24-LINE OF BRILLOUIN-ERBIUM FIBER LASER UTILIZING A FABRY–PÉROT CAVITY IN L-BAND

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ABSTRACT: *In this paper, the generation of a multiwavelength laser source from a Brillouin-Erbium fiber laser in the long wavelength band (L-band) region is experimentally demonstrated. The proposed laser system utilizes a Fabry–Pérot cavity formed by fiber-loop mirrors. Twenty-four lines of Brillouin–Stokes with line spacings of 10 GHz are obtained in the L-band region.*
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Key words: *Fabry–Pérot resonator; fiber laser; L-band; nonlinear Brillouin scattering; multiwavelength lasing*

INTRODUCTION

Multiwavelength generation based on Erbium-doped fiber lasers (EDFLs) have been proposed and demonstrated in the C-band (1530–1565-nm) region for various schemes. Significant progress has been made in improving the schemes and performance of multiwavelength EDFLs during the past few years [1–3]. Multiwavelength oscillation in the L-band (1570–1605 nm) has also been demonstrated [4–6]. Up to seven channels with 3.2-nm spacing have been obtained on a ring-cavity EDFL [4]. A tunable Fabry–Pérot etalon was used as the intracavity comb filter to achieve multiwavelength operation in an L-band erbium-doped fiber (EDF) ring laser [5]. A maximum of six stable lines with a spacing of 1.3 nm in the wavelength range near 1590 nm has been produced at room temperature.

Recently, multiwavelength Brillouin-Erbium fiber lasers (BEFLs) with several kinds of cavity configurations have been demonstrated in the L-band region [7–9]. A laser comb of up to 20 lines (including the anti-Stokes) has been obtained in the L-band region using a ring-cavity laser with 10-GHz line spacing [7]. A dual-cavity BEFL that consists of two EDF ring-cavity lasers that share a length of single-mode fiber (SMF) has been reported with a 10-nm tuning range [8]. An efficient BEFL has been obtained by recycling backward a 1550-nm-band amplified spontaneous emission as a secondary pump source for the unpumped EDF [9]. However, research on L-band BEFL has focused on utilizing a ring-cavity-laser system despite the use of other laser-cavity systems.

In this paper, the generation of BEFL signals operating in the L-band region and utilizing a Fabry–Pérot laser cavity is discussed for the first time to the authors' knowledge. A stable operation of

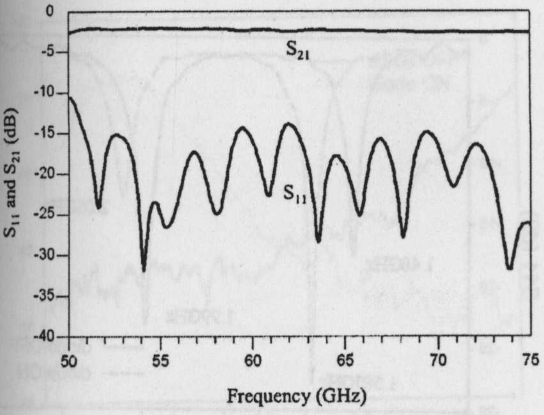

Figure 6 Measured results of the back-to-back transitions

2.3. Broadband Microstrip-Line-to-Rectangular-Waveguide Transition

One of the design parameters of the millimeter-wave module is to minimize the millimeter-wave interface length in order to reduce signal loss and mechanical complexity. Usually the transitions consist of several separated pieces that require judicious assembly, and a tuning mechanism is also essential. However, the module packaging (including the transition) is designed to have a simple structure composed of the least number of parts and robustness to compensate for assembling error.

The E-plane probe, the most commonly used type of transition, is well suited for simple and compact integration of the planar circuits with rectangular waveguide (RWG) [12]. It consists of a microstrip line on an alumina substrate inserted into the WR-15 RWG, as shown in Figure 5. The measured insertion loss of the back-to-back connected transition is 2.2 dB, as shown in Figure 6. The extracted insertion loss for a single transition is less than 0.4 dB from 50 to 75 GHz.

3. CONCLUSION

Broadband planar integration and packaging of millimeter-wave circuits has been proposed and demonstrated at the V-band. The proposed wideband microstrip-line-to-IWG transition is suitable for compact integration of planar circuits and the waveguide on the same substrate. It has features of low loss, wide bandwidth, and a simple structure, compared to conventional IWG transitions. The fabricated planar bandpass filter using the IWG transition exhibits an insertion loss of 3 dB with a 3.3% bandwidth at a center frequency of 62 GHz. The GCPW ribbon-bond interconnection and waveguide transition using the E-plane probe have low loss and robustness to compensate for assembling error. The proposed integration and packaging allow the design of a fully integrated, small-size planar millimeter-wave front-end with low loss.

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