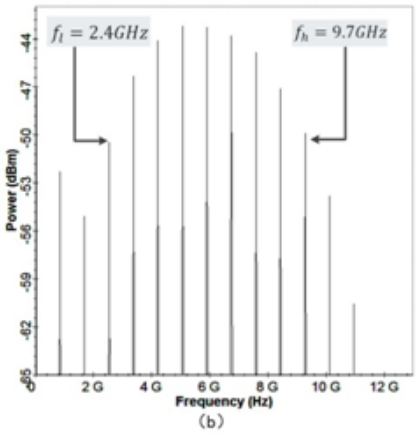

Fig. 4 Simulation experiment results, (a) generated UWB doublet pulse,(b) spectrum of generated UWB doublet pulses.

The FWHM of the generated UWB doublet pulses can be easily adjusted by tuning the time delay of the OTD [8]. So the central frequency and $-10dB$ bandwidth of the UWB signal are variable. When the time delay of the OTD is changed from 30ps to 120ps and the other parameters remain the same, the central frequency and $-10dB$ bandwidth of each UWB pulse is calculated, as shown in Fig. 5. The $-10dB$ bandwidth becomes smaller and the central frequency shifts to the low frequency region simultaneously as the time delay of the OTD increases. Thus, UWB doublet signals with a tunable central frequency and $-10dB$ bandwidth is obtained by adjusting the time delay of the OTD.

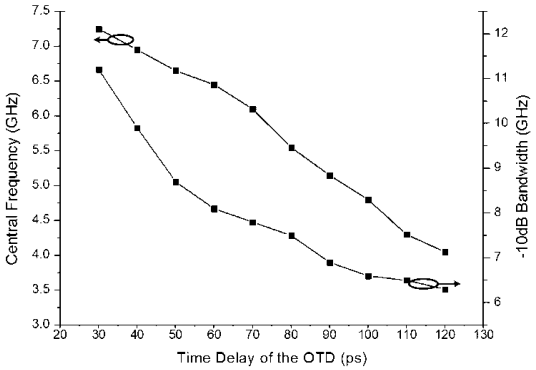

Fig. 5 Central frequency and $-10dB$ bandwidth of the UWB doublet pulse under different time delay of the OTD

IV . Conclusion

In this paper, we have proposed a method to generate UWB doublet signals using a SOA based NOLM by exploiting the XPM effect. And the simulation experiment based on the proposed method has also been carried out. In the simulation experiment, the CW and CCW light are both phase modulated by each other in the SOA by the XPM effect, and the phase modulation is converted to intensity modulation in the NOLM output. UWB doublet pulses which meet the FCC regulations are generated. It has a central frequency of 6.05GHz, the $-10dB$ bandwidth is 7.3GHz, and the fractional bandwidth is 121%. By tuning the relative time delay between the CW light and the CCW light, UWB doublet signals with a tunable central frequency and $-10dB$ bandwidth have also been generated.

References

[1] D. Porcine, P. Research, W. Hirt. "Ultra wideband radio technology: potential and challenges ahead". *IEEE Commun Mag*, 2003,41(7):66-74

[2] G.R. Aiello, G.D. Rogerson. "Ultra-wideband wireless systems". *IEEE microwave magazine*,2003,4(2):36-47.

[3] H. Nikookar, R. Prasad. "Introduction to Ultra Wideband for Wireless Commu nications". 2009:11-27.

[4] J.P. Yao, F. Zeng, Q. Wang, et al. "Photonic Generation of Ultra-wideband Signals". *Journal of Lightwave Technology*, 2007, 25(11): 3219-3235

[5] J.P. Yao. "Photonics for ultrawideband communications". *IEEE microwave magazine*, 2009,10(4):82-95

[6] N.J. Doran, W. David. "Nonlinear-optical loop mirror". *Optics Letters*, 1988, 13(1): 56-58

[7] M.F. Faridus, M.H.A. Wahid, N. Sabani, et al. "SOA characterization for AND logic operation on SOA based NOLM". *IEEE Regional Symposium on*, 2011,9:372-376.

[8] B.W. Luo, J. Dong, Y. Yu et al. "Bandwidth-Tunable Single-Carrier UWB Monocycle Generation Using a Nonlinear Optical Loop Mirror". *IEEE Photonics Technology Letters*,2012,24(18):1646-1649.