ABSTRACT

The hybrid fiber amplifier (HFA) based on the combination between the linear EDFA and nonlinear RFA has been investigated in many published works during the last decades. This is due to the advantages that the HFA produces for the wavelength division multiplexing communication system in comparison to the optical amplifiers within a single gain medium technology (individual EDFA or RFA). This work is divided into two parts, namely, the optimization as well as the performance evaluation of single gain medium technology fiber optical amplifier, and proposed a wide flat-gain bandwidth serial hybrid fiber amplifier (SHFA) utilizing dual pumping source, also different amplification stage positions are used.

Regarding to the fiber optical amplifier within single gain medium technology, two different types of fiber optical amplifier are simulated, namely: 3 m length of EDFA and 7 km length of the RFA. The counterpumped architecture is adopted for both proposed optical amplifiers. The optimum pump power (OPP) for each amplifier determines in which the longest 3-dB flat gain bandwidth (3-dB G_{BW}), reasonable average gain level ($G_{av.}$), proper average noise figure ($NF_{av.}$) and lower gain variation ($G_{var.}$) are achieved. The EDFA shows best performance at conventional band (C-band) within the pump power of 30 mW.While the better performance is observed at long band (L-band) within the pump power of 600 mW for the RFA.

Furthermore, regarding to the hybrid technology a wideband SHFA utilizing a dual-pumped technique is simulated. The proposed SHFA is created by combining 3 m of EDFA and 7 km of dispersion compensation fiber (DCF) as a gain medium for the RFA. In the small signal region of –30 dBm, a wide flat-gain bandwidth about 60 nm from

1530 nm to 1590 nm, average gain level of 21.09 dB and average noise figure of 7.35 dB are achieved, by optimally adjusting the pumping power at 35 mW and 650 mW for both the EDFA and RFA, respectively.