Experimental PDFA and its Application on the CATV System

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Summary

Because many existing fiber optical communication system operate at 1.3μm band, the praseodymium-doped fluoride fiber amplifier(PDFA) is attractive for the application on these systems. A 12.8 meters praseodymium-doped fluoride fiber with doping concentration of 1000 ppm and an Neodymium: Yttrium Lithium Fluoride (Nd: YLF) laser operation around 1.047 μm are used to experimentally implement the PDFA. In order to have the maximum gains, the PDFA is modeled and the optimum pumping power is set accordingly. The PDFA can achieve small signal gain of 15 dB, operating bandwidth of 27 nm, noise figure(NF) less than 7.5 dB, and the amplified spontaneous emission(ASE) noise less than –33 dBm. Most CATV systems have the hybrid fiber/coaxial architecture. In order to have large coverage, optical splitters may be used to form a passive optical network for main distribution paths. A PDFA is an ideal candidate to amplify the signals along the transmission. The experimental setup is shown in Fig. 1. A laser source at 1300 nm is connected with an external modulator. The output power of the laser source is set to 12 dBm to have the best performance. At the headend the AM-VSB channels are multiplexed and allocated from 55.25 MHz to 83.25 MHz and from 163.25 MHz to 547.25 MHz with 6 MHz channel spacing. Then the signals are fed into the external modulator. The optimum receiving range of optical power of the receiver is from –7 dBm to 0 dBm. In our system as shown in Fig. 1, the optical signal transmits through 70 km single mode fiber and is fed into the input of the PDFA, where the praseodymium-doped fluoride fiber(PDFF) is 12.8 meters long and the pumping power is 650 mW at 1047 nm. After the filter, an optical receiver is used to convert the optical signals to the electrical signals. Fig. 2 shows the CSO, CTB, and CNR at the receiver. The PDFA with small signal gain about

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15dB and low noise characteristics(NF < 7.5 dB, ASE < -33 dBm) can successfully amplify the CATV signal to meet the system required levels. The degradation in picture qualities monitored on a TV set, with and without PDFA, are imperceptible in subjective tests. It is shown that the PDFA is applicable to the 1300 nm CATV system

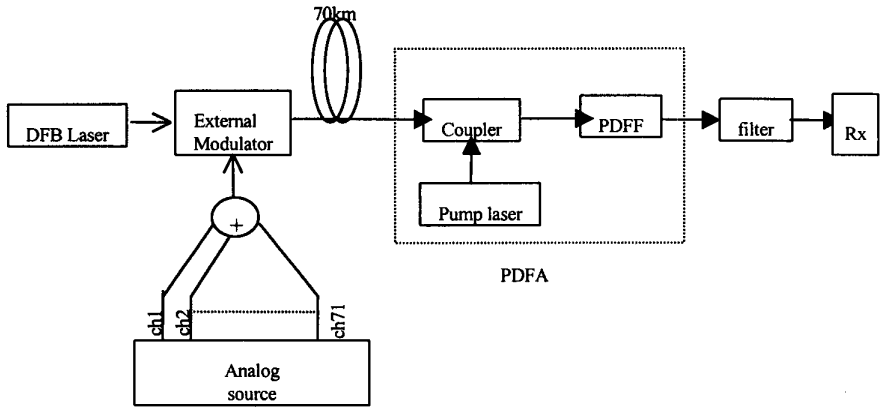

Fig. 1 Experimental Set up with PDFA

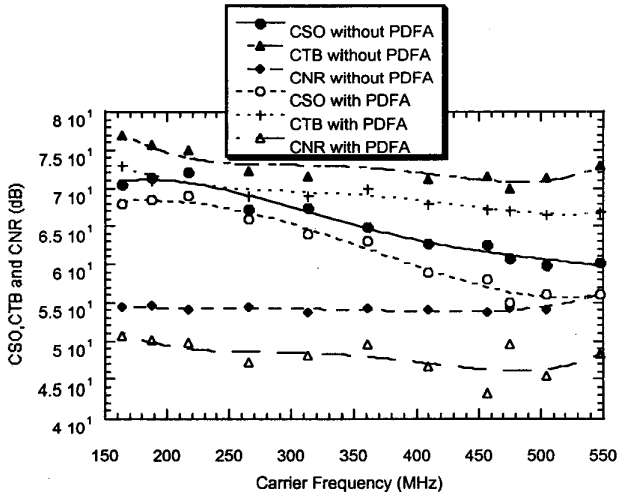

Fig. 2 experimental results without PDFA and theoretical results with PDFA