distributor and consolidation point.

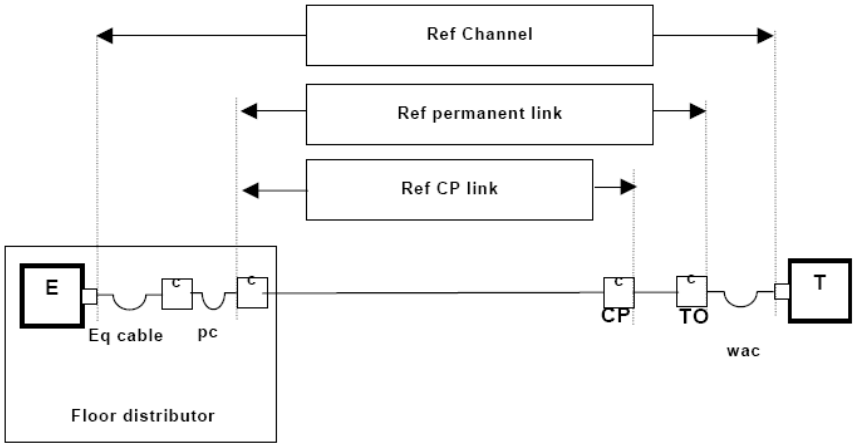


Figure 2: Reference planes for Permanent Link and Channel.

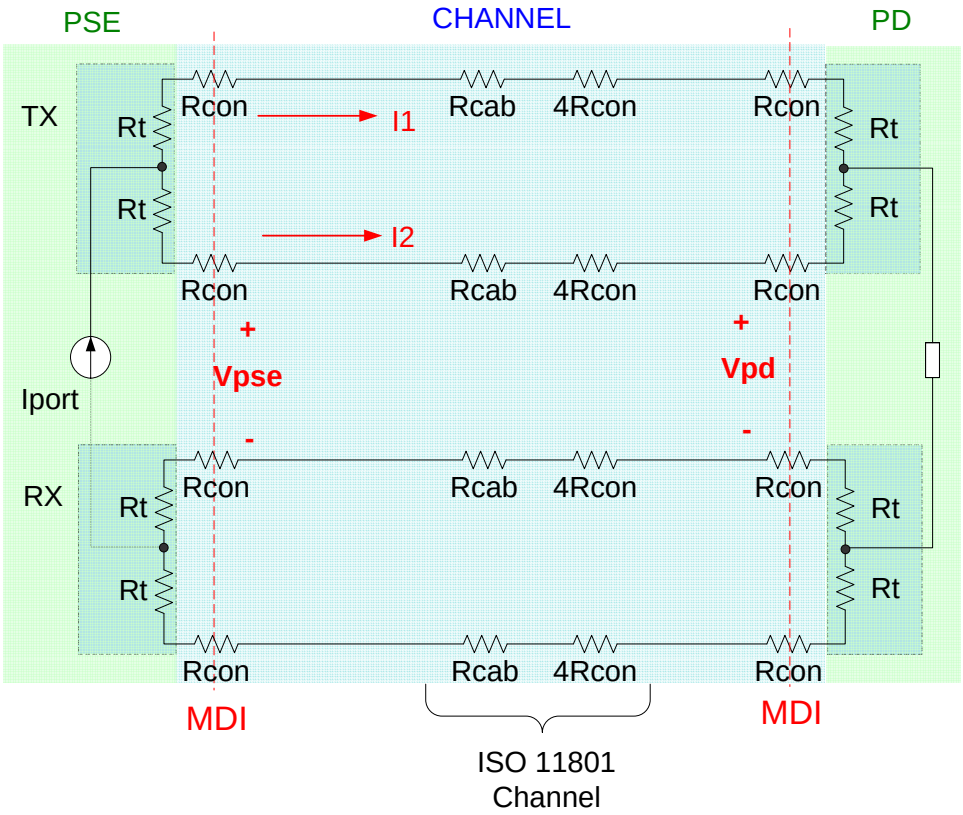
Legend:

Ref Channel	reference planes for channel
Ref Permanent link	reference planes for the permanent link
Ref CP link	reference planes for the CP link
E	equipment in floor distributor
c	connection
T	terminal equipment in work area
TO	telecommunications outlet
CP	consolidation point
Eq cable	equipment cable
pc	patch cord
wac	work area cable

In the worst-case, this model contain 4 connections, 10 m of jumper cables and 90 m of horizontal cabling.

Worst-case channel resistance:
Class C 40 ohms
Class D 25 ohms
DC resistance unbalance <= 3%

The Channel Models: Detailed IEEE 802.3



$$I_1 = I_{cable}\frac{\sum R_{\max} // \sum R_{\min}}{\sum R_{\max}}$$

$$I_2 = I_{cable}\frac{\sum R_{\max} // \sum R_{\min}}{\sum R_{\min}}$$

Valid for ISO channel with 4 connectors.

$$I_{UNBAL} = I_{cable} \times \sum R_{\max} // \sum R_{\min} \left(\frac{1}{\sum R_{\min}} - \frac{1}{\sum R_{\max}}\right)$$

$$I_{UNBAL} = 350mA \times 3\% = 10.5mA$$

This is not Ipeak.

Iunb

The worst-case current unbalance is modeled by combining the ISO channel resistance unbalance with an MDI connections and transformer resistance.

a // b => Replace with the resistance of “a” in parallel with “b”.

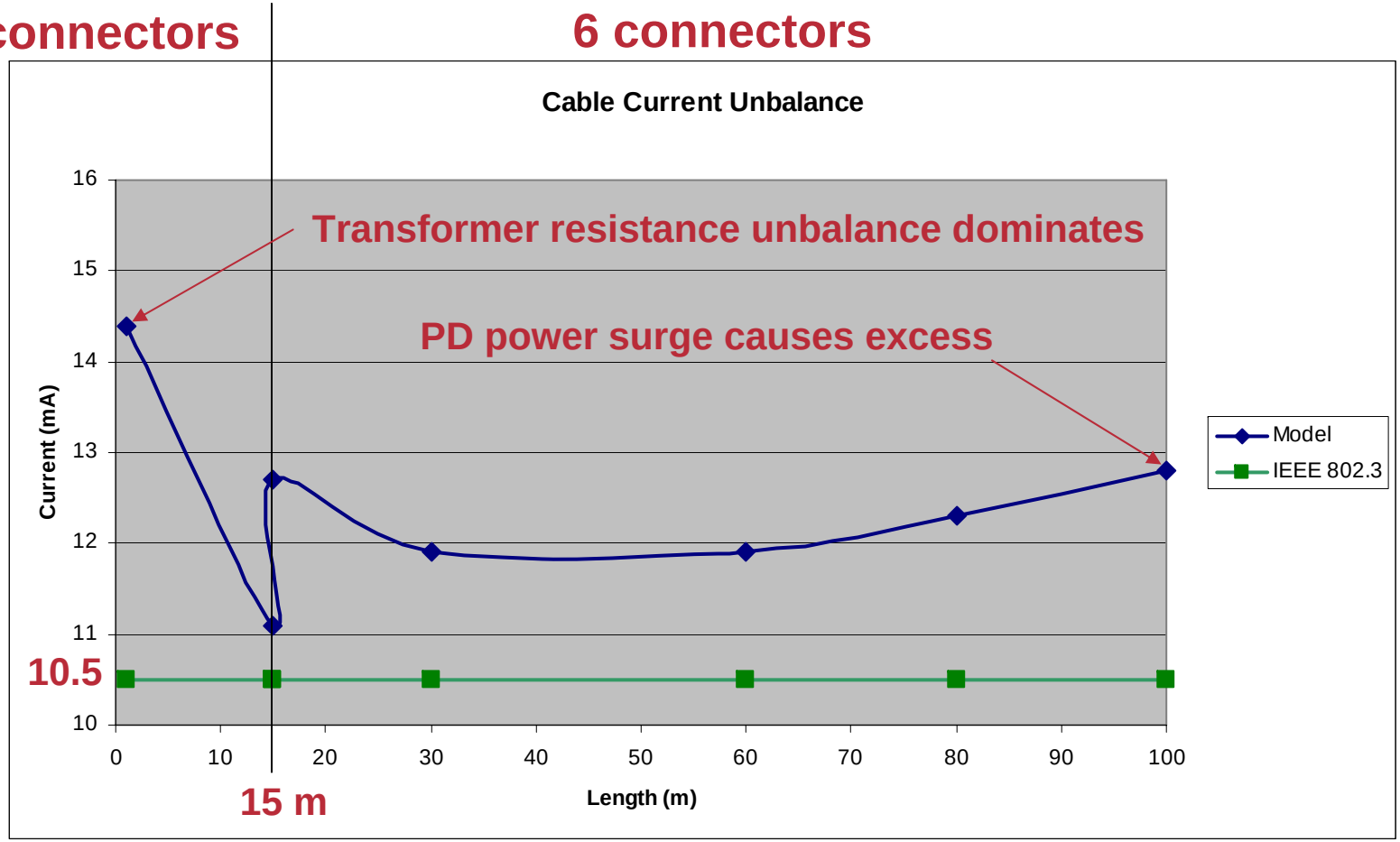
Task Force recommendations 1 of 2

- **Assume a constant Power PD.**
- **Consider the PD surge power.**
- **Calculate cable current based on system parameters.**
- **Use ISO/IEC 11801, 3% resistive unbalance and Rch recommendations Class-C 40 ohms, Class-D 25 ohms)**
- When cable reach is < 15 m assume 4 connectors
  When cable reach is >= 15 m assume 6 connectors
- **Assume CAT-5e connectors or better are used on PSEs and PDs.**
- **When a CAT-3 connector is mated with a higher grade plug use CAT-3 resistance values.**
- Assume the cable reach is 1 m to 100 m.

Task Force recommendations 2 of 2

- **Assume transformers in the PSE and PD.**
- **Use 0.5 ohms maximum for transformer resistance (CT-to-signal) with a 5% resistive unbalance (legacy).**
- **Assume that PSE and PD transformer resistance is uncorrelated.**
- **Determine how to deal with 100 MBPS 8 mA and PoE unbalance currents.**
- **Determine if short cable length (with less loss) permits reduced low frequency signal levels (as a result of current unbalance).**

IEEE 802.3 Current Unbalance



Power surge to 14.8 W, uncorrelated PSE and PD Rt. Class C. Vpse = 44V.

Review

- **IEEE 802.3 used average PD power (12.95 W) and ISO channel characteristics (4 connectors) to determine I_{unb} (10.5 mA).**
- **The model for this presentation results in an unbalance current (14.4 mA) that exceeds IEEE 802.3 requirements for all channel lengths.**

  PD surge power 14.8 W

  Transformers and 2 additional connectors

Next Step

- **Refine the model used.**
- **Take 100 MBPS requirements into account.**
- **Determine IEEE 802.3 and transformer current unbalance requirements.**
- **Select parameters for PoE plus.**
- **Determine IEEE 802.3at and transformer unbalance requirements.**