

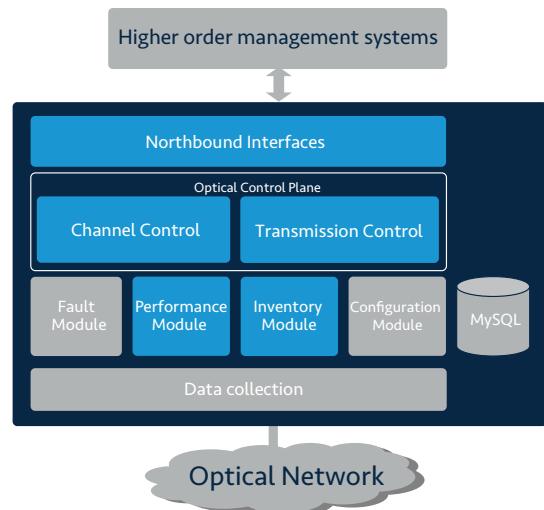
Transmission Control

A TNM application for simplified commissioning, maintenance and troubleshooting of amplified links

Key benefits:

- Reduced operational costs associated with commissioning of amplified links
- Simplified pro-active maintenance
- Faster troubleshooting of performance related network problems
- Graphical User Interface with full integration with the TNM map and features
- Automated power measurements across entire network segments
- Presentation of measurements, establishment of OCM – VOA relationships and configuration of VOAs and amplifiers

Transmission Control is an optional TNM module that is fully integrated with the TNM map, features and circuit model. It works in concert with Optical Channel Monitor (OCM) units, Variable Optical Attenuators (VOA), amplifiers and transceivers to simplify tuning of amplified links.



Power balancing and tuning in amplified optical networks

In amplified networks with multiple intermediate line amplifiers and/or OADM nodes the power balancing of the individual wavelengths is important to maintain optical transmission performance. It is imperative that all wavelengths that arrive at the optical revivers are within a certain power range to ensure that all channels are transported correctly.

There are multiple causes why wavelengths become unbalanced;

- Variations of output power between individual Transponders or between Transponders operating at different line rates
- Variations in add and drop losses through optical multiplexors and de-multiplexors
- Gain variations and gain tilt through optical amplifiers

Unbalanced systems result in increased levels of bit errors or even lost communication. Power balancing needs to be performed at the initial commissioning of an amplified link and at all capacity expansions. Links may occasionally also need to be re-balanced since component characteristics can change over time or a configuration error may be discovered.

Transmission Control

Power balancing without advanced management support requires time-consuming power measurements and even site visits. For trouble-shooting of performance related problems it is sometimes difficult to quickly understand how the network is configured to make necessary power adjustments in appropriate cards. As the complexity of networks increases, for instance when networks are ring-based or include multiple OADM nodes or even ROADMs, understanding network topology and associations between Network Elements may become a real challenge.

The Transmission Control application automates many aspects of tuning a network and supports maintenance and trouble-shooting activities.

Transmission Control provides two complementing views of the power parameters:

- Per channel display
- Amplifier chain display

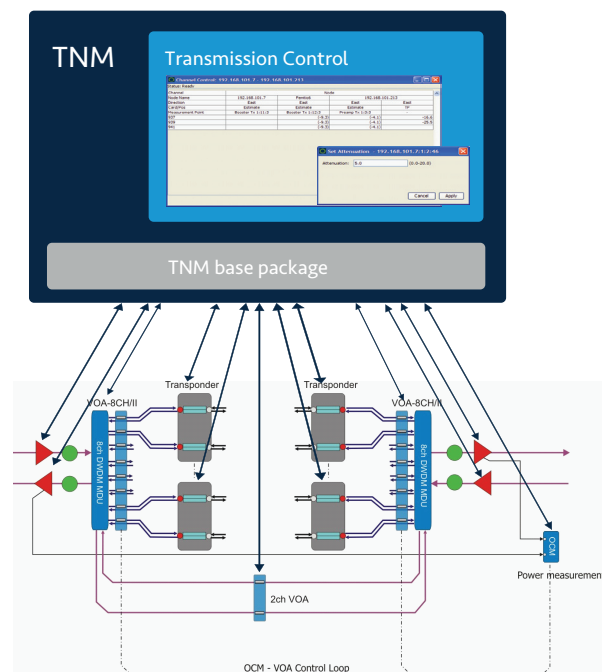


Fig 1. Transmission Control automates the collection and presentation of power values from amplified segments and allows the user to configure power parameters from the GUI.

Per channel display

For power balancing of individual channels, Transmission Control allows the user to select a network segment from the TNM map. The application automatically orders applicable OCMs and Transponders to report power values and presents the measurements per channel in a table.

Based on the measurements, Transmission Control allows the operator to instantly change the attenuation settings in applicable VOAs from the GUI. To reduce the burden on the operator further, the application automatically establishes all associations between VOAs and OCMs. Finally the user can request Transmission Control to repeat measurements and present the result for verification of the applied changes.

Amplifier chain display

For configuration of amplifiers, Transmission Control allows the user to select a network segment and then automatically collects and presents power parameters from this segment. Transmission Control estimates link-losses to simplify link-budget calculations and shows both configured and estimated amplifier settings to simplify trouble-shooting.

Transmission Control also allows the user to instantly change the amplifier gains directly from the GUI. Finally the user can request Transmission Control to repeat measurements and presents the result for verification of the applied changes.