Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>
Title	Corrigenda comment to fix Idle Mode issues
Date Submitted	2006-11-15
Source(s)	Phillip Barber Huawei pbarber@huawei.com
Re:	Fix some problems with Idle Mode in 802.16e-2005
Abstract	
Purpose	Fix some problems with Idle Mode in 802.16e-2005
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>.

Fix Idle Mode issues
Phillip Barber
Huawei

Problem 1:
1) Out-of-scope of 802.16 to make reference to specific backbone messages, especially what appears to be normative references. Remove the references.
2) The language prior to, and Figure 130i in the standard inappropriately imply that geography alone is the defining factor for Paging Group definition. 802.16 intended that Paging Groups may be established further differentiated by QoS factors (cycle), and for load balancing (offsets), not just geography. Add language to clarify that geography alone does not constrain paging group definition.
3) There appears confusion and internal consistency problem about Paging Group and Paging Group ID. In order for Idle Mode operation to work, Paging Group must be defined/constrained by PAGING_CYCLE or else every BS in a Paging Group will have to receive the individual PAGING_CYCLE information for each an every MS in the Paging Group, which was not intended and entirely not scalable. Need to provide clear definition that Paging Group ID identifies a specific Paging Group with a defined PAGING_CYCLE and Paging Interval Length.

Remedy 1:
In 802.16e-2005, page 260, paragraph immediately before, and first paragraph after Figure 130i, modify text as:

The BSs are divided into logical groups called paging groups. The purpose of these groups is to offer a contiguous coverage region in which the MS does not need to transmit in the UL, yet can be paged in the DL if there is traffic targeted at it. The paging groups should be large enough so that most MSs will remain within the same paging group most of the time, and small enough such that the paging overhead is reasonable. Figure 130i shows an example of four paging groups defined over multiple BS arranged in a hexagonal grid. A BS may be a member of one or more Paging Groups comprised of differing groupings of BS, of varying cycles and offsets, providing support for not only the geographic requirements of Idle Mode operation but may also support differentiated and dynamic quality of service requirements and scalable load-balancing distribution.

[Figure 130i; unmodified]

The paging-groups are defined in the management system. ~~One possible method of definition is by using the paging-group-action backbone message. Another backbone message, paging-announce, is used to manage the list of MS in idle mode and initiate paging of the MS on all BS belonging to the paging group.~~

In 802.16e-2005, page 752, in 11.14 DREG-CMD/REQ message encodings, in the 'Value' for 'Paging Information' in the Table, modify text as:

Bits 15:0 – PAGING_CYCLE— ~~Cycle~~ periodicity in frames in which the paging message is transmitted ~~within the paging group~~(see 6.3.24.5)
Bits 23:16 – PAGING OFFSET—Determines the frame within the cycle in which the paging message is transmitted. Must be smaller than PAGING CYCLE value (see 6.3.24.5)
Bits 39:24– Paging-group-ID—ID of the paging group the MS is assigned to

2

Problem 2:
Statement 'For a given BS Broadcast Paging message in a specific BS Paging Interval, the BS shall include only those MS MAC Address hash particular to the PAGING_CYCLE.' is in error, and conflicts with previous definition. In fact, the MAC Addresses included may be for any MS that would be listening during Paging Interval Length beginning at frame starting at PAGING_CYCLE and PAGING_OFFSET, exactly as it states three paragraphs above.

Remedy 2:
In 802.16e-2005, page 263, in 6.3.24.6 BS Broadcast Paging message, in the third paragraph, modify text as:

MSs are identified in the BS Broadcast Paging message by their MS MAC Address hash. A single BS Broadcast Paging message may include multiple MAC Addresses. For a given BS Broadcast Paging message in a specific BS Paging Interval, the BS shall include only those MS MAC Address hash particular to the Paging Interval Length, frame number, PAGING_CYCLE, and PAGING_OFFSET (see 6.3.24.5).

Problem 3:
1) The sentence 'The BS receives notification of active PAGING_CYCLEs through backbone messages.' is overspecification, erroneous, and meaningless. What is an active PAGING_CYCLE? The BS receives notice over the backbone network to page certain MS with certain MAC Addresses, in certain Paging Groups with specific PAGING_CYCLEs and PAGING_OFFSETs. Remove the erroneous and unnecessary sentence. We do not specify the behavior of the network in 802.16, though we may define BS behavior based on assumptions of network activity. But, in this case, it is unnecessary.
2) Contradicts normative language requiring transmission of at least one instance of the Broadcast Paging message in other locations in the standard.

Remedy 3:
In 802.16e-2005, page 263, first paragraph after the equation, modify text as:

on each BS, where N is Paging Interval Length. ~~The BS receives notification of active PAGING_CYCLEs through backbone messages.~~ A BS ~~may~~ shall broadcast at least one, but may broadcast ~~or~~ more than one BS Broadcast Paging messages during the MS Paging Listening Interval. Different BSs may synchronize their MS Paging Listening Intervals.

Problem 4:
Poor and contradictory language in the last two lines of paragraph 1, subclause 6.3.24.6, page 263. It says the message need not be sent and then it says the message must be sent. Also, contradicts normative language requiring transmission of the message in other locations in the standard.

Remedy 4:
In 802.16e-2005, page 263, section 6.3.24.6, paragraph 1, modify text as:

6.3.24.6 BS Broadcast Paging message

A BS Broadcast Paging message is an MS notification message indicating either the presence of DL traffic pending, through the BS or some network entity, for the specified MS or to poll the MS and request a location

update without requiring a full network entry. The BS Broadcast Paging message shall be sent on the Broadcast CID or Idle Mode Multicast CID (defined in Table 345 of 10.4) during the BS Paging Interval ~~if there is some MSs that need paging. If there is no MS that needs paging to corresponding frame, the BS may not broadcast BS Broadcast Paging message.~~ A <u>Broadcast_P</u>~~p~~aging message shall be transmitted during the MS Paging Listening Interval ~~if there is any MS that need paging~~ <u>in order to advertise the BS supported Paging Groups, regardless of any requirement for notification of any MS, and even without notification of any MS</u>.