

# **Feasibility Study of a Reconfigurable Fiber-Wireless Testbed Using Universal Software Radio Peripheral**

M. A. Ridwan<sup>1</sup>, N. A. M. Radzi<sup>1,\*</sup>, F. Abdullah<sup>1</sup>, N. M. Din<sup>1</sup>, and C. B. M. Rashidi<sup>2</sup>

<sup>1</sup>Department of Electronics and Communication Engineering, College of Engineering, Universiti Tenaga Nasional, Jalan Ikram-Uniten, 43000 Kajang, Malaysia

<sup>2</sup>Advanced Communication Engineering, Centre of Excellence School of Computer and Communication Eng. Universiti Malaysia Perlis, (UniMAP) Kangar, 01000, Kangar, Perlis, Malaysia

Received 21 June 2017; received in revised form 26 March 2018; accepted 26 April 2018

## **Abstract**

Fiber-wireless (FiWi) network is still improved ongoingly and there are a number of testbeds for the FiWi network available nowadays. However, most of them are hardware-based, making them not easy to reconfigure to perform architecture or protocol studies. This paper first proposes a reconfigurable FiWi testbed using software-defined radio, particularly universal software radio peripheral (USRP) with LabVIEW as the simulation platform. To evaluate the testbed, wireless range and power output were tested to optimize the best output for the USRP. With the range of 100 m, it was found that the best output power is 30 dB. Then, the study evaluated the performance of the upstream FiWi testbed transmission in terms of throughput, transmission time, and jitter. To test the testbed reconfigurability, the testbed architecture and transmission type were altered, and the performance was scrutinised. The experimental results indicate that USRP is suitable for a reconfigurable FiWi testbed.

**Keywords:** fiber wireless, testbed, reconfigurable, USRP

## **References**

- [1] R. Lin, M. Zhu, Z. Zhou, H. Chen, and J. Ye, "New progress of mm-wave radio-over-fiber system based on OFM," *Frontiers of Optoelectronics in China*, vol. 2, no. 4, pp. 368-378, December 2009.
- [2] Y. Liu, J. Wu, Y. Yu, Z. Ning, X. Wang, and K. Zhao, "Deployment of survivable fiber-wireless access for converged optical and data center networks," *Optical Switching and Networking*, vol. 14, pp. 226-232, 2014.
- [3] U. Bhatt, T. Sarsodia, and R. Upadhyay, "Performance evaluation of survivable fiber-wireless (FiWi) access network," *Procedia Computer Science*, vol. 46, pp. 1049-1055, 2015.
- [4] G. Vasileiou, G. Papadimitriou, P. Nicopolitidis, and P. Sarigiannidis, "An effective resource allocation medium access control protocol for radio-over-fiber access networks based on wavelength reuse," *Computer Communications*, vol. 88, pp. 45-56, 2016.
- [5] J. Sun, L. Yu, and Y. Zhong, "A single sideband radio-over-fiber system with improved dynamic range incorporating a dual-electrode dual-parallel Mach-Zehnder modulator," *Optics Communications*, vol. 336, pp. 315-318, 2015.
- [6] Q. Dai, G. Shou, Y. Hu, and Z. Guo, "Performance improvement for applying network virtualization in fiber-wireless (FiWi) access networks," *Journal of Zhejiang University Science C*, vol. 15, no. 11, pp. 1058-1070, 2014.
- [7] L. Chen, J. Yu, J. Xiao, X. Li, Y. Xu, and Z. Zhang, "Fiber-wireless-fiber link for 20-Gb/s QPSK signal delivery at W-band with DML for E/O conversion in wireless-fiber connection," *Optics Communications*, vol. 354, pp. 231-235, 2015.
- [8] R. Shaddad, A. Mohammad, A. Al-Hetar, S. Al-Gailani, and M. Elmagzoub, "Fiber-wireless (FiWi) access network: Performance evaluation and scalability analysis of the physical layer," *Optik - International Journal for Light and Electron Optics*, vol. 125, no. 18, pp. 5334-5338, 2014.

---

\* Corresponding author. E-mail address: asyikin@uniten.edu.my

- [9] R. Zhang, J. Ma, Z. Wang, J. Zhang, Y. Li, G. Zheng, W. Liu, J. Yu, Q. Zhang, Q. Wang, and R. Liu, "Full-duplex fiber-wireless link with 40Gbit/s 16-QAM signals for alternative wired and wireless accesses based on homodyne/heterodyne coherent detection," *Optical Fiber Technology*, vol. 20, no. 3, pp. 261-267, 2014.
- [10] "Compare and buy USRP- National Instruments," [http://www.ni.com/sdr/usrp/compare/NI\\_USRP\\_292x/293x\\_Datasheet](http://www.ni.com/sdr/usrp/compare/NI_USRP_292x/293x_Datasheet), National Instrument, 2015.
- [11] "IEEE P802.3ah Ethernet in the first mile task force," <http://www.ieee802.org/3/efm>, 2004.
- [12] C. Lim, A. Nirmalathas, and Y. Yang, "Digitized wireless transport for fiber-wireless system," *IEEE Transparent Optical Network*, pp. 1-4, June 2011.
- [13] N. A. M. Radzi, N. M. Din, N. I. M. Rawi, F. Abdullah, A. Ismail and M. H. Al-Mansoori, "A new dynamic bandwidth allocation algorithm for fiber wireless network," 2014 IEEE 2nd International Symposium on Telecommunication Technologies (ISTT), November 2014, pp. 301-304.
- [14] Y. Xu, Z. Zhang, X. Li, J. Xiao, and J. Yu, "Demonstration of 60 Gb/s W-band optical mm-wave signal full-duplex transmission over fiber-wireless-fiber network," *IEEE Communications Letters*, vol. 18, pp. 2105-2108, October 2014.