The generated sawtooth waveform is shown in Fig. 4b. The waveform was measured by an oscilloscope with 16 GHz bandwidth and 50 GS/s sampling rate. The figure indicates that the generated sawtooth waveform has a fundamental frequency of 1.52 GHz, which typically requires larger bandwidth than 30 GHz (20th harmonic). The generation of such a high-frequency sawtooth waveform is usually difficult with electronic circuits. It is worthwhile to note that there is no fundamental limit on the frequency of the sawtooth waveform that the JAWS filter can offer. With a smaller GVD, a sawtooth waveform with a higher fundamental frequency can easily be achieved. In practice, detection of such a high-frequency is difficult since detection systems with more than 20 GHz bandwidth are required.

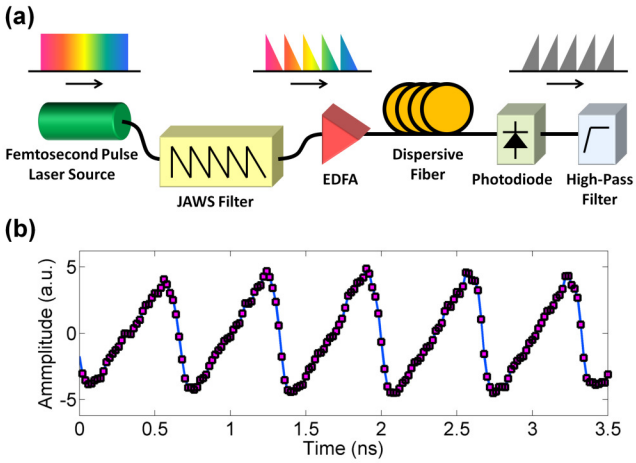

Fig. 4. Application of the JAWS filter to ultrahigh-frequency sawtooth waveform generation. (a) Experimental apparatus. The spectrum filtered by the JAWS filter is mapped into the time domain by GVD in the dispersive fiber. (b) Sawtooth waveform produced by the sawtooth generator and measured by an oscilloscope with 16 GHz bandwidth and 50 GS/s sampling rate. The fundamental frequency of the sawtooth waveform is 1.52 GHz.

4. Summary

We have proposed and demonstrated a simple all-optical passive low-cost spectral filter that produces a periodic sawtooth transfer function without the need for active optoelectronic components. To show the filter's utility, we have demonstrated two potential applications of the filter.

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