Abstracts

A 60-GHz optical frequency shifter using coupled inverted slot lines

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A millimeter-wave optical frequency shifter (OFS) using coupled inverted slot lines (ISL's) is integrated on an X-cut LiNbO/sub 3/ substrate, Theoretical analysis shows that the use of the coupled ISL's makes it possible to decrease the distance between the arms of a Mach-Zehnder interferometer for optical frequency shifting. The ISL coupling characteristics measured at 60 GHz coincide well with the calculated ones. A 60-GHz frequency shifting of a 1.3-/spl mu/m optical carrier is experimentally demonstrated using two- and four-branch OFS's. The theoretical analysis and experimental results of the two-branch OFS show that the ratio of the frequency-shifted signal intensity to the optical image intensity is in proportion to the difference between the applied dc-bias voltage and the half-wave voltage. The four-branch OFS consists of two two-branch OFS's excited 180/spl deg/ out of phase, and can suppress the optical image and original carrier simultaneously. The measurements of the four-branch OFS reveal the optical image suppression of over 12 dB and the original carrier suppression of 5 dB below the desired 60-GHz frequency-shifted signal.

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