

Support for Blue Book and 3PMD Set (1550 nm Serial, 1310 nm Serial & 1310 nm WWDM)

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Outline

Part 1:

- Why Support the Blue Book and 3 PMD Set?
- What About 850 nm MMF-based PMD's?
- Conclusions

Part 2:

- Further test data supporting the WWDM PMD proposal

Support for the Blue Book with 3 PMD Set: *Why?*

- To gain broad market momentum the taskforce must initiate a draft out of this meeting.
- Taskforce objectives and the IEEE 802 five criteria are met by the Blue Book and 3 PMD set.
- Many, many options have been presented and debated over the last 15 months ~ 20 PMD's,.
- We need to move-on.

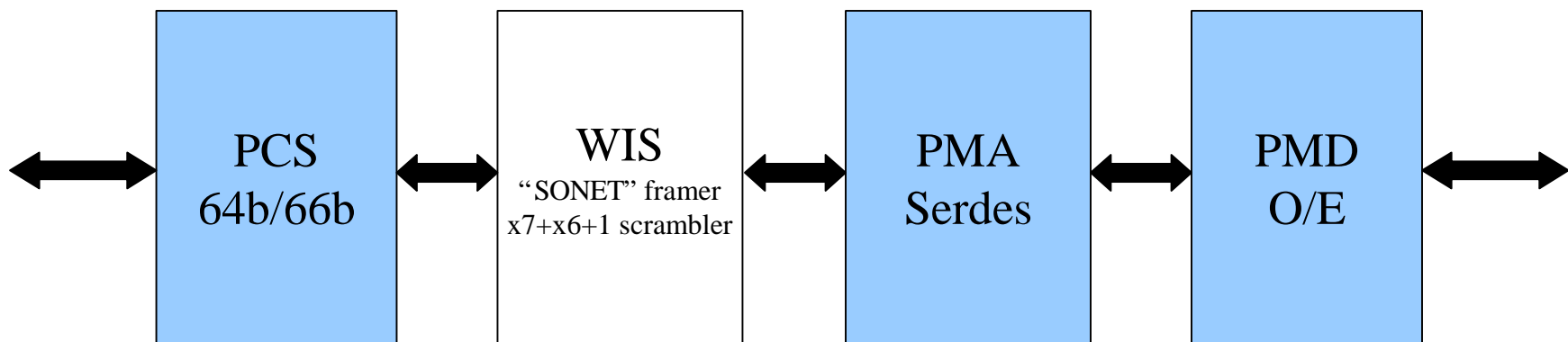
Our judgment is that the 3 PMD set is ready to move forward for detailed specification as a LAN/MAN standard – why wait?

Support for the Blue Book with 3 PMD Set: *Five Criteria Highlights*

- **Broad Market Potential:**
 - Serial 1550 nm for long reach, > 40 km SMF (MAN/WAN)
 - Serial 1310 nm for intermediate reach, 10 km SMF (LAN/MAN/WAN)
 - WWDM 1310 nm for short reach, 300m MMF, and intermediate reach, 10 km SMF (LAN/MAN)
- **Compatibility with IEEE 802.3 Standard:**
 - Full-Duplex MAC, MAC Client interface for 802.2 LLC, 802.1 Architecture, Management and Internetworking, 802 Functional Requirements, SNMP standards.
- **Distinct Identity:**
 - Each PMD has a unique application - but there is some useful overlap too.
- **Technical Feasibility:**
 - Numerous presentations have been made, models have been “agreed”, prototypes have been built and tested, products imminent.
- **Economic Feasibility:**
 - Proposal leverages OC-192 and Ethernet technologies, network architecture, management, software and structured cabling.
 - Target cost of 3 times 1000BASE-X challenging but possible.

Serial solution for LAN and WAN

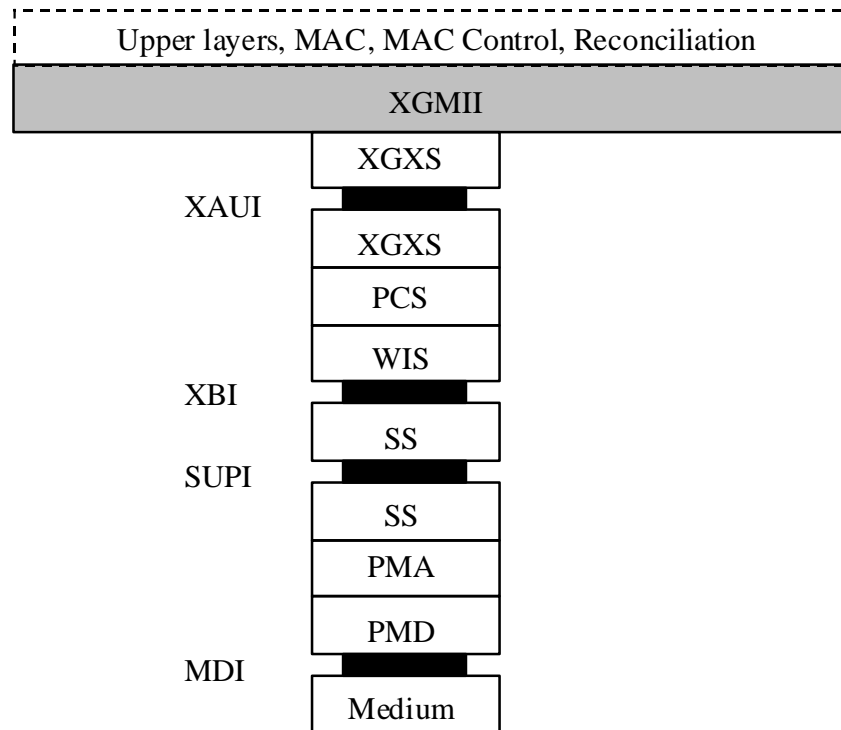
- 1310nm and 1550nm offer solutions for both LAN and WAN in SMF
 - LAN phy uses 64b/66b PCS for low overhead solution
 - WAN phy uses 64b/66b PCS for Ethernet frame encapsulation, WIS for Sonet framing
 - “UniPhy” covers distances to over 40km



Support for the Blue Book With 3 PMD Set: *What About 850 nm MMF-based PMD's?*

- We support the development of 850 nm MMF-based PMD's, however, we have concluded that these should be standardized in other forums that are short reach and interconnect application focused:
 - International Telecommunication Union (ITU)
 - Optical Internetworking Forum (OIF)
 - Fibre Channel (FC)
 - Infiniband (IB)
- Ethernet is LAN/MAN/WAN focused – not interconnect focused.

Support for the Blue Book with 3 PMD Set: *Layers and Interfaces*



Need detailed specifications for:

- Layers
- Interfaces

Interfaces very important, they will allow compatible 850 nm MMF-based transceivers to connect to 10 GBE systems too.

- There's a lot of work to do - let's move on!

Conclusion of Part 1

- We recommend supporting the Blue Book and the 3 PMD set.
- 850 nm, MMF-based PMD's should be standardized in ITU, OIF, FC and IB which can make better use of them.
- It is unreasonable to hold IEEE 802.3ae up for 850 nm, MMF-based PMD's which are better suited to other application spaces.
- Vote for the 3 PMD set in IEEE 802.3ae and get the standard moving.

Part 2:

Further test data supporting the
WWDM PMD proposal

1310nm WWDM System Tests

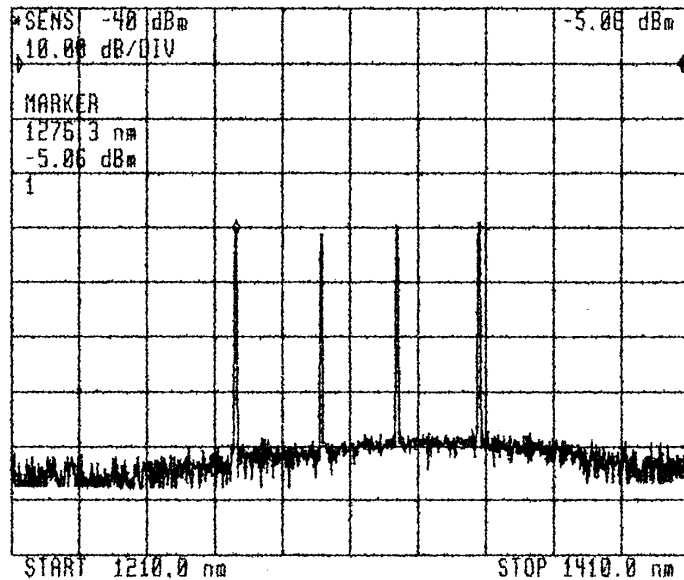
- 1310nm WWDM modules tested over the following fiber:-
 - 300 m over multi mode (Round Robin fiber from TIA Task Group 2.2 Cable Bandwidth).
 - 10km over single mode fiber.

1310nm WWDM System Tests

- Conditions used for the test:-
 - All four WWDM channels active
 - PRBS 2^7-1 bit pattern
 - For MMF, offset launch patch cord was used
 - Powers and wavelengths consistent with Del Hanson's three PMD proposal

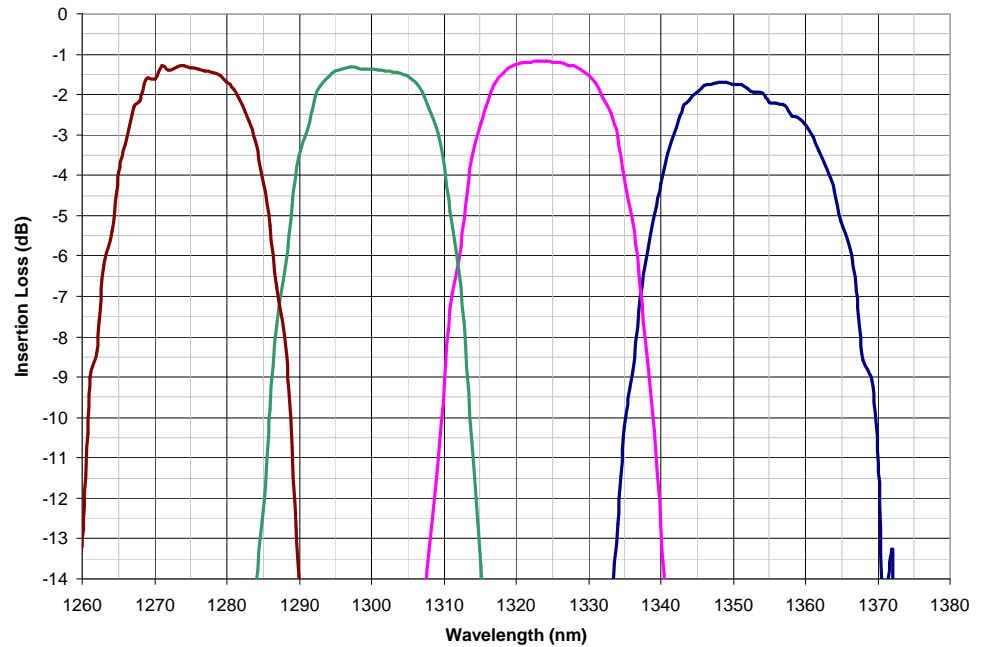
1310nm WWDM Wavelength Plan

Measured Transmit Spectral Output from Module



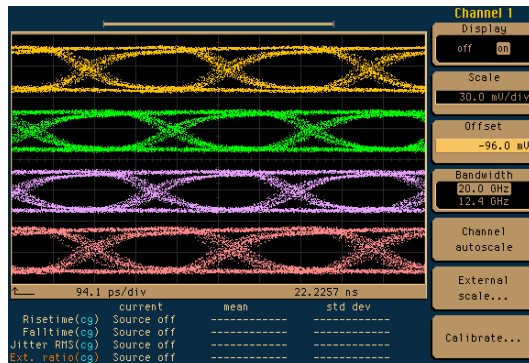
24.5nm Wavelength Spacing

Measured Receive Filter Response



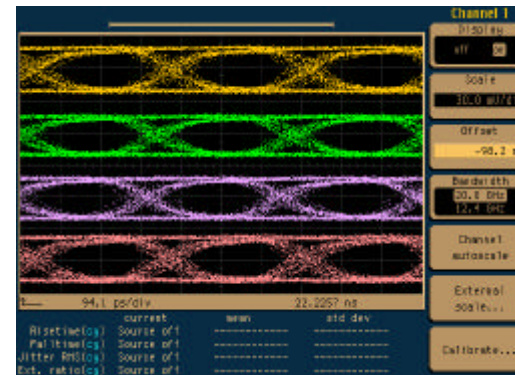
1310nm WWDM System Tests: *Results*

62.5um MMF Eye Patterns



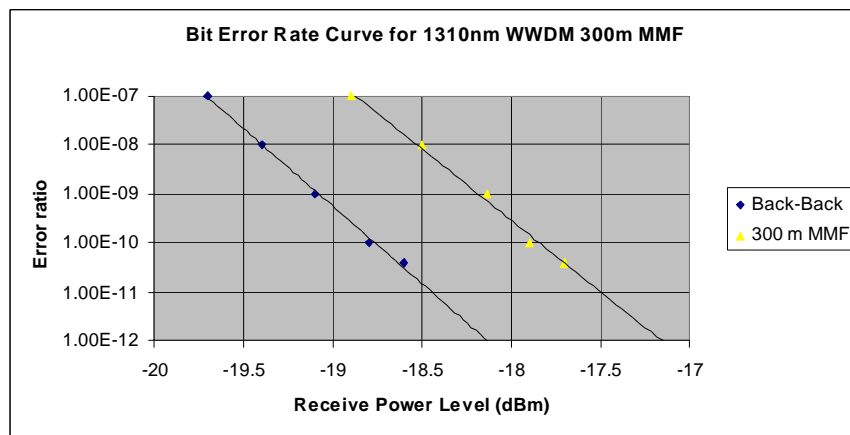
- 300m Fiber Length
- Off-set Launch Cable
- 2⁷-1 PRBS
- 3.125Gb/s Bit Rate
- All Receiver Outputs

SMF Eye Patterns



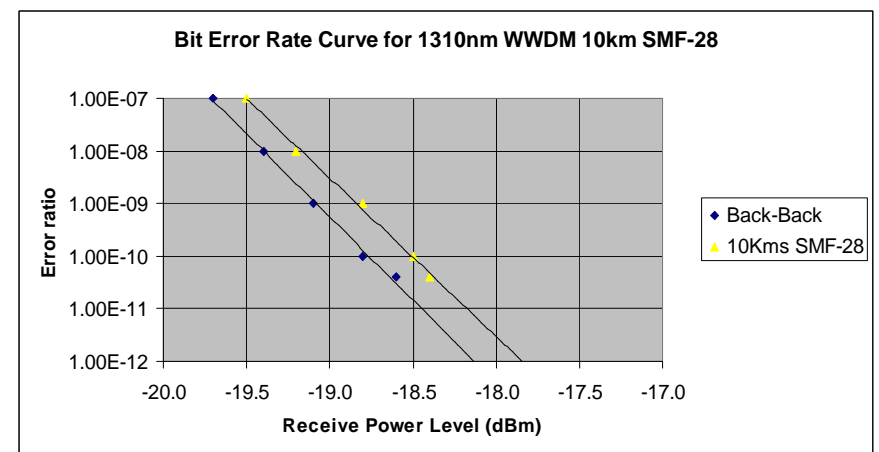
- 10km Fiber Length
- 2⁷-1 PRBS
- 3.125Gb/s Bit Rate
- All Receiver Outputs

1310nm WWDM System tests (MMF)



2⁷-1 Test pattern
 Off-set Launch Patch Cord, insertion loss ~ 0.5 dB
 TIA Task Group 2.2 Fibre (approx 470MHz*Km BW)

1310nm WWDM System tests (SMF)



2⁷-1 Test pattern

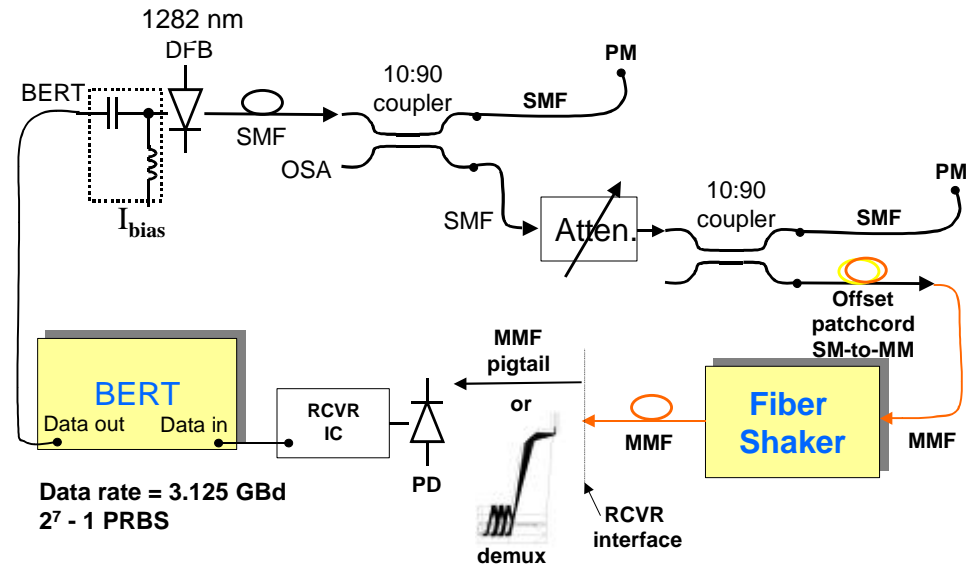
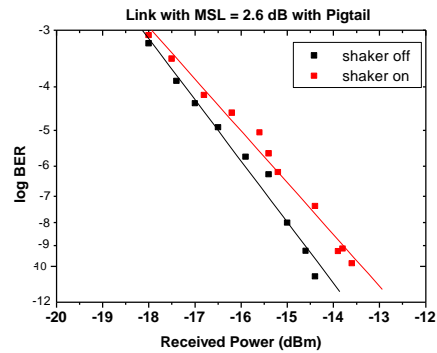
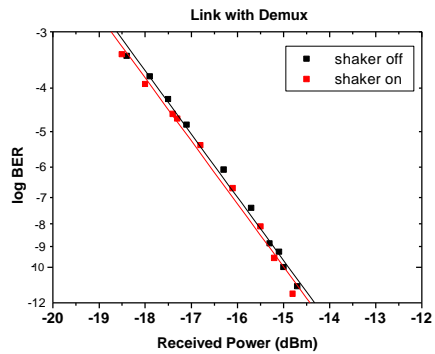
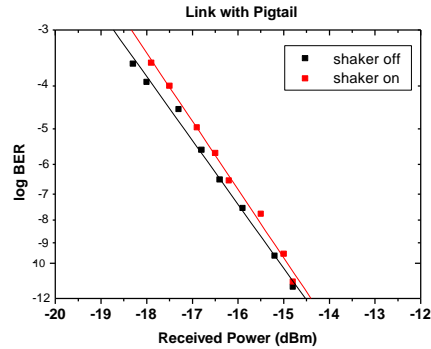
Modal Noise: *Demultiplexer Testing*

- The demux must be designed such that it introduces no additional modal noise power penalty.
- Modal Noise tests have been completed which confirm that the 4-channel molded-plastic demultiplexer used in the Agilent WWDM implementation introduces no additional modal noise power penalty.

Modal Noise: *Summary of Testing*

- Used Agilent Labs' WWDM prototype
- Used a DFB laser at ~1282 nm (worst case)
- Used an offset launch patchcord
- Used a fiber shaker per GBE and MNTMG
- Performed 5 consecutive sets of measurements per GBE and MNTMG
- Compared results to MMF pigtail and a real point of MSL

Modal Noise: *Test Setup & Results*



	Mean Power Penalty, dB
Pigtail	-0.1
De-mux	0.1
MSL	0.7

Measurement Variance ~ 0.1 dB