Testing of DWDM + CWDM high speed systems

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Need more bandwidth ?

xWDM - Class of WDM Devices

Wavelength Division Multiplexing (WDM) :

Access

2 channels

1310nm, 1550nm

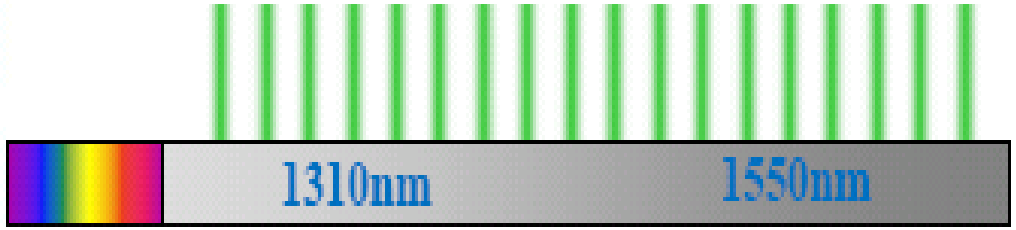
WDM

Coarse WDM (CWDM): MetroE, Mobile Backhaul

8 – 16 channels

Typical channel spacing 20nm

1271nm – 1611nm



CWDM

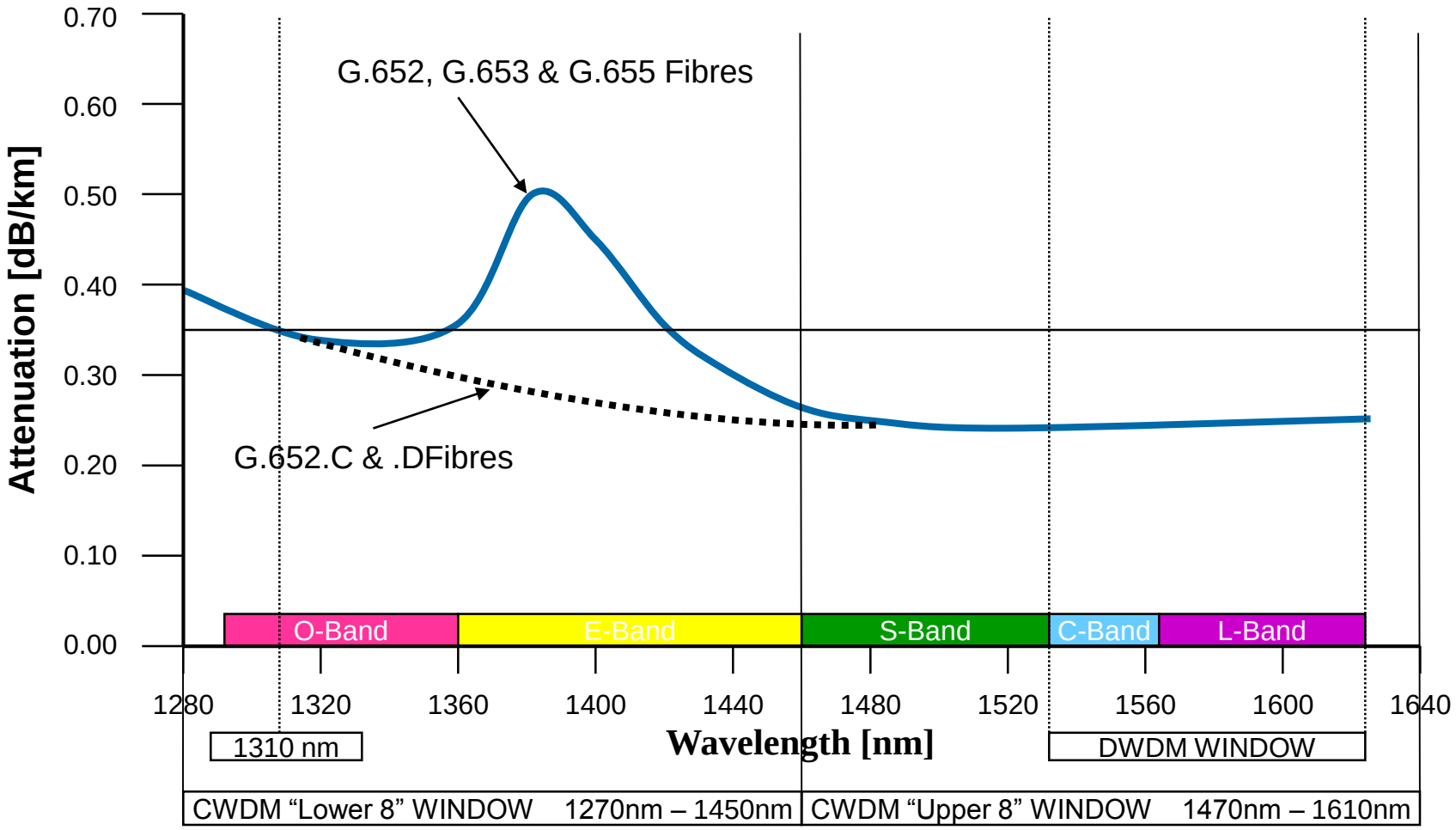
Dense WDM (DWDM): Long haul, MetroE, RPHY

Up to 160 – 320 channels

Typical spacing: 0.4 nm

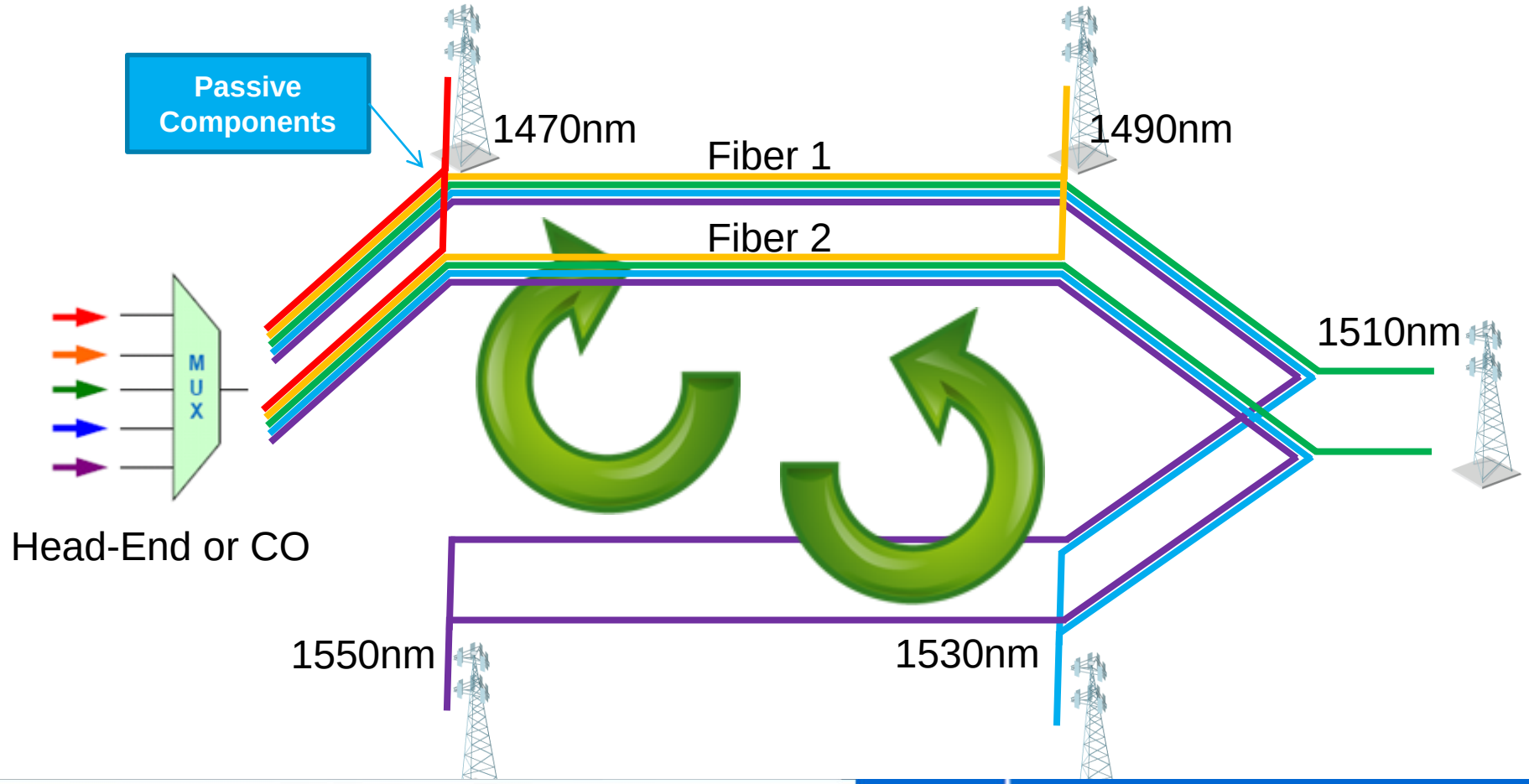
DWDM

xWDM - Class of WDM Devices



DWDM = EDFA’s, nearly unlimited reach
CWDM ≠ EDFA’s, upper 8 attenuation ~ 0.25dB/km, reach ~80 km (20dB)
CWDM ≠ EDFA’s, lower 8 attenuation ~ 0.40 – 0.50dB/km, reach ~40 - 50 km (20dB)

CWDM – Metro Ethernet ring type



CWDM - More Than 8 Customers?

Could turn up spare fibers if available

Could turn up lower 8 wavelengths

Higher attenuation - may not be able to reach customers

Non-uniform attenuation - loss budgeting more complex

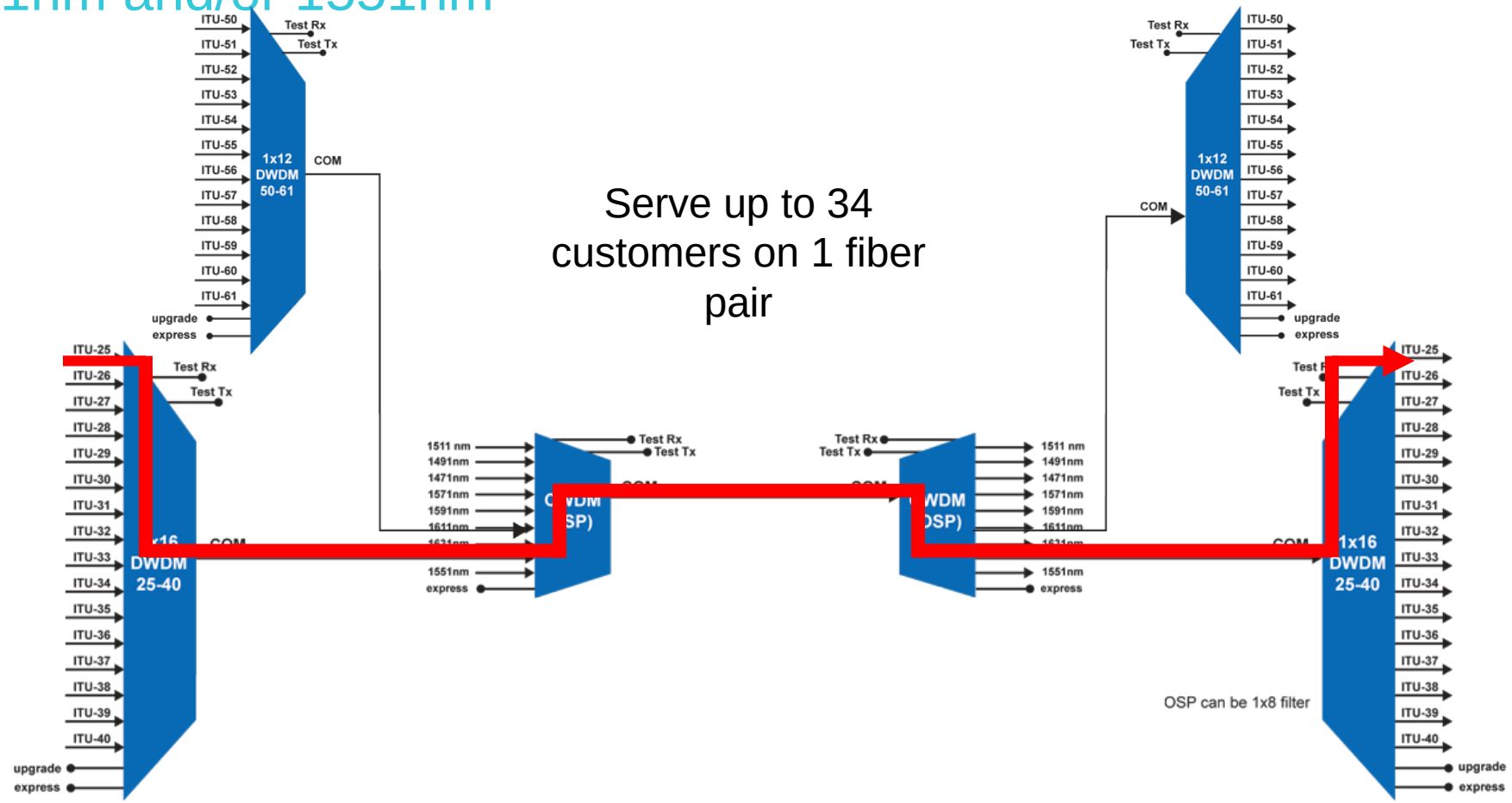
Could overlay additional DWDM channels - “DWDM over CWDM”

DWDM channels more costly than CWDM channels

Big bandwidth potential…a.k.a. support many new customers

DWDM over CWDM

Over 1531nm and/or 1551nm

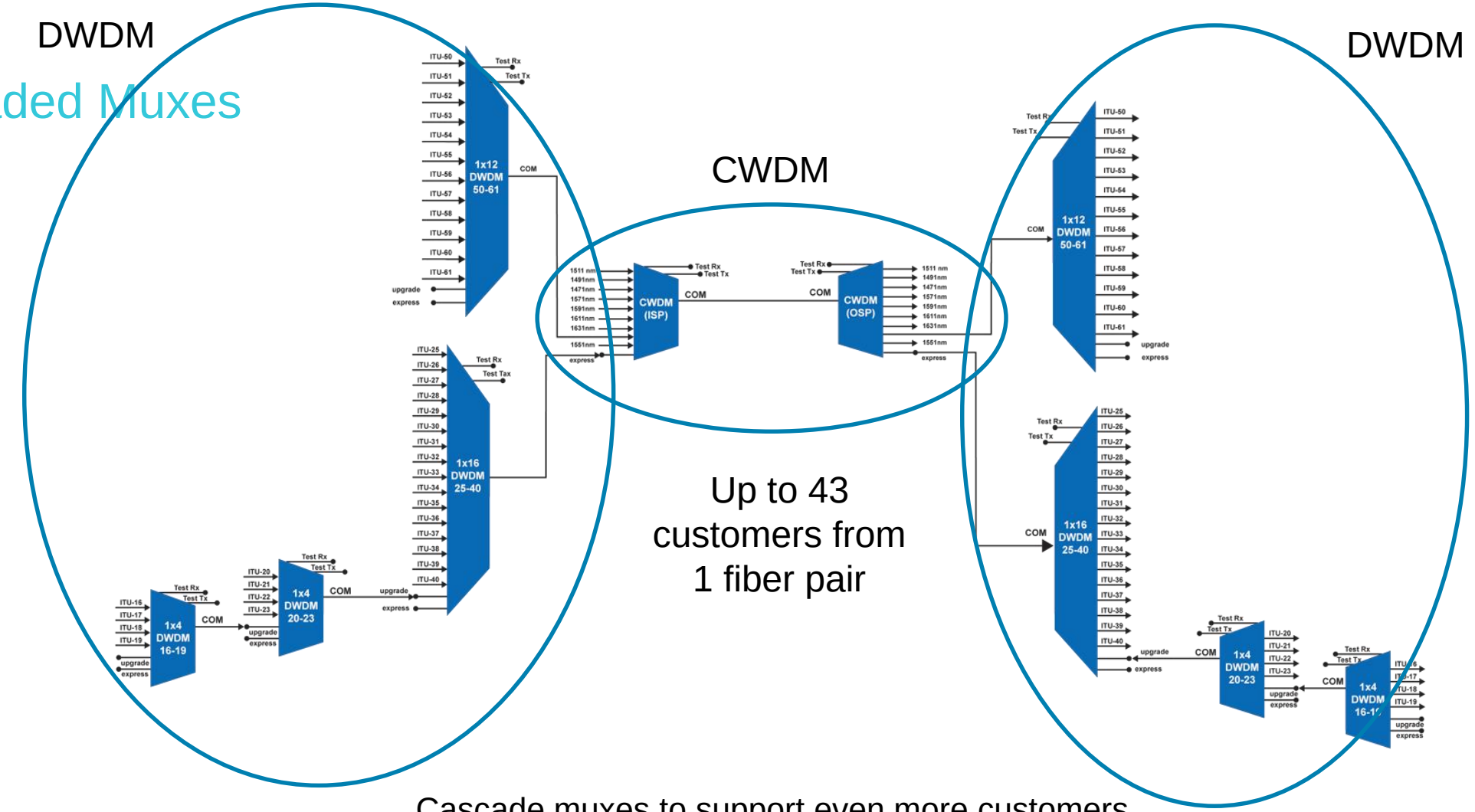


Sacrifice 1 CWDM channel (1551nm) to insert 16 DWDM channels
Could also sacrifice 2nd CWDM channel (1531nm to add 8 – 16 more)

DWDM over CWDM

DWDM

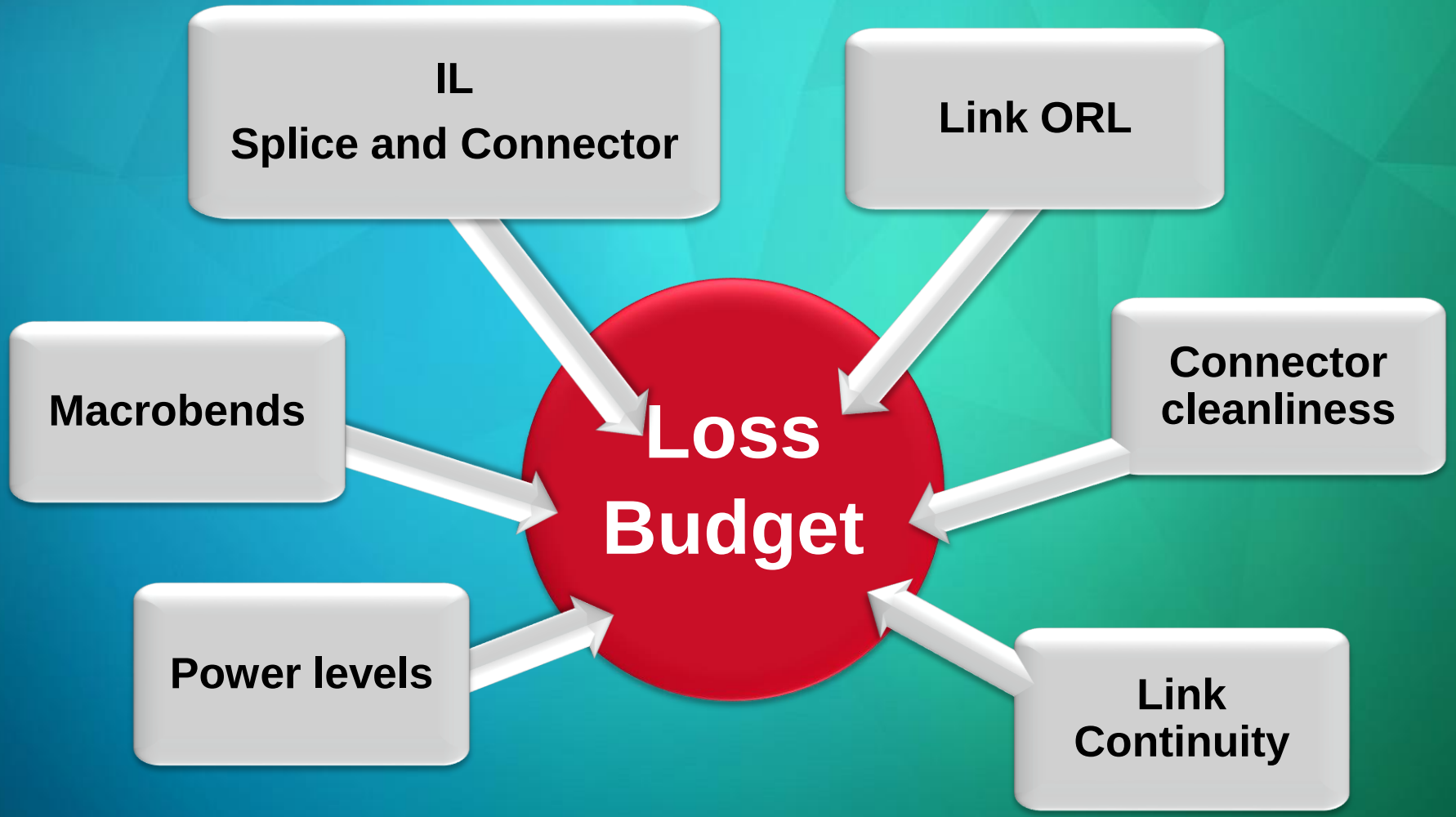
Cascaded Muxes



Cascade muxes to support even more customers

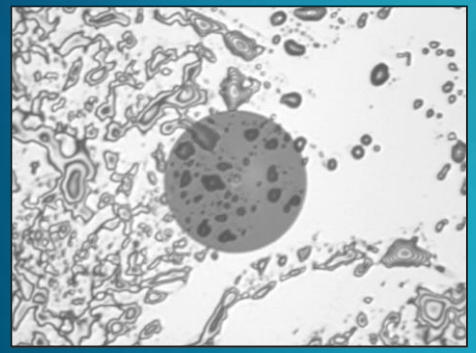
Many additional configurations possible

What to look for during the construction?

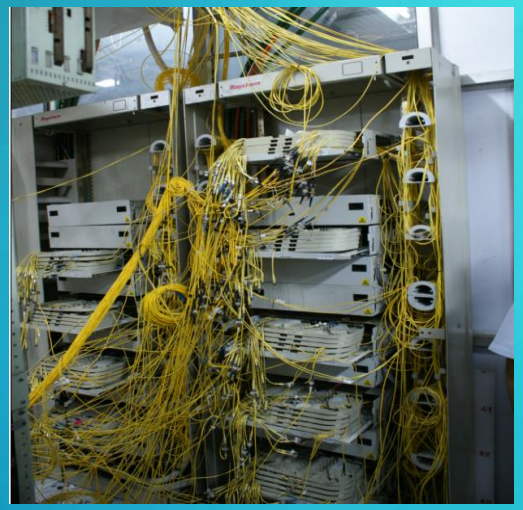


Fibers may impact your signals!

Dirty connectors

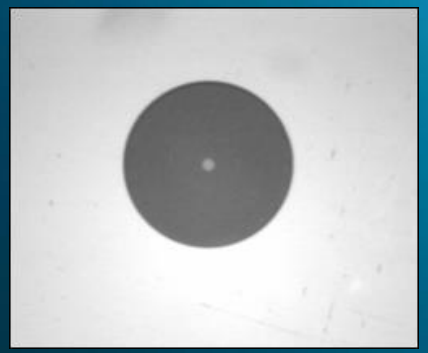


Macrobends



Fiber cuts / high loss

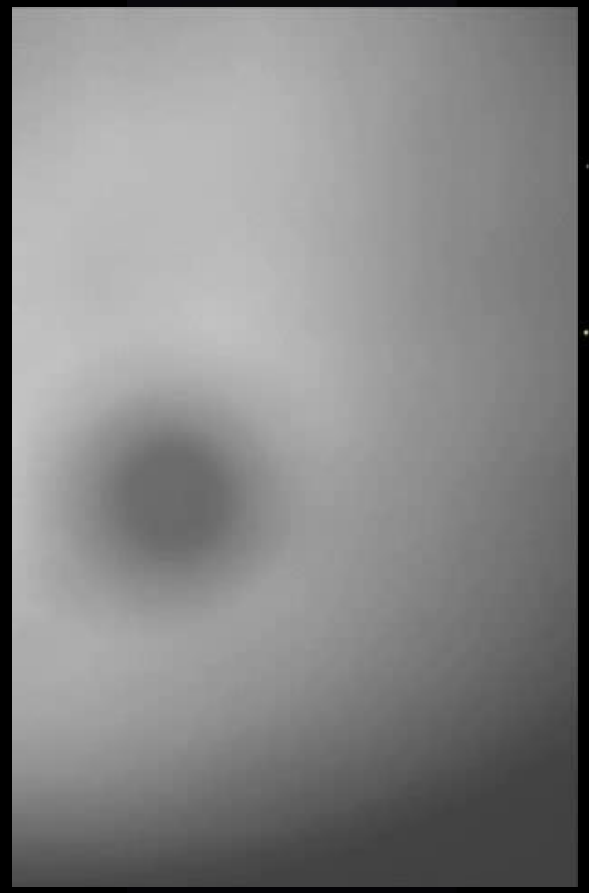
Clean connectors



Clean fiber management

CONNECTOR INSPECTION!

WHY AUTO CENTERING?



ConnectorMax2

1st Step

TO ANY FIBER TESTING

Testing Challenges

Muxes and Demuxes Are Wavelength Specific

Historical OTDRs and Light Sources Are Too Wide to “Fit” Through Filter Ports

CWDM Mux

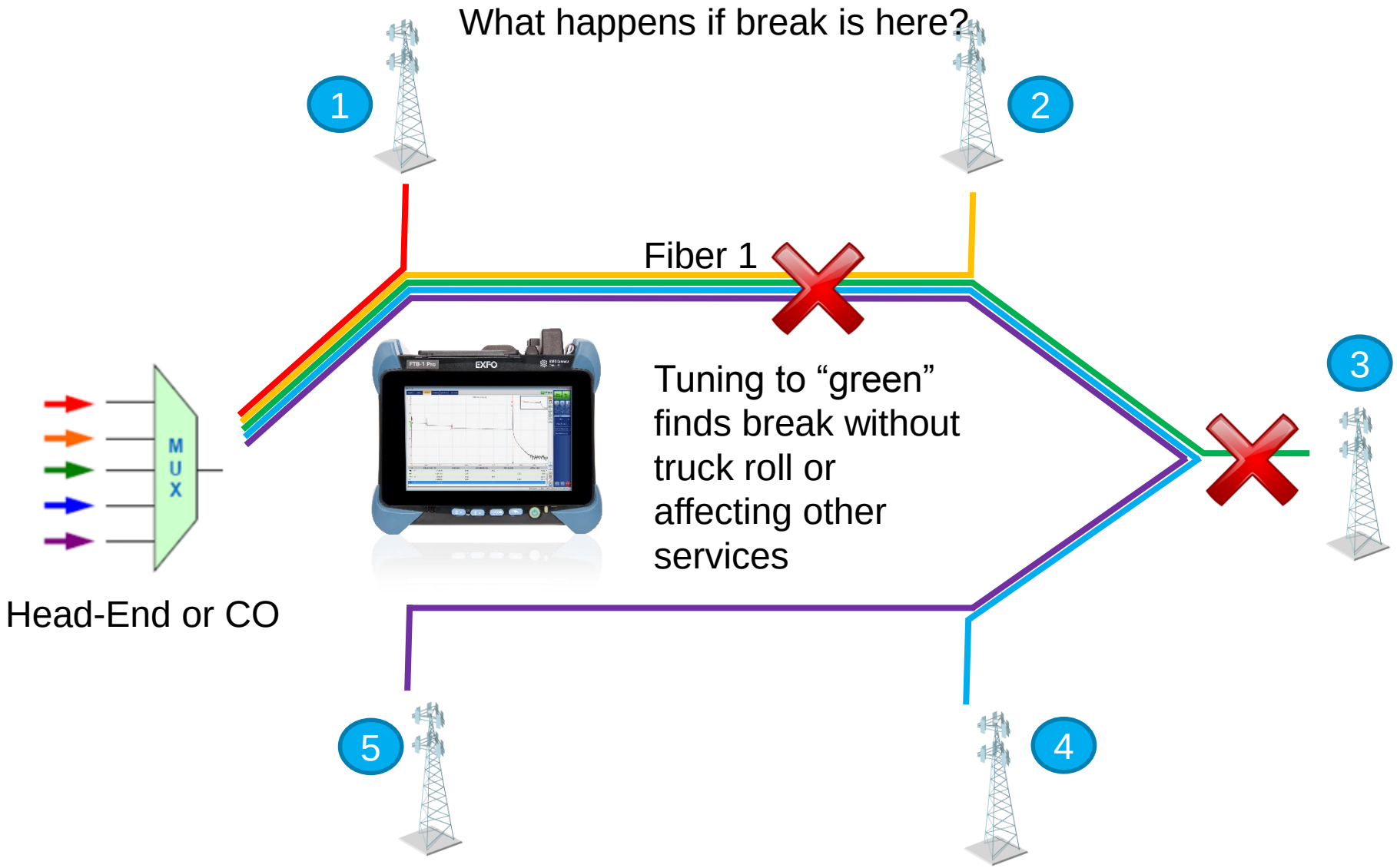
DWDM Mux

Typical OTDR Center λ “1550nm” ± 20nm
Typical OTDR Δλ = 10nm
Typical Light Source Center λ 1310nm or 1550nm
Typical Light Sources Δλ = 5nm

Traditional tools won’t pass through filters

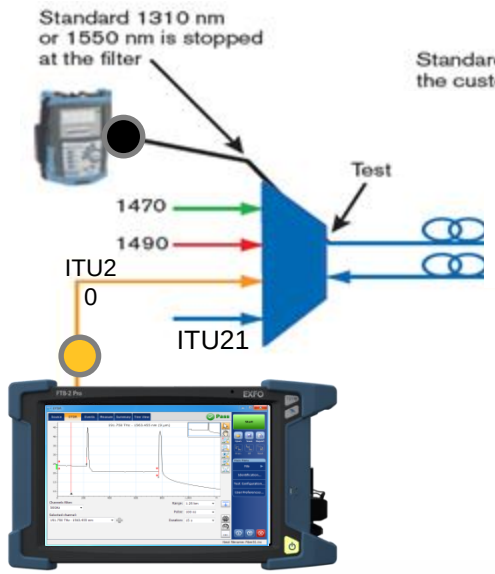
CWDM Test Tools

FTB-740C CWDM OTDRs Make Testing Simple

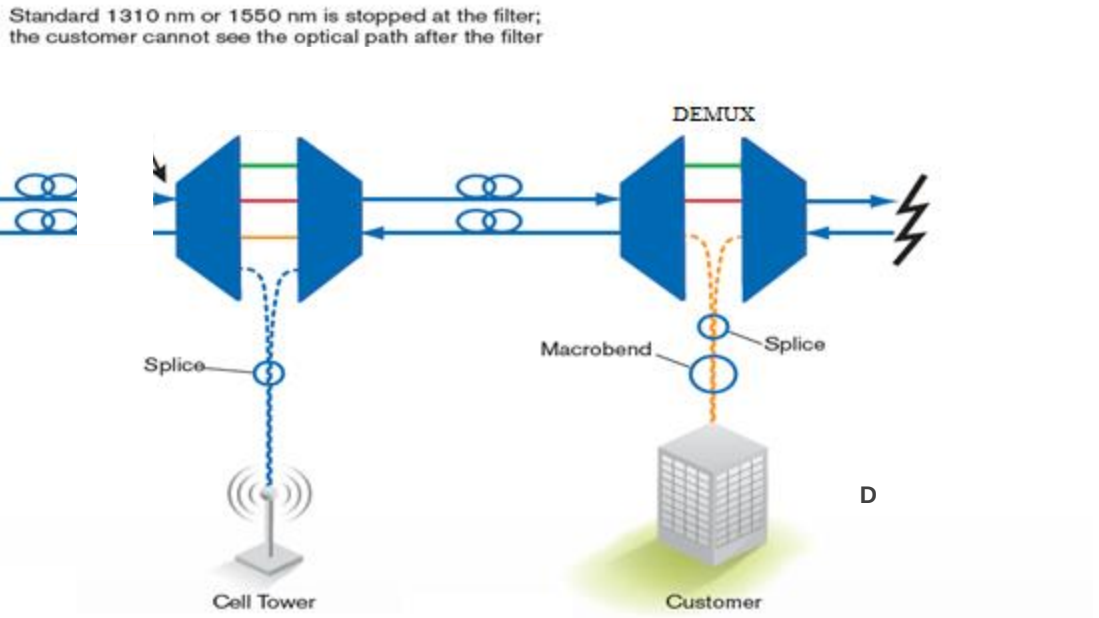


xWDM Troubleshooting

- Use the C/DWDM OTDR to **validate <u>continuity</u>** during construction **through the MUX/DEMUX** and get End-to-End budget loss
- Use the C/DWDM OTDR to **troubleshoot from the head-end**
- In-service testing using the customer's wvl port (ITU DWDM or CWDM)
- Single-ended CWDM/DWDM fiber characterization in one box



CWDM+DWDM modules



CHANGING THE WAY YOU TEST FIBERS

Get multiple OTDR fast acquisitions
@every pulses & @every wavelength

↓

Analyze OTDR traces

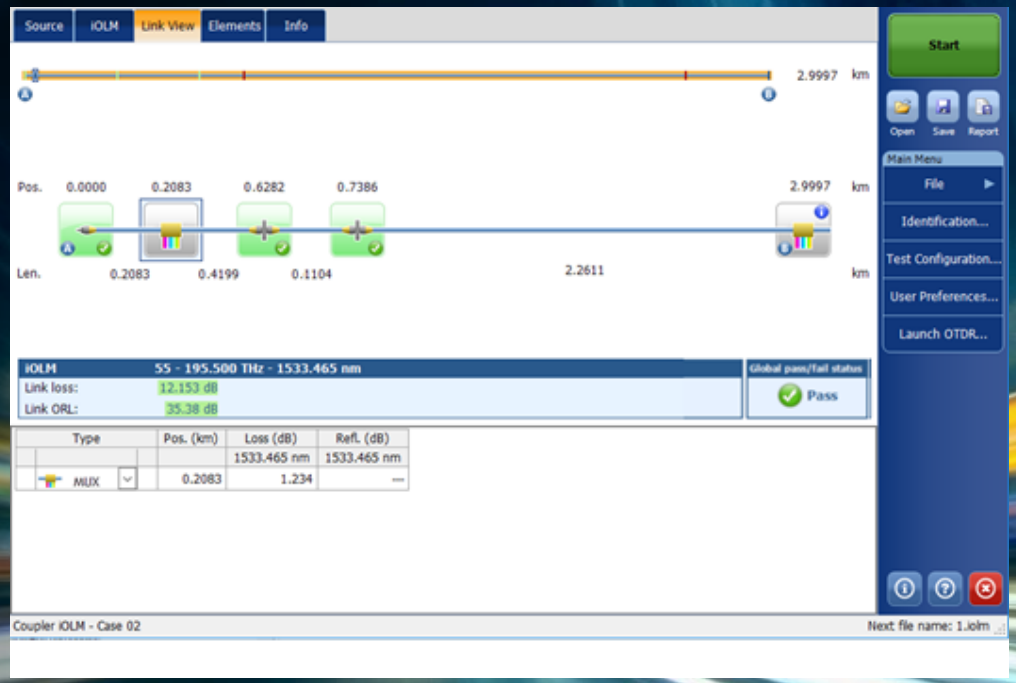
↓

Combine results

↓

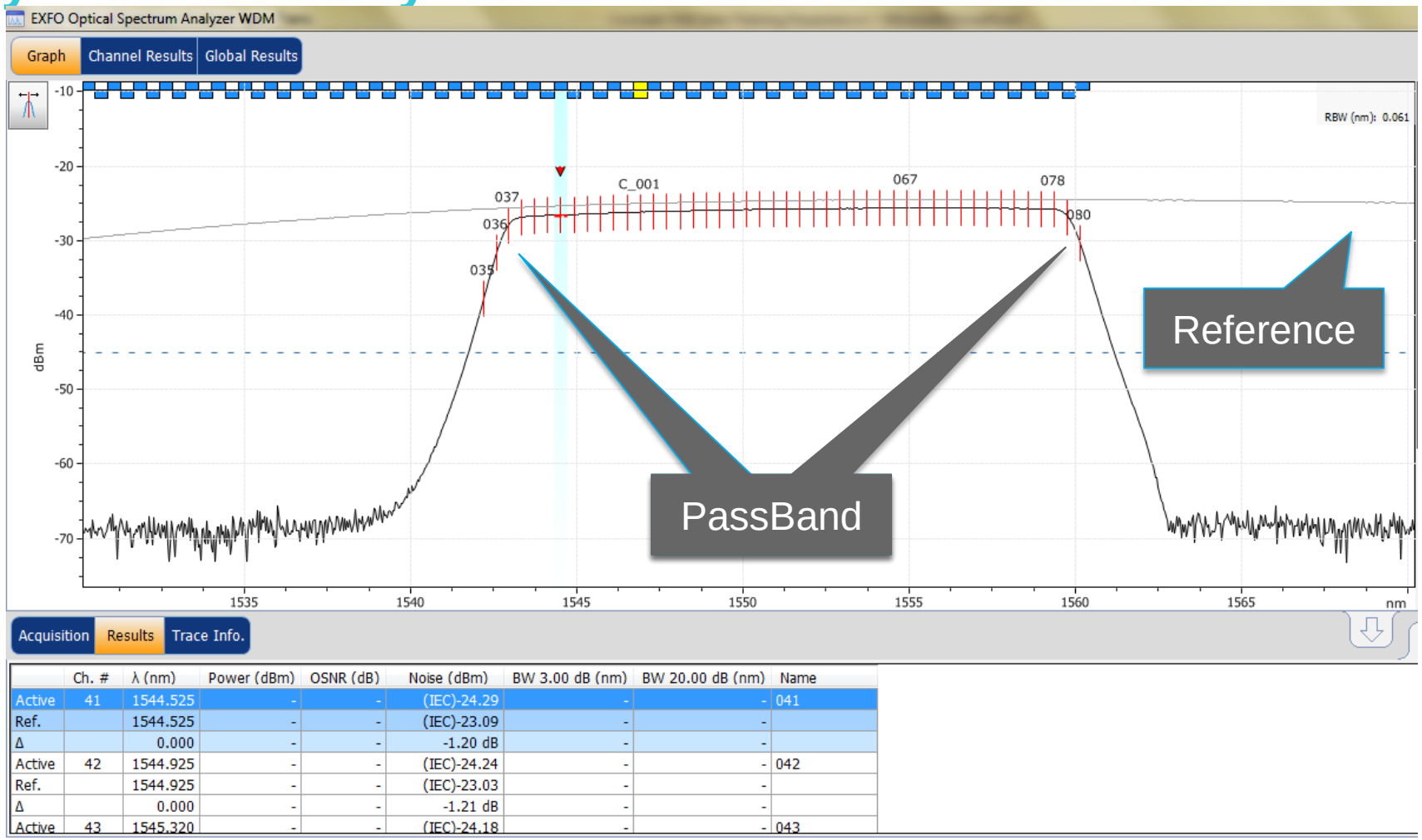
Display optical link view

LINK AWARE™ TECHNOLOGY



CWDM Test Tools

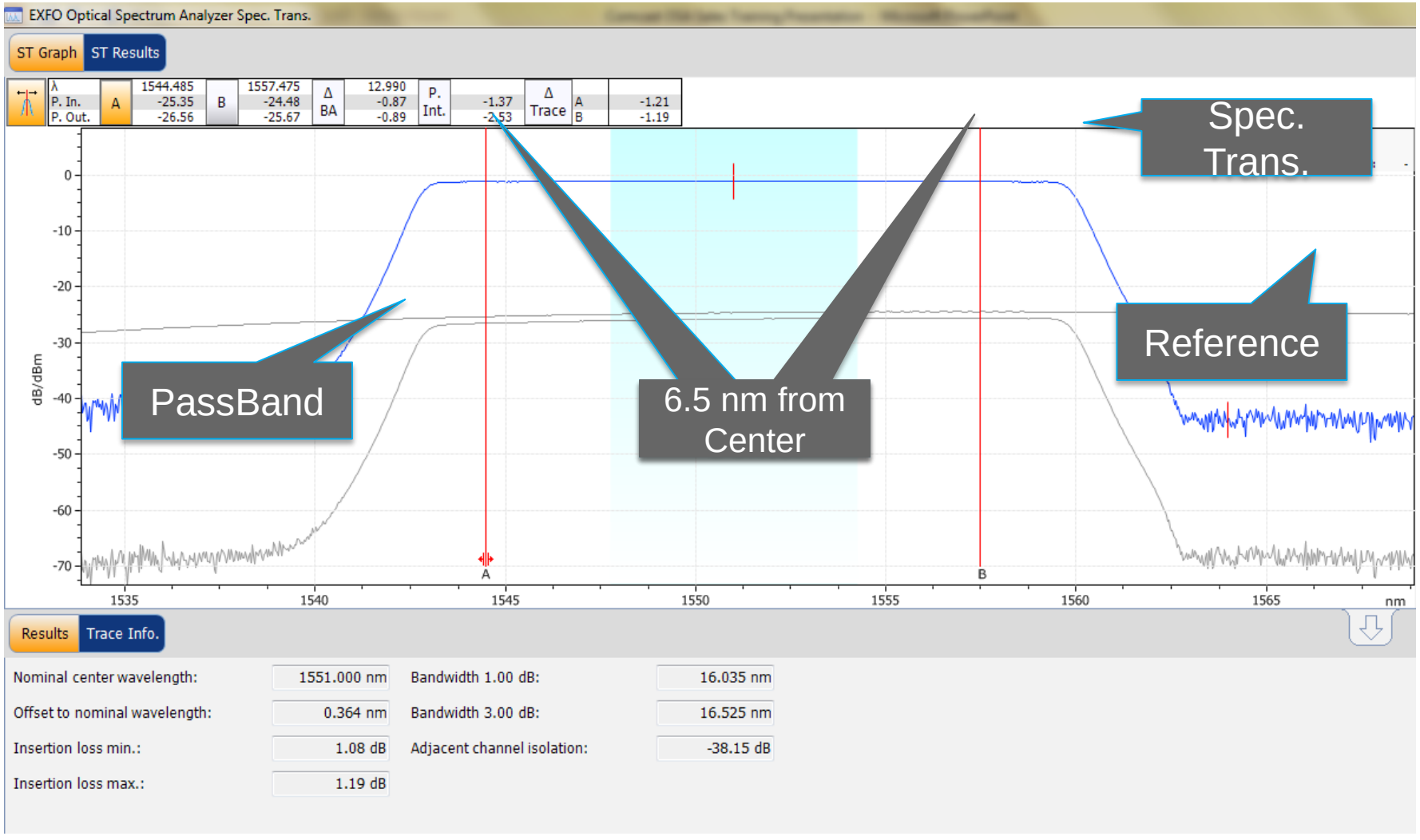
How Many DWDM Overlay Channels Can I Add?



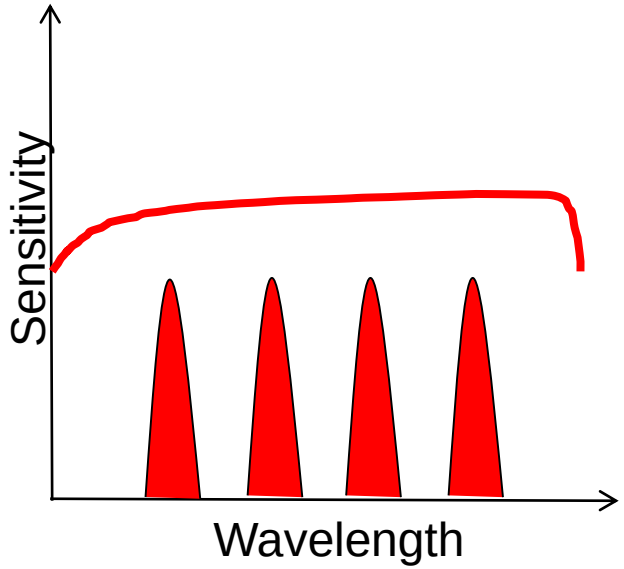
	Ch. #	λ (nm)	Power (dBm)	OSNR (dB)	Noise (dBm)	BW 3.00 dB (nm)	BW 20.00 dB (nm)	Name
Active	41	1544.525	-	-	(IEC)-24.29	-	-	041
Ref.		1544.525	-	-	(IEC)-23.09	-	-	
Δ		0.000	-	-	-1.20 dB	-	-	
Active	42	1544.925	-	-	(IEC)-24.24	-	-	042
Ref.		1544.925	-	-	(IEC)-23.03	-	-	
Δ		0.000	-	-	-1.21 dB	-	-	
Active	43	1545.320	-	-	(IEC)-24.18	-	-	043

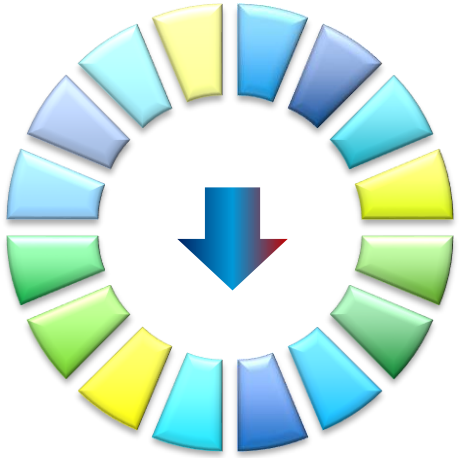
CWDM Test Tools

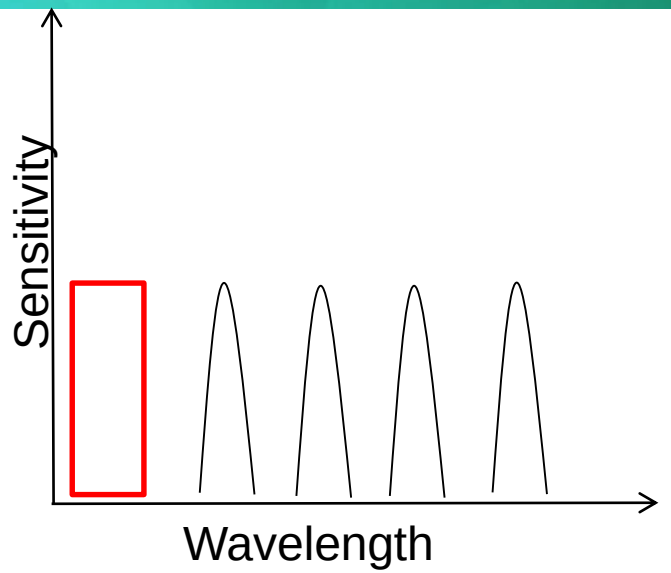
How Many DWDM Overlay Channels Can I Add?



PM vs. CWDM analyser vs. OSA

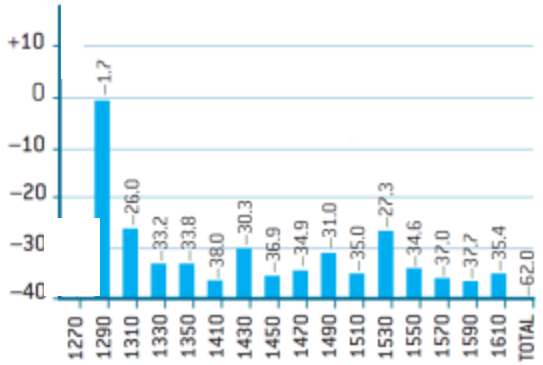




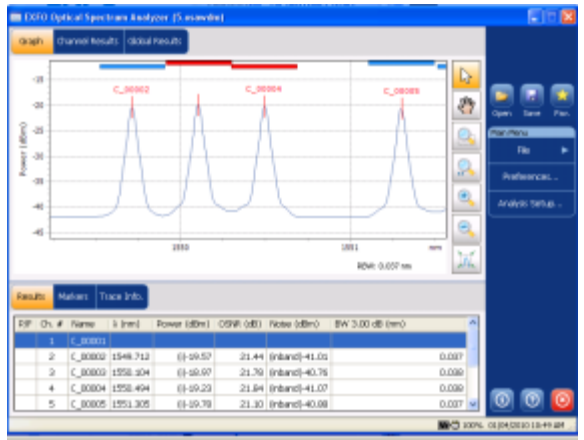


A power meter will mesure the TOTAL POWER

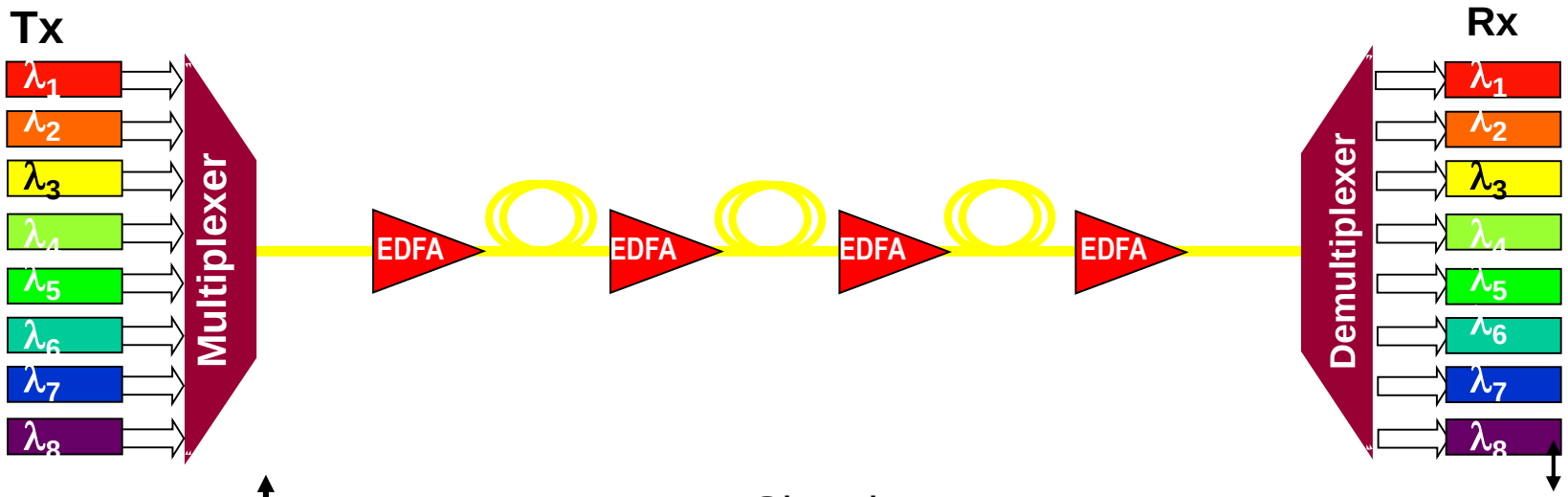
A FOT-5200 will measure the POWER per channel

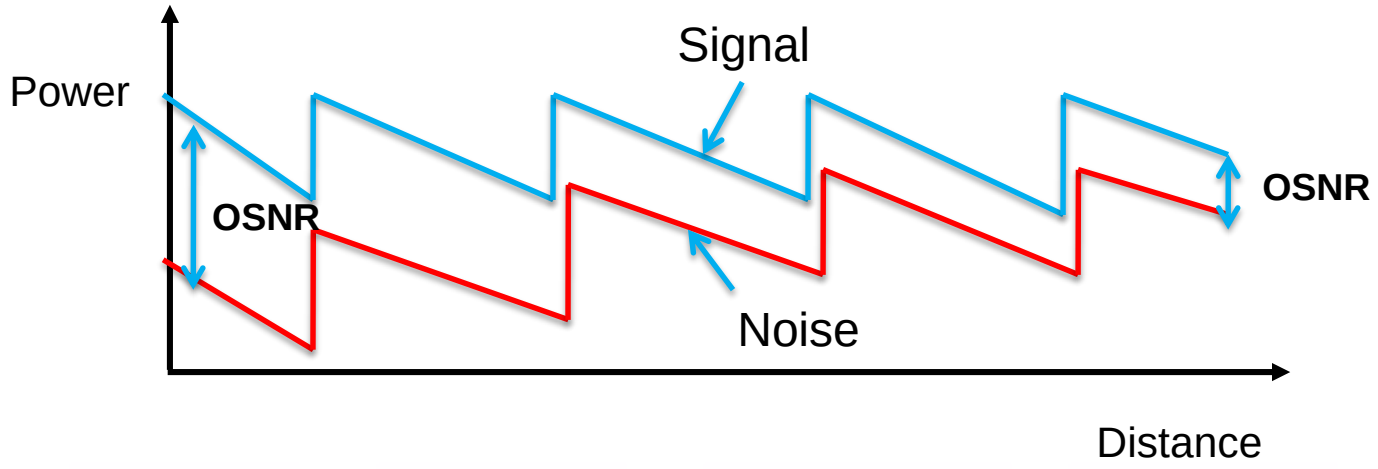


An OSA will measure the POWER versus wavelentgh Including OSNR & λ

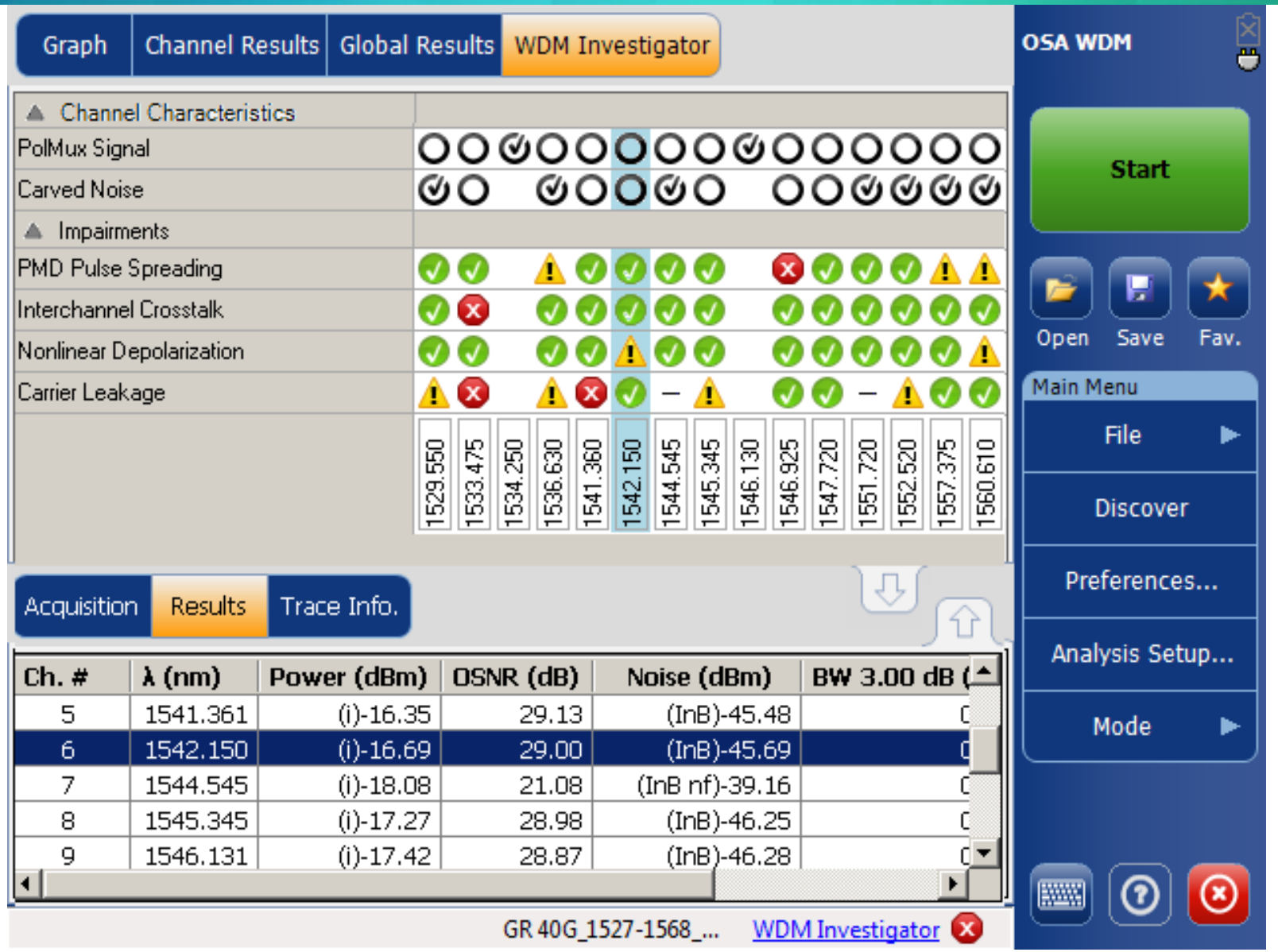


What is OSNR (Optical Signal to Noise Ratio)?





WDM Investigator



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- Optical Test and Measurement, Monitoring
- Fiber Cleaning and Inspection
- Fusion Splicers
- Time and Frequency Synchronization

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