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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 Idle Mode
Date Submitted	**2005-01-23**

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Re:	IEEE P802.16e/D5a-2004
Abstract	This contribution proposes the mechanism to support short data burst transmission/reception to/from a MSS in Idle Mode. This feature enable the support short messaging type of service regardless of the MSS' mode of operation. This is a revised contribution. Revision is marked by change bar.

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Purpose	Review and Adopt the suggested changes into P802.16e/D5a
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1 Introduction

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Short data burst (SDB) support for 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 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 Idle Mode MSS, for traffic with irregular arrival pattern

The current p802.16e/D5a 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:

When the MSS enters Idle mode, the connection CID associated with SDB traffic, shall be kept at both MSS and the Paging Controller. All security related profiles shall also be kept by both sides

- Support of DL SDB:
  - 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 (by including Location Update Response/SDB indication TLV) and to indicate to the MSS to skip certain network entry procedures. The RNG-RSP message may include a TLV field called 'Temporary CID Replacement' to assign a temporary CID to the MSS in case the original CID of the SDB connection is not available at this new serving BS. The BS also indicates a SDB transmission window within where the SDB transmission happens.
  - The SDB is transmitted to the MSS similar to normal operation during the SDB transmission window.
  - The MSS shall resume Idle mode operation at the closure of the SDB transmission window.
- Support of UL SDB:
  - MSS performs initial ranging
  - MSS sends RNG-REQ to the target BS to indicate the Paging Controller ID from which the MSS has entered into Idle mode and to indicate an UL SDB request by including Location Update Request/SDB indication TLV. The purpose of this is both to establish the location of the MSS and to request a UL short data burst transmission.
  - The target BS obtains the security keying profiles from the Paging Controller from which the MSS has entered Idle mode
  - The BS then response with RNG-REQ message for ranging purpose. This message may include a TLV field called 'Temporary CID Replacement' in case the original CIDs of SDB service is not available at this BS. The BS also indicates a SDB transmission window within which the SDB transmission happens.
  - The target BS then uses normal UL MAP IE to assign UL resource
  - The MSS shall resume Idle mode operation at the closure of the SDB Transmission window.

Support of SDB for 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 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.

Deleted: **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 perf ... [1]

Deleted: ¶
When the MSS enters Idle mode, the connection CID associated with SDB traffic or application, shall be kept ... [2]

Deleted: ¶

Deleted: after receiving the DL SDB if the connection is a non-ARQ-enabled or after normal ARQ acknowledgment procedure if the connection is ARQ ... [3]

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Deleted: <#>The target BS may send ARQ message if the connection is ARQ enabled¶

Deleted: after the completion of SDB transmission (with completion of acknowledgment procedure if the connection is ARQ-enabled)¶

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Deleted: 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 Id ... [4]

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2 Proposed Text Changes

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

[Insert the following into the end of Section 6.3.21]

6.3.21.11 Procedure of Short Data Burst (SDB) Operation

At the Idle Mode initialization, a MSS may request for the support of short data burst during Idle Mode, by including the CID Retain Information TLV in DREG-REQ message. The serving BS may response this request by including the CID Retain Information TLV in DREG-CMD message. Similarly, a serving BS may request a MSS to enter Idle Mode by sending DREG-CMD message. In this case, the BS includes the CID Retain Information TLV in DREG-CMD message to inform the MSS that short data burst will be supported on the connections identified in the CID Retain Information TLV after the MSS enters Idle Mode. To support short data burst during Idle Mode, all necessary information associated with the connections identified in the CID Retain Information TLV including CID, service flows, registration, security, MAC context etc. shall be kept in the Paging Controller or other network entity administrating Idle Mode activity of MSSs.

6.3.21.11.1 Unscheduled Short Data Burst Transmission

In this mode, the MSS is not scheduled ahead of time to receive DL SDB traffic or transmit UL SDB traffic.

6.3.21.11.1.1 DL Short Data Burst Transmission

When there is pending SDB on the DL for the MSS, the BSs in the Paging Group of the MSS shall broadcast MOB_PAG-ADV message that includes the MSS MAC address and Action Code set to 01-'performing Ranging to establish location and acknowledge message' during the BS Paging Interval per 6.3.21.7. After receiving the paging, the MSS shall perform the secure location update process with the target BS per 6.3.21.9.2.1. When the target BS replies with a RNG-RSP, it shall include the Location Update Response/SDB Indicationn TLV with Bit 1 set to 1, to indicate pending DL SDB transmission. The RNG-RSP shall also include a SDB Transmission Window TLV to indicate the time window during which DL SDB transmission will occur, starting from the current frame on which RNG-RSP is transmitted. The RNG-RSP may also include the Temporary CID Replacement TLV to assign temporary CID to the connection that has pending SDB traffic, if the current CID associated with the connection is not available at the target BS. During the SDB Transmission Window, the DL data transmission from the BS and data reception at the MSS is the same as normal operation. The MSS resumes the Idle Mode operation at the expiry of the SDB Transmission Window.

6.3.21.11.1.2 UL Short Data Burst Transmission

When there is pending SDB to be transmitted on the UL, the MSS shall conduct initial ranging with the target BS by sending a RNG-REQ including Ranging Purpose Indication TLV with Bit 2 set to 1, Paging Controller ID TLV. The RNG-REQ may also include the SDB Transmission Window TLV to request a time window during which UL SDB transmission will occur. The target BS shall reply with a RNG-RSP including Location Update Response/SDB Indication TLV with Bit 1 set to 1. The RNG-RSP shall also include a SDB Transmission Window TLV to indicate the time window during which UL SDB transmission will occur, starting from the current frame on which RNG-RSP is transmitted. The RNG-RSP may also include the Temporary CID Replacement TLV to assign temporary CID to the connection that has pending SDB traffic, if the current CID associated with the connection is not available at the target BS. During the SDB Transmission Window, the UL data transmission from the MSS and data reception at the BS is the same as normal operation. The MSS resumes the Idle Mode operation at the expiry of the SDB Transmission Window.

[Adding the following into the end of Section 6.3.2.3.26 De/Registration command (DREG-CMD) message]

The DREG-CMD may include the follow TLV if the BS intends to enable SDB during Idle Mode:

Deleted: ¶

.

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. ¶

¶

<sp>¶

¶

Fig. XXX. UL-SDB-BW request header.¶

¶

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

<#>The length of the header shall always be 6 bytes¶

<#>The HT field shall be set 1, indicating a BW request header¶

<#>The EC field shall be set 0, indicating no encryption¶

<#>The CID shall indicate the connection CID for which the UL bandwidth is requested¶

<#>The Type field shall be '100'¶

<#>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 ... [5]

Deleted: 2

CID Retain Information
BS uses this TLV to indicate the CIDs that will be kept during Idle Mode for SDB traffic.

[Adding the following into the end of Section 6.3.2.3.42 MSS De-Registration Request (DREG-REQ) message]

The DREG-REQ may include the follow TLV if MSS requests for SDB support during Idle Mode:

CID Retain Information
MSS uses this TLV to request for the CIDs that will be kept during Idle Mode for SDB traffic.

[Modify the following text in Section 6.3.2.3.5 Ranging Request (RNG_REQ) message, page 28, starting line 48]

The following TLV parameter shall be included in the RNG-REQ message when the MSS is attempting to perform re-entry, ~~or~~ handover or short data burst transmission:

~~**HO Indication**~~
~~Presence of item in message in combination with serving BS ID BSID indicates the MSS is currently attempting to HO; or in combination with Paging Controller ID the MSS is attempting Network Re-entry from Idle Mode to the BS.~~
~~**Location Update Request**~~
~~Presence of item in message indicates MSS action of Idle Mode Location Update Process.~~

Ranging Purpose Indication
Presence of item in message indicates MSS action as follows:
Bit 0: set to 1, in combination with serving BS ID BSID indicates the MSS is currently attempting to HO; or in combination with Paging Controller ID the MSS is attempting Network Re-entry from Idle Mode to the BS.
Bit 1: set to 1, indicates MSS action of Idle Mode Location Update Process
Bit 2: set to 1, indicates MSS action to initiate short data burst transmission

[Modify the following text in Section 6.3.2.3.6 Ranging Response (RNG_RSP) message, page 30, starting line 15]

Location Update Response/SDB Indication
Response to Idle Mode Location Update Request/SDB Indication:
~~0x00=Failure of Idle Mode Location Update. The MSS shall perform Network Re-entry from Idle Mode~~
~~0x01=Success of Idle Mode Location Update~~
~~0x10, 0x11: Reserved;~~
Bit 0: set to 1 to indicate a success of Idle Mode Location Update; set to 0 to indicate a failure of Idle Mode Location Update.
Bit 1: set to 1 to indicate a DL short data burst indication
Bit 2-7: reserved

[Add the following text in Section 6.3.2.3.6 Ranging Response (RNG_RSP) message, page 30, after line 32]

The following TLVs may be included when BS responses to a UL SDB request from a MSS in Idle Mode or BS is to perform DL SDB transmission to a MSS in Idle Mode:

Temporary CID Replacement
The BS uses this field to assign temporary CID to the connection that has pending SDB traffic, if the current CID associated with the connection is not available at the BS. The values of this TLV include the current CID and the temporary assigned CID

SDB Transmission Window
The BS uses this field to provide the SDB transmission window value in unit of frames, during which SDB transmission will occur.

[Combine HO indication, Location Update Request and short data burst indication TLVs into the Ranging Purpose Indication TLV

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Deleted: in Idle Mode
Deleted: that
Inserted: that SDB
Deleted: is enabled
Inserted: is enabled during Idle Mode:¶ ¶ **CID Retain Information in Idle Mode** ¶ MSS uses this TLV to
Deleted: in Idle Mode
Deleted: *Insert the following at the end of*
Deleted:
Deleted: ¶
Deleted: 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. ¶
Deleted: *Insert*
Deleted: *at the end of*
Deleted: When a BS sends a RNG-RSP message to indicate to the MSS that there is DL short data burst to be transmitted to the MSS, the BS shall include the following TLV parameter in the RNG-RSP message:¶ ¶ **Location Update Response/SDB Indication**¶ Short data burst indication:¶ 0x10 = Indication that BS will transmit short data burst on the DL to the MSS¶
Deleted: 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.¶
Inserted: When a BS sends a RNG-RSP message to indicate to the MSS that there is DL short data burst to be transmitted to the MSS, the BS shall include the following TLV parameter in the RNG-RSP message:¶ ¶ **Location Update Response/SDB Indication**¶ Short data burst indication:¶ 0x10 = Indication that BS v ... [6]
Deleted: *Modify the TLV "Location update request"*

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in Table 362a – RNG_REQ Message Encodings].

Table 362a - RNG_REQ Message Encodings

Name	Type (1byte)	Length	Value
~~HO indication~~	~~6~~	~~1~~	~~Presence of item in message in combination with other included information elements indicates the MSS is currently attempting to HO or Network Re-entry from Idle Mode to the BS, regardless of value~~
~~Location Update Request~~	~~8~~	~~1~~	~~Presence of item in message indicates MSS action of Idle Mode Location Update Process, regardless of value.~~
Ranging Purpose Indication	6	1	Presence of item in message indicates MSS action as follows: Bit 0: if set to 1, in combination with serving BS ID BSID indicates the MSS is currently attempting to HO; or in combination with Paging Controller ID the MSS is attempting Network Re-entry from Idle Mode to the BS. Bit 1: if set to 1, indicates MSS action of Idle Mode Location Update Process Bit 2: If set to 1, indicates MSS action to initiate short data burst transmission

Deleted: Location Update Request/SDB Indication ... [7]

Deleted: ¶ ¶ ¶

Inserted: ¶ ¶ ¶

Deleted: Location Update Request/SDB Indication ... [8]

Deleted: 0x00

Inserted: 0x00 = Failure of Idle Mode Location Update. The MSS shall perform Network Re-entry from Idle Mode.

[Adding one more row to the end of Table 362a]

Table 362a - RNG_REQ Message Encodings

Name	Type (1byte)	Length	Value
SDB Transmission Window	?	1	This value indicates the SDB transmission window in unit of frames

[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 Response/SDB indication	23	1	~~0x00=Failure of Idle Mode Location Update. The MSS shall perform Network Re-entry from Idle Mode~~ ~~0x01=Success of Idle Mode Location Update~~ ~~0x10, 0x11: Reserved~~ Bit 0: 0 = Failure of Idle Mode Location Update. The MSS shall perform Network Re-entry from Idle

			Mode. 1= Success of Idle Mode Location Update Bit 1: SDB indication Bits 2-7: Reserved

[Adding two more raws to the end of Table 365a]

Table 365a - RNG_RSP Message Encodings

Name	Type (1byte)	Length	Value
Temporary CID Replacement	28	4	Bit 0-16: current CID Bit 17-35: Temporary assigned CID
SDB Transmission Window	29	1	This value indicates the SDB transmission window in unit of frames

[Adding one raw to the end of Table in Section 11.14 DREG-CMD message encodings]

Name	Type (1byte)	Length	Value
CID Retain Information	5	Variable	Bit 0-7: number of CIDs For (i=0;i<number of CIDs;i++) { CID }

[Adding one raw to the end of Table in Section 11.15 DREG-REQ message encodings]

Name	Type (1byte)	Length	Value
CID Retain Information	54	Variable	Bit 0-7: number of CIDs For (i=0;i<number of CIDs;i++) { CID }

Remedy 2 – Support of SDB for Idle Mode MSS, for traffic with regular arrival pattern

[Insert the following section]

6.3.21.11.2 Scheduled Short Data Burst Transmission

In this mode, the BS informs the MSS ahead of time when the next SDB transmission will occur in either DL or UL, using the SDB_Forecast_IE as defined in Section 8.4.5.3.19 SDB Forecast IE. If SDB transmission is scheduled, the MSS shall scan, decode the DCD, UCD, DL-MAP and UL-MAP, and synchronize on the DL and UL of the Preferred BS in time for the MSS to decode SDB transmission from the BS or transmit SDB to the BS at the scheduled frame.

[Insert Section 8.4.5.3.19 SDB_Forecast IE]

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Deleted: The MSS shall perform Network Re-entry from Idle Mode
Deleted: 0x01 = Success of Location Update¶ 0x10 = Indication that BS will transmit short data burst on the DL to the MSS¶ 0x10, 0x11: Reserved
Inserted: 0x01 = Success of Location Update¶ 0x10 = Indication that BS will transmit short data burst on the DL to the MSS¶ 0x10, 0x11: Reserved … [9]
Deleted: ¶
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Inserted: aw
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Inserted: 2a - RNG_RSP Message Encodings¶ Name … [10]
Deleted:
Deleted: old
Inserted: old CID¶ Bit 17-35: Tempora
Deleted: l
Inserted: l CID Replacement … [11]
Deleted: l
Inserted: l CID … [12]
Deleted: 8
Inserted: 8: number of CIDs ¶ For (i=0;i<number of CIDs;i++)¶ { CID } … [13]
Deleted: in Idle Mode
Deleted: 8
Inserted: 8: number of CIDs ¶ For (i=0;i<number of CIDs;i++)¶ { CID } … [14]
Deleted: in Idle Mode
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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, SDB Forecast IE format Deleted: DL_

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.
}		
}		

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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

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When the MSS enters Idle mode, the connection CID associated with SDB tra ffic or application, shall be kept at both MSS and the Paging Controller. A ll security related profiles shall be also kept by both sides

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oafter receiving the DL SDB if the connection is a non-ARQ-enabled or after normal ARQ acknowledgment procedure if the connection is ARQ-enabled

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

Page 2: [5] Deleted mhfong 1/11/2005 11:30 PM

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