

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Fast DCD/UCD synchronization for sleep mode MSS	
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Re:	IEEE P802.16e/D4-2004	
Abstract	This contribution proposes methods to support fast DCD/UCD synchronization by MSS in sleep mode. This allows fast transition from sleep to normal mode. The revision is marked in 'green'.	
Purpose	Review and Adopt the suggested changes into P802.16e/D4	
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1 Introduction

In p802.16e/D4, the sleep mode is introduced in Section 6.3.19 for enabling power efficient operation of MSSes. In the current standard, there is no clear description regarding how a MSS in sleep mode to track DCD/UCD update. Assuming an irregular interval transmission of DCD/UCD message at the transmission interval $< 10s$ (See Section 10.1), it is possible that the updated DCD/UCD message is transmitted right before the listening interval of a MSS where the MSS is being 'awaken' by receiving the MOB-TRF-IND message. Under this scenario, the MSS has to wait, in the worst case, for 10s for the next DCD/UCD message before UL and DL data transmission can occur. The out-of-sync between MSS and BS regarding DCD/UCD update may cause unnecessary data transmission delay. (refer to Fig.1)

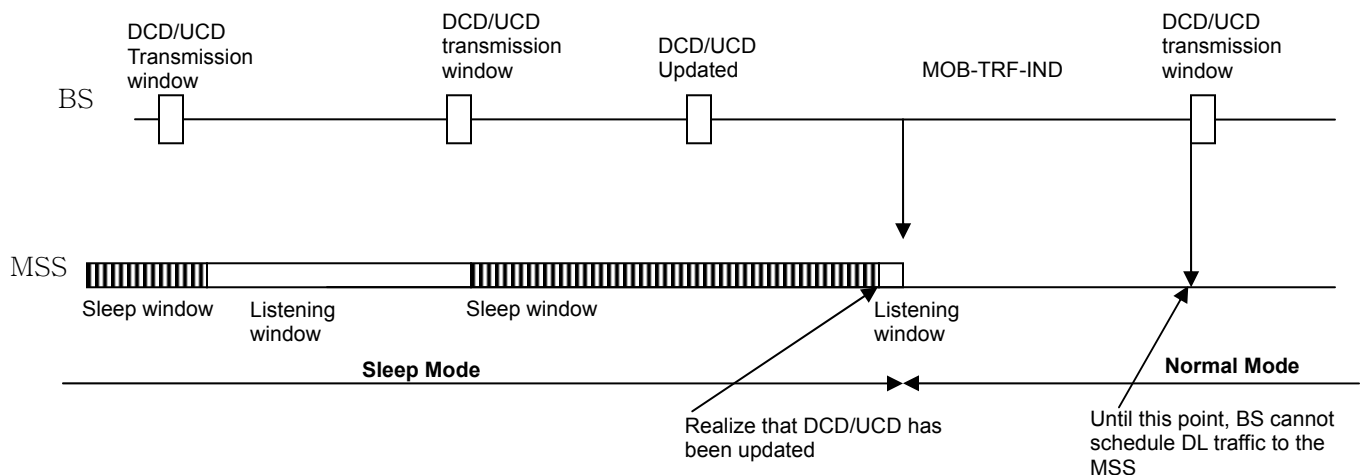


Fig. 1. Delay caused by asynchronization of DCD/UCD message between a MSS and BS.

2 Proposed Enhancements

In this contribution, two options are proposed:

1. DCD/UCD message is transmitted in a fixed interval. MSSs in sleep mode shall be awake during the DCD/UCD transmission regardless whether the MSS is in listening or sleep window. (refer to Fig.2)
 - This option can ensure that a MSS always keep the updated system configuration information transmitted in DCD/UCD message. When a MSS is 'awaken' by the MOB-TRF-IND message or a MSS has UL data to send, the MSS does not need to worry about DCD/UCD synchronization. DL traffic can be immediately scheduled to the MSS and UL BW request can be immediately sent by a MSS.
 - The parameter 'DCD/UCD transmission interval' shall be added to the DCD message as a new TLV
 - However this method may restrict the flexibility of BS to update system configuration information.

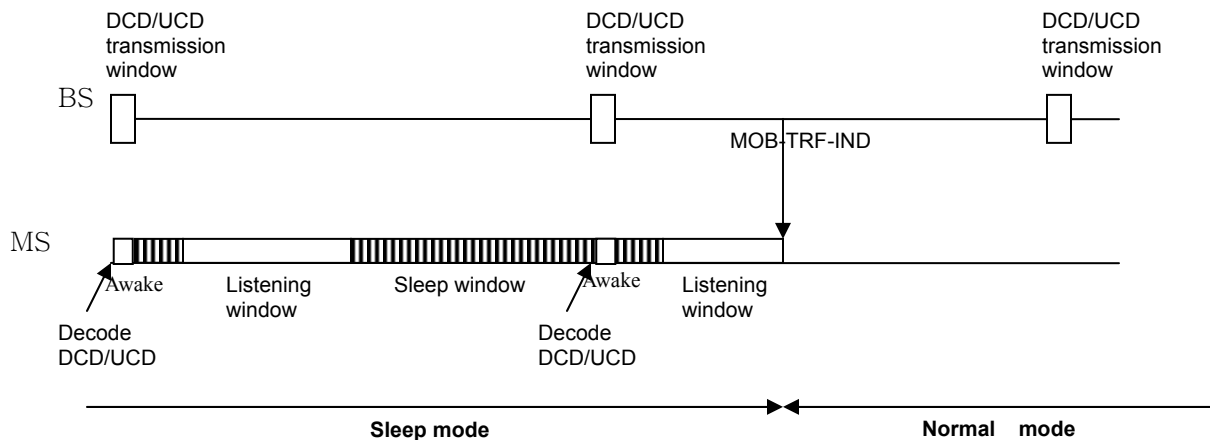


Fig. 2. Fast mode transition from sleep mode to awaked mode (option 1).

2. As defined in the current p802.16e/D4 text, DCD/UCD message can be transmitted at any time without any restriction. If a MSS in sleep mode realizes during listening interval that system configuration has been updated (by checking DCD/UCD count numbers), the MSS shall remain awake until receiving the next DCD/UCD message and then resuming sleep mode operation. Here we propose that when BS sends MOB-TRF-IND after the configuration has been updated and before the next transmission of DCD/UCD message, all the MOB-TRF-IND messages shall carry the TLV fields which show the differences between the latest DCD/UCD message and the previous one. In this way, for a BS initiated transition to normal mode, a MSS can obtain immediately updated system configuration parameters without having to wait for the next DCD/UCD message transmission. For a MSS initiated mode transition right after the DCD/UCD update, a MSS shall decode the first received MOB-TRF-IND from where the updated system configuration information can be obtained (refer to Fig.3).
 - By this method, a MSS can get the most updated system configuration parameter. The DL traffic can be immediately scheduled to the MSS. The MSS, if has UL data to send, can immediately send BW request after decoding one MOB-TRF-IND containing the TLV that provides the difference between the latest DCD/UCD message and the previous one.
 - This option does not require that a MSS wake up regularly to decode DCD/UCD message
 - The current MOB-TRF-IND message needs to be enhanced to include some TLV fields only when necessary, to provide the differences between the latest DCD/UCD and the previous one.

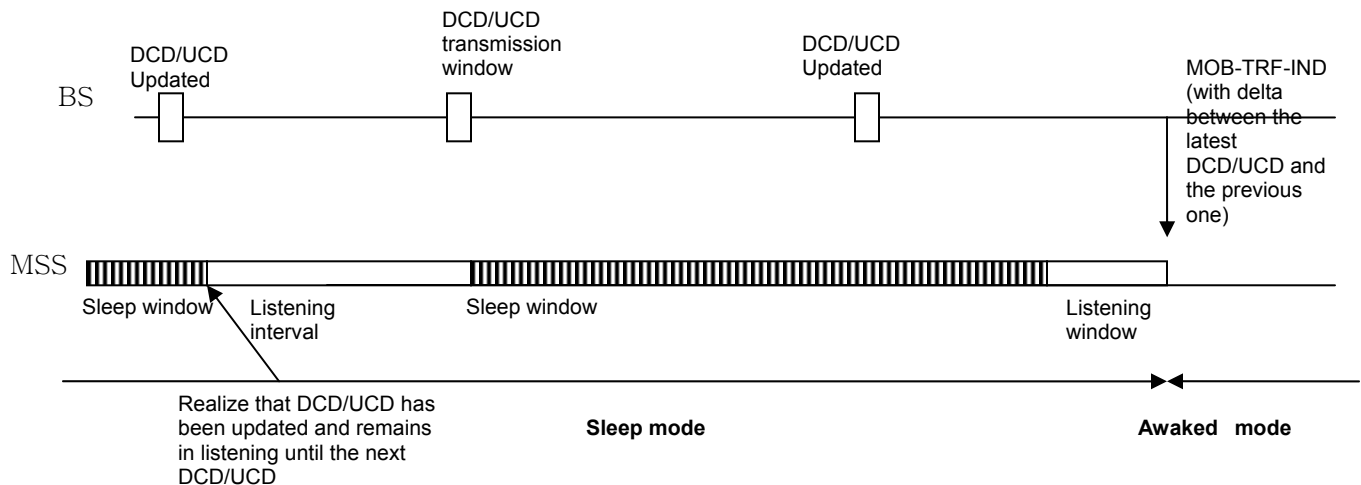


Fig. 3 Fast mode transition from sleep mode to normal mode (option 2- BS initiated)

Both the above two options enable fast mode transition from sleep mode to normal mode initiated by both MSS and BS.

3 Proposed Text Changes

3.1 Required text change for option 1

[Modify Table 356-DCD channel encodings by adding two more TLVs]

Table 356 –DCD channel encodings

<u>Name</u>	<u>Type (1 byte)</u>	<u>Length (1 byte)</u>	<u>Values</u>
<u>DCD/UCD transmission cycle (in unit of frames)</u>	<u>xxx</u>	<u>1</u>	<u>0-255x8 frames</u>
<u>DCD/UCD transmission offset (in unit of frame)</u>	<u>yyy</u>	<u>1</u>	<u>0-255x8 frames</u>

[Add description in section 6.3.19 regarding the operation of MSS in sleep mode to get synchronized with DCD/UCD updating]

The DCD/UCD message is may be transmitted in a semi-fixed cycle. When this is done, the BS shall include a DCD/UCD transmission cycle TLV in the DCD/UCD message respectively, and the messages shall be transmitted on the frame where the frame number N_{frame} meets the condition

$$N_{frame} \bmod (\text{DCD/UCD transmission cycle}) = \text{DCD/UCD transmission offset}$$

Should the BS decide to change the DCD/UCD transmission cycle TLV, it may do so gracefully, by maintaining transmissions with the old cycle and the new TLV value for a certain period after the change. Note that the presence of the DCD/UCD transmission cycle TLV in the DCD/UCD message does not imply that the transmission cycle of these messages is fixed. It is up to the MSS to detect the condition that the transmission cycle has changed, and to ensure it receives the DCD and UCD messages.

3.2 Required text change for option 2

[Modify Table 106C- Traffic-Indication (MOB-TRF-IND) message format by adding TLV fields required to show the differences between the latest DCD/UCD and the previous one]

Table 106c-Traffic-Indication (MOB-TRF-IND) message format

Syntax	Size	Notes
MOB-TRF-IND Message Format () {		
Management message type = 52	8 bits	
FMT	1 bits	0=SLPID based format 1=CID based format
If (FMT==0) {		
Byte of SLPID bitmap	8 bits	
SLPID bit-map	Variable	Two bits are allocated to one MSS 00: No periodic ranging opportunity and no PDUs such as DL Traffic 01: No periodic ranging opportunity

		and but PDUs such as DL Traffic
		10: Periodic ranging opportunity and no PDUs such as MAC management message (the MSS may return to sleep mode after Periodic Ranging operation)
		11: : Periodic ranging opportunity and PDUs such as MAC management message (the MSS shall remain Awake mode after Periodic Ranging operation)
NUM_of_MSS_Periodic_Ranging	8bits	
For (i=0;i<NUM_MSS_Periodic_Ranging;i++) {		
Ranging_Frame_Offset	10 bits	Frame Offset for case where SLPID bit map indicator is set to '10' or '11'
} else{		
Num_pos	7 bits	Number of CIDs on the positive indication list
For (j=0;j<Num_pos;j++) {		
Short_Basic_CID	12 bits	Basic CID
}		
While (!(byte_boundary)){		
}		
}		
<u>TLV fields</u>	Variable	TLV specific
}		

[Insert the following sentences into the end of 6.3.2.3.46]

The following may be included in MOB-TRF-IND message:

DCD_setting_changes

This DCD_setting_changes is a compound TLV value. This DCD_setting_changes field shall contain only the latest DCD message (DCD count = i) TLV values which are different from the TLV values in DCD message (DCD count = i-1). For values that are not included, the MSS shall assume they are identical to the values in DCD message with DCD count = i-1.

UCD_setting_changes

This UCD_setting_changes is a compound TLV value. This UCD_setting_changes field shall contain only the latest UCD message (UCD count = i) TLV values which are different from the TLV values in UCD message (UCD count = i-1). For values that are not included, the MSS shall assume they are identical to the values in UCD message with DCD count = i-1.

[Insert a new section 11.16 MOB-TRF-IND Message Encodings]

11.16 MOB-TRF-IND Message Encodings

Table xxx- MOB-TRF-IND Encodings

<u>Name</u>	<u>Type (1 byte)</u>	<u>Length (1 byte)</u>	<u>Value</u>
<u>DCD_setting_changes</u>	<u>150</u>	<u>Variable</u>	<u>This DCD_setting_changes is a compound TLV value. This DCD_setting_changes field shall contain only the latest DCD message (DCD count = i) TLV values which are different from the TLV values in DCD message (DCD count = i-1). For values that are not included, the MSS shall assume they are identical to the values in DCD message with DCD count = i-1.</u>

<u>UCD setting changes</u>	<u>151</u>	<u>Variable</u>	<u>This UCD_setting_changes is a compound TLV value. This UCD_setting_changes field shall contain only the latest UCD message (UCD count = i) TLV values which are different from the TLV values in UCD message (UCD count = $i-1$). For values that are not included, the MSS shall assume they are identical to the values in UCD message with DCD count = $i-1$</u>
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