Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Downlink Burst Profile Synchronization for MSS in Sleep Mode**
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Re:	This contribution is for reply of IEEEP802.16e/D5 recirculation.
Abstract	This contribution proposes the synchronization scheme of downlink burst profile for MSS in sleep mode.
Purpose	Discussion and Adoption in IEEE 802.16e
Notice	
Release	
Patent Policy and Procedures	

Downlink Burst Profile Synchronization for MSS in Sleep Mode

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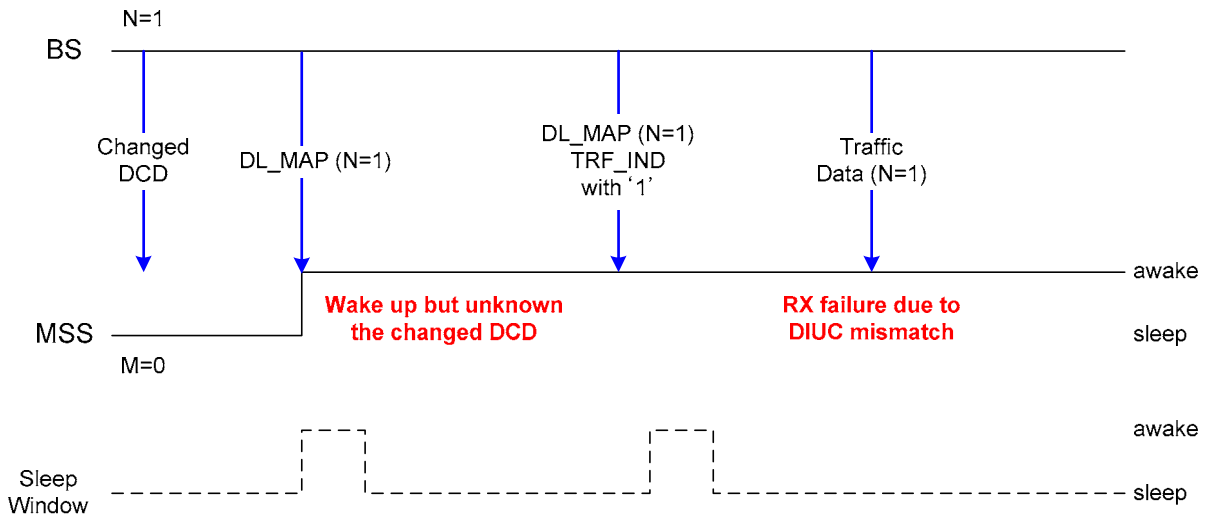
Introduction

Base station (BS) provides mobile subscriber station (MSS) with a set of downlink burst profiles, and determines one downlink burst profile according to the quality of the signal that received by each MSS. Even during Sleep Mode, BS should keep the downlink burst profile, so as to perform Normal Operation with MSS terminating Sleep Mode. However, since the message signaling between BS and MSS is restricted during Sleep Mode, the downlink burst profile which BS keeps may not match with that stored at MSS. The mismatch of downlink burst profile between BS and MSS can lead to a failure in the data receiving. Hence, we need the synchronization scheme of downlink burst profile for MSS in Sleep Mode.

The mismatch problem of downlink burst profile may occur in the following two cases:

- Case 1: When DCD count is changed during sleep-window

If BS transmits the new DCD message during sleep-window of a MSS, the MSS is not aware of the change of DCD message. Even though the MSS entering listening-window perceives the DCD change by receiving DL-MAP message, if BS transmits the data burst with the DIUC defined in the new DCD message, DIUC mismatch can occur. Hence, the transmitting data burst can be lost. Such DIUC mismatch case is depicted in Fig. 1.



N: BS DCD count, M: MSS DCD count

Fig. 1. DIUC mismatch due to the change of DCD message

- Case 2: When the received signal quality is changed during sleep-window

The received signal quality at MSS can be changed during sleep-window (e.g. due to MSS moving). Let us assume that the signal quality has gown below the required value for the DIUC which was determined before Sleep Mode. Then, if BS still transmits the data burst with such DIUC, the transmitting data burst can be lost.

In order to avoid the DCD and/or DIUC mismatch problem explained above, IEEE P802.16e/D5 allows MSS to send RNG-REQ message including the DCD count change and DIUC update during Sleep Mode. However, then MSS should first make the bandwidth request for RNG-REQ message by using the contention-based ranging method. Hence, several messages transaction between MSS and BS is required to report the DCD count change and DIUC update to BS. For example, in OFDMA PHY mode such report should be done through Bandwidth Request Ranging Code, CDMA Allocation IE in UL-MAP Message, Bandwidth Request Header, and RNG-REQ Message with the burst profile update.

In another way, BS may make a UL allocation at any time subsequent to transmitting MOB-TRF-IND Message. Such UL allocation is used by MSS to send Bandwidth Request Header for the confirmation of MOB-TRF-IND Message. The MSS can also utilize the allocated bandwidth to report the burst profile update. However, since the allocated bandwidth is supposed to be used to send the confirmation (i.e. Bandwidth Request Header), it is not large enough to send RNG-REQ Message. Therefore, this signaling method also requires the bandwidth request to BS before the MSS sends RNG-REQ Message.

As explained above, to let BS know the DCD and/or DIUC mismatch during Sleep Mode, several messages transaction between MSS and BS is needed in IEEE P802.16e/D5.

Suggested Remedy

In this contribution we propose new MAC header with which MSS can report the burst profile change during Sleep Mode. The proposed MAC header includes the same fields of DCD count change and DIUC update as in RNG-REQ message (in Suggested Remedy 2), and includes the received CINR at MSS and the DCD Change Indication (in Suggested Remedy 3). ~~but~~ Its size is equal to that of Bandwidth Request Header. When MSS receives MOB-TRF-IND Message with positive indication and also UL allocation for its confirmation, the MSS can send the proposed MAC header instead of Bandwidth Request Header. By using the proposed MAC header, MSS can inform BS of the DCD ~~count~~ change and/or DIUC update and also the signaling overhead for sending REQ-REQ message can be avoided.

During a sleep-window MSS can also make UL bandwidth request. The proposed MAC header provides the functions of both UL bandwidth request and the burst profile update at the same time. Hence, the efficiency of Sleep Mode can be improved through the use of the proposed MAC header.

Proposed Text Change

1. Modification about sleep mode section

[Remedy 1: Modify line 14~20 at page 104 as Following :]

The Serving BS may verify MSS exit from Sleep Mode by making a UL allocation for MSS at any time subsequent to transmitting a MOB-TRF-IND message with indication for MSS to exit Sleep Mode, or after receiving UL MAC PDU other than RNG-REQ or BR-DBPCR PDU with null BR field ~~DBPC-REQ~~ from an MSS supposed to be in a sleep-window. When an MSS receives a UL allocation after receiving a positive MOB-TRF-IND message indication or after transmitting a previous UL MAC PDU to the Serving BS during a sleep-window, the MSS shall transmit BR PDU or BR-DBPCR PDU ~~at least BR message~~ (if there is no data to transmit, BR field of the BR PDU shall be set to 0.)

2. Definition of new header ***(Suggested Remedy 2)***

[Remedy 2: Add following section at the end of section 6.3.2.1.5 at page 17, line 57:]

6.3.2.1.6 Bandwidth request and Downlink Burst Profile Change request header

Bandwidth Request and Downlink Burst Profile Change request (BR-DBPCR) PDU shall consist of bandwidth request and DL Burst Profile Change request header alone, and shall not contain a payload. The bandwidth request and Downlink Burst Profile Change request header is illustrated in Figure 20d

HT=1	EC=0	TYPE=100	BR(11)	
Requested Downlink Burst Profile(8)				CID MSB(8)
CID LSB(8)				HCS(8)

Figure 20d. Bandwidth Request and downlink Burst Profile Change Request Header

Table 7d. Description of the fields of BR and DL Burst Profile Change Request header

Name	Length(bits)	Description
HT	1	Header Type = 1
EC	1	Always set to zero
Type	3	Type = 100
BR	11	Bandwidth Request: The number of bytes of uplink bandwidth requested by the SS. The bandwidth request is for the CID. The request shall not include any PHY overhead. It is aggregate BW request
Requested Downlink Burst Profile	8	Bits 0-3: DIUC of the downlink burst profile requested by the SS for downlink traffic. Bits 4-7: 4 LSB of Configuration Change Count value of DCD defining the burst profile associated with DIUC
CID	16	SS Basic CID
HCS	8	Header Check Sequence (same usage as HCS entry in table 5)

3. Definition of new header (Suggested Remedy 3)

[Remedy 3: Add following section at the end of section 6.3.2.1.5 at page 17, line 57:]

6.3.2.1.6 Bandwidth request and Downlink Burst Profile Change request header

Bandwidth Request and Downlink Burst Profile Change request (BR-DBPCR) PDU shall consist of bandwidth request and DL Burst Profile Change request header alone, and shall not contain a payload. The bandwidth request and Downlink Burst Profile Change request header is illustrated in Figure 20d

HT=1	EC=0	TYPE=100	BR(11)	
CINR(7)		DCD Change Indication (1)	CID MSB(8)	
CID LSB(8)			HCS(8)	

Figure 20d. Bandwidth Request and downlink Burst Profile Change Request Header

Table 7d. Description of the fields of BR and DL Burst Profile Change Request header

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HT	1	Header Type = 1
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Type	3	Type = 100
BR	11	Bandwidth Request: The number of bytes of uplink bandwidth requested by the SS. The bandwidth request is for the CID. The request shall not include any PHY overhead. It is aggregate BW request
CINR	7	
DCD Change Indication	1	
CID	16	SS Basic CID
HCS	8	Header Check Sequence (same usage as HCS entry in table 5)

CINR
This parameter indicates the CINR in dB, and it shall be interpreted as a singed value from -16.0 dB to 47.5 dB in unit of 0.5 dB.

DCD Change Indication
This parameter is set to ‘1’ if the DCD Change Count stored at MSS is not equal to that in the received DL-MAP message. Otherwise, it is set to ‘0’.