Design and Analysis of Surface Emitting Distributed Feedback (SEDFB) Laser for Radio Over Fiber (ROF)

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This paper appears in: Wireless and Optical Communications Networks, 2007. WOCN '07.
IFIP International Conference on
Publication Date: 2-4 July 2007
On page(s): 1-6
Location: Singapore,
INSPEC Accession Number: 9801412
Digital Object Identifier: 10.1109/WOCN.2007.4284169
Current Version Published: 2007-08-08

Abstract
Present consumers need reliable, cost effective, and broadband communication system that can support anytime, anywhere, and any media that they want. Those requirements can only be satisfied with wireless communication system using radio over fiber (ROF) technology. Link of ROF system commonly uses Radio Frequency (RF) transmission combined with single-mode fiber optic network. For this hybrid communication system, on the optical side it requires semiconductor laser device, which has low noise dan low distortion at high frequencies. This research is focused on design and analysis of semiconductor laser for ROF application. The alternative and advanced laser is designed for high performance operation and ease in manufacturing, that is a surface emitting distributed feedback (SEDFB) laser. Optimization is performed on the wavelength of 1.55 mum using the horizontal-cavity structure. This device contains an active region by means of multi-quantum well (MQWs) structure and a separated confinement heterostructure (SCH) in order to optimize its performance. The simulation results on a ridge. SEDFB structure produces a single-mode, 1550-nm output operation with optical confinement factor of 0.186, and farfield angle divergence of 45deg. The transverse edge loss is 0.031 cm\(^{-1}\). An optimum grating duty cycle is in the interval of 0.5-0.6. with a surface loss of 2-1 cm\(^{-1}\). The resulting laser design has a single-lobe pattern with a differential quantum efficiency of 41.3%.

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