Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Fast cell search for OFDMA**
Date Submitted	**2004-06-25**
Source:	Wen Tong, Peiying Zhu, Jianglei Ma, Ming Jia Nortel Networks 3500 Carling Avenue Ottawa, ON. K2H 8E9 CANADA Voice: (613)-763-1315 Fax: (613)-765-7723 wentong@nortelnetworks.com
Re:	IEEE 802.16e D2 Draft
Abstract	To improve the cell search
Purpose	To incorporate the changes here proposed into the 802.16e D4 draft.
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

Fast Cell Search

1 Background

The current preamble per IEEE802.16-2004 is designed primarily for fixed deployment. The preamble search requires large amount of computation power at MSS for fast system access and for cell selection and reselection to support the device mobility in a multi-cell deployment scenarios and to perform frequency domain fine synchronization. For the initial cell search, there is no prior knowledge about the synchronization positions for potential base station candidates; hence MSS needs to perform the correlations with all possible PN sequences for each FFT window position within the entire searching window, such a window could be large even for the synchronous BS network. For hand-off, even with the presence of the adjacent BS list information broadcasted from the anchoring BS, the preamble search is of excessive high computational complexity. We propose a fast cell search procedure to reduce the cell search complexity by almost 60 times. Since the cell search must be performed for MSS in the active state, cell scanning and even idle mode. Fast cell search is very beneficial in terms drastically reduce the power consumption and battery life of portable device.

In this contribution, we propose to introduce a common preamble in addition to the existing cell specific preamble. The common preamble uses a common PN sequence for all BSs. MSS performs fine synchronization using the common PN sequence on the common preamble, the result will provide the locations of candidate BSs. The BS specific search is then performed in the vicinities of those peaks by using BS specific PN sequences. With this two stage cell search, the searching window is drastically reduced.

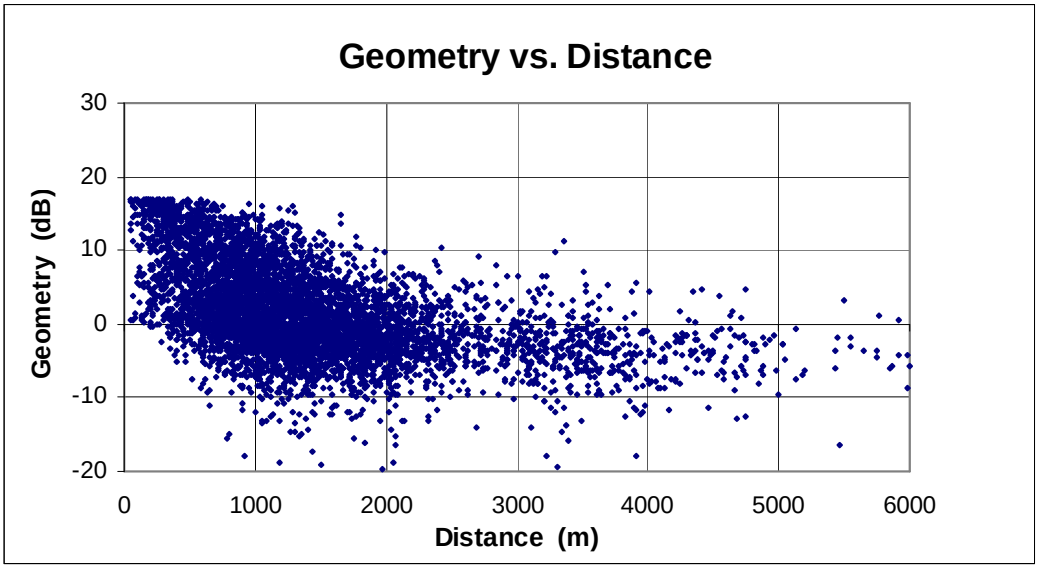

Figure 1 The best BS location may not be in the adjacent cell

For the synchronized BS deployment, let's assume that the anchor BS will broadcast the neighbor BS list for M sectors. And the searching window is 300 samples long (as we have 256 samples prefix), however the real world the searching window can be 2 times more than this (see Figure 1, where the cell to cell spacing is 3km). The correlation of common preamble allows the BS specific preamble search window to reduce to about 5 samples or less, then we can perform cell specific preamble search.

Table 1 Cell search for hand-off case

Number of preamble correlation	One tier cell		Two tier cell	
	3-sectors cell	9-beams cell (AAS)	3-sectors cell	9-beams cell (AAS)
Baseline Cell Search	300x20=6000	300x63=18900	300x19x3=17099	300x19x9=51299
Fast Cell Search	5x20=100	5x63=315	5x19x3=285	5x19x9=855

As we can see that the common preamble assisted cell search can speed up the preamble search time by 60 times, or to reduce the search computational complexity by 60 times.

Specific Text Proposal

Insert to Section 8.4.6.1.1

---------Start text proposal-------

In each segment, the 6 carrier sets are used; each segment uses two carrier sets. The same 6 carrier sets are used . One carriers set in each segment is used for the common preamble.

Each segment uses 2 types of preamble out of the 6 sets in the following manner:

Segment 0 uses preamble carrier-set 0 and 3
Segment 1 uses preamble carrier-set 1 and 4
Segment 2 uses preamble carrier-set 2 and 5

For 2 transmit antennas, antenna 0 uses odd carrier set, antenna 1 uses even carrier set. The common preamble is mapped to carriers sets used by antenna 0. Each segment uses 2 types of preamble carrier-sets (one for each antenna or pair of antennas) out of the 6 sets in the following manner:
For two transmit MIMO:

Segment 0 - carrier set 0 used by antenna 0, carrier set 3 used by antenna 1
Segment 1 - carrier set 1 used by antenna 0, carrier set 4 used by antenna 1
Segment 2 - carrier set 2 used by antenna 0, carrier set 5 used by antenna 1

The same PN series as defined in that Table 207 [Ref-1]

---------End text proposal-------

Ref-1: IEEE P802.16-REVd/D4-2004