

IEEE P802.3cs Terminology

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Introduction

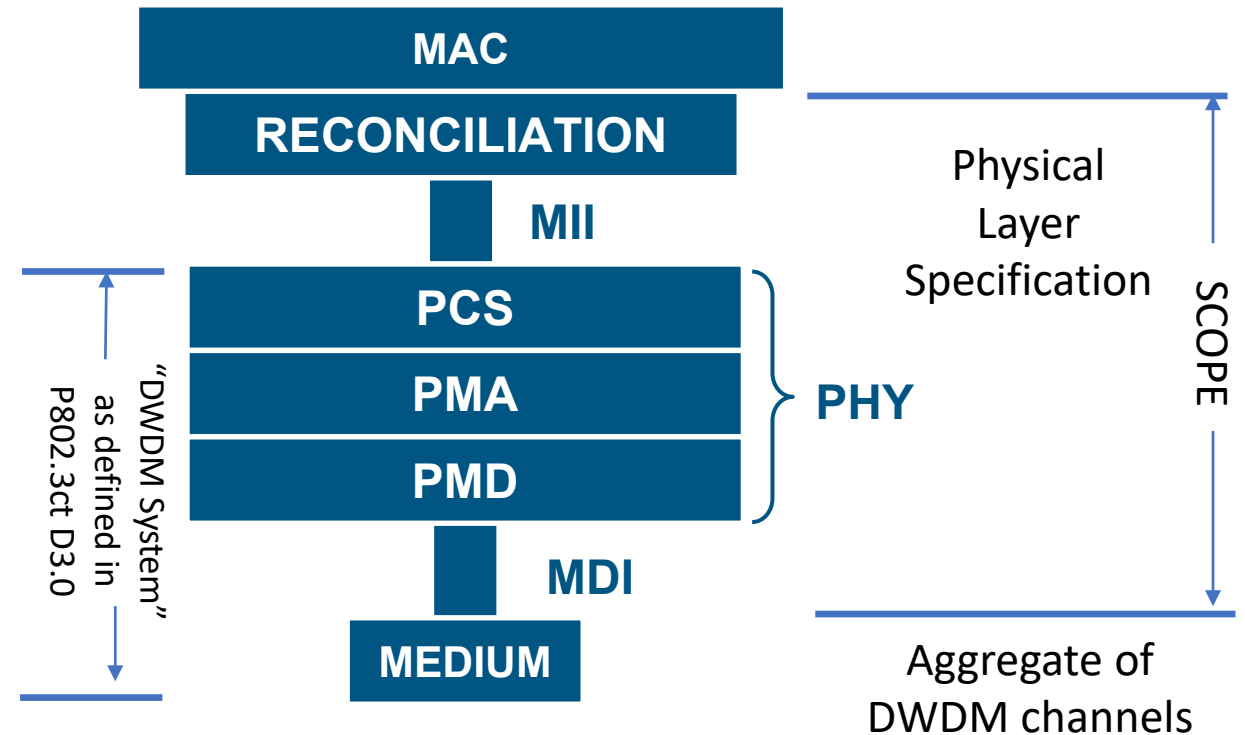
- Terminology is a key issue for 802.3cs and 802.3
- Related comments submitted against P802.3cs D2.3
 - #251
 - #250
 - #253
 - #249
 - #248
 - #256
- It's recommended to leverage the efforts in 802.3ct on terminology of “black link approach”, and to make the terminology in P802.3cs conceptually consistent with the 802.3ct terminology.
- This presentation focuses on terminology and recognizes that definitions will need to be developed for any agreed upon terminology.

Background

IEEE P802.3ct

Another Observation

- PAR Scope P802.3ct –
 - Define physical layer specifications and management parameters for the transfer of Ethernet format frames at 100 Gb/s at reaches greater than 10 km over DWDM systems. Change to scope of the project: Define physical layer specifications and management parameters for the transfer of Ethernet format frames at 100 Gb/s and 400 Gb/s at reaches greater than 10 km over DWDM systems.
- PAR Scope P802.3cw –
 - Optical solutions targeting 400 Gb/s operation at reaches in excess of 10 km over a DWDM system will address the bandwidth growth and reach requirements of interconnect for distributed data centers where reaches greater than 10 km are required, or where fiber availability drives the need for multiple instances of Ethernet over a DWDM system.



The scope of these two projects states PHYSICAL LAYER SPECIFICATIONS are being defined (which includes PHYs) to run over DWDM systems that includes PHYs

Lack of clearness in the scope of both projects. Perhaps “DWDM System” is best applied to the aggregate of DWDM channels.

Reference 154.6 DWDM channel over a DWDM black link

The black link approach implies that no details are provided on how the DWDM black link is constructed, configured or operated so that the end-to-end parameter requirements are met. This approach enables interoperability at the single-channel points (TP2 and TP3). However, it does not enable interoperability at multichannel points between TP2 and TP3 inside the DWDM black link.

NOTE 1—The presence of one or more optical add-drop multiplexers (OADMs) is not directly assumed but also not specifically excluded as long as the end-to-end link requirements are met.

Optical interface parameters are specified only at the single-channel points at the input (TP2 in Figure 154–2) and output (TP3 in Figure 154–2) of the DWDM black link, which are applicable for all channel frequencies f_i . Additional specifications are provided for the transfer parameters from TP2 to TP3, such as chromatic dispersion, ripple, polarization mode dispersion, etc. In this way the (single channel) DWDM channel is completely specified.

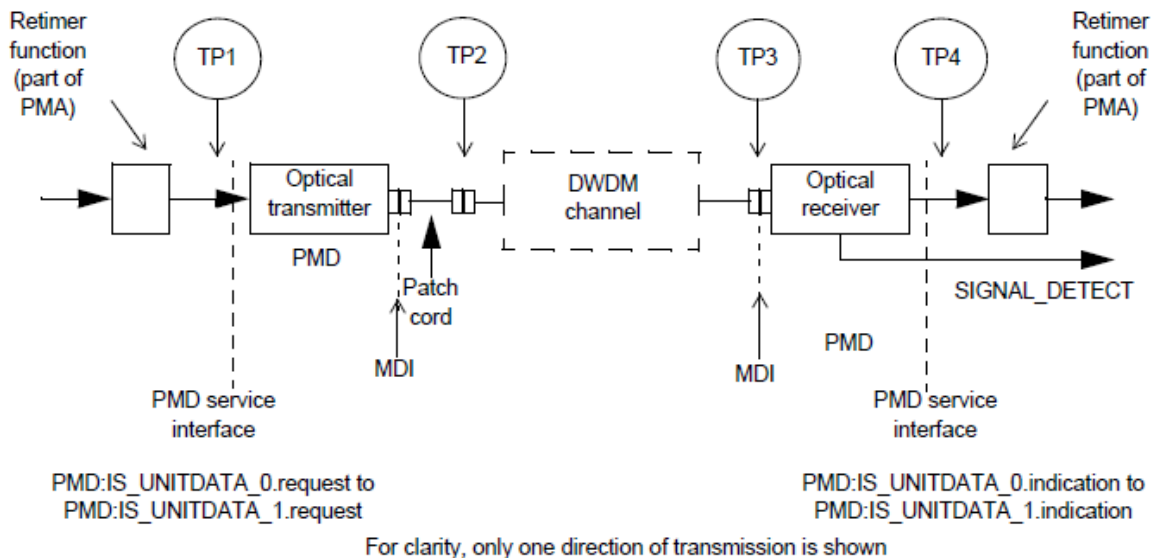
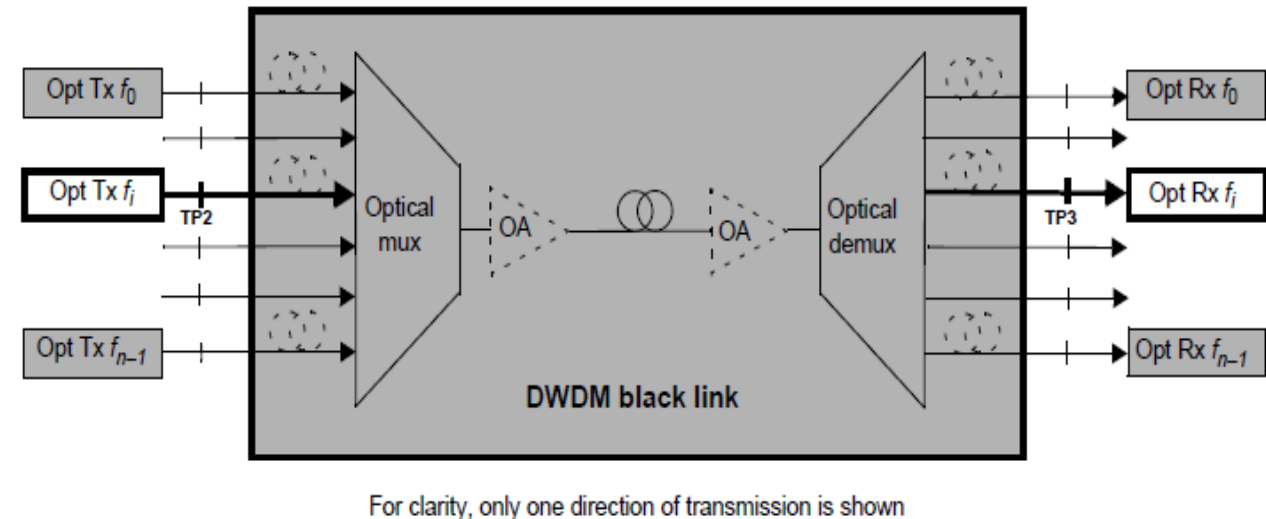


Figure 154–2—Block diagram for 100GBASE-ZR transmit/receive paths

The optical transmit signal is defined at the output end of a single-mode fiber patch cord (TP2), between 2 m and 5 m in length



154.8 specifies black link transfer characteristics (TP2 / TP3) and informative Annex 154A provides clarification and provides examples.

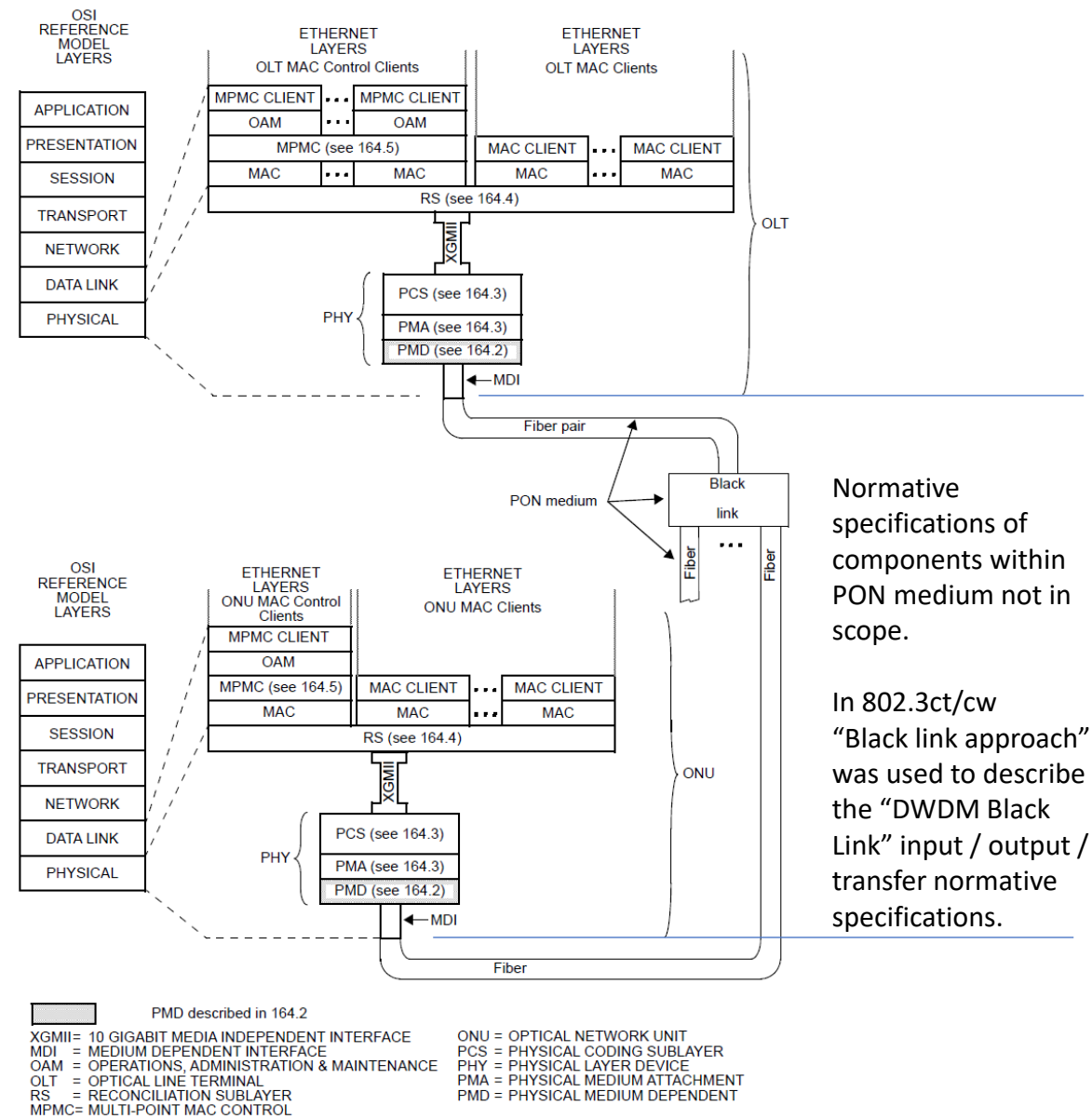
Per IEEE Std 802.3ct-2021

- **Key Definitions -**

- **1.4.237b DWDM channel:** The transmission path from a transmitting DWDM PHY (TP2) to a receiving DWDM PHY (TP3).
- **1.4.237c DWDM PHY:** An Ethernet PHY that transmits and receives on selected dense wavelength division multiplexing (DWDM) center frequencies for transmission over one selected DWDM channel in each direction.
- **1.4.237a DWDM black link:** An aggregate of pairs of dense wavelength division multiplexing (DWDM) channels, with each pair supporting one full duplex connection where the implementation of the transmission paths is not specified.
 - Note – the term “DWDM system” was proposed at one point but avoided due to potential confusion of whether it included the DWDM PHYs.
- **1.4.160a black link approach:** The specification of the input, output, and transfer characteristics of the unidirectional transmission path from TP2 to TP3 for a given dense wavelength division multiplexing (DWDM) channel within a DWDM black link, without specifying how the transmission path is implemented. (See, for example, IEEE Std 802.3, Clause 154, Figure 154–3.)
- Per 154.6 – “The medium associated with the 100GBASE-ZR PMD is also referred to as a DWDM channel.”

802.3cs

- Stated PAR Scope - This amendment adds physical layer specifications and management parameters for optical subscriber access supporting point-to-multipoint operations using wavelength division multiplexing over an increased-reach (up to at least 50 km) passive optical network (PON)



Normative specifications of components within PON medium not in scope.

In 802.3ct/cw “Black link approach” was used to describe the “DWDM Black Link” input / output / transfer normative specifications.

Figure 164-2—Relationship of Super-PON PMD to the ISO/IEC OSI reference model and the IEEE 802.3 Ethernet model

Starting at the “Top”

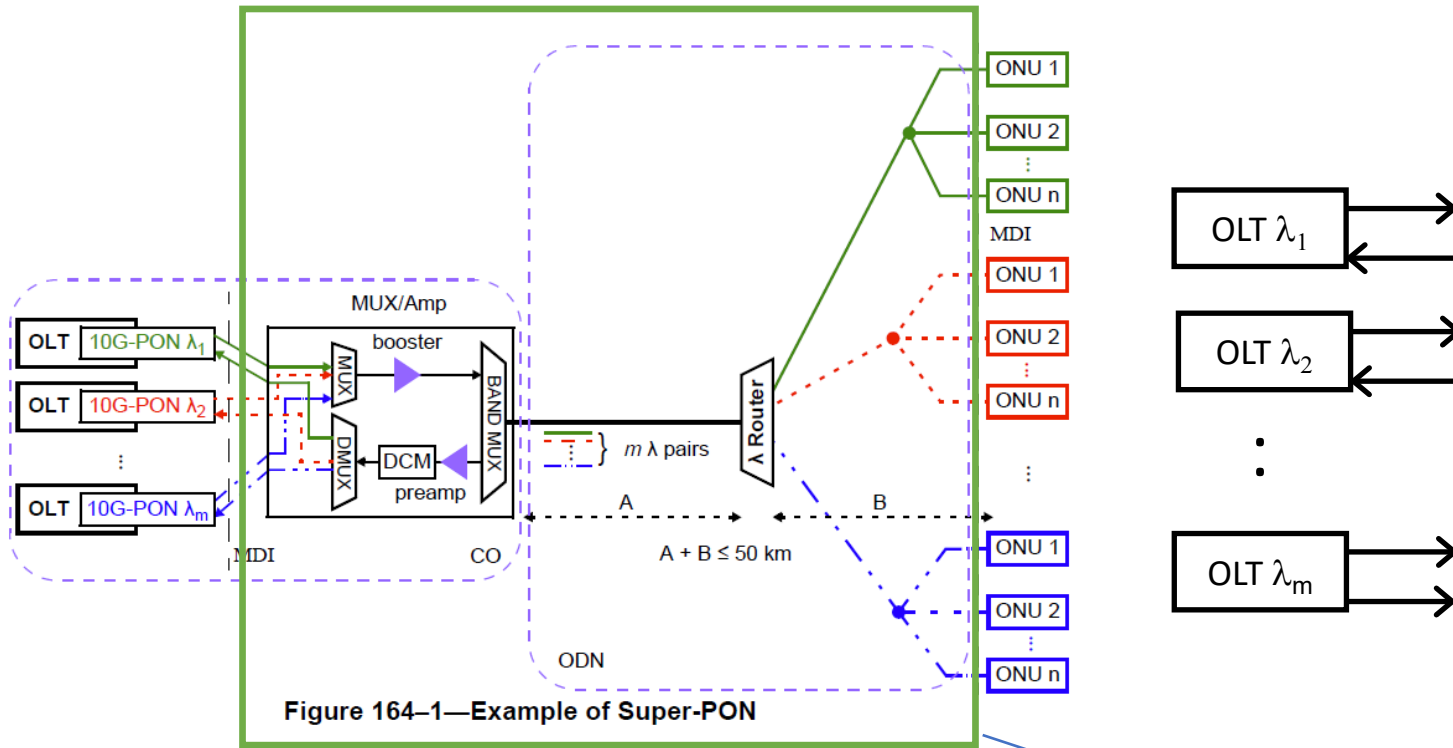
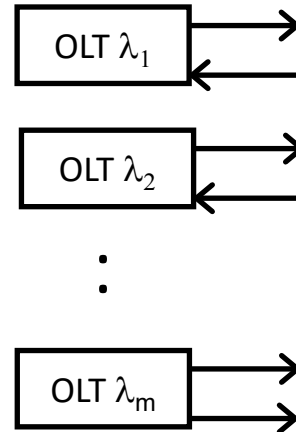


Figure 164-1—Example of Super-PON

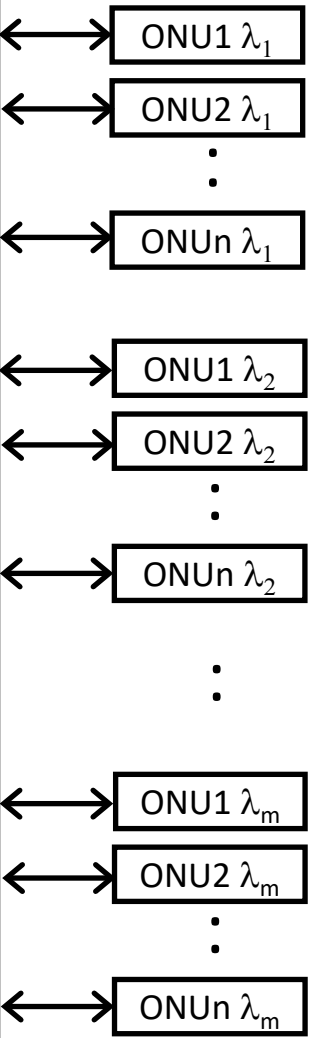


It is not clear if this is what is meant by “Black Link” from Fig 164-2.

The black link approach can be used to develop the specification of the input, output, and transfer characteristics for each unique unidirectional transmission path.

Following 802.3ct example – Super-PON Black Link?

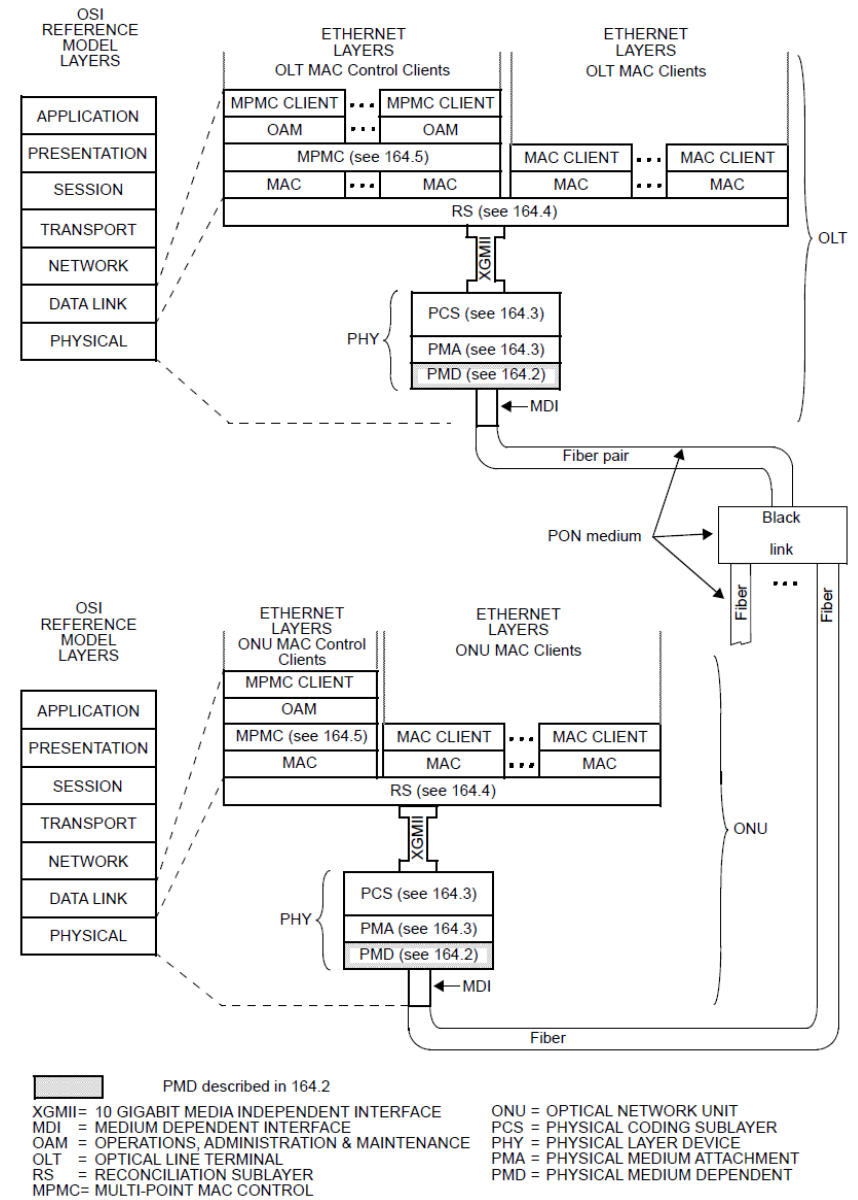
What is the name the TF wants ?



Note: the noted λ refers to the respective pair of frequencies

“Super-PON medium

- Called out as “Super-PON” medium in 1.4.160a. It can be interpreted from title of 164.2
- Noted as “PON medium” in Fig 164-2
 - noted as consisting of Fiber Pair + black link + Fiber Pair
- There is no definition for “black link”
 - 1.4.160a black link approach: The specification of the input, output, and transfer characteristics of the unidirectional transmission path from TP2 to TP3 for a given DWDM channel within a DWDM black link, or from MDI to MDI for a given DWDM channel within a Super-PON medium, without specifying how the transmission path is implemented. (See, for example, IEEE Std 802.3, [Clause 154, Figure 154-3](#))
- But is the real medium the “Super-PON channel (or “Super-PON optical path”)?



Where is the “Black Link”?

- Per response to comment #250 from 9/10/21
 - Fig 164-3 from D2.1 was agreed to be used per proposed response. See
 - Rename "164.2.8 Black link specification" to "164.2.8 Super-PON optical path specification"
- Per 164.2.4.2
- The optical transmit signal is defined at the output end of a patch cord (TP2 for the downstream channel and TP6 for the upstream channel), between 2 m and 5 m in length, of a fiber type consistent with the link type connected to the transmitter. Unless specified otherwise, all transmitter measurements and tests defined in 164.2.9 are made at TP2 or TP6. -
- The optical receive signal is defined at the output of the fiber optic cabling (TP3 for the downstream channel and TP7 for the upstream channel) connected to the receiver. Unless specified otherwise, all receiver measurements and tests defined in 164.2.9 are made at TP3 or TP7.
- Fig 164.2 implies that the “PON medium” is noted as consisting of Fiber Pair + black link + Fiber Pair
 - What is the “black link approach” defining?
 - Fiber + black link + fiber?
 - MDI to MDI (Super-PON medium)?
 - Super-PON optical path?

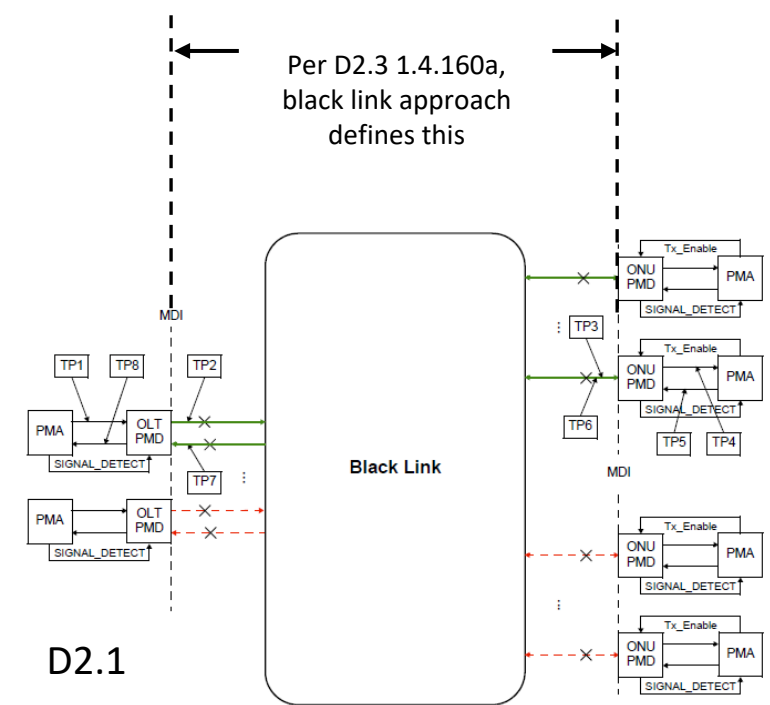
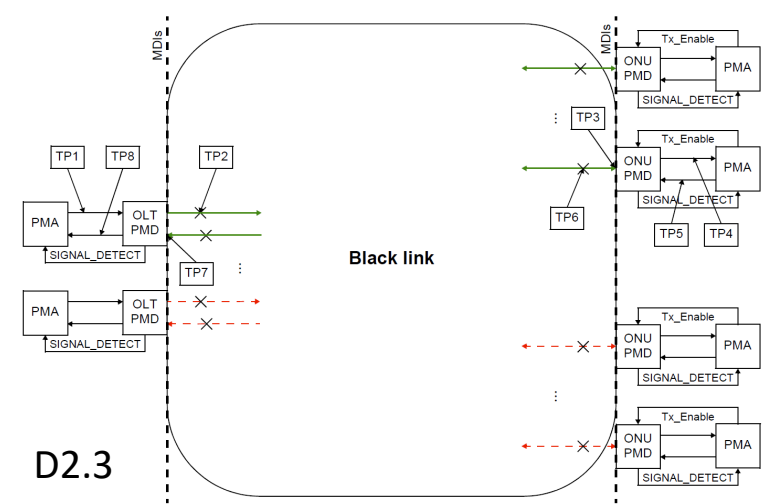


Figure 164-3—Super-PON PMD Test Points



Super-PON black link implementation

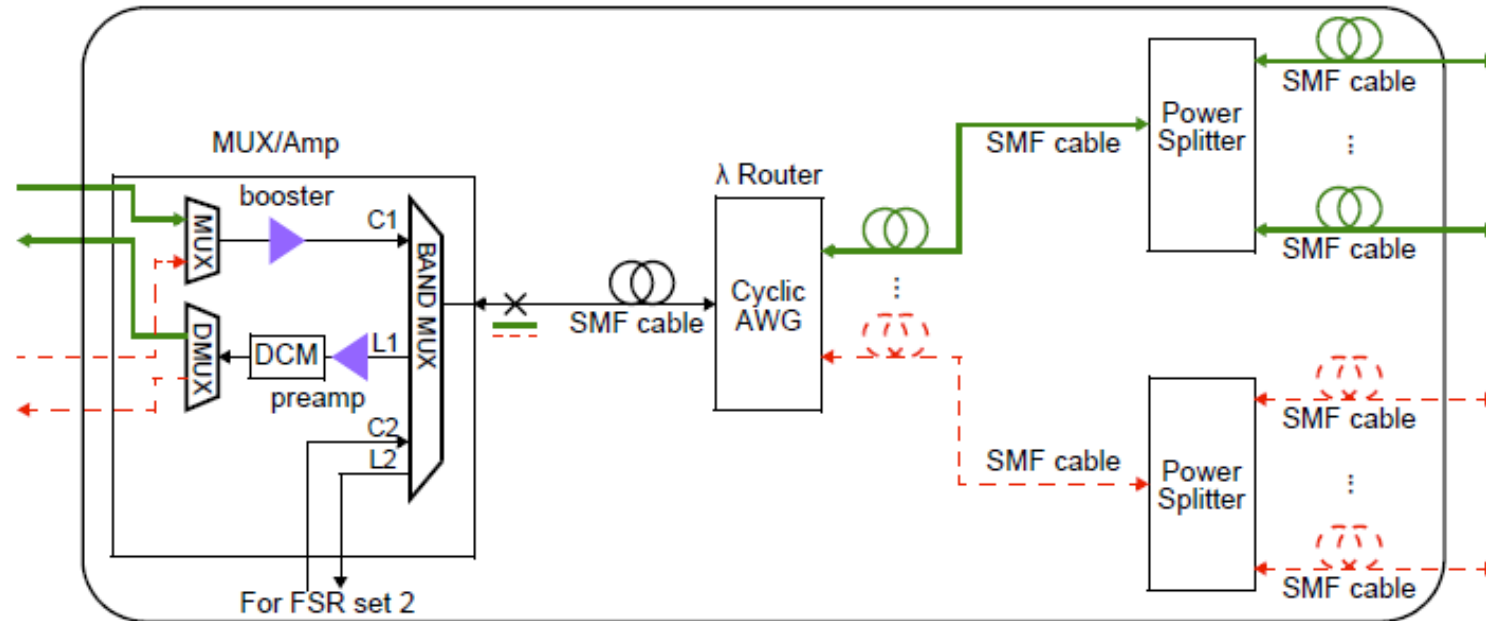


Figure 164A-1—Example of Black link implementation

SMF cabling is noted on one side, but not the other of the Super-PON black link implementation

Naming the Channels

- **Per 1.4.237b DWDM channel:** The transmission path from a transmitting DWDM PHY (TP2 or TP6) to a receiving DWDM PHY (TP3 or TP7).
- It was noted in Comment #251, the term DWDM channel is not used in the specification.
- Note that Table 164-4 calls out “Super-PON Channel Plan”
- Super-PON Channel - The transmission path from a transmitting Super-PON PHY to a receiving Super-PON PHY. (Location needs to be added)
- Super-PON PHY - TBD

Table 164-4—Super-PON Channel Plan

Channel	FSR set 1				FSR set 2			
	C-band 1 (downstream)		L-band 1 (upstream)		C-band 2 (downstream)		L-band 2 (upstream)	
	Frequency (THz)	Wave length (nm)	Frequency (THz)	Wave length (nm)	Frequency (THz)	Wave length (nm)	Frequency (THz)	Wave length (nm)
0	192.000	1561.42	187.613	1597.93	194.193	1543.78	189.807	1579.46
1	192.100	1560.61	187.711	1597.10	194.294	1542.98	189.906	1578.64
2	192.200	1559.79	187.809	1596.27	194.396	1542.18	190.004	1577.82
3	192.300	1558.98	187.906	1595.44	194.497	1541.38	190.103	1577.00
4	192.400	1558.17	188.004	1594.61	194.598	1540.57	190.202	1576.18
5	192.500	1557.36	188.102	1593.78	194.699	1539.77	190.301	1575.36
6	192.600	1556.56	188.200	1592.95	194.800	1538.97	190.400	1574.54
7	192.700	1555.75	188.297	1592.12	194.901	1538.18	190.499	1573.73
8	192.800	1554.94	188.395	1591.30	195.003	1537.38	190.597	1572.91
9	192.900	1554.13	188.493	1590.47	195.104	1536.58	190.696	1572.09
A	193.000	1553.33	188.590	1589.65	195.205	1535.78	190.795	1571.28
B	193.100	1552.52	188.688	1588.83	195.306	1534.99	190.894	1570.47
C	193.200	1551.72	188.786	1588.00	195.407	1534.19	190.993	1569.65
D	193.300	1550.92	188.883	1587.18	195.508	1533.40	191.092	1568.84
E	193.400	1550.12	188.981	1586.36	195.609	1532.61	191.191	1568.03
F	193.500	1549.32	189.079	1585.54	195.711	1531.82	191.289	1567.22

Observations & Recommendations

- In general test point discussions have been limited, other than to illustrate the impact on definitions. The TF will need to resolve the test points issue and modify any terms accordingly.
- There is great potential to cause confusion to use the same terms to address aspects of Ethernet DWDM Systems and Ethernet Super-PON. (802.3ct used “DWDM” to describe specific terms – perhaps .3cs may want to use “Super-PON” as a modifier?)
- Consistent language and diagrams need to be used throughout draft.
- “Black Link” is being used to describe the “network” between the OLTs and ONUs, rather than the “black link approach” to define the performance specifications of the “network.”
 - Is “black link” a term that the PON industry uses?
- A term other than “Black Link” needed to describe everything between OLTs and ONUs. Suggest “Super-PON Black Link” and definition will be necessary.
- Other definitions to consider:
 - Super-PON Channel - The transmission path from a transmitting Super-PON PHY to a receiving Super-PON PHY. (Locations to be resolved.) Currently, it appears that the term “Super-PON optical path” is being used.
 - Super-PON PHY – TBD?