

Comparison between Quadrature- and Polar-modulation Switching-mode Transmitter with Pulse-density Modulation

Hironori IZUMI[†], Michiaki KOJIMA^{†*}, Yohtaro UMEDA[†], Osamu TAKYU^{††}

[†]Department of Electrical Engineering, Graduate School of Science and Technology, Tokyo University of Science,

2641 Yamazaki, Noda, Chiba, 278-8510 Japan

^{††}Dept Electrical & Electronic Engineering, Shinshu University, 4-17-1 Wakasato, Nagano, 380-8553 Japan

*At present he is at Softbank Mobile Corp.

E-mail: j7311670@ed.tus.ac.jp

Abstract— This paper presents the performance of the quadrature modulation (QM) transmitter when compared with the (PM) transmitter. So as to evaluate the substantive power efficiency in both transmitters, the effective demodulation power efficiency (EDPE) is proposed as a novel figure of merit for transmitters. Computer simulation reveals that the EDPE for a QM transmitter is lower than that for a PM transmitter. In addition, D/U for a QM transmitter is higher than the one for PM transmitter due to lower quantization noise. As a result, the EVMs for a QM transmitter is higher than the one for a PM transmitter.

Keywords— Transmitter; Polar modulation; Quadrature modulation; Pulse density modulation; Delta-sigma modulation; Effective demodulation power efficiency



Hironori Izumi received the B.E. degree in Electrical Engineering from Tokyo University of Science, Chiba, Japan, in 2011. Since 2011, he is currently pursuing the M.E. degree in Electrical Engineering from Tokyo University of Science. His current research interest is in high power-efficiency transmitter



Michiaki Kojima received the B.E. and M.E. degrees in Electrical Engineering from Tokyo University of Science, Chiba, Japan, in 2010 and 2012, respectively. Since 2012, he joins Softbank Mobile Corporation.



Yohtaro Umeda received the B.S. and M.S. degrees in physics and the Ph.D. degree in electrical engineering from the University of Tokyo, Tokyo, Japan, in 1982, 1984, and 2000, respectively. In 1984, he joined Nippon Telegraph and Telephone (NTT) Corporation. He moved to Tokyo University of Science, Chiba, Japan, as a professor, where he is engaged in the study of high-speed analog circuits for radio and fiber-optic communication systems. Prof. Umeda is a recipient of the Outstanding Paper Award of 1997 IEEE GaAs IC Symposium. He is a member of the IEEE.



Osamu Takyu received the B.E. degree in Electrical Engineering from Tokyo University of Science, Chiba, Japan, in 2002 and the M.E. and Ph. D. degrees in Open and Environmental Systems from Keio University, Yokohama, Japan in 2003 and 2006, respectively. From 2003 to 2007, he was a research associate in the Department of Information and Computer Science, Keio University. From 2004 to 2005, he was visiting scholar in the School of Electrical and Information Engineering, University of Sydney. From 2007 to 2011, he was an assistant professor in the Department of Electrical Engineering, Tokyo University of Science. From 2011, he is an assistant professor in the Department of Electrical & Electronic Engineering, Shinshu University. Dr Osamu TAKYU is a recipient of Young Researcher's award of IEICE 2010. His current research interests are in wireless communication systems and distributed wireless communication technology. He is a member of IEEE.