Long-Haul Fiber Optic Communications Systems

DWDMs
CWDMs
EDFAs
DCMs

Advances in fiber optic technology have made long-haul communications systems reach distances that were once unheard of. Today's fiber optic transmission links transmit multiple channels of video and audio signals over worldwide distances, and can reach high traffic volumes. This distance is made possible by a number of devices that amplify optical signals and combine larger and larger numbers of signals for transmission over a single optical fiber. Olson, Technology, Inc.'s line of optical transport products facilitate and support fiber optic long-haul communications systems.

This system solution presents an overview of these technologies and the systems in which they can be incorporated. These new technologies include:

- 1550nm High Optical Output 110 Channel CATV Transmitters
- CWDM Signal Multiplexing (Up to 8 Channels)
- DWDM Signal Multiplexing (Up to 32 Channels)
- Erbium-Doped Fiber Amplifiers (EDFAs)
- Dispersion Compensation Modules (DCMs)

Figure 1 illustrates a basic long-haul CATV transmission system designed to carry 77 channels of CATV VSB/AM signals for 100km in a basic point-to-point configuration.

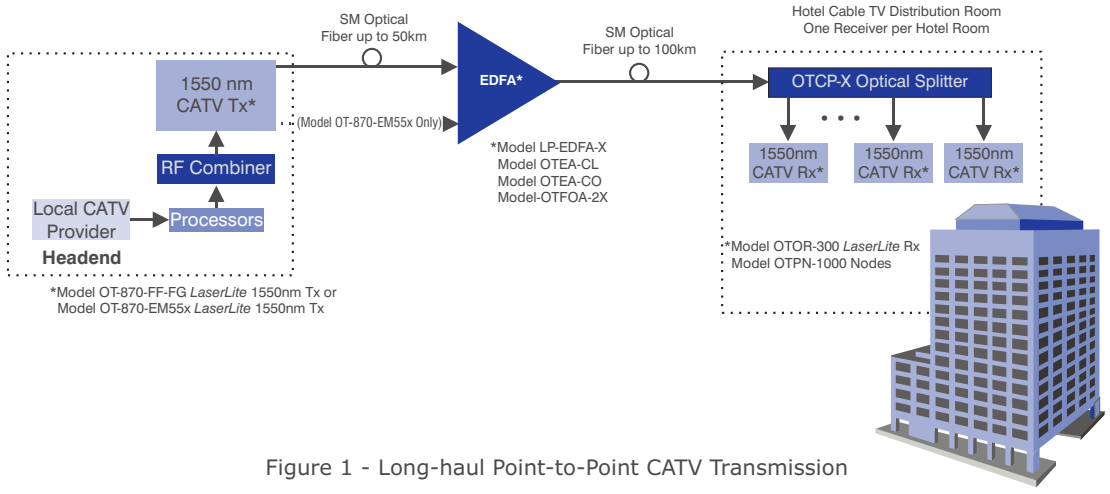

Figure 1 - Long-haul Point-to-Point CATV Transmission

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Long-Haul L-Band Satellite Transport Using CWDM

Olson Technology, Inc.'s family of L-Band transport links may be used with the Model OT-CWDM-X Coarse Wavelength-Division Multiplexers to combine up to eight channels of L-Band satellite signals onto one singlemode optical fiber. These signals are stacked in the 1471-1611nm region. The CWDM's feature very low insertion loss and low polarization-dependent loss. The L-Band link with CWDM can be configured for bidirectional transmission, or the CWDMs may provide eight signals in a unidirectional configuration. The CWDM works in conjunction with the family of L-Band Satellite Transport Links or with Olson's family of 1550nm CATV products. Regardless of the signal type, the CWDMs increase a given fiber's transmission capacity from one to eight channels. The use of single-mode fiber and low-backreflection angled physical contact (APC) connectors allows the system to transmit over 10km without amplification.

Because the system operates in the 1550nm range, the units are compatible with Model OTEA or OTFOA EDFAs which increase the transmission distance to 100 km or more.

Figure 2 illustrates a unidirectional application where the multiplexer combines the output of four L-Band transmitters. This configuration may occur in satellite-earth-station-to-headend applications. Transmit and receive ends use a 3RU rack chassis for minimum required space, and the chassis offers dual power supplies for redundant, fail-safe operation.

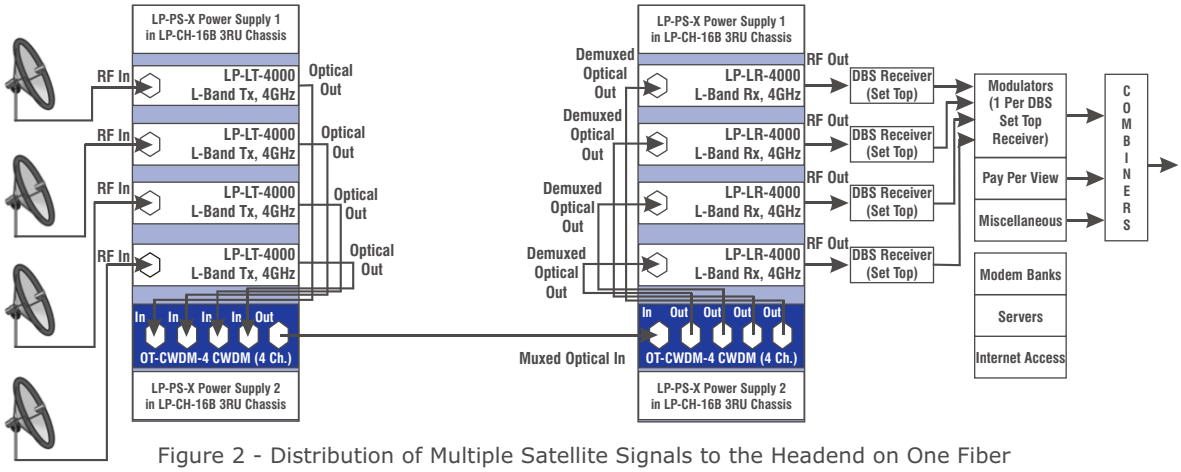

Figure 2 - Distribution of Multiple Satellite Signals to the Headend on One Fiber

Figure 3 illustrates a bidirectional application that multiplexes both L-Band and CATV VSB/AM signals. This configuration also incorporates a WDM channel at 1310nm as well as six channels in the C-Band region.

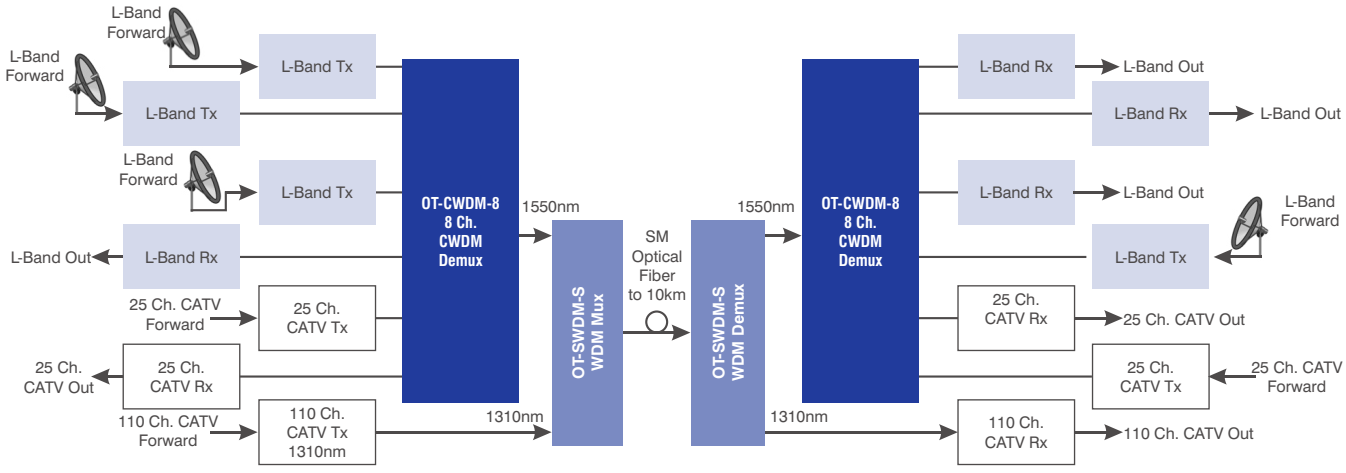

Figure 3 - Headend Configuration

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Long-Haul System Using DWDM

The Model OT-DWDM-X family of Dense Wavelength-Division Multiplexers (DWDMs) provide an all-fiber solution for combining up to 32 channels onto one singlemode fiber. All Olson Technology, Inc. DWDMs offer low insertion loss and low polarization-dependent loss.

The DWDM may be used for bidirectional transmission or unidirectional transmission. The DWDM works with the Olson's 1550nm CATV transport links. Regardless of the signal type, the DWDM increases a given fiber's transmission capacity from one to 32 channels. The use of singlemode fiber and low-backreflection APC connectors allows the system to transmit over 50km without amplification.

The system operates in the 1550nm range, making the units compatible with Model OTEA or OTFOA EDFAs EDFAs which increase the transmission distance to 100 km or more.

Figure 4 illustrates a unidirectional application where the DWDM transmits eight 1550nm signals over one single-mode fiber. These transmitters could represent a variety of video, audio, and/or data signal inputs.

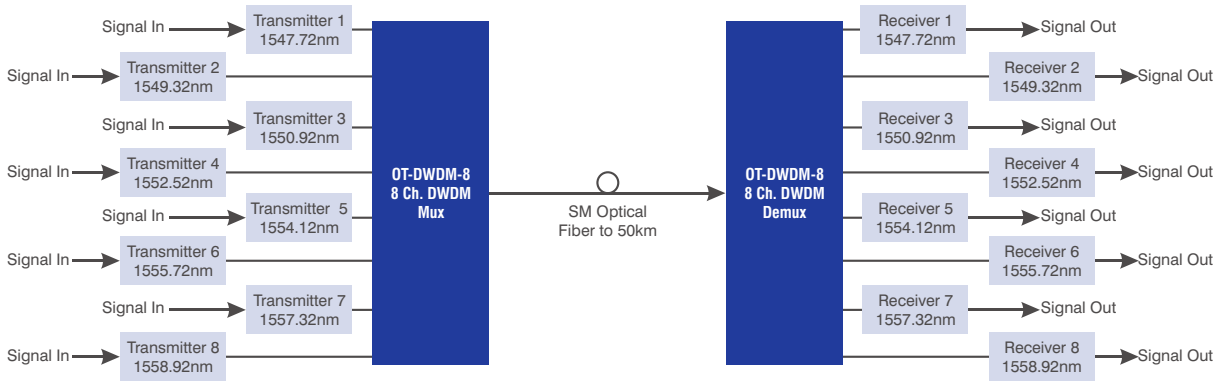

Figure 4 -DWDM Eight Channel Transport

Figure 5 illustrates the OT-DWDM-X used with an optical A/B switch to provide redundant path switching in long-haul communications systems. In the event of failure in the primary fiber, the system automatically switches to the secondary fiber, providing constant performance in "mission-critical" applications.

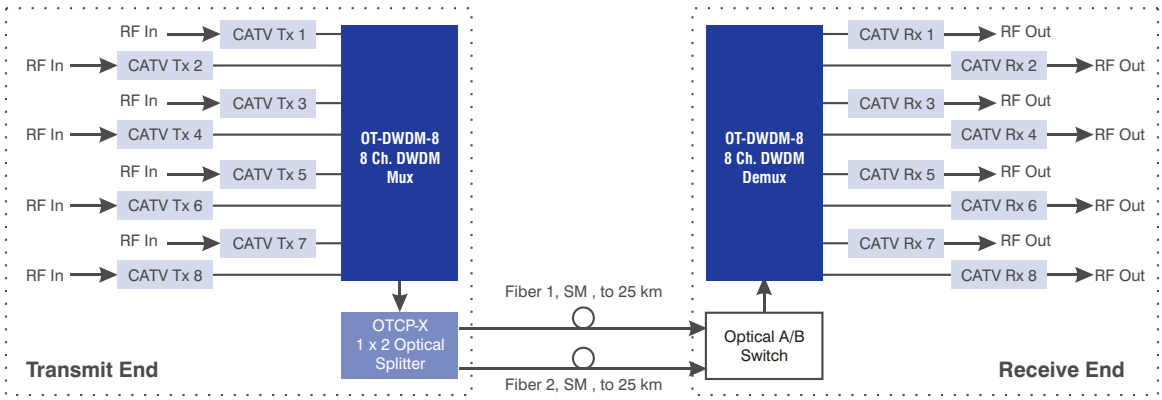

Figure 5 -Model OT-DWDM-8 in a Redundant Configuration

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Long-Haul Systems Using EDFA and DCM

The use of EDFAs has gained momentum, especially in long-haul communications systems where one EDFA can replace as many as five conventional amplifiers in the transmission path. In a fiber doped with the rare earth element erbium, 1550nm light has the property of stimulating the erbium atoms, causing them to emit additional 1550nm light, amplifying the signal in an all-optical domain.

Olson Technology, Inc. provides a family of EDFAs, including the Model OTFOA-25XX which includes input and output mid-stage optical connections for a Dispersion Compensation Module (DCM). All of Olson's EDFAs provides high output power (up to +23 dBm), allowing the units to function as an in-line amplifier, a headend booster, or a preamplifer power booster. As an in-line booster, the EDFA is placed midway between the transmitter and receiver in the transmission path. A headend booster EDFA is located at the transmitter end while a preamplifier is placed near the receiver to boost the weakened signal.

Low noise, excellent gain loss, and low insertion loss make Olson EDFAs ideal for CATV long-haul communications networks.

Figure 6 illustrates a DWDM configuration similar to the one shown in Figure 4; however, in this setup, an EDFA has been added to boost the transmission distance to greater than 200km.

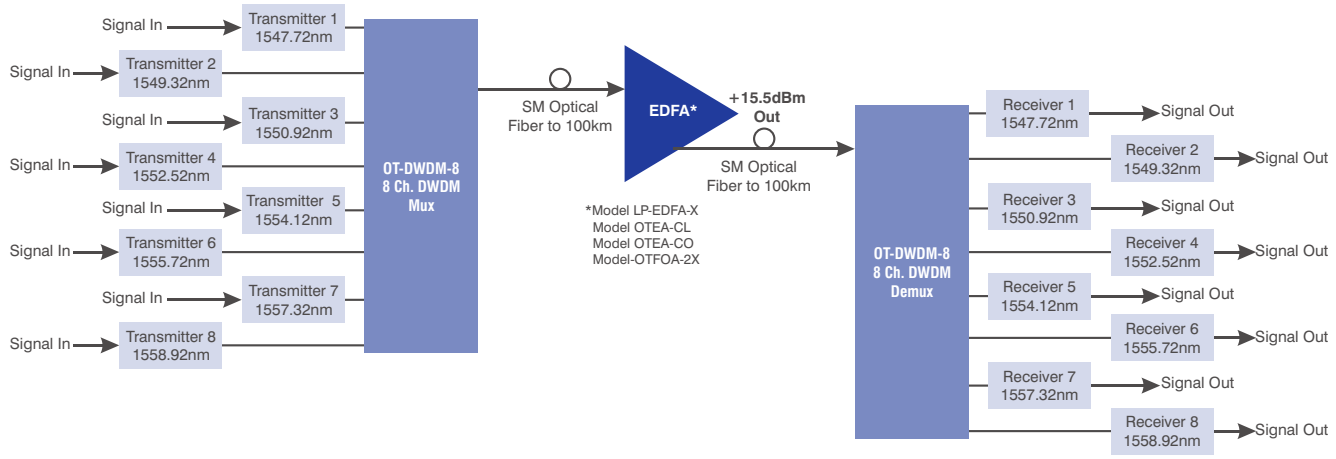

Figure 6 - DWDM and EDFA Long-haul System

Figure 7 shows a point-to-multipoint long-haul system that incorporates a DCM to extend the transmission distance while maintaining high signal quality.

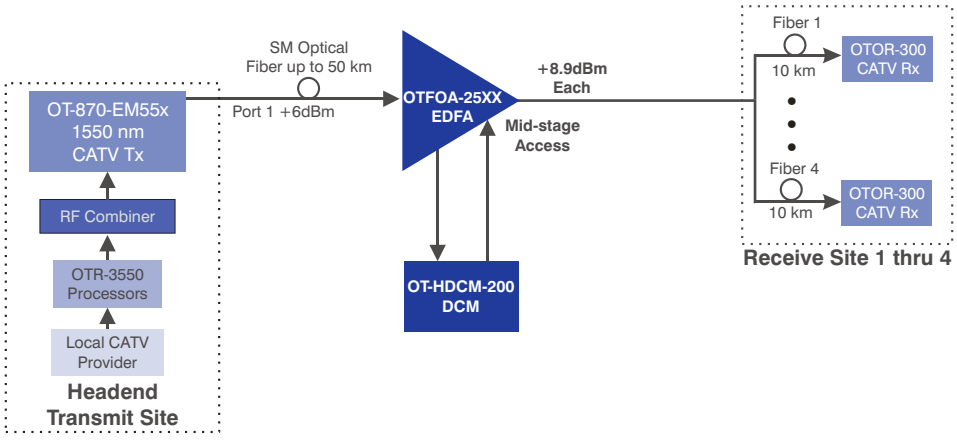

Figure 7 - Model OTFOA-25XX EDFA and OT-HDCM-200 DCM in a Point-to-Multipoint Configuration

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