



# Product Planning Guide

## Office Locations

**Minnetonka, Minnesota**  
**Thunder Bay, Ontario**

# Overview

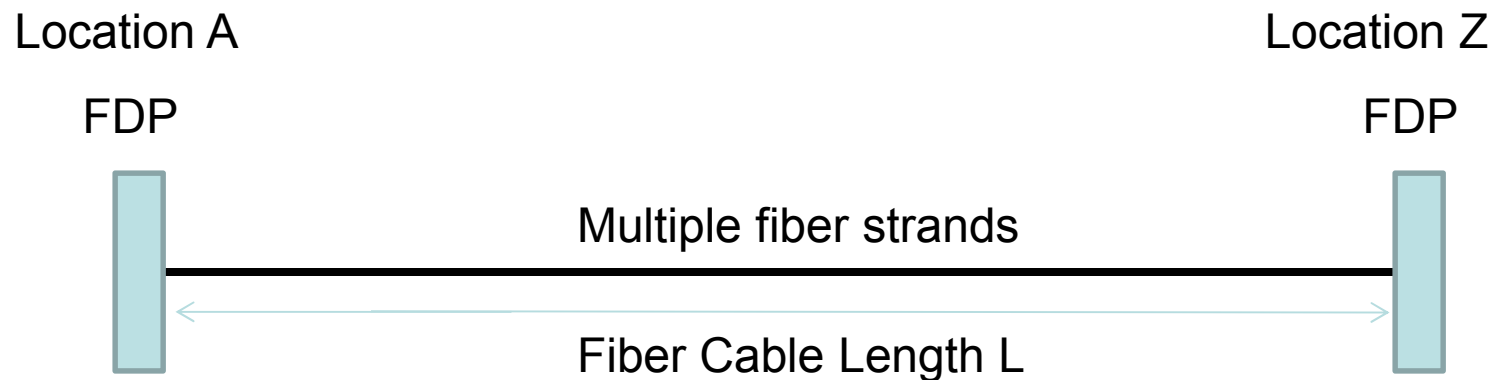
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**This guide explains how Telecom Engineering products and services can help expand your fiber optic network.**



# Typical Dark Fiber Link

Customer begins with a fiber cable with 1 or 2 available dark fiber strands between two end locations terminating in fiber distribution panels (FDP, a.k.a. fiber patch panels).



# DWDM Lite and CWDM Lite Multiplexers

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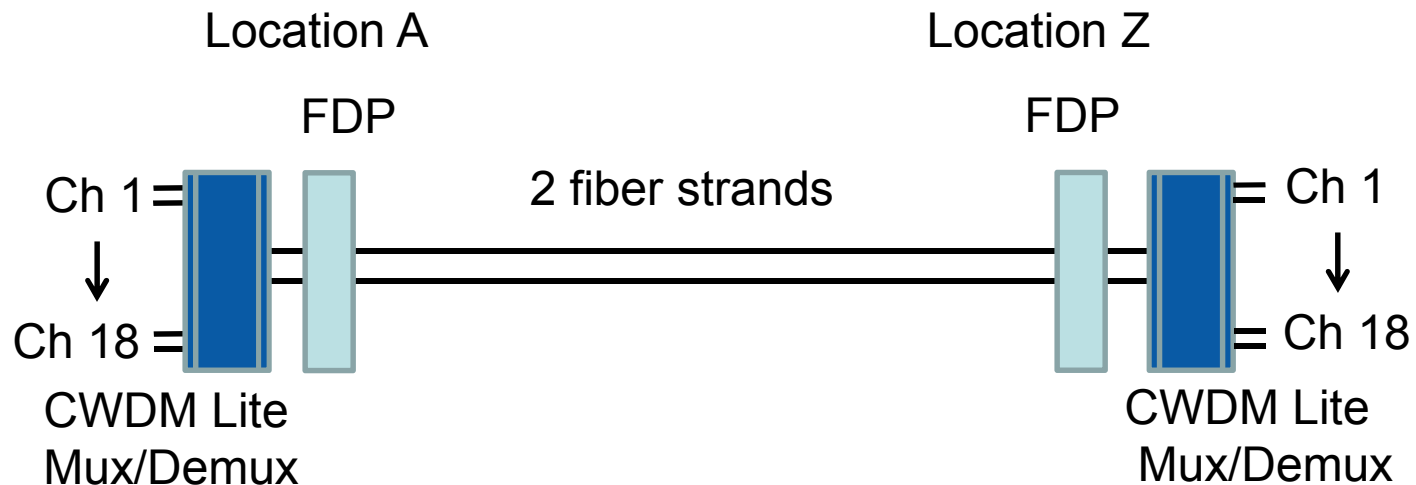
## Features:

- Standard DWDM 8, 16, 32, 40 and 44 channel multiplexers available with 100 GHz channel spacing. 88 channel system available using 50 GHz channels spacing. Optional 200 GHz channel spacing also available.
- Standard CWDM 4, 8 16 and 18 channel multiplexers available.
- Completely passive, do not require any power connection or cooling.
- Environmentally friendly and will not add load to your power plant
- Simple to install, operate and maintain, no configuration and no maintenance
- Transparent to all protocols, accepts all data rates up to 10Gbps, also 40G (DPSK, DQPSK) and 100G (DP-QPSK) capable (excluding OADM which is limited to 10G)
- Available for 2 network fibers or single fiber strand communication
- Fully universal accepts transmit and receive signals on any port
- ISO 9001 manufacturing, Telecordia GR-1209 and GR-1221 qualified
- 1310 nm window option available for most products
- *LifeTime Warranty*



# CWDM Lite Multiplexers (dual fiber)

Customer adds dual fiber CWDM Lite multiplexers to increase fiber link capacity up to a maximum of 18 channels (18 CWDM wavelengths 1271nm to 1611nm).



## Notes:

4ch (4wave) IL=2.4dB M&D pair;

8ch (8wave) IL=3.5dB M&D pair;

16ch (16wave) IL=4.8dB M&D pair

18ch (18wave) IL=5.2dB M&D pair



# CWDM Lite Multiplexers

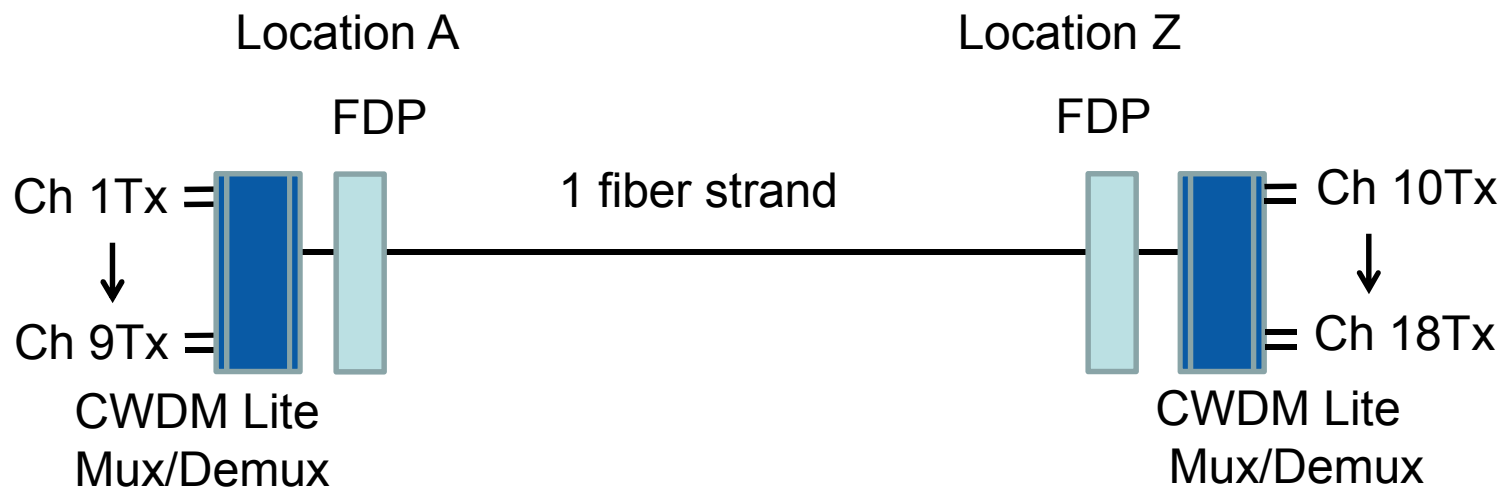
## 8 channel, dual fiber

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# CWDM Lite Multiplexers (single fiber)

Customer adds dual fiber CWDM Lite multiplexers to increase fiber link capacity to maximum 9 channels.



## Notes:

2ch (4wave) IL=2.4dB M&D pair;

4ch (8wave) IL=3.5dB M&D pair;

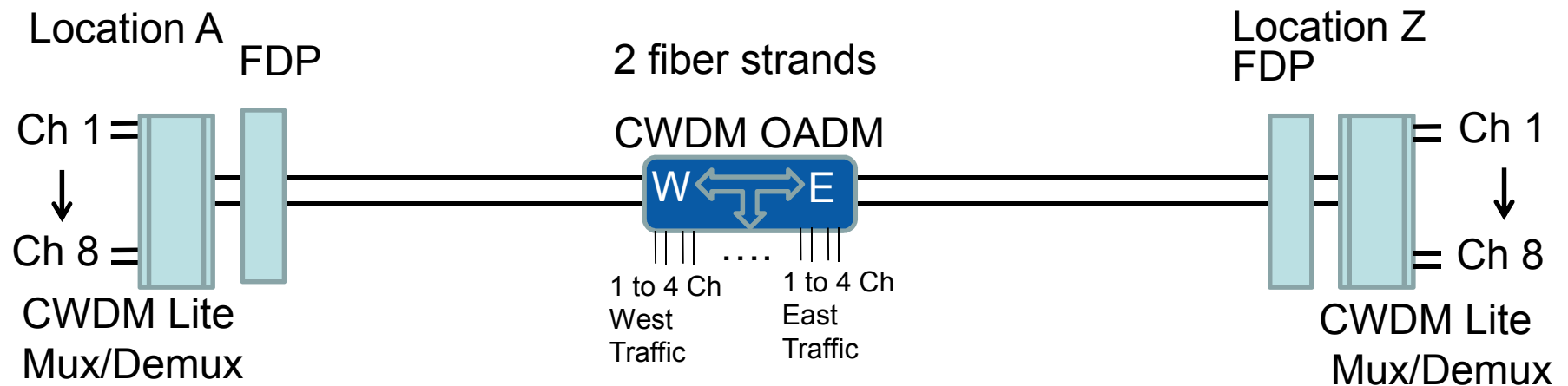
8ch (16wave) IL=4.8dB M&D pair

9ch (18wave) IL=5.2dB M&D pair



# CWDM Lite Optical Add/Drop Multiplexers OADM (dual fiber)

Customer inserts dual fiber CWDM Lite OADM multiplexer to add/drop 1 to 4 channels (1471nm to 1611nm only). Rate 10G and less.



## Notes:

2ch (2wave) IL WE=1.3dB, IL drop=1.3dB

4ch (4wave) IL WE=2.3dB, IL drop=1.5dB



# CWDM Lite OADM

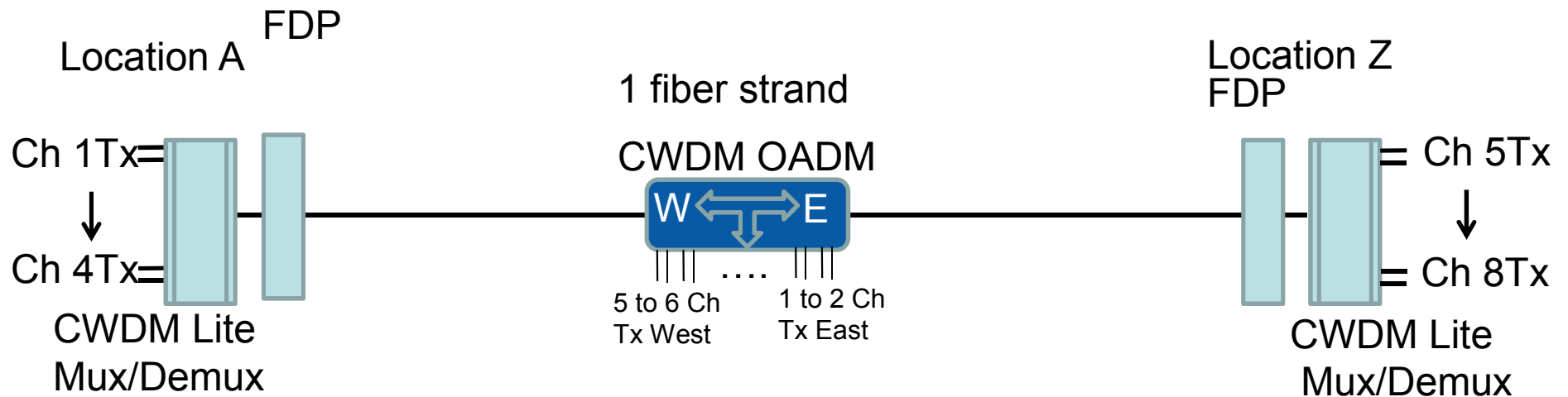
## 2 channel, dual fiber

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# CWDM Lite Optical Add/Drop Multiplexers OADM (single fiber)

Customer inserts dual fiber CWDM Lite OADM multiplexer to add/drop 1 to 2 channels (1471nm to 1611nm only). Rate 10G and less.



## Notes:

1ch (2wave) IL WE=1.3dB, IL drop=1.3dB

2ch (4wave) IL WE=2.3dB, IL drop=1.5dB



# CWDM Lite OADM

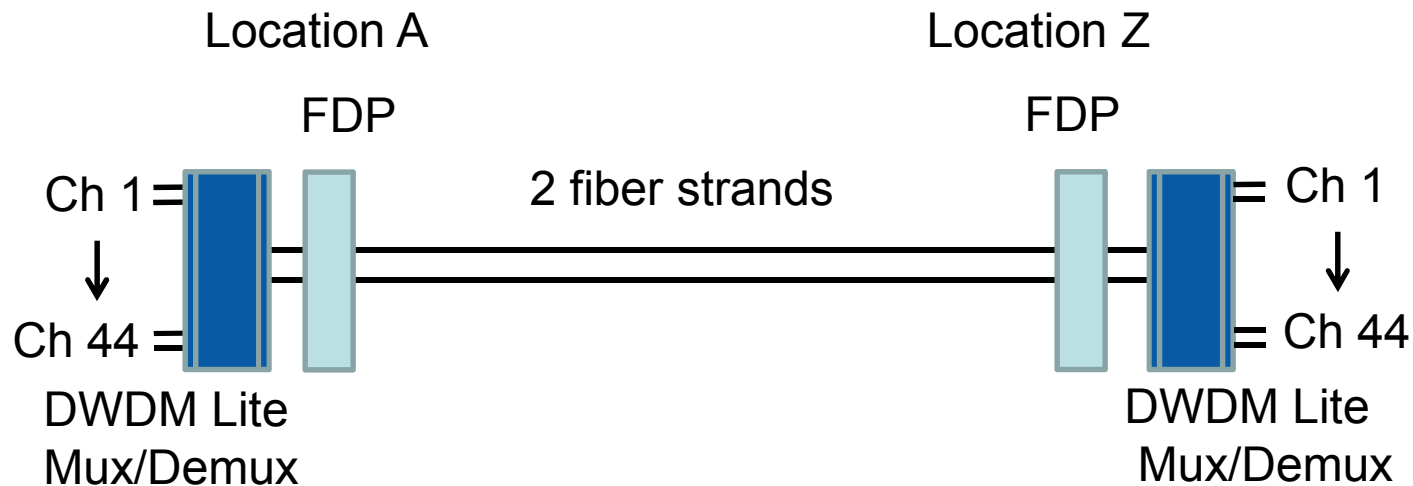
## 2 channel, single fiber

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# DWDM Lite Multiplexers (dual fiber)

Customer adds dual fiber DWDM Lite multiplexers to increase fiber link capacity to maximum 44 channels 100 GHz ch spacing (optional 50 GHz channel spacing with 88 channel mux/demux is available).



## Notes:

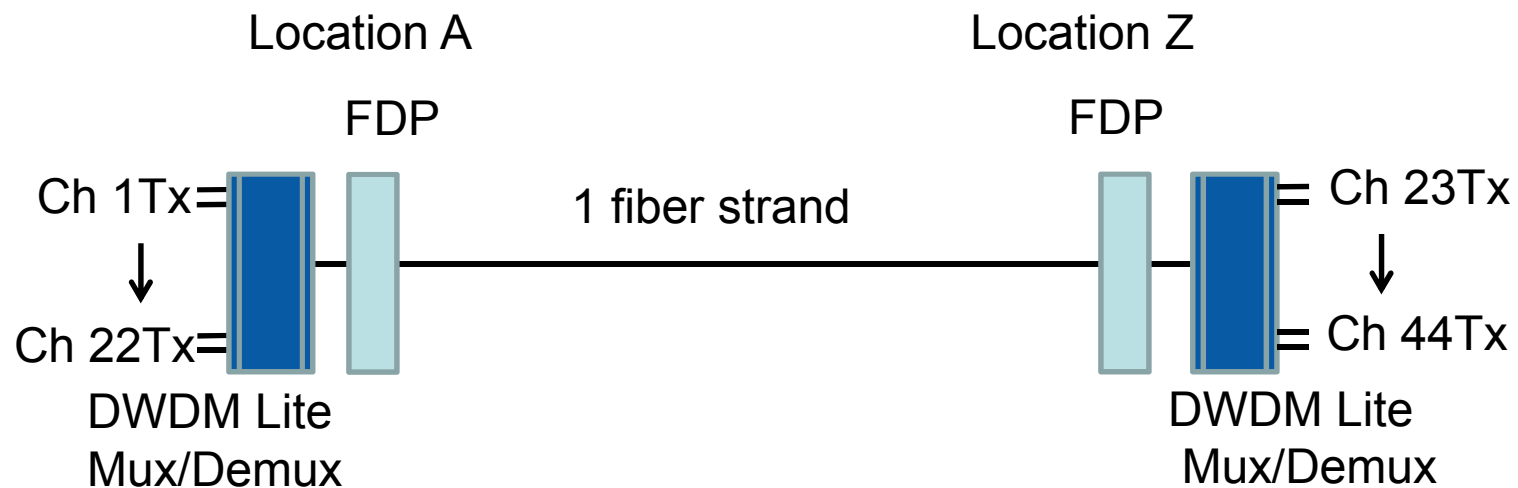
8ch (8wave) IL=4.5dB M&D pair; 32ch (32wave) IL=6.3dB M&D pair

16ch (16wave) IL=6.0dB M&D pair; 44ch (44wave) IL=7.5dB M&D pair



# DWDM Lite Multiplexers (single fiber)

Customer adds dual fiber DWDM Lite multiplexers to increase fiber link capacity to maximum 22 channels.

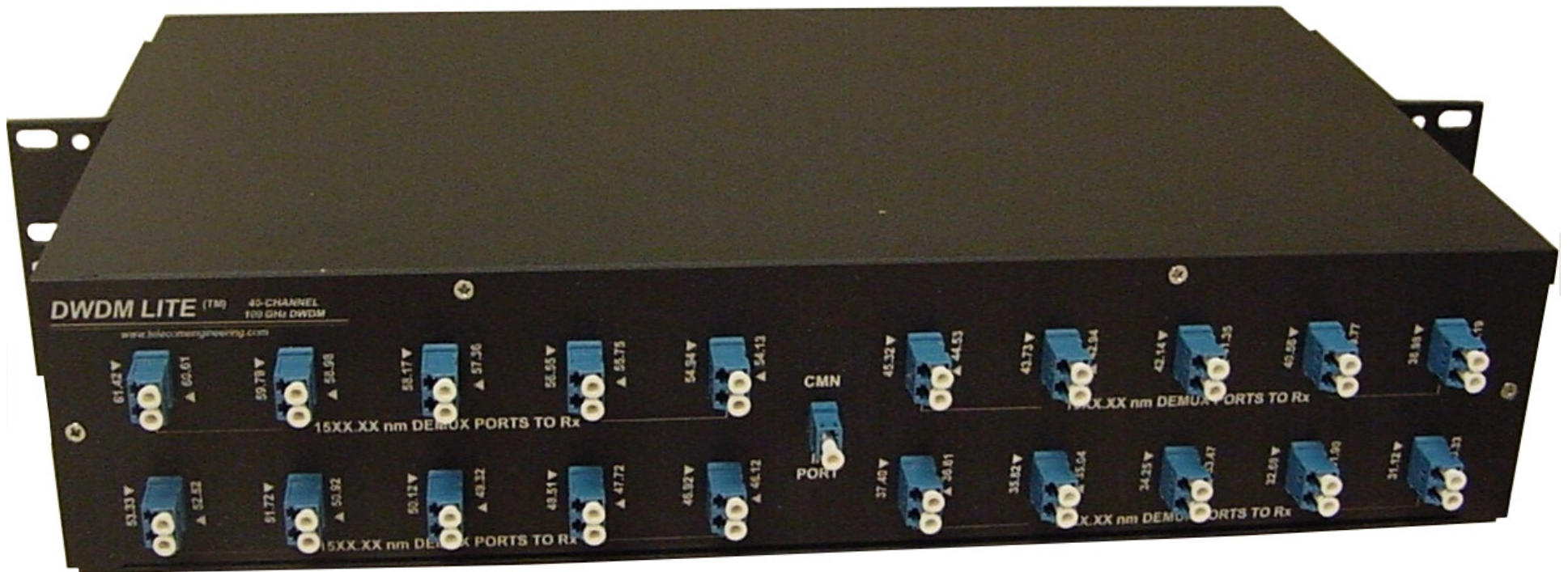


## Notes:

4ch (8wave) IL=4.5dB M&D pair;      16ch (32wave) IL=6.3dB M&D pair  
8ch (16wave) IL=6.0dB M&D pair;      22ch (44wave) IL=7.5dB M&D pair

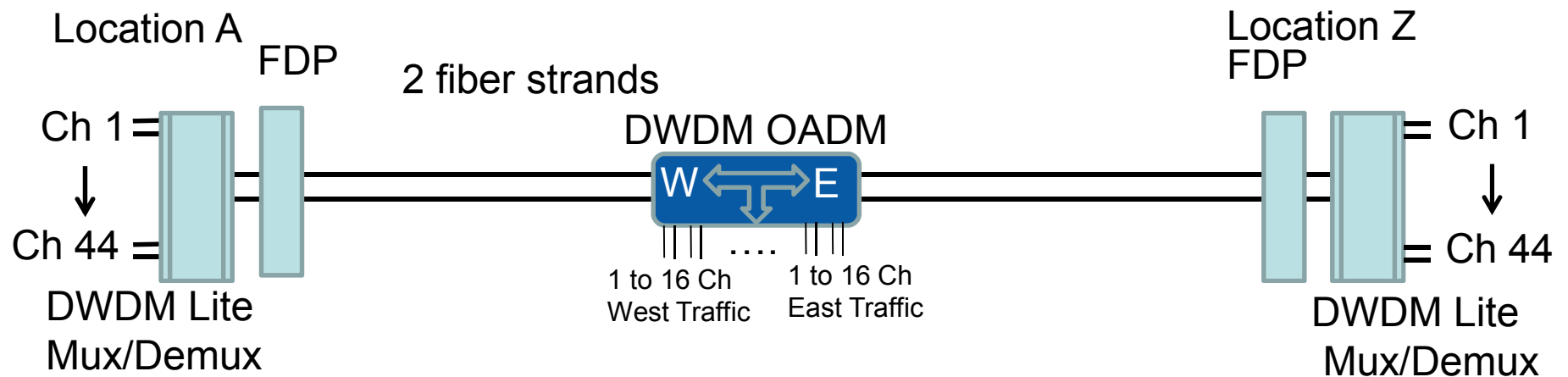


# DWDM Lite Multiplexers 40 channel, single fiber



# DWDM Lite Optical Add/Drop Multiplexers OADM (dual fiber)

Customer inserts dual fiber DWDM Lite OADM multiplexer to add/drop 1 to 16 channels. Rate 10G and less.



## Notes:

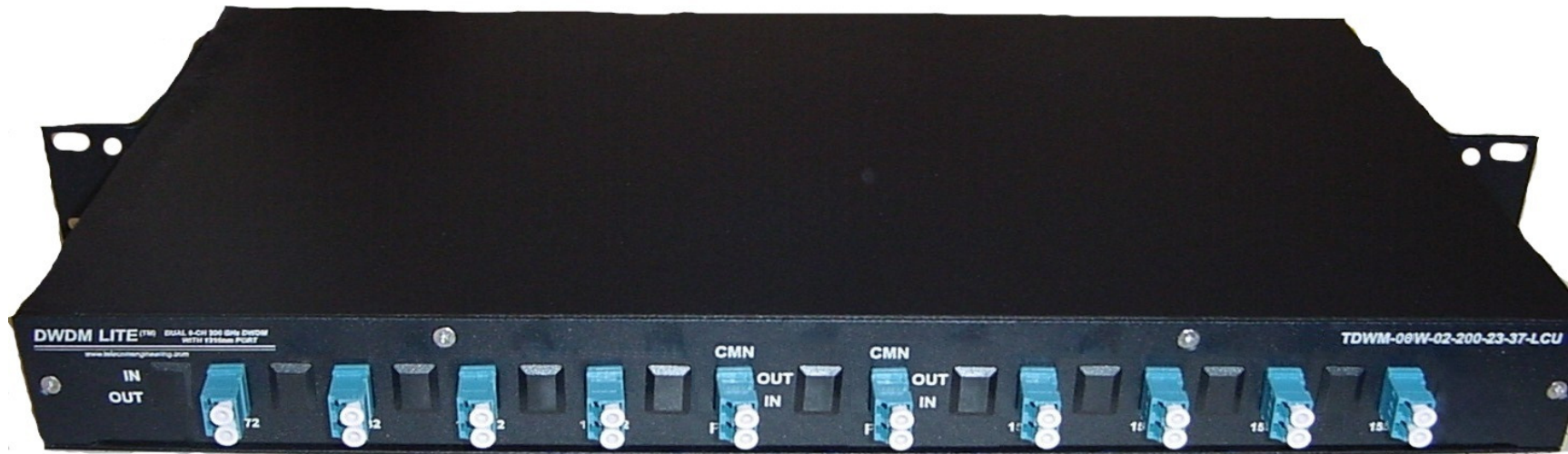
2ch (2wave) IL WE=1.5dB, IL Drop=1.9dB; 8ch (8wav) IL WE=1.2dB, IL Drop=3.8dB  
4ch (4wave) IL WE=1.2dB, IL Drop=2.7dB; 16ch (16wav) IL WE=1.8dB, IL Drop=4.5dB



# DWDM Lite OADM

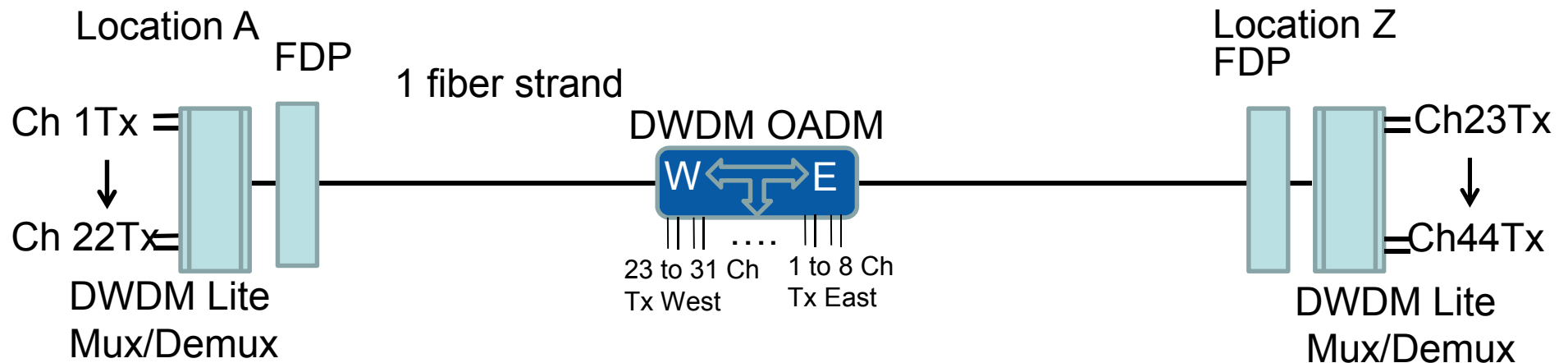
## 4 channel, dual fiber

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# DWDM Lite Optical Add/Drop Multiplexers OADM (single fiber)

Customer inserts dual fiber DWDM Lite OADM multiplexer to add/drop 1 to 8 channels. Rate 10G and less.



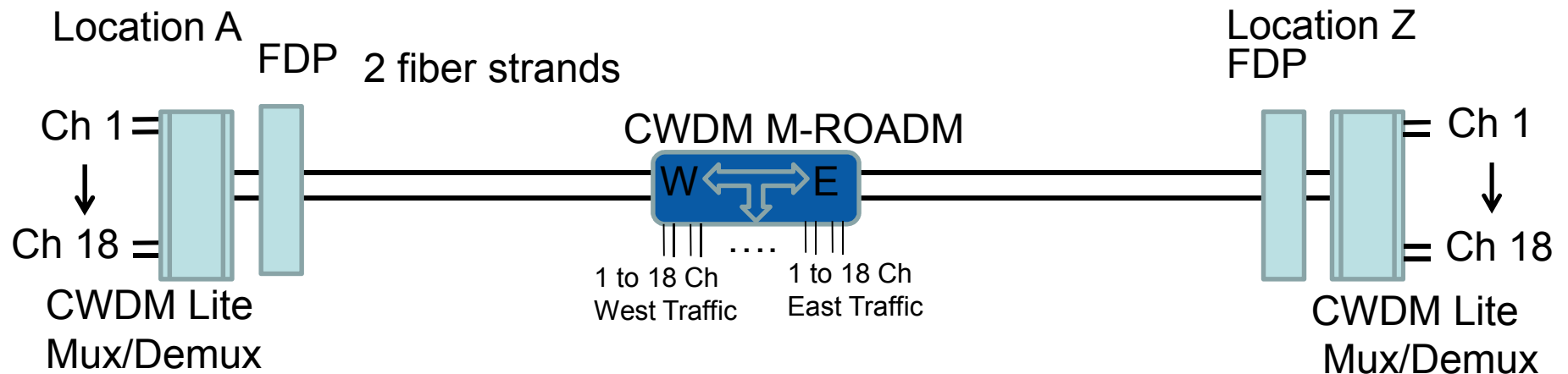
## Notes:

1ch (2wave) IL WE=1.5dB, IL Drop=1.9dB; 4ch (8wav) IL WE=1.2dB, IL Drop=3.8dB  
 2ch (4wave) IL WE=1.2dB, IL Drop=2.7dB; 8ch (16wav) IL WE=1.8dB, IL Drop=4.5dB



# CWDM Lite M-ROADM (dual fiber)

Customer inserts dual fiber CWDM Lite M-ROADM multiplexer to add/drop 1 to 18 channels.



## Notes:

8ch (8wave) IL WE=3.5dB, IL Drop=3.0dB; 18ch (18wav) IL WE=5.5dB, IL Drop=4.5dB  
16ch (16wav) IL WE=5.0dB, IL Drop=4.5dB



# CWDM Lite M-ROADM

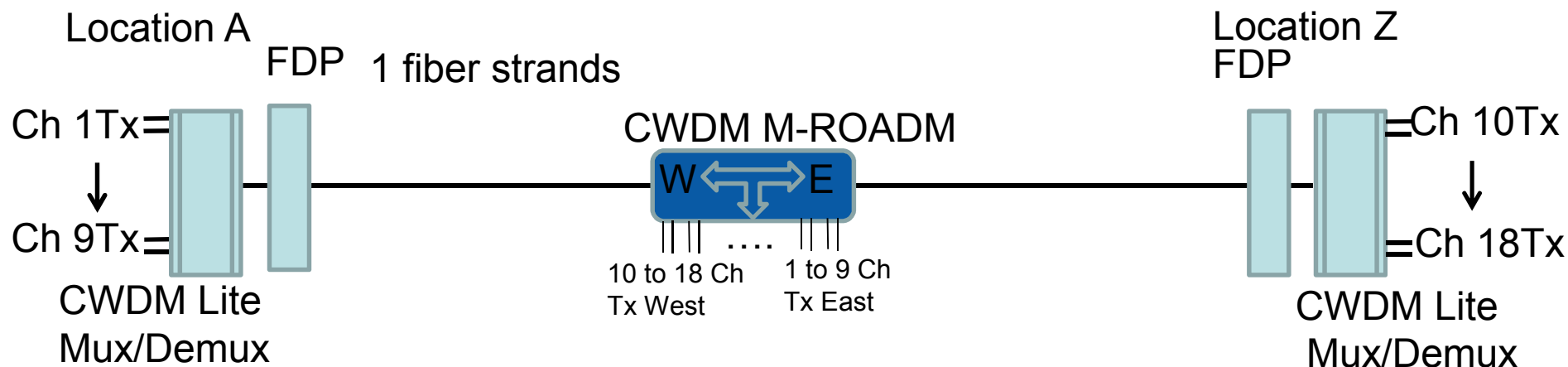
## 8 channel, dual fiber

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# CWDM Lite M-ROADM (single fiber)

Customer inserts dual fiber CWDM Lite M-ROADM multiplexer to add/drop 1 to 9 channels.



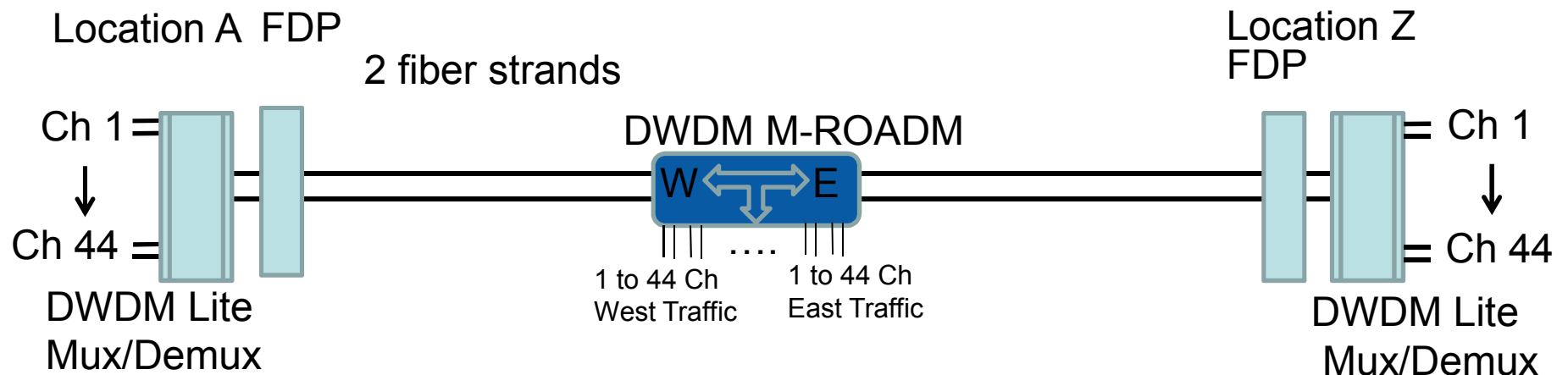
## Notes:

4ch (8wave) IL WE=3.5dB, IL Drop=3.0dB; 9ch (18wav) IL WE=5.5dB, IL Drop=4.5dB  
8ch (16wav) IL WE=5.0dB, IL Drop=4.5dB



# DWDM Lite M-ROADM (dual fiber)

Customer inserts dual fiber DWDM Lite M-ROADM multiplexer to add/drop 1 to 44 channels.



## Notes:

8ch (8wave) IL WE=3.5dB, IL Drop=3.0dB; 32ch (32wav) IL WE=5.5dB, IL Drop=4.5dB  
16ch (16wav) IL WE=5.0dB, IL Drop=4.5dB; 44ch (44wav) IL WE=7.5dB, IL Drop=5.5dB



# DWDM Lite M-ROADM

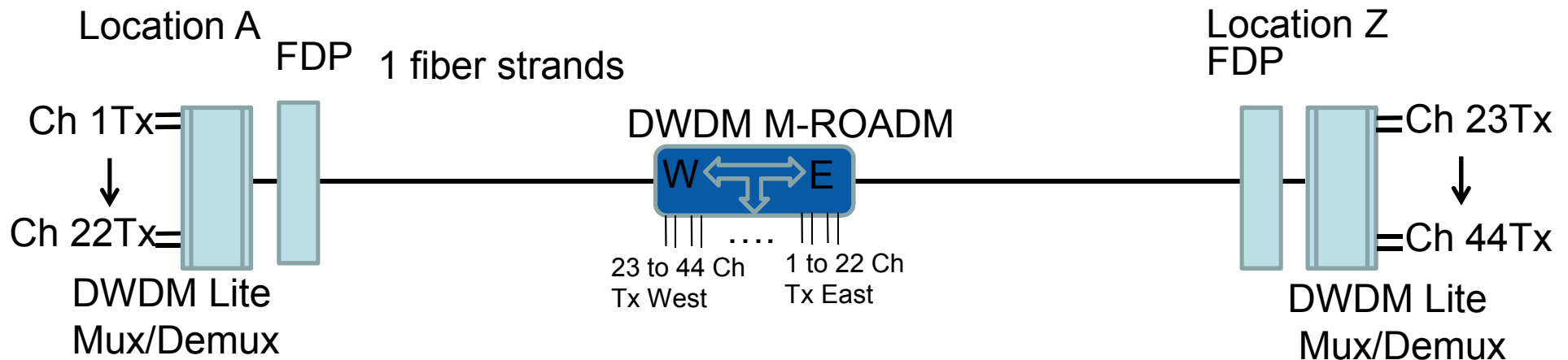
## 16 channel, dual fiber

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# DWDM Lite M-ROADM (single fiber)

Customer inserts dual fiber DWDM Lite M-ROADM multiplexer to add/drop 1 to 22 channels.



## Notes:

4ch (8wave) IL WE=3.5dB, IL Drop=3.0dB; 16ch (32wav) IL WE=5.5dB, IL Drop=4.5dB  
8ch (16wav) IL WE=5.0dB, IL Drop=4.5dB; 22ch (44wav) IL WE=7.5dB, IL Drop=5.5dB



# WDM Lite Cross Band Multiplexers (dual fiber)

Customer adds dual fiber WDM Lite 1310nm / 1550 nm cross band multiplexers to increase fiber link capacity to 2 channels, 1310nm and 1550nm. Advantage, double link bandwidth by using commonly available 1310nm and 1550nm transceivers



Notes:

2ch (2wave) IL=1.3dB per unit



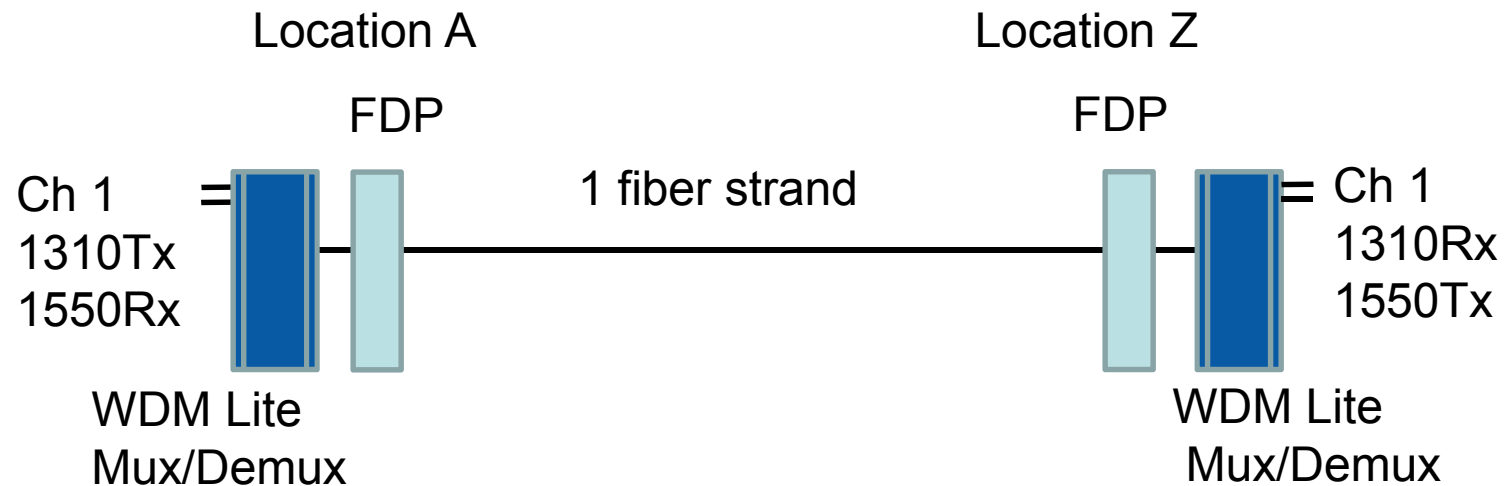
# WDM Lite Cross Band Multiplexers, dual fiber

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# WDM Lite Cross Band Multiplexers (single fiber)

Customer adds single fiber WDM Lite 1310nm / 1550 nm cross band multiplexers to provide bidirectional communication on one fiber.



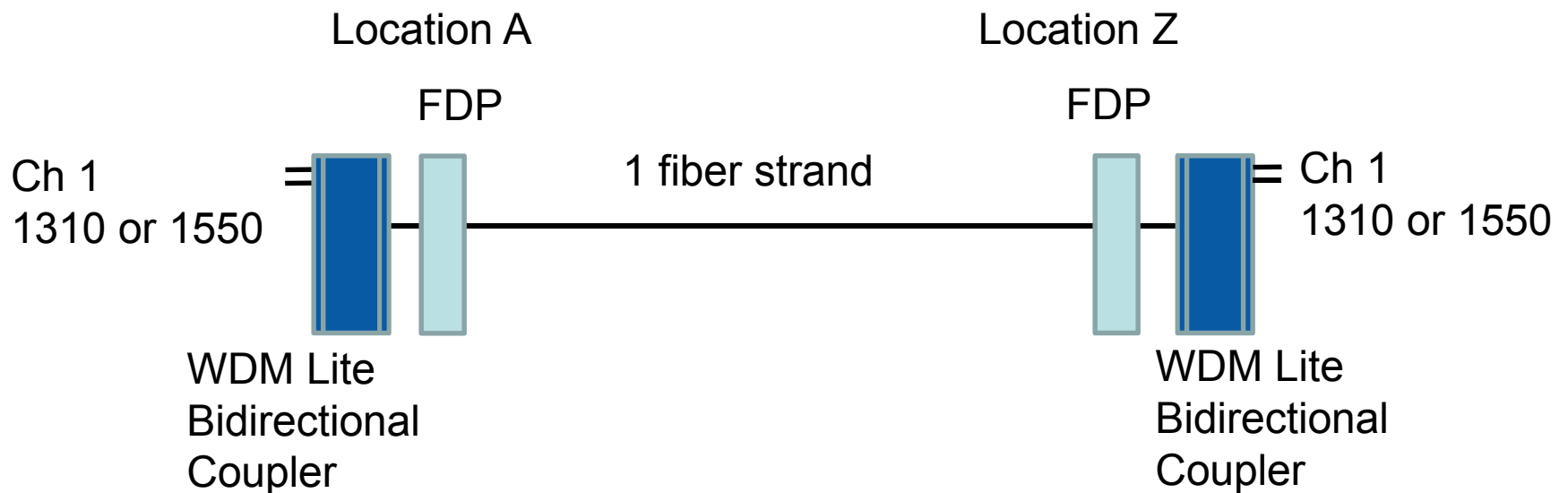
Notes:

1ch (2wave) IL=1.3dB per unit



# WDM Lite Bidirectional Coupler (single fiber)

Customer adds fiber bidirectional coupler to provide bidirectional communication on one fiber using commonly available 1310 or 1550nm transceivers. Fiber distance and transmission rate limitations, please refer to product specs.



Notes:

1ch (1wave) IL=1.0dB per unit



# WDM Lite Bidirectional Coupler (single fiber)

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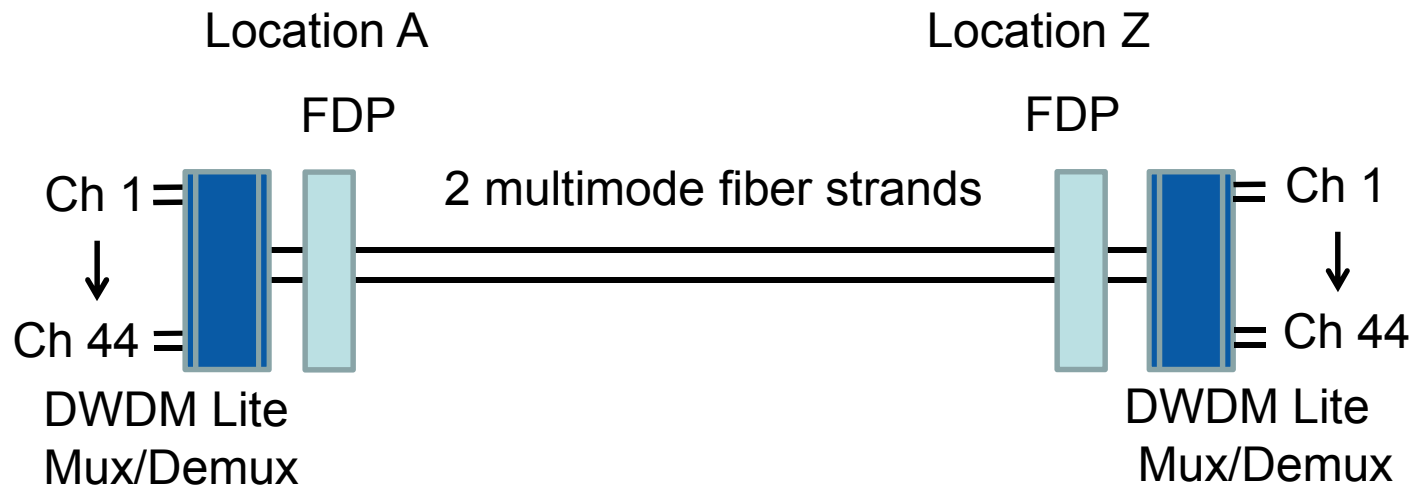


Notes:



# DWDM/CWDM Lite Multimode Multiplexers (dual or single fiber)

Customer adds dual fiber Multimode DWDM or CWDM Lite multiplexers to increase multimode fiber link capacity to maximum 44 channels 100 GHz ch spacing DWDM or 18 channels CWDM



Notes:

Special installation requirements.



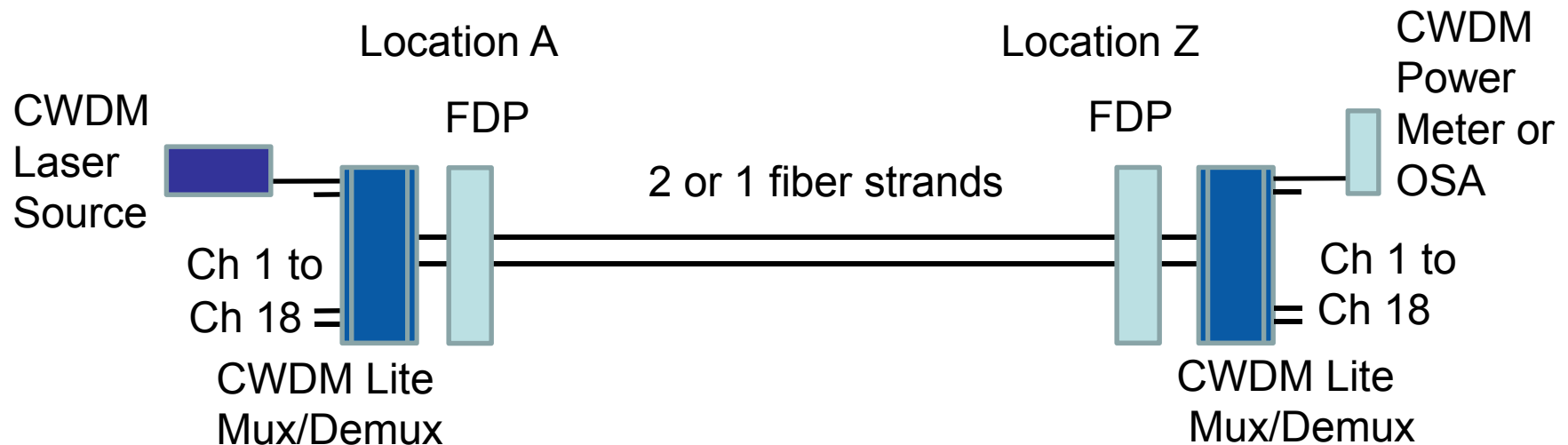
# DWDM Lite Multimode Multiplexers, dual fiber

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# CWDM Lite Laser Test Source

CWDM Laser Source with 18 CWDM laser outputs used for testing optical power loss on all 18 CWDM channels.



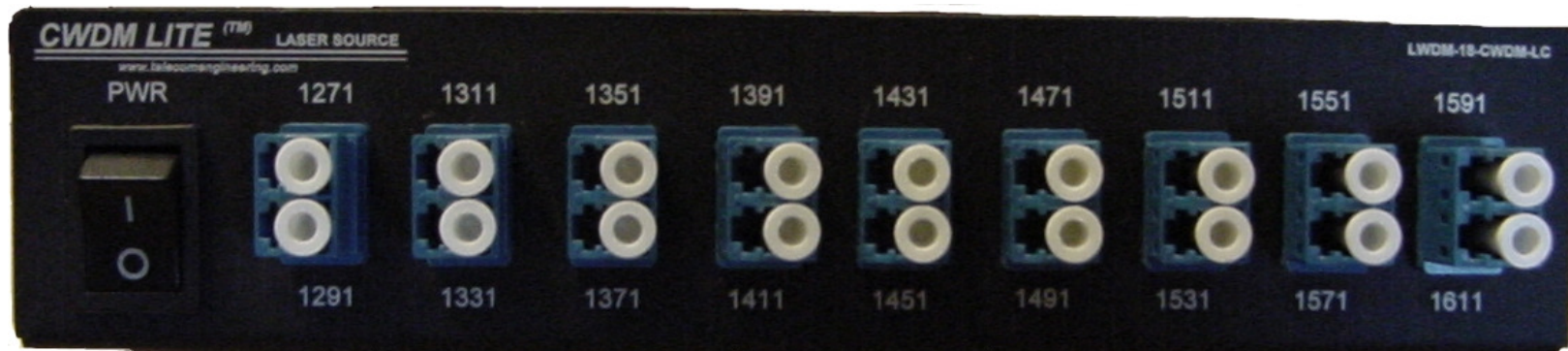
## Notes:

Laser source individual channel powers are adjustable



# CWDM Lite Laser Test Source

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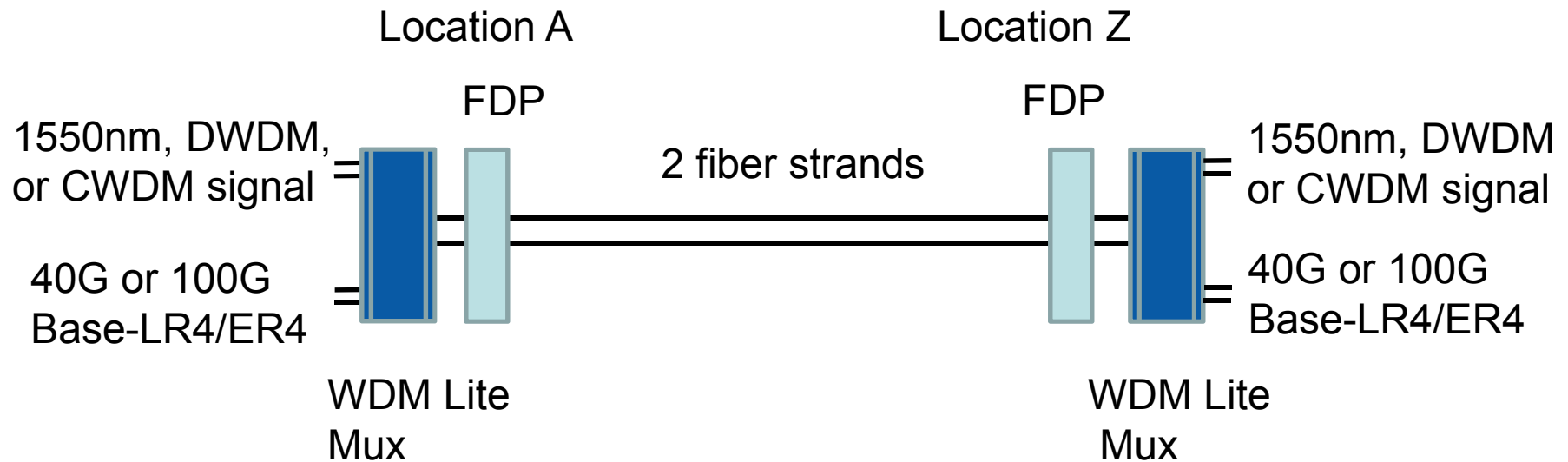


Notes:



# WDM Lite 40G/100G Cross Band Mux

Our new WDM Lite 40G/100G Cross Band Mux creates an O-Band channel (1310nm) allowing you to insert any 40GBase-LR4, 40GBase-ER4, 100GBase-LR4 or 100GBase-ER4 signals using 800GHz or 1300nm CWDM band spaced lanes into your existing 1550nm, DWDM C-Band, or 8 channel CWDM fiber span.



## Notes:

The 40G/100G port can also be used for any legacy 1310nm signals.

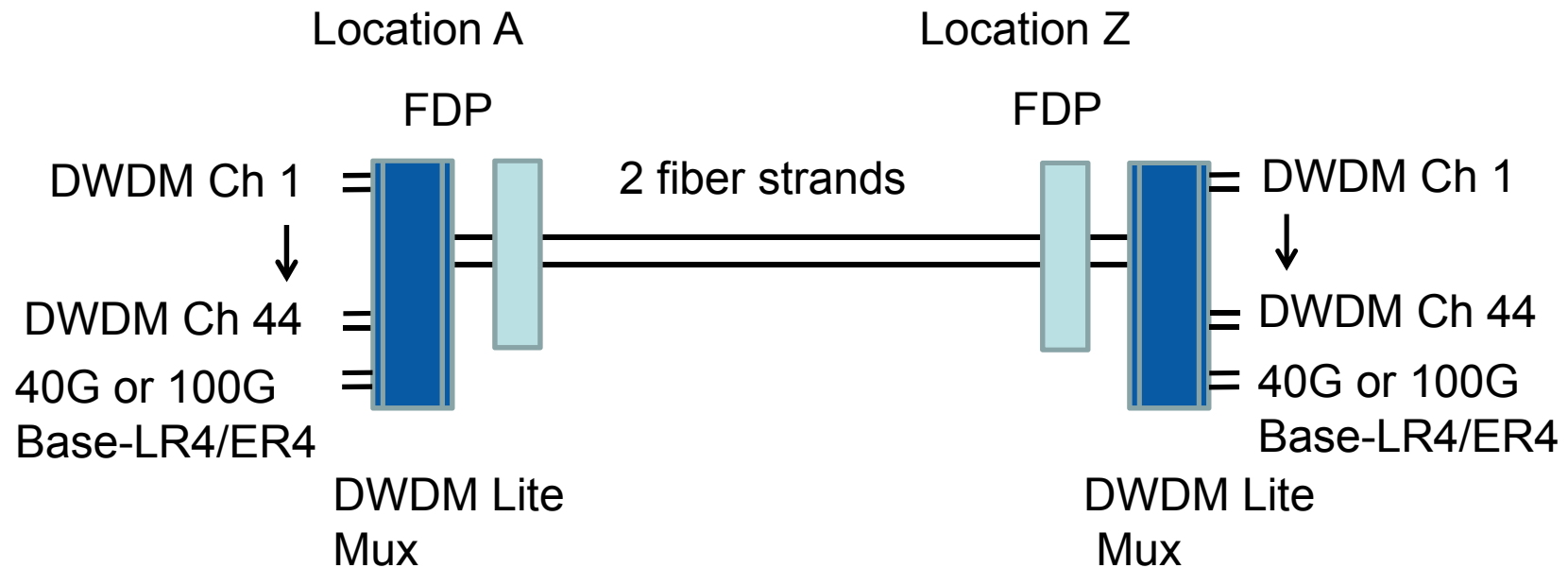
IL <1.5 dB



# DWDM Lite 40G/100G R4 Mux

## 40G/100GBase-LR4/ER4 Channel

Our new DWDM Lite 8 to 44 Channel 40G/100G R4 Mux has a dedicated channel port for connection of any IEEE802.3ba 40GBase-LR4, 40GBase-ER4, 100GBase-LR4 or 100GBase-ER4 signals using 800GHz or 1300nm CWDM band spaced lanes.



Notes:

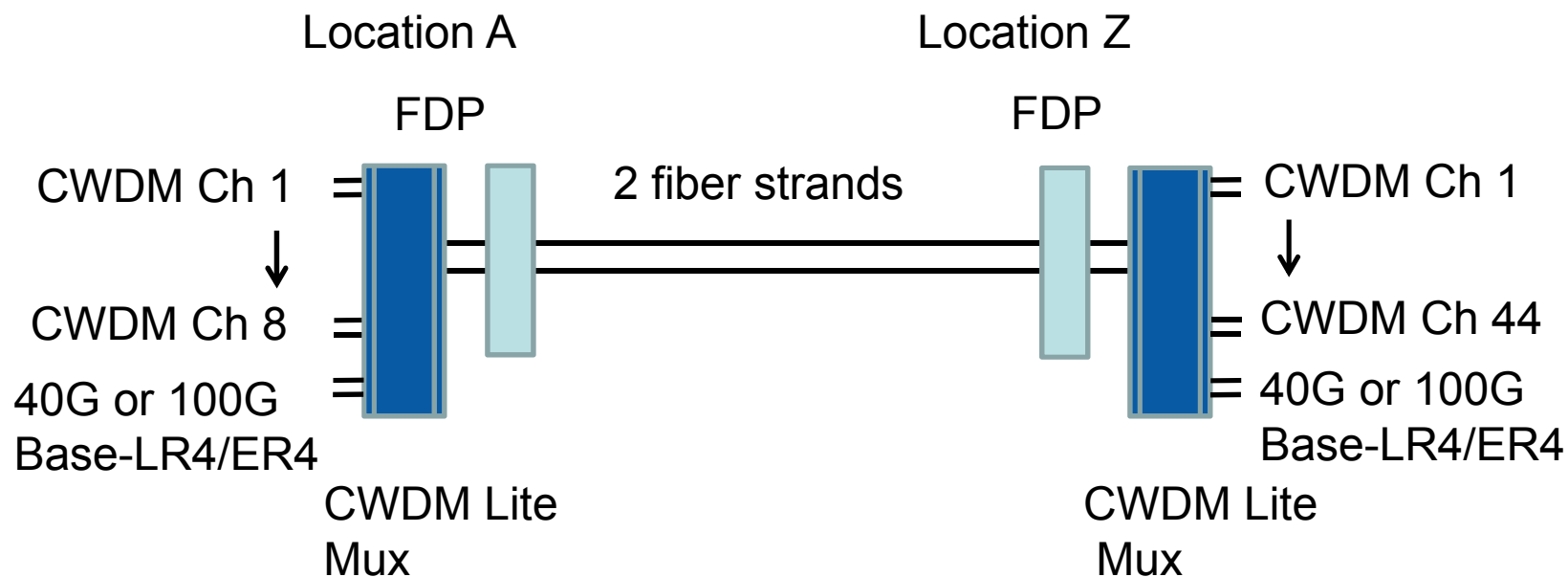
The 40G/100G port can also be used for any 1310nm signals.



# CWDM Lite 40G/100G R4 Mux

## 40G/100GBase-LR4/ER4 Channel

Our new CWDM Lite 8 Channel 40G/100G R4 Mux has a dedicated channel port for connection of any IEEE 802.3ba 40GBase-LR4, 40GBase-ER4, 100GBase-LR4 or 100GBase-ER4 signals using 800GHz or 1300nm CWDM band spaced lanes.



### Notes:

The 40G/100G port can also be used for any 1310nm signals.



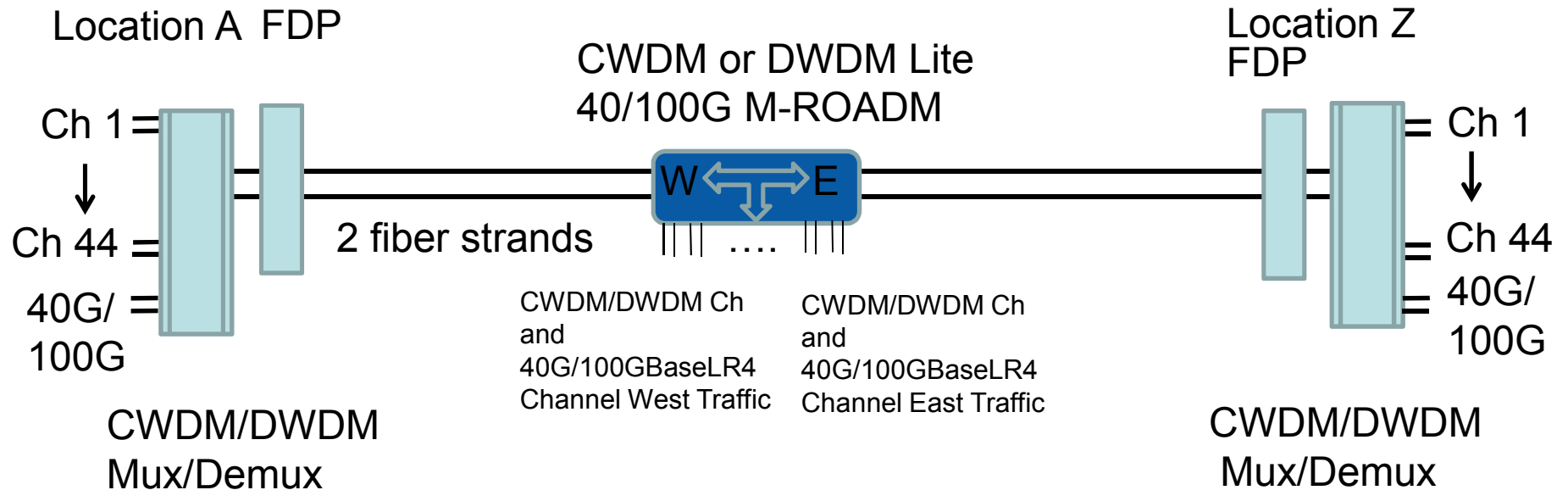
# CWDM Lite 40G/100G R4 Mux 40G/100GBase-LR4/ER4 Channel

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# CWDM/DWDM Lite M-ROADM 40G/100G LR4/ER4 Channel Option

Customer inserts dual fiber CWDM/DWDM Lite M-ROADM multiplexer to add/drop CWDM or DWDM channels as before but with an additional 40G/100G Base-LR4/ER4 channel for west and east traffic transmission directions.



## Notes:

The 40G/100G port can also be used for any 1310nm signals.



# DWDM Lite

## Optical Amplifier System

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### Components:

- 8 to 44 channel DWDM Lite CCM Multiplexers with channel monitor ports and power control (expandable to 88 @ 50GHz channels)
- EDFA and Raman optical amplifiers
- Dispersion Compensation

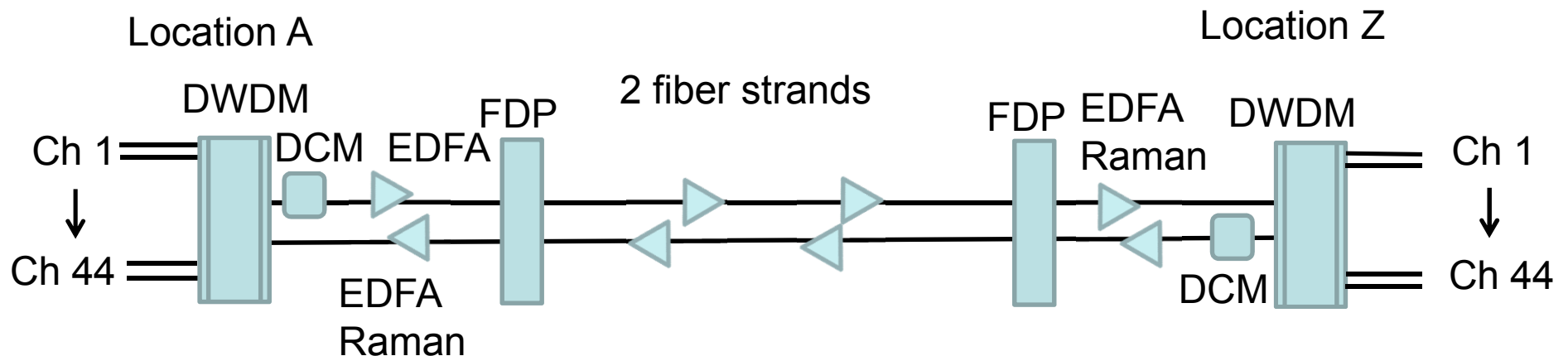
### General Features:

- Simple to add & drop channels, power balance, monitor channels. OSA not required.
- Completely passive, except for optical amplifiers
- Transparent to all protocols
- Available for 2 network fibers or single fiber strand communication
- Accepts all data rates including 10Gbps traffic, also 40G (DPSK, DQPSK) and 100G (DP-QPSK) capable (excludes OADM which are limited to 10G)
- ISO 9001 manufacturing, Telecordia GR-1209 and GR-1221 qualified
- 200 GHz, 100 GHz or 50 GHz channel spacing available



# DWDM Lite Amplifier System Network Configuration

Typical DWDM Lite 1 to 44 channel EDFA configuration.



## Notes:

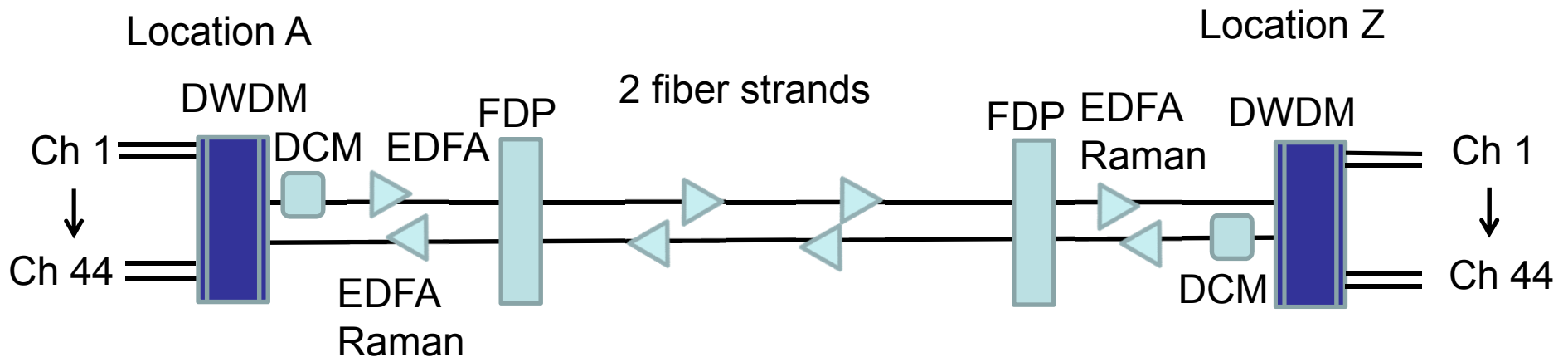
System is completely passive except for the EDFA and Raman amplifiers. This provides for simple installation, high reliability, and easy maintenance.



# DWDM Lite Amplifier System

## DWDM CCM Multiplexer

DWDM CCM Multiplexer is available as a 8, 16, 32, 40 or 44 channel system.



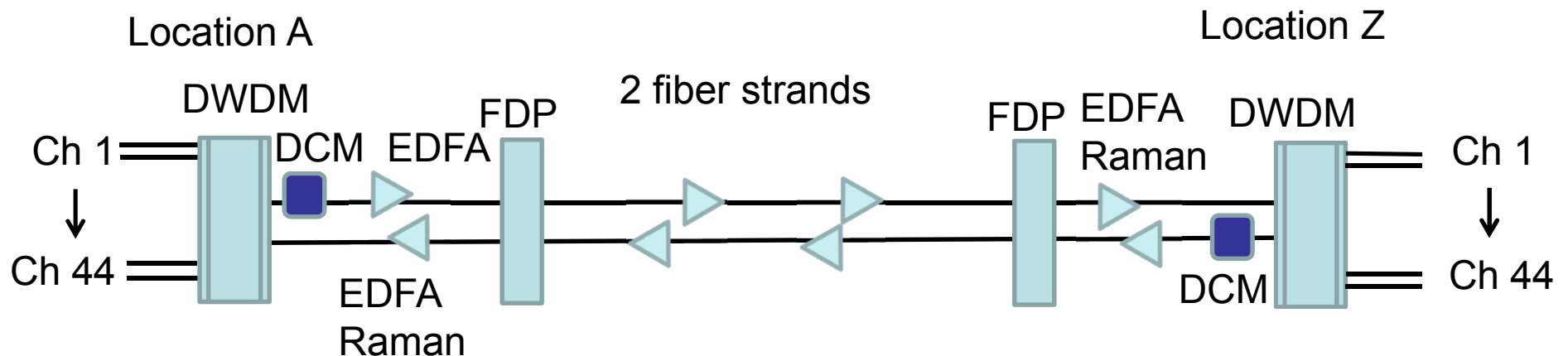
### Notes:

Our DWDM CCM multiplexers are specially designed to allow for simple individual channel power adjustment, EDFA channel leveling and channel power / OSNR monitoring. No special equipment required.



# DWDM Lite Amplifier System Dispersion Compensation

Compensates fiber chromatic dispersion for long distance transmission, typically used for greater than 80 km spans.



## Notes:

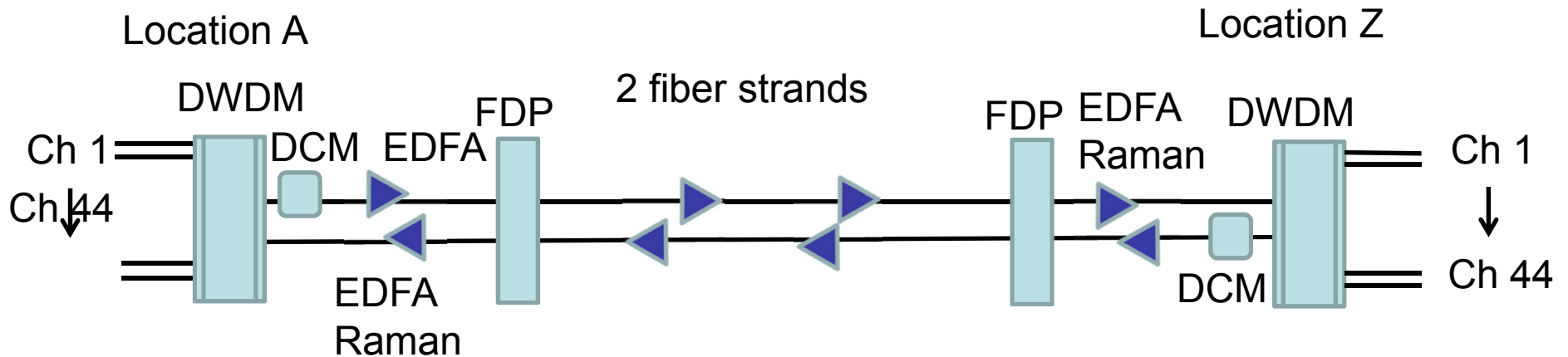
Unit is completely passive, no configuration or adjustment required. Various fiber compensation lengths available.



# DWDM Lite Amplifier System

## EDFA

The EDFA amplifier is used to amplify all signals in C-Band (DWDM) to compensate for optical span loss. It is available as a booster, inline or preamp. It cannot be used to amplify CWDM signals because of the very wide CWDM band.



### Notes:

Remote and local access are available by Ethernet connection and standard SNMP application. Hardened units to -25C and IEEE1613 are also available.



# DWDM Lite Amplifier System EDFA

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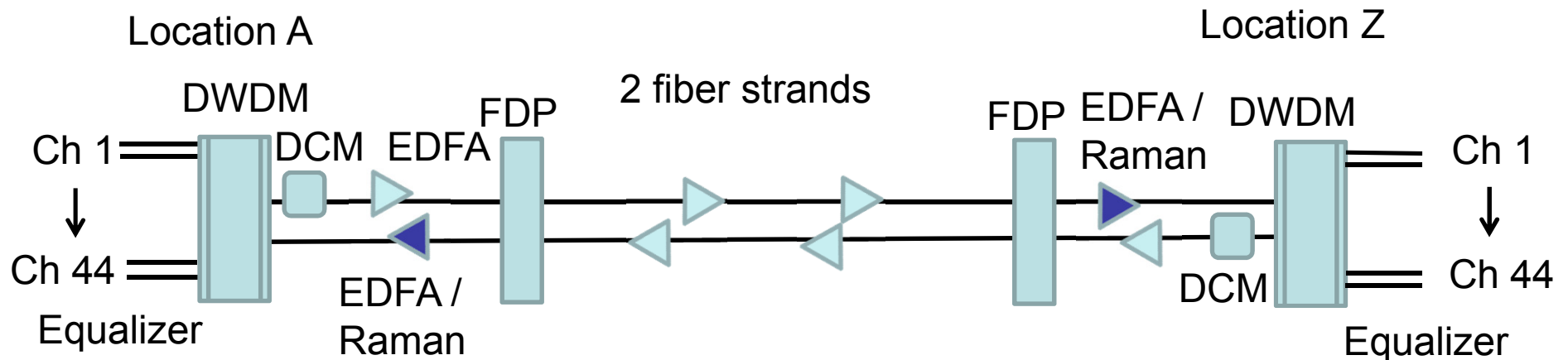
Notes:

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# DWDM Lite Amplifier System Raman

Raman amplifiers are deployed in spans where EDFA deployment would result in link OSNR to be lower than transceiver specification limit.



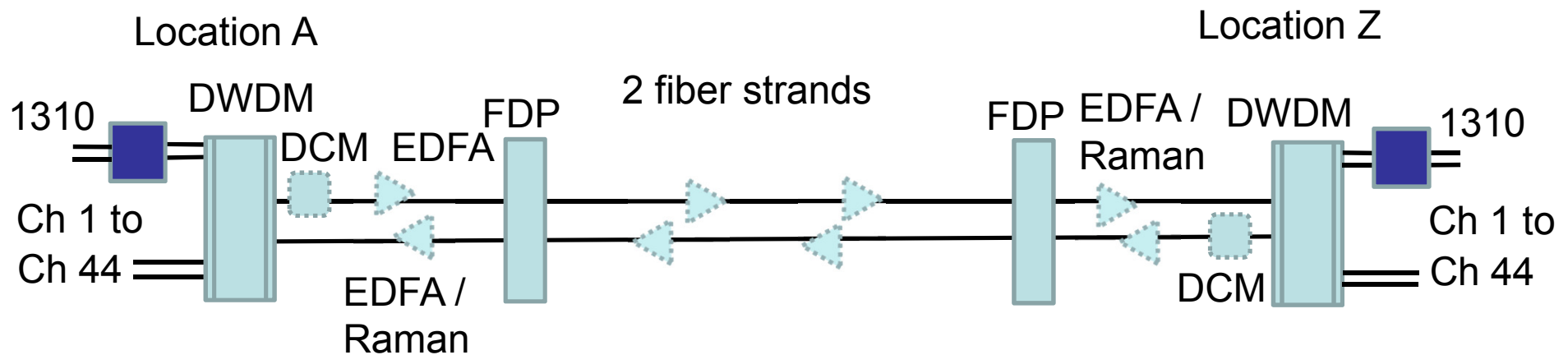
## Notes:

Remote and local access by Ethernet connection. Gain of 10 dB.



# DWDM Lite Transponder

Channel tunable self contained transponder that converts 1310nm or 1550nm 10G signals to DWDM channels with 100GHz or 50GHz channel spacing, tunable over 45 or 88 channels.



## Notes:

Can be installed in CO or customer premise, built in dual 48Vdc power or 120/240Vac power. Large optic budget, 30 or 35 dB without FEC, larger budget available with FEC. Transparent to all 10G protocols including 10GE, SONET/SDH, OTN FEC. Full 3R signal regeneration. Adjustable DWDM output laser power +4 to +6 dBm.



# DWDM Lite Transponder

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Notes:



# Pluggables, SFP, XFP, etc.

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## Notes

- XFP, SFP, SFP+, Xenpak, GBIC, X2
- Compatible with most brand name equipment including Cisco, Extreme, MRV, Alcatel, etc.
- 850, 1310, 1550, DWDM, CWDM, SR, LR, ELR, ZR, Bidi, DOM, etc.
- Single mode and multimode fiber
- Single rate or multi rate
- 100GHz or 50GHz channel spaced DWDM pluggables
- All pluggables fully tested before shipment to customer
- ISO 9001 manufacture factory
- 2 year warranty on all Lite brand pluggables
- Great prices!



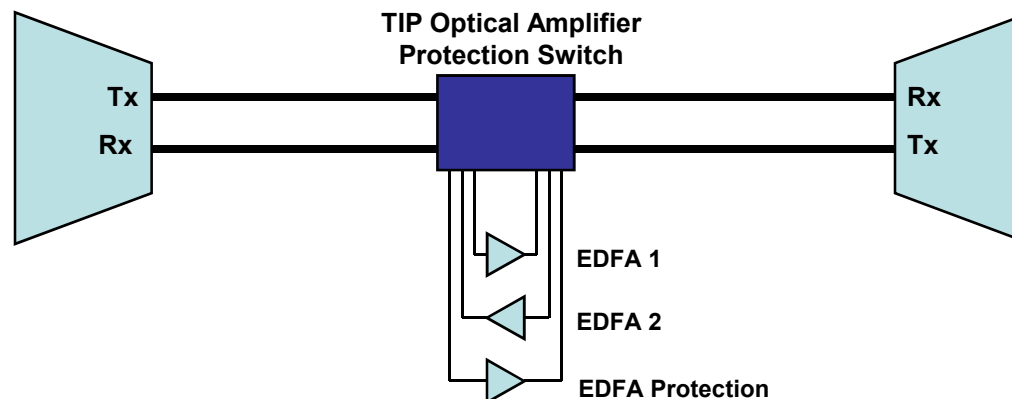
# Optical Amplifier Protection Switch

## Optical Amplifier Protection Switch

- 1:2 Protection for Optical Amplifiers
- Protocol and rate independent
- Protects all DWDM wavelengths in fiber in the event of an optical amplifier failure



*TIP Optical Amplifier  
Protection Switch*



# Telecom Team

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**Bob Chomycz, B.Eng. P. Eng.**

**President and Founder**



Bob Chomycz is the President of Telecom Engineering, Inc., and Telecom Engineering USA, Inc. He is responsible for company strategic engineering and operations.

Bob has over 24 years of engineering and management experience in the telecom industry, ranging from detailed engineering to management and team leadership. He has a broad range of industry experience spanning telephone, cable TV, electric utility and transportation industries. His engineering designs include fiber optic, SONET, DWDM, EDFA, wireless, and copper networks.

He is the author of three telecom books, “Planning Fiber Optic Networks”, “Fiber Optic Installations: A Practical Guide” and “Fiber Optic Installers Field Manual”.



# Telecom Team

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## **Daniel S. Guay, CD**

### **Network Operations Manager**



**Daniel S. Guay is the Network Operations Manager at Telecom Engineering, Inc. He is responsible for company network documentation, operations and support.**

**Daniel has been with Telecom Engineering, Inc. for 9 years and is very knowledgeable with network designs and support.**

**As well, Daniel designs, installs, provisions, and tests customer premise wired and wireless Local Area Networks.**



# Telecom Team

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**Michael Tate, B.Sci.**

**Telecom Engineer**

**Michael Tate is responsible for engineering and coordinating projects from initial customer request to final installation. He also heads up Research and Development for Telecom Engineering USA.**

**Michael has been with Telecom Engineering USA for 4 years and is knowledgeable in fiber optic design, installation, and troubleshooting.**

**He has also headed up research leading to the application for three separate patents in his time with Telecom Engineering USA.**



# Equipment Testing Service

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To ensure network equipment installation quality meets industry standards and customer requirements (SLA).

Services include:

- Bit Error Rate Test (BER)
- Data latency measurement
- Voltage and DC power measurements
- Equipment redundancy check
- DWDM network equalization report
- Network monitoring and alarms verification
- Wireless propagation tests and interference studies



# Fiber Characterization Service of Dark or Lit Fibers

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Fiber characterization service provides detail fiber span parameter information important for fiber network planning, records and SLA. If fiber is lit measurements are taken during a maintenance window.

Report includes:

- OTDR traces to identify anomalies, poor splices, connector loss, bad cable bends, fiber attenuation, reflectance, fiber length
- Power meter measurement at 1310, 1550 and 1611nm for span loss (all CWDM channel measurement also available)
- Chromatic dispersion (CD) measurement, for proper compensation
- Polarization mode dispersion (PMD) measurement, for 10Gbps+ links
- Fiber latency measurement, for SLA
- Fiber / connector optical return loss (ORL) measurement
- Connector visual inspection with fiber scope and photos identifying damaged connectors



# Documentation Services

Telecom Engineering takes pride in providing detailed telecom network documentation .

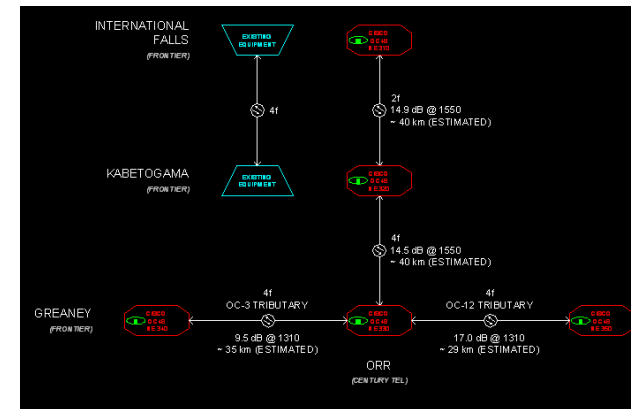
Documents ensure that the design and management of any project is communicated clearly and accurately to all parties involved.

Project documents include:

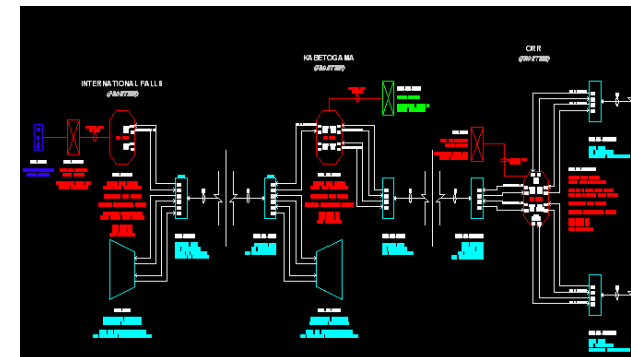
- For Construction and As Built drawings, Color Coded, 11x17 inch size
- Project Description
- Project Schedule
- Circuit Roll & Implementation Plan
- Project Inventory Equipment / Material List,
- Detailed Project Cost Accounting Spread Sheet
- Network Testing Verification Reports,
- Customer Acceptance Certificate

Our staff is well versed in various software applications:

- Microsoft Suite (Word, Excel, PowerPoint, Access, Project)
- AutoCAD
- Adobe Publishing Suite
- Simply Accounting



*As-Built Network Schematic*

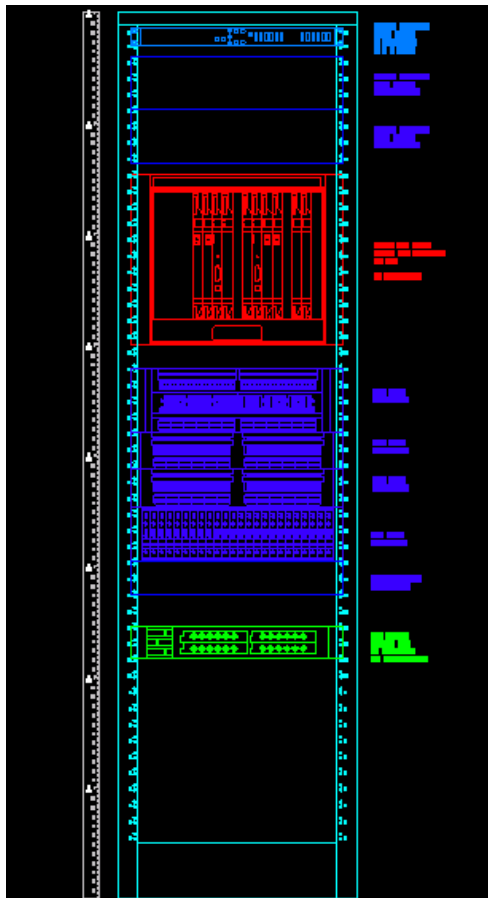


*As-Built System Schematic*



# Documentation Services

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*As-Built Equipment Rack*

We offer daily, weekly, and monthly status reports via email.

Documentation packages are vital in the design and installation process. We provide:

- Detailed network drawings
- Detailed system schematics (includes network elements and cabling identification)
- Telecom equipment room layouts
- Equipment rack layouts

Our documentation has proved its worthiness countless times during network troubleshooting, and scheduled maintenances.



# Technical Support Services

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## Services:

- Complete fiber optic link “Turn-key” engineering, installation, provisioning, and testing services
- Personnel training
- 24/7 network monitoring
- 24/7 telephone support, pre and post installation
- Dispatch technician/engineer for on-site maintenance service





## Office Locations

**Minnetonka, Minnesota  
Thunder Bay, Ontario**

**Phone: 1-807-683-1770**

**Toll Free: 1-888-250-1562**

**Fax: 1-807-344-6968**

**Email: [info@TelecomEngineering.com](mailto:info@TelecomEngineering.com)**

**Website: <http://www.TelecomEngineering.com>**