

A PMD for P2P links: Single or Dual Wavelength?

Tom Murphy
Infineon Technologies
IEEE 802.3ah
St Louis, MO. March 2002

thomas.murphy@infineon.com

Supporters

Bartur, Meir – Zonu

Brand, Richard – Nortel Networks

Cannata, Mark – Marconi

Effenberger, Frank – Quantum Bridge

Ivry, Raanan – Broadlight

Mc Cammon, Kent – SBC

Myers, Brock - Harmonic

Peng, Lisa – Corning

Radcliffe, Jerry – Hatteras Networks

Rotenstein, Sergiu – nBase

Stiscia, Jim – Virata

van Veen, Dora – Lucent

Contents

- 1 Introduction
- 2 Comparison Matrix
- 3 Technical issues
- 4 Cost issues
- 5 Field data
- 6 Summary

Introduction

Laser choices for single and dual wavelength single fibre P2P links

	1 Wavelength	2 Wavelength
Today	Two FPs at 1310 nm	FP at 1310 nm DFB at 1490 nm
Future	Two FPs/VCSELS at 1310 nm	FP and VCSEL or two VCSELS

We will show that a 1 wavelength PMD is the best solution for P2P single fibre links

Distributed Comparison Matrix

Single wavelength PMD advantageous for today and tomorrow

Issues	Today		Future	
	1 1	2 1	1 1	2 1
Tolerance of PMD to reflections Tx	0	0	0	0
Rx	0	1	0	1
Temperature performance	0	0	0	0
Power budget and distance considerations	0	1	0	1
P2P/P2MP Common ONU	0	0	0	0
Fewest variations of PMDs to track in field	1	0	1	0
Leverage of 1310 nm VCSELs from other applications	1	0	1	0
Volume considerations for laser	1	0	1	0
Use inexpensive TOSAs	1	0	0	0
Upgrade to wavelength overlay	1	0	1	0
Totals	5	2	4	2

Reflectance Issues

Manufacturing data shows same laser performance for 1&2 λ PMDs

	1 Wavelength	2 Wavelength
Laser	✓	✓
Receiver	Engineering issue ¹ . May require minor changes	✓

Both PMDs operate over 10 km and detect open connector reflections

¹http://grouper.ieee.org/groups/802/3/efm/public/jul01/presentations/bhatt_2_0701.pdf

Fewer PMDs in Standard

Single λ PMD reduces the number of components to track in the field

One PMD for P2P and P2MP

The “eggs laying, woolly milk pig” syndrome!!! A single PMD that meets all requirements is not really an option. Splitter losses for P2MP make this impractical and a P2MP to P2P migration implies electronic alterations requiring the end unit to be exchanged(?).

P2P links

A single λ PMD reduces the number of different types of units installed as the same module is used at both ends of the link. This also reduces logistics costs at manufacturing level.

Minimal inclusions to the PMD definition make it suitable for 100 Mbps

Cost Issues - Today

A single wavelength PMD has a significant cost advantage

Estimated Cost Comparison of Modules:

	Today
Single λ PMD TRx	100%
Single λ PMD TRx with full functionality (open connector detect)	100 to 110%
Dual λ PMD (with DFB)	200%

Cost Issues - Future

A single wavelength PMD also shows cost benefits in the future

- A two wavelength PMD where both λ 's are in the 1310 nm band requires two new sources which is counterproductive
- VCSELs operating at 1310 nm will be more cost effective than 1490/1550 nm because of volume issues which are influenced by PON and other technologies
- Possible to install the same module for 100 Mbps and 1 Gbps operation. This implies a 'no banana' upgrade and once again volume effects.
- Upgrade to a wavelength overlay for P2P is more cost effective with a single wavelength 1310/1310 nm PMD because of the increased guardband and hence relaxed WDM filter design

Field Data - 1

„NBase-Xyplex, a wholly owned division of MRV Communications, Inc., is a leader in providing complete solutions for creating end-to-end managed optical infrastructures. Over the last 3 years, NBase-Xyplex Fiber Driver provided the optical equipment that lighted more than 4,000 single fiber, full duplex, single mode single wavelength optical links using mainly the 1310 nm wavelength. These single fiber, single wavelength links covered distances from 10km to more than 100 km, enabling delivery of wide range of protocols and speeds from T1 (1.54 Mbps), to Fast and Gigabit Ethernet. As of this year, the equipment that lights these single fiber, single wavelength links incorporate sophisticated, yet inexpensive Reflection Detection technologies, that enable extremely fiber efficient network installation and buildup.“

Field Data - 2

„Marconi is a pioneer in the deployment of fiber optics in the last mile portion of the network. Over the past 5 years, Marconi has deployed more than 100,000 single fiber, full-duplex, single mode 1310nm optical links in the access network. As an integral part of the Deep Fiber FTTC system, these optical links have enabled the economical deployment of fiber to within a few hundred feet of each end user served from these networks. A last mile network designed and constructed in this manner enables enormous bandwidth delivery to end users, and, at an installed first cost that rivals the present methods of operation and deployment.“

Summary

- 1 A single wavelength, single fibre 1310/1310 nm PMD will work over a 10 km P2P link and detect open connector reflections
- 2 The advent of VCSELs will benefit both single and dual wavelength approaches with a single lambda 1310/1310 nm device having the advantage that higher volumes exist for 1310 nm
- 3 Today and in the future a cost advantage exists for a single wavelength device compared to a DFB based dual wavelength module
- 4 Details of networks based upon single wavelength, single fibre PMDs were presented