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PAPR REDUCTION AND RELATED TECHNIQUES FOR POWER EFFICIENT MULTI-CARRIER/MULTI-CODE WIRELESS COMMUNICATION SYSTEMS

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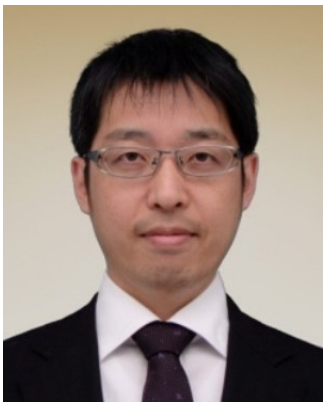

Demands for higher data rate in wireless communication systems have been increasing recently. In general, as transmission rate increases, cell coverage area decreases, and hence it is required to deploy many base nodes as access point (AP) in order to cover the service area, and consequently increase implementation cost of wire-line systems that are connected to each AP. One of solutions to this, a radio relay system such as wireless backhaul is promising, where several APs are connected to a radio relay station (RS) by radio channels and a few of them are connected to the outside network by cable. In this system, at each base station such as APs and RSs, it is desirable to use a power amplifier with high power efficiency and low nonlinear distortion. When the signal is amplified at a power amplifier with nonlinear characteristics, out-of-band radiation is generated attributable to nonlinear distortion. Although nonlinear distortion is reduced by decreasing the signal level to operate the amplifier within linear region, i.e., taking a large amount of back-off from saturation point of power amplifier, it causes power efficiency degradation. Therefore, it is necessary to compensate for nonlinearity of input-output characteristic in power amplifiers in order to satisfy two conflicting requirements, i.e., high power efficiency and low nonlinear distortion.

In multi-carrier/multi-code transmission systems, the transmit signal exhibits high peak-to-average power ratio (PAPR) which causes power efficiency degradation at the power amplifier. As a solution to the PAPR problem, several PAPR reduction techniques have been proposed. To achieve high power efficiency at power amplifiers, combination of adaptive linearization for input-output characteristics at power amplifier and PAPR reduction of the transmit signal is a promising and necessary approach. In addition, when special division multiple access in multi-antenna systems is considered, it is desirable to optimize the transmit weights under the constraints of total transmit power and per-antenna transmission power so that the transmit power for each antenna is limited below a given threshold; a low output (i.e., low cost) power amplifier is used for every antenna elements.

In this presentation, a topic related to PAPR reduction and related techniques for multi-carrier/multi-code wireless communication systems are mainly presented: PAPR reduction techniques for multi-carrier/multi-code transmission systems, an adaptive linearization technique using orthogonal functions for nonlinear power amplifier, and a transmitter weight optimization technique under per-antenna power constraint for spatial division multiple access systems.

Finally, our current research activities in Center for Japan-Egypt Cooperation in Science and Technology (EJUST Center) at Kyushu University are briefly introduced, where we have carried out collaboration research with E-JUST University (Egypt-Japan University of Science and Technology), a national university in Egypt, mainly on the field of wireless communications.

Osamu Muta received a B.E. degree from Ehime University, Ehime, Japan, in 1996, an M.E. degree from Kyushu Institute of Technology, Fukuoka, Japan, in 1998, and a Ph.D. degree from Kyushu University, Fukuoka, Japan in 2001. In 2001, he joined the Graduate School of Information Science and Electrical Engineering, Kyushu University as an assistant professor. Since 2010, he has been an associate professor in Center for Japan-Egypt Cooperation in Science and Technology, Kyushu University. His current research interests include signal transmission processing techniques for high-speed wireless communications and power-line communications, and nonlinear distortion compensation techniques for high-power amplifiers. He received the 2005 Active Research Award for excellent presentation from IEICE Radio Communication Systems.