

RESEARCH OF EDFA APPLICATION IN WDM SYSTEMS

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The capacity of fiber optical communication systems has undergone enormous growth during the last few years in response to huge capacity demand for data transmission. Because of signal absorption when transmitting optical signal at long distances it is necessary to use an optical amplifier.

Choosing a signal amplification method for wavelength division multiplexing (WDM) systems, preference is given to one of amplifier class - Erbium-Doped Fiber Amplifier (EDFA) [1]. EDFA amplifiers insert small noises, they are almost insensitive to the polarization of signal and can be relatively simply realized. Along with providing gain at 1550 nm, in the low-loss window of silica fiber, it can provide gain over a band that is more than 4000 GHz wide [2].

In this research we have investigated EDFA optical amplifier's operating parameters and its effects on the resulting gain and noise. In summary, it can be concluded that increase in input signal power reduced EDFA gain and ASE noise. According to our observations the most effective way to decrease ASE noise created by the amplifier is not to have a too weak signal to be amplified at EDFA input. There is always an optimum EDFA length depending on the pumping laser power. If the fiber is too short then the whole potential of the amplifier won't be realized. Some laser energy will remain unused. If the EDFA fiber is longer than the optimal value then erbium inversion level at the end of the EDF will be less than 50 % and fiber will start to absorb the signal.

The second key component of the EDFA besides erbium-doped fiber is pumping laser. All simulation results showed the advantage of 980 nm co-directional laser usage in amplifier setup. Compared to 1480 nm laser, higher gain and lower noise values are possible to achieve in this setup by using the same pumping power.

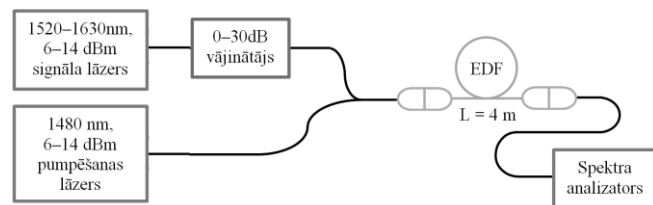


Figure 1. Experimental EDFA measurement scheme

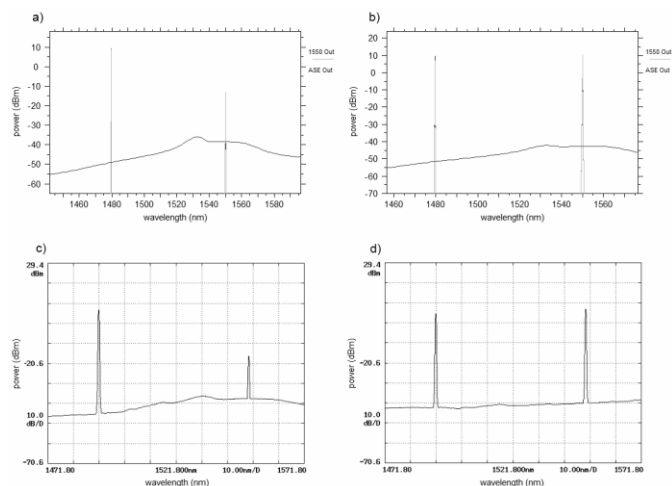


Figure 2. EDFA power spectrum at amplifier's output: Simulation – input power -22 dBm (a), 6 dBm (b); Measurement – input power -21.66 dBm (c), 6 dBm (d)

References

1. Cisco Systems, *Cisco Visual Networking Index – Forecast and Methodology 2009–2014* // White paper. – 2010. - No.1, P. 1–17.
2. M.Azadeh, *Fiber Optics Engineering*, Springer, 2009. – 379 p.
3. B.Mukherjee, *Optical WDM Networks*, – Springer, 2006. – 973 p.