Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	Support of Short Data Burst Transmission to/from an MSS in Sleep Mode or Idle Mode	
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Re:	IEEE P802.16e/D5-2004	
Abstract	This contribution proposes the mechanism to support short data burst transmission/reception to/from a MSS in Sleep or Idle Mode. This feature enable the support short messaging type of service regardless of the MSS' mode of operation.	
Purpose	Review and Adopt the suggested changes into P802.16e/D5	
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1 Introduction

Short data burst (SDB) support for Sleep mode and Idle mode MSS is an important feature to enable the support of short messaging type of services in 802.16e. The support of SDB to Sleep mode and Idle mode MSS means that the SDB transmission/reception should not interrupt the mode of the MSS. SDB traffic associated with short messaging type of service is typically characterized by small amount of traffic with most likely irregular traffic arriving pattern. However, there are also other types of short data burst traffic with predictable traffic arrival pattern, such as system broadcast messages (e.g. DCD, UCD). This contribution addresses SDB traffic with both irregular and regular traffic arrival pattern.

Support of SDB for Sleep Mode MSS, for traffic with irregular arrival pattern

Since the traffic arrival is unpredictable, the DL SDB transmission to a MSS in sleep mode can be implemented by transmitting DL SDB during the listening window of the MSS, as currently supported in the p802.16e/D5 text. However, for UL SDB from a MSS in sleep mode, the MSS has to wait until its listening window to send the UL SDB if the MSS doesn't want to go back to normal mode, based on 802.16e/D5. This introduces unnecessary delay. Although the SDB traffic may not be delay sensitive traffic, we should still try to enhance the Sleep mode so that MSS does not have to wait until the listening window to send UL SDB, since the sleep window can grow to a large value.

We propose the following to enhance UL SDB operation for an MSS in sleep mode:

- Define SDB-BW request header transmitted by a MSS in sleep mode during either listening window or sleep window to indicate a SDB bandwidth request without triggering a mode transition
- Then normal UL resource allocation and UL SDB transmission are performed
- For an ARQ-enabled connection, the MSS resumes sleep mode operation until after the acknowledgment procedure is completed. For a non-ARQ-enabled application, the MSS resume the sleep operation after it sends the UL SDB

Support of SDB for Idle Mode MSS, for traffic with irregular arrival pattern

The current p802.16e/D5 text does not support SDB transmission/reception for MSS in Idle mode. Based on the current standard, any DL or UL traffic, regardless the amount of the traffic, the MSS has to go back to normal mode before the data transmission can occur, and then go back to Idle mode again after the transmission. This will cause unnecessary signaling and processing overhead.

We propose the following to enable SDB for Idle mode MSS:

- Support of DL SDB:
  - When the MSS enters Idle mode, the connection CID associated with SDB traffic or application, shall be kept at both MSS and the Paging Controller. All security related profiles shall be also kept by both sides
  - When the BS intends to send SDB to the MSS, the BS shall send the MOB-PAG-ADV message to the MSS during the MSS' Paging Listening interval. The MSS performs paging-response by sending ranging code and RNG-REQ message. The purpose of this is to establish the location of the MSS.
  - The BS uses the RNG-RSP to indicate that the purpose of this paging is to send SDB to the MSS and to indicate to the MSS to skip certain network entry procedures.
  - The SDB is transmitted to the MSS similar to normal operation.
  - The MSS shall resume Idle mode operation after receiving the DL SDB if the connection is a non-ARQ-enabled or after normal ARQ acknowledgment procedure if the connection is ARQ-enabled

- Support of UL SDB:
  - MSS performs initial ranging
  - MSS sends RNG-REQ to the target BS to indicate the BS ID from which the MSS has entered into Idle mode and to indicate an UL SDB request
  - The target BS obtains the security keying profiles from the BS from which the MSS has entered Idle mode
  - The target BS then uses normal UL MAP IE to assign UL resource
  - The target BS may send ARQ message if the connection is ARQ enabled

- The MSS shall resume Idle mode operation after the completion of SDB transmission (with completion of acknowledgment procedure if the connection is ARQ-enabled)

Support of SDB for Sleep Mode and Idle Mode MSS, for traffic with regular arrival pattern

For regular or predicable DL SDB traffic, such as UGS type of services and system configuration management message transmission, the chain-type pre-scheduling can be used to alert one or multiple MSS(s) in either Sleep or Idle mode to wake up to listen to DL traffic at a specific time offset. To enable the pre-scheduling, an SDB_forecast_IE is defined.

For UL regular or predicable SDB traffic, such as UGS type of services, the method defined above is also applicable to sleep MSS but not Idle MSS. For Idle MSS, the SDB mechanism previously described for the irregular traffic pattern can be used.

2 Proposed Text Changes

Remedy 1- Support of SDB for Sleep Mode MSS, for traffic with irregular arrival pattern

[Add a new section 6.3.2.1.6 UL Short Data Burst Bandwidth request header]

6.3.2.1.6 UL Short Data Burst Bandwidth (UL-SDB-BW) Request Header

The UL Short Data Burst Bandwidth (UL-SDB-BW) Request Header is used by a MSS in sleep mode to send a UL resource request for short-data-burst transmission.

UL Short Data Burst Bandwidth (UL-SDB-BW) Request PDU shall consist of UL –SDB-BW request Header alone and shall not contain a payload. The UL-SDB-BW request header is illustrated in Fig. xxx.

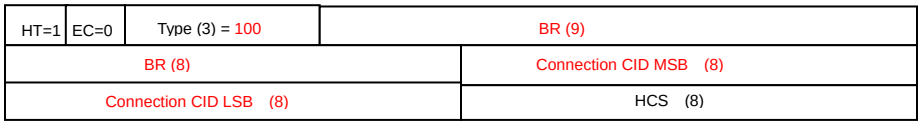

Fig. XXX. UL-SDB-BW request header.

The UL-SDB-BW request header shall have the following properties:

a) The length of the header shall always be 6 bytes
b) The HT field shall be set 1, indicating a BW request header
c) The EC field shall be set 0, indicating no encryption
d) The CID shall indicate the connection CID for which the UL bandwidth is requested
e) The Type field shall be ‘100’
f) The BR field shall indicate the number of bytes requested (in unit of byte)

A MSS receiving a UL-SDB-BW request header on the downlink shall discard the PDU.
The fields of the UL-SDB-BW request header arte defined in Table yyy.

Table yyy. UL-SDB-BW request fieds

Name	Length (bits)	Description
BR	17 bits	Number of bytes requested (in unit of byte)

Connection CID	16 bits	Connection CID for which the UL bandwidth is requested
HT	1 bit	Header Type = 1
EC	1 bit	Always set to 0
Type	3 bits	Type = 100
HCS	8 bits	Header Check Sequence (same usage as HCS entry in Table 5)
RES	1 bit	Reserved bit

Remedy 2 - Support of SDB for Idle Mode MSS, for traffic with irregular arrival pattern

[Insert the following at the end of Section 6.3.2.3.5 Ranging Request (RNG_REQ) message]

The location update request TLV (see 11.5) can be used to indicate a location update request or UL SDB indication by a MSS in idle mode. When used to indicate an UL SDB, the MSS is informing a BS that the purpose of ranging is to adjust time, power and so on in order to send UL short data burst. For any UL SDB transmission from a MSS in idle mode, the BS shall update the location of the MSS.

[Insert the following at the end of Section 6.3.2.3.6 Ranging Response (RNG_RSP) message]

The location Update request TLV (see 11.6) can be used as a location update response or a DL SDB indication. When used as DL SDB indication, the MSS shall understand that the BS is going to send DL SDB.

[Modify the TLV "Location update request" in Table 362a – RNG_REQ Message Encodings].

Table 362a - RNG_REQ Message Encodings

Name	Type (1byte)	Length	Value
Location Update Request/SDB Indication		1	Bit 0: location update request Bit 1: SDB indication Bits 2-7: reserved

[Modify the TLV "Location update response" in Table 365a – RNG_RSP Message Encodings].

Table 362a - RNG_RSP Message Encodings

Name	Type (1byte)	Length	Value
Location Update Request/SDB Indication		1	Bit 0: location update response Bit 1: SDB indication Bits 2-7: Reserved

Remedy 3 – Support of SDB for Sleep Mode and Idle Mode MSS, for traffic with regular arrival pattern

[Insert Section 8.4.5.3.19 SDB_Forecast IE]

8.4.5.3.19 SDB Forecast IE

This IE is used by a BS to alert MSSs regarding the future DL transmission and UL resource allocation. After receiving this IE, a MSS with its CID is included in this IE, shall monitor the DL-MAP and UL-MAP at the frame indicated by Frame offset in this IE. The

MSS shall remain in normal operation until the next SDB_Forecast_IE is received.

Table XXX. DL_SDB IE format

Syntax	Size	Notes
SDB_Forecast_IE() {		
Extended DIUC	4 bits	0x07
Length	4 bits	
Num_MSSs	4 bits	
For (i=0;i< Num_MSSs;i++) {		
CID	16 bits	
Frame_offset (p)	4 bits	To indicate the frame offset of 2^P from the current frame when the MSS shall monitor the DL-MAP and UL-MAP for DL or UL access allocation.
}		
}		