

# IEEE P802.3da Comment #123 on Mode Conversion

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# Background

- 188.8.3 “Mode conversion loss” lacks detail
  - “Where” specification applies
  - “What” specific MC specification(s) are meant
- Comment insufficient - requested to bring proposed change(s) for discussion

|     |         |    |    |   |  |   |      |   |
|-----|---------|----|----|---|--|---|------|---|
| 188 | 188.8.3 | 98 | 25 | T | No instruction is given on where to measure the mode conversion. | In ODVA we measure TCL and TCTL with setup similar to RL and IL. Needs some discussion. | Late | PROPOSED REJECT.<br>Commenter provides insufficient information for a remedy. |
|-----|---------|----|----|---|--|---|------|---|

# Where

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- Clause 147 specifies “where” the specification applies
  - **Impractically large** number of measurements

## **147.8.3 Mode conversion loss**

The mixing segment shall meet the mode conversion loss characteristics specified for link segments in 147.7.3 **between any two MDI attachment points.**

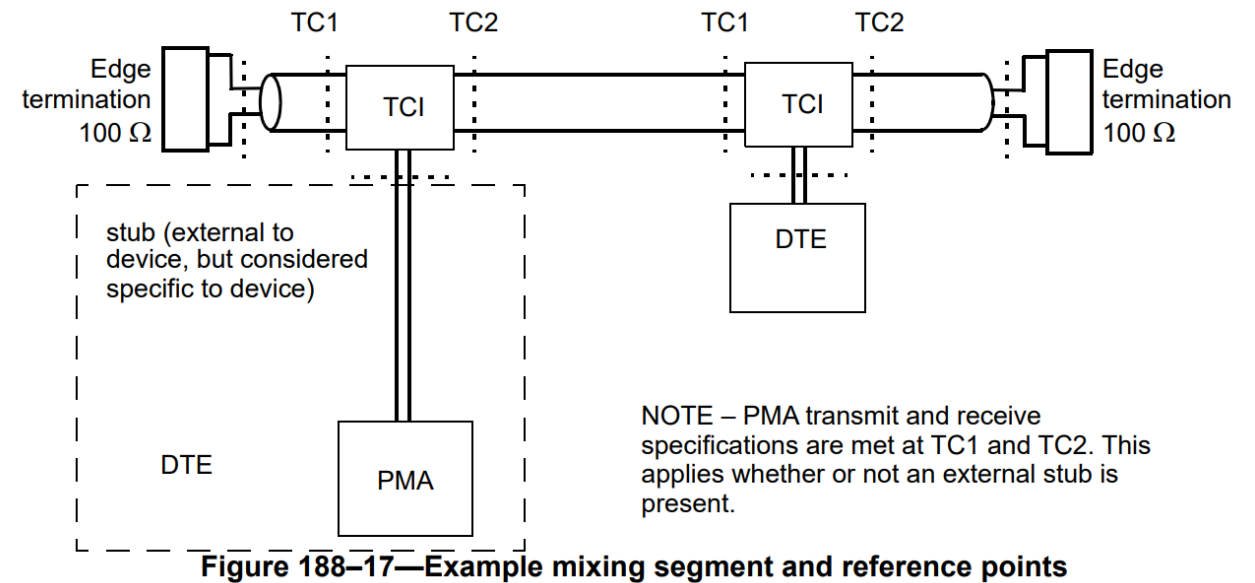
- Clause 188 lacks a “where”

## **188.8.3 Mode conversion loss**

The mode conversion loss of the 10BASE-T1M mixing segment shall meet the values determined using Equation (188–5).

# Where

- The other specifications state where they apply
- 188.8.1 Insertion loss
  - “Between edge termination attachment points”
- 188.8.2 Return loss
  - “at the edge terminations”



# What

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- Fluke Networks “101 Series: What are TCL and ELTCTL?”
  - “Mode conversion is measured via two mode conversion parameters – TCL and TCTL.”
  - ELTCTL: “TCTL testing is dependent on the length of the link due to insertion loss, equalization must be applied”
- ODVA
  - Interpreted Clause 147 MC as TCL and TCTL @ 25 m
  - Increased reach (50 m or 75 m) may require the adjustment of ELTCTL

# Proposed change to 188.8.3

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- Change from:
  - “The mode conversion loss of the 10BASE-T1M mixing segment shall meet the values determined using Equation (188–5).”
- To:
  - “The mode conversion loss of the 10BASE-T1M mixing segment, with DTEs or representative simulated DTE loads attached, shall meet the values determined using Equation (188–5); at each edge termination reference plane (TCL) and between edge termination reference planes (ELTCTL) in both directions. Measurements shall be made by substituting the measurement instrument for the respective edge terminator. The reference impedance is 100 Ω.”

# Further gap discovered...

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- MC using TCTL or ELTCTL is between edge termination reference planes - similar to IL
- IL notes the inclusion of TCI IL
  - 188.8.1 Insertion loss
    - “Mixing segment insertion loss includes any TCI insertion loss. See 188.9.1.1 for specification of TCI insertion loss.”
- There is no equivalent TCI MC
- ODVA includes “TCI” MC to avoid unbounded impairment

# Proposed change to 188.9.1.3

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- Insert new sub-clause and re-number headings:

## 188.9.1.3 TCI mode conversion loss

The mode conversion loss of the TCI, with DTEs or representative simulated DTE loads attached, shall meet the values determined using Equation (188–8), at TC1 and TC2 reference planes (TCL) with the other TC (i.e., TC2 or TC1, respectively) terminated in 100 Ω, and between TC1 and TC2 reference planes (ELTCTL). The reference impedance is 100 Ω.

$$\text{Mode conversion loss}(f) \geq 44 - 10 * \log_{10}(f / 40), 50 \text{ max.} \quad (188-8)$$

where  $f$  is the frequency in MHz;  $0.3 \leq f \leq 200$



# Further gap discovered...

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- MC-only originates from Automotive economic preference to use unshielded cable
  - Over short distance
  - Within an “enclosure”
- Clause 146 extends reach into the “field” (industrial and other)
  - Specifies TCL (MC) for unshielded link segments in less harsh electromagnetic environments
  - Specifies Coupling Attenuation for shielded link segments in more harsh electromagnetic environments

# Proposed change to 188.8.4

- Insert new sub-clause and re-number headings and tables:

## 188.8.4 Coupling attenuation

The coupling attenuation requirement applies to shielded mixing segments and depends on the electromagnetic noise environment. The requirements in Table 188–3 shall be met based on the local environment as described by the electromagnetic classifications  $E_1$ ,  $E_2$ , or  $E_3$  given in ISO/IEC 11801-1:2017 Table 2, where a given environment is determined by the most demanding parameter within the E group

Table 188-3 – Coupling attenuation

| Frequency<br>MHz      | Environmental classification      |                       |                        |
|-----------------------|-----------------------------------|-----------------------|------------------------|
|                       | $E_1$                             | $E_2$                 | $E_3$                  |
|                       | Minimum coupling attenuation (dB) |                       |                        |
| $30 \leq f < 100$     | $\geq 50$                         | $\geq 50$             | $\geq 60$              |
| $100 \leq f \leq 200$ | $90 - 20\log_{10}(f)$             | $90 - 20\log_{10}(f)$ | $100 - 20\log_{10}(f)$ |

# Confirming CA via measurement?

- How is the measurement made? Place entire mixing segment inside of a triaxial tube?
- Automotive wiring harnesses have a similar issue:
  - <https://grouper.ieee.org/groups/802/3/ch/public/adhoc/2017-10-09%20802.3ch%20screening%20measurement.pdf>
- Approach: Annex 149A (normative) “Coupling and screening attenuation test methodology”

## 149A.3 Reference cable assembly

The reference cable assembly is intended to be a simplified representation of the components used within a wiring harness. These include cable, PCB connectors, and in-line connectors. In order to reach sufficient accuracy to measure coupling and screening attenuation, the connectors and cable should be matched in terms of balance and shielding.

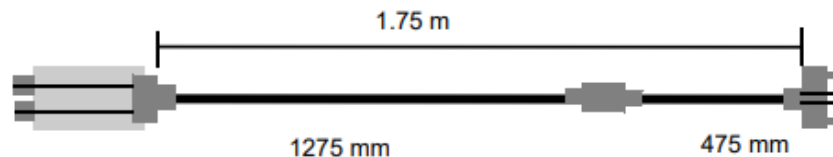


Figure 149A-1—Coupling attenuation reference cable assembly

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# QUESTIONS?