

## **Flat amplitude and wide multiwavelength Brillouin/erbium fiber laser based on Fresnel reflection in a micro-air cavity design**

### **ABSTRACT**

In this report, we demonstrate a wide multiwavelength Brillouin-erbium fiber laser (MBEFL) with improved flatness that integrates a micro-air cavity. This air-gap introduces a cavity loss to overcome the gain saturation as well as providing efficient pump recycling scheme through Fresnel back-reflection. In addition, the efficient four-wave mixing in the highly nonlinear fiber contributes to the self-flattening of the output spectra. During operation, the optimized pumping values are set at 13 dBm Brillouin power and 600 mW erbium-ytterbium doped fiber amplifier when the air-gap length is fixed at 10  $\mu\text{m}$ . A total of 180 Stokes lines are produced with a channel spacing of 0.08 nm. The flat lasing bandwidth is 14 nm that consists of 1557 to 1571 nm wavelengths within 3-dB span. The average optical signal-to-noise ratio is 18 dB, having high peak power of  $-8$  dBm. To our knowledge, this is the best result attained in MBEFLs with respect to the spectral flatness. In fact, the power stability of 0.76 dB order over 45 minute durations merits its applications in optical fiber sensing and communications.

**Keyword:** Flat amplitude; Wide multiwavelength; Brillouin/erbium fiber laser; Fresnel reflection; Micro-air cavity design

