

Development of PHY Velocity Estimation Algorithm for Downlink Wibro/Mobile WiMax TDD Telecommunication System

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Abstract — In this document development of an effective algorithm for estimation velocity of mobile user in downlink of mobile WiMax (IEEE 802.16e) telecommunication system is made. During research it was shown, that known methods of velocity estimation cannot be used directly for communication system like IEEE 802.16e according to some limitations of the standard signal generation. New method of estimation of velocity based on the improved algorithm of autocorrelation function estimation is suggested. Was shown, that for system parameters, specified for WiBro telecommunication system (variant of 802.16e standard) proposed algorithm demonstrate good results for acceptable length of observation interval.

Index Terms — Velocity Estimation, OFDM, WiMax, WiBro.

Several velocity estimation algorithms for mobile telecommunication systems are known in literature [1, 2]. Main idea of majority of proposed approaches is to calculate the autocorrelation function of received signal and to detect the lowest positive zero of autocorrelation function. As it is proved in [3], autocorrelation function (ACF) of Raleigh time-variant propagation channel is denoted by Bessel function of zero-order:

$$R(\tau) = J_0(\omega_{\max} \cdot \tau)$$

where $\omega_{\max}$ - maximum Doppler frequency of received signal. It is known, that the lowest positive zero crossing point of Bessel function occurs at $\omega_{\max} \cdot \tau = 2.405$.

At the same time direct application of approach, presented in literature [3] to WiMax OFDMA telecommunication system downlink is complicated due to the some limitations, applied by the standard to the signal structure.

First of all it is time division duplex (TDD) operation mode and variable frequency tone positions of pilot components of generated signal. Another additional obstacle in realization of algorithm in uplink of the same system is presence in signal generation rule some "rotation of subchannels" principle, used in UL

In current work we will report algorithm of velocity estimation for the DL TDD mobile WiMax telecommunication system and discuss some difficulties in realization of it, concerned to specialties of the standard signal generation.

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