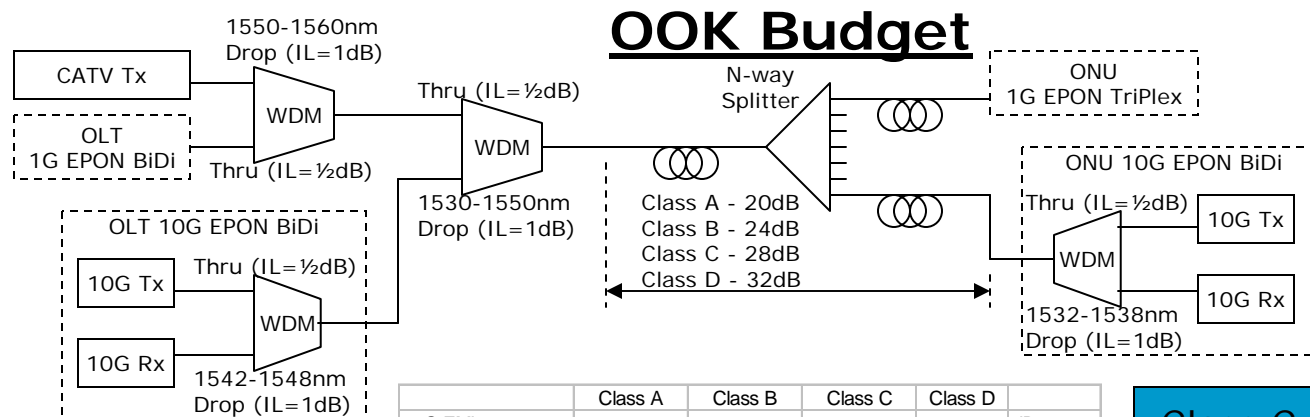


10G EPON PMD Considerations

Roger Merel

10G EPON – Technology Cautions

- ▶ We tend to simply fix the link by neglecting the power penalties, neglecting the WDM filter losses, & assuming that we can have extra dBm laser output.
- ▶ 10G EMLs tend to:
 - Be limited to ≤ 0 dBm output & affordable EMLs are ~ -4 dBm
 - Have power penalties of ~ 1.5 -2 dB
- ▶ 10G DMLs tend to:
 - Be limited to $\leq +5$ dBm & affordable DMLs are $\sim +1$ dBm
 - Have power penalties of ~ 4 -5 dB (@1550nm)



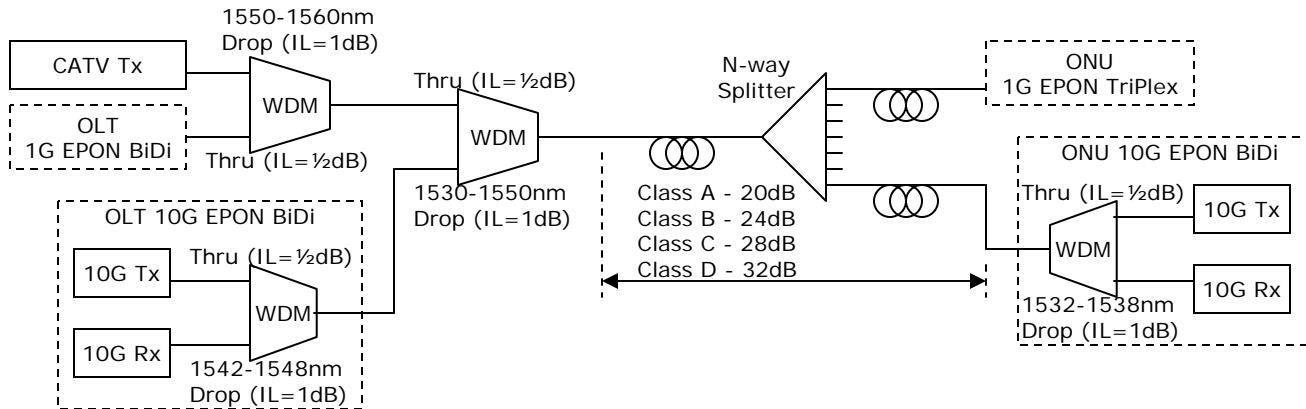
OOK Budget

	Class A	Class B	Class C	Class D	
10G EML	-4.0	-1.0	1.0	1.0	dBm
OLT WDM BiDi	-0.5	-0.5	-0.5	-0.5	dB
Ext WDM	-1.0	-1.0	-1.0	-1.0	dB
Path & Connector	-20.0	-24.0	-28.0	-32.0	dB
ONU WDM BiDi	-1.0	-1.0	-1.0	-1.0	dB
	-26.5	-27.5	-29.5	-33.5	dBm
10G Rx	-26.0	-26.0	-26.0	-26.0	dBm
Tx Penalty	2.0	2.0	2.0	2.0	dB
FEC	-4.5	-4.5	-4.5	-4.5	dB
	-28.5	-28.5	-28.5	-28.5	dBm
Margin / Shortage	2.0	1.0	-1.0	-5.0	dB
Optics used	SR-2+APD	IR-2+APD	LR-2	LR-2	
FEC used	BCH	BCH	BCH	BCH	

Class C & D don't work even with costly optics & FEC included for OOK.

10G EPON – PMD Consideration

- ▶ Selection of a “classic” PON PMD and wavelength plan will force support for discrete implementations at a relative costs of ~30x \$\$ for 10x the BW.
- ▶ Do not choose an plan which precludes monolithically integrated (multi-vendor) approaches which can enable a single die at a relative cost of ~3x \$\$ for 10x the BW.
- ▶ Improve economics by keeping laser power low and not requiring optical amplifiers.
- ▶ Utilize advanced modulation solutions (instead of OOK) such as DPSK or Coherent PSK which can offer link benefits of at least 3-10dB compared to OOK using APDs.



DPSK

Coherent PSK

	Class A	Class B	Class C	Class D		Class A	Class B	Class C	Class D	
10G DPSK Tx	-4.0	-4.0	-1.0	1.0	dBm	10G Ch-PSK Tx	-4.0	-4.0	-4.0	-4.0
OLT WDM BiDi	-0.5	-0.5	-0.5	-0.5	dB	OLT WDM BiDi	-0.5	-0.5	-0.5	-0.5
Ext WDM	-1.0	-1.0	-1.0	-1.0	dB	Ext WDM	-1.0	-1.0	-1.0	-1.0
Path & Connector	-20.0	-24.0	-28.0	-32.0	dB	Path & Connector	-20.0	-24.0	-28.0	-32.0
ONU WDM BiDi	-1.0	-1.0	-1.0	-1.0	dB	ONU WDM BiDi	-1.0	-1.0	-1.0	-1.0
	-26.5	-30.5	-31.5	-33.5	dBm		-26.5	-30.5	-34.5	-38.5
10G DSPK Rx	-29.0	-29.0	-29.0	-29.0	dBm	10G Ch-PSK Rx	-36.0	-36.0	-36.0	-36.0
Tx Penalty	2.0	2.0	2.0	2.0	dB	Tx Penalty	2.0	2.0	2.0	2.0
FEC	0.0	-4.5	-4.5	-4.5	dB	FEC	0.0	0.0	-4.5	-4.5
	-27.0	-31.5	-31.5	-31.5	dBm		-34.0	-34.0	-38.5	-38.5
Margin / Shortage	0.5	1.0	0.0	-2.0	dB	Margin / Shortage	7.5	3.5	4.0	0.0
FEC used	None	Yes	Yes	Yes		FEC used	None	None	Yes	Yes

10G EPON – Conclusions

- ▶ With integrated technology and advanced modulation seem to be able to support 10G symmetric for Class A/B/C and likely Class D.
- ▶ This will require further study and finding common ground between integrated optics vendors but provides the best long term economics.
- ▶ Potential to meet the entire 10G EPON “Wish List”