Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**PHY Requirement for Handoff Performance**
Date Submitted	**2005-01-10**

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Re:	Response to Sponsor Ballot on IEEE802.16e/D5a document
Abstract	Specify PHY Performance Requirement for Handoff for IEEE P802.16e/D5-2004
Purpose	To incorporate the text changes proposed in this contribution into the 802.16e/D6 draft.
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OFDMA PHY Requirement for Enhanced Handoff Performance

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1. Introduction

Current 802.16e standard emphasizes the mobile handoffs but did not specify enough physical layer requirements to enhance the handoff performance. In this contribution, we are proposing three PHY constrains for the BS network and MSS to enhance the handoff performance.

2. Background

In the current 802.16e standard, each BS can add independent buffering delays to the transmit path. The buffering delays will incur unspecified time differences among the neighboring BSs, when transmit frames go over-the-air.

The current standard places unprecedented burden on BS in handoff scheduling while MSSs stay in passive mode. BS needs to schedule each individual MSS to perform neighbor scanning, In PUSC deployment, there is no reason why MSS cannot perform neighbor cell scanning autonomously.

The following proposals aim at imposing reasonable constraints on 802.16e OFDMA devices (BS and MSS) to facilitate MSS in conducting handoffs. Specific improvements are

1. Specify the transmit frame timing on BS side to be aligned with 1pps system time at antenna ports and the requirements of equivalent alignment on MSS side at antenna ports. They will make radio frames between BSs and MSSs better structured and interference between neighbor cells reduced.

2. Further more, by constraining MSS to lock its epoch time upon the ranging process and track on the earliest arrival path, the MSS uplink timing is better behaved. Therefore, “ranging” handshake is no longer needed during the handoff and the frequency of periodic ranging can be greatly reduced therefore the success rate of CDMA based ranging request is highly improved.

3. By allowing MSS to initiate neighbor cell scanning, BS scheduler is freed up from managing the neighbor cell scanning of hundreds of MSSs. Updating the neighbor cell list shall be done by MSS autonomously and BS shall not have to dictate when and how MSS need to perform neighbor cell scanning.

3. Specific Text Changes

[Add section 8.4.15 as follows]

8.4.15 OFDMA PHY requirements for enhanced handoff performance

8.4.15.1 System reference timing accuracy

At the BS, the transmitted downlink radio frame shall be aligned with the 1pps timing pulse (8.4.10.1.2). The start of the preamble symbol, excluding the CP duration, shall be time aligned with 1pps timing pulse within $\pm 1/F_s$ (see 8.4.2.4) when measured at the antenna port.

At the MSS, upon close-loop adjustments of transmit and receive timings from BS through CDMA ranging methods during network entry and periodic ranging, the MSS obtains the system time reference. Thereafter the MSS shall maintain the time reference within $\pm 1/F_s$ when measured at the antenna port.

8.4.15.2 MSS uplink transmit time tracking accuracy

With the time reference MSS maintained in 8.4.15.1, MSS shall autonomously adjust uplink transmit timing according to the timing advances and retards of the detected downlink earliest arrival path detectable in the preamble symbol. The autonomous timing reference shall be tracked within $\pm 1/F_s$ without BS close-loop timing control.

At the MSS, the transmitted radio frame shall be aligned with the network specified uplink frame boundary. At zero timing advance and retard setting, the start of the first uplink data symbol, excluding the CP duration, shall be time aligned with the specified uplink frame boundary within $\pm 1/F_s$ relative to the downlink arrival time when measured at the antenna port without BS close-loop control.

8.4.15.3 MSS autonomous neighbor cell scanning

In cellular deployment, the MSS shall maintain autonomous neighbor cell scanning via preamble detection for neighbor cells in the same carrier frequency. The MSS shall maintain the signal quality database for neighbor cells without being instructed by the BS. To maintain effective handover performance the update rate of the active set needs to be less than 0.5s and for candidate set, 2s.

During idle mode, the MSS shall maintain active set update at least 10s per cycle and 20s for candidate set update.

References:

[1] IEEE P802.16-REVd/D5-2004 Draft IEEE Standards for local and metropolitan area networks part 16: Air interface for fixed broadband wireless access systems