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**Code for engineering design of wavelength division
multiplexing (WDM) optical fiber transmission systems**

波分复用(WDM)光纤传输系统工程设计规范

(English Translation)

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1 General

1.0.1

In order to unify and standardize the engineering design of wavelength division multiplexing (WDM) optical fiber transmission system, to achieve advanced technology, safety and reliability, economical and reasonable, energy saving and environmental protection, this specification is formulated.

1.0.2

This specification is applicable to the engineering design of single-fiber unidirectional open C-band DWDM system and single-fiber unidirectional open CWDM system.

1.0.3

The engineering design should be planned overall, jointly constructed, and resource shared to meet the requirements of building a resource-saving and environment-friendly society.

1.0.4

The engineering design should be based on ensuring the quality of communication, and compare multiple schemes to improve economic benefits and reduce project cost.

1.0.5

The engineering design of the wavelength division multiplexing optical fiber transmission system shall not only comply with this specification, but also comply with the current relevant national standards.

2.1.1 C-band conventional band

The C band refers to the band with a wavelength between 1530nm and 1565nm.

2.1.2 L-band long wavelength band

The L band refers to the band with a wavelength between 1565nm and 1625nm.

2.1.3 Optical channel

The channel for unidirectional transmission of optical signals in the optical multiplexing section.

2.1.4 Nominal central frequency (wavelength) nominal central frequency (wavelength)

Taking the frequency 193.10THz (vacuum wavelength 1552.52nm) as the reference frequency (wavelength), the frequency (wavelength) allocated at certain frequency intervals in the wavelength division multiplexing system.

2.1.5 Optical path

All facilities and means for transmitting specific service signals between the client interface of the source point and the sink point wavelength division multiplexing equipment.

2.1.6 Optical booster amplifier

It is used behind the multiplexer at the sending end of the wavelength division multiplexing system to increase the optical power of the system.

2.1.7 Optical pre-amplifier optical pre-amplifier

It is an optical amplifier used in front of the demultiplexer at the receiving end of the wavelength division multiplexing system to improve the sensitivity of signal reception.

2.1.8 Optical line amplifier optical line amplifier

An optical amplifier used to extend the distance of non-electric repeaters to supplement fiber loss between passive fiber segments.

2.1.9 Optical amplifier span

Refers to adjacent optical amplifier stations (OLA stations), between optical terminal stations (OTM stations) and adjacent optical amplifier stations (OLA stations), and between optical splitter stations (OADM stations) and adjacent optical amplifier stations (OLA stations), forming a transmission segment for extending the length of the non-electric relay.

2.1.10 Optical multiplex section optical multiplex section

Refers to adjacent optical terminal stations (OTM stations), between optical branch stations (OADM stations), and between optical terminal stations (OTM stations) and adjacent optical branch stations (OADM stations), forming a relay with electrical regeneration The transfer section of the function.

2.1.11 Raman amplifier raman amplifier

An optical amplifier that amplifies signals based on the Stimulated Raman Scattering (SRS) effect of transmission fibers in wavelength division multiplexing systems.

2.1.12 (optical) coherent reception (optical) coherent detection in the receiving device, the local optical carrier and the same-frequency optical carrier signal are used for coherent mixing, and the phase information of the carrier signal is detected and received.

2.1.13 Ultra-long-haul DWDM system

Multi-span section with target distance greater than 1000km and single-span section 40/80x10G DWDM system with target distance greater than 160km.

2.1.14 Receiver optical signal noise ratio tolerance receiver optical signal noise ratio tolerance

In a wavelength division multiplexing system, when the maximum bit error rate (such as 1×10^{-12}) is reached after the error correction of the reference receiver, the optical wavelength converter (OTU) is directly connected to the reference receiver Sn (or Rn) point The minimum tolerable OSNR value.

2.2 Abbreviations

ALS (Automatic Laser Shutdown) automatic laser shutdown APR (Automatic Power Reduction) Automatic optical power reduction ASON (Automatically Switched Optical Network) automatic switching optical network BBER (Background Block Error Ratio) background block error ratio BOL(Begin Of Life) BTB(Back-To-Back) back to back CMI (Coded Mark Inversion) mark reverse coding CORBA (Common Object Request Broker Architecture) public object request broker system CWDM (Coarse Wavelength Division Multiplexing) Coarse Wavelength Division Multiplexing DCM(Dispersion Compensation

Module) Dispersion Compensation Module DCN (Data Communication Network) data communication network DGD (Differential Group Delay) differential group delay DWDM (Dense Wavelength Division Multiplexing) dense wavelength division multiplexing DP-QPSK (Dual Polarization Quadrature Phase Shift Keying) Dual Polarization Quadrature Phase Shift Keying RZ-DQPSK (Return to Zero Differential Quadrature Phase Shift Keying) Return to Zero Differential Quadrature Phase Shift Keying EMS (Element Management System) network element management system EOL (End Of Life) end of life FEC (Forward Error Correction) forward error correction HRP (Hypothetical Reference Path) Hypothetical Reference Path LAN (Local Area Network) local area network LCT (Local Craft Terminal) local maintenance terminal MPI (Main Path Interface) main optical channel interface NMS (Network-level Management System) Network (level) management system NRZ (Non-Return to Zero) non-return to zero (code) OA(Optical Amplifier) optical amplifier OADM (Optical Add-Drop Multiplexer) Optical Add-Drop Multiplexer OCHP (Optical Channel Protection) optical channel protection ODB (Optical Duobinary) optical duobinary code ODF(Optical Distribution Frame) Optical Distribution Frame OD(U)[Optical De-multiplexer(Unit)] Optical demultiplexer (demultiplexer) device (unit) ODUk (Optical Channel Data Unit-k) optical channel data unit k OLA (Optical Line Amplifier) Optical Line Amplifier OLP (Optical Line Protection) optical line protection OM(U)[Optical Multiplexer(Unit)] Optical multiplexer (multiplexer) device (unit) OMSP (Optical Multiplex Section Protection) optical multiplex section protection OSC (Optical Supervisory Channel) Optical Supervisory Channel OSNR (Optical Signal-to-Noise Ratio) Optical Signal-to-Noise Ratio OTM (Optical Terminal Multiplexer) optical terminal multiplexer OTN (Optical Transport Network) Optical Transport Network OTU (Optical Transponder Unit) optical conversion unit (wavelength converter) OTUk (Optical Channel Transport Unit-k) Optical Channel Transport Unit k P-DPSK (Partial Differential Phase Shift Keying) partial differential phase shift keying PMD(Polarization Mode Dispersion) Polarization Mode Dispersion PSBT (Phase-Shaped Binary Transmission) phase shaping binary transmission (R) OADM [(Reconfigurable) Optical Add/Drop Multiplexer] (Reconfigurable) Optical Add-Drop Multiplexer RZ (Return to Zero) return to zero (code) RZ-AMI (Return-to-Zero Alternate Mark Inversion) return-to-zero signal flipped alternately SDH (Synchronous Digital Hierarchy) synchronous digital system SESR (Severely Errored Second Ratio) Severely Errored Second Ratio SNMS (Sub-network Management System) subnetwork management system STM (Synchronous Transport Module) synchronous transmission module WAN (Wide Area Network) wide area network WDM (Wavelength Division Multiplexing) wavelength division multiplexing

3.1 Characteristics of WDM system

3.1.1

Wavelength division multiplexing (WDM) system shall be divided into dense wavelength division multiplexing (DWDM) system and coarse wavelength division multiplexing (CWDM) system. The channel interval of the DWDM system should be 0.4nm or 0.8nm, and the