Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Fix for Sleep Mode Add/Remove CIDs from Power Saving Class ID**
Date Submitted	**2005-07-14**
Source(s)	Phillip Barber, Dongyao Wang, Yan Zhang, Yongmao Li, Jim Carlo, David Xiang, Duke Dang, Lucy Chen, John Lee mailto:john_lee@huawei.com HUAWEI
Re:	Call for contribution and comments.
Abstract	Fix for Sleep Mode Add/Remove CIDs from Power Saving Class ID.
Purpose	Adoption
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 for Sleep Mode Add/Remove CIDs from Power Saving Class ID

Phillip Barber, Dongyao Wang, Yan Zhang, Yongmao Li, Jim Carlo, David Xiang, Duke Dang, Lucy Chen, John Lee
HUAWEI

Problem Definition

While the method for defining and activating/deactivating Power Saving Class ID has been redefined and refined, the method for adding and removing CIDs from defined Power Saving Class IDs has not been similarly updated. In the existing structure, to add or remove a CID from a Power Saving Class ID that had been previously defined through SLP-REQ/RSP requires the complete redefinition of the Power Saving Class ID through SLP-REQ/RSP including its complete list of associated CIDs.

There are three actions to perform to establish and maintain the Sleep Mode function in 16e: define Power Saving Class IDs, add/remove CIDs to the defined Power Saving Class IDs, and activate/deactivate defined Power Saving Class IDs.

The method for defining Power Saving Class IDs remains unchanged. We use SLP-REQ/RSP to define Power Saving Class IDs.

The method for activating/deactivating defined Power Saving Class IDs was simplified previously with the addition of the Bandwidth control and uplink sleep control header, in the uplink, and DL Sleep control extended subheader, in the downlink. The use of these headers substantially reduced the overhead and complexity of the relatively frequent task of turning on and off Power Saving Class IDs (though they represent a minimal state-change security vulnerability).

However, the method for adding/removing CIDs to defined Power Saving Class IDs was omitted from the refinement of the header/extended subheader function. This is problematic because the frequency of add/remove CIDs is likely near, if not more frequent to activating/deactivating Sleep Mode. This is true because CIDs need to be added/removed to Power Saving Class ID at the time of establishment/deletion of a service flow (provided that the service flow is established as ‘active’), or during any DSA/DSC transaction changing the status of a service flow from admitted-to-active or active-to-admitted. So, the legacy definition model for adding/removing CIDs from Power Saving Class IDs defined through SLP-REQ/RSP messages no longer fits the adopted method for modifying defined Power Saving Class ID behavior using headers and extended subheaders. This omission has substantial penalties for Sleep Mode operation. However, this omission is easily rectified.

Remedy

Unfortunately, the existing Bandwidth control and uplink sleep control header and DL Sleep control extended subheader cannot be easily modified to also service the CID maintenance requirements. Fortunately, the recent modification to support the addition of new extended subheaders provides a ready mechanism that meets our requirements.

Add new DL and UL extended subheaders to add/remove CIDs from defined Power Saving Class IDs. Modify DL and UL extended subheader definition tables to accommodate new subheaders. Modify Sleep Mode language to include reference to Sleep Mode control CID maintenance extended subheaders.

Proposed Text Changes

[In 6.3.2.2.7 Extended subheader format, page 32, Table 13b—Description of extended subheaders types (DL), modify Table as:]

Table 13b—Description of extended subheaders types (DL)

ES type	Name	ES body Size (byte)	Description
0	SDU_SN extended subheader	1	See 6.3.2.2.7.1
1	DL Sleep control extended subheader	3	See 6.3.2.2.7.2
2	Feedback request extended subheader	3	See 6.3.2.2.7.3
3	SN request extended subheader	1	See 6.3.2.2.7.7
4	PDU SN(short) extended subheader	1	See 6.3.2.2.7.8
5	PDU SN(long) extended subheader	2	See 6.3.2.2.7.8
6	DL Sleep control CID maintenance extended subheader	3	See 6.3.2.2.7.9
47-127	*reserved*		

[In 6.3.2.2.7 Extended subheader format, page 32, Table 13c—Description of extended subheaders types (UL), modify Table as:]

Table 13c—Description of extended subheaders types (UL)

ES type	Name	ES body Size (byte)	Description
0	MIMO mode feedback extended subheader	1	See 6.3.2.2.7.4
1	UL Tx Power Report extended subheader	1	See 6.3.2.2.7.5
2	Mini-Feedback extended subheader	2	See 6.3.2.2.7.6
3	PDU SN(short) extended subheader	1	See 6.3.2.2.7.8
4	PDU SN(long) extended subheader	2	See 6.3.2.2.7.8
5	UL Sleep control CID maintenance extended subheader	3	See 6.3.2.2.7.9
36-127	*reserved*		

[In 6.3.2.2.7 Extended subheader format, page 32, insert new subclause at end of section:]

6.3.2.2.7.9 DL Sleep control CID maintenance extended subheader

The DL Sleep control CID maintenance extended subheader is sent by the BS to add/remove CIDs from defined Power Saving Class IDs. The format of DL Sleep control CID maintenance extended subheader is as described

in Table 13k.

Table 13k— DL Sleep control CID maintenance extended subheader

Name	Size (bits)	Description
Power_Saving_Class_ID	6	Power Saving Class ID this command refers to.
Operation	1	0 = remove CID in this message from Power Saving Class ID 1 = add CID in this message to Power Saving Class ID
CID	16	CID this command refers to.
reserved	1	

[In 6.3.2.2.7 Extended subheader format, page 32, insert new subclause at end of section:]

6.3.2.2.7.9 UL Sleep control CID maintenance extended subheader

The UL Sleep control CID maintenance extended subheader is sent by the MS to add/remove CIDs from defined Power Saving Class IDs. The format of UL Sleep control CID maintenance extended subheader is as described in Table 13l.

Table 13l— UL Sleep control CID maintenance extended subheader

Name	Size (bits)	Description
Power_Saving_Class_ID	6	Power Saving Class ID this command refers to.
Operation	1	0 = remove CID in this message from Power Saving Class ID 1 = add CID in this message to Power Saving Class ID
CID	16	CID this command refers to.
reserved	1	

[In 6.3.20.2 Power Saving Classes of type 1, page 167, lines 6-10, modify paragraph as:]

For definition and/or activation of one or several Power Saving Classes of Type 1 the MS shall send MOB_SLP-REQ or Bandwidth request and uplink sleep control header (for activation only); the BS shall respond with an MOB-SLP_RSP message or DL Sleep control extended subheader. BS may use the DL Sleep control CID maintenance extended subheader to add or remove CIDs from previously defined Power Saving Classes of Type 1. MS may use the UL Sleep control extended subheader to add or remove CIDs from previously defined Power Saving Classes of Type 1. The MS may retransmit MOB-SLP-REQ message if it does not receive the MOB-SLP-RSP message within the T43 timer.

[In 6.3.20.3 Power Saving Classes of type 2, page 168, lines 28-42, modify paragraph as:]

Power Saving Class becomes active at the frame specified as “Start frame number for first sleep window”. All sleep windows are of the same size as initial window. Sleep windows are interleaved with listening windows of fixed duration. Power Saving Classes of this type are defined/activated/deactivated by MOB_SLPREQ/MOB_SLP-RSP or Bandwidth request and uplink sleep control header/DL Sleep control extended subheader transaction. BS may use the DL Sleep control CID maintenance extended subheader to add

or remove CIDs from previously defined Power Saving Classes of Type 2. MS may use the UL Sleep control extended subheader to add or remove CIDs from previously defined Power Saving Classes of Type 2. The MS may retransmit MOB-SLP-REQ message or Bandwidth request and uplink sleep control header if it does not receive the MOB-SLP-RSP message or DL Sleep control extended subheader within the T43 timer. The BS may send unsolicited MOB_SLP-RSP or DL Sleep control extended subheader to initiate activation of Power Saving Class. Once started, the active state continues until explicit termination by MOB_SLP-REQ/MOB_SLP-RSP messages or Bandwidth request and uplink sleep control header/DL Sleep control extended subheader. BS may send unsolicited MOB_SLP-RSP message or DL Sleep control extended subheader to deactivate Power Saving Class. Alternatively Power Saving Class of type 2 may be defined and/or activated /deactivated by TLVs transmitted in RNG-REQ and RNG-RSP message.

[In 6.3.20.4 Power Saving Classes of type 3, page 168, lines 55-64, modify paragraph as:]
Power Saving Class of this type is recommended for multicast connections as well as for management operations, for example, Periodic Ranging, DSx operations, MOB_ NBR-ADV etc. Power Saving Classes of this type are defined/activated by MOB_SLP-REQ/MOB_SLP-RSP or Bandwidth request and uplink sleep control header/DL Sleep control extended subheader transaction. BS may use the DL Sleep control CID maintenance extended subheader to add or remove CIDs from previously defined Power Saving Classes of Type 3. MS may use the UL Sleep control extended subheader to add or remove CIDs from previously defined Power Saving Classes of Type 3. The MS may retransmit MOBSLP-REQ message or Bandwidth request and uplink sleep control header if it does not receive the MOB-SLP-RSP message within the T43 timer. The BS may send unsolicited MOB_SLP-RSP or DL Sleep control extended subheader to initiate activation of Power Saving Class. Deactivation of Power Saving Class occurs automatically after expiration of sleep window.

[In 11.7.24 MAC header and extended subheader support, page 435, modify Table as:]

Type	Length	Value	Scope
MAC header and extended subheader support Type 42	3	Bit #0: Bandwidth request and UL Tx Power Report header support Bit #1: Bandwidth request and downlink burst profile change request header support Bit #2: CQICH Allocation Request header support Bit #3: PHY channel report header support Bit #4: Bandwidth request and uplink sleep control header support Bit #5: SN report header support Bit #6: Feedback header support Bit #7-10: SDU_SN extended subheader support and parameter Bit #7: SDU_SN extended subheader support Bit #8-10 (=p): period of SDU_SN transmission for non-ARQ connection = once every 2p MAC PDUs Bit #11: DL sleep control extended subheader Bit #12: Feedback request extended sunheader Bit #13: MIMO mode feedback extended subheader Bit #14: UL Tx Power Report extended subheader Bit #15: Mini-feedback extended subheader Bit #16: SN request extended subheader Bit #17: PDU SN(short) extended subheader Bit #18: PDU SN(long) extended subheader	REG-REQ/RSP

		Bit #19: DL Sleep control CID maintenance extended subheader Bit #20: UL Sleep control CID maintenance extended subheader Bit #~~17~~21-23: reserved	