



Wireless Signal Processing Using Antenna-Coupled Electrode Electro-Optic Modulator and Optical Fiber Dispersion Effect

Naoki Ueda, Yamato Fujikata, Yui Otagaki, and Hiroshi Murata
Graduate School of Engineering, Mie University Tsu-City, Mie 514-8507 Japan;
e-mail: murata@elec.mie-u.ac.jp

In Beyond-5G/6G mobile communication networks, a wireless carrier frequency is to be expected going to the THz to secure high-speed data transfer over 50 Gb/s and low latency. Then, it is expected to develop new signal processing technologies. To meet this demand, we are trying to develop a new signal processing technique based on RoF (Radio-over-Fiber) technology using multiple laser lights and a silica optical fiber dispersion effect [1]. A silica optical fiber is widely used in today's long-haul telecommunication systems. It has a huge bandwidth of over 100 THz and extremely low loss of 0.2dB/km at 1.55 μ m. In addition, one of the important characteristics is chromatic dispersion. This characteristic causes a slight temporal delay between optical signals at different wavelength channels during fiber link propagation. Therefore, by utilizing a silica optical fiber as a delay line in a RoF link with a high-speed optical phase modulator, the detection and processing of wireless signals in millimeter-wave/THz frequency bands are obtainable. In this report, experimental demonstrations of wireless 1 Gb/s BPSK signal detection at the 30 GHz-band using the proposed technique are presented.

Figure 1 shows the experimental set-up and the detected signal patterns. A key point of the proposed signal processing technique is wireless signal temporal correlation through a fiber link by use of a high-speed optical phase modulator, multiple laser sources with tunable wavelengths, and a silica optical fiber for a wireless signal delay line. In the experiments, antenna-coupled electrode electro-optic (EO) phase modulator operating at the 30 GHz-band was used as the optical phase modulator. Figure 1 (b) is the measured signal pattern when a 30 GHz-band wireless signal with a differential coded BPSK signal stream at 1 Gb/s was irradiated to the antenna-coupled EO modulator. Clear signal patterns were observed successfully. The operational principles signal processing and the EO modulator are described in [1, 2]. Details will be provided in the conference.

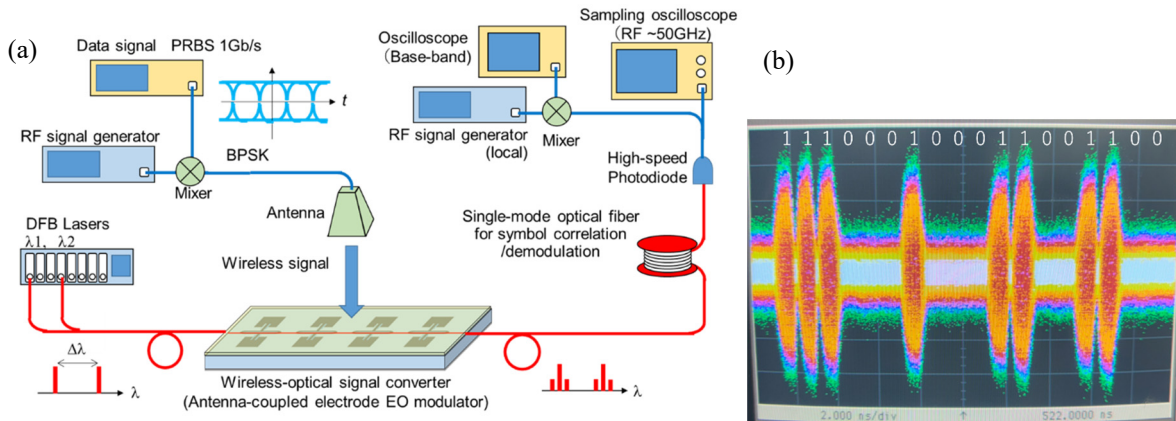


Figure 1. (a) Experimental set-up of the wireless signal conversion and detection using an optical phase modulator, 2-laser sources with different wavelengths and a silica fiber link.
(b) Measured signal stream of 1 Gb/s BPSK signal by the wireless signal detection.

This work was supported in part by the research project entitled ‘Toward-B5G’, NICT, Japan (JPJ012368C00501).

1. N. Ueda, Y. Otagaki, and H. Murata, “New Signal Processing Technique Using Optical Phase Modulator and Optical Fiber Dispersion Effect,” *URSI GASS 2023*, D09-2-3, Aug. 2023, Sapporo, Japan.
2. H. Murata, H. Yokohashi, S. Matsukawa, M. Sato, M. Onizawa and S. Kurokawa, “Antenna-Coupled Electrode Electro-Optic Modulator for 5G Mobile Applications,” *IEEE Journal of Microwaves*, vol. 1, no. 4, pp. 902-907, 2021. DOI: 10.1109/JMW.2021.3107030.