A FTN RATE TRANSMISSION SCHEME FOR MULTI-BAND OPTICAL TRANSMISSION SYSTEMS

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Introduction

In recent years, the rapid growth of mobile and cloud services has put forward a strong demand for optical communication with high bit rate and low cost, and the requirements of optoelectronic devices for bandwidth and sampling rate have also increased correspondingly. Ultra-wideband(UWB) WDM transmission system has attracted much attention because the capacity in C band is limited. UWB scheme with C+L band has been introduced because the widely used EDFAs can be adopted in both bands. Then bandwidth would be extended to the S band next, and finally five bands (the O, E, S, C, and L bands) would be utilized.

In this paper, the zero force (ZF) equalization technology ,which is a linear low complexity detection algorithm, is used to recover the signal. In addition, different modulation formats is used to achieve flexible signal transmission in multi-band optical transmission systems.

Transmission systems

A high spectral efficiency modulation scheme is designed for multi-band optical transmission system using the FTN technology as shown in Figure 1. In addition, the optimal modulation format is used according to the channel band. The wavelength of the transmitted signal is set as 1310nm and 1495nm. The optical fiber transmission distance is 20km.

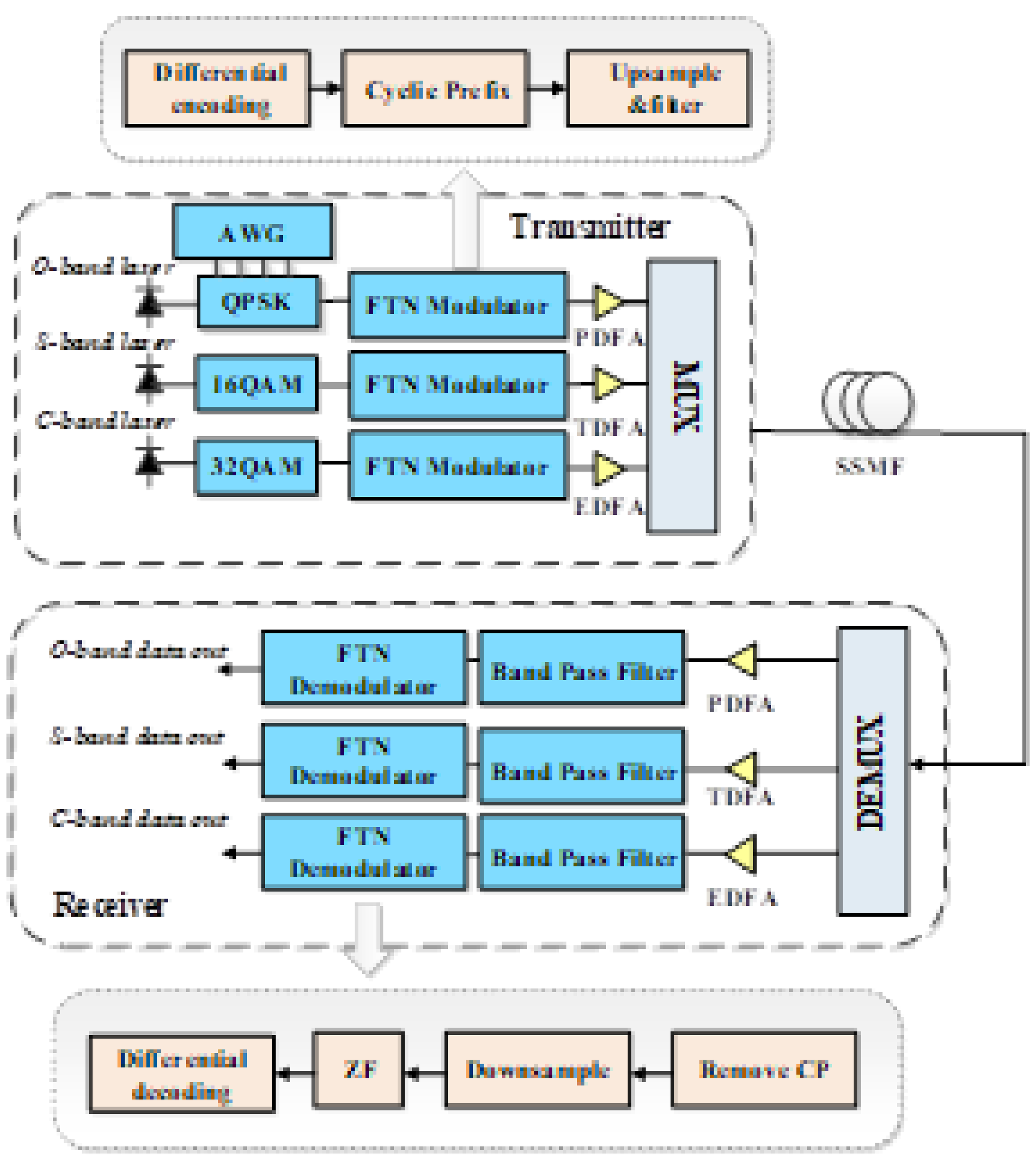

Figure 1. The FTN multi-band optical transmission system

It shows that QPSK is allocated in O-band , 16QAM is distributed in the E and S bands, and 32QAM is used in the C and L bands. At the transmitter, the signals in different band channels are mapped into QPSK,16QAM or 32QAM signals. The FTN signals of each band are obtained through the delay addition module.

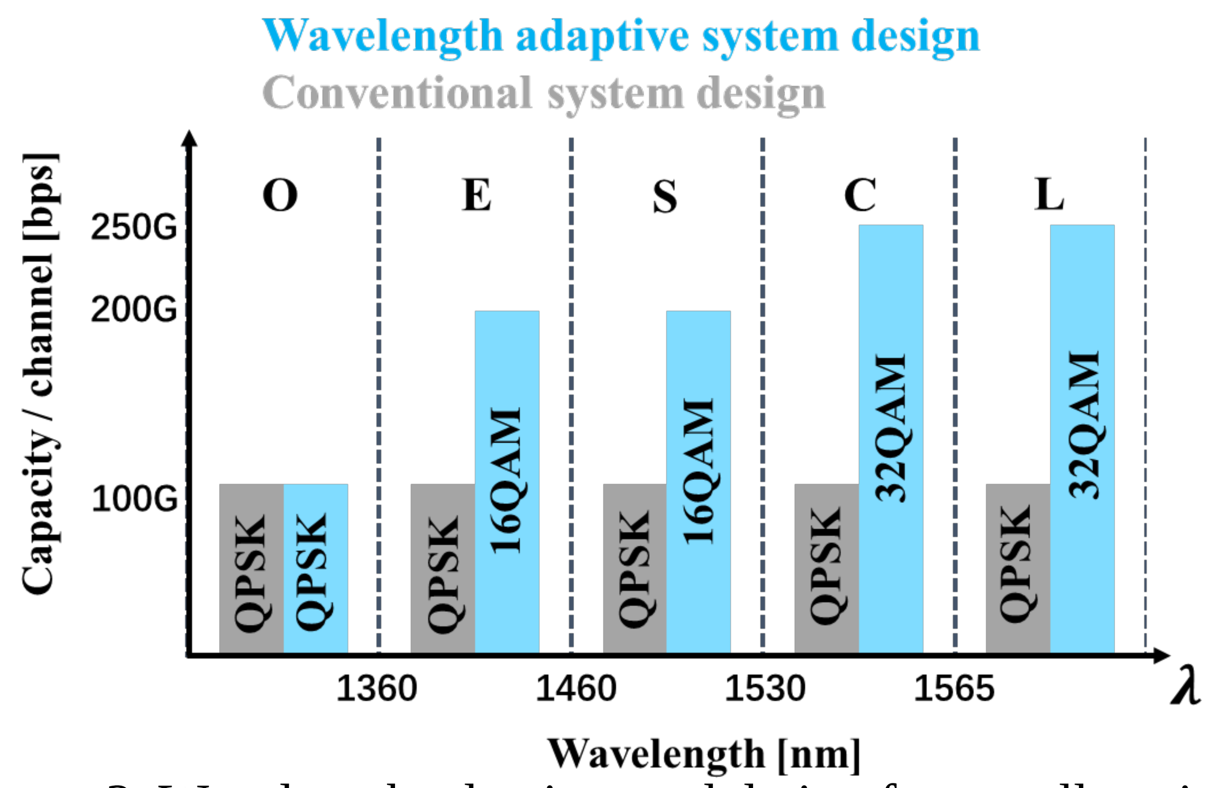

Figure 2. Wavelength adaptive modulation format allocation

Results and discussions

The performance of the FTN transmission technology assumed that the spectral efficiency of FTN-QPSK is 2.4bit/s/Hz. The spectral efficiency of FTN-16QAM is 4.11bit/s/Hz.

When the OSNR is set to 14dB, the BER of QPSK is 1.4×10^{-4}, and the BER of that is 8.97×10^{-3} with the addition of the FTN filter. While BER performance can be improved to 5.3×10^{-4} by using zero force equalization at the receiver. The BER performance in the C-band using FTN-16QAM showa that after FTN modulation, 16 points of 16QAM become 49 constellation points. When the OSNR is set to 16dB, the BER of 16QAM signal is 1.9×10^{-3}. The BER of that is 7.76×10^{-2} with the addition of the FTN filter. While BER performance can be improved by using zero force equalization at the receiver.The zero force equalization of the seventh-order transverse filter greatly improves the BER performance of FTN-16QAM.

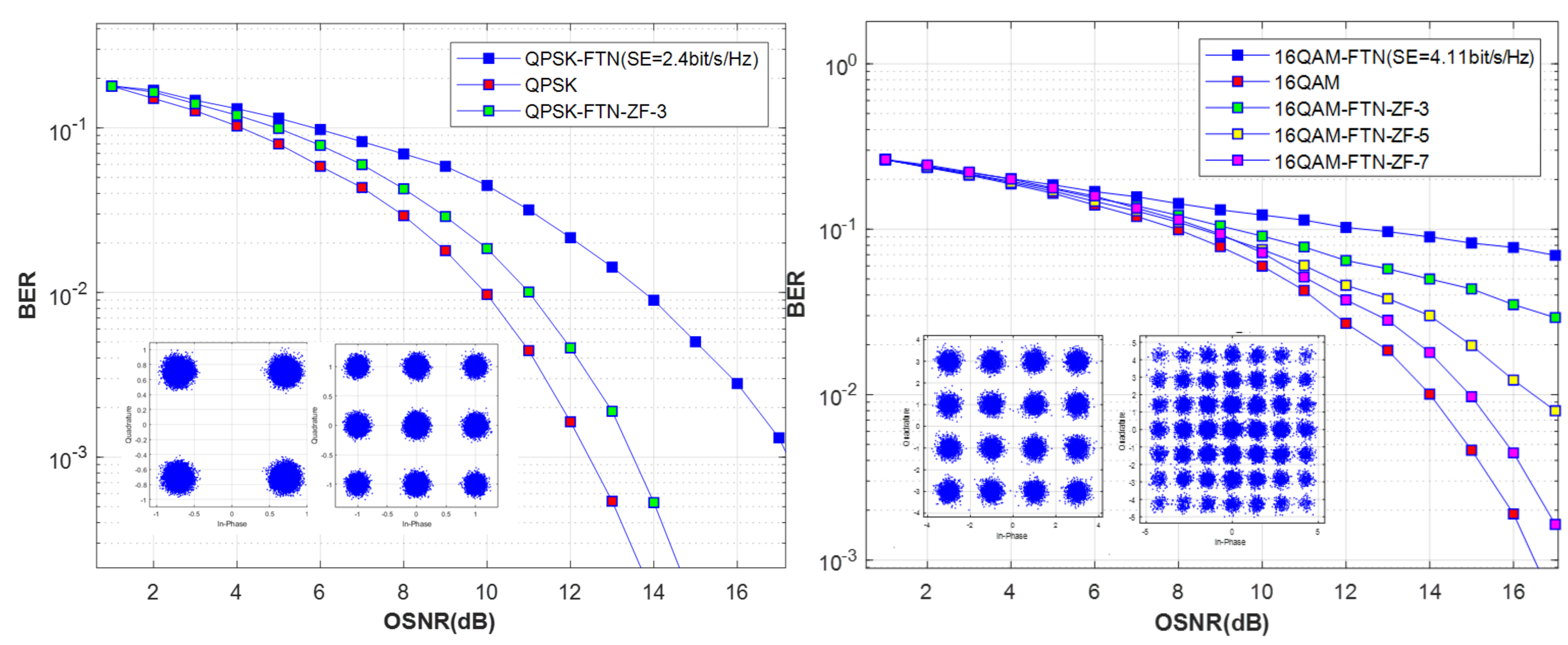

Figure 3. BER performance in O band and S band (L=20km)

Conclution

In this paper, we demonstrate the FTN scheme used in multi-band optical transmission system. The adaptive modulation format allocation is proposed to achieve the maximum capacity transmission. The spectral efficiency of QPSK modulation in O-band is increased to 2.4bit/s/Hz , and the spectral efficiency in S-band is increased to 4.11bit/s/Hz. At the receiver, the signals are recovered by ZF equalization algorithm to reduce the ISI effectively. The results show that the combination of FTN and multi-band optical transmission system has good application prospect in future high capacity optical communication.

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