P1394b joint PMD Task Groups - 6 August 1997 - Agenda

1. Welcome, Introductions, Objectives
2. Requirements
3. Connection scenarios review
   - need to define connector?
4. Media
   - POF presentations
   - MMF presentations
   - common media for all speeds?
   - EMC and eye safety
5. Provision of power to sub-phys
   - power consumption by sub-PHYs (3W enough)
   - power class (draw power, not repeat power, etc)
6. Wall-plate power
   - conflict with TIA 48.2 building wiring specifications?
   - leave this to VESA Home Network to solve?
   - central DC power supply?
7. Encoding schemes
   - review of suitablilty of candidates for S100 and S800 (no decisions, information in preparation for P1394b debate on Friday)
8. Sub-PHY properties
9. Timing changes required to P1394a to handle long-haul
   - root contention
   - PHY delay
   - Beta mode start-up
10. P1394b short haul electrical signal integrity
    - (possibly deferred to Thurs pm if insufficient time)

Meeting objectives

- Exchange of information between the S100 and S800 Task Groups
  - find maximum common ground
  - identify areas where different approaches are necessary.
  - Topics covered include
    - ✓ media,
    - ✓ transceiver delay,
    - ✓ power consumption,
    - ✓ root contention timings,
    - ✓ PHY delay,
    - ✓ encoding schemes,
    - ✓ EMC,
    - ✓ scrambling,
    - ✓ eye-safety,
    - ✓ beta mode start-up, etc
- Short haul copper PMD issues (connector and signal integrity issues)

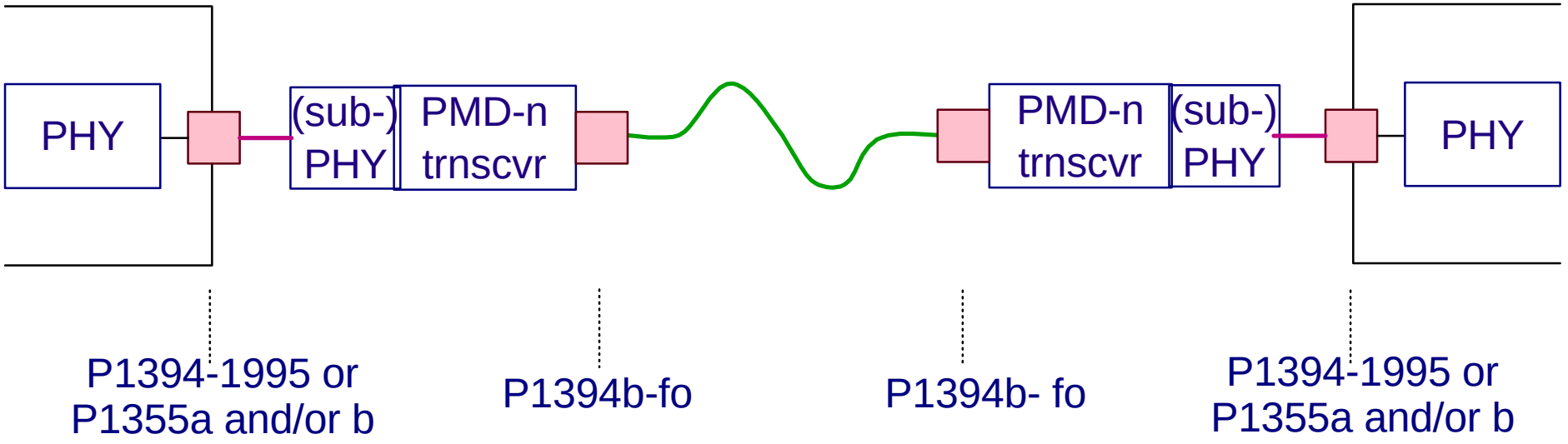
S800/1600/3200 Requirements

1. 50m reach per hop
   - Need P1394a phy pinging to determine worst-case delay
2. Optical fibre support for S800, S1600, S3200 speeds
   - minimise cost of S800 first (cost is king)
   - then common media where possible
   - no need for dynamic speed determination (no "modem-style" signal integrity testing)
     - ✓ PMDs must be able to identify their maximum speeds
     - ✓ PHYs must negotiate speeds
   - possibly use PMD intelligence to reduce PMD cost further
3. P1394a and P1394b above the PMD layers
   - agreed to use a common encoding for all P1394b PHYs/PMDs
   - same tree-ID algorithms, self-ID algorithms
   - fully interoperable with current 1394 - no bus bridging required
4. Amateur installable
   - Installation guidelines, installation test, ...
5. Facilitate FCC Class B emissions compliance
6. Lasers must be class 1 EYE-SAFE (IEC 825-1 and CDRM (r-DA)) for regulatory purposes
   - in order to be amateur installable.
7. Timescale: report in November

S100/200/400 Requirements

1. 50m reach per hop
   - Need P1394a phy pinging to determine worst-case delay
2. UTP and optical fibre at S100, optical fibre for higher speeds
   - minimise cost of S100 first (cost is king)
   - then common media where possible
   - no need for dynamic speed determination (no "modem-style" signal integrity testing)
     - ✓ PMDs must be able to identify their maximum speeds
     - ✓ PHYs must negotiate speeds
   - possibly use PMD intelligence to reduce PMD cost further
3. P1394a above the PMD layers
   - not constrained by P1394b timescales
   - same tree-ID algorithms, self-ID algorithms
   - fully interoperable with current 1394 - no bus bridging required
4. Amateur installable
   - Installation guidelines, installation test, ...
5. Facilitate FCC Class B emissions compliance
6. Lasers must be class 1 EYE-SAFE (IEC 825-1 and CDRM (r-DA)) for regulatory purposes
   - in order to be amateur installable
7. Timescale: November for S100 and S200.

General model - fibre optic implementation example

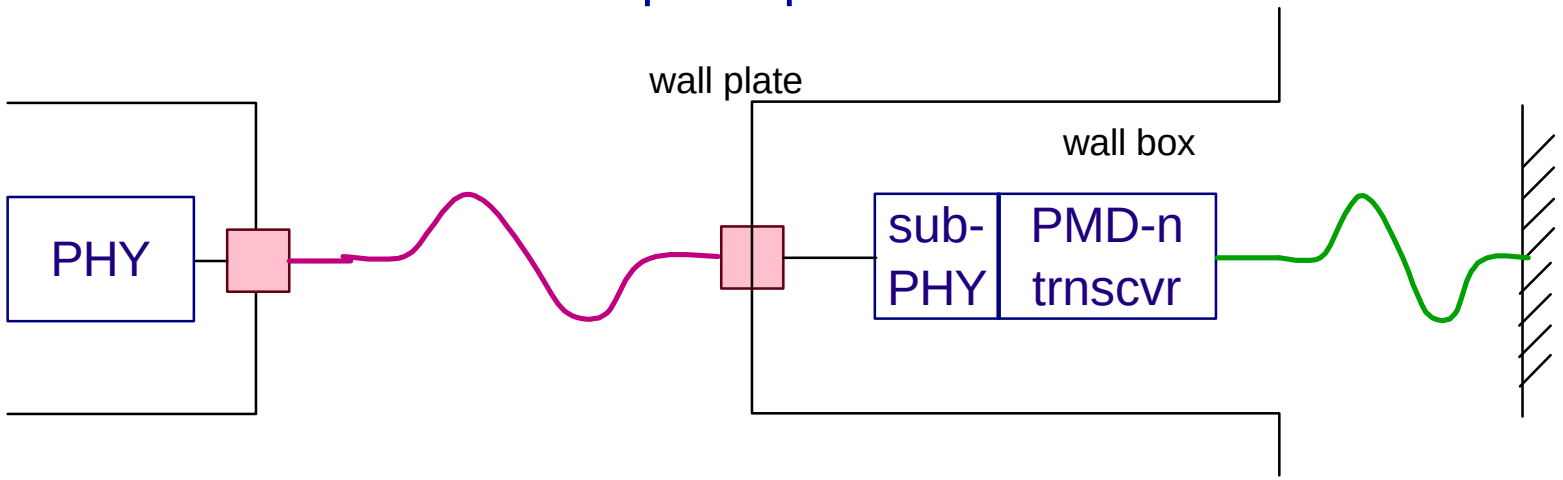


- cable-powered dongle provides EO/OE conversion, or P1394b electrical to long-haul electrical for S100 UTP
- sub-PHY is a full PHY (no link) in the S100 recommendation
- sub-PHY provides PHY repeater function
  - see later for full spec

Connection scenarios - 1

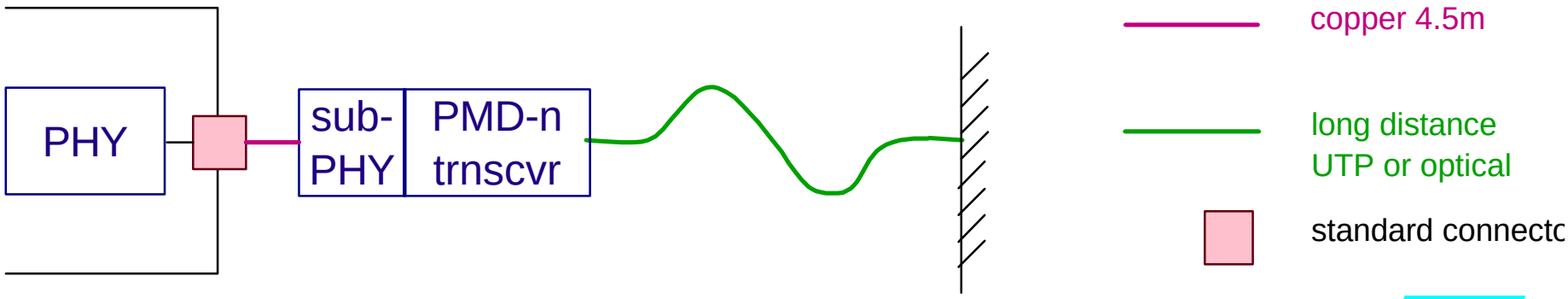
1. Wall plate

- standardise the fibre and optical performance



2. Long-distance cable incorporating a dongle

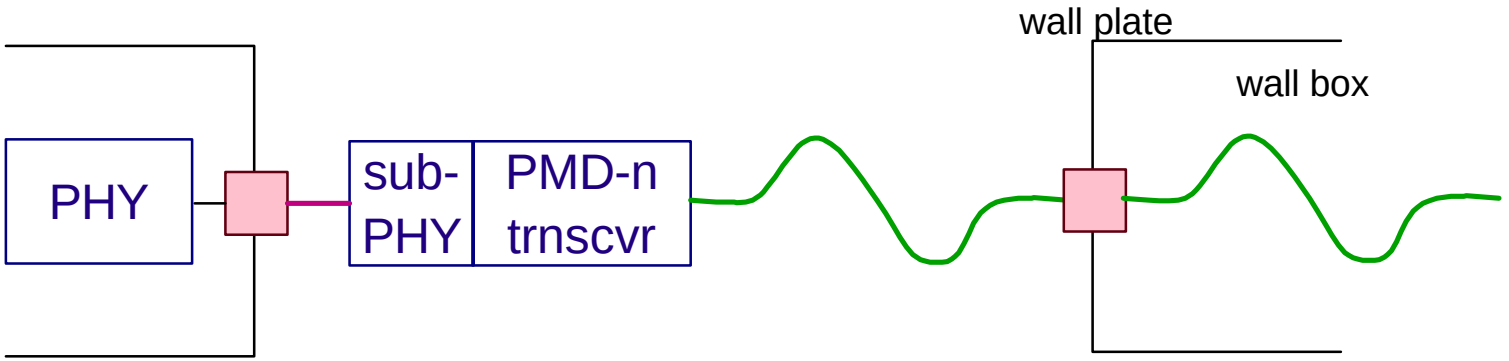
- standardise the medium and the optical parameters

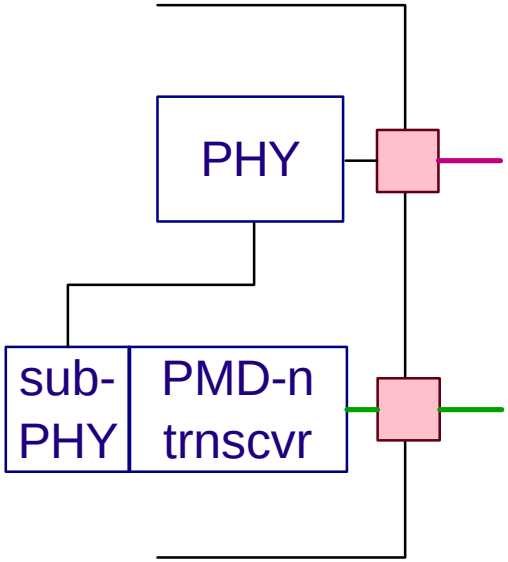


Connection scenarios - 2

3. Long-distance cable incorporating a dongle, with passive wall plate

   - standardise the medium, the optical parameters and the wall plate connector





4. Long-haul interface on the equipment

   - standardise the medium, optical parameters and the connector

S100/S800 connection scenario priorities

- S100 (see Taka's slide of S100 connection models)
  - Model 1 & 2 equal (scenarios 1 and 3)
  - Model 3 much later (scenario 4)
  - Cable power or acrtive wall plate power or power brick
  - Power distribution to be solved by VESA HN/DAVIC or other application standard
- S800
  - Prioritise scenarios 1 and 2
  - Requires resolving the "power to the subphy" issues
  - Avoids need to define an optical connector
  - Scenario 3 held in reserve, in case we need to avoid powered wall-plates

Media

- S100 looking to use UTP and POF, HPCF (various variants)
- Last meeting, the S800 PMD group identified 850nm multi-mode glass fibre (with 50u VCSEL technology) as suitable for S800, S1600, S3200 (1, 2 and 4GBaud)
  - different launch/sensitivity parameters for each speed
- Issues
  - emphasise single medium for future-proofness?
    - ✓ supported by both groups
  - will POF meet all speed requirements on suitable timescale?
  - are the benefits of POF for slow speed sufficient to justify two media
  - do the costs of MMF justify seeking an alternative for slow speed?
  - how easy is connectorisation/installation for the various media?
- Presentations please

Power issues

- Provision of power to sub-phys
  - power consumption by sub-PHYs (3W enough)
  - power class (draw power, not repeat power, etc)
    - ✓ power class 4 if powered from the cable (nearly matches)
    - ✓ power class 0 if powered separately
  - A long haul link (two sub-PHYs) needs at least one node-ID
- Wall-plate power
  - conflict with TIA 48.2 building wiring specifications?
  - solve the problem within 1394
    - ✓ do not leave this to VESA Home Network to solve
  - central AC power supply?
  - sub-PHY could be a power provider
    - ✓ min 15W, 20V

Encoding schemes - overview

- 4B5B
  - FDDI 4B5B encoding
  - NRZI encoding
  - bit-level scrambling for all copper specifications
    - ✓ not used for optical
  - MLT-3 for UTP only
    - ✓ not used for short haul copper and optical
- Modified IBM 8B10B
  - byte-level scrambling of data and control
  - IBM 8B10B data encoding
  - special encoding for control symbols
    - ✓ more robust than IBM 8B10B
  - all signalling binary
- Common features
  - continuous operation at constant line rate (determined at start-up)
  - control symbols for arbitration, speed signalling etc
  - developed from existing solutions in the market
  - patents, believed to comply with IEEE patent policy
  - low complexity of digital logic
    - ✓ (analog is proposal and media dependent)

Encoding schemes - 1

- General advantages/disadvantages

	Advantages	Disadvantages
4B5B	2 errors in 40ns for erroneous GRANT; short code allows faster serial/parallel conversion (40? ns less latency); Based on FDDI (in market at 100 Mbps)	unbounded disparity
8B10B	Based on IBM 8B10B (in market at multi-gigabaud rates); Detects three single error events in a packet (meets IEEE standard); Bounded disparity (+/- 6); Hamming distance of 2 between control and data symbols (and between control symbols); Spare control codes	2 errors in 80ns for erroneous grant; longer latency equivalent to approx 7r line length

Encoding schemes - 2

- S100 UTP advantages/disadvantages

	Advantages	Disadvantages
4B5B	100m at equivalent transmit power;	Long run length; not DC balanced; complex analog electronics for line conditioning (baseline wander), adaptive thresholding, etc; scrambling nullifies 4B5B encoding properties
8B10B		70m at equivalent transmit power; PHY latency (40 ns?)

Encoding schemes - 3

- S100 optical advantages/disadvantages

	Advantages	Disadvantages
4B5B		Not DC balanced (10% out of balance, cost is 1.25 dB); Spectral peak - may or may not be a problem (EMC leakage?)
8B10B		PHY latency (40 ns?)

Encoding schemes - 4

- S800 short haul copper advantages/disadvantages

	Advantages	Disadvantages
4B5B		Not DC balanced (10% out of balance, cost is 1.25 dB); Not practical to leverage short code advantage
8B10B		6dB worse emissions at lower frequencies, but within FCC Class B frequencies of interest

Encoding schemes - 5

- S800 optical advantages/disadvantages

	Advantages	Disadvantages
4B5B		Not DC balanced; Spectral peak is a big issue for transceivers; Not practical to leverage short code advantage
8B10B		

Properties of the sub-PHY

- Two port PHY repeater function - one port is P1394a/b and one is P1394b long haul
  - DS-capable on Cu side
  - Beta-only on optic side
  - May be beta capable on Cu side (though necessarily capable for S800 +)
- Needs a node ID on at least one end of a long-haul connection mated pair
  - decide next meeting whether each sub-PHY should have its own node-ID
- Does not have a LINK (its delay is intrinsic to the cable within which it is embedded)
  - Note, can attach a longhaul transceiver to a regular PHY
- Must be able to speed filter in both directions (speed filtering rules apply in both directions
- Participates (as a mated pair) in Tree-ID, Self-ID and a reduced version of arbitration
- Needs mechanism to resolve root contention problem
- opportunity to use gap reduction tricks in beta mode (performance improvements)
- Must retime signals due to prospect of D/S to beta transitions.
- Needs some form of elasticity buffer

Timing changes to P1394a

- Timing changes required to P1394a to handle long-haul
  - root contention
  - PHY delay
  - Beta mode start-up