Review of Optical PMD Clauses in terms of 802.3ah PAR, 5 Criteria and Objectives

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Optical Clauses Satisfy PAR

- Title: Clauses 58 - 60 define new optical PMDs, which are part of the Physical Layer
- Scope: Clause 58 - 60 PMDs operate from 100 Mb/s to 1000 Mb/s: within the scope of the current standard
- Purpose: Clause 58 - 60 PMDs provide a significant increase in performance compared to current standards for subscriber access networks, while minimizing equipment, operation, and maintenance costs. They use familiar PMD sub-components and interfaces such as in 100BASE-X and 1000BASE-X, and a conservative, thorough specification approach.

Optical Clauses Satisfy 5 Criteria

- **Broad Market Potential:**

- Broad sets of applicability: Current Optical specifications permit and enable a broad set of system applications. Designed to allow extended temperature operation for outdoor deployment.

- Multiple vendors and numerous users: A large number of vendors are actively developing EFM-compliant Optical PMDs or have products announced.

- Balanced costs (LAN vs. attached stations): Cost proximity with 1000BASE-LX and 100BASE-LX ensures this balance.

Optical Clauses Satisfy 5 Criteria

- **Compatibility:**

- Conformance with 802 Overview & Architecture: We meet the service availability requirements. Network extent of 10 to 20 km is suitable for access networks. Size and extent (ref 802 Overview, clause 7.2) can be readily extended with bridges. The BER of 10^-12 is 4 orders of magnitude better than the requirement of clause 7.3. The PMD Service Interfaces are either identical to familiar interfaces (C58, C59) or incremental extensions of them (C60).
- Conformance with 802.1D, 802.1Q, 802.1f: System conformance is supported by Optical PMD specifications.
- Compatible managed object definitions: System conformance is supported by Optical PMD specifications.

Optical Clauses Satisfy 5 Criteria

- **Distinct Identity:**

- Substantially different from other IEEE 802.3 standards: Three new approaches – extended temperature, bi-directional optics, and passive optical network operation.
- One unique solution per problem (not two solutions to a problem): Each 802.3ah objective is distinct and unique. Optical PMD specs follow objectives.
- Easy for the document reader to select the relevant specification: C58 (100BASE-BX and 100BASE-LX10), C59 (1000BASE-LX10 and 1000BASE-BX), C60 (1000BASE-PX).

Optical Clauses Satisfy 5 Criteria

- **Technical Feasibility:**

- Demonstrated system feasibility: PX and LX publicly demonstrated at the time of this meeting. Independently, email responses invited by STF Chair have confirmed existence of all PMD types, including BX. Similar PMDs in Japan have been deployed in large volumes.
- Proven technology, reasonable testing: These PMDs leverage the huge experience base of 100BASE-FX and 1000BASE-LX.
- Confidence in reliability: Reliability expectations of public networks have been noted. There is wide agreement on the reliability of long wavelength optics.

Optical Clauses Satisfy 5 Criteria

- **Economic Feasibility:**

- Known cost factors, reliable data: Yes. The bi-directional optical element is a well-understood component in the field. No new laser types needed. Any capital expense of extended temperature operation is repaid in reduced deployment expenses.

- Reasonable cost for performance: In invited responses, several PMD vendors have given estimates of cost. See attached table. The values show a reasonable range of cost figures.

- Consideration of installation costs: The PMD modules are either pluggable or installed on the host board. Costs for both cases are known and considered in the estimates shown in the attached table.

Relative-cost Matrix for PMD alone

Optical PMD	Estimated cost ratio, relative to 1000BASE-LX
100BASE-LX10	~1
100BASE-BX10	~1
1000BASE-LX10	~1.2
1000BASE-BX10-U	~1.4
1000BASE-BX10-D	~2
1000BASE-PX10-U	~1.4
1000BASE-PX10-D	~3
1000BASE-PX20-U	~3.5
1000BASE-PX20-D	~3.5

Estimate of current costs from a limited survey carried out in July 2003. Costs will evolve.

Optical Clauses Satisfy Objectives

- **Support subscriber access network topologies:**
  - Point to multipoint on optical fiber:
    C60 - 1000BASE-PX10, 1000BASE-PX20
  - Point to point on optical fiber:
    C58 - 100BASE-LX10, 100BASE-BX10;
    C59 - 1000BASE-LX10, 1000BASE-BX10

Optical Clauses Satisfy Objectives

- **Provide a family of physical layer specifications:**
  - 1000BASE-LX extended temperature range optics:
    C59 - 1000BASE-LX10
  - 1000BASE-X >= 10km over single SM fiber:
    C59 - 1000BASE-BX10
  - 100BASE-X >= 10km over SM fiber:
    C58 - 100BASE-LX10, 100BASE-BX10
  - PHY for PON, >= 10km, 1000Mbps, single SM fiber, >= 1:16:
    C60 - 1000BASE-PX10
  - PHY for PON, >= 20km, 1000Mbps, single SM fiber, >= 1:16:
    C60 - 1000BASE-PX20

Optical PMD specifications are ready for Working Group Ballot!